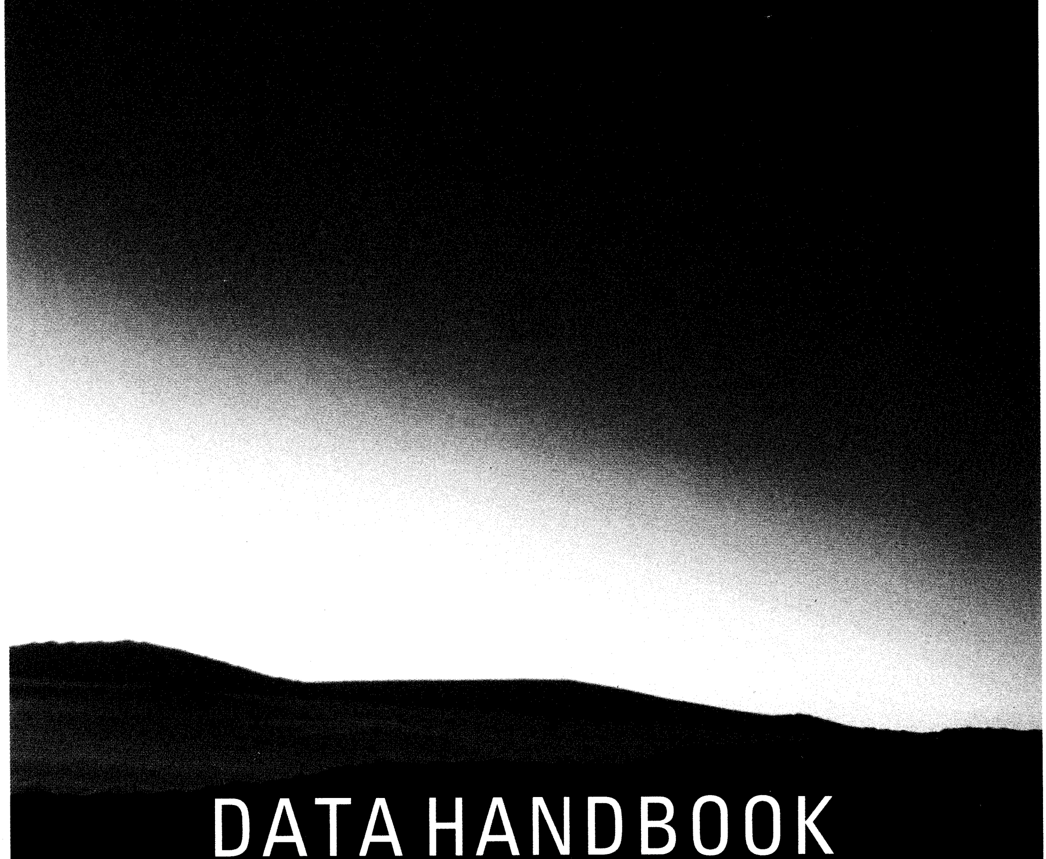
RF Wideband Transistors, Video Transistors and Modules



DATA HANDBOOK

BOOK SC14 1993

Philips Semiconductors

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RF Wideband Transistors, Video Transistors and Modules

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

PREFACE

RF Wideband Transistors, Video Transistors and Modules

Preface

In this Data Handbook, Product specifications are included for those types that are in mass production at time of printing (November 1992.) Also included are Preliminary data sheets for those types that are in pilot production stage and for which design-in samples are available to customers.

WHAT'S NEW?

An extensive **Selection Guide** is included in this handbook: overview per type family, per crystal, per envelope, and per application are given. Moreover, **line-ups** for applications in Cordless Telephones (900 MHz CT1, 1.9 GHz DECT, PHP and PCS etc), Pagers and Cellular Telephones (NMT, AMPS, TACS, GSM, PCN, etc) are described in detail.

S-parameters (Version 3.0 on 3.5" diskette, issue date February 1992) and **SPICE parameters** (Version 2.0 on 3.5" diskette, issue date August 1992) are discussed in separate chapters. Moreover, SPICE parameters have now also been included in a number of Product specifications in this Data Handbook.

Product specifications are included for **35 new 4th generation transistors**, featuring higher transition frequency (f_T > 9 GHz), lower noise (F < 1.1 dB at 1 GHz), and higher gain (G_{UM} > 19 dB at 1 GHz). These transistors use a range of crystals suitable for operating currents (I_C) from as low as 0.5 mA up to 240 mA, and operating voltages (V_{CE}) from 3 V up to 18 V. They can be recognised by the generic type number sequence **BFx5xx.** These types are available in the envelopes SOT23, SOT103, SOT143, SOT143R, SOT173, SOT173X, and SOT223.

Also, a number of RF Wideband Transistors in **the new SOT323 envelope** (S-mini or SC70) are included: BFQ67W, BFR92AW, BFR93AW, BFS17W, BF747W, BF547W, BFT92W, BFT93W, BFS25A, BFS505, BFS520 and BFS540. The last four types are also part of the new 4th generation family. For some of these types, Preliminary data is limited in this book to one page with characteristics; for more extensive data, please refer to the SOT23 equivalents for the time being.

For application in Class-AB power amplifiers in **1.9 GHz portable RF communication equipment** (DECT, PHP, PCS/PCN), Preliminary data sheets of 6 new types in SOT143 and SOT103 have been added as well: BFG10, BFG10/X, BFG11, BFG11/X, BLT10 and BLT11.

The **video transistor** product range has been extended with types in the SOT223 surface mount package: BFQ166, BFQ236, BFQ236A, BFQ256 and BFQ256A.

Moreover, a range of single and triple channel **video amplifier hybrid modules** has been included: CR2424;2425;2427, CR3424;3425;3427, CR4424;4425;4427, CR5527 and OM976.

The range of **high speed switching transistors** has been extended with the inclusion of PMBT3640, PMBTH10, MPSH10, PMBTH81 and MPSH81 in TO-92 and SOT23 envelopes.

Preliminary data sheets are included for a range of **video output transistors for HDTV** applications: BFQ290, BFQ291, BFQ292, BFQ294, BFQ295 and BFQ296.

New parts have been added to our range of **TV tuner transistors:** BF753 (SOT23), BF547 (SOT23), BF547W (SOT323), BF747 (SOT23), BF747W (SOT323) and BF748 (TO-92).

Please contact your local Philips Semiconductors sales office to obtain any additional information on the types included in this Data Handbook.

SELECTION GUIDE

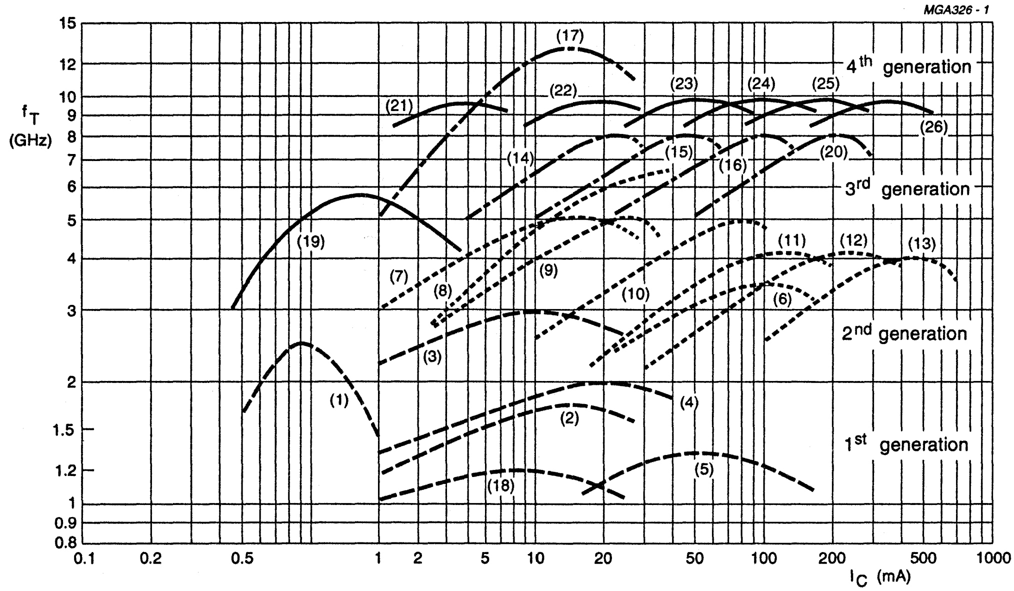


Fig.1 Transition frequency (f_T) characteristics as a function of collector current (I_C) for the four generations of RF bipolar wideband transistors.

FIRST-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 3.5 GHz)

ENVELOPE		TRANSITION FREQUENCY (f_T) CHARACTERISTICS numbers in parenthesis refer to curve profiles detailed in Fig.1						
		(1)	(2)	(3)	(4)	(5)	(6)	(18)
METAL CAN	SOT5 (TO-39)					BFW16A BFW17A	BFR95	
	TO-72		BFY90		BFW30			
PLASTIC	SOT54 (TO-92)		BF689K BF763					BF748
	SOT37	BFT24	BFW92	BFW92A	BFW93			
CERAMIC	SOT122E						BFR94A	
SURFACE MOUNT	SOT23	BFT25	BFS17	BFS17A	BFR53			BF547 BF747
	SOT89					BFQ17		
	SOT143			BFG17A				
	SOT223					BFG16A		
	SOT323		BFS17W					BF547W BF747W

SECOND-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 6 GHz)

ENVELOPE		TRANSITION FREQUENCY (f_T) CHARACTERISTICS numbers in parenthesis refer to curve profiles detailed in Fig.1					
		(7)	(8)	(10)	(11)	(12)	(13)
METAL CAN	TO-72	BFQ53	BFQ22S	BFQ63			
PLASTIC	SOT37	BFR90 BFR90A	BFR91 BFR91A	BFR96 BFR96S	BFQ34T		
	SOT103	BFG90A	BFG91A	BFG96	BFG34		
CERAMIC	SOT122				BFQ34	BFQ68	BFQ136
	SOT173 SOT173X	BFP90A	BFP91A	BFP96			
SURFACE MOUNT	SOT23	BFR92 BFR92A	BFR93 BFR93A	BFR106			
	SOT89			BFQ19	BFQ18A		
	SOT143 SOT143R	BFG92A BFG92A/X BFG92A/XR	BFG93A BFG93A/X BFG93A/XR				
	SOT223		BFG94	BFG97	BFG35		
	SOT323	BFR92AW	BFR93AW				

SECOND-GENERATION PNP WIDEBAND TRANSISTORS (f_T up to 6 GHz)

ENVELOPE		TRANSITION FREQUENCY (f_T) CHARACTERISTICS numbers in parenthesis refer to curve profiles detailed in Fig.1				
		(7)	(9)	(10)	(11)	(12)
METAL CAN	TO-72	BFQ52	BFQ24	BFQ32M		
PLASTIC	SOT37	BFQ51	BFQ23	BFQ32 BFQ32S	BFQ54T	
	SOT103			BFG32		
CERAMIC	SOT122					BFQ108
	SOT173 SOT173X		BFQ23C	BFQ32C		
SURFACE MOUNT	SOT23	BFT92	BFT93			
	SOT89			BFQ149		
	SOT223			BFG31	BFG55	
	SOT323	BFT92AW	BFT93AW			

THIRD-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 8 GHz)

ENVELOPE		TRANSITION FREQUENCY (f_T) CHARACTERISTICS numbers in parenthesis refer to curve profiles detailed in Fig.1				
		(14)	(15)	(16)	(17)	(20)
PLASTIC	SOT37	BFQ65		BFR134		
	SOT103	BFG65	BFG195	BFG134		
CERAMIC	SOT172			BFQ135		BFQ270
	SOT173 SOT173X	BFQ66			BFQ33C	
SURFACE MOUNT	SOT23	BFQ67				
	SOT143 SOT143R	BFG67 BFG67/X BFG67/XR	BFG197 BFG197/X BFG197/XR		BFG33 BFG33/X BFG33/XR	
	SOT223		BFG198	BFG135		
	SOT323	BFQ67W				

FOURTH-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 10 GHz)

ENVELOPE		TRANSITION FREQUENCY (f_T) CHARACTERISTICS numbers in parenthesis refer to curve profiles detailed in Fig.1						
		(19)	(21)	(22)	(23)	(24)	(25)	(26)
PLASTIC	SOT103			BFR521 (note 1)	BFR541 (note 1)	BFR591 (note 1)		
CERAMIC	SOT172						BFQ621 (note 1)	BFQ741 (note 1)
	SOT173 SOT173X		BFP505 (note 1)	BFP520 (note 1)	BFP540 (note 1)			
SURFACE MOUNT	SOT23	BFT25A	BFR505	BFR520	BFR540			
	SOT143 SOT143R	BFG25A/X	BFG505 BFG505/X BFG505/XR	BFG520 BFG520/X BFG520/XR	BFG540 BFG540/X BFG540/XR	BFG590 BFG590/X BFG590/XR		
	SOT223				BFG541	BFG591	BFG621 (note 1)	BFG741 (note 1)
	SOT323	BFS25A	BFS505	BFS520	BFS540			

Note

1. In development.

COMPETITOR NAME EQUIVALENTS FOR SURFACE MOUNT PACKAGES

PHILIPS	MOTOROLA	NEC	TOSHIBA	SIEMENS
SOT23	318-07 (SOT23)	mini-mold (3-pin)	SM (SOT23)	SOT23
SOT103	317-01 (macro-x)	disk mold	µX (24F1C)	SOT103
SOT143	–	–	–	–
SOT143 (cross-emitter pinning)	318-A-05 (SOT143)	–	–	SOT143
SOT143R (cross-emitter pinning)	–	mini-mold (4-pin)	SMQ (SC61) (SOT143)	–
SOT173	358-01 (micro-x)	µX	–	–
SOT173X	–	–	–	CEREC-x
SOT223	318E-04 (SOT223)	–	–	SOT223
SOT323	SC70	super mini-mold (3-pin)	USM (SC70)	–

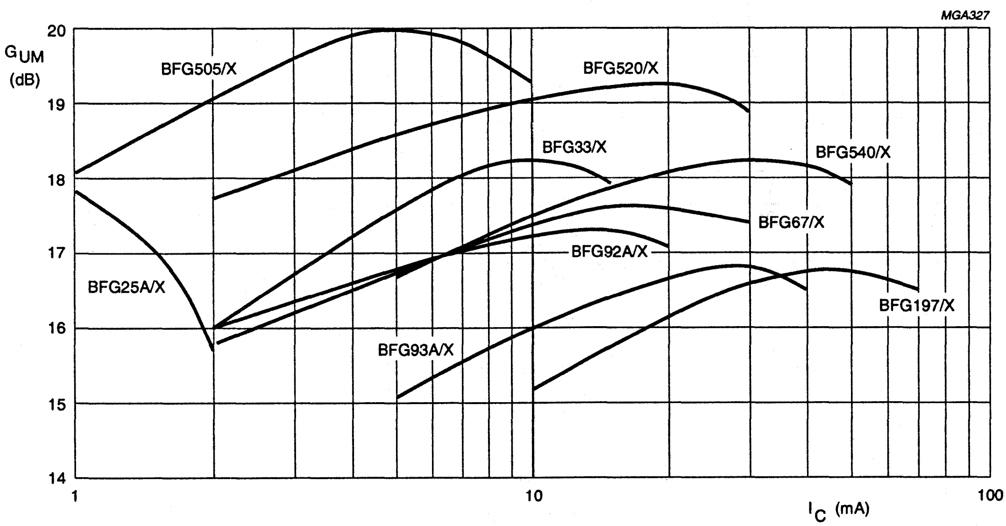
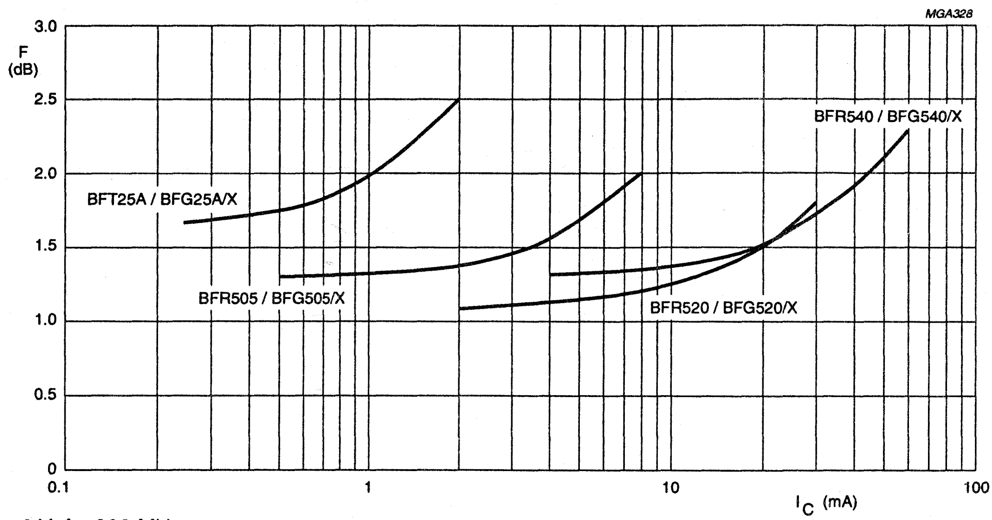
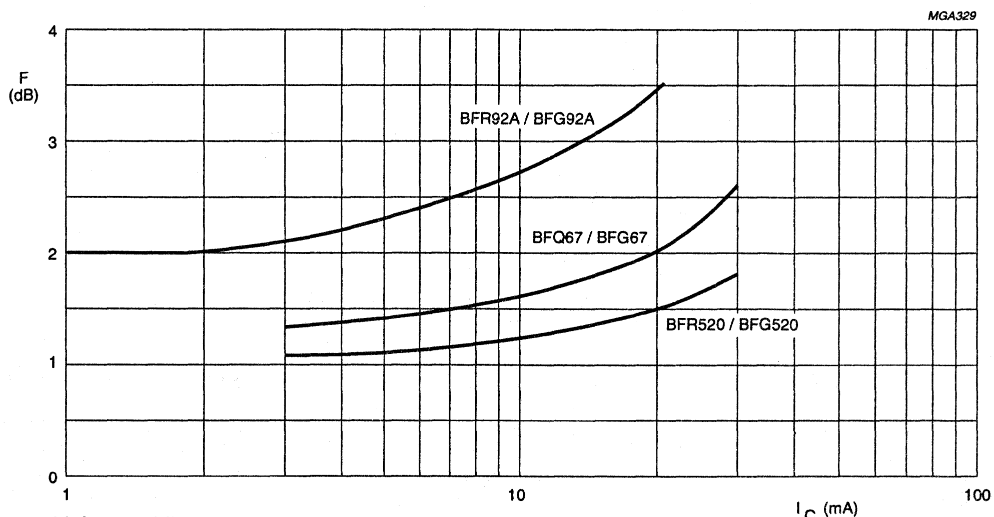


Fig.2 Maximum unilateral power gain (G_{UM}) as a function of collector current (I_C) for various types in SOT143 envelopes.



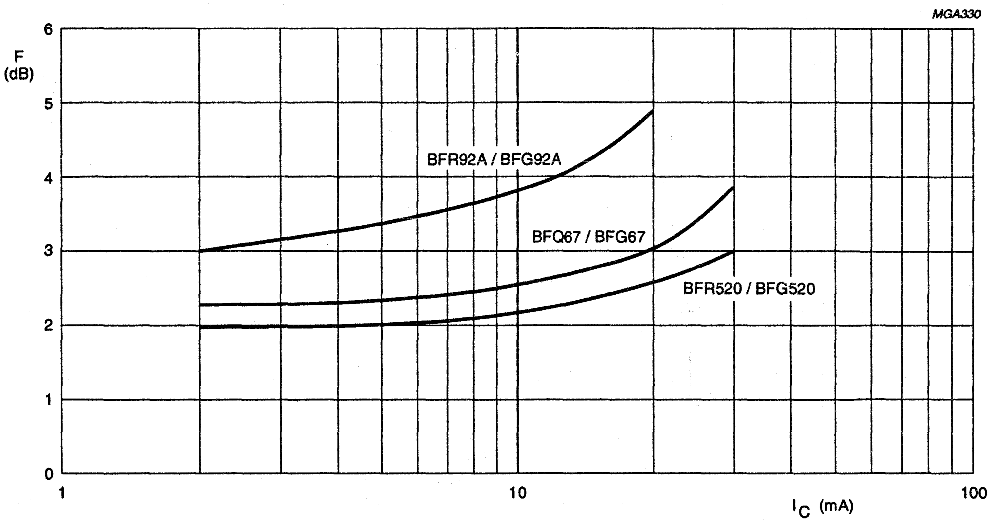
V_{CE} = 6 V; f = 900 MHz.

Fig.3 Noise figure (F) as a function of collector current (I_C) for 4th generation devices in SOT23 and SOT143 envelopes.



V_{CE} = 6 V; f = 900 MHz.

Fig.4 Noise figure (F) as a function of collector current (I_C) for three comparable crystals (nominal 20 mA) in SOT23 and SOT143 envelopes.



V_{CE} = 6 V; f = 2 GHz.

Fig.5 Noise figure (F) as a function of collector current (I_C) for three comparable crystals (nominal 20 mA) in SOT23 and SOT143 envelopes.

WIDEBAND TRANSISTORS FOR APPLICATIONS IN VIDEO OUTPUT AMPLIFIERS IN MONITORS

APPLICATION	TYPE NUMBERS GROUPED BY ENVELOPE					
	SOT54 (TO-92)	**SOT5 (TO-39)**	**SOT32 (TO-126)**	**SOT128 (TO-202)**	**SOT172**	**SOT223**
NPN cascode driver	BFQ161	BFQ163	BFQ162			BFQ166
NPN low current cascode output (I_{CM} = 300 mA)			BFQ232 BFQ232A	BFQ235 BFQ235A	BFQ234(/I)	
NPN high current cascode output (I_{CM} = 400 mA)		BFQ263 BFQ263A	BFQ262 BFQ262A	BFQ265 BFQ265A	BFQ268(/I)	
NPN buffer	BFQ231 BFQ231A	BFQ233 BFQ233A	BFQ232 BFQ232A	BFQ235 BFQ235A	BFQ234(/I)	BFQ236 BFQ236A
PNP buffer	BFQ251 BFQ251A	BFQ253 BFQ253A	BFQ252 BFQ252A	BFQ255 BFQ255A	BFQ254(/I)	BFQ256 BFQ256A

Note

For BFQ2xx (A) types;
Standard versions: $V_{(BR)CBO}$ = 100 V; $V_{(BR)CEO}$ = 65 V; $V_{(BR)CER}$ = 95 V.
'A' versions: $V_{(BR)CBO}$ = 115 V; $V_{(BR)CEO}$ = 95 V; $V_{(BR)CER}$ = 110 V.

WIDEBAND TRANSISTORS FOR APPLICATIONS IN VIDEO OUTPUT AMPLIFIERS IN HDTV

APPLICATION	TYPE NUMBERS GROUPED BY ENVELOPE		
	SOT32 (TO-126)	SOT128 (TO-202)	SOT172
NPN cascode output			BFQ291
NPN buffer	BFQ293	BFQ296	
PNP buffer	BFQ292	BFQ295	

Note

$V_{(BR)CBO}$ = 195 V; $V_{(BR)CER}$ = 190 V.

WIDEBAND HYBRID MODULES AND ICs FOR APPLICATIONS IN VIDEO OUTPUT AMPLIFIERS IN MONITORS

Pre-amplifier IC

TYPE NUMBER	OUTLINE	V_{CC} (V)	CHANNELS	BANDWIDTH (MHz)	GAIN (dB)	t_r, t_f (ns)	CONTRAST CONTROL
TDA4880 (note 1)	SOT146, 20 pin DIL	7.2 - 8.8	3	> 70	6.0	5.0	DC, control range > 20 dB

Note

1. For further information, refer to Data Handbook IC02c, 1992; "Semiconductors for Television and Video Systems".

Video output amplifier hybrid modules

TYPE NUMBER	OUTLINE	V_{CC} (V)	CHANNELS	BANDWIDTH (MHz)	VOLTAGE GAIN (V_O/V_I)	t_r, t_f (ns)	OUTPUT VOLTAGE (V_{p-p})
CR2424 CR2425 CR2427	SOT115L SOT115C SOT348	70	1	145	12.4	2.3	40
CR3424 CR3425 CR3427	SOT115L SOT115C SOT348	90	1	145	12.4	2.5	50
CR4424 (note 1) CR4425 (note 1) CR4427 (note 1)	SOT115L SOT115C SOT348	90	1	215	12.4	1.9	50
CR5527	SOT347	90	3	130	12.4	3.0	50
OM976	SOT115L	90	1	135	16	2.7	40

Note

1. Objective data

WIDEBAND TRANSISTORS FOR HIGH SPEED SWITCHING APPLICATIONS

TYPE NUMBER	INDUSTRY STANDARD TYPE NUMBER	POLARITY	ENVELOPE	f_T (GHz)	TYPICAL BIAS CONDITION	
					V_{CE} (V)	I_C (mA)
BSR12 (note 1)	–	PNP	SOT23	1.5	−10	−30
PMBT3640	MMBT3640	PNP	SOT23	1.3	−10	−15
MPS3640	MPS3640	PNP	SOT54 (TO-92)	1.3	−10	−15
PMBTH10	MMBTH10	NPN	SOT23	0.65	10	4
MPSH10	MPSH10	NPN	SOT54 (TO-92)	0.65	10	4
PMBTH81	MMBTH81	PNP	SOT23	0.6	−10	−5
MPSH81	MPSH81	PNP	SOT54 (TO-92)	0.6	−10	−5

Note

1. For further information, refer to Data Handbook SC10b, 1991; "Surface Mounted Semiconductors".

PLASTIC RF POWER TRANSISTORS (CLASS-AB) FOR CELLULAR AND CORDLESS TELEPHONES

TYPE NUMBER	ENVELOPE	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
BLT50 (note 1)	SOT223	470	7.5	1.2	> 10.5 typ. 11.2	> 55 typ. 65
		900	7.5	0.8	> 4.5 typ. 5	> 65 typ.70
BLT80 (note 1)	SOT223	900	7.5	0.8	> 6.0 typ. 7.5	> 60 typ. 67
BLT81 (note 1)	SOT223	900	7.5	1.2	> 6.0	> 65
BLT10	SOT103	1900	6.0	0.3	> 6.0	> 50
BLT11	SOT103	1900	6.0	0.6	> 6.0	> 50
BFG10; BFG10/X	SOT143; SOT143R	1900	3.6	0.2	> 5.0	> 50
BFG11; BFG11/X	SOT143; SOT143R	1900	3.6	0.4	> 4.0	> 50

Note

1. For further information, refer to Data Handbook SC08a, 1993; "RF Power Bipolar Transistors", available February 1993.

RF WIDEBAND TRANSISTORS FOR PAGERS

See Fig.6

SOCKET	SOT323	SOT23	SOT143 (note 1)	GENERATION
RF amp	BFR92AW	BFR92A	BFG92A/X	2nd
	BFS25A	BFT25A	BFG25A/X	4th
	BFS505	BFR505	BFG505/X	4th
	BFS520	BFR520	BFG520/X	4th
MIX	See RF amp			
OSC	See RF amp			

Note

1. European and Japanese pinning versions are also available.

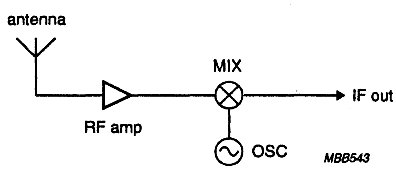


Fig.6 Pager RF input circuit.

RF WIDEBAND TRANSISTORS FOR CELLULAR PHONES

See Figs 7 and 8

SOCKET		SOT323	SOT23	SOT143 (note 1)	SOT223	GENERATION
Receiver	Input amp and MIX1	BFQ67W	BFQ67	BFG67/X		3rd
		BFS25A	BFT25A	BFG25A/X		4th
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	B1 amp	BFR92AW	BFR92A	BFG92A/X		2nd
		BFR93AW	BFR93A	BFG93A/X		2nd
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	IF amp	BFS25A	BFT25A	BFG25A/X		4th
		BFS505	BFR505	BFG505/X		4th
VCO1 and VCO2	OSC	BFR92AW	BFR92A	BFG92A/X		2nd
		BFR93AW	BFR93A	BFG93A/X		2nd
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	B2 amp: as OSC, plus:	BFQ67W	BFQ67	BFG67/X		3rd
Transmitter	Pre-amp	BFQ67W	BFQ67	BFG67/X		3rd
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	MIX2 and B1 amp:	see OSC	see OSC	see OSC		
	Driver amp		BFQ67	BFG67/X		3rd
			BFR520	BFG520/X		4th
	PA1				BFG35	2nd
					BFG198	3rd
				BFG540/X	BFG541	4th
				BFG590/X	BFG591	4th
	PA2				BLT50 (note 2)	3rd
					BFG135	3rd
					BFG621 (note 3)	4th
	PA3				BLT80 (note 2)	3rd
					BLT81 (note 2)	3rd

Notes

1. European and Japanese pinning versions are also available.
2. For further information, refer to Data Handbook SC08a, 1993; "RF Power Bipolar Transistors", available February 1993.
3. In development.

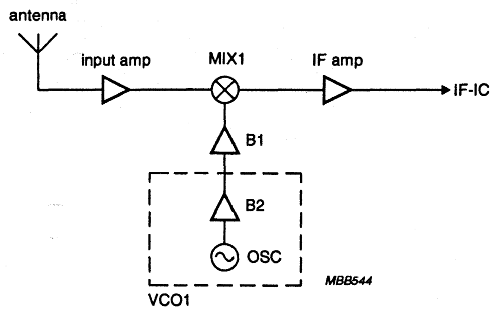


Fig.7 Cellular phone receiver circuit.

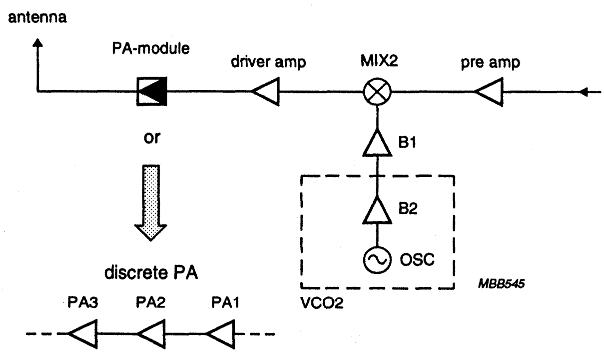


Fig.8 Cellular phone transmitter circuit.

RF WIDEBAND TRANSISTORS FOR CORDLESS PHONES

See Fig.9

SOCKET		SOT323	SOT23	SOT143 (note 1)	SOT223	SOT103	GENERATION
Receiver		See selection guide for cellular phones					
VCO1 and VCO2		See selection guide for cellular phones					
Transmitter	Pre-amp	BFQ67W	BFQ67	BFG67/X			3rd
		BFS505	BFR505	BFG505/X			4th
		BFS520	BFR520	BFG520/X			4th
	MIX2 and B1 amp: as pre-amp, plus:	BFR92AW	BFR92A	BFG92A/X			2nd
		BFR93AW	BFR93A	BFG93A/X			2nd
	PA1	BFQ67W	BFQ67	BFG67/X			3rd
		BFS505	BFR505	BFG505/X			4th
		BFS520	BFR520	BFG520/X			4th
	PA2 and PC1			BFG67/X			3rd
				BFG520/X			4th
				BFG540/X			4th
	PB1			BFG540/X			4th
	PB2				BFG541		4th
				BFG590/X	BFG591		4th
				BFG10/X		BLT10	4th
	PB3				BFG135		3rd
				BFG11/X	BFG621 (note 2)	BLT11	4th
					BFG741 (note 2)		4th

Notes

1. European and Japanese pinning versions are also available.
2. In development.

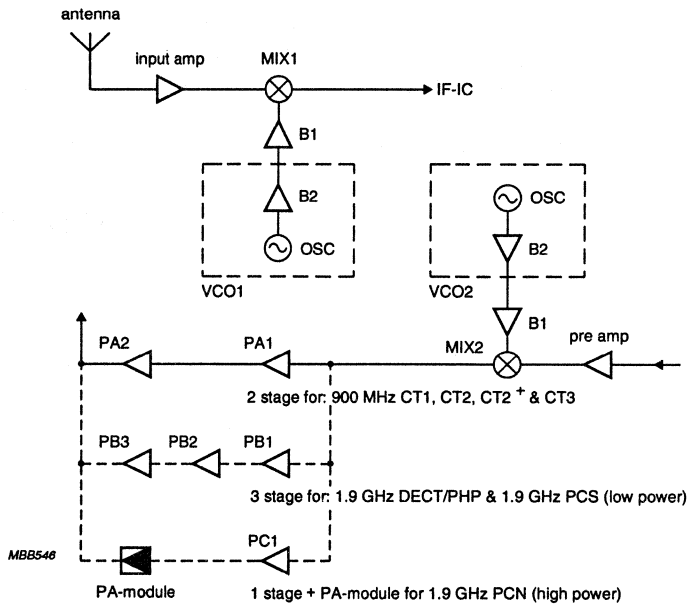


Fig.9 Cordless phone circuit.

TYPE NUMBER SURVEY

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BF547	SOT23	NPN	E16	TV tuners	102
BF547W	SOT323	NPN	E16	TV tuners	113
BF689K	SOT54 (TO-92)	NPN	F689		114
BF747	SOT23	NPN	E15	TV tuners	116
BF747W	SOT323	NPN	E15	TV tuners	127
BF748	SOT54 (TO-92)	NPN	F748		128
BF749	SOT143R	NPN	V34	satellite TV tuners	139
BF750	SOT143R	NPN	V32	satellite TV tuners	141
BF751	SOT54 (TO-92)	NPN		CATV converters	143
BF752	SOT143	NPN	V38	satellite TV tuners	147
BF753	SOT23	NPN		TV tuners	149
BF763	SOT54 (TO-92)	NPN	F763		151
BFG10	SOT143	NPN	N70	cordless telephones	153
BFG10/X	SOT143	NPN	N71	cordless telephones	153
BFG11	SOT143	NPN	N72	cordless telephones	155
BFG11/X	SOT143	NPN	N73	cordless telephones	155
BFG16A	SOT223	NPN		CATV/MATV	157
BFG17A	SOT143	NPN	E6		164
BFG25A/X	SOT143	NPN	V11	pagers	172
BFG31	SOT223	PNP		MATV/CATV; instrumentation	187
BFG32	SOT103	PNP		MATV/CATV	192
BFG33	SOT143	NPN	V6	instrumentation	199
BFG33/X	SOT143	NPN	V16	instrumentation	199
BFG34	SOT103	NPN		MATV/CATV	213
BFG35	SOT223	NPN		MATV/CATV	221
BFG55	SOT223	PNP		instrumentation	234
BFG65	SOT103	NPN		MATV/CATV	239
BFG67	SOT143	NPN	V3	cordless and cellular telephones; satellite TV tuners	248
BFG67/X	SOT143	NPN	V12	cordless and cellular telephones; satellite TV tuners	248
BFG67R	SOT143R	NPN	V27	cordless and cellular telephones; satellite TV tuners	248
BFG67/XR	SOT143R	NPN	V26	cordless and cellular telephones; satellite TV tuners	248
BFG90A	SOT103	NPN		MATV/CATV	268
BFG91A	SOT103	NPN		MATV/CATV	279
BFG92A	SOT143	NPN	P8	cordless and cellular telephones; satellite TV tuners	289

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BFG92A/X	SOT143	NPN	V14	cordless and cellular telephones; satellite TV tuners	289
BFG92A/XR	SOT143R	NPN	V29	cordless and cellular telephones; satellite TV tuners	289
BFG93A	SOT143	NPN	R8	cordless and cellular telephones; satellite TV tuners	308
BFG93A/X	SOT143	NPN	V15	cordless and cellular telephones; satellite TV tuners	308
BFG93A/XR	SOT143R	NPN	V33	cordless and cellular telephones; satellite TV tuners	308
BFG94	SOT223	NPN		MATV/CATV	325
BFG96	SOT103	NPN		MATV/CATV	338
BFG97	SOT223	NPN		MATV/CATV	348
BFG134	SOT103	NPN		MATV/CATV	361
BFG135	SOT223	NPN		MATV/CATV; cordless and cellular telephones	371
BFG195	SOT103	NPN		MATV/CATV	385
BFG197	SOT143	NPN	V5	MATV/CATV	392
BFG197/X	SOT143	NPN	V13	MATV/CATV	392
BFG197/XR	SOT143R	NPN	V35	MATV/CATV	392
BFG198	SOT223	NPN		MATV/CATV; cellular telephones	411
BFG505	SOT143	NPN	N33	pagers; cordless and cellular telephones	422
BFG505/X	SOT143	NPN	N39	pagers; cordless and cellular telephones	422
BFG505/XR	SOT143R	NPN	N45	pagers; cordless and cellular telephones	422
BFG520	SOT143	NPN	N36	pagers; cordless and cellular telephones	444
BFG520/X	SOT143	NPN	N42	pagers; cordless and cellular telephones	444
BFG520/XR	SOT143R	NPN	N48	pagers; cordless and cellular telephones	444
BFG540	SOT143	NPN	N37	cordless and cellular telephones; MATV; satellite TV tuners	466
BFG540/X	SOT143	NPN	N43	cordless and cellular telephones; MATV; satellite TV tuners	466
BFG540/XR	SOT143R	NPN	N49	cordless and cellular telephones; MATV; satellite TV tuners	466
BFG541	SOT223	NPN		MATV/CATV	488
BFG590	SOT143	NPN	N38	MATV/CATV	510
BFG590/X	SOT143	NPN	N44	MATV/CATV	510

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BFG590/XR	SOT143R	NPN	N50	MATV/CATV	510
BFG591	SOT223	NPN		MATV/CATV	512
BFG621	SOT223	NPN		MATV/CATV	513
BFG741	SOT223	NPN		MATV/CATV	514
BFP90A	SOT173 SOT173X	NPN	P0	professional telecommunications; military	515
BFP91A	SOT173 SOT173X	NPN	P1	professional telecommunications; military	523
BFP96	SOT173 SOT173X	NPN	P6	professional telecommunications; military	531
BFP505	SOT173 SOT173X	NPN		professional telecommunications; military	539
BFP520	SOT173 SOT173X	NPN		professional telecommunications; military	540
BFP540	SOT173 SOT173X	NPN		professional telecommunications; military	543
BFQ17	SOT89	NPN	FA	instrumentation	544
BFQ18A	SOT89	NPN	FF	instrumentation	547
BFQ19	SOT89	NPN	FB	instrumentation	551
BFQ22S	TO-72	NPN			555
BFQ23	SOT37	PNP			559
BFQ23C	SOT173 SOT173X	PNP	C3	professional telecommunications; military	567
BFQ24	TO-72	PNP		professional telecommunications; military	574
BFQ32	SOT37	PNP	BFQ32/02		577
BFQ32C	SOT173 SOT173X	PNP	C2	professional telecommunications; military	581
BFQ32M	TO-72	PNP		professional telecommunications; military	587
BFQ32S	SOT37	PNP		MATV/CATV	590
BFQ33C	SOT173 SOT173X	NPN	Q3	professional telecommunications; military	596
BFQ34	SOT122A	NPN	BFQ34/01	MATV/CATV	604
BFQ34T	SOT37	NPN		MATV/CATV	615
BFQ51	SOT37	PNP			624
BFQ52	TO-72	NPN			631
BFQ53	TO-72	PNP			634
BFQ54T	SOT37	PNP		MATV/CATV	637
BFQ63	TO-72	NPN			641
BFQ65	SOT37	NPN		MATV/CATV	645

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BFQ66	SOT173 SOT173X	NPN	Q6		652
BFQ67	SOT23	NPN		pagers; cordless and cellular telephones	661
BFQ67W	SOT323	NPN	V2	pagers; cordless and cellular telephones	679
BFQ68	SOT122A	NPN		MATV/CATV	699
BFQ108	SOT122A	PNP		MATV/CATV	710
BFQ135	SOT172A1	NPN		MATV/CATV	711
BFQ136	SOT122A	NPN		MATV/CATV	718
BFQ149	SOT89	PNP	FG	instrumentation	726
BFQ161	SOT54 (TO-92)	NPN		video amplifiers in monitors	730
BFQ162	SOT32 (TO-126)	NPN		video amplifiers in monitors	734
BFQ163	SOT5 (TO-39)	NPN		video amplifiers in monitors	738
BFQ166	SOT223	NPN		video amplifiers in monitors	742
BFQ231	SOT54 (TO-92)	NPN		video amplifiers in monitors	746
BFQ231A	SOT54 (TO-92)	NPN		video amplifiers in monitors	746
BFQ232	SOT32 (TO-126)	NPN		video amplifiers in monitors	750
BFQ232A	SOT32 (TO-126)	NPN		video amplifiers in monitors	750
BFQ233	SOT5 (TO-39)	NPN		video amplifiers in monitors	755
BFQ233A	SOT5 (TO-39)	NPN		video amplifiers in monitors	755
BFQ234	SOT172A1	NPN		video amplifiers in monitors	760
BFQ234/I	SOT172A3	NPN		video amplifiers in monitors	760
BFQ235	SOT128B	NPN		video amplifiers in monitors	764
BFQ235A	SOT128B	NPN		video amplifiers in monitors	764
BFQ236	SOT223	NPN		video amplifiers in monitors	769
BFQ236A	SOT223	NPN		video amplifiers in monitors	769
BFQ251	SOT54 (TO-92)	PNP		video amplifiers in monitors	773
BFQ251A	SOT54 (TO-92)	PNP		video amplifiers in monitors	773
BFQ252	SOT32 (TO-126)	PNP		video amplifiers in monitors	777
BFQ252A	SOT32 (TO-126)	PNP		video amplifiers in monitors	777
BFQ253	SOT5 (TO-39)	PNP		video amplifiers in monitors	782
BFQ253A	SOT5 (TO-39)	PNP		video amplifiers in monitors	782
BFQ254	SOT172A1	PNP		video amplifiers in monitors	787
BFQ254/I	SOT172A3	PNP		video amplifiers in monitors	787
BFQ255	SOT128B	PNP		video amplifiers in monitors	791
BFQ255A	SOT128B	PNP		video amplifiers in monitors	791
BFQ256	SOT223	PNP		video amplifiers in monitors	796
BFQ256A	SOT223	PNP		video amplifiers in monitors	796

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BFQ262	SOT32 (TO-126)	NPN		video amplifiers in monitors	800
BFQ262A	SOT32 (TO-126)	NPN		video amplifiers in monitors	800
BFQ263	SOT5 (TO-39)	NPN		video amplifiers in monitors	805
BFQ263A	SOT5 (TO-39)	NPN		video amplifiers in monitors	805
BFQ265	SOT128B	NPN		video amplifiers in monitors	810
BFQ265A	SOT128B	NPN		video amplifiers in monitors	810
BFQ268	SOT172A1	NPN		video amplifiers in monitors	814
BFQ268/I	SOT172A3	NPN		video amplifiers in monitors	814
BFQ270	SOT172A1	NPN		MATV/CATV	818
BFQ290	SOT172A1	PNP		HDTV video amplifiers	830
BFQ291	SOT172A1	NPN		HDTV video amplifiers	831
BFQ292	SOT32 (TO-126)	PNP		HDTV video amplifiers	832
BFQ293	SOT32 (TO-126)	NPN		HDTV video amplifiers	833
BFQ295	SOT128B	PNP		HDTV video amplifiers	834
BFQ296	SOT128B	NPN		HDTV video amplifiers	835
BFQ621	SOT172A1	NPN		MATV/CATV	836
BFQ741	SOT172A1	NPN		MATV/CATV	836
BFR53	SOT23	NPN	N1		838
BFR90	SOT37	NPN	BFR90/02	MATV/CATV	844
BFR90A	SOT37	NPN	BFR90A/02	MATV/CATV	849
BFR91	SOT37	NPN	BFR91/02	MATV/CATV	861
BFR91A	SOT37	NPN	BFR91A/02	MATV/CATV	866
BFR92	SOT23	NPN	P1p		878
BFR92A	SOT23	NPN	P2p		885
BFR92AW	SOT323	NPN	P2	cordless and cellular telephones; satellite TV tuners	900
BFR93	SOT23	NPN	R1p	cordless and cellular telephones; satellite TV tuners	901
BFR93A	SOT23	NPN	R2p	cordless and cellular telephones; satellite TV tuners	908
BFR93AW	SOT323	NPN	R2	cordless and cellular telephones; satellite TV tuners	923
BFR94A	SOT122E	NPN		MATV/CATV	924
BFR95	SOT5 (TO-39)	NPN		instrumentation	930
BFR96	SOT37	NPN	BFR96/02	MATV/CATV	933
BFR96S	SOT37	NPN	BFR96S/02	MATV/CATV	941
BFR106	SOT23	NPN	R7p	MATV/CATV	951
BFR134	SOT37	NPN		MATV/CATV	958
BFR505	SOT23	NPN	N30	cordless and cellular telephones; satellite TV tuners	970

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
BFR520	SOT23	NPN	N28	cordless and cellular telephones; satellite TV tuners	992
BFR521	SOT103	NPN		MATV/CATV	1014
BFR540	SOT23	NPN	N29	cordless and cellular telephones; satellite TV tuners	1015
BFR541	SOT103	NPN		MATV/CATV	1037
BFR591	SOT103	NPN		MATV/CATV	1038
BFS17	SOT23	NPN	E1p	TV tuners	1039
BFS17A	SOT23	NPN	E2p	TV tuners	1042
BFS17W	SOT323	NPN	E1	TV tuners	1049
BFS25A	SOT323	NPN	N6	pagers	1050
BFS505	SOT323	NPN	N0	pagers; cordless and cellular telephones	1069
BFS520	SOT323	NPN	N2	pagers; cordless and cellular telephones	1091
BFS540	SOT323	NPN	N4	pagers; cordless and cellular telephones; satellite TV tuners	1112
BFT24	SOT37	NPN		pagers; cordless and cellular telephones	1133
BFT25	SOT23	NPN	V1p		1141
BFT25A	SOT23	NPN	V10	pagers	1147
BFT92	SOT23	PNP	W1p	instrumentation	1162
BFT92W	SOT323	PNP	W1	instrumentation	1168
BFT93	SOT23	PNP	X1p	instrumentation	1169
BFT93W	SOT323	PNP	X1	instrumentation	1175
BFW16A	SOT5 (TO-39)	NPN		instrumentation	1176
BFW17A	SOT5 (TO-39)	NPN		instrumentation	1180
BFW30	TO-72	NPN			1183
BFW92	SOT37	NPN	BFW92/02	MATV	1186
BFW92A	SOT37	NPN	BFW92A/02	MATV	1189
BFW93	SOT37	NPN	BFW93/02	MATV	1196
BFY90	TO-72	NPN			1202
BLT10	SOT103	NPN		cordless telephones	1207
BLT11	SOT103	NPN		cordless telephones	1209
CR2424	SOT115C			video amplifiers in monitors	1211
CR2425	SOT115L			video amplifiers in monitors	1211
CR2427	SOT348			video amplifiers in monitors	1211
CR3424	SOT115C			video amplifiers in monitors	1216
CR3425	SOT115L			video amplifiers in monitors	1216
CR3427	SOT348			video amplifiers in monitors	1216

TYPE NUMBER	ENVELOPE	POLARITY	MARKING CODE	MAIN APPLICATION AREAS	PAGE
CR4424	SOT115C			video amplifiers in monitors	1220
CR4425	SOT115L			video amplifiers in monitors	1220
CR4427	SOT348			video amplifiers in monitors	1220
CR5527	SOT347			video amplifiers in monitors	1224
MPS3640	SOT54 (TO-92)	PNP		general purpose high-speed switching	1226
MPSH10	SOT54 (TO-92)	NPN		general purpose high-speed switching	1228
MPSH81	SOT54 (TO-92)	PNP		general purpose high-speed switching	1232
OM976	SOT115L			video amplifiers in monitors	1236
PMBT3640	SOT23	PNP	V25	general purpose high-speed switching	1239
PMBTH10	SOT23	NPN	V30	general purpose high-speed switching	1241
PMBTH81	SOT23	PNP	V31	general purpose high-speed switching	1245
X3A-BFG134	CRYSTAL	NPN		hybrids	1249
X3A-BFQ32	CRYSTAL	PNP		hybrids	1250
X3A-BFQ33	CRYSTAL	NPN		hybrids	1251
X3A-BFQ34	CRYSTAL	NPN		hybrids	1252
X3A-BFQ65	CRYSTAL	NPN		hybrids	1253
X3A-BFQ168	CRYSTAL	NPN		hybrids	1254
X3A-BFQ195	CRYSTAL	NPN		hybrids	1255
X3A-BFQ234	CRYSTAL	NPN		(video) hybrids	1256
X3A-BFQ254	CRYSTAL	PNP		(video) hybrids	1257
X3A-BFQ268	CRYSTAL	NPN		(video) hybrids	1258
X3A-BFR90A	CRYSTAL	NPN		hybrids	1259
X3A-BFR91A	CRYSTAL	NPN		hybrids	1260
X3A-BFR96	CRYSTAL	NPN		hybrids	1261
X3A-BFR505	CRYSTAL	NPN		hybrids	1262
X3A-BFR520	CRYSTAL	NPN		hybrids	1263
X3A-BFR540	CRYSTAL	NPN		hybrids	1264
X3A-BFT92	CRYSTAL	PNP		hybrids	1265
X3A-BFT93	CRYSTAL	PNP		hybrids	1266
X3A-BFW92	CRYSTAL	NPN		hybrids	1267

GENERAL

QUALITY

Total Quality Management

Philips Semiconductors are a Quality Company, renowned for the high quality of our products and service. We keep alive this tradition by constantly aiming towards one ultimate standard, that of zero defects. This aim is guided by our Total Quality Management (TQM) system, the basis of which is:

quality assurance

based on ISO 9000 standards, customer standards such as Ford Q1 and IBM MDQ, and the CECC system of conformity. Our factories are certified to ISO 9000 and CECC by external inspectorates

partnerships with customers

PPM co-operations, design-in agreements, and ship-to-stock, just-in-time and self-qualification programmes

partnerships with suppliers

ship-to-stock, statistical process control and ISO 9000 audits

quality improvement programme

continuous process and system improvement, design improvement, complete use of statistical process control, realization of our final objective of zero defects, and logistics improvement by ship-to-stock and just-in-time agreements.

Advanced quality planning

During the design and development of new products and processes, quality is built-in by advanced quality planning. Through failure-mode-and-effect analysis the critical parameters are detected and measures taken to ensure good performance on these parameters. The capability of process steps is also planned in this phase.

Product conformance

The assurance of product conformance is an integral part of our quality assurance (QA) practice. This is achieved by:

- incoming material management through partnerships with suppliers
- in-line quality assurance to monitor process reproducibility during manufacture and initiate any necessary corrective action. Critical process steps are 100% under statistical process control
- acceptance tests on finished products to verify conformance with the device specification. The test results are used for quality feedback and corrective actions. The inspection and test requirements are detailed in the general quality specifications
- periodic inspections to monitor and measure the conformance of products.

Product reliability

With the increasing complexity of OEM (original equipment manufacturer) equipment, component reliability must be extremely high. Our research laboratories and development departments study the failure mechanisms of semiconductors. Their studies have resulted in design rules and process optimization for the highest built-in product reliability. Highly accelerated tests are applied to the products reliability evaluation. Rejects from reliability tests and from customer complaints are submitted to failure analysis, to result in corrective action.

Customer responses

Our quality improvement depends on joint action with our customer. We need our customer's inputs and we invite constructive comments on all aspects of our performance. Please contact our local sales representative.

QUALITY TESTING

The TQM system of Philips Semiconductors ensures that quality is built-in during the design, development and manufacturing stages of semiconductors. In TQM, quality testing continuously verifies product conformance to the specifications and to product reliability.

Conformance test programmes

ACCEPTANCE TESTS (GROUP A TESTS)

Acceptance tests on finished products verify conformance to the final device specification. The test results are used for quality feedback and corrective actions.

PERIODIC INSPECTIONS (GROUP B TESTS)

These measure and monitor the conformance of final products to the required level of quality for processing in OEM assembly lines.

Table 1 Overview of group A tests (acceptance tests per lot)

EXAMINATION/TEST		CECC 50 000 REFERENCE	INSPECTION REQUIREMENTS	
SUBGROUP	DESCRIPTION		LEVEL	AQL (note 1)
A1	inoperative: visual/mechanical	4.2.1	II	0.1
A2a	inoperative: electrical	4.3.4	II	0.1
A2b	electrical: primary DC	4.3.4	II	0.1
A3	electrical: other DC	4.3.4	II	0.65
A4	electrical: AC	4.3.4	S4	1.0
A5	visual inspection	–	I	0.65

Note

1. Average quality level (AQL) refers to sample sizes and is not an indication of the quality of the product.

Table 2 Overview of group B tests (periodic inspections per lot)

EXAMINATION/TEST		CECC 50 000 REFERENCE	INSPECTION REQUIREMENTS	
SUBGROUP	DESCRIPTION		n (note 1)	c (note 2)
B1	dimensions (possibly checked with gauge)	4.2.2	20	0
B2a	characteristic inspection	4.3.3	20	0
B2b	complementary characteristics	4.3.3 and 4.3.4	20	0
B3	robustness of terminations, bending	4.4.9	20	0
B4	solderability, initial (0 h) and after ageing	4.4.7	20	0
B5	temperature cycling plus accelerated damp heat or sealing	4.4.4 plus 4.4.2 or 4.4.10	25	0
B8	electrical endurance (168 h)	4.5	30	0
B12	permanence of marking	4.4.12	15	0

Notes

1. n = sample size.
2. c = acceptance criterion.

QUARTERLY INSPECTIONS (GROUP C TESTS)

These measure and monitor the conformance of final products to the required level of reliability. Their purpose is to identify reliability performance trends and to collect data of failure rates and failure modes.

Table 3 Overview of group C tests (quarterly inspections for maintenance of qualification)

EXAMINATION/TEST		CECC 50 000 REFERENCE	INSPECTION REQUIREMENTS	
SUBGROUP	**DESCRIPTION**		**n (note 1)**	**c (note 2)**
C1	dimensions	4.2.2	20	0
C2a	characteristic inspection	4.3.3	20	0
C2b	complementary characteristics	4.3.3 and 4.3.4	20	0
C2c	verification of maximum ratings	4.3.4	15	0
C3	robustness of terminations other than B3	4.4.9	10	0
C4	soldering heat	4.4.8	20	0
C5	temperature cycling plus accelerated damp heat or sealing	4.4.4 plus 4.4.2 or 4.4.10	25	0
C6	mechanical treatment (shock and/or acceleration and/or vibration)	4.4.5, 4.4.11, 4.4.6	10	0
C7a	damp heat (cyclic) including check on solderability	4.4.2	20	0
C7b	reverse bias tropical at 85 °C, 85% RH for 1000 h	4.4.3	20	0
C8	endurance at maximum ratings, performed per test (1000 h)	4.5	30	0
C9	storage at high temperature (1000 h)	4.4.1	30	0

Notes

1. n = sample size.
2. c = acceptance criterion.

QUALIFICATION TESTS (GROUP D TESTS)

These are reliability tests to assess new or modified products or manufacturing processes.

Table 4 Overview of group D tests (qualification tests)

EXAMINATION/TEST		INSPECTION REQUIREMENTS	
SUBGROUP	**DESCRIPTION**	**n (note 1)**	**c (note 2)**
D8	endurance at maximum ratings, performed per test (> 1000 h)	30	1
D9	storage at high temperatures (> 1000 h)	30	1
D10	storage at low temperatures (> 1000 h)	30	1
D11	HAST test (unsaturated) 133 °C, 85% RH, 48 h with bias	25	1
D12	thermal shock, liquid to liquid	25	1
D13	passive flammability	25	1
D14	electrostatic discharge investigation	–	–

Notes

1. n = sample size.
2. c = acceptance criterion.

THE CECC SYSTEM

The objective of the CECC system is stated as:
'... to facilitate international trade by the publication of specifications and quality assessment procedures for electronic components and by the grant of an internationally recognized Mark and/or Certificate, of Conformity. The components produced under this system are thereby acceptable by all member countries without further testing.'

There are 15 member countries of CECC: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

CECC specifications

Harmonization of specifications greatly reduces the variety of test methods and specifications of both manufacturers and users of electronic components. This harmonization takes place on:

- testing and sampling methods
- blank detail specifications, which give the standard presentation and requirements for the detail specifications of a family of components
- detail specifications of specific components.

CECC approvals

Before components can be supplied with CECC approval, the factories producing these components must have CECC manufacturer approval. For this type of approval the certification to ISO 9000 is used.

There are two types of product approval:

qualification approval	this is the approval for one component of a specific type. Approval is granted after a series of fixed tests have been successfully completed and the results have been approved by the National Supervising Inspectorate
capability approval	this is the approval for a group of components sharing a common technology. From this group a number of 'capability qualifying components' are chosen as relevant for the technological domain and represent the group in tests as in the qualification approval.

Components with CECC approval are registered in the qualified products list, CECC 00200. Products are delivered in a sealed package with the CECC mark of conformity. The sealed package may only be opened by an approved distributor.

Policy towards CECC approvals

A key element of our quality policy is the securing of CECC approval for all standard products and all production centres.

For us, CECC's comprehensive system of quality assurance and result-reporting is another aid in our quest for zero defects.

For our customers, the benefits of CECC approval are:

- a guarantee of the quality of our components
- evidence of our highly developed QA system
- knowledge that our products are ship-to-stock capable.

PRO ELECTRON TYPE NUMBERING SYSTEM

Basic type number

This type designation code applies to discrete semiconductor devices (not integrated circuits), multiples of such devices, semiconductor chips and Darlington transistors.

FIRST LETTER

The first letter gives information about the material for the active part of the device.

- A germanium or other material with a band gap of 0.6 to 1 eV
- B silicon or other material with a band gap of 1 to 1.3 eV
- C gallium arsenide (GaAs) or other material with a band gap of 1.3 eV or more
- R compound materials, e.g. cadmium sulphide.

SECOND LETTER

The second letter indicates the function for which the device is primarily designed. The same letter can be used for multi-chip devices with similar elements.
In the following list low power types are defined by $R_{th\ j\text{-}mb} > 15$ K/W and power types by $R_{th\ j\text{-}mb} \leq 15$ K/W.

- A diode; signal, low power
- B diode; variable capacitance
- C transistor; low power, audio frequency
- D transistor; power, audio frequency
- E diode; tunnel
- F transistor; low power, high frequency
- G multiple of dissimilar devices/miscellaneous devices; e.g. oscillators. Also with special third letter, see under '*Serial number*'
- H diode; magnetic sensitive
- L transistor; power, high frequency
- N photocoupler
- P radiation detector; e.g. high sensitivity photo-transistor; with special third letter
- Q radiation generator; e.g. LED, laser; with special third letter
- R control or switching device; e.g. thyristor, low power; with special third letter
- S transistor; low power, switching
- T control and switching device; e.g. thyristor, power; with special third letter
- U transistor; power, switching
- W surface acoustic wave device
- X diode; multiplier, e.g. varactor, step recovery
- Y diode; rectifying, booster
- Z diode; voltage reference or regulator, transient suppressor diode; with special third letter.

SERIAL NUMBER/SPECIAL THIRD LETTER

The number comprises three figures running from 100 to 999 for devices primarily intended for consumer equipment, or one letter (Z, Y, X, etc.) and two figures running from 10 to 99 for devices primarily intended for industrial or professional equipment.(1) The letter has no fixed meaning, except in the following cases:

- A for triacs, after second letter 'R' or 'T'
- F for emitters and receivers in fibre-optic communication, after second letter 'G', 'P' or 'Q'. When the second letter is 'G', the first letter should be defined in accordance with the material of the main optical device.
- L for lasers in non-fibre-optic applications, after second letter 'G' or 'Q'. When the second letter is 'G', the first letter should be defined in accordance with the material of the main optical device.
- O for opto-triacs, after second letter 'R'
- T for 3-state bicolour LEDs, after second letter 'Q'
- W for transient voltage suppressor diodes, after second letter 'Z'.

(1) When the supply of these serial numbers is exhausted, the serial number may be expanded to three figures for industrial types and four figures for consumer types.

EXAMPLES OF BASIC TYPE NUMBERS

AA112	germanium, low power signal diode (consumer type)
ACY32	germanium, low power AF transistor (industrial type)
BD232	silicon, power AF transistor (consumer type)
CQY17	GaAs, light-emitting diode (industrial type)
RPY84	CdS, photo-conductive cell (industrial type).

Version letter(s)

One or two letters may be added to the basic type number to indicate minor electrical or mechanical variants of the basic type. The letters never have a fixed meaning, except that the letter 'R' indicates reverse polarity and the letter 'W' indicates a surface mounted device (SMD).

Suffix

Sub-classification can be used for devices supplied in a wide range of variants, called associated types. The following sub-coding suffixes are in use:

VOLTAGE REFERENCE AND VOLTAGE REGULATOR DIODES

One letter and one number, preceded by a hyphen (-). The letter, if required, indicates the nominal tolerance of the Zener voltage.

A 1%

B 2%

C 5%

D 10%

E 20%

In the case of a 3% tolerance, the letter 'F' is used.

The number denotes the typical operating (Zener) voltage, related to the nominal current rating for the entire range. The letter 'V' is used in place of the decimal point.

Example: BZY74-C6V3 or -C10.

TRANSIENT VOLTAGE SUPPRESSOR DIODES

One number, preceded by a hyphen (-). The number indicates the maximum recommended continuous reversed (stand-off) voltage, V_R. The letter 'V' is used in place of the decimal point.

Example: BZW70-9V1 or –39.

The letter 'B' may be used immediately after the last number, to indicate a bidirectional suppressor diode.

Example: BZW10-15B.

CONVENTIONAL AND CONTROLLED AVALANCHE RECTIFIER DIODES AND THYRISTORS

One number, preceded by a hyphen (-). The number indicates the rated maximum repetitive peak reverse voltage, V_{RRM}, or the rated repetitive peak off-state voltage, V_{DRM}, whichever is the lower. Reversed polarity with respect to the case is indicated by the letter 'R' immediately after the number.

Example: BYT-100 or -100R.

RADIATION DETECTORS

One number, preceded by a hyphen (-). The number indicates the depletion layer in micrometres (μm). The resolution is indicated by a version letter.

Example: BPX10-2A.

ARRAY OF RADIATION DETECTORS AND GENERATORS

One number, preceded by a hyphen (-). The number indicates the number of basic devices assembled into the array.

Examples: BPW50-6, BPW50-9, BPW50-12.

HIGH FREQUENCY POWER TRANSISTORS

One number, preceded by a hyphen (-). The number indicates the supply voltage.

Example: BLU80-24.

RATING SYSTEMS

The rating systems described are those recommended by the IEC in its publication number 134.

Definitions of terms used

ELECTRONIC DEVICE

An electronic tube or valve, transistor or other semiconductor device. This definition excludes inductors, capacitors, resistors and similar components.

CHARACTERISTIC

A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

BOGEY ELECTRONIC DEVICE

An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics that are directly related to the application.

RATING

A value that establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms. Limiting conditions may be either maxima or minima.

RATING SYSTEM

The set of principles upon which ratings are established and which determine their interpretation. The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type, as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout the life of the device, no absolute maximum value for the intended service is exceeded with any device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Design maximum rating system

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout the life of the device, no design maximum value for the intended service is exceeded with a bogey electronic device, under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design centre rating system

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS

The letter symbols for transistors detailed in this section are based on IEC publication number 148.

Basic letters

In the representation of currents, voltages and powers, lower-case letter symbols are used to indicate all instantaneous values that vary with time. All other values are represented by upper-case letters.

Electrical parameters[(1)] of external circuits and of circuits in which the device forms only a part are represented by upper-case letters. Lower-case letters are used for the representation of electrical parameters inherent in the device. Inductances and capacitances are always represented by upper-case letters.

The following is a list of basic letter symbols used with semiconductor devices:

B, b	susceptance (imaginary part of an admittance)
C	capacitance
G, g	conductance (real part of an admittance)
H, h	hybrid parameter
I, i	current
L	inductance
P, p	power
R, r	resistance (real part of an impedance)
V, v	voltage
X, x	reactance (imaginary part of an impedance)
Y, y	admittance
Z, z	impedance.

Subscripts

Upper-case subscripts are used for the indication of:

- continuous (DC) values (without signal), e.g. I_B
- instantaneous total values, e.g. i_B
- average total values, e.g. $I_{B(AV)}$
- peak total values, e.g. I_{BM}
- root-mean-square total values, e.g. $I_{B(RMS)}$.

Lower-case subscripts are used for the indication of values applying to the varying component alone:

- instantaneous values, e.g. i_b
- root-mean-square values, e.g. $I_{b(rms)}$
- peak values, e.g. I_{bm}
- average values, e.g. $I_{b(av)}$.

The following is a list of subscripts used with basic letter symbols for semiconductor devices:

A, a	anode
amb	ambient
(AV), (av)	average value
B, b	base
(BO)	breakover
(BR)	breakdown
case	case
C, c	collector
C	controllable
D, d	drain
E, e	emitter
F, f	fall, forward (or forward transfer)
G, g	gate
H	holding
I, i	input
j-a	junction to ambient
j-mb	junction to mounting base
K, k	cathode
L	load
M, m	peak value
min	minimum
max	maximum
mb	mounting base
O, o	as third subscript: the terminal not mentioned is open-circuit
(OV)	overload
P, p	pulse
Q, q	turn-off

(1) For the purpose of this publication, the term 'electrical parameters' applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

R, r	as first subscript: reverse (or reverse transfer), rise. As second subscript: repetitive, recovery. As third subscript: with a specified resistance between the terminal not mentioned and the reference terminal
(RMS), (rms)	root-mean-square value
S, s	as first subscript: series, source, storage, stray, switching. As second subscript: surge (non-repetitive). As third subscript: short circuit between the terminal not mentioned and the reference terminal
stg	storage
th	thermal
TO	threshold
tot	total
W	working
X, x	specified circuit
Z, z	reference or regulator (zener)
1	input (four-pole matrix)
2	output (four-pole matrix).

Applications and examples

TRANSISTOR CURRENTS

The first subscript indicates the terminal carrying the current (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}.

TRANSISTOR VOLTAGES

A voltage is indicated by the first two subscripts: the first identifies the terminal at which the voltage is measured and the second the reference terminal or the circuit node. The second subscript may be omitted when there is no possibility of confusion.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}.

SUPPLY VOLTAGES OR CURRENTS

Supply voltages or supply currents are indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}.

A reference terminal is indicated by a third subscript.

Example: V_{CCE}.

DEVICES WITH MORE THAN ONE TERMINAL OF THE SAME KIND

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal, followed by a number. Hyphens may be used to avoid confusion in multiple subscripts.

Examples:

I_{B2}	continuous (DC) current flowing into the second base terminal
V_{B2-E}	continuous (DC) voltage between the terminals of second base and emitter.

MULTIPLE DEVICES

For multiple unit devices, the subscripts are modified by a number preceding the letter subscript. Hyphens may be used to avoid confusion in multiple subscripts.

Examples:

I_{2C}	continuous (DC) current flowing into the collector terminal of the second unit
V_{1C-2C}	continuous (DC) voltage between the collector terminals of the first and second units.

ELECTRICAL PARAMETERS

The upper-case variant of a subscript is used for the designation of static (DC) values.

Examples:

h_{FE}	static value of forward current transfer ratio in common-emitter configuration (DC current gain)
R_E	DC value of the external emitter resistance.

The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript is used for the designation of small-signal values.

Examples:

h_{fe}	small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$Z_e = R_e + jX_e$	small-signal value of the external impedance.

If more than one subscript is used, subscripts for which a choice of style is allowed, the subscripts chosen are all upper-case or all lower-case.

Example: h_{FE}, y_{RE}, h_{fe}.

FOUR-POLE MATRIX PARAMETERS

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer.

Examples: h_i (or h_{11}), h_o (or h_{22}), h_f (or h_{21}), h_r (or h_{12}).

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E}).

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts are used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$, $y_{fe} = g_{fe} + jb_{fe}$.

If such symbols do not exist or are not suitable, the notation shown in the following examples is used.

Examples:

Re (h_{ib}) etc. for the real part of h_{ib}

Im (h_{ib}) etc. for the imaginary part of h_{ib}.

S-PARAMETER DEFINITIONS

The S-parameter symbols in this section are based on IEC publication 747-7.

S-parameters (return losses or reflection coefficients) of a module can be defined as the S_{11} and the S_{22} of a two-port network (see Fig.1).

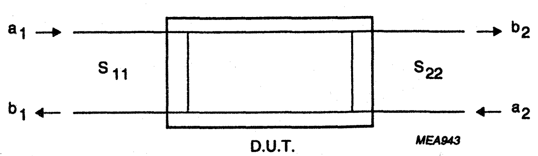


Fig.1 Two-port network with reflection coefficients S_{11} and S_{22}.

$$b_1 = S_{11} \cdot a_1 + S_{12} \cdot a_2 \quad (1)$$

$$b_2 = S_{21} \cdot a_1 + S_{22} \cdot a_2 \quad (2)$$

where

$$a_1 = \frac{1}{2 \cdot \sqrt{Z_o}} \cdot (V_1 + Z_o \cdot i_1) = \text{signal into port 1} \quad (3)$$

$$a_2 = \frac{1}{2 \cdot \sqrt{Z_o}} \cdot (V_2 + Z_o \cdot i_2) = \text{signal into port 2} \quad (4)$$

$$b_1 = \frac{1}{2 \cdot \sqrt{Z_o}} \cdot (V_1 + Z_o \cdot i_1) = \text{signal out of port 1}$$

$$b_2 = \frac{1}{2 \cdot \sqrt{Z_o}} \cdot (V_2 + Z_o \cdot i_2) = \text{signal out of port 2}$$

From (1) and (2) formulae for the return losses can be derived:

$$S_{11} = \frac{b_1}{a_1} \mid a_2 = 0 \quad (5)$$

$$S_{22} = \frac{b_2}{a_2} \mid a_1 = 0 \quad (6)$$

In (5), $a_2 = 0$ means output port terminated with Z_o (derived from formula (4)).

In (6), $a_1 = 0$ means input port terminated with Z_o (derived from formula (3)).

Measurement

The return losses are measured with a network analyzer after calibration, where the influence of the test jig is eliminated. The necessary termination of the other port with Z_o is done automatically by the network analyzer.

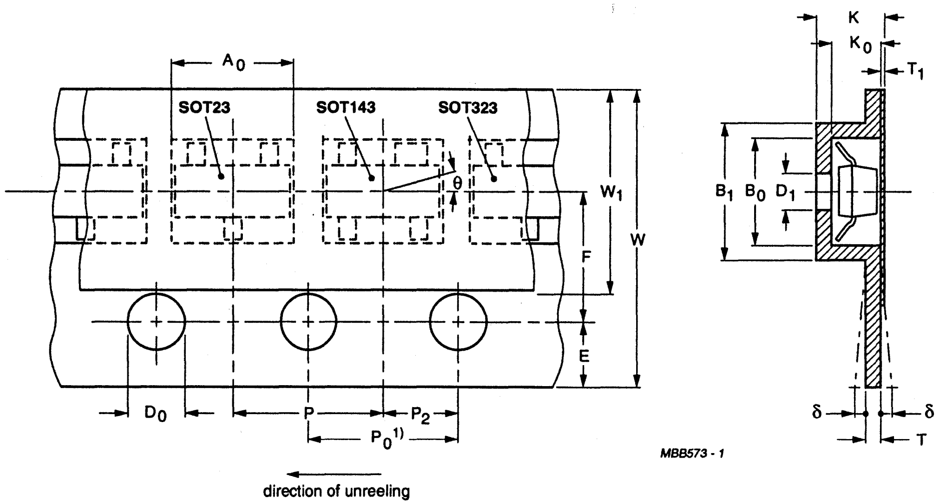
The network analyzer must have a directivity of at least 40 dB to obtain an accuracy of 0.5 dB when measuring return loss figures of 20 dB. A full two-port correction method can be used to improve the accuracy.

TAPE and REEL PACKING

Tape and reel packing meets the feed requirements of automatic pick and place equipment (packing conforms to IEC publication 286). The tape is an ideal shipping container, making handling easy and providing secure blister cavities in which the transistors are sealed with peel-off cover tape.

All components are placed with mounting side downwards in the compartments.

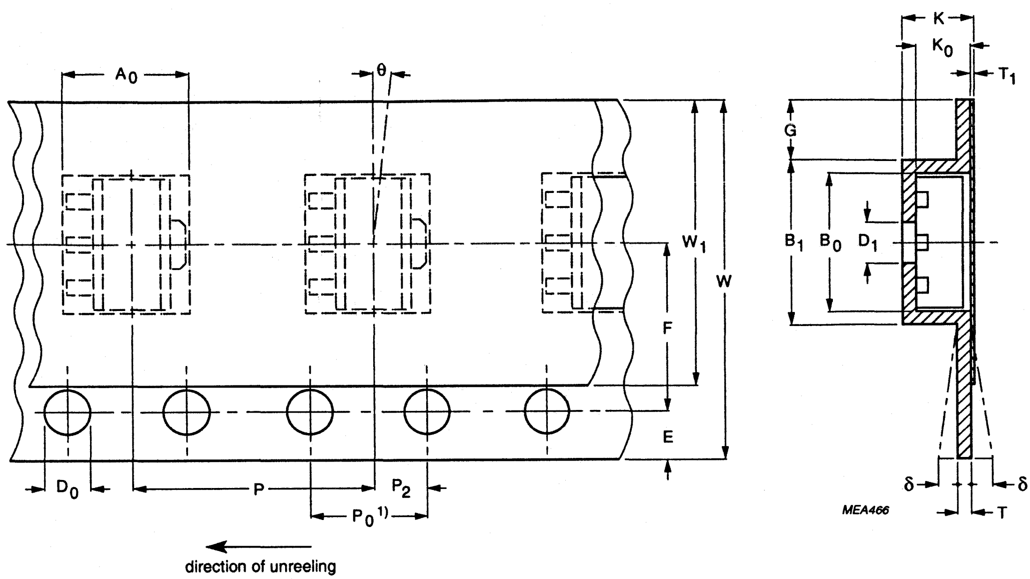
SOT23	8 mm tape, 7- or 13-inch reels
SOT143	8 mm tape, 7- or 13-inch reels
SOT323	8 mm tape, 7- or 13-inch reels
SOT89	12 mm tape, 7-inch reels
SOT223	12 mm tape, 7-inch reels
SOT173X	12 mm tape, 7-inch reels
SOT173	16 mm tape, 7-inch reels



For dimensions see Table 5.

1) Tolerance over any 10 pitches: ±0.2 mm.

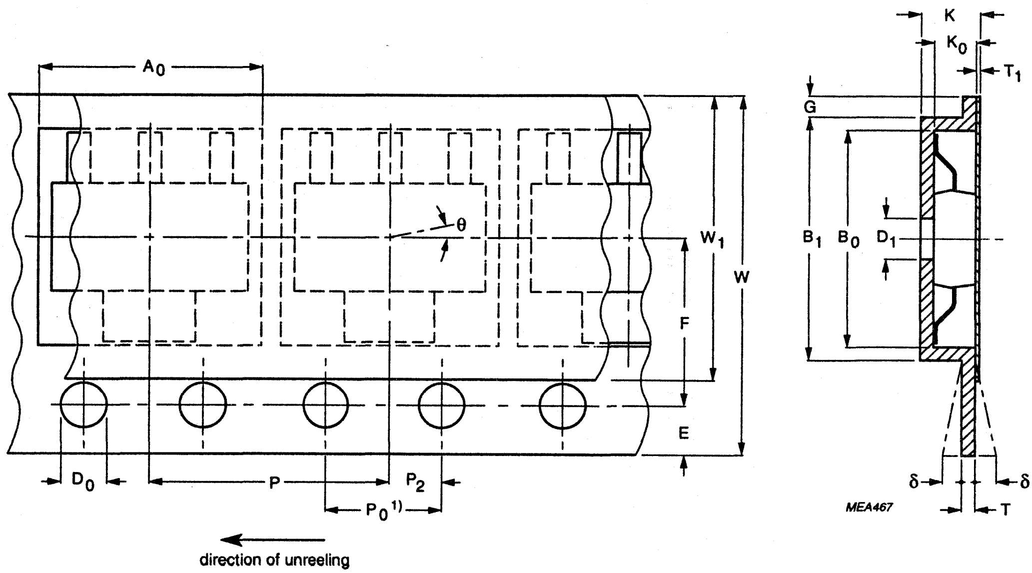
Fig.2 Specification for 8 mm tape (SOT23, SOT143 and SOT323).



For dimensions see Table 5.

1) Tolerance over any 10 pitches: ±0.2 mm.

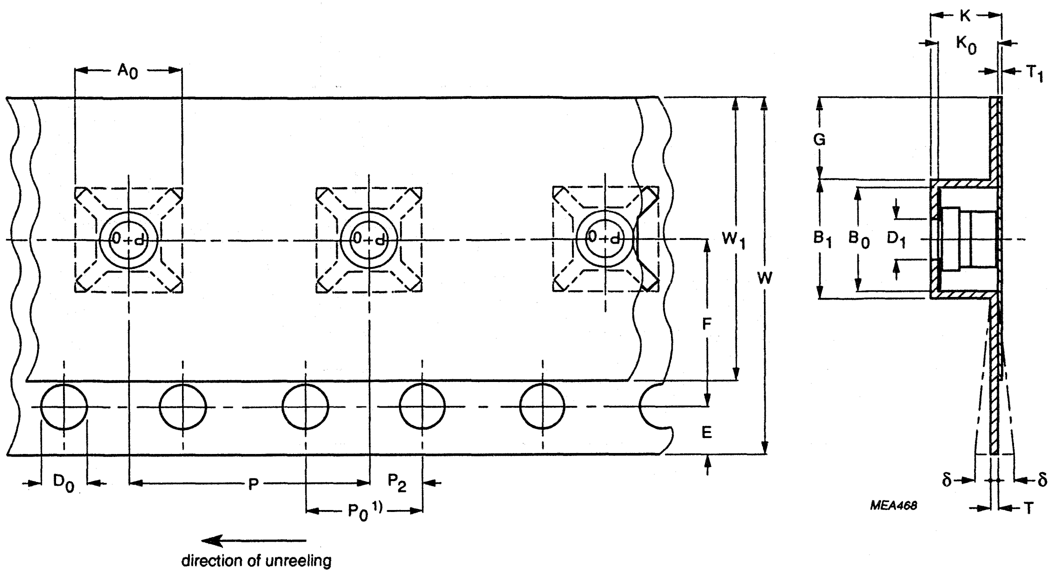
Fig.3 Specification for 12 mm tape (SOT89).



For dimensions see Table 5.

1) Tolerance over any 10 pitches: ±0.2 mm.

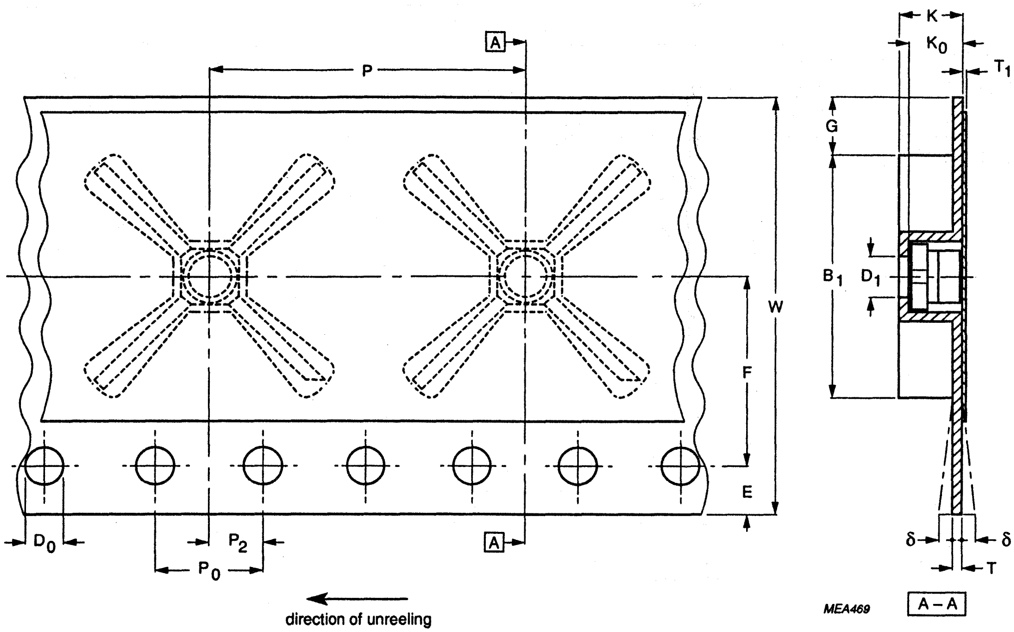
Fig.4 Specification for 12 mm tape (SOT223).



For dimensions see Table 5.

1) Tolerance over any 10 pitches: ±0.2 mm.

Fig.5 Specification for 12 mm tape (SOT173X).



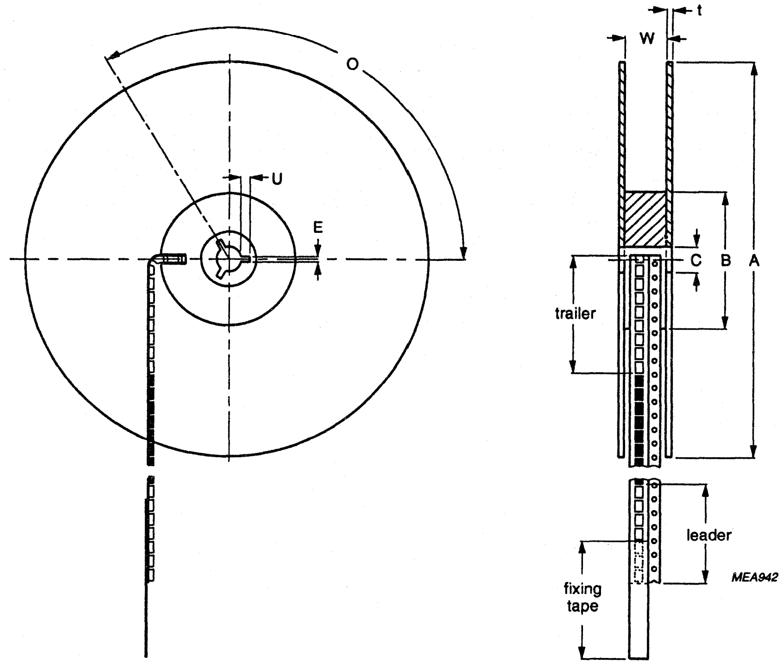
For dimensions see Table 5.

1) Tolerance over any 10 pitches: ±0.2 mm.

Fig.6 Specification for 16 mm tape (SOT173).

Table 5 Tape dimensions (in mm)

DIMENSION (Figs 2 to 6)	CARRIER TAPE FOR:					TOLERANCE
	SOT23 SOT143 SOT323	SOT89	SOT223	SOT173X	SOT173	
Overall dimensions						
W	8.0	12.0	12.0	12.0	16.0	±0.2
K	1.5	2.4	2.0	2.25	2.2	max.
G	–	1.8	0.75	2.75	1.65	min.
Sprocket holes						
D_0	1.5	1.5	1.5	1.5	1.5	+0.1/–0
E	1.75	1.75	1.75	1.75	1.75	±0.1
P_0	4.0	4.0	4.0	4.0	4.0	±0.1
Relative placement compartment						
P_2	2.0	2.0	2.0	2.0	2.0	±0.1
F	3.5	5.5	5.5	5.5	7.5	±0.05
Compartment						
A_0	component + 0.2	component + 0.2	component + 0.2	3.5 + 0.1	–	–
B_0	component + 0.2	component + 0.2	component + 0.2	3.5 + 0.1	–	–
B_1	3.3	5.7	8.0	4.0	10.2	max.
K_0	0.95 + 0.2	component	component	2 ±0.1	1.8 ±0.1	–
D_1	1.0	1.5	1.5	1.5	1.5	min.
P	4.0	8.0	8.0	8.0	12.0	±0.1
θ	15°	5°	5°	–	–	max.
Cover tape						
W_1	5.5 ±0.25	9.5 max.	9.5 max.	9.35 max.	–	–
T_1	0.1	0.1	0.1	0.062	–	max.
Carrier tape						
W	8.0	12.0	12.0	12.0	16.0	±0.2
T	0.4	0.4	0.4	0.25	0.4	max.
δ	0.3	0.3	0.3	0.3	0.3	max.



For dimensions see Table 6.

Fig.7 Reel specification.

Table 6 Reel dimensions (in mm)

DIMENSION (Fig.7)	8 mm tape	12 mm tape	16 mm tape
Flange			
A	180	180	180
t	1.5	1.5	1.5
W	9.5	14.0	18.0
Hub			
B	62	62	62
C	12.75	12.75	12.75
Key slot			
E	2	2	2
U	4	4	4
O	120°	120°	120°

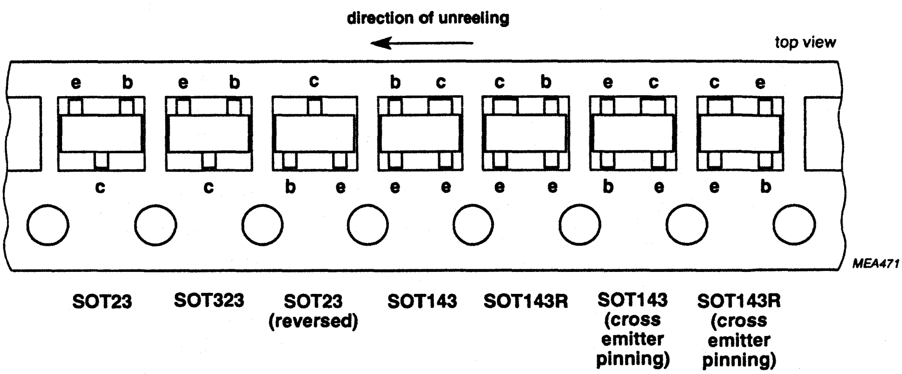


Fig.8 Orientation of components: SOT23, SOT143, SOT323 (8 mm tape).

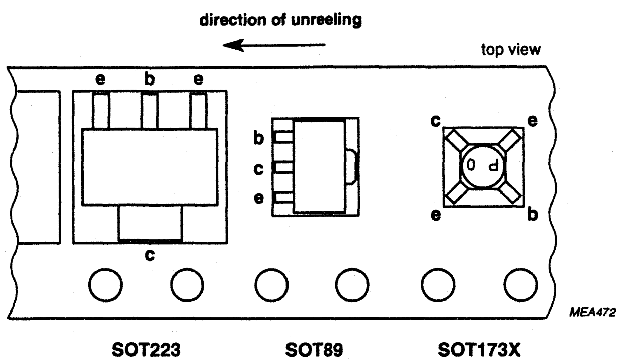
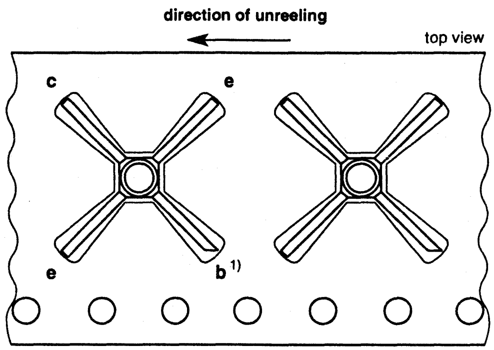


Fig.9 Orientation of components: SOT223, SOT89, SOT173X (12 mm tape).



1) Base connection indicated by red dot on body.

Fig.10 Orientation of components: SOT173 (16 mm tape).

Table 7 Packing quantities per reel

PACKAGE	TAPE WIDTH (mm)	REEL SIZE (inches)	QUANTITY PER REEL	12NC (note 1) ends with:
SOT23	8	7	3000	...215
		13	10 000	...235
SOT23 (reversed)		7	3000	...225
SOT143 SOT143R SOT143 (cross emitter pinning) SOT143R (cross emitter pinning)	8	7	3000	...215 (note 2)
SOT143 SOT143 (cross emitter pinning) SOT143R (cross emitter pinning)	8	13	10 000	...235 (note 2)
SOT323	8	7	3000	...315
		13	10 000	...315
SOT89	12	7	1000	...115
SOT223	12	7	1000	...115
SOT173X	12	7	1000	...115
SOT173	16	7	1000	...145

Notes

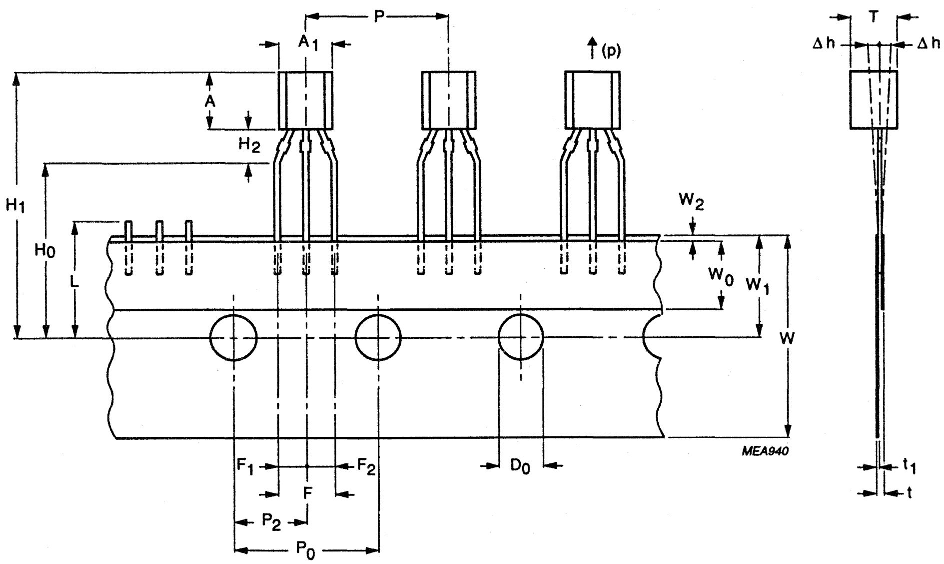
1. 12NC is the Philips twelve-digit ordering code.
2. Distinction between the pinning variants is made by the first nine digits of the 12NC.

TO-92 transistors on tape

TO-92 transistors are supplied on tape in boxes (ammopacks) or on reels. The number per ammopack or per reel is 2000. Each ammopack has 80 layers of 25 transistors. Following the 25th transistor in each layer is an empty position that allows the layer to fold correctly. The maximum number of empty positions per tape is not more than 0.5% of the total number of transistors per tape, and a maximum of three consecutive transistors may be missing provided that this gap is followed by six consecutive transistors.

The ammopack is accessible from both sides to enable the user to choose 'normal' or 'reverse' tape. 'Normal' is indicated by a plus sign (+) on the ammopack and 'reverse' by a minus sign (–). Orientation of the TO-92 package is such that its flat side is the upper side of the tape.

Tape splicing is permitted: splice the tape on the back and/or front so the feed hole pitch is maintained (see Fig. 13).



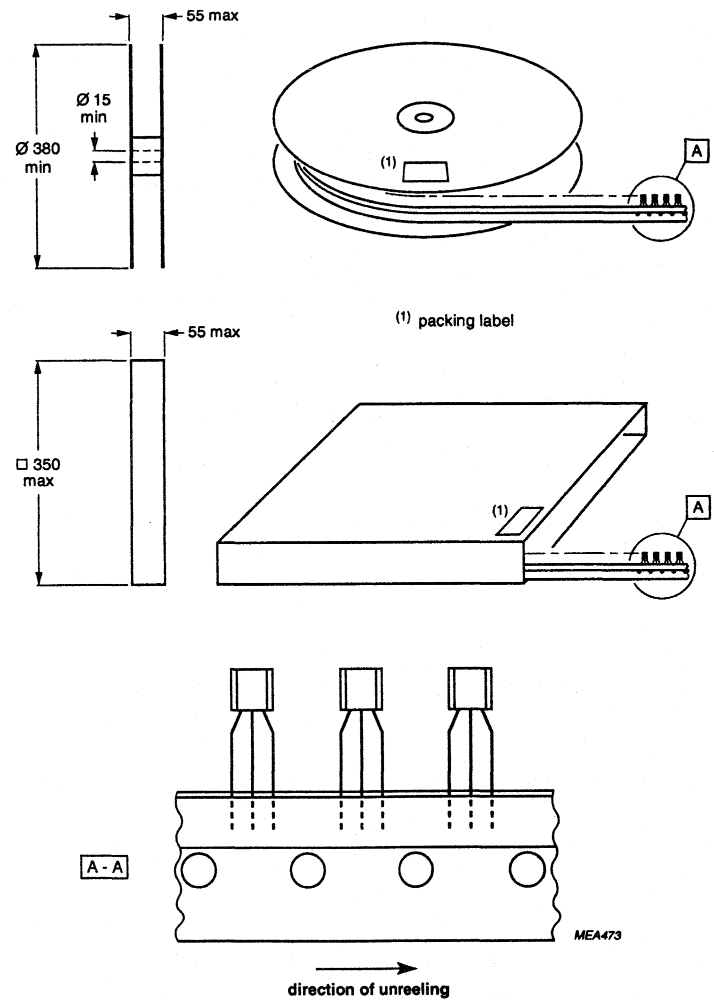
For dimensions see Table 8.

1) Tolerance over any 20 pitches: ±1.0 mm.

Fig.11 Specification for TO-92 tape.

Table 8 TO-92 tape dimensions

DIMENSION (Fig.11)	DESCRIPTION	MIN.	TYP.	MAX.	TOL.	UNIT
A_1	body width	4.0	–	4.8	–	mm
A	body height	4.8	–	5.2	–	mm
T	body thickness	3.9	–	4.2	–	mm
P	pitch of component	–	12.7	–	±1	mm
P_0	feed hole pitch	–	12.7	–	±0.3	mm
P_2	feed hole centre to component centre (measured at bottom of clinch)	–	6.35	–	±0.4	mm
F	distance between outer leads	–	5.08	–	+0.6/–0.2	mm
Δh	component alignment at top of body	–	0	1.0	–	mm
W	tape width	–	18.0	–	±0.5	mm
W_0	hold-down tape width	–	6.0	–	±0.2	mm
W_1	hole position	–	9.0	–	+0.7/–0.5	mm
W_2	hold-down tape position	–	0.5	–	±0.2	mm
H_0	lead wire clinch height	–	16.5	–	±0.5	mm
H_1	component height	–	–	23.25	–	mm
L	length of snipped leads	–	–	11.0	–	mm
D_0	feed hole diameter	–	4.0	–	±0.2	mm
t	total tape thickness (t_1 = 0.3 to 0.6)	–	–	1.2	–	mm
F_1, F_2	lead-to-lead distance	–	2.54	–	+0.4/–0.2	mm
H_2	clinch height	–	–	3.0	–	mm
(p)	pull-out force	6.0	–	–	–	N



Dimensions in mm.

Fig.12 Dimensions of reel and ammopack.

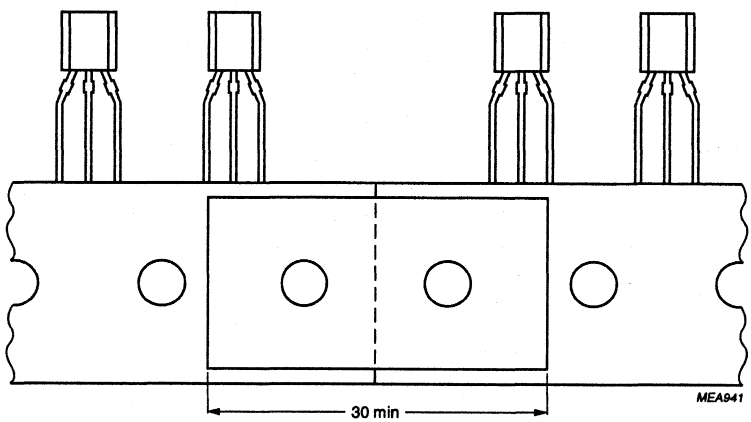


Fig.13 Splicing tape with jointing patch.

MOUNTING AND SOLDERING

Mounting methods

There are two basic forms of electronic component construction, those with leads for through-hole mounting and microminiature types for surface mounting (SMD). Through-hole mounting gives a very rugged construction and uses well established soldering methods. Surface mounting has the advantages of high packing density plus high-speed automated assembly. Surface mounting techniques are complex and this chapter gives only a simplified overview of the subject.

Although many electronic components are available as surface mounting types, some are not and this often leads to the use of through-hole as well as surface mounting components on one substrate (a mixed print). The mix of components affects the soldering methods that can be applied. A substrate having SMDs mounted on one or both sides but no through-hole components is likely to be suitable for reflow or wave soldering. A double sided mixed print that has through-hole components and some SMDs on one side and densely packed SMDs on the other normally undergoes a sequential combination of reflow and wave soldering. When the mixed print has only through-hole components on one side and all SMDs on the other, wave soldering is usually applied.

Reflow soldering

This is the preferred soldering technique for SOT23, SOT89, SOT143, SOT173, SOT173X, SOT223 and SOT323 components.

SOLDER PASTE

Most reflow soldering techniques utilize a paste that is a mixture of flux and solder. The solder paste is applied to the substrate before the components are placed. It is of sufficient viscosity to hold the components in place and, therefore, an application of adhesive is not required. Drying of the solder paste by preheating increases the viscosity and prevents any tendency for the components to become displaced during the soldering process. Preheating also minimizes thermal shock and drives off flux solvents.

Screen printing

This is the best high-volume production method of solder paste application. An emulsion-coated, fine mesh screen with apertures etched in the emulsion to coincide with the surfaces to be soldered is placed over the substrate. A squeegee is passed across the screen to force solder paste through the apertures and on to the substrate. The layer thickness of screened solder paste is usually between 150 and 200 μm.

Stencilling

In this method a stencil with etched holes to pass the paste is used. The thickness of the stencil determines the amount of amount of solder paste that is deposited on the substrate. This method is also suited to high-volume work.

Dispensing

A computer-controlled pressure syringe dispenses small doses of paste to where it is required. This method is mainly suitable for small production runs and laboratory use.

Pin transfer

A pin picks up a droplet of solder paste from a reservoir and transfers it to the surface of the substrate or component. A multi-pin arrangement with pins positioned to match the substrate is possible and this speeds up the process time.

REFLOW TECHNIQUES

Thermal conduction

The prepared substrates are carried on a conveyor belt, first through a preheating stage and then through a soldering stage. Heat is transferred to the substrate by conduction through the belt. Figure 14 shows a theoretical time/temperature relationship for thermal conduction reflow soldering. This method is particularly suited to thick film substrates and is often combined with infrared heating.

Infrared

An infrared oven has several heating elements giving a broad spectrum of infrared radiation, normally above and below a closed loop belt system. There are separate zones for preheating, soldering and cooling. Dwell time in the soldering zone is kept as short as possible to prevent damage to components and substrate. A typical heating profile is shown in Fig.15. This reflow method is often applied in double-sided prints.

Vapour phase

A substrate is immersed in the vapours of a suitable boiling liquid. The vapours transfer latent heat of condensation to the substrate and solder reflow takes place. Temperature is controlled precisely by the boiling point of the liquid at a given pressure. Some systems employ two vapour zones, one above the other. An elevator tray, suspended from a hoist mechanism passes the substrate vertically through the first vapour zone into the secondary soldering zone and then hoists it out of the vapour to be cooled. A theoretical time/temperature relationship for this method is shown in Fig.16.

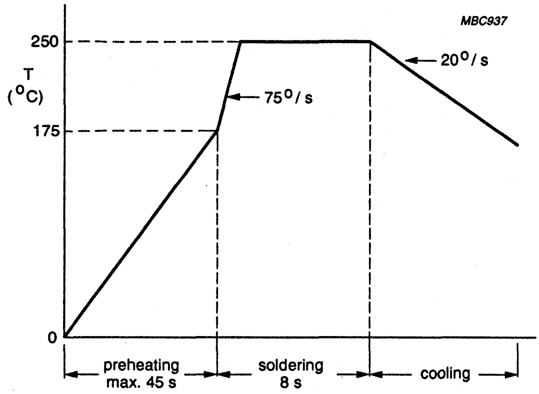


Fig.14 Theoretical time/temperature curve for a typical thermal conduction reflow cycle.

Wave soldering

This soldering technique can be applied to SOT23, SOT143, SOT223 and SOT323 components but is not recommended for SOT89, SOT173 or SOT173X.

ADHESIVE APPLICATION

Since there are no connecting wires to retain them, leadless and short-leaded components are held in place with adhesive for wave soldering. A spot of adhesive is carefully placed between each SMD and the substrate. The adhesive is then heat-cured to withstand the forces of the soldering process, during which the components are fully immersed in solder. There are several methods of adhesive application.

Pin transfer method

A pin is used to transfer a droplet of adhesive from a reservoir to a precise position on the surface where it is required. The size of the droplet depends on pin diameter, depth to which the pin is dipped in the reservoir, rheology of the adhesive, and the temperature of adhesive and surrounds. The pin can be part of a pin

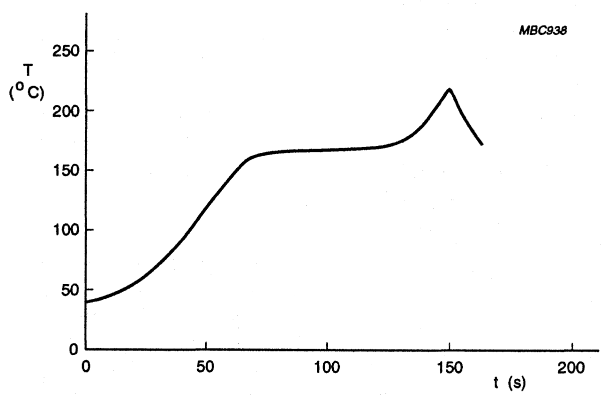


Fig.15 Typical temperature profile of an infrared oven operating at a belt speed of 0.41 m/min.

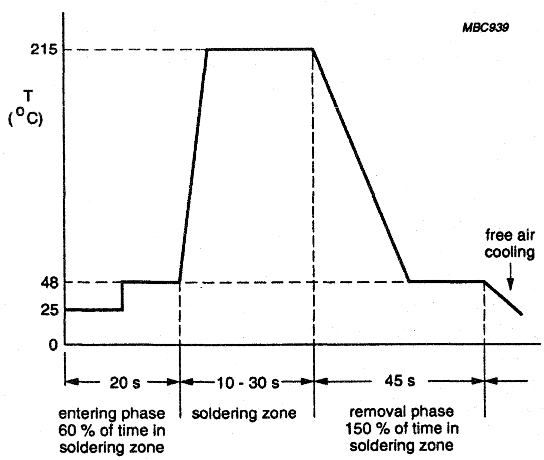


Fig.16 Theoretical time/temperature curve relationship for dual vapour reflow soldering.

array (bed of nails) that corresponds exactly with the required adhesive positions on the substrate. With this method, adhesive can be applied to the whole of one side of a substrate in one operation and is therefore suitable for high-volume production and can be used with pre-loaded mixed prints.

Alternatively, pins can be used to transfer adhesive to the components before they are placed on the substrate. This adds flexibility to production runs where variations in layout must be accommodated.

Screen printing method

A fine mesh screen is coated with emulsion except in the positions where the adhesive is required to pass. The screen is placed on the substrate and a squeegee passing across it forces adhesive through the uncoated parts of the screen. The amount of adhesive printed-through depends on the size of the uncoated screen areas, the thickness of the screen coating, the rheology of the adhesive and various machine parameters. With this method, the substrate must be flat and pre-loaded mixed prints cannot be accommodated.

Pressure syringe method

A computer-controlled syringe dispenses adhesive from an enclosed reservoir by means of pulses of compressed air. The adhesive dot size depends on the size of the syringe nozzle, the duration and pressure of the pulsed air and the viscosity of the adhesive. This method is most suited to low volume production. An advantage is the flexibility provided by computer programmability.

FLUXING

The quality of the soldered connections between components and substrate is critical for circuit performance and reliability. Flux promotes solderability of the connecting surfaces and is chosen for the following attributes:

- removal of surface oxides
- prevention of reoxidation
- transference of heat from source to joint area
- residue that is non-corrosive or, if residue is corrosive, should be easy to clean away after soldering
- ability to improve wettability (readiness of a metal surface to form an alloy at its interface with the solder) to ensure strong joints with low electrical resistance
- suitability for the desired method of flux application.

In wave soldering, liquified flux is usually applied as a foam, a spray or in a wave.

Foam

Flux foam is made by forcing low-pressure, water-free clean air through an aerator immersed in liquid flux. Fine bubbles of flux are directed onto the substrate/component surfaces where they burst and form a thin, even layer. The flux also penetrates any plated-through holes. The flux has to be chosen for its foaming capabilities.

Spray

Several methods of spray fluxing exist, the most common involves a mesh drum rotating in liquid flux. Air is blown into the drum which, when passing through the fine mesh, directs a spray of flux onto the underside of the substrate. The amount of flux deposited is controllable by the speed of the substrate passing through the spray, the speed of rotation of the drum and the density of the flux.

Wave

A wave fluxer creates a double flowing wave of liquid flux which adheres to the surface as the substrate passes through. Wave height control is essential and a soft wipe-off brush is usually incorporated to remove excess flux from the substrate.

PRE-HEATING

Pre-heating of the substrate and components is performed immediately before soldering. This reduces thermal shock as the substrate enters the soldering process, causes the flux to become more viscous and accelerates the chemical action of the flux and so speeds up the soldering action.

SOLDERING

Wave soldering is usually the best method to use when high throughput rates are required. The single-wave soldering principle (Fig.17) is the most straight forward method and can be used on simple substrates with two-terminal SMD components. More complex substrates with increased circuit density and closer spacing of conductors can pose the problems of nonwetting (dry joints) and solder bridging. Bridging can occur across the closely spaced leads of multi-leaded devices as well as across adjacent leads on neighbouring components. Nonwetting is usually caused by components with plastic bodies. The plastic is not wetted by solder and creates a depression in the solder wave, which is augmented by surface tension. This can cause a shadow behind the component and prevent solder from reaching the joint surfaces. A smooth laminar solder wave is required to avoid bridging and a high pressure wave is needed to completely cover the areas that are difficult to wet. These conflicting demands are difficult to attain in a single wave but dual wave techniques go a long way in overcoming the problem.

In a dual wave machine (Fig.18), the substrate first comes into contact with a turbulent wave which has a high vertical velocity. This ensures good solder contact with both edges of the components and prevents joints from being missed. The second smooth laminar wave completes the formation of the solder fillet, removes excess solder and prevents bridging. Figure 19 indicates the time/temperature relationship measured at the soldering site in dual wave soldering.

New methods of wave soldering are developing continually. For example, the Omega System is a single wave agitated by pulses, which combines the functions of smoothness and turbulence. In another, a lambda wave injects air bubbles in the final part of the wave. A further innovation is the hollow jet wave in which the solder wave flows in the opposite direction to the substrate.

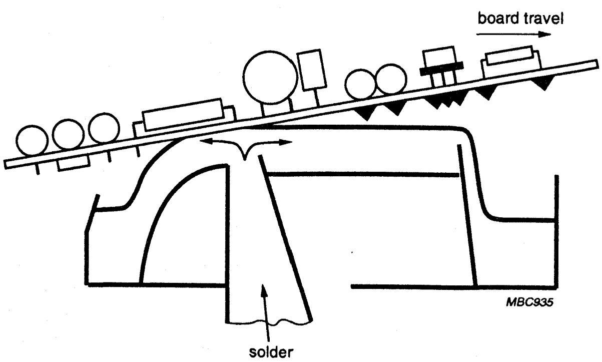


Fig.17 Single wave soldering principle.

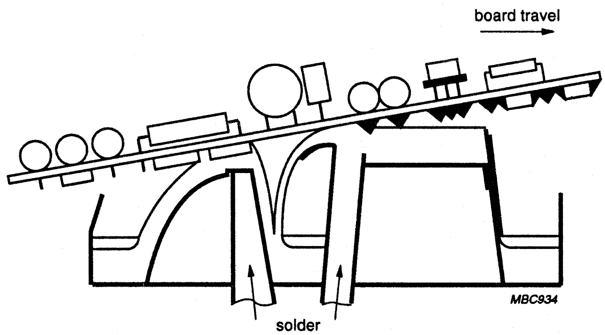


Fig.18 Dual wave soldering principle.

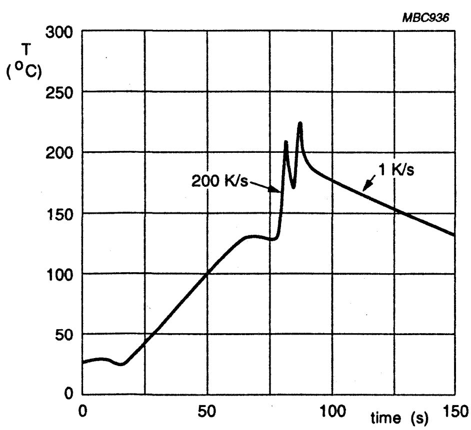


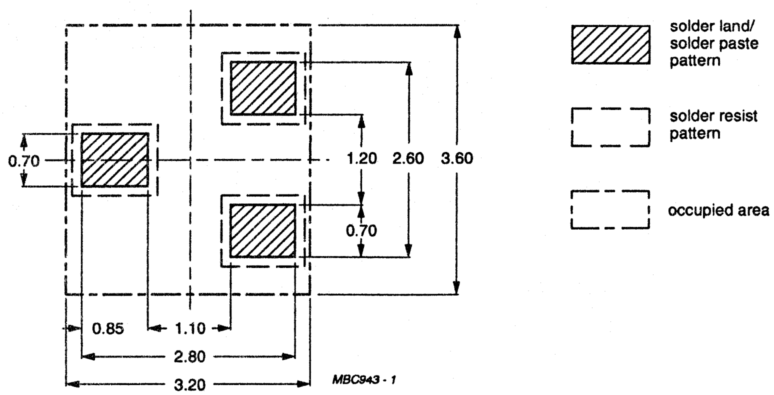
Fig.19 Typical time-temperature curve measured at the soldering site.

Footprint design

The footprint design of a component for surface mounting is influenced by many factors:

- features of the component, its dimensions and tolerances
- circuit board manufacturing processes
- desired component density
- minimum spacing between components
- circuit tracks under the component
- component orientation (if wave soldering)
- positional accuracy of solder resist to solder lands
- positional accuracy of solder paste to solder lands (if reflow soldering)
- component placement accuracy
- soldering process parameters
- solder joint reliability parameters.

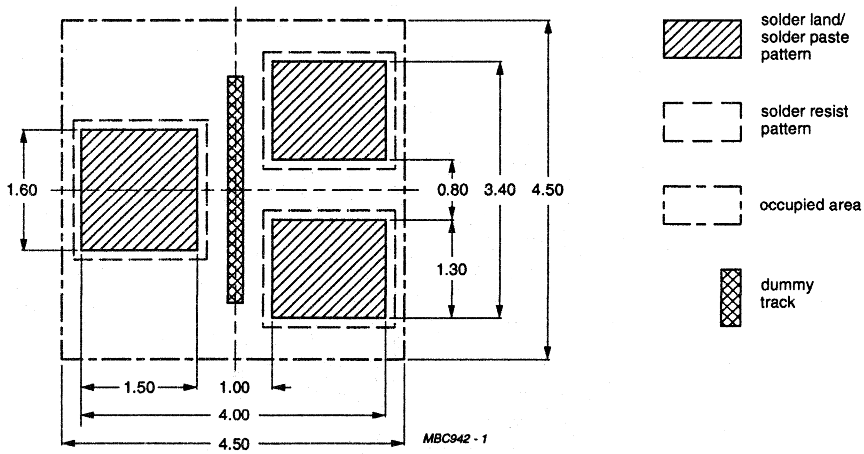
SOT23 FOOTPRINTS



Dimensions in mm.

Placement accuracy: ±0.25 mm.

Fig.20 Reflow soldering footprint for SOT23; typical dimensions.



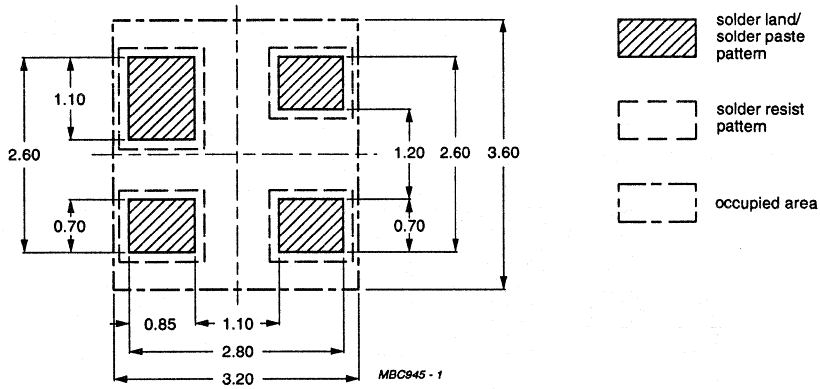
Dimensions in mm.

Dummy track dimensions: 0.40 × 3.00 mm.

Placement accuracy: ±0.25 mm.

Fig.21 Wave soldering footprint for SOT23; typical dimensions.

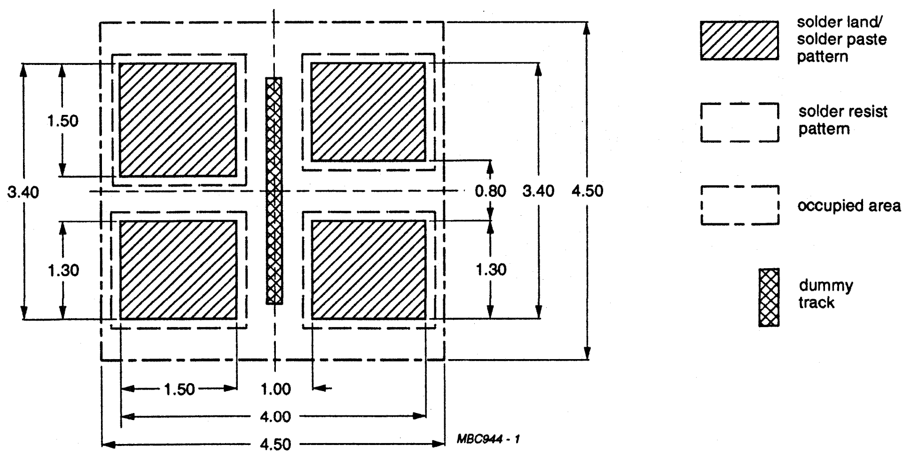
SOT143 FOOTPRINTS



Dimensions in mm.

Placement accuracy: ±0.25 mm.

Fig.22 Reflow soldering footprint for SOT143; typical dimensions.



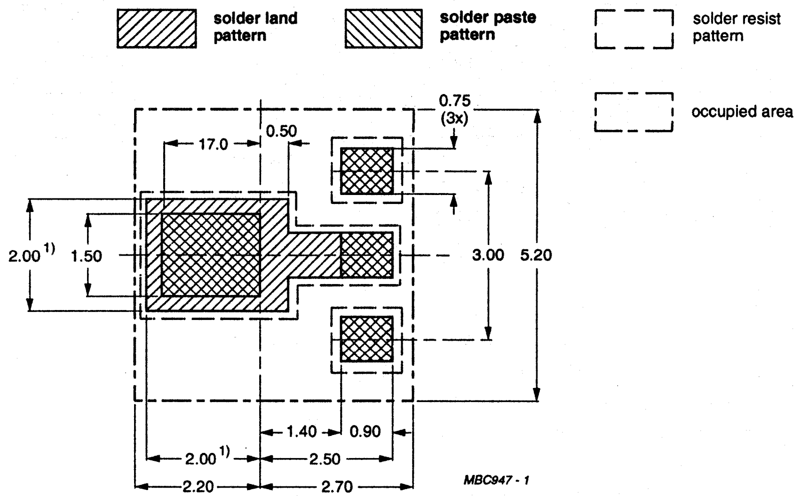
Dimensions in mm.

Dummy track dimensions: 0.40 × 3.00 mm.

Placement accuracy: ±0.25 mm.

Fig.23 Wave soldering footprint for SOT143; typical dimensions.

SOT89 FOOTPRINTS

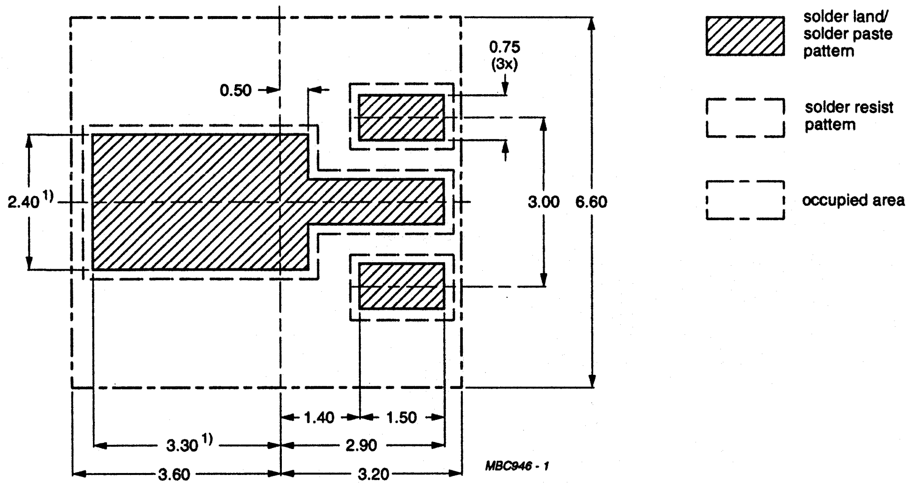


Dimensions in mm.

Placement accuracy: ±0.25 mm.

1) To improve the power dissipation the marked dimensions may be enlarged without changing the solder resist cut out of the footprint.

Fig.24 Reflow soldering footprint for SOT89; typical dimensions.



We do not recommend SOT89 for wave soldering, SOT223 is preferred.

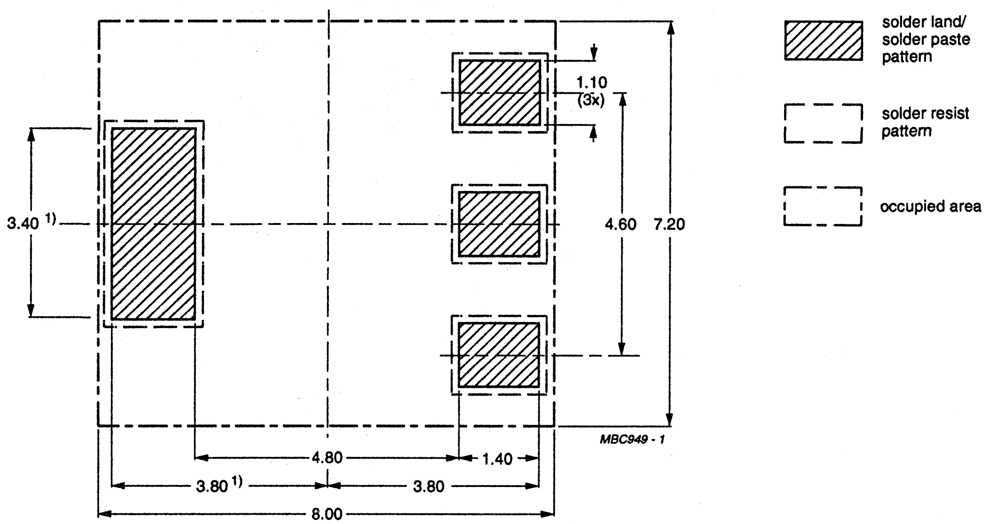
Dimensions in mm.

Placement accuracy: ±0.25 mm.

1) To improve power dissipation the marked dimensions may be enlarged without changing the solder resist cut out of the footprint.

Fig.25 Wave soldering footprint for SOT89; typical dimensions.

SOT223 FOOTPRINTS

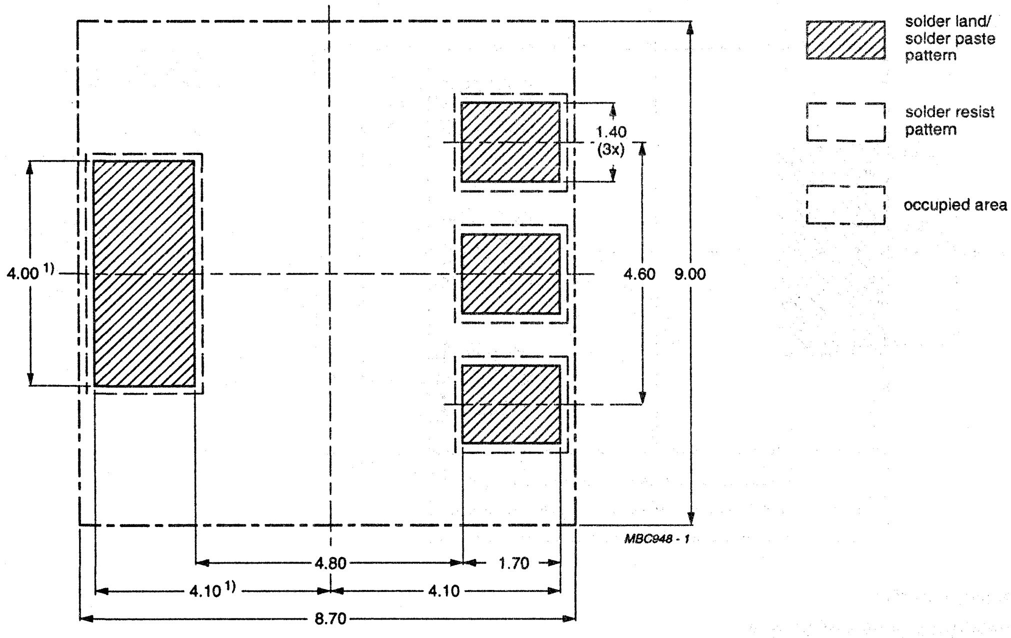


Dimensions in mm.

Placement accuracy: ±0.25 mm.

1) To improve power dissipation the marked dimensions may be enlarged without changing the solder resist cut out of the footprint.

Fig.26 Reflow soldering footprint for SOT223; typical dimensions.



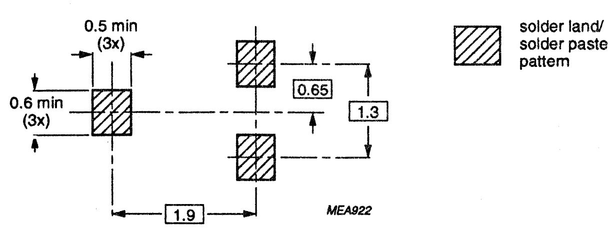
Dimensions in mm.

Placement accuracy: ±0.25 mm.

1) To improve power dissipation the marked dimensions may be enlarged without changing the solder resist cut out of the footprint.

Fig.27 Wave soldering footprint for SOT223; typical dimensions.

SOT323 FOOTPRINTS



Dimensions in mm.

Fig.28 Reflow soldering footprint for SOT323; typical dimensions.

Hand soldering microminiature components

It is possible to solder microminiature components with a light-weight hand-held soldering iron, but this method has obvious drawbacks and should be restricted to laboratory use and/or incidental repairs on production circuits:

- hand-soldering is time-consuming and therefore expensive
- the component cannot be positioned accurately and the connecting tags may come into contact with the substrate and damage it
- there is a risk of breaking the substrate and internal connections in the component could be damaged
- the component envelope could be damaged by the iron.

SOT37 and SOT103

Transistors in SOT37 and SOT103 envelopes may be mounted with leads flat, bent for surface mounting or bent for through-hole mounting.

When soldering by hand and with the leads flat (Fig.29), avoid putting any force on the leads during or just after soldering. Solder the leads one at a time and not simultaneously. Proceed from one lead to the adjacent lead, not to the lead opposite. With the leads bent (Figs 30 and 31) all leads may be soldered simultaneously if desired.

SOT37 and SOT103 are suitable for dip or wave soldering. The maximum allowable temperature of the solder is 260 °C. Solder at this temperature must not be in contact with the joint for more than 5 s and the total contact time of successive solder waves must not exceed 5 s. The component may be mounted up to the lead projections but the temperature of the body must not exceed the specified storage temperature.

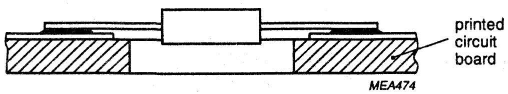
SOT122, SOT122E and SOT172

These transistors have a threaded stud and are supplied with a brass nut for securing to a heatsink:

- stud diameter: 1/4 inch
- thread: 8-32 UNC-2A(B)
- maximum diameter of threaded stud: 4.14 mm
- nut thickness: 3.5 mm (SOT172); 5.0 mm (SOT122).

The following notes should help obtain best possible heat transfer and avoid damage to the threaded stud of the transistor:

- diameter of the mounting hole in the heatsink: 4.15 +0.05/−0 mm
- heatsink surfaces at the mounting hole to be flat, parallel and free of burrs and oxidation
- torque on nut: minimum 0.75 Nm; maximum 0.85 Nm
- recommended distance from top surface of the heatsink to surface of the printed circuit board: 2.9 +0/−0.2 mm
- tension in the transistor leads sets the limit on spacing between heatsink and printed circuit board. In general, the leads can withstand more pull in the downward direction than in the upward direction
- solder the leads to the connection pads with resin-cored tin-lead solder using a light-weight soldering iron. Soldering iron temperatures as high as 350 °C are safely tolerable; the transistor can withstand an internal temperature of 250 °C for about ten minutes
- the leads may be tinned, if required, by dipping them into a solder bath at about 230 °C; each lead may be dipped to its full length. A flux of the quality of 'Super-Safe' is recommended. After tinning, surplus flux may be washed away with clean water.

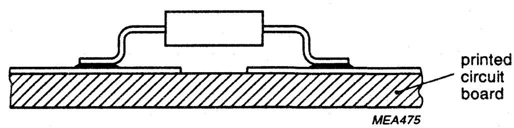


Maximum solder temperature = 300 °C.

Maximum soldering time = 5 s.

Minimum solder-to-case distance = 2 mm.

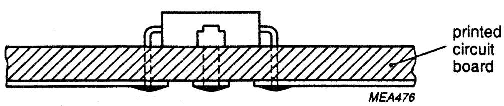
Fig.29 SOT37 and SOT103 flat-lead mounting.



Maximum solder temperature = 300 °C.

Maximum soldering time = 10 s.

Fig.30 SOT37 and SOT103 leads bent for surface mounting.



Maximum solder temperature = 260 °C.

Maximum soldering time = 5 s.

Fig.31 SOT37 and SOT103 leads bent for through-hole mounting.

THERMAL CONSIDERATIONS

Thermal resistance

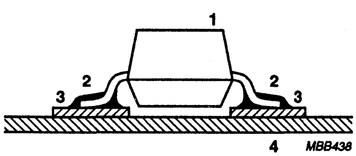
Circuit performance and long-term reliability are affected by the temperature of the transistor die. Normally, both are improved by keeping the die temperature (junction temperature) low.

Electrical power dissipated in any semiconductor device is a source of heat. This increases the temperature of the die about some reference point, normally an ambient temperature of 25 °C in still air. The size of the increase in temperature depends on the amount of power dissipated in the circuit and the net thermal resistance between the heat source and the reference point.

Devices lose most of their heat by conduction when mounted on a substrate. Referring to Fig.32, heat conducts from its source (the junction) via the envelope leads and soldered connections to the substrate. Some heat radiates from the envelope into the surrounding air where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The elements of thermal resistance shown in Fig.33 are defined as follows:

- $R_{th\ j\text{-}mb}$ thermal resistance from junction to mounting base
- $R_{th\ j\text{-}c}$ thermal resistance from junction to case
- $R_{th\ j\text{-}s}$ thermal resistance from junction to soldering point
- $R_{th\ s\text{-}a}$ thermal resistance from soldering point to ambient
- $R_{th\ c\text{-}a}$ thermal resistance from case to ambient ($R_{th\ s\text{-}a}$ and $R_{th\ c\text{-}a}$ are the same for most envelopes)



Heat radiates from the envelope (1) to ambient.

Heat conducts via leads (2), solder joints (3) to the substrate (4).

Fig.32 Heat losses.

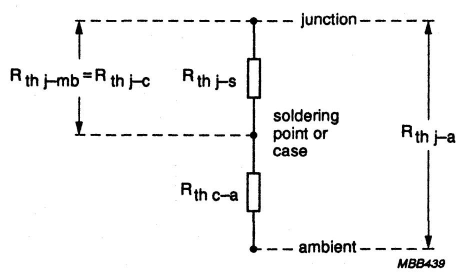


Fig.33 Representation of thermal resistance paths of a device mounted on a substrate or printed board.

The temperature at the junction depends on the ability of the envelope and its mounting to transfer heat from the junction region to the ambient environment. The basic relationship between junction temperature and power dissipation is:

$$T_{j\,max} = T_{amb} + P_{tot\,max}(R_{th\,j\text{-}s} + R_{th\,s\text{-}a})$$
$$= T_{amb} + P_{tot\,max}(R_{th\,j\text{-}a})$$

where

$T_{j\,max}$ is the maximum junction temperature

T_{amb} is the ambient temperature

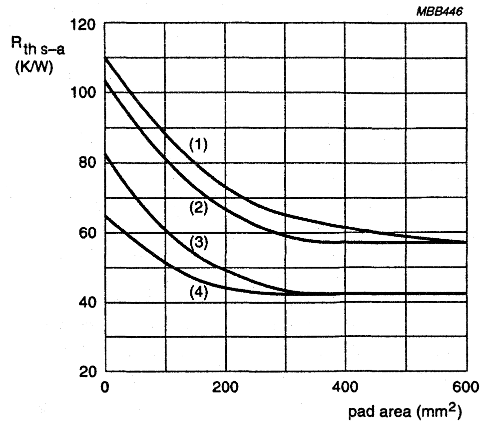
$P_{tot\,max}$ is the maximum power handling capability of the device, including the effects of external loads when applicable.

In the expression for $T_{j\,max}$, only T_{amb} and $R_{th\,s\text{-}a}$ can be varied by the user. The package mounting technique and the flow of cooling air are factors that affect $R_{th\,s\text{-}a}$. The device power dissipation can be controlled to a limited extent but under recommended usage, the supply voltage and circuit loading dictate a fixed power maximum. The $R_{th\,j\text{-}s}$ value is essentially independent of external mounting method and cooling air; but is sensitive to the materials used in the envelope construction, the die bonding method and the die area, all of which are fixed.

Values of $T_{j\,max}$ and $R_{th\,j\text{-}s}$ or $R_{th\,j\text{-}c}$ are given in the device data sheets. For applications where the temperature of the case is stabilized by a large or temperature-controlled heatsink, the junction temperature can be calculated from $T_j = T_{case} + P_{tot} \times R_{th\,j\text{-}c}$ or, using the soldering point definition, from $T_j = T_{solder} + P_{tot} \times R_{th\,j\text{-}s}$.

Thermal resistance ($R_{th\,s\text{-}a}$ and $R_{th\,c\text{-}a}$)

The thermal resistance from soldering point to ambient and that from case to ambient depends on the shape and material of the tracks and substrate as illustrated in Figs 34 and 35. Standard mounting conditions to set the maximum power ratings of the various envelopes are shown in Figs 36 to 41. Each figure shows single-sided 35 µm copper-clad epoxy fibre-glass print, 1.5 mm thick, the tracks are fully solder-tinned and the shaded areas shown are copper.



(1) single-sided, unplated

(2) single-sided, plated

(3) double-sided, unplated

(4) double-sided, plated.

Fig.34 Thermal resistance ($R_{th\,s\text{-}a}$) as a function of pad area on different configurations of FR4 epoxy fibre-glass circuit board.

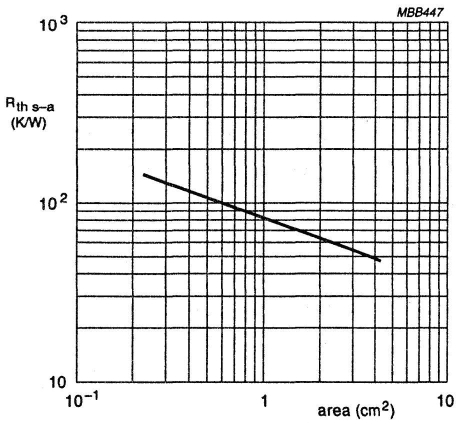
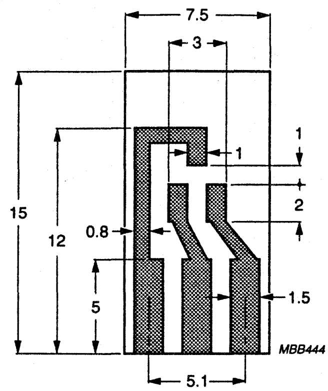
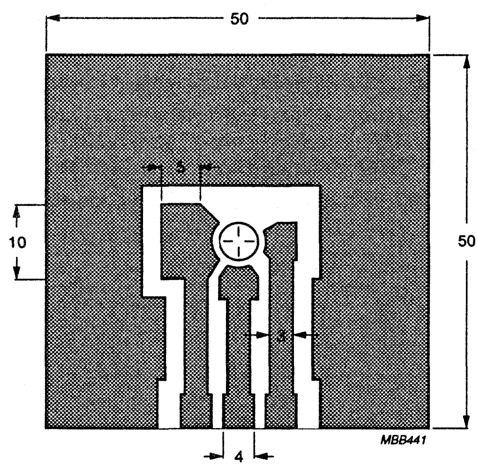


Fig.35 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of area of ceramic substrate.



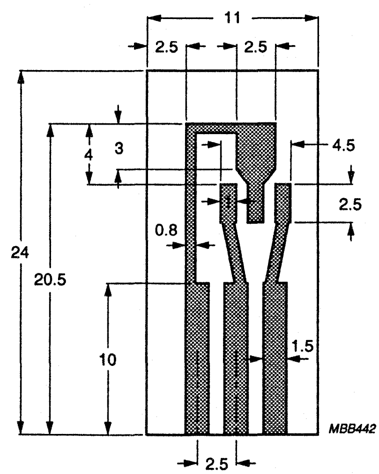
Dimensions in mm.

Fig.36 Standard mounting conditions for SOT23.



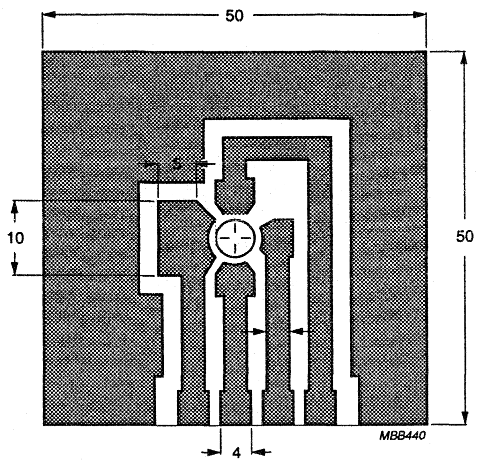
Dimensions in mm.

Fig.37 Standard mounting conditions for SOT37.



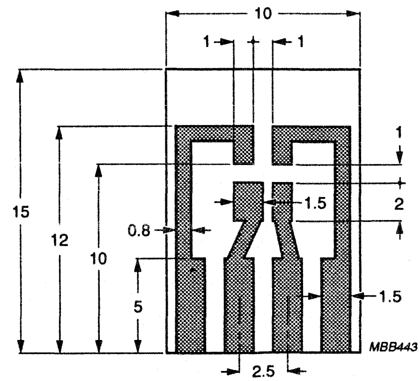
Dimensions in mm.

Fig.38 Standard mounting conditions for SOT89.



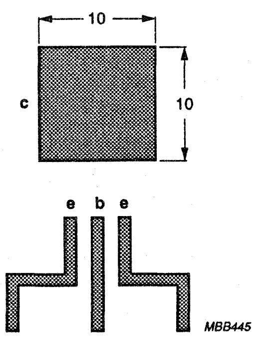
Dimensions in mm.

Fig.39 Standard mounting conditions for SOT103.



Dimensions in mm.

Fig.40 Standard mounting conditions for SOT143.



Dimensions in mm.

Fig.41 Standard mounting conditions for SOT223.

Device lifetime

Increasing the temperature of a transistor die will shorten its lifetime. The mean time before failure is determined by the alloying of the gold top metallization of the die into the silicon, after that it depends only on the junction temperature (T_j). The relationship between mean time before failure and junction temperature is shown in Table 9 and in Fig.42.

Taking the BFG198 as an example:

envelope: SOT223
$R_{th\ j\text{-}s}$: 40 K/W
bias: I_C = 100 mA; V_{CE} = 10 V

In these conditions, P_{tot} will be 1 W. Assuming the highest allowable soldering point (or case) temperature of 135 °C results in a junction temperature of 175 °C, it can be seen from Fig.42 that the mean time before failure is 7 × 10^5 hours (approximately 79 years).

The various devices in this publication have been rated in accordance with their thermal properties and application requirements as follows:

Table 9 Relationship between mean time before failure and junction temperature

T_j (°C)	MEAN TIME BEFORE FAILURE	
	HOURS	YEARS
140	2.8×10^7	3190
150	9.2×10^6	1050
160	3.2×10^6	365
170	1.2×10^6	136
180	4.5×10^5	51
190	1.8×10^5	20
200	7.5×10^4	8.5
210	3.2×10^4	3.6
220	1.4×10^4	1.6
230	6.6×10^3	0.8

$T_{j\ max}$ (°C)	ENVELOPE
150	SOT23, SOT89, SOT143, SOT323, TO-92
175	SOT37, SOT103, SOT223, TO-126, TO-220
200	SOT122, SOT172, SOT173, TO-39, TO-72

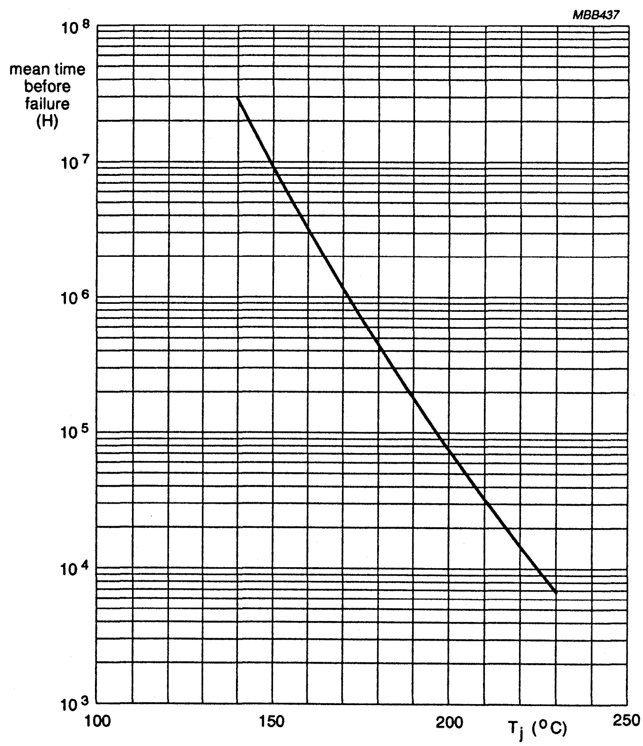


Fig.42 Mean time before failure as a function of junction temperature (T_j).

S-PARAMETERS

INTRODUCTION

S-parameters in this book are published generally both in tabular form, and as polar scattering diagrams. For each type for which we publish these S-parameters, more tables are available than could be printed in this issue. For additional bias condition settings (V_{CE}, I_C), please consult the S-parameter library on diskette. All tables printed in this book are also available on the diskette.

S-parameters on 3.5" Diskette, Version 3.0

S-parameters and noise parameters are now also available on 3.5" diskettes for use with the TOUCHSTONE®, LIBRA®, MDS® and SUPERCOMPACT® simulation programs under DOS.

Version 3.0 (February 1992) contains the parameters for almost all transistors in this book. A list of contents of Version 3.0 is given in the following pages. The diskette is available from your local Philips Semiconductors sales office. Philips continuously adds more S-parameters data to its libraries. Should certain data not be available on Version 3.0, please request these, as they might have been released prior to the next official issue, but after printing of this book.

A conversion program for using the S-parameters with APPCAD® is available from Philips on request and also via your local sales office.

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CONTENTS OF VERSION 3.0 DISKETTE

Common emitter data

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BF547A.S2P	23	BF547	10.0	2.0	0.04 - 1.0	–	8/91
BF547B.S2P	23	BF547	10.0	5.0	0.04 - 1.0	–	8/91
BF547C.S2P	23	BF547	10.0	10.0	0.04 - 1.0	–	8/91
BF547D.S2P	23	BF547	10.0	15.0	0.04 - 1.0	–	8/91
BF747A.S2P	23	BF747	10.0	2.0	0.04 - 2.0	–	5/90
BF747B.S2P	23	BF747	10.0	5.0	0.04 - 2.0	–	5/90
BF747C.S2P	23	BF747	10.0	10.0	0.04 - 2.0	–	5/90
BF747D.S2P	23	BF747	10.0	15.0	0.04 - 2.0	–	5/90
BF748A.S2P	54	BF748	10.0	2.0	0.04 - 2.0	–	3/90
BF748B.S2P	54	BF748	10.0	5.0	0.04 - 2.0	–	3/90
BF748C.S2P	54	BF748	10.0	10.0	0.04 - 2.0	–	3/90
BF748D.S2P	54	BF748	10.0	15.0	0.04 - 2.0	–	3/90
BFG16AA.S2P	223	BFG16A	5.0	50.0	0.04 - 2.0	–	7/90
BFG16AB.S2P	223	BFG16A	5.0	100.0	0.04 - 2.0	–	7/90
BFG16AC.S2P	223	BFG16A	5.0	150.0	0.04 - 2.0	–	7/90
BFG16AD.S2P	223	BFG16A	10.0	50.0	0.04 - 2.0	–	7/90
BFG16AE.S2P	223	BFG16A	10.0	75.0	0.04 - 2.0	–	7/90
BFG16AF.S2P	223	BFG16A	10.0	100.0	0.04 - 2.0	–	7/90
BFG16AG.S2P	223	BFG16A	15.0	50.0	0.04 - 2.0	–	7/90
BFG16AH.S2P	223	BFG16A	15.0	70.0	0.04 - 2.0	–	7/90
BFG25AXA.S2P	143	BFG25A/X	1.0	0.1	0.04 - 3.0	–	5/90
BFG25AXB.S2P	143	BFG25A/X	1.0	0.25	0.04 - 3.0	0.5 - 2.0	5/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG25AXC.S2P	143	BFG25A/X	1.0	0.5	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXD.S2P	143	BFG25A/X	1.0	1.0	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXE.S2P	143	BFG25A/X	1.0	2.0	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXF.S2P	143	BFG25A/X	3.0	0.1	0.04 - 3.0	–	5/90
BFG25AXG.S2P	143	BFG25A/X	3.0	0.25	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXH.S2P	143	BFG25A/X	3.0	0.5	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXI.S2P	143	BFG25A/X	3.0	1.0	0.04 - 3.0	0.5 - 2.0	5/90
BFG25AXJ.S2P	143	BFG25A/X	3.0	2.0	0.04 - 3.0	0.5 - 2.0	5/90
BFG31A.S2P	223	BFG31	–5.0	–15.0	0.04 - 2.0	–	8/90
BFG31B.S2P	223	BFG31	–5.0	–30.0	0.04 - 2.0	–	8/90
BFG31C.S2P	223	BFG31	–5.0	–50.0	0.04 - 2.0	–	8/90
BFG31D.S2P	223	BFG31	–5.0	–70.0	0.04 - 2.0	–	8/90
BFG31E.S2P	223	BFG31	–10.0	–15.0	0.04 - 2.0	–	8/90
BFG31F.S2P	223	BFG31	–10.0	–30.0	0.04 - 2.0	–	8/90
BFG31G.S2P	223	BFG31	–10.0	–50.0	0.04 - 2.0	–	8/90
BFG31H.S2P	223	BFG31	–10.0	–70.0	0.04 - 2.0	–	8/90
BFG33A.S2P	143	BFG33	2.5	2.0	0.04 - 6.0	–	7/90
BFG33B.S2P	143	BFG33	2.5	5.0	0.04 - 6.0	–	7/90
BFG33C.S2P	143	BFG33	2.5	10.0	0.04 - 6.0	–	7/90
BFG33D.S2P	143	BFG33	2.5	15.0	0.04 - 6.0	–	7/90
BFG33E.S2P	143	BFG33	5.0	2.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33F.S2P	143	BFG33	5.0	5.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33G.S2P	143	BFG33	5.0	10.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33H.S2P	143	BFG33	5.0	15.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33XA.S2P	143	BFG33/X	2.5	2.0	0.04 - 6.0	–	7/90
BFG33XB.S2P	143	BFG33/X	2.5	5.0	0.04 - 6.0	–	7/90
BFG33XC.S2P	143	BFG33/X	2.5	10.0	0.04 - 6.0	–	7/90
BFG33XD.S2P	143	BFG33/X	2.5	15.0	0.04 - 6.0	–	7/90
BFG33XE.S2P	143	BFG33/X	5.0	2.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33XF.S2P	143	BFG33/X	5.0	5.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33XG.S2P	143	BFG33/X	5.0	10.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG33XH.S2P	143	BFG33/X	5.0	15.0	0.04 - 6.0	0.5 - 2.0	7/90
BFG34A.S2P	103	BFG34	10.0	20.0	0.04 - 3.0	–	7/90
BFG34B.S2P	103	BFG34	10.0	30.0	0.04 - 3.0	–	7/90
BFG34C.S2P	103	BFG34	10.0	50.0	0.04 - 3.0	–	7/90
BFG34D.S2P	103	BFG34	10.0	70.0	0.04 - 3.0	–	7/90
BFG34E.S2P	103	BFG34	10.0	100.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG35A.S2P	223	BFG35	10.0	20.0	0.04 - 3.0	–	7/90
BFG35B.S2P	223	BFG35	10.0	30.0	0.04 - 3.0	–	7/90
BFG35C.S2P	223	BFG35	10.0	50.0	0.04 - 3.0	–	7/90
BFG35D.S2P	223	BFG35	10.0	70.0	0.04 - 3.0	–	7/90
BFG35E.S2P	223	BFG35	10.0	100.0	0.04 - 3.0	–	7/90
BFG55A.S2P	223	BFG55	–10.0	–20.0	0.04 - 2.0	–	8/90
BFG55B.S2P	223	BFG55	–10.0	–30.0	0.04 - 2.0	–	8/90
BFG55C.S2P	223	BFG55	–10.0	–50.0	0.04 - 2.0	–	8/90
BFG55D.S2P	223	BFG55	–10.0	–70.0	0.04 - 2.0	–	8/90
BFG55E.S2P	223	BFG55	–10.0	–100.0	0.04 - 2.0	–	8/90
BFG65A.S2P	103	BFG65	4.0	2.0	0.04 - 3.0	–	8/90
BFG65B.S2P	103	BFG65	4.0	5.0	0.04 - 3.0	–	8/90
BFG65C.S2P	103	BFG65	4.0	10.0	0.04 - 3.0	–	8/90
BFG65D.S2P	103	BFG65	4.0	15.0	0.04 - 3.0	–	8/90
BFG65E.S2P	103	BFG65	4.0	20.0	0.04 - 3.0	–	8/90
BFG65F.S2P	103	BFG65	4.0	30.0	0.04 - 3.0	–	8/90
BFG65G.S2P	103	BFG65	8.0	2.0	0.04 - 3.0	–	8/90
BFG65H.S2P	103	BFG65	8.0	5.0	0.04 - 3.0	–	8/90
BFG65I.S2P	103	BFG65	8.0	10.0	0.04 - 3.0	–	8/90
BFG65J.S2P	103	BFG65	8.0	15.0	0.04 - 3.0	–	8/90
BFG65K.S2P	103	BFG65	8.0	20.0	0.04 - 3.0	–	8/90
BFG65L.S2P	103	BFG65	8.0	30.0	0.04 - 3.0	–	8/90
BFG67A.S2P	143	BFG67	4.0	2.0	0.04 - 3.0	–	7/90
BFG67B.S2P	143	BFG67	4.0	5.0	0.04 - 3.0	–	7/90
BFG67C.S2P	143	BFG67	4.0	10.0	0.04 - 3.0	–	7/90
BFG67D.S2P	143	BFG67	4.0	15.0	0.04 - 3.0	–	7/90
BFG67E.S2P	143	BFG67	4.0	20.0	0.04 - 3.0	–	7/90
BFG67F.S2P	143	BFG67	4.0	30.0	0.04 - 3.0	–	7/90
BFG67G.S2P	143	BFG67	8.0	2.0	0.04 - 3.0	–	7/90
BFG67H.S2P	143	BFG67	8.0	5.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG67I.S2P	143	BFG67	8.0	10.0	0.04 - 3.0	–	7/90
BFG67J.S2P	143	BFG67	8.0	15.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG67K.S2P	143	BFG67	8.0	20.0	0.04 - 3.0	–	7/90
BFG67L.S2P	143	BFG67	8.0	30.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG67XA.S2P	143	BFG67/X	4.0	2.0	0.04 - 3.0	–	7/90
BFG67XB.S2P	143	BFG67/X	4.0	5.0	0.04 - 3.0	–	7/90
BFG67XC.S2P	143	BFG67/X	4.0	10.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG67XD.S2P	143	BFG67/X	4.0	15.0	0.04 - 3.0	–	7/90
BFG67XE.S2P	143	BFG67/X	4.0	20.0	0.04 - 3.0	–	7/90
BFG67XF.S2P	143	BFG67/X	4.0	30.0	0.04 - 3.0	–	7/90
BFG67XG.S2P	143	BFG67/X	8.0	2.0	0.04 - 3.0	–	7/90
BFG67XH.S2P	143	BFG67/X	8.0	5.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG67XI.S2P	143	BFG67/X	8.0	10.0	0.04 - 3.0	–	7/90
BFG67XJ.S2P	143	BFG67/X	8.0	15.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG67XK.S2P	143	BFG67/X	8.0	20.0	0.04 - 3.0	–	7/90
BFG67XL.S2P	143	BFG67/X	8.0	30.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG90AA.S2P	103	BFG90A	5.0	2.0	0.04 - 3.0	–	7/90
BFG90AB.S2P	103	BFG90A	5.0	5.0	0.04 - 3.0	–	7/90
BFG90AC.S2P	103	BFG90A	5.0	10.0	0.04 - 3.0	–	7/90
BFG90AD.S2P	103	BFG90A	5.0	15.0	0.04 - 3.0	–	7/90
BFG90AE.S2P	103	BFG90A	5.0	20.0	0.04 - 3.0	–	7/90
BFG90AF.S2P	103	BFG90A	10.0	2.0	0.04 - 3.0	–	7/90
BFG90AG.S2P	103	BFG90A	10.0	5.0	0.04 - 3.0	–	7/90
BFG90AH.S2P	103	BFG90A	10.0	10.0	0.04 - 3.0	–	7/90
BFG90AI.S2P	103	BFG90A	10.0	15.0	0.04 - 3.0	–	7/90
BFG91AA.S2P	103	BFG91A	5.0	5.0	0.04 - 3.0	–	8/90
BFG91AB.S2P	103	BFG91A	5.0	10.0	0.04 - 3.0	–	8/90
BFG91AC.S2P	103	BFG91A	5.0	20.0	0.04 - 3.0	–	8/90
BFG91AD.S2P	103	BFG91A	5.0	30.0	0.04 - 3.0	–	8/90
BFG91AE.S2P	103	BFG91A	8.0	5.0	0.04 - 3.0	–	8/90
BFG91AF.S2P	103	BFG91A	8.0	10.0	0.04 - 3.0	–	8/90
BFG91AG.S2P	103	BFG91A	8.0	20.0	0.04 - 3.0	–	8/90
BFG91AH.S2P	103	BFG91A	8.0	30.0	0.04 - 3.0	–	8/90
BFG92AA.S2P	143	BFG92A	5.0	2.0	0.04 - 3.0	–	6/90
BFG92AB.S2P	143	BFG92A	5.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AC.S2P	143	BFG92A	5.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AD.S2P	143	BFG92A	5.0	15.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AE.S2P	143	BFG92A	5.0	20.0	0.04 - 3.0	–	6/90
BFG92AF.S2P	143	BFG92A	10.0	2.0	0.04 - 3.0	–	6/90
BFG92AG.S2P	143	BFG92A	10.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AH.S2P	143	BFG92A	10.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AI.S2P	143	BFG92A	10.0	15.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AJ.S2P	143	BFG92A	10.0	20.0	0.04 - 3.0	–	6/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG92AXA.S2P	143	BFG92A/X	5.0	2.0	0.04 - 3.0	–	6/90
BFG92AXB.S2P	143	BFG92A/X	5.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXC.S2P	143	BFG92A/X	5.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXD.S2P	143	BFG92A/X	5.0	15.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXE.S2P	143	BFG92A/X	5.0	20.0	0.04 - 3.0	–	6/90
BFG92AXF.S2P	143	BFG92A/X	10.0	2.0	0.04 - 3.0	–	6/90
BFG92AXG.S2P	143	BFG92A/X	10.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXH.S2P	143	BFG92A/X	10.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXI.S2P	143	BFG92A/X	10.0	15.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG92AXJ.S2P	143	BFG92A/X	10.0	20.0	0.04 - 3.0	–	6/90
BFG93AA.S2P	143	BFG93A	5.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AB.S2P	143	BFG93A	5.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AC.S2P	143	BFG93A	5.0	20.0	0.04 - 3.0	–	6/90
BFG93AD.S2P	143	BFG93A	5.0	30.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AE.S2P	143	BFG93A	8.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AF.S2P	143	BFG93A	8.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AG.S2P	143	BFG93A	8.0	20.0	0.04 - 3.0	–	6/90
BFG93AH.S2P	143	BFG93A	8.0	30.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXA.S2P	143	BFG93A/X	5.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXB.S2P	143	BFG93A/X	5.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXC.S2P	143	BFG93A/X	5.0	20.0	0.04 - 3.0	–	6/90
BFG93AXD.S2P	143	BFG93A/X	5.0	30.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXE.S2P	143	BFG93A/X	8.0	5.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXF.S2P	143	BFG93A/X	8.0	10.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG93AXG.S2P	143	BFG93A/X	8.0	20.0	0.04 - 3.0	–	6/90
BFG93AXH.S2P	143	BFG93A/X	8.0	30.0	0.04 - 3.0	0.5 - 2.0	6/90
BFG94A.S2P	223	BFG94	10.0	15.0	0.04 - 3.0	0.5 - 1.0	5/90
BFG94B.S2P	223	BFG94	10.0	30.0	0.04 - 3.0	0.5 - 1.0	5/90
BFG94C.S2P	223	BFG94	10.0	45.0	0.04 - 3.0	0.5 - 1.0	5/90
BFG96A.S2P	103	BFG96	5.0	15.0	0.04 - 3.0	–	7/90
BFG96B.S2P	103	BFG96	5.0	30.0	0.04 - 3.0	–	7/90
BFG96C.S2P	103	BFG96	5.0	50.0	0.04 - 3.0	–	7/90
BFG96D.S2P	103	BFG96	5.0	70.0	0.04 - 3.0	–	7/90
BFG96E.S2P	103	BFG96	10.0	15.0	0.04 - 3.0	–	7/90
BFG96F.S2P	103	BFG96	10.0	30.0	0.04 - 3.0	–	7/90
BFG96G.S2P	103	BFG96	10.0	50.0	0.04 - 3.0	–	7/90
BFG96H.S2P	103	BFG96	10.0	70.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG97A.S2P	223	BFG97	5.0	15.0	0.04 - 3.0	–	7/90
BFG97B.S2P	223	BFG97	5.0	30.0	0.04 - 3.0	–	7/90
BFG97C.S2P	223	BFG97	5.0	50.0	0.04 - 3.0	–	7/90
BFG97D.S2P	223	BFG97	5.0	70.0	0.04 - 3.0	–	7/90
BFG97E.S2P	223	BFG97	10.0	15.0	0.04 - 3.0	–	7/90
BFG97F.S2P	223	BFG97	10.0	30.0	0.04 - 3.0	–	7/90
BFG97G.S2P	223	BFG97	10.0	50.0	0.04 - 3.0	–	7/90
BFG97H.S2P	223	BFG97	10.0	70.0	0.04 - 3.0	–	7/90
BFG134A.S2P	103	BFG134	10.0	10.0	0.04 - 3.0	–	5/90
BFG134B.S2P	103	BFG134	10.0	25.0	0.04 - 3.0	–	5/90
BFG134C.S2P	103	BFG134	10.0	50.0	0.04 - 3.0	–	5/90
BFG134D.S2P	103	BFG134	10.0	75.0	0.04 - 3.0	–	5/90
BFG134E.S2P	103	BFG134	10.0	100.0	0.04 - 3.0	–	5/90
BFG135A.S2P	223	BFG135	10.0	10.0	0.04 - 3.0	–	7/90
BFG135B.S2P	223	BFG135	10.0	25.0	0.04 - 3.0	–	7/90
BFG135C.S2P	223	BFG135	10.0	50.0	0.04 - 3.0	–	7/90
BFG135D.S2P	223	BFG135	10.0	75.0	0.04 - 3.0	–	7/90
BFG135E.S2P	223	BFG135	10.0	100.0	0.04 - 3.0	–	7/90
BFG195A.S2P	103	BFG195	4.0	10.0	0.04 - 3.0	–	8/90
BFG195B.S2P	103	BFG195	4.0	20.0	0.04 - 3.0	–	8/90
BFG195C.S2P	103	BFG195	4.0	30.0	0.04 - 3.0	–	8/90
BFG195D.S2P	103	BFG195	4.0	50.0	0.04 - 3.0	–	8/90
BFG195E.S2P	103	BFG195	4.0	70.0	0.04 - 3.0	–	8/90
BFG195F.S2P	103	BFG195	8.0	10.0	0.04 - 3.0	–	8/90
BFG195G.S2P	103	BFG195	8.0	20.0	0.04 - 3.0	–	8/90
BFG195H.S2P	103	BFG195	8.0	30.0	0.04 - 3.0	–	8/90
BFG195I.S2P	103	BFG195	8.0	50.0	0.04 - 3.0	–	8/90
BFG197A.S2P	143	BFG197	4.0	10.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197B.S2P	143	BFG197	4.0	20.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197C.S2P	143	BFG197	4.0	30.0	0.04 - 3.0	–	7/90
BFG197D.S2P	143	BFG197	4.0	50.0	0.04 - 3.0	–	7/90
BFG197E.S2P	143	BFG197	4.0	70.0	0.04 - 3.0	–	7/90
BFG197F.S2P	143	BFG197	6.0	50.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197G.S2P	143	BFG197	8.0	10.0	0.04 - 3.0	–	7/90
BFG197H.S2P	143	BFG197	8.0	20.0	0.04 - 3.0	–	7/90
BFG197I.S2P	143	BFG197	8.0	30.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG197XA.S2P	143	BFG197/X	4.0	10.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197XB.S2P	143	BFG197/X	4.0	20.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197XC.S2P	143	BFG197/X	4.0	30.0	0.04 - 3.0	–	7/90
BFG197XD.S2P	143	BFG197/X	4.0	50.0	0.04 - 3.0	–	7/90
BFG197XE.S2P	143	BFG197/X	4.0	70.0	0.04 - 3.0	–	7/90
BFG197XF.S2P	143	BFG197/X	6.0	50.0	0.04 - 3.0	0.5 - 2.0	7/90
BFG197XG.S2P	143	BFG197/X	8.0	10.0	0.04 - 3.0	–	7/90
BFG197XH.S2P	143	BFG197/X	8.0	20.0	0.04 - 3.0	–	7/90
BFG197XI.S2P	143	BFG197/X	8.0	30.0	0.04 - 3.0	–	7/90
BFG198A.S2P	223	BFG198	4.0	10.0	0.04 - 3.0	–	7/90
BFG198B.S2P	223	BFG198	4.0	20.0	0.04 - 3.0	–	7/90
BFG198C.S2P	223	BFG198	4.0	30.0	0.04 - 3.0	–	7/90
BFG198D.S2P	223	BFG198	4.0	50.0	0.04 - 3.0	–	7/90
BFG198E.S2P	223	BFG198	4.0	70.0	0.04 - 3.0	–	7/90
BFG198F.S2P	223	BFG198	8.0	10.0	0.04 - 3.0	–	7/90
BFG198G.S2P	223	BFG198	8.0	20.0	0.04 - 3.0	–	7/90
BFG198H.S2P	223	BFG198	8.0	30.0	0.04 - 3.0	–	7/90
BFG198I.S2P	223	BFG198	8.0	50.0	0.04 - 3.0	–	7/90
BFG198J.S2P	223	BFG198	8.0	70.0	0.04 - 3.0	–	7/90
BFG505A.S2P	143	BFG505	3.0	0.5	0.04 - 3.0	–	2/92
BFG505B.S2P	143	BFG505	3.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFG505C.S2P	143	BFG505	3.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFG505D.S2P	143	BFG505	3.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFG505E.S2P	143	BFG505	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG505F.S2P	143	BFG505	3.0	7.5	0.04 - 3.0	–	2/92
BFG505G.S2P	143	BFG505	6.0	0.5	0.04 - 3.0	–	2/92
BFG505H.S2P	143	BFG505	6.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFG505I.S2P	143	BFG505	6.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFG505J.S2P	143	BFG505	6.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFG505K.S2P	143	BFG505	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG505L.S2P	143	BFG505	6.0	7.5	0.04 - 3.0	–	2/92
BFG505XA.S2P	143	BFG505/X	3.0	0.5	0.04 - 3.0	–	2/92
BFG505XB.S2P	143	BFG505/X	3.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XC.S2P	143	BFG505/X	3.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XD.S2P	143	BFG505/X	3.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XE.S2P	143	BFG505/X	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XF.S2P	143	BFG505/X	3.0	7.5	0.04 - 3.0	–	2/92

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			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG505XG.S2P	143	BFG505/X	6.0	0.5	0.04 - 3.0	–	2/92
BFG505XH.S2P	143	BFG505/X	6.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XI.S2P	143	BFG505/X	6.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XJ.S2P	143	BFG505/X	6.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XK.S2P	143	BFG505/X	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG505XL.S2P	143	BFG505/X	6.0	7.5	0.04 - 3.0	–	2/92
BFG520A.S2P	143	BFG520	3.0	2.0	0.04 - 3.0	–	2/92
BFG520B.S2P	143	BFG520	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520C.S2P	143	BFG520	3.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520D.S2P	143	BFG520	3.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520E.S2P	143	BFG520	3.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520F.S2P	143	BFG520	3.0	30.0	0.04 - 3.0	–	2/92
BFG520G.S2P	143	BFG520	6.0	2.0	0.04 - 3.0	–	2/92
BFG520H.S2P	143	BFG520	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520I.S2P	143	BFG520	6.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520J.S2P	143	BFG520	6.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520K.S2P	143	BFG520	6.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520L.S2P	143	BFG520	6.0	30.0	0.04 - 3.0	–	2/92
BFG520XA.S2P	143	BFG520/X	3.0	2.0	0.04 - 3.0	–	2/92
BFG520XB.S2P	143	BFG520/X	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XC.S2P	143	BFG520/X	3.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XD.S2P	143	BFG520/X	3.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XE.S2P	143	BFG520/X	3.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XF.S2P	143	BFG520/X	3.0	30.0	0.04 - 3.0	–	2/92
BFG520XG.S2P	143	BFG520/X	6.0	2.0	0.04 - 3.0	–	2/92
BFG520XH.S2P	143	BFG520/X	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XI.S2P	143	BFG520/X	6.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XJ.S2P	143	BFG520/X	6.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XK.S2P	143	BFG520/X	6.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG520XL.S2P	143	BFG520/X	6.0	30.0	0.04 - 3.0	–	2/92
BFG540A.S2P	143	BFG540	4.0	4.0	0.04 - 3.0	–	2/92
BFG540B.S2P	143	BFG540	4.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540C.S2P	143	BFG540	4.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540D.S2P	143	BFG540	4.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540E.S2P	143	BFG540	4.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540F.S2P	143	BFG540	4.0	50.0	0.04 - 3.0	–	2/92
BFG540G.S2P	143	BFG540	8.0	4.0	0.04 - 3.0	–	2/92

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			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFG540H.S2P	143	BFG540	8.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540I.S2P	143	BFG540	8.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540J.S2P	143	BFG540	8.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540K.S2P	143	BFG540	8.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XA.S2P	143	BFG540/X	4.0	4.0	0.04 - 3.0	–	2/92
BFG540XB.S2P	143	BFG540/X	4.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XC.S2P	143	BFG540/X	4.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XD.S2P	143	BFG540/X	4.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XE.S2P	143	BFG540/X	4.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XF.S2P	143	BFG540/X	4.0	50.0	0.04 - 3.0	–	2/92
BFG540XG.S2P	143	BFG540/X	8.0	4.0	0.04 - 3.0	–	2/92
BFG540XH.S2P	143	BFG540/X	8.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XI.S2P	143	BFG540/X	8.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XJ.S2P	143	BFG540/X	8.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG540XK.S2P	143	BFG540/X	8.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFG541A.S2P	223	BFG541	4.0	10.0	0.04 - 3.0	–	2/92
BFG541B.S2P	223	BFG541	4.0	20.0	0.04 - 3.0	–	2/92
BFG541C.S2P	223	BFG541	4.0	30.0	0.04 - 3.0	–	2/92
BFG541D.S2P	223	BFG541	4.0	40.0	0.04 - 3.0	–	2/92
BFG541E.S2P	223	BFG541	4.0	60.0	0.04 - 3.0	–	2/92
BFG541F.S2P	223	BFG541	4.0	10.0	0.04 - 3.0	–	2/92
BFG541G.S2P	223	BFG541	8.0	20.0	0.04 - 3.0	–	2/92
BFG541H.S2P	223	BFG541	8.0	30.0	0.04 - 3.0	–	2/92
BFG541I.S2P	223	BFG541	8.0	40.0	0.04 - 3.0	–	2/92
BFG541J.S2P	223	BFG541	8.0	60.0	0.04 - 3.0	–	2/92
BFP90AA.S2P	173	BFP90A	5.0	2.0	0.04 - 2.0	–	6/90
BFP90AB.S2P	173	BFP90A	5.0	5.0	0.04 - 2.0	–	6/90
BFP90AC.S2P	173	BFP90A	5.0	10.0	0.04 - 2.0	–	6/90
BFP90AD.S2P	173	BFP90A	5.0	15.0	0.04 - 2.0	–	6/90
BFP90AE.S2P	173	BFP90A	5.0	20.0	0.04 - 2.0	–	6/90
BFP90AF.S2P	173	BFP90A	10.0	2.0	0.04 - 2.0	–	6/90
BFP90AG.S2P	173	BFP90A	10.0	5.0	0.04 - 2.0	–	6/90
BFP90AH.S2P	173	BFP90A	10.0	10.0	0.04 - 2.0	–	6/90
BFP90AI.S2P	173	BFP90A	10.0	15.0	0.04 - 2.0	–	6/90
BFP90AJ.S2P	173	BFP90A	10.0	20.0	0.04 - 2.0	–	6/90
BFP91AA.S2P	173	BFP91A	5.0	5.0	0.04 - 2.0	–	6/90
BFP91AB.S2P	173	BFP91A	5.0	10.0	0.04 - 2.0	–	6/90

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			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFP91AC.S2P	173	BFP91A	5.0	20.0	0.04 - 2.0	–	6/90
BFP91AD.S2P	173	BFP91A	5.0	30.0	0.04 - 2.0	–	6/90
BFP91AE.S2P	173	BFP91A	8.0	5.0	0.04 - 2.0	–	6/90
BFP91AF.S2P	173	BFP91A	8.0	10.0	0.04 - 2.0	–	6/90
BFP91AG.S2P	173	BFP91A	8.0	20.0	0.04 - 2.0	–	6/90
BFP91AH.S2P	173	BFP91A	8.0	30.0	0.04 - 2.0	–	6/90
BFP96A.S2P	173	BFP96	5.0	15.0	0.04 - 3.0	–	7/90
BFP96B.S2P	173	BFP96	5.0	30.0	0.04 - 3.0	–	7/90
BFP96C.S2P	173	BFP96	5.0	50.0	0.04 - 3.0	–	7/90
BFP96D.S2P	173	BFP96	5.0	70.0	0.04 - 3.0	–	7/90
BFP96E.S2P	173	BFP96	10.0	15.0	0.04 - 3.0	–	7/90
BFP96F.S2P	173	BFP96	10.0	30.0	0.04 - 3.0	–	7/90
BFP96G.S2P	173	BFP96	10.0	50.0	0.04 - 3.0	–	7/90
BFQ18AA.S2P	89	BFQ18A	10.0	20.0	0.04 - 3.0	–	5/90
BFQ18AB.S2P	89	BFQ18A	10.0	30.0	0.04 - 3.0	–	5/90
BFQ18AC.S2P	89	BFQ18A	10.0	50.0	0.04 - 3.0	–	5/90
BFQ18AD.S2P	89	BFQ18A	10.0	70.0	0.04 - 3.0	–	5/90
BFQ18AE.S2P	89	BFQ18A	10.0	100.0	0.04 - 3.0	–	5/90
BFQ19A.S2P	89	BFQ19	5.0	15.0	0.04 - 3.0	–	7/90
BFQ19B.S2P	89	BFQ19	5.0	30.0	0.04 - 3.0	–	7/90
BFQ19C.S2P	89	BFQ19	5.0	50.0	0.04 - 3.0	–	7/90
BFQ19D.S2P	89	BFQ19	5.0	70.0	0.04 - 3.0	–	7/90
BFQ19E.S2P	89	BFQ19	10.0	15.0	0.04 - 3.0	–	7/90
BFQ19F.S2P	89	BFQ19	10.0	30.0	0.04 - 3.0	–	7/90
BFQ19G.S2P	89	BFQ19	10.0	50.0	0.04 - 3.0	–	7/90
BFQ23A.S2P	37	BFQ23	–5.0	–5.0	0.04 - 3.0	–	5/90
BFQ23B.S2P	37	BFQ23	–5.0	–10.0	0.04 - 3.0	–	5/90
BFQ23C.S2P	37	BFQ23	–5.0	–20.0	0.04 - 3.0	–	5/90
BFQ23D.S2P	37	BFQ23	–5.0	–30.0	0.04 - 3.0	–	5/90
BFQ23E.S2P	37	BFQ23	–8.0	–5.0	0.04 - 3.0	–	5/90
BFQ23F.S2P	37	BFQ23	–8.0	–10.0	0.04 - 3.0	–	5/90
BFQ23G.S2P	37	BFQ23	–8.0	–20.0	0.04 - 3.0	–	5/90
BFQ23CA.S2P	173	BFQ23C	–5.0	–5.0	0.04 - 2.0	–	6/90
BFQ23CB.S2P	173	BFQ23C	–5.0	–10.0	0.04 - 2.0	–	6/90
BFQ23CC.S2P	173	BFQ23C	–5.0	–20.0	0.04 - 2.0	–	6/90
BFQ23CD.S2P	173	BFQ23C	–5.0	–30.0	0.04 - 2.0	–	6/90
BFQ23CE.S2P	173	BFQ23C	–8.0	–5.0	0.04 - 2.0	–	6/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFQ23CF.S2P	173	BFQ23C	−8.0	−10.0	0.04 - 2.0	–	6/90
BFQ23CG.S2P	173	BFQ23C	−8.0	−20.0	0.04 - 2.0	–	6/90
BFQ23CH.S2P	173	BFQ23C	−8.0	−30.0	0.04 - 2.0	–	6/90
BFQ32CA.S2P	173	BFQ32C	−5.0	−15.0	0.04 - 3.0	–	8/90
BFQ32CB.S2P	173	BFQ32C	−5.0	−30.0	0.04 - 3.0	–	8/90
BFQ32CC.S2P	173	BFQ32C	−5.0	−50.0	0.04 - 3.0	–	8/90
BFQ32CD.S2P	173	BFQ32C	−5.0	−70.0	0.04 - 3.0	–	8/90
BFQ32CE.S2P	173	BFQ32C	−10.0	−15.0	0.04 - 3.0	–	8/90
BFQ32CF.S2P	173	BFQ32C	−10.0	−30.0	0.04 - 3.0	–	8/90
BFQ32CG.S2P	173	BFQ32C	−10.0	−50.0	0.04 - 3.0	–	8/90
BFQ32SA.S2P	37	BFQ32S	−5.0	−15.0	0.04 - 3.0	–	7/90
BFQ32SB.S2P	37	BFQ32S	−5.0	−30.0	0.04 - 3.0	–	7/90
BFQ32SC.S2P	37	BFQ32S	−5.0	−50.0	0.04 - 3.0	–	7/90
BFQ32SD.S2P	37	BFQ32S	−5.0	−70.0	0.04 - 3.0	–	7/90
BFQ32SE.S2P	37	BFQ32S	−10.0	−15.0	0.04 - 3.0	–	7/90
BFQ32SF.S2P	37	BFQ32S	−10.0	−30.0	0.04 - 3.0	–	7/90
BFQ32SG.S2P	37	BFQ32S	−10.0	−50.0	0.04 - 3.0	–	7/90
BFQ32SH.S2P	37	BFQ32S	−10.0	−70.0	0.04 - 3.0	–	7/90
BFQ34TA.S2P	37	BFQ34T	10.0	20.0	0.04 - 2.0	–	7/90
BFQ34TB.S2P	37	BFQ34T	10.0	30.0	0.04 - 2.0	–	7/90
BFQ34TC.S2P	37	BFQ34T	10.0	50.0	0.04 - 2.0	–	7/90
BFQ34TD.S2P	37	BFQ34T	10.0	70.0	0.04 - 2.0	–	7/90
BFQ34TE.S2P	37	BFQ34T	10.0	100.0	0.04 - 2.0	–	7/90
BFQ51A.S2P	37	BFQ51	−5.0	−2.0	0.04 - 2.0	–	6/90
BFQ51B.S2P	37	BFQ51	−5.0	−5.0	0.04 - 2.0	–	6/90
BFQ51C.S2P	37	BFQ51	−5.0	−10.0	0.04 - 2.0	–	6/90
BFQ51D.S2P	37	BFQ51	−5.0	−15.0	0.04 - 2.0	–	6/90
BFQ51E.S2P	37	BFQ51	−5.0	−20.0	0.04 - 2.0	–	6/90
BFQ51F.S2P	37	BFQ51	−10.0	−2.0	0.04 - 2.0	–	6/90
BFQ51G.S2P	37	BFQ51	−10.0	−5.0	0.04 - 2.0	–	6/90
BFQ51H.S2P	37	BFQ51	−10.0	−10.0	0.04 - 2.0	–	6/90
BFQ51I.S2P	37	BFQ51	−10.0	−15.0	0.04 - 2.0	–	6/90
BFQ51CA.S2P	173	BFQ51C	−5.0	−2.0	0.04 - 2.0	–	6/90
BFQ51CB.S2P	173	BFQ51C	−5.0	−5.0	0.04 - 2.0	–	6/90
BFQ51CC.S2P	173	BFQ51C	−5.0	−10.0	0.04 - 2.0	–	6/90
BFQ51CD.S2P	173	BFQ51C	−5.0	−15.0	0.04 - 2.0	–	6/90
BFQ51CE.S2P	173	BFQ51C	−5.0	−20.0	0.04 - 2.0	–	6/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFQ51CF.S2P	173	BFQ51C	−10.0	−2.0	0.04 - 2.0	–	6/90
BFQ51CG.S2P	173	BFQ51C	−10.0	−5.0	0.04 - 2.0	–	6/90
BFQ51CH.S2P	173	BFQ51C	−10.0	−10.0	0.04 - 2.0	–	6/90
BFQ51CI.S2P	173	BFQ51C	−10.0	−15.0	0.04 - 2.0	–	6/90
BFQ51CJ.S2P	173	BFQ51C	−10.0	−20.0	0.04 - 2.0	–	6/90
BFQ65A.S2P	37	BFQ65	4.0	2.0	0.04 - 3.0	–	8/90
BFQ65B.S2P	37	BFQ65	4.0	5.0	0.04 - 3.0	–	8/90
BFQ65C.S2P	37	BFQ65	4.0	10.0	0.04 - 3.0	–	8/90
BFQ65D.S2P	37	BFQ65	4.0	15.0	0.04 - 3.0	–	8/90
BFQ65E.S2P	37	BFQ65	4.0	20.0	0.04 - 3.0	–	8/90
BFQ65F.S2P	37	BFQ65	4.0	30.0	0.04 - 3.0	–	8/90
BFQ65G.S2P	37	BFQ65	8.0	2.0	0.04 - 3.0	–	8/90
BFQ65H.S2P	37	BFQ65	8.0	5.0	0.04 - 3.0	–	8/90
BFQ65I.S2P	37	BFQ65	8.0	10.0	0.04 - 3.0	–	8/90
BFQ65J.S2P	37	BFQ65	8.0	15.0	0.04 - 3.0	–	8/90
BFQ65K.S2P	37	BFQ65	8.0	20.0	0.04 - 3.0	–	8/90
BFQ65L.S2P	37	BFQ65	8.0	30.0	0.04 - 3.0	–	8/90
BFQ66A.S2P	173	BFQ66	4.0	2.0	0.04 - 3.0	–	8/90
BFQ66B.S2P	173	BFQ66	4.0	5.0	0.04 - 3.0	–	8/90
BFQ66C.S2P	173	BFQ66	4.0	10.0	0.04 - 3.0	–	8/90
BFQ66D.S2P	173	BFQ66	4.0	15.0	0.04 - 3.0	–	8/90
BFQ66E.S2P	173	BFQ66	4.0	20.0	0.04 - 3.0	–	8/90
BFQ66F.S2P	173	BFQ66	4.0	30.0	0.04 - 3.0	–	8/90
BFQ66G.S2P	173	BFQ66	8.0	2.0	0.04 - 3.0	–	8/90
BFQ66H.S2P	173	BFQ66	8.0	5.0	0.04 - 3.0	–	8/90
BFQ66I.S2P	173	BFQ66	8.0	10.0	0.04 - 3.0	–	8/90
BFQ66J.S2P	173	BFQ66	8.0	15.0	0.04 - 3.0	–	8/90
BFQ66K.S2P	173	BFQ66	8.0	20.0	0.04 - 3.0	–	8/90
BFQ66L.S2P	173	BFQ66	8.0	30.0	0.04 - 3.0	–	8/90
BFQ67A.S2P	23	BFQ67	4.0	2.0	0.04 - 3.0	–	8/90
BFQ67B.S2P	23	BFQ67	4.0	5.0	0.04 - 3.0	–	8/90
BFQ67C.S2P	23	BFQ67	4.0	10.0	0.04 - 3.0	–	8/90
BFQ67D.S2P	23	BFQ67	4.0	15	0.04 - 3.0	–	8/90
BFQ67E.S2P	23	BFQ67	4.0	20.0	0.04 - 3.0	–	8/90
BFQ67F.S2P	23	BFQ67	4.0	30.0	0.04 - 3.0	–	8/90
BFQ67G.S2P	23	BFQ67	8.0	2.0	0.04 - 3.0	–	8/90
BFQ67H.S2P	23	BFQ67	8.0	5.0	0.04 - 3.0	–	8/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFQ67I.S2P	23	BFQ67	8.0	10.0	0.04 - 3.0	–	8/90
BFQ67J.S2P	23	BFQ67	8.0	15.0	0.04 - 3.0	–	8/90
BFQ67K.S2P	23	BFQ67	8.0	20.0	0.04 - 3.0	–	8/90
BFQ67L.S2P	23	BFQ67	8.0	30.0	0.04 - 3.0	–	8/90
BFQ135A.S2P	172	BFQ135	12.0	60.0	0.04 - 2.0	–	7/90
BFQ135B.S2P	172	BFQ135	12.0	90.0	0.04 - 2.0	–	7/90
BFQ135C.S2P	172	BFQ135	12.0	120.0	0.04 - 2.0	–	7/90
BFQ135D.S2P	172	BFQ135	12.0	150.0	0.04 - 2.0	–	7/90
BFQ135E.S2P	172	BFQ135	18.0	60.0	0.04 - 2.0	–	7/90
BFQ135F.S2P	172	BFQ135	18.0	90.0	0.04 - 2.0	–	7/90
BFQ135G.S2P	172	BFQ135	18.0	120.0	0.04 - 2.0	–	7/90
BFQ135H.S2P	172	BFQ135	18.0	150.0	0.04 - 2.0	–	7/90
BFQ149A.S2P	89	BFQ149	–5.0	–15.0	0.04 - 3.0	–	8/90
BFQ149B.S2P	89	BFQ149	–5.0	–30.0	0.04 - 3.0	–	8/90
BFQ149C.S2P	89	BFQ149	–5.0	–50.0	0.04 - 3.0	–	8/90
BFQ149D.S2P	89	BFQ149	–5.0	–70.0	0.04 - 3.0	–	8/90
BFQ149E.S2P	89	BFQ149	–10.0	–15.0	0.04 - 3.0	–	8/90
BFQ149F.S2P	89	BFQ149	–10.0	–30.0	0.04 - 3.0	–	8/90
BFQ149G.S2P	89	BFQ149	–10.0	–50.0	0.04 - 3.0	–	8/90
BFQ149H.S2P	89	BFQ149	–10.0	–70.0	0.04 - 3.0	–	8/90
BFQ270A.S2P	172	BFQ270	12.0	180.0	0.04 - 3.0	–	5/90
BFQ270B.S2P	172	BFQ270	12.0	240.0	0.04 - 3.0	–	5/90
BFQ270C.S2P	172	BFQ270	12.0	300.0	0.04 - 3.0	–	5/90
BFQ270D.S2P	172	BFQ270	12.0	360.0	0.04 - 3.0	–	5/90
BFQ270E.S2P	172	BFQ270	12.0	420.0	0.04 - 3.0	–	5/90
BFQ270F.S2P	172	BFQ270	18.0	180.0	0.04 - 3.0	–	5/90
BFQ270G.S2P	172	BFQ270	18.0	240.0	0.04 - 3.0	–	5/90
BFQ270H.S2P	172	BFQ270	18.0	300.0	0.04 - 3.0	–	5/90
BFQ270I.S2P	172	BFQ270	18.0	360.0	0.04 - 3.0	–	5/90
BFQ270J.S2P	172	BFQ270	18.0	420.0	0.04 - 3.0	–	5/90
BFR90AA.S2P	37	BFR90A	5.0	2.0	0.04 - 3.0	–	7/90
BFR90AB.S2P	37	BFR90A	5.0	5.0	0.04 - 3.0	–	7/90
BFR90AC.S2P	37	BFR90A	5.0	10.0	0.04 - 3.0	–	7/90
BFR90AD.S2P	37	BFR90A	5.0	15.0	0.04 - 3.0	–	7/90
BFR90AE.S2P	37	BFR90A	5.0	20.0	0.04 - 3.0	–	7/90
BFR90AF.S2P	37	BFR90A	10.0	2.0	0.04 - 3.0	–	7/90
BFR90AG.S2P	37	BFR90A	10.0	5.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFR90AH.S2P	37	BFR90A	10.0	10.0	0.04 - 3.0	–	7/90
BFR90AI.S2P	37	BFR90A	10.0	15.0	0.04 - 3.0	–	7/90
BFR91AA.S2P	37	BFR91A	5.0	5.0	0.04 - 3.0	–	7/90
BFR91AB.S2P	37	BFR91A	5.0	10.0	0.04 - 3.0	–	7/90
BFR91AC.S2P	37	BFR91A	5.0	20.0	0.04 - 3.0	–	7/90
BFR91AD.S2P	37	BFR91A	5.0	30.0	0.04 - 3.0	–	7/90
BFR91AE.S2P	37	BFR91A	8.0	5.0	0.04 - 3.0	–	7/90
BFR91AF.S2P	37	BFR91A	8.0	10.0	0.04 - 3.0	–	7/90
BFR91AG.S2P	37	BFR91A	8.0	20.0	0.04 - 3.0	–	7/90
BFR91AH.S2P	37	BFR91A	8.0	30.0	0.04 - 3.0	–	7/90
BFR92AA.S2P	23	BFR92A	5.0	2.0	0.04 - 3.0	–	5/90
BFR92AB.S2P	23	BFR92A	5.0	5.0	0.04 - 3.0	–	5/90
BFR92AC.S2P	23	BFR92A	5.0	10.0	0.04 - 3.0	–	5/90
BFR92AD.S2P	23	BFR92A	5.0	15.0	0.04 - 3.0	–	5/90
BFR92AE.S2P	23	BFR92A	5.0	20.0	0.04 - 3.0	–	5/90
BFR92AF.S2P	23	BFR92A	10.0	2.0	0.04 - 3.0	–	5/90
BFR92AG.S2P	23	BFR92A	10.0	5.0	0.04 - 3.0	–	5/90
BFR92AH.S2P	23	BFR92A	10.0	10.0	0.04 - 3.0	–	5/90
BFR92AI.S2P	23	BFR92A	10.0	15.0	0.04 - 3.0	–	5/90
BFR92AJ.S2P	23	BFR92A	10.0	20.0	0.04 - 3.0	–	5/90
BFR93AA.S2P	23	BFR93A	5.0	5.0	0.04 - 3.0	–	5/90
BFR93AB.S2P	23	BFR93A	5.0	10.0	0.04 - 3.0	–	5/90
BFR93AC.S2P	23	BFR93A	5.0	20.0	0.04 - 3.0	–	5/90
BFR93AD.S2P	23	BFR93A	5.0	30.0	0.04 - 3.0	–	5/90
BFR93AE.S2P	23	BFR93A	8.0	5.0	0.04 - 3.0	–	5/90
BFR93AF.S2P	23	BFR93A	8.0	10.0	0.04 - 3.0	–	5/90
BFR93AG.S2P	23	BFR93A	8.0	20.0	0.04 - 3.0	–	5/90
BFR93AH.S2P	23	BFR93A	8.0	30.0	0.04 - 3.0	–	5/90
BFR96SA.S2P	37	BFR96S	5.0	15.0	0.04 - 3.0	–	7/90
BFR96SB.S2P	37	BFR96S	5.0	30.0	0.04 - 3.0	–	7/90
BFR96SC.S2P	37	BFR96S	5.0	50.0	0.04 - 3.0	–	7/90
BFR96SD.S2P	37	BFR96S	5.0	70.0	0.04 - 3.0	–	7/90
BFR96SE.S2P	37	BFR96S	10.0	15.0	0.04 - 3.0	–	7/90
BFR96SF.S2P	37	BFR96S	10.0	30.0	0.04 - 3.0	–	7/90
BFR96SG.S2P	37	BFR96S	10.0	50.0	0.04 - 3.0	–	7/90
BFR96SH.S2P	37	BFR96S	10.0	70.0	0.04 - 3.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFR106A.S2P	23	BFR106	5.0	15.0	0.04 - 2.0	–	6/90
BFR106B.S2P	23	BFR106	5.0	30.0	0.04 - 2.0	–	6/90
BFR106C.S2P	23	BFR106	5.0	50.0	0.04 - 2.0	–	6/90
BFR106D.S2P	23	BFR106	5.0	70.0	0.04 - 2.0	–	6/90
BFR106E.S2P	23	BFR106	10.0	15.0	0.04 - 2.0	–	6/90
BFR106F.S2P	23	BFR106	10.0	30.0	0.04 - 2.0	–	6/90
BFR134A.S2P	37	BFR134	10.0	10.0	0.04 - 3.0	–	5/90
BFR134B.S2P	37	BFR134	10.0	25.0	0.04 - 3.0	–	5/90
BFR134C.S2P	37	BFR134	10.0	50.0	0.04 - 3.0	–	5/90
BFR134D.S2P	37	BFR134	10.0	75.0	0.04 - 3.0	–	5/90
BFR134E.S2P	37	BFR134	10.0	100.0	0.04 - 3.0	–	5/90
BFR505A.S2P	23	BFR505	3.0	0.5	0.04 - 3.0	–	2/92
BFR505B.S2P	23	BFR505	3.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFR505C.S2P	23	BFR505	3.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFR505D.S2P	23	BFR505	3.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFR505E.S2P	23	BFR505	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR505F.S2P	23	BFR505	3.0	7.5	0.04 - 3.0	–	2/92
BFR505G.S2P	23	BFR505	6.0	0.5	0.04 - 3.0	–	2/92
BFR505H.S2P	23	BFR505	6.0	1.25	0.04 - 3.0	0.5 - 2.0	2/92
BFR505I.S2P	23	BFR505	6.0	2.5	0.04 - 3.0	0.5 - 2.0	2/92
BFR505J.S2P	23	BFR505	6.0	3.75	0.04 - 3.0	0.5 - 2.0	2/92
BFR505K.S2P	23	BFR505	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR505L.S2P	23	BFR505	6.0	7.5	0.04 - 3.0	–	2/92
BFR520A.S2P	23	BFR520	3.0	2.0	0.04 - 3.0	–	2/92
BFR520B.S2P	23	BFR520	3.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520C.S2P	23	BFR520	3.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520D.S2P	23	BFR520	3.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520E.S2P	23	BFR520	3.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520F.S2P	23	BFR520	3.0	30.0	0.04 - 3.0	–	2/92
BFR520G.S2P	23	BFR520	6.0	2.0	0.04 - 3.0	–	2/92
BFR520H.S2P	23	BFR520	6.0	5.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520I.S2P	23	BFR520	6.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520J.S2P	23	BFR520	6.0	15.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520K.S2P	23	BFR520	6.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR520L.S2P	23	BFR520	6.0	30.0	0.04 - 3.0	–	2/92

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFR540A.S2P	23	BFR540	4.0	4.0	0.04 - 3.0	–	2/92
BFR540B.S2P	23	BFR540	4.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540C.S2P	23	BFR540	4.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540D.S2P	23	BFR540	4.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540E.S2P	23	BFR540	4.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540F.S2P	23	BFR540	4.0	50.0	0.04 - 3.0	–	2/92
BFR540G.S2P	23	BFR540	8.0	4.0	0.04 - 3.0	–	2/92
BFR540H.S2P	23	BFR540	8.0	10.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540I.S2P	23	BFR540	8.0	20.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540J.S2P	23	BFR540	8.0	30.0	0.04 - 3.0	0.5 - 2.0	2/92
BFR540K.S2P	23	BFR540	8.0	40.0	0.04 - 3.0	0.5 - 2.0	2/92
BFS17A.S2P	23	BFS17	5.0	2.0	0.04 - 2.0	–	7/90
BFS17B.S2P	23	BFS17	5.0	5.0	0.04 - 2.0	–	7/90
BFS17C.S2P	23	BFS17	5.0	10.0	0.04 - 2.0	–	7/90
BFS17D.S2P	23	BFS17	5.0	15.0	0.04 - 2.0	–	7/90
BFS17E.S2P	23	BFS17	5.0	20.0	0.04 - 2.0	–	7/90
BFS17F.S2P	23	BFS17	10.0	2.0	0.04 - 2.0	–	7/90
BFS17G.S2P	23	BFS17	10.0	5.0	0.04 - 2.0	–	7/90
BFS17H.S2P	23	BFS17	10.0	10.0	0.04 - 2.0	–	7/90
BFS17I.S2P	23	BFS17	10.0	15.0	0.04 - 2.0	–	7/90
BFS17J.S2P	23	BFS17	10.0	20.0	0.04 - 2.0	–	7/90
BFS17AA.S2P	23	BFS17A	5.0	2.0	0.04 - 2.0	–	5/90
BFS17AB.S2P	23	BFS17A	5.0	5.0	0.04 - 2.0	–	5/90
BFS17AC.S2P	23	BFS17A	5.0	10.0	0.04 - 2.0	–	5/90
BFS17AD.S2P	23	BFS17A	5.0	15.0	0.04 - 2.0	–	5/90
BFS17AE.S2P	23	BFS17A	5.0	20.0	0.04 - 2.0	–	5/90
BFS17AF.S2P	23	BFS17A	10.0	2.0	0.04 - 2.0	–	5/90
BFS17AG.S2P	23	BFS17A	10.0	5.0	0.04 - 2.0	–	5/90
BFS17AH.S2P	23	BFS17A	10.0	10.0	0.04 - 2.0	–	5/90
BFS17AI.S2P	23	BFS17A	10.0	15.0	0.04 - 2.0	–	5/90
BFS17AJ.S2P	23	BFS17A	10.0	20.0	0.04 - 2.0	–	5/90
BFT24A.S2P	37	BFT24	1.0	0.1	0.04 - 3.0	–	5/90
BFT24B.S2P	37	BFT24	1.0	0.2	0.04 - 3.0	–	5/90
BFT24C.S2P	37	BFT24	1.0	0.5	0.04 - 3.0	–	5/90
BFT24D.S2P	37	BFT24	1.0	1.0	0.04 - 3.0	–	5/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFT25A.S2P	23	BFT25	1.0	0.1	0.04 - 3.0	–	7/90
BFT25B.S2P	23	BFT25	1.0	0.2	0.04 - 3.0	–	7/90
BFT25C.S2P	23	BFT25	1.0	0.5	0.04 - 3.0	–	7/90
BFT25D.S2P	23	BFT25	1.0	1.0	0.04 - 3.0	–	7/90
BFT25AA.S2P	23	BFT25A	1.0	0.1	0.04 - 3.0	–	8/90
BFT25AB.S2P	23	BFT25A	1.0	0.25	0.04 - 3.0	–	8/90
BFT25AC.S2P	23	BFT25A	1.0	0.5	0.04 - 3.0	–	8/90
BFT25AD.S2P	23	BFT25A	1.0	1.0	0.04 - 3.0	–	8/90
BFT25AE.S2P	23	BFT25A	1.0	2.0	0.04 - 3.0	–	8/90
BFT25AF.S2P	23	BFT25A	3.0	0.1	0.04 - 3.0	–	8/90
BFT25AG.S2P	23	BFT25A	3.0	0.25	0.04 - 3.0	–	8/90
BFT25AH.S2P	23	BFT25A	3.0	0.5	0.04 - 3.0	–	8/90
BFT25AI.S2P	23	BFT25A	3.0	1.0	0.04 - 3.0	–	8/90
BFT25AJ.S2P	23	BFT25A	3.0	2.0	0.04 - 3.0	–	8/90
BFT92A.S2P	23	BFT92	–5.0	–2.0	0.04 - 3.0	–	5/90
BFT92B.S2P	23	BFT92	–5.0	–5.0	0.04 - 3.0	–	5/90
BFT92C.S2P	23	BFT92	–5.0	–10.0	0.04 - 3.0	–	5/90
BFT92D.S2P	23	BFT92	–5.0	–15.0	0.04 - 3.0	–	5/90
BFT92E.S2P	23	BFT92	–5.0	–20.0	0.04 - 3.0	–	5/90
BFT92F.S2P	23	BFT92	–10.0	–2.0	0.04 - 3.0	–	5/90
BFT92G.S2P	23	BFT92	–10.0	–5.0	0.04 - 3.0	–	5/90
BFT92H.S2P	23	BFT92	–10.0	–10.0	0.04 - 3.0	–	5/90
BFT92I.S2P	23	BFT92	–10.0	–15.0	0.04 - 3.0	–	5/90
BFT92J.S2P	23	BFT92	–10.0	–20.0	0.04 - 3.0	–	5/90
BFT93A.S2P	23	BFT93	–5.0	–5.0	0.04 - 3.0	–	5/90
BFT93B.S2P	23	BFT93	–5.0	–10.0	0.04 - 3.0	–	5/90
BFT93C.S2P	23	BFT93	–5.0	–20.0	0.04 - 3.0	–	5/90
BFT93D.S2P	23	BFT93	–5.0	–30.0	0.04 - 3.0	–	5/90
BFT93E.S2P	23	BFT93	–10.0	–5.0	0.04 - 3.0	–	5/90
BFT93F.S2P	23	BFT93	–10.0	–10.0	0.04 - 3.0	–	5/90
BFT93G.S2P	23	BFT93	–10.0	–20.0	0.04 - 3.0	–	5/90
BFT93H.S2P	23	BFT93	–10.0	–30.0	0.04 - 3.0	–	5/90
BFW92A.S2P	37	BFW92	5.0	2.0	0.04 - 2.0	–	6/90
BFW92B.S2P	37	BFW92	5.0	5.0	0.04 - 2.0	–	6/90
BFW92C.S2P	37	BFW92	5.0	10.0	0.04 - 2.0	–	6/90
BFW92D.S2P	37	BFW92	5.0	15.0	0.04 - 2.0	–	6/90
BFW92E.S2P	37	BFW92	5.0	20.0	0.04 - 2.0	–	6/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFW92F.S2P	37	BFW92	10.0	2.0	0.04 - 2.0	–	6/90
BFW92G.S2P	37	BFW92	10.0	5.0	0.04 - 2.0	–	6/90
BFW92H.S2P	37	BFW92	10.0	10.0	0.04 - 2.0	–	6/90
BFW92I.S2P	37	BFW92	10.0	15.0	0.04 - 2.0	–	6/90
BFW92J.S2P	37	BFW92	10.0	20.0	0.04 - 2.0	–	6/90
BFW92AA.S2P	37	BFW92A	5.0	2.0	0.04 - 3.0	–	5/90
BFW92AB.S2P	37	BFW92A	5.0	5.0	0.04 - 3.0	–	5/90
BFW92AC.S2P	37	BFW92A	5.0	10.0	0.04 - 3.0	–	5/90
BFW92AD.S2P	37	BFW92A	5.0	15.0	0.04 - 3.0	–	5/90
BFW92AE.S2P	37	BFW92A	5.0	20.0	0.04 - 3.0	–	5/90
BFW92AF.S2P	37	BFW92A	10.0	2.0	0.04 - 3.0	–	5/90
BFW92AG.S2P	37	BFW92A	10.0	5.0	0.04 - 3.0	–	5/90
BFW92AH.S2P	37	BFW92A	10.0	10.0	0.04 - 3.0	–	5/90
BFW92AI.S2P	37	BFW92A	10.0	15.0	0.04 - 3.0	–	5/90
BFW92AJ.S2P	37	BFW92A	10.0	20.0	0.04 - 3.0	–	5/90
MPSH10A.S2P	54	MPSH10	10.0	5.0	0.04 - 1.0	–	1/91
MPSH10B.S2P	54	MPSH10	10.0	10.0	0.04 - 1.0	–	1/91
MPSH10C.S2P	54	MPSH10	10.0	20.0	0.04 - 1.0	–	1/91
MPSH81A.S2P	54	MPSH81	–10.0	–5.0	0.04 - 1.0	–	8/91
MPSH81B.S2P	54	MPSH81	–10.0	–10.0	0.04 - 1.0	–	8/91
MPSH81C.S2P	54	MPSH81	–10.0	–20.0	0.04 - 1.0	–	8/91
PMBTH10A.S2P	23	PMBTH10	10.0	5.0	0.04 - 1.0	–	1/91
PMBTH10B.S2P	23	PMBTH10	10.0	10.0	0.04 - 1.0	–	1/91
PMBTH10C.S2P	23	PMBTH10	10.0	20.0	0.04 - 1.0	–	1/91
PMBTH81A.S2P	23	PMBTH81	–10.0	–5.0	0.04 - 1.0	–	8/91
PMBTH81B.S2P	23	PMBTH81	–10.0	–10.0	0.04 - 1.0	–	8/91
PMBTH81C.S2P	23	PMBTH81	–10.0	–20.0	0.04 - 1.0	–	8/91

Common base data

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION V_{CE} (V)	I_C (mA)	SCATTERING PARAMETERS f (GHz)	NOISE PARAMETERS f (GHz)	DATE
BF547CBA.S2P	23	BF547	10.0	2.0	0.04 - 1.0	–	8/91
BF547CBB.S2P	23	BF547	10.0	5.0	0.04 - 1.0	–	8/91
BF547CBC.S2P	23	BF547	10.0	10.0	0.04 - 1.0	–	8/91
BF547CBD.S2P	23	BF547	10.0	15.0	0.04 - 1.0	–	8/91
BF747CBA.S2P	23	BF747	10.0	2.0	0.04 - 2.0	–	5/90
BF747CBB.S2P	23	BF747	10.0	5.0	0.04 - 2.0	–	5/90
BF747CBC.S2P	23	BF747	10.0	10.0	0.04 - 2.0	–	5/90
BF747CBD.S2P	23	BF747	10.0	15.0	0.04 - 2.0	–	5/90
BF748CBA.S2P	54	BF748	10.0	2.0	0.04 - 2.0	–	3/90
BF748CBB.S2P	54	BF748	10.0	5.0	0.04 - 2.0	–	3/90
BF748CBC.S2P	54	BF748	10.0	10.0	0.04 - 2.0	–	3/90
BF748CBD.S2P	54	BF748	10.0	15.0	0.04 - 2.0	–	3/90
BFR92ACA.S2P	23	BFR92A	5.0	2.0	0.04 - 3.0	–	7/90
BFR92ACB.S2P	23	BFR92A	5.0	5.0	0.04 - 3.0	–	7/90
BFR92ACC.S2P	23	BFR92A	5.0	10.0	0.04 - 3.0	–	7/90
BFR92ACD.S2P	23	BFR92A	5.0	15.0	0.04 - 3.0	–	7/90
BFR92ACE.S2P	23	BFR92A	5.0	20.0	0.04 - 3.0	–	7/90
BFR92ACF.S2P	23	BFR92A	10.0	2.0	0.04 - 3.0	–	7/90
BFR92ACG.S2P	23	BFR92A	10.0	5.0	0.04 - 3.0	–	7/90
BFR92ACH.S2P	23	BFR92A	10.0	10.0	0.04 - 3.0	–	7/90
BFR92ACI.S2P	23	BFR92A	10.0	15.0	0.04 - 3.0	–	7/90
BFR92ACJ.S2P	23	BFR92A	10.0	20.0	0.04 - 3.0	–	7/90
BFR93ACA.S2P	23	BFR93A	5.0	5.0	0.04 - 3.0	–	7/90
BFR93ACB.S2P	23	BFR93A	5.0	10.0	0.04 - 3.0	–	7/90
BFR93ACC.S2P	23	BFR93A	5.0	20.0	0.04 - 3.0	–	7/90
BFR93ACD.S2P	23	BFR93A	5.0	30.0	0.04 - 3.0	–	7/90
BFR93ACE.S2P	23	BFR93A	8.0	5.0	0.04 - 3.0	–	7/90
BFR93ACF.S2P	23	BFR93A	8.0	10.0	0.04 - 3.0	–	7/90
BFR93ACG.S2P	23	BFR93A	8.0	20.0	0.04 - 3.0	–	7/90
BFR93ACH.S2P	23	BFR93A	8.0	30.0	0.04 - 3.0	–	7/90
BFR106CA.S2P	23	BFR106	5.0	15.0	0.04 - 2.0	–	7/90
BFR106CB.S2P	23	BFR106	5.0	30.0	0.04 - 2.0	–	7/90
BFR106CC.S2P	23	BFR106	5.0	50.0	0.04 - 2.0	–	7/90
BFR106CD.S2P	23	BFR106	5.0	70.0	0.04 - 2.0	–	7/90
BFR106CE.S2P	23	BFR106	10.0	15.0	0.04 - 2.0	–	7/90
BFR106CF.S2P	23	BFR106	10.0	30.0	0.04 - 2.0	–	7/90

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	f (GHz)	f (GHz)	
BFS17CBA.S2P	23	BFS17	5.0	2.0	0.04 - 2.0	–	7/90
BFS17CBB.S2P	23	BFS17	5.0	5.0	0.04 - 2.0	–	7/90
BFS17CBC.S2P	23	BFS17	5.0	10.0	0.04 - 2.0	–	7/90
BFS17CBD.S2P	23	BFS17	5.0	15.0	0.04 - 2.0	–	7/90
BFS17CBE.S2P	23	BFS17	5.0	20.0	0.04 - 2.0	–	7/90
BFS17CBF.S2P	23	BFS17	10.0	2.0	0.04 - 2.0	–	7/90
BFS17CBG.S2P	23	BFS17	10.0	5.0	0.04 - 2.0	–	7/90
BFS17CBH.S2P	23	BFS17	10.0	10.0	0.04 - 2.0	–	7/90
BFS17CBI.S2P	23	BFS17	10.0	15.0	0.04 - 2.0	–	7/90
BFS17CBJ.S2P	23	BFS17	10.0	20.0	0.04 - 2.0	–	7/90
BFS17ACA.S2P	23	BFS17A	5.0	2.0	0.04 - 2.0	–	7/90
BFS17ACB.S2P	23	BFS17A	5.0	5.0	0.04 - 2.0	–	7/90
BFS17ACC.S2P	23	BFS17A	5.0	10.0	0.04 - 2.0	–	7/90
BFS17ACD.S2P	23	BFS17A	5.0	15.0	0.04 - 2.0	–	7/90
BFS17ACE.S2P	23	BFS17A	5.0	20.0	0.04 - 2.0	–	7/90
BFS17ACF.S2P	23	BFS17A	10.0	2.0	0.04 - 2.0	–	7/90
BFS17ACG.S2P	23	BFS17A	10.0	5.0	0.04 - 2.0	–	7/90
BFS17ACH.S2P	23	BFS17A	10.0	10.0	0.04 - 2.0	–	7/90
BFS17ACI.S2P	23	BFS17A	10.0	15.0	0.04 - 2.0	–	7/90
BFS17ACJ.S2P	23	BFS17A	10.0	20.0	0.04 - 2.0	–	7/90
MPSH10CA.S2P	54	MPSH10	10.0	5.0	0.04 - 1.0	–	1/91
MPSH10CB.S2P	54	MPSH10	10.0	10.0	0.04 - 1.0	–	1/91
MPSH10CC.S2P	54	MPSH10	10.0	20.0	0.04 - 1.0	–	1/91
MPSH81CA.S2P	54	MPSH81	–10.0	–5.0	0.04 - 1.0	–	8/91
MPSH81CB.S2P	54	MPSH81	–10.0	–10.0	0.04 - 1.0	–	8/91
MPSH81CC.S2P	54	MPSH81	–10.0	–20.0	0.04 - 1.0	–	8/91
MBTH10CA.S2P	23	PMBTH10	10.0	5.0	0.04 - 1.0	–	1/91
MBTH10CB.S2P	23	PMBTH10	10.0	10.0	0.04 - 1.0	–	1/91
MBTH10CC.S2P	23	PMBTH10	10.0	20.0	0.04 - 1.0	–	1/91
MBTH81CA.S2P	23	PMBTH81	–10.0	–5.0	0.04 - 1.0	–	8/91
MBTH81CB.S2P	23	PMBTH81	–10.0	–10.0	0.04 - 1.0	–	8/91
MBTH81CC.S2P	23	PMBTH81	–10.0	–20.0	0.04 - 1.0	–	8/91

SPICE AND PACKAGE PARAMETERS

INTRODUCTION

SPICE and package parameters for TIME-DOMAIN simulations, such as MICROWAVE SPICE®, HSPICE®, PSPICE®, and for HARMONIC-BALANCE simulations, such as LIBRA®, jOMEGA®, MDS®, and HARMONICA® are now available. In this handbook, most datasheets of recently released types contain a listing of the model parameters for both the crystal and the envelope.

More parameters are available than could be included in the datasheets at time of printing of this handbook. For these types the parameters are available on a 3.5" diskette. The relevant types are listed below.

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SPICE and package parameters on 3.5" Diskette, Version 2.0

Version 2.0 (August 1992) contains SPICE and package parameters for most RF wideband transistors suitable for non-linear circuit applications. Parameters are given individually for crystals and envelopes. By embedding the crystal data inside the envelope, an accurate non-linear model for each transistor type can be constructed. The data for about **90** transistors are released in Version 2.0, and can be easily selected using a simple procedure. The contents of Version 2.0 are as follows:

Transistor types (in alphanumeric order):

BFG25A/X, BFG31, BFG32, BFG33, BFG33/X, BFG33/XR, BFG34, BFG65, BFG67, BFG67R, BFG67/X, BFG67/XR, BFG90A, BFG91A, BFG92A, BFG92A/X, BFG92A/XR, BFG93A, BFG93A/X, BFG93A/XR, BFG94, BFG96, BFG97, BFG134, BFG135, BFG195, BFG197, BFG197/X, BFG197/XR, BFG198, BFG505, BFG505/X, BFG505/XR, BFG520, BFG520/X, BFG520/XR, BFG540, BFG540/X, BFG540/XR, BFG541, BFQ23, BFQ32, BFQ32S, BFQ34, BFQ34T, BFQ51, BFQ65, BFQ67, BFQ67W, BFQ135, BFQ161, BFQ162, BFQ163, BFQ166, BFQ231, BFQ231A, BFQ232, BFQ232A, BFQ233, BFQ233A, BFQ234, BFQ234/I, BFQ235, BFQ235A, BFQ236, BFQ236A, BFQ251, BFQ251A, BFQ252, BFQ252A, BFQ253, BFQ253A, BFQ254, BFQ254/I, BFQ255, BFQ255A, BFQ256, BFQ256A, BFQ262, BFQ262A, BFQ263, BFQ263A, BFQ265, BFQ265A, BFQ268, BFQ268/I, BFQ270, BFR90A, BFR91A, BFR92A, BFR92AW, BFR93A, BFR93AW, BFR96, BFR96S, BFR106, BFR134, BFR505, BFR520, BFR540, BFS17, BFS17W, BFS25A, BFS505, BFS520, BFS540, BFT25A, BFT92, BFT92AW, BFT93, BFT93AW, BFW92.

Package parameters (by envelope name):

SOT5 (TO-39), SOT23, SOT32 (TO-126), SOT37, SOT103, SOT128 (TO-202), SOT143, SOT143R, SOT172A2, SOT223, SOT323 (SC70).

SPICE parameters (by crystal name):

BFQ32, BFQ33, BFQ34, BFQ65, BFQ135, BFQ168, BFQ195, BFQ234, BFQ254, BFQ268, BFQ270, BFR90A, BFR91A, BFR96, BFR134, BFR505, BFR520, BFR540, BFT25A, BFT92, BFT93, BLT91, BFW92.

Please contact the local Philips Semiconductor sales office to obtain this diskette.

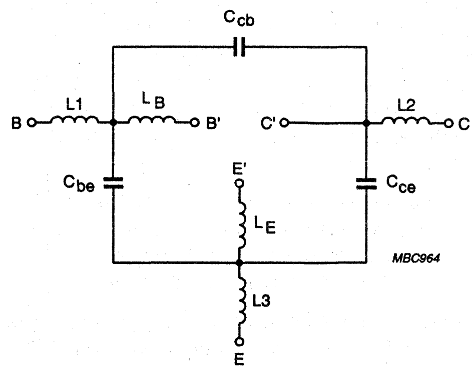
Philips continuously adds more SPICE and package parameter data to its libraries. Should certain data not be available on Version 2.0, please request these, as they might have been released prior to the next official issue, but after printing of this handbook.

Example

To accurately model the type BFQ67W, the data of the BFQ65 crystal, and the SOT323 envelope data are required. A sample listing of both, as they appear on the diskette and in the relevant datasheet, is given below. (The instructions on the diskette will help the user to select the correct crystal name and envelope name, for each type chosen).

Model parameters for BFQ65 crystal

1	IS = 556.4	aA
2	BF = 170.0	–
3	NF = 994.8	m
4	VAF = 48.03	V
5	IKF = 918.1	mA
6	ISE = 10.47	fA
7	NE = 1.479	–
8	BR = 142.1	–
9	NR = 994.1	m
10	VAR = 2.555	V
11	IKR = 9.632	A
12	ISC = 438.2	aA
13	NC = 1.089	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 655.9	mΩ
18	RC = 2.000	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.137	pF
23	VJE = 600.0	mV
24	MJE = 249.4	m
25	TF = 11.97	ps
26	XTF = 25.99	–
27	VTF = 1.223	V
28	ITF = 197.3	mA
29	PTF = 10.03	deg
30	CJC = 515.9	fF
31	VJC = 155.8	mV
32	MJC = 56.02	m
33	XCJC = 130.0	m
34	TR = 1.877	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 870.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.1 Package equivalent circuit, SOT323.

List of components (see Fig.1)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.1 nH
L3	0.34 nH
L_B	0.6 nH
L_E	0.6 nH

Note

1. These parameters have not been extracted, the default values are shown.

NAKED CRYSTALS

RF WIDEBAND TRANSISTOR CRYSTALS

Philips Semiconductors offers a range of RF wideband transistors in un-encapsulated form (see Table 1). The transistor crystals are supplied as whole wafers, fully tested(1) but unsawn. Electrical, dimensional and metallization data are given in the individual 'X3A crystal' data sheets in this handbook.

The minimum order per crystal type is one wafer. The average expectancy for good die per wafer is shown in Table 1.

Samples for customer's development purposes can be supplied on request. These comprise limited quantities of sawn, tested and separated crystals in 'waffle' packs (maximum 50 crystals).

Table 1 Naked crystals

TYPE NUMBER	POLARITY	ENCAPSULATED EQUIVALENT	WAFER SIZE (INCHES)	AVERAGE GOOD DIE PER WAFER	ORDERING CODE
X3A-BFG134	NPN	BFG135 (SOT223)	3	4000	note 1
X3A-BFQ32	PNP	BFQ32S (SOT37)	3	15 000	9338 283 60002
X3A-BFQ33	NPN	BFG33 (SOT143)	3	15 000	9340 077 60002
X3A-BFQ34	NPN	BFQ34 (SOT122)	3	10 000	9340 167 70002
X3A-BFQ65	NPN	BFQ67 (SOT23)	3	15 000	9339 768 90002
X3A-BFQ168	NPN	BFQ162 (SOT32)	3	8000	9340 132 70002
X3A-BFQ195	NPN	BFG197 (SOT143)	3	10 000	note 1
X3A-BFQ234	NPN	BFQ232 (SOT32)	3	8000	9340 132 80002
X3A-BFQ254	PNP	BFQ252 (SOT32)	3	8000	9340 132 90002
X3A-BFQ268	NPN	BFQ262 (SOT32)	3	8000	9340 133 00002
X3A-BFR90A	NPN	BFR92A (SOT23)	3	20 000	9338 282 00002
X3A-BFR91A	NPN	BFR93A (SOT23)	3	20 000	9338 282 30002
X3A-BFR96	NPN	BFR106 (SOT23)	3	20 000	9338 282 50002
X3A-BFR505	NPN	BFR505 (SOT23)	3	30 000	note 1
X3A-BFR520	NPN	BFR520 (SOT23)	3	30 000	note 1
X3A-BFR540	NPN	BFR540 (SOT23)	3	30 000	note 1
X3A-BFT92	PNP	BFT92 (SOT23)	3	20 000	9338 283 00002
X3A-BFT93	PNP	BFT93 (SOT23)	3	20 000	9338 283 30002
X3A-BFW92	NPN	BFS17 (SOT23)	3	25 000	9339 520 40002

Note

1. Not available at date of publication.

(1) Pre-delivery visual inspection criteria are laid down in Quality Publication URV-3-5-52/733, available via your local sales office.

APPLICATION REPORTS

APPLICATION REPORTS

Copies of the following application reports can be requested via your local sales office.

1. A wideband amplifier with the BFR90A and BFR91A. NCO8002, 17 April 1980.
2. Two-stage MATV wideband amplifier with BFR96S and BFQ34. NCO8001, 17 April 1980.
3. The BFR90A, BFR91A and BFR96S as driver-amplifiers in mobile and portable radio transmitters. ECO8102, 19 November 1981.
4. The BFG90A, BFG91A and BFG96 as driver-amplifiers in mobile and portable radio transmitters. NCO8402, 9 April 1984.
5. A three-stage line-up for the 900 MHz band with 8 W output power at 12.5 V. (BFG34, BLV91 and BLV93). NCO8404, 1 October 1984.
6. MATV wideband amplifier equipped with the BFR96S and BFQ34 transistors. CON7704, 28 February 1977.
7. MATV wideband amplifier equipped with the BFQ34 transistor. CON7702, 18 February 1977.
8. Three-stage MATV wideband amplifier equipped with the BFR96S and BFQ34 transistors. CON7708, 6 April 1977.
9. D2 investigation of broadband MATV amplifiers by means of a vector diagram. CON7711, 8 April 1977.
10. D2 investigation of broadband MATV amplifiers. CON7712, 8 April 1977.
11. Amplifier with frequency range 47 to 860 MHz with output voltage of 122 dBμV according to DIN45004. AT-TVT 19/88, 20 July 1988. (German language)
12. House connection amplifier with BFG135 (and BFG31) in push-pull technique. PCALH/AT-TVT 20/89, 11 September 1989. (German language)
13. Satellite IF amplifier with BFG198 and BFG67. PCALH/AT-TVT 45/90, 11 October 1990. (German language)
14. The design of a cost-effective video amplifier for very high resolution monitors (BFQ162, BFQ232, BFQ252, BFQ262). MDS 89002, 3 May 1989.
15. Economical I²C-bus controlled auto frequency monitor (BFQ65, BFR134, BFQ161/BFQ265A, BFQ235A, BFQ255A). SDS 91005, August 1991.
16. 60 MHz video amplifier for XGA (TDA4881, BFQ235, BFQ256, and BFQ236). EN92007, November 1992.
17. 25 MHz HDTV video amplifier (BFQ291, BFQ295 and BFQ296), ETV92005, October 1992.
18. Power amplifier for 1.9 GHz at 3 V; application information of a surface mount power amplifier for 1.9 GHz digital Personal Handy Phone (PHP) and DECT at 3 V. (BFG10/X, BFG11/X and BFG540/X). RNR45/391/1992, September 4th, 1992.
19. Low noise, low current preamplifier for 1.9 GHz at 3 V. (BFG505). RNR45/343/1992, July 1992.

DEVICE DATA

NPN 1 GHz wideband transistor — BF547

FEATURES

- Stable oscillator operation
- High current gain
- Good thermal stability.

DESCRIPTION

The BF547 is a low cost NPN transistor in a plastic SOT23 envelope. It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

PINNING

PIN	DESCRIPTION
Code: E16	
1	base
2	emitter
3	collector

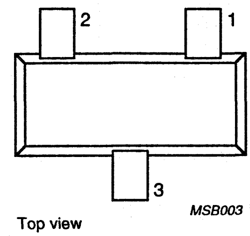


Fig.1 SOT23.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–55	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 10$ V	40	95	250	
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 500 MHz	0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 1$ mA; $V_{CE} = 10$ V; f = 100 MHz	–	20	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

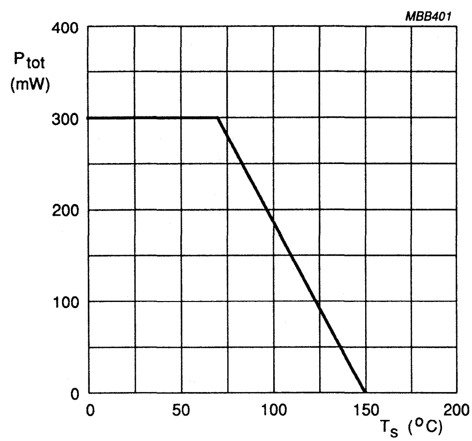
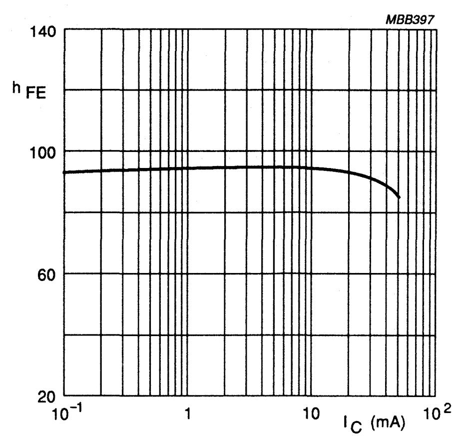
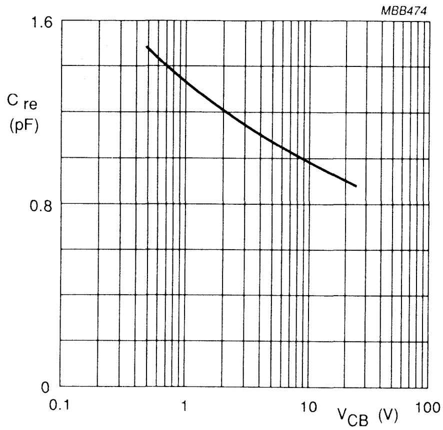


Fig.2 Power derating curve.



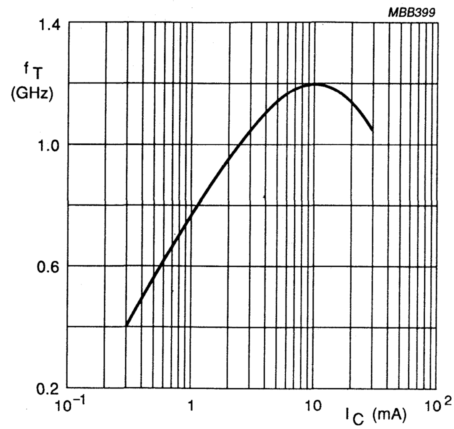
V_{CE} = 10 V.

Fig.3 DC current gain as a function of collector current.



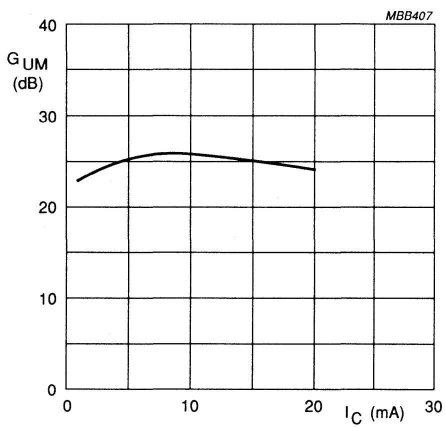
$I_E = i_e = 0$; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



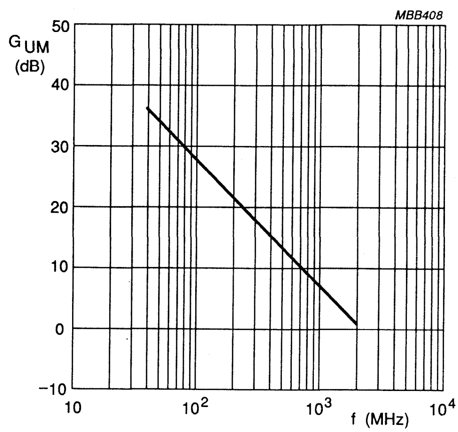
V_{CE} = 10 V; f = 500 MHz.

Fig.5 Transition frequency as a function of collector current.



V_{CE} = 10 V; f = 100 MHz.

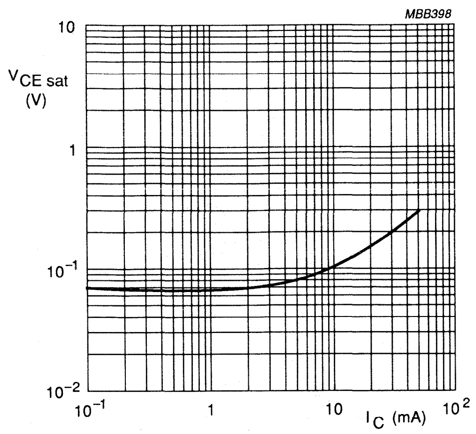
Fig.6 Maximum unilateral power gain as a function of collector current.



V_{CE} = 10 V; I_C = 15 mA.

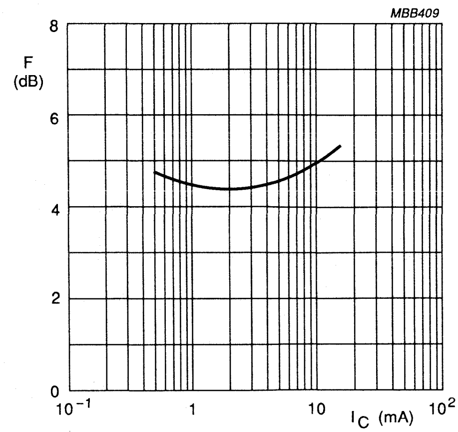
Fig.7 Maximum unilateral power gain as a function of frequency.

NPN 1 GHz wideband transistor BF547



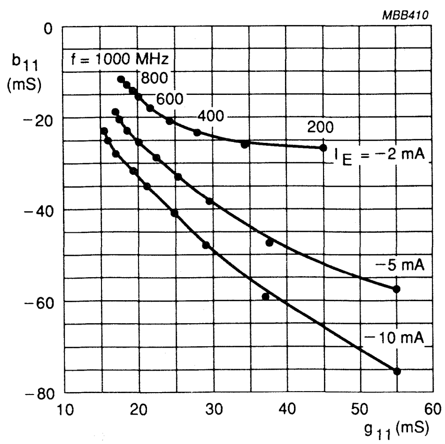
$I_C/I_B = 10$.

Fig.8 Collector-emitter saturation voltage as a function of collector current.



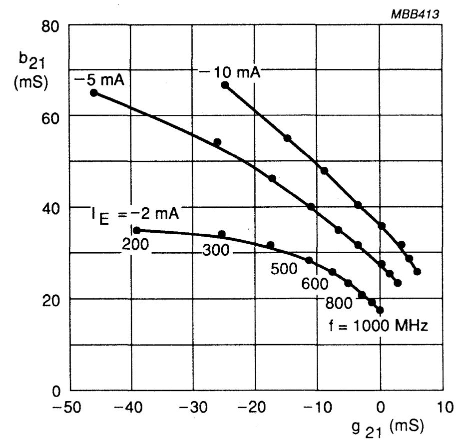
$V_{CE} = 10$ V; $Z_S = Z_L = 50\ \Omega$; f = 100 MHz.

Fig.9 Common emitter noise figure as a function of collector current.



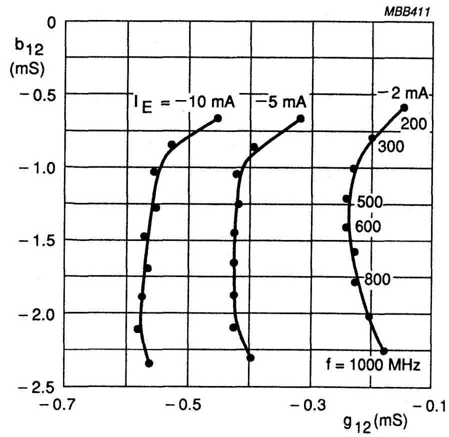
$V_{CB} = 10$ V.

Fig.10 Common base input admittance (Y_{11}).



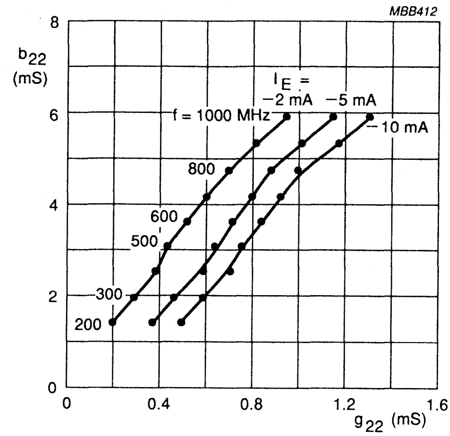
$V_{CB} = 10$ V.

Fig.11 Common base forward admittance (Y_{21}).



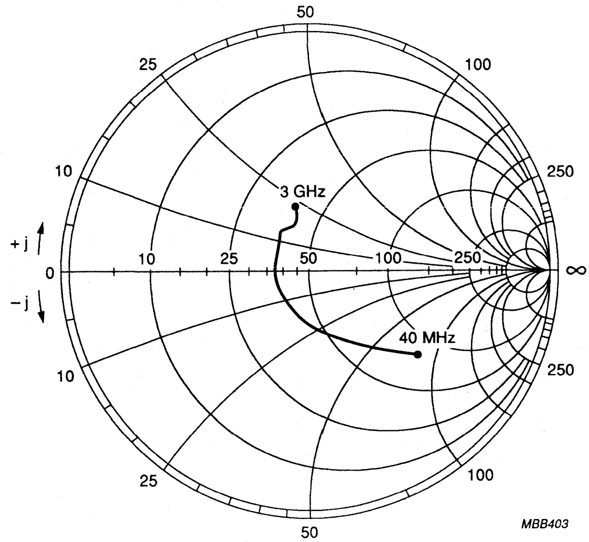
V_{CB} = 10 V.

Fig.12 Common base reverse admittance (Y_{12}).



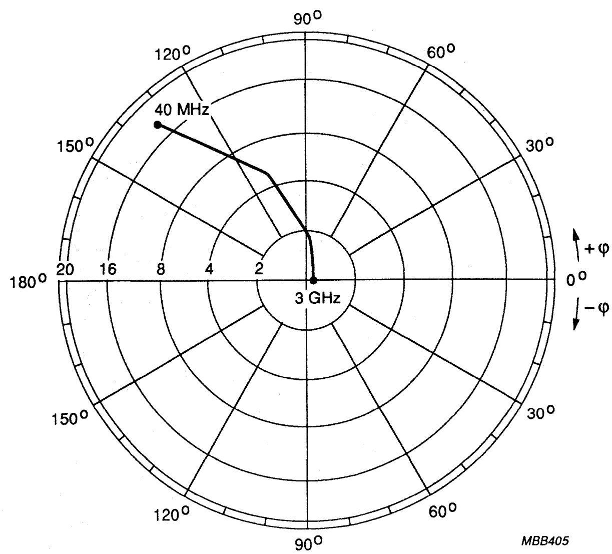
V_{CB} = 10 V.

Fig.13 Common base output admittance (Y_{22}).



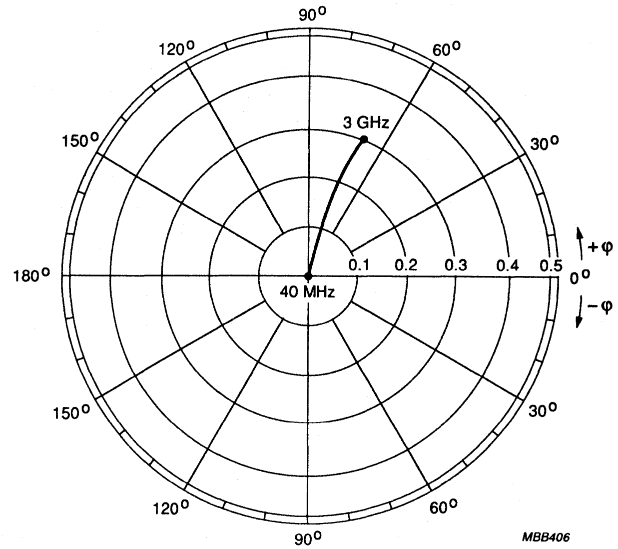
V_{CE} = 10 V; I_C = 15 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}).



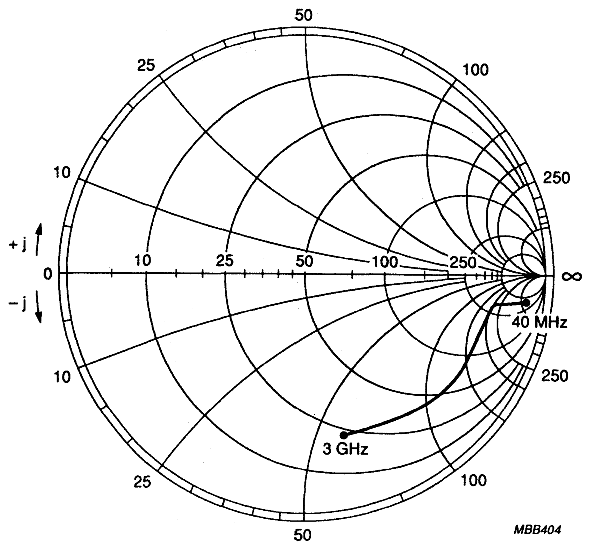
V_{CE} = 10 V; I_C = 15 mA.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 10 V; I_C = 15 mA.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



V_{CE} = 10 V; I_C = 15 mA.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common base Y-parameters, V_{CB} = 10 V, $-I_E$ = 2 mA

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	69.0	−10.2	−68.0	12.3	−0.02	−0.1	−0.01	0.3
100	60.4	−20.6	−58.0	25.6	−0.06	−0.3	−0.08	0.7
200	45.0	−27.4	−39.1	34.5	−0.10	−0.6	0.19	1.4
300	34.3	−26.4	−25.4	34.0	−0.20	−0.8	0.29	1.9
400	27.7	−23.3	−17.2	31.1	−0.20	−1.0	0.37	2.5
500	24.0	−20.4	−11.7	27.6	−0.20	−1.2	0.45	3.0
600	21.5	−18.0	−7.8	25.0	−0.20	−1.4	0.53	3.6
700	20.0	−15.6	−5.3	22.6	−0.20	−1.6	0.60	4.2
800	18.6	−14.0	−3.0	20.2	−0.20	−1.8	0.69	4.7
900	18.3	−12.8	−1.3	18.7	−0.20	−2.0	0.82	5.3
1000	17.8	−11.7	−0.1	17.1	−0.20	−2.2	0.95	5.9

Table 2 Common base Y-parameters, V_{CB} = 10 V, $-I_E$ = 5 mA

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	132.6	−35.7	−130.5	38.8	−0.06	−0.2	−0.06	0.4
100	96.3	−62.0	−91.1	67.9	−0.20	−0.5	0.21	0.8
200	54.7	−57.8	−46.0	64.7	−0.30	−0.7	0.38	1.4
300	37.5	−46.9	−26.4	53.8	−0.40	−0.8	0.47	2.0
400	29.2	−38.6	−16.6	45.8	−0.40	−1.0	0.58	2.5
500	25.3	−32.8	−11.0	39.8	−0.40	−1.3	0.63	3.1
600	22.0	−28.4	−6.3	35.0	−0.40	−1.4	0.71	3.6
700	20.3	−25.2	−3.3	31.4	−0.40	−1.6	0.80	4.2
800	18.7	−22.6	−0.6	27.6	−0.40	−1.9	0.88	4.7
900	17.8	−20.7	1.4	25.2	−0.40	−2.1	1.01	5.3
1000	17.3	−19.1	3.0	23.0	−0.40	−2.3	1.15	6.0

Table 3 Common base Y-parameters, V_{CB} = 10 V, $-I_E$ = 10 mA

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	189.0	−79.6	−185.5	83.0	−0.10	−0.3	−0.09	0.4
100	108.5	−99.0	−101.4	105.4	−0.30	−0.5	0.30	0.9
200	55.2	−76.2	−44.6	82.8	−0.50	−0.7	0.44	1.4
300	37.1	−59.0	−24.3	65.7	−0.50	−0.9	0.60	2.0
400	28.8	−47.6	−14.6	54.4	−0.60	−1.0	0.69	2.5
500	24.7	−40.2	−8.6	46.7	−0.60	−1.3	0.75	3.1
600	21.2	−35.0	−3.4	40.8	−0.60	−1.5	0.84	3.6
700	19.3	−31.0	−0.2	36.2	−0.60	−1.7	0.93	4.2
800	17.2	−27.5	2.6	31.1	−0.60	−1.9	1.00	4.7
900	16.4	−25.2	4.6	28.3	−0.60	−2.1	1.15	5.3
1000	15.8	−23.0	6.0	25.5	−0.60	−2.3	1.31	6.0

Table 4 Common base Y-parameters, V_{CB} = 10 V, $-I_E$ = 15 mA

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	206.5	−113.8	−202.6	118.1	−0.20	−0.3	0.2	0.5
100	104.3	−114.0	−96.4	120.1	−0.40	−0.5	0.4	0.9
200	53.1	−81.1	−41.7	87.7	−0.50	−0.7	0.6	1.4
300	35.9	−62.1	−22.0	68.6	−0.60	−0.8	0.7	2.0
400	28.1	−50.0	−12.5	56.9	−0.60	−1.1	0.8	2.5
500	23.4	−42.3	−6.1	48.2	−0.60	−1.3	0.8	3.1
600	20.1	−36.4	−1.2	41.6	−0.60	−1.5	0.9	3.6
700	18.2	−32.0	2.0	36.7	−0.60	−1.7	1.0	4.2
800	16.2	−28.2	4.5	31.3	−0.60	−1.9	1.1	4.7
900	15.5	−25.7	6.5	28.1	−0.60	−2.1	1.3	5.3
1000	14.7	−23.5	7.9	24.9	−0.60	−2.3	1.4	5.9

Table 5 Common base scattering parameters, V_{CE} = 10 V, I_C = 2 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.890	−17.0	5.897	160.3	0.012	79.3	0.985	−3.9	37.5
100	0.740	−37.1	4.889	137.8	0.027	69.3	0.935	−7.7	26.2
200	0.521	−55.9	3.377	115.2	0.043	64.0	0.882	−10.5	18.5
300	0.404	−65.8	2.477	103.1	0.056	63.2	0.857	−12.5	14.4
400	0.331	−73.2	1.967	94.3	0.069	62.9	0.846	−14.6	11.8
500	0.288	−78.7	1.617	87.9	0.081	63.1	0.838	−16.9	9.8
600	0.258	−84.6	1.386	82.4	0.092	63.1	0.834	−19.2	8.3
700	0.233	−89.1	1.227	77.9	0.102	62.6	0.832	−21.7	7.1
800	0.213	−94.9	1.095	73.8	0.112	62.5	0.829	−23.9	6.0
900	0.199	−100.3	1.001	69.9	0.122	62.0	0.827	−26.3	5.2
1000	0.183	−106.5	0.931	66.5	0.130	61.9	0.822	−28.8	4.4
1200	0.153	−120.2	0.823	59.5	0.148	61.0	0.812	−33.5	3.1
1400	0.142	−134.3	0.741	53.9	0.164	60.7	0.806	−38.4	2.0
1600	0.130	−146.0	0.681	50.0	0.178	60.9	0.798	−43.2	1.1
1800	0.121	−161.9	0.636	45.9	0.194	60.8	0.791	−47.6	0.4
2000	0.116	179.8	0.604	40.9	0.207	60.4	0.771	−52.1	−0.4

Table 6 Common base scattering parameters, V_{CE} = 10 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.767	−26.3	11.308	149.3	0.011	75.7	0.956	−6.0	35.6
100	0.542	−49.0	7.603	123.2	0.022	67.5	0.875	−8.7	25.4
200	0.359	−65.2	4.493	104.4	0.036	66.6	0.827	−10.0	18.7
300	0.283	−75.1	3.141	95.3	0.049	66.6	0.811	−11.7	15.0
400	0.244	−84.1	2.452	88.6	0.061	66.5	0.804	−13.9	12.6
500	0.213	−92.3	1.991	83.4	0.073	66.5	0.798	−16.0	10.6
600	0.196	−100.7	1.696	78.7	0.083	66.5	0.797	−18.4	9.1
700	0.180	−108.6	1.484	74.7	0.093	66.5	0.797	−20.7	8.0
800	0.170	−115.6	1.318	71.1	0.102	66.5	0.796	−23.1	6.9
900	0.156	−123.6	1.195	67.7	0.112	66.0	0.792	−25.4	5.9
1000	0.146	−131.7	1.106	64.4	0.121	66.0	0.790	−27.7	5.2
1200	0.132	−150.4	0.968	57.5	0.138	65.9	0.783	−32.4	3.9
1400	0.131	−164.8	0.856	52.3	0.155	65.9	0.778	−37.4	2.8
1600	0.133	−176.8	0.783	48.4	0.171	66.1	0.776	−42.0	2.0
1800	0.132	169.2	0.726	44.4	0.189	66.2	0.770	−46.4	1.2
2000	0.140	152.4	0.679	39.3	0.205	65.5	0.752	−50.9	0.3

NPN 1 GHz wideband transistor BF547

Table 7 Common base scattering parameters, V_{CE} = 10 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.637	–34.1	15.486	139.3	0.010	72.5	0.921	–7.2	34.2
100	0.416	–54.7	8.908	114.1	0.020	68.8	0.837	–8.4	25.1
200	0.283	–71.9	4.955	99.0	0.033	68.5	0.802	–9.4	18.7
300	0.236	–84.7	3.421	91.5	0.046	68.2	0.790	–11.0	15.2
400	0.204	–97.6	2.644	85.3	0.057	68.0	0.785	–13.2	12.8
500	0.186	–108.3	2.144	80.6	0.068	68.5	0.781	–15.4	10.9
600	0.173	–117.8	1.818	76.1	0.077	68.8	0.780	–17.7	9.4
700	0.155	–127.4	1.586	72.3	0.087	69.1	0.781	–20.0	8.2
800	0.151	–134.7	1.404	68.8	0.096	69.4	0.781	–22.4	7.1
900	0.143	–143.3	1.266	65.2	0.106	69.2	0.778	–24.6	6.2
1000	0.139	–152.2	1.168	62.3	0.115	69.4	0.779	–27.0	5.5
1200	0.135	–170.8	1.011	55.5	0.134	69.3	0.773	–31.6	4.1
1400	0.139	177.5	0.891	50.3	0.152	69.2	0.768	–36.6	3.0
1600	0.143	167.3	0.807	46.4	0.170	69.3	0.766	–41.4	2.1
1800	0.146	152.1	0.745	42.5	0.188	69.3	0.762	–45.8	1.3
2000	0.161	140.1	0.695	37.5	0.205	68.3	0.746	–50.4	0.5

Table 8 Common base scattering parameters, V_{CE} = 10 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.564	–37.8	16.887	133.4	0.009	73.0	0.901	–7.4	33.5
100	0.365	–57.2	8.999	110.3	0.019	69.3	0.826	–7.9	24.7
200	0.260	–75.7	4.932	96.9	0.032	69.3	0.797	–8.8	18.5
300	0.216	–91.4	3.410	89.8	0.044	69.1	0.786	–10.7	15.0
400	0.187	–105.1	2.636	83.6	0.055	69.2	0.781	–12.8	12.7
500	0.174	–116.4	2.127	78.9	0.065	69.9	0.779	–15.0	10.7
600	0.160	–126.6	1.802	74.4	0.075	70.1	0.778	–17.3	9.3
700	0.152	–136.3	1.569	70.5	0.085	70.7	0.781	–19.7	8.1
800	0.143	–145.0	1.384	67.0	0.095	71.0	0.780	–22.1	7.0
900	0.138	–152.1	1.247	63.6	0.104	70.9	0.780	–24.4	6.1
1000	0.136	–161.8	1.149	60.4	0.113	71.0	0.778	–26.7	5.3
1200	0.137	–178.2	0.991	53.8	0.132	70.9	0.774	–31.5	4.0
1400	0.144	168.8	0.875	48.5	0.151	70.6	0.770	–36.4	2.8
1600	0.145	159.3	0.789	44.6	0.169	70.8	0.768	–41.2	1.9
1800	0.150	146.1	0.730	41.0	0.188	70.7	0.764	–45.7	1.2
2000	0.167	134.1	0.677	35.8	0.206	69.4	0.748	–50.3	0.3

NPN 1 GHz wideband transistor BF547W

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 (S-mini) envelope. It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners. The BF547W uses the same crystal as the SOT23 version, BF547.

PINNING

PIN	DESCRIPTION
	Code: E16
1	base
2	emitter
3	collector

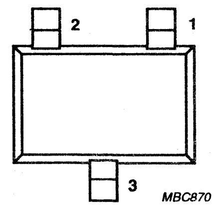


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 87 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V	0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	–	20	–	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	290	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 2 GHz wideband transistor BF689K

DESCRIPTION

NPN transistor in a plastic SOT54 (TO-92 variant) envelope. It is intended for application as an amplifier or oscillator in the VHF and UHF range.

PINNING

PIN	DESCRIPTION
Code: F689	
1	emitter
2	base
3	collector

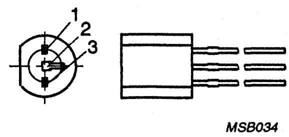


Fig.1 SOT54.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_{amb} = 60 °C	–	–	360	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 5 V; T_j = 25 °C	20	–	–	
		I_C = 20 mA; V_{CE} = 5 V; T_j = 25 °C	35	–	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 5 V; f = 500 MHz	–	1.8	–	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current	$t_p < 1\ \mu s$	–	50	mA
P_{tot}	total power dissipation	up to T_{amb}= 60 °C	–	360	mW
T_{stg}	storage temperature		–55	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	250 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 15$ V	–	–	50	nA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 2$ V	–	–	1	µA
$V_{CE\ sat}$	collector-emitter saturation voltage	$I_C = 25$ mA; $I_B = 1.25$ mA	–	–	1.0	V
$V_{BE\ sat}$	base-emitter saturation voltage	$I_C = 25$ mA; $I_B = 1.25$ mA	–	–	1.0	V
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 5$ V	20	–	–	
		$I_C = 20$ mA; $V_{CE} = 5$ V	35	–	–	
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 5$ V; f = 500 MHz	–	1.8	–	GHz
C_{re}	feedback capacitance	$I_C = 2$ mA; $V_{CE} = 5$ V; f = 1 MHz; $T_{amb} = 25$ °C	–	1.1	–	pF
G_p	power gain	$I_C = 2$ mA; $V_{CE} = 5$ V; f = 100 MHz; $T_{amb} = 25$ °C; $Z_S = 60\ \Omega$; $R_L = 2\ k\Omega$	–	16	–	dB
		$I_C = 2$ mA; $V_{CE} = 5$ V; f = 200 MHz; $T_{amb} = 25$ °C; $Z_S = 60\ \Omega$; $R_L = 920\ \Omega$	–	16	–	dB
F	noise figure	$I_C = 2$ mA; $V_{CE} = 5$ V; f = 100 MHz; $T_{amb} = 25$ °C; $Z_S = 60\ \Omega$	–	4	–	dB
		$I_C = 2$ mA; $V_{CE} = 5$ V; f = 200 MHz; $T_{amb} = 25$ °C; $Z_S = 60\ \Omega$	–	3	–	dB

NPN 1 GHz wideband transistor BF747

FEATURES

- Stable oscillator operation
- High current gain
- Good thermal stability.

DESCRIPTION

Low cost NPN transistor in a plastic SOT23 envelope.

It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

PINNING

PIN	DESCRIPTION
	Code: E15
1	base
2	emitter
3	collector

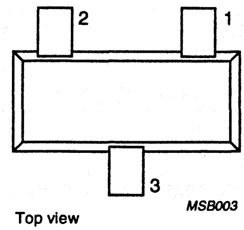


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	1.2	1.6	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–55	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	–	20	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

 Capability approved CECC 50 000 (issue 4), 1986.

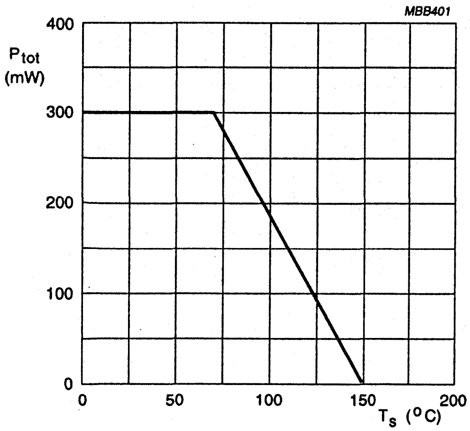
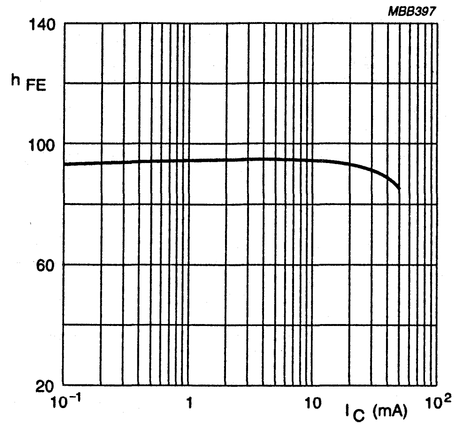
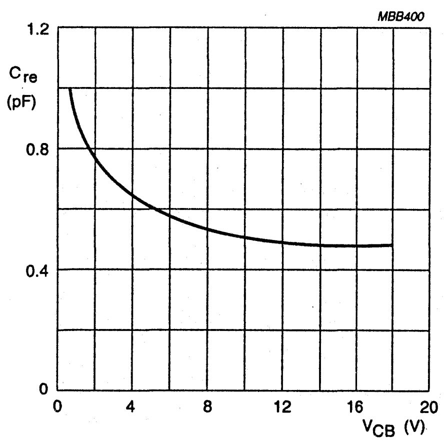


Fig.2 Power derating curve.



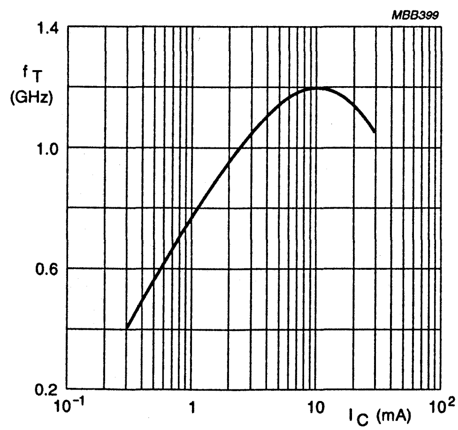
V_{CE} = 10 V.

Fig.3 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz.

Fig.5 Transition frequency as a function of collector current.

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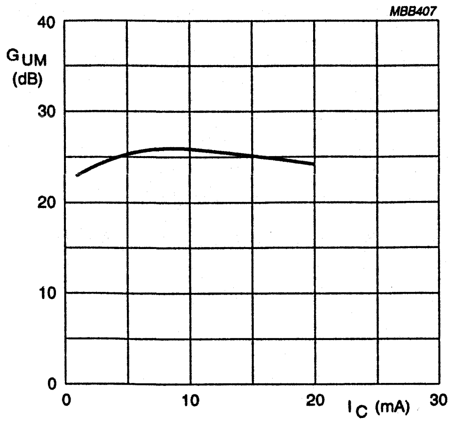
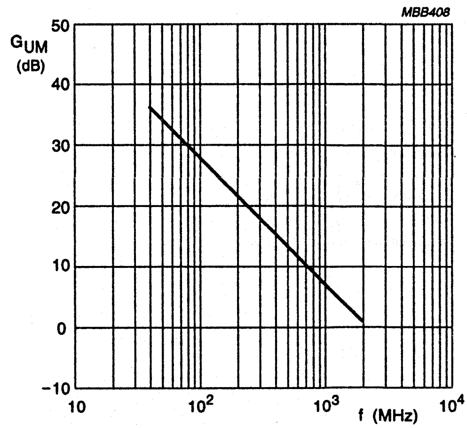


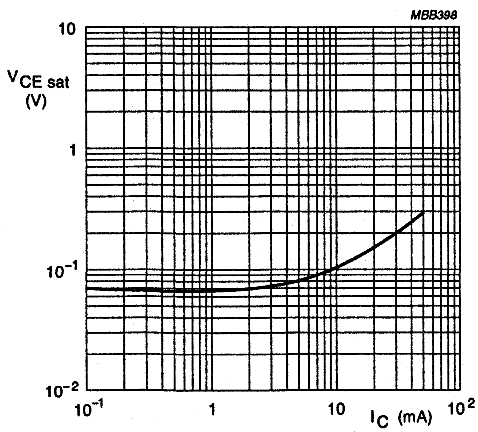
V_{CE} = 10 V; f = 100 MHz.

Fig.6 Maximum unilateral power gain as a function of collector current.



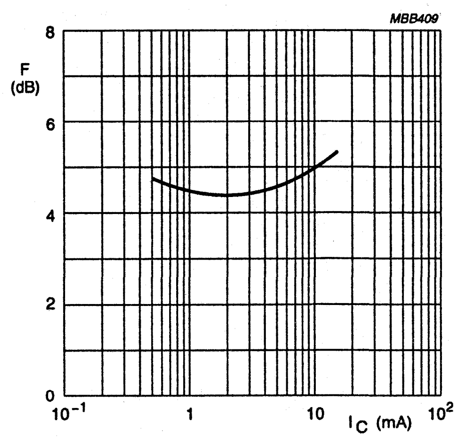
I_C = 15 mA; V_{CE} = 10 V.

Fig.7 Maximum unilateral power gain as a function of frequency.



I_C/I_B = 10.

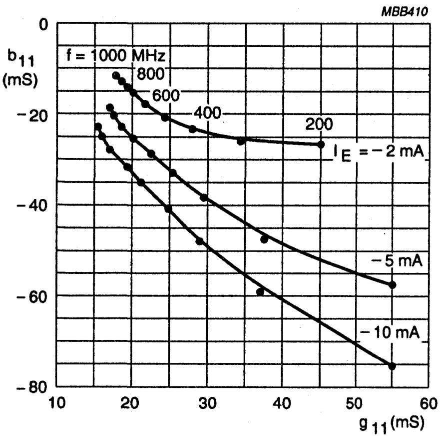
Fig.8 Collector-emitter saturation voltage as a function of collector current.



V_{CE} = 10 V; f = 100 MHz; $Z_S = Z_L$ = 50 Ω

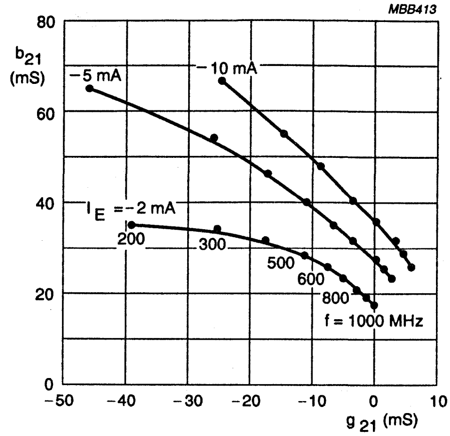
Fig.9 Common emitter noise figure as a function of collector current.

Capability approved CECC 50 000 (issue 4), 1986.



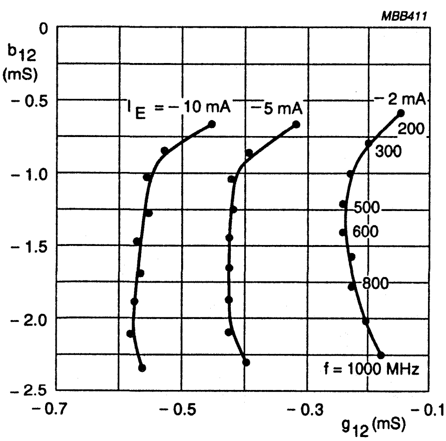
V_{CB} = 10 V.

Fig.10 Common base input admittance (Y_{11}).



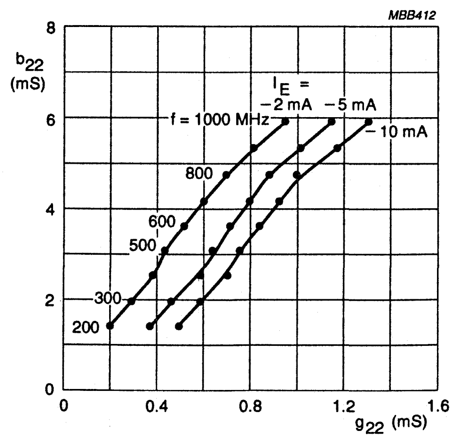
V_{CB} = 10 V.

Fig.11 Common base forward admittance (Y_{21}).



V_{CB} = 10 V.

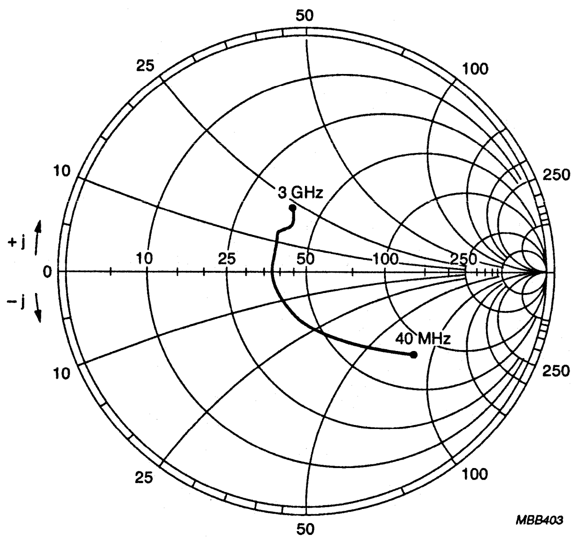
Fig.12 Common base reverse admittance (Y_{12}).



V_{CB} = 10 V.

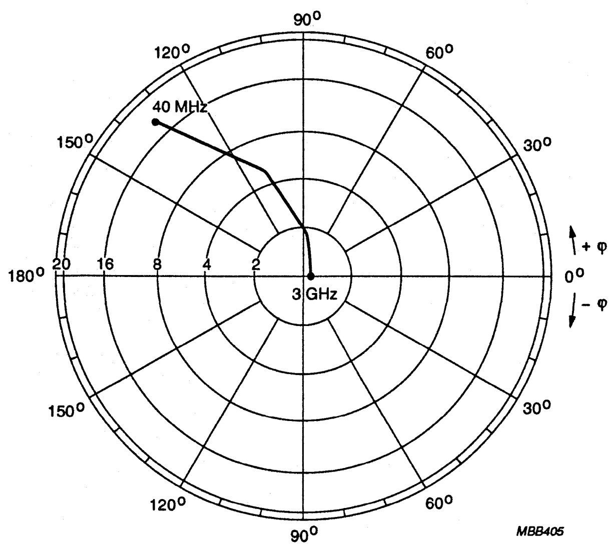
Fig.13 Common base output admittance (Y_{22}).

Capability approved CECC 50 000 (issue 4), 1986.



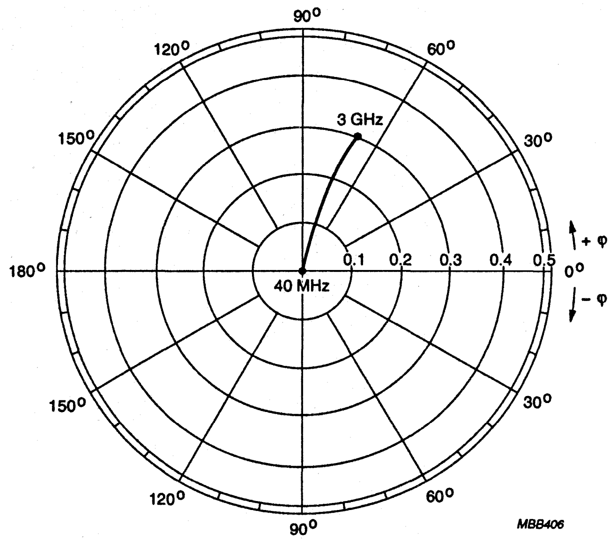
I_C = 15 mA; V_{CE} = 10 V

Fig.14 Common emitter input reflection coefficient (S_{11}).



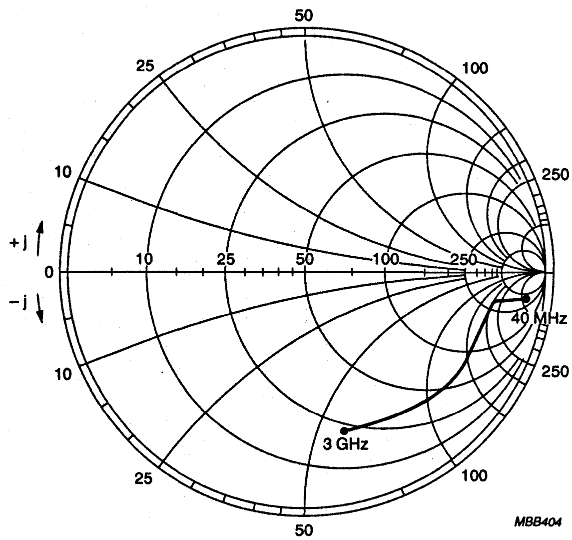
I_C = 15 mA; V_{CE} = 10 V.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 10 V.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 15 mA; V_{CE} = 10 V.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common base Y-parameters, $I_E = -2$ mA; $V_{CB} = 10$ V, typical values

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	69.0	−10.2	−68.0	12.3	−0.02	−0.1	−0.01	0.3
100	60.4	−20.6	−58.0	25.6	−0.06	−0.3	−0.08	0.7
200	45.0	−27.4	−39.1	34.5	−0.10	−0.6	0.19	1.4
300	34.3	−26.4	−25.4	34.0	−0.20	−0.8	0.29	1.9
400	27.7	−23.3	−17.2	31.1	−0.20	−1.0	0.37	2.5
500	24.0	−20.4	−11.7	27.6	−0.20	−1.2	0.45	3.0
600	21.5	−18.0	−7.8	25.0	−0.20	−1.4	0.53	3.6
700	20.0	−15.6	−5.3	22.6	−0.20	−1.6	0.60	4.2
800	18.6	−14.0	−3.0	20.2	−0.20	−1.8	0.69	4.7
900	18.3	−12.8	−1.3	18.7	−0.20	−2.0	0.82	5.3
1000	17.8	−11.7	−0.1	17.1	−0.20	−2.2	0.95	5.9

Table 2 Common base Y-parameters, $I_E = -5$ mA; $V_{CB} = 10$ V, typical values

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	132.6	−35.7	−130.5	38.8	−0.06	−0.2	−0.06	0.4
100	96.3	−62.0	−91.1	67.9	−0.20	−0.5	0.21	0.8
200	54.7	−57.8	−46.0	64.7	−0.30	−0.7	0.38	1.4
300	37.5	−46.9	−26.4	53.8	−0.40	−0.8	0.47	2.0
400	29.2	−38.6	−16.6	45.8	−0.40	−1.0	0.58	2.5
500	25.3	−32.8	−11.0	39.8	−0.40	−1.3	0.63	3.1
600	22.0	−28.4	−6.3	35.0	−0.40	−1.4	0.71	3.6
700	20.3	−25.2	−3.3	31.4	−0.40	−1.6	0.80	4.2
800	18.7	−22.6	−0.6	27.6	−0.40	−1.9	0.88	4.7
900	17.8	−20.7	1.4	25.2	−0.40	−2.1	1.01	5.3
1000	17.3	−19.1	3.0	23.0	−0.40	−2.3	1.15	6.0

Table 3 Common base Y-parameters, $I_E = -10$ mA; $V_{CB} = 10$ V, typical values

f (MHz)	Y_{11} REAL (mS)	Y_{11} IMAG. (mS)	Y_{21} REAL (mS)	Y_{21} IMAG. (mS)	Y_{12} REAL (mS)	Y_{12} IMAG. (mS)	Y_{22} REAL (mS)	Y_{22} IMAG. (mS)
40	189.0	−79.6	−185.5	83.0	−0.10	−0.3	−0.09	0.4
100	108.5	−99.0	−101.4	105.4	−0.30	−0.5	0.30	0.9
200	55.2	−76.2	−44.6	82.8	−0.50	−0.7	0.44	1.4
300	37.1	−59.0	−24.3	65.7	−0.50	−0.9	0.60	2.0
400	28.8	−47.6	−14.6	54.4	−0.60	−1.0	0.69	2.5
500	24.7	−40.2	−8.6	46.7	−0.60	−1.3	0.75	3.1
600	21.2	−35.0	−3.4	40.8	−0.60	−1.5	0.84	3.6
700	19.3	−31.0	−0.2	36.2	−0.60	−1.7	0.93	4.2
800	17.2	−27.5	2.6	31.1	−0.60	−1.9	1.00	4.7
900	16.4	−25.2	4.6	28.3	−0.60	−2.1	1.15	5.3
1000	15.8	−23.0	6.0	25.5	−0.60	−2.3	1.31	6.0

Table 4 Common base Y-parameters, $I_E = -15$ mA; $V_{CB} = 10$ V, typical values

f (MHz)	Y_{11} REAL (mS)	Y_{11} IMAG. (mS)	Y_{21} REAL (mS)	Y_{21} IMAG. (mS)	Y_{12} REAL (mS)	Y_{12} IMAG. (mS)	Y_{22} REAL (mS)	Y_{22} IMAG. (mS)
40	206.5	−113.8	−202.6	118.1	−0.20	−0.3	0.2	0.5
100	104.3	−114.0	−96.4	120.1	−0.40	−0.5	0.4	0.9
200	53.1	−81.1	−41.7	87.7	−0.50	−0.7	0.6	1.4
300	35.9	−62.1	−22.0	68.6	−0.60	−0.8	0.7	2.0
400	28.1	−50.0	−12.5	56.9	−0.60	−1.1	0.8	2.5
500	23.4	−42.3	−6.1	48.2	−0.60	−1.3	0.8	3.1
600	20.1	−36.4	−1.2	41.6	−0.60	−1.5	0.9	3.6
700	18.2	−32.0	2.0	36.7	−0.60	−1.7	1.0	4.2
800	16.2	−28.2	4.5	31.3	−0.60	−1.9	1.1	4.7
900	15.5	−25.7	6.5	28.1	−0.60	−2.1	1.3	5.3
1000	14.7	−23.5	7.9	24.9	−0.60	−2.3	1.4	5.9

Table 5 Common base scattering parameters, I_C = 2 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.890	−17.0	5.897	160.3	0.012	79.3	0.985	−3.9	37.5
100	0.740	−37.1	4.889	137.8	0.027	69.3	0.935	−7.7	26.2
200	0.521	−55.9	3.377	115.2	0.043	64.0	0.882	−10.5	18.5
300	0.404	−65.8	2.477	103.1	0.056	63.2	0.857	−12.5	14.4
400	0.331	−73.2	1.967	94.3	0.069	62.9	0.846	−14.6	11.8
500	0.288	−78.7	1.617	87.9	0.081	63.1	0.838	−16.9	9.8
600	0.258	−84.6	1.386	82.4	0.092	63.1	0.834	−19.2	8.3
700	0.233	−89.1	1.227	77.9	0.102	62.6	0.832	−21.7	7.1
800	0.213	−94.9	1.095	73.8	0.112	62.5	0.829	−23.9	6.0
900	0.199	−100.3	1.001	69.9	0.122	62.0	0.827	−26.3	5.2
1000	0.183	−106.5	0.931	66.5	0.130	61.9	0.822	−28.8	4.4
1200	0.153	−120.2	0.823	59.5	0.148	61.0	0.812	−33.5	3.1
1400	0.142	−134.3	0.741	53.9	0.164	60.7	0.806	−38.4	2.0
1600	0.130	−146.0	0.681	50.0	0.178	60.9	0.798	−43.2	1.1
1800	0.121	−161.9	0.636	45.9	0.194	60.8	0.791	−47.6	0.4
2000	0.116	179.8	0.604	40.9	0.207	60.4	0.771	−52.1	−0.4

Table 6 Common base scattering parameters, I_C = 5 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.767	−26.3	11.308	149.3	0.011	75.7	0.956	−6.0	35.6
100	0.542	−49.0	7.603	123.2	0.022	67.5	0.875	−8.7	25.4
200	0.359	−65.2	4.493	104.4	0.036	66.6	0.827	−10.0	18.7
300	0.283	−75.1	3.141	95.3	0.049	66.6	0.811	−11.7	15.0
400	0.244	−84.1	2.452	88.6	0.061	66.5	0.804	−13.9	12.6
500	0.213	−92.3	1.991	83.4	0.073	66.5	0.798	−16.0	10.6
600	0.196	−100.7	1.696	78.7	0.083	66.5	0.797	−18.4	9.1
700	0.180	−108.6	1.484	74.7	0.093	66.5	0.797	−20.7	8.0
800	0.170	−115.6	1.318	71.1	0.102	66.5	0.796	−23.1	6.9
900	0.156	−123.6	1.195	67.7	0.112	66.0	0.792	−25.4	5.9
1000	0.146	−131.7	1.106	64.4	0.121	66.0	0.790	−27.7	5.2
1200	0.132	−150.4	0.968	57.5	0.138	65.9	0.783	−32.4	3.9
1400	0.131	−164.8	0.856	52.3	0.155	65.9	0.778	−37.4	2.8
1600	0.133	−176.8	0.783	48.4	0.171	66.1	0.776	−42.0	2.0
1800	0.132	169.2	0.726	44.4	0.189	66.2	0.770	−46.4	1.2
2000	0.140	152.4	0.679	39.3	0.205	65.5	0.752	−50.9	0.3

NPN 1 GHz wideband transistor BF747

Table 7 Common base scattering parameters, I_C = 10 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.637	−34.1	15.486	139.3	0.010	72.5	0.921	−7.2	34.2
100	0.416	−54.7	8.908	114.1	0.020	68.8	0.837	−8.4	25.1
200	0.283	−71.9	4.955	99.0	0.033	68.5	0.802	−9.4	18.7
300	0.236	−84.7	3.421	91.5	0.046	68.2	0.790	−11.0	15.2
400	0.204	−97.6	2.644	85.3	0.057	68.0	0.785	−13.2	12.8
500	0.186	−108.3	2.144	80.6	0.068	68.5	0.781	−15.4	10.9
600	0.173	−117.8	1.818	76.1	0.077	68.8	0.780	−17.7	9.4
700	0.155	−127.4	1.586	72.3	0.087	69.1	0.781	−20.0	8.2
800	0.151	−134.7	1.404	68.8	0.096	69.4	0.781	−22.4	7.1
900	0.143	−143.3	1.266	65.2	0.106	69.2	0.778	−24.6	6.2
1000	0.139	−152.2	1.168	62.3	0.115	69.4	0.779	−27.0	5.5
1200	0.135	−170.8	1.011	55.5	0.134	69.3	0.773	−31.6	4.1
1400	0.139	177.5	0.891	50.3	0.152	69.2	0.768	−36.6	3.0
1600	0.143	167.3	0.807	46.4	0.170	69.3	0.766	−41.4	2.1
1800	0.146	152.1	0.745	42.5	0.188	69.3	0.762	−45.8	1.3
2000	0.161	140.1	0.695	37.5	0.205	68.3	0.746	−50.4	0.5

Table 8 Common base scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.564	−37.8	16.887	133.4	0.009	73.0	0.901	−7.4	33.5
100	0.365	−57.2	8.999	110.3	0.019	69.3	0.826	−7.9	24.7
200	0.260	−75.7	4.932	96.9	0.032	69.3	0.797	−8.8	18.5
300	0.216	−91.4	3.410	89.8	0.044	69.1	0.786	−10.7	15.0
400	0.187	−105.1	2.636	83.6	0.055	69.2	0.781	−12.8	12.7
500	0.174	−116.4	2.127	78.9	0.065	69.9	0.779	−15.0	10.7
600	0.160	−126.6	1.802	74.4	0.075	70.1	0.778	−17.3	9.3
700	0.152	−136.3	1.569	70.5	0.085	70.7	0.781	−19.7	8.1
800	0.143	−145.0	1.384	67.0	0.095	71.0	0.780	−22.1	7.0
900	0.138	−152.1	1.247	63.6	0.104	70.9	0.780	−24.4	6.1
1000	0.136	−161.8	1.149	60.4	0.113	71.0	0.778	−26.7	5.3
1200	0.137	−178.2	0.991	53.8	0.132	70.9	0.774	−31.5	4.0
1400	0.144	168.8	0.875	48.5	0.151	70.6	0.770	−36.4	2.8
1600	0.145	159.3	0.789	44.6	0.169	70.8	0.768	−41.2	1.9
1800	0.150	146.1	0.730	41.0	0.188	70.7	0.764	−45.7	1.2
2000	0.167	134.1	0.677	35.8	0.206	69.4	0.748	−50.3	0.3

NPN 1 GHz wideband transistor BF747W

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 (S-mini) envelope. It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners. The BF747W uses the same crystal as the SOT23 version, BF747.

PINNING

PIN	DESCRIPTION
	Code: E15
1	base
2	emitter
3	collector

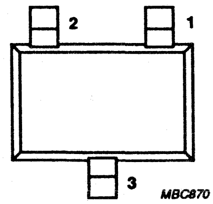


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 87 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V	0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz	–	20	–	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	290	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 1 GHz wideband transistor BF748

FEATURES

- Stable oscillator operation
- High current gain
- Low feedback capacitance
- Good thermal stability.

DESCRIPTION

Low cost NPN transistor in a plastic SOT54 (TO-92 variant) envelope.

It is intended for VHF and UHF TV tuner applications and can be used as a mixer and/or oscillator.

PINNING

PIN	DESCRIPTION
Code: F748	
1	collector
2	emitter
3	base

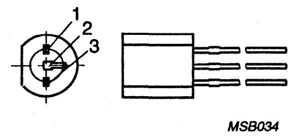


Fig.1 SOT54.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	–	3	V
I_{CM}	peak collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (note 1)	–	–	500	mW
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (note 1)	–	500	mW
T_{stg}	storage temperature		–55	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

Capability approved CECC 50 000 (issue 4), 1986.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 75 °C (note 1)	150 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	0.65	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	–	25	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

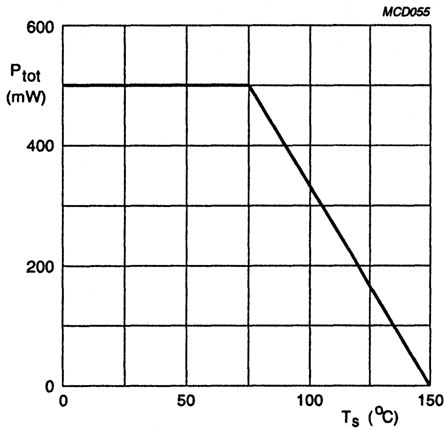
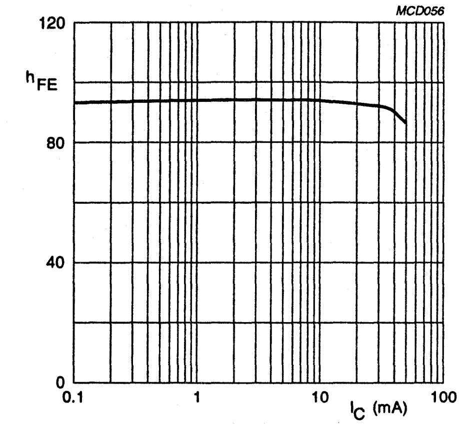
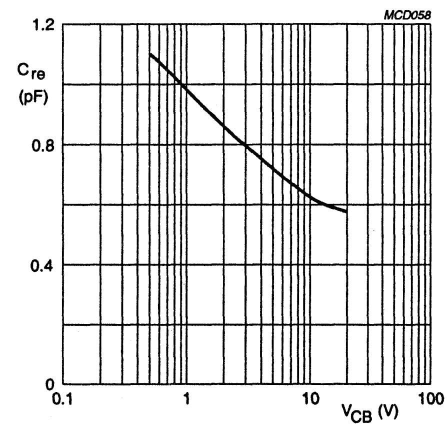


Fig.2 Power derating curve.



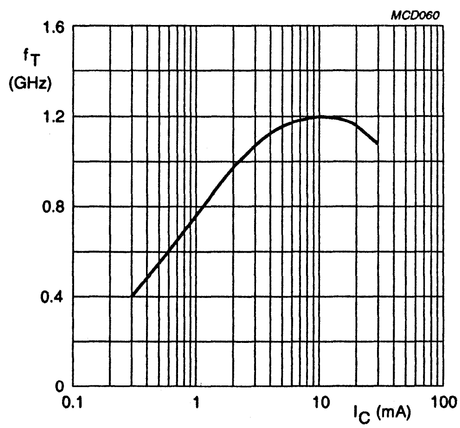
V_{CE} = 10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



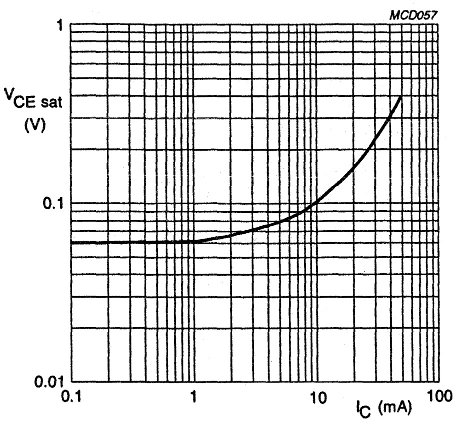
$I_E = i_e = 0$; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



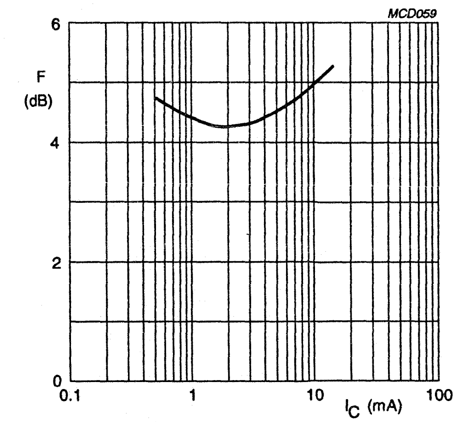
V_{CE} = 10 V; f = 500 MHz.

Fig.5 Transition frequency as a function of collector current.



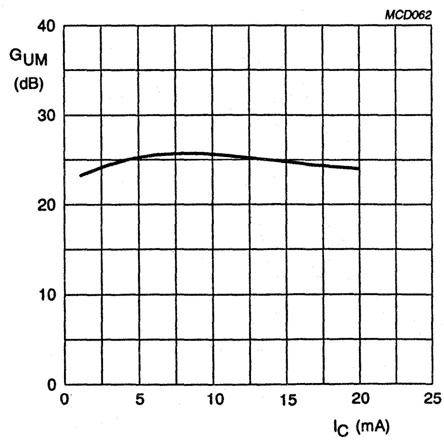
$I_C/I_B = 10$.

Fig.6 Collector-emitter saturation voltage as a function of collector current.



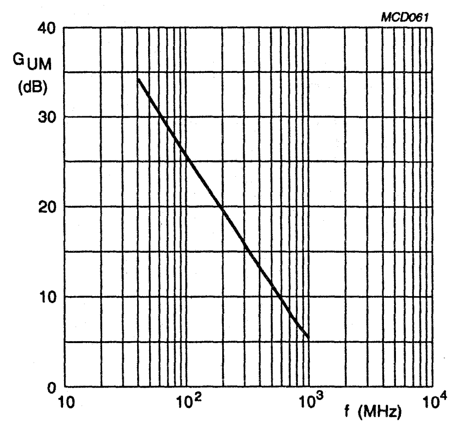
$V_{CE} = 10$ V; f = 100 MHz; $Z_S = Z_L = 50\ \Omega$.

Fig.7 Noise figure as a function of collector current.



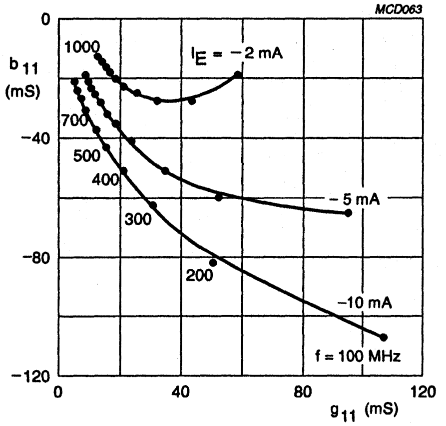
$V_{CE} = 10$ V; f = 100 MHz.

Fig.8 Maximum unilateral power gain as a function of collector current.



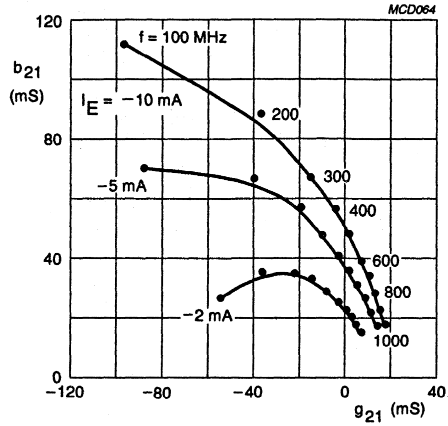
$I_C = 15$ mA; $V_{CE} = 10$ V.

Fig.9 Maximum unilateral power gain as a function of frequency.



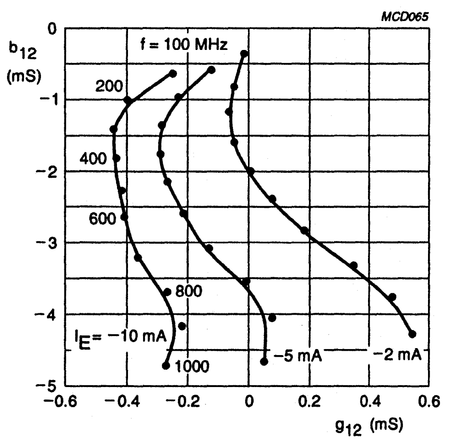
V_{CB} = 10 V.

Fig.10 Common base input admittance (Y_{11}).



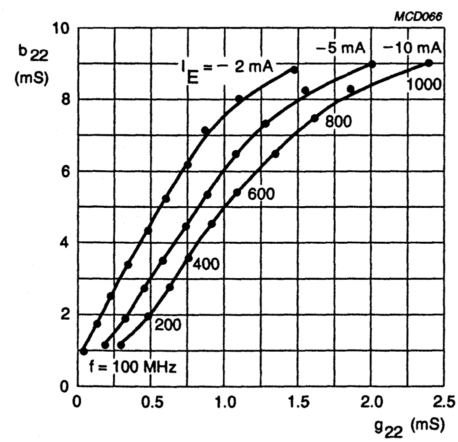
V_{CB} = 10 V.

Fig.11 Common base forward admittance (Y_{21}).



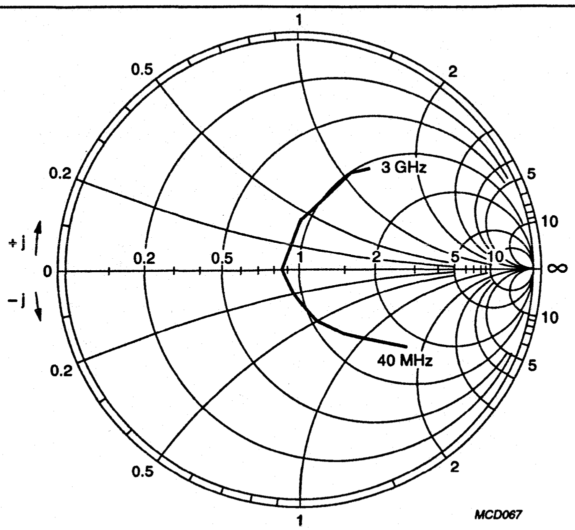
V_{CB} = 10 V.

Fig.12 Common base reverse admittance (Y_{12}).



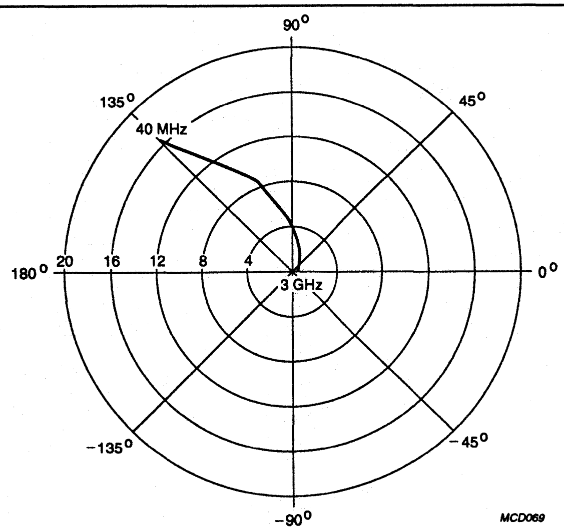
V_{CB} = 10 V.

Fig.13 Common base output admittance (Y_{22}).



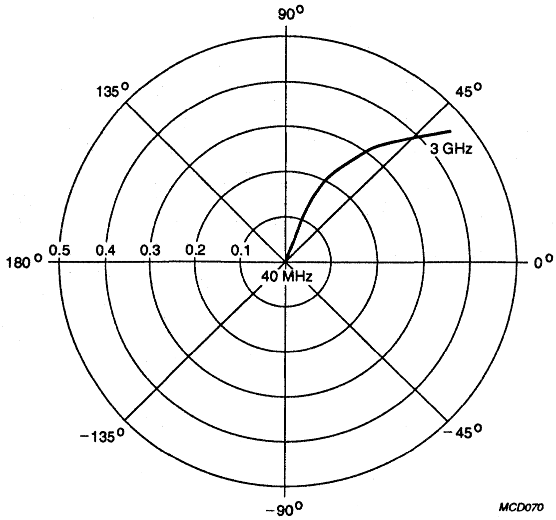
I_C = 15 mA; V_{CE} = 10 V.

Fig.14 Common emitter input reflection coefficient (S_{11}).



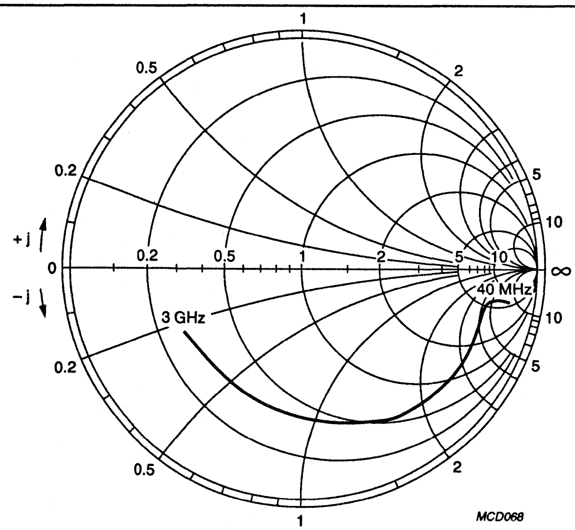
I_C = 15 mA; V_{CE} = 10 V.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 10 V.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 15 mA; V_{CE} = 10 V.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common base Y-parameters, $I_E = -2$ mA; $V_{CB} = 10$ V

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
100	57	−19.6	−54.6	24.3	−0.02	−0.44	0.04	0.88
200	42.6	−26.8	−36.7	33.8	−0.05	−0.84	0.13	1.71
300	31.7	−26.9	−22.7	34.4	−0.07	−1.2	0.22	2.51
400	24.7	−24.9	−13.2	31.9	−0.06	−1.59	0.34	3.37
500	20.4	−22	−7.3	28.6	0	−1.98	0.46	4.24
600	17.7	−19.8	−3.1	25.3	0.06	−2.4	0.59	5.2
700	16	−17.9	0.2	22.7	0.18	−2.87	0.73	6.16
800	14.4	−16.3	3.1	20	0.35	−3.31	0.86	7.07
900	13.2	−14.9	5.3	17.4	0.47	−3.77	1.08	7.93
1000	11.9	−13.9	7.4	14.4	0.53	−4.26	1.47	8.73

Table 2 Common base Y-parameters, $I_E = -5$ mA; $V_{CB} = 10$ V

f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
100	92.5	−63.7	−87.5	69.3	−0.14	−0.58	0.16	1.02
200	50.4	−60.4	−41.3	66.9	−0.25	−0.99	0.32	1.83
300	32	−49.5	−20.4	55.7	−0.29	−1.35	0.44	2.63
400	22.9	−41.4	−9.1	46.9	−0.29	−1.75	0.57	3.5
500	17.8	−35.3	−2.6	40.3	−0.27	−2.18	0.72	4.4
600	14.6	−30.5	1.5	34.4	−0.21	−2.62	0.86	5.38
700	12.6	−27.1	5	30.1	−0.13	−3.13	1.06	6.4
800	10.7	−24.1	8.2	25.7	−0.01	−3.59	1.26	7.31
900	9.3	−21.5	10.3	21.8	0.07	−4.07	1.55	8.18
1000	7.8	−19.5	12.3	17.6	0.05	−4.6	2.01	8.95

Table 3 Common base Y-parameters, $I_E = -10$ mA; $V_{CB} = 10$ V

f (MHz)	Y_{11} REAL (mS)	Y_{11} IMAG. (mS)	Y_{21} REAL (mS)	Y_{21} IMAG. (mS)	Y_{12} REAL (mS)	Y_{12} IMAG. (mS)	Y_{22} REAL (mS)	Y_{22} IMAG. (mS)
100	104.8	−106.3	−97.5	111.9	−0.27	−0.75	0.29	1.08
200	48.3	−81.6	−37.2	87.5	−0.41	−1.02	0.48	1.86
300	29.4	−62.1	−16.1	67.9	−0.43	−1.4	0.59	2.67
400	20.1	−50.5	−4.7	55.5	−0.44	−1.82	0.74	3.55
500	14.9	−42.6	2	46.7	−0.42	−2.27	0.89	4.49
600	11.4	−36.5	6.4	39	−0.41	−2.72	1.08	5.45
700	9.2	−31.9	10	33.2	−0.36	−3.24	1.32	6.48
800	7.4	−27.9	12.7	27.6	−0.27	−3.72	1.57	7.38
900	6	−24.3	14.3	22.6	−0.22	−4.17	1.86	8.21
1000	4.6	−21.4	15.7	17.6	−0.27	−4.7	2.37	8.95

Table 4 Common base Y-parameters, $I_E = -15$ mA; $V_{CB} = 10$ V

f (MHz)	Y_{11} REAL (mS)	Y_{11} IMAG. (mS)	Y_{21} REAL (mS)	Y_{21} IMAG. (mS)	Y_{12} REAL (mS)	Y_{12} IMAG. (mS)	Y_{22} REAL (mS)	Y_{22} IMAG. (mS)
100	102.4	−124.4	−94.1	130.1	−0.35	−0.64	0.37	1.07
200	45.7	−87.7	−33.9	93.6	−0.47	−1.02	0.55	1.85
300	27.4	−66.4	−12.9	72	−0.5	−1.4	0.65	1.69
400	18	−53.7	−1.2	58.2	−0.52	−1.83	0.82	3.56
500	12.8	−45	5.4	48.3	−0.52	−2.29	1.01	4.49
600	9.3	−38	9.7	39.6	−0.51	−2.75	2.21	5.46
700	7.2	−32.8	12.5	32.9	−0.47	−3.26	1.44	6.46
800	5.7	−28.3	15	26.9	−0.38	−3.73	1.72	7.35
900	4.6	−24.4	16	21.7	−0.33	−4.18	2.04	8.18
1000	3.4	−21.3	17	16.3	−0.41	−4.68	2.52	8.84

NPN 1 GHz wideband transistor BF748

Table 5 Common emitter scattering parameters, $I_C = 2$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.884	−16.7	5.736	160.3	0.0132	79.8	0.985	−4.11	37.1
100	0.737	−36.0	4.758	137.0	0.0287	70.2	0.941	−8.27	26.4
200	0.511	−53.5	3.265	113.2	0.0457	64.3	0.886	−11.7	18.3
300	0.373	−62.7	2.387	99.3	0.0600	63.9	0.860	−14.4	14.1
400	0.286	−69.2	1.919	88.9	0.0738	62.7	0.845	−17.1	11.5
500	0.223	−75.3	1.593	81.2	0.0868	62.4	0.835	−20.2	9.46
600	0.180	−84.3	1.379	74.7	0.100	61.7	0.825	−23.4	7.90
700	0.152	−95.0	1.236	68.6	0.113	61.4	0.825	−26.8	6.91
800	0.128	−103.	1.131	63.1	0.126	60.9	0.820	−30.3	6.00
900	0.107	−106.	1.036	59.0	0.137	60.3	0.818	−33.5	5.17
1000	0.0720	−117.	0.943	54.3	0.149	59.5	0.815	−37.2	4.25
1200	0.0351	167.8	0.841	45.6	0.172	58.2	0.805	−44.4	3.04
1400	0.0800	114.3	0.754	37.1	0.196	56.7	0.800	−51.9	2.01
1600	0.125	99.0	0.702	30.8	0.220	55.9	0.793	−58.7	1.29
1800	0.187	83.4	0.652	24.4	0.246	53.4	0.756	−66.6	0.119
2000	0.253	75.5	0.613	20.0	0.272	51.0	0.721	−76.6	−0.769

Table 6 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.767	−26.3	11.308	149.3	0.011	75.7	0.956	−6.0	35.6
100	0.542	−49.0	7.603	123.2	0.022	67.5	0.875	−8.7	25.4
200	0.359	−65.2	4.493	104.4	0.036	66.6	0.827	−10.0	18.7
300	0.283	−75.1	3.141	95.3	0.049	66.6	0.811	−11.7	15.0
400	0.244	−84.1	2.452	88.6	0.061	66.5	0.804	−13.9	12.6
500	0.213	−92.3	1.991	83.4	0.073	66.5	0.798	−16.0	10.6
600	0.196	−100.7	1.696	78.7	0.083	66.5	0.797	−18.4	9.1
700	0.180	−108.6	1.484	74.7	0.093	66.5	0.797	−20.7	8.0
800	0.170	−115.6	1.318	71.1	0.102	66.5	0.796	−23.1	6.9
900	0.156	−123.6	1.195	67.7	0.112	66.0	0.792	−25.4	5.9
1000	0.146	−131.7	1.106	64.4	0.121	66.0	0.790	−27.7	5.2
1200	0.132	−150.4	0.968	57.5	0.138	65.9	0.783	−32.4	3.9
1400	0.131	−164.8	0.856	52.3	0.155	65.9	0.778	−37.4	2.8
1600	0.133	−176.8	0.783	48.4	0.171	66.1	0.776	−42.0	2.0
1800	0.132	169.2	0.726	44.4	0.189	66.2	0.770	−46.4	1.2
2000	0.140	152.4	0.679	39.3	0.205	65.5	0.752	−50.9	0.3

Table 7 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.637	−34.1	15.486	139.3	0.010	72.5	0.921	−7.2	34.2
100	0.416	−54.7	8.908	114.1	0.020	68.8	0.837	−8.4	25.1
200	0.283	−71.9	4.955	99.0	0.033	68.5	0.802	−9.4	18.7
300	0.236	−84.7	3.421	91.5	0.046	68.2	0.790	−11.0	15.2
400	0.204	−97.6	2.644	85.3	0.057	68.0	0.785	−13.2	12.8
500	0.186	−108.3	2.144	80.6	0.068	68.5	0.781	−15.4	10.9
600	0.173	−117.8	1.818	76.1	0.077	68.8	0.780	−17.7	9.4
700	0.155	−127.4	1.586	72.3	0.087	69.1	0.781	−20.0	8.2
800	0.151	−134.7	1.404	68.8	0.096	69.4	0.781	−22.4	7.1
900	0.143	−143.3	1.266	65.2	0.106	69.2	0.778	−24.6	6.2
1000	0.139	−152.2	1.168	62.3	0.115	69.4	0.779	−27.0	5.5
1200	0.135	−170.8	1.011	55.5	0.134	69.3	0.773	−31.6	4.1
1400	0.139	177.5	0.891	50.3	0.152	69.2	0.768	−36.6	3.0
1600	0.143	167.3	0.807	46.4	0.170	69.3	0.766	−41.4	2.1
1800	0.146	152.1	0.745	42.5	0.188	69.3	0.762	−45.8	1.3
2000	0.161	140.1	0.695	37.5	0.205	68.3	0.746	−50.4	0.5

Table 8 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.553	−35.7	16.578	134.5	0.0101	75.2	0.909	−7.56	33.6
100	0.352	−53.3	8.927	109.5	0.0205	71.1	0.833	−8.47	24.7
200	0.230	−68.1	4.870	93.9	0.0350	71.2	0.803	−9.98	18.5
300	0.164	−81.3	3.327	85.0	0.0486	70.6	0.793	−12.3	14.9
400	0.116	−100.	2.573	77.7	0.0614	70.2	0.786	−15.0	12.4
500	0.0833	−124.	2.102	71.3	0.0738	69.9	0.780	−18.1	10.6
600	0.0798	−154.	1.779	66.0	0.0862	69.7	0.777	−21.3	9.04
700	0.0851	−175.	1.561	60.7	0.0989	69.5	0.776	−24.6	7.91
800	0.0895	169.5	1.407	55.8	0.111	69.5	0.774	−28.1	6.98
900	0.0868	150.1	1.267	51.8	0.123	69.1	0.774	−31.4	6.05
1000	0.0975	128.9	1.145	47.7	0.136	68.5	0.775	−35.1	5.19
1200	0.146	104.9	0.991	39.4	0.163	67.2	0.767	−42.2	3.88
1400	0.198	94.9	0.877	31.2	0.191	65.4	0.766	−49.9	2.87
1600	0.240	85.1	0.793	25.0	0.220	63.8	0.762	−56.8	2.01
1800	0.292	75.7	0.719	18.2	0.250	60.2	0.727	−64.7	0.786
2000	0.344	69.9	0.671	14.5	0.280	57.3	0.695	−74.7	−0.0555

NPN 5 GHz wideband transistor — BF749

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BF749 is an npn silicon transistor, intended for wideband applications in the UHF and microwave range.

The transistor is encapsulated in a 4-lead, dual-emitter plastic SOT143R envelope.

PINNING

PIN	DESCRIPTION
Code: V34	
1	collector
2	emitter
3	base
4	emitter

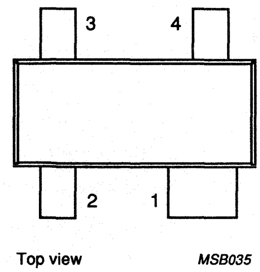


Fig.1 SOT143R.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current	continuous	–	25	mA
P_{tot}	total power dissipation	T_s = 80 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 10$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 10$ V	90	–	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	0.9	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	0.6	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 10$ V; f = 1 MHz	0.35	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	16	–	dB
		$I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	9.5	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	2.1	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

NPN 7 GHz wideband transistor

BF750

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BF750 is an npn silicon transistor, primarily intended for satellite tuner applications.

The transistor is encapsulated in a 4-lead dual-emitter plastic SOT143R envelope.

PINNING

PIN	DESCRIPTION
Code: V32	
1	collector
2	emitter
3	base
4	emitter

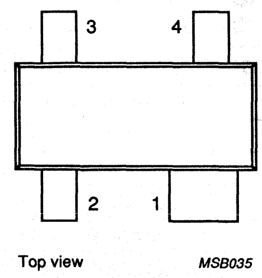


Fig.1 SOT143R.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current	continuous	–	35	mA
P_{tot}	total power dissipation	T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	I_E = 0; V_{CB} = 5 V	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	90	–	
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz	1.9	–	pF
C_c	collector capacitance	I_E = i_e =0; V_{CB} = 5 V; f = 1 MHz	0.9	–	pF
C_{re}	feedback capacitance	I_C = i_c = 0; V_{CB} = 5 V; f = 1 MHz	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V	7	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	16.5	–	dB
		I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	1.9	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

NPN 6.5 GHz wideband transistor — BF751

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base

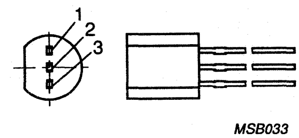


Fig.1 TO-92 (JEDEC).

DESCRIPTION

The BF751 is an npn silicon epitaxial transistor, primarily intended for use in low noise voltage controlled oscillators (VCOs) and high gain amplifiers for signal frequencies up to 2 GHz. The transistor is encapsulated in the JEDEC TO-92 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage		–	–	14	V
I_C	DC collector current	continuous	–	–	35	mA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 10 V	50	80	200	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.65	1	pF
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	9	11	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	1.8	2.7	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	14	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current	continuous	–	35	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (note 1)	–	600	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

NPN 6.5 GHz wideband transistor BF751

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	125 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 µA; I_E = 0	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; I_B = 0	14	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 100 µA; I_C = 0	3	–	–	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 15 V	–	–	50	nA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 2 V	–	–	1	µA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 10 V	50	80	200	
C_{cb}	collector capacitance	$I_E = i_e$ =0; V_{CB} = 10 V; f = 1 MHz	–	–	1	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.65	1	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	5	6.25	–	GHz
		I_C = 30 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	5.25	6.5	–	GHz
		I_C = 25 mA; V_{CE} = 9.5 V; T_{amb} = 25 °C; f = 1 GHz	–	6.5	–	GHz
		I_C = 20 mA; V_{CE} = 6.5 V; T_{amb} = 25 °C; f = 1 GHz	–	6.4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	10	–	dB
		I_C = 20 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	9	11	–	dB
		I_C = 30 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	12.5	–	dB
		I_C = 25 mA; V_{CE} = 9.5 V; T_{amb} = 25 °C; f = 1 GHz	9	11	–	dB
		I_C = 20 mA; V_{CE} = 6.5 V; T_{amb} = 25 °C; f = 1 GHz	9	11	–	dB

NPN 6.5 GHz wideband transistor BF751

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	1.8	2.7	–	dB
		I_C = 40 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	–	2.5	3.5	dB
		I_C = 25 mA; V_{CE} = 9.5 V; T_{amb} = 25 °C; f = 1 GHz	–	–	2.7	dB
		I_C = 20 mA; V_{CE} = 6.5 V; T_{amb} = 25 °C; f = 2 GHz	–	–	2.6	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

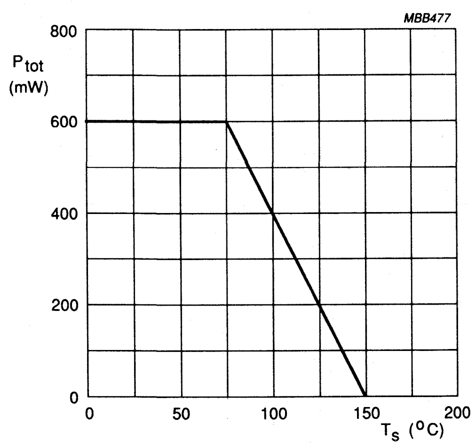
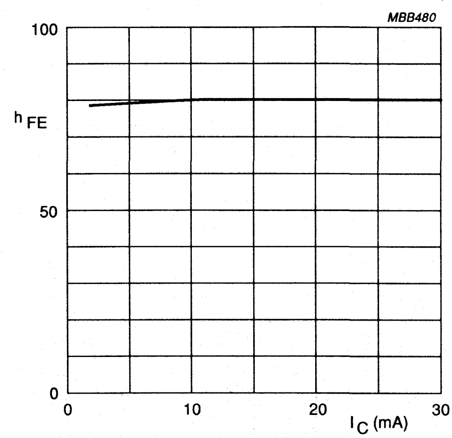
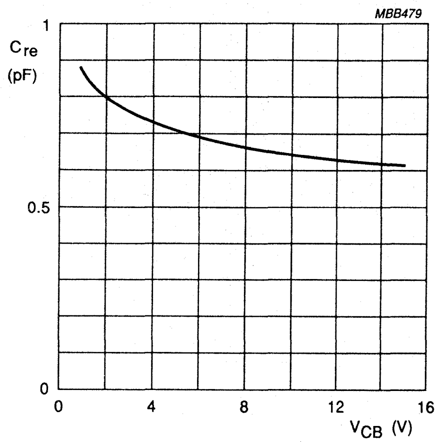


Fig.2 Power derating curve.



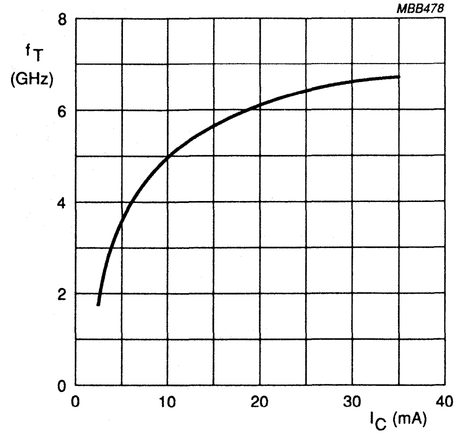
V_{CE} = 10 V.

Fig.3 DC current gain as a function of collector current.



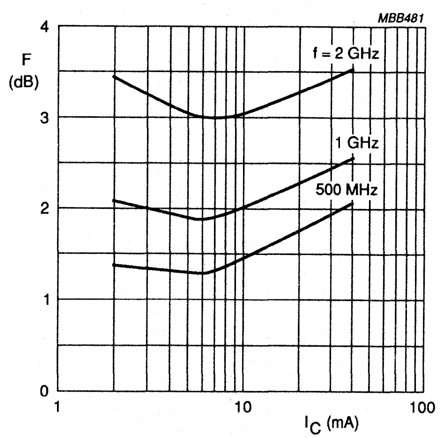
$I_C = i_c = 0$; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz.

Fig.5 Transition frequency as a function of collector current.



V_{CE} = 10 V.

Fig.6 Minimum noise figure as a function of collector current.

NPN 7 GHz wideband transistor — BF752

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BF752 is an npn silicon transistor, primarily intended for wideband applications in the UHF and microwave range.

The transistor is encapsulated in a 4-lead dual-emitter plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
Code: V38	
1	collector
2	emitter
3	base
4	emitter

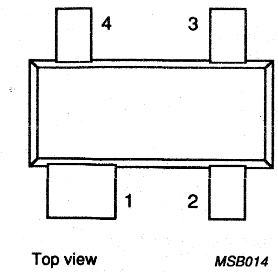


Fig.1 SOT143.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current	continuous	–	35	mA
P_{tot}	total power dissipation	T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 7 GHz wideband transistor BF752

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 5$ V	–	50	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	90	–	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	1.9	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	0.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 5$ V; f = 1 MHz	0.6	–	pF
f_T	transition frequency	$I_C = 30$ mA; $V_{CE} = 5$ V	7	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	16.5	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	1.9	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

NPN 5 GHz wideband transistor | BF753

FEATURES

- Low cost
- Low noise figure
- 5 V tuner applications.

DESCRIPTION

NPN silicon planar epitaxial transistor, mounted in a plastic SOT23 envelope.

It is primarily intended for application in broadband amplifiers, oscillators and mixers with signal frequencies up to 1 GHz.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

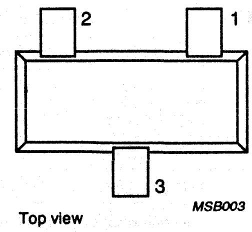


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 55 °C	–	–	300	mW
h_{FE}	DC current gain	I_C = 3 mA; V_{CE} = 5 V; T_j = 25 °C	30	120	200	
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.65	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 5 V; f = 1 GHz; T_{amb} = 25 °C	–	11	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 3 mA; V_{CE} = 5 V; f = 800 MHz	–	1.8	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 25 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 25 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 3 mA; V_{CE} = 5 V	30	120	200	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB}= 5 V; f = 1 MHz	–	0.85	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	1.7	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.65	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	13	–	dB
		I_C = 15 mA; V_{CE} = 5 V; f = 1 GHz; T_{amb} = 25 °C	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 3 mA; V_{CE} = 5 V; f = 800 MHz	–	1.8	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

NPN 2 GHz wideband transistor BF763

DESCRIPTION

NPN transistor in a plastic SOT54 (TO-92 variant) envelope.

It is primarily intended for use in RF amplifiers and oscillators.

PINNING

PIN	DESCRIPTION
Code: F763	
1	emitter
2	base
3	collector

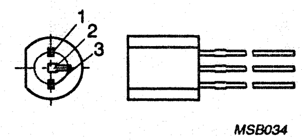


Fig.1 SOT54.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base	15	–	–	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_{amb} = 60 °C	–	–	360	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V; T_j = 25 °C	25	–	250	
f_T	transition frequency	I_C = 5 mA; V_{CE} = 10 V; f = 100 MHz	–	1.8	–	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_{amb} = 60 °C	–	360	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	250 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA; I_B = 0	15	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 10 μA; I_E = 0	25	–	–	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 10 mA; I_B = 1 mA	–	–	0.5	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 10 V	25	–	250	
f_T	transition frequency	I_C = 5 mA; V_{CE} = 10 V; f = 100 MHz	–	1.8	–	GHz
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω	–	5.0	–	dB

2 GHz RF power transistor BFG10; BFG10/X

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in handheld radio equipment at 1.9 GHz.

The transistor is encapsulated in a SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG10: Code: N70	
1	collector
2	base
3	emitter
4	emitter
BFG10/X: Code: N71	
1	collector
2	emitter
3	base
4	emitter

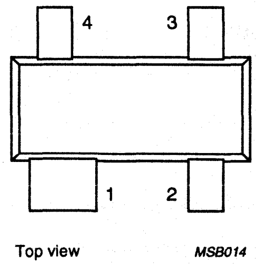


Fig.1 SOT143.

QUICK REFERENCE DATA

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:8	1.9	3.6	200	≥ 5	≥ 50

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	250	mA
$I_{C(AV)}$	average collector current		–	250	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	thermal resistance from junction to soldering point	up to T_s = 75 °C (note 1); P_{tot} = 250 mW	max. 300 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 5 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 5 V	–	100	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 3.6 V; f = 1 MHz	–	4	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 3.6 V; f = 1 MHz	–	3	pF

APPLICATION INFORMATION

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:8	1.9	3.6	1	200	> 5 typ. 7	> 50 typ. 60

Ruggedness in class-AB operation

The BFG10 is capable of withstanding a load mismatch corresponding to VSWR = 8:1 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.9 GHz and a duty cycle of 1:8.

2 GHz RF power transistor — BFG11; BFG11/X

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in handheld radio equipment at 1.9 GHz.

The transistor is encapsulated in a SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG11: Code: N72	
1	collector
2	base
3	emitter
4	emitter
BFG11/X: Code: N73	
1	collector
2	emitter
3	base
4	emitter

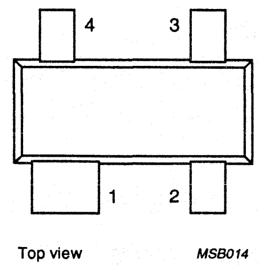


Fig.1 SOT143.

QUICK REFERENCE DATA

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:8	1.9	3.6	400	≥ 4	≥ 50

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	500	mA
$I_{C(AV)}$	average collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 80 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	thermal resistance from junction to soldering point	up to T_s = 80 °C (note 1); P_{tot} = 300 mW	max. 230 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 8 V	–	100	µA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 3.6 V; f = 1 MHz	–	5	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 3.6 V; f = 1 MHz	–	4	pF

APPLICATION INFORMATION

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:8	1.9	3.6	1	400	> 4 typ. 5	> 50 typ. 60

Ruggedness in class-AB operation

The BFG11 is capable of withstanding a load mismatch corresponding to VSWR = 8:1 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.9 GHz and a duty cycle of 1:8.

NPN 2 GHz wideband transistor BFG16A

FEATURES

- High power gain
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope.

It is primarily intended for use in wideband amplifiers, aerial amplifiers and vertical amplifiers in high speed oscilloscopes.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

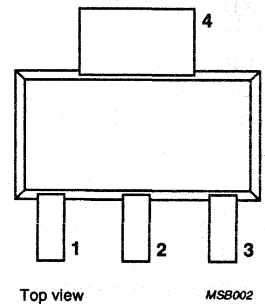


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	–	25	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V; T_j = 25 °C	25	80	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	1.6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	10	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	25	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 28 V	–	–	20	µA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	10.0	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	1.6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	10	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

Capability approved CECC 50 000 (issue 4), 1986.

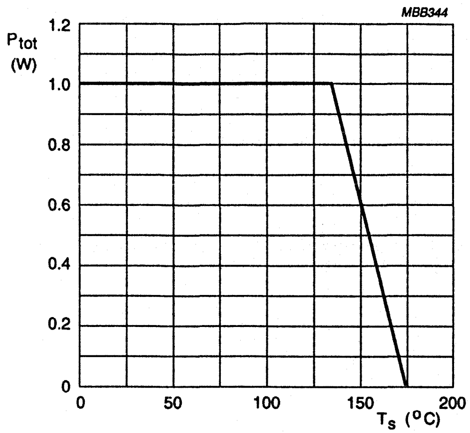
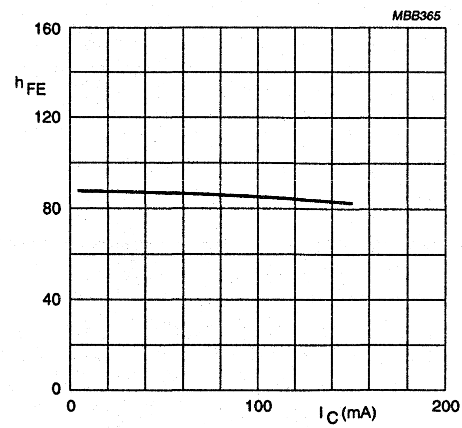
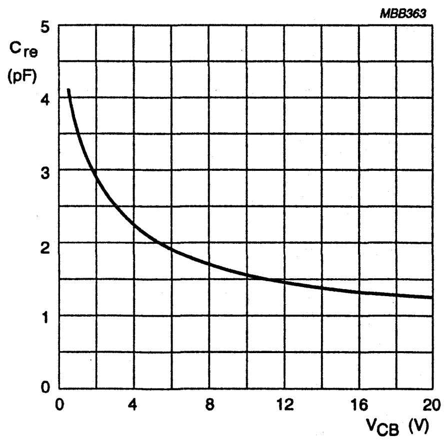


Fig.2 Power derating curve.



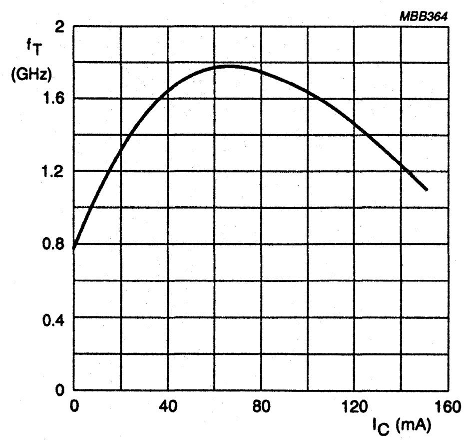
V_{CE} = 10 V; T_j = 25 °C.

Fig.3 DC current gain as function of collector current.



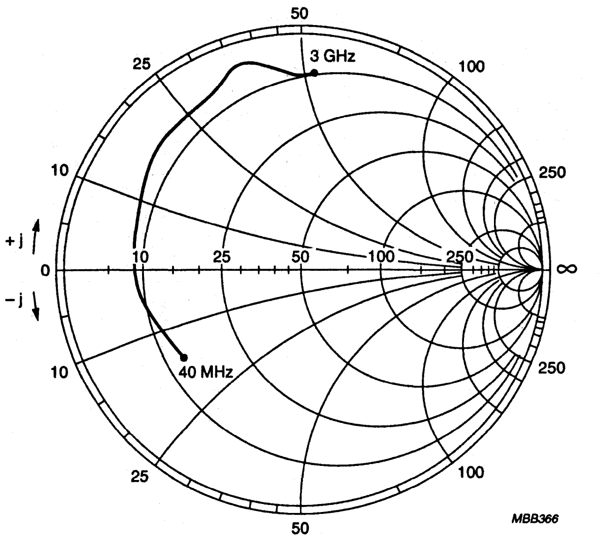
$I_C = i_c = 0$; f = 1 MHz.

Fig.4 Feedback capacitance as function of collector-base voltage.



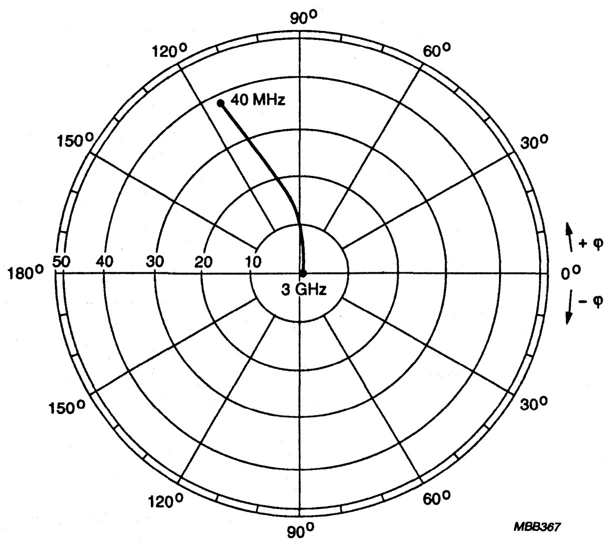
V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current.



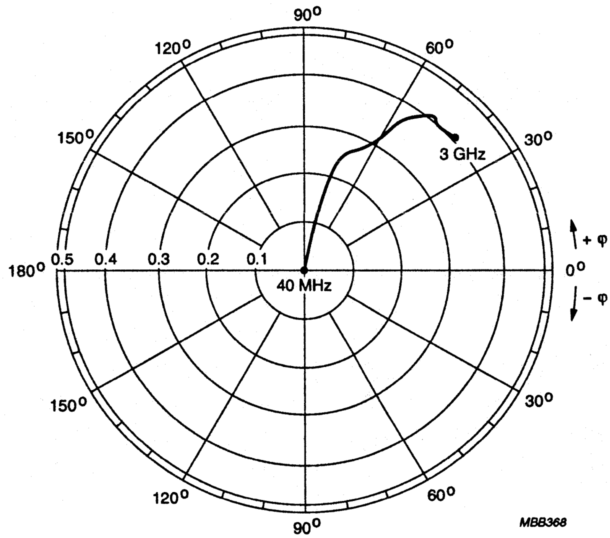
I_C = 70 mA; V_{CE} = 15 V.

Fig.6 Common emitter input reflection coefficient (S_{11}).



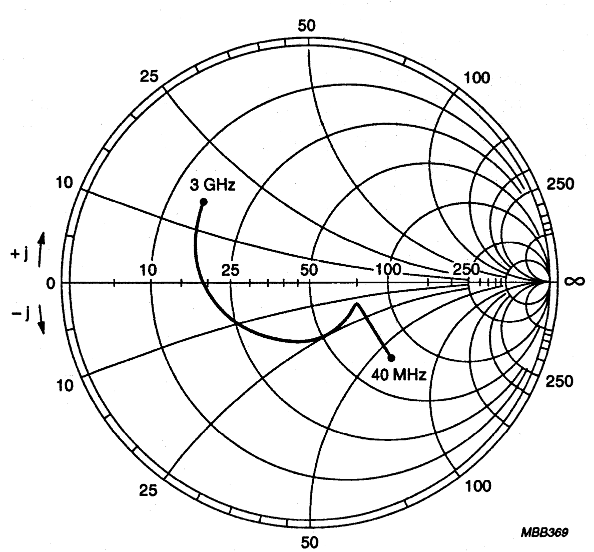
I_C = 70 mA; V_{CE} = 15 V.

Fig.7 Common emitter forward transmission coefficient (S_{21}).



I_C = 70 mA; V_{CE} = 15 V.

Fig.8 Common emitter reverse transmission coefficient (S_{12}).



I_C = 70 mA; V_{CE} = 15 V.

Fig.9 Common emitter output transmission coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.651	−155.5	35.509	111.2	0.010	53.5	0.409	−47.8	34.2
100	0.707	−171.9	15.313	94.8	0.016	62.2	0.227	−43.1	26.9
200	0.722	179.9	7.768	84.9	0.028	70.1	0.177	−35.7	21.1
300	0.729	175.0	5.188	78.1	0.040	73.9	0.166	−35.2	17.7
400	0.734	171.2	3.892	72.3	0.051	75.2	0.164	−38.1	15.3
500	0.738	167.6	3.124	66.9	0.063	75.8	0.167	−42.9	13.4
600	0.742	164.2	2.614	61.8	0.074	76.0	0.171	−48.9	11.9
700	0.746	160.6	2.250	56.9	0.086	76.5	0.177	−55.2	10.7
800	0.751	157.0	1.975	52.2	0.098	76.7	0.183	−62.0	9.7
900	0.759	153.4	1.761	47.8	0.109	77.1	0.188	−69.3	8.8
1000	0.767	149.9	1.585	43.7	0.123	77.1	0.193	−77.3	8.0
1200	0.789	143.4	1.325	35.8	0.150	76.4	0.210	−95.6	6.9
1400	0.803	137.5	1.127	28.1	0.175	75.2	0.241	−114.5	5.8
1600	0.806	131.2	0.970	21.2	0.209	74.5	0.282	−130.5	4.7
1800	0.813	124.2	0.859	15.3	0.247	69.5	0.321	−145.3	3.8
2000	0.832	117.3	0.761	10.4	0.280	66.8	0.360	−160.8	3.4

Table 2 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.660	−160.1	35.392	109.6	0.009	55.3	0.385	−47.5	34.2
100	0.710	−173.7	15.125	94.1	0.016	65.0	0.219	−41.3	26.9
200	0.725	179.0	7.655	84.3	0.027	72.6	0.175	−33.7	21.1
300	0.732	174.5	5.109	77.7	0.039	75.3	0.166	−33.6	17.6
400	0.738	170.8	3.830	71.8	0.051	76.3	0.165	−36.7	15.2
500	0.743	167.3	3.068	66.4	0.063	76.7	0.167	−41.8	13.3
600	0.746	163.9	2.569	61.4	0.074	77.0	0.172	−47.9	11.9
700	0.750	160.3	2.209	56.5	0.086	77.3	0.178	−54.4	10.6
800	0.755	156.7	1.938	51.7	0.097	77.3	0.184	−61.4	9.6
900	0.763	153.1	1.728	47.4	0.109	77.8	0.190	−68.8	8.7
1000	0.772	149.6	1.557	43.3	0.123	77.7	0.195	−76.9	8.0
1200	0.794	143.2	1.298	35.4	0.151	77.0	0.211	−95.4	6.8
1400	0.808	137.3	1.106	27.7	0.175	75.7	0.242	−114.5	5.7
1600	0.811	130.9	0.951	20.8	0.210	74.8	0.282	−130.6	4.6
1800	0.817	123.9	0.842	15.1	0.248	69.8	0.320	−145.5	3.7
2000	0.836	116.9	0.745	10.3	0.281	66.9	0.359	−161.0	3.3

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Table 3 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.622	−141.6	36.261	115.6	0.011	49.5	0.504	−38.1	34.6
100	0.685	−166.1	16.136	97.1	0.016	55.8	0.316	−33.0	27.4
200	0.702	−177.3	8.233	86.3	0.026	66.0	0.266	−27.1	21.6
300	0.710	177.1	5.511	79.4	0.036	71.0	0.255	−27.4	18.2
400	0.716	172.8	4.141	73.5	0.047	73.7	0.252	−30.2	15.7
500	0.720	168.9	3.321	68.1	0.057	75.0	0.252	−34.4	13.9
600	0.723	165.5	2.781	63.1	0.068	76.0	0.255	−39.3	12.4
700	0.727	161.8	2.397	58.3	0.078	77.0	0.258	−44.6	11.2
800	0.732	158.1	2.105	53.6	0.089	77.6	0.262	−50.3	10.1
900	0.740	154.4	1.876	49.2	0.100	78.4	0.265	−56.2	9.2
1000	0.749	151.0	1.690	45.1	0.112	78.8	0.267	−62.8	8.5
1200	0.772	144.4	1.412	37.2	0.138	78.8	0.273	−78.3	7.3
1400	0.787	138.6	1.207	29.2	0.162	78.1	0.292	−95.6	6.2
1600	0.794	132.3	1.035	22.0	0.196	78.1	0.323	−111.8	5.1
1800	0.802	125.2	0.919	15.9	0.233	73.5	0.352	−127.1	4.3
2000	0.823	118.2	0.812	10.6	0.267	70.9	0.380	−143.5	3.8

Table 4 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.625	−149.1	37.456	112.9	0.010	52.8	0.464	−38.7	34.7
100	0.684	−169.1	16.338	95.8	0.015	60.4	0.295	−31.9	27.4
200	0.700	−178.6	8.298	85.5	0.026	69.2	0.253	−25.7	21.6
300	0.708	176.2	5.548	78.8	0.036	73.2	0.244	−26.0	18.2
400	0.714	172.2	4.163	73.0	0.047	75.0	0.242	−28.8	15.8
500	0.719	168.5	3.338	67.6	0.058	76.0	0.243	−33.0	13.9
600	0.723	165.1	2.789	62.7	0.068	76.6	0.246	−38.0	12.4
700	0.728	161.5	2.404	57.9	0.079	77.4	0.251	−43.3	11.2
800	0.732	157.9	2.109	53.2	0.089	77.9	0.254	−49.1	10.1
900	0.741	154.2	1.880	48.8	0.100	78.6	0.257	−55.1	9.2
1000	0.750	150.7	1.691	44.7	0.113	79.0	0.259	−61.8	8.5
1200	0.773	144.3	1.412	36.9	0.139	78.8	0.265	−77.3	7.3
1400	0.788	138.4	1.206	29.0	0.162	78.0	0.283	−95.1	6.2
1600	0.794	132.1	1.037	21.8	0.196	77.9	0.313	−111.5	5.1
1800	0.803	125.1	0.920	15.8	0.233	73.3	0.341	−126.8	4.3
2000	0.824	118.1	0.812	10.4	0.267	70.8	0.369	−143.2	3.8

NPN 3 GHz wideband transistor BFG17A

DESCRIPTION

NPN wideband transistor in a microminiature plastic SOT143 surface mounting envelope with double emitter bonding.

It is intended for use in wideband aerial amplifiers using SMD technology.

PINNING

PIN	DESCRIPTION
	Code: E6
1	collector
2	base
3	emitter
4	emitter

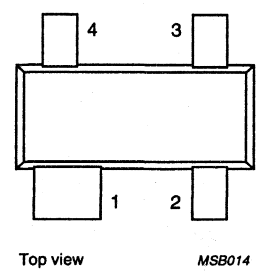


Fig.1 SOT143.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 1 V; T_{amb} = 25 °C	20	–	150	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	2.8	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	–	0.6	–	pF
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω; b_s = opt.	–	2.5	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 60 °C (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

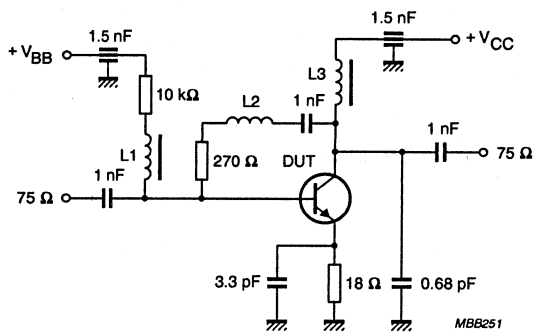
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 1 V; T_{amb} = 25 °C	20	75	150	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	2.8	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	0.7	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.25	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	–	0.6	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω; b_s = opt.	–	2.5	–	dB
V_O	output voltage	note 2	–	150	–	mV

Notes

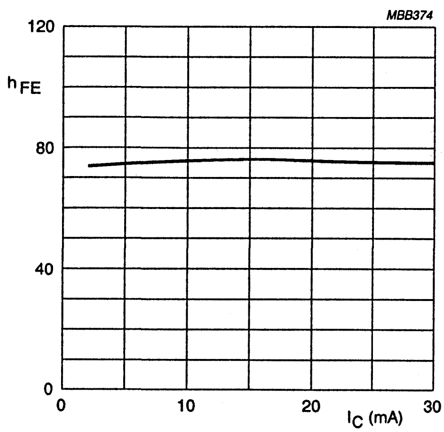
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B, para. 6 3: 3-tone); I_C = 14 mA; V_{CE} = 10 V; Z_L = 75 Ω
   $V_p = V_O$; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



L1 = L3 = 5 μH Ferroxcube choke.

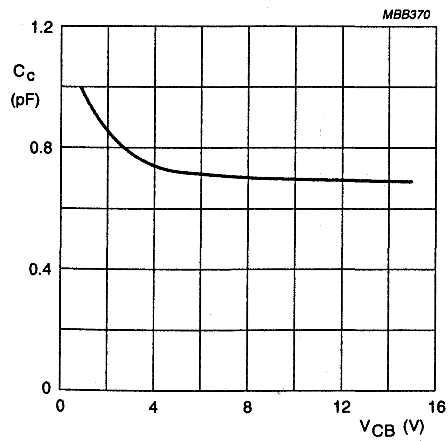
L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.



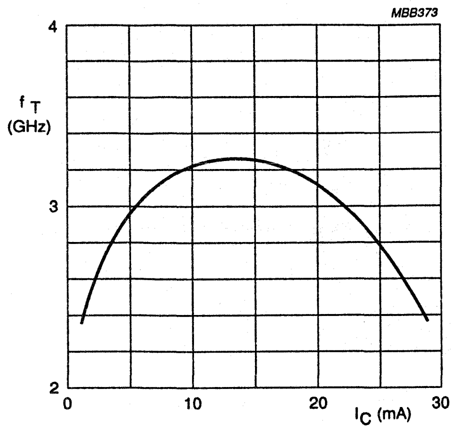
V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.3 DC current gain as function of collector current.



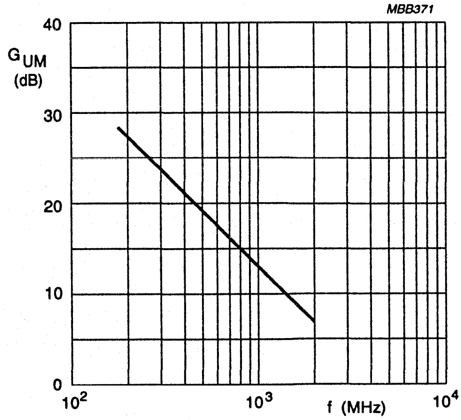
I_E = 0; f = 1 MHz; T_{amb} = 25 °C

Fig.4 Collector capacitance as a function of collector-base voltage.



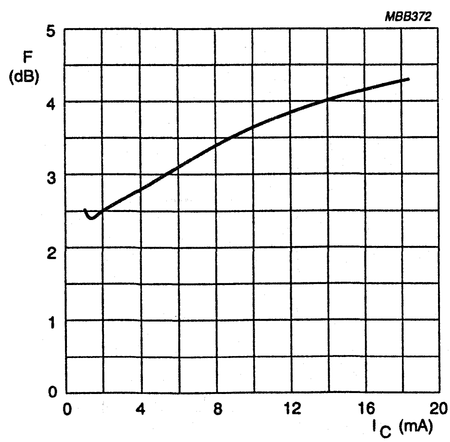
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current.



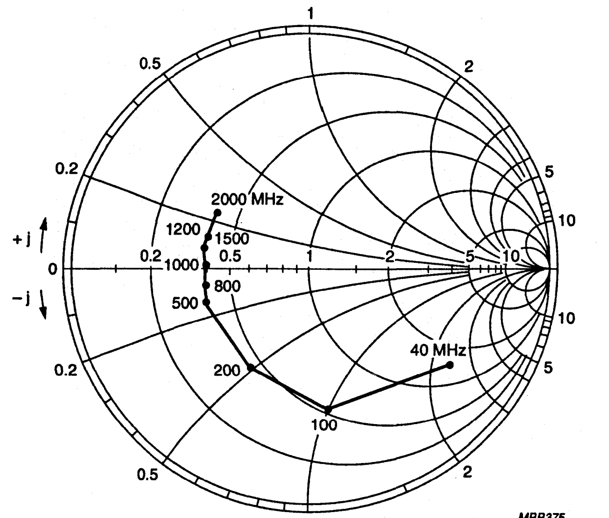
I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



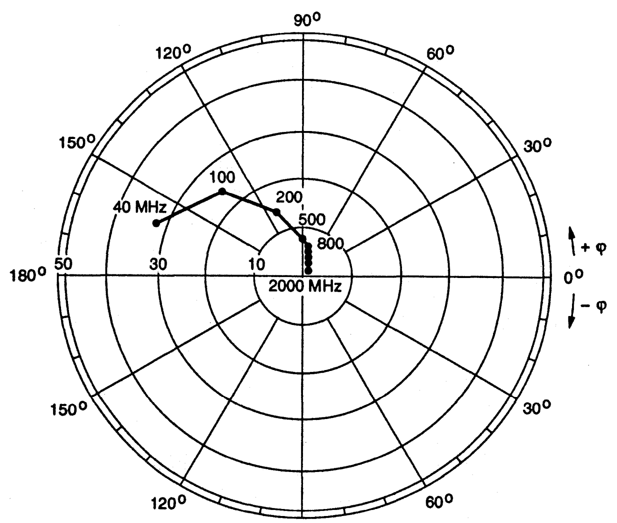
V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω; b_s = opt.

Fig.7 Minimum noise figure as a function of collector current.



I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).

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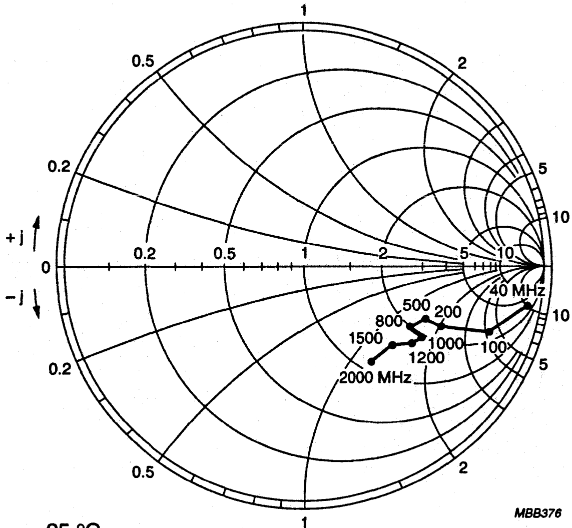
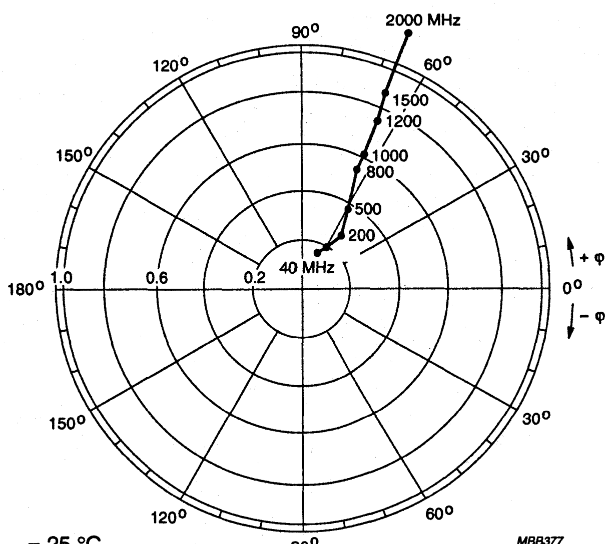


I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 10$ V.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.8	−19.4	14.3	168.2	0.02	67.7	1.0	−5.1	41.9
100	0.8	−50.0	12.8	147.8	0.02	65.6	1.0	−13.0	35.7
200	0.6	−84.3	9.3	128.7	0.03	54.4	0.8	−19.3	25.9
500	0.5	−136.7	5.2	99.3	0.05	47.0	0.7	−26.2	18.5
800	0.5	−157.4	3.5	84.6	0.06	50.3	0.6	−32.0	14.2
1000	0.5	−168.7	2.9	75.4	0.07	51.4	0.6	−34.2	12.5
1200	0.5	179.8	2.3	68.1	0.07	53.5	0.6	−38.9	10.7
1500	0.5	173.4	2.0	60.2	0.09	56.8	0.6	−42.7	8.6
2000	0.5	157.3	1.4	45.6	0.11	59.8	0.6	−55.6	5.9

Table 2 Common emitter scattering parameters, $I_C = 10$ mA; $V_{CE} = 10$ V.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.8	−27.9	24.6	163.4	0.02	67.9	1.0	−8.1	42.8
100	0.7	−68.5	20.0	138.6	0.02	58.9	0.9	−17.9	34.3
200	0.5	−107.8	13.0	118.2	0.03	51.3	0.7	−22.3	26.6
500	0.5	−152.8	6.3	91.7	0.04	54.2	0.6	−25.4	19.0
800	0.5	−170.1	4.1	79.0	0.06	59.1	0.6	−30.5	14.9
1000	0.5	−179.0	3.3	71.0	0.06	60.4	0.6	−32.2	13.1
1200	0.5	171.4	2.7	64.6	0.07	62.0	0.6	−36.5	11.4
1500	0.5	167.3	2.2	57.0	0.09	63.6	0.5	−40.8	9.3
2000	0.5	152.7	1.6	43.4	0.11	64.3	0.5	−53.7	6.7

Table 3 Common emitter scattering parameters, $I_C = 15$ mA; $V_{CE} = 10$ V.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.7	−34.4	31.3	159.8	0.02	62.6	0.9	−10.2	42.3
100	0.6	−80.7	23.7	132.7	0.02	55.5	0.8	−20.2	34.0
200	0.5	−120.7	14.5	112.6	0.02	52.5	0.6	−22.6	26.7
500	0.5	−160.1	6.6	88.3	0.04	58.2	0.6	−23.7	19.1
800	0.5	−174.7	4.3	76.3	0.05	63.3	0.5	−28.8	15.0
1000	0.5	177.6	3.4	68.7	0.06	64.0	0.6	−30.6	13.2
1200	0.5	168.6	2.8	62.6	0.07	65.0	0.5	−34.8	11.5
1500	0.5	165.2	2.3	55.2	0.09	65.7	0.5	−39.6	9.4
2000	0.5	151.1	1.7	42.0	0.11	66.0	0.5	−52.8	6.8

Table 4 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 10 V.

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−39.4	35.5	157.2	0.02	54.5	0.9	−11.4	42.3
100	0.6	−89.4	25.6	128.6	0.02	57.3	0.8	−20.9	33.7
200	0.5	−128.5	15.0	109.0	0.02	53.5	0.6	−21.7	26.6
500	0.5	−163.8	6.6	86.0	0.04	61.0	0.5	−22.0	19.0
800	0.5	−176.8	4.2	74.5	0.05	66.0	0.5	−27.4	14.9
1000	0.5	175.9	3.4	67.1	0.06	65.9	0.6	−29.4	13.1
1200	0.5	167.4	2.8	61.2	0.07	66.7	0.6	−33.8	11.4
1500	0.5	164.2	2.2	53.8	0.09	67.3	0.5	−38.8	9.3
2000	0.5	150.4	1.6	40.9	0.11	67.1	0.5	−52.5	6.6

Table 5 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 10 V.

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.6	−51.2	39.4	150.7	0.01	57.5	0.9	−13.0	40.6
100	0.5	−105.8	25.1	121.1	0.02	54.2	0.7	−19.3	32.3
200	0.5	−141.0	13.7	103.2	0.02	55.2	0.6	−17.9	25.6
500	0.5	−169.0	5.8	82.5	0.03	64.8	0.6	−19.0	18.0
800	0.5	179.7	3.7	71.7	0.05	67.9	0.6	−25.7	13.8
1000	0.5	173.1	2.9	64.5	0.06	67.9	0.6	−28.6	12.1
1200	0.5	165.1	2.4	58.9	0.07	68.4	0.6	−33.9	10.4
1500	0.5	161.8	2.0	51.9	0.09	69.2	0.5	−39.1	8.2
2000	0.5	148.0	1.4	39.3	0.11	69.0	0.5	−53.8	5.6

NPN 5 GHz wideband transistor — BFG25A/X

FEATURES

- Low current consumption (100 μA - 1 mA)
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG25A/X is a silicon npn transistor, primarily intended for use in RF low power amplifiers, such as pocket telephones, paging systems, with signal frequencies up to 2 GHz.

The transistor is encapsulated in a four-lead dual emitter plastic SOT143 envelope (cross emitter).

PINNING

PIN	DESCRIPTION
Code: V11	
1	collector
2	emitter
3	base
4	emitter

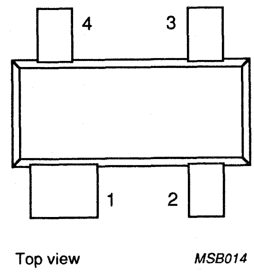


Fig.1 SOT143.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	–	5	V
I_C	DC collector current		–	–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	–	32	mW
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	18	–	dB
F	noise figure	$\Gamma = \Gamma_{opt}$; I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	1.8	–	dB
		$\Gamma = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	2	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	32	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 5 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 500 MHz	3.5	5	–	GHz
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 1 V; f = 1 MHz	–	0.21	0.3	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	18	–	dB
F	noise figure	$\Gamma = \Gamma_{opt}$; I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	1.8	–	dB
		$\Gamma = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	2	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

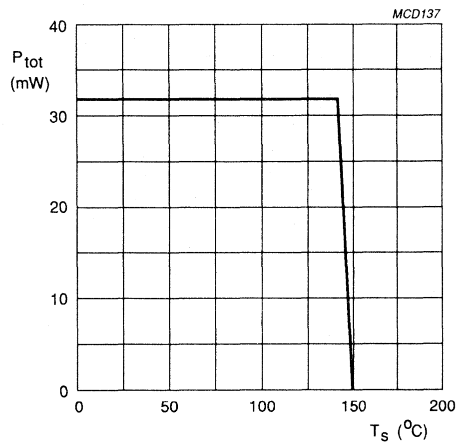
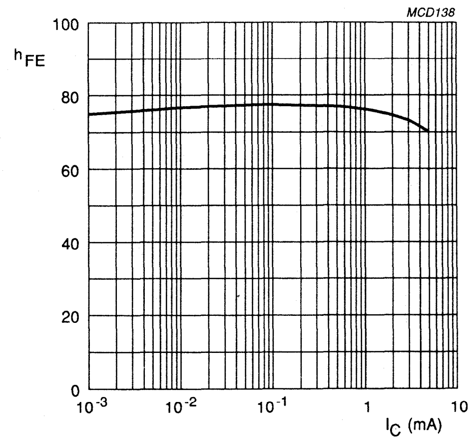
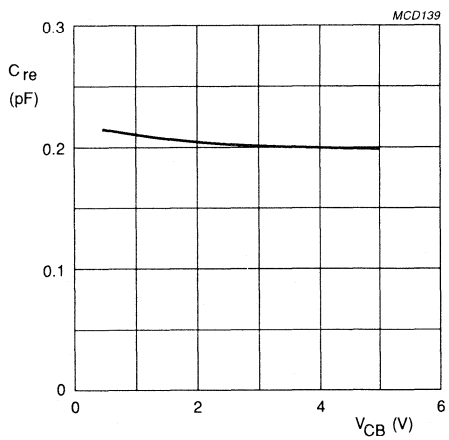


Fig.2 Power derating curve.



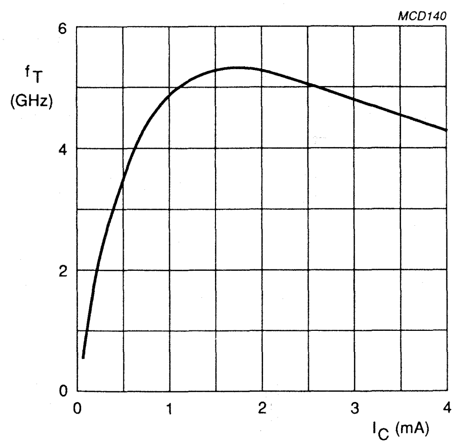
V_{CE} = 1 V.

Fig.3 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

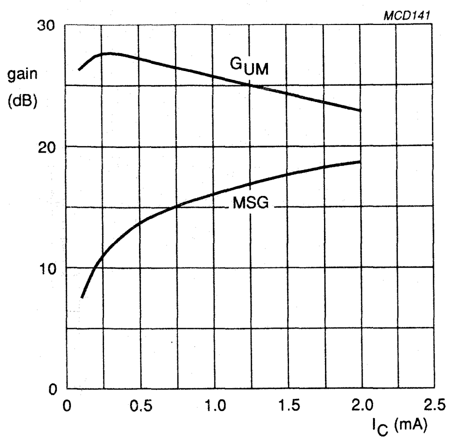
Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 1 V; T_{amb} = 25 °C; f = 500 MHz.

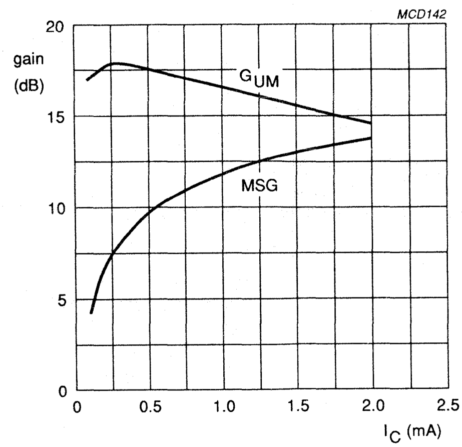
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain.



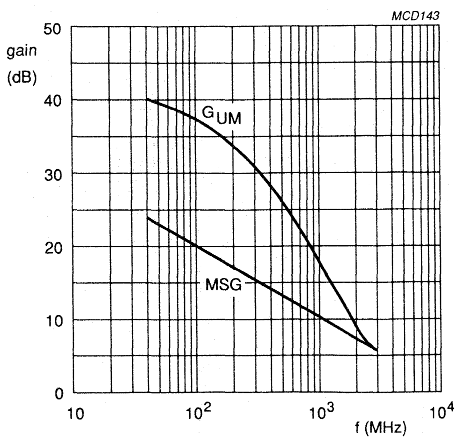
V_{CE} = 1 V; f = 500 MHz.

Fig.6 Gain as a function of collector current.



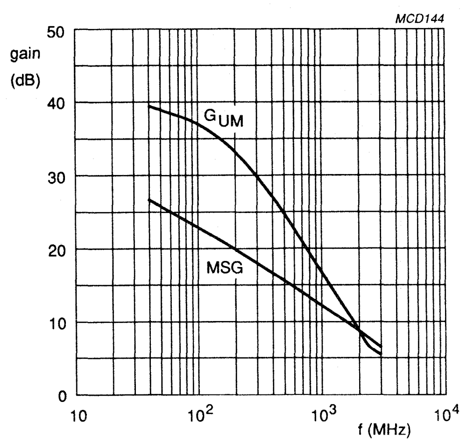
V_{CE} = 1 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



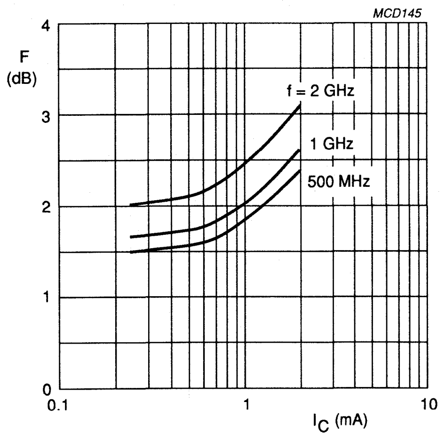
V_{CE} = 1 V; I_C = 0.5 mA.

Fig.8 Gain as a function of frequency.



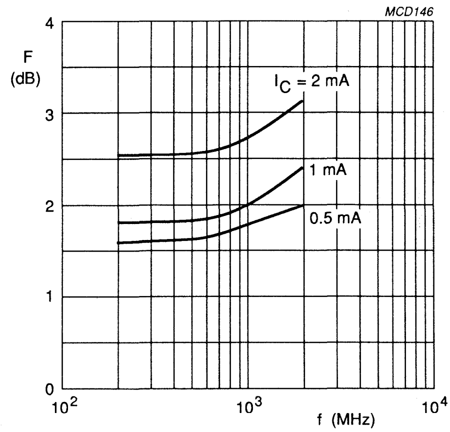
V_{CE} = 1 V; I_C = 1 mA.

Fig.9 Gain as a function of frequency.



V_{CE} = 1 V.

Fig.10 Minimum noise figure as a function of collector current.



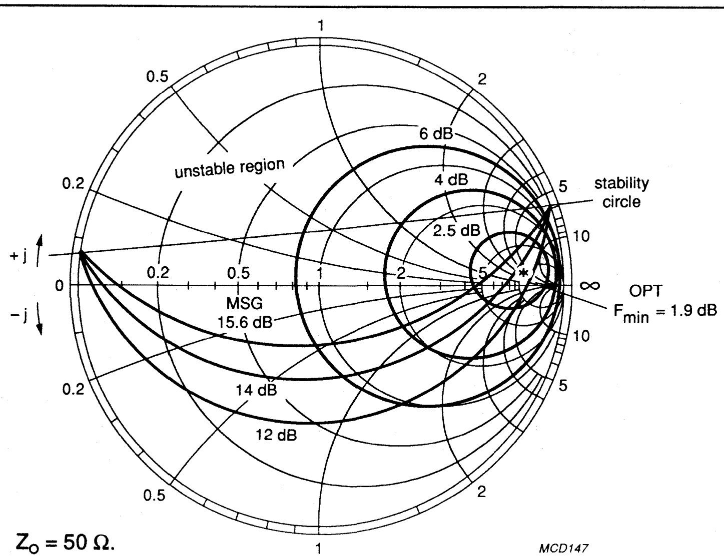
V_{CE} = 1 V.

Fig.11 Minimum noise figure as a function of frequency.

f (MHz)	V_{CE} (V)	I_C (mA)
500	1	1

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.9	0.85	5	2.4



Z_o = 50 Ω.

Maximum stable gain = 15.6 dB.

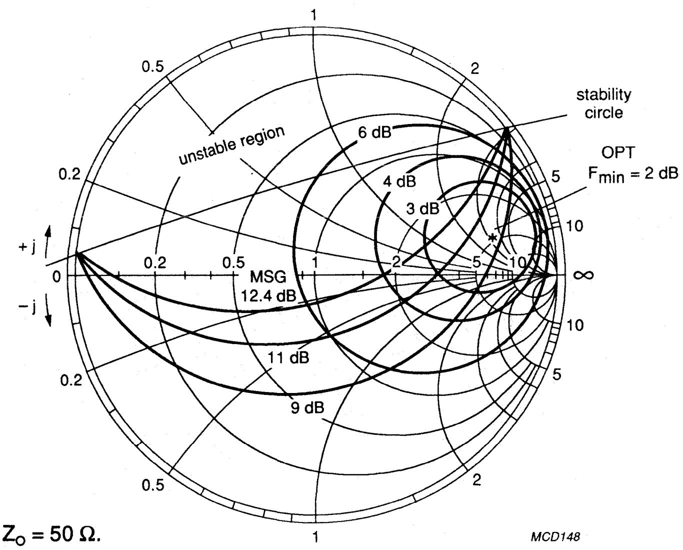
Fig.12 Noise circle figure.

NPN 5 GHz wideband transistor BFG25A/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	1	1

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.78	14	2.6



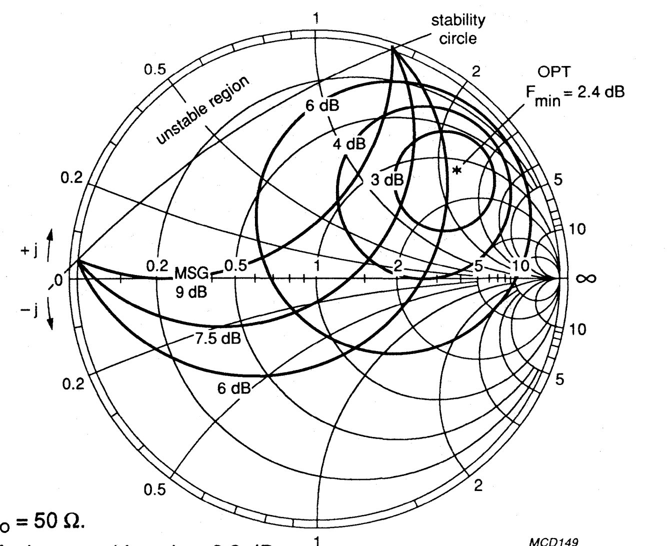
Z_O = 50 Ω.
Maximum stable gain = 12.4 dB.

Fig.13 Noise circle figure.

f (MHz)	V_{CE} (V)	I_C (mA)
2000	1	1

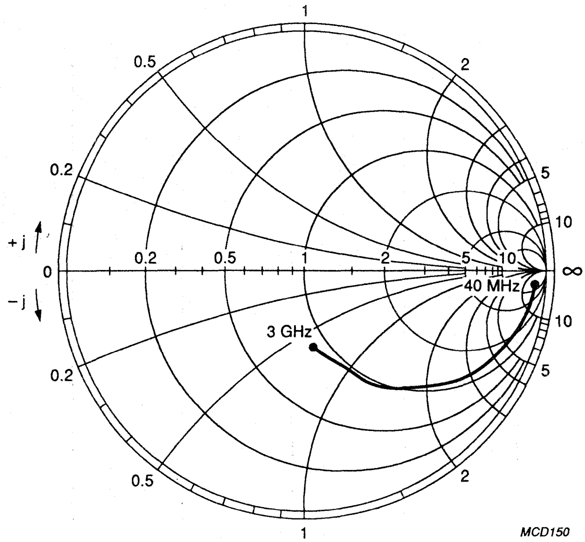
Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.72	38	1.9



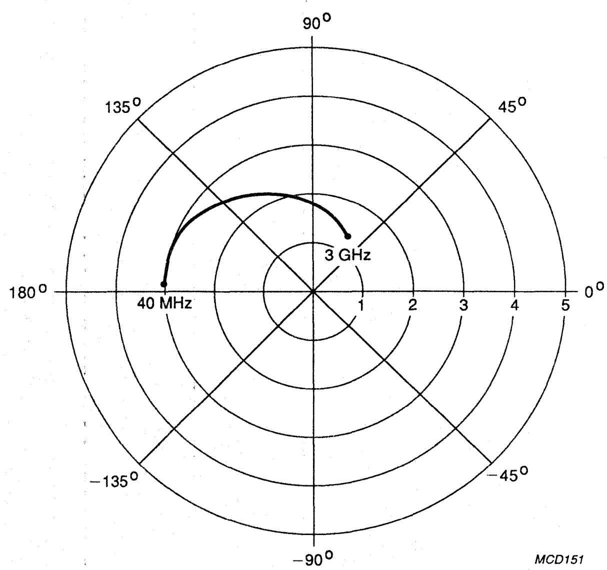
Z_O = 50 Ω.
Maximum stable gain = 8.9 dB.

Fig.14 Noise circle figure.



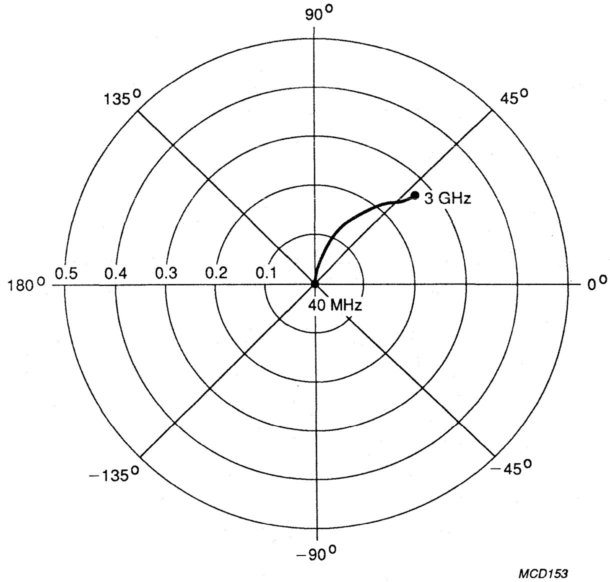
V_{CE} = 1 V; I_C = 1 mA.

Fig.15 Common emitter input reflection coefficient (S_{11}).



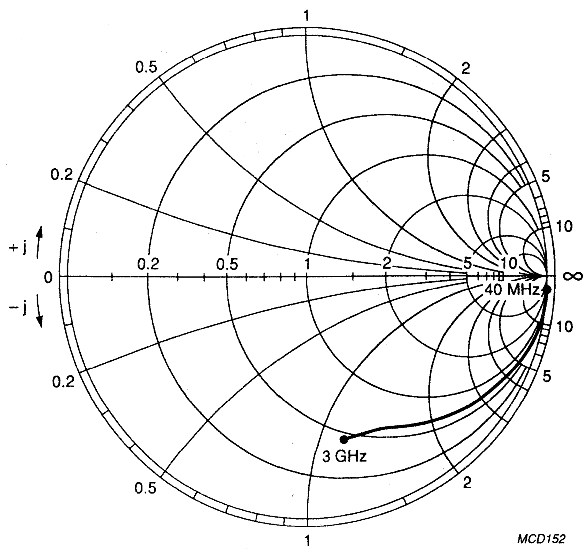
V_{CE} = 1 V; I_C = 1 mA.

Fig.16 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 1 V; I_C = 1 mA.

Fig.17 Common emitter reverse transmission coefficient (S_{12}).

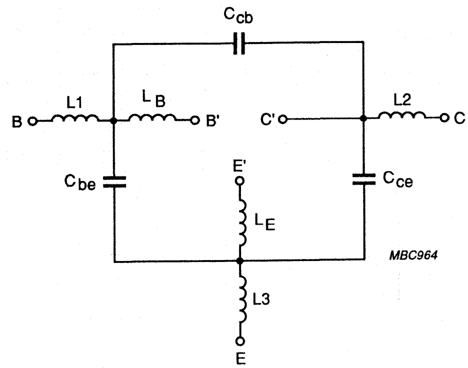


V_{CE} = 1 V; I_C = 1 mA.

Fig.18 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFT25A crystal

1	IS = 13.77	aA
2	BF = 85.65	–
3	NF = 979.9	m
4	VAF = 50.80	V
5	IKF = 10.00	A
6	ISE = 2.199	fA
7	NE = 1.857	–
8	BR = 16.97	–
9	NR = 985.5	m
10	VAR = 2.491	V
11	IKR = 188.0	mA
12	ISC = 205.1	aA
13	NC = 1.107	–
14	RB = 80.00	Ω
15	IRB = 1.000	μA
16	RBM = 80.00	Ω
17	RE = 7.911	Ω
18	RC = 5.300	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 223.0	fF
23	VJE = 669.7	mV
24	MJE = 59.66	m
25	TF = 5.112	ps
26	XTF = 7.909	–
27	VTF = 1.338	V
28	ITF = 5.662	mA
29	PTF = 15.37	deg
30	CJC = 229.0	fF
31	VJC = 394.7	mV
32	MJC = 43.32	m
33	XCJC = 50.00	m
34	TR = 13.26	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 987.8	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.19 Package equivalent circuit SOT143.

List of components (see Fig.19)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 0.25 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.984	−1.2	0.900	178.0	0.007	85.2	0.999	−1.2	41.7
100	0.983	−3.0	0.897	175.0	0.016	88.0	0.998	−3.1	38.9
200	0.980	−5.9	0.893	170.3	0.034	85.0	0.996	−6.1	34.4
300	0.973	−8.8	0.894	165.7	0.050	82.7	0.994	−9.1	30.7
400	0.971	−11.7	0.898	161.3	0.066	80.4	0.991	−12.2	29.2
500	0.962	−14.5	0.893	156.8	0.083	78.7	0.989	−15.2	27.1
600	0.954	−17.4	0.888	152.3	0.098	76.9	0.986	−18.1	25.1
700	0.947	−20.0	0.880	148.0	0.113	75.0	0.984	−20.9	23.7
800	0.937	−22.7	0.874	143.4	0.126	73.2	0.979	−23.5	21.8
900	0.926	−25.2	0.874	139.5	0.140	71.1	0.973	−26.2	20.1
1000	0.908	−28.1	0.875	134.7	0.155	69.2	0.966	−28.9	18.1
1200	0.882	−33.1	0.873	126.0	0.181	64.3	0.947	−34.2	15.2
1400	0.856	−38.2	0.868	118.3	0.204	60.8	0.935	−39.5	13.5
1600	0.837	−43.1	0.866	111.9	0.230	58.2	0.928	−44.5	12.6
1800	0.812	−47.0	0.868	105.4	0.250	54.4	0.912	−48.7	11.2
2000	0.774	−51.0	0.846	97.7	0.261	50.9	0.887	−52.7	9.2
2200	0.735	−55.3	0.824	91.4	0.276	48.0	0.857	−57.3	7.4
2400	0.701	−60.1	0.836	85.6	0.294	43.8	0.834	−62.9	6.6
2600	0.677	−65.2	0.844	78.6	0.314	40.0	0.829	−68.0	6.2
2800	0.657	−68.7	0.823	73.1	0.322	37.9	0.832	−71.8	5.9
3000	0.630	−71.6	0.821	70.9	0.335	37.7	0.819	−74.8	5.3

Table 2 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.92	4	4.0
1000	1.8	0.81	13	3.8
2000	2.1	0.80	39	2.4

Table 3 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 0.5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.967	−1.5	1.702	177.8	0.007	85.6	0.997	−1.4	39.3
100	0.965	−3.9	1.697	174.4	0.016	86.9	0.996	−3.5	37.7
200	0.960	−7.5	1.679	169.4	0.033	84.2	0.993	−6.9	34.1
300	0.950	−11.2	1.675	164.2	0.049	81.7	0.988	−10.4	30.8
400	0.941	−15.0	1.669	159.3	0.065	79.0	0.983	−13.7	28.6
500	0.929	−18.5	1.644	154.4	0.081	76.5	0.977	−17.1	26.3
600	0.914	−22.0	1.618	149.5	0.095	74.5	0.970	−20.2	24.3
700	0.898	−25.1	1.587	145.0	0.109	72.4	0.964	−23.3	22.7
800	0.880	−28.3	1.559	140.2	0.122	70.3	0.955	−26.2	20.9
900	0.860	−31.4	1.536	135.9	0.135	68.4	0.944	−29.0	19.2
1000	0.832	−34.5	1.511	131.0	0.148	66.1	0.932	−31.8	17.5
1200	0.789	−40.2	1.464	122.2	0.170	61.4	0.905	−37.1	15.0
1400	0.750	−45.8	1.407	114.3	0.189	58.3	0.886	−42.4	13.2
1600	0.718	−50.9	1.362	108.0	0.211	55.8	0.873	−47.3	12.1
1800	0.684	−54.6	1.325	101.5	0.227	52.5	0.853	−51.3	10.8
2000	0.641	−58.3	1.256	94.3	0.236	49.7	0.825	−54.9	9.2
2200	0.595	−62.4	1.195	88.5	0.249	47.1	0.793	−59.3	7.8
2400	0.554	−66.9	1.175	82.9	0.264	43.7	0.769	−64.6	6.9
2600	0.528	−71.9	1.158	76.4	0.279	40.2	0.763	−69.5	6.5
2800	0.506	−74.8	1.104	71.0	0.287	39.0	0.766	−73.1	6.0
3000	0.480	−76.9	1.078	69.1	0.298	38.6	0.757	−75.9	5.5

Table 4 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.6	0.89	5	2.8
1000	1.8	0.80	14	3.0
2000	2.0	0.75	39	2.1

Table 5 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 1 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.938	−2.2	3.065	177.1	0.007	85.2	0.995	−1.7	39.4
100	0.935	−5.3	3.055	172.8	0.016	86.6	0.994	−4.2	37.7
200	0.924	−10.4	3.000	166.3	0.033	82.5	0.986	−8.3	33.4
300	0.905	−15.5	2.958	159.8	0.048	79.7	0.975	−12.4	29.9
400	0.885	−20.4	2.903	153.7	0.063	76.2	0.964	−16.2	27.3
500	0.857	−25.1	2.817	147.7	0.078	73.5	0.949	−20.0	24.8
600	0.828	−29.3	2.717	141.9	0.090	71.3	0.935	−23.4	22.7
700	0.803	−33.2	2.613	136.7	0.102	69.1	0.921	−26.6	21.0
800	0.771	−36.9	2.513	131.4	0.114	67.2	0.904	−29.5	19.3
900	0.739	−40.1	2.421	126.7	0.124	65.2	0.887	−32.3	17.8
1000	0.700	−43.3	2.334	121.6	0.134	62.9	0.868	−34.9	16.4
1200	0.640	−49.2	2.167	112.7	0.152	59.0	0.833	−39.8	14.1
1400	0.589	−54.7	2.010	105.0	0.167	56.8	0.808	−44.7	12.5
1600	0.552	−59.3	1.881	99.0	0.185	54.5	0.793	−49.1	11.4
1800	0.516	−62.2	1.777	93.0	0.198	52.5	0.774	−52.5	10.3
2000	0.470	−64.9	1.646	86.5	0.208	50.4	0.751	−55.7	9.0
2200	0.429	−67.9	1.530	81.3	0.219	48.6	0.721	−59.5	7.8
2400	0.392	−72.5	1.476	76.5	0.232	45.8	0.700	−64.6	7.0
2600	0.367	−76.7	1.422	70.7	0.246	43.5	0.696	−69.3	6.6
2800	0.352	−79.3	1.341	65.8	0.256	42.2	0.702	−72.7	6.1
3000	0.328	−80.1	1.292	64.1	0.267	42.0	0.697	−75.3	5.6

Table 6 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.9	0.85	5	2.4
1000	2.0	0.78	14	2.6
2000	2.4	0.72	38	1.9

Table 7 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 0.5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.970	−1.3	1.698	177.8	0.007	86.7	0.999	−1.3	42.4
100	0.969	−3.5	1.694	174.7	0.016	87.5	0.998	−3.4	40.5
200	0.963	−6.9	1.677	169.9	0.032	84.4	0.994	−6.7	35.4
300	0.956	−10.6	1.672	165.1	0.047	81.8	0.990	−10.1	32.1
400	0.947	−14.0	1.668	160.5	0.062	79.3	0.986	−13.3	29.8
500	0.936	−17.3	1.647	156.0	0.078	77.3	0.981	−16.6	27.5
600	0.923	−20.6	1.622	151.2	0.091	75.2	0.975	−19.7	25.6
700	0.911	−23.6	1.594	147.0	0.104	73.3	0.970	−22.7	24.0
800	0.894	−26.6	1.570	142.4	0.117	71.6	0.961	−25.5	22.1
900	0.877	−29.5	1.546	138.3	0.130	69.5	0.951	−28.2	20.4
1000	0.850	−32.5	1.527	133.6	0.142	67.4	0.941	−31.0	18.6
1200	0.813	−38.0	1.485	125.1	0.164	62.8	0.915	−36.4	16.0
1400	0.775	−43.4	1.432	117.5	0.183	59.6	0.896	−41.6	14.2
1600	0.745	−48.2	1.389	111.3	0.204	57.1	0.885	−46.6	13.0
1800	0.714	−51.9	1.354	105.1	0.220	53.8	0.866	−50.6	11.8
2000	0.671	−55.7	1.288	98.0	0.230	50.9	0.838	−54.2	10.1
2200	0.626	−59.6	1.227	92.2	0.243	48.3	0.805	−58.6	8.5
2400	0.585	−64.2	1.207	86.7	0.258	44.8	0.781	−63.9	7.5
2600	0.561	−68.9	1.191	80.2	0.273	41.4	0.776	−68.9	7.2
2800	0.543	−72.4	1.138	74.7	0.281	40.0	0.779	−72.5	6.7
3000	0.513	−74.0	1.112	72.9	0.293	39.9	0.767	−75.3	6.1

Table 8 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.6	0.88	4	3.0
1000	1.8	0.80	13	3.2
2000	2.0	0.79	37	2.2

Table 9 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 1 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.943	−1.9	3.095	177.1	0.006	89.8	0.998	−1.6	42.4
100	0.940	−4.9	3.080	173.4	0.016	87.7	0.995	−4.0	39.3
200	0.930	−9.5	3.034	167.5	0.031	83.4	0.989	−8.0	34.9
300	0.915	−14.2	3.000	161.5	0.046	80.4	0.979	−12.0	31.3
400	0.898	−18.8	2.956	155.8	0.060	77.3	0.969	−15.7	28.7
500	0.877	−23.0	2.882	150.3	0.075	74.6	0.957	−19.4	26.3
600	0.851	−27.0	2.795	144.8	0.087	72.6	0.945	−22.9	24.2
700	0.828	−30.7	2.700	140.0	0.098	70.4	0.931	−26.0	22.4
800	0.799	−34.2	2.611	134.9	0.109	68.5	0.916	−29.0	20.7
900	0.770	−37.4	2.527	130.4	0.120	66.5	0.900	−31.8	19.2
1000	0.735	−40.5	2.449	125.5	0.130	64.5	0.883	−34.5	17.7
1200	0.679	−46.3	2.292	116.8	0.148	60.3	0.847	−39.5	15.4
1400	0.627	−51.7	2.137	109.3	0.164	58.0	0.822	−44.5	13.6
1600	0.591	−56.5	2.012	103.4	0.181	55.9	0.807	−49.1	12.5
1800	0.555	−59.5	1.906	97.5	0.194	53.4	0.787	−52.6	11.4
2000	0.510	−62.3	1.770	91.0	0.204	51.3	0.760	−55.7	10.0
2200	0.465	−65.7	1.650	85.8	0.216	49.2	0.729	−59.6	8.7
2400	0.428	−69.4	1.589	80.9	0.228	46.9	0.705	−64.7	7.9
2600	0.402	−74.2	1.535	75.1	0.242	44.0	0.701	−69.4	7.4
2800	0.387	−76.7	1.446	70.2	0.251	42.8	0.707	−72.8	6.9
3000	0.363	−78.0	1.395	68.6	0.263	42.8	0.699	−75.4	6.4

Table 10 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.9	0.83	5	2.6
1000	2.0	0.78	13	2.8
2000	2.3	0.76	37	2.0

Table 11 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.895	−2.6	5.176	176.1	0.006	88.6	0.995	−2.0	41.0
100	0.889	−6.8	5.134	171.2	0.015	85.4	0.991	−5.0	38.4
200	0.870	−13.3	4.996	163.3	0.030	81.3	0.977	−9.9	33.6
300	0.842	−19.6	4.854	155.5	0.044	77.6	0.957	−14.6	29.8
400	0.806	−25.6	4.677	148.4	0.056	74.4	0.935	−18.9	26.9
500	0.768	−30.7	4.447	141.7	0.069	71.6	0.911	−22.8	24.5
600	0.729	−35.4	4.202	135.4	0.080	69.6	0.889	−26.4	22.5
700	0.694	−39.5	3.958	130.0	0.089	67.3	0.867	−29.5	20.8
800	0.653	−43.1	3.733	124.7	0.098	66.2	0.845	−32.2	19.3
900	0.616	−46.2	3.530	120.0	0.107	64.4	0.823	−34.6	17.9
1000	0.575	−49.2	3.344	115.2	0.115	62.7	0.802	−37.0	16.7
1200	0.513	−54.5	3.012	106.9	0.130	59.7	0.764	−41.3	14.7
1400	0.463	−59.5	2.722	100.0	0.143	58.6	0.739	−45.5	13.2
1600	0.429	−63.4	2.498	94.7	0.159	57.0	0.727	−49.6	12.1
1800	0.398	−65.2	2.319	89.5	0.172	55.4	0.712	−52.6	11.1
2000	0.358	−67.3	2.122	83.8	0.180	53.7	0.692	−55.3	10.0
2200	0.320	−69.4	1.951	79.3	0.193	52.2	0.665	−58.9	8.8
2400	0.288	−73.7	1.856	75.1	0.204	50.2	0.647	−63.7	8.1
2600	0.271	−77.7	1.769	70.0	0.219	47.9	0.644	−68.5	7.6
2800	0.257	−80.0	1.654	65.7	0.230	46.8	0.652	−71.8	7.1
3000	0.242	−80.5	1.583	64.3	0.239	46.2	0.649	−74.4	6.6

Table 12 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	2.5	0.79	5	2.3
1000	2.5	0.74	14	2.5
2000	3.0	0.70	37	1.8

PNP 5 GHz wideband transistor BFG31

FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope.

It is intended for wideband amplifier applications.

NPN complement is the BFG97.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

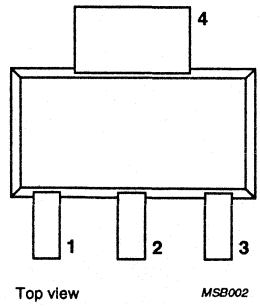


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = –70 mA; V_{CE} = –10 V; T_{amb} = 25 °C	25	–	–	
f_T	transition frequency	I_C = –70 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	5.0	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –70 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	I_C = –100 mA; V_{CE} = –10 V; R_L = 75 Ω; T_{amb} = 25 °C	–	600	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

PNP 5 GHz wideband transistor BFG31

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −10 mA	−20	−	−	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA	−18	−	−	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	−	−	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	−	−	−1	μA
h_{FE}	DC current gain	I_C = −70 mA; V_{CE} = −10 V; T_{amb} = 25 °C	25	−	−	
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz	−	1.8	−	pF
C_{eb}	emitter-base capacitance	I_C = 0; V_{EB} = −10 V; f = 1 MHz	−	5	−	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz; T_{amb} = 25 °C	−	1.6	−	pF
f_T	transition frequency	I_C = −70 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	−	5	−	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = −70 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	−	16	−	dB
		I_C = −70 mA; V_{CE} = −10 V; f = 800 MHz; T_{amb} = 25 °C	−	12	−	dB
V_O	output voltage	note 2	−	600	−	mV
V_O	output voltage	note 3	−	550	−	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = −60 dB; I_C = −70 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 850.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 858.25 MHz;
   $V_r = V_O$ −6 dB;f_r = 860.25 MHz;
   measured at $f_{(p+q-r)}$ = 848.25 MHz.
3. d_{im} = −60 dB (DIN 45004B); I_C = −70 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ = at d_{im} = −60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.

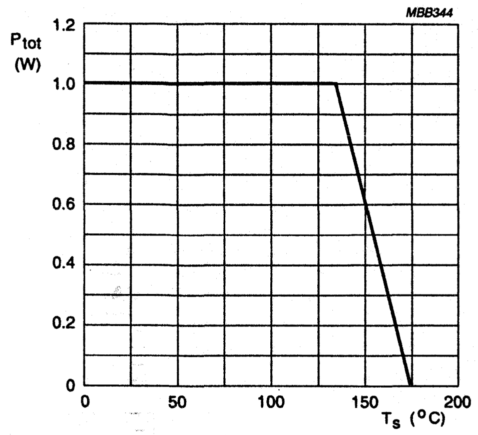
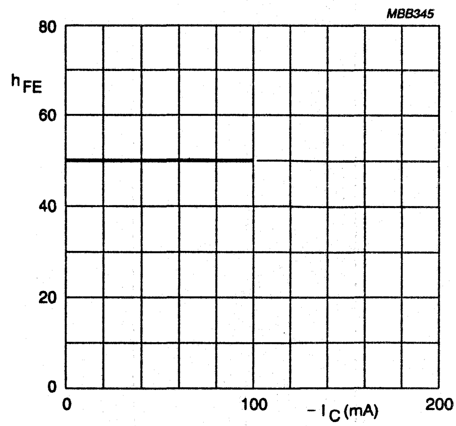
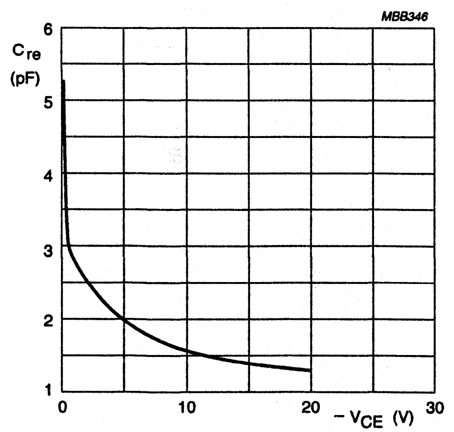


Fig.2 Power derating curve.



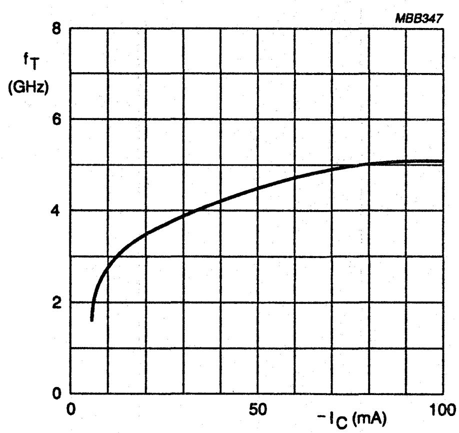
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.3 DC current gain as a function of collector current.



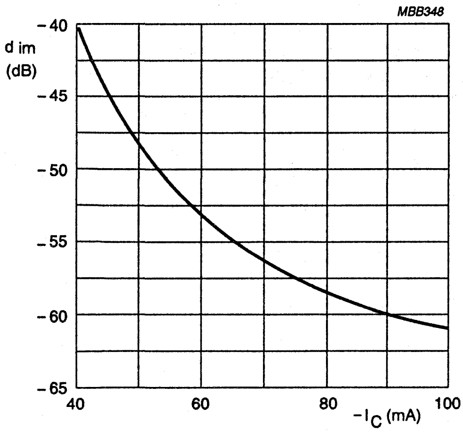
f = 1 MHz; $T_{amb} = 25$ °C.

Fig.4 Feedback capacitance as a function of collector-emitter voltage.



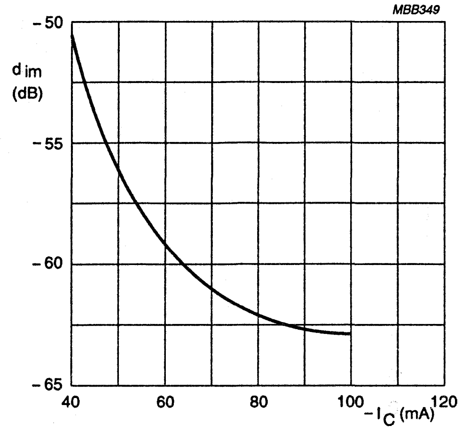
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.5 Transition frequency as a function of collector current.



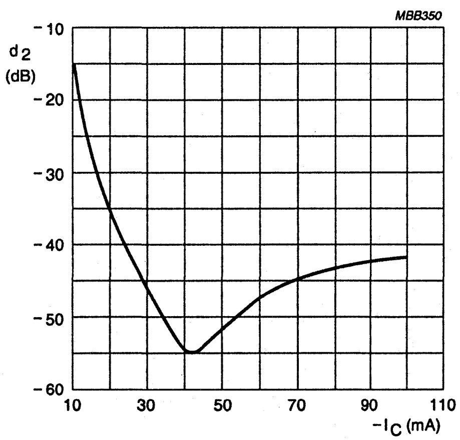
V_{CE} = −10 V; V_O = 650 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

Fig.6 Intermodulation distortion as a function of collector current.



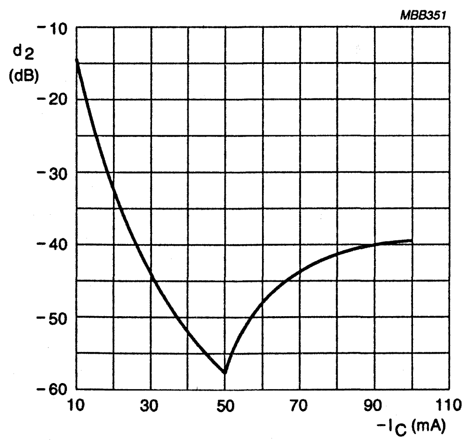
V_{CE} = −10 V; V_O = 550 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 848.25 MHz.

Fig.7 Intermodulation distortion as a function of collector current.



V_{CE} = −10 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 450 MHz.

Fig.8 Second order intermodulation distortion as a function of collector current.



V_{CE} = −10 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 810 MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.

PNP 5 GHz wideband transistor BFG31

Table 1 Common emitter scattering parameters, $I_C = -50$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.374	−135.9	36.570	138.9	0.013	63.7	0.695	−45.8	34.8
100	0.516	−158.6	20.922	113.5	0.024	64.6	0.409	−80.3	28.6
200	0.563	−173.4	11.135	98.0	0.038	66.6	0.247	−109.4	22.9
300	0.590	179.2	7.726	89.9	0.052	69.6	0.195	−128.7	19.8
400	0.605	174.6	5.744	84.0	0.067	69.3	0.177	−143.0	17.3
500	0.611	172.2	4.707	79.3	0.081	69.9	0.169	−152.7	15.6
600	0.598	167.5	3.921	74.6	0.096	69.9	0.164	−161.6	13.9
700	0.607	163.1	3.400	70.8	0.111	68.6	0.162	−168.8	12.7
800	0.606	160.0	2.975	67.4	0.124	67.8	0.162	−176.0	11.6
900	0.625	154.6	2.677	63.6	0.138	66.8	0.165	177.3	10.8
1000	0.624	152.1	2.426	60.1	0.152	66.1	0.172	171.3	10.0
1200	0.628	145.4	2.072	54.1	0.179	63.7	0.193	162.3	8.7
1400	0.665	139.2	1.772	47.8	0.201	60.0	0.210	155.9	7.7
1600	0.678	134.4	1.588	41.3	0.227	58.2	0.229	149.9	6.9
1800	0.699	128.0	1.436	36.0	0.254	54.0	0.248	143.7	6.3
2000	0.708	121.7	1.338	31.1	0.274	51.7	0.274	137.2	5.9

Table 2 Common emitter scattering parameters, $I_C = -70$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.394	−145.8	37.514	136.9	0.012	63.3	0.651	−48.5	34.6
100	0.537	−163.0	20.864	112.0	0.021	66.9	0.377	−84.0	28.5
200	0.579	−176.1	11.029	97.1	0.037	69.9	0.231	−114.0	22.9
300	0.601	178.9	7.630	89.3	0.051	71.2	0.187	−133.5	19.7
400	0.615	173.5	5.641	83.6	0.067	71.9	0.173	−147.4	17.2
500	0.611	170.6	4.645	78.8	0.080	70.8	0.167	−156.6	15.5
600	0.613	167.5	3.861	74.0	0.095	70.6	0.164	−165.0	13.9
700	0.612	161.8	3.332	70.4	0.111	70.3	0.162	−171.7	12.6
800	0.612	158.6	2.925	66.8	0.124	68.4	0.164	−178.5	11.5
900	0.636	154.8	2.637	63.1	0.139	67.7	0.167	175.0	10.8
1000	0.632	151.5	2.390	59.8	0.152	66.7	0.174	169.2	9.9
1200	0.640	145.9	2.030	53.6	0.179	63.9	0.195	160.8	8.6
1400	0.681	139.0	1.747	47.5	0.202	60.0	0.215	154.9	7.8
1600	0.684	133.7	1.568	41.1	0.227	58.8	0.233	148.9	6.9
1800	0.716	127.8	1.414	35.6	0.255	54.2	0.252	142.7	6.4
2000	0.732	120.6	1.322	30.8	0.275	51.9	0.279	136.2	6.1

PNP 5 GHz wideband transistor — BFG32

DESCRIPTION

PNP transistor in a four-lead dual-emitter plastic SOT103 envelope.

It is designed for application in wideband amplifiers, such as MATV and CATV systems, up to 5 GHz.

NPN complement is the BFG96.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

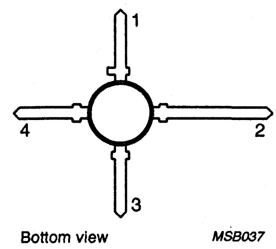


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s = 137 °C (note 1)	–	–	700	mW
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V; T_j = 25 °C	25	–	–	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_j = 25 °C	–	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz	–	1.4	–	pF
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	4.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current	f > 1 MHz	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 137 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 137 °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

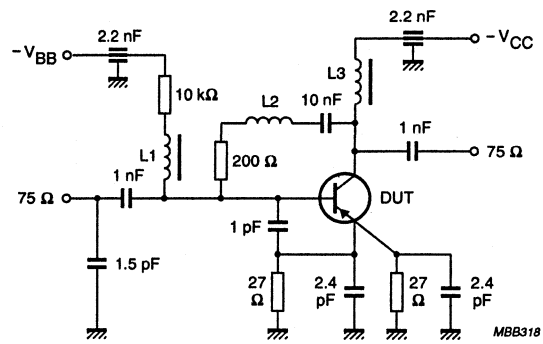
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	−100	nA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V	25	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	1.4	–	pF
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz	–	5	–	GHz
F	noise figure	I_C = −50 mA; V_{CE} = −10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	4.3	–	dB
G_{UM}	maximum unilateral power gain (note 1)	I_C = −50 mA; V_{CE} = −10 V; f = 800 MHz; T_{amb} = 25 °C	–	13.5	–	dB
		I_C = −50 mA; V_{CE} = −10 V; f = 2 GHz; T_{amb} = 25 °C	–	6	–	dB
V_O	output voltage	note 2	–	500	–	mV
d_2	second order intermodulation distortion (Fig.2)	note 3	–	−50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = −60 dB; I_C = −70 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ −6 dB;f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. I_C = −70 mA; V_{CE} = −10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   $V_p = V_O$ = 150 mV at f_p = 250 MHz;
   $V_q = V_O$ = 150 mV at f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.



L1 = L3 = 5 μH micro-choke.

L2 = 1.5 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

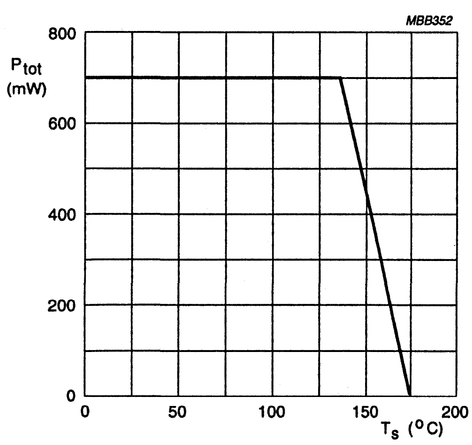
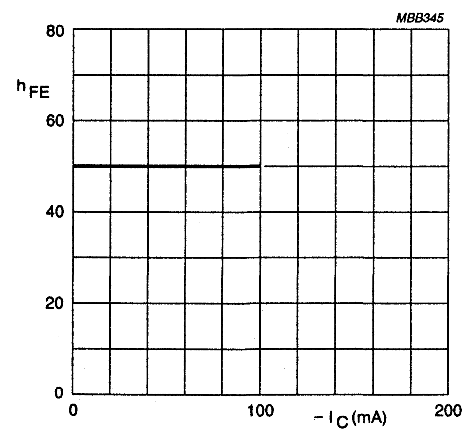
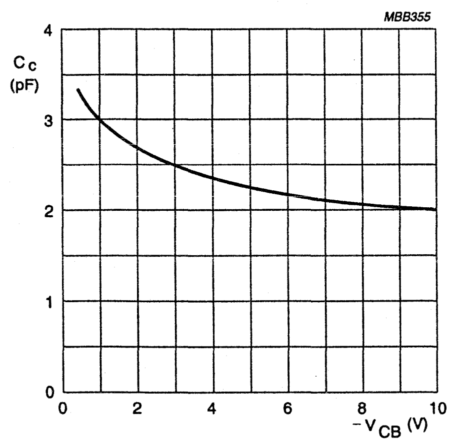


Fig.3 Power derating curve.



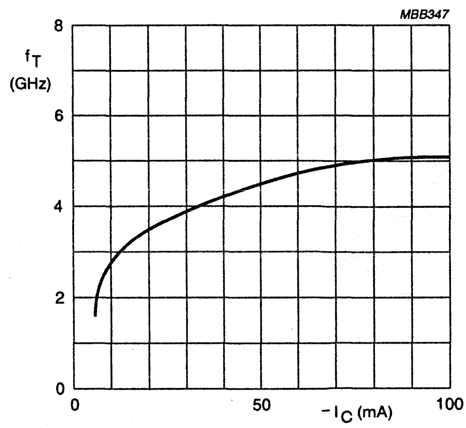
V_{CE} = −10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



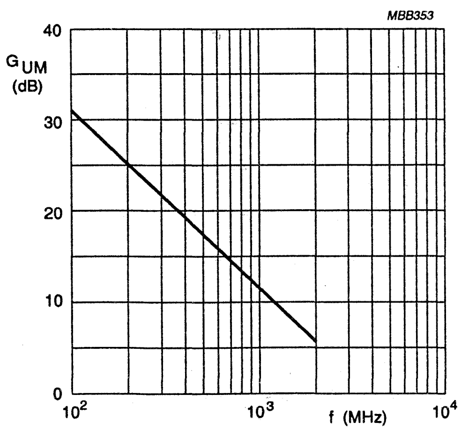
$I_E = i_e = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



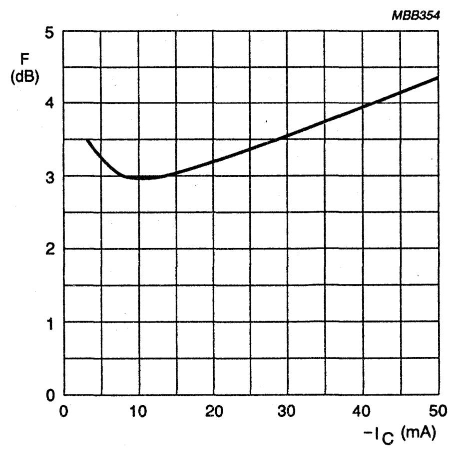
$V_{CE} = -10$ V; f = 500 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.



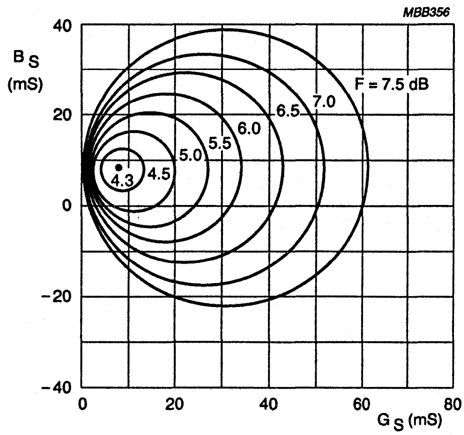
$V_{CE} = -10$ V; $I_C = -50$ mA; $T_{amb} = 25$ °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



$V_{CE} = -10$ V; Z_S = opt.; f = 800 MHz; $T_{amb} = 25$ °C.

Fig.8 Minimum noise figure as a function of collector current.



V_{CE} = −10 V; I_C = −50 mA; f = 800 MHz;
T_{amb} = 25 °C.

Fig.9 Noise circle figure.

Table 1 Common emitter scattering parameters, I_C = –5 mA; V_{CE} = –10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.75	–42.7	13.8	159.7	0.03	70.9	0.93	–20.1	35.4
100	0.74	–90.7	10.8	133.3	0.06	49.2	0.74	–41.9	27.5
200	0.75	–128.8	7.0	112.1	0.08	33.6	0.52	–59.2	21.8
500	0.74	–167.7	3.0	83.6	0.09	25.1	0.32	–79.5	13.4
800	0.74	–178.7	2.0	69.0	0.10	26.8	0.37	–89.3	10.1
1000	0.74	–172.2	1.6	59.3	0.11	27.7	0.41	–99.6	8.4
2000	0.76	139.8	0.8	33.3	0.14	47.5	0.40	–139.1	2.6

Table 2 Common emitter scattering parameters, I_C = –10 mA; V_{CE} = –10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.61	–63.4	22.1	153.0	0.03	65.7	0.88	–30.7	35.3
100	0.67	–115.6	15.2	124.9	0.05	44.3	0.62	–61.2	28.4
200	0.73	–146.7	9.0	106.0	0.06	34.0	0.41	–85.1	23.1
500	0.74	–176.1	3.8	83.3	0.07	36.2	0.25	–117.2	15.3
800	0.73	173.2	2.5	70.5	0.09	40.5	0.28	–119.4	11.5
1000	0.73	168.5	2.0	62.1	0.10	41.8	0.44	–126.0	9.6
2000	0.75	137.4	1.0	38.2	0.16	53.3	0.31	–159.4	4.1

Table 3 Common emitter scattering parameters, I_C = –20 mA; V_{CE} = –10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.50	–193.5	30.5	146.0	0.02	60.6	0.81	–43.2	35.5
100	0.66	–138.4	18.7	118.4	0.03	42.7	0.53	–82.0	29.4
200	0.72	–160.8	10.5	101.8	0.04	38.9	0.38	–111.9	24.3
500	0.74	178.5	4.3	83.3	0.06	48.9	0.28	–148.3	16.5
800	0.73	168.9	2.8	71.6	0.08	52.5	0.30	–147.7	12.6
1000	0.73	165.2	2.2	63.3	0.09	52.3	0.54	–150.6	10.7
2000	0.74	135.5	1.2	42.2	0.17	57.7	0.30	176.9	5.3

Table 4 Common emitter scattering parameters, I_C = −30 mA; V_{CE} = −10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.48	−111.8	34.6	142.5	0.02	58.6	0.76	−50.3	35.7
100	0.67	−148.2	20.1	115.3	0.03	43.8	0.50	−93.2	29.9
200	0.73	−166.2	11.0	99.9	0.03	43.7	0.38	−124.1	24.8
500	0.74	175.8	4.5	83.2	0.05	55.4	0.32	−158.2	17.0
800	0.73	168.4	2.1	72.1	0.08	57.7	0.32	−157.9	13.0
1000	0.73	164.3	2.3	64.2	0.09	56.6	0.35	−159.8	11.2
2000	0.75	134.8	1.2	44.0	0.17	59.2	0.32	167.5	5.8

Table 5 Common emitter scattering parameters, I_C = −50 mA; V_{CE} = −10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.49	−131.2	38.8	139.8	0.01	57.1	0.70	−58.7	35.9
100	0.69	−157.6	21.1	112.6	0.02	46.5	0.48	−104.7	30.3
200	0.73	−171.3	11.5	98.3	0.03	49.5	0.39	−234.9	25.2
500	0.75	174.1	4.6	82.4	0.05	61.6	0.35	−165.6	17.4
800	0.73	166.8	3.0	71.5	0.08	62.0	0.34	−165.3	13.5
1000	0.73	162.7	2.4	64.1	0.09	59.9	0.37	−166.8	11.4
2000	0.76	134.0	1.2	45.3	0.18	60.9	0.34	160.9	6.0

NPN 12 GHz wideband transistor

BFG33; BFG33/X

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG33 is a silicon npn transistor, primarily intended for wideband applications in the 2 GHz range, such as portable RF communications equipment (DECT, PCN cellular).

The transistor is encapsulated in a 4-pin, dual-emitter plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG33; Code: V6	
1	collector
2	base
3	emitter
4	emitter
BFG33/X; Code: V16	
1	collector
2	emitter
3	base
4	emitter

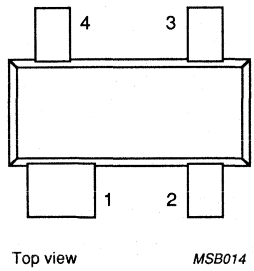


Fig.1 SOT143.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	–	7	V
I_C	DC collector current		–	–	20	mA
P_{tot}	total power dissipation	up to T_s = 110 °C (note 1)	–	–	140	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	50	90	–	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 5 V; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 2 GHz	–	12	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 2 GHz	–	12.5	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 2 GHz	–	3	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	7	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	20	mA
P_{tot}	total power dissipation	up to T_s = 110 °C (note 1)	–	140	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	50	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.4	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	12	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	12.5	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

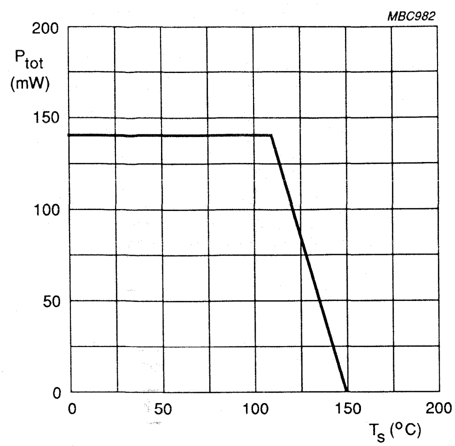
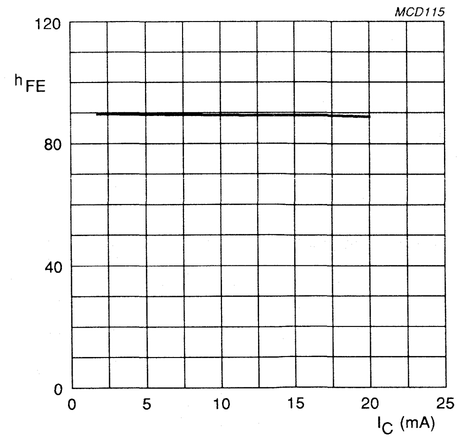
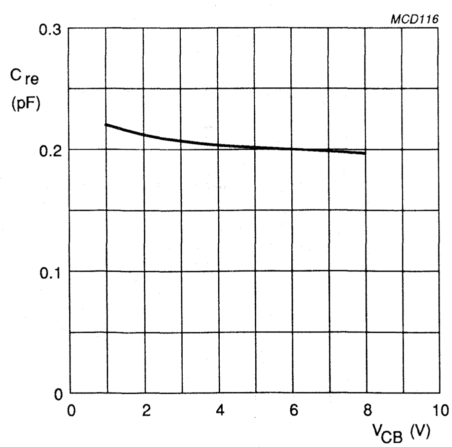


Fig.2 Power derating curve.



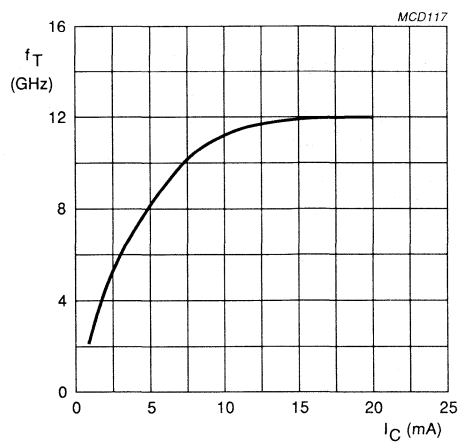
V_{CE} = 5 V.

Fig.3 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

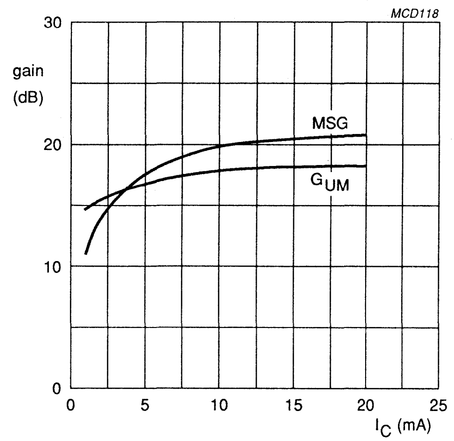
Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 5 V; T_{amb} = 25 °C; f = 2 GHz.

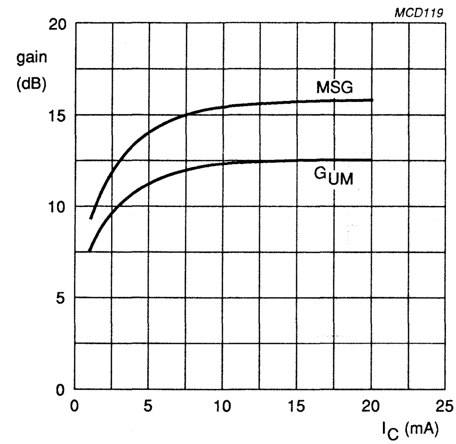
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



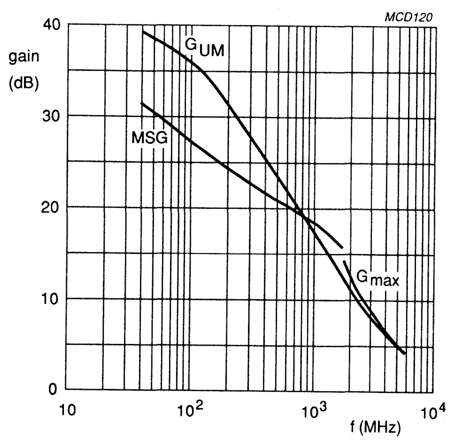
V_{CE} = 5 V; f = 1 GHz.

Fig.6 Gain as a function of collector current.



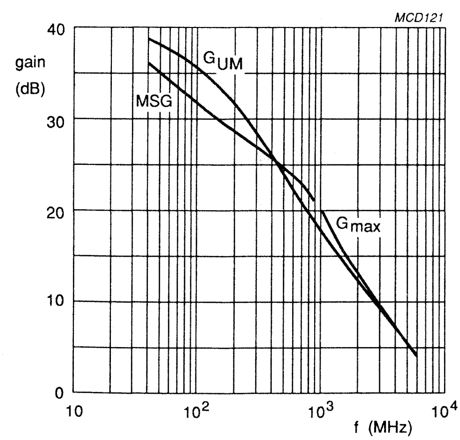
V_{CE} = 5 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



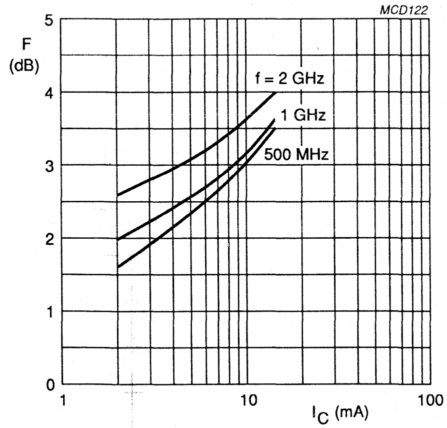
V_{CE} = 5 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



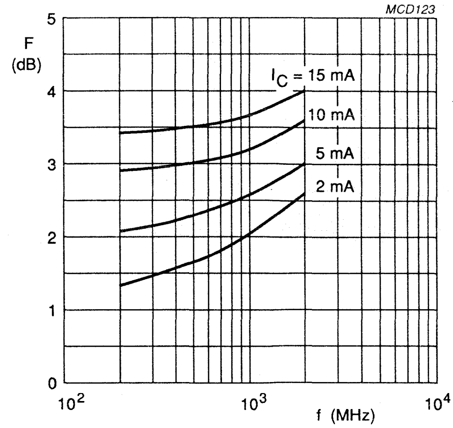
V_{CE} = 5 V; I_C = 15 mA.

Fig.9 Gain as a function of frequency.



V_{CE} = 5 V.

Fig.10 Minimum noise figure as a function of collector current.



V_{CE} = 5 V.

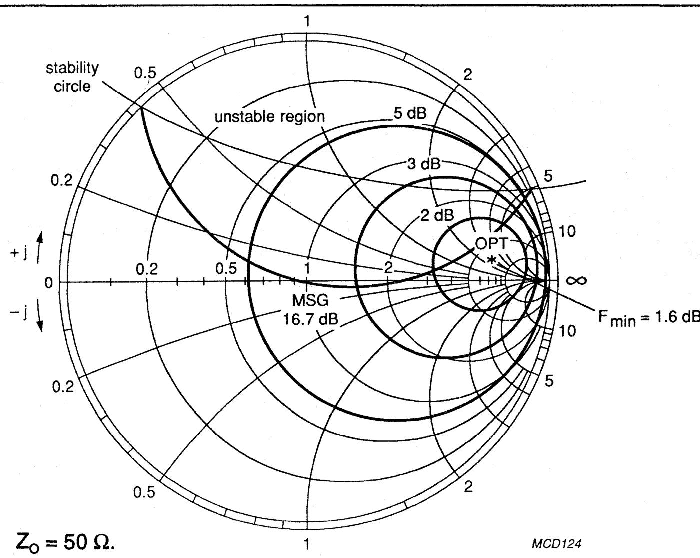
Fig.11 Minimum noise figure as a function of frequency.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	5	2

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.6	0.774	6.2	1.254



Z_O = 50 Ω.

Maximum stable gain = 16.7 dB.

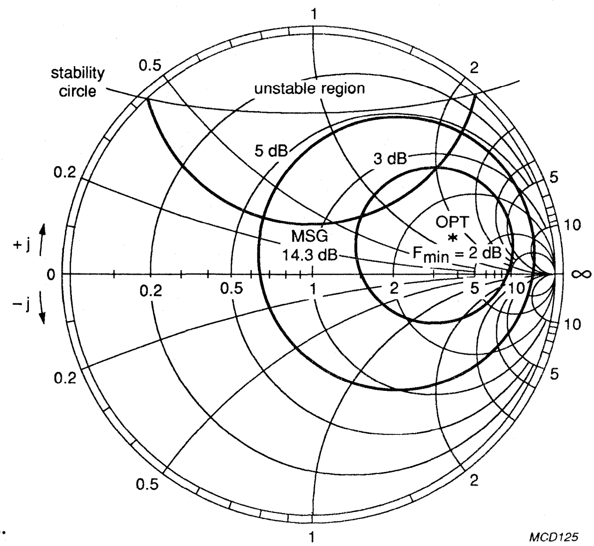
Fig.12 Noise circle figure.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	5	2

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.627	13.6	1.458



$Z_O = 50\ \Omega$.

Maximum stable gain = 14.3 dB.

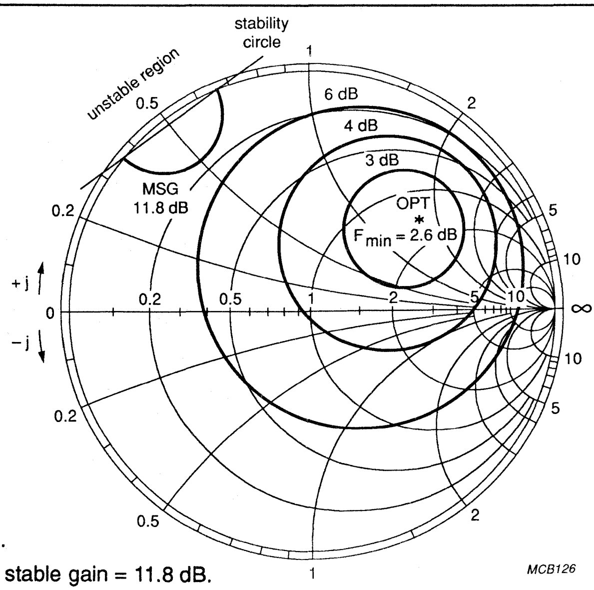
Fig.13 Noise circle figure.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
2000	5	2

Noise Parameters

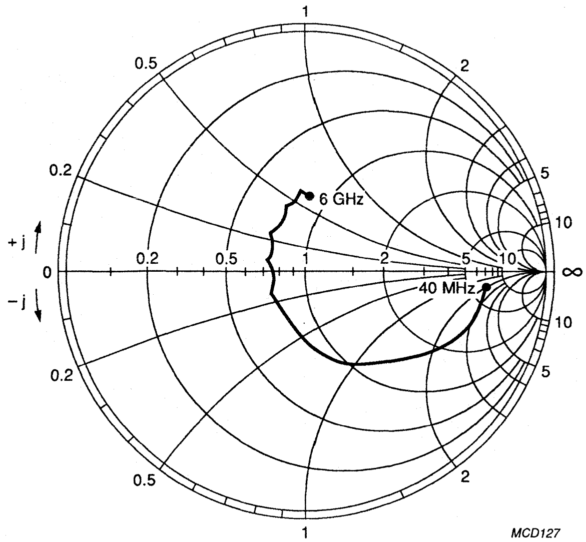
F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.6	0.58	40.2	1.064



$Z_O = 50\ \Omega$.

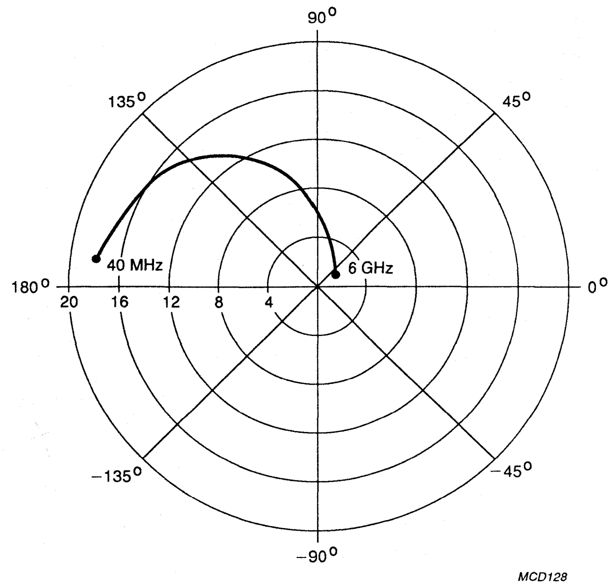
Maximum stable gain = 11.8 dB.

Fig.14 Noise circle figure.



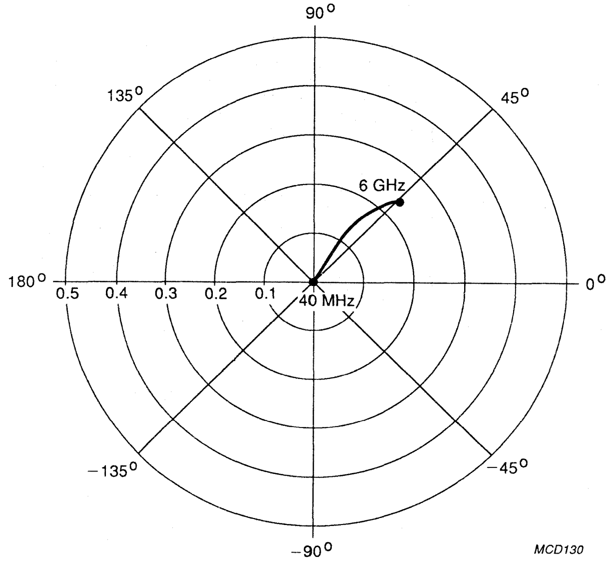
V_{CE} = 5 V; I_C = 15 mA.

Fig.15 Common emitter input reflection coefficient (S_{11}).



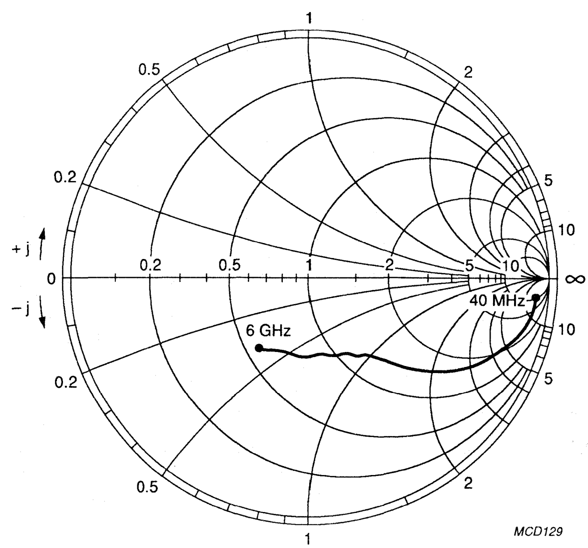
V_{CE} = 5 V; I_C = 15 mA.

Fig.16 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 5 V; I_C = 15 mA.

Fig.17 Common emitter reverse transmission coefficient (S_{12}).



V_{CE} = 5 V; I_C = 15 mA.

Fig.18 Common emitter output reflection coefficient (S_{22}).

NPN 12 GHz wideband transistor BFG33; BFG33/X

Table 1 Common emitter scattering parameters, V_{CE} = 2.5 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.957	−2.4	3.176	176.6	0.006	87.1	0.994	−2.1	40.0
100	0.956	−5.9	3.049	171.6	0.014	84.1	0.990	−5.3	37.5
200	0.939	−11.6	3.027	163.0	0.028	78.9	0.974	−10.4	31.8
300	0.917	−17.2	2.985	155.3	0.041	74.3	0.950	−15.1	27.6
400	0.890	−23.0	2.988	149.2	0.053	70.1	0.928	−19.3	24.9
500	0.863	−28.2	2.878	143.6	0.064	66.1	0.905	−23.5	22.5
600	0.831	−33.6	2.855	138.4	0.073	63.0	0.875	−27.1	20.5
700	0.799	−38.6	2.795	133.7	0.081	60.3	0.848	−30.0	18.9
800	0.759	−44.1	2.814	128.9	0.088	58.0	0.820	−32.5	17.6
900	0.717	−48.4	2.716	123.2	0.095	56.0	0.800	−34.5	16.2
1000	0.686	−53.6	2.638	120.6	0.100	53.7	0.777	−37.1	15.2
1200	0.613	−63.6	2.510	113.4	0.110	50.3	0.734	−41.4	13.4
1400	0.534	−74.3	2.506	105.0	0.120	48.5	0.697	−44.4	12.3
1600	0.479	−83.0	2.382	98.4	0.127	46.8	0.676	−47.3	11.3
1800	0.429	−90.6	2.248	94.3	0.133	46.2	0.653	−50.0	10.3
2000	0.364	−98.1	2.127	88.8	0.138	45.1	0.630	−51.9	9.4
2200	0.309	−107.6	2.017	83.9	0.144	43.8	0.605	−54.4	8.5
2400	0.273	−119.4	1.920	78.0	0.149	42.5	0.581	−57.9	7.8
2600	0.253	−129.9	1.820	74.3	0.155	41.8	0.572	−62.3	7.2
2800	0.228	−137.4	1.789	69.7	0.163	40.8	0.578	−65.6	7.0
3000	0.202	−146.9	1.698	65.8	0.167	40.7	0.573	−67.5	6.5
3250	0.183	−163.1	1.609	61.8	0.173	40.6	0.555	−69.9	5.9
3500	0.186	−176.7	1.514	57.8	0.178	39.7	0.532	−74.3	5.2
3750	0.183	174.3	1.479	53.5	0.184	38.6	0.527	−79.8	5.0
4000	0.177	162.9	1.374	49.9	0.192	38.3	0.534	−83.5	4.4
4250	0.184	148.4	1.338	47.3	0.197	37.3	0.539	−86.7	4.2
4500	0.208	140.9	1.263	42.6	0.202	36.7	0.526	−90.0	3.6
4750	0.213	137.2	1.226	39.7	0.206	35.7	0.521	−95.3	3.3
5000	0.206	129.2	1.188	36.9	0.212	34.0	0.532	−100.8	3.1
5250	0.219	118.0	1.155	33.9	0.214	33.5	0.547	−105.1	3.0
5500	0.250	112.5	1.067	31.2	0.222	32.9	0.547	−108.4	2.4
5750	0.261	110.6	1.056	28.3	0.222	33.0	0.545	−112.6	2.3
6000	0.254	105.9	1.016	24.2	0.229	31.4	0.555	−118.0	2.0

Table 2 Common emitter scattering parameters, V_{CE} = 2.5 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.893	−3.6	7.425	174.8	0.005	86.4	0.983	−3.4	39.2
100	0.888	−8.8	7.078	167.7	0.013	81.6	0.972	−8.6	36.3
200	0.850	−17.2	6.935	156.8	0.025	74.6	0.927	−16.6	30.9
300	0.802	−25.4	6.711	147.7	0.036	69.2	0.870	−22.9	27.2
400	0.748	−33.8	6.544	140.1	0.045	64.8	0.818	−28.1	24.7
500	0.698	−41.2	6.205	133.7	0.052	61.3	0.768	−32.8	22.6
600	0.638	−49.3	6.078	127.8	0.058	59.2	0.719	−36.2	21.1
700	0.579	−56.8	5.897	122.1	0.064	57.7	0.681	−38.7	19.9
800	0.517	−64.3	5.712	116.6	0.068	56.7	0.647	−40.6	18.8
900	0.466	−70.1	5.375	111.8	0.073	55.8	0.621	−42.0	17.8
1000	0.422	−76.8	5.097	107.9	0.077	55.1	0.597	−43.7	16.9
1200	0.340	−90.0	4.614	100.5	0.085	54.2	0.555	−46.5	15.4
1400	0.280	−104.0	4.256	93.9	0.093	53.9	0.526	−48.9	14.3
1600	0.249	−113.5	3.830	88.7	0.101	53.8	0.510	−51.2	13.2
1800	0.215	−122.3	3.488	85.0	0.108	54.0	0.496	−53.0	12.3
2000	0.178	−132.9	3.178	80.8	0.115	53.7	0.480	−54.2	11.3
2200	0.155	−149.7	2.940	77.2	0.122	53.0	0.459	−56.3	10.5
2400	0.157	−165.2	2.726	72.9	0.129	52.3	0.439	−59.8	9.8
2600	0.164	−175.2	2.532	70.0	0.137	51.9	0.433	−64.3	9.1
2800	0.159	177.4	2.416	66.7	0.144	51.0	0.439	−67.7	8.7
3000	0.155	166.7	2.261	63.5	0.151	50.7	0.441	−69.6	8.1
3250	0.167	152.1	2.113	60.2	0.159	50.4	0.428	−71.7	7.5
3500	0.187	144.5	1.973	56.8	0.166	49.4	0.409	−76.2	6.9
3750	0.192	138.9	1.895	53.2	0.174	48.4	0.405	−82.3	6.5
4000	0.196	129.6	1.762	50.0	0.183	47.7	0.415	−86.6	5.9
4250	0.219	120.4	1.700	47.7	0.189	46.6	0.420	−89.4	5.7
4500	0.244	117.6	1.602	43.7	0.196	45.8	0.409	−92.9	5.2
4750	0.247	115.6	1.544	41.2	0.202	45.0	0.403	−98.6	4.8
5000	0.242	108.7	1.486	38.5	0.209	43.2	0.414	−104.5	4.5
5250	0.262	100.3	1.440	35.6	0.213	42.6	0.430	−108.7	4.4
5500	0.293	97.4	1.340	33.3	0.222	41.1	0.434	−111.9	3.8
5750	0.301	96.7	1.310	30.6	0.224	41.4	0.434	−116.3	3.7
6000	0.292	92.7	1.255	26.9	0.232	39.4	0.446	−121.8	3.3

Table 3 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.908	−3.3	7.375	174.9	0.005	84.9	0.982	−3.3	39.3
100	0.901	−8.2	7.042	168.1	0.013	82.0	0.970	−8.2	36.5
200	0.867	−16.1	6.911	157.5	0.025	75.3	0.929	−15.8	31.5
300	0.822	−23.8	6.706	148.6	0.035	70.2	0.876	−22.0	27.7
400	0.770	−31.6	6.547	141.1	0.044	66.1	0.827	−27.1	25.2
500	0.721	−38.5	6.219	134.8	0.052	62.6	0.780	−31.7	23.1
600	0.663	−45.8	6.093	128.9	0.058	60.6	0.732	−35.2	21.5
700	0.605	−52.6	5.906	123.3	0.063	59.1	0.694	−37.7	20.3
800	0.544	−59.2	5.735	117.8	0.068	58.0	0.661	−39.6	19.2
900	0.493	−64.3	5.405	113.0	0.073	57.1	0.636	−41.1	18.1
1000	0.448	−70.1	5.129	109.3	0.077	56.3	0.611	−42.8	17.2
1200	0.363	−81.3	4.658	101.9	0.085	55.3	0.570	−45.8	15.7
1400	0.298	−93.1	4.314	95.3	0.094	54.8	0.540	−48.1	14.6
1600	0.262	−101.2	3.894	90.1	0.102	54.5	0.523	−50.5	13.5
1800	0.225	−108.2	3.551	86.5	0.109	54.6	0.509	−52.3	12.5
2000	0.183	−115.7	3.239	82.4	0.117	54.1	0.492	−53.7	11.6
2200	0.149	−129.9	3.000	78.7	0.124	53.3	0.470	−55.7	10.7
2400	0.141	−146.4	2.787	74.3	0.131	52.4	0.450	−59.2	10.0
2600	0.143	−158.0	2.592	71.5	0.139	51.9	0.443	−63.7	9.3
2800	0.135	−165.6	2.478	68.2	0.147	50.9	0.449	−67.1	8.9
3000	0.126	−177.1	2.320	65.1	0.153	50.5	0.450	−69.0	8.4
3250	0.131	164.3	2.170	61.8	0.161	50.0	0.436	−71.0	7.7
3500	0.151	154.2	2.028	58.4	0.168	48.9	0.416	−75.5	7.1
3750	0.156	147.9	1.953	54.8	0.176	47.7	0.412	−81.4	6.7
4000	0.158	136.8	1.818	51.6	0.185	47.0	0.420	−85.7	6.1
4250	0.178	125.7	1.753	49.3	0.191	45.9	0.425	−88.5	5.9
4500	0.205	122.2	1.654	45.3	0.198	45.0	0.414	−91.8	5.4
4750	0.209	120.5	1.596	42.7	0.204	44.1	0.407	−97.4	5.0
5000	0.205	113.1	1.539	40.1	0.210	42.3	0.417	−103.4	4.8
5250	0.224	103.6	1.490	37.2	0.214	41.6	0.433	−107.6	4.6
5500	0.256	100.3	1.387	34.8	0.223	40.3	0.436	−110.7	4.0
5750	0.266	100.0	1.359	32.1	0.224	40.3	0.435	−115.0	3.9
6000	0.258	96.0	1.304	28.5	0.232	38.4	0.446	−120.6	3.6

Table 4 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	2.3	0.644	5.3	1.170
1000	2.5	0.560	13.3	1.350
2000	3.0	0.519	39.1	0.994

Table 5 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.828	−4.8	13.346	173.1	0.005	83.9	0.964	−4.6	39.0
100	0.813	−11.9	12.673	164.5	0.012	79.3	0.941	−11.5	36.1
200	0.752	−23.5	12.218	151.5	0.022	72.0	0.867	−21.3	31.4
300	0.677	−34.7	11.599	141.1	0.031	67.2	0.784	−28.4	28.1
400	0.596	−45.6	10.955	132.1	0.037	63.8	0.714	−33.6	25.8
500	0.524	−55.2	10.150	124.8	0.043	61.8	0.654	−37.7	23.9
600	0.449	−65.1	9.558	118.1	0.048	61.1	0.605	−40.4	22.6
700	0.387	−73.0	8.832	112.4	0.053	60.5	0.568	−42.2	21.3
800	0.338	−79.6	8.108	107.6	0.057	60.4	0.539	−43.5	20.2
900	0.297	−85.3	7.408	103.7	0.062	60.3	0.516	−44.5	19.1
1000	0.264	−91.3	6.812	100.3	0.066	60.3	0.496	−45.5	18.2
1200	0.211	−104.4	5.875	94.6	0.074	60.2	0.463	−47.5	16.6
1400	0.184	−118.2	5.207	89.7	0.083	60.0	0.441	−49.7	15.4
1600	0.168	−127.5	4.620	85.5	0.092	59.9	0.430	−52.0	14.3
1800	0.146	−135.9	4.151	82.4	0.100	59.9	0.422	−53.4	13.3
2000	0.121	−149.0	3.756	78.9	0.108	59.4	0.410	−54.5	12.4
2200	0.115	−169.8	3.454	75.8	0.116	58.7	0.391	−56.4	11.5
2400	0.130	175.8	3.192	72.2	0.123	57.8	0.373	−60.1	10.8
2600	0.143	168.9	2.955	69.7	0.131	57.1	0.368	−64.9	10.1
2800	0.143	162.9	2.801	66.9	0.139	56.1	0.374	−68.7	9.7
3000	0.144	153.0	2.617	64.0	0.146	55.5	0.378	−70.6	9.1
3250	0.162	140.6	2.439	61.0	0.155	54.8	0.367	−72.5	8.5
3500	0.185	135.3	2.277	58.0	0.163	53.7	0.348	−77.1	7.9
3750	0.191	131.0	2.176	54.6	0.170	52.6	0.345	−83.8	7.5
4000	0.197	122.2	2.028	51.6	0.179	51.7	0.356	−88.5	6.9
4250	0.222	114.3	1.951	49.4	0.186	50.5	0.361	−91.1	6.6
4500	0.248	112.5	1.839	45.8	0.193	49.7	0.350	−94.6	6.1
4750	0.250	111.0	1.767	43.3	0.200	48.9	0.344	−100.8	5.8
5000	0.246	104.2	1.700	40.8	0.206	47.1	0.355	−107.1	5.5

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
5250	0.267	96.2	1.644	38.0	0.211	46.5	0.371	−111.2	5.3
5500	0.299	93.8	1.537	35.8	0.221	44.8	0.376	−114.3	4.8
5750	0.306	93.5	1.498	33.3	0.223	45.0	0.376	−118.7	4.6
6000	0.296	89.6	1.434	29.8	0.232	42.9	0.389	−124.4	4.2

Table 6 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	3.1	0.528	5.3	1.18
1000	3.1	0.477	12.7	1.33
2000	3.6	0.418	39.1	0.98

Table 7 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 15 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.760	−6.2	18.053	171.9	0.005	81.2	0.948	−5.3	38.9
100	0.740	−15.2	17.102	162.0	0.011	77.5	0.916	−13.4	36.0
200	0.657	−30.0	16.185	147.4	0.021	70.4	0.821	−24.2	31.5
300	0.563	−44.3	14.989	135.7	0.028	66.2	0.724	−31.4	28.4
400	0.472	−57.3	13.618	126.0	0.034	63.7	0.647	−36.3	26.1
500	0.400	−68.0	12.164	118.5	0.039	62.6	0.587	−39.7	24.3
600	0.340	−77.8	10.943	112.4	0.044	62.4	0.541	−41.8	22.8
700	0.294	−85.4	9.810	107.5	0.048	62.4	0.509	−43.3	21.5
800	0.258	−91.9	8.829	103.4	0.053	62.6	0.483	−44.3	20.4
900	0.228	−98.1	7.983	100.0	0.057	62.8	0.464	−44.9	19.3
1000	0.203	−104.8	7.279	97.1	0.062	62.9	0.447	−45.7	18.4
1200	0.170	−120.1	6.203	92.0	0.070	63.0	0.419	−47.4	16.8
1400	0.157	−134.6	5.444	87.6	0.079	62.7	0.401	−49.7	15.6
1600	0.149	−144.1	4.812	83.8	0.088	62.5	0.394	−51.9	14.5
1800	0.133	−153.6	4.313	80.8	0.097	62.3	0.389	−53.4	13.5
2000	0.119	−168.7	3.900	77.6	0.105	61.8	0.378	−54.4	12.6
2200	0.125	172.8	3.580	74.7	0.112	61.0	0.360	−56.3	11.8
2400	0.146	162.2	3.305	71.3	0.120	60.1	0.344	−60.2	11.0
2600	0.161	157.6	3.056	68.9	0.128	59.3	0.339	−65.2	10.3
2800	0.163	152.5	2.894	66.2	0.136	58.2	0.346	−69.2	9.9
3000	0.166	144.3	2.703	63.5	0.143	57.7	0.350	−71.1	9.3
3250	0.187	134.2	2.517	60.5	0.152	56.9	0.340	−72.9	8.7

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
3500	0.210	130.0	2.348	57.6	0.160	55.8	0.322	−77.7	8.1
3750	0.215	126.2	2.239	54.3	0.168	54.8	0.320	−84.7	7.7
4000	0.222	118.1	2.086	51.4	0.176	53.8	0.332	−89.6	7.1
4250	0.248	111.1	2.006	49.1	0.184	52.6	0.337	−92.2	6.8
4500	0.273	109.5	1.889	45.7	0.191	51.8	0.327	−95.8	6.4
4750	0.274	107.9	1.813	43.3	0.198	51.0	0.321	−102.3	6.0
5000	0.270	101.3	1.742	40.7	0.204	49.2	0.333	−108.7	5.7
5250	0.292	93.7	1.684	37.9	0.210	48.7	0.350	−112.8	5.5
5500	0.323	91.4	1.576	35.9	0.220	46.8	0.356	−115.9	5.0
5750	0.329	91.2	1.533	33.4	0.222	47.2	0.356	−120.4	4.8
6000	0.318	87.2	1.466	30.0	0.231	45.0	0.369	−126.1	4.4

Table 8 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	3.6	0.463	5.5	1.180
1000	3.6	0.420	13.2	1.34
2000	4.0	0.350	39.2	0.984

NPN 4 GHz wideband transistor — BFG34

DESCRIPTION

NPN transistor in a four-lead dual-emitter plastic SOT103 envelope.

It is designed for wideband application in CATV and MATV amplifier systems and features high output voltage capabilities.

A TO-39 version (ON4497) is available on request.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

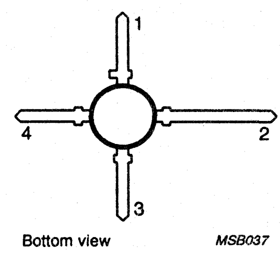


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	18	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 120 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	–	4	–	GHz
F	noise figure	I_C = 20 mA; V_{CE} = 10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	22	–	dBm
ITO	third order intercept point	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	41	–	dBm

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 120 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 120 °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

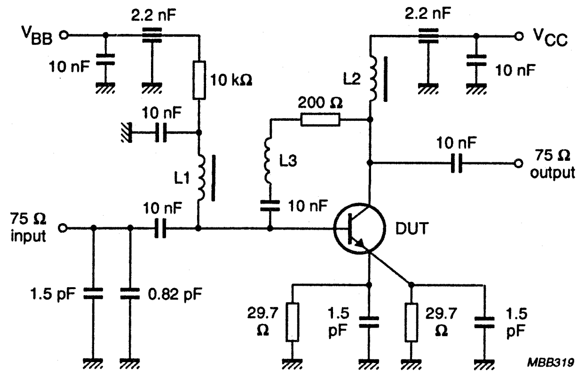
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 15 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	70	–	
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 10 V; f = 1 MHz	–	2.1	–	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = 0.5 V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	I_E = 0; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	14.5	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C	–	7	–	dB
F	noise figure	I_C = 20 mA; V_{CE} = 10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	22	–	dBm
		I_C = 100 mA; V_{CE} = 10 V; f = 300 MHz; T_{amb} = 25 °C	–	24	–	dBm
ITO	third order intercept point	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	41	–	dBm
		I_C = 100 mA; V_{CE} = 10 V; f = 300 MHz; T_{amb} = 25 °C	–	43	–	dBm
V_O	output voltage	note 2	–	750	–	mV
d_2	second order intermodulation distortion (Fig.2)	note 3	–	–55	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im}; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   $V_p = V_O$ = 316 mV at f_p = 250 MHz;
   $V_q = V_O$ = 315 mV at f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.



L1 = L2 = 5 μH Ferroxcube choke.

L3 = 2 turns 0.5 mm copper wire, internal diameter 4 mm, winding pitch 2 mm.

Fig.2 Intermodulation distortion and second harmonic distortion test circuit.

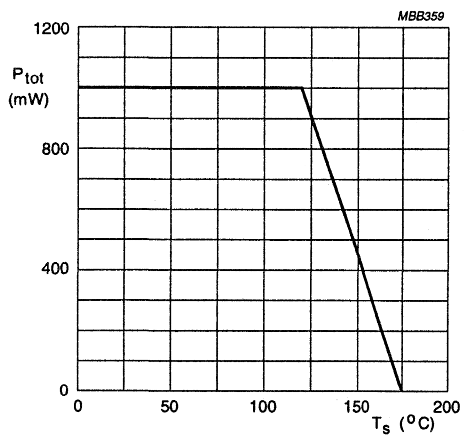
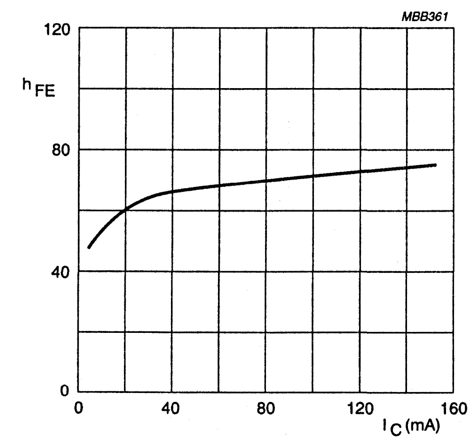
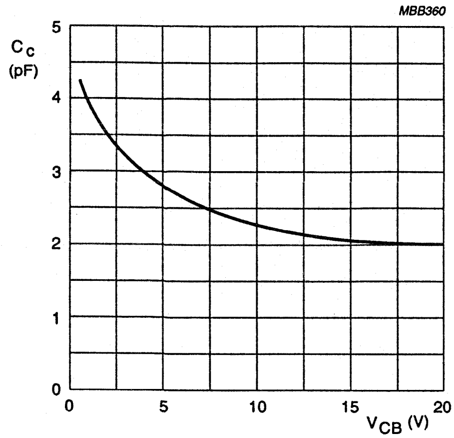


Fig.3 Power derating curve.



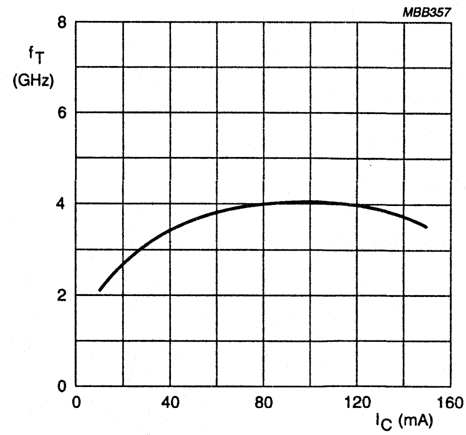
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



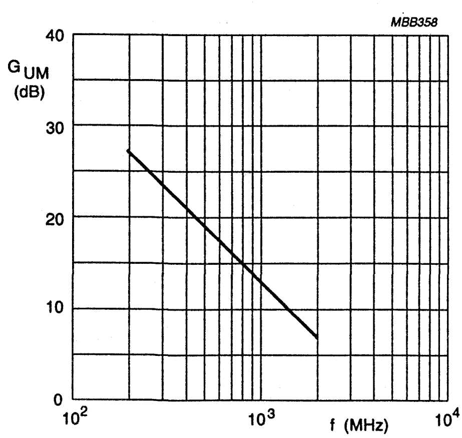
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



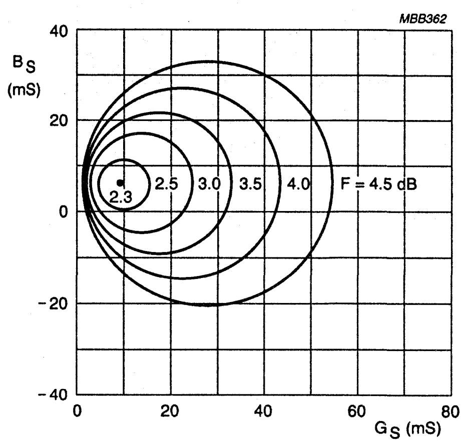
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



V_{CE} = 10 V; I_C = 20 mA; f = 800 MHz; T_{amb} = 25 °C.

Fig.8 Noise circle figure.

Table 1 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.649	−58.6	26.551	150.9	0.0240	65.7	0.876	−28.6	37.2
100	0.703	−110.	18.267	125.8	0.0400	45.4	0.624	−55.5	30.3
200	0.734	−144.	10.958	105.7	0.0490	33.0	0.404	−77.6	24.9
300	0.740	−160.	7.558	95.8	0.0530	30.5	0.315	−89.9	21.5
400	0.751	−168.	5.756	88.8	0.0550	32.7	0.279	−98.2	19.2
500	0.757	−174.	4.683	83.6	0.0590	34.6	0.263	−105.	17.4
600	0.749	−179.	3.927	79.7	0.0610	37.5	0.259	−110.	15.8
700	0.755	175.9	3.400	75.2	0.0640	39.6	0.259	−114.	14.6
800	0.754	171.5	2.967	71.4	0.0670	43.4	0.261	−117.	13.4
900	0.764	168.8	2.655	68.1	0.0710	45.8	0.265	−121.	12.6
1000	0.763	163.8	2.365	64.5	0.0750	48.6	0.270	−124.	11.6
1200	0.775	159.2	2.033	58.6	0.0850	51.4	0.287	−132.	10.5
1400	0.779	152.8	1.730	51.8	0.0930	54.9	0.314	−139.	9.27
1600	0.790	147.8	1.497	45.5	0.105	59.0	0.346	−144.	8.31
1800	0.787	142.6	1.358	40.2	0.119	59.2	0.375	−149.	7.51
2000	0.817	137.2	1.232	35.9	0.132	60.7	0.396	−155.	7.33
2200	0.853	129.9	1.152	30.1	0.145	61.2	0.420	−161.	7.72
2400	0.856	126.6	1.019	26.8	0.157	62.9	0.454	−168.	6.90
2600	0.859	123.7	0.907	24.3	0.175	61.8	0.495	−174.	6.19
2800	0.827	118.5	0.827	17.2	0.182	59.4	0.529	−179.	4.78
3000	0.834	112.8	0.753	13.4	0.196	60.0	0.552	176.9	4.28

Table 2 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.635	−67.7	34.292	147.5	0.0220	63.7	0.839	−37.1	38.2
100	0.693	−119.	22.176	121.9	0.0360	43.4	0.571	−71.6	31.5
200	0.726	−149.	12.797	103.3	0.0440	34.6	0.376	−101.	26.1
300	0.735	−164.	8.723	94.6	0.0470	34.8	0.308	−118.	22.6
400	0.737	−172.	6.639	88.4	0.0520	37.4	0.281	−129.	20.2
500	0.758	−177.	5.372	83.6	0.0540	41.3	0.272	−136.	18.6
600	0.741	178.5	4.508	80.2	0.0590	43.3	0.267	−141.	16.9
700	0.756	173.5	3.892	76.1	0.0640	45.4	0.266	−144.	15.8
800	0.751	170.0	3.402	72.9	0.0680	49.4	0.265	−147.	14.6
900	0.751	167.0	3.028	70.0	0.0740	50.4	0.265	−150.	13.5
1000	0.750	163.7	2.728	66.7	0.0810	52.4	0.268	−153.	12.6
1200	0.775	156.9	2.330	61.4	0.0900	55.4	0.280	−158.	11.7
1400	0.765	152.1	1.978	55.0	0.100	57.0	0.301	−163.	10.2
1600	0.785	146.8	1.731	49.1	0.113	59.4	0.321	−165.	9.40
1800	0.789	142.3	1.564	44.3	0.127	58.7	0.340	−168.	8.65
2000	0.794	136.6	1.432	39.9	0.140	59.0	0.355	−172.	8.03
2200	0.831	129.5	1.339	34.5	0.154	58.5	0.374	−177.	8.28
2400	0.842	126.5	1.211	32.0	0.163	59.9	0.404	177.8	7.80
2600	0.846	123.4	1.080	28.3	0.180	59.2	0.440	174.3	7.07
2800	0.822	118.0	0.990	22.0	0.185	56.2	0.470	171.5	5.89
3000	0.830	113.7	0.913	18.5	0.196	56.9	0.485	168.1	5.45

Table 3 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.651	−70.3	37.094	146.2	0.0218	58.4	0.819	−41.6	38.6
100	0.698	−122.	23.369	119.6	0.0354	40.5	0.551	−79.2	31.9
200	0.726	−152.	13.177	102.4	0.0423	35.1	0.373	−111.	26.3
300	0.740	−165.	9.042	93.8	0.0465	34.9	0.317	−129.	23.0
400	0.744	−173.	6.854	88.1	0.0497	38.9	0.297	−140.	20.6
500	0.748	−179.	5.526	83.5	0.0539	41.5	0.290	−146.	18.8
600	0.749	176.9	4.638	79.5	0.0587	44.6	0.285	−151.	17.3
700	0.750	173.2	3.990	76.0	0.0638	47.1	0.283	−154.	16.0
800	0.748	169.5	3.517	72.7	0.0690	49.0	0.282	−157.	14.8
900	0.751	166.0	3.136	69.5	0.0748	51.8	0.281	−160.	13.9
1000	0.753	162.8	2.836	66.8	0.0800	53.0	0.282	−162.	13.1
1200	0.764	156.6	2.377	61.4	0.0924	55.4	0.292	−167.	11.7
1400	0.776	151.0	2.031	55.7	0.101	56.0	0.309	−171.	10.6
1600	0.778	146.3	1.784	50.8	0.114	58.7	0.324	−173.	9.55
1800	0.776	140.9	1.607	45.0	0.129	57.0	0.338	−175.	8.66
2000	0.791	135.2	1.465	40.6	0.141	58.0	0.351	−179.	8.16
2200	0.818	129.9	1.353	36.1	0.153	56.8	0.369	176.6	8.06
2400	0.844	126.3	1.208	33.2	0.161	58.1	0.396	172.1	7.79
2600	0.848	122.5	1.137	29.6	0.179	56.9	0.427	168.9	7.52
2800	0.839	118.2	1.026	23.3	0.185	54.6	0.452	166.5	6.50
3000	0.842	112.6	0.949	20.3	0.192	55.3	0.467	163.0	5.97

NPN 4 GHz wideband transistor — BFG35

DESCRIPTION

NPN planar epitaxial transistor mounted in a plastic SOT223 envelope, intended for wideband amplifier applications. It features high output voltage capabilities.

PNP complement is the BFG55.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

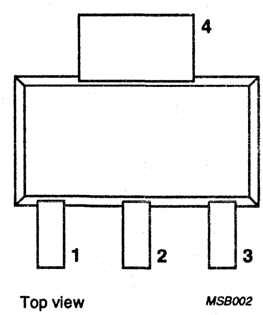


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	18	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	I_C = 100 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	–	750	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	1	μA
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V	25	70	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	15	–	dB
		$I_C = 100$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	11	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	800	–	mV
d_2	second order intermodulation distortion	note 4	–	–55	–	dB
		note 5	–	–57	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B); $I_C = 100$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B); $I_C = 100$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 445.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 453.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 455.25$ MHz;
   measured at $f_{(p+q-r)} = 443.25$ MHz.
4. $I_C = 60$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_q = V_O = 50$ dBmV; $f_{(p+q)} = 450$ MHz.
5. $I_C = 60$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_q = V_O = 50$ dBmV; $f_{(p+q)} = 810$ MHz.

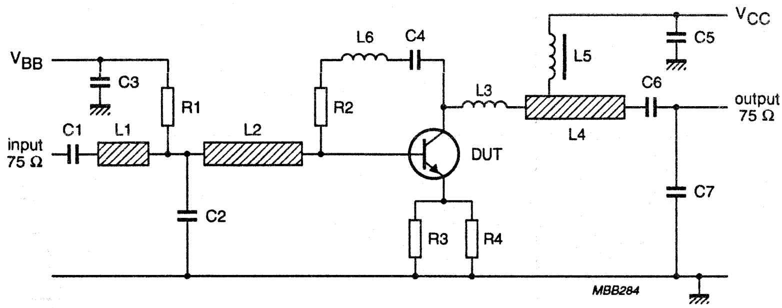


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C5, C6	multilayer ceramic capacitor	10 nF		2222 590 08627
C2, C7	multilayer ceramic capacitor	1 pF		2222 851 12108
C4 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1	microstripline	75 Ω	length 7 mm; width 2.5 mm	
L2	microstripline	75 Ω	length 22mm; width 2.5 mm	
L3 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L5	Ferroxcube choke	5 μH		3122 108 20153
L6 (note 1)	0.4 mm copper wire	≈25 nH	length 30 mm	
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	200 Ω		2322 180 73201
R3, R4	metal film resistor	27 Ω		2322 180 73279

Notes

The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 1⁄32 inch.

1. Components C4, L3, L6 and R2 are mounted on the underside of the PCB.

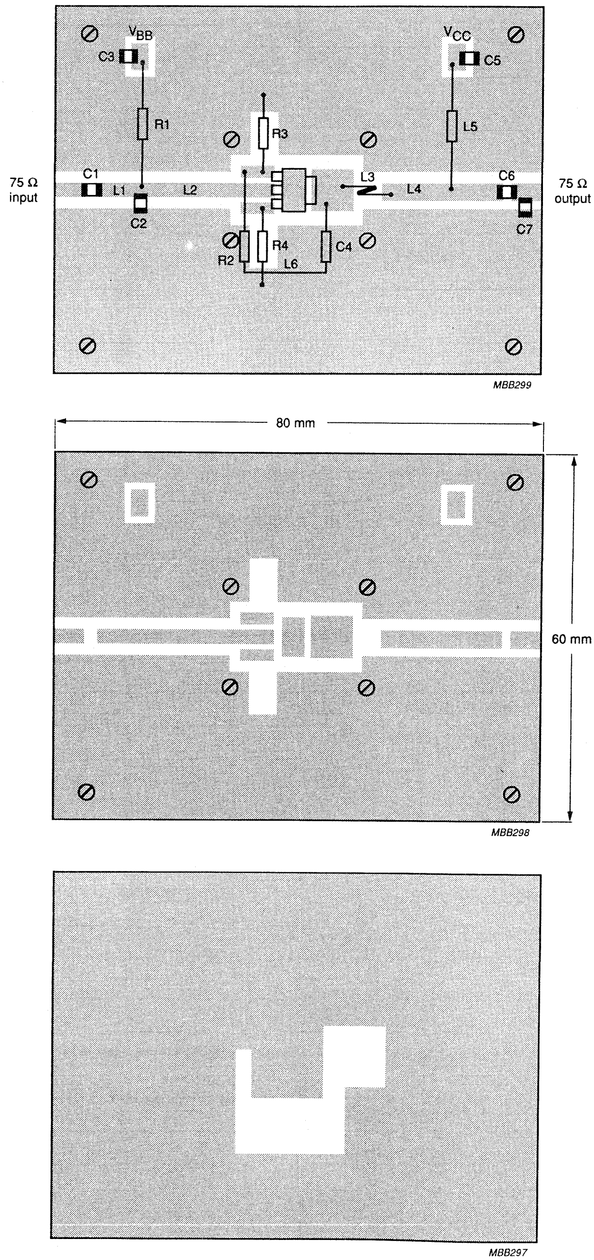


Fig.3 Intermodulation test circuit printed circuit board.

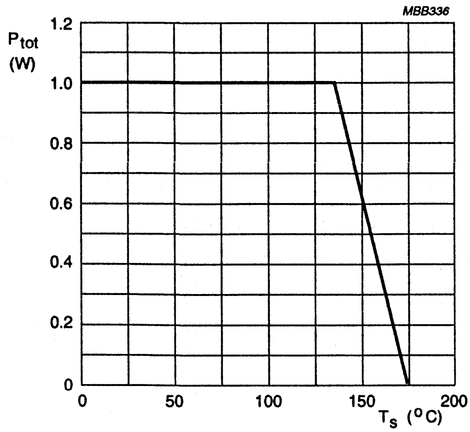
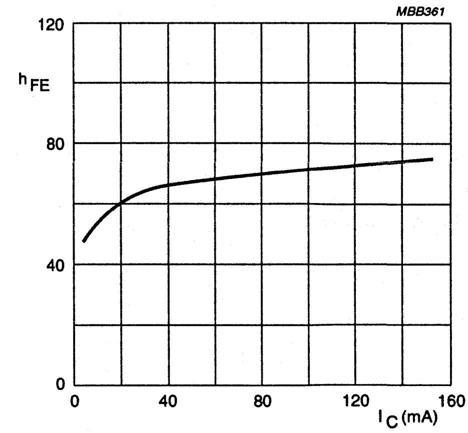
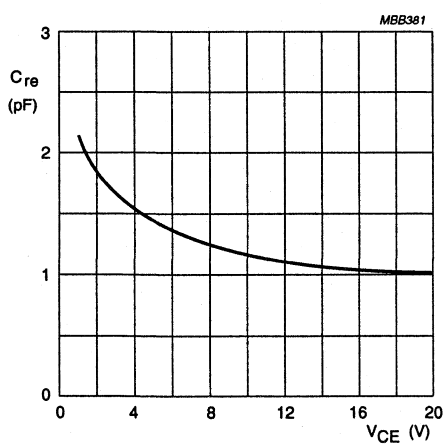


Fig.4 Power derating curve.



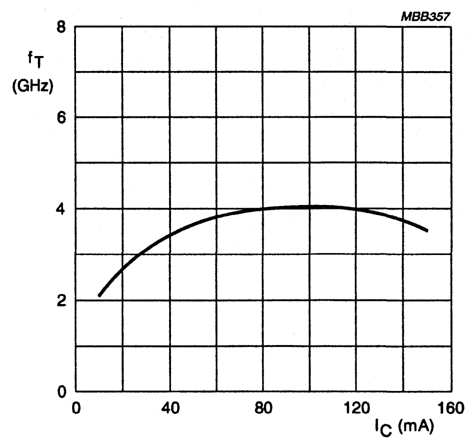
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



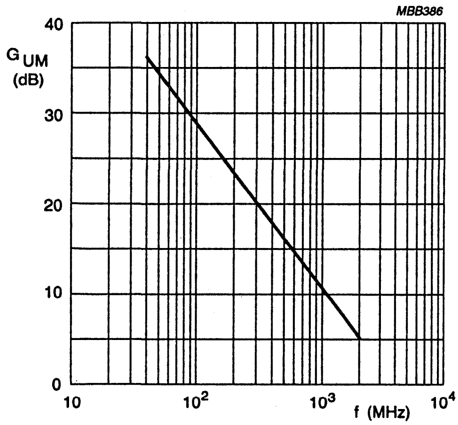
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



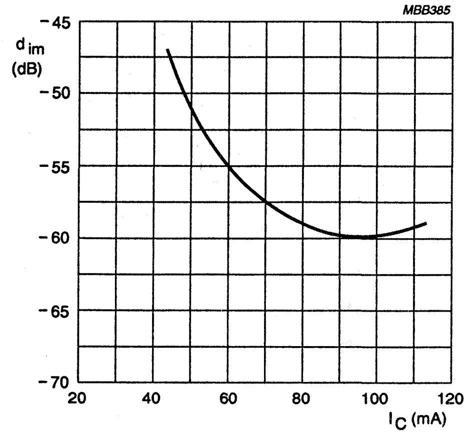
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C

Fig.7 Transition frequency as a function of collector current.



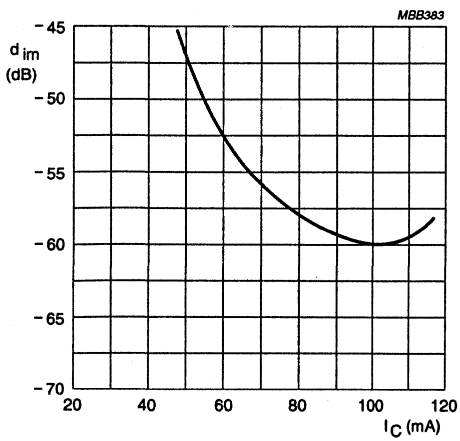
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



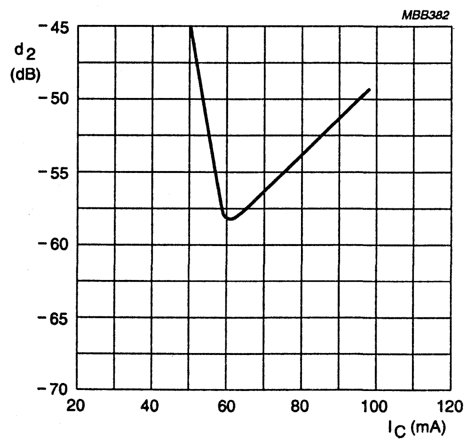
V_{CE} = 10 V; V_O = 800 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion as a function of collector current.



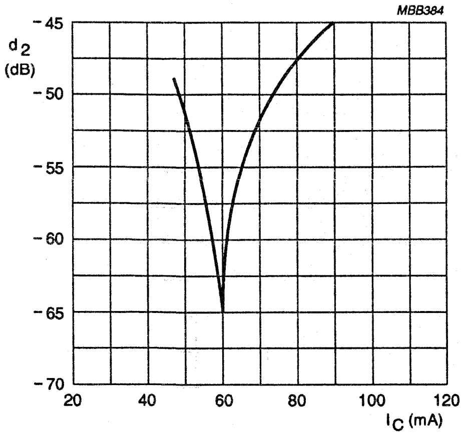
V_{CE} = 10 V; V_O = 750 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.10 Intermodulation distortion as a function of collector current.



V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.11 Second order intermodulation distortion as a function of collector current.



V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz;
T_{amb} = 25 °C.

Fig.12 Second order intermodulation distortion as a function of collector current.

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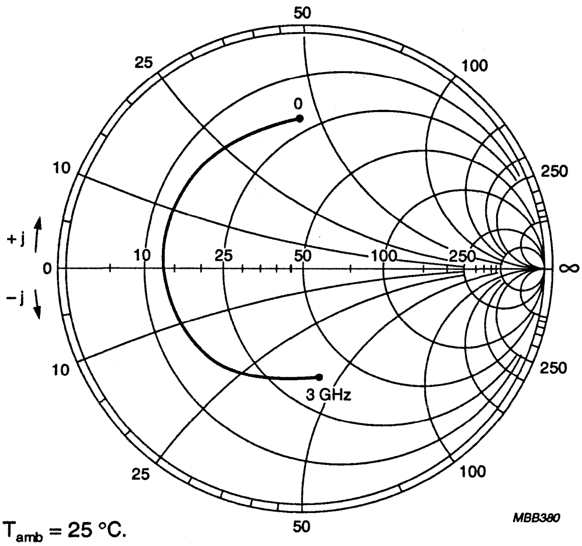
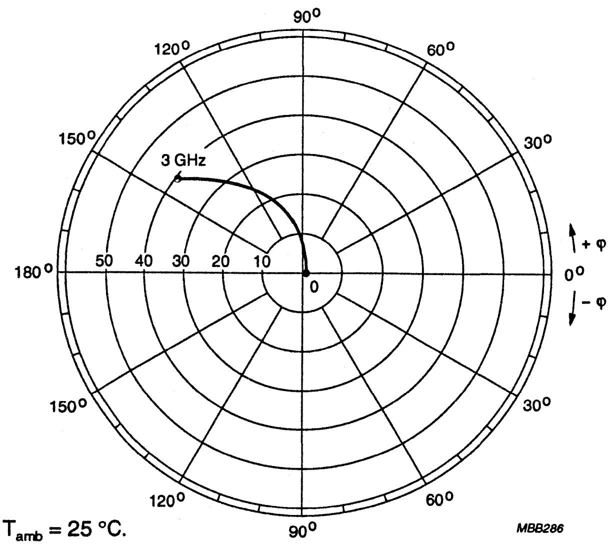


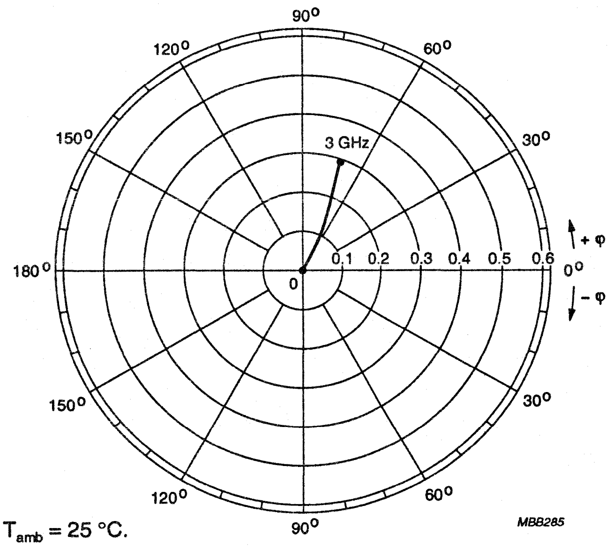
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter input reflection coefficient (S_{11}).



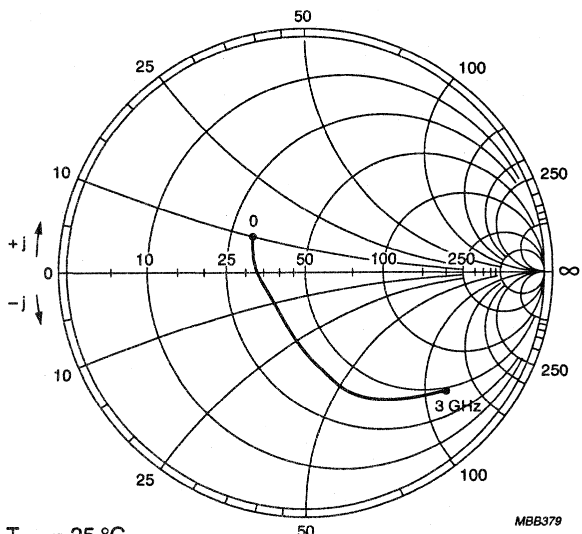
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter forward transmission coefficient (S_{21}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.15 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.16 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.537	−61.9	23.791	150.4	0.0230	69.3	0.874	−26.6	35.3
100	0.585	−115.	16.161	122.5	0.0380	51.2	0.610	−50.0	28.0
200	0.626	−148.	9.600	102.5	0.0490	44.5	0.384	−64.9	22.5
300	0.625	−163.	6.598	92.0	0.0560	47.1	0.292	−71.5	18.9
400	0.641	−172.	5.032	85.1	0.0640	50.2	0.249	−76.9	16.6
500	0.645	−180.	4.092	79.0	0.0730	55.2	0.228	−82.8	14.8
600	0.642	175.2	3.457	73.1	0.0810	58.3	0.217	−88.4	13.3
700	0.646	170.6	3.017	68.3	0.0910	60.5	0.213	−94.6	12.1
800	0.650	165.3	2.634	63.5	0.102	62.6	0.210	−101.	11.0
900	0.658	161.3	2.391	60.4	0.113	63.7	0.209	−108.	10.2
1000	0.668	157.4	2.156	55.5	0.126	65.7	0.214	−115.	9.44
1200	0.680	149.5	1.824	48.0	0.153	66.2	0.230	−131.	8.15
1400	0.713	143.7	1.567	40.0	0.178	66.0	0.263	−146.	7.30
1600	0.720	137.0	1.359	33.6	0.208	65.4	0.300	−159.	6.25
1800	0.746	130.9	1.253	27.2	0.245	61.4	0.333	−171.	6.00
2000	0.755	122.8	1.124	21.9	0.275	59.1	0.372	176.1	5.33
2200	0.782	116.9	1.028	14.4	0.301	55.9	0.424	164.1	5.21
2400	0.798	112.3	0.883	12.9	0.323	53.7	0.473	154.2	4.42
2600	0.811	107.8	0.838	8.30	0.360	48.6	0.508	143.9	4.42
2800	0.783	98.9	0.755	1.60	0.375	42.2	0.532	133.1	3.13
3000	0.804	91.4	0.727	−0.200	0.396	39.6	0.568	122.5	3.44

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Table 2 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.494	−70.4	30.261	147.2	0.0210	68.5	0.836	−34.0	36.0
100	0.548	−123.	19.381	119.3	0.0350	50.9	0.549	−63.3	28.9
200	0.598	−153.	11.140	101.0	0.0470	49.9	0.328	−86.1	23.4
300	0.597	−167.	7.647	91.4	0.0570	53.7	0.241	−99.1	19.8
400	0.605	−174.	5.805	85.2	0.0670	55.3	0.201	−110.	17.4
500	0.617	178.9	4.716	79.7	0.0780	59.8	0.181	−119.	15.7
600	0.610	174.6	3.971	74.3	0.0880	61.0	0.171	−127.	14.1
700	0.606	169.6	3.471	69.9	0.101	62.5	0.167	−134.	12.9
800	0.625	164.6	3.024	65.6	0.114	62.7	0.166	−140.	11.9
900	0.624	160.3	2.742	62.6	0.126	63.1	0.167	−147.	11.0
1000	0.630	157.0	2.483	58.1	0.139	63.9	0.173	−154.	10.2
1200	0.648	149.5	2.116	51.3	0.165	62.8	0.193	−167.	9.04
1400	0.685	142.6	1.784	43.9	0.190	61.9	0.223	−176.	8.00
1600	0.686	137.4	1.587	37.9	0.216	60.4	0.256	175.9	7.07
1800	0.709	131.3	1.461	31.6	0.247	56.7	0.284	167.0	6.69
2000	0.722	124.1	1.312	26.4	0.275	54.8	0.318	157.5	6.02
2200	0.749	118.0	1.213	18.7	0.296	51.7	0.366	149.3	5.88
2400	0.767	112.1	1.062	16.7	0.314	50.5	0.410	142.2	5.18
2600	0.779	108.9	1.012	11.8	0.347	45.8	0.440	134.2	5.09
2800	0.780	101.6	0.918	4.40	0.360	40.0	0.464	125.3	4.38
3000	0.774	93.0	0.874	1.10	0.379	38.0	0.502	116.4	4.06

Table 3 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.496	−72.9	31.926	145.8	0.021	64.6	0.823	−36.4	36.2
100	0.556	−124.3	20.080	118.8	0.035	50.7	0.530	−67.6	29.1
200	0.590	−154.4	11.397	100.7	0.046	50.0	0.317	−92.9	23.5
300	0.601	−167.3	7.828	91.4	0.056	53.8	0.237	−109.0	20.1
400	0.609	−175.4	5.952	85.0	0.067	57.1	0.201	−121.4	17.7
500	0.612	178.7	4.814	79.6	0.078	59.5	0.185	−131.3	15.8
600	0.616	173.9	4.048	74.8	0.090	61.0	0.177	−139.4	14.4
700	0.617	169.4	3.507	70.4	0.102	62.0	0.174	−146.6	13.1
800	0.619	165.1	3.093	66.4	0.115	62.5	0.173	−153.4	12.0
900	0.625	161.0	2.767	62.7	0.127	63.1	0.176	−160.0	11.1
1000	0.633	157.0	2.522	59.2	0.140	63.0	0.181	−166.5	10.4
1200	0.652	150.1	2.129	52.3	0.166	62.2	0.203	−177.9	9.2
1400	0.671	144.3	1.834	45.1	0.188	60.5	0.234	173.7	8.1
1600	0.680	138.4	1.623	38.7	0.216	59.7	0.264	166.8	7.2
1800	0.692	131.6	1.479	32.0	0.244	55.6	0.292	159.2	6.6
2000	0.716	124.7	1.355	26.6	0.268	53.8	0.325	151.1	6.2
2200	0.748	119.2	1.235	21.0	0.289	50.7	0.367	143.8	6.0
2400	0.771	114.9	1.113	17.8	0.303	49.7	0.405	137.6	5.6
2600	0.770	109.8	1.044	12.1	0.335	45.1	0.433	130.5	5.2
2800	0.767	103.0	0.936	6.6	0.345	39.6	0.451	122.1	4.3
3000	0.788	95.9	0.895	2.7	0.363	37.7	0.479	113.6	4.4

Table 4 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.517	−73.1	33.002	145.4	0.0210	65.2	0.809	−38.2	36.3
100	0.548	−124.	20.327	117.2	0.0350	51.3	0.511	−70.2	29.0
200	0.579	−155.	11.501	100.6	0.0460	51.2	0.307	−95.9	23.4
300	0.599	−168.	7.894	90.4	0.0570	54.3	0.233	−112.	20.1
400	0.600	−176.	5.972	84.6	0.0690	58.2	0.199	−124.	17.6
500	0.601	177.0	4.868	79.2	0.0810	60.5	0.184	−134.	15.8
600	0.607	172.9	4.080	74.5	0.0940	61.4	0.175	−143.	14.3
700	0.603	168.3	3.534	69.6	0.105	62.3	0.172	−150.	13.1
800	0.608	163.9	3.106	66.1	0.120	63.0	0.173	−157.	12.0
900	0.611	159.8	2.753	62.4	0.132	63.2	0.175	−164.	11.0
1000	0.622	155.1	2.511	58.8	0.146	62.8	0.184	−170.	10.3
1200	0.642	148.5	2.138	51.7	0.173	61.5	0.204	−179.	9.09
1400	0.677	142.3	1.841	44.1	0.196	59.2	0.231	172.5	8.20
1600	0.675	136.7	1.634	38.7	0.223	58.8	0.257	165.0	7.20
1800	0.677	129.3	1.475	31.3	0.252	54.4	0.283	157.2	6.40
2000	0.714	121.6	1.394	26.4	0.276	52.4	0.315	149.4	6.44
2200	0.748	116.0	1.242	21.1	0.298	49.8	0.354	142.0	6.02
2400	0.773	112.2	1.119	16.9	0.313	48.4	0.394	135.8	5.66
2600	0.758	107.1	1.059	10.9	0.347	43.9	0.426	128.3	5.08
2800	0.751	100.4	0.952	5.00	0.356	38.7	0.447	120.6	4.15
3000	0.786	92.9	0.908	2.20	0.376	37.1	0.479	112.8	4.47

PNP 4 GHz wideband transistor BFG55

FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope. It is intended for wideband amplifier applications.

NPN complement is the BFG35.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

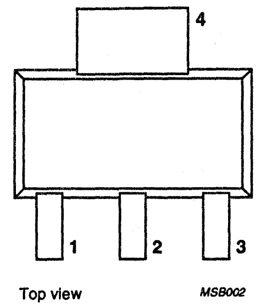


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	–25	V
V_{CEO}	collector-emitter voltage	open base	–	–	–18	V
I_C	DC collector current		–	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = –100 mA; V_{CE} = –10 V; T_{amb} = 25 °C	25	70	–	
f_T	transition frequency	I_C = –100 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –100 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	I_C = –100 mA; V_{CE} = –10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 848.25 MHz; T_{amb} = 25 °C	–	750	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–25	V
V_{CEO}	collector-emitter voltage	open base	–	–18	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	35 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA	−25	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA	−18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	–	–	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	1	µA
h_{FE}	DC current gain	I_C = −100 mA; V_{CE} = −10 V; T_{amb} = 25 °C	25	70	–	
C_c	collector capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz	–	2.3	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = −10 V; f = 1 MHz	–	8	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz; T_{amb} = 25 °C	–	1.5	–	pF
f_T	transition frequency	I_C = −100 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = −100 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = −100 mA; V_{CE} = −10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	800	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = −60 dB (DIN 45004B); I_C = −100 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 850.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 858.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 860.25 MHz;
   measured at $f_{(p+q-r)}$ = 848.25 MHz.
3. d_{im} = −60 dB (DIN 45004B); I_C = −100 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.

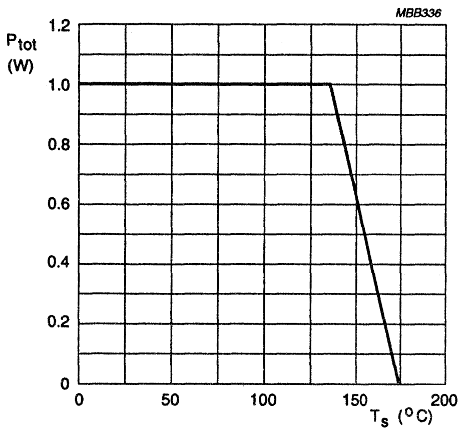
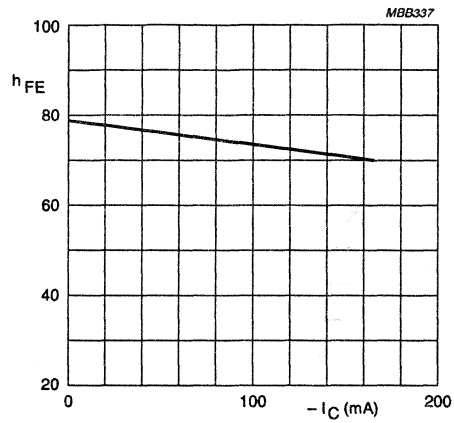
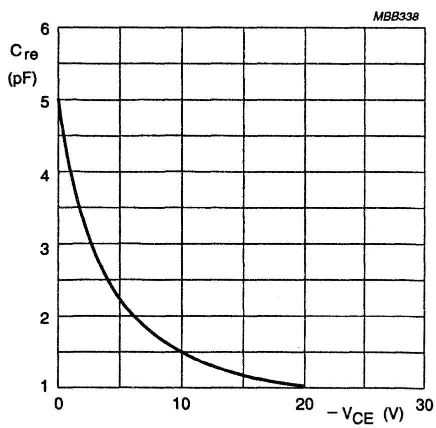


Fig.2 Power derating curve.



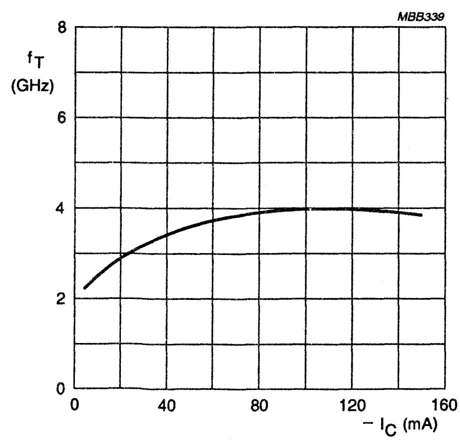
V_{CE} = −10 V; T_{amb} = 25 °C.

Fig.3 DC current gain as a function of collector current.



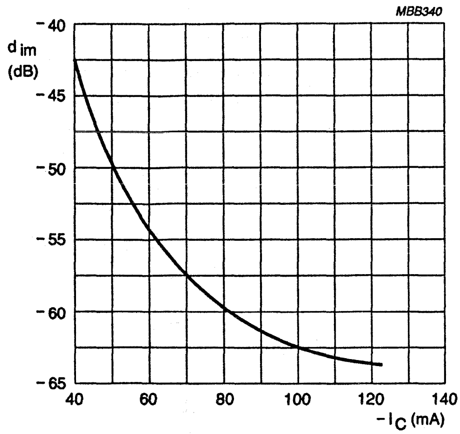
f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Feedback capacitance as a function of collector-emitter voltage.



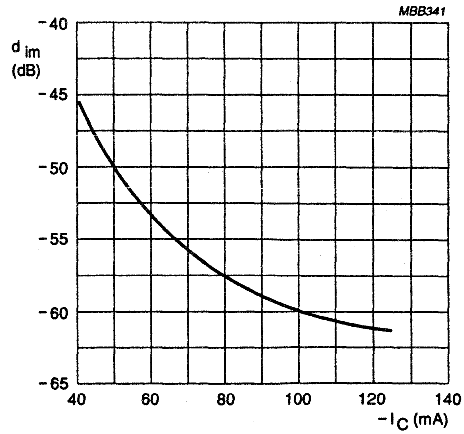
V_{CE} = −10 V; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current.



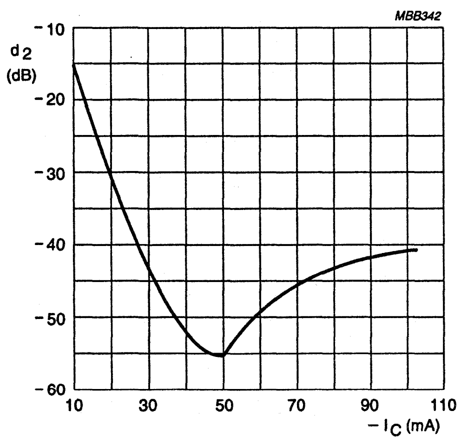
$V_{CE} = -10$ V; $V_O = 650$ mV; $f_{(p+q-r)} = 443.25$ MHz;
$T_{amb} = 25$ °C

Fig.6 Intermodulation distortion as a function of collector current.



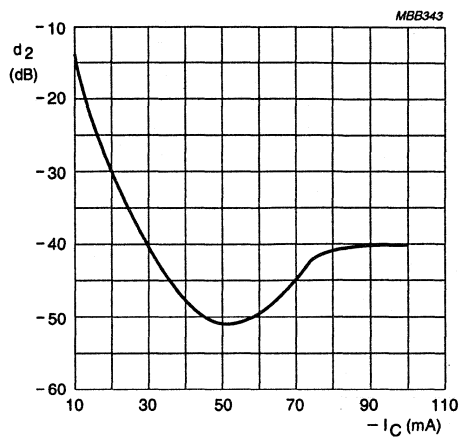
$V_{CE} = -10$ V; $V_O = 600$ mV; $f_{(p+q-r)} = 848.25$ MHz;
$T_{amb} = 25$ °C

Fig.7 Intermodulation distortion as a function of collector current.



$V_{CE} = -10$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 450$ MHz;
$T_{amb} = 25$ °C.

Fig.8 Second order intermodulation distortion as a function of collector current.



$V_{CE} = -10$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 810$ MHz;
$T_{amb} = 25$ °C

Fig.9 Second order intermodulation distortion as a function of collector current.

Table 1 Common emitter scattering parameters, $I_C = -50$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.356	−115.4	26.280	144.9	0.020	64.8	0.781	−41.8	33.1
100	0.555	−147.7	16.367	117.6	0.034	53.6	0.516	−79.4	27.2
200	0.628	−166.9	9.224	99.3	0.047	54.0	0.344	−111.5	22.0
300	0.649	−176.1	6.333	89.8	0.060	57.8	0.290	−130.4	18.8
400	0.659	177.7	4.812	82.9	0.073	60.8	0.270	−142.9	16.4
500	0.666	172.7	3.890	77.2	0.086	62.7	0.264	−151.9	14.7
600	0.669	168.2	3.277	72.0	0.100	63.5	0.263	−158.9	13.2
700	0.670	164.2	2.837	67.3	0.115	64.1	0.266	−164.9	12.0
800	0.674	160.1	2.505	62.8	0.129	64.1	0.272	−170.2	10.9
900	0.676	156.3	2.246	59.0	0.143	64.1	0.280	−175.3	10.0
1000	0.684	152.4	2.043	55.3	0.159	63.6	0.291	−138.0	9.3
1200	0.703	145.8	1.730	47.8	0.189	61.8	0.319	172.0	8.2
1400	0.721	139.7	1.487	40.5	0.214	59.4	0.350	165.0	7.2
1600	0.728	133.6	1.318	34.1	0.244	58.0	0.382	158.2	6.4
1800	0.738	126.9	1.203	27.3	0.276	53.2	0.413	151.0	5.8
2000	0.760	120.2	1.099	22.1	0.301	50.6	0.449	143.7	5.6

Table 2 Common emitter scattering parameters, $I_C = -100$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.384	−114.3	28.507	141.8	0.020	58.1	0.720	−47.5	33.0
100	0.556	−148.7	17.103	115.5	0.034	52.1	0.472	−88.2	27.4
200	0.624	−169.1	9.272	98.4	0.048	55.0	0.332	−122.4	22.0
300	0.655	−177.4	6.447	89.1	0.061	59.4	0.295	−141.2	19.0
400	0.663	176.6	4.782	82.3	0.076	60.7	0.286	−153.4	16.5
500	0.669	172.6	3.953	76.8	0.089	62.7	0.284	−161.3	14.9
600	0.664	169.5	3.293	71.1	0.104	63.3	0.285	−167.9	13.2
700	0.660	163.5	2.854	67.1	0.119	63.5	0.286	−173.4	12.0
800	0.655	160.3	2.493	62.9	0.133	63.5	0.292	−178.6	10.8
900	0.676	155.5	2.254	59.2	0.148	63.0	0.298	176.6	10.1
1000	0.686	151.7	2.056	54.8	0.163	62.5	0.308	172.4	9.5
1200	0.695	144.7	1.760	47.6	0.194	60.7	0.337	164.6	8.3
1400	0.731	137.9	1.499	40.9	0.217	57.7	0.364	158.5	7.5
1600	0.734	133.5	1.349	34.2	0.248	56.5	0.390	152.0	6.7
1800	0.763	126.2	1.219	27.7	0.278	51.5	0.418	145.5	6.3
2000	0.765	119.3	1.136	23.4	0.305	49.3	0.453	138.8	5.9

NPN 8 GHz wideband transistor BFG65

DESCRIPTION

NPN transistor in a four-lead dual emitter plastic envelope (SOT103). It is designed for wideband application in the GHz range, such as satellite TV systems and repeater amplifiers in fibre-optical systems. The device features a very high transition frequency, high gain and a very low noise figure up to 2 GHz.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

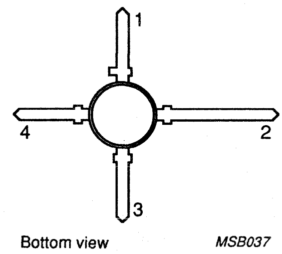


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	–	300	mW
T_j	junction temperature		–	–	175	°C
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz	–	10.5	–	dB
F	noise figure at optimum source impedance	Z_S = 50 Ω; I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	1.7	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 8 GHz wideband transistor BFG65

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	55 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 500 MHz	–	8	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1.1	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 800 MHz	–	18.5	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10.5	–	dB
F	noise figure at optimum source impedance	$Z_S = 50\ \Omega$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.3	–	dB
		$Z_S = 50\ \Omega$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$Z_S = 50\ \Omega$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.1	–	dB
		$Z_S = 50\ \Omega$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.7	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

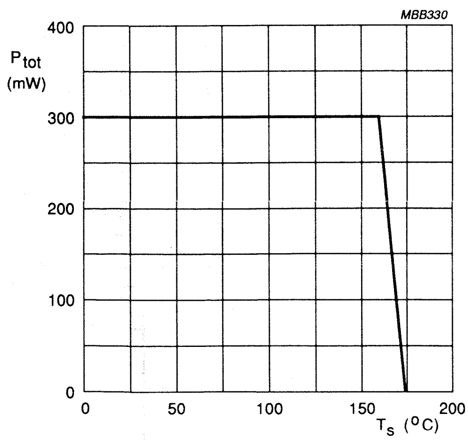
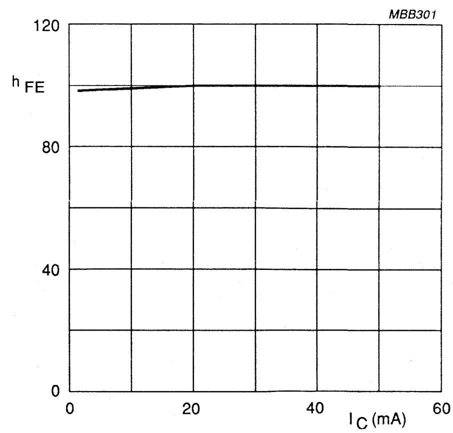
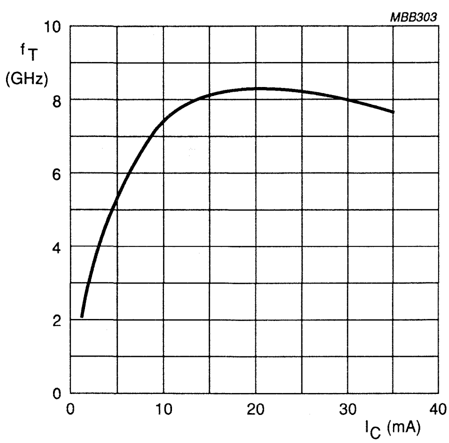


Fig.2 Power derating curve.



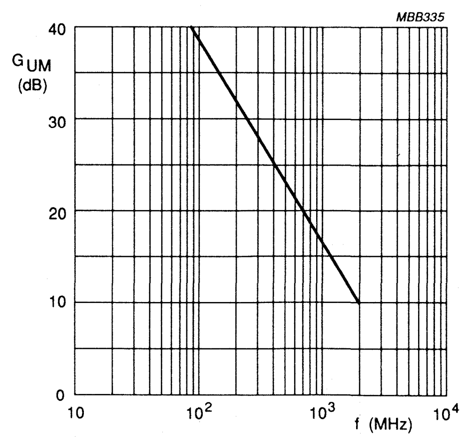
V_{CE} = 8 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



V_{CE} = 8 V; f = 500 MHz.

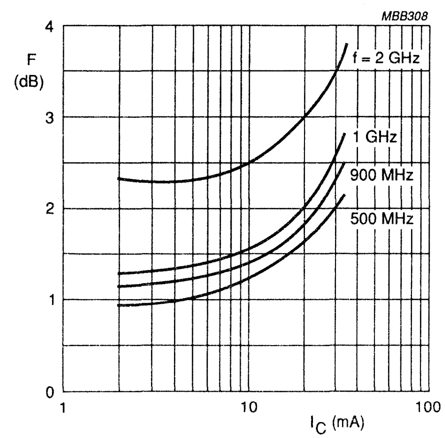
Fig.4 Transition frequency as a function of collector current.



V_{CE} = 8 V; I_C = 15 mA; T_{amb} = 25 °C.

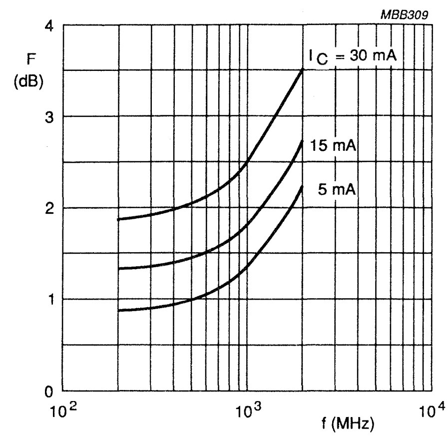
Fig.5 Maximum unilateral power gain as a function of frequency.

NPN 8 GHz wideband transistor | BFG65



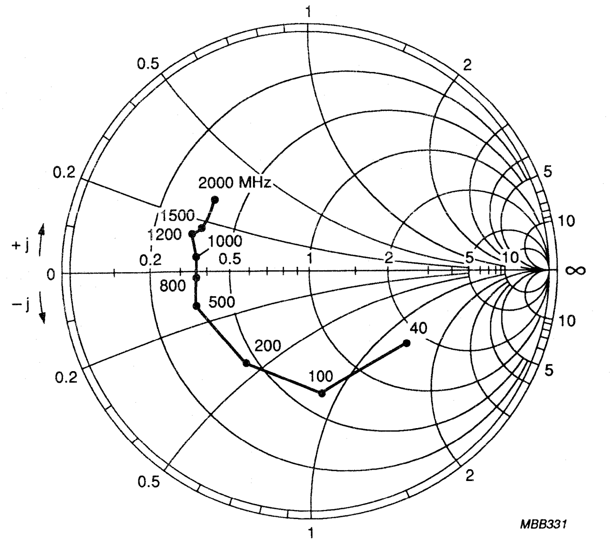
V_{CE} = 8 V.

Fig.6 Minimum noise figure as a function of collector current.



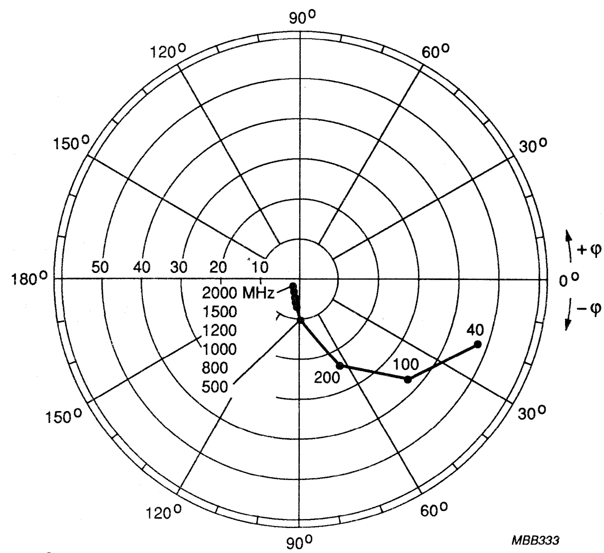
V_{CE} = 8 V.

Fig.7 Minimum noise figure as a function of frequency.



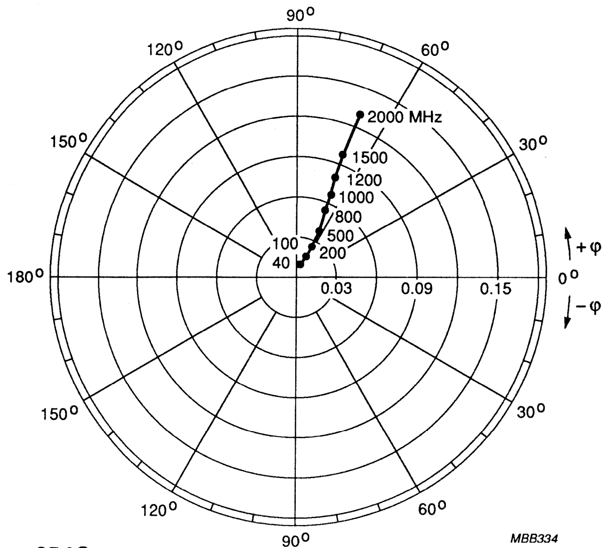
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



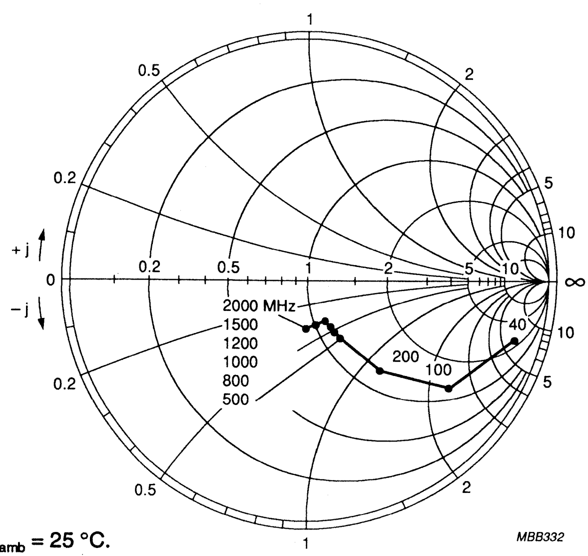
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.737	−20.0	26.381	167.0	0.010	79.3	0.968	−10.5	43.8
100	0.700	−47.4	23.940	150.5	0.022	66.7	0.880	−24.6	37.0
200	0.627	−84.5	18.946	129.8	0.036	53.4	0.702	−40.8	30.7
300	0.584	−110.8	14.923	115.9	0.043	46.2	0.563	−50.6	26.9
400	0.567	−128.6	12.112	106.4	0.048	43.2	0.470	−56.6	24.4
500	0.558	−141.7	10.112	98.9	0.052	41.6	0.411	−60.6	22.5
600	0.550	−151.2	8.653	93.1	0.055	41.1	0.371	−63.5	20.9
700	0.542	−159.6	7.515	88.2	0.059	41.6	0.343	−65.2	19.6
800	0.533	−166.2	6.667	84.1	0.062	42.2	0.320	−66.4	18.4
900	0.533	−171.9	5.964	79.9	0.066	42.5	0.302	−67.1	17.4
1000	0.532	−178.0	5.380	76.3	0.069	43.3	0.284	−67.9	16.4
1200	0.535	171.5	4.564	69.2	0.077	43.6	0.256	−72.3	14.9
1400	0.551	162.8	3.934	62.9	0.084	43.6	0.236	−79.7	13.7
1600	0.551	156.2	3.452	57.1	0.092	44.1	0.238	−85.4	12.6
1800	0.552	149.7	3.143	50.8	0.101	43.6	0.245	−89.6	11.8
2000	0.558	142.9	2.848	45.4	0.110	42.2	0.240	−92.6	11.0
2200	0.580	135.9	2.597	40.2	0.119	41.8	0.225	−97.8	10.3
2400	0.602	130.7	2.402	35.7	0.127	40.8	0.217	−107.2	9.8
2600	0.617	127.0	2.229	30.1	0.135	38.8	0.230	−117.1	9.3
2800	0.622	121.6	2.099	24.4	0.143	37.1	0.248	−123.5	8.8
3000	0.623	116.7	1.971	20.1	0.154	36.0	0.256	−126.1	8.3

NPN 8 GHz wideband transistor BFG65

Table 2 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.653	−25.8	34.244	164.3	0.009	77.1	0.950	−13.2	43.2
100	0.620	−59.5	29.823	145.1	0.020	63.6	0.827	−29.8	36.6
200	0.563	−100.4	21.965	123.5	0.031	52.1	0.616	−46.9	30.6
300	0.541	−125.7	16.612	110.5	0.036	46.6	0.476	−55.9	27.0
400	0.537	−141.4	13.167	101.8	0.041	46.1	0.391	−61.3	24.6
500	0.534	−152.8	10.854	95.2	0.045	45.8	0.340	−64.8	22.7
600	0.532	−161.2	9.223	89.9	0.048	46.6	0.306	−66.9	21.2
700	0.527	−168.0	7.978	85.5	0.053	47.5	0.284	−68.3	19.8
800	0.522	−173.9	7.061	81.7	0.057	48.9	0.265	−69.3	18.7
900	0.523	−179.3	6.308	77.8	0.062	49.1	0.250	−69.8	17.7
1000	0.522	175.9	5.693	74.4	0.066	49.8	0.236	−70.4	16.7
1200	0.532	166.2	4.809	67.8	0.074	49.8	0.211	−74.9	15.3
1400	0.545	158.3	4.141	61.9	0.084	49.2	0.195	−83.3	14.0
1600	0.550	152.6	3.629	56.2	0.093	49.2	0.200	−89.1	12.9
1800	0.550	146.6	3.287	50.2	0.103	48.0	0.208	−93.1	12.1
2000	0.558	139.8	2.987	45.1	0.113	46.2	0.205	−95.9	11.3
2200	0.575	133.8	2.710	39.8	0.123	45.0	0.191	−101.4	10.6
2400	0.597	128.4	2.515	35.5	0.131	43.5	0.185	−112.1	10.1
2600	0.615	125.1	2.326	30.4	0.140	41.3	0.199	−122.5	9.6
2800	0.620	119.6	2.197	24.3	0.148	39.0	0.218	−128.8	9.2
3000	0.624	114.6	2.060	20.3	0.159	37.3	0.225	−130.9	8.6

Table 3 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.586	−31.0	40.395	162.1	0.009	77.1	0.933	−15.3	42.9
100	0.561	−70.0	33.893	141.0	0.019	61.3	0.782	−33.7	36.4
200	0.527	−112.1	23.701	119.4	0.028	51.7	0.556	−50.7	30.5
300	0.521	−135.9	17.482	107.2	0.032	48.3	0.421	−59.2	27.1
400	0.524	−149.8	13.702	99.1	0.037	49.1	0.343	−63.9	24.7
500	0.526	−159.7	11.222	92.9	0.041	50.1	0.297	−67.1	22.8
600	0.528	−167.3	9.485	88.0	0.045	50.7	0.269	−69.0	21.3
700	0.522	−173.2	8.189	83.7	0.050	52.1	0.250	−70.2	19.9
800	0.518	−178.7	7.244	80.1	0.055	53.1	0.234	−70.6	18.8
900	0.520	176.9	6.460	76.5	0.060	53.5	0.221	−71.0	17.8
1000	0.522	171.6	5.822	73.2	0.064	53.7	0.209	−71.6	16.9
1200	0.532	163.2	4.930	66.9	0.074	53.5	0.186	−76.3	15.5
1400	0.545	156.1	4.221	61.1	0.084	52.6	0.172	−85.2	14.2
1600	0.548	150.2	3.702	55.6	0.094	52.0	0.179	−91.4	13.1
1800	0.547	144.5	3.361	49.7	0.105	50.5	0.188	−95.3	12.2
2000	0.557	138.2	3.046	44.6	0.115	48.2	0.185	−98.1	11.4
2200	0.575	132.3	2.775	39.6	0.125	46.8	0.172	−103.7	10.7
2400	0.604	127.3	2.566	35.4	0.134	45.2	0.168	−115.1	10.3
2600	0.609	124.2	2.381	30.1	0.142	42.5	0.183	−126.0	9.7
2800	0.617	119.1	2.239	24.4	0.152	40.1	0.204	−132.0	9.3
3000	0.620	114.1	2.087	20.3	0.162	38.2	0.210	−133.7	8.7

NPN 8 GHz wideband transistor

BFG67; BFG67/X; BFG67R; BFG67/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG67 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is available as in-line emitter pinning (BFG67) and cross emitter pinning (BFG67/X). Versions with reverse pinning (BFG67R and BFG67/XR) are available upon request.

This transistor is designed for wideband applications in the GHz range, such as satellite TV tuners and portable RF communications equipment.

PINNING

PIN	DESCRIPTION
BFG67 (Fig.1) Code: V3	
1	collector
2	base
3	emitter
4	emitter
BFG67/X (Fig.1) Code: V12	
1	collector
2	emitter
3	base
4	emitter
BFG67R (Fig.2) Code: V27	
1	collector
2	base
3	emitter
4	emitter
BFG67/XR (Fig.2) Code: V26	
1	collector
2	emitter
3	base
4	emitter

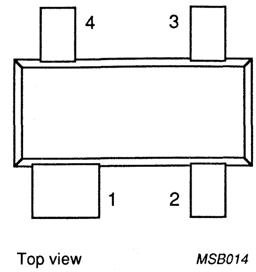


Fig.1 SOT143.

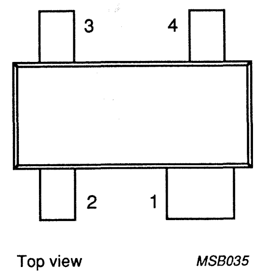


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	2.2	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V; f= 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	17	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

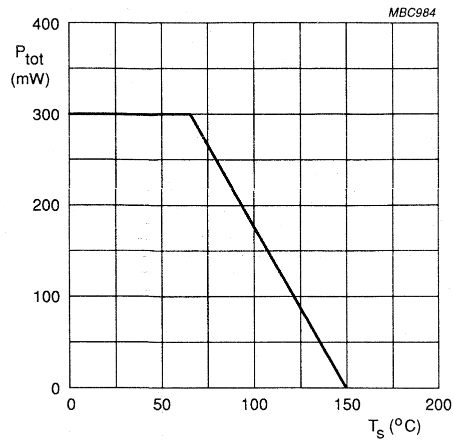
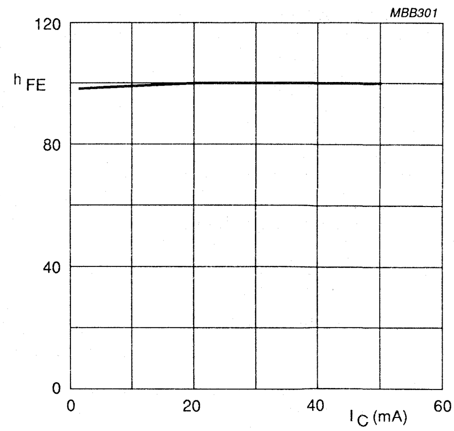
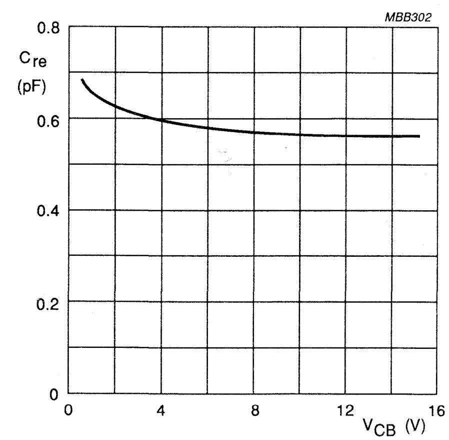


Fig.3 Power derating curve.



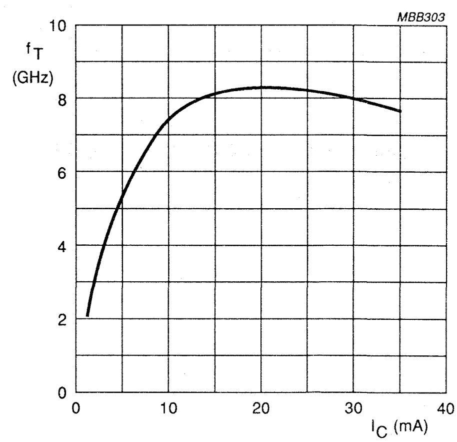
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

Fig.5 Feedback capacitance as a function of collector-base voltage.

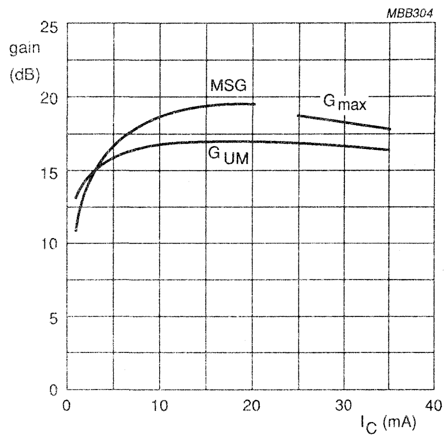


V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz.

Fig.6 Transition frequency as a function of collector current.

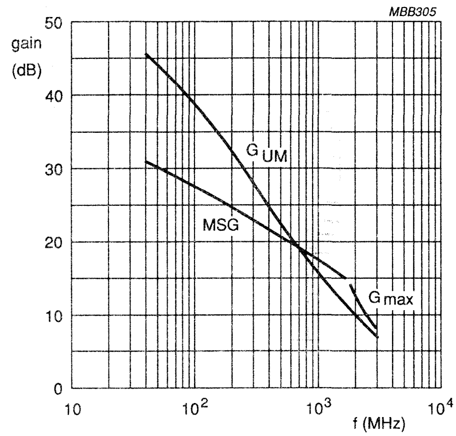
Capability approved CECC 50 000 (issue 4), 1986

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



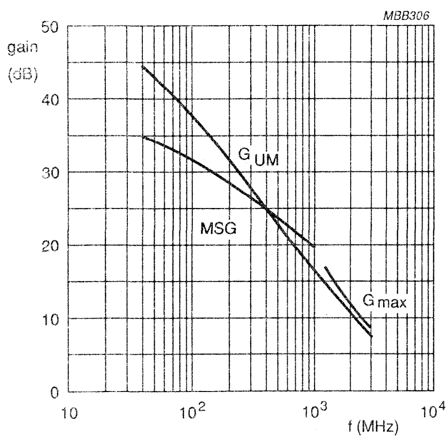
V_{CE} = 8 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



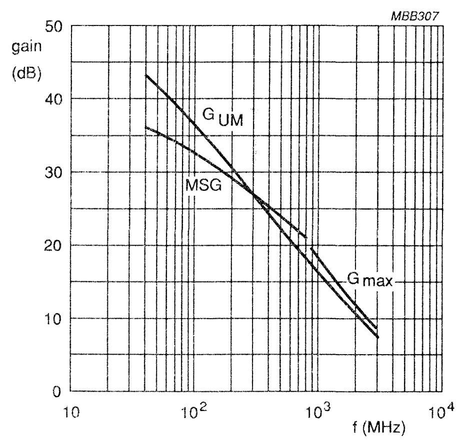
V_{CE} = 8 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



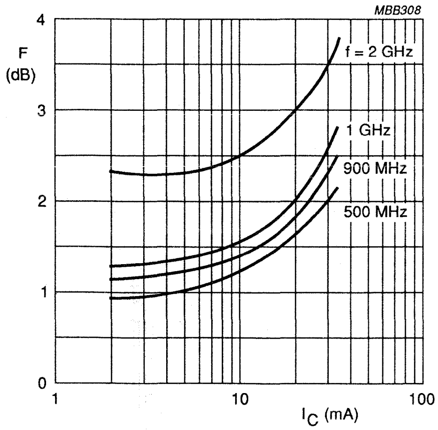
V_{CE} = 8 V; I_C = 15 mA.

Fig.9 Gain as a function of frequency.



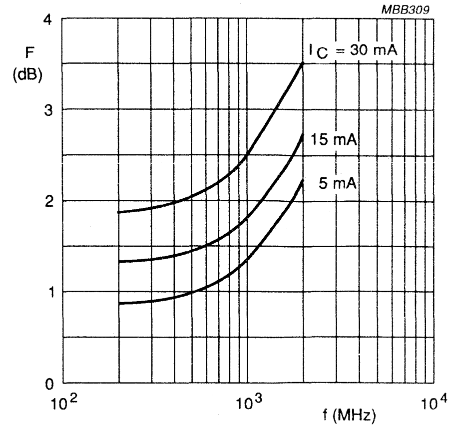
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



V_{CE} = 8 V.

Fig.11 Minimum noise figure as a function of collector current.



V_{CE} = 8 V.

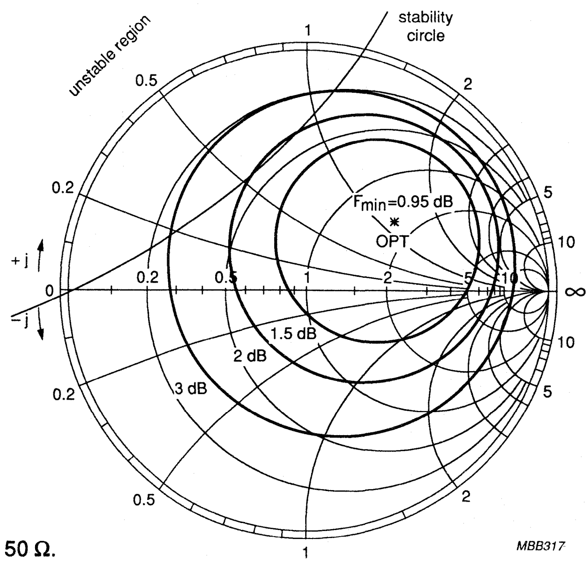
Fig.12 Minimum noise figure as a function of frequency.

BFG67/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	8	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
0.95	0.455	33.8	0.288



Z_o = 50 Ω.

Fig.13 Noise circle figure.

BFG67/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	8	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.3	0.375	65.9	0.304

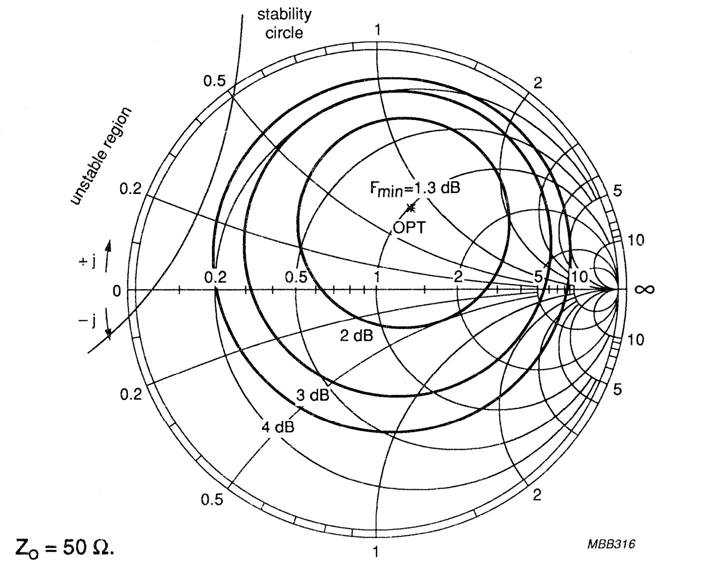


Fig.14 Noise circle figure.

BFG67/X

f (MHz)	V_{CE} (V)	I_C (mA)
2000	8	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.2	0.391	136.5	0.184

Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
12	0.839	−170

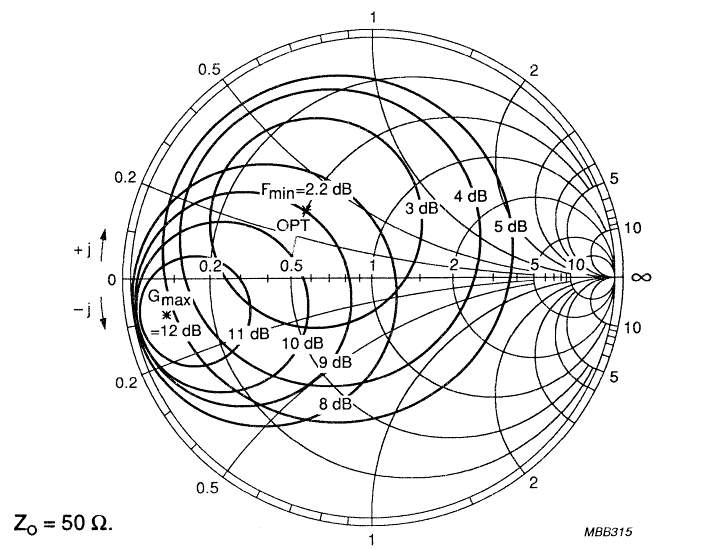
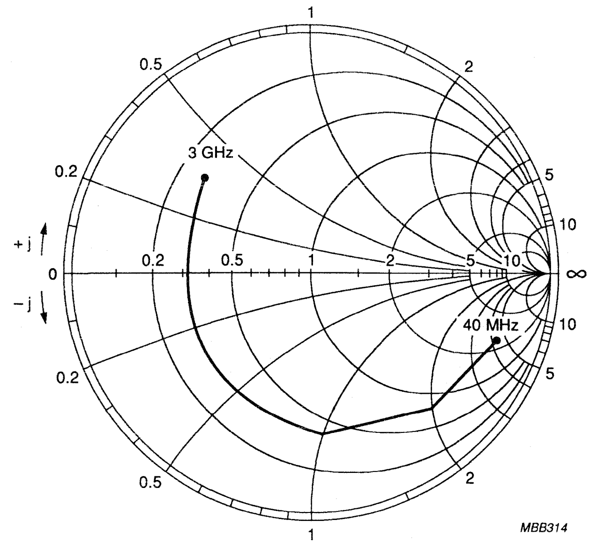
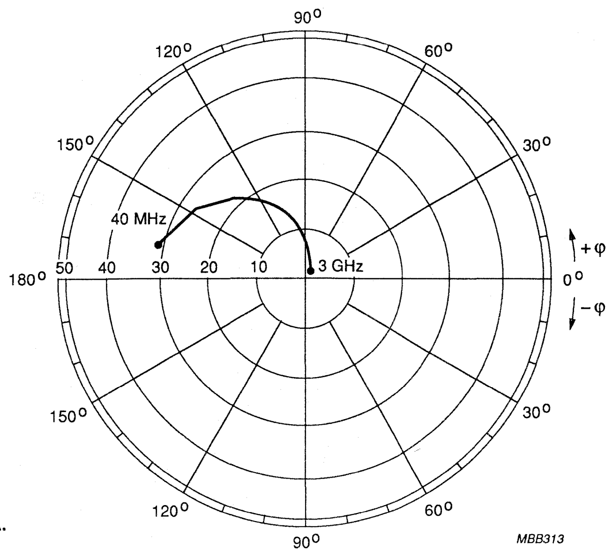


Fig.15 Noise circle figure.



V_{CE} = 8 V; I_C = 15 mA.

Fig.16 Common emitter input reflection coefficient (S_{11}).



V_{CE} = 8 V; I_C = 15 mA.

Fig.17 Common emitter forward transmission coefficient (S_{21}).

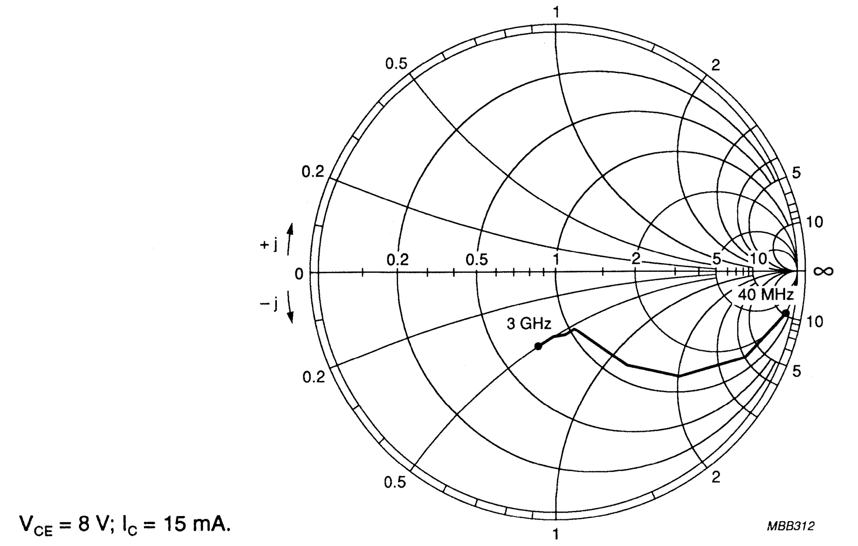


Fig.18 Common emitter reverse transmission coefficient (S_{12}).

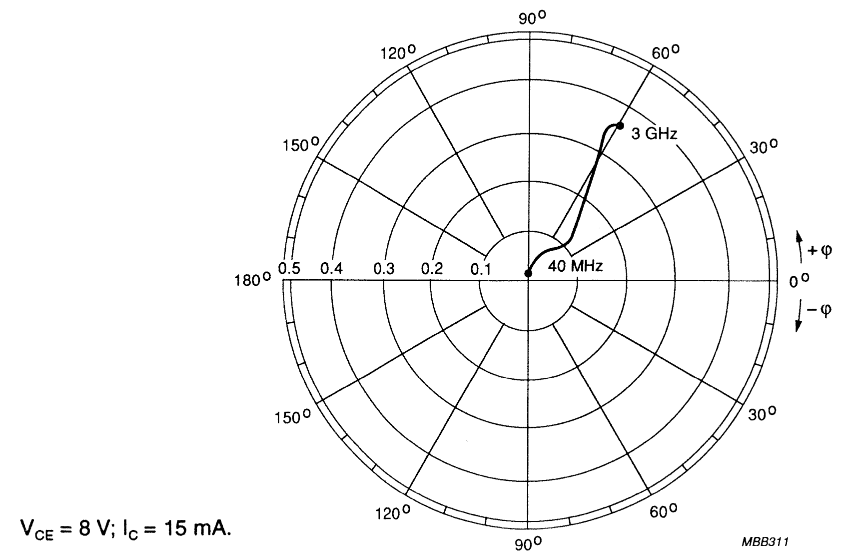
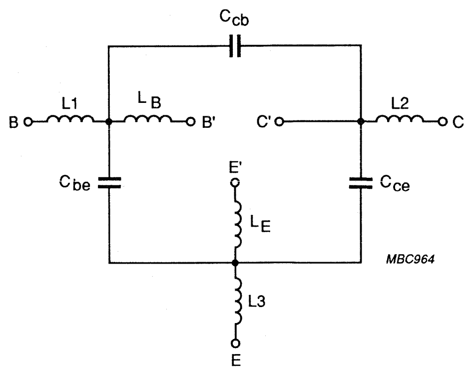


Fig.19 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFQ65 crystal

1	IS = 556.4	aA
2	BF = 170.0	–
3	NF = 994.8	m
4	VAF = 48.03	V
5	IKF = 918.1	mA
6	ISE = 10.47	fA
7	NE = 1.479	–
8	BR = 142.1	–
9	NR = 994.1	m
10	VAR = 2.555	V
11	IKR = 9.632	A
12	ISC = 438.2	aA
13	NC = 1.089	–
14	RB = 10.00	Ω
15	IRB = 1.000	µA
16	RBM = 10.00	Ω
17	RE = 655.9	mOhm
18	RC = 2.000	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.137	pF
23	VJE = 600.0	mV
24	MJE = 249.4	m
25	TF = 11.97	ps
26	XTF = 25.99	–
27	VTF = 1.223	V
28	ITF = 197.3	mA
29	PTF = 10.03	deg
30	CJC = 515.9	fF
31	VJC = 155.8	mV
32	MJC = 56.02	m
33	XCJC = 130.0	m
34	TR = 1.877	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 870.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.20 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.20)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.953	−7.5	6.681	174.3	0.011	86.1	0.999	−3.5	52.8
100	0.940	−18.5	6.535	166.3	0.027	78.3	0.986	−9.1	41.1
200	0.904	−35.9	6.187	154.5	0.051	69.2	0.942	−17.1	32.7
300	0.865	−52.1	5.783	143.6	0.070	60.3	0.893	−24.2	28.2
400	0.821	−66.9	5.338	134.0	0.086	53.2	0.838	−30.2	24.7
500	0.779	−79.8	4.860	125.7	0.098	46.8	0.787	−35.1	22.0
600	0.745	−91.3	4.442	118.7	0.106	41.9	0.741	−39.0	19.9
700	0.714	−101.2	4.069	112.4	0.113	38.0	0.705	−42.3	18.3
800	0.688	−110.5	3.737	106.5	0.117	34.8	0.673	−45.1	16.9
900	0.664	−118.7	3.436	101.4	0.120	32.1	0.646	−47.4	15.6
1000	0.644	−126.2	3.164	96.7	0.122	29.8	0.623	−49.5	14.5
1200	0.621	−139.8	2.738	88.6	0.124	26.4	0.587	−53.2	12.7
1400	0.614	−151.1	2.428	81.2	0.125	23.8	0.562	−57.1	11.4
1600	0.609	−160.2	2.161	74.6	0.123	23.2	0.550	−60.8	10.3
1800	0.603	−168.0	1.951	69.2	0.123	22.8	0.544	−63.7	9.3
2000	0.596	−176.0	1.775	64.0	0.120	22.9	0.532	−66.4	8.3
2200	0.600	176.5	1.631	59.4	0.118	23.9	0.516	−70.4	7.5
2400	0.613	170.1	1.494	54.0	0.116	25.4	0.508	−75.6	6.8
2600	0.625	164.8	1.376	49.9	0.115	27.6	0.514	−80.6	6.3
2800	0.629	159.8	1.304	45.3	0.115	28.9	0.526	−84.7	5.9
3000	0.635	154.5	1.218	41.1	0.115	31.9	0.533	−88.1	5.4

Table 2 Common emitter scattering parameters (V_{CE} = 4 V; I_C = 5 mA)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.897	−12.3	14.969	171.2	0.011	82.7	0.987	−6.3	46.6
100	0.867	−30.1	14.202	159.4	0.025	73.1	0.949	−15.6	39.1
200	0.800	−56.3	12.502	143.2	0.044	60.9	0.846	−27.8	31.8
300	0.737	−78.3	10.798	130.3	0.057	51.7	0.743	−36.8	27.6
400	0.686	−96.0	9.256	120.3	0.065	45.6	0.655	−43.1	24.5
500	0.649	−110.0	7.964	112.5	0.071	41.4	0.587	−47.5	22.2
600	0.623	−121.3	6.965	106.4	0.075	38.7	0.536	−50.5	20.5
700	0.604	−130.5	6.173	101.2	0.078	37.2	0.500	−52.9	19.0
800	0.589	−138.8	5.522	96.5	0.080	36.4	0.471	−54.7	17.8
900	0.577	−145.9	4.983	92.5	0.082	35.8	0.450	−56.2	16.7
1000	0.568	−152.3	4.522	88.9	0.084	35.8	0.432	−57.3	15.7
1200	0.562	−163.3	3.826	82.6	0.088	36.2	0.405	−60.0	14.1
1400	0.565	−171.8	3.334	76.8	0.091	37.1	0.388	−63.2	12.8
1600	0.567	−178.9	2.940	71.5	0.094	39.0	0.384	−66.3	11.7
1800	0.565	174.7	2.637	67.1	0.099	40.6	0.383	−68.5	10.8
2000	0.563	168.2	2.392	62.7	0.102	42.2	0.375	−70.5	9.9
2200	0.574	162.2	2.188	58.9	0.106	43.8	0.363	−74.2	9.2
2400	0.590	157.3	2.002	54.5	0.111	45.6	0.358	−79.7	8.5
2600	0.600	153.3	1.843	51.0	0.116	47.4	0.367	−84.8	7.9
2800	0.605	149.3	1.738	46.8	0.121	47.4	0.379	−88.8	7.5
3000	0.610	144.9	1.622	43.2	0.127	49.3	0.387	−91.8	6.9

Table 3 Common emitter scattering parameters (V_{CE} = 4 V; I_C = 10 mA)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.823	−18.7	25.316	167.4	0.010	80.4	0.968	−9.8	45.0
100	0.775	−44.7	22.879	151.5	0.023	67.7	0.887	−23.2	37.9
200	0.691	−78.9	18.240	132.1	0.037	54.6	0.719	−38.2	31.2
300	0.636	−103.5	14.476	119.0	0.045	47.0	0.587	−47.0	27.3
400	0.602	−120.8	11.751	110.1	0.049	44.0	0.495	−52.3	24.6
500	0.580	−133.4	9.772	103.6	0.053	42.3	0.434	−55.4	22.5
600	0.569	−142.9	8.359	98.6	0.056	42.3	0.393	−57.6	20.9
700	0.560	−150.7	7.295	94.3	0.059	42.7	0.366	−59.1	19.5
800	0.554	−157.2	6.457	90.6	0.062	43.5	0.346	−60.2	18.3
900	0.549	−162.9	5.782	87.3	0.064	44.5	0.331	−61.2	17.3
1000	0.546	−168.0	5.224	84.4	0.067	45.9	0.319	−61.9	16.4
1200	0.549	−176.7	4.386	79.1	0.074	48.0	0.301	−64.0	14.8
1400	0.555	176.6	3.794	74.2	0.080	49.1	0.292	−67.1	13.6
1600	0.559	171.0	3.335	69.5	0.086	51.5	0.292	−70.1	12.5
1800	0.558	165.7	2.986	65.6	0.094	52.8	0.295	−71.9	11.5
2000	0.559	160.0	2.706	61.7	0.101	53.9	0.290	−73.5	10.7
2200	0.572	154.7	2.475	58.3	0.108	54.9	0.280	−77.3	9.9
2400	0.589	150.6	2.263	54.4	0.115	55.7	0.277	−83.4	9.3
2600	0.599	147.3	2.083	51.1	0.122	56.3	0.287	−89.0	8.7
2800	0.602	143.9	1.957	47.3	0.129	55.9	0.301	−92.8	8.2
3000	0.607	139.9	1.831	43.8	0.135	56.5	0.310	−95.6	7.7

NPN 8 GHz wideband transistor

BFG67; BFG67/X; BFG67R; BFG67/XR

Table 4 Common emitter scattering parameters (V_{CE} = 4 V; I_C = 15 mA)

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.771	−23.6	32.164	164.8	0.010	77.3	0.951	−12.2	44.3
100	0.715	−54.9	27.929	146.4	0.022	64.7	0.838	−27.8	37.3
200	0.637	−92.7	20.824	126.0	0.033	51.9	0.640	−43.4	30.9
300	0.596	−117.1	15.868	113.6	0.038	46.3	0.505	−51.3	27.2
400	0.576	−133.0	12.597	105.6	0.042	45.4	0.421	−55.6	24.6
500	0.562	−144.2	10.353	99.7	0.046	45.3	0.367	−58.1	22.6
600	0.556	−152.5	8.788	95.2	0.049	45.8	0.333	−59.6	21.0
700	0.551	−159.0	7.637	91.5	0.052	46.9	0.311	−60.9	19.7
800	0.548	−165.0	6.737	88.1	0.055	48.6	0.295	−61.7	18.5
900	0.546	−169.9	6.019	85.1	0.059	50.3	0.285	−62.4	17.5
1000	0.545	−174.3	5.430	82.4	0.062	51.5	0.275	−63.0	16.6
1200	0.549	178.1	4.549	77.5	0.070	53.4	0.262	−65.0	15.0
1400	0.558	172.2	3.928	73.0	0.077	54.9	0.256	−68.2	13.8
1600	0.561	167.1	3.450	68.5	0.085	56.7	0.258	−71.2	12.7
1800	0.561	162.2	3.086	64.7	0.094	57.4	0.263	−73.0	11.7
2000	0.563	156.8	2.795	61.0	0.101	58.1	0.259	−74.5	10.9
2200	0.576	152.0	2.554	57.7	0.109	58.8	0.251	−78.4	10.2
2400	0.593	148.2	2.337	54.0	0.116	59.2	0.249	−84.9	9.5
2600	0.603	145.3	2.149	50.8	0.125	59.6	0.260	−90.7	8.9
2800	0.605	142.0	2.017	47.1	0.131	58.6	0.275	−94.6	8.4
3000	0.612	138.2	1.887	43.7	0.139	58.9	0.285	−97.3	7.9

Table 5 Common emitter scattering parameters (V_{CE} = 4 V; I_C = 20 mA)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.726	−28.4	37.780	162.4	0.009	77.7	0.933	−14.2	43.7
100	0.668	−64.5	31.514	142.0	0.020	62.1	0.792	−31.4	36.8
200	0.603	−103.9	22.228	121.5	0.029	50.6	0.575	−46.6	30.6
300	0.576	−127.1	16.475	109.8	0.034	46.8	0.446	−53.4	27.1
400	0.563	−141.7	12.907	102.4	0.038	46.9	0.370	−56.8	24.5
500	0.556	−151.6	10.538	97.1	0.042	47.8	0.324	−58.6	22.5
600	0.555	−158.9	8.904	93.0	0.044	49.3	0.295	−59.8	21.0
700	0.549	−164.7	7.715	89.5	0.048	50.9	0.278	−60.7	19.7
800	0.548	−169.9	6.795	86.3	0.052	52.9	0.266	−61.4	18.5
900	0.547	−174.4	6.065	83.5	0.056	54.2	0.258	−62.0	17.5
1000	0.547	−178.4	5.467	81.0	0.060	55.8	0.251	−62.4	16.6
1200	0.553	174.7	4.574	76.3	0.068	57.5	0.241	−64.4	15.1
1400	0.562	169.4	3.944	71.9	0.076	58.3	0.237	−67.8	13.8
1600	0.567	164.7	3.462	67.6	0.084	59.8	0.241	−71.0	12.7
1800	0.565	160.0	3.095	63.9	0.093	60.2	0.248	−72.8	11.8
2000	0.568	154.8	2.804	60.2	0.101	60.9	0.244	−74.2	10.9
2200	0.581	150.1	2.562	57.0	0.109	61.1	0.237	−78.4	10.2
2400	0.600	146.8	2.343	53.4	0.117	61.3	0.236	−85.1	9.6
2600	0.609	143.9	2.154	50.2	0.126	61.4	0.248	−91.1	9.0
2800	0.612	140.8	2.019	46.5	0.133	60.2	0.264	−95.0	8.5
3000	0.617	136.9	1.888	43.2	0.140	60.6	0.274	−97.7	7.9

NPN 8 GHz wideband transistor

BFG67; BFG67/X; BFG67R; BFG67/XR

Table 6 Common emitter scattering parameters (V_{CE} = 8 V; I_C = 5 mA)

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.908	−11.2	14.230	172.0	0.0102	83.4	0.984	−5.78	45.70
100	0.880	−27.6	13.539	160.5	0.0243	74.6	0.951	−14.4	39.30
200	0.816	−52.3	12.210	144.9	0.0436	62.7	0.859	−26.3	32.30
300	0.751	−73.7	10.623	132.2	0.0566	53.9	0.762	−35.2	27.90
400	0.691	−91.1	9.200	122.2	0.0657	47.5	0.678	−41.6	24.80
500	0.650	−105.0	8.021	114.5	0.0720	43.5	0.614	−46.4	22.50
600	0.624	−117.0	7.033	108.0	0.0761	40.9	0.564	−49.8	20.70
700	0.596	−126.0	6.211	102.6	0.0793	39.5	0.528	−52.3	19.20
800	0.579	−135.0	5.559	98.0	0.0822	38.6	0.501	−54.2	17.90
900	0.562	−142.0	5.021	94.3	0.0849	38.3	0.477	−55.7	16.80
1000	0.550	−149.0	4.626	90.2	0.0867	37.6	0.458	−57.3	15.90
1200	0.538	−161.0	3.890	83.6	0.0899	38.8	0.433	−60.3	14.20
1400	0.537	−171.0	3.382	77.9	0.0940	39.4	0.417	−63.7	12.90
1600	0.537	−178.0	2.976	72.8	0.0979	41.0	0.415	−66.4	11.80
1800	0.533	174.9	2.692	68.0	0.1010	42.6	0.414	−68.5	10.90
2000	0.535	167.5	2.429	63.4	0.1070	44.8	0.406	−70.9	9.95
2200	0.536	161.0	2.201	60.1	0.1120	46.4	0.398	−74.8	9.07
2400	0.542	155.6	2.027	56.2	0.1150	47.9	0.396	−79.4	8.39
2600	0.549	150.3	1.872	51.9	0.1200	49.7	0.406	−84.4	7.79
2800	0.551	145.8	1.716	47.4	0.1270	51.5	0.423	−88.1	7.12
3000	0.557	141.4	1.633	44.9	0.1340	51.0	0.433	−90.4	6.77

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	0.95	0.455	33.8	0.288
1000	1.30	0.375	65.9	0.304
2000	2.20	0.391	136.5	0.184

Table 8 Common emitter scattering parameters (V_{CE} = 8 V; I_C = 10 mA)

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.851	−16.5	23.911	168.5	0.00998	81.4	0.966	−8.92	44.90
100	0.800	−39.7	21.821	153.3	0.0226	69.7	0.896	−21.3	38.20
200	0.712	−72.3	17.984	134.4	0.0372	56.7	0.743	−36.1	31.70
300	0.644	−96.4	14.448	121.4	0.0458	49.8	0.614	−45.1	27.60
400	0.592	−114.0	11.857	112.3	0.0510	45.9	0.525	−51.0	24.80
500	0.570	−127.0	9.975	105.6	0.0553	44.5	0.463	−54.6	22.70
600	0.553	−138.0	8.538	100.2	0.0585	44.3	0.422	−57.2	21.10
700	0.537	−146.0	7.425	95.8	0.0616	44.8	0.392	−58.9	19.60
800	0.530	−154.0	6.580	92.0	0.0648	45.5	0.372	−60.1	18.40
900	0.520	−160.0	5.902	89.1	0.0683	46.4	0.357	−61.1	17.40
1000	0.516	−165.0	5.385	85.6	0.0710	47.0	0.343	−62.1	16.50
1200	0.512	−175.0	4.505	80.1	0.0776	49.2	0.327	−64.5	14.90
1400	0.517	177.8	3.887	75.3	0.0843	51.2	0.319	−67.6	13.60
1600	0.521	171.4	3.413	70.9	0.0915	52.5	0.319	−70.4	12.50
1800	0.514	165.2	3.071	66.7	0.0980	53.9	0.323	−72.0	11.60
2000	0.519	158.9	2.773	62.6	0.1060	55.4	0.321	−74.2	10.70
2200	0.522	153.5	2.510	59.6	0.1150	55.9	0.311	−77.6	9.81
2400	0.536	148.9	2.311	56.2	0.1200	56.7	0.311	−82.7	9.19
2600	0.536	143.7	2.132	52.2	0.1270	57.7	0.323	−88.0	8.53
2800	0.539	140.3	1.955	48.1	0.1360	58.5	0.341	−91.5	7.85
3000	0.545	136.6	1.871	45.9	0.1450	57.2	0.351	−93.4	7.54

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.2	0.353	35.0	0.300
1000	1.5	0.311	69.7	0.313
2000	2.4	0.311	140.0	0.174

Table 10 Common emitter scattering parameters (V_{CE} = 8 V; I_C = 15 mA)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.811	−20.9	30.808	166.2	0.00932	79.4	0.950	−11.3	44.50
100	0.753	−49.4	27.203	148.4	0.0213	66.6	0.850	−26.1	37.90
200	0.659	−85.7	21.003	128.3	0.0334	53.5	0.662	−42.0	31.40
300	0.601	−110.0	16.153	115.7	0.0396	48.1	0.527	−50.7	27.50
400	0.568	−127.0	12.934	107.4	0.0439	46.1	0.441	−55.7	24.90
500	0.555	−139.0	10.735	101.5	0.0477	45.8	0.386	−58.9	22.90
600	0.543	−147.0	9.109	96.6	0.0512	46.5	0.351	−61.0	21.30
700	0.532	−155.0	7.891	92.8	0.0543	47.9	0.327	−62.3	19.90
800	0.530	−161.0	6.953	89.4	0.0581	49.3	0.311	−63.3	18.70
900	0.523	−166.0	6.221	86.7	0.0615	50.3	0.298	−64.2	17.70
1000	0.522	−171.0	5.676	83.6	0.0651	51.3	0.288	−65.1	16.80
1200	0.519	−179.0	4.727	78.5	0.0725	53.9	0.275	−67.5	15.20
1400	0.524	173.8	4.072	74.0	0.0802	55.4	0.271	−70.6	13.90
1600	0.524	169.0	3.565	69.9	0.0880	56.3	0.273	−73.2	12.80
1800	0.524	163.3	3.211	65.7	0.0959	57.3	0.276	−74.8	11.90
2000	0.528	157.6	2.894	61.9	0.1050	58.5	0.273	−76.9	11.00
2200	0.532	151.9	2.634	59.2	0.1140	58.5	0.266	−80.9	10.20
2400	0.547	147.9	2.423	55.7	0.1200	59.4	0.267	−86.3	9.55
2600	0.544	143.9	2.230	52.0	0.1270	59.8	0.279	−92.1	8.84
2800	0.549	140.7	2.053	48.1	0.1360	60.0	0.298	−95.7	8.21
3000	0.560	136.4	1.957	45.6	0.145	58.1	0.308	−97.6	7.90

Table 11 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.4	0.305	38.8	0.289
1000	1.7	0.278	78.1	0.318
2000	2.7	0.359	152.0	0.192

Table 12 Common emitter scattering parameters (V_{CE} = 8 V; I_C = 20 mA)

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.784	−23.8	35.157	164.3	0.00953	78.4	0.935	−12.6	44.10
100	0.714	−55.2	30.142	145.0	0.0202	65.0	0.815	−28.6	37.40
200	0.623	−93.3	22.267	124.5	0.0310	52.6	0.613	−44.2	31.10
300	0.569	−117.0	16.274	112.5	0.0366	48.9	0.482	−51.8	27.30
400	0.541	−134.0	13.219	104.7	0.0406	48.4	0.404	−56.1	24.70
500	0.531	−145.0	10.900	99.1	0.0446	48.8	0.353	−58.5	22.80
600	0.522	−153.0	9.222	94.7	0.0483	50.2	0.325	−60.1	21.20
700	0.513	−160.0	7.965	91.1	0.0520	51.8	0.304	−61.2	19.80
800	0.508	−165.0	7.023	87.8	0.0561	53.4	0.292	−61.9	18.60
900	0.501	−171.0	6.273	85.4	0.0603	54.6	0.282	−62.6	17.60
1000	0.505	−176.0	5.703	82.3	0.0640	55.4	0.275	−63.3	16.70
1200	0.504	176.7	4.748	77.4	0.0726	57.8	0.266	−65.6	15.10
1400	0.513	170.3	4.080	73.4	0.0811	59.2	0.263	−69.1	13.80
1600	0.518	165.2	3.592	69.3	0.0901	59.8	0.268	−71.6	12.80
1800	0.517	160.1	3.226	65.0	0.0980	60.6	0.274	−73.0	11.90
2000	0.516	154.4	2.905	61.4	0.1080	61.6	0.272	−75.0	10.90
2200	0.525	148.7	2.632	58.5	0.1170	61.1	0.266	−78.7	10.10
2400	0.540	144.4	2.424	55.3	0.1240	61.5	0.268	−84.1	9.51
2600	0.538	141.1	2.233	51.7	0.1320	62.2	0.281	−89.8	8.82
2800	0.545	136.4	2.053	47.8	0.1410	62.3	0.300	−93.2	8.19
3000	0.550	132.7	1.941	45.5	0.1500	59.9	0.311	−95.0	7.77

Table 13 Common emitter scattering parameters (V_{CE} = 8 V; I_C = 30 mA)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.746	−28.6	40.528	161.6	0.00923	76.2	0.910	−14.6	43.30
100	0.669	−64.9	33.161	140.1	0.0190	61.4	0.761	−31.7	36.70
200	0.585	−105.0	23.008	119.6	0.0279	51.1	0.547	−46.0	30.60
300	0.548	−128.0	16.808	108.4	0.0327	49.4	0.424	−51.7	26.90
400	0.529	−142.0	13.116	101.4	0.0365	50.0	0.357	−54.5	24.40
500	0.522	−152.0	10.735	96.3	0.0409	51.7	0.317	−56.0	22.50
600	0.519	−159.0	9.031	92.2	0.0448	53.3	0.295	−56.9	20.90
700	0.511	−166.0	7.793	88.7	0.0489	55.6	0.280	−57.9	19.50
800	0.511	−170.0	6.842	85.7	0.0533	57.2	0.273	−58.6	18.40
900	0.509	−175.0	6.121	83.4	0.0576	58.2	0.266	−58.8	17.40
1000	0.510	−180.0	5.551	80.5	0.0618	58.8	0.261	−59.7	16.50
1200	0.512	173.0	4.612	76.1	0.0708	61.0	0.256	−62.2	14.90
1400	0.516	167.5	3.982	71.8	0.0801	61.9	0.257	−66.0	13.60
1600	0.517	163.2	3.469	67.6	0.0889	62.3	0.264	−68.8	12.50
1800	0.517	157.5	3.123	63.8	0.0970	62.9	0.272	−70.4	11.60
2000	0.527	152.0	2.817	60.1	0.1070	63.6	0.272	−72.8	10.70
2200	0.532	147.0	2.550	57.4	0.1170	63.0	0.267	−76.7	9.90
2400	0.544	143.2	2.348	54.0	0.1230	63.4	0.269	−82.2	9.26
2600	0.547	139.3	2.160	50.3	0.1320	63.6	0.283	−88.2	8.60
2800	0.550	135.3	1.987	46.9	0.1410	63.4	0.304	−91.8	7.95
3000	0.550	131.7	1.880	44.0	0.1500	61.5	0.315	−93.9	7.50

Table 14 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.0	0.212	46.4	0.336
1000	2.5	0.211	93.5	0.379
2000	3.5	0.379	166.0	0.213

NPN 5 GHz wideband transistor — BFG90A

DESCRIPTION

NPN transistor in a 4-lead dual-emitter plastic SOT103 envelope.

It is designed for application in wideband amplifiers, such as MATV and CATV systems, up to 5 GHz.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

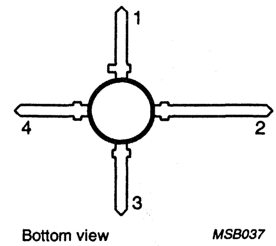


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	–	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	0.35	–	pF
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	19	–	dB
F	noise figure	I_C = 14 mA; V_{CE} = 10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.4	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	8	–	dBm
ITO	third order intercept point	I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	27	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

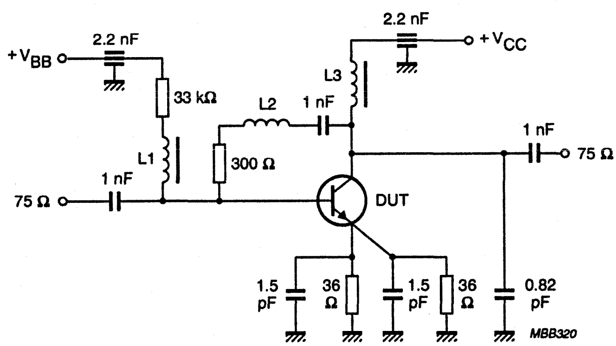
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 14$ mA; $V_{CE} = 10$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 14$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	19	–	dB
		$I_C = 14$ mA; $V_{CE} = 10$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	10.5	–	dB
F	noise figure	$I_C = 4$ mA; $V_{CE} = 10$ V; Z_S = opt.; f = 800 MHz; $T_{amb} = 25$ °C	–	1.7	–	dB
		$I_C = 14$ mA; $V_{CE} = 10$ V; Z_S = opt.; f = 800 MHz; $T_{amb} = 25$ °C	–	2.4	–	dB
		$I_C = 4$ mA; $V_{CE} = 10$ V; $Z_S = 60\ \Omega$; f = 2 GHz; $T_{amb} = 25$ °C	–	3.6	–	dB
P_{L1}	output power at 1 dB gain compression	note 2	–	8	–	dBm
ITO	third order intercept point (see Fig.2)	note 3	–	27	–	dBm
V_O	output voltage	note 4	–	150	–	mV
d_2	second order intermodulation distortion (see Fig.2)	note 5	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C
   measured at f = 800 MHz.
3. $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   P_p = ITO – 6 dB; f_p = 800 MHz;
   P_q = ITO – 6 dB; f_q = 801 MHz;
   measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz.
4. $d_{im} = -60$ dB; $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
5. $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25$ °C;
   $V_p = V_O$ = 60 mV at f_p = 250 MHz;
   $V_q = V_O$ = 60 mV at f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.



L1 = L3 = 5 μH Ferroxcube choke.

L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

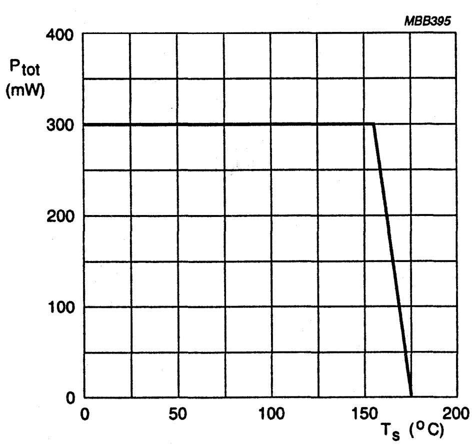
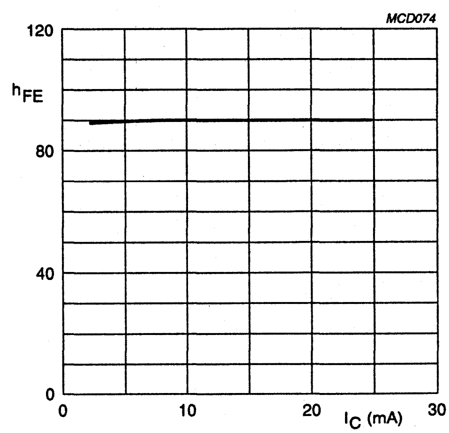
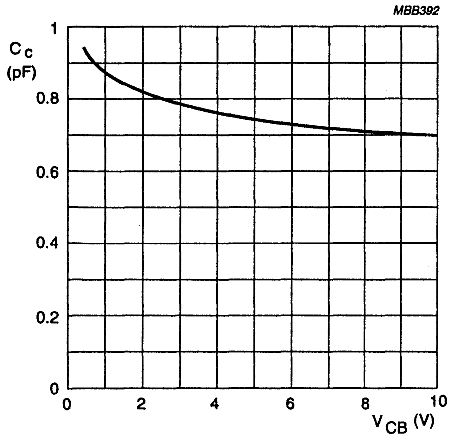


Fig.3 Power derating curve.



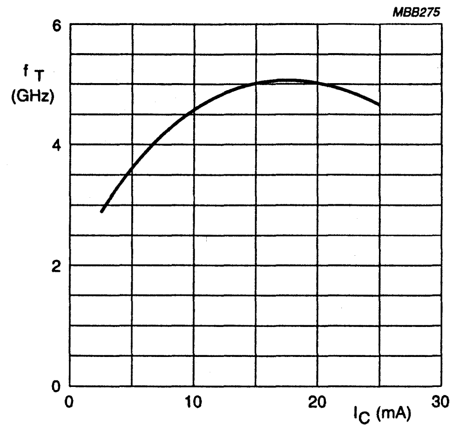
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



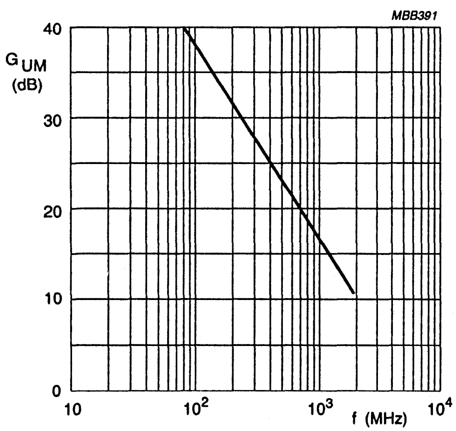
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



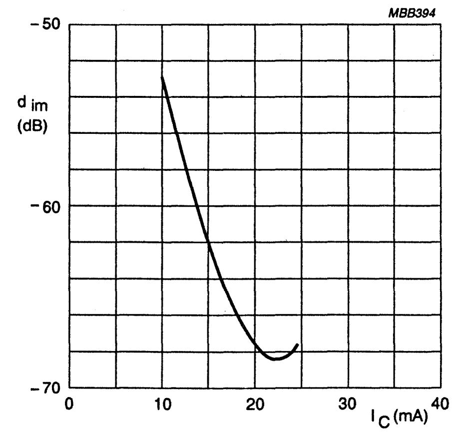
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



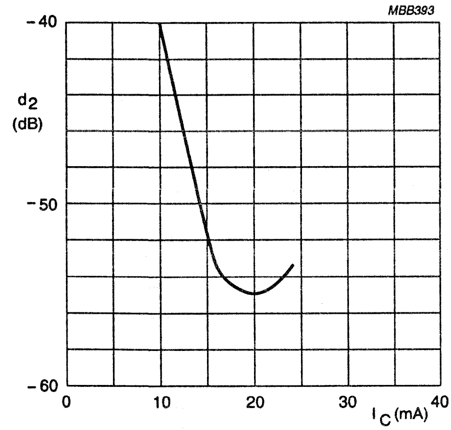
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



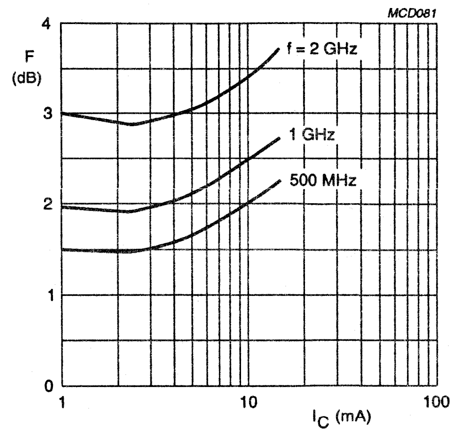
V_{CE} = 10 V; V_O = 150 mV; $f_{(p+q)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation distortion as a function of collector current.



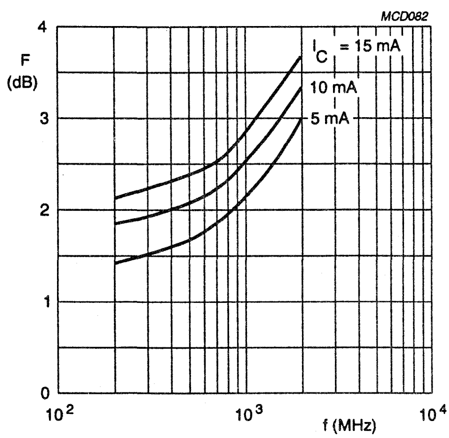
V_{CE} = 10 V; V_O = 60 dBmV; $f_{(p+q)}$ = 810 MHz;
T_{amb} = 25 °C.

Fig.9 Second order intermodulation distortion as a function of collector current.



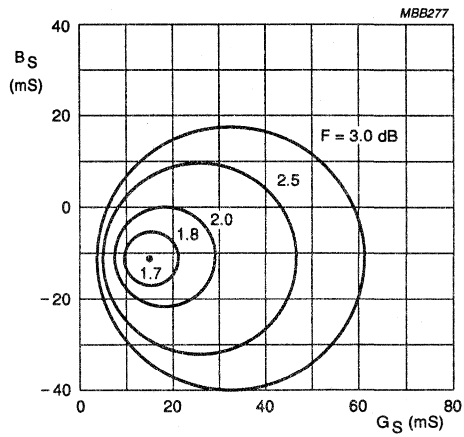
V_{CE} = 10 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



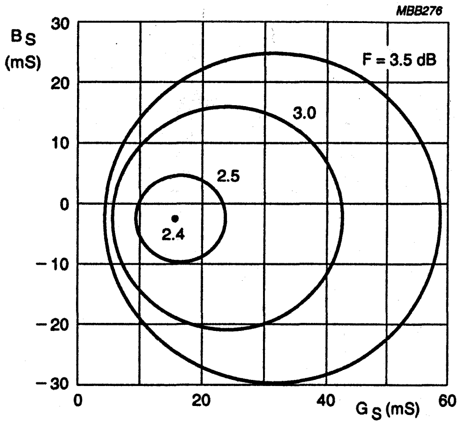
V_{CE} = 10 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



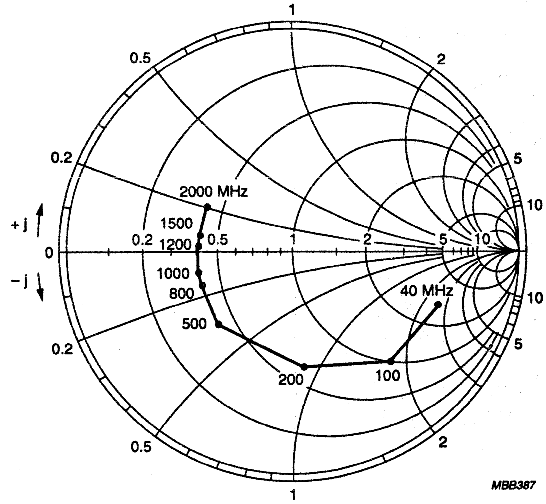
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.12 Noise circle figure.



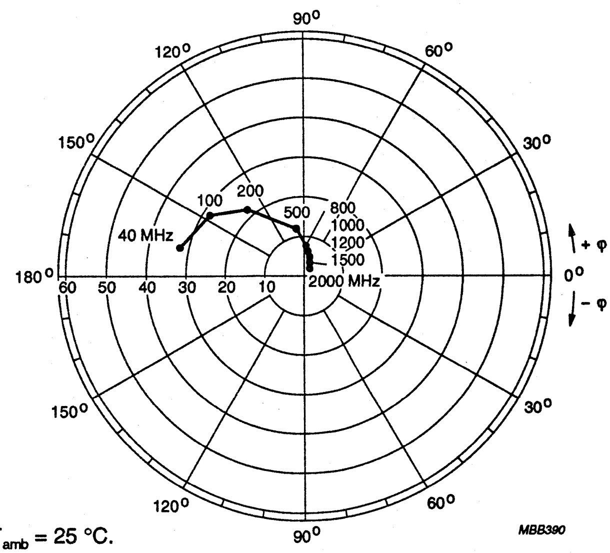
I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.13 Noise circle figure.



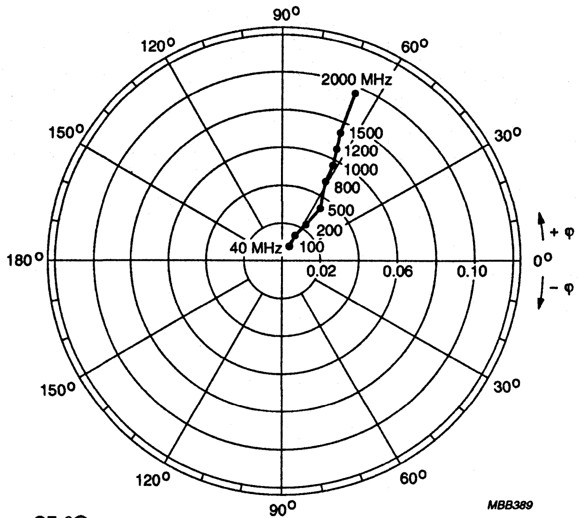
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter input reflection coefficient (S_{11}).



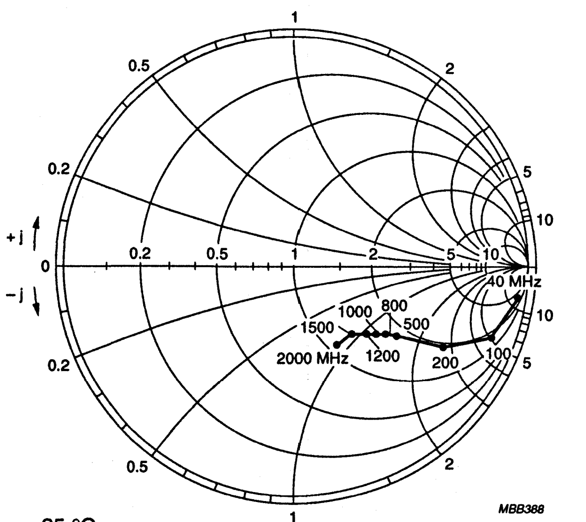
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.865	−11.2	14.825	171.5	0.007	83.0	0.992	−4.6	47.4
100	0.836	−26.9	14.202	159.8	0.017	74.4	0.961	−11.3	39.4
200	0.756	−51.4	12.641	142.9	0.031	63.3	0.881	−20.2	32.2
300	0.678	−72.8	10.989	129.2	0.040	55.0	0.797	−26.4	27.9
400	0.618	−90.1	9.526	118.7	0.047	49.6	0.728	−30.5	24.9
500	0.573	−104.7	8.283	110.0	0.052	46.0	0.678	−33.6	22.8
600	0.535	−116.9	7.278	103.0	0.056	43.6	0.639	−35.7	21.0
700	0.507	−126.7	6.416	96.9	0.059	42.2	0.613	−37.5	19.5
800	0.486	−135.9	5.760	91.9	0.062	41.6	0.591	−38.7	18.2
900	0.467	−143.8	5.208	87.1	0.065	41.2	0.573	−39.9	17.1
1000	0.458	−151.9	4.734	82.7	0.068	40.6	0.557	−41.0	16.1
1200	0.438	−166.4	4.081	74.2	0.073	39.8	0.528	−44.5	14.6
1400	0.445	−178.9	3.536	66.9	0.079	38.8	0.507	−49.2	13.2
1600	0.442	172.1	3.117	60.2	0.084	38.9	0.502	−53.9	12.1
1800	0.439	164.8	2.840	54.0	0.091	39.2	0.503	−57.8	11.3
2000	0.446	154.8	2.586	47.9	0.097	38.3	0.498	−60.8	10.5
2200	0.457	146.7	2.352	42.2	0.102	38.0	0.477	−64.2	9.6
2400	0.483	139.4	2.189	37.4	0.107	37.4	0.457	−69.7	9.0
2600	0.499	134.7	2.058	31.3	0.114	35.9	0.458	−76.4	8.5
2800	0.504	129.5	1.921	24.8	0.121	34.9	0.467	−82.4	8.0
3000	0.509	123.9	1.813	20.8	0.129	34.5	0.477	−86.0	7.6

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.716	−19.0	28.898	165.8	0.006	80.0	0.967	−8.4	44.2
100	0.657	−45.6	25.907	148.8	0.014	69.1	0.879	−18.6	37.2
200	0.549	−82.6	20.511	128.3	0.023	59.1	0.718	−27.6	30.9
300	0.486	−108.7	16.018	115.3	0.028	55.8	0.612	−30.8	27.3
400	0.455	−126.7	12.843	106.8	0.032	55.7	0.549	−32.0	24.7
500	0.440	−139.7	10.625	100.8	0.036	56.7	0.512	−32.6	22.8
600	0.429	−149.4	9.063	96.2	0.040	58.1	0.489	−33.2	21.2
700	0.420	−157.3	7.895	92.2	0.044	59.3	0.475	−33.9	19.9
800	0.412	−164.1	6.981	88.7	0.048	60.5	0.465	−34.7	18.7
900	0.406	−170.6	6.233	85.4	0.052	61.7	0.457	−35.6	17.7
1000	0.403	−176.7	5.608	82.7	0.056	62.7	0.450	−36.6	16.7
1200	0.411	172.6	4.702	77.9	0.064	63.9	0.436	−39.5	15.2
1400	0.427	164.4	4.108	73.3	0.072	63.9	0.423	−43.3	14.0
1600	0.429	158.5	3.599	68.5	0.080	65.9	0.423	−47.5	12.9
1800	0.428	152.0	3.212	65.0	0.090	65.5	0.425	−51.6	11.9
2000	0.434	144.3	2.908	60.9	0.097	65.8	0.423	−54.9	11.0
2200	0.459	137.2	2.692	58.1	0.105	65.5	0.412	−58.4	10.4
2400	0.487	132.6	2.480	53.0	0.112	66.0	0.396	−63.7	9.8
2600	0.504	129.8	2.252	50.8	0.122	65.9	0.390	−70.5	9.0
2800	0.506	125.7	2.181	46.9	0.128	64.9	0.399	−76.8	8.8
3000	0.507	119.4	2.019	42.4	0.135	65.9	0.411	−81.2	8.2

NPN 6 GHz wideband transistor BFG91A

DESCRIPTION

NPN transistor in a 4-lead dual-emitter plastic SOT103 envelope.

It is designed for application in wideband amplifiers, such as MATV and CATV systems.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

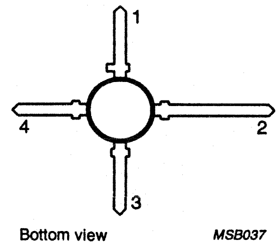


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	–	6	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	17.5	–	dB
F	noise figure	I_C = 30 mA; V_{CE} = 8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	17	–	dBm
ITO	third order intercept point	I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	36	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 158 °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

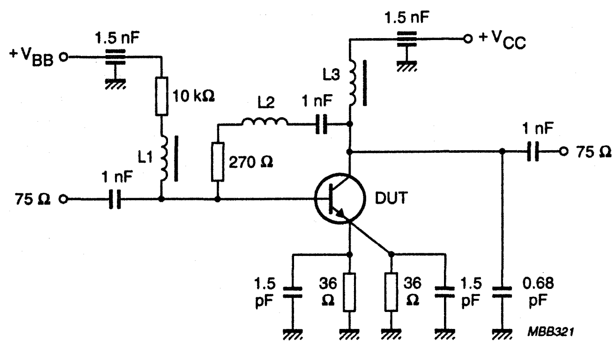
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.9	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 5$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	–	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	17.5	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	9.5	–	dB
F	noise figure	$I_C = 4$ mA; $V_{CE} = 8$ V; Z_S = opt.; f = 800 MHz; $T_{amb} = 25$ °C	–	1.6	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; Z_S = opt.; f = 800 MHz; $T_{amb} = 25$ °C	–	2.3	–	dB
P_{L1}	output power at 1 dB gain compression	$V_{CE} = 8$ V; $I_C = 30$ mA; $R_L = 75\ \Omega$; f = 800 MHz; $T_{amb} = 25$ °C	–	17	–	dBm
ITO	third order intercept point (see Fig. 2)	note 2	–	36	–	dBm
V_O	output voltage	note 3	–	425	–	mV
d_2	second order intermodulation distortion (see Fig.2)	note 4	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 30$ mA; $V_{CE} = 8$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   P_p = ITO – 6 dB; $f_p = 800$ MHz;
   P_q = ITO – 6 dB; $f_q = 801$ MHz;
   measured at $f_{(2q-p)} = 802$ MHz and at $f_{(2p-q)} = 799$ MHz.
3. $d_{im} = -60$ dB; $I_C = 30$ mA; $V_{CE} = 8$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $I_C = 30$ mA; $V_{CE} = 8$ V; $R_L = 75\ \Omega$; VSWR < 2; $T_{amb} = 25$ °C;
   $V_p = V_O = 200$ mV at $f_p = 250$ MHz;
   $V_q = V_O = 200$ mV at $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.



L1 = L3 = 5 μH Ferroxcube choke.

L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

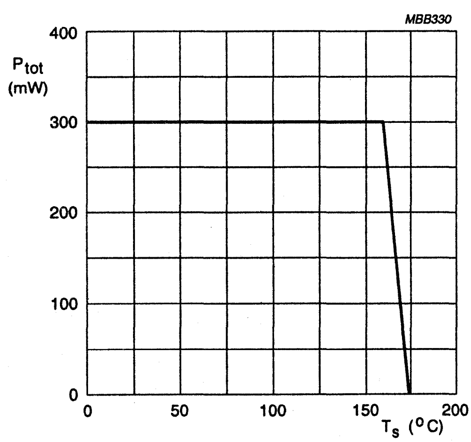
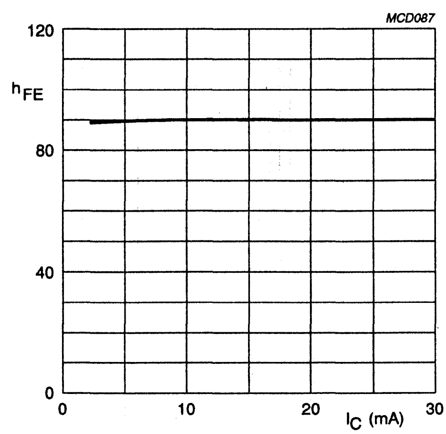
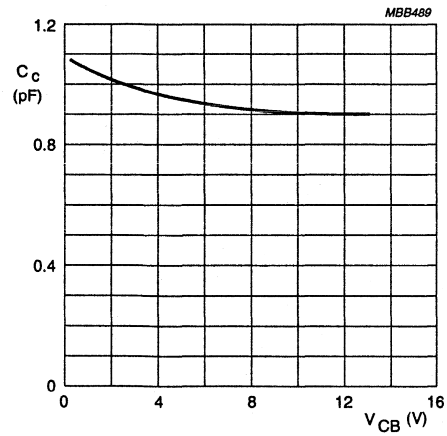


Fig.3 Power derating curve.



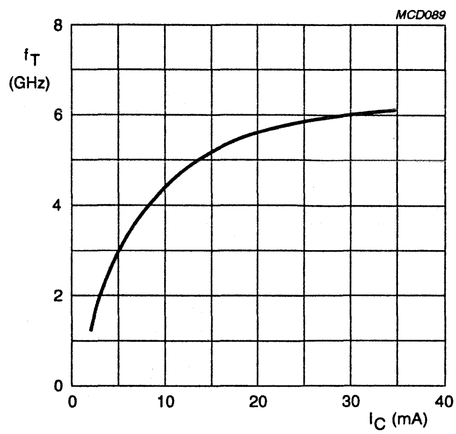
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



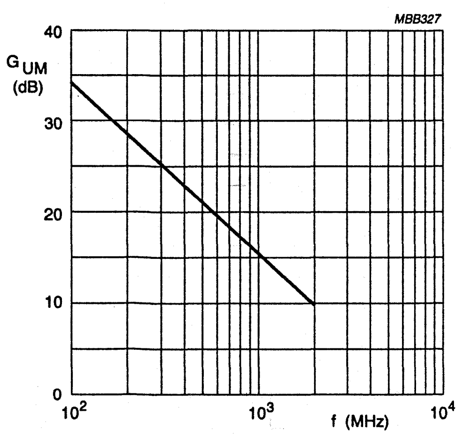
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



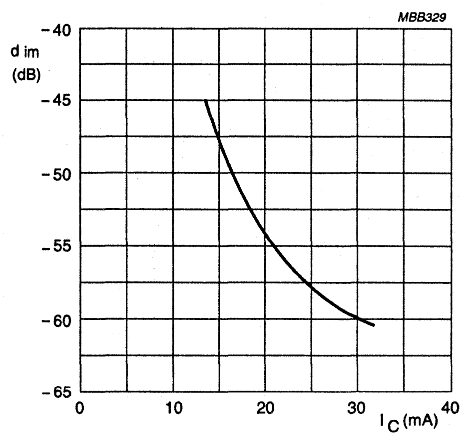
V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



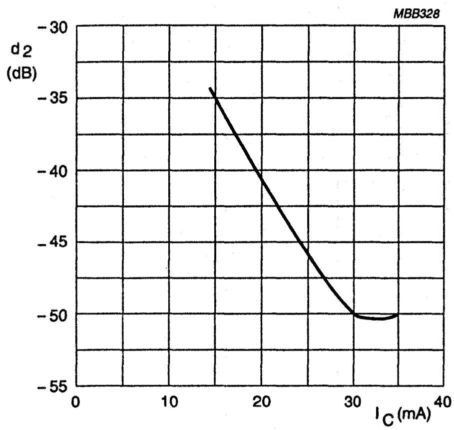
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



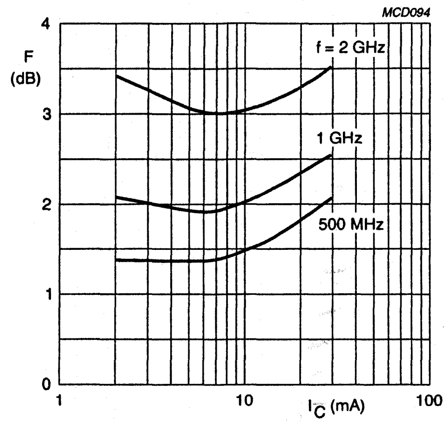
V_{CE} = 8 V; V_O = 425 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation distortion as a function of collector current.



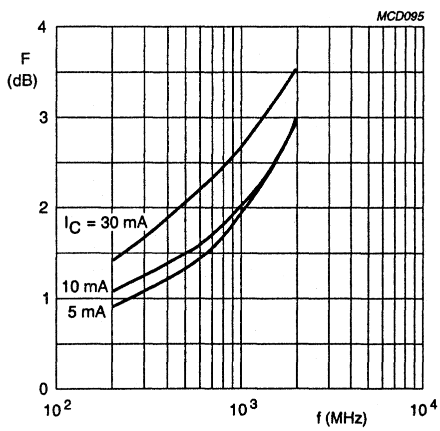
V_{CE} = 8 V; V_O = 200 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.9 Second order intermodulation distortion as a function of collector current.



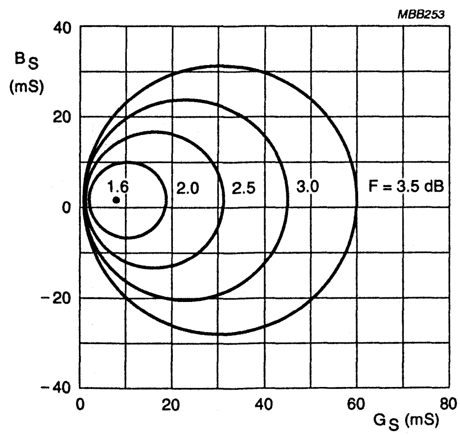
V_{CE} = 8 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



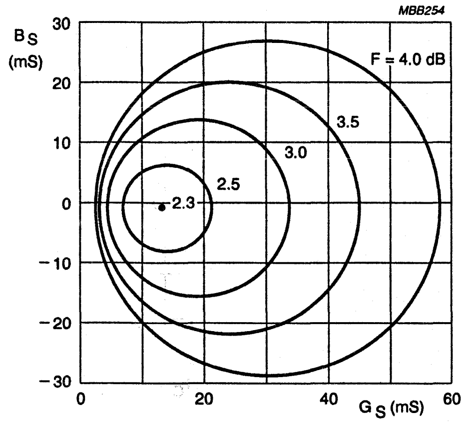
V_{CE} = 8 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



V_{CE} = 8 V; I_C = 4 mA; f = 800 MHz; T_{amb} = 25 °C.

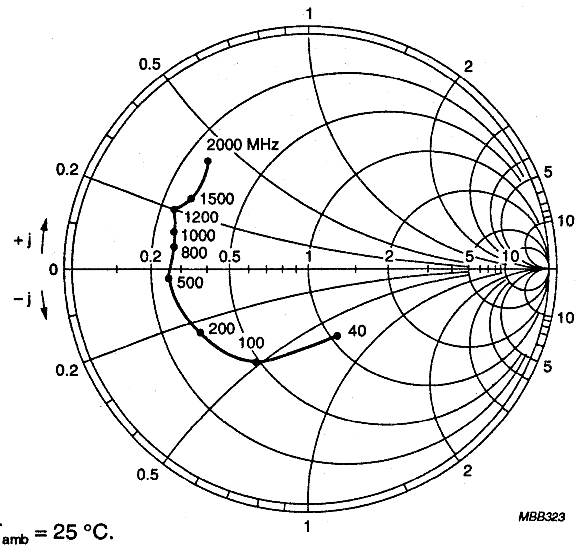
Fig.12 Noise circle figure.



V_{CE} = 8 V; I_C = 30 mA; f = 800 MHz; T_{amb} = 25 °C.

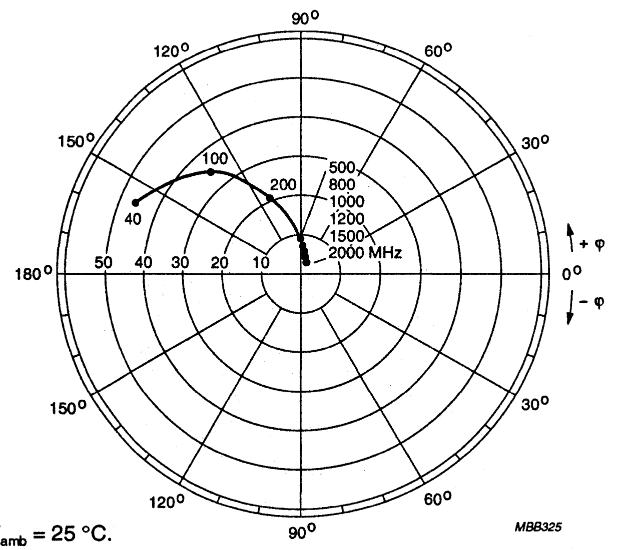
Fig.13 Noise circle figure.

NPN 6 GHz wideband transistor BFG91A



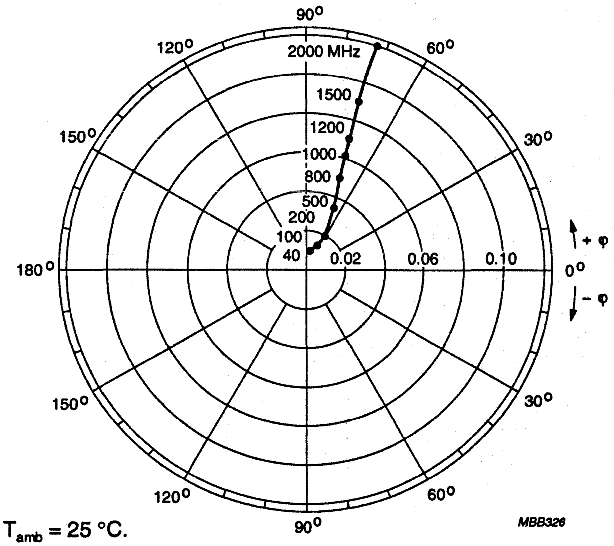
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.14 Common emitter input reflection coefficient (S_{11}).



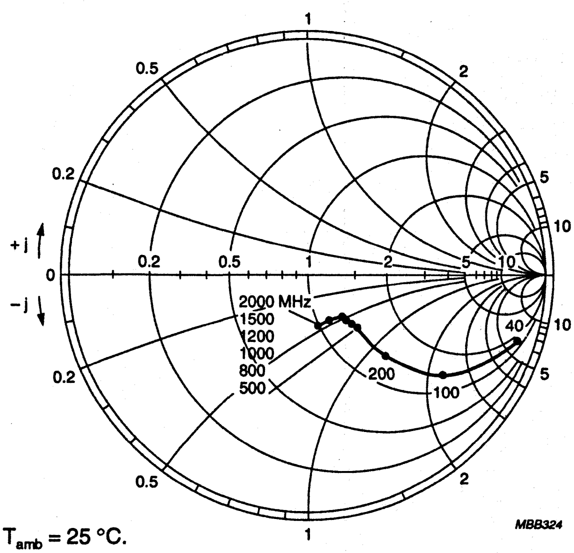
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.687	−29.3	25.578	163.6	0.009	84.2	0.960	−10.0	42.0
100	0.652	−66.0	21.764	143.8	0.021	63.3	0.847	−21.5	34.6
200	0.623	−106.0	15.792	123.8	0.030	48.9	0.665	−30.4	28.6
300	0.614	−129.5	11.802	111.9	0.035	42.7	0.553	−32.6	25.1
400	0.608	−142.9	9.275	104.4	0.038	41.5	0.489	−32.6	22.5
500	0.615	−152.2	7.658	99.2	0.041	41.2	0.453	−32.2	20.7
600	0.612	−159.2	6.491	94.9	0.044	44.2	0.429	−31.6	19.2
700	0.612	−164.5	5.641	91.4	0.045	45.5	0.412	−31.4	17.9
800	0.609	−169.4	4.996	88.1	0.049	46.7	0.402	−31.1	16.8
900	0.601	−173.5	4.461	85.3	0.051	48.4	0.393	−31.4	15.7
1000	0.606	−177.4	4.034	82.7	0.054	50.9	0.386	−31.6	14.8
1200	0.606	176.1	3.377	78.1	0.060	52.1	0.374	−32.7	13.2
1400	0.605	170.3	2.914	73.8	0.065	53.5	0.367	−34.5	11.9
1600	0.605	167.0	2.571	69.4	0.071	56.3	0.366	−36.5	10.8
1800	0.596	162.0	2.290	65.8	0.079	56.7	0.360	−38.3	9.7
2000	0.599	157.2	2.074	62.5	0.084	59.3	0.350	−40.1	8.8

Table 2 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.475	−48.9	47.699	157.1	0.008	83.2	0.910	−18.1	42.3
100	0.507	−97.9	36.132	133.1	0.016	60.1	0.707	−35.9	35.4
200	0.545	−134.2	23.140	113.8	0.022	52.8	0.476	−46.7	29.9
300	0.568	−151.6	16.353	104.0	0.025	52.4	0.364	−48.9	26.6
400	0.574	−160.6	12.551	97.9	0.029	53.3	0.305	−48.5	24.1
500	0.580	−166.3	10.211	93.8	0.033	56.7	0.274	−47.6	22.3
600	0.582	−171.1	8.574	90.3	0.038	60.8	0.254	−46.5	20.8
700	0.584	−174.8	7.407	87.4	0.041	62.0	0.240	−46.3	19.5
800	0.578	−178.0	6.532	84.8	0.047	63.4	0.232	−45.5	18.3
900	0.580	178.8	5.822	82.4	0.052	64.1	0.226	−45.5	17.3
1000	0.584	175.8	5.263	80.3	0.057	66.1	0.221	−45.6	16.4
1200	0.587	170.4	4.393	76.4	0.065	65.8	0.213	−47.4	14.9
1400	0.586	166.3	3.775	72.7	0.074	67.1	0.210	−49.7	13.6
1600	0.588	163.1	3.335	68.7	0.083	66.6	0.212	−51.6	12.5
1800	0.580	159.6	2.974	65.4	0.093	66.3	0.210	−54.4	11.4
2000	0.585	154.4	2.700	62.3	0.102	66.7	0.202	−56.7	10.6

NPN 5 GHz wideband transistors BFG92A; BFG92A/X; BFG92A/XR

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG92 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is primarily intended for wideband applications in the UHF and microwave range.

PINNING

PIN	DESCRIPTION
BFG92A (Fig.1) Code: P8	
1	collector
2	base
3	emitter
4	emitter
BFG92A/X (Fig.1) Code: V14	
1	collector
2	emitter
3	base
4	emitter
BFG92A/XR (Fig.2) Code: V29	
1	collector
2	emitter
3	base
4	emitter

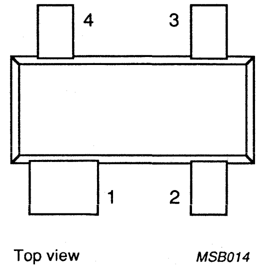


Fig.1 SOT143.

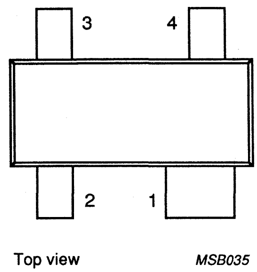


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	17	–	dB
		I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	2.1	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 10 V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 10 V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	17	–	dB
		I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	2.1	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

NPN 5 GHz wideband transistors
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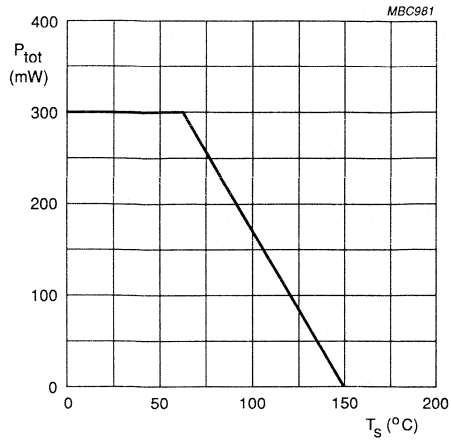
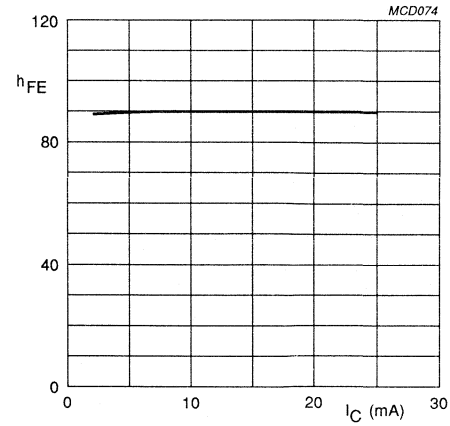
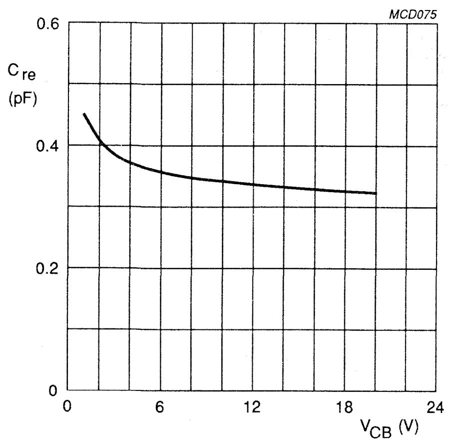


Fig.3 Power derating curve.



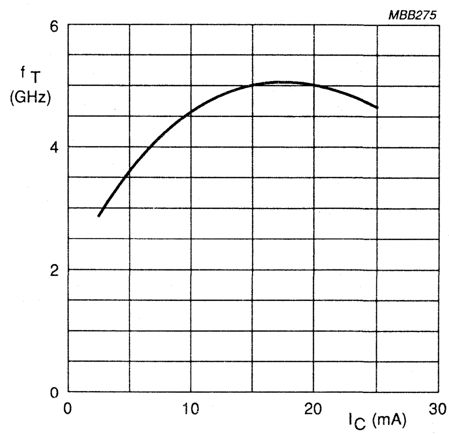
V_{CE} = 10 V.

Fig.4 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

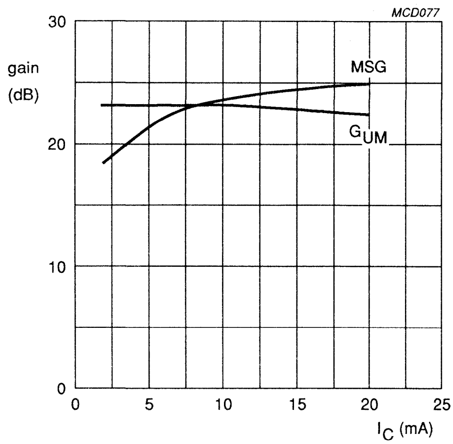
Fig.5 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 10 V; T_{amb} = 25 °C; f = 500 MHz.

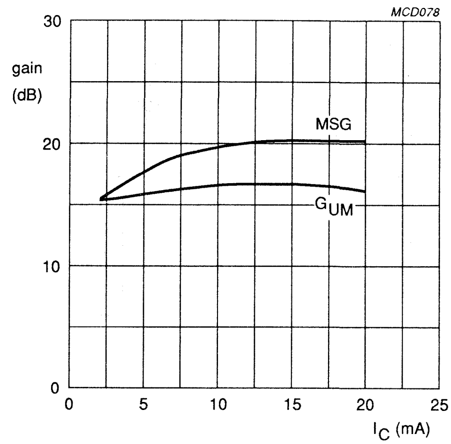
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



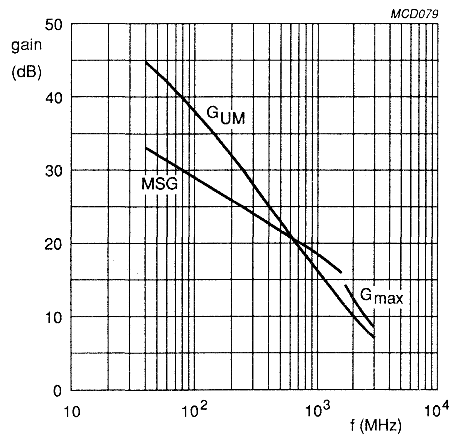
V_{CE} = 10 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



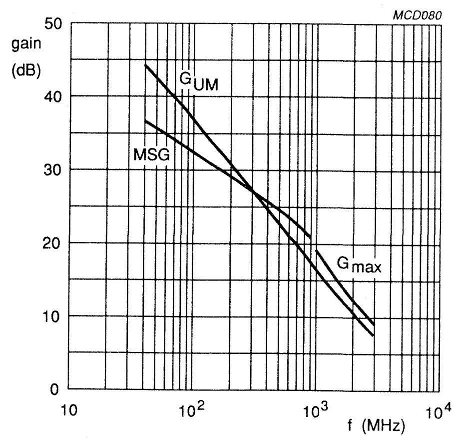
V_{CE} = 10 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



V_{CE} = 10 V; I_C = 5 mA.

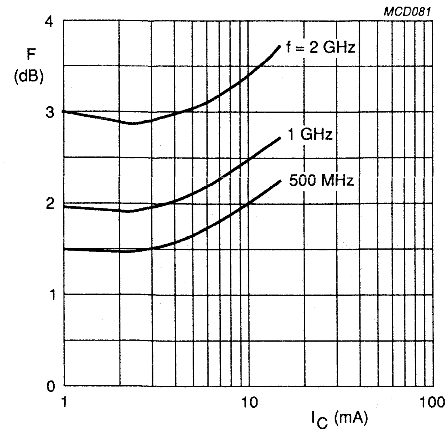
Fig.9 Gain as a function of frequency.



V_{CE} = 10 V; I_C = 15 mA.

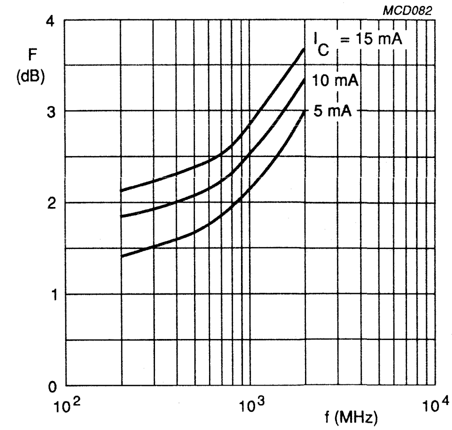
Fig.10 Gain as a function of frequency.

NPN 5 GHz wideband transistors BFG92A; BFG92A/X; BFG92A/XR



V_{CE} = 10 V.

Fig.11 Minimum noise figure as a function of collector current.



V_{CE} = 10 V.

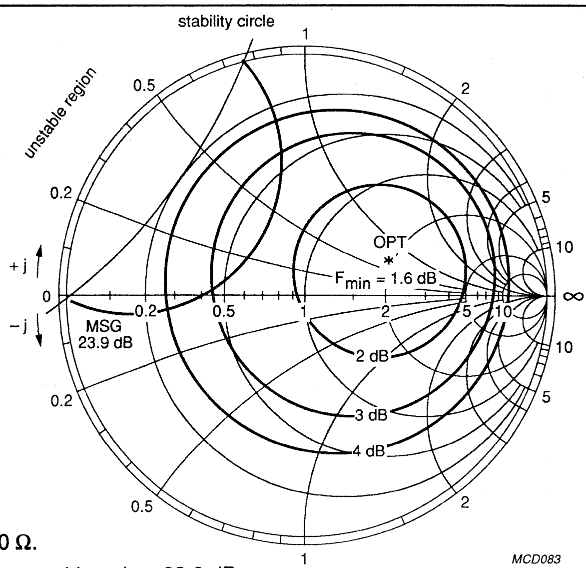
Fig.12 Minimum noise figure as a function of frequency.

BFG92A/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		R_n/50
	(mag)	(ang)	
1.6	0.384	21.6	0.4



Z_o = 50 Ω.
Maximum stable gain = 23.9 dB.

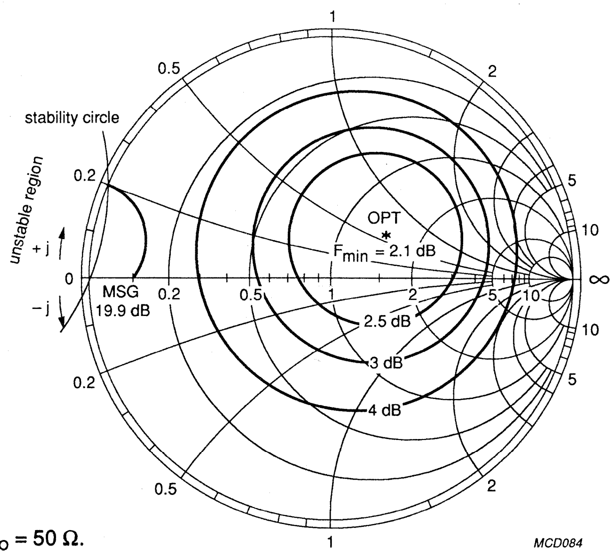
Fig.13 Noise circle figure.

BFG92A/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.1	0.288	39.9	0.45



Z_O = 50 Ω.

Maximum stable gain = 19.9 dB.

Fig.14 Noise circle figure.

BFG92A/X

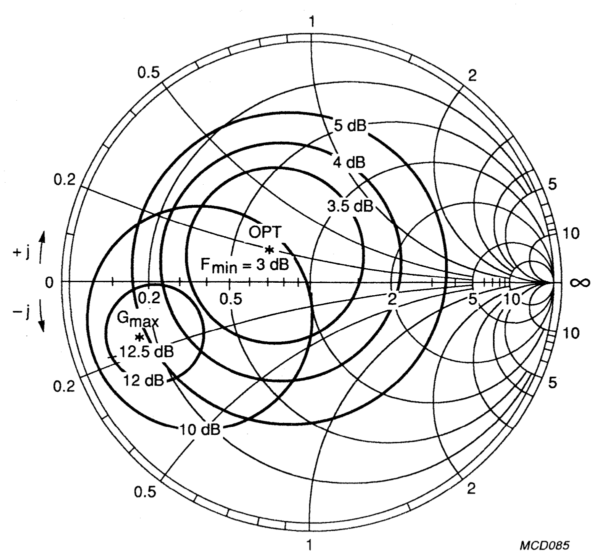
f (MHz)	V_{CE} (V)	I_C (mA)
2000	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3	0.21	142.8	0.2

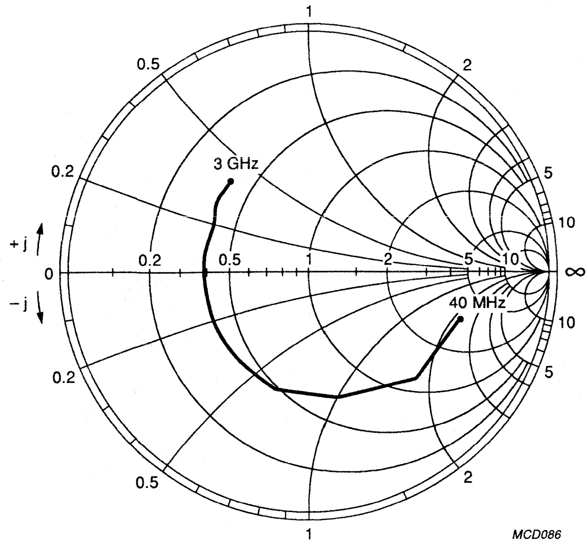
Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
12.5	0.734	−162



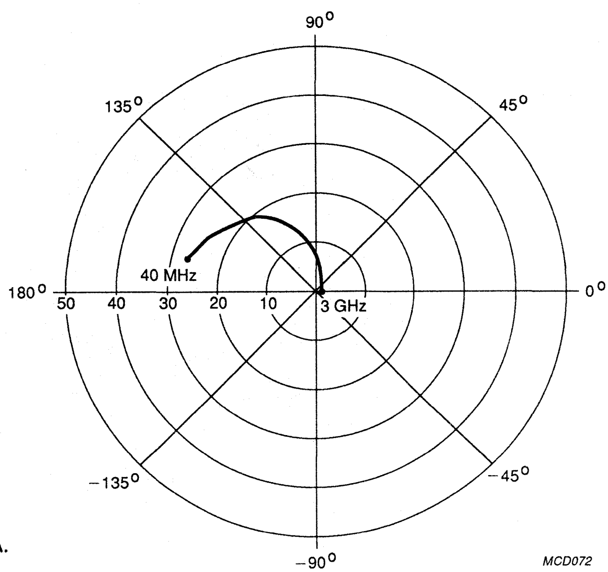
Z_O = 50 Ω.

Fig.15 Noise circle figure.



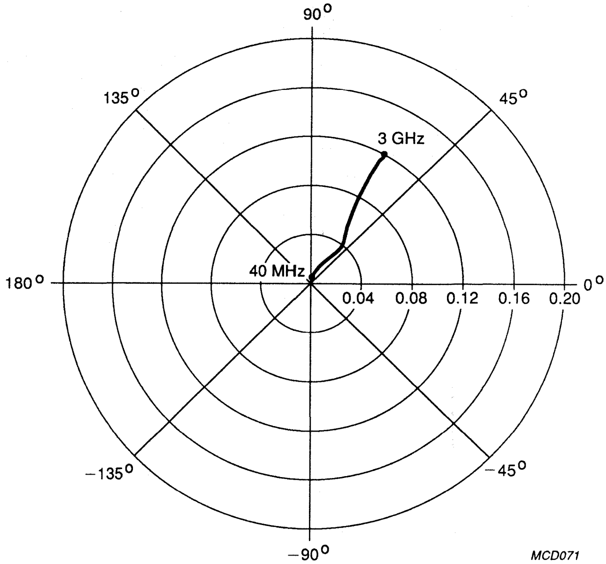
V_{CE} = 10 V; I_C = 15 mA.

Fig.16 Common emitter input reflection coefficient (S_{11}).



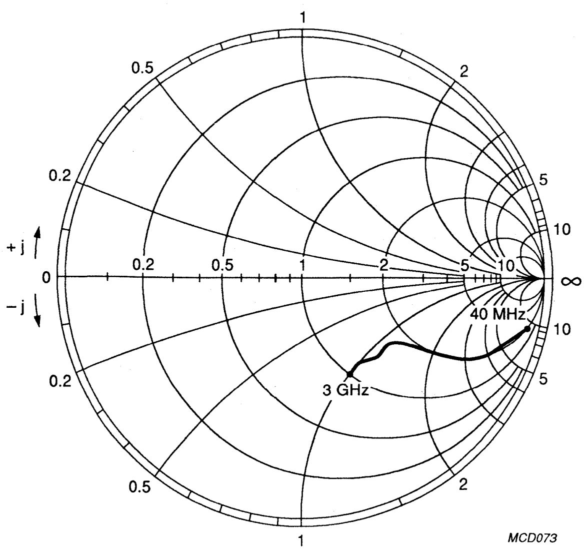
V_{CE} = 10 V; I_C = 15 mA.

Fig.17 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 10 V; I_C = 15 mA.

Fig.18 Common emitter reverse transmission coefficient (S_{12}).

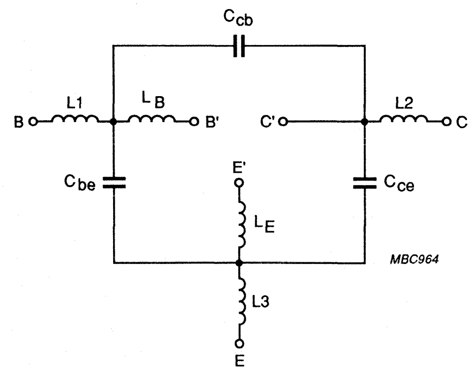


V_{CE} = 10 V; I_C = 15 mA.

Fig.19 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR90A crystal

1	IS = 411.8	aA
2	BF = 102.6	–
3	NF = 997.2	m
4	VAF = 62.67	V
5	IKF = 3.200	A
6	ISE = 4.010	fA
7	NE = 1.577	–
8	BR = 18.10	–
9	NR = 996.2	m
10	VAR = 3.369	V
11	IKR = 1.281	A
12	ISC = 279.9	aA
13	NC = 1.075	–
14	RB = 10.00	Ω
15	IRB = 1.000	uA
16	RBM = 10.00	Ω
17	RE = 1.164	Ω
18	RC = 2.320	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 890.5	fF
23	VJE = 600.0	mV
24	MJE = 258.5	m
25	TF = 15.49	ps
26	XTF = 39.14	
27	VTF = 2.152	V
28	ITF = 213.7	mA
29	PTF = 0.000	deg
30	CJC = 546.5	fF
31	VJC = 380.8	mV
32	MJC = 202.9	m
33	XCJC = 150.0	m
34	TR = 5.618	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	
38	FC = 850.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.20 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.20)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.894	−6.9	6.556	174.8	0.008	86.3	0.996	−2.6	44.4
100	0.883	−17.0	6.441	167.5	0.019	80.5	0.987	−6.5	38.5
200	0.850	−33.4	6.156	156.1	0.036	71.7	0.957	−12.4	32.1
300	0.811	−48.9	5.801	145.9	0.051	64.1	0.918	−17.6	28.0
400	0.769	−62.9	5.370	136.7	0.063	57.6	0.876	−21.9	24.8
500	0.729	−75.7	4.939	128.8	0.072	52.6	0.836	−25.4	22.4
600	0.695	−87.0	4.546	122.0	0.079	48.4	0.801	−28.3	20.5
700	0.662	−97.2	4.186	115.8	0.085	45.0	0.772	−30.7	18.9
800	0.631	−106.3	3.851	110.0	0.089	42.3	0.746	−32.6	17.4
900	0.604	−114.7	3.544	105.0	0.092	40.1	0.725	−34.2	16.2
1000	0.582	−122.6	3.270	100.4	0.094	38.6	0.706	−35.7	15.1
1200	0.556	−137.5	2.843	92.4	0.098	36.1	0.675	−38.7	13.3
1400	0.544	−149.9	2.532	85.2	0.101	34.2	0.655	−41.8	12.0
1600	0.536	−159.2	2.261	78.9	0.102	34.1	0.644	−44.7	10.9
1800	0.522	−168.1	2.032	74.0	0.105	34.4	0.639	−47.1	9.8
2000	0.512	−177.1	1.846	68.8	0.105	35.1	0.628	−49.3	8.8
2200	0.515	174.2	1.697	64.3	0.107	35.7	0.610	−52.3	8.0
2400	0.528	167.1	1.569	58.9	0.107	36.7	0.597	−56.5	7.2
2600	0.534	161.4	1.436	55.3	0.110	38.3	0.597	−61.0	6.5
2800	0.536	155.8	1.372	51.1	0.113	39.0	0.606	−64.6	6.2
3000	0.537	150.0	1.274	46.9	0.115	41.1	0.612	−67.4	5.6

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Table 2 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.785	−11.3	14.028	172.0	0.007	84.7	0.990	−4.4	44.0
100	0.762	−27.7	13.467	161.2	0.017	76.1	0.962	−10.8	37.6
200	0.707	−52.8	12.081	145.7	0.031	65.0	0.886	−19.3	31.3
300	0.653	−74.2	10.574	133.1	0.041	56.8	0.804	−25.3	27.4
400	0.609	−91.9	9.151	123.3	0.048	51.4	0.734	−29.3	24.6
500	0.577	−106.3	7.958	115.5	0.053	48.3	0.680	−32.0	22.5
600	0.554	−118.0	7.010	109.4	0.057	46.1	0.640	−33.8	20.8
700	0.534	−127.8	6.235	104.1	0.060	45.1	0.610	−35.1	19.4
800	0.517	−136.4	5.588	99.3	0.062	44.5	0.588	−36.1	18.1
900	0.504	−144.0	5.046	95.3	0.065	44.5	0.571	−37.0	17.0
1000	0.496	−151.0	4.583	91.7	0.067	44.8	0.557	−37.8	16.1
1200	0.492	−163.0	3.887	85.4	0.072	45.6	0.535	−39.8	14.5
1400	0.494	−172.6	3.393	79.7	0.076	46.5	0.521	−42.4	13.2
1600	0.494	−179.8	2.995	74.5	0.081	48.1	0.517	−45.0	12.1
1800	0.487	173.1	2.674	70.4	0.086	49.4	0.516	−47.1	11.1
2000	0.486	165.5	2.419	66.0	0.091	50.9	0.510	−48.9	10.2
2200	0.498	158.6	2.214	62.4	0.096	51.7	0.496	−51.6	9.4
2400	0.513	153.4	2.038	57.9	0.100	52.8	0.484	−55.7	8.7
2600	0.520	149.1	1.863	54.7	0.107	53.8	0.484	−60.5	7.9
2800	0.522	144.8	1.768	51.0	0.113	53.9	0.494	−64.2	7.6
3000	0.525	139.7	1.642	47.3	0.118	55.1	0.502	−66.9	7.0

Table 3 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.332	22.7	0.340
1000	2.1	0.269	43.4	0.400
2000	3.0	0.219	154.8	0.250

Table 4 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.663	−17.1	22.606	168.9	0.007	82.7	0.980	−6.6	43.5
100	0.635	−41.4	20.907	154.4	0.016	71.6	0.923	−15.2	36.9
200	0.577	−75.1	17.229	135.7	0.026	60.0	0.795	−25.1	30.8
300	0.538	−99.8	13.987	122.6	0.033	53.7	0.688	−30.1	27.2
400	0.516	−117.6	11.484	113.5	0.037	50.7	0.614	−32.6	24.6
500	0.503	−131.0	9.654	106.7	0.041	49.9	0.564	−34.0	22.6
600	0.495	−141.1	8.302	101.5	0.044	50.0	0.532	−34.8	21.0
700	0.487	−149.2	7.268	97.1	0.047	50.9	0.510	−35.4	19.7
800	0.480	−156.2	6.442	93.1	0.050	51.6	0.495	−35.9	18.5
900	0.475	−162.5	5.773	89.8	0.052	52.6	0.484	−36.3	17.5
1000	0.473	−168.0	5.213	86.7	0.056	53.8	0.475	−36.9	16.6
1200	0.479	−177.3	4.381	81.4	0.062	55.5	0.461	−38.7	15.0
1400	0.487	175.3	3.799	76.5	0.068	56.7	0.453	−41.2	13.8
1600	0.488	169.6	3.341	71.9	0.075	58.2	0.452	−44.0	12.7
1800	0.483	163.5	2.974	68.2	0.082	59.0	0.455	−46.0	11.6
2000	0.486	156.8	2.688	64.2	0.088	60.0	0.451	−47.8	10.7
2200	0.501	150.9	2.458	61.0	0.095	60.3	0.439	−50.4	10.0
2400	0.518	146.7	2.260	56.9	0.101	60.8	0.428	−54.6	9.3
2600	0.524	143.4	2.064	53.9	0.108	61.1	0.428	−59.6	8.6
2800	0.525	139.4	1.951	50.4	0.115	60.6	0.439	−63.6	8.1
3000	0.529	135.0	1.812	47.0	0.121	61.2	0.447	−66.3	7.6

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.0	0.206	24.5	0.35
1000	2.5	0.151	55.9	0.40
2000	3.4	0.217	175.6	0.27

Table 6 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 15 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.581	−22.4	28.521	166.5	0.006	81.4	0.969	−8.0	43.1
100	0.554	−53.0	25.474	149.4	0.014	69.0	0.888	−18.1	36.5
200	0.514	−91.3	19.658	129.4	0.023	57.7	0.732	−27.5	30.5
300	0.495	−116.1	15.275	116.8	0.028	53.3	0.622	−31.2	27.0
400	0.488	−132.4	12.229	108.4	0.032	52.2	0.555	−32.5	24.5
500	0.483	−144.1	10.134	102.2	0.035	53.1	0.513	−33.1	22.6
600	0.481	−152.6	8.632	97.6	0.038	54.2	0.488	−33.5	21.0
700	0.478	−159.6	7.515	93.7	0.042	55.5	0.472	−33.8	19.7
800	0.475	−165.6	6.635	90.1	0.045	56.6	0.461	−34.2	18.6
900	0.473	−170.9	5.932	87.1	0.048	57.9	0.454	−34.7	17.6
1000	0.473	−175.6	5.346	84.3	0.052	59.0	0.448	−35.3	16.6
1200	0.482	176.4	4.479	79.4	0.059	60.6	0.437	−37.1	15.1
1400	0.491	170.2	3.875	74.8	0.066	61.6	0.432	−39.8	13.9
1600	0.492	165.1	3.402	70.4	0.073	62.8	0.433	−42.7	12.7
1800	0.487	159.5	3.027	66.9	0.080	63.2	0.437	−44.9	11.7
2000	0.493	153.4	2.735	63.1	0.087	63.8	0.435	−46.7	10.9
2200	0.509	148.0	2.498	59.9	0.094	63.8	0.423	−49.4	10.1
2400	0.526	144.1	2.296	56.0	0.100	64.1	0.413	−53.7	9.4
2600	0.532	141.1	2.097	53.1	0.109	64.2	0.413	−58.9	8.7
2800	0.533	137.6	1.979	49.7	0.115	63.4	0.424	−63.0	8.2
3000	0.538	132.9	1.839	46.4	0.121	63.7	0.433	−65.7	7.7

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.3	0.136	30.6	0.35
1000	2.8	0.102	75.6	0.42
2000	3.7	0.237	−173.5	0.30

Table 8 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.521	−28.0	32.499	164.2	0.006	79.0	0.958	−9.2	42.5
100	0.504	−64.3	27.978	145.0	0.013	67.1	0.854	−19.8	35.9
200	0.484	−104.8	20.406	124.4	0.021	56.7	0.685	−28.0	30.1
300	0.480	−128.2	15.371	112.5	0.025	54.0	0.582	−30.1	26.7
400	0.479	−142.8	12.121	104.7	0.028	54.2	0.525	−30.6	24.2
500	0.481	−152.8	9.955	99.1	0.032	55.7	0.492	−30.7	22.3
600	0.480	−160.1	8.440	94.9	0.035	57.4	0.473	−31.0	20.8
700	0.480	−166.1	7.323	91.2	0.039	58.7	0.461	−31.4	19.5
800	0.479	−171.3	6.452	87.9	0.042	60.2	0.454	−31.9	18.3
900	0.478	−176.1	5.760	85.1	0.046	61.3	0.449	−32.5	17.3
1000	0.480	179.8	5.188	82.5	0.050	62.6	0.445	−33.2	16.4
1200	0.490	172.6	4.338	77.8	0.057	63.8	0.438	−35.4	14.9
1400	0.499	167.0	3.752	73.4	0.064	64.5	0.434	−38.3	13.6
1600	0.499	162.4	3.292	69.1	0.071	65.5	0.436	−41.5	12.5
1800	0.496	157.0	2.927	65.7	0.079	65.7	0.441	−43.9	11.5
2000	0.503	151.2	2.645	61.9	0.086	66.0	0.439	−45.9	10.6
2200	0.518	146.3	2.416	58.9	0.093	65.9	0.428	−48.7	9.9
2400	0.536	142.6	2.221	54.9	0.100	66.0	0.418	−53.2	9.2
2600	0.542	139.7	2.027	52.1	0.108	66.0	0.419	−58.4	8.5
2800	0.544	136.1	1.913	48.7	0.115	65.2	0.430	−62.6	8.0
3000	0.547	131.8	1.777	45.4	0.121	65.5	0.439	−65.4	7.5

Table 9 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 2 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.905	−6.5	6.339	174.9	0.007	86.1	0.996	−2.4	44.6
100	0.894	−16.1	6.239	167.9	0.018	81.0	0.988	−6.0	39.1
200	0.861	−31.7	5.988	157.0	0.034	72.6	0.962	−11.5	32.7
300	0.823	−46.4	5.667	147.1	0.048	65.2	0.927	−16.4	28.5
400	0.782	−60.0	5.276	138.1	0.059	59.0	0.889	−20.5	25.3
500	0.741	−72.4	4.875	130.2	0.068	54.0	0.852	−23.9	22.8
600	0.706	−83.5	4.506	123.5	0.075	49.8	0.819	−26.7	20.9
700	0.672	−93.4	4.167	117.3	0.081	46.4	0.791	−29.0	19.3
800	0.639	−102.4	3.843	111.5	0.085	43.6	0.767	−30.9	17.8
900	0.609	−110.8	3.547	106.5	0.088	41.4	0.746	−32.5	16.5
1000	0.584	−118.7	3.278	101.8	0.091	39.8	0.728	−34.0	15.4
1200	0.555	−133.7	2.861	93.7	0.095	37.2	0.698	−37.0	13.6
1400	0.540	−146.3	2.552	86.5	0.098	35.3	0.678	−40.0	12.3
1600	0.531	−155.9	2.282	80.1	0.099	35.1	0.667	−42.9	11.2
1800	0.514	−165.1	2.051	75.2	0.101	35.3	0.662	−45.3	10.1
2000	0.503	−174.3	1.865	69.8	0.102	36.0	0.651	−47.5	9.1
2200	0.505	176.9	1.715	65.5	0.103	36.5	0.633	−50.5	8.2
2400	0.517	169.5	1.587	59.9	0.104	37.4	0.620	−54.5	7.5
2600	0.523	163.5	1.451	56.3	0.107	39.1	0.620	−58.9	6.7
2800	0.524	157.8	1.390	52.0	0.110	39.9	0.628	−62.5	6.4
3000	0.527	151.7	1.290	48.0	0.111	42.0	0.634	−65.2	5.8

Table 10 Common emitter scattering parameters, $V_{CE} = 10$ V, $I_C = 5$ mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.810	−10.4	13.548	172.4	0.007	84.1	0.991	−4.0	44.8
100	0.789	−25.6	13.055	162.2	0.016	77.0	0.966	−9.8	38.3
200	0.732	−49.0	11.828	147.2	0.030	66.2	0.899	−17.8	32.0
300	0.674	−69.4	10.464	134.9	0.040	58.3	0.824	−23.6	28.0
400	0.626	−86.4	9.130	125.1	0.047	52.7	0.758	−27.5	25.1
500	0.588	−100.6	7.995	117.2	0.052	49.5	0.706	−30.1	22.9
600	0.560	−112.4	7.067	111.0	0.056	47.2	0.667	−32.0	21.2
700	0.535	−122.4	6.311	105.6	0.059	45.9	0.637	−33.3	19.7
800	0.515	−131.1	5.668	100.8	0.061	45.3	0.615	−34.4	18.5
900	0.498	−139.0	5.125	96.7	0.064	45.1	0.598	−35.2	17.4
1000	0.487	−146.0	4.662	92.9	0.066	45.4	0.583	−36.1	16.4
1200	0.481	−158.8	3.961	86.5	0.071	45.9	0.561	−38.1	14.7
1400	0.481	−168.7	3.465	80.8	0.075	46.6	0.547	−40.6	13.5
1600	0.479	−176.2	3.062	75.5	0.079	48.2	0.542	−43.2	12.4
1800	0.471	176.2	2.731	71.4	0.085	49.5	0.541	−45.3	11.3
2000	0.468	168.3	2.472	66.9	0.089	50.9	0.535	−47.1	10.4
2200	0.480	161.1	2.264	63.4	0.094	51.8	0.520	−49.6	9.6
2400	0.494	155.5	2.085	58.7	0.098	52.8	0.508	−53.6	8.9
2600	0.504	151.2	1.904	55.5	0.105	53.8	0.509	−58.2	8.2
2800	0.504	146.6	1.809	51.8	0.110	53.9	0.518	−61.9	7.8
3000	0.507	141.6	1.680	48.2	0.115	55.1	0.525	−64.5	7.2

Table 11 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.384	21.6	0.40
1000	2.1	0.288	39.9	0.45
2000	3.0	0.210	142.8	0.28

Table 12 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.716	−15.4	22.004	169.4	0.006	82.3	0.981	−6.0	44.3
100	0.684	−37.3	20.510	155.6	0.015	72.8	0.931	−14.0	37.7
200	0.612	−68.4	17.161	137.3	0.026	61.5	0.815	−23.3	31.5
300	0.558	−92.4	14.099	124.3	0.032	54.6	0.713	−28.3	27.7
400	0.523	−110.3	11.662	115.0	0.037	51.6	0.641	−30.8	25.0
500	0.500	−124.1	9.849	108.1	0.041	50.5	0.591	−32.2	23.0
600	0.485	−134.7	8.495	102.8	0.044	50.4	0.559	−33.1	21.4
700	0.475	−143.3	7.449	98.3	0.047	50.8	0.537	−33.8	20.0
800	0.465	−150.7	6.613	94.2	0.050	51.6	0.521	−34.3	18.8
900	0.456	−157.5	5.929	90.9	0.052	52.6	0.510	−34.8	17.8
1000	0.453	−163.3	5.359	87.7	0.055	53.6	0.501	−35.4	16.8
1200	0.457	−173.4	4.508	82.3	0.062	55.2	0.485	−37.1	15.3
1400	0.463	178.6	3.914	77.4	0.068	56.2	0.477	−39.5	14.0
1600	0.464	172.7	3.445	72.7	0.074	57.8	0.476	−42.2	12.9
1800	0.458	166.5	3.065	69.1	0.081	58.6	0.478	−44.3	11.9
2000	0.460	159.2	2.769	65.1	0.087	59.5	0.474	−45.9	11.0
2200	0.475	153.1	2.532	61.8	0.093	59.8	0.462	−48.4	10.2
2400	0.493	148.7	2.331	57.6	0.099	60.2	0.450	−52.5	9.5
2600	0.501	145.2	2.128	54.7	0.107	60.7	0.451	−57.3	8.8
2800	0.502	141.1	2.013	51.3	0.113	60.2	0.461	−61.2	8.4
3000	0.502	136.6	1.870	47.8	0.118	60.7	0.469	−63.8	7.8

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.0	0.287	21.9	0.40
1000	2.5	0.209	43.8	0.48
2000	3.4	0.194	158.0	0.30

Table 14 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.665	−19.1	27.412	167.3	0.006	81.3	0.973	−7.2	44.0
100	0.627	−45.8	24.819	151.2	0.014	70.6	0.903	−16.4	37.4
200	0.555	−80.9	19.587	131.5	0.023	59.1	0.760	−25.5	31.2
300	0.510	−105.7	15.432	118.8	0.029	54.0	0.653	−29.4	27.5
400	0.486	−123.0	12.457	110.1	0.033	52.6	0.586	−30.9	24.9
500	0.474	−135.6	10.367	103.8	0.036	53.0	0.543	−31.6	22.9
600	0.464	−144.9	8.856	99.0	0.039	53.7	0.517	−32.0	21.3
700	0.457	−152.6	7.722	94.9	0.042	54.6	0.500	−32.4	20.0
800	0.450	−159.4	6.823	91.3	0.046	55.8	0.489	−32.9	18.8
900	0.445	−165.2	6.106	88.2	0.049	57.0	0.481	−33.3	17.8
1000	0.445	−170.5	5.507	85.3	0.052	58.1	0.474	−33.9	16.9
1200	0.453	−179.3	4.620	80.3	0.059	59.7	0.463	−35.7	15.3
1400	0.461	173.9	4.001	75.7	0.066	60.4	0.457	−38.3	14.1
1600	0.462	168.5	3.513	71.3	0.073	61.6	0.458	−41.1	13.0
1800	0.457	162.4	3.126	67.7	0.080	62.1	0.462	−43.3	12.0
2000	0.462	156.0	2.824	63.9	0.087	62.7	0.459	−45.0	11.1
2200	0.477	150.3	2.581	60.8	0.094	62.6	0.447	−47.6	10.3
2400	0.495	146.2	2.373	56.8	0.100	62.9	0.436	−51.7	9.6
2600	0.502	143.0	2.165	53.9	0.107	63.0	0.436	−56.6	8.9
2800	0.503	139.3	2.049	50.5	0.114	62.2	0.446	−60.6	8.5
3000	0.509	134.8	1.903	47.2	0.120	62.7	0.455	−63.3	7.9

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	2.3	0.238	22.5	0.44
1000	2.8	0.170	48.8	0.50
2000	3.7	0.197	168.1	0.34

Table 16 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.634	−22.2	31.001	165.5	0.006	72.4	0.967	−8.0	43.9
100	0.593	−52.8	27.210	147.7	0.014	69.3	0.879	−17.9	37.0
200	0.523	−90.5	20.627	127.3	0.022	59.0	0.723	−26.2	30.9
300	0.486	−114.5	15.771	115.2	0.027	54.9	0.621	−28.9	27.2
400	0.470	−130.9	12.572	107.0	0.029	53.7	0.559	−29.7	24.7
500	0.462	−142.5	10.361	101.1	0.033	55.4	0.524	−30.1	22.7
600	0.455	−151.4	8.817	96.7	0.037	56.1	0.502	−30.3	21.2
700	0.449	−158.2	7.661	92.7	0.041	57.3	0.489	−30.8	19.9
800	0.448	−164.2	6.783	89.8	0.043	59.2	0.481	−31.3	18.7
900	0.444	−169.7	6.038	86.6	0.047	59.9	0.476	−31.9	17.7
1000	0.444	−174.6	5.436	83.8	0.051	60.5	0.470	−32.5	16.7
1200	0.449	177.4	4.562	79.2	0.059	61.6	0.463	−34.5	15.2
1400	0.463	170.7	3.951	74.9	0.065	62.4	0.457	−37.1	14.0
1600	0.461	165.5	3.460	70.5	0.072	65.2	0.460	−40.1	12.8
1800	0.455	160.1	3.081	67.0	0.080	63.8	0.465	−42.4	11.8
2000	0.463	153.7	2.770	63.3	0.087	64.7	0.463	−44.2	10.9
2200	0.479	148.0	2.540	60.2	0.094	64.7	0.453	−47.0	10.2
2400	0.498	144.9	2.326	56.2	0.101	65.2	0.443	−51.1	9.5
2600	0.504	141.5	2.130	53.5	0.110	64.7	0.443	−55.9	8.8
2800	0.507	137.8	2.002	50.4	0.115	63.8	0.454	−60.0	8.3
3000	0.508	132.8	1.866	47.0	0.120	64.2	0.463	−62.6	7.8

NPN 6 GHz wideband transistor — BFG93A; BFG93A/X; BFG93A/XR

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG93 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is intended for wideband applications in the UHF and microwave range.

PINNING

PIN	DESCRIPTION
BFG93A (Fig.1) Code: R8	
1	collector
2	base
3	emitter
4	emitter
BFG93A/X (Fig.1) Code: V15	
1	collector
2	emitter
3	base
4	emitter
BFG93A/XR (Fig.2) Code: V33	
1	collector
2	emitter
3	base
4	emitter

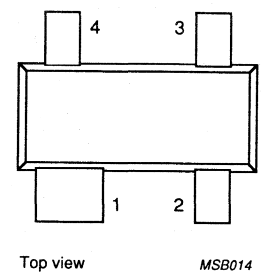


Fig.1 SOT143.

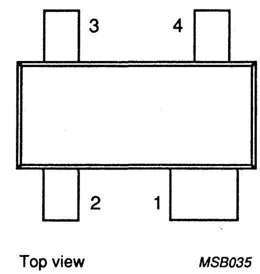


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 5 V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.9	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		−65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.9	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	16	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.9	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

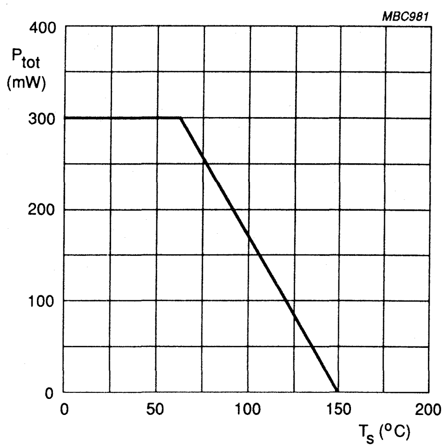
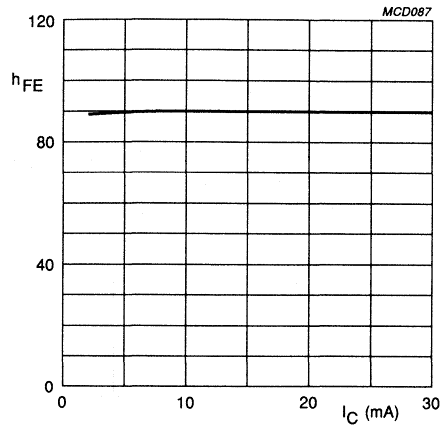
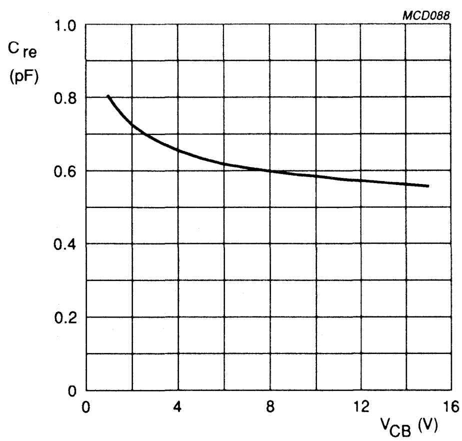


Fig.3 Power derating curve.



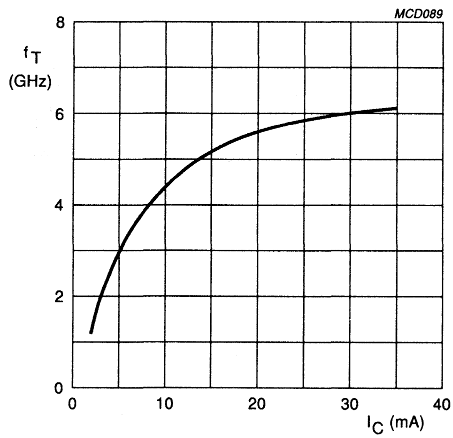
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

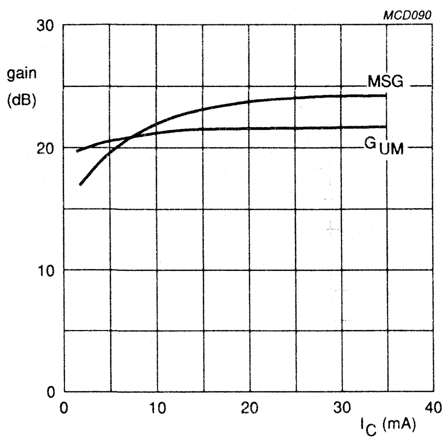
Fig.5 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 5 V; T_{amb} = 25 °C; f = 500 MHz.

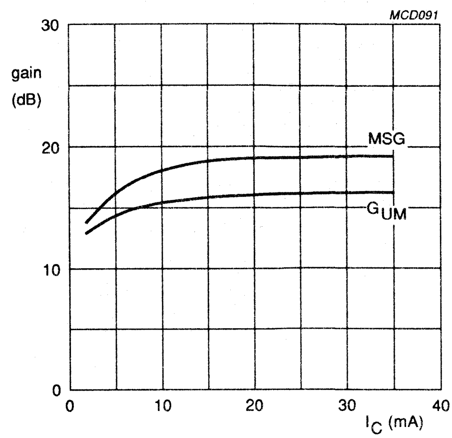
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



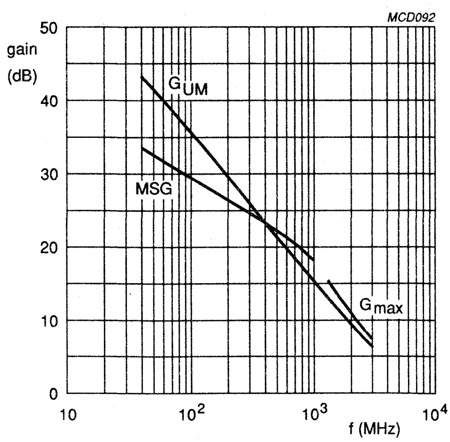
V_{CE} = 8 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



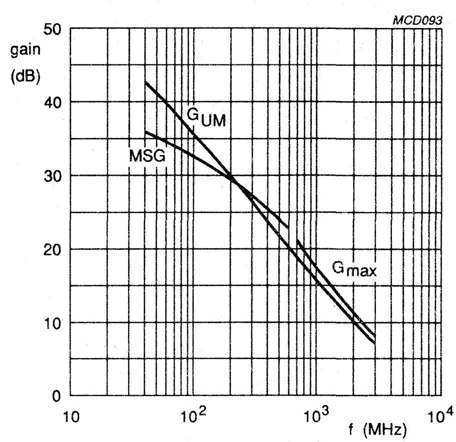
V_{CE} = 8 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



V_{CE} = 8 V; I_C = 10 mA.

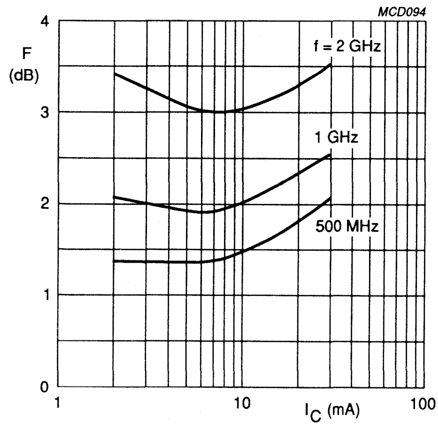
Fig.9 Gain as a function of frequency.



V_{CE} = 8 V; I_C = 30 mA.

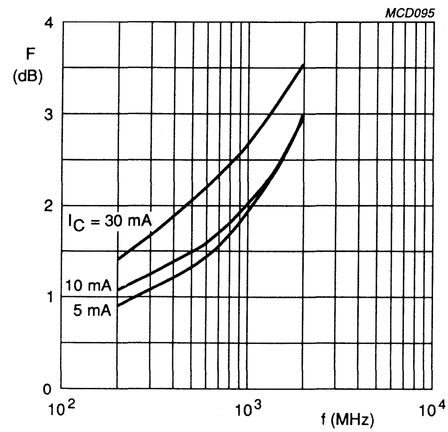
Fig.10 Gain as a function of frequency.

NPN 6 GHz wideband transistor BFG93A; BFG93A/X; BFG93A/XR



V_{CE} = 8 V.

Fig.11 Minimum noise figure as a function of collector current.



V_{CE} = 8 V.

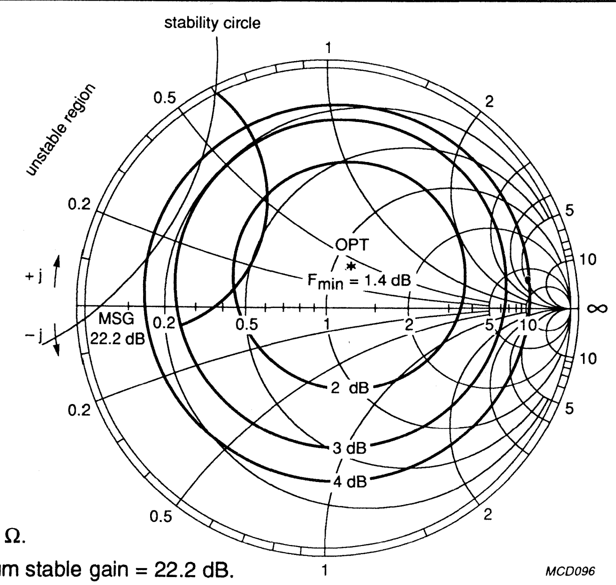
Fig.12 Minimum noise figure as a function of frequency.

BFG93A/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	8	10

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.4	0.215	60.2	0.206



Z_O = 50 Ω.
Maximum stable gain = 22.2 dB.

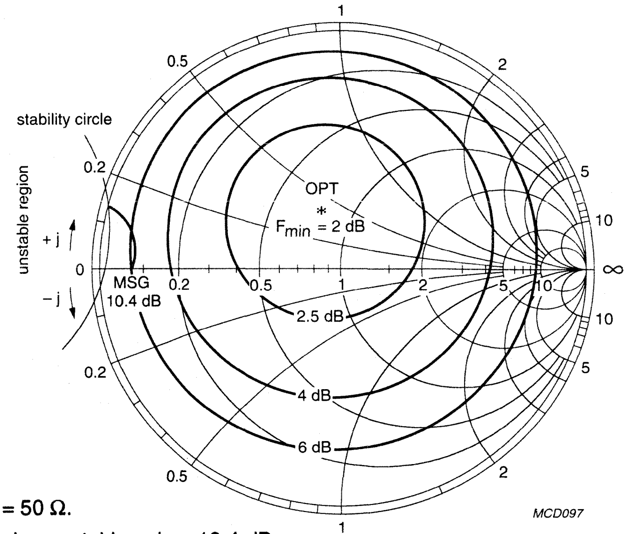
Fig.13 Noise circle figure.

BFG93A/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	8	10

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.249	107.9	0.25



$Z_O = 50\ \Omega$.

Maximum stable gain = 10.4 dB.

Fig.14 Noise circle figure.

BFG93A/X

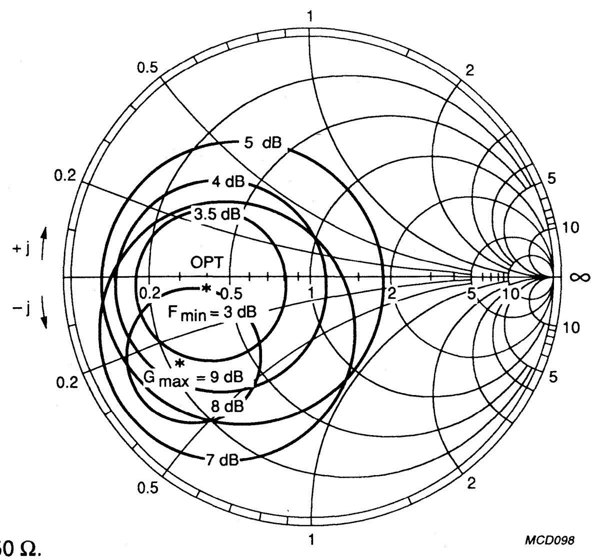
f (MHz)	V_{CE} (V)	I_C (mA)
2000	8	10

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3	0.46	−174	0.136

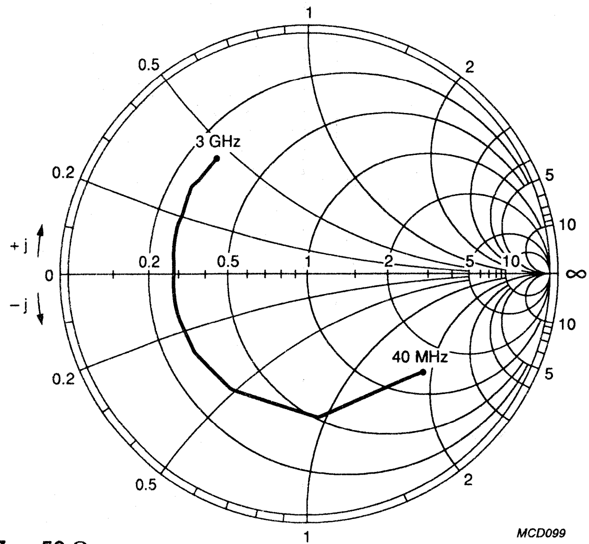
Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
9	0.654	−147



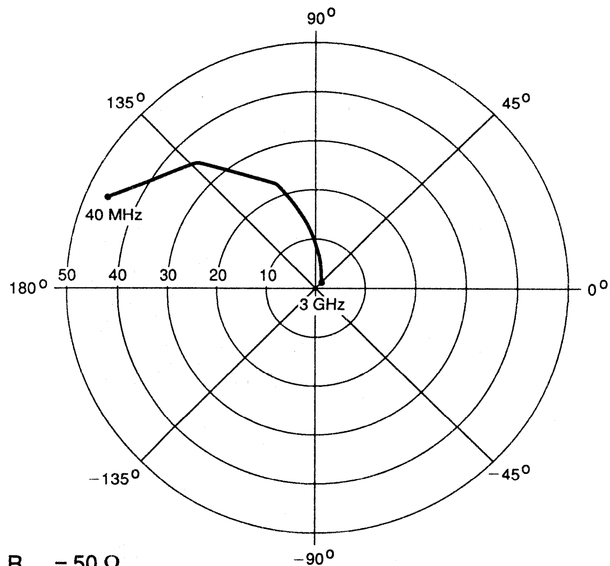
$Z_O = 50\ \Omega$.

Fig.15 Noise circle figure.



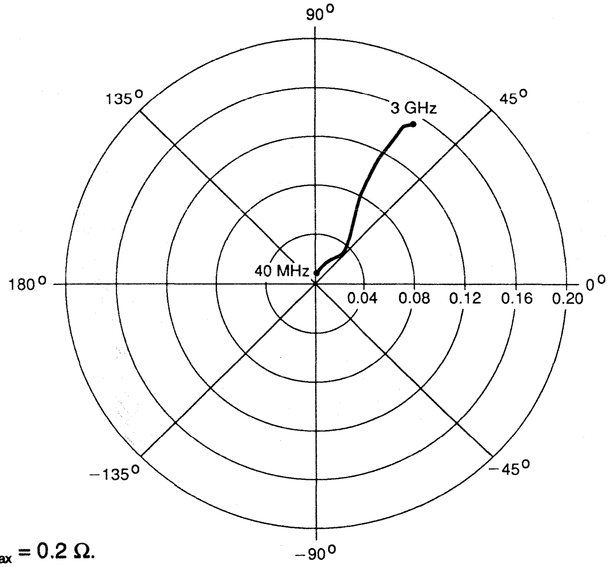
V_{CE} = 8 V; I_C = 30 mA; Z_O = 50 Ω.

Fig.16 Common emitter input reflection coefficient (S_{11}).



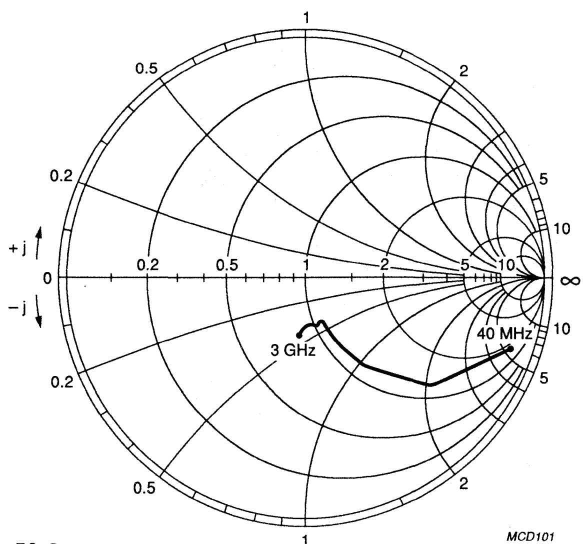
V_{CE} = 8 V; I_C = 30 mA; R_{max} = 50 Ω.

Fig.17 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 8 V; I_C = 30 mA; R_{max} = 0.2 Ω.

Fig.18 Common emitter reverse transmission coefficient (S_{12}).

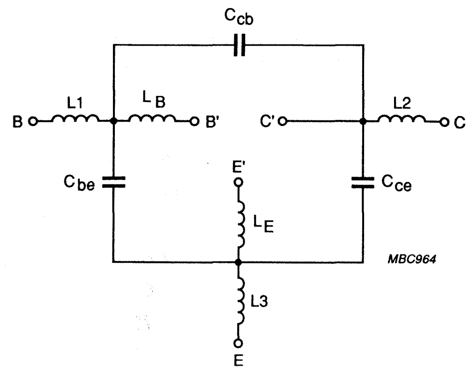


V_{CE} = 8 V; I_C = 30 mA; Z_O = 50 Ω.

Fig.19 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR91A crystal

1	IS = 1.328	fA
2	BF = 102.0	–
3	NF = 1.000	–
4	VAF = 51.90	V
5	IKF = 8.155	A
6	ISE = 13.90	fA
7	NE = 1.512	–
8	BR = 17.69	–
9	NR = 994.0	m
10	VAR = 3.280	V
11	IKR = 10.00	A
12	ISC = 1.043	fA
13	NC = 1.189	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 763.6	mΩ
18	RC = 9.000	Ω
19 (note 1)	XTB = 0.000	
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 2.032	pF
23	VJE = 600.0	mV
24	MJE = 290.0	m
25	TF = 6.557	ps
26	XTF = 38.97	–
27	VTF = 10.93	V
28	ITF = 521.0	mA
29	PTF = 0.000	deg
30	CJC = 1.003	pF
31	VJC = 340.8	mV
32	MJC = 194.2	m
33	XCJC = 120.0	m
34	TR = 3.073	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	
38	FC = 800.0	m



$QL_B = 50$; $QL_E = 50$.
$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.
Fc = scaling frequency = 1000 MHz.

Fig.20 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.20)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.837	−17.1	15.166	169.4	0.013	81.8	0.982	−7.7	43.2
100	0.807	−41.6	14.010	154.4	0.029	68.7	0.921	−18.3	35.7
200	0.750	−75.8	11.777	135.4	0.049	54.1	0.780	−31.0	29.1
300	0.709	−100.8	9.568	121.9	0.059	44.9	0.660	−38.5	25.1
400	0.678	−119.0	7.897	112.3	0.065	39.4	0.575	−43.0	22.4
500	0.666	−131.8	6.664	105.3	0.069	36.5	0.518	−45.8	20.4
600	0.655	−141.6	5.721	99.5	0.072	34.8	0.480	−47.6	18.7
700	0.647	−150.0	4.990	94.9	0.074	34.2	0.455	−49.1	17.3
800	0.641	−156.6	4.418	90.7	0.076	34.1	0.437	−50.0	16.1
900	0.634	−162.5	3.964	87.4	0.078	34.4	0.424	−50.8	15.1
1000	0.635	−167.8	3.630	83.8	0.080	34.6	0.413	−51.8	14.2
1200	0.634	−177.0	3.026	77.7	0.083	36.7	0.394	−54.3	12.6
1400	0.635	175.8	2.606	72.5	0.086	38.6	0.386	−58.3	11.3
1600	0.637	170.0	2.294	67.6	0.090	40.3	0.393	−61.7	10.2
1800	0.632	163.7	2.078	63.0	0.094	42.9	0.400	−64.1	9.3
2000	0.632	157.5	1.871	58.5	0.099	45.4	0.395	−66.6	8.4
2200	0.639	151.9	1.689	55.3	0.105	47.2	0.383	−70.8	7.5
2400	0.653	147.9	1.561	52.0	0.108	49.4	0.386	−77.0	7.0
2600	0.649	144.0	1.442	47.5	0.114	51.6	0.401	−82.3	6.3
2800	0.653	139.6	1.319	43.1	0.121	53.4	0.418	−86.0	5.7
3000	0.654	135.0	1.257	40.6	0.129	52.1	0.424	−89.0	5.3

Table 2 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.2	0.290	53.4	0.204
1000	1.9	0.307	109.7	0.228
2000	3.0	0.484	−174.6	0.138

Table 3 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.730	−25.4	25.704	165.3	0.012	78.0	0.959	−12.2	42.5
100	0.698	−58.9	22.382	146.4	0.026	63.8	0.846	−27.6	35.4
200	0.656	−99.2	16.867	125.6	0.039	48.8	0.644	−43.1	29.3
300	0.635	−123.2	12.775	113.1	0.045	43.1	0.506	−50.7	25.7
400	0.622	−138.7	10.135	105.0	0.049	41.0	0.424	−55.0	23.1
500	0.618	−149.4	8.369	99.2	0.052	40.7	0.373	−57.5	21.2
600	0.616	−157.2	7.082	94.5	0.055	41.3	0.341	−59.0	19.6
700	0.609	−163.7	6.117	90.6	0.058	42.5	0.320	−60.0	18.2
800	0.611	−168.9	5.391	87.2	0.061	44.2	0.305	−60.5	17.1
900	0.608	−173.5	4.822	84.7	0.065	45.2	0.295	−61.0	16.1
1000	0.609	−178.1	4.392	81.5	0.067	46.4	0.285	−61.6	15.2
1200	0.612	174.4	3.642	76.5	0.074	49.3	0.271	−64.2	13.6
1400	0.615	168.6	3.147	71.9	0.081	51.2	0.266	−68.1	12.3
1600	0.618	163.8	2.756	67.7	0.088	52.7	0.273	−71.0	11.2
1800	0.612	158.0	2.483	63.6	0.095	54.2	0.282	−72.2	10.3
2000	0.616	152.8	2.241	59.7	0.104	55.8	0.277	−74.0	9.4
2200	0.619	147.4	2.025	56.9	0.112	56.5	0.266	−78.5	8.5
2400	0.636	144.1	1.872	53.6	0.117	57.3	0.269	−84.9	8.0
2600	0.632	140.0	1.726	49.6	0.125	58.4	0.286	−90.4	7.3
2800	0.634	136.3	1.593	46.0	0.134	59.0	0.303	−93.4	6.7
3000	0.638	131.9	1.507	43.1	0.143	57.0	0.309	−95.8	6.3

Table 4 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.4	0.181	70.3	0.191
1000	1.9	0.248	117.9	0.222
2000	2.9	0.473	−169.9	0.134

Table 5 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.612	−37.6	39.288	159.9	0.011	74.2	0.924	−18.1	42.3
100	0.597	−81.7	31.205	137.1	0.022	58.4	0.741	−38.3	35.3
200	0.595	−122.5	20.879	116.6	0.030	47.2	0.503	−55.2	29.6
300	0.596	−142.6	14.997	106.0	0.034	46.2	0.375	−62.7	26.1
400	0.596	−154.7	11.613	99.4	0.038	46.7	0.306	−67.1	23.6
500	0.598	−162.7	9.464	94.6	0.042	48.9	0.267	−69.8	21.8
600	0.599	−168.3	7.955	90.8	0.046	50.8	0.243	−71.3	20.2
700	0.596	−173.7	6.848	87.6	0.050	52.7	0.229	−72.2	18.8
800	0.596	−177.4	6.007	84.7	0.054	54.6	0.217	−72.8	17.7
900	0.597	178.6	5.361	82.5	0.058	56.0	0.209	−73.0	16.7
1000	0.597	175.1	4.880	79.7	0.063	56.9	0.201	−73.3	15.9
1200	0.602	168.8	4.055	75.4	0.071	59.2	0.190	−76.1	14.3
1400	0.607	163.7	3.482	71.5	0.080	60.3	0.189	−80.7	13.0
1600	0.602	159.5	3.048	67.5	0.090	61.0	0.198	−82.8	11.8
1800	0.598	154.3	2.748	63.5	0.098	61.4	0.206	−82.8	10.9
2000	0.604	149.2	2.471	60.1	0.108	61.8	0.200	−84.2	10.0
2200	0.613	144.7	2.246	57.5	0.118	61.8	0.192	−89.3	9.2
2400	0.629	141.6	2.065	54.4	0.125	61.9	0.197	−96.5	8.7
2600	0.622	138.1	1.908	50.9	0.133	62.2	0.215	−101.6	7.9
2800	0.624	134.2	1.763	47.2	0.143	62.1	0.232	−103.7	7.3
3000	0.628	130.2	1.668	44.8	0.151	59.4	0.238	−105.3	6.3

Table 6 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 30 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.553	−46.7	47.367	156.3	0.010	71.5	0.893	−21.8	42.0
100	0.560	−95.5	35.212	131.9	0.019	56.3	0.673	−44.1	35.2
200	0.579	−133.8	22.209	112.2	0.026	47.9	0.433	−60.7	29.6
300	0.588	−151.0	15.635	102.7	0.030	49.1	0.319	−67.8	26.2
400	0.589	−161.1	12.005	97.0	0.034	51.0	0.259	−72.2	23.7
500	0.593	−167.8	9.745	92.6	0.038	53.6	0.225	−74.6	21.9
600	0.593	−172.8	8.161	89.1	0.043	55.7	0.206	−76.5	20.3
700	0.591	−177.2	7.024	86.1	0.047	57.7	0.194	−77.5	19.0
800	0.593	179.2	6.160	83.4	0.052	59.4	0.186	−77.7	17.8
900	0.591	175.8	5.499	81.5	0.057	60.4	0.179	−77.9	16.8
1000	0.593	172.7	4.986	78.8	0.061	61.4	0.172	−78.2	16.0
1200	0.603	166.8	4.143	74.7	0.071	62.9	0.164	−81.1	14.4
1400	0.606	162.2	3.561	71.2	0.081	63.8	0.165	−86.3	13.1
1600	0.607	158.5	3.107	67.0	0.090	63.7	0.175	−88.0	12.0
1800	0.600	153.2	2.801	63.3	0.099	63.8	0.182	−87.1	11.0
2000	0.607	148.1	2.522	60.0	0.109	64.0	0.177	−88.6	10.2
2200	0.617	143.8	2.298	57.4	0.120	63.3	0.169	−94.1	9.4
2400	0.623	140.9	2.109	54.4	0.127	63.4	0.177	−101.7	8.8
2600	0.624	137.1	1.944	51.1	0.135	63.5	0.196	−106.5	8.1
2800	0.621	133.3	1.794	47.4	0.145	63.1	0.213	−108.0	7.4
3000	0.620	129.4	1.696	44.9	0.154	60.3	0.218	−109.5	6.9

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.1	0.137	135.1	0.200
1000	2.6	0.242	144.1	0.240
2000	3.4	0.480	−161.4	0.183

Table 8 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.850	−16.2	15.103	169.7	0.012	81.6	0.981	−7.1	43.5
100	0.819	−39.5	14.031	155.2	0.027	69.8	0.927	−16.9	36.3
200	0.760	−72.9	11.891	136.5	0.046	55.0	0.796	−28.8	29.6
300	0.712	−97.6	9.737	123.0	0.056	46.1	0.680	−35.8	25.5
400	0.678	−115.8	8.076	113.4	0.062	40.5	0.597	−40.0	22.7
500	0.662	−128.9	6.840	106.2	0.066	37.5	0.541	−42.7	20.7
600	0.650	−138.9	5.880	100.5	0.069	35.9	0.504	−44.5	19.0
700	0.638	−147.4	5.134	95.6	0.071	35.2	0.478	−45.7	17.6
800	0.633	−154.6	4.548	91.4	0.073	35.2	0.462	−46.6	16.4
900	0.626	−160.7	4.094	88.3	0.076	35.2	0.449	−47.3	15.4
1000	0.625	−166.1	3.736	84.5	0.077	35.4	0.438	−48.2	14.5
1200	0.621	−175.4	3.129	78.3	0.080	37.5	0.419	−50.7	12.9
1400	0.626	177.5	2.686	73.0	0.084	39.6	0.410	−54.5	11.5
1600	0.624	171.3	2.369	68.3	0.088	41.4	0.417	−57.8	10.5
1800	0.620	164.7	2.143	63.8	0.091	43.8	0.422	−59.9	9.6
2000	0.626	158.3	1.933	59.1	0.096	46.3	0.419	−62.5	8.7
2200	0.631	153.2	1.743	56.1	0.102	48.0	0.405	−66.7	7.8
2400	0.638	148.9	1.604	52.5	0.105	50.5	0.407	−72.2	7.2
2600	0.642	144.7	1.482	48.3	0.111	52.5	0.420	−77.5	6.6
2800	0.642	140.1	1.370	43.9	0.118	54.0	0.437	−81.3	6.0
3000	0.642	135.6	1.294	41.6	0.125	53.3	0.442	−84.1	5.5

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.2	0.308	55.5	0.221
1000	1.9	0.304	103.3	0.255
2000	3.0	0.484	−174.4	0.134

Table 10 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.764	−23.0	25.164	166.0	0.011	78.5	0.963	−11.0	43.2
100	0.721	−54.8	22.161	147.7	0.024	64.7	0.861	−25.1	36.0
200	0.665	−93.7	17.007	127.1	0.038	50.5	0.668	−39.5	29.7
300	0.635	−118.3	13.004	114.5	0.044	44.2	0.535	−46.5	26.0
400	0.618	−134.5	10.372	106.2	0.048	41.7	0.451	−50.1	23.4
500	0.612	−145.7	8.575	100.2	0.052	41.2	0.400	−52.3	21.5
600	0.606	−153.9	7.277	95.4	0.054	41.6	0.367	−53.5	19.9
700	0.600	−160.7	6.302	91.5	0.057	43.1	0.347	−54.3	18.5
800	0.597	−166.2	5.550	88.0	0.060	44.0	0.333	−54.8	17.3
900	0.592	−171.1	4.969	85.4	0.063	45.6	0.323	−55.1	16.3
1000	0.595	−175.8	4.524	82.2	0.066	46.3	0.312	−55.5	15.5
1200	0.595	176.3	3.761	77.0	0.072	49.4	0.298	−57.6	13.8
1400	0.603	170.5	3.232	72.8	0.079	51.1	0.292	−61.4	12.5
1600	0.600	165.2	2.851	68.3	0.086	52.8	0.299	−64.5	11.4
1800	0.595	159.8	2.561	64.0	0.092	54.3	0.306	−65.9	10.5
2000	0.600	154.1	2.314	60.3	0.101	55.9	0.302	−67.6	9.6
2200	0.604	149.1	2.094	57.2	0.109	56.1	0.292	−71.6	8.8
2400	0.625	145.1	1.927	54.0	0.114	57.5	0.292	−77.7	8.2
2600	0.617	141.6	1.779	50.3	0.121	58.4	0.306	−83.2	7.5
2800	0.621	137.7	1.634	45.9	0.130	59.1	0.324	−86.5	6.9
3000	0.625	133.1	1.552	43.7	0.138	57.2	0.329	−88.8	6.5

Table 11 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.4	0.215	60.2	0.206
1000	2.0	0.249	107.9	0.250
2000	3.0	0.460	−173.9	0.136

NPN 6 GHz wideband transistor BFG93A; BFG93A/X; BFG93A/XR

Table 12 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.672	−33.2	38.337	160.9	0.010	75.5	0.931	−16.3	43.0
100	0.630	−74.2	31.025	138.9	0.021	60.2	0.762	−34.8	35.8
200	0.600	−115.4	21.190	118.1	0.030	48.4	0.531	−50.2	29.9
300	0.587	−136.8	15.330	107.2	0.034	46.4	0.402	−56.4	26.3
400	0.583	−150.1	11.920	100.4	0.038	46.5	0.333	−59.8	23.8
500	0.580	−158.7	9.746	95.5	0.042	48.4	0.291	−61.6	21.9
600	0.579	−164.8	8.196	91.6	0.046	50.1	0.267	−62.7	20.4
700	0.576	−170.4	7.051	88.3	0.049	52.5	0.251	−63.0	19.0
800	0.577	−174.7	6.190	85.3	0.054	54.1	0.241	−63.2	17.8
900	0.573	−178.9	5.536	83.1	0.058	55.2	0.233	−63.2	16.8
1000	0.576	177.4	5.023	80.2	0.062	56.3	0.226	−63.4	16.0
1200	0.582	170.8	4.187	76.0	0.070	58.6	0.215	−65.6	14.4
1400	0.586	165.5	3.596	71.9	0.079	59.8	0.212	−69.8	13.1
1600	0.587	161.2	3.151	67.9	0.088	60.2	0.221	−72.4	12.0
1800	0.584	155.7	2.833	63.9	0.096	60.7	0.230	−72.9	11.1
2000	0.585	150.7	2.554	60.4	0.106	61.6	0.225	−74.1	10.2
2200	0.593	146.0	2.319	57.9	0.115	61.1	0.215	−78.4	9.4
2400	0.606	142.6	2.125	54.7	0.122	61.5	0.217	−85.3	8.7
2600	0.602	139.0	1.963	51.1	0.129	61.8	0.233	−91.1	8.1
2800	0.605	135.3	1.812	47.4	0.139	62.0	0.250	−93.6	7.4
3000	0.611	131.3	1.718	44.9	0.147	59.1	0.256	−95.5	7.0

Table 13 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.630	−40.2	45.838	157.6	0.010	73.9	0.905	−19.5	42.8
100	0.595	−85.7	34.915	133.8	0.019	57.5	0.699	−39.6	35.7
200	0.578	−125.7	22.478	113.8	0.027	48.7	0.461	−54.3	29.8
300	0.573	−144.9	15.925	103.9	0.031	48.5	0.345	−59.7	26.3
400	0.573	−156.3	12.289	97.8	0.035	50.4	0.284	−62.5	23.9
500	0.573	−163.8	9.980	93.3	0.039	52.8	0.249	−63.9	22.0
600	0.573	−169.2	8.362	89.8	0.043	54.7	0.229	−65.2	20.4
700	0.569	−174.3	7.183	86.7	0.047	56.7	0.217	−65.2	19.0
800	0.569	−177.9	6.311	83.9	0.052	58.3	0.210	−65.2	17.9
900	0.568	178.2	5.637	82.0	0.057	59.5	0.204	−65.1	16.9
1000	0.571	174.7	5.122	79.2	0.061	60.3	0.198	−65.2	16.1
1200	0.578	168.8	4.244	75.1	0.070	61.9	0.189	−67.4	14.5
1400	0.581	163.7	3.636	71.3	0.080	62.6	0.188	−72.1	13.2
1600	0.583	159.9	3.204	67.4	0.089	62.7	0.198	−74.6	12.1
1800	0.577	154.8	2.867	63.6	0.098	62.8	0.208	−74.7	11.1
2000	0.586	149.9	2.593	60.1	0.107	63.1	0.204	−75.9	10.3
2200	0.595	145.3	2.348	57.9	0.117	62.6	0.194	−80.4	9.5
2400	0.603	142.2	2.165	54.5	0.124	62.6	0.197	−87.7	8.8
2600	0.599	138.8	1.992	51.0	0.132	62.9	0.214	−93.3	8.1
2800	0.604	134.6	1.849	47.1	0.141	62.8	0.231	−95.9	7.5
3000	0.611	130.2	1.749	44.6	0.150	59.9	0.237	−97.6	7.1

Table 14 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.1	0.123	87.3	0.263
1000	2.6	0.216	121.4	0.309
2000	3.6	0.444	−169.0	0.190

NPN 6 GHz wideband transistor BFG94

FEATURES

- High power gain
- Low noise figure
- Low intermodulation distortion
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope. It is primarily intended for use in communication and instrumentation systems.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

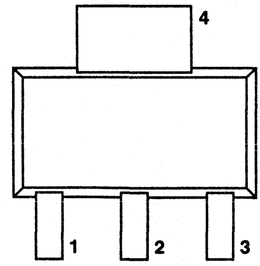


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	60	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	–	700	mW
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	–	0.8	pF
f_T	transition frequency	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	4	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	11.5	13.5	–	dB
V_O	output voltage	I_C = 45 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	500	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	21.5	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	60	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 140 °C (note 1)	50 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

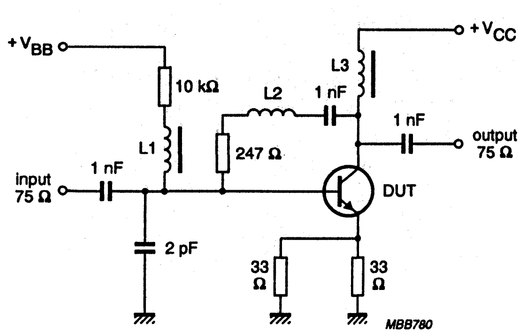
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	45	90	–	
		$I_C = 45$ mA; $V_{CE} = 10$ V	–	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.9	2	pF
C_e	emitter capacitance	$I_C = i_e = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2.9	4.5	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	0.5	0.8	pF
f_T	transition frequency	$I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz; $T_{amb} = 25$ °C	4	–	–	GHz
		$I_C = 30$ mA; $V_{CE} = 5$ V; f = 1 GHz; $T_{amb} = 25$ °C	4	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz; $T_{amb} = 25$ °C	11.5	13.5	–	dB
F	minimum noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 45$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz	–	3	–	dB
V_O	output voltage	note 2	–	500	–	mV
d_2	second order intermodulation distortion	note 3	–	–51	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 50$ Ω; $T_{amb} = 25$ °C; measured at f = 1 GHz	–	21.5	–	dBm
ITO	third order intercept point	note 4	–	34	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B, par 6.3: 3-tone); $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 75$ Ω; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O -6$ dB; $V_r = V_O -6$ dB;
   $f_q = 803.25$ MHz; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
3. $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 75$ Ω; $T_{amb} = 25$ °C;
   $V_q = V_O = 280$ mV;
   $f_p = 250$ MHz; $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.
4. $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 50$ Ω; $T_{amb} = 25$ °C;
   $f_p = 1000$ MHz; $f_q = 1001$ MHz;
   measured at $f_{(2p-q)}$ and $f_{(2q-p)}$.



L1 = L3 = 5 μH micro-choke.

L2 = 1 turn copper wire (0.4 mm), internal diameter 4 mm.

Fig.2 Test circuit for second and third order intermodulation distortion.

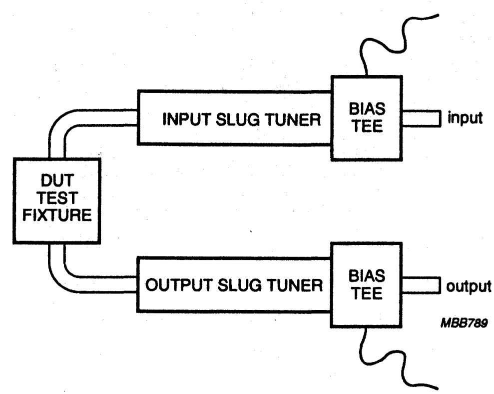


Fig.3 Measurement set-up for third order intercept point and 1 dB gain compression.

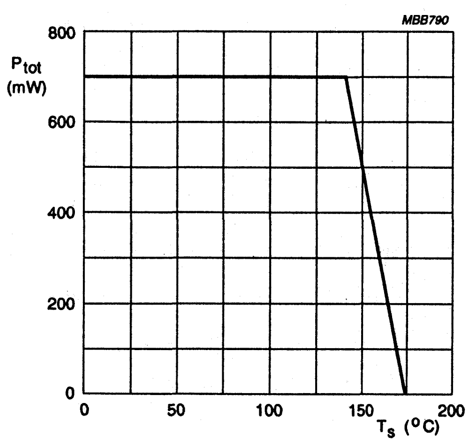
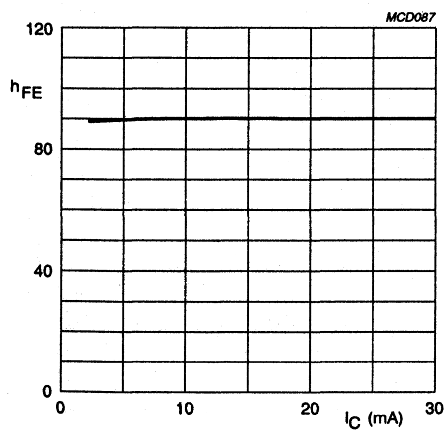
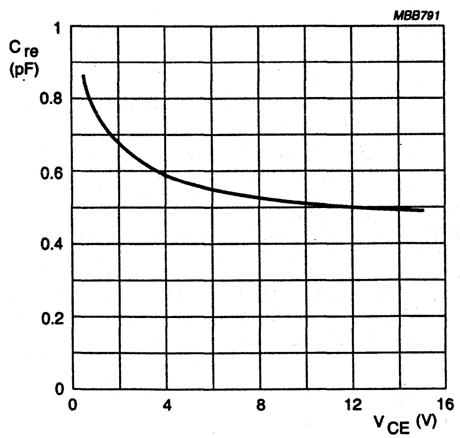


Fig.4 Power derating curve.



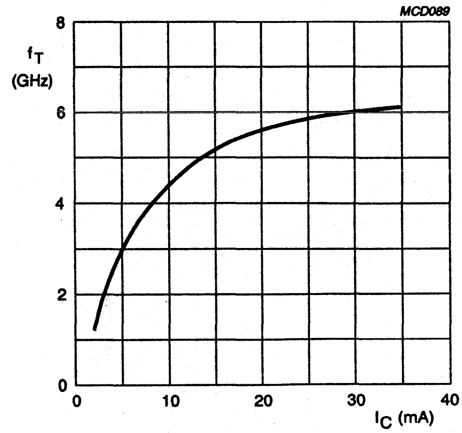
V_{CE} = 10 V; T_j = 25 °C

Fig.5 DC current gain as a function of collector current.



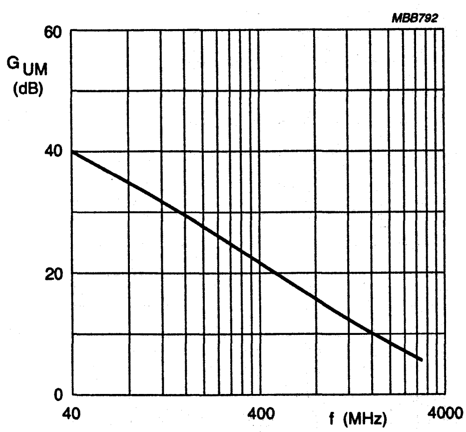
$I_C = i_c = 0$; f = 1 MHz.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



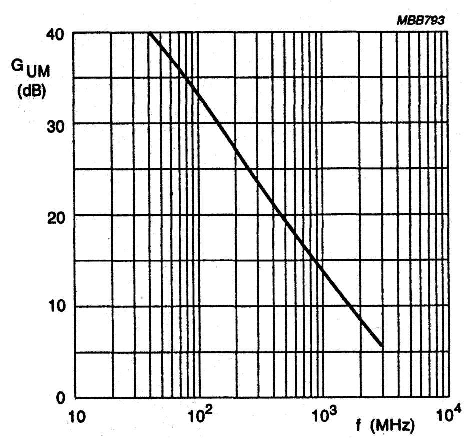
V_{CE} = 10 V; f = 1 GHz.

Fig.7 Transition frequency as a function of collector current.



I_C = 45 mA; V_{CE} = 10 V.

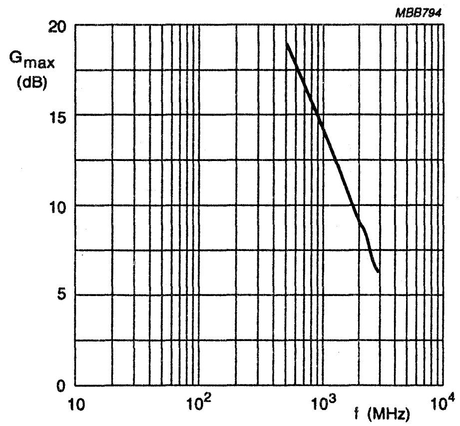
Fig.8 Maximum unilateral power gain as a function of frequency.



I_C = 20 mA; V_{CE} = 8 V.

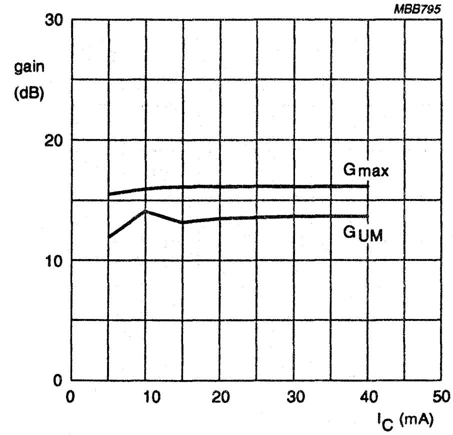
Fig.9 Maximum unilateral power gain as a function of frequency.

NPN 6 GHz wideband transistor BFG94



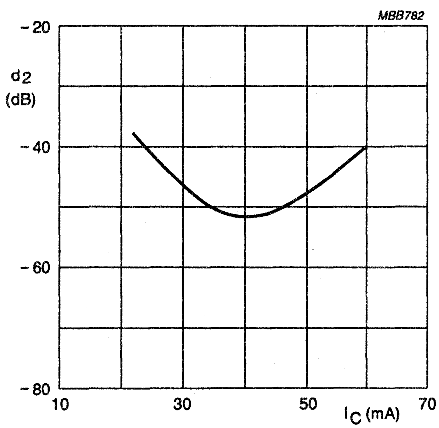
I_C = 20 mA; V_{CE} = 8 V.

Fig.10 Maximum available stable gain as a function of frequency.



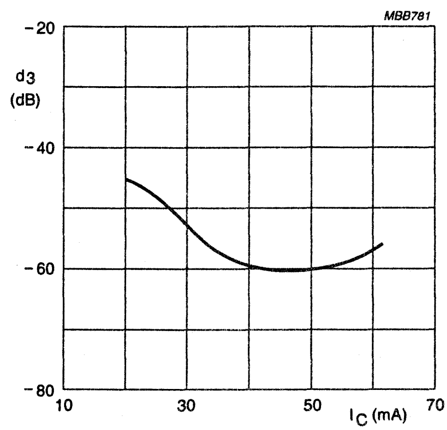
V_{CE} = 8 V; f = 1 GHz.
G_{max} = maximum available stable gain.
G_{UM} = maximum unilateral power gain.

Fig.11 Gain as a function of collector current.



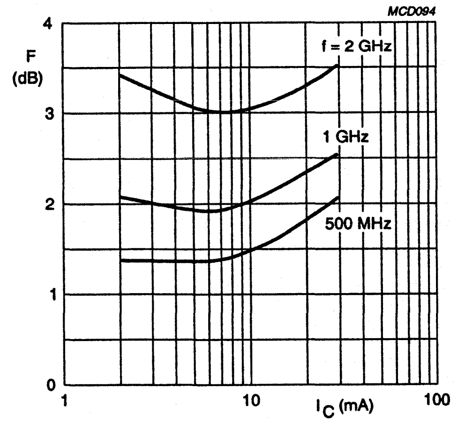
I_C = 45 mA; V_{CE} = 10 V; $f_{(p+q)}$ = 810 MHz.
See test circuit, Fig.2

Fig.12 Second order intermodulation distortion as a function of collector current.



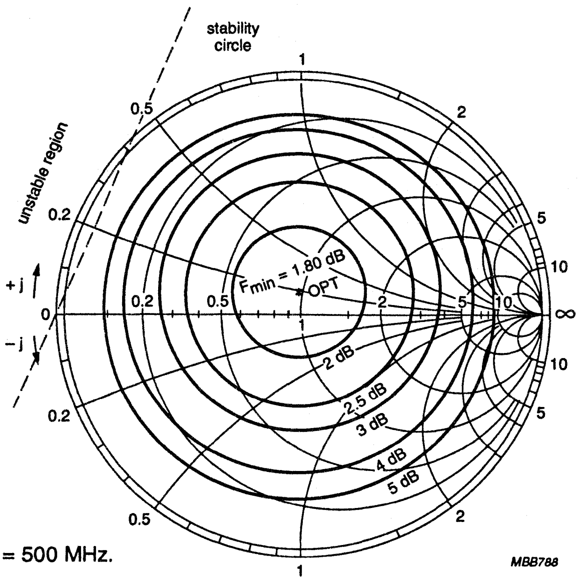
I_C = 45 mA; V_{CE} = 10 V; $f_{(p+q-r)}$ = 793.25 MHz.
See test circuit, Fig.2

Fig.13 Third order intermodulation distortion as a function of collector current.



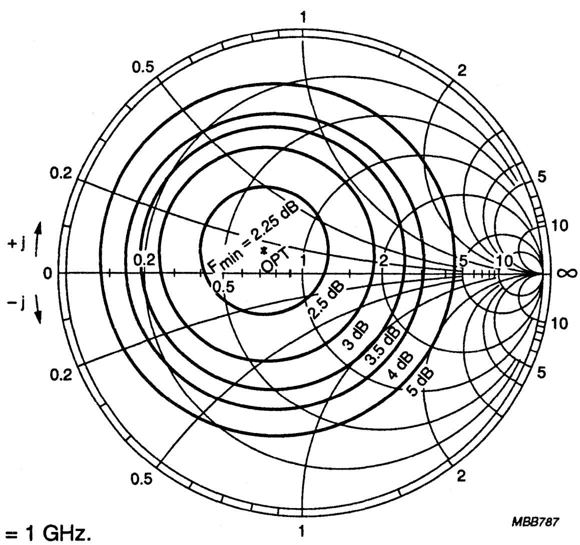
$V_{CE} = 8$ V.

Fig.14 Minimum noise figure as a function of collector current.



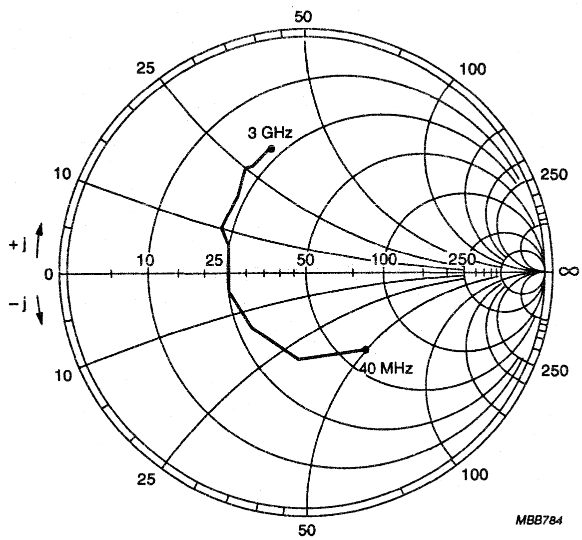
I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz.

Fig.15 Noise circle.



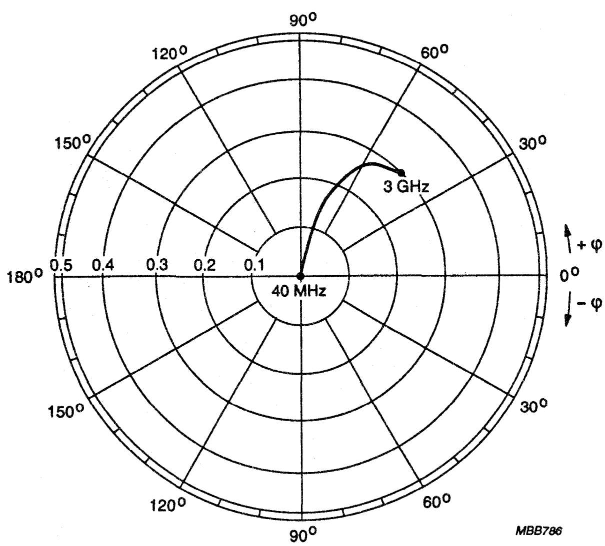
I_C = 15 mA; V_{CE} = 10 V; f = 1 GHz.

Fig.16 Noise circle.



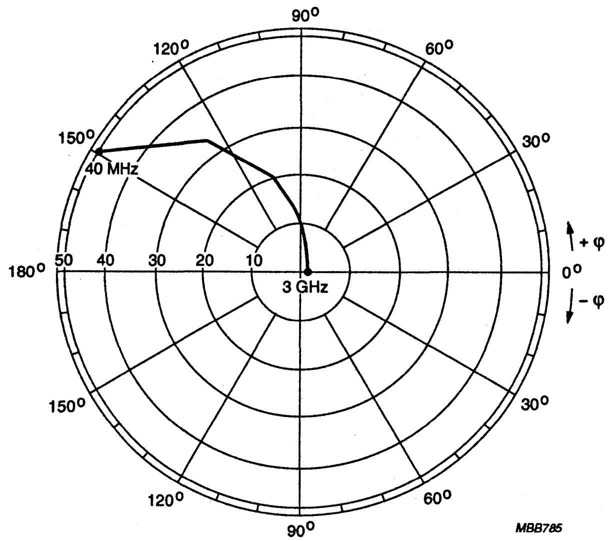
I_C = 45 mA; V_{CE} = 10 V.

Fig.17 Common emitter input reflection coefficient (S_{11}).



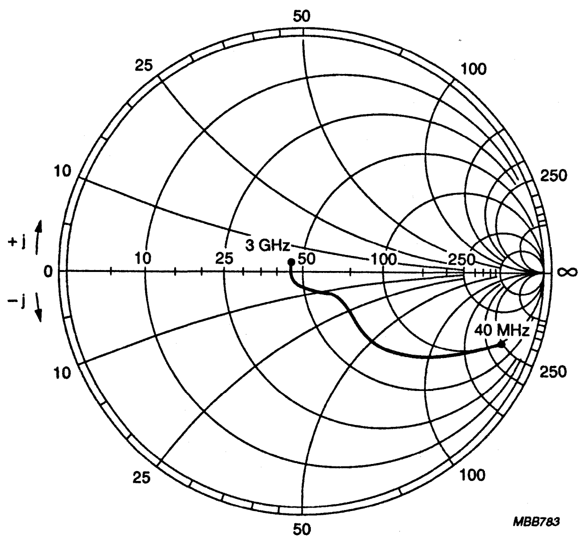
I_C = 45 mA; V_{CE} = 10 V.

Fig.18 Common emitter forward transmission coefficient (S_{21}).



I_C = 45 mA; V_{CE} = 10 V.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).



I_C = 45 mA; V_{CE} = 10 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.61	−29.1	32.10	159.5	0.01	76.7	0.93	−14.6	40.6
100	0.53	−65.4	25.66	136.9	0.02	65.5	0.76	−30.1	33.3
200	0.43	−104.2	17.25	115.9	0.03	59.5	0.54	−40.5	27.1
300	0.39	−128.2	12.43	104.5	0.04	60.7	0.43	−43.1	23.5
400	0.37	−143.8	9.72	96.9	0.05	62.2	0.36	−43.4	21.0
500	0.36	−154.5	7.91	91.4	0.06	63.6	0.32	−43.7	19.1
600	0.36	−163.1	6.66	87.0	0.07	64.7	0.30	−43.6	17.5
700	0.35	−169.8	5.78	83.1	0.08	65.6	0.28	−43.5	16.2
800	0.35	−176.3	5.08	79.8	0.09	65.6	0.27	−44.1	15.0
900	0.35	177.6	4.55	76.4	0.10	66.0	0.25	−44.7	14.0
1000	0.36	171.6	4.13	73.3	0.10	65.5	0.24	−45.8	13.2
1200	0.37	162.4	3.48	67.2	0.12	65.6	0.22	−49.3	11.7
1400	0.39	155.5	2.99	61.7	0.14	64.2	0.20	−54.9	10.4
1600	0.40	150.1	2.65	56.6	0.16	63.0	0.18	−61.1	9.4
1800	0.41	143.3	2.40	51.3	0.18	61.8	0.17	−66.8	8.6
2000	0.43	135.8	2.21	46.5	0.20	60.2	0.15	−73.9	7.9
2200	0.47	130.3	2.03	42.4	0.21	57.4	0.13	−86.9	7.3
2400	0.49	125.5	1.87	37.8	0.23	56.1	0.12	−104.2	6.7
2600	0.51	121.9	1.73	32.9	0.25	55.0	0.11	−119.0	6.1
2800	0.51	117.2	1.61	28.3	0.27	52.5	0.10	−129.7	5.5
3000	0.53	109.4	1.55	24.0	0.28	47.7	0.09	−144.9	5.3

Table 2 Noise data, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.80	0.11	98.1	0.21
1000	2.25	0.20	152.1	0.21

Table 3 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.44	−41.5	44.41	153.0	0.01	74.6	0.87	−19.7	39.9
100	0.37	−87.1	31.75	128.2	0.02	66.3	0.64	−36.3	33.0
200	0.32	−126.9	19.27	108.7	0.03	66.9	0.43	−43.2	27.1
300	0.31	−147.0	13.58	99.2	0.04	68.6	0.34	−43.0	23.6
400	0.32	−158.3	10.38	92.9	0.05	69.9	0.29	−41.7	21.2
500	0.31	−166.3	8.38	88.3	0.06	70.6	0.26	−40.5	19.2
600	0.32	−174.1	7.05	84.3	0.07	71.6	0.25	−40.1	17.7
700	0.32	−178.9	6.08	80.8	0.08	71.3	0.23	−40.4	16.4
800	0.32	175.3	5.35	77.7	0.09	70.7	0.22	−40.8	15.2
900	0.32	170.3	4.79	74.8	0.10	70.1	0.21	−41.6	14.3
1000	0.33	165.1	4.36	71.9	0.11	69.3	0.20	−43.1	13.5
1200	0.35	157.1	3.66	66.2	0.13	68.4	0.18	−46.7	12.0
1400	0.37	150.9	3.14	61.1	0.15	66.6	0.16	−51.8	10.7
1600	0.39	146.8	2.79	56.0	0.17	64.5	0.14	−57.8	9.7
1800	0.39	139.1	2.52	51.4	0.19	62.8	0.12	−63.8	8.8
2000	0.41	132.5	2.29	46.2	0.21	60.7	0.10	−73.7	8.1
2200	0.46	126.1	2.12	42.3	0.22	57.6	0.08	−92.2	7.6
2400	0.48	122.7	1.96	38.2	0.24	55.7	0.08	−113.2	7.0
2600	0.49	118.3	1.81	33.0	0.26	54.4	0.08	−130.0	6.4
2800	0.50	113.4	1.67	29.1	0.28	51.8	0.07	−149.4	5.8
3000	0.51	106.1	1.60	24.3	0.29	46.7	0.06	−179.0	5.5

Table 4 Noise data, I_C = 30 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	2.30	0.13	155.2	0.22
1000	2.70	0.25	175.6	0.22

Table 5 Common emitter scattering parameters, I_C = 45 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.40	−48.4	50.03	150.0	0.01	74.3	0.84	−22.0	40.0
100	0.35	−97.6	33.55	124.0	0.02	66.9	0.59	−38.4	32.9
200	0.32	−134.5	19.73	105.9	0.03	67.6	0.39	−43.0	27.1
300	0.32	−152.0	13.62	97.2	0.04	70.5	0.30	−41.8	23.6
400	0.32	−162.4	10.46	91.3	0.05	71.4	0.26	−40.1	21.2
500	0.33	−169.4	8.42	86.8	0.06	72.1	0.24	−39.2	19.3
600	0.33	−175.0	7.07	83.3	0.07	72.3	0.22	−38.5	17.7
700	0.32	179.8	6.10	80.1	0.08	72.2	0.21	−38.6	16.4
800	0.33	175.1	5.37	77.0	0.08	71.4	0.20	−38.8	15.3
900	0.33	170.0	4.81	74.2	0.10	70.8	0.19	−39.4	14.3
1000	0.34	164.9	4.37	71.2	0.11	69.9	0.18	−40.1	13.5
1200	0.36	157.5	3.65	65.7	0.13	68.8	0.16	−43.1	12.0
1400	0.39	152.6	3.15	60.9	0.15	66.8	0.14	−48.2	10.8
1600	0.39	147.8	2.79	55.6	0.17	64.9	0.12	−54.1	9.7
1800	0.41	140.5	2.51	50.4	0.19	63.0	0.10	−60.5	8.8
2000	0.43	133.4	2.31	45.9	0.20	60.7	0.08	−70.5	8.2
2200	0.47	127.8	2.11	41.8	0.22	57.7	0.06	−92.9	7.6
2400	0.49	124.8	1.95	37.8	0.24	56.1	0.05	−125.7	7.0
2600	0.51	121.6	1.79	33.0	0.26	54.6	0.05	−155.3	6.4
2800	0.51	115.7	1.68	27.9	0.28	52.0	0.05	179.9	5.8
3000	0.53	108.7	1.61	23.7	0.29	46.8	0.66	154.9	5.6

Table 6 Noise data, I_C = 45 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	2.7	0.17	159.1	0.24
1000	3.0	0.30	−177.3	0.20

NPN 5 GHz wideband transistor BFG96

DESCRIPTION

NPN transistor in a 4-lead dual-emitter plastic SOT103 envelope.

It is designed for application in wideband amplifiers, such as MATV and CATV systems.

PNP complement is the BFG32.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

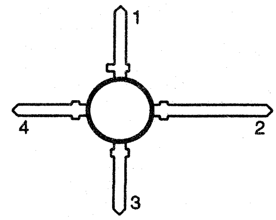


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	75	mA
P_{tot}	total power dissipation	up to T_s = 136 °C (note 1)	–	–	700	mW
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_j = 25 °C	25	80	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	–	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point	I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	40	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

 Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	75	mA
P_{tot}	total power dissipation	up to T_s = 136 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 136 °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

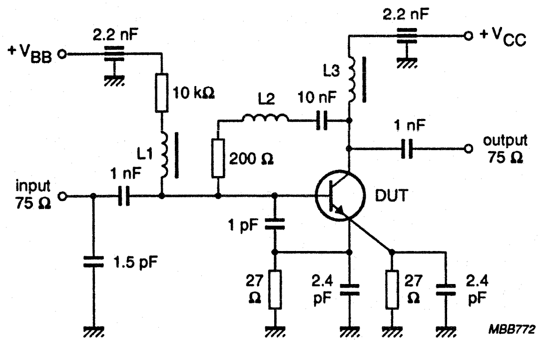
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	25	80	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 50 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	I_C = 70 mA; V_{CE} = 10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	4	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 10 V; I_C = 70 mA; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point (see Fig.2)	note 2	–	40	–	dBm
V_O	output voltage	note 3	–	700	–	mV
d_2	second order intermodulation distortion (see Fig.2)	note 4	–	–52	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   P_p = ITO –6 dB; f_p = 800 MHz;
   P_q = ITO –6 dB; f_q = 801 MHz;
   measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz.
3. d_{im} = –60 dB; I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   $V_p = V_O$ = 320 mV at f_p = 250 MHz;
   $V_q = V_O$ = 320 mV at f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.



L1 = L3 = 5 μH micro-choke.

L2 = 1.5 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

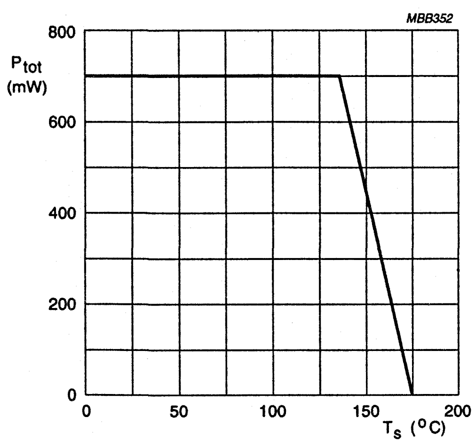
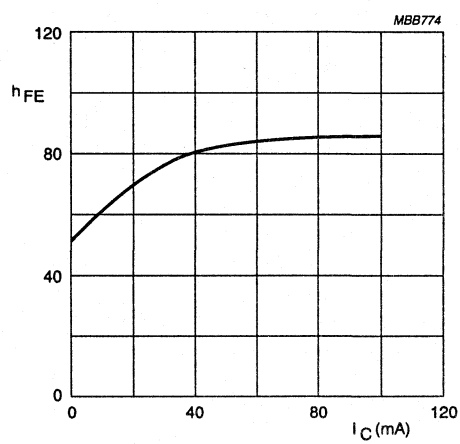
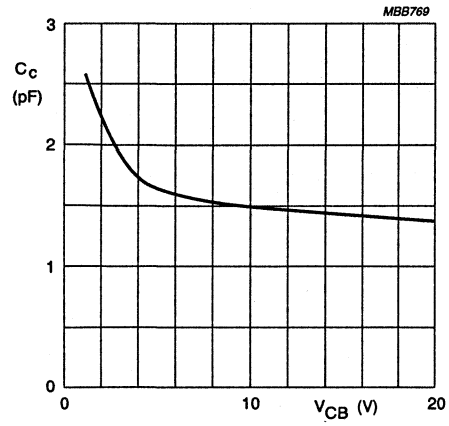


Fig.3 Power derating curve.



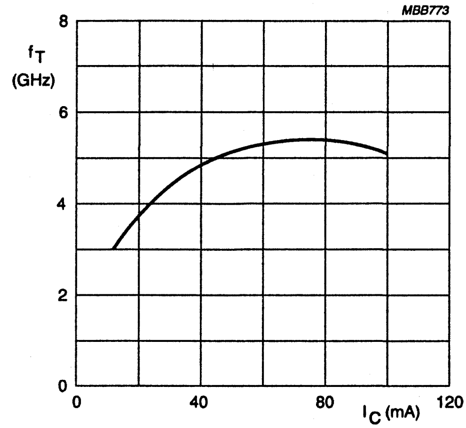
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



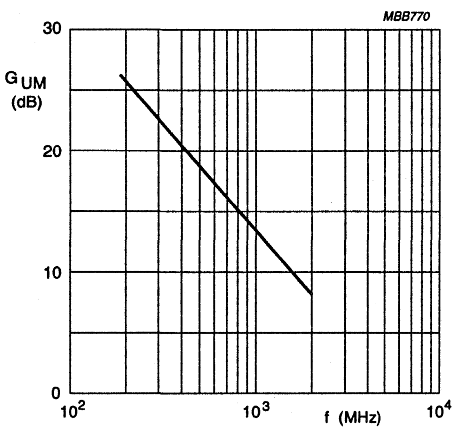
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



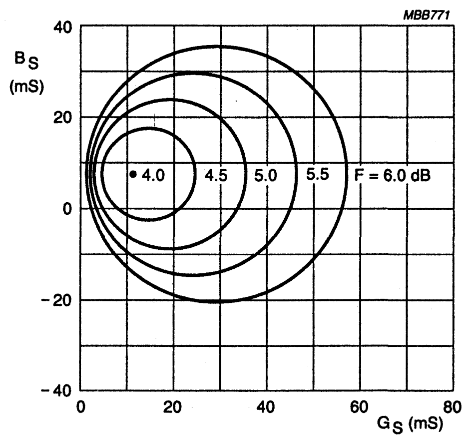
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



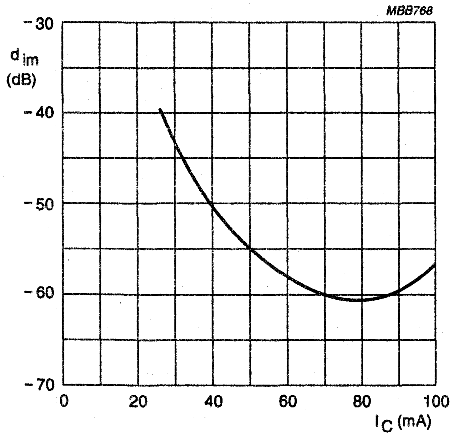
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



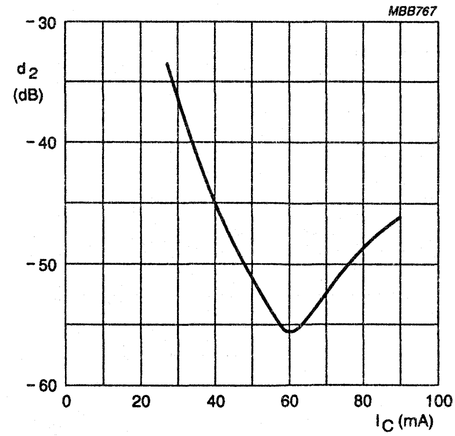
I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.8 Noise circle figure.



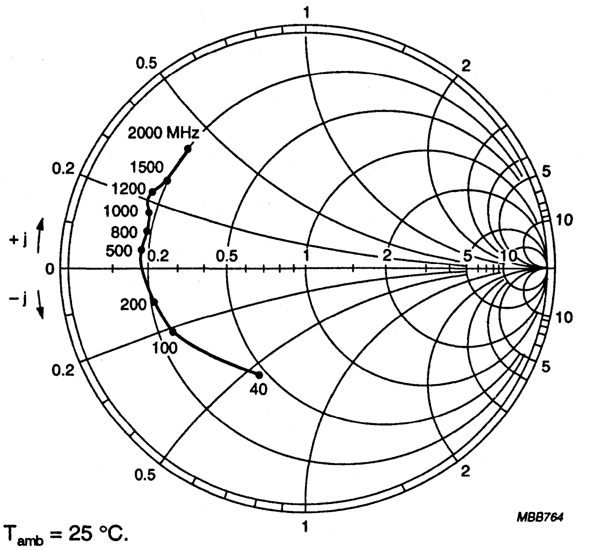
V_{CE} = 10 V; V_O = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion as a function of collector current.



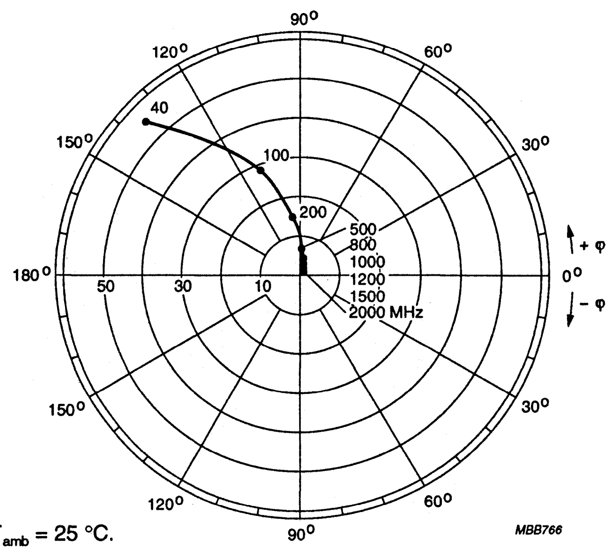
V_{CE} = 10 V; V_O = 320 mV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.10 Second order intermodulation distortion as a function of collector current.



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

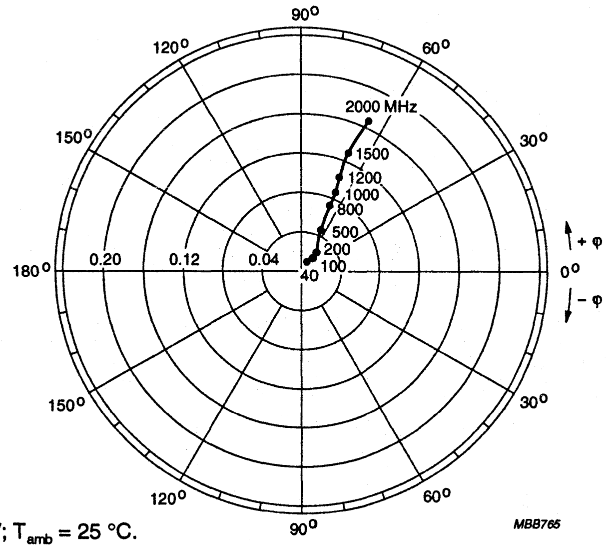
Fig.11 Common emitter input reflection coefficient (S_{11}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

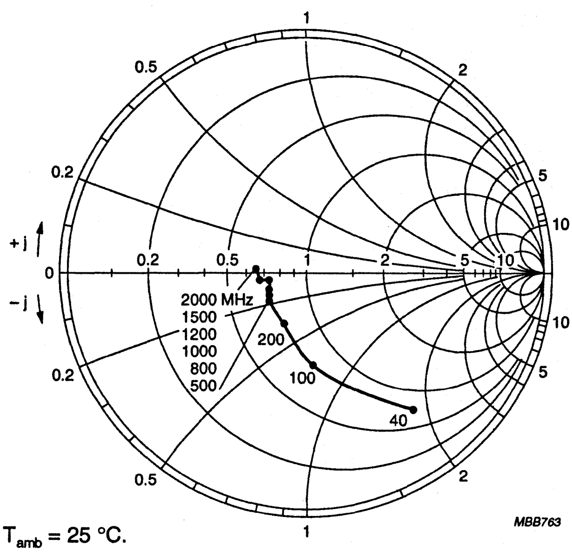
Fig.12 Common emitter forward transmission coefficient (S_{21}).

NPN 5 GHz wideband transistor BFG96



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.435	−95.0	50.872	135.1	0.0120	62.5	0.698	−43.0	37.9
100	0.551	−138.	28.689	113.1	0.0210	51.0	0.417	−72.3	31.6
200	0.615	−161.	15.554	99.2	0.0280	51.4	0.249	−95.9	26.2
300	0.623	−171.	10.577	92.6	0.0360	57.2	0.190	−110.	22.8
400	0.636	−176.	7.991	87.4	0.0420	61.0	0.164	−120.	20.4
500	0.646	178.5	6.427	84.3	0.0490	61.7	0.153	−128.	18.6
600	0.637	174.9	5.428	80.4	0.0580	61.8	0.146	−132.	17.0
700	0.647	171.5	4.636	77.9	0.0660	63.5	0.141	−135.	15.8
800	0.642	167.6	4.118	73.9	0.0730	64.5	0.135	−138.	14.7
900	0.642	164.9	3.683	71.7	0.0820	64.1	0.133	−142.	13.7
1000	0.648	161.5	3.308	69.9	0.0890	65.1	0.132	−146.	12.8
1200	0.664	155.7	2.765	64.8	0.104	64.1	0.135	−152.	11.4
1400	0.670	149.7	2.369	59.0	0.116	62.7	0.147	−157.	10.2
1600	0.681	145.9	2.094	54.7	0.130	63.3	0.158	−159.	9.24
1800	0.690	141.5	1.881	50.0	0.146	60.8	0.170	−161.	8.42
2000	0.716	135.1	1.713	47.2	0.159	59.8	0.173	−164.	7.93
2200	0.735	128.5	1.629	42.7	0.172	58.5	0.184	−171.	7.76
2400	0.735	124.6	1.484	38.5	0.180	58.5	0.206	−178.	6.99
2600	0.744	123.9	1.323	35.8	0.197	57.6	0.236	178.2	6.18
2800	0.762	117.4	1.262	31.3	0.201	54.7	0.261	177.0	6.10
3000	0.744	112.5	1.167	26.7	0.210	55.2	0.274	175.2	5.18

Table 2 Common emitter scattering parameters, $I_C = 70$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.379	−56.7	27.463	132.2	0.0157	72.0	0.668	−21.9	32.0
100	0.393	−90.1	14.206	112.6	0.0324	66.3	0.515	−25.8	25.1
200	0.512	−120.	7.781	101.9	0.0551	52.6	0.431	−29.8	20.0
300	0.589	−140.	5.603	96.6	0.0628	44.6	0.380	−36.3	17.5
400	0.635	−151.	4.319	90.0	0.0704	40.3	0.355	−39.3	15.5
500	0.651	−159.	3.476	84.0	0.0754	38.6	0.346	−42.5	13.8
600	0.679	−165.	2.904	81.0	0.0813	36.5	0.347	−46.1	12.5
700	0.695	−171.	2.527	79.1	0.0809	36.5	0.347	−53.3	11.5
800	0.705	−177.	2.265	75.7	0.0829	36.9	0.344	−58.0	10.6
900	0.698	179.3	2.013	71.1	0.0863	36.6	0.341	−61.0	9.51
1000	0.705	174.6	1.842	68.1	0.0892	39.8	0.340	−65.9	8.83
1200	0.722	168.0	1.510	63.1	0.0937	40.1	0.351	−74.0	7.35
1400	0.737	161.2	1.319	58.0	0.0961	43.2	0.352	−88.0	6.37
1600	0.738	155.5	1.182	52.5	0.102	49.0	0.358	−99.5	5.46
1800	0.744	150.2	1.058	48.5	0.112	50.4	0.391	−108.	4.71
2000	0.759	143.2	0.978	43.9	0.120	53.7	0.388	−115.	4.24
2200	0.780	137.8	0.899	41.7	0.129	54.5	0.405	−127.	3.92
2400	0.802	134.1	0.822	37.7	0.141	57.8	0.410	−139.	3.57
2600	0.804	130.5	0.754	34.5	0.155	58.5	0.444	−149.	3.01
2800	0.791	125.8	0.725	30.3	0.163	56.6	0.477	−157.	2.61
3000	0.794	119.9	0.680	26.9	0.174	58.4	0.488	−163.	2.15

NPN 5 GHz wideband transistor — BFG97

DESCRIPTION

NPN planar epitaxial transitor mounted in a plastic SOT223 envelope.
It features excellent output voltage capabilities, and is primarily intended for use in MATV applications.

PNP complement is the BFG31.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

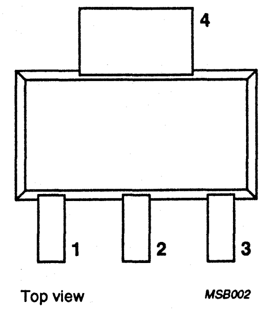


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V; T_j = 25 °C	25	80	–	
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	5.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	I_C = 70 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	–	700	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	50 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	80	–	
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	5.5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	700	–	mV
d_2	second order intermodulation distortion	note 4	–	–56	–	dB
		note 5	–	–53	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 445.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 453.25 MHz; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 795.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 410 MHz.
5. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

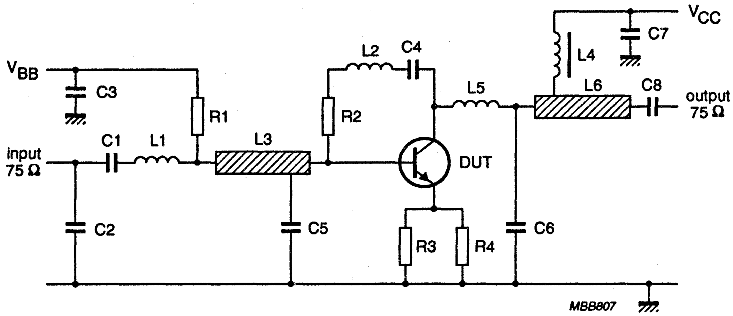


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

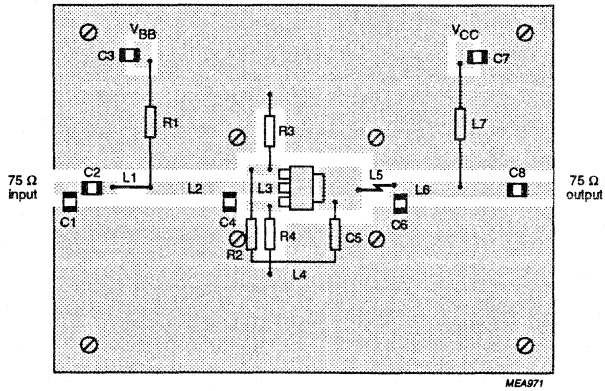
List of components (see test circuit)

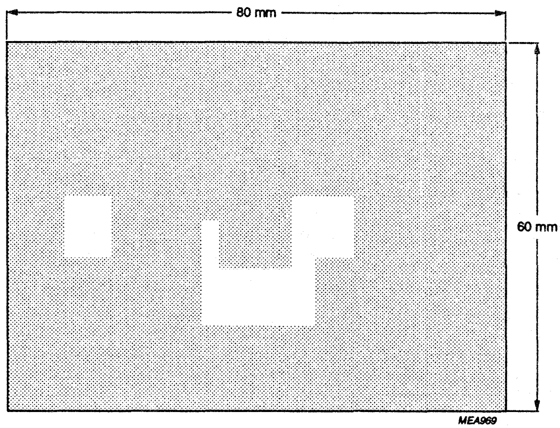
DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C2, C3, C7, C8	multilayer ceramic capacitor	10 nF		2222 590 08627
C1, C4, C6	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C5 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1 (note 1)	0.5 turns 0.4 mm copper wire		int. dia. 3 mm	
L2	microstripline	75 Ω	length 14 mm; width 2.5 mm	
L3	microstripline	75 Ω	length 8 mm; width 2.5 mm	
L4, L5 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L6	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L7	Ferroxcube choke	5 μH		3122 108 20153
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	220 Ω		2322 180 73221
R3, R4	metal film resistor	30 Ω		2322 180 73309

Notes

The circuit has been built on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 2 x 35 μm.

1. Components C5, L1, L4, L5, and R2 are mounted on the underside of the PCB.





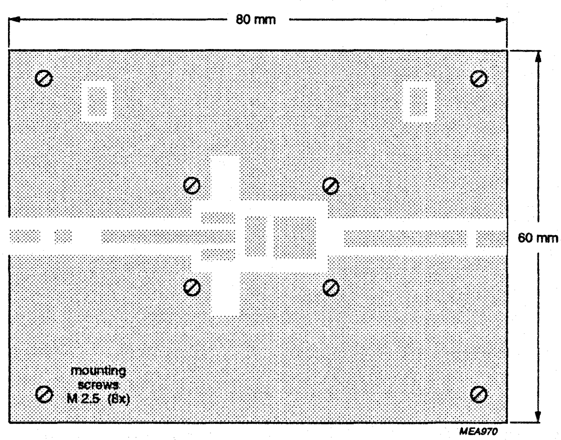


Fig.3 Intermodulation distortion and second order intermodulation distortion printed circuit board.

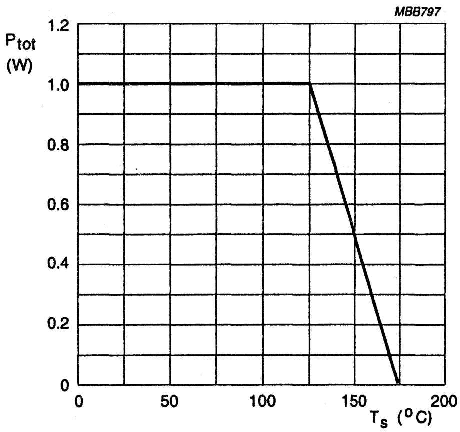
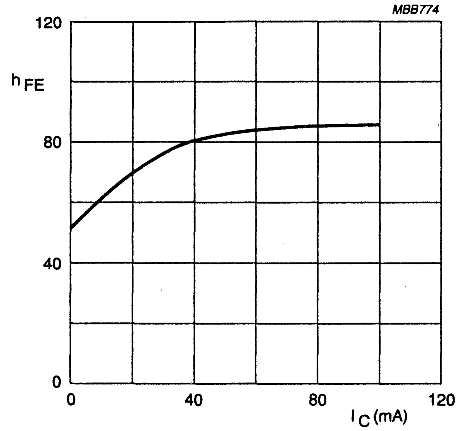
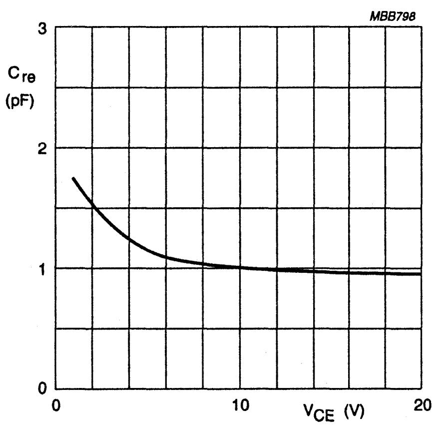


Fig.4 Power derating curve.



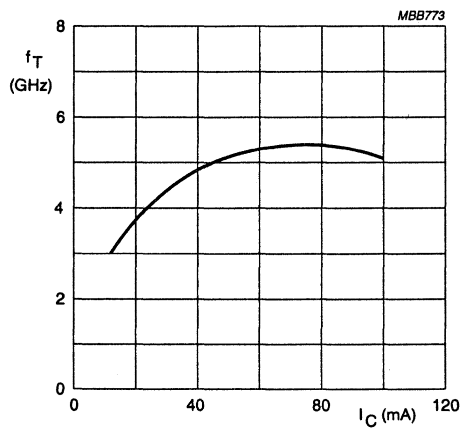
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



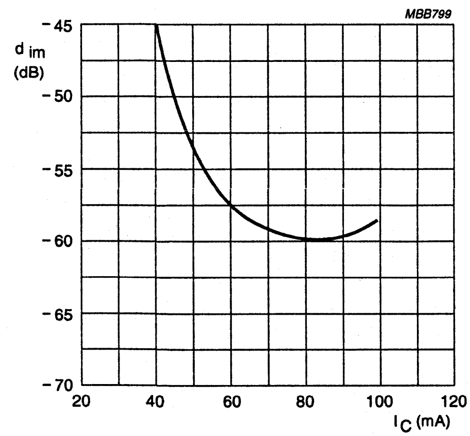
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



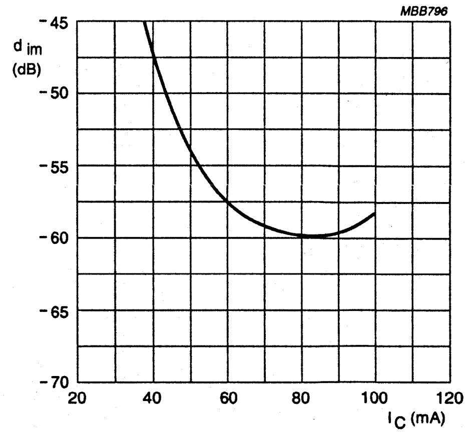
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.7 Transition frequency as a function of collector current.



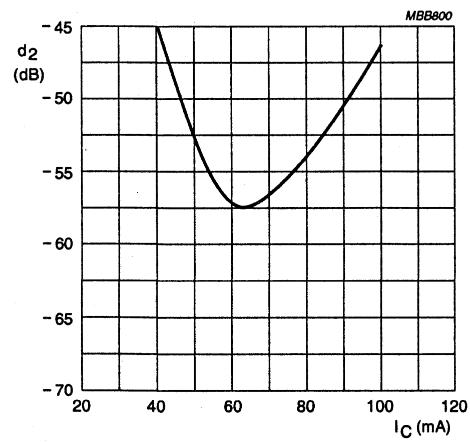
V_{CE} = 10 V; V_O = 750 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation disortion as a function of collector current.



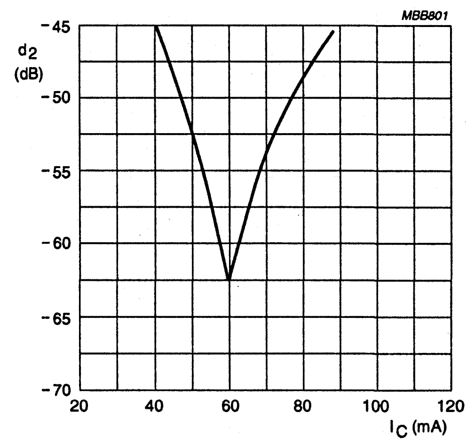
V_{CE} = 10 V; V_O = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion as a function of collector current.



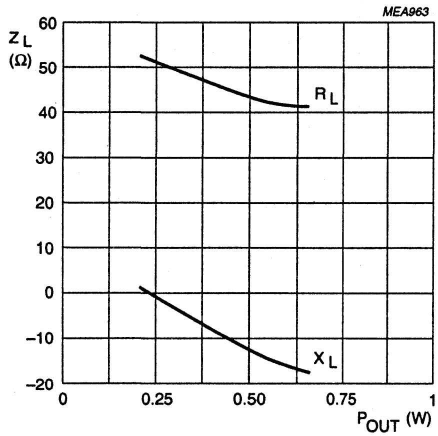
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.10 Second order intermodulation distortion as a function of collector current.



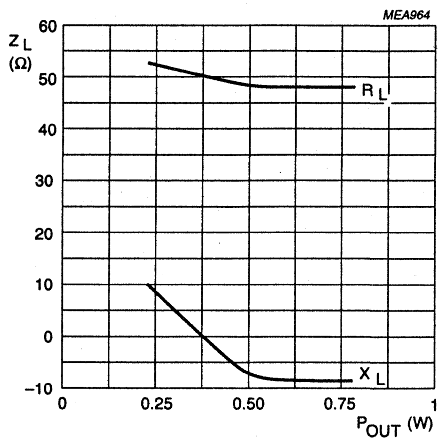
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.11 Second order intermodulation distortion as a function of collector current.



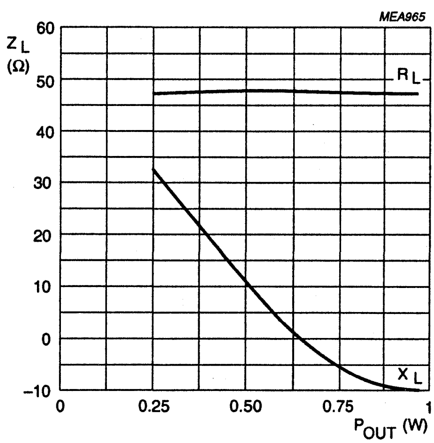
V_{CE} = 6 V; f = 900 MHz.

Fig.12 Load impedance as a function of output power.



V_{CE} = 7.5 V; f = 900 MHz.

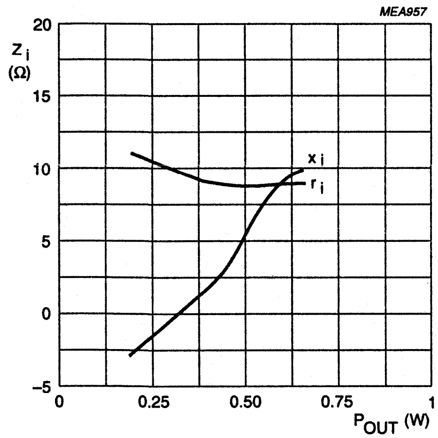
Fig.13 Load impedance as a function of output power.



V_{CE} = 10 V; f = 900 MHz.

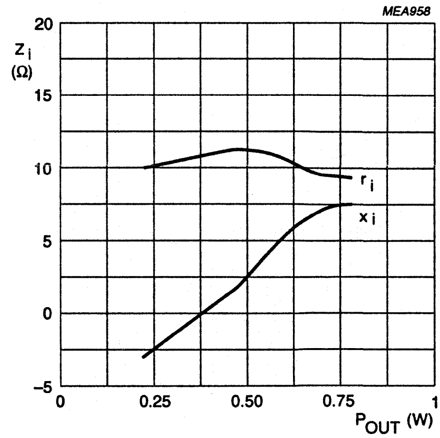
Fig.14 Load impedance as a function of output power.

NPN 5 GHz wideband transistor | BFG97



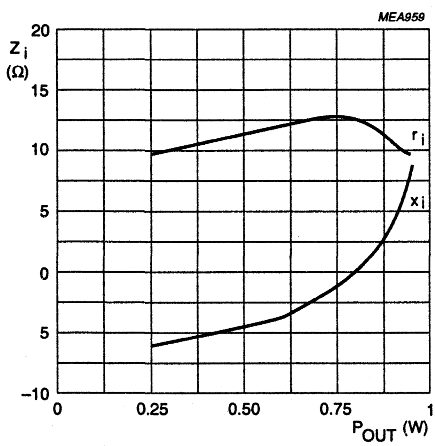
V_{CE} = 6 V; f = 900 MHz.

Fig.15 Input impedance as a function of output power.



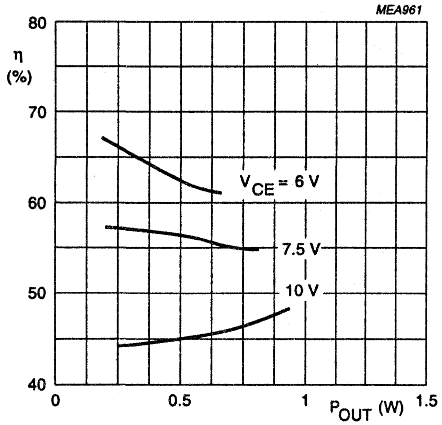
V_{CE} = 7.5 V; f = 900 MHz.

Fig.16 Input impedance as a function of output power.



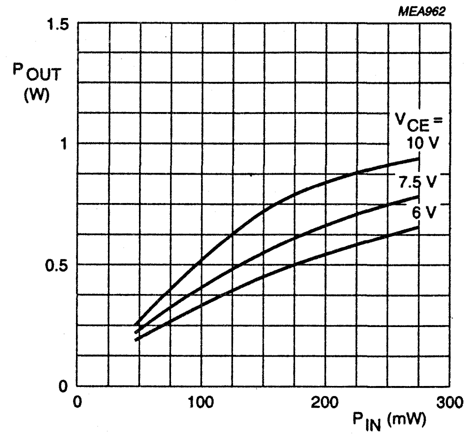
V_{CE} = 10 V; f = 900 MHz.

Fig.17 Input impedance as a function of output power.



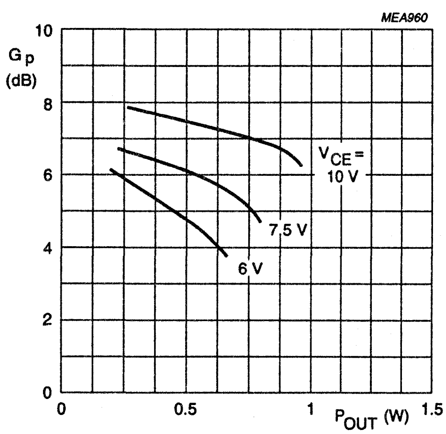
f = 900 MHz.

Fig.18 Efficiency as a function of output power.



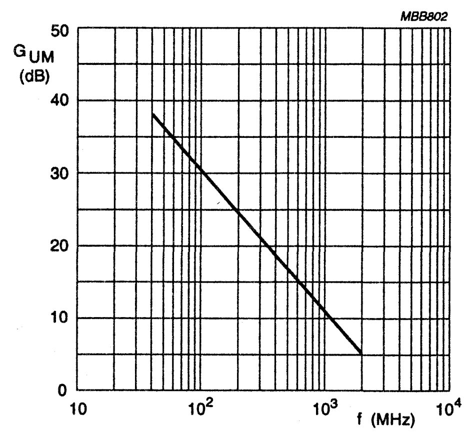
f = 900 MHz.

Fig.19 Output power as a function of input power.



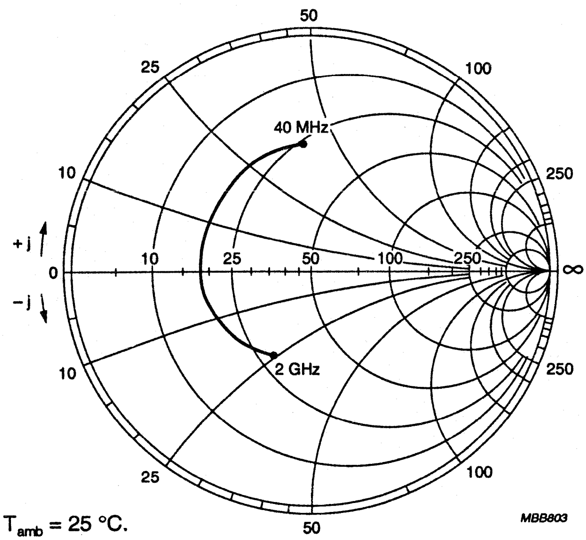
f = 900 MHz.

Fig.20 Power gain as a function of output power.



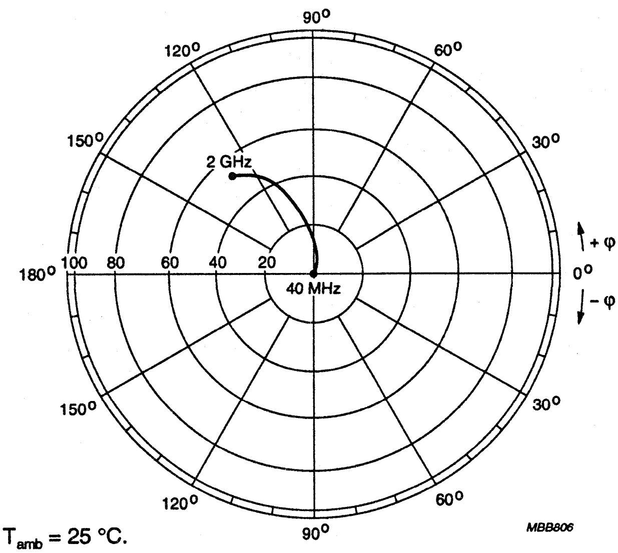
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.21 Maximum unilateral power gain as a function of frequency.



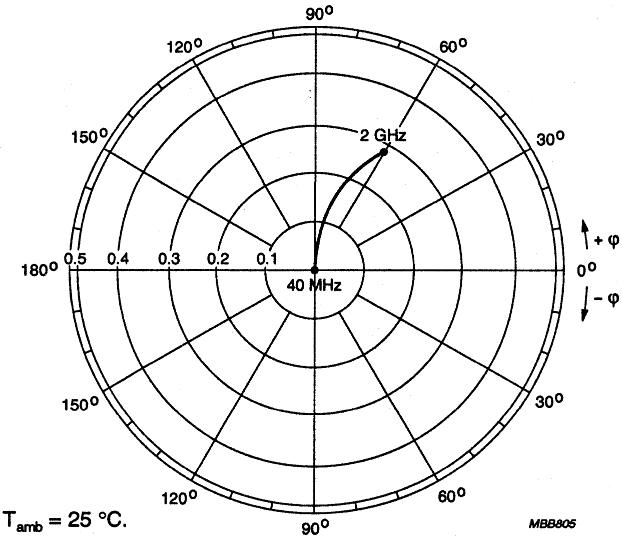
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.22 Common emitter input reflection coefficient (S_{11}).



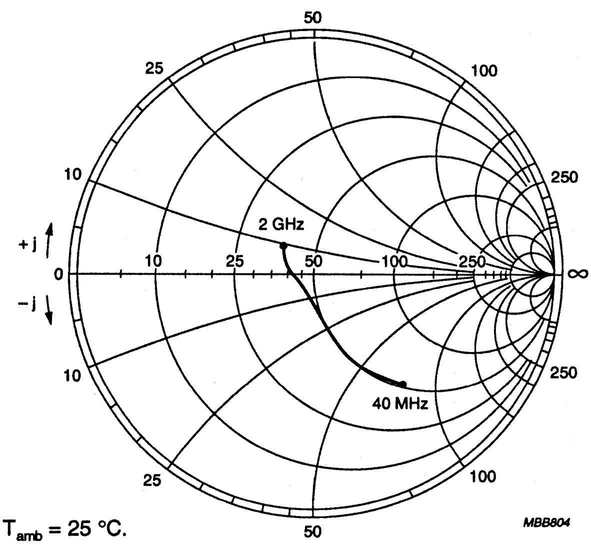
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.23 Common emitter forward transmission coefficient (S_{21}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.24 Common emitter reverse transmission coefficient (S_{12}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.25 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.437	−102.2	53.674	130.5	0.013	61.1	0.629	−49.8	37.7
100	0.474	−146.2	27.244	106.8	0.021	60.7	0.326	−76.3	30.3
200	0.482	−166.9	14.286	95.1	0.035	67.9	0.175	−95.5	24.4
300	0.496	−174.8	9.637	88.4	0.048	69.1	0.124	−110.5	21.0
400	0.505	179.5	7.339	82.9	0.062	69.9	0.103	−123.7	18.6
500	0.491	174.2	5.901	79.2	0.077	70.3	0.091	−133.9	16.7
600	0.511	169.7	4.931	75.9	0.090	69.9	0.085	−143.1	15.2
700	0.513	166.5	4.261	72.5	0.103	69.3	0.082	−152.8	13.9
800	0.519	163.6	3.772	69.2	0.117	67.9	0.077	−162.6	12.9
900	0.521	159.0	3.344	66.0	0.129	67.0	0.078	−172.4	11.9
1000	0.539	155.1	3.030	63.3	0.142	65.6	0.084	−179.9	11.2
1200	0.554	148.2	2.534	56.6	0.169	63.5	0.102	164.6	9.7
1400	0.571	143.4	2.259	51.3	0.187	60.3	0.122	157.5	8.9
1600	0.585	139.3	1.947	45.8	0.213	58.6	0.139	152.0	7.7
1800	0.592	130.7	1.767	39.1	0.237	53.9	0.157	145.6	6.9
2000	0.622	124.8	1.630	34.7	0.256	52.2	0.182	138.3	6.5
2200	0.649	118.4	1.474	29.5	0.275	49.4	0.213	132.7	5.9
2400	0.655	115.2	1.360	27.1	0.286	48.5	0.241	128.3	5.4
2600	0.674	111.2	1.285	21.2	0.312	44.2	0.266	123.5	5.1
2800	0.675	104.4	1.170	16.0	0.319	39.7	0.280	117.3	4.4
3000	0.698	97.2	1.130	12.1	0.335	38.1	0.302	109.8	4.4

NPN 5 GHz wideband transistor BFG97

Table 2 Common emitter scattering parameters, $I_C = 70$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.421	−112.5	57.018	126.8	0.011	60.6	0.575	−54.9	37.7
100	0.470	−152.3	27.744	104.6	0.021	61.0	0.287	−81.8	30.3
200	0.483	−169.6	14.399	94.0	0.033	69.8	0.157	−103.7	24.4
300	0.490	−177.5	9.723	87.6	0.048	71.9	0.116	−120.3	21.0
400	0.490	178.8	7.379	82.3	0.063	71.2	0.101	−134.4	18.6
500	0.495	172.9	5.943	78.7	0.078	71.6	0.093	−145.7	16.7
600	0.507	169.7	4.950	75.6	0.091	70.7	0.089	−154.2	15.2
700	0.508	166.5	4.283	72.1	0.104	70.2	0.089	−163.4	14.0
800	0.506	164.4	3.784	69.2	0.118	68.3	0.086	−172.8	12.9
900	0.512	159.1	3.367	65.8	0.131	67.8	0.088	178.6	11.9
1000	0.535	155.0	3.038	63.1	0.144	65.7	0.094	171.6	11.2
1200	0.545	148.4	2.556	56.4	0.169	63.7	0.115	159.1	9.7
1400	0.577	142.1	2.270	51.5	0.190	60.2	0.138	153.0	9.0
1600	0.569	138.2	1.955	46.1	0.215	58.8	0.154	147.9	7.6
1800	0.592	131.6	1.767	38.9	0.239	54.3	0.171	141.3	6.9
2000	0.626	122.8	1.644	34.7	0.258	51.7	0.196	135.2	6.6
2200	0.641	118.2	1.483	29.7	0.276	49.4	0.226	129.6	5.9
2400	0.678	115.3	1.366	27.3	0.289	48.1	0.255	125.2	5.7
2600	0.684	110.5	1.284	21.1	0.314	44.0	0.277	120.7	5.3
2800	0.673	103.3	1.171	16.3	0.321	39.7	0.290	114.8	4.4
3000	0.702	97.1	1.140	12.1	0.336	38.0	0.313	107.2	4.5

NPN 7 GHz wideband transistor — BFG134

DESCRIPTION

NPN planar epitaxial transistor in a 4-lead double-emitter plastic SOT103 envelope, intended for wideband amplifier applications.

The small emitter structures ensure high output voltage capabilities at a low distortion level. The distribution of the active areas across the surface of the device gives an excellent temperature profile.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

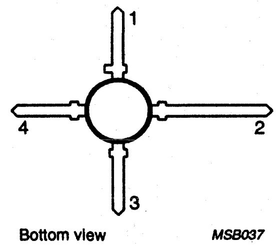


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_j = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	14.5	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
V_O	output voltage	I_C = 100 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	–	850	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	1	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	130	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz;	–	7	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	14.5	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
V_O	output voltage	note 2	–	900	–	mV
		note 3	–	850	–	mV
d_2	second order intermodulation distortion	note 4	–	–60	–	dB
		note 5	–	–56	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 80 mA; V_{CE} = 10 V; T_{amb} = 25 °C; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz.
5. I_C = 80 mA; V_{CE} = 10 V; T_{amb} = 25 °C; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

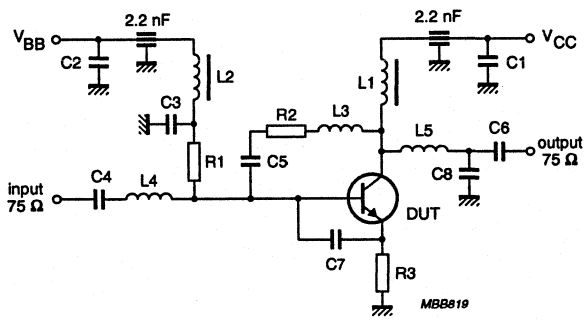


Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic capacitor	10 nF		2222 629 08103
C3, C4, C5, C6	multilayer ceramic capacitor	10 nF		2222 851 06627
C7	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C8	multilayer ceramic capacitor	1 pF		2222 851 12108
L1, L2	Ferroxcube choke	5 μH		3122 108 20153
L3	4 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4, L5	1.5 turns 0.4 mm copper wire		int. dia. 3 mm	
R1	chip resistor	10 kΩ		2322 712 30103
R2	chip resistor	220 Ω		2322 712 30221
R3	chip resistor	15 Ω		2322 712 30158

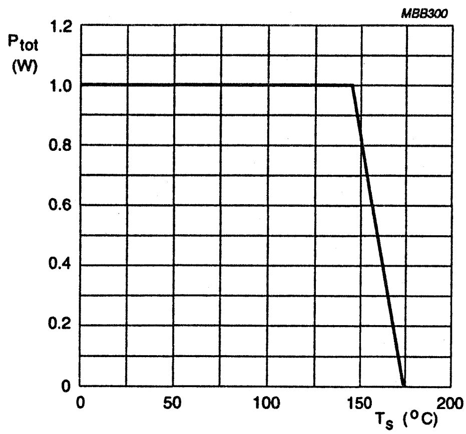
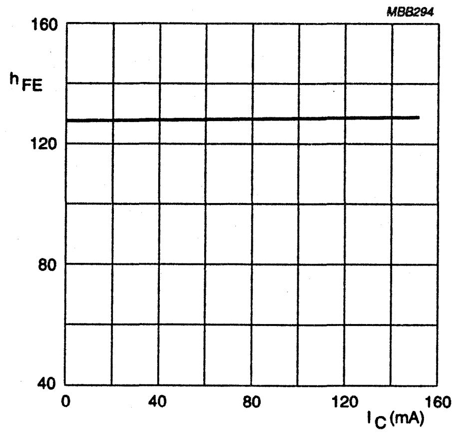
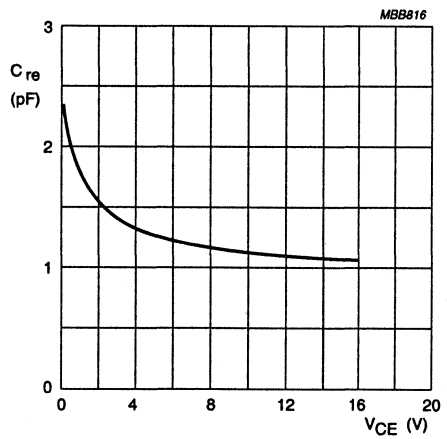


Fig.3 Power derating curve.



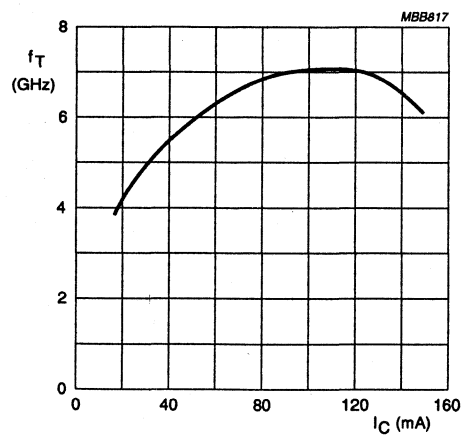
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



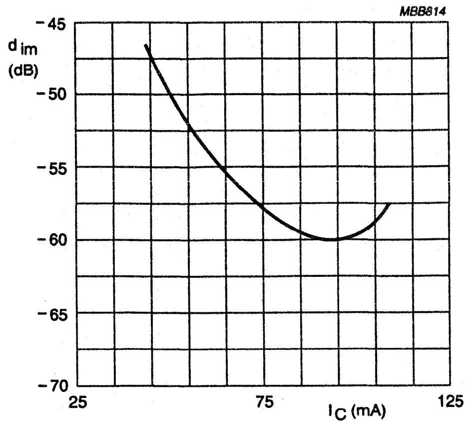
I_C = 0; f = 1 MHz; T_j = 25 °C.

Fig.5 Feedback capacitance as a function of collector-emitter voltage.



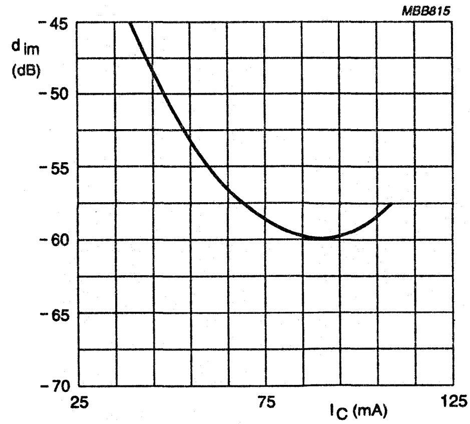
V_{CE} = 10 V; f = 1 GHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



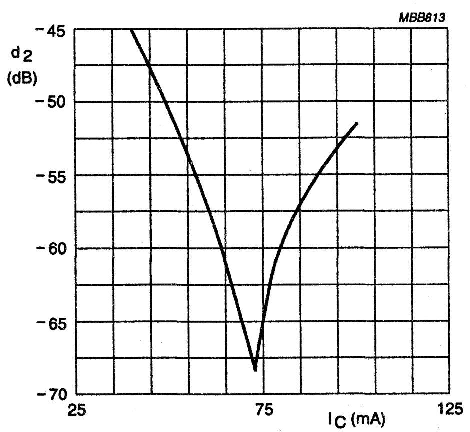
V_{CE} = 10 V; V_O = 900 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.7 Intermodulation distortion as a function of collector current.



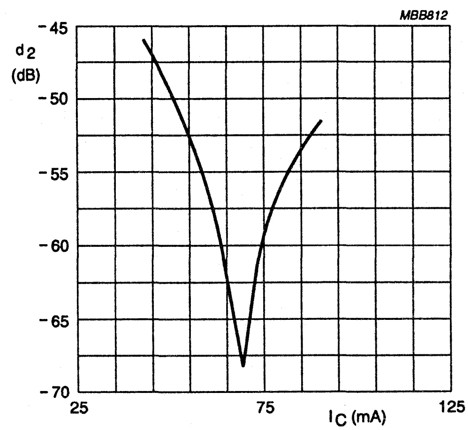
V_{CE} = 10 V; V_O = 850 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation distortion as a function of collector current.



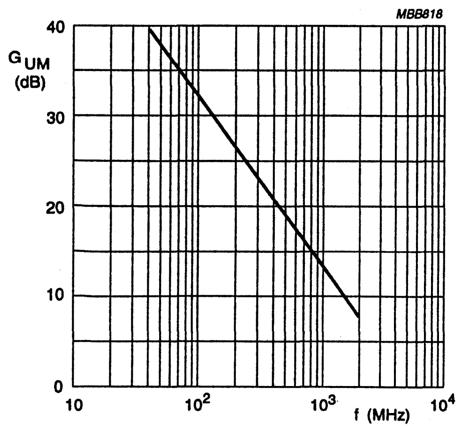
V_{CE} = 10 V; f_p = 50 MHz; f_q = 400 MHz; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C; V_O = 50 dBmV.

Fig.9 Second order intermodulation distortion as a function of collector current.



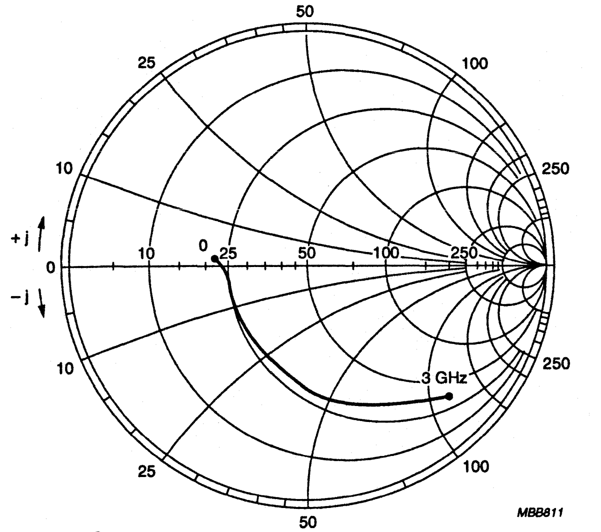
V_{CE} = 10 V; f_p = 250 MHz; f_q = 560 MHz; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; V_O = 50 dBmV.

Fig.10 Second order intermodulation distortion as a function of collector current.



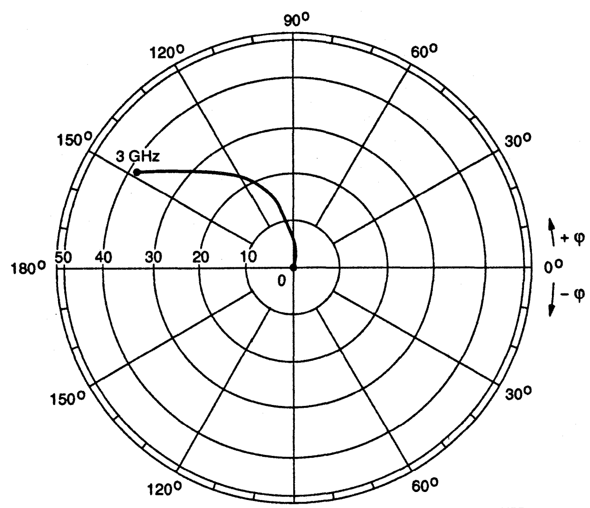
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Maximum unilateral power gain as a function of frequency.



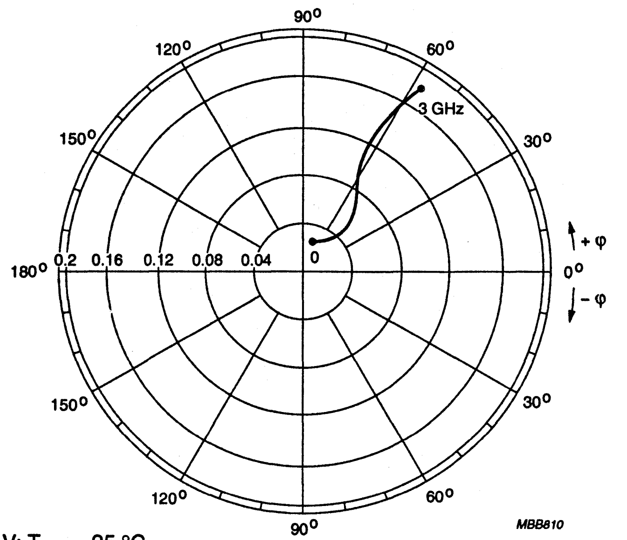
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter input reflection coefficient (S_{11}).



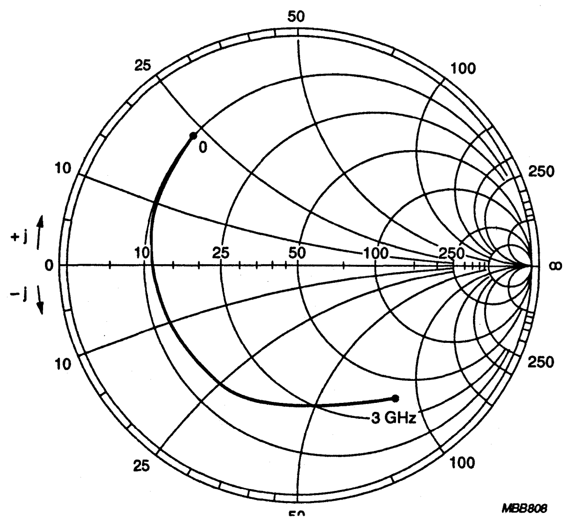
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter forward transmission coefficient (S_{21}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.15 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.671	−56.3	36.656	149.6	0.022	64.8	0.860	−37.5	39.7
100	0.649	−106.8	24.710	122.9	0.038	45.4	0.614	−75.0	32.3
200	0.637	−142.9	14.402	103.7	0.047	37.4	0.431	−108.5	26.3
300	0.640	−159.2	9.959	93.9	0.052	37.4	0.369	−127.3	22.9
400	0.648	−168.4	7.597	86.8	0.057	39.6	0.348	−138.6	20.5
500	0.649	−174.9	6.140	81.1	0.063	41.9	0.341	−145.9	18.7
600	0.652	179.6	5.175	76.2	0.069	43.8	0.337	−150.9	17.2
700	0.648	175.2	4.452	71.6	0.076	45.3	0.335	−154.5	15.9
800	0.650	170.7	3.936	67.7	0.082	47.0	0.334	−157.6	14.8
900	0.651	167.1	3.524	63.6	0.090	48.0	0.334	−160.8	13.9
1000	0.652	163.0	3.161	59.8	0.097	48.7	0.335	−163.7	12.9
1200	0.667	156.1	2.677	52.6	0.112	49.1	0.349	−169.8	11.7
1400	0.683	150.1	2.296	45.6	0.125	48.5	0.372	−174.8	10.6
1600	0.689	144.6	2.016	38.6	0.141	47.6	0.392	−177.6	9.6
1800	0.684	138.5	1.836	31.1	0.159	45.4	0.408	179.4	8.8
2000	0.694	131.9	1.665	24.7	0.176	42.9	0.423	175.0	8.1
2200	0.728	126.5	1.513	19.3	0.193	41.9	0.444	169.8	7.8
2400	0.754	121.9	1.397	14.2	0.207	40.2	0.477	165.4	7.7
2600	0.761	118.3	1.292	8.1	0.220	37.3	0.514	162.3	7.3
2800	0.766	113.2	1.208	2.0	0.234	33.8	0.540	159.4	7.0
3000	0.764	108.0	1.123	−3.5	0.252	30.4	0.557	155.4	6.4

Table 2 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.672	−57.5	37.650	148.8	0.022	63.5	0.849	−39.1	39.7
100	0.648	−108.7	25.019	122.0	0.037	44.5	0.604	−77.9	32.3
200	0.639	−144.2	14.463	103.1	0.046	37.6	0.429	−111.8	26.4
300	0.640	−159.9	9.974	93.5	0.051	37.7	0.373	−130.3	22.9
400	0.647	−169.0	7.611	86.6	0.057	40.6	0.354	−141.6	20.6
500	0.646	−175.9	6.147	80.9	0.063	42.7	0.347	−148.9	18.7
600	0.650	179.1	5.177	76.1	0.069	44.5	0.345	−153.7	17.2
700	0.645	174.7	4.461	71.8	0.076	46.0	0.343	−157.2	15.9
800	0.646	170.4	3.936	67.7	0.083	47.4	0.341	−160.3	14.8
900	0.649	166.6	3.528	63.6	0.091	48.2	0.341	−163.4	13.9
1000	0.649	162.8	3.176	60.0	0.098	49.0	0.343	−166.3	13.0
1200	0.662	155.8	2.681	52.9	0.113	49.3	0.357	−172.3	11.7
1400	0.680	149.5	2.307	46.0	0.127	48.6	0.379	−177.3	10.6
1600	0.686	144.2	2.025	39.0	0.143	47.4	0.396	−179.7	9.6
1800	0.680	138.3	1.842	31.6	0.160	45.1	0.411	177.3	8.8
2000	0.693	131.9	1.670	25.2	0.177	42.7	0.426	172.8	8.2
2200	0.724	126.3	1.521	19.4	0.194	41.5	0.446	167.7	7.8
2400	0.750	121.9	1.407	14.5	0.209	39.8	0.479	163.7	7.7
2600	0.758	118.1	1.283	8.5	0.221	36.5	0.515	160.4	7.2
2800	0.763	113.1	1.209	2.5	0.234	33.3	0.539	157.7	6.9
3000	0.767	107.3	1.125	−3.0	0.253	30.1	0.557	154.1	6.5

NPN 7 GHz wideband transistor BFG135

DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The small emitter structures, with integrated emitter-ballasting resistors, ensure high output voltage capabilities at a low distortion level.

The distribution of the active areas across the surface of the device gives an excellent temperature profile.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

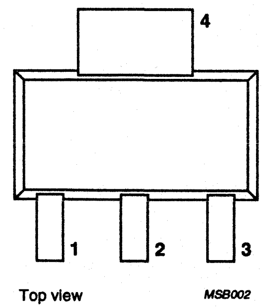


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	850	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	1	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	130	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	7	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	note 1	–	900	–	mV
		note 2	–	850	–	mV
d_2	second order intermodulation distortion	I_C = 90 mA; V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 450 MHz	–	−58	–	dB
		I_C = 90 mA; V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 810 MHz	–	−53	–	dB

Notes

1. d_{im} = −60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
2. d_{im} = −60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.

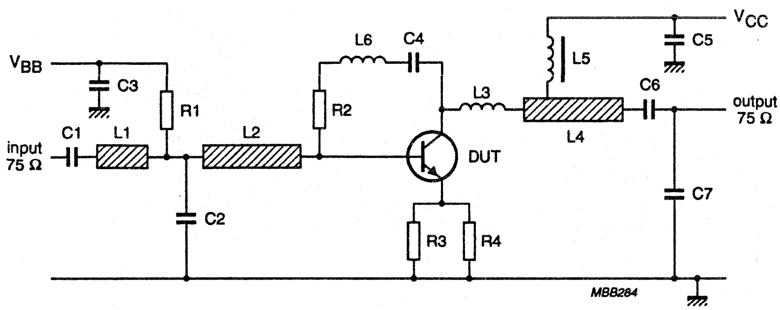


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C5, C6	multilayer ceramic capacitor	10 nF		2222 590 08627
C2, C7	multilayer ceramic capacitor	1 pF		2222 851 12108
C4 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1	microstripline	75 Ω	length 7 mm; width 2.5 mm	
L2	microstripline	75 Ω	length 22mm; width 2.5 mm	
L3 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L5	Ferroxcube choke	5 μH		3122 108 20153
L6 (note 1)	0.4 mm copper wire	≈25 nH	length 30 mm	
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	200 Ω		2322 180 73201
R3, R4	metal film resistor	27 Ω		2322 180 73279

Notes

The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric ($\varepsilon_r = 2.2$); thickness 1⁄16 inch; thickness of copper sheet 1⁄32 inch.

1. Components C4, L3, L6 and R2 are mounted on the underside of the PCB.

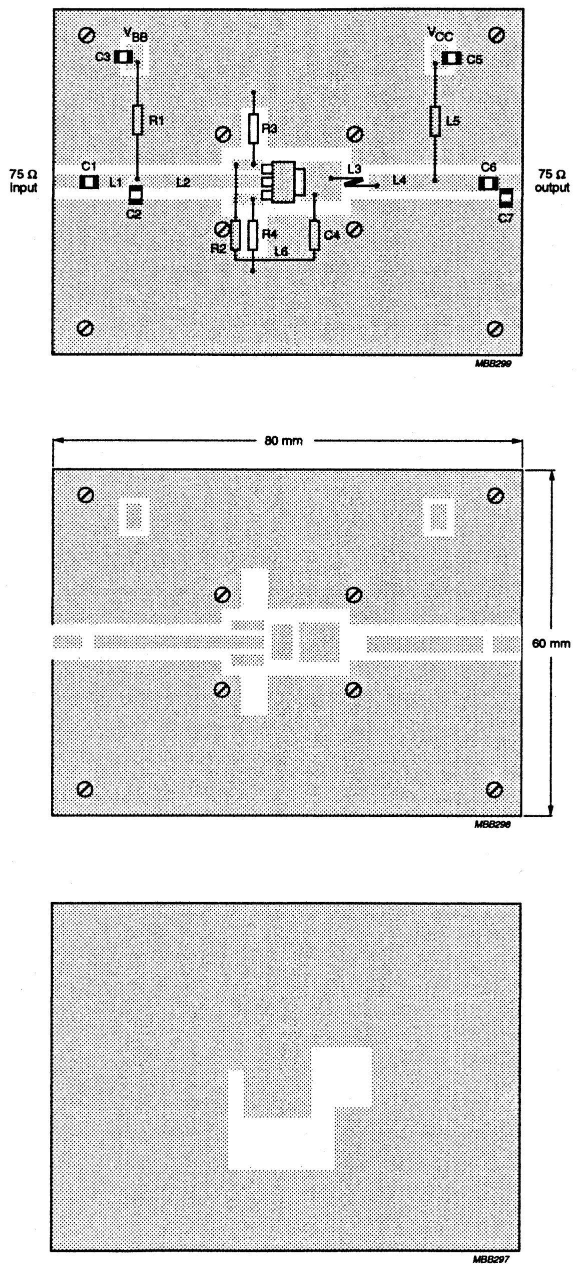


Fig.3 Intermodulation distortion test printed circuit board.

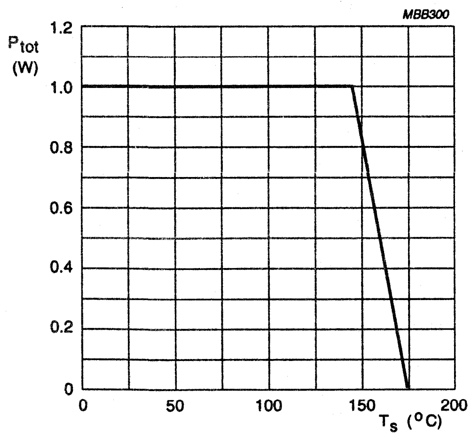
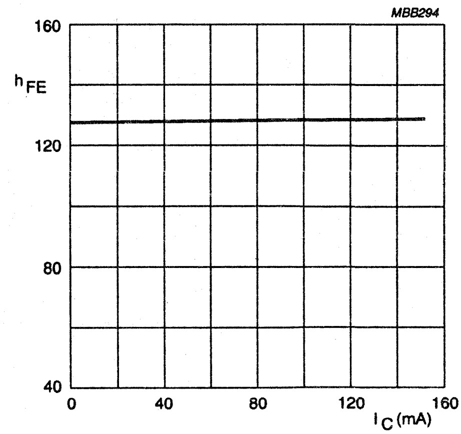
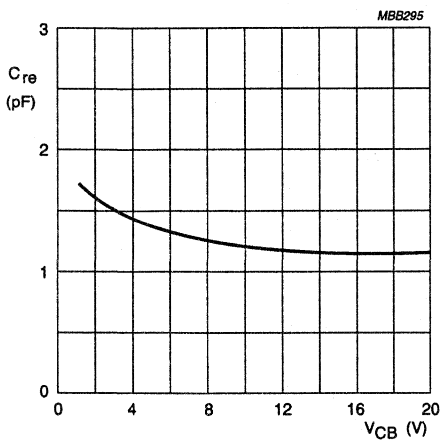


Fig.4 Power derating curve.



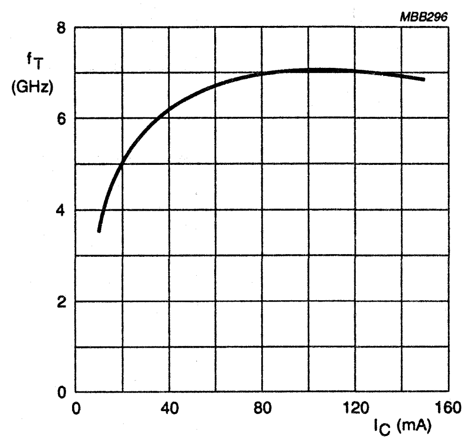
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.

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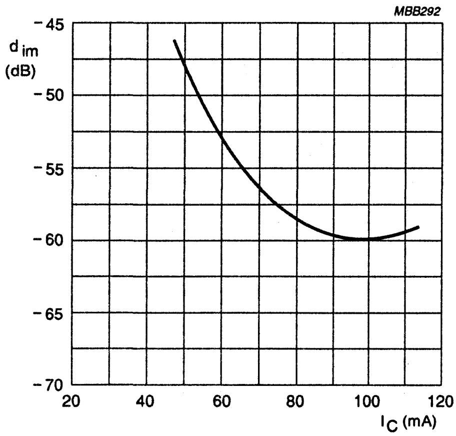
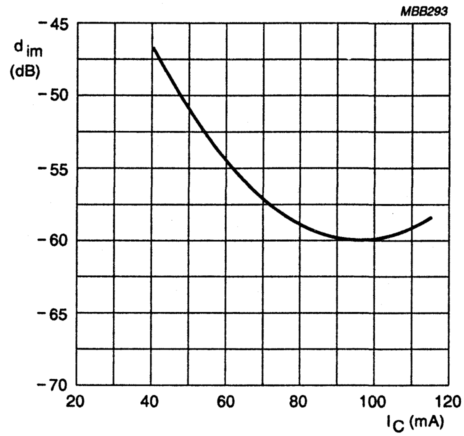


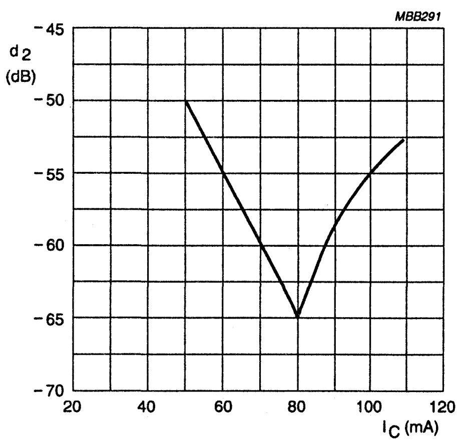
V_{CE} = 10 V; V_O = 900 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 443.25 MHz.

Fig.8 Intermodulation distortion as a function of collector current.



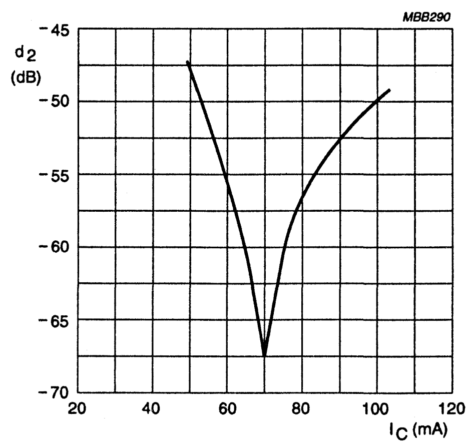
V_{CE} = 10 V; V_O = 850 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz.

Fig.9 Intermodulation distortion as a function of collector current.



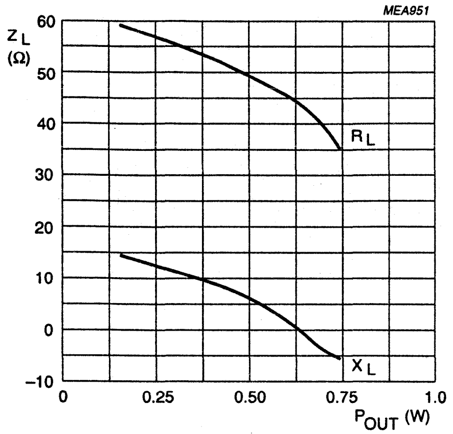
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 450 MHz.

Fig.10 Second order intermodulation distortion as a function of collector current.



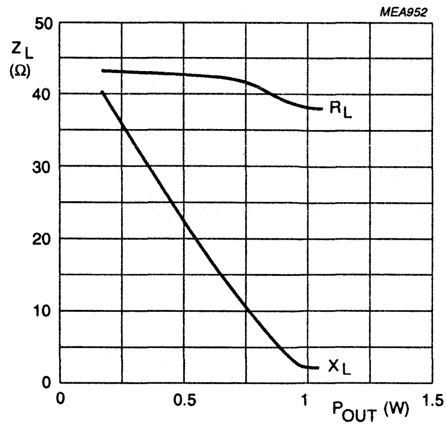
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C $f_{(p+q)}$ = 810 MHz.

Fig.11 Second order intermodulation distortion as a function of collector current.



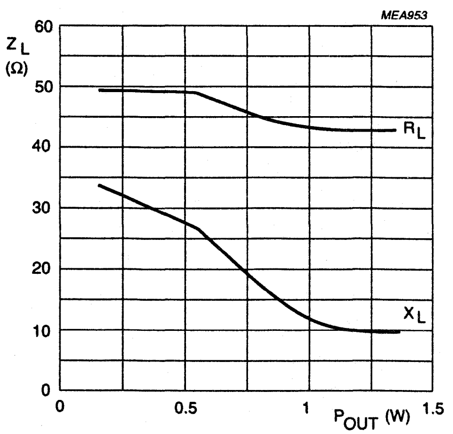
V_{CE} = 7.5 V; f = 900 MHz.

Fig.12 Load impedance as a function of output power.



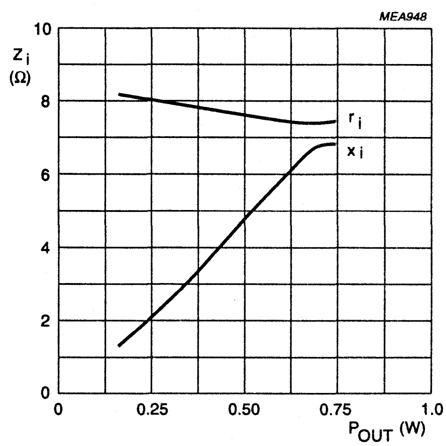
V_{CE} = 10 V; f = 900 MHz.

Fig.13 Load impedance as a function of output power.



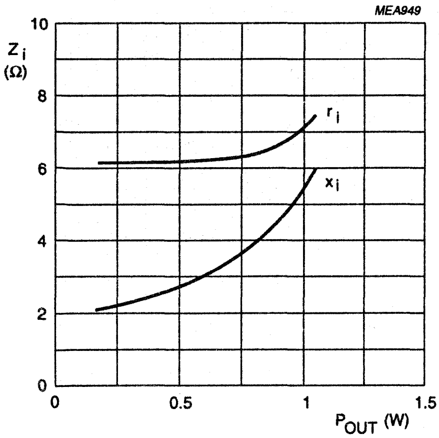
V_{CE} = 12.5 V; f = 900 MHz.

Fig.14 Load impedance as a function of output power.



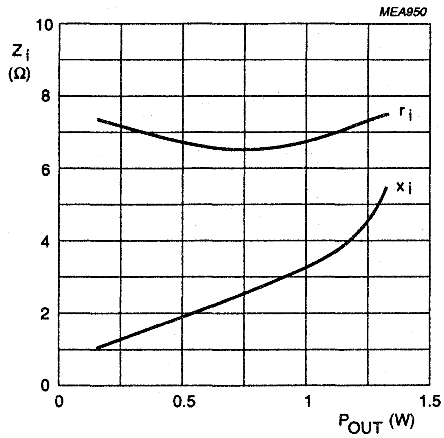
V_{CE} = 7.5 V; f = 900 MHz.

Fig.15 Input impedance as a function of output power.



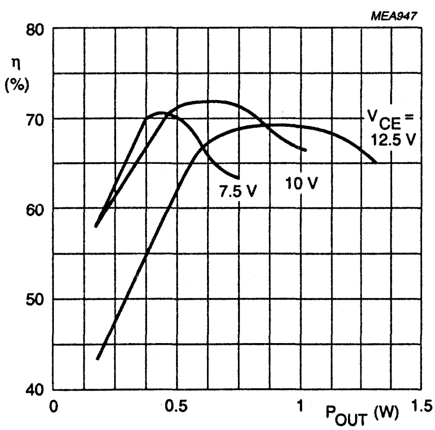
V_{CE} = 10 V; f = 900 MHz.

Fig.16 Input impedance as a function of output power.



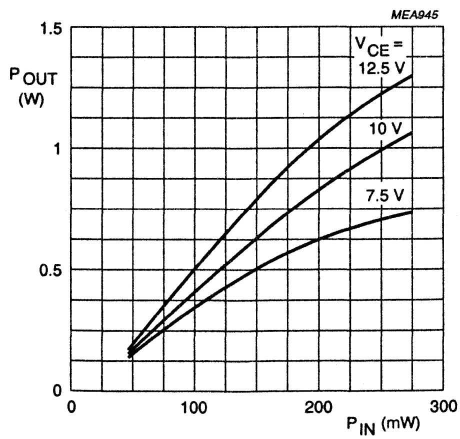
V_{CE} = 12.5 V; f = 900 MHz.

Fig.17 Input impedance as a function of output power.



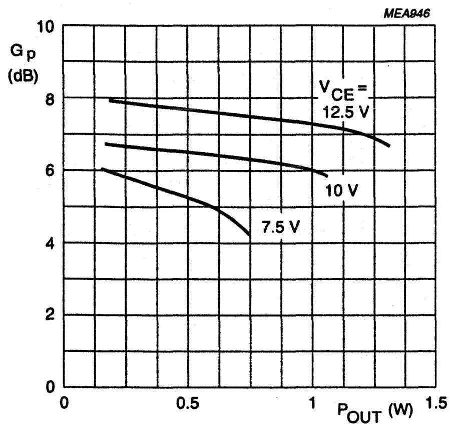
f = 900 MHz.

Fig.18 Efficiency as a function of output power.



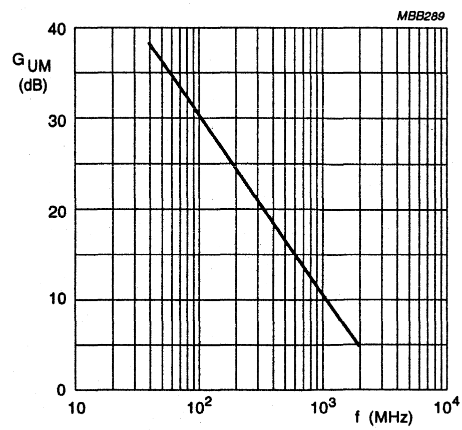
f = 900 MHz.

Fig.19 Output power as a function of input power.



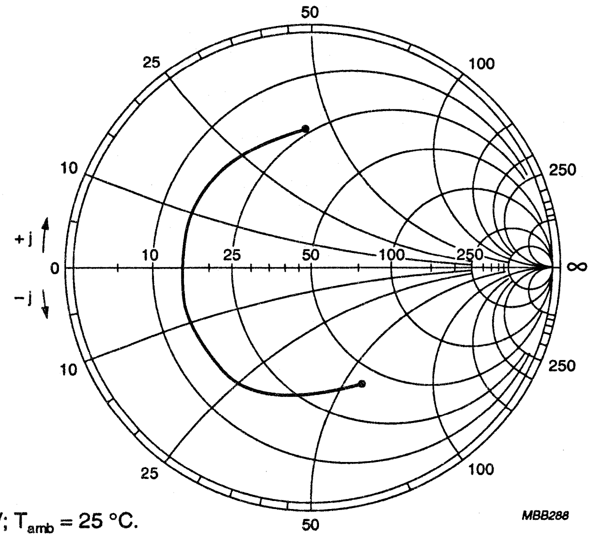
f = 900 MHz.

Fig.20 Power gain as a function of output power.



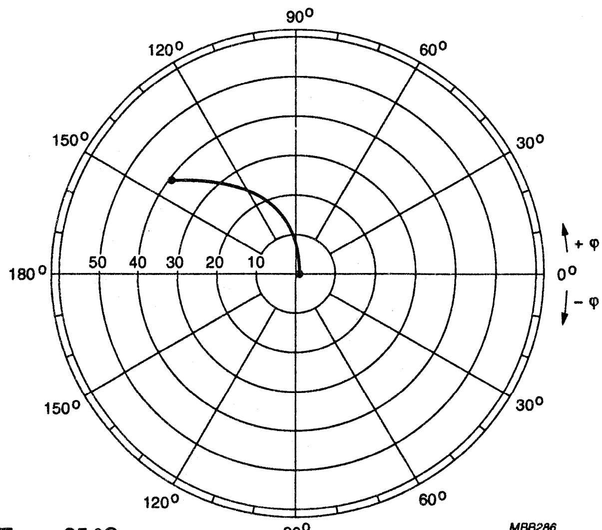
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.21 Maximum unilateral power gain as a function of frequency.



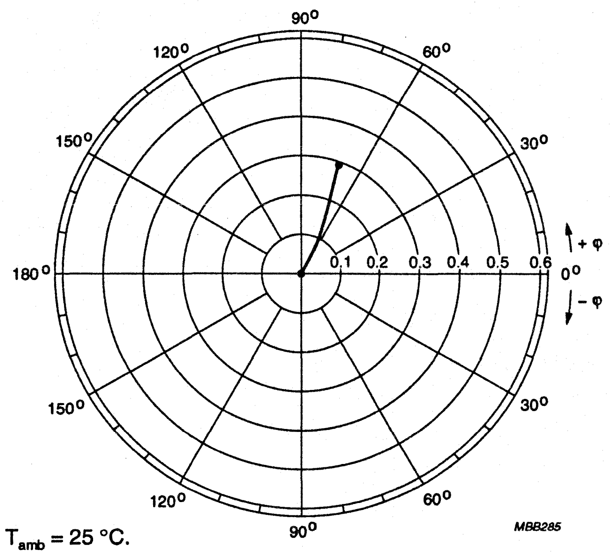
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.22 Common emitter input reflection coefficient (S_{11}).



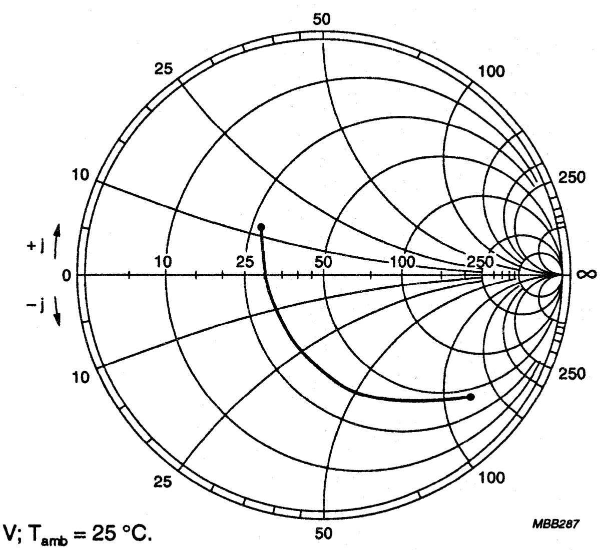
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.23 Common emitter forward transmission coefficient (S_{21}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.24 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.25 Common emitter output reflection coefficient (S_{22}).

NPN 7 GHz wideband transistor BFG135

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.664	−52.8	34.530	148.0	0.022	67.1	0.833	−36.3	38.4
100	0.565	−104.1	22.367	120.3	0.038	51.3	0.561	−69.8	30.3
200	0.534	−140.8	12.969	102.0	0.052	49.2	0.353	−98.9	24.3
300	0.509	−157.7	8.879	92.9	0.062	52.4	0.276	−116.8	20.6
400	0.514	−168.4	6.794	86.8	0.074	55.4	0.243	−130.0	18.2
500	0.521	−175.8	5.501	81.4	0.085	58.0	0.230	−140.3	16.4
600	0.520	178.3	4.640	76.1	0.097	59.1	0.223	−148.5	14.9
700	0.516	174.1	4.048	71.9	0.109	60.4	0.221	−155.3	13.7
800	0.532	167.2	3.530	67.8	0.124	60.9	0.221	−161.7	12.6
900	0.520	163.7	3.201	65.2	0.136	60.7	0.225	−167.4	11.7
1000	0.538	160.0	2.885	61.0	0.150	60.6	0.232	−173.1	10.9
1200	0.553	151.3	2.466	54.3	0.176	59.9	0.252	176.9	9.7
1400	0.595	144.5	2.085	47.5	0.201	58.0	0.279	169.5	8.6
1600	0.589	137.9	1.850	41.7	0.226	57.2	0.308	162.9	7.6
1800	0.618	130.8	1.696	35.4	0.257	52.9	0.331	155.2	7.2
2000	0.632	124.8	1.538	30.3	0.282	50.7	0.364	147.6	6.6
2200	0.658	117.9	1.439	22.0	0.303	48.2	0.405	140.9	6.4
2400	0.688	113.0	1.260	20.5	0.319	46.6	0.440	134.9	5.7
2600	0.702	109.3	1.202	14.7	0.350	42.4	0.466	128.1	5.6
2800	0.695	101.8	1.108	7.2	0.361	37.2	0.487	120.1	4.9
3000	0.707	93.7	1.071	4.2	0.379	35.3	0.519	112.3	5.0

Table 2 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.650	−56.2	36.130	146.2	0.022	64.7	0.815	−38.7	38.3
100	0.551	−106.4	22.936	119.3	0.038	51.1	0.535	−73.0	30.2
200	0.513	−142.7	13.020	101.2	0.051	50.2	0.340	−103.3	24.2
300	0.505	−159.1	8.969	92.2	0.062	54.4	0.270	−122.1	20.7
400	0.506	−169.3	6.847	85.9	0.075	57.1	0.244	−135.7	18.3
500	0.508	−177.1	5.533	80.7	0.088	59.1	0.232	−146.2	16.4
600	0.510	177.0	4.655	75.9	0.101	60.0	0.226	−154.2	14.9
700	0.512	171.2	4.025	71.7	0.114	61.1	0.227	−161.0	13.6
800	0.512	166.4	3.536	67.7	0.128	61.1	0.227	−167.6	12.5
900	0.518	161.5	3.183	64.2	0.141	60.9	0.233	−173.5	11.7
1000	0.525	157.0	2.891	60.5	0.156	60.6	0.241	−179.2	10.9
1200	0.550	148.6	2.439	53.8	0.183	59.1	0.263	171.1	9.6
1400	0.573	142.0	2.110	46.8	0.208	57.1	0.290	163.7	8.6
1600	0.583	136.4	1.865	40.7	0.236	55.8	0.318	157.2	7.7
1800	0.600	129.2	1.702	33.9	0.265	51.5	0.341	149.9	7.1
2000	0.626	122.5	1.557	28.6	0.289	49.1	0.370	142.5	6.6
2200	0.663	115.8	1.422	22.9	0.309	46.0	0.407	135.8	6.4
2400	0.683	111.4	1.300	19.8	0.324	44.6	0.444	129.7	6.0
2600	0.696	106.2	1.228	13.7	0.350	40.4	0.467	123.1	5.7
2800	0.701	99.6	1.099	8.3	0.360	34.9	0.480	115.0	4.9
3000	0.721	92.5	1.052	3.8	0.377	32.6	0.505	107.1	4.9

NPN 7 GHz wideband transistor BFG135

Table 3 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.674	−56.8	36.826	146.5	0.022	65.7	0.804	−39.9	38.5
100	0.559	−107.5	22.954	118.4	0.037	52.1	0.526	−75.6	30.2
200	0.524	−143.2	13.112	101.8	0.049	50.1	0.338	−106.2	24.3
300	0.517	−160.5	9.061	91.8	0.061	52.5	0.276	−125.2	20.8
400	0.521	−169.1	6.841	86.1	0.073	57.0	0.248	−138.7	18.4
500	0.519	−176.2	5.572	80.8	0.086	59.1	0.237	−149.1	16.5
600	0.526	177.5	4.675	76.4	0.099	60.1	0.231	−157.4	15.0
700	0.525	172.0	4.056	71.8	0.112	60.0	0.231	−164.2	13.8
800	0.529	167.0	3.559	68.4	0.126	61.0	0.234	−170.7	12.7
900	0.533	163.6	3.165	65.0	0.139	61.0	0.238	−176.8	11.7
1000	0.537	158.4	2.880	61.4	0.152	60.8	0.247	178.0	10.9
1200	0.552	151.0	2.438	54.1	0.179	59.1	0.269	169.1	9.6
1400	0.586	144.5	2.114	47.7	0.202	57.1	0.294	161.9	8.7
1600	0.597	138.8	1.865	42.2	0.230	56.4	0.318	155.3	7.8
1800	0.597	131.1	1.699	35.3	0.259	52.3	0.344	148.0	7.1
2000	0.615	123.1	1.603	30.1	0.281	49.8	0.374	141.3	6.8
2200	0.671	118.4	1.418	24.6	0.304	47.1	0.410	134.8	6.4
2400	0.694	113.9	1.280	21.4	0.316	46.1	0.444	129.0	6.0
2600	0.678	109.4	1.239	14.7	0.348	41.8	0.472	122.5	5.6
2800	0.686	101.9	1.107	8.8	0.355	36.6	0.491	115.3	4.8
3000	0.713	95.2	1.069	5.5	0.374	34.9	0.521	108.4	5.0

NPN 7 GHz wideband transistor — BFG195

DESCRIPTION

NPN transistor in a 4-lead dual-emitter plastic SOT103 envelope.

It is designed for wideband applications in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optic systems. The device features a very high transition frequency, high gain and a very low noise figure up to high frequencies.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

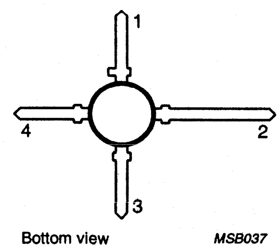


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 136 °C (note 1)	–	–	700	mW
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V; T_j = 25 °C	40	110	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	11	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 136 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 136 °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 5$ V	40	110	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	3.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 50$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	11	–	dB
F	noise figure	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C; Z_S = opt.	–	1.4	–	dB
		$I_C = 50$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C; Z_S = opt.	–	1.9	–	dB
V_O	output voltage	note 2	–	700	–	mV
d_2	second order intermodulation distortion	note 3	–	–55	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. d_{im} = –60 dB; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz.
3. I_C = 50 mA; V_{CE} = 8 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

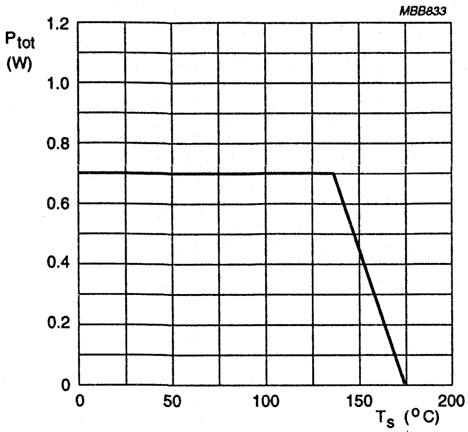
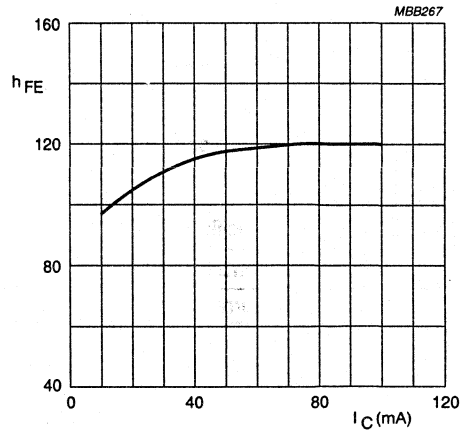
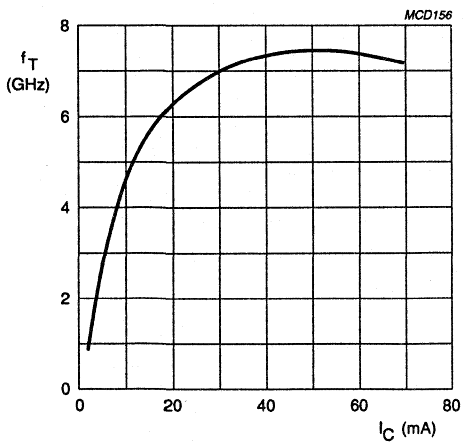


Fig.2 Power derating curve.



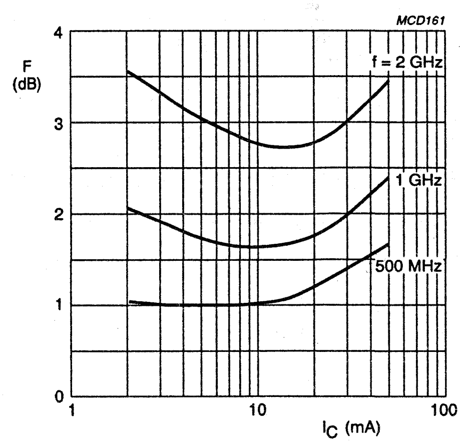
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



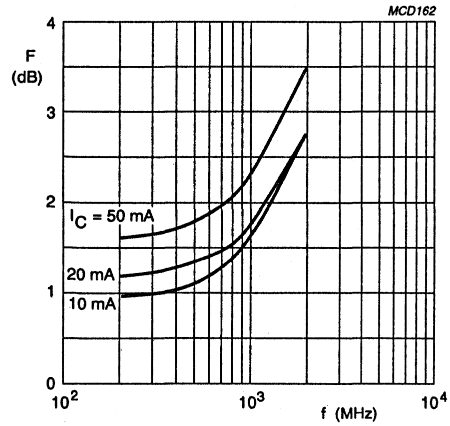
V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.4 Transition frequency as a function of collector current.



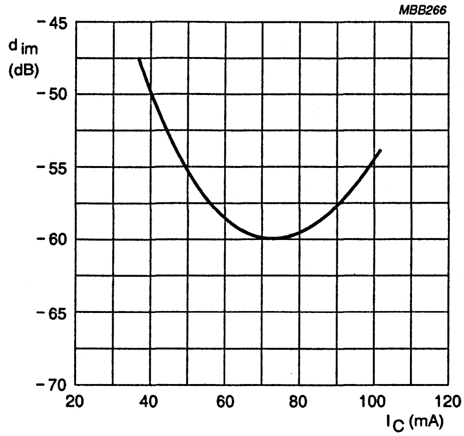
V_{CE} = 6 V; T_{amb} = 25 °C; Z_S = opt.

Fig.5 Minimum noise figure as a function of collector current.



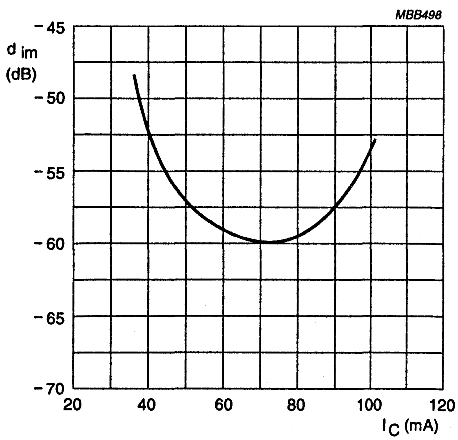
V_{CE} = 6 V; T_{amb} = 25 °C; Z_S = opt.

Fig.6 Minimum noise figure as a function of frequency.



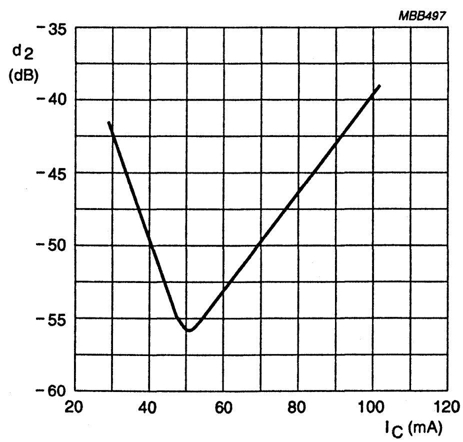
V_{CE} = 8 V; V_O = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.7 Intermodulation distortion as a function of collector current.



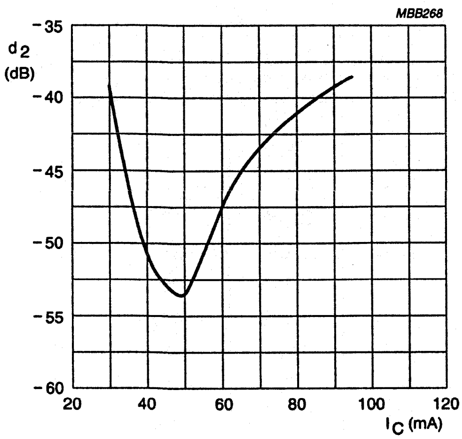
V_{CE} = 8 V; V_O = 750 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation distortion as a function of collector current.



V_{CE} = 8 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.9 Second order intermodulation distortion as a function of collector current.



V_{CE} = 8 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz;
T_{amb} = 25 °C.

Fig.10 Second order intermodulation distortion as a function of collector current.

Table 1 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.405	−88.9	48.469	148.5	0.012	65.3	0.820	−36.4	39.3
100	0.580	−133.6	31.901	121.8	0.021	48.9	0.554	−70.7	33.4
200	0.658	−158.9	18.336	103.8	0.027	46.4	0.356	−100.3	28.3
300	0.684	−170.0	12.623	94.8	0.031	48.5	0.286	−117.9	25.1
400	0.693	−176.3	9.610	88.6	0.036	51.6	0.258	−129.4	22.8
500	0.698	178.4	7.755	83.6	0.042	54.4	0.246	−136.7	21.0
600	0.702	174.4	6.520	79.4	0.048	55.8	0.239	−141.8	19.5
700	0.701	170.7	5.609	75.4	0.054	56.9	0.233	−145.4	18.2
800	0.703	167.0	4.950	72.0	0.060	57.8	0.229	−148.4	17.1
900	0.702	163.6	4.427	68.5	0.067	58.0	0.225	−151.6	16.1
1000	0.704	160.5	3.978	65.4	0.073	58.4	0.222	−154.9	15.2
1200	0.719	154.1	3.353	59.2	0.086	58.0	0.230	−161.6	13.9
1400	0.734	148.3	2.884	53.1	0.097	56.6	0.247	−167.0	12.8
1600	0.737	143.5	2.517	47.3	0.110	55.3	0.259	−168.6	11.7
1800	0.737	137.8	2.292	40.5	0.124	52.6	0.267	−170.1	10.9
2000	0.741	132.0	2.064	35.0	0.137	49.9	0.273	−174.1	10.1
2200	0.764	126.9	1.877	29.9	0.149	48.5	0.283	180.0	9.6
2400	0.790	122.9	1.738	25.9	0.160	47.0	0.308	175.4	9.5
2600	0.801	119.6	1.598	20.2	0.171	44.0	0.340	173.3	9.1
2800	0.806	115.1	1.510	14.4	0.181	41.0	0.361	171.7	8.7
3000	0.804	109.9	1.403	8.8	0.195	38.4	0.368	169.3	8.1

NPN 7 GHz wideband transistor BFG195

Table 2 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.398	−113.3	57.101	143.7	0.010	63.2	0.757	−44.1	39.6
100	0.598	−147.3	34.668	117.1	0.017	50.5	0.489	−82.1	33.9
200	0.666	−166.5	19.217	100.8	0.022	52.2	0.327	−113.7	28.7
300	0.685	−175.0	13.102	92.9	0.028	56.0	0.279	−131.2	25.4
400	0.695	179.8	9.942	87.2	0.034	59.0	0.263	−142.2	23.1
500	0.699	175.5	7.998	82.5	0.041	61.2	0.256	−148.6	21.3
600	0.702	171.9	6.728	78.6	0.047	62.1	0.252	−153.2	19.8
700	0.698	168.4	5.790	74.8	0.054	62.5	0.248	−156.2	18.4
800	0.699	164.7	5.112	71.5	0.061	62.7	0.244	−159.1	17.3
900	0.701	161.8	4.562	68.1	0.068	62.5	0.241	−162.0	16.4
1000	0.703	158.8	4.093	65.2	0.075	62.2	0.240	−165.1	15.5
1200	0.717	152.8	3.453	59.1	0.088	60.9	0.248	−171.2	14.2
1400	0.734	147.3	2.959	53.5	0.100	59.0	0.266	−175.9	13.1
1600	0.733	142.8	2.594	47.6	0.113	57.0	0.274	−177.1	12.0
1800	0.733	136.9	2.353	40.8	0.128	54.0	0.279	−178.4	11.1
2000	0.739	131.2	2.131	35.1	0.142	50.6	0.283	177.7	10.4
2200	0.765	126.2	1.928	30.4	0.155	49.1	0.294	172.2	9.9
2400	0.791	122.2	1.796	26.3	0.165	47.2	0.319	168.3	9.8
2600	0.802	119.6	1.645	21.0	0.175	43.9	0.348	166.8	9.4
2800	0.801	115.0	1.551	15.2	0.186	40.8	0.366	165.6	8.9
3000	0.804	110.0	1.450	10.3	0.200	38.0	0.369	163.3	8.4

NPN 7 GHz wideband transistor BFG197; BFG197/X; BFG197/XR

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG197 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is primarily intended for wideband applications in the GHz range, such as satellite TV systems and repeater amplifiers in fibre-optic systems.

PINNING

PIN	DESCRIPTION
BFG197 (Fig.1) Code: V5	
1	collector
2	base
3	emitter
4	emitter
BFG197/X (Fig.1) Code: V13	
1	collector
2	emitter
3	base
4	emitter
BFG197/XR (Fig.2) Code: V35	
1	collector
2	emitter
3	base
4	emitter

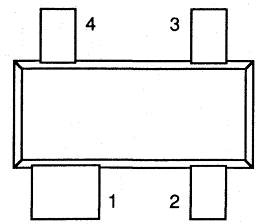


Fig.1 SOT143.

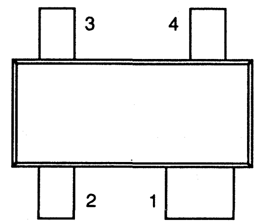


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	–	500	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 4 V; T_{amb} = 25 °C; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.7	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	500	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 5$ V	40	110	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	3.3	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 4$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	16	–	dB
		$I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	2.3	–	dB
d_2	second order intermodulation distortion	$V_{CE} = 8$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 810$ MHz; $I_C = 40$ mA	–	–51	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

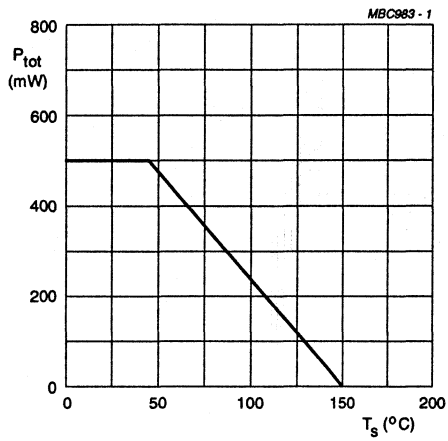
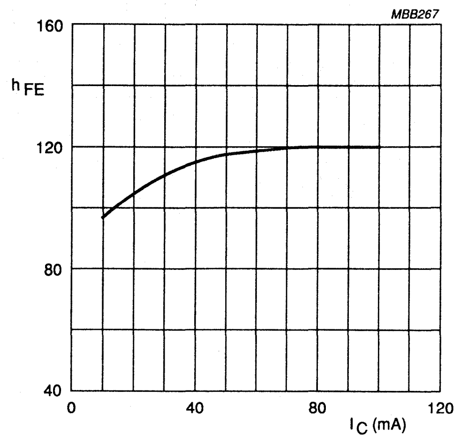
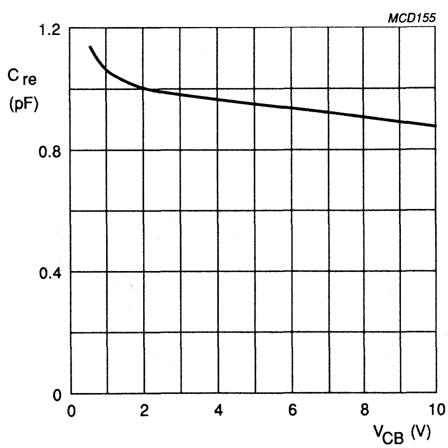


Fig.3 Power derating curve.



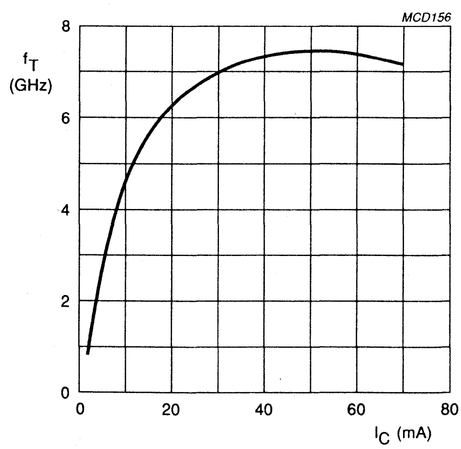
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

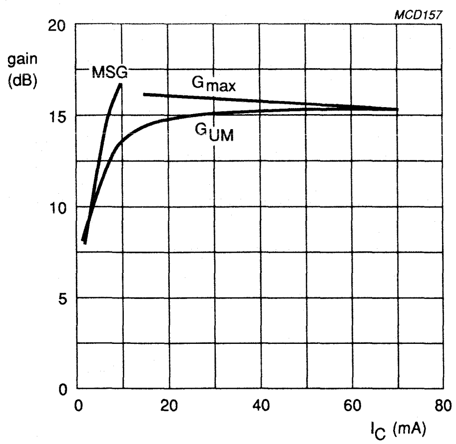
Fig.5 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 4 V; T_{amb} = 25 °C; f = 2 GHz.

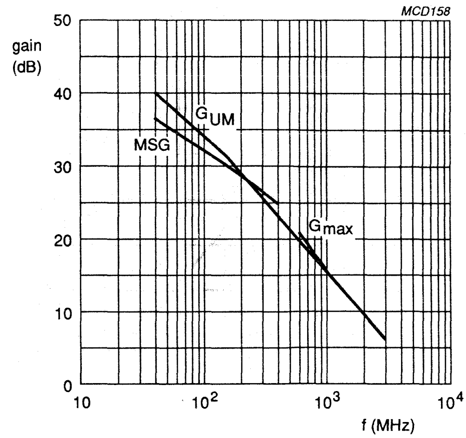
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



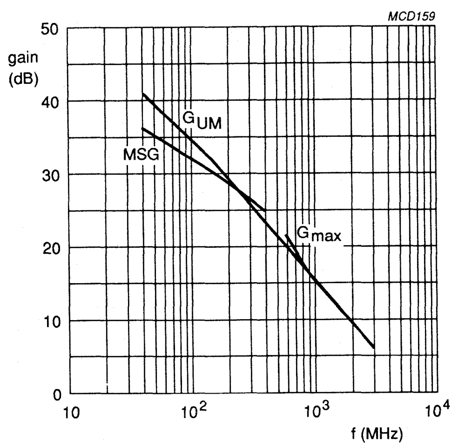
V_{CE} = 4 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



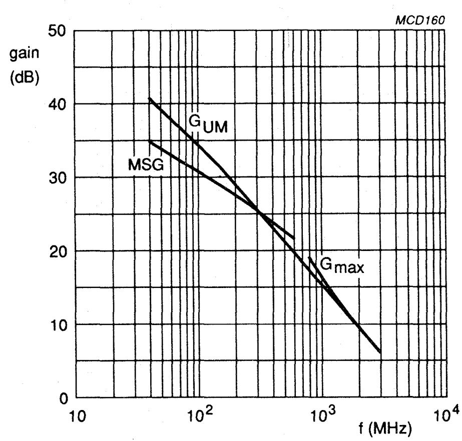
V_{CE} = 4 V; I_C = 50 mA.

Fig.8 Gain as a function of frequency.



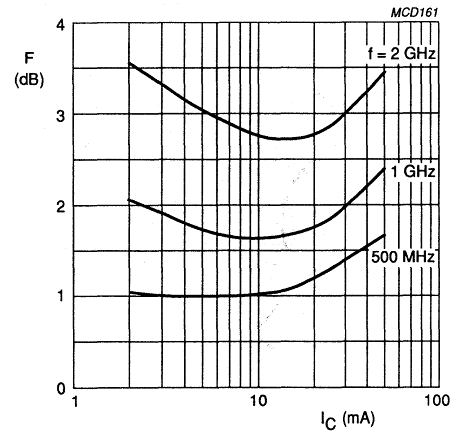
V_{CE} = 6 V; I_C = 50 mA.

Fig.9 Gain as a function of frequency.



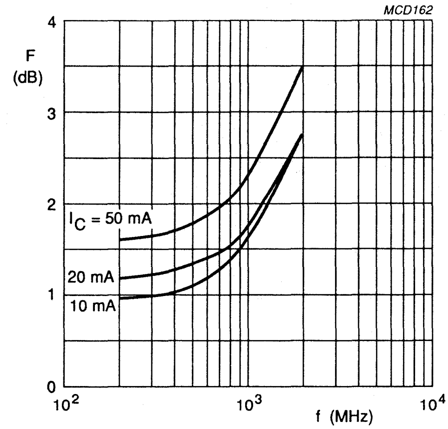
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



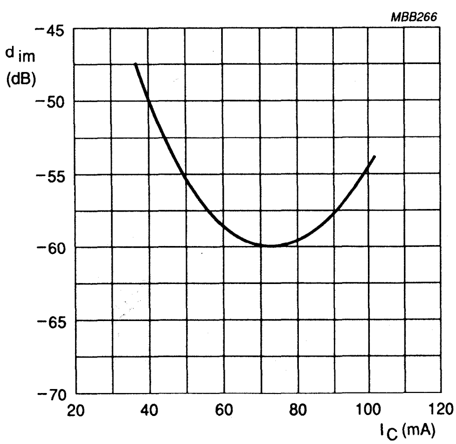
V_{CE} = 6 V.

Fig.11 Minimum noise figure as a function of collector current.



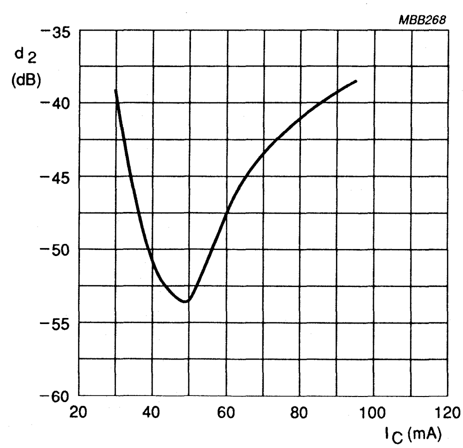
V_{CE} = 6 V.

Fig.12 Minimum noise figure as a function of frequency.



V_{CE} = 8 V; V_O = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.13 Intermodulation distortion, typical values.



V_{CE} = 8 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

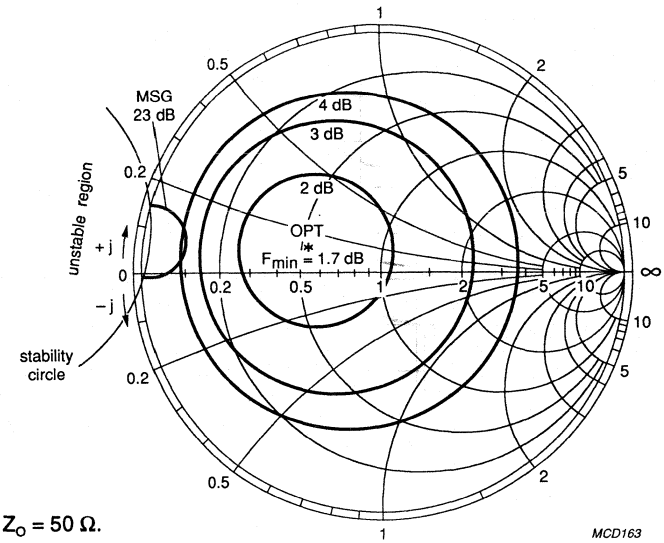
Fig.14 Second order intermodulation distortion, typical values.

BFG197(/X)

f (MHz)	V_{CE} (V)	I_C (mA)
500	6	50

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.7	0.317	161	0.123



Z_O = 50 Ω.
Maximum stable gain = 23 dB.

Fig.15 Noise circle figure.

BFG197(/X)

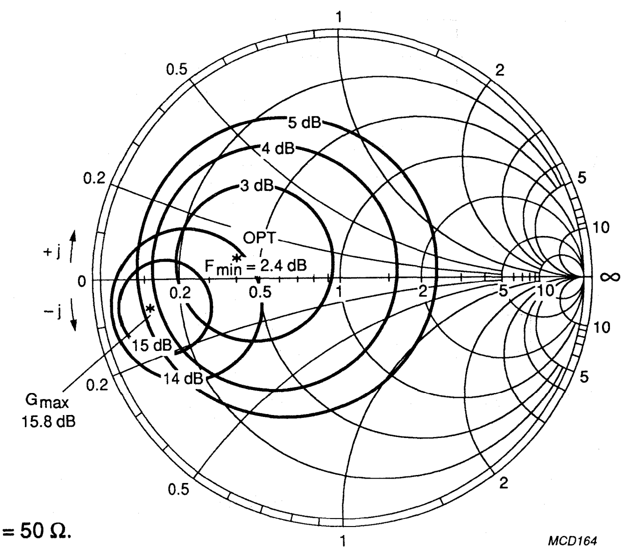
f (MHz)	V_{CE} (V)	I_C (mA)
1000	6	50

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.408	169.9	0.17

Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
15.8	0.824	−171



Z_O = 50 Ω.

Fig.16 Noise circle figure.

BFG197(/X)

f (MHz)	V_{CE} (V)	I_C (mA)
2000	6	50

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3.5	0.644	−168	0.134

Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
9.7	0.797	−149

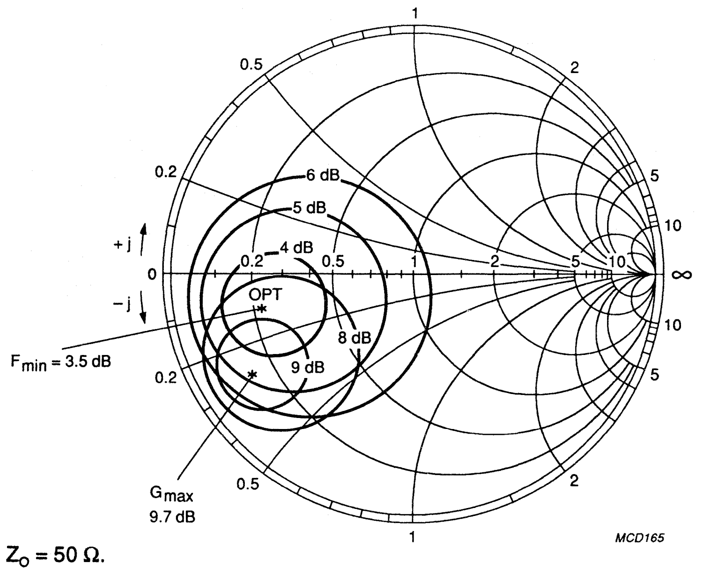
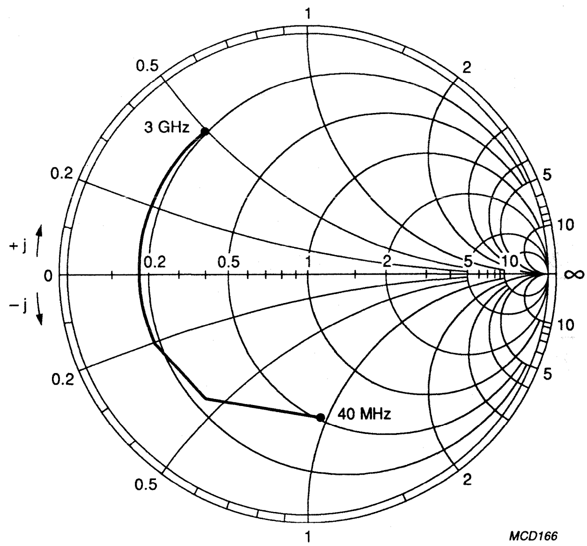
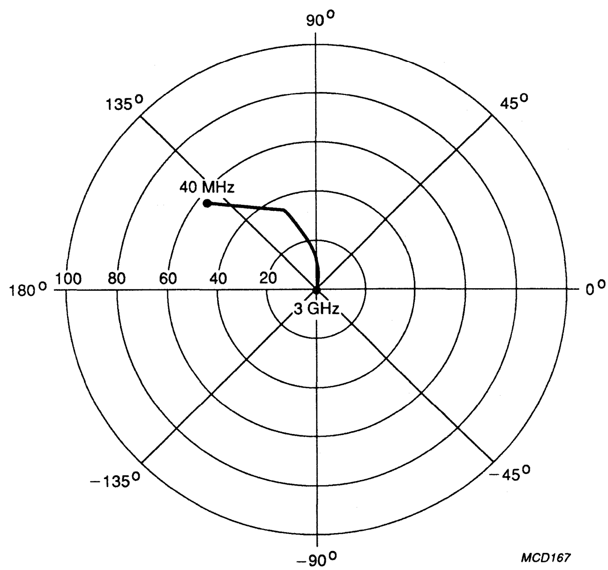


Fig.17 Noise circle figure.



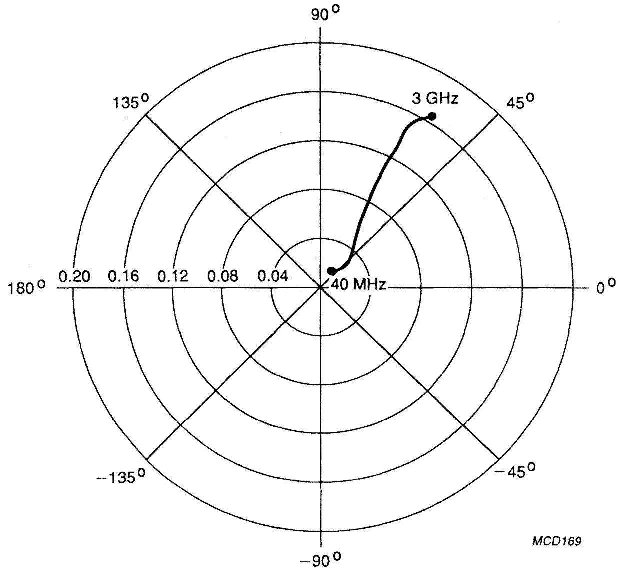
V_{CE} = 6 V; I_C = 50 mA.

Fig.18 Common emitter input reflection coefficient (S_{11}).



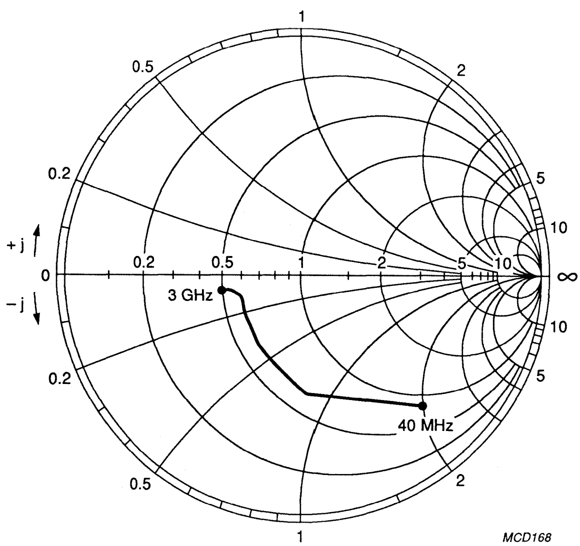
V_{CE} = 6 V; I_C = 50 mA.

Fig.19 Common emitter forward transmission coefficient (S_{21}).



$V_{CE} = 6$ V; $I_C = 50$ mA.

Fig.20 Common emitter reverse transmission coefficient (S_{12}).

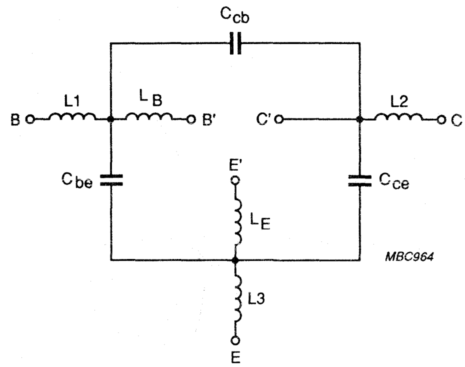


$V_{CE} = 6$ V; $I_C = 50$ mA.

Fig.21 Common emitter output reflection coefficient (S_{22}).

SPICE parameters of the BFQ195 crystal

1	IS = 1.972	fA
2	BF = 150.0	–
3	NF = 990.8	m
4	VAF = 54.72	V
5	IKF = 30.00	A
6	ISE = 47.82	fA
7	NE = 1.580	–
8	BR = 165.4	–
9	NR = 993.9	m
10	VAR = 2.351	V
11	IKR = 9.967	A
12	ISC = 3.510	fA
13	NC = 1.124	–
14	RB = 5.000	Ω
15	IRB = 1.000	µA
16	RBM = 5.000	Ω
17	RE = 368.1	mΩ
18	RC = 937.2	mΩ
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 3.388	pF
23	VJE = 600.0	mV
24	MJE = 302.9	m
25	TF = 11.06	ps
26	XTF = 30.02	–
27	VTF = 1.649	V
28	ITF = 401.9	mA
29	PTF = 0.000	deg
30 (note 1)	CJC = 1.190	pF
31 (note 1)	VJC = 160.1	mV
32 (note 1)	MJC = 89.44	m
33	XCJC = 130.0	m
34	TR = 2.148	ns
35	CJS = 0.000	F
36	VJS = 750.0	mV
37	MJS = 0.000	–
38	FC = 785.9	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}$ (f) = $QL_{B,E}$ $\sqrt{}$ (f/Fc).

Fc = scaling frequency = 1000 MHz.

Fig.22 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.22)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.727	−39.8	26.035	159.2	0.0195	71.3	0.927	−21.4	40.1
100	0.723	−85.0	20.536	135.8	0.0383	52.0	0.739	−46.2	32.9
200	0.731	−126.0	13.680	114.7	0.0511	36.4	0.507	−69.5	27.3
300	0.736	−145.0	9.804	103.6	0.0554	31.0	0.390	−82.8	23.9
400	0.739	−157.0	7.581	96.6	0.0576	29.1	0.330	−91.6	21.5
500	0.741	−164.0	6.168	91.3	0.0597	29.1	0.298	−98.2	19.7
600	0.744	−170.0	5.182	87.0	0.0609	30.1	0.281	−102.0	18.2
700	0.742	−175.0	4.454	83.2	0.0627	31.2	0.271	−106.0	16.8
800	0.740	−179.0	3.915	79.9	0.0646	32.9	0.267	−108.0	15.6
900	0.743	177.5	3.502	77.4	0.0670	34.7	0.266	−110.0	14.7
1000	0.741	173.8	3.172	74.1	0.0681	36.6	0.265	−112.0	13.8
1200	0.747	168.2	2.624	68.9	0.0724	40.9	0.272	−116.0	12.3
1400	0.753	163.2	2.252	63.9	0.0776	44.5	0.286	−120.0	11.1
1600	0.754	158.5	1.969	58.8	0.0829	47.7	0.303	−123.0	9.96
1800	0.753	153.7	1.761	53.9	0.0886	50.8	0.317	−125.0	9.01
2000	0.762	149.3	1.583	50.2	0.0973	53.9	0.326	−128.0	8.25
2200	0.765	144.3	1.448	47.0	0.1060	55.9	0.339	−133.0	7.57
2400	0.774	141.0	1.316	43.2	0.1120	58.1	0.362	−137.0	6.96
2600	0.772	137.2	1.202	39.0	0.1200	60.0	0.391	−141.0	6.25
2800	0.774	133.4	1.100	35.8	0.1310	61.3	0.417	−143.0	5.62
3000	0.776	129.4	1.043	32.8	0.1420	59.4	0.431	−145.0	5.25

Table 2 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.0	0.299	135.8	0.089
1000	1.6	0.429	159.3	0.117
2000	2.7	0.660	−171.2	0.085

NPN 7 GHz wideband transistor BFG197; BFG197/X; BFG197/XR

Table 3 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.620	−60.6	40.443	151.5	0.0168	66.1	0.859	−32.9	40.1
100	0.672	−112.0	27.734	125.5	0.0291	45.6	0.610	−65.9	33.5
200	0.714	−145.0	16.542	107.1	0.0360	35.9	0.402	−94.6	28.2
300	0.729	−160.0	11.435	98.3	0.0392	36.2	0.323	−111.0	24.9
400	0.734	−168.0	8.726	92.8	0.0419	37.7	0.290	−121.0	22.6
500	0.739	−173.0	7.057	88.6	0.0450	40.4	0.274	−128.0	20.7
600	0.741	−178.0	5.898	85.1	0.0485	42.9	0.267	−133.0	19.2
700	0.735	178.2	5.071	82.0	0.0516	45.4	0.262	−136.0	17.8
800	0.737	175.2	4.453	79.1	0.0554	47.9	0.259	−138.0	16.7
900	0.739	172.1	3.971	76.9	0.0596	49.8	0.259	−140.0	15.7
1000	0.740	168.9	3.599	74.1	0.0629	51.6	0.259	−141.0	14.9
1200	0.744	164.0	2.984	69.8	0.0712	54.9	0.264	−144.0	13.3
1400	0.746	159.4	2.563	65.4	0.0803	57.1	0.275	−146.0	12.0
1600	0.745	155.2	2.244	60.8	0.0892	58.4	0.285	−147.0	10.9
1800	0.744	150.8	2.010	56.4	0.0978	59.7	0.291	−147.0	9.94
2000	0.751	146.5	1.813	53.1	0.1090	61.2	0.296	−149.0	9.17
2200	0.757	142.3	1.656	50.1	0.1200	61.1	0.307	−153.0	8.51
2400	0.762	138.8	1.521	46.4	0.1260	62.0	0.327	−156.0	7.91
2600	0.763	135.4	1.385	42.9	0.1350	62.6	0.352	−157.0	7.20
2800	0.761	131.2	1.276	39.5	0.1460	62.7	0.371	−158.0	6.51
3000	0.758	127.6	1.212	36.2	0.1560	59.8	0.381	−159.0	6.06

Table 4 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.2	0.308	157.8	0.085
1000	1.8	0.422	167.2	0.117
2000	2.9	0.662	−168.8	0.087

Table 5 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.573	−75.8	49.097	146.5	0.0153	61.7	0.807	−40.9	40.1
100	0.667	−126.0	30.903	120.2	0.0245	43.7	0.543	−78.0	33.9
200	0.718	−154.0	17.590	103.6	0.0296	38.2	0.369	−109.0	28.7
300	0.731	−165.0	12.018	96.0	0.0330	40.8	0.313	−125.0	25.4
400	0.735	−173.0	9.113	91.2	0.0364	43.7	0.293	−135.0	23.0
500	0.738	−177.0	7.362	87.5	0.0406	47.2	0.284	−141.0	21.1
600	0.740	178.9	6.162	84.2	0.0444	50.5	0.280	−145.0	19.6
700	0.736	175.5	5.294	81.3	0.0487	52.9	0.277	−148.0	18.2
800	0.737	172.7	4.643	78.6	0.0534	55.1	0.275	−149.0	17.1
900	0.740	169.9	4.139	76.9	0.0580	56.7	0.273	−151.0	16.1
1000	0.740	167.1	3.751	74.0	0.0627	57.9	0.273	−152.0	15.3
1200	0.744	162.3	3.103	69.8	0.0722	60.6	0.278	−155.0	13.7
1400	0.746	157.9	2.674	65.9	0.0818	61.7	0.287	−156.0	12.4
1600	0.744	154.1	2.334	61.5	0.0916	62.3	0.292	−157.0	11.3
1800	0.744	149.8	2.092	57.2	0.1010	62.7	0.296	−157.0	10.3
2000	0.749	145.4	1.889	53.9	0.1130	63.5	0.300	−159.0	9.51
2200	0.754	141.0	1.725	51.2	0.1250	63.2	0.310	−162.0	8.83
2400	0.761	137.9	1.583	47.7	0.1320	63.4	0.328	−164.0	8.24
2600	0.759	134.3	1.445	43.8	0.1400	63.8	0.349	−165.0	7.50
2800	0.756	130.7	1.338	41.0	0.1520	63.4	0.364	−165.0	6.83
3000	0.757	127.0	1.269	37.5	0.1620	60.3	0.370	−166.0	6.40

Table 6 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 50 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.550	−95.0	58.124	140.1	0.0133	57.6	0.730	−51.1	40.2
100	0.674	−140.0	33.107	114.6	0.0199	42.8	0.472	−92.1	34.1
200	0.725	−162.0	18.112	100.2	0.0243	42.6	0.343	−123.0	28.9
300	0.735	−171.0	12.258	93.6	0.0280	47.5	0.310	−138.0	25.6
400	0.737	−177.0	9.263	89.5	0.0324	51.5	0.300	−147.0	23.2
500	0.744	179.5	7.467	86.1	0.0371	54.9	0.296	−152.0	21.4
600	0.743	176.4	6.244	83.1	0.0422	57.5	0.296	−155.0	19.8
700	0.743	173.0	5.355	80.5	0.0469	59.6	0.292	−157.0	18.4
800	0.740	170.5	4.698	78.2	0.0521	61.3	0.291	−158.0	17.3
900	0.741	167.7	4.205	76.1	0.0577	62.5	0.289	−159.0	16.3
1000	0.744	165.3	3.799	73.5	0.0625	63.2	0.290	−160.0	15.5
1200	0.747	160.6	3.135	69.5	0.0733	65.0	0.293	−162.0	13.9
1400	0.752	156.6	2.710	65.8	0.0842	65.4	0.301	−163.0	12.7
1600	0.750	153.0	2.368	61.6	0.0945	65.1	0.303	−164.0	11.5
1800	0.745	148.7	2.125	57.4	0.1050	65.3	0.305	−164.0	10.5
2000	0.753	144.5	1.918	54.1	0.1170	65.5	0.308	−166.0	9.72
2200	0.756	140.5	1.757	51.5	0.1290	64.5	0.317	−169.0	9.03
2400	0.759	137.1	1.620	47.7	0.1360	64.7	0.334	−171.0	8.43
2600	0.763	133.7	1.467	44.8	0.1450	65.0	0.352	−171.0	7.70
2800	0.761	129.7	1.354	41.6	0.1570	64.2	0.365	−171.0	7.01
3000	0.760	126.6	1.290	38.0	0.1670	60.8	0.370	−172.0	6.59

Table 7 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 70 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.529	−89.8	50.397	138.3	0.014	59.8	0.675	−47.4	38.1
100	0.603	−135.2	28.226	114.2	0.022	48.5	0.418	−82.3	31.8
200	0.645	−157.0	15.465	100.8	0.031	48.7	0.291	−108.8	26.5
300	0.670	−166.0	10.586	94.5	0.037	49.3	0.259	−123.2	23.4
400	0.687	−171.6	8.064	90.2	0.043	50.8	0.251	−132.2	21.2
500	0.697	−175.8	6.514	86.8	0.050	51.1	0.251	−138.0	19.5
600	0.707	−179.3	5.478	83.7	0.054	51.5	0.253	−142.1	18.1
700	0.712	177.6	4.737	80.9	0.060	52.4	0.256	−144.7	16.9
800	0.718	174.4	4.168	78.2	0.065	53.2	0.258	−146.8	15.8
900	0.723	171.8	3.720	75.8	0.070	53.9	0.259	−148.3	14.9
1000	0.728	169.1	3.362	73.5	0.075	54.8	0.260	−150.0	14.1
1200	0.740	164.4	2.812	69.0	0.085	55.7	0.265	−153.0	12.7
1400	0.748	160.3	2.413	64.5	0.094	56.1	0.275	−155.3	11.5
1600	0.752	156.5	2.119	60.2	0.104	56.9	0.285	−156.1	10.5
1800	0.755	152.4	1.908	56.0	0.114	56.7	0.288	−156.9	9.6
2000	0.763	148.2	1.737	52.4	0.123	57.1	0.289	−159.3	9.0
2200	0.776	144.5	1.586	49.1	0.133	57.5	0.299	−162.7	8.4
2400	0.791	141.7	1.439	46.0	0.141	57.7	0.319	−165.3	7.9
2600	0.797	139.0	1.332	42.6	0.152	57.6	0.338	−166.1	7.4
2800	0.797	136.2	1.237	38.6	0.159	55.9	0.352	−166.7	6.8
3000	0.804	132.8	1.159	35.8	0.167	55.9	0.360	−167.8	6.4

Table 8 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 50 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.594	−85.0	57.889	141.4	0.0142	58.6	0.738	−48.6	40.6
100	0.675	−133.0	33.628	115.7	0.0211	43.2	0.478	−88.7	34.3
200	0.712	−158.0	18.540	100.9	0.0258	41.3	0.340	−120.0	29.0
300	0.723	−168.0	12.583	94.1	0.0295	45.2	0.302	−136.0	25.6
400	0.727	−175.0	9.514	89.9	0.0337	49.8	0.289	−144.0	23.2
500	0.728	−179.0	7.661	86.3	0.0383	52.7	0.285	−149.0	21.3
600	0.730	177.6	6.395	83.4	0.0431	55.7	0.283	−153.0	19.8
700	0.728	174.3	5.496	80.8	0.0479	57.8	0.280	−155.0	18.4
800	0.728	171.6	4.828	78.2	0.0536	59.9	0.279	−156.0	17.3
900	0.733	168.9	4.308	76.4	0.0585	60.7	0.277	−157.0	16.4
1000	0.731	166.2	3.909	73.8	0.0633	61.5	0.277	−159.0	15.5
1200	0.733	161.4	3.237	69.8	0.0740	63.4	0.280	−161.0	13.9
1400	0.739	157.3	2.772	65.9	0.0843	64.1	0.288	−162.0	12.7
1600	0.733	153.6	2.430	61.7	0.0952	64.0	0.291	−162.0	11.4
1800	0.732	149.2	2.177	57.6	0.1050	63.9	0.292	−163.0	10.5
2000	0.738	145.0	1.968	54.1	0.1170	64.4	0.294	−164.0	9.69
2200	0.740	140.8	1.794	51.6	0.1280	63.5	0.303	−167.0	8.94
2400	0.751	137.7	1.648	47.7	0.1350	63.6	0.320	−169.0	8.41
2600	0.743	134.4	1.508	44.6	0.1440	63.7	0.338	−169.0	7.59
2800	0.749	130.3	1.389	41.3	0.1560	63.2	0.352	−169.0	7.00
3000	0.747	126.9	1.324	38.1	0.1660	59.7	0.356	−170.0	6.58

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.7	0.317	161.0	0.123
1000	2.4	0.408	169.9	0.170
2000	3.5	0.644	−168.0	0.134

Table 10 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.774	−35.7	25.550	160.5	0.0188	72.6	0.931	−19.7	40.8
100	0.747	−78.2	20.632	137.9	0.0380	53.8	0.758	−43.0	33.6
200	0.737	−120.0	14.073	116.6	0.0518	37.8	0.528	−65.5	27.8
300	0.734	−140.0	10.181	105.2	0.0568	31.8	0.404	−78.2	24.3
400	0.732	−153.0	7.888	97.9	0.0592	29.3	0.340	−86.7	21.8
500	0.732	−161.0	6.437	92.5	0.0612	29.0	0.303	−92.8	19.9
600	0.733	−167.0	5.416	88.1	0.0629	29.9	0.284	−97.2	18.4
700	0.733	−173.0	4.669	84.2	0.0643	30.8	0.272	−101.0	17.1
800	0.729	−177.0	4.094	80.9	0.0664	32.4	0.267	−103.0	15.9
900	0.732	179.3	3.655	78.1	0.0681	33.8	0.264	−105.0	14.9
1000	0.732	176.1	3.321	74.9	0.0696	35.5	0.262	−107.0	14.1
1200	0.735	169.7	2.744	69.8	0.0733	40.0	0.266	−111.0	12.5
1400	0.739	164.5	2.363	64.9	0.0785	43.0	0.279	−115.0	11.2
1600	0.739	159.6	2.064	59.8	0.0834	46.1	0.294	−118.0	10.1
1800	0.737	155.1	1.854	54.9	0.0888	49.2	0.305	−120.0	9.19
2000	0.750	150.3	1.665	51.2	0.0972	52.5	0.314	−123.0	8.47
2200	0.755	145.9	1.511	48.1	0.1050	54.5	0.326	−128.0	7.73
2400	0.755	142.1	1.380	44.2	0.1110	56.5	0.346	−133.0	7.01
2600	0.762	138.0	1.263	40.5	0.1190	58.7	0.375	−137.0	6.45
2800	0.763	134.4	1.155	36.6	0.1290	60.1	0.400	−139.0	5.80
3000	0.762	130.4	1.092	33.5	0.1390	58.7	0.414	−141.0	5.36

Table 11 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.694	−51.7	39.502	153.5	0.0170	67.0	0.867	−30.0	40.8
100	0.696	−102.0	28.085	128.1	0.0303	47.4	0.634	−61.2	34.1
200	0.711	−139.0	17.156	108.9	0.0383	36.3	0.417	−89.1	28.6
300	0.718	−155.0	11.948	99.7	0.0416	35.5	0.326	−105.0	25.2
400	0.720	−164.0	9.125	93.9	0.0444	36.7	0.288	−116.0	22.8
500	0.721	−170.0	7.389	89.5	0.0476	38.7	0.270	−123.0	20.9
600	0.720	−175.0	6.193	86.0	0.0504	40.9	0.259	−128.0	19.3
700	0.723	−180.0	5.331	82.9	0.0536	43.6	0.253	−131.0	18.0
800	0.722	177.2	4.671	80.0	0.0572	45.5	0.249	−133.0	16.9
900	0.721	173.8	4.172	77.7	0.0612	47.7	0.246	−135.0	15.9
1000	0.723	171.0	3.780	74.7	0.0642	49.2	0.245	−137.0	15.0
1200	0.726	165.3	3.129	70.4	0.0723	52.7	0.249	−140.0	13.4
1400	0.731	161.0	2.686	66.2	0.0809	55.0	0.259	−142.0	12.2
1600	0.727	156.7	2.350	61.6	0.0894	56.1	0.268	−143.0	11.0
1800	0.730	152.0	2.103	57.3	0.0975	57.7	0.273	−143.0	10.1
2000	0.736	147.8	1.905	53.6	0.1080	59.2	0.278	−146.0	9.34
2200	0.743	143.2	1.748	50.7	0.1190	59.6	0.287	−149.0	8.71
2400	0.748	139.6	1.589	47.1	0.1250	60.3	0.307	−152.0	8.01
2600	0.746	136.2	1.454	43.3	0.1330	61.2	0.330	−154.0	7.28
2800	0.746	132.5	1.345	40.3	0.1440	61.5	0.349	−155.0	6.68
3000	0.744	128.7	1.279	36.9	0.1530	58.7	0.359	−156.0	6.24

Table 12 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.652	−63.5	47.981	148.7	0.0158	62.5	0.816	−37.2	40.8
100	0.679	−115.0	31.329	122.6	0.0263	44.9	0.561	−72.6	34.2
200	0.705	−147.0	18.188	105.2	0.0324	37.7	0.375	−103.0	28.8
300	0.716	−161.0	12.498	97.1	0.0357	38.9	0.310	−120.0	25.5
400	0.717	−169.0	9.517	92.2	0.0391	41.8	0.285	−130.0	23.1
500	0.720	−174.0	7.679	88.1	0.0427	44.8	0.273	−137.0	21.2
600	0.720	−178.0	6.418	84.9	0.0468	47.8	0.268	−141.0	19.7
700	0.717	177.6	5.523	82.0	0.0506	50.0	0.264	−144.0	18.3
800	0.719	174.7	4.842	79.3	0.0550	52.3	0.262	−146.0	17.2
900	0.718	171.4	4.322	77.3	0.0596	53.7	0.259	−147.0	16.2
1000	0.719	168.7	3.909	74.5	0.0639	55.1	0.258	−149.0	15.3
1200	0.724	163.3	3.252	70.4	0.0731	57.7	0.262	−151.0	13.8
1400	0.728	158.9	2.787	66.4	0.0829	59.2	0.269	−153.0	12.5
1600	0.724	155.2	2.437	61.7	0.0924	59.9	0.275	−154.0	11.3
1800	0.726	150.6	2.193	57.4	0.1020	60.6	0.278	−154.0	10.4
2000	0.729	146.5	1.974	54.2	0.1130	61.6	0.281	−156.0	9.55
2200	0.732	142.1	1.806	51.4	0.1240	61.3	0.289	−159.0	8.85
2400	0.742	138.6	1.651	47.7	0.1300	61.4	0.307	−161.0	8.27
2600	0.740	135.1	1.506	44.1	0.1390	62.0	0.328	−162.0	7.50
2800	0.738	131.5	1.387	40.9	0.1500	61.8	0.344	−162.0	6.81
3000	0.735	127.7	1.322	37.6	0.1600	58.9	0.350	−163.0	6.36

NPN 8 GHz wideband transistor — BFG198

DESCRIPTION

NPN planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The device features a high gain and excellent output voltage capabilities.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

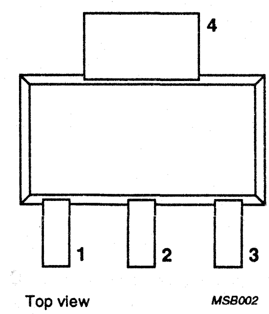


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	700	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	8	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 8 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 8 V; f = 1 MHz	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	700	–	mV
d_2	second order intermodulation distortion	note 4	–	–55	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 445.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 453.25 MHz; f_r = 445.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 795.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 50 mA; V_{CE} = 8 V; V_O = 50 dBmV;
   $f_{(p+q)}$ = 810 MHz.

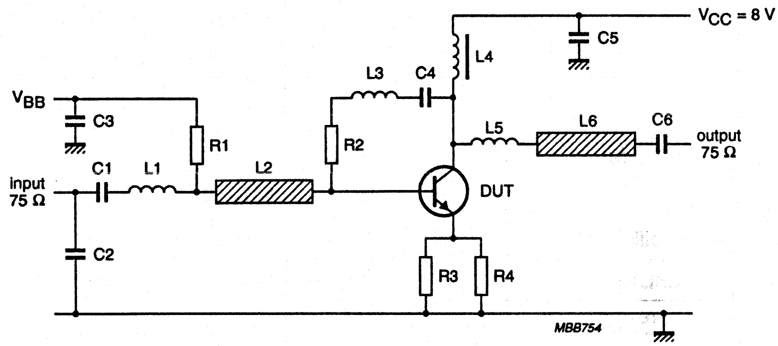


Fig.2 Intermodulation and second order intermodulation distortion test circuit.

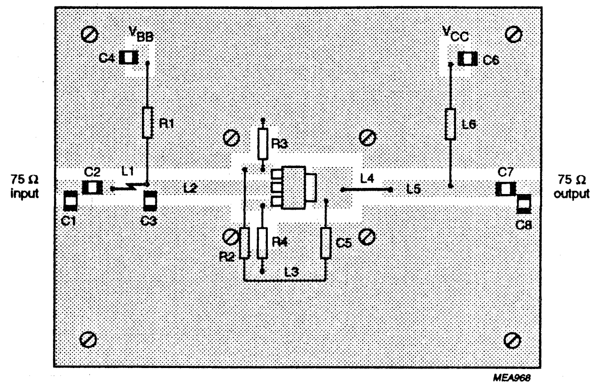
List of components (see test circuit)

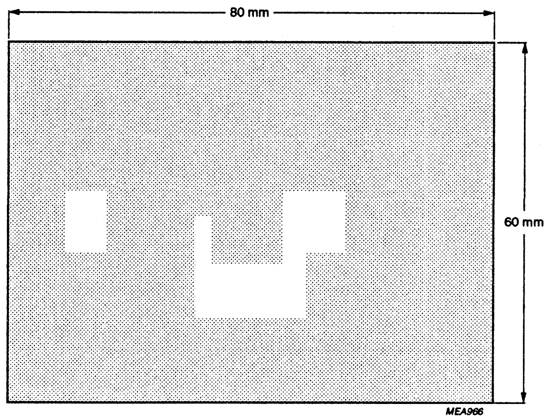
DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C2	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C1, C4, C6, C7	multilayer ceramic capacitor	10 nF		2222 590 08627
C3	multilayer ceramic capacitor	10 nF		2222 851 12128
C5 (note 1)	multilayer ceramic capacitor	10 nF		2222 629 08103
C8	multilayer ceramic capacitor	1.5 pF		2222 851 12158
L1 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L2	microstripline	75 Ω	length 22 mm; width 2.5 mm	
L3 (note 1)	0.4 mm copper wire	≈ 24 nH	length 30 mm	
L4 (note 1)	0.4 mm copper wire	≈ 3.6 nH	length 4 mm	
L5	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L6	Ferroxcube choke	5 µH		3122 108 20153
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	220 Ω		2322 180 73221
R3, R4	metal film resistor	30 Ω		2322 180 73309

Notes

The circuit has been built on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 2 x 35 µm; see Fig.2.

1. Components C5, L1, L3, L4, and R2 are mounted on the underside of the PCB.





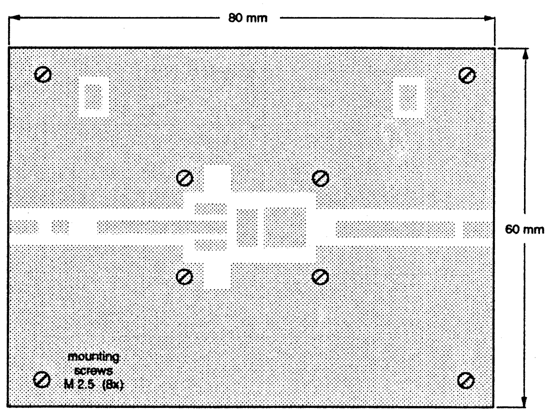


Fig.3 Intermodulation distortion and second order intermodulation distortion printed circuit board.

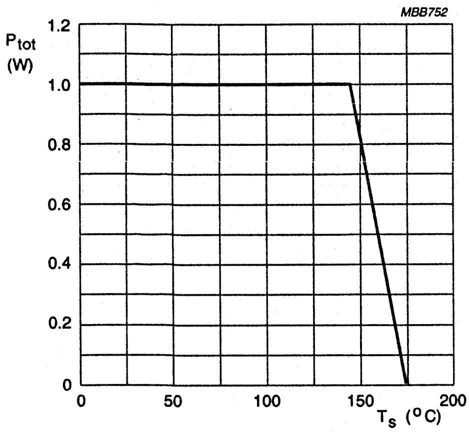
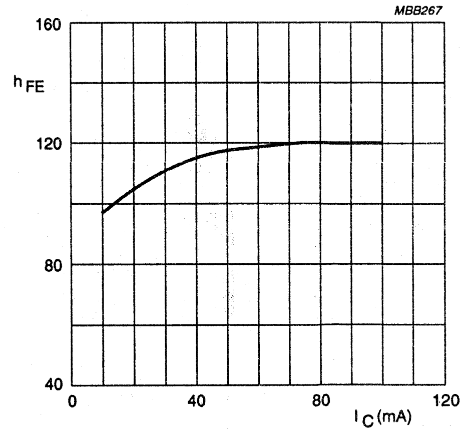
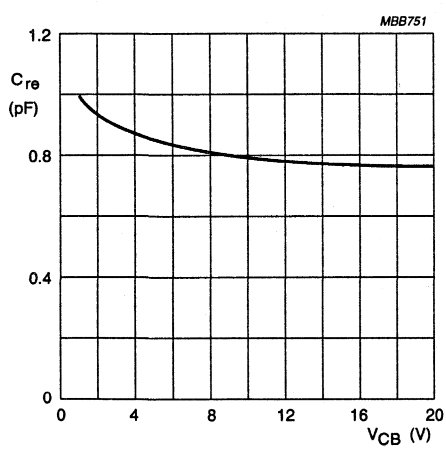


Fig.4 Power derating curve.



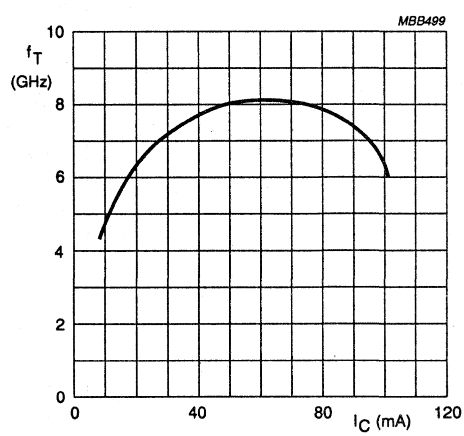
V_{CE} = 5 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



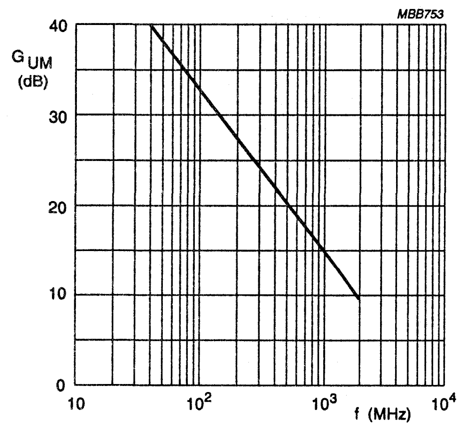
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-base voltage.



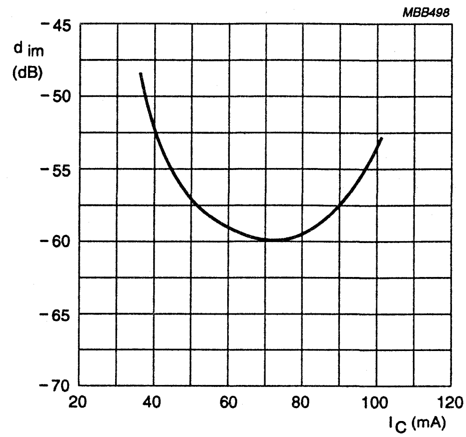
V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.



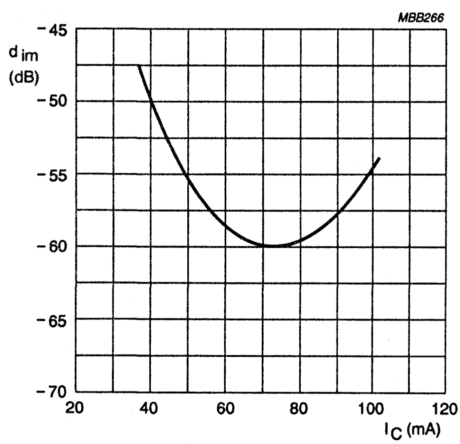
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



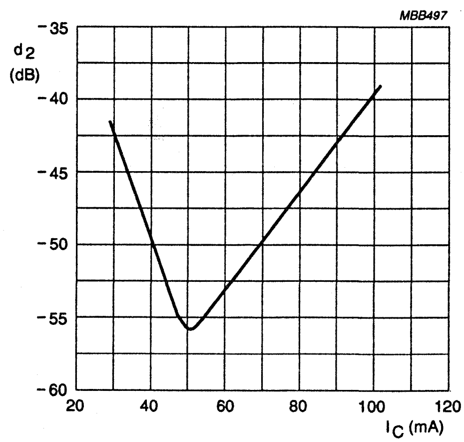
V_{CE} = 8 V; V_O = 750 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 443.25 MHz.

Fig.9 Intermodulation distortion as a function of collector current.



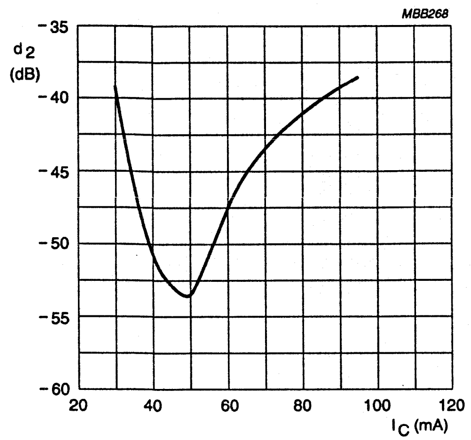
V_{CE} = 8 V; V_O = 700 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz.

Fig.10 Intermodulation distortion as a function of collector current.



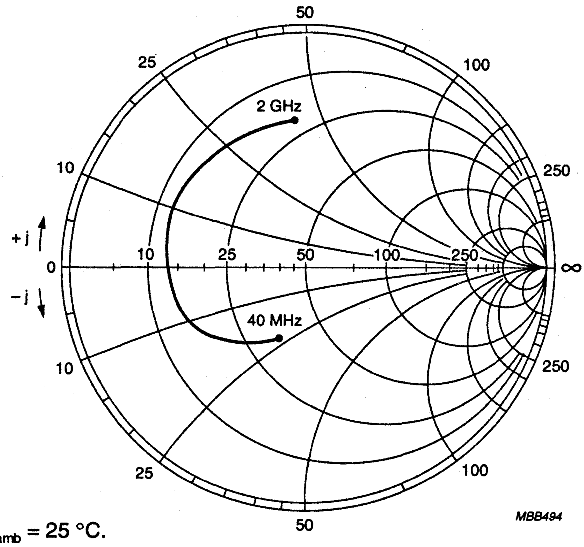
V_{CE} = 8 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 450 MHz.

Fig.11 Second order intermodulation distortion as a function of collector current.



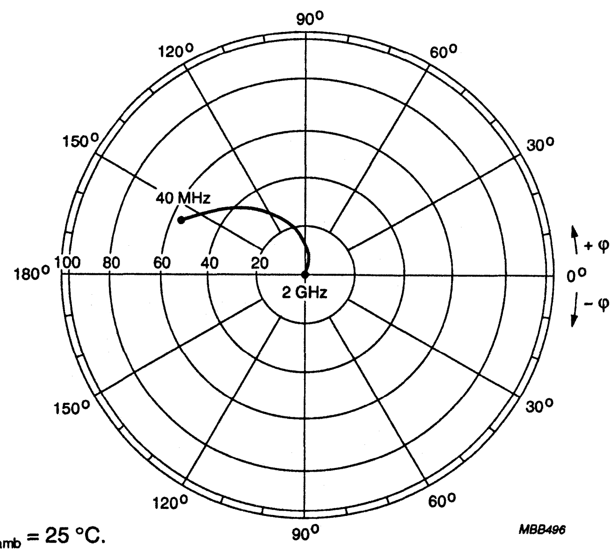
V_{CE} = 8 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 810 MHz.

Fig.12 Second order intermodulation distortion as a function of collector current.



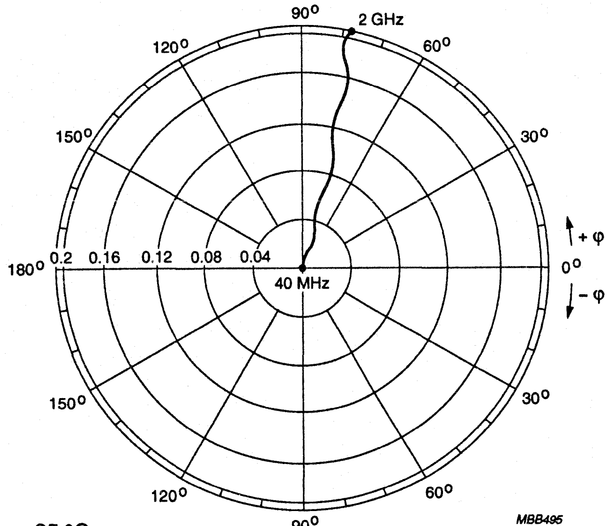
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.13 Common emitter input reflection coefficient (S_{11}).



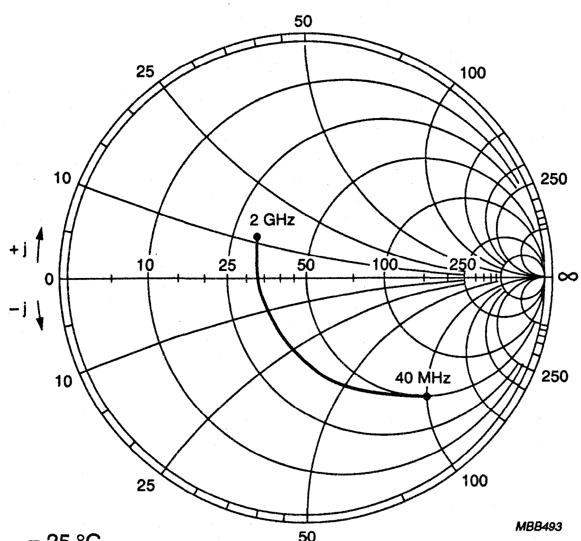
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.14 Common emitter forward transmission coefficient (S_{21}).



I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.15 Common emitter reverse transmission coefficient (S_{12}).



I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.16 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.343	−105.	53.980	142.8	0.0100	73.1	0.744	−41.3	38.7
100	0.492	−145.	32.614	116.4	0.0180	61.2	0.452	−73.8	32.5
200	0.551	−165.	18.159	100.5	0.0270	62.2	0.273	−101.	27.1
300	0.569	−174.	12.362	92.8	0.0360	66.8	0.208	−118.	23.7
400	0.574	179.2	9.375	87.7	0.0450	68.5	0.182	−131.	21.3
500	0.584	174.8	7.590	83.3	0.0550	69.4	0.170	−141.	19.5
600	0.586	171.1	6.337	79.7	0.0650	70.7	0.162	−149.	18.0
700	0.582	167.0	5.488	75.9	0.0740	70.7	0.159	−157.	16.7
800	0.584	163.2	4.822	72.9	0.0820	69.9	0.159	−163.	15.6
900	0.590	159.1	4.296	69.9	0.0930	69.6	0.160	−170.	14.6
1000	0.595	155.7	3.885	67.2	0.104	69.6	0.165	−176.	13.8
1200	0.622	149.4	3.245	62.0	0.123	67.7	0.179	173.5	12.5
1400	0.635	144.5	2.777	56.3	0.140	65.6	0.199	167.5	11.3
1600	0.643	139.2	2.455	51.0	0.160	64.6	0.219	161.7	10.3
1800	0.655	133.2	2.220	45.3	0.178	60.5	0.234	154.8	9.61
2000	0.672	127.1	2.030	40.1	0.196	59.1	0.257	147.8	9.06
2200	0.710	121.9	1.830	35.4	0.210	55.9	0.286	142.2	8.67
2400	0.724	117.4	1.669	32.1	0.222	55.3	0.314	137.2	8.13
2600	0.724	114.1	1.549	26.7	0.243	51.6	0.336	132.5	7.55
2800	0.724	107.4	1.409	20.9	0.254	47.0	0.350	125.5	6.77
3000	0.748	101.0	1.353	17.0	0.268	45.8	0.370	118.3	6.83

Table 2 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.357	−122.	60.320	139.1	0.00885	69.9	0.687	−46.7	39.0
100	0.508	−153.	33.731	113.3	0.0164	64.7	0.407	−81.8	32.6
200	0.561	−169.	18.605	98.4	0.0266	65.9	0.253	−110.	27.3
300	0.574	−177.	12.479	91.8	0.0359	69.8	0.205	−128.	23.8
400	0.583	178.5	9.438	86.0	0.0461	71.5	0.184	−142.	21.5
500	0.586	173.0	7.651	82.6	0.0560	71.6	0.176	−151.	19.6
600	0.586	169.9	6.488	79.8	0.0676	71.8	0.173	−159.	18.2
700	0.585	166.0	5.579	76.0	0.0751	70.6	0.172	−165.	16.9
800	0.588	163.1	4.790	73.1	0.0868	71.7	0.173	−171.	15.6
900	0.578	158.4	4.346	69.7	0.0955	71.1	0.176	−177.	14.7
1000	0.606	154.9	3.941	66.8	0.106	69.7	0.181	177.5	14.0
1200	0.613	150.7	3.325	61.4	0.127	68.3	0.198	168.8	12.7
1400	0.633	144.3	2.820	55.9	0.143	66.0	0.217	162.3	11.4
1600	0.639	139.7	2.464	50.9	0.163	64.6	0.235	157.2	10.4
1800	0.646	133.7	2.267	44.7	0.182	60.1	0.249	150.9	9.73
2000	0.685	127.0	2.042	40.2	0.199	57.6	0.272	144.5	9.28
2200	0.695	121.4	1.817	36.4	0.215	55.2	0.303	138.5	8.47
2400	0.741	118.9	1.675	33.4	0.223	55.0	0.329	134.7	8.44
2600	0.744	114.5	1.570	27.6	0.246	51.2	0.351	129.5	7.98
2800	0.728	110.2	1.409	22.3	0.257	46.7	0.362	122.5	6.86
3000	0.743	102.1	1.360	17.2	0.270	45.2	0.382	116.0	6.85

NPN 9 GHz wideband transistor — BFG505; BFG505/X; BFG505/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG505 is an NPN silicon planar epitaxial transistor, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV).

The transistors are mounted in a plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG505 (Fig.1) Code: N33	
1	collector
2	base
3	emitter
4	emitter
BFG505/X (Fig.1) Code: N39	
1	collector
2	emitter
3	base
4	emitter
BFG505/XR (Fig.2) Code: N45	
1	collector
2	emitter
3	base
4	emitter

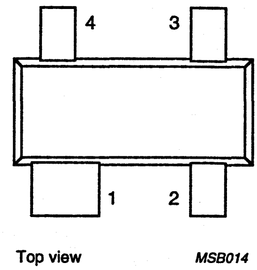


Fig.1 SOT143.

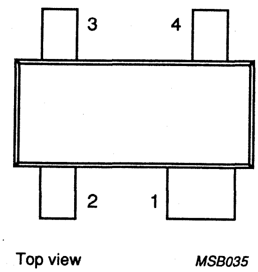


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	–	150	mW
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 5 mA	60	120	250	
C_{re}	feedback capacitance	V_{CB} = 6 V; $I_C = i_c = 0$; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	18	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	150	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 6 V; I_E = 0;	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 5 mA;	60	120	250	
C_e	emitter capacitance	V_{EB} = 0.5 V; $I_C = i_c$ = 0; f = 1 MHz	–	0.4	–	pF
C_c	collector capacitance	V_{CB} = 6 V; $I_E = i_e$ =0; f = 1 MHz	–	0.3	–	pF
C_{re}	feedback capacitance	V_{CB} = 6 V; I_C = 0; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.

NPN 9 GHz wideband transistor BFG505; BFG505/X; BFG505/XR

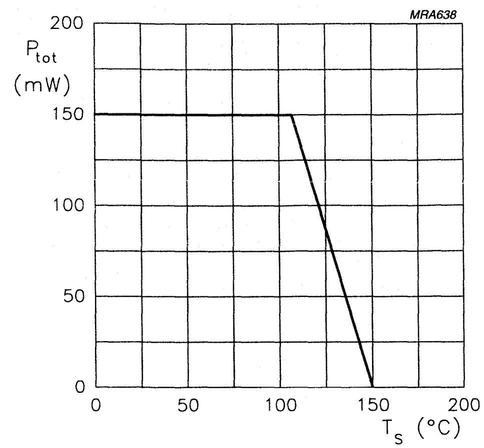
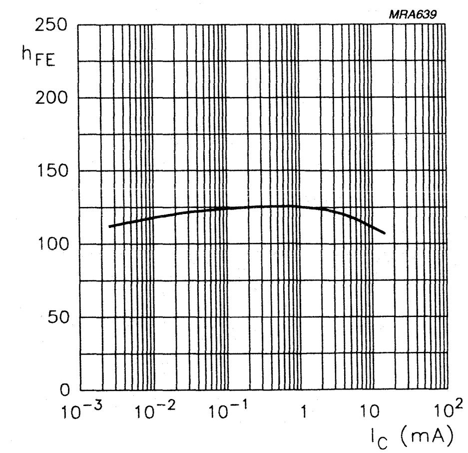
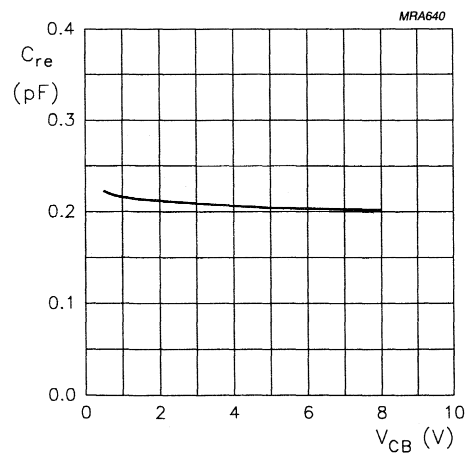


Fig.3 Power derating curve.



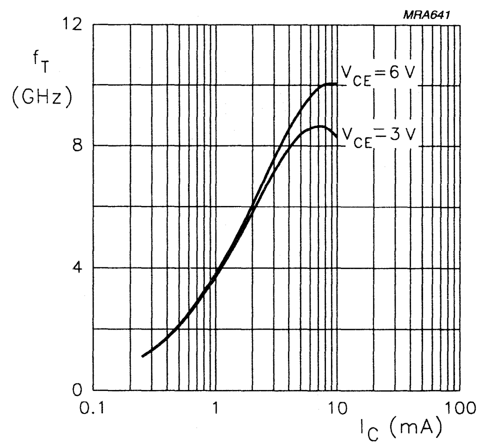
V_{CE} = 6 V.

Fig.4 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

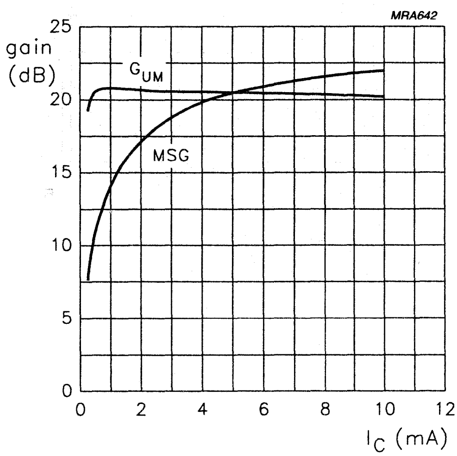
Fig.5 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

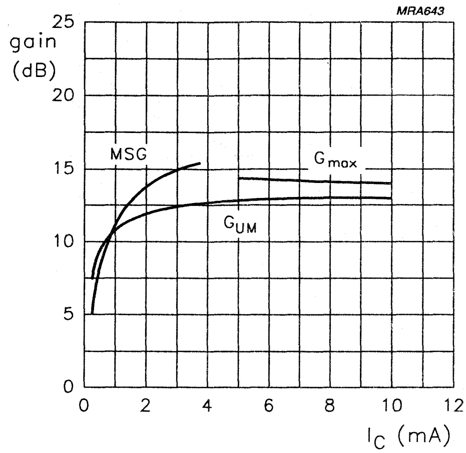
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



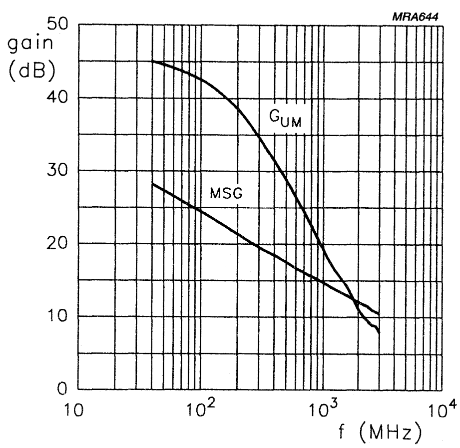
V_{CE} = 6 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



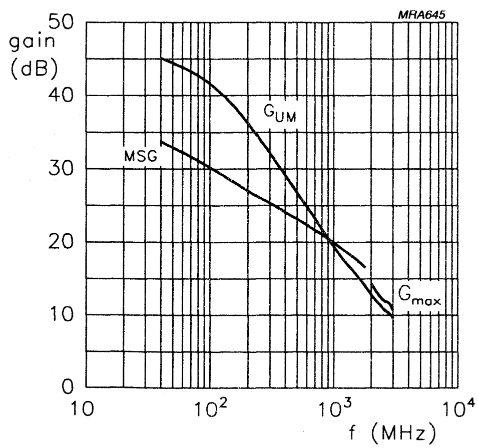
V_{CE} = 6 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



V_{CE} = 6 V; I_C = 1.25 mA.

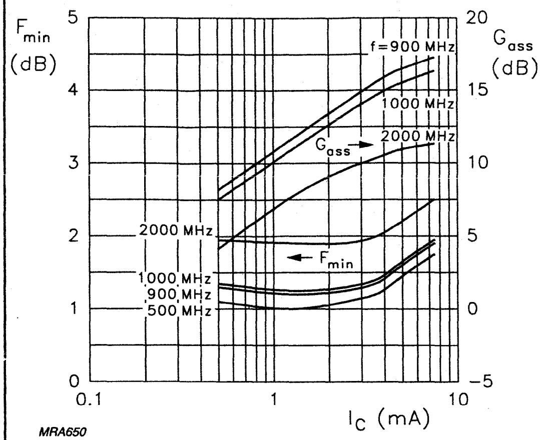
Fig.9 Gain as a function of frequency.



V_{CE} = 6 V; I_C = 5 mA.

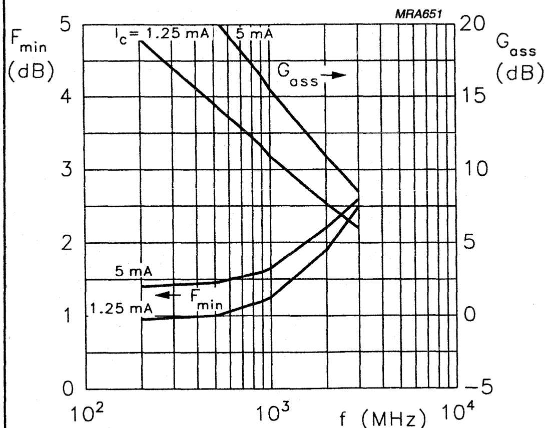
Fig.10 Gain as a function of frequency.

NPN 9 GHz wideband transistor — BFG505; BFG505/X; BFG505/XR



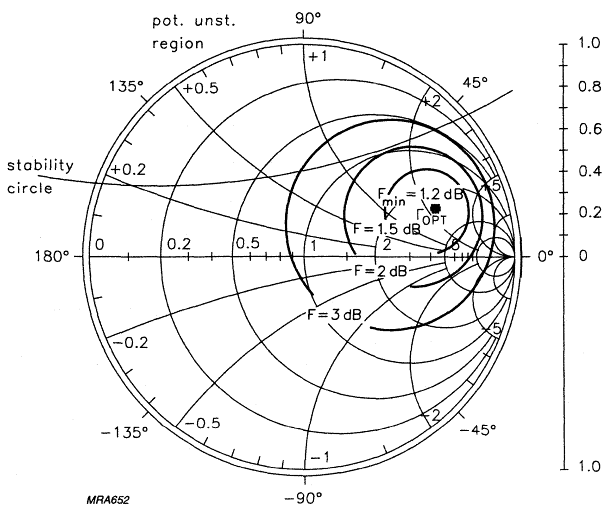
V_{CE} = 6 V.

Fig.11 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 6 V.

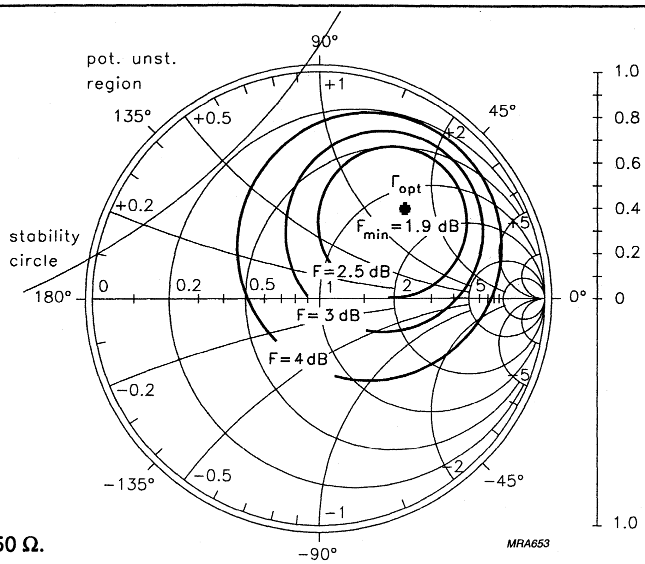
Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.

V_{CE} = 6 V; I_C = 1.25 mA; f = 900 MHz.

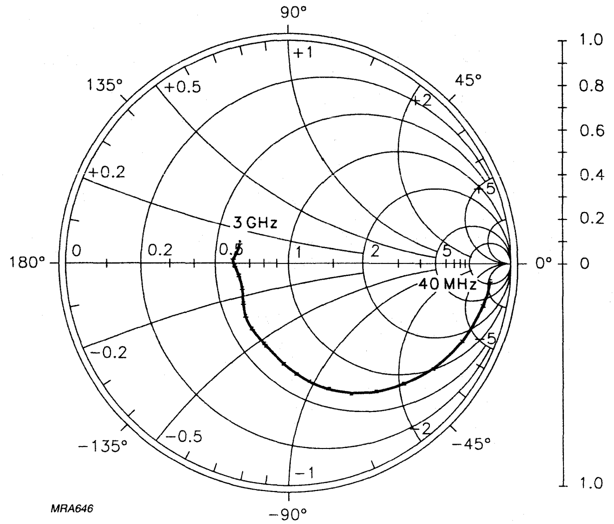
Fig.13 Noise circle figure.



Z_O = 50 Ω.

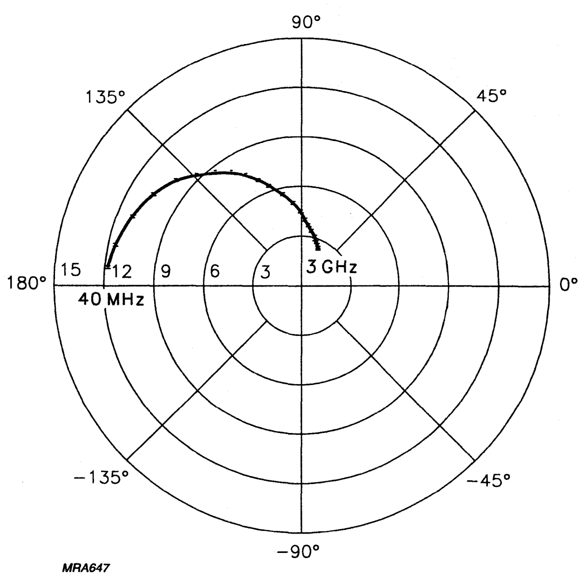
V_{CE} = 6 V; I_C = 1.25 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



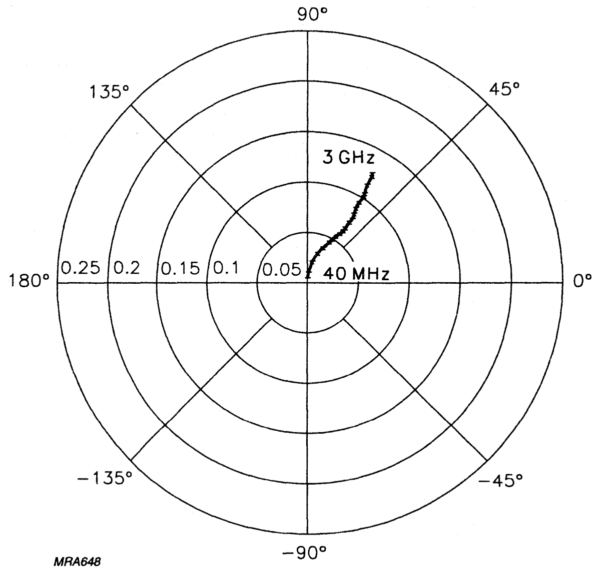
V_{CE} = 6 V; I_C = 5 mA.

Fig.15 Common emitter input reflection coefficient (S_{11}).



V_{CE} = 6 V; I_C = 5 mA.

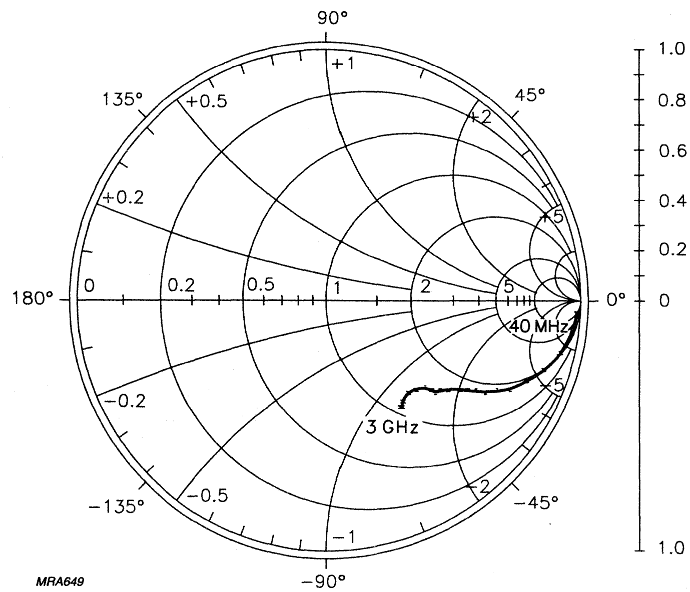
Fig.16 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_C = 5 mA.

MRA648

Fig.17 Common emitter reverse transmission coefficient (S_{12}).



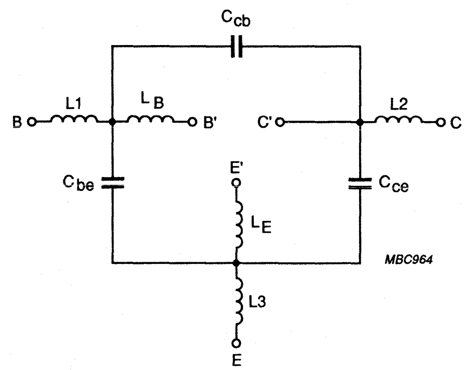
V_{CE} = 6 V; I_C = 5 mA.

MRA649

Fig.18 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for the BFR505 crystal

1	IS = 134.1	aA
2	BF = 180.0	-
3	NF = 988.2	m
4	VAF = 38.34	V
5	IKF = 150.0	mA
6	ISE = 27.81	fA
7	NE = 2.051	-
8	BR = 55.19	-
9	NR = 982.2	m
10	VAR = 2.459	V
11	IKR = 2.920	mA
12	ISC = 17.45	aA
13	NC = 1.062	-
14	RB = 20.00	Ω
15	IRB = 1.000	μA
16	RBM = 20.00	Ω
17	RE = 1.171	Ω
18	RC = 4.350	Ω
19(note 1)	XTB = 0.000	-
20(note 1)	EG = 1.110	EV
21(note 1)	XTI = 3.000	-
22	CJE = 284.7	fF
23	VJE = 600.0	mV
24	MJE = 303.6	m
25	TF = 7.037	ps
26	XTF = 12.34	-
27	VTF = 1.701	V
28	ITF = 30.64	mA
29(note 1)	PTF = 0.000	deg
30	CJC = 242.4	fF
31	VJC = 188.6	mV
32	MJC = 41.49	m
33	XCJC = 130.0	m
34	TR = 1.332	ns
35(note 1)	CJS = 0.000	F
36(note 1)	VJS = 750.0	mV
37(note 1)	MJS = 0.000	-
38	FC = 897.4	m



$QL_B = 50; QL_E = 50.$

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}.$

Fc = scaling frequency = 1000 MHz.

Fig.19 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.19)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.990	−1.7	1.390	177.9	0.005	87.1	0.998	−1.0	43.7
100	0.988	−4.3	1.380	175.0	0.012	87.2	0.997	−2.5	41.0
200	0.984	−8.6	1.371	170.3	0.025	84.3	0.995	−4.9	38.3
300	0.980	−12.9	1.383	165.7	0.037	81.3	0.992	−7.4	35.0
400	0.972	−17.4	1.385	161.5	0.049	78.2	0.988	−9.7	31.6
500	0.964	−21.5	1.366	157.4	0.060	75.7	0.984	−12.1	29.1
600	0.957	−25.4	1.324	153.5	0.072	73.4	0.978	−14.4	26.8
700	0.947	−29.4	1.311	149.8	0.082	70.6	0.971	−16.5	24.6
800	0.932	−33.4	1.312	145.8	0.091	67.9	0.961	−18.7	22.3
900	0.916	−37.2	1.292	141.4	0.101	65.2	0.950	−20.7	20.3
1000	0.896	−41.1	1.268	137.5	0.109	62.7	0.939	−22.9	18.4
1200	0.855	−49.4	1.245	130.1	0.127	58.4	0.923	−27.3	15.9
1400	0.821	−57.8	1.255	123.0	0.143	54.4	0.907	−31.3	14.4
1600	0.789	−66.0	1.242	116.1	0.153	50.8	0.896	−34.6	13.2
1800	0.751	−72.5	1.176	111.0	0.161	48.5	0.873	−37.5	11.2
2000	0.691	−80.0	1.143	104.5	0.168	44.3	0.843	−40.7	9.3
2200	0.636	−89.1	1.126	98.6	0.177	40.5	0.819	−44.9	8.1
2400	0.602	−99.0	1.113	90.8	0.183	36.7	0.809	−49.3	7.5
2600	0.588	−107.3	1.059	86.6	0.190	36.0	0.820	−53.1	7.2
2800	0.564	−113.7	1.062	82.6	0.197	34.9	0.826	−55.4	7.2
3000	0.520	−121.3	1.008	77.5	0.194	33.1	0.811	−57.2	6.1

Table 2 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 1.25 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.975	−2.4	3.440	177.1	0.005	86.8	0.996	−1.4	44.5
100	0.971	−6.1	3.404	173.4	0.012	86.1	0.995	−3.4	43.0
200	0.961	−12.0	3.359	167.5	0.025	82.1	0.988	−6.8	38.0
300	0.948	−18.1	3.363	161.6	0.036	78.2	0.978	−10.1	34.2
400	0.930	−24.2	3.329	156.4	0.047	74.4	0.966	−13.2	30.8
500	0.911	−29.8	3.238	151.7	0.058	70.9	0.952	−16.1	28.2
600	0.892	−34.9	3.125	147.2	0.067	68.3	0.936	−19.0	25.9
700	0.871	−40.3	3.069	143.2	0.076	65.3	0.918	−21.4	23.9
800	0.843	−45.5	3.021	138.5	0.083	62.2	0.897	−23.8	22.1
900	0.812	−50.3	2.917	133.8	0.090	59.6	0.877	−26.0	20.3
1000	0.780	−55.4	2.821	129.8	0.096	57.1	0.856	−28.2	18.8
1200	0.714	−65.8	2.685	122.2	0.108	53.1	0.821	−32.6	16.6
1400	0.658	−76.5	2.621	114.7	0.118	49.8	0.795	−36.3	15.2
1600	0.610	−86.0	2.478	107.8	0.124	47.8	0.775	−39.2	13.9
1800	0.560	−93.6	2.305	102.9	0.129	46.5	0.747	−41.4	12.4
2000	0.492	−102.5	2.167	96.9	0.132	44.1	0.713	−43.8	11.0
2200	0.440	−113.9	2.074	91.6	0.137	41.8	0.684	−47.4	10.0
2400	0.415	−125.2	1.975	84.8	0.140	40.2	0.671	−51.7	9.3
2600	0.403	−134.2	1.845	81.3	0.146	40.6	0.679	−55.3	8.8
2800	0.380	−141.2	1.800	77.5	0.151	40.5	0.687	−57.2	8.6
3000	0.348	−150.4	1.677	73.2	0.151	40.5	0.676	−58.4	7.7

Table 3 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.20	0.652	20.0	0.81
2000	1.90	0.546	48.0	0.59

Table 4 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.949	−3.5	6.588	176.1	0.005	86.6	0.993	−2.0	45.1
100	0.942	−8.7	6.499	170.9	0.012	83.9	0.988	−4.9	42.0
200	0.920	−17.1	6.337	163.0	0.024	79.0	0.972	−9.5	36.8
300	0.892	−25.6	6.226	155.7	0.035	74.1	0.949	−13.8	32.8
400	0.858	−33.9	6.046	149.3	0.045	69.6	0.922	−17.6	29.6
500	0.823	−41.3	5.771	143.5	0.053	65.8	0.893	−21.1	27.1
600	0.788	−48.4	5.529	138.3	0.060	62.9	0.862	−24.1	25.0
700	0.750	−55.5	5.338	133.3	0.066	60.0	0.830	−26.5	23.2
800	0.706	−62.1	5.126	128.1	0.071	57.6	0.801	−28.6	21.6
900	0.663	−68.1	4.858	123.3	0.076	55.6	0.772	−30.5	20.2
1000	0.619	−74.2	4.605	119.0	0.080	53.8	0.745	−32.3	18.9
1200	0.539	−86.9	4.210	111.0	0.088	51.6	0.702	−35.9	16.9
1400	0.480	−99.2	3.910	103.9	0.094	49.9	0.675	−38.8	15.6
1600	0.436	−109.5	3.550	97.7	0.099	49.6	0.656	−40.9	14.4
1800	0.388	−118.1	3.232	93.3	0.104	49.8	0.633	−42.1	13.1
2000	0.337	−129.1	2.967	88.3	0.107	49.2	0.604	−43.8	11.9
2200	0.307	−142.7	2.770	83.9	0.112	48.6	0.577	−46.9	11.0
2400	0.304	−154.6	2.585	78.5	0.115	48.6	0.566	−51.0	10.3
2600	0.304	−163.0	2.386	75.5	0.123	49.7	0.576	−54.8	9.7
2800	0.288	−170.1	2.291	72.2	0.129	50.2	0.588	−56.5	9.4
3000	0.275	179.0	2.125	68.6	0.131	51.1	0.582	−57.3	8.7

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.583	19.0	0.69
2000	1.90	0.473	45.0	0.55

Table 6 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 3.75 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.924	−4.5	9.431	175.1	0.005	86.0	0.990	−2.4	45.0
100	0.912	−11.2	9.265	168.8	0.012	82.7	0.982	−6.0	41.5
200	0.879	−21.9	8.937	159.4	0.023	76.7	0.955	−11.8	36.0
300	0.836	−32.5	8.617	150.8	0.033	71.2	0.917	−16.7	31.9
400	0.789	−42.5	8.214	143.5	0.042	66.3	0.877	−20.8	28.9
500	0.742	−51.6	7.716	137.0	0.048	62.4	0.837	−24.2	26.5
600	0.695	−60.1	7.289	131.1	0.054	59.9	0.797	−26.9	24.5
700	0.647	−68.2	6.897	125.7	0.059	57.6	0.761	−28.9	22.9
800	0.598	−75.6	6.479	120.4	0.063	56.1	0.729	−30.6	21.4
900	0.551	−82.2	6.039	115.6	0.067	54.6	0.699	−32.0	20.1
1000	0.506	−89.1	5.633	111.4	0.070	53.9	0.672	−33.4	18.9
1200	0.432	−102.9	4.992	104.0	0.076	53.0	0.631	−36.2	17.1
1400	0.386	−115.8	4.511	97.6	0.082	52.3	0.608	−38.7	15.8
1600	0.353	−126.1	4.029	92.1	0.087	53.1	0.595	−40.3	14.6
1800	0.315	−136.0	3.630	88.2	0.093	54.0	0.578	−41.1	13.4
2000	0.278	−148.2	3.300	83.8	0.097	54.0	0.553	−42.5	12.3
2200	0.267	−162.5	3.055	80.0	0.103	54.0	0.528	−45.4	11.4
2400	0.276	−173.4	2.834	75.2	0.107	54.7	0.519	−49.6	10.8
2600	0.281	179.6	2.608	72.5	0.115	55.8	0.531	−53.5	10.1
2800	0.270	172.9	2.488	69.6	0.122	56.2	0.544	−55.3	9.8
3000	0.266	162.0	2.305	66.2	0.126	57.0	0.541	−56.0	9.1

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.40	0.563	17.0	0.62
2000	2.00	0.433	46.0	0.48

Table 8 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.898	−5.5	12.035	174.3	0.005	85.2	0.987	−2.9	44.5
100	0.882	−13.6	11.746	166.9	0.012	82.1	0.974	−7.2	40.9
200	0.838	−26.6	11.204	156.1	0.022	74.2	0.936	−13.6	35.3
300	0.782	−39.0	10.618	146.5	0.032	68.2	0.886	−18.9	31.3
400	0.725	−50.7	9.930	138.4	0.039	64.1	0.836	−22.9	28.4
500	0.670	−61.1	9.180	131.5	0.045	60.6	0.788	−26.1	26.1
600	0.615	−70.5	8.520	125.3	0.050	58.7	0.745	−28.4	24.2
700	0.564	−79.3	7.901	119.7	0.054	57.0	0.709	−29.9	22.6
800	0.515	−86.9	7.294	114.6	0.057	55.9	0.677	−31.1	21.3
900	0.471	−93.9	6.705	110.1	0.060	55.1	0.648	−32.2	20.0
1000	0.431	−101.2	6.198	106.2	0.063	55.0	0.624	−33.2	18.9
1200	0.368	−115.7	5.387	99.4	0.069	55.0	0.589	−35.5	17.1
1400	0.335	−128.7	4.800	93.6	0.075	55.1	0.570	−37.8	15.8
1600	0.310	−139.4	4.259	88.6	0.081	56.6	0.560	−39.2	14.7
1800	0.281	−149.4	3.815	85.0	0.087	57.4	0.548	−39.8	13.5
2000	0.256	−162.7	3.456	81.1	0.092	57.9	0.525	−41.1	12.5
2200	0.257	−176.3	3.188	77.5	0.098	58.0	0.503	−44.0	11.6
2400	0.272	174.6	2.949	73.1	0.103	58.7	0.494	−48.3	10.9
2600	0.279	168.8	2.707	70.6	0.111	59.7	0.507	−52.3	10.3
2800	0.271	162.3	2.574	67.8	0.119	59.9	0.522	−54.2	9.9
3000	0.271	152.2	2.384	64.6	0.123	60.8	0.520	−54.9	9.2

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.60	0.508	18.0	0.60
2000	2.20	0.370	46.0	0.47

Table 10 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 7.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.849	−7.5	16.291	172.7	0.005	82.9	0.980	−3.6	43.7
100	0.823	−18.5	15.705	163.4	0.011	79.6	0.960	−8.9	39.9
200	0.759	−35.7	14.603	150.4	0.021	71.1	0.899	−16.3	34.2
300	0.685	−51.3	13.379	139.3	0.029	65.4	0.830	−21.5	30.4
400	0.616	−65.3	12.060	130.3	0.035	61.1	0.768	−25.0	27.6
500	0.555	−77.2	10.805	123.0	0.039	58.6	0.716	−27.4	25.4
600	0.502	−87.6	9.721	116.8	0.043	57.8	0.675	−28.8	23.7
700	0.456	−96.7	8.776	111.7	0.047	57.1	0.643	−29.7	22.2
800	0.416	−104.6	7.948	107.1	0.049	57.1	0.616	−30.3	20.9
900	0.381	−112.0	7.201	103.1	0.052	57.1	0.592	−30.9	19.7
1000	0.351	−119.8	6.584	99.8	0.055	57.9	0.573	−31.5	18.7
1200	0.311	−134.9	5.626	93.9	0.062	59.0	0.546	−33.3	17.0
1400	0.294	−147.8	4.947	88.9	0.068	59.8	0.534	−35.5	15.7
1600	0.281	−157.6	4.360	84.4	0.074	61.4	0.530	−36.8	14.6
1800	0.262	−167.8	3.893	81.2	0.081	62.4	0.522	−37.5	13.5
2000	0.253	179.3	3.516	77.6	0.087	62.9	0.503	−38.8	12.5
2200	0.265	167.9	3.232	74.5	0.094	63.0	0.484	−41.8	11.7
2400	0.283	161.3	2.984	70.4	0.099	63.8	0.476	−46.3	11.0
2600	0.292	156.9	2.733	68.1	0.108	64.6	0.490	−50.5	10.3
2800	0.284	151.0	2.593	65.5	0.116	64.5	0.507	−52.6	9.9
3000	0.291	142.0	2.400	62.4	0.121	65.0	0.507	−53.3	9.3

Table 11 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.992	−1.7	1.318	178.0	0.005	88.3	0.998	−1.0	44.1
100	0.989	−4.1	1.305	175.2	0.012	86.6	0.997	−2.4	41.3
200	0.985	−8.3	1.297	170.6	0.024	84.4	0.995	−4.8	37.8
300	0.982	−12.4	1.313	166.1	0.036	81.4	0.993	−7.1	35.2
400	0.974	−16.7	1.317	161.9	0.048	78.7	0.989	−9.5	31.9
500	0.967	−20.7	1.301	158.0	0.059	76.1	0.985	−11.7	29.4
600	0.960	−24.4	1.259	154.2	0.070	74.0	0.980	−13.9	27.0
700	0.951	−28.3	1.248	150.6	0.080	71.3	0.974	−16.1	24.9
800	0.938	−32.1	1.250	146.6	0.089	68.8	0.964	−18.2	22.7
900	0.921	−35.8	1.228	142.2	0.099	66.0	0.955	−20.2	20.5
1000	0.902	−39.6	1.206	138.3	0.107	63.7	0.944	−22.3	18.6
1200	0.864	−47.5	1.186	131.0	0.124	59.4	0.929	−26.7	16.1
1400	0.831	−55.7	1.199	124.1	0.141	55.6	0.915	−30.6	14.5
1600	0.801	−63.6	1.190	117.2	0.151	52.0	0.904	−34.0	13.3
1800	0.763	−69.8	1.127	112.1	0.159	49.7	0.882	−36.8	11.4
2000	0.703	−77.1	1.100	105.6	0.166	45.4	0.852	−40.1	9.4
2200	0.649	−85.8	1.086	99.9	0.176	41.6	0.828	−44.2	8.1
2400	0.613	−95.4	1.079	92.0	0.183	37.8	0.821	−48.7	7.6
2600	0.598	−103.5	1.028	87.9	0.190	37.1	0.831	−52.5	7.3
2800	0.574	−109.9	1.033	83.9	0.198	36.1	0.838	−54.7	7.3
3000	0.529	−116.9	0.980	78.8	0.196	34.1	0.823	−56.6	6.2

Table 12 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 1.25 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.978	−2.4	3.335	177.2	0.005	88.0	0.996	−1.3	45.4
100	0.974	−5.8	3.334	173.6	0.012	86.2	0.994	−3.3	42.8
200	0.965	−11.5	3.289	167.9	0.024	82.4	0.989	−6.6	38.4
300	0.953	−17.2	3.266	162.3	0.036	78.6	0.980	−9.8	34.7
400	0.937	−22.9	3.241	157.3	0.046	75.2	0.969	−12.7	31.4
500	0.919	−28.2	3.152	152.7	0.056	71.9	0.957	−15.7	28.8
600	0.900	−33.3	3.084	148.2	0.066	69.3	0.942	−18.4	26.5
700	0.879	−38.4	3.021	144.2	0.074	66.2	0.924	−20.9	24.4
800	0.853	−43.3	2.963	139.8	0.082	63.5	0.905	−23.2	22.5
900	0.822	−48.2	2.902	135.1	0.089	60.8	0.885	−25.5	20.8
1000	0.791	−53.0	2.807	131.0	0.095	58.3	0.865	−27.7	19.2
1200	0.726	−62.9	2.679	123.5	0.107	54.5	0.831	−32.3	16.9
1400	0.672	−73.1	2.616	116.2	0.118	51.2	0.804	−35.9	15.5
1600	0.625	−82.0	2.471	109.4	0.124	48.9	0.786	−38.7	14.2
1800	0.574	−89.3	2.295	104.6	0.130	47.6	0.758	−41.0	12.7
2000	0.507	−97.6	2.160	98.6	0.133	45.0	0.723	−43.6	11.2
2200	0.452	−108.2	2.071	93.3	0.138	42.7	0.692	−47.2	10.1
2400	0.422	−119.3	1.979	86.5	0.141	40.9	0.679	−51.4	9.5
2600	0.408	−128.3	1.854	82.9	0.147	41.3	0.686	−55.1	8.9
2800	0.382	−135.1	1.818	79.1	0.153	41.3	0.694	−57.0	8.7
3000	0.346	−144.0	1.699	74.8	0.153	41.1	0.683	−58.1	7.9

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.20	0.664	20.0	0.87
2000	1.90	0.550	46.0	0.68

Table 14 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 2.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.955	−3.3	6.467	176.2	0.005	86.3	0.993	−1.9	45.2
100	0.948	−8.1	6.385	171.3	0.012	84.9	0.988	−4.7	42.4
200	0.929	−16.1	6.243	163.8	0.023	80.0	0.975	−9.2	37.5
300	0.902	−24.0	6.145	156.7	0.034	75.0	0.953	−13.4	33.5
400	0.871	−31.8	5.989	150.5	0.044	70.7	0.928	−17.0	30.3
500	0.839	−38.8	5.729	144.9	0.052	67.1	0.901	−20.5	27.7
600	0.804	−45.4	5.504	139.8	0.059	64.2	0.871	−23.6	25.5
700	0.767	−52.1	5.323	134.9	0.066	61.5	0.842	−26.1	23.7
800	0.725	−58.3	5.124	129.9	0.071	58.9	0.812	−28.2	22.1
900	0.682	−64.1	4.873	125.0	0.076	56.8	0.783	−30.3	20.6
1000	0.638	−69.9	4.633	120.8	0.080	55.2	0.756	−32.1	19.3
1200	0.557	−81.7	4.251	113.0	0.088	52.7	0.713	−35.9	17.3
1400	0.495	−93.5	3.972	105.8	0.096	50.9	0.685	−38.9	16.0
1600	0.449	−103.0	3.615	99.6	0.100	50.3	0.665	−41.0	14.7
1800	0.398	−111.2	3.300	95.1	0.105	50.5	0.641	−42.3	13.4
2000	0.341	−121.4	3.032	90.1	0.109	49.5	0.610	−44.0	12.2
2200	0.305	−134.5	2.837	85.6	0.114	48.7	0.582	−47.1	11.3
2400	0.296	−146.6	2.652	80.2	0.118	48.6	0.570	−51.2	10.6
2600	0.293	−155.5	2.454	77.1	0.125	49.7	0.579	−55.0	10.0
2800	0.276	−162.4	2.360	73.9	0.131	50.0	0.590	−56.7	9.7
3000	0.257	−173.5	2.190	70.2	0.134	50.6	0.584	−57.4	8.9

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.619	17.0	0.74
2000	1.90	0.526	44.0	0.59

Table 16 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 3.75 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.934	−4.1	9.293	175.3	0.005	86.2	0.990	−2.3	45.2
100	0.922	−10.3	9.137	169.4	0.012	83.4	0.983	−5.8	42.2
200	0.893	−20.3	8.842	160.5	0.023	77.5	0.959	−11.3	36.8
300	0.853	−30.0	8.572	152.2	0.033	72.3	0.925	−16.1	32.7
400	0.809	−39.4	8.208	145.1	0.041	67.6	0.886	−20.2	29.6
500	0.764	−47.9	7.737	138.8	0.048	64.1	0.848	−23.8	27.1
600	0.719	−55.7	7.327	133.2	0.054	61.5	0.810	−26.7	25.1
700	0.671	−63.4	6.960	127.8	0.059	59.3	0.775	−28.8	23.4
800	0.621	−70.3	6.569	122.6	0.064	57.4	0.742	−30.6	21.9
900	0.574	−76.4	6.135	117.8	0.067	55.7	0.711	−32.2	20.5
1000	0.527	−82.8	5.745	113.6	0.071	54.9	0.683	−33.6	19.3
1200	0.448	−95.7	5.121	106.1	0.078	53.6	0.641	−36.6	17.5
1400	0.396	−108.0	4.652	99.6	0.084	53.1	0.616	−39.2	16.2
1600	0.357	−118.1	4.165	94.1	0.089	53.7	0.601	−40.8	14.9
1800	0.314	−127.1	3.760	90.1	0.095	54.2	0.582	−41.7	13.8
2000	0.271	−138.7	3.424	85.7	0.099	54.0	0.555	−43.0	12.6
2200	0.252	−153.5	3.175	81.8	0.105	53.8	0.529	−45.9	11.7
2400	0.257	−165.2	2.948	76.9	0.109	54.2	0.518	−50.1	11.0
2600	0.260	−172.8	2.715	74.2	0.117	55.2	0.529	−54.0	10.4
2800	0.248	−179.7	2.591	71.3	0.124	55.6	0.543	−55.8	10.1
3000	0.239	168.8	2.403	67.9	0.128	56.1	0.539	−56.3	9.4

Table 17 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.40	0.579	17.0	0.71
2000	2.00	0.491	43.0	0.55

Table 18 Common emitter scattering parameters, $V_{CE} = 6$ V, $I_C = 5$ mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.913	−5.0	11.799	174.6	0.005	84.5	0.987	−2.7	45.1
100	0.899	−12.2	11.563	167.8	0.011	82.1	0.976	−6.8	41.7
200	0.859	−24.1	11.087	157.7	0.022	76.1	0.943	−13.1	36.2
300	0.809	−35.4	10.563	148.6	0.031	70.3	0.897	−18.3	32.2
400	0.753	−46.1	9.951	140.7	0.039	65.6	0.850	−22.4	29.2
500	0.700	−55.6	9.248	134.0	0.045	62.1	0.804	−25.9	26.8
600	0.647	−64.3	8.624	128.0	0.050	60.4	0.762	−28.3	24.9
700	0.595	−72.4	8.048	122.4	0.055	58.5	0.724	−30.1	23.2
800	0.544	−79.6	7.469	117.3	0.058	57.0	0.691	−31.5	21.8
900	0.496	−86.0	6.901	112.7	0.062	55.9	0.661	−32.8	20.5
1000	0.452	−92.8	6.394	108.7	0.065	55.7	0.635	−33.9	19.4
1200	0.381	−106.3	5.598	101.8	0.072	55.4	0.597	−36.4	17.6
1400	0.340	−119.2	5.009	95.8	0.078	55.4	0.575	−38.7	16.3
1600	0.309	−129.2	4.452	90.7	0.083	56.4	0.563	−40.1	15.1
1800	0.273	−138.7	3.996	87.1	0.089	57.5	0.548	−40.7	13.9
2000	0.240	−151.8	3.621	83.0	0.094	57.6	0.524	−41.9	12.8
2200	0.233	−166.5	3.345	79.5	0.101	57.2	0.501	−44.8	12.0
2400	0.245	−177.3	3.098	75.0	0.105	57.8	0.491	−49.0	11.3
2600	0.252	176.1	2.847	72.5	0.114	58.9	0.503	−53.0	10.6
2800	0.241	169.5	2.709	69.7	0.122	59.0	0.518	−54.8	10.3
3000	0.239	158.4	2.512	66.5	0.126	59.7	0.515	−55.3	9.6

Table 19 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.60	0.546	17.0	0.69
2000	2.20	0.442	44.0	0.54

Table 20 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 7.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.875	−6.5	16.129	173.3	0.005	85.2	0.982	−3.3	44.9
100	0.855	−15.9	15.632	165.1	0.011	80.2	0.964	−8.4	41.1
200	0.798	−31.0	14.708	153.0	0.021	73.4	0.911	−15.7	35.4
300	0.727	−45.0	13.645	142.3	0.029	67.1	0.849	−21.1	31.5
400	0.659	−57.7	12.428	133.6	0.035	63.3	0.788	−25.0	28.6
500	0.595	−68.7	11.252	126.3	0.040	60.2	0.736	−27.8	26.3
600	0.537	−78.2	10.194	120.1	0.045	59.2	0.692	−29.6	24.5
700	0.488	−86.6	9.265	114.9	0.048	58.5	0.656	−30.7	23.0
800	0.441	−94.1	8.432	110.1	0.051	57.8	0.627	−31.6	21.6
900	0.400	−100.8	7.661	106.1	0.055	57.7	0.600	−32.3	20.4
1000	0.364	−108.0	7.027	102.6	0.058	58.2	0.578	−33.0	19.3
1200	0.311	−122.3	6.027	96.5	0.064	58.7	0.546	−35.0	17.6
1400	0.285	−135.5	5.317	91.2	0.071	59.2	0.531	−37.1	16.3
1600	0.265	−145.8	4.694	86.7	0.077	61.1	0.524	−38.3	15.1
1800	0.239	−156.0	4.195	83.5	0.084	61.6	0.515	−38.8	14.0
2000	0.221	−170.0	3.789	79.8	0.089	62.0	0.494	−39.9	13.0
2200	0.227	176.2	3.487	76.6	0.097	61.9	0.473	−42.7	12.2
2400	0.246	167.8	3.219	72.5	0.102	62.5	0.464	−47.2	11.5
2600	0.254	162.9	2.956	70.2	0.112	63.1	0.477	−51.4	10.8
2800	0.247	157.0	2.803	67.7	0.119	63.1	0.493	−53.4	10.4
3000	0.248	146.6	2.596	64.6	0.124	63.7	0.492	−53.9	9.8

NPN 9 GHz wideband transistor — BFG520; BFG520/X; BFG520/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistors, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV) and repeater amplifiers in fibre-optic systems.

The transistors are encapsulated in 4-pin, dual-emitter plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG520 (Fig.1) Code: N36	
1	collector
2	base
3	emitter
4	emitter
BFG520/X (Fig.1) Code: N42	
1	collector
2	emitter
3	base
4	emitter
BFG520/XR (Fig.2) Code: N48	
1	collector
2	emitter
3	base
4	emitter

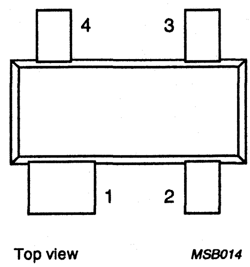


Fig.1 SOT143.

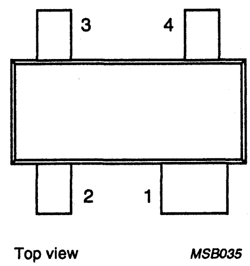


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to T_s = 63 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V; T_j = 25 °C	60	120	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 63 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 63 °C (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.6	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	19	–	dB
		$I_C = 20$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm
V_O	output voltage	note 3	–	275	–	mV
d_2	second order intermodulation distortion	$I_C = 20$ mA; $V_{CE} = 6$ V; $V_O = 75$ mV; $T_{amb} = 25$ °C; $f_{(p+q)} = 810$ MHz	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and $f_{(2q-p)} = 904$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B);
   $V_p = V_O$; $V_q = V_O$ –6 dB; $V_r = V_O$ –6 dB;
   $f_p = 795.25$ MHz; $f_q = 803.25$ MHz; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz

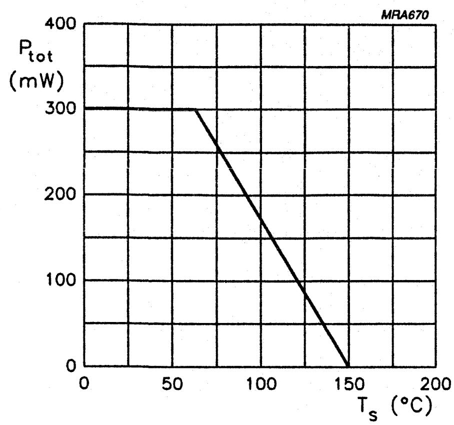
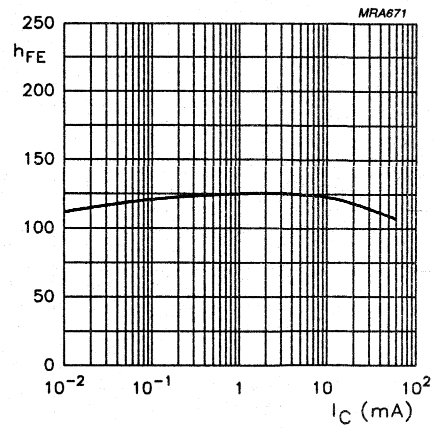
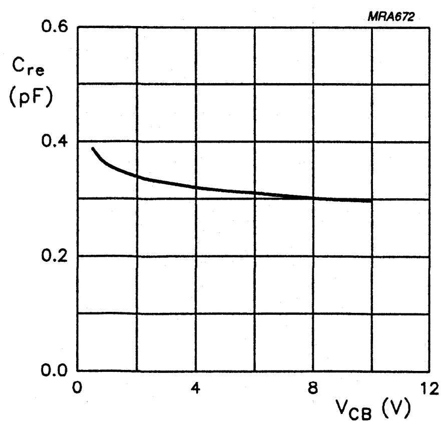


Fig.3 Power derating curve.



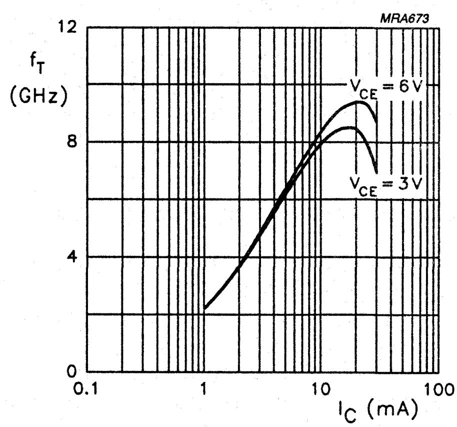
V_{CE} = 6 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

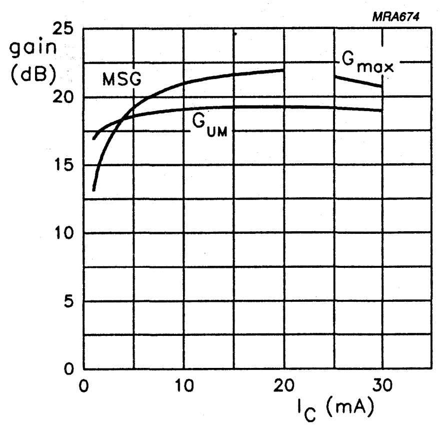
Fig.5 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

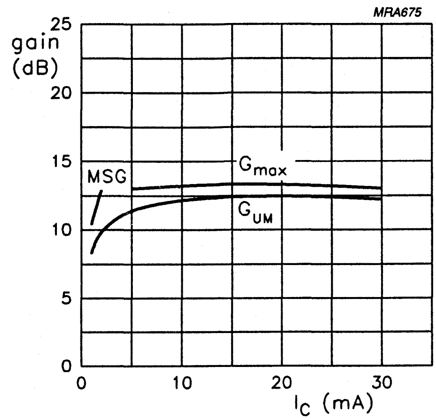
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



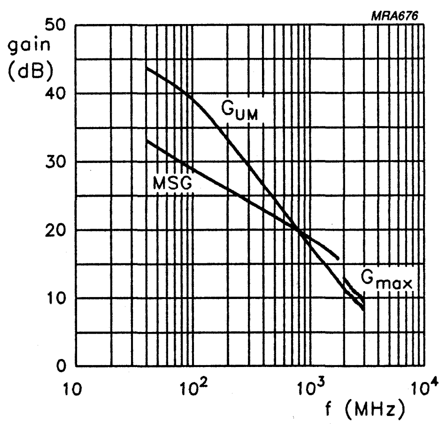
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



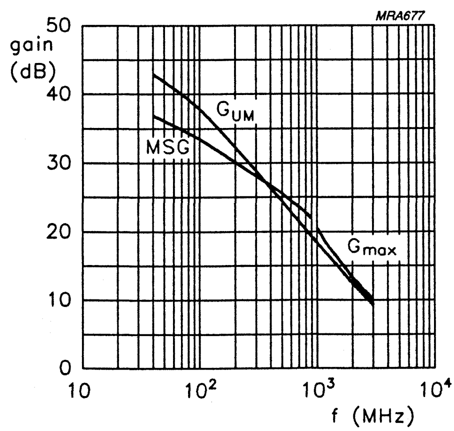
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.8 Gain as a function of collector current.



I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.10 Gain as a function of frequency.

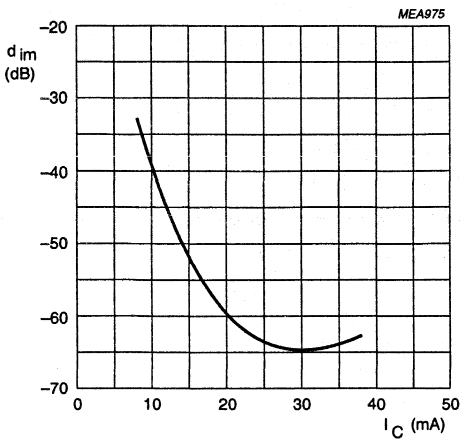


Fig.11 Intermodulation distortion as a function of collector current.

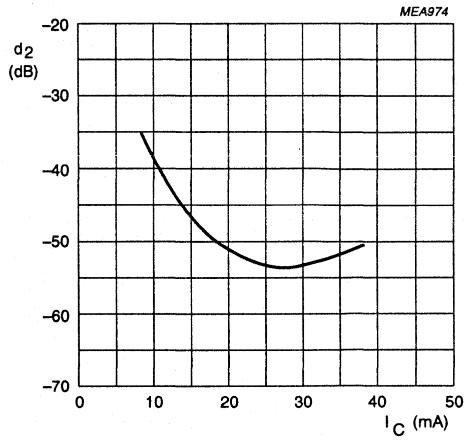
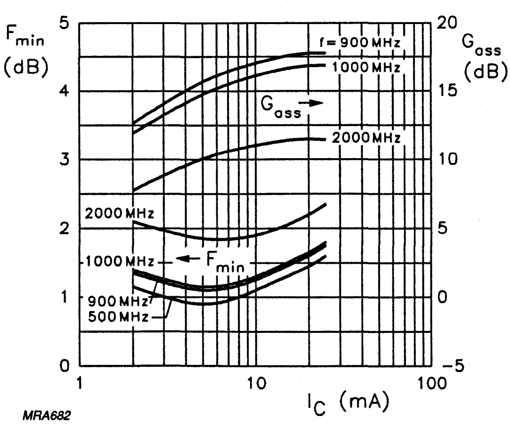
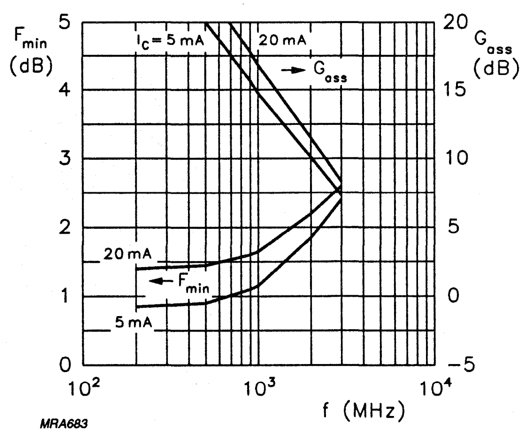


Fig.12 Second order intermodulation distortion as a function of collector current.



V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.

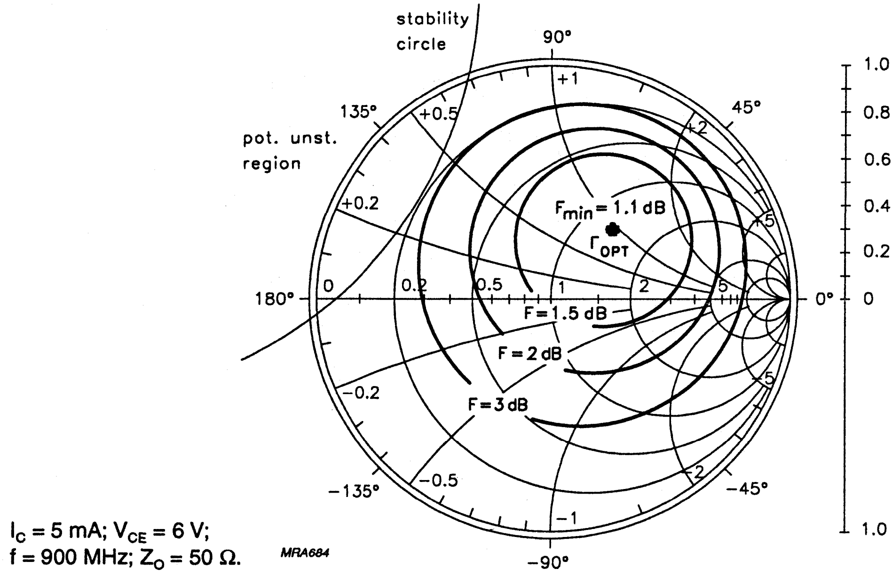


Fig.15 Noise circle figure.

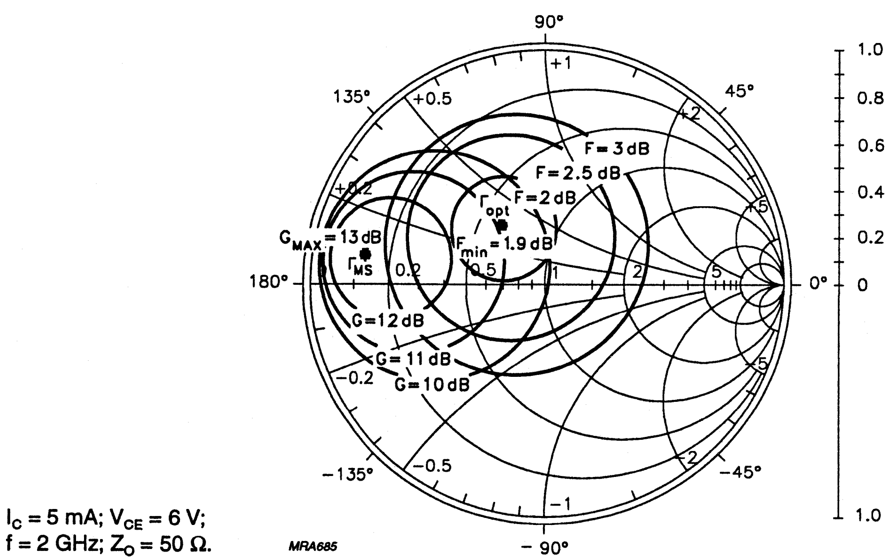
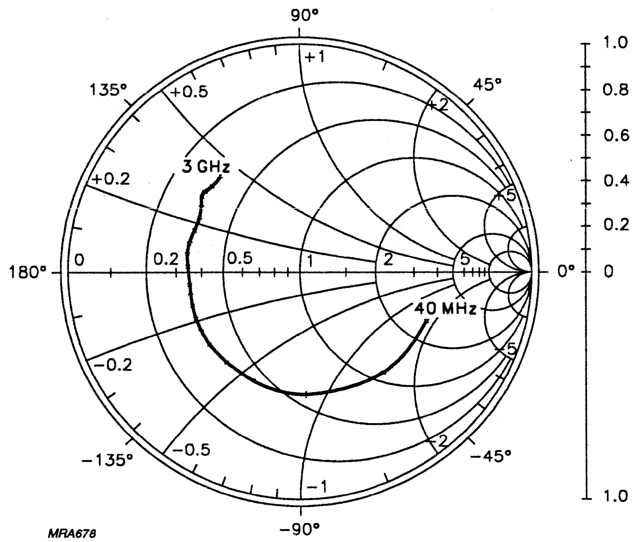
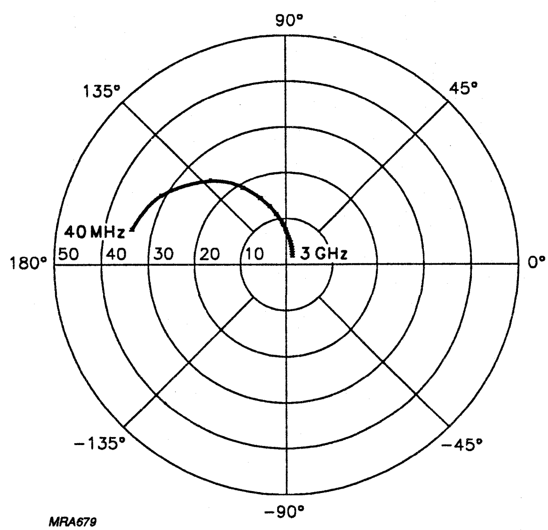


Fig.16 Noise circle figure.



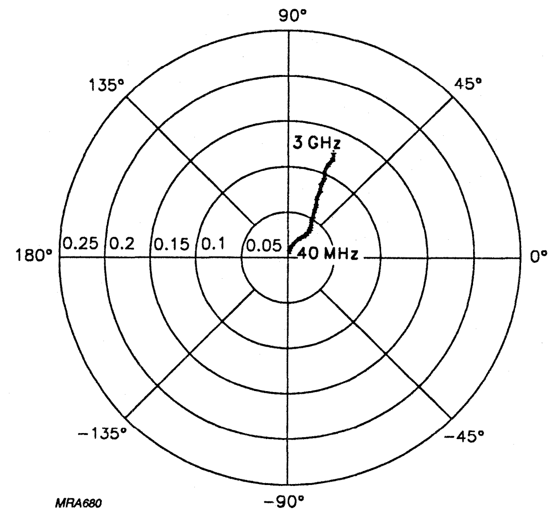
I_C = 20 mA; V_{CE} = 6 V.

Fig.17 Common emitter input reflection coefficient (S_{11}).



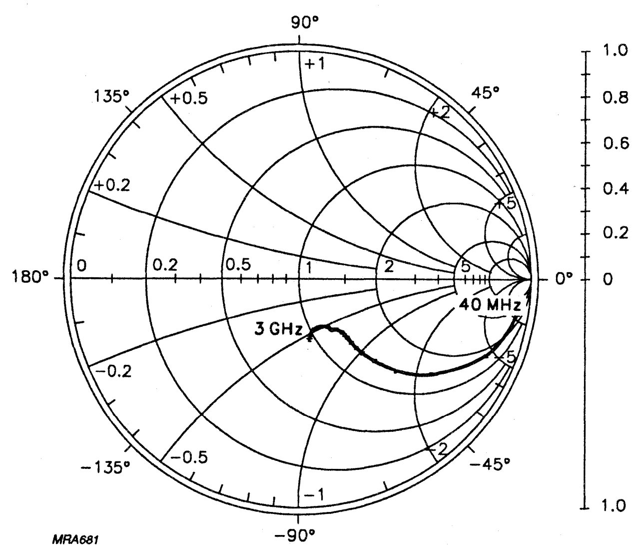
I_C = 20 mA; V_{CE} = 6 V.

Fig.18 Common emitter forward transmission coefficient (S_{21}).



I_C = 20 mA; V_{CE} = 6 V.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).

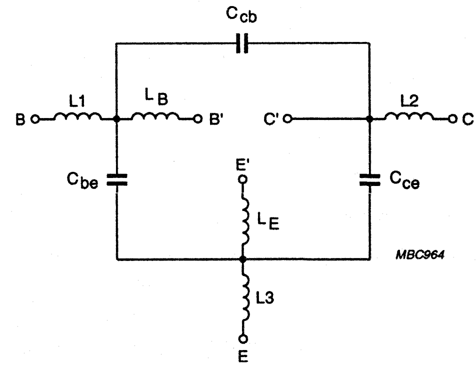


I_C = 20 mA; V_{CE} = 6 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR520 crystal

1	IS = 1.016	fA
2	BF = 220.1	–
3	NF = 1.000	–
4	VAF = 48.06	V
5	IKF = 510.0	mA
6	ISE = 283.0	fA
7	NE = 2.035	–
8	BR = 100.7	–
9	NR = 988.1	m
10	VAR = 1.692	V
11	IKR = 2.352	mA
12	ISC = 24.48	aA
13	NC = 1.022	
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 775.3	mΩ
18	RC = 2.210	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.245	pF
23	VJE = 600.0	mV
24	MJE = 258.1	m
25	TF = 8.616	ps
26	XTF = 6.788	–
27	VTF = 1.414	V
28	ITF = 110.3	mA
29	PTF = 45.01	deg
30	CJC = 447.6	fF
31	VJC = 189.2	mV
32	MJC = 70.51	m
33	XCJC = 130.0	m
34	TR = 543.7	ps
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 780.2	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.21)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.903	−6.4	6.678	175.4	0.008	85.5	0.997	−2.7	46.7
100	0.895	−15.9	6.594	168.8	0.020	81.6	0.989	−7.0	40.1
200	0.873	−31.3	6.344	158.7	0.039	72.5	0.960	−13.4	33.4
300	0.845	−46.3	6.077	149.2	0.055	65.5	0.924	−19.0	29.5
400	0.814	−59.7	5.679	140.6	0.069	59.1	0.883	−24.0	26.4
500	0.788	−72.0	5.290	133.3	0.079	53.5	0.840	−28.1	24.0
600	0.760	−83.0	4.922	126.7	0.088	48.5	0.798	−31.5	22.0
700	0.736	−92.7	4.575	120.8	0.094	44.5	0.760	−34.3	20.4
800	0.707	−101.6	4.242	115.3	0.099	41.4	0.728	−36.6	18.8
900	0.677	−110.1	3.916	110.1	0.102	38.5	0.697	−38.8	17.4
1000	0.654	−117.9	3.633	105.8	0.105	36.3	0.670	−40.8	16.2
1200	0.621	−132.9	3.176	97.6	0.109	32.8	0.627	−44.5	14.3
1400	0.609	−145.6	2.850	90.1	0.111	29.6	0.602	−48.1	13.1
1600	0.601	−155.8	2.536	83.9	0.110	29.1	0.589	−50.7	11.9
1800	0.586	−165.2	2.287	79.1	0.112	28.5	0.572	−52.9	10.7
2000	0.574	−174.6	2.078	74.3	0.109	28.4	0.547	−55.5	9.6
2200	0.579	176.3	1.913	69.9	0.108	28.2	0.525	−60.0	8.8
2400	0.594	169.1	1.748	64.2	0.105	29.7	0.525	−65.5	8.1
2600	0.602	163.4	1.607	60.8	0.107	31.9	0.541	−69.7	7.6
2800	0.600	157.6	1.535	56.7	0.107	32.9	0.553	−71.8	7.2
3000	0.601	150.6	1.420	53.0	0.106	36.2	0.545	−73.9	6.5

Table 2 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 3$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.799	−10.3	14.524	173.1	0.008	84.1	0.989	−4.8	44.4
100	0.783	−25.3	14.070	163.5	0.019	77.0	0.965	−11.9	38.8
200	0.743	−48.5	12.891	149.4	0.034	66.6	0.894	−21.9	32.7
300	0.700	−69.2	11.585	137.5	0.046	58.1	0.813	−29.7	28.9
400	0.664	−86.3	10.193	128.0	0.055	52.3	0.736	−35.4	26.1
500	0.638	−100.5	9.020	120.4	0.060	47.6	0.670	−39.5	24.0
600	0.615	−112.1	8.033	114.1	0.065	44.7	0.615	−42.2	22.2
700	0.598	−121.7	7.204	108.9	0.068	42.6	0.571	−44.2	20.8
800	0.577	−130.4	6.491	104.2	0.070	41.7	0.535	−45.8	19.5
900	0.560	−138.4	5.868	100.1	0.072	41.1	0.504	−47.1	18.3
1000	0.546	−145.4	5.356	96.7	0.074	40.9	0.479	−48.4	17.2
1200	0.535	−158.4	4.556	90.3	0.078	40.6	0.442	−51.1	15.6
1400	0.536	−168.8	3.989	84.4	0.080	41.1	0.422	−54.0	14.3
1600	0.534	−176.7	3.507	79.5	0.083	43.4	0.413	−55.8	13.2
1800	0.527	175.3	3.144	75.5	0.088	44.4	0.402	−56.9	12.1
2000	0.524	167.1	2.847	71.7	0.090	46.6	0.380	−58.8	11.2
2200	0.540	159.7	2.610	68.2	0.094	47.7	0.360	−63.5	10.4
2400	0.558	154.5	2.372	63.8	0.096	50.1	0.360	−69.8	9.7
2600	0.565	150.3	2.183	60.9	0.104	51.9	0.380	−74.2	9.1
2800	0.559	145.5	2.065	57.2	0.109	52.4	0.392	−75.7	8.7
3000	0.565	139.3	1.918	54.1	0.113	54.8	0.386	−77.1	8.0

Table 3 Noise data, $I_C = 5$ mA; $V_{CE} = 3$ V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	0.90	0.396	29.0	0.240
900	1.10	0.334	50.0	0.260
1000	1.15	0.355	55.0	0.260
2000	1.85	0.275	130.0	0.160

Table 4 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.668	−15.5	23.878	170.3	0.007	81.8	0.977	−7.2	43.5
100	0.648	−38.0	22.433	157.3	0.017	73.4	0.926	−17.5	37.9
200	0.608	−69.8	19.090	139.8	0.029	61.1	0.801	−30.4	32.1
300	0.578	−94.6	15.944	126.9	0.037	53.9	0.684	−38.7	28.6
400	0.559	−112.5	13.292	117.8	0.042	50.3	0.592	−43.8	26.0
500	0.548	−126.0	11.320	110.9	0.045	47.5	0.524	−46.9	24.0
600	0.538	−136.3	9.809	105.5	0.049	46.9	0.473	−48.6	22.4
700	0.530	−144.3	8.626	101.0	0.051	47.1	0.434	−49.7	21.1
800	0.521	−151.7	7.669	97.2	0.054	47.8	0.405	−50.4	19.8
900	0.513	−158.5	6.874	93.9	0.056	49.0	0.380	−51.1	18.7
1000	0.507	−164.4	6.235	91.1	0.059	50.2	0.360	−51.9	17.8
1200	0.509	−174.9	5.249	85.9	0.064	51.5	0.332	−54.1	16.2
1400	0.517	177.1	4.552	80.9	0.069	53.0	0.320	−56.9	15.0
1600	0.517	170.7	3.987	76.8	0.075	56.2	0.316	−58.3	13.8
1800	0.513	163.7	3.566	73.2	0.082	57.1	0.308	−58.9	12.8
2000	0.514	156.4	3.228	70.0	0.087	59.0	0.289	−60.4	11.9
2200	0.534	150.2	2.952	66.8	0.094	59.6	0.270	−65.9	11.2
2400	0.553	146.2	2.680	63.2	0.098	61.3	0.273	−73.3	10.5
2600	0.559	143.0	2.469	60.5	0.108	61.9	0.294	−78.0	9.9
2800	0.551	138.8	2.324	57.2	0.115	61.5	0.308	−79.1	9.3
3000	0.557	132.8	2.162	54.2	0.121	62.8	0.302	−80.1	8.7

Table 5 Noise data, I_C = 10 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.10	0.260	27.0	0.220
900	1.25	0.231	54.0	0.220
1000	1.30	0.240	58.0	0.240
2000	1.90	0.245	148.0	0.140

Table 6 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.570	−20.7	30.262	168.2	0.007	80.6	0.964	−9.0	42.8
100	0.557	−49.3	27.641	152.7	0.015	71.7	0.890	−21.4	37.3
200	0.535	−86.5	22.173	133.7	0.026	58.7	0.731	−35.3	31.7
300	0.527	−111.9	17.699	120.8	0.032	52.8	0.601	−43.0	28.3
400	0.522	−128.6	14.354	112.3	0.036	50.8	0.511	−47.1	25.8
500	0.523	−140.5	12.018	106.0	0.039	49.8	0.449	−49.3	24.0
600	0.519	−149.3	10.302	101.2	0.042	50.4	0.404	−50.3	22.4
700	0.516	−156.1	8.995	97.2	0.045	51.4	0.372	−50.8	21.1
800	0.511	−162.5	7.959	93.8	0.048	52.8	0.347	−51.0	19.9
900	0.507	−168.4	7.116	90.8	0.050	54.8	0.327	−51.4	18.8
1000	0.504	−173.5	6.441	88.4	0.054	56.2	0.311	−52.0	17.9
1200	0.510	177.4	5.404	83.7	0.060	57.9	0.289	−54.2	16.3
1400	0.518	170.7	4.671	79.1	0.066	59.6	0.280	−57.0	15.1
1600	0.519	165.2	4.085	75.2	0.073	62.1	0.279	−58.4	13.9
1800	0.516	158.6	3.653	71.8	0.081	62.6	0.274	−58.9	12.9
2000	0.520	151.8	3.308	68.7	0.087	64.3	0.255	−60.3	12.1
2200	0.541	146.3	3.024	65.8	0.094	64.3	0.238	−66.3	11.4
2400	0.560	142.7	2.747	62.4	0.100	65.9	0.242	−74.5	10.7
2600	0.564	139.8	2.528	59.8	0.110	66.1	0.264	−79.5	10.0
2800	0.557	135.8	2.377	56.5	0.118	65.0	0.278	−80.4	9.5
3000	0.562	130.1	2.212	53.7	0.124	66.2	0.273	−81.2	8.9

Table 7 Noise data, I_C = 15 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.30	0.161	31.0	0.210
900	1.45	0.155	63.0	0.200
1000	1.50	0.160	67.0	0.230
2000	2.05	0.230	165.0	0.140

Table 8 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 3$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.503	−25.2	34.613	166.5	0.006	78.4	0.950	−10.3	42.1
100	0.501	−59.1	30.839	149.3	0.014	68.8	0.858	−23.8	36.8
200	0.501	−98.9	23.669	129.5	0.023	57.2	0.679	−37.9	31.4
300	0.508	−123.2	18.370	117.0	0.028	53.0	0.547	−44.6	28.1
400	0.513	−138.4	14.678	109.0	0.032	52.7	0.463	−47.8	25.7
500	0.516	−148.9	12.176	103.2	0.035	52.1	0.406	−49.3	23.8
600	0.517	−156.7	10.381	98.7	0.039	53.2	0.368	−49.6	22.3
700	0.515	−162.8	9.027	95.0	0.041	54.8	0.340	−49.8	21.0
800	0.512	−168.5	7.974	91.8	0.044	56.8	0.319	−49.7	19.8
900	0.509	−173.8	7.115	89.0	0.048	59.0	0.303	−49.8	18.8
1000	0.508	−178.5	6.434	86.7	0.051	59.8	0.289	−50.4	17.8
1200	0.516	173.3	5.390	82.2	0.058	62.2	0.270	−52.6	16.3
1400	0.525	167.2	4.652	77.9	0.064	63.3	0.264	−55.5	15.1
1600	0.525	162.0	4.064	74.1	0.072	65.7	0.264	−57.0	13.9
1800	0.523	155.7	3.634	70.8	0.080	65.8	0.261	−57.4	12.9
2000	0.528	149.4	3.289	67.8	0.087	67.1	0.244	−59.1	12.0
2200	0.550	144.1	3.006	64.9	0.095	67.2	0.228	−65.1	11.4
2400	0.566	140.9	2.729	61.6	0.101	68.4	0.232	−73.7	10.6
2600	0.570	138.0	2.511	59.0	0.111	68.4	0.254	−79.0	10.0
2800	0.564	134.1	2.359	55.8	0.119	67.2	0.270	−80.0	9.4
3000	0.570	128.4	2.196	53.0	0.125	67.9	0.265	−80.8	8.8

Table 9 Noise data, $I_C = 20$ mA; $V_{CE} = 3$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.103	38.0	0.210
900	1.60	0.104	84.0	0.220
1000	1.65	0.118	84.0	0.240
2000	2.20	0.231	−177.0	0.160

Table 10 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.405	−37.6	38.295	163.1	0.007	75.3	0.907	−12.4	40.0
100	0.445	−80.9	32.269	142.8	0.013	64.8	0.781	−27.2	35.2
200	0.494	−120.9	22.824	122.3	0.021	54.9	0.583	−39.4	30.2
300	0.523	−141.4	16.960	110.8	0.024	52.4	0.465	−43.3	27.0
400	0.534	−153.3	13.272	103.6	0.027	54.0	0.399	−44.2	24.7
500	0.541	−161.4	10.877	98.4	0.031	55.0	0.357	−44.3	22.8
600	0.544	−167.4	9.206	94.4	0.034	57.2	0.331	−43.7	21.3
700	0.542	−172.3	7.970	91.1	0.037	59.0	0.314	−43.5	20.0
800	0.541	−177.1	7.019	88.2	0.041	61.1	0.300	−43.2	18.8
900	0.541	178.5	6.255	85.6	0.044	63.2	0.290	−43.4	17.8
1000	0.541	174.6	5.650	83.4	0.048	64.8	0.280	−44.1	16.9
1200	0.551	167.7	4.721	79.1	0.055	66.4	0.269	−46.6	15.4
1400	0.558	162.5	4.070	74.9	0.062	67.7	0.266	−50.1	14.1
1600	0.558	157.8	3.553	71.2	0.070	69.7	0.270	−52.3	13.0
1800	0.555	152.0	3.172	67.8	0.079	69.5	0.270	−53.4	12.0
2000	0.564	146.1	2.871	64.8	0.086	70.9	0.256	−55.5	11.1
2200	0.584	141.4	2.622	61.9	0.094	71.0	0.241	−61.8	10.4
2400	0.602	138.4	2.383	58.5	0.100	72.0	0.245	−70.4	9.8
2600	0.602	135.8	2.189	56.0	0.111	71.6	0.269	−76.2	9.1
2800	0.595	131.8	2.055	52.6	0.119	69.8	0.285	−77.6	8.5
3000	0.602	126.5	1.912	49.8	0.126	70.8	0.281	−78.9	7.9

Table 11 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.910	−6.1	6.548	175.5	0.008	84.5	0.994	−2.6	43.5
100	0.903	−15.2	6.463	169.3	0.019	81.8	0.987	−6.5	39.6
200	0.881	−30.0	6.260	159.5	0.037	73.5	0.963	−12.6	33.8
300	0.853	−44.4	6.009	150.0	0.053	66.4	0.929	−18.1	29.8
400	0.824	−57.5	5.629	141.9	0.066	60.2	0.890	−22.8	26.7
500	0.797	−69.6	5.286	134.6	0.076	54.4	0.850	−26.9	24.4
600	0.768	−80.4	4.922	128.0	0.085	49.7	0.811	−30.3	22.4
700	0.745	−89.9	4.589	122.3	0.092	45.7	0.774	−33.1	20.7
800	0.714	−98.9	4.268	116.6	0.097	42.3	0.742	−35.5	19.2
900	0.684	−107.1	3.941	111.4	0.100	39.5	0.711	−37.6	17.7
1000	0.661	−115.0	3.672	107.1	0.103	37.2	0.684	−39.6	16.5
1200	0.623	−130.0	3.213	98.9	0.107	33.3	0.641	−43.4	14.6
1400	0.609	−143.0	2.888	91.3	0.109	30.1	0.617	−47.0	13.3
1600	0.601	−153.4	2.576	85.0	0.109	29.7	0.602	−49.6	12.1
1800	0.585	−162.9	2.326	80.2	0.110	29.2	0.585	−51.7	11.0
2000	0.570	−172.4	2.111	75.5	0.108	28.8	0.559	−54.3	9.8
2200	0.574	178.1	1.944	71.0	0.107	28.8	0.538	−58.7	9.0
2400	0.589	170.7	1.781	65.2	0.103	29.7	0.537	−64.0	8.3
2600	0.597	164.7	1.640	61.8	0.106	31.9	0.553	−68.2	7.8
2800	0.594	158.8	1.567	57.8	0.106	33.1	0.564	−70.4	7.5
3000	0.595	151.9	1.448	54.0	0.104	36.6	0.558	−72.4	6.7

Table 12 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.816	−9.6	14.372	173.3	0.007	84.3	0.987	−4.5	43.7
100	0.802	−23.7	13.946	164.2	0.018	78.1	0.966	−11.1	39.1
200	0.761	−45.9	12.883	150.6	0.033	67.3	0.901	−20.8	33.2
300	0.716	−65.9	11.658	138.8	0.045	59.2	0.824	−28.3	29.4
400	0.676	−82.4	10.313	129.5	0.053	53.4	0.750	−34.0	26.5
500	0.647	−96.6	9.188	121.9	0.059	48.8	0.686	−38.2	24.4
600	0.621	−108.1	8.202	115.5	0.064	45.8	0.632	−41.1	22.6
700	0.601	−117.8	7.379	110.3	0.067	43.2	0.587	−43.1	21.1
800	0.577	−126.6	6.665	105.5	0.070	42.3	0.552	−44.7	19.8
900	0.557	−134.5	6.028	101.3	0.072	41.6	0.519	−46.0	18.6
1000	0.542	−141.8	5.513	97.9	0.074	41.4	0.493	−47.3	17.6
1200	0.527	−155.4	4.695	91.4	0.077	41.0	0.455	−50.1	15.9
1400	0.527	−166.0	4.116	85.4	0.080	41.1	0.435	−53.0	14.6
1600	0.525	−174.4	3.623	80.5	0.083	43.3	0.425	−54.6	13.4
1800	0.516	177.5	3.250	76.5	0.088	44.6	0.412	−55.8	12.4
2000	0.512	169.1	2.941	72.8	0.089	46.6	0.390	−57.6	11.4
2200	0.526	161.4	2.695	69.2	0.093	47.4	0.370	−62.1	10.7
2400	0.546	155.8	2.454	64.8	0.096	49.9	0.370	−68.0	10.0
2600	0.553	151.7	2.259	61.9	0.103	51.8	0.387	−72.5	9.4
2800	0.548	146.7	2.138	58.3	0.108	52.2	0.400	−74.2	8.9
3000	0.552	140.3	1.982	55.1	0.111	54.5	0.395	−75.4	8.3

Table 13 Noise data, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	0.90	0.439	29.0	0.270
900	1.10	0.395	49.0	0.280
1000	1.15	0.400	53.0	0.290
2000	1.85	0.312	126.0	0.170

Table 14 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.711	−14.1	23.473	170.8	0.007	82.3	0.974	−6.8	43.5
100	0.690	−34.5	22.218	158.5	0.016	74.0	0.931	−16.3	38.5
200	0.640	−64.3	19.183	141.5	0.029	62.4	0.816	−28.8	32.7
300	0.597	−88.3	16.207	128.8	0.037	54.2	0.703	−37.1	29.1
400	0.569	−106.1	13.627	119.5	0.042	50.9	0.613	−42.4	26.4
500	0.553	−119.9	11.673	112.5	0.046	48.6	0.544	−45.7	24.5
600	0.538	−130.7	10.152	107.0	0.050	47.2	0.493	−47.6	22.8
700	0.526	−139.2	8.947	102.5	0.052	47.1	0.453	−48.8	21.4
800	0.514	−146.7	7.968	98.6	0.055	47.9	0.422	−49.5	20.2
900	0.503	−154.1	7.148	95.1	0.057	48.8	0.396	−50.2	19.1
1000	0.495	−160.2	6.488	92.4	0.059	49.7	0.374	−51.1	18.1
1200	0.494	−171.7	5.468	87.0	0.065	51.3	0.344	−53.4	16.5
1400	0.500	−131.8	4.748	82.0	0.069	52.5	0.331	−56.1	15.3
1600	0.500	173.3	4.159	77.8	0.075	55.2	0.326	−57.3	14.1
1800	0.494	166.0	3.722	74.3	0.082	56.4	0.317	−57.9	13.1
2000	0.496	158.4	3.368	71.0	0.087	58.2	0.297	−59.5	12.2
2200	0.515	151.9	3.080	67.9	0.093	59.0	0.279	−64.4	11.5
2400	0.535	147.6	2.798	64.2	0.097	60.7	0.280	−71.4	10.8
2600	0.540	144.2	2.579	61.6	0.107	61.3	0.298	−76.3	10.1
2800	0.534	139.8	2.428	58.2	0.114	60.9	0.313	−77.7	9.6
3000	0.541	133.9	2.259	55.3	0.120	62.3	0.309	−78.3	9.0

Table 15 Noise data, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.330	27.0	0.250
900	1.25	0.294	48.0	0.260
1000	1.30	0.298	52.0	0.270
2000	1.90	0.242	134.0	0.160

Table 16 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.642	−17.7	29.807	168.9	0.007	80.7	0.964	−8.4	43.3
100	0.620	−43.0	27.554	154.5	0.015	71.9	0.900	−19.7	38.1
200	0.573	−77.3	22.604	135.9	0.026	60.1	0.753	−33.4	32.4
300	0.544	−102.6	18.314	123.1	0.032	53.2	0.627	−41.5	28.9
400	0.526	−120.0	14.988	114.4	0.037	51.6	0.536	−46.0	26.4
500	0.519	−132.7	12.629	108.0	0.040	50.0	0.471	−48.6	24.5
600	0.510	−142.4	10.858	103.0	0.043	50.0	0.425	−49.9	22.9
700	0.503	−149.9	9.497	98.9	0.046	50.9	0.390	−50.4	21.5
800	0.495	−156.9	8.418	95.3	0.049	52.3	0.364	−50.7	20.3
900	0.488	−163.2	7.526	92.3	0.052	54.1	0.341	−51.1	19.2
1000	0.484	−168.8	6.819	89.8	0.055	55.5	0.323	−51.7	18.3
1200	0.487	−178.8	5.725	85.0	0.061	57.1	0.298	−53.9	16.7
1400	0.496	173.9	4.955	80.4	0.066	58.6	0.289	−56.6	15.5
1600	0.495	167.9	4.335	76.5	0.073	61.1	0.286	−57.8	14.3
1800	0.491	160.9	3.877	73.1	0.082	61.6	0.279	−58.0	13.3
2000	0.495	153.8	3.507	70.1	0.088	63.2	0.260	−59.6	12.4
2200	0.515	147.8	3.205	67.1	0.094	63.3	0.244	−65.0	11.7
2400	0.535	144.1	2.913	63.7	0.099	64.8	0.245	−72.9	11.0
2600	0.540	141.1	2.684	61.1	0.110	64.9	0.266	−78.1	10.4
2800	0.533	136.9	2.522	57.9	0.117	64.2	0.281	−79.1	9.8
3000	0.539	131.1	2.348	55.1	0.123	65.2	0.276	−79.5	9.3

Table 17 Noise data, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.30	0.256	27.0	0.250
900	1.45	0.228	52.0	0.250
1000	1.50	0.233	57.0	0.280
2000	2.05	0.215	147.0	0.170

Table 18 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.592	−20.9	34.283	167.4	0.007	78.3	0.953	−9.5	43.0
100	0.572	−49.9	31.035	151.5	0.014	70.8	0.874	−22.2	37.8
200	0.536	−87.3	24.483	132.1	0.024	59.1	0.706	−36.1	32.2
300	0.518	−112.5	19.296	119.4	0.030	53.3	0.576	−43.6	28.8
400	0.508	−129.0	15.549	111.2	0.033	52.2	0.488	−47.4	26.3
500	0.506	−140.8	12.978	105.2	0.036	51.5	0.428	−49.4	24.4
600	0.500	−149.6	11.093	100.5	0.040	52.5	0.387	−50.1	22.9
700	0.496	−156.3	9.666	96.7	0.042	53.6	0.356	−50.3	21.5
800	0.490	−162.7	8.549	93.4	0.045	55.7	0.333	−50.3	20.3
900	0.485	−168.6	7.631	90.6	0.049	57.7	0.313	−50.5	19.3
1000	0.482	−173.7	6.909	88.2	0.052	58.5	0.298	−50.9	18.3
1200	0.488	177.1	5.790	83.6	0.059	60.8	0.276	−53.2	16.8
1400	0.496	170.4	5.002	79.3	0.065	61.9	0.269	−56.0	15.5
1600	0.497	164.8	4.374	75.5	0.072	64.3	0.268	−57.0	14.4
1800	0.493	158.1	3.910	72.2	0.081	64.6	0.263	−57.2	13.4
2000	0.496	151.4	3.537	69.3	0.088	66.0	0.245	−58.9	12.5
2200	0.519	145.7	3.233	66.4	0.095	65.7	0.229	−64.6	11.8
2400	0.539	142.3	2.936	63.1	0.101	67.1	0.231	−72.8	11.1
2600	0.543	139.4	2.705	60.6	0.111	67.1	0.252	−78.3	10.4
2800	0.535	135.4	2.542	57.5	0.118	66.0	0.267	−79.3	9.9
3000	0.541	129.7	2.367	54.6	0.125	66.9	0.263	−79.7	9.3

Table 19 Noise data, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.204	28.0	0.250
900	1.60	0.183	56.0	0.260
1000	1.65	0.190	61.0	0.270
2000	2.20	0.216	156.0	0.170

Table 20 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.532	−26.6	39.491	165.1	0.006	76.9	0.932	−11.1	42.2
100	0.520	−61.8	34.496	146.9	0.014	67.5	0.828	−25.0	37.1
200	0.505	−101.9	25.639	126.7	0.022	56.6	0.638	−38.4	31.7
300	0.502	−126.0	19.503	114.5	0.026	53.0	0.511	−44.1	28.4
400	0.502	−140.6	15.434	107.0	0.030	53.5	0.433	−46.4	25.9
500	0.504	−150.7	12.756	101.5	0.033	54.3	0.383	−47.2	24.1
600	0.501	−158.4	10.828	97.2	0.036	55.9	0.350	−47.2	22.5
700	0.498	−164.2	9.398	93.8	0.039	57.7	0.326	−46.9	21.2
800	0.495	−169.8	8.287	90.7	0.042	59.8	0.309	−46.5	20.0
900	0.492	−175.0	7.386	88.1	0.046	61.4	0.294	−46.5	19.0
1000	0.491	−179.7	6.680	85.9	0.050	62.7	0.281	−47.0	18.1
1200	0.499	172.3	5.587	81.6	0.057	64.3	0.266	−49.2	16.5
1400	0.507	166.4	4.820	77.4	0.064	65.5	0.261	−52.3	15.3
1600	0.508	161.2	4.210	73.7	0.071	67.8	0.263	−53.7	14.1
1800	0.504	155.0	3.763	70.5	0.080	67.7	0.260	−54.2	13.1
2000	0.511	148.6	3.403	67.6	0.087	68.8	0.244	−55.9	12.2
2200	0.532	143.3	3.110	64.8	0.095	68.7	0.229	−61.7	11.5
2400	0.551	140.2	2.826	61.5	0.100	69.8	0.231	−70.1	10.8
2600	0.554	137.6	2.602	59.0	0.111	69.6	0.252	−75.9	10.2
2800	0.546	133.5	2.442	55.9	0.119	68.1	0.269	−77.2	9.6
3000	0.554	128.0	2.274	53.1	0.125	68.9	0.266	−77.8	9.0

NPN 9 GHz wideband transistor — BFG540; BFG540/X; BFG540/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistors, intended for wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optical systems.

The transistors are mounted in plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG540 (Fig.1) Code: N37	
1	collector
2	base
3	emitter
4	emitter
BFG540/X (Fig.1) Code: N43	
1	collector
2	emitter
3	base
4	emitter
BFG540/XR (Fig.2) Code: N49	
1	collector
2	emitter
3	base
4	emitter

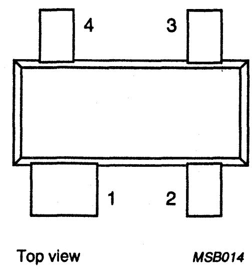


Fig.1 SOT143.

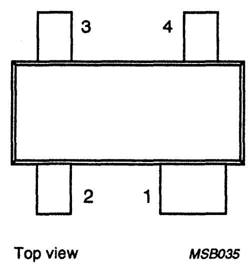


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to $T_s = 35$ °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V; $T_j = 25$ °C	60	120	250	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	18	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	11	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	15	16	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to $T_s = 35$ °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to $T_s = 35$ °C (note 1)	230 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 9 GHz wideband transistor BFG540; BFG540/X; BFG540/XR

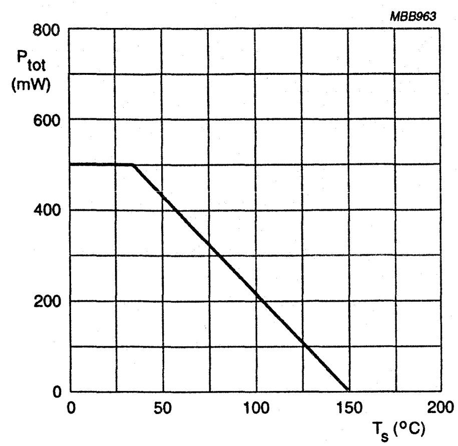
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 8 V;	–	–	50	nA
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 40 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	11	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	15	16	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_O	output voltage	note 3	–	500	–	mV
d_2	second order intermodulation distortion	note 4	–	–50	–	dB

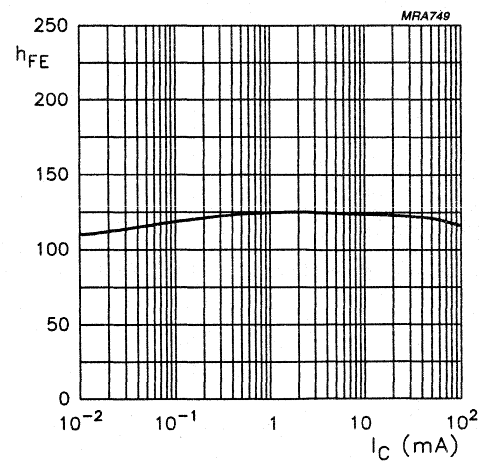
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 40 mA; V_{CE} = 8 V; $Z_L = Z_S$ = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$; $V_q = V_O$ –6 dB; $V_r = V_O$ –6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz
4. I_C = 40 mA; V_{CE} = 8 V; V_O = 275 mV; T_{amb} = 25 °C;
   f_p = 250 MHz; f_q = 560 MHz; measured at $f_{(p+q)}$ = 810 MHz



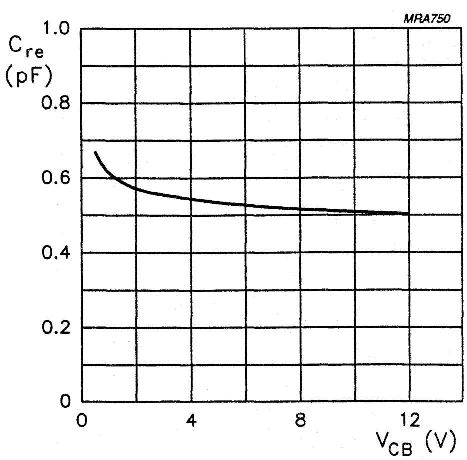
$V_{CE} \leq 10$ V.

Fig.3 Power derating curve.



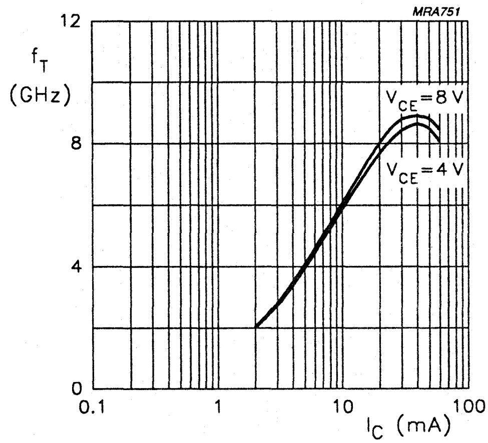
$V_{CE} = 8$ V; $T_j = 25$ °C.

Fig.4 DC current gain as a function of collector current.



$I_C = 0$; f = 1 MHz.

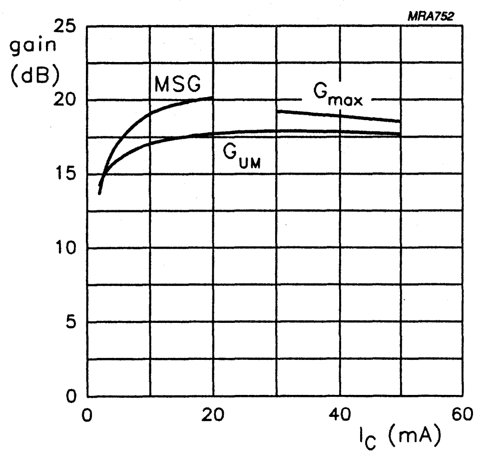
Fig.5 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; $T_{amb} = 25$ °C.

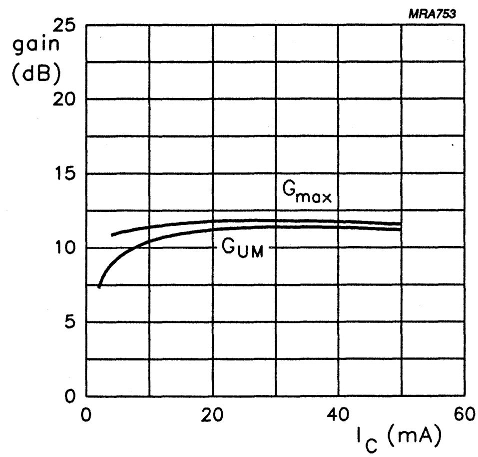
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



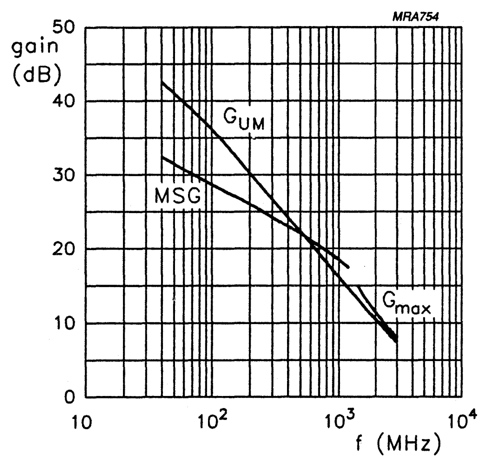
V_{CE} = 8 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



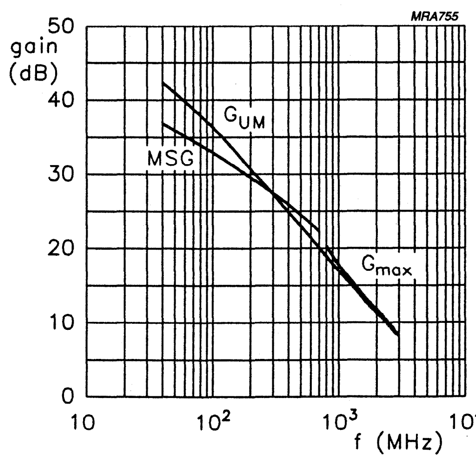
V_{CE} = 8 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



I_C = 10 mA; V_{CE} = 8 V.

Fig.9 Gain as a function of frequency.



I_C = 40 mA; V_{CE} = 8 V.

Fig.10 Gain as a function of frequency.

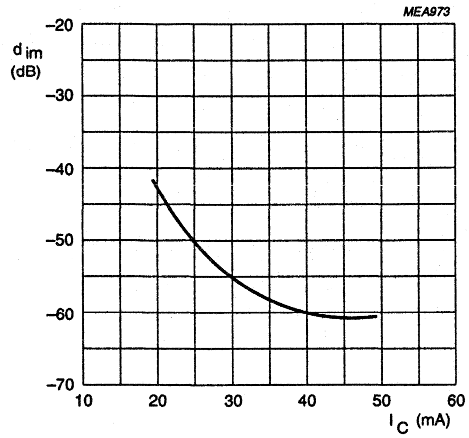


Fig.11 Intermodulation distortion as a function of collector current.

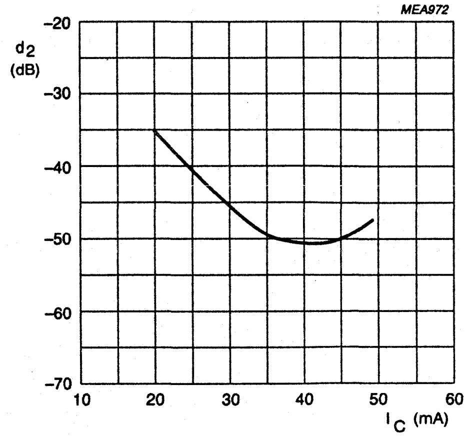
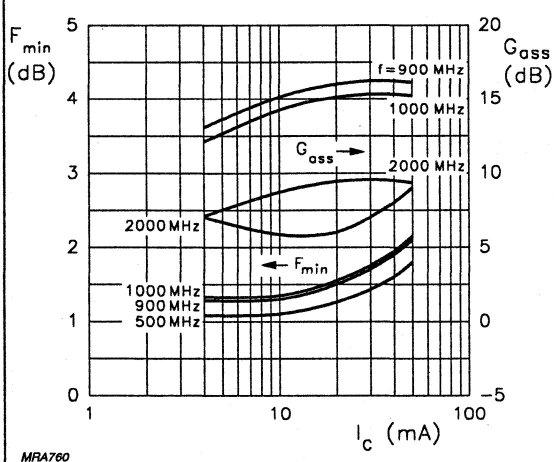
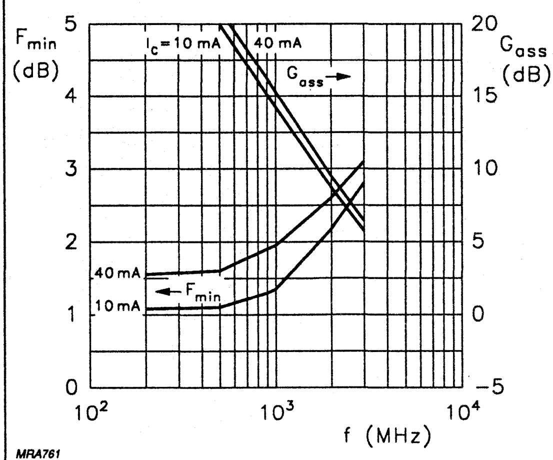


Fig.12 Second order intermodulation distortion as a function of collector current.



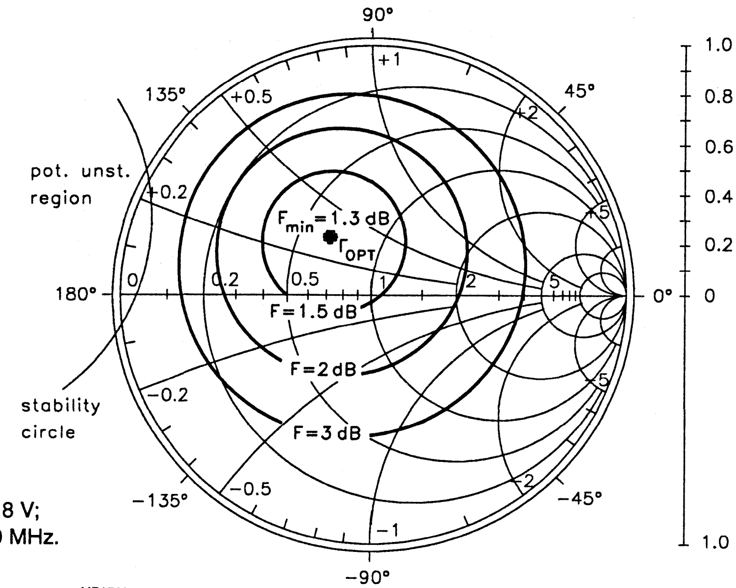
V_{CE} = 8 V.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



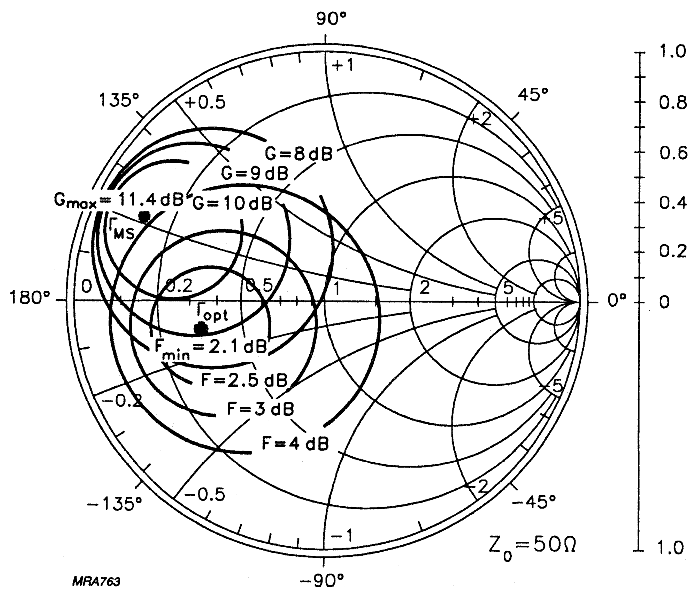
V_{CE} = 8 V.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.



I_C = 10 mA; V_{CE} = 8 V;
Z_O = 50 Ω; f = 900 MHz.

Fig.15 Noise circle figure.



I_C = 10 mA; V_{CE} = 8 V;
Z_O = 50 Ω; f = 2 GHz.

Fig.16 Noise circle figure.

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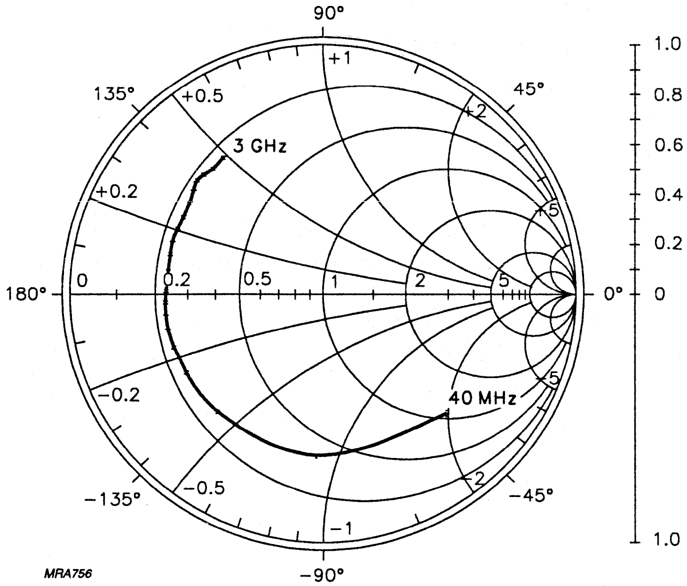
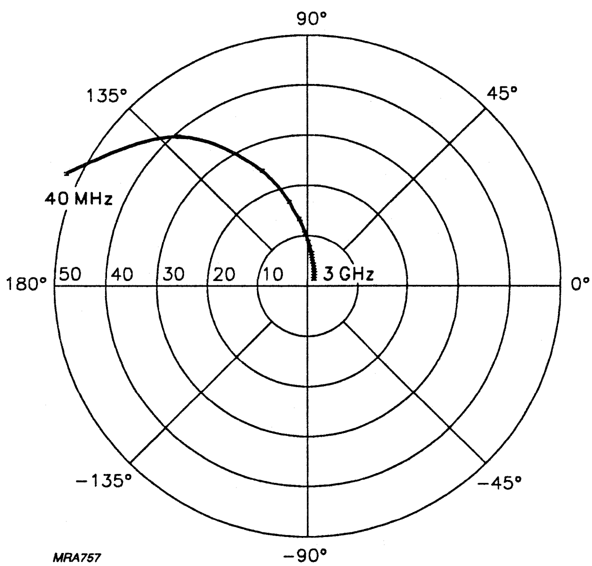


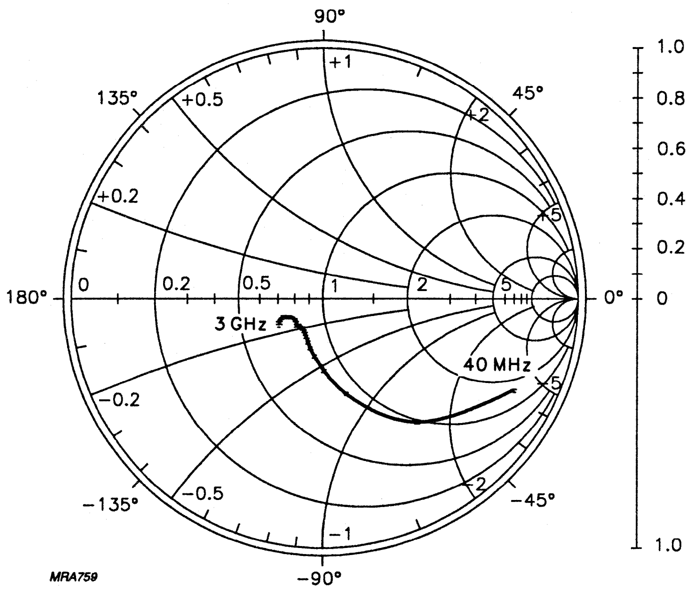
I_C = 40 mA; V_{CE} = 8 V.

Fig.17 Common emitter input reflection coefficient (S_{11}).



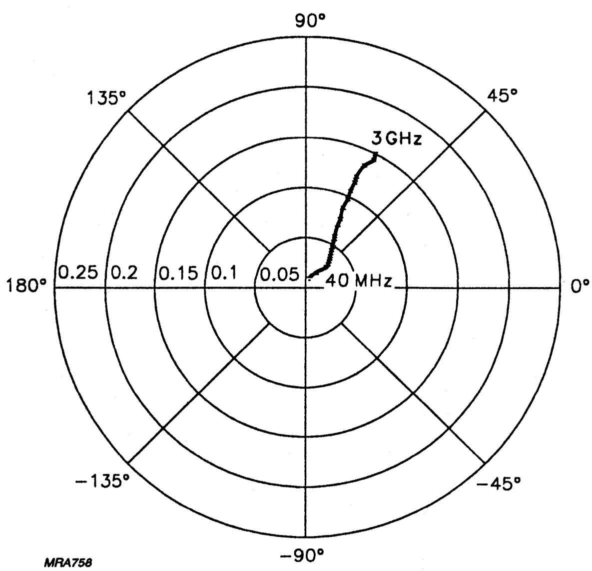
I_C = 40 mA; V_{CE} = 8 V.

Fig.18 Common emitter forward transmission coefficient (S_{21}).



I_C = 40 mA; V_{CE} = 8 V.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).

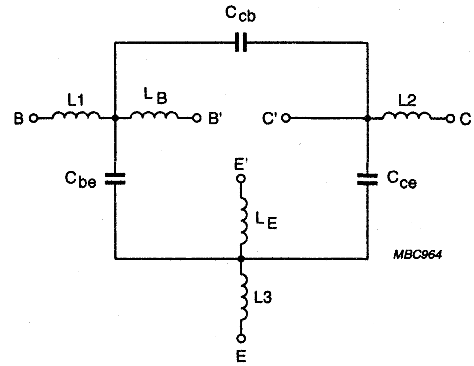


I_C = 40 mA; V_{CE} = 8 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for the BFR540 crystal

1	IS = 1.045	fA
2	BF = 184.3	-
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	-
8	BR = 43.99	-
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	-
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	-
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	-
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.40	-
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	-
38	FC = 814.7	m



$QL_B = 50$; $QL_E = 50$.
$QL_{B,E}$ (f) = $QL_{B,E}\sqrt{(f/Fc)}$.
Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.21)

DESIGNATION	VALUE
C_{be}	84 fF
C_{cb}	17 fF
C_{ce}	191 fF
L1	0.12 nH
L2	0.21 nH
L3	0.06 nH
L_B	0.95 nH
L_E	0.40 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.909	−14.0	10.705	169.8	0.014	82.2	0.981	−7.1	42.4
100	0.881	−33.9	10.082	157.2	0.033	70.3	0.934	−17.0	35.5
200	0.832	−64.7	9.138	140.4	0.056	55.2	0.814	−29.9	29.1
300	0.790	−90.1	8.025	126.9	0.070	44.9	0.704	−38.1	25.3
400	0.767	−109.2	6.901	116.9	0.078	38.0	0.618	−43.4	22.7
500	0.751	−123.9	5.996	109.2	0.083	33.6	0.555	−47.0	20.8
600	0.737	−135.2	5.269	102.9	0.086	30.7	0.510	−49.3	19.1
700	0.726	−144.2	4.673	97.8	0.088	28.5	0.476	−51.0	17.8
800	0.716	−151.7	4.177	93.3	0.088	27.1	0.450	−52.5	16.5
900	0.707	−158.1	3.748	89.4	0.089	26.4	0.428	−54.0	15.4
1000	0.701	−164.1	3.400	86.1	0.089	26.3	0.411	−55.7	14.4
1200	0.697	−174.2	2.867	80.0	0.089	26.6	0.391	−60.0	12.8
1400	0.703	177.8	2.492	74.1	0.089	27.0	0.386	−64.4	11.6
1600	0.704	170.9	2.181	68.9	0.089	30.0	0.387	−67.6	10.5
1800	0.705	164.4	1.959	65.0	0.091	32.1	0.383	−70.4	9.5
2000	0.713	157.9	1.771	61.1	0.091	35.5	0.371	−74.9	8.7
2200	0.727	152.3	1.617	57.2	0.092	38.6	0.366	−81.6	8.1
2400	0.739	148.0	1.458	52.8	0.092	42.6	0.379	−88.8	7.4
2600	0.739	143.9	1.339	49.9	0.098	45.9	0.406	−94.1	6.7
2800	0.736	138.9	1.262	45.7	0.103	47.8	0.427	−96.9	6.3
3000	0.750	133.3	1.168	42.8	0.108	52.2	0.427	−99.8	5.8

Table 2 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.799	−23.1	23.640	164.6	0.013	77.3	0.950	−13.6	42.0
100	0.760	−54.5	21.010	147.6	0.028	61.7	0.835	−31.1	35.4
200	0.711	−96.6	16.834	126.9	0.042	47.0	0.628	−49.4	29.8
300	0.690	−122.6	13.109	114.0	0.049	39.9	0.490	−59.5	26.3
400	0.683	−138.5	10.481	105.8	0.052	37.6	0.403	−65.4	23.9
500	0.680	−149.5	8.682	99.9	0.055	36.6	0.347	−69.3	22.0
600	0.675	−157.5	7.399	95.2	0.057	37.0	0.309	−71.9	20.5
700	0.671	−163.9	6.429	91.5	0.059	38.0	0.280	−73.7	19.1
800	0.667	−169.4	5.671	88.2	0.061	39.1	0.259	−75.3	17.9
900	0.662	−174.3	5.060	85.4	0.064	40.7	0.241	−77.2	16.9
1000	0.661	−178.9	4.569	82.9	0.066	42.4	0.227	−79.4	15.9
1200	0.663	173.4	3.823	78.3	0.071	45.6	0.214	−84.7	14.4
1400	0.669	167.3	3.288	73.6	0.076	47.6	0.215	−89.1	13.1
1600	0.671	161.9	2.878	69.5	0.082	51.0	0.216	−91.2	12.0
1800	0.672	156.1	2.589	66.0	0.090	52.6	0.211	−92.9	11.1
2000	0.682	150.2	2.349	62.8	0.096	54.9	0.201	−97.9	10.3
2200	0.699	145.5	2.138	59.5	0.102	56.4	0.202	−106.6	9.7
2400	0.709	142.1	1.926	56.2	0.106	58.3	0.221	−114.1	8.9
2600	0.708	138.6	1.780	53.5	0.117	59.0	0.249	−117.2	8.3
2800	0.703	134.1	1.667	49.5	0.125	58.1	0.265	−117.5	7.7
3000	0.716	128.9	1.558	47.0	0.132	59.9	0.263	−119.1	7.3

Table 3 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.298	143.0	0.10
2000	2.10	0.537	−162.0	0.09

Table 4 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.680	−35.9	39.017	159.1	0.012	73.1	0.903	−21.0	41.8
100	0.658	−80.2	31.861	137.5	0.023	56.1	0.716	−44.9	35.6
200	0.650	−123.4	21.805	116.5	0.032	44.4	0.480	−66.6	30.3
300	0.652	−143.9	15.757	106.0	0.036	41.8	0.358	−78.4	26.9
400	0.656	−155.6	12.204	99.5	0.039	42.9	0.289	−86.0	24.6
500	0.657	−163.5	9.939	94.9	0.042	44.6	0.248	−91.4	22.7
600	0.656	−169.4	8.383	91.2	0.045	47.4	0.220	−95.4	21.1
700	0.653	−174.4	7.240	88.2	0.049	49.2	0.199	−98.6	19.8
800	0.651	−178.7	6.368	85.5	0.052	51.2	0.183	−101.7	18.6
900	0.648	177.4	5.675	83.2	0.056	53.4	0.171	−105.2	17.6
1000	0.650	173.6	5.117	81.2	0.059	55.2	0.163	−108.8	16.7
1200	0.654	167.1	4.276	77.2	0.067	57.7	0.158	−115.6	15.2
1400	0.661	162.0	3.664	73.2	0.075	59.1	0.164	−119.4	13.9
1600	0.662	157.2	3.206	69.6	0.084	61.6	0.164	−120.4	12.7
1800	0.661	151.9	2.891	66.3	0.094	61.9	0.157	−122.3	11.8
2000	0.672	146.3	2.623	63.5	0.102	63.2	0.152	−129.0	11.1
2200	0.690	142.0	2.385	60.5	0.110	63.4	0.162	−137.9	10.5
2400	0.700	138.9	2.149	57.7	0.116	64.5	0.186	−142.5	9.7
2600	0.698	135.7	1.994	55.0	0.128	63.8	0.211	−141.9	9.1
2800	0.693	131.4	1.857	51.3	0.137	61.9	0.219	−140.0	8.4
3000	0.704	126.3	1.747	48.9	0.145	62.8	0.214	−141.5	8.0

Table 5 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.281	159.0	0.11
2000	2.20	0.518	−157.0	0.12

NPN 9 GHz wideband transistor BFG540; BFG540/X; BFG540/XR

Table 6 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.610	−46.5	49.003	155.3	0.011	69.0	0.863	−25.9	41.8
100	0.618	−96.6	37.160	131.4	0.020	53.2	0.640	−52.9	35.8
200	0.635	−135.8	23.444	111.8	0.027	45.2	0.410	−76.1	30.4
300	0.645	−152.8	16.534	102.6	0.031	44.8	0.304	−89.0	27.1
400	0.651	−162.5	12.684	96.9	0.034	47.7	0.248	−97.6	24.7
500	0.654	−169.1	10.280	92.8	0.038	50.2	0.216	−103.9	22.9
600	0.653	−174.2	8.647	89.6	0.042	53.4	0.194	−108.7	21.3
700	0.651	−178.5	7.455	86.8	0.046	55.3	0.178	−112.6	20.0
800	0.649	177.7	6.554	84.4	0.050	57.2	0.166	−116.4	18.8
900	0.647	174.1	5.835	82.2	0.054	59.3	0.157	−120.6	17.8
1000	0.647	170.6	5.261	80.4	0.058	60.7	0.152	−124.5	16.9
1200	0.653	164.6	4.395	76.7	0.067	62.8	0.152	−131.2	15.4
1400	0.660	159.9	3.760	72.8	0.075	63.6	0.158	−133.9	14.1
1600	0.660	155.3	3.293	69.3	0.085	65.3	0.158	−134.7	12.9
1800	0.660	150.1	2.973	66.2	0.097	65.2	0.151	−137.1	12.0
2000	0.671	144.7	2.697	63.5	0.105	65.9	0.149	−144.2	11.3
2200	0.690	140.6	2.452	60.5	0.114	65.8	0.163	−151.7	10.7
2400	0.699	137.7	2.207	58.0	0.119	66.5	0.188	−154.4	9.9
2600	0.697	134.6	2.052	55.3	0.132	65.5	0.209	−152.5	9.3
2800	0.690	130.4	1.908	51.6	0.141	63.3	0.214	−150.0	8.6
3000	0.703	125.3	1.796	49.3	0.149	63.9	0.207	−151.7	8.2

Table 7 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.70	0.312	171.0	0.11
2000	2.40	0.543	−155.0	0.12

NPN 9 GHz wideband transistor BFG540; BFG540/X; BFG540/XR

Table 8 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.565	−56.1	55.755	152.1	0.010	68.6	0.826	−29.6	41.6
100	0.602	−108.2	39.714	127.2	0.018	51.9	0.583	−58.5	35.7
200	0.633	−143.2	23.954	108.9	0.024	46.1	0.364	−82.3	30.4
300	0.646	−158.1	16.688	100.5	0.028	47.3	0.272	−95.8	27.1
400	0.652	−166.5	12.742	95.3	0.032	51.0	0.225	−104.9	24.7
500	0.654	−172.3	10.301	91.5	0.036	53.9	0.198	−111.5	22.9
600	0.654	−177.0	8.651	88.4	0.040	56.7	0.181	−116.4	21.3
700	0.652	179.1	7.453	85.8	0.044	59.0	0.167	−120.7	20.0
800	0.650	175.6	6.547	83.5	0.048	60.9	0.158	−124.6	18.8
900	0.649	172.2	5.831	81.5	0.053	62.5	0.151	−128.8	17.8
1000	0.650	168.8	5.261	79.7	0.058	63.9	0.147	−132.8	16.9
1200	0.656	163.2	4.390	76.1	0.067	65.5	0.150	−139.0	15.4
1400	0.663	158.6	3.756	72.3	0.076	65.8	0.158	−141.1	14.1
1600	0.662	154.2	3.288	69.0	0.086	67.5	0.158	−141.5	13.0
1800	0.661	149.2	2.967	65.9	0.098	66.9	0.151	−144.0	12.0
2000	0.674	143.9	2.696	63.2	0.107	67.5	0.150	−151.1	11.3
2200	0.691	139.8	2.449	60.3	0.115	67.2	0.166	−158.0	10.7
2400	0.702	136.9	2.205	57.8	0.121	67.7	0.191	−159.6	10.0
2600	0.698	134.0	2.049	55.1	0.134	66.5	0.210	−157.1	9.3
2800	0.692	129.8	1.907	51.4	0.143	64.0	0.214	−154.6	8.6
3000	0.704	124.8	1.796	49.2	0.152	64.5	0.207	−156.5	8.3

Table 9 Noise data, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.351	179.0	0.11
2000	2.60	0.543	−150.0	0.17

Table 10 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.534	−64.6	59.745	149.6	0.010	65.9	0.792	−32.4	41.3
100	0.597	−116.5	40.618	124.2	0.017	50.6	0.538	−62.4	35.6
200	0.636	−148.3	23.837	106.9	0.022	47.2	0.332	−86.3	30.3
300	0.649	−161.6	16.497	99.1	0.026	49.4	0.249	−100.0	27.0
400	0.656	−169.2	12.559	94.2	0.030	53.3	0.208	−109.3	24.6
500	0.658	−174.6	10.137	90.6	0.034	56.2	0.186	−115.8	22.7
600	0.658	−178.8	8.509	87.6	0.039	59.4	0.171	−120.7	21.2
700	0.656	177.6	7.325	85.1	0.043	61.4	0.159	−124.9	19.9
800	0.654	174.2	6.434	82.9	0.048	62.9	0.151	−128.7	18.7
900	0.653	170.9	5.729	80.9	0.052	64.7	0.146	−132.8	17.7
1000	0.654	167.7	5.164	79.1	0.057	65.9	0.144	−136.8	16.8
1200	0.661	162.3	4.312	75.6	0.067	67.2	0.148	−142.5	15.3
1400	0.667	157.9	3.685	71.8	0.076	67.4	0.156	−144.0	14.0
1600	0.666	153.5	3.229	68.5	0.086	68.6	0.156	−144.2	12.8
1800	0.666	148.5	2.912	65.4	0.098	68.1	0.150	−146.8	11.9
2000	0.679	143.3	2.647	62.8	0.107	68.5	0.150	−153.7	11.2
2200	0.696	139.4	2.405	59.8	0.116	68.0	0.167	−160.2	10.6
2400	0.706	136.5	2.166	57.4	0.122	68.4	0.192	−161.4	9.9
2600	0.703	133.7	2.011	54.7	0.135	67.1	0.211	−158.7	9.2
2800	0.696	129.3	1.869	51.0	0.144	64.6	0.214	−156.1	8.5
3000	0.709	124.4	1.763	48.7	0.153	64.9	0.207	−158.1	8.1

Table 11 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.921	−13.3	10.695	170.2	0.013	81.1	0.980	−6.7	42.9
100	0.894	−32.4	10.108	158.0	0.032	70.9	0.938	−16.2	36.3
200	0.843	−61.9	9.196	141.5	0.054	56.4	0.825	−28.6	29.6
300	0.799	−86.8	8.142	128.3	0.069	46.1	0.718	−36.8	25.8
400	0.771	−105.9	7.047	118.2	0.077	39.3	0.633	−42.1	23.1
500	0.751	−120.5	6.137	110.5	0.082	34.5	0.571	−45.7	21.1
600	0.735	−132.1	5.419	104.2	0.085	31.7	0.525	−48.0	19.5
700	0.722	−141.3	4.813	98.9	0.087	29.5	0.490	−49.7	18.0
800	0.711	−149.0	4.306	94.5	0.088	27.8	0.462	−51.2	16.8
900	0.701	−155.7	3.871	90.5	0.088	27.3	0.440	−52.7	15.6
1000	0.693	−161.9	3.511	87.1	0.089	26.9	0.422	−54.3	14.6
1200	0.688	−172.3	2.966	80.9	0.089	27.0	0.401	−58.4	13.0
1400	0.693	179.5	2.580	75.1	0.089	27.4	0.395	−62.6	11.8
1600	0.695	172.5	2.258	69.8	0.089	30.5	0.395	−65.8	10.7
1800	0.693	165.7	2.028	65.9	0.092	32.4	0.390	−68.4	9.7
2000	0.702	158.9	1.834	62.0	0.091	35.5	0.377	−72.6	8.9
2200	0.717	153.3	1.676	58.1	0.092	38.5	0.371	−79.1	8.3
2400	0.727	148.9	1.512	53.7	0.092	42.3	0.382	−86.3	7.5
2600	0.728	144.8	1.387	50.8	0.098	45.5	0.408	−91.6	6.9
2800	0.725	139.7	1.307	46.6	0.103	47.4	0.429	−94.4	6.5
3000	0.738	134.1	1.211	43.7	0.107	51.7	0.429	−97.1	6.0

Table 12 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.837	−21.1	23.102	165.5	0.013	77.7	0.949	−12.6	42.6
100	0.794	−50.1	20.741	149.2	0.028	63.4	0.848	−28.9	36.2
200	0.729	−90.2	16.884	128.9	0.042	48.5	0.652	−46.8	30.2
300	0.695	−116.5	13.347	115.9	0.050	41.2	0.514	−56.9	26.7
400	0.681	−133.3	10.752	107.4	0.054	37.8	0.424	−62.9	24.2
500	0.673	−145.0	8.943	101.3	0.056	37.0	0.366	−66.8	22.3
600	0.667	−153.6	7.640	96.5	0.059	37.2	0.326	−69.4	20.7
700	0.660	−160.5	6.649	92.6	0.061	37.8	0.295	−71.2	19.3
800	0.655	−166.3	5.872	89.3	0.063	38.6	0.272	−72.7	18.1
900	0.649	−171.4	5.240	86.4	0.065	40.0	0.253	−74.4	17.0
1000	0.647	−176.3	4.732	83.8	0.067	41.5	0.238	−76.4	16.1
1200	0.648	175.5	3.964	79.1	0.072	44.3	0.223	−81.4	14.6
1400	0.655	169.2	3.412	74.4	0.077	46.4	0.221	−85.8	13.3
1600	0.656	163.4	2.987	70.3	0.083	49.8	0.222	−87.8	12.2
1800	0.655	157.6	2.686	66.8	0.091	51.4	0.216	−89.4	11.2
2000	0.665	151.4	2.434	63.6	0.096	53.8	0.204	−94.2	10.4
2200	0.682	146.7	2.218	60.3	0.102	55.1	0.203	−102.6	9.8
2400	0.694	143.1	1.999	56.9	0.106	57.1	0.220	−110.2	9.1
2600	0.693	139.5	1.848	54.1	0.117	57.8	0.248	−113.6	8.5
2800	0.688	135.0	1.731	50.2	0.124	57.1	0.263	−114.0	7.9
3000	0.701	129.7	1.619	47.7	0.131	58.9	0.261	−115.5	7.4

Table 13 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.284	125.0	0.13
1000	1.40	0.290	134.0	0.12
2000	2.10	0.505	−167.0	0.11

Table 14 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.754	−31.1	37.624	160.6	0.012	73.4	0.904	−19.0	42.6
100	0.707	−71.0	31.376	140.0	0.024	57.2	0.738	−41.5	36.4
200	0.661	−114.2	22.110	118.9	0.033	45.2	0.508	−62.8	30.7
300	0.648	−136.6	16.188	107.9	0.038	42.1	0.381	−74.5	27.2
400	0.645	−149.9	12.606	101.1	0.041	42.1	0.308	−82.0	24.8
500	0.643	−158.7	10.292	96.2	0.044	43.2	0.263	−87.2	22.9
600	0.640	−165.4	8.698	92.4	0.048	45.4	0.232	−91.0	21.3
700	0.637	−170.7	7.518	89.2	0.051	47.5	0.209	−94.0	20.0
800	0.633	−175.4	6.617	86.5	0.054	49.3	0.191	−96.9	18.8
900	0.629	−179.8	5.894	84.1	0.057	51.4	0.177	−100.1	17.7
1000	0.629	176.1	5.320	82.0	0.061	53.3	0.167	−103.6	16.8
1200	0.633	169.3	4.445	78.0	0.069	55.7	0.160	−110.5	15.3
1400	0.640	163.7	3.812	73.9	0.076	57.2	0.163	−114.5	14.0
1600	0.641	158.8	3.338	70.2	0.084	59.7	0.163	−115.7	12.9
1800	0.639	153.2	3.004	67.0	0.095	60.0	0.155	−117.3	11.9
2000	0.650	147.5	2.730	64.1	0.103	61.4	0.148	−124.0	11.2
2200	0.668	143.0	2.482	61.1	0.110	61.9	0.156	−133.5	10.6
2400	0.679	139.9	2.236	58.3	0.115	62.9	0.179	−138.6	9.8
2600	0.678	136.7	2.073	55.6	0.127	62.4	0.203	−138.4	9.2
2800	0.673	132.4	1.935	51.8	0.136	60.5	0.213	−136.3	8.6
3000	0.685	127.2	1.818	49.5	0.144	61.3	0.207	−137.7	8.1

Table 15 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.50	0.232	140.0	0.14
2000	2.20	0.490	−163.0	0.11

Table 16 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.711	−38.6	46.953	157.3	0.011	71.0	0.866	−23.2	42.5
100	0.668	−84.2	36.734	134.4	0.022	54.4	0.667	−48.7	36.4
200	0.639	−125.6	23.900	114.2	0.029	44.8	0.437	−71.4	30.8
300	0.635	−145.2	17.038	104.4	0.033	43.9	0.324	−83.9	27.3
400	0.635	−156.7	13.125	98.4	0.037	45.6	0.262	−92.2	24.9
500	0.634	−164.3	10.656	94.0	0.040	48.0	0.226	−98.2	23.0
600	0.632	−170.0	8.973	90.6	0.044	50.8	0.202	−102.7	21.5
700	0.629	−174.9	7.740	87.7	0.047	53.0	0.183	−106.5	20.1
800	0.626	−179.1	6.807	85.2	0.051	54.8	0.169	−110.0	18.9
900	0.623	176.9	6.063	83.0	0.055	56.6	0.158	−113.9	17.9
1000	0.623	173.1	5.468	81.1	0.060	58.2	0.151	−118.0	17.0
1200	0.630	166.7	4.567	77.3	0.068	60.5	0.149	−125.2	15.5
1400	0.636	161.7	3.913	73.4	0.076	61.4	0.154	−128.4	14.2
1600	0.635	156.9	3.425	69.9	0.086	63.3	0.153	−129.1	13.0
1800	0.634	151.5	3.088	66.7	0.097	63.3	0.145	−131.1	12.1
2000	0.646	145.9	2.803	64.0	0.105	64.2	0.141	−138.6	11.4
2200	0.664	141.7	2.549	61.1	0.114	64.1	0.153	−147.1	10.8
2400	0.676	138.7	2.297	58.4	0.119	64.7	0.177	−150.5	10.0
2600	0.674	135.6	2.133	55.7	0.132	63.8	0.199	−148.7	9.4
2800	0.668	131.3	1.988	52.0	0.140	61.7	0.204	−146.2	8.7
3000	0.679	126.2	1.869	49.7	0.148	62.4	0.197	−147.6	8.3

Table 17 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.70	0.241	149.0	0.15
2000	2.40	0.479	−163.0	0.12

Table 18 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.687	−44.2	52.655	154.8	0.011	69.5	0.834	−25.9	42.4
100	0.650	−92.4	39.166	130.8	0.020	53.2	0.617	−52.9	36.3
200	0.632	−132.0	24.429	111.5	0.027	45.1	0.394	−75.9	30.7
300	0.629	−149.9	17.180	102.4	0.031	45.1	0.291	−88.6	27.3
400	0.631	−160.2	13.173	96.8	0.034	48.1	0.237	−97.2	24.8
500	0.632	−167.2	10.670	92.8	0.038	50.7	0.206	−103.3	23.0
600	0.630	−172.5	8.971	89.5	0.042	53.6	0.185	−108.0	21.4
700	0.627	−177.0	7.733	86.8	0.046	55.8	0.169	−111.9	20.1
800	0.624	179.0	6.793	84.3	0.050	57.6	0.157	−115.6	18.9
900	0.621	175.3	6.051	82.2	0.055	59.2	0.148	−119.7	17.9
1000	0.622	171.6	5.458	80.4	0.059	60.9	0.142	−123.8	17.0
1200	0.627	165.4	4.559	76.7	0.069	62.8	0.143	−130.7	15.4
1400	0.634	160.5	3.902	72.8	0.077	63.5	0.149	−133.5	14.2
1600	0.634	155.9	3.417	69.4	0.087	65.1	0.148	−134.0	13.0
1800	0.634	150.7	3.078	66.2	0.098	64.7	0.141	−136.2	12.1
2000	0.645	145.1	2.796	63.5	0.107	65.4	0.137	−143.6	11.4
2200	0.662	141.0	2.542	60.6	0.116	65.2	0.151	−151.9	10.7
2400	0.675	138.1	2.293	58.1	0.121	65.6	0.176	−154.3	10.0
2600	0.673	135.0	2.127	55.3	0.134	64.6	0.196	−152.1	9.3
2800	0.666	130.8	1.981	51.7	0.143	62.3	0.201	−149.2	8.7
3000	0.677	125.7	1.864	49.4	0.150	62.8	0.193	−150.8	8.2

Table 19 Noise data, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.90	0.263	155.0	0.14
2000	2.60	0.494	−162.0	0.13

Table 20 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.668	−49.0	56.198	152.8	0.011	68.1	0.805	−27.9	42.1
100	0.638	−98.7	40.134	128.1	0.020	51.1	0.576	−55.6	36.1
200	0.628	−136.4	24.336	109.6	0.025	45.6	0.361	−78.3	30.5
300	0.629	−153.2	16.979	101.0	0.029	46.7	0.267	−90.7	27.1
400	0.630	−162.7	12.976	95.7	0.033	49.8	0.218	−99.0	24.7
500	0.631	−169.2	10.494	91.8	0.037	52.5	0.190	−104.9	22.8
600	0.629	−174.2	8.814	88.7	0.041	55.7	0.171	−109.5	21.2
700	0.627	−178.5	7.593	86.0	0.046	57.7	0.157	−113.2	19.9
800	0.625	177.7	6.670	83.7	0.050	59.5	0.146	−116.8	18.7
900	0.622	174.1	5.941	81.6	0.054	61.2	0.139	−120.9	17.7
1000	0.624	170.6	5.357	79.8	0.059	62.5	0.134	−124.9	16.8
1200	0.628	164.6	4.474	76.1	0.068	64.1	0.136	−131.6	15.3
1400	0.635	159.8	3.829	72.3	0.077	64.6	0.143	−134.1	14.0
1600	0.635	155.3	3.350	68.9	0.087	66.1	0.143	−134.2	12.8
1800	0.634	150.1	3.020	65.6	0.099	65.7	0.136	−136.3	11.9
2000	0.646	144.7	2.745	62.9	0.107	66.1	0.133	−143.6	11.2
2200	0.663	140.5	2.495	60.0	0.116	65.6	0.147	−151.8	10.6
2400	0.676	137.6	2.247	57.4	0.122	66.2	0.172	−154.3	9.8
2600	0.675	134.7	2.086	54.7	0.135	65.1	0.193	−151.8	9.2
2800	0.667	130.4	1.944	51.0	0.144	62.9	0.198	−148.9	8.5
3000	0.678	125.4	1.827	48.7	0.152	63.3	0.191	−150.3	8.1

NPN 9 GHz wideband transistor BFG541

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor, intended for wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optic systems.

The transistors are mounted in a plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

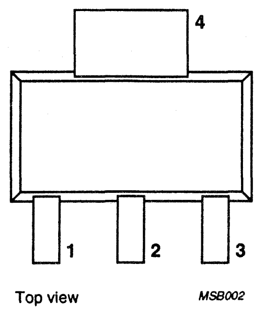


Fig.1 SOT223.

NPN 9 GHz wideband transistor BFG541

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to $T_s = 115$ °C (note 1)	–	–	650	mW
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V; $T_j = 25$ °C	60	120	250	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	15	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C	–	21	–	dBm
ITO	third order intercept point	$I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C	–	34	–	dBm

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to $T_s = 115$ °C (note 1)	–	650	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to $T_s = 115$ °C (note 1)	55 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 8$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	15	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_O	output voltage	note 3	–	500	–	mV
d_2	second order intermodulation distortion	note 4	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and at $f_{(2p-q)} = 904$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B); $I_C = 40$ mA; $V_{CE} = 8$ V; $Z_L = Z_S = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$; $V_q = V_O - 6$ dB; $V_r = V_O - 6$ dB;
   $f_p = 795.25$ MHz; $f_q = 803.25$ MHz; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz
4. $I_C = 40$ mA; $V_{CE} = 8$ V; $V_O = 325$ mV; $T_{amb} = 25$ °C;
   $f_p = 250$ MHz; $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz

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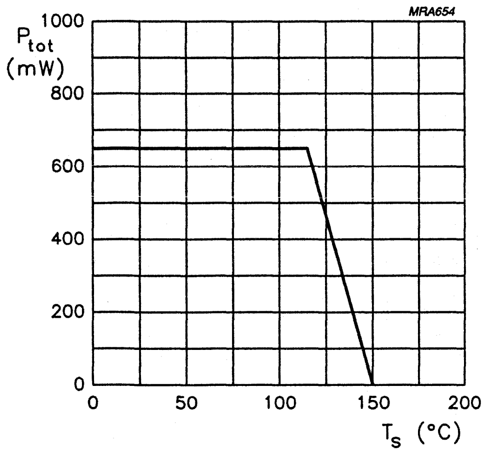
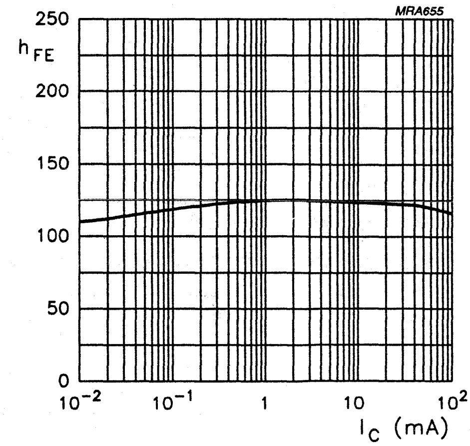


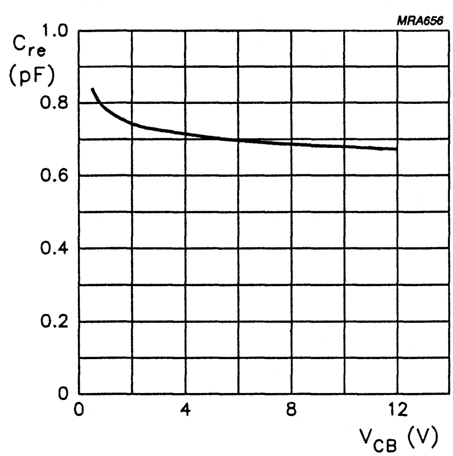
$V_{CE} \leq 10$ V.

Fig.2 Power derating curve.



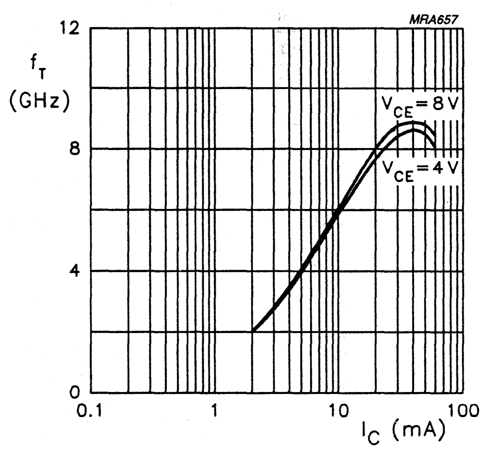
$V_{CE} = 8$ V; $T_j = 25$ °C.

Fig.3 DC current gain as a function of collector current.



$I_C = 0$; f = 1 MHz.

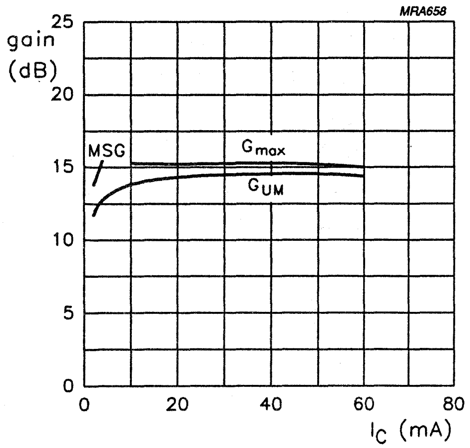
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; $T_{amb} = 25$ °C.

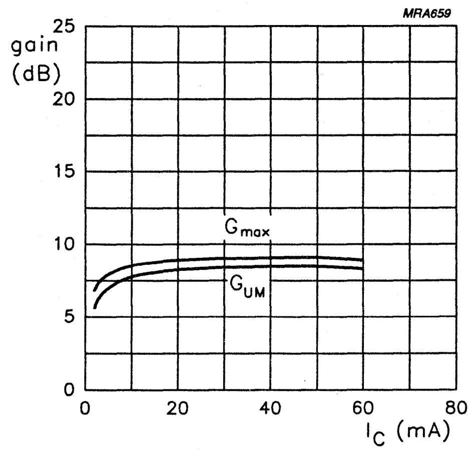
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



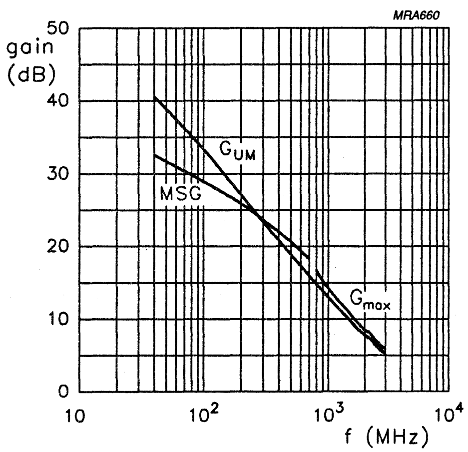
V_{CE} = 8 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



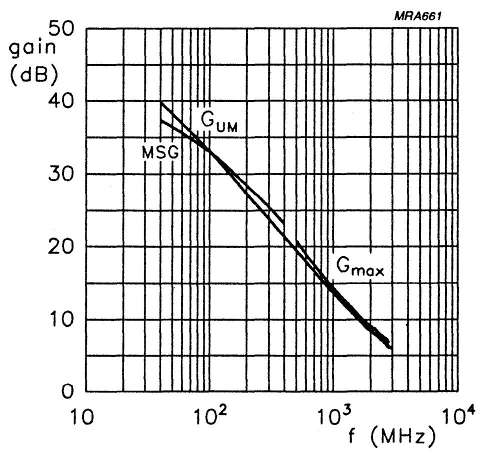
V_{CE} = 8 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



I_C = 10 mA; V_{CE} = 8 V.

Fig.8 Gain as a function of frequency.



I_C = 40 mA; V_{CE} = 8 V.

Fig.9 Gain as a function of frequency.

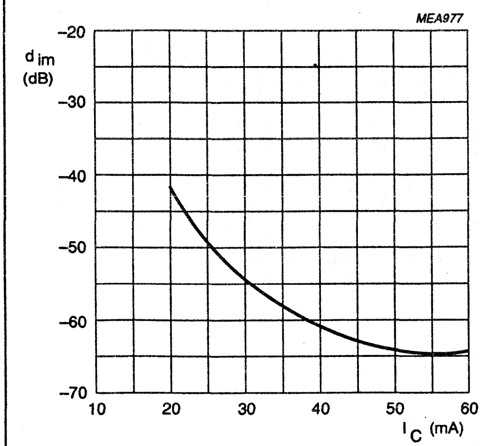


Fig.10 Intermodulation distortion as a function of collector current.

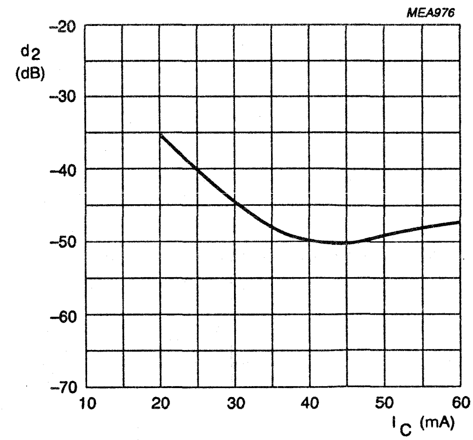
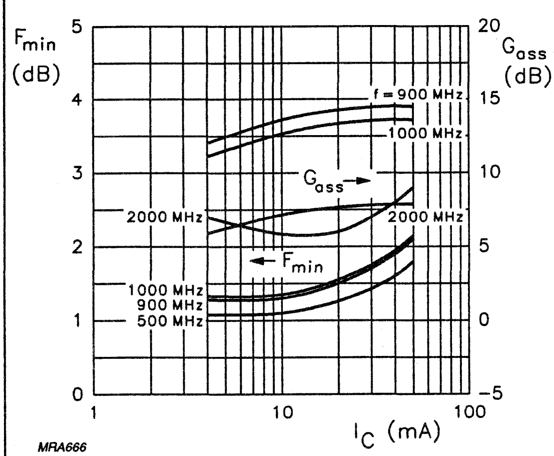
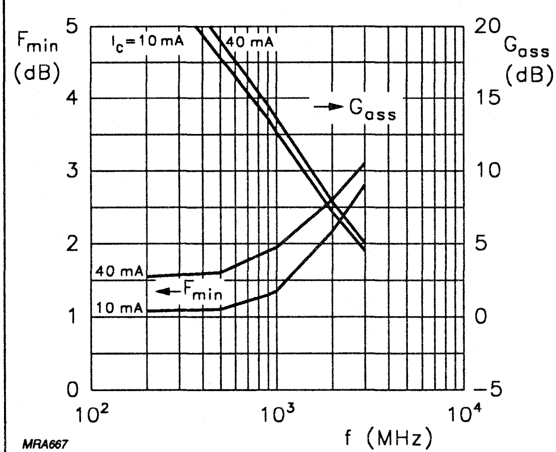


Fig.11 Second order intermodulation distortion as a function of collector current.



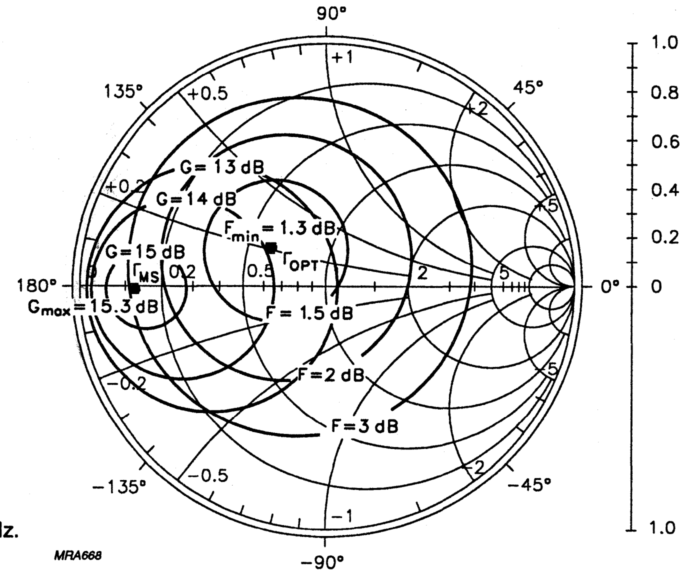
V_{CE} = 8 V.

Fig.12 Minimum noise figure and associated available gain as functions of collector current.



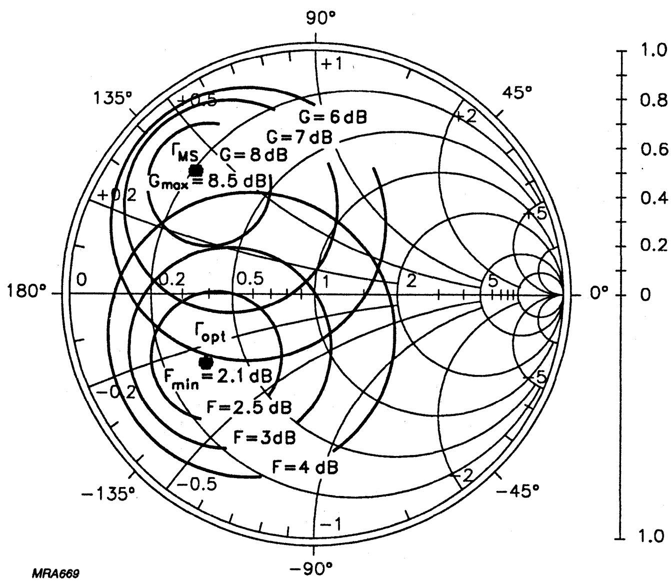
V_{CE} = 8 V.

Fig.13 Minimum noise figure and associated available gain as functions of frequency.



I_C = 10 mA; V_{CE} = 8 V;
Z_o = 50 Ω; f = 900 MHz.

Fig.14 Noise circle figure.



I_C = 10 mA; V_{CE} = 8 V;
Z_o = 50 Ω; f = 2 GHz.

Fig.15 Noise circle figure.

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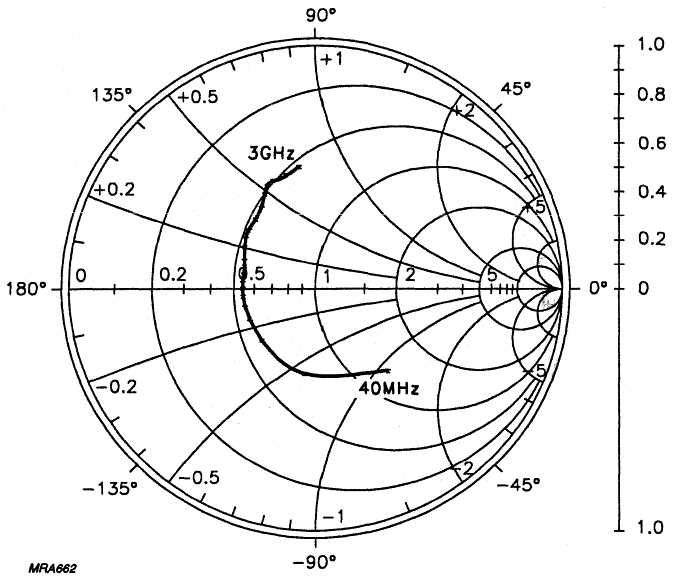
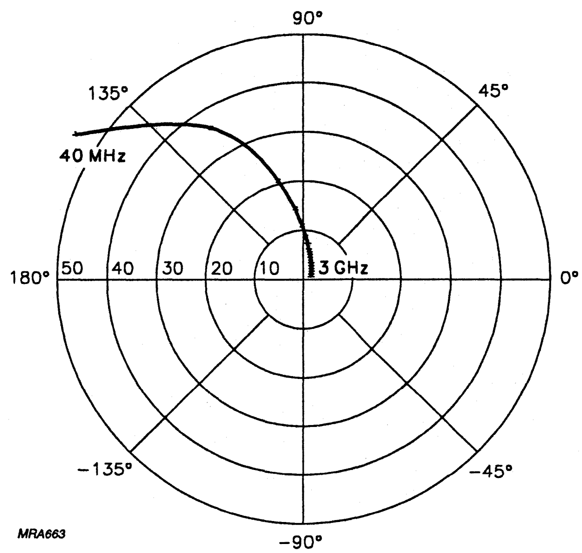


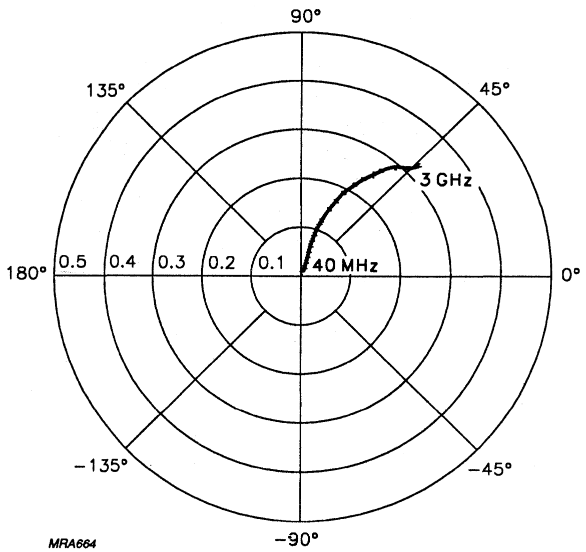
I_C = 40 mA; V_{CE} = 8 V.

Fig.16 Common emitter input reflection coefficient (S_{11}).



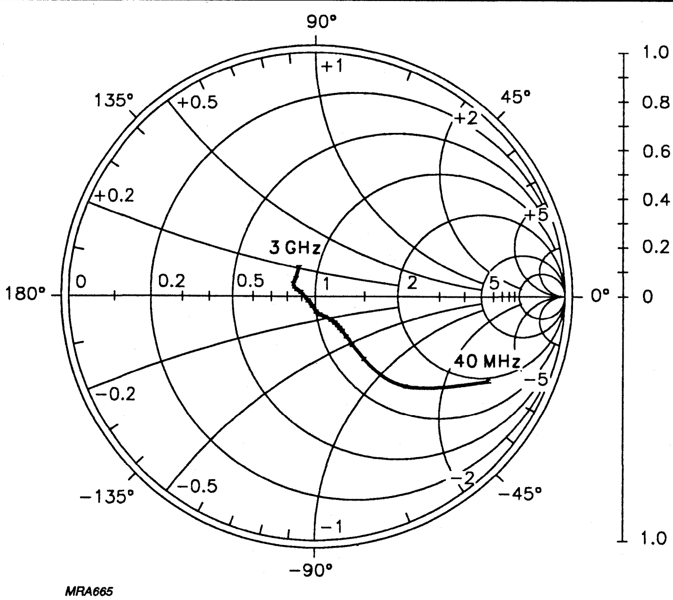
I_C = 40 mA; V_{CE} = 8 V.

Fig.17 Common emitter forward transmission coefficient (S_{21}).



I_C = 40 mA; V_{CE} = 8 V.

Fig.18 Common emitter reverse transmission coefficient (S_{12}).

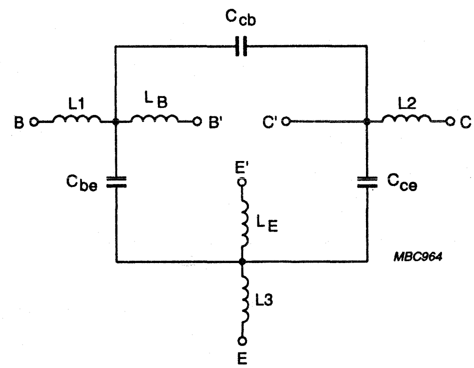


I_C = 40 mA; V_{CE} = 8 V.

Fig.19 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR540 crystal

1	IS = 1.045	fA
2	BF = 184.3	–
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	–
8	BR = 43.99	–
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	–
14	RB = 5.000	Ω
15	IRB = 1.000	µA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.40	–
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 814.7	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.20 Package equivalent circuit, SOT223.

List of components (see Fig.20)

DESIGNATION	VALUE
C_{be}	182 fF
C_{cb}	16 fF
C_{ce}	249 fF
L1	0.025 nH
L2	1.19 nH
L3	0.60 nH
L_B	1.50 nH
L_E	0.50 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, $I_C = 4$ mA; $V_{CE} = 4$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.891	−14.3	10.848	168.0	0.014	81.7	0.977	−7.6	41.0
100	0.844	−34.5	10.107	153.7	0.033	70.1	0.918	−18.0	33.5
200	0.742	−65.7	8.907	135.0	0.054	57.6	0.777	−30.2	26.5
300	0.652	−91.7	7.631	120.5	0.067	50.2	0.661	−37.0	22.5
400	0.591	−111.9	6.419	109.9	0.075	46.4	0.578	−41.2	19.8
500	0.552	−128.0	5.492	101.9	0.081	45.0	0.519	−43.9	17.7
600	0.525	−141.0	4.800	95.2	0.086	44.9	0.476	−45.9	16.1
700	0.506	−152.0	4.237	89.6	0.091	45.4	0.445	−47.7	14.8
800	0.493	−161.6	3.786	84.6	0.095	46.2	0.420	−49.3	13.6
900	0.485	−170.2	3.411	80.1	0.100	47.6	0.399	−51.2	12.6
1000	0.485	−178.3	3.094	76.1	0.105	48.9	0.381	−53.4	11.7
1200	0.491	168.3	2.637	68.9	0.116	51.6	0.353	−58.6	10.2
1400	0.504	157.9	2.325	61.8	0.128	53.6	0.335	−65.0	9.1
1600	0.510	148.5	2.053	55.3	0.143	56.6	0.318	−71.4	8.0
1800	0.521	139.0	1.866	50.2	0.161	56.9	0.298	−78.3	7.2
2000	0.545	130.2	1.713	44.6	0.178	58.0	0.274	−88.0	6.5
2200	0.576	123.5	1.600	39.4	0.196	57.8	0.260	−101.0	6.1
2400	0.594	118.6	1.456	33.6	0.212	58.6	0.262	−114.2	5.5
2600	0.595	113.1	1.356	29.7	0.242	56.8	0.264	−125.1	4.9
2800	0.597	105.4	1.289	23.8	0.262	53.9	0.253	−135.7	4.4
3000	0.626	97.3	1.220	19.5	0.287	53.2	0.237	−151.2	4.1

Table 2 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.753	−23.0	23.482	161.5	0.013	77.8	0.938	−14.1	40.2
100	0.661	−54.2	20.228	141.8	0.027	65.3	0.789	−30.0	32.8
200	0.519	−95.4	15.119	119.7	0.041	57.3	0.572	−42.8	26.7
300	0.450	−121.8	11.361	107.0	0.050	56.0	0.447	−47.5	23.1
400	0.420	−139.5	8.914	98.8	0.058	57.3	0.376	−49.4	20.5
500	0.406	−152.4	7.317	92.9	0.067	58.6	0.331	−50.4	18.6
600	0.397	−162.3	6.218	88.0	0.076	59.9	0.299	−51.2	17.0
700	0.390	−170.7	5.397	83.7	0.085	60.9	0.277	−52.1	15.7
800	0.388	−178.3	4.770	79.9	0.094	61.6	0.258	−52.9	14.6
900	0.387	174.5	4.271	76.3	0.103	62.3	0.241	−54.3	13.6
1000	0.393	168.1	3.859	73.1	0.113	62.4	0.226	−56.1	12.7
1200	0.409	157.5	3.260	67.1	0.132	62.3	0.202	−61.4	11.2
1400	0.427	149.5	2.843	61.3	0.150	61.5	0.185	−68.4	10.1
1600	0.435	142.1	2.509	55.6	0.171	61.3	0.169	−75.2	9.0
1800	0.448	133.7	2.275	50.8	0.192	59.1	0.147	−82.6	8.2
2000	0.474	125.9	2.082	45.8	0.211	57.8	0.122	−95.6	7.5
2200	0.508	120.2	1.932	41.1	0.230	55.9	0.110	−117.1	7.1
2400	0.530	116.3	1.768	36.3	0.245	55.1	0.119	−137.1	6.4
2600	0.534	111.8	1.648	32.0	0.272	52.2	0.124	−150.7	5.9
2800	0.539	104.9	1.551	26.7	0.288	48.5	0.117	−165.6	5.4
3000	0.567	97.2	1.477	22.3	0.308	47.1	0.118	170.4	5.1

Table 3 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.301	158.0	0.09
2000	2.10	0.525	−146.0	0.14

Table 4 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.578	−35.3	38.335	154.7	0.011	75.1	0.875	−21.0	39.7
100	0.468	−79.1	29.219	130.0	0.022	64.9	0.647	−39.8	32.7
200	0.380	−121.9	18.421	109.8	0.033	62.7	0.422	−50.2	26.8
300	0.356	−144.2	13.039	99.8	0.044	64.8	0.319	−52.7	23.4
400	0.350	−158.1	9.996	93.4	0.054	66.9	0.265	−53.1	20.9
500	0.347	−167.7	8.107	88.7	0.065	67.9	0.232	−53.4	19.0
600	0.347	−175.3	6.834	84.6	0.076	68.6	0.208	−53.7	17.4
700	0.345	178.0	5.906	81.0	0.087	68.7	0.191	−54.3	16.1
800	0.346	171.7	5.209	77.6	0.097	68.5	0.176	−54.9	15.0
900	0.349	165.8	4.654	74.6	0.109	68.1	0.163	−56.3	14.0
1000	0.358	160.3	4.201	71.7	0.120	67.5	0.150	−58.4	13.2
1200	0.377	151.5	3.540	66.3	0.142	66.1	0.127	−64.7	11.7
1400	0.396	145.0	3.076	60.9	0.163	64.1	0.112	−74.0	10.6
1600	0.404	138.4	2.714	55.7	0.185	62.7	0.096	−82.8	9.5
1800	0.418	130.9	2.455	51.1	0.208	59.6	0.076	−93.7	8.7
2000	0.445	123.4	2.248	46.3	0.228	57.7	0.055	−120.2	8.0
2200	0.480	118.3	2.076	41.9	0.246	55.2	0.062	−160.2	7.5
2400	0.503	115.0	1.902	37.6	0.261	53.8	0.085	−178.5	6.9
2600	0.510	110.9	1.776	33.2	0.287	50.5	0.098	169.6	6.3
2800	0.514	104.3	1.660	28.1	0.303	46.5	0.102	152.6	5.8
3000	0.542	96.8	1.585	23.8	0.322	44.7	0.123	132.1	5.6

Table 5 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.50	0.330	179.0	0.09
2000	2.20	0.533	−140.0	0.19

Table 6 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.457	–46.4	47.782	150.0	0.010	75.0	0.826	–25.3	39.6
100	0.376	–96.6	33.018	123.9	0.020	66.3	0.565	–44.5	32.7
200	0.335	–136.3	19.468	105.7	0.031	67.5	0.354	–53.1	26.9
300	0.330	–155.1	13.548	97.0	0.042	69.5	0.265	–54.5	23.5
400	0.331	–166.6	10.321	91.3	0.053	70.9	0.220	–54.4	21.0
500	0.332	–174.6	8.344	87.0	0.065	71.5	0.192	–54.4	19.1
600	0.333	179.1	7.019	83.2	0.077	71.5	0.172	–54.8	17.6
700	0.334	173.1	6.060	79.9	0.088	71.4	0.157	–55.4	16.3
800	0.335	167.5	5.339	76.7	0.100	70.7	0.144	–56.0	15.2
900	0.340	162.0	4.768	73.8	0.111	70.0	0.131	–57.5	14.2
1000	0.349	157.1	4.307	71.1	0.123	69.3	0.119	–59.9	13.3
1200	0.368	149.0	3.622	65.9	0.146	67.2	0.097	–67.4	11.9
1400	0.387	143.0	3.143	60.6	0.167	64.9	0.084	–79.1	10.7
1600	0.397	136.9	2.776	55.6	0.190	63.2	0.068	–90.8	9.6
1800	0.409	129.6	2.509	51.0	0.214	59.8	0.050	–107.7	8.8
2000	0.437	122.5	2.294	46.4	0.234	57.6	0.040	–151.8	8.1
2200	0.473	117.4	2.115	42.1	0.253	54.9	0.063	171.6	7.6
2400	0.497	114.3	1.940	37.9	0.268	53.4	0.091	161.5	7.0
2600	0.503	110.5	1.813	33.4	0.294	49.8	0.106	152.7	6.5
2800	0.507	103.9	1.692	28.5	0.309	45.8	0.114	137.5	5.9
3000	0.536	96.4	1.615	24.2	0.327	43.8	0.141	120.8	5.7

Table 7 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.70	0.402	–172.0	0.08
2000	2.40	0.581	–134.0	0.21

Table 8 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.375	−56.7	53.699	146.7	0.010	74.5	0.786	−28.1	39.4
100	0.331	−109.6	34.743	120.3	0.018	68.1	0.513	−47.2	32.6
200	0.320	−145.6	19.848	103.5	0.030	70.4	0.315	−54.5	26.9
300	0.322	−161.7	13.707	95.4	0.041	72.3	0.235	−55.3	23.5
400	0.325	−171.6	10.415	90.1	0.053	73.4	0.195	−55.0	21.0
500	0.329	−178.6	8.409	86.1	0.065	73.4	0.170	−54.9	19.1
600	0.331	175.7	7.065	82.4	0.077	73.4	0.152	−55.3	17.6
700	0.332	170.3	6.097	79.2	0.089	72.6	0.139	−55.9	16.3
800	0.334	165.0	5.368	76.1	0.101	71.8	0.126	−56.6	15.2
900	0.339	160.0	4.799	73.3	0.113	71.1	0.114	−58.2	14.2
1000	0.349	155.1	4.329	70.6	0.125	70.1	0.102	−61.0	13.3
1200	0.368	147.5	3.646	65.5	0.148	67.8	0.081	−69.8	11.9
1400	0.388	142.0	3.160	60.4	0.170	65.2	0.069	−83.6	10.7
1600	0.397	136.0	2.788	55.4	0.193	63.3	0.055	−98.4	9.7
1800	0.410	128.9	2.519	50.8	0.217	59.9	0.039	−122.5	8.8
2000	0.437	121.8	2.305	46.2	0.238	57.5	0.040	−175.2	8.2
2200	0.474	116.8	2.123	41.9	0.256	54.9	0.070	158.3	7.7
2400	0.497	113.8	1.946	37.9	0.271	53.2	0.099	152.7	7.1
2600	0.504	110.1	1.819	33.4	0.297	49.6	0.114	145.1	6.5
2800	0.508	103.5	1.694	28.4	0.312	45.4	0.124	131.0	5.9
3000	0.537	96.2	1.619	24.2	0.330	43.4	0.153	116.2	5.8

Table 9 Noise data, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.455	−168.0	0.08
2000	2.60	0.590	−134.0	0.25

Table 10 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.319	−67.1	57.333	144.2	0.009	74.3	0.753	−30.0	39.3
100	0.310	−120.1	35.488	118.0	0.017	70.1	0.475	−48.9	32.6
200	0.315	−152.0	19.920	102.1	0.029	72.3	0.289	−55.3	26.8
300	0.322	−166.1	13.699	94.5	0.041	74.0	0.215	−55.7	23.4
400	0.328	−174.9	10.392	89.4	0.053	74.6	0.178	−55.2	21.0
500	0.331	178.7	8.379	85.4	0.066	74.5	0.156	−55.2	19.1
600	0.333	173.5	7.042	81.8	0.078	74.2	0.140	−55.6	17.5
700	0.335	168.5	6.073	78.7	0.090	73.4	0.127	−56.2	16.3
800	0.338	163.3	5.348	75.6	0.102	72.5	0.115	−57.0	15.1
900	0.343	158.5	4.777	72.9	0.114	71.6	0.103	−58.8	14.2
1000	0.352	153.9	4.312	70.3	0.126	70.6	0.091	−61.8	13.3
1200	0.373	146.7	3.628	65.1	0.150	68.1	0.071	−71.9	11.9
1400	0.391	141.1	3.143	60.1	0.172	65.5	0.059	−87.4	10.7
1600	0.401	135.3	2.775	55.1	0.195	63.4	0.047	−105.8	9.6
1800	0.413	128.3	2.507	50.5	0.219	60.0	0.034	−136.8	8.8
2000	0.441	121.3	2.293	45.9	0.240	57.6	0.043	171.2	8.2
2200	0.477	116.5	2.111	41.6	0.258	54.7	0.076	151.8	7.6
2400	0.501	113.4	1.937	37.7	0.273	53.1	0.105	148.0	7.0
2600	0.507	109.6	1.809	33.1	0.299	49.4	0.120	141.0	6.5
2800	0.511	103.1	1.684	28.3	0.314	45.2	0.131	127.8	5.9
3000	0.540	95.8	1.611	24.0	0.333	43.2	0.161	113.7	5.8

Table 11 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.903	−13.6	10.689	168.4	0.014	81.9	0.978	−7.2	41.5
100	0.858	−32.8	9.976	154.5	0.032	71.0	0.923	−17.0	34.1
200	0.759	−62.7	8.866	136.4	0.053	58.5	0.791	−28.7	26.9
300	0.664	−87.9	7.670	121.9	0.066	51.0	0.678	−35.5	22.9
400	0.598	−107.8	6.490	111.2	0.074	47.2	0.596	−39.7	20.1
500	0.554	−124.0	5.583	103.2	0.080	45.6	0.537	−42.5	18.0
600	0.524	−137.2	4.890	96.4	0.085	45.2	0.494	−44.5	16.4
700	0.501	−148.3	4.327	90.8	0.090	45.5	0.463	−46.2	15.0
800	0.485	−158.3	3.871	85.6	0.093	46.3	0.437	−47.8	13.8
900	0.476	−167.2	3.483	81.1	0.098	47.8	0.416	−49.7	12.8
1000	0.473	−175.6	3.165	77.1	0.103	49.1	0.398	−51.7	11.9
1200	0.479	170.5	2.698	69.8	0.114	51.6	0.369	−56.9	10.4
1400	0.490	159.7	2.382	62.8	0.125	53.7	0.351	−62.9	9.3
1600	0.497	150.1	2.105	56.3	0.139	56.7	0.334	−69.0	8.2
1800	0.506	140.4	1.913	51.2	0.157	57.2	0.314	−75.5	7.4
2000	0.530	131.5	1.756	45.7	0.174	58.4	0.290	−84.5	6.7
2200	0.561	124.6	1.643	40.5	0.191	58.3	0.274	−96.8	6.3
2400	0.580	119.5	1.495	34.5	0.207	59.1	0.275	−109.5	5.6
2600	0.581	114.0	1.391	30.7	0.237	57.5	0.276	−120.0	5.0
2800	0.584	106.4	1.324	24.9	0.257	54.8	0.263	−129.9	4.6
3000	0.612	98.2	1.252	20.6	0.281	54.2	0.244	−144.4	4.3

Table 12 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.781	−21.5	23.444	162.1	0.013	78.3	0.936	−13.3	40.6
100	0.687	−50.7	20.346	142.9	0.026	65.5	0.797	−28.6	33.3
200	0.532	−90.1	15.425	121.0	0.040	57.8	0.587	−41.2	27.0
300	0.451	−116.3	11.691	108.1	0.050	56.4	0.463	−45.9	23.4
400	0.412	−134.5	9.206	99.8	0.058	57.3	0.390	−47.8	20.8
500	0.393	−147.9	7.570	93.9	0.066	58.7	0.344	−48.8	18.9
600	0.382	−158.2	6.438	88.9	0.075	60.0	0.313	−49.5	17.3
700	0.373	−167.2	5.593	84.6	0.084	61.0	0.290	−50.3	16.0
800	0.368	−175.2	4.945	80.7	0.092	61.6	0.271	−51.1	14.8
900	0.367	177.4	4.428	77.2	0.102	62.2	0.254	−52.4	13.8
1000	0.372	170.5	4.001	74.0	0.111	62.5	0.239	−54.0	12.9
1200	0.388	159.4	3.381	68.0	0.130	62.3	0.214	−59.2	11.5
1400	0.405	151.4	2.951	62.2	0.148	61.6	0.197	−65.5	10.3
1600	0.414	143.5	2.604	56.6	0.168	61.3	0.180	−71.7	9.3
1800	0.426	135.1	2.356	51.9	0.189	59.3	0.159	−78.0	8.4
2000	0.452	127.1	2.159	46.9	0.208	58.1	0.133	−89.5	7.8
2200	0.487	121.3	2.003	42.3	0.226	56.2	0.117	−108.9	7.3
2400	0.508	117.4	1.833	37.3	0.241	55.3	0.121	−128.3	6.6
2600	0.513	113.0	1.710	33.1	0.267	52.5	0.124	−142.0	6.1
2800	0.518	106.0	1.609	27.8	0.284	49.0	0.114	−155.5	5.5
3000	0.547	98.3	1.532	23.5	0.303	47.6	0.109	179.9	5.3

Table 13 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.273	144.0	0.10
1000	1.40	0.250	150.0	0.12
2000	2.10	0.523	−147.0	0.12

Table 14 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.627	−32.2	38.486	155.4	0.011	74.9	0.872	−19.8	40.1
100	0.501	−72.3	29.773	131.4	0.022	64.7	0.657	−38.1	33.2
200	0.382	−114.1	19.066	110.9	0.033	63.0	0.435	−48.4	27.2
300	0.344	−137.5	13.551	100.7	0.043	64.5	0.332	−50.7	23.7
400	0.331	−152.5	10.409	94.2	0.053	66.7	0.277	−51.1	21.2
500	0.325	−163.0	8.449	89.5	0.064	67.6	0.243	−51.4	19.3
600	0.322	−171.3	7.125	85.3	0.075	68.2	0.220	−51.5	17.7
700	0.320	−178.5	6.163	81.8	0.086	68.3	0.203	−52.0	16.4
800	0.320	174.7	5.431	78.4	0.096	68.3	0.188	−52.5	15.3
900	0.322	168.4	4.852	75.4	0.107	67.9	0.174	−53.7	14.3
1000	0.330	162.7	4.382	72.5	0.118	67.4	0.161	−55.5	13.4
1200	0.349	153.2	3.693	67.2	0.140	66.0	0.137	−61.3	12.0
1400	0.368	146.6	3.208	61.9	0.160	64.1	0.122	−69.3	10.8
1600	0.378	139.8	2.834	56.8	0.182	62.7	0.105	−76.9	9.8
1800	0.391	132.1	2.559	52.2	0.205	59.8	0.084	−85.2	8.9
2000	0.417	124.6	2.343	47.5	0.225	57.8	0.060	−106.5	8.2
2200	0.454	119.2	2.164	43.1	0.243	55.4	0.057	−146.4	7.7
2400	0.478	116.0	1.984	38.7	0.258	54.0	0.077	−169.5	7.1
2600	0.486	112.1	1.852	34.4	0.283	50.7	0.088	177.2	6.6
2800	0.489	105.5	1.735	29.4	0.299	46.8	0.089	159.1	6.0
3000	0.517	97.9	1.654	25.2	0.317	45.0	0.108	135.4	5.8

Table 15 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.50	0.277	171.0	0.10
2000	2.20	0.514	−144.0	0.15

Table 16 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.522	−40.8	48.316	150.9	0.010	73.6	0.820	−23.8	39.9
100	0.403	−86.7	34.010	125.2	0.020	65.9	0.574	−42.6	33.1
200	0.328	−127.3	20.288	106.7	0.031	66.7	0.365	−51.0	27.3
300	0.310	−148.1	14.166	97.8	0.042	69.2	0.276	−52.2	23.8
400	0.305	−161.0	10.806	92.1	0.053	70.6	0.230	−52.0	21.3
500	0.304	−170.1	8.740	87.8	0.065	71.1	0.203	−51.9	19.4
600	0.304	−177.1	7.354	84.0	0.076	71.4	0.183	−52.1	17.9
700	0.303	176.6	6.350	80.7	0.087	70.9	0.168	−52.4	16.6
800	0.304	170.5	5.594	77.5	0.098	70.5	0.155	−53.0	15.5
900	0.308	164.7	4.996	74.7	0.110	69.9	0.142	−54.2	14.5
1000	0.317	159.2	4.507	72.0	0.122	69.0	0.129	−56.2	13.6
1200	0.337	150.7	3.797	66.8	0.144	67.1	0.107	−63.0	12.2
1400	0.357	144.6	3.297	61.7	0.165	64.9	0.093	−72.6	11.0
1600	0.367	138.4	2.907	56.7	0.188	63.1	0.076	−81.9	9.9
1800	0.379	130.8	2.628	52.1	0.211	60.0	0.056	−93.8	9.1
2000	0.405	123.4	2.402	47.6	0.231	57.7	0.038	−131.5	8.4
2200	0.443	118.5	2.216	43.3	0.249	55.1	0.053	−179.3	7.9
2400	0.468	115.4	2.033	39.2	0.264	53.5	0.080	167.5	7.3
2600	0.476	111.7	1.897	34.8	0.290	50.1	0.094	157.4	6.7
2800	0.481	105.2	1.774	29.9	0.305	46.0	0.100	140.9	6.2
3000	0.508	97.6	1.692	25.7	0.323	44.1	0.125	122.2	5.9

Table 17 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.70	0.342	180.0	0.09
2000	2.40	0.533	−139.0	0.17

Table 18 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.449	–48.1	54.881	147.6	0.010	73.6	0.778	–26.5	39.8
100	0.351	–97.1	36.115	121.5	0.018	67.0	0.519	–45.1	33.1
200	0.304	–135.7	20.825	104.4	0.030	69.2	0.324	–52.1	27.3
300	0.296	–154.6	14.414	96.2	0.041	71.4	0.245	–52.6	23.8
400	0.296	–166.0	10.964	90.9	0.053	72.6	0.205	–52.1	21.4
500	0.296	–174.1	8.852	86.8	0.065	72.9	0.180	–51.9	19.5
600	0.297	179.5	7.438	83.2	0.076	72.6	0.163	–52.1	17.9
700	0.298	173.6	6.422	80.0	0.088	72.4	0.149	–52.5	16.7
800	0.299	168.0	5.654	76.9	0.100	71.6	0.137	–52.9	15.5
900	0.303	162.5	5.052	74.2	0.112	70.7	0.125	–54.3	14.6
1000	0.313	157.3	4.558	71.5	0.123	69.8	0.113	–56.4	13.7
1200	0.334	149.2	3.835	66.5	0.146	67.6	0.091	–64.0	12.2
1400	0.353	143.4	3.326	61.5	0.168	65.2	0.077	–75.2	11.0
1600	0.364	137.6	2.936	56.6	0.191	63.2	0.061	–86.6	10.0
1800	0.376	130.2	2.653	52.1	0.214	60.0	0.042	–102.8	9.1
2000	0.402	122.8	2.425	47.6	0.234	57.6	0.032	–156.4	8.5
2200	0.440	117.9	2.236	43.3	0.253	55.0	0.057	164.5	7.9
2400	0.466	114.9	2.049	39.2	0.268	53.2	0.086	156.7	7.3
2600	0.474	111.4	1.913	34.8	0.293	49.7	0.101	148.5	6.8
2800	0.477	105.0	1.786	30.0	0.308	45.7	0.109	133.1	6.2
3000	0.506	97.4	1.705	25.7	0.326	43.6	0.137	116.9	6.0

Table 19 Noise data, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.90	0.397	–174.0	0.08
2000	2.60	0.530	–138.0	0.21

Table 20 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.399	−54.3	59.171	145.2	0.009	72.8	0.744	−28.3	39.7
100	0.322	−105.0	37.203	119.1	0.018	68.0	0.481	−46.6	33.0
200	0.293	−141.7	21.045	102.9	0.029	70.9	0.297	−52.5	27.3
300	0.291	−158.9	14.501	95.2	0.041	73.2	0.225	−52.5	23.8
400	0.293	−169.2	11.008	90.1	0.053	73.8	0.189	−51.8	21.4
500	0.295	−176.7	8.883	86.2	0.065	73.9	0.166	−51.5	19.5
600	0.296	177.4	7.457	82.6	0.077	73.6	0.150	−51.7	17.9
700	0.297	171.9	6.437	79.6	0.089	73.1	0.138	−52.1	16.7
800	0.299	166.3	5.668	76.6	0.100	72.2	0.126	−52.6	15.5
900	0.302	161.0	5.060	73.8	0.112	71.2	0.114	−54.0	14.6
1000	0.313	156.2	4.568	71.2	0.124	70.3	0.103	−56.3	13.7
1200	0.334	148.3	3.841	66.2	0.147	67.9	0.082	−64.4	12.2
1400	0.354	142.6	3.330	61.2	0.169	65.4	0.068	−77.1	11.0
1600	0.363	136.8	2.939	56.4	0.192	63.3	0.053	−89.9	10.0
1800	0.377	129.8	2.656	51.9	0.216	59.9	0.034	−111.7	9.2
2000	0.404	122.5	2.427	47.4	0.236	57.6	0.031	−173.9	8.5
2200	0.441	117.6	2.237	43.1	0.255	54.9	0.061	156.5	7.9
2400	0.467	114.6	2.053	39.2	0.270	53.1	0.090	151.4	7.4
2600	0.475	111.1	1.915	34.7	0.295	49.5	0.106	144.0	6.8
2800	0.479	104.8	1.786	29.9	0.310	45.4	0.115	129.3	6.2
3000	0.507	97.2	1.706	25.7	0.328	43.4	0.143	114.4	6.0

NPN 8 GHz wideband transistor — BFG590; BFG590/X; BFG590/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG590 is an NPN silicon planar epitaxial transistor, intended for wideband applications in the HF and GHz range, such as MATV/CATV amplifiers and RF communications subscriber equipment. It is ideally suitable for use in class-A, (A)B and C amplifiers with either pulsed or continuous drive.

The transistor is mounted in a plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG590 (Fig.1) Code: N38	
1	collector
2	base
3	emitter
4	emitter
BFG590/X (Fig.1) Code: N44	
1	collector
2	emitter
3	base
4	emitter
BFG590/XR (Fig.2) Code: N50	
1	collector
2	emitter
3	base
4	emitter

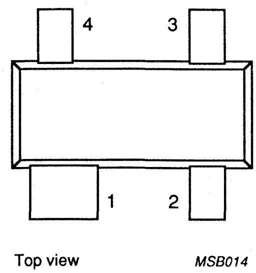


Fig.1 SOT143.

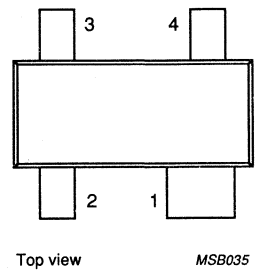


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	200	mA
P_{tot}	total power dissipation	up to $T_s = 33$ °C (note 1)	–	–	650	mW
h_{FE}	DC current gain	$V_{CE} = 10$ V; $I_C = 90$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CE} = 10$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	$V_{CE} = 10$ V; $I_C = 90$ mA	–	8	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 5$ V; $I_C = 80$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	$V_{CE} = 5$ V; $I_C = 80$ mA; $T_{amb} = 25$ °C; f = 900 MHz	10	11	–	dB
P_{L1}	output power at 1 dB gain compression	$V_{CE} = 5$ V; $I_C = 80$ mA; f = 900 MHz	–	21	–	dBm
T_j	junction temperature		–	–	180	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	note 1	180 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 8 GHz wideband transistor | BFG591

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG591 is an NPN silicon planar epitaxial transistor, intended for wideband applications in the GHz range, such as MATV/CATV amplifiers and RF communications subscriber equipment.

The transistor is mounted in a plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

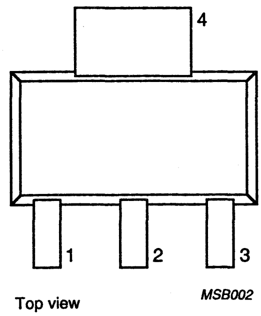


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	200	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	1.2	W
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 90 mA	60	120	250	
C_{re}	feedback capacitance	V_{CE} = 10 V; I_C = i_c = 0; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 90 mA	–	8	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	–	12	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	9	10	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	–	25	–	dBm
T_j	junction temperature		–	–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	50 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 8 GHz wideband transistor | BFG621

FEATURES

- Low distortion
- Gold metallization ensures excellent reliability
- SOT223 plastic envelope
- High output voltage
- Integrated emitter-ballasting resistors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

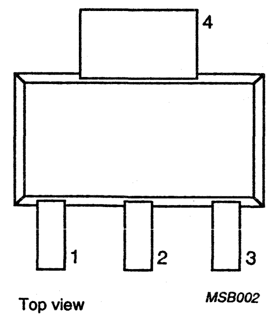


Fig.1 SOT223.

DESCRIPTION

The BFG621 is an NPN silicon planar epitaxial transistor, primarily intended for use as a power amplifier in RF communications subscriber equipment and MATV/CATV amplifiers.

The transistor is mounted in a plastic SOT223 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	1	W
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 10 V; f = 1 MHz	0.9	–	pF
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 50 mA	80	–	
f_T	transition frequency	V_{CE} = 10 V; I_C = 100 mA; f = 500 MHz	8	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; f = 800 MHz	14	–	dB
V_O	output voltage	V_{CE} = 10 V; I_C = 100 mA; R_L = 75 Ω (note 2)	0.85	–	V
d_2	second order intermodulation distortion	V_{CE} = 10 V; I_C = 100 mA; V_O = 54 dBmV (0.5 V); $f_{(p+q)}$ = 810 MHz	–50	–	dB
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	35 K/W

Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. d_{im} = –60 dB (3-tone); $V_p = V_O$; $V_q = V_r = V_O$ –6 dB; f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at $f_{(p+q-r)}$ = 793.25 MHz.

NPN 7 GHz wideband transistor — BFG741

FEATURES

- Low distortion
- Gold metallization ensures excellent reliability
- SOT223 plastic envelope
- High output voltage
- Integrated emitter-ballasting resistors

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

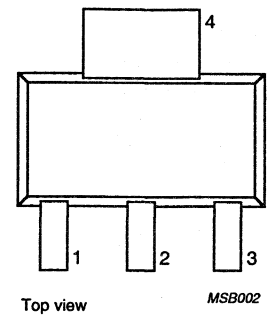


Fig.1 SOT223.

DESCRIPTION

The BFG741 is an NPN silicon planar epitaxial transistor, primarily intended for use as a power amplifier in RF communications subscriber equipment and MATV/CATV amplifiers.

The transistor is mounted in a plastic SOT223 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	–	2	W
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 10 V; f = 1 MHz	–	1.8	–	pF
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 100 mA	60	–	–	
f_T	transition frequency	V_{CE} = 10 V; I_C = 200 mA; f = 500 MHz	–	7	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 10 V; I_C = 130 mA; T_{amb} = 25 °C; f = 800 MHz	–	13	–	dB
V_O	output voltage	V_{CE} = 10 V; I_C = 130 mA; R_L = 75 Ω (note 2)	–	1	–	V
d_2	second order intermodulation distortion	V_{CE} = 10 V; I_C = 130 mA; T_{amb} = 25 °C; V_O = 54 dBmV (0.5 V); $f_{(p+q)}$ = 810 MHz	–	–60	–	dB
T_j	junction temperature		–	–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	25 K/W

Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. d_{im} = –60 dB (3-tone); $V_p = V_O$; $V_q = V_r = V_O$ –6 dB; f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at $f_{(p+q-r)}$ = 793.25 MHz.

NPN 5 GHz wideband transistor | BFP90A

DESCRIPTION

NPN transistor in hermetically sealed, sub-miniature SOT173 and SOT173X micro-stripline envelopes. It is designed for RF wideband amplifiers and applications up to 1 GHz.

The transistor features low noise, high gain and low distortion figures.

PINNING

PIN	DESCRIPTION
Code: P0	
1	collector
2	emitter
3	base (indicated by red dot on body)
4	emitter

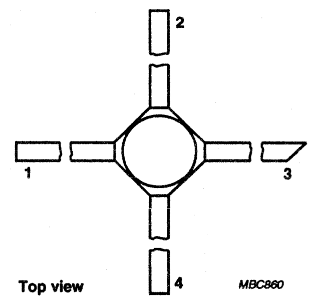


Fig.1 SOT173.

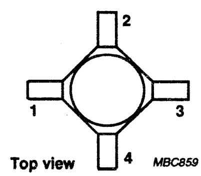


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	30	mA
P_{tot}	total power dissipation	up to T_s = 137 °C (note 1)	–	–	450	mW
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	–	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	23.5	–	dB
		I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	19.5	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	30	mA
P_{tot}	total power dissipation	up to T_s = 137 °C (note 1)	–	450	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 137 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V	40	90	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	23.5	–	dB
		I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	19.5	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 10 V; Z_S = opt. f = 800 MHz; T_{amb} = 25 °C	–	1.7	–	dB
		I_C = 14 mA; V_{CE} = 10 V; Z_S = opt. f = 800 MHz; T_{amb} = 25 °C	–	2.4	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

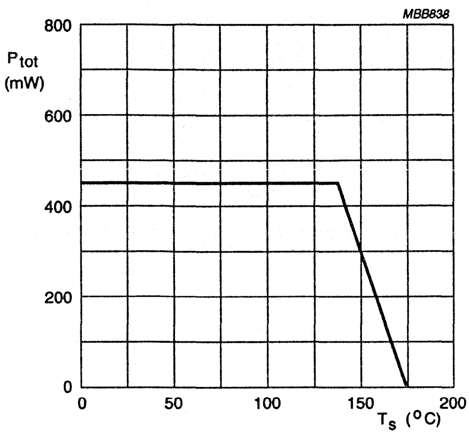
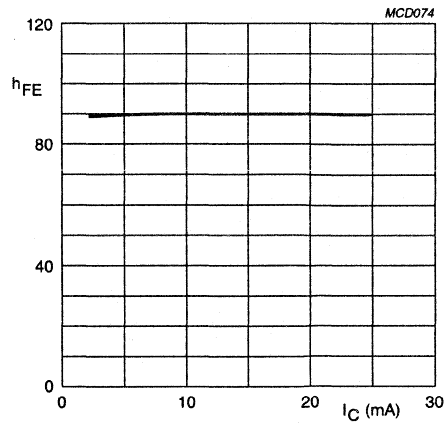
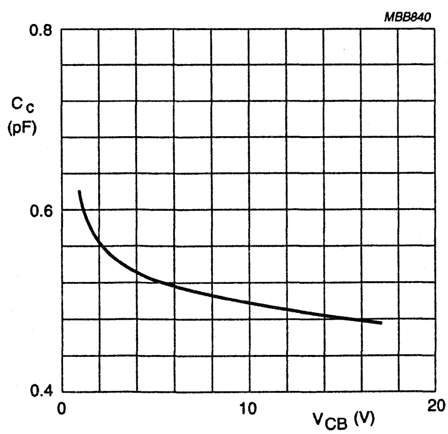


Fig.3 Power derating curve.



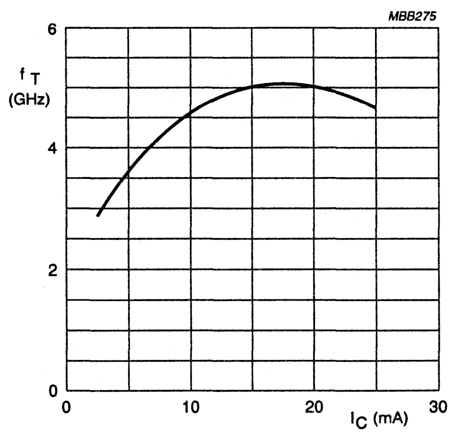
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



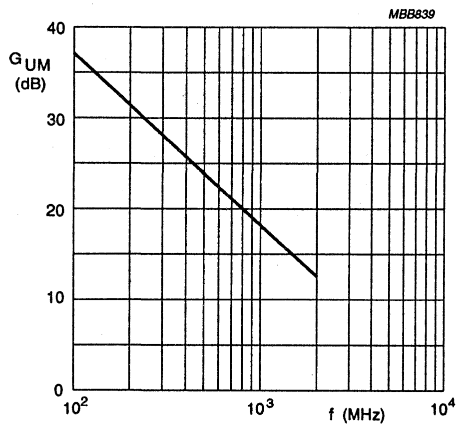
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



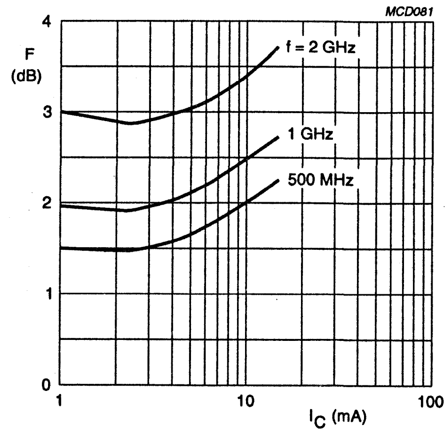
V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



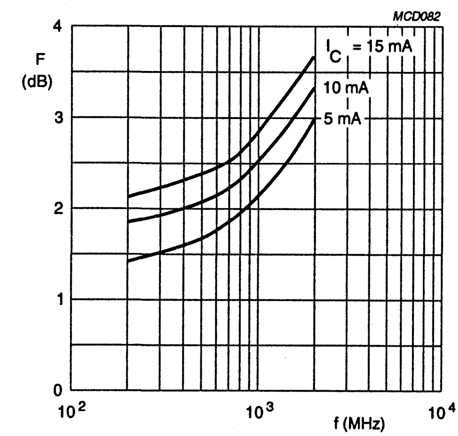
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



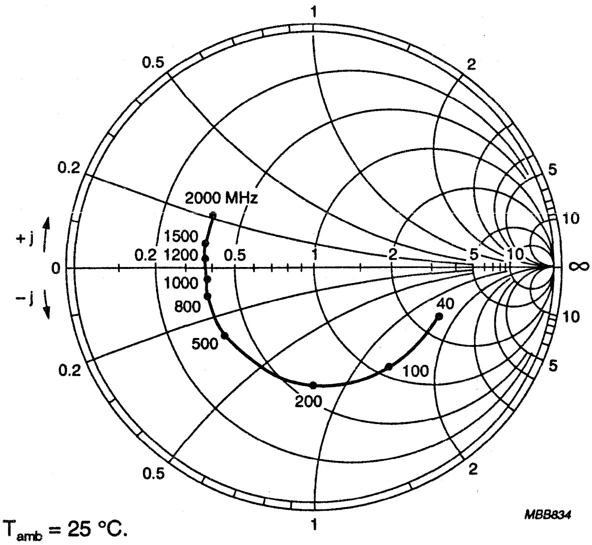
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Minimum noise figure as a function of collector current.



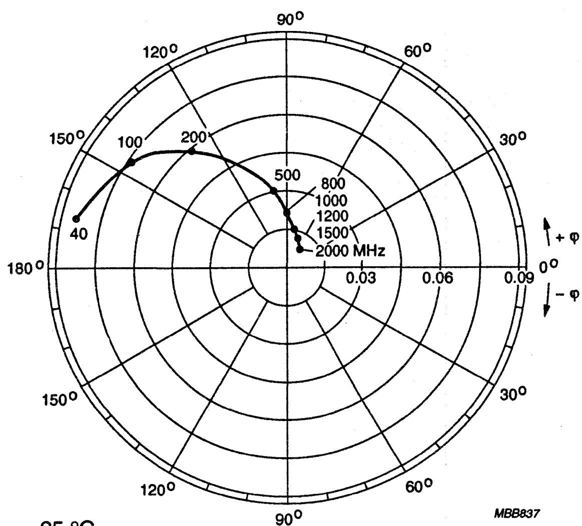
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.9 Minimum noise figure as a function of frequency.



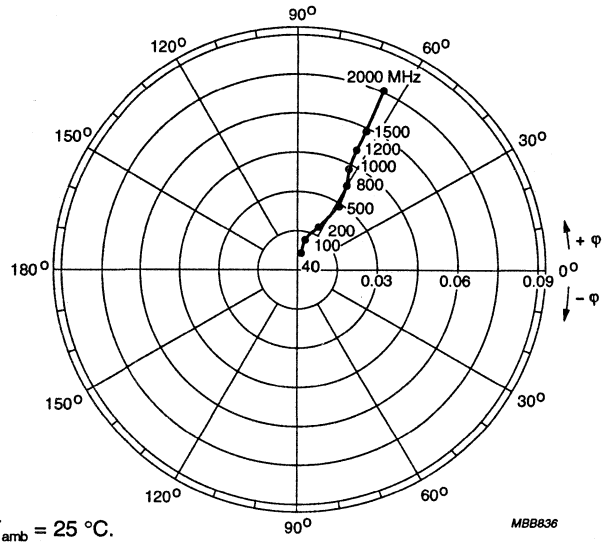
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.10 Common emitter input reflection coefficient (S_{11}).



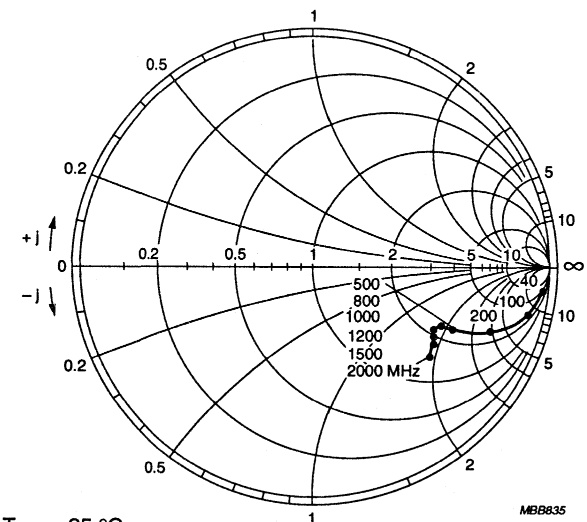
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter forward transmission coefficient (S_{21}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter reverse transmission coefficient (S_{12}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter output reflection coefficient (S_{22}).

NPN 5 GHz wideband transistor BFP90A

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.698	−18.0	24.215	168.0	0.007	89.2	0.976	−6.5	43.7
100	0.656	−43.1	22.078	152.1	0.015	71.6	0.915	−15.0	37.2
200	0.589	−76.3	17.817	133.3	0.025	58.2	0.786	−23.8	31.0
300	0.538	−101.4	14.180	120.2	0.030	53.8	0.683	−27.9	27.2
400	0.510	−117.7	11.468	111.4	0.035	50.4	0.614	−29.5	24.6
500	0.503	−130.0	9.636	105.3	0.038	51.1	0.571	−30.0	22.7
600	0.491	−139.2	8.240	100.3	0.042	52.9	0.542	−30.5	21.0
700	0.484	−145.9	7.202	96.3	0.044	52.7	0.522	−30.9	19.7
800	0.476	−151.9	6.398	92.5	0.048	53.7	0.508	−31.3	18.5
900	0.465	−157.5	5.712	89.3	0.051	53.8	0.498	−31.9	17.4
1000	0.465	−162.3	5.173	86.4	0.055	55.8	0.490	−32.6	16.5
1200	0.464	−171.1	4.333	81.4	0.061	56.3	0.475	−34.5	14.9
1400	0.467	−178.1	3.762	76.9	0.069	56.5	0.468	−37.1	13.6
1600	0.471	177.7	3.318	72.3	0.074	57.6	0.465	−39.6	12.6
1800	0.466	172.7	2.952	68.9	0.082	58.7	0.459	−42.3	11.5
2000	0.469	166.9	2.680	65.1	0.087	59.4	0.447	−44.7	10.6

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.612	−23.5	31.011	165.4	0.007	92.7	0.965	−8.2	43.5
100	0.574	−54.4	27.158	147.0	0.014	66.5	0.877	−17.8	36.8
200	0.523	−92.1	20.504	127.2	0.021	58.7	0.722	−26.1	30.8
300	0.496	−117.1	15.649	114.8	0.026	52.2	0.618	−28.7	27.2
400	0.480	−132.1	12.394	106.7	0.030	53.6	0.557	−29.3	24.6
500	0.485	−142.5	10.273	101.3	0.034	53.4	0.522	−29.1	22.8
600	0.478	−150.1	8.718	96.8	0.037	57.7	0.499	−29.2	21.2
700	0.477	−155.7	7.582	93.3	0.041	56.9	0.483	−29.5	19.9
800	0.471	−161.0	6.711	89.9	0.043	58.2	0.474	−29.8	18.7
900	0.466	−165.7	5.984	87.0	0.048	58.2	0.466	−30.3	17.7
1000	0.465	−170.0	5.408	84.3	0.051	60.3	0.460	−31.1	16.7
1200	0.471	−177.2	4.522	79.8	0.058	60.3	0.449	−33.3	15.2
1400	0.471	177.0	3.913	75.6	0.065	60.8	0.443	−35.7	13.9
1600	0.478	173.3	3.451	71.3	0.073	62.1	0.442	−38.3	12.8
1800	0.476	168.7	3.067	68.0	0.080	62.5	0.437	−40.8	11.8
2000	0.480	163.6	2.783	64.4	0.086	61.6	0.426	−43.3	10.9

Table 3 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.730	−16.6	23.896	168.4	0.007	93.7	0.977	−6.0	44.2
100	0.685	−39.5	21.957	153.1	0.015	71.2	0.922	−13.8	37.8
200	0.606	−71.3	17.946	134.6	0.023	59.5	0.805	−22.1	31.6
300	0.543	−95.5	14.412	121.5	0.029	54.1	0.706	−25.9	27.7
400	0.506	−112.1	11.712	112.5	0.034	51.7	0.640	−27.7	24.9
500	0.493	−124.4	9.867	106.4	0.038	50.7	0.600	−28.3	23.0
600	0.475	−133.9	8.456	101.2	0.041	54.2	0.570	−28.9	21.4
700	0.467	−141.3	7.400	97.2	0.044	53.3	0.550	−29.3	20.0
800	0.457	−147.3	6.577	93.4	0.047	54.2	0.537	−29.8	18.9
900	0.444	−153.2	5.878	90.1	0.050	53.9	0.528	−30.4	17.8
1000	0.441	−158.6	5.320	87.2	0.054	57.1	0.518	−31.1	16.8
1200	0.440	−167.4	4.460	82.2	0.060	56.4	0.505	−33.3	15.2
1400	0.443	−174.6	3.875	77.7	0.067	57.7	0.498	−35.7	14.0
1600	0.448	−178.9	3.421	73.1	0.074	58.3	0.494	−38.4	12.9
1800	0.442	176.3	3.045	69.7	0.080	58.5	0.489	−40.9	11.8
2000	0.449	170.2	2.763	65.9	0.087	59.1	0.477	−43.2	10.9

Table 4 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.663	−20.9	30.454	166.0	0.006	94.9	0.967	−7.3	44.1
100	0.613	−48.9	26.979	148.3	0.014	69.1	0.889	−16.2	37.5
200	0.536	−85.0	20.716	128.7	0.021	58.3	0.746	−24.2	31.3
300	0.494	−109.4	15.978	116.1	0.026	55.0	0.647	−26.8	27.6
400	0.471	−124.9	12.710	107.9	0.030	55.0	0.586	−27.5	25.0
500	0.467	−135.9	10.562	102.4	0.033	54.3	0.552	−27.5	23.1
600	0.456	−144.5	8.977	97.8	0.037	57.6	0.530	−27.6	21.5
700	0.451	−150.5	7.818	94.2	0.039	56.1	0.512	−28.1	20.2
800	0.445	−155.8	6.923	90.8	0.043	59.1	0.504	−28.4	19.0
900	0.439	−160.9	6.172	87.8	0.047	59.8	0.496	−28.9	18.0
1000	0.441	−165.4	5.578	85.1	0.052	60.3	0.489	−29.7	17.1
1200	0.440	−173.6	4.664	80.6	0.058	60.8	0.477	−31.8	15.4
1400	0.445	−179.8	4.046	76.4	0.064	60.3	0.472	−34.4	14.2
1600	0.449	176.5	3.568	72.1	0.071	62.0	0.472	−37.0	13.1
1800	0.448	171.7	3.167	68.8	0.078	61.5	0.466	−39.5	12.0
2000	0.450	166.8	2.873	65.3	0.085	62.4	0.455	−41.8	11.2

DESCRIPTION

NPN transistor in hermetically-sealed sub-miniature SOT173 and SOT173X micro-stripline envelopes. It features low noise, high gain and low distortion figures and is primarily designed for RF wideband amplifiers and applications up to 1 GHz.

PNP complement is BFQ23C.

PINNING

PIN	DESCRIPTION
Code: P1	
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

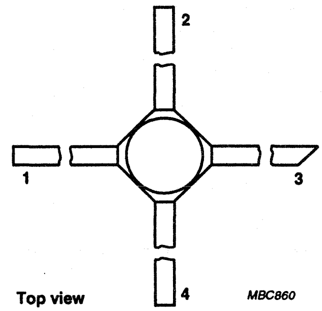


Fig.1 SOT173.

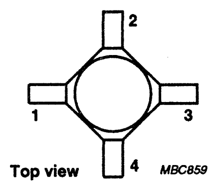


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	–	600	mW
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	–	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	22.5	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	18.5	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	600	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 10 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	22.5	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	18.5	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	1.6	–	dB
		I_C = 30 mA; V_{CE} = 8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

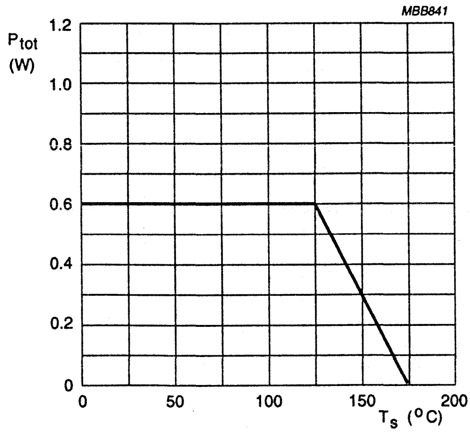
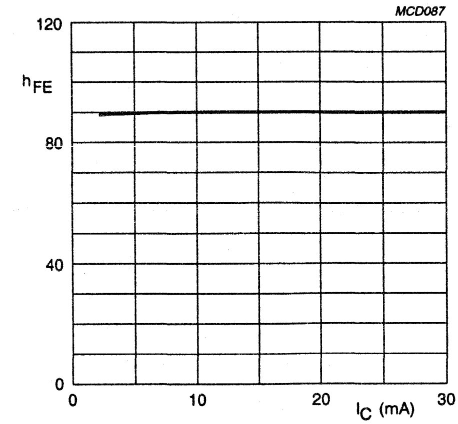
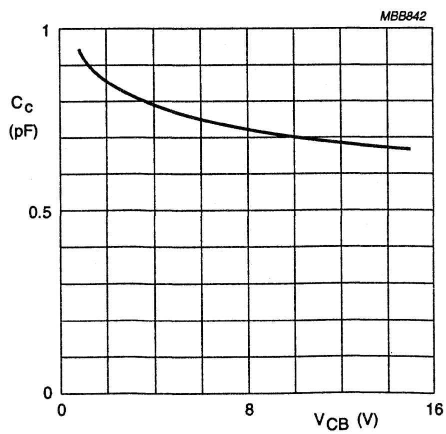


Fig.3 Power derating curve.



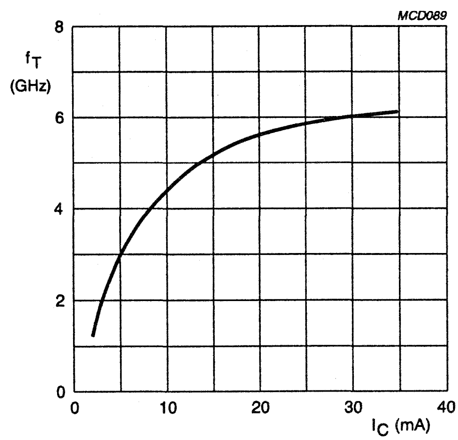
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



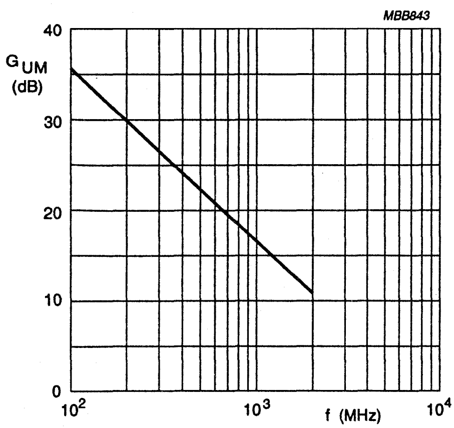
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



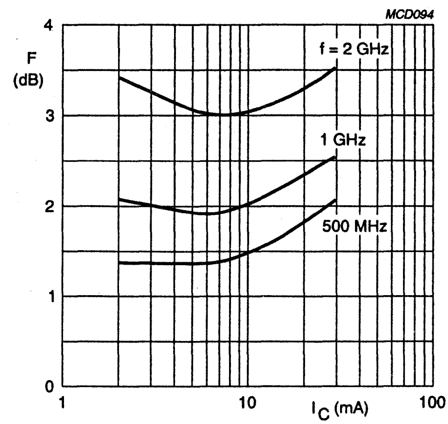
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



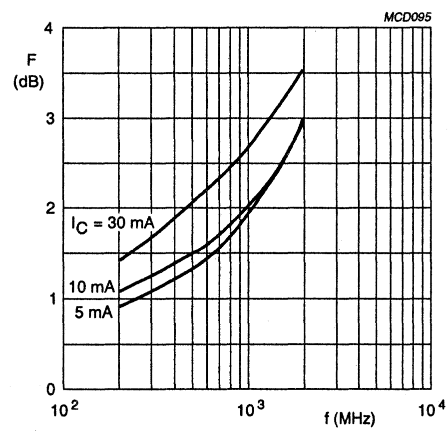
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



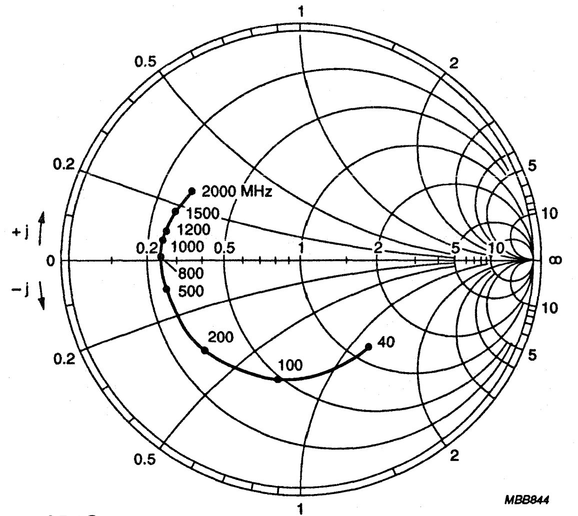
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Minimum noise figure as a function of collector current.



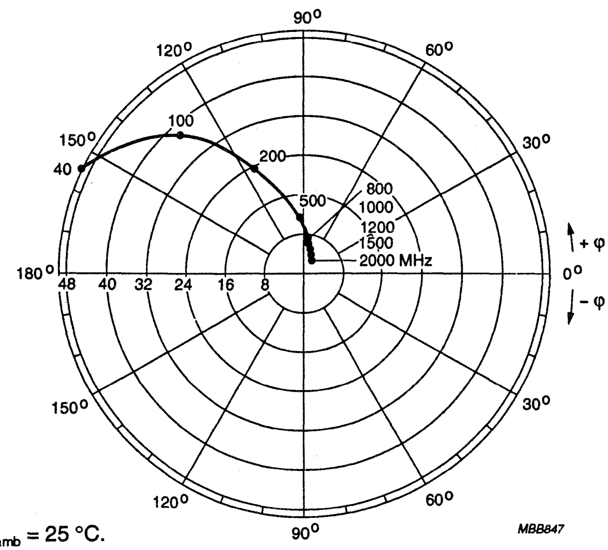
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Minimum noise figure as a function of frequency.



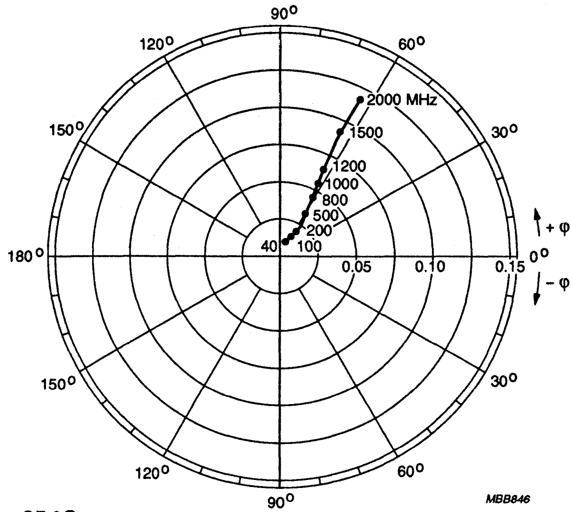
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Common emitter input reflection coefficient (S_{11}).



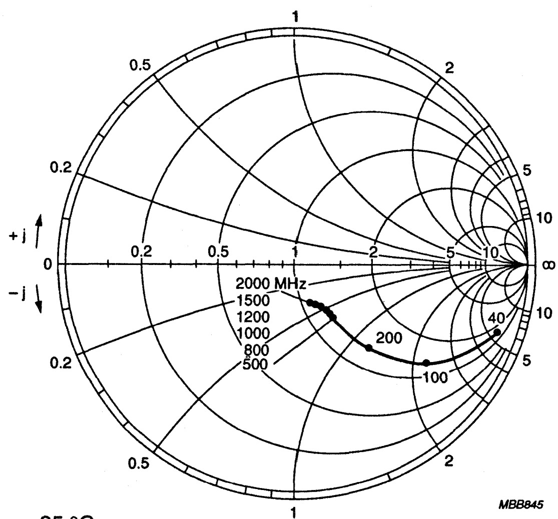
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.12 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.13 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.515	−41.4	39.659	159.9	0.009	82.4	0.931	−16.3	42.0
100	0.535	−87.5	31.553	137.1	0.019	61.0	0.755	−33.9	35.1
200	0.568	−126.3	21.122	117.1	0.025	49.3	0.524	−47.2	29.6
300	0.584	−145.5	15.157	106.4	0.030	47.4	0.398	−51.3	26.2
400	0.590	−156.0	11.706	99.8	0.033	49.0	0.330	−52.3	23.7
500	0.597	−162.9	9.563	95.2	0.038	52.0	0.292	−52.1	21.9
600	0.599	−168.4	8.046	91.4	0.042	55.9	0.266	−51.8	20.4
700	0.600	−172.1	6.960	88.3	0.045	57.2	0.250	−51.6	19.1
800	0.597	−176.1	6.143	85.5	0.050	59.1	0.239	−51.1	17.9
900	0.595	−179.5	5.476	83.1	0.055	59.5	0.230	−51.2	16.9
1000	0.597	177.6	4.958	80.8	0.059	61.4	0.223	−51.5	16.0
1200	0.601	171.9	4.140	76.6	0.068	62.0	0.215	−53.5	14.5
1400	0.603	167.2	3.561	72.7	0.076	63.0	0.209	−56.1	13.2
1600	0.606	163.9	3.148	68.6	0.084	63.8	0.212	−58.1	12.1
1800	0.598	159.8	2.810	65.2	0.096	63.7	0.209	−60.8	11.1
2000	0.601	155.3	2.549	62.0	0.104	64.8	0.201	−63.3	10.3

Table 2 Common emitter scattering parameters, $I_C = 30$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.430	−54.4	47.536	156.5	0.009	76.5	0.903	−19.6	41.8
100	0.496	−104.9	35.535	132.1	0.016	58.1	0.690	−38.7	35.0
200	0.555	−139.1	22.511	113.0	0.022	52.9	0.454	−50.7	29.7
300	0.582	−154.7	15.836	103.3	0.026	53.4	0.341	−53.8	26.3
400	0.591	−163.2	12.137	97.4	0.030	54.0	0.281	−54.1	23.9
500	0.597	−168.4	9.863	93.3	0.034	57.5	0.249	−53.5	22.1
600	0.599	−173.1	8.282	89.8	0.039	62.1	0.227	−52.9	20.5
700	0.598	−176.4	7.154	87.0	0.044	60.8	0.214	−52.3	19.2
800	0.597	−179.6	6.307	84.3	0.048	63.7	0.205	−51.9	18.1
900	0.597	177.4	5.623	82.1	0.053	64.4	0.199	−51.8	17.1
1000	0.598	174.4	5.086	79.9	0.058	66.9	0.192	−52.1	16.2
1200	0.602	169.6	4.245	76.0	0.068	66.2	0.184	−53.8	14.7
1400	0.606	165.0	3.646	72.3	0.077	67.0	0.181	−56.7	13.4
1600	0.609	162.6	3.225	68.3	0.086	66.9	0.184	−58.6	12.3
1800	0.598	158.5	2.877	64.8	0.096	65.7	0.181	−61.3	11.2
2000	0.601	154.3	2.611	62.0	0.105	66.7	0.174	−63.4	10.4

Table 3 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.547	−39.4	39.322	160.0	0.008	84.0	0.933	−15.0	42.3
100	0.549	−84.2	31.404	137.5	0.018	58.4	0.765	−30.9	35.3
200	0.568	−123.8	21.105	117.5	0.024	48.5	0.541	−42.0	29.7
300	0.579	−143.7	15.191	106.7	0.028	47.6	0.423	−44.3	26.3
400	0.581	−154.5	11.742	100.1	0.032	49.7	0.359	−44.3	23.8
500	0.589	−161.5	9.596	95.6	0.037	51.1	0.324	−43.3	22.0
600	0.591	−167.2	8.078	91.8	0.039	54.9	0.301	−42.7	20.4
700	0.592	−171.2	6.992	88.7	0.043	55.1	0.286	−42.3	19.1
800	0.587	−175.2	6.171	85.8	0.047	58.7	0.276	−41.6	18.0
900	0.586	−179.1	5.504	83.4	0.052	58.9	0.268	−41.5	17.0
1000	0.587	177.8	4.975	81.1	0.055	60.8	0.261	−41.5	16.1
1200	0.594	172.2	4.152	77.0	0.065	62.3	0.253	−43.2	14.5
1400	0.596	167.8	3.577	73.1	0.072	62.7	0.248	−45.3	13.3
1600	0.595	164.5	3.156	68.9	0.080	63.7	0.248	−47.3	12.2
1800	0.586	159.8	2.817	65.5	0.090	63.0	0.246	−49.7	11.1
2000	0.588	155.7	2.556	62.3	0.097	64.5	0.235	−51.6	10.2

Table 4 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.475	−48.9	47.699	157.1	0.008	83.2	0.910	−18.1	42.3
100	0.507	−97.9	36.132	133.1	0.016	60.1	0.707	−35.9	35.4
200	0.545	−134.2	23.140	113.8	0.022	52.8	0.476	−46.7	29.9
300	0.568	−151.6	16.353	104.0	0.025	52.4	0.364	−48.9	26.6
400	0.574	−160.6	12.551	97.9	0.029	53.3	0.305	−48.5	24.1
500	0.580	−166.3	10.211	93.8	0.033	56.7	0.274	−47.6	22.3
600	0.582	−171.1	8.574	90.3	0.038	60.8	0.254	−46.5	20.8
700	0.584	−174.8	7.407	87.4	0.041	62.0	0.240	−46.3	19.5
800	0.578	−178.0	6.532	84.8	0.047	63.4	0.232	−45.5	18.3
900	0.580	178.8	5.822	82.4	0.052	64.1	0.226	−45.5	17.3
1000	0.584	175.8	5.263	80.3	0.057	66.1	0.221	−45.6	16.4
1200	0.587	170.4	4.393	76.4	0.065	65.8	0.213	−47.4	14.9
1400	0.586	166.3	3.775	72.7	0.074	67.1	0.210	−49.7	13.6
1600	0.588	163.1	3.335	68.7	0.083	66.6	0.212	−51.6	12.5
1800	0.580	159.6	2.974	65.4	0.093	66.3	0.210	−54.4	11.4
2000	0.585	154.4	2.700	62.3	0.102	66.7	0.202	−56.7	10.6

NPN 5 GHz wideband transistor BFP96

DESCRIPTION

NPN transistor in hermetically sealed sub-miniature SOT173 and SOT173X micro-stripline envelopes. It features low noise, high gain and low distortion figures and is primarily intended for RF wideband amplifiers and applications up to 1 GHz.

PNP complement is BFQ32C.

PINNING

PIN	DESCRIPTION
	Code: P6
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

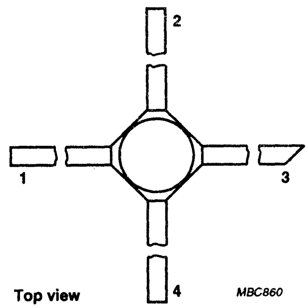


Fig.1 SOT173.

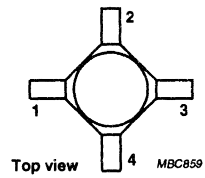


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 90 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_j = 25 °C	25	80	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	–	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 90 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 90 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.3	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	5.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	3.7	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

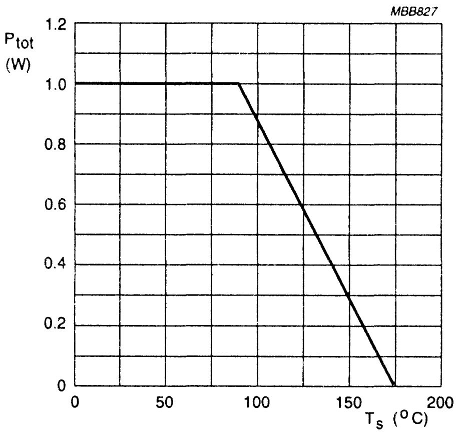
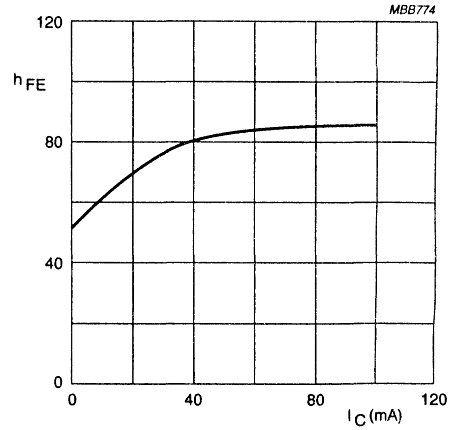
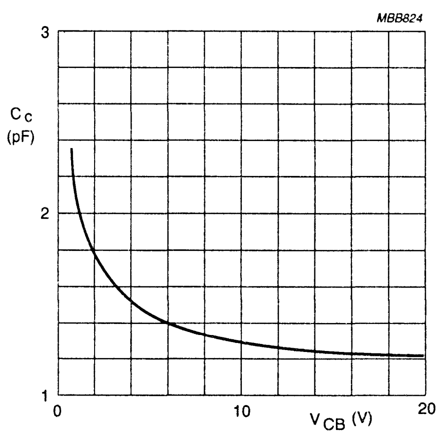


Fig.3 Power derating curve.



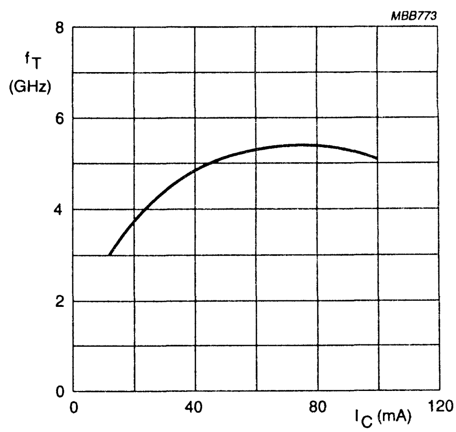
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

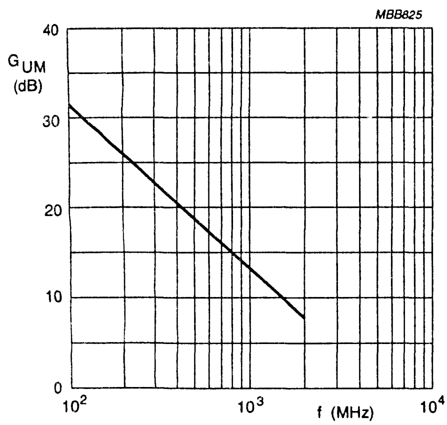
Fig.5 Collector capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

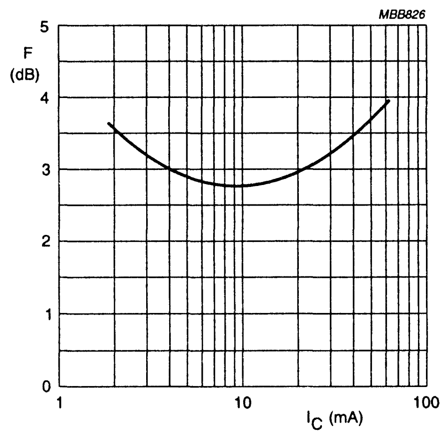
Fig.6 Transition frequency as a function of collector current.

NPN 5 GHz wideband transistor BFP96



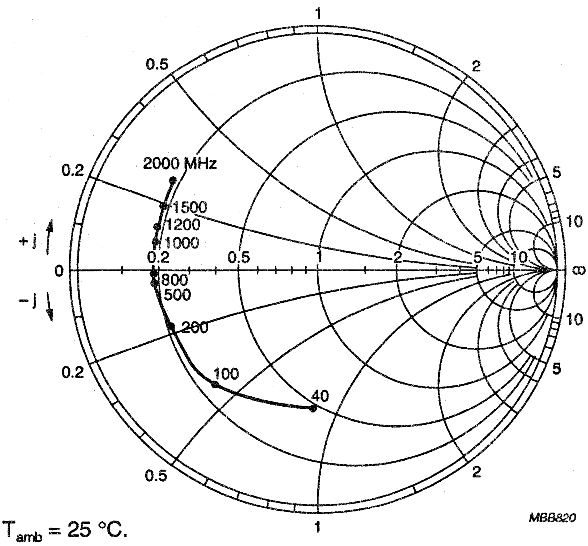
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



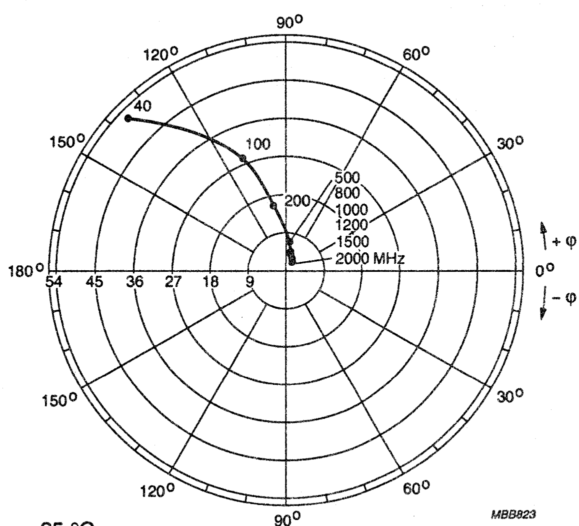
V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C.

Fig.8 Minimum noise figure as a function of collector current.



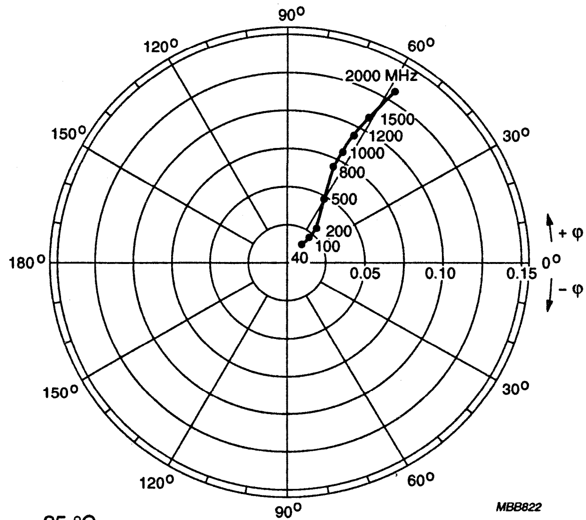
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.9 Common emitter input reflection coefficient (S_{11}).



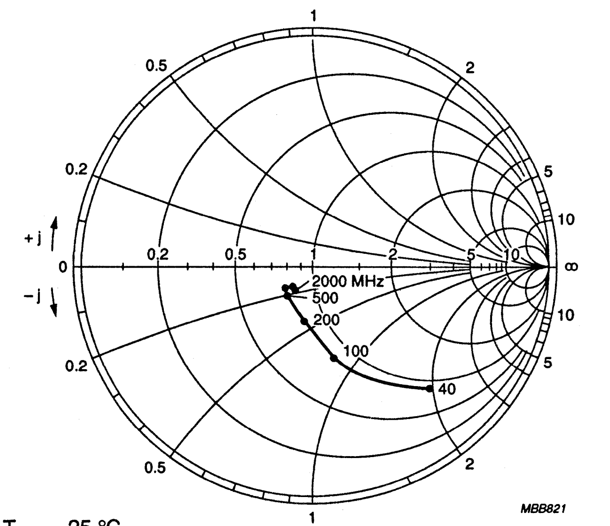
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.10 Common emitter forward transmission coefficient (S_{21}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter reverse transmission coefficient (S_{12}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.465	−121.9	50.515	138.8	0.010	62.4	0.750	−44.8	38.7
100	0.656	−153.2	28.622	113.6	0.016	48.5	0.437	−76.5	32.5
200	0.706	−168.1	15.449	99.8	0.021	53.2	0.260	−99.5	27.1
300	0.726	−174.5	10.464	93.6	0.026	57.0	0.200	−112.4	23.8
400	0.734	−178.3	7.933	89.2	0.032	62.5	0.176	−120.1	21.5
500	0.737	178.8	6.380	85.8	0.038	64.2	0.164	−125.3	19.6
600	0.736	176.7	5.327	83.0	0.043	65.4	0.159	−129.0	18.0
700	0.736	174.3	4.601	80.5	0.049	67.2	0.153	−131.1	16.7
800	0.733	172.3	4.060	78.0	0.056	69.1	0.152	−132.6	15.6
900	0.731	170.1	3.624	76.0	0.062	69.0	0.152	−133.9	14.6
1000	0.734	167.8	3.273	73.8	0.068	70.3	0.152	−134.0	13.8
1200	0.739	164.2	2.746	69.8	0.081	69.9	0.158	−135.4	12.3
1400	0.744	161.0	2.366	65.8	0.091	69.9	0.164	−136.0	11.1
1600	0.742	157.9	2.085	61.4	0.104	70.6	0.170	−135.5	10.0
1800	0.733	154.1	1.880	57.7	0.119	69.4	0.176	−136.7	9.0
2000	0.732	150.6	1.710	54.3	0.129	69.6	0.185	−138.8	8.1
2200	0.744	147.1	1.569	51.0	0.140	68.9	0.196	−142.0	7.6
2400	0.744	144.8	1.411	47.7	0.150	68.3	0.213	−144.8	6.7
2600	0.734	142.4	1.324	44.6	0.164	68.0	0.235	−145.9	6.0
2800	0.715	139.0	1.240	39.8	0.174	66.1	0.252	−146.2	5.3
3000	0.703	134.6	1.181	37.2	0.186	66.2	0.262	−147.2	4.7

Table 2 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.474	−106.0	52.454	138.8	0.0110	58.3	0.757	−40.6	39.2
100	0.632	−145.0	29.510	113.5	0.0170	41.4	0.435	−67.4	32.5
200	0.672	−164.0	15.987	99.9	0.0210	48.3	0.246	−83.0	27.0
300	0.690	−171.0	10.971	92.9	0.0270	57.4	0.179	−90.2	23.8
400	0.701	−176.0	8.224	89.2	0.0320	57.7	0.148	−95.2	21.3
500	0.700	−178.0	6.528	86.3	0.0360	63.2	0.133	−98.9	19.3
600	0.697	178.0	5.589	82.4	0.0430	65.4	0.124	−101.0	17.9
700	0.709	175.8	4.752	79.8	0.0490	64.5	0.119	−103.0	16.6
800	0.696	173.1	4.216	77.4	0.0550	67.3	0.117	−104.0	15.4
900	0.709	171.6	3.724	75.5	0.0600	65.5	0.116	−106.0	14.5
1000	0.704	168.6	3.391	72.6	0.0660	67.6	0.117	−107.0	13.6
1200	0.712	165.7	2.817	68.2	0.0780	67.6	0.122	−111.0	12.1
1400	0.720	162.2	2.464	64.9	0.0890	67.0	0.129	−114.0	11.1
1600	0.711	158.2	2.131	59.7	0.101	67.1	0.138	−116.0	9.71
1800	0.707	154.8	1.944	55.7	0.114	66.7	0.145	−118.0	8.88
2000	0.725	151.3	1.766	53.4	0.124	66.4	0.152	−123.0	8.28
2200	0.719	147.0	1.624	48.3	0.133	66.2	0.164	−130.0	7.49
2400	0.720	144.4	1.474	46.2	0.142	64.7	0.182	−135.0	6.69
2600	0.718	142.8	1.351	40.9	0.155	64.7	0.206	−138.0	5.95
2800	0.709	138.9	1.265	36.6	0.165	62.7	0.220	−140.0	5.29
3000	0.700	135.1	1.207	33.6	0.174	63.4	0.230	−143.0	4.79

NPN 9 GHz wideband transistor BFP505

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- Tape and reel packing for surface mounting (SOT173X).

DESCRIPTION

The BFP505 is an NPN silicon planar epitaxial transistor, intended for low current RF wideband applications up to 3 GHz.

The transistor is mounted in a hermetically sealed subminiature SOT173 and SOT173X envelope.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

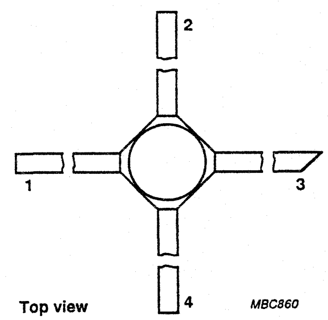


Fig.1 SOT173.

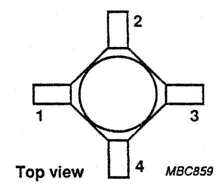


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 150 °C (note 1)	–	–	250	mW
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 20 mA	60	120	250	
C_{re}	feedback capacitance	V_{CE} = 6 V; $I_C = i_c = 0$; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA	–	9	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 9 GHz wideband transistor — BFP520

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- Tape and reel packing for surface mounting (SOT173X).

DESCRIPTION

The BFP520 is an NPN silicon planar epitaxial transistor, intended for RF wideband applications up to 3 GHz.

The transistor is mounted in a hermetically sealed subminiature SOT173 and SOT173X envelope.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

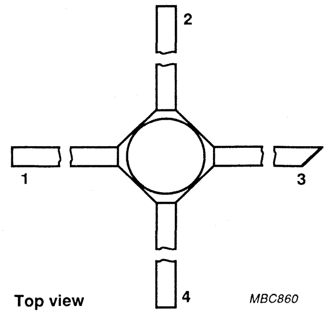


Fig.1 SOT173.

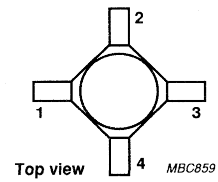


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to $T_s = 125$ °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	$V_{CE} = 6$ V; $I_C = 20$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CE} = 6$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$V_{CE} = 6$ V; $I_C = 20$ mA	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 6$ V; $I_C = 20$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	19	–	dB
		$V_{CE} = 6$ V; $I_C = 20$ mA; $T_{amb} = 25$ °C; f = 2 GHz	–	12	–	dB
$\|S_{21}\|^2$	insertion power gain	$V_{CE} = 6$ V; $I_C = 20$ mA; $T_{amb} = 25$ °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $V_{CE} = 6$ V; $I_C = 5$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	1.1	1.6	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	100 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

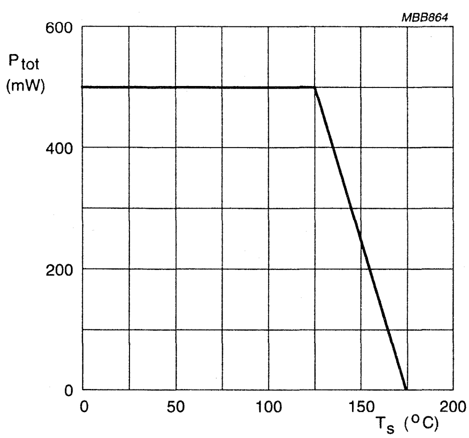
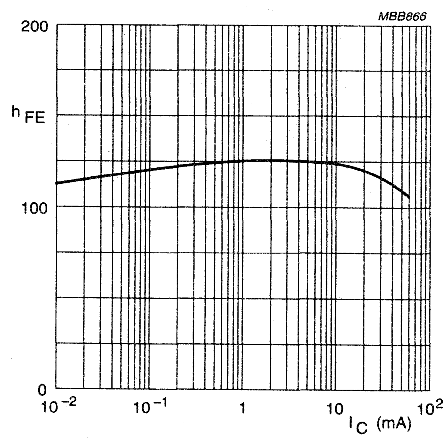
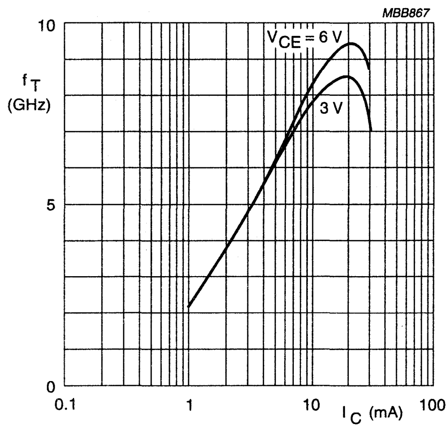


Fig.3 Power derating curve.



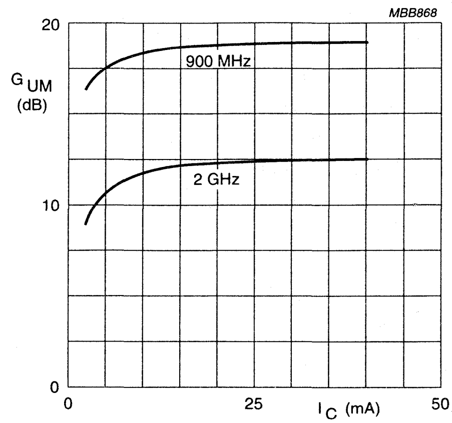
V_{CE} = 6 V.

Fig.4 DC current gain as a function of collector current.



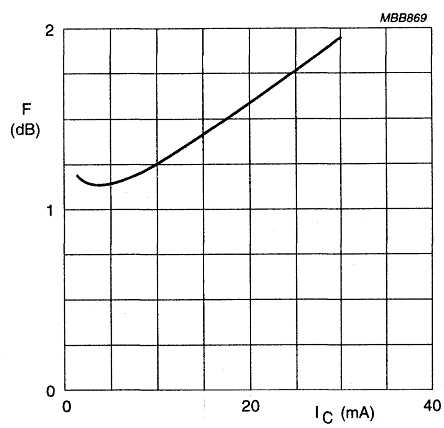
T_{amb} = 25 °C; f = 900 MHz.

Fig.5 Transition frequency as a function of collector current.



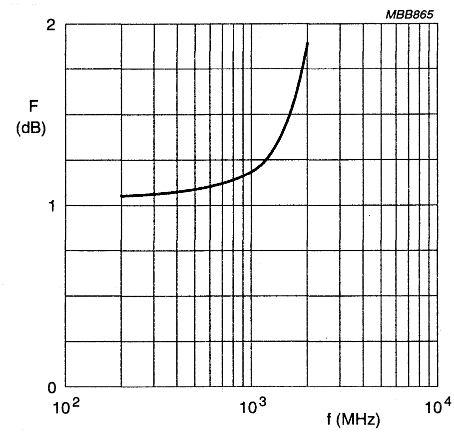
V_{CE} = 6 V.

Fig.6 Maximum unilateral power gain as a function of collector current.



V_{CE} = 6 V; f = 900 MHz.

Fig.7 Minimum noise figure as a function of collector current.



V_{CE} = 6 V; I_C = 5 mA.

Fig.8 Minimum noise figure as a function of frequency.

NPN 9 GHz wideband transistor

BFP540

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- Tape and reel packing for surface mounting (SOT173X).

DESCRIPTION

The BFP540 is an NPN silicon planar epitaxial transistor, intended for RF wideband applications up to 3 GHz.

The transistor is mounted in a hermetically sealed subminiature SOT173 and SOT173X envelope.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

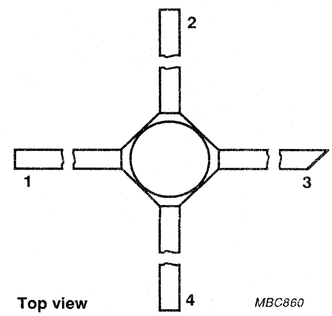


Fig.1 SOT173.

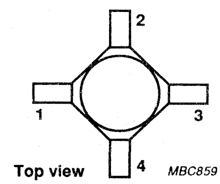


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to $T_s = 100$ °C (note 1)	–	–	750	mW
h_{FE}	DC current gain	$V_{CE} = 8$ V; $I_C = 20$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CE} = 8$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$V_{CE} = 8$ V; $I_C = 40$ mA	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 8$ V; $I_C = 40$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	18	–	dB
		$V_{CE} = 8$ V; $I_C = 40$ mA; $T_{amb} = 25$ °C; f = 2 GHz	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $V_{CE} = 8$ V; $I_C = 10$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	1.3	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 1 GHz wideband transistor — BFQ17

DESCRIPTION

NPN transistor in a SOT89 plastic envelope intended for application in thick and thin-film circuits. The transistor has extremely good intermodulation properties and a high power gain.

PINNING

PIN	DESCRIPTION
Code: FA	
1	emitter
2	base
3	collector

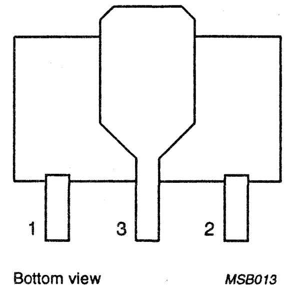


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_{CM}	peak collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	1.5	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	1.9	–	pF

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

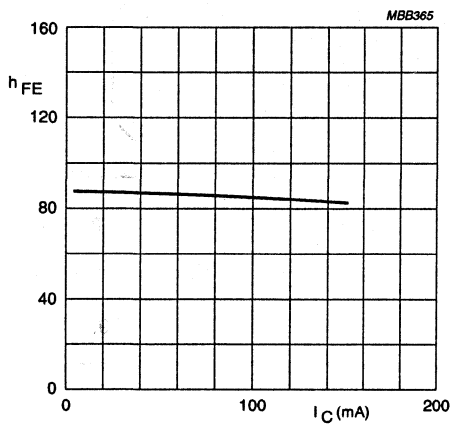
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V; T_j = 50 °C	–	–	20	μA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	0.5	V
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 15 V; f = 1 MHz	–	–	4	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	–	1.9	–	pF
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	–	1.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 60 mA; V_{CE} = 15 V; f = 200 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 60 mA; V_{CE} = 15 V; f = 800 MHz; T_{amb} = 25 °C	–	6.5	–	dB

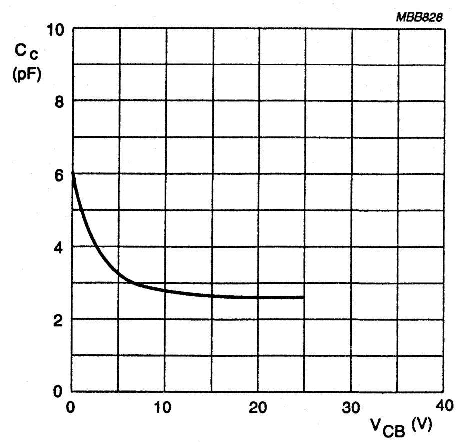
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.



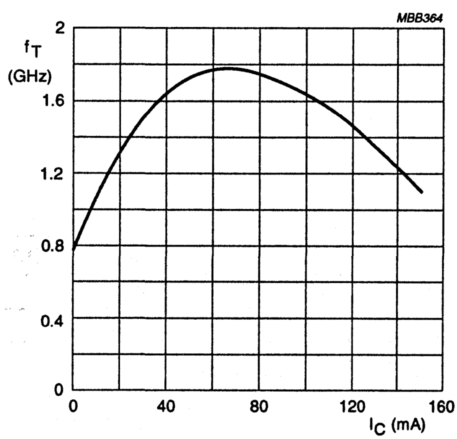
$V_{CE} = 5$ V; $T_j = 25$ °C.

Fig.2 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



$V_{CE} = 15$ V; f = 500 MHz; $T_j = 25$ °C.

Fig.4 Transition frequency as a function of collector current.

NPN 4 GHz wideband transistor | BFQ18A

DESCRIPTION

NPN transistor in a plastic SOT89 envelope intended for application in thick and thin-film circuits. It is primarily intended for MATV purposes.

PINNING

PIN	DESCRIPTION
Code: FF	
1	emitter
2	base
3	collector

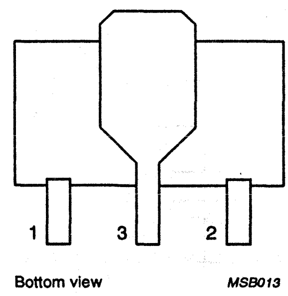


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	4	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 10.7 MHz	1.2	–	pF
d_{im}	intermodulation distortion	I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω; V_O = 700 mV; measured at $f_{(p+q-r)}$ = 793.25 MHz	–	–60	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	20 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

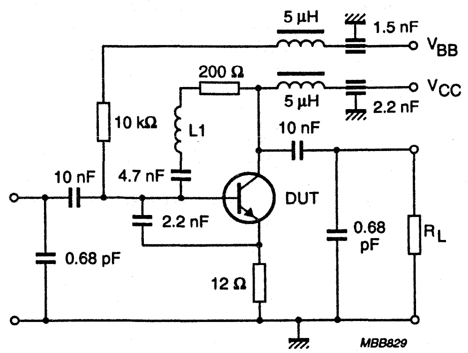
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 10.7 MHz	–	1.2	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz	–	4	GHz
d_{im}	intermodulation distortion (see Fig.2)	note 1	–	–60	dB

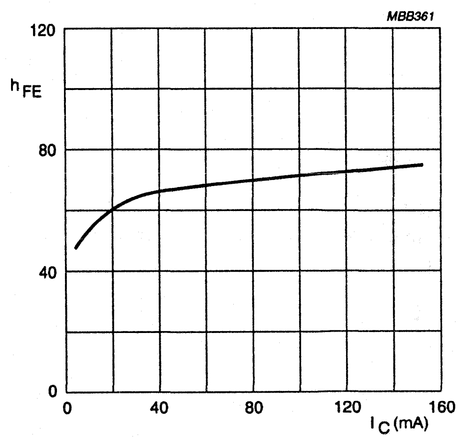
Note

1. I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω;
   $V_p = V_O$ = 700 mV; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



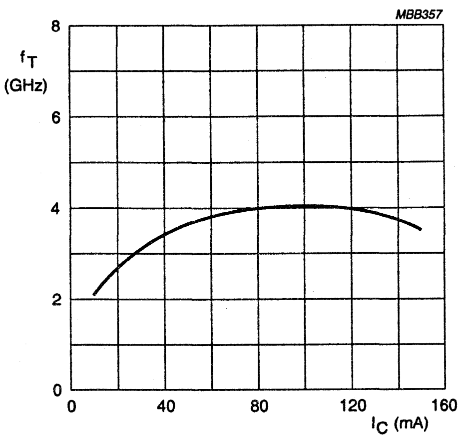
f = 40 - 860 MHz.

Fig.2 Intermodulation distortion MATV test circuit.



V_{CE} = 10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

Table 1 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.643	−49.9	26.561	143.3	0.027	68.3	0.807	−34.2	35.4
100	0.464	−96.0	16.118	116.8	0.047	57.0	0.509	−59.1	26.5
200	0.362	−135.8	9.205	100.8	0.069	59.2	0.304	−73.3	20.3
300	0.362	−157.6	6.337	90.5	0.090	63.1	0.231	−80.3	16.9
400	0.374	−172.5	4.851	83.9	0.112	65.6	0.199	−85.8	14.5
500	0.391	−177.8	3.946	78.7	0.135	66.5	0.184	−91.5	12.8
600	0.391	176.3	3.342	74.8	0.158	67.0	0.172	−96.5	11.3
700	0.393	171.4	2.915	69.9	0.181	67.6	0.168	−100.4	10.1
800	0.407	165.7	2.597	66.5	0.205	67.0	0.169	−104.5	9.2
900	0.407	160.4	2.383	62.8	0.229	66.1	0.174	−108.0	8.5
1000	0.417	157.7	2.181	59.5	0.250	65.4	0.178	−111.9	7.7
1200	0.458	145.8	1.880	52.5	0.292	63.9	0.194	−120.2	6.7
1400	0.499	139.3	1.662	47.3	0.337	62.4	0.210	−128.5	5.9
1600	0.513	132.1	1.504	40.0	0.378	58.1	0.204	−134.5	5.1
1800	0.531	125.3	1.418	37.2	0.410	57.6	0.244	−135.6	4.7
2000	0.579	121.3	1.333	32.2	0.453	55.4	0.274	−143.6	4.6
2200	0.619	117.5	1.252	29.1	0.489	53.7	0.307	−150.4	4.5
2400	0.626	113.0	1.182	24.7	0.525	50.8	0.344	−155.5	4.2
2600	0.638	110.5	1.088	20.0	0.545	48.1	0.366	−159.4	3.6
2800	0.645	106.5	1.057	16.4	0.575	46.7	0.397	−162.4	3.6
3000	0.672	101.6	1.048	14.0	0.609	43.7	0.427	−167.2	3.9

NPN 5 GHz wideband transistor — BFQ19

DESCRIPTION

NPN transistor in a SOT89 plastic envelope intended for application in thick and thin-film circuits. It is primarily intended for use in UHF and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features very low intermodulation distortion and high power gain. Due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PINNING

PIN	DESCRIPTION
Code: FB	
1	emitter
2	base
3	collector

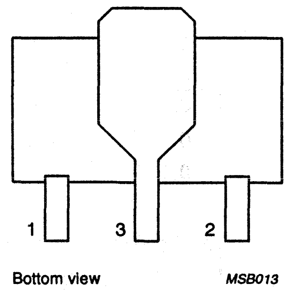


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5.5	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	1.3	–	pF
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	3.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3.3	V
I_C	DC collector current		–	100	mA
I_{CM}	peak collector current	f > 1 MHz	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermla resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

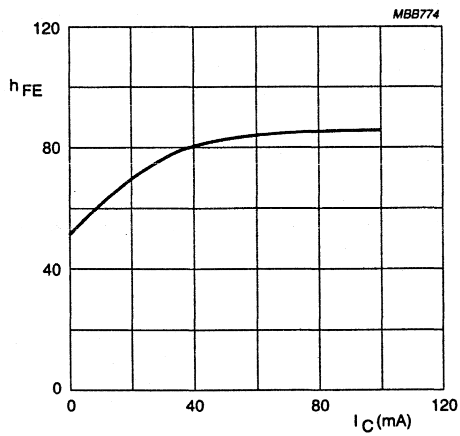
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.6	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	5	–	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	1.3	–	pF
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz	4.4	5.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	11.5	–	dB
		I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	7.5	–	dB
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	3.3	–	dB

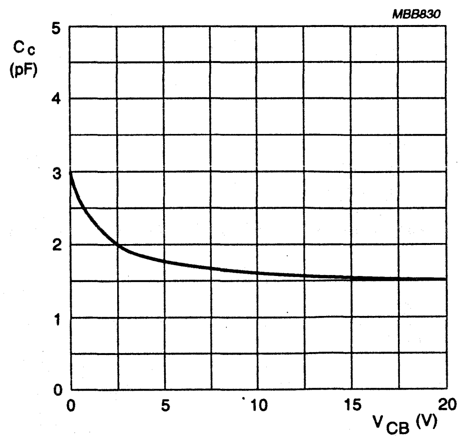
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.



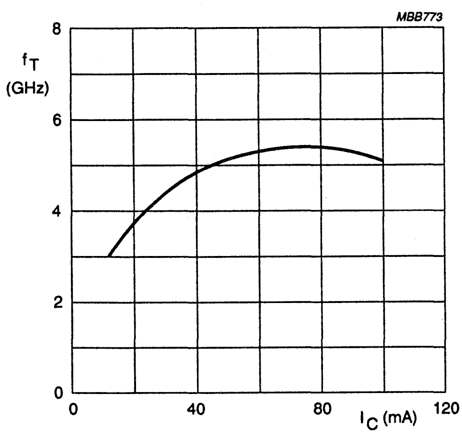
V_{CE} = 10 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

Table 1 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.289	−94.7	42.853	124.3	0.015	70.0	0.566	−48.2	34.7
100	0.251	−142.7	20.280	103.1	0.030	72.9	0.290	−61.9	26.8
200	0.254	−168.6	10.636	93.0	0.057	75.3	0.172	−63.4	21.0
300	0.285	177.9	7.194	86.2	0.082	76.6	0.137	−63.2	17.6
400	0.294	169.3	5.452	81.6	0.107	76.0	0.123	−64.8	15.2
500	0.316	166.7	4.407	77.7	0.132	75.0	0.119	−68.9	13.4
600	0.326	165.2	3.724	74.9	0.156	74.1	0.114	−73.6	12.0
700	0.325	161.7	3.219	70.9	0.180	72.8	0.113	−77.6	10.7
800	0.342	157.5	2.869	67.9	0.206	71.3	0.112	−83.2	9.7
900	0.338	151.2	2.618	64.8	0.229	69.5	0.117	−88.1	8.9
1000	0.352	149.6	2.397	62.3	0.250	68.0	0.119	−93.1	8.2
1200	0.379	139.3	2.044	55.8	0.291	64.9	0.126	−104.6	7.0
1400	0.419	133.2	1.813	51.6	0.334	63.1	0.132	−115.9	6.1
1600	0.455	127.5	1.650	44.9	0.374	58.0	0.136	−117.4	5.4
1800	0.453	117.6	1.543	41.9	0.401	56.7	0.164	−124.0	4.9
2000	0.507	115.5	1.450	36.6	0.434	54.3	0.178	−135.4	4.7
2200	0.542	114.8	1.359	34.2	0.465	52.7	0.201	−144.5	4.4
2400	0.540	110.0	1.282	30.2	0.497	49.8	0.228	−149.5	3.9
2600	0.556	109.1	1.195	26.9	0.511	47.3	0.249	−153.2	3.4
2800	0.556	105.7	1.154	21.8	0.535	46.1	0.273	−156.2	3.2
3000	0.602	100.6	1.142	19.1	0.563	43.4	0.296	−161.3	3.5

NPN 6 GHz wideband transistor BFQ22S

DESCRIPTION

NPN transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in UHF and microwave aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor has extremely high power gain and good low noise performance.

PNP complement is BFQ24.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

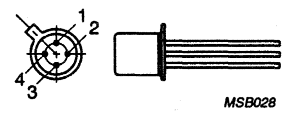


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	12	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	6	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	0.65	–	pF
F	noise figure	I_C = 10 mA; V_{CE} = 8 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	1.5	–	dB
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	16	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

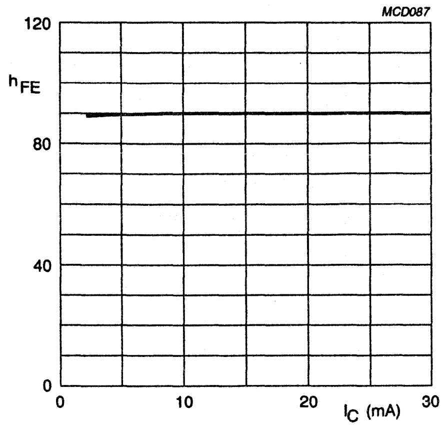
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	45	90	–	
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.65	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
F	noise figure	I_C = 10 mA; V_{CE} = 8 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	1.5	–	dB

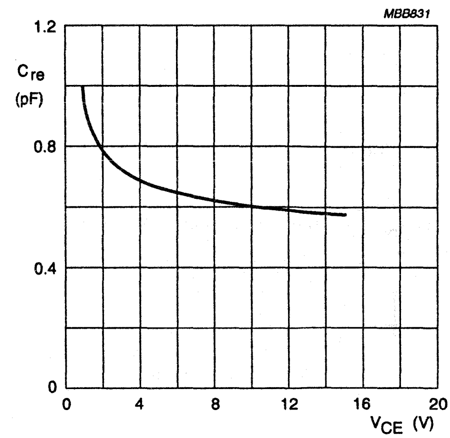
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



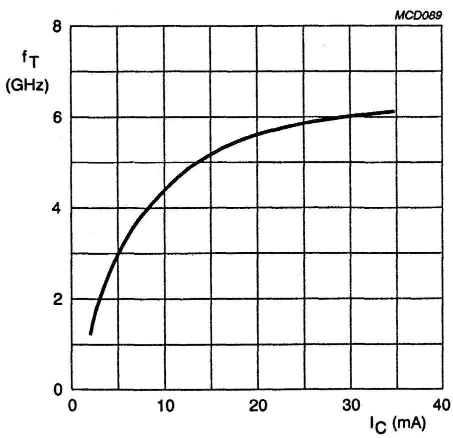
V_{CE} = 8 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



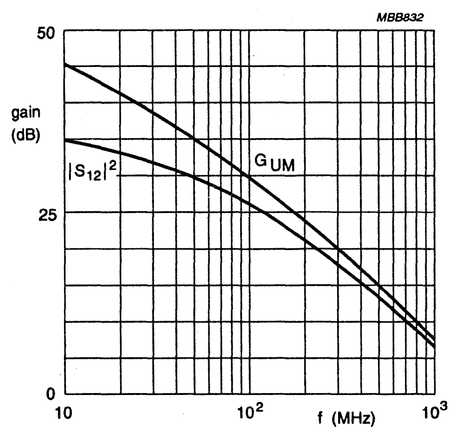
f = 1 MHz; T_{amb} = 25 °C.

Fig.3 Feedback capacitance as a function of collector-emitter voltage.



V_{CE} = 5 V; T_j = 25 °C.

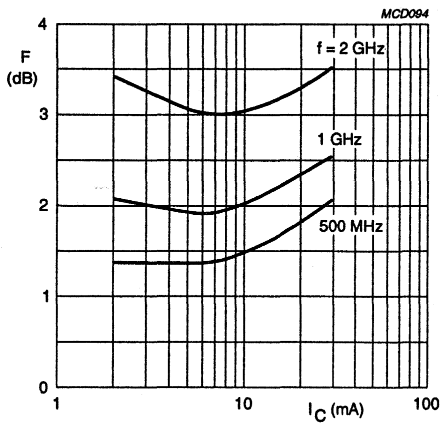
Fig.4 Transition frequency as a function of collector current.



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.5 Maximum unilateral power gain as a function of frequency.

NPN 6 GHz wideband transistor BFQ22S



V_{CE} = 8 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.

PNP 5 GHz wideband transistor BFQ23

DESCRIPTION

PNP transistor in a plastic SOT37 envelope, primarily intended for use in UHF and microwave amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor features low intermodulation distortion and high power gain. It also has excellent wideband properties due to its very high transition frequency, and low noise up to high frequencies.

NPN complement is BFR91A.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

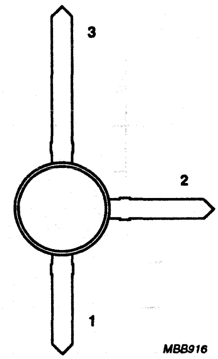


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–12	V
I_C	DC collector current		–	–35	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz	0.8	–	pF
F	noise figure	I_C = –2 mA; V_{CE} = –5 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	2.4	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–15	V
V_{CEO}	collector-emitter voltage	open base	–	–12	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–35	mA
I_{CM}	peak collector current	f > 1 MHz	–	–50	mA
P_{tot}	total power dissipation	up to T_s = 158 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 158 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

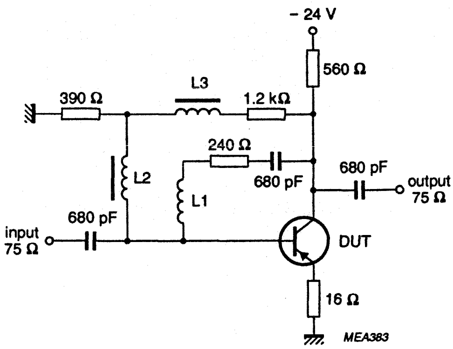
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -5$ V	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -30$ mA; $V_{CE} = -5$ V	20	40	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	1.2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	1.8	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
F	noise figure	$I_C = -2$ mA; $V_{CE} = -5$ V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	2.4	–	dB
V_O	output voltage	note 2	–	300	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

2. $d_{im} = -60$ dB; $I_C = -30$ mA; $V_{CE} = -5$ V; $R_L = 75\ \Omega$; T_{amb} = 25 °C
   $V_p = V_O$ at $d_{im} = -60$ dB; f_p = 495.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 505.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 495.25 MHz.



L3 = 5 μH (catalogue number 3122 108 20150).

L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.

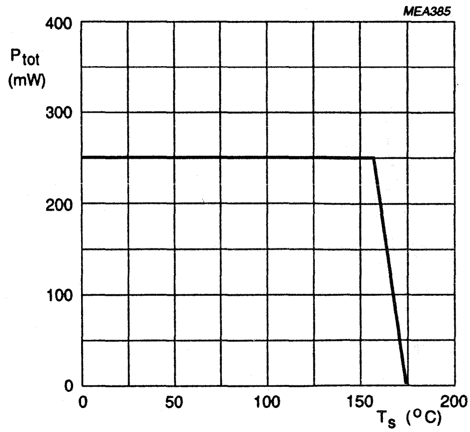
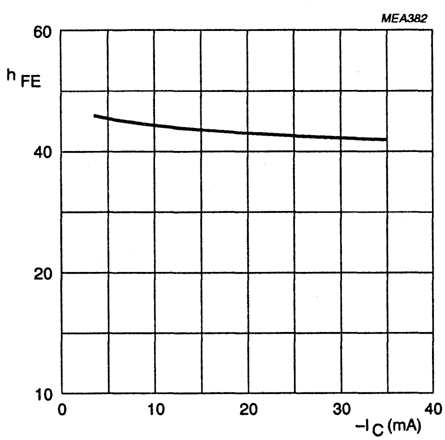
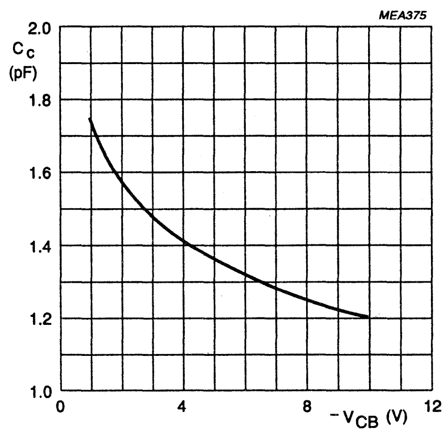


Fig.3 Power derating curve.



$V_{CE} = -5$ V; $T_j = 25$ °C.

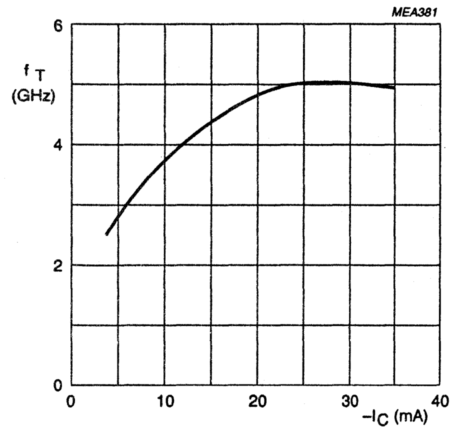
Fig.4 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; $T_j = 25$ °C.

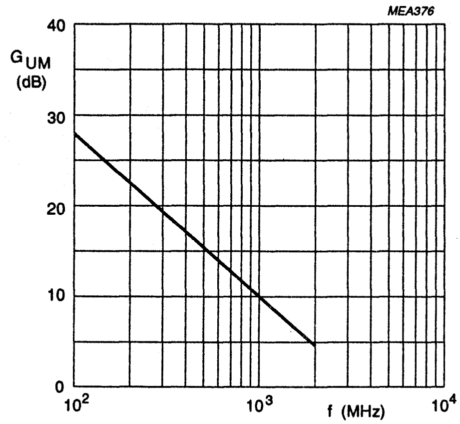
Fig.5 Collector capacitance as a function of collector–base voltage.

PNP 5 GHz wideband transistor BFQ23



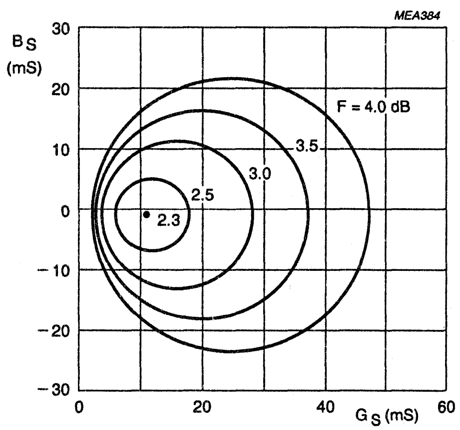
V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



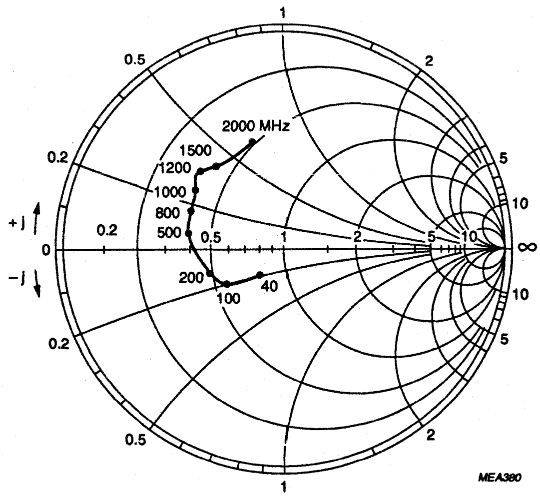
I_C = –30 mA; V_{CE} = –5 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



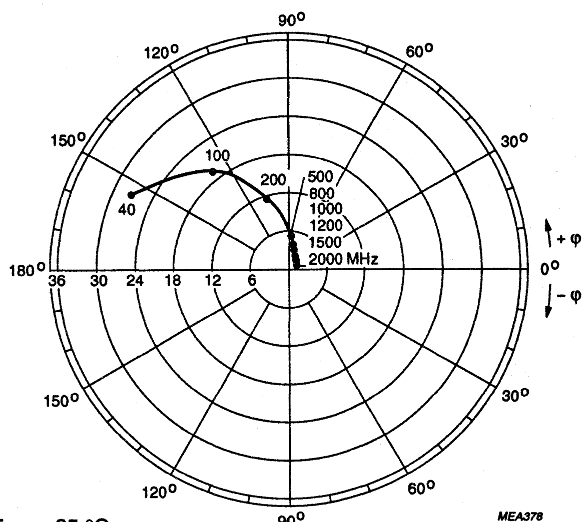
I_C = –4 mA; V_{CE} = –8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C.

Fig.8 Noise circle figure.



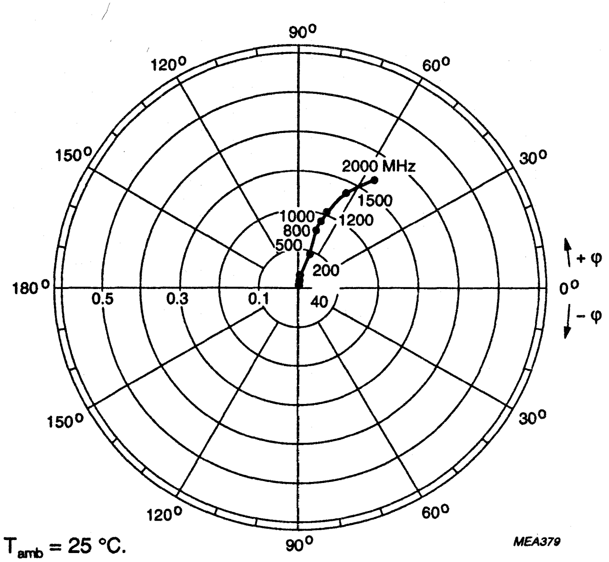
$I_C = -30$ mA; $V_{CE} = -5$ V; $T_{amb} = 25$ °C.

Fig.9 Common emitter input reflection coefficient (S_{11}).



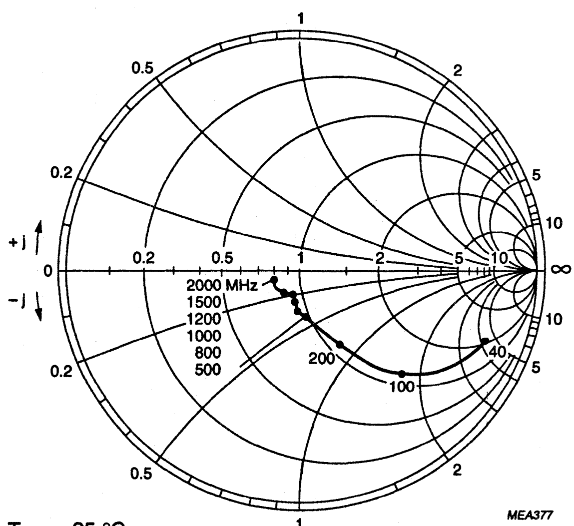
$I_C = -30$ mA; $V_{CE} = -5$ V; $T_{amb} = 25$ °C.

Fig.10 Common emitter forward transmission coefficient (S_{21}).



I_C = –30 mA; V_{CE} = –5 V; T_{amb} = 25 °C.

Fig.11 Common emitter reverse transmission coefficient (S_{12}).



I_C = –30 mA; V_{CE} = –5 V; T_{amb} = 25 °C.

Fig.12 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = -10$ mA; $V_{CE} = -5$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.398	−44.1	19.225	162.6	0.017	76.2	0.925	−17.9	34.8
100	0.484	−89.1	16.228	141.0	0.037	58.8	0.781	−40.6	29.5
200	0.573	−129.1	11.404	118.7	0.053	44.7	0.555	−65.1	24.5
300	0.617	−148.3	8.419	105.5	0.061	38.8	0.420	−80.6	21.4
400	0.639	−159.2	6.605	96.6	0.066	37.1	0.345	−91.7	19.2
500	0.650	−167.4	5.415	89.7	0.071	36.9	0.301	−100.1	17.5
600	0.657	−173.3	4.594	84.1	0.076	36.9	0.272	−106.1	16.0
700	0.657	−178.4	3.974	79.1	0.081	37.4	0.252	−111.1	14.7
800	0.658	177.3	3.523	74.9	0.086	38.0	0.235	−115.3	13.6
900	0.662	173.1	3.153	70.8	0.092	38.5	0.220	−119.0	12.7
1000	0.663	169.1	2.837	66.8	0.097	38.9	0.207	−123.4	11.8
1200	0.673	162.1	2.410	59.4	0.108	38.7	0.196	−134.0	10.4
1400	0.686	155.8	2.075	52.6	0.118	38.0	0.202	−144.1	9.3
1600	0.690	150.3	1.829	46.0	0.129	37.0	0.216	−149.3	8.3
1800	0.689	145.1	1.670	38.9	0.141	35.2	0.225	−152.4	7.5
2000	0.700	139.6	1.523	33.2	0.154	33.4	0.226	−157.6	6.8
2200	0.717	133.7	1.400	27.2	0.166	32.0	0.232	−165.3	6.3
2400	0.739	129.5	1.299	22.4	0.174	30.4	0.253	−173.4	6.0
2600	0.745	125.5	1.198	16.6	0.182	27.9	0.283	−178.2	5.4
2800	0.748	121.3	1.130	10.2	0.191	25.2	0.308	179.0	5.1
3000	0.750	115.9	1.069	5.2	0.202	22.8	0.317	175.3	4.6

Table 2 Common emitter scattering parameters, I_C = −30 mA; V_{CE} = −5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.240	−119.3	27.300	157.9	0.012	71.9	0.847	−25.5	34.5
100	0.461	−138.7	21.121	133.3	0.023	57.3	0.661	−55.5	30.0
200	0.596	−158.6	13.535	111.9	0.033	50.2	0.446	−85.8	25.5
300	0.642	−168.6	9.634	100.4	0.039	49.2	0.345	−105.0	22.5
400	0.659	−174.7	7.423	92.7	0.046	51.2	0.296	−118.8	20.3
500	0.673	−179.8	6.028	86.6	0.052	51.9	0.270	−128.6	18.5
600	0.677	176.1	5.090	81.6	0.059	52.8	0.255	−135.7	17.1
700	0.677	172.6	4.395	76.9	0.066	53.3	0.242	−141.2	15.8
800	0.676	169.0	3.882	73.4	0.073	53.4	0.229	−146.2	14.7
900	0.682	166.0	3.468	69.3	0.080	53.4	0.219	−150.9	13.7
1000	0.684	163.0	3.113	65.9	0.087	53.2	0.212	−156.0	12.8
1200	0.700	156.9	2.637	59.2	0.101	51.9	0.212	−166.1	11.5
1400	0.711	151.5	2.261	52.9	0.113	50.1	0.225	−173.4	10.4
1600	0.714	147.0	1.983	46.4	0.127	47.8	0.234	−176.3	9.3
1800	0.713	141.9	1.800	39.9	0.141	44.9	0.238	−178.4	8.4
2000	0.722	136.4	1.648	34.1	0.155	42.0	0.238	177.0	7.8
2200	0.747	131.2	1.503	28.5	0.168	40.0	0.247	170.4	7.4
2400	0.766	126.7	1.401	24.1	0.178	37.6	0.270	165.0	7.1
2600	0.771	123.7	1.286	18.8	0.187	34.5	0.298	162.5	6.5
2800	0.781	119.0	1.222	12.8	0.196	31.2	0.314	161.2	6.3
3000	0.774	113.8	1.141	8.0	0.209	28.4	0.319	158.2	5.6

PNP 5 GHz wideband transistor BFQ23C

DESCRIPTION

PNP transistor in hermetically-sealed, sub-miniature, SOT173 and SOT173X micro-stripline envelopes. It is primarily intended for use in RF wideband amplifiers such as aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features low intermodulation distortion and, due to its very high transition frequency, high power gain, excellent wideband properties and low noise up to high frequencies.

NPN complement is BFP91A.

PINNING

PIN	DESCRIPTION
	Code: C3
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

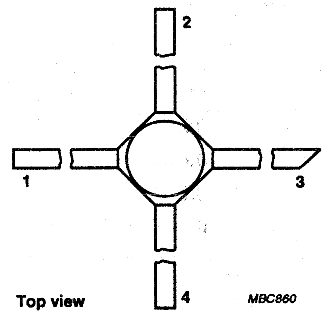


Fig.1 SOT173.

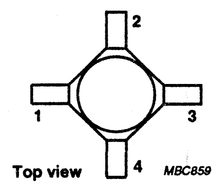


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–12	V
I_C	DC collector current		–	–50	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	350	mW
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –30 mA; V_{CE} = –8 V; f = 500 MHz; T_{amb} = 25 °C	20	–	dB
		I_C = –30 mA; V_{CE} = –8 V; f = 800 MHz; T_{amb} = 25 °C	16	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−15	V
V_{CEO}	collector-emitter voltage	open base	–	−12	V
V_{EBO}	emitter-base voltage	open collector	–	−2	V
I_C	DC collector current		–	−50	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	350	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

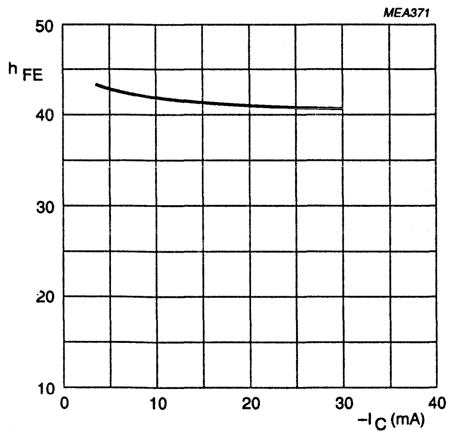
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -5$ V	–	–	−50	nA
h_{FE}	DC current gain	$I_C = -30$ mA; $V_{CE} = -5$ V	20	40	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	1	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	1.8	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -30$ mA; $V_{CE} = -8$ V; f = 500 MHz; T_{amb} = 25 °C	–	20	–	dB
		$I_C = -30$ mA; $V_{CE} = -8$ V; f = 800 MHz; T_{amb} = 25 °C	–	16	–	dB
F	noise figure	$I_C = -4$ mA; $V_{CE} = -8$ V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.3	–	dB
		$I_C = -30$ mA; $V_{CE} = -8$ V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	3.7	–	dB

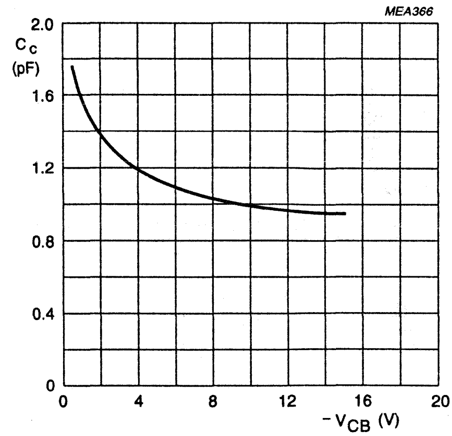
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



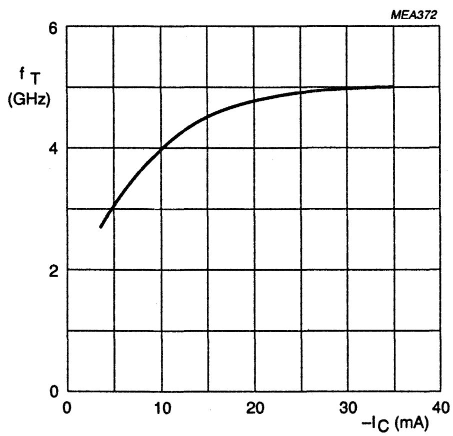
V_{CE} = –5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



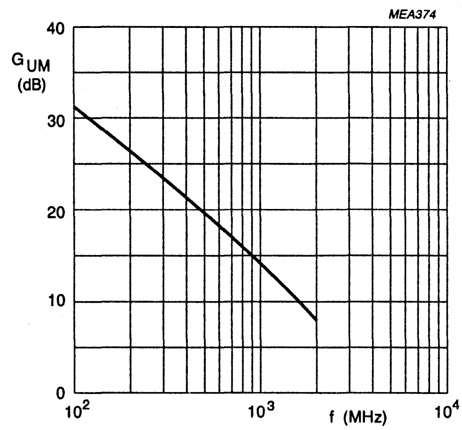
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



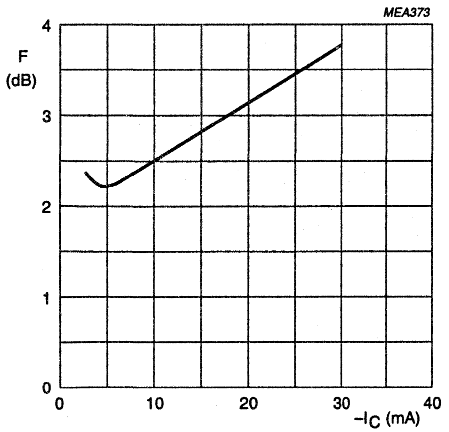
V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C

Fig.5 Transition frequency as a function of collector current.



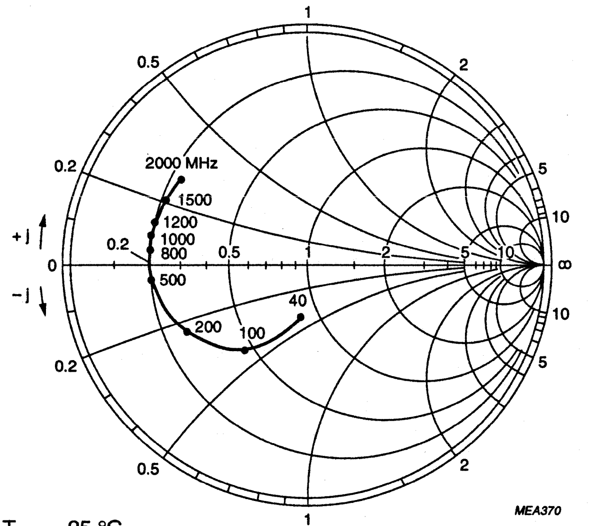
I_C = –30 mA; V_{CE} = –8 V; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



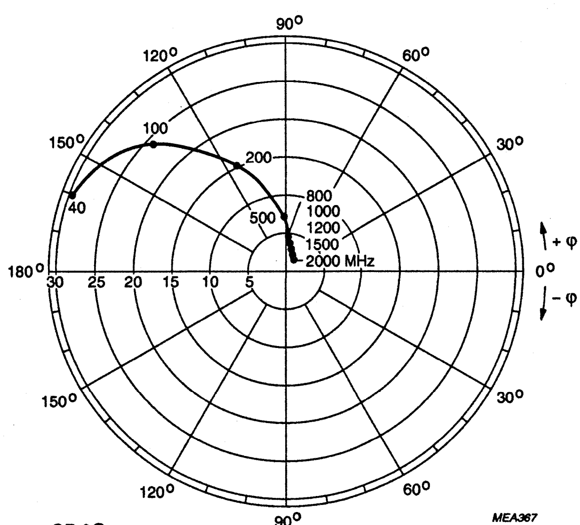
V_{CE} = −8 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C

Fig.7 Minimum noise figure as a function of collector current.



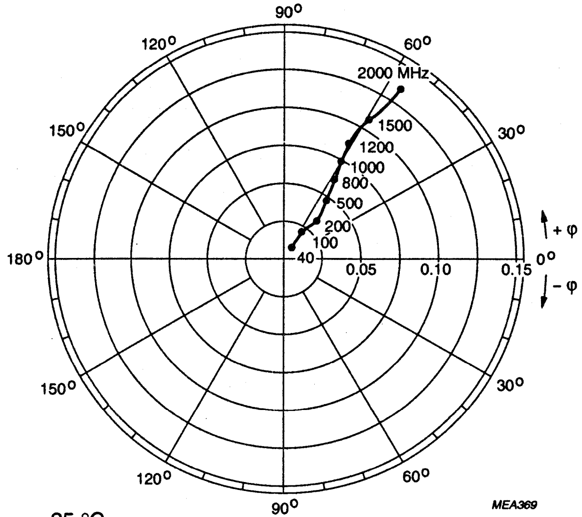
I_C = −30 mA; V_{CE} = −8 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



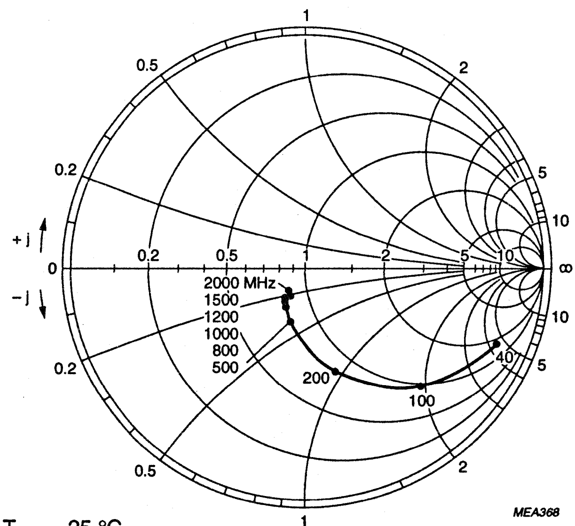
I_C = −30 mA; V_{CE} = −8 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = −30 mA; V_{CE} = −8 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = −30 mA; V_{CE} = −8 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = -10$ mA; $V_{CE} = -5$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.533	−37.4	20.606	162.0	0.019	77.5	0.903	−18.9	35.1
100	0.561	−81.1	17.084	140.5	0.040	58.9	0.759	−42.3	30.0
200	0.603	−121.0	11.959	119.5	0.056	45.4	0.541	−67.3	25.0
300	0.627	−141.9	8.726	107.4	0.063	39.3	0.412	−82.6	21.8
400	0.635	−153.3	6.790	99.8	0.069	38.9	0.338	−93.0	19.4
500	0.643	−160.7	5.581	94.2	0.074	39.1	0.293	−100.6	17.6
600	0.649	−166.6	4.710	89.6	0.078	40.6	0.264	−106.8	16.1
700	0.648	−170.9	4.087	85.7	0.084	41.8	0.243	−111.5	14.9
800	0.649	−175.0	3.613	82.2	0.088	42.5	0.228	−115.3	13.8
900	0.643	−178.8	3.229	79.4	0.094	43.9	0.217	−118.9	12.7
1000	0.648	178.0	2.931	76.5	0.100	45.5	0.210	−122.1	11.9
1200	0.651	172.1	2.460	71.3	0.111	45.9	0.201	−127.8	10.4
1400	0.655	167.5	2.112	66.4	0.121	46.9	0.201	−132.2	9.1
1600	0.658	163.8	1.879	61.4	0.132	47.1	0.201	−135.0	8.1
1800	0.646	159.4	1.693	57.0	0.144	46.8	0.202	−137.8	7.1
2000	0.654	155.0	1.543	53.4	0.152	47.1	0.201	−142.5	6.4

Table 2 Common emitter scattering parameters, $I_C = -30$ mA; $V_{CE} = -5$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.284	−90.0	30.234	155.9	0.013	73.7	0.799	−28.8	34.4
100	0.490	−128.9	22.417	131.1	0.025	55.1	0.613	−61.0	30.3
200	0.611	−153.0	14.101	111.5	0.033	47.8	0.418	−92.4	25.9
300	0.652	−164.4	9.852	101.4	0.040	47.5	0.332	−111.3	22.8
400	0.662	−170.6	7.553	95.2	0.045	50.9	0.289	−124.1	20.4
500	0.673	−174.7	6.139	90.5	0.052	53.0	0.266	−132.8	18.7
600	0.676	−178.3	5.148	86.6	0.058	55.5	0.251	−139.6	17.2
700	0.676	178.4	4.450	83.2	0.064	56.8	0.241	−144.9	15.9
800	0.679	175.8	3.917	80.3	0.070	57.7	0.232	−149.0	14.8
900	0.676	173.0	3.498	77.9	0.077	58.0	0.224	−152.5	13.8
1000	0.683	170.6	3.174	75.4	0.084	59.2	0.221	−155.7	13.0
1200	0.688	166.1	2.653	70.7	0.097	59.1	0.219	−160.8	11.5
1400	0.687	162.2	2.264	66.5	0.108	58.8	0.220	−164.6	10.1
1600	0.694	158.9	2.008	62.0	0.121	58.6	0.213	−166.8	9.1
1800	0.685	155.2	1.808	57.7	0.136	57.2	0.212	−169.2	8.1
2000	0.691	150.9	1.648	54.6	0.145	57.1	0.213	−173.9	7.4

PNP 5 GHz wideband transistor BFQ24

DESCRIPTION

PNP transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in UHF and microwave amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features extremely high power gain coupled with good low noise performance.

NPN complement is BFQ22S.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

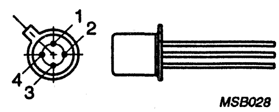


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–12	V
I_C	DC collector current		–	–35	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –5 V; f = 1 MHz; T_{amb} = 25 °C	0.8	–	pF
G_{UM}	maximum unilateral power gain	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	15	–	dB
F	noise figure	I_C = –2 mA; V_{CE} = –5 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	2.4	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–15	V
V_{CEO}	collector-emitter voltage	open base	–	–12	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–35	mA
I_{CM}	peak collector current	f > 1 MHz	–	–50	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

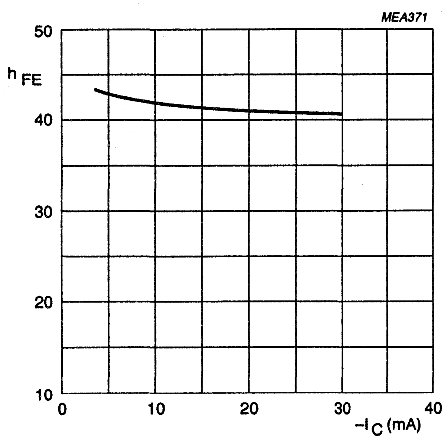
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -5$ V	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -30$ mA; $V_{CE} = -5$ V	20	40	–	
C_c	collector capacitance (note 2)	$I_E = i_e = 0$; $V_{CB} = -5$ V; f = 1 MHz	–	1.2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance (note 1)	$I_C = 0$; $V_{CE} = -5$ V; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency (note 1)	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (notes 1 and 3)	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz T_{amb} = 25 °C	–	15	–	dB
F	noise figure (note 1)	$I_C = -2$ mA; $V_{CE} = -5$ V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	2.4	–	dB

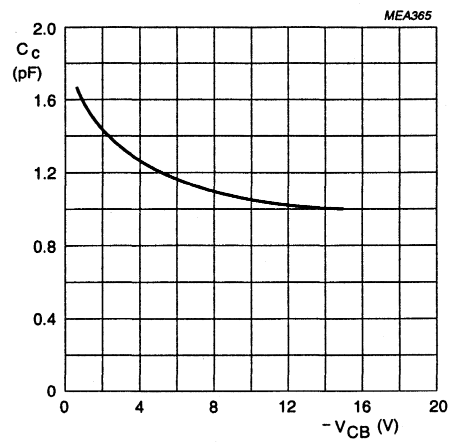
Notes

1. Shield lead grounded.
2. Shield lead not connected.
3. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.



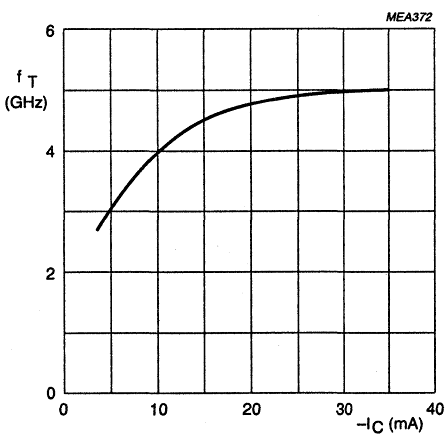
V_{CE} = −5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



I_E = i_e = 0; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = −5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

PNP 4 GHz wideband transistor | BFQ32

DESCRIPTION

PNP transistor in a plastic SOT37 envelope, intended for use in UHF applications such as broadband aerial amplifiers (30 to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analyzers etc.

The device offers a high transition frequency and a low intermodulation distortion figure over a wide current range.

NPN complement is BFR96.

PINNING

PIN	DESCRIPTION
Code: BFQ32/02	
1	base
2	emitter
3	collector

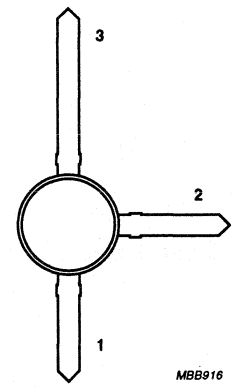


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s =143 °C (note 1)	–	–	700	mW
f_T	transition frequency	I_C = –70 mA; V_{CE} = –10 V; f = 500 MHz	4	–	–	GHz
C_{re}	feedback capacitance	I_C = –10 mA; V_{CE} = –10 V; f = 1 MHz	–	1.3	–	pF
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; Z_S = opt.	–	3.75	–	dB
V_O	output voltage	I_C = –50 mA; V_{CE} = –10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 493.25 MHz; d_{im} = –60 dB	–	500	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current	f > 1 MHz	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 143 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s =143 °C (note 1)	45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –10 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –70 mA; V_{CE} = –10 V	20	50	–	
f_T	transition frequency	I_C = –70 mA; V_{CE} = –10 V; f = 500 MHz	4	5	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = –10 V; f = 1 MHz	–	1.3	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = –0.5 V; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	I_C = –10 mA; V_{CE} = –10 V; f = 1 MHz	–	1.3	–	pF
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	–	3.75	–	dB
G_{UM}	maximum unilateral power gain (note 1)	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	14	–	dB
V_O	output voltage	note 2	–	500	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. d_{im} = –60 dB; I_C = –50 mA; V_{CE} = –10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 495.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 503.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.

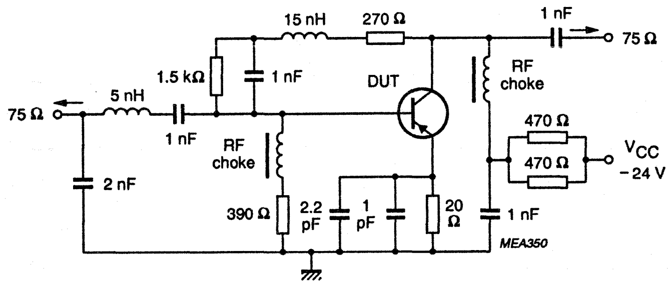


Fig.2 Intermodulation distortion test circuit.

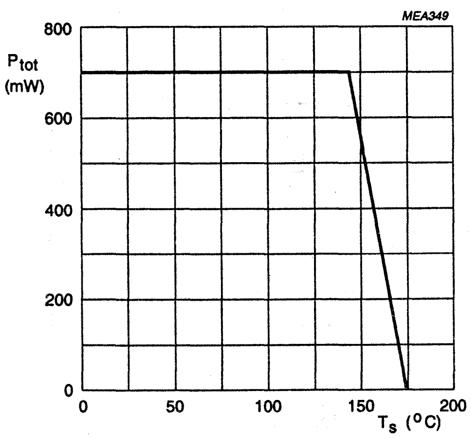
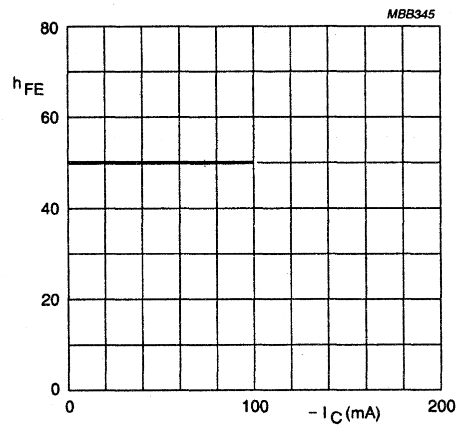


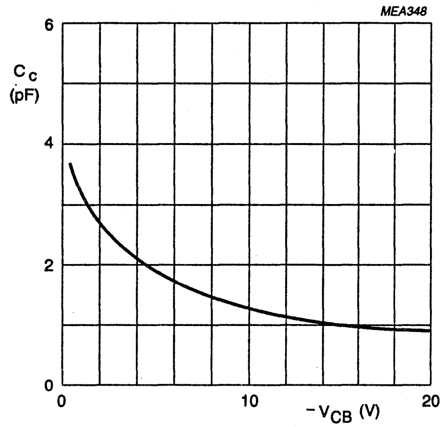
Fig.3 Power derating curve.



$V_{CE} = -10$ V; $T_j = 25$ °C.

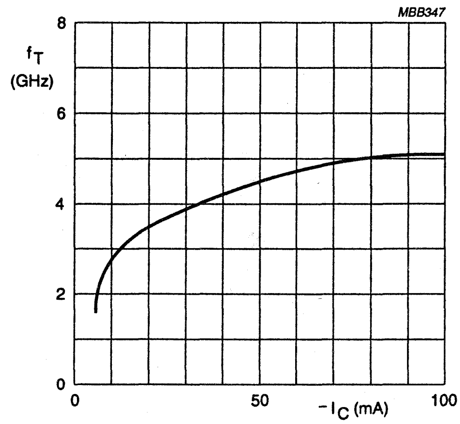
Fig.4 DC current gain as a function of collector current.

PNP 4 GHz wideband transistor | BFQ32



$I_E = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



$V_{CE} = -10$ V; f = 500 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.

PNP 4 GHz wideband transistor | BFQ32C

DESCRIPTION

PNP transistor in hermetically-sealed, sub-miniature, SOT173 and SOT173X micro-stripline envelopes. It is intended for use in UHF applications such as broadband aerial amplifiers. Microwave applications include radar systems, spectrum analyzers etc.

The transistor features a high transition frequency and a low intermodulation distortion figure over a wide current range.

NPN complement is BFP96.

PINNING

PIN	DESCRIPTION
	Code: C2
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

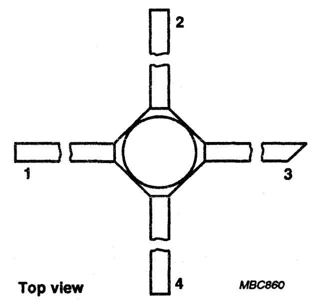


Fig.1 SOT173.

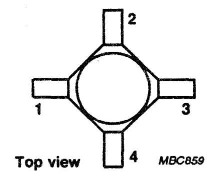


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	700	mW
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V; T_j = 25 °C	20	50	–	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_j = 25 °C	–	4.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = –50 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	–	14	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 115 °C (note 1)	85 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

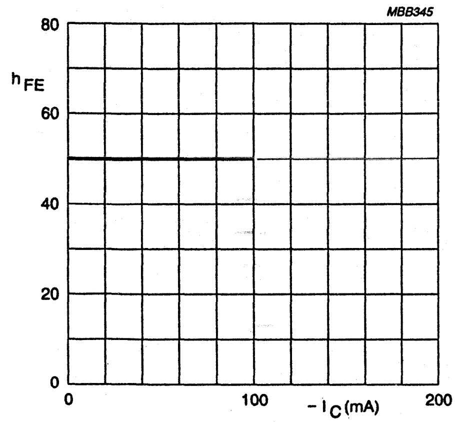
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –10 V	–	–	–100	nA
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V	20	50	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	1.9	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz	–	1.4	–	pF
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz	–	4.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = –50 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	–	14	–	dB
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; Z_S = opt. f = 800 MHz; T_{amb} = 25 °C	–	4.3	–	dB

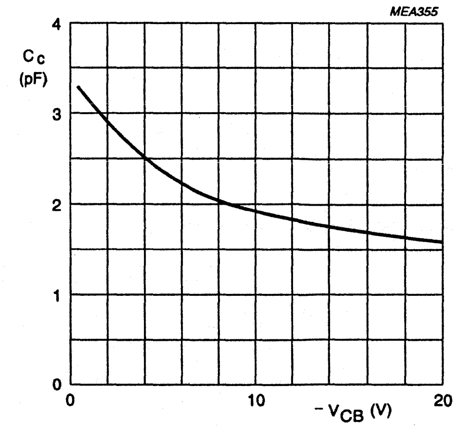
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



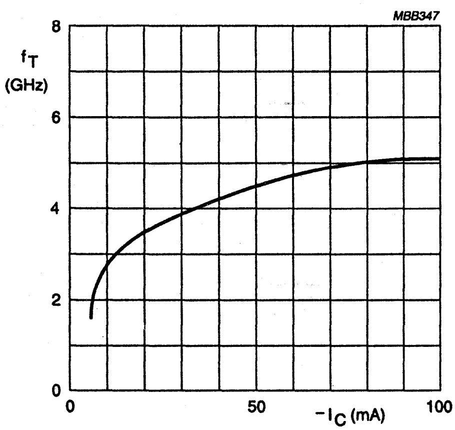
V_{CE} = –10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



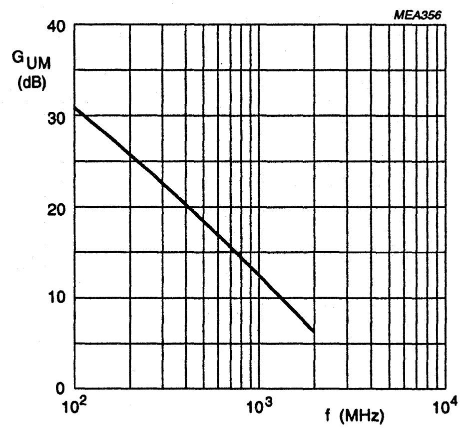
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



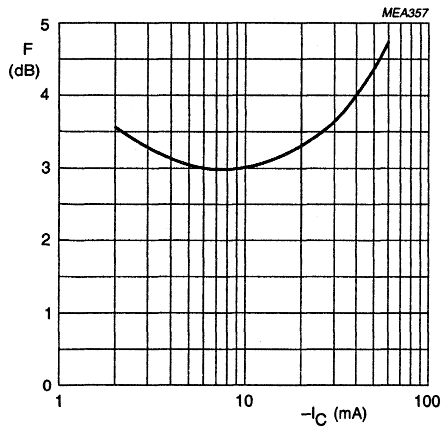
V_{CE} = –10 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



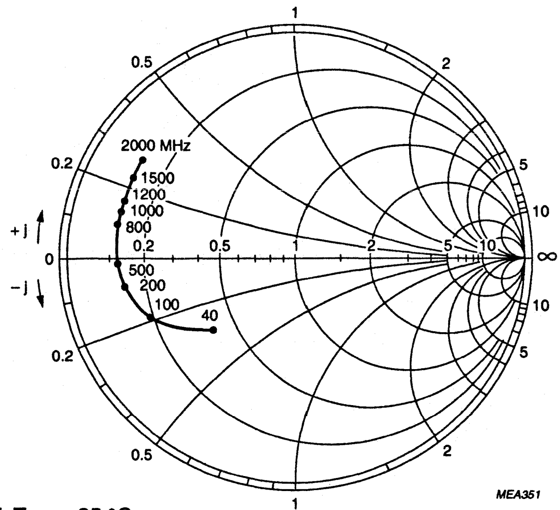
I_C = –50 mA; V_{CE} = –10 V; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



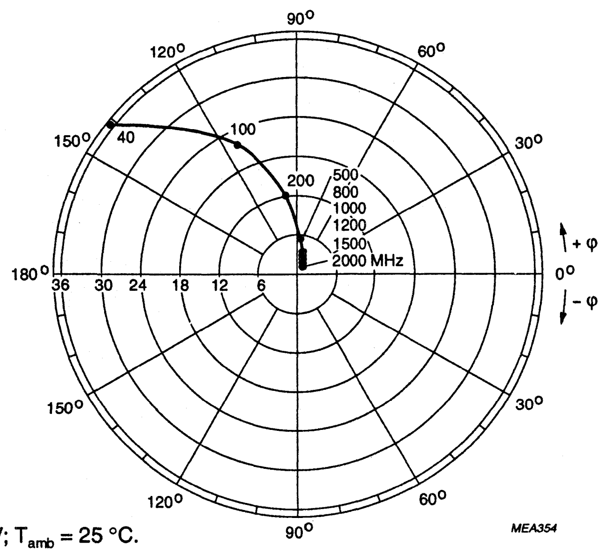
$V_{CE} = -10$ V; Z_S = opt; f = 800 MHz; $T_{amb} = 25$ °C.

Fig.7 Minimum noise figure as a function of collector current.



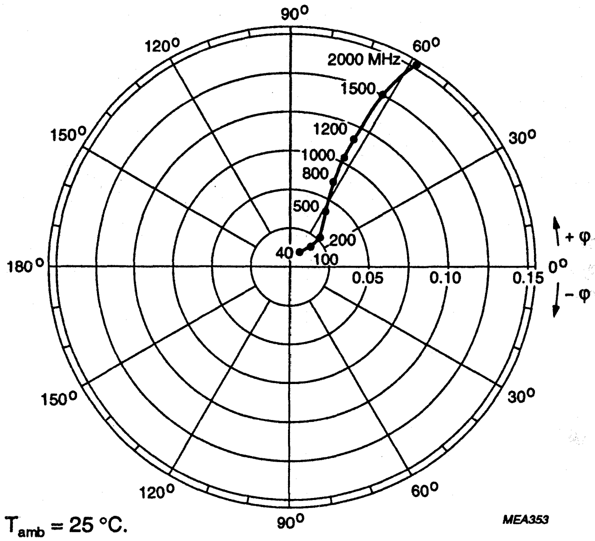
$I_C = -50$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



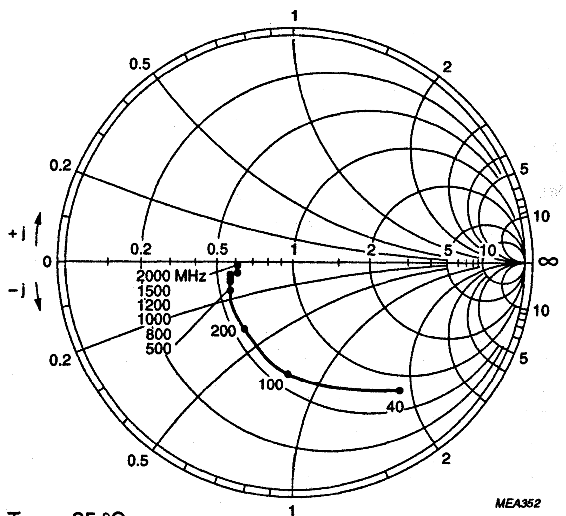
$I_C = -50$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

PNP 4 GHz wideband transistor — BFQ32M

DESCRIPTION

PNP transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in UHF and microwave amplifiers such as aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features high power gain, high transition frequency and low noise up to high frequencies.

NPN complement is BFQ63.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

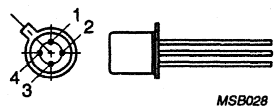


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
I_C	DC collector current		–	–100	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = –50 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	4.5	–	GHz
C_{re}	feedback capacitance	I_C = –10 mA; V_{CE} = –10 V; f = 1 MHz	1.4	–	pF
F	noise figure	I_C = –10 mA; V_{CE} = –5 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	2.3	–	dB
G_{UM}	maximum unilateral power gain	I_C = –20 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	11	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current	f > 1 MHz	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

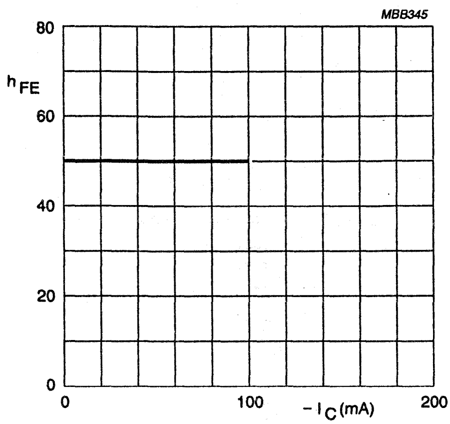
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -10$ V	–	–	−100	nA
h_{FE}	DC current gain	$I_C = -50$ mA; $V_{CE} = -5$ V	20	50	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	1.8	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	0.4	–	pF
C_{re}	feedback capacitance	$I_C = -10$ mA; $V_{CE} = -10$ V; f = 1 MHz; T_{amb} = 25 °C	–	1.4	–	pF
f_T	transition frequency	$I_C = -50$ mA; $V_{CE} = -5$ V; f = 500 MHz	–	4.5	–	GHz
F	noise figure	$I_C = -10$ mA; $V_{CE} = -5$ V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	2.3	–	dB
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -50$ mA; $V_{CE} = -5$ V; f = 500 MHz; T_{amb} = 25 °C	–	11	–	dB

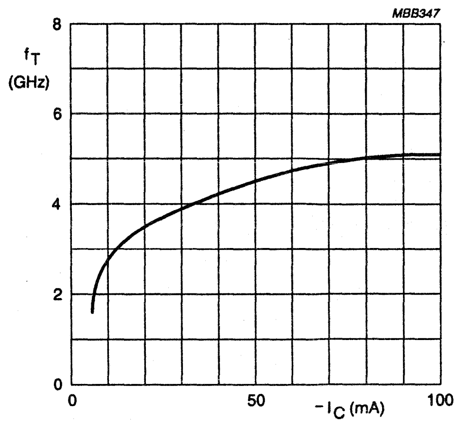
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



V_{CE} = –5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



V_{CE} = –5 V; T_j = 25 °C.

Fig.3 Transition frequency as a function of collector current.

PNP 4 GHz wideband transistor BFQ32S

DESCRIPTION

PNP transistor in a plastic SOT37 envelope. It is intended for use in UHF applications such as broadcast aerial amplifiers and in microwave amplifiers such as radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor offers a high transition frequency and a low modulation distortion figure over a wide current range.

NPN complement is BFR96S.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

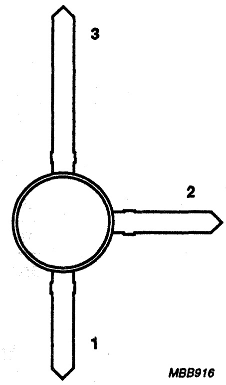


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–15	V
I_C	DC collector current		–	–100	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	700	mW
f_T	transition frequency	I_C = –70 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	4.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –70 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	10	–	dB
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	4.3	–	dB
V_O	output voltage	I_C = –70 mA; V_{CE} = –10 V; d_{im} = –60 dB; $f_{(p+q-r)}$ = 793.25 MHz	600	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

PNP 4 GHz wideband transistor BFQ32S

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

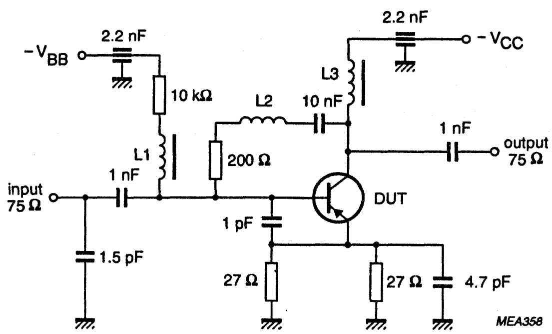
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -10$ V	–	–	–100	nA
h_{FE}	DC current gain	$I_C = -70$ mA; $V_{CE} = -10$ V; T_{amb} = 25 °C	20	50	–	
C_c	collector capacitance	$I_E = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	1.8	–	pF
C_e	emitter capacitance	$I_C = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	1.3	–	pF
f_T	transition frequency	$I_C = -70$ mA; $V_{CE} = -10$ V; f = 500 MHz; T_{amb} = 25 °C	4	4.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -70$ mA; $V_{CE} = -10$ V; f = 800 MHz; T_{amb} = 25 °C	–	10	–	dB
F	noise figure	$I_C = -50$ mA; $V_{CE} = -10$ V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	4.3	–	dB
V_O	output voltage (see Fig.2)	note 2	–	600	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB; $I_C = -70$ mA; $V_{CE} = -10$ V; $R_L = 75\ \Omega$; T_{amb} = 25 °C
   $V_p = V_O$ at $d_{im} = -60$ dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



L1 = L3 = 5 µH microchoke.

L2 = 1.5 turns 0.4 mm copper wire; internal diameter 3 mm; winding pitch 1 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

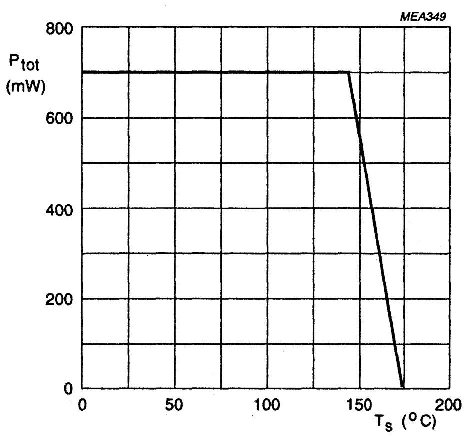
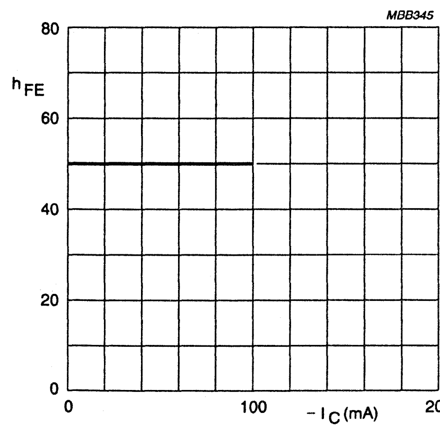
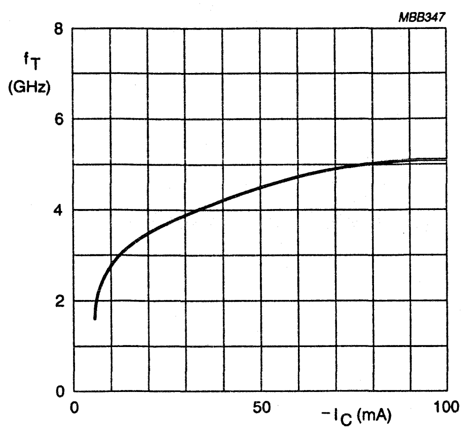


Fig.3 Power derating curve.



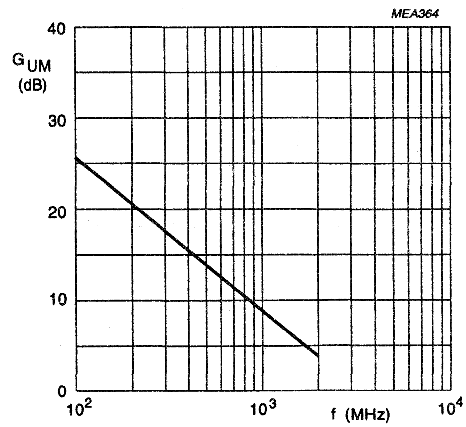
V_{CE} = −10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



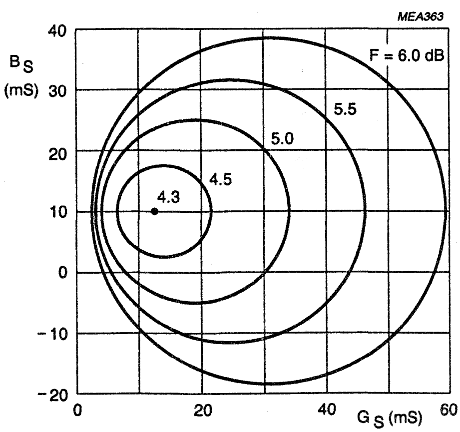
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.5 Transition frequency as a function of collector current.



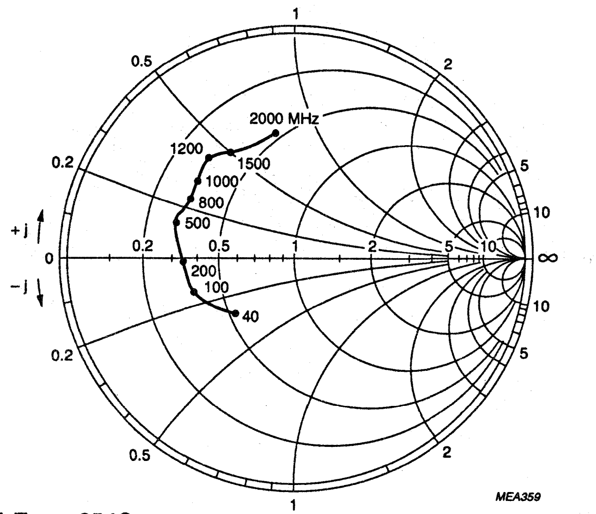
$I_C = -70$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



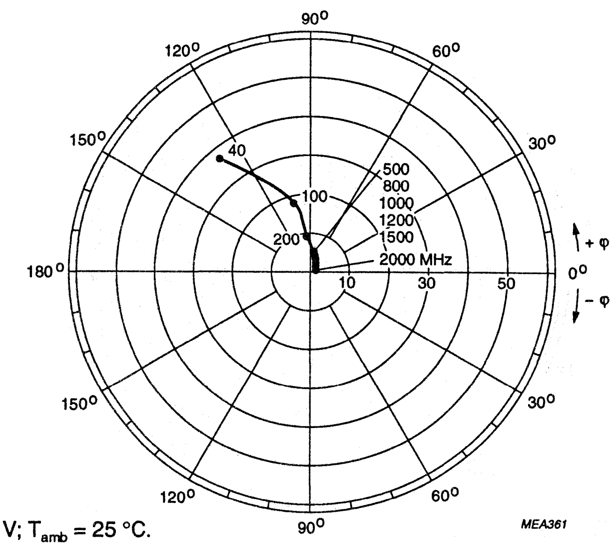
$I_C = -50$ mA; $V_{CE} = -10$ V; f = 800 MHz; $T_{amb} = 25$ °C.

Fig.7 Noise circle figure.



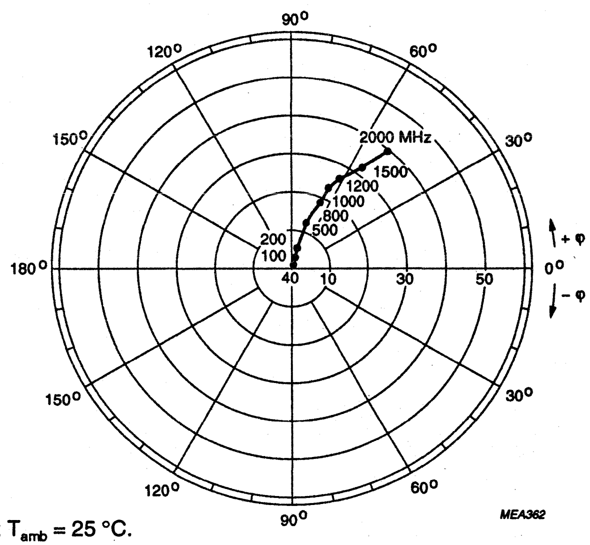
$I_C = -70$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



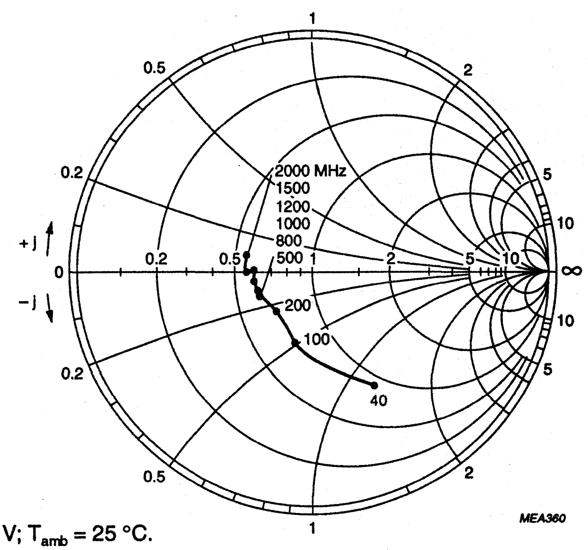
$I_C = -70$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



$I_C = -70$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



$I_C = -70$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

NPN 12 GHz wideband transistor BFQ33C

DESCRIPTION

NPN transistor in hermetically-sealed, sub-miniature, SOT173 and SOT173X micro-stripline envelopes, primarily intended for RF amplifier applications up to 4 GHz.

The transistor features an extremely high transition frequency of 12 GHz and very low noise.

PINNING

PIN	DESCRIPTION
	Code: Q3
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

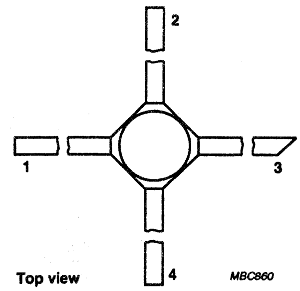


Fig.1 SOT173.

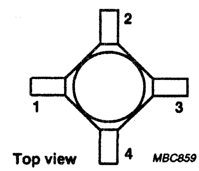


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	7	V
I_C	DC collector current		–	20	mA
P_{tot}	total power dissipation	up to T_s = 165 °C (note 1)	–	140	mW
f_T	transition frequency	I_C = 15 mA; V_{CE} = 5 V; f = 1.5 GHz; T_{amb} = 25 °C	12.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 5 V; f = 2 GHz; T_{amb} = 25 °C	12.5	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 5 V; Z_S = opt.; f = 2 GHz; T_{amb} = 25 °C	3	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	7	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	20	mA
P_{tot}	total power dissipation	up to T_s = 165 °C (note 1)	–	140	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 165 °C (note 1)	80 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

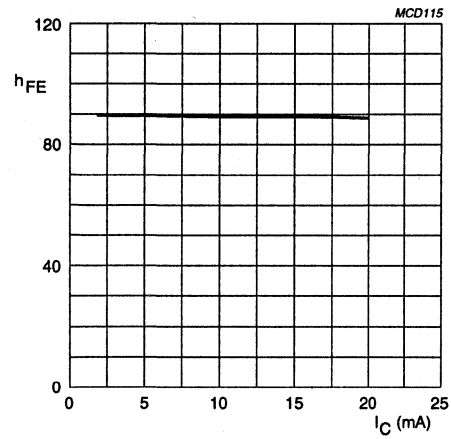
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	50	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.35	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 5$ V; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 5$ V; f = 1.5 GHz; $T_{amb} = 25$ °C	–	12.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 5$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	12.5	–	dB
		$I_C = 15$ mA; $V_{CE} = 5$ V; f = 4 GHz; $T_{amb} = 25$ °C	–	7.5	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 5$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	3	–	dB

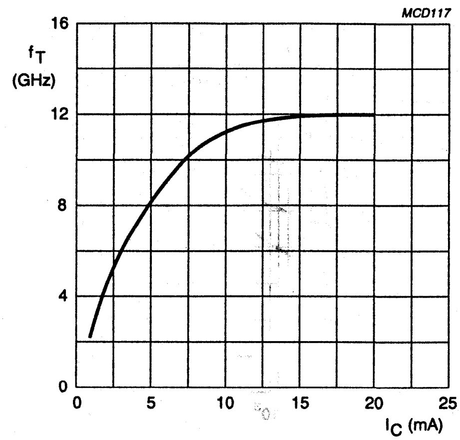
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



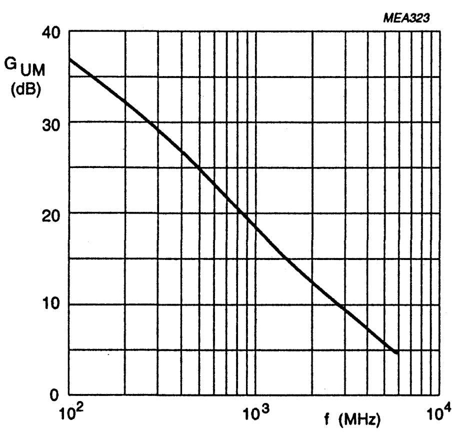
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



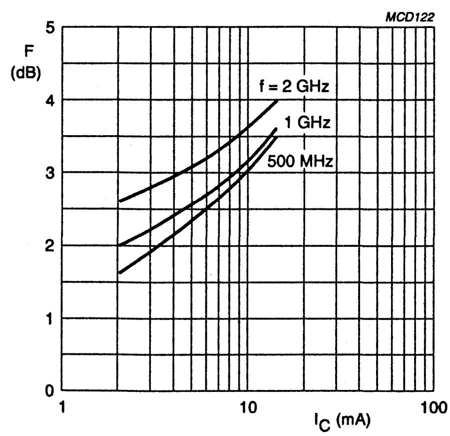
V_{CE} = 5 V; f = 1.5 GHz; T_{amb} = 25 °C.

Fig.4 Transition frequency as a function of collector current.



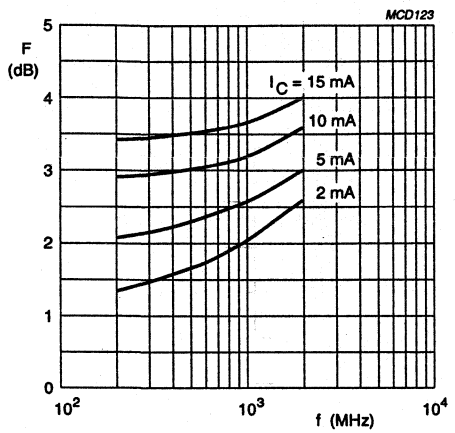
I_C = 15 mA; V_{CE} = 5 V; Z_S = 60 Ω; T_{amb} = 25 °C

Fig.5 Maximum unilateral power gain as a function of frequency.



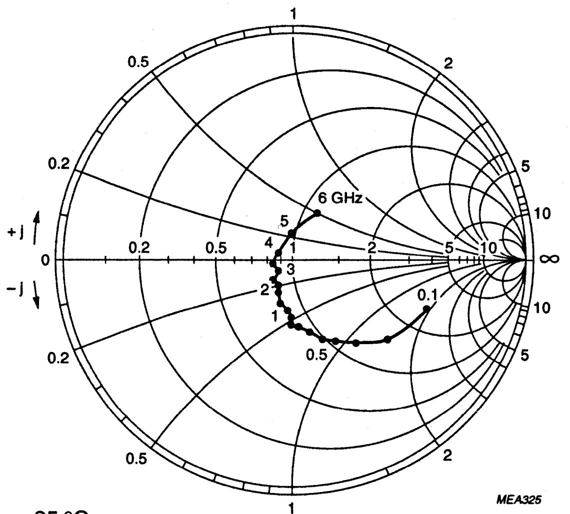
V_{CE} = 5 V; Z_S = 60 Ω; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.



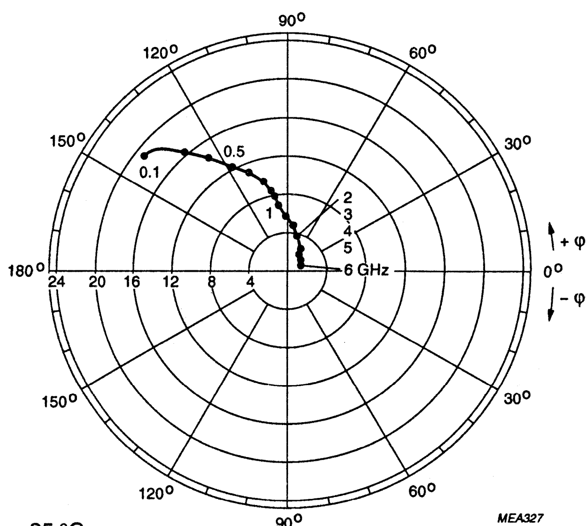
V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.7 Minimum noise figure as a function of frequency.



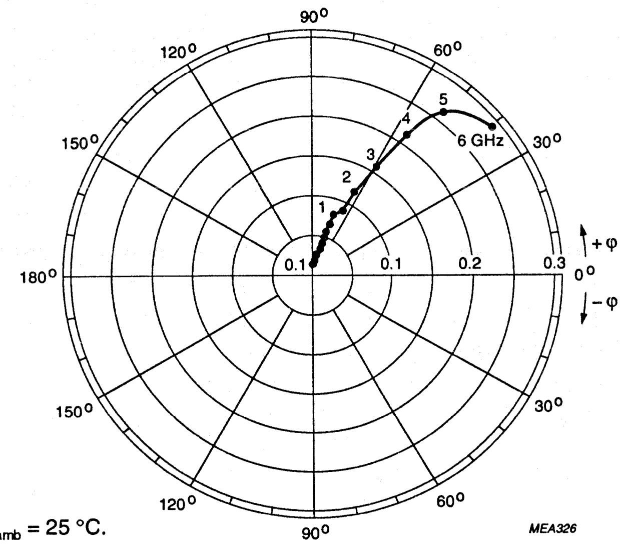
I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



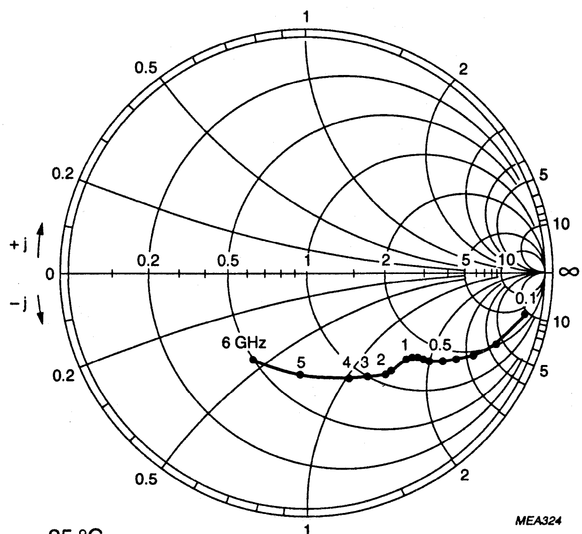
I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 15 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
100	0.82	−12.3	12.6	168.1	0.013	82.1	0.97	−7.6	39.1
200	0.78	−24.2	12.0	156.1	0.024	77.0	0.93	−14.6	34.5
300	0.72	−33.9	11.0	146.1	0.034	72.3	0.89	−20.3	30.8
400	0.67	−42.9	10.1	138.3	0.043	69.4	0.85	−25.3	28.1
500	0.62	−50.0	9.2	131.3	0.050	67.4	0.81	−28.6	25.9
600	0.57	−56.3	8.3	124.8	0.056	65.6	0.77	−31.4	24.0
700	0.53	−61.5	7.6	119.8	0.062	64.4	0.74	−33.8	22.5
800	0.49	−66.6	6.9	115.2	0.068	63.7	0.71	−35.7	21.0
900	0.45	−67.3	6.3	111.4	0.073	63.6	0.69	−36.1	19.8
1000	0.41	−71.8	5.8	107.4	0.078	62.6	0.66	−37.4	18.6
1200	0.35	−78.7	5.1	100.5	0.088	61.8	0.63	−39.7	16.8
1500	0.29	−80.0	3.9	89.6	0.098	57.6	0.63	−40.0	14.4
2000	0.23	−88.5	3.2	79.8	0.125	56.7	0.59	−44.2	12.3
2500	0.19	−100.7	2.7	70.8	0.147	55.1	0.56	−49.5	10.3
3000	0.16	−101.6	2.3	64.1	0.169	53.0	0.57	−53.7	9.1
3500	0.15	−112.5	2.1	60.4	0.211	53.4	0.55	−58.2	8.3
4000	0.10	−124.8	1.9	52.7	0.219	49.5	0.52	−68.6	7.1
5000	0.02	127.0	1.6	38.9	0.267	43.5	0.45	−92.3	5.3
6000	0.14	56.1	1.4	24.3	0.298	32.4	0.44	−122.2	4.1

Table 2 Common emitter scattering parameters, I_C = 14 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
100	0.61	−20.1	21.2	161.3	0.011	78.8	0.93	−11.4	37.3
200	0.55	−37.8	18.7	144.7	0.020	73.3	0.85	−20.6	32.5
300	0.47	−50.7	15.9	132.7	0.027	69.6	0.77	−26.2	29.0
400	0.42	−61.6	13.8	124.5	0.034	68.2	0.71	−30.3	26.6
500	0.37	−68.8	11.9	118.0	0.040	68.0	0.66	−32.5	24.7
600	0.34	−75.4	10.3	112.2	0.045	67.7	0.63	−33.9	23.0
700	0.29	−81.0	9.2	108.0	0.050	67.6	0.60	−35.4	21.6
800	0.29	−86.0	8.2	104.4	0.055	67.9	0.58	−36.4	20.5
900	0.26	−85.1	7.4	101.4	0.060	68.2	0.57	−36.0	19.4
1000	0.23	−91.1	6.7	78.3	0.065	68.0	0.55	−36.6	18.4
1200	0.20	−99.8	5.7	92.9	0.076	67.7	0.53	−38.4	16.8
1500	0.15	−101.4	4.4	83.0	0.088	63.9	0.55	−37.7	14.6
2000	0.12	−110.6	3.6	75.4	0.114	63.2	0.53	−41.8	12.5
2500	0.10	−132.5	2.9	67.8	0.137	61.3	0.51	−46.9	10.7
3000	0.07	−137.0	2.6	61.8	0.160	59.1	0.52	−51.3	9.6
3500	0.07	−163.9	2.3	60.0	0.191	61.8	0.55	−54.0	8.4
4000	0.05	163.7	2.1	52.0	0.208	56.2	0.47	−65.6	7.5
5000	0.11	81.7	1.8	37.9	0.261	49.2	0.41	−91.1	5.8
6000	0.23	56.0	1.5	24.0	0.291	38.3	0.41	−122.9	4.6

NPN 4 GHz wideband transistor — BFQ34

DESCRIPTION

NPN transistor encapsulated in a 4 lead SOT122A envelope with a ceramic cap. All leads are isolated from the stud.

It is primarily intended for driver and final stages in MATV system amplifiers. It is also suitable for use in low power band IV and V equipment. Diffused emitter-ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. The device also features high output voltage capabilities.

A SOT5 (TO-39) version (ref: ON4497) is available on request.

PINNING

PIN	DESCRIPTION
Code: BFQ34/01	
1	collector
2	emitter
3	base
4	emitter

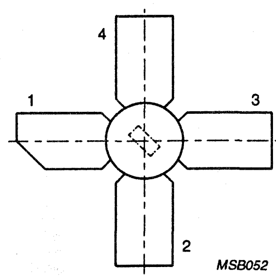


Fig.1 SOT122A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	collector current		–	150	mA
P_{tot}	total power dissipation	up to T_c = 160 °C	–	2.7	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	4	–	GHz
V_O	output voltage	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C; d_{im} = −60 dB $f_{(p+q-r)}$ = 793.25 MHz	1.2	–	V
P_{L1}	output power at 1 dB gain compression	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	26	–	dBm
ITO	third order intercept point	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C	45	–	dBm

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_c = 160 °C	–	2.7	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	15 K/W

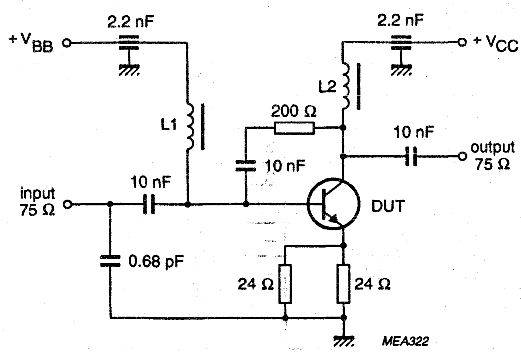
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 15$ V	–	–	100	μA
h_{FE}	DC current gain	$I_C = 75$ mA; $V_{CE} = 15$ V	25	70	–	
		$I_C = 150$ mA; $V_{CE} = 15$ V	25	70	–	
f_T	transition frequency	$I_C = 75$ mA; $V_{CE} = 15$ V; f = 500 MHz	3	3.5	–	GHz
		$I_C = 150$ mA; $V_{CE} = 15$ V; f = 500 MHz	3.5	4	–	GHz
C_c	collector capacitance	$I_E = 0$; $V_{CB} = 15$ V; f = 1 MHz	–	2	2.75	pF
C_e	emitter capacitance	$I_C = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	11	–	pF
C_{re}	feedback capacitance	$I_C = 10$ mA; $V_{CE} = 15$ V; f = 1 MHz; $T_{amb} = 25$ °C	–	1	1.35	pF
$C_{c\text{-}s}$	collector-stud capacitance	note 1	–	0.8	–	pF
F	noise figure (see Fig.2)	$I_C = 120$ mA; $V_{CE} = 15$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	8	–	dB
G_{UM}	maximum unilateral power gain (note 2)	$I_C = 120$ mA; $V_{CE} = 15$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	16.3	–	dB
V_O	output voltage	Figs 2 and 7 and note 3	–	1.2	–	dB
P_{L1}	output power at 1 dB gain compression (see Fig.2)	note 4	–	26	–	dBm
ITO	third order intercept point (see Fig.2)	note 5	–	45	–	dBm

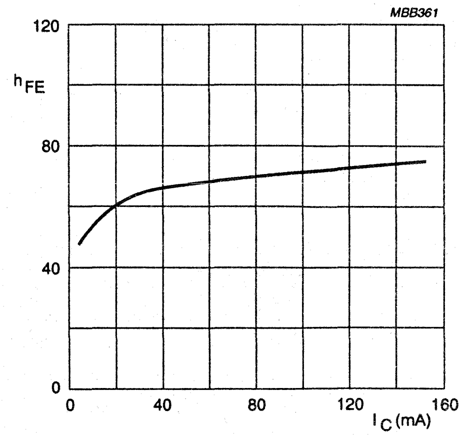
Notes

1. Measured with grounded emitter and base.
2. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
3. $d_{im} = -60$ dB (DIN 45004B, par. 6.3.: 3-tone); $I_C = 120$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $I_C = 120$ mA; $V_{CE} = 15$ V; $T_{amb} = 25$ °C; $R_L = 75\ \Omega$;
   measured at f = 800 MHz.
5. $I_C = 120$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   P_p = ITO – 6 dB; $f_p = 800$ MHz;
   P_q = ITO – 6 dB; $f_q = 801$ MHz;
   measured at $f_{(2q-p)} = 802$ MHz and at $f_{(2p-q)} = 799$ MHz.



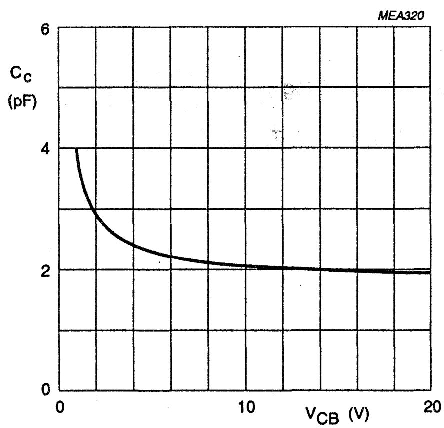
f = 40 to 860 MHz; L1 = L2 = 5 μH Ferroxcube coil.

Fig.2 Intermodulation distortion MATV test circuit.



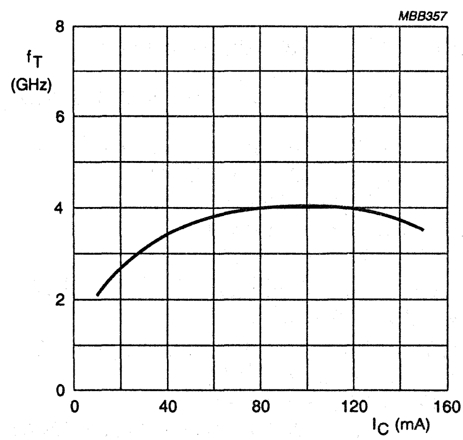
V_{CE} = 15 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



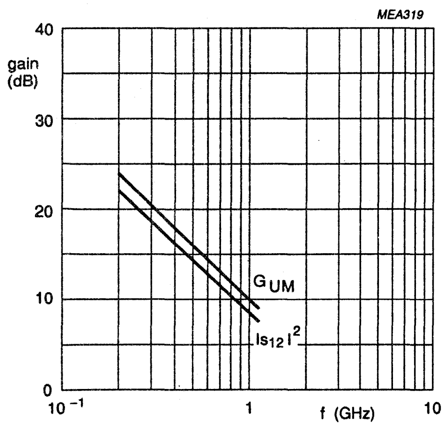
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



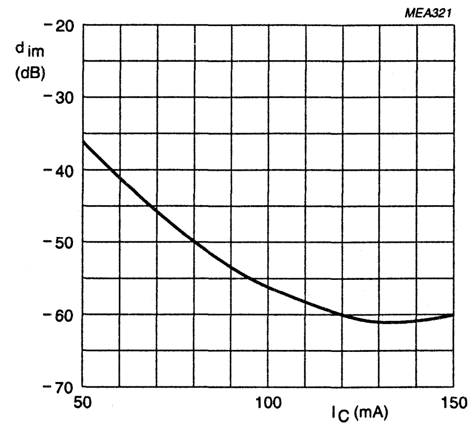
V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



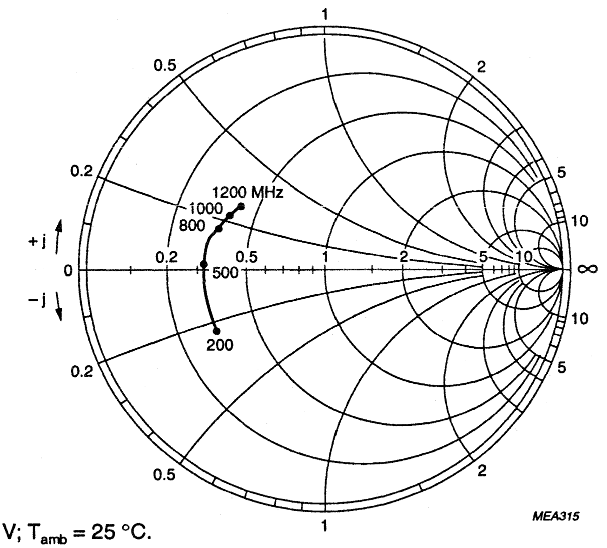
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.6 Gain as a function of frequency.



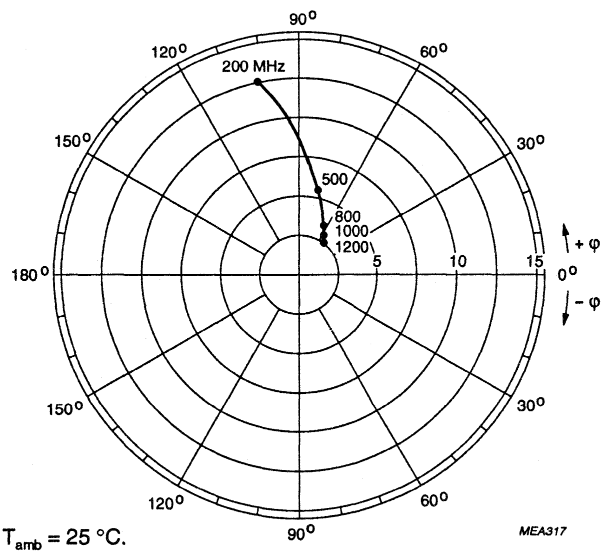
V_O = 1.2 V; V_{CE} = 15 V; $f_{(p+q-r)}$ = 793.25 MHz

Fig.7 Intermodulation distortion as a function of collector current.



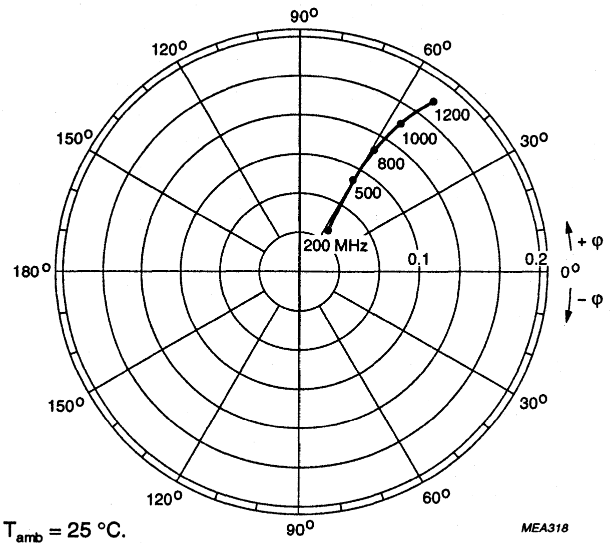
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



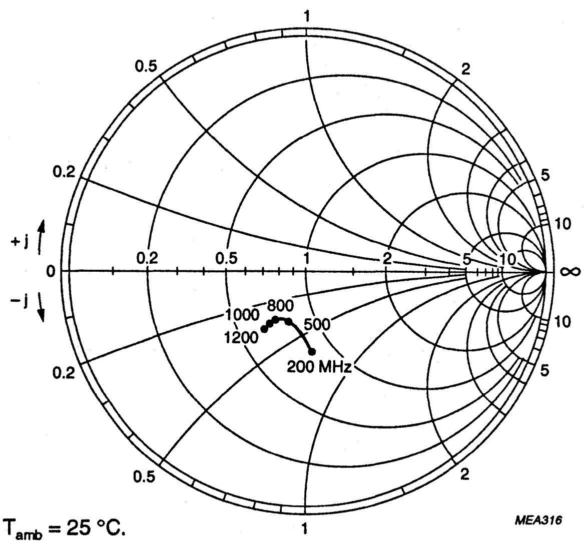
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	−72	0.02	64	30.5	147	0.9	−34	36.3
200	0.6	−154	0.06	52	11.3	101	0.4	−84	23.2
500	0.5	177	0.08	58	4.9	78	0.3	−104	15.6
800	0.5	160	0.12	58	3.2	63	0.3	−113	11.8
1000	0.5	150	0.15	57	2.6	54	0.3	−118	9.9
1200	0.5	142	0.18	54	2.2	46	0.3	−122	8.3

Table 2 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	−76	0.02	64	32.1	144	0.8	−36	36.2
200	0.5	−156	0.05	53	11.6	100	0.4	−90	23.4
500	0.5	176	0.08	59	5.0	78	0.2	−112	15.7
800	0.5	160	0.13	63	3.3	63	0.2	−121	11.9
1000	0.5	150	0.16	57	2.7	55	0.2	−124	10.1
1200	0.5	142	0.18	54	2.3	47	0.3	−128	8.6

Table 3 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	−79	0.02	63	33.0	145	0.8	−37	36.2
200	0.5	−152	0.06	54	11.8	100	0.4	−93	23.5
500	0.5	175	0.09	60	5.1	78	0.2	−117	15.8
800	0.5	159	0.13	59	3.3	64	0.2	−126	11.9
1000	0.5	150	0.16	57	2.7	55	0.2	−129	10.1
1200	0.5	142	0.19	54	2.3	47	0.3	−131	8.6

Table 4 Common emitter scattering parameters, I_C = 120 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	−81	0.02	63	33.5	145	0.8	−38	36.2
200	0.5	−157	0.05	55	12.0	99	0.4	−95	23.6
500	0.5	175	0.09	60	5.1	77	0.2	−119	15.8
800	0.5	159	0.13	59	3.3	63	0.2	−128	11.9
1000	0.5	149	0.16	56	2.7	55	0.2	−131	10.0
1200	0.5	141	0.19	53	2.3	47	0.3	−132	8.5

Table 5 Common emitter scattering parameters, I_C = 150 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	−82	0.02	63	33.6	145	0.8	−39	36.1
200	0.5	−158	0.05	55	11.8	99	0.3	−96	23.5
500	0.5	175	0.09	60	5.1	77	0.2	−121	15.8
800	0.5	159	0.13	59	3.3	63	0.2	−129	11.9
1000	0.5	149	0.16	56	2.7	55	0.2	−132	10.1
1200	0.5	141	0.19	53	2.3	47	0.3	−134	8.6

Table 6 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.5	−65	0.02	62	31.0	148	0.8	−30	36.0
200	0.5	−149	0.04	52	12.0	102	0.4	−73	23.7
500	0.5	179	0.08	58	5.2	78	0.3	−89	16.0
800	0.5	162	0.12	59	3.4	64	0.3	−99	12.2
1000	0.5	152	0.14	57	2.8	55	0.3	−104	10.4
1200	0.5	144	0.2	55	2.3	47	0.3	−109	8.7

Table 7 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.5	−68	0.02	62	32.9	148	0.8	−32	36.2
200	0.5	−151	0.04	53	12.5	101	0.4	−79	23.9
500	0.5	178	0.08	59	5.4	78	0.2	−97	16.2
800	0.5	161	0.12	59	3.5	64	0.2	−106	12.3
1000	0.5	152	0.15	57	2.8	56	0.3	−110	10.3
1200	0.4	144	0.17	55	2.4	48	0.3	−114	8.9

Table 8 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.5	−69	0.02	62	33.9	147	0.8	−34	36.3
200	0.5	−151	0.04	54	12.6	101	0.4	−82	23.9
500	0.5	178	0.08	59	5.5	78	0.2	−101	16.3
800	0.5	161	0.12	59	3.5	64	0.2	−109	12.3
1000	0.5	152	0.15	57	2.9	56	0.3	−113	10.5
1200	0.4	144	0.18	54	2.4	48	0.3	−117	8.8

Table 9 Common emitter scattering parameters, I_C = 120 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	−69	0.02	62	34.6	146	0.8	−32	36.5
200	0.5	−151	0.04	54	12.7	101	0.4	−83	24.0
500	0.5	178	0.08	60	5.5	78	0.2	−103	16.3
800	0.5	161	0.12	59	3.5	64	0.2	−112	12.3
1000	0.5	152	0.15	57	2.9	56	0.2	−115	10.5
1200	0.4	144	0.18	54	2.4	48	0.3	−118	8.8

Table 10 Common emitter scattering parameters, I_C = 150 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	−70	0.02	61	34.8	146	0.8	−35	36.5
200	0.5	−152	0.04	54	12.6	100	0.3	−84	23.9
500	0.5	178	0.08	60	5.4	78	0.2	−103	16.1
800	0.5	162	0.12	59	3.5	64	0.2	−111	12.3
1000	0.5	152	0.15	57	2.8	55	0.2	−114	9.6
1200	0.4	144	0.18	54	2.3	48	0.3	−117	8.9

NPN 4 GHz wideband transistor — BFQ34T

DESCRIPTION

NPN transistor in a plastic SOT37 envelope, intended for wideband amplification applications. The device features high output voltage capabilities.

A SOT5 (TO-39) version (ref: ON4497) is available on request.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

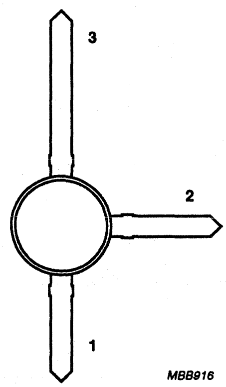


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	18	V
I_C	collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_j = 25 °C	–	3.7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	750	–	mV
P_{L1}	output power at 1 dB gain compression	V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz; T_{amb} = 25 °C	–	22	–	dBm
ITO	third order intercept point	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	41	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

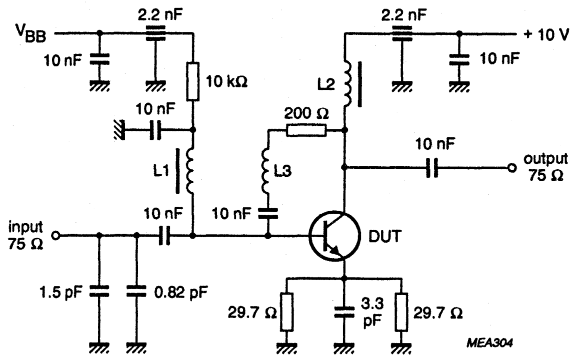
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 15$ V	–	–	100	μA
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V	25	70	–	
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 800 MHz	–	3.7	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1.2	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	12	–	dB
d_2	second order intermodulation distortion (Fig.2)	note 2	–	–55	–	dB
V_O	output voltage	note 3	–	1	–	V
		note 4	–	750	–	mV
P_{L1}	output power at 1 dB gain compression	$I_C = 90$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; measured at f = 800 MHz	–	22	–	dBm
ITO	third order intercept point	$I_C = 90$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	41	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $I_C = 60$ mA; $V_{CE} = 10$ V; $R_L = 75$ Ω; $T_{amb} = 25$ °C;
   $V_q = V_p = V_O = 48$ dBmV; $f_p = 560$ MHz;
   $V_q = V_O = 50$ dBmV; $f_q = 250$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B); $I_C = 100$ mA; $V_{CE} = 10$ V; $R_L = 75$ Ω; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 287.25$ MHz;
   $V_q = V_O -6$ dB; $f_q = 294.25$ MHz;
   $V_r = V_O -6$ dB; $f_r = 295.25$ MHz;
   measured at $f_{(p+q-r)} = 285.25$ MHz.
4. $d_{im} = -60$ dB (DIN 45004B); $I_C = 90$ mA; $V_{CE} = 10$ V; $R_L = 75$ Ω; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 797.25$ MHz;
   $V_q = V_O -6$ dB; $f_q = 803.25$ MHz;
   $V_r = V_O -6$ dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.



L1 = L2 = 5 μH Ferroxcube choke.

L3 = 2 turns 0.5 mm copper wire; winding pitch 2 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

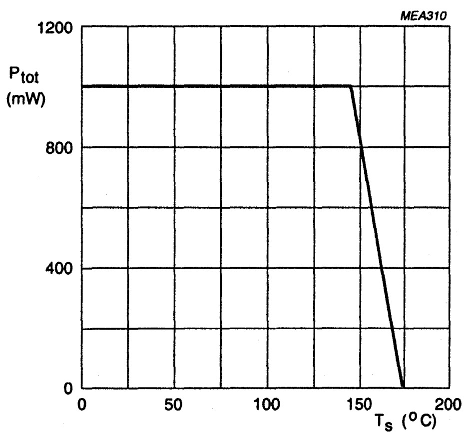
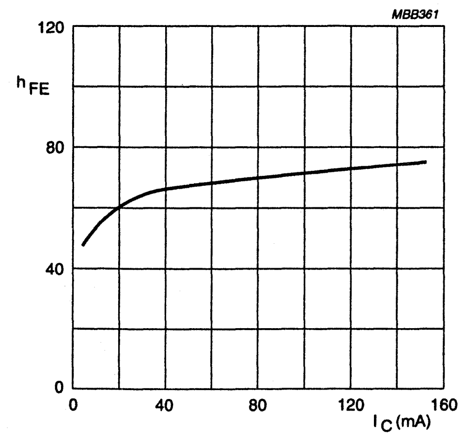
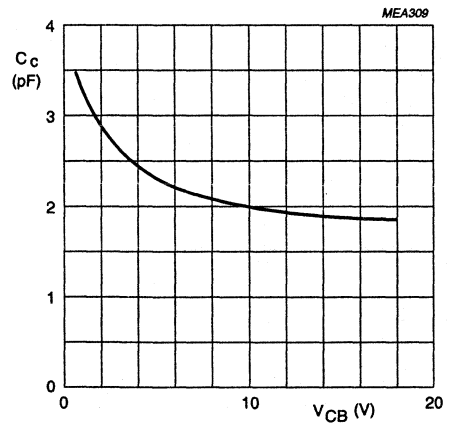


Fig.3 Power derating curve.



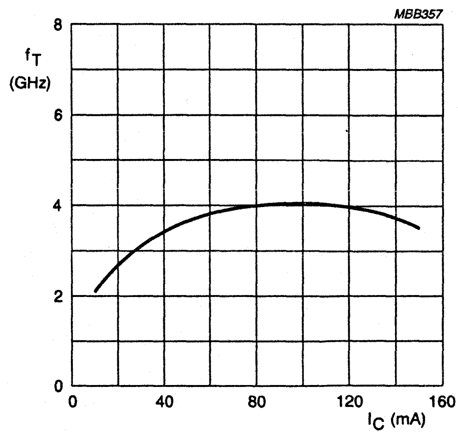
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



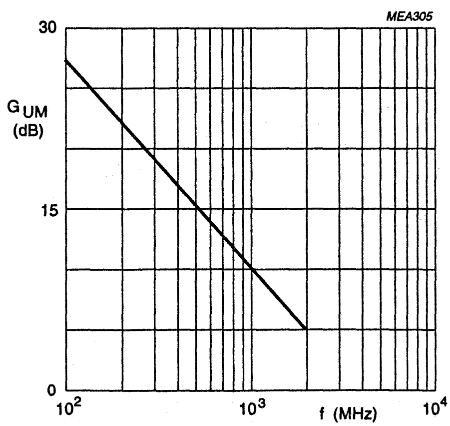
$I_E = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



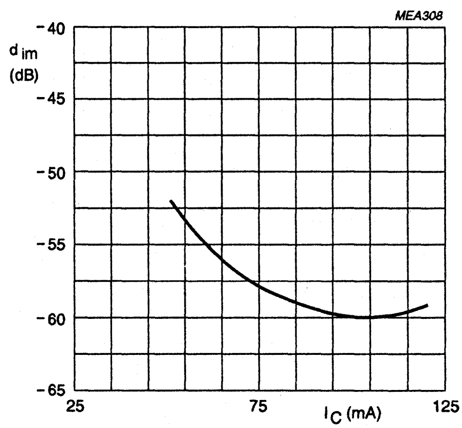
$V_{CE} = 10$ V; f = 800 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.



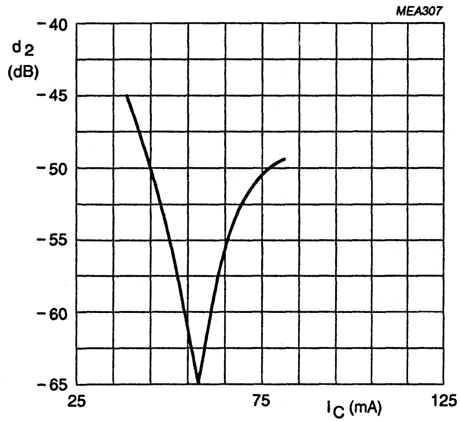
$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



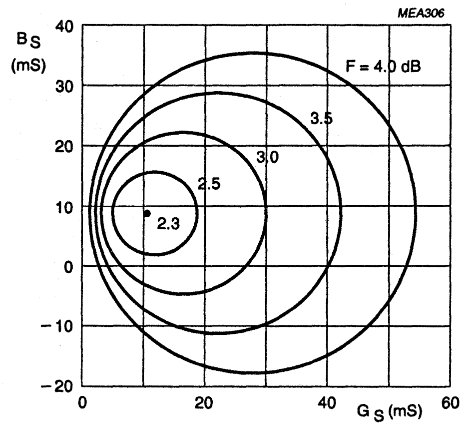
$V_{CE} = 10$ V; $V_O = 750$ mV; $T_{amb} = 25$ °C;
$f_{(p+q-r)} = 793.25$ MHz.

Fig.8 Intermodulation distortion as a function of collector current.



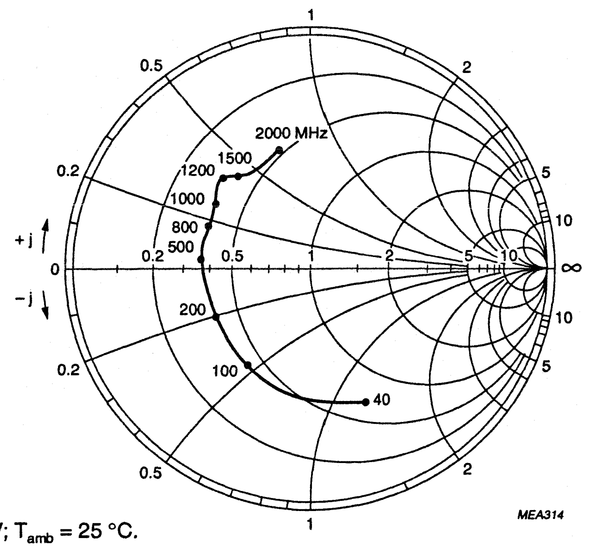
V_{CE} = 10 V; V_O = 48 dBmV; T_{amb} = 25 °C;
f_p = 560 MHz; f_q = 250 MHz; $f_{(p+q)}$ = 810 MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.



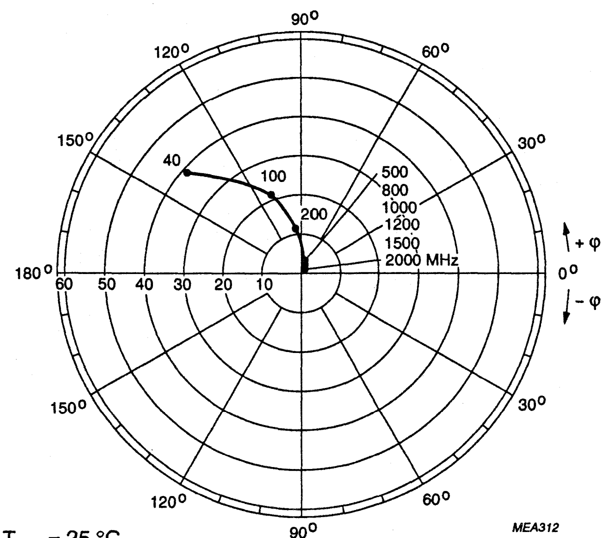
I_C = 20 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.



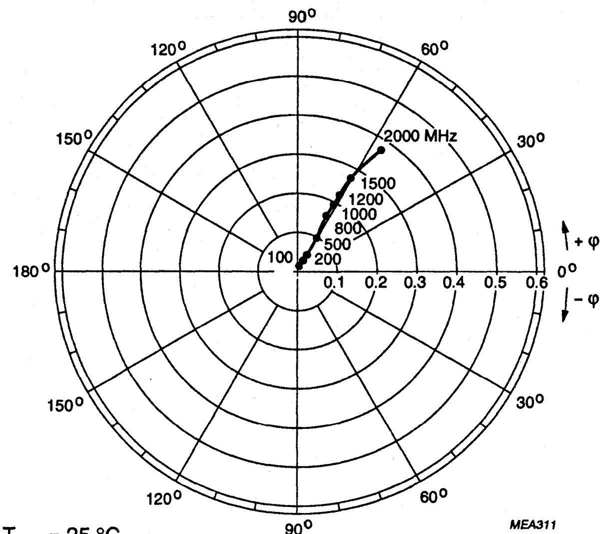
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter input reflection coefficient (S_{11}).



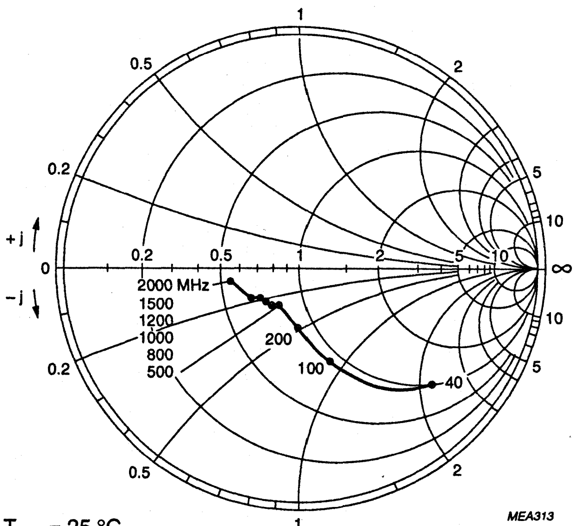
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter forward transmission coefficient (S_{21}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

NPN 4 GHz wideband transistor BFQ34T

Table 1 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.459	−73.8	32.733	142.7	0.019	65.0	0.801	−35.7	35.8
100	0.469	−126.0	19.677	116.6	0.033	56.9	0.500	−61.7	28.2
200	0.479	−156.6	10.977	98.5	0.048	58.6	0.307	−78.8	22.4
300	0.483	−171.9	7.424	89.5	0.063	61.8	0.241	−88.2	18.8
400	0.507	179.1	5.674	82.8	0.078	64.1	0.216	−94.6	16.6
500	0.507	172.8	4.597	77.4	0.093	66.0	0.211	−100.5	14.7
600	0.488	165.6	3.858	73.2	0.108	66.2	0.212	−105.1	13.1
700	0.511	159.7	3.356	68.7	0.124	65.8	0.217	−108.3	12.0
800	0.507	153.1	2.937	64.2	0.138	66.5	0.223	−111.7	10.9
900	0.521	147.9	2.643	60.4	0.156	66.1	0.229	−114.9	10.1
1000	0.526	142.5	2.364	56.4	0.172	65.3	0.237	−118.5	9.1
1200	0.554	133.2	2.041	49.9	0.203	63.5	0.254	−127.3	8.1
1400	0.549	125.2	1.760	42.5	0.229	61.7	0.281	−136.1	6.8
1600	0.578	118.3	1.552	36.3	0.263	60.1	0.315	−142.3	6.0
1800	0.580	109.9	1.403	30.5	0.292	56.7	0.344	−148.6	5.3
2000	0.613	100.8	1.302	25.5	0.322	54.6	0.363	−154.8	5.0

Table 2 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.463	−74.1	33.964	141.6	0.020	64.0	0.786	−37.5	35.8
100	0.475	−126.8	20.065	115.5	0.033	58.0	0.481	−64.3	28.3
200	0.484	−156.8	11.112	98.0	0.048	57.9	0.294	−82.6	22.5
300	0.479	−173.0	7.528	89.3	0.062	61.6	0.230	−92.9	18.9
400	0.494	177.7	5.729	82.6	0.079	64.5	0.210	−99.6	16.6
500	0.487	172.5	4.642	77.2	0.094	65.6	0.204	−105.5	14.7
600	0.487	164.6	3.896	73.1	0.110	66.5	0.205	−110.0	13.2
700	0.503	159.6	3.382	68.7	0.127	66.0	0.210	−113.1	12.0
800	0.506	151.9	2.965	64.1	0.141	66.1	0.216	−116.1	10.9
900	0.512	148.2	2.667	60.5	0.159	65.2	0.221	−119.3	10.1
1000	0.525	142.8	2.384	56.6	0.174	64.7	0.228	−122.5	9.2
1200	0.544	133.5	2.069	50.4	0.205	62.8	0.245	−131.4	8.1
1400	0.555	124.4	1.773	42.8	0.232	61.1	0.273	−139.3	6.9
1600	0.579	117.7	1.578	36.7	0.264	59.3	0.307	−145.3	6.2
1800	0.587	110.0	1.434	31.1	0.293	55.8	0.332	−151.1	5.5
2000	0.617	101.6	1.310	26.5	0.322	53.5	0.353	−157.1	5.0

PNP 5 GHz wideband transistor BFQ51

DESCRIPTION

PNP transistor in a plastic SOT37 envelope.

It is primarily intended for use in RF amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc. The transistor features extremely high power gain coupled with good low noise performance.

NPN complement is the BFR90A.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

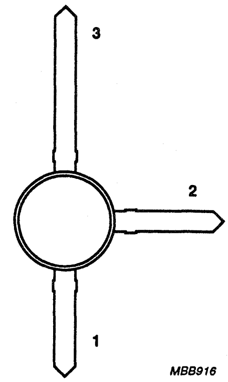


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–15	V
I_C	collector current		–	–25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = –14 mA; V_{CE} = –10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz	0.45	–	pF
F	noise figure	I_C = –4 mA; V_{CE} = –10 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	2.4	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

 Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–25	mA
I_{CM}	peak collector current	f > 1 MHz	–	–35	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -10$ V	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -14$ mA; $V_{CE} = -10$ V	20	50	–	
f_T	transition frequency	$I_C = -14$ mA; $V_{CE} = -10$ V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	0.65	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	0.45	–	pF
F	noise figure	$I_C = -4$ mA; $V_{CE} = -10$ V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	2.4	–	dB
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -14$ mA; $V_{CE} = -10$ V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		$I_C = -14$ mA; $V_{CE} = -10$ V; f = 800 MHz; T_{amb} = 25 °C	–	14	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

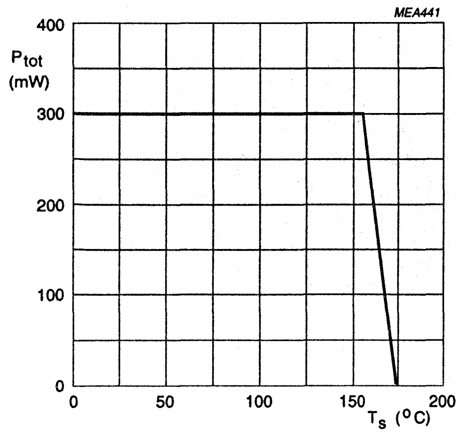
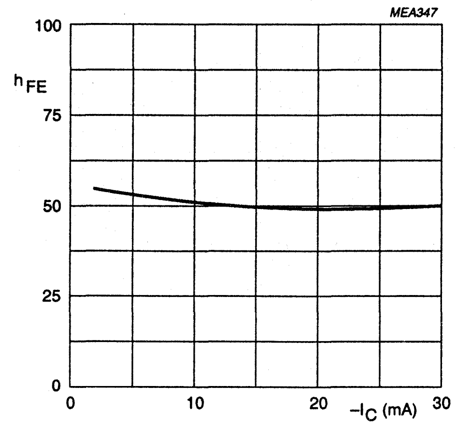
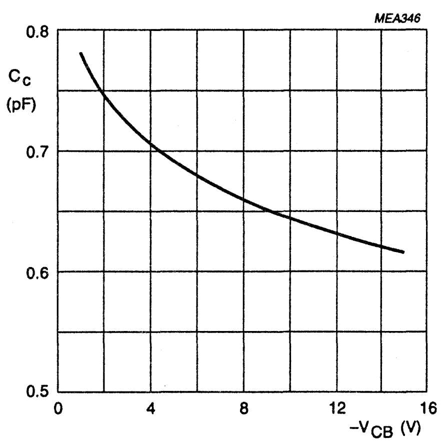


Fig.2 Power derating curve.



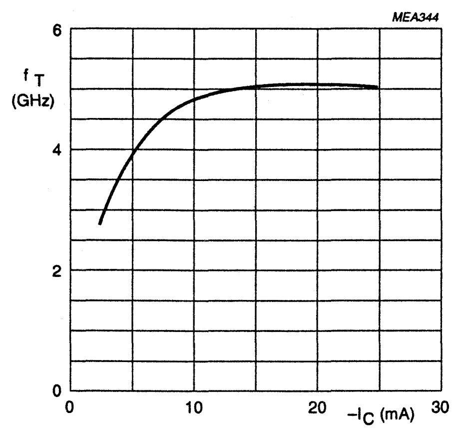
V_{CE} = −10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



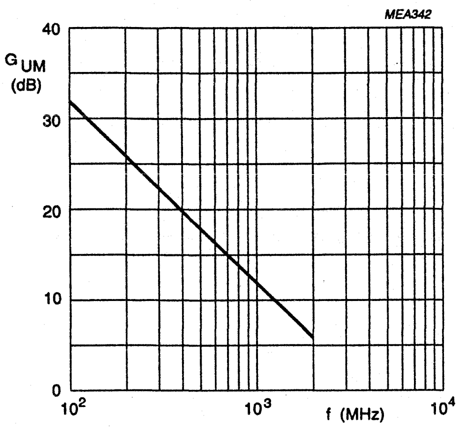
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



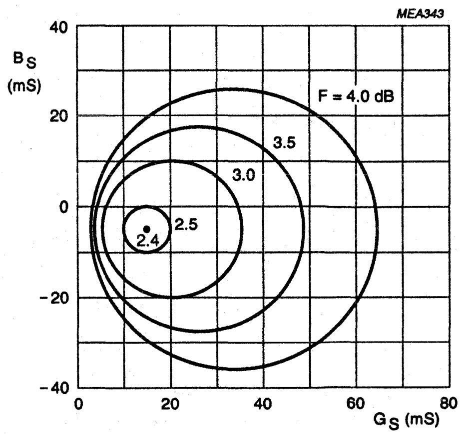
V_{CE} = −10 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



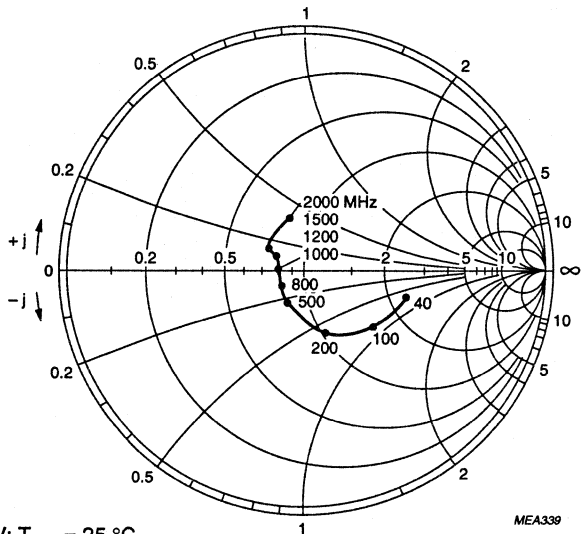
$I_C = -14$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



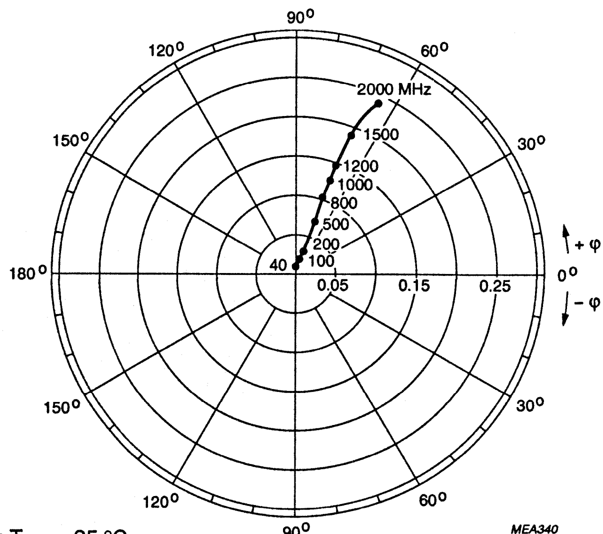
$I_C = -4$ mA; $V_{CE} = -10$ V; f = 800 MHz; $T_{amb} = 25$ °C.

Fig.7 Noise circle figure.



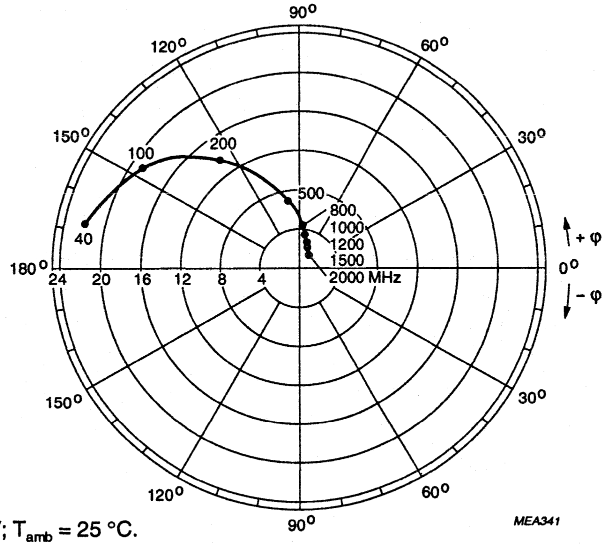
$I_C = -14$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



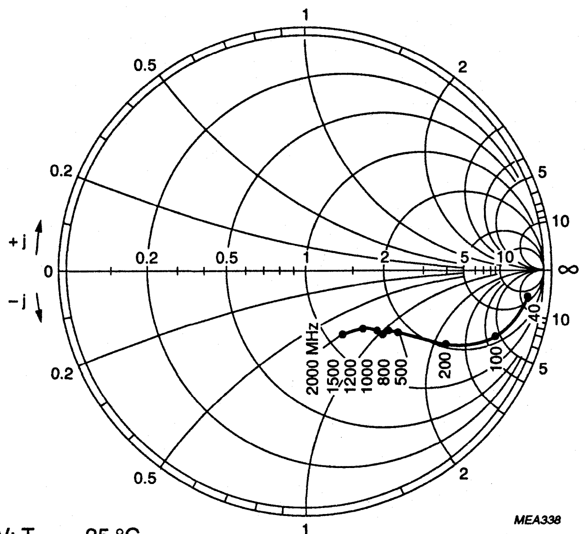
$I_C = -14$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.9 Common emitter reverse transmission coefficient (S_{12}).



$I_C = -14$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.10 Common emitter forward transmission coefficient (S_{21}).



$I_C = -14$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = -15$ mA; $V_{CE} = -5$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.289	−22.5	17.125	164.9	0.009	80.7	0.934	−9.3	34.0
100	0.265	−54.2	15.010	146.1	0.022	75.4	0.842	−20.6	29.2
200	0.229	−94.5	11.245	124.7	0.039	71.5	0.676	−30.9	23.9
300	0.215	−124.3	8.596	111.3	0.053	70.5	0.567	−35.2	20.6
400	0.211	−143.8	6.849	102.0	0.065	69.9	0.501	−37.2	18.2
500	0.213	−158.3	5.644	95.3	0.078	69.7	0.461	−38.5	16.3
600	0.212	−169.6	4.844	89.9	0.092	70.0	0.435	−39.8	14.8
700	0.213	−179.8	4.222	85.1	0.103	69.8	0.418	−41.0	13.5
800	0.211	170.6	3.746	80.5	0.117	69.4	0.406	−42.2	12.5
900	0.216	161.2	3.355	76.5	0.129	68.6	0.393	−43.6	11.4
1000	0.222	152.4	3.044	72.9	0.142	67.6	0.382	−44.8	10.6
1200	0.253	139.1	2.591	66.5	0.167	66.0	0.359	−48.9	9.2
1400	0.284	129.7	2.288	60.1	0.191	64.3	0.337	−54.6	8.1
1600	0.296	122.0	2.028	54.1	0.215	62.5	0.328	−60.7	7.0
1800	0.312	112.9	1.843	49.2	0.238	59.9	0.322	−66.7	6.2
2000	0.340	103.1	1.690	43.7	0.260	58.2	0.310	−71.6	5.5

Table 2 Common emitter scattering parameters, $I_C = -15$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.413	−16.7	18.889	165.1	0.009	80.7	0.940	−8.6	35.7
100	0.366	−39.9	16.649	147.0	0.021	75.9	0.854	−19.2	30.7
200	0.278	−70.6	12.589	126.1	0.037	72.3	0.696	−28.8	25.2
300	0.218	−94.8	9.679	112.8	0.050	70.7	0.590	−32.7	21.8
400	0.183	−114.0	7.733	103.6	0.062	70.3	0.525	−34.6	19.3
500	0.166	−130.5	6.380	97.1	0.075	70.3	0.486	−35.8	17.4
600	0.151	−144.6	5.479	91.8	0.087	70.5	0.461	−37.1	15.9
700	0.143	−157.4	4.779	87.3	0.099	70.3	0.444	−38.1	14.6
800	0.135	−170.1	4.240	82.9	0.112	69.5	0.433	−39.3	13.5
900	0.129	176.1	3.794	79.0	0.123	68.9	0.418	−40.5	12.5
1000	0.134	162.5	3.436	75.6	0.136	68.3	0.409	−41.6	11.6
1200	0.162	144.4	2.923	69.4	0.159	66.4	0.384	−45.2	10.1
1400	0.194	133.2	2.580	63.3	0.183	64.7	0.363	−50.3	9.0
1600	0.207	125.2	2.287	57.7	0.205	62.9	0.352	−56.0	7.9
1800	0.222	115.4	2.073	53.1	0.227	60.5	0.345	−61.3	7.1
2000	0.249	104.5	1.896	47.8	0.248	58.8	0.333	−65.4	6.3

PNP 5 GHz wideband transistor | BFQ52

DESCRIPTION

PNP transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in RF amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor features extremely high power gain coupled with good low noise performance.

NPN complement is BFQ53.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

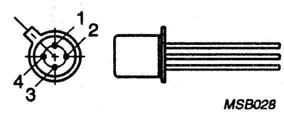


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–15	V
I_C	DC collector current		–	–25	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = –14 mA; V_{CE} = –10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz	0.5	–	pF
G_{UM}	maximum unilateral power gain	I_C = –14 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	17	–	dB
F	noise figure	I_C = –2 mA; V_{CE} = –10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	2.7	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–25	mA
I_{CM}	peak collector current	f > 1 MHz	–	–35	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

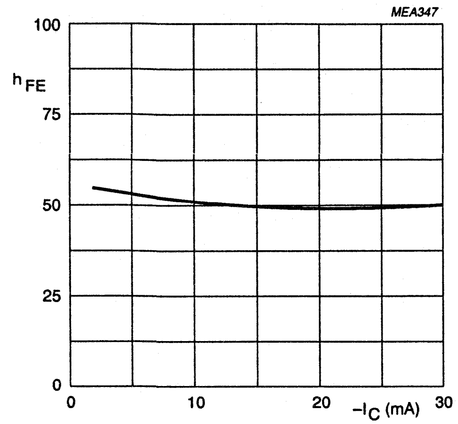
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	−50	nA
h_{FE}	DC current gain	I_C = −14 mA; V_{CE} = −10 V	20	50	–	
C_c	collector capacitance (note 2)	$I_E = i_e$ = 0; V_{CB} = −10 V; f = 1 MHz	–	0.85	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = −0.5 V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance (note 1)	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency (note 1)	I_C = −14 mA; V_{CE} = −10 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (notes 1 and 3)	I_C = −14 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	17	–	dB
F	noise figure (note 1)	I_C = −2 mA; V_{CE} = −10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	2.7	–	dB

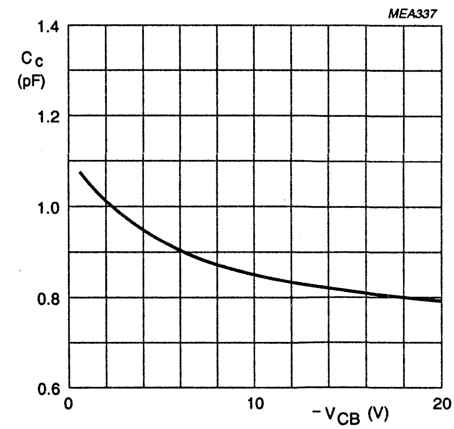
Notes

1. Shield lead grounded.
2. Shield lead not connected
3. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



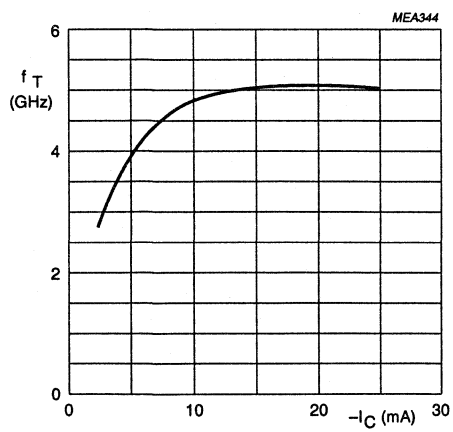
$V_{CE} = -10$ V; $T_j = 25$ °C.

Fig.2 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; $T_j = 25$ °C

Fig.3 Collector capacitance as a function of collector-base voltage.



$V_{CE} = -10$ V; f = 500 MHz; $T_j = 25$ °C

Fig.4 Transition frequency as a function of collector current.

NPN 5 GHz wideband transistor — BFQ53

DESCRIPTION

NPN transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in RF amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor has extremely high power gain coupled with good low noise performance.

PNP complement is BFQ52.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

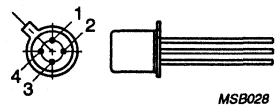


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	0.45	–	pF
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	18	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; Z_S = opt.; f = 1 GHz; T_{amb} = 25 °C	2.1	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current	f > 1 MHz	–	35	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

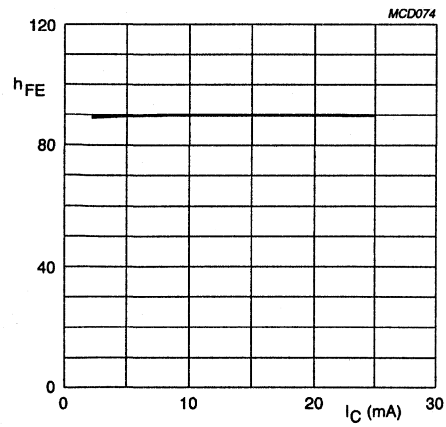
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V	40	90	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.75	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	0.45	–	pF
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; Z_S = opt.; f = 1 GHz; T_{amb} = 25 °C	–	2.1	–	dB

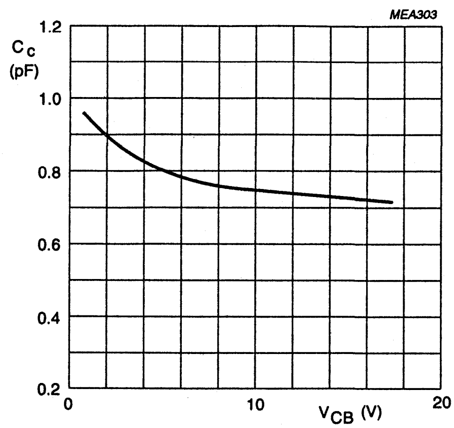
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



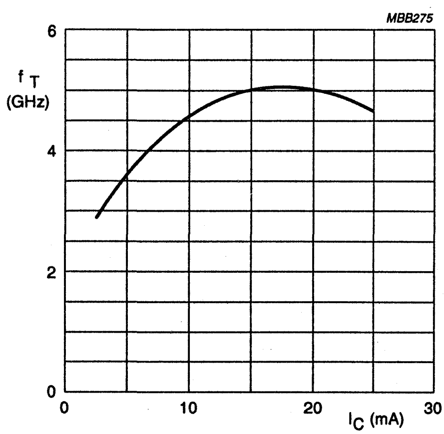
V_{CE} = 10 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



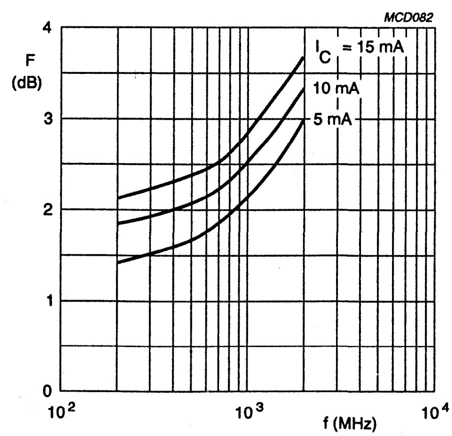
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



V_{CE} = 10 V; Z_S = opt.; T_{amb} = 25 °C

Fig.5 Minimum noise figure as a function of frequency.

PNP 4 GHz wideband transistor BFQ54T

DESCRIPTION

PNP transistor in a plastic SOT37 package.

It is primarily intended for use in MATV and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

Emitter-ballasting resistors and application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

NPN complement is BFQ34T.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

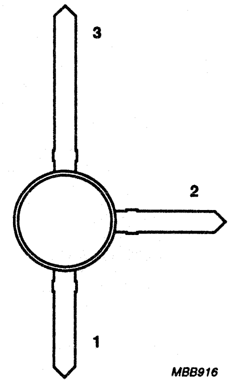


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–18	V
I_C	collector current		–	–150	mA
P_{tot}	total power dissipation	up to T_s = 130 °C (note 1)	–	1	W
f_T	transition frequency	I_C = –100 mA; V_{CE} = –10 V; f = 500 MHz	4.5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = –10 V; f = 1 MHz; T_{amb} = 25 °C	1.7	–	pF
V_O	output voltage	d_{im} = –60 dB; I_C = –100 mA; V_{CE} = –10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	700	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

PNP 4 GHz wideband transistor BFQ54T

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–25	V
V_{CEO}	collector-emitter voltage	open base	–	–18	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–150	mA
P_{tot}	total power dissipation	up to T_s = 130 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 130 °C (note 1)	45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

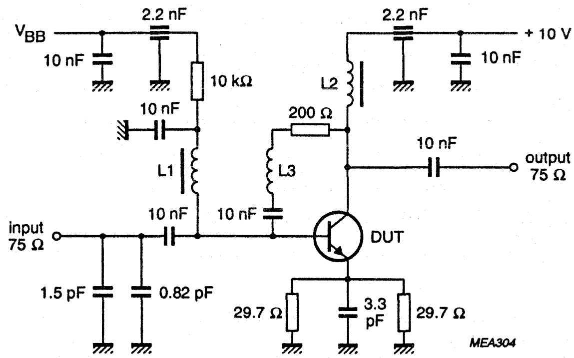
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -15$ V	–	–	–1	μA
h_{FE}	DC current gain	$I_C = -100$ mA; $V_{CE} = -10$ V; T_{amb} = 25 °C	25	70	–	
f_T	transition frequency	$I_C = -100$ mA; $V_{CE} = -10$ V; f = 500 MHz; T_{amb} = 25 °C	–	4.5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	2.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = -10$ V; f = 1 MHz	–	1.7	–	pF
G_{UM}	maximum unilateral power gain	$I_C = -100$ mA; $V_{CE} = -10$ V; f = 300 MHz; T_{amb} = 25 °C	–	18	–	dB
V_O	output voltage (see Fig.2)	note 1	–	700	–	mV

Note

1. $d_{im} = -60$ dB (DIN 45004B); $I_C = -100$ mA; $V_{CE} = -10$ V; $R_L = 75\ \Omega$; T_{amb} = 25 °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



L1 = L2 = 5 μH Ferroxcube choke.

L3 = 2 turns 0.5 mm copper wire; winding pitch 2 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

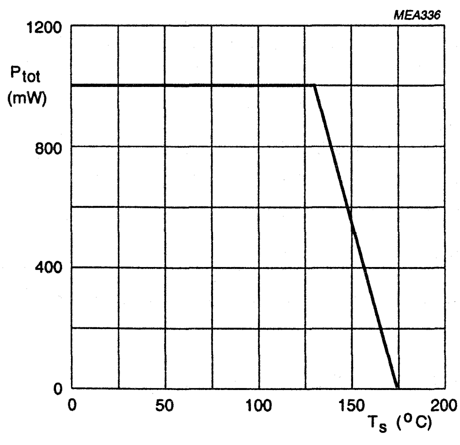
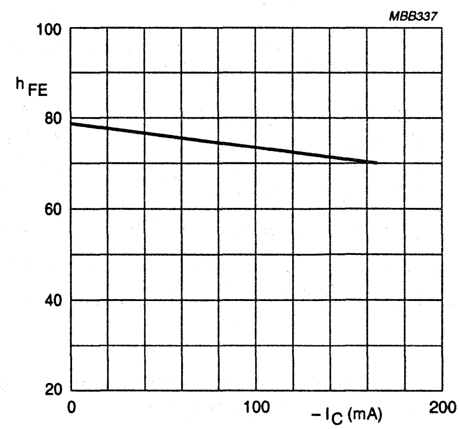
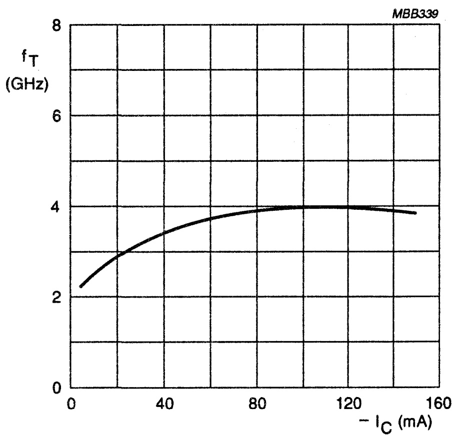


Fig.3 Power derating curve.



$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.4 DC current gain as a function of collector current.



$V_{CE} = -10$ V; f = 500 MHz; $T_{amb} = 25$ °C.

Fig.5 Transition frequency as a function of collector current.

NPN 5 GHz wideband transistor — BFQ63

DESCRIPTION

NPN transistor in a TO-72 metal envelope with insulated electrodes and a shield lead connected to the case. It is primarily intended for use in UHF and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor features the combination of high power gain, high transition frequency and low noise up to high frequencies.

PNP complement is BFQ32M.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

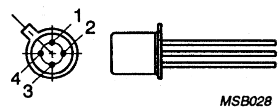


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	75	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 5 V; f = 200 MHz; T_{amb} = 25 °C	17.5	–	dB
F	noise figure	I_C = 10 mA; V_{CE} = 5 V; Z_S = opt.; f = 200 MHz; T_{amb} = 25 °C	–	3	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	75	mA
I_{CM}	peak collector current	f > 1 MHz	–	150	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 50 °C (note 1)	600 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 5 V	25	80	–	
C_c	collector capacitance	$I_C = i_c$ = 0; V_{CB} = 5 V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1	1.4	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	11.5	–	dB
F	noise figure	I_C = 10 mA; V_{CE} = 5 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	2.3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

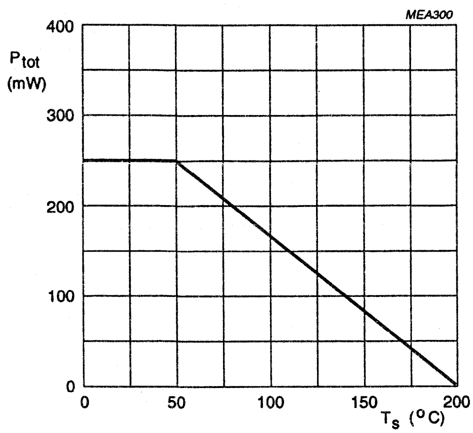
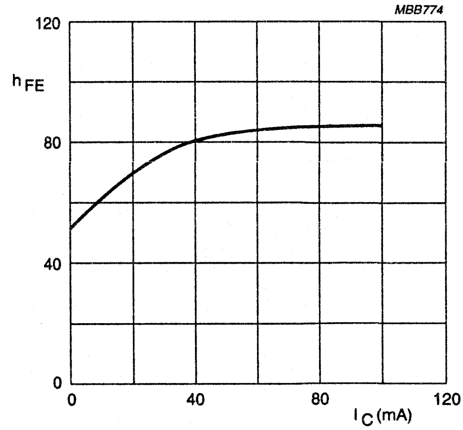
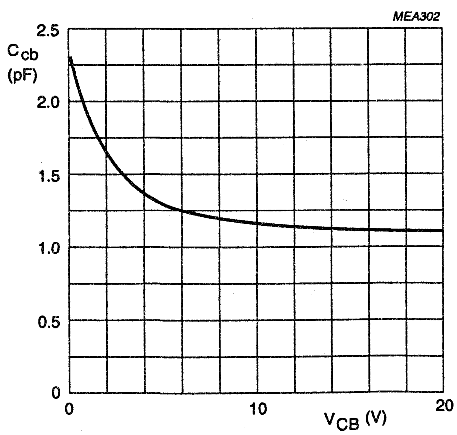


Fig.2 Power derating curve.



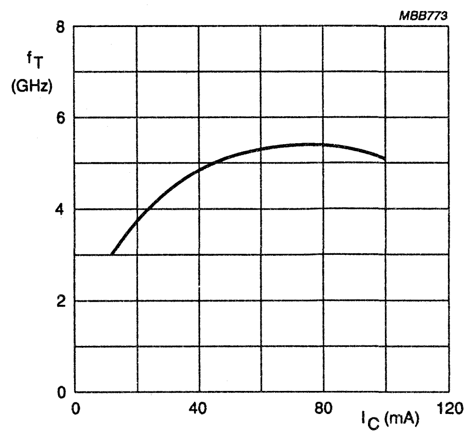
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



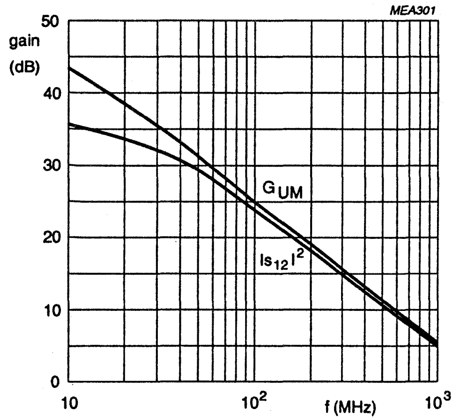
$I_C = i_c = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



I_C = 50 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.6 Gain as a function of frequency.

NPN 8 GHz wideband transistor — BFQ65

DESCRIPTION

NPN transistor in a plastic SOT37 envelope. It is designed for wideband application in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optic systems.

The transistor features a very high transition frequency and a very low noise figure up to 2 GHz.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

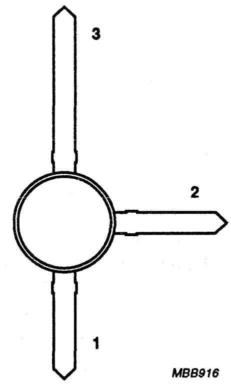


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V; T_j = 25 °C	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	I_C = 15 mA; V_{CE} = 8 V; Z_S = opt.; f = 1 GHz; T_{amb} = 25 °C	–	1.7	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.8	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; Z_S = opt.; f = 1 GHz; T_{amb} = 25 °C	–	1.3	–	dB
		I_C = 15 mA; V_{CE} = 8 V; Z_S = opt.; f = 1 GHz; T_{amb} = 25 °C	–	1.7	–	dB
		I_C = 5 mA; V_{CE} = 8 V; Z_S = opt.; f = 2 GHz; T_{amb} = 25 °C	–	2.1	–	dB
		I_C = 15 mA; V_{CE} = 8 V; Z_S = opt.; f = 2 GHz; T_{amb} = 25 °C	–	2.7	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

NPN 8 GHz wideband transistor BFQ65

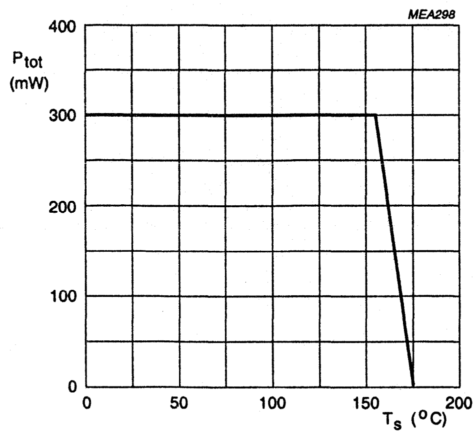
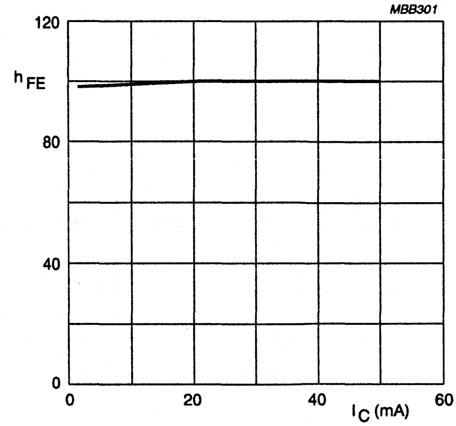
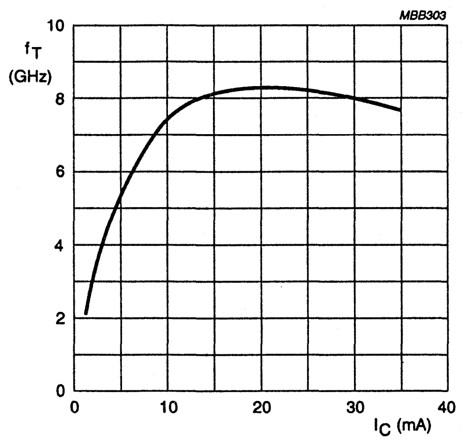


Fig.2 Power derating curve.



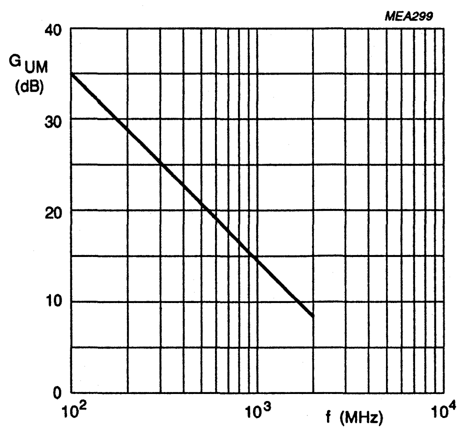
V_{CE} = 8 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



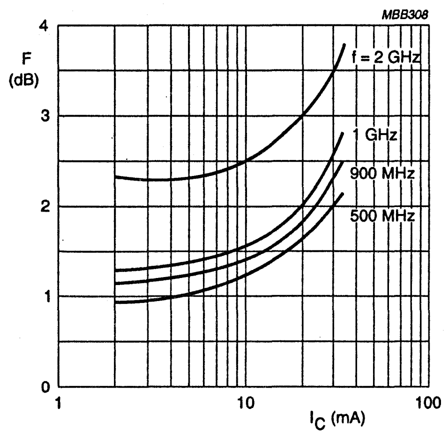
V_{CE} = 8 V; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



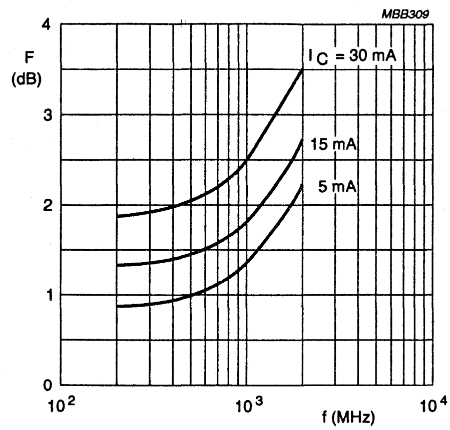
I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.5 Maximum unilateral power gain as a function of frequency.



V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.



V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Minimum noise figure as a function of frequency.

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.732	−17.5	25.377	163.7	0.009	81.6	0.959	−9.1	42.4
100	0.633	−40.1	21.968	143.9	0.020	71.4	0.854	−19.8	34.7
200	0.453	−67.8	16.078	121.9	0.033	65.2	0.685	−28.2	27.9
300	0.335	−87.5	12.134	108.6	0.043	63.4	0.584	−31.0	24.0
400	0.269	−102.8	9.631	99.7	0.052	64.0	0.528	−32.0	21.4
500	0.227	−116.7	7.945	92.7	0.062	64.6	0.496	−33.2	19.5
600	0.196	−128.9	6.752	87.1	0.072	64.5	0.477	−34.3	17.9
700	0.169	−139.6	5.836	82.2	0.082	64.4	0.466	−35.3	16.5
800	0.151	−150.8	5.165	78.2	0.091	63.9	0.457	−36.5	15.4
900	0.139	−162.3	4.626	73.8	0.101	63.0	0.448	−37.4	14.4
1000	0.137	−176.6	4.205	70.1	0.111	62.4	0.440	−38.4	13.5
1200	0.143	159.6	3.596	62.6	0.132	60.0	0.415	−42.2	12.0
1400	0.170	141.7	3.132	55.6	0.152	57.1	0.391	−48.2	10.8
1600	0.179	132.5	2.774	49.2	0.172	54.9	0.383	−54.9	9.7
1800	0.188	122.2	2.536	43.0	0.194	52.1	0.383	−60.7	8.9
2000	0.213	111.5	2.327	36.8	0.213	48.6	0.373	−65.0	8.2
2200	0.247	101.9	2.142	30.8	0.233	45.7	0.348	−69.7	7.4
2400	0.286	96.4	2.015	25.6	0.252	42.8	0.319	−77.6	6.9
2600	0.317	93.4	1.918	19.2	0.272	39.1	0.305	−88.7	6.5
2800	0.336	86.3	1.803	12.9	0.292	35.4	0.305	−98.4	6.1
3000	0.344	81.4	1.715	8.4	0.312	32.5	0.309	−104.8	5.7

Table 2 Common emitter scattering parameters, $I_C = 15$ mA; $V_{CE} = 8$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.644	−21.3	32.556	160.1	0.008	80.0	0.936	−11.2	41.7
100	0.524	−47.0	26.487	137.6	0.018	70.6	0.796	−22.7	34.2
200	0.347	−75.5	17.904	115.8	0.030	67.5	0.615	−29.1	27.7
300	0.248	−96.2	13.062	103.7	0.040	67.0	0.526	−30.2	24.0
400	0.201	−110.6	10.190	95.9	0.051	68.4	0.481	−30.7	21.5
500	0.169	−124.5	8.328	89.6	0.061	68.4	0.457	−31.6	19.6
600	0.147	−138.1	7.043	84.6	0.072	68.1	0.444	−32.7	18.0
700	0.130	−149.1	6.080	79.9	0.082	67.4	0.436	−33.7	16.7
800	0.116	−160.1	5.369	76.2	0.093	66.5	0.430	−34.9	15.5
900	0.110	−172.7	4.796	72.4	0.103	65.6	0.423	−36.0	14.5
1000	0.111	172.1	4.349	68.8	0.114	64.6	0.416	−37.1	13.6
1200	0.126	150.6	3.722	61.6	0.135	61.4	0.393	−41.0	12.2
1400	0.154	134.9	3.234	55.0	0.157	58.3	0.369	−47.0	10.9
1600	0.171	125.5	2.858	48.7	0.178	55.4	0.361	−54.1	9.9
1800	0.177	117.2	2.619	42.7	0.199	52.5	0.361	−60.2	9.1
2000	0.203	106.6	2.399	36.6	0.220	48.8	0.352	−64.7	8.4
2200	0.240	100.3	2.203	31.0	0.239	45.6	0.326	−69.1	7.6
2400	0.276	95.1	2.073	25.6	0.259	42.4	0.296	−77.3	7.1
2600	0.310	92.3	1.965	19.3	0.279	38.3	0.281	−88.7	6.7
2800	0.321	86.9	1.859	13.1	0.298	34.7	0.282	−99.1	6.2
3000	0.345	80.4	1.770	8.8	0.319	31.8	0.286	−105.5	5.9

Table 3 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.579	−24.3	37.831	157.3	0.008	78.0	0.915	−12.7	41.2
100	0.445	−52.4	29.303	133.3	0.017	70.9	0.752	−24.4	33.9
200	0.280	−81.4	18.867	112.2	0.029	69.3	0.573	−29.1	27.6
300	0.200	−102.0	13.485	100.9	0.039	70.2	0.493	−29.3	24.0
400	0.161	−117.8	10.448	93.7	0.050	70.3	0.455	−29.4	21.5
500	0.141	−132.4	8.505	87.9	0.061	70.7	0.436	−30.3	19.6
600	0.125	−145.5	7.176	83.1	0.072	69.8	0.426	−31.5	18.1
700	0.111	−156.9	6.179	78.7	0.083	69.1	0.420	−32.9	16.7
800	0.100	−170.5	5.454	75.1	0.093	68.1	0.415	−34.0	15.6
900	0.096	−178.6	4.874	71.4	0.104	66.7	0.410	−35.1	14.6
1000	0.104	164.7	4.407	67.8	0.115	65.4	0.403	−36.2	13.7
1200	0.122	143.4	3.771	60.8	0.137	62.3	0.381	−40.1	12.3
1400	0.151	131.6	3.274	54.3	0.159	58.8	0.357	−46.4	11.0
1600	0.166	122.5	2.901	48.3	0.181	55.8	0.350	−53.4	9.9
1800	0.171	115.6	2.651	42.4	0.203	52.7	0.349	−59.9	9.2
2000	0.197	106.0	2.433	36.4	0.223	48.8	0.341	−64.2	8.4
2200	0.236	98.3	2.236	30.5	0.243	45.6	0.315	−68.9	7.7
2400	0.272	92.5	2.105	25.4	0.262	42.1	0.285	−77.3	7.2
2600	0.304	91.5	1.995	19.3	0.283	38.1	0.270	−88.9	6.7
2800	0.316	85.1	1.881	13.0	0.302	34.3	0.269	−99.4	6.3
3000	0.335	79.4	1.791	8.5	0.321	31.4	0.274	−106.0	5.9

NPN 8 GHz wideband transistor | BFQ66

DESCRIPTION

Small-signal planar epitaxial NPN transistor in hermetically-sealed sub-miniature SOT173 and SOT173X micro-stripline envelopes.

It is designed for wideband applications in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optic systems. The transistor features a very high transition frequency and a very low noise figure up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: Q6	
1	collector
2	emitter
3	base (indicated by a red dot on body)
4	emitter

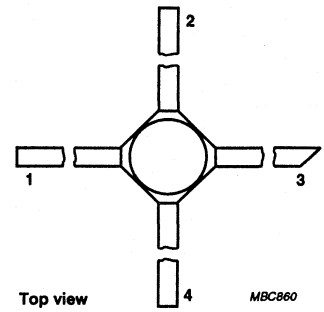


Fig.1 SOT173.

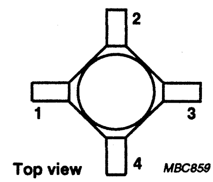


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	350	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V; T_j = 25 °C	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	11.5	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	350	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	80 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

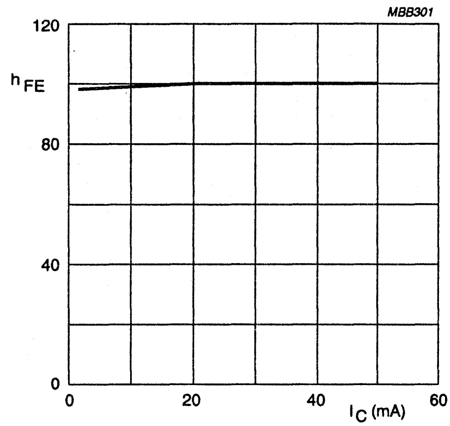
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	11.5	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 8$ V; $Z_S = 50\ \Omega$; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; $Z_S = 50\ \Omega$; f = 2 GHz; $T_{amb} = 25$ °C	–	2.7	4	dB

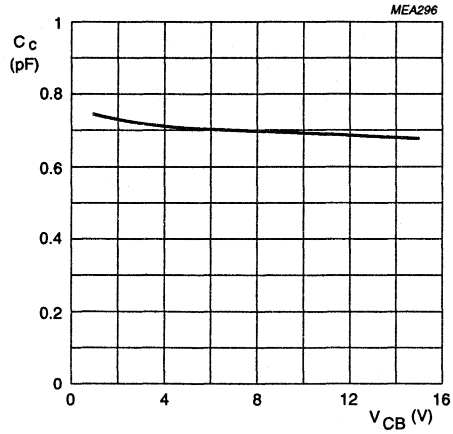
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



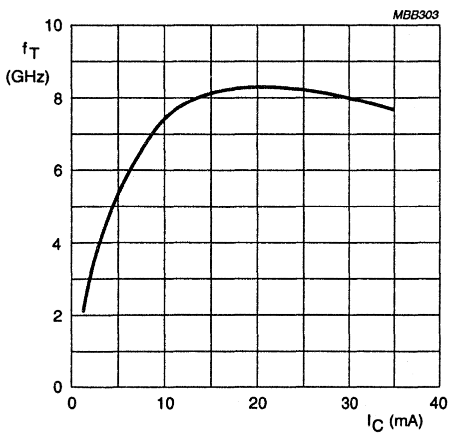
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



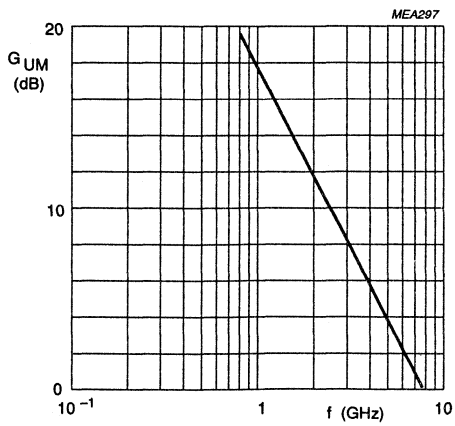
I_E = i_e = 0; f = 1 MHz; T_j = 25 °C

Fig.4 Collector capacitance as a function of collector-base voltage.



V_{CE} = 8 V; f = 500 MHz; T_j = 25 °C

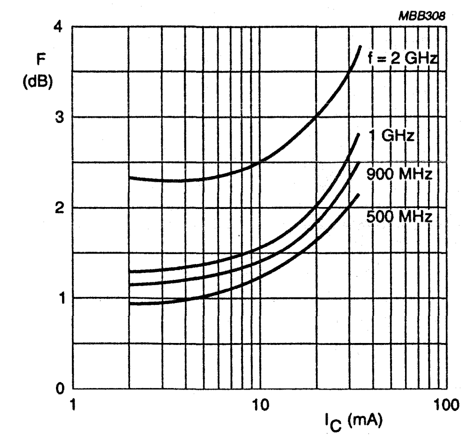
Fig.5 Transition frequency as a function of collector current.



I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C

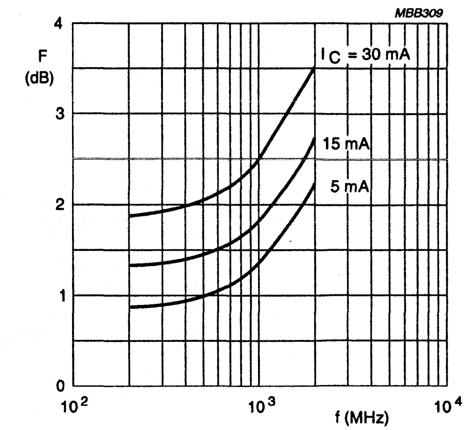
Fig.6 Maximum unilateral power gain as a function of frequency.

NPN 8 GHz wideband transistor BFQ66



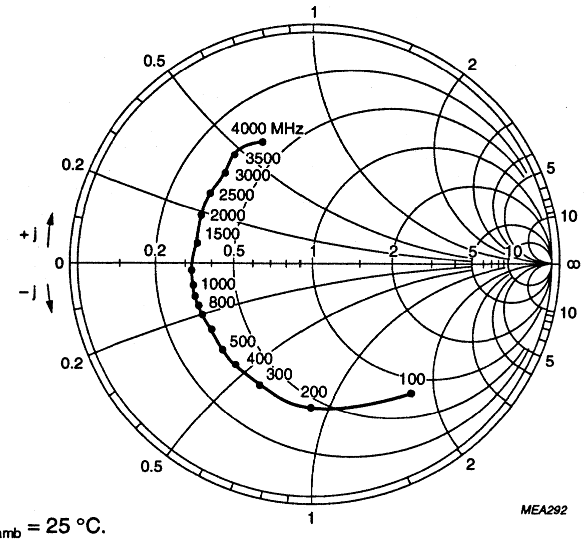
V_{CE} = 8 V; T_{amb} = 25 °C

Fig.7 Minimum noise figure as a function of collector current.



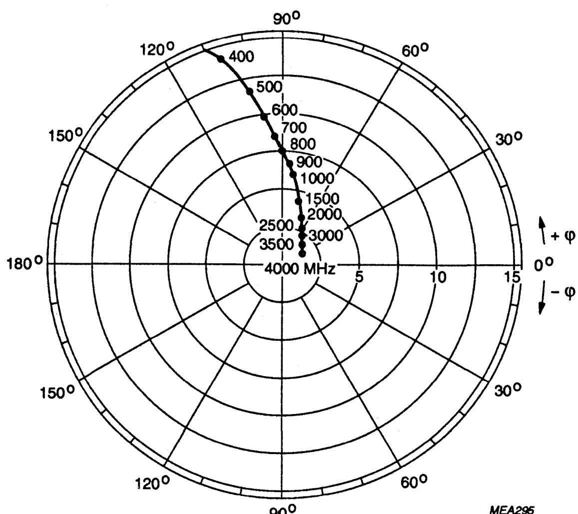
V_{CE} = 8 V; T_{amb} = 25 °C

Fig.8 Minimum noise figure as a function of frequency.



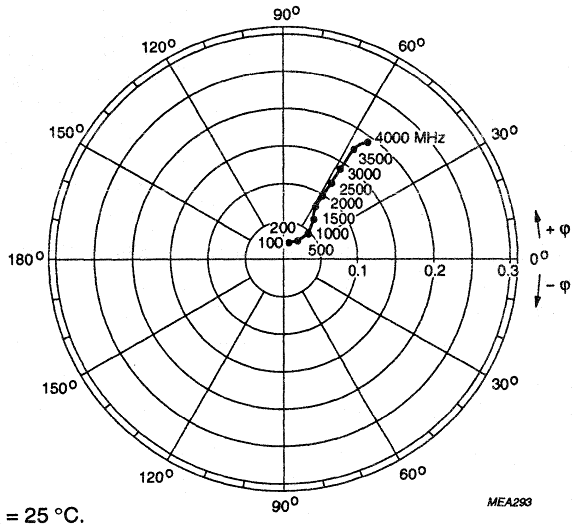
I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Common emitter input reflection coefficient (S_{11}).



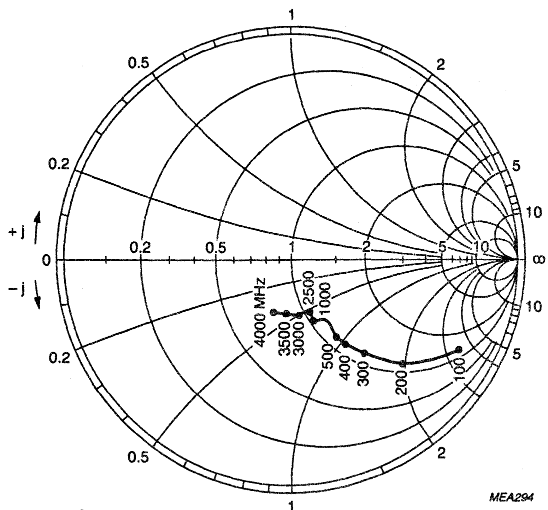
I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Common emitter reverse transmission coefficient (S_{12}).



I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.12 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.796	−16.8	25.543	168.7	0.009	82.5	0.966	−8.5	44.3
100	0.757	−40.5	23.670	154.2	0.021	71.1	0.904	−20.0	38.6
200	0.679	−73.5	19.454	135.3	0.034	58.5	0.757	−34.2	32.2
300	0.621	−98.0	15.710	122.3	0.043	51.6	0.630	−42.6	28.2
400	0.591	−115.6	12.885	113.4	0.048	47.9	0.538	−47.7	25.6
500	0.575	−128.6	10.830	106.9	0.052	47.0	0.475	−50.8	23.5
600	0.565	−137.7	9.316	101.8	0.056	46.6	0.429	−52.8	21.9
700	0.552	−145.3	8.148	97.7	0.059	47.2	0.397	−54.0	20.5
800	0.543	−151.5	7.232	94.0	0.062	48.2	0.374	−54.9	19.4
900	0.533	−157.3	6.482	91.0	0.066	49.2	0.356	−55.8	18.3
1000	0.526	−162.7	5.860	88.2	0.069	50.4	0.342	−56.6	17.3
1200	0.524	−171.7	4.930	83.4	0.076	52.1	0.323	−58.5	15.7
1400	0.529	−178.4	4.267	78.6	0.082	53.6	0.312	−60.9	14.5
1600	0.531	176.2	3.762	74.4	0.090	56.0	0.309	−62.8	13.4
1800	0.523	171.1	3.379	70.8	0.098	56.4	0.306	−65.1	12.4
2000	0.522	165.5	3.058	67.5	0.106	57.6	0.300	−67.3	11.5
2200	0.529	160.5	2.805	64.3	0.113	58.4	0.293	−71.0	10.8
2400	0.541	156.9	2.564	60.5	0.119	59.8	0.291	−75.8	10.1
2600	0.541	154.6	2.383	57.7	0.129	60.1	0.300	−80.9	9.5
2800	0.530	151.2	2.257	53.9	0.137	59.7	0.312	−84.3	8.9
3000	0.518	146.9	2.115	51.0	0.144	61.2	0.320	−86.5	8.3

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	**ANG. (DEG)**	**MAG. (RAT)**	**ANG. (DEG)**	**MAG. (RAT)**	**ANG. (DEG)**	**MAG. (RAT)**	**ANG. (DEG)**	
40	0.731	−21.3	33.483	166.2	0.008	81.4	0.951	−10.7	44.0
100	0.686	−50.6	29.946	149.2	0.019	67.6	0.860	−24.7	38.1
200	0.610	−87.7	22.993	129.0	0.030	55.6	0.676	−39.9	31.9
300	0.569	−112.4	17.764	116.6	0.037	51.5	0.541	−47.7	28.2
400	0.552	−128.8	14.214	108.5	0.041	49.6	0.453	−51.9	25.6
500	0.545	−140.3	11.771	102.6	0.045	49.8	0.397	−54.2	23.7
600	0.538	−148.1	10.029	98.1	0.049	50.9	0.358	−55.5	22.1
700	0.530	−154.6	8.726	94.4	0.053	52.2	0.331	−56.3	20.8
800	0.524	−160.0	7.711	91.2	0.056	53.6	0.312	−56.8	19.6
900	0.517	−165.0	6.895	88.5	0.060	54.8	0.298	−57.4	18.5
1000	0.513	−169.7	6.225	86.0	0.064	56.4	0.287	−58.0	17.6
1200	0.514	−177.7	5.224	81.7	0.072	58.0	0.272	−59.7	16.0
1400	0.522	176.6	4.505	77.3	0.080	59.3	0.265	−61.9	14.8
1600	0.522	171.8	3.970	73.3	0.089	61.0	0.264	−63.7	13.7
1800	0.515	167.2	3.560	70.0	0.099	61.4	0.262	−65.7	12.7
2000	0.516	161.9	3.221	66.8	0.107	62.0	0.258	−67.8	11.8
2200	0.524	157.4	2.950	63.9	0.115	62.3	0.252	−71.6	11.1
2400	0.536	154.1	2.696	60.3	0.121	63.4	0.251	−76.6	10.4
2600	0.536	152.0	2.505	57.5	0.133	63.3	0.260	−82.2	9.8
2800	0.525	149.3	2.366	53.9	0.141	62.4	0.274	−85.5	9.2
3000	0.512	144.7	2.217	51.1	0.148	63.7	0.280	−87.4	8.6

Table 3 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 8$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.684	−25.2	39.224	164.4	0.008	80.1	0.938	−12.4	43.8
100	0.637	−58.6	34.039	145.5	0.018	65.3	0.823	−27.9	37.8
200	0.572	−97.8	24.914	125.0	0.028	55.0	0.620	−43.2	31.8
300	0.543	−121.8	18.747	113.1	0.033	52.0	0.485	−50.2	28.1
400	0.534	−136.9	14.811	105.6	0.037	51.4	0.403	−53.7	25.6
500	0.531	−147.2	12.169	100.1	0.042	52.6	0.353	−55.4	23.7
600	0.528	−154.1	10.327	96.0	0.045	54.2	0.319	−56.3	22.2
700	0.522	−160.0	8.956	92.6	0.050	56.0	0.296	−56.8	20.8
800	0.517	−164.7	7.906	89.6	0.054	57.3	0.280	−57.1	19.7
900	0.512	−169.4	7.062	87.1	0.058	58.6	0.268	−57.5	18.6
1000	0.509	−173.8	6.370	84.8	0.062	59.7	0.259	−58.0	17.7
1200	0.512	178.9	5.338	80.7	0.071	61.4	0.247	−59.7	16.1
1400	0.520	173.7	4.599	76.5	0.079	62.2	0.242	−61.8	14.9
1600	0.521	169.4	4.047	72.7	0.089	63.6	0.242	−63.6	13.8
1800	0.514	165.0	3.627	69.4	0.099	63.6	0.242	−65.6	12.8
2000	0.515	159.8	3.281	66.3	0.107	64.3	0.238	−67.7	11.9
2200	0.524	155.7	3.004	63.5	0.115	64.3	0.232	−71.5	11.2
2400	0.538	152.6	2.745	60.0	0.122	65.2	0.233	−76.9	10.5
2600	0.536	150.8	2.546	57.3	0.134	64.8	0.242	−82.5	9.8
2800	0.522	147.9	2.404	53.6	0.142	63.9	0.256	−85.9	9.3
3000	0.513	143.6	2.255	51.0	0.150	65.0	0.263	−87.8	8.7

NPN 8 GHz wideband transistor | BFQ67

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

Silicon NPN transistor in a plastic SOT23 envelope. It is designed for wideband applications such as satellite TV tuners and RF portable communications equipment up to 2 GHz.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

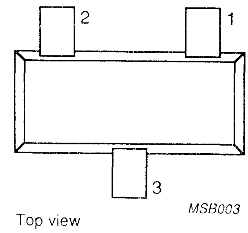


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	14	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s= 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	14	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz	–	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

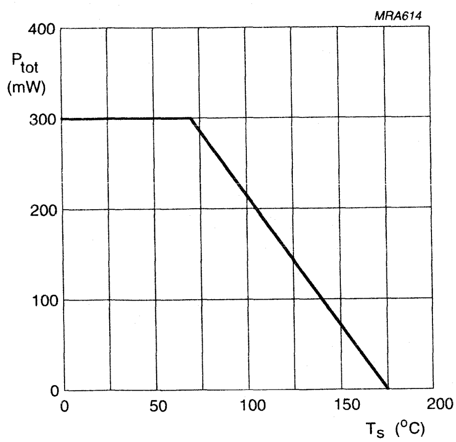
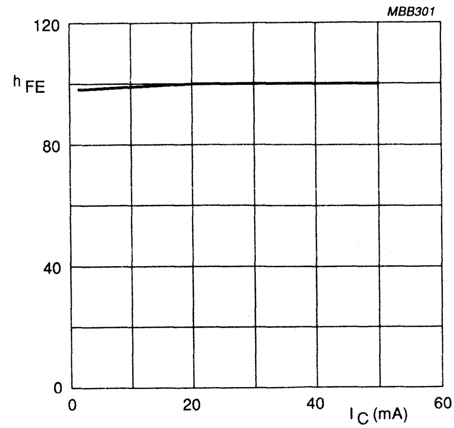
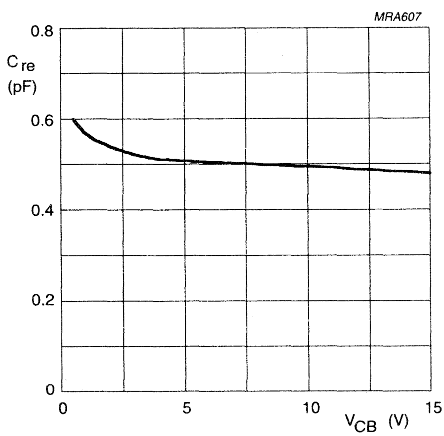


Fig.2 Power derating curve.



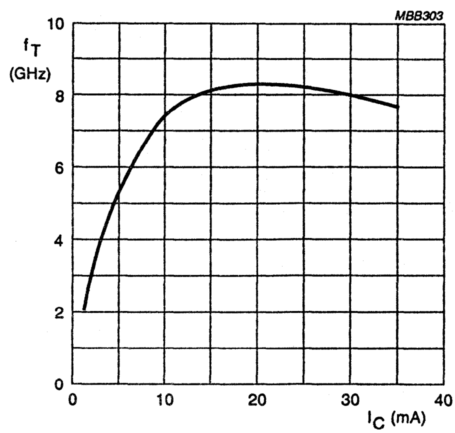
V_{CE} = 5 V.

Fig.3 DC current gain as a function of collector current, typical values.



$I_C = I_c = 0$; f = 1 MHz.

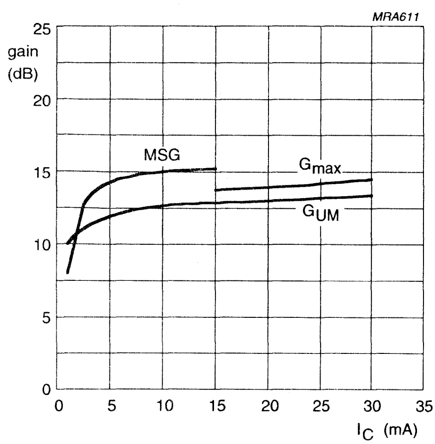
Fig.4 Feedback capacitance as a function of collector-base voltage, typical values.



V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz.

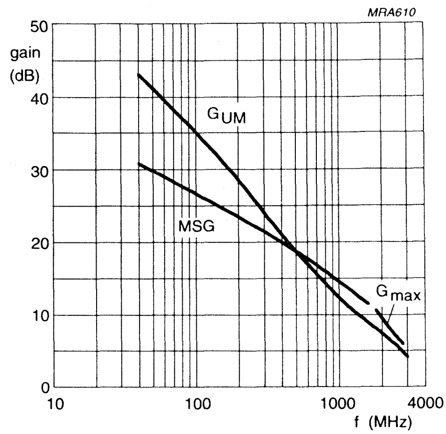
Fig.5 Transition frequency as a function of collector current, typical values.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



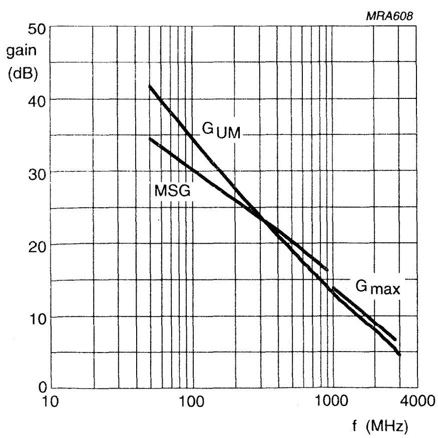
V_{CE} = 8 V; f = 1 GHz.

Fig.6 Gain as a function of collector current, typical values.



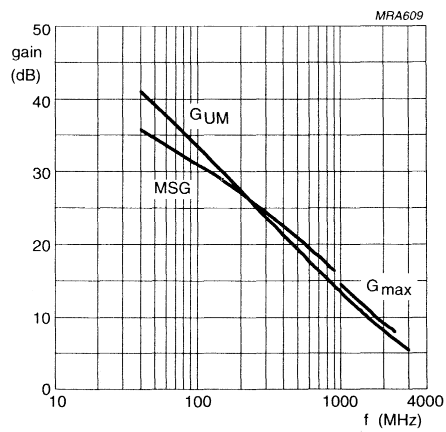
V_{CE} = 8 V; I_C = 5 mA.

Fig.7 Gain as a function of frequency, typical values.



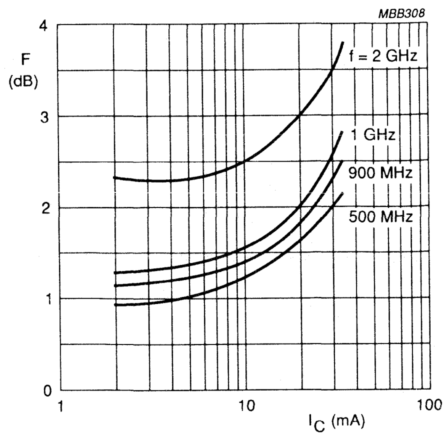
V_{CE} = 8 V; I_C = 15 mA.

Fig.8 Gain as a function of frequency, typical values.



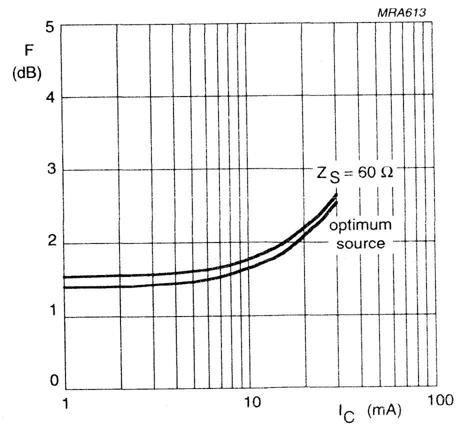
V_{CE} = 8 V; I_C = 30 mA.

Fig.9 Gain as a function of frequency, typical values.



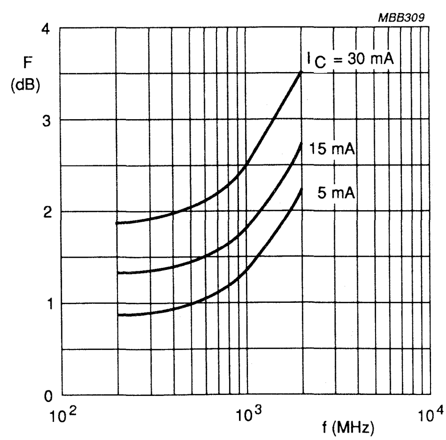
V_{CE} = 8 V.

Fig.10 Minimum noise figure as a function of collector current, typical values.



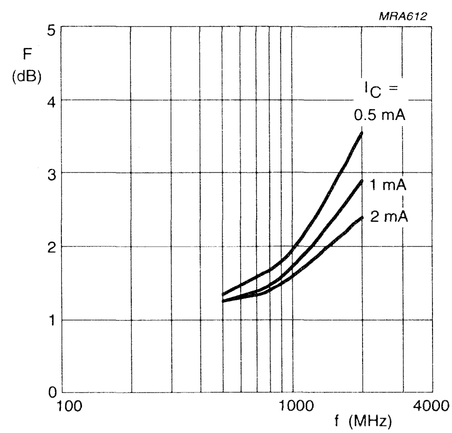
V_{CE} = 6 V; f = 900 MHz.

Fig.11 Noise figure as a function of collector current, typical values.



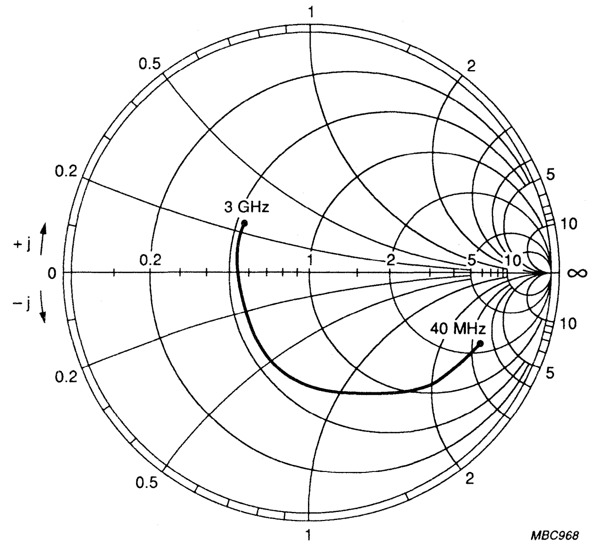
V_{CE} = 8 V.

Fig.12 Minimum noise figure as a function of frequency, typical values.



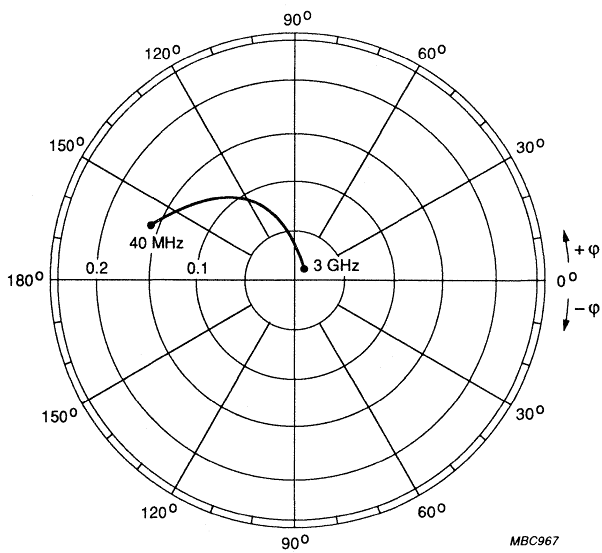
V_{CE} = 1 V.

Fig.13 Minimum noise figure as a function of frequency, typical values.



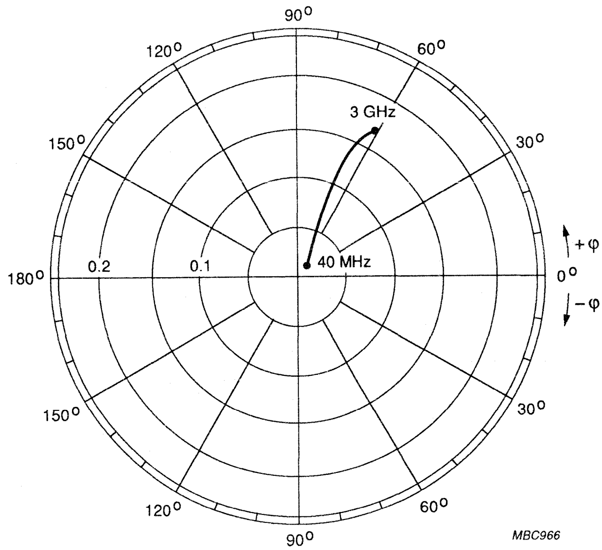
V_{CE} = 8 V; I_C = 15 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}), typical values.



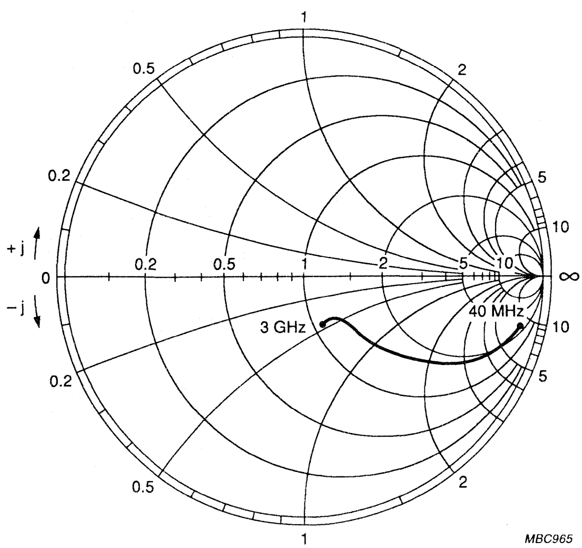
V_{CE} = 8 V; I_C = 15 mA.

Fig.15 Common emitter forward transmission coefficient (S_{21}), typical values.



V_{CE} = 8 V; I_C = 15 mA.

Fig.16 Common emitter reverse transmission coefficient (S_{12}), typical values.

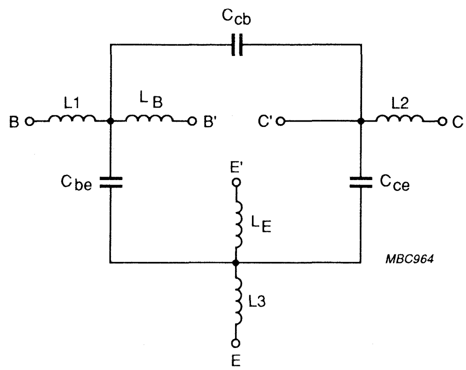


V_{CE} = 8 V; I_C = 15 mA.

Fig.17 Common emitter output reflection coefficient (S_{22}), typical values.

SPICE parameters for BFQ65 crystal

1	IS = 556.4	aA
2	BF = 170.0	–
3	NF = 994.8	m
4	VAF = 48.03	V
5	IKF = 918.1	mA
6	ISE = 10.47	fA
7	NE = 1.479	–
8	BR = 142.1	–
9	NR = 994.1	m
10	VAR = 2.555	V
11	IKR = 9.632	A
12	ISC = 438.2	aA
13	NC = 1.089	–
14	RB = 10.00	O
15	IRB = 1.000	µA
16	RBM = 10.00	O
17	RE = 655.9	mO
18	RC = 2.000	O
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.137	pF
23	VJE = 600.0	mV
24	MJE = 249.4	m
25	TF = 11.97	ps
26	XTF = 25.99	–
27	VTF = 1.223	V
28	ITF = 197.3	mA
29	PTF = 10.03	deg
30	CJC = 515.9	fF
31	VJC = 155.8	mV
32	MJC = 56.02	m
33	XCJC = 130.0	m
34	TR = 1.877	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 870.0	m



$QL_B = 50; QL_E = 50.$

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}.$

Fc = scaling frequency = 1000 MHz.

Fig.18 Package equivalent circuit SOT23.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.35 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

NPN 8 GHz wideband transistor BFQ67

Table 1 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.943	−8.4	6.555	173.0	0.013	84.5	0.991	−4.0	43.3
100	0.921	−20.6	6.385	163.6	0.032	78.0	0.972	−9.8	36.9
200	0.862	−39.3	5.934	149.4	0.060	68.2	0.916	−18.3	29.3
300	0.792	−56.0	5.355	137.3	0.081	60.2	0.848	−25.1	24.4
400	0.729	−70.6	4.804	127.2	0.097	54.6	0.783	−30.2	21.1
500	0.672	−83.0	4.295	118.8	0.107	50.5	0.729	−34.1	18.6
600	0.623	−93.7	3.869	111.7	0.115	47.7	0.683	−36.9	16.6
700	0.582	−103.0	3.496	105.5	0.121	46.1	0.647	−39.0	15.0
800	0.548	−111.0	3.180	100.1	0.125	45.6	0.619	−40.7	13.7
900	0.513	−118.6	2.907	95.2	0.128	45.3	0.596	−42.1	12.5
1000	0.490	−126.1	2.678	90.7	0.131	45.5	0.576	−43.3	11.5
1200	0.458	−139.6	2.322	82.9	0.137	47.3	0.544	−45.8	9.9
1400	0.446	−150.8	2.077	76.2	0.143	50.1	0.525	−48.5	8.7
1600	0.432	−159.2	1.867	70.3	0.149	54.0	0.515	−50.7	7.7
1800	0.415	−167.4	1.708	65.4	0.161	58.1	0.505	−53.5	6.7
2000	0.408	−176.8	1.577	60.8	0.174	62.0	0.489	−56.0	5.9
2200	0.421	173.9	1.471	56.4	0.191	64.8	0.472	−59.8	5.3
2400	0.438	167.2	1.388	51.5	0.211	67.1	0.461	−65.2	4.8
2600	0.443	162.1	1.306	47.6	0.233	68.8	0.459	−70.3	4.3
2800	0.440	156.1	1.258	44.6	0.258	70.1	0.458	−74.4	3.9
3000	0.451	148.2	1.200	41.2	0.285	70.6	0.445	−78.5	3.5

Table 2 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.873	−13.6	15.136	168.5	0.013	82.5	0.974	−7.5	42.7
100	0.816	−32.8	13.991	154.0	0.030	73.1	0.913	−17.6	35.5
200	0.693	−59.1	11.564	135.3	0.051	62.4	0.777	−29.5	28.1
300	0.586	−79.6	9.413	122.0	0.064	57.2	0.659	−36.3	23.8
400	0.515	−95.2	7.782	112.5	0.073	55.5	0.575	−40.0	20.9
500	0.465	−107.3	6.562	105.5	0.081	55.0	0.517	−42.1	18.8
600	0.427	−117.0	5.667	100.0	0.088	55.7	0.478	−43.3	17.1
700	0.399	−125.4	4.977	95.3	0.096	57.0	0.451	−44.0	15.7
800	0.375	−132.4	4.437	91.2	0.104	58.3	0.431	−44.5	14.5
900	0.354	−139.4	3.999	87.5	0.111	59.5	0.416	−44.9	13.4
1000	0.343	−145.9	3.633	84.2	0.119	60.6	0.403	−45.4	12.5
1200	0.332	−157.5	3.092	78.3	0.135	62.6	0.383	−46.6	11.0
1400	0.331	−166.5	2.727	73.0	0.152	64.1	0.372	−48.6	9.9
1600	0.322	−172.5	2.429	68.2	0.169	65.7	0.367	−49.8	8.8
1800	0.311	−179.3	2.202	64.1	0.189	66.6	0.361	−52.0	7.9
2000	0.309	172.4	2.024	60.3	0.209	67.3	0.348	−53.3	7.1
2200	0.328	163.8	1.884	56.5	0.230	67.2	0.334	−56.3	6.5
2400	0.348	159.2	1.774	52.2	0.251	67.0	0.320	−61.6	6.0
2600	0.354	156.7	1.660	48.6	0.273	66.6	0.316	−66.8	5.4
2800	0.353	151.8	1.594	45.8	0.295	66.2	0.317	−70.3	5.1
3000	0.364	144.6	1.522	42.5	0.318	65.7	0.307	−73.2	4.7

Table 3 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.787	−20.1	25.207	163.3	0.012	79.1	0.945	−11.8	41.9
100	0.687	−46.4	21.556	144.0	0.026	69.2	0.824	−25.5	34.4
200	0.530	−77.7	15.667	123.5	0.042	61.4	0.629	−37.6	27.5
300	0.434	−98.8	11.767	111.7	0.052	60.0	0.506	−42.2	23.6
400	0.383	−114.0	9.314	103.8	0.062	61.3	0.434	−43.8	21.0
500	0.351	−125.2	7.658	98.1	0.071	62.7	0.390	−44.3	19.0
600	0.330	−133.8	6.517	93.8	0.080	64.3	0.363	−44.5	17.4
700	0.314	−141.1	5.664	90.0	0.090	65.9	0.345	−44.5	16.1
800	0.299	−147.0	5.013	86.7	0.100	67.0	0.334	−44.4	14.9
900	0.286	−153.3	4.498	83.6	0.110	67.8	0.325	−44.5	13.9
1000	0.281	−158.9	4.071	80.8	0.120	68.4	0.317	−44.7	13.0
1200	0.280	−169.0	3.444	75.9	0.141	69.0	0.304	−45.5	11.5
1400	0.286	−175.8	3.025	71.3	0.161	69.2	0.297	−47.4	10.4
1600	0.276	179.5	2.683	67.0	0.182	69.4	0.297	−48.4	9.3
1800	0.268	173.8	2.427	63.4	0.203	69.0	0.292	−50.6	8.4
2000	0.271	165.7	2.229	59.9	0.226	68.7	0.281	−51.3	7.7
2200	0.292	158.1	2.072	56.5	0.247	67.8	0.267	−53.9	7.0
2400	0.314	154.7	1.948	52.5	0.269	66.8	0.253	−59.7	6.5
2600	0.319	153.0	1.818	49.2	0.291	65.8	0.249	−65.2	5.9
2800	0.319	149.0	1.740	46.5	0.312	64.8	0.249	−68.4	5.6
3000	0.329	141.9	1.662	43.3	0.335	63.8	0.240	−70.5	5.2

Table 4 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 15 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.718	−25.3	32.676	159.3	0.011	77.0	0.916	−14.9	41.4
100	0.593	−56.4	26.079	137.4	0.024	67.2	0.752	−30.3	33.8
200	0.440	−89.7	17.484	117.3	0.038	62.8	0.540	−41.0	27.3
300	0.365	−110.9	12.683	106.6	0.048	63.3	0.428	−43.8	23.6
400	0.331	−125.2	9.876	99.8	0.058	65.8	0.367	−44.3	21.0
500	0.308	−135.3	8.049	94.8	0.068	67.4	0.333	−44.1	19.1
600	0.294	−143.1	6.814	91.0	0.078	68.8	0.313	−43.9	17.5
700	0.283	−149.4	5.904	87.7	0.089	69.9	0.301	−43.6	16.2
800	0.273	−154.8	5.216	84.6	0.100	70.7	0.293	−43.4	15.1
900	0.263	−160.8	4.674	81.9	0.111	71.0	0.287	−43.4	14.1
1000	0.261	−165.8	4.225	79.3	0.122	71.3	0.281	−43.6	13.2
1200	0.263	−174.6	3.568	74.7	0.144	71.3	0.271	−44.5	11.7
1400	0.271	179.5	3.128	70.4	0.166	70.8	0.267	−46.5	10.6
1600	0.264	175.5	2.772	66.4	0.187	70.7	0.268	−47.5	9.5
1800	0.257	170.4	2.506	62.9	0.209	70.0	0.264	−49.8	8.6
2000	0.259	162.5	2.299	59.5	0.231	69.2	0.254	−50.1	7.8
2200	0.282	155.3	2.136	56.3	0.254	68.1	0.240	−52.7	7.2
2400	0.305	152.7	2.005	52.5	0.277	66.8	0.226	−58.7	6.7
2600	0.310	151.4	1.870	49.2	0.298	65.5	0.221	−64.5	6.1
2800	0.310	147.7	1.791	46.6	0.319	64.4	0.222	−67.7	5.7
3000	0.319	140.8	1.708	43.4	0.341	63.2	0.213	−69.6	5.3

Table 5 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.668	−29.2	37.465	156.5	0.011	76.2	0.893	−17.0	41.0
100	0.534	−63.3	28.465	133.3	0.023	66.5	0.703	−33.1	33.5
200	0.393	−97.8	18.248	113.8	0.035	64.1	0.490	−42.3	27.1
300	0.333	−118.5	13.024	104.0	0.046	65.7	0.387	−43.9	23.5
400	0.308	−132.2	10.072	97.7	0.056	68.2	0.334	−43.7	21.0
500	0.291	−141.5	8.177	93.1	0.067	69.9	0.306	−43.3	19.1
600	0.280	−148.5	6.908	89.6	0.077	71.0	0.289	−42.9	17.5
700	0.272	−154.4	5.978	86.4	0.089	71.9	0.279	−42.7	16.2
800	0.262	−159.3	5.275	83.6	0.100	72.4	0.274	−42.4	15.1
900	0.256	−164.9	4.726	80.9	0.112	72.7	0.269	−42.5	14.1
1000	0.256	−169.5	4.271	78.4	0.123	72.7	0.265	−42.6	13.2
1200	0.260	−177.7	3.603	74.0	0.145	72.3	0.256	−43.8	11.7
1400	0.269	177.2	3.157	69.9	0.168	71.7	0.253	−45.8	10.6
1600	0.260	173.4	2.794	65.9	0.189	71.2	0.256	−46.9	9.5
1800	0.255	168.7	2.526	62.5	0.212	70.3	0.252	−49.2	8.6
2000	0.259	161.1	2.317	59.2	0.235	69.6	0.242	−49.4	7.9
2200	0.283	154.2	2.151	56.0	0.258	68.2	0.229	−52.0	7.2
2400	0.304	151.2	2.019	52.2	0.280	66.8	0.214	−58.3	6.7
2600	0.310	150.4	1.882	48.9	0.301	65.5	0.209	−64.2	6.1
2800	0.310	146.6	1.802	46.3	0.322	64.3	0.209	−67.5	5.7
3000	0.321	140.0	1.720	43.2	0.344	63.0	0.201	−69.4	5.4

Table 6 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.895	−13.4	14.929	167.9	0.012	84.5	0.972	−7.2	43.1
100	0.805	−30.3	13.705	155.6	0.029	73.4	0.918	−16.8	35.3
200	0.730	−58.4	11.838	134.4	0.052	63.5	0.786	−28.4	28.9
300	0.627	−77.2	9.551	122.4	0.064	58.1	0.672	−35.3	24.4
400	0.524	−89.4	7.512	114.0	0.075	55.9	0.589	−39.2	20.8
500	0.474	−105.3	6.559	107.4	0.082	55.4	0.529	−41.6	18.9
600	0.399	−107.9	5.732	100.0	0.091	56.1	0.488	−42.7	17.1
700	0.381	−123.6	4.936	95.2	0.100	56.9	0.459	−43.5	15.6
800	0.354	−120.3	4.520	92.8	0.105	58.4	0.439	−43.8	14.6
900	0.340	−126.9	4.078	90.1	0.114	58.8	0.423	−43.9	13.6
1000	0.324	−137.4	3.500	86.4	0.121	59.9	0.409	−44.0	12.2
1200	0.322	−154.8	3.106	78.5	0.137	62.0	0.385	−44.9	11.0
1400	0.314	−164.2	2.817	71.4	0.155	62.7	0.371	−47.5	10.1
1600	0.295	−169.1	2.485	69.1	0.174	64.1	0.367	−48.4	8.9
1800	0.271	−168.4	2.183	69.2	0.188	64.5	0.360	−49.6	7.7
2000	0.254	175.7	2.075	61.6	0.209	65.2	0.348	−51.0	7.2
2200	0.373	169.9	1.934	55.6	0.229	65.3	0.328	−53.2	6.9
2400	0.336	164.4	1.823	53.4	0.252	65.1	0.315	−58.1	6.2
2600	0.406	151.0	1.650	48.3	0.267	64.3	0.309	−62.9	5.6
2800	0.286	150.0	1.593	42.8	0.290	64.2	0.309	−66.3	4.8
3000	0.413	146.8	1.596	42.6	0.313	63.4	0.301	−68.5	5.3

Table 7 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.834	−18.0	24.861	162.7	0.012	79.1	0.943	−11.1	42.6
100	0.724	−42.2	21.178	145.9	0.026	68.4	0.831	−24.5	34.8
200	0.543	−78.5	15.974	122.6	0.044	62.2	0.641	−36.6	27.9
300	0.473	−96.2	11.999	112.0	0.054	60.7	0.517	−41.7	24.0
400	0.368	−106.3	9.097	105.0	0.064	60.8	0.444	−43.6	20.8
500	0.353	−121.8	7.685	99.8	0.073	62.9	0.399	−44.4	19.0
600	0.319	−124.1	6.691	93.7	0.084	64.6	0.370	−44.5	17.6
700	0.311	−138.1	5.665	90.0	0.094	65.7	0.351	−44.5	16.1
800	0.264	−126.8	5.134	87.6	0.102	66.2	0.337	−43.9	15.0
900	0.257	−144.6	4.647	85.9	0.112	66.5	0.329	−43.8	14.1
1000	0.248	−153.3	4.002	82.7	0.122	67.5	0.320	−43.4	12.8
1200	0.247	−164.9	3.491	75.8	0.145	68.2	0.302	−44.1	11.5
1400	0.268	−175.9	3.152	69.8	0.165	67.5	0.294	−46.8	10.7
1600	0.196	−174.3	2.747	68.5	0.186	67.9	0.293	−47.2	9.3
1800	0.214	−178.9	2.435	67.5	0.205	67.2	0.288	−48.2	8.3
2000	0.235	175.1	2.260	61.0	0.227	66.2	0.279	−48.8	7.7
2200	0.315	159.8	2.128	55.2	0.248	66.2	0.258	−50.9	7.3
2400	0.314	165.0	2.000	54.7	0.273	64.5	0.246	−56.2	6.7
2600	0.357	152.2	1.843	48.7	0.288	63.1	0.237	−61.6	6.2
2800	0.328	150.2	1.698	44.9	0.309	62.6	0.238	−64.9	5.3
3000	0.332	138.8	1.742	42.3	0.332	61.4	0.230	−65.9	5.6

Table 8 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.766	−22.7	31.457	159.5	0.011	77.6	0.917	−13.8	41.8
100	0.656	−49.7	25.409	139.9	0.025	66.8	0.764	−28.7	34.3
200	0.482	−84.3	17.647	117.1	0.040	61.8	0.558	−40.0	27.7
300	0.397	−102.7	12.887	107.3	0.049	63.5	0.444	−43.4	23.9
400	0.323	−112.6	9.671	101.2	0.061	64.3	0.381	−44.2	20.9
500	0.330	−125.9	8.062	96.8	0.071	66.8	0.343	−44.3	19.2
600	0.263	−133.6	6.992	91.0	0.081	68.4	0.322	−44.2	17.7
700	0.266	−150.3	5.903	87.8	0.093	69.3	0.307	−43.7	16.2
800	0.217	−133.3	5.340	85.3	0.102	69.9	0.298	−43.1	15.2
900	0.181	−148.9	4.814	83.8	0.113	69.8	0.292	−42.9	14.2
1000	0.206	−163.7	4.139	80.8	0.124	70.1	0.286	−42.5	12.9
1200	0.250	−173.3	3.635	75.8	0.147	70.0	0.272	−43.2	11.8
1400	0.248	−176.9	3.268	68.3	0.169	69.5	0.264	−45.9	10.9
1600	0.216	−177.0	2.857	67.8	0.191	68.6	0.264	−46.5	9.6
1800	0.189	174.2	2.531	66.9	0.210	67.8	0.261	−47.4	8.5
2000	0.210	169.6	2.365	60.7	0.235	66.8	0.252	−47.6	8.0
2200	0.281	171.3	2.190	55.6	0.256	66.1	0.233	−49.5	7.4
2400	0.316	161.7	2.061	53.9	0.279	64.2	0.217	−55.0	6.9
2600	0.323	144.9	1.888	49.2	0.296	62.7	0.211	−61.1	6.2
2800	0.272	153.8	1.764	45.1	0.316	62.2	0.214	−64.1	5.5
3000	0.342	141.5	1.772	42.8	0.340	60.7	0.205	−65.0	5.7

Table 9 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.746	−25.9	36.059	157.1	0.011	74.0	0.891	−15.9	41.5
100	0.607	−54.0	27.794	135.8	0.023	66.9	0.722	−31.6	34.1
200	0.447	−92.7	18.491	113.7	0.037	62.7	0.507	−41.5	27.6
300	0.364	−109.2	13.283	104.6	0.047	64.9	0.400	−43.7	23.8
400	0.310	−120.0	9.892	99.2	0.059	67.2	0.346	−43.9	20.9
500	0.287	−133.5	8.181	95.2	0.069	69.2	0.314	−43.7	19.1
600	0.224	−144.1	7.099	89.4	0.080	70.2	0.295	−43.1	17.6
700	0.271	−148.3	6.009	86.5	0.093	71.0	0.283	−42.8	16.3
800	0.205	−129.5	5.424	84.7	0.102	71.6	0.278	−42.3	15.2
900	0.198	−151.6	4.901	83.2	0.115	71.5	0.274	−42.0	14.3
1000	0.212	−165.7	4.204	79.8	0.124	71.1	0.267	−41.7	13.0
1200	0.246	−176.9	3.676	74.6	0.149	70.8	0.255	−42.2	11.9
1400	0.249	−179.8	3.307	67.7	0.172	70.1	0.249	−45.3	10.9
1600	0.206	175.7	2.877	67.0	0.194	69.0	0.251	−46.0	9.7
1800	0.159	163.6	2.559	66.2	0.214	68.1	0.249	−46.8	8.6
2000	0.221	147.8	2.389	60.2	0.237	67.1	0.240	−47.1	8.0
2200	0.295	168.6	2.180	55.0	0.260	66.2	0.220	−48.7	7.4
2400	0.258	164.9	2.094	53.3	0.283	64.3	0.206	−54.3	6.9
2600	0.341	139.8	1.926	49.7	0.298	63.0	0.197	−60.7	6.4
2800	0.277	154.8	1.805	45.1	0.320	62.1	0.201	−63.4	5.7
3000	0.371	147.0	1.824	42.9	0.343	60.3	0.191	−64.6	6.0

Table 10 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.697	−30.4	41.641	154.7	0.011	74.7	0.857	−18.2	41.0
100	0.538	−64.4	30.643	131.0	0.022	65.3	0.657	−34.6	33.7
200	0.384	−97.4	19.157	112.0	0.034	64.6	0.450	−42.9	27.3
300	0.320	−117.6	13.554	102.7	0.045	66.6	0.355	−43.8	23.7
400	0.292	−130.5	10.444	96.7	0.055	69.0	0.308	−43.2	21.2
500	0.275	−139.7	8.464	92.4	0.066	70.4	0.283	−42.6	19.3
600	0.264	−146.3	7.141	89.0	0.077	71.5	0.269	−42.0	17.7
700	0.256	−151.9	6.174	86.0	0.089	72.0	0.261	−41.7	16.4
800	0.246	−156.7	5.447	83.2	0.100	72.7	0.256	−41.4	15.3
900	0.239	−162.2	4.875	80.6	0.111	72.6	0.253	−41.3	14.3
1000	0.238	−166.6	4.403	78.3	0.123	72.6	0.249	−41.6	13.4
1200	0.243	−174.8	3.713	74.0	0.145	72.0	0.241	−42.5	11.9
1400	0.253	−180.0	3.251	69.9	0.167	71.1	0.238	−44.4	10.8
1600	0.246	177.4	2.875	66.0	0.188	70.5	0.241	−45.4	9.7
1800	0.241	172.5	2.597	62.7	0.210	69.6	0.238	−47.7	8.8
2000	0.244	164.9	2.380	59.4	0.233	68.6	0.228	−47.5	8.0
2200	0.266	157.6	2.207	56.2	0.254	67.2	0.214	−49.8	7.4
2400	0.291	154.9	2.071	52.5	0.276	65.8	0.199	−55.9	6.9
2600	0.299	154.2	1.930	49.3	0.296	64.5	0.193	−62.1	6.3
2800	0.298	150.9	1.845	46.7	0.316	63.3	0.194	−65.3	5.9
3000	0.307	144.0	1.760	43.5	0.337	62.1	0.186	−66.7	5.5

NPN 8 GHz wideband transistor BFQ67W

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 envelope.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is designed for wideband applications such as satellite TV tuners and RF portable communications equipment up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: V2	
1	base
2	emitter
3	collector

PIN CONFIGURATION

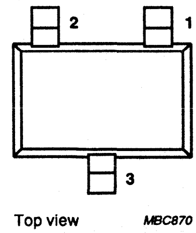


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V; T_j = 25 °C	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 93 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 8 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
		I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	2	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz; Z_S = 60 Ω	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; Z_S = 60 Ω	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

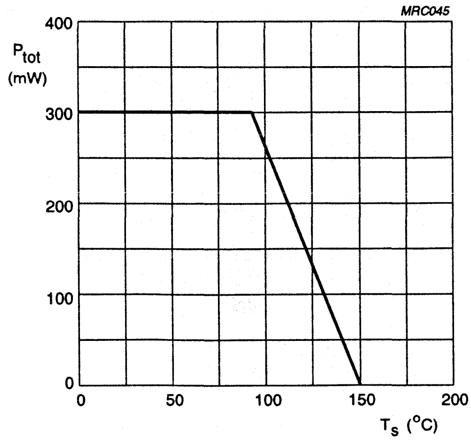
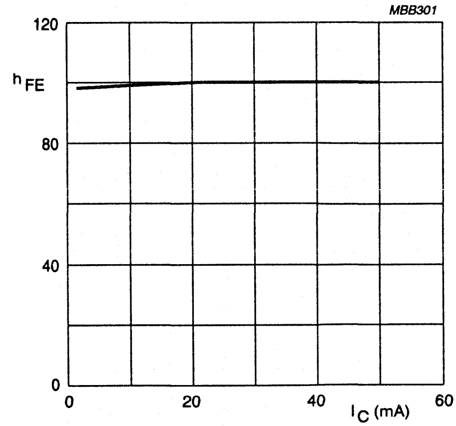
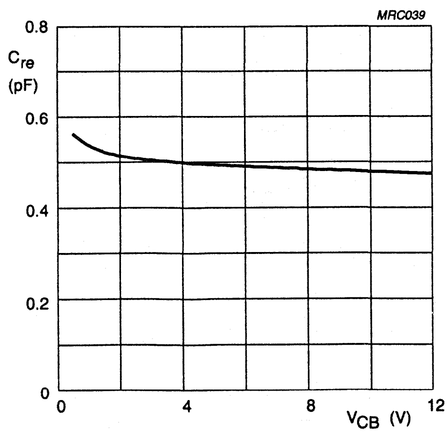


Fig.2 Power derating curve.



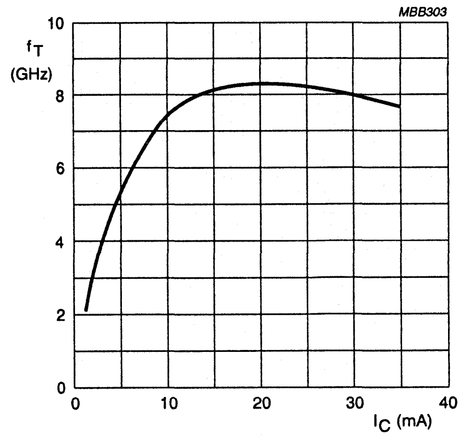
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

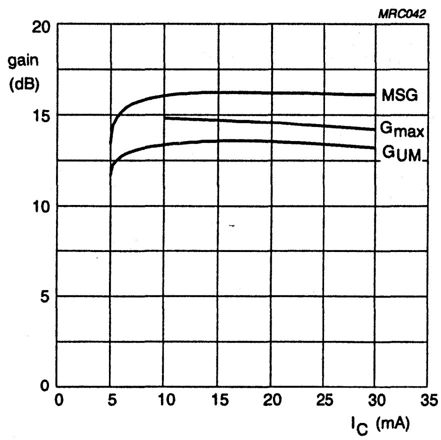
Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C.

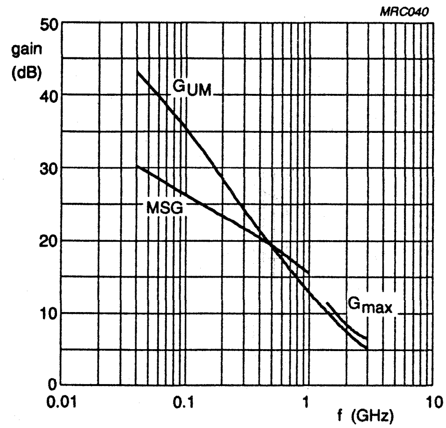
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



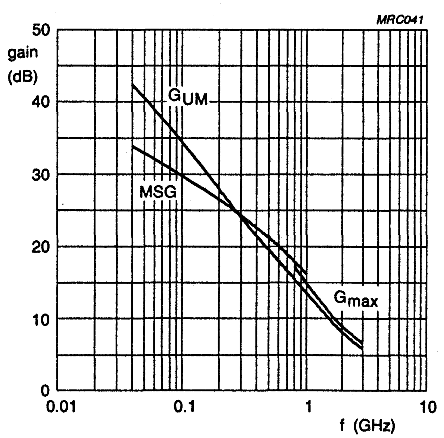
V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.6 Gain as a function of collector current.



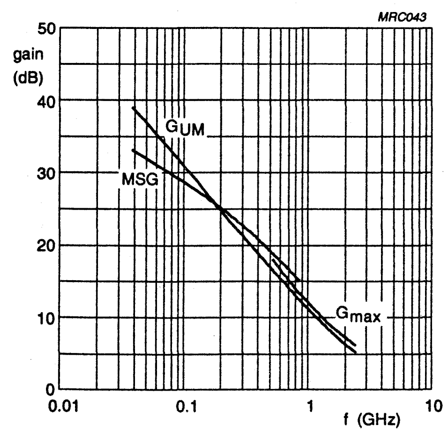
I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Gain as a function of frequency.



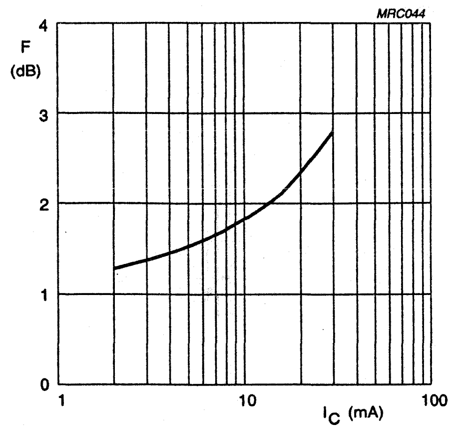
I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



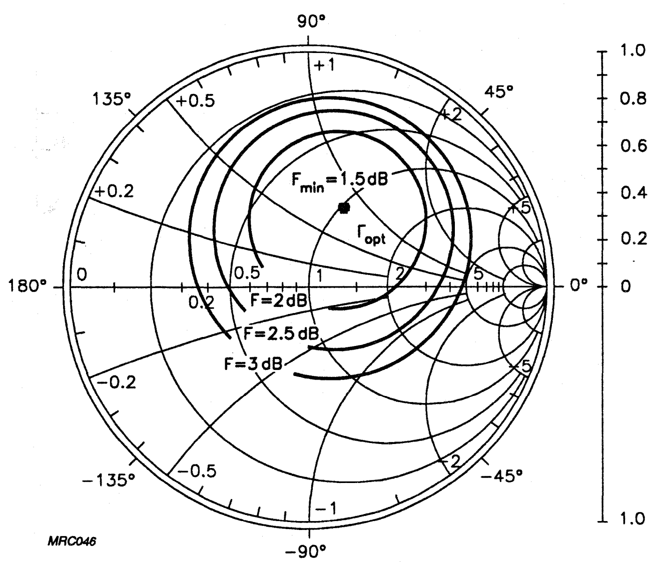
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



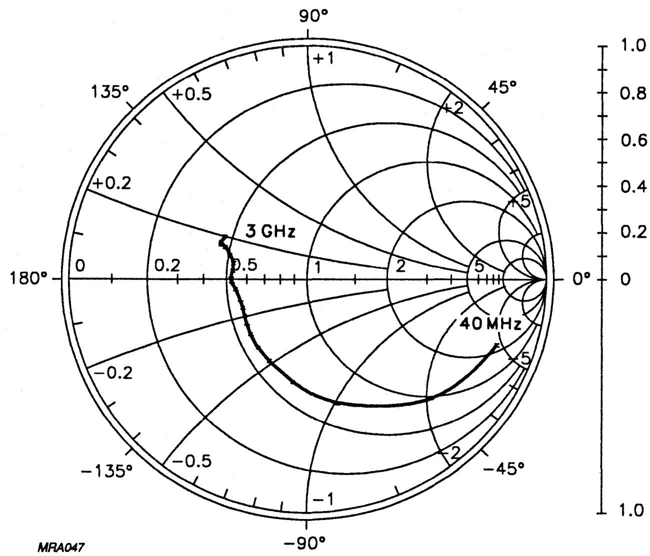
V_{CE} = 8 V.

Fig.10 Minimum noise figure as a function of collector current.



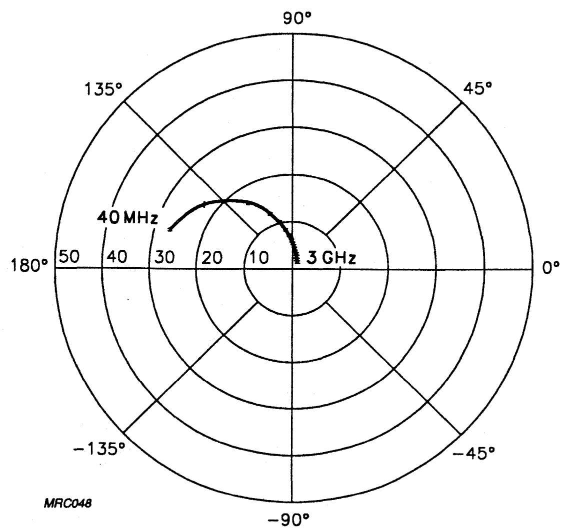
I_C = 5 mA; V_{CE} = 8 V;
f = 1 GHz; Z_O = 50 Ω.

Fig.11 Noise circle.



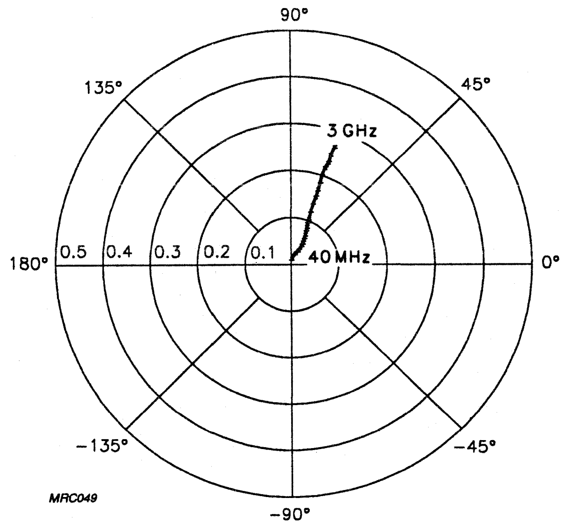
I_C = 15 mA; V_{CE} = 8 V; Z_O = 50 Ω.

Fig.12 Common emitter input reflection coefficient (S_{11}).



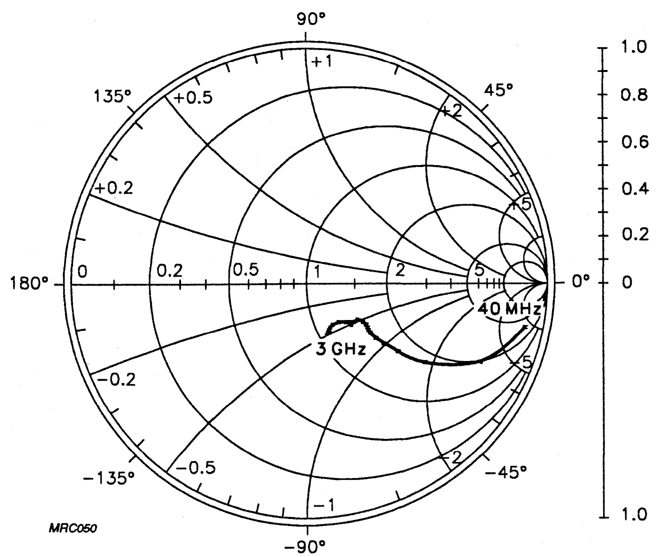
I_C = 15 mA; V_{CE} = 8 V.

Fig.13 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 8 V.

Fig.14 Common emitter reverse transmission coefficient (S_{12}).

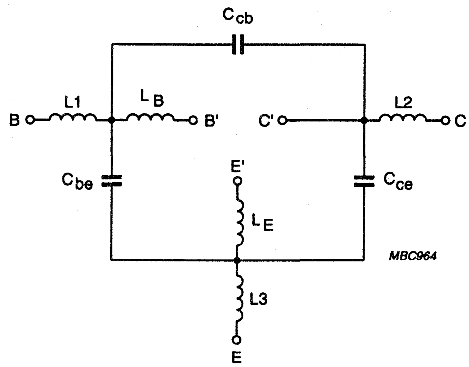


I_C = 15 mA; V_{CE} = 8 V; Z_O = 50 Ω.

Fig.15 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFQ67W crystal

1	IS = 556.4	aA
2	BF = 170.0	–
3	NF = 994.8	m
4	VAF = 48.03	V
5	IKF = 918.1	mA
6	ISE = 10.47	fA
7	NE = 1.479	–
8	BR = 142.1	–
9	NR = 994.1	m
10	VAR = 2.555	V
11	IKR = 9.632	A
12	ISC = 438.2	aA
13	NC = 1.089	–
14	RB = 10.00	Ω
15	IRB = 1.000	µA
16	RBM = 10.00	Ω
17	RE = 655.9	mΩ
18	RC = 2.000	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.137	pF
23	VJE = 600.0	mV
24	MJE = 249.4	m
25	TF = 11.97	ps
26	XTF = 25.99	–
27	VTF = 1.223	V
28	ITF = 197.3	mA
29	PTF = 10.03	deg
30	CJC = 515.9	fF
31	VJC = 155.8	mV
32	MJC = 56.02	m
33	XCJC = 130.0	m
34	TR = 1.877	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 870.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E} \sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.16 Package equivalent circuit, SOT323.

List of components (see Fig.16)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.960	−7.1	5.547	172.8	0.012	84.9	0.990	−3.7	43.1
100	0.938	−17.3	5.366	163.7	0.030	77.8	0.971	−8.9	36.2
200	0.884	−33.8	5.056	150.9	0.055	67.5	0.910	−16.7	28.3
300	0.819	−49.5	4.766	139.9	0.075	59.5	0.839	−22.8	23.7
400	0.756	−63.9	4.403	130.5	0.090	53.5	0.774	−27.7	20.5
500	0.704	−76.4	4.045	122.7	0.100	49.0	0.718	−31.5	18.3
600	0.654	−87.7	3.726	115.7	0.107	46.1	0.674	−34.0	16.5
700	0.608	−97.7	3.441	109.6	0.112	44.5	0.639	−35.7	15.0
800	0.567	−106.4	3.161	104.2	0.116	43.3	0.611	−36.8	13.7
900	0.534	−114.6	2.910	99.4	0.119	42.7	0.586	−37.6	12.6
1000	0.506	−122.4	2.685	95.2	0.120	42.7	0.563	−38.2	11.5
1200	0.477	−137.0	2.351	87.8	0.123	43.4	0.521	−39.9	9.9
1400	0.471	−148.5	2.111	81.4	0.127	45.4	0.493	−42.7	8.8
1600	0.465	−157.2	1.904	76.0	0.132	48.1	0.478	−45.9	7.8
1800	0.457	−164.9	1.739	71.8	0.135	52.0	0.468	−48.2	6.9
2000	0.454	−173.5	1.601	67.5	0.142	55.8	0.455	−50.2	6.1
2200	0.467	178.4	1.492	63.8	0.150	59.9	0.434	−53.4	5.5
2400	0.490	172.4	1.401	59.3	0.161	63.1	0.419	−58.6	5.0
2600	0.509	169.0	1.312	56.3	0.172	65.7	0.419	−64.5	4.5
2800	0.512	165.1	1.273	53.4	0.186	68.9	0.431	−68.6	4.3
3000	0.509	159.9	1.215	50.5	0.204	71.1	0.433	−71.2	3.9

Table 2 Noise data, I_C = 2 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.30	0.750	73.0	0.215

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Table 3 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 4$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.910	−11.6	12.647	168.6	0.012	82.7	0.974	−6.7	42.7
100	0.858	−27.7	11.757	155.6	0.028	73.0	0.917	−15.6	35.2
200	0.744	−52.5	10.339	138.7	0.047	61.1	0.781	−26.1	27.9
300	0.638	−73.8	8.913	125.8	0.059	55.4	0.665	−32.0	23.8
400	0.559	−91.0	7.578	116.1	0.068	52.5	0.581	−35.6	21.0
500	0.508	−104.4	6.529	109.0	0.074	51.6	0.522	−37.8	19.0
600	0.468	−115.3	5.701	103.3	0.080	52.0	0.484	−38.8	17.4
700	0.436	−124.4	5.035	98.6	0.086	53.0	0.458	−39.2	16.0
800	0.412	−132.2	4.494	94.6	0.091	54.3	0.439	−39.0	14.8
900	0.394	−139.6	4.050	91.0	0.097	55.6	0.423	−38.7	13.7
1000	0.381	−146.6	3.683	87.9	0.102	56.9	0.407	−38.3	12.8
1200	0.377	−158.9	3.138	82.4	0.113	59.4	0.376	−38.7	11.3
1400	0.385	−167.5	2.764	77.6	0.125	61.7	0.355	−41.0	10.1
1600	0.386	−173.8	2.463	73.2	0.139	63.2	0.345	−44.3	9.1
1800	0.381	−179.8	2.229	69.7	0.150	65.2	0.341	−46.2	8.2
2000	0.386	172.8	2.045	66.1	0.164	66.7	0.332	−47.5	7.4
2200	0.406	166.2	1.897	63.2	0.178	68.3	0.313	−50.0	6.8
2400	0.432	162.1	1.777	59.3	0.194	69.2	0.297	−55.8	6.3
2600	0.449	160.6	1.654	56.6	0.207	69.4	0.296	−62.9	5.7
2800	0.450	158.3	1.596	54.0	0.222	70.6	0.310	−67.4	5.5
3000	0.448	153.7	1.523	51.0	0.240	71.0	0.316	−69.7	5.1

Table 4 Noise data, $I_C = 5$ mA; $V_{CE} = 4$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.50	0.308	74.0	0.277

Table 5 Common emitter scattering parameters, $I_C = 10$ mA; $V_{CE} = 4$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.844	−17.5	21.739	164.0	0.011	79.8	0.948	−10.2	42.1
100	0.751	−40.9	19.105	146.9	0.025	68.1	0.836	−22.3	34.4
200	0.589	−73.2	14.965	126.8	0.039	58.9	0.644	−32.6	27.7
300	0.486	−96.4	11.644	114.5	0.048	56.6	0.521	−36.4	23.9
400	0.430	−113.2	9.326	106.5	0.056	57.2	0.446	−38.1	21.2
500	0.400	−125.2	7.742	100.8	0.063	58.4	0.401	−38.8	19.3
600	0.378	−134.6	6.607	96.4	0.070	60.2	0.375	−38.9	17.7
700	0.361	−142.3	5.754	92.8	0.077	62.0	0.359	−38.6	16.4
800	0.348	−149.0	5.091	89.6	0.085	63.6	0.348	−37.8	15.3
900	0.339	−155.6	4.566	86.8	0.092	64.7	0.338	−37.0	14.2
1000	0.334	−161.7	4.131	84.1	0.100	65.7	0.328	−36.3	13.3
1200	0.343	−171.8	3.495	79.6	0.114	67.4	0.303	−36.1	11.8
1400	0.355	−178.2	3.060	75.5	0.130	68.8	0.286	−38.4	10.7
1600	0.358	177.3	2.716	71.6	0.147	69.1	0.279	−42.3	9.6
1800	0.356	172.0	2.453	68.5	0.160	70.0	0.277	−44.2	8.7
2000	0.362	165.4	2.247	65.2	0.177	70.5	0.270	−45.2	8.0
2200	0.385	160.0	2.082	62.7	0.192	71.2	0.252	−47.5	7.4
2400	0.414	156.8	1.947	59.1	0.210	71.2	0.236	−53.9	6.9
2600	0.429	156.4	1.807	56.5	0.223	70.7	0.234	−62.4	6.3
2800	0.430	154.9	1.743	54.1	0.239	71.2	0.249	−67.4	6.0
3000	0.424	150.4	1.661	51.1	0.257	70.9	0.256	−69.7	5.6

Table 6 Noise data, $I_C = 10$ mA; $V_{CE} = 4$ V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.70	0.230	86.5	0.260

Table 7 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.790	−22.3	28.448	160.6	0.011	77.9	0.923	−12.8	41.6
100	0.671	−51.0	23.726	140.7	0.023	66.3	0.773	−26.0	34.0
200	0.503	−86.2	16.929	120.3	0.035	59.3	0.566	−34.8	27.5
300	0.422	−109.0	12.580	109.4	0.044	59.2	0.452	−37.0	23.8
400	0.383	−124.2	9.869	102.3	0.052	61.1	0.389	−37.6	21.3
500	0.364	−135.7	8.104	97.4	0.059	62.9	0.352	−37.6	19.4
600	0.349	−144.0	6.867	93.6	0.067	64.4	0.332	−37.4	17.8
700	0.338	−151.0	5.962	90.3	0.075	66.2	0.320	−37.0	16.5
800	0.330	−157.1	5.263	87.5	0.084	67.7	0.313	−36.1	15.4
900	0.325	−163.0	4.713	84.9	0.092	68.6	0.306	−35.2	14.4
1000	0.323	−168.5	4.261	82.5	0.100	69.3	0.298	−34.5	13.5
1200	0.336	−177.1	3.598	78.3	0.117	70.4	0.277	−34.2	12.0
1400	0.350	177.6	3.142	74.5	0.133	71.3	0.261	−36.6	10.8
1600	0.354	173.6	2.785	70.7	0.151	71.1	0.256	−40.7	9.8
1800	0.350	169.2	2.510	67.8	0.165	71.7	0.254	−43.0	8.9
2000	0.355	163.3	2.293	64.8	0.182	71.9	0.247	−43.9	8.1
2200	0.380	158.3	2.133	62.5	0.199	72.5	0.232	−46.0	7.5
2400	0.411	155.2	1.998	58.8	0.217	72.1	0.216	−53.0	7.0
2600	0.427	154.5	1.850	56.3	0.230	71.4	0.212	−62.0	6.4
2800	0.429	153.1	1.783	54.0	0.246	71.7	0.226	−67.3	6.1
3000	0.425	149.1	1.701	51.0	0.265	71.2	0.236	−69.8	5.7

Table 8 Noise data, I_C = 15 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.95	0.200	100.0	0.251

Table 9 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.744	−26.5	33.373	157.8	0.011	77.0	0.900	−14.5	41.2
100	0.608	−59.0	26.488	136.1	0.022	65.3	0.725	−28.2	33.7
200	0.451	−95.3	17.750	116.3	0.033	60.1	0.517	−35.4	27.3
300	0.387	−117.6	12.887	106.3	0.041	61.5	0.413	−36.3	23.7
400	0.358	−132.6	10.013	99.9	0.050	63.9	0.357	−36.2	21.2
500	0.345	−142.6	8.179	95.4	0.058	65.8	0.326	−36.0	19.3
600	0.336	−150.0	6.912	91.9	0.066	67.4	0.310	−35.7	17.8
700	0.328	−156.5	5.992	88.8	0.075	69.0	0.302	−35.2	16.5
800	0.321	−162.1	5.283	86.1	0.084	69.9	0.297	−34.4	15.3
900	0.319	−167.5	4.728	83.7	0.093	70.8	0.292	−33.4	14.3
1000	0.320	−172.5	4.269	81.4	0.101	71.3	0.285	−32.7	13.4
1200	0.334	179.7	3.601	77.4	0.118	72.2	0.266	−32.6	12.0
1400	0.348	174.9	3.145	73.6	0.136	72.9	0.251	−35.1	10.8
1600	0.351	171.3	2.786	70.0	0.153	72.4	0.246	−39.4	9.7
1800	0.348	167.0	2.510	67.1	0.168	72.7	0.246	−42.0	8.8
2000	0.355	161.3	2.294	64.2	0.186	72.9	0.239	−42.9	8.1
2200	0.381	156.7	2.134	61.9	0.203	73.2	0.225	−44.9	7.5
2400	0.411	153.7	1.995	58.4	0.221	72.8	0.208	−52.2	7.0
2600	0.427	153.4	1.849	55.9	0.234	72.0	0.204	−61.7	6.4
2800	0.430	152.0	1.780	53.5	0.251	72.2	0.219	−67.2	6.1
3000	0.427	148.1	1.698	50.6	0.270	71.7	0.229	−69.6	5.7

Table 10 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.20	0.820	117.0	0.245

Table 11 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.675	−34.1	38.831	153.5	0.010	75.5	0.859	−16.9	40.2
100	0.531	−71.9	28.464	130.0	0.020	63.5	0.656	−30.2	33.0
200	0.407	−109.0	17.813	111.6	0.030	61.6	0.459	−34.6	26.8
300	0.368	−129.9	12.662	102.7	0.039	63.8	0.372	−33.8	23.3
400	0.354	−143.1	9.753	97.0	0.048	66.6	0.328	−33.1	20.9
500	0.347	−151.6	7.930	93.0	0.056	68.6	0.305	−32.8	19.0
600	0.342	−158.0	6.683	89.7	0.065	70.1	0.293	−32.7	17.4
700	0.337	−163.5	5.784	86.9	0.074	71.4	0.289	−32.4	16.1
800	0.334	−168.4	5.096	84.4	0.083	72.3	0.287	−31.8	15.0
900	0.333	−173.1	4.559	82.0	0.092	72.9	0.284	−31.2	14.1
1000	0.336	−177.5	4.117	79.9	0.101	73.3	0.278	−30.7	13.2
1200	0.352	176.0	3.471	76.0	0.118	73.8	0.262	−30.9	11.7
1400	0.367	171.9	3.027	72.3	0.136	74.3	0.248	−33.9	10.5
1600	0.371	168.6	2.681	68.7	0.154	73.7	0.244	−38.6	9.5
1800	0.370	164.5	2.416	65.8	0.169	73.9	0.243	−41.5	8.6
2000	0.378	159.3	2.208	62.9	0.187	74.0	0.237	−42.7	7.8
2200	0.405	155.1	2.053	60.7	0.204	74.3	0.223	−45.2	7.2
2400	0.435	152.2	1.919	57.1	0.223	73.7	0.207	−52.9	6.8
2600	0.451	151.7	1.778	54.7	0.237	73.0	0.204	−62.6	6.2
2800	0.454	150.3	1.711	52.3	0.253	73.1	0.219	−68.3	5.9
3000	0.451	146.2	1.632	49.4	0.273	72.5	0.229	−71.0	5.5

Table 12 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.50	0.158	140.0	0.290

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Table 13 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.966	−6.7	5.396	173.1	0.012	85.5	0.990	−3.5	43.5
100	0.946	−16.3	5.244	164.3	0.029	78.5	0.972	−8.5	36.7
200	0.894	−31.9	4.957	151.8	0.054	68.3	0.916	−16.0	28.8
300	0.831	−46.8	4.685	141.1	0.074	60.8	0.850	−22.0	24.1
400	0.768	−60.5	4.352	131.8	0.089	54.9	0.787	−26.9	20.9
500	0.715	−72.5	4.012	124.0	0.100	50.5	0.732	−30.8	18.5
600	0.662	−83.5	3.716	117.1	0.108	47.4	0.687	−33.4	16.7
700	0.613	−93.2	3.442	110.9	0.114	45.6	0.652	−35.2	15.2
800	0.570	−101.7	3.168	105.5	0.118	44.5	0.623	−36.2	13.9
900	0.533	−109.7	2.919	100.8	0.121	43.7	0.597	−37.1	12.7
1000	0.504	−117.6	2.701	96.5	0.123	43.4	0.573	−37.8	11.6
1200	0.469	−132.3	2.372	88.8	0.126	43.9	0.529	−39.6	10.0
1400	0.457	−144.1	2.134	82.4	0.130	45.6	0.500	−42.1	8.8
1600	0.449	−153.1	1.925	76.9	0.135	47.9	0.485	−45.2	7.8
1800	0.438	−160.9	1.757	72.7	0.138	51.5	0.474	−47.4	6.9
2000	0.430	−169.3	1.613	68.5	0.145	55.3	0.459	−49.3	6.1
2200	0.442	−177.6	1.513	65.0	0.153	59.5	0.439	−52.2	5.5
2400	0.465	175.5	1.424	60.2	0.164	62.2	0.423	−57.3	5.0
2600	0.485	171.4	1.334	57.1	0.174	64.7	0.421	−63.0	4.5
2800	0.490	167.6	1.294	54.3	0.187	68.0	0.433	−66.9	4.3
3000	0.488	162.3	1.236	51.3	0.204	70.3	0.436	−69.5	3.9

Table 14 Noise data, I_C = 2 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.30	0.690	65.0	0.320

Table 15 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.926	−10.7	12.221	169.3	0.012	82.5	0.974	−6.2	43.1
100	0.877	−25.5	11.435	156.9	0.027	73.9	0.923	−14.7	35.8
200	0.767	−48.3	10.145	140.4	0.047	62.7	0.797	−25.1	28.4
300	0.660	−68.2	8.835	127.8	0.060	56.7	0.684	−31.3	24.1
400	0.576	−84.5	7.584	118.0	0.070	53.6	0.600	−35.2	21.3
500	0.517	−97.5	6.571	110.8	0.077	52.4	0.539	−37.6	19.2
600	0.469	−108.3	5.758	104.9	0.083	52.5	0.498	−38.8	17.5
700	0.432	−117.3	5.103	100.0	0.089	53.4	0.470	−39.3	16.1
800	0.403	−125.1	4.560	96.0	0.094	54.4	0.449	−39.1	14.9
900	0.381	−132.8	4.116	92.4	0.100	55.3	0.431	−38.8	13.9
1000	0.365	−140.1	3.748	89.1	0.105	56.6	0.415	−38.5	12.9
1200	0.355	−153.2	3.201	83.5	0.116	58.7	0.381	−38.8	11.4
1400	0.359	−162.3	2.818	78.6	0.129	61.0	0.359	−40.7	10.2
1600	0.359	−169.0	2.513	74.1	0.142	62.2	0.349	−43.8	9.2
1800	0.352	−175.4	2.272	70.6	0.153	64.2	0.343	−45.7	8.2
2000	0.351	177.2	2.078	67.2	0.167	65.8	0.332	−46.7	7.4
2200	0.371	170.3	1.937	64.4	0.181	67.5	0.315	−48.8	6.8
2400	0.398	165.2	1.818	60.2	0.197	68.1	0.299	−54.4	6.3
2600	0.417	163.2	1.693	57.5	0.209	68.3	0.295	−61.2	5.8
2800	0.422	160.9	1.635	54.9	0.224	69.4	0.307	−65.5	5.6
3000	0.419	156.3	1.559	51.9	0.242	69.8	0.314	−67.8	5.1

Table 16 Noise data, I_C = 5 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.50	0.370	66.0	0.330

Table 17 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.877	−15.7	20.874	165.0	0.011	80.1	0.949	−9.5	42.8
100	0.788	−36.8	18.559	148.8	0.025	69.8	0.849	−21.0	35.1
200	0.623	−66.0	14.808	129.2	0.040	60.4	0.668	−31.7	28.1
300	0.507	−87.7	11.695	116.7	0.050	57.3	0.543	−36.2	24.2
400	0.437	−103.9	9.441	108.4	0.058	57.6	0.465	−38.4	21.5
500	0.396	−116.1	7.877	102.5	0.066	58.4	0.415	−39.4	19.5
600	0.366	−125.7	6.734	97.9	0.073	59.8	0.386	−39.6	17.9
700	0.344	−133.8	5.874	94.1	0.080	61.4	0.367	−39.3	16.6
800	0.327	−140.9	5.205	90.9	0.088	62.9	0.355	−38.5	15.4
900	0.313	−147.9	4.668	87.9	0.096	64.0	0.343	−37.6	14.4
1000	0.306	−154.6	4.224	85.3	0.103	64.9	0.331	−36.8	13.4
1200	0.310	−165.8	3.580	80.6	0.118	66.4	0.306	−36.5	11.9
1400	0.321	−173.0	3.134	76.4	0.134	67.7	0.287	−38.3	10.8
1600	0.323	−178.1	2.781	72.5	0.150	67.8	0.279	−41.8	9.7
1800	0.318	176.7	2.509	69.4	0.164	68.7	0.276	−43.8	8.8
2000	0.320	169.8	2.292	66.3	0.180	69.3	0.268	−44.4	8.0
2200	0.343	163.5	2.135	63.8	0.196	70.0	0.252	−46.0	7.4
2400	0.372	159.7	2.000	60.0	0.214	69.8	0.235	−52.4	6.9
2600	0.390	158.9	1.858	57.5	0.226	69.3	0.230	−60.6	6.3
2800	0.394	157.3	1.789	55.1	0.241	69.8	0.243	−65.4	6.0
3000	0.390	153.2	1.706	52.1	0.260	69.6	0.252	−67.6	5.6

Table 18 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.80	0.363	70.0	0.290

Table 19 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.842	−19.4	26.813	162.2	0.011	79.0	0.926	−11.5	42.4
100	0.726	−44.6	22.819	143.4	0.024	67.7	0.796	−24.4	34.8
200	0.543	−76.2	16.779	123.2	0.037	59.9	0.596	−34.1	27.9
300	0.440	−97.9	12.669	111.7	0.046	59.3	0.476	−37.2	24.1
400	0.384	−113.7	10.011	104.3	0.054	60.3	0.407	−38.3	21.5
500	0.354	−125.1	8.254	99.2	0.062	62.1	0.366	−38.7	19.5
600	0.332	−134.1	7.010	95.1	0.070	63.6	0.342	−38.6	18.0
700	0.315	−141.7	6.095	91.7	0.079	65.1	0.328	−38.1	16.6
800	0.302	−148.4	5.381	88.7	0.087	66.5	0.320	−37.1	15.5
900	0.293	−154.8	4.820	86.1	0.095	67.4	0.311	−36.1	14.5
1000	0.290	−161.1	4.362	83.6	0.103	68.0	0.302	−35.1	13.6
1200	0.298	−171.3	3.684	79.3	0.120	69.1	0.279	−34.6	12.1
1400	0.312	−177.5	3.220	75.4	0.137	69.9	0.262	−36.7	10.9
1600	0.314	178.2	2.855	71.6	0.154	69.6	0.255	−40.4	9.9
1800	0.310	173.4	2.572	68.7	0.168	70.1	0.254	−42.6	8.9
2000	0.313	166.8	2.349	65.7	0.185	70.3	0.246	−43.0	8.1
2200	0.339	161.2	2.187	63.3	0.201	70.8	0.231	−44.6	7.6
2400	0.368	157.7	2.046	59.7	0.219	70.4	0.213	−51.3	7.0
2600	0.387	157.3	1.897	57.2	0.232	69.7	0.208	−60.2	6.5
2800	0.389	156.0	1.828	54.8	0.247	70.0	0.222	−65.3	6.2
3000	0.385	152.0	1.742	51.9	0.266	69.6	0.231	−67.7	5.8

Table 20 Noise data, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.00	0.300	77.0	0.330

Table 17 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.877	−15.7	20.874	165.0	0.011	80.1	0.949	−9.5	42.8
100	0.788	−36.8	18.559	148.8	0.025	69.8	0.849	−21.0	35.1
200	0.623	−66.0	14.808	129.2	0.040	60.4	0.668	−31.7	28.1
300	0.507	−87.7	11.695	116.7	0.050	57.3	0.543	−36.2	24.2
400	0.437	−103.9	9.441	108.4	0.058	57.6	0.465	−38.4	21.5
500	0.396	−116.1	7.877	102.5	0.066	58.4	0.415	−39.4	19.5
600	0.366	−125.7	6.734	97.9	0.073	59.8	0.386	−39.6	17.9
700	0.344	−133.8	5.874	94.1	0.080	61.4	0.367	−39.3	16.6
800	0.327	−140.9	5.205	90.9	0.088	62.9	0.355	−38.5	15.4
900	0.313	−147.9	4.668	87.9	0.096	64.0	0.343	−37.6	14.4
1000	0.306	−154.6	4.224	85.3	0.103	64.9	0.331	−36.8	13.4
1200	0.310	−165.8	3.580	80.6	0.118	66.4	0.306	−36.5	11.9
1400	0.321	−173.0	3.134	76.4	0.134	67.7	0.287	−38.3	10.8
1600	0.323	−178.1	2.781	72.5	0.150	67.8	0.279	−41.8	9.7
1800	0.318	176.7	2.509	69.4	0.164	68.7	0.276	−43.8	8.8
2000	0.320	169.8	2.292	66.3	0.180	69.3	0.268	−44.4	8.0
2200	0.343	163.5	2.135	63.8	0.196	70.0	0.252	−46.0	7.4
2400	0.372	159.7	2.000	60.0	0.214	69.8	0.235	−52.4	6.9
2600	0.390	158.9	1.858	57.5	0.226	69.3	0.230	−60.6	6.3
2800	0.394	157.3	1.789	55.1	0.241	69.8	0.243	−65.4	6.0
3000	0.390	153.2	1.706	52.1	0.260	69.6	0.252	−67.6	5.6

Table 18 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.80	0.363	70.0	0.290

Table 19 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.842	−19.4	26.813	162.2	0.011	79.0	0.926	−11.5	42.4
100	0.726	−44.6	22.819	143.4	0.024	67.7	0.796	−24.4	34.8
200	0.543	−76.2	16.779	123.2	0.037	59.9	0.596	−34.1	27.9
300	0.440	−97.9	12.669	111.7	0.046	59.3	0.476	−37.2	24.1
400	0.384	−113.7	10.011	104.3	0.054	60.3	0.407	−38.3	21.5
500	0.354	−125.1	8.254	99.2	0.062	62.1	0.366	−38.7	19.5
600	0.332	−134.1	7.010	95.1	0.070	63.6	0.342	−38.6	18.0
700	0.315	−141.7	6.095	91.7	0.079	65.1	0.328	−38.1	16.6
800	0.302	−148.4	5.381	88.7	0.087	66.5	0.320	−37.1	15.5
900	0.293	−154.8	4.820	86.1	0.095	67.4	0.311	−36.1	14.5
1000	0.290	−161.1	4.362	83.6	0.103	68.0	0.302	−35.1	13.6
1200	0.298	−171.3	3.684	79.3	0.120	69.1	0.279	−34.6	12.1
1400	0.312	−177.5	3.220	75.4	0.137	69.9	0.262	−36.7	10.9
1600	0.314	178.2	2.855	71.6	0.154	69.6	0.255	−40.4	9.9
1800	0.310	173.4	2.572	68.7	0.168	70.1	0.254	−42.6	8.9
2000	0.313	166.8	2.349	65.7	0.185	70.3	0.246	−43.0	8.1
2200	0.339	161.2	2.187	63.3	0.201	70.8	0.231	−44.6	7.6
2400	0.368	157.7	2.046	59.7	0.219	70.4	0.213	−51.3	7.0
2600	0.387	157.3	1.897	57.2	0.232	69.7	0.208	−60.2	6.5
2800	0.389	156.0	1.828	54.8	0.247	70.0	0.222	−65.3	6.2
3000	0.385	152.0	1.742	51.9	0.266	69.6	0.231	−67.7	5.8

Table 20 Noise data, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.00	0.300	77.0	0.330

Table 21 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.817	−22.3	30.844	160.0	0.011	78.5	0.908	−12.9	42.1
100	0.682	−50.2	25.281	139.7	0.023	66.5	0.757	−26.3	34.5
200	0.497	−82.9	17.607	119.6	0.035	60.4	0.552	−34.9	27.7
300	0.405	−104.4	12.993	108.9	0.044	60.6	0.440	−36.9	24.0
400	0.359	−120.0	10.167	102.0	0.052	62.4	0.377	−37.4	21.4
500	0.335	−130.8	8.336	97.3	0.061	63.9	0.342	−37.4	19.5
600	0.317	−139.1	7.061	93.5	0.069	65.8	0.322	−37.1	17.9
700	0.304	−146.3	6.127	90.3	0.078	67.1	0.311	−36.6	16.6
800	0.293	−152.5	5.405	87.5	0.087	68.2	0.305	−35.6	15.5
900	0.287	−158.8	4.842	84.9	0.095	68.9	0.298	−34.6	14.5
1000	0.285	−164.7	4.373	82.6	0.104	69.5	0.290	−33.7	13.6
1200	0.297	−174.1	3.690	78.4	0.121	70.3	0.269	−33.2	12.1
1400	0.311	−179.7	3.226	74.6	0.138	70.9	0.253	−35.3	10.9
1600	0.313	176.3	2.858	70.9	0.156	70.4	0.247	−39.3	9.8
1800	0.309	171.9	2.573	68.0	0.170	70.7	0.246	−41.5	8.9
2000	0.316	165.4	2.351	65.1	0.187	70.9	0.238	−42.1	8.1
2200	0.340	160.1	2.187	62.8	0.204	71.2	0.224	−43.7	7.6
2400	0.370	156.7	2.048	59.1	0.222	70.7	0.206	−50.7	7.1
2600	0.389	156.5	1.897	56.7	0.234	70.0	0.201	−59.8	6.5
2800	0.393	155.3	1.827	54.4	0.250	70.2	0.215	−65.2	6.2
3000	0.390	151.3	1.740	51.4	0.268	69.8	0.224	−67.6	5.8

Table 22 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.30	0.271	83.0	0.297

Table 23 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.780	−27.0	35.290	156.9	0.011	76.8	0.877	−14.5	41.4
100	0.623	−58.4	27.212	134.6	0.022	65.2	0.702	−27.8	33.8
200	0.447	−92.2	17.771	115.3	0.033	61.1	0.503	−34.1	27.2
300	0.374	−113.5	12.817	105.6	0.042	62.2	0.405	−34.5	23.6
400	0.340	−128.4	9.936	99.3	0.050	64.5	0.354	−34.1	21.1
500	0.323	−138.3	8.110	94.9	0.059	66.3	0.326	−33.9	19.1
600	0.312	−145.9	6.847	91.5	0.068	67.7	0.311	−33.7	17.6
700	0.302	−152.5	5.933	88.5	0.077	69.0	0.304	−33.3	16.3
800	0.295	−158.1	5.229	85.8	0.086	70.0	0.300	−32.5	15.2
900	0.291	−163.9	4.680	83.3	0.095	70.5	0.295	−31.8	14.2
1000	0.291	−169.2	4.226	81.1	0.103	71.0	0.290	−31.1	13.3
1200	0.305	−177.5	3.569	77.0	0.121	71.5	0.271	−31.0	11.8
1400	0.321	177.7	3.114	73.3	0.138	71.9	0.256	−33.4	10.6
1600	0.326	173.9	2.758	69.7	0.156	71.3	0.251	−37.7	9.6
1800	0.324	169.7	2.485	66.7	0.170	71.6	0.250	−40.3	8.7
2000	0.331	163.8	2.270	63.8	0.187	71.6	0.244	−41.2	7.9
2200	0.357	158.8	2.111	61.5	0.204	71.9	0.229	−43.1	7.3
2400	0.389	155.5	1.975	57.9	0.222	71.5	0.212	−50.2	6.8
2600	0.407	155.3	1.830	55.5	0.234	70.7	0.207	−59.3	6.2
2800	0.412	153.8	1.762	53.1	0.250	70.9	0.221	−64.9	5.9
3000	0.409	149.8	1.679	50.2	0.269	70.5	0.230	−67.5	5.5

Table 24 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.80	0.230	97.0	0.332

NPN 4 GHz wideband transistor BFQ68

DESCRIPTION

NPN transistor mounted in a four-lead dual-emitter SOT122A envelope with a ceramic cap. All leads are isolated from the stud. Diffused emitter-ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. It features very high output voltage capabilities.

It is primarily intended for final stages in MATV system amplifiers, and is also suitable for use in low power band IV and V equipment.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

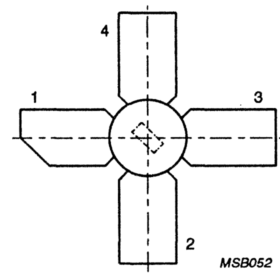


Fig.1 SOT122A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	collector current		–	300	mA
P_{tot}	total power dissipation	up to T_c = 110 °C	–	4.5	W
f_T	transition frequency	I_C = 240 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	4	–	GHz
V_O	output voltage	I_C = 240 mA; V_{CE} = 15 V; d_{im} = −60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	1.6	–	V
P_{L1}	output power at 1 dB gain compression	I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	28	–	dBm
ITO	third order intercept point	I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	47	–	dBm

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_c = 110 °C	–	4.5	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-c}$	thermal resistance from junction to case	20 K/W

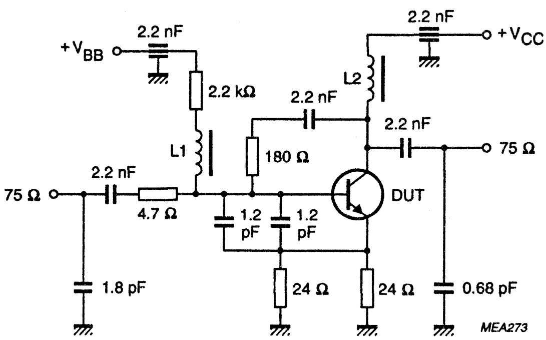
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 15$ V	–	–	50	μA
h_{FE}	DC current gain	$I_C = 240$ mA; $V_{CE} = 15$ V	25	75	–	
f_T	transition frequency	$I_C = 240$ mA; $V_{CE} = 15$ V; f = 500 MHz	–	4	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 15$ V; f = 1 MHz	–	3.8	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	20	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 15$ V; f = 1 MHz	–	2.3	–	pF
C_{cs}	collector-stud capacitance	note 1	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 2)	$I_C = 240$ mA; $V_{CE} = 15$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	13	–	dB
V_O	output voltage	note 3	–	1.6	–	V
P_{L1}	output power at 1 dB gain compression (see Fig.2)	$I_C = 240$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C; measured at f = 800 MHz	–	28	–	dBm
ITO	third order intercept point (see Fig.2)	note 4	–	47	–	dBm

Notes

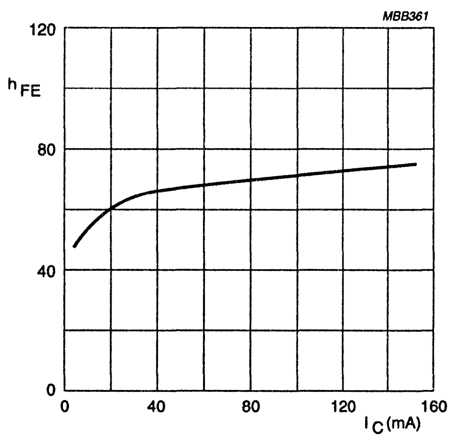
1. Measured with emitter and base grounded.
2. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
3. $d_{im} = -60$ dB (see Figs 2 and 7) (DIN 45004B); $I_C = 240$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O - 6$ dB; $f_q = 803.25$ MHz;
   $V_r = V_O - 6$ dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $I_C = 240$ mA; $V_{CE} = 15$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   P_p = ITO – 6 dB; $f_p = 800$ MHz;
   P_q = ITO – 6 dB; $f_q = 801$ MHz;
   measured at $f_{(2q-p)} = 802$ MHz and at $f_{(2p-q)} = 799$ MHz.



f = 40 to 860 MHz.

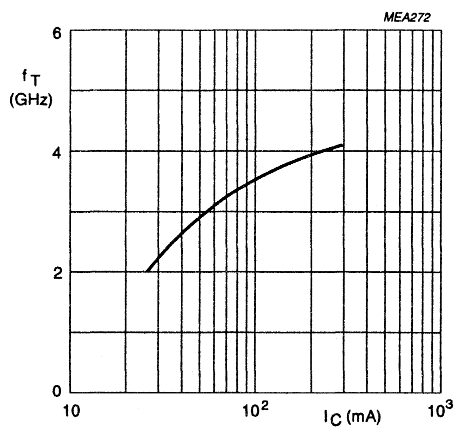
L1 = L2 = 5 μH Ferroxcube choke.

Fig.2 Intermodulation distortion MATV test circuit.



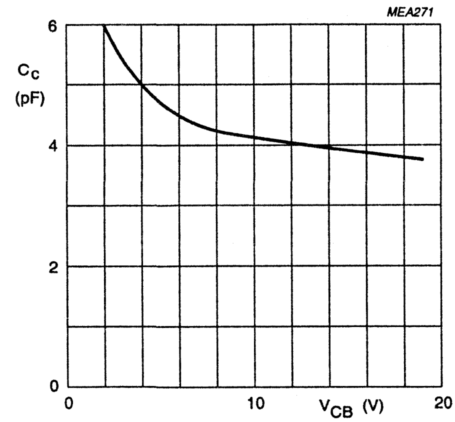
V_{CE} = 10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



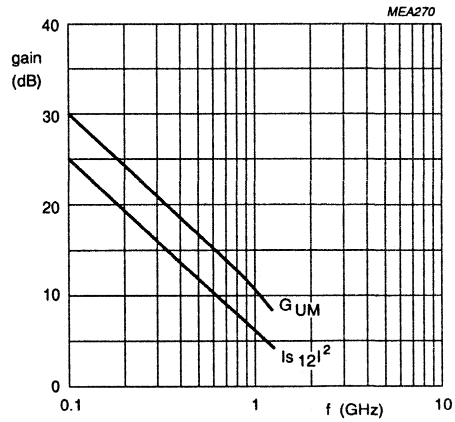
V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C

Fig.4 Transition frequency as a function of collector current.



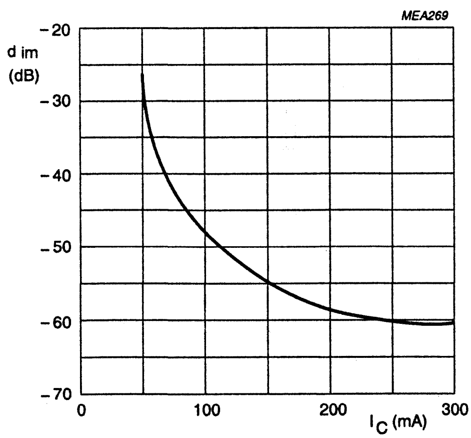
$I_E = i_e = 0$; f = 1 MHz

Fig.5 Collector capacitance as a function of collector-base voltage.



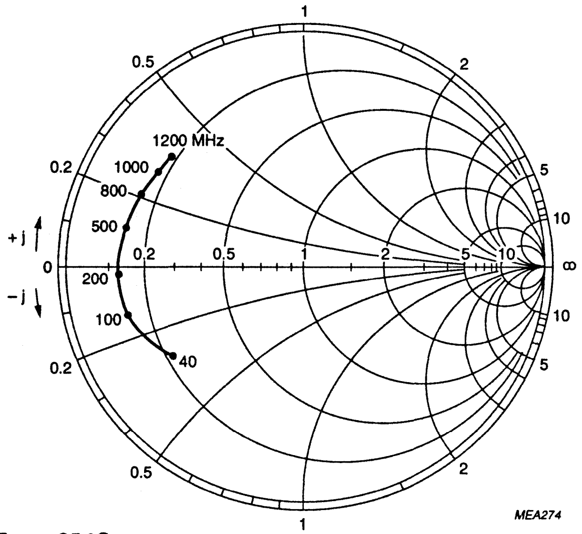
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C

Fig.6 Gain as a function of frequency.



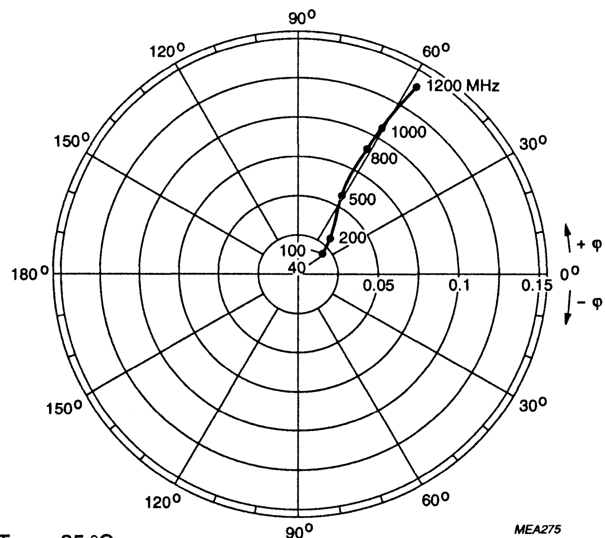
V_{CE} = 15 V; V_O = 1.6 V; $f_{(p+q-r)}$ = 793.25 MHz.

Fig.7 Intermodulation distortion as a function of collector current.



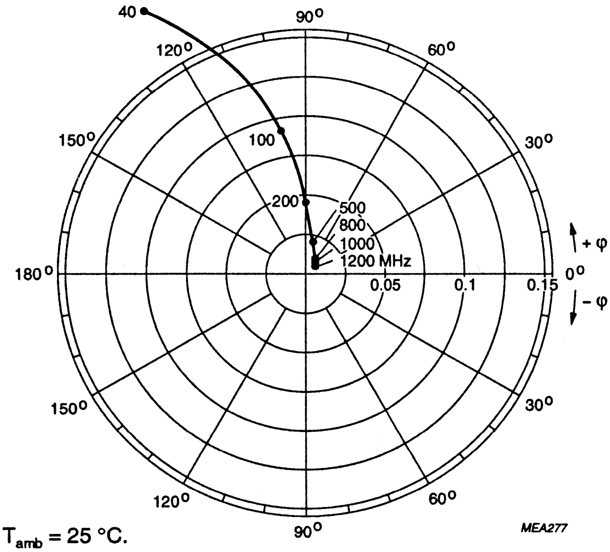
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



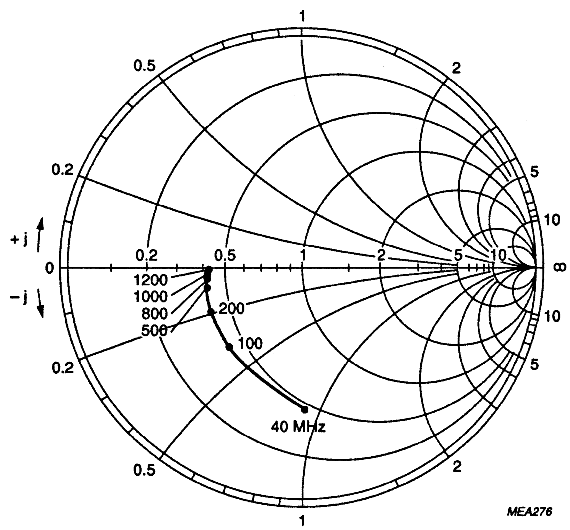
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.7	−135.7	0.02	41.1	30.4	124.0	0.6	−79.0	34.4
100	0.8	−164.0	0.03	33.6	14.8	101.2	0.5	−125.3	28.3
200	0.8	−176.3	0.03	44.1	7.7	89.1	0.4	−148.0	22.9
500	0.8	170.2	0.06	55.3	3.1	70.3	0.4	−159.5	14.9
800	0.8	157.0	0.09	60.5	2.0	57.2	0.4	−165.6	10.9
1000	0.8	152.4	0.11	61.8	1.6	48.1	0.4	−167.6	9.0
1200	0.8	142.7	0.13	59.9	1.4	41.1	0.5	−171.2	7.5

Table 2 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.7	−146.1	0.02	41.0	33.5	121.5	0.6	−90.4	35.4
100	0.8	−167.5	0.02	37.2	15.6	100.4	0.5	−134.4	29.1
200	0.8	−178.3	0.03	47.0	8.1	89.2	0.5	−155.5	23.6
500	0.8	169.0	0.06	60.4	3.4	72.0	0.4	−170.5	15.8
800	0.8	156.1	0.09	62.0	2.2	59.5	0.4	−174.5	11.7
1000	0.8	151.5	0.11	62.0	1.8	51.5	0.4	−178.5	9.9
1200	0.7	141.8	0.14	59.4	1.5	44.0	0.5	−178.5	8.0

Table 3 Common emitter scattering parameters, I_C = 150 mA; V_{CE} = 7.5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.7	−149.0	0.02	40.8	34.3	120.6	0.6	−94.6	35.7
100	0.8	−168.8	0.02	38.8	15.9	100.0	0.5	−138.0	29.3
200	0.8	−179.0	0.03	49.0	8.2	89.2	0.5	−158.2	23.8
500	0.8	168.5	0.06	61.6	3.4	72.5	0.5	−173.2	16.0
800	0.8	155.8	0.09	62.5	2.2	60.3	0.5	−177.1	11.8
1000	0.8	151.2	0.12	62.1	1.8	52.5	0.5	177.1	10.0
1200	0.7	141.6	0.14	59.1	1.5	45.1	0.5	177.1	8.0

Table 4 Common emitter scattering parameters, I_C = 200 mA; V_{CE} = 7.5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−150.7	0.02	40.5	34.7	120.0	0.6	−97.3	37.2
100	0.8	−169.7	0.02	39.6	16.0	99.7	0.5	−140.4	29.4
200	0.8	−179.8	0.03	50.1	8.2	89.0	0.5	−159.8	23.9
500	0.8	168.2	0.06	62.1	3.4	72.6	0.5	−174.8	16.0
800	0.8	155.6	0.09	62.6	2.2	60.5	0.5	−178.6	11.8
1000	0.8	151.0	0.12	62.1	1.8	53.0	0.5	175.5	9.9
1200	0.7	141.4	0.14	59.0	1.5	45.3	0.5	174.6	7.9

Table 5 Common emitter scattering parameters, I_C = 250 mA; V_{CE} = 7.5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−152.0	0.02	40.1	34.6	119.4	0.6	−99.4	36.0
100	0.8	−170.3	0.02	40.0	15.8	99.5	0.5	−141.8	29.6
200	0.8	180.0	0.03	51.0	8.1	89.0	0.5	−161.0	23.8
500	0.8	168.0	0.06	62.5	3.4	72.6	0.5	−175.6	16.2
800	0.8	155.4	0.09	62.8	2.2	60.6	0.5	−179.5	12.1
1000	0.8	150.8	0.12	62.1	1.8	53.0	0.5	174.5	10.1
1200	0.7	141.3	0.14	59.0	1.5	45.6	0.5	173.9	7.9

Table 6 Common emitter scattering parameters, I_C = 300 mA; V_{CE} = 7.5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−153.0	0.02	39.7	34.4	119.0	0.6	−101.2	35.6
100	0.8	−170.8	0.02	40.1	15.5	99.2	0.5	−143.2	29.4
200	0.8	179.6	0.03	51.5	8.0	88.8	0.5	−161.7	23.7
500	0.8	168.0	0.06	62.8	3.4	72.5	0.5	−176.2	16.2
800	0.8	155.3	0.09	60.5	2.2	60.5	0.5	179.8	12.1
1000	0.8	150.6	0.12	53.0	1.8	53.0	0.5	174.0	10.1
1200	0.7	141.1	0.14	45.5	1.5	45.5	0.5	173.4	8.1

Table 7 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.6	−132.3	0.02	41.8	33.5	126.6	0.6	−73.0	34.8
100	0.8	−161.1	0.02	34.0	16.4	103.0	0.4	−115.2	28.7
200	0.8	−174.8	0.03	40.7	8.6	90.1	0.3	−139.4	23.3
500	0.8	170.0	0.06	56.8	3.6	71.4	0.3	−153.8	15.7
800	0.8	157.5	0.08	61.0	2.3	57.6	0.4	−157.4	11.8
1000	0.7	150.3	0.10	61.8	2.0	48.8	0.4	−160.3	9.8
1200	0.7	143.2	0.12	61.0	1.5	41.2	0.4	−163.0	7.7

Table 8 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.6	−140.5	0.02	41.6	36.4	125.0	0.6	−82.0	35.4
100	0.8	−164.8	0.02	37.3	17.5	102.3	0.4	−126.8	29.5
200	0.8	−176.8	0.03	46.7	9.1	90.3	0.4	−149.8	24.0
500	0.8	168.8	0.06	60.3	3.6	72.6	0.4	−164.2	16.2
800	0.8	156.7	0.09	62.1	2.4	60.0	0.4	−168.6	12.1
1000	0.7	149.6	0.11	61.7	2.0	51.2	0.4	−170.8	10.1
1200	0.7	142.6	0.13	60.2	1.7	44.6	0.4	−172.6	8.6

Table 9 Common emitter scattering parameters, I_C = 150 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.6	−143.2	0.02	41.1	37.6	124.0	0.6	−86.5	35.7
100	0.8	−166.0	0.02	38.3	18.0	101.8	0.5	−131.0	29.8
200	0.8	−177.5	0.03	48.1	9.3	90.2	0.4	−153.1	24.2
500	0.8	168.2	0.06	61.2	4.0	73.1	0.4	−167.7	16.5
800	0.8	156.3	0.09	62.2	2.5	60.6	0.4	−172.0	12.5
1000	0.7	149.2	0.11	61.5	2.0	52.2	0.4	−174.6	10.0
1200	0.7	142.2	0.13	59.5	1.7	45.3	0.4	−176.1	8.6

Table 10 Common emitter scattering parameters, I_C = 200 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−144.0	0.02	40.6	38.5	122.8	0.6	−90.2	36.0
100	0.8	−166.7	0.02	39.0	18.0	101.2	0.5	−133.7	30.0
200	0.8	−178.0	0.03	49.1	9.3	90.0	0.4	−155.2	24.3
500	0.8	168.0	0.06	61.6	3.9	73.3	0.4	−169.7	16.5
800	0.8	156.1	0.09	62.3	2.5	61.0	0.4	−174.0	12.7
1000	0.7	149.1	0.11	61.5	2.1	52.8	0.4	−175.7	10.5
1200	0.7	142.1	0.13	59.2	1.7	45.8	0.4	−177.3	8.5

Table 11 Common emitter scattering parameters, I_C = 250 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−145.0	0.02	40.7	38.6	122.1	0.6	−91.6	36.2
100	0.8	−167.0	0.02	39.2	18.0	100.8	0.5	−135.4	20.0
200	0.8	−178.1	0.03	49.5	9.3	89.7	0.4	−156.2	24.3
500	0.8	167.8	0.06	62.0	4.0	73.2	0.4	−170.3	16.6
800	0.8	156.1	0.09	62.4	2.5	61.0	0.4	−174.8	12.8
1000	0.7	149.0	0.11	61.5	2.0	52.6	0.4	−177.2	10.0
1200	0.7	141.8	0.14	58.8	1.7	45.7	0.4	−178.3	8.6

Table 12 Common emitter scattering parameters, I_C = 300 mA; V_{CE} = 15 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.7	−145.2	0.02	40.1	38.7	121.3	0.6	−93.3	37.2
100	0.8	−167.3	0.02	39.0	18.0	100.3	0.5	−136.5	30.0
200	0.8	−178.2	0.03	49.6	9.2	89.4	0.4	−156.8	24.4
500	0.8	167.7	0.06	62.0	4.0	73.0	0.4	−170.6	16.7
800	0.8	156.1	0.09	62.4	2.5	60.8	0.4	−174.7	12.8
1000	0.7	148.8	0.11	61.4	2.0	52.5	0.4	−177.4	10.1
1200	0.7	142.0	0.14	59.2	1.7	45.7	0.4	177.4	8.6

PNP 4 GHz wideband transistor | BFQ108

DESCRIPTION

The BFQ108 is a high output voltage PNP transistor in a SOT122A envelope, primarily intended for use in instrumentation equipment. All leads are isolated from the stud.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

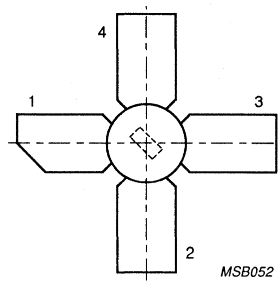


Fig.1 SOT122A.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage		–	25	V
$-V_{CEO}$	collector-emitter voltage		–	18	V
$-V_{EBO}$	emitter-base voltage		–	2	V
$-I_C$	DC collector current	continuous	–	300	mA
P_{tot}	total power dissipation	up to T_c = 120 °C	–	4	W
T_{stg}	storage temperature range		–55	150	°C
T_j	junction temperature		–	150	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current	$-V_{CB}$ = 15 V; I_E = 0	–	–	100	μA
h_{FE}	DC current gain	$-I_C$ = 240 mA; $-V_{CE}$ = 15 V	25	–	–	
f_T	transition frequency	$-I_C$ = 240 mA; $-V_{CE}$ = 15 V; f = 500 MHz (note 1)	–	4	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; $-V_{CB}$ = 15 V; f = 1 MHz	–	5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; $-V_{EB}$ = 0.5 V; f = 1 MHz	–	15	–	pF
C_{re}	feedback capacitance	I_C = 0; $-V_{CE}$ = 0; f = 1 MHz	–	3	–	pF
V_O	output voltage	note 2	–	1.2	–	V

Notes

1. Measured under pulse conditions.
2. d_{im} = –60 dB (DIN 45005B); $-V_{CE}$ = 15 V; $-I_C$ = 240 mA; R_L = 75 Ω; f_p = 795.25 MHz; $V_p = V_O$; f_q = 803.25 MHz; $V_q = V_O$ –6 dB; f_r = 805.25 MHz; $V_r = V_O$ –6 dB; measured at $f_{(p+q-r)}$ = 793.25 MHz.

NPN 6.5 GHz wideband transistor BFQ135

DESCRIPTION

NPN transistor in a 4-lead dual-emitter SOT172A1 envelope with a ceramic cap. All leads are isolated from the mounting base.

It is primarily intended for use in MATV and microwave amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

Emitter-ballasting resistors and application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector
4	emitter

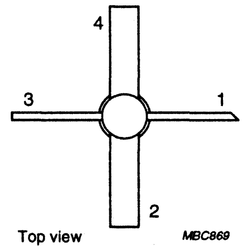


Fig.1 SOT172A1.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	19	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_c = 145 °C	–	–	2.7	W
h_{FE}	DC current gain	I_C = 120 mA; V_{CE} = 18 V; T_{amb} = 25 °C	55	–	–	
f_T	transition frequency	I_C = 120 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	6.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 120 mA; V_{CE} = 18 V; f = 500 MHz; T_{amb} = 25 °C	–	17	–	pF
		I_C = 120 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	13.5	–	dB
V_O	output voltage	d_{im} = -60dB; I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	1.2	–	V

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_c = 145 °C	–	2.7	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	20 K/W

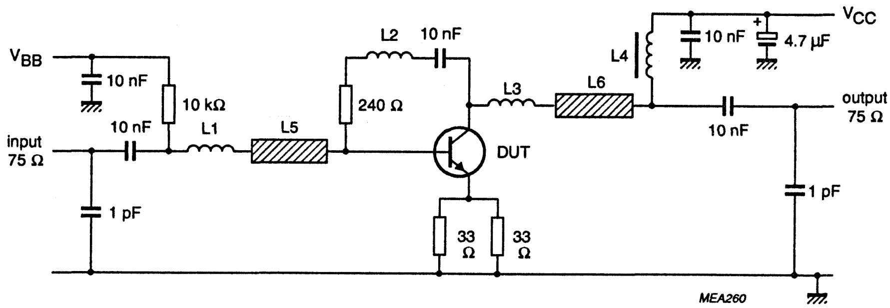
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 18 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 120 mA; V_{CE} = 18 V; T_{amb} = 25 °C	55	–	–	
f_T	transition frequency	I_C = 120 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	6.5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 18 V; f = 1 MHz	–	1.8	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	5.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 18 V; f = 1 MHz	–	1	1.2	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 120 mA; V_{CE} = 18 V; f = 500 MHz; T_{amb} = 25 °C	–	17	–	dB
		I_C = 120 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	13.5	–	dB
V_O	output voltage	note 2	–	1.35	–	V
		note 3	–	1.2	–	V
d_2	second order intermodulation distortion	note 4	–	–70	–	dB
		note 5	–	–70	–	dB

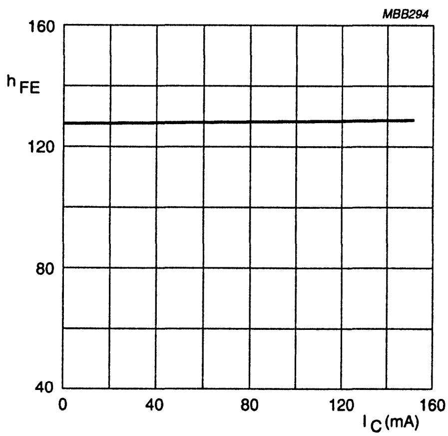
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN45004B); I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 90 mA; V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C;
   measured at $f_{(p+q)}$ = 450 MHz.
5. I_C = 95 mA; V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C;
   measured at $f_{(p+q)}$ = 810 MHz.



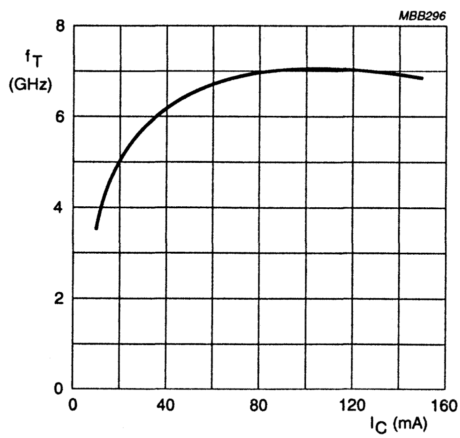
L1 = 8 nH
L2 = 15 nH (2 turns copper wire, internal diameter 2 mm)
L3 = 10 nH (2 turns copper wire, internal diameter 1.5 mm)
L5: Lp = 21 mm; Rc = 75 Ω
L6: Lp = 16 mm; Rc = 75 Ω

Fig.2 Intermodulation distortion test circuit.



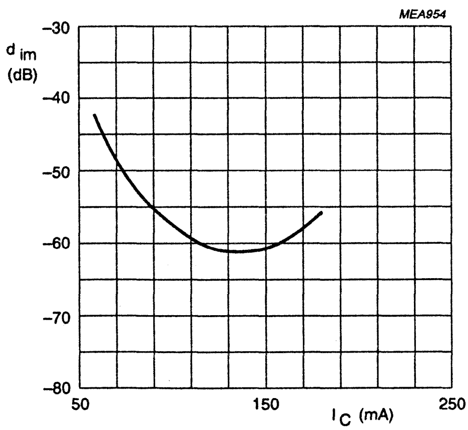
V_{CE} = 18 V; T_{amb} = 25 °C.

Fig.3 DC current gain as a function of collector current.



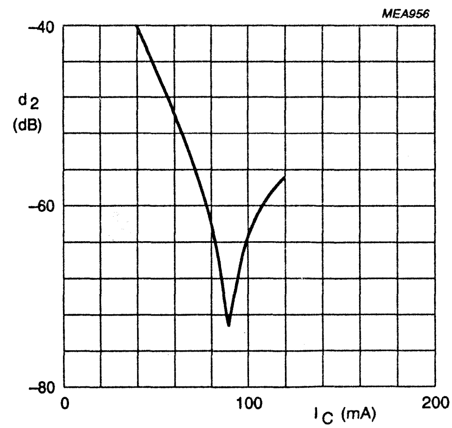
V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.4 Transition frequency as a function of collector current.



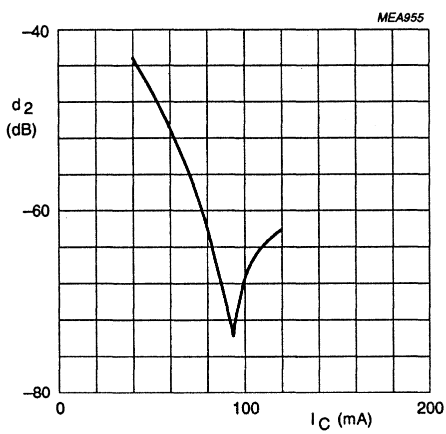
V_{CE} = 18 V.

Fig.5 Intermodulation distortion as a function of collector current.



V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C; measured at $f_{(p+q)}$ = 450 MHz.

Fig.6 Second order intermodulation distortion as a function of collector current.



V_{CE} = 18 V; V_O = 50 dBmV; T_{amb} = 25 °C; measured at $f_{(p+q)}$ = 810 MHz.

Fig.7 Second order intermodulation distortion as a function of collector current.

Table 1 Common emitter scattering parameters, $I_C = 90$ mA; $V_{CE} = 18$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.513	−53.1	32.678	152.2	0.020	58.0	0.738	−33.4	35.0
100	0.481	−101.1	22.431	125.8	0.036	47.4	0.550	−67.4	29.7
200	0.489	−142.9	13.652	104.2	0.049	48.9	0.388	−98.6	24.6
300	0.485	−158.0	9.511	94.0	0.060	50.7	0.329	−115.2	21.2
400	0.482	−169.1	7.334	86.9	0.069	52.9	0.309	−125.1	18.9
500	0.479	−176.5	5.878	80.9	0.083	55.0	0.301	−130.6	16.9
600	0.474	177.7	4.980	75.0	0.095	55.6	0.296	−134.0	15.4
700	0.473	170.6	4.217	71.0	0.107	56.4	0.290	−136.8	14.0
800	0.454	165.3	3.830	65.6	0.121	55.5	0.289	−139.1	13.0
900	0.457	158.6	3.383	62.9	0.134	55.3	0.282	−141.9	12.0
1000	0.454	154.0	3.099	59.4	0.147	55.2	0.280	−144.7	11.2
1200	0.449	144.6	2.570	51.3	0.173	52.6	0.290	−150.9	9.6
1400	0.444	135.3	2.243	43.7	0.198	50.8	0.310	−154.7	8.4
1600	0.432	126.1	2.018	37.7	0.228	47.9	0.316	−157.4	7.5
1800	0.436	114.0	1.817	31.1	0.257	43.5	0.304	−161.8	6.5
2000	0.474	104.7	1.707	25.3	0.288	40.9	0.301	−170.2	6.2

Table 2 Common emitter scattering parameters, $I_C = 120$ mA; $V_{CE} = 18$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.497	−55.0	33.304	152.2	0.018	60.3	0.765	−32.5	35.5
100	0.465	−104.0	22.871	125.8	0.034	50.5	0.565	−65.4	29.9
200	0.486	−142.8	13.908	104.2	0.047	50.4	0.390	−95.3	24.8
300	0.475	−157.7	9.678	93.9	0.059	51.9	0.326	−111.5	21.3
400	0.488	−168.5	7.425	86.6	0.069	54.3	0.303	−121.2	19.0
500	0.483	−176.4	5.979	81.0	0.081	56.3	0.293	−126.7	17.1
600	0.465	178.1	5.069	75.1	0.093	56.5	0.289	−130.2	15.5
700	0.470	171.0	4.298	71.1	0.106	57.5	0.282	−132.5	14.1
800	0.452	166.0	3.923	65.7	0.118	56.3	0.282	−134.8	13.2
900	0.458	158.0	3.440	63.0	0.131	56.1	0.274	−137.6	12.1
1000	0.448	153.3	3.150	59.3	0.145	56.2	0.273	−140.6	11.3
1200	0.448	145.0	2.627	51.2	0.171	53.6	0.284	−146.8	9.7
1400	0.443	134.4	2.277	44.0	0.195	51.7	0.303	−150.6	8.5
1600	0.426	125.8	2.046	37.7	0.226	48.5	0.313	−153.3	7.5
1800	0.430	112.9	1.864	31.1	0.254	44.5	0.300	−157.2	6.7
2000	0.458	102.8	1.731	24.9	0.284	41.4	0.298	−165.9	6.2

Table 3 Common emitter scattering parameters, I_C = 150 mA; V_{CE} = 18 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.494	−56.1	33.269	151.7	0.020	52.4	0.691	−34.5	34.5
100	0.466	−105.3	22.622	125.1	0.035	47.6	0.516	−70.1	29.5
200	0.480	−145.0	13.681	103.8	0.048	49.1	0.370	−102.0	24.5
300	0.480	−159.4	9.514	93.5	0.059	50.7	0.319	−118.9	21.2
400	0.488	−169.6	7.285	86.3	0.070	53.4	0.303	−128.5	18.8
500	0.489	−177.2	5.870	80.7	0.082	55.5	0.295	−133.9	17.0
600	0.470	175.6	4.980	75.0	0.095	56.1	0.293	−136.9	15.4
700	0.471	170.1	4.206	71.0	0.108	56.6	0.286	−139.5	13.9
800	0.456	164.9	3.841	65.7	0.121	55.1	0.287	−141.9	13.1
900	0.460	158.0	3.371	63.0	0.135	55.4	0.279	−144.7	11.9
1000	0.450	152.7	3.098	59.6	0.148	55.1	0.277	−147.3	11.2
1200	0.454	143.8	2.578	51.6	0.175	52.7	0.288	−153.4	9.6
1400	0.446	133.8	2.241	43.8	0.198	50.5	0.306	−157.0	8.4
1600	0.433	125.9	2.018	37.8	0.229	47.4	0.311	−159.6	7.4
1800	0.434	113.4	1.830	31.3	0.258	43.4	0.299	−163.7	6.6
2000	0.464	103.5	1.714	25.1	0.289	40.6	0.296	−172.4	6.1

NPN 4 GHz wideband transistor

BFQ136

DESCRIPTION

NPN transistor in a four-lead dual-emitter SOT122A envelope with a ceramic cap. All leads are isolated from the stud. Diffused emitter-ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. It features extremely high output voltage capabilities.

It is primarily intended for final stages in UHF amplifiers.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

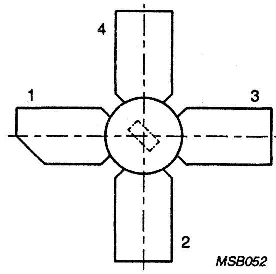


Fig.1 SOT122A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	DC collector current		–	600	mA
P_{tot}	total power dissipation	up to T_c = 100 °C	–	9	W
f_T	transition frequency	I_C = 500 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	4.0	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 500 mA; V_{CE} = 15 V; f = 800 MHz; T_{amb} = 25 °C	12.5	–	dB
V_O	output voltage	I_C = 500 mA; V_{CE} = 15 V; d_{im} = −60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	2.5	–	V

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	600	mA
P_{tot}	total power dissipation	up to T_c = 100 °C	–	9	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	11 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 15 V	–	–	75	µA
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 15 V	25	75	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 15 V; f = 1 MHz	–	7.0	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	40	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 15 V; f = 1 MHz	–	4.0	–	pF
C_{cs}	collector-stud capacitance	note 1	–	0.8	–	pF
f_T	transition frequency	I_C = 500 mA; V_{CE} = 15 V; f = 500 MHz	–	4.0	–	GHz
G_{UM}	maximum unilateral power gain (note 2)	I_C = 500 mA; V_{CE} = 15 V; f = 800 MHz; T_{amb} = 25 °C;	–	12.5	–	dB
V_O	output voltage (see Fig.2)	note 3	–	2.5	–	V

Notes

1. Measured with emitter and base grounded.
2. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
3. d_{im} = –60 dB; I_C = 500 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.

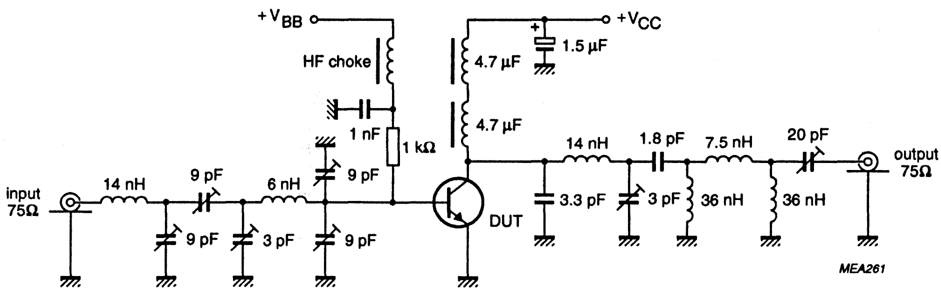
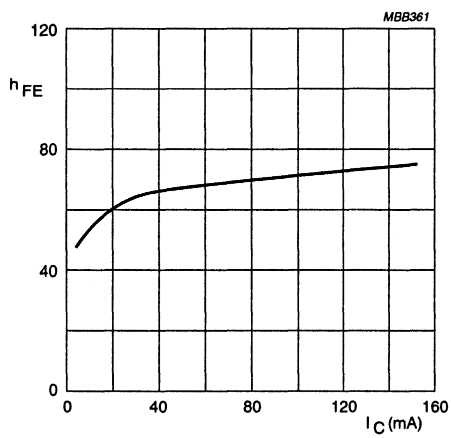
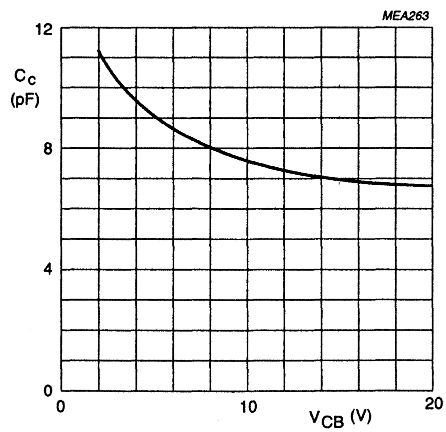


Fig.2 Intermodulation distortion MATV test circuit.



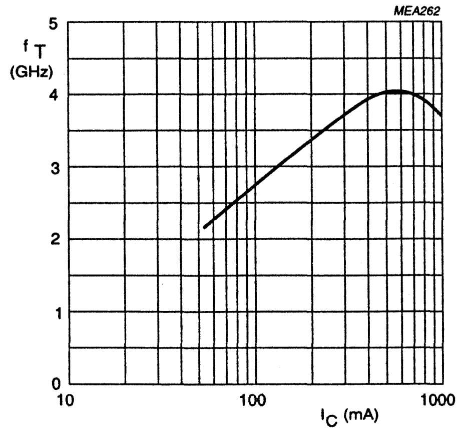
V_{CE} = 15 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



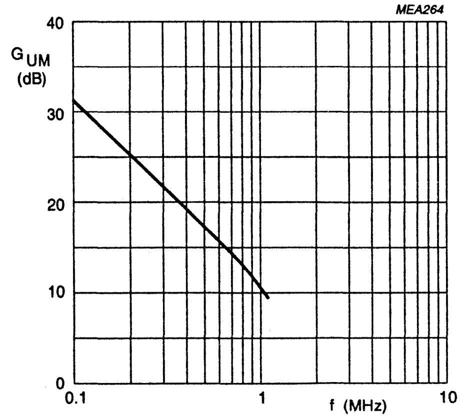
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C

Fig.4 Collector capacitance as a function of collector-base voltage.



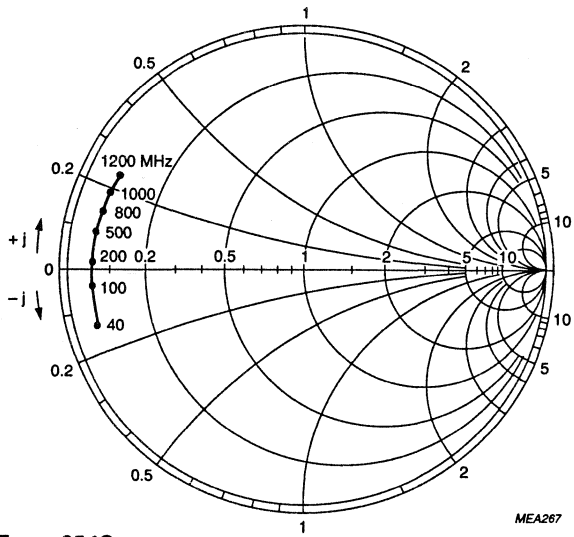
V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C

Fig.5 Transition frequency as a function of collector current.



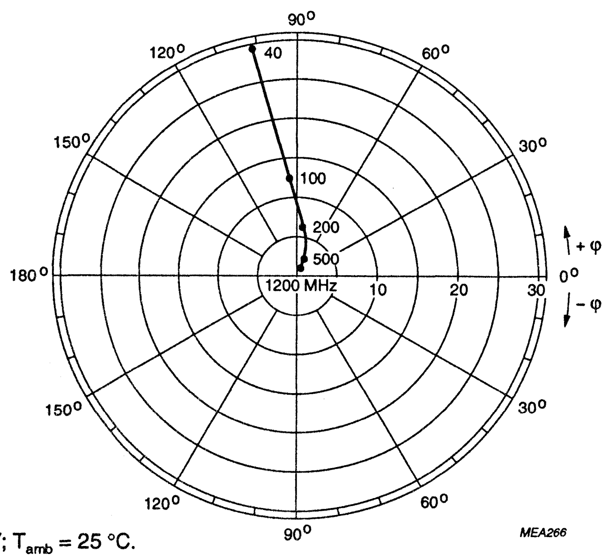
I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of frequency.



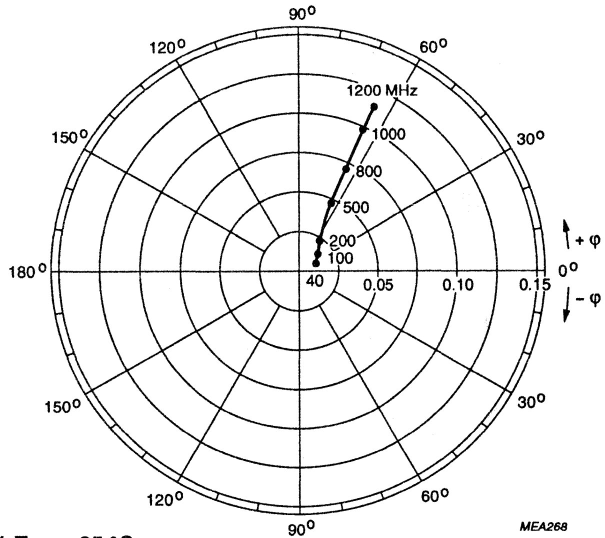
I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.7 Common emitter input reflection coefficient (S_{11}).



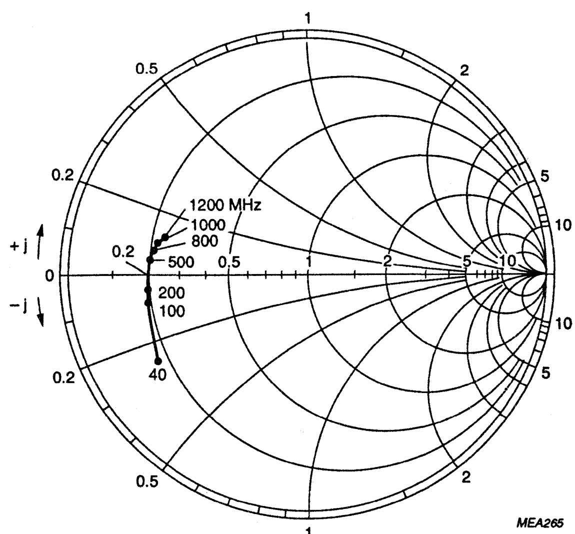
I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.8 Common emitter forward transmission coefficient (S_{21}).



I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.9 Common emitter reverse transmission coefficient (S_{12}).



I_C = 500 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.10 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.87	−161.9	27.9	104.8	0.017	24.5	0.60	−140.2	37.0
100	0.89	−174.2	11.7	92.6	0.019	29.3	0.58	−163.7	30.0
200	0.90	180.0	5.8	85.8	0.024	43.0	0.58	−172.5	24.3
500	0.89	171.6	2.4	70.3	0.044	59.9	0.59	−178.3	16.3
800	0.82	164.3	1.6	58.1	0.068	64.2	0.60	179.0	12.3
1000	0.86	159.9	1.2	51.7	0.086	66.1	0.60	176.4	9.4
1200	0.86	155.6	1.1	42.4	0.105	63.7	0.60	173.8	8.6

Table 2 Common emitter scattering parameters, I_C = 200 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.87	−165.2	29.3	103.8	0.014	26.2	0.65	−146.8	37.9
100	0.90	−175.8	12.1	92.7	0.017	34.9	0.65	−167.3	31.3
200	0.90	179.1	6.1	86.9	0.023	49.7	0.65	−175.5	25.3
500	0.89	170.7	2.5	72.7	0.046	63.5	0.65	177.7	17.2
800	0.88	163.5	1.6	61.4	0.072	65.8	0.64	173.6	12.6
1000	0.86	159.2	1.3	55.3	0.090	66.5	0.63	170.6	10.5
1200	0.84	155.1	1.2	48.9	0.109	63.3	0.62	167.8	9.0

Table 3 Common emitter scattering parameters, I_C = 300 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.88	−166.4	29.6	103.2	0.013	26.8	0.67	−149.3	38.5
100	0.90	−176.1	12.3	92.7	0.016	36.2	0.67	−168.5	31.6
200	0.90	178.6	6.2	86.9	0.023	51.8	0.67	−176.2	25.6
500	0.89	171.0	2.5	73.5	0.046	69.6	0.67	176.6	17.4
800	0.88	163.8	1.6	63.2	0.072	66.2	0.66	172.0	12.6
1000	0.86	159.5	1.4	56.9	0.091	66.7	0.64	168.7	11.1
1200	0.85	154.5	1.2	49.5	0.110	63.3	0.63	165.8	9.3

Table 4 Common emitter scattering parameters, I_C = 400 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.88	−166.8	29.6	102.7	0.013	26.8	0.69	−150.8	38.7
100	0.90	−176.4	12.1	92.4	0.016	36.9	0.68	169.2	31.6
200	0.90	178.5	6.1	87.1	0.023	52.4	0.68	−176.7	25.6
500	0.89	170.7	2.5	74.1	0.047	65.2	0.68	176.0	17.5
800	0.88	163.4	1.6	64.1	0.073	66.3	0.66	171.4	12.5
1000	0.86	159.0	1.3	56.4	0.092	66.7	0.65	168.0	10.5
1200	0.85	154.6	1.2	50.7	0.111	63.1	0.64	164.9	9.4

Table 5 Common emitter scattering parameters, I_C = 500 mA; V_{CE} = 15 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.88	−167.0	29.3	102.2	0.013	27.0	0.69	−151.8	38.6
100	0.90	−176.6	12.1	92.2	0.016	37.0	0.69	−169.5	31.7
200	0.90	178.6	6.1	86.8	0.023	52.8	0.68	−176.8	25.6
500	0.89	170.5	2.5	73.5	0.047	65.2	0.68	175.8	17.5
800	0.88	164.0	1.6	62.5	0.073	66.5	0.67	171.0	12.5
1000	0.86	159.2	1.3	56.6	0.092	66.7	0.65	167.7	10.5
1200	0.84	154.8	1.2	50.6	0.112	63.1	0.64	164.7	9.2

PNP 5 GHz wideband transistor — BFQ149

DESCRIPTION

PNP transistor in a SOT89 envelope. It is intended for use in UHF applications such as broadband aerial amplifiers (30 to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analyzers, etc., using SMD technology.

PINNING

PIN	DESCRIPTION
Code: FG	
1	emitter
2	base
3	collector

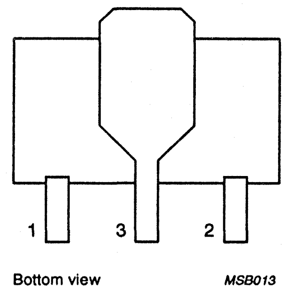


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = –70 mA; V_{CE} = –10 V; T_j = 25 °C	20	50	–	
f_T	transition frequency	I_C = –75 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	4	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	12	–	dB
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; R_s = 60 Ω; f = 500 MHz; T_{amb} = 25 °C	–	3.75	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current	f > 1 MHz	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

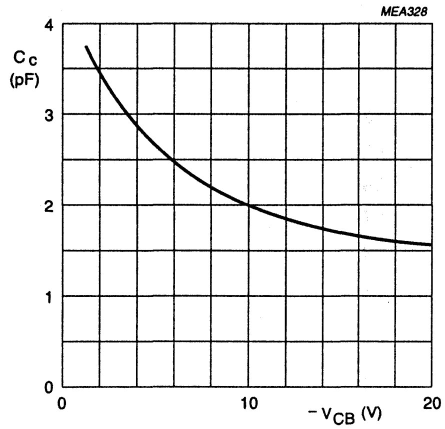
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = −70 mA; V_{CE} = −10 V	20	50	–	
f_T	transition frequency	I_C = −70 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	4	5	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = −10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = −0.5 V; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	1.7	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	12	–	dB
F	noise figure	I_C = −50 mA; V_{CE} = −10 V; R_s = 60 Ω; f = 500 MHz; T_{amb} = 25 °C	–	3.75	–	dB

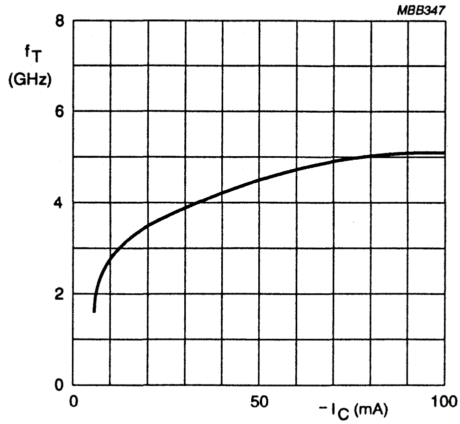
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



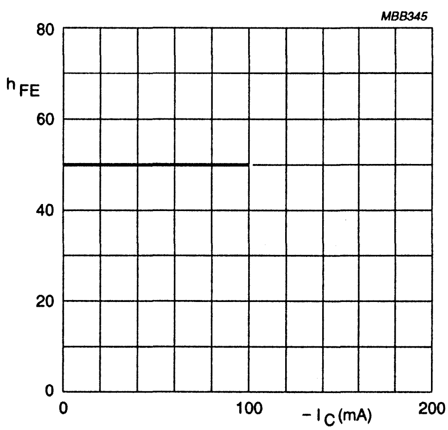
$I_E = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.2 Collector capacitance as a function of collector-base voltage.



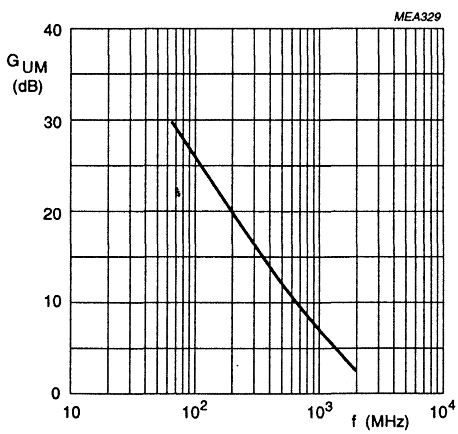
$V_{CE} = -10$ V; f = 500 MHz; $T_{amb} = 25$ °C.

Fig.3 Transition frequency as a function of collector current.



$V_{CE} = -10$ V; $T_j = 25$ °C.

Fig.4 DC current gain as a function of collector current.



$I_C = -50$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.5 Maximum unilateral power gain as a function of frequency.

Table 1 Common emitter scattering parameters, $I_C = -70$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.286	−137.8	33.887	131.9	0.015	75.2	0.576	−45.6	32.7
100	0.350	−163.5	17.349	106.1	0.032	76.3	0.307	−65.3	25.8
200	0.368	−179.7	9.099	93.6	0.057	77.9	0.180	−72.8	20.0
300	0.387	174.5	6.167	86.0	0.085	77.7	0.142	−77.4	16.6
400	0.397	167.3	4.752	80.3	0.111	76.2	0.126	−81.4	14.4
500	0.396	163.4	3.775	75.9	0.138	75.5	0.118	−86.0	12.3
600	0.405	159.0	3.211	72.2	0.163	73.3	0.115	−91.6	11.0
700	0.413	152.5	2.758	68.0	0.188	72.0	0.116	−95.9	9.7
800	0.428	148.0	2.468	64.6	0.213	70.3	0.120	−101.3	8.8
900	0.424	143.6	2.230	61.2	0.234	68.3	0.124	−107.1	7.9
1000	0.441	137.6	2.042	57.5	0.258	66.6	0.128	−113.0	7.2
1200	0.487	132.7	1.744	51.5	0.298	63.5	0.141	−122.1	6.1
1400	0.509	126.4	1.573	45.0	0.343	60.9	0.155	−133.5	5.3
1600	0.526	119.5	1.425	40.1	0.381	56.7	0.151	−133.1	4.6
1800	0.559	111.0	1.336	36.1	0.411	54.7	0.189	−139.1	4.3
2000	0.561	105.9	1.235	31.4	0.442	52.3	0.207	−150.4	3.7
2200	0.610	102.7	1.167	28.3	0.472	50.1	0.235	−157.2	3.6
2400	0.604	100.0	1.096	24.2	0.502	47.4	0.268	−162.9	3.1
2600	0.645	98.2	1.027	20.9	0.516	44.9	0.290	−166.4	3.0
2800	0.617	94.0	0.991	19.7	0.541	43.2	0.314	−169.3	2.5
3000	0.650	90.7	0.951	14.7	0.566	40.3	0.333	−174.2	2.5

NPN 1 GHz video transistor BFQ161

FEATURES

- Low output capacitance
- High gain bandwidth product
- High current applicability
- Good thermal stability
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

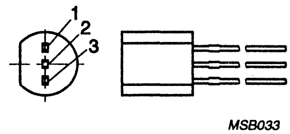


Fig.1 SOT54.

DESCRIPTION

NPN silicon epitaxial transistor in a plastic SOT54 (TO-92) envelope. It is intended for use as a pre-stage driver in high resolution colour graphics monitors.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
I_C	DC collector current	continuous	–	500	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (note 1)	–	1	W
T_j	junction temperature		–	150	°C
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	25	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C	1	–	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 75 °C (notes 1 and 2)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Notes

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.
2. Transistor mounted on a printed circuit board with a metallized pad area of 10 mm^2.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	75 K/W
$R_{th\ j\text{-}a}$	from junction to ambient	175 K/W
$R_{th\ s\text{-}a}$	from soldering point to ambient	100 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector-emitter cut-off current	I_B = 0; V_{CE} = 10 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	25	–	–	
		I_C = 100 µA; V_{CE} = 5 V	40	50	–	
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 5 V; f = 1 MHz	–	4.3	–	pF
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 5 V; f = 1 MHz	–	6	–	pF
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V	1	–	–	GHz

NPN 1 GHz video transistor BFQ161

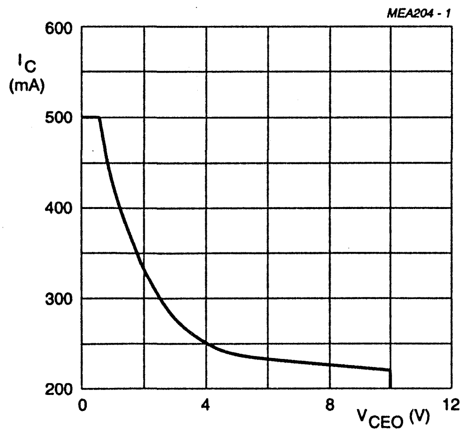


Fig.2 DC SOAR.

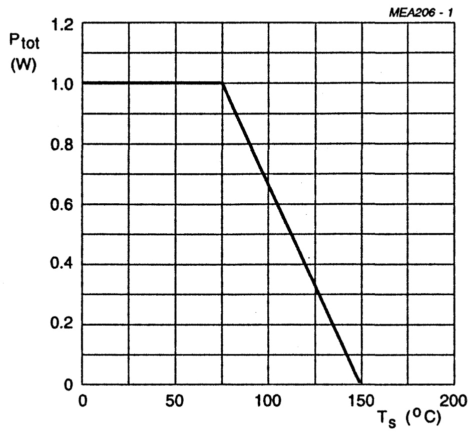
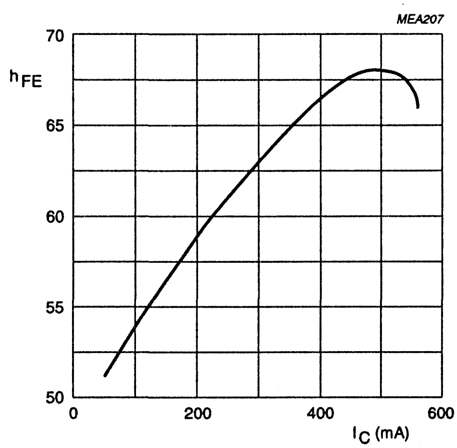
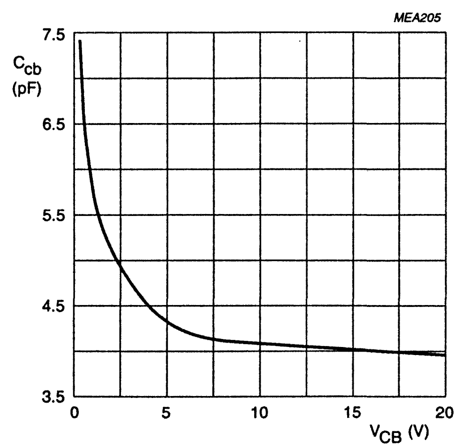


Fig.3 Power derating curve.



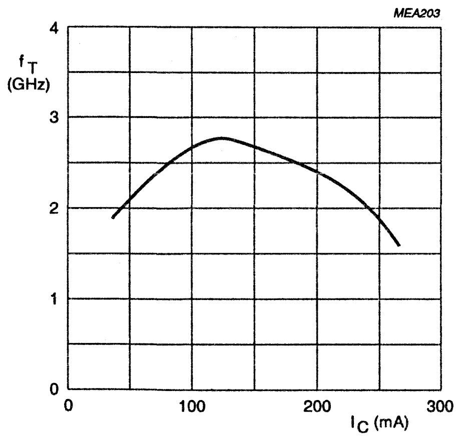
V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



T_{amb} = 25 °C; f = 1 MHz.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current, typical values.

NPN 1 GHz video transistor BFQ162

DESCRIPTION

NPN silicon epitaxial transistor in a SOT32 (TO-126) package, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high frequency behaviour and a low output capacitance.

This device is primarily intended for application in the pre-stage of the driver for high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

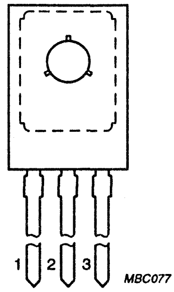


Fig.1 SOT32.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	–	19	V
I_C	DC collector current		–	–	500	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	3	W
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C	50	60	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; f = 100 MHz; T_{amb} = 25 °C	1	–	–	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature measured at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 115 °C (note 1)	20 K/W

Note

1. T_s is the temperature measured at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω	19	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 10 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C	50	60	–	
		I_C = 100 mA; V_{CE} = 5 V; T_{amb} = 25 °C	40	50	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; f = 100 MHz; T_{amb} = 25 °C	1	–	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	4.2	–	pF
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 5 V; f = 1 MHz	–	5.8	–	pF

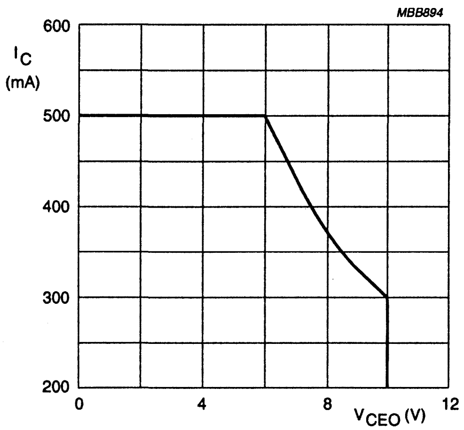


Fig.2 DC SOAR.

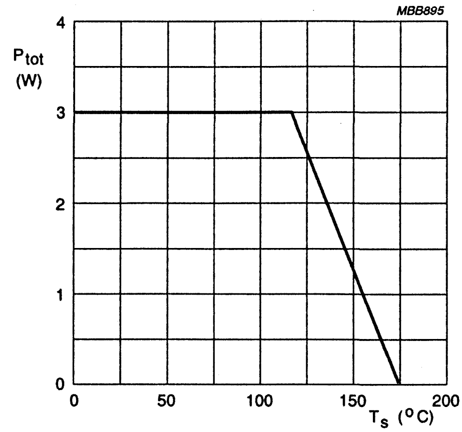
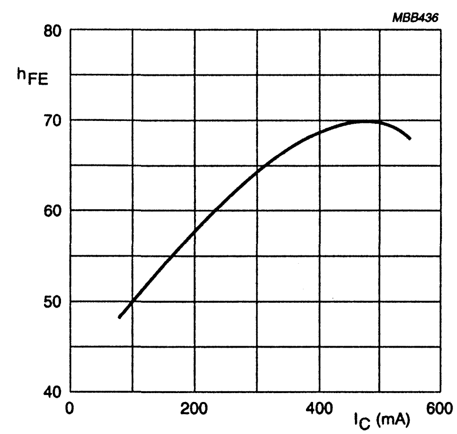
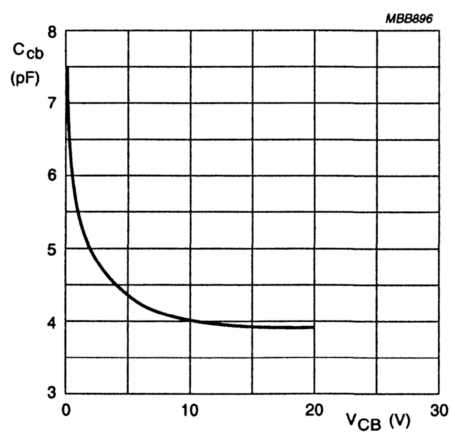


Fig.3 Power derating curve.



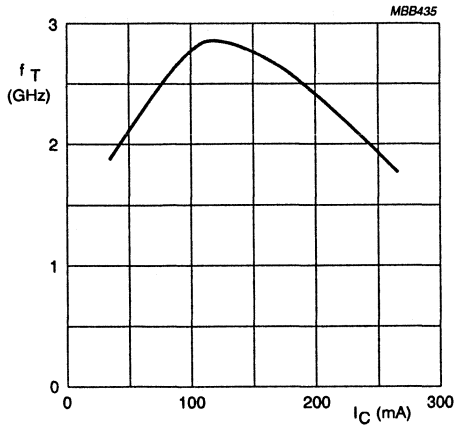
V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 100 MHz; T_{amb} = 25 °C

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistor | BFQ163

DESCRIPTION

NPN silicon epitaxial transistor in a SOT5 (TO-39) envelope with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high frequency behaviour and a low output capacitance.

This transistor is primarily intended for application in the pre-stage of the driver for high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

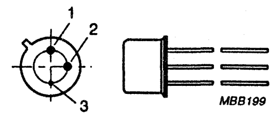


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	–	19	V
I_C	DC collector current		–	–	500	mA
P_{tot}	total power dissipation	up to T_s = 95 °C (note 1)	–	–	3	W
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C	50	60	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	1	–	–	GHz

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 95 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 95 °C (note 1)	35 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	R_{BE} = 100 Ω	19	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 10 V	–	–	100	μA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C	50	60	–	
		I_C = 100 mA; V_{CE} = 5 V; T_{amb} = 25 °C	40	50	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	1	–	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	4.5	–	pF
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = 5 V; f = 1 MHz	–	6	–	pF

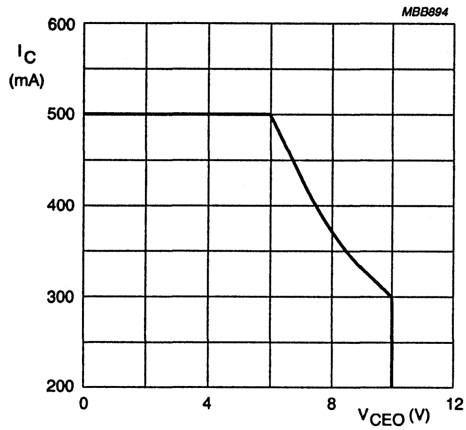


Fig.2 DC SOAR.

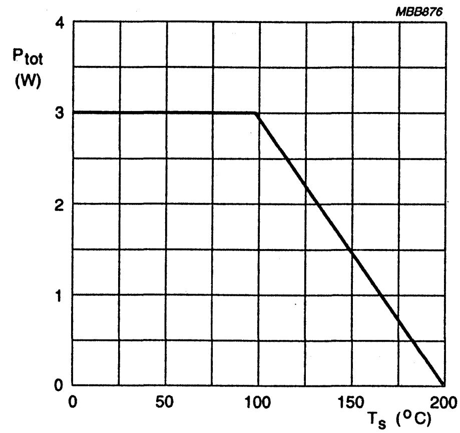
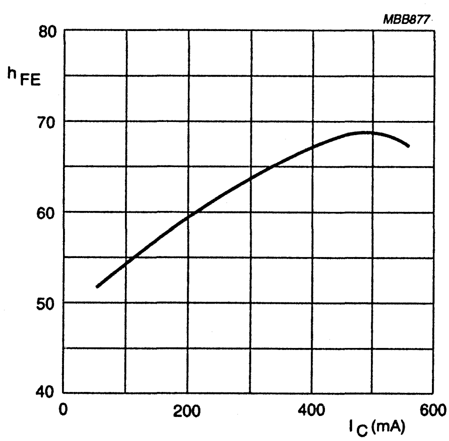
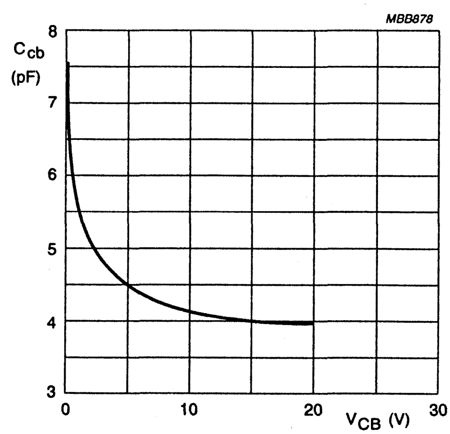


Fig.3 Power derating curve.



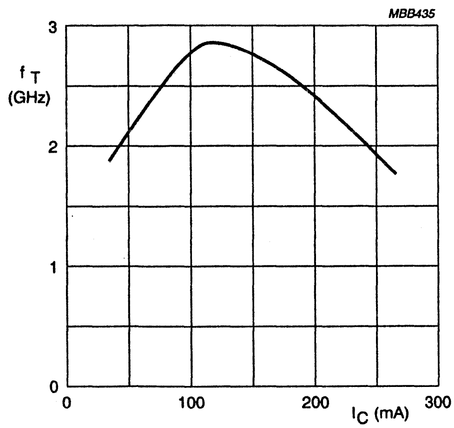
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistor | BFQ166

FEATURES

- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- High current applicability
- Surface mounting.

DESCRIPTION

NPN silicon epitaxial transistor in a plastic SOT223 envelope and intended for use as a surface-mounted cascode driver in video amplifiers in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

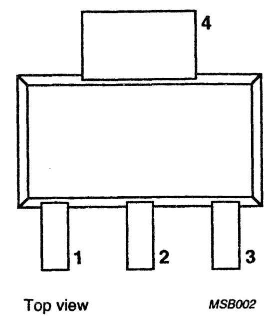


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$	–	19	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to $T_s = 105$ °C (note 1)	–	2	W
f_T	transition frequency	$I_C = 300$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; f = 100 MHz	1	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	T_s = 105 °C; P_{tot} = 2 W (notes 1 and 2)	35 K/W

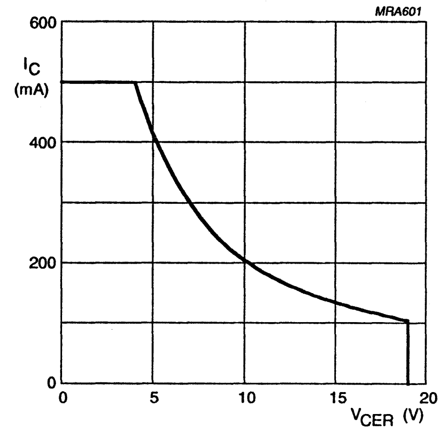
Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. Device mounted on a printed circuit board measuring 40 x 40 x 1 mm (collector pad 35 x 17 mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 µA	20	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω	19	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = 10 V; V_{BE} = 0	–	–	100	µA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	50	60	–	
C_c	collector capacitance	$I_C = i_c$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4.5	–	pF
C_{cb}	collector-base capacitance	$I_C = i_c$ = 0; V_{CB} = 5 V; f = 1 MHz	–	3.2	–	pF
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 100 MHz	1	–	–	GHz



$R_{BE} \leq 100\ \Omega$.

Fig.2 DC SOAR.

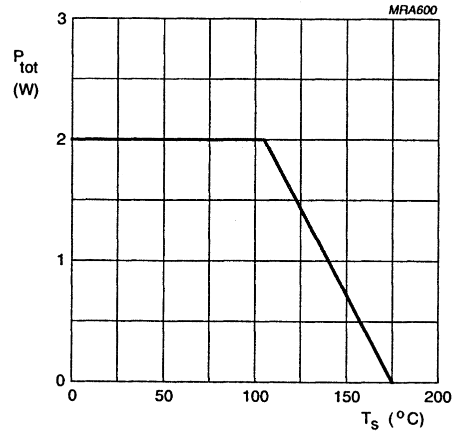
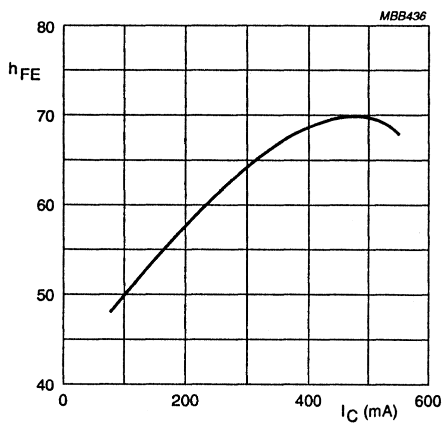
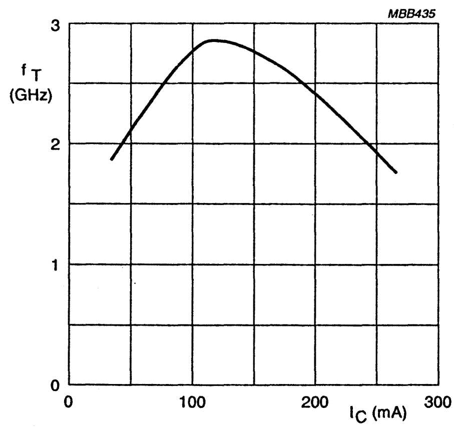


Fig.3 Power derating curve.



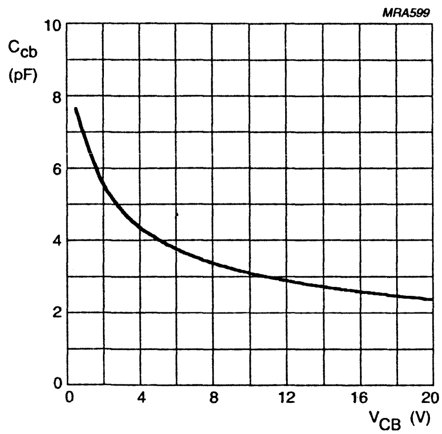
$V_{CE} = 5$ V.

Fig.4 DC current gain as a function of collector current, typical values.



$V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.5 Transition frequency as a function of collector current, typical values.



$I_C = 0$; f = 1 MHz.

Fig.6 Collector-base capacitance as a function of collector-base voltage, typical values.

NPN 1 GHz video transistors — BFQ231; BFQ231A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary pnp types BFQ251/BFQ251A.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

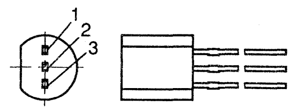


Fig.1 SOT54.

DESCRIPTION

The BFQ231 and BFQ231A are npn silicon epitaxial transistors in a plastic SOT54 (TO-92) envelope and intended for use as buffer drivers in high-resolution colour graphics monitors.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ231		–	100	V
	BFQ231A		–	115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ231		–	95	V
	BFQ231A		–	110	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	1	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	20	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C			
	BFQ231		1	–	GHz
	BFQ231A		800	–	MHz

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ231		–	100	V
	BFQ231A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ231		–	65	V
	BFQ231A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ231		–	95	V
	BFQ231A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (notes 1 and 2)	–	1	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	85 K/W
$R_{th\ j\text{-}a}$	from junction to ambient	185 K/W
$R_{th\ s\text{-}a}$	from soldering point to ambient	100 K/W

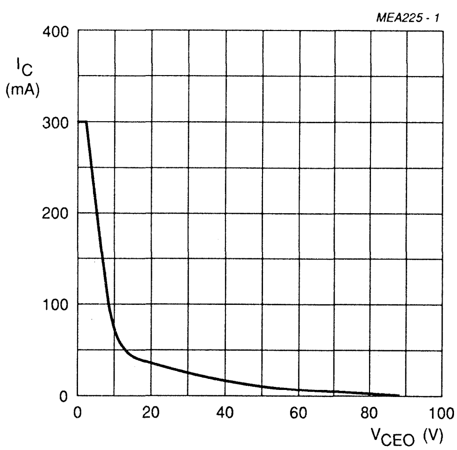
Notes

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.
2. Transistor mounted on a printed circuit board with a metallized pad area of 10 mm^2.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.1 mA				
	BFQ231		100	–	–	V
	BFQ231A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA				
	BFQ231		65	–	–	V
	BFQ231A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ231		95	–	–	V
	BFQ231A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	3	–	–	V
I_{CES}	collector-emitter cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector-base cut-off current	I_C = 0; V_{CE} = 10 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	20	35	–	
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1.8	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V				
	BFQ231		1	1.4	–	GHz
	BFQ231A		0.8	1.2	–	GHz



T_{amb} = 25 °C.

Fig.2 DC SOAR.

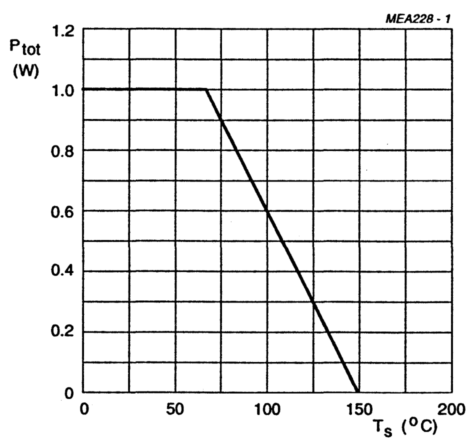
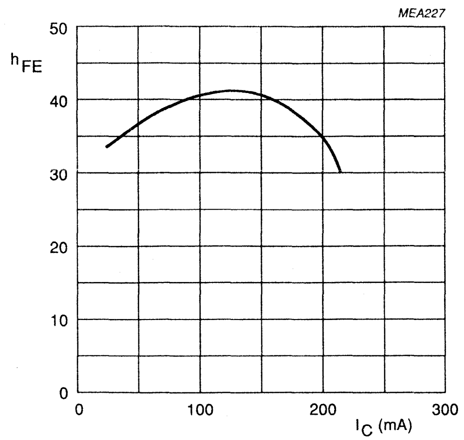
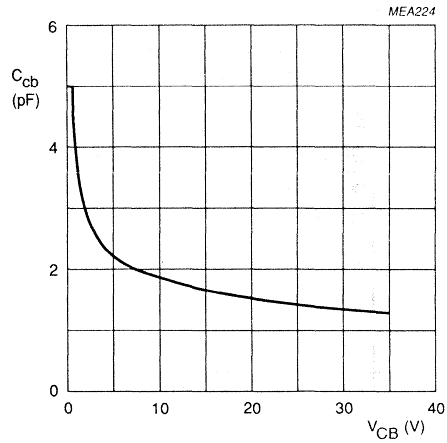


Fig.3 Power derating curve.



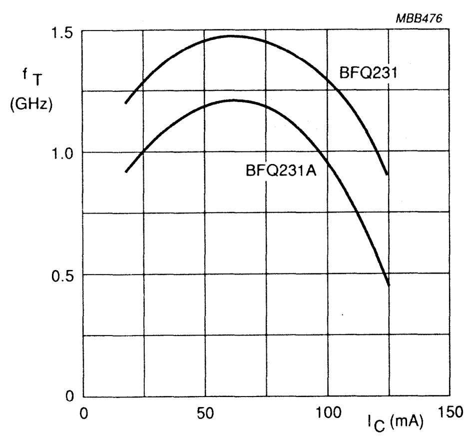
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



T_{amb} = 25 °C; f = 1 MHz.

Fig.5 Collector-base capacitance as a function of collector-base voltage, typical values.



V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current, typical values.

NPN 1 GHz video transistors — BFQ232; BFQ232A

DESCRIPTION

NPN silicon epitaxial transistor in a SOT32 (TO-126) package, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

PNP complements are BFQ252 and BFQ252A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

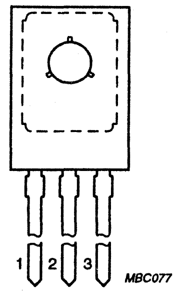


Fig.1 SOT32.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ232		–	100	V
	BFQ232A		–	115	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ232		–	95	V
	BFQ232A		–	110	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to $T_s = 115$ °C (note 1)	–	3	W
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	20	–	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 10$ V; f = 100 MHz; $T_{amb} = 25$ °C			
	BFQ232		1	–	GHz
	BFQ232A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ232		–	100	V
	BFQ232A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ232		–	65	V
	BFQ232A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ232		–	95	V
	BFQ232A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 115 °C (note 1)	20 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ232		100	–	–	V
	BFQ232A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ232		65	–	–	V
	BFQ232A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ232		95	–	–	V
	BFQ232A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	35	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ232		1	1.4	–	GHz
	BFQ232A		0.8	1.2	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF

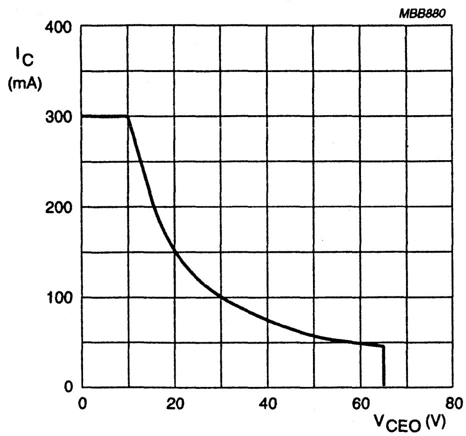


Fig.2 DC SOAR.

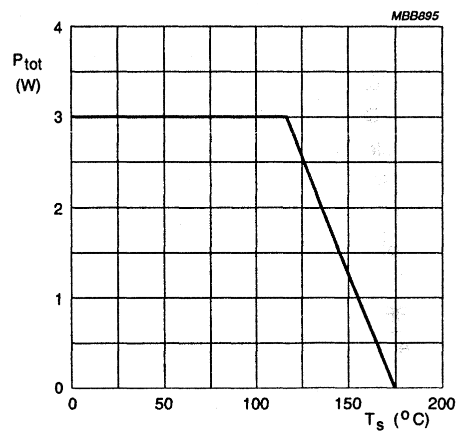
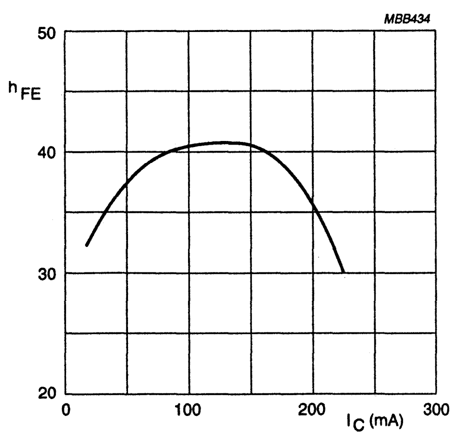
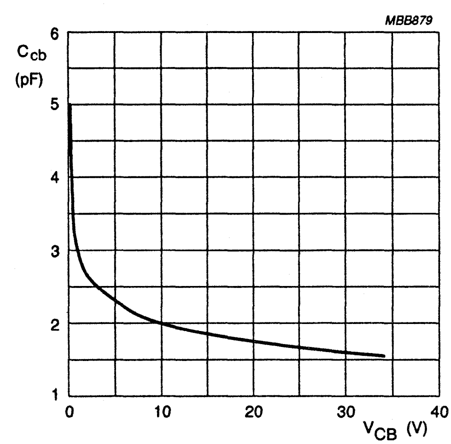


Fig.3 Power derating curve.



V_{CE} = 10 V; T_{amb} = 25 °C.

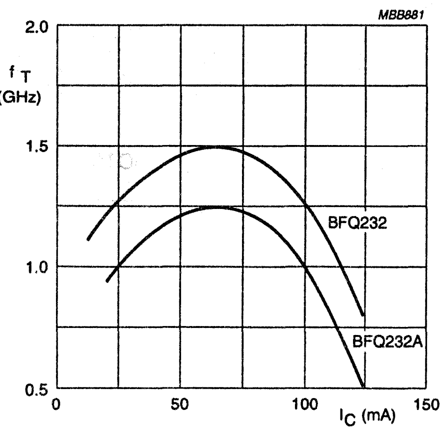
Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.

 Capability approved CECC 50 000 (issue 4), 1986.



V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistors | BFQ233; BFQ233A

DESCRIPTION

NPN silicon epitaxial transistor in a SOT5 (TO-39) envelope with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

PNP complements are the BFQ253 and BFQ253A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

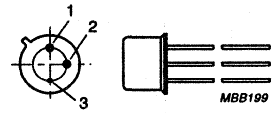


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ233		–	100	V
	BFQ233A		–	115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ233		–	95	V
	BFQ233A		–	110	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	3	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C			
	BFQ233		1	–	GHz
	BFQ233A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ233		–	100	V
	BFQ233A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ233		–	65	V
	BFQ233A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ233		–	95	V
	BFQ233A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	25 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ233		100	–	–	V
	BFQ233A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ233		65	–	–	V
	BFQ233A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ233		95	–	–	V
	BFQ233A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	35	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C				
	BFQ233		1	1.4	–	GHz
	BFQ233A		0.8	1.2	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF

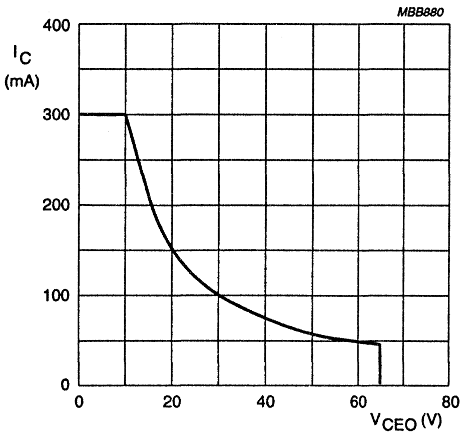


Fig.2 DC SOAR.

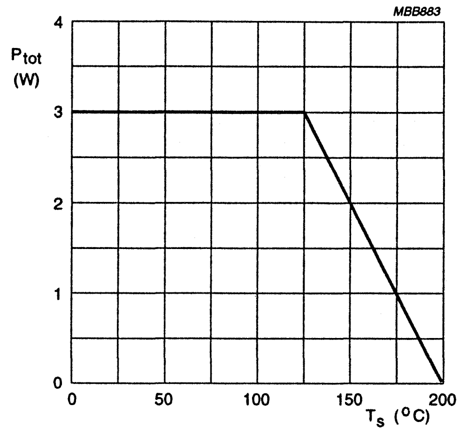
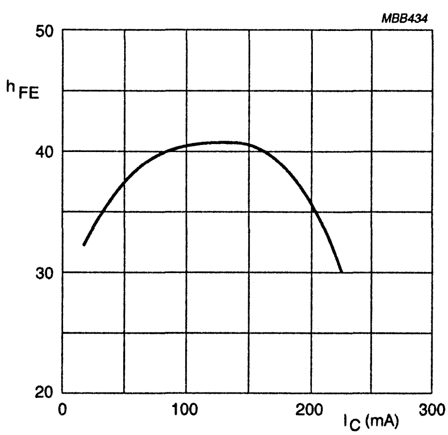
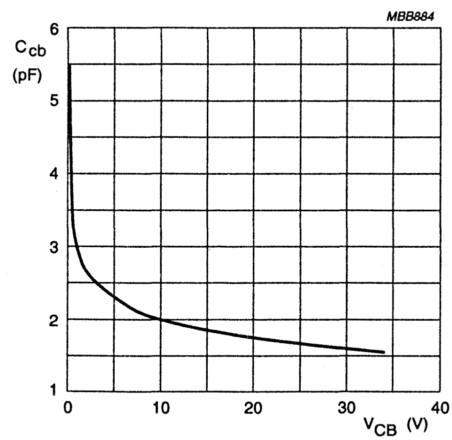


Fig.3 Power derating curve.



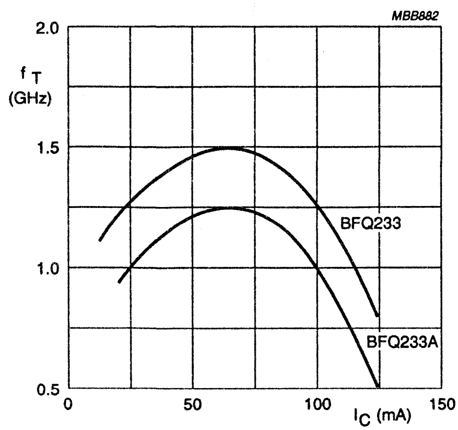
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

DESCRIPTION

NPN silicon epitaxial transistor in SOT172A1 and SOT172A3 envelopes, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high frequency behaviour and a low output capacitance.

This transistor is primarily intended for application in the driver for high-resolution colour graphics monitors.

This BFQ234 has a 4-lead stud envelope with a ceramic cap (SOT172A1). All leads are isolated from the stud.

The BFQ234/I uses the SOT172A3 envelope, with the leads formed in accordance with the footprint of the industry standard package, 244D-01 (Motorola).

A version with $V_{(BR)CBO}$ = 115 V, $V_{(BR)CER}$ = 110 V and $V_{(BR)CEO}$ = 95 V is available on request.

PNP complements are the BFQ254 and BFQ254/I respectively.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	base

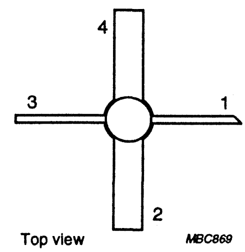


Fig.1 SOT172A1.

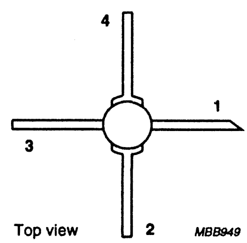


Fig.2 SOT172A3.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	100	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	95	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_c = 140 °C	–	3	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	1	–	GHz

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	100	V
V_{CEO}	collector-emitter voltage	open base	–	65	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	95	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_c = 140 °C	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	20 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	100	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	65	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω	95	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	35	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	1	1.4	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF

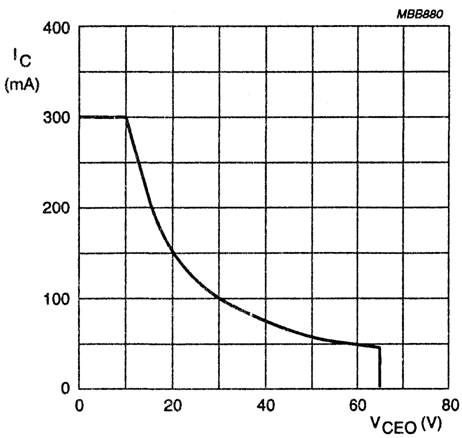


Fig.3 DC SOAR.

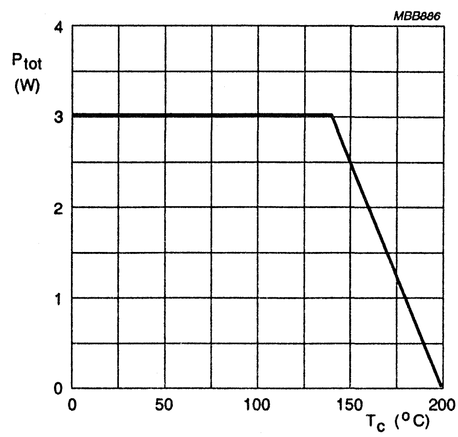
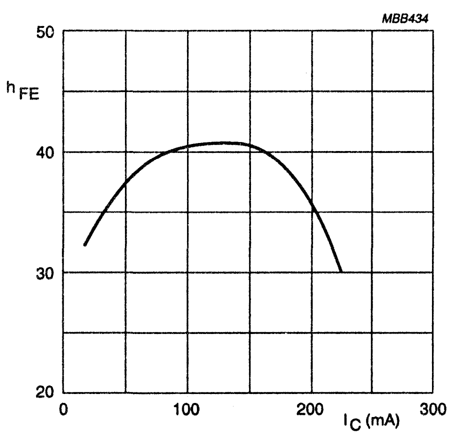
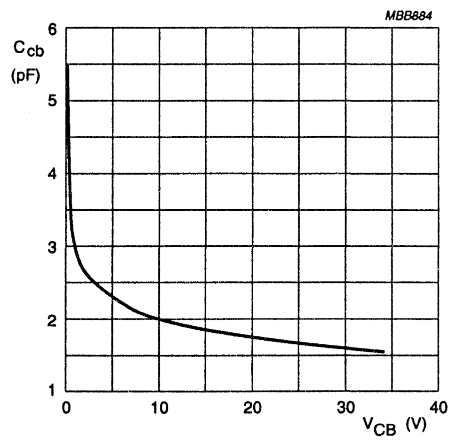


Fig.4 Power derating curve.



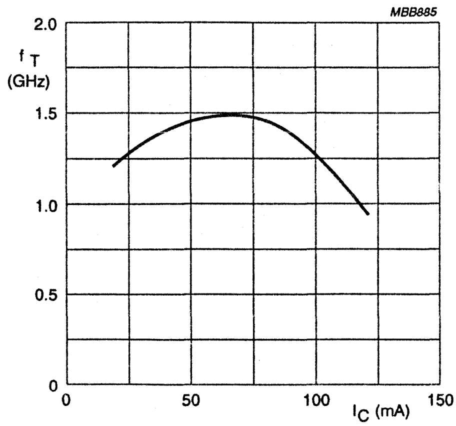
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.5 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.6 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.

NPN 1 GHz video transistors BFQ235; BFQ235A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon epitaxial transistor in a plastic SOT128B envelope, with the collector connected to the mounting base.

It is intended for use as a buffer/driver in CRT amplifiers in high-resolution colour graphics monitors.

PNP complements are BFQ255 and BFQ255A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

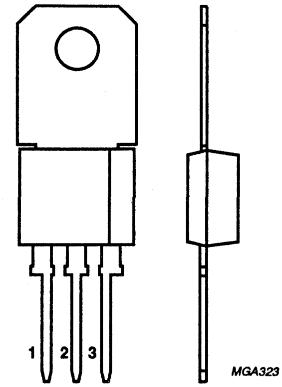


Fig.1 SOT128B.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ235		–	100	V
	BFQ235A		–	115	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ235		–	95	V
	BFQ235A		–	110	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to $T_s = 100$ °C (note 1)	–	3	W
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	20	–	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C			
	BFQ235		1	–	GHz
	BFQ235A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ235		–	100	V
	BFQ235A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ235		–	65	V
	BFQ235A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ235		–	95	V
	BFQ235A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 100 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 100 °C (note 1)	25 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ235		100	–	–	V
	BFQ235A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ235		65	–	–	V
	BFQ235A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ235		95	–	–	V
	BFQ235A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C	20	35	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ235		1	1.4	–	GHz
	BFQ235A		0.8	1.2	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF

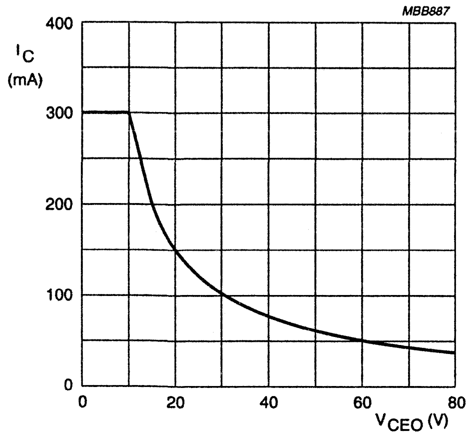


Fig.2 DC SOAR.

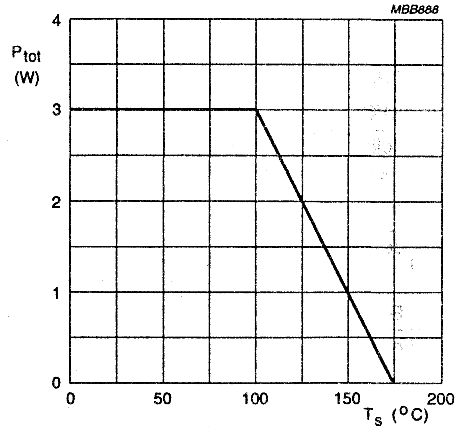
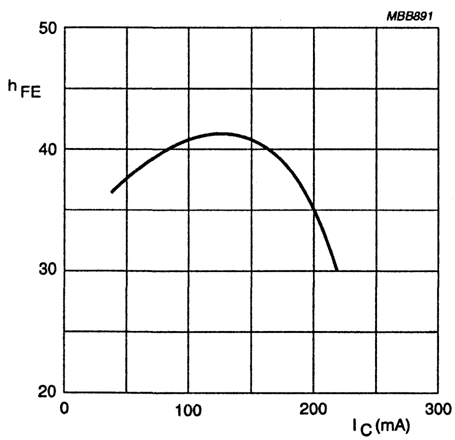
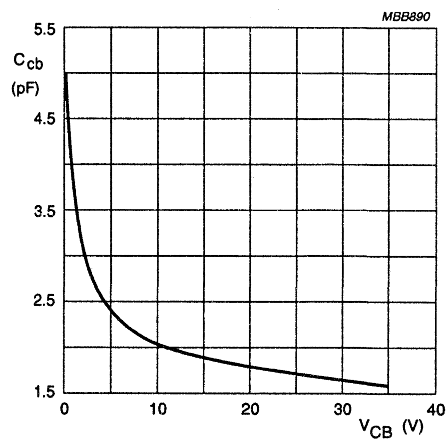


Fig.3 Power derating curve.



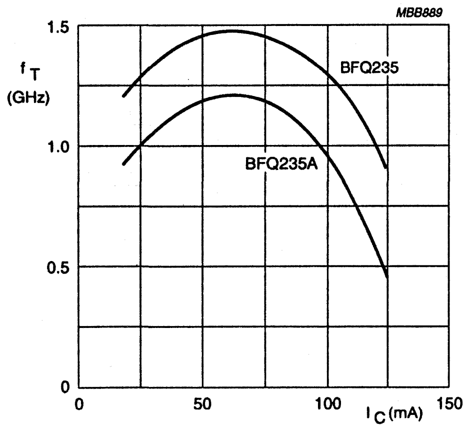
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistors | BFQ236; BFQ236A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary PNP types BFQ256 and BFQ256A
- Surface mounting.

DESCRIPTION

NPN silicon epitaxial transistor in a plastic SOT223 envelope and intended for use as a surface-mounted buffer in video amplifiers in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

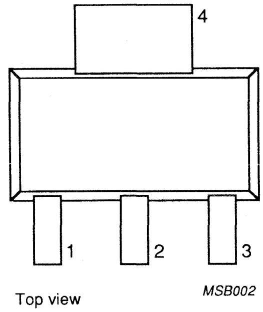


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BFQ236		–	–	100	V
	BFQ236A		–	–	115	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$				
	BFQ236		–	–	95	V
	BFQ236A		–	–	110	V
I_C	DC collector current		–	–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	2	W
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz				
	BFQ236		1	1.4	–	GHz
	BFQ236A		0.8	1.2	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ236		–	100	V
	BFQ236A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ236		–	65	V
	BFQ236A		–	95	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ236		–	95	V
	BFQ236A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_S = 115 °C (note 1)	–	2	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	T_s = 115 °C; P_{tot} = 2 W (notes 1 and 2)	30 K/W

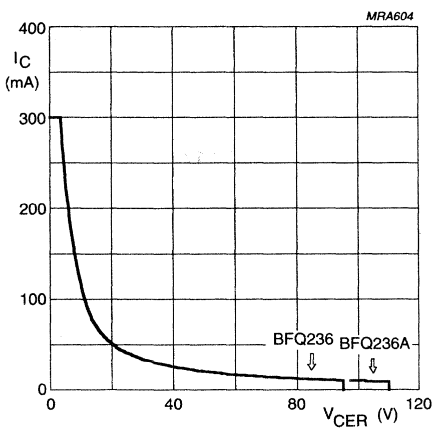
Notes

1. T_s is the temperature measured at the soldering point of the collector tab.
2. Device mounted on a printed circuit board measuring 40 x 40 x 1 mm (collector pad 35 x 17 mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA				
	BFQ236		100	–	–	V
	BFQ236A		115	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω				
	BFQ236		95	–	–	V
	BFQ236A		110	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ236		65	–	–	V
	BFQ236A		95	–	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = 50 V; I_B = 0	–	–	100	μA
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	20	35	–	
C_c	collector capacitance	$I_C = i_c$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.8	–	pF
C_{cb}	collector-base capacitance	$I_C = i_c$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz				
	BFQ236		1	1.4	–	GHz
	BFQ236A		0.8	1.2	–	GHz



R_{BE} ≤ 100 Ω.

Fig.2 DC SOAR.

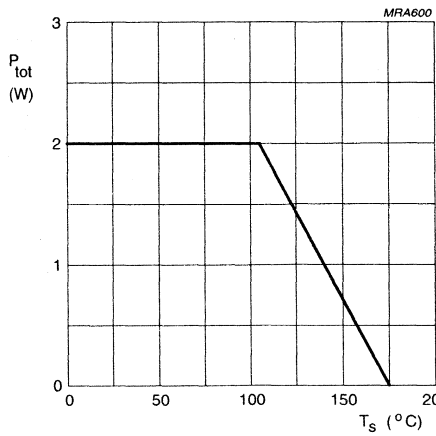
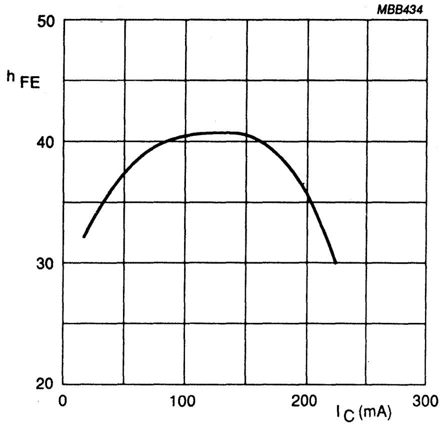
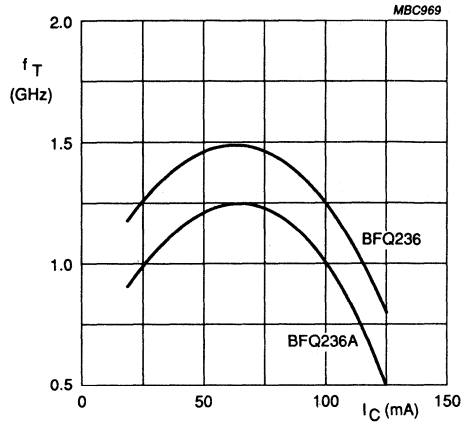


Fig.3 Power derating curve.



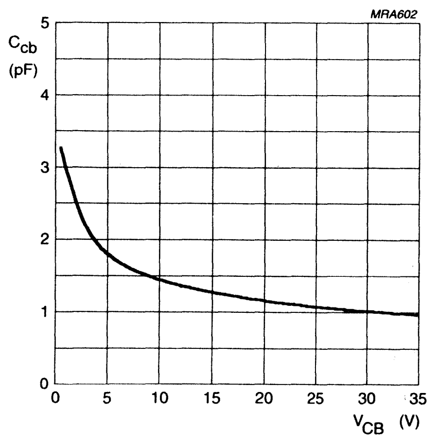
V_{CE} = 10 V.

Fig.4 DC current gain as a function of collector current, typical values.



V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current, typical values.



I_C = 0; f = 1 MHz.

Fig.6 Collector-base capacitance as a function of collector-base voltage, typical values.

PNP 1 GHz video transistors

BFQ251; BFQ251A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary npn types BFQ231/BFQ231A.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter

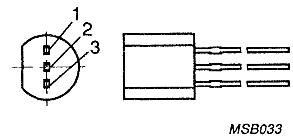


Fig.1 SOT54.

DESCRIPTION

The BFQ251 and BFQ251A are pnp silicon epitaxial transistors in a plastic SOT54 (TO-92) envelope and intended for use as buffer drivers in high-resolution colour graphics monitors.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BFQ251		–	100	V
	BFQ251A		–	115	V
$-V_{CER}$	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ251		–	95	V
	BFQ251A		–	110	V
$-I_C$	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to $T_s = 65$ °C (note 1)	–	1	W
h_{FE}	DC current gain	$-I_C = 50$ mA; $-V_{CE} = 10$ V	20	–	
f_T	transition frequency	$-I_C = 50$ mA; $-V_{CE} = 10$ V; $T_{amb} = 25$ °C			
	BFQ251		1	–	GHz
	BFQ251A		800	–	MHz

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BFQ251		–	100	V
	BFQ251A		–	115	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BFQ251		–	65	V
	BFQ251A		–	95	V
$-V_{CER}$	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ251		–	95	V
	BFQ251A		–	110	V
$-V_{EBO}$	emitter-base voltage	open collector	–	3	V
$-I_C$	collector current	DC value	–	300	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (notes 1 and 2)	–	1	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	85 K/W
$R_{th\ j\text{-}a}$	from junction to ambient	185 K/W
$R_{th\ s\text{-}a}$	from soldering point to ambient	100 K/W

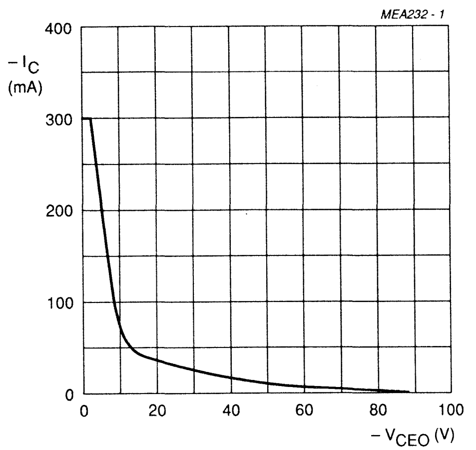
Notes

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.
2. Transistor mounted on a printed circuit board with a metallized pad area of 10 mm².

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	$-I_C$ = 0.1 mA				
	BFQ251		100	–	–	V
	BFQ251A		115	–	–	V
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	$-I_C$ = 10 mA				
	BFQ251		65	–	–	V
	BFQ251A		95	–	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 10 mA; R_{BE} = 100 Ω				
	BFQ251		95	–	–	V
	BFQ251A		110	–	–	V
$-V_{(BR)EBO}$	emitter-base breakdown voltage	$-I_E$ = 0.1 mA	3	–	–	V
$-I_{CES}$	collector-emitter cut-off current	$-I_B$ = 0; $-V_{CE}$ = 50 V	–	–	100	µA
$-I_{CBO}$	collector-base cut-off current	$-I_C$ = 0; $-V_{CE}$ = 10 V	–	–	20	µA
h_{FE}	DC current gain	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	20	30	–	
C_{cb}	collector-base capacitance	$-I_C$ = 0; $-V_{CB}$ = 10 V; f = 1 MHz	–	2	–	pF
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V				
	BFQ251		1	1.3	–	GHz
	BFQ251A		0.8	1.2	–	GHz



T_{amb} = 25 °C.

Fig.2 DC SOAR.

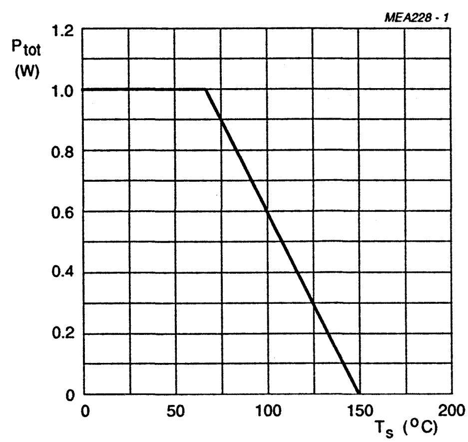
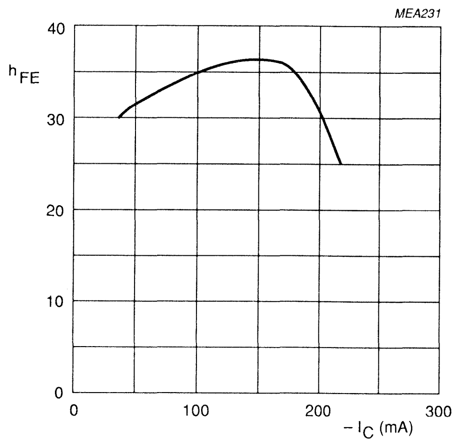
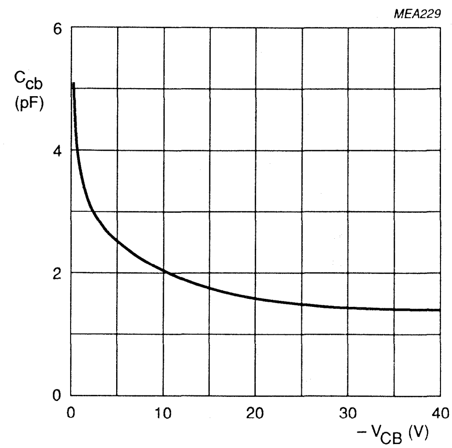


Fig.3 Power derating curve.



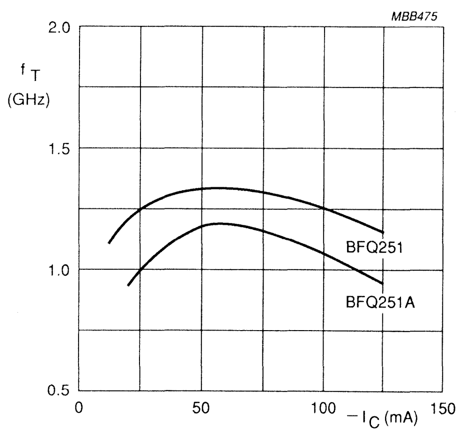
$-V_{CE}$ = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



T_{amb} = 25 °C; f = 1 MHz.

Fig.5 Collector-base capacitance as a function of collector-base voltage, typical values.



$-V_{CE}$ = 10 V; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current, typical values.

PNP 1 GHz video transistors — BFQ252; BFQ252A

DESCRIPTION

PNP silicon epitaxial transistor in a SOT32 (TO-126) package, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

NPN complements are BFQ232 and BFQ232A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

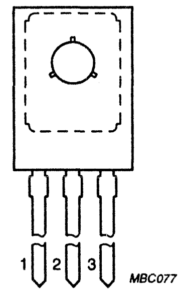


Fig.1 SOT32.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ252		–	–100	V
	BFQ252A		–	–115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ252		–	–95	V
	BFQ252A		–	–110	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	3	W
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 100 MHz; T_{amb} = 25 °C			
	BFQ252		1	–	GHz
	BFQ252A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ252		–	–100	V
	BFQ252A		–	–115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ252		–	–65	V
	BFQ252A		–	–95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ252		–	–95	V
	BFQ252A		–	–110	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 115 °C (note 1)	20 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA				
	BFQ252		−100	−	−	V
	BFQ252A		−115	−	−	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA				
	BFQ252		−65	−	−	V
	BFQ252A		−95	−	−	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = −10 mA; R_{BE} = 100 Ω				
	BFQ252		−95	−	−	V
	BFQ252A		−110	−	−	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	−	−	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = −50 V	−	−	−100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	−	−	−20	μA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C	20	30	−	
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ252		1	1.3	−	GHz
	BFQ252A		0.8	1.2	−	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz; T_{amb} = 25 °C	−	2.5	−	pF

 Capability approved CECC 50 000 (issue 4), 1986.

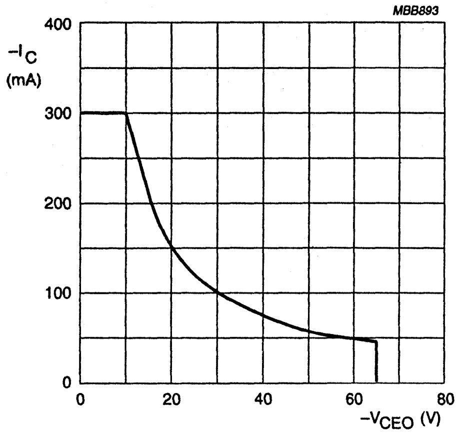


Fig.2 DC SOAR.

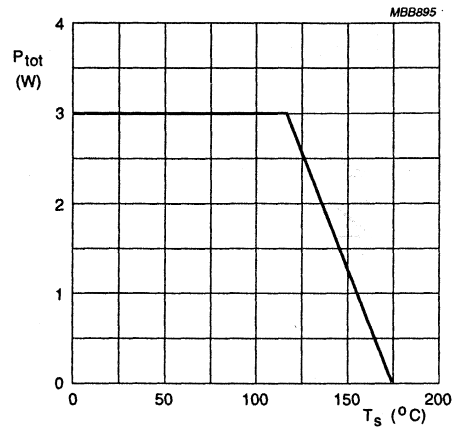
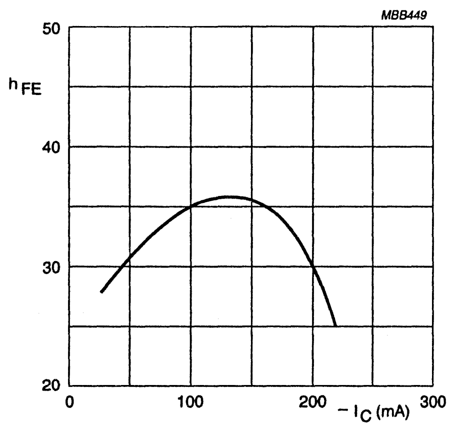
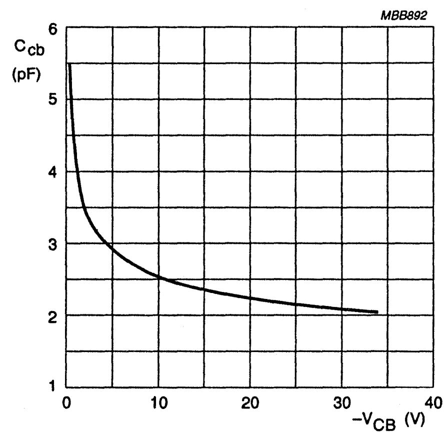


Fig.3 Power derating curve.



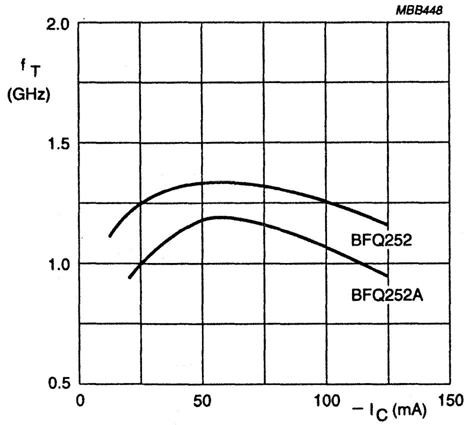
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

PNP 1 GHz video transistor — BFQ253; BFQ253A

DESCRIPTION

PNP silicon epitaxial transistor in a SOT5 (TO-39) envelope with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

NPN complements are the BFQ233 and BFQ233A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

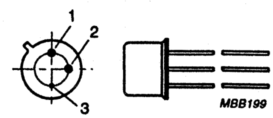


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ253		–	–100	V
	BFQ253A		–	–115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ253		–	–95	V
	BFQ253A		–	–110	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	3	W
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C			
	BFQ253		1	–	GHz
	BFQ253A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ253		–	–100	V
	BFQ253A		–	–115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ253		–	–65	V
	BFQ253A		–	–95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ253		–	–95	V
	BFQ253A		–	–110	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	25 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA				
	BFQ253		−100	−	−	V
	BFQ253A		−115	−	−	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA				
	BFQ253		−65	−	−	V
	BFQ253A		−95	−	−	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = −10 mA; R_{BE} = 100 Ω				
	BFQ253		−95	−	−	V
	BFQ253A		−110	−	−	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	−	−	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = −50 V	−	−	−100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	−	−	−20	μA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C	20	30	−	
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C				
	BFQ253		.1	1.3	−	GHz
	BFQ253A		0.8	1.2	−	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz; T_{amb} = 25 °C	−	2.5	−	pF

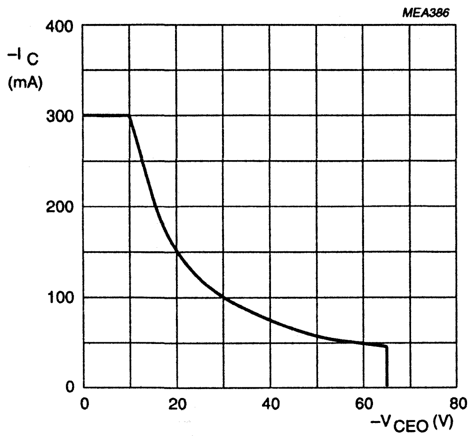


Fig.2 DC SOAR.

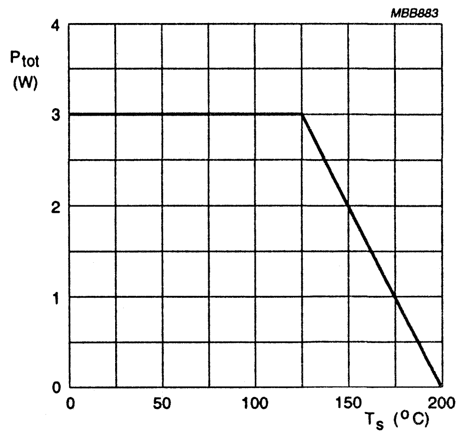
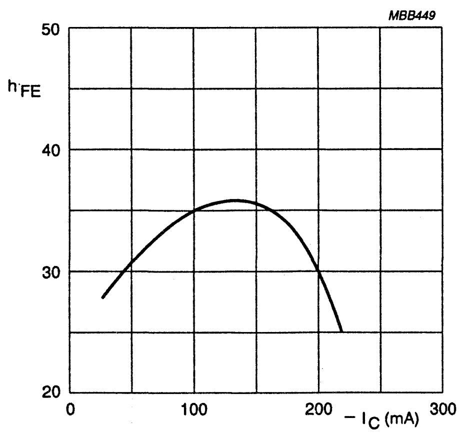
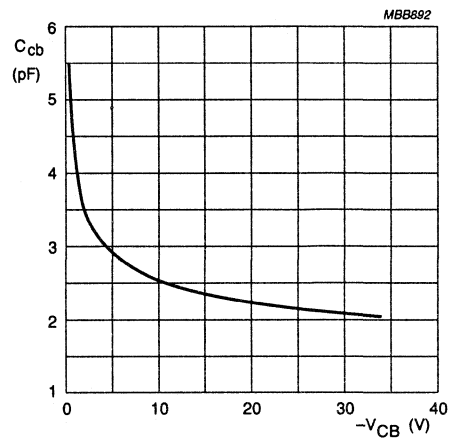


Fig.3 Power derating curve.



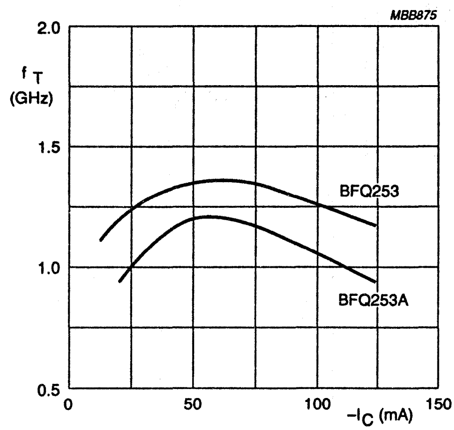
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

PNP 1 GHz video transistor

BFQ254; BFQ254/I

DESCRIPTION

PNP silicon epitaxial transistor in SOT172A1 and SOT172A3 envelopes, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

The BFQ254 has a 4-lead stud envelope with a ceramic cap (SOT172A1). The BFQ254/I uses the SOT172A3 envelope, with the leads formed in accordance with the footprint of the industry standard package 244D-01 (Motorola).

A version with $V_{(BR)CBO}$ = 115 V, $V_{(BR)CER}$ = 110 V and $V_{(BR)CEO}$ = 95 V is available on request.

NPN complements are the BFQ234 and BFQ234/I.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	base

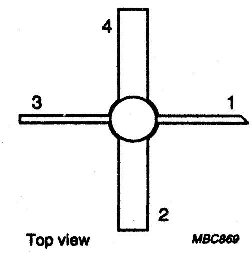


Fig.1 SOT172A1.

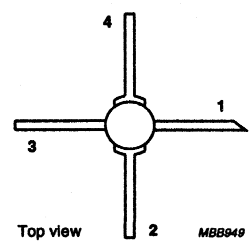


Fig.2 SOT172A3.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−100	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	−95	V
I_C	DC collector current		–	−300	mA
P_{tot}	total power dissipation	up to T_c = 140 °C	–	3	W
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	1	–	GHz

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	−100	V
V_{CEO}	collector-emitter voltage	open base	–	−65	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	−95	V
V_{EBO}	emitter-base voltage	open collector	–	−3	V
I_C	DC collector current		–	−300	mA
P_{tot}	total power dissipation	up to T_c = 140 °C	–	3	W
T_{stg}	storage temperature		−65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	20 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA	−100	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA	−65	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = −10 mA; R_{BE} = 100 Ω	−95	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = −50 V	–	–	−100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	–	–	−20	μA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C	20	30	–	
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	1	1.3	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz; T_{amb} = 25 °C	–	2.5	–	pF

PNP 1 GHz video transistor BFQ254; BFQ254/I

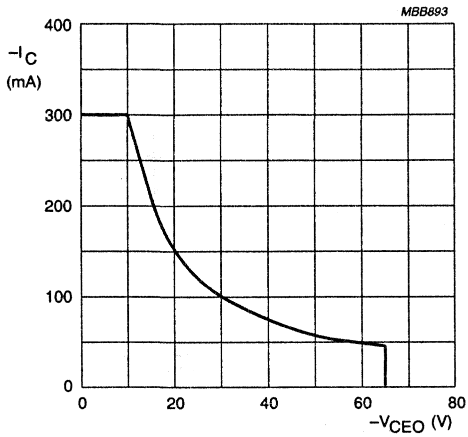


Fig.3 DC SOAR.

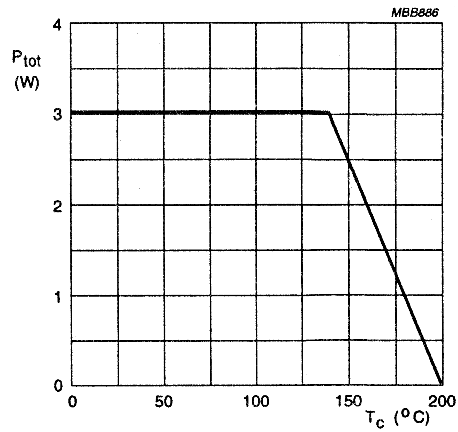
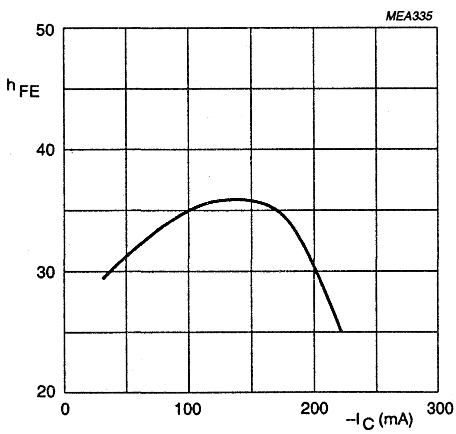
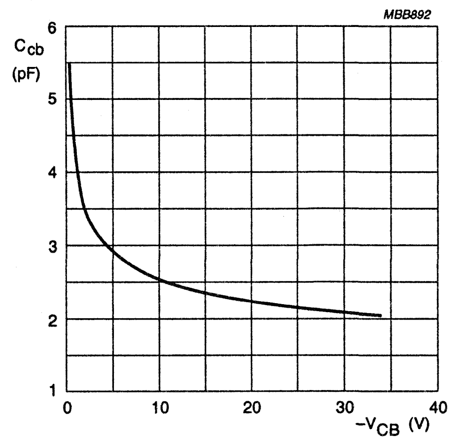


Fig.4 Power derating curve.



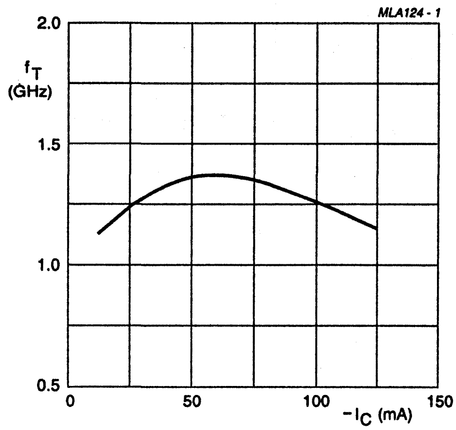
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.5 DC current gain as a function of collector current.



f = 1 MHz; $T_{amb} = 25$ °C.

Fig.6 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.

PNP 1 GHz video transistors | BFQ255; BFQ255A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

PNP silicon epitaxial transistor mounted in a plastic SOT128 (TO-202) envelope, with the collector connected to the mounting base.

It is intended for use as a buffer/driver in high-resolution colour graphics monitors.

NPN complements are BFQ235 and BFQ235A respectively.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

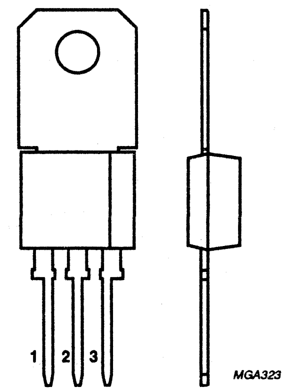


Fig.1 SOT128.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ255		–	–100	V
	BFQ255A		–	–115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ255		–	–95	V
	BFQ255A		–	–110	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 100 °C (note 1)	–	3	W
h_{FE}	DC current gain	I_C = –50 mA; V_{CE} = –10 V; T_{amb} = 25 °C	20	–	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –10 V; f = 100 MHz; T_{amb} = 25 °C			
	BFQ255		1	–	GHz
	BFQ255A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

 Capability approved CECC 50 000 (issue 4), 1986.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ255		–	–100	V
	BFQ255A		–	–115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ255		–	–65	V
	BFQ255A		–	–95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ255		–	–95	V
	BFQ255A		–	–110	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–300	mA
P_{tot}	total power dissipation	up to T_s = 100 °C (note 1)	–	3	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 100 °C (note 1)	25 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

PNP 1 GHz video transistors BFQ255; BFQ255A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA				
	BFQ255		−100	−	−	V
	BFQ255A		−115	−	−	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA				
	BFQ255		−65	−	−	V
	BFQ255A		−95	−	−	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = −10 mA; R_{BE} = 100 Ω				
	BFQ255		−95	−	−	V
	BFQ255A		−110	−	−	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	−	−	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = −50 V	−	−	−100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −50 V	−	−	−20	μA
h_{FE}	DC current gain	I_C = −50 mA; V_{CE} = −10 V; T_{amb} = 25 °C	20	30	−	
f_T	transition frequency	I_C = −50 mA; V_{CE} = −10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ255		1	1.3	−	GHz
	BFQ255A		0.8	1.2	−	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz; T_{amb} = 25 °C	−	2	−	pF

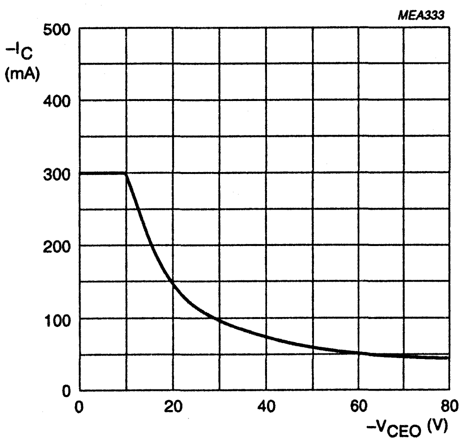


Fig.2 DC SOAR.

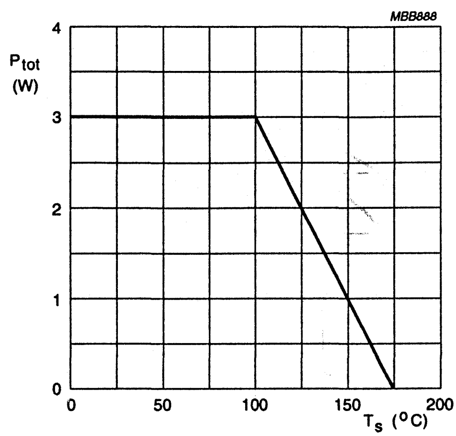
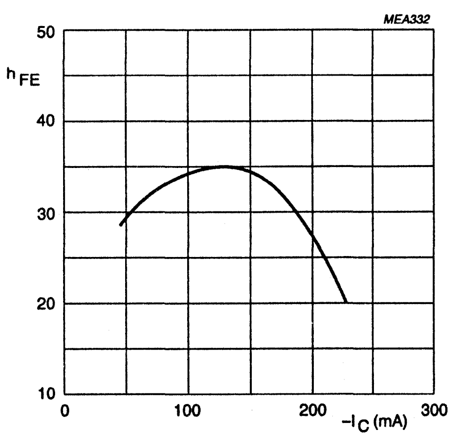
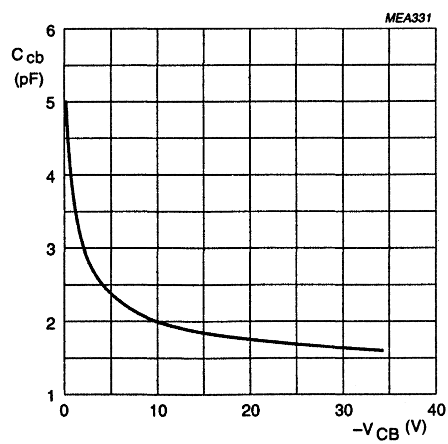


Fig.3 Power derating curve.



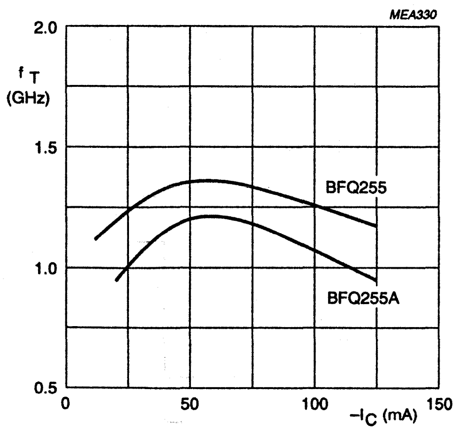
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; $T_{amb} = 25$ °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



$V_{CE} = -10$ V; f = 100 MHz; $T_{amb} = 25$ °C.

Fig.6 Transition frequency as a function of collector current.

PNP 1 GHz video transistors — BFQ256; BFQ256A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary NPN types BFQ236 and BFQ236A
- Surface mounting.

DESCRIPTION

PNP silicon epitaxial transistor in a plastic SOT223 envelope and intended for use as a surface-mounted buffer in video amplifiers in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

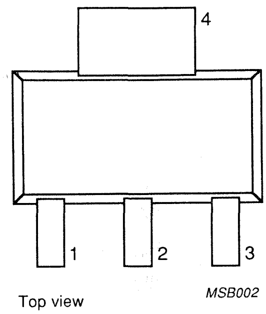


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter				
	BFQ256		–	–	100	V
	BFQ256A		–	–	115	V
$-V_{CER}$	collector-emitter voltage	$R_{BE} = 100\ \Omega$				
	BFQ256		–	–	95	V
	BFQ256A		–	–	110	V
$-I_C$	DC collector current		–	–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	2	W
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 100 MHz				
	BFQ256		1	1.3	–	GHz
	BFQ256A		0.8	1.2	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BFQ256		–	100	V
	BFQ256A		–	115	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BFQ256		–	65	V
	BFQ256A		–	95	V
$-V_{CER}$	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ256		–	95	V
	BFQ256A		–	110	V
$-V_{EBO}$	emitter-base voltage	open collector	–	3	V
$-I_C$	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	2	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	T_s = 115 °C; P_{tot} = 2 W (notes 1 and 2)	30 K/W

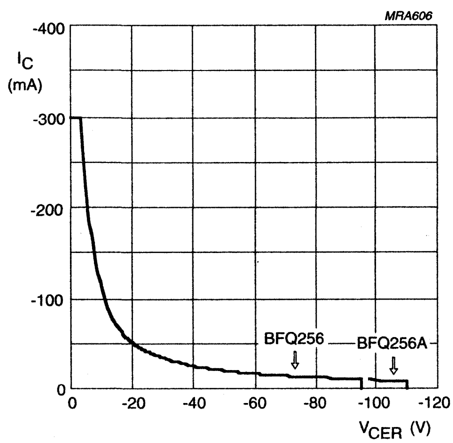
Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. Device mounted on a printed circuit board measuring 40 x 40 x 1 mm (collector pad 35 x 17 mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $-I_C$ = 100 μA				
	BFQ256		100	–	–	V
	BFQ256A		115	–	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 1 mA; R_{BE} = 100 Ω				
	BFQ256		95	–	–	V
	BFQ256A		110	–	–	V
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $-I_C$ = 10 mA				
	BFQ256		65	–	–	V
	BFQ256A		95	–	–	V
$-I_{CES}$	collector-emitter cut-off current	$-V_{CE}$ = 50 V; $-I_B$ = 0	–	–	100	μA
$-I_{CBO}$	collector-base cut-off current	$-V_{CB}$ = 50 V; $-I_E$ = 0	–	–	20	μA
h_{FE}	DC current gain	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	20	30	–	
C_c	collector capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.9	–	pF
C_{cb}	collector-base capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.6	–	pF
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 100 MHz				
	BFQ256		1	1.3	–	GHz
	BFQ256A		0.8	1.2	–	GHz



R_{BE} ≤ 100 Ω.

Fig.2 DC SOAR.

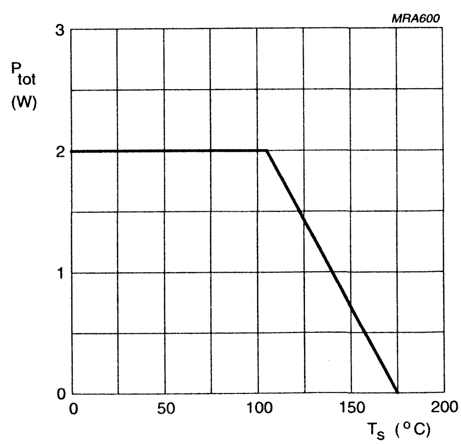
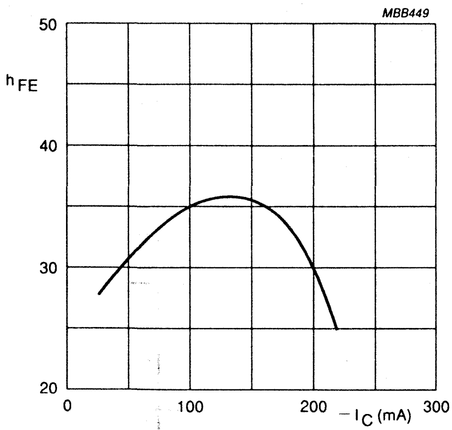
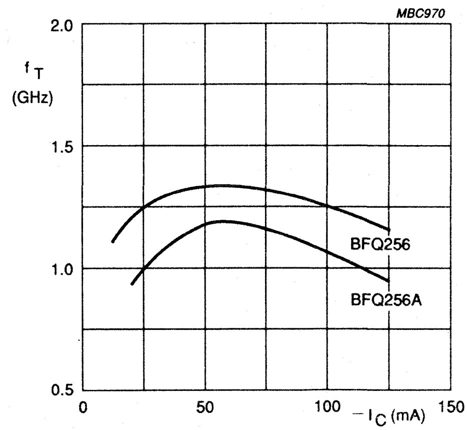


Fig.3 Power derating curve.



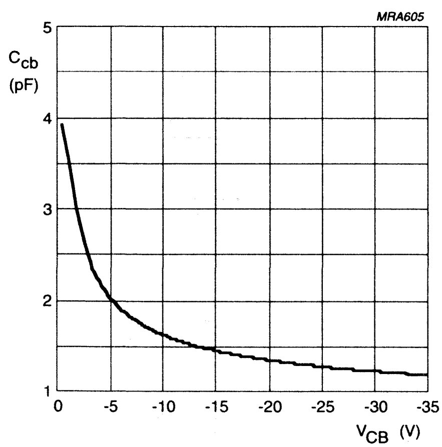
$-V_{CE}$ = 10 V.

Fig.4 DC current gain as a function of collector current, typical values.



$-V_{CE}$ = 10 V; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current, typical values.



I_C = 0; f = 1 MHz.

Fig.6 Collector-base capacitance as a function of collector-base voltage, typical values.

NPN 1 GHz video transistors

BFQ262; BFQ262A

DESCRIPTION

NPN silicon epitaxial transistor in a SOT32 (TO-126) envelope, with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the cascode stage of the driver for high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

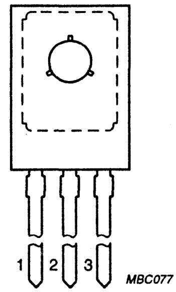


Fig.1 SOT32.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter				
	BFQ262		–	–	100	V
	BFQ262A		–	–	115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω				
	BFQ262		–	–	95	V
	BFQ262A		–	–	110	V
I_C	DC collector current		–	–	400	mA
P_{tot}	total power dissipation	up to T_s = 85 °C (note 1)	–	–	5	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	60	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ262		1	–	–	GHz
	BFQ262A		0.8	–	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ262		–	100	V
	BFQ262A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ262		–	65	V
	BFQ262A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ262		–	95	V
	BFQ262A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to T_s = 85 °C (note 1)	–	5	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to T_s = 85 °C (note 1)	18 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ262		100	–	–	V
	BFQ262A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ262		65	–	–	V
	BFQ262A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ262		95	–	–	V
	BFQ262A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	60	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ262		1	1.4	–	GHz
	BFQ262A		0.8	1.2	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	3.5	–	pF

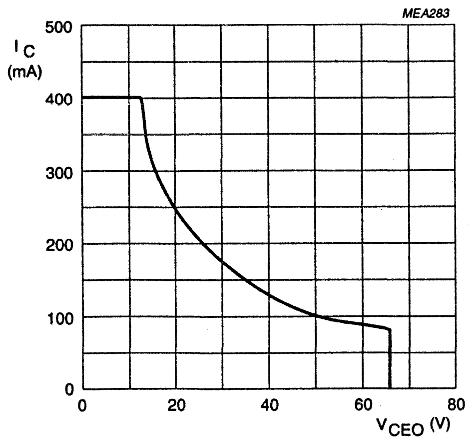


Fig.2 DC SOAR.

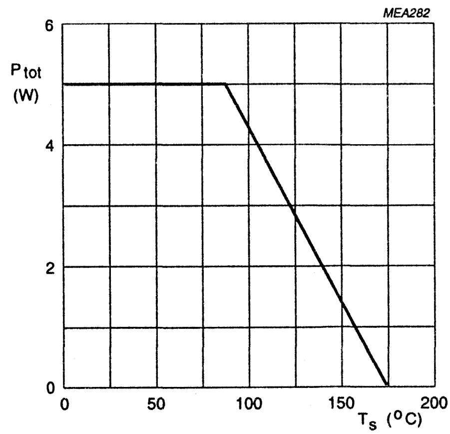
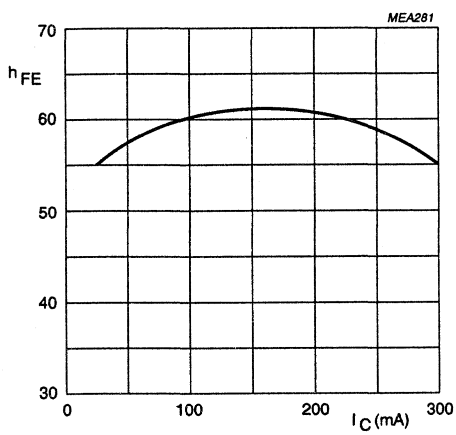
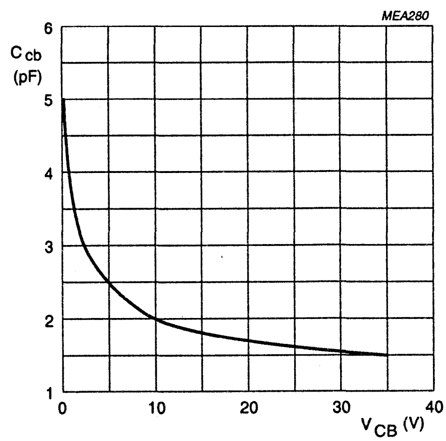


Fig.3 Power derating curve.



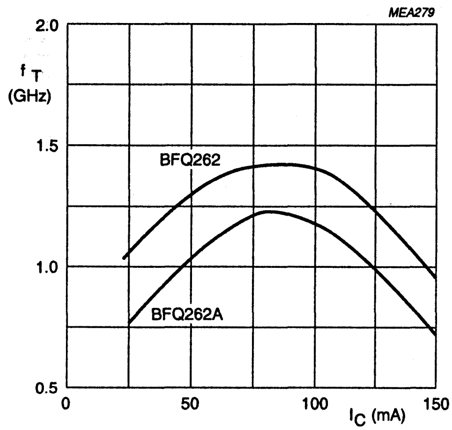
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistors | BFQ263; BFQ263A

DESCRIPTION

NPN silicon epitaxial transistor in a SOT5 (TO-39) envelope with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the buffer stage of the driver for high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

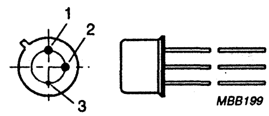


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ263		–	100	V
	BFQ263A		–	115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ263		–	95	V
	BFQ263A		–	110	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	5	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C			
	BFQ263		1	–	GHz
	BFQ263A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ263		–	100	V
	BFQ263A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ263		–	65	V
	BFQ263A		–	95	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ263		–	95	V
	BFQ263A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	5	W
T_{stg}	storage temperature		–65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	21 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ263		100	–	–	V
	BFQ263A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ263		65	–	–	V
	BFQ263A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ263		95	–	–	V
	BFQ263A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	60	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ263		1	1.4	–	GHz
	BFQ263A		0.8	1.2	–	GHz
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2	–	pF

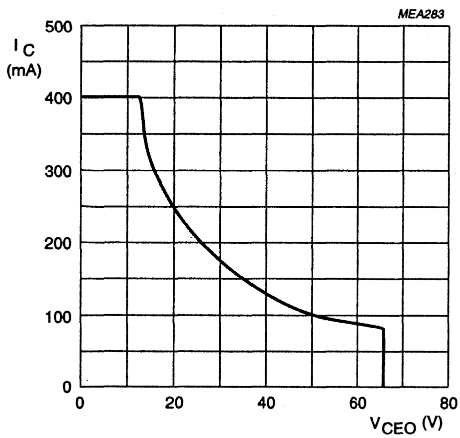


Fig.2 DC SOAR.

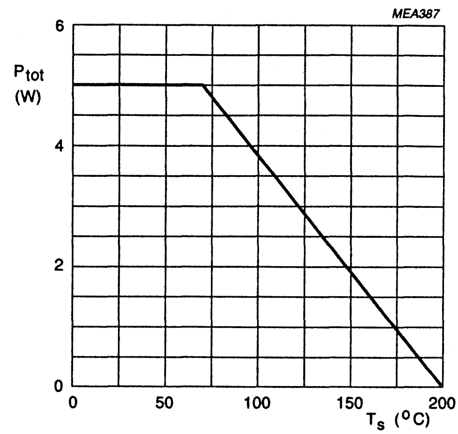
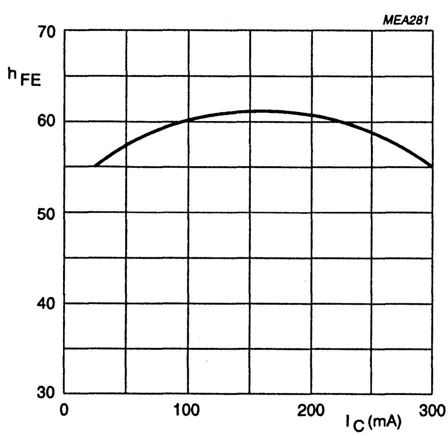
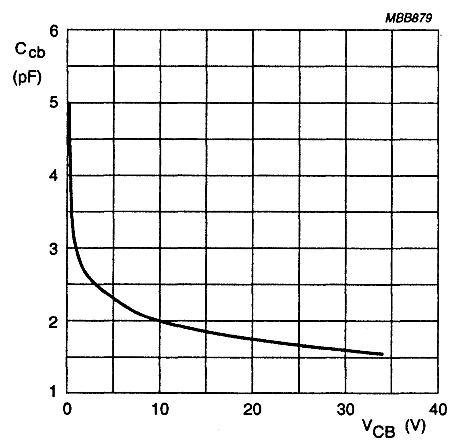


Fig.3 Power derating curve.



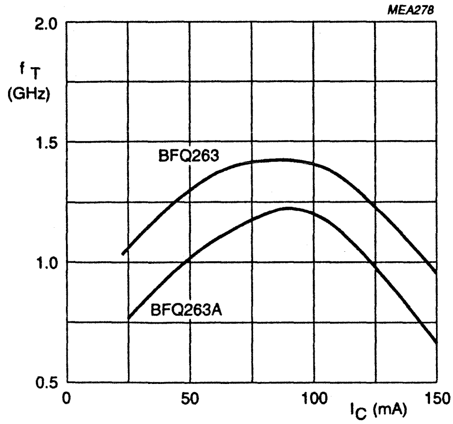
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN high frequency high voltage transistor

BFQ265; BFQ265A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon epitaxial transistor mounted in a SOT128B plastic envelope, with the collector connected to the mounting base.

It is intended for use in the cascode stage in the driver in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

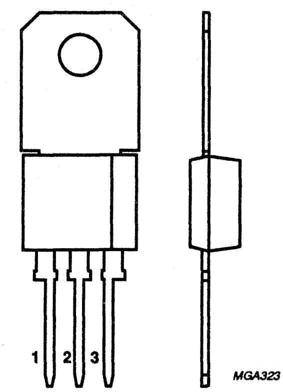


Fig.1 SOT128B.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ265		–	100	V
	BFQ265A		–	115	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ265		–	95	V
	BFQ265A		–	110	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to $T_s = 65$ °C (note 1)	–	5	W
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	50	–	
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 100 MHz; $T_{amb} = 25$ °C			
	BFQ265		1	–	GHz
	BFQ265A		0.8	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BFQ265		–	100	V
	BFQ265A		–	115	V
V_{CEO}	collector-emitter voltage	open base			
	BFQ265		–	65	V
	BFQ265A		–	95	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$			
	BFQ265		–	95	V
	BFQ265A		–	110	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	5	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 65 °C (note 1)	22 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA				
	BFQ265		100	–	–	V
	BFQ265A		115	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA				
	BFQ265		65	–	–	V
	BFQ265A		95	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 100 Ω				
	BFQ265		95	–	–	V
	BFQ265A		110	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	3	–	–	V
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	μA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	–	20	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	60	–	
C_{cb}	collector-base capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	2.5	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C				
	BFQ265		1	1.4	–	GHz
	BFQ265A		0.8	1.2	–	GHz

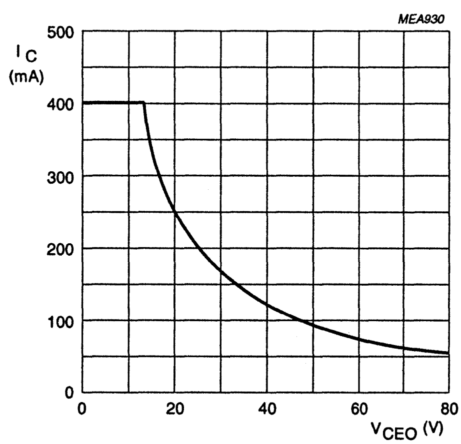


Fig.2 DC SOAR.

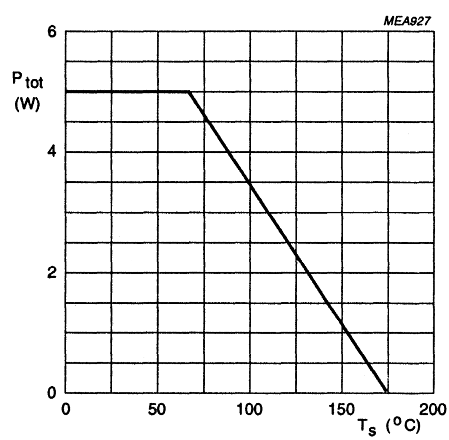
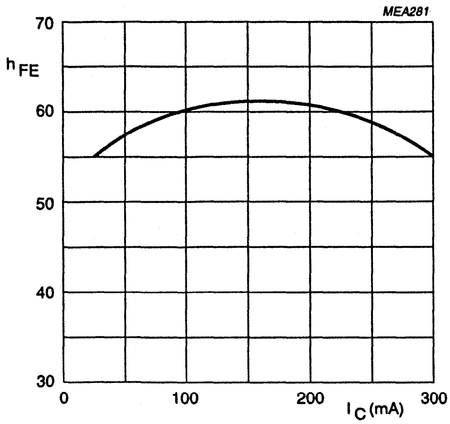
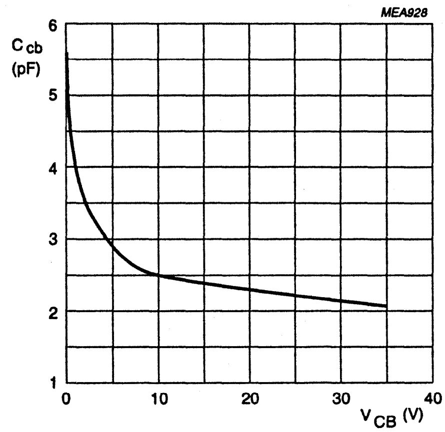


Fig.3 Power derating curve.



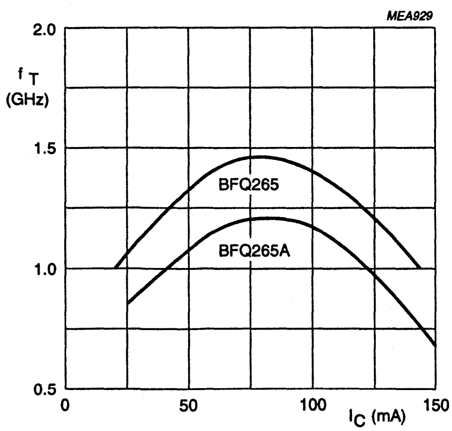
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.4 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.5 Collector-base capacitance as a function of collector-base voltage.



V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.

NPN 1 GHz video transistor

BFQ268; BFQ268/I

DESCRIPTION

NPN silicon epitaxial transistor with emitter-ballasting resistors and a gold sandwich metallization to ensure optimum temperature profile and excellent reliability properties. It features high breakdown voltages and a low output capacitance.

This transistor is primarily intended for application in the driver for high-resolution colour graphics monitors.

The BFQ268 has a 4-lead stud envelope with a ceramic cap (SOT172A1). All leads are isolated from the stud.

The BFQ268/I uses the SOT172A3 envelope, with the leads formed in accordance with the footprint of the industry standard package 244D-01 (Motorola).

A version with $V_{(BR)CBO}$ = 115 V, $V_{(BR)CER}$ = 110 V and $V_{(BR)CEO}$ = 95 V is available on request.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	base

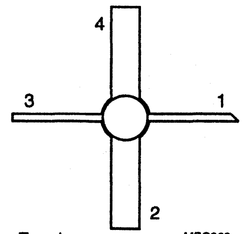


Fig.1 SOT172A1.

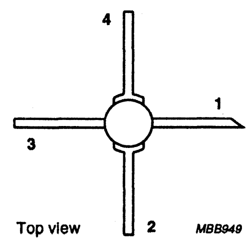


Fig.2 SOT172A3.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	100	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	95	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to T_c = 100 °C	–	5	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	50	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	1	–	GHz

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	100	V
V_{CEO}	collector-emitter voltage	open base	–	65	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$	–	95	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	400	mA
P_{tot}	total power dissipation	up to $T_c = 100\ °C$	–	5	W
T_{stg}	storage temperature		−65	175	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	20 K/W

CHARACTERISTICS

$T_j = 25\ °C$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 0.1$ mA	100	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 10$ mA	65	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	$I_C = 10$ mA; $R_{BE} = 100\ \Omega$	95	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 0.1$ mA	3	–	–	V
I_{CES}	collector cut-off current	$I_B = 0$; $V_{CE} = 50$ V	–	–	100	µA
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 50$ V	–	–	20	µA
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25\ °C$	50	60	–	
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25\ °C$	1	1.4	–	GHz
C_{cb}	collector-base capacitance	$I_C = 0$; $V_{CB} = 10$ V; f = 1 MHz; $T_{amb} = 25\ °C$	–	2	–	pF
C_{ob}	output capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	4	–	pF

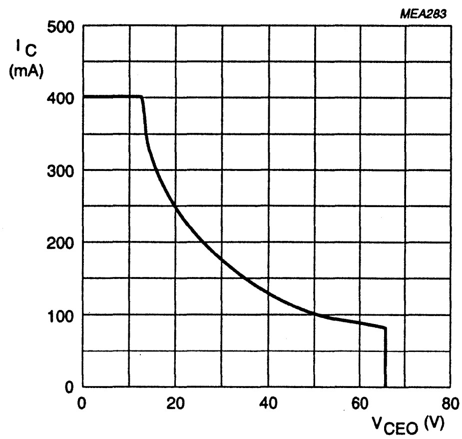


Fig.3 DC SOAR.

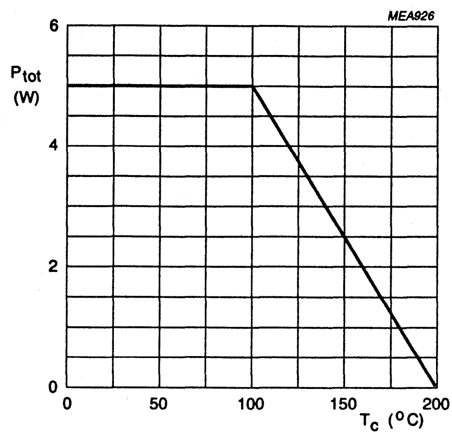
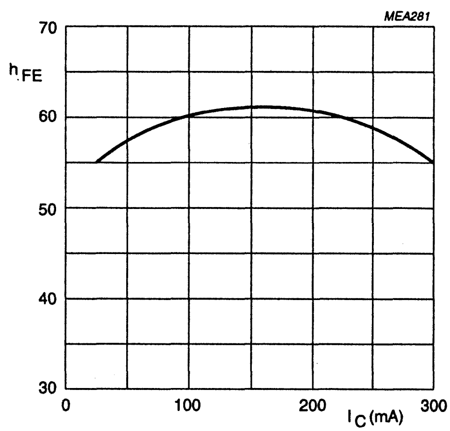
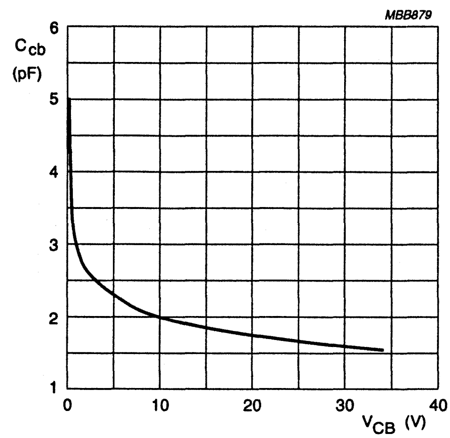


Fig.4 Power derating curve.



V_{CE} = 10 V; T_{amb} = 25 °C.

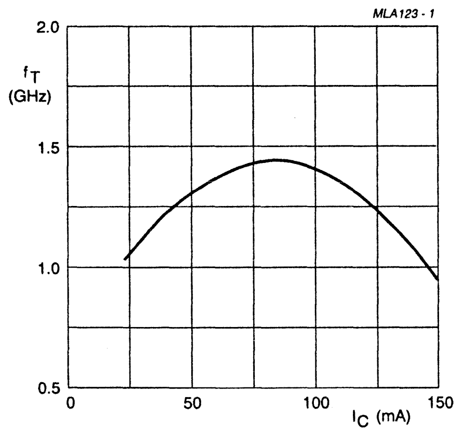
Fig.5 DC current gain as a function of collector current.



f = 1 MHz; T_{amb} = 25 °C.

Fig.6 Collector-base capacitance as a function of collector-base voltage.

NPN 1 GHz video transistor BFQ268; BFQ268/I



V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.

NPN 6 GHz wideband transistor | BFQ270

FEATURES

- High power gain
- Emitter-ballasting resistors for good thermal stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Silicon NPN transistor mounted in a 4-lead dual-emitter SOT172A1 envelope with a ceramic cap. All leads are isolated from the mounting base.

It is primarily intended for use in MATV and CATV amplifiers.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector
4	emitter

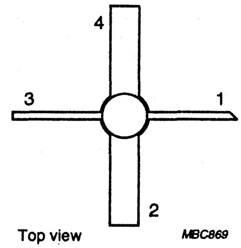


Fig.1 SOT172A1.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	19	V
I_C	DC collector current		–	–	500	mA
P_{tot}	total power dissipation	up to T_c = 100 °C	–	–	10	W
h_{FE}	DC current gain	I_C = 240 mA; V_{CE} = 18 V; T_j = 25 °C	60	–	–	
f_T	transition frequency	I_C = 240 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 240 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	10	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 240 mA; V_{CE} = 18 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	–	1.6	–	V

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO discs are not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_c = 100 °C	–	10	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	10 K/W

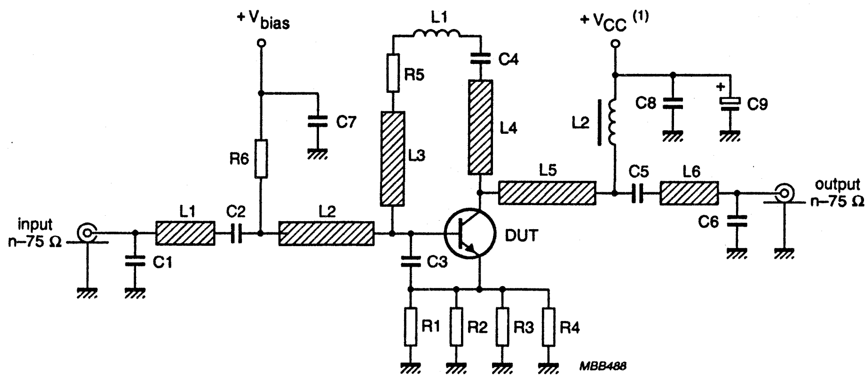
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 18 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 240 mA; V_{CE} = 18 V	60	110	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 18 V; f = 1 MHz	–	3.6	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CB} = 18 V; f = 1 MHz	2	2.6	–	pF
C_{cs}	collector-stud capacitance		–	1.2	–	pF
f_T	transition frequency	I_C = 240 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 240 mA; V_{CE} = 18 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 240 mA; V_{CE} = 18 V; f = 1 GHz; T_{amb} = 25 °C	–	10	–	dB
V_O	output voltage	note 2	–	1.6	–	V
d_2	second order intermodulation distortion	note 3	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004); I_C = 240 mA; V_{CE} = 18 V; R_L = 75 Ω;
   $V_p = V_O$; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. I_C = 240 mA; V_{CE} = 18 V; R_L = 75 Ω;
   $V_p = V_q = V_O$ = 50.5 dBmV = 335 mV;
   $f_{(p+q)}$ = 810 MHz.



(1) +V_C is equivalent to $V_{CE} = V_C - I_C$ (A) x 17.

Fig.2 Intermodulation and second order intermodulation distortion test circuit.

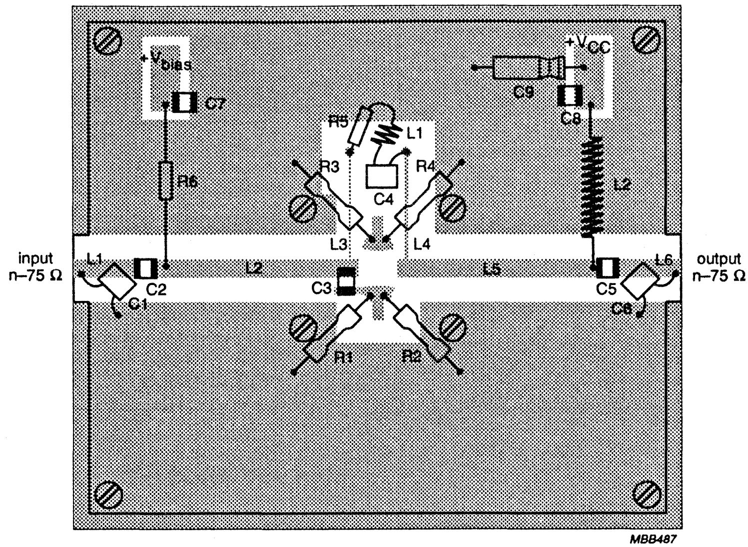
List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	miniature ceramic plate capacitor	0.82 pF		2222 680 03827
C2, C5, C7, C8	multilayer ceramic capacitor	10 nF		2222 852 47103
C3	multilayer ceramic chip capacitor	2.2 pF		2222 855 12228
C4 (note 1)	miniature ceramic plate capacitor	1 nF		2222 630 08102
C6	miniature ceramic plate capacitor	1.2 pF		2222 680 03128
C9	electrolytic capacitor	4.7 μF		2222 014 28478
L1 (note 1)	4.5 turns loosely wound 0.4 mm enamelled copper wire	≈35 nH	internal coil diameter 2 mm	
L2	Ferroxcube choke	5 μH		3122 108 20153
ML1, ML6	microstripline	75 Ω	width 2.46 mm; length 9 mm	
ML2, ML5	microstripline	75 Ω	width 2.46 mm; length 22 mm	
ML3, ML4	microstripline	145 Ω	width 0.5 mm; length 12 mm	
R1, R2, R3, R4	metal film resistor	68 Ω	type MR25	2322 151 76819
R5 (note 1)	metal film resistor	240 Ω	type SFR16T	2322 180 73241
R6	metal film resistor	10 kΩ	type SFR16T	2322 180 73103

Notes

The circuit is constructed on a printed circuit board and 10 mm thick brass ground plate, with a relative dielectric constant of (ε_r = 2.2), thickness 1.57 mm; thickness of copper 0.017 mm (E. G. Rogers' RT/Duroid 5880).

1. Components C4, L1, and R5 are mounted in a cavity in the brass ground plate.



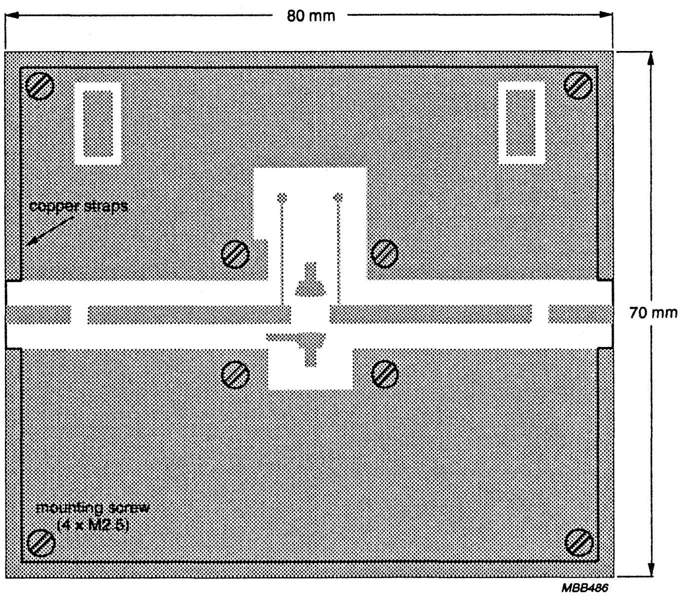


Fig.3 Intermodulation test circuit printed circuit board.

NPN 6 GHz wideband transistor BFQ270

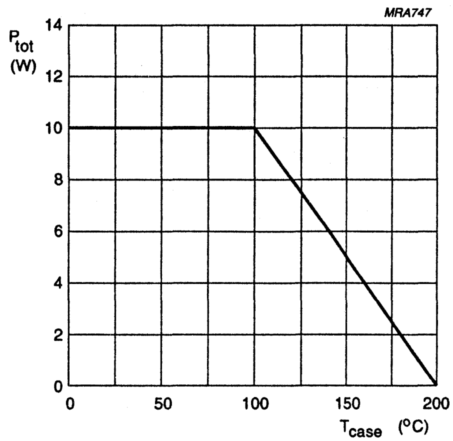
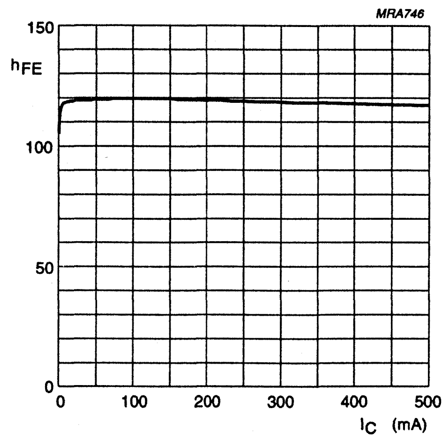
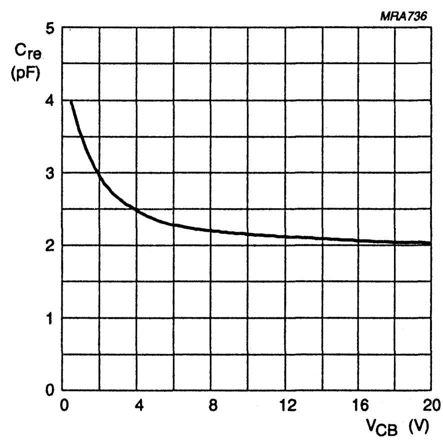


Fig.4 Power derating curve.



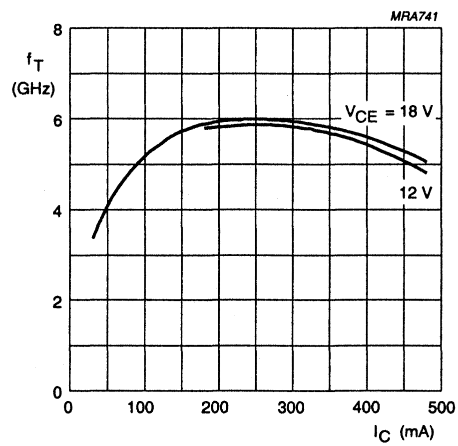
V_{CE} = 18 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



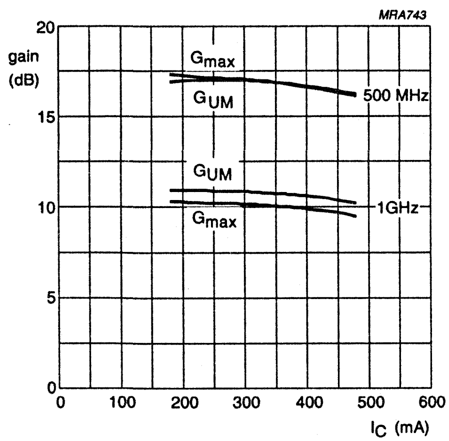
I_C = 0; f = 1 MHz.

Fig.6 Feedback capacitance as a function of collector-base voltage.



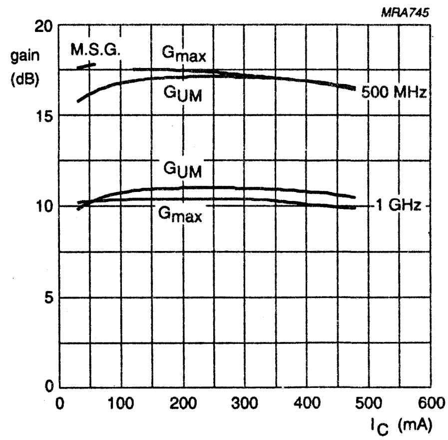
f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.



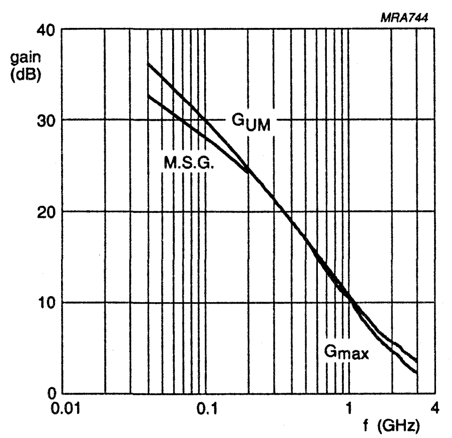
V_{CE} = 12 V.

Fig.8 Gain as a function of collector current.



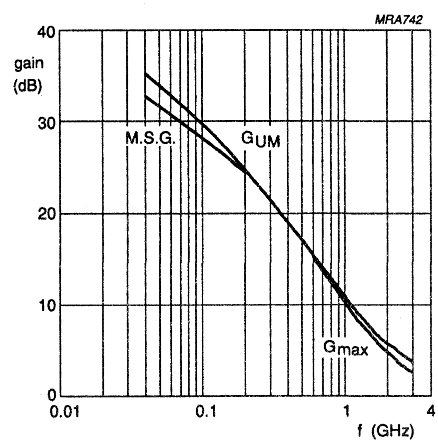
V_{CE} = 18 V.

Fig.9 Gain as a function of collector current.



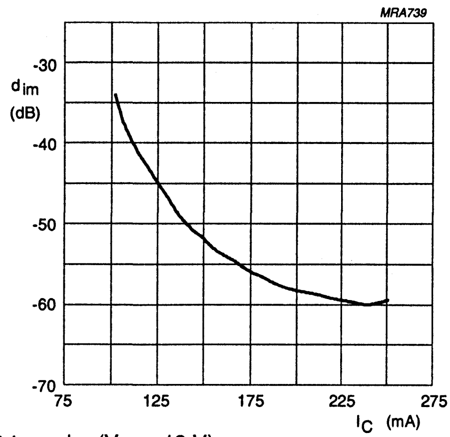
I_C = 240 mA; V_{CE} = 12 V.

Fig.10 Gain as a function of frequency.



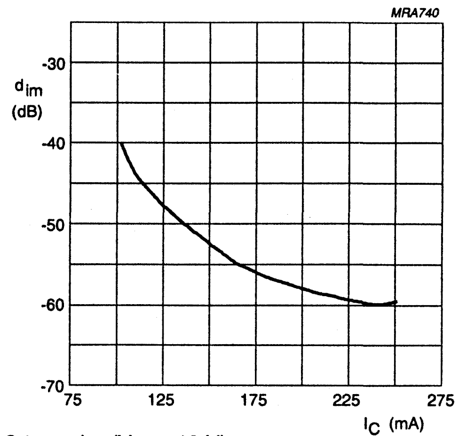
I_C = 240 mA; V_{CE} = 18 V.

Fig.11 Gain as a function of frequency.



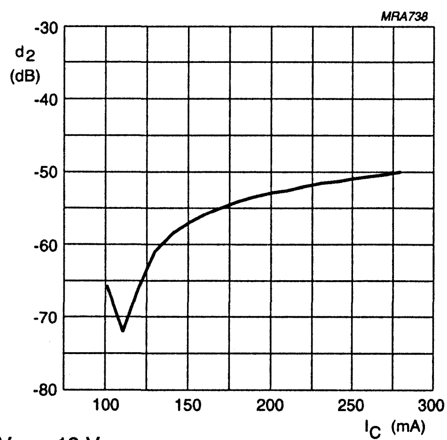
3-tone d_{im}; (V_{CE} = 18 V);
f_p = 445.25 MHz; V_O = 65.11 dBmV (1.8 V);
f_q = 453.25 MHz; V_O = 59.11 dBmV;
f_r = 455.25 MHz; V_O = 59.11 dBmV;
$f_{(p+q-r)}$ = 443.25 MHz.

Fig.12 Intermodulation distortion as a function of collector current.



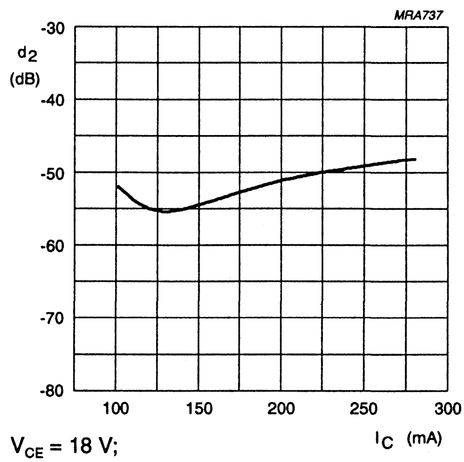
3-tone d_{im}; (V_{CE} = 18 V);
f_p = 795.25 MHz; V_O = 64.08 dBmV (1.6 V);
f_q = 803.25 MHz; V_O = 58.08 dBmV;
f_r = 805.25 MHz; V_O = 58.08 dBmV;
$f_{(p+q-r)}$ = 793.25 MHz.

Fig.13 Intermodulation distortion as a function of collector current.



V_{CE} = 18 V;
f_p = 50 MHz; V_O = 50.5 dBmV (0.335 V);
f_q = 400 MHz; V_O = 50.5 dBmV;
$f_{(p+q)}$ = 450 MHz.

Fig.14 Second order intermodulation distortion as a function of collector current.



V_{CE} = 18 V;
f_p = 250 MHz; V_O = 50.5 dBmV (0.335 V);
f_q = 560 MHz; V_O = 50.5 dBmV;
$f_{(p+q)}$ = 810 MHz.

Fig.15 Second order intermodulation distortion as a function of collector current.

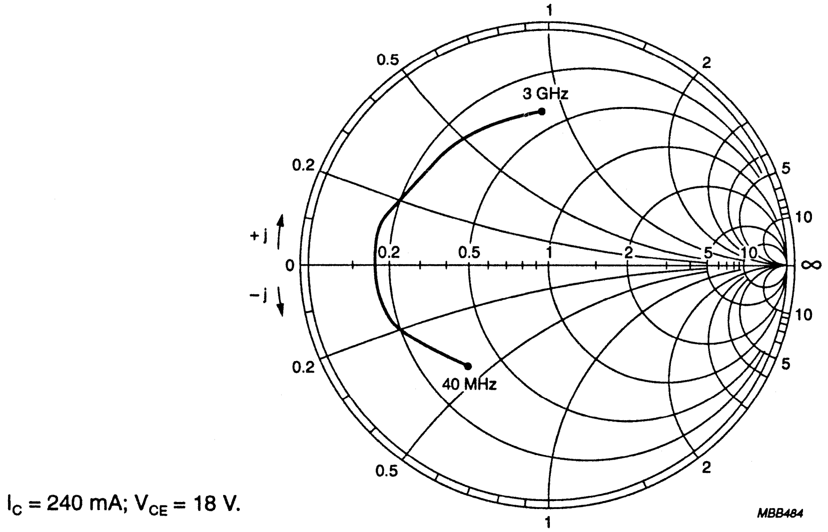


Fig.16 Common emitter input reflection coefficient (S_{11}).

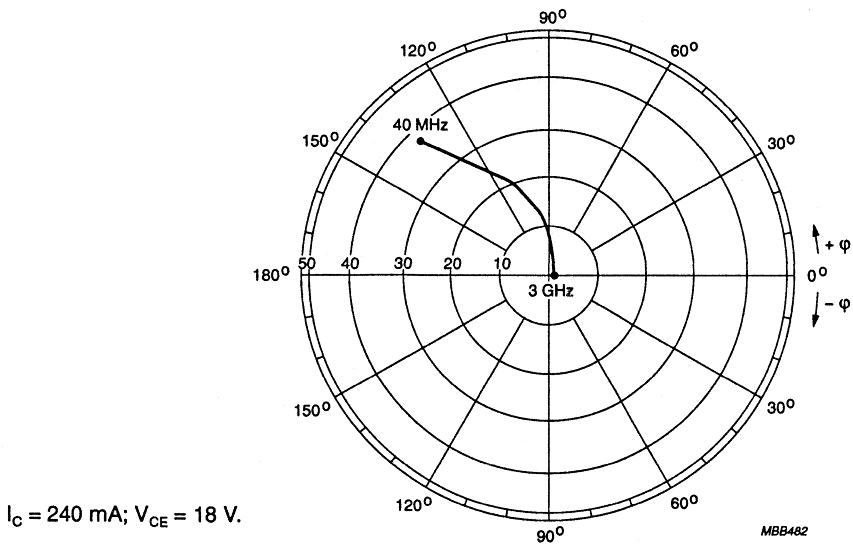
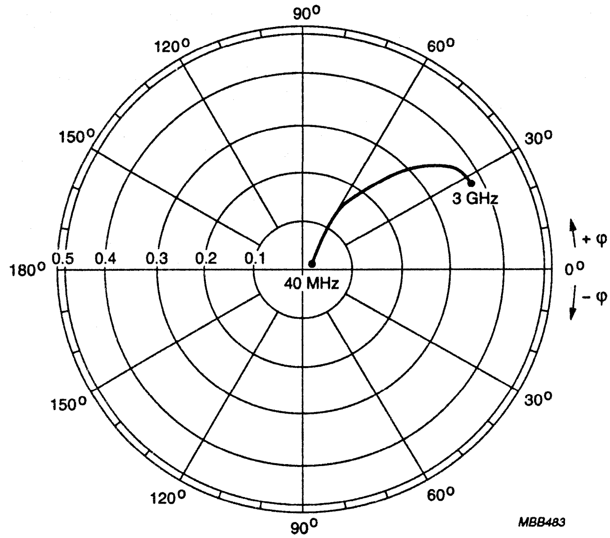
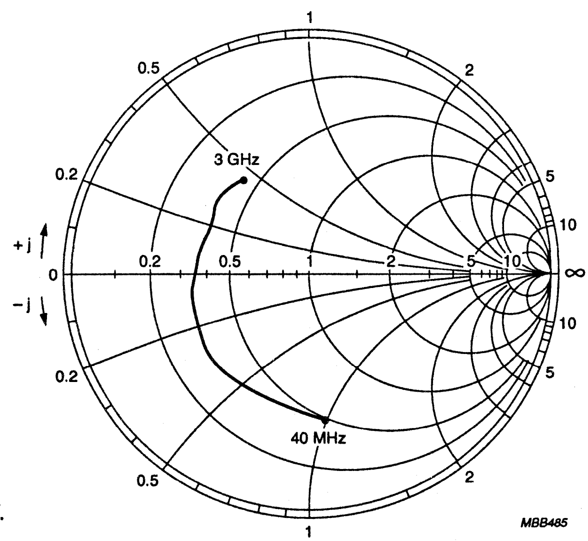


Fig.17 Common emitter forward transmission coefficient (S_{21}).



I_C = 240 mA; V_{CE} = 18 V.

Fig.18 Common emitter reverse transmission coefficient (S_{12}).



I_C = 240 mA; V_{CE} = 18 V.

Fig.19 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 240 mA; V_{CE} = 18 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.539	−130.0	38.439	131.2	0.020	44.6	0.609	−83.6	35.2
100	0.691	−158.0	19.757	107.0	0.028	41.2	0.525	−132.0	30.1
200	0.726	−173.0	10.362	93.3	0.037	48.8	0.504	−156.0	24.8
300	0.730	−179.0	6.996	86.4	0.048	54.6	0.501	−165.0	21.5
400	0.736	176.4	5.262	81.0	0.058	58.2	0.501	−170.0	19.1
500	0.730	172.6	4.249	76.8	0.070	59.6	0.498	−173.0	17.1
600	0.726	169.1	3.556	72.7	0.082	60.5	0.494	−176.0	15.5
700	0.718	166.0	3.108	68.7	0.095	61.0	0.488	−178.0	14.2
800	0.708	162.7	2.743	64.8	0.108	60.8	0.482	179.3	12.9
900	0.707	159.4	2.469	61.2	0.121	60.1	0.478	176.6	12.0
1000	0.702	156.2	2.225	57.8	0.132	59.5	0.477	174.0	11.0
1200	0.690	149.9	1.866	51.8	0.157	59.1	0.480	169.5	9.4
1400	0.676	143.8	1.661	45.7	0.183	56.1	0.483	166.3	8.2
1600	0.663	137.1	1.506	39.1	0.207	52.5	0.471	162.9	7.2
1800	0.661	129.5	1.362	33.9	0.235	50.4	0.455	157.9	6.2
2000	0.661	122.1	1.296	30.2	0.274	47.8	0.464	150.6	5.8
2200	0.673	117.1	1.213	24.7	0.299	44.5	0.487	144.6	5.5
2400	0.665	111.3	1.123	19.3	0.317	42.6	0.509	141.3	4.8
2600	0.653	105.7	1.039	16.0	0.345	39.7	0.507	137.8	4.0
2800	0.650	98.3	1.061	12.2	0.379	33.4	0.495	132.8	4.1
3000	0.668	92.7	1.005	5.7	0.388	27.8	0.487	125.9	3.8

Table 2 Common emitter scattering parameters, I_C = 300 mA; V_{CE} = 18 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.548	−130.0	38.623	130.5	0.020	44.4	0.605	−85.2	35.3
100	0.695	−159.0	19.674	106.6	0.028	40.9	0.526	−133.0	30.1
200	0.731	−173.0	10.305	93.0	0.037	48.8	0.504	−156.0	24.9
300	0.732	−179.0	6.952	86.3	0.048	54.5	0.502	−165.0	21.4
400	0.738	176.4	5.222	80.9	0.058	58.1	0.502	−170.0	19.0
500	0.732	172.4	4.224	76.5	0.069	59.8	0.500	−174.0	17.1
600	0.728	169.0	3.544	72.4	0.082	60.6	0.495	−176.0	15.5
700	0.720	165.9	3.089	68.5	0.095	61.0	0.489	−178.0	14.2
800	0.711	162.5	2.721	64.6	0.108	60.7	0.485	179.1	12.9
900	0.709	159.3	2.443	61.1	0.121	60.2	0.480	176.5	11.9
1000	0.705	156.2	2.214	57.6	0.132	59.6	0.479	173.9	11.0
1200	0.694	149.7	1.858	51.7	0.157	59.1	0.482	169.3	9.4
1400	0.681	143.3	1.651	45.6	0.183	56.0	0.485	166.0	8.2
1600	0.667	136.8	1.492	39.1	0.207	52.4	0.472	162.7	7.1
1800	0.665	129.1	1.357	34.0	0.235	50.3	0.459	157.6	6.2
2000	0.663	121.7	1.285	30.1	0.274	47.6	0.467	150.4	5.8
2200	0.671	116.8	1.216	24.3	0.298	44.4	0.491	144.4	5.5
2400	0.671	111.1	1.118	19.4	0.316	42.6	0.509	141.0	4.9
2600	0.654	105.3	1.038	16.0	0.344	39.5	0.508	137.6	4.0
2800	0.651	98.2	1.050	12.4	0.378	33.4	0.495	132.8	4.0
3000	0.663	93.0	1.002	5.8	0.387	27.7	0.488	125.8	3.7

Table 3 Common emitter scattering parameters, I_C = 360 mA; V_{CE} = 18 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.553	−132.0	38.374	130.1	0.020	43.3	0.593	−86.7	35.1
100	0.697	−159.0	19.456	106.3	0.028	40.0	0.520	−134.0	30.0
200	0.731	−173.0	10.165	92.8	0.037	48.7	0.501	−157.0	24.7
300	0.735	−179.0	6.856	86.1	0.047	54.7	0.499	−166.0	21.3
400	0.736	176.1	5.158	80.7	0.058	58.4	0.498	−170.0	18.9
500	0.733	172.4	4.167	76.4	0.070	59.9	0.496	−174.0	17.0
600	0.731	168.7	3.493	72.4	0.082	60.8	0.492	−176.0	15.4
700	0.721	165.5	3.049	68.4	0.095	61.0	0.488	−178.0	14.1
800	0.714	162.3	2.695	64.4	0.108	60.8	0.482	179.1	12.9
900	0.714	159.3	2.419	60.9	0.121	60.3	0.478	176.5	11.9
1000	0.708	155.9	2.187	57.4	0.132	59.7	0.478	174.0	10.9
1200	0.697	149.9	1.834	51.5	0.157	59.2	0.481	169.5	9.3
1400	0.683	143.3	1.631	45.3	0.183	56.2	0.484	166.3	8.1
1600	0.669	136.5	1.472	39.0	0.207	52.4	0.473	162.9	7.0
1800	0.666	128.9	1.341	33.9	0.235	50.5	0.459	157.8	6.1
2000	0.668	121.7	1.272	29.8	0.273	47.6	0.468	150.5	5.7
2200	0.679	116.7	1.203	24.0	0.298	44.3	0.493	144.6	5.5
2400	0.674	110.8	1.090	19.2	0.317	42.7	0.511	141.1	4.7
2600	0.655	105.1	1.017	15.5	0.345	39.6	0.510	137.8	3.9
2800	0.655	98.4	1.038	12.0	0.378	33.4	0.496	132.9	4.0
3000	0.670	92.3	0.983	5.2	0.388	27.7	0.488	125.8	3.6

PNP HDTV video transistor BFQ290

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary NPN type BFQ291.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	base

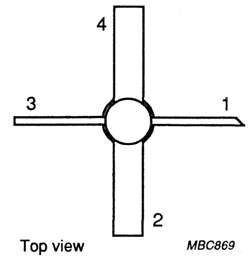


Fig.1 SOT172A1.

DESCRIPTION

The BFQ290 has a 4-lead SOT172A1 stud envelope with a ceramic cap. All leads are isolated from the flange.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	–	230	V
$-V_{CER}$	collector-emitter voltage	–	225	V
$-I_C$	collector current	–	250	mA
P_{tot}	total power dissipation (note 1)	–	4	W
T_j	junction temperature	–	200	°C

Note

1. T_{mb} = 100 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $-I_C$ = 100 μA	195	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V	15	–	
f_T	transition frequency	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.8	pF

NPN HDTV video transistor — BFQ291

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary PNP type BFQ290.

DESCRIPTION

The BFQ291 has a 4-lead SOT172A1 stud envelope with a ceramic cap. All leads are isolated from the stud.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	base

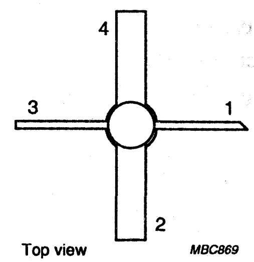


Fig.1 SOT172A1.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	–	230	V
V_{CER}	collector-emitter voltage	–	225	V
I_C	collector current	–	250	mA
P_{tot}	total power dissipation (note 1)	–	4	W
T_j	junction temperature	–	200	°C

Note

1. T_{mb} = 100 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA	195	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 10 V	15	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	I_C = i_c = 0; V_{CB} = 10 V; f = 1 MHz	–	1.8	pF

PNP HDTV video transistor — BFQ292

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary NPN type BFQ293.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

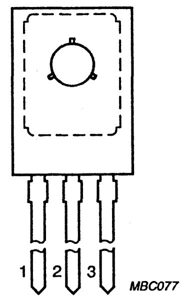


Fig.1 SOT32.

DESCRIPTION

The BFQ292 is mounted in a SOT32 plastic envelope, with the collector connected to the mounting base.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	–	230	V
$-V_{CER}$	collector-emitter voltage	–	225	V
$-I_C$	collector current	–	250	mA
P_{tot}	total power dissipation (note 1)	–	4	W
f_T	transition frequency	400	–	MHz
T_j	junction temperature	–	175	°C

Note

1. T_{mb} = 85 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $-I_C$ = 100 μA	195	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V	15	–	
f_T	transition frequency	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.8	pF

NPN HDTV video transistor — BFQ293

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary PNP type BFQ292.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

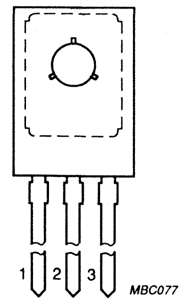


Fig.1 SOT32.

DESCRIPTION

The BFQ293 is mounted in a SOT32 plastic envelope, with the collector connected to the mounting base.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	–	230	V
V_{CER}	collector-emitter voltage	–	225	V
I_C	collector current	–	250	mA
P_{tot}	total power dissipation (note 1)	–	4	W
f_T	transition frequency	400	–	MHz
T_j	junction temperature	–	175	°C

Note

1. T_{mb} = 85 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA	195	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 10 V	15	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	I_C = i_c = 0; V_{CB} = 10 V; f = 1 MHz	–	1.8	pF

PNP HDTV video transistor | BFQ295

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary NPN type BFQ296.

DESCRIPTION

The BFQ295 is mounted in a SOT128B plastic envelope, with the collector connected to the mounting base.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

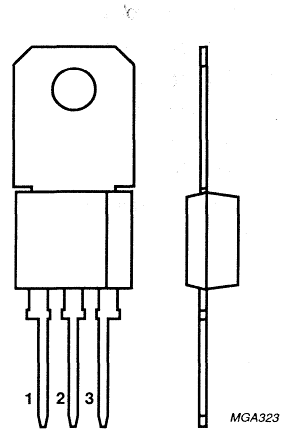


Fig.1 SOT128B.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	230	V
$-V_{CER}$	collector-emitter voltage	225	V
$-I_C$	collector current	250	mA
P_{tot}	total power dissipation (note 1)	4	W
T_j	junction temperature	175	°C

Note

1. T_{mb} = 67 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $-I_C$ = 100 μA	195	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V	15	–	
f_T	transition frequency	$-I_C$ = 25 mA; $-V_{CE}$ = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	$I_C = i_c$ = 0; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.8	pF

NPN HDTV video transistor BFQ296

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary PNP type BFQ295.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

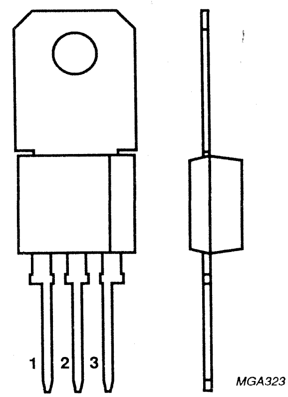


Fig.1 SOT128B.

DESCRIPTION

The BFQ296 is mounted in a SOT128B plastic envelope, with the collector connected to the mounting base.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MAX.	UNIT
V_{CBO}	collector-base voltage	230	V
V_{CER}	collector-emitter voltage	225	V
I_C	collector current	250	mA
P_{tot}	total power dissipation (note 1)	4	W
T_j	junction temperature	175	°C

Note

1. T_{mb} = 67 °C.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA	195	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω	190	–	V
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 10 V	15	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 10 V; f = 100 MHz	400	–	MHz
C_{cb}	collector-base capacitance	I_C = i_c = 0; V_{CB} = 10 V; f = 1 MHz	–	1.8	pF

NPN 8 GHz wideband transistor BFQ621

FEATURES

- Low distortion
- Gold metallization ensures excellent reliability
- SOT172 ceramic envelope
- High output voltage
- Integrated emitter-ballasting resistors.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

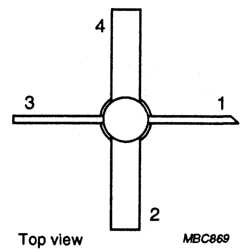


Fig.1 SOT172A1.

DESCRIPTION

NPN silicon planar epitaxial transistor, mounted in a 4-lead dual-emitter SOT172A1 envelope with a ceramic cap. It is primarily intended for use in MATV and CATV amplifiers.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	19	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_{mb} = 120 °C	–	2	W
h_{FE}	DC current gain	I_C = 120 mA; V_{CE} = 18 V	120	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 18 V; f = 500 MHz	8	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 18 V; f = 1 MHz	0.9	–	pF
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	15	–	dB
V_O	output voltage	note 1	1.2	–	V
T_j	junction temperature		–	200	°C

Note

1. d_{im} = −60 dB (3-tone); I_C = 120 mA; V_{CE} = 18 V; R_L = 75 Ω;
   $V_p = V_O$; $V_q = V_r = V_O$ −6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at f = 793.25 MHz.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	40 K/W

NPN 7 GHz wideband transistor BFQ741

FEATURES

- Low distortion
- Gold metallization ensures excellent reliability
- SOT172 ceramic envelope
- High output voltage
- Integrated emitter-ballasting resistors.

DESCRIPTION

NPN silicon planar epitaxial transistor, mounted in a 4-lead dual-emitter SOT172A1 envelope with a ceramic cap. It is primarily intended for use in MATV and CATV amplifiers.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

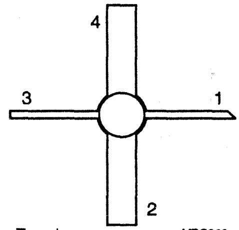


Fig.1 SOT172A1.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	19	V
I_C	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_{mb} = 120 °C	–	4	W
h_{FE}	DC current gain	I_C = 200 mA; V_{CE} = 18 V	120	–	
f_T	transition frequency	I_C = 200 mA; V_{CE} = 18 V; f = 500 MHz	7	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 18 V; f = 1 MHz	1.8	–	pF
G_{UM}	maximum unilateral power gain	I_C = 200 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	14	–	dB
V_O	output voltage	note 1	1.6	–	V
T_j	junction temperature		–	200	°C

Note

1. d_{im} = –60 dB (3-tone); I_C = 240 mA; V_{CE} = 18 V; R_L = 75 Ω;
   $V_p = V_O$; $V_q = V_r = V_O$ –6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at f = 793.25 MHz.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	20 K/W

NPN 2 GHz wideband transistor — BFR53

DESCRIPTION

NPN transistor in a plastic SOT23 envelope. It is intended for application in thick and thin-film circuits. The transistor has very low intermodulation distortion and very high power gain.

PINNING

PIN	DESCRIPTION
	Code: N1
1	base
2	emitter
3	collector

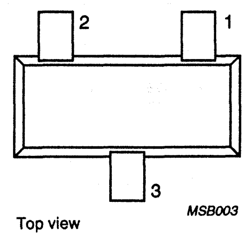


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	18	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	400	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	2	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	0.9	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	10.5	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	18	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	400	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 45 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

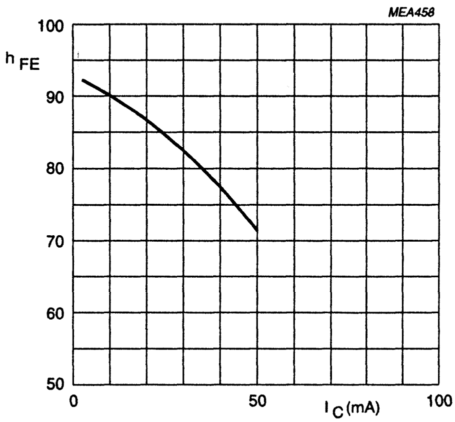
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 5 V	25	–	–	
		I_C = 50 mA; V_{CE} = 5 V	25	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	0.9	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.5	–	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.9	–	pF
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	–	2	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	–	10.5	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	–	5	dB

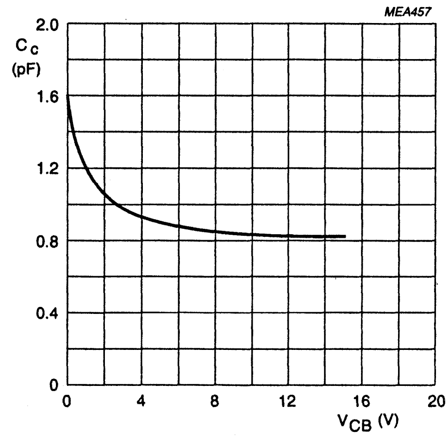
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.



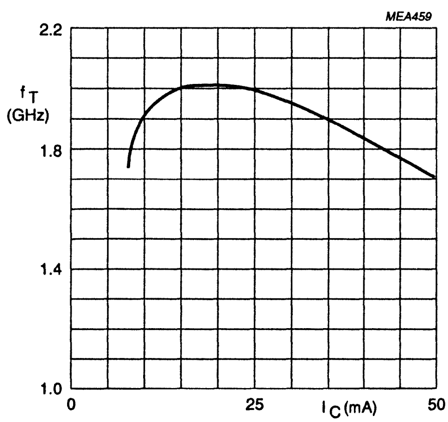
V_{CE} = 5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



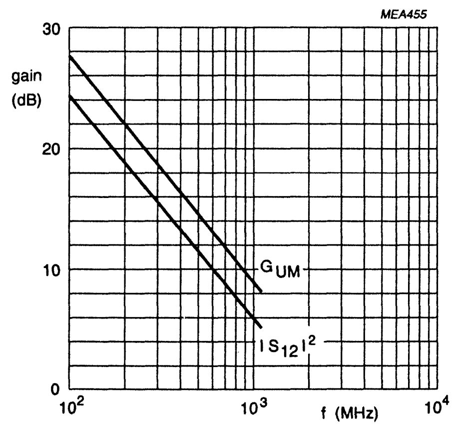
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C

Fig.3 Collector capacitance as a function of collector-base voltage.



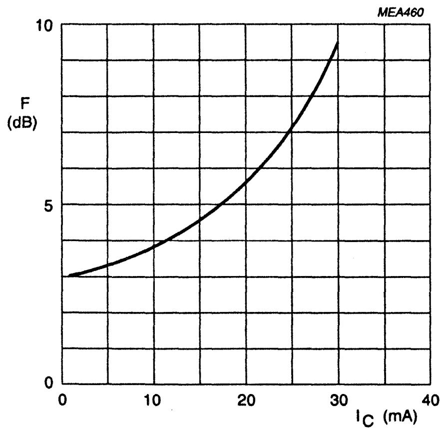
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



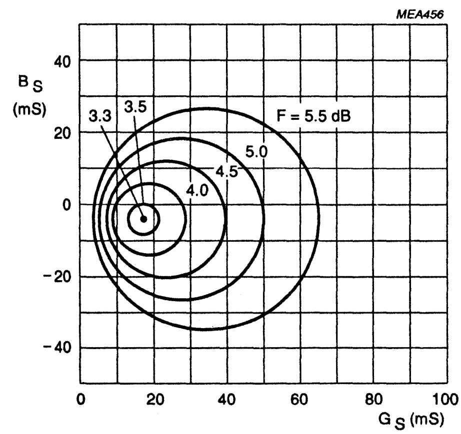
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.5 Gain as a function of frequency.



V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; G_S = 20 mS; B_S is tuned.

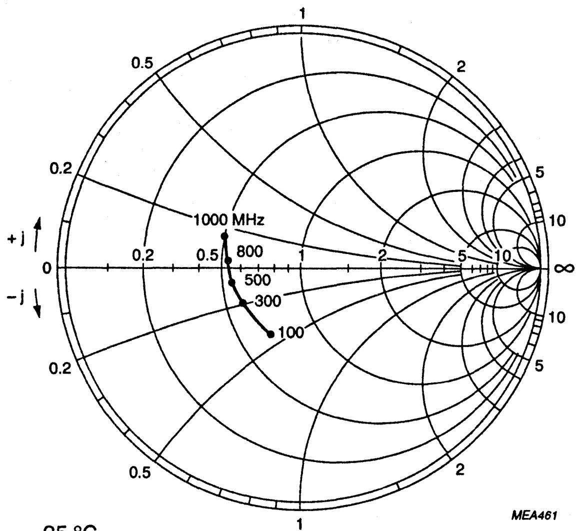
Fig.6 Minimum noise figure as a function of collector current.



I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

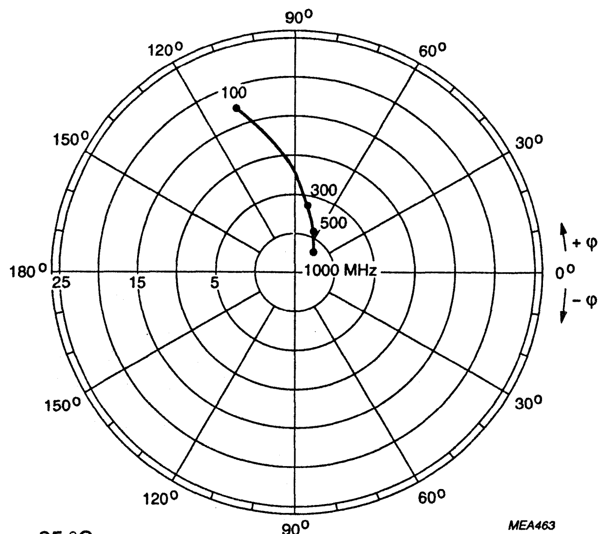
Fig.7 Noise circle figure.

NPN 2 GHz wideband transistor BFR53



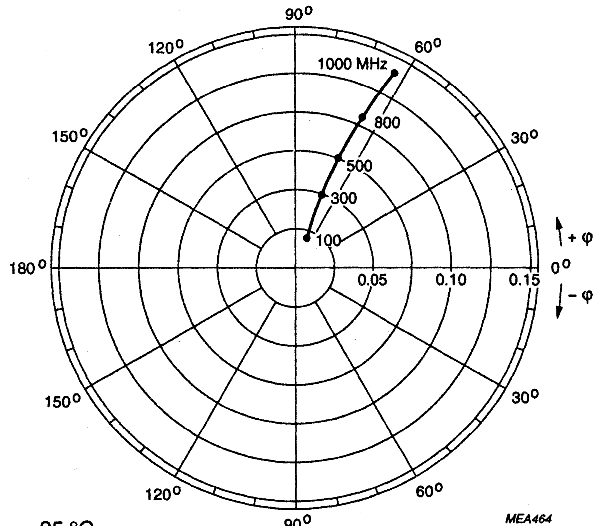
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



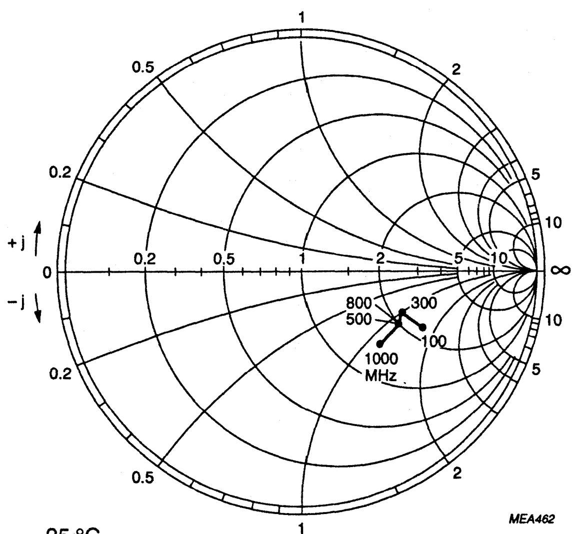
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

NPN 5 GHz wideband transistor — BFR90

DESCRIPTION

NPN transistor in a plastic SOT37 envelope. It is primarily intended for use in RF amplifiers such as aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PNP complement is the BFQ51.

PINNING

PIN	DESCRIPTION
	Code: BFR90/02
1	base
2	emitter
3	collector

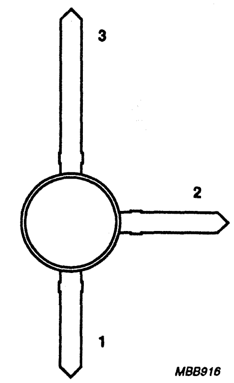


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	0.4	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	2.4	–	dB
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	19.5	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	150	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

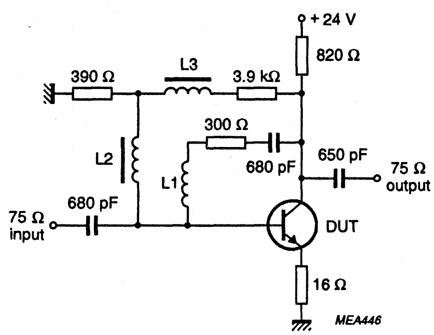
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 14$ mA; $V_{CE} = 10$ V	40	90	–	
f_T	transition frequency	$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	0.4	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 14$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	19.5	–	dB
F	noise figure	$I_C = 2$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C; Z_S = opt.	–	2.4	–	dB
V_O	output voltage	note 2	–	150	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB; $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 495.25$ MHz;
   $V_q = V_O -6$ dB; $f_q = 503.25$ MHz;
   $V_r = V_O -6$ dB; $f_r = 505.25$ MHz;
   measured at $f_{(p+q-r)} = 493.25$ MHz.



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

L1 = 4 turns 0.35 mm copper wire, internal diameter 4 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion test circuit.

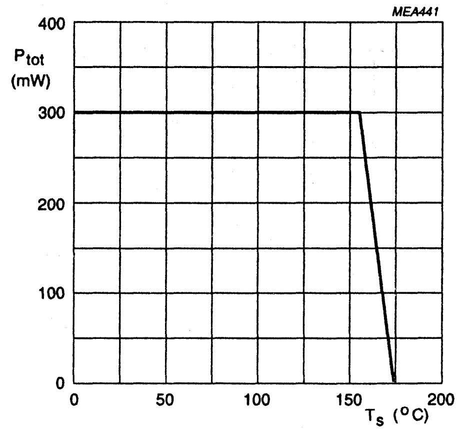
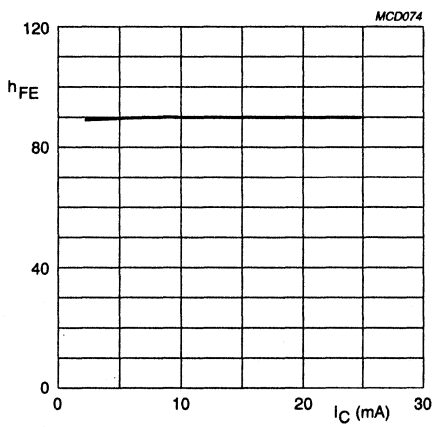
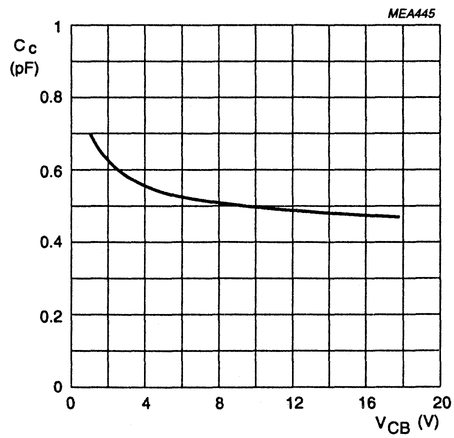


Fig.3 Power derating curve.



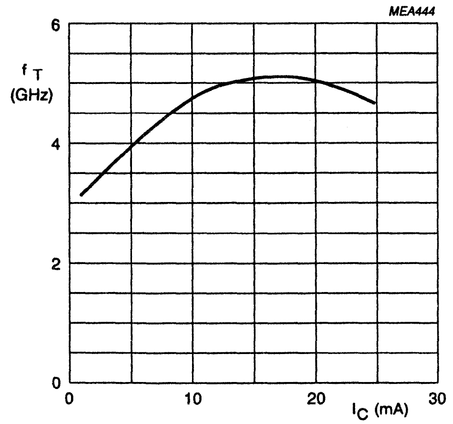
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



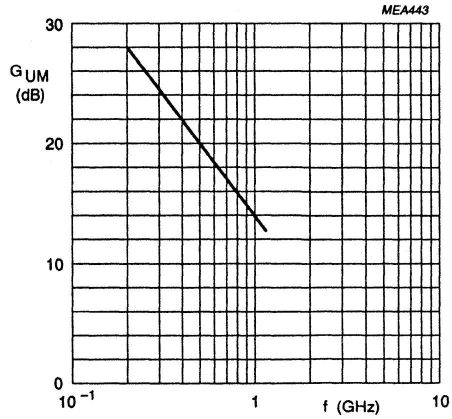
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C

Fig.5 Collector capacitance as a function of collector-base voltage.



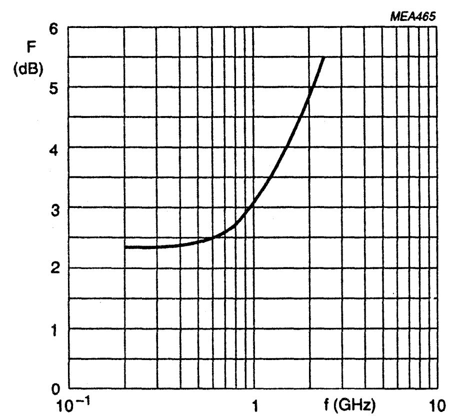
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



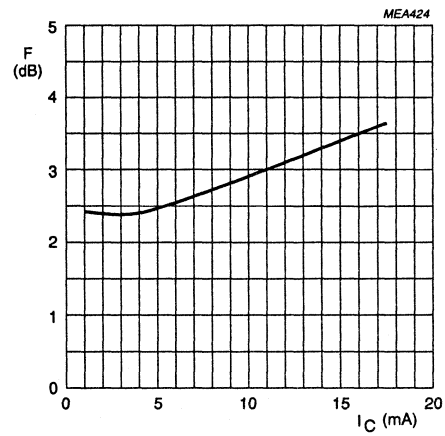
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



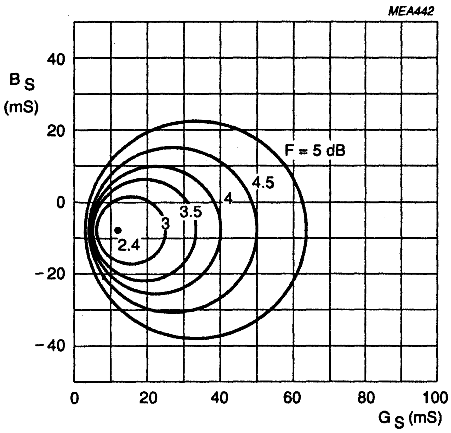
I_C = 2 mA; V_{CE} = 10 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.8 Minimum noise figure as a function of frequency.



V_{CE} = 10 V; f = 500 MHz; Z_S = opt.; T_{amb} = 25 °C.

Fig.9 Minimum noise figure as a function of collector current.



I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.

NPN 5 GHz wideband transistor — BFR90A

FEATURES

- Low noise
- Low intermodulation distortion
- High power gain
- Gold metallization.

DESCRIPTION

NPN transistor in a plastic SOT37 envelope primarily intended for use in RF wideband amplifiers.

A SOT54 (TO-92) version (ref: ON4184) is available on request.

PNP complement is the BFQ51.

PINNING

PIN	DESCRIPTION
Code: BFR90A/02	
1	base
2	emitter
3	collector

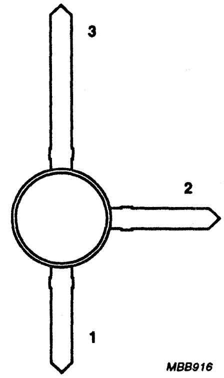


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	0.35	–	pF
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	15.5	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω	1.7	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	150	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	8	–	dBm
ITO	third order intercept point	I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C	27	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

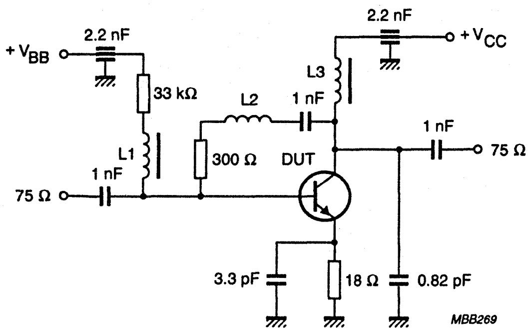
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V	40	90	–	
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	0.35	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	15.5	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω	–	1.7	–	dB
		I_C = 4 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C; Z_S = opt.	–	3.6	–	dB
d_2	second order intermodulation distortion	see Figs 2 and 8 and note 2	–	–50	–	dB
V_O	output voltage	see Figs 2 and 7 and note 3	–	150	–	mV
P_{L1}	output power at 1 dB gain compression (see Fig.2)	I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	–	8	–	dBm
ITO	third order intercept point	see Fig.2 and note 4	–	27	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   V_p = 60 mV at f_p = 250 MHz;
   V_q = 60 mV at f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   P_p = ITO –6 dB; f_p = 800 MHz;
   P_q = ITO –6 dB; f_q = 801 MHz;
   measured at $f_{(2q-p)}$ = 802 MHz and $f_{(2p-q)}$ = 799 MHz.



L1 = L3 = 5 μH microchoke.

L2 = 3 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

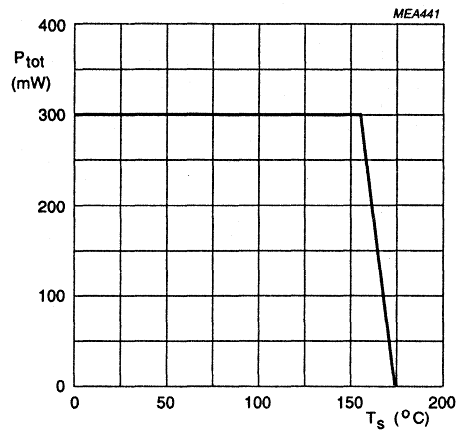
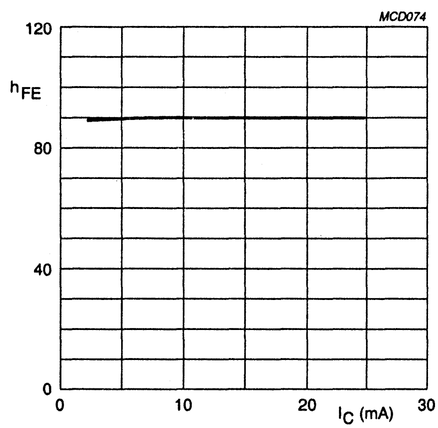
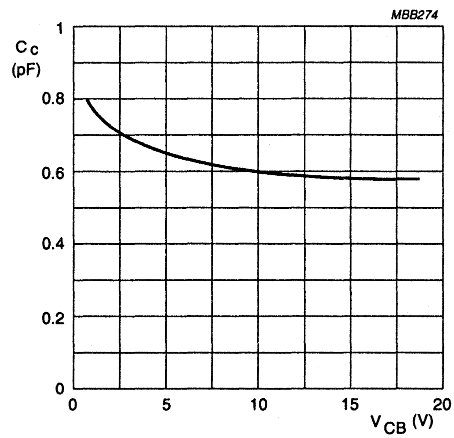


Fig.3 Power derating curve.



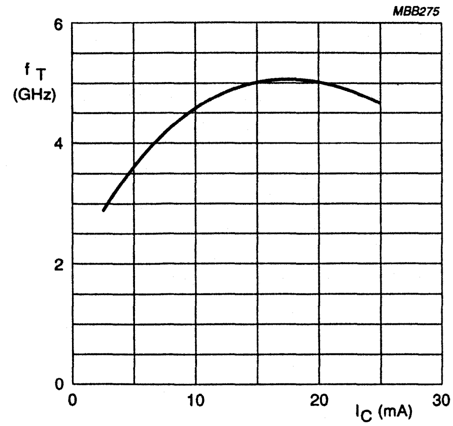
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



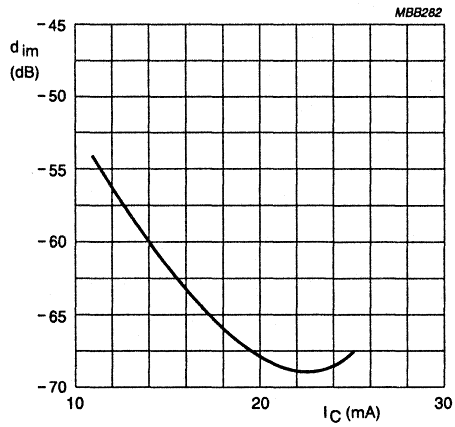
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



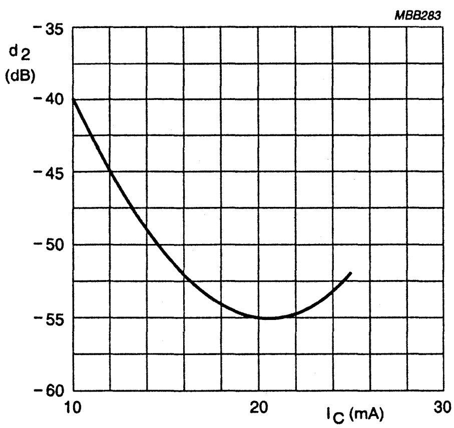
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



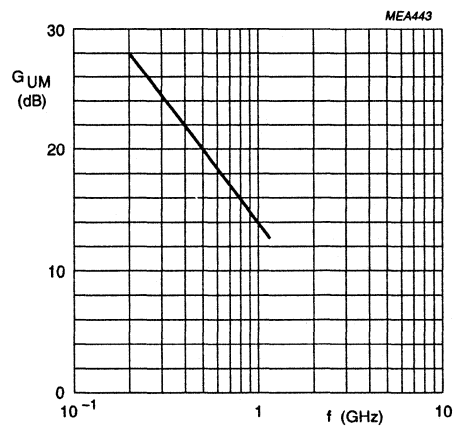
V_{CE} = 10 V; V_O = 43.5 dBmV = 150 mV;
$f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C;
measured in test circuit (see Fig.2).

Fig.7 Intermodulation distortion as a function of collector current.



V_{CE} = 10 V; V_O = 60 mV;
$f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C;
measured in test circuit (see Fig.2).

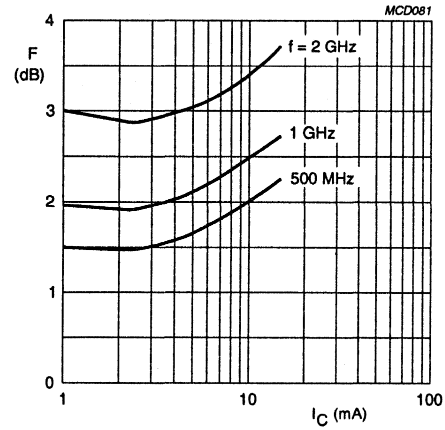
Fig.8 Second order intermodulation distortion as a function of collector current.



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

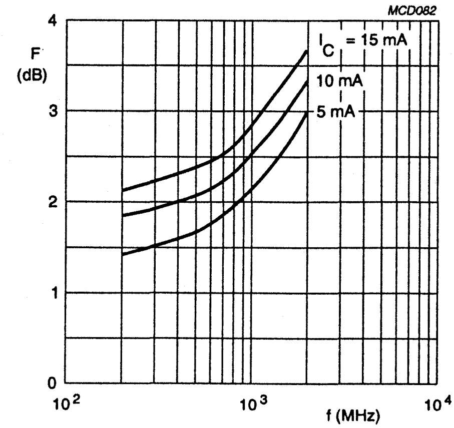
Fig.9 Maximum unilateral power gain as a function of frequency.

NPN 5 GHz wideband transistor BFR90A



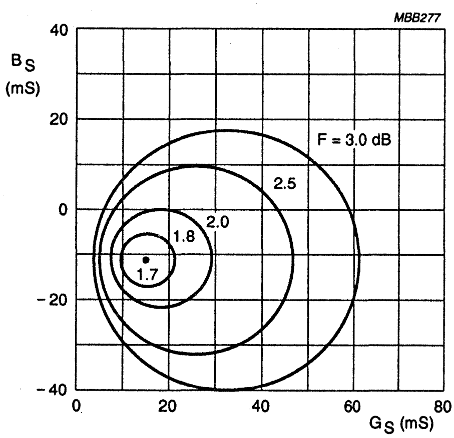
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



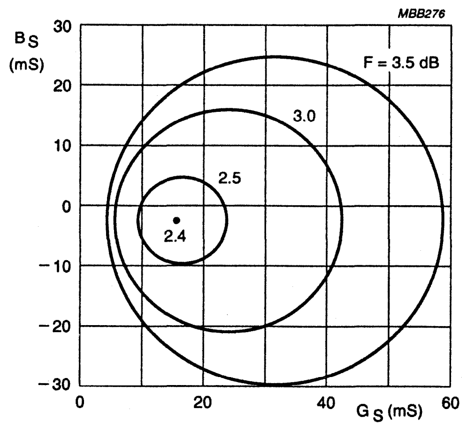
V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



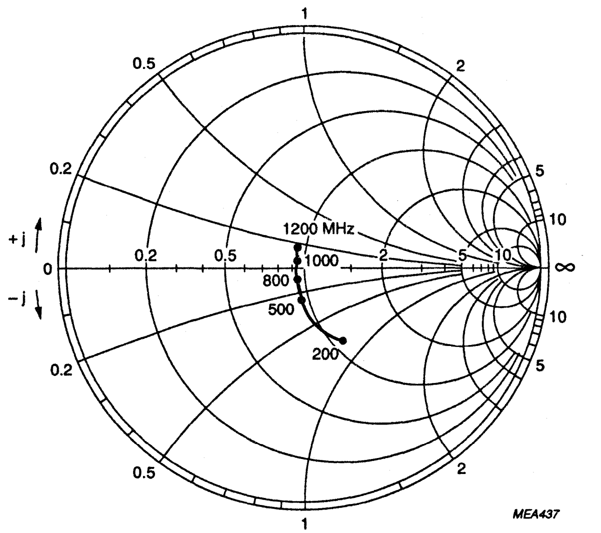
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.12 Noise circle figure.



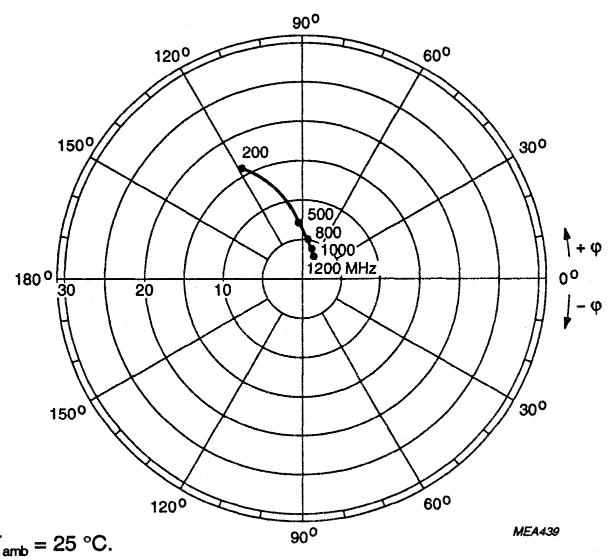
I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.13 Noise circle figure.



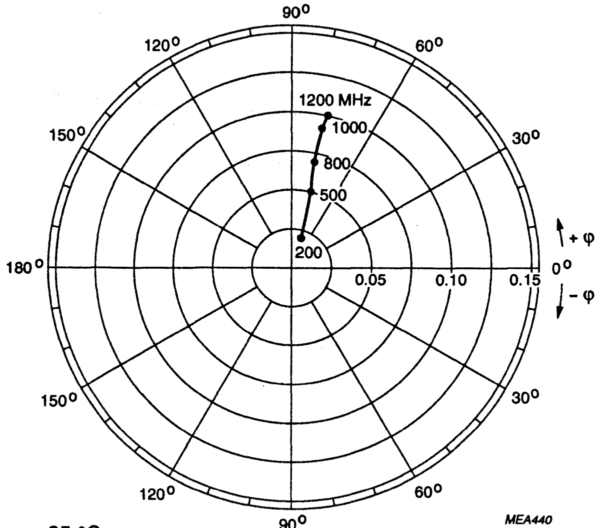
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter input reflection coefficient (S_{11}).



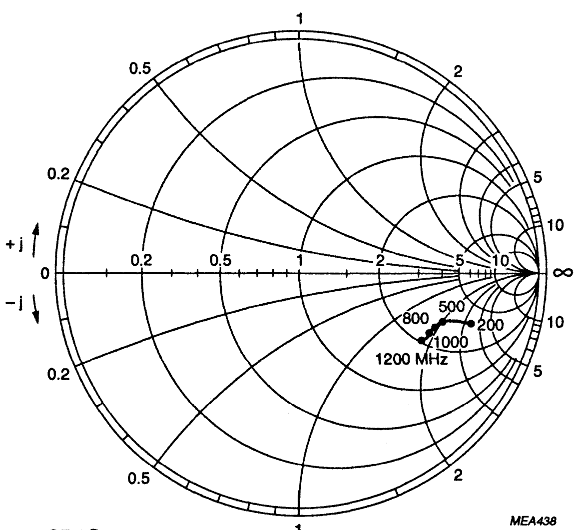
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.754	−15.0	24.542	163.3	0.007	81.6	0.971	−7.0	43.9
100	0.646	−33.3	20.969	142.8	0.017	74.2	0.881	−15.3	35.3
200	0.451	−52.5	15.098	120.9	0.029	69.2	0.745	−20.7	28.1
300	0.325	−63.8	11.337	107.9	0.038	68.2	0.669	−22.2	24.1
400	0.251	−70.9	8.979	99.3	0.048	68.2	0.631	−23.2	21.5
500	0.195	−76.6	7.417	92.4	0.058	68.4	0.607	−24.7	19.6
600	0.154	−80.3	6.306	87.1	0.067	67.5	0.596	−26.0	18.0
700	0.121	−80.6	5.431	82.0	0.077	67.0	0.587	−27.5	16.6
800	0.094	−80.6	4.808	78.3	0.086	66.3	0.582	−28.8	15.5
900	0.073	−79.9	4.306	74.1	0.095	65.1	0.574	−30.2	14.4
1000	0.046	−80.3	3.908	70.1	0.105	64.0	0.567	−31.5	13.5
1200	0.004	54.5	3.357	62.5	0.124	60.9	0.545	−35.4	12.1
1400	0.042	88.7	2.912	55.7	0.143	57.4	0.521	−40.4	10.7
1600	0.067	84.8	2.587	49.7	0.161	55.3	0.515	−46.0	9.6
1800	0.085	79.8	2.379	43.7	0.181	52.5	0.513	−51.1	8.9
2000	0.122	72.5	2.177	37.4	0.197	48.9	0.506	−55.1	8.1
2200	0.162	70.3	1.996	31.4	0.214	45.9	0.484	−58.7	7.3
2400	0.196	71.5	1.890	26.3	0.230	43.0	0.456	−64.6	6.7
2600	0.225	71.2	1.812	20.0	0.249	39.3	0.437	−72.3	6.3
2800	0.245	65.8	1.705	13.8	0.266	36.0	0.434	−79.4	5.8
3000	0.263	60.7	1.622	9.7	0.282	33.6	0.437	−84.2	5.4

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 5 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.664	−18.4	32.077	158.9	0.007	82.3	0.944	−9.2	42.3
100	0.525	−38.8	25.368	136.2	0.015	75.0	0.822	−17.1	34.4
200	0.342	−56.1	16.776	115.8	0.026	73.6	0.685	−20.2	27.8
300	0.238	−64.7	12.160	105.1	0.036	73.8	0.623	−20.5	24.1
400	0.178	−70.2	9.445	98.2	0.046	75.0	0.592	−20.9	21.5
500	0.141	−73.6	7.695	93.3	0.055	75.6	0.574	−21.9	19.5
600	0.111	−75.6	6.508	89.5	0.065	75.3	0.565	−23.1	18.0
700	0.088	−74.2	5.656	86.0	0.076	75.3	0.559	−24.5	16.7
800	0.067	−70.6	5.004	82.7	0.085	74.8	0.554	−26.0	15.6
900	0.047	−60.8	4.462	79.3	0.095	74.3	0.549	−27.4	14.6
1000	0.028	−38.4	4.021	76.6	0.105	73.7	0.542	−29.0	13.6
1200	0.026	59.7	3.404	71.5	0.124	72.1	0.527	−32.6	12.1
1400	0.056	86.0	3.016	66.7	0.144	70.7	0.511	−36.9	10.9
1600	0.072	86.1	2.668	61.8	0.162	69.1	0.503	−41.9	9.8
1800	0.092	78.3	2.404	58.3	0.180	67.8	0.494	−46.5	8.9
2000	0.126	71.3	2.200	53.5	0.198	66.0	0.486	−50.3	8.1
2200	0.171	71.0	2.060	49.9	0.215	64.1	0.466	−54.4	7.5
2400	0.207	73.1	1.931	44.0	0.233	62.6	0.437	−59.7	6.8
2600	0.226	74.3	1.786	41.4	0.251	60.3	0.416	−66.5	6.1
2800	0.241	70.3	1.755	37.1	0.266	58.9	0.412	−73.8	6.0
3000	0.268	63.9	1.633	32.6	0.284	57.9	0.411	−79.8	5.4

Table 3 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.779	−13.9	24.287	163.6	0.007	82.5	0.974	−6.4	44.7
100	0.672	−31.2	20.893	143.5	0.016	74.2	0.889	−14.2	35.8
200	0.481	−49.2	15.178	121.7	0.027	69.8	0.763	−19.2	28.6
300	0.351	−59.1	11.458	108.7	0.036	68.7	0.690	−20.9	24.6
400	0.272	−65.2	9.092	100.1	0.046	68.7	0.653	−21.9	21.9
500	0.217	−68.9	7.510	93.3	0.055	68.6	0.631	−23.4	19.9
600	0.176	−71.4	6.391	87.8	0.063	68.1	0.620	−24.9	18.4
700	0.146	−70.5	5.514	82.9	0.073	67.5	0.611	−26.2	17.0
800	0.121	−67.6	4.885	79.0	0.082	66.7	0.606	−27.6	15.8
900	0.100	−65.5	4.373	74.9	0.091	65.5	0.601	−28.9	14.8
1000	0.072	−63.1	3.967	71.2	0.100	64.3	0.593	−30.3	13.9
1200	0.033	−38.7	3.408	63.5	0.118	61.3	0.573	−34.2	12.4
1400	0.025	47.3	2.963	56.8	0.136	58.1	0.548	−39.1	11.0
1600	0.046	62.7	2.629	50.6	0.154	56.0	0.542	−44.3	9.9
1800	0.061	62.7	2.422	44.9	0.172	53.3	0.542	−49.3	9.2
2000	0.099	64.7	2.214	38.6	0.187	49.9	0.533	−53.1	8.4
2200	0.131	65.8	2.023	32.7	0.203	47.1	0.511	−56.8	7.5
2400	0.171	69.8	1.922	27.5	0.219	44.1	0.486	−62.3	7.0
2600	0.200	70.2	1.843	21.4	0.237	40.5	0.469	−69.7	6.6
2800	0.220	64.5	1.735	14.7	0.253	37.3	0.464	−76.6	6.1
3000	0.236	60.5	1.653	10.7	0.268	35.1	0.469	−81.2	5.7

Table 4 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.708	−16.9	31.405	159.6	0.006	81.6	0.948	−8.4	42.9
100	0.570	−36.0	25.156	137.4	0.014	75.1	0.836	−15.9	34.9
200	0.381	−51.8	16.853	117.0	0.025	73.3	0.706	−19.0	28.2
300	0.273	−58.8	12.283	106.1	0.035	73.8	0.645	−19.5	24.5
400	0.209	−62.5	9.559	99.1	0.044	75.2	0.615	−20.0	21.9
500	0.170	−64.6	7.798	94.2	0.054	75.6	0.598	−21.0	19.9
600	0.140	−64.8	6.603	90.4	0.063	75.2	0.589	−22.2	18.3
700	0.117	−63.2	5.742	86.9	0.072	75.2	0.583	−23.5	17.0
800	0.098	−59.4	5.081	83.6	0.082	74.8	0.578	−25.0	15.9
900	0.080	−52.1	4.531	80.2	0.091	74.4	0.573	−26.4	14.9
1000	0.062	−42.1	4.085	77.5	0.101	73.7	0.567	−27.9	13.9
1200	0.035	−5.5	3.457	72.5	0.119	72.4	0.552	−31.5	12.4
1400	0.036	50.4	3.070	67.7	0.138	71.0	0.536	−35.7	11.2
1600	0.049	65.0	2.718	62.9	0.156	69.6	0.528	−40.5	10.1
1800	0.068	63.4	2.445	59.4	0.172	68.3	0.520	−45.0	9.2
2000	0.104	62.2	2.239	54.7	0.189	66.7	0.512	−48.7	8.4
2200	0.145	66.5	2.098	51.2	0.206	65.1	0.493	−52.6	7.7
2400	0.181	70.8	1.970	45.1	0.223	63.4	0.464	−57.7	7.1
2600	0.199	72.8	1.821	42.6	0.240	61.3	0.444	−64.2	6.3
2800	0.213	69.4	1.793	38.4	0.255	59.9	0.441	−71.2	6.2
3000	0.241	62.8	1.670	33.8	0.272	59.1	0.440	−76.7	5.6

NPN 5 GHz wideband transistor BFR91

DESCRIPTION

NPN transistor in a plastic SOT37 envelope primarily intended for use in RF amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor features very low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

A SOT54 (TO-92) version (ref: ON4186) is available on request.

PNP complement is BFQ23.

PINNING

PIN	DESCRIPTION
Code: BFR91/02	
1	base
2	emitter
3	collector

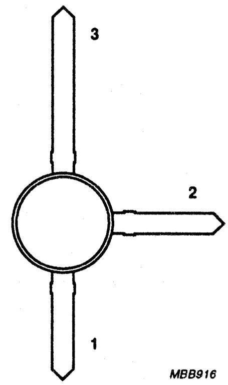


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	0.8	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	18	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	1.9	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	300	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

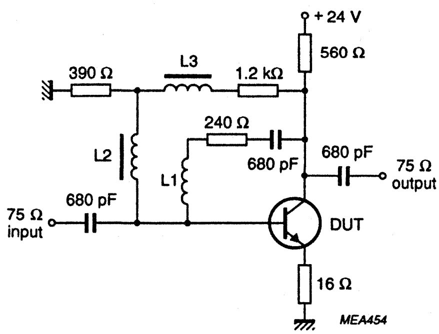
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 5 V; f = 1 MHz	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	–	1.9	–	dB
V_O	output voltage	note 2	–	300	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 495.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 503.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.

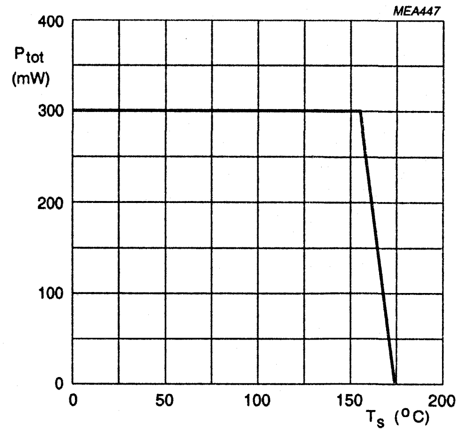
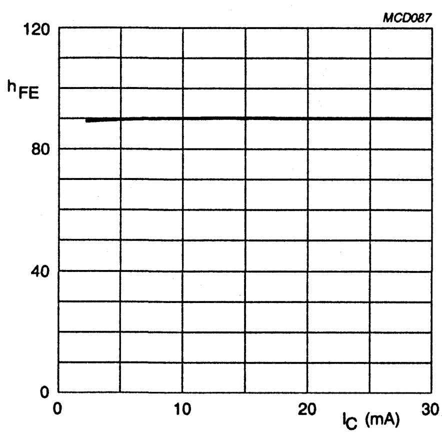
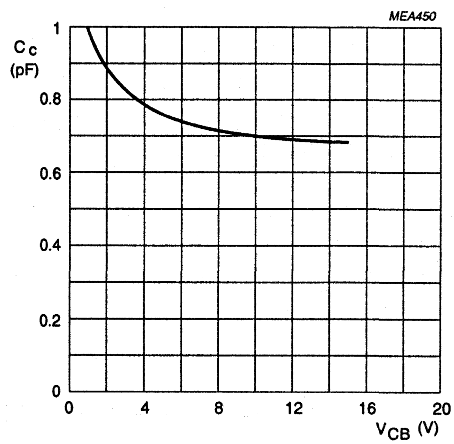


Fig.3 Power derating curve.



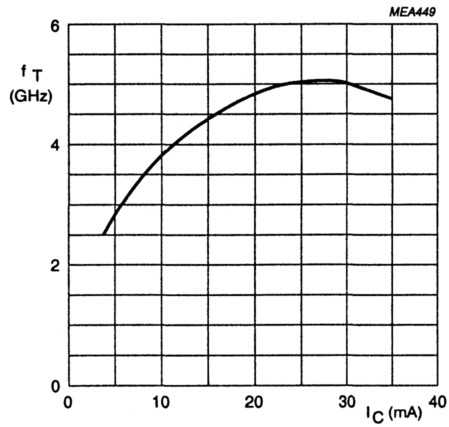
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



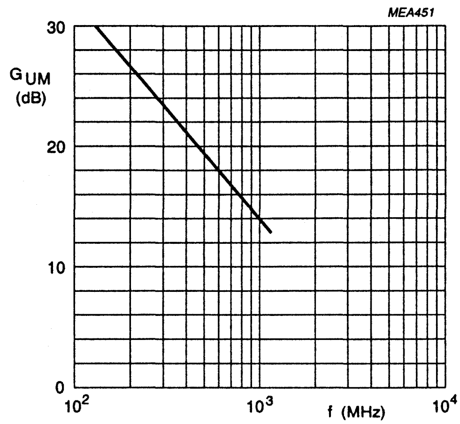
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



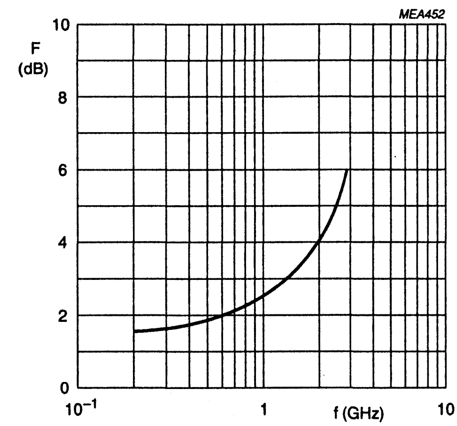
$V_{CE} = 5$ V; f = 500 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.



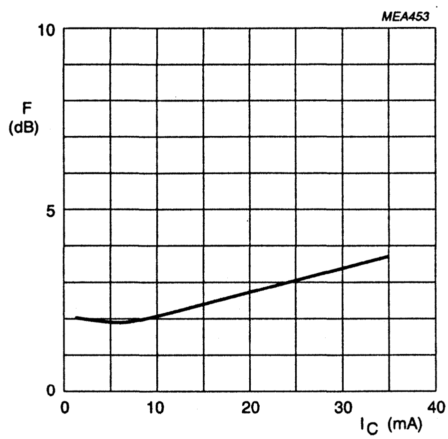
$I_C = 30$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; Z_S = opt.

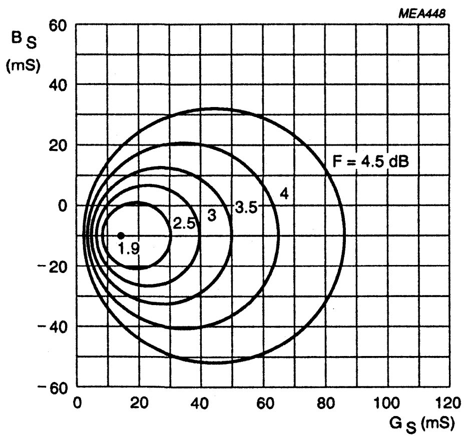
Fig.8 Minimum noise figure as a function of frequency.



$V_{CE} = 5$ V; f = 500 MHz; $T_{amb} = 25$ °C; Z_S = opt.

Fig.9 Minimum noise figure as a function of collector current.

NPN 5 GHz wideband transistor BFR91



I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.

NPN 6 GHz wideband transistor — BFR91A

FEATURES

- Low noise
- Low intermodulation distortion
- High power gain
- Gold metallization.

DESCRIPTION

NPN transistor in a plastic SOT37 envelope primarily intended for use in RF wideband amplifiers.

A SOT54 (TO-92) version (ref: ON4185) is available on request.

PNP complement is BFQ23.

PINNING

PIN	DESCRIPTION
Code: BFR91A/02	
1	base
2	emitter
3	collector

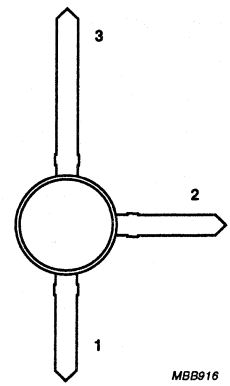


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	6	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	0.6	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	14	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = opt.	1.6	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	425	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	17	–	dBm
ITO	third order intercept point	I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C	36	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

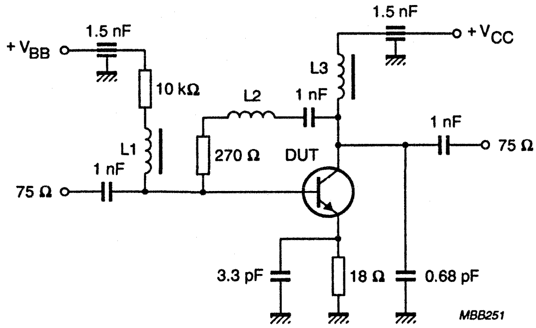
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	6	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.9	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	0.6	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	14	–	dB
F	noise figure	I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = opt.	–	1.6	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C; Z_S = opt.	–	2.3	–	dB
V_O	output voltage	see Figs 2 and 8 and note 2	–	425	–	mV
		see Figs 2 and 12 and note 3	–	200	–	mV
P_{L1}	output power at 1 dB gain compression (see Fig.2)	I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	–	17	–	dBm
ITO	third order intercept point	see Fig.2 and note 4	–	36	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = −60 dB (DIN 45004B); I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. d_2 = −50 dB; I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_2 = −50 dB; f_p = 250 MHz;
   $V_q = V_O$ at d_2 = −50 dB; f_p = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.
4. I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   P_p = ITO −6 dB; f_p = 800 MHz;
   P_q = ITO −6 dB; f_q = 801 MHz;
   measured at $f_{(2q-p)}$ = 802 MHz and $f_{(2p-q)}$ = 799 MHz.



L1 = L3 = 5 µH microchoke.

L2 = 3 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

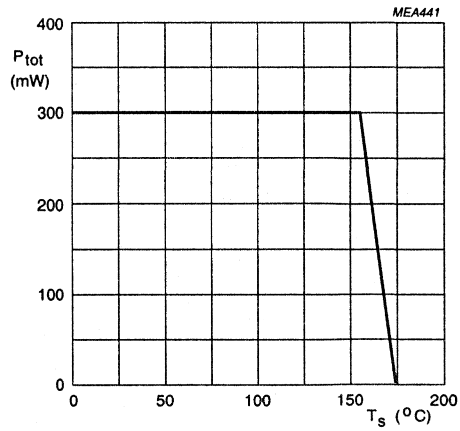
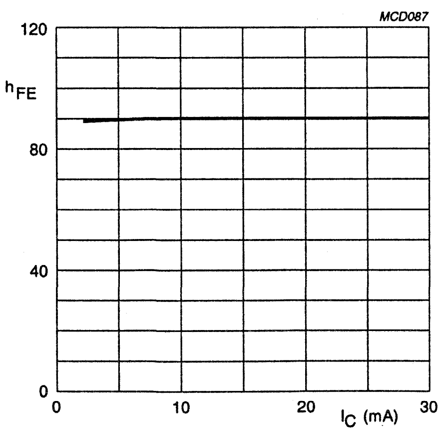
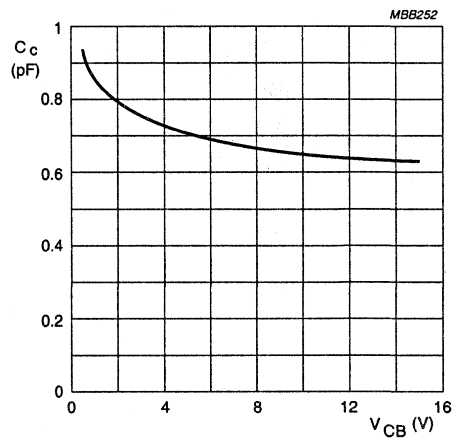


Fig.3 Power derating curve.



V_{CE} = 5 V; T_j = 25 °C.

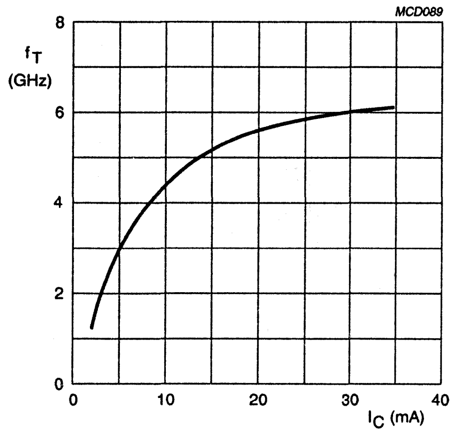
Fig.4 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

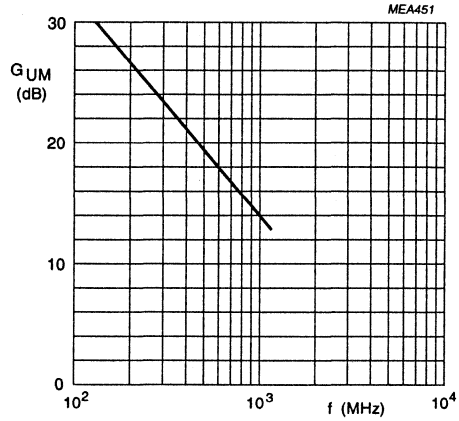
Fig.5 Collector capacitance as a function of collector-base voltage.

NPN 6 GHz wideband transistor BFR91A



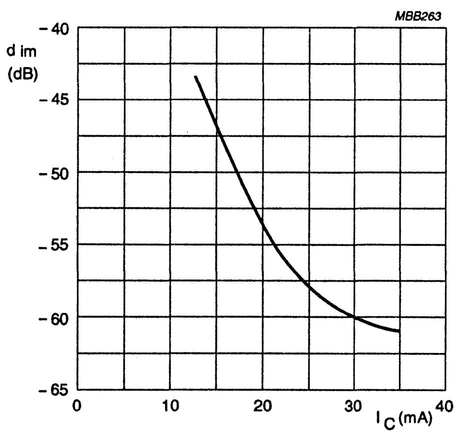
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



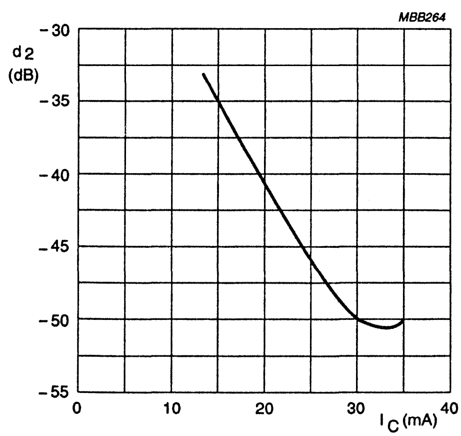
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



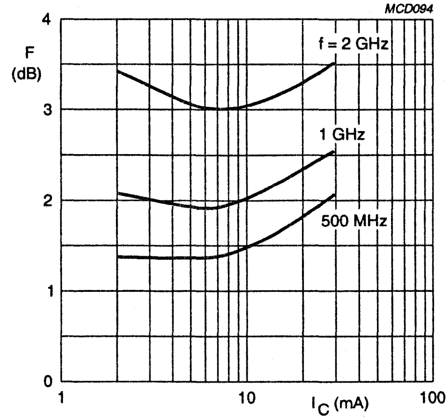
V_{CE} = 8 V; V_O = 425 mV = 52.60 dBmV;
$f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C;
measured in test circuit (see Fig.2).

Fig.8 Intermodulation distortion as a function of collector current.



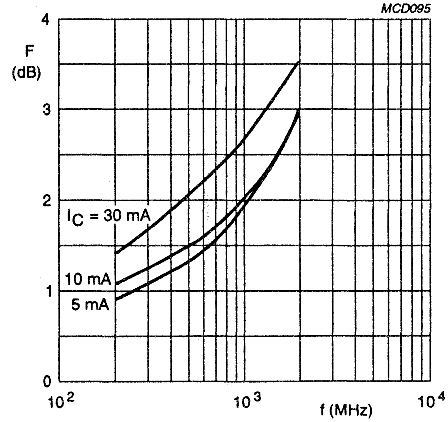
V_{CE} = 8 V; V_O = 200 mV = 46 dBmV;
$f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C;
measured in test circuit (see Fig.2).

Fig.9 Second order intermodulation distortion as a function of collector current.



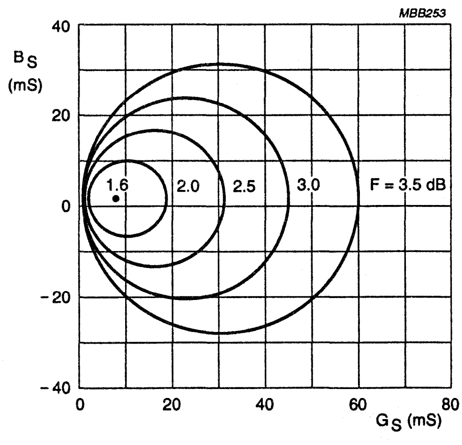
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



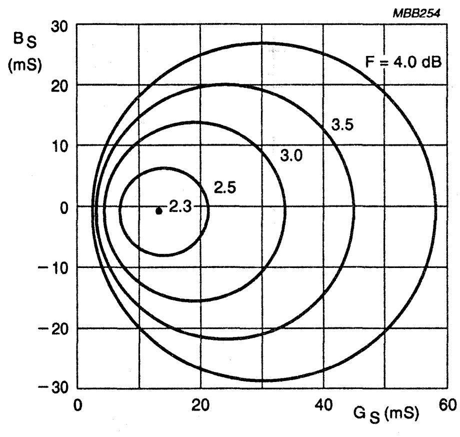
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



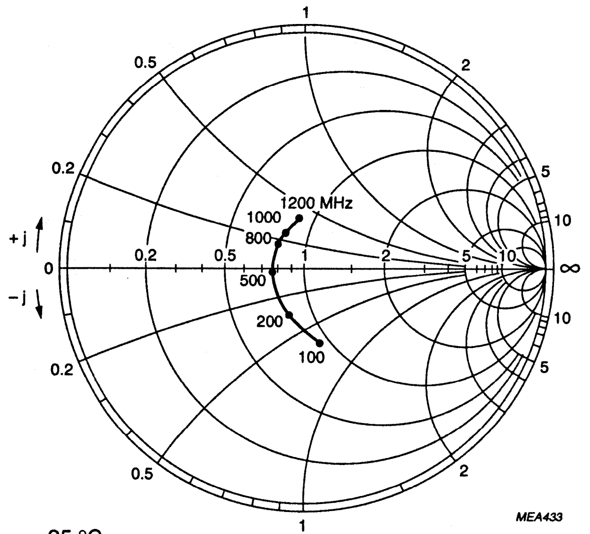
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.12 Noise circle figure.



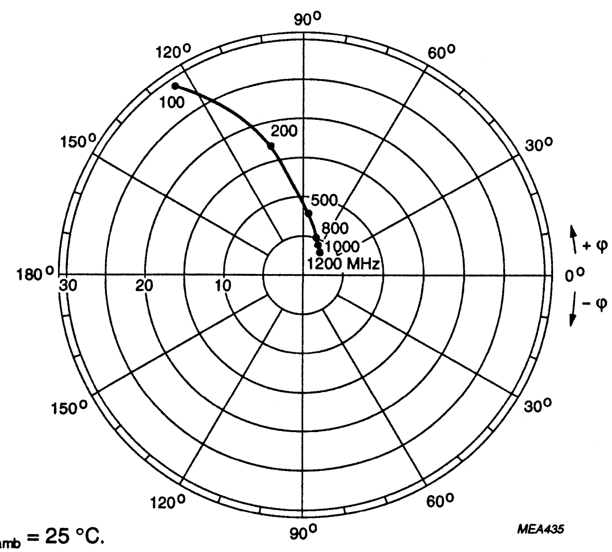
I_C = 30 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.13 Noise circle figure.



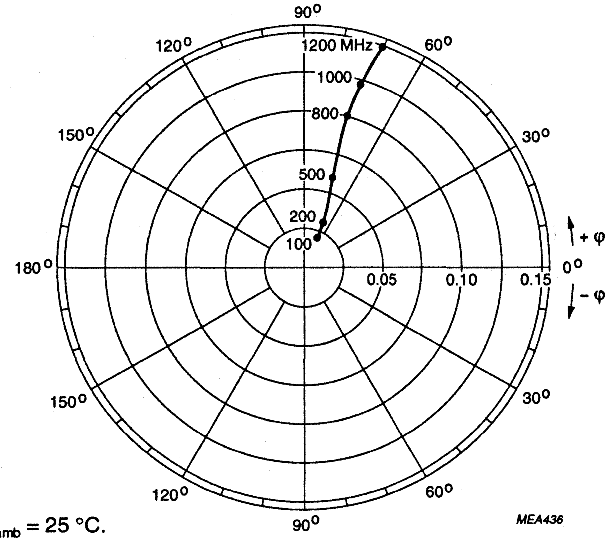
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.14 Common emitter input reflection coefficient (S_{11}).



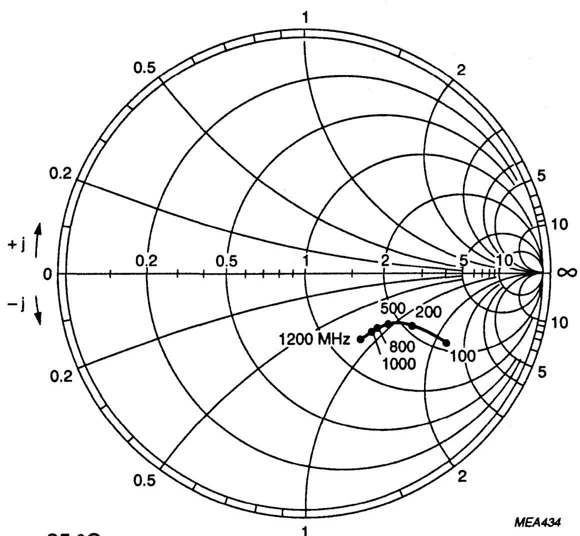
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.17 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.479	−33.9	36.860	152.9	0.010	78.4	0.894	−16.9	39.4
100	0.350	−71.5	26.190	127.3	0.020	70.2	0.683	−29.3	31.7
200	0.234	−109.6	15.844	107.9	0.034	70.3	0.501	−32.4	25.5
300	0.194	−136.0	11.107	98.3	0.046	72.0	0.429	−31.9	22.0
400	0.180	−154.6	8.502	91.9	0.059	73.3	0.396	−31.8	19.5
500	0.177	−168.1	6.879	87.2	0.072	73.4	0.377	−32.5	17.6
600	0.175	−179.6	5.792	83.4	0.085	73.2	0.367	−33.9	16.0
700	0.173	170.2	5.017	79.6	0.098	72.5	0.360	−35.5	14.7
800	0.174	160.3	4.427	76.2	0.110	71.7	0.355	−37.2	13.6
900	0.178	149.6	3.945	72.8	0.123	71.2	0.349	−38.8	12.6
1000	0.188	140.5	3.563	70.0	0.136	70.1	0.342	−40.6	11.7
1200	0.220	127.1	3.008	64.3	0.161	68.0	0.324	−45.4	10.3
1400	0.252	118.4	2.641	58.9	0.184	65.8	0.305	−51.6	9.1
1600	0.267	111.7	2.332	53.7	0.209	63.8	0.297	−58.9	8.1
1800	0.282	102.8	2.103	49.2	0.231	61.2	0.288	−65.6	7.2
2000	0.311	93.0	1.928	44.2	0.254	58.8	0.278	−71.3	6.5
2200	0.356	86.3	1.800	39.9	0.275	56.2	0.257	−77.9	6.0
2400	0.396	82.0	1.671	34.7	0.296	54.5	0.230	−87.8	5.4
2600	0.418	78.9	1.560	31.5	0.318	51.4	0.217	−100.5	4.9
2800	0.428	73.2	1.486	26.6	0.332	49.0	0.221	−112.7	4.5
3000	0.451	66.5	1.383	22.5	0.352	47.7	0.224	−121.9	4.0

Table 2 Common emitter scattering parameters, $I_C = 30$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.377	−40.1	43.686	148.7	0.009	77.3	0.858	−19.8	39.3
100	0.262	−81.4	28.795	122.5	0.019	72.9	0.621	−31.5	31.6
200	0.181	−120.9	16.681	104.7	0.032	74.4	0.452	−32.5	25.6
300	0.160	−147.3	11.556	96.0	0.046	74.9	0.391	−31.3	22.1
400	0.156	−164.4	8.808	90.3	0.059	76.0	0.364	−31.2	19.6
500	0.158	−176.4	7.109	86.0	0.073	75.7	0.348	−32.1	17.7
600	0.158	173.5	5.977	82.4	0.087	74.8	0.340	−33.6	16.2
700	0.158	164.1	5.171	78.9	0.100	74.0	0.334	−35.3	14.9
800	0.161	154.8	4.562	75.6	0.113	73.0	0.330	−37.2	13.8
900	0.166	144.6	4.065	72.3	0.127	72.1	0.325	−38.9	12.8
1000	0.178	135.7	3.670	69.6	0.140	70.8	0.318	−40.9	11.9
1200	0.209	123.8	3.097	64.2	0.165	68.3	0.300	−45.8	10.4
1400	0.242	115.9	2.718	58.9	0.190	66.0	0.281	−52.3	9.3
1600	0.257	109.9	2.399	53.9	0.215	63.8	0.273	−60.1	8.2
1800	0.272	101.3	2.164	49.5	0.237	60.9	0.264	−67.1	7.4
2000	0.301	91.6	1.982	44.6	0.261	58.4	0.254	−72.8	6.6
2200	0.346	85.2	1.849	40.3	0.281	55.8	0.233	−79.9	6.1
2400	0.386	81.2	1.717	35.2	0.302	53.9	0.206	−90.6	5.6
2600	0.407	78.4	1.604	31.9	0.325	50.6	0.194	−104.4	5.1
2800	0.419	73.0	1.524	27.2	0.338	48.2	0.200	−117.5	4.7
3000	0.442	66.3	1.422	23.1	0.358	46.7	0.203	−127.2	4.2

Table 3 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.506	−31.1	37.283	153.0	0.009	78.6	0.902	−15.6	40.0
100	0.364	−64.6	26.682	127.0	0.019	70.0	0.701	−27.0	32.1
200	0.225	−99.3	16.147	106.7	0.033	69.9	0.528	−29.5	25.8
300	0.170	−125.8	11.336	96.4	0.045	70.4	0.461	−29.2	22.3
400	0.151	−143.9	8.697	89.5	0.058	70.3	0.430	−29.4	19.8
500	0.138	−159.6	7.070	83.7	0.071	70.0	0.414	−30.9	17.9
600	0.138	−173.7	5.958	78.9	0.083	68.9	0.406	−32.5	16.4
700	0.131	173.4	5.122	74.5	0.096	67.7	0.402	−34.1	15.0
800	0.132	161.9	4.530	70.7	0.109	66.3	0.398	−35.9	13.9
900	0.136	150.8	4.039	66.6	0.121	64.5	0.393	−37.3	12.9
1000	0.150	141.8	3.665	63.0	0.133	63.0	0.386	−38.9	12.1
1200	0.178	124.3	3.117	55.5	0.158	59.2	0.362	−43.4	10.6
1400	0.215	116.2	2.709	48.8	0.181	55.3	0.337	−50.1	9.4
1600	0.236	108.2	2.408	42.2	0.205	51.9	0.329	−58.4	8.4
1800	0.247	99.7	2.211	35.5	0.229	48.2	0.329	−65.3	7.7
2000	0.283	91.4	2.018	29.1	0.251	43.8	0.317	−70.5	6.9
2200	0.318	85.1	1.855	23.1	0.271	40.1	0.293	−76.0	6.2
2400	0.362	80.5	1.750	17.8	0.292	36.4	0.265	−85.4	5.8
2600	0.388	76.7	1.661	11.2	0.312	32.4	0.250	−97.8	5.4
2800	0.407	70.0	1.562	5.0	0.332	28.3	0.251	−108.8	4.9
3000	0.426	64.3	1.474	0.0	0.349	24.8	0.253	−116.4	4.5

Table 4 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.414	−36.1	44.351	148.8	0.009	77.3	0.867	−18.2	39.8
100	0.279	−71.3	29.406	122.0	0.018	71.7	0.641	−28.7	32.0
200	0.167	−106.9	17.042	103.4	0.032	73.3	0.482	−29.1	25.9
300	0.131	−134.2	11.814	94.1	0.045	73.4	0.426	−28.3	22.4
400	0.120	−152.4	9.011	87.8	0.058	73.0	0.399	−28.7	19.9
500	0.114	−167.4	7.315	82.5	0.072	72.0	0.388	−30.1	18.0
600	0.118	178.3	6.152	77.9	0.085	70.6	0.382	−31.9	16.5
700	0.115	166.1	5.295	73.6	0.099	68.8	0.378	−34.0	15.2
800	0.117	155.2	4.665	70.1	0.111	67.3	0.374	−35.7	14.1
900	0.121	145.0	4.162	66.1	0.124	65.4	0.370	−37.3	13.1
1000	0.135	136.8	3.770	62.6	0.137	63.7	0.363	−38.8	12.2
1200	0.167	121.0	3.213	55.6	0.162	59.3	0.341	−43.5	10.8
1400	0.203	113.0	2.789	48.8	0.187	55.5	0.316	−50.5	9.5
1600	0.223	106.7	2.478	42.4	0.211	51.6	0.306	−59.0	8.5
1800	0.236	98.2	2.277	35.9	0.235	47.7	0.305	−66.4	7.8
2000	0.266	90.1	2.073	29.6	0.257	43.4	0.294	−71.5	7.0
2200	0.309	83.4	1.913	23.4	0.278	39.5	0.269	−77.2	6.4
2400	0.347	79.5	1.802	18.0	0.298	35.8	0.241	−87.0	5.9
2600	0.381	76.0	1.706	11.8	0.319	31.5	0.227	−100.4	5.6
2800	0.397	70.2	1.606	5.3	0.337	27.3	0.228	−112.0	5.1
3000	0.420	64.7	1.528	0.6	0.355	23.7	0.230	−119.8	4.8

NPN 5 GHz wideband transistor — BFR92

DESCRIPTION

NPN transistor in a plastic SOT23 envelope primarily intended for use in RF wideband amplifiers and oscillators. The transistor features low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PNP complement is BFT92.

PINNING

PIN	DESCRIPTION
	Code: P1p
1	base
2	emitter
3	collector

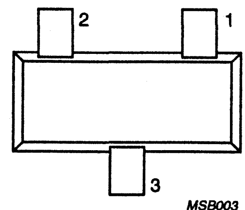


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 10 V; f = 1 MHz	0.4	–	pF
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	18	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	2.4	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	150	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

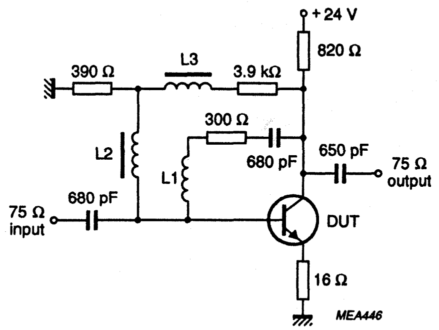
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 14 mA; V_{CE} = 10 V	40	90	–	
f_T	transition frequency	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.75	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	0.8	–	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	0.4	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 14 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
F	noise figure (see Fig.2 and note 2)	I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	–	2.4	–	dB
V_O	output voltage	note 3	–	150	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. Crystal mounted in a SOT37 envelope (BFR90).
3. d_{im} = −60 dB (DIN 45004B); I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 495.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 503.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.

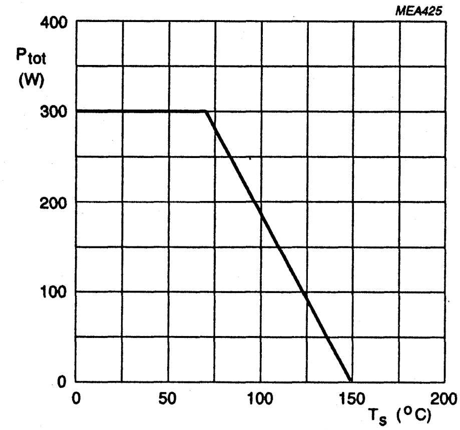
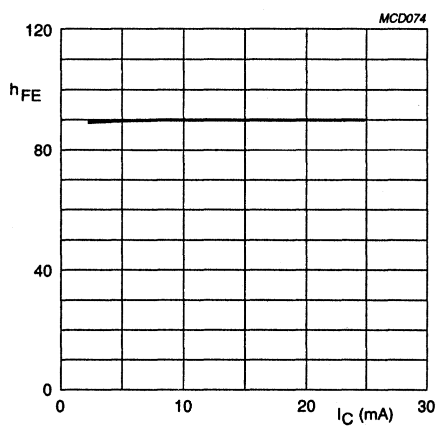
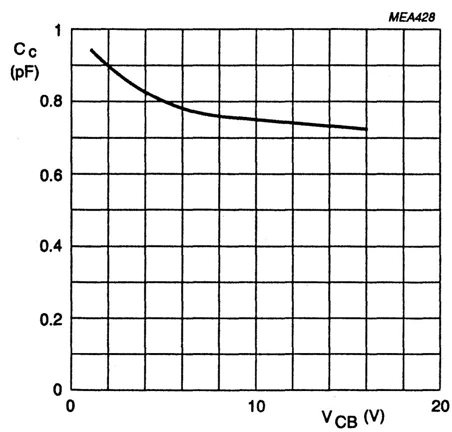


Fig.3 Power derating curve.



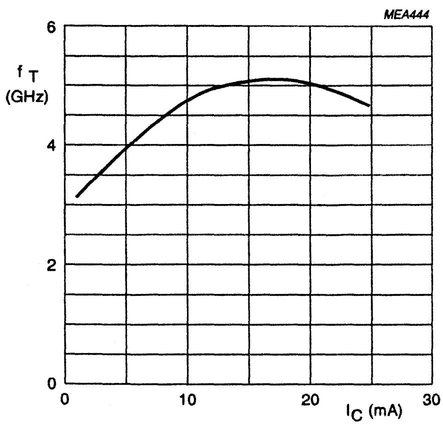
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



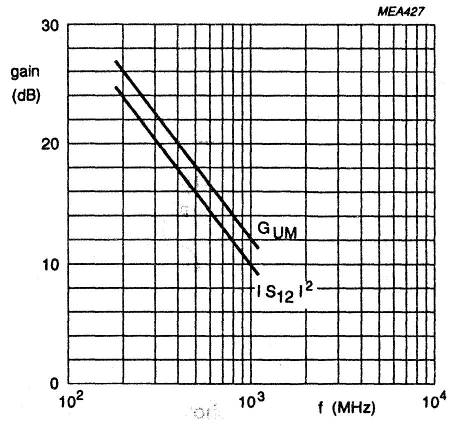
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



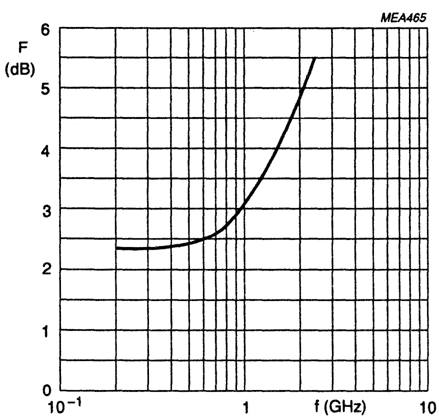
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



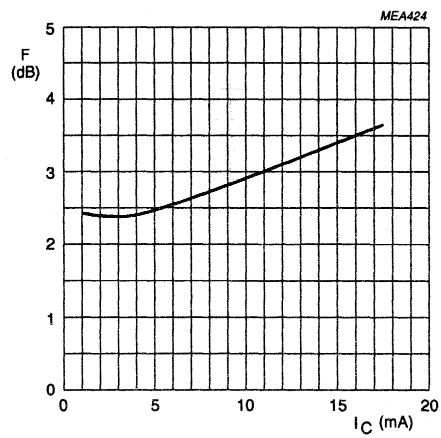
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Gain as a function of frequency.



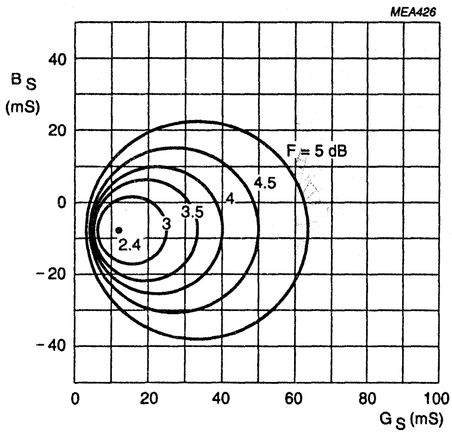
I_C = 2 mA; V_{CE} = 10 V; T_{amb} = 25 °C; Z_S = opt.

Fig.8 Minimum noise figure as a function of frequency.



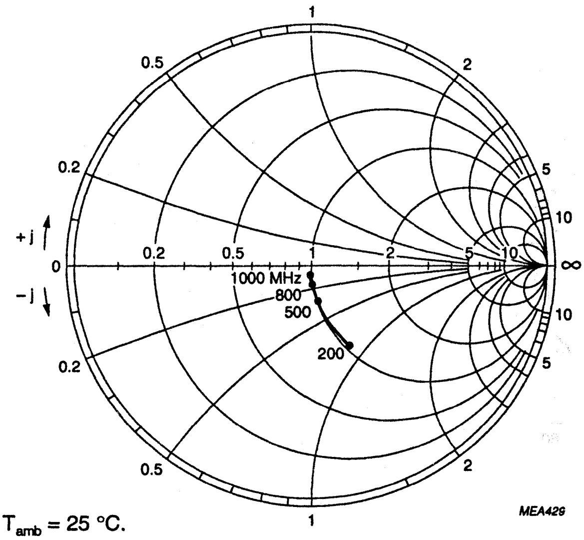
V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.

Fig.9 Minimum noise figure as a function of collector current.



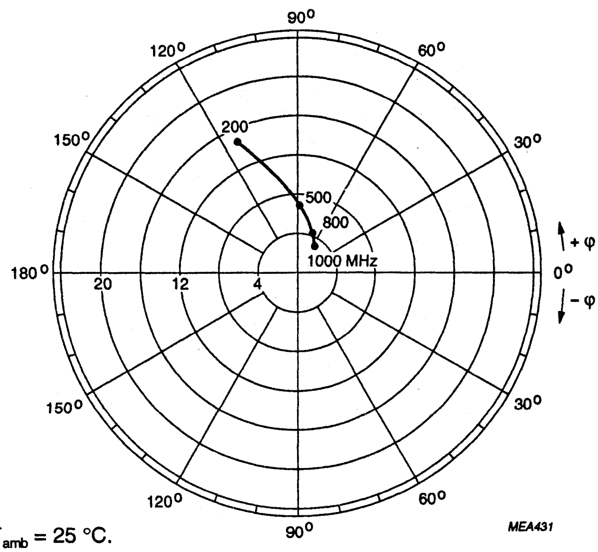
I_C = 2 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.



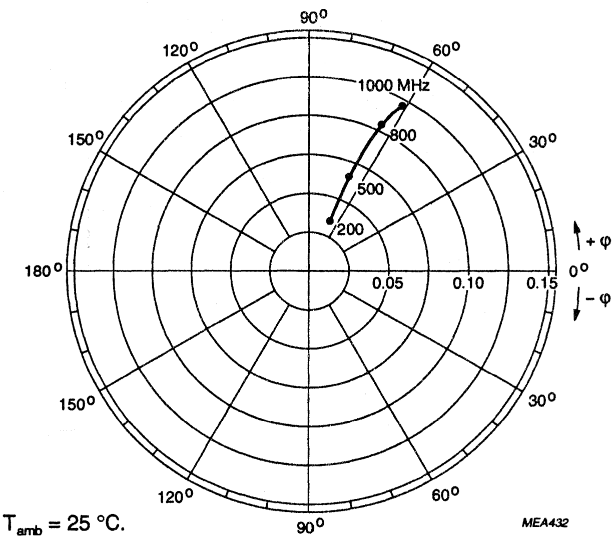
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter input reflection coefficient (S_{11}).



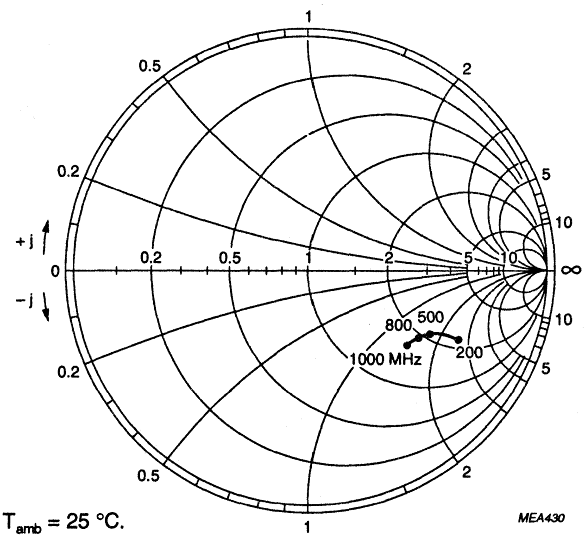
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter forward transmission coefficient (S_{21}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

NPN 5 GHz wideband transistor — BFR92A

FEATURES

- High power gain
- Low noise figure
- Low intermodulation distortion
- PNP complement is BFT92.

DESCRIPTION

NPN transistor in a plastic SOT23 envelope. It is primarily intended for use in RF wideband amplifiers and oscillators.

PINNING

PIN	DESCRIPTION
Code: P2p	
1	base
2	emitter
3	collector

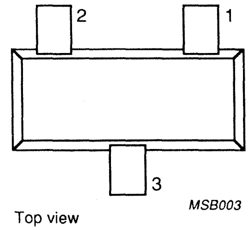


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	20	V
V_{CEO}	collector-emitter voltage		–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 10 V; f = 1 MHz	0.35	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	14	–	dB
		I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	2.1	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	150	–	mV

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		−65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

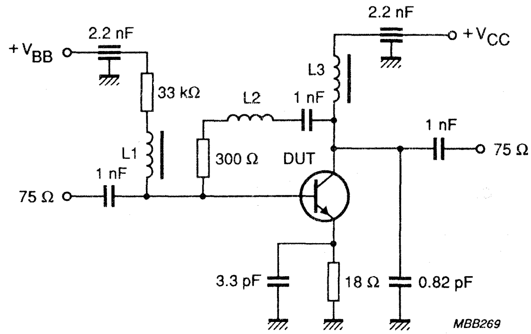
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 10$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 10$ V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	14	–	dB
		$I_C = 15$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	2.1	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB
V_O	output voltage	notes 2 and 3	–	150	–	mV
d_2	second order intermodulation distortion	notes 2 and 4	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. Measured on the same crystal in a SOT37 envelope (BFR90A).
3. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $T_{amb} = 25$ °C; $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; VSWR < 2;
   $V_p = 60$ mV at $f_p = 250$ MHz;
   $V_q = 60$ mV at $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.



L1 = L3 = 5 μH choke.

L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second harmonic distortion MATV test circuit.

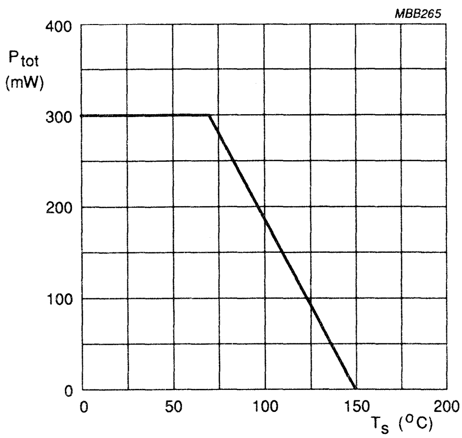
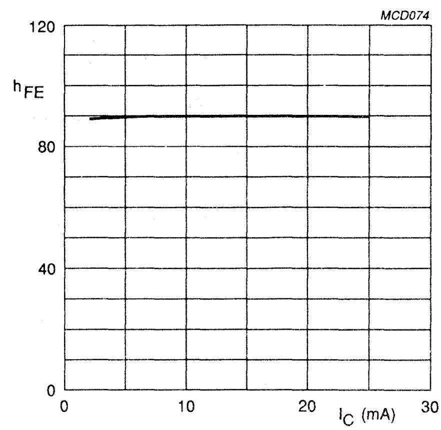


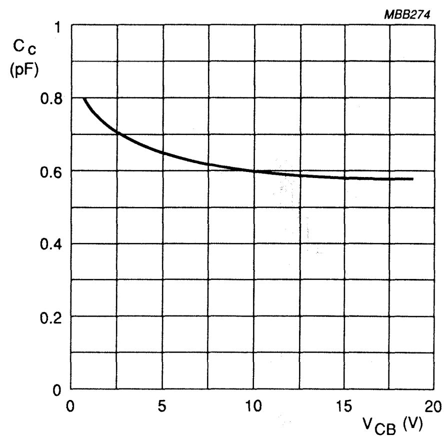
Fig.3 Power derating curve.



V_{CE} = 10 V; T_j = 25 °C.

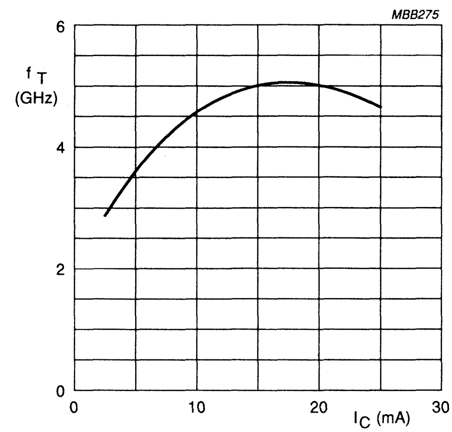
Fig.4 DC current gain as a function of collector current, typical values.

NPN 5 GHz wideband transistor BFR92A



$I_C = i_c = 0$; f = 1 MHz; T_j = 25 °C.

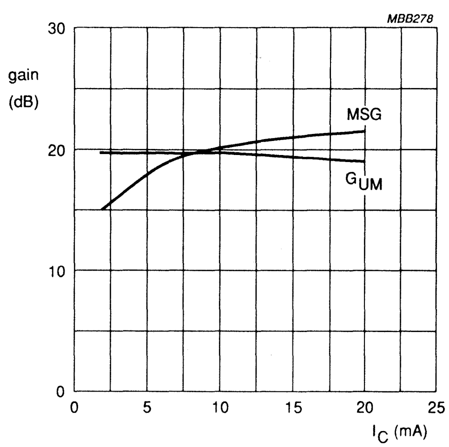
Fig.5 Collector capacitance as a function of collector-base voltage, typical values.



V_{CE} = 10 V; T_{amb} = 25 °C; f = 500 MHz.

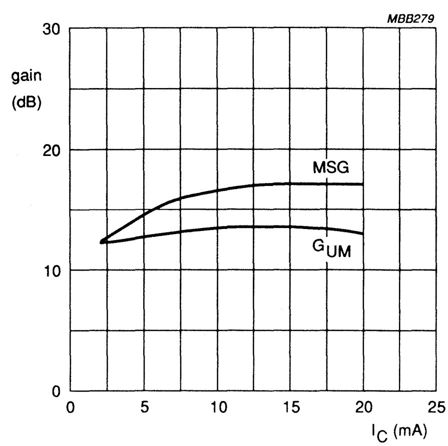
Fig.6 Transition frequency as a function of collector current, typical values.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



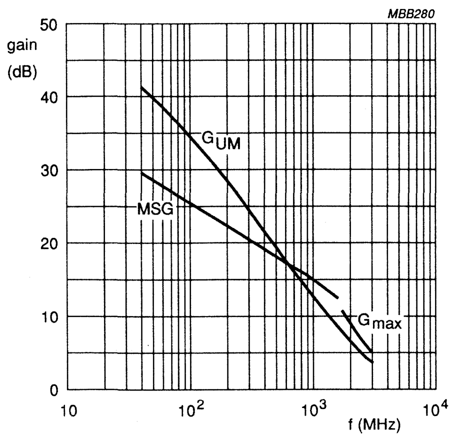
V_{CE} = 10 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



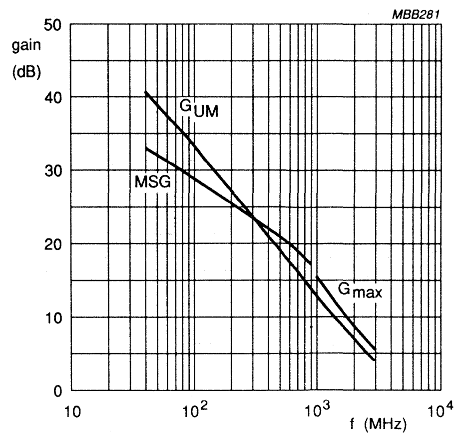
V_{CE} = 10 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



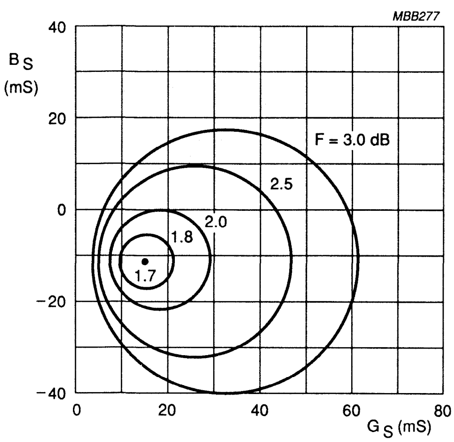
V_{CE} = 10 V; I_C = 5 mA.

Fig.9 Gain as a function of frequency.



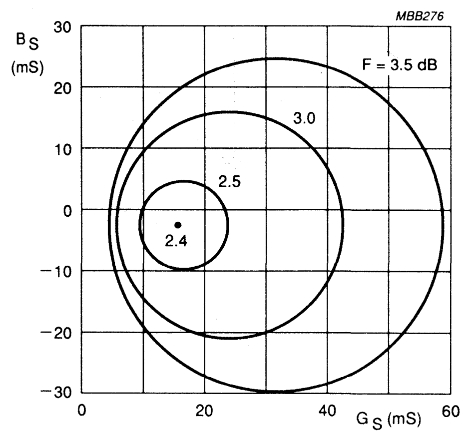
V_{CE} = 10 V; I_C = 15 mA.

Fig.10 Gain as a function of frequency.



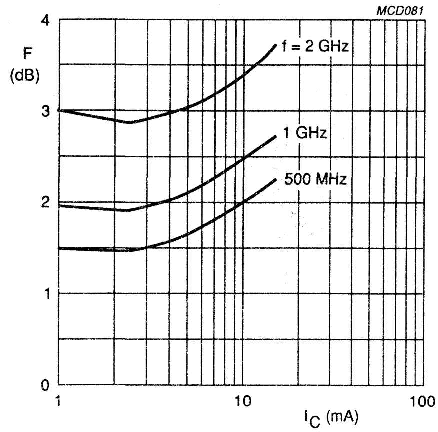
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.11 Circles of constant noise figure, typical values.



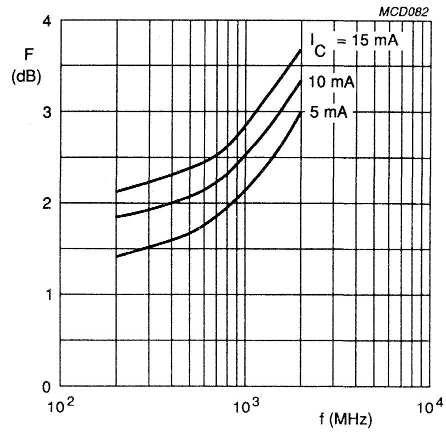
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.12 Circles of constant noise figure, typical values.



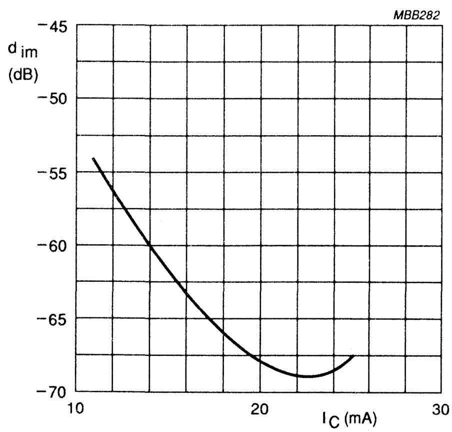
$V_{CE} = 10$ V.

Fig.13 Minimum noise figure as a function of collector current.



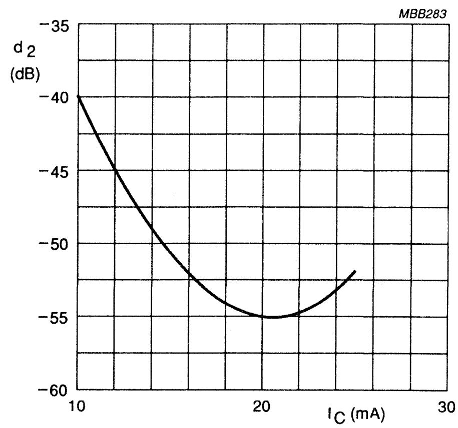
$V_{CE} = 10$ V.

Fig.14 Minimum noise figure as a function of frequency.



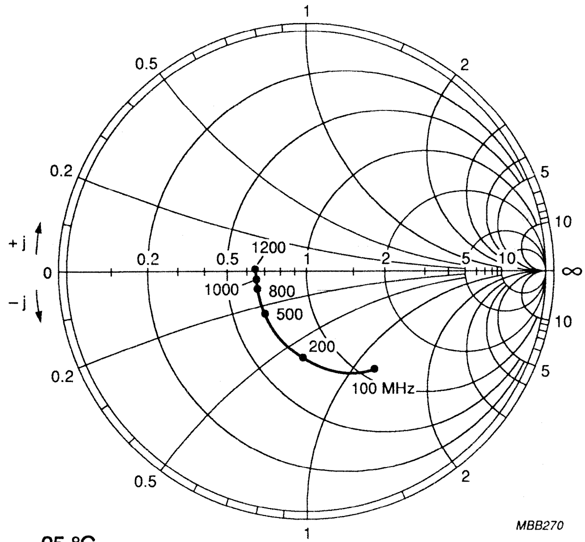
$V_{CE} = 10$ V; $V_O = 150$ mV (43.5 dBmV);
$f_{(p+q-r)} = 793.25$ MHz; $T_{amb} = 25$ °C.
Measured in MATV test circuit (see Fig.2).

Fig.15 Intermodulation distortion, typical values.



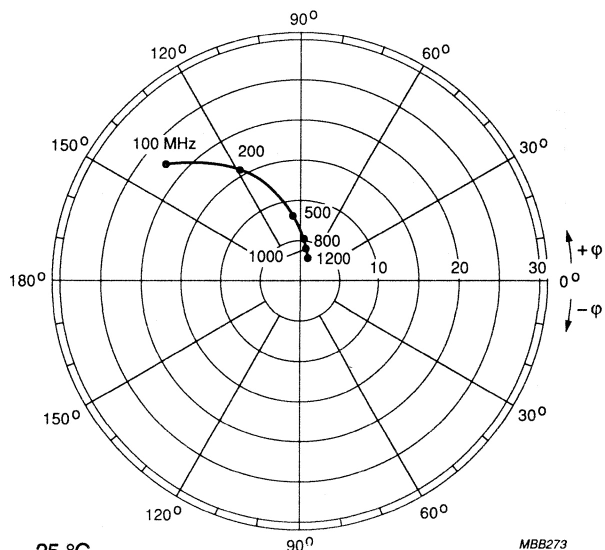
$V_{CE} = 10$ V; $V_O = 60$ mV; $f_{(p+q-r)} = 810$ MHz;
$T_{amb} = 25$ °C.
Measured in MATV test circuit (see Fig.2).

Fig.16 Second order intermodulation distortion, typical values.



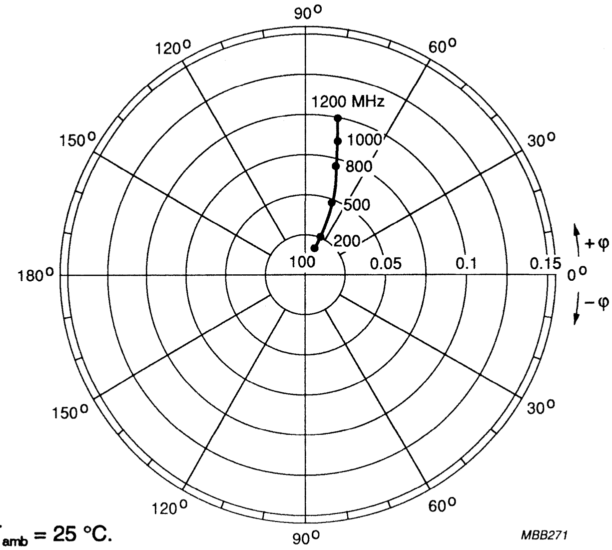
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig.17 Common emitter input reflection coefficient (S_{11}).



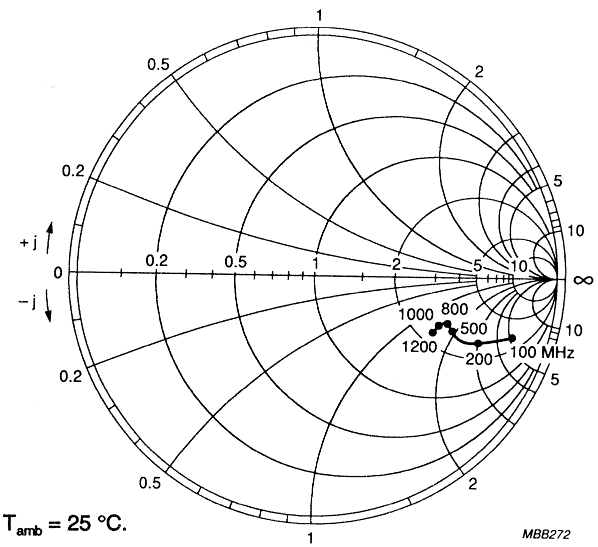
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig.18 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).

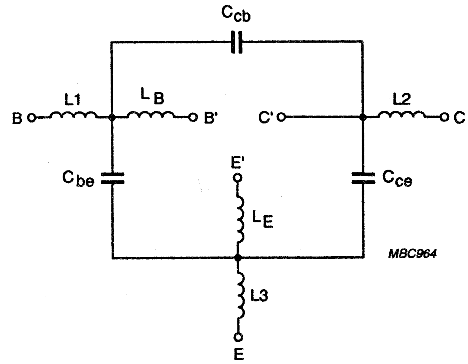


V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR90A crystal

1	IS = 411.8	aA
2	BF = 102.6	–
3	NF = 997.2	m–
4	VAF = 62.67	V
5	IKF = 3.200	A
6	ISE = 4.010	fA
7	NE = 1.577	–
8	BR = 18.10	–
9	NR = 996.2	m
10	VAR = 3.369	V
11	IKR = 1.281	A
12	ISC = 279.9	aA
13	NC = 1.075	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 1.164	Ω
18	RC = 2.320	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 890.5	fF
23	VJE = 600.0	mV
24	MJE = 258.5	m
25	TF = 15.49	ps
26	XTF = 39.14	–
27	VTF = 2.152	V
28	ITF = 213.7	mA
29	PTF = 0.000	deg
30	CJC = 546.5	fF
31	VJC = 380.8	mV
32	MJC = 202.9	m
33	XCJC = 150.0	m
34	TR = 5.618	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 850.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT23.

List of components (see Fig.21)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.25 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.789	−12.2	14.151	169.0	0.009	85.7	0.987	−5.4	43.0
100	0.742	−28.7	12.938	154.2	0.023	74.9	0.936	−12.5	34.8
200	0.627	−53.5	10.952	136.7	0.040	66.9	0.824	−20.4	27.9
300	0.524	−72.0	8.943	123.7	0.050	62.6	0.736	−24.4	23.8
400	0.455	−86.4	7.427	114.4	0.059	60.9	0.670	−26.6	21.0
500	0.400	−100.5	6.449	107.0	0.067	60.8	0.625	−27.1	19.1
600	0.354	−109.4	5.509	101.8	0.075	62.4	0.596	−27.8	17.3
700	0.324	−113.7	4.835	97.3	0.081	63.9	0.576	−28.1	15.9
800	0.296	−124.7	4.293	93.0	0.089	64.8	0.563	−28.3	14.7
900	0.281	−129.5	3.890	89.5	0.097	66.0	0.555	−28.6	13.8
1000	0.251	−141.5	3.524	85.4	0.103	67.3	0.543	−28.8	12.7
1200	0.246	−153.8	3.007	79.6	0.119	68.9	0.532	−29.8	11.3
1400	0.243	−165.3	2.651	74.3	0.136	69.1	0.521	−31.5	10.1
1600	0.237	−174.0	2.363	70.5	0.152	71.0	0.520	−32.6	9.1
1800	0.211	174.9	2.091	65.9	0.170	71.2	0.518	−34.3	8.0
2000	0.226	163.6	1.969	61.9	0.186	71.6	0.513	−35.7	7.4
2200	0.240	149.9	1.783	57.6	0.206	72.3	0.495	−37.3	6.5
2400	0.243	149.5	1.690	54.2	0.227	71.5	0.482	−40.9	6.0
2600	0.253	146.9	1.593	51.7	0.245	71.1	0.478	−44.4	5.5
2800	0.244	136.4	1.506	49.0	0.265	71.1	0.481	−46.9	5.0
3000	0.275	129.0	1.427	44.9	0.286	70.2	0.469	−48.4	4.5

Table 2 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.669	−16.6	23.024	164.2	0.008	79.9	0.970	−8.2	42.1
100	0.593	−39.2	19.631	145.4	0.020	72.1	0.873	−17.5	34.0
200	0.449	−67.6	14.753	125.9	0.033	68.7	0.716	−24.7	27.5
300	0.356	−86.7	11.181	113.9	0.043	66.2	0.620	−26.8	23.7
400	0.313	−99.2	8.899	106.3	0.052	68.0	0.562	−27.2	21.1
500	0.275	−113.9	7.512	99.9	0.060	67.4	0.531	−26.9	19.3
600	0.243	−120.1	6.336	95.7	0.070	69.7	0.512	−26.9	17.6
700	0.219	−127.0	5.513	92.2	0.078	71.3	0.499	−26.9	16.3
800	0.213	−139.5	4.868	88.8	0.089	72.4	0.494	−27.0	15.2
900	0.194	−144.7	4.391	85.8	0.098	72.5	0.488	−27.2	14.2
1000	0.182	−156.2	3.953	82.4	0.106	73.1	0.479	−27.4	13.2
1200	0.190	−163.4	3.339	77.5	0.125	73.5	0.472	−28.3	11.7
1400	0.193	−175.5	2.945	72.4	0.144	73.3	0.465	−30.1	10.6
1600	0.185	−179.0	2.626	69.3	0.163	73.6	0.466	−31.4	9.6
1800	0.163	163.1	2.316	65.0	0.181	73.3	0.465	−32.8	8.5
2000	0.179	156.0	2.174	61.7	0.200	72.6	0.462	−34.0	7.9
2200	0.210	142.6	1.977	57.6	0.219	72.5	0.443	−35.4	7.1
2400	0.216	144.8	1.857	54.6	0.240	71.1	0.429	−38.9	6.5
2600	0.230	143.8	1.762	52.1	0.258	70.5	0.424	−42.4	6.0
2800	0.213	136.1	1.657	49.3	0.279	70.0	0.427	−44.9	5.5
3000	0.240	127.1	1.571	45.5	0.299	68.6	0.419	−46.0	5.0

Table 3 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 15 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.611	−47.6	23.942	153.8	0.018	70.1	0.899	−21.1	36.8
100	0.585	−97.9	17.649	128.3	0.034	53.6	0.663	−39.5	29.3
200	0.580	−136.4	10.944	108.4	0.044	49.3	0.441	−48.3	23.5
300	0.586	−153.8	7.705	98.4	0.052	50.8	0.349	−49.8	20.1
400	0.591	−163.6	5.905	92.0	0.061	54.1	0.306	−50.6	17.7
500	0.596	−170.5	4.800	86.8	0.068	57.6	0.283	−51.4	15.9
600	0.596	−175.5	4.045	82.7	0.078	60.2	0.271	−52.7	14.4
700	0.591	−179.8	3.519	79.2	0.086	62.2	0.265	−54.4	13.1
800	0.590	176.4	3.119	75.7	0.096	64.2	0.263	−56.3	12.0
900	0.590	172.5	2.777	72.5	0.105	65.3	0.261	−58.4	11.0
1000	0.588	168.7	2.522	69.6	0.115	66.6	0.260	−60.9	10.2
1200	0.595	162.6	2.131	64.5	0.136	68.3	0.263	−66.0	8.8
1400	0.609	157.1	1.869	59.1	0.157	68.8	0.269	−72.4	7.8
1600	0.613	152.1	1.661	53.9	0.180	69.8	0.277	−78.0	6.8
1800	0.604	146.7	1.510	49.6	0.206	69.4	0.284	−83.8	5.9
2000	0.609	140.9	1.392	45.3	0.229	69.5	0.287	−90.0	5.3
2200	0.623	135.9	1.299	41.6	0.255	68.7	0.290	−98.3	4.8
2400	0.630	132.4	1.197	37.6	0.279	68.7	0.301	−107.1	4.2
2600	0.618	128.7	1.117	34.6	0.309	67.3	0.321	−114.3	3.5
2800	0.602	123.0	1.071	30.4	0.336	65.4	0.344	−120.4	3.1
3000	0.597	117.1	1.009	27.5	0.368	64.8	0.355	−126.1	2.6

Table 4 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.813	−11.6	13.669	169.3	0.009	82.2	0.987	−4.9	43.3
100	0.769	−27.1	12.628	155.3	0.021	74.3	0.944	−11.4	35.5
200	0.650	−50.5	10.807	138.0	0.038	68.1	0.841	−19.1	28.4
300	0.547	−67.7	8.877	125.0	0.049	63.7	0.756	−22.8	24.2
400	0.471	−81.3	7.404	116.0	0.057	62.0	0.693	−24.8	21.3
500	0.419	−95.8	6.458	108.1	0.064	61.1	0.650	−25.5	19.4
600	0.358	−103.4	5.540	102.9	0.072	62.4	0.622	−26.2	17.6
700	0.325	−107.4	4.858	98.5	0.078	64.2	0.600	−26.5	16.2
800	0.302	−120.5	4.332	93.9	0.087	64.5	0.588	−26.7	15.0
900	0.277	−126.3	3.927	90.5	0.093	65.4	0.580	−26.9	14.0
1000	0.248	−136.6	3.550	86.3	0.100	67.0	0.569	−27.3	13.0
1200	0.231	−148.8	3.023	80.6	0.116	68.8	0.557	−28.2	11.5
1400	0.232	−160.5	2.670	75.2	0.131	69.6	0.547	−29.9	10.3
1600	0.218	−166.8	2.382	71.5	0.147	71.3	0.546	−31.1	9.3
1800	0.189	176.8	2.111	66.9	0.164	72.1	0.544	−32.6	8.2
2000	0.200	170.6	1.986	62.9	0.179	72.4	0.541	−34.0	7.6
2200	0.216	154.4	1.791	58.5	0.197	72.9	0.522	−35.6	6.7
2400	0.241	153.0	1.713	55.4	0.219	72.4	0.510	−39.1	6.2
2600	0.237	147.5	1.595	52.7	0.235	72.4	0.506	−42.4	5.6
2800	0.231	139.9	1.511	50.2	0.255	72.4	0.509	−44.9	5.1
3000	0.250	130.6	1.449	46.0	0.275	71.7	0.499	−46.0	4.7

Table 5 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.720	−15.5	22.111	164.9	0.009	84.4	0.971	−7.4	42.5
100	0.640	−36.3	19.093	146.7	0.019	71.8	0.888	−16.0	34.6
200	0.491	−62.5	14.569	127.5	0.033	66.9	0.737	−22.9	27.9
300	0.399	−79.3	11.152	115.3	0.042	66.2	0.645	−25.0	24.0
400	0.332	−93.0	8.913	107.6	0.051	66.1	0.590	−25.5	21.4
500	0.293	−105.2	7.577	101.1	0.059	67.9	0.558	−25.3	19.6
600	0.254	−113.7	6.396	96.8	0.068	69.1	0.539	−25.5	17.9
700	0.231	−116.5	5.558	93.2	0.076	70.7	0.525	−25.5	16.5
800	0.205	−128.9	4.910	89.6	0.085	71.8	0.519	−25.5	15.4
900	0.189	−134.8	4.431	86.7	0.095	72.5	0.516	−25.8	14.4
1000	0.180	−146.7	3.989	83.1	0.103	72.7	0.508	−26.0	13.5
1200	0.169	−156.5	3.375	78.3	0.121	73.5	0.499	−26.8	11.9
1400	0.167	−169.7	2.967	73.4	0.139	73.3	0.492	−28.7	10.8
1600	0.160	−171.2	2.653	70.2	0.157	73.9	0.493	−29.7	9.8
1800	0.147	172.2	2.333	65.9	0.175	73.2	0.493	−31.2	8.7
2000	0.161	164.3	2.197	62.7	0.192	73.1	0.492	−32.4	8.2
2200	0.181	143.5	1.998	58.6	0.212	73.0	0.472	−33.8	7.3
2400	0.197	151.3	1.868	55.5	0.232	71.9	0.458	−37.1	6.6
2600	0.211	147.3	1.760	52.8	0.249	71.1	0.455	−40.6	6.1
2800	0.189	139.6	1.663	51.2	0.269	71.0	0.458	−42.8	5.6
3000	0.200	128.0	1.591	46.5	0.287	69.7	0.448	−44.1	5.2

Table 6 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.672	−18.4	26.592	162.4	0.008	77.9	0.958	−8.7	42.0
100	0.578	−41.1	22.062	142.4	0.019	69.8	0.853	−17.8	34.3
200	0.415	−67.7	15.884	123.0	0.032	69.8	0.695	−23.9	27.7
300	0.326	−84.7	11.832	111.6	0.040	68.6	0.604	−25.0	23.9
400	0.283	−97.6	9.353	104.5	0.049	70.2	0.555	−25.1	21.4
500	0.247	−110.7	7.884	98.6	0.058	70.0	0.527	−24.5	19.6
600	0.211	−119.1	6.622	94.7	0.067	71.7	0.512	−24.5	17.9
700	0.197	−123.3	5.747	91.3	0.076	73.6	0.503	−24.7	16.6
800	0.172	−135.1	5.060	88.1	0.087	73.4	0.499	−24.6	15.5
900	0.159	−139.5	4.561	85.2	0.095	74.8	0.496	−25.0	14.5
1000	0.147	−152.9	4.106	82.0	0.105	74.6	0.489	−25.1	13.6
1200	0.149	−160.4	3.476	77.1	0.124	74.6	0.482	−26.1	12.1
1400	0.160	−172.5	3.055	72.7	0.143	74.2	0.477	−28.1	10.9
1600	0.151	−173.3	2.723	69.8	0.160	74.0	0.478	−29.1	9.9
1800	0.128	168.0	2.396	65.6	0.179	74.0	0.478	−30.8	8.8
2000	0.153	159.3	2.249	62.0	0.195	73.2	0.476	−32.0	8.3
2200	0.168	141.5	2.040	57.9	0.214	72.8	0.458	−33.1	7.3
2400	0.195	148.3	1.915	55.5	0.235	71.6	0.443	−36.5	6.8
2600	0.192	144.7	1.809	52.5	0.254	70.8	0.440	−39.8	6.2
2800	0.175	137.8	1.694	50.8	0.272	70.3	0.443	−42.3	5.7
3000	0.205	127.6	1.619	47.0	0.292	69.0	0.433	−43.2	5.3

NPN 5 GHz wideband transistor | BFR92AW

FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 envelope. It is designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz. The BFR92AW uses the same crystal as the SOT23 version, BFR92A.

PINNING

PIN	DESCRIPTION
Code: P2	
1	base
2	emitter
3	collector

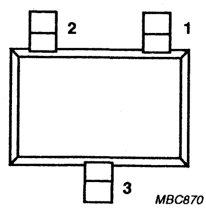


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 10 V	40	90	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V	–	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; f = 1 GHz	–	14	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; f = 1 GHz	–	2.1	–	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	190	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 5 GHz wideband transistor

BFR93

DESCRIPTION

NPN transistor in a plastic SOT23 envelope primarily intended for use in RF amplifiers and oscillators. The transistor features very low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

A SOT54 (TO-92) version (ref: ON4186) is available on request.

PNP complement is BFT93.

PINNING

PIN	DESCRIPTION
Code: R1p	
1	base
2	emitter
3	collector

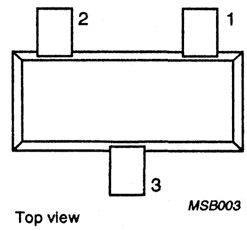


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	0.8	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	16.5	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	1.9	–	dB
d_{im}	intermodulation distortion	I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_O = 300 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	–60	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

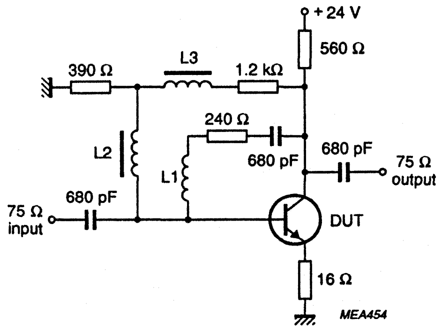
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	1.8	–	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	16.5	–	dB
F	noise figure (note 2)	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.	–	1.9	–	dB
d_{im}	intermodulation distortion	note 3	–	–60	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. Crystal mounted in a SOT37 envelope (BFR91).
3. I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C;
   $V_p = V_O$ = 300 mV at f_p = 495.25 MHz;
   $V_q = V_O$ –6 dB at f_q = 503.25 MHz;
   $V_r = V_O$ –6 dB at f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.

NPN 5 GHz wideband transistor BFR93



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.

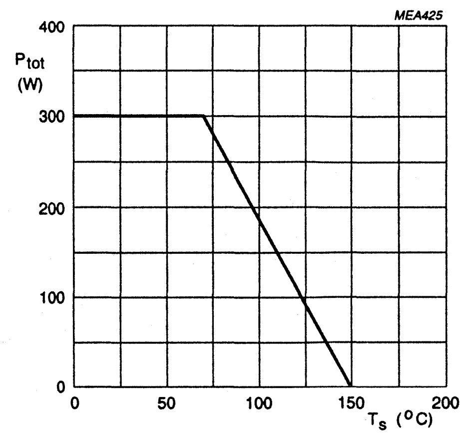
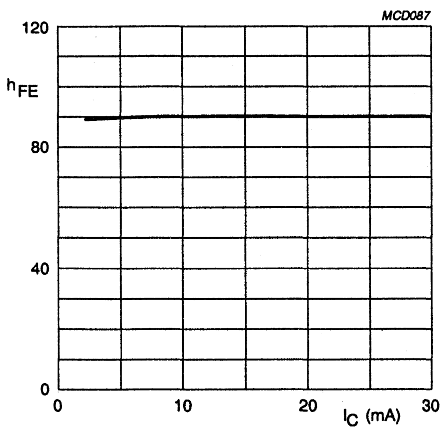
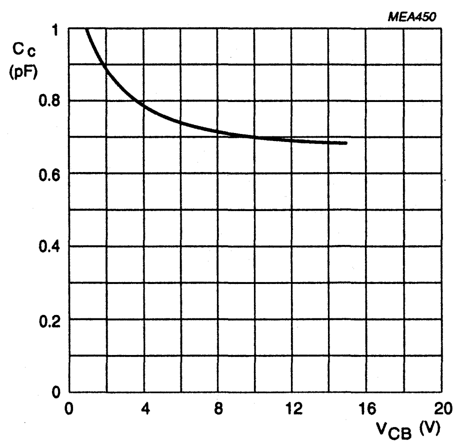


Fig.3 Power derating curve.



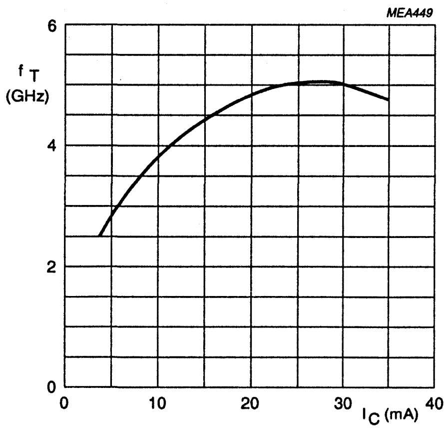
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



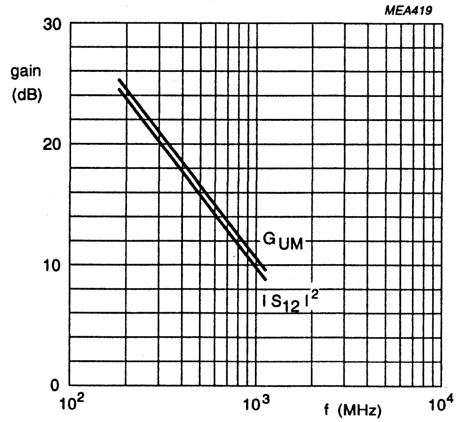
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



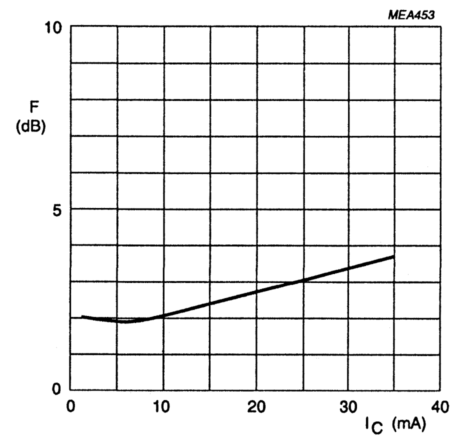
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



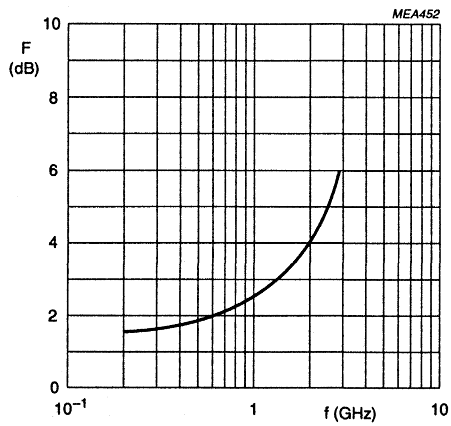
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.7 Gain as a function of frequency.



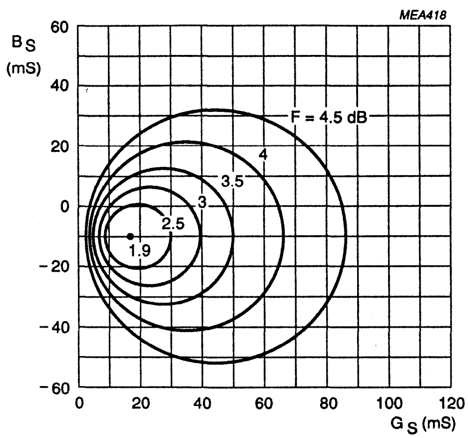
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; Z_S = opt.

Fig.8 Minimum noise figure as a function of collector current.



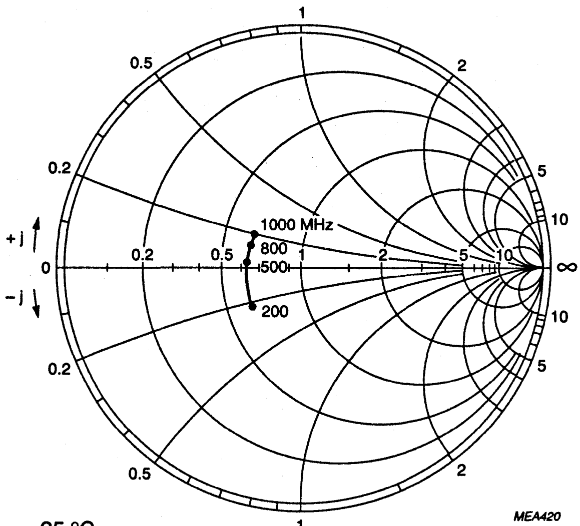
I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C; Z_S = opt.

Fig.9 Minimum noise figure as a function of frequency.



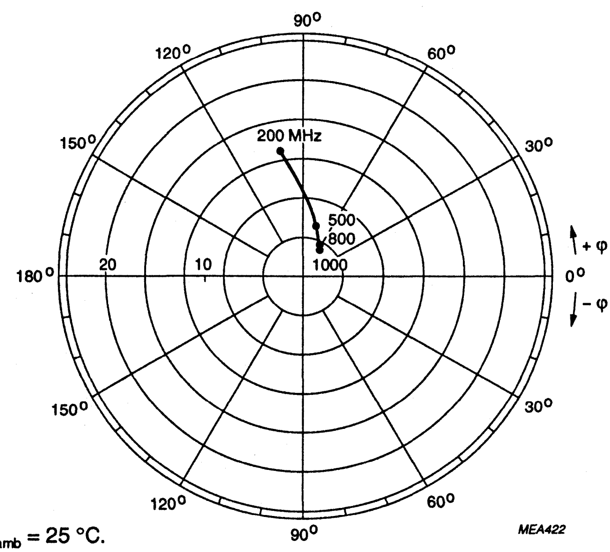
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.



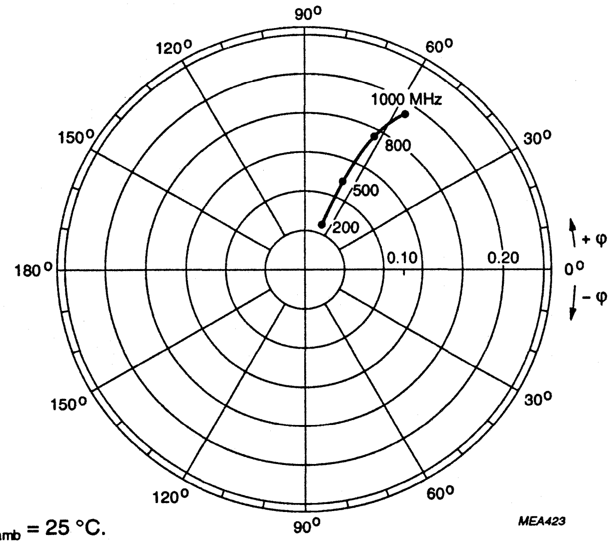
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Common emitter input reflection coefficient (S_{11}).



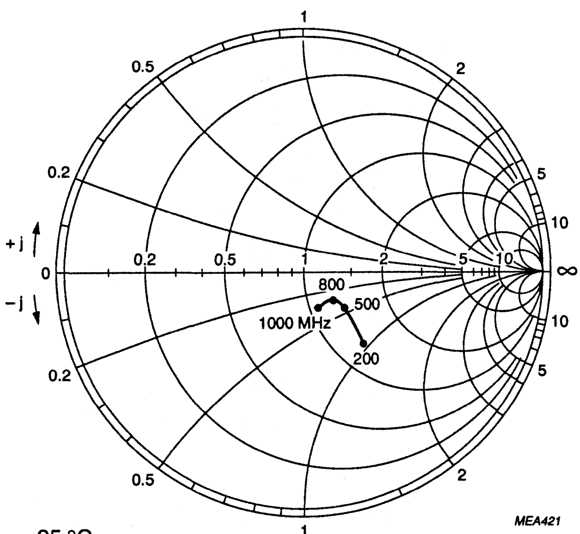
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.12 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

NPN 6 GHz wideband transistor — BFR93A

FEATURES

- High power gain
- Low noise figure
- Very low intermodulation distortion
- PNP complement is the BFT93.

PINNING

PIN	DESCRIPTION
Code: R2p	
1	base
2	emitter
3	collector

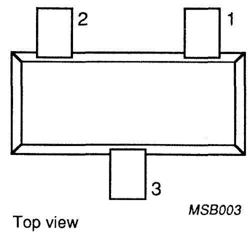


Fig.1 SOT23.

DESCRIPTION

NPN transistor in a plastic SOT23 envelope. It is primarily intended for use in RF wideband amplifiers and oscillators.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
C_{re}	feedback capacitance	V_{CE} = 5 V; I_C = 0; f = 1 MHz	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	13	–	dB
		I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	7	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	1.9	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 30 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	425	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

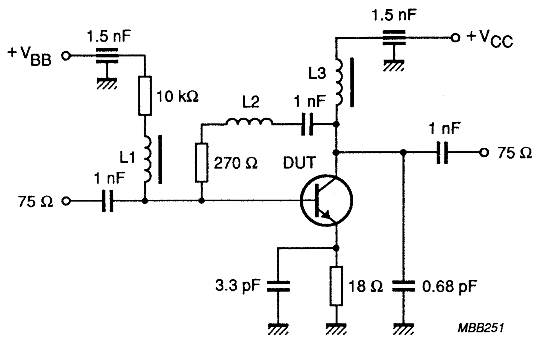
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	13	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	7	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.9	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB
V_O	output voltage	notes 2 and 3	–	425	–	mV
d_2	second order intermodulation distortion	notes 2 and 4	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. Measured on the same crystal in a SOT37 envelope (BFR91A).
3. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 30$ mA; $V_{CE} = 8$ V; $R_L = 75\ \Omega$;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $T_{amb} = 25$ °C; $I_C = 30$ mA; $V_{CE} = 8$ V; $R_L = 75\ \Omega$;
   $V_p = 200$ mV at $f_p = 250$ MHz;
   $V_q = 200$ mV at $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.



L1 = L3 = 5 μH choke.

L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second harmonic distortion MATV test circuit.

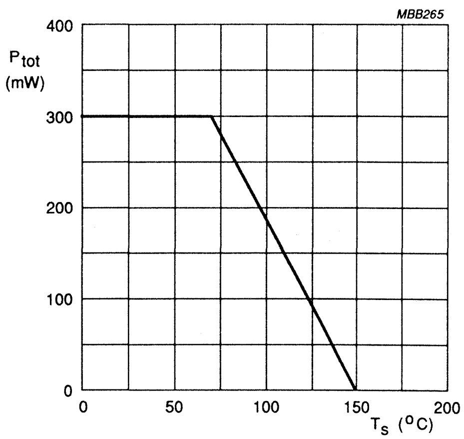
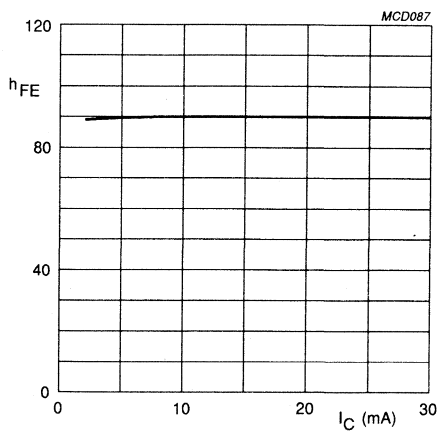
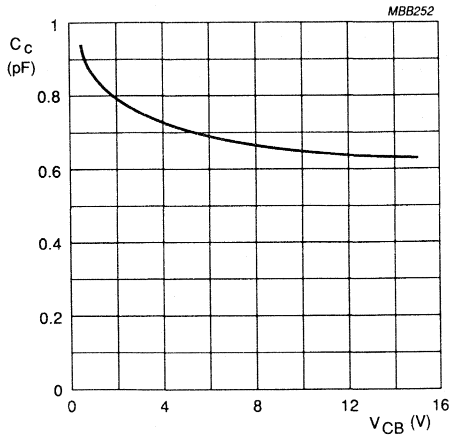


Fig.3 Power derating curve.



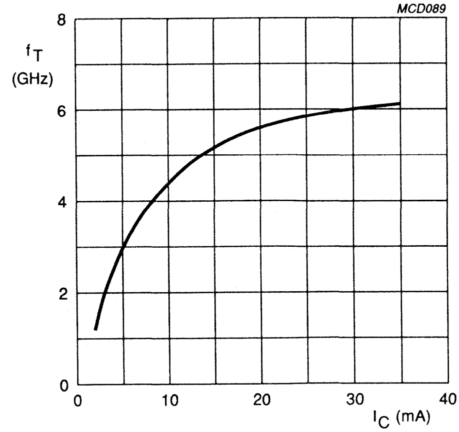
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



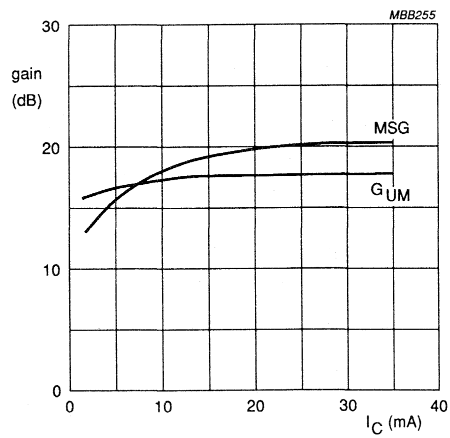
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage, typical values.



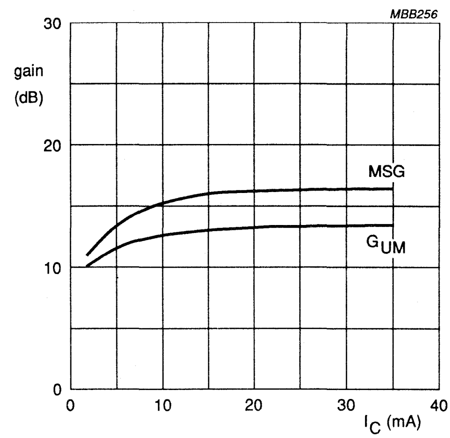
V_{CE} = 5 V; T_j = 25 °C; f = 500 MHz.

Fig.6 Transition frequency as a function of collector current, typical values.



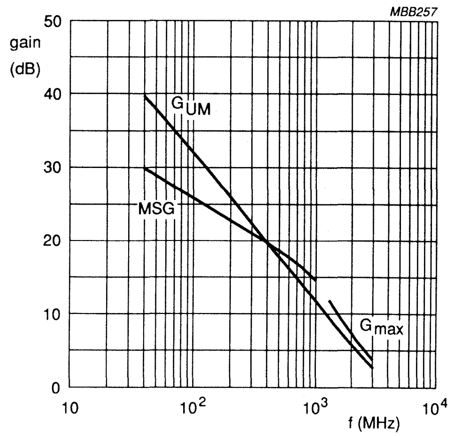
V_{CE} = 8 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



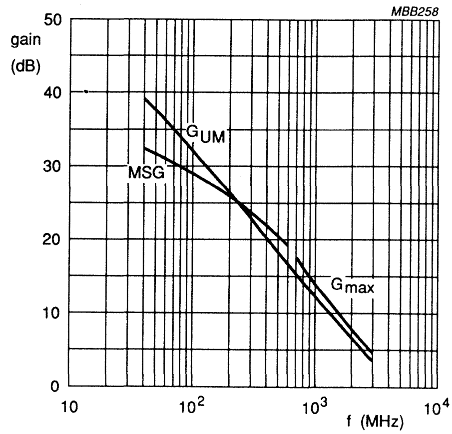
V_{CE} = 8 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



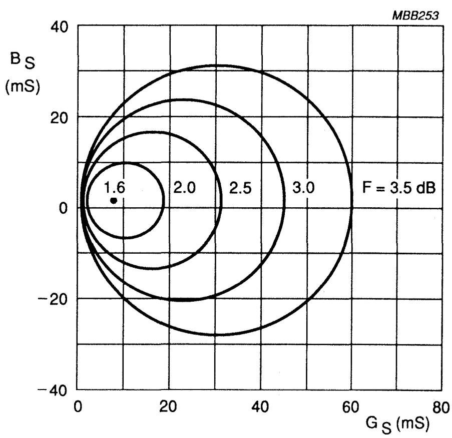
V_{CE} = 8 V; I_C = 10 mA.

Fig.9 Gain as a function of frequency.



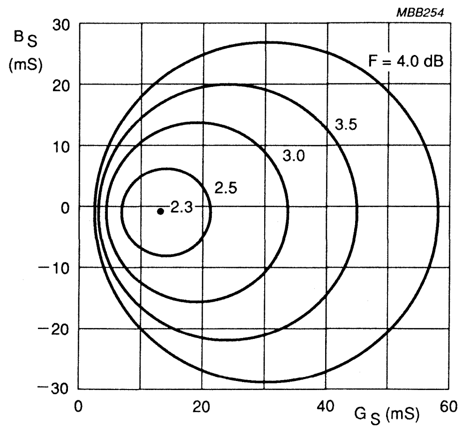
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



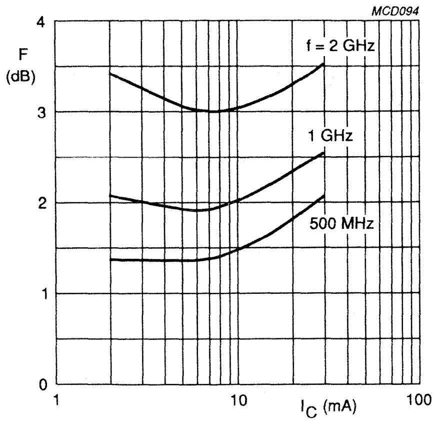
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.11 Circles of constant noise figure, typical values.



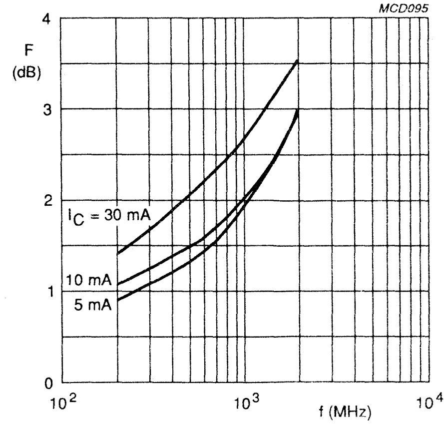
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.12 Circles of constant noise figure, typical values.



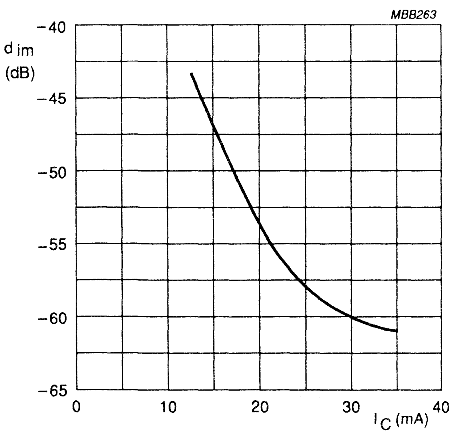
V_{CE} = 8 V.

Fig.13 Minimum noise figure as a function of collector current.



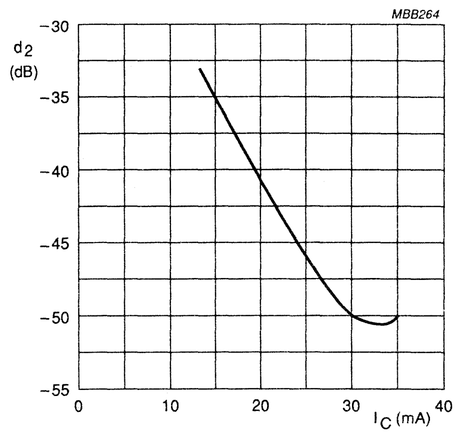
V_{CE} = 8 V.

Fig.14 Minimum noise figure as a function of frequency.



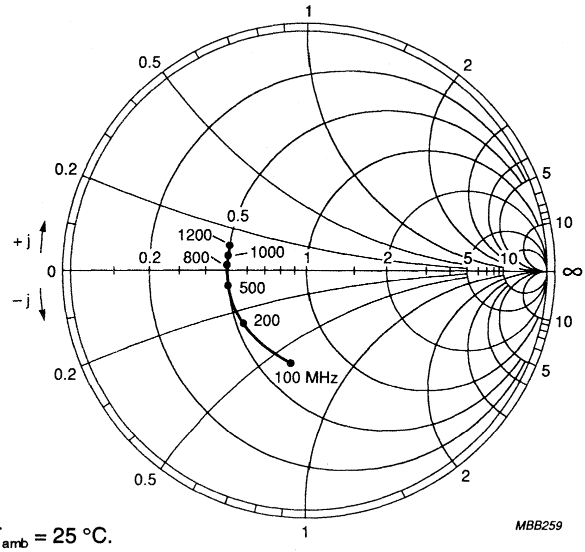
V_{CE} = 8 V; V_O = 425 mV (52.6 dBmV);
$f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.15 Intermodulation distortion, typical values.



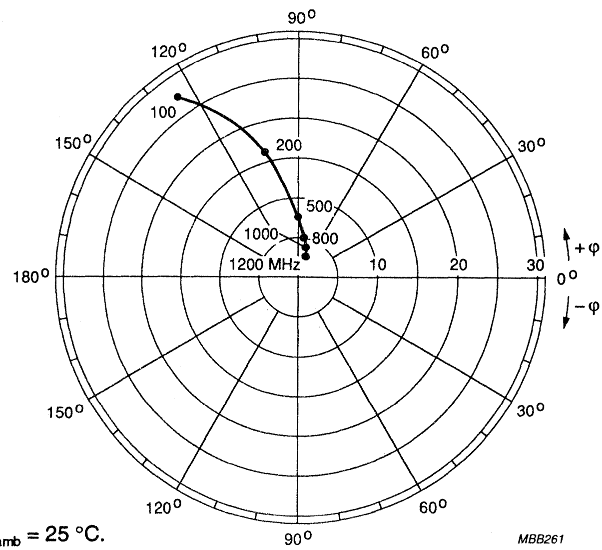
V_{CE} = 8 V; V_O = 200 mV (46 dBmV);
$f_{(p+q-r)}$ = 810 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.16 Second order intermodulation distortion, typical values.



V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.17 Common emitter input reflection coefficient (S_{11}).



V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.18 Common emitter forward transmission coefficient (S_{21}).

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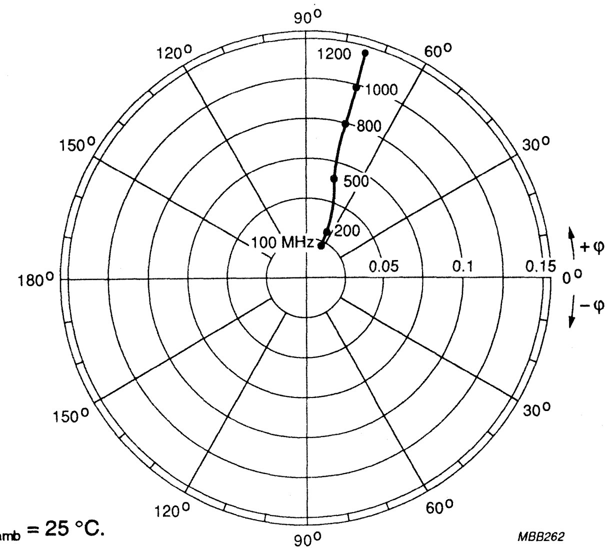
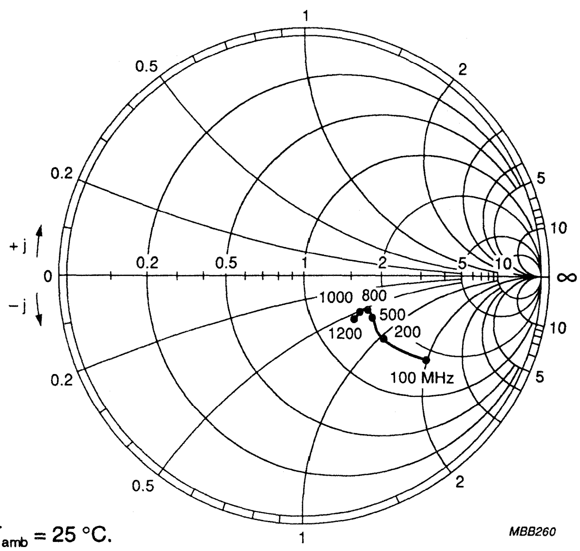


V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).

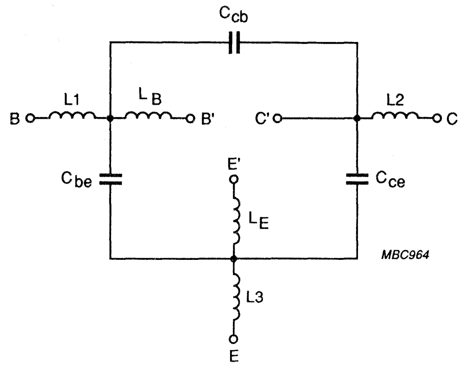


V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR91A crystal

1	IS = 1.328	fA
2	BF = 102.0	–
3	NF = 1.000	–
4	VAF = 51.90	V
5	IKF = 8.155	A
6	ISE = 13.90	fA
7	NE = 1.512	–
8	BR = 17.69	–
9	NR = 994.0	m
10	VAR = 3.280	V
11	IKR = 10.00	A
12	ISC = 1.043	fA
13	NC = 1.189	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 763.6	mΩ
18	RC = 9.000	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 2.032	pF
23	VJE = 600.0	mV
24	MJE = 290.0	m
25	TF = 6.557	ps
26	XTF = 38.97	–
27	VTF = 10.93	V
28	ITF = 521.0	mA
29	PTF = 0.000	deg
30	CJC = 1.003	pF
31	VJC = 340.8	mV
32	MJC = 194.2	m
33	XCJC = 120.0	m
34	TR = 3.073	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 800.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}$ (f) = $QL_{B,E}$ √ (f/Fc).

Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT23.

List of components (see Fig.21)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.25 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.70	−26.0	24.58	161.0	0.01	77.0	0.95	−13.9	40.5
100	0.62	−58.0	19.89	139.4	0.03	64.2	0.80	−28.7	32.4
200	0.51	−98.1	13.90	119.3	0.04	57.3	0.58	−40.4	25.9
300	0.46	−119.1	10.22	107.7	0.05	56.0	0.46	−44.2	22.2
400	0.43	−133.1	7.99	100.7	0.06	57.6	0.40	−45.6	19.7
500	0.44	−144.4	6.67	94.6	0.07	58.9	0.36	−45.6	18.0
600	0.41	−152.5	5.61	90.6	0.08	61.1	0.33	−45.7	16.3
700	0.40	−156.2	4.88	87.2	0.09	62.8	0.32	−46.0	15.0
800	0.41	−163.5	4.29	83.8	0.10	64.0	0.31	−45.7	13.9
900	0.39	−168.2	3.89	80.8	0.11	65.1	0.30	−46.0	12.9
1000	0.39	−173.0	3.47	77.6	0.12	66.0	0.29	−46.2	11.9
1200	0.39	179.2	2.96	72.2	0.14	66.8	0.28	−47.2	10.5
1400	0.40	175.0	2.58	66.9	0.16	67.1	0.28	−50.0	9.3
1600	0.39	170.1	2.31	63.7	0.18	67.5	0.28	−51.7	8.3
1800	0.38	161.7	2.05	59.3	0.20	67.0	0.28	−53.5	7.3
2000	0.40	158.4	1.94	55.6	0.22	66.8	0.27	−54.8	6.8
2200	0.41	149.9	1.77	52.0	0.24	66.5	0.24	−57.7	6.0
2400	0.43	150.7	1.66	48.1	0.27	65.4	0.23	−64.9	5.5
2600	0.43	146.4	1.55	45.2	0.29	64.1	0.23	−71.0	4.9
2800	0.41	142.6	1.47	41.8	0.31	63.5	0.23	−74.8	4.4
3000	0.44	136.9	1.40	39.0	0.33	61.8	0.22	−77.7	4.1

Table 2 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.58	−36.9	36.29	154.1	0.01	74.7	0.89	−19.8	39.9
100	0.47	−77.2	26.07	129.7	0.02	61.3	0.68	−37.3	32.0
200	0.42	−117.9	16.36	111.4	0.03	61.4	0.45	−47.4	26.1
300	0.39	−136.5	11.55	101.9	0.04	63.3	0.35	−49.6	22.5
400	0.38	−147.9	8.94	96.1	0.05	65.4	0.30	−50.3	20.1
500	0.38	−156.0	7.34	91.1	0.07	67.4	0.27	−49.9	18.3
600	0.37	−162.7	6.16	87.8	0.08	68.3	0.25	−49.6	16.7
700	0.35	−163.6	5.35	84.7	0.09	70.0	0.24	−49.6	15.4
800	0.37	−172.2	4.68	82.1	0.10	69.8	0.24	−49.2	14.3
900	0.35	−175.4	4.22	79.4	0.12	70.2	0.23	−49.4	13.3
1000	0.36	−179.5	3.78	76.4	0.13	70.6	0.22	−49.1	12.4
1200	0.36	173.4	3.21	71.6	0.15	70.4	0.21	−50.0	10.9
1400	0.39	171.0	2.80	66.8	0.17	69.2	0.20	−52.8	9.9
1600	0.36	169.2	2.50	63.6	0.19	69.1	0.21	−54.2	8.8
1800	0.36	160.6	2.24	59.6	0.22	67.6	0.21	−55.6	7.8
2000	0.38	155.4	2.09	56.0	0.24	66.3	0.20	−55.8	7.3
2200	0.39	148.8	1.90	52.8	0.26	65.8	0.18	−58.4	6.4
2400	0.40	148.9	1.78	48.9	0.28	64.4	0.16	−66.7	5.9
2600	0.42	145.2	1.68	46.0	0.30	62.7	0.16	−73.5	5.5
2800	0.39	141.0	1.59	43.5	0.32	61.5	0.17	−77.0	4.9
3000	0.42	136.6	1.50	39.7	0.35	59.8	0.15	−79.5	4.4

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Table 3 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.50	−44.2	42.81	149.9	0.01	74.3	0.85	−23.4	39.5
100	0.41	−88.8	28.62	124.9	0.02	62.9	0.61	−41.3	31.9
200	0.37	−127.6	17.10	107.9	0.04	64.2	0.39	−49.9	26.0
300	0.36	−144.5	11.93	99.3	0.05	66.9	0.30	−51.1	22.5
400	0.35	−153.5	9.17	94.3	0.06	68.3	0.26	−51.5	20.1
500	0.37	−160.2	7.51	89.4	0.07	70.5	0.23	−50.9	18.4
600	0.37	−167.0	6.30	86.7	0.08	70.8	0.22	−50.7	16.8
700	0.34	−168.3	5.46	83.7	0.09	72.8	0.21	−50.7	15.5
800	0.36	−175.7	4.78	81.3	0.11	72.0	0.21	−49.9	14.4
900	0.35	−177.4	4.32	78.8	0.12	72.3	0.20	−50.4	13.4
1000	0.35	176.8	3.86	76.0	0.13	72.3	0.20	−49.9	12.5
1200	0.35	173.4	3.29	71.2	0.15	71.5	0.19	−50.8	11.1
1400	0.37	168.3	2.85	66.7	0.17	70.2	0.18	−53.4	9.9
1600	0.36	166.1	2.55	63.4	0.20	69.2	0.18	−54.4	8.9
1800	0.35	158.4	2.27	59.3	0.22	68.0	0.19	−56.0	7.8
2000	0.35	154.7	2.13	56.0	0.24	66.5	0.18	−56.0	7.3
2200	0.37	147.1	1.93	52.6	0.26	66.2	0.15	−58.2	6.4
2400	0.39	148.6	1.81	49.5	0.29	64.1	0.14	−67.2	6.0
2600	0.39	146.3	1.69	46.1	0.31	62.5	0.14	−74.4	5.4
2800	0.39	142.6	1.63	43.3	0.33	61.4	0.14	−78.4	5.0
3000	0.41	136.2	1.54	40.6	0.35	59.2	0.13	−80.1	4.6

Table 4 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.74	−24.7	24.13	161.4	0.01	77.8	0.95	−12.7	41.0
100	0.64	−55.3	19.70	140.2	0.03	65.6	0.80	−26.6	32.7
200	0.51	−92.7	13.93	120.1	0.04	58.4	0.60	−37.4	26.1
300	0.45	−113.9	10.26	108.5	0.05	57.0	0.49	−40.8	22.4
400	0.41	−129.2	8.06	101.5	0.06	58.5	0.42	−41.7	19.8
500	0.41	−140.5	6.73	95.2	0.07	60.1	0.38	−41.6	18.1
600	0.38	−149.0	5.66	91.2	0.08	61.7	0.36	−41.7	16.3
700	0.37	−152.9	4.93	87.6	0.09	64.4	0.35	−41.7	15.1
800	0.37	−161.9	4.33	84.3	0.10	65.1	0.34	−41.5	13.9
900	0.37	−165.5	3.91	81.3	0.11	66.5	0.33	−42.0	13.0
1000	0.37	−172.8	3.51	78.1	0.12	66.7	0.33	−42.0	12.0
1200	0.37	−179.3	2.98	72.8	0.14	67.7	0.31	−43.1	10.6
1400	0.38	173.9	2.60	67.7	0.16	67.7	0.31	−45.7	9.4
1600	0.38	169.3	2.34	64.2	0.18	68.5	0.31	−47.4	8.4
1800	0.36	161.2	2.08	59.8	0.20	67.7	0.31	−49.0	7.4
2000	0.37	157.9	1.96	55.8	0.22	67.5	0.30	−50.4	6.9
2200	0.39	148.4	1.78	52.5	0.24	67.9	0.28	−53.2	6.1
2400	0.40	149.8	1.65	48.5	0.27	66.3	0.27	−59.4	5.4
2600	0.40	144.1	1.55	46.1	0.29	65.5	0.27	−64.9	4.9
2800	0.40	138.9	1.49	42.8	0.31	64.4	0.27	−67.8	4.5
3000	0.41	134.4	1.42	40.1	0.33	63.2	0.25	−70.5	4.1

Table 5 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.62	−33.5	35.36	154.9	0.01	76.1	0.90	−18.2	40.3
100	0.50	−70.8	25.82	130.9	0.03	62.7	0.69	−34.4	32.3
200	0.41	−109.3	16.36	112.3	0.04	62.0	0.48	−43.3	26.2
300	0.37	−129.1	11.63	102.7	0.05	63.3	0.38	−44.7	22.6
400	0.35	−141.8	8.96	96.9	0.06	65.8	0.33	−44.9	20.1
500	0.35	−150.3	7.40	91.8	0.06	66.7	0.30	−44.2	18.4
600	0.34	−158.0	6.20	88.2	0.08	69.2	0.28	−43.8	16.7
700	0.32	−162.5	5.39	85.2	0.09	69.8	0.27	−44.1	15.4
800	0.34	−168.1	4.72	82.5	0.10	70.2	0.27	−43.5	14.3
900	0.33	−171.1	4.25	79.8	0.12	70.7	0.26	−43.9	13.4
1000	0.33	179.9	3.82	77.1	0.13	70.7	0.26	−43.7	12.4
1200	0.32	175.4	3.25	71.8	0.15	70.5	0.25	−44.7	11.0
1400	0.35	171.7	2.82	67.3	0.17	69.8	0.24	−47.1	9.8
1600	0.33	167.2	2.53	64.0	0.19	69.3	0.24	−48.5	8.8
1800	0.32	158.1	2.25	60.0	0.22	68.1	0.24	−50.2	7.8
2000	0.34	156.3	2.11	56.4	0.24	67.2	0.24	−50.7	7.3
2200	0.36	145.7	1.92	52.8	0.26	66.7	0.22	−52.8	6.5
2400	0.38	147.0	1.78	49.3	0.28	64.9	0.20	−59.2	5.9
2600	0.38	145.8	1.68	47.1	0.30	63.7	0.20	−66.0	5.3
2800	0.36	141.8	1.60	44.2	0.32	62.7	0.20	−68.6	4.9
3000	0.39	133.5	1.52	41.0	0.34	60.9	0.19	−70.5	4.5

Table 6 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.57	−39.6	41.36	151.0	0.01	73.0	0.87	−21.3	40.1
100	0.45	−79.2	28.22	126.2	0.02	63.2	0.63	−37.7	32.2
200	0.37	−117.3	17.12	109.0	0.04	64.3	0.42	−45.0	26.2
300	0.34	−134.9	11.97	100.1	0.05	65.9	0.33	−45.6	22.6
400	0.32	−146.6	9.21	95.0	0.06	68.7	0.29	−45.2	20.1
500	0.34	−154.1	7.59	90.0	0.07	70.1	0.27	−44.3	18.4
600	0.33	−161.4	6.33	87.1	0.08	70.4	0.25	−44.0	16.8
700	0.31	−164.2	5.51	84.2	0.09	72.1	0.24	−43.8	15.5
800	0.31	−172.9	4.82	81.6	0.11	71.4	0.24	−43.5	14.3
900	0.31	−174.5	4.33	79.1	0.12	72.3	0.24	−43.9	13.4
1000	0.31	177.6	3.89	76.1	0.12	72.1	0.23	−43.6	12.5
1200	0.32	174.0	3.29	71.4	0.15	71.6	0.22	−44.7	11.0
1400	0.34	169.3	2.87	67.0	0.18	70.0	0.22	−47.4	9.9
1600	0.32	168.3	2.57	63.7	0.19	69.6	0.22.	−49.2	8.9
1800	0.30	157.3	2.29	60.2	0.22	68.2	0.22	−50.2	7.8
2000	0.33	157.2	2.14	56.3	0.24	66.8	0.22	−50.6	7.3
2200	0.35	146.9	1.94	53.0	0.26	66.4	0.20	−52.9	6.5
2400	0.36	146.9	1.83	49.9	0.29	64.5	0.18	−59.9	6.0
2600	0.37	145.5	1.71	46.7	0.30	63.0	0.18	−66.2	5.4
2800	0.35	140.4	1.63	44.0	0.33	61.8	0.18	−69.4	4.9
3000	0.38	133.9	1.53	40.9	0.35	60.1	0.17	−70.8	4.5

NPN 6 GHz wideband transistor | BFR93AW

FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 envelope. It is designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz. The BFR93AW uses the same crystal as the SOT23 version, BFR93A.

PINNING

PIN	DESCRIPTION
Code: R2	
1	base
2	emitter
3	collector

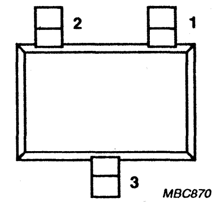


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	15	V
V_{CEO}	collector-emitter voltage		–	–	12	V
I_C	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; f = 1 GHz	–	16	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.9	–	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	190	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 3.5 GHz wideband transistor — BFR94A

DESCRIPTION

NPN resistance-stabilized transistor in a SOT122E capstan envelope.

It features extremely low cross modulation, intermodulation and second order intermodulation distortion. Due to its high transition frequency, it has a high power gain, in conjunction with good wideband properties, and low noise up to high frequencies.

It is primarily intended for CATV and MATV applications.

The BFR94A is a replacement for the BFR94. The SOT122E footprint is similar to that of the SOT48, used for the BFR94.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

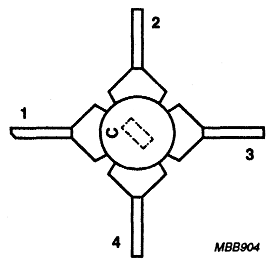


Fig.1 SOT122E.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_c = 145 °C; f > 1 MHz	–	3.5	W
f_T	transition frequency	I_C = 90 mA; V_{CE} = 20 V; f = 500 MHz; T_j = 25 °C	3.5	–	GHz
F	noise figure	I_C = 90 mA; V_{CE} = 20 V; f = 200 MHz; T_{amb} = 25 °C	8	10	dB
d_{im}	intermodulation distortion	I_C = 90 mA; V_{CE} = 20 V; V_O = 60 dBmV; $f_{(p+q-r)}$ = 194.25 MHz	–63	–	dB
d_2	second order intermodulation distortion	I_C = 90 mA; V_{CE} = 20 V; V_O = 48 dBmV; $f_p + f_q$ = 210 MHz	–	–56	dB

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_c = 145 °C; f > 1 MHz	–	3.5	W
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	15 K/W

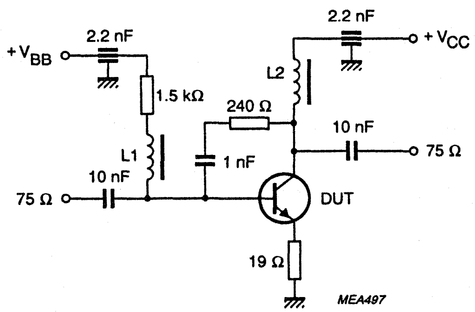
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 20 V	30	–	–	
		I_C = 150 mA; V_{CE} = 20 V	30	–	–	
f_T	transition frequency	I_C = 90 mA; V_{CE} = 20 V; f = 500 MHz	–	3.5	–	GHz
		I_C = 150 mA; V_{CE} = 20 V; f = 500 MHz	–	3.5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz	–	3.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	12	–	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 20 V; f = 1 MHz	–	1.3	–	pF
C_{cs}	collector-stud capacitance	f = 1 MHz	–	2	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 90 mA; V_{CE} = 20 V; f = 500 MHz; T_{amb} = 25 °C	–	13.5	–	dB
F	noise figure	I_C = 90 mA; V_{CE} = 20 V; f = 200 MHz; T_{amb} = 25 °C	–	8	10	dB
		I_C = 90 mA; V_{CE} = 20 V; f = 500 MHz; T_{amb} = 25 °C	–	5	–	dB
d_{im}	intermodulation distortion	note 2	–	−63	–	dB
d_2	second order intermodulation distortion	note 3	–	–	−56	dB
V_O	output voltage	see Fig.2 and note 4	–	700	–	mV

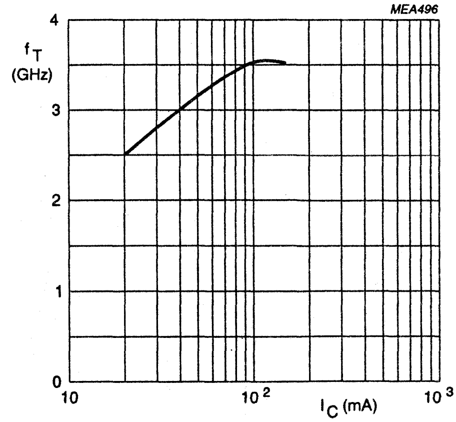
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω;
   $V_p = V_O$ = 60 dBmV at f_p = 196.25 MHz;
   $V_q = V_O$ −6 dB at f_q = 203.25 MHz;
   $V_r = V_O$ −6 dB at f_r = 205.25 MHz;
   measured at $f_{(p+q-r)}$ = 194.25 MHz.
3. I_C = 90 mA; V_{CE} = 20 V;
   f_p = 66 MHz; f_q = 144 MHz; $f_p + f_q$ = 210 MHz; V_O = 48 dBmV.
4. d_{im} = −60 dB (DIN 45004B); I_C = 90 mA; V_{CE} = 20 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 495.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 503.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.



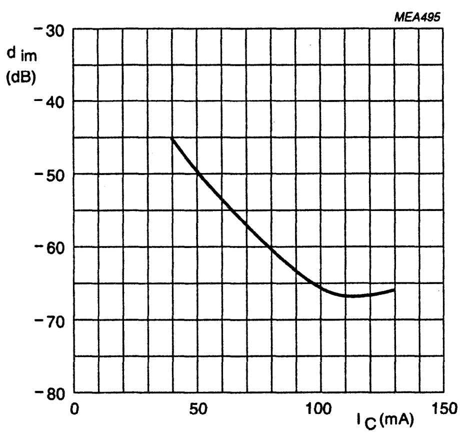
L1 = L2 = 5 μH Ferroxcube choke, catalogue number 3122 108 20153.

Fig.2 Intermodulation distortion MATV test circuit.



V_{CE} = 20 V; f = 500 MHz; T_j = 25 °C.

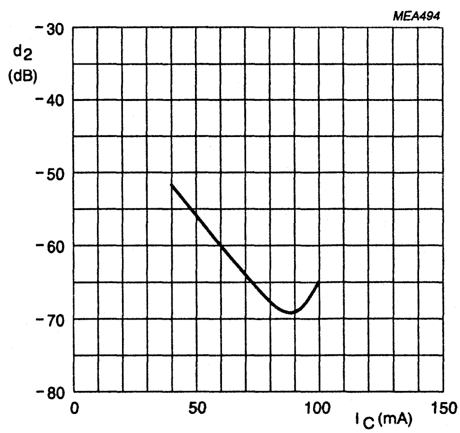
Fig.3 Transition frequency as a function of collector current.



Measured in CATV test circuit.

V_{CE} = 20 V; V_o = 60 dBmV;
$f_{(p+q-r)}$ = 194.25 MHz.

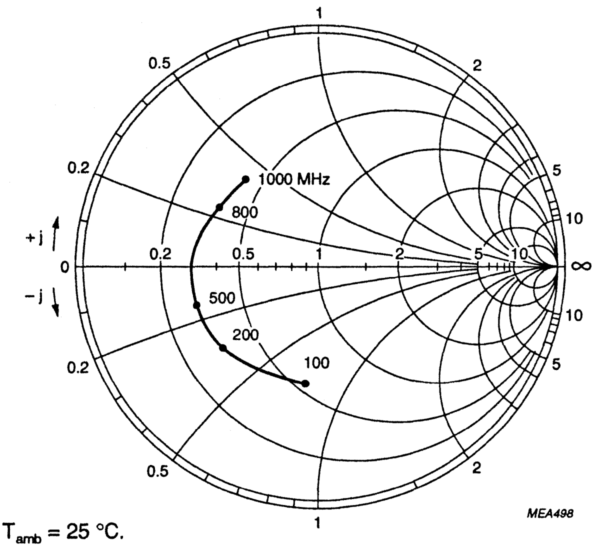
Fig.4 Intermodulation distortion as a function of collector current.



Measured in CATV test circuit.

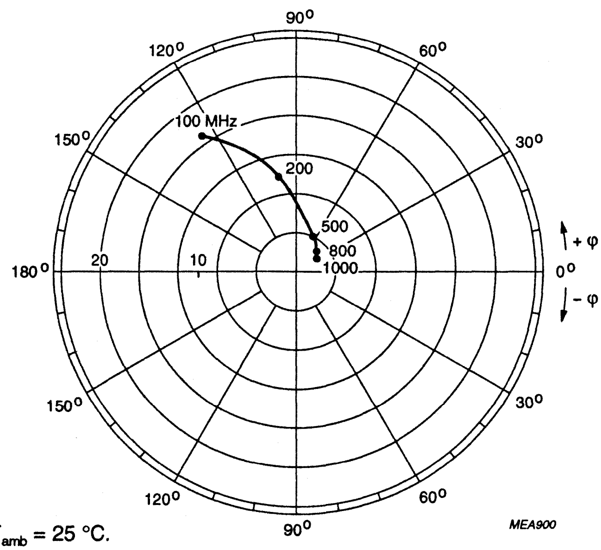
V_{CE} = 20 V; V_o = 48 dBmV; f = 210 MHz.

Fig.5 Second order intermodulation distortion as a function of collector current.



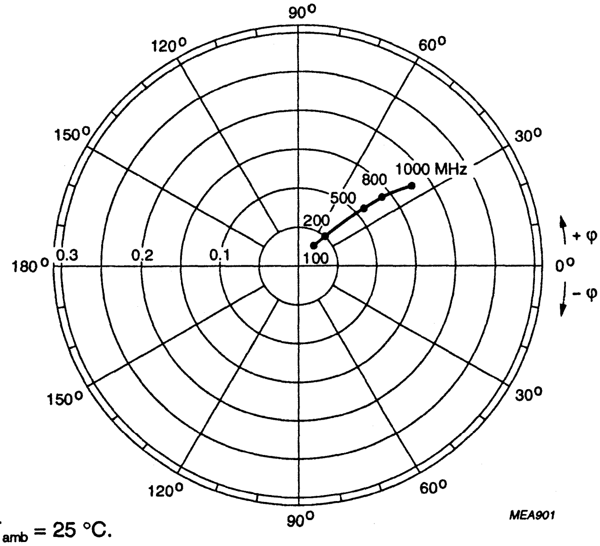
I_C = 90 mA; V_{CE} = 20 V; T_{amb} = 25 °C.

Fig.6 Common emitter input reflection coefficient (S_{11}).



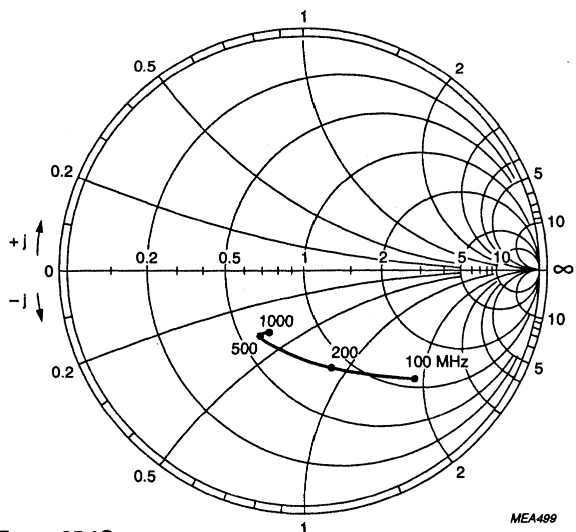
I_C = 90 mA; V_{CE} = 20 V; T_{amb} = 25 °C.

Fig.7 Common emitter forward transmission coefficient (S_{21}).



I_C = 90 mA; V_{CE} = 20 V; T_{amb} = 25 °C.

Fig.8 Common emitter reverse transmission coefficient (S_{12}).



I_C = 90 mA; V_{CE} = 20 V; T_{amb} = 25 °C.

Fig.9 Common emitter output reflection coefficient (S_{22}).

NPN 3.5 GHz wideband transistor — BFR95

DESCRIPTION

NPN resistance-stabilized transistor in a SOT5 (TO-39) metal envelope, with collector connected to the case.

The transistor features low cross modulation, intermodulation and second order intermodulation distortion. Due to its high transition frequency, it has a high power gain combined with excellent wideband properties and low noise up to high frequencies.

It is primarily intended for CATV and MATV applications.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

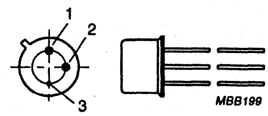


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
f_T	transition frequency	I_C = 80 mA; V_{CE} = 20 V; f = 500 MHz; T_j = 25 °C	3.5	–	GHz
F	noise figure	I_C = 80 mA; V_{CE} = 18 V; f = 200 MHz; T_{amb} = 25 °C	9	10	dB
d_{im}	intermodulation distortion	I_C = 80 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C; V_O = 60 dBmV; $f_{(p+q-r)}$ = 194.25 MHz	–64	–	dB
d_2	second order intermodulation distortion	I_C = 80 mA; V_{CE} = 18 V; T_{amb} = 25 °C V_O = 48 dBmV; $f_{(p+q)}$ = 210 MHz	–62	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	50 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 20 V	30	–	–	
		I_C = 150 mA; V_{CE} = 20 V	30	–	–	
f_T	transition frequency	I_C = 80 mA; V_{CE} = 20 V; f = 500 MHz	–	3.5	–	GHz
		I_C = 150 mA; V_{CE} = 20 V; f = 500 MHz	–	3.5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 20 V; f = 1 MHz	–	3.5	–	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 20 V; f = 1 MHz	–	1.6	–	pF
F	noise figure	I_C = 80 mA; V_{CE} = 18 V; f = 200 MHz; T_{amb} = 25 °C	–	9	10	dB
d_{im}	intermodulation distortion	note 1	–	–64	–	dB
d_2	second order intermodulation distortion	note 2	–	–62	–56	dB

Notes

1. I_C = 80 mA; V_{CE} = 18 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ = 60 dBmV at f_p = 196.25 MHz;
   $V_q = V_O$ –6 dB at f_q = 203.25 MHz;
   $V_r = V_O$ –6 dB at f_r = 205.25 MHz;
   measured at $f_{(p+q-r)}$ = 194.25 MHz.
2. I_C = 80 mA; V_{CE} = 18 V; T_{amb} = 25 °C;
   f_p = 66 MHz; f_q = 144 MHz; $f_{(p+q)}$ = 210 MHz; V_O = 48 dBmV.

NPN 5 GHz wideband transistor BFR96

DESCRIPTION

NPN transistor in a plastic SOT37 envelope primarily intended for use in RF wideband amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc.

The transistor features very low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

A SOT54 (TO-92) version (ref: ON4487) is available on request.

PNP complement is BFQ32.

PINNING

PIN	DESCRIPTION
Code: BFR96/02	
1	base
2	emitter
3	collector

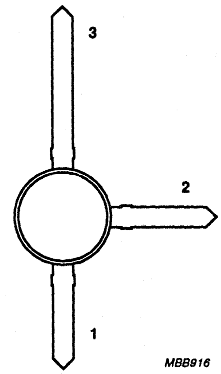


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	75	mA
P_{tot}	total power dissipation	up to T_s = 143 °C (note 1)	–	700	mW
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	1.4	pF
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	15.2	–	dB
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	3.3	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 50 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	500	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	75	mA
I_{CM}	peak collector current	f > 1 MHz	–	150	mA
P_{tot}	total power dissipation	up to T_s = 143 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 143 °C (note 1)	45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 10$ V	25	80	–	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz	4	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	1.3	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	$I_C = 10$ mA; $V_{CE} = 10$ V; f = 1 MHz; $T_{amb} = 25$ °C	–	1	1.4	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	15.2	–	dB
F	noise figure	$I_C = 50$ mA; $V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	3.3	–	dB
V_O	output voltage	see Fig.2 and note 2	–	500	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B); $I_C = 50$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 495.25$ MHz;
   $V_q = V_O - 6$ dB; $f_q = 503.25$ MHz;
   $V_r = V_O - 6$ dB; $f_r = 505.25$ MHz;
   measured at $f_{(p+q-r)} = 493.25$ MHz.

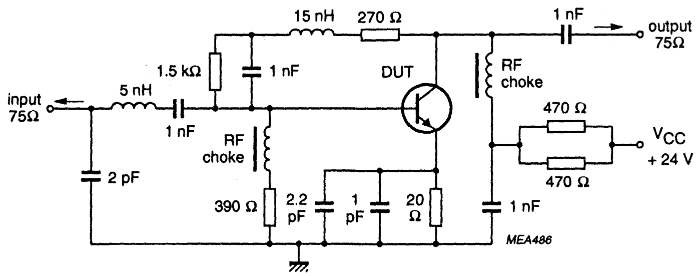


Fig.2 Intermodulation distortion test circuit.

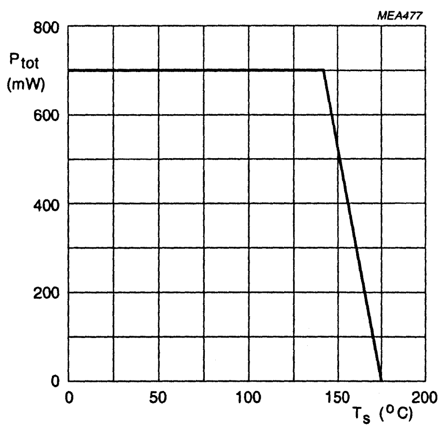
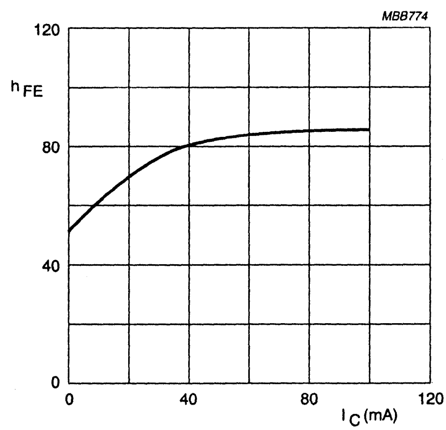
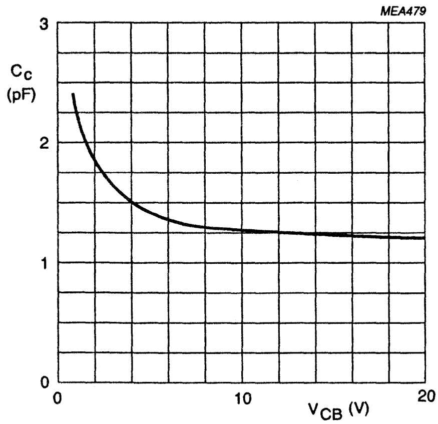


Fig.3 Power derating curve.



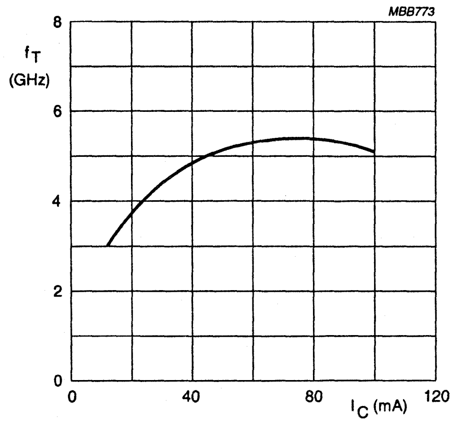
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



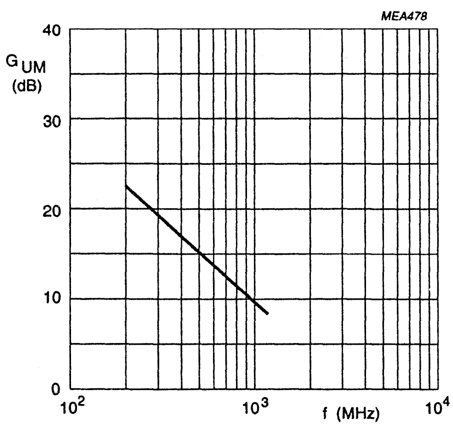
$I_E = i_e = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



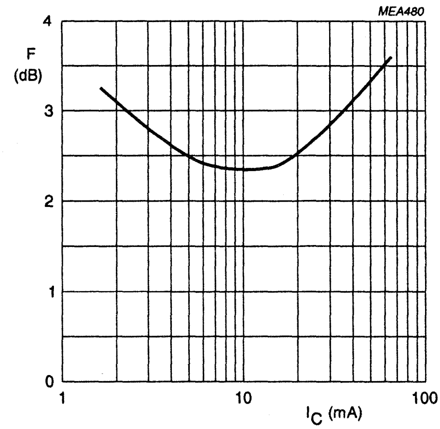
$V_{CE} = 10$ V; f = 500 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.



$I_C = 50$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C.

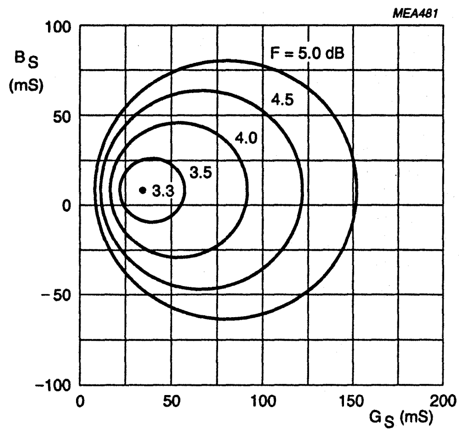
Fig.7 Maximum unilateral power gain as a function of frequency.



$V_{CE} = 10$ V; f = 500 MHz; $T_{amb} = 25$ °C; Y_S = opt.

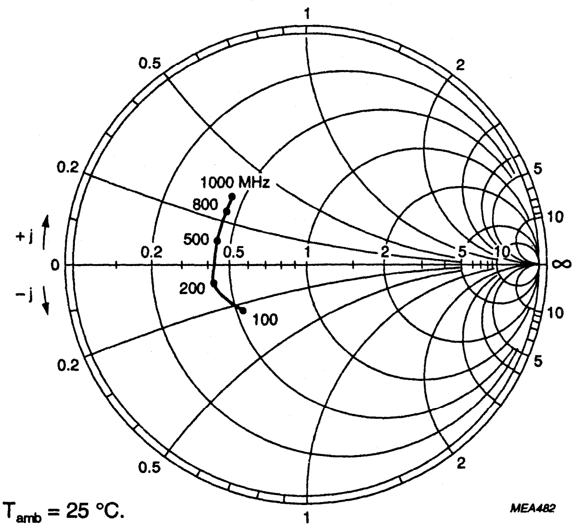
Fig.8 Minimum noise figure as a function of collector current.

NPN 5 GHz wideband transistor BFR96



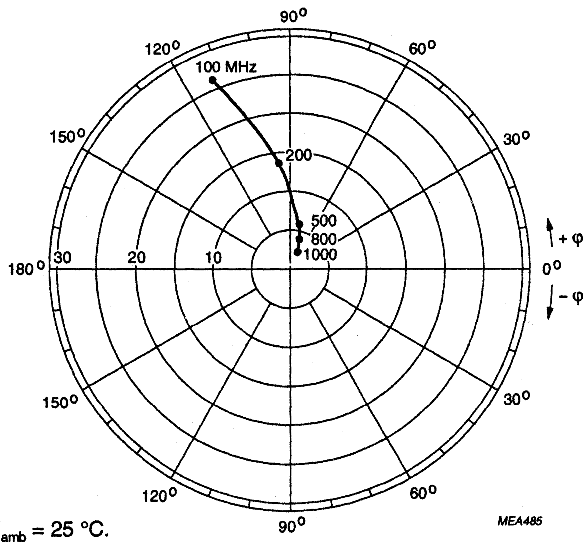
I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.9 Noise circle figure.



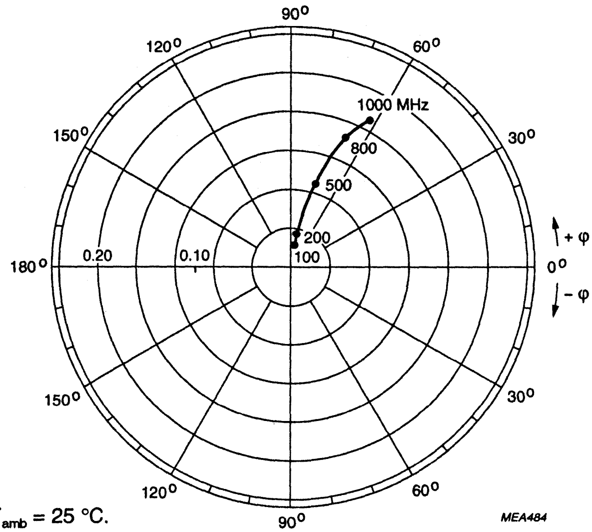
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.10 Common emitter input reflection coefficient (S_{11}).



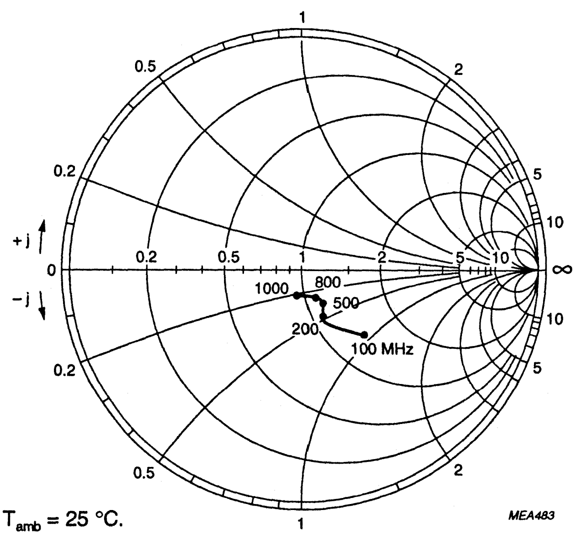
I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter forward transmission coefficient (S_{21}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter reverse transmission coefficient (S_{12}).



I_C = 50 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter output reflection coefficient (S_{22}).

NPN 5 GHz wideband transistor BFR96S

DESCRIPTION

NPN transistor in a plastic SOT37 envelope primarily intended for MATV applications. The device features excellent output voltage capabilities.

PNP complement is the BFQ32S.

PINNING

PIN	DESCRIPTION
Code: BFR96S/02	
1	base
2	emitter
3	collector

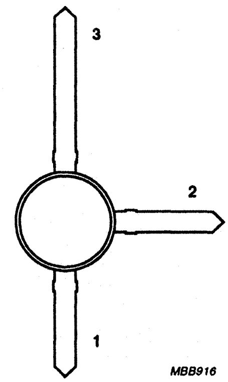


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 143 °C (note 1)	–	700	mW
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	11.5	–	dB
F	noise figure	I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	4	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793.25 MHz	700	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	21	–	dBm
ITO	third order intercept point	I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C	40	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 143 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 143 °C (note 1)	45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

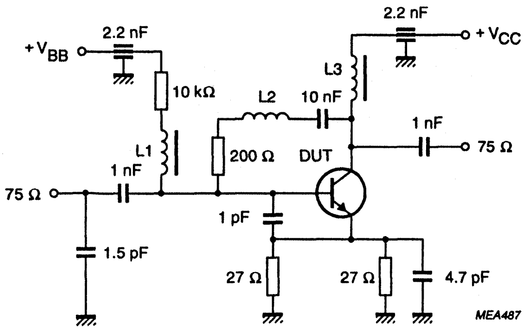
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 70$ mA; $V_{CE} = 10$ V	25	80	–	
f_T	transition frequency	$I_C = 70$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	11.5	–	dB
F	noise figure	$I_C = 70$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	4	–	dB
d_2	second order intermodulation distortion	note 2	–	–52	–	dB
V_O	output voltage	note 3	–	700	–	mV
P_{L1}	output power at 1 dB gain compression	$I_C = 70$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C; measured at f = 800 MHz	–	21	–	dBm
ITO	third order intercept point	note 4	–	40	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 70$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O = 316$ mV = 50 dBmV; $f_p = 250$ MHz;
   $V_q = V_O = 316$ mV = 50 dBmV; $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B); $I_C = 70$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O - 6$ dB; $f_q = 803.25$ MHz;
   $V_r = V_O - 6$ dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
4. $I_C = 70$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   P_p = ITO –6 dB; $f_p = 800$ MHz;
   P_q = ITO –6 dB; $f_q = 801$ MHz;
   measured at $f_{(2p-q)} = 799$ MHz.



L1 = L3 = 5 μH microchoke.

L2 = 1.5 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

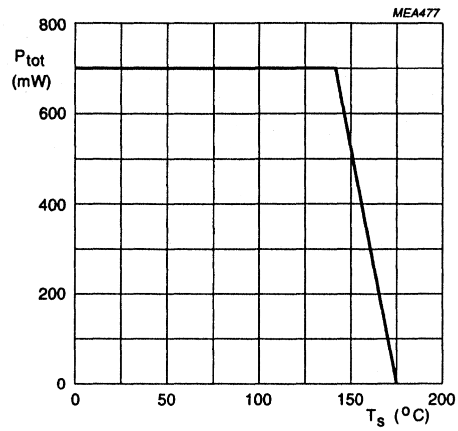
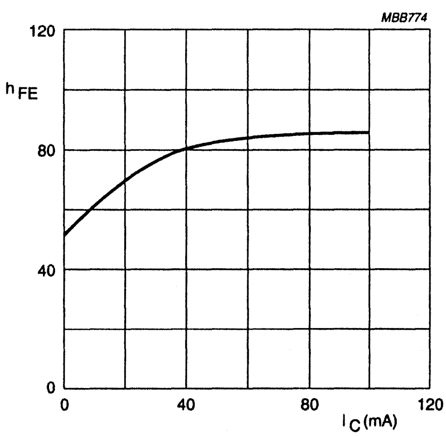
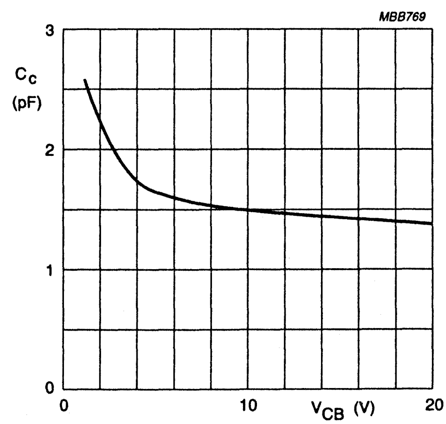


Fig.3 Power derating curve.



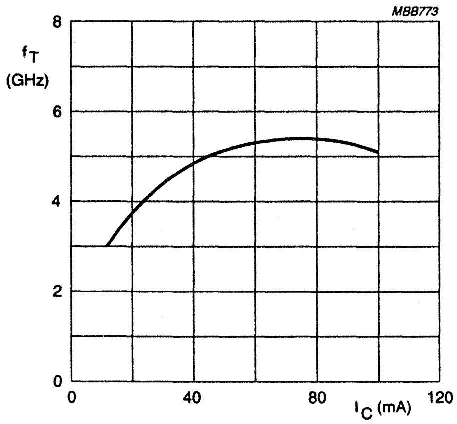
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



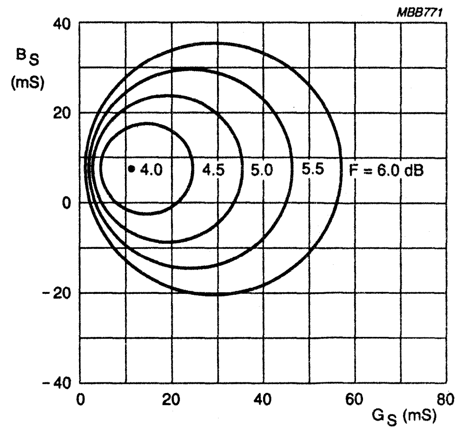
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



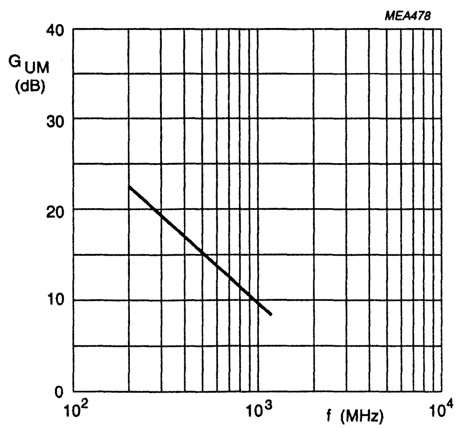
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



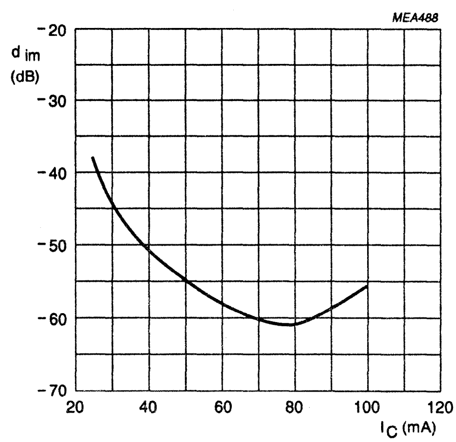
I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.7 Noise circle figure.



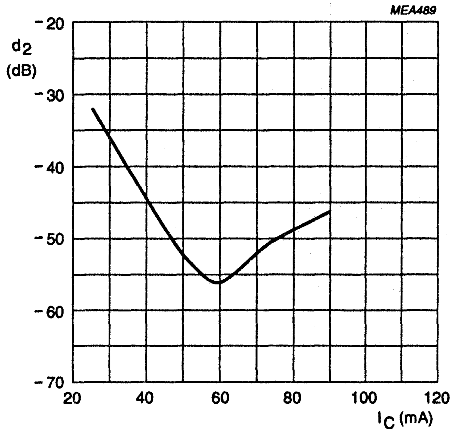
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



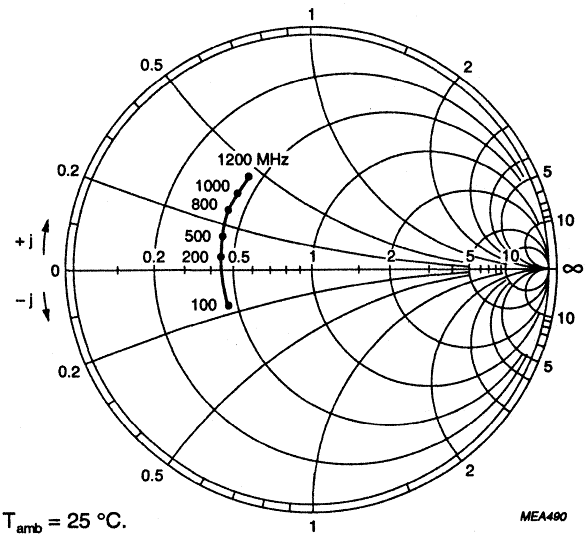
V_{CE} = 10 V; V_O = 700 mV = 56.9 dBmV;
T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz;
measured in test circuit (see Fig.2).

Fig.9 Intermodulation distortion as a function of collector current.



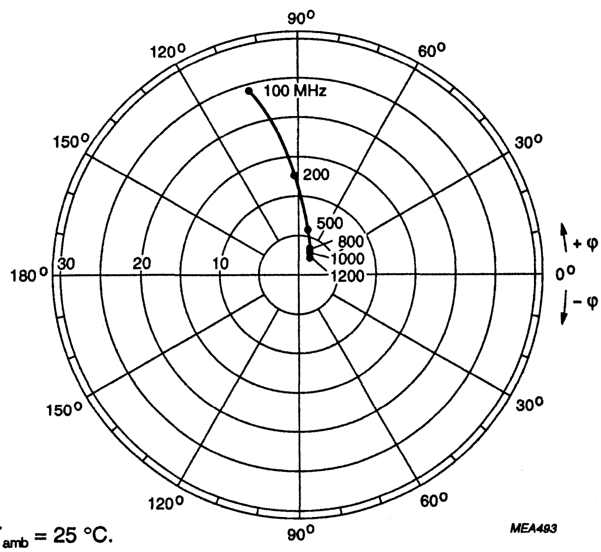
V_{CE} = 10 V; V_O = 316 mV = 50 dBmV;
T_{amb} = 25 °C; $f_{(p+q)}$ = 810 MHz;
measured in test circuit (see Fig.2).

Fig.10 Second order intermodulation distortion as a function of collector current.



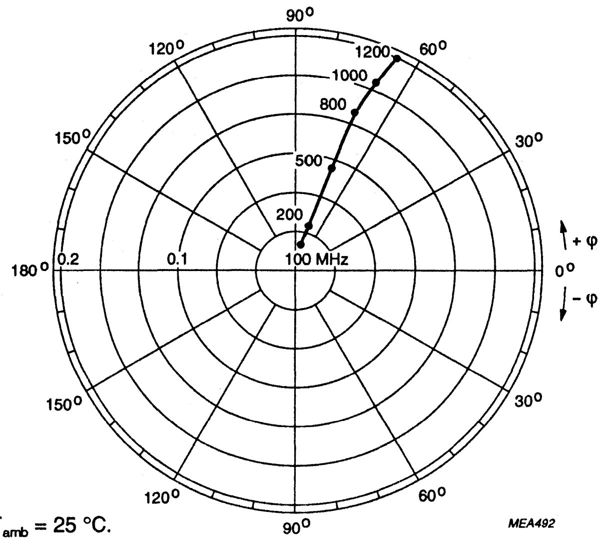
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.11 Common emitter input reflection coefficient (S_{11}).



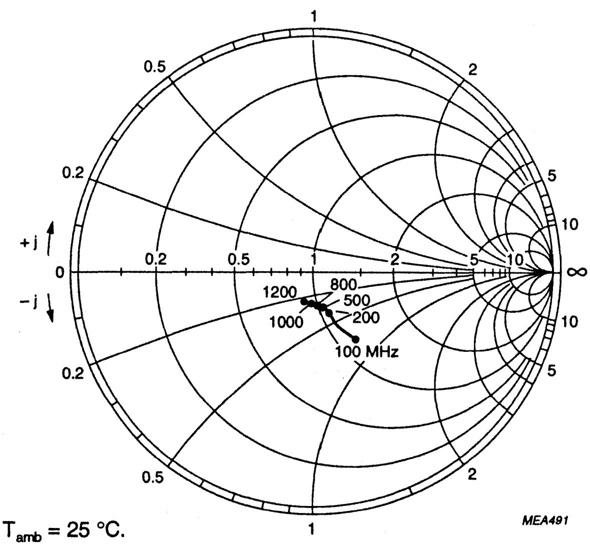
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter forward transmission coefficient (S_{21}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.333	−96.0	49.624	130.8	0.012	70.5	0.648	−43.8	36.8
100	0.345	−144.7	25.627	107.3	0.023	67.5	0.348	−61.9	29.3
200	0.354	−168.9	13.375	94.2	0.041	73.3	0.208	−68.8	23.3
300	0.365	−179.7	9.016	87.9	0.058	74.3	0.165	−71.9	19.8
400	0.373	173.9	6.820	82.4	0.076	74.0	0.148	−76.4	17.4
500	0.380	166.6	5.483	78.7	0.092	73.3	0.143	−81.5	15.5
600	0.377	162.0	4.636	74.5	0.110	71.3	0.144	−85.9	14.1
700	0.377	158.1	3.983	71.4	0.128	70.5	0.146	−88.4	12.8
800	0.380	152.0	3.537	66.8	0.144	69.2	0.148	−91.5	11.7
900	0.375	145.1	3.151	63.9	0.160	67.9	0.151	−95.6	10.7
1000	0.376	141.4	2.846	61.3	0.175	66.4	0.151	−100.5	9.8
1200	0.422	131.9	2.411	55.0	0.206	63.4	0.156	−110.9	8.6
1400	0.424	123.3	2.097	47.8	0.233	60.2	0.173	−122.6	7.4
1600	0.452	117.1	1.869	42.5	0.261	58.0	0.192	−131.0	6.6
1800	0.448	112.1	1.707	37.0	0.288	53.6	0.213	−137.2	5.8
2000	0.488	100.5	1.556	33.1	0.311	51.0	0.221	−143.9	5.2
2200	0.506	94.5	1.483	28.3	0.333	48.3	0.232	−153.5	4.9
2400	0.524	88.7	1.351	22.5	0.355	46.6	0.251	−163.9	4.3
2600	0.560	86.2	1.262	19.6	0.379	43.0	0.282	−171.8	4.0
2800	0.547	78.5	1.183	14.6	0.387	39.7	0.313	−177.4	3.5
3000	0.563	71.9	1.114	10.6	0.406	38.5	0.330	177.4	3.1

Table 2 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.317	−109.4	52.636	127.2	0.011	66.9	0.596	−47.3	36.8
100	0.335	−151.1	26.034	105.0	0.023	70.4	0.306	−64.3	29.3
200	0.354	−172.6	13.450	92.9	0.041	73.9	0.184	−70.8	23.3
300	0.358	177.7	9.044	86.9	0.059	75.4	0.147	−74.5	19.8
400	0.368	173.9	6.852	82.0	0.075	75.2	0.135	−79.3	17.4
500	0.381	167.9	5.499	78.4	0.094	74.2	0.131	−84.4	15.6
600	0.373	160.3	4.641	74.2	0.111	71.7	0.135	−89.4	14.1
700	0.382	157.1	3.979	71.0	0.129	71.3	0.138	−92.1	12.8
800	0.377	151.7	3.551	66.7	0.145	69.6	0.139	−95.7	11.8
900	0.381	145.1	3.169	63.4	0.161	67.9	0.143	−99.2	10.8
1000	0.396	139.6	2.863	61.2	0.177	66.5	0.145	−103.8	10.0
1200	0.411	133.0	2.418	55.0	0.208	63.3	0.151	−114.5	8.6
1400	0.424	124.9	2.101	48.0	0.234	60.1	0.168	−126.8	7.4
1600	0.447	116.8	1.879	42.7	0.263	58.1	0.188	−134.4	6.6
1800	0.456	110.6	1.700	37.2	0.289	53.3	0.209	−140.5	5.8
2000	0.502	101.4	1.568	33.3	0.314	51.0	0.218	−147.2	5.4
2200	0.505	95.0	1.495	28.1	0.337	48.2	0.230	−156.3	5.0
2400	0.525	88.1	1.365	22.8	0.358	46.3	0.249	−166.9	4.4
2600	0.549	86.1	1.273	20.4	0.382	42.7	0.280	−174.6	4.0
2800	0.561	77.6	1.193	14.9	0.389	39.7	0.311	−179.7	3.6
3000	0.553	71.5	1.122	11.0	0.410	38.2	0.326	175.5	3.1

NPN 5 GHz wideband transistor — BFR106

DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT23 envelope. It is primarily intended for low noise, general RF applications.

PINNING

PIN	DESCRIPTION
	Code: R7p
1	base
2	emitter
3	collector

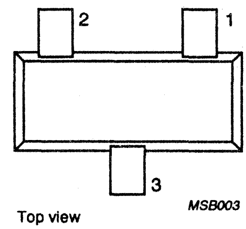


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 9 V; T_{amb} = 25 °C	25	80	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 9 V; f = 500 MHz; T_{amb} = 25 °C	–	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 6 V; f = 800 MHz; T_{amb} = 25 °C	–	11.5	–	dB
V_O	output voltage	I_C = 50 mA; V_{CE} = 9 V; R_L = 75 Ω; T_{amb} = 25 °C; d_{im} = –60 dB; $f_{(p+q-r)}$ = 793.25 MHz	–	350	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 45 °C (note 1)	210 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 9$ V	25	80	–	
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 9$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	4.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1.2	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 6$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	11.5	–	dB
F	noise figure	$I_C = 30$ mA; $V_{CE} = 6$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	3.5	–	dB
d_2	second order intermodulation distortion	note 2	–	–50	–	dB
V_O	output voltage	note 3	–	350	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 30$ mA; $V_{CE} = 6$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C; $f_{(p+q)} = 810$ MHz; $V_O = 100$ mV.
3. $d_{im} = -60$ dB (DIN 45004B); $I_C = 50$ mA; $V_{CE} = 9$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C; $f_{(p+q-r)} = 793.25$ MHz.

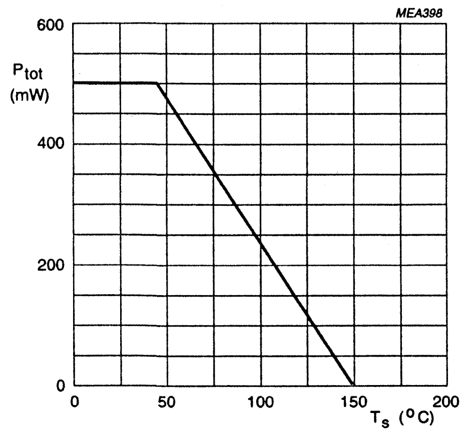
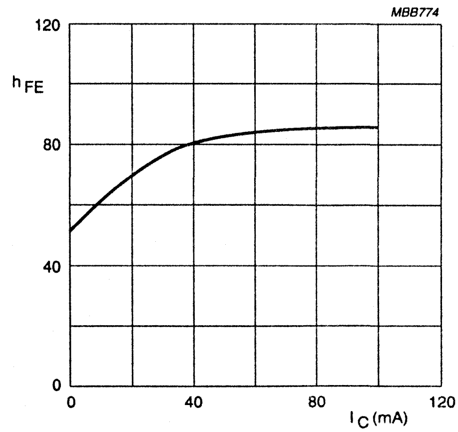
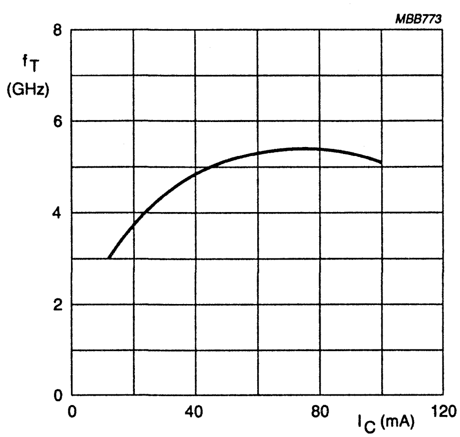


Fig.2 Power derating curve.



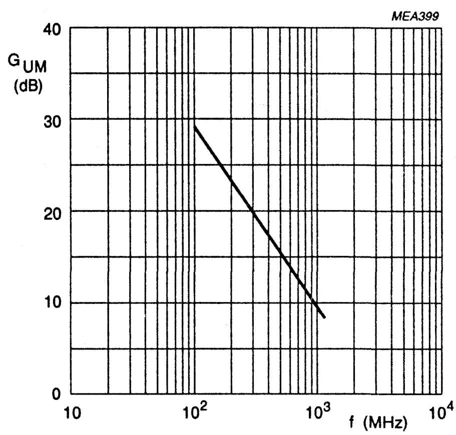
V_{CE} = 9 V; T_{amb} = 25 °C.

Fig.3 DC current gain as a function of collector current.



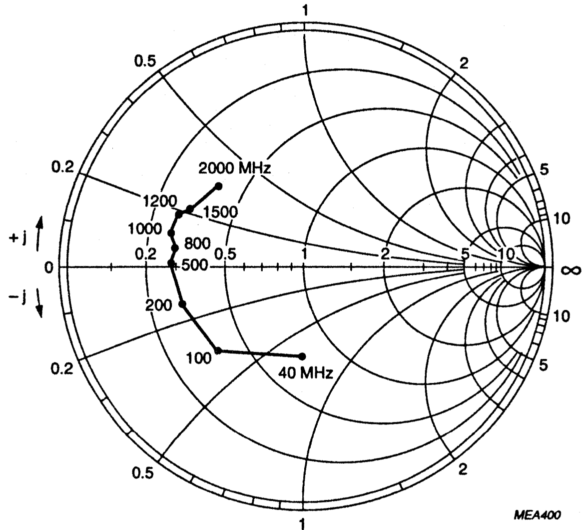
V_{CE} = 9 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



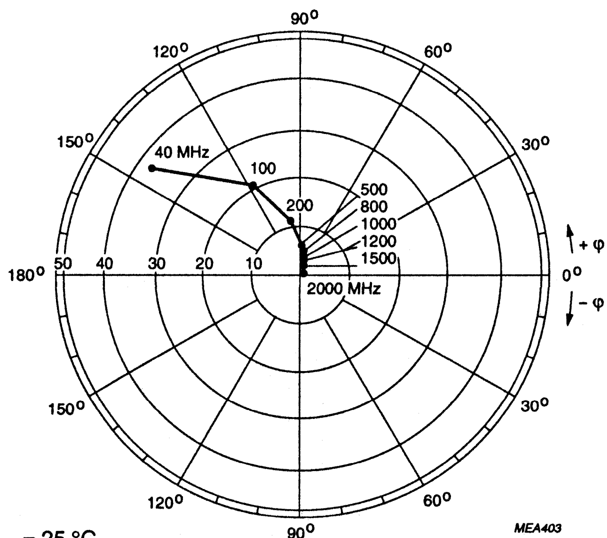
I_C = 30 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.5 Maximum unilateral power gain as a function of frequency.



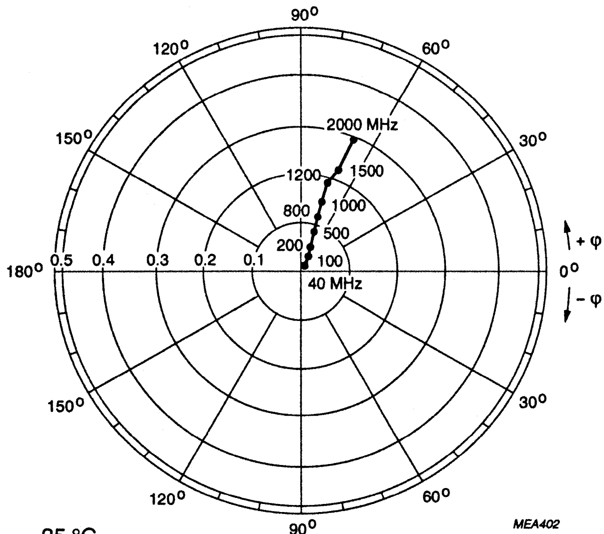
I_C = 30 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.6 Common emitter input reflection coefficient (S_{11}).



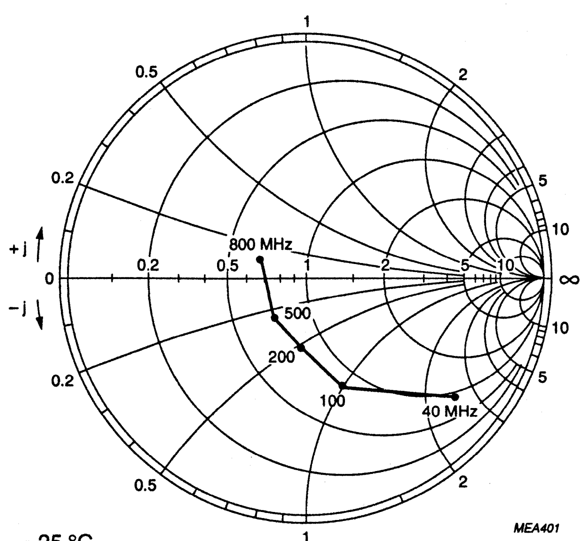
I_C = 30 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.7 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.8 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 30$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.460	−86.7	39.780	136.7	0.017	63.4	0.717	−42.1	36.2
100	0.487	−136.5	21.728	110.9	0.027	56.5	0.403	−66.4	28.7
200	0.519	−159.7	11.675	97.7	0.042	63.0	0.230	−80.3	22.9
300	0.506	−169.8	8.005	90.7	0.055	66.6	0.171	−87.5	19.5
400	0.516	−175.0	6.068	86.8	0.070	69.2	0.146	−92.3	17.1
500	0.507	−177.4	4.899	82.2	0.085	70.6	0.132	−95.7	15.2
600	0.511	179.1	4.153	78.6	0.102	70.9	0.128	−97.9	13.8
700	0.510	175.4	3.568	76.1	0.116	71.1	0.127	−98.9	12.4
800	0.513	171.6	3.146	72.9	0.132	71.2	0.123	−100.1	11.3
900	0.510	169.3	2.834	70.0	0.148	71.2	0.125	−99.7	10.4
1000	0.518	168.1	2.561	67.0	0.163	70.2	0.123	−101.6	9.6
1200	0.534	162.9	2.180	62.5	0.193	69.3	0.123	−106.2	8.3
1400	0.534	158.3	1.902	57.5	0.223	67.6	0.130	−110.6	7.1
1600	0.538	155.0	1.716	52.5	0.251	66.5	0.132	−113.0	6.3
1800	0.524	151.1	1.565	49.3	0.282	64.7	0.140	−117.5	5.4
2000	0.542	144.0	1.456	45.0	0.308	63.2	0.137	−123.5	4.9

Table 2 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.422	−103.7	44.957	130.4	0.015	61.2	0.629	−50.3	36.1
100	0.477	−147.4	22.741	106.7	0.024	60.8	0.332	−74.9	28.8
200	0.510	−165.6	11.956	95.3	0.040	69.2	0.188	−91.2	23.0
300	0.507	−173.6	8.115	89.3	0.055	70.5	0.145	−101.2	19.6
400	0.499	−177.5	6.179	85.8	0.071	72.5	0.126	−107.2	17.1
500	0.498	179.4	4.974	81.4	0.087	73.3	0.116	−111.2	15.2
600	0.500	177.1	4.207	78.0	0.103	73.2	0.117	−113.6	13.8
700	0.506	173.7	3.609	75.4	0.119	72.8	0.114	−114.3	12.5
800	0.511	170.6	3.188	72.8	0.136	72.3	0.112	−115.5	11.4
900	0.506	168.2	2.868	69.6	0.151	72.0	0.113	−114.6	10.5
1000	0.506	166.7	2.594	66.9	0.168	71.0	0.111	−116.5	9.6
1200	0.526	162.0	2.213	62.4	0.197	69.5	0.114	−120.9	8.4
1400	0.540	157.6	1.925	57.4	0.227	67.7	0.120	−124.1	7.3
1600	0.537	155.5	1.745	52.0	0.256	66.5	0.123	−126.7	6.4
1800	0.521	149.6	1.590	49.0	0.285	64.6	0.127	−129.8	5.5
2000	0.542	142.4	1.470	45.5	0.313	63.1	0.128	−136.2	4.9

Table 3 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.427	−115.1	46.126	126.4	0.015	63.2	0.567	−54.4	35.8
100	0.493	−153.2	22.301	104.3	0.023	62.6	0.288	−78.3	28.6
200	0.515	−168.0	11.587	94.1	0.040	70.2	0.166	−94.7	22.7
300	0.508	−174.8	7.868	88.4	0.054	72.6	0.130	−104.9	19.3
400	0.502	−179.5	5.988	84.9	0.071	74.0	0.116	−110.3	16.9
500	0.512	177.7	4.820	80.7	0.087	74.2	0.109	−114.6	15.0
600	0.509	176.7	4.064	77.5	0.104	74.2	0.110	−116.2	13.5
700	0.507	173.6	3.498	74.9	0.120	73.6	0.110	−117.3	12.2
800	0.513	169.6	3.094	72.1	0.136	72.8	0.109	−117.6	11.2
900	0.517	168.4	2.786	69.1	0.153	72.5	0.111	−117.6	10.3
1000	0.520	165.9	2.516	66.3	0.169	71.2	0.111	−119.4	9.4
1200	0.538	162.3	2.146	61.9	0.198	69.8	0.113	−123.7	8.2
1400	0.535	158.1	1.874	56.7	0.228	68.0	0.120	−127.2	7.0
1600	0.540	154.1	1.692	52.1	0.257	66.7	0.123	−129.6	6.1
1800	0.532	149.3	1.552	47.9	0.287	64.5	0.128	−133.4	5.3
2000	0.553	143.1	1.424	45.1	0.316	63.1	0.129	−139.1	4.7

Table 4 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.537	−72.6	39.272	139.0	0.018	64.2	0.745	−37.4	36.9
100	0.484	−125.7	22.247	112.7	0.027	57.1	0.433	−58.1	29.0
200	0.482	−152.1	12.075	98.7	0.041	61.6	0.251	−66.8	23.1
300	0.474	−165.3	8.282	91.6	0.054	64.6	0.189	−70.0	19.6
400	0.479	−171.3	6.288	87.5	0.069	67.4	0.161	−71.2	17.2
500	0.485	−175.7	5.076	82.7	0.083	69.2	0.146	−72.2	15.4
600	0.482	−178.5	4.281	79.2	0.098	70.0	0.142	−74.3	13.9
700	0.483	178.5	3.690	76.5	0.113	70.5	0.141	−74.7	12.6
800	0.474	174.0	3.257	73.5	0.127	70.4	0.138	−75.2	11.4
900	0.485	172.3	2.926	70.4	0.142	70.8	0.142	−75.6	10.6
1000	0.486	170.3	2.645	67.7	0.157	69.9	0.140	−77.2	9.7
1200	0.502	164.9	2.260	62.6	0.184	68.9	0.139	−81.1	8.4
1400	0.504	161.6	1.967	57.7	0.212	67.3	0.142	−85.9	7.2
1600	0.502	157.6	1.761	52.8	0.239	66.8	0.148	−89.2	6.3
1800	0.507	152.4	1.621	49.4	0.267	65.3	0.150	−93.7	5.6
2000	0.524	146.2	1.484	45.2	0.294	64.1	0.148	−98.9	4.9

NPN 7 GHz wideband transistor

BFR134

DESCRIPTION

NPN transistor in a plastic SOT37 envelope.

It is primarily intended for use in MATV and microwave amplifiers, such as aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

Emitter-ballasting resistors and application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

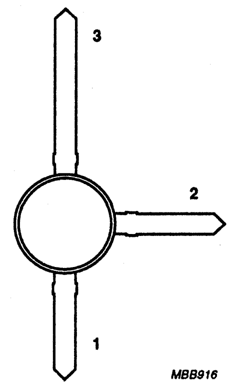


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11.5	–	dB
V_O	output voltage	I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; d_{im} = −60 dB; $f_{(p+q-r)}$ = 793.25 MHz	–	850	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11.5	–	dB
V_O	output voltage	note 2	–	900	–	mV
		note 3	–	850	–	mV
d_2	second order intermodulation distortion	note 4	–	–60	–	dB
		note 5	–	–56	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN45004B); I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN45004B); I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 80 mA; V_{CE} = 10 V; T_{amb} = 25 °C; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz.
5. I_C = 80 mA; V_{CE} = 10 V; T_{amb} = 25 °C; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

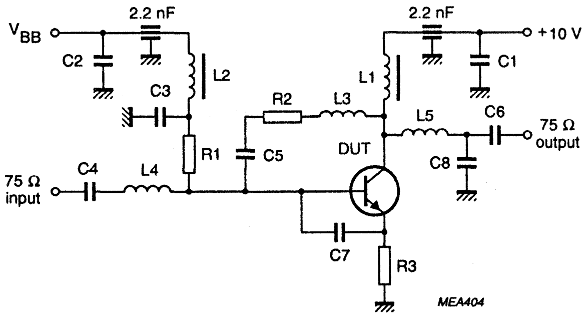


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	miniature ceramic capacitor	10 nF		2222 629 08103
C3, C4, C5, C6	multilayer ceramic capacitor	10 nF		2222 851 06627
C7	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C8	multilayer ceramic capacitor	1.0 pF		2222 851 12108
L1, L2	Ferroxcube choke	5 μH		3122 108 20153
L3	4 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4, L5	1.5 turns 0.4 mm copper wire		int. dia. 3 mm	
R1	chip resistor	10 kΩ		2322 712 30103
R2	chip resistor	220 Ω		2322 712 30221
R3, R4	chip resistor	15 Ω		2322 712 30159

NPN 7 GHz wideband transistor BFR134

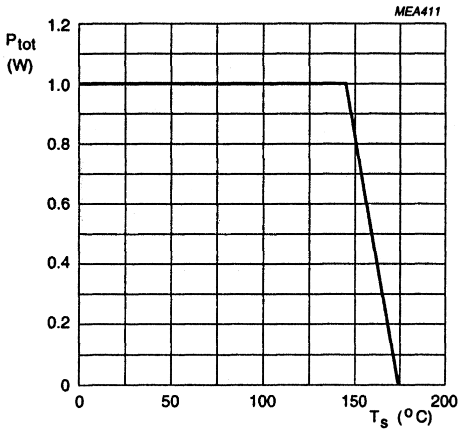
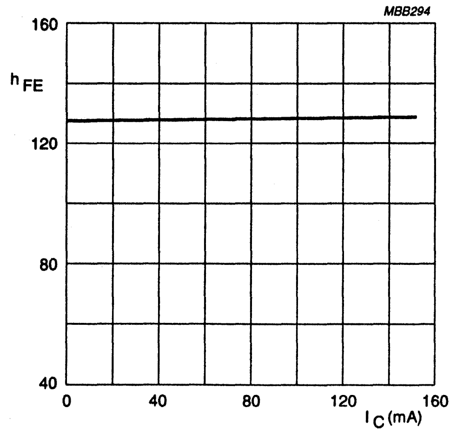
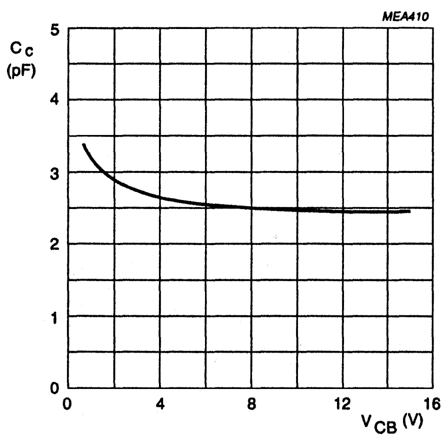


Fig.3 Power derating curve.



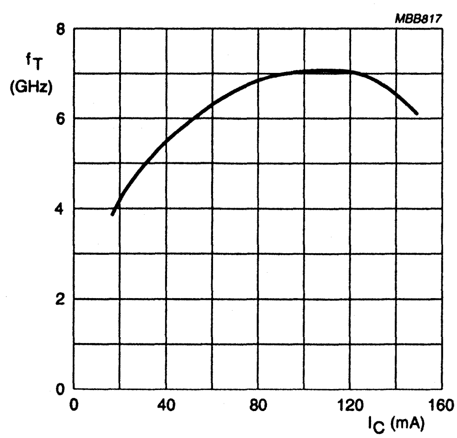
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



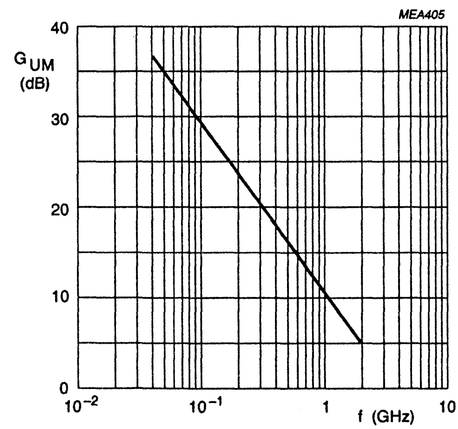
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



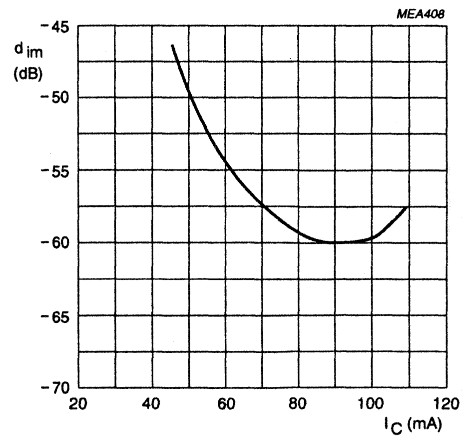
V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.6 Transition frequency as a function of collector current.



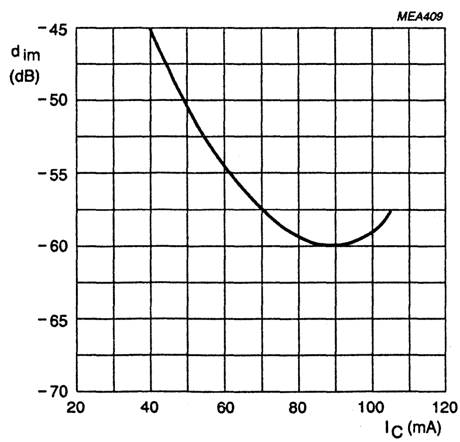
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



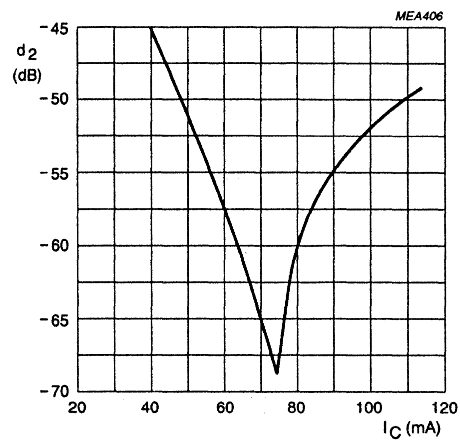
V_{CE} = 10 V; V_O = 900 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

Fig.8 Intermodulation distortion as a function of collector current.



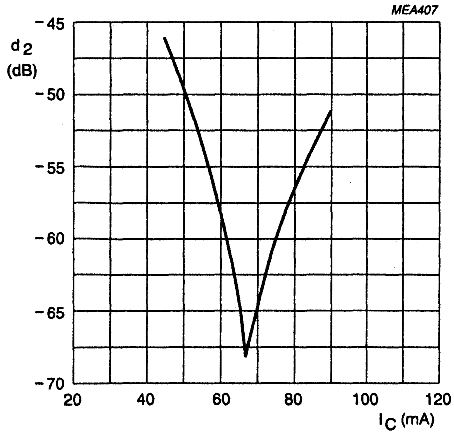
V_{CE} = 10 V; V_O = 850 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 793.25 MHz.

Fig.9 Intermodulation distortion as a function of collector current.



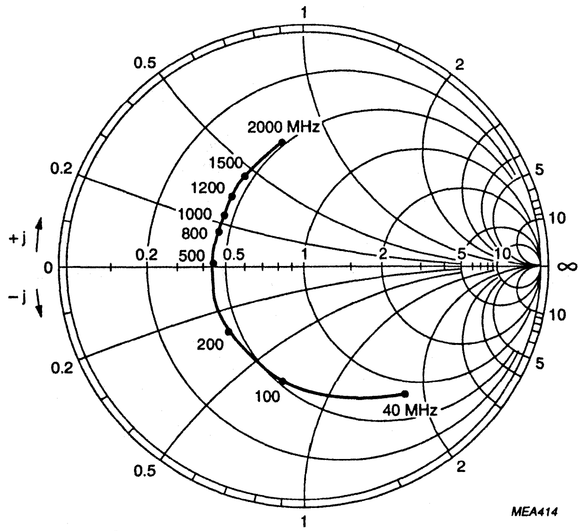
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C;
f_p = 50 MHz; f_q = 400 MHz; $f_{(p+q)}$ = 450 MHz.

Fig.10 Second order intermodulation distortion as a function of collector current.



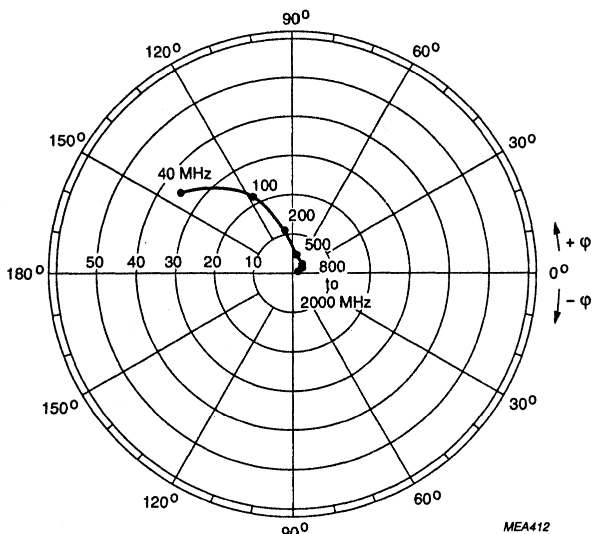
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C;
f_p = 250 MHz; f_q = 560 MHz; $f_{(p+q)}$ = 810 MHz.

Fig.11 Second order intermodulation distortion as a function of collector current.



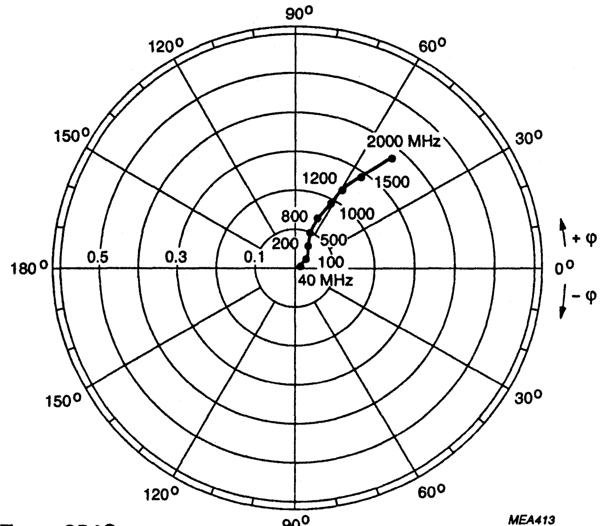
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter input reflection coefficient (S_{11}).



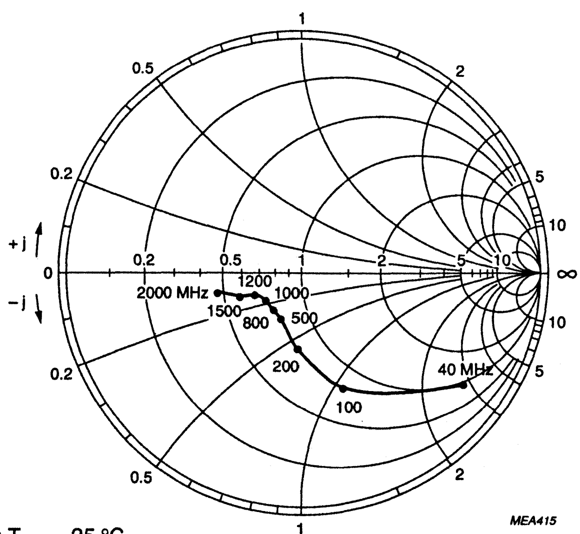
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter forward transmission coefficient (S_{21}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.15 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.635	−53.3	35.903	144.0	0.022	66.4	0.796	−36.8	37.7
100	0.475	−101.0	22.081	116.5	0.037	56.1	0.503	−66.0	29.3
200	0.394	−139.8	12.325	98.5	0.054	57.9	0.310	−87.6	23.0
300	0.377	−159.9	8.454	89.0	0.071	60.1	0.245	−100.3	19.5
400	0.378	−171.5	6.454	81.9	0.089	61.7	0.222	−109.5	17.1
500	0.377	179.9	5.220	75.8	0.107	61.7	0.217	−116.0	15.2
600	0.380	172.4	4.406	70.6	0.125	61.1	0.218	−120.3	13.8
700	0.376	165.4	3.816	65.5	0.143	60.2	0.223	−123.9	12.5
800	0.376	158.9	3.376	60.9	0.161	59.2	0.226	−126.8	11.5
900	0.378	153.2	3.036	56.4	0.180	57.8	0.229	−130.1	10.5
1000	0.386	147.0	2.748	52.2	0.198	56.4	0.234	−133.8	9.7
1200	0.403	136.0	2.356	43.8	0.233	52.9	0.251	−143.4	8.5
1400	0.432	127.1	2.061	36.0	0.266	49.0	0.281	−152.8	7.5
1600	0.443	119.2	1.837	28.2	0.299	44.9	0.313	−158.2	6.7
1800	0.445	110.2	1.701	20.4	0.333	40.1	0.341	−163.4	6.1
2000	0.467	101.8	1.550	13.5	0.365	35.4	0.361	−170.1	5.5
2200	0.506	93.3	1.436	7.0	0.395	31.8	0.381	−177.9	5.1
2400	0.528	87.5	1.351	1.6	0.422	28.0	0.415	174.9	4.9
2600	0.546	82.4	1.266	−5.1	0.448	23.8	0.456	169.1	4.6
2800	0.554	75.7	1.194	−10.9	0.469	18.8	0.483	163.5	4.3
3000	0.560	68.0	1.132	−16.4	0.495	13.9	0.508	158.1	4.0

Table 2 Common emitter scattering parameters, I_C = 75 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.622	−55.3	37.152	143.3	0.022	66.8	0.777	−38.6	37.6
100	0.462	−104.0	22.432	116.3	0.036	56.9	0.486	−68.3	29.2
200	0.391	−142.5	12.452	99.1	0.052	60.1	0.299	−90.3	23.0
300	0.375	−161.0	8.532	90.9	0.070	63.2	0.239	−103.4	19.5
400	0.372	−173.1	6.496	84.8	0.087	65.3	0.218	−112.4	17.1
500	0.377	178.8	5.262	79.6	0.105	66.1	0.212	−119.0	15.3
600	0.372	171.4	4.417	75.2	0.123	66.2	0.213	−123.2	13.7
700	0.373	165.4	3.830	71.0	0.142	65.9	0.217	−126.4	12.5
800	0.372	158.6	3.374	67.0	0.158	65.6	0.220	−129.8	11.4
900	0.374	152.6	3.023	63.4	0.177	65.0	0.224	−132.9	10.5
1000	0.379	145.9	2.759	60.1	0.195	64.0	0.230	−137.0	9.7
1200	0.401	135.7	2.344	53.8	0.229	62.1	0.246	−145.8	8.4
1400	0.419	127.4	2.043	47.1	0.260	59.5	0.276	−153.1	7.4
1600	0.427	119.6	1.814	41.5	0.294	57.9	0.305	−158.6	6.5
1800	0.431	112.0	1.666	35.8	0.328	53.7	0.332	−163.6	5.8
2000	0.456	102.9	1.535	31.1	0.358	51.4	0.347	−169.4	5.3
2200	0.485	95.0	1.435	25.4	0.388	48.3	0.368	−177.3	4.9
2400	0.511	89.6	1.307	21.9	0.414	46.9	0.400	174.9	4.4
2600	0.525	84.5	1.260	18.1	0.444	43.0	0.435	169.1	4.3
2800	0.523	79.0	1.153	12.4	0.455	39.5	0.467	164.3	3.7
3000	0.529	71.4	1.096	9.4	0.479	37.5	0.483	158.9	3.4

Table 3 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.605	−57.2	38.147	141.8	0.021	64.4	0.766	−40.0	37.4
100	0.452	−106.4	22.641	114.5	0.036	56.5	0.470	−70.4	29.2
200	0.381	−143.9	12.470	97.3	0.054	59.1	0.290	−93.3	23.0
300	0.373	−162.8	8.520	88.3	0.071	61.7	0.233	−107.2	19.5
400	0.372	−173.7	6.494	81.5	0.090	62.6	0.216	−116.7	17.1
500	0.375	177.5	5.256	75.6	0.109	62.7	0.213	−122.9	15.3
600	0.376	170.9	4.447	70.3	0.127	61.8	0.215	−127.2	13.8
700	0.372	163.7	3.831	65.5	0.146	60.6	0.220	−130.3	12.5
800	0.374	157.1	3.392	61.0	0.165	59.3	0.224	−133.2	11.5
900	0.374	151.4	3.055	56.4	0.184	57.7	0.226	−136.5	10.6
1000	0.382	145.5	2.763	52.6	0.202	56.3	0.231	−139.9	9.8
1200	0.400	135.1	2.372	44.1	0.238	52.5	0.249	−149.0	8.5
1400	0.428	125.6	2.073	36.3	0.271	48.3	0.278	−157.5	7.6
1600	0.439	117.7	1.853	28.7	0.305	44.3	0.308	−162.7	6.7
1800	0.438	109.3	1.709	20.9	0.338	39.4	0.336	−167.4	6.1
2000	0.461	100.7	1.562	14.0	0.369	34.4	0.358	−173.9	5.5
2200	0.496	92.5	1.449	7.9	0.400	30.8	0.376	178.7	5.1
2400	0.523	86.5	1.358	2.2	0.427	27.2	0.407	171.9	4.8
2600	0.536	81.7	1.274	−4.2	0.450	22.6	0.446	166.3	4.5
2800	0.542	75.3	1.212	−10.2	0.469	17.7	0.476	161.1	4.3
3000	0.546	67.3	1.149	−15.5	0.494	12.9	0.497	156.3	4.0

NPN 9 GHz wideband transistor — BFR505

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFR505 is an npn silicon planar epitaxial transistor, intended for applications in the RF frontend in wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV).

The transistor is encapsulated in a plastic SOT23 envelope.

PINNING

PIN	DESCRIPTION
Code: N30	
1	base
2	emitter
3	collector

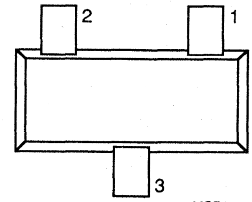


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 110 °C (note 1)	–	–	150	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 5 mA; V_{CE} = 6 V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	17	–	dB
		I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 1.25 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 1.25 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 9 GHz wideband transistor BFR505

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage		–	2.5	V
I_C	DC collector current	continuous	–	18	mA
P_{tot}	total power dissipation	up to T_s = 110 °C (note 1)	–	150	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 6$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	0.4	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.4	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	17	–	dB
		$I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 5$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C; f = 900 MHz	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 5$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and $f_{(2q-p)} = 904$ MHz.

NPN 9 GHz wideband transistor BFR505

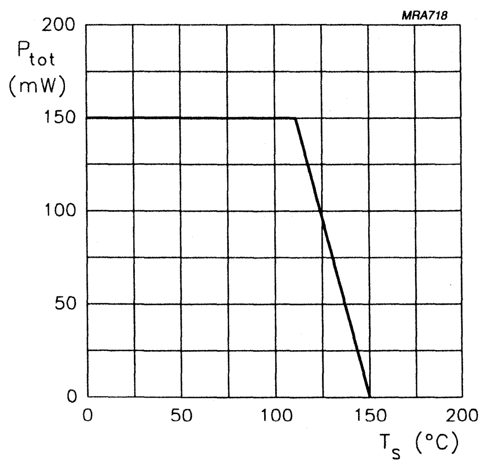
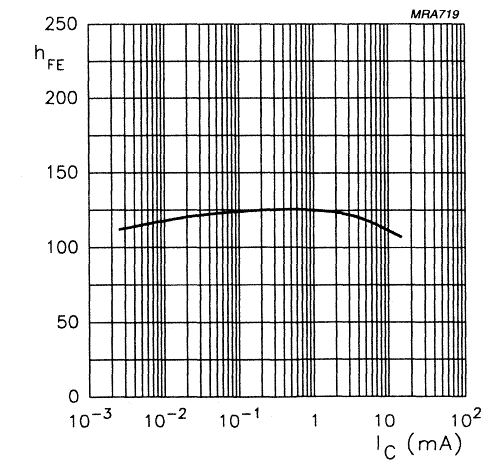
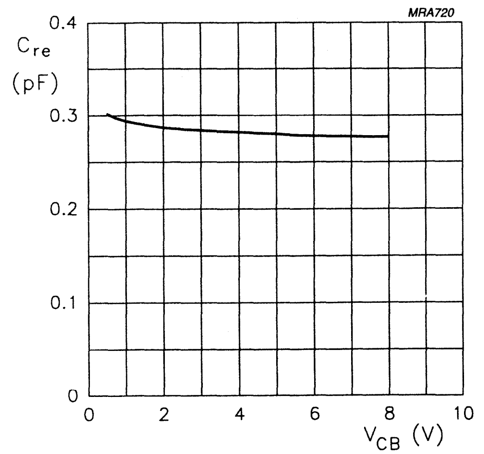


Fig.2 Power derating curve.



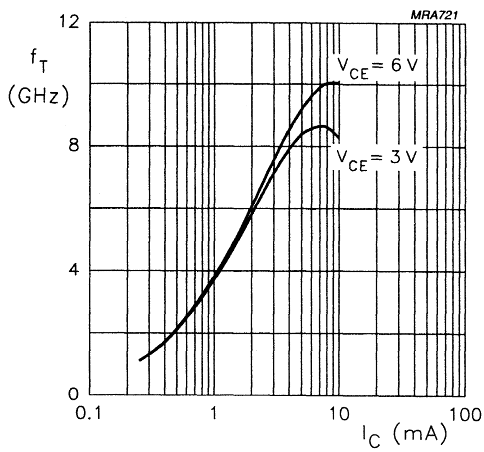
V_{CE} = 6 V.

Fig.3 DC current gain as a function of collector current.



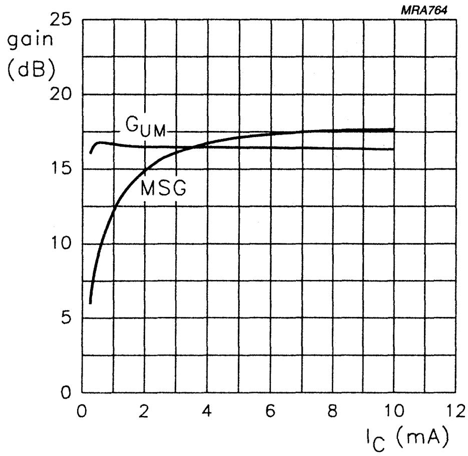
I_C = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



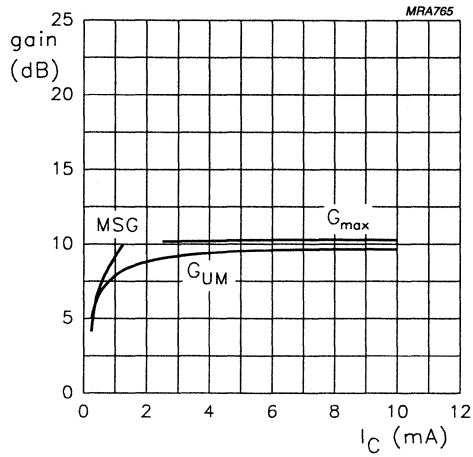
T_{amb} = 25 °C; f = 1 GHz.

Fig.5 Transition frequency as a function of collector current.



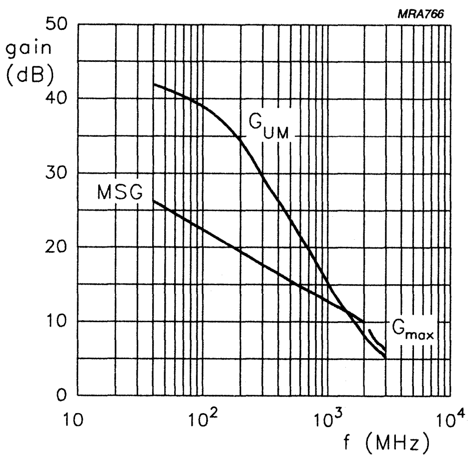
V_{CE} = 6 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



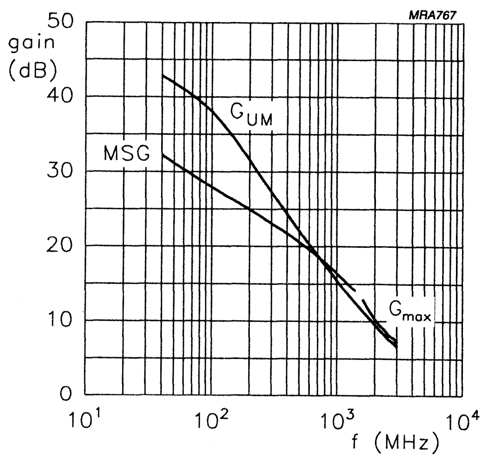
V_{CE} = 6 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



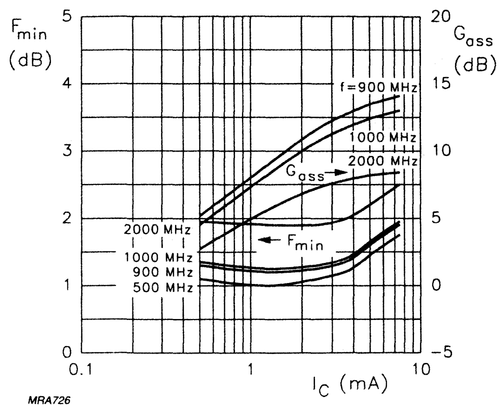
V_{CE} = 6 V; I_C = 1.25 mA.

Fig.8 Gain as a function of frequency.



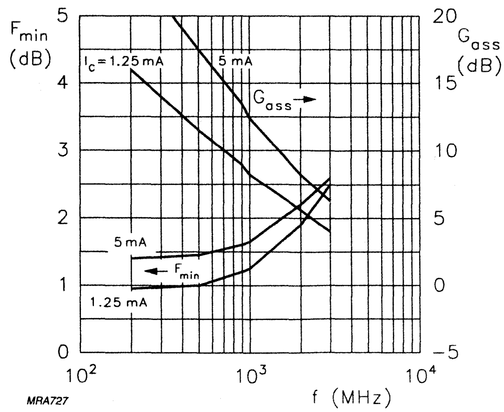
V_{CE} = 6 V; I_C = 5 mA.

Fig.9 Gain as a function of frequency.



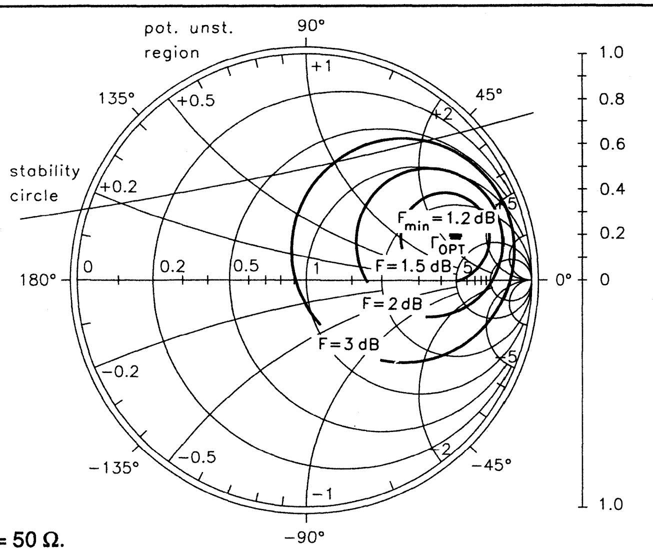
V_{CE} = 6 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 6 V.

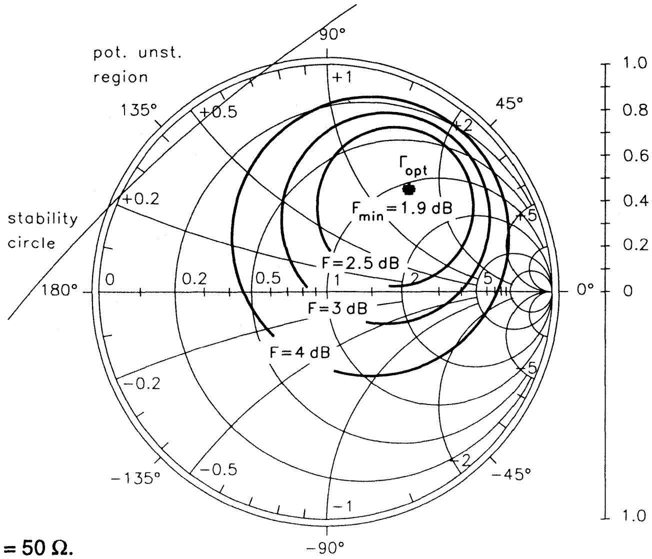
Fig.11 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.

V_{CE} = 6 V; I_C = 5 mA; f = 900 MHz.

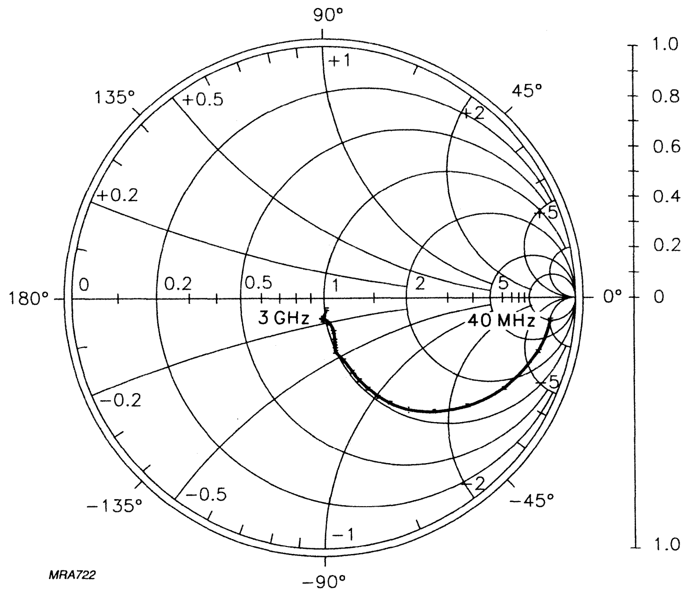
Fig.12 Noise circle figure.



$Z_o = 50\ \Omega$.

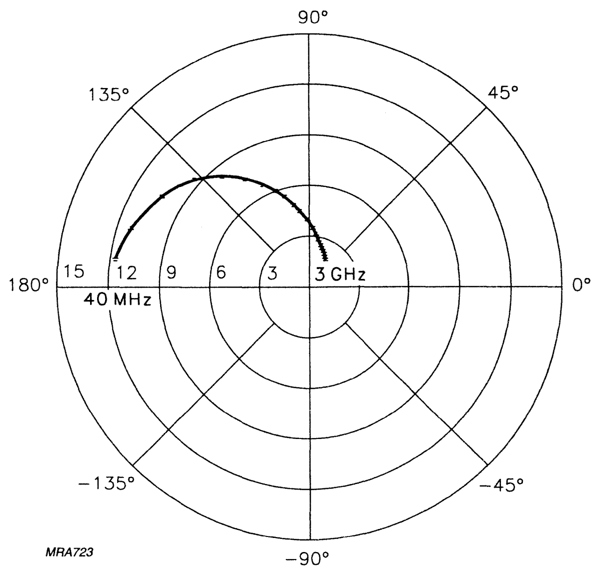
$V_{CE} = 6$ V; $I_C = 5$ mA; f = 2000 MHz.

Fig.13 Noise circle figure.



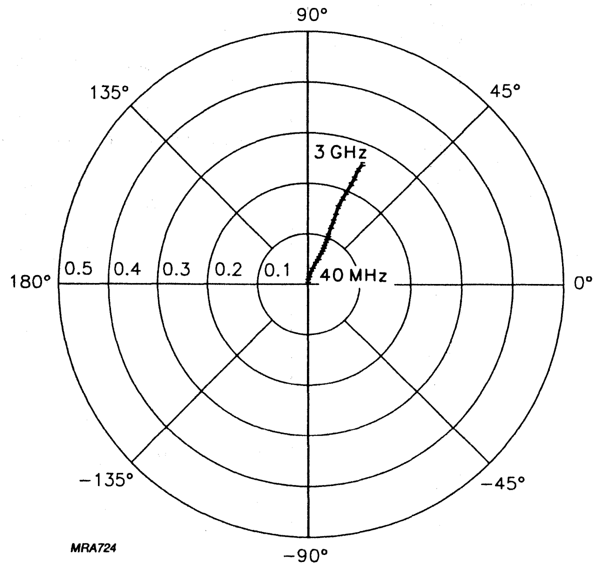
V_{CE} = 6 V; I_C = 5 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}).



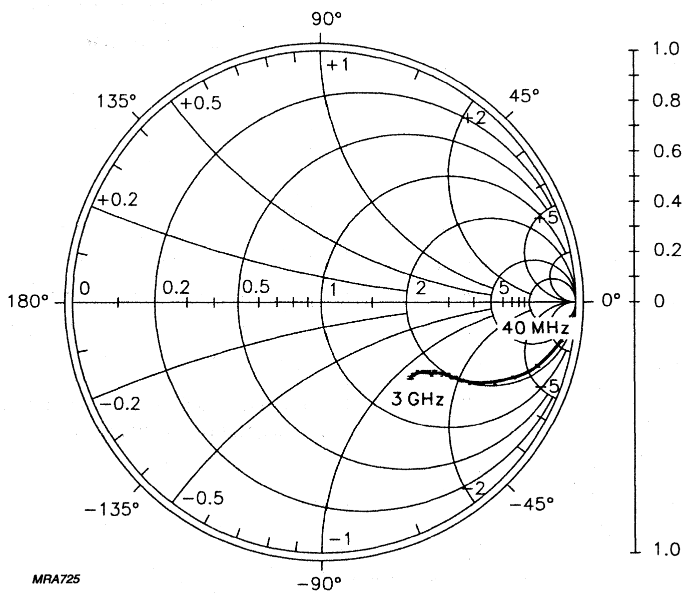
V_{CE} = 6 V; I_C = 5 mA.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_C = 5 mA.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).

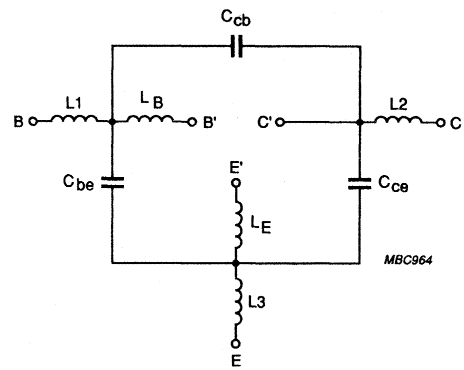


V_{CE} = 6 V; I_C = 5 mA.

Fig.17 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR505 crystal

1	IS = 134.1	aA
2	BF = 180.0	–
3	NF = 988.2	m
4	VAF = 38.34	V
5	IKF = 150.0	mA
6	ISE = 27.81	fA
7	NE = 2.051	–
8	BR = 55.19	–
9	NR = 982.2	m
10	VAR = 2.459	V
11	IKR = 2.920	mA
12	ISC = 17.45	aA
13	NC = 1.062	–
14	RB = 20.00	Ω
15	IRB = 1.000	μA
16	RBM = 20.00	Ω
17	RE = 1.171	Ω
18	RC = 4.350	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 284.7	fF
23	VJE = 600.0	mV
24	MJE = 303.6	m
25	TF = 7.037	ps
26	XTF = 12.34	–
27	VTF = 1.701	V
28	ITF = 30.64	mA
29 (note 1)	PTF = 0.000	deg
30	CJC = 242.4	fF
31	VJC = 188.6	mV
32	MJC = 41.49	m
33	XCJC = 130.0	m
34	TR = 1.332	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 897.4	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}$ (f) = $QL_{B,E}$ $\sqrt{}$ (f/Fc).

Fc = scaling frequency = 1000 MHz.

Fig.18 Package equivalent circuit, SOT23.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.35 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.987	−1.8	1.368	177.3	0.008	87.7	0.995	−1.2	38.9
100	0.984	−4.5	1.362	173.8	0.019	86.4	0.994	−2.8	37.2
200	0.981	−9.1	1.353	167.9	0.039	82.7	0.991	−5.8	34.5
300	0.972	−13.8	1.354	161.9	0.057	79.5	0.983	−8.7	30.0
400	0.959	−18.3	1.351	156.8	0.075	76.8	0.975	−11.5	26.6
500	0.948	−22.5	1.333	151.7	0.092	74.2	0.967	−14.2	24.3
600	0.933	−26.7	1.314	146.8	0.108	71.5	0.957	−16.8	22.0
700	0.916	−30.8	1.298	142.2	0.123	68.9	0.946	−19.3	20.0
800	0.894	−34.7	1.291	137.4	0.137	66.5	0.933	−21.4	18.1
900	0.869	−38.7	1.284	132.4	0.149	64.0	0.921	−23.5	16.5
1000	0.844	−42.7	1.263	127.9	0.160	61.6	0.906	−25.5	14.9
1200	0.791	−50.7	1.232	119.2	0.180	57.0	0.873	−29.6	12.3
1400	0.740	−58.8	1.224	111.5	0.195	53.5	0.841	−33.1	10.5
1600	0.693	−65.3	1.199	105.0	0.204	50.3	0.814	−35.9	9.1
1800	0.648	−71.1	1.155	98.9	0.212	48.6	0.792	−38.5	7.9
2000	0.581	−77.5	1.127	92.1	0.217	46.1	0.761	−40.8	6.6
2200	0.518	−85.3	1.111	85.9	0.220	44.2	0.728	−43.5	5.6
2400	0.476	−94.2	1.106	79.5	0.223	43.0	0.699	−46.6	4.9
2600	0.450	−101.1	1.081	75.3	0.223	43.0	0.683	−49.6	4.4
2800	0.413	−106.2	1.072	71.7	0.225	44.3	0.677	−51.6	4.1
3000	0.356	−112.4	1.038	67.1	0.225	45.3	0.658	−53.1	3.4

Table 2 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 1.25 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.971	−2.7	3.415	176.1	0.008	87.8	0.993	−1.8	41.6
100	0.965	−6.6	3.375	171.2	0.019	85.2	0.990	−4.2	39.0
200	0.951	−13.3	3.305	163.3	0.038	80.3	0.977	−8.6	33.9
300	0.926	−19.7	3.244	156.0	0.055	76.4	0.955	−12.6	29.2
400	0.897	−25.8	3.173	149.9	0.071	73.0	0.932	−16.2	25.9
500	0.867	−31.5	3.059	143.8	0.086	69.8	0.909	−19.6	23.4
600	0.835	−36.7	2.947	138.6	0.098	67.0	0.882	−22.6	21.1
700	0.798	−41.9	2.868	133.3	0.110	64.8	0.857	−25.1	19.3
800	0.758	−46.7	2.780	128.1	0.119	62.8	0.832	−27.1	17.7
900	0.715	−51.4	2.688	123.0	0.128	61.0	0.810	−29.0	16.3
1000	0.674	−55.7	2.584	118.3	0.136	59.4	0.785	−30.6	15.0
1200	0.590	−64.5	2.413	109.5	0.149	56.9	0.739	−33.7	12.9
1400	0.520	−73.0	2.282	102.0	0.160	55.7	0.702	−36.1	11.5
1600	0.466	−78.4	2.121	95.7	0.167	55.0	0.674	−37.8	10.2
1800	0.413	−83.0	1.978	90.2	0.177	55.5	0.653	−39.3	9.2
2000	0.350	−87.9	1.856	84.3	0.185	55.2	0.627	−40.2	8.1
2200	0.294	−95.6	1.763	79.1	0.194	55.3	0.599	−41.9	7.2
2400	0.263	−104.5	1.692	73.7	0.204	55.4	0.574	−44.4	6.6
2600	0.247	−110.3	1.604	70.1	0.213	56.3	0.561	−46.8	6.0
2800	0.220	−113.6	1.551	67.0	0.224	57.7	0.559	−48.3	5.7
3000	0.174	−119.3	1.478	63.0	0.234	58.4	0.547	−48.9	5.1

Table 3 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.20	0.670	17.0	0.86
2000	1.90	0.560	51.0	0.55

Table 4 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.944	−3.9	6.565	174.4	0.008	87.9	0.989	−2.7	42.6
100	0.931	−9.7	6.408	167.3	0.019	83.4	0.979	−6.4	38.7
200	0.895	−19.0	6.133	156.9	0.036	77.4	0.945	−12.3	32.5
300	0.844	−27.7	5.850	147.8	0.051	72.9	0.900	−17.3	28.0
400	0.789	−35.6	5.540	140.1	0.065	69.2	0.856	−21.3	24.8
500	0.734	−42.7	5.190	133.1	0.076	67.0	0.813	−24.6	22.4
600	0.679	−48.9	4.872	127.0	0.085	65.0	0.774	−27.1	20.4
700	0.622	−54.5	4.582	121.0	0.094	63.8	0.741	−28.9	18.8
800	0.569	−59.1	4.291	115.7	0.102	63.0	0.712	−30.1	17.4
900	0.518	−63.4	4.012	110.7	0.109	62.6	0.688	−31.2	16.2
1000	0.471	−67.3	3.750	106.3	0.116	62.0	0.665	−32.0	15.1
1200	0.389	−74.5	3.324	98.5	0.129	61.7	0.625	−33.6	13.3
1400	0.332	−81.4	2.997	92.2	0.141	62.0	0.597	−35.0	12.0
1600	0.291	−84.4	2.699	87.1	0.152	62.6	0.579	−35.8	10.8
1800	0.252	−86.7	2.461	82.6	0.166	63.5	0.567	−36.6	9.8
2000	0.204	−89.5	2.267	77.8	0.179	63.5	0.550	−37.0	8.9
2200	0.161	−97.2	2.121	73.6	0.193	63.5	0.528	−38.2	8.1
2400	0.141	−108.4	2.011	69.2	0.207	63.2	0.508	−40.4	7.5
2600	0.135	−113.1	1.885	66.1	0.221	63.4	0.499	−43.0	6.8
2800	0.118	−113.6	1.804	63.6	0.235	64.0	0.500	−44.3	6.4
3000	0.079	−118.6	1.711	60.0	0.249	63.7	0.493	−44.7	5.9

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.600	17.0	0.67
2000	1.90	0.438	48.0	0.52

Table 6 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 3.75 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.918	−5.0	9.316	172.9	0.007	87.3	0.985	−3.4	42.6
100	0.897	−12.3	8.982	164.3	0.018	81.8	0.966	−8.0	38.0
200	0.840	−23.8	8.420	151.9	0.035	75.5	0.913	−15.0	31.6
300	0.766	−34.1	7.818	141.5	0.048	71.1	0.848	−20.1	27.2
400	0.692	−43.1	7.188	132.8	0.060	67.9	0.791	−23.8	24.2
500	0.622	−50.5	6.543	125.3	0.069	66.5	0.743	−26.6	21.9
600	0.558	−56.7	5.983	118.9	0.078	65.5	0.702	−28.4	20.1
700	0.499	−61.6	5.467	113.2	0.086	65.3	0.670	−29.5	18.6
800	0.447	−65.3	5.004	108.4	0.093	65.1	0.646	−30.1	17.3
900	0.402	−68.9	4.597	103.9	0.101	65.2	0.626	−30.6	16.2
1000	0.361	−72.0	4.237	100.0	0.108	65.2	0.606	−31.0	15.1
1200	0.291	−78.0	3.670	93.2	0.122	65.6	0.575	−32.0	13.4
1400	0.248	−84.1	3.261	87.8	0.137	66.0	0.554	−33.1	12.1
1600	0.217	−85.0	2.908	83.3	0.149	66.5	0.543	−33.7	11.0
1800	0.187	−86.2	2.634	79.3	0.164	67.2	0.536	−34.5	10.0
2000	0.145	−86.9	2.415	74.9	0.179	66.9	0.523	−34.8	9.1
2200	0.107	−95.3	2.252	71.2	0.195	66.6	0.503	−35.9	8.4
2400	0.092	−108.8	2.127	67.2	0.211	66.1	0.485	−38.2	7.8
2600	0.092	−114.0	1.986	64.4	0.225	66.0	0.476	−40.8	7.1
2800	0.079	−112.4	1.895	62.1	0.241	66.2	0.479	−42.3	6.7
3000	0.043	−116.2	1.797	58.7	0.256	65.5	0.474	−42.6	6.2

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.40	0.554	17.0	0.62
2000	2.00	0.402	47.0	0.49

Table 8 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.893	−6.1	11.842	171.6	0.007	86.6	0.980	−4.0	42.5
100	0.863	−14.9	11.284	161.6	0.018	80.8	0.954	−9.5	37.4
200	0.785	−28.2	10.345	147.6	0.033	73.7	0.881	−17.0	31.0
300	0.693	−39.7	9.345	136.1	0.046	69.9	0.804	−21.9	26.8
400	0.607	−48.9	8.330	126.9	0.056	67.8	0.742	−25.0	23.9
500	0.531	−56.1	7.395	119.4	0.065	67.1	0.692	−27.1	21.6
600	0.469	−61.7	6.613	113.4	0.073	66.6	0.654	−28.3	19.9
700	0.415	−65.8	5.932	108.1	0.081	67.0	0.626	−29.0	18.4
800	0.370	−68.9	5.367	103.7	0.089	67.3	0.606	−29.3	17.2
900	0.328	−71.8	4.881	99.7	0.096	67.5	0.589	−29.5	16.1
1000	0.293	−74.4	4.472	96.1	0.104	67.7	0.573	−29.7	15.1
1200	0.234	−79.4	3.833	90.0	0.119	68.2	0.548	−30.4	13.5
1400	0.198	−85.4	3.385	85.1	0.135	68.6	0.532	−31.5	12.2
1600	0.174	−85.5	3.003	80.9	0.148	69.0	0.525	−32.1	11.1
1800	0.149	−85.0	2.714	77.3	0.164	69.5	0.521	−33.0	10.1
2000	0.112	−84.9	2.484	73.2	0.180	68.9	0.510	−33.2	9.3
2200	0.077	−93.8	2.311	69.7	0.196	68.4	0.492	−34.3	8.5
2400	0.065	−111.8	2.181	65.8	0.213	67.8	0.474	−36.7	7.9
2600	0.067	−116.3	2.032	63.3	0.228	67.3	0.466	−39.4	7.2
2800	0.058	−113.1	1.938	61.1	0.244	67.3	0.470	−41.0	6.8
3000	0.022	−120.6	1.835	57.8	0.260	66.5	0.465	−41.4	6.3

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.60	0.509	16.0	0.60
2000	2.20	0.353	46.0	0.49

Table 10 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 7.5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.841	−8.1	16.013	169.4	0.007	84.5	0.971	−5.0	41.8
100	0.796	−19.6	14.950	157.0	0.017	79.3	0.929	−11.6	36.5
200	0.685	−35.8	13.083	140.5	0.031	72.1	0.828	−19.3	30.1
300	0.572	−48.1	11.182	128.0	0.042	69.7	0.739	−23.4	26.1
400	0.480	−57.1	9.517	118.9	0.051	68.6	0.675	−25.4	23.4
500	0.411	−63.5	8.163	112.0	0.060	68.9	0.631	−26.5	21.2
600	0.357	−68.1	7.124	106.7	0.067	69.1	0.601	−27.0	19.6
700	0.313	−71.2	6.289	102.1	0.076	69.9	0.580	−27.2	18.2
800	0.278	−73.5	5.626	98.3	0.084	70.3	0.566	−27.2	17.0
900	0.245	−75.9	5.082	94.8	0.092	70.9	0.555	−27.3	16.0
1000	0.215	−77.8	4.626	91.7	0.100	71.0	0.544	−27.3	15.0
1200	0.168	−82.7	3.939	86.4	0.116	71.4	0.526	−28.0	13.4
1400	0.143	−89.2	3.456	82.0	0.133	71.6	0.514	−29.2	12.2
1600	0.126	−86.9	3.058	78.2	0.148	71.7	0.511	−30.0	11.1
1800	0.104	−85.6	2.755	74.8	0.164	71.8	0.509	−31.0	10.2
2000	0.073	−83.5	2.519	71.0	0.181	71.1	0.501	−31.4	9.3
2200	0.041	−97.8	2.340	67.8	0.198	70.4	0.485	−32.6	8.6
2400	0.036	−130.1	2.205	64.2	0.215	69.6	0.468	−35.1	7.9
2600	0.042	−132.4	2.052	61.7	0.230	69.0	0.460	−37.9	7.3
2800	0.032	−129.6	1.954	59.7	0.247	68.8	0.464	−39.6	6.9
3000	0.011	144.2	1.852	56.5	0.263	67.8	0.460	−40.1	6.4

Table 11 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.988	−1.7	1.312	177.4	0.008	89.6	0.995	−1.2	38.5
100	0.985	−4.4	1.313	174.0	0.019	86.8	0.994	−2.7	37.0
200	0.983	−8.8	1.303	168.1	0.038	83.0	0.992	−5.6	34.7
300	0.975	−13.3	1.296	162.3	0.057	80.0	0.984	−8.5	30.3
400	0.962	−17.7	1.295	157.3	0.074	77.0	0.977	−11.2	26.9
500	0.952	−21.8	1.279	152.2	0.091	74.6	0.969	−13.9	24.5
600	0.938	−25.7	1.256	147.5	0.107	72.1	0.960	−16.4	22.2
700	0.921	−29.6	1.243	142.9	0.122	69.6	0.949	−18.8	20.1
800	0.901	−33.5	1.237	138.2	0.135	67.1	0.938	−20.9	18.3
900	0.878	−37.4	1.237	133.2	0.148	64.7	0.927	−22.9	16.7
1000	0.854	−41.2	1.215	128.7	0.159	62.3	0.912	−24.9	15.1
1200	0.801	−49.0	1.194	120.0	0.179	57.8	0.880	−29.0	12.5
1400	0.752	−56.9	1.191	112.5	0.195	54.2	0.848	−32.5	10.6
1600	0.706	−63.2	1.171	105.9	0.204	51.0	0.822	−35.4	9.3
1800	0.660	−68.8	1.128	99.8	0.213	49.2	0.801	−38.1	8.0
2000	0.595	−74.8	1.100	93.0	0.218	46.7	0.771	−40.4	6.6
2200	0.533	−82.4	1.084	86.9	0.223	44.6	0.739	−43.2	5.6
2400	0.492	−90.8	1.081	80.5	0.226	43.2	0.709	−46.3	4.9
2600	0.465	−97.5	1.058	76.3	0.226	43.1	0.693	−49.2	4.4
2800	0.428	−102.4	1.051	72.7	0.227	44.1	0.685	−51.3	4.1
3000	0.370	−108.0	1.019	68.2	0.227	45.0	0.666	−52.8	3.4

Table 12 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 1.25 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.974	−2.5	3.336	176.2	0.008	88.8	0.993	−1.8	42.1
100	0.968	−6.4	3.297	171.5	0.019	85.5	0.989	−4.2	38.9
200	0.955	−12.6	3.235	163.9	0.037	80.6	0.978	−8.4	34.4
300	0.931	−18.8	3.184	156.7	0.055	76.9	0.957	−12.3	29.6
400	0.904	−24.7	3.116	150.7	0.070	73.6	0.936	−15.8	26.3
500	0.876	−30.1	3.009	144.8	0.085	70.6	0.914	−19.2	23.7
600	0.845	−35.2	2.910	139.5	0.098	67.9	0.889	−22.1	21.5
700	0.810	−40.2	2.834	134.4	0.109	65.6	0.864	−24.7	19.6
800	0.770	−44.8	2.754	129.2	0.119	63.5	0.839	−26.7	18.0
900	0.730	−49.3	2.662	124.1	0.128	61.8	0.817	−28.6	16.6
1000	0.689	−53.6	2.565	119.5	0.136	60.1	0.794	−30.3	15.3
1200	0.608	−61.8	2.399	110.8	0.149	57.6	0.747	−33.5	13.2
1400	0.538	−69.9	2.273	103.3	0.161	56.1	0.710	−36.0	11.7
1600	0.484	−75.2	2.119	97.0	0.169	55.3	0.681	−37.7	10.4
1800	0.433	−79.6	1.978	91.5	0.178	55.6	0.660	−39.2	9.3
2000	0.368	−83.8	1.857	85.6	0.187	55.3	0.633	−40.2	8.2
2200	0.310	−90.8	1.768	80.2	0.196	55.2	0.604	−42.0	7.4
2400	0.277	−99.2	1.701	74.9	0.206	55.1	0.578	−44.3	6.7
2600	0.259	−104.6	1.615	71.2	0.214	55.9	0.565	−46.8	6.1
2800	0.233	−107.0	1.562	68.2	0.225	57.3	0.562	−48.2	5.8
3000	0.186	−111.2	1.488	64.1	0.235	57.6	0.550	−48.8	5.2

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.20	0.694	17.0	0.87
2000	1.90	0.580	51.0	0.58

Table 14 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 2.5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.949	−3.7	6.445	174.4	0.007	87.1	0.989	−2.6	42.7
100	0.937	−9.2	6.297	167.8	0.018	84.1	0.979	−6.1	39.0
200	0.905	−18.0	6.045	157.7	0.036	77.8	0.949	−12.0	33.0
300	0.856	−26.2	5.781	148.8	0.051	73.6	0.905	−16.9	28.4
400	0.804	−33.8	5.494	141.3	0.064	70.2	0.863	−20.9	25.3
500	0.751	−40.4	5.160	134.4	0.076	67.7	0.821	−24.3	22.7
600	0.698	−46.4	4.859	128.3	0.086	65.8	0.783	−26.9	20.8
700	0.643	−51.8	4.578	122.5	0.095	64.4	0.750	−28.8	19.1
800	0.591	−56.1	4.303	117.1	0.102	63.6	0.721	−30.1	17.7
900	0.540	−60.1	4.030	112.2	0.110	62.9	0.697	−31.2	16.5
1000	0.494	−63.9	3.775	107.8	0.117	62.4	0.673	−32.1	15.4
1200	0.410	−70.6	3.358	99.9	0.130	61.9	0.631	−33.8	13.5
1400	0.353	−77.1	3.036	93.6	0.143	62.1	0.602	−35.2	12.2
1600	0.312	−79.6	2.737	88.4	0.154	62.4	0.583	−36.0	11.0
1800	0.273	−81.5	2.498	83.9	0.167	63.3	0.570	−36.9	10.0
2000	0.224	−83.3	2.302	79.0	0.180	63.0	0.552	−37.2	9.0
2200	0.178	−89.2	2.154	74.8	0.194	63.0	0.530	−38.4	8.2
2400	0.155	−98.2	2.044	70.3	0.209	62.6	0.508	−40.6	7.6
2600	0.150	−102.6	1.915	67.3	0.221	62.8	0.498	−43.0	7.0
2800	0.134	−102.3	1.833	64.8	0.236	63.3	0.499	−44.4	6.6
3000	0.094	−102.7	1.739	61.2	0.249	63.0	0.492	−44.7	6.0

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.631	16.0	0.74
2000	1.90	0.483	46.0	0.55

Table 16 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 3.75 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.928	−4.7	9.181	173.0	0.007	87.4	0.985	−3.3	43.0
100	0.908	−11.5	8.876	164.9	0.018	82.5	0.969	−7.8	38.6
200	0.855	−22.4	8.351	152.9	0.034	75.7	0.918	−14.6	32.2
300	0.786	−32.1	7.782	142.7	0.048	71.8	0.856	−19.7	27.7
400	0.714	−40.5	7.184	134.2	0.060	68.7	0.802	−23.6	24.7
500	0.646	−47.5	6.568	126.8	0.070	67.2	0.752	−26.5	22.3
600	0.583	−53.4	6.031	120.5	0.078	66.0	0.712	−28.5	20.5
700	0.524	−58.1	5.530	114.7	0.087	65.7	0.679	−29.7	18.9
800	0.473	−61.5	5.072	109.9	0.094	65.5	0.653	−30.4	17.6
900	0.427	−64.9	4.671	105.3	0.102	65.5	0.632	−31.0	16.5
1000	0.385	−67.6	4.309	101.4	0.109	65.3	0.612	−31.4	15.4
1200	0.313	−72.8	3.747	94.5	0.123	65.5	0.578	−32.4	13.7
1400	0.269	−78.2	3.332	89.1	0.138	66.0	0.556	−33.5	12.4
1600	0.238	−78.7	2.968	84.5	0.151	66.3	0.543	−34.1	11.2
1800	0.208	−79.1	2.693	80.5	0.166	66.9	0.536	−34.8	10.3
2000	0.167	−78.9	2.470	76.2	0.181	66.4	0.522	−35.0	9.4
2200	0.128	−84.0	2.302	72.5	0.196	66.2	0.502	−36.1	8.6
2400	0.108	−94.7	2.175	68.4	0.212	65.5	0.483	−38.3	8.0
2600	0.107	−98.6	2.031	65.6	0.227	65.3	0.474	−40.9	7.3
2800	0.097	−96.2	1.938	63.4	0.241	65.5	0.476	−42.2	6.9
3000	0.062	−90.3	1.838	60.0	0.256	64.8	0.471	−42.5	6.4

Table 17 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.40	0.600	15.0	0.68
2000	2.00	0.492	45.0	0.51

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Table 18 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.906	−5.6	11.695	171.8	0.007	86.3	0.980	−3.9	42.9
100	0.879	−13.8	11.190	162.3	0.018	81.4	0.956	−9.1	38.1
200	0.806	−26.3	10.317	148.8	0.033	74.5	0.888	−16.6	31.6
300	0.719	−36.9	9.359	137.6	0.046	70.9	0.814	−21.6	27.3
400	0.635	−45.7	8.398	128.6	0.056	68.5	0.752	−25.0	24.3
500	0.561	−52.5	7.491	121.1	0.066	67.6	0.701	−27.3	22.1
600	0.497	−57.7	6.727	115.0	0.074	67.1	0.663	−28.6	20.3
700	0.443	−61.4	6.055	109.7	0.082	67.3	0.633	−29.4	18.8
800	0.397	−64.2	5.485	105.2	0.090	67.4	0.611	−29.8	17.6
900	0.355	−66.7	5.005	101.1	0.097	67.6	0.594	−30.1	16.5
1000	0.318	−68.9	4.587	97.5	0.105	67.7	0.577	−30.3	15.4
1200	0.257	−73.0	3.944	91.4	0.121	68.1	0.549	−31.0	13.8
1400	0.220	−78.0	3.482	86.4	0.136	68.4	0.531	−32.1	12.5
1600	0.197	−77.2	3.094	82.2	0.150	68.7	0.523	−32.6	11.4
1800	0.172	−76.0	2.792	78.6	0.166	69.0	0.518	−33.3	10.4
2000	0.137	−74.1	2.555	74.5	0.182	68.3	0.507	−33.5	9.5
2200	0.100	−78.1	2.377	71.0	0.198	67.8	0.488	−34.5	8.7
2400	0.083	−90.3	2.242	67.2	0.215	67.0	0.470	−36.8	8.1
2600	0.085	−94.8	2.090	64.6	0.229	66.6	0.461	−39.4	7.5
2800	0.077	−90.8	1.992	62.5	0.245	66.6	0.465	−40.9	7.1
3000	0.045	−77.8	1.886	59.2	0.260	65.8	0.459	−41.2	6.5

Table 19 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.60	0.552	16.0	0.67
2000	2.20	0.412	44.0	0.51

Table 20 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 7.5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.866	−7.3	15.867	169.8	0.007	84.5	0.972	−4.8	42.7
100	0.825	−17.5	14.896	158.3	0.017	80.1	0.934	−11.2	37.4
200	0.722	−32.4	13.178	142.4	0.031	73.4	0.839	−19.0	30.9
300	0.612	−43.8	11.373	130.1	0.042	70.2	0.752	−23.5	26.8
400	0.520	−52.2	9.759	121.0	0.052	69.1	0.687	−25.9	23.9
500	0.448	−57.9	8.422	114.0	0.061	69.3	0.640	−27.2	21.8
600	0.393	−62.0	7.377	108.6	0.069	69.3	0.607	−27.9	20.1
700	0.347	−64.8	6.527	103.9	0.077	69.8	0.584	−28.1	18.7
800	0.310	−66.5	5.850	100.1	0.085	70.1	0.567	−28.2	17.5
900	0.276	−68.0	5.289	96.5	0.093	70.6	0.555	−28.3	16.4
1000	0.246	−69.4	4.817	93.4	0.102	70.7	0.543	−28.3	15.4
1200	0.197	−72.5	4.104	87.9	0.118	71.0	0.522	−28.9	13.8
1400	0.168	−76.8	3.604	83.5	0.134	71.0	0.509	−30.0	12.6
1600	0.152	−74.3	3.184	79.8	0.149	71.1	0.505	−30.5	11.4
1800	0.134	−71.9	2.869	76.4	0.166	71.2	0.503	−31.5	10.5
2000	0.105	−67.3	2.626	72.6	0.183	70.2	0.493	−31.7	9.6
2200	0.071	−69.5	2.437	69.4	0.199	69.5	0.476	−32.7	8.9
2400	0.055	−84.2	2.298	65.8	0.217	68.5	0.459	−35.1	8.3
2600	0.060	−91.2	2.137	63.4	0.232	68.0	0.451	−37.8	7.6
2800	0.054	−84.5	2.034	61.4	0.248	67.8	0.455	−39.4	7.2
3000	0.029	−56.7	1.927	58.2	0.264	66.7	0.451	−39.7	6.7

NPN 9 GHz wideband transistor

BFR520

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
Code: N28	
1	base
2	emitter
3	collector

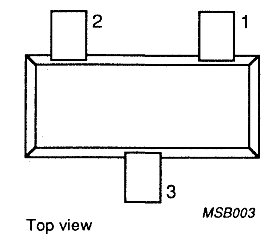


Fig.1 SOT23.

DESCRIPTION

The BFR520 is an npn silicon planar epitaxial transistor, intended for applications in the RF frontend in wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV) and repeater amplifiers in fibre-optic systems.

The transistor is encapsulated in a plastic SOT23 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to T_s = 72 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 6 V; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	15	–	dB
		I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 72 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	15	–	dB
		$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C; f = 900 MHz	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and $f_{(2q-p)} = 904$ MHz.

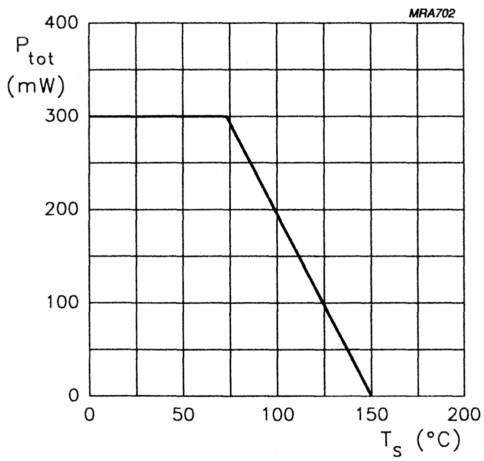
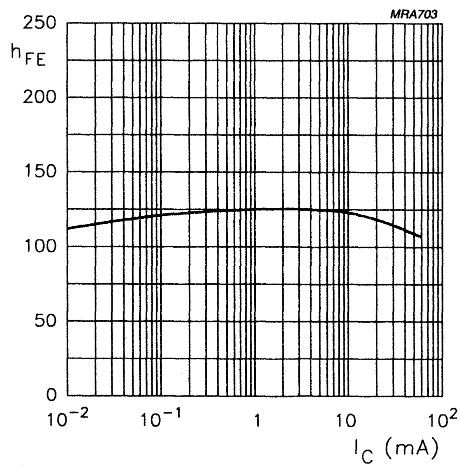
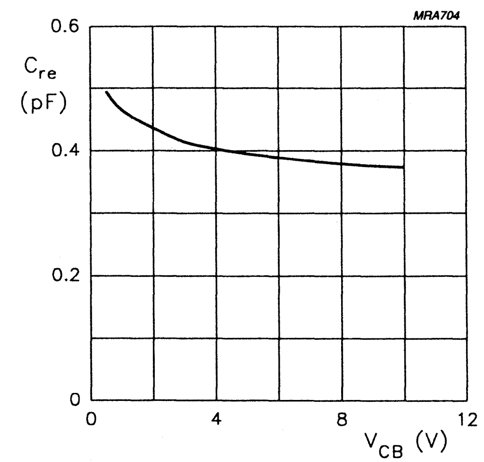


Fig.2 Power derating curve.



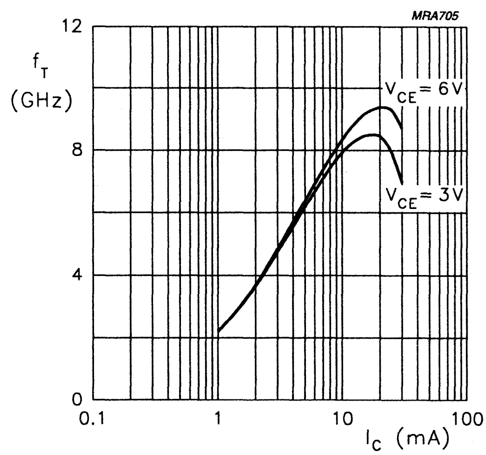
V_{CE} = 6 V.

Fig.3 DC current gain as a function of collector current.



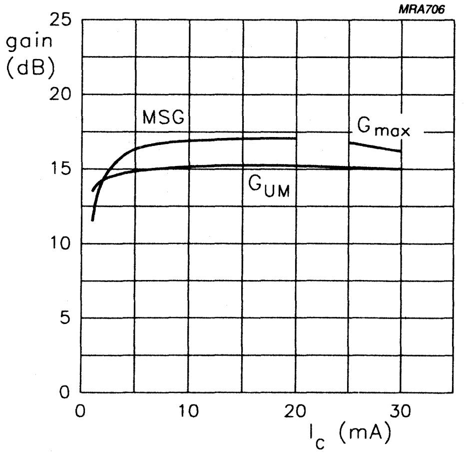
I_C = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage.



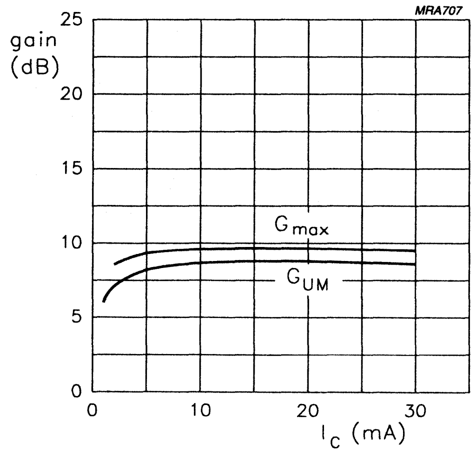
T_{amb} = 25 °C; f = 1 GHz.

Fig.5 Transition frequency as a function of collector current.



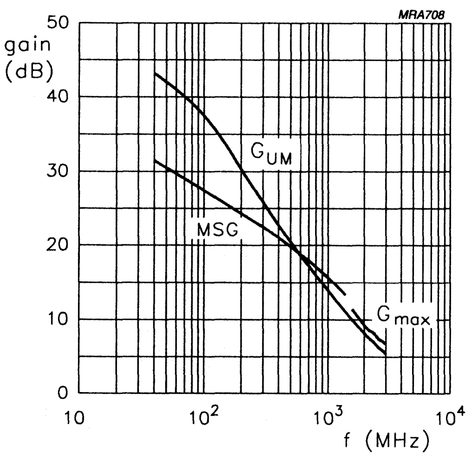
V_{CE} = 6 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



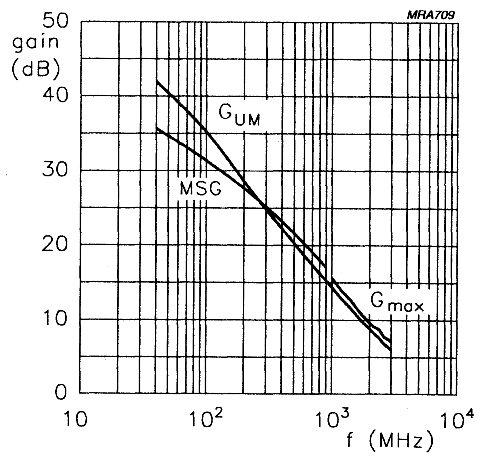
V_{CE} = 6 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



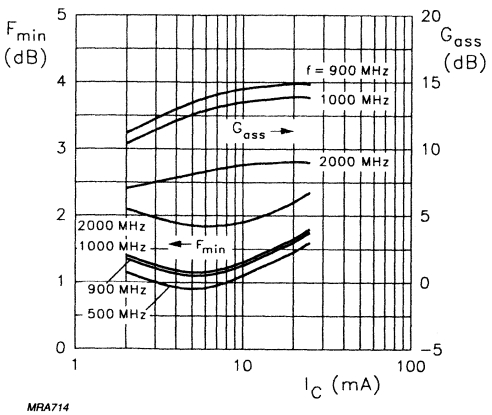
V_{CE} = 6 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



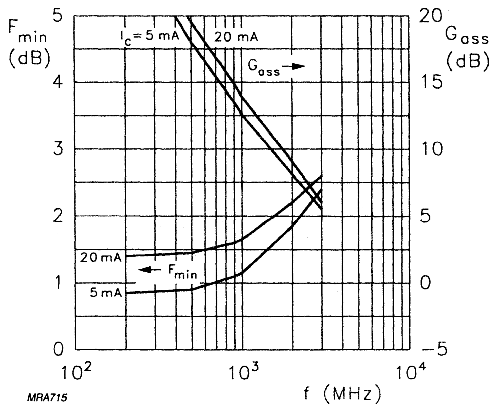
V_{CE} = 6 V; I_C = 20 mA.

Fig.9 Gain as a function of frequency.



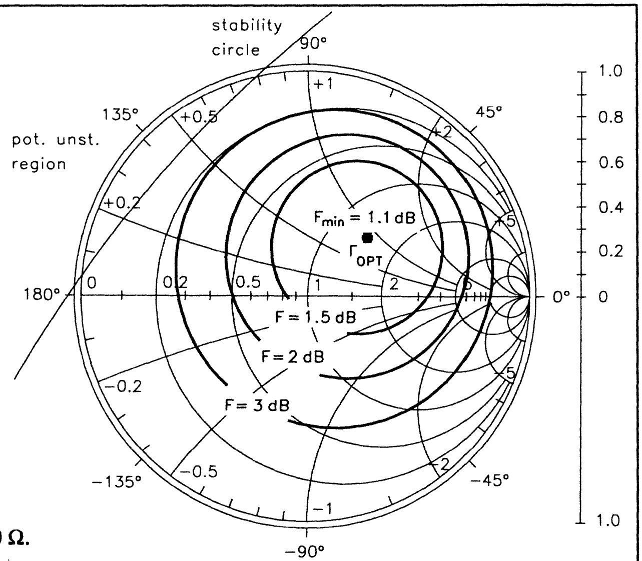
V_{CE} = 6 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



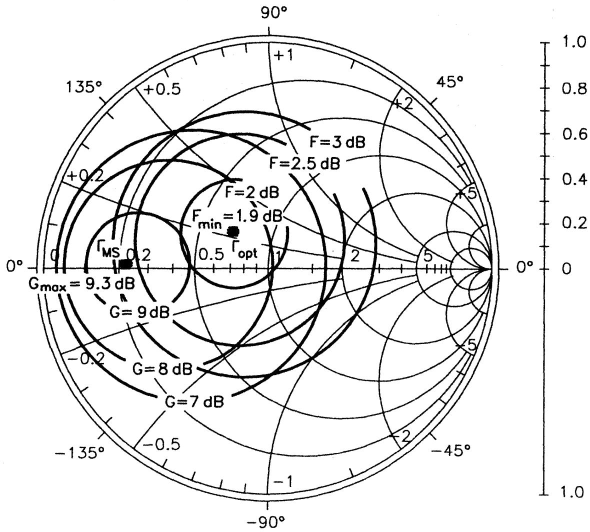
V_{CE} = 6 V.

Fig.11 Minimum noise figure and associated available gain as functions of frequency.



Z_o = 50 Ω.
V_{CE} = 6 V; I_C = 5 mA; f = 900 MHz.

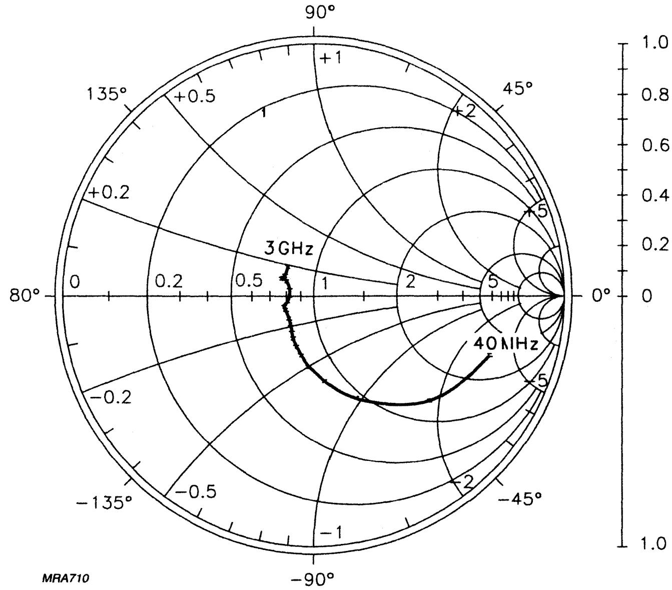
Fig.12 Noise circle figure.



Z_O = 50 Ω.

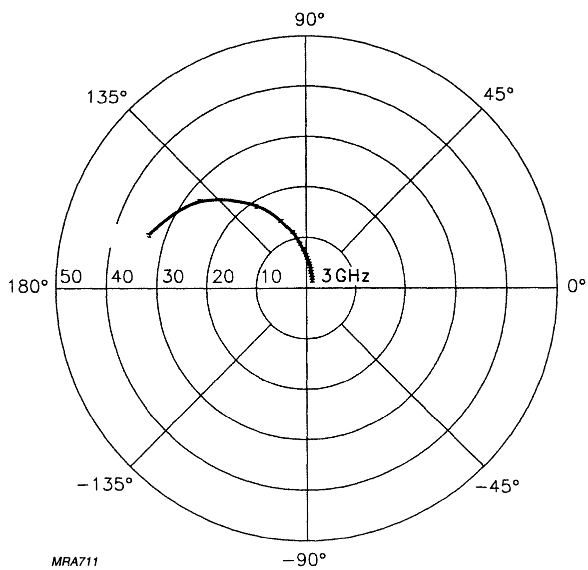
V_{CE} = 6 V; I_C = 5 mA; f = 2000 MHz.

Fig.13 Noise circle figure.



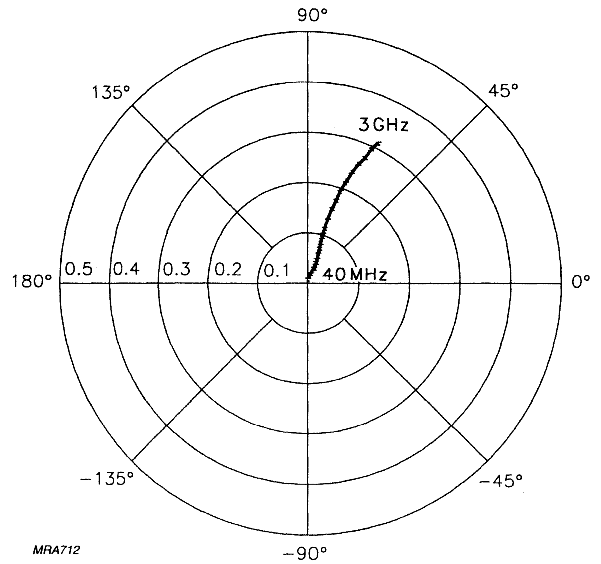
V_{CE} = 6 V; I_C = 20 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}).



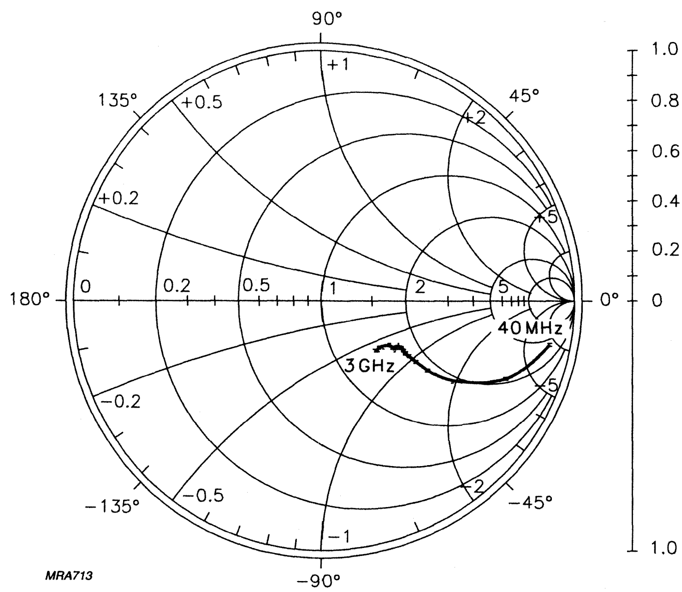
V_{CE} = 6 V; I_C = 20 mA.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_C = 20 mA.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).

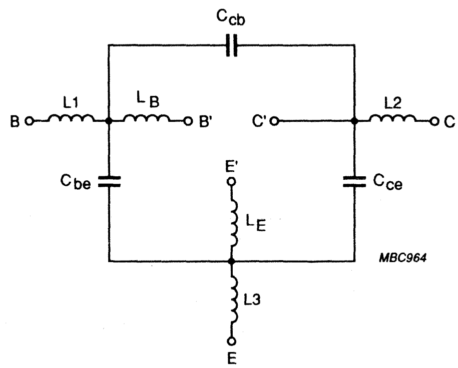


V_{CE} = 6 V; I_C = 20 mA.

Fig.17 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR520 crystal

1	IS = 1.016	fA
2	BF = 220.1	–
3	NF = 1.000	–
4	VAF = 48.06	V
5	IKF = 510.0	mA
6	ISE = 283.0	fA
7	NE = 2.035	–
8	BR = 100.7	–
9	NR = 988.1	m
10	VAR = 1.692	V
11	IKR = 2.352	mA
12	ISC = 24.48	aA
13	NC = 1.022	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 775.3	mΩ
18	RC = 2.210	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.245	pF
23	VJE = 600.0	mV
24	MJE = 258.1	m
25	TF = 8.616	ps
26	XTF = 6.788	–
27	VTF = 1.414	V
28	ITF = 110.3	mA
29	PTF = 45.01	deg
30	CJC = 447.6	fF
31	VJC = 189.2	mV
32	MJC = 70.51	m
33	XCJC = 130.0	m
34	TR = 543.7	ps
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 780.2	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}$ (f) = $QL_{B,E}$ √ (f/Fc).

Fc = scaling frequency = 1000 MHz.

Fig.18 Package equivalent circuit, SOT23.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.35 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.951	−6.2	6.413	174.3	0.011	87.8	0.991	−3.0	43.8
100	0.937	−15.5	6.275	166.6	0.026	80.5	0.978	−7.4	38.8
200	0.891	−30.1	5.934	154.5	0.050	72.8	0.939	−14.2	31.6
300	0.832	−43.6	5.531	144.0	0.069	66.5	0.887	−19.8	26.7
400	0.769	−55.7	5.087	134.7	0.084	60.9	0.834	−24.3	23.2
500	0.709	−66.2	4.639	126.8	0.097	57.3	0.785	−27.9	20.5
600	0.653	−75.6	4.249	119.9	0.106	54.2	0.742	−30.5	18.5
700	0.600	−84.2	3.897	113.7	0.113	52.3	0.706	−32.4	16.7
800	0.552	−91.7	3.578	108.3	0.119	51.1	0.674	−33.7	15.3
900	0.510	−98.9	3.302	103.3	0.124	50.3	0.648	−34.7	14.0
1000	0.471	−106.4	3.054	98.6	0.128	50.0	0.624	−35.4	12.9
1200	0.419	−120.3	2.676	90.9	0.135	50.2	0.585	−36.9	11.2
1400	0.388	−132.3	2.399	84.4	0.144	51.5	0.559	−38.5	9.9
1600	0.355	−141.7	2.161	78.6	0.150	53.4	0.544	−39.4	8.8
1800	0.325	−152.0	1.965	73.8	0.158	56.4	0.533	−40.4	7.8
2000	0.306	−164.4	1.815	68.9	0.169	58.5	0.516	−41.1	6.9
2200	0.310	−176.7	1.690	64.5	0.181	60.7	0.495	−42.6	6.2
2400	0.322	175.1	1.604	59.9	0.196	62.6	0.479	−45.5	5.7
2600	0.323	169.6	1.504	56.3	0.211	64.0	0.472	−48.7	5.1
2800	0.317	161.7	1.441	53.4	0.228	65.6	0.472	−50.8	4.7
3000	0.324	151.3	1.375	49.9	0.247	66.5	0.461	−52.0	4.3

NPN 9 GHz wideband transistor BFR520

Table 2 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.888	−10.0	14.292	170.5	0.010	84.7	0.977	−5.6	43.2
100	0.846	−24.3	13.459	158.3	0.024	76.9	0.936	−13.2	37.1
200	0.737	−44.9	11.641	141.4	0.043	68.1	0.833	−23.0	29.9
300	0.630	−61.3	9.877	128.8	0.057	63.2	0.732	−29.1	25.4
400	0.542	−74.5	8.377	119.2	0.067	60.5	0.653	−32.6	22.4
500	0.473	−84.8	7.179	112.0	0.076	59.6	0.595	−34.7	20.1
600	0.420	−93.5	6.263	106.3	0.084	59.6	0.554	−35.7	18.4
700	0.375	−101.2	5.539	101.4	0.092	60.3	0.524	−36.1	16.9
800	0.337	−107.9	4.952	97.2	0.100	61.0	0.501	−36.1	15.7
900	0.306	−114.9	4.479	93.3	0.107	61.7	0.484	−36.0	14.6
1000	0.280	−122.1	4.078	89.8	0.115	62.4	0.469	−35.9	13.6
1200	0.250	−135.7	3.484	84.1	0.130	63.7	0.444	−36.1	12.1
1400	0.235	−146.6	3.068	79.1	0.147	64.5	0.427	−37.2	10.9
1600	0.213	−154.4	2.727	74.5	0.162	65.1	0.421	−37.5	9.8
1800	0.193	−164.6	2.462	70.6	0.179	66.0	0.417	−38.2	8.8
2000	0.186	−178.6	2.256	66.6	0.196	66.0	0.405	−38.2	8.0
2200	0.202	168.9	2.093	63.1	0.214	66.0	0.386	−39.0	7.3
2400	0.220	163.0	1.977	59.2	0.233	65.6	0.369	−41.7	6.8
2600	0.221	160.7	1.842	56.1	0.250	65.1	0.361	−45.1	6.1
2800	0.216	153.7	1.759	53.6	0.268	65.0	0.362	−47.0	5.7
3000	0.225	142.6	1.673	50.3	0.287	64.3	0.354	−47.4	5.3

Table 3 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	0.90	0.400	26.0	0.250
900	1.10	0.331	47.0	0.260
1000	1.15	0.336	49.0	0.250
2000	1.85	0.211	145.0	0.140

Table 4 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.800	−14.7	23.665	166.0	0.010	82.8	0.954	−8.6	42.3
100	0.721	−34.4	20.958	149.2	0.022	73.2	0.868	−19.2	35.7
200	0.562	−59.0	16.124	129.4	0.037	66.8	0.706	−29.4	28.8
300	0.449	−76.0	12.566	117.3	0.048	65.3	0.591	−33.6	24.8
400	0.371	−89.1	10.109	109.0	0.058	64.7	0.518	−35.0	22.1
500	0.317	−98.6	8.387	103.1	0.067	65.9	0.473	−35.4	20.0
600	0.281	−106.6	7.170	98.6	0.076	66.7	0.444	−35.3	18.4
700	0.250	−114.1	6.255	94.6	0.086	67.9	0.426	−34.9	17.1
800	0.224	−120.3	5.539	91.3	0.095	68.7	0.413	−34.4	15.9
900	0.205	−127.3	4.978	88.2	0.104	69.1	0.402	−34.0	14.9
1000	0.189	−135.3	4.509	85.3	0.114	69.6	0.394	−33.7	14.0
1200	0.175	−149.0	3.823	80.6	0.133	69.9	0.378	−33.7	12.5
1400	0.170	−159.0	3.348	76.4	0.153	69.8	0.366	−34.9	11.2
1600	0.153	−165.3	2.965	72.3	0.171	69.6	0.365	−35.3	10.2
1800	0.141	−175.6	2.665	68.9	0.191	69.4	0.364	−36.1	9.2
2000	0.141	168.5	2.441	65.3	0.210	68.5	0.355	−35.9	8.4
2200	0.164	157.0	2.261	62.2	0.230	67.8	0.337	−36.5	7.7
2400	0.183	154.0	2.131	58.6	0.251	66.7	0.320	−39.3	7.2
2600	0.183	153.6	1.981	55.8	0.268	65.5	0.311	−43.0	6.5
2800	0.179	146.7	1.888	53.4	0.287	64.9	0.312	−45.0	6.1
3000	0.191	135.1	1.797	50.4	0.306	63.7	0.305	−44.8	5.7

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.10	0.262	25.0	0.220
900	1.25	0.217	46.0	0.210
1000	1.30	0.212	48.0	0.230
2000	1.90	0.159	167.0	0.150

Table 6 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 15 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.731	−18.2	29.853	162.7	0.010	82.7	0.932	−10.7	41.6
100	0.629	−41.4	25.095	143.3	0.021	72.2	0.814	−22.5	34.9
200	0.461	−67.9	17.933	123.1	0.034	67.4	0.631	−31.7	28.3
300	0.359	−85.3	13.444	111.9	0.044	67.2	0.522	−34.1	24.5
400	0.297	−98.3	10.603	104.5	0.054	68.2	0.460	−34.3	21.9
500	0.256	−107.8	8.712	99.4	0.064	69.4	0.424	−34.1	20.0
600	0.229	−115.7	7.394	95.3	0.074	70.1	0.402	−33.6	18.4
700	0.205	−123.1	6.425	91.9	0.084	71.4	0.390	−33.2	17.1
800	0.185	−129.6	5.673	88.9	0.094	71.9	0.381	−32.5	15.9
900	0.170	−136.9	5.090	86.0	0.104	72.1	0.374	−32.1	14.9
1000	0.161	−145.2	4.602	83.4	0.115	72.1	0.368	−31.9	14.0
1200	0.156	−158.8	3.896	79.0	0.135	72.2	0.356	−32.1	12.5
1400	0.154	−167.2	3.405	75.1	0.156	71.7	0.346	−33.5	11.3
1600	0.140	−173.6	3.012	71.2	0.175	71.0	0.347	−34.0	10.2
1800	0.130	175.4	2.708	67.9	0.195	70.4	0.347	−35.0	9.3
2000	0.134	160.5	2.479	64.4	0.215	69.3	0.338	−34.8	8.5
2200	0.161	151.0	2.296	61.5	0.235	68.3	0.321	−35.2	7.8
2400	0.179	149.2	2.161	58.0	0.257	67.2	0.304	−38.2	7.3
2600	0.179	149.2	2.008	55.3	0.274	65.8	0.294	−42.1	6.6
2800	0.177	143.1	1.914	53.0	0.293	65.0	0.295	−44.2	6.2
3000	0.189	131.9	1.821	50.0	0.313	63.5	0.290	−43.9	5.7

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.30	0.164	27.0	0.210
900	1.45	0.130	58.0	0.210
1000	1.50	0.134	62.0	0.240
2000	2.05	0.160	−169.0	0.160

Table 8 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.673	−21.4	33.855	160.2	0.009	79.8	0.911	−12.1	40.9
100	0.559	−47.4	27.286	139.2	0.020	71.7	0.771	−24.5	34.3
200	0.398	−75.6	18.570	119.2	0.032	68.0	0.582	−32.3	27.9
300	0.310	−93.7	13.629	108.7	0.043	68.9	0.482	−33.5	24.3
400	0.259	−107.3	10.647	101.8	0.053	70.4	0.428	−33.0	21.7
500	0.228	−116.8	8.690	97.1	0.063	71.2	0.399	−32.4	19.8
600	0.207	−125.0	7.358	93.4	0.073	72.2	0.382	−31.9	18.2
700	0.189	−132.4	6.382	90.1	0.083	73.1	0.373	−31.5	16.9
800	0.173	−139.8	5.631	87.3	0.094	73.5	0.366	−30.9	15.8
900	0.164	−146.8	5.048	84.5	0.104	73.5	0.362	−30.7	14.8
1000	0.157	−155.3	4.563	82.1	0.115	73.9	0.357	−30.5	13.9
1200	0.156	−167.5	3.859	77.8	0.135	73.4	0.347	−30.8	12.4
1400	0.158	−174.5	3.370	74.0	0.157	72.7	0.338	−32.4	11.2
1600	0.143	179.1	2.981	70.2	0.176	71.8	0.340	−33.1	10.1
1800	0.138	168.4	2.680	67.0	0.196	71.3	0.341	−34.2	9.2
2000	0.146	155.6	2.454	63.6	0.217	69.9	0.333	−34.1	8.4
2200	0.172	147.2	2.272	60.7	0.238	68.8	0.316	−34.7	7.7
2400	0.191	145.8	2.140	57.2	0.259	67.6	0.298	−37.7	7.2
2600	0.189	146.0	1.987	54.6	0.277	66.2	0.289	−41.7	6.5
2800	0.187	140.0	1.893	52.2	0.296	65.2	0.290	−44.0	6.1
3000	0.201	129.8	1.804	49.2	0.316	63.8	0.284	−43.9	5.7

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.090	32.0	0.210
900	1.60	0.080	76.0	0.210
1000	1.65	0.070	78.0	0.230
2000	2.20	0.210	−154.0	0.170

Table 10 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 30 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.570	−29.5	36.792	156.0	0.009	77.3	0.849	−14.0	38.6
100	0.455	−63.1	27.504	132.7	0.019	69.4	0.684	−26.2	32.5
200	0.331	−97.4	17.456	113.4	0.030	68.7	0.508	−30.8	26.6
300	0.279	−118.1	12.470	104.0	0.040	70.8	0.430	−30.1	23.2
400	0.254	−132.3	9.628	97.9	0.051	71.8	0.392	−29.0	20.7
500	0.238	−142.0	7.818	93.5	0.061	73.1	0.373	−28.4	18.8
600	0.229	−149.5	6.596	90.1	0.072	73.9	0.362	−28.1	17.2
700	0.220	−156.5	5.712	87.0	0.082	74.9	0.358	−28.0	15.9
800	0.212	−162.8	5.035	84.3	0.093	75.1	0.355	−27.8	14.8
900	0.209	−168.7	4.512	81.6	0.103	75.2	0.353	−27.8	13.9
1000	0.209	−175.0	4.079	79.2	0.114	75.1	0.350	−28.0	13.0
1200	0.215	176.0	3.447	75.0	0.135	74.7	0.343	−28.9	11.5
1400	0.219	170.4	3.013	71.2	0.157	74.0	0.336	−30.9	10.3
1600	0.209	164.5	2.668	67.2	0.177	72.9	0.339	−32.3	9.2
1800	0.207	156.3	2.404	63.9	0.198	72.3	0.339	−33.7	8.3
2000	0.217	147.5	2.206	60.5	0.219	71.0	0.332	−34.0	7.6
2200	0.245	141.9	2.043	57.5	0.240	69.8	0.314	−35.1	6.9
2400	0.262	140.4	1.925	54.0	0.262	68.5	0.298	−38.5	6.4
2600	0.261	139.2	1.790	51.2	0.281	67.0	0.288	−42.8	5.7
2800	0.261	133.8	1.709	48.8	0.301	66.1	0.289	−45.4	5.3
3000	0.277	125.8	1.629	45.7	0.322	64.6	0.282	−45.7	4.9

Table 11 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 2 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.957	−6.0	6.256	174.5	0.010	87.6	0.990	−2.8	43.6
100	0.945	−14.8	6.129	167.1	0.025	80.8	0.978	−7.0	39.1
200	0.900	−28.8	5.815	155.3	0.048	73.5	0.942	−13.5	32.0
300	0.845	−41.7	5.443	145.1	0.068	67.4	0.894	−18.9	27.1
400	0.783	−53.4	5.030	135.9	0.083	61.8	0.845	−23.3	23.6
500	0.723	−63.6	4.601	128.1	0.095	58.1	0.797	−26.8	20.8
600	0.668	−72.8	4.228	121.3	0.105	55.0	0.755	−29.5	18.8
700	0.614	−81.0	3.887	115.1	0.112	53.3	0.720	−31.4	17.0
800	0.565	−88.4	3.575	109.7	0.118	51.8	0.688	−32.7	15.5
900	0.522	−95.6	3.307	104.6	0.123	50.9	0.662	−33.8	14.3
1000	0.481	−102.6	3.063	99.9	0.126	50.5	0.638	−34.6	13.1
1200	0.424	−116.3	2.692	92.1	0.134	50.5	0.599	−36.0	11.4
1400	0.390	−128.2	2.419	85.6	0.142	51.6	0.572	−37.6	10.1
1600	0.354	−137.6	2.178	79.7	0.148	53.6	0.556	−38.5	9.0
1800	0.322	−147.8	1.982	74.8	0.157	56.4	0.545	−39.5	7.9
2000	0.300	−160.3	1.830	69.8	0.167	58.4	0.528	−40.1	7.1
2200	0.302	−173.0	1.706	65.5	0.178	60.6	0.507	−41.6	6.3
2400	0.312	178.4	1.620	60.8	0.192	62.6	0.491	−44.3	5.8
2600	0.312	172.7	1.520	57.3	0.206	64.1	0.484	−47.4	5.2
2800	0.305	164.7	1.455	54.2	0.223	65.9	0.484	−49.4	4.8
3000	0.311	153.5	1.387	50.8	0.241	66.8	0.474	−50.6	4.4

Table 12 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.903	−9.4	14.064	170.8	0.010	85.3	0.974	−5.3	43.3
100	0.863	−22.9	13.287	159.1	0.024	77.4	0.937	−12.6	37.5
200	0.759	−42.5	11.590	142.6	0.043	69.2	0.841	−22.0	30.3
300	0.651	−58.1	9.914	130.1	0.056	64.1	0.745	−28.1	25.8
400	0.560	−70.8	8.450	120.5	0.067	61.2	0.667	−31.7	22.7
500	0.489	−80.6	7.274	113.3	0.076	60.0	0.609	−33.8	20.4
600	0.433	−88.9	6.360	107.5	0.084	60.0	0.567	−34.9	18.7
700	0.385	−96.3	5.636	102.5	0.091	60.6	0.537	−35.4	17.2
800	0.345	−102.7	5.045	98.3	0.099	61.2	0.514	−35.4	15.9
900	0.311	−109.0	4.566	94.4	0.106	61.9	0.496	−35.4	14.9
1000	0.283	−116.2	4.160	90.9	0.113	62.5	0.480	−35.3	13.9
1200	0.247	−129.2	3.558	85.1	0.129	63.7	0.454	−35.5	12.3
1400	0.229	−140.2	3.134	80.0	0.145	64.6	0.437	−36.5	11.1
1600	0.203	−147.3	2.786	75.4	0.160	65.2	0.431	−36.7	10.0
1800	0.182	−157.7	2.513	71.6	0.177	66.0	0.427	−37.4	9.0
2000	0.170	−171.9	2.304	67.5	0.194	66.0	0.415	−37.3	8.2
2200	0.182	173.7	2.136	64.0	0.211	66.0	0.396	−38.0	7.5
2400	0.202	167.1	2.019	60.1	0.230	65.7	0.379	−40.6	7.0
2600	0.202	164.7	1.880	57.1	0.246	65.2	0.371	−43.9	6.3
2800	0.196	157.1	1.795	54.5	0.264	65.1	0.372	−45.7	5.9
3000	0.203	144.7	1.706	51.2	0.283	64.4	0.365	−45.9	5.4

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	0.90	0.442	25.0	0.270
900	1.10	0.374	44.0	0.260
1000	1.15	0.378	48.0	0.270
2000	1.85	0.232	135.0	0.150

Table 14 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.836	−13.3	22.877	166.6	0.010	82.7	0.953	−8.0	42.8
100	0.760	−31.4	20.460	150.7	0.022	74.6	0.877	−18.0	36.3
200	0.604	−54.5	16.069	131.4	0.037	67.0	0.726	−28.2	29.3
300	0.482	−70.5	12.675	119.1	0.048	65.1	0.612	−32.7	25.2
400	0.398	−82.5	10.263	110.7	0.058	64.7	0.538	−34.3	22.5
500	0.339	−91.5	8.558	104.7	0.067	65.8	0.491	−34.9	20.4
600	0.297	−98.7	7.322	99.9	0.076	66.7	0.460	−34.9	18.7
700	0.262	−105.2	6.399	96.0	0.085	67.7	0.441	−34.6	17.4
800	0.231	−111.2	5.675	92.5	0.095	68.4	0.426	−34.1	16.2
900	0.207	−117.4	5.099	89.3	0.104	68.8	0.416	−33.7	15.2
1000	0.188	−124.9	4.623	86.5	0.113	69.2	0.406	−33.4	14.2
1200	0.167	−138.3	3.920	81.7	0.131	69.6	0.389	−33.4	12.7
1400	0.157	−148.8	3.434	77.4	0.151	69.5	0.377	−34.4	11.5
1600	0.138	−154.8	3.041	73.4	0.170	69.3	0.376	−34.8	10.4
1800	0.123	−165.4	2.734	70.0	0.188	69.2	0.375	−35.5	9.5
2000	0.118	176.8	2.503	66.4	0.207	68.3	0.365	−35.2	8.7
2200	0.138	162.0	2.316	63.3	0.226	67.6	0.347	−35.6	7.9
2400	0.159	157.9	2.185	59.7	0.247	66.6	0.330	−38.3	7.4
2600	0.158	157.9	2.030	57.0	0.264	65.4	0.320	−41.8	6.7
2800	0.153	151.2	1.934	54.6	0.282	64.9	0.322	−43.7	6.3
3000	0.163	137.5	1.838	51.5	0.301	63.7	0.316	−43.5	5.9

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.10	0.333	25.0	0.240
900	1.25	0.291	41.0	0.240
1000	1.30	0.273	43.0	0.250
2000	1.90	0.170	148.0	0.160

Table 16 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.784	−16.2	28.912	163.7	0.009	83.1	0.934	−9.8	42.3
100	0.684	−37.3	24.730	145.3	0.021	73.3	0.829	−21.2	35.7
200	0.509	−61.5	18.106	125.3	0.034	67.4	0.654	−30.6	28.9
300	0.395	−77.3	13.734	113.8	0.045	67.2	0.544	−33.5	25.0
400	0.321	−88.9	10.898	106.2	0.054	67.8	0.479	−34.1	22.4
500	0.274	−97.6	8.977	100.9	0.064	68.9	0.441	−34.0	20.3
600	0.239	−104.6	7.637	96.7	0.074	69.6	0.417	−33.7	18.7
700	0.211	−111.0	6.644	93.2	0.084	70.8	0.403	−33.2	17.4
800	0.187	−116.7	5.871	90.1	0.094	71.4	0.393	−32.5	16.3
900	0.167	−122.9	5.269	87.2	0.104	71.7	0.386	−32.1	15.3
1000	0.151	−131.0	4.765	84.6	0.114	71.9	0.378	−31.8	14.3
1200	0.138	−145.4	4.034	80.2	0.133	71.8	0.365	−31.9	12.8
1400	0.134	−155.5	3.528	76.2	0.154	71.3	0.356	−33.2	11.6
1600	0.117	−160.6	3.118	72.4	0.173	70.7	0.355	−33.5	10.5
1800	0.104	−172.5	2.802	69.2	0.192	70.3	0.355	−34.4	9.6
2000	0.104	168.9	2.564	65.7	0.212	69.2	0.347	−34.1	8.8
2200	0.127	155.9	2.372	62.8	0.232	68.2	0.330	−34.4	8.1
2400	0.147	152.9	2.234	59.3	0.253	66.9	0.312	−37.2	7.5
2600	0.147	154.1	2.074	56.7	0.270	65.6	0.302	−40.9	6.8
2800	0.142	146.9	1.975	54.4	0.289	64.9	0.304	−42.9	6.4
3000	0.155	133.8	1.878	51.4	0.308	63.6	0.298	−42.4	6.0

Table 17 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.30	0.250	25.0	0.240
900	1.45	0.218	45.0	0.250
1000	1.50	0.205	53.0	0.280
2000	2.05	0.135	167.0	0.170

Table 18 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.743	−18.7	33.272	161.4	0.009	81.0	0.918	−11.1	41.9
100	0.627	−41.8	27.392	141.4	0.020	72.1	0.792	−23.2	35.2
200	0.447	−66.7	19.114	121.4	0.033	68.1	0.607	−31.5	28.6
300	0.342	−82.4	14.179	110.6	0.043	68.6	0.503	−33.4	24.8
400	0.278	−94.3	11.131	103.5	0.053	69.6	0.446	−33.1	22.2
500	0.237	−102.7	9.118	98.7	0.063	71.1	0.414	−32.7	20.3
600	0.209	−109.7	7.724	94.8	0.073	71.7	0.395	−32.2	18.7
700	0.185	−116.5	6.708	91.5	0.083	72.7	0.384	−31.7	17.4
800	0.164	−122.5	5.920	88.7	0.094	73.0	0.377	−31.1	16.2
900	0.148	−129.1	5.307	85.9	0.104	73.2	0.371	−30.8	15.2
1000	0.135	−137.3	4.799	83.4	0.114	73.2	0.365	−30.5	14.3
1200	0.126	−152.3	4.058	79.2	0.134	73.0	0.354	−30.7	12.8
1400	0.125	−161.6	3.545	75.4	0.156	72.3	0.345	−32.1	11.6
1600	0.111	−166.7	3.132	71.7	0.175	71.4	0.347	−32.7	10.5
1800	0.099	−178.7	2.813	68.6	0.195	70.9	0.348	−33.6	9.6
2000	0.101	163.6	2.574	65.1	0.215	69.6	0.339	−33.4	8.8
2200	0.126	151.0	2.382	62.3	0.235	68.5	0.322	−33.7	8.1
2400	0.147	149.6	2.244	58.9	0.256	67.3	0.305	−36.4	7.5
2600	0.147	151.2	2.082	56.3	0.273	65.9	0.295	−40.3	6.9
2800	0.143	144.3	1.983	54.0	0.292	65.0	0.297	−42.4	6.4
3000	0.157	131.2	1.884	51.0	0.312	63.6	0.290	−42.0	6.0

Table 19 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.45	0.194	27.0	0.250
900	1.60	0.164	49.0	0.260
1000	1.65	0.166	55.0	0.280
2000	2.20	0.165	−175.0	0.180

Table 20 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 30 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.691	−22.1	37.360	158.7	0.009	80.4	0.892	−12.5	41.2
100	0.559	−47.9	29.323	137.1	0.019	71.6	0.744	−24.8	34.5
200	0.387	−74.7	19.484	117.4	0.031	68.8	0.560	−31.3	28.1
300	0.294	−91.4	14.155	107.3	0.041	70.4	0.468	−31.8	24.5
400	0.242	−103.6	11.009	100.9	0.051	71.6	0.420	−30.9	21.9
500	0.209	−112.9	8.974	96.4	0.062	72.7	0.395	−30.3	20.0
600	0.187	−120.3	7.584	92.8	0.072	73.4	0.380	−29.8	18.4
700	0.169	−127.8	6.574	89.7	0.082	74.2	0.373	−29.5	17.1
800	0.153	−134.1	5.797	87.0	0.093	74.6	0.368	−29.0	16.0
900	0.141	−141.3	5.192	84.4	0.103	74.5	0.364	−28.8	15.0
1000	0.133	−150.1	4.694	82.0	0.114	74.5	0.361	−28.6	14.1
1200	0.131	−163.8	3.965	77.9	0.134	73.8	0.351	−29.1	12.6
1400	0.133	−171.6	3.463	74.2	0.156	73.2	0.344	−30.7	11.4
1600	0.120	−177.7	3.062	70.5	0.175	72.3	0.346	−31.6	10.3
1800	0.113	171.5	2.750	67.4	0.195	71.7	0.347	−32.7	9.4
2000	0.117	156.0	2.515	64.0	0.216	70.3	0.339	−32.6	8.6
2200	0.145	146.6	2.330	61.2	0.236	69.1	0.322	−33.1	7.9
2400	0.166	146.1	2.195	57.8	0.258	67.8	0.305	−35.9	7.4
2600	0.164	146.9	2.038	55.2	0.275	66.4	0.295	−39.9	6.7
2800	0.161	140.8	1.941	53.0	0.294	65.5	0.297	−42.1	6.3
3000	0.176	129.3	1.844	49.9	0.314	64.1	0.291	−41.9	5.8

NPN 9 GHz wideband transistor — BFR521

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFR521 is an NPN silicon planar epitaxial transistor, intended for wideband applications up to 3 GHz, such as MATV/CATV amplifiers, repeater amplifiers in fibre-optic systems and RF communications subscriber equipment.

The transistor is mounted in a plastic SOT103 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

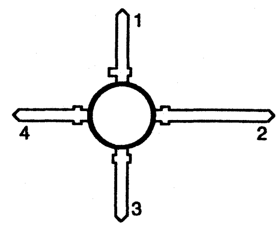


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to $T_s = 155$ °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	$V_{CE} = 6$ V; $I_C = 20$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CE} = 6$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	$V_{CE} = 6$ V; $I_C = 20$ mA	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 6$ V; $I_C = 20$ mA; f = 900 MHz	–	19	–	dB
$\|S_{21}\|^2$	insertion power gain	$V_{CE} = 6$ V; $I_C = 20$ mA; f = 900 MHz	17	18	–	dB
F	noise figure	$V_{CE} = 6$ V; $I_C = 5$ mA; f = 900 MHz	–	1.1	1.6	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	55	K/W
T_j	junction temperature		–	–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 9 GHz wideband transistor — BFR540

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
Code: N29	
1	base
2	emitter
3	collector

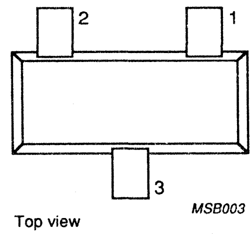


Fig.1 SOT23.

DESCRIPTION

The BFR540 is an npn silicon planar epitaxial transistor, intended for applications in the RF frontend in wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optic systems.

The transistor is encapsulated in a plastic SOT23 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	14	–	dB
		I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	7	–	dB
$\vert S_{21}\vert^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	2.1	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

 Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	210 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 8 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	14	–	dB
		I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	7	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 900 MHz	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_O	output voltage (note 3)	I_C = 40 mA; V_{CE} = 8 V; $Z_L = Z_S$ = 75 Ω; T_{amb} = 25 °C	–	550	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω;
   T_{amb} = 25 °C; f = 900 MHz;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.
3. d_{im} = −60 dB (DIN 45004B);
   $V_p = V_O$; $V_q = V_O$ −6 dB; f_p = 795.25 MHz;
   $V_R = V_O$ −6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz; preliminary data.

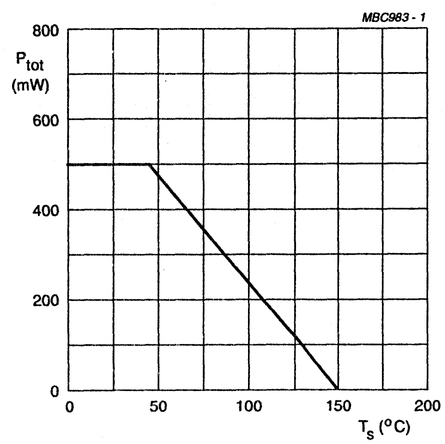
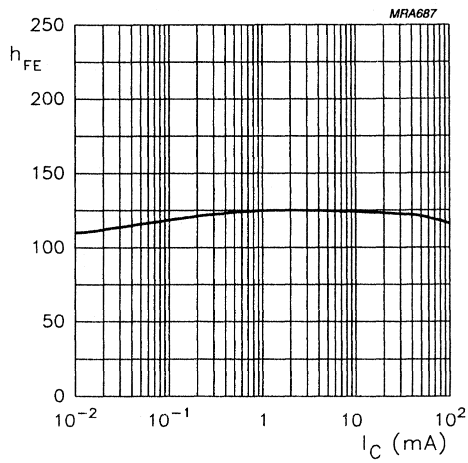
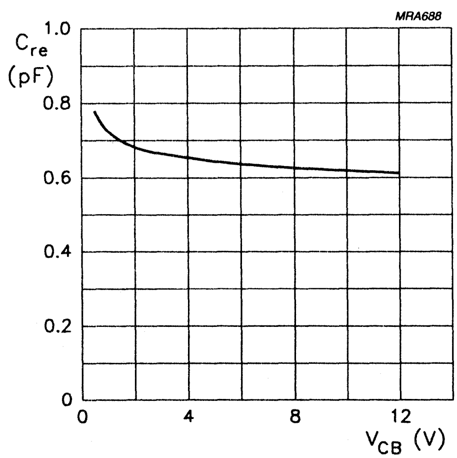


Fig.2 Power derating curve.



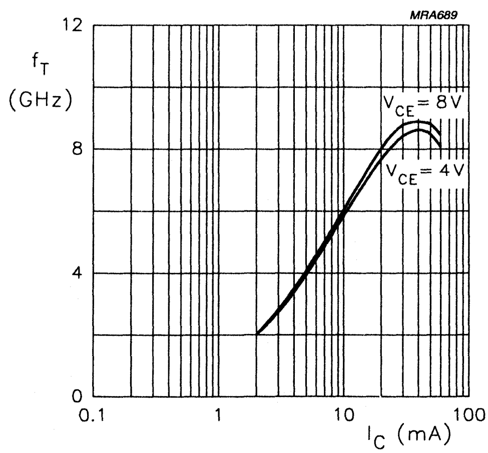
V_{CE} = 8 V.

Fig.3 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

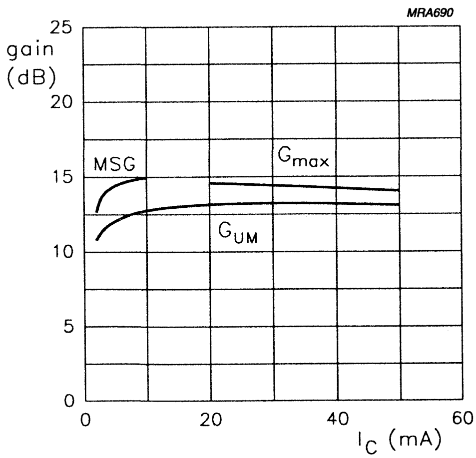
Fig.4 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

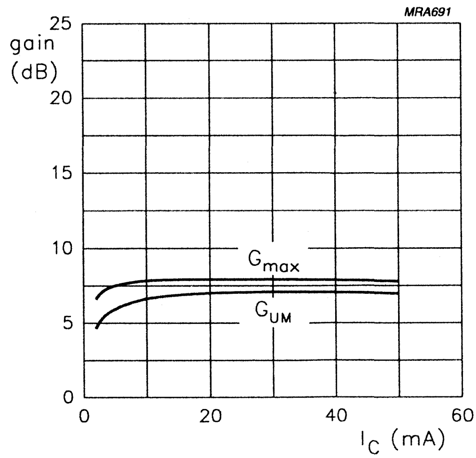
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



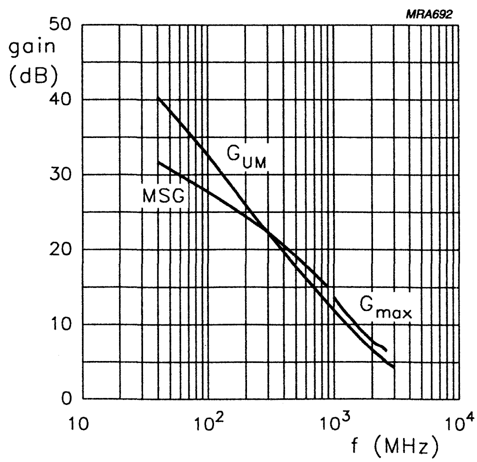
V_{CE} = 8 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



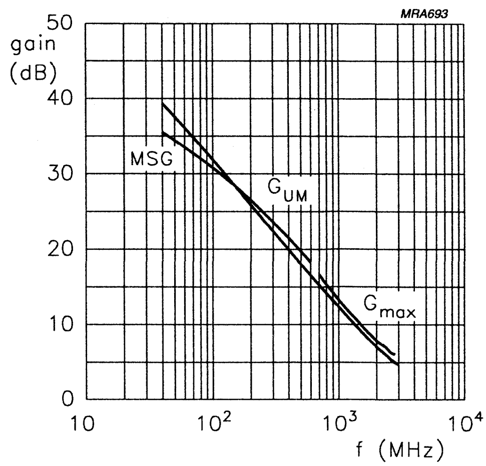
V_{CE} = 8 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



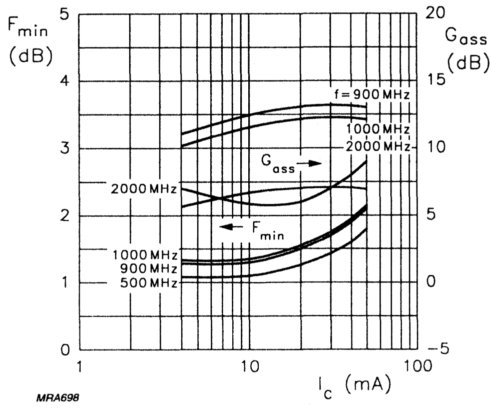
V_{CE} = 8 V; I_C = 10 mA.

Fig.8 Gain as a function of frequency.



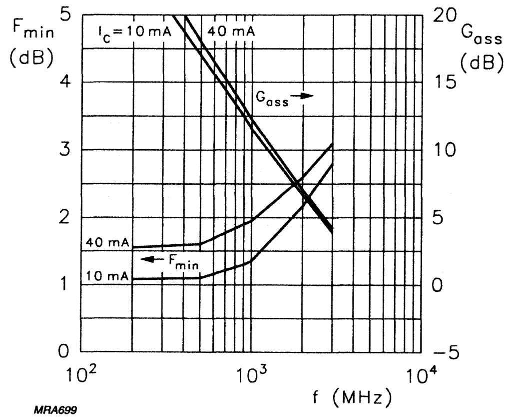
V_{CE} = 8 V; I_C = 40 mA.

Fig.9 Gain as a function of frequency.



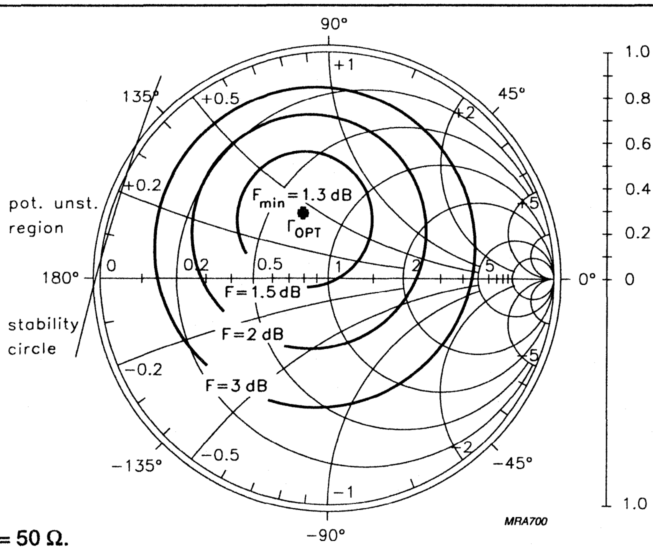
V_{CE} = 8 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



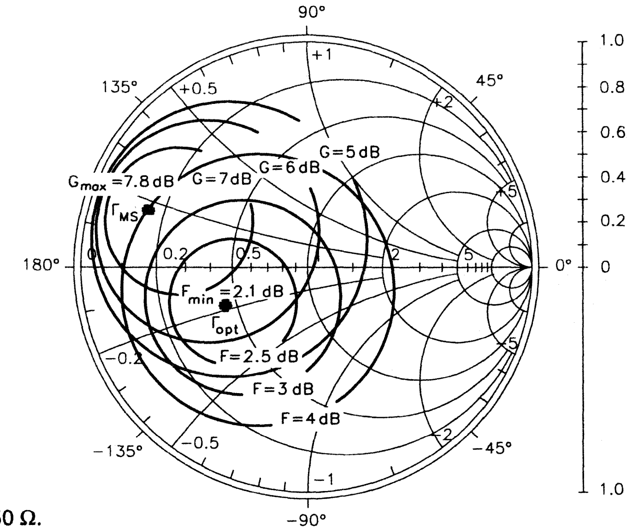
V_{CE} = 8 V.

Fig.11 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.
V_{CE} = 8 V; I_C = 10 mA; f = 900 MHz.

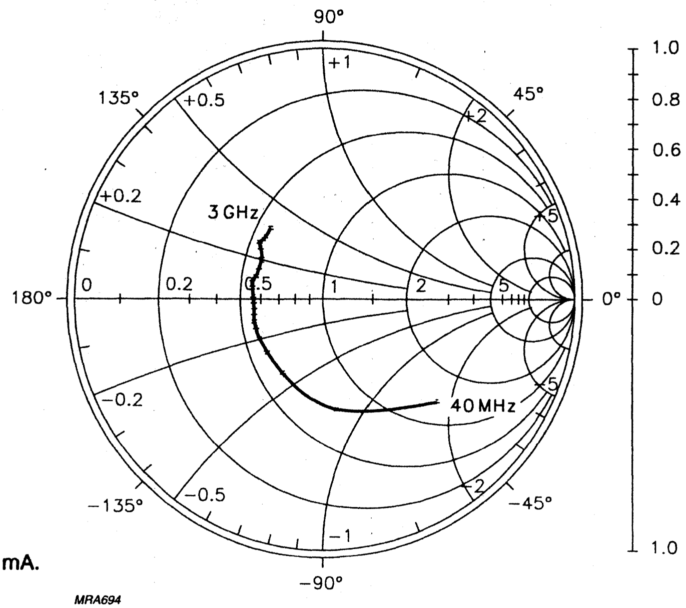
Fig.12 Noise circle figure.



Z_0 = 50 Ω.

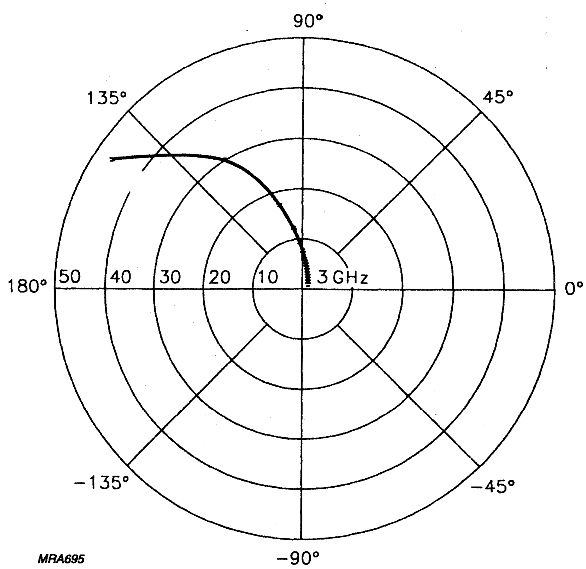
V_{CE} = 8 V; I_C = 10 mA; f = 2000 MHz.

Fig.13 Noise circle figure.



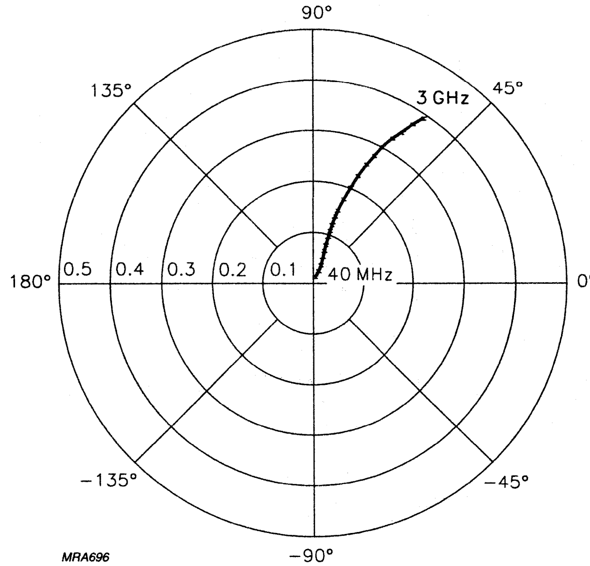
V_{CE} = 8 V; I_C = 40 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}).



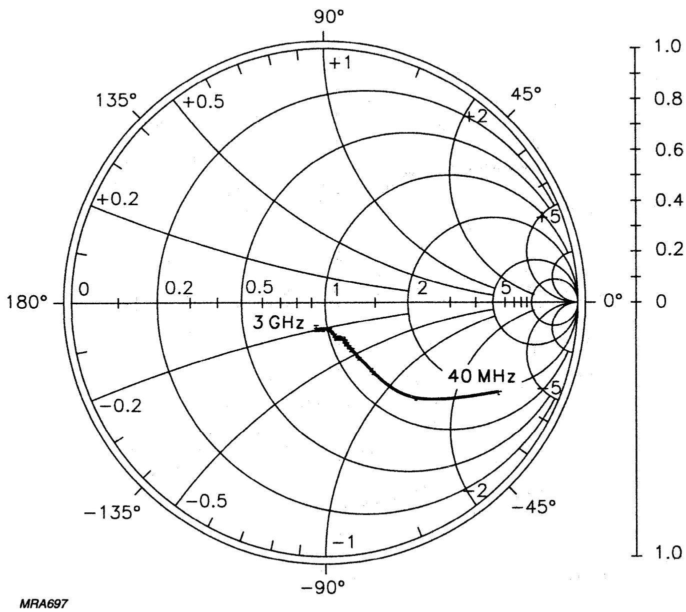
V_{CE} = 8 V; I_C = 40 mA.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 8 V; I_C = 40 mA.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



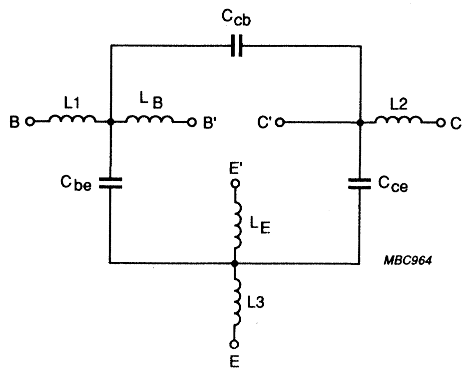
V_{CE} = 8 V; I_C = 40 mA.

Fig.17 Common emitter output reflection coefficient (S_{22}).

NPN 9 GHz wideband transistor BFR540

SPICE parameters for BFR505 crystal

1	IS = 1.045	fA
2	BF = 184.3	–
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	–
8	BR = 43.99	–
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	–
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.40	–
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 814.7	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E} \sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.18 Package equivalent circuit, SOT23.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.35 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

NPN 9 GHz wideband transistor BFR540

Table 1 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 4 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.908	−14.2	10.429	167.1	0.017	81.4	0.974	−8.2	40.8
100	0.855	−34.2	9.573	152.6	0.039	70.1	0.905	−19.1	32.8
200	0.741	−64.3	8.335	134.0	0.065	57.7	0.755	−31.4	25.5
300	0.643	−88.2	7.018	120.0	0.080	51.4	0.637	−38.2	21.5
400	0.581	−106.1	5.873	110.2	0.090	48.5	0.555	−42.2	18.8
500	0.538	−120.2	5.006	102.5	0.097	47.8	0.500	−44.5	16.7
600	0.507	−131.0	4.344	96.6	0.103	48.2	0.464	−45.9	15.1
700	0.486	−139.9	3.830	91.6	0.110	49.2	0.439	−46.8	13.8
800	0.469	−147.7	3.428	87.2	0.116	50.7	0.421	−47.4	12.6
900	0.454	−154.8	3.087	83.3	0.122	52.3	0.407	−48.1	11.6
1000	0.448	−161.3	2.814	79.7	0.129	53.7	0.394	−48.9	10.7
1200	0.442	−172.5	2.403	73.4	0.143	56.8	0.375	−51.4	9.2
1400	0.444	178.6	2.114	67.6	0.159	59.4	0.365	−54.6	8.1
1600	0.433	171.5	1.895	62.6	0.177	62.2	0.363	−56.9	7.1
1800	0.432	163.9	1.727	58.2	0.198	63.9	0.360	−59.6	6.2
2000	0.440	155.6	1.591	54.0	0.220	65.1	0.347	−62.4	5.5
2200	0.461	148.8	1.479	50.3	0.243	65.9	0.329	−67.0	4.9
2400	0.477	144.3	1.389	46.3	0.268	65.9	0.319	−73.8	4.4
2600	0.479	140.6	1.305	42.9	0.293	65.7	0.321	−80.2	3.9
2800	0.478	135.0	1.254	39.9	0.321	65.2	0.326	−84.6	3.6
3000	0.494	127.8	1.200	36.9	0.349	64.3	0.315	−88.5	3.3

Table 2 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.788	−23.3	22.641	159.8	0.016	77.8	0.926	−15.6	39.8
100	0.675	−54.1	18.988	139.7	0.032	65.0	0.762	−32.4	32.0
200	0.514	−92.0	13.709	118.5	0.049	58.0	0.542	−45.4	25.6
300	0.440	−115.4	10.166	107.0	0.061	57.6	0.424	−50.6	21.9
400	0.408	−130.9	7.979	99.6	0.071	58.9	0.357	−53.1	19.4
500	0.388	−141.9	6.534	94.2	0.082	60.8	0.318	−54.5	17.5
600	0.376	−150.0	5.553	90.0	0.093	62.0	0.294	−55.1	15.9
700	0.365	−156.9	4.820	86.3	0.105	63.5	0.278	−55.4	14.6
800	0.357	−162.8	4.278	83.0	0.116	64.3	0.267	−55.5	13.5
900	0.352	−168.8	3.832	80.0	0.128	65.1	0.258	−55.7	12.5
1000	0.350	−174.2	3.474	77.2	0.139	65.5	0.248	−56.2	11.7
1200	0.353	176.6	2.946	72.1	0.162	66.0	0.234	−58.5	10.2
1400	0.360	170.3	2.576	67.4	0.186	65.8	0.226	−61.7	9.0
1600	0.349	164.7	2.298	63.0	0.209	65.8	0.227	−63.0	8.0
1800	0.349	158.0	2.085	59.1	0.233	65.2	0.224	−65.1	7.2
2000	0.359	150.2	1.919	55.3	0.257	64.4	0.211	−66.9	6.5
2200	0.382	144.3	1.783	52.1	0.281	63.6	0.191	−71.4	5.9
2400	0.400	141.1	1.672	48.4	0.305	62.4	0.182	−79.8	5.4
2600	0.401	138.8	1.566	45.1	0.327	61.1	0.184	−87.6	4.8
2800	0.400	134.2	1.503	42.1	0.351	59.9	0.190	−91.4	4.5
3000	0.415	127.4	1.440	39.0	0.375	58.5	0.178	−94.1	4.1

Table 3 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.269	129.0	0.11
2000	2.10	0.406	−151.0	0.16

Table 4 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.645	−34.8	36.002	152.2	0.014	75.1	0.856	−23.0	39.2
100	0.499	−75.1	26.225	128.0	0.027	64.5	0.618	−42.2	31.7
200	0.384	−113.4	16.211	109.4	0.042	63.1	0.403	−53.5	25.7
300	0.349	−133.8	11.437	100.5	0.054	65.2	0.307	−57.4	22.2
400	0.338	−146.2	8.800	94.7	0.067	66.9	0.257	−59.6	19.7
500	0.330	−154.8	7.140	90.4	0.080	68.5	0.230	−60.8	17.8
600	0.325	−161.1	6.029	87.0	0.093	69.2	0.214	−61.5	16.3
700	0.320	−166.5	5.218	83.9	0.107	69.7	0.204	−61.8	15.0
800	0.315	−171.5	4.618	81.0	0.120	69.8	0.196	−61.8	13.9
900	0.313	−176.5	4.132	78.4	0.133	69.8	0.190	−62.0	12.9
1000	0.315	178.8	3.742	76.0	0.146	69.7	0.182	−62.5	12.1
1200	0.320	170.7	3.164	71.5	0.173	68.8	0.171	−65.4	10.6
1400	0.327	165.5	2.763	67.1	0.198	67.8	0.166	−69.2	9.4
1600	0.317	160.6	2.460	63.1	0.223	66.8	0.167	−70.0	8.4
1800	0.318	154.6	2.230	59.4	0.249	65.6	0.165	−72.0	7.6
2000	0.328	147.2	2.050	55.9	0.274	64.1	0.150	−73.6	6.8
2200	0.352	141.4	1.904	52.9	0.299	62.8	0.131	−79.3	6.2
2400	0.370	138.9	1.784	49.3	0.323	61.1	0.124	−90.4	5.7
2600	0.371	137.3	1.669	46.1	0.344	59.5	0.129	−99.9	5.2
2800	0.369	133.2	1.601	43.1	0.368	58.0	0.134	−103.4	4.8
3000	0.384	126.2	1.535	40.2	0.390	56.3	0.121	−106.3	4.5

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.222	156.0	0.13
2000	2.20	0.398	−148.0	0.16

Table 6 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 30 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.549	−43.7	44.033	147.1	0.013	73.4	0.800	−27.3	38.9
100	0.414	−88.0	29.004	122.2	0.025	65.3	0.539	−46.8	31.6
200	0.340	−124.7	16.938	105.7	0.039	66.6	0.340	−56.8	25.6
300	0.322	−142.7	11.783	97.9	0.053	68.9	0.259	−60.3	22.2
400	0.318	−153.6	9.018	92.8	0.067	70.2	0.218	−62.4	19.8
500	0.315	−160.9	7.295	88.9	0.080	71.3	0.196	−63.8	17.9
600	0.312	−166.2	6.150	85.8	0.094	71.6	0.184	−64.6	16.4
700	0.308	−171.0	5.320	82.9	0.108	71.8	0.175	−65.1	15.1
800	0.305	−175.4	4.706	80.2	0.122	71.7	0.169	−65.1	14.0
900	0.304	179.7	4.206	77.7	0.136	71.4	0.165	−65.4	13.0
1000	0.306	175.6	3.806	75.4	0.149	70.9	0.158	−66.1	12.1
1200	0.313	168.0	3.220	71.1	0.177	69.8	0.148	−69.4	10.7
1400	0.321	163.2	2.807	66.9	0.203	68.4	0.144	−73.7	9.5
1600	0.310	158.8	2.502	62.9	0.229	67.1	0.145	−74.2	8.5
1800	0.311	153.2	2.268	59.3	0.255	65.6	0.143	−76.3	7.6
2000	0.321	145.9	2.083	55.9	0.281	64.0	0.129	−78.1	6.9
2200	0.346	140.2	1.933	52.9	0.305	62.5	0.110	−85.0	6.3
2400	0.364	137.8	1.810	49.4	0.330	60.7	0.105	−98.2	5.8
2600	0.365	136.5	1.695	46.2	0.351	58.9	0.112	−108.3	5.3
2800	0.363	132.5	1.624	43.3	0.374	57.3	0.117	−111.4	4.9
3000	0.377	125.6	1.557	40.4	0.397	55.5	0.104	−115.2	4.6

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.70	0.252	172.0	0.12
2000	2.40	0.435	−142.0	0.19

Table 8 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 40 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.490	−50.7	48.572	143.6	0.012	72.1	0.758	−30.1	38.6
100	0.375	−97.0	30.052	118.9	0.024	66.5	0.489	−49.3	31.4
200	0.324	−132.0	17.092	103.7	0.038	68.3	0.305	−58.3	25.6
300	0.314	−148.3	11.818	96.5	0.052	70.7	0.232	−61.6	22.1
400	0.314	−157.9	9.023	91.7	0.066	71.9	0.196	−63.8	19.7
500	0.312	−164.6	7.289	88.0	0.081	72.7	0.178	−65.3	17.8
600	0.311	−169.2	6.140	85.0	0.095	72.8	0.167	−66.3	16.3
700	0.308	−173.8	5.307	82.2	0.109	72.8	0.161	−66.8	15.0
800	0.305	−177.9	4.694	79.6	0.123	72.5	0.156	−66.8	14.0
900	0.306	177.7	4.197	77.2	0.137	72.1	0.152	−67.0	13.0
1000	0.307	173.5	3.799	74.9	0.151	71.5	0.145	−67.9	12.1
1200	0.315	166.5	3.210	70.7	0.179	70.2	0.137	−71.7	10.7
1400	0.322	161.9	2.802	66.6	0.206	68.7	0.133	−76.3	9.5
1600	0.312	157.7	2.496	62.5	0.232	67.3	0.135	−76.7	8.5
1800	0.313	152.1	2.261	59.0	0.258	65.7	0.133	−78.8	7.6
2000	0.325	144.7	2.079	55.5	0.284	63.9	0.119	−80.9	6.9
2200	0.349	139.5	1.928	52.6	0.309	62.5	0.101	−88.9	6.3
2400	0.367	137.2	1.806	49.2	0.333	60.5	0.097	−103.2	5.8
2600	0.367	136.0	1.691	46.0	0.354	58.7	0.106	−113.4	5.2
2800	0.365	132.0	1.621	43.1	0.378	57.0	0.110	−116.3	4.9
3000	0.381	125.1	1.553	40.2	0.400	55.2	0.098	−120.8	4.5

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.279	180.0	0.13
2000	2.60	0.429	−140.0	0.22

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Table 10 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 50 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.448	−56.8	50.866	141.1	0.012	72.2	0.723	−32.0	38.3
100	0.355	−104.0	30.259	116.7	0.023	67.4	0.454	−50.7	31.2
200	0.321	−137.4	16.964	102.4	0.038	69.5	0.281	−59.0	25.4
300	0.316	−152.4	11.687	95.6	0.052	71.9	0.215	−62.1	22.0
400	0.319	−161.1	8.911	90.9	0.066	72.8	0.183	−64.4	19.6
500	0.318	−167.1	7.194	87.3	0.081	73.6	0.166	−65.9	17.7
600	0.317	−171.6	6.060	84.5	0.095	73.4	0.157	−66.9	16.2
700	0.315	−175.7	5.236	81.6	0.110	73.3	0.152	−67.6	14.9
800	0.312	−179.8	4.632	79.1	0.123	72.9	0.147	−67.6	13.9
900	0.313	176.0	4.140	76.6	0.138	72.5	0.144	−68.0	12.9
1000	0.314	172.0	3.747	74.4	0.152	71.9	0.138	−68.9	12.0
1200	0.323	165.4	3.171	70.1	0.180	70.5	0.131	−73.0	10.6
1400	0.331	160.8	2.764	66.0	0.207	68.9	0.128	−77.8	9.4
1600	0.320	156.7	2.462	62.0	0.233	67.4	0.130	−78.2	8.4
1800	0.321	151.1	2.231	58.5	0.260	65.7	0.128	−80.5	7.5
2000	0.333	144.0	2.052	55.1	0.286	64.0	0.114	−82.7	6.8
2200	0.358	138.7	1.905	52.1	0.311	62.4	0.097	−91.4	6.2
2400	0.374	136.6	1.782	48.7	0.335	60.5	0.094	−106.5	5.7
2600	0.376	135.2	1.670	45.5	0.356	58.6	0.104	−116.6	5.2
2800	0.374	131.2	1.601	42.6	0.380	56.9	0.109	−119.3	4.8
3000	0.388	124.7	1.535	39.7	0.402	55.1	0.096	−124.4	4.5

Table 11 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 4 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.921	−13.6	10.345	167.6	0.016	81.8	0.974	−7.8	41.3
100	0.868	−32.7	9.562	153.4	0.038	71.0	0.910	−18.2	33.4
200	0.755	−61.5	8.356	135.1	0.063	58.6	0.766	−30.2	25.9
300	0.655	−84.6	7.085	121.3	0.078	52.4	0.651	−36.8	21.8
400	0.588	−102.4	5.966	111.3	0.089	49.1	0.570	−40.9	19.1
500	0.540	−116.4	5.091	103.7	0.096	48.4	0.515	−43.2	17.0
600	0.506	−127.4	4.438	97.7	0.103	48.6	0.478	−44.6	15.4
700	0.481	−136.4	3.913	92.6	0.109	49.6	0.452	−45.5	14.0
800	0.461	−144.3	3.504	88.2	0.115	50.8	0.434	−46.1	12.8
900	0.446	−151.8	3.166	84.2	0.121	52.4	0.419	−46.7	11.8
1000	0.436	−158.5	2.882	80.7	0.128	53.8	0.406	−47.4	10.9
1200	0.428	−170.1	2.463	74.3	0.142	56.7	0.386	−49.8	9.4
1400	0.429	−179.1	2.168	68.6	0.158	59.4	0.375	−52.8	8.3
1600	0.418	173.6	1.941	63.6	0.174	62.1	0.373	−54.9	7.2
1800	0.417	165.7	1.766	59.2	0.195	64.0	0.370	−57.4	6.4
2000	0.424	157.1	1.627	54.9	0.216	65.2	0.357	−60.0	5.7
2200	0.445	150.2	1.513	51.2	0.238	66.0	0.339	−64.3	5.1
2400	0.462	145.6	1.421	47.1	0.263	66.2	0.328	−70.7	4.6
2600	0.463	141.8	1.334	43.7	0.287	66.1	0.329	−77.0	4.1
2800	0.462	136.1	1.283	40.7	0.315	65.7	0.334	−81.2	3.7
3000	0.479	128.9	1.228	37.7	0.342	64.8	0.322	−84.8	3.4

Table 12 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.823	−21.6	22.154	160.7	0.015	78.6	0.927	−14.5	40.3
100	0.710	−50.1	18.770	141.3	0.032	65.9	0.777	−30.5	32.5
200	0.538	−86.0	13.808	120.2	0.050	58.4	0.564	−43.5	26.0
300	0.450	−108.9	10.338	108.4	0.061	57.7	0.444	−48.8	22.2
400	0.408	−124.8	8.150	100.9	0.072	58.6	0.375	−51.3	19.7
500	0.383	−136.2	6.690	95.3	0.082	60.3	0.334	−52.6	17.7
600	0.367	−144.9	5.691	91.1	0.093	61.6	0.309	−53.2	16.2
700	0.354	−152.0	4.945	87.3	0.104	62.8	0.292	−53.5	14.9
800	0.344	−158.4	4.387	84.0	0.115	63.8	0.280	−53.5	13.7
900	0.338	−164.7	3.936	80.8	0.126	64.6	0.271	−53.7	12.8
1000	0.333	−170.4	3.565	78.1	0.137	65.0	0.260	−54.1	11.9
1200	0.335	179.8	3.024	73.0	0.160	65.5	0.246	−56.1	10.4
1400	0.341	172.9	2.644	68.3	0.183	65.6	0.237	−59.1	9.2
1600	0.330	167.2	2.358	63.9	0.206	65.6	0.237	−60.3	8.2
1800	0.330	160.5	2.139	60.0	0.230	65.2	0.235	−62.2	7.3
2000	0.339	152.2	1.967	56.2	0.253	64.3	0.221	−63.7	6.6
2200	0.361	145.8	1.827	53.0	0.276	63.6	0.202	−67.5	6.0
2400	0.380	142.5	1.711	49.2	0.300	62.4	0.191	−75.3	5.5
2600	0.381	140.3	1.605	46.0	0.322	61.2	0.192	−82.8	5.0
2800	0.381	135.7	1.538	43.0	0.345	60.1	0.196	−86.4	4.6
3000	0.395	128.5	1.476	39.9	0.368	58.7	0.185	−88.6	4.3

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.311	112.0	0.13
2000	2.10	0.400	−155.0	0.14

Table 14 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.714	−31.2	35.048	153.6	0.014	75.0	0.859	−21.2	39.8
100	0.553	−67.6	26.124	130.1	0.028	64.5	0.640	−39.8	32.2
200	0.404	−104.2	16.483	111.1	0.042	62.2	0.425	−51.2	26.0
300	0.351	−125.2	11.711	101.8	0.055	64.2	0.326	−55.2	22.4
400	0.330	−138.8	9.035	95.9	0.067	65.8	0.274	−57.2	20.0
500	0.317	−148.2	7.338	91.4	0.080	67.5	0.245	−58.4	18.0
600	0.310	−155.2	6.202	88.0	0.093	68.2	0.228	−58.9	16.5
700	0.302	−161.1	5.370	84.8	0.106	68.9	0.216	−59.2	15.2
800	0.295	−166.6	4.753	82.0	0.119	69.1	0.208	−59.1	14.1
900	0.293	−172.1	4.254	79.3	0.132	69.2	0.201	−59.1	13.1
1000	0.291	−177.3	3.847	76.8	0.145	69.0	0.194	−59.6	12.3
1200	0.297	174.0	3.255	72.3	0.171	68.4	0.182	−62.1	10.8
1400	0.304	168.3	2.839	68.0	0.196	67.5	0.175	−65.6	9.6
1600	0.293	163.5	2.530	63.9	0.221	66.6	0.176	−66.3	8.6
1800	0.294	157.2	2.292	60.3	0.246	65.4	0.174	−68.1	7.7
2000	0.302	149.0	2.107	56.7	0.270	64.0	0.159	−69.1	7.0
2200	0.327	143.0	1.956	53.7	0.294	62.7	0.140	−73.8	6.4
2400	0.346	140.5	1.832	50.2	0.318	61.1	0.130	−84.0	5.9
2600	0.347	139.0	1.714	47.0	0.339	59.5	0.133	−93.2	5.3
2800	0.345	134.8	1.643	44.1	0.362	58.0	0.138	−96.6	4.9
3000	0.359	127.5	1.574	41.1	0.384	56.4	0.125	−98.7	4.6

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.50	0.231	130.0	0.14
2000	2.20	0.410	−154.0	0.13

Table 16 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.651	−37.6	42.346	149.2	0.013	73.6	0.810	−24.8	39.6
100	0.480	−77.0	28.902	124.7	0.026	64.7	0.567	−43.8	32.0
200	0.357	−113.0	17.237	107.5	0.040	64.9	0.365	−54.0	25.9
300	0.321	−132.5	12.068	99.3	0.053	67.3	0.280	−57.4	22.5
400	0.307	−145.0	9.257	94.0	0.067	68.6	0.235	−59.4	20.0
500	0.298	−153.3	7.499	90.0	0.080	70.1	0.212	−60.5	18.1
600	0.293	−159.5	6.324	86.8	0.094	70.4	0.198	−61.3	16.6
700	0.287	−164.9	5.471	83.8	0.108	70.8	0.189	−61.5	15.3
800	0.283	−170.0	4.842	81.1	0.121	70.7	0.183	−61.5	14.2
900	0.281	−175.4	4.330	78.5	0.135	70.6	0.177	−61.7	13.2
1000	0.281	179.9	3.915	76.2	0.148	70.2	0.170	−62.1	12.3
1200	0.287	171.5	3.312	71.8	0.174	69.1	0.159	−65.2	10.9
1400	0.295	166.3	2.893	67.7	0.200	68.0	0.154	−69.0	9.7
1600	0.285	161.8	2.572	63.7	0.226	66.8	0.156	−69.5	8.7
1800	0.285	155.7	2.328	60.2	0.251	65.4	0.153	−71.2	7.8
2000	0.294	147.7	2.140	56.7	0.276	63.9	0.138	−72.3	7.1
2200	0.320	141.8	1.986	53.7	0.300	62.4	0.119	−77.9	6.5
2400	0.338	139.4	1.859	50.3	0.325	60.6	0.111	−89.9	6.0
2600	0.340	138.2	1.740	47.1	0.345	59.0	0.116	−99.7	5.4
2800	0.339	134.2	1.668	44.3	0.368	57.4	0.120	−102.8	5.0
3000	0.351	126.9	1.597	41.3	0.390	55.7	0.107	−105.5	4.7

Table 17 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.70	0.221	139.0	0.14
2000	2.40	0.420	−153.0	0.13

Table 18 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 40 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.612	−42.1	46.529	146.3	0.013	72.7	0.773	−27.0	39.3
100	0.443	−82.9	30.029	121.7	0.025	65.2	0.522	−45.8	31.9
200	0.337	−118.5	17.433	105.6	0.039	66.2	0.331	−55.0	25.9
300	0.308	−137.0	12.119	97.9	0.053	68.6	0.254	−58.0	22.4
400	0.300	−148.8	9.272	92.9	0.066	70.2	0.215	−59.9	20.0
500	0.293	−156.7	7.502	89.1	0.080	71.4	0.195	−61.1	18.1
600	0.290	−162.3	6.321	86.0	0.094	71.5	0.183	−61.9	16.5
700	0.284	−167.7	5.467	83.1	0.108	71.7	0.176	−62.2	15.3
800	0.280	−172.2	4.835	80.5	0.122	71.6	0.170	−62.2	14.2
900	0.279	−177.2	4.325	78.0	0.136	71.3	0.165	−62.3	13.2
1000	0.281	178.0	3.912	75.8	0.149	70.8	0.159	−62.9	12.3
1200	0.288	170.1	3.308	71.5	0.176	69.7	0.149	−66.1	10.9
1400	0.294	165.3	2.886	67.3	0.203	68.2	0.145	−70.3	9.7
1600	0.284	160.9	2.567	63.4	0.228	67.0	0.147	−70.7	8.6
1800	0.285	154.8	2.326	59.9	0.254	65.5	0.144	−72.5	7.8
2000	0.295	146.7	2.137	56.4	0.279	63.9	0.130	−73.8	7.1
2200	0.321	141.1	1.984	53.5	0.303	62.4	0.111	−79.8	6.5
2400	0.338	138.9	1.857	50.0	0.327	60.5	0.103	−92.7	6.0
2600	0.341	137.8	1.738	46.8	0.348	58.7	0.109	−102.9	5.4
2800	0.339	133.6	1.664	43.9	0.371	57.2	0.113	−105.9	5.0
3000	0.353	126.6	1.596	41.1	0.393	55.5	0.101	−108.8	4.7

Table 19 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.205	145.0	0.17
2000	2.60	0.430	−152.0	0.14

Table 20 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 50 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.587	−45.6	48.707	144.3	0.013	71.6	0.743	−28.3	39.1
100	0.422	−87.4	30.314	119.8	0.024	65.1	0.490	−46.7	31.7
200	0.330	−122.6	17.334	104.3	0.038	66.7	0.310	−55.0	25.7
300	0.306	−140.6	12.007	97.0	0.052	69.6	0.239	−57.5	22.3
400	0.299	−151.6	9.171	92.1	0.066	71.0	0.203	−59.2	19.8
500	0.295	−159.0	7.413	88.4	0.080	71.9	0.185	−60.3	17.9
600	0.292	−164.5	6.246	85.4	0.094	72.1	0.175	−61.1	16.4
700	0.286	−169.5	5.397	82.6	0.108	72.1	0.169	−61.5	15.1
800	0.283	−174.0	4.775	80.0	0.122	71.9	0.164	−61.6	14.1
900	0.283	−178.8	4.273	77.5	0.136	71.6	0.160	−61.7	13.1
1000	0.284	176.8	3.865	75.3	0.150	71.0	0.154	−62.5	12.2
1200	0.292	169.0	3.269	71.0	0.177	69.9	0.145	−65.8	10.8
1400	0.299	164.3	2.848	66.9	0.203	68.4	0.141	−69.9	9.6
1600	0.289	159.9	2.537	62.9	0.229	67.1	0.143	−70.6	8.6
1800	0.290	154.1	2.298	59.4	0.255	65.6	0.141	−72.5	7.7
2000	0.301	146.4	2.111	55.9	0.280	63.9	0.127	−73.7	7.0
2200	0.325	140.6	1.960	52.9	0.304	62.3	0.108	−79.9	6.4
2400	0.345	138.4	1.837	49.4	0.329	60.5	0.101	−93.2	5.9
2600	0.346	137.2	1.720	46.3	0.349	58.7	0.107	−103.7	5.3
2800	0.344	133.3	1.644	43.4	0.372	57.1	0.112	−106.7	4.9
3000	0.359	126.2	1.578	40.5	0.394	55.4	0.099	−109.8	4.6

NPN 9 GHz wideband transistor BFR541

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

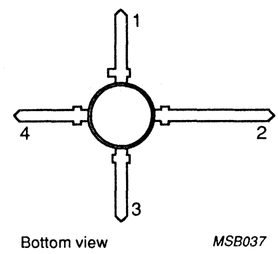


Fig.1 SOT103.

DESCRIPTION

The BFR541 is an NPN silicon planar epitaxial transistor, intended for wideband applications up to 3 GHz, such as MATV/CATV amplifiers, repeater amplifiers in fibre-optic systems and RF communications subscriber equipment.

The transistor is mounted in a plastic SOT103 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to $T_s = 140$ °C (note 1)	–	–	650	mW
h_{FE}	DC current gain	$V_{CE} = 8$ V; $I_C = 40$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CE} = 8$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$V_{CE} = 8$ V; $I_C = 40$ mA	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 8$ V; $I_C = 40$ mA; f = 900 MHz	–	18	–	dB
$\|S_{21}\|^2$	insertion power gain	$V_{CE} = 8$ V; $I_C = 40$ mA; f = 900 MHz	15	16	–	dB
F	noise figure	$V_{CE} = 8$ V; $I_C = 10$ mA; f = 900 MHz	–	1.3	1.8	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	55	K/W
T_j	junction temperature		–	–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 8 GHz wideband transistor BFR591

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

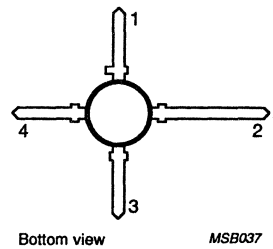


Fig.1 SOT103.

DESCRIPTION

The BFR591 is an NPN silicon planar epitaxial transistor, intended for wideband applications in the GHz range, such as MATV/CATV amplifiers and RF communications subscriber equipment.

The transistor is mounted in a plastic SOT103 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	200	mA
P_{tot}	total power dissipation	up to T_s = 110 °C (note 1)	–	–	1.2	W
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 90 mA	60	120	250	
C_{re}	feedback capacitance	V_{CE} = 10 V; I_C = i_c = 0; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 90 mA	–	8	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	–	15	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	12	13	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 10 V; I_C = 90 mA; f = 900 MHz	–	25	–	dBm
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	55	K/W
T_j	junction temperature		–	–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

NPN 1 GHz wideband transistor BFS17

DESCRIPTION

NPN transistor in a plastic SOT23 envelope.

It is intended for a wide range of RF applications, such as mixers and oscillators in TV tuners and RF communications equipment.

PINNING

PIN	DESCRIPTION
Code: E1p	
1	base
2	emitter
3	collector

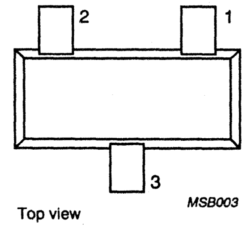


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	1	–	GHz
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz; T_j = 25 °C	4.5	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 1 GHz wideband transistor BFS17

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

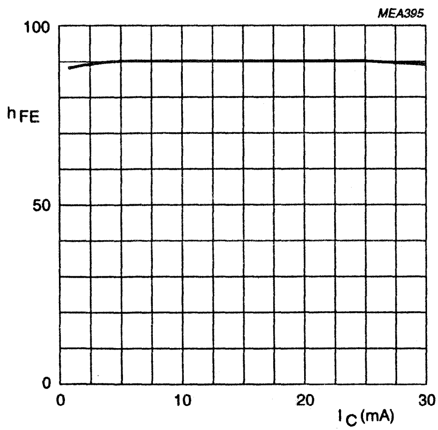
Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

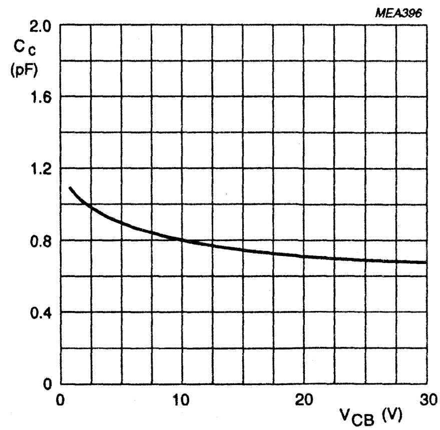
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	10	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 1 V	25	90	–	
		I_C = 25 mA; V_{CE} = 1 V	25	90	–	
f_T	transition frequency	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz	–	1	–	GHz
		I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	–	1.6	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.8	1.5	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	–	2	pF
C_{re}	feedback capacitance	I_C = 1 mA; V_{CE} = 5 V; f = 1 MHz	–	0.65	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz	–	4.5	–	dB



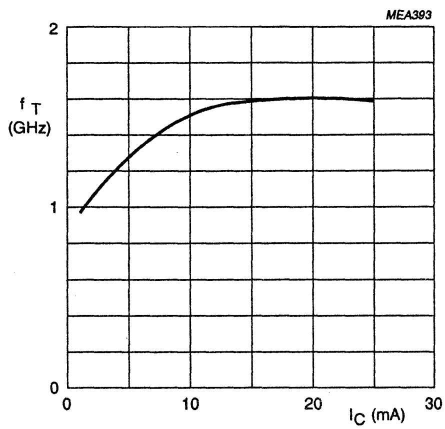
V_{CE} = 1 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



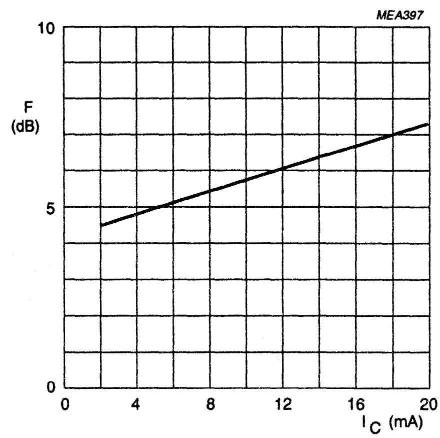
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz; T_j = 25 °C.

Fig.5 Minimum noise figure as a function of collector current.

NPN 3 GHz wideband transistor BFS17A

DESCRIPTION

NPN transistor in a plastic SOT23 envelope.

It is intended for a wide range of RF applications such as TV tuners.

PINNING

PIN	DESCRIPTION
	Code: E2p
1	base
2	emitter
3	collector

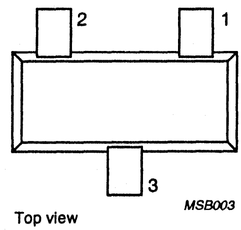


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	2.8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz	13.5	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	2.5	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	150	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

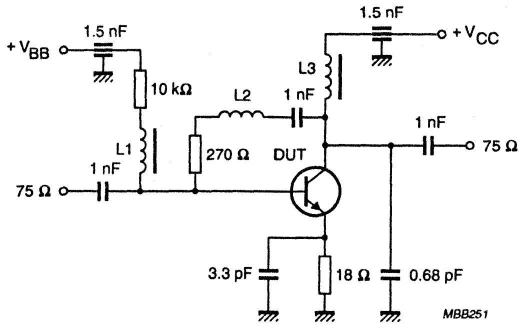
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 1 V; T_{amb} = 25 °C	25	90	–	
		I_C = 25 mA; V_{CE} = 1 V; T_{amb} = 25 °C	25	90	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	2.8	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	0.7	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.25	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	–	0.6	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz	–	13.5	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; Z_S = 60 Ω; f = 800 MHz; T_{amb} = 25 °C	–	2.5	–	dB
V_O	output voltage	note 2	–	150	–	mV

Notes

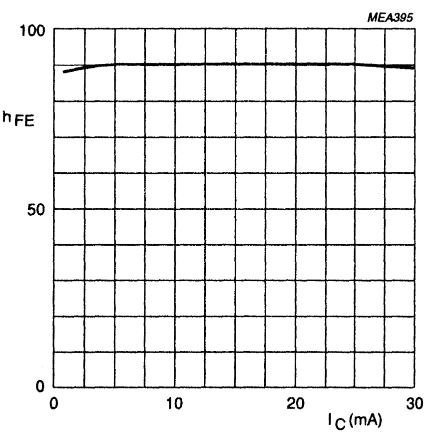
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



L1 = L3 = 5 μH Ferroxcube choke.

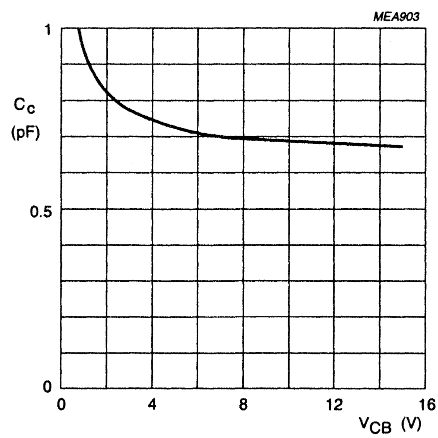
L2 = 3 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.



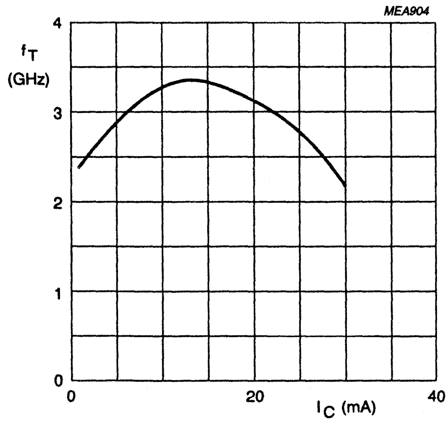
V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.3 DC current gain as a function of collector current.



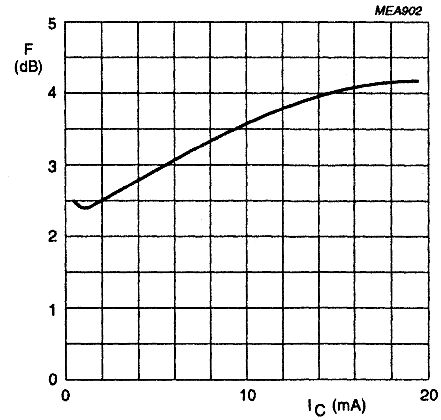
I_E = 0; f = 1 MHz; T_{amb} = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current.



V_{CE} = 5 V; Z_S = 60 Ω; f = 800 MHz; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.

Table 1 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.590	−29.5	21.379	158.1	0.009	76.3	0.950	−9.1	38.6
100	0.491	−64.5	16.515	134.4	0.021	64.3	0.828	−16.7	30.6
200	0.386	−103.1	10.912	114.5	0.031	62.6	0.689	−19.0	24.3
300	0.349	−124.1	7.833	103.6	0.039	64.4	0.630	−18.8	20.6
400	0.331	−137.6	6.080	96.8	0.047	67.1	0.603	−18.9	18.1
500	0.322	−146.7	5.055	90.8	0.055	68.8	0.590	−19.0	16.4
600	0.319	−155.5	4.244	86.9	0.065	70.7	0.585	−19.8	14.8
700	0.306	−157.4	3.666	83.3	0.074	72.5	0.582	−20.8	13.5
800	0.317	−165.6	3.232	79.7	0.082	73.6	0.582	−21.7	12.4
900	0.301	−172.1	2.909	76.9	0.092	74.5	0.582	−23.0	11.5
1000	0.307	−177.7	2.610	73.1	0.100	75.1	0.579	−23.9	10.5
1200	0.311	177.2	2.234	67.5	0.119	75.8	0.578	−26.5	9.2
1400	0.330	170.6	1.966	62.3	0.138	76.4	0.579	−29.8	8.1
1600	0.310	164.5	1.746	58.5	0.157	77.4	0.582	−32.6	7.1
1800	0.326	153.7	1.552	53.6	0.175	77.6	0.580	−35.4	6.1
2000	0.351	149.2	1.458	50.1	0.196	77.2	0.580	−38.5	5.6

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 5 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.496	−37.6	26.019	153.3	0.009	76.8	0.929	−10.9	38.1
100	0.404	−78.8	18.591	128.4	0.018	66.2	0.777	−17.7	30.2
200	0.335	−116.9	11.439	109.2	0.028	66.0	0.651	−18.0	24.1
300	0.314	−136.4	8.062	99.5	0.037	68.7	0.605	−17.1	20.6
400	0.307	−148.4	6.191	93.2	0.046	71.0	0.585	−16.8	18.1
500	0.304	−156.1	5.023	88.4	0.055	73.0	0.576	−17.3	16.2
600	0.303	−162.1	4.232	84.5	0.065	74.1	0.573	−18.0	14.7
700	0.301	−167.2	3.657	81.0	0.074	75.3	0.572	−19.0	13.4
800	0.299	−171.9	3.228	77.7	0.083	75.7	0.573	−20.1	12.3
900	0.298	−176.8	2.889	74.6	0.092	76.1	0.573	−21.3	11.3
1000	0.300	179.4	2.614	71.8	0.102	76.6	0.573	−22.5	10.5
1200	0.312	172.0	2.218	66.6	0.120	77.1	0.573	−25.1	9.1
1400	0.326	166.8	1.948	61.9	0.139	77.6	0.573	−28.1	8.0
1600	0.326	161.6	1.739	57.4	0.157	77.7	0.576	−31.0	7.0
1800	0.328	155.4	1.568	53.5	0.176	77.9	0.575	−33.9	6.1
2000	0.344	147.8	1.440	49.5	0.197	77.6	0.568	−36.8	5.4

Table 3 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 5$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.429	−45.4	28.889	149.3	0.008	68.0	0.906	−12.0	37.6
100	0.355	−91.8	19.198	123.2	0.017	62.0	0.742	−17.3	29.7
200	0.321	−131.3	11.342	105.9	0.026	67.9	0.632	−16.6	23.8
300	0.312	−145.1	7.873	96.9	0.035	71.2	0.596	−15.6	20.3
400	0.322	−154.3	6.023	91.4	0.044	73.4	0.583	−15.8	17.9
500	0.331	−162.4	4.965	86.3	0.053	74.5	0.577	−16.2	16.2
600	0.316	−168.2	4.149	82.9	0.062	74.9	0.576	−17.4	14.6
700	0.308	−171.4	3.568	79.6	0.071	77.3	0.576	−18.5	13.2
800	0.329	−177.2	3.147	76.4	0.081	77.6	0.579	−19.9	12.2
900	0.314	−178.4	2.840	73.2	0.089	78.1	0.581	−21.2	11.3
1000	0.330	175.6	2.544	69.8	0.099	78.9	0.579	−22.5	10.4
1200	0.332	170.0	2.166	64.8	0.117	79.2	0.579	−25.3	9.0
1400	0.357	163.8	1.896	59.9	0.136	79.2	0.581	−28.9	7.9
1600	0.345	159.3	1.682	56.3	0.156	80.1	0.585	−31.7	6.9
1800	0.343	153.1	1.490	51.4	0.175	80.1	0.585	−35.0	5.8
2000	0.384	146.7	1.408	47.8	0.195	79.6	0.583	−38.3	5.5

Table 4 Common emitter scattering parameters, $I_C = 10$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.654	−25.7	20.995	159.2	0.009	74.2	0.959	−8.1	39.8
100	0.533	−58.1	16.521	136.1	0.019	66.9	0.849	−14.8	31.4
200	0.410	−93.4	11.123	116.1	0.030	63.4	0.719	−17.3	24.9
300	0.353	−114.2	8.037	105.1	0.037	64.8	0.665	−17.1	21.2
400	0.321	−129.8	6.264	98.1	0.045	66.8	0.640	−17.2	18.7
500	0.308	−139.0	5.217	92.0	0.053	68.9	0.628	−17.3	17.0
600	0.290	−148.1	4.374	88.1	0.061	70.4	0.622	−18.2	15.3
700	0.276	−152.1	3.777	84.5	0.069	73.4	0.619	−19.1	14.0
800	0.286	−161.9	3.341	80.8	0.078	73.8	0.618	−20.0	12.9
900	0.271	−165.8	3.004	77.6	0.086	75.2	0.621	−21.0	12.0
1000	0.281	−172.9	2.708	74.1	0.094	75.2	0.615	−22.0	11.1
1200	0.279	177.3	2.309	68.6	0.111	76.9	0.616	−24.5	9.7
1400	0.301	174.1	2.036	63.6	0.129	77.2	0.616	−27.5	8.7
1600	0.296	169.4	1.813	59.7	0.146	78.1	0.620	−30.0	7.7
1800	0.290	159.4	1.593	54.9	0.163	78.6	0.619	−32.7	6.5
2000	0.307	153.8	1.504	51.1	0.182	78.3	0.620	−35.6	6.1

Table 5 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.573	−32.7	25.747	154.5	0.009	76.8	0.938	−9.6	39.2
100	0.453	−69.6	18.801	130.1	0.017	67.3	0.802	−15.9	31.0
200	0.345	−105.9	11.759	110.6	0.027	65.9	0.682	−16.5	24.7
300	0.306	−126.5	8.332	100.7	0.036	68.0	0.637	−15.8	21.1
400	0.291	−139.6	6.408	94.3	0.044	70.4	0.618	−15.6	18.6
500	0.282	−148.4	5.206	89.5	0.053	72.3	0.609	−16.0	16.7
600	0.278	−155.3	4.386	85.5	0.061	73.7	0.605	−16.7	15.2
700	0.273	−160.8	3.792	82.1	0.070	75.2	0.604	−17.6	13.9
800	0.272	−166.2	3.347	78.8	0.079	75.4	0.606	−18.6	12.8
900	0.268	−171.4	2.992	75.7	0.088	76.1	0.606	−19.7	11.8
1000	0.270	−176.0	2.707	72.9	0.096	76.6	0.606	−20.8	11.0
1200	0.282	175.9	2.295	67.7	0.113	77.3	0.606	−23.3	9.6
1400	0.295	170.2	2.016	63.1	0.131	78.0	0.606	−26.1	8.5
1600	0.294	164.6	1.797	58.6	0.148	78.3	0.609	−28.7	7.5
1800	0.296	158.3	1.619	54.7	0.166	78.6	0.609	−31.4	6.6
2000	0.312	149.9	1.484	50.8	0.185	78.4	0.602	−34.1	5.8

Table 6 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.526	−38.1	28.982	151.1	0.008	75.1	0.919	−10.7	38.8
100	0.409	−77.7	19.795	125.2	0.016	64.3	0.775	−16.0	30.7
200	0.320	−115.1	11.907	107.4	0.026	66.7	0.667	−15.2	24.5
300	0.297	−134.0	8.293	98.2	0.033	69.8	0.630	−14.5	21.0
400	0.276	−146.2	6.358	92.7	0.042	71.7	0.615	−14.7	18.5
500	0.293	−152.8	5.256	87.6	0.051	73.3	0.609	−15.1	16.8
600	0.286	−160.3	4.387	84.1	0.060	75.4	0.608	−16.1	15.2
700	0.271	−163.7	3.775	80.8	0.068	76.9	0.608	−17.2	13.9
800	0.289	−171.1	3.323	77.6	0.078	76.9	0.611	−18.4	12.8
900	0.287	−174.0	2.993	74.7	0.085	77.7	0.613	−19.5	11.9
1000	0.280	179.2	2.684	71.2	0.094	78.6	0.610	−20.6	11.0
1200	0.300	173.3	2.282	65.9	0.112	79.0	0.612	−23.3	9.6
1400	0.310	168.8	2.000	61.2	0.128	79.2	0.613	−26.5	8.5
1600	0.308	163.6	1.778	57.7	0.146	80.4	0.618	−29.3	7.5
1800	0.312	154.0	1.577	53.1	0.165	80.7	0.619	−32.1	6.5
2000	0.335	149.6	1.480	49.6	0.182	80.3	0.619	−35.1	6.0

NPN 1 GHz wideband transistor

BFS17W

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 (S-mini) envelope. It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners. The BFS17W uses the same crystal as the SOT23 version, BFS17.

PINNING

PIN	DESCRIPTION
Code: E1	
1	base
2	emitter
3	collector

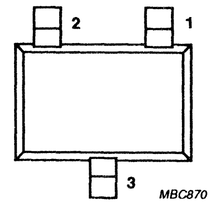


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 87 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 1 V	25	90	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V	–	1.6	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = 10 V; f = 1 MHz	–	0.8	1.5	pF
C_{re}	feedback capacitance	I_C = 1 mA; V_{CE} = 5 V; f = 1 MHz	–	0.65	–	pF
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	290	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 5 GHz wideband transistor BFS25A

FEATURES

- Low current consumption
- Low noise figure
- Gold metallization ensures excellent reliability
- SOT323 envelope.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is designed for use in RF amplifiers and oscillators in pagers and pocket phones with signal frequencies up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: N6	
1	base
2	emitter
3	collector

PIN CONFIGURATION

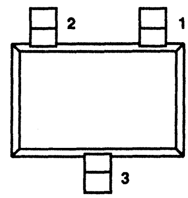


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	–	5	V
I_C	DC collector current		–	–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 142 °C (note 1)	–	–	32	mW
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V; T_j = 25 °C	50	80	200	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
F	noise figure	I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	–	1.8	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 142 °C (note 1)	–	32	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 142 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 1 V; f = 1 MHz	–	0.3	0.45	pF
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	–	1.8	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 1 V; f = 1 GHz; T_{amb} = 25 °C	–	2	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

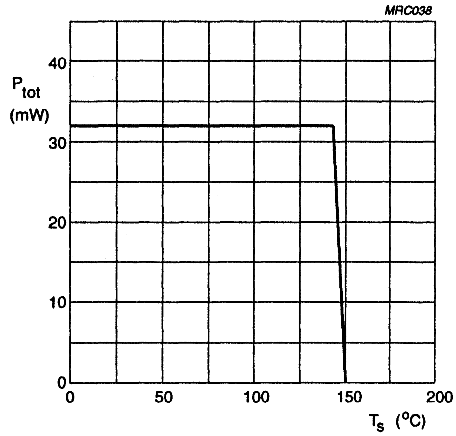
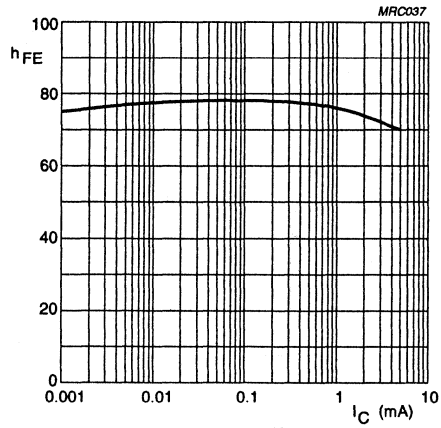
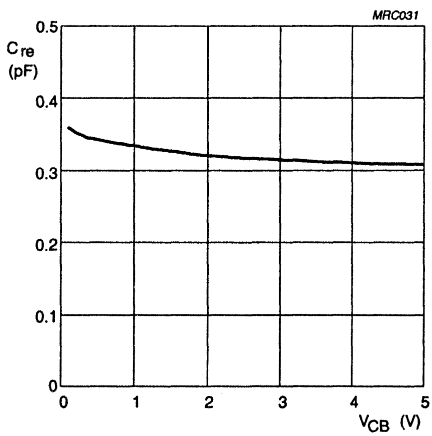


Fig.2 Power derating curve.



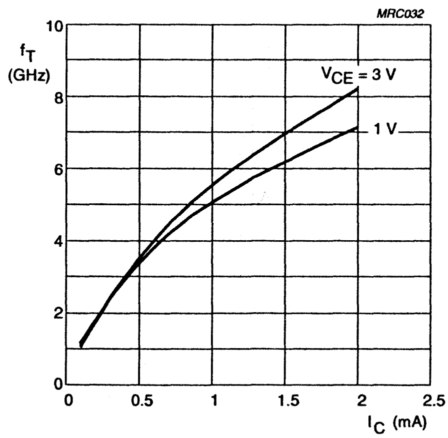
V_{CE} = 1 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

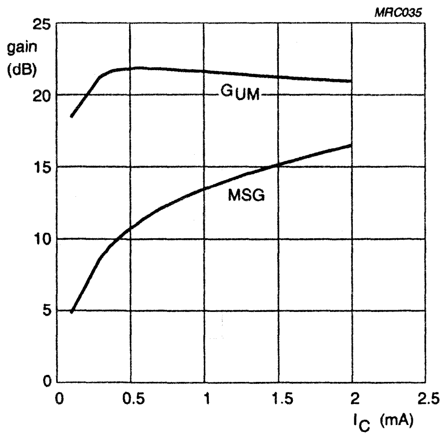
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

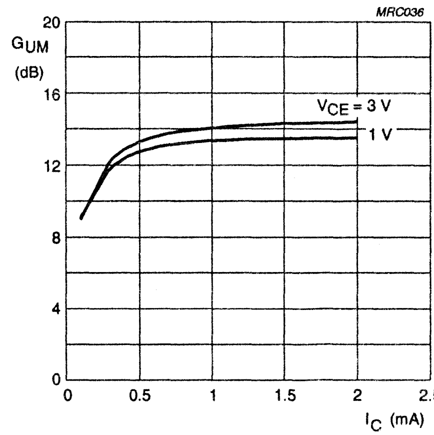
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



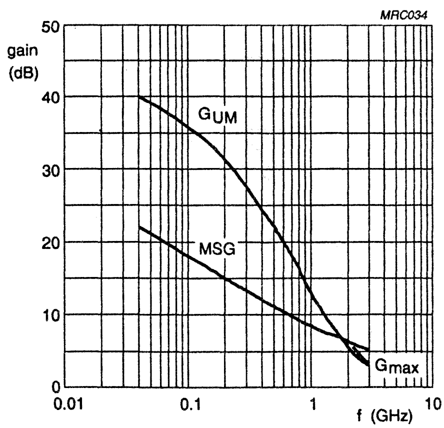
V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Gain as a function of collector current.



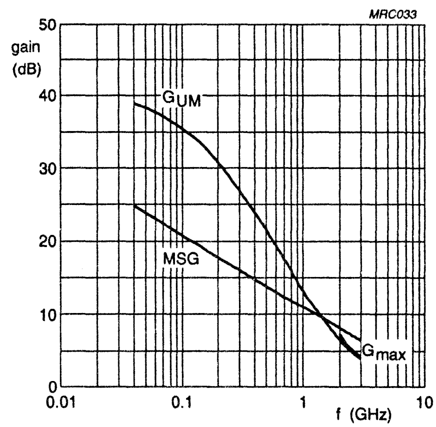
f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Maximum unilateral power gain as a function of collector current.



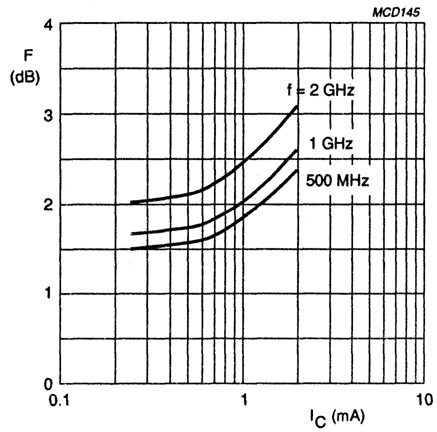
I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



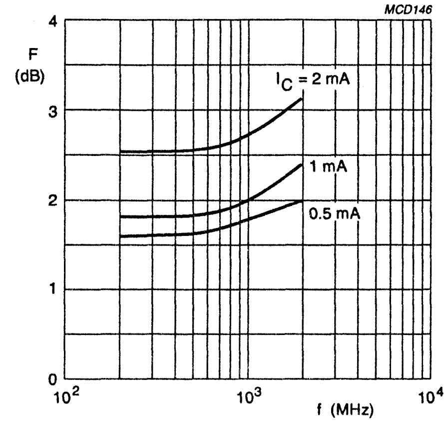
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



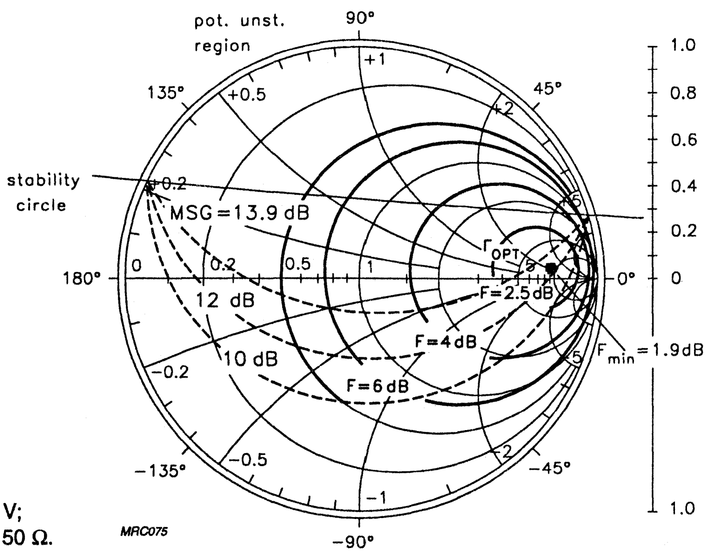
V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



I_C = 1 mA; V_{CE} = 1 V;
f = 500 MHz; Z_O = 50 Ω.

Fig.12 Noise circle.

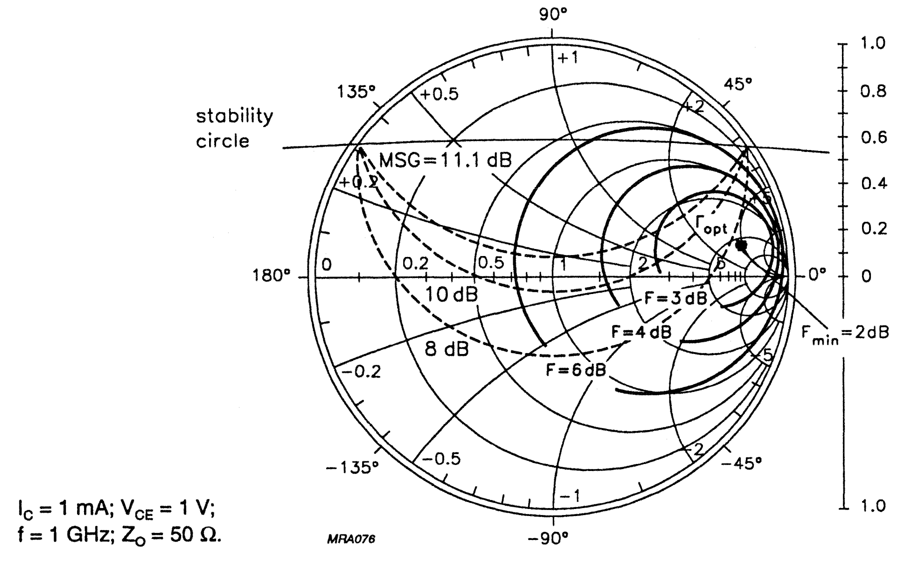


Fig.13 Noise circle.

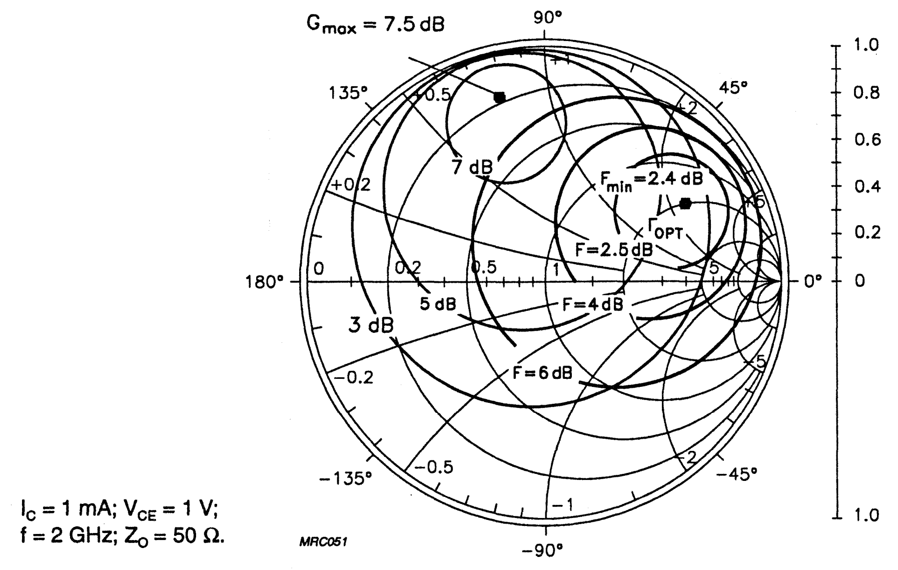
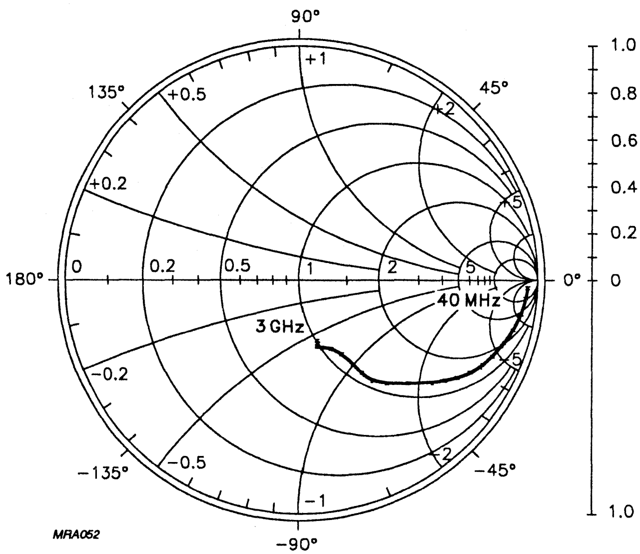
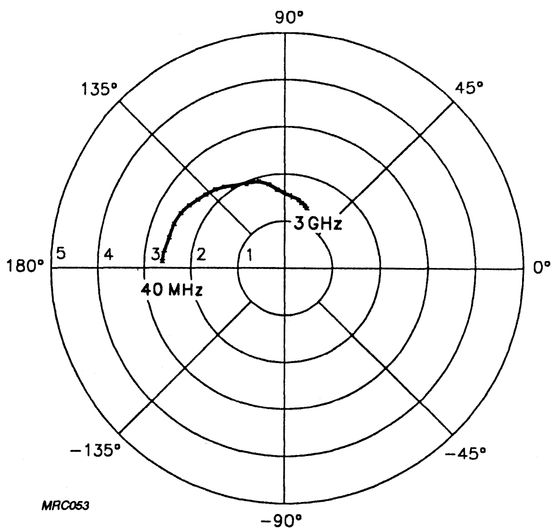


Fig.14 Noise circle.



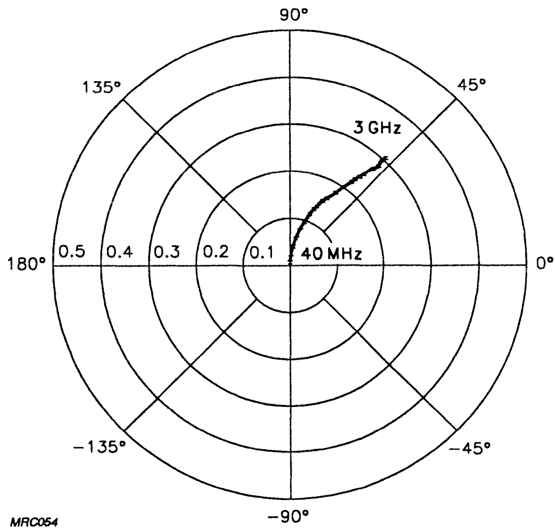
I_C = 1 mA; V_{CE} = 1 V;
Z_O = 50 Ω.

Fig.15 Common emitter input reflection coefficient (S_{11}).



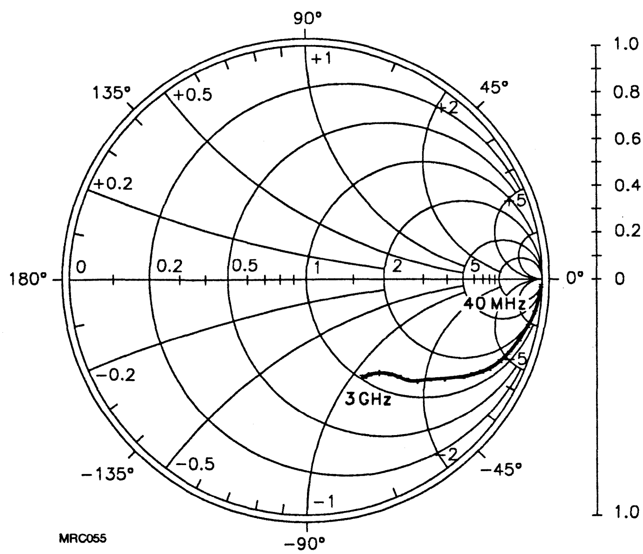
I_C = 1 mA; V_{CE} = 1 V.

Fig.16 Common emitter forward transmission coefficient (S_{21}).



I_C = 1 mA; V_{CE} = 1 V.

Fig.17 Common emitter reverse transmission coefficient (S_{12}).

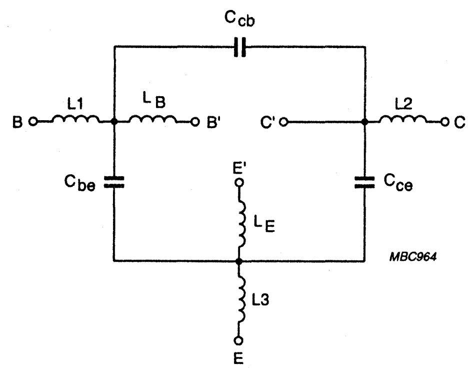


I_C = 1 mA; V_{CE} = 1 V;
Z_O = 50 Ω.

Fig.18 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFT25A crystal

1	IS = 13.77	aA
2	BF = 85.65	–
3	NF = 979.9	m
4	VAF = 50.80	V
5	IKF = 10.00	A
6	ISE = 2.199	fA
7	NE = 1.857	–
8	BR = 16.97	–
9	NR = 985.5	m
10	VAR = 2.491	V
11	IKR = 188.0	mA
12	ISC = 205.1	aA
13	NC = 1.107	–
14	RB = 80.00	Ω
15	IRB = 1.000	µA
16	RBM = 80.00	Ω
17	RE = 7.911	Ω
18	RC = 5.300	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 223.0	fF
23	VJE = 669.7	mV
24	MJE = 59.66	m
25	TF = 5.112	ps
26	XTF = 7.909	–
27	VTF = 1.338	V
28	ITF = 5.662	mA
29	PTF = 15.37	deg
30	CJC = 229.0	fF
31	VJC = 394.7	mV
32	MJC = 43.32	m
33	XCJC = 50.00	m
34	TR = 13.26	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 987.8	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.19 Package equivalent circuit, SOT323.

List of components (see Fig.19)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 0.1 mA; V_{CE} = 1 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.994	−0.8	0.295	176.8	0.008	87.3	0.999	−0.9	37.5
100	0.994	−2.0	0.299	172.6	0.021	86.4	0.998	−2.3	32.7
200	0.992	−4.1	0.301	165.3	0.043	84.1	0.995	−4.6	27.7
300	0.989	−6.3	0.302	158.4	0.064	81.6	0.991	−6.9	23.5
400	0.984	−8.5	0.308	151.5	0.086	79.9	0.986	−9.3	20.3
500	0.980	−10.7	0.320	145.6	0.106	78.0	0.981	−11.7	18.3
600	0.975	−12.8	0.329	139.7	0.127	76.2	0.977	−13.9	16.8
700	0.968	−14.8	0.337	133.6	0.146	74.4	0.970	−16.1	14.9
800	0.957	−16.7	0.344	128.1	0.163	72.4	0.962	−18.1	12.7
900	0.945	−18.6	0.359	123.0	0.180	70.1	0.950	−20.0	10.9
1000	0.930	−20.6	0.369	117.9	0.196	67.8	0.936	−22.0	9.1
1200	0.901	−24.9	0.396	108.9	0.228	63.1	0.907	−26.2	6.7
1400	0.879	−29.3	0.428	100.9	0.263	59.2	0.879	−30.4	5.5
1600	0.857	−32.9	0.448	94.6	0.292	55.5	0.859	−34.1	4.6
1800	0.829	−35.7	0.465	89.7	0.311	53.2	0.834	−37.5	3.6
2000	0.792	−38.7	0.478	82.9	0.331	49.7	0.799	−40.5	2.3
2200	0.751	−42.1	0.502	77.4	0.349	46.5	0.763	−43.9	1.4
2400	0.721	−46.3	0.532	71.1	0.378	42.7	0.733	−48.1	1.0
2600	0.705	−51.1	0.554	68.4	0.394	39.8	0.714	−52.2	0.9
2800	0.686	−54.3	0.583	65.7	0.408	38.9	0.705	−55.3	1.1
3000	0.664	−56.0	0.582	62.3	0.419	36.8	0.688	−57.2	0.6

Table 2 Common emitter scattering parameters, $I_C = 0.25$ mA; $V_{CE} = 1$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.989	−1.0	0.699	177.5	0.008	89.3	0.998	−1.1	37.5
100	0.988	−2.5	0.696	174.1	0.021	86.6	0.997	−2.6	35.3
200	0.985	−5.0	0.693	168.4	0.042	83.5	0.993	−5.2	30.6
300	0.979	−7.7	0.709	163.0	0.064	80.8	0.987	−7.9	26.7
400	0.971	−10.3	0.717	157.6	0.085	78.7	0.980	−10.6	23.6
500	0.965	−12.9	0.717	152.9	0.105	76.6	0.972	−13.3	21.3
600	0.956	−15.4	0.714	147.8	0.125	74.6	0.965	−15.9	19.4
700	0.945	−17.7	0.713	142.9	0.143	72.6	0.955	−18.2	17.3
800	0.930	−20.0	0.713	138.2	0.160	70.5	0.944	−20.3	15.4
900	0.913	−22.2	0.714	133.3	0.175	68.1	0.928	−22.4	13.4
1000	0.893	−24.4	0.711	128.6	0.189	65.7	0.911	−24.5	11.7
1200	0.855	−29.3	0.716	120.1	0.219	60.9	0.874	−28.9	9.1
1400	0.823	−34.2	0.736	112.5	0.250	57.2	0.840	−33.1	7.6
1600	0.791	−38.4	0.749	106.1	0.275	53.6	0.813	−37.1	6.5
1800	0.757	−41.3	0.742	100.8	0.290	51.4	0.785	−40.5	5.3
2000	0.710	−44.5	0.743	94.2	0.306	48.3	0.746	−43.3	4.0
2200	0.660	−48.1	0.757	88.4	0.321	45.6	0.708	−46.5	3.1
2400	0.618	−52.9	0.780	81.9	0.343	42.3	0.673	−50.7	2.6
2600	0.596	−58.4	0.791	78.5	0.356	39.7	0.652	−54.9	2.3
2800	0.577	−61.7	0.811	75.2	0.368	39.2	0.645	−57.8	2.3
3000	0.551	−63.1	0.798	71.4	0.377	37.5	0.628	−59.7	1.8

Table 3 Noise data, $I_C = 0.25$ mA; $V_{CE} = 1$ V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.60	0.935	2.00	3.00
1000	1.80	0.920	9.00	3.00
2000	2.10	0.796	28.00	1.60

Table 4 Common emitter scattering parameters, $I_C = 0.5$ mA; $V_{CE} = 1$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.979	−1.3	1.367	177.4	0.008	89.5	0.998	−1.3	40.5
100	0.977	−3.2	1.376	173.8	0.021	86.2	0.995	−3.1	36.2
200	0.971	−6.4	1.362	167.8	0.042	82.6	0.989	−6.3	31.7
300	0.961	−9.7	1.356	162.3	0.063	79.6	0.978	−9.5	27.4
400	0.948	−13.1	1.355	156.9	0.083	77.1	0.967	−12.6	24.5
500	0.936	−16.1	1.336	152.2	0.103	74.6	0.955	−15.8	22.1
600	0.921	−19.1	1.320	147.3	0.121	72.4	0.942	−18.6	20.1
700	0.903	−22.0	1.303	142.6	0.138	70.2	0.927	−21.2	18.2
800	0.882	−24.6	1.282	138.0	0.153	68.0	0.909	−23.5	16.3
900	0.855	−27.3	1.281	133.1	0.167	65.8	0.888	−25.6	14.6
1000	0.828	−29.8	1.254	128.7	0.179	63.4	0.866	−27.7	13.0
1200	0.774	−35.5	1.236	120.6	0.204	58.8	0.817	−32.2	10.6
1400	0.728	−41.1	1.235	113.2	0.229	55.5	0.772	−36.4	9.0
1600	0.684	−45.5	1.215	106.8	0.250	52.3	0.742	−40.2	7.9
1800	0.644	−48.5	1.166	101.7	0.262	50.7	0.711	−43.3	6.7
2000	0.590	−51.2	1.128	95.2	0.275	48.3	0.670	−45.6	5.5
2200	0.532	−54.8	1.117	89.8	0.287	46.5	0.630	−48.4	4.6
2400	0.485	−59.7	1.117	83.3	0.305	44.1	0.592	−52.5	4.0
2600	0.461	−65.6	1.103	79.8	0.314	42.2	0.571	−56.7	3.6
2800	0.439	−68.9	1.111	76.5	0.325	42.2	0.564	−59.5	3.5
3000	0.414	−69.4	1.077	72.7	0.334	41.4	0.549	−61.1	3.0

Table 5 Noise data, $I_C = 0.5$ mA; $V_{CE} = 1$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.60	0.902	3.00	2.40
1000	1.80	0.800	10.00	2.40
2000	2.00	0.846	26.00	1.40

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Table 6 Common emitter scattering parameters, $I_C = 1$ mA; $V_{CE} = 1$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.958	−1.8	2.617	176.6	0.008	89.4	0.995	−1.7	39.2
100	0.954	−4.4	2.587	172.3	0.021	84.6	0.992	−4.1	36.7
200	0.942	−8.9	2.545	165.1	0.041	80.9	0.978	−8.1	31.2
300	0.922	−13.4	2.535	158.7	0.061	77.5	0.959	−12.1	27.3
400	0.899	−17.8	2.497	152.5	0.081	74.6	0.937	−15.9	24.3
500	0.875	−21.8	2.425	147.0	0.098	71.8	0.915	−19.6	21.9
600	0.849	−25.5	2.344	141.9	0.114	69.2	0.890	−22.8	19.8
700	0.818	−29.0	2.288	136.9	0.128	67.2	0.865	−25.6	18.0
800	0.783	−32.2	2.223	131.9	0.141	65.3	0.839	−27.8	16.3
900	0.747	−35.0	2.148	127.0	0.152	63.2	0.811	−29.8	14.8
1000	0.708	−37.9	2.073	122.5	0.162	61.3	0.783	−31.7	13.5
1200	0.635	−43.9	1.972	114.3	0.181	57.7	0.723	−35.4	11.4
1400	0.572	−49.8	1.905	106.8	0.201	55.5	0.674	−38.9	9.9
1600	0.523	−54.0	1.802	100.6	0.218	53.3	0.640	−42.3	8.8
1800	0.479	−56.1	1.690	95.7	0.228	52.7	0.609	−44.7	7.7
2000	0.423	−57.6	1.594	89.9	0.241	51.5	0.573	−46.1	6.6
2200	0.366	−60.3	1.534	85.1	0.253	50.6	0.536	−48.2	5.8
2400	0.323	−65.1	1.491	79.3	0.271	49.1	0.503	−51.9	5.2
2600	0.303	−71.5	1.434	76.1	0.281	47.9	0.483	−56.2	4.7
2800	0.290	−74.4	1.412	73.2	0.293	48.4	0.480	−58.9	4.5
3000	0.273	−73.2	1.349	69.8	0.306	47.9	0.472	−60.1	4.0

Table 7 Noise data, $I_C = 1$ mA; $V_{CE} = 1$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.90	0.807	3.00	2.10
1000	2.00	0.814	10.00	2.00
2000	2.40	0.681	29.00	1.50

Table 8 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 1 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.917	−2.8	4.710	175.4	0.008	87.9	0.990	−2.2	38.6
100	0.908	−6.7	4.641	169.5	0.020	83.8	0.983	−5.6	35.5
200	0.882	−13.3	4.493	160.3	0.040	78.7	0.955	−10.9	30.2
300	0.843	−19.6	4.361	152.1	0.058	74.6	0.918	−15.8	26.2
400	0.799	−25.5	4.185	144.5	0.075	71.5	0.878	−20.2	23.3
500	0.757	−30.5	3.967	138.1	0.089	68.7	0.838	−24.2	20.9
600	0.713	−35.0	3.753	132.1	0.102	66.7	0.801	−27.2	19.0
700	0.664	−39.0	3.567	126.4	0.113	65.1	0.767	−29.5	17.4
800	0.616	−42.0	3.364	121.1	0.123	63.9	0.735	−31.2	16.0
900	0.570	−44.6	3.167	116.1	0.133	62.6	0.705	−32.4	14.7
1000	0.525	−46.9	2.981	111.6	0.141	61.6	0.675	−33.6	13.5
1200	0.445	−52.1	2.697	103.8	0.158	59.6	0.617	−35.9	11.7
1400	0.388	−56.9	2.485	97.3	0.176	58.8	0.574	−38.4	10.3
1600	0.349	−59.6	2.267	91.9	0.193	57.6	0.546	−41.0	9.2
1800	0.315	−59.9	2.074	87.7	0.204	57.5	0.523	−42.7	8.2
2000	0.273	−58.9	1.914	82.9	0.219	56.9	0.497	−43.5	7.2
2200	0.227	−60.1	1.811	79.1	0.233	56.4	0.468	−45.1	6.5
2400	0.191	−65.5	1.733	74.2	0.252	55.3	0.438	−48.7	5.9
2600	0.179	−73.6	1.640	71.6	0.265	54.2	0.422	−53.1	5.3
2800	0.175	−76.5	1.598	69.2	0.278	54.7	0.423	−56.1	5.1
3000	0.165	−72.6	1.516	66.1	0.293	54.1	0.419	−57.4	4.6

Table 9 Noise data, I_C = 2 mA; V_{CE} = 1 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.50	0.746	4.00	1.90
1000	2.60	0.716	10.00	1.90
2000	3.10	0.647	27.00	1.30

Table 10 Common emitter scattering parameters, I_C = 0.1 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.995	−0.8	0.239	176.6	0.008	89.0	0.999	−0.9	34.1
100	0.994	−1.8	0.243	172.2	0.020	86.6	0.999	−2.1	32.9
200	0.994	−3.9	0.245	164.4	0.040	84.5	0.995	−4.3	27.5
300	0.991	−5.9	0.250	157.1	0.061	82.0	0.992	−6.5	23.3
400	0.986	−7.9	0.256	150.0	0.081	80.3	0.988	−8.8	20.1
500	0.984	−9.9	0.268	143.9	0.101	78.6	0.984	−11.1	18.4
600	0.979	−11.9	0.280	138.2	0.120	76.9	0.979	−13.2	16.6
700	0.973	−13.8	0.289	132.0	0.138	75.3	0.974	−15.3	14.8
800	0.964	−15.6	0.296	126.2	0.156	73.3	0.966	−17.1	12.6
900	0.952	−17.3	0.310	121.1	0.172	71.1	0.955	−19.1	10.7
1000	0.939	−19.3	0.321	116.1	0.187	68.9	0.943	−20.9	9.0
1200	0.913	−23.3	0.347	107.2	0.218	64.3	0.915	−25.0	6.5
1400	0.893	−27.4	0.380	99.2	0.253	60.6	0.890	−29.2	5.4
1600	0.874	−30.7	0.399	93.0	0.282	57.0	0.872	−32.8	4.5
1800	0.848	−33.5	0.419	88.5	0.301	54.8	0.848	−36.1	3.5
2000	0.813	−36.3	0.435	82.0	0.321	51.2	0.815	−39.1	2.2
2200	0.775	−39.7	0.461	76.7	0.340	48.0	0.780	−42.5	1.3
2400	0.748	−43.5	0.491	70.6	0.368	44.3	0.751	−46.6	1.0
2600	0.733	−48.1	0.514	68.1	0.385	41.4	0.733	−50.7	0.9
2800	0.715	−51.2	0.543	65.6	0.400	40.5	0.725	−53.6	1.0
3000	0.694	−52.8	0.545	62.3	0.412	38.3	0.708	−55.7	0.6

Table 11 Common emitter scattering parameters, I_C = 0.25 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.990	−1.0	0.661	177.6	0.008	88.3	0.999	−1.0	39.5
100	0.989	−2.3	0.655	174.3	0.020	85.9	0.998	−2.5	36.1
200	0.987	−4.7	0.653	168.8	0.040	83.7	0.993	−4.9	30.9
300	0.982	−7.2	0.670	163.6	0.061	81.3	0.988	−7.5	27.1
400	0.975	−9.7	0.676	158.5	0.081	79.2	0.982	−10.1	24.1
500	0.969	−12.0	0.679	153.9	0.100	77.3	0.976	−12.6	22.1
600	0.961	−14.3	0.676	149.0	0.119	75.4	0.969	−15.1	19.9
700	0.952	−16.6	0.676	144.3	0.136	73.5	0.960	−17.4	17.9
800	0.938	−18.7	0.677	139.6	0.152	71.5	0.949	−19.4	15.9
900	0.922	−20.8	0.677	134.7	0.167	69.2	0.934	−21.5	13.8
1000	0.904	−22.9	0.677	130.3	0.181	66.9	0.919	−23.5	12.1
1200	0.870	−27.5	0.680	121.9	0.210	62.2	0.884	−27.9	9.4
1400	0.841	−32.1	0.700	114.2	0.240	58.5	0.851	−32.0	7.8
1600	0.812	−36.1	0.715	108.2	0.265	55.0	0.827	−35.8	6.7
1800	0.779	−39.0	0.710	102.9	0.281	52.9	0.800	−39.2	5.5
2000	0.734	−42.0	0.712	96.4	0.297	49.7	0.762	−42.0	4.2
2200	0.686	−45.5	0.728	90.6	0.313	47.0	0.724	−45.2	3.2
2400	0.649	−50.0	0.754	84.0	0.336	43.7	0.690	−49.4	2.7
2600	0.627	−55.0	0.767	80.8	0.348	41.1	0.670	−53.6	2.5
2800	0.607	−58.3	0.788	77.7	0.361	40.5	0.663	−56.5	2.4
3000	0.582	−59.7	0.775	73.8	0.370	38.9	0.646	−58.3	1.9

Table 12 Noise data, I_C = 0.25 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.60	0.927	2.00	3.70
1000	1.80	0.903	7.00	3.40
2000	2.00	0.694	29.00	2.00

Table 13 Common emitter scattering parameters, I_C = 0.5 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.980	−1.2	1.356	177.4	0.008	88.4	0.997	−1.2	39.1
100	0.979	−2.9	1.346	174.1	0.020	86.0	0.996	−3.0	37.2
200	0.974	−6.0	1.335	168.5	0.040	82.9	0.989	−6.0	32.1
300	0.965	−9.1	1.345	163.2	0.060	80.2	0.980	−9.0	28.2
400	0.953	−12.2	1.345	158.1	0.079	77.6	0.970	−12.1	25.2
500	0.943	−15.0	1.329	153.5	0.098	75.4	0.960	−15.1	23.0
600	0.930	−17.8	1.288	148.9	0.115	73.2	0.948	−17.8	20.8
700	0.914	−20.4	1.275	144.4	0.132	71.2	0.933	−20.4	18.9
800	0.894	−22.9	1.266	139.9	0.146	69.2	0.916	−22.6	16.9
900	0.871	−25.4	1.247	135.2	0.160	66.9	0.897	−24.7	15.2
1000	0.846	−27.8	1.225	130.9	0.172	64.6	0.877	−26.8	13.6
1200	0.795	−33.1	1.213	123.0	0.196	60.2	0.831	−31.1	11.1
1400	0.752	−38.4	1.219	115.8	0.222	56.8	0.787	−35.3	9.5
1600	0.710	−42.8	1.209	109.5	0.242	53.7	0.756	−39.2	8.4
1800	0.671	−45.7	1.165	104.5	0.254	52.0	0.725	−42.3	7.2
2000	0.615	−48.4	1.135	98.0	0.268	49.7	0.685	−44.6	5.9
2200	0.561	−51.7	1.123	92.6	0.281	47.7	0.646	−47.4	5.0
2400	0.515	−56.4	1.124	86.2	0.300	45.2	0.609	−51.4	4.4
2600	0.493	−61.8	1.109	82.8	0.310	43.2	0.588	−55.7	3.9
2800	0.474	−65.0	1.114	79.5	0.321	43.2	0.581	−58.5	3.8
3000	0.449	−65.6	1.079	75.7	0.330	42.3	0.565	−60.0	3.3

Table 14 Noise data, I_C = 0.5 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.60	0.886	2.00	2.60
1000	1.80	0.839	9.00	2.60
2000	2.00	0.718	29.00	1.80

Table 15 Common emitter scattering parameters, I_C = 1 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.961	−1.7	2.608	176.7	0.008	89.6	0.996	−1.6	40.3
100	0.958	−4.1	2.582	172.7	0.020	85.5	0.993	−3.9	37.5
200	0.948	−8.2	2.544	166.0	0.039	81.5	0.980	−7.7	32.1
300	0.930	−12.4	2.541	159.9	0.058	78.3	0.963	−11.5	28.1
400	0.909	−16.5	2.509	154.0	0.076	75.5	0.944	−15.2	25.2
500	0.888	−20.2	2.441	148.9	0.093	72.8	0.923	−18.8	22.8
600	0.864	−23.6	2.369	143.8	0.109	70.5	0.900	−22.0	20.7
700	0.837	−26.9	2.314	139.0	0.123	68.5	0.876	−24.7	18.9
800	0.804	−29.8	2.255	134.2	0.136	66.6	0.851	−26.9	17.2
900	0.770	−32.6	2.183	129.4	0.147	64.5	0.824	−28.9	15.6
1000	0.734	−35.3	2.111	125.1	0.156	62.6	0.797	−30.8	14.2
1200	0.665	−41.0	2.013	117.1	0.176	59.0	0.738	−34.6	12.0
1400	0.604	−46.6	1.952	109.8	0.196	56.6	0.689	−38.2	10.6
1600	0.556	−50.7	1.853	103.6	0.213	54.5	0.655	−41.6	9.4
1800	0.513	−52.7	1.740	98.8	0.224	53.7	0.623	−44.1	8.3
2000	0.457	−54.1	1.644	92.9	0.236	52.4	0.586	−45.6	7.2
2200	0.401	−56.6	1.587	88.0	0.249	51.5	0.548	−47.6	6.3
2400	0.356	−60.9	1.546	82.3	0.266	49.9	0.513	−51.4	5.7
2600	0.334	−67.0	1.489	79.2	0.277	48.6	0.493	−55.6	5.2
2800	0.322	−69.6	1.465	76.3	0.289	49.1	0.489	−58.3	5.0
3000	0.305	−68.5	1.399	72.9	0.301	48.6	0.481	−59.4	4.5

Table 16 Noise data, I_C = 1 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.90	0.839	3.00	2.40
1000	2.00	0.775	9.00	2.40
2000	2.30	0.804	26.00	1.60

Table 17 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.926	−2.5	4.735	175.5	0.008	88.2	0.992	−2.1	40.0
100	0.919	−5.9	4.667	170.3	0.020	83.9	0.985	−5.2	36.8
200	0.897	−11.9	4.541	161.8	0.038	79.7	0.961	−10.3	31.4
300	0.863	−17.6	4.434	154.1	0.055	75.8	0.927	−15.1	27.4
400	0.824	−23.1	4.274	147.0	0.072	72.8	0.892	−19.4	24.5
500	0.786	−27.8	4.077	140.9	0.086	70.1	0.856	−23.4	22.1
600	0.745	−31.9	3.881	135.1	0.099	67.9	0.819	−26.5	20.1
700	0.702	−35.6	3.708	129.6	0.110	66.5	0.785	−29.0	18.5
800	0.655	−38.6	3.514	124.3	0.121	65.3	0.754	−30.7	17.0
900	0.611	−41.1	3.322	119.5	0.130	63.8	0.723	−32.2	15.7
1000	0.566	−43.5	3.136	115.0	0.138	62.6	0.692	−33.4	14.4
1200	0.487	−48.4	2.861	107.2	0.154	60.6	0.631	−35.9	12.5
1400	0.429	−53.1	2.647	100.6	0.173	59.3	0.585	−38.5	11.2
1600	0.389	−55.6	2.421	95.2	0.190	58.2	0.556	−41.2	10.0
1800	0.355	−56.2	2.217	91.1	0.201	58.1	0.531	−43.0	8.9
2000	0.312	−55.2	2.047	86.3	0.215	57.4	0.502	−43.7	7.9
2200	0.264	−56.3	1.935	82.3	0.229	56.9	0.471	−45.0	7.1
2400	0.226	−60.4	1.856	77.4	0.248	55.7	0.440	−48.6	6.5
2600	0.212	−67.6	1.755	74.9	0.261	54.6	0.423	−53.0	5.9
2800	0.208	−70.3	1.708	72.5	0.274	55.1	0.423	−55.8	5.7
3000	0.199	−67.0	1.618	69.4	0.289	54.5	0.420	−57.0	5.2

Table 18 Noise data, I_C = 2 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.50	0.775	4.00	2.20
1000	2.50	0.731	10.00	2.20
2000	3.00	0.662	27.00	1.60

NPN 9 GHz wideband transistor BFS505

FEATURES

- Low current consumption
- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 envelope.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is intended for low power amplifiers, oscillators and mixers particularly in RF portable communication equipment (cellular phones, cordless phones, pagers) up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: N0	
1	base
2	emitter
3	collector

PIN CONFIGURATION

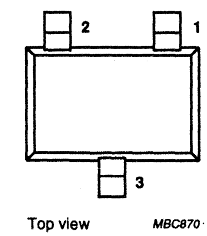


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 122 °C (note 1)	–	–	150	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V; T_j = 25 °C	60	120	250	
f_T	transition frequency	I_C = 5 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	17	–	dB
F	noise figure	I_C = 1.25 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.2	1.7	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	18	mA
P_{tot}	total power dissipation	up to T_s = 122 °C (note 1)	–	150	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 122 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 6$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	0.4	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.4	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 0.5$ V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	17	–	dB
		$I_C = 5$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	10	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 1.25$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 1.25$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 5$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $I_C = 5$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C; $f_p = 900$ MHz; $f_q = 902$ MHz; measured at $f_{(2p-q)} = 898$ MHz and at $f_{(2p-q)} = 904$ MHz.

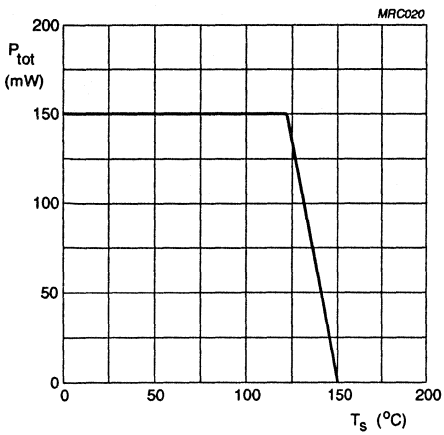
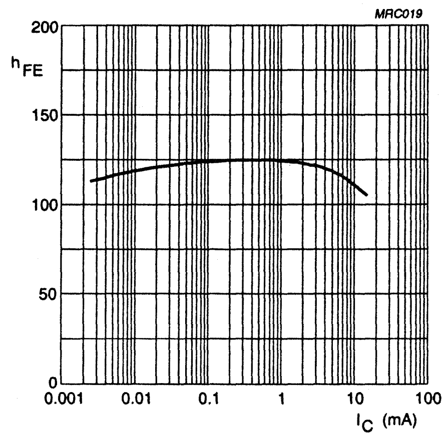
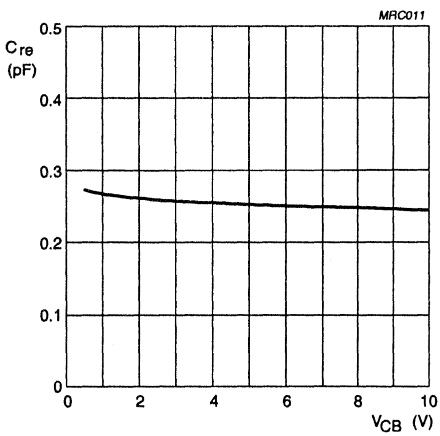


Fig.2 Power derating curve.



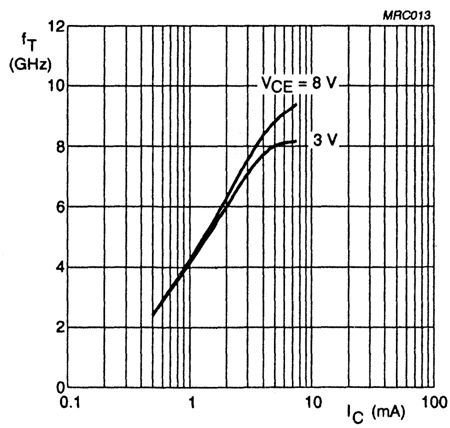
V_{CE} = 6 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

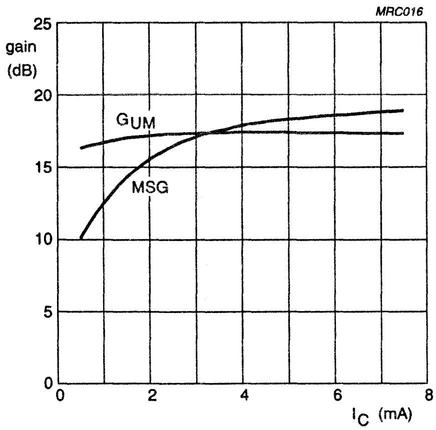
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

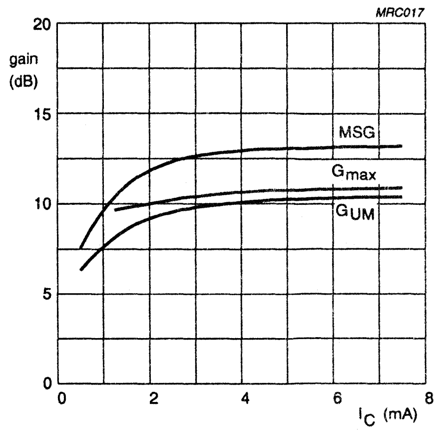
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



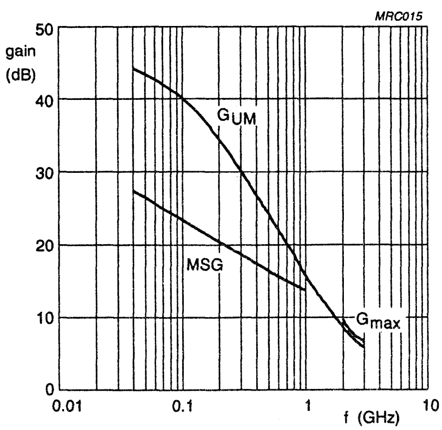
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.6 Gain as a function of collector current.



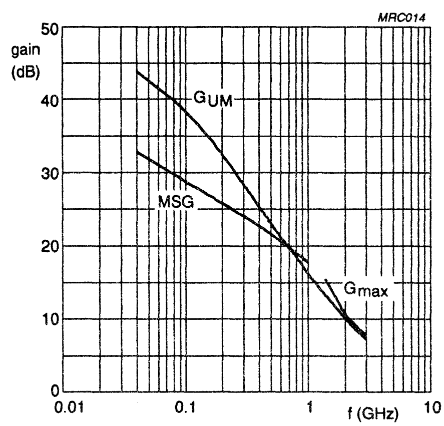
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



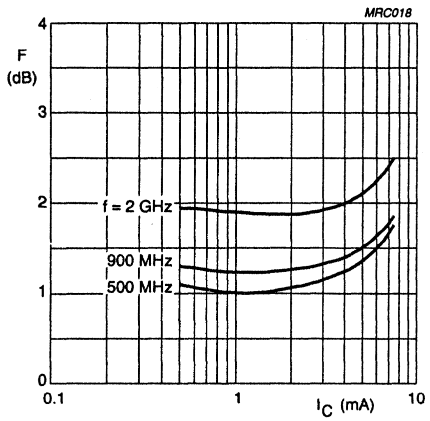
I_C = 1.25 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



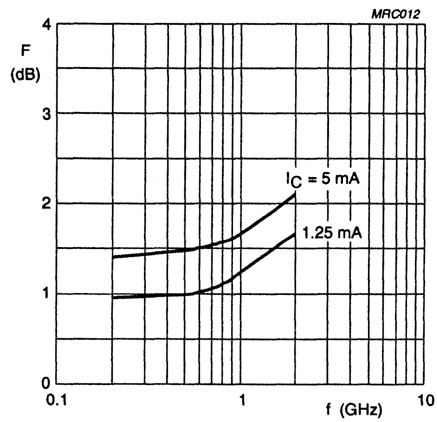
I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



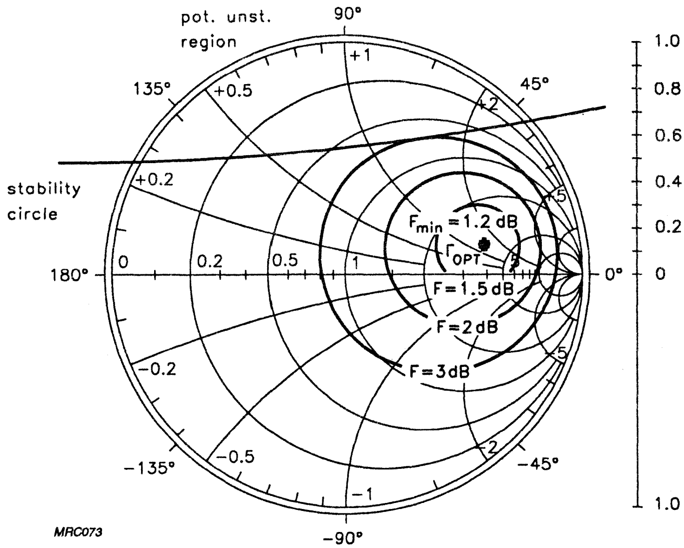
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



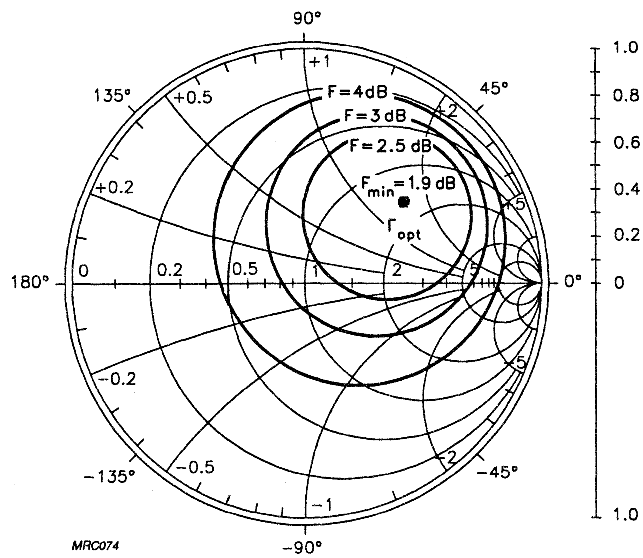
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



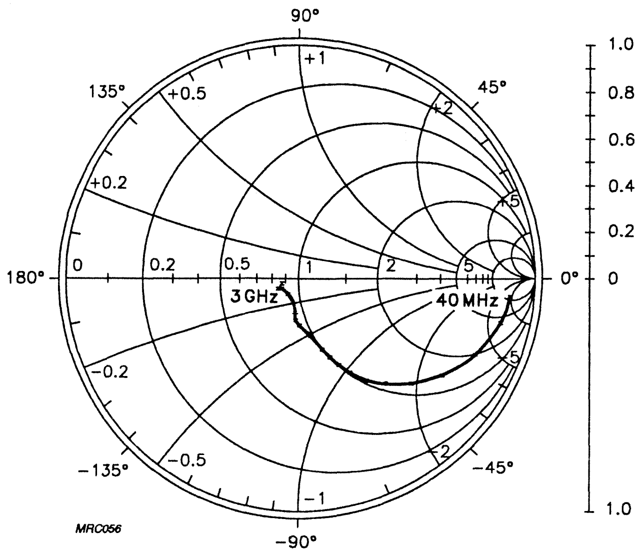
I_C = 1.25 mA; V_{CE} = 6 V;
f = 900 MHz; Z_O = 50 Ω.

Fig.12 Noise circle.



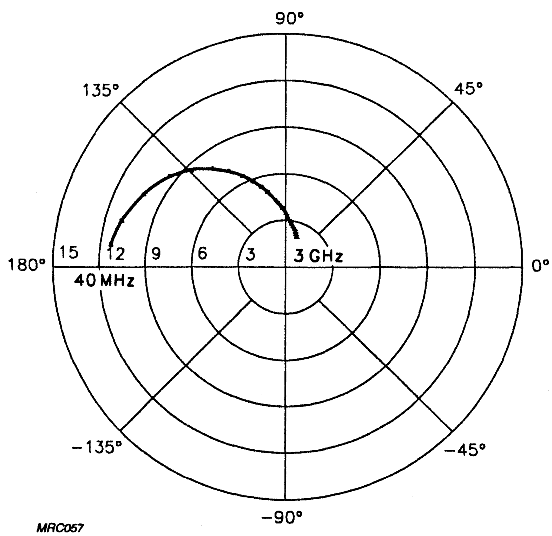
I_C = 1.25 mA; V_{CE} = 6 V;
f = 2 GHz; Z_O = 50 Ω.

Fig.13 Noise circle.



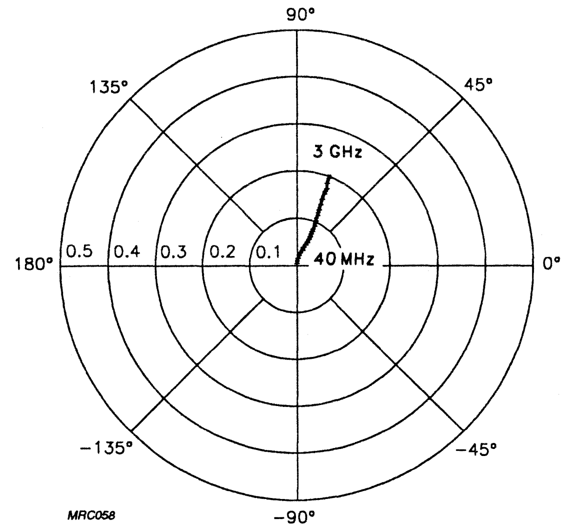
I_C = 5 mA; V_{CE} = 6 V;
Z_O = 50 Ω.

Fig.14 Common emitter input reflection coefficient (S_{11}).



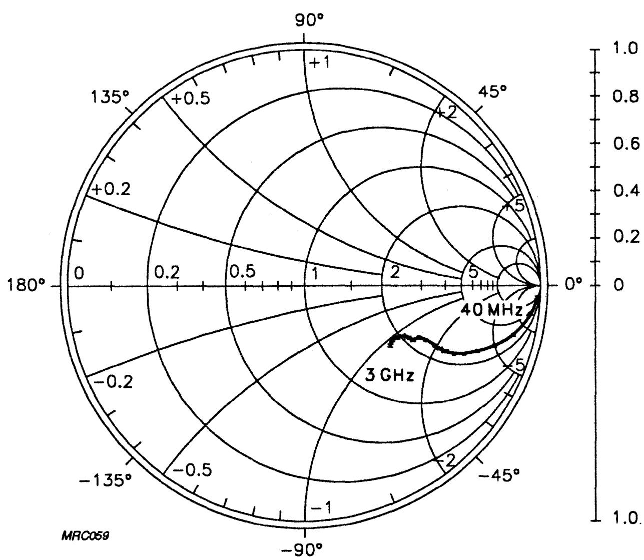
I_C = 5 mA; V_{CE} = 6 V.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 5 mA; V_{CE} = 6 V.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).

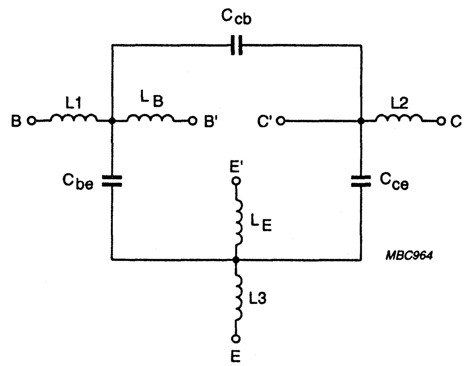


I_C = 5 mA; V_{CE} = 6 V;
Z_O = 50 Ω.

Fig.17 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR505 crystal

1	IS = 134.1	aA
2	BF = 180.0	–
3	NF = 988.2	m
4	VAF = 38.34	V
5	IKF = 150.0	A
6	ISE = 27.81	fA
7	NE = 2.051	–
8	BR = 55.19	–
9	NR = 982.2	m
10	VAR = 2.459	V
11	IKR = 2.920	mA
12	ISC = 17.45	aA
13	NC = 1.062	–
14	RB = 20.00	Ω
15	IRB = 1.000	μA
16	RBM = 20.00	Ω
17	RE = 1.171	Ω
18	RC = 4.350	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 284.7	fF
23	VJE = 600.0	mV
24	MJE = 303.6	m
25	TF = 7.037	ps
26	XTF = 12.34	–
27	VTF = 1.701	V
28	ITF = 30.64	mA
29	PTF = 0.000	deg
30	CJC = 242.4	fF
31	VJC = 188.6	mV
32	MJC = 41.49	m
33	XCJC = 130.0	m
34	TR = 1.332	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 897.4	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.18 Package equivalent circuit, SOT323.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 0.5 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.987	−1.7	1.389	177.6	0.006	88.4	0.999	−0.9	44.2
100	0.985	−4.0	1.385	174.3	0.016	85.8	0.998	−2.3	41.3
200	0.979	−8.2	1.371	168.8	0.031	82.1	0.992	−4.6	34.5
300	0.969	−12.2	1.372	163.8	0.046	79.0	0.983	−7.0	29.6
400	0.956	−16.5	1.368	158.8	0.061	76.5	0.975	−9.3	26.4
500	0.944	−20.3	1.349	154.5	0.076	73.0	0.966	−11.7	24.0
600	0.929	−24.0	1.307	150.1	0.089	71.4	0.957	−13.7	21.7
700	0.912	−27.6	1.290	146.0	0.101	69.1	0.944	−15.7	19.6
800	0.891	−31.1	1.279	141.8	0.112	66.8	0.931	−17.5	17.8
900	0.867	−34.6	1.267	137.2	0.122	64.2	0.917	−19.0	16.1
1000	0.839	−38.2	1.239	133.1	0.131	61.6	0.900	−20.6	14.3
1200	0.782	−45.8	1.218	125.4	0.147	56.4	0.859	−23.8	11.6
1400	0.732	−53.4	1.220	118.9	0.161	52.9	0.822	−26.7	10.0
1600	0.694	−60.4	1.212	113.0	0.175	49.7	0.798	−29.6	8.9
1800	0.654	−65.9	1.158	108.0	0.180	47.3	0.772	−31.9	7.6
2000	0.592	−71.9	1.123	101.9	0.185	45.0	0.742	−33.4	6.4
2200	0.533	−79.9	1.106	96.7	0.189	43.0	0.708	−35.4	5.3
2400	0.491	−89.3	1.104	90.2	0.195	41.0	0.679	−38.1	4.7
2600	0.480	−97.2	1.073	86.8	0.196	39.7	0.662	−41.2	4.3
2800	0.459	−102.6	1.080	84.0	0.196	40.6	0.656	−43.2	4.1
3000	0.421	−107.2	1.048	80.2	0.196	41.2	0.644	−44.3	3.6

Table 2 Common emitter scattering parameters, I_C = 1.25 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.968	−2.4	3.435	176.5	0.006	89.0	0.997	−1.4	44.4
100	0.963	−6.0	3.400	171.9	0.015	84.7	0.993	−3.4	40.3
200	0.947	−11.9	3.325	164.8	0.030	79.5	0.980	−6.9	34.3
300	0.924	−17.8	3.288	158.3	0.044	76.0	0.959	−10.1	29.6
400	0.895	−23.6	3.226	152.3	0.058	72.6	0.937	−13.2	26.4
500	0.867	−28.9	3.115	147.1	0.070	69.3	0.915	−16.2	23.8
600	0.836	−33.7	2.986	142.3	0.081	66.7	0.892	−18.7	21.6
700	0.802	−38.6	2.911	137.7	0.090	64.6	0.868	−20.7	19.8
800	0.763	−43.0	2.827	132.9	0.098	62.6	0.843	−22.3	18.2
900	0.722	−47.3	2.725	128.2	0.105	60.5	0.819	−23.6	16.7
1000	0.679	−51.5	2.619	123.9	0.111	58.5	0.794	−24.9	15.4
1200	0.593	−60.7	2.472	116.1	0.121	55.3	0.740	−27.0	13.2
1400	0.524	−69.9	2.373	109.4	0.131	53.9	0.696	−29.0	11.8
1600	0.474	−77.1	2.237	103.6	0.140	52.8	0.668	−31.1	10.7
1800	0.425	−82.6	2.080	98.9	0.144	52.8	0.643	−32.4	9.5
2000	0.362	−88.4	1.949	93.5	0.150	52.8	0.619	−32.9	8.5
2200	0.307	−97.9	1.858	89.0	0.156	53.1	0.588	−33.9	7.7
2400	0.278	−109.5	1.788	83.6	0.164	53.1	0.561	−36.0	7.0
2600	0.273	−117.6	1.691	80.7	0.170	53.6	0.546	−38.9	6.4
2800	0.260	−122.5	1.655	78.3	0.176	55.6	0.544	−40.8	6.2
3000	0.277	−127.2	1.573	74.9	0.183	56.9	0.540	−41.5	5.7

Table 3 Noise data, I_C = 1.25 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.00	0.716	9.00	0.770
900	1.20	0.659	12.00	0.740
2000	1.90	0.505	37.00	0.580

Table 4 Common emitter scattering parameters, I_C = 2.5 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.938	−3.6	6.470	175.0	0.006	87.8	0.993	−2.1	43.9
100	0.927	−8.8	6.361	168.6	0.015	83.1	0.984	−5.0	39.7
200	0.893	−17.2	6.103	159.2	0.029	77.0	0.954	−9.8	33.1
300	0.848	−25.3	5.871	151.0	0.042	72.1	0.914	−13.9	28.7
400	0.796	−33.0	5.600	143.7	0.053	69.0	0.873	−17.4	25.6
500	0.747	−39.8	5.282	137.5	0.062	66.0	0.834	−20.4	23.2
600	0.696	−45.9	4.983	131.8	0.070	64.2	0.798	−22.6	21.2
700	0.641	−51.7	4.731	126.4	0.078	62.7	0.766	−24.1	19.6
800	0.586	−56.6	4.453	121.2	0.084	61.6	0.738	−24.9	18.2
900	0.533	−61.0	4.189	116.5	0.089	60.9	0.712	−25.5	17.0
1000	0.482	−65.3	3.922	112.3	0.093	60.1	0.686	−25.9	15.8
1200	0.391	−74.5	3.521	104.9	0.102	59.3	0.636	−26.6	13.9
1400	0.331	−83.8	3.217	99.2	0.112	59.9	0.600	−27.5	12.6
1600	0.292	−90.9	2.923	94.2	0.123	60.2	0.579	−29.1	11.5
1800	0.252	−95.0	2.658	90.4	0.130	61.3	0.562	−29.7	10.4
2000	0.203	−101.0	2.442	86.1	0.139	61.9	0.546	−29.7	9.5
2200	0.164	−114.3	2.287	82.6	0.148	62.7	0.521	−30.2	8.7
2400	0.154	−130.8	2.172	78.2	0.160	63.1	0.498	−32.2	8.1
2600	0.162	−138.6	2.025	75.9	0.169	63.2	0.484	−35.3	7.4
2800	0.155	−142.0	1.959	74.0	0.178	64.9	0.485	−37.3	7.1
3000	0.130	−148.7	1.852	70.9	0.190	65.5	0.485	−38.2	6.6

Table 5 Noise data, I_C = 2.5 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.640	9.00	0.610
900	1.25	0.581	10.00	0.650
2000	1.90	0.410	37.00	0.530

Table 6 Common emitter scattering parameters, I_C = 3.75 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.909	−4.6	9.162	173.7	0.006	86.4	0.989	−2.6	43.6
100	0.891	−11.3	8.921	165.9	0.015	82.2	0.975	−6.3	38.9
200	0.840	−21.9	8.412	154.7	0.028	74.9	0.928	−11.9	32.4
300	0.744	−31.7	7.908	145.3	0.039	70.4	0.871	−16.2	28.1
400	0.704	−40.7	7.358	137.0	0.049	67.2	0.818	−19.7	25.1
500	0.640	−48.3	6.782	130.1	0.057	64.9	0.771	−22.2	22.8
600	0.578	−54.9	6.255	124.1	0.064	63.8	0.732	−23.8	21.0
700	0.517	−60.7	5.781	118.5	0.070	63.3	0.701	−24.7	19.5
800	0.462	−65.1	5.313	113.7	0.075	63.2	0.676	−25.0	18.2
900	0.410	−69.1	4.903	109.3	0.080	62.9	0.653	−25.0	17.0
1000	0.362	−73.0	4.523	105.4	0.085	63.0	0.631	−25.0	15.9
1200	0.285	−82.2	3.953	99.0	0.095	63.2	0.589	−24.8	14.2
1400	0.238	−92.1	3.544	94.1	0.106	64.4	0.559	−25.5	12.9
1600	0.208	−98.9	3.182	89.9	0.118	64.8	0.542	−26.9	11.8
1800	0.176	−102.7	2.874	86.4	0.126	66.0	0.530	−27.5	10.7
2000	0.134	−110.3	2.624	82.6	0.137	66.5	0.518	−27.4	9.8
2200	0.108	−129.8	2.447	79.6	0.148	67.1	0.497	−27.8	9.1
2400	0.112	−150.3	2.314	75.6	0.161	67.3	0.474	−29.7	8.4
2600	0.125	−155.4	2.149	73.6	0.171	67.2	0.461	−33.0	7.7
2800	0.120	−158.1	2.071	71.9	0.182	68.4	0.463	−35.4	7.4
3000	0.100	−167.8	1.954	69.0	0.194	68.7	0.465	−36.3	6.9

Table 7 Noise data, I_C = 3.75 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.20	0.591	8.00	0.570
900	1.35	0.503	9.00	0.630
2000	2.00	0.352	41.00	0.490

Table 8 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.881	−5.6	11.534	172.6	0.006	87.2	0.986	−3.1	43.4
100	0.856	−13.6	11.129	163.5	0.015	80.4	0.965	−7.4	38.4
200	0.788	−26.1	10.306	150.8	0.027	73.9	0.904	−13.5	31.8
300	0.707	−37.3	9.476	140.4	0.037	69.1	0.835	−17.7	27.7
400	0.624	−47.1	8.592	131.5	0.046	66.7	0.774	−20.8	24.8
500	0.552	−55.0	7.742	124.4	0.053	64.9	0.726	−22.7	22.6
600	0.487	−61.6	6.993	118.4	0.059	64.6	0.687	−23.8	20.8
700	0.429	−66.8	6.339	113.1	0.065	64.6	0.660	−24.2	19.4
800	0.379	−70.9	5.748	108.7	0.071	64.9	0.638	−24.2	18.1
900	0.332	−74.6	5.247	104.7	0.076	65.3	0.619	−24.0	17.0
1000	0.289	−78.3	4.805	101.2	0.081	65.5	0.600	−23.7	16.0
1200	0.221	−88.0	4.147	95.5	0.092	66.1	0.565	−23.2	14.2
1400	0.184	−99.0	3.685	91.1	0.103	67.4	0.539	−23.7	13.0
1600	0.162	−106.2	3.293	87.2	0.116	67.9	0.525	−25.2	11.9
1800	0.134	−109.9	2.962	84.1	0.125	68.8	0.516	−25.8	10.9
2000	0.097	−120.7	2.701	80.5	0.137	69.1	0.506	−25.8	10.0
2200	0.083	−147.1	2.513	77.8	0.148	69.6	0.486	−26.2	9.2
2400	0.099	−168.2	2.374	74.0	0.162	69.6	0.464	−28.2	8.6
2600	0.111	−169.6	2.199	72.1	0.173	69.4	0.451	−31.5	7.9
2800	0.108	−171.6	2.115	70.6	0.184	70.4	0.454	−34.0	7.6
3000	0.091	177.0	1.994	67.7	0.197	70.4	0.457	−35.1	7.0

Table 9 Noise data, I_C = 5 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.536	7.00	0.550
900	1.60	0.487	8.00	0.570
2000	2.10	0.297	41.00	0.470

Table 10 Common emitter scattering parameters, I_C = 7.5 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.828	−7.5	15.309	170.7	0.006	84.7	0.979	−3.8	42.5
100	0.790	−18.2	14.502	159.5	0.014	78.8	0.946	−9.0	37.3
200	0.693	−33.9	12.929	144.4	0.025	71.9	0.861	−15.4	30.9
300	0.592	−46.9	11.369	132.7	0.034	67.8	0.778	−19.0	27.0
400	0.500	−57.3	9.871	123.5	0.042	66.5	0.715	−21.1	24.2
500	0.428	−65.2	8.598	116.7	0.048	65.9	0.669	−22.1	22.1
600	0.370	−71.3	7.566	111.2	0.054	66.5	0.637	−22.5	20.5
700	0.320	−76.1	6.726	106.7	0.060	67.4	0.616	−22.5	19.1
800	0.279	−79.9	6.020	102.8	0.066	68.2	0.601	−22.2	17.9
900	0.240	−83.7	5.446	99.4	0.071	68.5	0.587	−21.8	16.8
1000	0.205	−87.8	4.954	96.3	0.077	69.1	0.574	−21.3	15.8
1200	0.153	−100.2	4.229	91.3	0.088	69.8	0.545	−20.7	14.2
1400	0.129	−114.7	3.733	87.5	0.101	71.0	0.525	−21.3	12.9
1600	0.117	−123.3	3.318	84.0	0.114	71.3	0.514	−23.0	11.8
1800	0.095	−129.6	2.982	81.2	0.124	72.0	0.508	−23.8	10.8
2000	0.070	−150.3	2.713	77.9	0.137	72.1	0.500	−23.9	9.9
2200	0.078	179.9	2.521	75.4	0.148	72.3	0.482	−24.4	9.2
2400	0.104	167.8	2.379	71.9	0.163	72.2	0.461	−26.4	8.6
2600	0.116	170.6	2.201	70.1	0.174	71.8	0.448	−30.0	7.9
2800	0.112	169.7	2.114	68.7	0.185	72.7	0.451	−32.6	7.5
3000	0.102	156.4	1.991	65.9	0.199	72.5	0.454	−33.9	7.0

Table 11 Common emitter scattering parameters, I_C = 0.5 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.988	−1.5	1.295	177.7	0.006	88.8	0.998	−0.9	43.7
100	0.987	−3.9	1.298	174.4	0.015	85.7	0.997	−2.2	40.9
200	0.982	−7.8	1.284	169.2	0.030	82.3	0.992	−4.5	34.7
300	0.972	−11.7	1.292	164.3	0.045	79.3	0.984	−6.7	30.0
400	0.960	−15.7	1.296	159.5	0.060	76.9	0.976	−9.0	26.6
500	0.949	−19.4	1.277	155.2	0.074	74.3	0.969	−11.2	24.2
600	0.934	−23.1	1.265	150.8	0.087	72.0	0.959	−13.3	22.0
700	0.918	−26.6	1.250	146.8	0.100	69.9	0.949	−15.2	20.0
800	0.898	−29.9	1.229	142.6	0.110	67.6	0.938	−16.9	18.1
900	0.875	−33.4	1.225	138.1	0.120	64.9	0.922	−18.6	16.3
1000	0.849	−36.8	1.201	134.0	0.129	62.3	0.907	−20.1	14.6
1200	0.794	−44.0	1.169	126.5	0.145	57.2	0.866	−23.4	11.7
1400	0.748	−51.3	1.166	120.1	0.161	53.7	0.831	−26.3	10.0
1600	0.712	−58.0	1.158	114.3	0.175	50.4	0.809	−29.1	9.0
1800	0.674	−63.3	1.104	109.3	0.181	48.1	0.783	−31.4	7.6
2000	0.612	−69.0	1.075	103.1	0.186	45.6	0.751	−33.1	6.3
2200	0.552	−76.6	1.067	97.9	0.190	43.5	0.717	−35.1	5.3
2400	0.508	−85.8	1.074	91.4	0.196	41.4	0.687	−37.8	4.7
2600	0.494	−93.7	1.050	88.2	0.197	40.0	0.670	−40.9	4.2
2800	0.472	−99.0	1.063	85.3	0.198	40.6	0.665	−43.0	4.2
3000	0.434	−103.4	1.034	81.5	0.198	41.0	0.653	−44.0	3.6

Table 12 Common emitter scattering parameters, I_C = 1.25 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.971	−2.3	3.306	176.6	0.006	87.8	0.996	−1.4	44.2
100	0.967	−5.6	3.287	172.2	0.015	84.6	0.993	−3.3	41.1
200	0.953	−11.3	3.219	165.4	0.030	80.4	0.980	−6.6	34.6
300	0.931	−16.9	3.184	159.1	0.044	76.5	0.962	−9.8	30.1
400	0.904	−22.4	3.133	153.3	0.058	73.2	0.942	−12.8	26.8
500	0.878	−27.4	3.029	148.3	0.069	70.3	0.921	−15.7	24.2
600	0.848	−32.2	2.937	143.4	0.080	67.5	0.899	−18.2	22.0
700	0.815	−36.7	2.863	138.9	0.090	65.3	0.877	−20.3	20.2
800	0.779	−41.0	2.779	134.2	0.098	63.4	0.854	−21.8	18.6
900	0.738	−45.1	2.696	129.5	0.105	61.2	0.828	−23.3	17.1
1000	0.696	−49.2	2.595	125.2	0.111	59.4	0.803	−24.5	15.7
1200	0.613	−57.8	2.447	117.6	0.121	56.0	0.748	−26.9	13.4
1400	0.544	−66.5	2.354	111.0	0.132	54.5	0.705	−28.9	12.0
1600	0.496	−73.5	2.222	105.2	0.142	53.1	0.678	−31.1	10.8
1800	0.449	−78.6	2.068	100.5	0.146	52.9	0.652	−32.5	9.7
2000	0.383	−83.8	1.940	95.1	0.152	52.7	0.625	−33.0	8.6
2200	0.325	−92.6	1.857	90.5	0.157	52.9	0.594	−34.0	7.7
2400	0.290	−103.7	1.793	85.1	0.166	52.9	0.566	−36.1	7.1
2600	0.284	−111.9	1.701	82.1	0.171	53.1	0.550	−39.0	6.5
2800	0.269	−116.2	1.668	79.7	0.177	55.0	0.547	−40.9	6.3
3000	0.235	−120.1	1.588	76.2	0.184	56.3	0.543	−41.6	5.8

Table 13 Noise data, I_C = 1.25 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.00	0.739	8.00	0.820
900	1.20	0.602	12.00	0.810
2000	1.90	0.544	39.00	0.600

Table 14 Common emitter scattering parameters, I_C = 2.5 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.945	−3.3	6.332	175.1	0.006	85.0	0.993	−1.9	44.4
100	0.935	−8.2	6.233	169.0	0.015	83.1	0.985	−4.9	40.2
200	0.904	−16.2	6.000	160.0	0.029	77.5	0.957	−9.4	33.7
300	0.862	−23.8	5.801	152.1	0.041	73.3	0.919	−13.5	29.2
400	0.813	−31.1	5.557	145.0	0.053	69.8	0.881	−17.0	26.1
500	0.764	−37.5	5.254	138.9	0.062	66.8	0.843	−20.1	23.6
600	0.714	−43.4	4.982	133.3	0.071	64.7	0.808	−22.3	21.6
700	0.662	−48.9	4.744	127.9	0.078	63.5	0.776	−24.0	20.0
800	0.609	−53.4	4.471	122.9	0.084	62.5	0.748	−25.0	18.6
900	0.557	−57.6	4.216	118.1	0.089	61.4	0.721	−25.6	17.3
1000	0.506	−61.6	3.961	113.8	0.094	60.5	0.694	−26.1	16.1
1200	0.415	−70.1	3.559	106.5	0.103	59.6	0.642	−26.9	14.2
1400	0.352	−78.6	3.264	100.7	0.114	59.9	0.605	−27.9	12.8
1600	0.311	−84.8	2.969	95.7	0.124	60.0	0.583	−29.4	11.7
1800	0.271	−88.4	2.705	91.9	0.131	61.0	0.564	−30.1	10.6
2000	0.218	−93.1	2.487	87.5	0.140	61.5	0.547	−30.0	9.7
2200	0.175	−104.0	2.332	84.0	0.150	62.2	0.521	−30.5	8.9
2400	0.157	−120.1	2.217	79.5	0.162	62.5	0.497	−32.4	8.3
2600	0.162	−128.1	2.070	77.2	0.170	62.6	0.482	−35.4	7.6
2800	0.155	−131.0	2.003	75.3	0.179	64.2	0.483	−37.5	7.3
3000	0.126	−135.6	1.893	72.2	0.191	64.8	0.483	−38.2	6.8

Table 15 Noise data, I_C = 2.5 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.10	0.692	8.00	0.660
900	1.25	0.612	9.00	0.700
2000	1.90	0.439	36.00	0.580

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Table 16 Common emitter scattering parameters, I_C = 3.75 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.920	−4.2	8.980	173.9	0.006	87.6	0.990	−2.5	44.1
100	0.905	−10.4	8.768	166.6	0.015	81.9	0.976	−6.1	39.5
200	0.858	−20.3	8.301	155.8	0.028	75.7	0.933	−11.5	33.0
300	0.797	−29.5	7.844	146.7	0.039	71.2	0.880	−15.9	28.7
400	0.730	−37.8	7.335	138.6	0.049	68.1	0.829	−19.4	25.6
500	0.668	−45.0	6.790	131.9	0.057	65.8	0.782	−22.1	23.3
600	0.606	−51.2	6.296	125.9	0.065	64.5	0.743	−23.8	21.5
700	0.545	−56.6	5.846	120.3	0.071	63.7	0.712	−24.9	19.9
800	0.491	−60.7	5.389	115.5	0.077	63.7	0.685	−25.3	18.6
900	0.439	−64.4	4.987	111.1	0.082	63.3	0.660	−25.5	17.4
1000	0.390	−67.9	4.613	107.1	0.087	63.1	0.637	−25.4	16.3
1200	0.308	−75.8	4.044	100.6	0.096	63.2	0.592	−25.4	14.4
1400	0.258	−84.4	3.632	95.6	0.108	64.1	0.560	−26.0	13.1
1600	0.226	−90.2	3.264	91.3	0.119	64.5	0.543	−27.5	12.0
1800	0.192	−92.4	2.949	87.9	0.128	65.5	0.530	−28.0	11.0
2000	0.146	−96.6	2.695	84.0	0.139	65.9	0.516	−27.8	10.1
2200	0.112	−112.1	2.515	81.0	0.149	66.5	0.494	−28.1	9.3
2400	0.105	−133.5	2.379	77.0	0.163	66.5	0.470	−30.0	8.7
2600	0.116	−140.7	2.212	74.9	0.173	66.5	0.456	−33.2	8.0
2800	0.111	−142.3	2.131	73.2	0.183	67.7	0.459	−35.5	7.6
3000	0.087	−149.4	2.012	70.4	0.196	67.9	0.460	−36.3	7.1

Table 17 Noise data, I_C = 3.75 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.20	0.628	8.00	0.640
900	1.35	0.544	9.00	0.670
2000	2.00	0.388	37.00	0.540

Table 18 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.898	−5.0	11.309	172.9	0.006	85.6	0.986	−2.9	43.9
100	0.876	−12.4	10.944	164.5	0.014	80.8	0.968	−7.1	39.2
200	0.815	−23.8	10.199	152.4	0.027	74.7	0.911	−13.1	32.6
300	0.738	−34.2	9.448	142.3	0.037	70.1	0.846	−17.5	28.4
400	0.658	−43.3	8.631	133.5	0.047	67.4	0.786	−20.7	25.4
500	0.588	−50.7	7.824	126.5	0.054	65.8	0.737	−22.9	23.1
600	0.522	−56.8	7.109	120.5	0.060	65.0	0.698	−24.2	21.3
700	0.463	−61.6	6.473	115.2	0.067	65.0	0.669	−24.8	19.8
800	0.411	−65.1	5.887	110.7	0.072	65.1	0.646	−24.8	18.5
900	0.362	−68.3	5.388	106.6	0.078	65.4	0.624	−24.7	17.4
1000	0.319	−71.4	4.945	103.0	0.083	65.5	0.604	−24.4	16.3
1200	0.246	−79.1	4.279	97.2	0.093	65.9	0.565	−23.9	14.6
1400	0.204	−88.1	3.811	92.7	0.105	66.9	0.538	−24.4	13.3
1600	0.178	−93.6	3.406	88.8	0.118	67.3	0.523	−25.9	12.2
1800	0.149	−95.5	3.062	85.6	0.127	68.1	0.512	−26.4	11.1
2000	0.107	−100.3	2.796	82.0	0.138	68.4	0.501	−26.3	10.2
2200	0.079	−121.0	2.602	79.2	0.150	68.8	0.481	−26.5	9.5
2400	0.081	−147.7	2.458	75.5	0.164	68.8	0.458	−28.4	8.9
2600	0.094	−152.6	2.280	73.6	0.174	68.4	0.444	−31.7	8.2
2800	0.092	−153.1	2.191	72.0	0.185	69.5	0.447	−34.2	7.8
3000	0.070	−163.4	2.066	69.2	0.198	69.5	0.450	−35.1	7.3

Table 19 Noise data, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.584	8.00	0.630
900	1.60	0.506	9.00	0.680
2000	2.20	0.365	35.00	0.550

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Table 20 Common emitter scattering parameters, I_C = 7.5 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.858	−6.5	15.093	171.3	0.006	85.9	0.980	−3.6	43.5
100	0.827	−15.8	14.388	161.1	0.014	80.3	0.952	−8.6	38.4
200	0.740	−29.8	12.990	146.8	0.026	72.8	0.874	−15.0	32.0
300	0.640	−41.6	11.565	135.4	0.035	69.2	0.794	−19.0	27.9
400	0.548	−51.1	10.151	126.2	0.043	67.2	0.729	−21.5	25.0
500	0.475	−58.2	8.909	119.3	0.049	66.5	0.680	−22.9	22.8
600	0.414	−63.6	7.884	113.8	0.056	66.6	0.646	−23.5	21.1
700	0.361	−67.7	7.037	109.0	0.062	67.3	0.621	−23.7	19.7
800	0.316	−70.6	6.315	105.1	0.068	68.0	0.604	−23.4	18.4
900	0.275	−73.0	5.720	101.5	0.073	68.3	0.587	−22.9	17.3
1000	0.237	−75.8	5.211	98.4	0.079	68.5	0.572	−22.4	16.3
1200	0.178	−84.2	4.459	93.2	0.090	69.2	0.541	−21.7	14.6
1400	0.145	−93.9	3.943	89.4	0.103	70.2	0.518	−22.2	13.4
1600	0.126	−100.6	3.507	85.8	0.116	70.5	0.506	−23.7	12.3
1800	0.102	−101.2	3.143	83.0	0.126	71.1	0.498	−24.4	11.2
2000	0.065	−110.2	2.867	79.6	0.139	71.0	0.490	−24.3	10.4
2200	0.049	−145.1	2.661	77.1	0.151	71.2	0.471	−24.6	9.6
2400	0.068	−174.5	2.511	73.6	0.166	71.1	0.449	−26.5	9.0
2600	0.081	−172.9	2.323	71.9	0.176	70.5	0.435	−30.0	8.3
2800	0.080	−171.8	2.231	70.5	0.188	71.5	0.438	−32.7	7.9
3000	0.063	173.4	2.101	67.8	0.201	71.2	0.442	−33.7	7.4

NPN 9 GHz wideband transistor BFS520

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 envelope.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is intended for wideband applications such as satellite TV tuners, cellular phones, cordless phones, pagers etc., with signal frequencies up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: N2	
1	base
2	emitter
3	collector

PIN CONFIGURATION

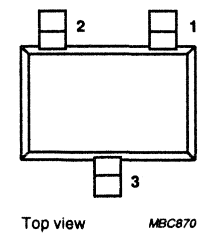


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to $T_s = 93$ °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V; $T_j = 25$ °C	60	120	250	
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	15	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.1	1.6	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to $T_s = 93$ °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 93 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CE} = 6 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1	–	pF
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	0.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz; measured at $f_{(2p-q)}$ = 898 MHz and at $f_{(2p-q)}$ = 904 MHz.

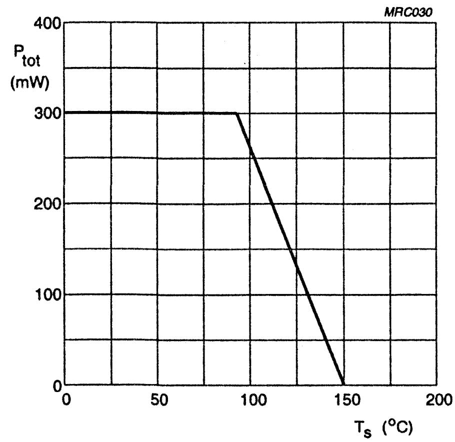
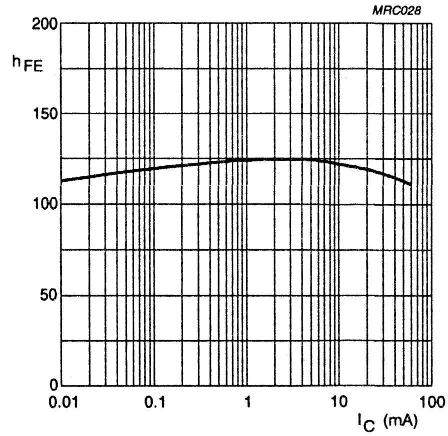
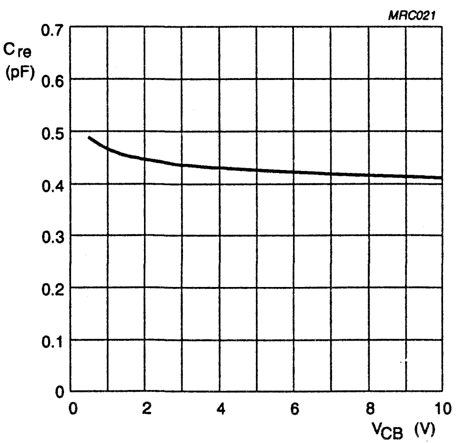


Fig.2 Power derating curve.



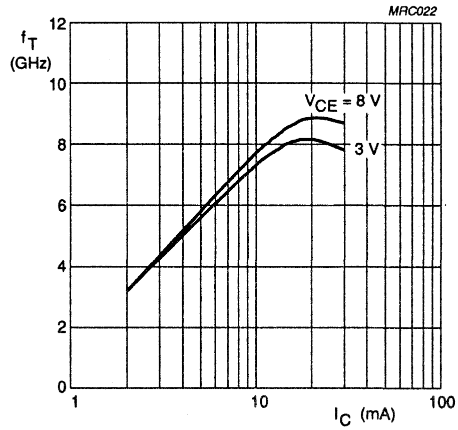
V_{CE} = 6 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

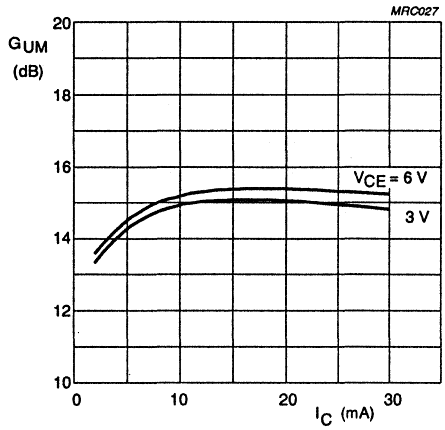
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

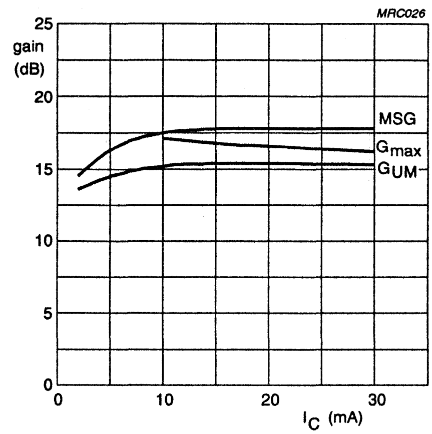
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



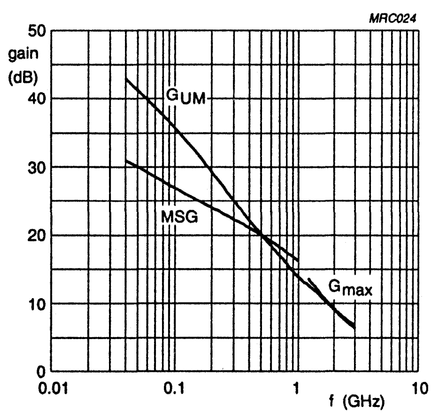
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of collector current.



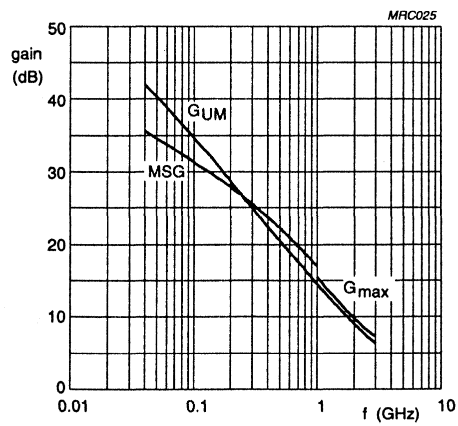
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



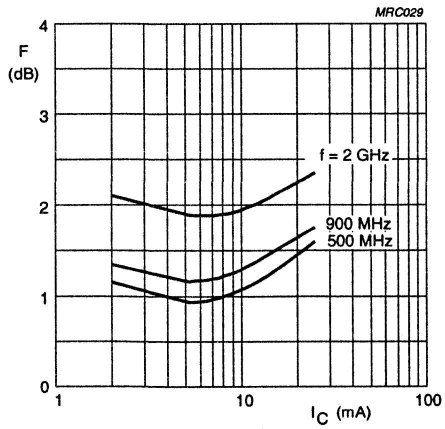
I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



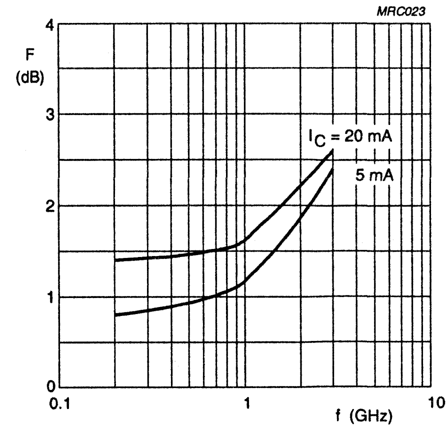
I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.

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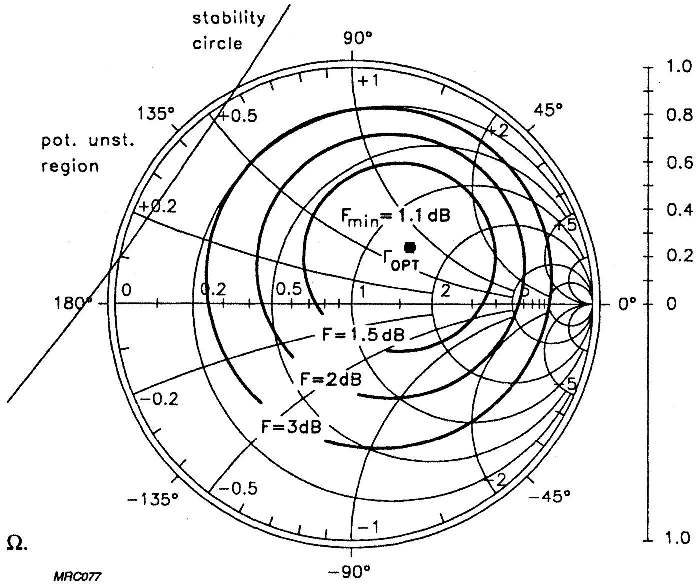


Fig.12 Noise circle.

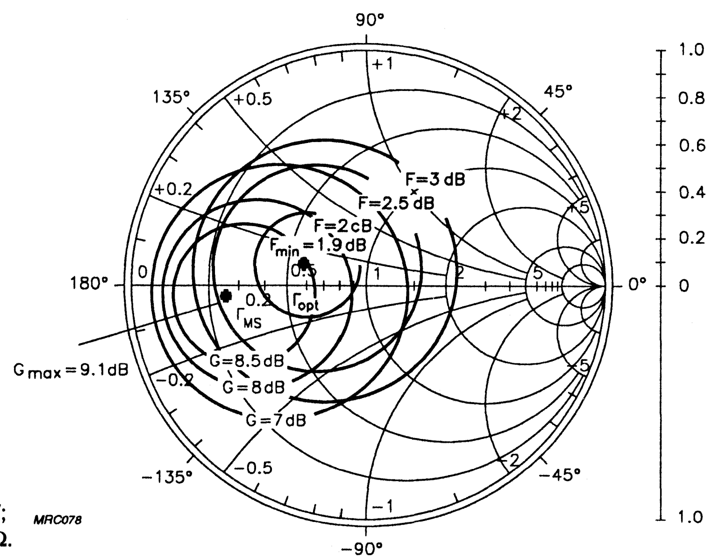
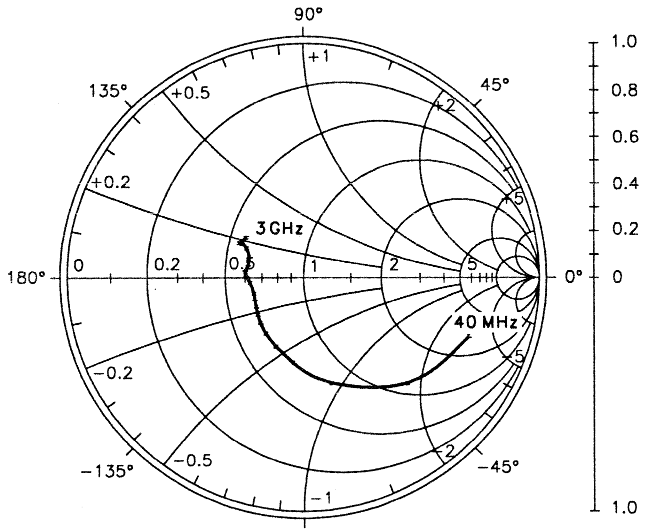


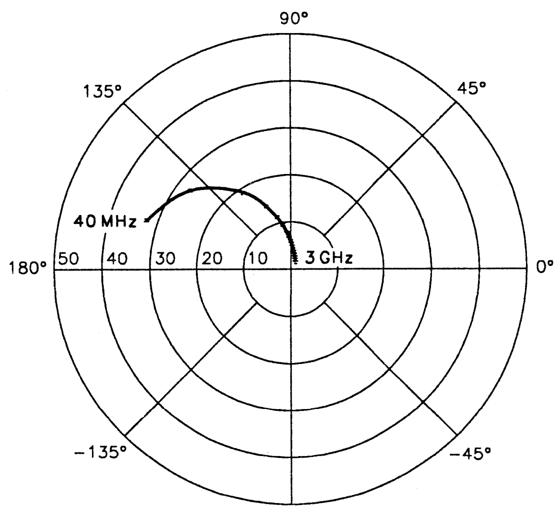
Fig.13 Noise circle.



I_C = 20 mA; V_{CE} = 6 V;
Z_O = 50 Ω.

MRC066

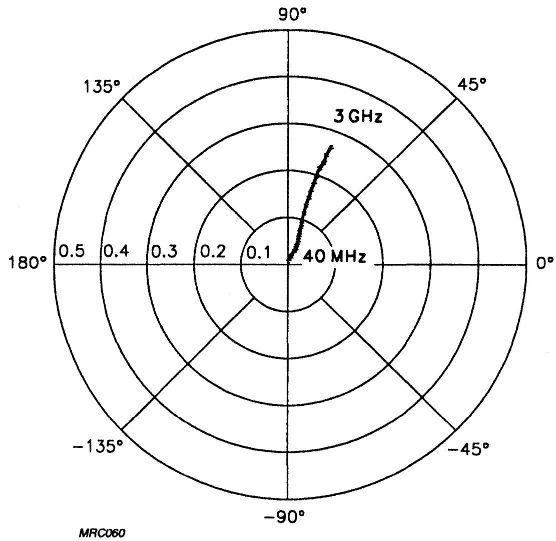
Fig.14 Common emitter input reflection coefficient (S_{11}).



I_C = 20 mA; V_{CE} = 6 V.

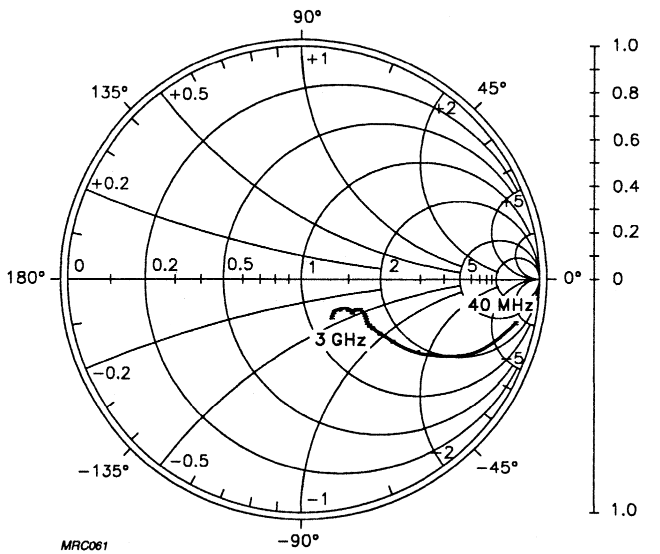
MRC067

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 20 mA; V_{CE} = 6 V.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).

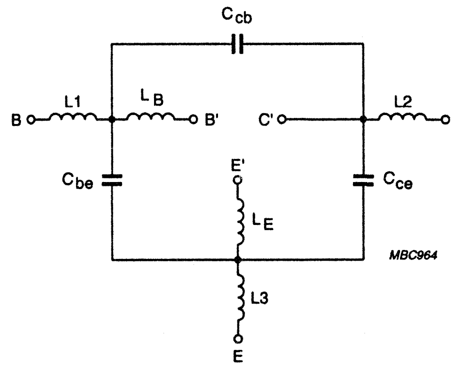


I_C = 20 mA; V_{CE} = 6 V;
Z_O = 50 Ω.

Fig.17 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR520 crystal

1	IS = 1.016	fA
2	BF = 220.1	–
3	NF = 1.000	–
4	VAF = 48.06	V
5	IKF = 510.0	mA
6	ISE = 283.0	fA
7	NE = 2.035	–
8	BR = 100.7	–
9	NR = 988.1	m
10	VAR = 1.692	V
11	IKR = 2.352	mA
12	ISC = 24.48	aA
13	NC = 1.022	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 775.3	mΩ
18	RC = 2.210	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.245	pF
23	VJE = 600.0	mV
24	MJE = 258.1	m
25	TF = 8.616	ps
26	XTF = 6.788	–
27	VTF = 1.414	V
28	ITF = 110.3	mA
29	PTF = 45.01	deg
30	CJC = 447.6	fF
31	VJC = 189.2	mV
32	MJC = 70.51	m
33	XCJC = 130.0	m
34	TR = 543.7	ps
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 780.2	m



QL_B = 50; QL_E = 50.
$QL_{B,E}$ (f) = $QL_{B,E}$ $\sqrt{}$ (f/Fc).
Fc = scaling frequency = 100 MHz.

Fig.18 Package equivalent circuit, SOT323.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.951	−6.5	5.567	173.5	0.011	85.2	0.992	−3.1	43.1
100	0.933	−16.0	5.416	165.0	0.026	79.0	0.976	−7.6	36.8
200	0.885	−31.3	5.128	153.8	0.049	69.6	0.925	−14.3	29.2
300	0.827	−46.0	4.862	142.8	0.067	62.0	0.862	−19.7	24.6
400	0.767	−59.4	4.532	133.8	0.081	56.2	0.803	−24.1	21.5
500	0.713	−71.5	4.186	126.4	0.091	51.9	0.751	−27.5	19.1
600	0.663	−82.3	3.885	119.8	0.099	48.9	0.708	−29.8	17.3
700	0.614	−92.3	3.615	113.7	0.105	47.1	0.673	−31.3	15.8
800	0.570	−101.0	3.342	108.5	0.109	45.9	0.644	−32.1	14.5
900	0.532	−109.2	3.088	103.7	0.112	44.9	0.619	−32.6	13.3
1000	0.499	−117.3	2.857	99.5	0.114	44.7	0.595	−33.0	12.3
1200	0.458	−132.8	2.514	92.2	0.117	45.2	0.550	−33.8	10.6
1400	0.447	−145.5	2.270	86.2	0.121	47.0	0.520	−35.6	9.5
1600	0.442	−154.8	2.050	81.0	0.126	49.3	0.502	−37.9	8.4
1800	0.429	−163.2	1.871	77.0	0.130	52.8	0.491	−39.4	7.5
2000	0.421	−172.9	1.725	72.8	0.137	56.2	0.478	−40.5	6.7
2200	0.435	178.0	1.610	69.3	0.144	59.9	0.458	−42.4	6.1
2400	0.459	171.6	1.514	64.9	0.154	62.9	0.438	−46.1	5.5
2600	0.470	167.8	1.416	62.1	0.164	65.4	0.431	−50.9	5.0
2800	0.469	163.3	1.373	59.5	0.177	68.6	0.438	−54.3	4.8
3000	0.467	156.9	1.311	56.5	0.192	70.8	0.440	−56.2	4.4

Table 2 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 3$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.885	−10.1	12.638	169.8	0.010	83.8	0.979	−5.7	42.4
100	0.841	−24.6	11.872	157.6	0.024	74.5	0.932	−13.5	35.7
200	0.741	−46.8	10.599	141.8	0.042	64.1	0.812	−23.1	28.6
300	0.639	−66.4	9.319	129.5	0.054	58.5	0.703	−28.8	24.6
400	0.555	−82.8	8.055	119.9	0.063	55.7	0.620	−32.3	21.8
500	0.496	−95.9	7.005	112.8	0.070	54.6	0.560	−34.3	19.8
600	0.449	−107.0	6.617	107.0	0.076	54.7	0.520	−35.2	18.1
700	0.411	−116.4	5.475	102.2	0.082	55.4	0.491	−35.5	16.8
800	0.382	−124.5	4.898	98.2	0.088	56.4	0.470	−35.1	15.6
900	0.358	−132.4	4.426	94.7	0.093	57.5	0.452	−34.5	14.5
1000	0.340	−140.3	4.022	91.5	0.098	58.5	0.434	−33.8	13.5
1200	0.327	−154.7	3.431	86.3	0.109	60.6	0.400	−33.1	12.0
1400	0.333	−164.8	3.025	81.7	0.121	63.0	0.376	−34.2	10.8
1600	0.334	−171.7	2.694	77.7	0.135	64.2	0.364	−36.6	9.7
1800	0.326	−178.5	2.438	74.5	0.146	66.1	0.357	−37.6	8.8
2000	0.327	172.3	2.235	71.0	0.160	67.2	0.348	−37.8	8.0
2200	0.348	164.5	2.076	68.3	0.174	68.6	0.329	−38.9	7.4
2400	0.375	160.2	1.946	64.6	0.190	69.1	0.308	−42.8	6.9
2600	0.385	158.6	1.808	62.1	0.202	69.3	0.299	−48.5	6.2
2800	0.382	155.8	1.743	59.9	0.216	70.3	0.308	−52.6	5.9
3000	0.379	149.9	1.660	56.9	0.234	70.5	0.313	−54.2	5.5

Table 3 Noise data, $I_C = 5$ mA; $V_{CE} = 3$ V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	0.90	0.325	31.0	0.200
900	1.10	0.266	54.0	0.210
2000	1.94	0.245	174.0	0.170

Table 4 Common emitter scattering parameters, $I_C = 10$ mA; $V_{CE} = 3$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.793	−15.0	21.963	165.5	0.010	82.3	0.956	−8.9	41.8
100	0.718	−35.8	19.615	149.5	0.022	71.5	0.860	−19.7	34.9
200	0.568	−65.1	15.811	130.3	0.035	62.8	0.684	−29.8	28.4
300	0.462	−87.1	12.578	117.9	0.045	60.1	0.560	−33.8	24.7
400	0.396	−103.8	10.183	109.7	0.053	60.5	0.482	−35.5	22.0
500	0.358	−116.3	8.508	103.9	0.060	61.5	0.433	−36.1	20.1
600	0.330	−126.2	7.279	99.5	0.067	62.8	0.404	−36.0	18.5
700	0.309	−134.8	6.354	95.8	0.074	64.3	0.385	−35.5	17.2
800	0.292	−142.3	5.624	92.7	0.082	65.7	0.372	−34.5	16.0
900	0.279	−149.9	5.046	89.8	0.090	66.5	0.361	−33.4	15.0
1000	0.270	−157.1	4.562	87.4	0.097	67.4	0.348	−32.2	14.1
1200	0.273	−169.9	3.860	83.1	0.111	68.8	0.322	−30.8	12.5
1400	0.287	−177.7	3.383	79.4	0.128	70.1	0.302	−31.8	11.4
1600	0.291	177.4	2.999	75.8	0.144	70.2	0.292	−34.8	10.3
1800	0.284	171.2	2.706	73.0	0.158	71.0	0.288	−35.8	9.4
2000	0.288	162.7	2.476	70.0	0.175	71.0	0.282	−35.5	8.6
2200	0.314	155.8	2.297	67.6	0.191	71.4	0.263	−36.1	8.0
2400	0.342	153.1	2.150	64.2	0.208	71.2	0.241	−40.3	7.4
2600	0.351	153.3	1.991	62.0	0.221	70.6	0.231	−47.4	6.8
2800	0.346	151.1	1.914	59.9	0.237	70.8	0.240	−52.2	6.5
3000	0.341	145.4	1.821	57.0	0.255	70.4	0.246	−53.9	6.0

Table 5 Noise data, $I_C = 10$ mA; $V_{CE} = 3$ V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.716	32.0	0.190
900	1.25	0.318	59.0	0.160
2000	1.90	0.257	−171.0	0.150

Table 6 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.722	−19.1	28.824	162.3	0.009	80.4	0.934	−11.2	41.4
100	0.624	−44.7	24.593	143.7	0.020	70.1	0.804	−23.5	34.5
200	0.468	−77.2	18.171	123.7	0.032	63.0	0.607	−32.4	28.3
300	0.380	−99.5	13.751	112.4	0.041	62.8	0.488	−35.0	24.6
400	0.333	−116.1	10.875	105.2	0.049	64.1	0.419	−35.6	22.1
500	0.308	−127.7	8.966	100.2	0.057	65.5	0.379	−35.5	20.2
600	0.291	−137.0	7.618	96.4	0.065	67.1	0.356	−35.1	18.6
700	0.276	−145.0	6.619	93.2	0.073	68.5	0.342	−34.5	17.3
800	0.265	−151.8	5.841	90.4	0.081	69.6	0.333	−33.3	16.2
900	0.255	−159.0	5.231	87.8	0.089	70.4	0.324	−32.0	15.1
1000	0.251	−165.8	4.723	85.6	0.097	70.9	0.315	−30.7	14.2
1200	0.261	−177.4	3.986	81.7	0.114	71.8	0.291	−29.1	12.7
1400	0.277	176.3	3.485	78.3	0.131	72.5	0.273	−30.3	11.5
1600	0.281	172.1	3.087	74.9	0.148	72.2	0.264	−33.7	10.5
1800	0.274	166.7	2.782	72.2	0.163	72.5	0.261	−34.7	9.5
2000	0.281	158.3	2.548	69.3	0.181	72.3	0.255	−34.4	8.8
2200	0.308	152.4	2.362	67.1	0.197	72.4	0.237	−34.8	8.1
2400	0.335	150.2	2.210	63.9	0.215	72.0	0.214	−39.3	7.6
2600	0.343	150.8	2.043	61.8	0.229	71.0	0.204	−47.0	6.9
2800	0.337	149.0	1.965	59.7	0.244	71.1	0.213	−52.4	6.6
3000	0.332	143.5	1.869	56.9	0.263	70.4	0.220	−54.2	6.2

Table 7 Noise data, I_C = 15 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.30	0.0980	37.0	0.200
900	1.45	0.0750	99.0	0.180
2000	2.05	0.265	−158.0	0.180

Table 8 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.665	−22.9	33.838	159.8	0.009	80.4	0.914	−12.9	40.9
100	0.556	−52.1	27.652	139.3	0.019	69.1	0.759	−25.7	34.2
200	0.409	−86.3	19.226	119.5	0.030	63.7	0.556	−33.6	28.1
300	0.340	−108.7	14.178	109.2	0.039	64.7	0.445	−35.0	24.5
400	0.306	−124.8	11.088	102.6	0.047	66.4	0.383	−35.0	22.0
500	0.288	−135.9	9.094	98.1	0.055	68.1	0.348	−34.6	20.1
600	0.275	−144.5	7.701	94.6	0.064	69.6	0.330	−34.0	18.6
700	0.265	−151.9	6.681	91.6	0.072	70.9	0.319	−33.3	17.3
800	0.257	−158.9	5.888	89.0	0.081	71.7	0.312	−32.1	16.1
900	0.250	−165.1	5.266	86.6	0.090	72.2	0.305	−30.8	15.1
1000	0.249	−171.4	4.754	84.5	0.098	72.7	0.297	−29.6	14.2
1200	0.261	178.3	4.007	80.8	0.115	73.3	0.276	−27.9	12.7
1400	0.278	172.7	3.501	77.6	0.133	73.8	0.258	−29.2	11.5
1600	0.282	169.1	3.100	74.2	0.151	73.2	0.250	−32.9	10.5
1800	0.276	164.0	2.794	71.7	0.166	73.4	0.247	−34.0	9.5
2000	0.283	155.9	2.557	68.8	0.184	72.9	0.242	−33.6	8.8
2200	0.311	150.5	2.370	66.6	0.201	72.9	0.224	−34.1	8.2
2400	0.339	148.5	2.215	63.4	0.219	72.4	0.201	−38.7	7.6
2600	0.345	149.4	2.050	61.4	0.233	71.3	0.191	−47.0	6.9
2800	0.340	147.7	1.970	59.3	0.248	71.3	0.200	−52.8	6.6
3000	0.335	142.2	1.873	56.5	0.268	70.6	0.207	−54.5	6.2

Table 9 Noise data, I_C = 20 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.0480	61.0	0.200
900	1.60	0.0780	136.0	0.180
2000	2.20	0.311	−153.0	0.170

Table 10 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.579	−30.5	39.467	155.6	0.009	77.8	0.872	−15.2	39.9
100	0.467	−65.7	29.988	133.1	0.018	67.5	0.688	−28.3	33.4
200	0.354	−102.1	19.424	114.5	0.028	64.7	0.490	−33.8	27.5
300	0.313	−123.9	13.983	105.3	0.037	66.9	0.394	−33.6	24.1
400	0.295	−138.6	10.823	99.5	0.046	69.1	0.344	−32.8	21.6
500	0.288	−148.1	8.827	95.4	0.054	70.9	0.316	−32.2	19.7
600	0.281	−155.4	7.452	92.2	0.063	72.1	0.303	−31.7	18.2
700	0.276	−161.7	6.453	89.5	0.072	73.1	0.296	−31.1	16.9
800	0.270	−167.5	5.684	87.0	0.081	73.8	0.292	−30.1	15.8
900	0.267	−173.2	5.079	84.8	0.090	74.1	0.288	−28.9	14.8
1000	0.268	−178.7	4.585	82.8	0.099	74.5	0.281	−27.7	13.9
1200	0.283	172.9	3.861	79.3	0.116	74.7	0.263	−26.2	12.4
1400	0.300	168.3	3.375	76.1	0.134	75.2	0.246	−27.9	11.2
1600	0.304	165.0	2.987	72.8	0.153	74.4	0.238	−32.0	10.2
1800	0.298	160.5	2.691	70.3	0.168	74.3	0.237	−33.4	9.3
2000	0.306	153.1	2.466	67.4	0.187	73.7	0.232	−33.3	8.5
2200	0.335	148.3	2.287	65.3	0.204	73.7	0.214	−33.8	7.9
2400	0.363	146.5	2.138	62.2	0.223	73.0	0.192	−38.9	7.4
2600	0.368	147.3	1.976	60.0	0.237	71.9	0.182	−47.8	6.7
2800	0.362	145.3	1.900	58.0	0.253	71.8	0.192	−53.9	6.3
3000	0.359	140.3	1.808	55.2	0.272	71.0	0.198	−55.8	5.9

Table 11 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.956	−6.2	5.495	173.7	0.010	86.1	0.992	−2.9	43.4
100	0.939	−15.4	5.368	165.4	0.025	79.2	0.977	−7.2	37.3
200	0.893	−30.1	5.096	153.8	0.047	70.1	0.929	−13.7	29.7
300	0.836	−44.1	4.834	143.8	0.065	62.8	0.869	−19.0	25.0
400	0.777	−57.3	4.527	135.0	0.079	57.3	0.813	−23.3	21.8
500	0.724	−68.8	4.196	127.6	0.090	52.8	0.762	−26.7	19.5
600	0.672	−79.5	3.915	121.0	0.097	49.9	0.720	−29.0	17.6
700	0.622	−89.3	3.650	115.0	0.103	47.9	0.685	−30.5	16.1
800	0.577	−97.8	3.375	109.7	0.107	46.6	0.657	−31.4	14.8
900	0.536	−105.9	3.130	104.9	0.110	45.7	0.630	−31.9	13.6
1000	0.501	−113.8	2.899	100.6	0.113	45.2	0.606	−32.3	12.5
1200	0.456	−129.4	2.555	93.4	0.116	45.5	0.561	−33.2	10.8
1400	0.442	−142.4	2.309	87.4	0.121	47.2	0.530	−34.9	9.6
1600	0.435	−151.9	2.085	82.1	0.126	49.4	0.512	−37.2	8.6
1800	0.419	−160.3	1.903	78.1	0.129	52.7	0.501	−38.5	7.7
2000	0.410	−170.2	1.753	73.9	0.135	56.0	0.487	−39.5	6.9
2200	0.422	−179.8	1.638	70.4	0.142	59.7	0.465	−41.4	6.2
2400	0.445	173.5	1.543	65.9	0.153	62.7	0.446	−44.9	5.7
2600	0.457	169.6	1.442	63.1	0.162	65.2	0.439	−49.5	5.1
2800	0.455	165.0	1.400	60.6	0.174	68.3	0.445	−52.9	4.9
3000	0.451	158.5	1.336	57.5	0.189	70.6	0.446	−54.7	4.5

Table 12 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.900	−9.4	12.307	170.3	0.010	84.3	0.980	−5.3	42.9
100	0.860	−23.0	11.606	158.7	0.024	75.8	0.938	−12.6	36.3
200	0.764	−43.8	10.436	143.4	0.041	65.3	0.828	−21.9	29.2
300	0.663	−62.3	9.258	131.3	0.054	59.4	0.723	−27.7	25.1
400	0.577	−77.8	8.062	121.7	0.063	56.4	0.641	−31.4	22.2
500	0.513	−90.6	7.058	114.5	0.070	54.9	0.580	−33.6	20.1
600	0.462	−101.3	6.235	108.7	0.077	54.9	0.538	−34.6	18.4
700	0.420	−110.6	5.554	103.7	0.082	55.5	0.508	−35.0	17.0
800	0.385	−118.6	4.976	99.7	0.088	56.3	0.486	−34.6	15.8
900	0.358	−126.5	4.503	96.0	0.093	57.2	0.467	−34.1	14.7
1000	0.335	−134.3	4.098	92.8	0.098	58.2	0.448	−33.5	13.7
1200	0.317	−149.3	3.504	87.4	0.109	60.3	0.413	−32.8	12.2
1400	0.321	−160.2	3.093	82.9	0.121	62.3	0.388	−33.8	11.0
1600	0.320	−167.6	2.753	78.7	0.134	63.6	0.375	−36.0	9.9
1800	0.310	−174.7	2.492	75.5	0.145	65.5	0.367	−36.9	9.0
2000	0.307	175.4	2.284	72.0	0.158	66.7	0.358	−37.1	8.2
2200	0.329	167.0	2.122	69.3	0.171	67.9	0.339	−38.0	7.6
2400	0.355	162.2	1.990	65.6	0.187	68.6	0.318	−41.6	7.0
2600	0.366	160.9	1.847	63.1	0.199	68.8	0.308	−47.1	6.4
2800	0.363	158.1	1.781	60.8	0.213	69.8	0.316	−50.9	6.1
3000	0.358	152.0	1.694	57.9	0.230	70.1	0.320	−52.5	5.6

Table 13 Noise data, I_C = 5 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	0.900	0.359	27.0	0.240
900	1.10	0.338	45.0	0.230
2000	1.85	0.277	161.0	0.130

Table 14 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.830	−13.7	21.306	166.3	0.009	82.2	0.957	−8.2	42.4
100	0.758	−32.7	19.195	151.0	0.022	72.8	0.873	−18.5	35.6
200	0.608	−59.5	15.715	132.4	0.036	63.4	0.707	−28.5	28.9
300	0.492	−80.1	12.682	119.9	0.045	60.5	0.584	−33.0	25.1
400	0.415	−95.9	10.348	111.5	0.053	60.1	0.503	−35.0	22.4
500	0.368	−108.2	8.684	105.6	0.060	60.9	0.452	−35.8	20.4
600	0.333	−118.1	7.455	101.0	0.068	62.3	0.420	−35.8	18.8
700	0.306	−126.8	6.519	97.2	0.075	63.8	0.400	−35.4	17.5
800	0.285	−134.4	5.778	93.9	0.082	64.9	0.386	−34.4	16.3
900	0.267	−142.1	5.184	91.0	0.089	66.0	0.372	−33.3	15.3
1000	0.255	−149.9	4.689	88.5	0.096	66.8	0.360	−32.2	14.3
1200	0.253	−164.0	3.971	84.1	0.111	68.2	0.332	−30.6	12.8
1400	0.265	−172.8	3.479	80.4	0.127	69.4	0.311	−31.5	11.6
1600	0.267	−178.4	3.090	76.8	0.143	69.5	0.300	−34.3	10.5
1800	0.260	175.5	2.782	74.1	0.157	70.3	0.296	−35.1	9.6
2000	0.262	165.7	2.547	71.0	0.173	70.4	0.289	−34.7	8.8
2200	0.287	158.3	2.362	68.6	0.189	70.8	0.270	−35.2	8.2
2400	0.315	155.1	2.211	65.2	0.206	70.6	0.247	−39.0	7.6
2600	0.324	155.3	2.047	63.1	0.219	70.0	0.237	−45.8	7.0
2800	0.320	153.4	1.970	61.0	0.234	70.3	0.245	−50.5	6.6
3000	0.315	147.5	1.871	58.1	0.252	69.9	0.251	−52.0	6.2

Table 15 Noise data, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.10	0.250	48.0	0.230
900	1.25	0.210	49.0	0.230
2000	1.90	0.230	162.0	0.150

Table 16 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.781	−17.0	27.776	163.5	0.009	81.3	0.939	−10.3	42.2
100	0.685	−39.7	24.046	145.8	0.021	70.7	0.823	−21.9	35.3
200	0.516	−69.2	18.202	126.1	0.033	63.5	0.634	−31.3	28.8
300	0.410	−89.9	13.964	114.5	0.042	62.3	0.513	−34.4	25.0
400	0.349	−105.7	11.119	107.0	0.050	63.3	0.441	−35.4	22.4
500	0.312	−117.4	9.205	101.9	0.057	64.9	0.397	−35.6	20.5
600	0.287	−127.0	7.841	97.8	0.065	66.2	0.372	−35.3	18.9
700	0.267	−135.2	6.821	94.5	0.074	67.5	0.356	−34.6	17.6
800	0.251	−142.7	6.025	91.6	0.082	68.7	0.346	−33.4	16.4
900	0.238	−150.3	5.396	89.0	0.090	69.4	0.336	−32.1	15.4
1000	0.230	−157.9	4.874	86.7	0.097	70.1	0.325	−30.8	14.5
1200	0.234	−171.1	4.115	82.8	0.113	70.9	0.301	−29.1	12.9
1400	0.249	−178.6	3.601	79.3	0.130	71.7	0.281	−30.1	11.8
1600	0.252	176.6	3.191	76.0	0.148	71.3	0.272	−33.1	10.7
1800	0.245	170.7	2.874	73.4	0.162	71.8	0.268	−34.0	9.8
2000	0.249	161.2	2.629	70.3	0.179	71.6	0.263	−33.5	9.0
2200	0.275	154.4	2.436	68.1	0.195	71.6	0.244	−33.8	8.3
2400	0.305	152.1	2.279	64.9	0.213	71.2	0.221	−37.8	7.8
2600	0.313	153.0	2.108	62.8	0.226	70.3	0.210	−45.2	7.1
2800	0.307	151.3	2.027	60.8	0.242	70.5	0.218	−50.4	6.8
3000	0.303	145.6	1.926	58.0	0.260	69.8	0.224	−52.0	6.3

Table 17 Noise data, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.30	0.192	26.0	0.230
900	1.45	0.158	56.0	0.230
2000	2.05	0.202	175.0	0.180

NPN 9 GHz wideband transistor BFS520

Table 18 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.746	−19.7	32.383	161.4	0.009	80.3	0.922	−11.6	42.0
100	0.633	−45.1	27.053	142.0	0.020	69.5	0.785	−23.9	35.0
200	0.462	−75.6	19.369	122.2	0.031	64.2	0.588	−32.5	28.6
300	0.368	−96.6	14.485	111.4	0.040	63.8	0.473	−34.6	24.9
400	0.315	−112.4	11.399	104.5	0.048	65.4	0.407	−35.0	22.4
500	0.287	−123.8	9.381	99.8	0.056	66.8	0.368	−34.8	20.5
600	0.266	−133.1	7.959	96.1	0.065	68.5	0.347	−34.3	18.9
700	0.250	−140.8	6.912	93.0	0.073	69.7	0.334	−33.6	17.6
800	0.237	−148.0	6.096	90.3	0.082	70.6	0.327	−32.3	16.4
900	0.227	−155.6	5.456	87.8	0.090	71.2	0.318	−31.0	15.4
1000	0.221	−162.9	4.924	85.7	0.098	71.6	0.309	−29.6	14.5
1200	0.229	−175.5	4.154	81.9	0.114	72.2	0.287	−27.8	13.0
1400	0.244	177.8	3.629	78.6	0.132	72.8	0.268	−28.9	11.8
1600	0.249	173.6	3.215	75.3	0.150	72.3	0.259	−32.3	10.7
1800	0.241	168.2	2.897	72.7	0.164	72.4	0.256	−33.3	9.8
2000	0.247	158.9	2.647	69.9	0.182	72.1	0.251	−32.7	9.0
2200	0.274	152.5	2.453	67.7	0.199	72.1	0.232	−32.8	8.4
2400	0.303	150.4	2.295	64.5	0.217	71.6	0.209	−37.0	7.8
2600	0.311	151.6	2.124	62.5	0.230	70.6	0.198	−44.8	7.2
2800	0.305	150.1	2.040	60.5	0.246	70.7	0.206	−50.3	6.8
3000	0.299	144.4	1.937	57.7	0.264	69.9	0.212	−51.9	6.3

Table 19 Noise data, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.154	28.0	0.250
900	1.60	0.130	63.0	0.250
2000	2.20	0.228	−175.0	0.180

Table 20 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.697	−24.1	37.925	158.2	0.009	78.9	0.892	−13.3	41.4
100	0.566	−53.3	29.886	136.8	0.019	68.6	0.731	−26.0	34.5
200	0.403	−85.6	20.003	117.6	0.029	64.4	0.532	−32.7	28.2
300	0.327	−106.7	14.570	107.8	0.038	65.6	0.429	−33.4	24.6
400	0.289	−122.4	11.346	101.6	0.047	67.7	0.373	−32.9	22.1
500	0.270	−133.3	9.276	97.3	0.055	69.4	0.341	−32.4	20.2
600	0.255	−141.9	7.845	93.9	0.064	70.4	0.325	−31.9	18.7
700	0.244	−149.4	6.799	91.1	0.072	71.6	0.316	−31.2	17.4
800	0.234	−156.2	5.989	88.6	0.081	72.4	0.312	−30.1	16.2
900	0.227	−162.7	5.357	86.2	0.090	72.8	0.305	−28.9	15.2
1000	0.225	−169.8	4.834	84.1	0.098	73.3	0.298	−27.6	14.3
1200	0.237	179.3	4.075	80.6	0.115	73.5	0.278	−25.9	12.8
1400	0.253	173.8	3.557	77.4	0.133	74.0	0.261	−27.2	11.6
1600	0.257	170.2	3.151	74.2	0.151	73.3	0.253	−30.9	10.6
1800	0.250	164.5	2.838	71.6	0.166	73.3	0.250	−32.1	9.6
2000	0.259	156.0	2.596	68.8	0.184	72.9	0.245	−31.7	8.9
2200	0.286	150.5	2.406	66.6	0.201	72.7	0.227	−31.9	8.2
2400	0.313	148.9	2.249	63.5	0.220	72.1	0.204	−36.2	7.7
2600	0.321	149.8	2.080	61.4	0.233	71.1	0.193	−44.3	7.0
2800	0.316	148.3	1.998	59.4	0.249	71.0	0.202	−50.1	6.6
3000	0.311	143.0	1.899	56.7	0.267	70.2	0.208	−51.9	6.2

NPN 9 GHz wideband transistor BFS540

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 envelope.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is intended for RF wideband amplifier applications such as satellite TV systems and RF portable communication equipment with signal frequencies up to 2 GHz.

PINNING

PIN	DESCRIPTION
Code: N4	
1	base
2	emitter
3	collector

PIN CONFIGURATION

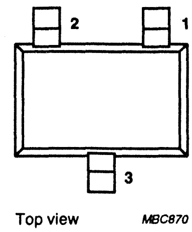


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to T_s = 55 °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V; T_j = 25 °C	60	120	250	
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	14	–	dB
F	noise figure	I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.3	1.7	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	R_{BE} = 0	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to T_s = 55 °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 55 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

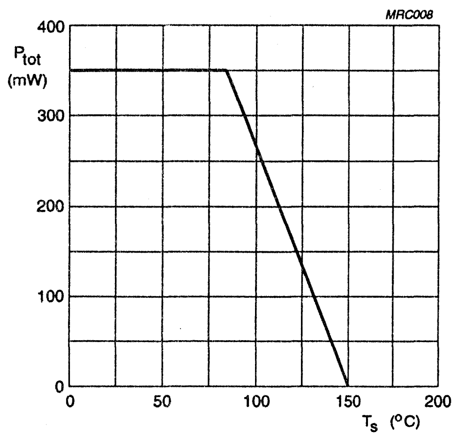
CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CE} = 8$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	14	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	8	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm

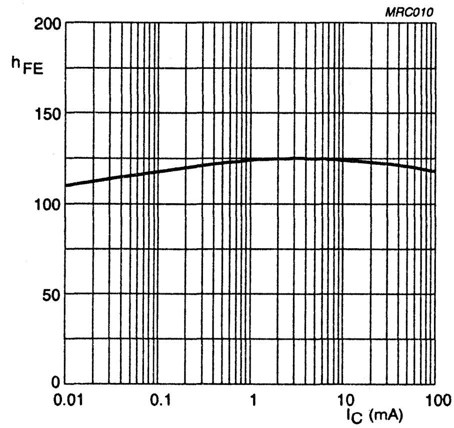
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C; $f_p = 900$ MHz; $f_q = 902$ MHz; measured at $f_{(2p-q)} = 898$ MHz and at $f_{(2p-q)} = 904$ MHz.



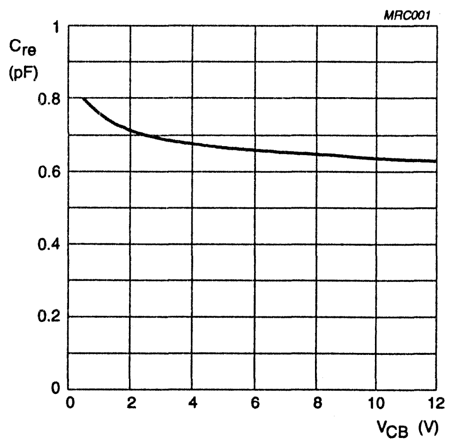
$V_{CE} \leq 10$ V.

Fig.2 Power derating curve.



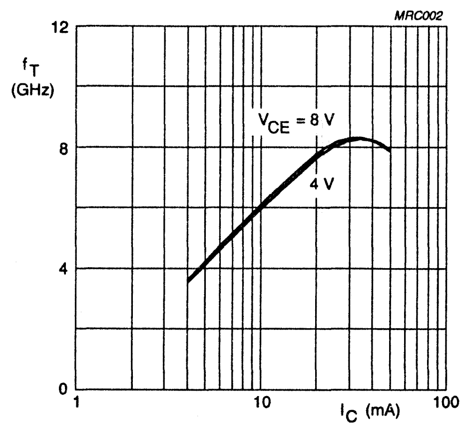
$V_{CE} = 8$ V; $T_j = 25$ °C.

Fig.3 DC current gain as a function of collector current.



$I_C = 0$; f = 1 MHz.

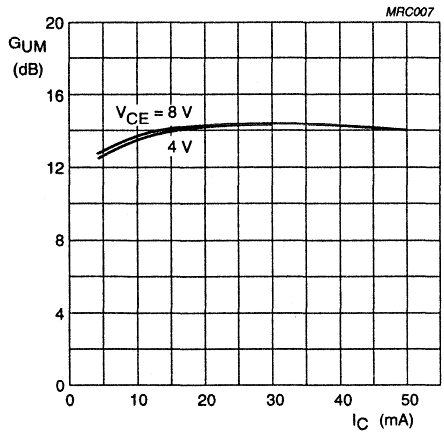
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; $T_{amb} = 25$ °C.

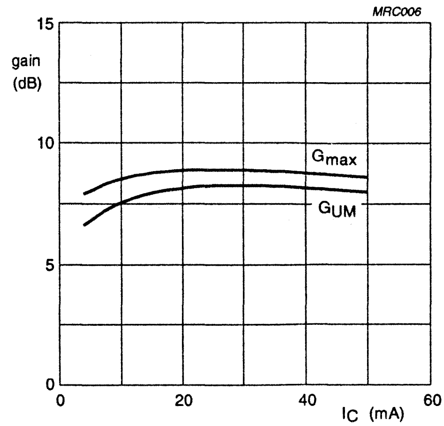
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



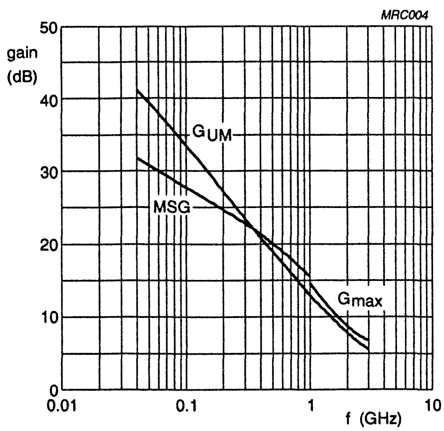
f = 900 MHz; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of collector current.



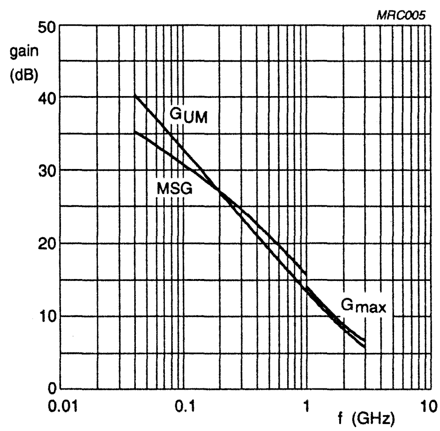
V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



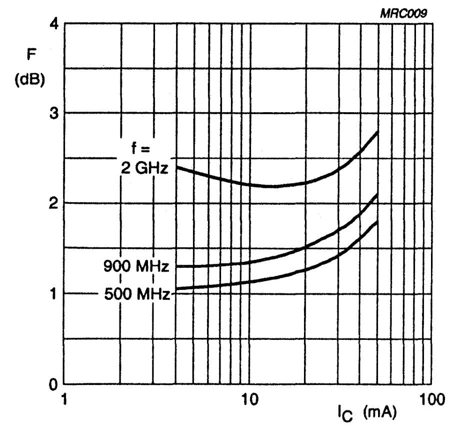
I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



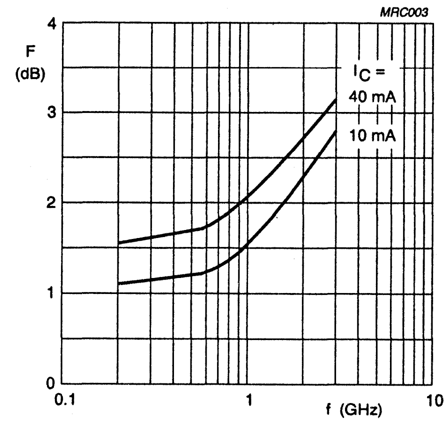
I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.

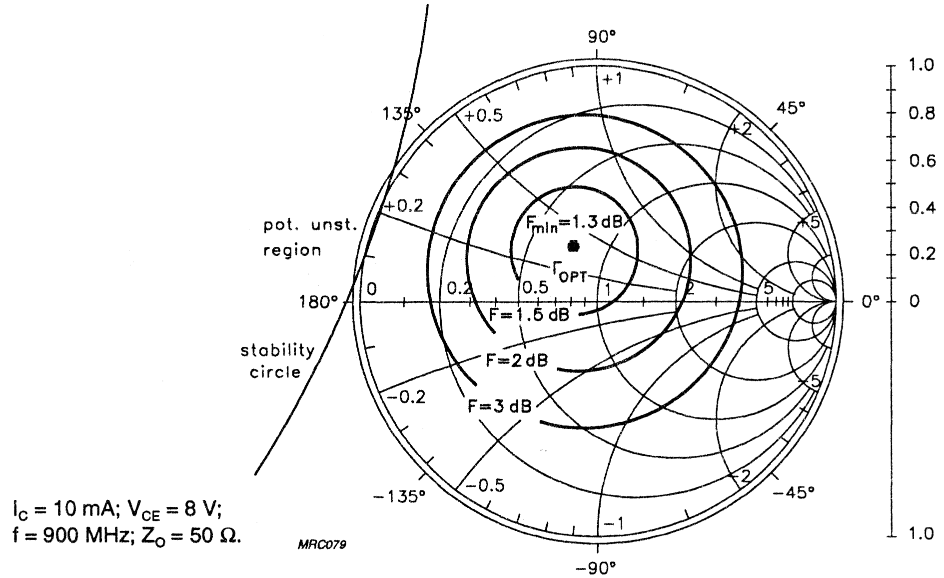


Fig.12 Noise circle.

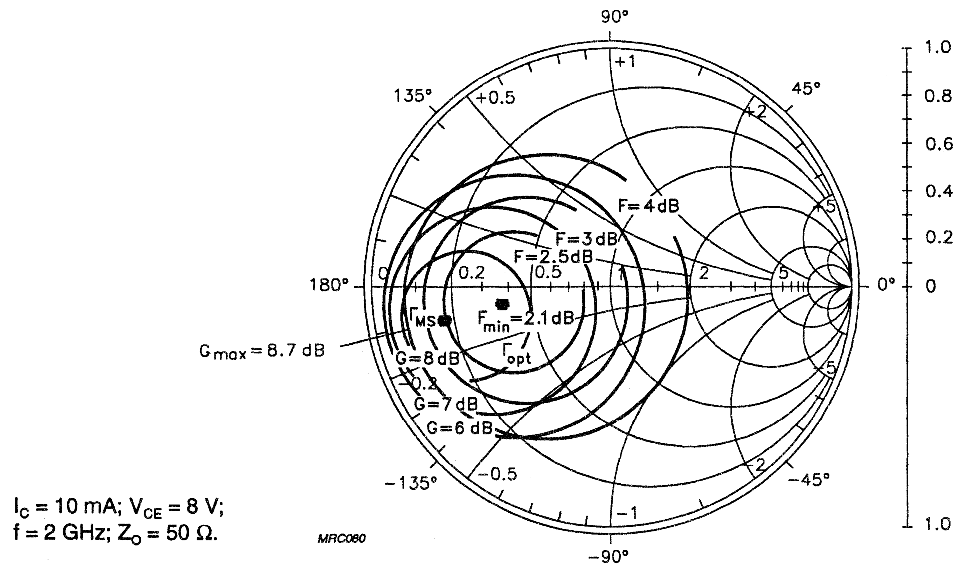
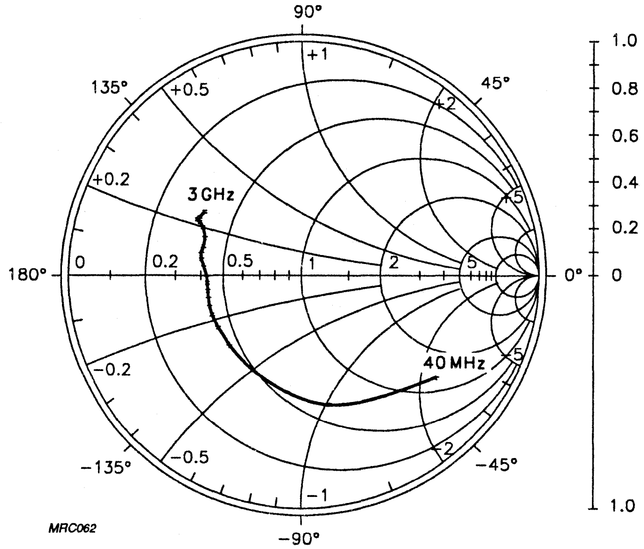
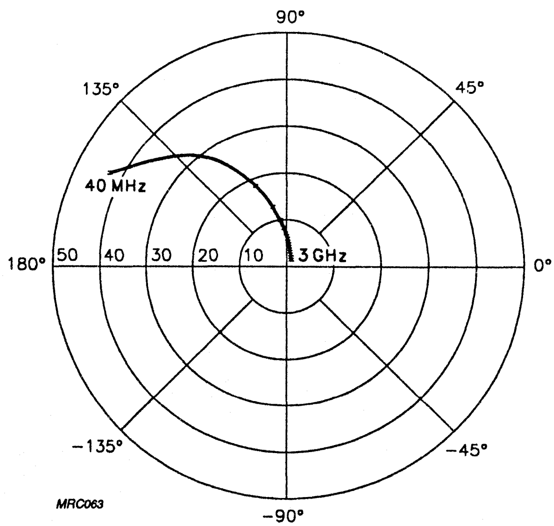


Fig.13 Noise circle.



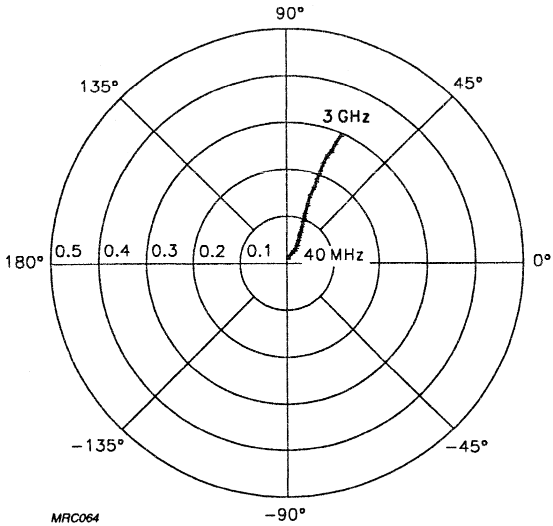
I_C = 40 mA; V_{CE} = 8 V;
Z_O = 50 Ω.

Fig.14 Common emitter input reflection coefficient (S_{11}).



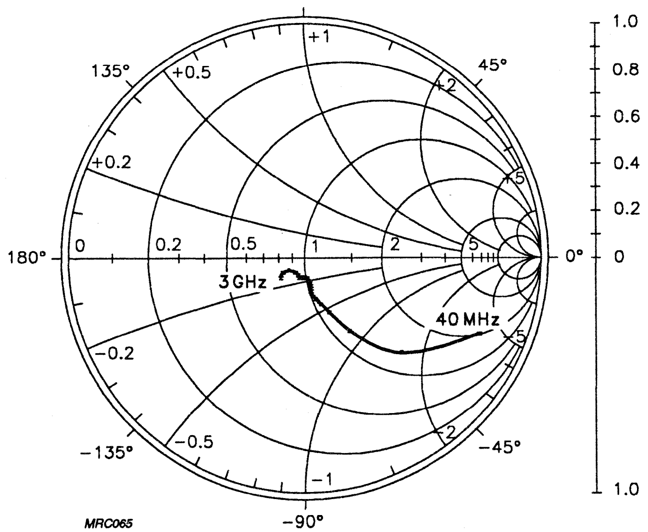
I_C = 40 mA; V_{CE} = 8 V.

Fig.15 Common emitter forward transmission coefficient (S_{21}).



I_C = 40 mA; V_{CE} = 8 V.

Fig.16 Common emitter reverse transmission coefficient (S_{12}).

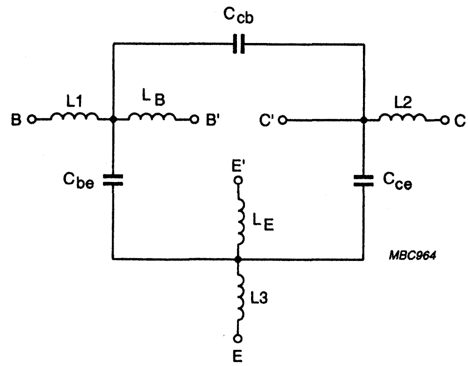


I_C = 40 mA; V_{CE} = 8 V;
Z_O = 50 Ω.

Fig.17 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR540 crystal

1	IS = 1.045	fA
2	BF = 184.3	–
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	–
8	BR = 43.99	–
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	–
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.4	–
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 814.7	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.18 Package equivalent circuit, SOT323.

List of components (see Fig.18)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.909	−13.6	10.406	168.4	0.016	81.7	0.975	−7.6	41.0
100	0.863	−32.9	9.687	154.8	0.037	70.2	0.913	−17.8	33.5
200	0.768	−62.4	8.519	137.2	0.062	56.4	0.764	−30.1	26.3
300	0.688	−86.5	7.296	124.1	0.077	48.5	0.637	−37.4	22.3
400	0.637	−104.9	6.175	114.4	0.086	44.4	0.549	−42.1	19.6
500	0.606	−118.6	5.313	107.3	0.091	42.3	0.487	−45.1	17.7
600	0.582	−129.4	4.640	101.6	0.096	41.8	0.447	−46.8	16.1
700	0.563	−137.9	4.102	96.8	0.100	42.1	0.420	−47.7	14.8
800	0.547	−145.0	3.660	92.8	0.104	43.1	0.399	−47.9	13.6
900	0.536	−151.5	3.300	89.3	0.107	44.2	0.380	−47.9	12.5
1000	0.530	−157.5	2.999	86.1	0.110	45.7	0.363	−47.9	11.6
1200	0.533	−167.5	2.555	80.6	0.116	49.2	0.329	−49.1	10.1
1400	0.545	−174.6	2.251	75.7	0.124	53.0	0.308	−52.4	9.0
1600	0.549	179.9	2.012	71.2	0.135	55.9	0.301	−56.9	8.0
1800	0.550	174.6	1.830	67.7	0.144	59.3	0.298	−59.8	7.2
2000	0.559	168.9	1.684	64.3	0.156	62.4	0.291	−62.2	6.5
2200	0.578	163.6	1.561	61.4	0.169	65.3	0.275	−66.5	6.0
2400	0.601	159.9	1.455	57.7	0.184	67.4	0.266	−74.0	5.5
2600	0.614	157.6	1.355	54.8	0.197	68.4	0.273	−82.1	5.0
2800	0.614	154.7	1.309	52.1	0.213	70.0	0.291	−86.6	4.8
3000	0.614	150.3	1.256	49.3	0.233	70.9	0.298	−89.3	4.4

Table 2 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.806	−22.1	22.248	162.2	0.015	77.7	0.935	−14.3	40.5
100	0.719	−51.7	19.148	143.7	0.032	64.2	0.790	−30.8	33.0
200	0.586	−90.5	14.458	123.2	0.048	53.9	0.564	−45.8	26.7
300	0.525	−115.2	10.993	111.5	0.057	51.5	0.427	−53.2	23.1
400	0.500	−131.3	8.703	104.0	0.064	51.9	0.346	−57.9	20.6
500	0.488	−141.9	7.190	98.8	0.071	53.2	0.298	−61.0	18.7
600	0.479	−149.8	6.117	94.6	0.078	54.9	0.268	−62.6	17.2
700	0.470	−156.2	5.321	91.2	0.086	56.9	0.248	−63.2	15.9
800	0.463	−161.7	4.704	88.2	0.093	58.6	0.233	−62.7	14.7
900	0.459	−166.8	4.214	85.6	0.101	59.9	0.218	−62.0	13.7
1000	0.458	−171.6	3.809	83.3	0.108	61.4	0.202	−61.4	12.8
1200	0.470	−179.2	3.211	79.1	0.123	63.7	0.173	−62.4	11.3
1400	0.484	175.8	2.807	75.2	0.139	65.5	0.157	−67.6	10.2
1600	0.488	171.8	2.499	71.4	0.156	66.0	0.154	−74.4	9.2
1800	0.488	167.4	2.266	68.3	0.171	67.0	0.153	−77.0	8.4
2000	0.496	162.1	2.085	65.4	0.189	67.8	0.145	−78.7	7.7
2200	0.517	157.7	1.930	63.1	0.205	68.7	0.132	−84.9	7.1
2400	0.541	154.9	1.797	59.7	0.222	68.8	0.130	−98.0	6.7
2600	0.553	153.8	1.667	57.1	0.235	68.2	0.145	−108.8	6.1
2800	0.551	151.8	1.607	54.5	0.252	68.4	0.166	−110.9	5.8
3000	0.546	147.8	1.541	51.6	0.272	68.1	0.173	−111.6	5.4

Table 3 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.159	78.0	0.140
900	1.30	0.234	133.0	0.140
2000	2.10	0.520	−165.0	0.070

Table 4 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.693	−32.8	35.366	155.7	0.014	74.2	0.875	−21.1	40.1
100	0.578	−72.6	27.190	133.1	0.027	61.3	0.659	−41.6	32.9
200	0.478	−113.0	17.616	113.9	0.039	56.2	0.421	−57.1	26.9
300	0.453	−134.1	12.631	104.6	0.048	57.5	0.303	−64.9	23.4
400	0.447	−147.0	9.759	98.7	0.057	60.1	0.241	−70.8	21.0
500	0.444	−154.9	7.960	94.6	0.065	62.0	0.206	−75.0	19.2
600	0.440	−161.0	6.724	91.3	0.074	63.7	0.185	−77.6	17.6
700	0.437	−166.1	5.824	88.5	0.083	65.3	0.171	−78.6	16.4
800	0.432	−170.6	5.137	86.0	0.093	66.6	0.159	−78.2	15.2
900	0.431	−175.0	4.595	83.8	0.103	67.4	0.146	−77.6	14.2
1000	0.432	−179.1	4.147	81.8	0.112	68.2	0.133	−77.7	13.3
1200	0.447	174.5	3.489	78.2	0.130	69.4	0.106	−81.8	11.9
1400	0.461	170.7	3.043	74.7	0.149	70.2	0.097	−91.8	10.7
1600	0.465	167.5	2.702	71.2	0.168	69.5	0.102	−100.8	9.7
1800	0.465	163.5	2.450	68.4	0.184	69.9	0.102	−103.7	8.9
2000	0.472	158.6	2.252	65.8	0.204	69.7	0.095	−106.5	8.2
2200	0.495	154.5	2.084	63.7	0.222	70.0	0.087	−118.3	7.6
2400	0.519	152.1	1.939	60.5	0.240	69.5	0.099	−134.3	7.2
2600	0.531	151.5	1.795	58.0	0.253	68.5	0.124	−140.6	6.6
2800	0.526	149.8	1.729	55.5	0.270	68.2	0.142	−138.3	6.3
3000	0.520	146.2	1.657	52.7	0.291	67.3	0.146	−137.2	5.9

Table 5 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.25	0.104	123.0	0.140
900	1.50	0.225	153.0	0.140
2000	2.20	0.487	−160.0	0.090

Table 6 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.630	−40.6	42.829	151.5	0.013	72.5	0.830	−25.1	39.9
100	0.516	−84.8	30.299	127.6	0.025	60.8	0.584	−46.9	32.8
200	0.446	−123.5	18.450	110.0	0.036	58.4	0.357	−62.3	26.9
300	0.434	−142.4	13.000	101.8	0.045	61.0	0.253	−70.6	23.5
400	0.434	−153.5	9.980	96.6	0.055	63.5	0.201	−77.3	21.1
500	0.435	−160.3	8.111	92.9	0.064	65.6	0.172	−82.4	19.2
600	0.433	−165.6	6.837	89.9	0.074	67.1	0.157	−85.5	17.7
700	0.430	−170.1	5.916	87.3	0.084	68.5	0.146	−86.8	16.4
800	0.426	−174.1	5.213	84.9	0.094	69.3	0.135	−86.4	15.3
900	0.426	−178.2	4.664	82.9	0.104	69.9	0.123	−86.3	14.3
1000	0.429	178.1	4.208	81.0	0.113	70.4	0.111	−87.0	13.4
1200	0.445	172.3	3.540	77.6	0.133	71.1	0.087	−94.2	12.0
1400	0.459	168.7	3.085	74.4	0.152	71.6	0.083	−107.0	10.8
1600	0.462	165.8	2.735	70.8	0.172	70.7	0.092	−115.8	9.8
1800	0.462	162.0	2.480	68.2	0.189	70.7	0.093	−118.4	9.0
2000	0.470	157.2	2.281	65.6	0.210	70.4	0.086	−122.0	8.3
2200	0.492	153.1	2.111	63.5	0.228	70.4	0.084	−135.5	7.7
2400	0.517	151.0	1.964	60.4	0.246	69.8	0.102	−149.1	7.3
2600	0.527	150.6	1.816	58.0	0.260	68.6	0.128	−152.2	6.7
2800	0.523	149.0	1.748	55.4	0.277	68.2	0.143	−148.5	6.3
3000	0.516	145.3	1.677	52.6	0.298	67.2	0.146	−147.4	5.9

Table 7 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.45	0.129	150.0	0.140
900	1.70	0.235	163.0	0.150
2000	2.40	0.488	−154.0	0.120

Table 8 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.587	−47.0	47.166	148.3	0.013	71.2	0.789	−27.8	39.5
100	0.484	−93.5	31.466	124.0	0.024	60.7	0.532	−50.0	32.6
200	0.435	−130.5	18.561	107.7	0.034	59.9	0.317	−65.0	26.7
300	0.432	−147.6	12.969	100.1	0.044	62.8	0.223	−73.4	23.4
400	0.434	−157.5	9.921	95.3	0.054	65.7	0.177	−80.7	21.0
500	0.436	−163.6	8.049	91.8	0.063	67.5	0.154	−86.2	19.1
600	0.435	−168.4	6.777	88.9	0.073	68.8	0.141	−89.5	17.6
700	0.432	−172.5	5.864	86.4	0.084	69.9	0.132	−90.8	16.3
800	0.430	−176.4	5.166	84.2	0.094	70.7	0.123	−90.4	15.2
900	0.430	179.8	4.618	82.1	0.104	71.1	0.112	−90.5	14.2
1000	0.433	176.3	4.170	80.3	0.114	71.5	0.100	−91.7	13.3
1200	0.450	170.9	3.505	77.1	0.134	72.1	0.079	−100.5	11.9
1400	0.464	167.6	3.052	73.8	0.154	72.4	0.078	−114.4	10.8
1600	0.467	164.7	2.709	70.4	0.174	71.4	0.088	−122.5	9.8
1800	0.466	161.0	2.456	67.7	0.191	71.2	0.090	−124.6	8.9
2000	0.474	156.4	2.259	65.1	0.212	70.7	0.084	−128.8	8.2
2200	0.498	152.4	2.092	63.1	0.230	70.7	0.084	−142.4	7.7
2400	0.522	150.4	1.945	60.1	0.250	70.1	0.104	−154.4	7.2
2600	0.532	150.1	1.799	57.6	0.262	68.7	0.130	−156.4	6.6
2800	0.528	148.4	1.732	55.0	0.280	68.3	0.145	−152.2	6.3
3000	0.521	144.7	1.661	52.2	0.301	67.3	0.148	−151.0	5.9

Table 9 Noise data, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.60	0.153	164.0	0.150
900	1.90	0.253	170.0	0.160
2000	2.60	0.496	−152.0	0.140

Table 10 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 4$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.556	−52.7	48.898	146.0	0.012	70.2	0.756	−29.7	39.1
100	0.470	−100.6	31.374	121.7	0.023	60.0	0.493	−51.9	32.2
200	0.437	−135.7	18.167	106.1	0.034	60.5	0.289	−66.3	26.5
300	0.438	−151.4	12.630	99.0	0.043	64.1	0.203	−74.7	23.1
400	0.443	−160.5	9.644	94.3	0.053	66.7	0.162	−82.0	20.7
500	0.446	−166.2	7.812	90.9	0.063	68.5	0.141	−87.7	18.9
600	0.446	−170.6	6.579	88.1	0.073	69.8	0.131	−91.0	17.4
700	0.443	−174.5	5.688	85.7	0.084	70.7	0.123	−92.1	16.1
800	0.440	−178.1	5.013	83.5	0.094	71.5	0.115	−91.7	15.0
900	0.442	178.4	4.480	81.5	0.104	71.8	0.105	−91.7	14.0
1000	0.445	175.0	4.045	79.7	0.114	72.1	0.094	−93.0	13.1
1200	0.461	169.9	3.402	76.4	0.134	72.6	0.075	−102.6	11.7
1400	0.475	166.7	2.964	73.1	0.155	72.7	0.075	−116.9	10.6
1600	0.479	163.8	2.631	69.7	0.175	71.7	0.087	−124.6	9.6
1800	0.479	160.1	2.385	67.0	0.192	71.5	0.089	−126.5	8.7
2000	0.488	155.7	2.196	64.3	0.213	71.0	0.084	−130.7	8.0
2200	0.510	151.9	2.032	62.3	0.232	71.0	0.085	−143.9	7.5
2400	0.534	149.8	1.890	59.3	0.251	70.3	0.106	−155.5	7.0
2600	0.544	149.3	1.749	56.8	0.264	69.0	0.132	−157.0	6.5
2800	0.539	147.7	1.683	54.3	0.281	68.4	0.147	−152.8	6.1
3000	0.533	144.1	1.617	51.4	0.303	67.5	0.150	−151.7	5.7

Table 11 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.925	−12.8	10.157	169.0	0.015	82.3	0.974	−7.0	41.5
100	0.882	−30.9	9.500	155.9	0.036	71.0	0.919	−16.6	34.2
200	0.787	−58.9	8.419	138.7	0.061	57.6	0.780	−28.4	26.8
300	0.703	−82.2	7.281	125.7	0.076	49.7	0.659	−35.6	22.7
400	0.646	−100.3	6.211	116.0	0.086	45.3	0.571	−40.3	19.9
500	0.611	−114.0	5.371	108.7	0.092	42.8	0.509	−43.4	17.9
600	0.583	−125.0	4.704	102.9	0.097	42.1	0.467	−45.1	16.3
700	0.561	−133.9	4.169	98.1	0.100	42.3	0.438	−46.0	15.0
800	0.543	−141.3	3.723	94.0	0.104	43.1	0.416	−46.2	13.8
900	0.529	−148.0	3.365	90.4	0.107	44.1	0.397	−46.3	12.7
1000	0.521	−154.3	3.057	87.2	0.110	45.4	0.379	−46.2	11.8
1200	0.521	−164.8	2.605	81.6	0.116	48.6	0.344	−47.2	10.2
1400	0.532	−172.2	2.296	76.6	0.124	52.2	0.323	−50.2	9.1
1600	0.537	−177.9	2.053	72.1	0.134	55.1	0.314	−54.4	8.2
1800	0.537	176.5	1.867	68.5	0.142	58.6	0.310	−57.1	7.3
2000	0.544	170.6	1.717	65.1	0.154	61.6	0.302	−59.3	6.6
2200	0.563	165.1	1.593	62.2	0.166	64.7	0.286	−63.2	6.1
2400	0.586	161.2	1.486	58.4	0.180	66.7	0.275	−70.3	5.6
2600	0.599	158.9	1.384	55.5	0.193	67.9	0.280	−78.2	5.1
2800	0.601	155.9	1.337	52.8	0.208	69.7	0.297	−82.7	4.9
3000	0.599	151.5	1.281	50.0	0.228	70.6	0.303	−85.4	4.5

Table 12 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.849	−20.0	21.314	163.4	0.014	78.4	0.936	−12.9	41.2
100	0.762	−46.9	18.589	145.8	0.032	65.6	0.809	−28.3	33.8
200	0.619	−83.1	14.351	125.5	0.049	54.5	0.593	−43.0	27.1
300	0.541	−107.5	11.062	113.6	0.058	51.4	0.456	−50.5	23.4
400	0.504	−124.1	8.822	105.8	0.066	51.3	0.372	−55.2	20.8
500	0.485	−135.6	7.317	100.3	0.073	52.2	0.320	−58.2	18.9
600	0.471	−144.1	6.243	96.0	0.080	53.7	0.288	−59.8	17.4
700	0.459	−151.1	5.435	92.4	0.087	55.6	0.267	−60.3	16.1
800	0.450	−157.0	4.808	89.4	0.094	57.4	0.250	−59.7	14.9
900	0.443	−162.6	4.310	86.7	0.101	58.7	0.234	−59.0	13.9
1000	0.441	−167.8	3.895	84.2	0.108	60.0	0.218	−58.3	13.0
1200	0.451	−176.1	3.291	80.0	0.123	62.4	0.187	−58.7	11.5
1400	0.465	178.3	2.879	76.0	0.138	64.3	0.169	−63.0	10.4
1600	0.469	174.2	2.560	72.2	0.154	64.8	0.165	−69.2	9.4
1800	0.469	169.6	2.322	69.1	0.168	66.1	0.162	−71.6	8.5
2000	0.475	164.0	2.134	66.1	0.186	66.9	0.154	−72.8	7.8
2200	0.496	159.3	1.974	63.7	0.201	67.8	0.139	−78.1	7.2
2400	0.521	156.3	1.839	60.4	0.218	68.0	0.133	−90.4	6.7
2600	0.534	155.2	1.707	57.7	0.231	67.5	0.145	−101.6	6.2
2800	0.532	153.3	1.644	55.1	0.247	67.8	0.164	−104.5	5.9
3000	0.527	149.3	1.577	52.3	0.266	67.6	0.171	−105.4	5.5

Table 13 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.225	59.0	0.170
900	1.30	0.255	113.0	0.160
2000	2.10	0.459	−171.0	0.100

Table 14 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.778	−28.1	32.958	157.8	0.014	75.8	0.882	−18.5	40.9
100	0.651	−63.0	26.163	136.4	0.028	62.1	0.692	−37.7	33.6
200	0.510	−101.6	17.548	116.6	0.041	55.6	0.458	−53.1	27.2
300	0.460	−124.0	12.748	106.7	0.050	56.0	0.334	−60.7	23.7
400	0.442	−138.4	9.905	100.5	0.059	57.8	0.266	−66.1	21.2
500	0.433	−147.6	8.105	96.0	0.067	59.9	0.227	−69.9	19.3
600	0.426	−154.6	6.857	92.5	0.076	61.7	0.204	−72.2	17.8
700	0.419	−160.5	5.945	89.6	0.084	63.4	0.188	−72.9	16.5
800	0.412	−165.5	5.243	87.0	0.094	64.7	0.175	−72.3	15.3
900	0.410	−170.4	4.693	84.7	0.103	65.6	0.161	−71.5	14.3
1000	0.410	−175.0	4.238	82.6	0.111	66.3	0.147	−71.0	13.4
1200	0.424	177.8	3.569	78.9	0.129	67.8	0.118	−73.3	12.0
1400	0.437	173.4	3.110	75.4	0.147	68.7	0.105	−81.6	10.8
1600	0.442	170.0	2.763	71.8	0.166	68.2	0.106	−90.4	9.8
1800	0.441	165.8	2.505	69.1	0.182	68.7	0.105	−93.1	9.0
2000	0.448	160.6	2.301	66.3	0.201	68.7	0.097	−95.1	8.3
2200	0.469	156.1	2.129	64.1	0.218	69.0	0.086	−105.4	7.7
2400	0.495	153.6	1.981	61.0	0.237	68.6	0.092	−123.3	7.2
2600	0.507	153.1	1.835	58.4	0.249	67.6	0.114	−132.2	6.6
2800	0.503	151.5	1.765	55.9	0.266	67.5	0.132	−130.8	6.3
3000	0.498	147.7	1.691	53.1	0.286	66.7	0.137	−130.0	5.9

Table 15 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.25	0.156	64.0	0.180
900	1.50	0.206	121.0	0.170
2000	2.20	0.413	−167.0	0.120

Table 16 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.739	−33.5	39.365	154.4	0.013	73.4	0.841	−21.6	40.7
100	0.596	−72.0	29.173	131.4	0.026	61.2	0.625	−42.1	33.4
200	0.472	−110.3	18.416	112.8	0.038	56.9	0.396	−57.2	27.1
300	0.436	−131.4	13.127	103.9	0.047	58.5	0.284	−64.8	23.6
400	0.423	−144.6	10.122	98.3	0.056	60.8	0.226	−70.6	21.2
500	0.419	−152.8	8.246	94.3	0.065	62.9	0.193	−74.8	19.3
600	0.414	−159.0	6.963	91.1	0.075	64.6	0.174	−77.4	17.8
700	0.408	−164.3	6.028	88.3	0.084	66.1	0.151	−78.3	16.5
800	0.403	−169.0	5.315	85.9	0.094	67.2	0.149	−77.6	15.4
900	0.401	−173.5	4.753	83.7	0.104	67.8	0.137	−77.0	14.4
1000	0.403	−177.9	4.293	81.8	0.113	68.6	0.123	−76.6	13.5
1200	0.418	175.5	3.610	78.3	0.131	69.4	0.097	−80.7	12.0
1400	0.432	171.5	3.149	74.8	0.151	70.2	0.087	−91.5	10.9
1600	0.436	168.2	2.792	71.4	0.170	69.4	0.092	−101.3	9.9
1800	0.435	164.3	2.531	68.6	0.186	69.6	0.092	−104.1	9.0
2000	0.442	159.1	2.326	65.9	0.206	69.3	0.084	−106.8	8.3
2200	0.465	154.7	2.153	63.8	0.224	69.4	0.076	−120.0	7.7
2400	0.489	152.6	2.002	60.7	0.242	68.9	0.088	−137.5	7.3
2600	0.502	152.2	1.854	58.3	0.255	67.7	0.113	−143.5	6.7
2800	0.498	150.7	1.783	55.7	0.272	67.4	0.129	−140.3	6.3
3000	0.492	147.0	1.708	52.9	0.292	66.6	0.133	−139.2	5.9

Table 17 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.45	0.133	68.0	0.200
900	1.70	0.191	122.0	0.190
2000	2.40	0.405	−166.0	0.140

Table 18 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.716	−37.3	42.648	152.1	0.013	71.9	0.809	−23.4	40.3
100	0.567	−77.7	30.194	128.4	0.025	60.6	0.581	−44.1	33.1
200	0.456	−115.7	18.486	110.8	0.037	57.8	0.360	−58.5	27.0
300	0.427	−135.8	13.056	102.4	0.046	59.9	0.257	−65.6	23.5
400	0.419	−148.1	10.036	97.0	0.055	62.6	0.204	−71.2	21.1
500	0.416	−155.8	8.162	93.2	0.064	64.6	0.175	−75.5	19.2
600	0.412	−161.7	6.882	90.1	0.074	66.1	0.159	−78.0	17.7
700	0.407	−166.6	5.957	87.5	0.084	67.4	0.147	−78.6	16.4
800	0.403	−171.0	5.251	85.1	0.094	68.4	0.137	−77.8	15.3
900	0.402	−175.4	4.693	83.0	0.104	68.9	0.126	−76.9	14.3
1000	0.404	−179.5	4.236	81.1	0.113	69.6	0.114	−76.6	13.4
1200	0.419	174.2	3.556	77.6	0.132	70.3	0.089	−80.8	11.9
1400	0.433	170.3	3.105	74.2	0.152	70.8	0.080	−92.6	10.8
1600	0.438	167.3	2.758	70.7	0.171	69.9	0.086	−103.0	9.8
1800	0.437	163.5	2.499	68.0	0.188	70.0	0.086	−105.4	8.9
2000	0.444	158.3	2.296	65.3	0.208	69.7	0.079	−108.1	8.2
2200	0.467	154.2	2.125	63.2	0.226	69.6	0.072	−122.1	7.6
2400	0.492	152.1	1.977	60.1	0.244	69.0	0.086	−139.9	7.2
2600	0.504	151.6	1.830	57.6	0.257	67.9	0.111	−145.4	6.6
2800	0.500	150.1	1.761	55.1	0.274	67.5	0.127	−141.8	6.2
3000	0.494	146.5	1.688	52.3	0.294	66.6	0.130	−140.4	5.8

Table 19 Noise data, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.60	0.123	72.0	0.240
900	1.90	0.184	127.0	0.230
2000	2.60	0.400	−164.0	0.170

Table 20 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.700	−40.1	43.866	150.6	0.013	71.1	0.780	−24.3	39.8
100	0.551	−81.9	30.164	126.6	0.025	60.3	0.550	−44.7	32.7
200	0.451	−119.5	18.142	109.4	0.036	58.0	0.337	−57.9	26.7
300	0.426	−138.8	12.750	101.3	0.045	60.8	0.241	−64.1	23.2
400	0.422	−150.6	9.777	96.1	0.055	63.6	0.191	−69.1	20.8
500	0.420	−157.8	7.942	92.4	0.064	65.3	0.165	−72.9	19.0
600	0.416	−163.4	6.693	89.4	0.074	66.8	0.151	−75.0	17.4
700	0.412	−168.1	5.789	86.8	0.083	68.1	0.141	−75.5	16.1
800	0.408	−172.5	5.103	84.4	0.093	69.0	0.133	−74.3	15.0
900	0.408	−176.6	4.563	82.3	0.104	69.5	0.123	−73.1	14.0
1000	0.410	179.4	4.118	80.4	0.113	70.0	0.111	−72.4	13.1
1200	0.426	173.4	3.468	76.9	0.132	70.8	0.088	−75.7	11.7
1400	0.440	169.7	3.024	73.5	0.152	71.1	0.078	−87.2	10.6
1600	0.444	166.6	2.682	70.0	0.171	70.3	0.084	−97.8	9.6
1800	0.444	162.8	2.430	67.2	0.188	70.3	0.085	−100.3	8.7
2000	0.452	157.7	2.235	64.5	0.208	69.9	0.078	−102.8	8.0
2200	0.474	153.7	2.070	62.4	0.226	69.9	0.070	−116.6	7.4
2400	0.500	151.6	1.927	59.3	0.244	69.3	0.082	−135.5	7.0
2600	0.513	151.1	1.781	56.8	0.257	68.1	0.107	−141.7	6.4
2800	0.508	149.7	1.714	54.2	0.274	67.8	0.124	−138.6	6.0
3000	0.502	146.0	1.644	51.3	0.295	66.8	0.128	−137.2	5.7

NPN 2 GHz wideband transistor BFT24

DESCRIPTION

NPN transistor in a plastic SOT37 envelope.

It is primarily intended for use in RF low power amplifiers, such as in pocket phones, paging systems, etc.

The transistor features low current consumption (100 μA to 1 mA); due to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

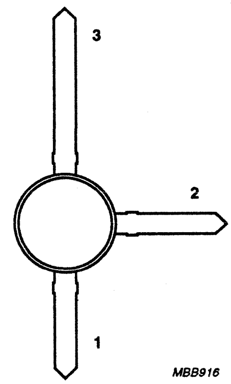


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
I_C	DC collector current		–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 173 °C (note 1)	–	30	mW
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_j = 25 °C	2.3	–	GHz
C_{re}	feedback capacitance	I_C = 1 mA; V_{CE} = 1 V; f = 1 MHz; T_{amb} = 25 °C	–	0.4	pF
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	17	–	dB
F	noise figure	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	3.8	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	6.5	mA
I_{CM}	peak collector current	f > 1 MHz	–	10	mA
P_{tot}	total power dissipation	up to T_s = 173 °C (note 1)	–	30	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 173 °C (note 1)	75 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 10$ µA; $V_{CE} = 1$ V	20	30	–	
		$I_C = 1$ mA; $V_{CE} = 1$ V	20	40	–	
f_T	transition frequency	$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz	1.2	2.3	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 0.5$ V; f = 1 MHz	–	0.55	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0$; f = 1 MHz	–	0.45	–	pF
C_{re}	feedback capacitance	$I_C = 1$ mA; $V_{CE} = 1$ V; f = 1 MHz; $T_{amb} = 25$ °C	–	0.4	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	17	–	dB
		$I_C = 1$ mA; $V_{CE} = 1$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	11	–	dB
F	noise figure	$I_C = 0.1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	5.5	–	dB
		$I_C = 1$ mA; $V_{CE} = 1$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	3.8	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

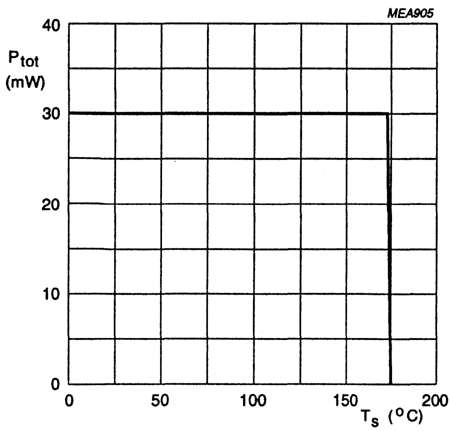
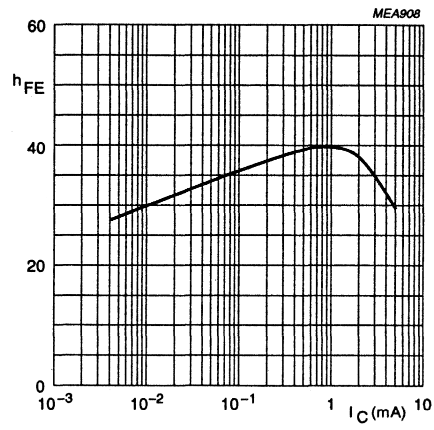
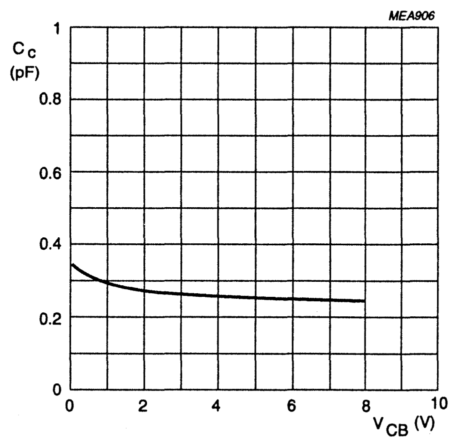


Fig.2 Power derating curve.



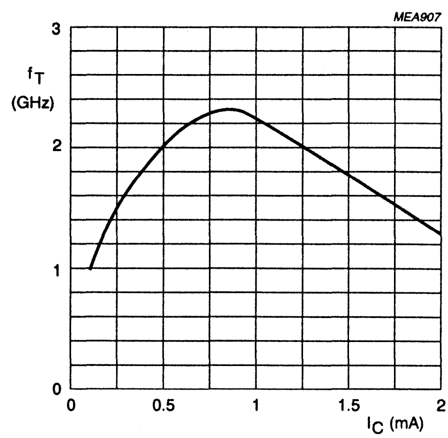
V_{CE} = 1 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



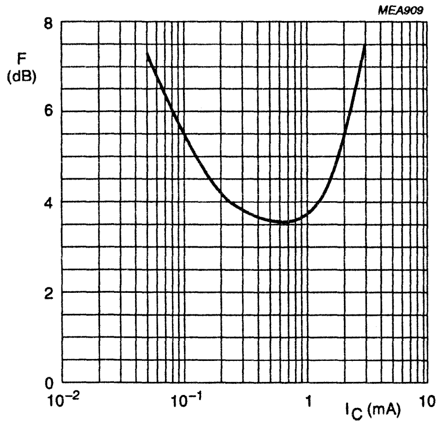
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



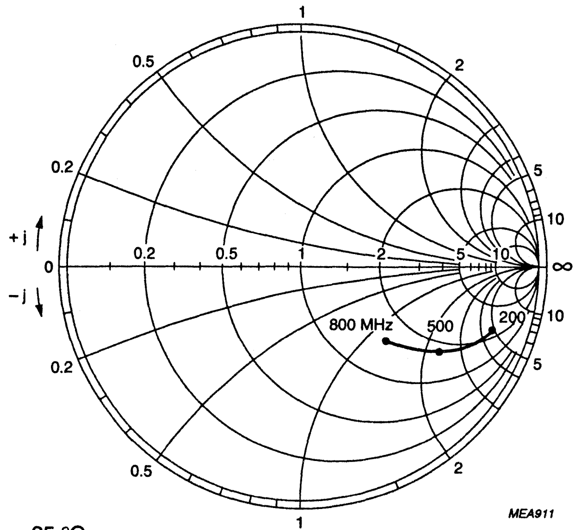
V_{CE} = 1 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



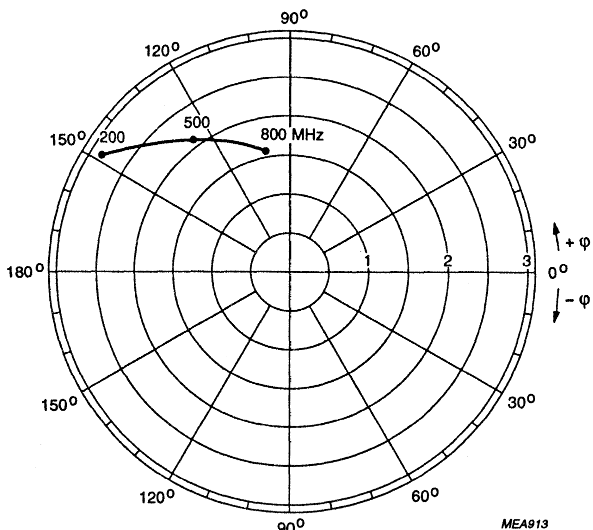
V_{CE} = 1 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.



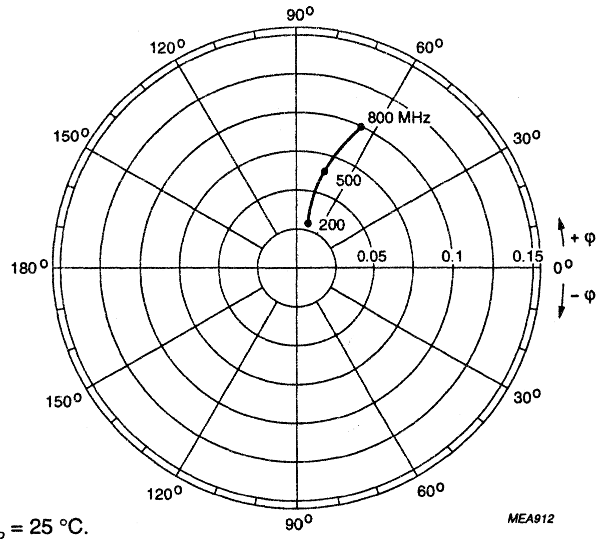
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.7 Common emitter input reflection coefficient (S_{11}).



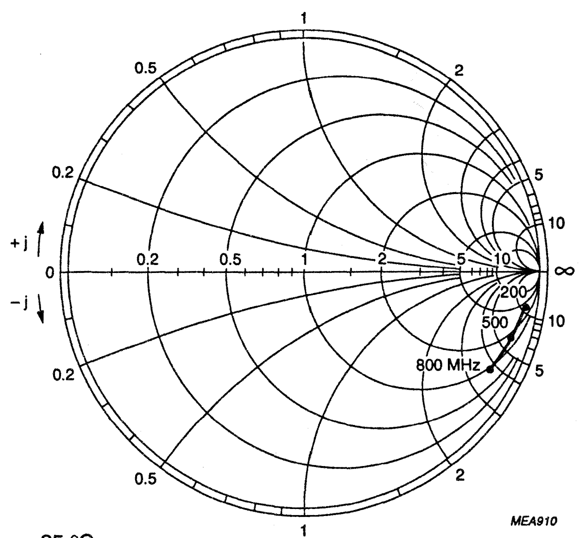
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.8 Common emitter forward transmission coefficient (S_{21}).



I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.9 Common emitter reverse transmission coefficient (S_{12}).



I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.10 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 1 mA; V_{CE} = 1 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.951	−3.3	3.291	174.4	0.008	87.9	0.995	−2.1	40.7
100	0.941	−8.5	3.218	168.3	0.020	84.7	0.991	−4.8	37.1
200	0.908	−16.5	3.057	157.9	0.039	79.7	0.970	−9.7	29.5
300	0.866	−22.3	2.904	147.1	0.056	75.4	0.952	−13.7	25.6
400	0.804	−29.3	2.811	137.4	0.072	70.8	0.925	−17.0	21.9
500	0.758	−34.7	2.602	129.7	0.085	70.2	0.902	−20.5	19.3
600	0.708	−38.2	2.422	123.3	0.099	68.3	0.872	−23.5	16.9
700	0.663	−43.4	2.308	116.7	0.110	66.0	0.851	−25.9	15.4
800	0.603	−45.7	2.137	109.8	0.122	64.6	0.832	−28.4	13.7
900	0.561	−48.1	2.024	103.4	0.133	62.8	0.811	−30.3	12.4
1000	0.521	−50.6	1.856	98.8	0.142	61.3	0.793	−32.6	11.1
1200	0.441	−54.7	1.683	90.2	0.161	59.7	0.758	−36.5	9.2
1400	0.407	−57.8	1.574	83.3	0.183	57.7	0.731	−41.4	8.0
1600	0.342	−62.0	1.454	74.7	0.201	55.2	0.711	−45.9	6.8
1800	0.309	−62.6	1.347	70.3	0.218	54.7	0.698	−50.5	5.9
2000	0.278	−60.4	1.253	62.7	0.236	52.5	0.680	−53.9	5.0
2200	0.236	−54.4	1.206	58.7	0.250	50.2	0.648	−58.3	4.2
2400	0.187	−59.0	1.168	50.9	0.269	47.6	0.612	−63.8	3.5
2600	0.155	−67.2	1.081	47.2	0.282	45.2	0.595	−70.2	2.7
2800	0.156	−61.6	1.102	43.3	0.299	44.0	0.591	−76.0	2.8
3000	0.144	−60.9	1.057	36.5	0.315	41.6	0.583	−81.0	2.4

NPN 2 GHz wideband transistor BFT25

DESCRIPTION

NPN transistor in a plastic SOT23 envelope.

It is primarily intended for use in RF low power amplifiers, such as in pocket phones, paging systems, etc. The transistor features low current consumption (100 µA to 1 mA); due to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PINNING

PIN	DESCRIPTION
Code: V1p	
1	base
2	emitter
3	collector

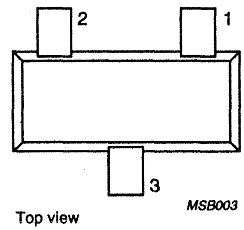


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
I_C	DC collector current		–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 142 °C (note 1)	–	30	mW
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_j = 25 °C	2.3	–	GHz
C_{re}	feedback capacitance	I_C = 1 mA; V_{CE} = 1 V; f = 1 MHz; T_{amb} = 25 °C	–	0.45	pF
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	18	–	dB
F	noise figure	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	3.8	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	6.5	mA
I_{CM}	peak collector current	f > 1 MHz	–	10	mA
P_{tot}	total power dissipation	up to T_s = 142 °C (note 1)	–	30	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 142 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

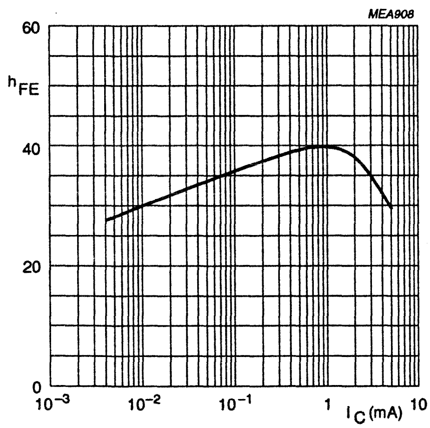
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 10 μA; V_{CE} = 1 V	20	30	–	
		I_C = 1 mA; V_{CE} = 1 V	20	40	–	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz	1.2	2.3	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 0.5 V; f = 1 MHz	–	–	0.6	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0; f = 1 MHz	–	–	0.5	pF
C_{re}	feedback capacitance	I_C = 1 mA; V_{CE} = 1 V; f = 1 MHz; T_{amb} = 25 °C	–	–	0.45	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 1 mA; V_{CE} = 1 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
F	noise figure	I_C = 0.1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	–	5.5	–	dB
		I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	–	3.8	–	dB

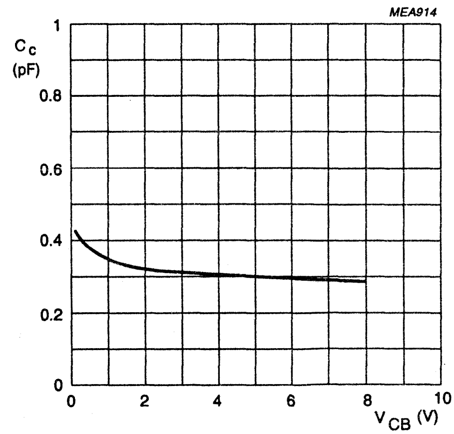
Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.



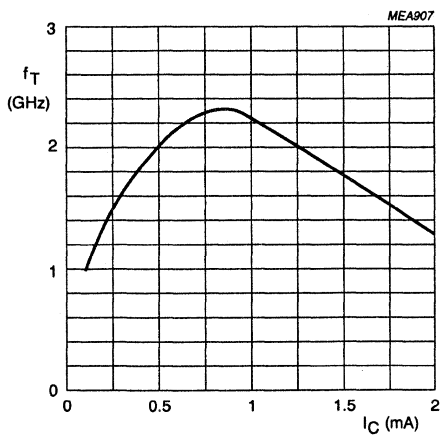
V_{CE} = 1 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



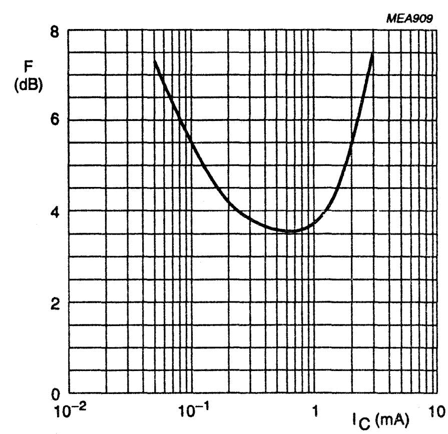
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



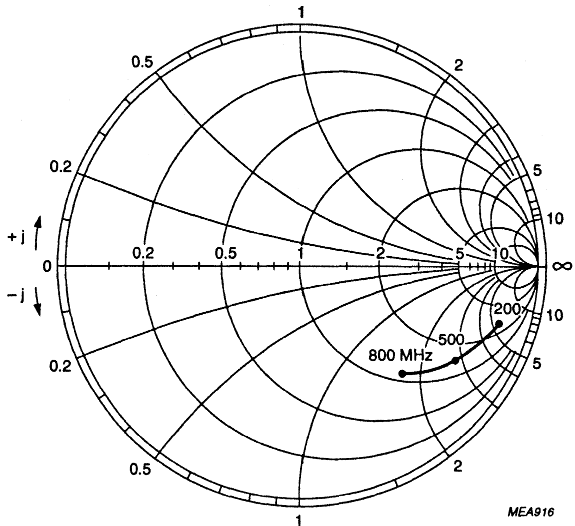
V_{CE} = 1 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



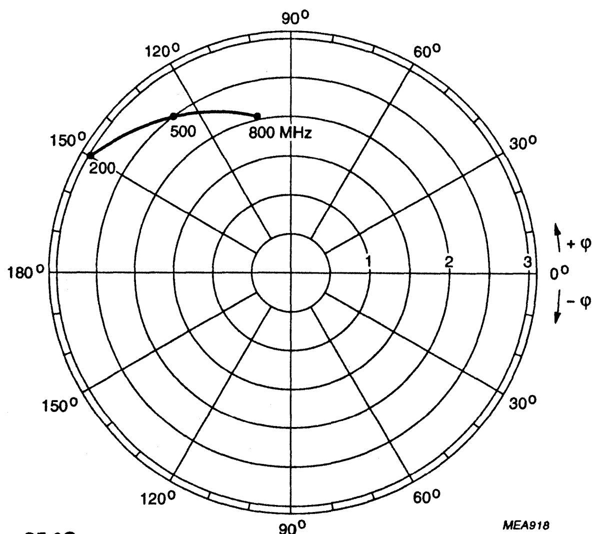
V_{CE} = 1 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C.

Fig.5 Minimum noise figure as a function of collector current.



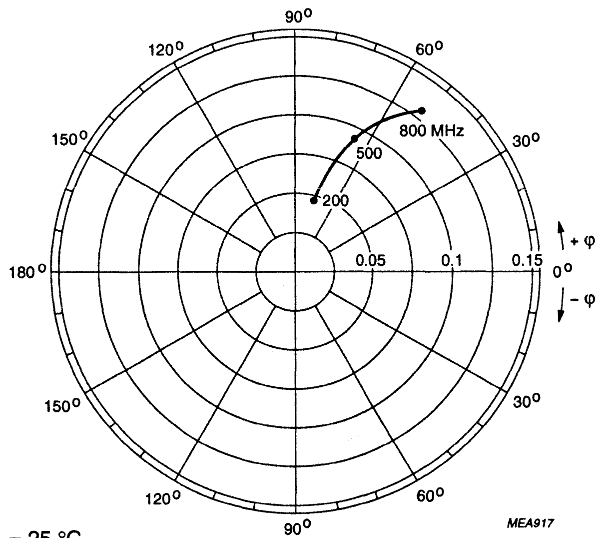
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.6 Common emitter input reflection coefficient (S_{11}).



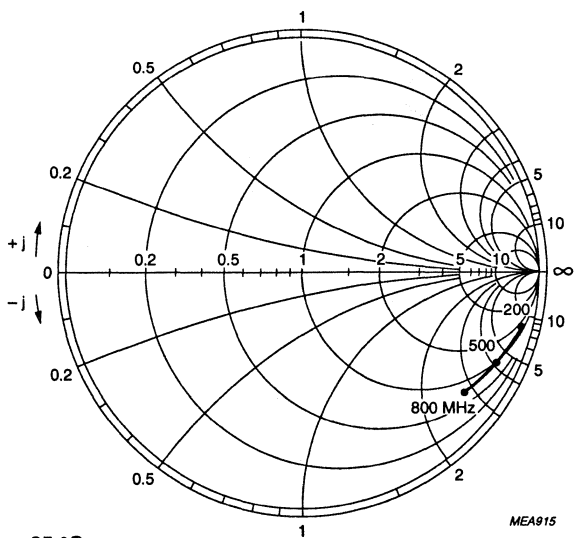
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.7 Common emitter forward transmission coefficient (S_{21}).



I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.8 Common emitter reverse transmission coefficient (S_{12}).



I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C.

Fig.9 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, $I_C = 1$ mA; $V_{CE} = 1$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.948	−2.8	3.158	176.0	0.008	83.6	0.998	−1.7	43.9
100	0.935	−7.2	3.098	168.9	0.023	84.2	0.993	−4.4	37.4
200	0.913	−13.0	3.061	160.5	0.045	80.5	0.972	−8.6	30.1
300	0.881	−19.7	2.917	151.2	0.066	76.6	0.952	−12.6	26.1
400	0.849	−24.9	2.753	143.5	0.085	74.1	0.930	−16.1	23.0
500	0.797	−30.4	2.722	135.8	0.102	71.9	0.899	−19.0	20.2
600	0.747	−34.0	2.526	129.3	0.118	69.3	0.878	−21.7	18.0
700	0.717	−36.3	2.364	123.6	0.132	68.0	0.848	−23.8	16.1
800	0.663	−40.7	2.237	116.7	0.145	65.7	0.829	−25.7	14.6
900	0.638	−43.0	2.112	112.1	0.156	64.7	0.814	−27.2	13.5
1000	0.584	−44.7	1.993	106.1	0.168	63.4	0.791	−28.8	12.1
1200	0.523	−49.3	1.797	97.1	0.189	61.3	0.756	−31.4	10.2
1400	0.463	−54.4	1.677	90.0	0.211	59.6	0.726	−34.1	8.8
1600	0.438	−53.3	1.548	84.9	0.230	58.4	0.707	−36.0	7.7
1800	0.396	−52.8	1.383	78.0	0.244	57.0	0.690	−37.8	6.4
2000	0.364	−56.7	1.351	72.8	0.262	55.7	0.671	−39.7	5.8
2200	0.295	−54.3	1.245	66.6	0.279	54.2	0.639	−41.7	4.6
2400	0.286	−57.4	1.222	62.5	0.301	52.5	0.615	−44.9	4.2
2600	0.263	−61.3	1.175	59.5	0.315	51.3	0.604	−47.8	3.7
2800	0.268	−60.1	1.120	56.6	0.332	50.6	0.597	−49.9	3.2
3000	0.238	−58.1	1.079	52.2	0.346	48.8	0.577	−51.3	2.7

NPN 5 GHz wideband transistor

BFT25A

FEATURES

- Low current consumption (100 μA - 1 mA)
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFT25A is a silicon npn transistor, primarily intended for use in RF low power amplifiers, such as pocket telephones and paging systems with signal frequencies up to 2 GHz.

The transistor is encapsulated in a 3-pin plastic SOT23 envelope.

PINNING

PIN	DESCRIPTION
Code: V10	
1	base
2	emitter
3	collector

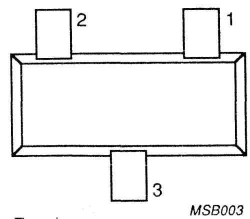


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	–	5	V
I_C	DC collector current		–	–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 140 °C note 1	–	–	32	mW
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	15	–	dB
F	noise figure	$\Gamma = \Gamma_{opt}$; I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	1.8	–	dB
		$\Gamma = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	2	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	8	V
V_{CEO}	collector-emitter voltage	open base	–	5	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 140 °C; note 1	–	32	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 5 V	–	–	50	µA
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
f_T	transition frequency	I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 500 MHz	3.5	5	–	GHz
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 1 V; f = 1 MHz	–	0.3	0.45	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	15	–	dB
F	noise figure	$\Gamma = \Gamma_{opt}$; I_C = 0.5 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	1.8	–	dB
		$\Gamma = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C; f = 1 GHz	–	2	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

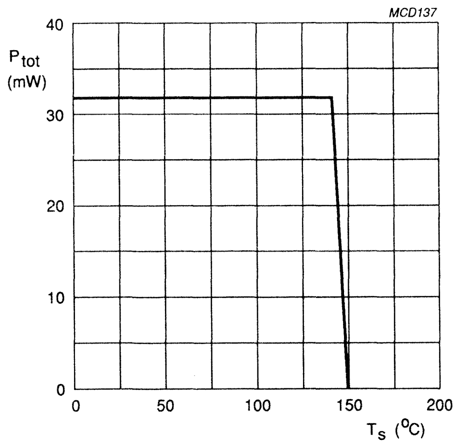
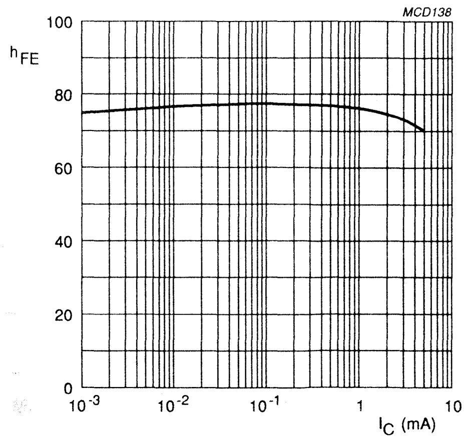
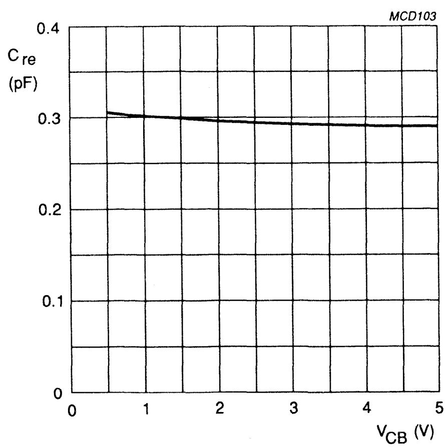


Fig.2 Power derating curve.



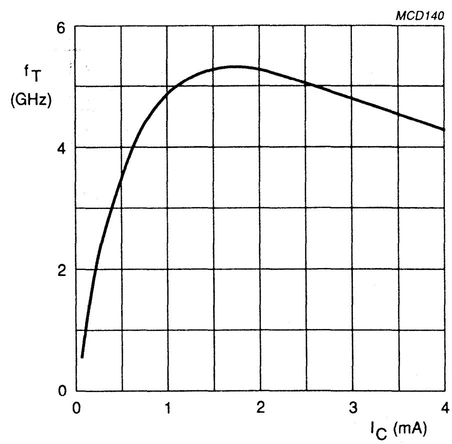
V_{CE} = 1 V.

Fig.3 DC current gain as a function of collector current.



$I_C = i_c = 0$; f = 1 MHz.

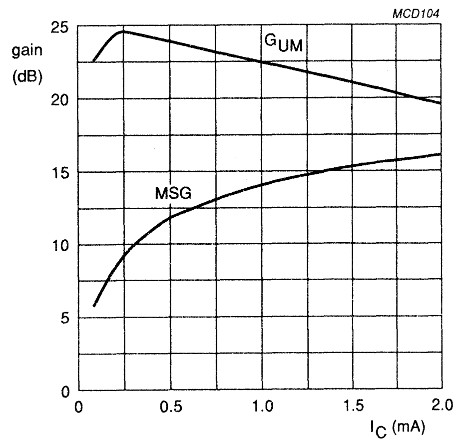
Fig.4 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 1 V; T_{amb} =25 °C; f = 500 MHz.

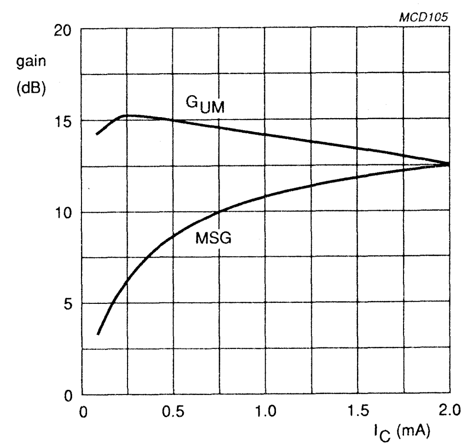
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



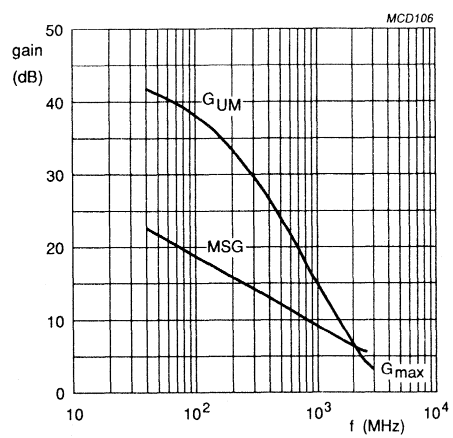
V_{CE} = 1 V; f = 500 MHz.

Fig.6 Gain as a function of collector current.



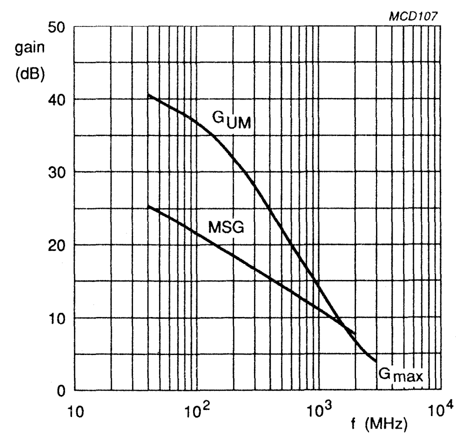
V_{CE} = 1 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



V_{CE} = 1 V; I_C = 0.5 mA.

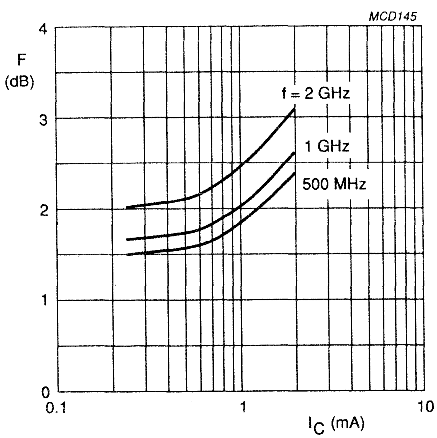
Fig.8 Gain as a function of frequency.



V_{CE} = 1 V; I_C = 1 mA.

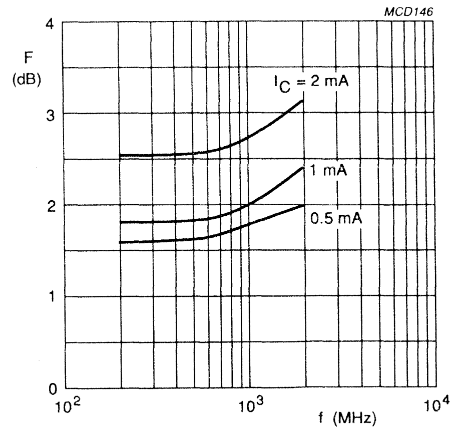
Fig.9 Gain as a function of frequency.

NPN 5 GHz wideband transistor BFT25A



V_{CE} = 1 V.

Fig.10 Minimum noise figure as a function of collector current.



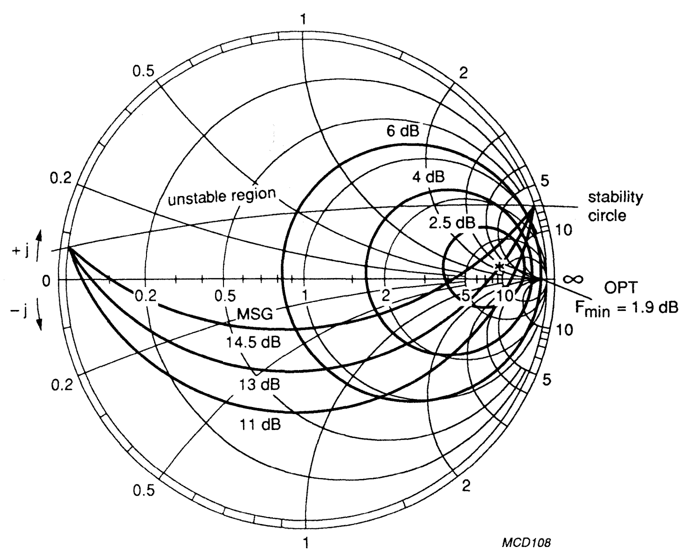
V_{CE} = 1 V.

Fig.11 Minimum noise figure as a function of frequency.

f (MHz)	V_{CE} (V)	I_C (mA)
500	1	1

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.9	0.79	4	2.5



Z_o = 50 Ω.

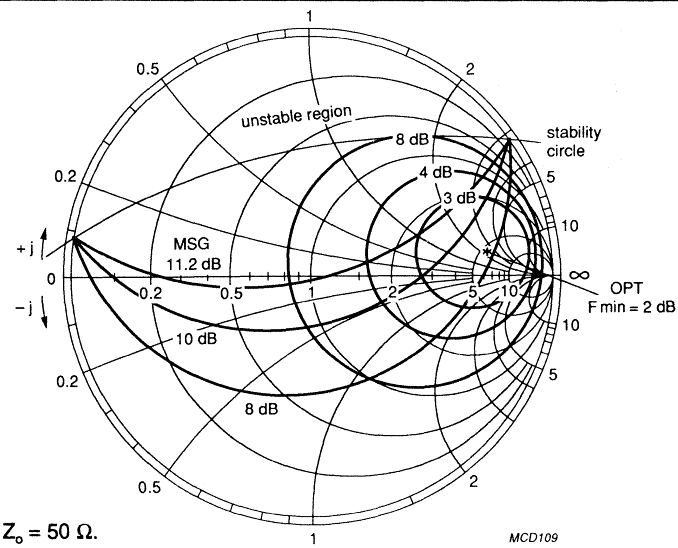
Average gain parameter: MSG = 14.5 dB.

Fig.12 Noise circle figure.

f (MHz)	V_{CE} (V)	I_C (mA)
1000	1	1

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.74	8	2.6



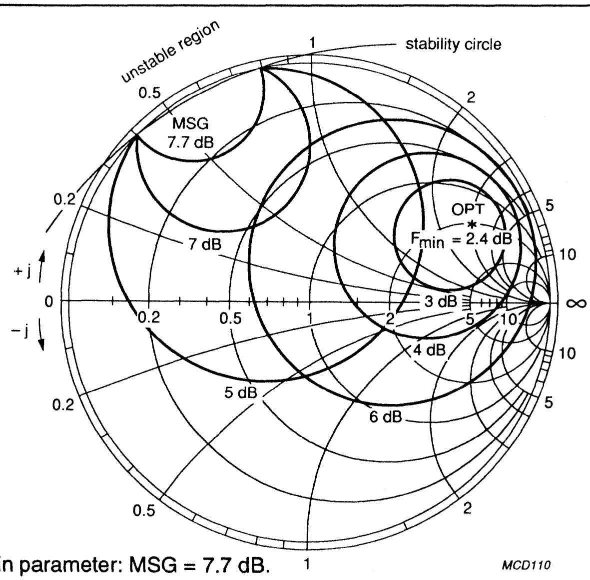
$Z_o = 50\ \Omega$.
Average gain parameter: MSG = 11.2 dB.

Fig.13 Noise circle figure.

f (MHz)	V_{CE} (V)	I_C (mA)
2000	1	1

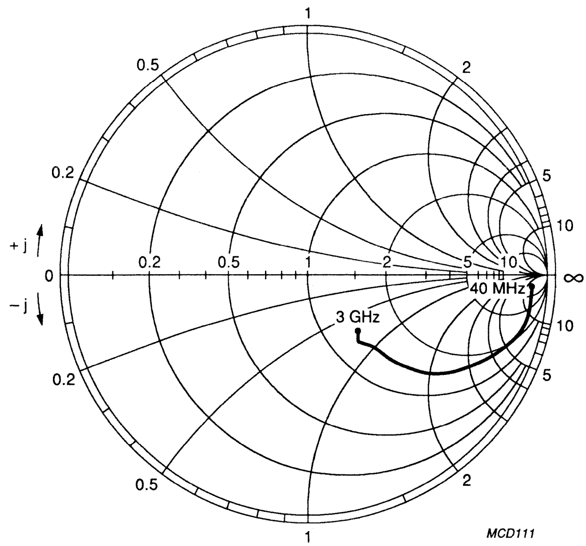
Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.72	26	1.7



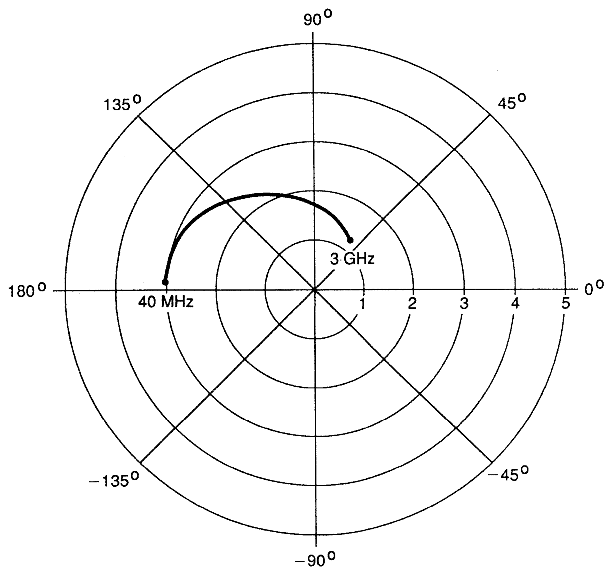
$Z_o = 50\ \Omega$.
Average gain parameter: MSG = 7.7 dB.

Fig.14 Noise circle figure.



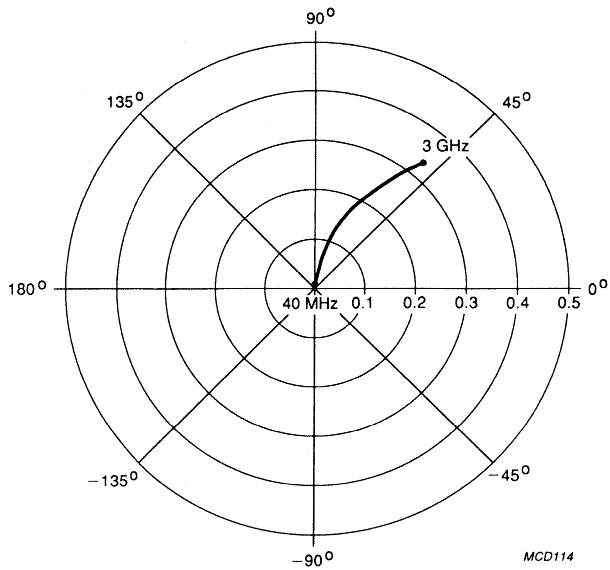
V_{CE} = 1 V; I_C = 1 mA.

Fig.15 Common emitter input reflection coefficient (S_{11}).



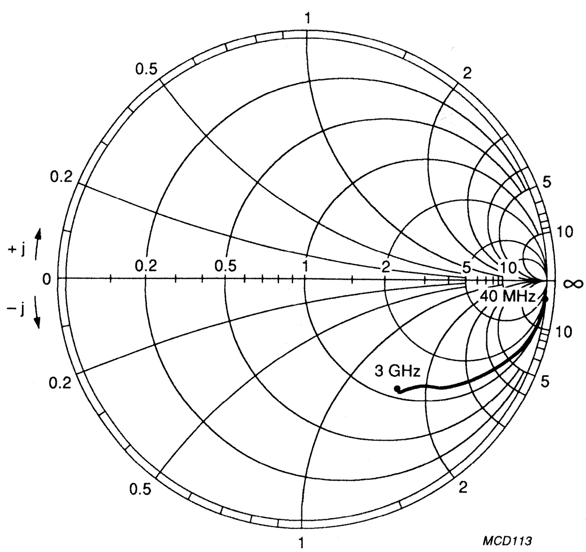
V_{CE} = 1 V; I_C = 1 mA.

Fig.16 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 1 V; I_C = 1 mA.

Fig.17 Common emitter reverse transmission coefficient (S_{12}).

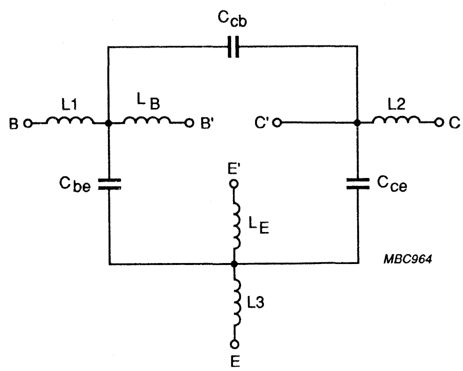


V_{CE} = 1 V; I_C = 1 mA.

Fig.18 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFT25A crystal

1	IS = 13.77	aA
2	BF = 85.65	–
3	NF = 979.9	m
4	VAF = 50.80	V
5	IKF = 10.00	A
6	ISE = 2.199	fA
7	NE = 1.857	–
8	BR = 16.97	–
9	NR = 985.5	m
10	VAR = 2.491	V
11	IKR = 188.0	mA
12	ISC = 205.1	aA
13	NC = 1.107	–
14	RB = 80.00	Ω
15	IRB = 1.000	μA
16	RBM = 80.00	Ω
17	RE = 7.911	Ω
18	RC = 5.300	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 223.0	fF
23	VJE = 669.7	mV
24	MJE = 59.66	m
25	TF = 5.112	ps
26	XTF = 7.909	–
27	VTF = 1.338	V
28	ITF = 5.662	mA
29	PTF = 15.37	deg
30	CJC = 229.0	fF
31	VJC = 394.7	mV
32	MJC = 43.32	m
33	XCJC = 50.00	m
34	TR = 13.26	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 987.8	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 1000 MHz.

Fig.19 Package equivalent circuit SOT23.

List of components (see Fig.19)

DESIGNATION	VALUE
C_{be}	71 fF
C_{cb}	71 fF
C_{ce}	2 fF
L1	0.35 nH
L2	0.17 nH
L3	0.35 nH
L_B	0.40 nH
L_E	0.83 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 0.25 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.986	−1.2	0.89	177.8	0.009	88.5	0.999	−1	40.8
100	0.983	−2.8	0.893	174.1	0.022	85.7	0.998	−2.5	37.1
200	0.98	−5.4	0.89	169.3	0.043	85.5	0.996	−5.1	33.6
300	0.976	−8.1	0.888	164.3	0.063	83	0.992	−7.6	30.1
400	0.967	−10.6	0.883	159.1	0.084	81.2	0.987	−10.2	26.8
500	0.96	−13.1	0.884	154.2	0.104	79	0.983	−12.6	24.7
600	0.953	−15.8	0.885	149.6	0.122	77.3	0.977	−14.9	22.7
700	0.941	−18.2	0.879	144.6	0.141	75.6	0.971	−17.2	20.8
800	0.929	−20.4	0.874	140.1	0.158	73.4	0.963	−19.3	18.8
900	0.911	−22.6	0.873	135.1	0.174	71.5	0.955	−21.4	17.1
1000	0.896	−24.7	0.875	130.5	0.19	69.5	0.943	−23.5	15.4
1200	0.859	−29.3	0.874	121.2	0.221	65.5	0.916	−27.6	12.6
1400	0.825	−33.2	0.882	113.7	0.25	62.1	0.894	−31.6	10.8
1600	0.795	−36.6	0.87	106.6	0.272	59.2	0.871	−34.9	9.3
1800	0.755	−39.7	0.867	99.4	0.292	56.3	0.846	−38	7.9
2000	0.707	−42.2	0.858	92.1	0.305	52.9	0.808	−40.7	6.3
2200	0.66	−45.7	0.864	85.6	0.322	49.8	0.769	−44.3	5.1
2400	0.623	−49.1	0.871	80.3	0.343	47.2	0.74	−48.2	4.4
2600	0.602	−52.5	0.881	75.3	0.359	45	0.723	−51.5	4.1
2800	0.577	−52.8	0.861	71.2	0.364	43.7	0.707	−53.3	3.5
3000	0.532	−54	0.849	67	0.369	42.3	0.674	−55	2.7

Table 2 Noise data, V_{CE} = 1 V, I_C = 0.25 mA

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.6	0.91	4	3.6
1000	1.8	0.78	9	3.5
2000	2.1	0.8	28	2

Table 3 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.971	−1.5	1.706	177.5	0.009	85.6	0.998	−1.2	42
100	0.97	−3.7	1.706	173.5	0.022	85.9	0.997	−3.1	38.5
200	0.961	−7.3	1.691	167.9	0.042	84.5	0.992	−6.1	33.6
300	0.953	−10.8	1.676	162.1	0.063	81.8	0.984	−9.1	29.9
400	0.939	−14.2	1.65	156.5	0.082	79.4	0.975	−12.1	26.7
500	0.921	−17.4	1.628	151.1	0.101	77.3	0.965	−14.9	24.1
600	0.905	−20.6	1.604	146	0.119	75	0.954	−17.5	22
700	0.882	−23.7	1.569	140.6	0.135	73.1	0.942	−19.9	20
800	0.863	−26.2	1.531	135.7	0.151	70.8	0.928	−22.2	18.2
900	0.836	−28.8	1.499	130.6	0.165	69.1	0.914	−24.4	16.5
1000	0.81	−31.2	1.475	126	0.179	67	0.896	−26.4	15.1
1200	0.756	−35.8	1.416	116.6	0.205	63.3	0.859	−30.4	12.5
1400	0.709	−40	1.372	108.9	0.229	60.6	0.828	−34.1	10.8
1600	0.67	−42.7	1.306	102.2	0.247	58.4	0.801	−37	9.4
1800	0.624	−45.2	1.257	95.1	0.265	56.4	0.775	−39.4	8.1
2000	0.573	−46.9	1.21	88.4	0.276	53.7	0.736	−41.5	6.8
2200	0.523	−49.7	1.179	82.4	0.292	51.4	0.697	−44.4	5.7
2400	0.486	−53	1.156	77.1	0.309	49.5	0.669	−48	5
2600	0.465	−55.5	1.143	72.4	0.326	48.3	0.654	−51	4.6
2800	0.444	−55	1.099	68.4	0.334	47.4	0.641	−52.5	4.1
3000	0.404	−54.2	1.065	64.6	0.341	46.8	0.612	−53.6	3.4

Table 4 Noise data, V_{CE} = 1 V, I_C = 0.5 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.84	4	2.8
1000	1.8	0.77	8	2.9
2000	2	0.75	27	1.8

Table 5 Common emitter scattering parameters, V_{CE} = 1 V, I_C = 1 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.946	−2.2	3.078	176.5	0.009	86.5	0.996	−1.6	40.6
100	0.94	−5.4	3.067	171.3	0.021	85.3	0.993	−4	37.5
200	0.923	−10.6	3.003	163.8	0.041	82.7	0.981	−7.8	32.1
300	0.903	−15.6	2.923	156.3	0.061	79.5	0.964	−11.5	28.2
400	0.873	−19.9	2.815	149.2	0.08	76.7	0.945	−14.9	25
500	0.84	−24.1	2.708	142.6	0.096	74.5	0.924	−18	22.3
600	0.807	−27.9	2.597	136.5	0.111	72.2	0.902	−20.7	20.2
700	0.772	−31.1	2.472	130.4	0.125	70	0.881	−23.1	18.3
800	0.736	−33.6	2.35	125.3	0.138	68.5	0.859	−25.1	16.6
900	0.699	−35.9	2.24	119.9	0.15	67	0.839	−27	15.2
1000	0.665	−38	2.147	115.3	0.161	65.6	0.817	−28.6	14
1200	0.599	−41.8	1.966	106.2	0.183	63	0.775	−31.7	11.8
1400	0.551	−44.8	1.83	99	0.204	61.2	0.745	−34.6	10.3
1600	0.513	−46.3	1.688	92.9	0.221	60.2	0.721	−36.7	9.1
1800	0.472	−47.6	1.58	86.8	0.239	59	0.702	−38.4	8
2000	0.427	−47.6	1.485	80.8	0.252	57.1	0.671	−40	6.9
2200	0.384	−49.2	1.417	75.7	0.268	55.4	0.637	−42.3	6
2400	0.354	−51.8	1.36	71.2	0.288	54.2	0.613	−45.5	5.3
2600	0.34	−53.7	1.326	67.1	0.306	52.9	0.601	−48.5	4.9
2800	0.33	−52	1.262	63.4	0.317	52.2	0.595	−49.7	4.4
3000	0.299	−50	1.208	60.2	0.326	51.6	0.573	−50.7	3.8

Table 6 Noise data, V_{CE} = 1 V, I_C = 1 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.9	0.79	4	2.5
1000	2	0.74	8	2.6
2000	2.4	0.72	26	1.7

Table 7 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 0.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.972	−1.3	1.703	177.5	0.008	86.7	0.999	−1.2	42.7
100	0.971	−3.5	1.702	173.8	0.021	86.1	0.997	−3	39.1
200	0.966	−6.8	1.689	168.5	0.04	84.7	0.992	−5.9	34.5
300	0.957	−10.2	1.674	163	0.06	82	0.986	−8.9	30.8
400	0.945	−13.3	1.65	157.8	0.08	80.2	0.978	−11.7	27.7
500	0.93	−16.4	1.632	152.6	0.098	77.7	0.969	−14.4	25.1
600	0.915	−19.4	1.609	147.7	0.115	75.7	0.959	−17	22.9
700	0.894	−22.3	1.578	142.5	0.131	74	0.947	−19.4	20.8
800	0.874	−24.7	1.543	137.8	0.147	71.8	0.934	−21.7	19
900	0.852	−27.1	1.514	132.9	0.161	69.8	0.92	−23.9	17.3
1000	0.828	−29.2	1.489	128.4	0.174	68.1	0.903	−25.9	15.8
1200	0.777	−33.9	1.435	119.3	0.2	64.4	0.868	−29.9	13.2
1400	0.733	−38	1.396	111.7	0.224	61.7	0.838	−33.7	11.5
1600	0.695	−40.7	1.331	105	0.243	59.3	0.811	−36.5	10
1800	0.65	−43	1.282	98.2	0.26	57.4	0.784	−39	8.7
2000	0.599	−45.1	1.233	91.3	0.273	54.6	0.745	−41.2	7.3
2200	0.55	−48	1.202	85.3	0.288	52.3	0.706	−44.1	6.2
2400	0.515	−50.9	1.182	80.1	0.306	50.3	0.676	−47.7	5.4
2600	0.496	−53.3	1.167	75.5	0.322	48.9	0.66	−50.7	5.1
2800	0.473	−53.1	1.126	71.5	0.33	48	0.646	−52.1	4.5
3000	0.435	−52.9	1.086	67.7	0.336	47.4	0.618	−53.2	3.7

Table 8 Noise data, V_{CE} = 3 V, I_C = 0.5 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.85	3	3
1000	1.8	0.78	8	3.1
2000	2	0.8	25	2.2

Table 9 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 1 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.95	−2.1	3.086	176.6	0.008	83.9	0.997	−1.5	41.4
100	0.945	−4.9	3.073	171.9	0.02	85.2	0.994	−3.8	38.3
200	0.931	−9.6	3.021	165.1	0.04	83.4	0.984	−7.6	33.3
300	0.914	−14	2.953	158.2	0.058	80.5	0.97	−11.1	29.5
400	0.889	−18.2	2.858	151.6	0.077	77.5	0.952	−14.5	26.2
500	0.859	−21.9	2.766	145.4	0.093	75.4	0.933	−17.6	23.5
600	0.83	−25.6	2.669	139.6	0.109	73.4	0.913	−20.4	21.4
700	0.798	−28.9	2.554	133.8	0.123	71.5	0.892	−22.8	19.5
800	0.767	−31.3	2.438	128.8	0.136	69.5	0.872	−24.9	17.8
900	0.733	−33.7	2.336	123.6	0.148	68.1	0.851	−26.9	16.3
1000	0.701	−35.6	2.247	119	0.159	66.8	0.828	−28.6	15
1200	0.636	−39.6	2.072	110.1	0.181	63.9	0.786	−31.9	12.8
1400	0.587	−42.9	1.939	102.9	0.202	62.4	0.753	−35	11.2
1600	0.551	−44.4	1.789	96.8	0.219	60.8	0.727	−37	9.9
1800	0.51	−45.7	1.679	90.8	0.237	59.5	0.706	−38.8	8.8
2000	0.465	−45.9	1.577	84.7	0.249	57.4	0.672	−40.2	7.6
2200	0.42	−48.1	1.505	79.4	0.265	56	0.637	−42.5	6.7
2400	0.39	−50.1	1.447	74.9	0.284	54.5	0.611	−45.7	6
2600	0.375	−52.6	1.408	70.9	0.302	53.2	0.599	−48.6	5.6
2800	0.361	−51.4	1.337	67.1	0.313	52.6	0.591	−49.7	5
3000	0.331	−49.3	1.282	63.9	0.321	52	0.568	−50.4	4.4

Table 10 Noise data, V_{CE} = 3 V, I_C = 1 mA

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.9	0.8	3	2.6
1000	2	0.75	8	2.8
2000	2.3	0.75	25	1.9

Table 11 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.905	−2.9	5.215	175.2	0.008	86.7	0.994	−2	40.8
100	0.896	−7.1	5.152	168.8	0.02	84.5	0.987	−5.1	37.2
200	0.868	−13.7	4.955	159.3	0.038	81.9	0.965	−9.9	31.6
300	0.829	−19.6	4.7	150.2	0.055	78.2	0.935	−14.1	27.5
400	0.784	−24.7	4.396	142	0.072	75.9	0.901	−17.8	24.3
500	0.736	−28.7	4.105	134.7	0.086	73	0.869	−20.8	21.8
600	0.695	−32.5	3.824	128.3	0.098	71.6	0.838	−23.2	19.8
700	0.65	−35	3.544	122.3	0.111	70.2	0.812	−25.2	18
800	0.615	−37.1	3.287	117.3	0.122	69	0.787	−26.7	16.6
900	0.579	−38.9	3.066	112.4	0.132	68.3	0.766	−28.1	15.3
1000	0.545	−40	2.884	108.2	0.143	67.6	0.744	−29.1	14.2
1200	0.484	−42.4	2.561	100.2	0.163	65.8	0.706	−31.4	12.3
1400	0.442	−44.1	2.323	93.9	0.184	64.8	0.679	−33.7	11
1600	0.417	−44.5	2.099	88.7	0.201	63.9	0.662	−35.1	9.8
1800	0.386	−44.4	1.937	83.5	0.22	63.1	0.649	−36.6	8.8
2000	0.351	−43	1.796	78.2	0.234	61.4	0.624	−37.6	7.8
2200	0.317	−44.2	1.692	73.8	0.252	59.8	0.594	−39.6	6.9
2400	0.295	−45.8	1.608	70	0.273	58.7	0.573	−42.6	6.3
2600	0.285	−48.6	1.551	66.4	0.291	57.4	0.564	−45.6	5.8
2800	0.279	−46	1.466	63.1	0.304	56.7	0.56	−46.7	5.3
3000	0.255	−42.9	1.398	60.4	0.315	56	0.542	−47.3	4.7

Table 12 Noise data, V_{CE} = 3 V, I_C = 2 mA

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.5	0.81	3	2.4
1000	2.5	0.71	8	2.6
2000	3	0.69	25	1.7

PNP 5 GHz wideband transistor

BFT92

DESCRIPTION

PNP transistor in a plastic SOT23 envelope.

It is primarily intended for use in RF wideband amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc. The transistor features low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

NPN complements are BFR92 and BFR92A.

PINNING

PIN	DESCRIPTION
Code: W1p	
1	base
2	emitter
3	collector

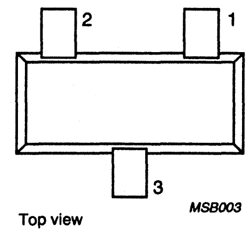


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
I_C	DC collector current		–	–25	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = –14 mA; V_{CE} = –10 V; f = 500 MHz	5	–	GHz
C_{re}	feedback capacitance	I_C = –2 mA; V_{CE} = –10 V; f = 1 MHz	0.7	–	pF
G_{UM}	maximum unilateral power gain	I_C = –14 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	18	–	dB
F	noise figure	I_C = –5 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	2.5	–	dB
d_{im}	intermodulation distortion	I_C = –14 mA; V_{CE} = –10 V; R_L = 75 Ω; V_O = 150 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 493.25 MHz	–60	–	dB

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–25	mA
I_{CM}	peak collector current	f > 1 MHz	–	–35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

PNP 5 GHz wideband transistor BFT92

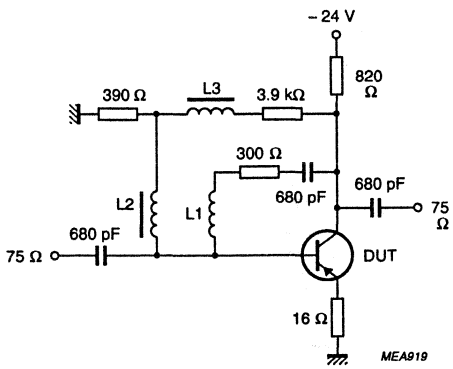
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -10$ V	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -14$ mA; $V_{CE} = -10$ V	20	50	–	
f_T	transition frequency	$I_C = -14$ mA; $V_{CE} = -10$ V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	0.75	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	0.8	–	pF
C_{re}	feedback capacitance	$I_C = -2$ mA; $V_{CE} = -10$ V; f = 1 MHz	–	0.7	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -14$ mA; $V_{CE} = -10$ V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
F	noise figure	$I_C = -5$ mA; $V_{CE} = -10$ V; f = 500 MHz; T_{amb} = 25 °C	–	2.5	–	dB
V_O	output voltage	note 2	–	150	–	mV

Notes

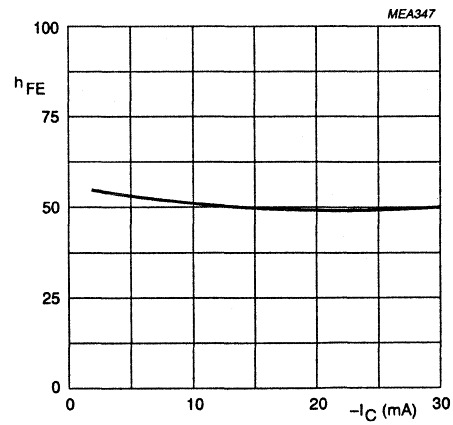
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B); $I_C = -14$ mA; $V_{CE} = -10$ V; $R_L = 75\ \Omega$;
   $V_p = V_O$ at $d_{im} = -60$ dB; f_p = 495.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 503.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.



L2 = L3 = 5 µH Ferroxcube choke, catalogue number 3122 108 20150.

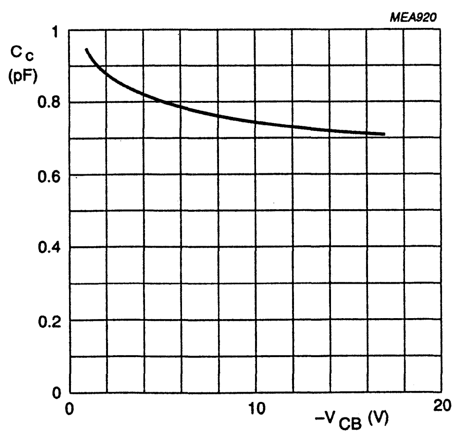
L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.



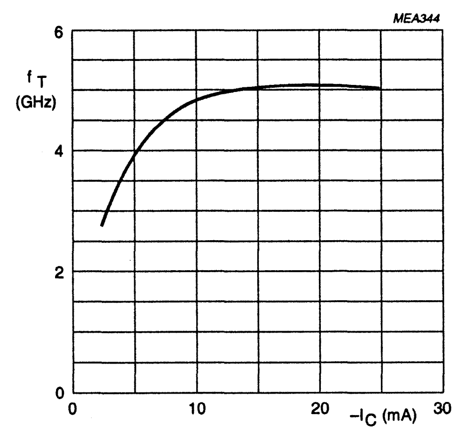
V_{CE} = −10 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



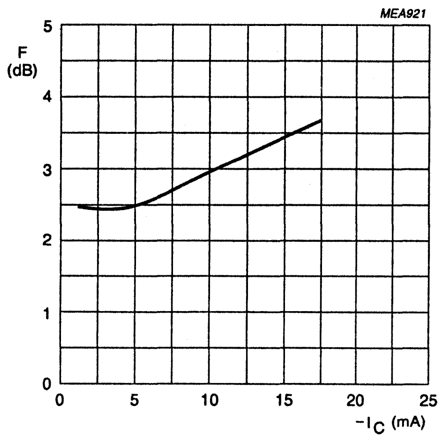
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



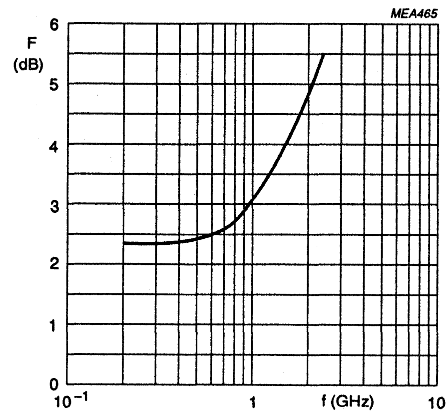
V_{CE} = −10 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



$V_{CE} = -10$ V; Z_S = opt.; f = 500 MHz; $T_{amb} = 25$ °C.

Fig.6 Minimum noise figure as a function of collector current.



$I_C = -2$ mA; $V_{CE} = -10$ V; Z_S = opt.; $T_{amb} = 25$ °C.

Fig.7 Minimum noise figure as a function of frequency.

Table 1 Common emitter scattering parameters, $I_C = -15$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.475	−21.7	19.699	163.2	0.010	81.5	0.937	−9.0	36.2
100	0.428	−51.1	16.745	143.8	0.022	72.4	0.836	−19.1	30.6
200	0.355	−86.3	12.160	123.0	0.036	67.0	0.675	−26.6	24.9
300	0.316	−109.2	9.143	110.8	0.048	66.7	0.579	−28.4	21.5
400	0.297	−124.4	7.231	102.7	0.057	67.3	0.525	−28.5	19.0
500	0.287	−135.0	5.962	96.8	0.068	68.2	0.494	−28.5	17.1
600	0.281	−143.0	5.069	92.1	0.078	69.1	0.476	−28.6	15.6
700	0.275	−149.2	4.409	88.1	0.088	69.7	0.465	−28.8	14.3
800	0.269	−155.1	3.904	84.5	0.098	70.2	0.459	−29.1	13.2
900	0.264	−160.7	3.504	81.1	0.109	70.3	0.453	−29.4	12.2
1000	0.265	−165.8	3.177	78.1	0.119	70.4	0.449	−30.1	11.3
1200	0.273	−174.7	2.700	72.7	0.138	70.3	0.442	−31.6	9.9
1400	0.286	179.0	2.375	67.8	0.158	70.2	0.437	−33.6	8.8
1600	0.285	174.0	2.123	63.1	0.177	69.7	0.437	−35.5	7.8
1800	0.284	168.0	1.918	59.1	0.195	69.4	0.434	−37.6	6.9
2000	0.296	159.9	1.762	55.1	0.215	68.8	0.425	−39.6	6.2
2200	0.325	153.8	1.642	51.7	0.235	68.2	0.411	−42.3	5.6
2400	0.351	150.6	1.554	47.6	0.256	67.4	0.400	−46.5	5.2
2600	0.359	148.9	1.451	44.4	0.273	66.7	0.394	−50.8	4.6
2800	0.365	144.1	1.396	41.8	0.294	66.5	0.393	−53.9	4.2
3000	0.381	137.2	1.334	38.4	0.316	65.6	0.382	−56.7	3.9

PNP 5 GHz wideband transistor BFT92W

FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

DESCRIPTION

Silicon PNP transistor in a plastic SOT323 envelope. It is intended as a general purpose transistor for wideband applications up to 2 GHz. The BFT92W uses the same crystal as the SOT23 version, BFT92.

PINNING

PIN	DESCRIPTION
Code: W1	
1	base
2	emitter
3	collector

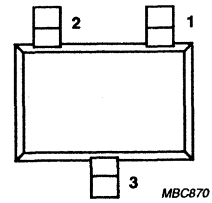


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	–	–	20	V
$-V_{CEO}$	collector-emitter voltage	open base	–	–	15	V
$-I_C$	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 87 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	$-I_C$ = 15 mA; $-V_{CE}$ = 10 V	20	50	–	
f_T	transition frequency	$-I_C$ = 15 mA; $-V_{CE}$ = 10 V	–	5	–	GHz
G_{UM}	maximum unilateral power gain	$-I_C$ = 15 mA; $-V_{CE}$ = 10 V; f = 500 MHz	–	18	–	dB
F	noise figure	$-I_C$ = 5 mA; $-V_{CE}$ = 10 V; f = 500 MHz	–	2.5	–	dB
C_{re}	feedback capacitance	$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 MHz	–	0.7	–	pF
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	290	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

PNP 5 GHz wideband transistor BFT93

DESCRIPTION

PNP transistor in a plastic SOT23 envelope.

It is primarily intended for use in RF wideband amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc. The transistor features low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

NPN complements are BFR93 and BFR93A.

PINNING

PIN	DESCRIPTION
	Code: X1p
1	base
2	emitter
3	collector

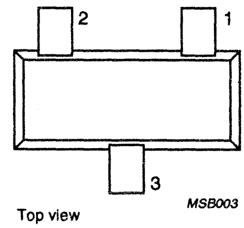


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–15	V
V_{CEO}	collector-emitter voltage	open base	–	–12	V
I_C	DC collector current		–	–35	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = –2 mA; V_{CE} = –5 V; f = 1 MHz	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	16.5	–	dB
F	noise figure	I_C = –10 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	2.4	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = –30 mA; V_{CE} = –5 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 493.25 MHz	300	–	mV

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

PNP 5 GHz wideband transistor BFT93

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–15	V
V_{CEO}	collector-emitter voltage	open base	–	–12	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–35	mA
I_{CM}	peak collector current	f > 1 MHz	–	–50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °C (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

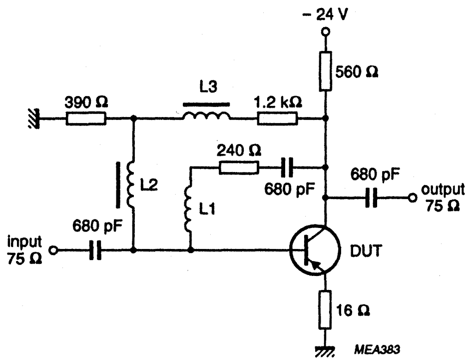
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -5$ V	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -30$ mA; $V_{CE} = -5$ V	20	50	–	
f_T	transition frequency	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	0.95	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = -0.5$ V; f = 1 MHz	–	1.8	–	pF
C_{re}	feedback capacitance	$I_C = -2$ mA; $V_{CE} = -5$ V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -30$ mA; $V_{CE} = -5$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	16.5	–	dB
F	noise figure	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	2.4	–	dB
V_O	output voltage	see Fig.2 and note 2	–	300	–	mV

Notes

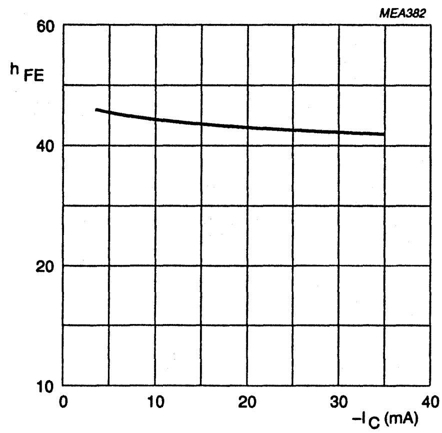
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B); $I_C = -30$ mA; $V_{CE} = -5$ V; $R_L = 75\ \Omega$;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 495.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 503.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 505.25$ MHz;
   measured at $f_{(p+q-r)} = 493.25$ MHz.



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

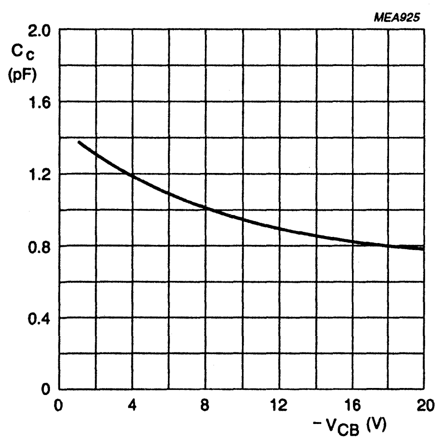
L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.



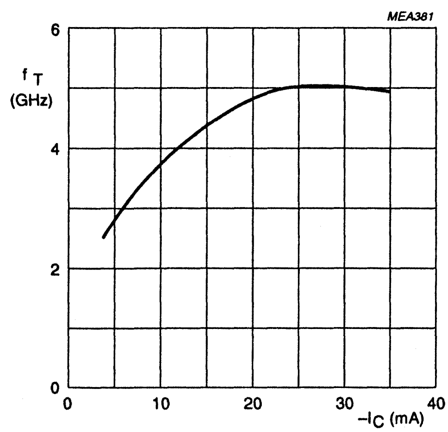
V_{CE} = –5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



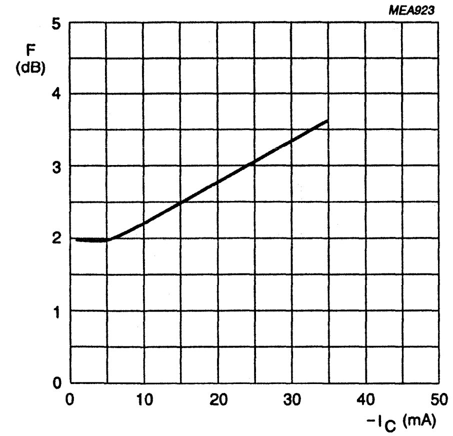
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



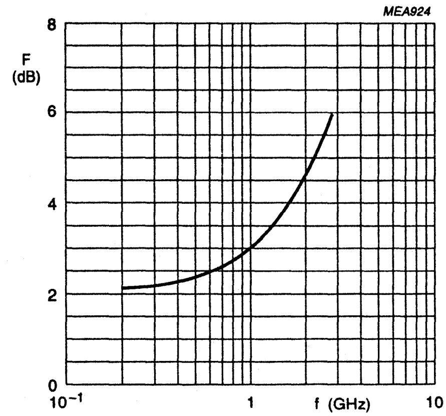
V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



V_{CE} = –5 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.



I_C = –2 mA; V_{CE} = –5 V; Z_S = opt.; T_{amb} = 25 °C.

Fig.7 Minimum noise figure as a function of frequency.

Table 1 Common emitter scattering parameters, $I_C = -30$ mA; $V_{CE} = -10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.464	−44.5	30.411	151.4	0.017	73.5	0.777	−26.2	34.7
100	0.406	−91.1	21.158	126.3	0.032	64.6	0.553	−50.5	28.9
200	0.370	−128.2	12.731	107.6	0.050	63.9	0.346	−68.4	23.3
300	0.363	−145.9	8.907	98.4	0.066	65.8	0.252	−77.2	19.9
400	0.363	−155.9	6.831	92.1	0.082	67.4	0.204	−82.9	17.5
500	0.361	−162.5	5.533	87.5	0.098	68.2	0.177	−86.9	15.6
600	0.360	−167.5	4.671	83.6	0.115	68.3	0.160	−89.4	14.1
700	0.360	−171.9	4.045	80.2	0.132	68.2	0.149	−91.1	12.8
800	0.355	−175.8	3.579	77.0	0.148	68.0	0.140	−91.9	11.7
900	0.354	−179.9	3.215	74.0	0.164	67.3	0.133	−93.1	10.8
1000	0.357	176.5	2.913	71.3	0.180	66.7	0.127	−94.5	10.0
1200	0.367	170.3	2.471	66.2	0.211	65.1	0.117	−98.2	8.5
1400	0.380	165.7	2.176	61.4	0.241	63.3	0.113	−101.9	7.5
1600	0.376	161.5	1.944	56.7	0.269	61.7	0.111	−102.3	6.5
1800	0.376	156.9	1.774	52.8	0.296	59.9	0.107	−106.9	5.7
2000	0.387	150.6	1.646	49.3	0.324	58.4	0.095	−110.9	5.1
2200	0.412	144.9	1.538	45.9	0.350	56.6	0.089	−121.3	4.6
2400	0.434	141.5	1.446	42.1	0.373	54.8	0.095	−135.6	4.1
2600	0.440	139.1	1.358	38.6	0.395	52.9	0.105	−143.9	3.6
2800	0.443	134.8	1.308	35.5	0.417	51.1	0.109	−147.1	3.3
3000	0.458	129.0	1.261	32.7	0.440	49.5	0.106	−154.6	3.1

PNP 5 GHz wideband transistor | BFT93W

FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

PINNING

PIN	DESCRIPTION
Code: X1	
1	base
2	emitter
3	collector

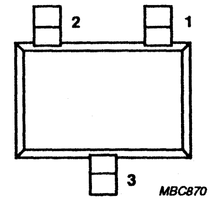


Fig.1 SOT323.

DESCRIPTION

Silicon PNP transistor in a plastic SOT323 envelope. It is intended as a general purpose transistor for wideband applications up to 2 GHz. The BFT93W uses the same crystal as the SOT23 version, BFT93.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	–	–	15	V
$-V_{CEO}$	collector-emitter voltage	open base	–	–	12	V
$-I_C$	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 87 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	20	50	–	
f_T	transition frequency	$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	–	5	–	GHz
G_{UM}	maximum unilateral power gain	$-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz	–	16.5	–	dB
F	noise figure	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 500 MHz	–	2.4	–	dB
C_{re}	feedback capacitance	$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 MHz	–	1	–	pF
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	290	K/W
T_j	junction temperature		–	–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

NPN 1 GHz wideband transistor BFW16A

DESCRIPTION

NPN transistor in a SOT5 (TO-39) metal envelope, with the collector connected to the case.

The transistor has extremely good intermodulation properties and a high power gain. It is primarily intended for the final and driver stages of channel and band aerial amplifiers with high output power for bands I, II, III and IV/V (40 to 860 MHz) and for the final stage of the wideband vertical amplifier in high speed oscilloscopes.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

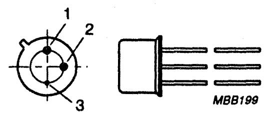


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	1.2	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	1.7	–	pF
G_p	power gain	I_C = 70 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	6.5	–	dB
P_O	output power	d_{im} = −30 dB; VSWR at output < 2; I_C = 70 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	90	–	mW

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
T_{stg}	storage temperature		−65	200	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	50 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

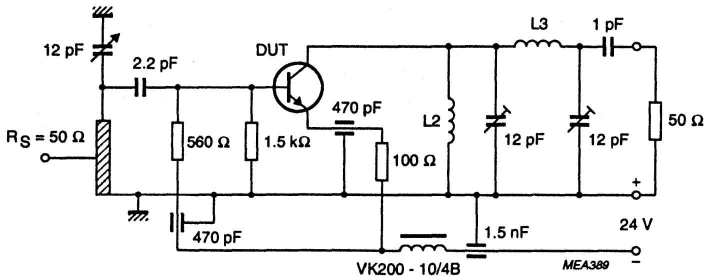
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 20 V; T_j = 150 °C	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	25	80	–	
		I_C = 150 mA; V_{CE} = 5 V	25	80	–	
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	–	1.2	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 15 V; f = 1 MHz	–	–	4	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	–	1.7	–	pF
G_p	power gain	I_C = 70 mA; V_{CE} = 18 V; f = 800 MHz; T_{amb} = 25 °C	–	6.5	–	dB
P_O	output power	note 1	70	90	–	mW

Note

1. I_C = 70 mA; V_{CE} = 18 V; VSWR at output < 2; d_{im} = −30 dB; f = 800 MHz; T_{amb} = 25 °C;
   f_p = 798 MHz; f_q = 802 MHz;
   measured at $f_{(2p-q)}$ = 806 MHz (Channel 62).

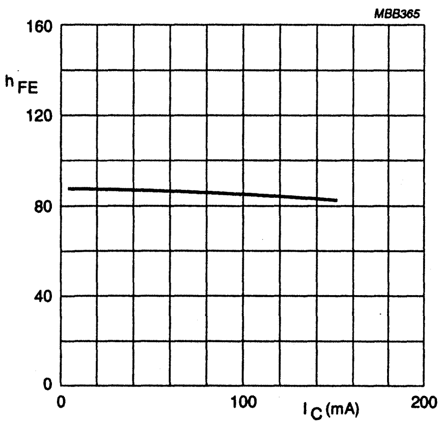


L1 = 25 mm x 7 mm x 0.85 mm silver plated copper strip. Tap of the input at 5 mm from earth.

L2 = 13 turns enamelled 0.6 mm copper wire; internal diameter 8 mm.

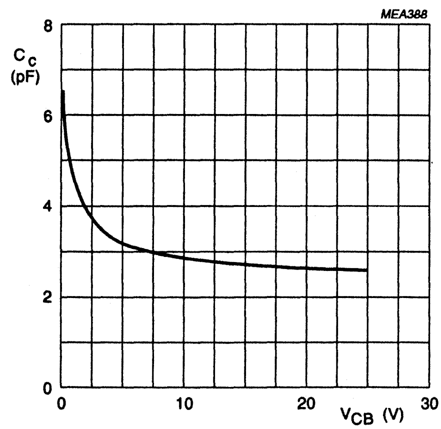
L3 = 1.5 turns 1.3 mm copper wire; internal diameter 8 mm.

Fig.2 Intermodulation distortion test circuit.



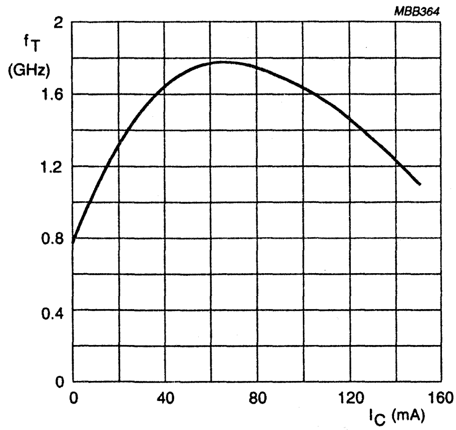
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.

NPN 1 GHz wideband transistor | BFW17A

DESCRIPTION

NPN transistor in a SOT5 (TO-39) metal envelope, with the collector connected to the case.

The transistor has extremely good intermodulation properties and a high power gain. It is primarily intended for final and driver stages of channel and band aerial amplifiers with high output power for bands I, II and III (40 to 230 MHz).

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector

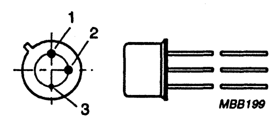


Fig.1 SOT5.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	1.1	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	1.7	–	pF

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1.5	W
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	50 K/W

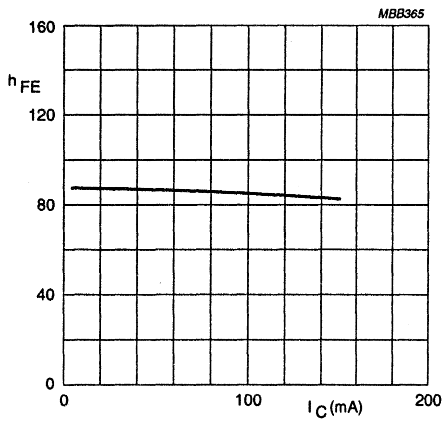
Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

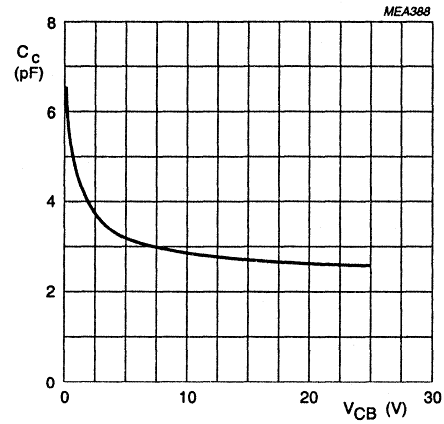
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V; T_j = 150 °C	–	–	20	μA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	25	80	–	
		I_C = 150 mA; V_{CE} = 5 V	25	80	–	
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	–	1.1	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 15 V; f = 1 MHz	–	–	4	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	–	1.7	–	pF



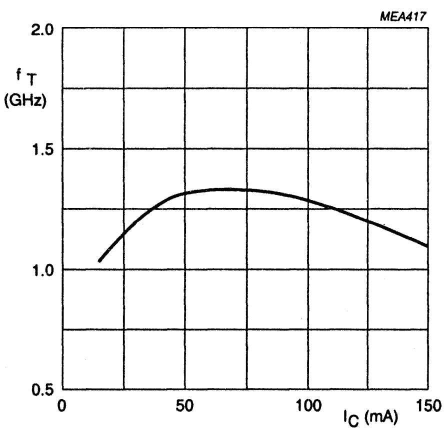
V_{CE} = 5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

NPN 2 GHz wideband transistor | BFW30

DESCRIPTION

NPN transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case.

The transistor has very low intermodulation distortion and very high power gain. It is primarily intended for wideband vertical amplifiers in high speed oscilloscopes, wideband aerial amplifiers (40 to 860 MHz) and television distribution amplifiers.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

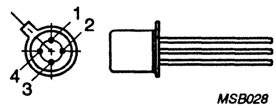


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 25 °C (note 1)	–	250	mW
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	1.6	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	0.8	–	pF
G_p	power gain	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	7.5	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 25 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 25 °C (note 1)	500 K/W

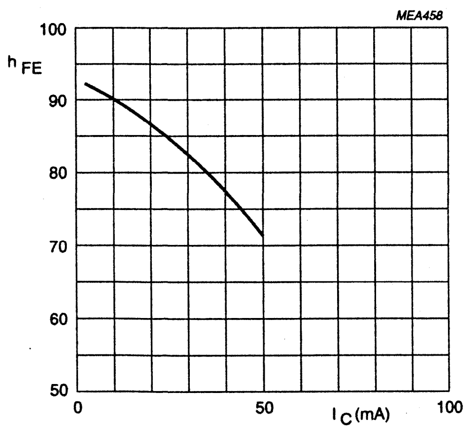
Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

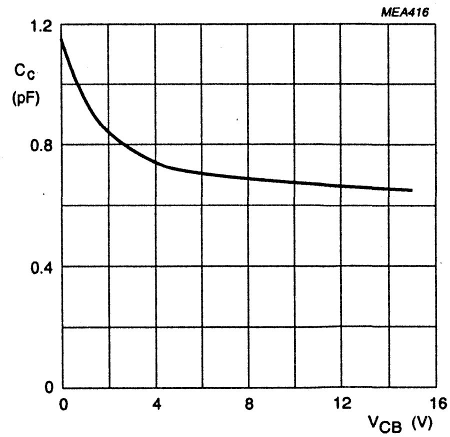
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 5 V	25	–	–	
		I_C = 50 mA; V_{CE} = 5 V	25	–	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	–	1.6	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 5 V; f = 1 MHz	–	–	1.5	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz	–	0.8	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; Z_S = 50 Ω; f = 500 MHz	–	–	5	dB
G_p	power gain	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	–	7.5	–	dB



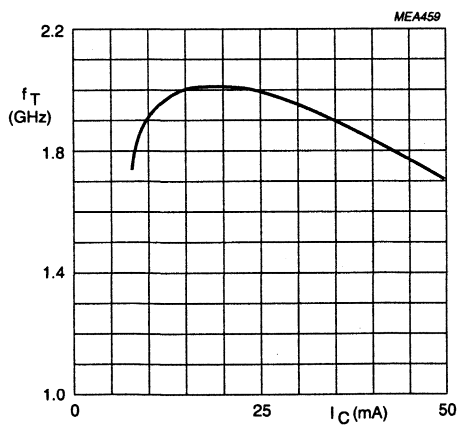
V_{CE} = 5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.3 Collector capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

NPN 1 GHz wideband transistor — BFW92

DESCRIPTION

NPN transistor in a plastic SOT37 envelope.

It has a low noise over a wide current range, a very high power gain and good intermodulation properties. It is primarily intended for wideband aerial amplifiers (40 to 860 MHz), channel and band aerial amplifiers for band I, II, III and IV/V (40 to 860 MHz), television distribution amplifiers and low noise wideband vertical amplifiers in high speed oscilloscopes.

PINNING

PIN	DESCRIPTION
Code: BFW92/02	
1	base
2	emitter
3	collector

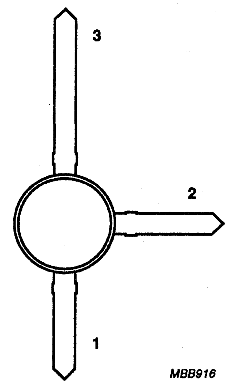


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	1.6	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	0.6	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz; T_{amb} = 25 °C	4	–	dB
G_p	power gain	I_C = 10 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	11	–	dB
P_O	output power	I_C = 10 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C; d_{im} = –30 dB; VSWR at output < 2	8	–	mW

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

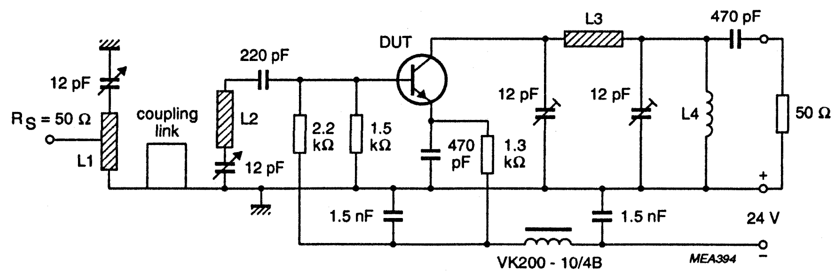
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 1 V	25	90	–	
		I_C = 25 mA; V_{CE} = 1 V	25	90	–	
f_T	transition frequency	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz	–	1	–	GHz
		I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	–	1.6	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.5	–	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.6	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; R_S = 50 Ω; f = 500 MHz; T_{amb} = 25 °C	–	4	–	dB
G_p	power gain	I_C = 10 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
P_O	output power	note 1	–	8	–	mW

Note

1. I_C = 10 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C; d_{im} = –30 dB; VSWR at output < 2
   f_p = 798 MHz; f_q = 802 MHz;
   measured at $f_{(2p-q)}$ = 806 MHz.



L1 = 24 mm x 6 mm x 0.5 mm silver plated copper strip. Tap of the input at 5 mm from earth.

L2 = 15 mm x 6 mm x 0.5 mm silver plated copper strip.

L3 = 20 mm x 8 mm x 0.5 mm silver plated copper strip.

L4 = 4 turns enamelled 0.5 mm copper wire; winding pitch 1.5 mm; internal diameter 4 mm. Coupling link: 42 mm silver plated 1 mm copper wire.

Fig.2 Intermodulation distortion test circuit.

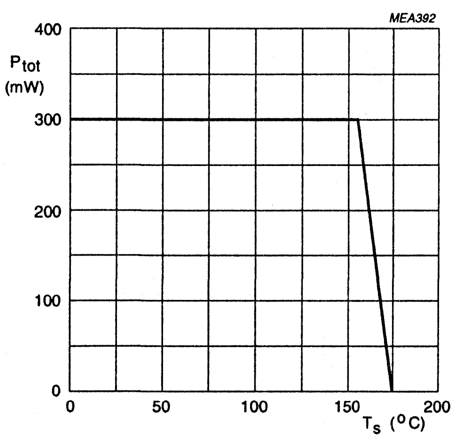
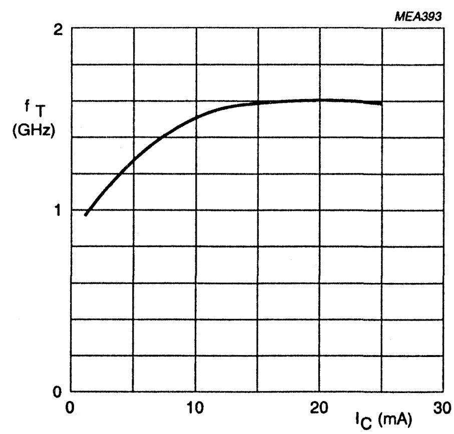


Fig.3 Power derating curve.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

NPN 3 GHz wideband transistor

BFW92A

DESCRIPTION

NPN transistor in a plastic SOT37 envelope.

It is primarily intended for use in amplifiers in the 40 to 860 MHz range.

The BFW92A is the successor to the BFW92 and offers high power gain and improved noise behaviour.

PINNING

PIN	DESCRIPTION
Code: BFW92A/02	
1	base
2	emitter
3	collector

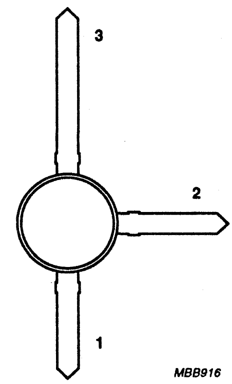


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	2.8	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	0.45	–	pF
G_{UM}	maximum unilateral power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	13	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; Z_S = 60 Ω; f = 800 MHz; T_{amb} = 25 °C	2.5	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	150	–	mV

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

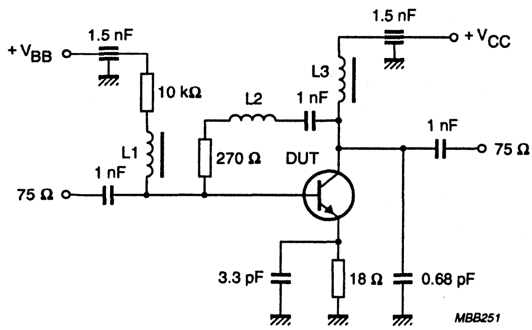
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 1$ V	25	90	–	
		$I_C = 25$ mA; $V_{CE} = 1$ V	25	90	–	
f_T	transition frequency	$I_C = 25$ mA; $V_{CE} = 5$ V; f = 500 MHz	–	2.8	–	GHz
C_c	collector capacitance	$I_E = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.75	–	pF
C_e	emitter capacitance	$I_C = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.4	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 5$ V; f = 1 MHz	–	0.45	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 14$ mA; $V_{CE} = 10$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	13	–	dB
F	noise figure	$I_C = 2$ mA; $V_{CE} = 5$ V; $Z_S = 60\ \Omega$; f = 800 MHz; $T_{amb} = 25$ °C	–	2.5	–	dB
V_O	output voltage	see Fig.2 and note 2	–	150	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B); $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O$ –6 dB; $f_q = 803.25$ MHz;
   $V_r = V_O$ –6 dB; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.



L1 = L3 = 5 µH microchoke.

L2 = 3 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

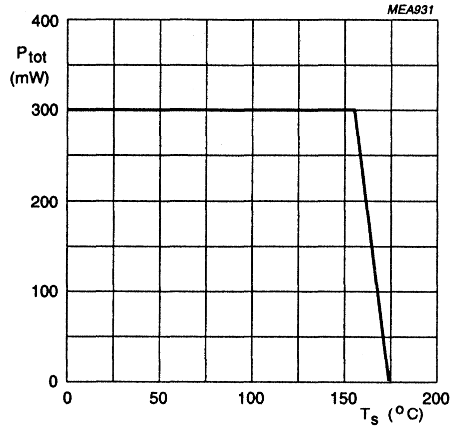
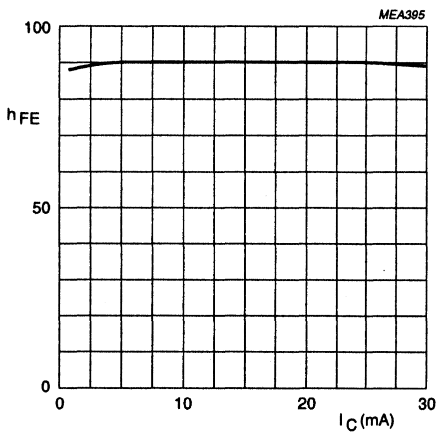
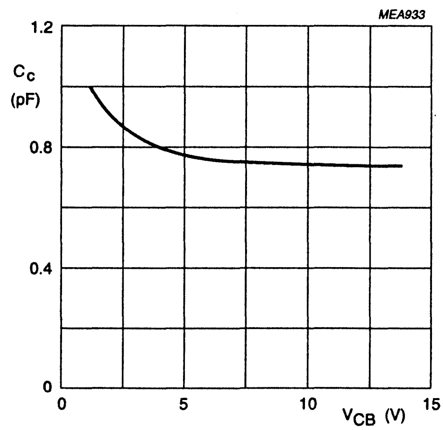


Fig.3 Power derating curve.



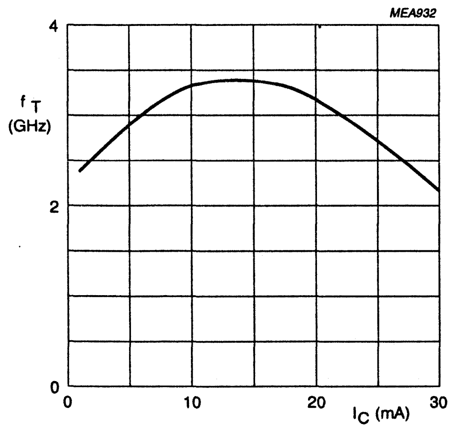
V_{CE} = 5 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



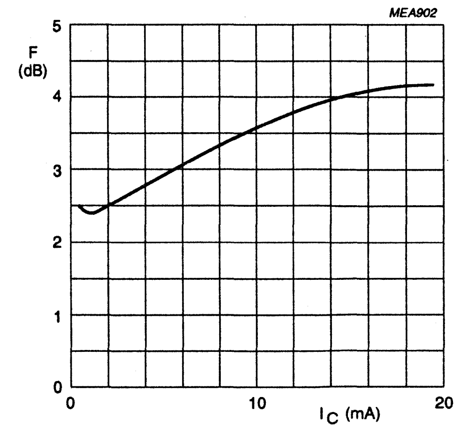
$I_E = i_e = 0$; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.6 Transition frequency as a function of collector current.



V_{CE} = 5 V; Z_S = 60 Ω; f = 800 MHz; T_{amb} = 25 °C.

Fig.7 Minimum noise figure as a function of collector current.

Table 1 Common emitter scattering parameters, $I_C = 10$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.732	−24.5	24.394	158.2	0.009	77.9	0.948	−9.2	41.0
100	0.566	−54.9	19.367	134.5	0.019	69.6	0.825	−16.5	32.4
200	0.354	−85.2	12.518	113.3	0.030	65.3	0.695	−19.5	25.4
300	0.267	−105.8	9.038	102.5	0.037	64.1	0.638	−19.8	21.7
400	0.227	−122.7	7.018	95.0	0.047	69.2	0.611	−20.4	19.2
500	0.191	−139.7	5.705	89.1	0.057	70.3	0.598	−21.5	17.2
600	0.176	−154.7	4.835	84.9	0.063	69.8	0.588	−23.2	15.7
700	0.171	−158.2	4.207	81.2	0.075	70.4	0.585	−24.7	14.4
800	0.160	−175.9	3.696	78.0	0.083	71.1	0.581	−26.6	13.3
900	0.163	174.5	3.309	72.6	0.092	71.1	0.575	−28.3	12.2
1000	0.171	157.0	2.994	70.2	0.102	70.3	0.571	−30.1	11.4
1200	0.196	144.7	2.536	63.9	0.121	69.7	0.557	−34.3	9.9
1400	0.224	132.4	2.258	58.7	0.137	69.4	0.546	−39.2	8.8
1600	0.236	122.3	1.979	52.1	0.155	68.9	0.539	−44.7	7.7
1800	0.265	109.3	1.774	48.5	0.174	67.9	0.540	−49.7	6.8
2000	0.312	102.0	1.629	43.1	0.190	66.5	0.535	−54.3	6.1
2200	0.337	91.1	1.536	38.4	0.205	65.2	0.516	−59.4	5.6
2400	0.375	89.0	1.420	31.5	0.226	64.8	0.494	−65.9	4.9
2600	0.413	84.5	1.290	28.8	0.246	62.7	0.483	−74.1	4.2
2800	0.421	76.9	1.269	25.1	0.260	61.6	0.493	−81.9	4.1
3000	0.430	70.8	1.163	20.2	0.281	61.7	0.496	−87.9	3.4

Table 2 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.649	−30.8	30.938	153.2	0.008	75.2	0.925	−11.0	40.6
100	0.464	−63.5	22.135	127.6	0.017	68.4	0.773	−17.7	31.9
200	0.288	−94.7	13.474	108.1	0.027	68.8	0.652	−18.4	25.4
300	0.216	−117.2	9.483	98.3	0.036	70.3	0.608	−18.2	21.8
400	0.183	−135.0	7.274	91.7	0.046	72.6	0.588	−18.9	19.2
500	0.170	−148.5	5.883	86.8	0.055	73.5	0.577	−20.2	17.3
600	0.161	−160.5	4.956	82.9	0.065	73.3	0.572	−21.8	15.7
700	0.156	−171.5	4.300	79.1	0.075	73.6	0.569	−23.5	14.5
800	0.153	177.8	3.799	75.5	0.084	73.4	0.566	−25.4	13.4
900	0.153	166.3	3.384	71.8	0.094	73.1	0.563	−27.2	12.3
1000	0.160	155.2	3.045	68.8	0.103	72.5	0.559	−29.0	11.4
1200	0.190	139.5	2.570	63.1	0.122	71.6	0.547	−33.4	9.9
1400	0.222	129.8	2.276	57.6	0.140	70.5	0.536	−38.5	8.8
1600	0.240	122.0	2.008	52.0	0.158	69.9	0.531	−44.1	7.8
1800	0.257	112.3	1.806	47.8	0.176	68.7	0.527	−49.4	6.8
2000	0.288	101.3	1.651	42.4	0.195	67.4	0.520	−54.3	6.1
2200	0.331	93.6	1.548	38.4	0.212	66.0	0.504	−59.6	5.6
2400	0.371	88.7	1.443	32.0	0.231	65.3	0.481	−66.3	5.0
2600	0.391	84.8	1.327	29.3	0.253	63.2	0.468	−74.4	4.3
2800	0.404	78.7	1.295	24.3	0.269	61.7	0.471	−82.7	4.1
3000	0.427	70.9	1.189	19.6	0.291	61.4	0.475	−89.6	3.5

NPN 2 GHz wideband transistor BFW93

DESCRIPTION

NPN transistor in a plastic SOT37 envelope.

It is intended for use in VHF and UHF applications, primarily wideband aerial amplifiers in the 40 to 860 MHz range.

PINNING

PIN	DESCRIPTION
Code: BFW93/02	
1	base
2	emitter
3	collector

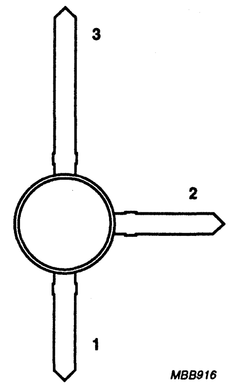


Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	18	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	1.7	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	0.6	–	pF
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	10.5	–	dB

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	18	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
I_{CM}	peak collector current	f > 1 MHz	–	100	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	65 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 5 V	25	–	–	
		I_C = 50 mA; V_{CE} = 5 V	25	–	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 5 V; f = 500 MHz	–	1.7	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.5	–	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.6	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 30 mA; V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C	–	10.5	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; G_S = 20 mS; B_S is tuned	–	–	5	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

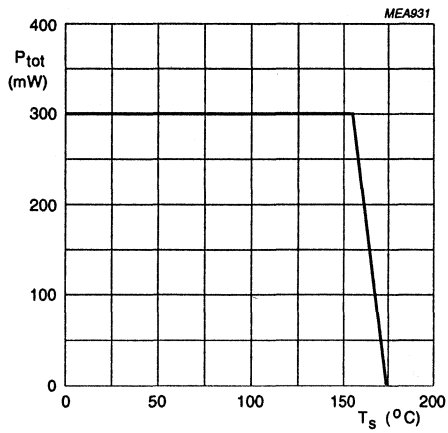
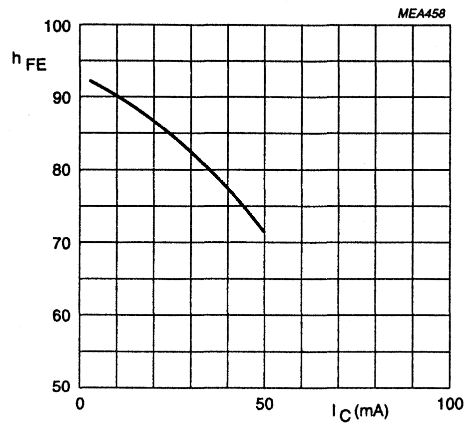
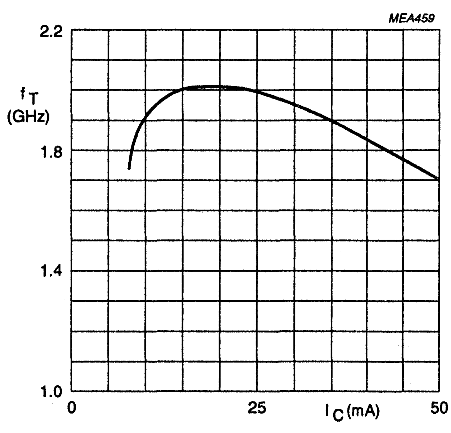


Fig.2 Power derating curve.



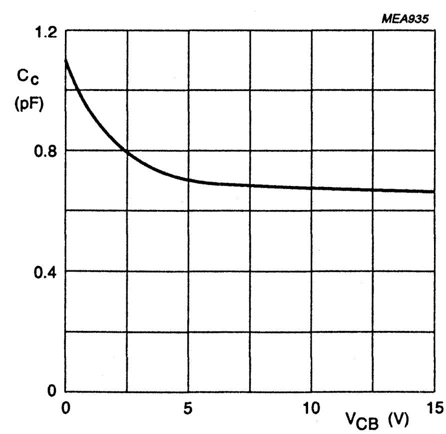
V_{CE} = 5 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



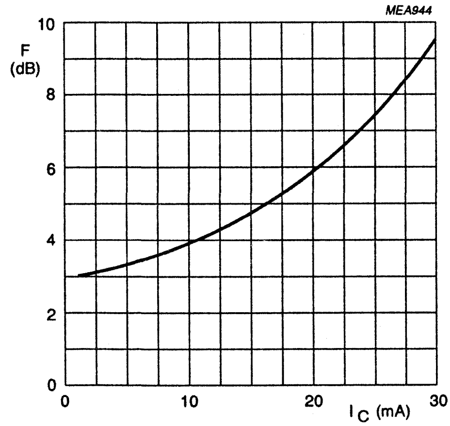
V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.



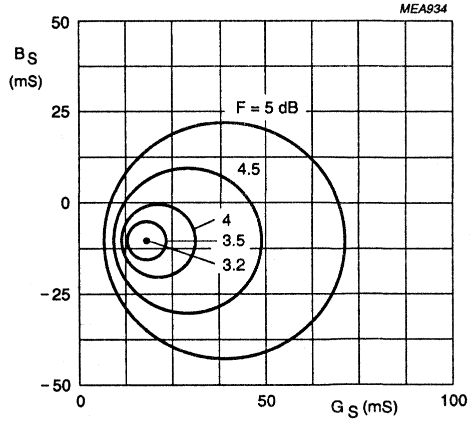
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



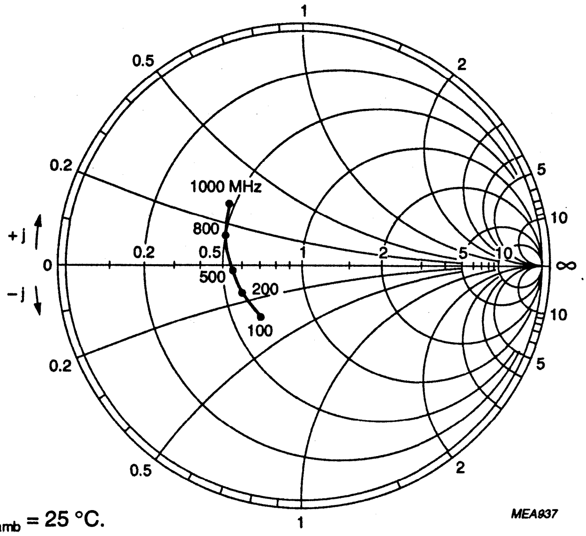
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C; G_S = 20 mS; B_S is tuned.

Fig.6 Minimum noise figure as a function of collector current.



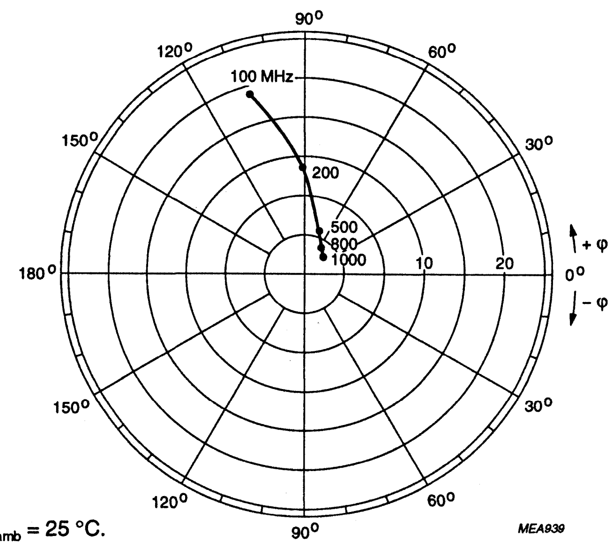
I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz.

Fig.7 Noise circle figure.



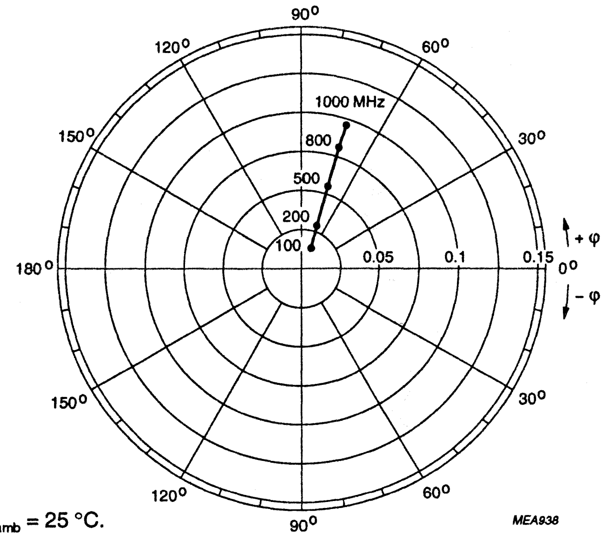
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.8 Common emitter input reflection coefficient (S_{11}).



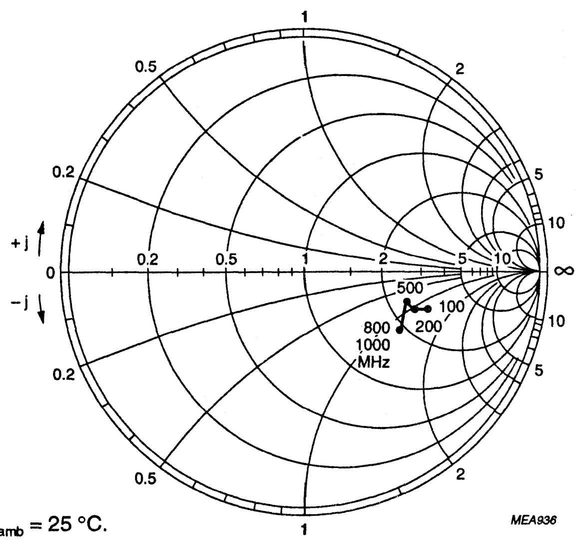
I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.9 Common emitter forward transmission coefficient (S_{21}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

NPN 1 GHz wideband transistor | BFY90

DESCRIPTION

NPN transistor in a TO-72 metal envelope, with insulated electrodes and a shield lead connected to the case.

The transistor has very low noise over a wide current range, a very high power gain and excellent intermodulation properties.

It is primarily intended for channel and band aerial amplifiers for band I, II, III and IV/V (40 to 860 MHz), wideband aerial amplifiers (40 to 860 MHz), television distribution amplifiers and low noise wideband vertical amplifiers in high speed oscilloscopes.

It is also suitable for military and industrial applications, such as RF amplifiers and mixers for communication equipment, microwave telephony link systems, wideband IF amplifiers and large bandwidth radar IF amplifiers.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	shield lead (connected to case)

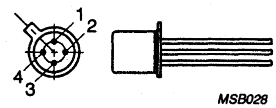


Fig.1 TO-72.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 25 °C (note 1)	–	200	mW
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C	1.4	–	GHz
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	0.6	–	pF
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	5.5	–	dB
G_p	power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	8	–	dB
P_O	output power	d_{im} = –30 dB; VSWR at output < 2; I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	12	–	mW

Note

1. T_s is the temperature at the soldering point of the collector lead.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	25	mA
I_{CM}	peak collector current	f > 1 MHz	–	50	mA
P_{tot}	total power dissipation	up to T_s = 25 °C (note 1)	–	200	mW
T_{stg}	storage temperature		–65	200	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 25 °C (note 1)	580 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

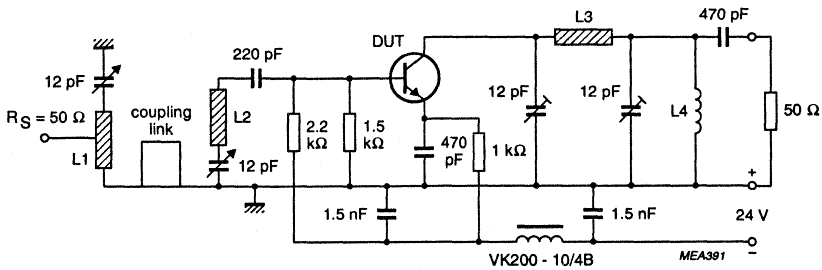
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 15 V	10	–	–	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 1 V	25	150	–	
		I_C = 25 mA; V_{CE} = 1 V	20	125	–	
f_T	transition frequency	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz	1	1.1	–	GHz
		I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	1.3	1.4	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	–	1.5	pF
C_{re}	feedback capacitance	I_C = 2 mA; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.6	0.8	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	–	22	–	dB
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; Z_S = opt.; f = 800 MHz; T_{amb} = 25 °C	–	5.5	–	dB
G_p	power gain	I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	8	–	dB
P_O	output power	note 2	–	12	–	mW

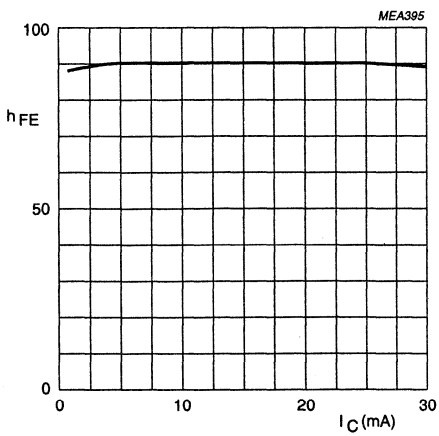
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 14 mA; V_{CE} = 10 V; VSWR at output < 2; T_{amb} = 25 °C; f = 800 MHz; d_{im} = −30 dB;
   f_p = 798 MHz; f_q = 802 MHz;
   measured at $f_{(2p-q)}$ = 806 MHz (Channel 62).



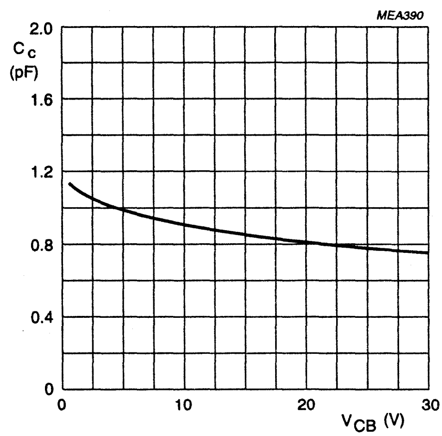
L1 = 24 mm x 6 mm x 0.5 mm silver plated copper strip. Tap of the input at 5 mm from earth.
L2 = 15 mm x 6 mm x 0.5 mm silver plated copper strip.
L3 = 20 mm x 8 mm x 0.5 mm silver plated copper strip.
L4 = 4 turns enamelled 0.5 mm copper wire; winding pitch 1.5 mm; internal diameter 4 mm.
Coupling link: 42 mm silver plated 1 mm copper wire.

Fig.2 Intermodulation distortion test circuit.



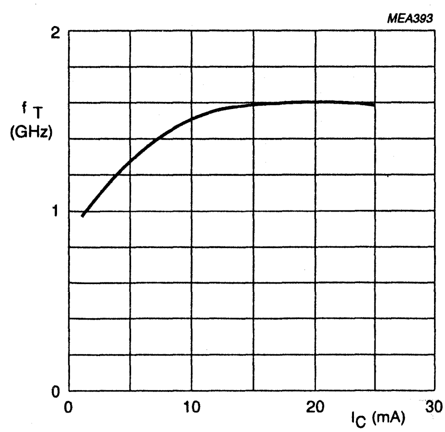
V_{CE} = 1 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



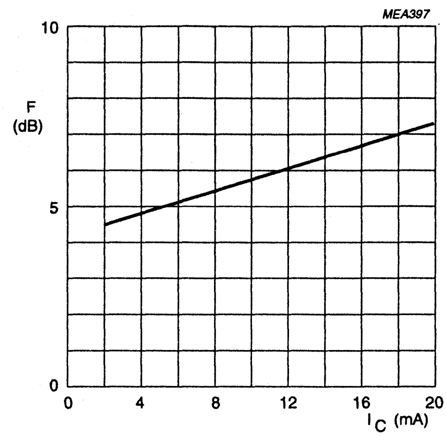
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



V_{CE} = 5 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



V_{CE} = 5 V; Z_S = 50 Ω; f = 500 MHz; T_{amb} = 25 °C.

Fig.6 Minimum noise figure as a function of collector current.

2 GHz RF power transistor BLT10

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in handheld radio equipment at 1.9 GHz.

The transistor is encapsulated in a SOT103 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

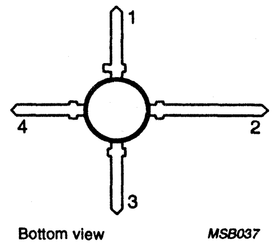


Fig.1 SOT103.

QUICK REFERENCE DATA

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:2	1.9	6	300	≥ 6	≥ 50

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	250	mA
$I_{C(AV)}$	average collector current		–	250	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	thermal resistance from junction to soldering point	up to T_s = 105 °C (note 1); P_{tot} = 1 W	max. 70 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 5 mA	10	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 8 V	–	100	μA
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	3	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	2	pF

APPLICATION INFORMATION

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:2	1.9	6	1	300	> 6 typ. 7	> 50 typ. 60

Ruggedness in class-AB operation

The BLT10 is capable of withstanding a load mismatch corresponding to VSWR = 8:1 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.9 GHz and a duty cycle of 1:2.

2 GHz RF power transistor BLT11

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in handheld radio equipment at 1.9 GHz.

The transistor is encapsulated in a SOT103 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

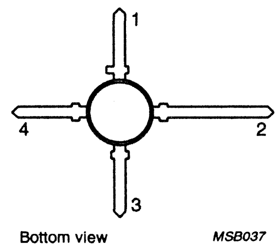


Fig.1 SOT103.

QUICK REFERENCE DATA

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:2	1.9	6	600	≥ 6	≥ 50

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	500	mA
$I_{C(AV)}$	average collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 130 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector lead.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	thermal resistance from junction to soldering point	T_s = 130 °C (note 1); P_{tot} = 1 W	max. 45 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.1 mA	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 8 V	–	100	μA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	4	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	3	pF

APPLICATION INFORMATION

RF performance at T_{amb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed, class-AB, duty cycle: < 1:2	1.9	6	1	600	> 6 typ. 6.5	> 50 typ. 60

Ruggedness in class-AB operation

The BLT11 is capable of withstanding a load mismatch corresponding to VSWR = 8:1 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.9 GHz and a duty cycle of 1:2.

Video driver hybrid amplifiers CR2424; CR2425; CR2427

FEATURES

- Typical 10 to 90% transition times with C_L = 8.5 pF:
  t_r: 2.2 ns; t_f: typ. 2.0 ns at 35 V(p-p) swing
  t_r: 2.3 ns; t_f: typ. 2.1 ns at 40 V(p-p) swing
  t_r: 2.5 ns; t_f: typ. 2.2 ns at 50 V(p-p) swing
- Low power consumption
- Minimum bandwidth 130 MHz
- Very fast slew rate; 15 V/µs
- Excellent grey-scale linearity
- Unconditional stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier modules mounted in SOT115 (CR2424; CR2425) and SOT348 (CR2427) packages and designed for application in cathode-ray tube (CRT) drivers in high-resolution colour and monochrome monitors.

PINNING - SOT115

PIN	DESCRIPTION
1	input
2	ground
3	ground
5	supply voltage (V_{CC})
7	ground
8	ground
9	output

PINNING - SOT348

PIN	DESCRIPTION
1	input
2	ground
3	supply voltage (V_{CC})
4	ground
5	output

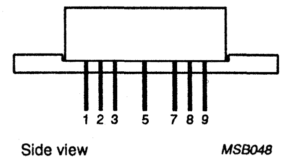


Fig.1 SOT115L (CR2424).

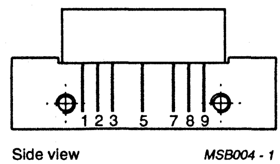


Fig.2 SOT115C (CR2425).

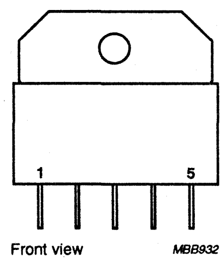


Fig.3 SOT348 (CR2427).

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	–	70	V
T_{mb}	mounting base operating temperature (note 1)	–20	100	°C
T_{stg}	storage temperature	–40	125	°C

Note

1. To ensure proper thermal contact, a layer of heatsink compound should be applied between the module and heatsink.

ELECTRICAL CHARACTERISTICS

V_{CC} = 60 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 215 Ω; C1 = 50 pF; 40 V(p-p) output swing with 30 V DC offset, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CC}	supply current	input and output open	39	45	51	mA
V_I	DC input level	input and output open	1.2	1.5	1.8	V
V_O	DC output level	input and output open	26	29	32	V
P_{tot}	total power dissipation	50 MHz square wave	–	4.6	6	W
t_r	transient response rise time	10 to 90% (note 1)	–	2.3	2.9	ns
t_f	transient response fall time	10 to 90% (note 1)	–	2.1	2.6	ns
B	bandwidth	between −3 dB points	130	145	–	MHz
V_{TILT}	low frequency tilt voltage	1 kHz square wave	–	1.3	1.5	V
ΔV_I	input voltage swing (rise and fall time)	varied by C1 (see Fig.12)	–	3	10	%
	linearity	V_O = 5 to 55 V	–	2	5	%
ΔG	insertion gain	50 Ω source (note 2)	160	180	200	
ΔG_V	voltage gain	50 Ω source (note 3)	11.2	12.4	13.2	
V_{CC} = 65 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 215 Ω; C1 = 50 pF; 50 V(p-p) output swing with 32.5 V DC offset, unless otherwise specified.						
I_{CC}	supply current	input and output open	–	50	57	mA
V_I	DC input level	input and output open	1.3	1.65	2	V
V_O	DC output level	input and output open	27	30	33	V
t_r	rise time transient response	10 to 90% (note 4)	–	2.5	3.2	ns
t_f	fall time transient response	10 to 90% (note 4)	–	2.2	3.2	ns

Notes

1. Input signal is a nominal 100 kHz square wave of 3.25 V(p-p), with 1.5 V DC offset (50 Ω source).
2. Measured V_O/V_I port 1 (see voltage ratio figure).
3. Measured in CRT amplifier test circuit: $V_O/V_{RF\ input}$.
4. Input signal is a nominal 100 kHz square wave of 3.4 V(p-p), with 1.65 V DC offset (50 Ω source).

In Figs 4 to 7, V_{CC} = 60 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 215 Ω; C1 = 50 pF; 40 V(p-p) output swing with 30 V DC offset.

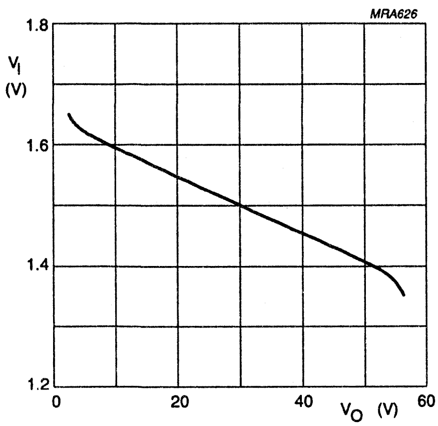


Fig.4 Voltage ratio at RF input port, typical values.

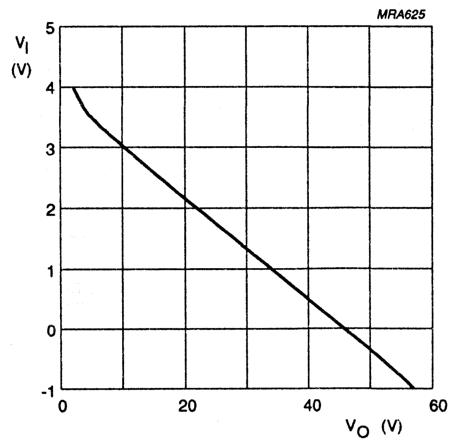


Fig.5 Voltage ratio at port 1, typical values.

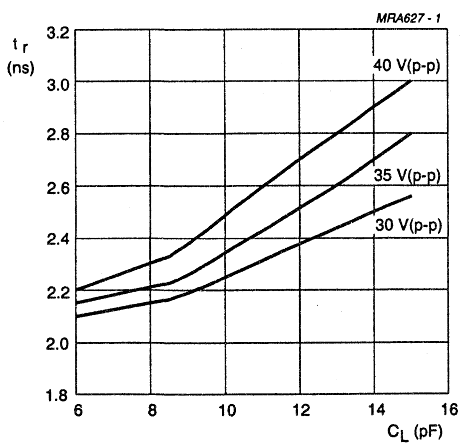


Fig.6 Rise time as a function of load capacitance, typical values.

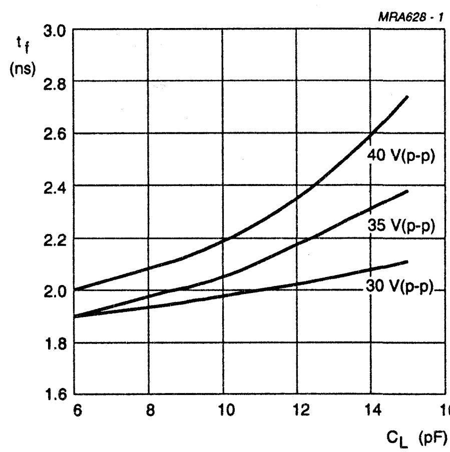


Fig.7 Fall time as a function of load capacitance, typical values.

In Figs 8 to 11, V_{CC} = 65 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 215 Ω; C1 = 50 pF; 50 V(p-p) output swing with 32.5 V DC offset.

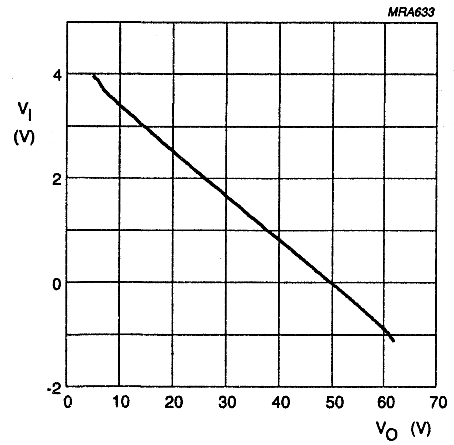


Fig.8 Voltage ratio at RF input port, typical values.

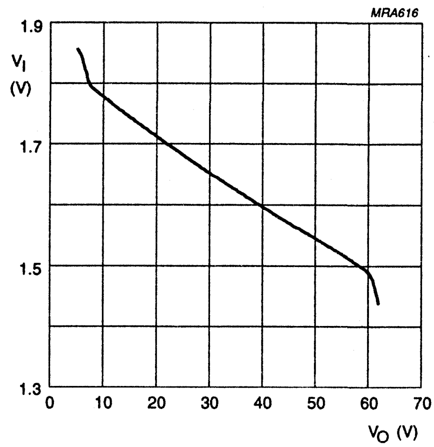


Fig.9 Voltage ratio at port 1, typical values.

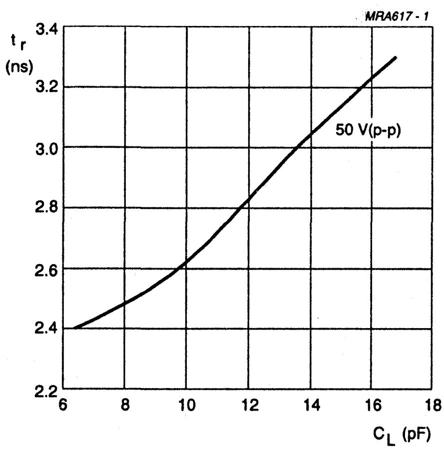


Fig.10 Rise time as a function of load capacitance, typical values.

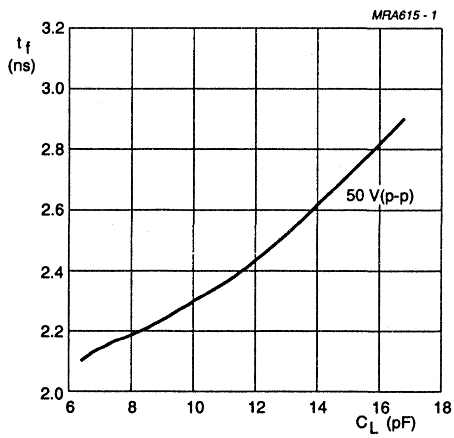


Fig.11 Fall time as a function of load capacitance, typical values.

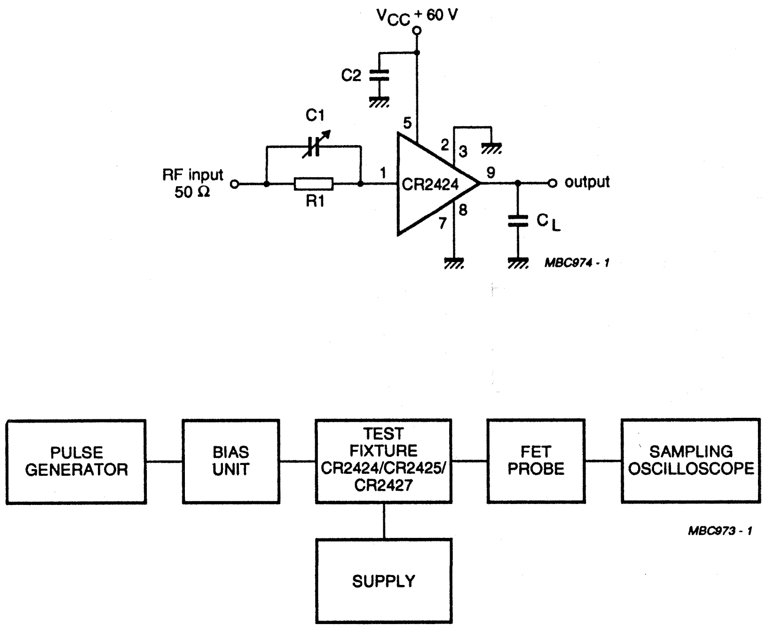


Fig.12 CRT amplifier test circuit and block diagram.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE
C1	capacitor	10 to 120 pF (typically 50 pF)
C2	chip capacitor	10 nF
R1	resistor	typically 215 Ω

Equipment used in test circuit

Pulse generator	Pico Second, model 2600B, rise time 350 ps
Bias unit	Pico Second, model 5555
Power supply	Philips, model PE1541, 75 V
FET probe	Philips, model PM8943, attenuation 100:1
Sampling oscilloscope	Tektronix, model 11803, sampling head SD24

Video driver hybrid amplifiers — CR3424; CR3425; CR3427

FEATURES

- Typical 10 to 90% transition times with C_L = 10 pF:
  - t_r: 2.2 ns; t_f: typ. 2.0 ns at 35 V(p-p) swing
  - t_r: 2.3 ns; t_f: typ. 2.1 ns at 40 V(p-p) swing
  - t_r: 2.5 ns; t_f: typ. 2.2 ns at 50 V(p-p) swing
- Low power consumption
- Minimum bandwidth 130 MHz
- Very fast slew rate; 15 V/µs
- Excellent grey-scale linearity
- Unconditional stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier modules mounted in SOT115 (CR3424; CR3425) and SOT348 (CR3427) packages and designed for application in cathode-ray tube (CRT) drivers in high-resolution colour and monochrome monitors.

PINNING - SOT115

PIN	DESCRIPTION
1	input
2	ground
3	ground
5	supply voltage (V_{CC})
7	ground
8	ground
9	output

PINNING - SOT348

PIN	DESCRIPTION
1	input
2	ground
3	supply voltage (V_{CC})
4	ground
5	output

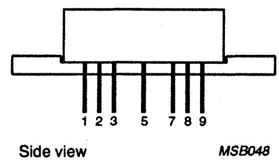


Fig.1 SOT115L (CR3424).

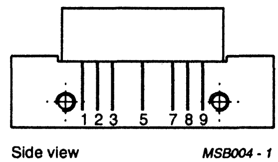


Fig.2 SOT115C (CR3425).

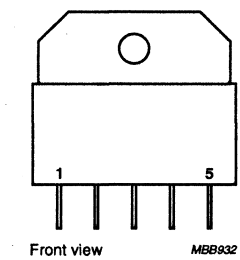


Fig.3 SOT348 (CR3427).

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	–	90	V
T_{mb}	mounting base operating temperature (note 1)	–20	100	°C
T_{stg}	storage temperature	–40	125	°C

Note

1. To ensure proper thermal contact, a layer of heatsink compound should be applied between the module and heatsink.

ELECTRICAL CHARACTERISTICS

V_{CC} = 80 V; T_c = 25 °C; C_L = 10 pF; R1 = 287 Ω; C1 = 60 pF; 40 V(p-p) output swing with 40 V DC offset, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CC}	supply current	input and output open	41	47	53	mA
V_I	DC input level	input and output open	1.4	1.6	1.9	V
V_O	DC output level	input and output open	37	41	45	V
P_{tot}	total power dissipation	50 MHz square wave	–	6.4	8	W
t_r	transient response rise time	10 to 90% (note 1)	–	2.3	2.9	ns
t_f	transient response fall time	10 to 90% (note 1)	–	2.1	2.6	ns
B	bandwidth	between –3 dB points	130	145	–	MHz
V_{TILT}	low frequency tilt voltage	1 kHz square wave	–	1.3	1.5	V
ΔV_I	input voltage swing (rise and fall time)	varied by C1 (see Fig.8)	–	3	10	%
	non-linearity	V_O = 5 to 75 V	–	2	5	%
ΔG	insertion gain	50 Ω source (note 2)	160	180	200	
ΔG_V	voltage gain	50 Ω source (note 3)	11.2	12.4	13.2	

Notes

1. Input signal is a nominal 100 kHz square wave of 3.25 V(p-p), with 1.5 V DC offset (50 Ω source).
2. Measured V_O/V_I port 1 (see voltage ratio figure).
3. Measured in CRT amplifier test circuit: $V_O/V_{RF\ input}$.

In Figs 4 to 7, V_{CC} = 80 V; T_c = 25 °C; C_L = 10 pF; R1 = 287 Ω; C1 = 60 pF; 40 V(p-p) output swing with 40 V DC offset, unless otherwise specified.

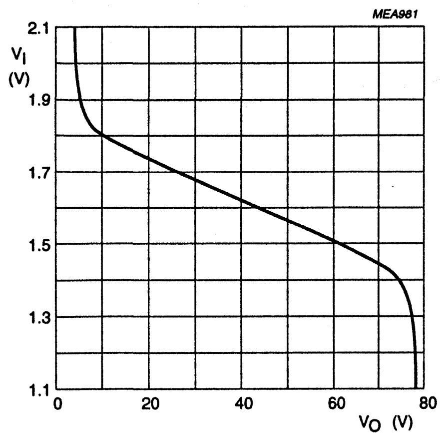


Fig.4 Voltage ratio at RF input port, typical values.

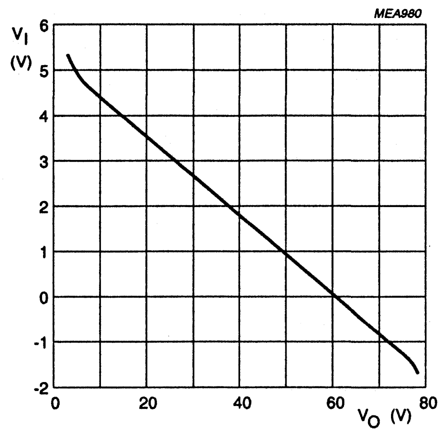


Fig.5 Voltage ratio at port 1, typical values.

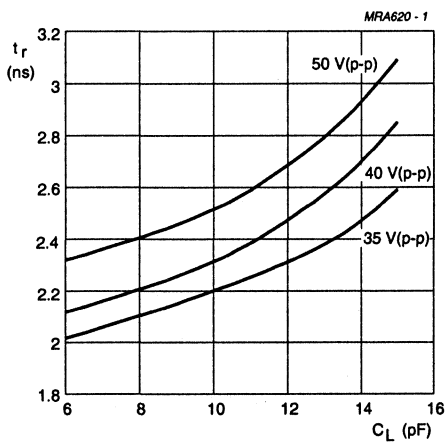


Fig.6 Rise time as a function of load capacitance, typical values.

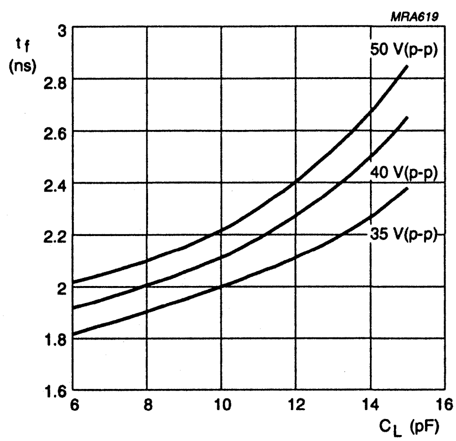
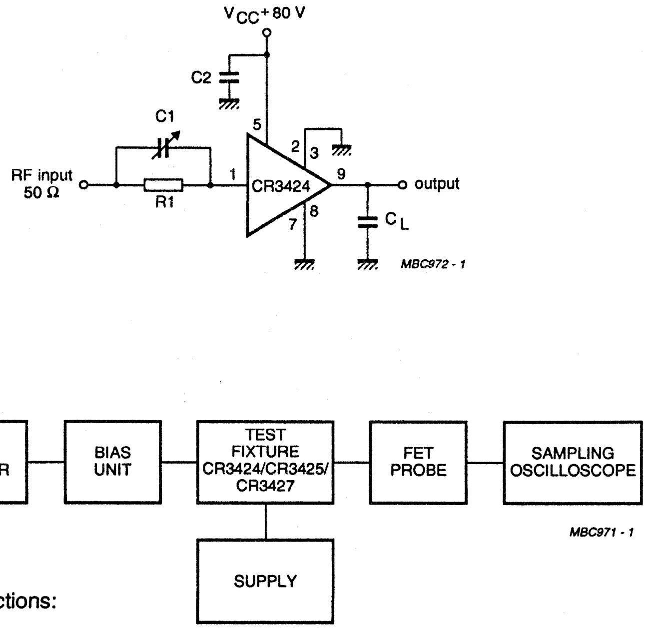


Fig.7 Fall time as a function of load capacitance, typical values.



Recommended earth connections:
pins 2 and 3 input
pins 7 and 8 output

Fig.8 CRT amplifier test circuit and block diagram.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE
C1	capacitor	10 to 120 pF (typically 60 pF)
C2	chip capacitor, plus electrolytic capacitor	10 nF, plus 4.7 µF/160 V
R1	resistor	typically 287 Ω

Equipment used in test circuit

Pulse generator	Pico Second, model 2600B, rise time 350 ps
Bias unit	Pico Second, model 5555
Power supply	80 V
FET probe	Philips, model PM8943, attenuation 100:1
Sampling oscilloscope	Tektronix, model 11803, sampling head SD24

Video driver hybrid amplifiers CR4424; CR4425; CR4427

FEATURES

- Typical 10 to 90% transition times with C_L = 8.5 pF:
  1.6 ns at 35 V(p-p) swing
  1.7 ns at 40 V(p-p) swing
  1.9 ns at 50 V(p-p) swing
- Low power consumption
- Minimum bandwidth 200 MHz
- Very fast slew rate; 25 V/μs
- Excellent grey-scale linearity
- Unconditional stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier modules mounted in SOT115 (CR4424; CR4425) and SOT348 (CR4427) packages and designed for application in cathode-ray tube (CRT) drivers in high-resolution colour and monochrome monitors.

PINNING - SOT115

PIN	DESCRIPTION
1	input
2	ground
3	ground
5	supply voltage (V_{CC})
7	ground
8	ground
9	output

PINNING - SOT348

PIN	DESCRIPTION
1	input
2	ground
3	supply voltage (V_{CC})
4	ground
5	output

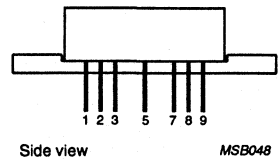


Fig.1 SOT115L (CR4424).

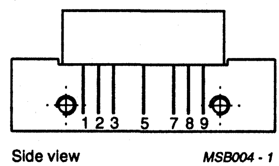


Fig.2 SOT115C (CR4425).

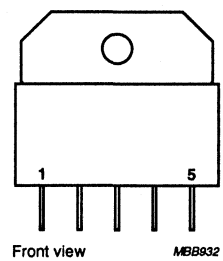


Fig.3 SOT348 (CR4427).

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	–	90	V
T_{mb}	mounting base operating temperature (note 1)	–20	100	°C
T_{stg}	storage temperature	–40	125	°C

Note

1. To ensure proper thermal contact, a layer of heatsink compound should be applied between the module and heatsink.

ELECTRICAL CHARACTERISTICS

V_{CC} = 80 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 287 Ω; C1 = 60 pF; 40 V(p-p) output swing with 40 V DC offset, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CC}	supply current	input and output open	39	45	51	mA
V_I	DC input level	input and output open	1.3	1.5	1.8	V
V_O	DC output level	input and output open	36	40	44	V
P_{tot}	total power dissipation	50 MHz square wave	–	–	8	W
t_r	transient response rise time	10 to 90% (note 1)	–	1.7	2.0	ns
t_f	transient response fall time	10 to 90% (note 1)	–	1.7	2.0	ns
B	bandwidth	between −3 dB points	200	215	–	MHz
V_{TILT}	low frequency tilt voltage	1 kHz square wave	–	1.3	1.5	V
ΔV_I	input voltage swing (rise and fall time)	varied by C1 (see Fig.8)	–	–	10	%
	linearity	V_O = 5 to 75 V	–	2	5	%
ΔG	insertion gain	50 Ω source (note 2)	160	180	200	
ΔG_V	voltage gain	50 Ω source (note 3)	11.2	12.4	13.2	

Notes

1. Input signal is a nominal 100 kHz square wave of 3.25 V(p-p), with 1.5 V DC offset (50 Ω source).
2. Measured V_O/V_I port 1 (see voltage ratio figure).
3. Measured in CRT amplifier test circuit: $V_O/V_{RF\ input}$.

In Figs 4 to 7, V_{CC} = 80 V; T_c = 25 °C; C_L = 8.5 pF; R1 = 287 Ω; C1 = 60 pF; 40 V(p-p) output swing with 40 V DC offset, unless otherwise specified.

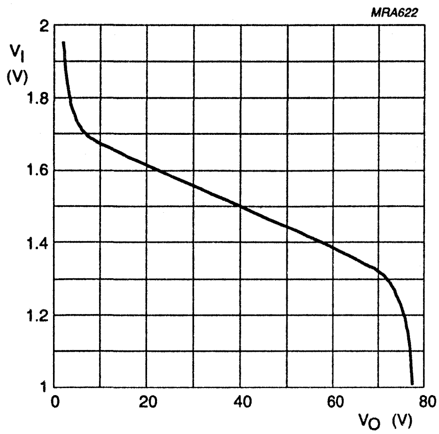


Fig.4 Voltage ratio at RF input port, typical values.

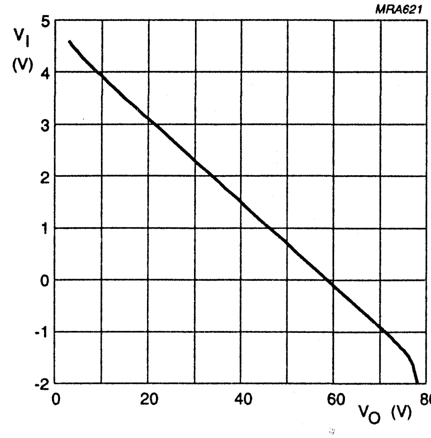


Fig.5 Voltage ratio at port 1, typical values.

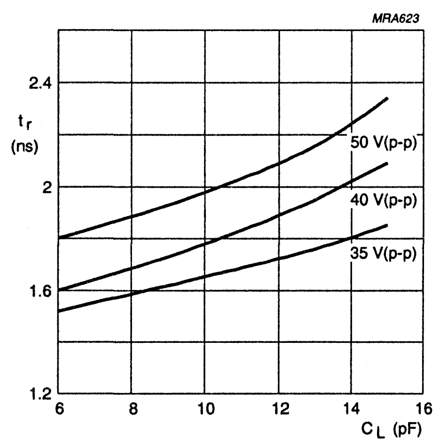


Fig.6 Rise time as a function of load capacitance, typical values.

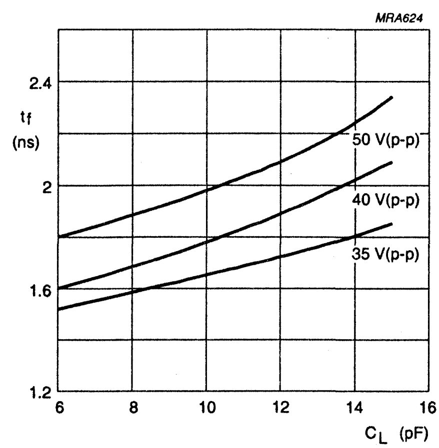
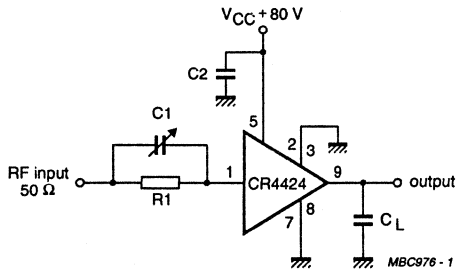


Fig.7 Fall time as a function of load capacitance, typical values.



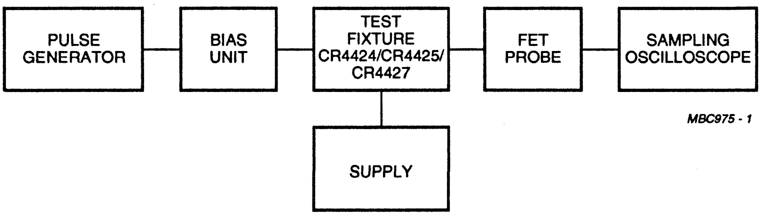


Fig.8 CRT amplifier test circuit and block diagram.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE
C1	capacitor	10 to 120 pF (typically 60 pF)
C2	chip capacitor, plus electrolytic capacitor	10 nF, plus 4.7 μF/160 V
R1	resistor	typically 287 Ω

Equipment used in test circuit

Pulse generator	Pico Second, model 2600B, rise time 350 ps
Bias unit	Pico Second, model 5555
Power supply	80 V
FET probe	Philips, model PM8943, attenuation 100:1
Sampling oscilloscope	Tektronix, model 11803, sampling head SD24

Triple video driver hybrid amplifier — CR5527

FEATURES

- Typical 10 to 90% transition times with C_L = 10 pF:
  2.7 ns at 40 V(p-p) swing
  3.3 ns at 50 V(p-p) swing
- Low power consumption; 8 W with 25 MHz square wave
- Minimum bandwidth 120 MHz
- Very fast slew rate; 12 V/µs
- Excellent grey-scale linearity
- Unconditional stability
- Gold metallization ensures excellent reliability.

DESCRIPTION

Hybrid amplifier module comprising three wideband video amplifiers in a SOT347 package and designed for application in cathode-ray tube (CRT) drivers in high-resolution colour monitors.

PINNING - SOT347

PIN	DESCRIPTION
1	supply voltage 1 (V_{CC})
2	input 1
3	ground
4	output 1
5	supply voltage 2 (V_{CC})
6	input 2
7	ground
8	output 2
9	supply voltage 3 (V_{CC})
10	input 3
11	ground
12	output 3

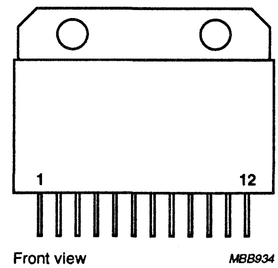
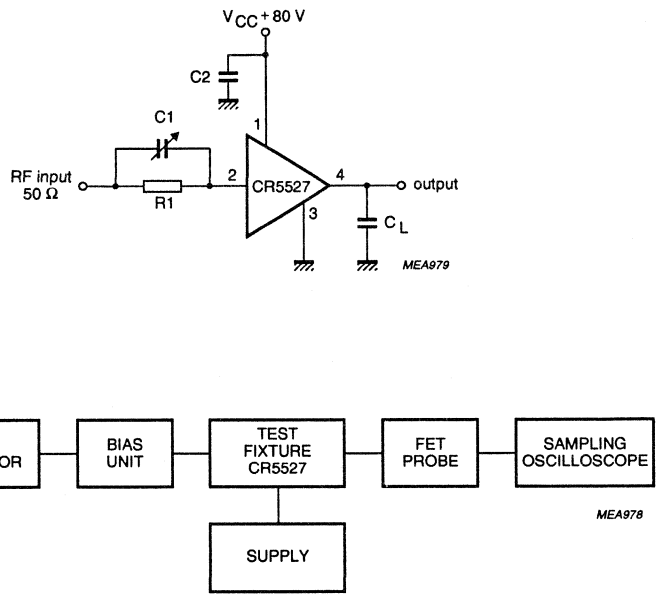


Fig.1 SOT347.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	–	90	V
T_{mb}	mounting base operating temperature	–20	100	°C
T_{stg}	storage temperature	–40	125	°C



Test circuit for one of the three CRT amplifiers.

Fig.2 CRT amplifier test circuit and block diagram.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE
C1	capacitor	10 to 120 pF (typically 39 pF)
C2	chip capacitor, plus electrolytic capacitor	10 nF, plus 4.7 µF/160 V
R1	resistor	typically 430 Ω

Equipment used in test circuit

Pulse generator	Pico Second, model 2600B, rise time 350 ps
Bias unit	Pico Second, model 5555
Power supply	80 V
FET probe	Philips, model PM8943, attenuation 100:1
Sampling oscilloscope	Tektronix, model 11803, sampling head SD24

PNP 1 GHz switching transistor | MPS3640

DESCRIPTION

PNP general purpose switching transistor in a SOT54 (TO-92) envelope.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

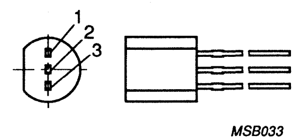


Fig.1 SOT54.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	–	12	V
$-V_{CEO}$	collector-emitter voltage	open base	–	12	V
$-V_{EBO}$	emitter-base voltage	open collector	–	4	V
$-I_C$	DC collector current		–	80	mA
P_{tot}	total power dissipation	T_s = 72 °C (note 1)	–	625	mW
T_{stg}	storage temperature		–55	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	125 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

 Capability approved CECC 50 000 (issue 4), 1986

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Off characteristics					
$-V_{(BR)CBO}$	collector-base breakdown voltage	$-I_C$ = 100 µA; I_E = 0	12	–	V
$-V_{(BR)CES}$	collector-emitter breakdown voltage	$-I_C$ = 100 µA; V_{BE} = 0	12	–	V
$-V_{(BR)EBO}$	emitter-base breakdown voltage	$-I_E$ = 100 µA; I_C = 0	4	–	V
$-I_{CES}$	collector cut-off current	$-V_{CE}$ = 6 V; V_{BE} = 0	–	0.01	µA
		$-V_{CE}$ = 6 V; V_{BE} = 0; T_{amb} = 65 °C	–	1	µA
$-I_B$	base current	$-V_{CE}$ = 6 V; V_{EB} = 0	–	10	nA
On characteristics; pulse test: pulse width ≤ 300 µs, duty cycle ≤ 2%.					
h_{FE}	DC current gain	$-I_C$ = 10 mA; $-V_{CE}$ = 0.3 V	30	120	
		$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	20	–	
$-V_{CEsat}$	collector-emitter saturation voltage	$-I_C$ = 10 mA; $-I_B$ = 1 mA	–	0.2	V
		$-I_C$ = 50 mA; $-I_B$ = 5 mA	–	0.6	V
		$-I_C$ = 10 mA; $-I_B$ = 5 mA; T_{amb} = 65 °C	–	0.25	V
$-V_{BEsat}$	base-emitter saturation voltage	$-I_C$ = 10 mA; $-I_B$ = 0.5 mA	0.75	0.95	V
		$-I_C$ = 10 mA; $-I_B$ = 1 mA	0.75	1	V
		$-I_C$ = 50 mA; $-I_B$ = 5 mA	–	1.5	V
Small-signal characteristics					
f_T	transition frequency	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 100 MHz	500	–	MHz
C_o	output capacitance	I_E = 0; $-V_{CB}$ = 5 V; f = 1 MHz	–	3.5	pF
C_i	input capacitance	I_C = 0; $-V_{EB}$ = 0.5 V; f = 1 MHz	–	3.5	pF
Switching times					
t_d	delay time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = 5 mA	–	10	ns
t_s	storage time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = $-I_{B2}$ = 5 mA	–	20	ns
t_r	rise time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = 5 mA	–	30	ns
t_f	fall time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = $-I_{B2}$ = 5 mA	–	12	ns
t_{on}	turn-on time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = 5 mA	–	25	ns
		$-V_{CC}$ = 1.5 V; $-I_C$ = 10 mA; $-I_{B1}$ = 0.5 mA	–	60	ns
t_{off}	turn-off time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = I_{B2} = 5 mA	–	35	ns
		$-V_{CC}$ = 1.5 V; $-I_C$ = 10 mA; $-I_{B1}$ = I_{B2} = 0.5 mA	–	75	ns

NPN 1 GHz general purpose switching transistor

MPSH10

FEATURES

- Low cost
- High power gain.

DESCRIPTION

Silicon NPN general purpose transistor in a SOT54 (TO-92) envelope. PNP complement is the MPSH81.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base

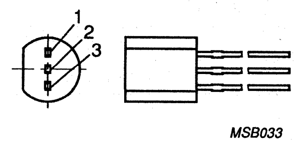


Fig.1 SOT54.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
P_{tot}	total power dissipation	T_s = 25 °C (note 1)	–	1	W
T_j	junction temperature		–	150	°C
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 mA	60	–	
C_{re}	collector-emitter feedback capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.7	pF
C_{rb}	collector-base feedback capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	0.35	0.65	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	650	–	MHz
r_bC_c	collector-base time constant	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	–	9	ps

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	40	mA
P_{tot}	total power dissipation	T_s = 25 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	125 K/W
$R_{th\ j\text{-}a}$	from junction to ambient	250 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

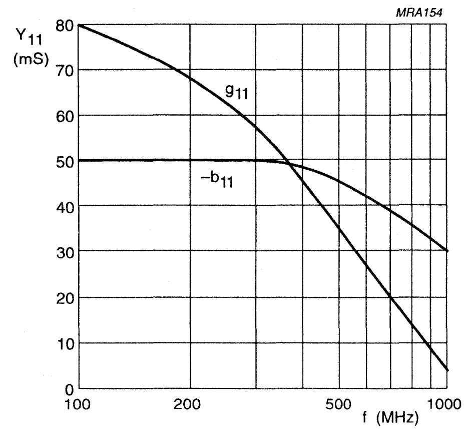
CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA; I_E = 0	30	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; I_B = 0	25	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 μA; I_C = 0	3	–	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 4 mA; I_B = 0.4 mA	–	0.5	V
$V_{BE\ on}$	base-emitter ON voltage	V_{CE} = 10 V; I_C = 4 mA	–	0.95	V
I_{CBO}	collector-base cut-off current	V_{CB} = 25 V; I_E = 0	–	100	nA
I_{EBO}	emitter-base cut-off current	V_{CB} = 25 V; I_C = 0	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 mA	60	–	
C_{re}	collector-emitter feedback capacitance	V_{CB} = 10 V; I_E = i_e = 0; f = 1 MHz	–	0.7	pF
C_{rb}	collector-base feedback capacitance	V_{CB} = 10 V; I_C = i_c = 0; f = 1 MHz	0.35	0.65	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	650	–	MHz
r_bC_c	collector-base time constant	V_{CB} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	–	9	ps

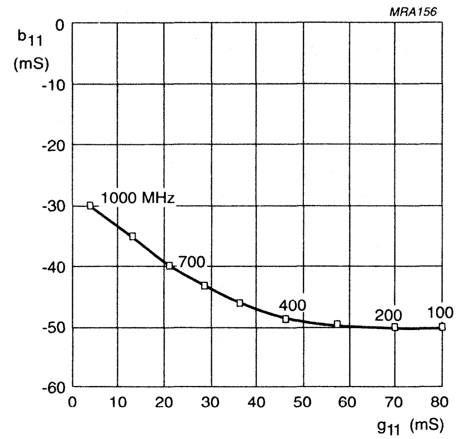
NPN 1 GHz general purpose switching transistor

MPSH10



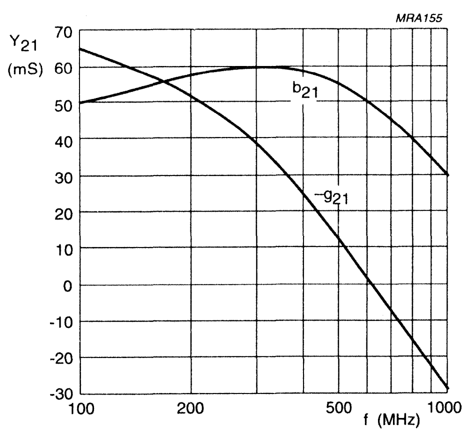
V_{CB} = 10 V; I_C = 4 mA.

Fig.2 Common base input admittance (Y_{11}) as a function of frequency.



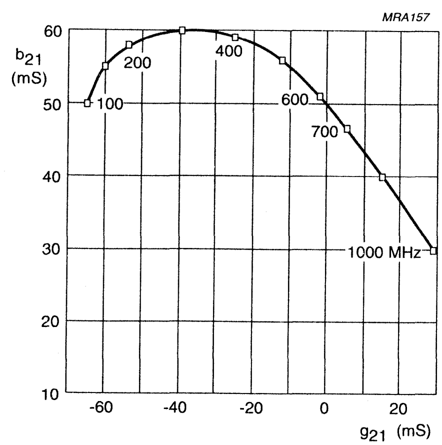
V_{CB} = 10 V; I_C = 4 mA.

Fig.3 Common base input admittance (Y_{11}).



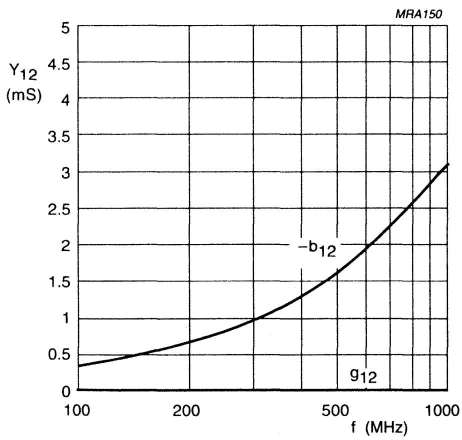
V_{CB} = 10 V; I_C = 4 mA.

Fig.4 Common base forward transfer admittance (Y_{21}) as a function of frequency.



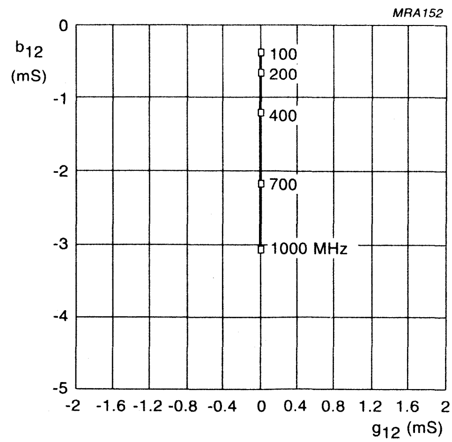
V_{CB} = 10 V; I_C = 4 mA.

Fig.5 Common base forward transfer admittance (Y_{21}).



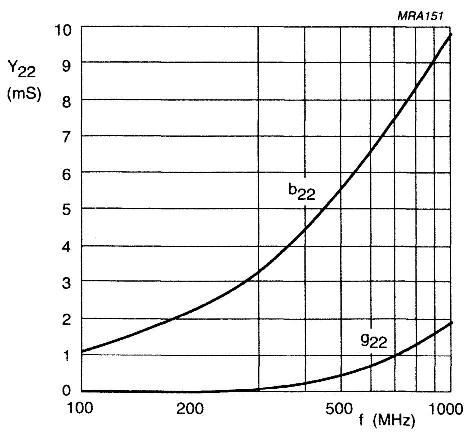
V_{CB} = 10 V; I_C = 4 mA.

Fig.6 Common base reverse transfer admittance (Y_{12}) as a function of frequency.



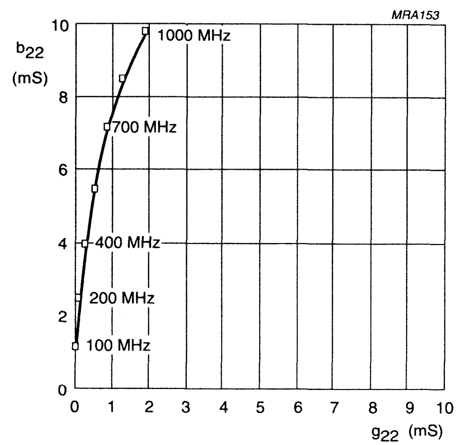
V_{CB} = 10 V; I_C = 4 mA.

Fig.7 Common base reverse transfer admittance (Y_{12}).



V_{CB} = 10 V; I_C = 4 mA.

Fig.8 Common base reverse admittance (Y_{22}) as a function of frequency.



V_{CB} = 10 V; I_C = 4 mA.

Fig.9 Common base reverse admittance (Y_{22}).

PNP 1 GHz switching transistor MPSH81

FEATURES

- Low cost
- High transition frequency.

DESCRIPTION

Silicon PNP general purpose transistor in a SOT54 (TO-92) envelope. NPN complement is the MPSH10.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base

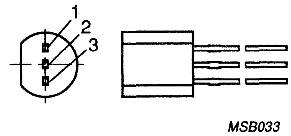


Fig.1 TO-92.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
P_{tot}	total power dissipation	T_s = 25 °C (note 1)	–	1	W
C_{ce}	collector-emitter capacitance	V_{CB} = 10 V; I_B = 0; f = 1 MHz	–	0.65	pF
C_{cb}	collector-base capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.85	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 5 mA; f = 100 MHz; T_{amb} = 25 °C	600	–	MHz

Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	40	mA
P_{tot}	total power dissipation	T_s = 25 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	125 K/W
$R_{th\ j\text{-}a}$	from junction to ambient	250 K/W

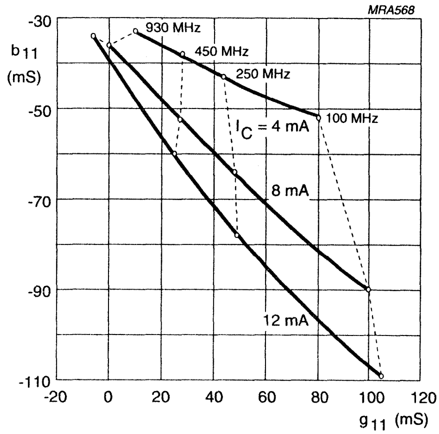
Note

1. T_s is the temperature at the soldering point of the collector lead, 4 mm from the body.

CHARACTERISTICS

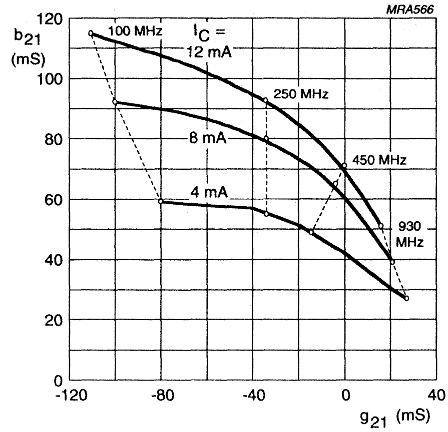
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 μA; I_E = 0	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; I_B = 0	20	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 μA; I_C = 0	3	–	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.5 mA	–	0.5	V
$V_{BE\ on}$	base-emitter ON voltage	V_{CE} = 10 V; I_C = 5 mA	–	0.9	V
I_{CBO}	collector-base cut-off current	V_{CB} = 10 V; I_E = 0	–	100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 2 V; I_C = 0	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 5 mA	60	–	
C_{ce}	collector-emitter capacitance	V_{CB} = 10 V; I_B = 0; f = 1 MHz	–	0.65	pF
C_{cb}	collector-base capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.85	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 5 mA; f = 100 MHz; T_{amb} = 25 °C	600	–	MHz



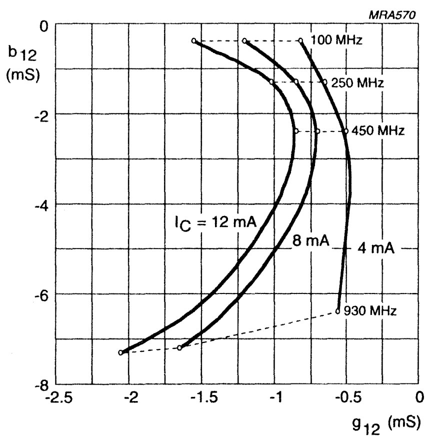
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.2 Common base input admittance (Y_{11}).



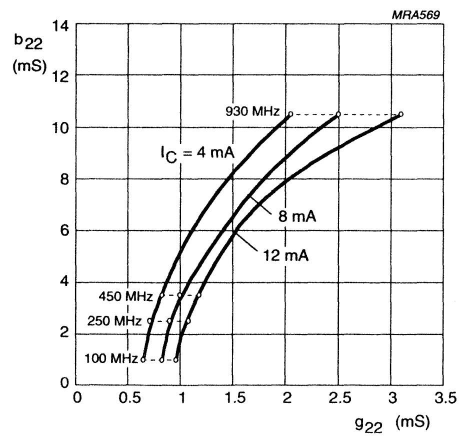
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.3 Forward transfer admittance (Y_{21}).



V_{CB} = 10 V; T_{amb} = 25 °C.

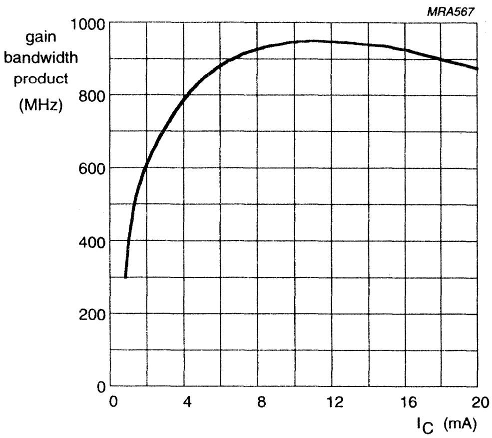
Fig.4 Reverse transfer admittance (Y_{12}).



V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.5 Common base output admittance (Y_{22}).

PNP 1 GHz switching transistor MPSH81



V_{CE} = 10 V; f = 100 MHz.

Fig.6 Current gain-bandwidth product as a function of collector current.

Video output amplifier | OM976

FEATURES

- DC coupled video amplifier for cathode drive, with a positive going video input
- Low internal thermal resistance
- A single fixed supply voltage and no components other than the series input resistor and capacitor.

DESCRIPTION

The OM976 is a hybrid integrated video amplifier circuit with a buffered output stage. It is intended for use in colour or monochrome high resolution video displays.

PINNING

PIN	DESCRIPTION
1	input
2	ground
3	ground
5	supply (+)
7	ground
8	ground
9	output

PIN CONFIGURATION

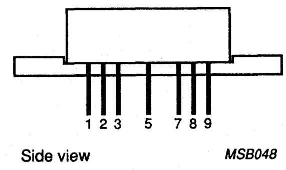


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
V_S	output supply voltage		80	V
I_5	supply current		45	mA
V_{in}	input voltage signal (positive)	DC value; with a 250 Ω resistor in series		
	black level		0	V
	white level		2.5	V
V_{out}	output voltage signal			
	peak-to-peak		40	V
	DC offset range possibility	by varying the DC input level	30	V

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{5-7}	supply voltage		–	90	V
T_{stg}	storage temperature range		–40	125	°C
$T_{hs\ max}$	heatsink working temperature		–	80	°C
P_{tot}	total power dissipation	at max. working temperature	–	8	W

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{5-7}	supply voltage		–	80	90	V
I_5	supply current	input and output open	39.5	43.5	47.5	mA
V_{1-2}	open input DC voltage	output open	1.15	1.5	1.85	V
V_{9-7}	open output DC voltage	input open	36	40	44	V
V_o/I_i	output voltage as a function of input current		3.5	4	4.5	V/mA
V_o/V_i	output voltage as a function of input voltage	with a 250 Ω resistor in series	14	16	18	V/V
V_{om}	minimum output saturation voltage		–	–	5	V
V_{oM}	maximum output saturation voltage		75	–	–	V
B	3 dB bandwidth	note 1	–	135	–	MHz
Switching times						
t_r	rise time	note 1	–	2.7	3.2	ns
t_f	fall time	note 1	–	2.7	3.2	ns

Note

1. At optimum drive and compensation, with an output load capacitance of 8.5 pF.

APPLICATION INFORMATION

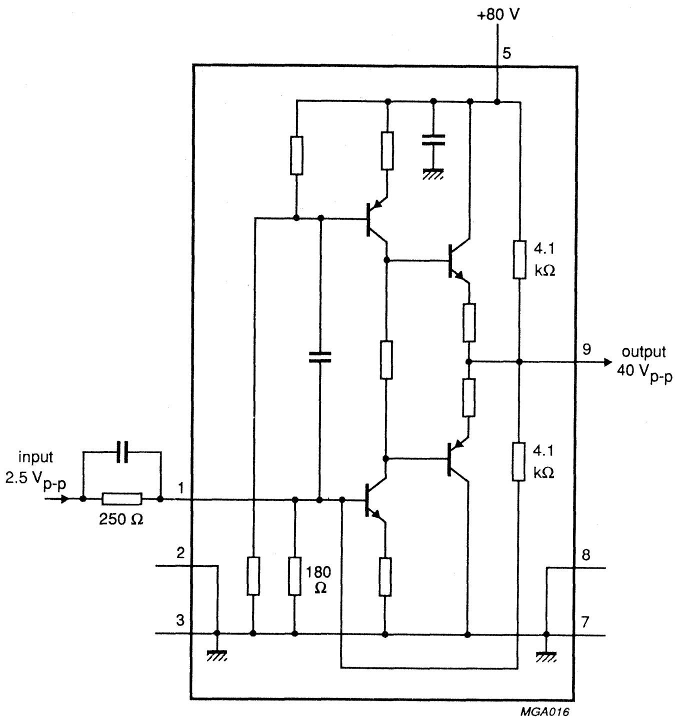


Fig.2 Simplified electrical diagram.

PNP 1 GHz switching transistor — PMBT3640

DESCRIPTION

PNP general purpose switching transistor in a SOT23 package.

PINNING

PIN	DESCRIPTION
Code: V25	
1	base
2	emitter
3	collector

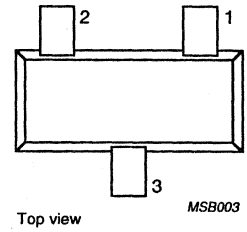


Fig.1 SOT23.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	–	12	V
$-V_{CEO}$	collector-emitter voltage	open base	–	12	V
$-V_{EBO}$	emitter-base voltage	open collector	–	4	V
$-I_C$	DC collector current		–	80	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	350	mW
T_{stg}	storage temperature		–55	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Off characteristics					
$-V_{(BR)CBO}$	collector-base breakdown voltage	$-I_C$ = 100 μA; I_E = 0	12	–	V
$-V_{(BR)CES}$	collector-emitter breakdown voltage	$-I_C$ = 100 μA; V_{BE} = 0	12	–	V
$-V_{(BR)EBO}$	emitter-base breakdown voltage	$-I_E$ = 100 μA; I_C = 0	4	–	V
$-I_{CES}$	collector cut-off current	$-V_{CE}$ = 6 V; V_{BE} = 0	–	0.01	μA
		$-V_{CE}$ = 6 V; V_{BE} = 0; T_{amb} = 65 °C	–	1	μA
$-I_B$	base current	$-V_{CE}$ = 6 V; V_{EB} = 0	–	10	nA
On characteristics; pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2%.					
h_{FE}	DC current gain	$-I_C$ = 10 mA; $-V_{CE}$ = 0.3 V	30	120	
		$-I_C$ = 50 mA; $-V_{CE}$ = 1 V	20	–	
$-V_{CEsat}$	collector-emitter saturation voltage	$-I_C$ = 10 mA; $-I_B$ = 1 mA	–	0.2	V
		$-I_C$ = 50 mA; $-I_B$ = 5 mA	–	0.6	V
		$-I_C$ = 10 mA; $-I_B$ = 1 mA; T_{amb} = 65 °C	–	0.25	V
$-V_{BEsat}$	base-emitter saturation voltage	$-I_C$ = 10 mA; $-I_B$ = 0.5 mA	0.75	0.95	V
		$-I_C$ = 10 mA; $-I_B$ = 1 mA	0.8	1	V
		$-I_C$ = 50 mA; $-I_B$ = 5 mA	–	1.5	V
Small-signal characteristics					
f_T	transition frequency	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 100 MHz	500	–	MHz
C_o	output capacitance	I_E = 0; $-V_{CB}$ = 5 V; f = 1 MHz	–	3.5	pF
C_i	input capacitance	I_C = 0; $-V_{EB}$ = 0.5 V; f = 1 MHz	–	3.5	pF
Switching times					
t_d	delay time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = 5 mA	–	10	ns
t_s	storage time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = $-I_{B2}$ = 5 mA	–	20	ns
t_r	rise time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = 5 mA	–	30	ns
t_f	fall time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-I_{B1}$ = $-I_{B2}$ = 5 mA	–	12	ns
t_{on}	turn-on time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = 5 mA	–	25	ns
		$-V_{CC}$ = 1.5 V; $-I_C$ = 10 mA; $-I_{B1}$ = 0.5 mA	–	60	ns
t_{off}	turn-off time	$-V_{CC}$ = 6 V; $-I_C$ = 50 mA; $-V_{BE(off)}$ = 1.9 V; $-I_{B1}$ = I_{B2} = 5 mA	–	35	ns
		$-V_{CC}$ = 1.5 V; $-I_C$ = 10 mA; $-I_{B1}$ = I_{B2} = 0.5 mA	–	75	ns

NPN 1 GHz general purpose switching transistor

PMBTH10

FEATURES

- Low cost
- High power gain.

DESCRIPTION

The PMBTH10 is a general purpose silicon npn transistor, encapsulated in a SOT23 plastic envelope. Its pnp complement is the PMBTH81.

PINNING

PIN	DESCRIPTION
Code: V30	
1	base
2	emitter
3	collector

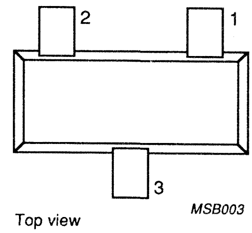


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
P_{tot}	total power dissipation	T_s = 45 °C (note 1)	–	400	mW
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 mA	60	–	
C_{re}	collector-emitter feedback capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.7	pF
C_{rb}	collector-base feedback capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	0.35	0.65	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	650	–	MHz
r_bC_c	collector-base time constant	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	–	9	ps

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	40	mA
P_{tot}	total power dissipation	T_s = 45 °C (note 1)	–	400	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

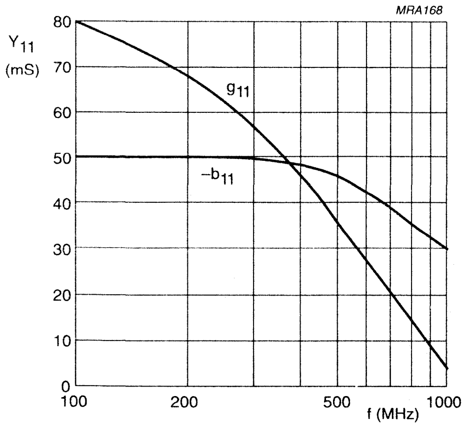
Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

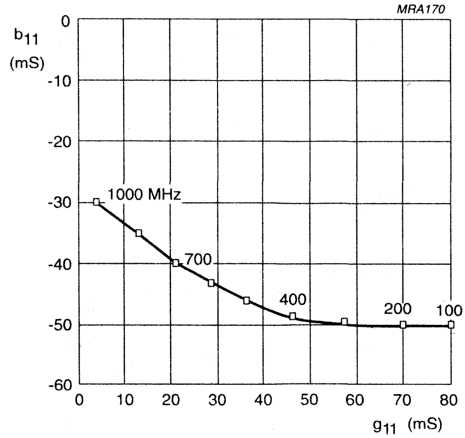
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 µA; I_E = 0	30	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; I_B = 0	25	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 µA; I_C = 0	3	–	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 4 mA; I_B = 0.4 mA	–	0.5	V
$V_{BE\ on}$	base-emitter ON voltage	V_{CE} = 10 V; I_C = 4 mA	–	0.95	V
I_{CBO}	collector-base cut-off current	V_{CB} = 25 V; I_E = 0	–	100	nA
I_{EBO}	emitter-base cut-off current	V_{CB} = 25 V; I_C = 0	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 mA	60	–	
C_{re}	collector-emitter feedback capacitance	V_{CB} = 10 V; I_E = i_e = 0; f = 1 MHz	–	0.7	pF
C_{rb}	collector-base feedback capacitance	V_{CB} = 10 V; I_C = i_c = 0; f = 1 MHz	0.35	0.65	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	650	–	MHz
r_bC_c	collector-base time constant	V_{CB} = 10 V; I_C = 4 mA; f = 100 MHz; T_{amb} = 25 °C	–	9	ps



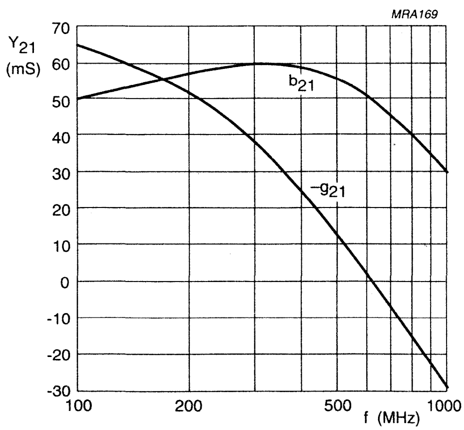
V_{CB} = 10 V; I_C = 4 mA.

Fig.2 Common base input admittance (Y_{11}) as a function of frequency.



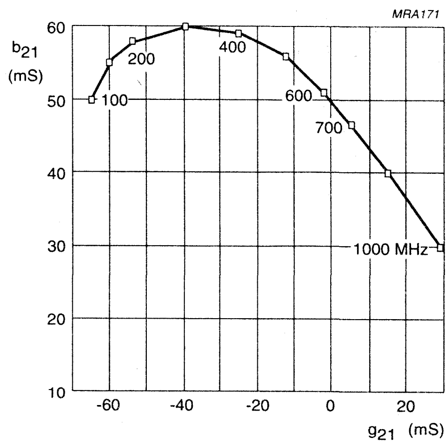
V_{CB} = 10 V; I_C = 4 mA.

Fig.3 Common base input admittance (Y_{11}).



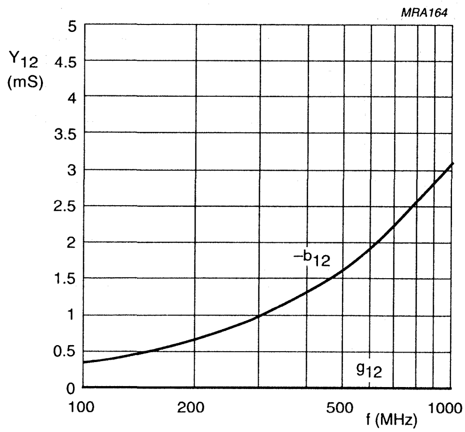
V_{CB} = 10 V; I_C = 4 mA.

Fig.4 Common base forward transfer admittance (Y_{21}) as a function of frequency.



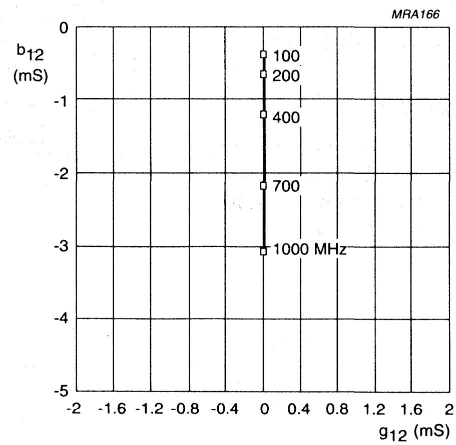
V_{CB} = 10 V; I_C = 4 mA.

Fig.5 Common base forward transfer admittance (Y_{21}).



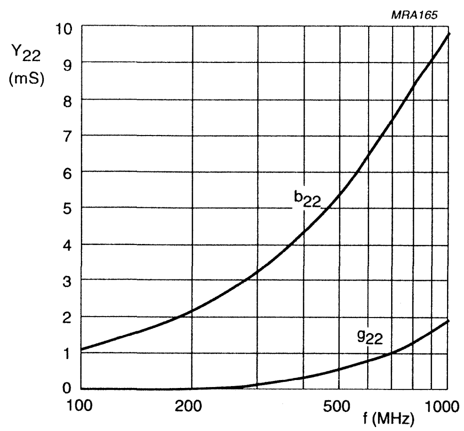
V_{CB} = 10 V; I_C = 4 mA.

Fig.6 Common base reverse transfer admittance (Y_{12}) as a function of frequency.



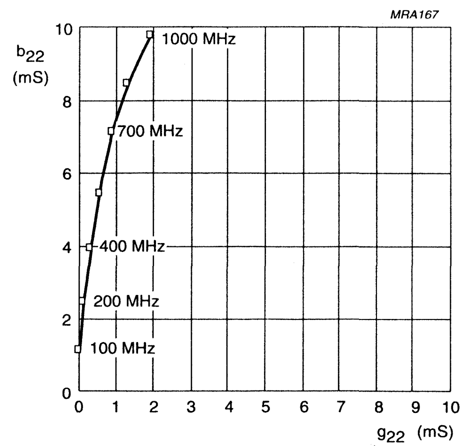
V_{CB} = 10 V; I_C = 4 mA.

Fig.7 Common base reverse transfer admittance (Y_{12}).



V_{CB} = 10 V; I_C = 4 mA.

Fig.8 Common base reverse admittance (Y_{22}) as a function of frequency.



V_{CB} = 10 V; I_C = 4 mA.

Fig.9 Common base reverse admittance (Y_{22}).

PNP 1 GHz switching transistor | PMBTH81

FEATURES

- Low cost
- High transition frequency.

DESCRIPTION

The PMBTH81 is a general purpose silicon pnp transistor, encapsulated in a SOT23 plastic envelope. Its complement is the PMBTH10.

PINNING

PIN	DESCRIPTION
Code: V31	
1	base
2	emitter
3	collector

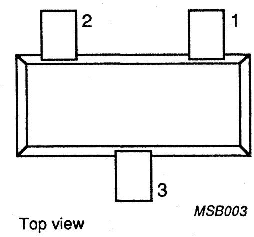


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
P_{tot}	total power dissipation	T_s = 45 °C (note 1)	–	400	mW
C_{ce}	collector-emitter capacitance	V_{CB} = 10 V; I_B = 0; f = 1 MHz	–	0.65	pF
C_{cb}	collector-base capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.85	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 5 mA; f = 100 MHz; T_{amb} = 25 °C	600	–	MHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

 Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	40	mA
P_{tot}	total power dissipation	T_s = 45 °C (note 1)	–	400	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

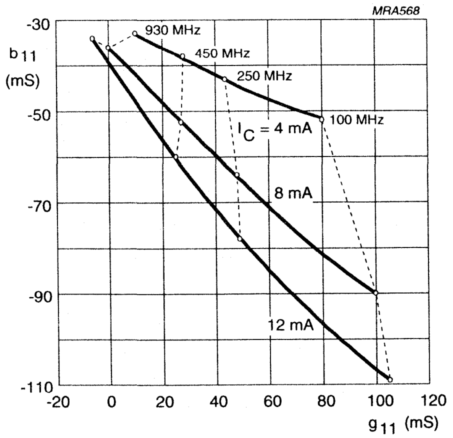
Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

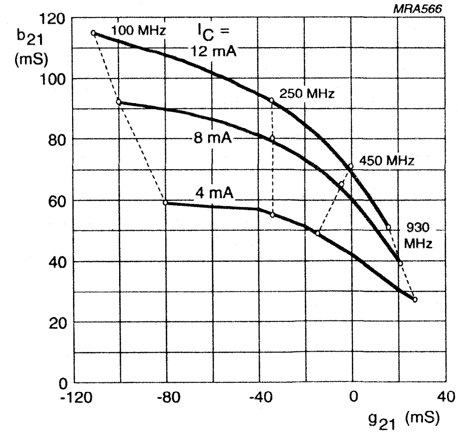
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 µA; I_E = 0	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 1 mA; I_B = 0	20	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 µA; I_C = 0	3	–	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 5 mA; I_B = 0.5 mA	–	0.5	V
$V_{BE\ on}$	base-emitter ON voltage	V_{CE} = 10 V; I_C = 5 mA	–	0.9	V
I_{CBO}	collector-base cut-off current	V_{CB} = 10 V; I_E = 0	–	100	nA
I_{EBO}	emitter-base cut-off current	V_{EB} = 2 V; I_C = 0	–	100	nA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 5 mA	60	–	
C_{ce}	collector-emitter capacitance	V_{CB} = 10 V; I_B = 0; f = 1 MHz	–	0.65	pF
C_{cb}	collector-base capacitance	V_{CB} = 10 V; I_E = 0; f = 1 MHz	–	0.85	pF
f_T	transition frequency	V_{CE} = 10 V; I_C = 5 mA; f = 100 MHz; T_{amb} = 25 °C	600	–	MHz



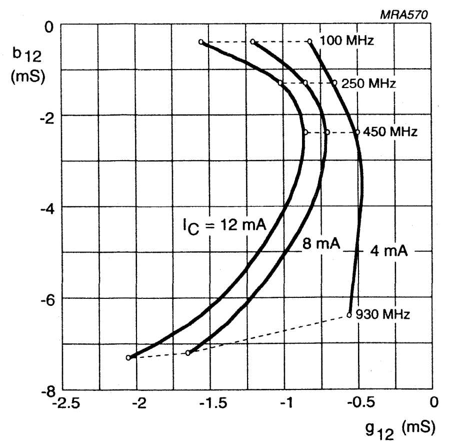
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.2 Common base input admittance (Y_{11}).



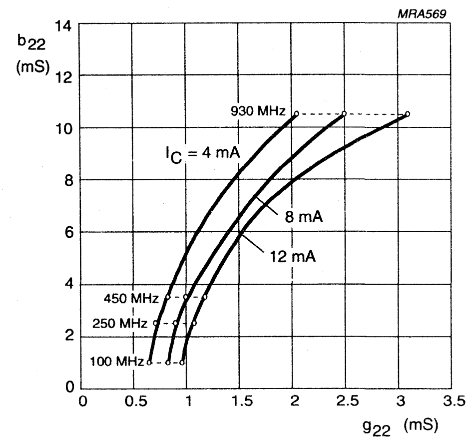
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.3 Forward transfer admittance (Y_{21}).



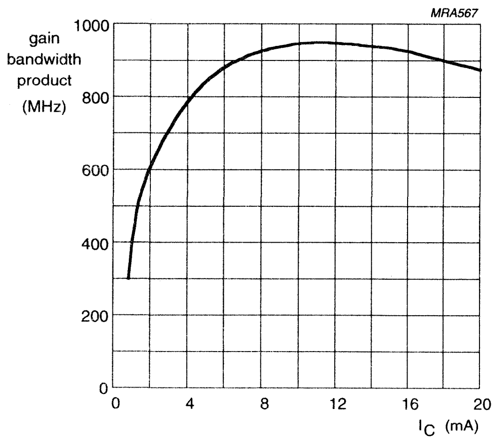
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.4 Reverse transfer admittance (Y_{12}).



V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.5 Common base output admittance (Y_{22}).



V_{CE} = 10 V; f = 100 MHz.

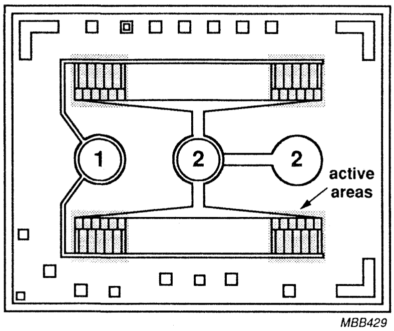
Fig.6 Current gain-bandwidth product as a function of collector current.

NPN 7 GHz wideband transistor crystal — X3A-BFG134

DESCRIPTION

NPN crystal used in BFR134 (SOT37), BFQ135 (SOT172) and BFG135 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Note: Elements are positioned at 180° to the reference (flat side).

Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFG134 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 75 µm
Emitter bond pad 2	dia. 75 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	750 x 570 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	5000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	25	V
V_{CEO}	collector-emitter voltage	open base	15	V
V_{EBO}	emitter-base voltage	open collector	2	V
I_C	DC collector current		150	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	1	µA
h_{FE}	DC current gain		80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz	–	7	–	GHz

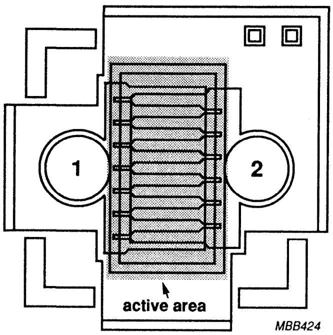
PNP 4 GHz wideband transistor crystal

X3A-BFQ32

DESCRIPTION

PNP crystal used in BFQ32S (SOT37), BFQ149 (SOT89) and BFG31 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFQ32 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	Au 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 60 µm
Emitter bond pad 2	dia. 60 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 350 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	15 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	20	V
$-V_{CEO}$	collector-emitter voltage	open base	15	V
$-V_{EBO}$	emitter-base voltage	open collector	3	V
$-I_C$	DC collector current		100	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current		–	–	100	nA
h_{FE}	DC current gain		25	50	–	
f_T	transition frequency	$-I_C$ = 70 mA; $-V_{CE}$ = 10 V; f = 500 MHz	–	4.5	–	GHz
F	noise figure	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 800 MHz	–	4.3	–	dB

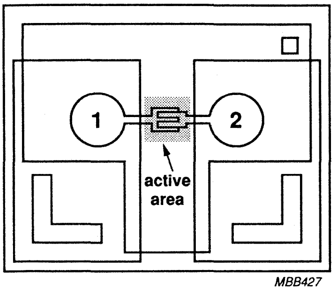
NPN 12 GHz wideband transistor crystal

X3A-BFQ33

DESCRIPTION

NPN crystal used in BFQ33C (SOT173) and BFG33 (SOT143). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFQ33 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 50 µm
Emitter bond pad 2	dia. 50 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 300 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	10 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	9	V
V_{CEO}	collector-emitter voltage	open base	7	V
V_{EBO}	emitter-base voltage	open collector	2	V
I_C	DC collector current		20	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

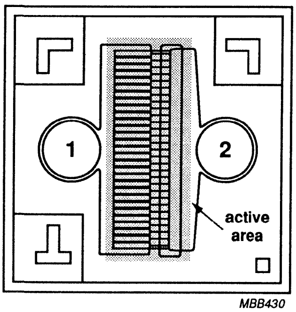
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		50	90	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 5 V; f = 500 MHz	–	12	–	GHz
F	noise figure	I_C = 5 mA; V_{CE} = 5 V; f = 2 GHz	–	3	–	dB

NPN 4 GHz wideband transistor crystal | X3A-BFQ34

DESCRIPTION

NPN crystal used in BFQ34T (SOT37), BFQ34 (SOT172) and BFG35 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFQ34 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 0.35 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 75 μm
Emitter bond pad 2	dia. 75 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	400 x 400 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	160 ±15 μm
Average number of good elements per wafer	10 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	25	V
V_{CEO}	collector-emitter voltage	open base	18	V
V_{EBO}	emitter-base voltage	open collector	2	V
I_C	DC collector current		150	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

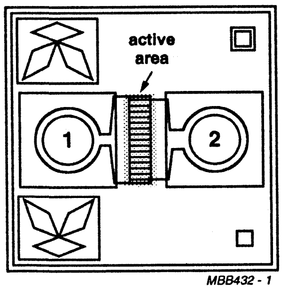
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	100	μA
h_{FE}	DC current gain		25	90	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz	–	4	–	GHz

NPN 8 GHz wideband transistor crystal X3A-BFQ65

DESCRIPTION

NPN crystal used in BFQ65 (SOT37), BFG67 (SOT143) and BFQ67 (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFQ65 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 0.35 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 45 μm
Emitter bond pad 2	dia. 45 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 350 μm
Separation lane	80 μm
Sawing lane	50 μm
Slice thickness	160 ±15 μm
Average number of good elements per wafer	15 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CEO}	collector-emitter voltage	open base	10	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		50	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

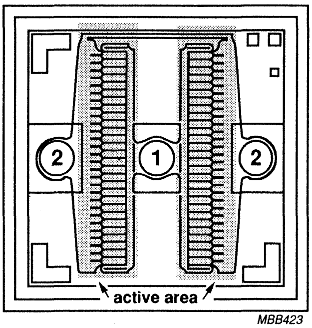
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz	–	8	–	GHz
F	noise figure	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	1.7	–	dB

NPN 1 GHz video transistor crystal | X3A-BFQ168

DESCRIPTION

NPN crystal used in BFQ161 (TO-92), BFQ162 (SOT32) and BFQ166 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFQ168 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 1.5 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 55 μm
Emitter bond pad 2	dia. 55 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	500 x 500 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	200 ±15 μm
Average number of good elements per wafer	8000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	19	V
V_{EBO}	emitter-base voltage	open collector	3	V
I_C	DC collector current		500	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	V_{CE} = 10 V; V_{BE} = 0	–	–	100	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 5 V	40	50	–	
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; f = 100 MHz	1	–	–	GHz

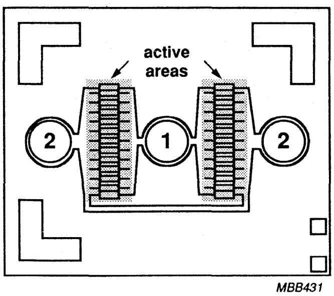
NPN 8 GHz wideband transistor crystal

X3A-BFQ195

DESCRIPTION

NPN crystal used in BFG195 (SOT103), BFG197 (SOT143) and BFG198 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFQ195 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 0.35 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 45 μm
Emitter bond pad 2	dia. 45 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	200 ±15 μm
Average number of good elements per wafer	7000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CEO}	collector-emitter voltage	open base	10	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		100	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

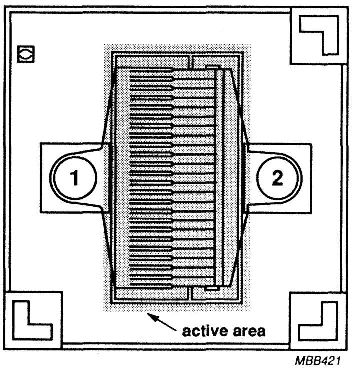
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	100	nA
h_{FE}	DC current gain		40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz	–	8	–	GHz
F	noise figure	I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz	–	2	–	dB

NPN 1 GHz video transistor crystal — X3A-BFQ234

DESCRIPTION

NPN crystal used in BFQ232(A) (SOT32), BFQ235(A) (SOT128) and BFQ236(A) (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFQ234 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 1.5 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 70 µm
Emitter bond pad 2	dia. 70 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	600 x 600 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	200 ±15 µm
Average number of good elements per wafer	8000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	115	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	110	V
V_{EBO}	emitter-base voltage	open collector	3	V
I_C	DC collector current		300	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

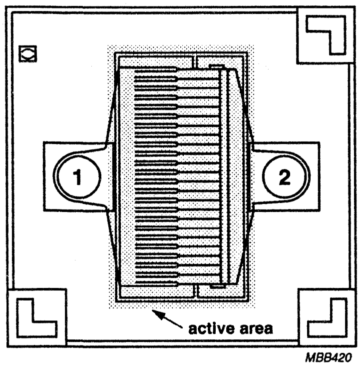
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	I_B = 0; V_{CE} = 50 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 10 V	20	35	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 100 MHz	0.8	1.2	–	GHz

PNP 1 GHz video transistor crystal X3A-BFQ254

DESCRIPTION

PNP crystal used in BFQ251 (TO-92), BFQ252(A) (SOT32) and BFQ256(A) (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFQ254 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	Au 1.5 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 70 µm
Emitter bond pad 2	dia. 70 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	600 x 600 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	200 ±15 µm
Average number of good elements per wafer	8000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	115	V
$-V_{CER}$	collector-emitter voltage	R_{BE} = 100 Ω	110	V
$-V_{EBO}$	emitter-base voltage	open collector	3	V
$-I_C$	DC collector current		300	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

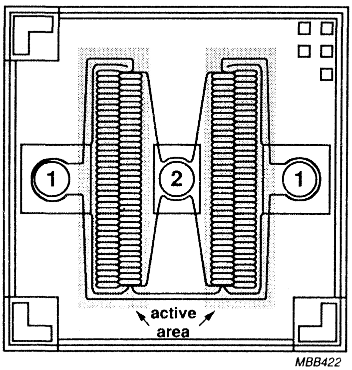
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CES}$	collector cut-off current	$I_B = 0$; $-V_{CE} = 50$ V	–	–	100	µA
h_{FE}	DC current gain	$-I_C = 50$ mA; $-V_{CE} = 10$ V	20	30	–	
f_T	transition frequency	$-I_C = 50$ mA; $-V_{CE} = 10$ V; f = 100 MHz	0.8	1.2	–	GHz

NPN 1 GHz video transistor crystal | X3A-BFQ268

DESCRIPTION

NPN crystal used in BFQ262(A) (SOT32), BFQ265(A) (SOT128) and BFQ268 (SOT172). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFQ268 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 1.5 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 55 μm
Emitter bond pad 2	dia. 55 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	600 x 600 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	200 ±15 μm
Average number of good elements per wafer	8000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	115	V
V_{CER}	collector-emitter voltage	$R_{BE} = 100\ \Omega$	110	V
V_{EBO}	emitter-base voltage	open collector	3	V
I_C	DC collector current		400	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	collector cut-off current	$I_E = 0$; $V_{CE} = 50$ V	–	–	100	μA
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V	50	60	–	
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; f = 100 MHz	0.8	1.2	–	GHz

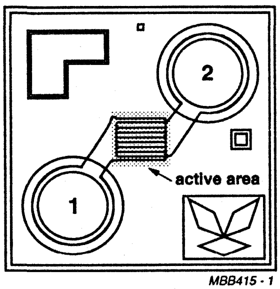
NPN 5 GHz wideband transistor crystal

X3A-BFR90A

DESCRIPTION

NPN crystal used in BFR90A (SOT37), BFQ53 (TO-72) and BFR92A (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFR90A crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	AuAs 0.35 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 60 μm
Emitter bond pad 2	dia. 60 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	160 ±15 μm
Average number of good elements per wafer	20 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CEO}	collector-emitter voltage	open base	15	V
V_{EBO}	emitter-base voltage	open collector	2	V
I_C	DC collector current		25	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		40	90	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; f = 1 GHz	–	2.1	–	dB

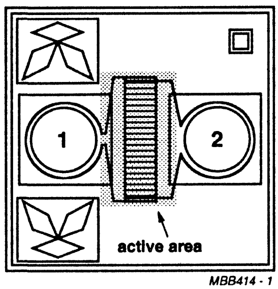
NPN 6 GHz wideband transistor crystal

X3A-BFR91A

DESCRIPTION

NPN crystal used in BFR91A (SOT37), BFQ22S (TO-72) and BFR93A (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFR91A crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 60 µm
Emitter bond pad 2	dia. 60 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	20 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	15	V
V_{CEO}	collector-emitter voltage	open base	12	V
V_{EBO}	emitter-base voltage	open collector	2	V
I_C	DC collector current		35	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		40	90	–	
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	–	6	–	GHz
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.9	–	dB

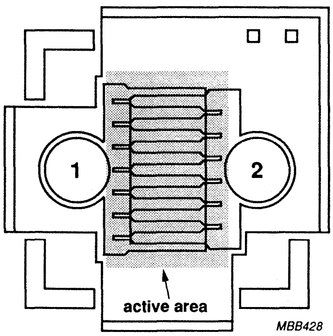
NPN 5 GHz wideband transistor crystal

X3A-BFR96

DESCRIPTION

NPN crystal used in BFR96S (SOT37), BFQ63 (TO-72) and BFR106 (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFR96 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 60 µm
Emitter bond pad 2	dia. 60 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 350 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	20 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CEO}	collector-emitter voltage	open base	15	V
V_{EBO}	emitter-base voltage	open collector	3	V
I_C	DC collector current		100	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	100	nA
h_{FE}	DC current gain		25	80	–	
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz	–	5	–	GHz
F	noise figure	I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz	–	4	–	dB

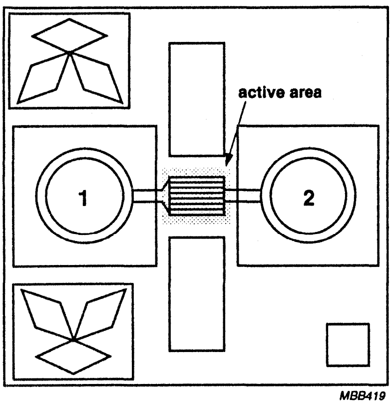
NPN 9 GHz wideband transistor crystal

X3A-BFR505

DESCRIPTION

NPN crystal used in BFR505 (SOT23), BFG505 (SOT143) and BFP505 (SOT173). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFR505 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 55 µm
Emitter bond pad 2	dia. 55 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	290 x 290 µm
Separation lane	60 µm
Sawing lane	50 µm
Slice thickness	200 ±15 µm
Average number of good elements per wafer	30 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	15	V
V_{CES}	collector-emitter voltage		15	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		18	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

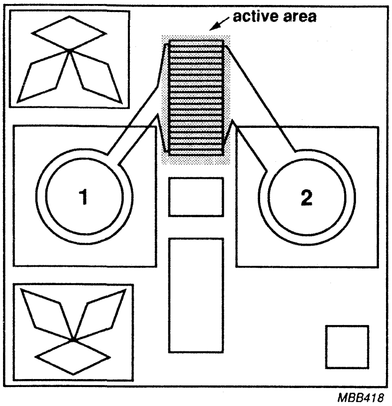
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 5$ mA; $V_{CE} = 6$ V	60	120	–	
f_T	transition frequency	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 1 GHz	–	9	–	GHz
F	noise figure	$I_C = 1.25$ mA; $V_{CE} = 6$ V; f = 900 MHz	–	1.1	–	dB

NPN 9 GHz wideband transistor crystal X3A-BFR520

DESCRIPTION

NPN crystal used in BFR520 (SOT23), BFG520 (SOT143) and BFP520 (SOT173). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFR520 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 55 µm
Emitter bond pad 2	dia. 55 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	290 x 290 µm
Separation lane	60 µm
Sawing lane	50 µm
Slice thickness	200 ±15 µm
Average number of good elements per wafer	30 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CES}	collector-emitter voltage		15	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		70	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	–	
f_T	transition frequency	$I_C = 70$ mA; $V_{CE} = 6$ V; f = 1 GHz	–	9	–	GHz
F	noise figure	$I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz	–	1.2	–	dB

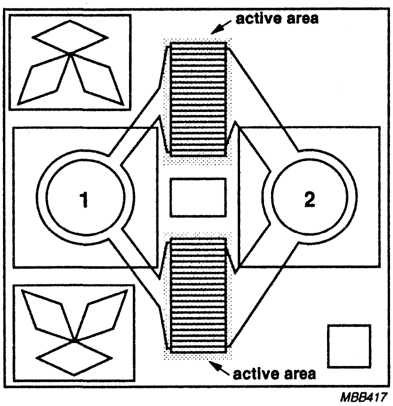
NPN 9 GHz wideband transistor crystal

X3A-BFR540

DESCRIPTION

NPN crystal used in BFR540 (SOT23), BFG540 (SOT143) and BFG541 (SOT223). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFR540 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 55 µm
Emitter bond pad 2	dia. 55 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	290 x 290 µm
Separation lane	60 µm
Sawing lane	50 µm
Slice thickness	200 ±15 µm
Average number of good elements per wafer	30 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	20	V
V_{CES}	collector-emitter voltage		15	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		120	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 8$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V	60	120	–	
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz	–	9	–	GHz
F	noise figure	$I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz	–	1.3	–	dB

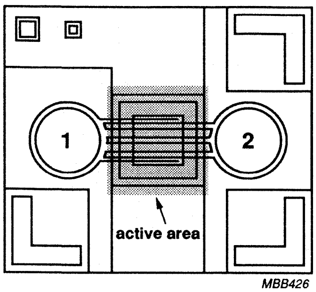
PNP 5 GHz wideband transistor crystal

X3A-BFT92

DESCRIPTION

PNP crystal used in BFQ51 (SOT37), BFQ52 (TO-72) and BFT92 (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 μm around metallization pattern.

Fig.1 X3A-BFT92 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 μm
Back metallization	Au 0.35 μm
Passivation	Si_3N_4 0.5 μm
Base bond pad 1	dia. 60 μm
Emitter bond pad 2	dia. 60 μm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 μm
Separation lane	70 μm
Sawing lane	50 μm
Slice thickness	160 ±15 μm
Average number of good elements per wafer	20 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	20	V
$-V_{CEO}$	collector-emitter voltage	open base	15	V
$-V_{EBO}$	emitter-base voltage	open collector	2	V
$-I_C$	DC collector current		25	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

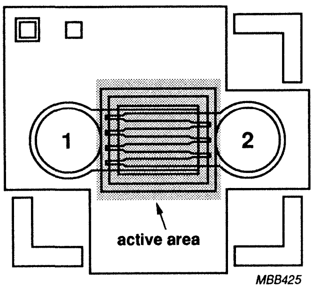
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		25	50	–	
f_T	transition frequency	$-I_C$ = 14 mA; $-V_{CE}$ = 10 V; f = 500 MHz	–	5	–	GHz
F	noise figure	$-I_C$ = 5 mA; $-V_{CE}$ = 10 V; f = 500 MHz	–	2.5	–	dB

PNP 5 GHz wideband transistor crystal | X3A-BFT93

DESCRIPTION

PNP crystal used in BFQ23 (SOT37), BFQ24 (TO-72) and BFT93 (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFT93 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	Au 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 60 µm
Emitter bond pad 2	dia. 60 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	20 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	15	V
$-V_{CEO}$	collector-emitter voltage	open base	12	V
$-V_{EBO}$	emitter-base voltage	open collector	2	V
$-I_C$	DC collector current		35	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current		–	–	50	nA
h_{FE}	DC current gain		20	50	–	
f_T	transition frequency	$-I_C$ = 30 mA; $-V_{CE}$ = 5 V; f = 500 MHz	–	5	–	GHz
F	noise figure	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 500 MHz	–	2.4	–	dB

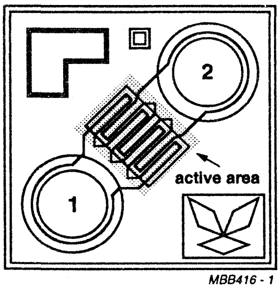
NPN 1 GHz wideband transistor crystal

X3A-BFW92

DESCRIPTION

NPN crystal used in BFW92 (SOT37), BFY90 (TO-72) and BFS17 (SOT23). Crystals are supplied as whole wafer, fully tested but unsawn.

ELEMENT LAYOUT



Active area: 10 µm around metallization pattern.

Fig.1 X3A-BFW92 crystal.

MECHANICAL DATA

Crystal	
Top metallization	Au 1.15 µm
Back metallization	AuAs 0.35 µm
Passivation	Si_3N_4 0.5 µm
Base bond pad 1	dia. 60 µm
Emitter bond pad 2	dia. 60 µm
Collector contact	on underside of crystal
Wafer	
Diameter	76.1 mm (3 inches)
Crystal pitch	350 x 320 µm
Separation lane	70 µm
Sawing lane	50 µm
Slice thickness	160 ±15 µm
Average number of good elements per wafer	25 000
Faulty devices	inked out
Visual inspection	to URV-3-5-52/733

LIMITING VALUES

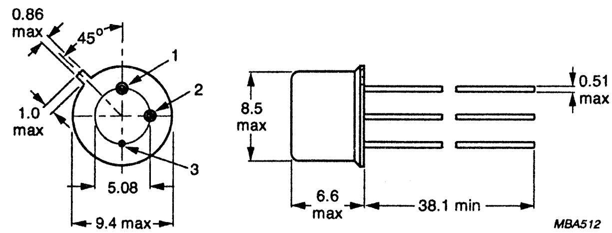
In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	25	V
V_{CEO}	collector-emitter voltage	open base	15	V
V_{EBO}	emitter-base voltage	open collector	2.5	V
I_C	DC collector current		25	mA
T_j	junction temperature		150	°C

CHARACTERISTICS

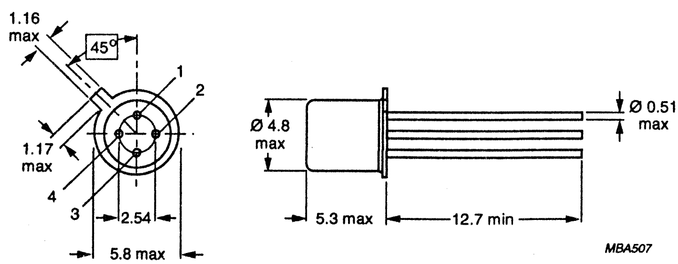
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current		–	–	10	nA
h_{FE}	DC current gain		25	90	–	
f_T	transition frequency	I_C = 25 mA; V_{CE} = 5 V; f = 500 MHz	–	1.6	–	GHz
F	noise figure	I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz	–	4	–	GHz

PACKAGE OUTLINES



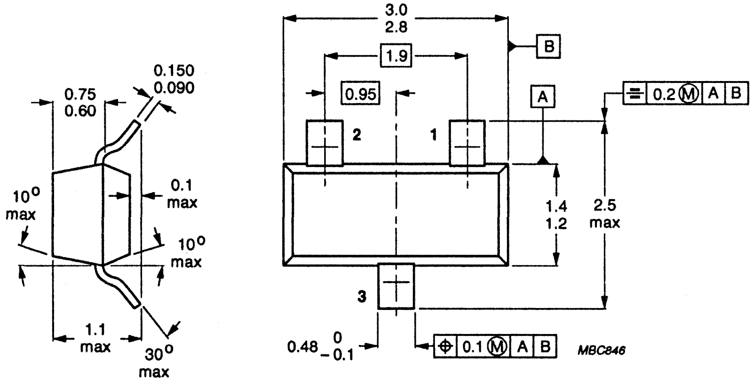
Dimensions in mm.

Fig.1 SOT5 (TO-39).



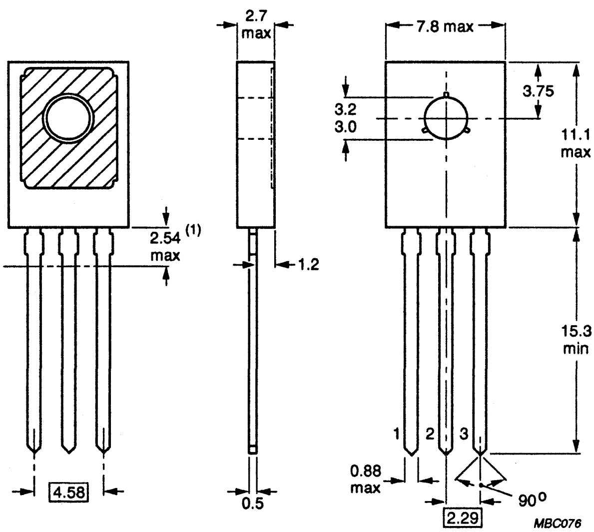
Dimensions in mm.

Fig.2 SOT18 (TO-72).



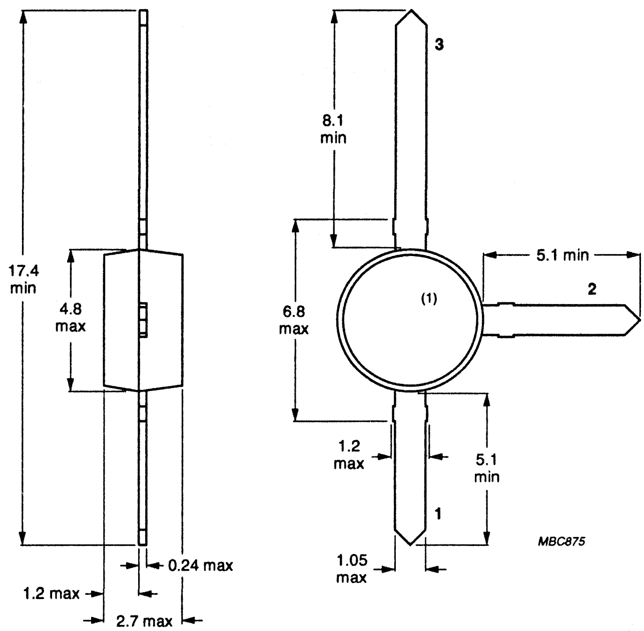
Dimensions in mm.

Fig.3 SOT23.



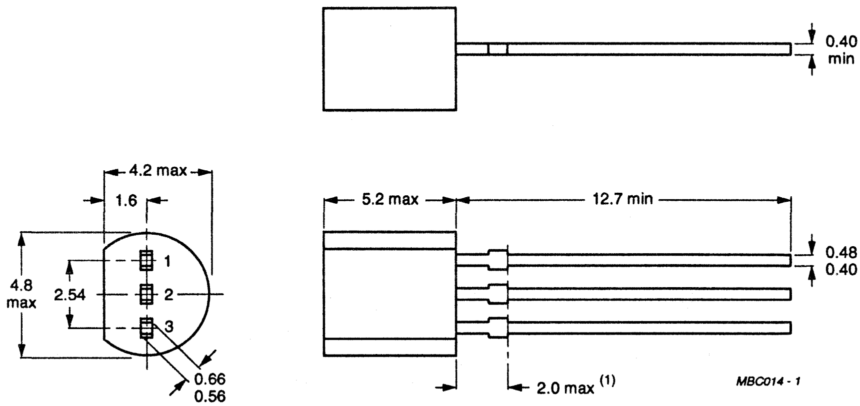
Dimensions in mm.
(1) Terminal dimensions within this zone are uncontrolled

Fig.4 SOT32 (TO-126).



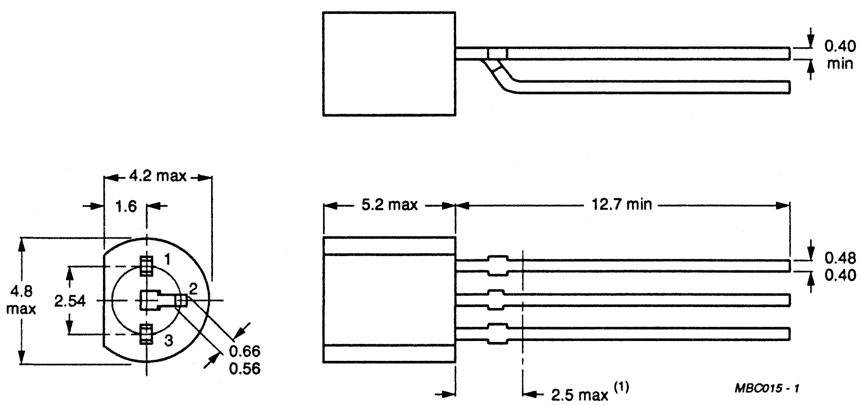
Dimensions in mm.
(1) Type number marking

Fig.5 SOT37.



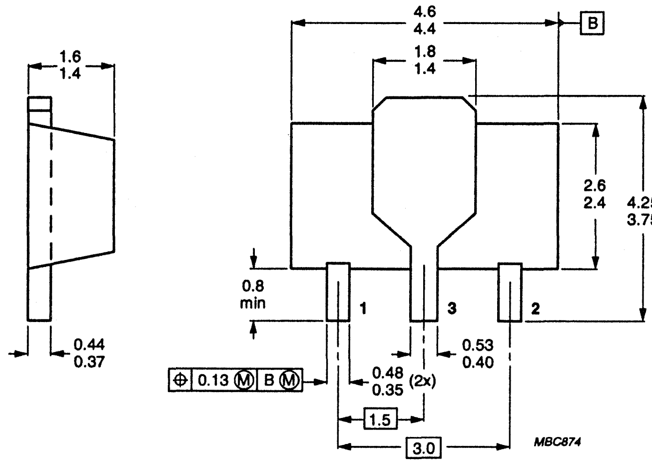
Dimensions in mm.
(1) Terminal dimensions within this zone are uncontrolled.

Fig.6 SOT54 (TO-92).



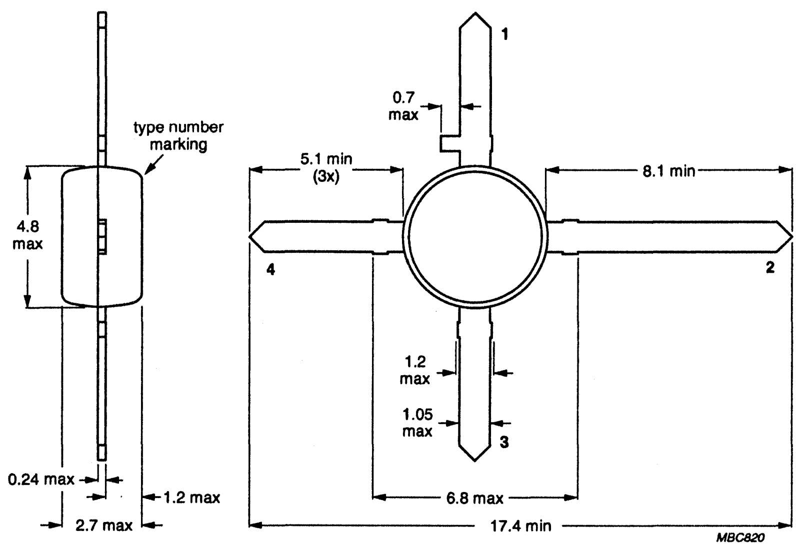
Dimensions in mm.
(1) Terminal dimensions within this zone are uncontrolled.

Fig.7 SOT54 (TO-92) variant.



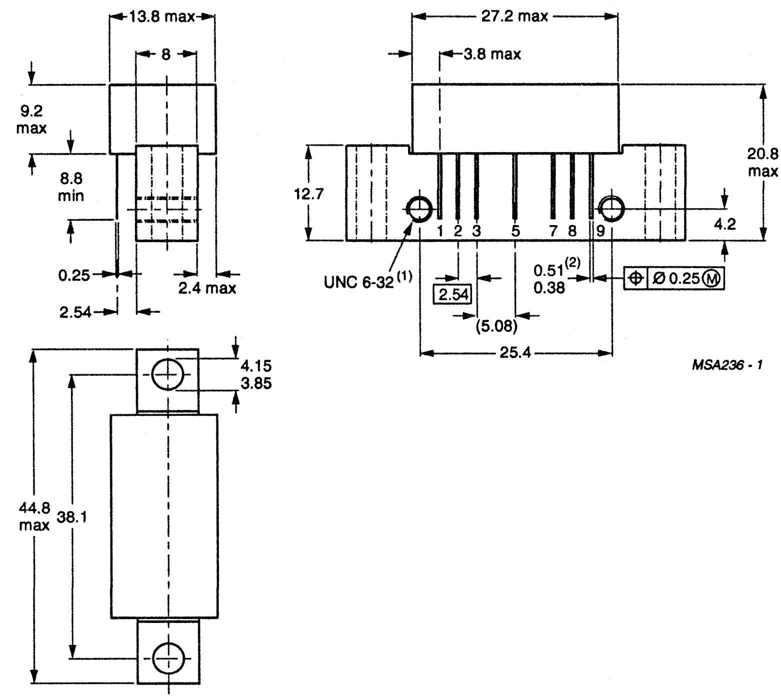
Dimensions in mm.

Fig.8 SOT89.



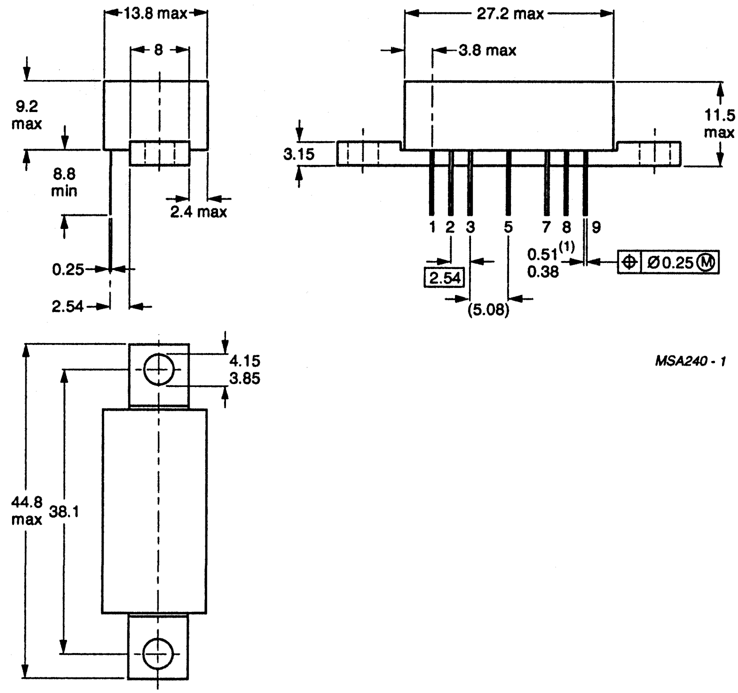
Dimensions in mm.

Fig.9 SOT103.



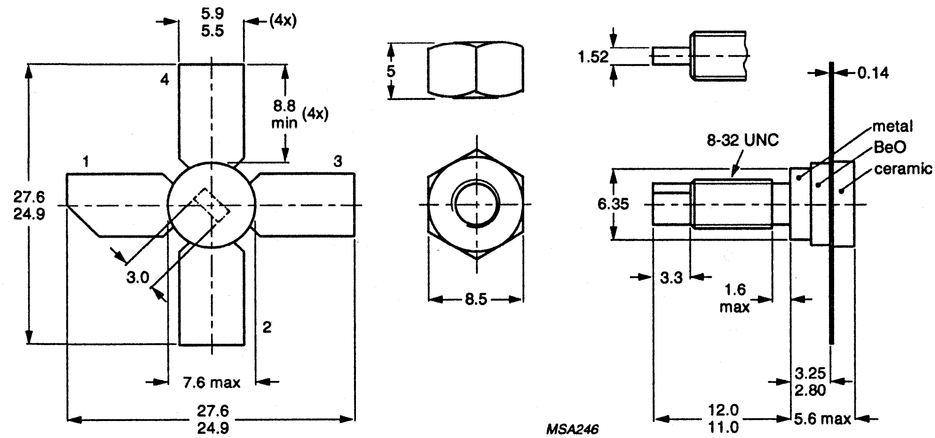
Dimensions in mm.
(1) Screw 6-32 UNC-2A available on request.
(2) Leads tin plated. Gold plated leads available upon request.

Fig.10 SOT115C.



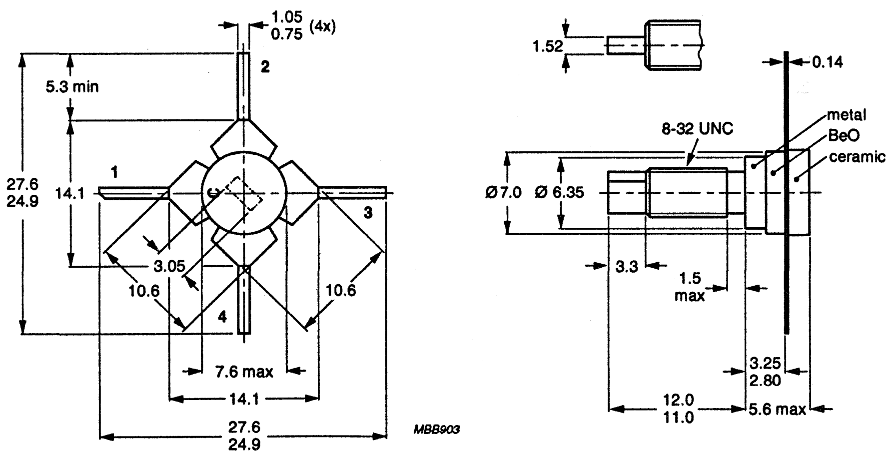
Dimensions in mm.
(1) Leads tin plated. Gold plated leads available upon request.

Fig.11 SOT115L.



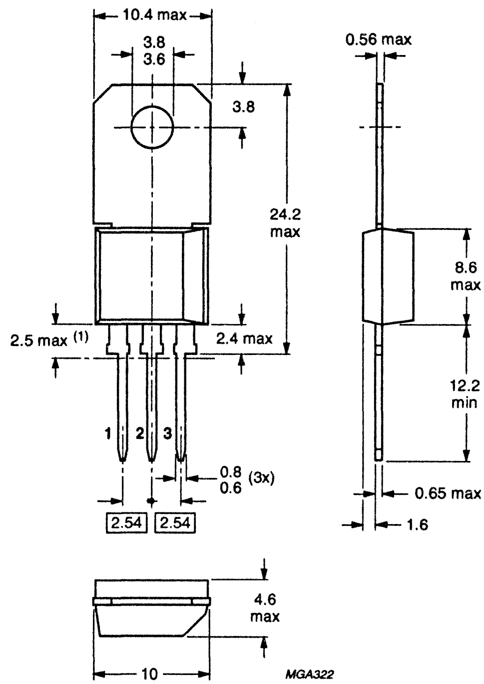
Dimensions in mm.

Fig.12 SOT122A.



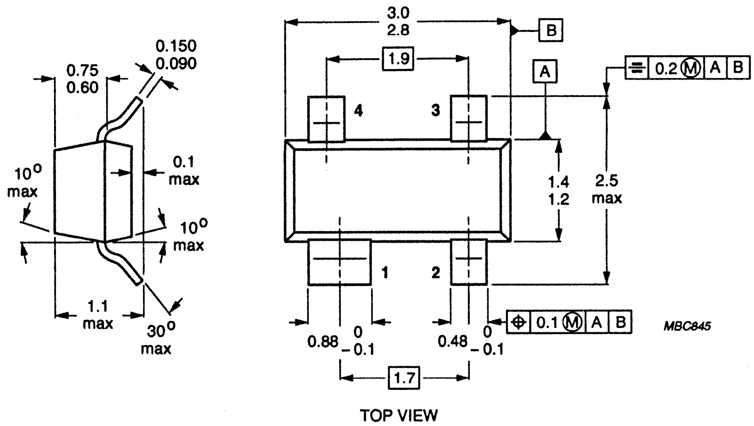
Dimensions in mm.

Fig.13 SOT122E.



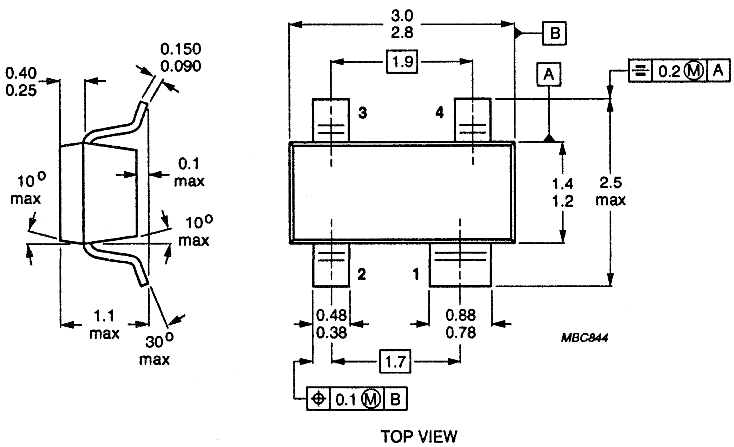
Dimensions in mm
(1) Terminal dimensions within this zone are uncontrolled..

Fig.14 SOT128B.



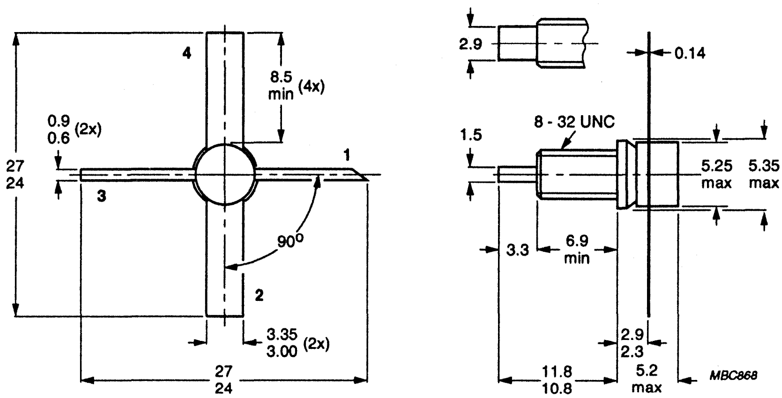
Dimensions in mm.

Fig.15 SOT143.



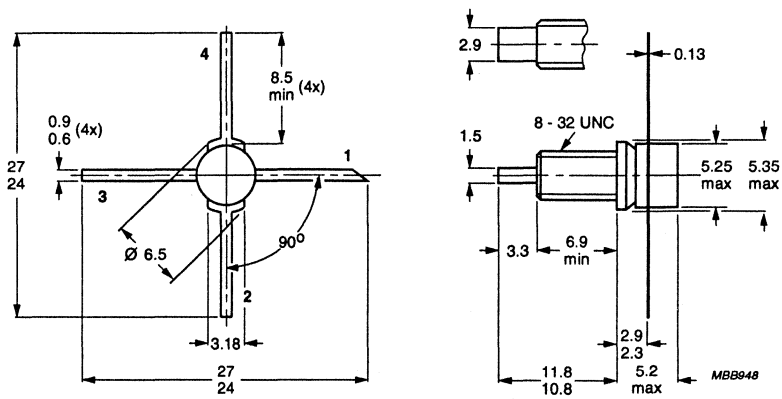
Dimensions in mm.

Fig.16 SOT143R.



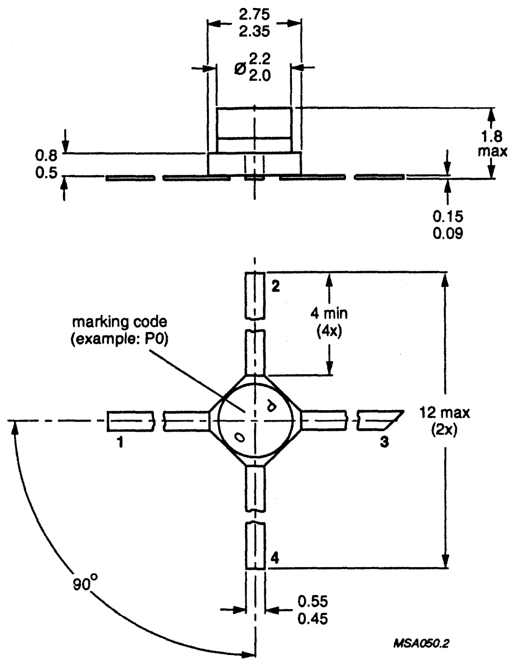
Dimensions in mm.

Fig.17 SOT172A1.



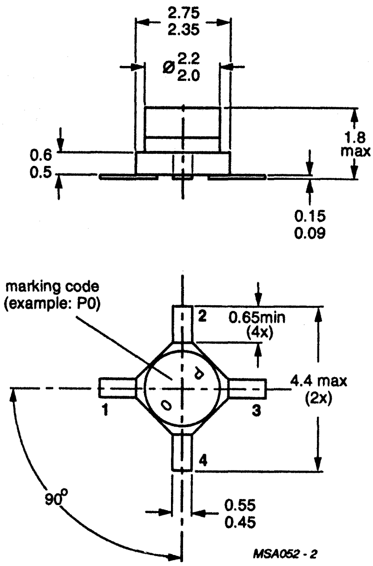
Dimensions in mm.

Fig.18 SOT172A3.



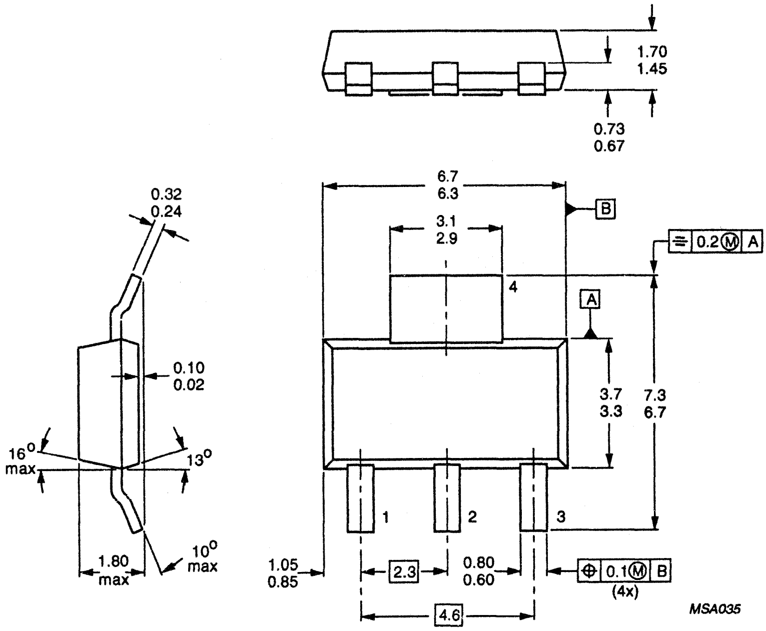
Dimensions in mm.

Fig.19 SOT173.



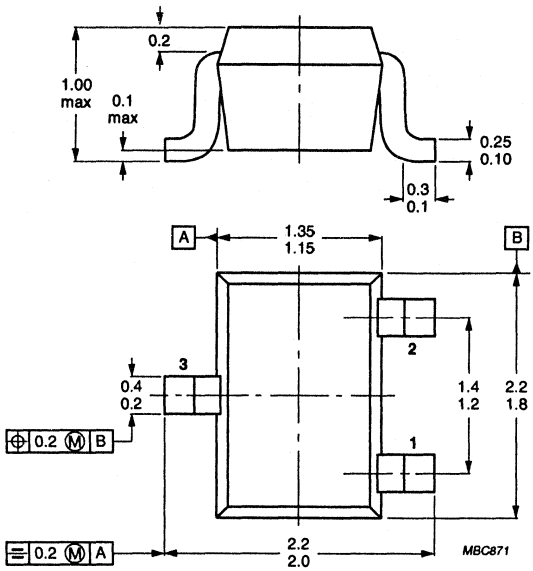
Dimensions in mm.

Fig.20 SOT173X.



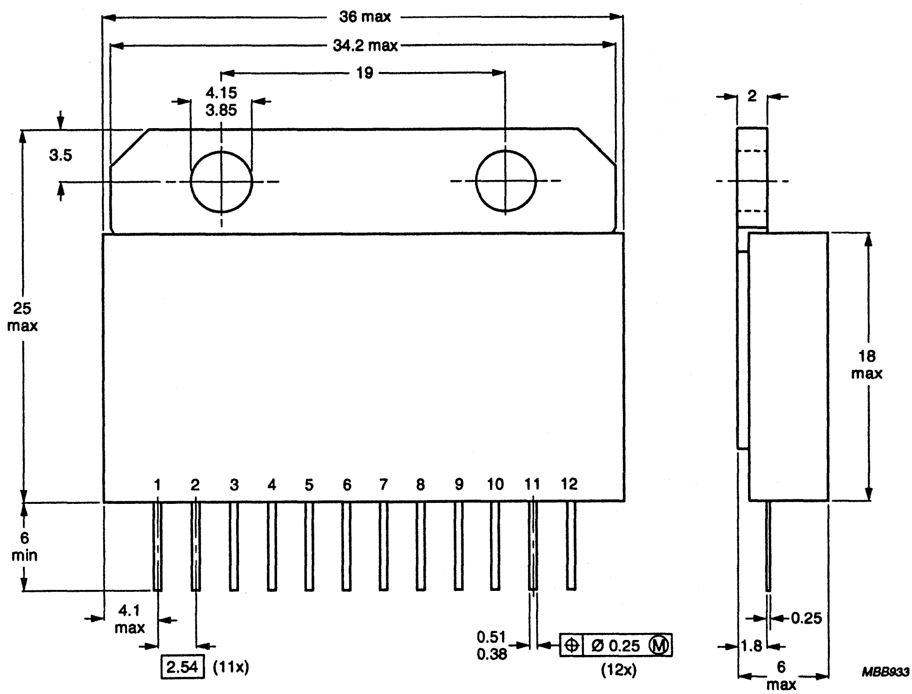
Dimensions in mm.

Fig.21 SOT223.



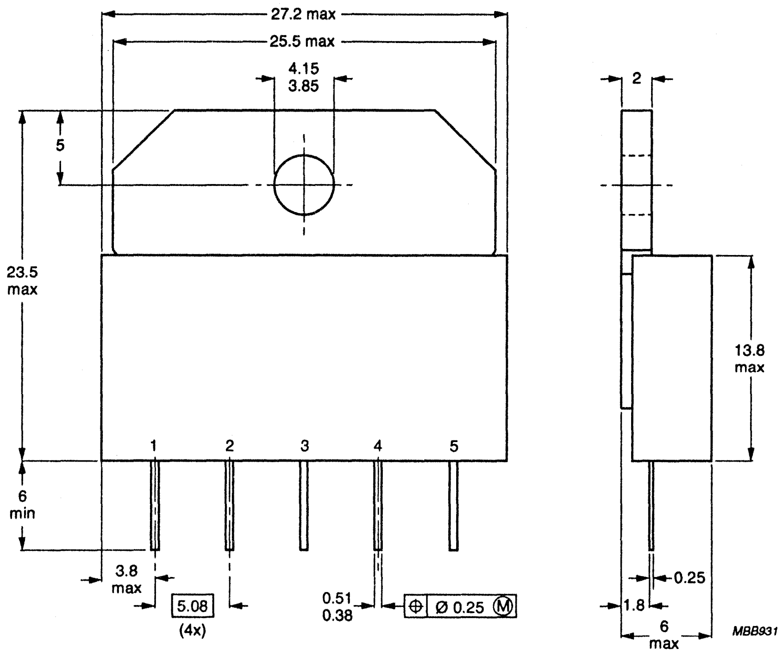
Dimensions in mm.

Fig.22 SOT323.



Dimensions in mm.

Fig.23 SOT347.



Dimensions in mm.

Fig.24 SOT348.

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