DISCRETE SEMICONDUCTORS

RF Wideband Transistors The New Generation

Philips Semiconductors

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RF Wideband Transistors
The New Generation

Contents

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.	

RF Wideband Transistors The New Generation

Preface

INTRODUCTION

Philips Semiconductors has just released a new series of RF wideband 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. In total, there are about **35** new devices.

This Data Compilation is an addendum to the Philips Semiconductors Data Handbook 'Wideband Transistors and Wideband Hybrid IC Modules', SC14 (1991). The next issue, called 'RF Wideband Transistors', SC14 (1992) is scheduled for release in the second half of 1992, at which time all data in this Data Compilation will be included in the new Data Handbook. As the types described above represent a major breakthrough in terms of overall achievable circuit performance, this means of intermediate publication was decided upon.

In this Data Compilation, the Product Specifications are included for those types that are in mass production at time of printing (June 1992). Also included are Preliminary Datasheets 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 book: Overview per type family, per crystal, per envelope, and per application are given. Moreover, line-ups for applications in Cordless Telephones (900 MHz CT1, 1.8 GHz DECT, 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 1.0 on 3.5" diskette, issue date February 1992) are discussed in separate chapters. Moreover, SPICE parameters have now also been included in a number of Product Specifications in this Data Compilation.

Product specifications are included for **35 new 4th generation transistors**. 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.

More **extensive datasheets** are now available than in previous issues of the Data Handbook. The relevant types are: BFG33, BFG67, BFG92A, BFG93A, BFG135, BFG197, BFQ67, BFR92A, BFR93A.

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

For application in Class AB in **1.8 GHz portable RF communication equipment** (DECT, PCN), preliminary datasheets of 6 new types in SOT143, and SOT103 have been added as well: BFG10, BFG10/X, BFG11, BFG11/X, BLT10 and BLT11.

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

SELECTION GUIDE

Table 1 FIRST-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 3.5 GHz)

f_T/I_C (see Fig.1)	ENVELOPE				
	METAL CAN		PLASTIC		CERAMIC
	TO-39	TO-72	TO-92	SOT37	SOT122E
(1)				BFT24	
(18)			BF748		
(2)		BFY90	BF689K BF763	BFW92	
(3)				BFW92A	
(4)		BFW30		BFW93	
(5)	BFW16A BFW17A				
(6)	BFR95				BFR94A

Table 2 SECOND-GENERATION WIDEBAND TRANSISTORS (f_T up to 6 GHz)

f_T/I_C (see Fig.1)	POLARITY	ENVELOPE				
		METAL CAN	PLASTIC		CERAMIC	
		TO-72	SOT37	SOT103	SOT122	SOT173 SOT173/X
(7)	npn pnp	BFQ53 BFQ52	BFR90(A) BFQ51	BFG90A		BFP90A
(8)	npn	BFQ22S	BFR91(A)	BFG91A		BFP91A
(9)	pnp	BFQ24	BFQ23			BFQ23C
(10)	npn pnp	BFQ63 BFQ32M	BFR96(S) BFQ32(S)	BFG96 BFG32		BFP96 BFQ32C
(11)	npn pnp		BFQ34T BFQ54T	BFG34		
(11)	npn pnp				BFQ34	
(12)	npn pnp				BFQ68 BFQ108	
(13)	npn pnp				BFQ136	

Table 1 (continued)

f_T/I_C (see Fig.1)	ENVELOPE (SURFACE MOUNT)				
	SOT323	SOT23	SOT89	SOT143	SOT223
(1)		BFT25			
(18)	BF547W BF747W	BF547 BF747			
(2)	BFS17W	BFS17			
(3)		BFS17A		BFG17A	
(4)		BFR53			
(5)			BFQ17		BFG16A
(6)					

Table 2 (continued)

f_T/I_C (see Fig.1)	POLARITY	ENVELOPE (SURFACE MOUNT)				
		SOT323	SOT23	SOT89	SOT143	SOT223
(7)	npn pnp	BFR92AW BFT92AW	BFR92(A) BFT92		BFG92A(/X,/XR)	
(8)	npn	BFR93AW	BFR93(A)		BFG93A(/X,/XR)	BFG94
(9)	pnp	BFT93AW	BFT93			
(10)	npn pnp		BFR106	BFQ19 BFQ149		BFG97 BFG31
(11)	npn pnp			BFQ18A		BFG35 BFG55
(11)	npn pnp					
(12)	npn pnp					
(13)	npn pnp					

Table 3 THIRD-GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 8 GHz)

f_T/I_C (see Fig.1)	ENVELOPE							
	PLASTIC		CERAMIC		SURFACE MOUNT			
	SOT37	SOT103	SOT172	SOT173 SOT173/X	SOT323	SOT23	SOT143	SOT223
(14)	BFQ65	BFG65		BFQ66	BFQ67W	BFQ67	BFG67(/X,/XR)	
(15)		BFG195					BFG197(/X,/XR)	BFG198
(16)	BFR134	BFG134	BFQ135					BFG135
(17)				BFQ33C			BFG33(/X,/XR)	
(20)			BFQ270					

Table 4 FOURTH GENERATION NPN WIDEBAND TRANSISTORS (f_T up to 10 GHz)

f_T/I_C (see Fig.1)	ENVELOPE							
	PLASTIC		CERAMIC		SURFACE MOUNT			
	SOT37	SOT103	SOT172	SOT173 SOT173/X	SOT323	SOT23	SOT143	SOT223
(19)					BFS25A	BFT25A	BFG25A/X	
(21)				BFP505 (note 1)	BFS505	BFR505	BFG505(/X,/XR)	
(22)		BFR521 (note 1)		BFP520 (note 1)	BFS520	BFR520	BFG520(/X,/XR)	
(23)		BFR541 (note 1)		BFP540 (note 1)	BFS540	BFR540	BFG540(/X,/XR)	BFG541
(24)		BFR591 (note 1)					BFG590(/X,/XR)	BFG591
(25)			BFQ620 (note 1)					BFG621 (note 1)
(26)			BFQ740 (note 1)					BFG741 (note 1)

Note

1. Under development.

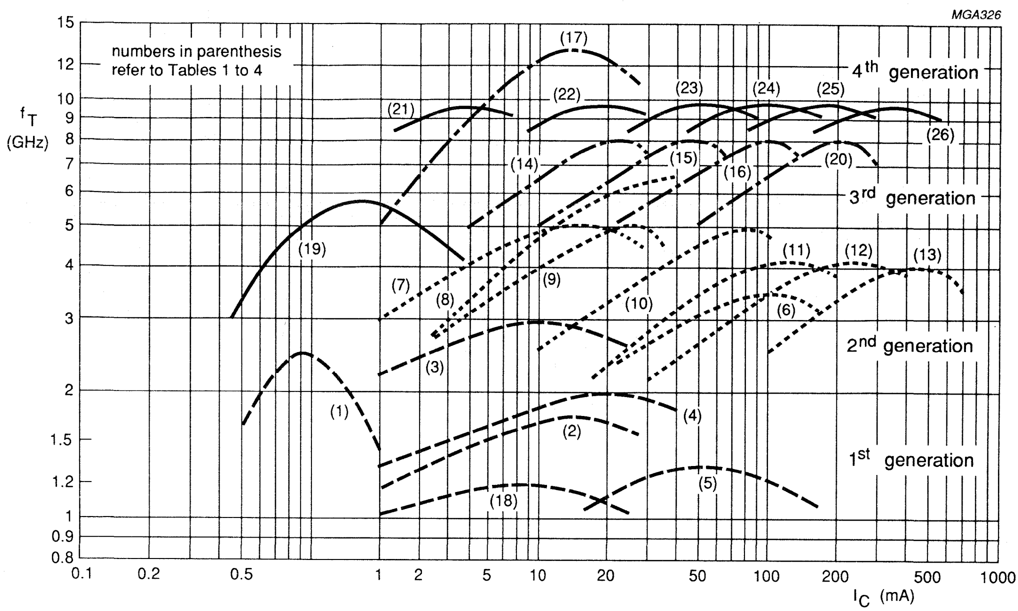


Fig.1 Transition frequency (f_T) as a function of collector current (I_C) for each of the four generations of RF bipolar wideband transistors.

COMPETITOR PACKAGE NAME EQUIVALENT CHART

Philips	SOT23	SOT323	SOT143	SOT143/X	SOT143/XR	SOT223	SOT103	SOT173	SOT173/X
Motorola	318-07 (SOT23)	SC70	–	318A-05 (SOT143)	–	318E-04 (SOT223)	317-01 (macro-x)	358-01 (micro-x)	–
NEC	mini-mold (3-pin)	super mini-mold (3-pin)	–	–	mini-mold (4-pin)	–	disk mold	µX	–
Toshiba	SM (SOT23)	USM (SC70)	–	–	SMQ (SC61) (SOT143)	–	µX (24F1C)	–	–
Siemens	SOT23	–	–	SOT143	–	SOT223	SOT103	–	CEREC-x

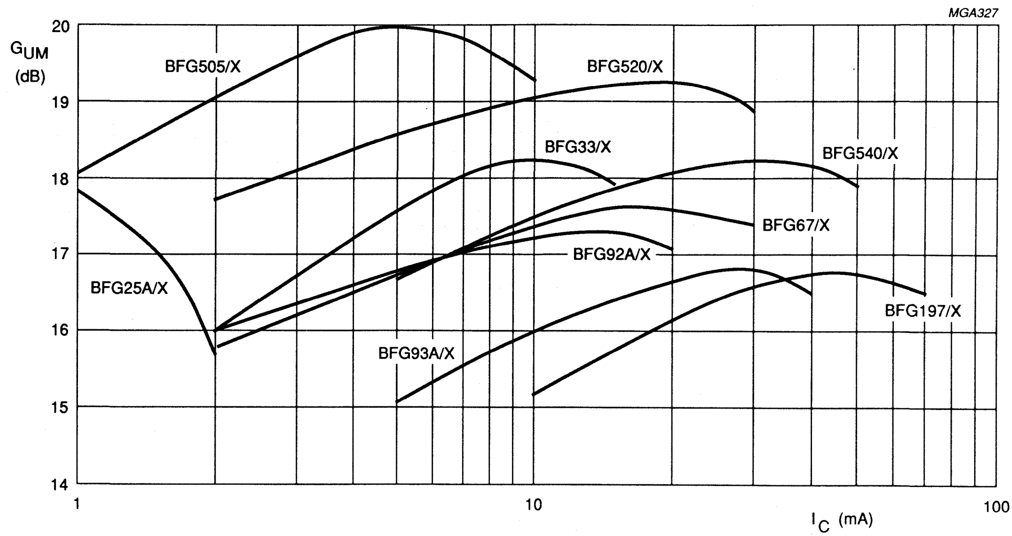
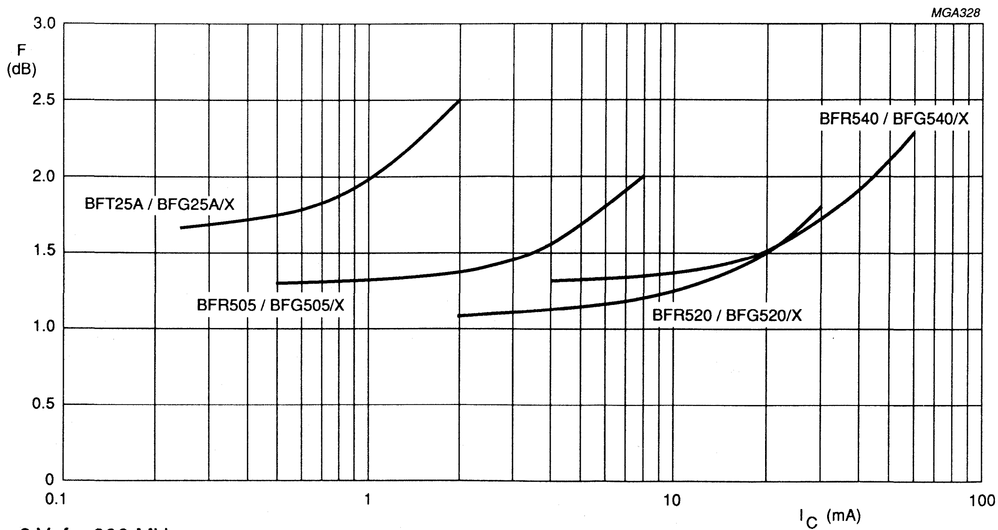
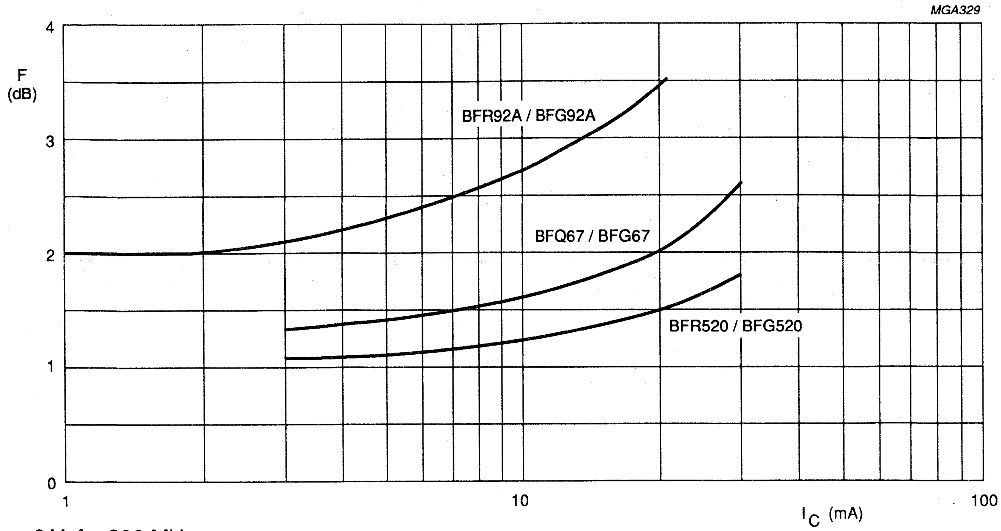


Fig.2 Maximum unilateral power gain (G_{UM}) as a function of collector current (I_C) for various types in SOT143X envelopes..



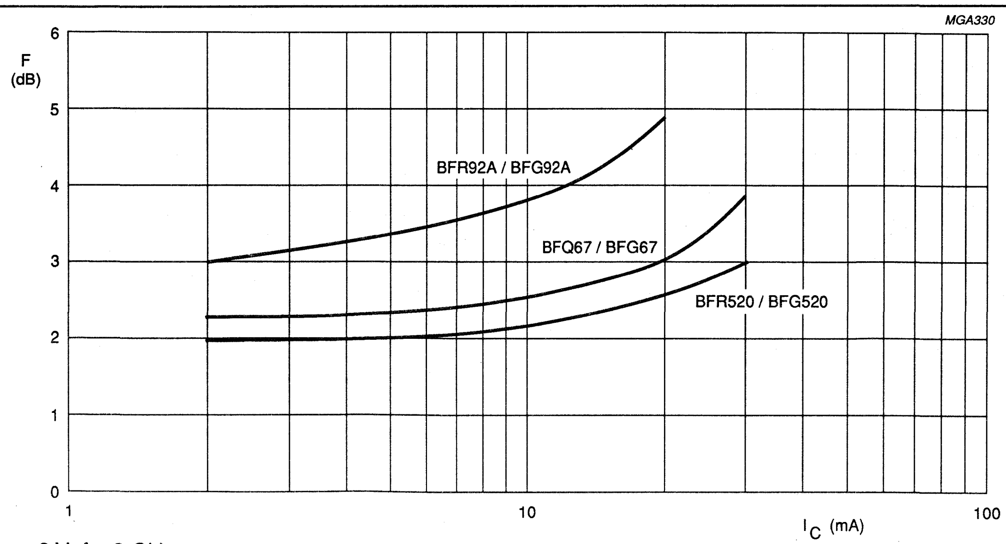
V_{CE} = 6 V; f = 900 MHz.

Fig.3 Noise figure (F) as a function of collector current (I_C) for 4th generation devices in SOT23 and SOT143X 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 APPLICATION IN CRT VIDEO OUTPUT AMPLIFIERS

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 BFQ236A	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

Standard versions: BV_{CBO} = 100 V; BV_{CEO} = 65 V; BV_{CER} = 95 V.
'A' versions: BV_{CBO} = 115 V; BV_{CEO} = 95 V; BV_{CER} = 110 V.

WIDEBAND HYBRID MODULES AND ICs FOR APPLICATION IN CRT VIDEO OUTPUT AMPLIFIERS

Application: pre-amplifier

TYPE NUMBER	OUTLINE	V_{supply} (V)	CHANNELS	BAND-WIDTH (MHz)	VOLTAGE GAIN V_O/V_I	t_r, t_f (ns)	CONTRAST CONTROL	CONTRAST CONTROL RANGE (dB)
OM3016	10 pin SIL hybrid	12	1	> 300	4 ±0.5	1.7	DC, non-linear	> 40
OM3026	11 pin SIL hybrid	10 - 15	1	> 300	5 ±0.25	1.7	DC, linear	> 40
TDA4880 (note 1)	20 pin DIL IC, SOT146	7.2 - 8.8	3	> 70	6.0 (dB)	5.0	DC	> 20

Note

1. See Data Handbook IC02b, 1992; 'Preliminary Data'.

Application: video output amplifier

TYPE NUMBER	OUTLINE	V_{supply} (V)	CHANNELS	BAND-WIDTH (MHz)	VOLTAGE GAIN (V_O/V_I)	t_r, t_f (ns)	OUTPUT VOLTAGE (V_{p-p})
CR2424 CR2425	hybrid, SOT115L hybrid, SOT115C	70	1	145	12.4	2.5	40
CR3424 CR3425	hybrid, SOT115L hybrid, SOT115C	90	1	135	12.4	2.8	50
CR4424 (note 1) CR4425 (note 1)	hybrid, SOT115L hybrid, SOT115C	90	1	215	12.4	1.9	50
OM976	hybrid, SOT115L	90	1	135	16	2.7	40

Note

1. Preliminary 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	–	pnp	SOT23	1.5	−10	−30
PMBT3640	MMBT3640	pnp	SOT23	1.3	−10	−15
MPSH3640	MPSH3640	pnp	TO-92	1.3	−10	−15
PMBTH10	MMBTH10	npn	SOT23	0.65	10	4
MPSH10	MPSH10	npn	TO-92	0.65	10	4
PMBTH81	MMBTH81	pnp	SOT23	0.6	−10	−5
MPSH81	MPSH81	pnp	TO-92	0.6	−10	−5

Note

For data on devices mentioned in these tables, please refer to Data Handbook SC14, 1993: RF Wideband Transistors (issue date November 1992), or to loose-leaf data sheets (issue dates between March 1992 and May 1992).

RF POWER TRANSISTORS (PLASTIC) FOR CELLULAR AND CORDLESS TELEPHONES

TYPE NUMBER	ENVELOPE	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
BLT50	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	SOT223	900	7.5	0.8	> 6.0 typ. 7.5	> 60 typ. 67
BLT81 (note 1)	SOT223	900	7.5	1.2	> 6	> 65
BLT10	SOT103	1800	6.0 3.0	0.3 0.2	> 5.0 > 4.5	> 45 > 65
BLT11 (note 1)	SOT103	1800	6.0 3.0	0.6 0.4	> 5 > 4	> 50 > 65
BFG10, BFG10/X (note 1)	SOT143, SOT143/X	1800	6.0 4.5	0.3 0.2	> 5 > 5	> 45 > 40
BFG11, BFG11/X (note 1)	SOT143, SOT143/X	1800	6.0 4.5	0.6 0.4	> 4.5 > 4	> 50 > 50

Note

1. Preliminary data.

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
MIX	See RF amp			
OSC	See RF amp			

Note

1. European and Japanese pinning versions are also available.

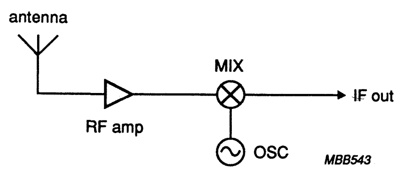


Fig.6 Pager RF input circuit.

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		3rd
		BFR93AW	BFR93A	BFG93A/X		3rd
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	B2 amp: as OSC, plus:	BFQ67W	BFQ67	BFG67/X		2nd
Transmitter	Pre-amp	BFQ67W	BFQ67	BFG67/X		4th
		BFS505	BFR505	BFG505/X		4th
		BFS520	BFR520	BFG520/X		4th
	MIX2 and B1 amp: as OSC, plus:	BFR92AW	BFR92A	BFG92A/X		2nd
		BFR93AW	BFR93A	BFG93A/X		2nd
	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	3rd
					BFG135	3rd
					BFG620 (note 2)	4th
	PA3				BLT80	3rd
					BLT81	3rd

Notes

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

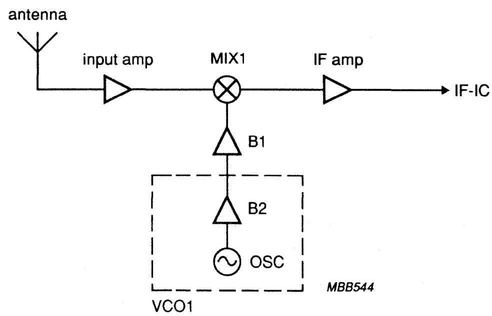


Fig.7 Cellular phone receiver circuit.

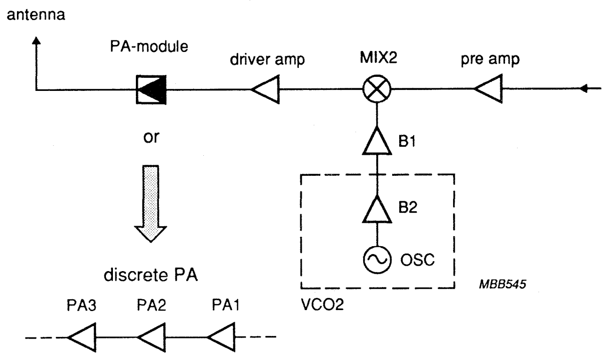


Fig.8 Cellular phone transmitter circuit.

RF WIDEBAND TRANSISTORS FOR CORDLESS PHONES

See Fig.9

SOCKET		SOT323	S0T23	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			BFG33/X			3rd
				BFG520/X			4th
	PB2			BFG197/X	BFG198		3rd
				BFG540/X	BFG541		4th
				BFG590/X	BFG591		4th
				BFG10/X (note 2)		BLT10 (note 2)	4th
	PB3				BFG135		3rd
				BFG11/X (note 2)	BFG621 (note 2)	BLT11 (note 2)	4th
					BFG741 (note 2)		4th

Notes

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

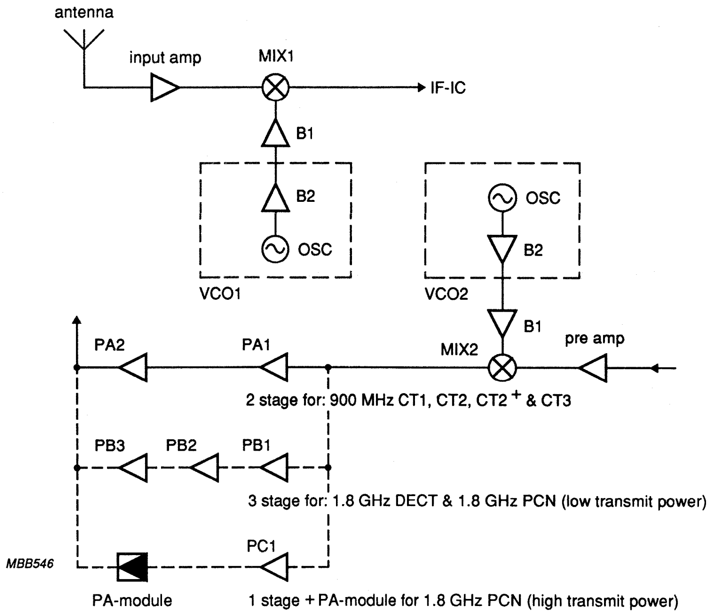


Fig.9 Cordless phone circuit.

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 below. 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. This new issue (Version 4.0) of the S-parameter library is scheduled for September 1993.

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 V_{CE} (V)	BIAS CONDITION I_C (mA)	SCATTERING PARAMETERS (f) (GHz)	NOISE PARAMETERS (f) (GHz)	DATE
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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
FG33C.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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION V_{CE} (V)	BIAS CONDITION I_C (mA)	SCATTERING PARAMETERS (f) (GHz)	NOISE PARAMETERS (f) (GHz)	DATE
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
BFG197I.S2P	143	BFG197	8.0	30.0	0.04 - 3.0	–	7/90
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
BFG505XF.S2P	143	BFG505/X	3.0	7.5	0.04 - 3.0	–	2/92
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
BFG540G.S2P	143	BFG540	8.0	4.0	0.04 - 3.0	–	2/92
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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	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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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
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

DOS Destination File name	Directory (SOT)	Part #	BIAS CONDITION		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
BFR96SH.S2P	37	BFR96S	10.0	70.0	0.04 - 3.0	–	7/90
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

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			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		SCATTERING PARAMETERS	NOISE PARAMETERS	DATE
			V_{CE} (V)	I_C (mA)	(f) (GHz)	(f) (GHz)	
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. Most datasheets of recently released types in this book 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 book. The relevant types are listed below. For these types the parameters are also available on a 3.5" diskette.

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SPICE and package parameters on 3.5" Diskette, Version 1.0

Version 1.0 (February 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 **80** transistors are released in Version 1.0, and can be easily selected using this simple procedure. The contents of Version 1.0 are as follows:

Transistor types (in alphanumeric order):

BFG25A/X, BFG65, BFG67, BFG67R, BFG67/X, BFG67/XR, BFG90A, BFG91A, BFG92A, BFG92A/X, BFG92A/XR, BFG93A, BFG93A/X, BFG93A/XR, BFG94, BFG195, BFG197, BFG197/X, BFG197/XR, BFG198, BFG505, BFG505/X, BFG505/XR, BFG520, BFG520/X, BFG520/XR, BFG540, BFG540/X, BFG540/XR, BFG541, BFQ65, BFQ67, BFQ67W, 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, BFR90A, BFR91A, BFR92A, BFR92AW, BFR93A, BFR93AW, BFR505, BFR520, BFR540, BFS25A, BFS505, BFS520, BFS540, BFT25A.

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):

BFQ65, BFQ168, BFQ195, BFQ234, BFQ254, BFQ268, BFR90A, BFR91A, BFR505, BFR520, BFR540, BFT25A.

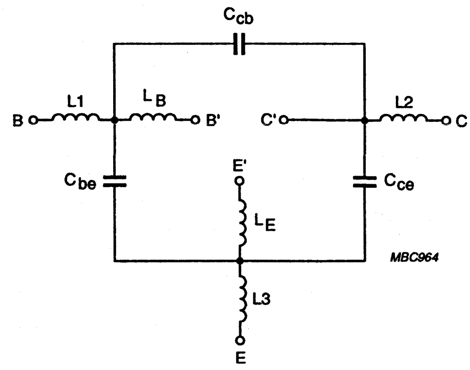
Please contact the local Philips Semiconductor sales office to obtain this diskette. Philips continuously adds more SPICE and package parameter data to its libraries. Should certain data not be available on Version 1.0, please request these, as they might have been released prior to the next official issue, but after printing of this book. This new issue (Version 2.0) is scheduled for July 1992.

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 recently released datasheets, 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.

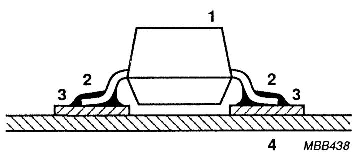
THERMAL CHARACTERISTICS

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.1, 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.



Heat radiates from the envelope (1) to ambient.

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

Fig.1 Heat losses.

The elements of thermal resistance shown in Fig.2 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)

$R_{th\ j\text{-}a}$ thermal resistance from junction to ambient.

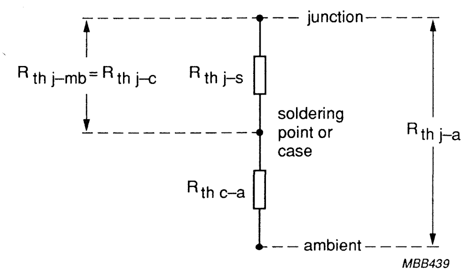


Fig.2 Representation of thermal resistance paths of a device mounted on a substrate or printed board.

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

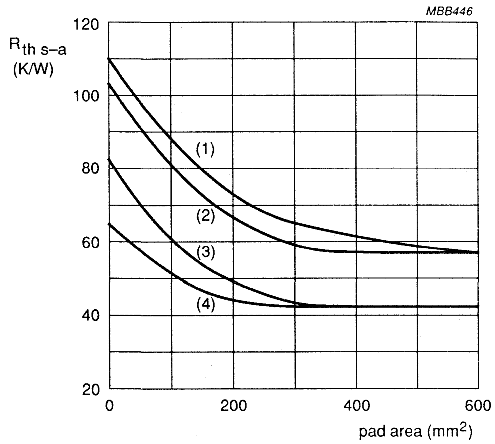
$P_{tot\ max}$ is the maximum power handling capability of the device, including the effects of external loads when applicable.

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 3 and 4. Standard mounting conditions to set the maximum power ratings of the various envelopes are shown in Figs 5 to 10. 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.3 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of pad area on different configurations of FR4 epoxy fibre-glass circuit board.

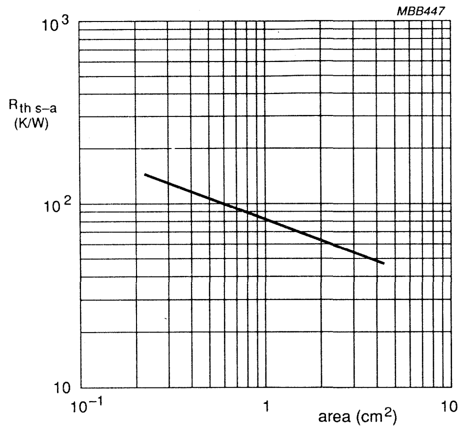
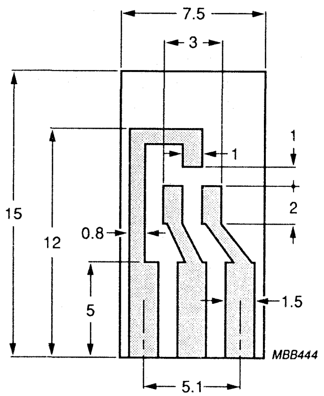
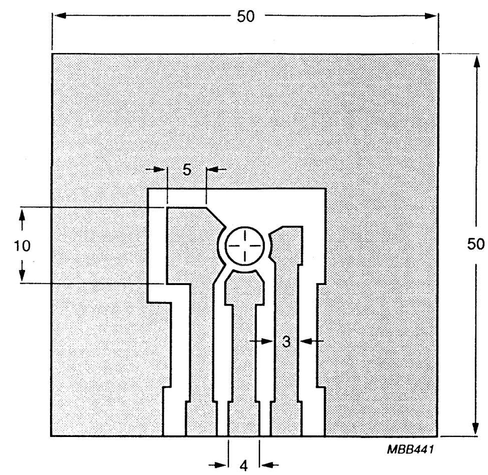


Fig.4 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of area of ceramic substrate.



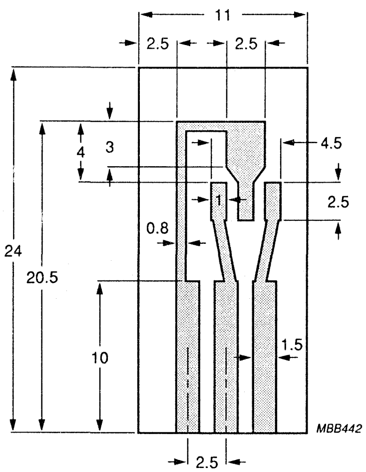
Dimensions in mm.

Fig.5 Standard mounting conditions for SOT23.



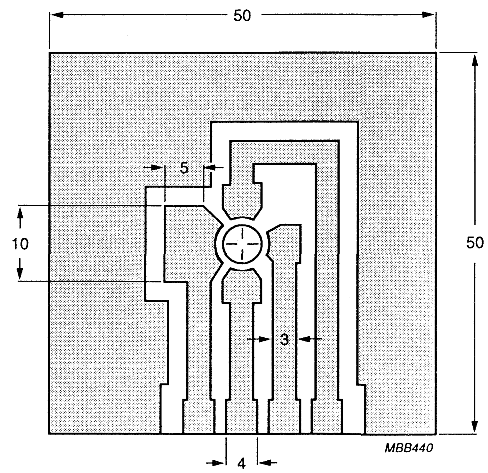
Dimensions in mm.

Fig.6 Standard mounting conditions for SOT37.



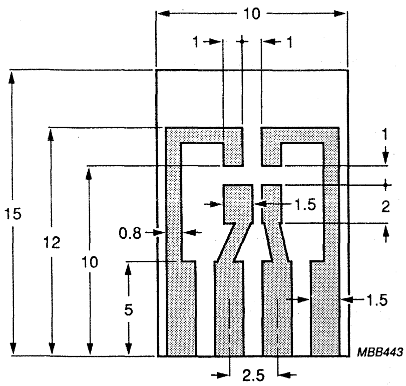
Dimensions in mm.

Fig.7 Standard mounting conditions for SOT89.



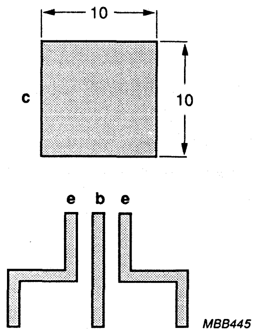
Dimensions in mm.

Fig.8 Standard mounting conditions for SOT103.



Dimensions in mm.

Fig.9 Standard mounting conditions for SOT143.



Dimensions in mm.

Fig.10 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 1 and in Fig.11.

Table 1 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

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.11 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:

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

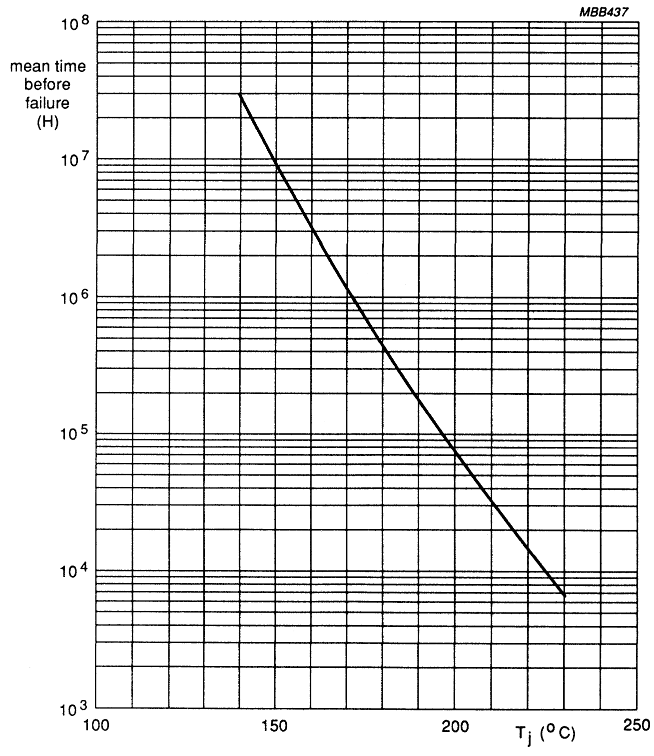


Fig.11 Mean time before failure as a function of junction temperature (T_j).

DEVICE DATA

UHF power transistor — BFG10; BFG10/X

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in RF communications subscriber equipment at 1.8 GHz (DECT, PCN).

The transistor is encapsulated in a SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG10	
1	collector
2	base
3	emitter
4	emitter
BFG10/X	
1	collector
2	emitter
3	base
4	emitter

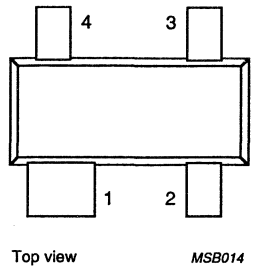


Fig.1 SOT143.

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 at a duty cycle of 1:24	1.8	6.0	300	≥ 5	≥ 45
	1.8	4.5	200	≥ 5	≥ 40

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		–	250	mA
$I_{C(AV)}$	average collector current		–	250	mA
P_{tot}	total power dissipation	T_s = 135 °C; (note 1) f > 1 MHz; duty cycle 1:24	–	1	W
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 tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	T_s = 135 °C; (note 1) P_{tot} = 1 W; duty cycle 1:24	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
$V_{(BR)CBO}$	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} = 5 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	–	1.7	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	1.1	–	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 at a duty cycle of 1:24	1.8	6.0	1	300	> 5 typ. 5.5	> 45 typ. 50
	1.8	4.5	1	200	> 5 typ. 5.5	> 40 typ. 45

Ruggedness in class-AB operation

The BFG10 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.8 GHz and a duty cycle of 1:24.

UHF power transistor — BFG11; BFG11/X

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in RF communications subscriber equipment at 1.8 GHz (DECT, PCN).

The transistor is encapsulated in a SOT143 envelope.

PINNING

PIN	DESCRIPTION
	BFG11
1	collector
2	base
3	emitter
4	emitter
	BFG11/X
1	collector
2	emitter
3	base
4	emitter

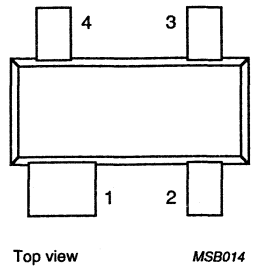


Fig.1 SOT143.

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 at a duty cycle of 1:24	1.8	6.0	600	≥ 4.5	≥ 50
	1.8	4.5	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	–	10	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	T_s = 115 °C; (note 1) f > 1 MHz; duty cycle 1:24	–	2	W
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 tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	T_s = 115 °C; (note 1) P_{tot} = 2 W; duty cycle 1:24	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
$V_{(BR)CBO}$	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	2.5	–	–	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	25	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	2.9	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	2.1	–	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 at a duty cycle of 1:24	1.8	6.0	2	600	> 4.5 typ. 5	> 50 typ. 55
	1.8	4.5	2	400	> 4 typ. 4.5	> 50 typ. 55

Ruggedness in class-AB operation

The BFG11 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.8 GHz and a duty cycle of 1:24.

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

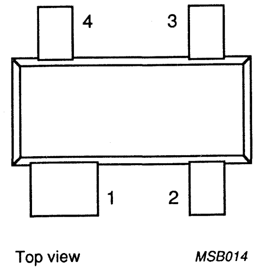


Fig.1 SOT143.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	8	V
V_{CEO}	collector-emitter voltage		–	–	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 leakage 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.

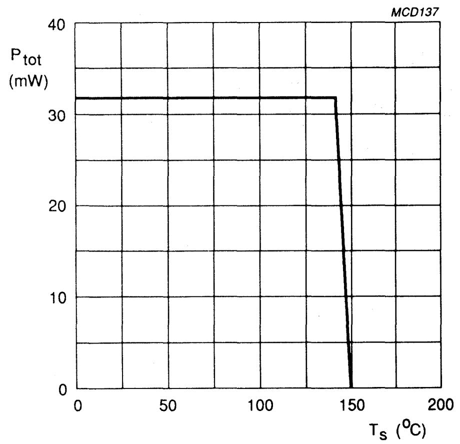
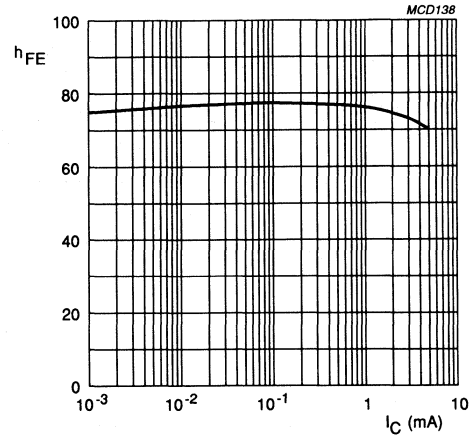
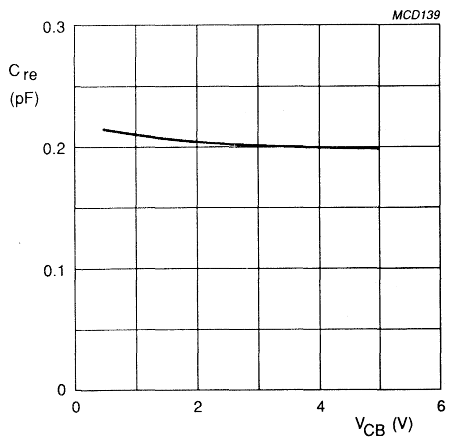


Fig.2 Power derating curve.



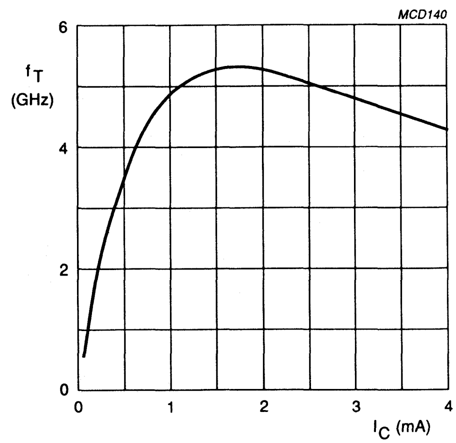
V_{CE} = 1 V.

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



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

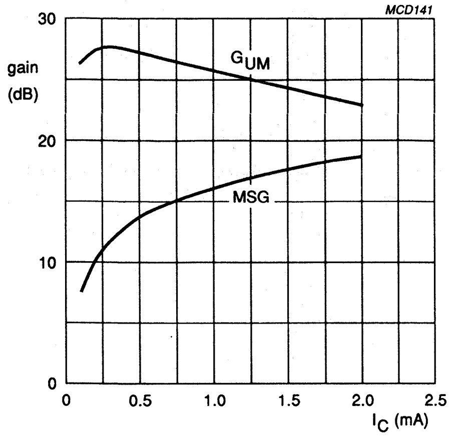
Fig.4 Feedback capacitance as a function of collector-base voltage.



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

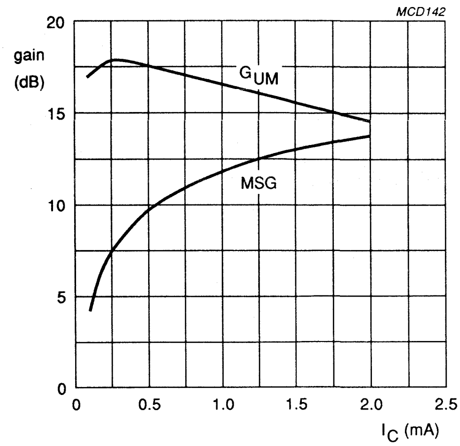
Fig.5 Transition frequency as a function of collector current.

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



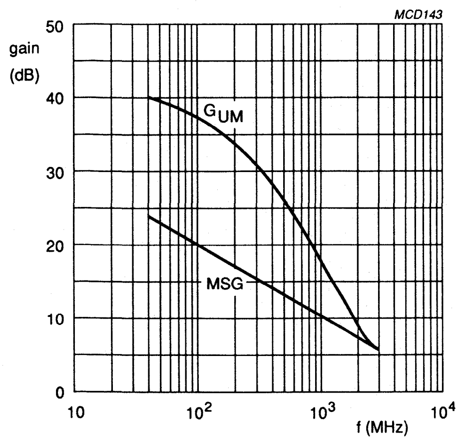
V_{CE} = 1 V; f = 500 MHz.

Fig.6 Gain as a function of collector current.



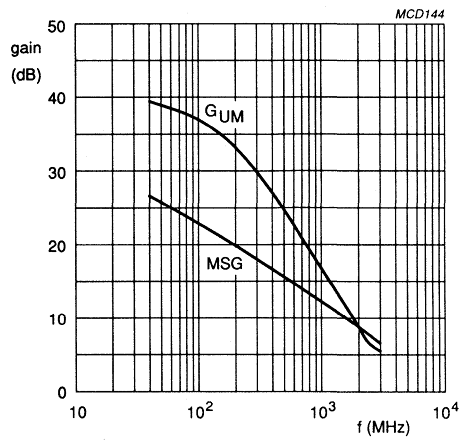
V_{CE} = 1 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



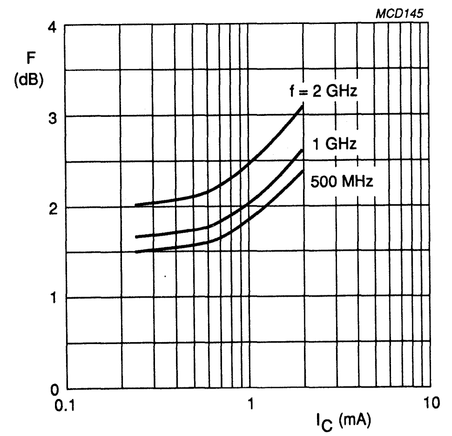
V_{CE} = 1 V; I_C = 0.5 mA.

Fig.8 Gain as a function of frequency.



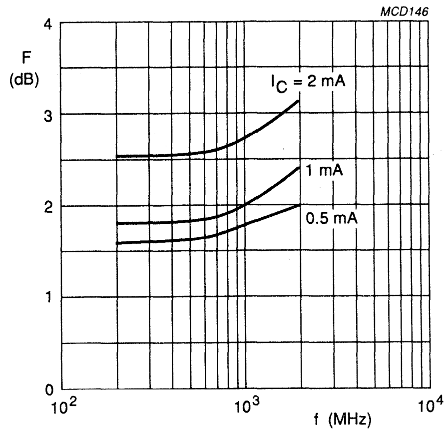
V_{CE} = 1 V; I_C = 1 mA.

Fig.9 Gain as a function of frequency.



V_{CE} = 1 V.

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



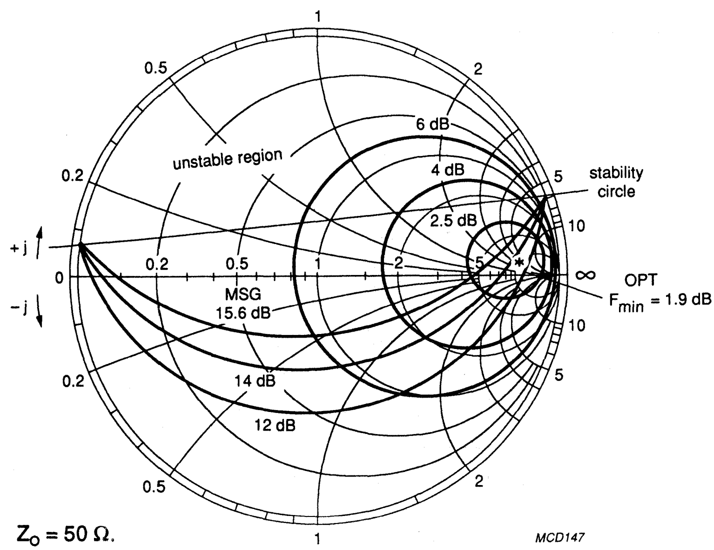
V_{CE} = 1 V.

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.

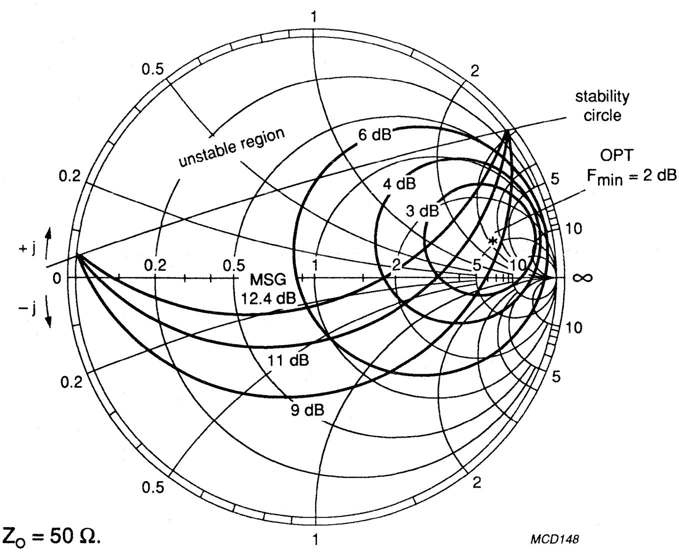
Maximum stable gain = 15.6 dB.

Fig.12 Noise circle figure.

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



$Z_O = 50\ \Omega$.

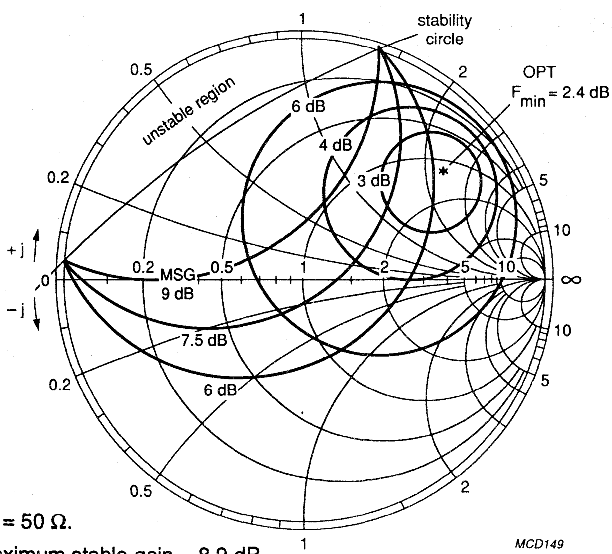
Maximum stable gain = 12.4 dB.

Fig.13 Noise circle figure.

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

Noise Parameters

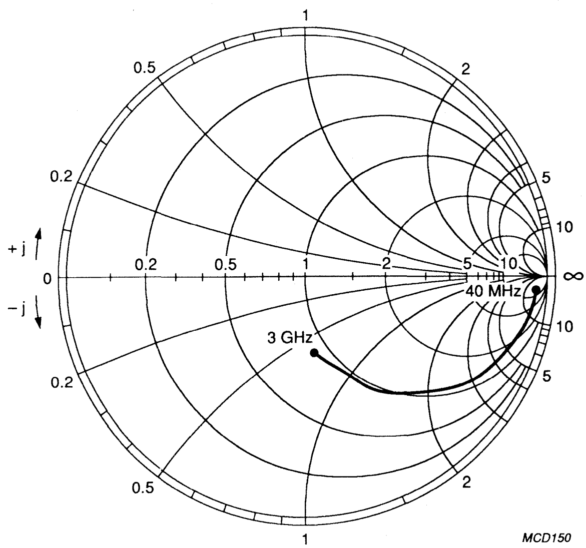
F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.72	38	1.9



$Z_O = 50\ \Omega$.

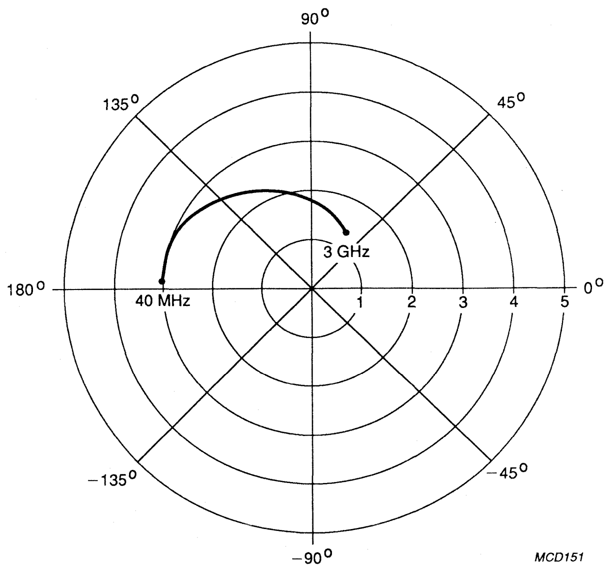
Maximum stable gain = 8.9 dB.

Fig.14 Noise circle figure.



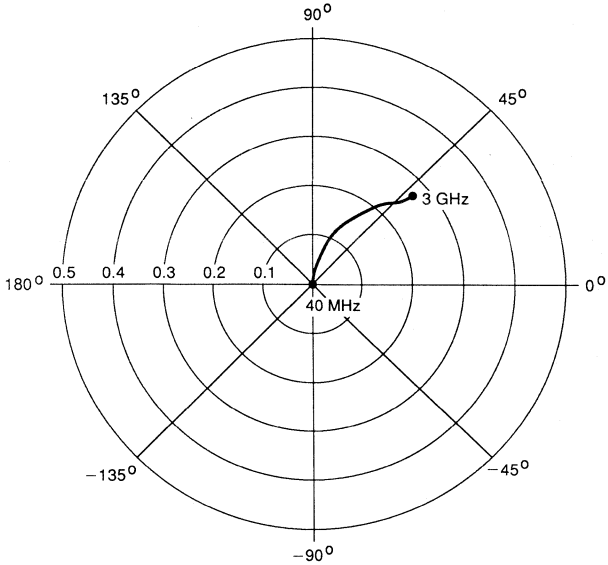
V_{CE} = 1 V; I_C = 1 mA.

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



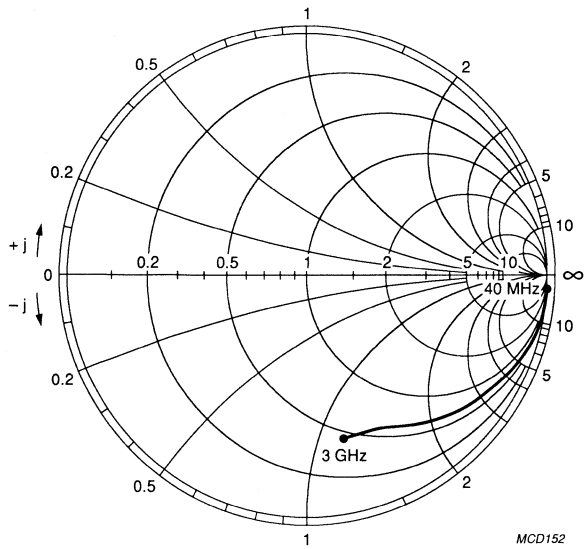
V_{CE} = 1 V; I_C = 1 mA.

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}).

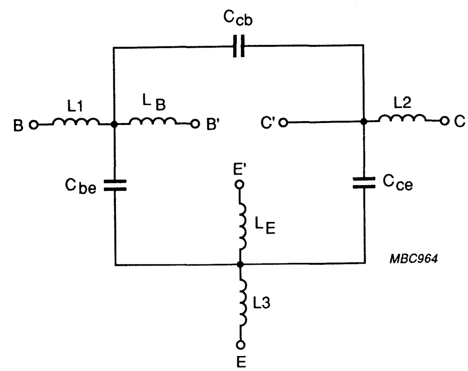


V_{CE} = 1 V; I_C = 1 mA.

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} 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	0.984	−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} (RAT)	Γ_{opt} (DEG)	R_n
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}		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	0.967	−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}		R_n
		(RAT)	(DEG)	
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}		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	0.943	−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}		R_n
		(RAT)	(DEG)	
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

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

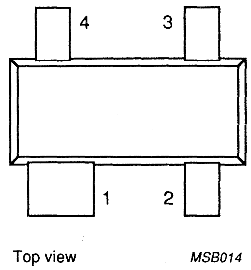


Fig.1 SOT143.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	9	V
V_{CEO}	collector-emitter voltage		–	–	7	V
I_C	collector current	DC value	–	–	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.

Qualification approval CECC 50 000 (issue 4), 1986

NPN 12 GHz wideband transistor BFG33; BFG33/X

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	collector current	DC value, continuous	–	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 operating 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 leakage current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 14$ 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.

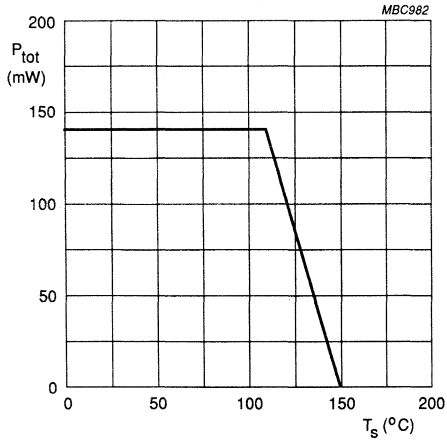
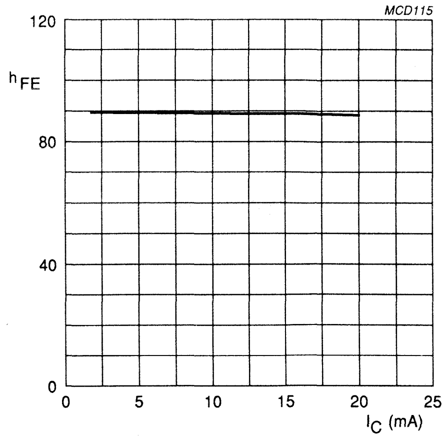
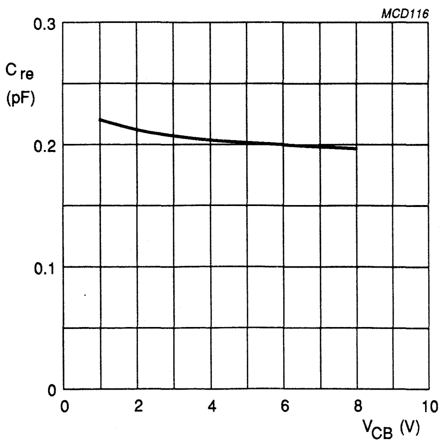


Fig.2 Power derating curve.



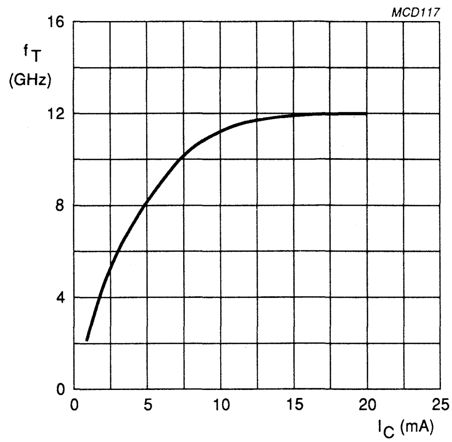
V_{CE} = 5 V.

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



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

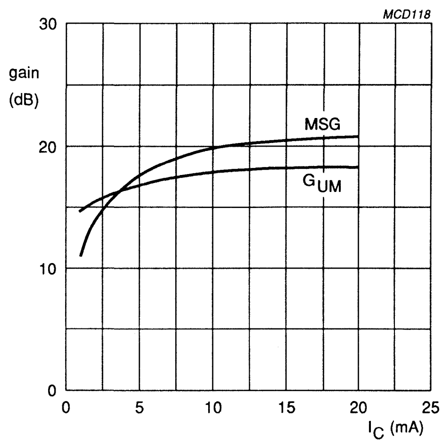
Fig.4 Feedback capacitance as a function of collector-base voltage.



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

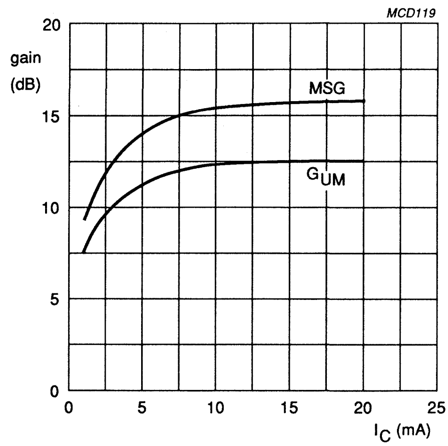
Fig.5 Transition frequency as a function of collector current.

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



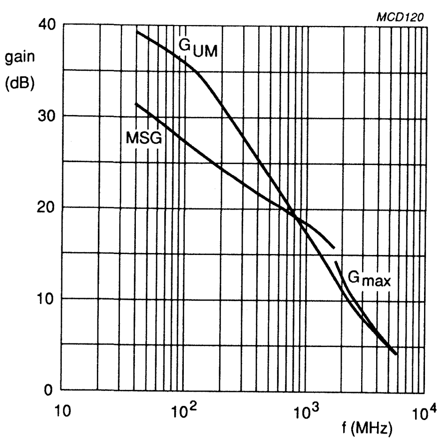
V_{CE} = 5 V; f = 1 GHz.

Fig.6 Gain as a function of collector current.



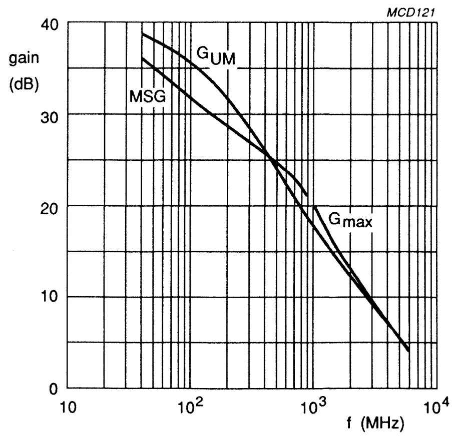
V_{CE} = 5 V; f = 2 GHz.

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.

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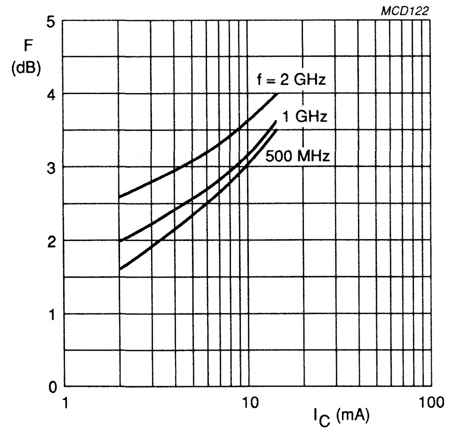
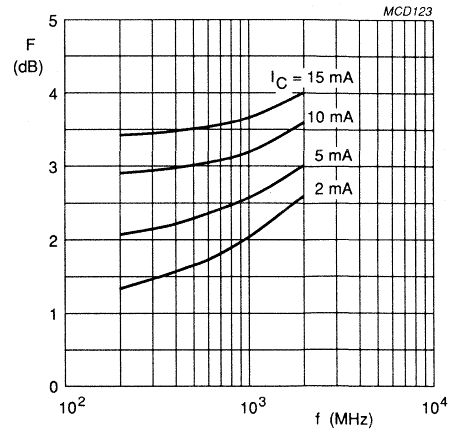


V_{CE} = 5 V.

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



V_{CE} = 5 V.

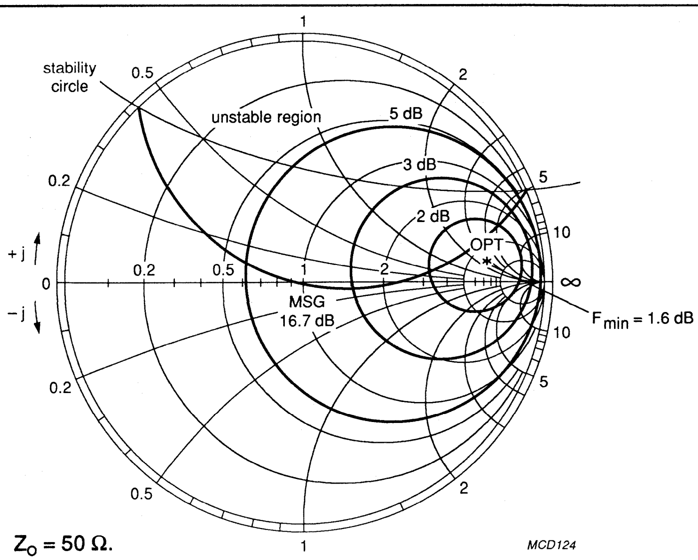
Fig.11 Minimum noise figure as a function of frequency.

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.

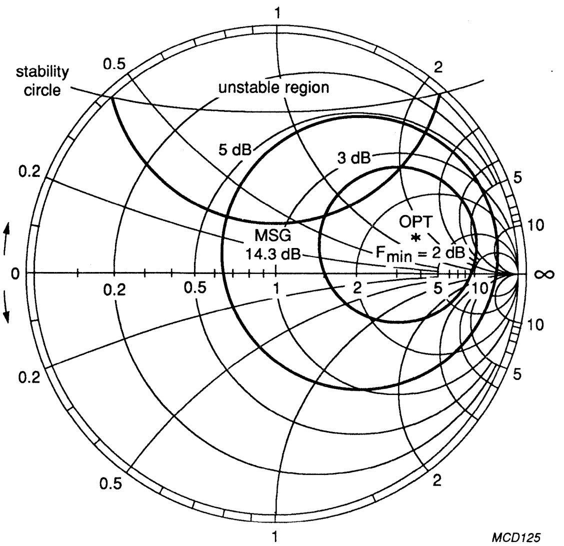
Fig.12 Noise circle figure.

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 Ω.
Maximum stable gain = 14.3 dB.

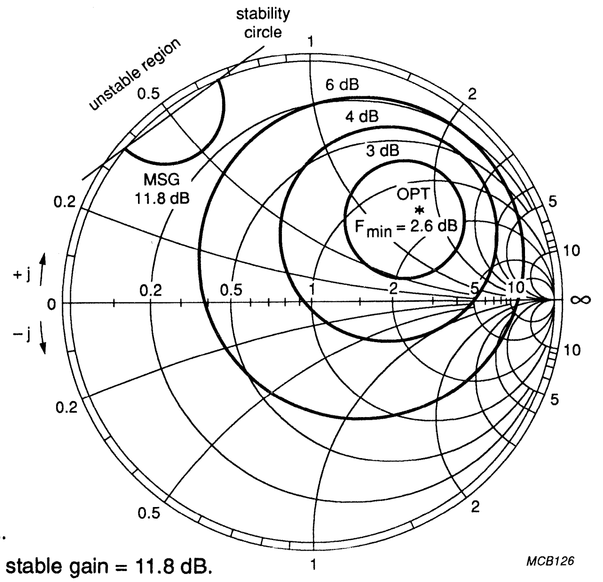
Fig.13 Noise circle figure.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
2000	5	2

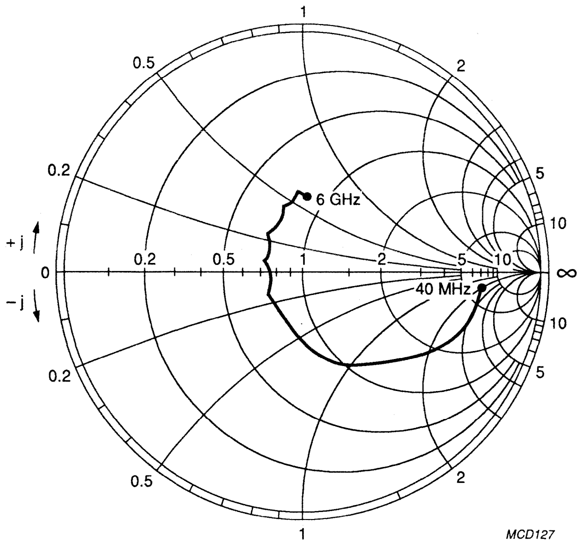
Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.6	0.58	40.2	1.064



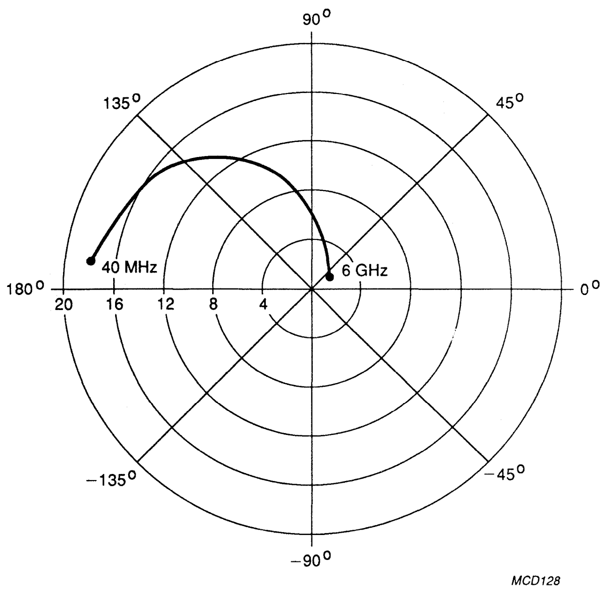
Z_O = 50 Ω.
Maximum stable gain = 11.8 dB.

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}).

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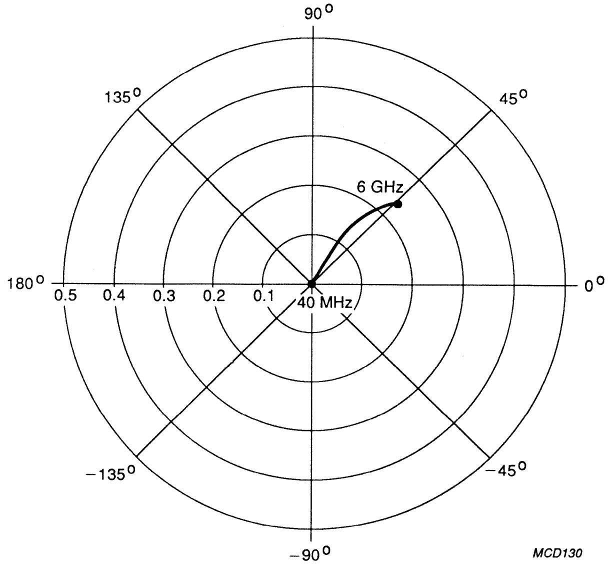
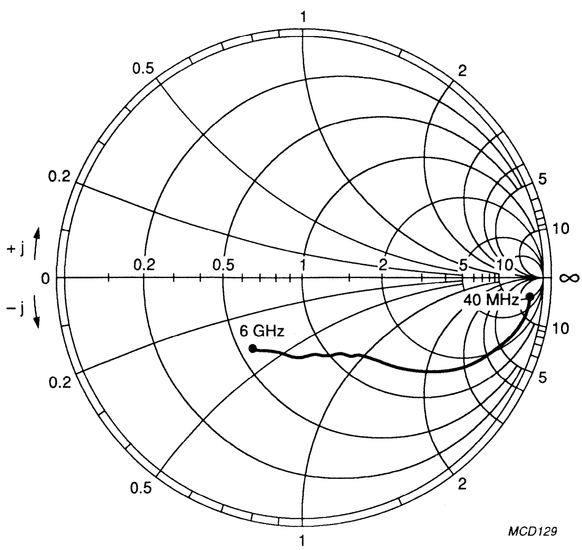


V_{CE} = 5 V; I_C = 15 mA.

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}		R_n
		(RAT)	(DEG)	
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}		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	0.828	−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)	S11		S21		S12		S22		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)	S11		S21		S12		S22		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 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

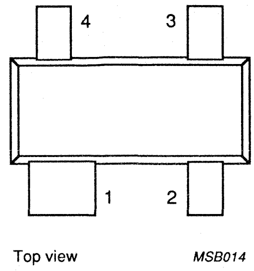


Fig.1 SOT143.

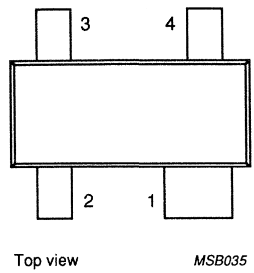


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage		–	–	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.

Qualification approval 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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	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 leakage 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.

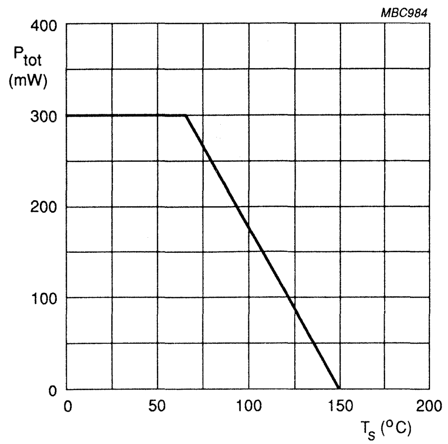
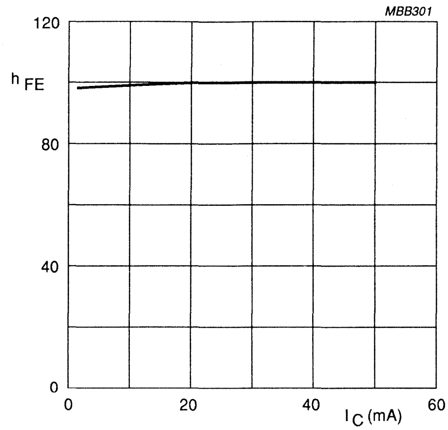
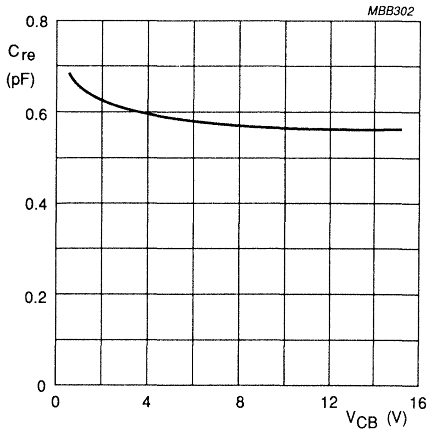


Fig.3 Power derating curve.



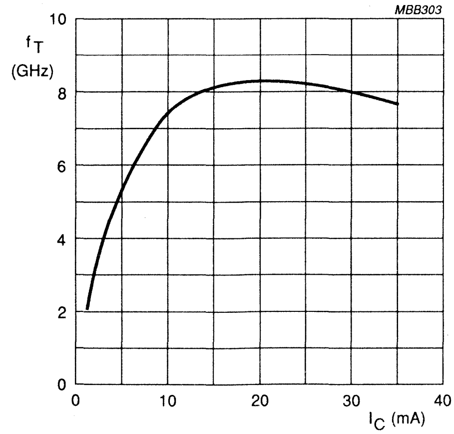
V_{CE} = 5 V.

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



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

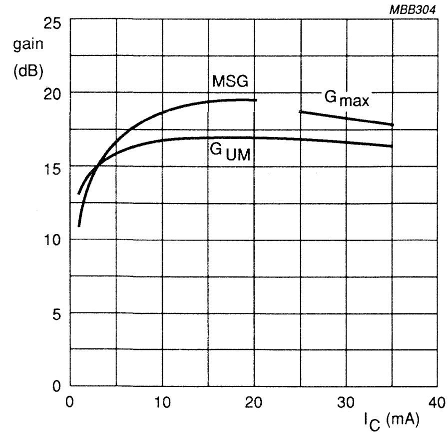
Fig.5 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz.

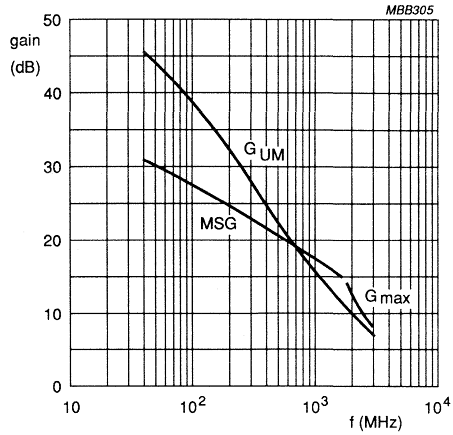
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



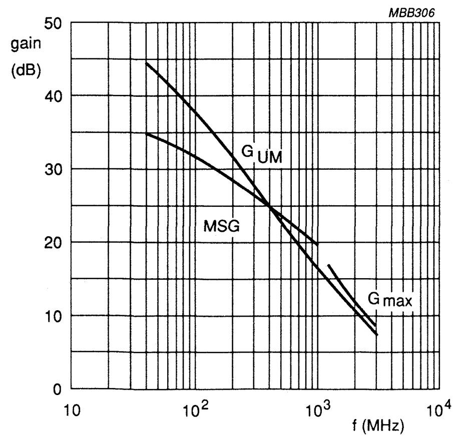
V_{CE} = 8 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



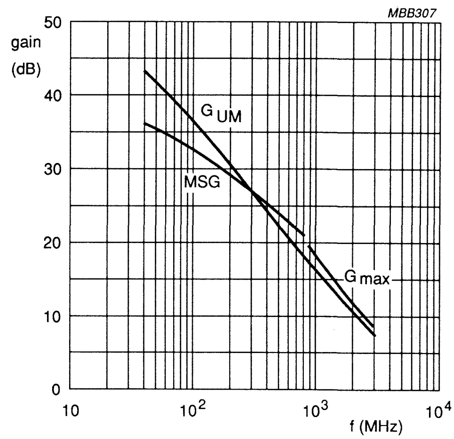
V_{CE} = 8 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



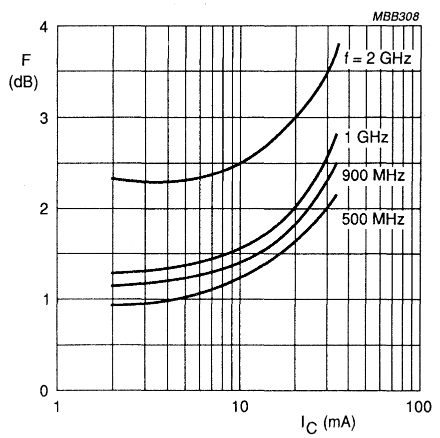
V_{CE} = 8 V; I_C = 15 mA.

Fig.9 Gain as a function of frequency.



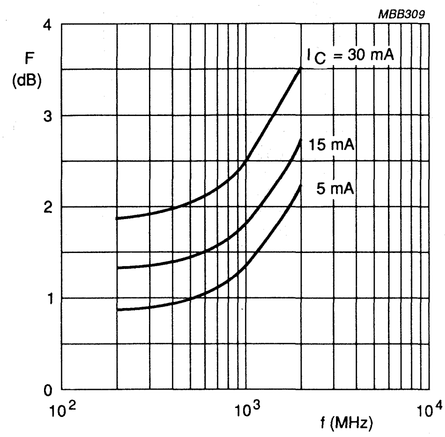
V_{CE} = 8 V; I_C = 30 mA.

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.

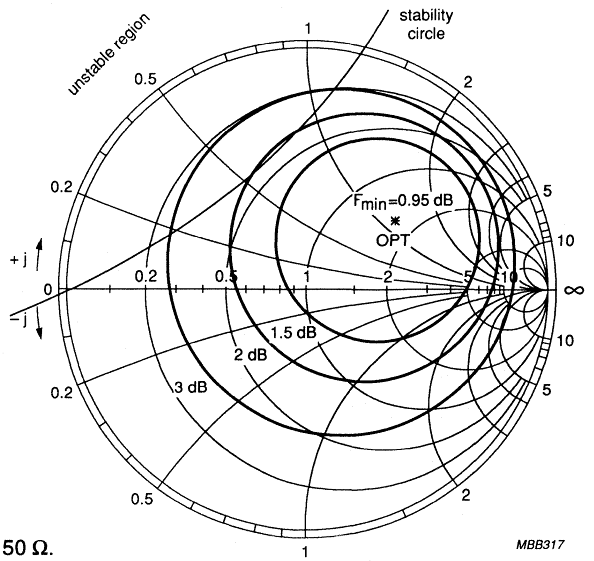
Fig.12 Minimum noise figure as a function of frequency.

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

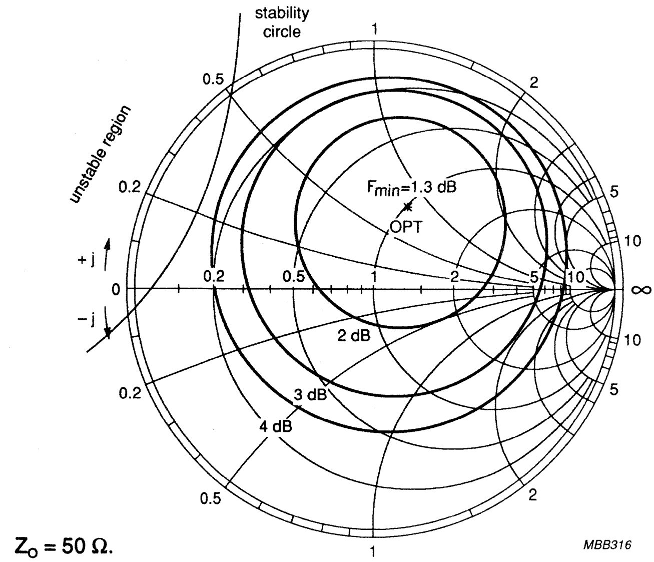


Fig.14 Noise circle figure.

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

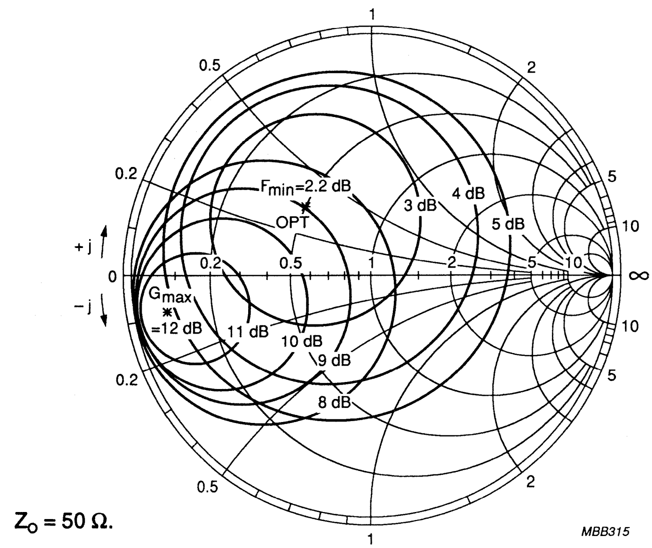
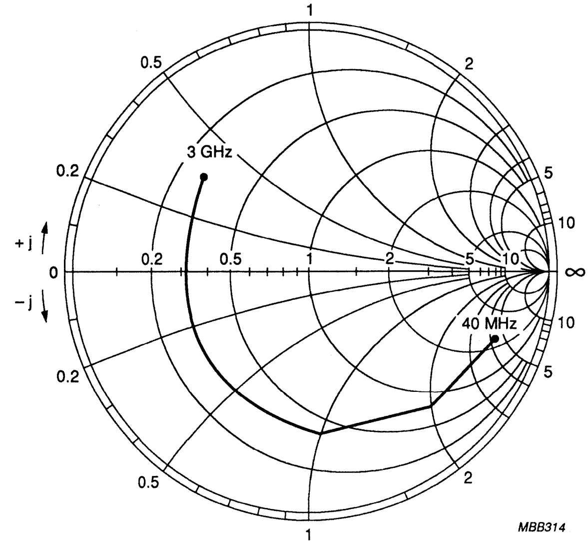
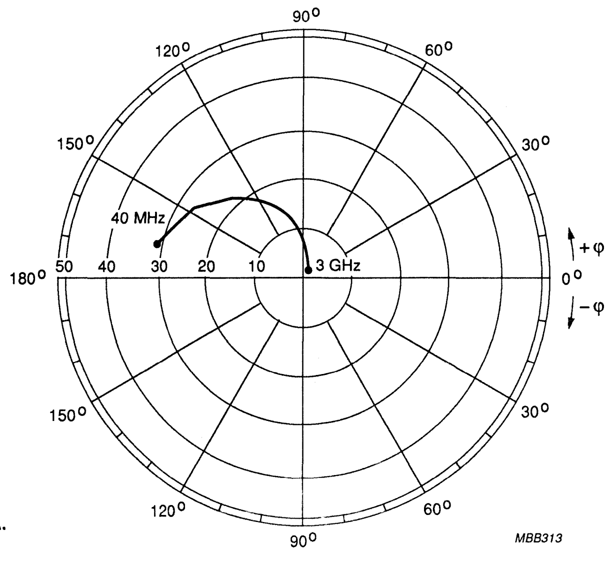


Fig.15 Noise circle figure.



V_{CE} = 8 V; I_C = 15 mA.

Fig.16 Common emitter input reflection coefficient (S_{11}).

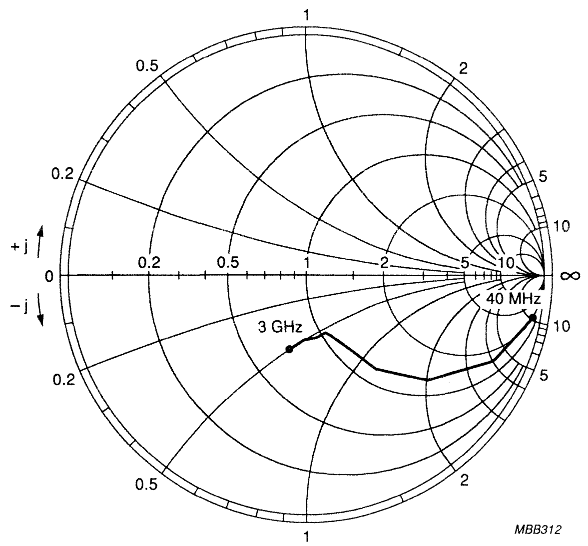


V_{CE} = 8 V; I_C = 15 mA.

Fig.17 Common emitter forward transmission coefficient (S_{21}).

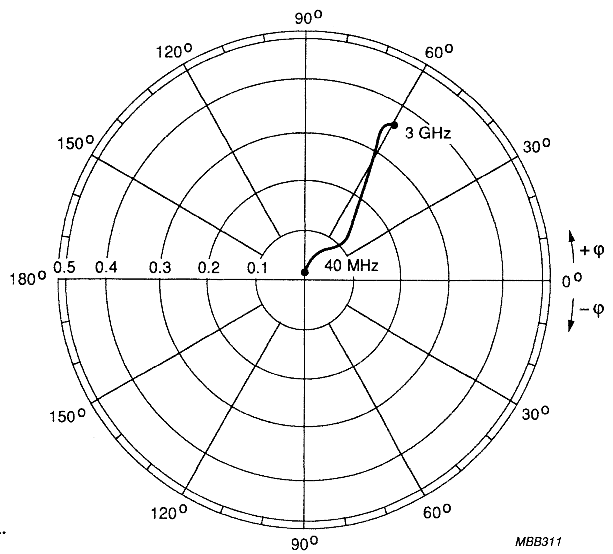
NPN 8 GHz wideband transistor

BFG67; BFG67/X; BFG67R; BFG67/XR



V_{CE} = 8 V; I_C = 15 mA.

Fig.18 Common emitter reverse transmission coefficient (S_{12}).

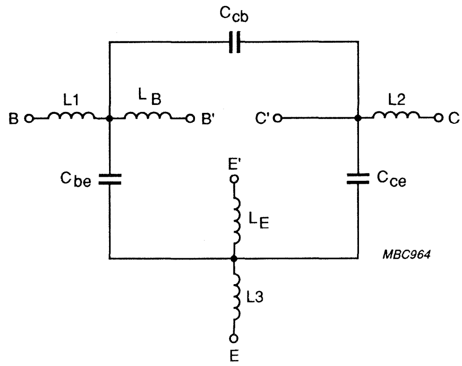


V_{CE} = 8 V; I_C = 15 mA.

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}		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	0.953	−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} 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	0.897	−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

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	0.771	−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} 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	0.726	−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

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}		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	0.851	−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}		R_n
		(RAT)	(DEG)	
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 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

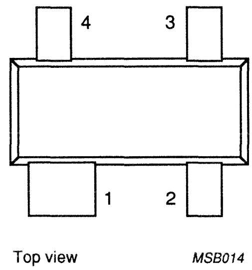


Fig.1 SOT143.

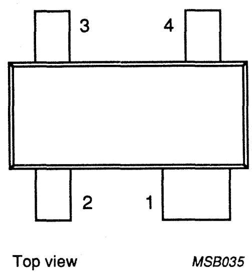


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	15	V
I_C	collector current	DC value	–	–	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.

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	collector current	DC value, continuous	–	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 operating 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 leakage 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.

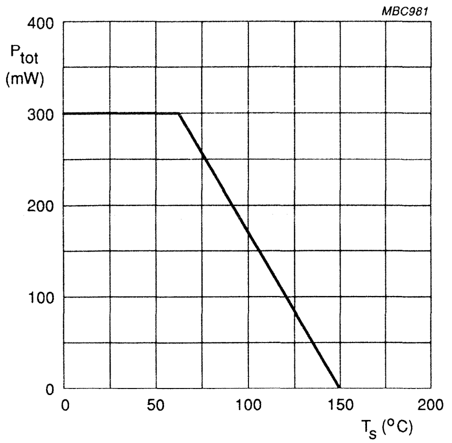
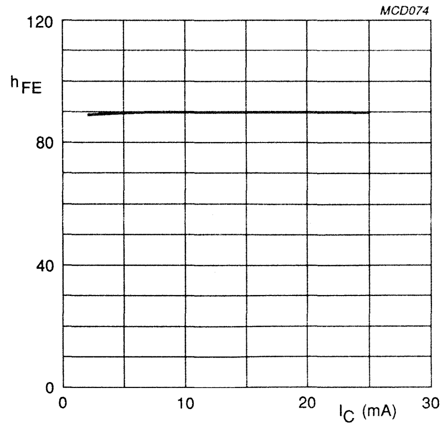
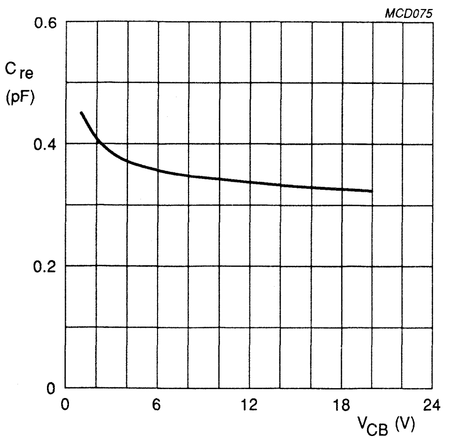


Fig.3 Power derating curve.



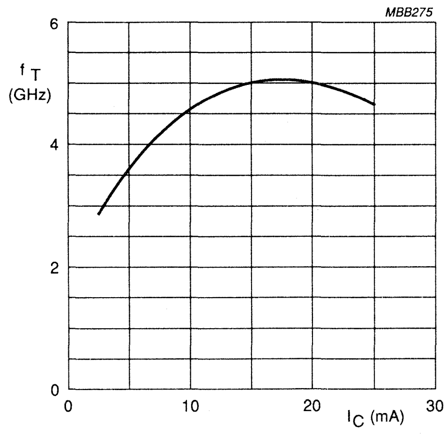
V_{CE} = 10 V.

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



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

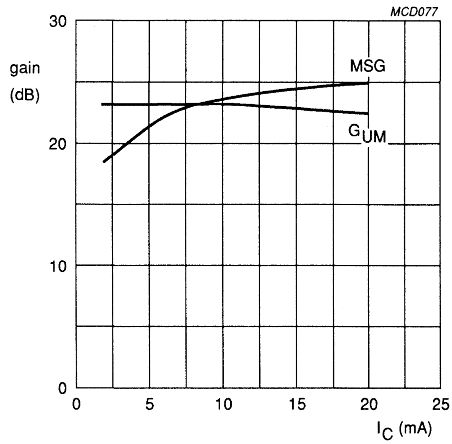
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

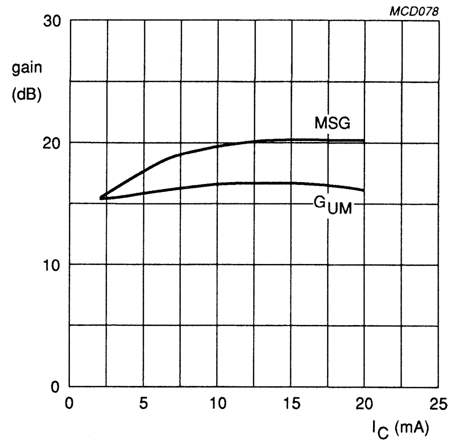
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



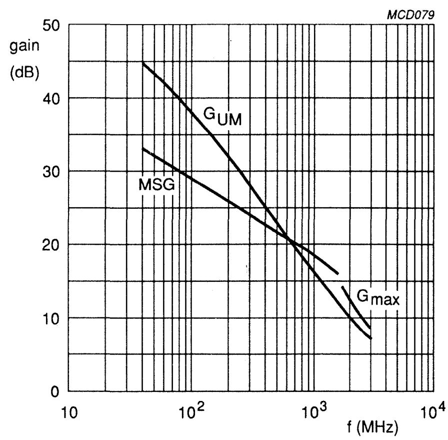
V_{CE} = 10 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



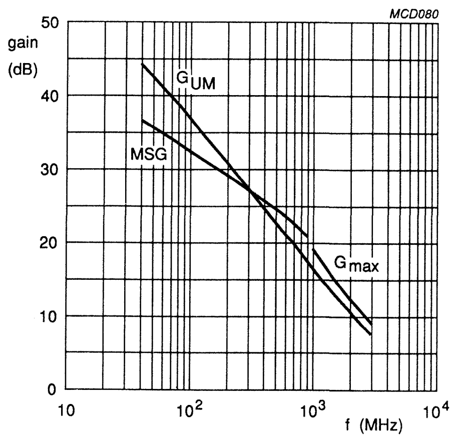
V_{CE} = 10 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



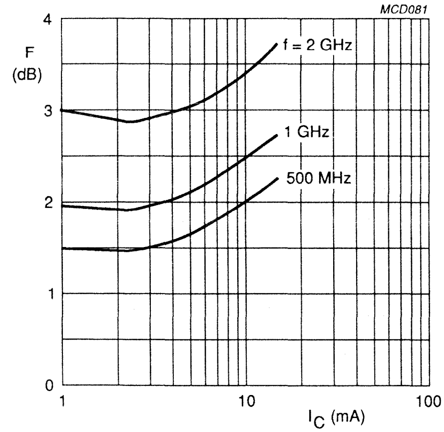
V_{CE} = 10 V; I_C = 5 mA.

Fig.9 Gain as a function of frequency.



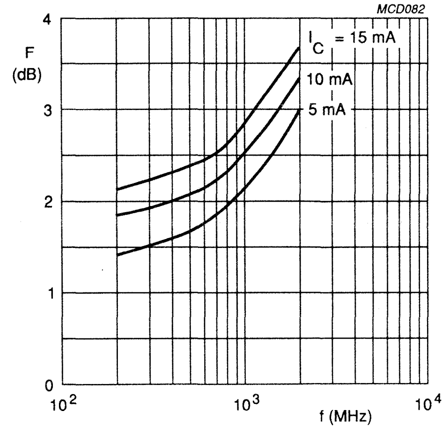
V_{CE} = 10 V; I_C = 15 mA.

Fig.10 Gain as a function of frequency.



V_{CE} = 10 V.

Fig.11 Minimum noise figure as a function of collector current.



V_{CE} = 10 V.

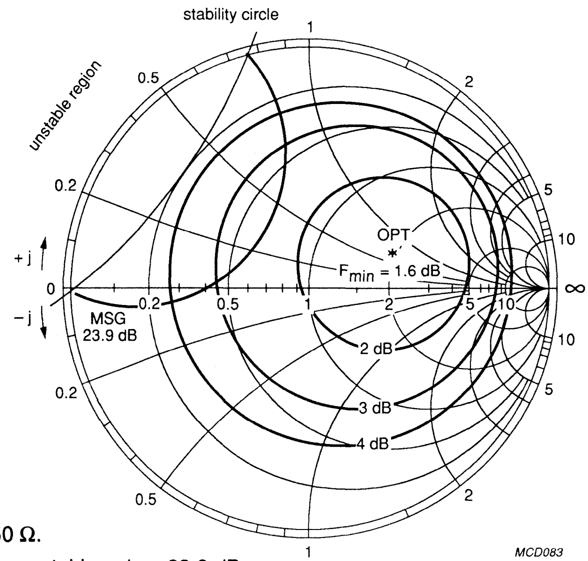
Fig.12 Minimum noise figure as a function of frequency.

BFG92A/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt) (mag)	Gamma (opt) (ang)	R_n/50
1.6	0.384	21.6	0.4



Z_o = 50 Ω.
Maximum stable gain = 23.9 dB.

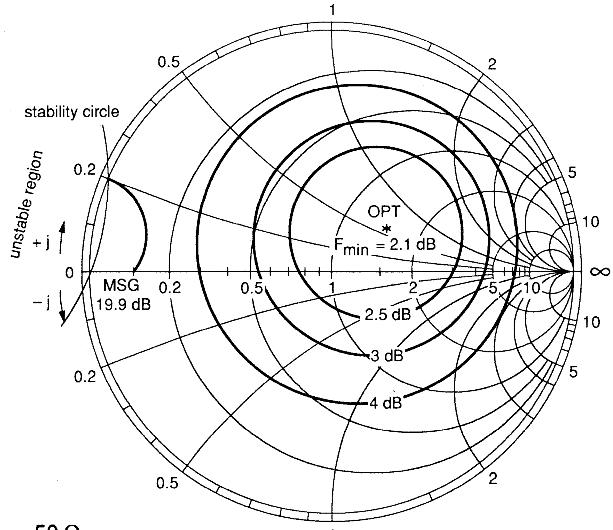
Fig.13 Noise circle figure.

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



$Z_O = 50\ \Omega$.

Maximum stable gain = 19.9 dB.

Fig.14 Noise circle figure.

BFG92A/X

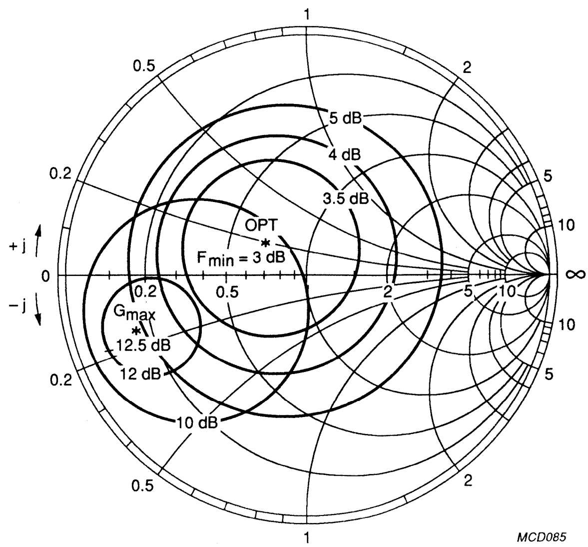
f (MHz)	V_{CE} (V)	I_C (mA)
2000	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3	0.21	142.8	0.2

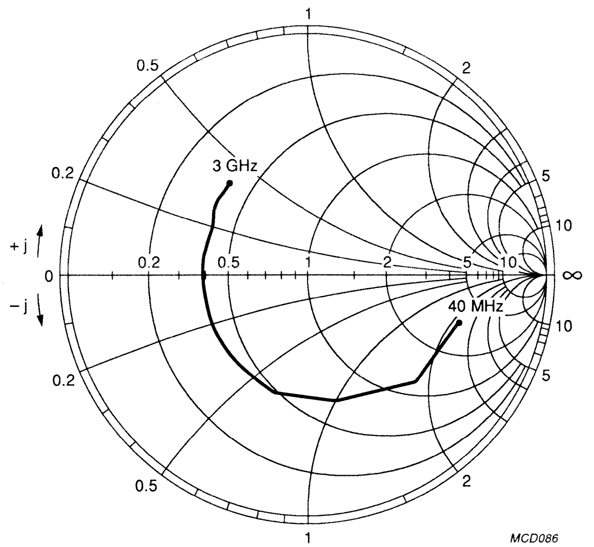
Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
12.5	0.734	−162



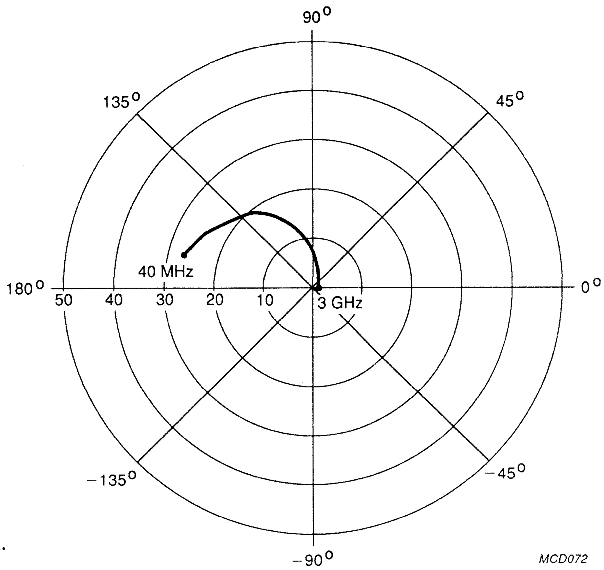
$Z_O = 50\ \Omega$.

Fig.15 Noise circle figure.



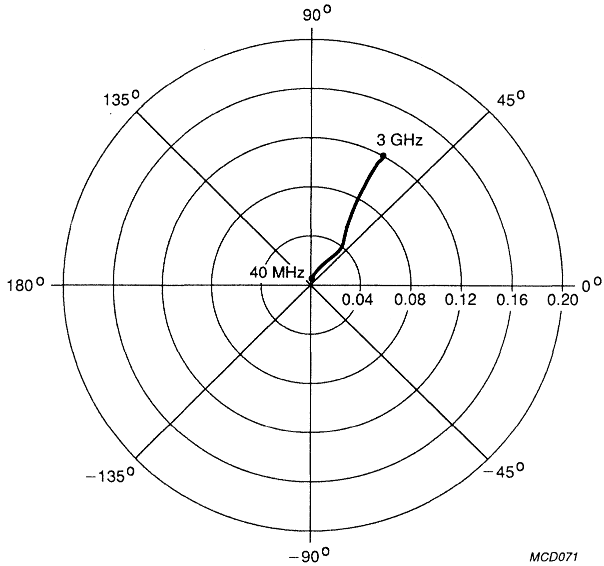
V_{CE} = 10 V; I_C = 15 mA.

Fig.16 Common emitter input reflection coefficient (S_{11}).



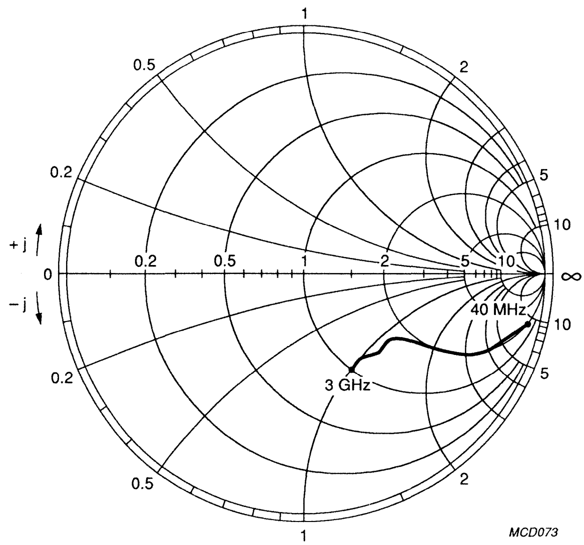
V_{CE} = 10 V; I_C = 15 mA.

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}).

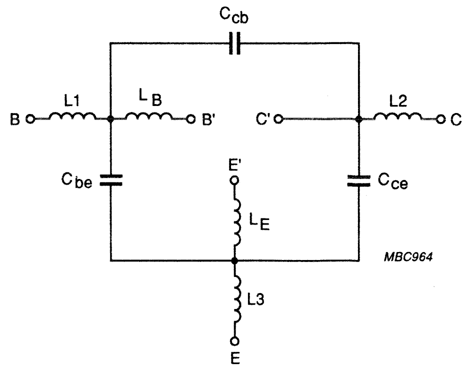


V_{CE} = 10 V; I_C = 15 mA.

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}		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	0.894	−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

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} 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	0.581	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.905	−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} 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	0.810	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.716	−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} (RAT)	Γ_{opt} (DEG)	R_n
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}		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	0.665	−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}		R_n
		(RAT)	(DEG)	
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} 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	0.634	−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

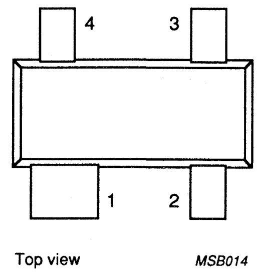


Fig.1 SOT143.

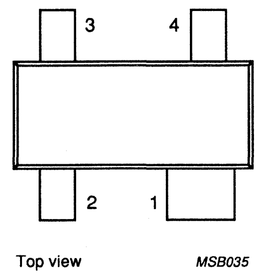


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	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 = 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.

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	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 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	–	0.9	–	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.

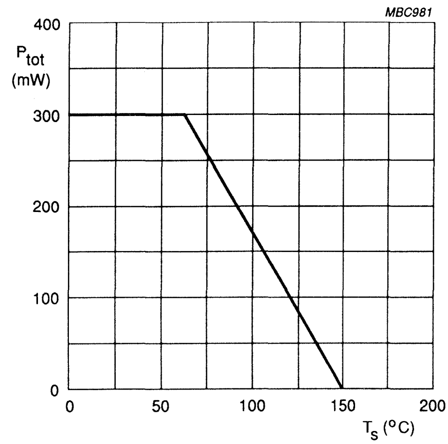
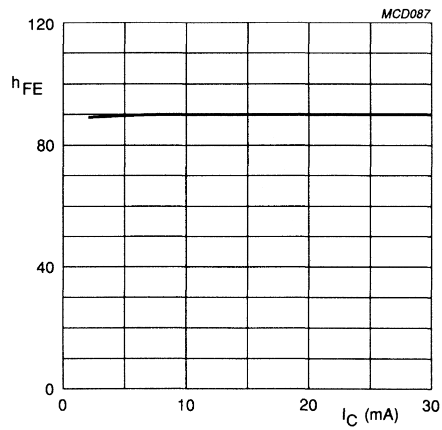
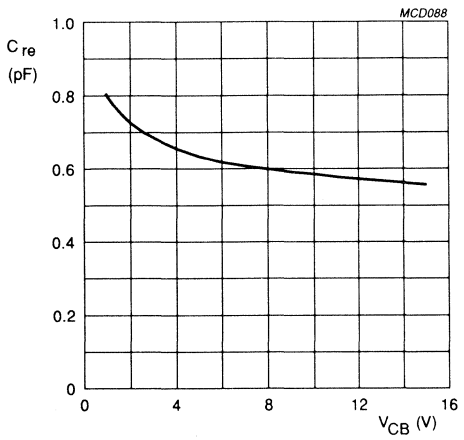


Fig.3 Power derating curve.



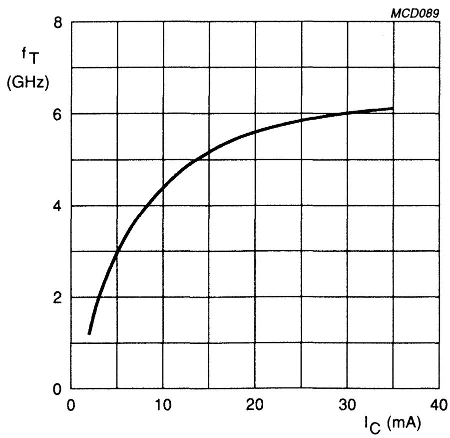
V_{CE} = 5 V.

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



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

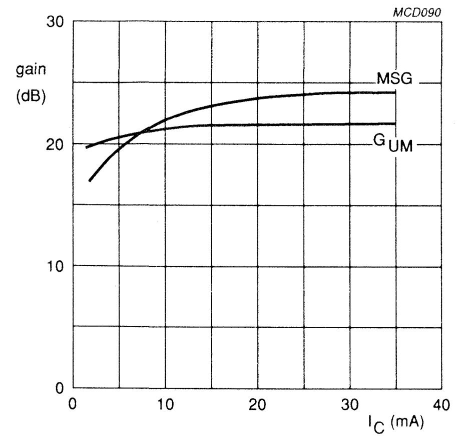
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

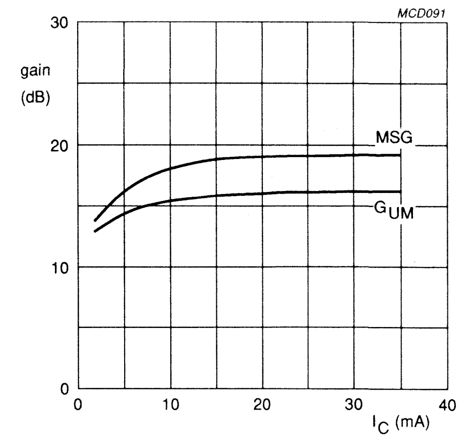
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



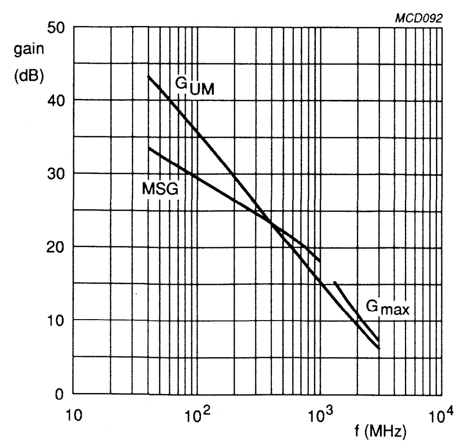
V_{CE} = 8 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



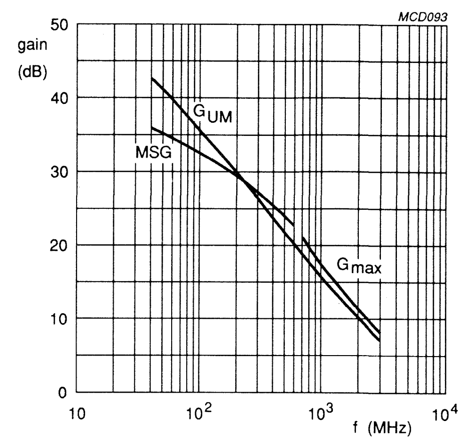
V_{CE} = 8 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



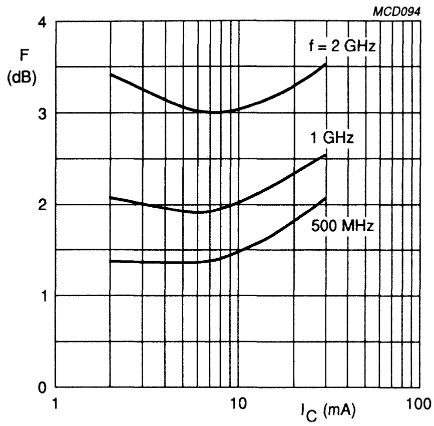
V_{CE} = 8 V; I_C = 10 mA.

Fig.9 Gain as a function of frequency.



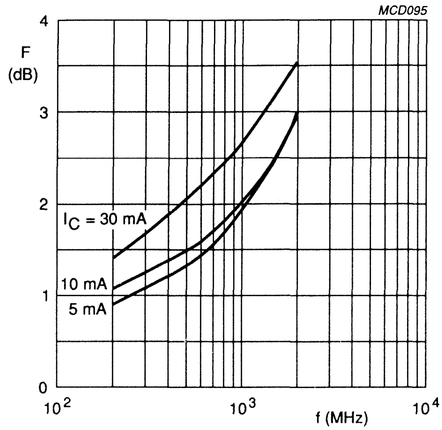
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



V_{CE} = 8 V.

Fig.11 Minimum noise figure as a function of collector current.



V_{CE} = 8 V.

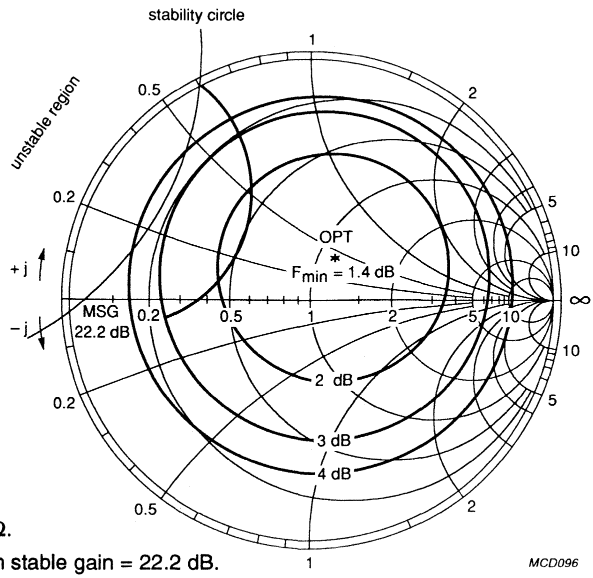
Fig.12 Minimum noise figure as a function of frequency.

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.

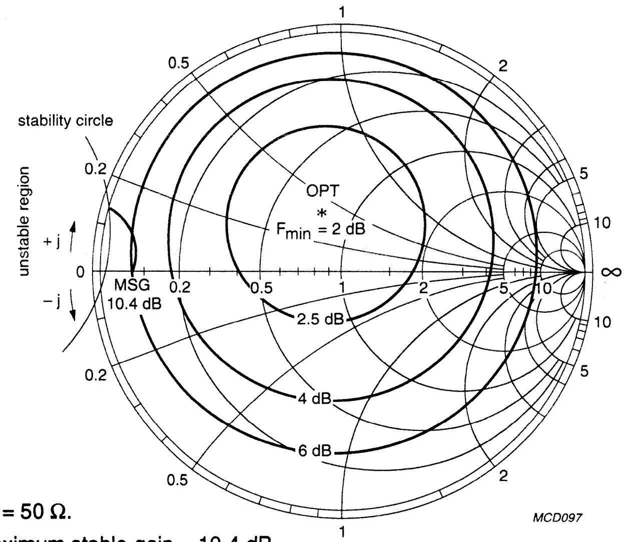
Fig.13 Noise circle figure.

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

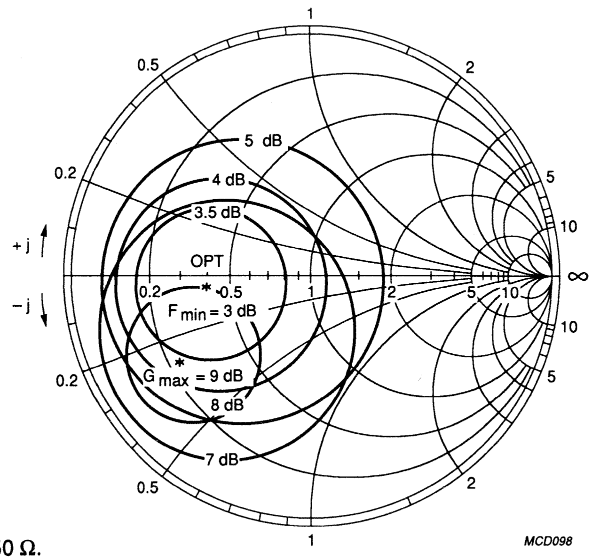
f (MHz)	V_{CE} (V)	I_C (mA)
2000	8	10

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3	0.46	−174	0.136

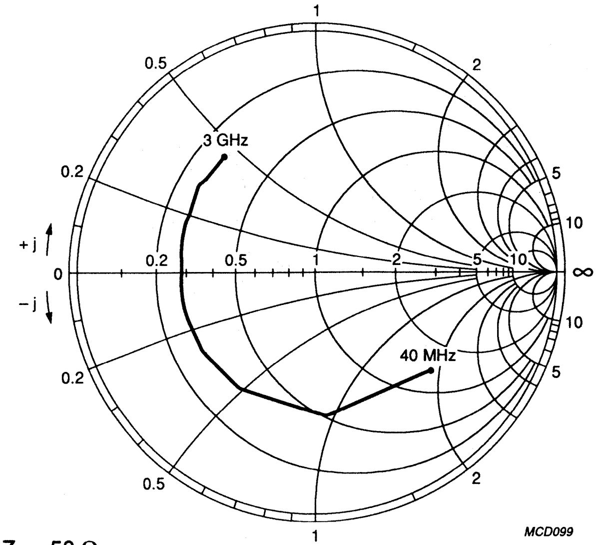
Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
9	0.654	−147



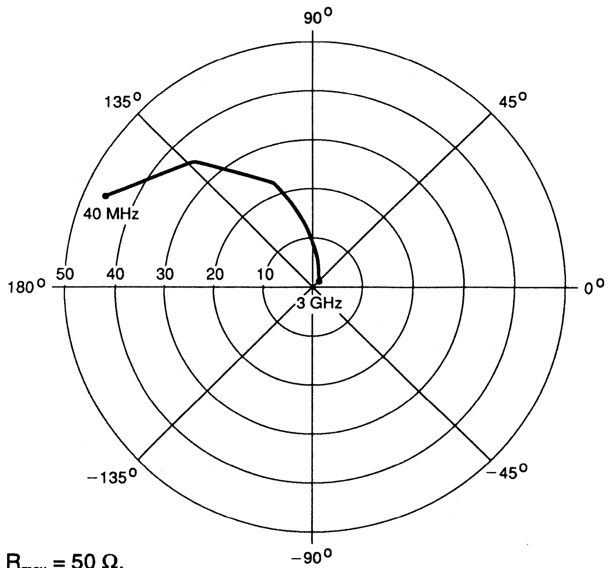
$Z_O = 50\ \Omega$.

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}).

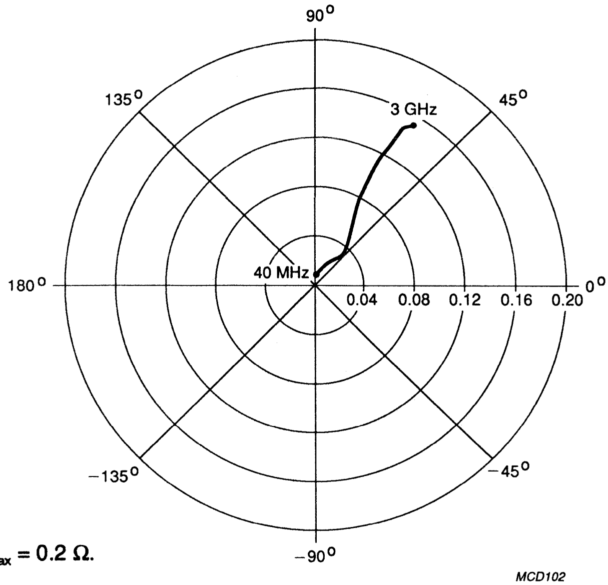


Fig.18 Common emitter reverse transmission coefficient (S_{12}).

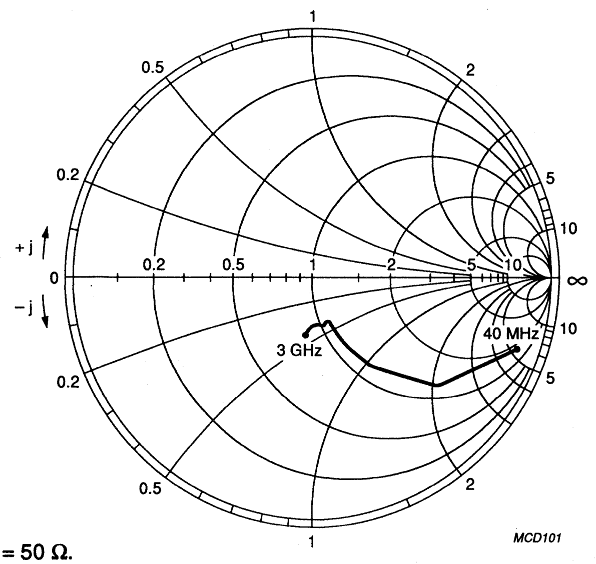
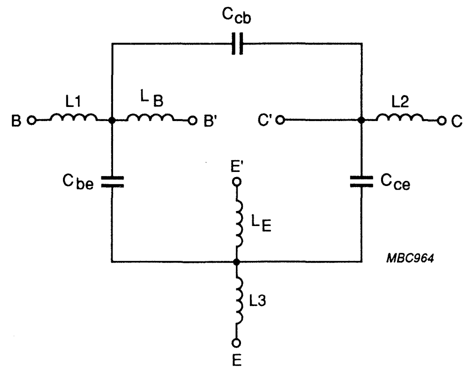


Fig.19 Common emitter output reflection coefficient (S_{22}).

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) = $QL_{B,E}$ √ (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

NPN 6 GHz wideband transistor BFG93A; BFG93A/X; BFG93A/XR

Table 3 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	0.730	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	−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} (RAT)	Γ_{opt} (DEG)	R_n
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}		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	0.850	−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}		R_n
		(RAT)	(DEG)	
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}		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	0.764	−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}		R_n
		(RAT)	(DEG)	
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

Table 12 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	0.672	−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} 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	0.630	−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} (RAT)	Γ_{opt} (DEG)	R_n
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 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

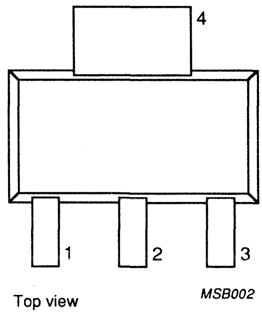


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	25	V
V_{CEO}	collector-emitter voltage		–	–	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	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz	–	12	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	–	850	–	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).

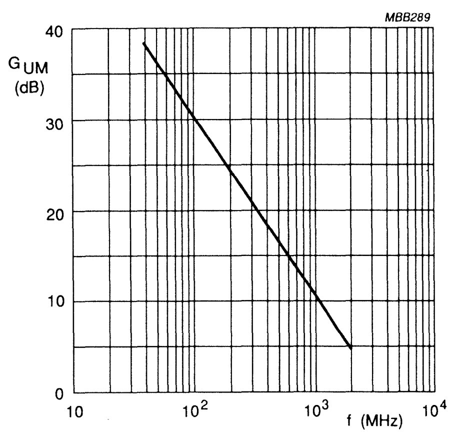
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage 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	30 K/W



V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.2 Maximum unilateral gain as a function of frequency, typical values.

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	$I_C = i_c = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	7	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 500 MHz	–	16	–	dB
		$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 800 MHz	–	12	–	dB
V_O	output voltage	note 1	–	900	–	mV
		note 2	–	850	–	mV
d_2	second order intermodulation distortion	$V_{CE} = 10$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 450$ MHz; $I_C = 90$ mA; $T_{amb} = 25$ °C	–	–58	–	dB
		$V_{CE} = 10$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 810$ MHz; $I_C = 90$ mA; $T_{amb} = 25$ °C	–	–53	–	dB

Notes

1. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 100$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_O$ 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.
2. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 100$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_O$ 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.

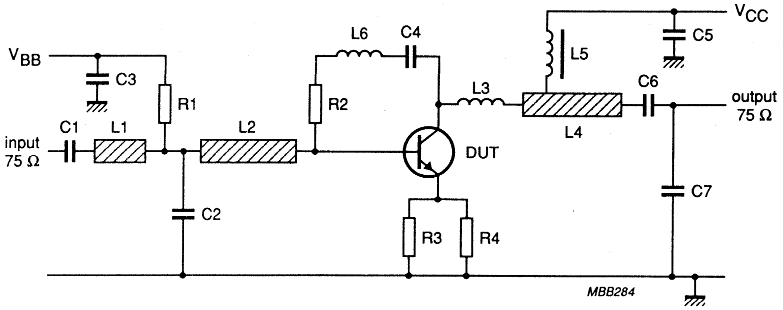


Fig.3 Intermodulation and second harmonic test circuit.

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.

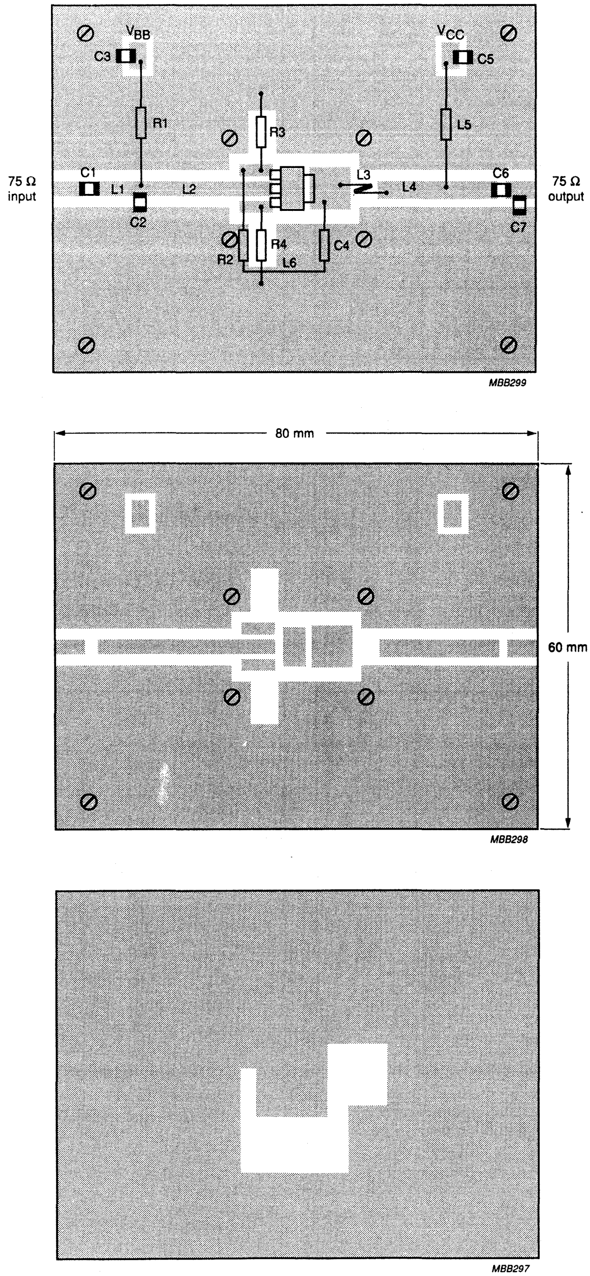


Fig.4 Intermodulation test circuit printed circuit board.

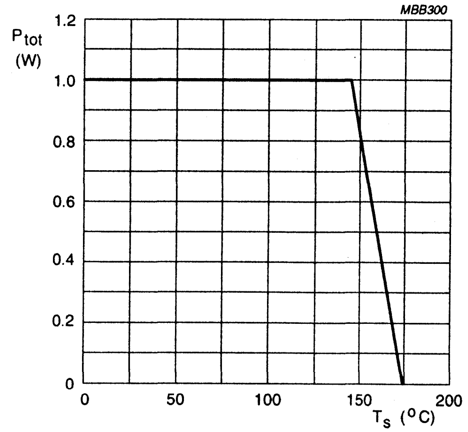
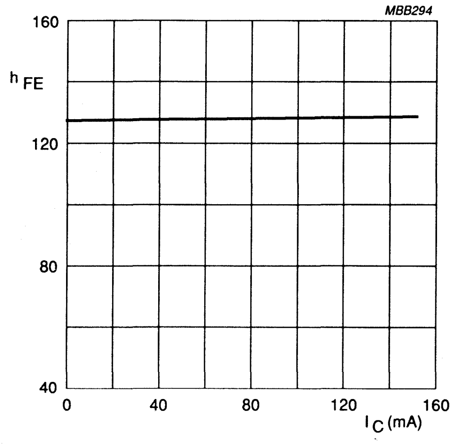
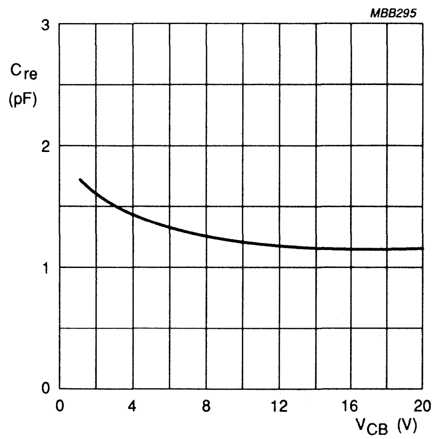


Fig.5 Power derating curve.



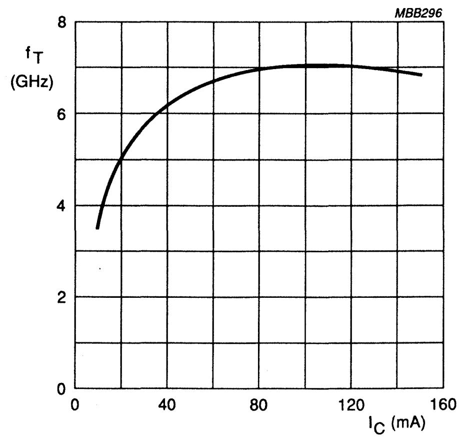
V_{CE} = 10 V; T_j = 25 °C.

Fig.6 DC current gain as a function of collector current, typical values.



I_E = 0; f = 1 MHz; T_j = 25 °C.

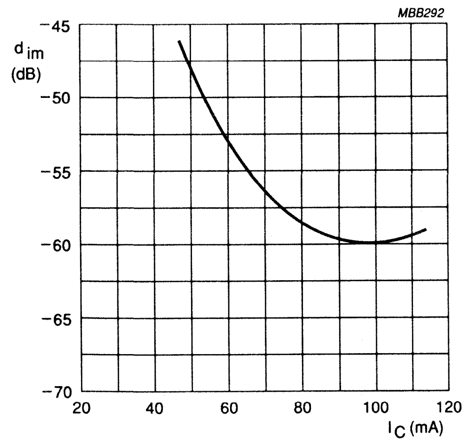
Fig.7 Feedback capacitance as a function of collector-base voltage, typical values.



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

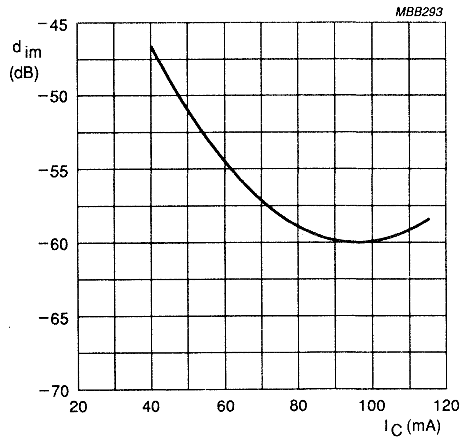
Fig.8 Transition frequency as a function of collector current, typical values.

NPN 7 GHz wideband transistor BFG135



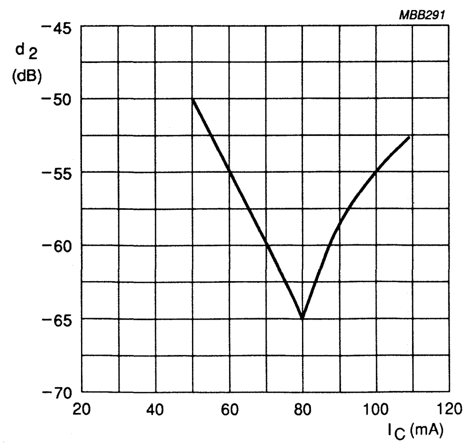
V_{CE} = 10 V; V_O = 900 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion, typical values.



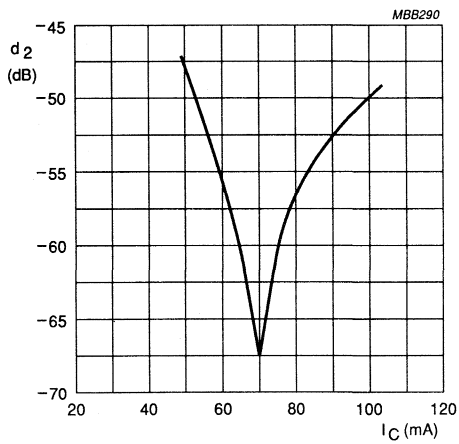
V_{CE} = 10 V; V_O = 850 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.10 Intermodulation distortion, typical values.



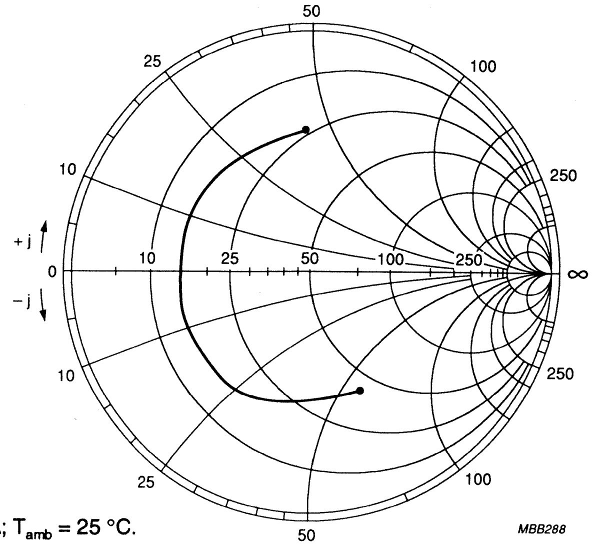
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.11 Second order intermodulation distortion, typical values.



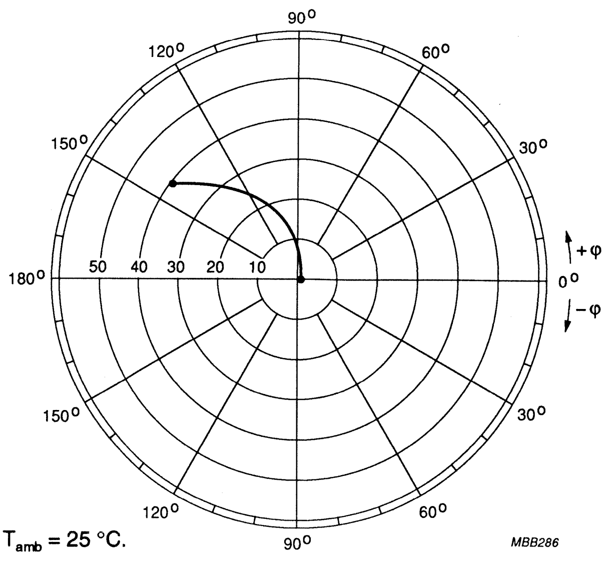
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.12 Second order intermodulation distortion, typical values.



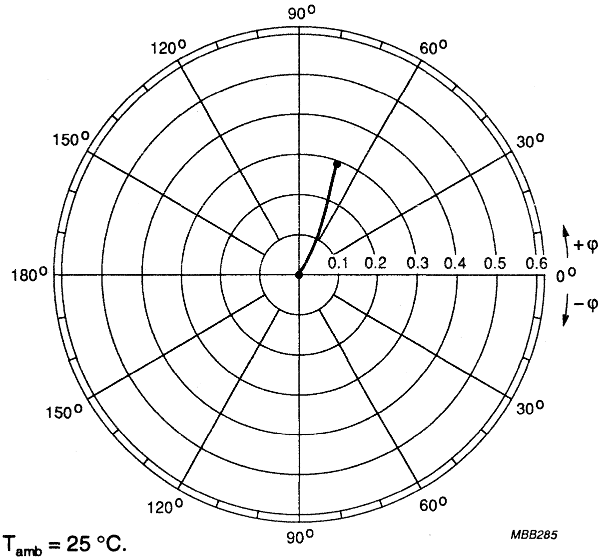
V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.13 Common emitter input reflection coefficient (S_{11}), typical values.



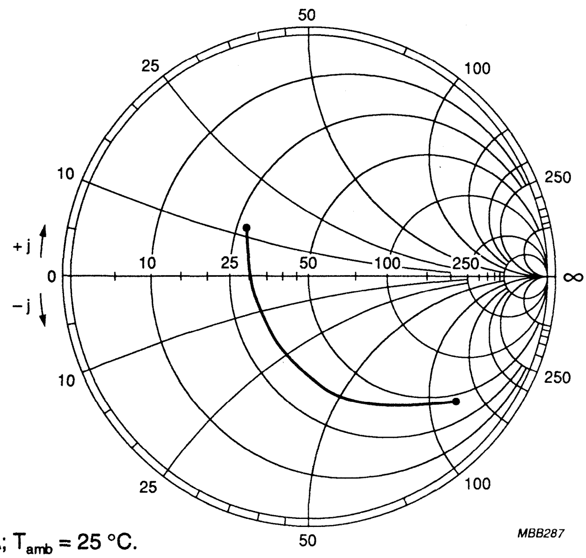
V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.14 Common emitter forward transmission coefficient (S_{21}), typical values.



V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.15 Common emitter reverse transmission coefficient (S_{12}), typical values.



V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C.

Fig.16 Common emitter output reflection coefficient (S_{22}), typical values.

Table 1 Common emitter scattering parameters, V_{CE} = 10 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	0.664	−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, V_{CE} = 10 V, I_C = 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	0.650	−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

Table 3 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 100 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	0.674	−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 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

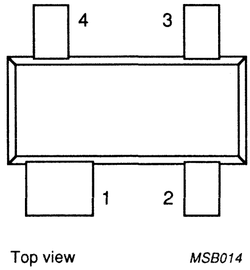


Fig.1 SOT143.

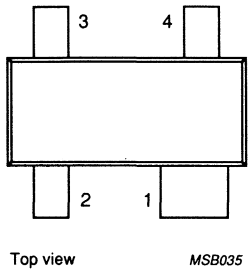


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 50 °C (note 1)	–	–	350	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.

Qualification approval 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	–	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 = 50 °C (note 1)	–	350	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 leakage 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 $G_{UM} = 10\log\dfrac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

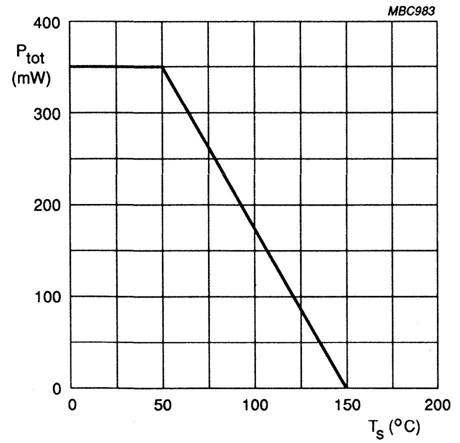
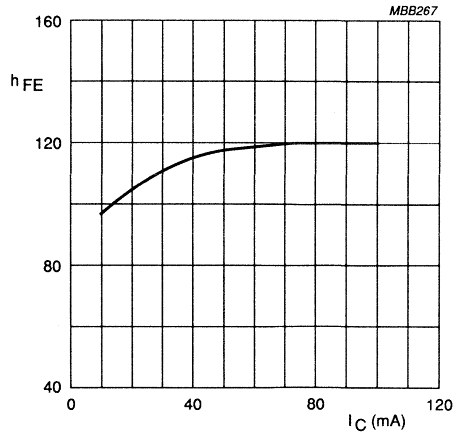
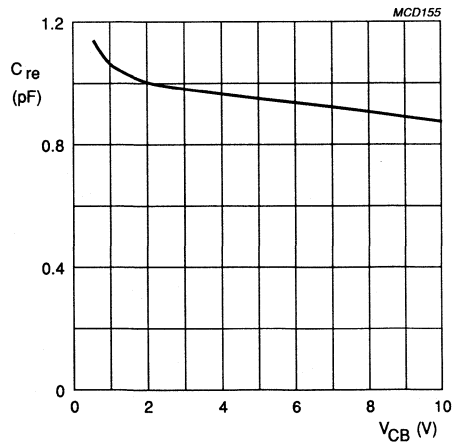


Fig.3 Power derating curve.



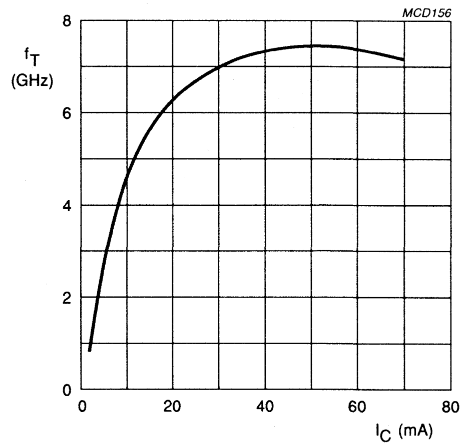
V_{CE} = 5 V.

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



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

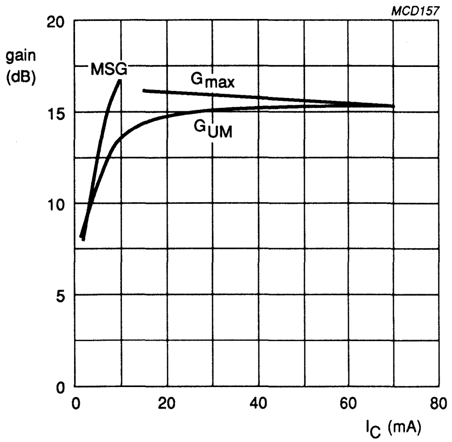
Fig.5 Feedback capacitance as a function of collector-base voltage.



V_{CE} = 4 V; T_{amb} = 25 °C; f = 2 GHz.

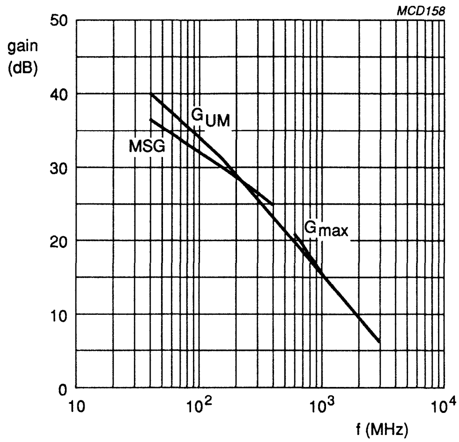
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



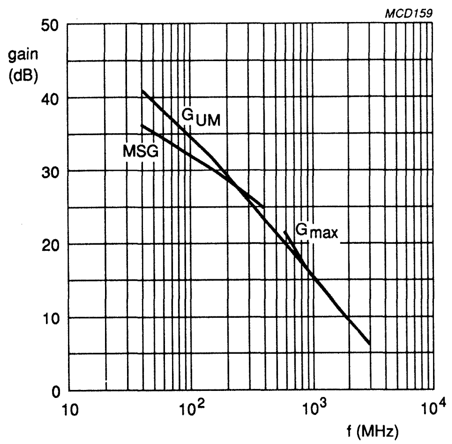
V_{CE} = 4 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



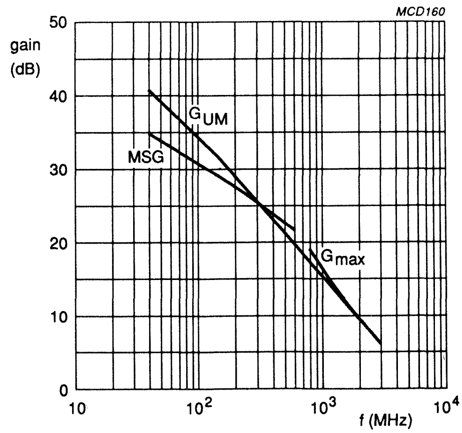
V_{CE} = 4 V; I_C = 50 mA.

Fig.8 Gain as a function of frequency.



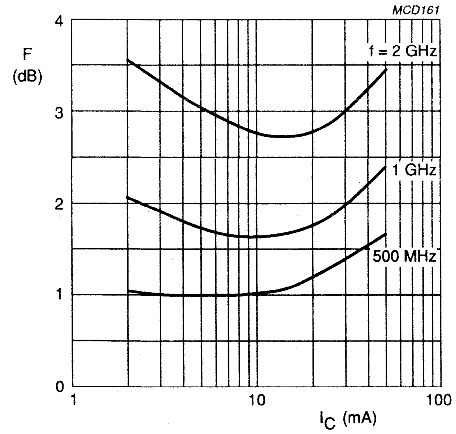
V_{CE} = 6 V; I_C = 50 mA.

Fig.9 Gain as a function of frequency.



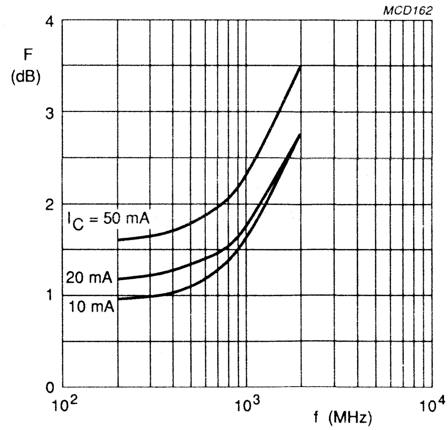
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



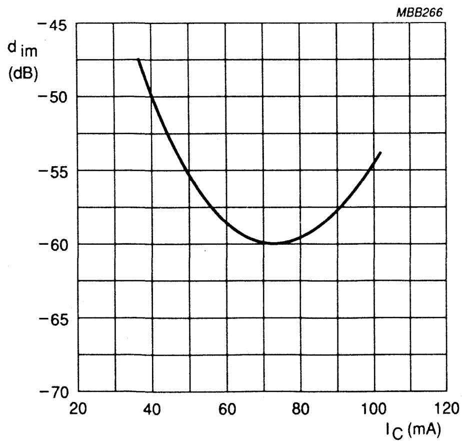
$V_{CE} = 6$ V.

Fig.11 Minimum noise figure as a function of collector current.



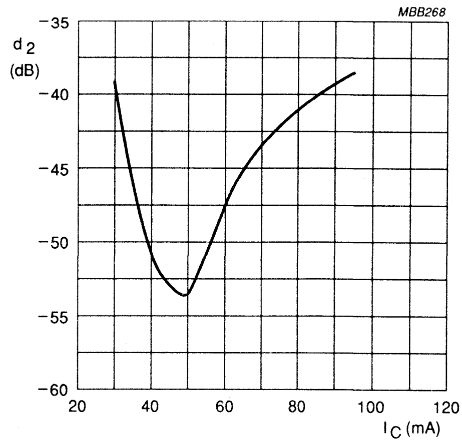
$V_{CE} = 6$ V.

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.

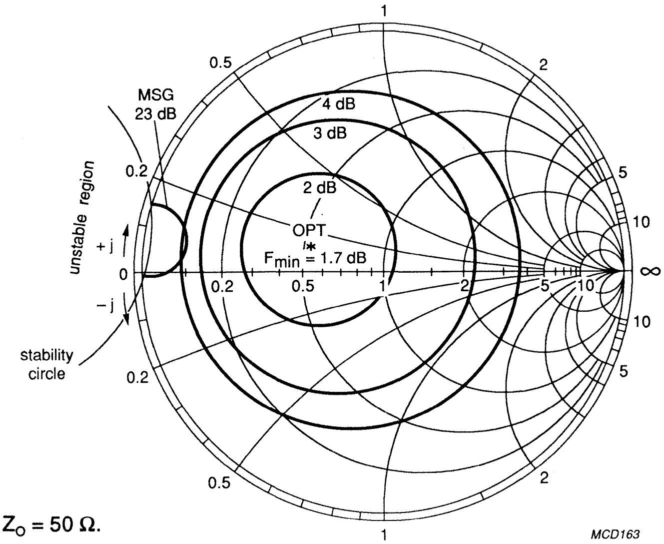
Fig.14 Second order intermodulation distortion, typical values.

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)

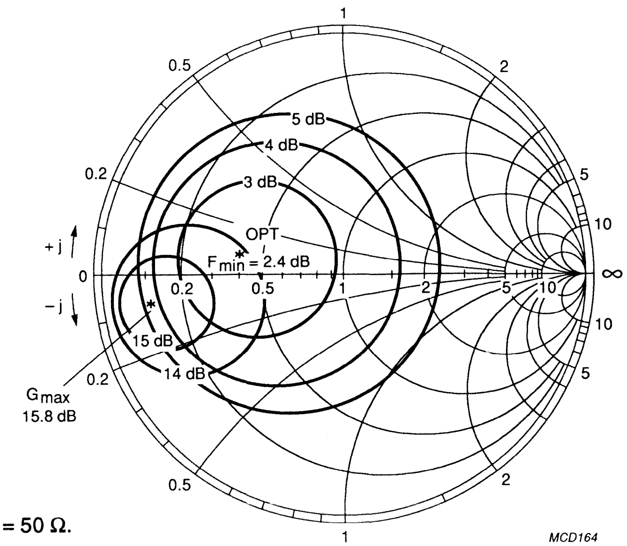
f (MHz)	V_{CE} (V)	I_C (mA)
1000	6	50

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)

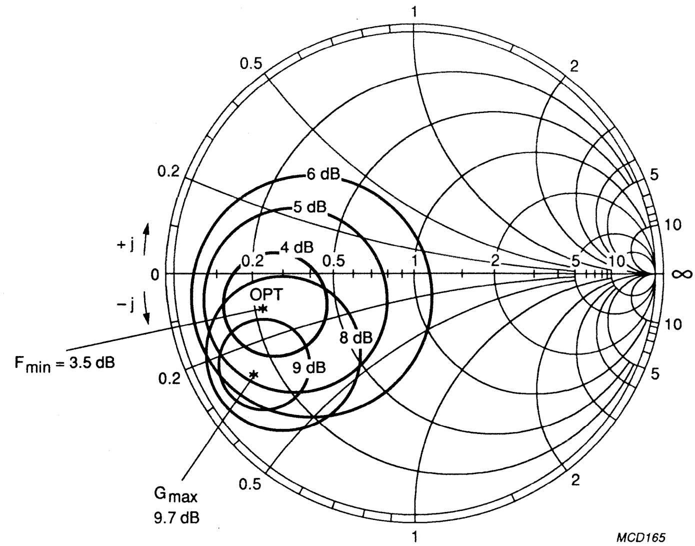
f (MHz)	V_{CE} (V)	I_C (mA)
2000	6	50

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



Z_O = 50 Ω.

Fig.17 Noise circle figure.

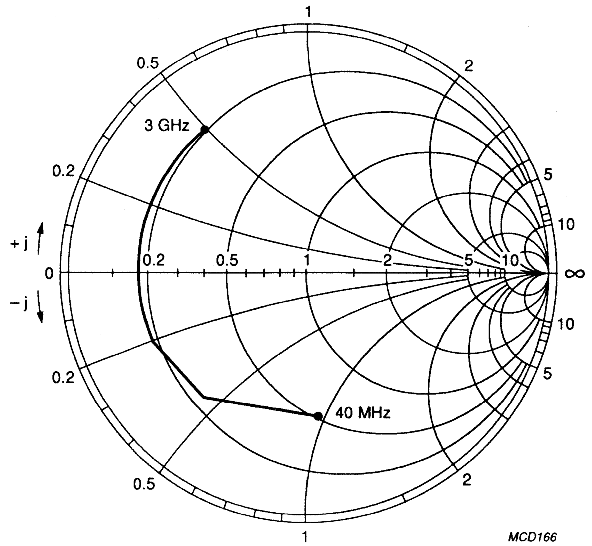


Fig.18 Common emitter input reflection coefficient (S_{11}).

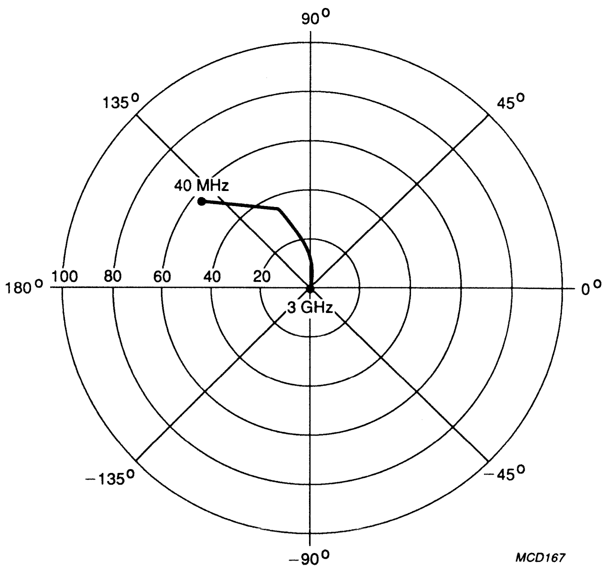
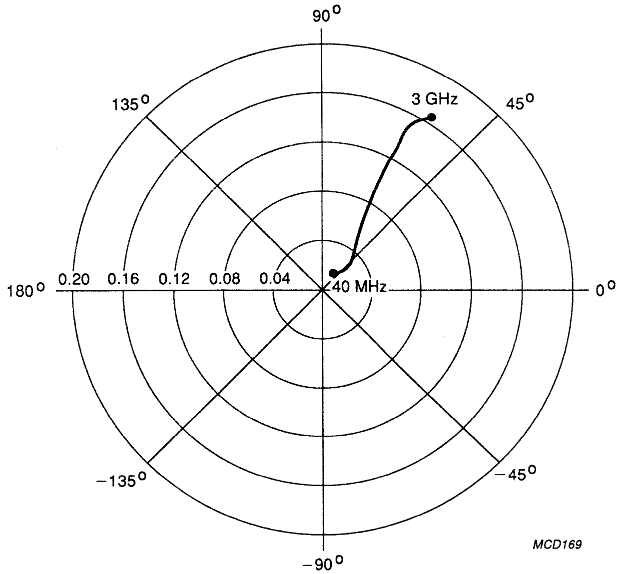
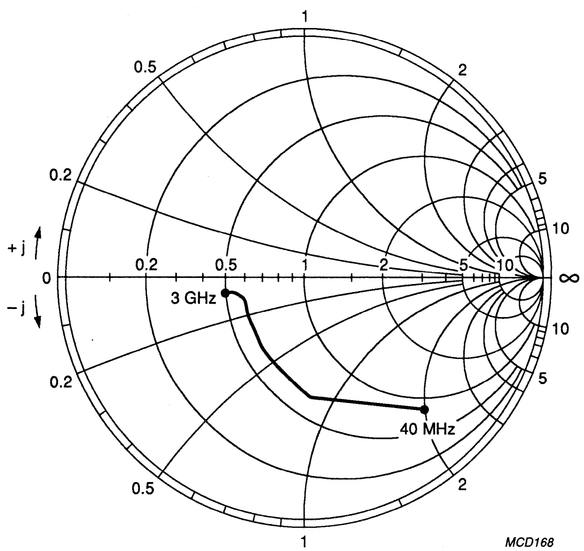


Fig.19 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_C = 50 mA.

Fig.20 Common emitter reverse transmission coefficient (S_{12}).

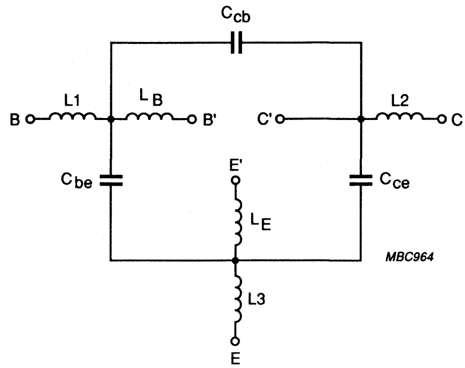


V_{CE} = 6 V; I_C = 50 mA.

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

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}		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	0.573	−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

NPN 7 GHz wideband transistor BFG197; BFG197/X; BFG197/XR

Table 6 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	0.550	−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} 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	0.594	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.694	−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}		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	0.652	−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

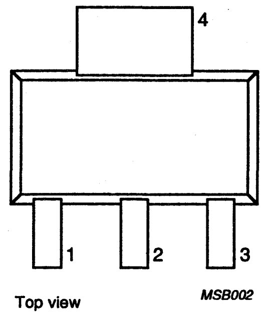


Fig.1 SOT223.

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	T_s = 135 °C (note 1)	–	–	1	W
T_j	junction temperature		–	–	175	°C
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; T_{amb} = 25 °C; f = 1 GHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz	–	15	–	dB
V_O	output voltage	d_{im} = −60 dB; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	–	700	–	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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	T_s = 135 °C (note 1)	–	1	W
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	40 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	–	–	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; $T_{amb} = 25$ °C; f = 1 GHz	–	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; $T_{amb} = 25$ °C; f = 500 MHz.	–	18	–	dB
		$I_C = 50$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 800 MHz	–	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); T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω;
   $V_p = V_O$ 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); T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω;
   $V_p = V_O$ 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.

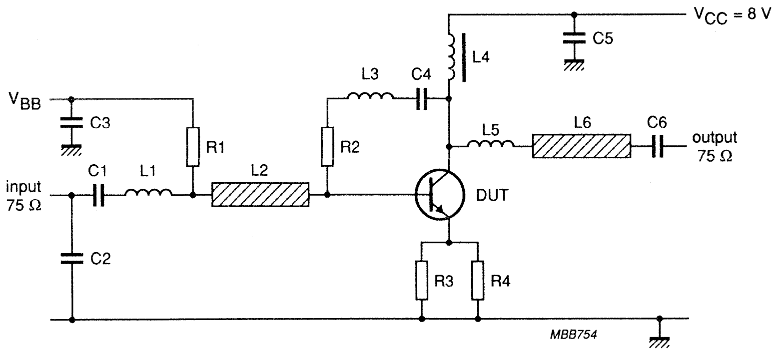


Fig.2 Intermodulation and second harmonic test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C2, 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 ($\varepsilon_r = 2.2$); 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.

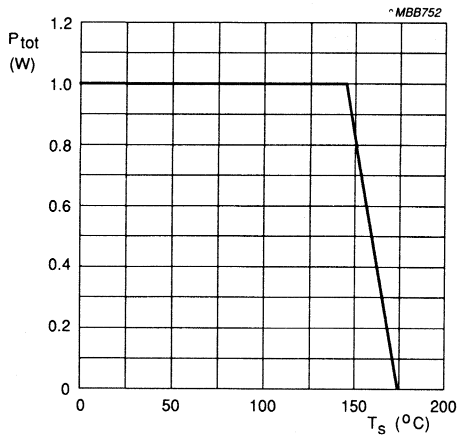
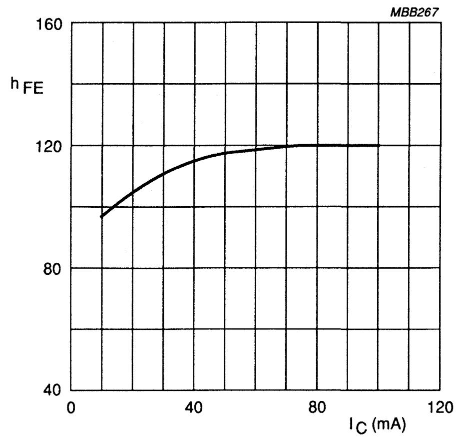
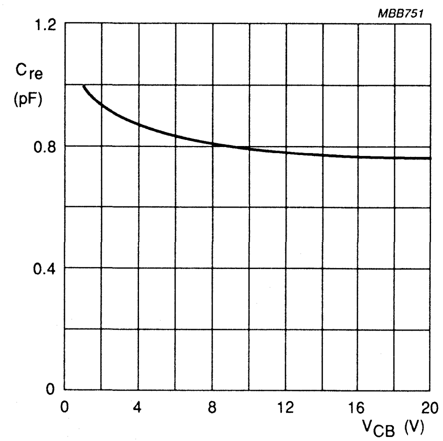


Fig.3 Power derating curve.



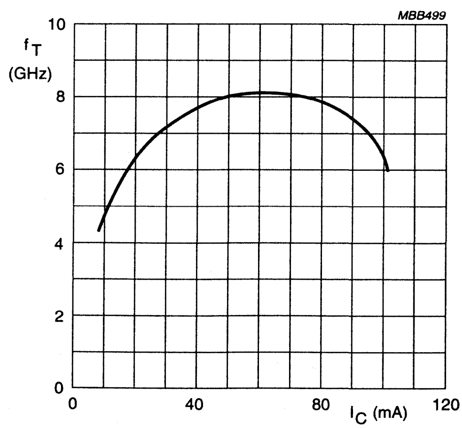
V_{CE} = 5 V; T_j = 25 °C.

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



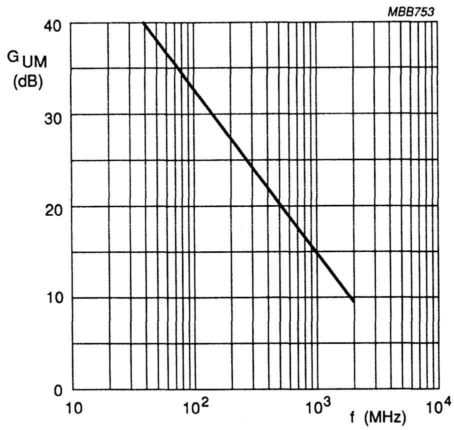
I_E = 0; T_j = 25 °C; f = 1 MHz.

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



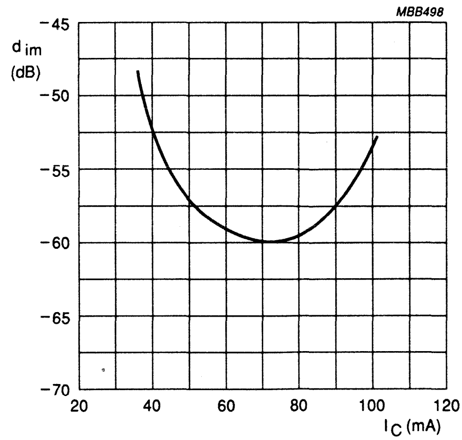
V_{CE} = 8 V; T_j = 25 °C; f = 1 GHz.

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



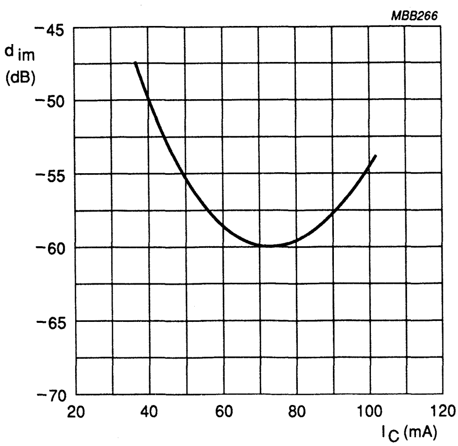
V_{CE} = 8 V; I_C = 50 mA; T_{amb} = 25 °C.

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



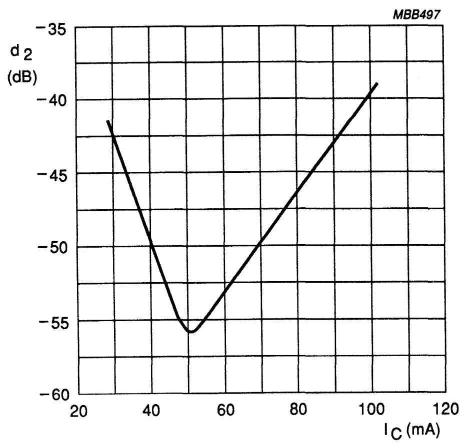
V_{CE} = 8 V; V_o = 750 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.8 Intermodulation distortion as a function of collector current.



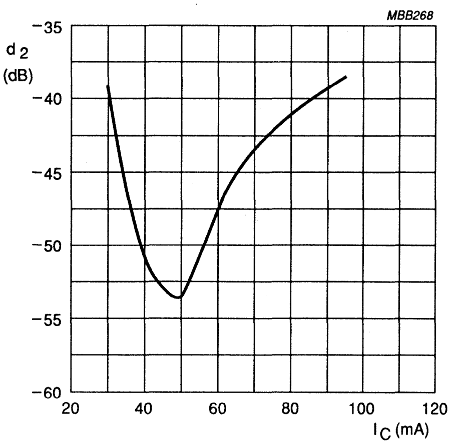
V_{CE} = 8 V; V_o = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion as a function of collector current.



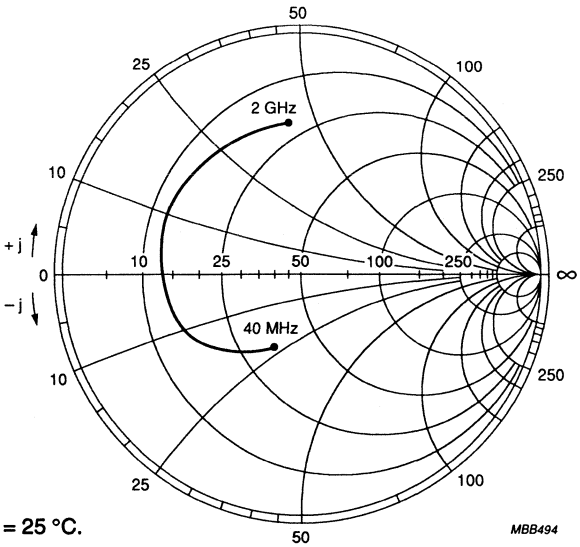
V_{CE} = 8 V; V_o = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.10 Second order intermodulation distortion as a function of collector current.



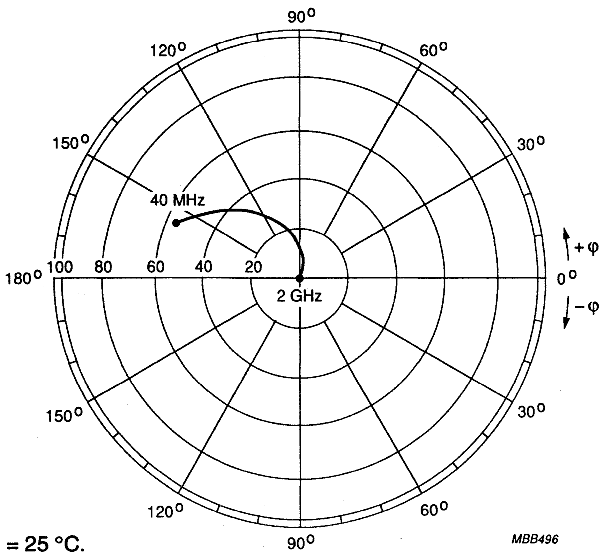
V_{CE} = 8 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz;
T_{amb} = 25 °C.

Fig.11 Second order intermodulation distortion as a function of collector current.



$V_{CE} = 8$ V; $I_C = 50$ mA; $T_{amb} = 25$ °C.

Fig.12 Common emitter input reflection coefficient (S_{11}).



$V_{CE} = 8$ V; $I_C = 50$ mA; $T_{amb} = 25$ °C.

Fig.13 Common emitter forward transmission coefficient (S_{21}).

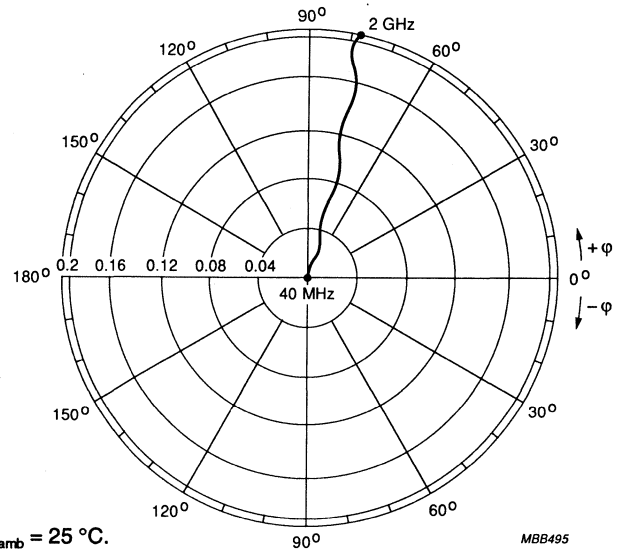


Fig.14 Common emitter reverse transmission coefficient (S_{12}).

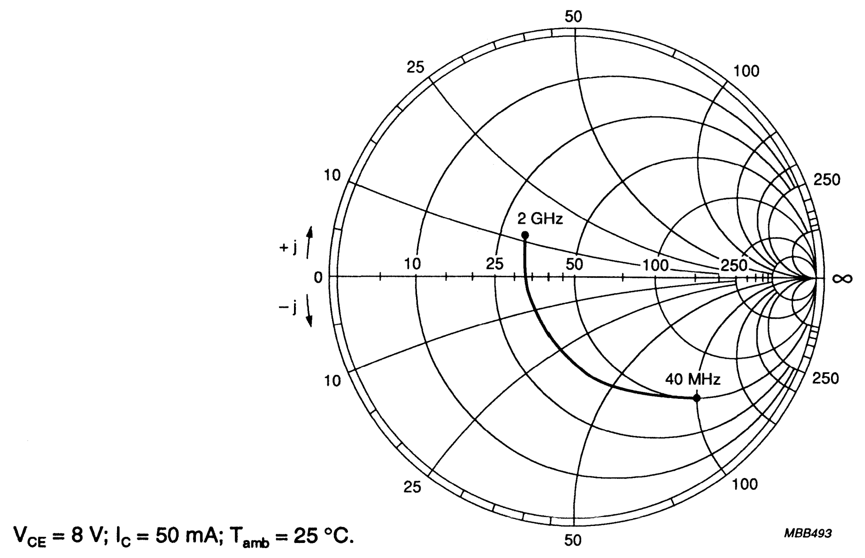


Fig.15 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, V_{CE} = 8 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	0.343	−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, V_{CE} = 8 V, I_C = 70 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	0.357	−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

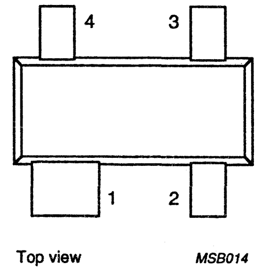


Fig.1 SOT143.

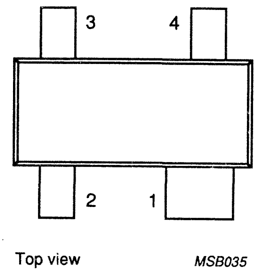


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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	base-emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	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 leakage 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
$\vert S_{21}\vert^2$	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.

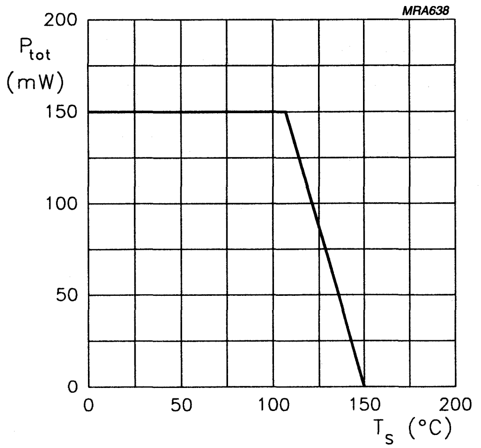
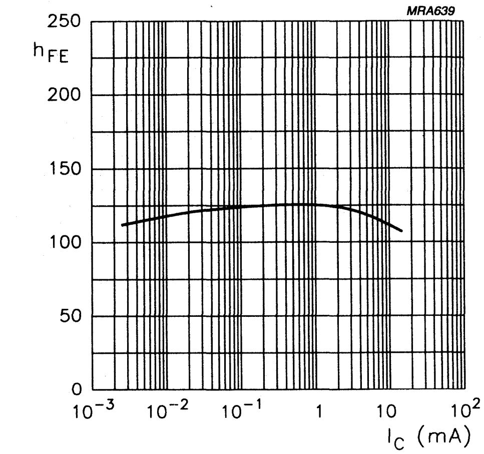
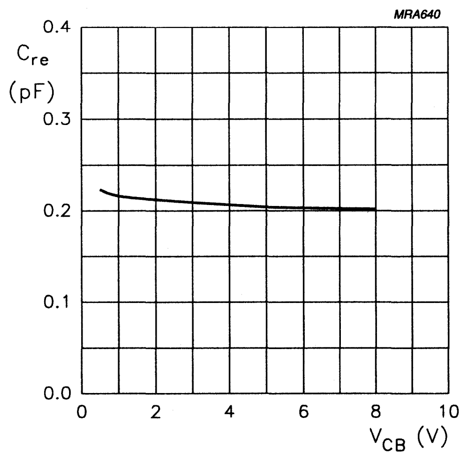


Fig.3 Power derating curve.



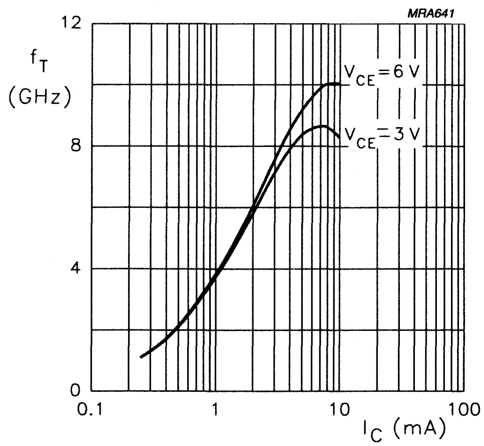
$V_{CE} = 6$ V.

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



$I_C = 0$; f = 1 MHz.

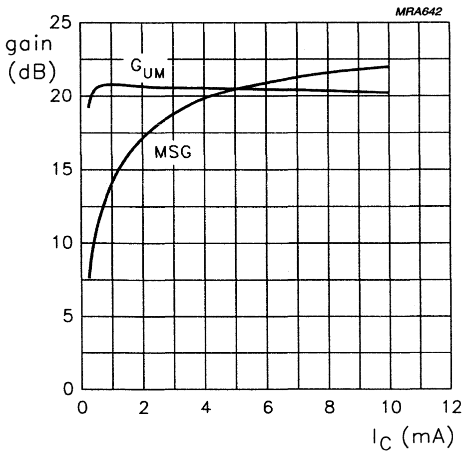
Fig.5 Feedback capacitance as a function of collector-base voltage.



$T_{amb} = 25$ °C; f = 1 GHz.

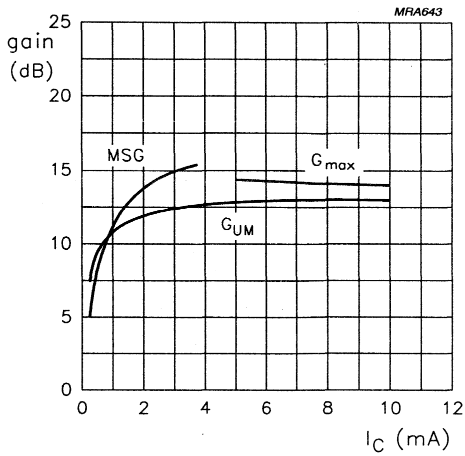
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



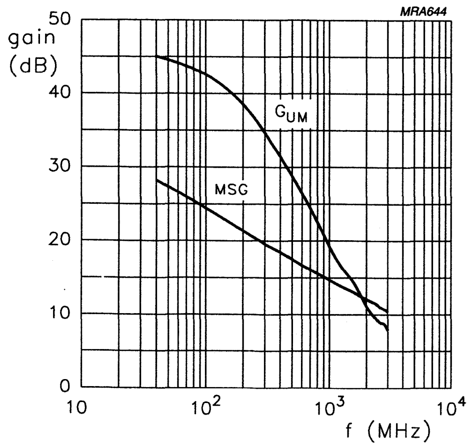
V_{CE} = 6 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



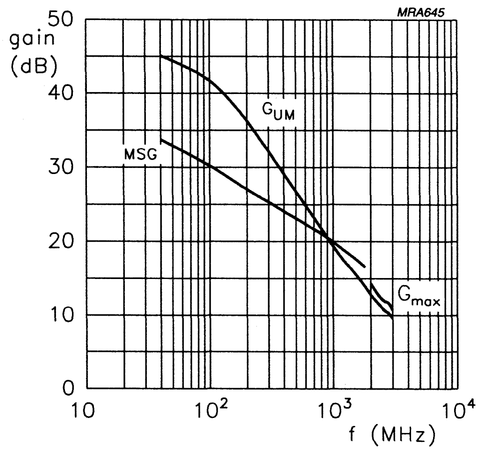
V_{CE} = 6 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



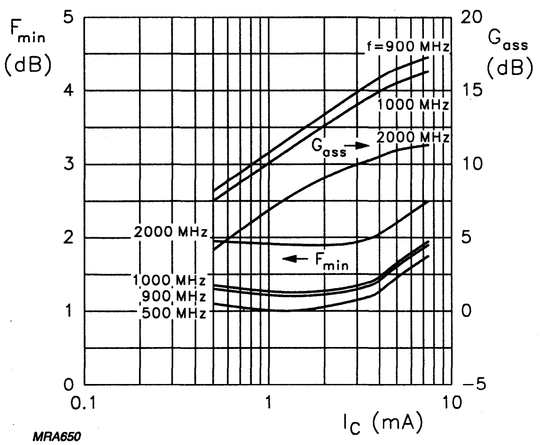
V_{CE} = 6 V; I_C = 1.25 mA.

Fig.9 Gain as a function of frequency.



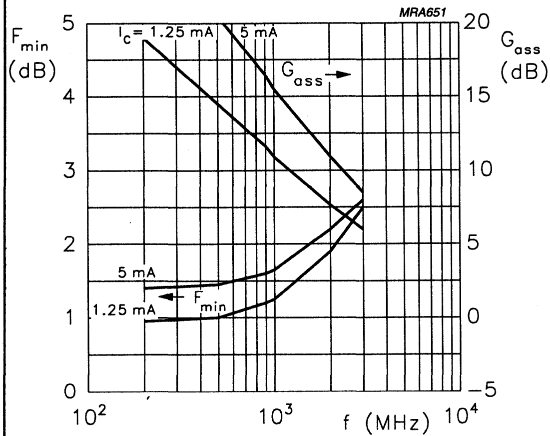
V_{CE} = 6 V; I_C = 5 mA.

Fig.10 Gain as a function of frequency.



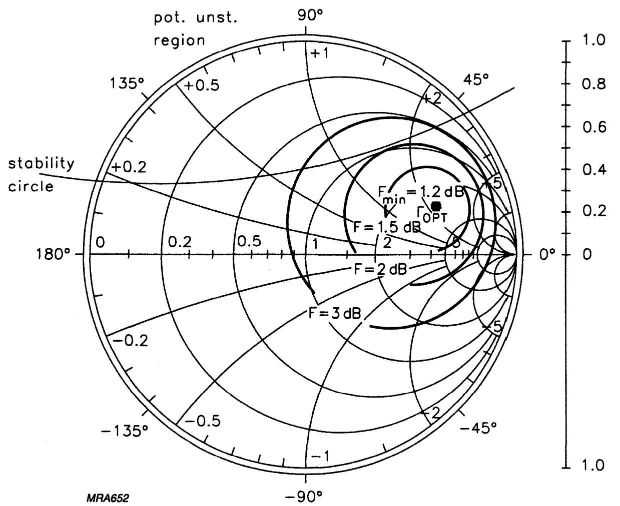
V_{CE} = 6 V.

Fig.11 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 6 V.

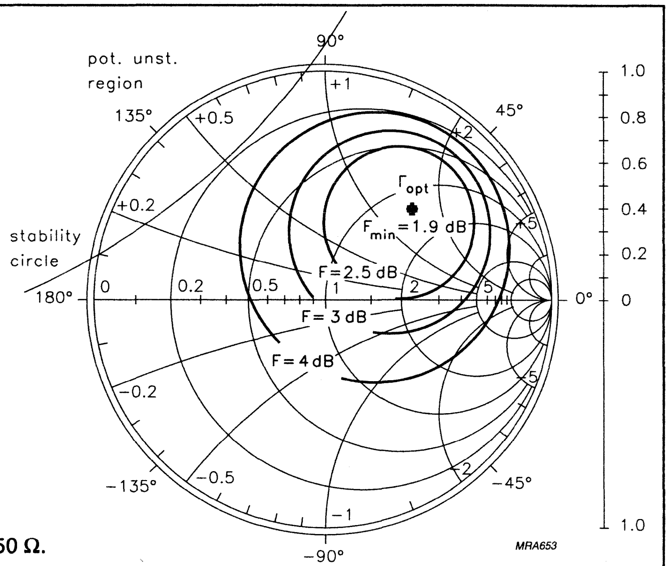
Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.
V_{CE} = 6 V; I_C = 1.25 mA; f = 900 MHz.

Fig.13 Noise circle figure.

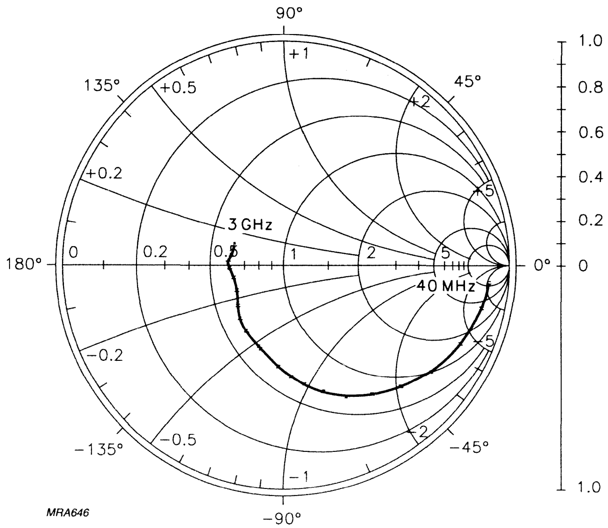
NPN 9 GHz wideband transistor BFG505; BFG505/X; BFG505/XR



Z_O = 50 Ω.

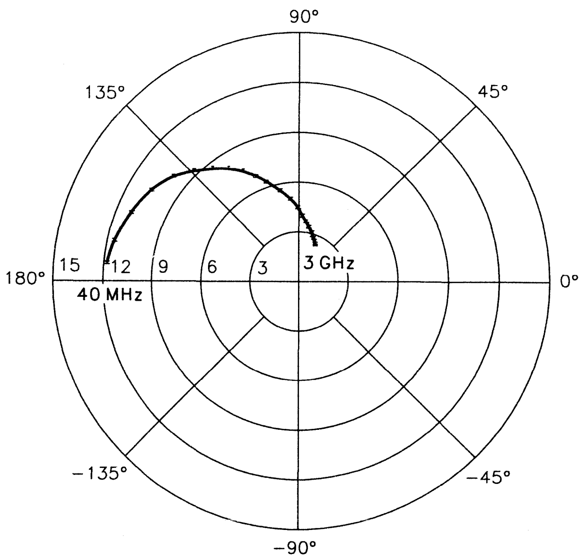
V_{CE} = 6 V; I_C = 1.25 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



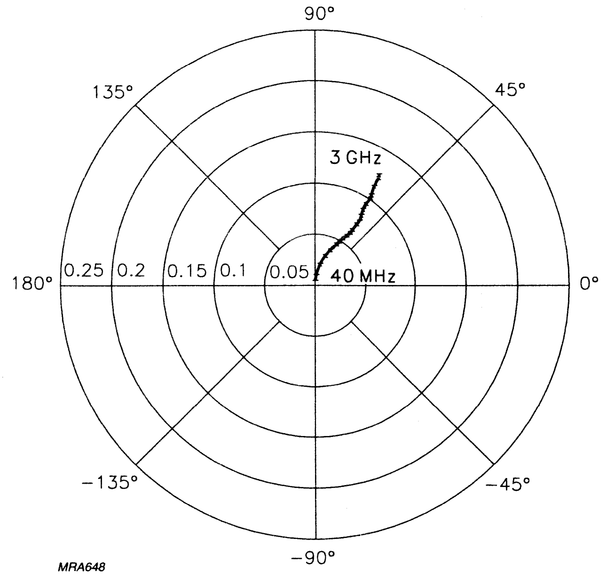
V_{CE} = 6 V; I_C = 5 mA.

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



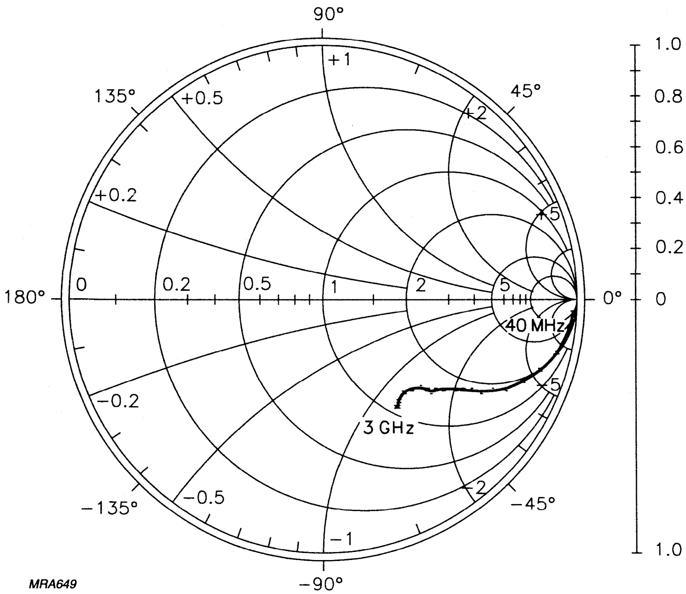
V_{CE} = 6 V; I_C = 5 mA.

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



V_{CE} = 6 V; I_C = 5 mA.

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

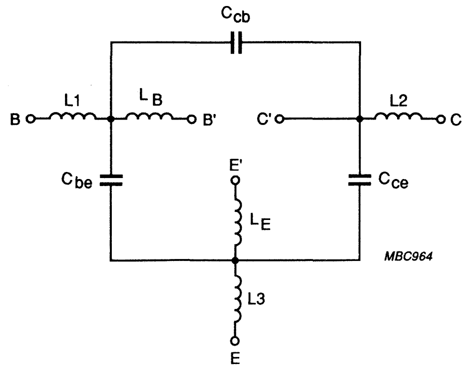


V_{CE} = 6 V; I_C = 5 mA.

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.

NPN 9 GHz wideband transistor BFG505; BFG505/X; BFG505/XR

Table 1 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	0.990	−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}		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	0.975	−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}		R_n
		(RAT)	(DEG)	
900	1.20	0.652	20.0	0.81
2000	1.90	0.546	48.0	0.59

NPN 9 GHz wideband transistor BFG505; BFG505/X; BFG505/XR

Table 4 Common emitter scattering parameters, V_{CE} = 3 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	−3.5	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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	−5.5	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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.849	−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} 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	0.934	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.875	−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

The BFG520 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) and repeater amplifiers in fibre-optic systems.

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

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

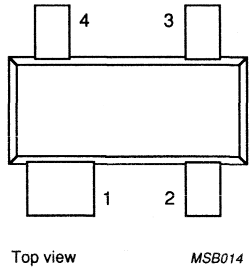


Fig.1 SOT143.

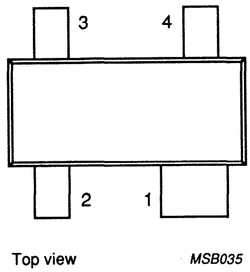


Fig.2 SOT143R.

Qualification approval CECC 50 000 (issue 4), 1986

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	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	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CE} = 6 V; f = 1 MHz	–	0.3	–	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	–	19	–	dB
		I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	17	18	–	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.

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	continuous	–	70	mA
P_{tot}	total power dissipation	up to T_s = 63 °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 leakage 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	–	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	–	19	–	dB
		$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 900 MHz	17	18	–	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 = 900 MHz;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and $f_{(2q-p)} = 904$ MHz.

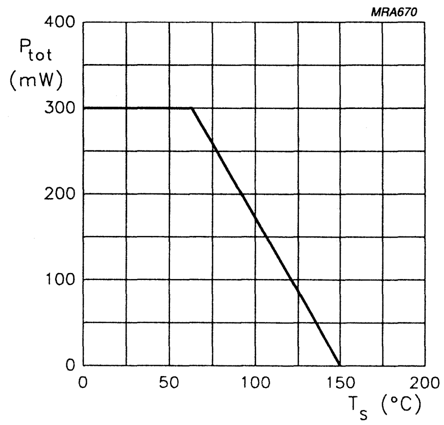
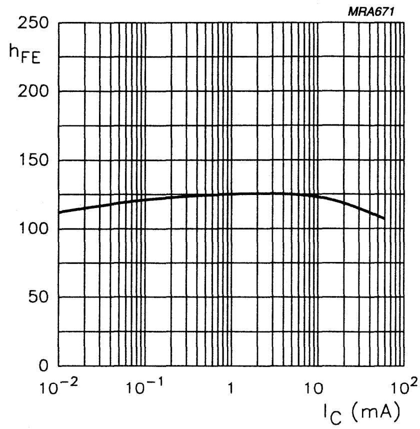
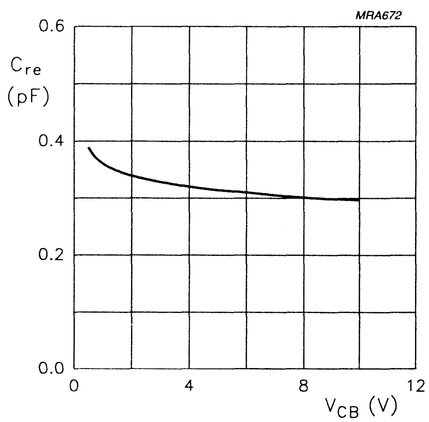


Fig.3 Power derating curve.



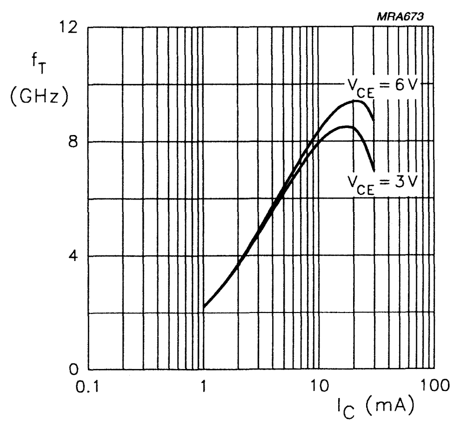
V_{CE} = 6 V.

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



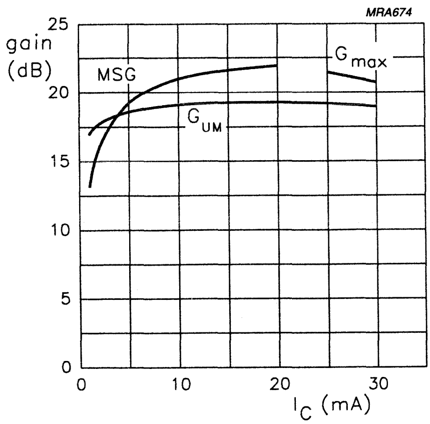
I_C = 0; f = 1 MHz.

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



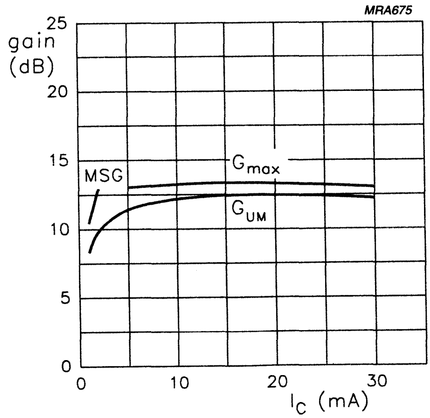
T_{amb} = 25 °C; f = 1 GHz.

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



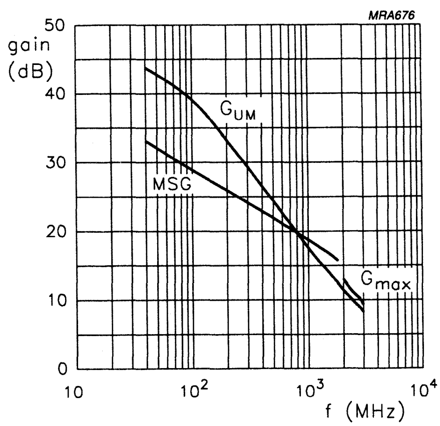
V_{CE} = 6 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



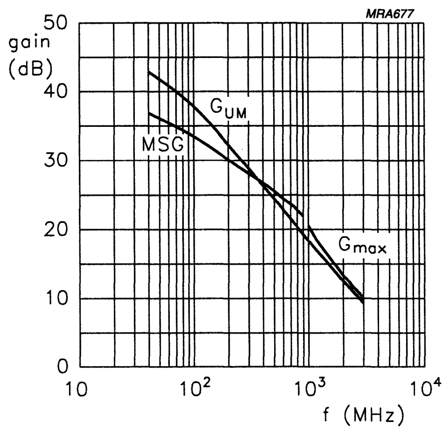
V_{CE} = 6 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



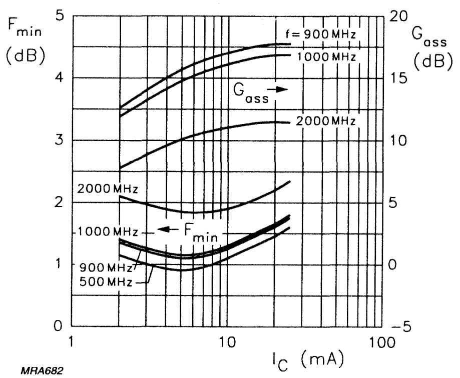
V_{CE} = 6 V; I_C = 5 mA.

Fig.9 Gain as a function of frequency.



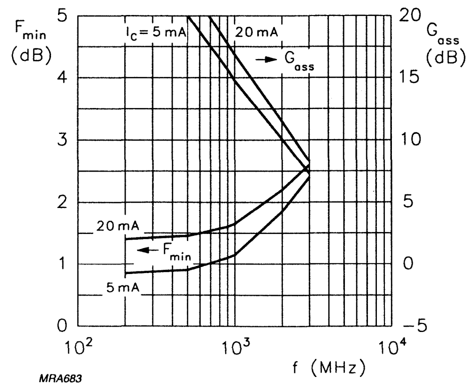
V_{CE} = 6 V; I_C = 20 mA.

Fig.10 Gain as a function of frequency.



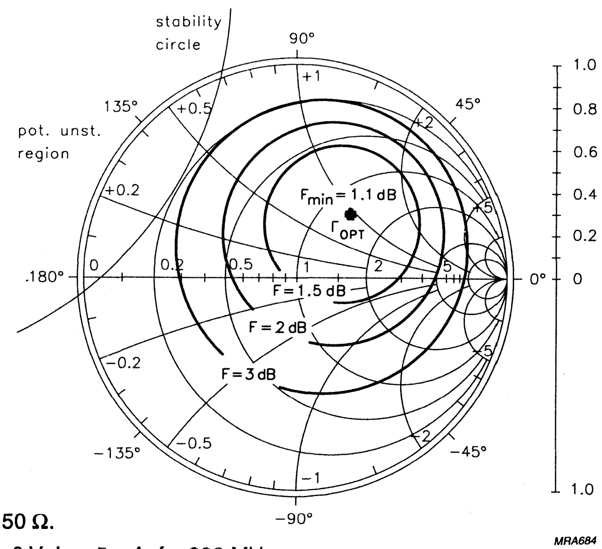
V_{CE} = 6 V.

Fig.11 Minimum noise figure and associated available gain as functions of collector current.



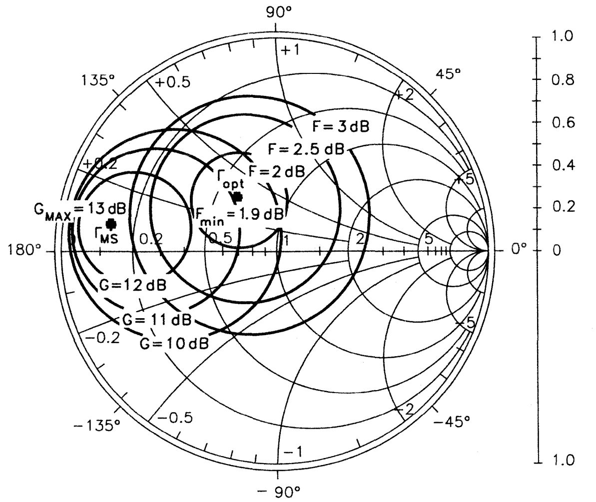
V_{CE} = 6 V.

Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.
V_{CE} = 6 V; I_C = 5 mA; f = 900 MHz.

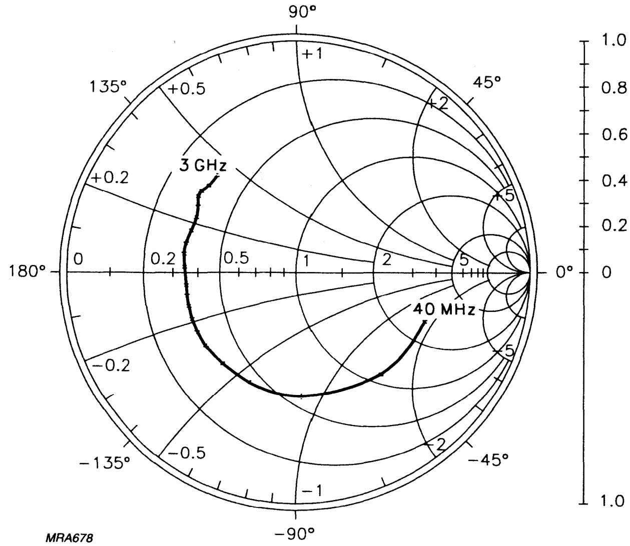
Fig.13 Noise circle figure.



Z_O = 50 Ω.

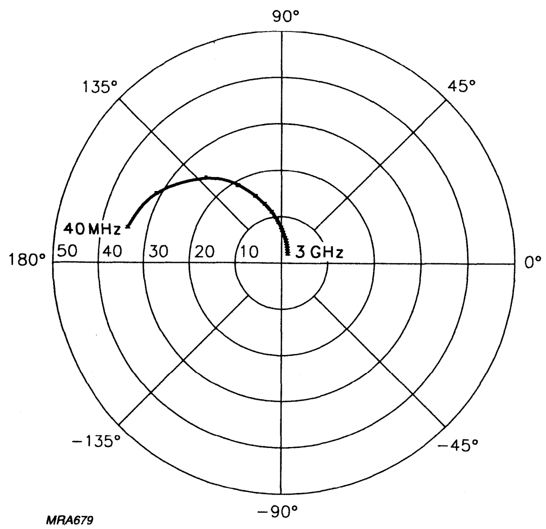
V_{CE} = 6 V; I_C = 5 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



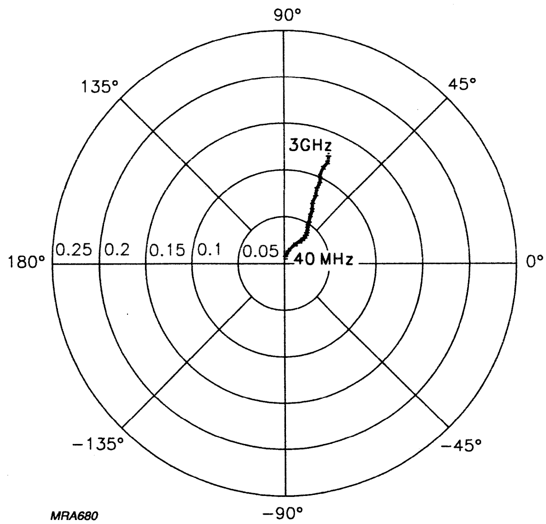
V_{CE} = 6 V; I_C = 20 mA.

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



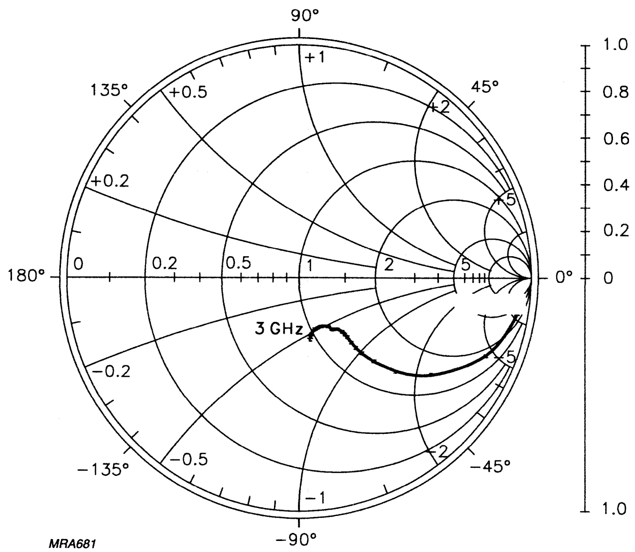
V_{CE} = 6 V; I_C = 20 mA.

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



V_{CE} = 6 V; I_C = 20 mA.

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

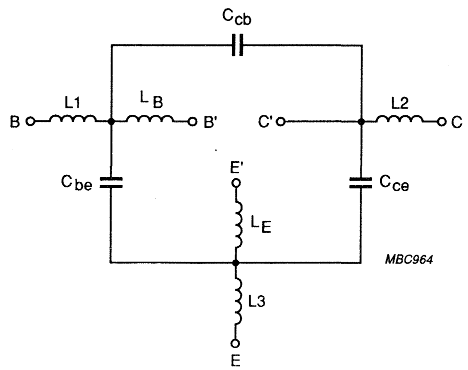


V_{CE} = 6 V; I_C = 20 mA.

Fig.18 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.19 Package equivalent circuit, SOT143; 143R.

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, $I_C = 2$ 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	0.903	−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, 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	0.799	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
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, $V_{CE} = 3$ 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	0.668	−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

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

NPN 9 GHz wideband transistor BFG520; BFG520/X; BFG520/XR

Table 6 Common emitter scattering parameters, V_{CE} = 3 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	0.570	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
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, $V_{CE} = 3$ 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	0.503	−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

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, V_{CE} = 3 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	0.405	−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, 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	0.910	−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, 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	0.816	−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

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
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, 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	0.711	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
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, 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	0.642	−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

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, 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	0.592	−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

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
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, 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	0.532	−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

The BFG540 is an 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-optical systems.

The transistors are mounted in a plastic SOT143 envelope.

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

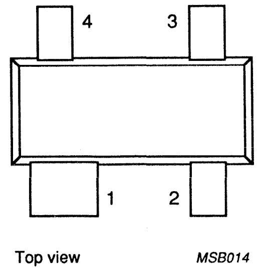


Fig.1 SOT143.

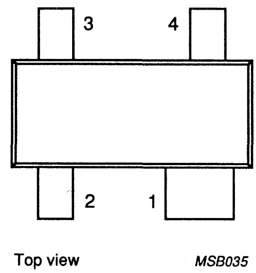


Fig.2 SOT143R.

 Qualification approval CECC 50 000 (issue 4), 1986.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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	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; f = 1 GHz	–	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
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	15	16	–	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	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 10 mA; 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.

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	base-emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	120	mA
P_{tot}	total power dissipation	up to T_s = 35 °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)	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.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 8 V; I_E = 0;	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 8 V; I_C = 40 mA;	60	120	250	
C_e	emitter capacitance	V_{EB} = 0.5 V; $I_C = i_c$ = 0; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	V_{CB} = 8 V; $I_E = i_e$ =0; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	V_{CB} = 8 V; I_C = 0; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	V_{CE} = 8 V; I_C = 40 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	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
$\lvert S_{21}\rvert^2$	insertion power gain	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	15	16	–	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	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 10 mA; T_{amb} = 25 °C; f = 2 GHz	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 8 V; I_C = 40 mA; 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)	V_{CE} = 8 V; I_C = 40 mA; $Z_L = Z_S$ = 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. 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);
   $V_p = V_O$; $V_q = V_O$ –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.

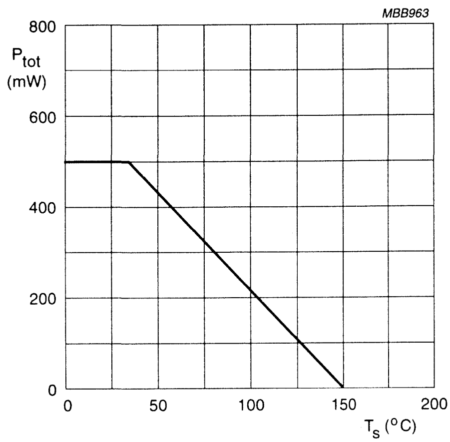
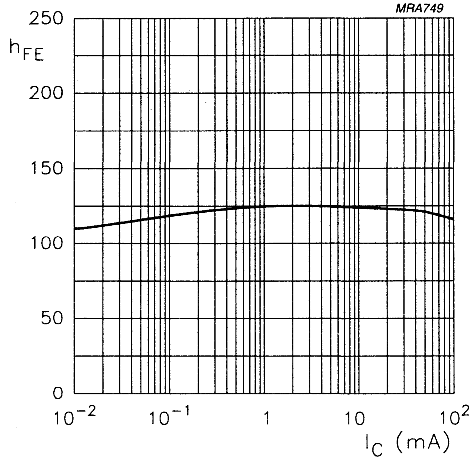
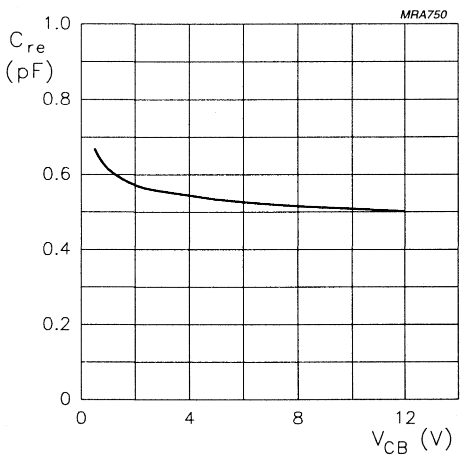


Fig.3 Power derating curve.



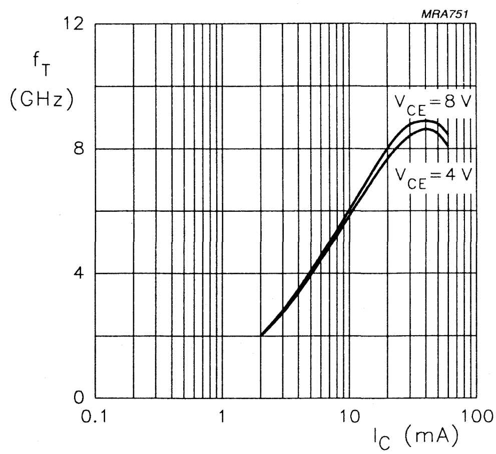
V_{CE} = 8 V.

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



I_C = 0; f = 1 MHz.

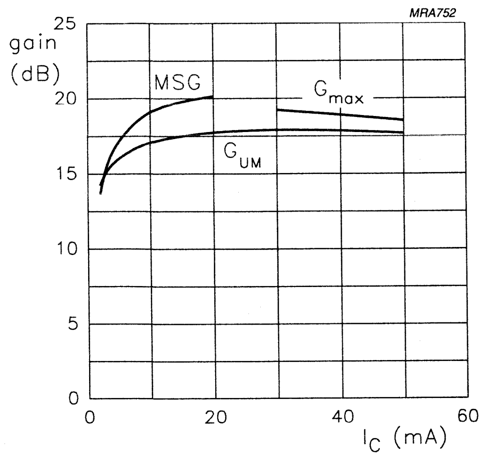
Fig.5 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

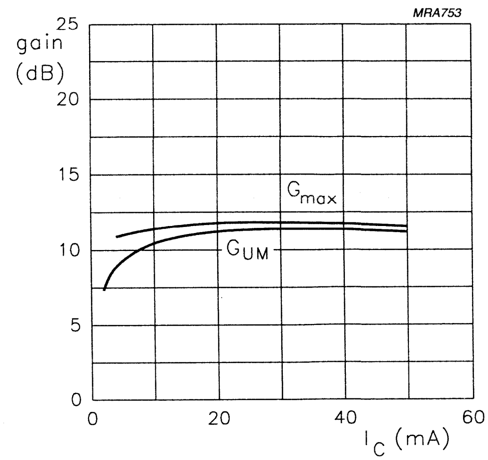
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



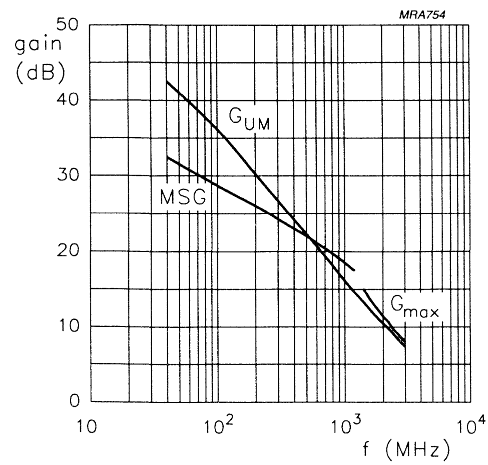
V_{CE} = 8 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



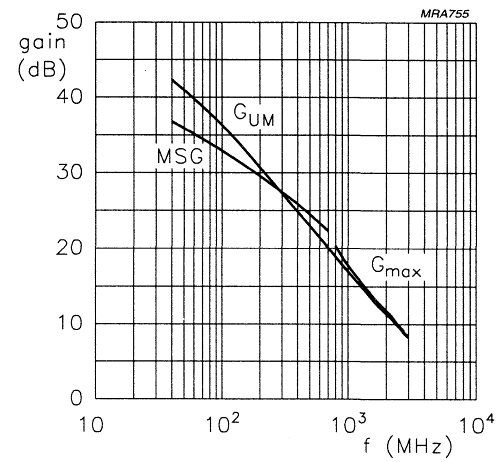
V_{CE} = 8 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



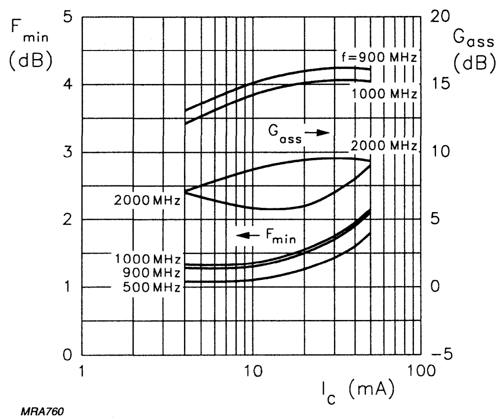
V_{CE} = 8 V; I_C = 10 mA.

Fig.9 Gain as a function of frequency.



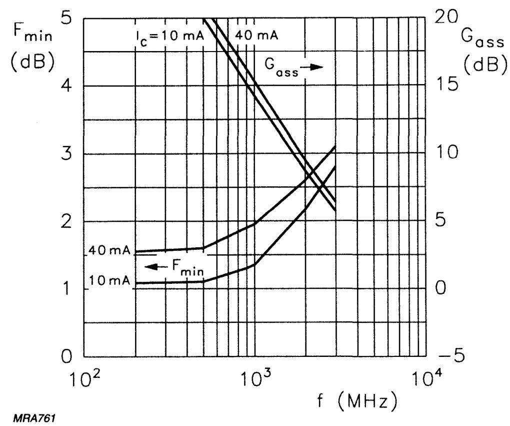
V_{CE} = 8 V; I_C = 40 mA.

Fig.10 Gain as a function of frequency.



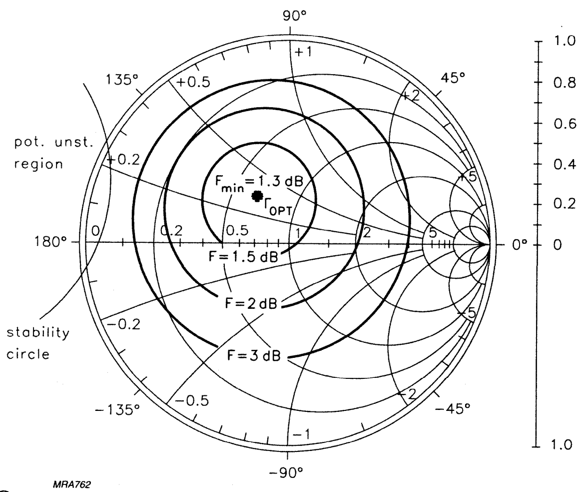
V_{CE} = 8 V.

Fig.11 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 8 V.

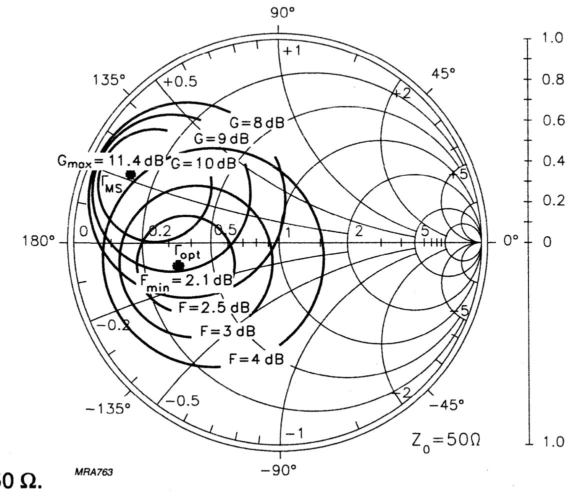
Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_o = 50 Ω.

V_{CE} = 8 V; I_C = 10 mA; f = 900 MHz.

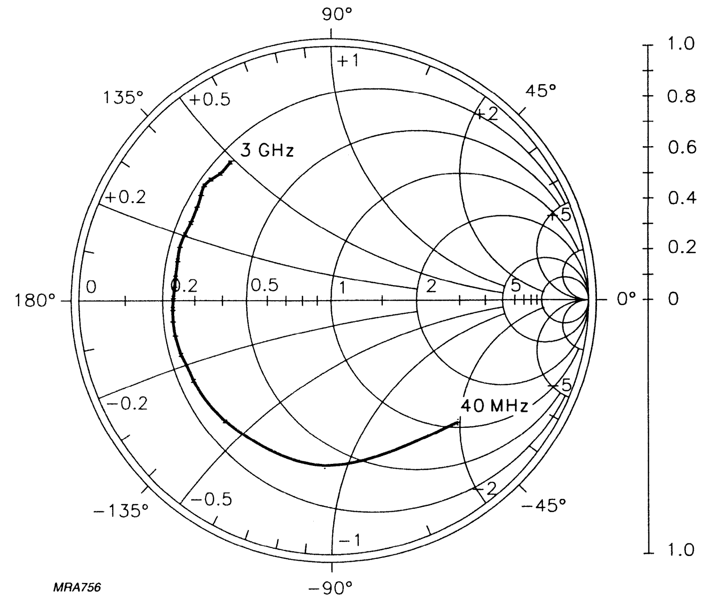
Fig.13 Noise circle figure.



Z_O = 50 Ω.

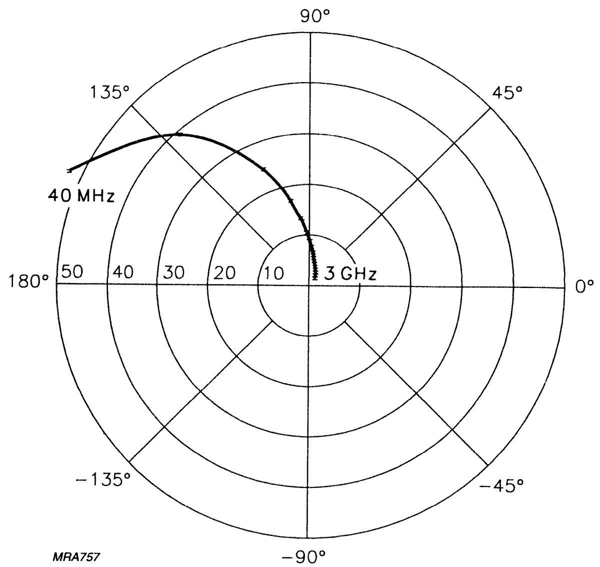
V_{CE} = 8 V; I_C = 10 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



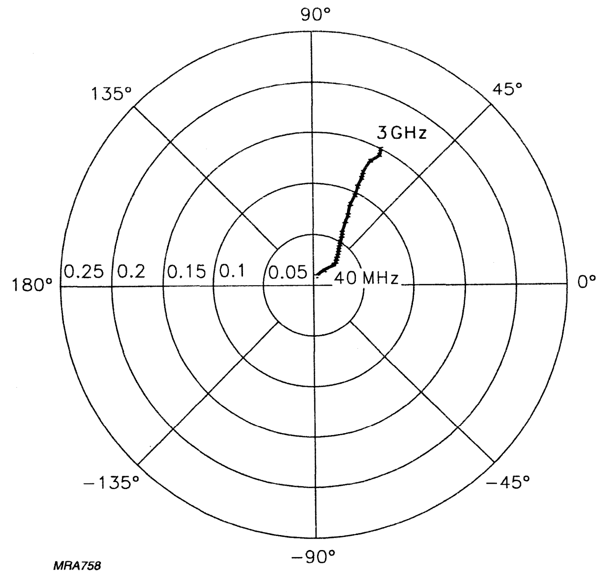
V_{CE} = 8 V; I_C = 40 mA.

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



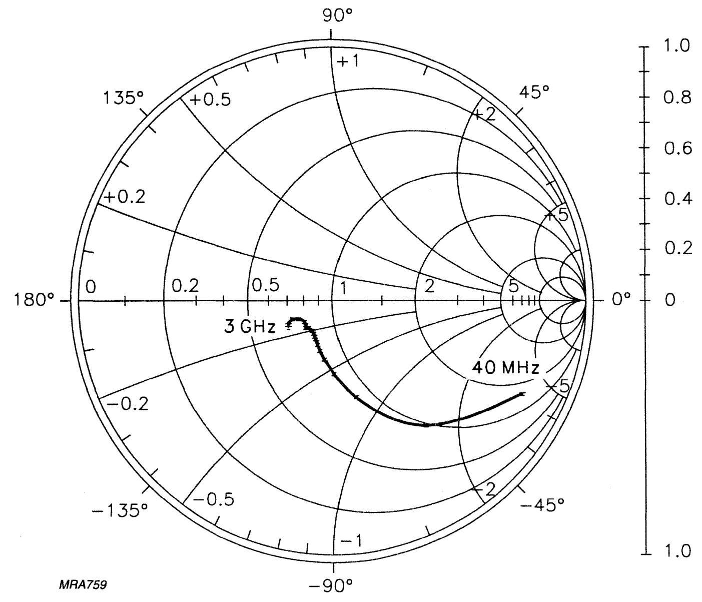
V_{CE} = 8 V; I_C = 40 mA.

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



V_{CE} = 8 V; I_C = 40 mA.

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

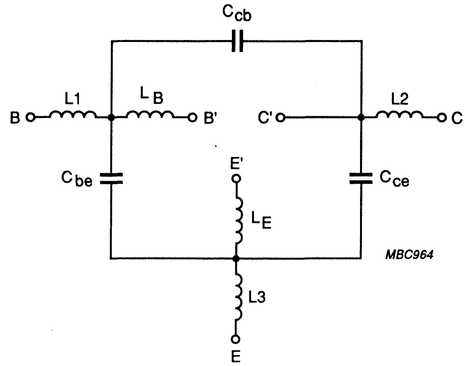


V_{CE} = 8 V; I_C = 40 mA.

Fig.18 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) = $QL_{B,E}$ √ (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} = 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	0.909	−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, 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	0.799	−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

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, 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	0.680	−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

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

Qualification approval CECC 50 000 (issue 4), 1986.

Table 6 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	0.610	−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

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

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	0.565	−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

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, $V_{CE} = 4$ 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	0.534	−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, V_{CE} = 8 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	0.921	−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, 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	0.837	−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

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
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, 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	0.754	−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

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

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Table 16 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	0.711	−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

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, V_{CE} = 8 V; I_C = 40 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	0.687	−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

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, V_{CE} = 8 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	0.668	−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

The BFG541 is an 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.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

The transistors are mounted in a plastic SOT223 envelope.

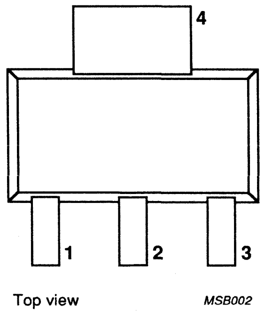


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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	V_{CE} = 8 V; I_C = 40 mA	60	120	250	
C_{re}	feedback capacitance	V_{CB} = 8 V; I_C = i_c = 0; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	V_{CE} = 8 V; I_C = 40 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	–	15	–	dB
		V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 2 GHz	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	13	14	–	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	1.8	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	21	–	dBm
ITO	third order intercept point	V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	34	–	dBm

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	base-emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	120	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	650	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)	55 K/W

Note

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

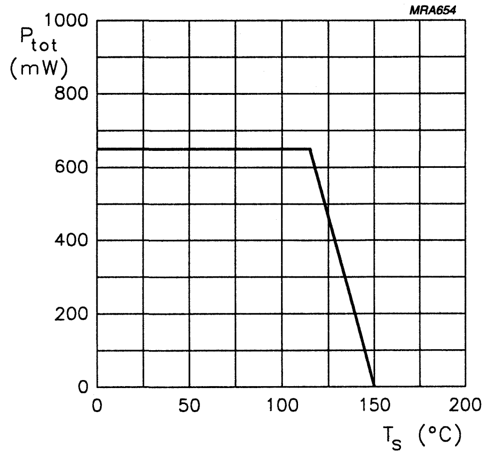
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 8 V; I_E = 0;	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 8 V; I_C = 40 mA;	60	120	250	
C_e	emitter capacitance	V_{EB} = 0.5 V; I_C = i_c = 0; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	V_{CB} = 8 V; I_E = i_e =0; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	V_{CB} = 8 V; I_C = 0; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	V_{CE} = 8 V; I_C = 40 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	–	15	–	dB
		V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 2 GHz	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	13	14	–	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	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 40 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 8 V; I_C = 10 mA; T_{amb} = 25 °C; f = 2 GHz	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	21	–	dBm
ITO	third order intercept point (note 2)	V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	34	–	dBm
V_O	output voltage (note 3)	V_{CE} = 8 V; I_C = 40 mA; Z_L = Z_S = 75 Ω; T_{amb} = 25 °C	–	550	–	mV

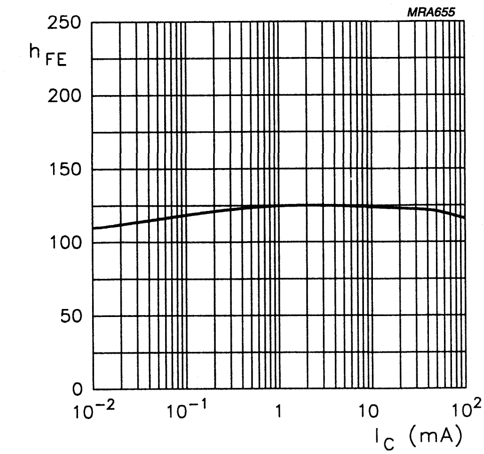
Notes

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. 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);
   $V_p = V_O$; $V_q = V_O$ −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.



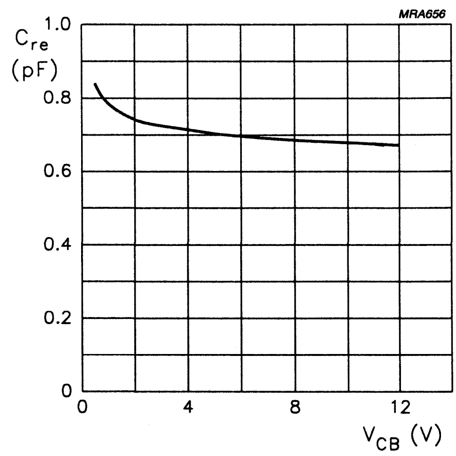
$V_{CE} \leq 10$ V.

Fig.2 Power derating curve.



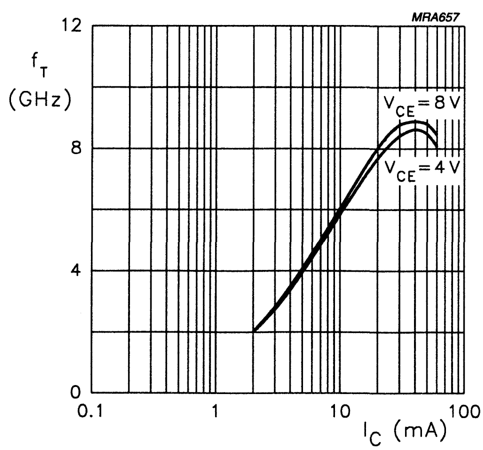
$V_{CE} = 8$ V.

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



$I_C = 0$; f = 1 MHz.

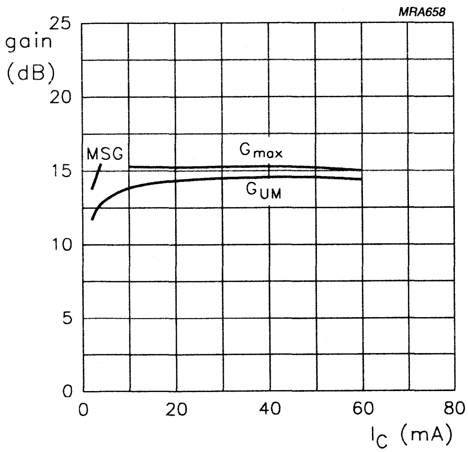
Fig.4 Feedback capacitance as a function of collector-base voltage.



$T_{amb} = 25$ °C; f = 1 GHz.

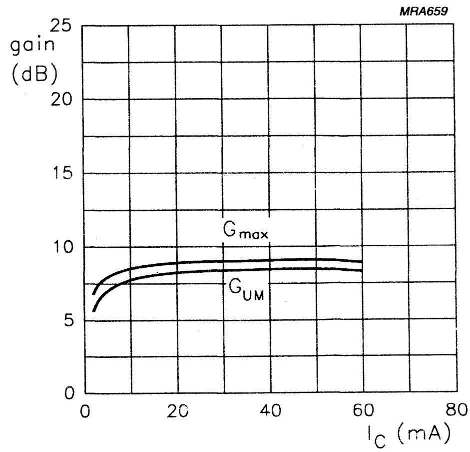
Fig.5 Transition frequency as a function of collector current.

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



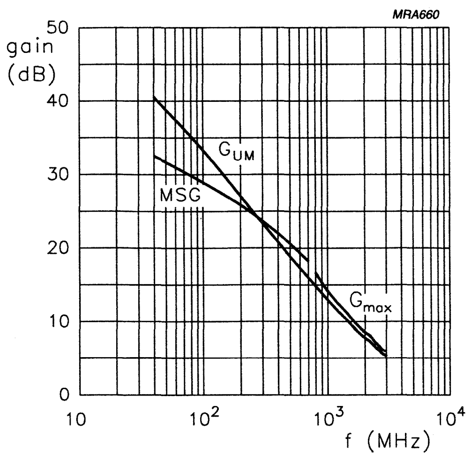
V_{CE} = 8 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



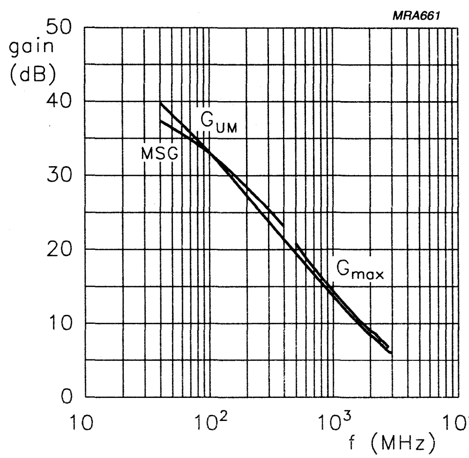
V_{CE} = 8 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



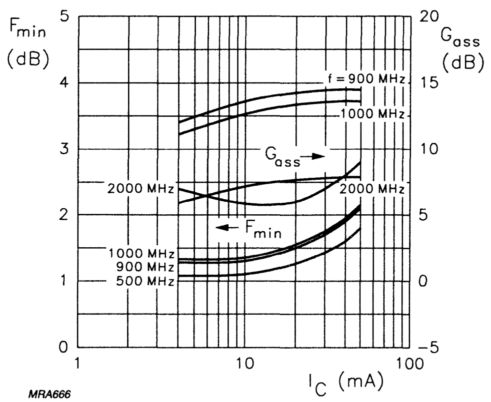
V_{CE} = 8 V; I_C = 10 mA.

Fig.8 Gain as a function of frequency.



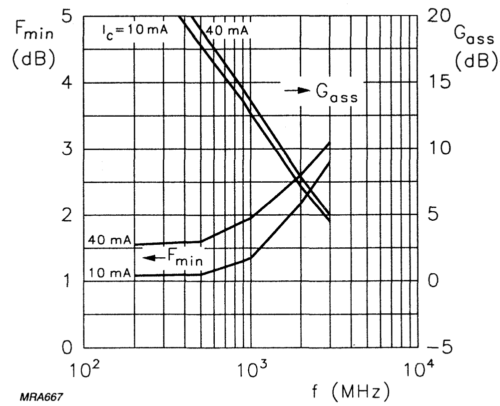
V_{CE} = 8 V; I_C = 40 mA.

Fig.9 Gain as a function of frequency.



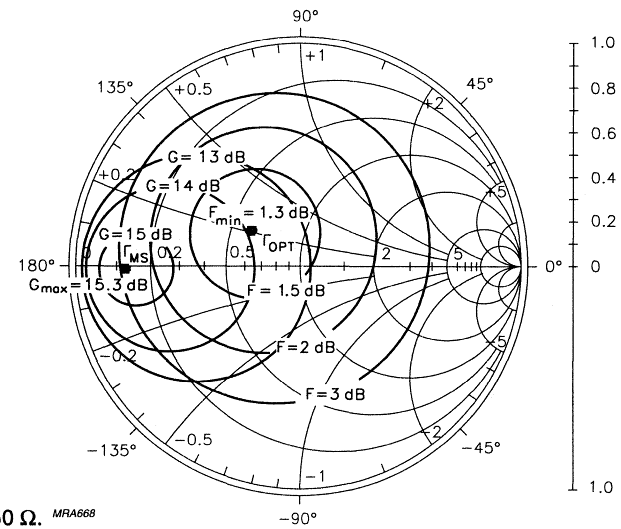
V_{CE} = 8 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 8 V.

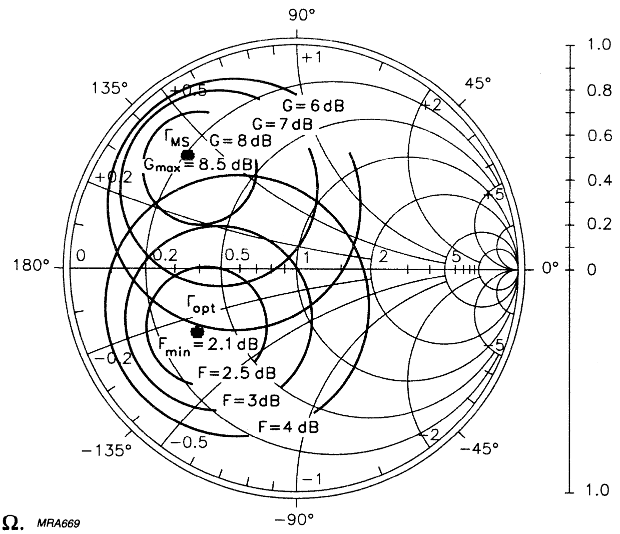
Fig.11 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.

V_{CE} = 8 V; I_C = 10 mA; f = 900 MHz.

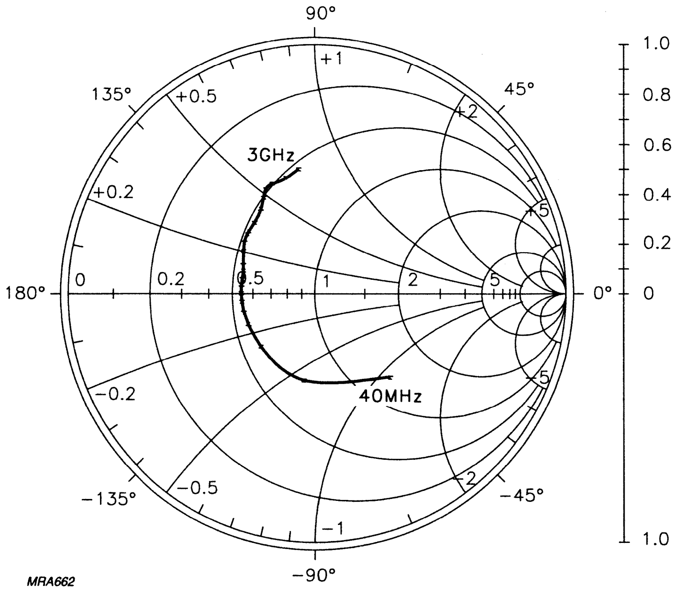
Fig.12 Noise circle figure.



$Z_O = 50\ \Omega$.

$V_{CE} = 8$ V; $I_C = 10$ mA; f = 2000 MHz.

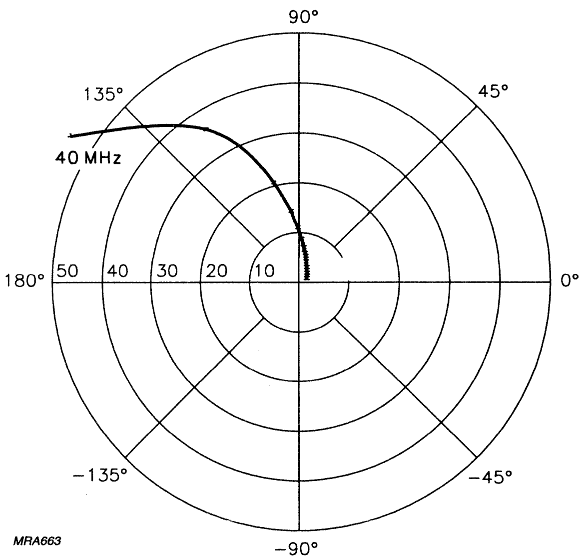
Fig.13 Noise circle figure.



V_{CE} = 8 V; I_C = 40 mA.

MRA662

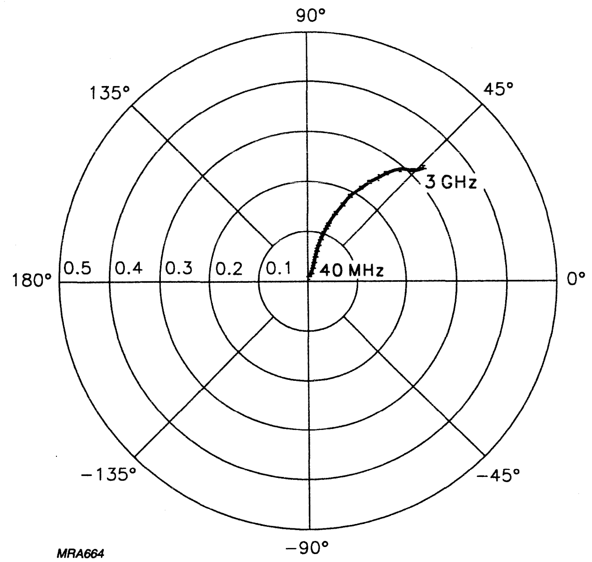
Fig.14 Common emitter input reflection coefficient (S_{11}).



V_{CE} = 8 V; I_C = 40 mA.

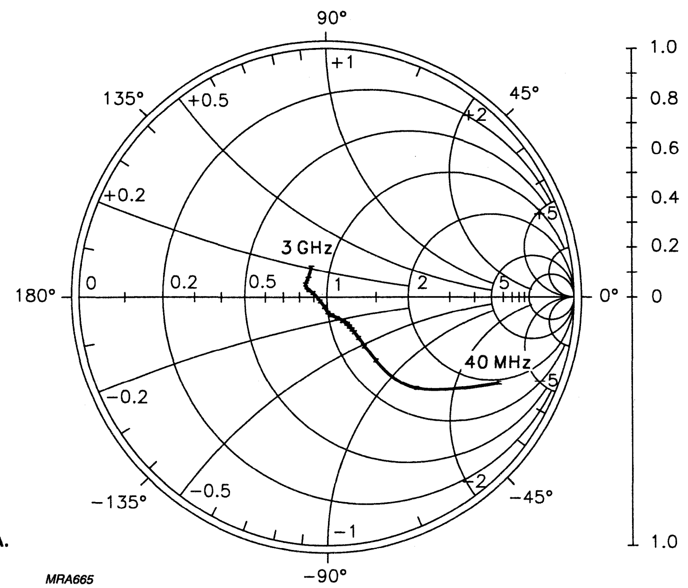
MRA663

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}).

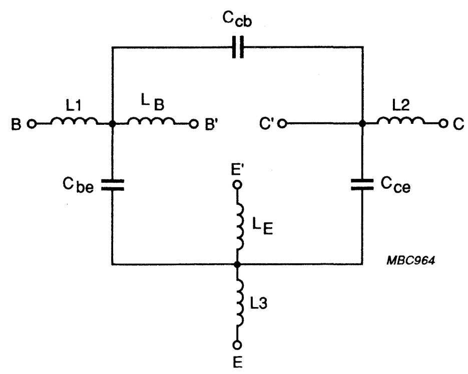


V_{CE} = 8 V; I_C = 40 mA.

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

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.18 Package equivalent circuit, SOT223.

List of components (see Fig.18)

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, V_{CE} = 4 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	0.891	−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, $V_{CE} = 4$ 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	0.753	−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

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, 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	0.578	−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

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.330	179.0	0.09
2000	2.20	0.533	−140.0	0.19

Table 6 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	0.457	−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

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, V_{CE} = 4 V, I_C = 40 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	0.375	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.90	0.455	−168.0	0.08
2000	2.60	0.590	−134.0	0.25

Table 10 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	0.319	−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, V_{CE} = 8 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	0.903	−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, 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	0.781	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
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, 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	0.627	−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

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, 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	0.522	−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

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.70	0.342	180.0	0.09
2000	2.40	0.533	−139.0	0.17

Table 18 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 40 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	0.449	−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

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, V_{CE} = 8 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	0.399	−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 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

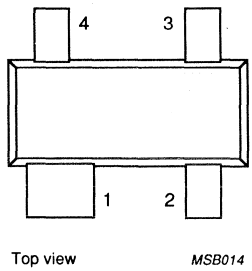


Fig.1 SOT143.

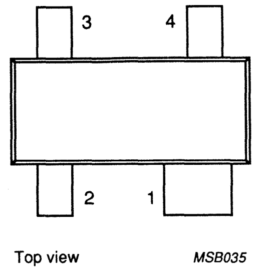


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	emitter and base shorted	–	–	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

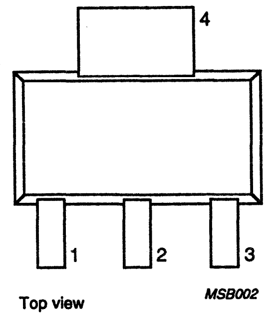


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	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.

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

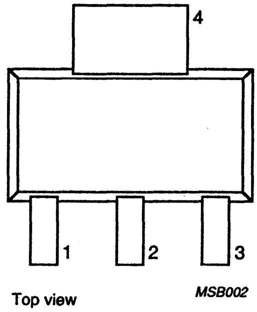


Fig.1 SOT223.

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

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.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

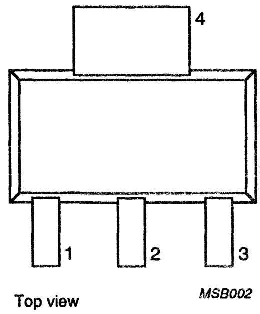


Fig.1 SOT223.

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		–	–	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 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

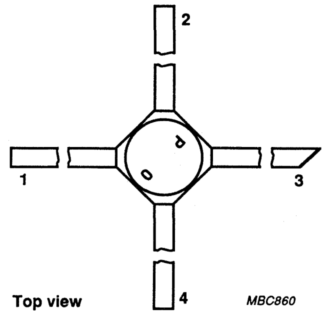


Fig.1 SOT173.

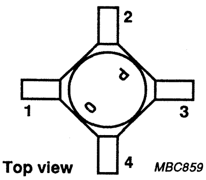


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage		–	–	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 tab.

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

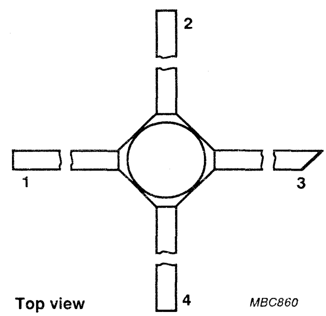


Fig.1 SOT173.

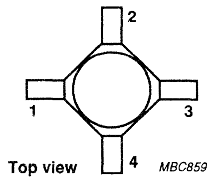


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	–	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
$\lvert S_{21}\rvert^2$	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 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	$V_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	70	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	500	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)	100 K/W

Note

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

CHARACTERISTICS

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

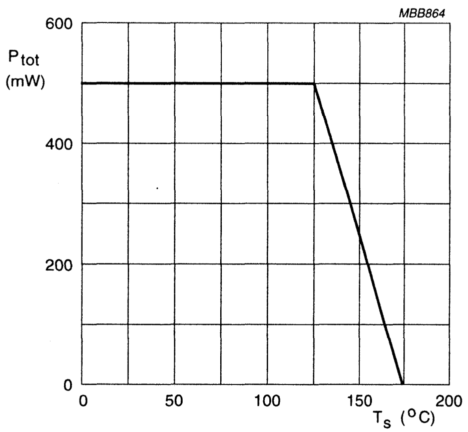
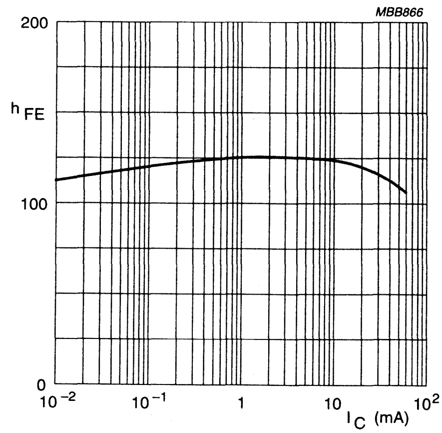
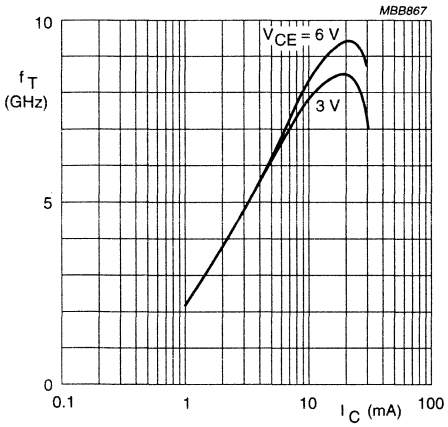


Fig.3 Power derating curve.



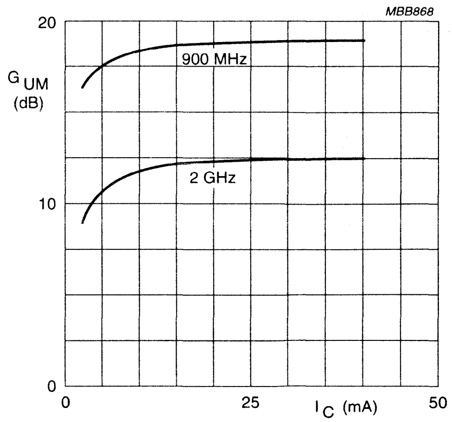
V_{CE} = 6 V.

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



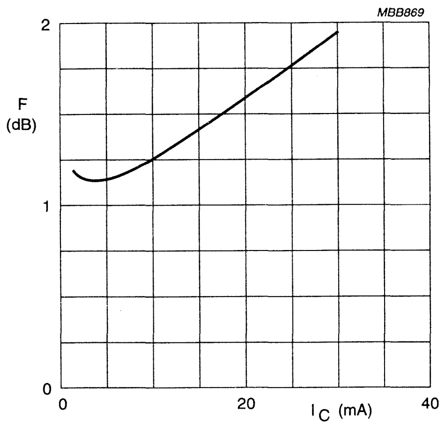
T_{amb} = 25 °C; f = 900 MHz.

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



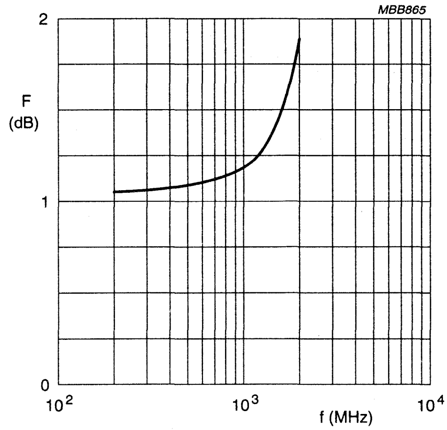
V_{CE} = 6 V.

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

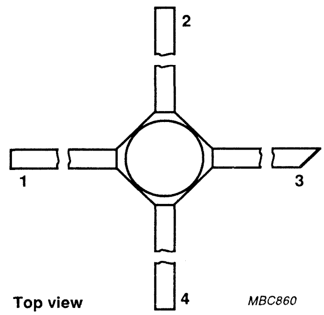


Fig.1 SOT173.

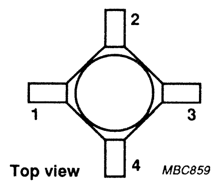


Fig.2 SOT173X.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage		–	–	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 tab.

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

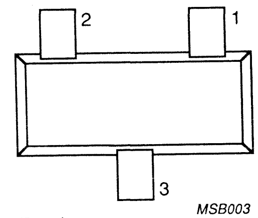


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	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 leakage 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.

NPN 8 GHz wideband transistor BFQ67

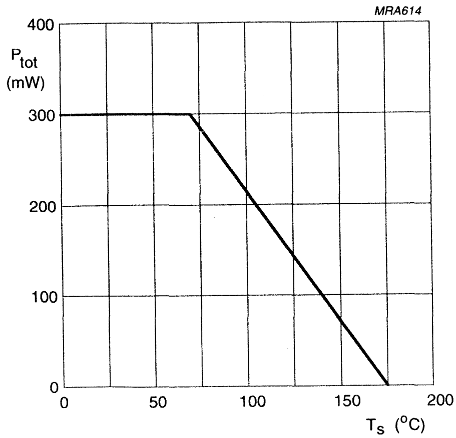
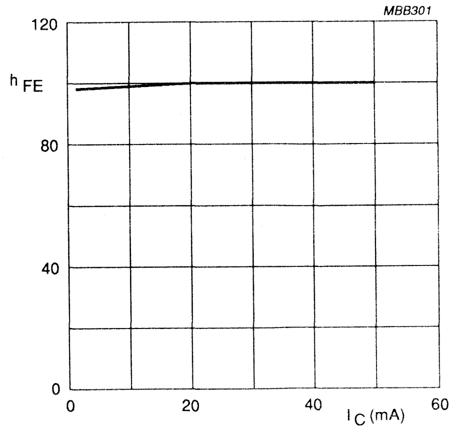
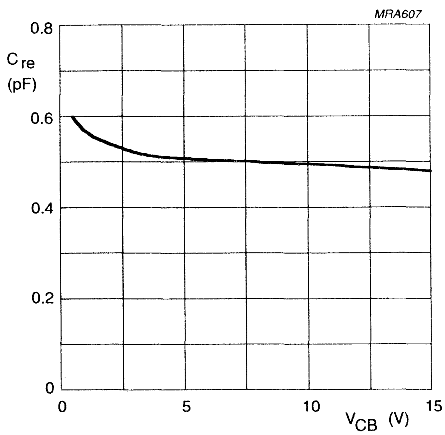


Fig.2 Power derating curve.



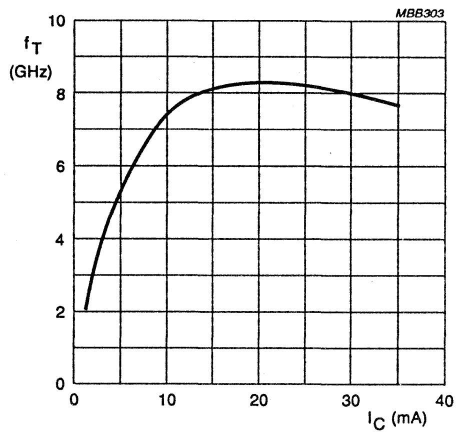
V_{CE} = 5 V.

Fig.3 DC current gain as a function of collector current, typical values.



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

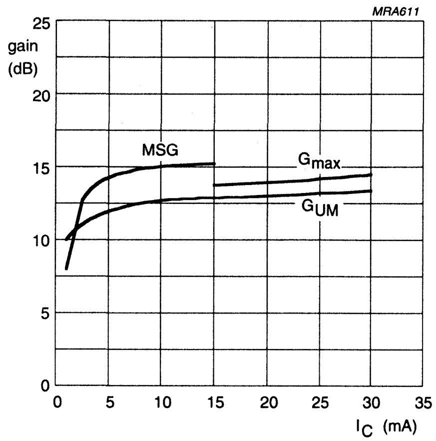
Fig.4 Feedback capacitance as a function of collector-base voltage, typical values.



V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz.

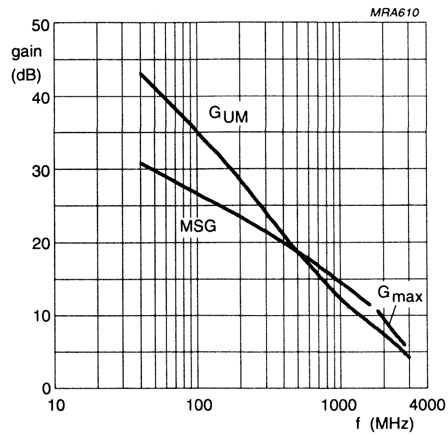
Fig.5 Transition frequency as a function of collector current, typical values.

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



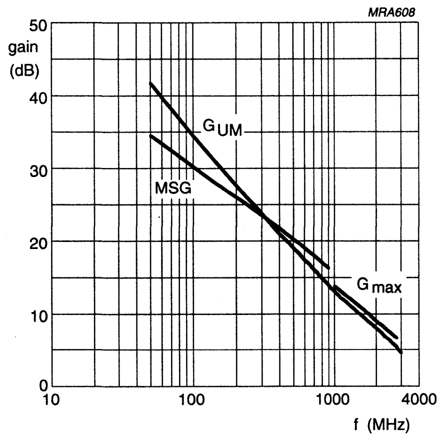
V_{CE} = 8 V; f = 1 GHz.

Fig.6 Gain as a function of collector current, typical values.



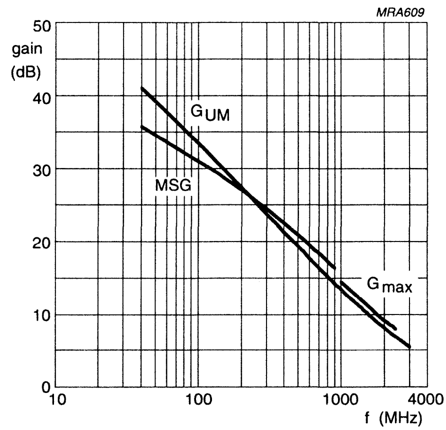
V_{CE} = 8 V; I_C = 5 mA.

Fig.7 Gain as a function of frequency, typical values.



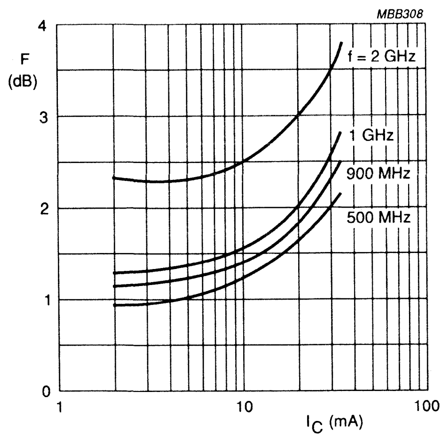
V_{CE} = 8 V; I_C = 15 mA.

Fig.8 Gain as a function of frequency, typical values.



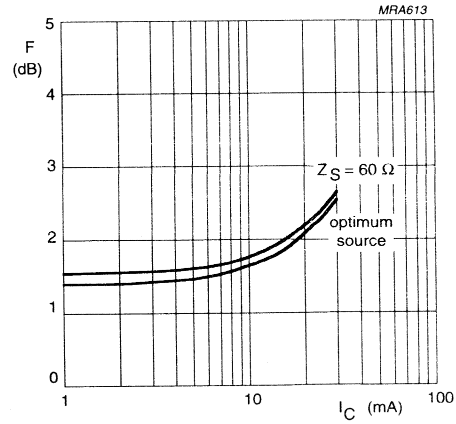
V_{CE} = 8 V; I_C = 30 mA.

Fig.9 Gain as a function of frequency, typical values.



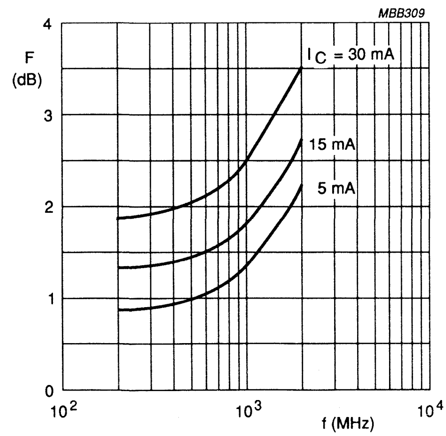
V_{CE} = 8 V.

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



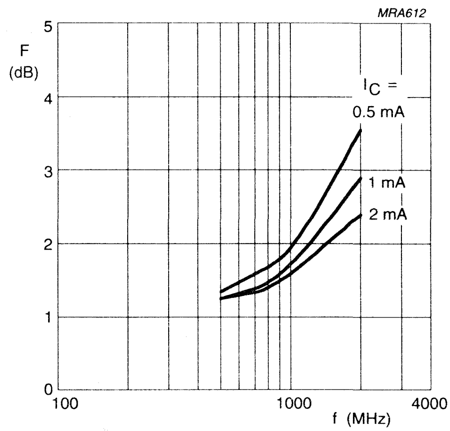
V_{CE} = 6 V; f = 900 MHz.

Fig.11 Noise figure as a function of collector current, typical values.



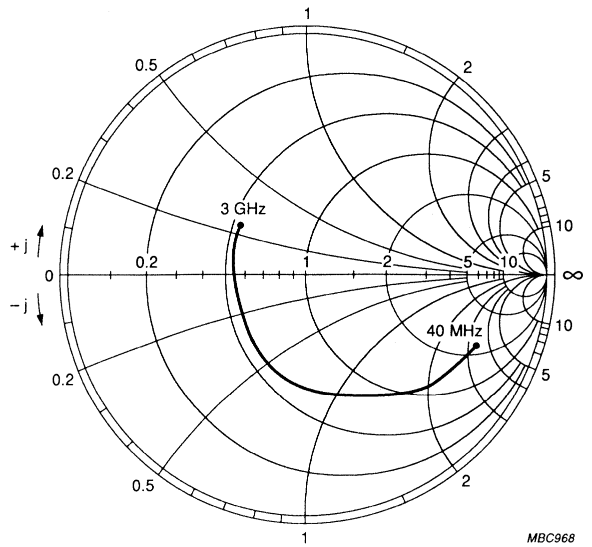
V_{CE} = 8 V.

Fig.12 Minimum noise figure as a function of frequency, typical values.



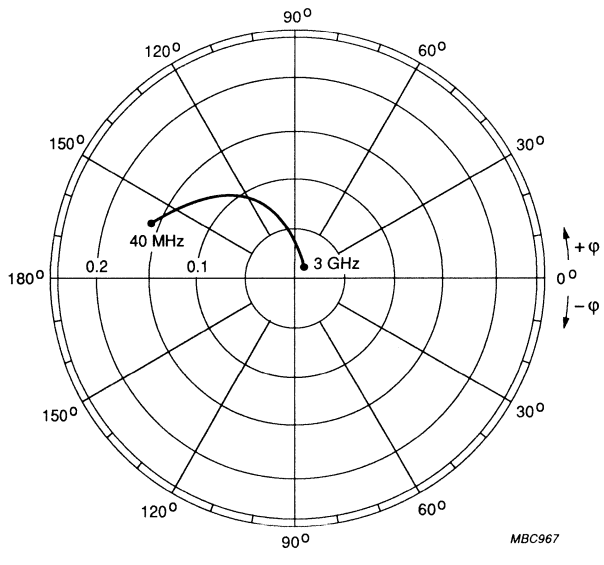
V_{CE} = 1 V.

Fig.13 Minimum noise figure as a function of frequency, typical values.



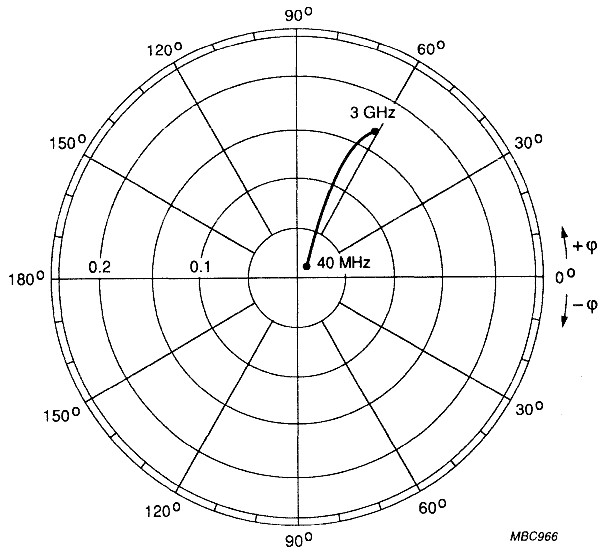
$V_{CE} = 8$ V; $I_C = 15$ mA.

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



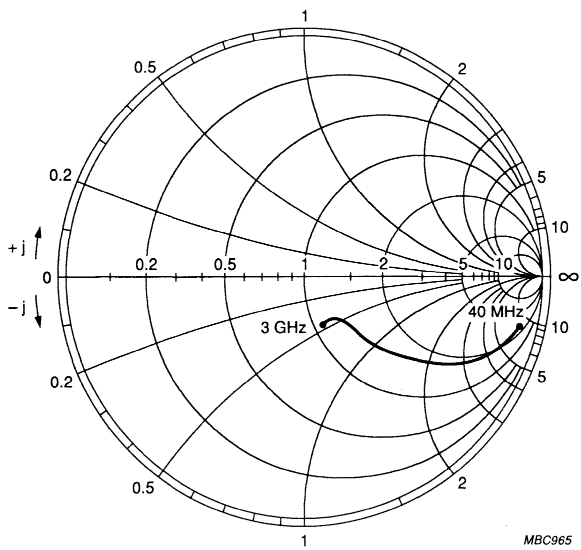
$V_{CE} = 8$ V; $I_C = 15$ mA.

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.

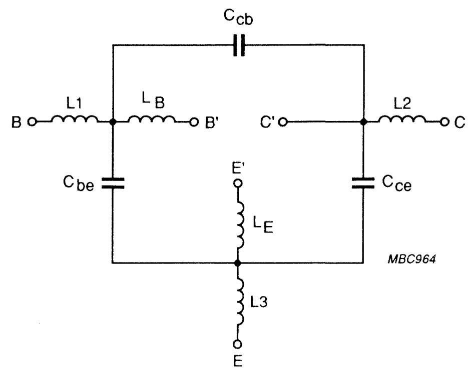


V_{CE} = 8 V; I_C = 15 mA.

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.

Table 1 Common emitter scattering parameters, V_{CE} = 4 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	0.943	−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}		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	0.787	−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

NPN 8 GHz wideband transistor BFQ67

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}		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	0.766	−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 (S-mini) envelope.

PINNING

PIN	DESCRIPTION
Code: V2	
1	base
2	emitter
3	collector

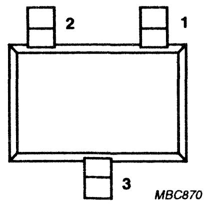


Fig.1 SOT323.

DESCRIPTION

Silicon 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. The BFQ67W uses the same crystal as the SOT23 version, BFQ67.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	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	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
$R_{th\ j\text{-}s}$	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 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

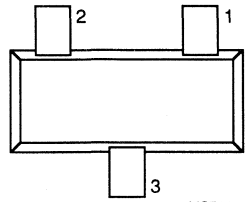


Fig.1 SOT23.

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.

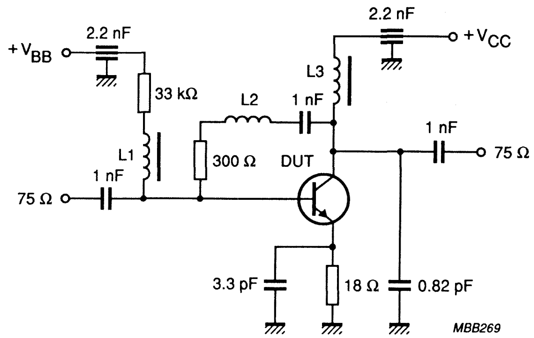
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage 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.

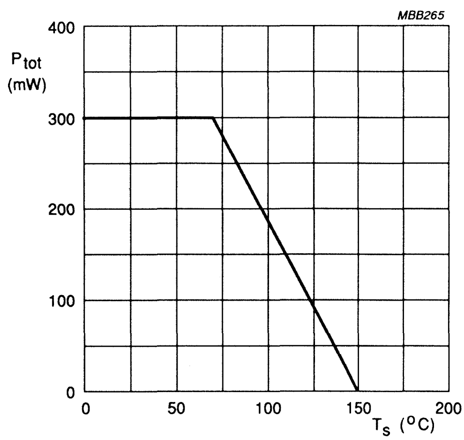
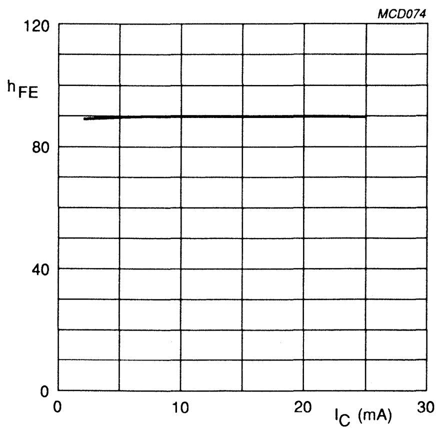


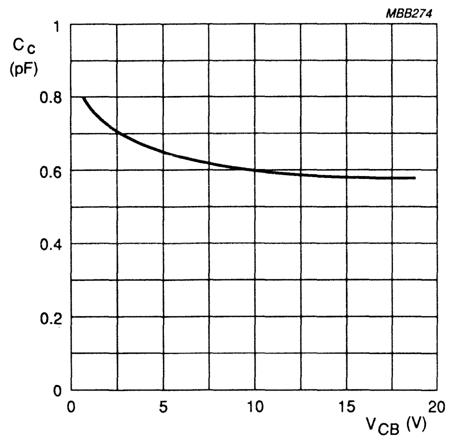
Fig.3 Power derating curve.



V_{CE} = 10 V; T_j = 25 °C.

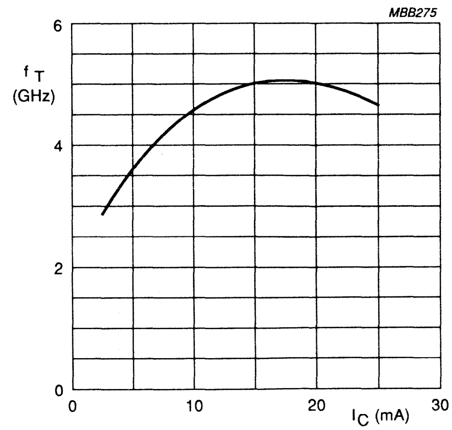
Fig.4 DC current gain as a function of collector current, typical values.

NPN 5 GHz wideband transistor BFR92A



$I_C = I_c = 0$; f = 1 MHz; $T_j = 25$ °C.

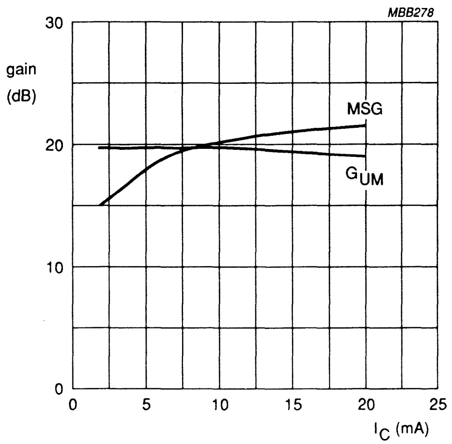
Fig.5 Collector capacitance as a function of collector-base voltage, typical values.



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

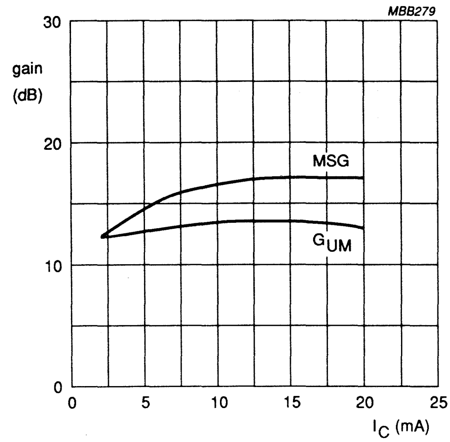
Fig.6 Transition frequency as a function of collector current, typical values.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



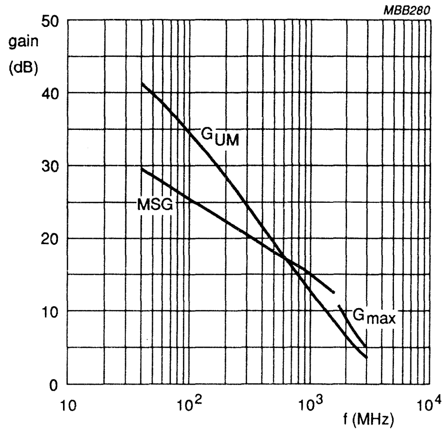
$V_{CE} = 10$ V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



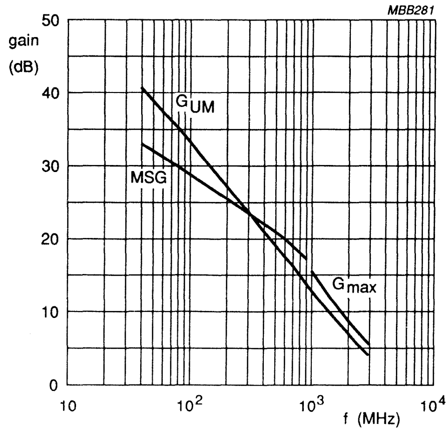
$V_{CE} = 10$ V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



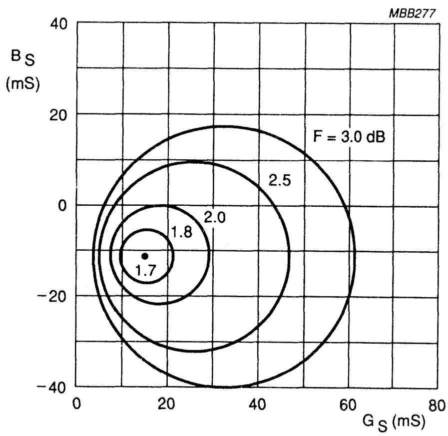
V_{CE} = 10 V; I_C = 5 mA.

Fig.9 Gain as a function of frequency.



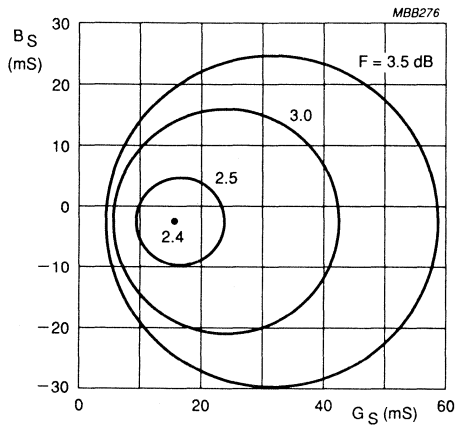
V_{CE} = 10 V; I_C = 15 mA.

Fig.10 Gain as a function of frequency.



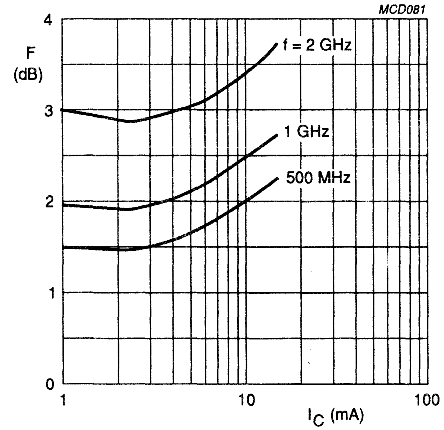
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.11 Circles of constant noise figure, typical values.



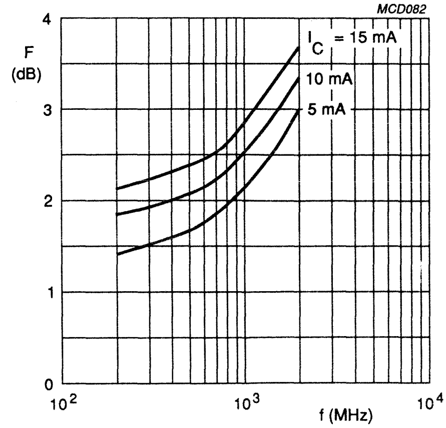
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.12 Circles of constant noise figure, typical values.



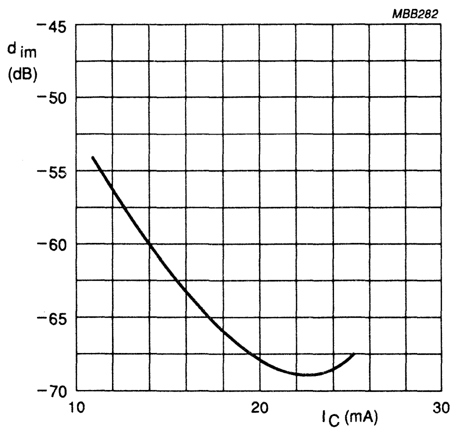
V_{CE} = 10 V.

Fig.13 Minimum noise figure as a function of collector current.



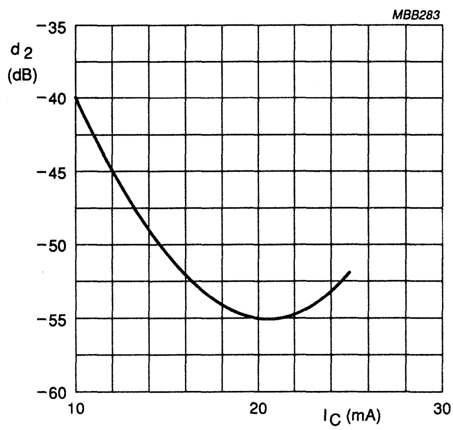
V_{CE} = 10 V.

Fig.14 Minimum noise figure as a function of frequency.



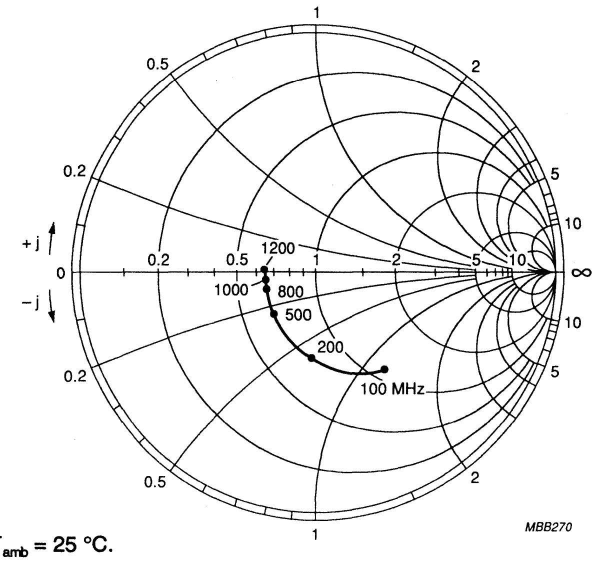
V_{CE} = 10 V; V_O = 150 mV (43.5 dBmV);
$f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.15 Intermodulation distortion, typical values.



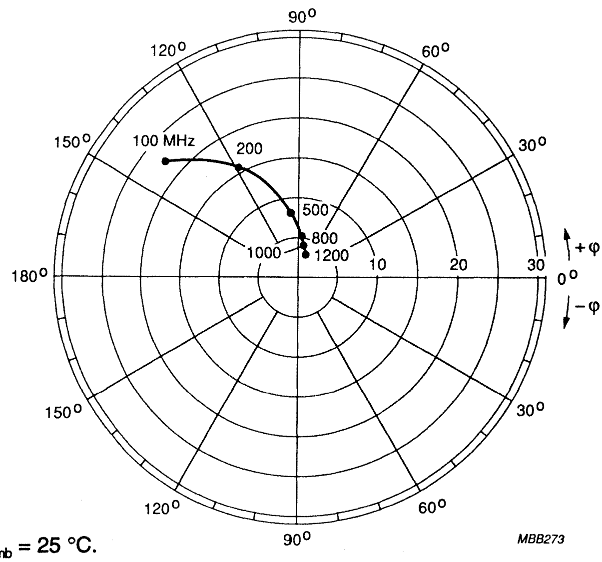
V_{CE} = 10 V; V_O = 60 mV; $f_{(p+q-r)}$ = 810 MHz;
T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.16 Second order intermodulation distortion, typical values.



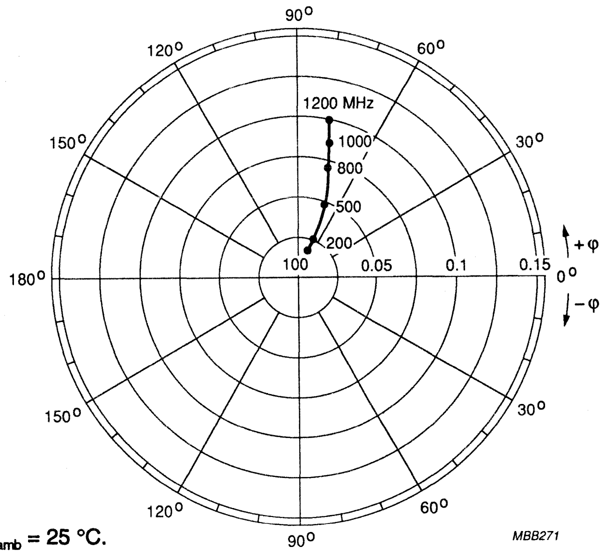
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

Fig.17 Common emitter input reflection coefficient (S_{11}).



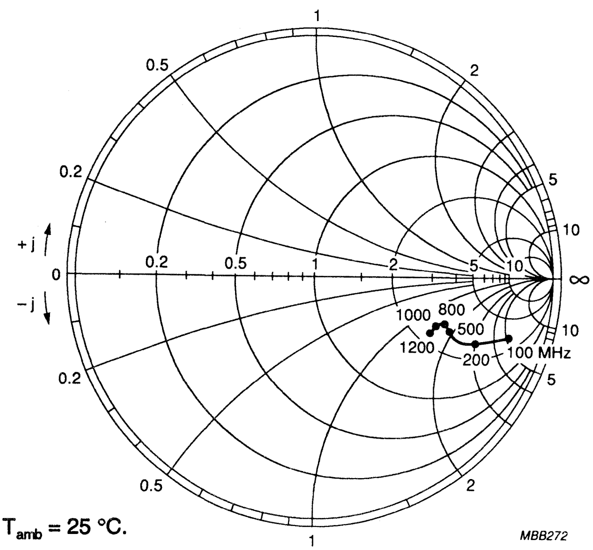
V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

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}).

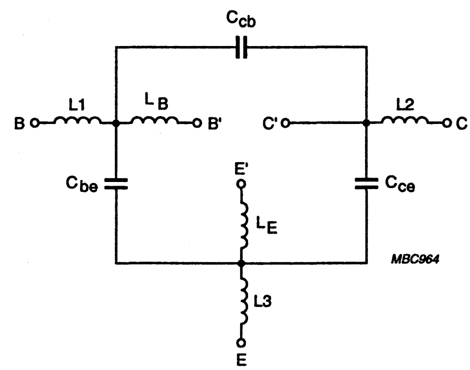


V_{CE} = 10 V; I_C = 14 mA; T_{amb} = 25 °C.

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} 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	0.669	−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} 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	0.611	−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} 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	0.813	−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}		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	0.720	−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

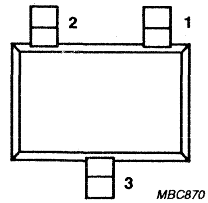


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	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 = 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 6 GHz wideband transistor — BFR93A

FEATURES

- High power gain
- Low noise figure
- Very low intermodulation distortion
- PNP complement is the BFT93.

DESCRIPTION

NPN transistor in a plastic SOT23 envelope. It is primarily intended for use in RF wideband amplifiers and oscillators.

PINNING

PIN	DESCRIPTION
Code: R2p	
1	base
2	emitter
3	collector

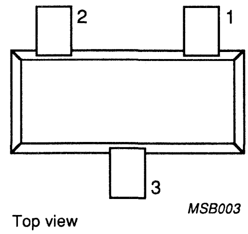


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	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 = 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

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	–	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 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.

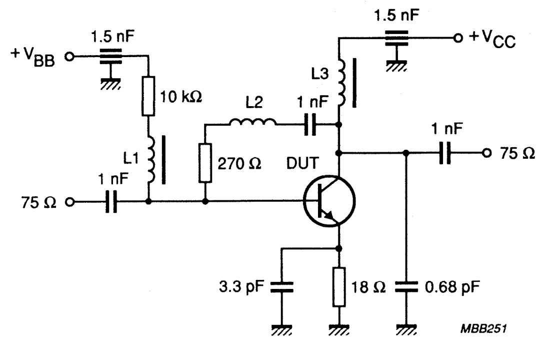
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector 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 Ω;
   $V_p = V_O$ 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 Ω;
   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.

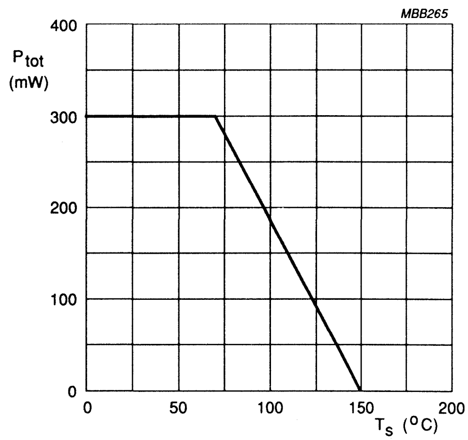
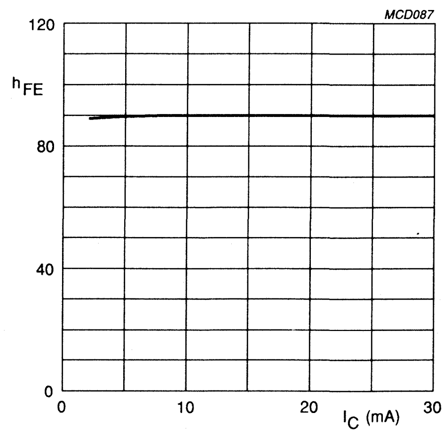
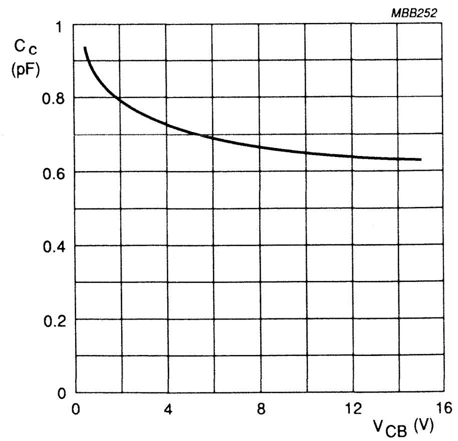


Fig.3 Power derating curve.



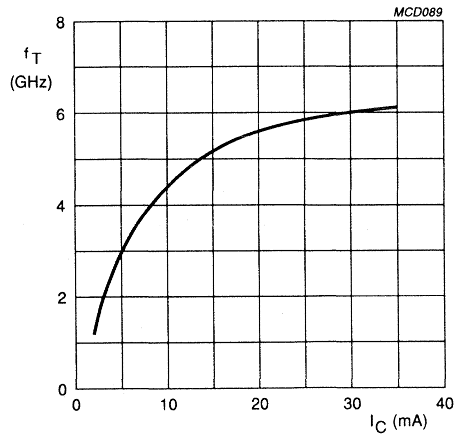
V_{CE} = 5 V; T_j = 25 °C.

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



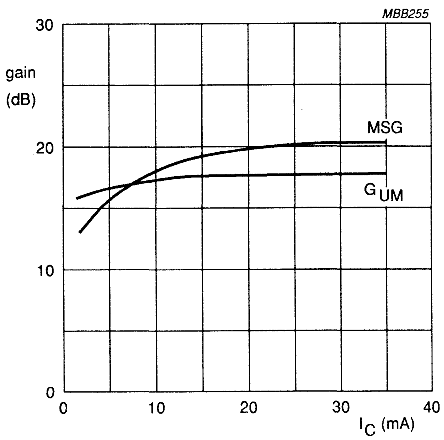
$I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

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



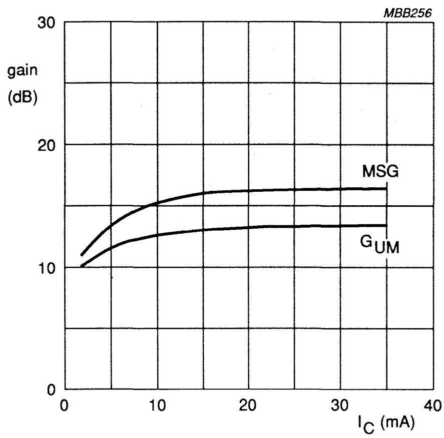
V_{CE} = 5 V; T_j = 25 °C; f = 500 MHz.

Fig.6 Transition frequency as a function of collector current, typical values.



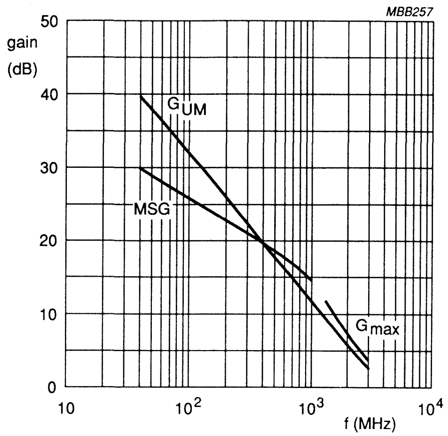
V_{CE} = 8 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



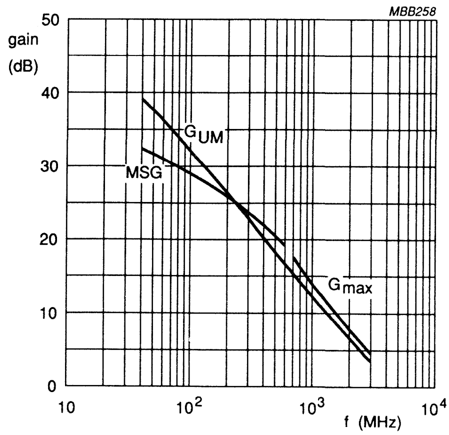
V_{CE} = 8 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



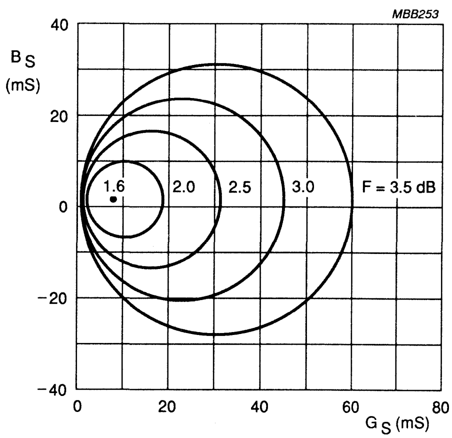
V_{CE} = 8 V; I_C = 10 mA.

Fig.9 Gain as a function of frequency.



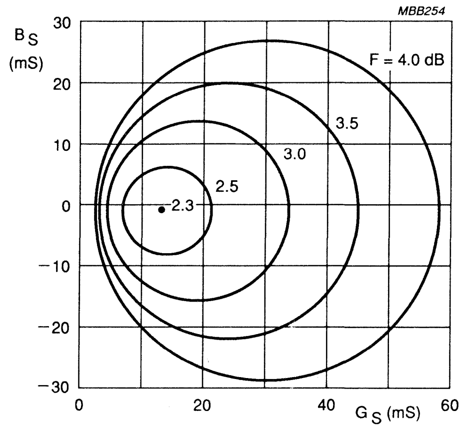
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



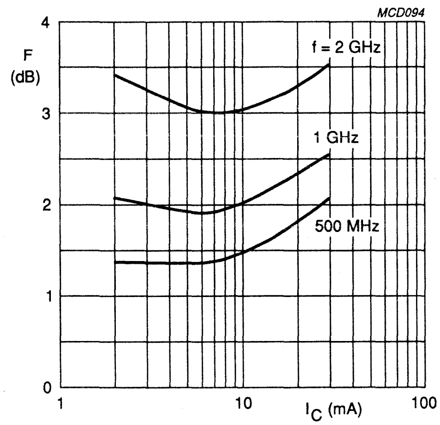
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.11 Circles of constant noise figure, typical values.



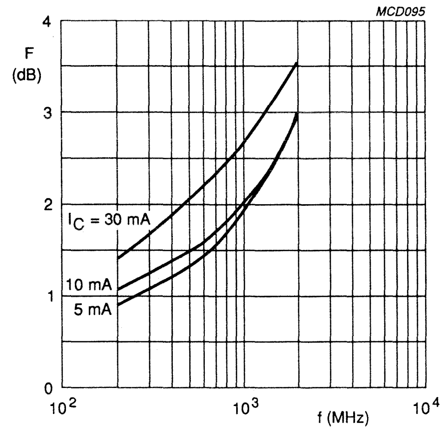
I_C = 4 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.12 Circles of constant noise figure, typical values.



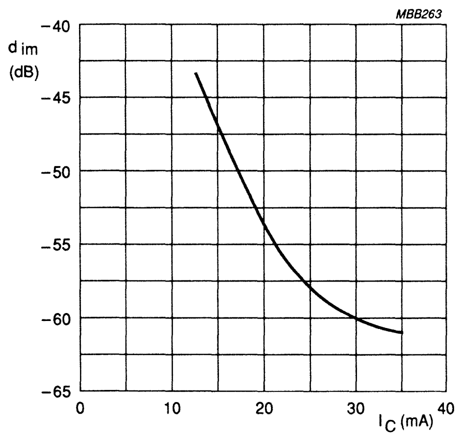
V_{CE} = 8 V.

Fig.13 Minimum noise figure as a function of collector current.



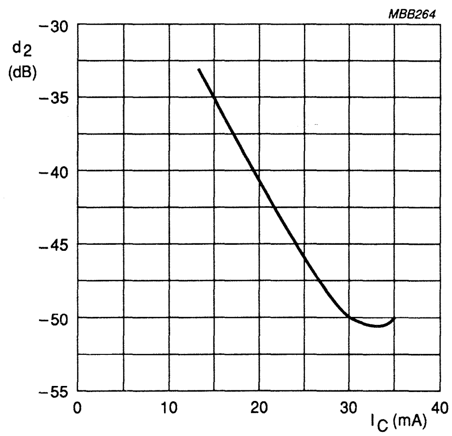
V_{CE} = 8 V.

Fig.14 Minimum noise figure as a function of frequency.



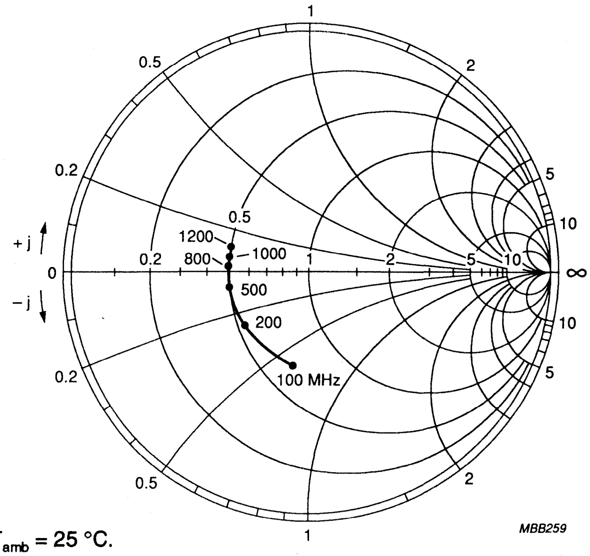
V_{CE} = 8 V; V_O = 425 mV (52.6 dBmV);
$f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.15 Intermodulation distortion, typical values.



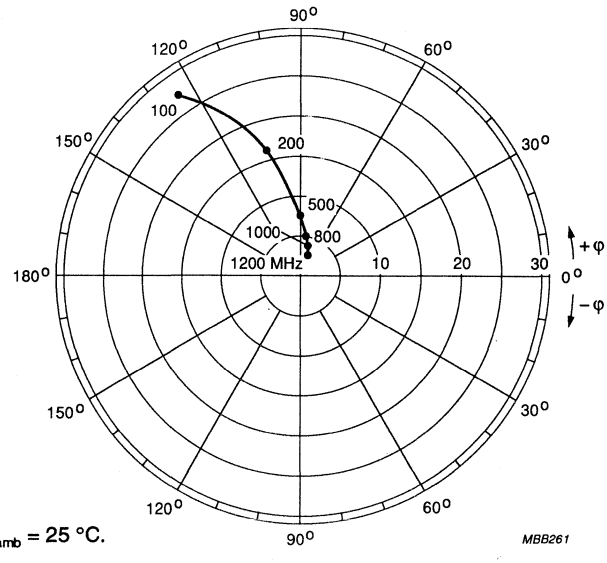
V_{CE} = 8 V; V_O = 200 mV (46 dBmV);
$f_{(p+q-r)}$ = 810 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.16 Second order intermodulation distortion, typical values.



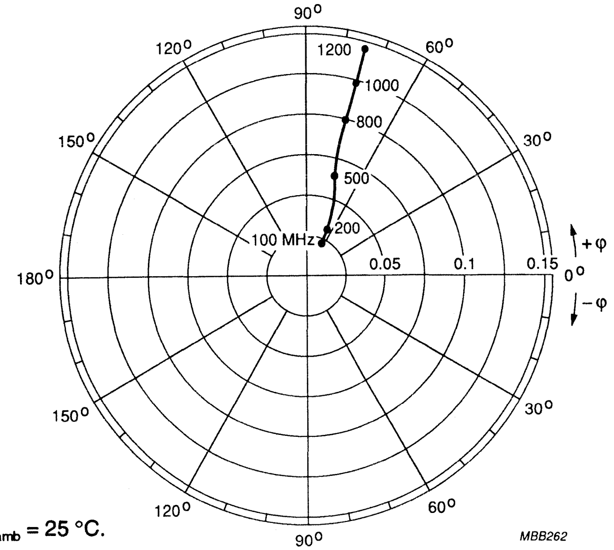
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.17 Common emitter input reflection coefficient (S_{11}).



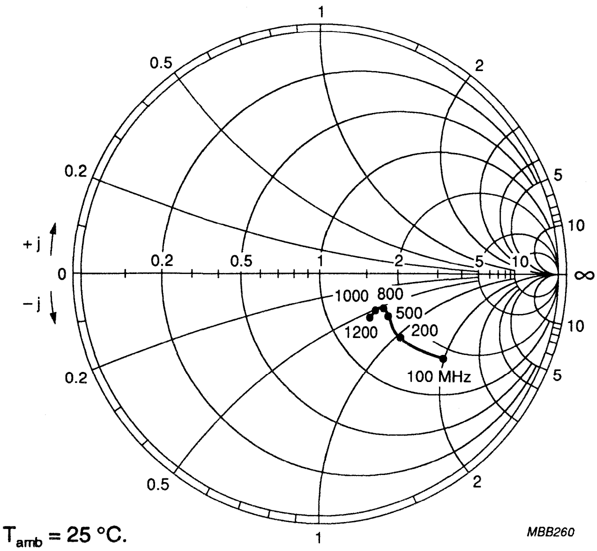
V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.18 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).

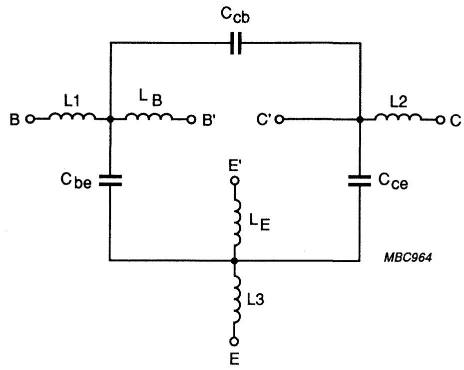


V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

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}		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	0.70	−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} 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	0.58	−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

NPN 6 GHz wideband transistor BFR93A

Table 3 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	0.50	−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	0.5	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}		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	0.62	−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 = 30m A

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.

PINNING

PIN	DESCRIPTION
Code: R2	
1	base
2	emitter
3	collector

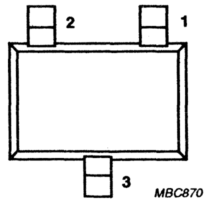


Fig.1 SOT323.

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.

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 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

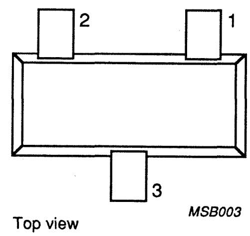


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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.

Qualification approval 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	base and emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	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 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.

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CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 6$ 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
$\lvert S_{21}\rvert^2$	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 $G_{UM} = 10 \log \frac{\lvert S_{21}\rvert^2}{(1-\lvert S_{11}\rvert^2)(1-\lvert S_{22}\rvert^2)}$ 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.

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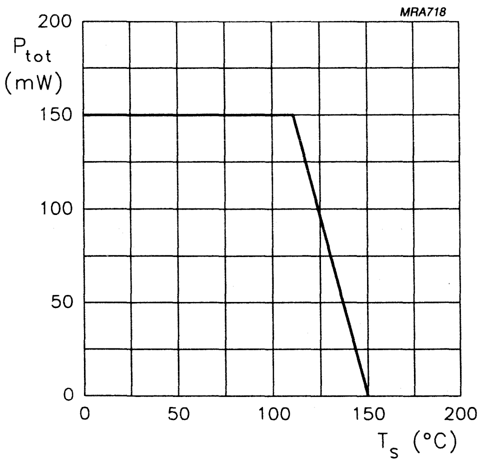
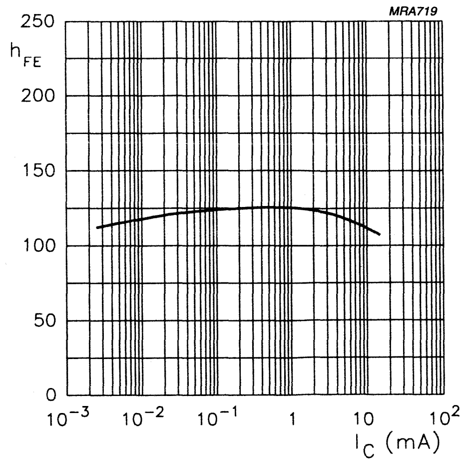
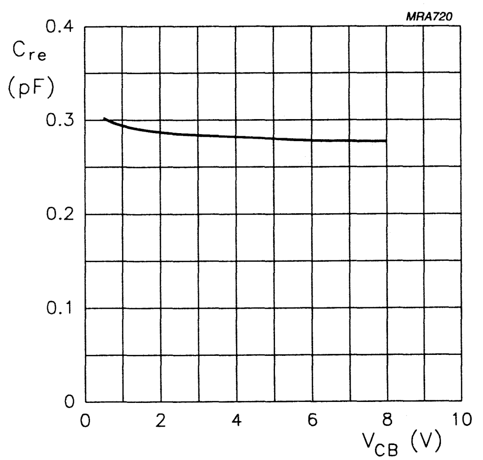


Fig.2 Power derating curve.



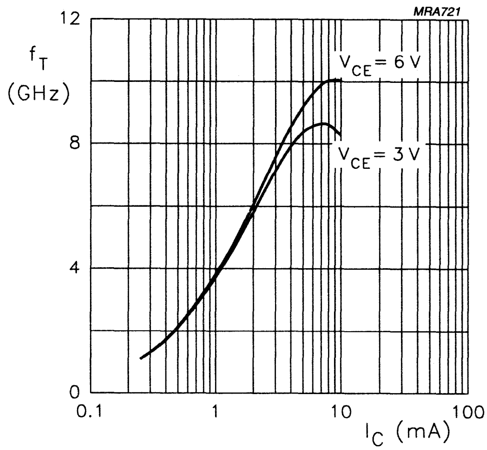
V_{CE} = 6 V.

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.

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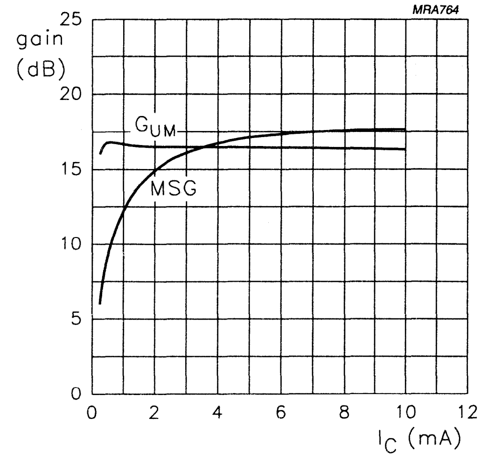
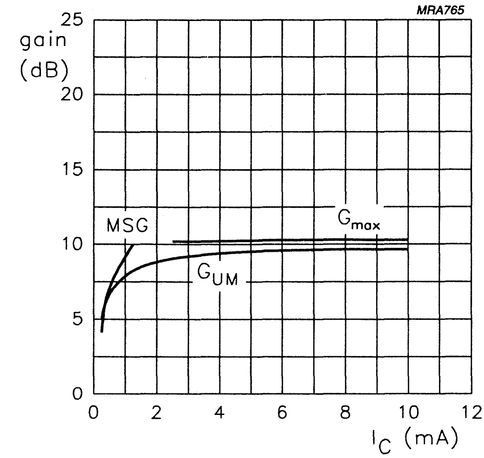


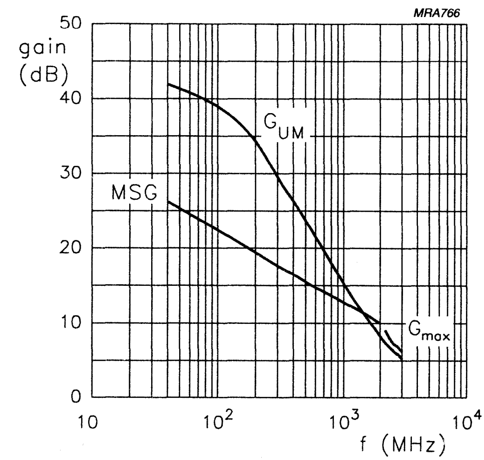
V_{CE} = 6 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



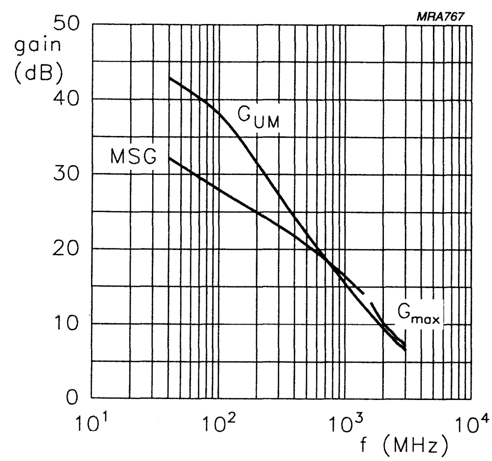
V_{CE} = 6 V; f = 2 GHz.

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.

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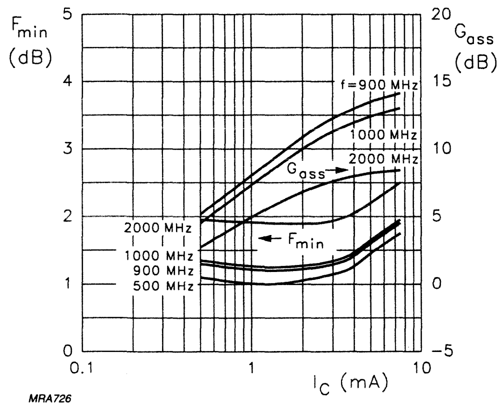
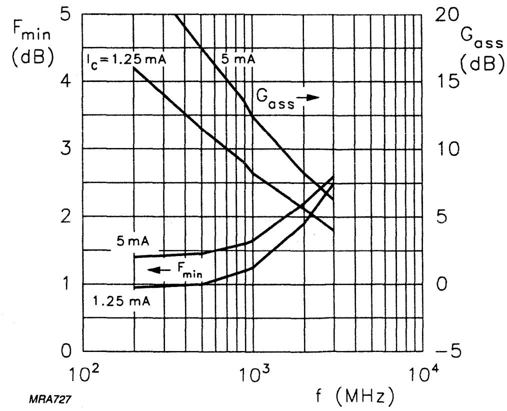


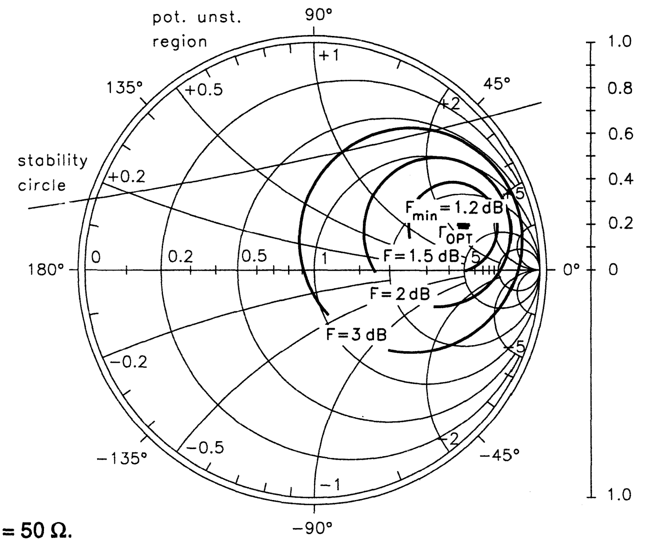
V_{CE} = 6 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



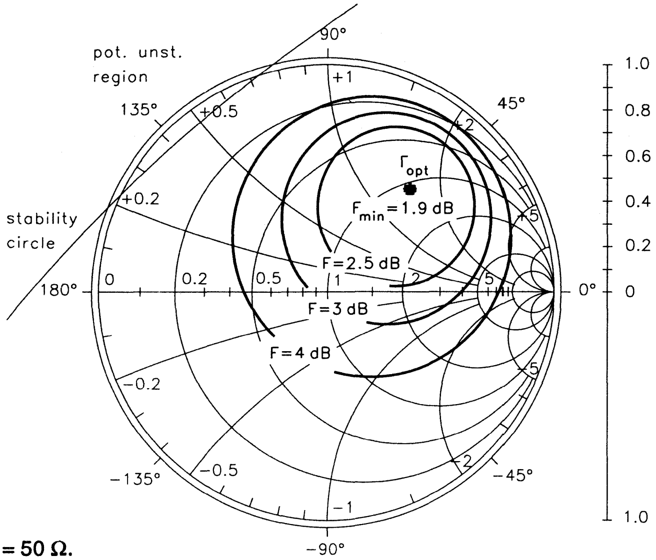
V_{CE} = 6 V.

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.

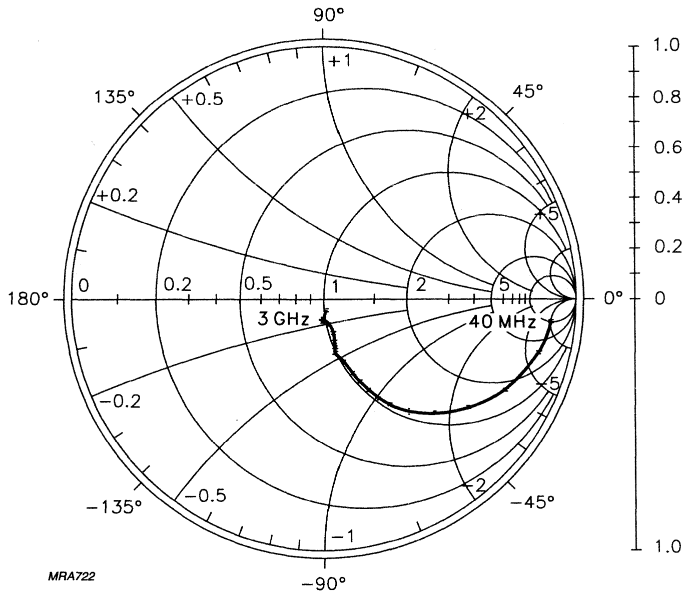
Fig.12 Noise circle figure.



$Z_O = 50\ \Omega$.

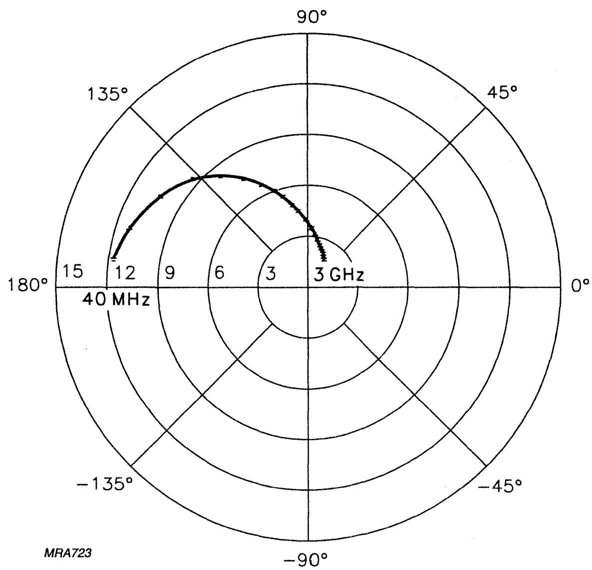
$V_{CE} = 6$ V; $I_C = 5$ mA; f = 2000 MHz.

Fig.13 Noise circle figure.



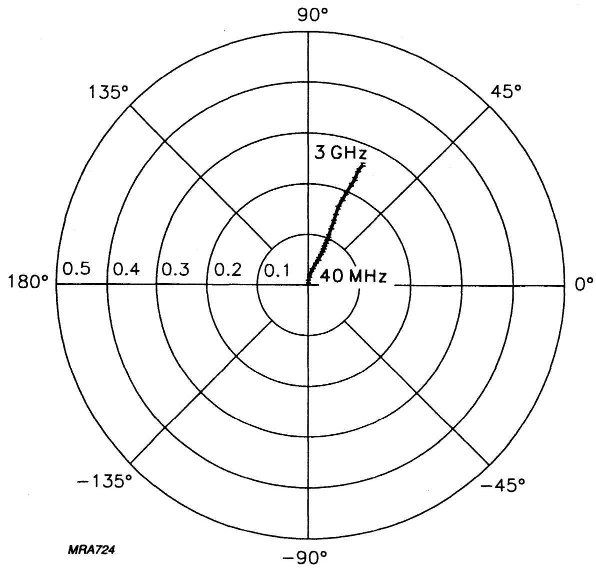
V_{CE} = 6 V; I_C = 5 mA.

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



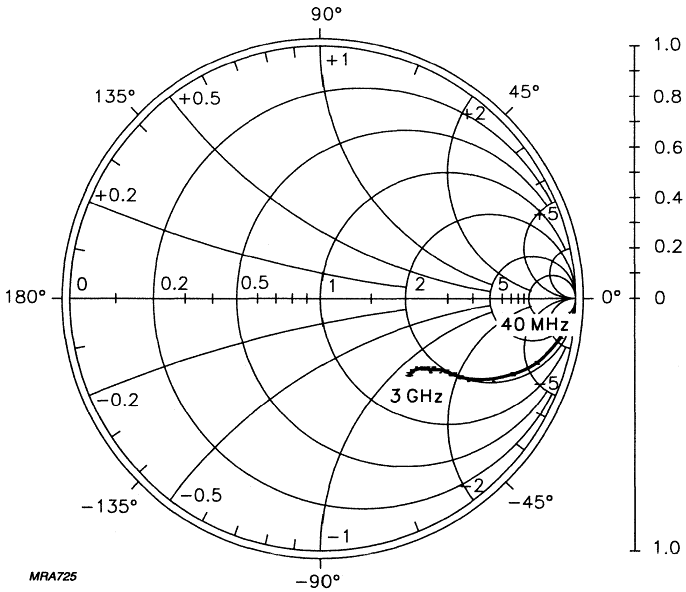
V_{CE} = 6 V; I_C = 5 mA.

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}).

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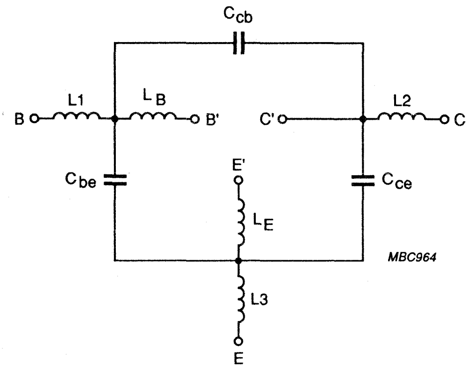
SPICE parameters for BFR505 crystal

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.

Qualification approval CECC 50 000 (issue 4), 1986.

Table 1 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	0.987	−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

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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	0.971	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.944	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.918	−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} (RAT)	Γ_{opt} (DEG)	R_n
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}		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	0.893	−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}		R_n
		(RAT)	(DEG)	
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} 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	0.988	−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}		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	0.974	−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}		R_n
		(RAT)	(DEG)	
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}		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	0.928	−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}		R_n
		(RAT)	(DEG)	
900	1.40	0.600	15.0	0.68
2000	2.00	0.492	45.0	0.51

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

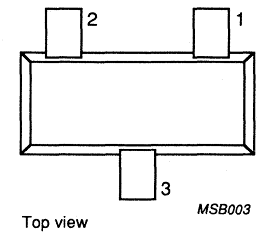


Fig.1 SOT23.

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	base and emitter shorted	–	–	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
$\vert S_{21}\vert^2$	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.

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	base and emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	70	mA
P_{tot}	total power dissipation	up to T_s = 72 °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 leakage 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.

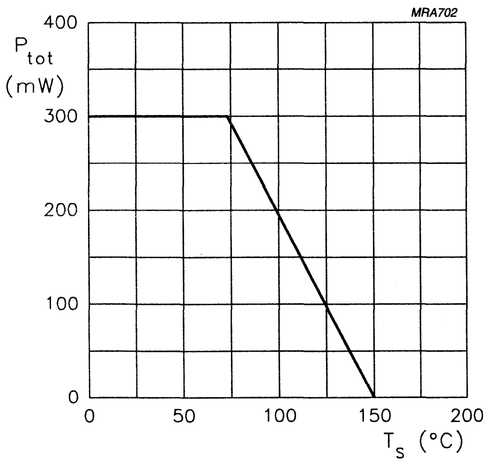
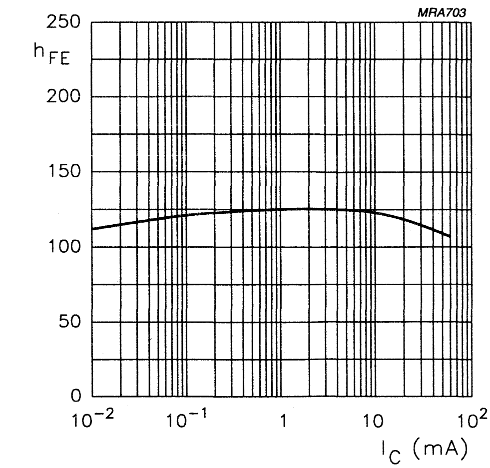
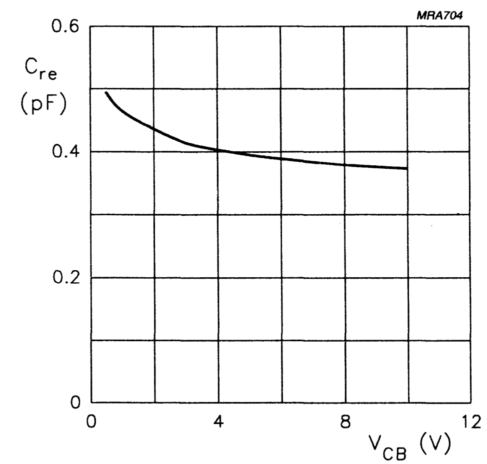


Fig.2 Power derating curve.



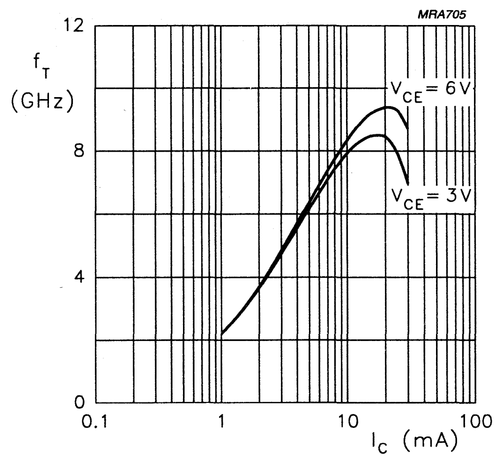
V_{CE} = 6 V.

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



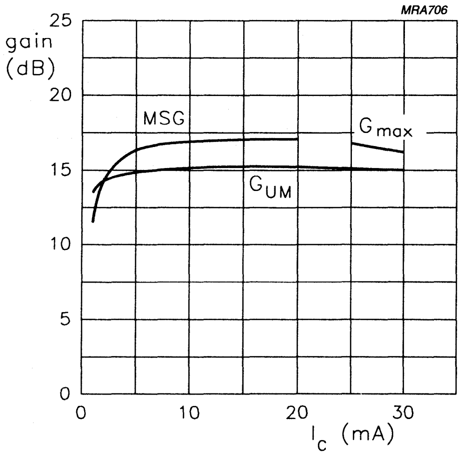
I_C = 0; f = 1 MHz.

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



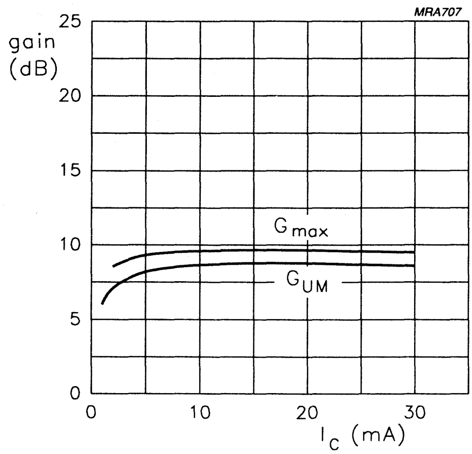
T_{amb} = 25 °C; f = 1 GHz.

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



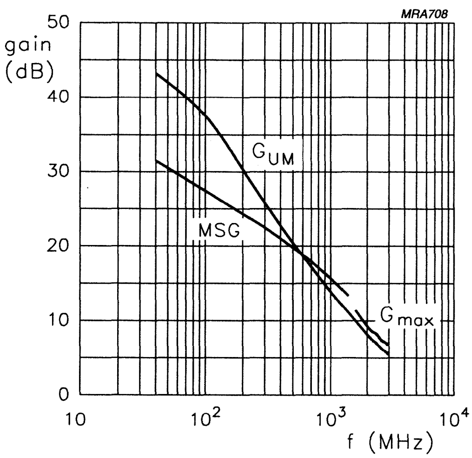
V_{CE} = 6 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



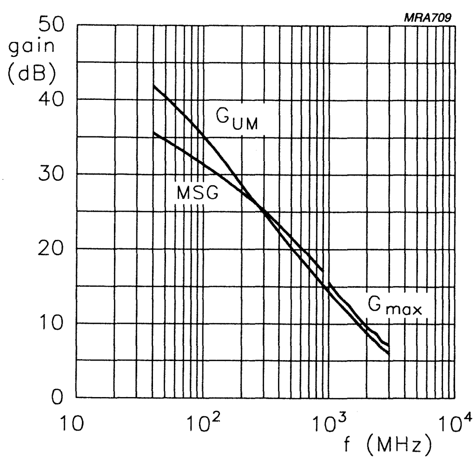
V_{CE} = 6 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



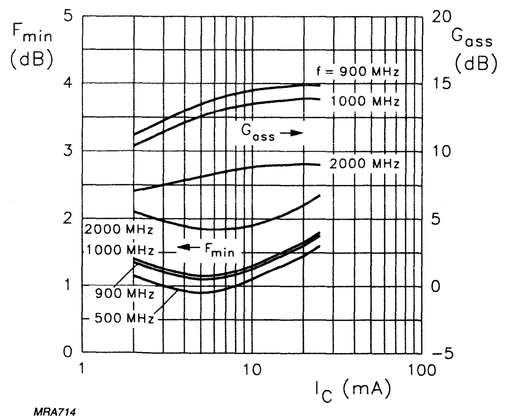
V_{CE} = 6 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



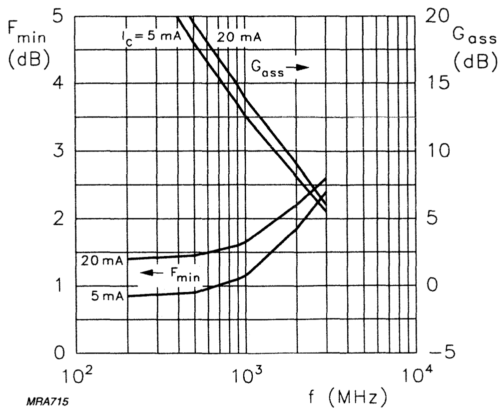
V_{CE} = 6 V; I_C = 20 mA.

Fig.9 Gain as a function of frequency.



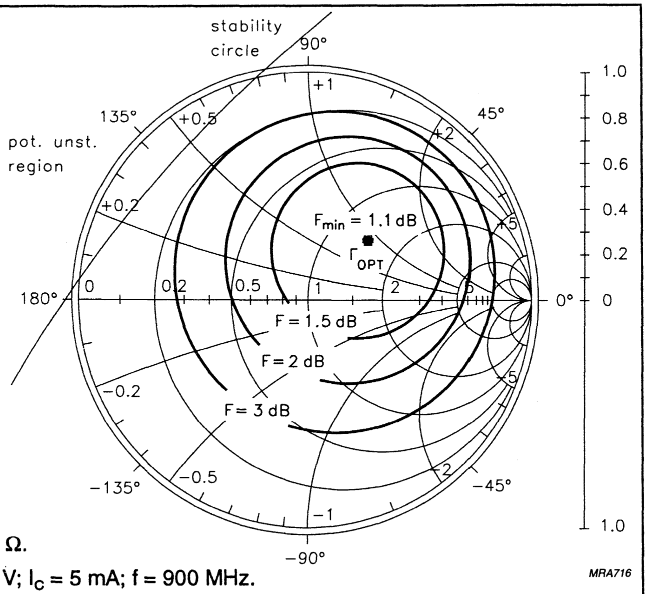
V_{CE} = 6 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



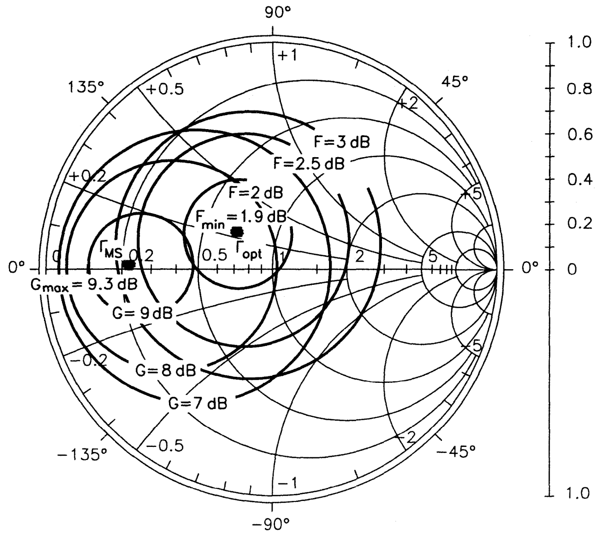
V_{CE} = 6 V.

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.

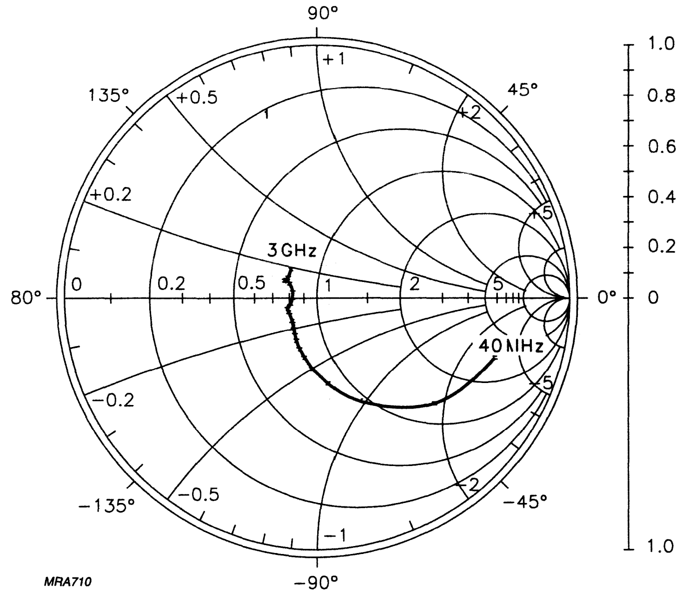


$Z_O = 50\ \Omega$.

$V_{CE} = 6$ V; $I_C = 5$ mA; f = 2000 MHz.

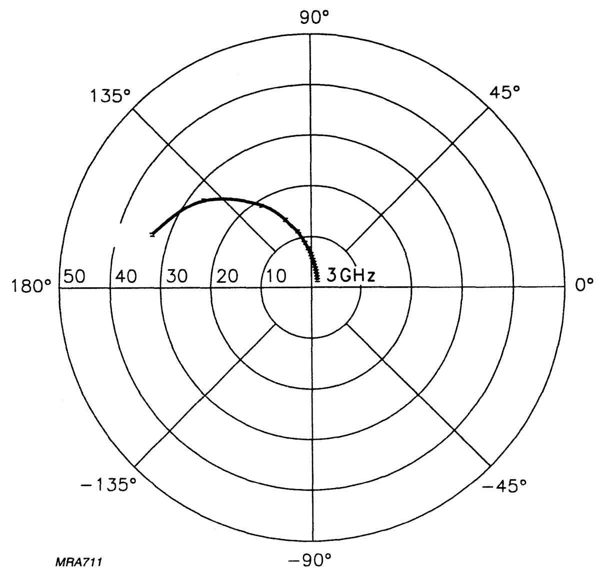
MRA717

Fig.13 Noise circle figure.



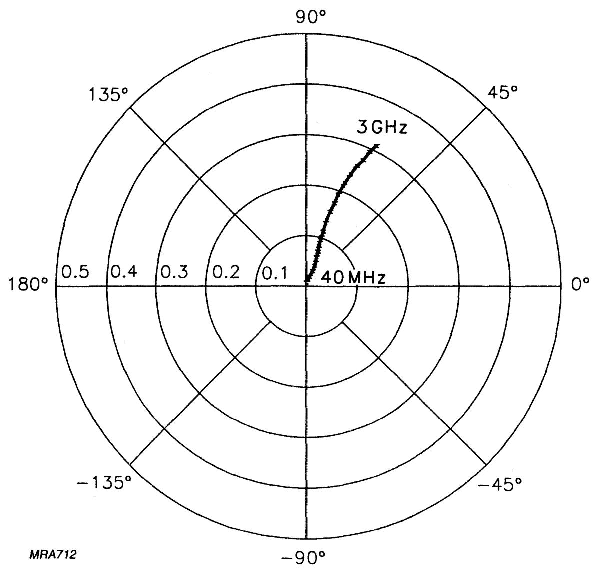
V_{CE} = 6 V; I_C = 20 mA.

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



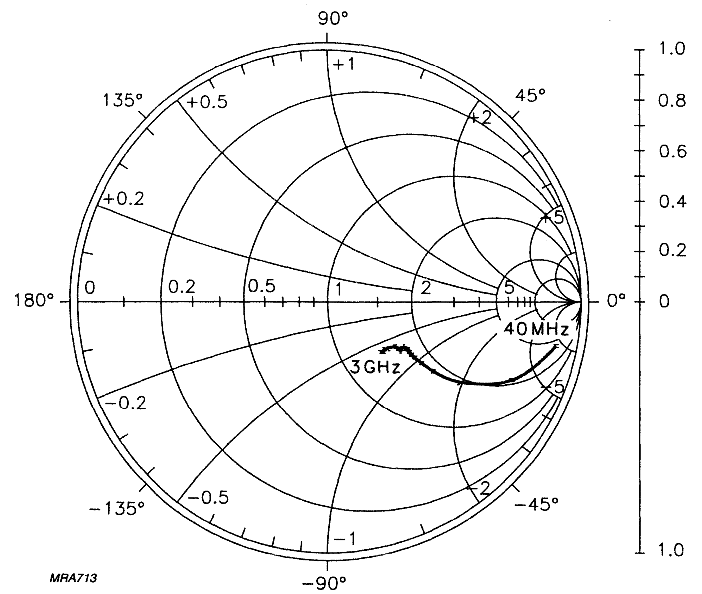
V_{CE} = 6 V; I_C = 20 mA.

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}).

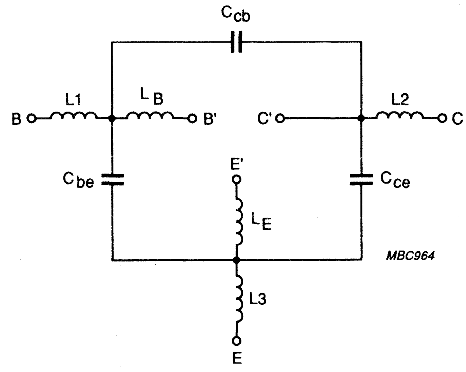


V_{CE} = 6 V; I_C = 20 mA.

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



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

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

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, $I_C = 2$ 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

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

NPN 9 GHz wideband transistor BFR520

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} 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	0.731	−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} (RAT)	Γ_{opt} (DEG)	R_n
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

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Table 10 Common emitter scattering parameters, V_{CE} = 3 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	0.570	−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} 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	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.743	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.691	−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

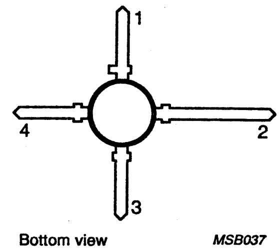


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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.

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.

PINNING

PIN	DESCRIPTION
	Code: N29
1	base
2	emitter
3	collector

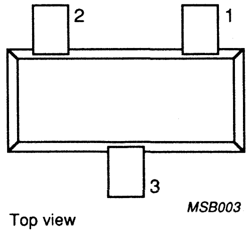


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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
$\|S_{21}\|^2$	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

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	base and emitter shorted	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	120	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)	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 leakage 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
$\lvert S_{21}\rvert^2$	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; $R_L = 50\ \Omega$; $T_{amb} = 25$ °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; $Z_L = Z_S = 75\ \Omega$; $T_{amb} = 25$ °C	–	550	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \dfrac{\lvert S_{21}\rvert^2}{(1 - \lvert S_{11}\rvert^2)(1 - \lvert S_{22}\rvert^2)}$ dB.
2. $I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50\ \Omega$;
   $T_{amb} = 25$ °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.

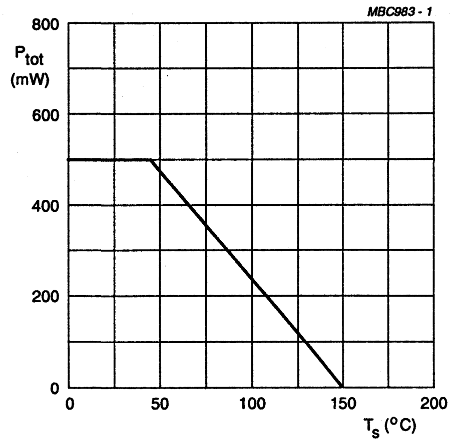
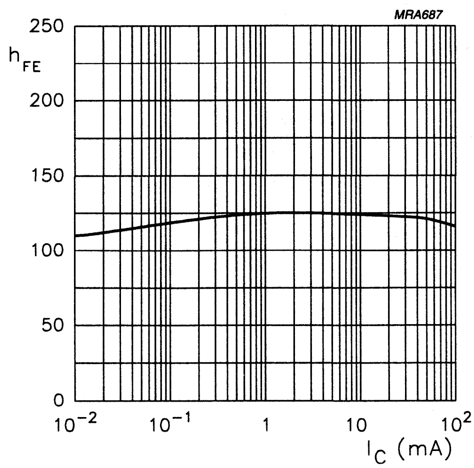
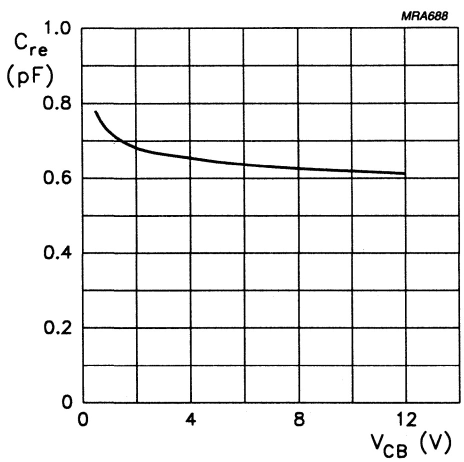


Fig.2 Power derating curve.



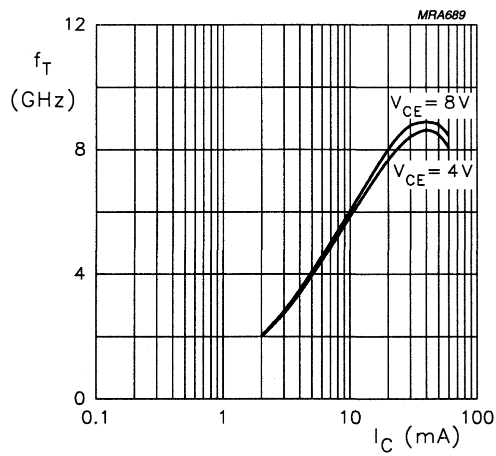
V_{CE} = 8 V.

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



I_C = 0; f = 1 MHz.

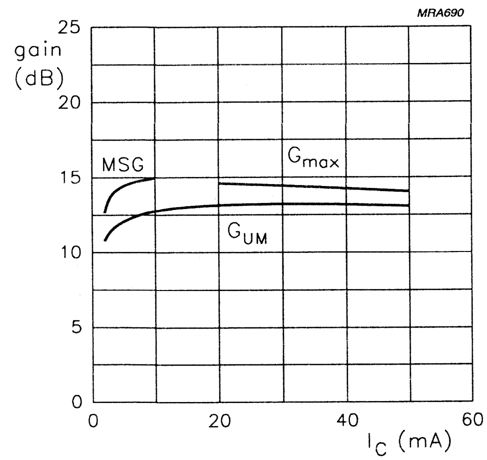
Fig.4 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

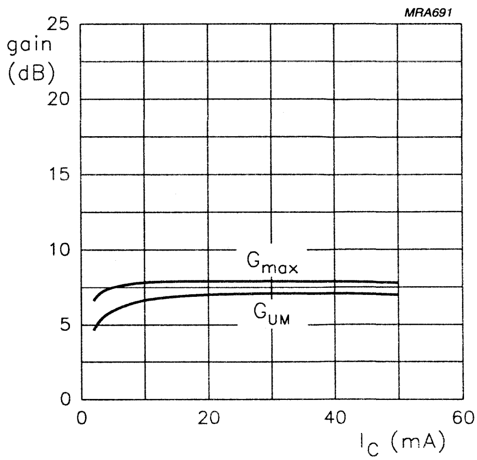
Fig.5 Transition frequency as a function of collector current.

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



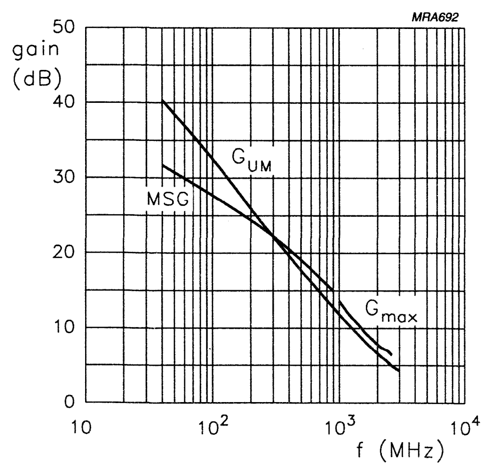
V_{CE} = 8 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



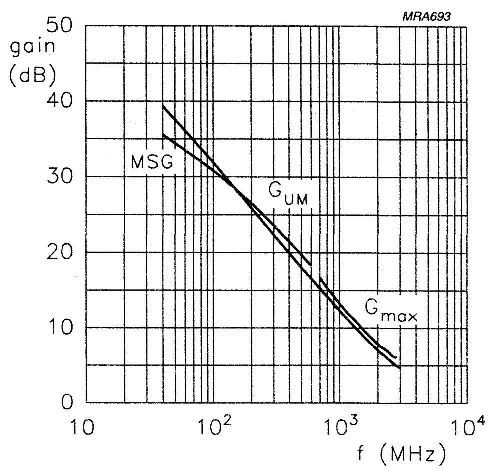
V_{CE} = 8 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



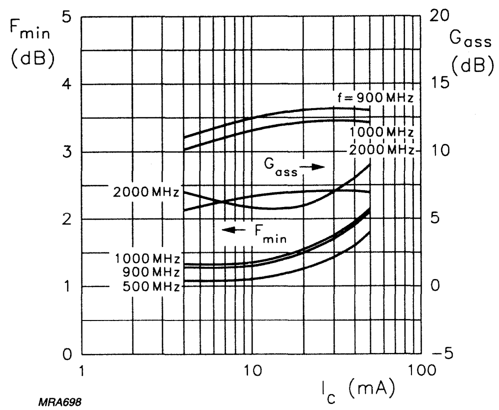
V_{CE} = 8 V; I_C = 10 mA.

Fig.8 Gain as a function of frequency.



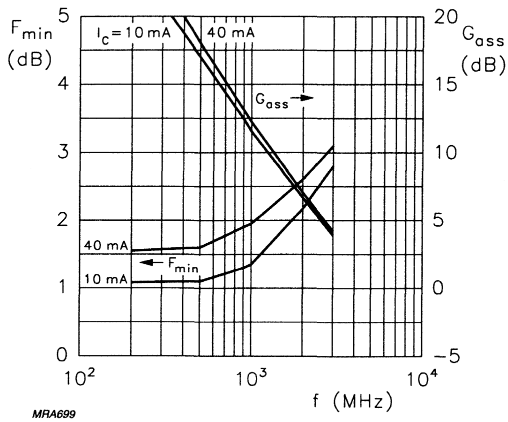
V_{CE} = 8 V; I_C = 40 mA.

Fig.9 Gain as a function of frequency.



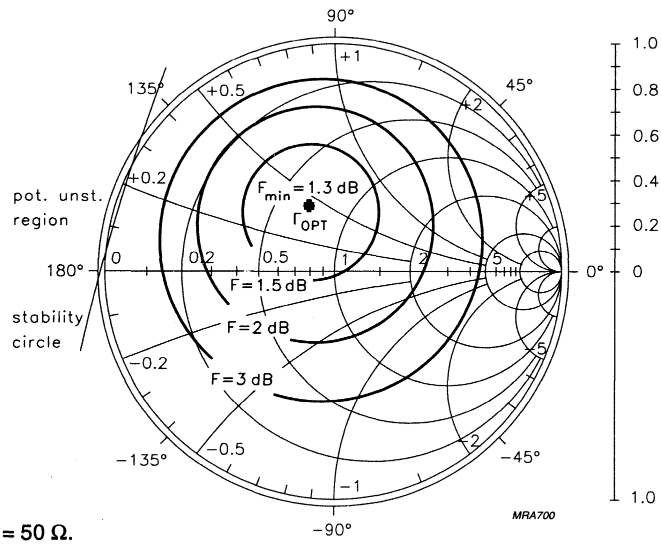
V_{CE} = 8 V.

Fig.10 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 8 V.

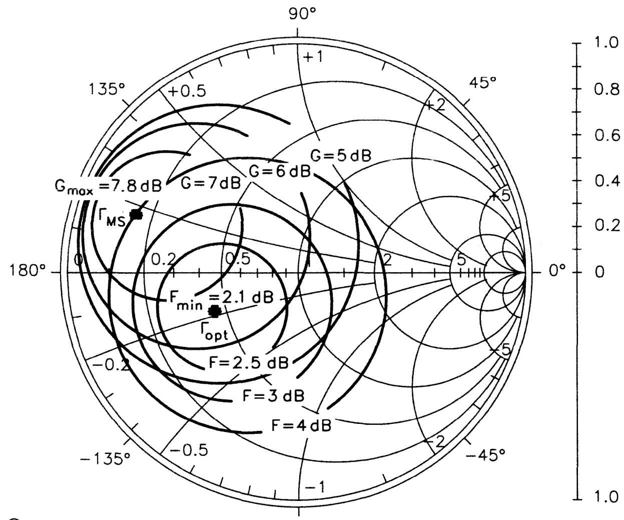
Fig.11 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.

V_{CE} = 8 V; I_C = 10 mA; f = 900 MHz.

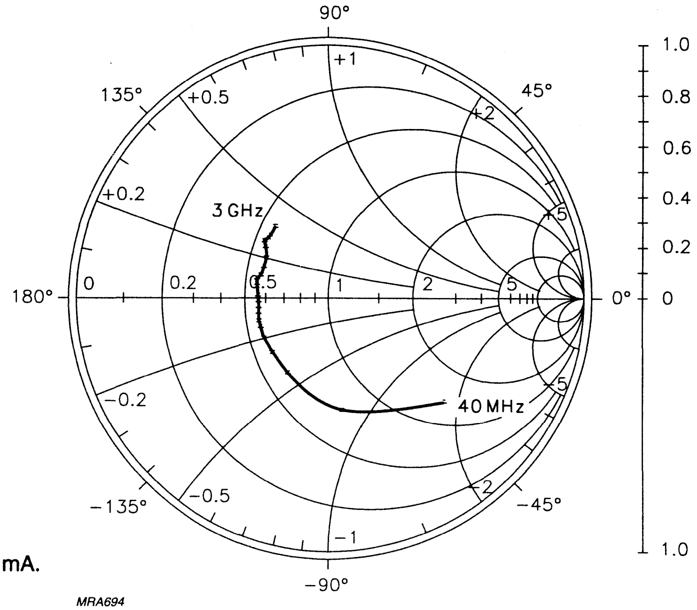
Fig.12 Noise circle figure.



Z_O = 50 Ω. MRA701

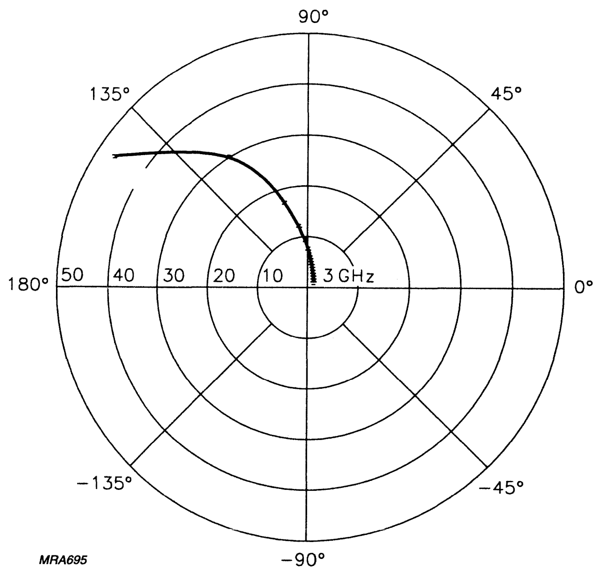
V_{CE} = 8 V; I_C = 10 mA; f = 2000 MHz.

Fig.13 Noise circle figure.



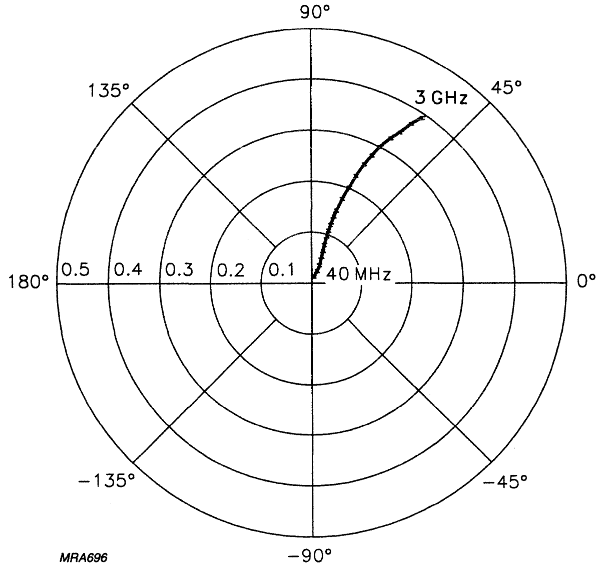
V_{CE} = 8 V; I_C = 40 mA.

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



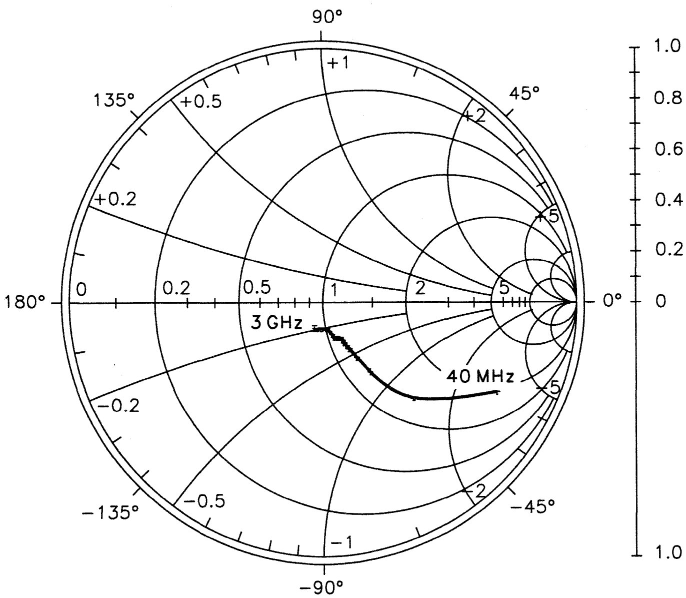
V_{CE} = 8 V; I_C = 40 mA.

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}).

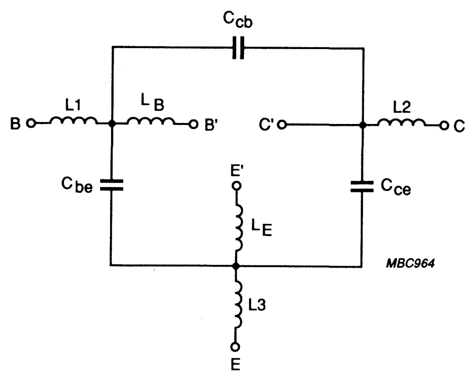


V_{CE} = 8 V; I_C = 40 mA.

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

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.

Table 1 Common emitter scattering parameters, $V_{CE} = 4$ 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	0.908	−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} 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	0.645	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.549	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.490	−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} (RAT)	Γ_{opt} (DEG)	R_n
900	1.90	0.279	180.0	0.13
2000	2.60	0.429	−140.0	0.22

Table 10 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	0.448	−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

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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} 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	−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.

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.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

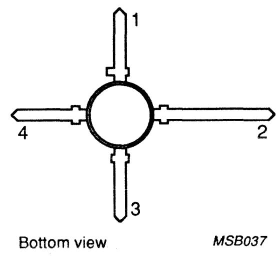


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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.

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.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

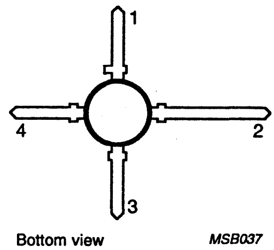


Fig.1 SOT103.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CEO}	collector-emitter voltage		–	–	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
$\lvert S_{21}\rvert^2$	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 5 GHz wideband transistor BFS25A

FEATURES

- Low current consumption (100 μA to 1 mA)
- 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 in pagers and pocket telephones with signal frequencies up to 2 GHz. The BFS25A uses the same crystal as the SOT23 version, BFT25A.

PINNING

PIN	DESCRIPTION
Code: N6	
1	base
2	emitter
3	collector

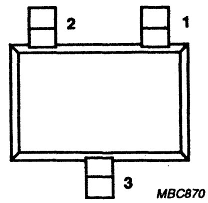


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	8	V
V_{CEO}	collector-emitter voltage		–	–	5	V
I_C	DC collector current		–	–	6.5	mA
P_{tot}	total power dissipation	up to T_s = 143 °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 = 0.5 mA; V_{CE} = 1 V	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz	–	15	–	dB
F	noise figure	I_C = 0.5 mA; V_{CE} = 1 V; f = 1 GHz	–	1.8	–	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 9 GHz wideband transistor — BFS505

FEATURES

- Low current consumption (1 to 5 mA)
- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

PINNING

PIN	DESCRIPTION
Code: N0	
1	base
2	emitter
3	collector

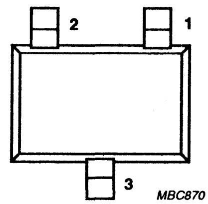


Fig.1 SOT323.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 envelope. It is intended for low power amplifiers, oscillators and mixers, particularly in RF portable communications equipment (cellular and cordless phones and pagers) up to 2 GHz. The BFS505 uses the same crystal as the SOT23 version, BFR505.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	15	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 121 °C (note 1)	–	–	150	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V	60	120	250	
f_T	transition frequency	I_C = 5 mA; V_{CE} = 6 V	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz	–	16	–	dB
F	noise figure	I_C = 1.25 mA; V_{CE} = 6 V; f = 900 MHz	–	1.1	1.5	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 9 GHz wideband transistor | BFS520

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

PINNING

PIN	DESCRIPTION
	Code: N2
1	base
2	emitter
3	collector

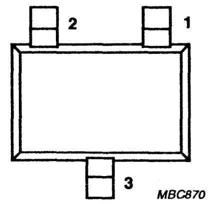


Fig.1 SOT323.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 envelope. It is intended for wideband applications such as satellite TV tuners, cellular and cordless phones, pagers, etc. with signal frequencies up to 2 GHz. The BFS520 uses the same crystal as the SOT23 version, BFR520.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	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	60	120	250	
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz	–	15	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz	–	1.1	1.5	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 9 GHz wideband transistor BFS540

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) envelope.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 envelope. It is intended as an RF amplifier for wideband applications such as (satellite) TV systems and RF portable communications equipment with signal frequencies up to 2 GHz. The BFS540 uses the same crystal as the SOT23 version, BFR540.

PINNING

PIN	DESCRIPTION
Code: N4	
1	base
2	emitter
3	collector

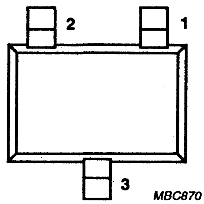


Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	20	V
V_{CES}	collector-emitter voltage	base and emitter shorted	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to T_s = 67 °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz	–	14	–	dB
F	noise figure	I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz	–	1.3	1.7	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	note 1	–	–	165	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

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

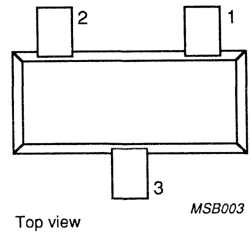


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	–	8	V
V_{CEO}	collector-emitter voltage		–	–	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.

Qualification approval 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 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 leakage 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.

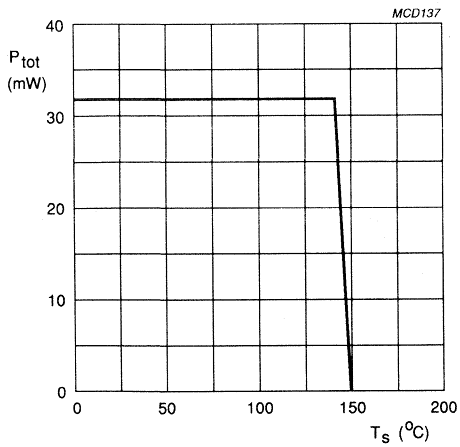
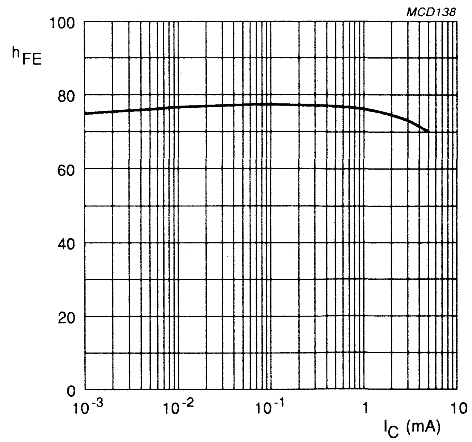
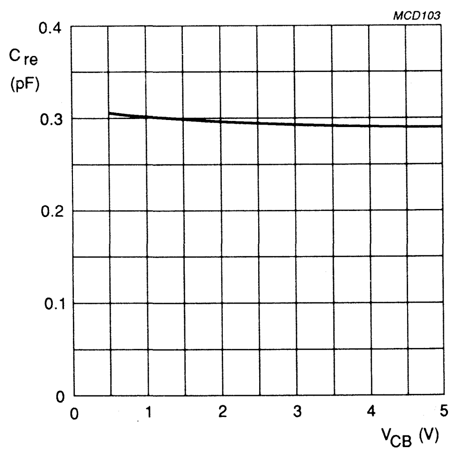


Fig.2 Power derating curve.



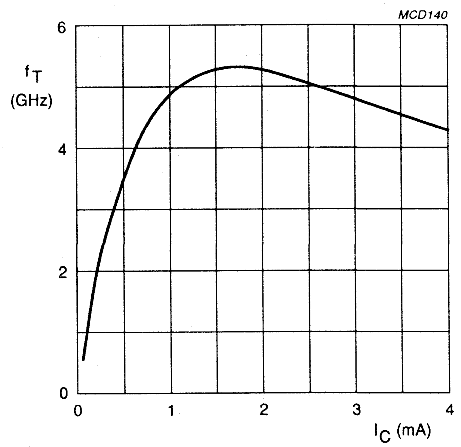
V_{CE} = 1 V.

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



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

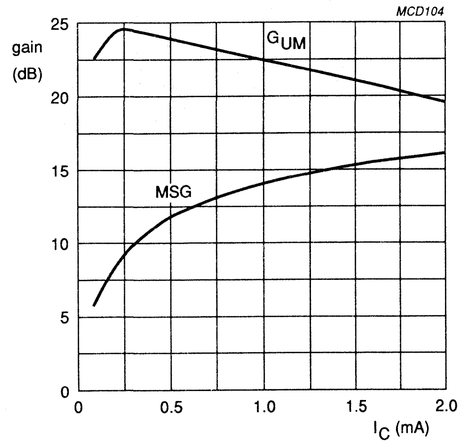
Fig.4 Feedback capacitance as a function of collector-base voltage.



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

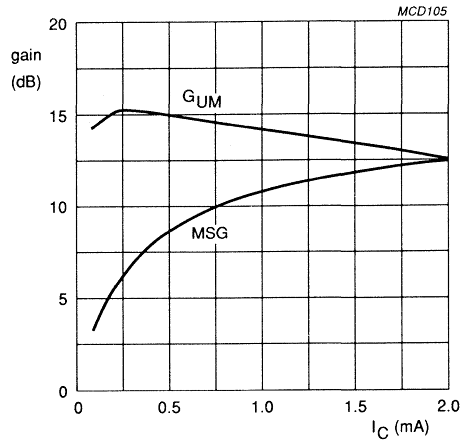
Fig.5 Transition frequency as a function of collector current.

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



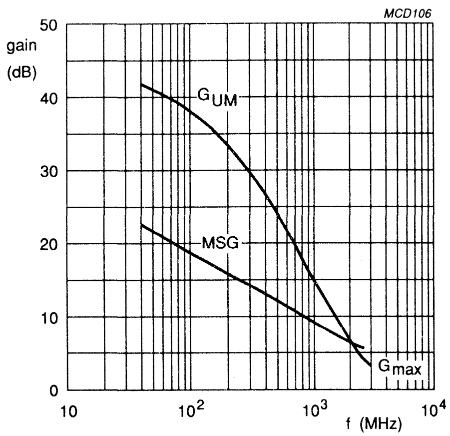
V_{CE} = 1 V; f = 500 MHz.

Fig.6 Gain as a function of collector current.



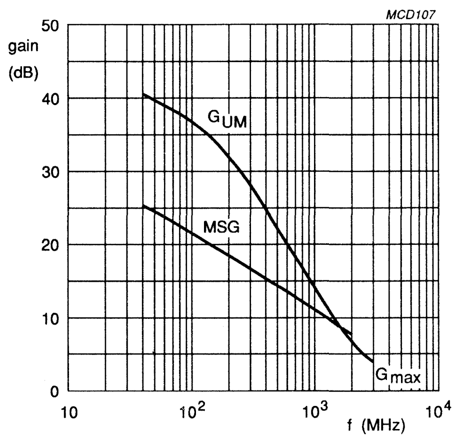
V_{CE} = 1 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



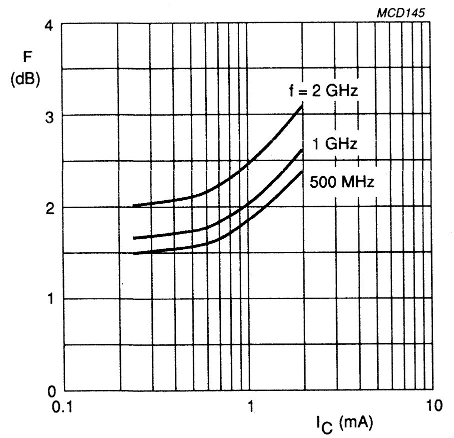
V_{CE} = 1 V; I_C = 0.5 mA.

Fig.8 Gain as a function of frequency.



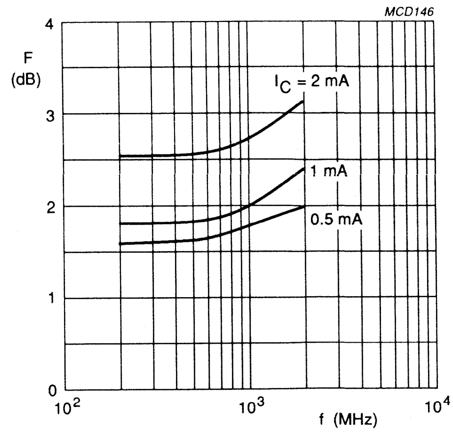
V_{CE} = 1 V; I_C = 1 mA.

Fig.9 Gain as a function of frequency.



V_{CE} = 1 V.

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



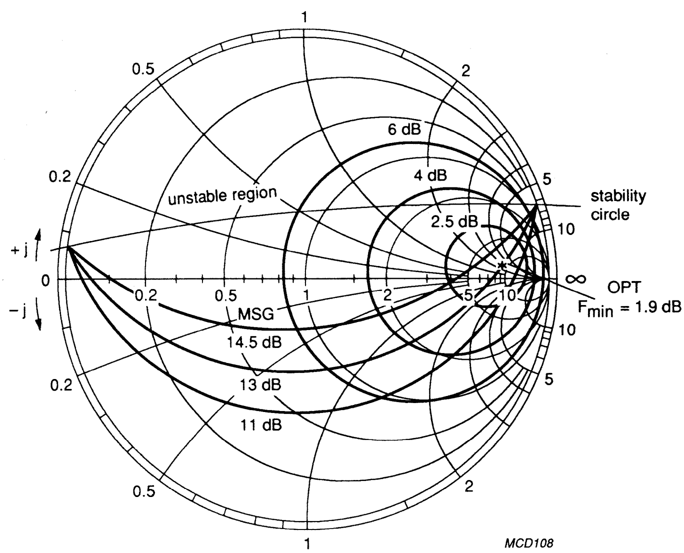
V_{CE} = 1 V.

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.

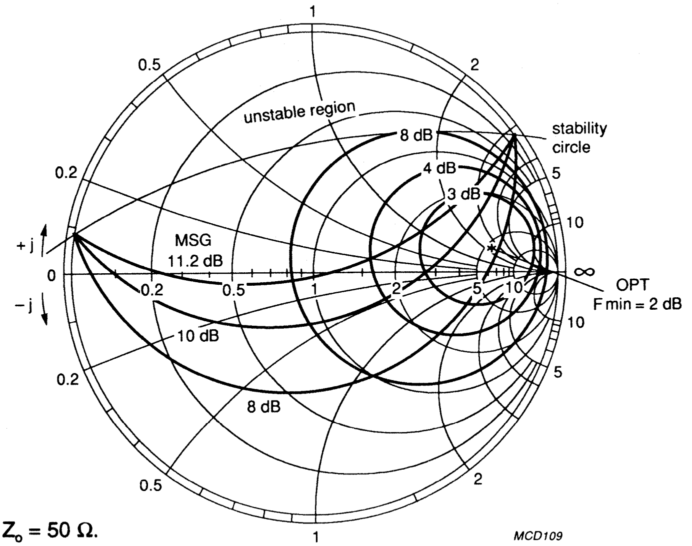
Average gain parameter: MSG = 14.5 dB.

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



$Z_o = 50\ \Omega$.

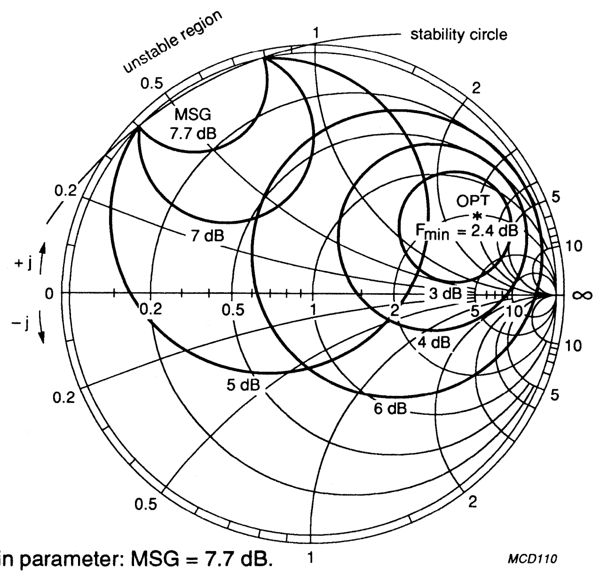
Average gain parameter: MSG = 11.2 dB.

Fig.13 Noise circle figure.

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

Noise Parameters

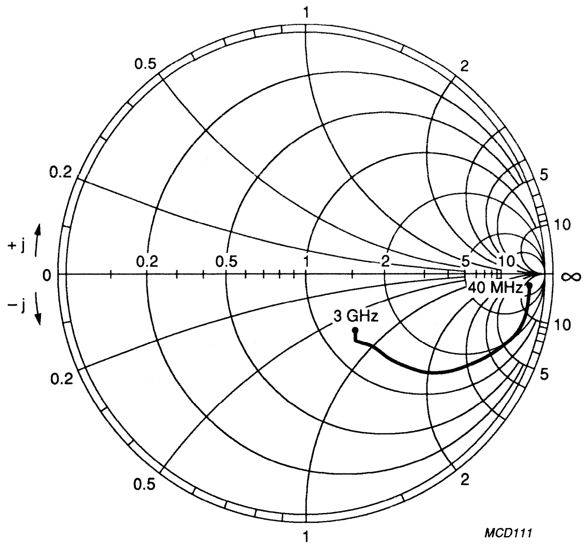
F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.72	26	1.7



$Z_o = 50\ \Omega$.

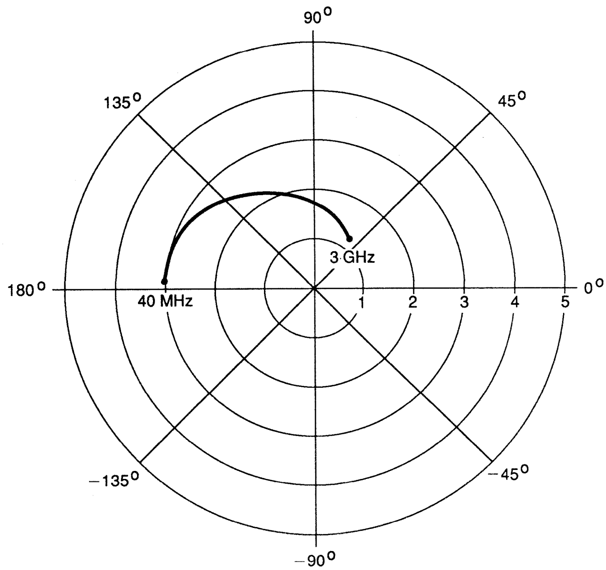
Average gain parameter: MSG = 7.7 dB.

Fig.14 Noise circle figure.



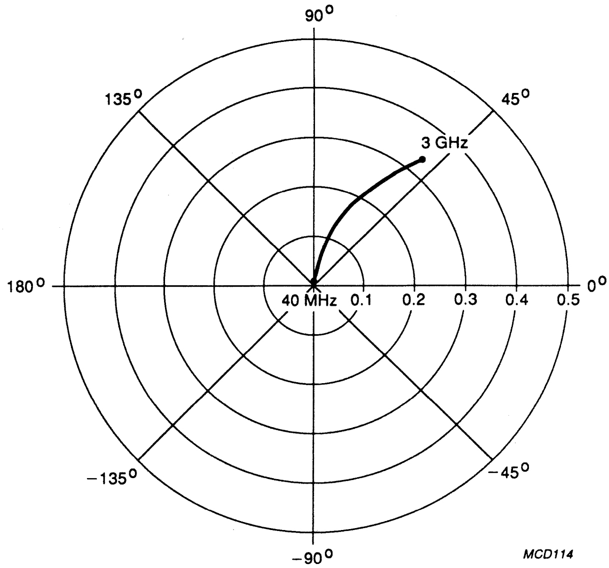
V_{CE} = 1 V; I_C = 1 mA.

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



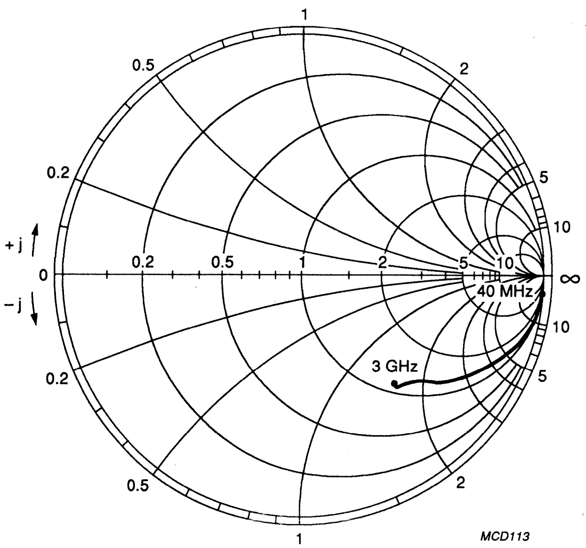
V_{CE} = 1 V; I_C = 1 mA.

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}).

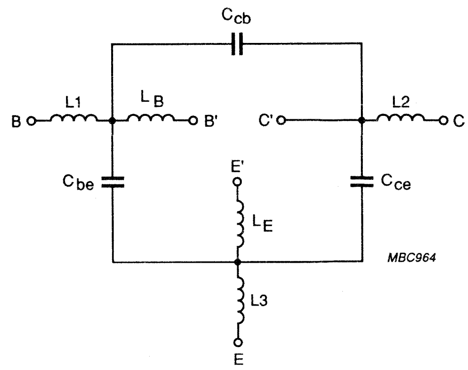


V_{CE} = 1 V; I_C = 1 mA.

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.

NPN 5 GHz wideband transistor BFT25A

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} 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	0.971	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.972	−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} (RAT)	Γ_{opt} (DEG)	R_n
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} 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	0.905	−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} (RAT)	Γ_{opt} (DEG)	R_n
500	2.5	0.81	3	2.4
1000	2.5	0.71	8	2.6
2000	3	0.69	25	1.7

UHF power transistor

BLT10

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in RF communications subscriber equipment at 1.8 GHz (DECT, PCN).

The transistor is encapsulated in a SOT103 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

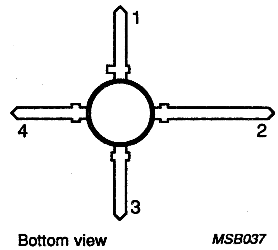


Fig.1 SOT103.

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 (%)
c.w. class-AB	1.8	6	300	≥ 5	≥ 45
	1.8	3	200	≥ 4.5	≥ 65

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		–	250	mA
$I_{C(AV)}$	average collector current		–	250	mA
P_{tot}	total power dissipation	T_s = 135 °C; (note 1) f > 1 MHz	–	1	W
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	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	T_s = 135 °C; (note 1) P_{tot} = 1 W	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	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} = 10 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	–	1.7	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	1.1	–	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 (%)
c.w. class-AB	1.8	6	1	300	> 5 typ. 5.5	> 45 typ. 50
	1.8	3	1	200	> 4.5 typ. 5	> 65 typ. 70

Ruggedness in class-AB operation

The BLT10 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.8 GHz and a duty cycle of 1:8.

UHF power transistor BLT11

DESCRIPTION

NPN silicon planar epitaxial transistor primarily designed for common emitter class-AB operation in RF communications subscriber equipment at 1.8 GHz (DECT, PCN).

The transistor is encapsulated in a SOT103 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base

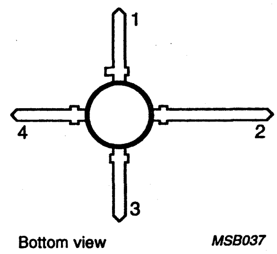


Fig.1 SOT103.

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 (%)
c.w. class-AB	1.8	6	600	≥ 5	≥ 50
	1.8	3	400	≥ 4	≥ 65

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		–	500	mA
$I_{C(AV)}$	average collector current		–	500	mA
P_{tot}	total power dissipation	T_s = 115 °C; (note 1) f > 1 MHz	–	2	W
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	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	T_s = 115 °C; (note 1) P_{tot} = 2 W	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
$V_{(BR)CBO}$	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	2.5	–	–	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	25	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	2.9	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 6 V; f = 1 MHz	–	2.1	–	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 (%)
c.w. class-AB	1.8	6	2	600	> 4.5 typ. 5.5	> 50 typ. 55
	1.8	3	2	400	> 4 typ. 4.5	> 65 typ. 70

Ruggedness in class-AB operation

The BLT11 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, at rated output power under pulsed conditions, up to a supply voltage of 8 V, f = 1.8 GHz and a duty cycle of 1:8.

UHF power transistor | BLT50

FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT223 surface mounted envelope and designed primarily for use in hand-held radio equipment in the 470 MHz communications band.

PINNING - SOT223

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

RF performance at $T_S \leq 60$ °C in a common emitter class-B test circuit (see note 1).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	470	7.5	1.2	> 10	> 55

Note

1. T_S = temperature at soldering point of collector tab.

PIN CONFIGURATION

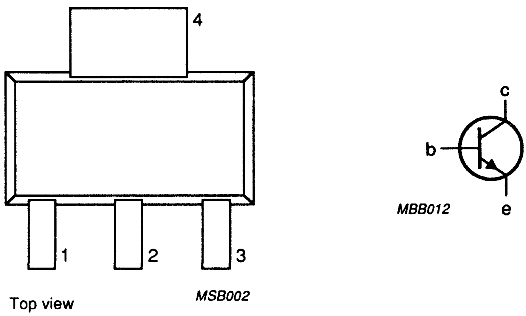


Fig.1 Simplified outline and symbol.

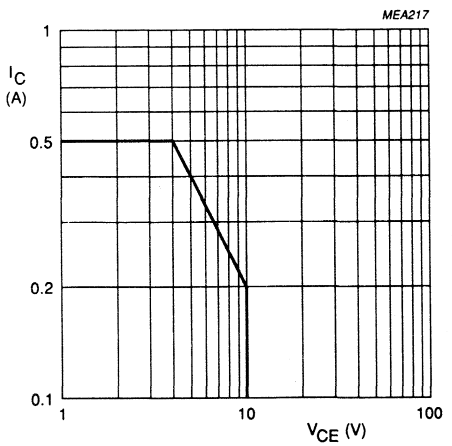
LIMITING VALUES

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	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	500	mA
I_{CM}	collector current	peak value f > 1 MHz	–	1.5	A
P_{tot}	total power dissipation	f > 1 MHz; T_S = 103 °C (note 1)	–	2	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		–	175	°C

Note

1. T_S = temperature at soldering point of collector tab.



T_S = 103 °C.

Fig.2 DC SOAR.

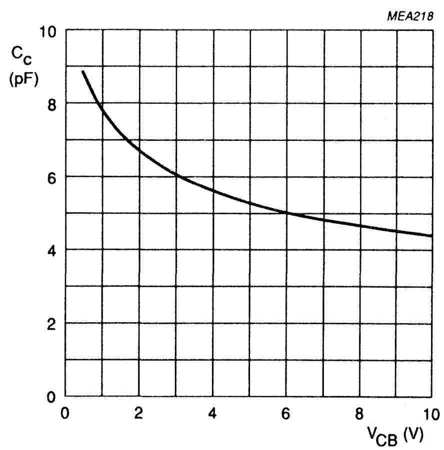
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	P_{tot} = 2 W; T_s = 103 °C	36	K/W

CHARACTERISTICS

$T_j = 25\ °C$.

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
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 1$ mA	3	–	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 10$ V	–	–	250	μA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 300$ mA	25	–	–	
E_{SBR}	second breakdown energy	L = 25 mH; $R_{BE} = 10\ \Omega$; f = 50 Hz	0.55	–	–	mJ
C_c	collector capacitance	$V_{CB} = 7.5$ V; $I_E = I_e = 0$; f = 1 MHz	–	4.7	6	pF
C_{re}	feedback capacitance	$V_{CE} = 7.5$ V; $I_C = 0$; f = 1 MHz	–	2.9	4.5	pF



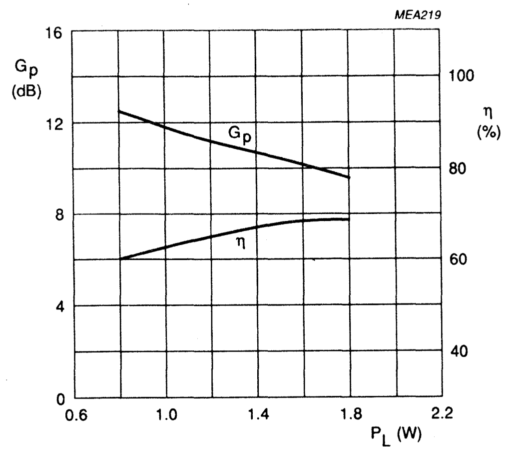
$I_E = i_e = 0$; f = 1 MHz.

Fig.3 Collector capacitance as a function of collector-base voltage, typical values.

APPLICATION INFORMATION

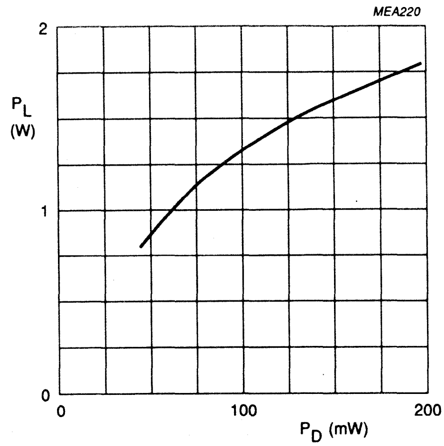
RF performance at $T_s \leq 60$ °C in a common emitter class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	470	7.5	1.2	> 10 typ. 11.2	> 55 typ. 65



$V_{CE} = 7.5$ V; f = 470 MHz.

Fig.4 Gain and efficiency as functions of load power, typical values.



$V_{CE} = 7.5$ V; f = 470 MHz.

Fig.5 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLT50 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 9 V, f = 470 MHz and $T_S \leq 60$ °C, where T_s is the temperature at the soldering point of the collector tab.

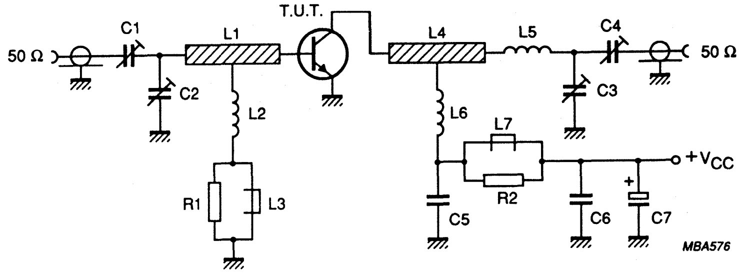


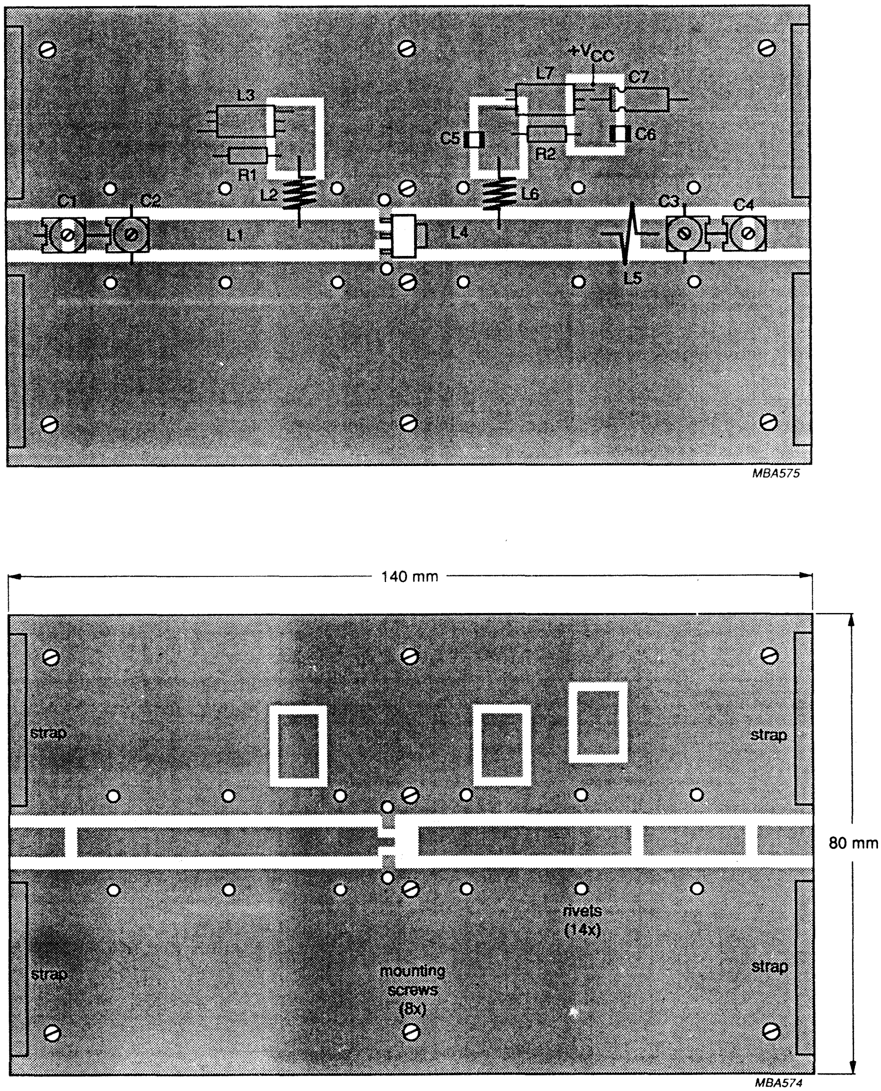
Fig.6 Class-B test circuit at f = 470 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09004
C2	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C3	film dielectric trimmer	2 to 9 pF		2222 809 09002
C4	film dielectric trimmer	2 to 9 pF		2222 809 09005
C5	multilayer ceramic chip capacitor (note 1)	100 pF		
C6	multilayer ceramic chip capacitor (note 1)	1 nF		
C7	63 V electrolytic capacitor	2.2 μF		
L1	stripline (note 2)	50 Ω	54 mm x 4.7 mm	
L2	5 turns enamelled 0.4 mm copper wire		int. dia. 3 mm	
L3, L7	grade 3B1 Ferroxcube wideband RF choke			4312 020 36640
L4	stripline (note 2)	50 Ω	36 mm x 4.7 mm	
L5	1 turn enamelled 1.4 mm copper wire	5 nH	int. dia. 4 mm	
L6	3 turns enamelled 0.4 mm copper wire		int. dia. 3 mm	
R1, R2	0.25 W metal film resistor	10 Ω, 5%		

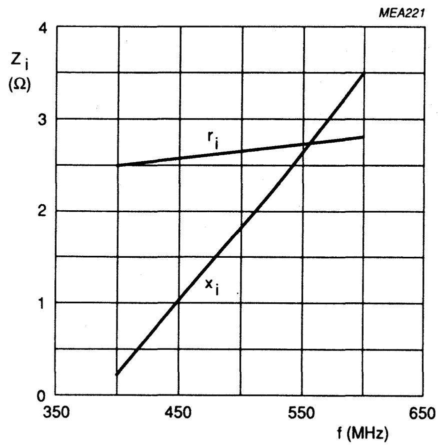
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.



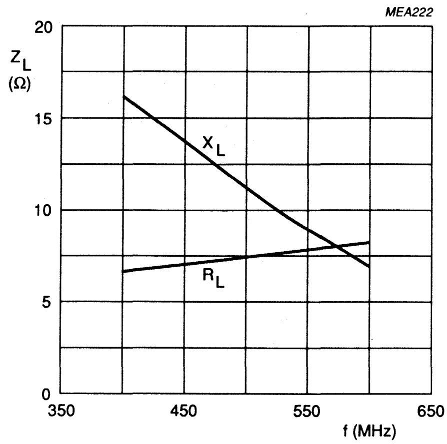
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.7 Component layout for 470 MHz class-B test circuit.



Class-B operation; V_{CE} = 7.5 V; P_L = 1.2 W.

Fig.8 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 7.5 V; P_L = 1.2 W.

Fig.9 Load impedance (series components) as a function of frequency, typical values.

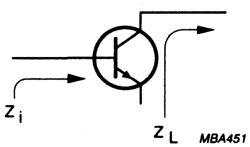
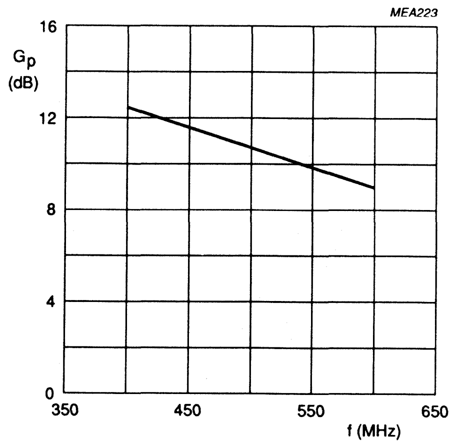


Fig.10 Definition of transistor impedance.



Class-B operation; V_{CE} = 7.5 V; P_L = 1.2 W.

Fig.11 Power gain as a function of frequency, typical values.

UHF power transistor — BLT80

FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor designed primarily for use in hand-held radio equipment in the 900 MHz communications band.

The transistor is encapsulated in a surface-mountable SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see note 1).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B narrow band	900	7.5	0.8	≥ 6	≥ 60

Note

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

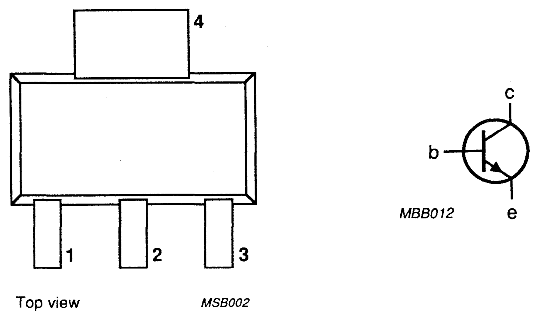


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

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

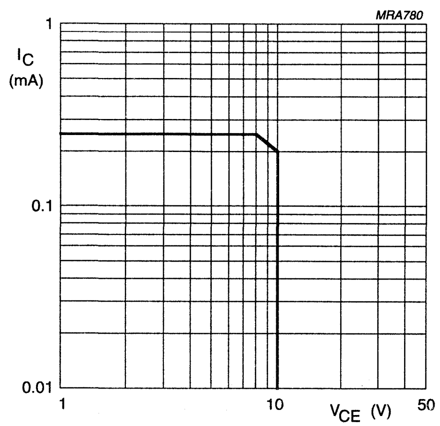
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC or average collector current		–	250	mA
I_{CM}	peak collector current	f > 1 MHz	–	750	mA
P_{tot}	total power dissipation	T_s = 131 °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
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	P_{dis} = 2 W; T_s = 131 °C (note 1)	22 K/W
$R_{th\ j\text{-}amb}$	from junction to ambient	P_{dis} = 2 W; T_{amb} = 25 °C (note 2)	85 K/W

Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. Mounted on a PCB measuring 40 x 40 x 1 mm, collector pad 35 x 17 mm.



T_s = 131 °C.

Fig.2 DC SOAR.

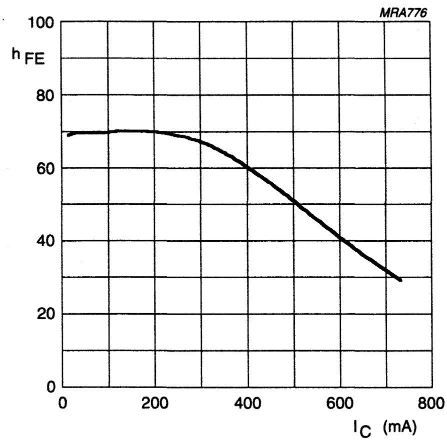
CHARACTERISTICS

$T_j = 25\ °C$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 2.5$ 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; $I_E = 0.5$ mA	3	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 10$ V	–	0.1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 150$ mA (note 1)	25	–	
C_c	collector capacitance	$V_{CB} = 7.5$ V; $I_E = I_e = 0$; f = 1 MHz	–	3.5	pF
C_{re}	feedback capacitance	$V_{CE} = 7.5$ V; $I_C = 0$; f = 1 MHz	–	2.5	pF

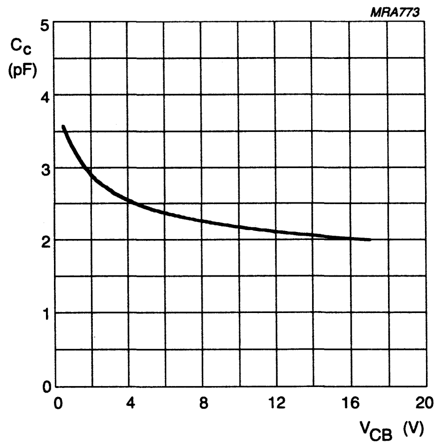
Note

1. Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0.02$.



$V_{CE} = 7.5$ V; $t_p \leq 200\ \mu s$; $\delta \leq 0.02$.

Fig.3 DC current gain as a function of collector current, typical values.



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

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

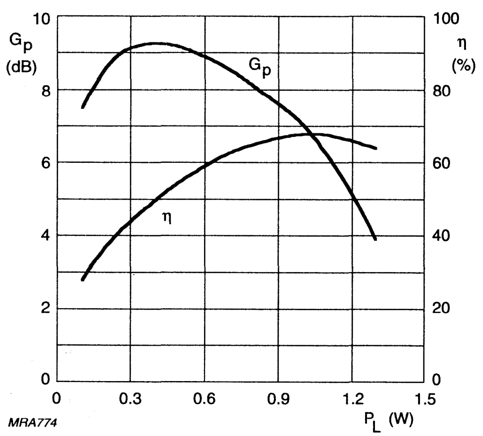
APPLICATION INFORMATION

RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see note 1.)

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B narrow band	900	7.5	0.8	≤ 6 typ. 8	> 60 typ. 67

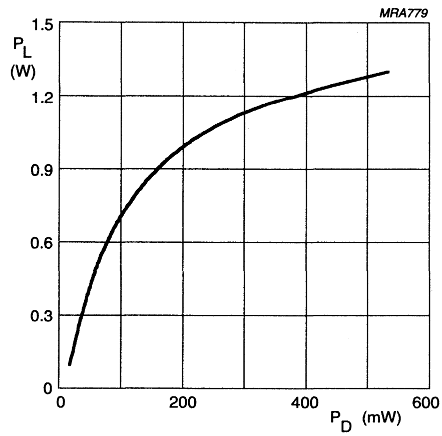
Note

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



Class-B operation; V_{CE} = 7.5 V; f = 900 MHz.

Fig.5 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 7.5 V; f = 900 MHz.

Fig.6 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLT80 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 9 V, f = 900 MHz and $T_s \leq 60$ °C, where T_s is the temperature at the soldering point of the collector tab.

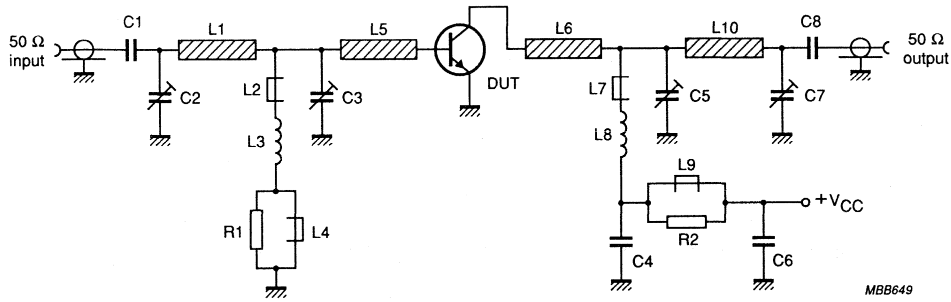


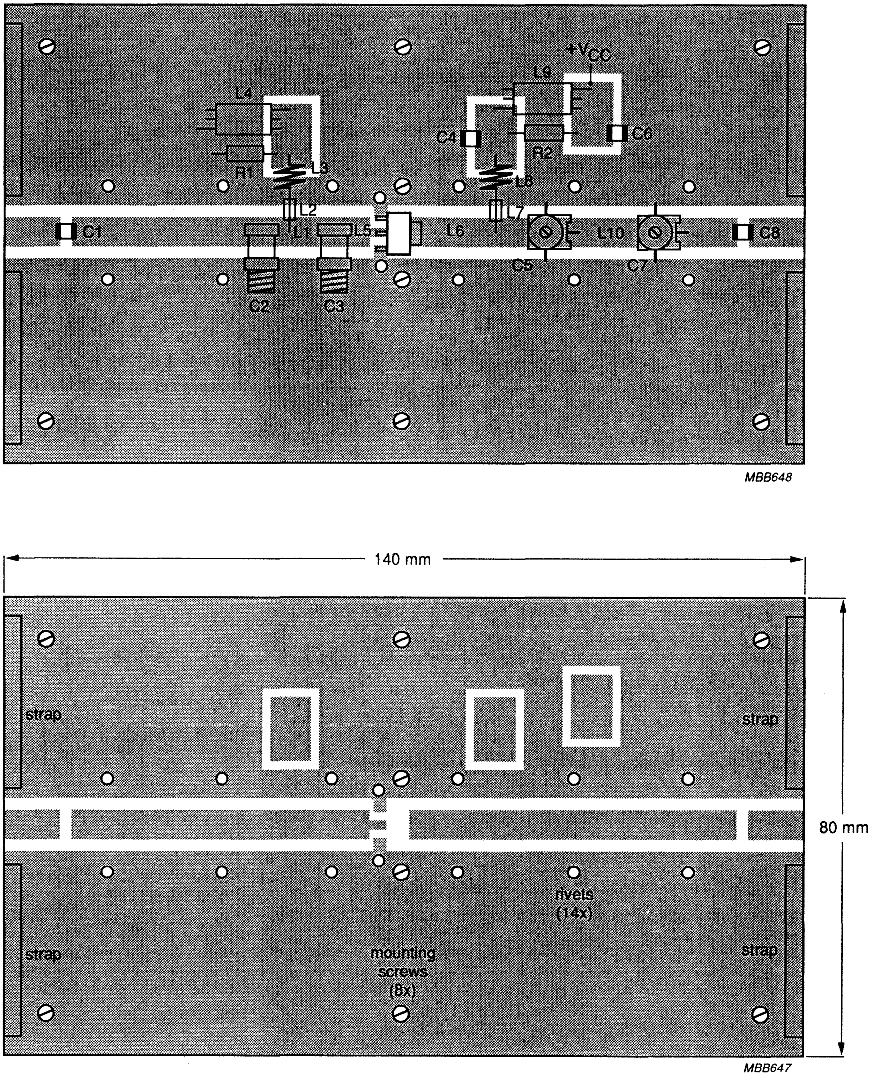
Fig.7 Class-B test circuit at f = 900 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8	multilayer ceramic chip capacitor (note 1)	100 pF		
C2, C3	type 9105 Voltronix KM10 trimmer	0.6 to 10 pF		
C4	multilayer ceramic chip capacitor (note 1)	220 pF		
C5, C7	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C6	multilayer ceramic chip capacitor (note 1)	1 nF		
L1	stripline (note 2)	50 Ω	length 13 mm width 4.85 mm	
L2, L7	1 turn 0.4 mm copper wire on grade 3B core			4330 030 32221
L3, L8	6 turns enamelled 0.8 mm copper wire		int. dia. 3 mm	
L4, L9	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L5	stripline (note 2)	50 Ω	length 8.4 mm width 4.85 mm	
L6	stripline (note 2)	50 Ω	length 20 mm width 4.85 mm	
L10	stripline (note 2)	50 Ω	length 21 mm width 4.85 mm	
R1, R2	metal film resistor	10 Ω, 0.25 W		

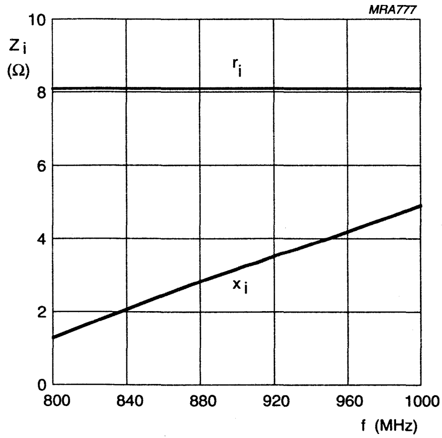
Notes

1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.



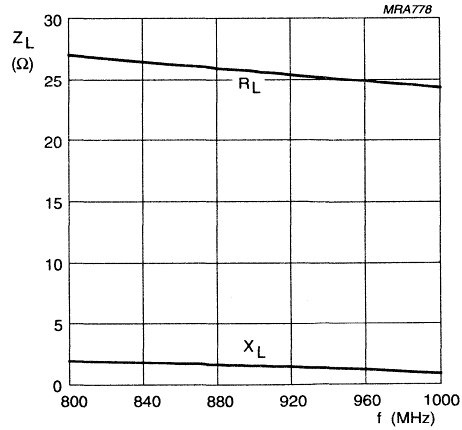
The components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws and copper straps under the emitter leads.

Fig.8 Printed circuit board and component layout for 900 MHz test circuit.



Class-B operation; V_{CE} = 7.5 V; P_L = 0.8 W; $T_s \leq 60$ °C.

Fig.9 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 7.5 V; P_L = 0.8 W; $T_s \leq 60$ °C.

Fig.10 Load impedance (series components) as a function of frequency, typical values.

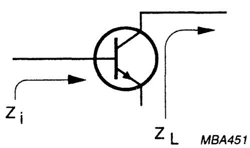
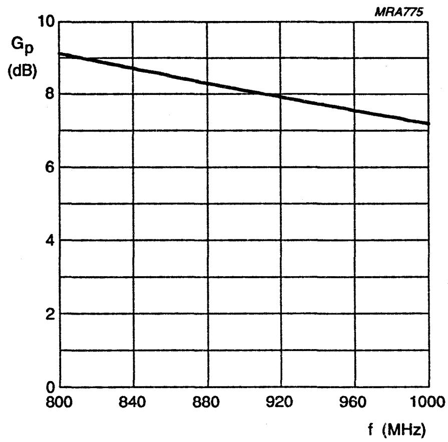


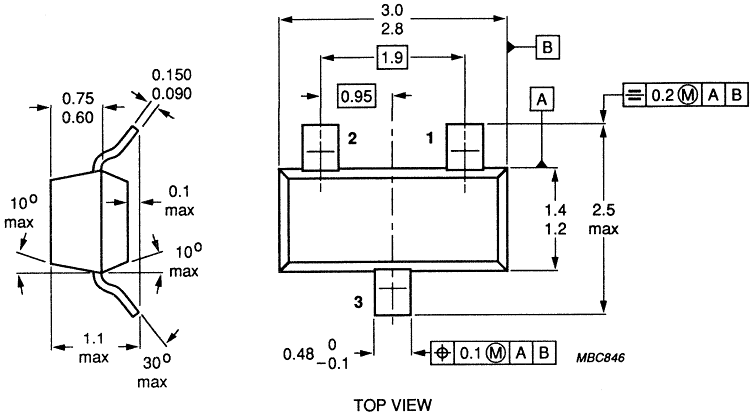
Fig.11 Definition of transistor impedance.



Class-B operation; V_{CE} = 7.5 V; P_L = 0.8 W; $T_s \leq 60$ °C.

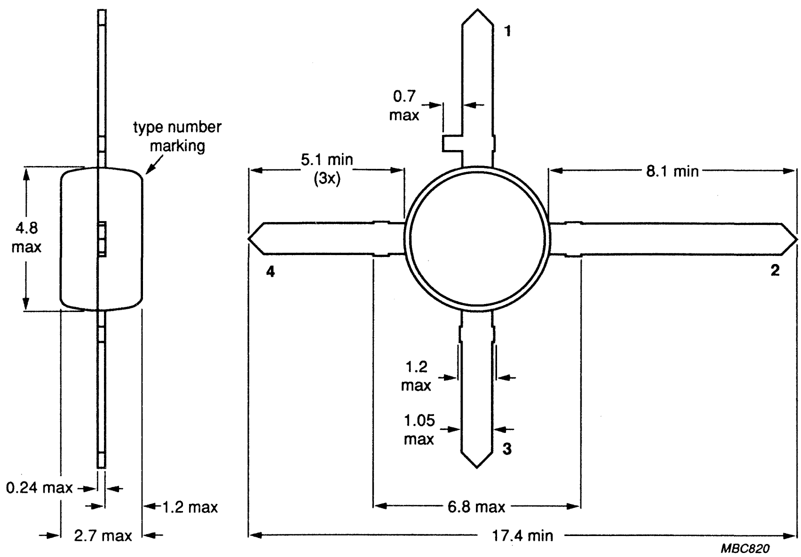
Fig.12 Power gain as a function of frequency, typical values.

OUTLINES



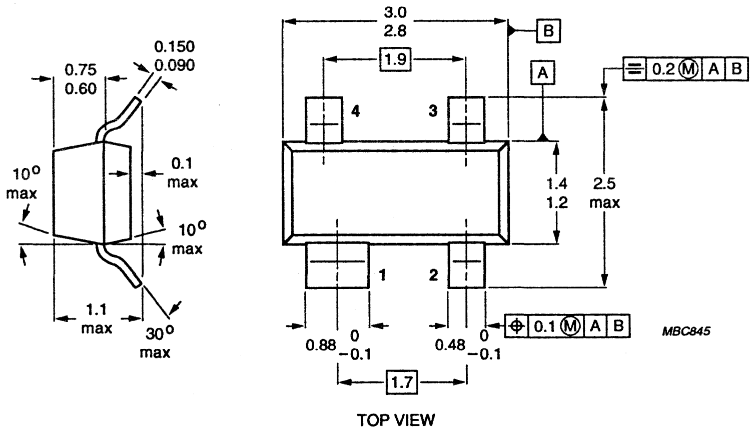
Dimensions in mm.

Fig.1 SOT23.



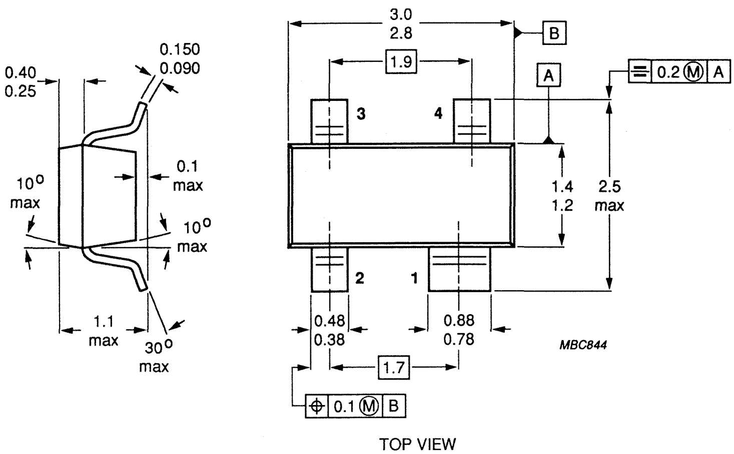
Dimensions in mm.

Fig.2 SOT103.



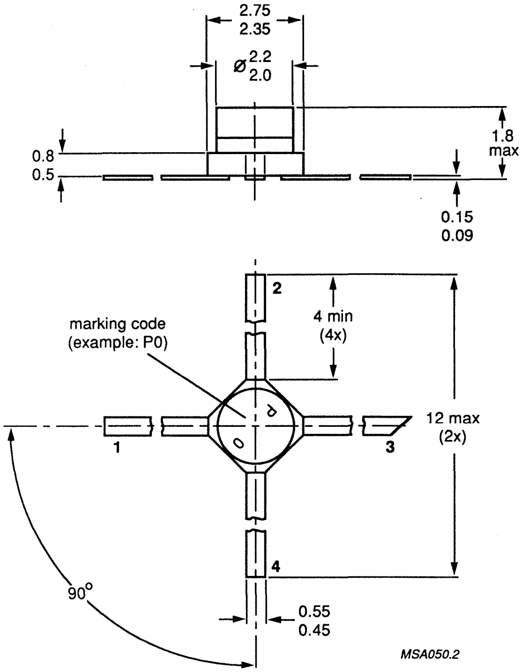
Dimensions in mm.

Fig.3 SOT143.



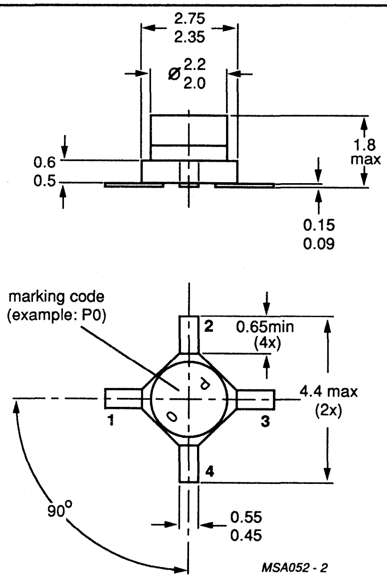
Dimensions in mm.

Fig.4 SOT143R.



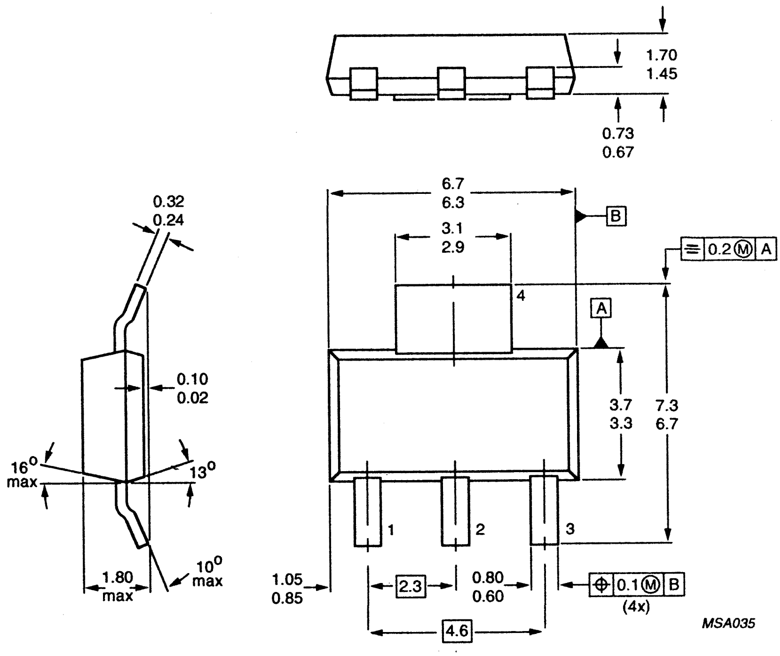
Dimensions in mm.

Fig.5 SOT173.



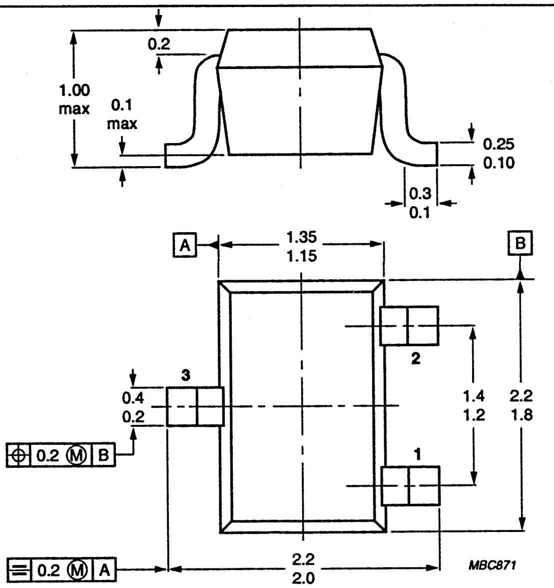
Dimensions in mm.

Fig.6 SOT173X.



Dimensions in mm.

Fig.7 SOT223.



Dimensions in mm.

Fig.8 SOT323.

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