Surface Mounted Semiconductors

DATA HANDBOOK

BOOK SC10a 1994

Philips Semiconductors

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QUALITY ASSURED

Our quality system focuses on the continuing high quality of our components and the best possible service for our customers. We have a three-sided quality strategy: we apply a system of total quality control and assurance; we operate customer-oriented dynamic improvement programmes; and we promote a partnering relationship with our customers and suppliers.

PRODUCT SAFETY

In striving for state-of-the-art perfection, we continuously improve components and processes with respect to environmental demands. Our components offer no hazard to the environment in normal use when operated or stored within the limits specified in the data sheet.

Some components unavoidably contain substances that, if exposed by accident or misuse, are potentially hazardous to health. Users of these components are informed of the danger by warning notices in the data sheets supporting the components. Where necessary the warning notices also indicate safety precautions to be taken and disposal instructions to be followed. Obviously users of these components, in general the set-making industry, assume responsibility towards the consumer with respect to safety matters and environmental demands.

All used or obsolete components should be disposed of according to the regulations applying at the disposal location. Depending on the location, electronic components are considered to be 'chemical', 'special' or sometimes 'industrial' waste. Disposal as domestic waste is usually not permitted.

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the 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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products or use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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PXT2222A	SOT89	npn	PH2222A	PXT2907A	1955
PXT2907	SOT89	pnp	PH2907	PXT2222	1959
PXT2907A	SOT89	pnp	PH2907A	PXT2222A	1959
PXT3904	SOT89	npn	2N3904	PXT3906	1963
PXT3906	SOT89	pnp	2N3906	PXT3904	1967
PXT4401	SOT89	npn	2N4401	PXT4403	1971
PXT4403	SOT89	pnp	2N4403	PXT4401	1975
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PXTA27	SOT89	npn	MPSA27	PXTA77	1981
PXTA64	SOT89	pnp	MPSA64	PXTA14	1983
PXTA77	SOT89	pnp	MPSA77	PXTA27	1985
PXTA92	SOT89	pnp	MPSA92	PXTA42	1987
PXTA93	SOT89	pnp	MPSA93	PXTA43	1987
PZT2222	SOT223	npn	PH2222	PZT2907	1989
PZT2222A	SOT223	npn	PH2222A	PZT2907A	1989
PZT2907	SOT223	pnp	PH2907	PZT2222	1993
PZT2907A	SOT223	pnp	PH2907A	PZT222A	1993
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PZT3906	SOT223	pnp	2N3906	PZT3904	2001
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PZTA06	SOT223	npn	MPSA06	PZTA56	2005
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PZTA43	SOT223	npn	MPSA43	PZTA93	2011
PZTA44	SOT223	npn	MPSA44	–	2015
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PZTA55	SOT223	pnp	MPSA55	PZTA05	2019
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1PS193	SC59	diode	1N4148		2035
1PS226	SC59	diode	1N4148 (double)		2039
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2PD601/601A	SC59	npn	BC547	2PB709/709A	2057
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SELECTION GUIDE

GENERAL PURPOSE TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
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NPN												
BC817	45	45	500	250	100	600	100	1	0.7	500/50	200	315
BC817W	–	45	500	200	100	600	100	1	0.7	500/50	100	319
BC818	25	25	500	250	100	600	100	1	0.7	500/50	200	315
BC818W	–	25	500	200	100	600	100	1	0.7	500/50	100	319
BC846	65	65	100	250	220	800	2	5	0.25	10/0.5	300	323
BC846W	80	65	100	200	110	450	2	5	0.6	100/5	100	329
BC847	45	45	100	250	220	800	2	5	0.25	10/0.5	300	323
BC847W	50	45	100	200	110	800	2	5	0.6	100/5	100	329
BC848	30	30	100	250	220	800	2	5	0.25	10/0.5	300	323
BC848W	30	30	100	200	110	800	2	5	0.6	100/5	100	329
BC868	20	20	1000	1000	85	375	500	1	0.5	1000/100	60	363
BCP54	45	45	1000	1500	40	250	150	2	0.5	500/50	130	399
BCP55	60	60	1000	1500	40	250	150	2	0.5	500/50	130	399
BCP56	100	80	1000	1500	40	250	150	2	0.5	500/50	130	399
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BCV27	40	30	300	250	20000	–	100	5	1.0	100/0.1	220	417
BCV29	40	30	500	1000	20000	–	100	5	1.0	100/0.1	220	421
BCV47	80	60	500	250	4000	–	10	5	1.0	100/0.1	220	417
BCV49	80	60	500	1000	10000	–	100	5	1.0	100/0.1	220	421
BCV71	80	60	100	250	110	220	2	5	0.25	10/0.5	300	441
BCV72	80	60	100	250	200	450	2	5	0.25	10/0.5	300	441
BCW31	32	32	100	250	110	220	2	5	0.25	10/0.5	300	449
BCW32	32	32	100	250	200	450	2	5	0.25	10/0.5	300	449
BCW33	32	32	100	250	420	800	2	5	0.25	10/0.5	300	449
BCW60A	32	32	200	250	120	220	2	5	0.35	10/0.25	250	455
BCW60B	32	32	200	250	180	310	2	5	0.35	10/0.25	250	455
BCW60C	32	32	200	250	250	460	2	5	0.35	10/0.25	250	455
BCW60D	32	32	200	250	380	630	2	5	0.35	10/0.25	250	455
BCW71	50	45	100	250	110	220	2	5	0.25	10/0.5	300	469
BCW72	50	45	100	250	220	450	2	5	0.25	10/0.5	300	469
BCW81	50	45	100	250	450	800	2	5	0.25	10/0.5	300	475
BCX19	50	45	500	250	100	600	100	1	0.62	500/50	200	483
BCX20	30	25	500	250	100	600	100	1	0.62	500/50	200	483
BCX54	45	45	1000	1000	45	250	150	2	0.5	500/50	130	491
BCX55	60	60	1000	1000	40	160	150	2	0.5	500/50	130	491

GENERAL PURPOSE TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN *(Continued)*												
BCX56	100	80	1000	1000	40	160	150	2	0.5	500/50	130	491
BCX70G	45	45	200	250	120	220	2	5	0.35	10/0.25	250	495
BCX70H	45	45	200	250	180	310	2	5	0.35	10/0.25	250	495
BCX70J	45	45	200	250	250	460	2	5	0.35	10/0.25	250	495
BCX70K	45	45	200	250	380	630	2	5	0.35	10/0.25	250	495
BSP40	70	60	1000	1500	40	120	100	5	0.25	150/15	100	1401
BSP41	70	60	1000	1500	100	300	100	5	0.25	150/15	100	1401
BSP42	90	80	1000	1500	40	120	100	5	0.25	150/15	100	1401
BSP43	90	80	1000	1500	100	300	100	5	0.25	150/15	100	1401
PMBT4401	60	40	600	250	100	300	150	1	0.75	500/50	250	1843
PMBT6428	60	50	200	350	250	650	–	–	0.2	10/0.5	300	1861
PMBT6429	55	45	200	350	500	1250	–	–	0.2	10/0.5	300	1861
PMBTA05	60	60	500	300	50	–	10	1	0.25	100/10	100	1865
PMBTA06	80	80	500	300	50	–	10	1	0.25	100/10	100	1865
PMBTA13	30	30	300	300	5000	–	10	5	1.5	100/0.1	125	1867
PMBTA14	30	30	300	300	10000	–	10	5	1.5	100/0.1	125	1867
PXT4401	60	40	600	1000	100	300	150	1	0.75	500/50	250	1971
PXTA14	30	30	300	1000	20000	–	100	5	1.5	100/0.1	125	1979
PXTA27	–	60	500	1000	10000	–	100	5	1.5	100/0.1	125	1981
PZTA05	60	60	500	1500	50	–	100	1	0.25	100/10	100	2005
PZTA06	80	80	500	1500	50	–	100	1	0.25	100/10	100	2005
PZTA13	30	30	300	1500	5000	–	10	5	1.5	100/0.1	125	2009
PZTA14	30	30	300	1500	10000	–	10	5	1.5	100/0.1	125	2009
2PD601	30	25	100	200	160	460	2	10	0.5	100/10	100	2057
2PD601A	60	50	100	200	160	460	2	10	0.5	100/10	100	2057
2PD602	30	25	500	200	85	340	150	10	0.6	300/30	150	2061
2PD602A	60	50	500	200	85	340	150	10	0.6	300/30	150	2061
PNP												
BC807	45	45	500	250	100	600	100	1	0.7	500/50	100	307
BC807W	–	45	500	200	100	600	100	1	0.7	500/50	80	311
BC808	25	25	500	250	100	600	100	1	0.7	500/50	100	307
BC808W	–	25	500	200	100	600	100	1	0.7	500/50	80	311
BC856	65	65	100	250	75	475	2	5	0.3	10/0.5	150	343
BC856W	80	65	100	200	125	800	2	5	0.65	100/5	100	349
BC857	45	45	100	250	75	800	2	5	0.3	10/0.5	150	343

GENERAL PURPOSE TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP *(Continued)*												
BC857W	50	45	100	200	125	800	2	5	0.65	100/5	100	349
BC858	30	30	100	250	75	800	2	5	0.3	10/0.5	150	343
BC858W	30	30	100	200	125	800	2	5	0.65	100/5	100	349
BC869	20	20	1000	1000	85	375	500	1	0.5	1000/100	60	369
BCP51	45	45	1000	1500	40	250	150	2	0.5	500/50	50	395
BCP52	60	60	1000	1500	40	250	150	2	0.5	500/50	50	395
BCP53	100	80	1000	1500	40	250	150	2	0.5	500/50	50	395
BCP69	–	25	1000	1500	85	375	500	1	0.5	1000/100	60	409
BCV26	40	30	250	350	20000	–	100	5	1.0	100/0.1	220	415
BCV28	40	30	500	1000	20000	–	100	5	1.0	100/0.1	220	419
BCV46	80	60	250	300	4000	–	10	5	1.0	100/0.1	220	415
BCV48	80	60	500	1000	10000	–	100	5	1.0	100/0.1	220	419
BCW29	32	32	100	250	120	260	2	5	0.3	10/0.5	150	443
BCW30	32	32	100	250	215	500	2	5	0.3	10/0.5	150	443
BCW61A	32	32	200	250	120	220	2	5	0.25	10/0.25	180	459
BCW61B	32	32	200	250	180	310	2	5	0.25	10/0.25	180	459
BCW61C	32	32	200	250	250	460	2	5	0.25	10/0.25	180	459
BCW61D	32	32	200	250	380	630	2	5	0.25	10/0.25	180	459
BCW69	50	45	100	250	120	260	2	5	0.3	10/0.5	150	463
BCW70	50	45	100	250	120	500	2	5	0.3	10/0.5	150	463
BCW89	80	60	100	250	120	260	2	5	0.3	10/0.5	150	477
BCX17	50	45	500	250	100	600	100	1	0.62	500/50	100	479
BCX18	30	25	500	250	100	600	100	1	0.62	500/50	100	479
BCX51	45	45	1000	1000	40	250	150	2	0.5	500/50	50	487
BCX52	60	60	1000	1000	40	160	150	2	0.5	500/50	50	487
BCX53	100	80	1000	1000	40	160	150	2	0.5	500/50	50	487
BCX71G	45	45	200	250	120	220	2	5	0.25	10/0.25	180	499
BCX71H	45	45	200	250	180	310	2	5	0.25	10/0.25	180	499
BCX71J	45	45	200	250	250	460	2	5	0.25	10/0.25	180	499
BCX71K	45	45	200	250	380	630	2	5	0.25	10/0.25	180	499
BSP30	70	60	1000	1500	40	120	100	5	0.25	150/15	100	1397
BSP31	70	60	1000	1500	100	300	100	5	0.25	150/15	100	1397
BSP32	90	80	1000	1500	40	120	100	5	0.25	150/15	100	1397
BSP33	90	80	1000	1500	100	300	100	5	0.25	150/15	100	1397
PMBT4403	40	40	600	250	100	300	150	2	0.75	500/50	200	1847

GENERAL PURPOSE TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP *(Continued)*												
PMBTA55	60	60	500	250	50	–	10	1	0.25	100/10	50	1873
PMBTA56	80	80	500	250	50	–	10	1	0.25	100/10	50	1873
PMBTA63	30	30	500	250	5000	–	10	5	1.5	100/0.1	125	1875
PMBTA64	30	30	500	250	5000	–	10	5	1.5	100/0.1	125	1875
PXT4403	40	40	600	1000	100	300	150	2	0.4	150/15	200	1975
PXTA64	30	30	300	1000	20000	–	100	5	1.5	100/0.1	125	1983
PXTA77	-	60	500	1000	10000	–	100	5	1.5	100/0.1	125	1985
PXTA92	300	300	500	1500	40	–	10	10	0.5	20/2	50	1987
PXTA93	200	200	500	1500	40	–	10	10	0.5	20/2	50	1987
PZTA55	60	60	500	1500	50	–	100	1	0.25	100/10	50	2019
PZTA56	80	80	500	1500	50	–	100	1	0.25	100/10	50	2019
PZTA63	30	30	500	1500	10000	–	100	5	1.5	100/0.1	125	2023
PZTA64	30	30	500	1500	10000	–	100	5	1.5	100/0.1	125	2023
2PB709	25	25	100	200	160	460	2	10	0.5	100/10	80	2049
2PB709A	45	45	100	200	160	460	2	10	0.5	100/10	80	2049
2PB710	30	25	500	200	85	340	150	10	0.6	300/30	150	2053
2PB710A	60	50	500	200	85	30	150	10	0.6	300/30	150	2053

HIGH-FREQUENCY TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	F typ. (dB)	at f (MHz)	f_T typ. (MHz)	C_{re} typ (pF)	
NPN													
BF570	40	15	100	250	40	–	10	1	–	–	>490	1.6	545
BF840	40	40	25	250	–	–	–	–	–	–	380	0.3	601
BF841	40	40	25	250	–	–	–	–	–	–	380	0.3	601
BFQ166	20	10	500	2000	50	60	300	5	–	–	1000	–	1017
BFS18	30	20	20	250	35	125	1	10	4	100	200	0.85	1191
BFS19	30	20	30	250	65	225	1	10	4	100	260	0.85	1191
BFS20	30	20	25	250	40	85	7	10	–	–	450	–	1197
BLT50	20	10	500	2000	25	–	300	5	–	–	–	2.9	1333
BLT80	20	10	250	2000	25	–	150	5	–	–	–	2.5	1341
BLT81	20	9.5	500	2000	25	–	300	5	–	–	–	1.7	1349
BLU56	36	16	200	2000	25	–	150	10	–	–	–	1.2	1357
BLU86	32	16	200	2000	25	–	150	10	–	–	–	1.2	1365
PNP													
BF550	40	40	25	250	50	–	1	10	2	0.1	325	0.5	535
BF660	40	30	25	250	30	–	3	10	–	–	650	0.65	557
BF824	30	30	25	250	–	–	–	–	3	100	450	0.1	595
BFQ256	100	65	300	2000	20	30	50	10	–	–	1300	–	1021

BROADBAND TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	d_{im} typ. (dB)	at f (MHz)	f_T typ. (GHz)	C_{re} typ. (pF)	
NPN													
BF547W	30	20	50	300	40	250	2	10	–	–	1.2	1	533
BF747	30	20	50	150	40	250	2	10	–	–	1.2	0.5	567
BF749	20	15	25	300	90	90	15	10	–	–	5	0.35	579
BF750	15	12	35	300	90	90	30	5	–	–	7	0.6	581
BF752	15	12	35	300	90	90	30	5	–	–	7	0.6	583
BF753	15	10	35	300	30	200	3	5	–	–	5	0.65	585
BFG16A	40	25	150	1000	25	–	50	5	–	–	1.5	1.8	671
BFG17A	25	15	50	300	20	–	2	1	60	793.25	2.8	0.6	679
BFG25AX	8	5	6.5	32	50	200	0.5	1	–	–	5	0.22	687
BFG33	9	7	20	300	50	–	14	5	–	–	12	–	709
BFG33X	9	7	20	300	50	–	14	5	–	–	12	–	709
BFG35	25	18	150	1000	25	–	100	10	60	793.25	4	1.2	723
BFG67	20	10	50	300	60	100	15	5	–	–	7.5	0.5	743
BFG67X	20	10	50	300	60	–	15	5	–	–	7.5	0.5	743
BFG92A	20	15	25	300	40	–	14	10	–	–	5	0.35	763
BFG92AX	20	15	25	300	40	–	14	10	–	–	5	0.35	763
BFG93A	15	12	35	300	40	–	30	5	–	–	6	0.6	783
BFG93AX	15	12	35	300	40	–	30	5	–	–	6	0.6	783
BFG94	15	12	60	700	45	–	30	5	60	793.25	6	0.5	801
BFG97	20	15	100	1000	25	–	70	10	60	793.25	5.5	1.0	815
BFG135	25	15	150	1000	80	–	100	10	60	793.25	7.0	1.2	829
BFG197	20	10	100	300	40	–	50	5	–	–	7.5	0.85	843
BFG197X	20	10	100	300	40	–	50	5	–	–	7.5	0.85	843
BFG198	20	10	100	1000	40	–	50	5	60	793.25	8.0	0.8	863
BFG505	20	15	18	150	60	250	5	6	–	–	9	0.2	875
BFG505X	20	15	18	150	60	250	5	6	–	–	9	0.2	875
BFG505XR	20	15	18	150	60	250	5	6	–	–	9	0.2	875
BFG520	20	15	70	300	60	250	20	6	–	–	9	0.3	897
BFG520X	20	15	17	300	60	250	20	6	–	–	9	0.3	897
BFG505XR	20	15	70	300	60	250	20	6	–	–	9	0.3	897
BFG540	20	15	120	500	60	250	40	8	–	–	9	0.5	919
BFG540X	20	15	120	500	60	250	40	8	–	–	9	0.5	919
BFG540XR	20	15	120	500	60	250	40	8	–	–	9	0.5	919
BFG541	20	15	120	650	60	250	40	8	–	–	9	0.7	941
BFQ17	40	25	150	1000	25	–	150	5	–	–	1.2	1.9	963

BROADBAND TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	d_{im} typ. (dB)	at f (MHz)	f_T typ. (GHz)	C_{re} typ. (pF)	
NPN *(Continued)*													
BFQ18A	25	15	150	1000	25	–	100	10	60	793.25	3.6	1.2	967
BFQ19	20	15	75	500	25	–	75	10	–	–	5.0	1.3	971
BFQ67	20	10	50	180	100	–	15	5	–	–	7.5	0.5	975
BFQ67W	20	10	50	300	60	–	15	5	–	–	8	0.5	993
BFR53	18	10	50	250	25	–	50	5	60	217	2.0	0.9	1059
BFR92	20	15	25	200	25	–	14	10	60	493.25	5.0	0.7	1065
BFR92A	20	15	25	200	40	–	14	10	60	793.25	5.0	0.35	1075
BFR92AW	20	15	25	300	40	–	15	10	–	–	5	–	1089
BFR93	15	12	35	200	25	–	30	5	60	493.25	5.0	0.8	1091
BFR93A	15	12	35	250	40	–	30	5	60	793.25	5.0	0.6	1099
BFR93AW	15	12	35	300	40	–	30	5	–	–	6	–	1115
BFR106	20	15	100	350	–	–	–	–	–	–	3.7	1.2	1119
BFR505	20	15	18	150	60	250	5	6	–	–	9	–	1131
BFR520	20	15	70	300	60	250	20	6	–	–	9	0.4	1153
BFR541	20	15	120	650	60	250	40	8	–	–	9	0.5	1175
BFS17	25	15	25	250	20	150	2	1	45	217	1.3	0.65	1177
BFS17A	25	15	25	300	20	150	2	1	–	–	2.8	0.6	1181
BFS17W	25	15	50	300	25	–	2	1	–	–	1.6	0.65	1189
BFS25A	8	5	6.5	32	50	200	0.5	1	–	–	5	0.3	1203
BFS505	20	15	18	150	60	250	5	6	–	–	9	0.3	1223
BFS520	20	15	70	300	60	250	20	6	–	–	9	0.4	1245
BFS540	20	15	120	500	60	250	40	8	–	–	9	0.6	1267
BFT25	8	5	2.5	50	20	–	1	1	–	–	2.3	0.45	1289
BFT25A	8	5	6.5	50	–	–	–	–	–	–	5	0.22	1295
PNP													
BFG31	20	15	100	1000	25	–	100	10	60	848.25	5	1.6	703
BFG55	25	18	150	1000	25	–	100	10	60	848.25	4	1.7	737
BFQ149	20	15	75	1000	20	–	50	10	–	–	4.2	1.7	1013
BFT92	20	15	25	200	20	–	14	10	60	493.25	5	0.7	1319
BFT92W	20	15	35	300	20	–	15	10	–	–	5	0.7	1325
BFT93	15	12	35	200	20	–	30	5	60	493.25	5	1.0	1326
BFT93W	15	12	50	300	20	–	30	5	–	–	5	1	1332

SWITCHING TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	t_{on}/t_{off} max. (ns)	at I_C/I_B (mA)	
NPN													
BSP50	60	45	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1405
BSP51	80	60	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1405
BSP52	90	80	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1405
BSR13	60	30	800	250	100	300	150	10	1.6	500/50	35/285	150/–	1511
BSR14	75	40	800	250	100	300	150	10	1.0	500/50	–	–	1511
BSR17A	60	40	200	250	100	300	10	1	0.3	50/5	70/250	10/1	1519
BSR40	70	60	1000	1000	40	120	100	5	0.5	500/50	250/1000	100/5	1539
BSR41	70	60	1000	1000	100	300	100	5	0.5	500/50	250/1000	100/5	1539
BSR42	90	80	1000	1000	40	120	100	5	0.5	500/50	250/1000	100/5	1539
BSR43	90	80	1000	1000	100	300	100	5	0.5	500/50	250/1000	100/5	1539
BSS64	120	80	100	250	20	80	10	1	0.2	50/15	–/1000	15/1	1553
BST50	60	45	500	1000	1000	–	150	10	1.3	500/50	400/1500	500/0.5	1587
BST51	80	60	500	1000	1000	–	150	10	1.3	500/50	400/1500	500/0.5	1587
BST52	90	80	500	1000	1000	–	150	10	1.3	500/50	400/1500	500/0.5	1587
BSV52	20	12	100	250	40	120	10	1	0.2	50/5	12/18	10/3	1619
PMBT2222	60	30	600	250	100	300	150	10	0.4	150/15	10/225	150/–	1823
PMBT2222A	75	40	600	250	100	300	150	10	0.3	150/15	10/225	150/–	1823
PMBT2369	40	40	500	250	40	120	10	1	0.25	10/1	12/18	10/3	1827
PMBT3904	60	40	200	300	100	300	10	1	0.3	50/5	35/200	10/1	1835
PMBTH10	30	25	40	400	60	–	4	10	0.5	4/0.4	–	–	1879
PXT2222	60	30	600	1000	100	300	150	10	0.4	150/15	10/225	150/15	1955
PXT2222A	75	40	600	1000	100	300	150	10	0.4	150/15	10/225	150/15	1955
PXT3904	60	40	200	1000	100	300	10	1	0.3	50/5	35/200	10/1	1963
PZT2222	60	30	600	1500	100	300	150	10	0.4	150/15	–	–	1989
PZT2222A	75	40	600	1500	100	300	150	10	0.3	150/10	10/225	150/15	1989
PZT3904	60	40	200	1500	100	300	10	1	0.3	10/1	35/200	10/1	1997
PNP													
BSP60	60	45	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1409
BSP61	80	60	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1409
BSP62	90	80	500	1500	2000	–	500	10	1.3	500/0.5	400/1500	500/0.5	1409
BSR12	15	15	100	250	30	120	50	1	0.45	100/10	20/30	30/3	1505
BSR15	60	40	600	250	100	300	150	10	1.6	500/50	45/100	150/15	1515
BSR16	60	60	600	250	100	300	150	10	1.6	500/50	45/100	150/15	1515
BSR18A	40	40	200	250	100	300	10	1	0.4	50/5	70/300	10/1	1523

SWITCHING TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ max. (V)	at I_C/I_B (mA)	t_{on}/t_{off} max. (ns)	at I_C/I_B (mA)	
PNP *(Continued)*													
BSR30	70	60	1000	1000	40	120	100	5	0.5	500/50	500/650	100/5	1535
BSR31	70	60	1000	1000	100	300	100	5	0.5	500/50	500/650	100/5	1535
BSR32	90	80	1000	1000	40	120	100	5	0.5	500/50	500/650	100/5	1535
BSR33	90	80	1000	1000	100	300	100	5	0.5	500/50	500/650	100/5	1535
BSS63	110	100	100	250	30	–	25	1	0.25	25/2.5	–	–	1547
BST60	60	45	500	1000	1000	–	150	10	1.3	500/0.5	400/1500	500/0.5	1591
BST61	80	60	500	1000	1000	–	150	10	1.3	500/0.5	400/1500	500/0.5	1591
BST62	90	80	500	1000	1000	–	150	10	1.3	500/0.5	400/1500	500/0.5	1591
PMBT2907	60	40	600	250	30	50	500	10	0.4	150/15	45/100	150/15	1829
PMBT2907A	60	60	600	250	30	50	500	10	0.4	150/15	45/100	150/15	1829
PMBT3640	12	12	80	350	30	120	10	0.3	0.25	10/1	25/35	50/50	1833
PMBT3906	40	40	200	250	100	300	10	1	0.25	10/1	35/225	10/1	1839
PMBTH81	20	20	40	400	60	–	5	10	0.5	5/0.5	–	–	1883
PXT2907	60	40	600	1000	100	300	150	10	0.4	150/10	45/100	150/15	1959
PXT2907A	60	60	600	1000	100	300	150	10	0.4	150/10	45/100	150/15	1959
PXT3906	40	40	200	1000	100	300	10	1	0.25	10/1	35/225	10/1	1967
PZT2907	60	40	600	1500	100	300	150	10	0.4	150/15	45/100	150/15	1993
PZT2907A	60	60	600	1500	100	300	150	10	0.4	150/15	45/100	150/15	1993
PZT3906	40	40	200	1500	100	300	10	1	0.4	50/5	35/225	10/1	2001

LOW-NOISE TRANSISTORS (F > 4 dB at f = 1 kHz; B = 200 Hz) (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BC849	30	30	100	250	–	800	2	5	0.25	10/0.5	300	333
BC849W	30	30	100	200	200	800	2	5	0.6	100/5	100	339
BC850	45	45	100	250	–	800	2	5	0.25	10/0.5	300	333
BC850W	45	45	100	200	200	800	2	5	0.6	100/5	100	339
BCF32	32	32	100	250	200	450	2	5	0.25	10/0.5	300	381
BCF33	32	32	100	250	420	800	2	5	0.25	10/0.5	300	381
BCF81	50	45	100	250	420	800	2	5	0.25	10/0.5	300	393
PMBT5088	35	30	50	250	350	–	1	5	0.5	10/1	200	1851
PNP												
BC859	30	30	100	250	125	800	2	5	0.3	10/0.5	150	353
BC859W	30	30	100	200	125	800	2	5	0.65	100/5	100	359
BC860	45	45	100	250	125	800	2	5	0.3	10/0.5	150	353
BC860W	50	45	100	200	125	800	2	5	0.65	100/5	100	359
BCF29	32	32	100	250	120	260	2	5	0.3	10/0.5	150	375
BCF30	32	32	100	250	215	500	2	5	0.3	10/0.5	150	475
BCF70	50	45	100	250	215	500	2	5	0.3	10/0.5	150	387

HIGH-VOLTAGE TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BF620	300	–	50	1000	50	–	25	20	0.6	30/5	60	549
BF622	250	250	50	1000	50	–	25	20	0.6	30/5	60	549
BF720	300	–	50	1500	50	–	25	20	0.6	30/5	60	559
BF722	250	250	50	1500	50	–	25	20	0.6	30/5	60	559
BF820	300	–	50	310	50	–	25	20	0.6	30/5	60	587
BF822	250	250	50	310	50	–	25	20	0.6	30/5	60	587
BSP19	400	350	1000	1500	40	–	10	20	1.3	50/4	70	1395
BSP20	300	250	1000	1500	40	–	10	20	1.3	50/4	70	1395
BSR19	160	140	600	350	60	250	10	5	0.25	50/5	100	1527
BSR19A	180	160	600	360	80	250	10	5	0.2	50/5	100	1527
BST39	400	350	1000	1000	40	160	20	10	0.5	50/4	70	1583
BST40	300	250	1000	1000	40	160	20	10	0.5	50/4	70	1583
PMBT5550	160	140	600	300	60	250	10	5	0.25	50/5	200	1857
PMBT5551	180	160	600	250	80	250	10	5	0.2	50/5	100	1859
PMBTA42	300	300	500	250	40	–	30	10	0.5	20/2	50	1869
PMBTA43	200	200	500	250	40	–	30	10	0.5	20/2	50	1869
PZTA42	300	300	500	1500	40	–	10	10	0.5	20/2	50	2011
PZTA43	200	200	500	1500	40	–	10	10	0.5	20/2	50	2011
PZTA44	500	400	300	1500	50	200	10	10	0.75	50/5	20	2015
PZTA45	400	350	300	1500	50	200	10	10	0.75	50/5	20	2015
PNP												
BF621	300	-	20	1000	50	–	25	20	0.8	30/5	60	553
BF623	250	250	20	1000	50	–	25	20	0.8	30/5	60	553
BF721	300	–	50	1500	50	–	25	20	0.8	30/5	60	563
BF723	250	250	50	1500	50	–	25	20	0.8	30/5	60	563
BF821	300	–	50	250	50	–	25	20	0.8	30/5	60	591
BF823	250	250	50	250	50	–	25	20	0.8	30/5	60	591
BSP15	200	200	1000	1500	30	150	10	50	2.5	50/5	15	1393
BSP16	350	300	1000	1500	30	120	10	50	2.0	50/5	15	1393
BSR20	130	120	600	250	40	180	10	5	0.5	50/5	100	1531
BSR20A	160	150	600	250	60	240	10	5	0.5	50/5	100	1531
BST15	200	200	1000	1000	30	150	50	10	2.5	50/5	15	1579
BST16	350	300	1000	1000	30	120	50	10	2.0	50/5	15	1579
PMBT5401	160	150	500	250	60	240	10	5	0.5	50/5	100	1855
PMBTA92	300	300	500	250	40	–	10	10	0.5	20/2	50	1877

HIGH-VOLTAGE TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP *(Continued)*												
PMBTA93	200	200	500	250	40	–	10	10	0.5	20/2	50	1877
PZTA92	300	300	500	1500	40	–	10	10	0.5	20/2	50	2025
PZTA93	200	200	500	1500	40	–	10	10	0.5	20/2	50	2025

FIELD-EFFECT TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ max. (nA)	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ max. (V)	$\lvert Y_{fs} \rvert$ min. (mS)	C_{rs} max. (pF)	V_n max. (μV)	
BF510	20	–	30	250	10	0.7	3	0.8	2.5	0.4	–	503
BF511	20	–	30	250	10	2.5	7	1.5	4	0.4	–	503
BF512	20	–	30	250	10	6	12	2.2	6	0.4	–	503
BF513	20	–	30	250	10	10	18	3	7	0.4	–	503
BF545A	30	30	6.5	250	1/100	2	6.5	2.2	3	0.9	–	509
BF545B	30	30	15	250	1/100	6	15	3.8	3	0.9	–	509
BF545C	30	30	25	250	1/100	12	25	7.8	3	0.9	–	509
BF556A	30	30	7	250	5	3	7	7.5	4.5	0.9	–	537
BF556B	30	30	13	250	5	6	13	7.5	4.5	0.9	–	537
BF556C	30	30	18	250	5	11	18	7.5	4.5	0.9	–	537
BF901	12	–	30	200	50	–	–	–	28	25	–	603
BF901R	12	–	30	200	50	–	–	–	28	25	–	603
BF904	7	–	30	200	50	–	–	–	22	35	–	607
BF904R	7	–	30	200	50	–	–	–	22	35	–	607
BF908	12	–	40	200	50	3	27	2/1.5	36	45	–	613
BF908R	12	–	40	200	50	3	27	2/1.5	36	45	–	613
BF989	20	–	20	200	50	2	20	2.7	9.5	0.025	–	619
BF990A	18	–	30	200	25	–	–	1.3	17	0.025	–	623
BF990AR	18	–	30	200	25	–	–	1.3/1.1	18	25	–	627
BF991	20	–	20	200	50	4	25	2.5	10	0.020	–	629
BF992	20	–	40	200	25	–	–	1.3	20	0.04	–	633
BF994S	20	–	50	300	50	4	20	2.5	15	0.025	–	639
BF996S	20	–	30	300	50	4	20	2.5	15	0.025	–	643
BF997	20	–	30	300	10	2	20	2.5	15	0.025	–	647
BF998	12	–	30	200	50	2	18	2.5	21	–	–	651
BF998R	12	–	30	200	50	2	18	2.5/2.0	21	25	–	661

FIELD-EFFECT TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ max. (nA)	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ max. (V)	$\lvert Y_{fs} \rvert$ min. (mS)	C_{rs} max. (pF)	V_n max. (μV)	
BFR30	25	25	10	250	0.2	4	10	5	1	1.5	0.5	1049
BFR31	25	–	–	–	–	1	5	2.5	1.5	1.5	0.5	1049
BFR101A	30	30	10	200	5	0.2	1.5	1.0	1.2	–	–	1117
BFR101B	30	30	10	200	5	1	5	2.5	2.5	–	–	1117
BFR200	30	30	20	250	.003	0.2	3.5	-	1.3	–	–	1127
BFT46	25	25	10	250	0.2	0.2	1.5	1.2	1.0	1.5	0.5	1311
BSD22	20	–	50	230	1	–	–	2.0	–	0.6	–	1385
BSN20	50	20	100	300	100	0.001	0.001	–	40	2	–	1389
BSP89	240	20	350	1500	100	–	0.200	–	140	5	–	1413
BSP92	240	20	180	1500	100	–	1000	2.8	100	15	–	1417
BSP103	35	20	700	1500	–	–	–	–	–	–	–	1421
BSP105	60	20	500	1500	–	–	–	–	–	–	–	1421
BSP106	60	20	425	1500	10	–	0.001	–	100	10	–	1425
BSP107	200	20	200	1500	10	–	.030	–	90	10	–	1431
BSP108	80	20	500	1500	100	–	0.001	–	150	12	–	1437
BSP109	90	20	450	1500	–	–	–	–	–	–	–	1421
BSP110	80	20	325	1500	100	–	0.001	–	75	6	–	1441
BSP120	200	20	250	1500	100	–	0.001	–	125	10	–	1445
BSP121	200	20	350	1500	100	–	0.001	–	200	10	–	1449
BSP122	200	20	550	1500	100	–	1000	–	400	9	–	1455
BSP124	250	20	250	1500	100	70	–	–	200	15	–	1457
BSP126	250	20	350	1500	100	–	0.001	–	200	15	–	1463
BSP127	270	20	350	1500	100	–	1000	–	200	10	–	1469
BSP128	200	20	350	1500	100	–	1000	–	200	10	–	1471
BSP130	300	20	300	1500	100	–	1000	2	200	15	–	1473
BSP152	200	40	550	1500	100	–	1000	3.5	400	8	–	1479
BSP205	60	20	275	1500	100	–	0.001	–	60	10	–	1485
BSP206	60	20	350	1500	100	–	0.001	–	100	12	–	1489
BSP220	200	20	225	1500	100	–	0.001	–	100	15	–	1493
BSP225	250	20	225	1500	100	–	0.001	–	100	15	–	1499
BSR56	40	40	–	250	1	50	–	10	–	5	–	1543
BSR57	40	40	–	250	1	20	100	6	–	5	–	1543
BSR58	40	40	–	250	1	8	80	4	–	5	–	1543
BSS83	10	–	50	230	10	–	–	2	–	0.6	–	1557
BSS84	50	20	130	360	6000	–	0.06	–	50	–	–	1561
BSS87	200	20	280	1000	100	–	0.06	–	140	10	–	1565

FIELD-EFFECT TRANSISTORS (see Index for package outline details) *(Continued)*

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ max. (nA)	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ max. (V)	$\|Y_{fs}\|$ min. (mS)	C_{rs} max. (pF)	V_n max. (μV)	
BSS131	240	20	100	360	10	–	0.06	–	60	–	–	1569
BSS192	200	20	150	1000	100	–	0.06	–	60	15	–	1573
BST80	80	20	500	1000	100	–	0.01	3.5	300	8	–	1595
BST82	80	20	175	300	100	–	0.001	3.5	150	3	–	1599
BST84	200	20	250	1000	100	–	0.01	2.8	250	5	–	1603
BST86	180	20	300	1000	100	–	0.01	2.4	250	6	–	1607
BST120	60	20	300	1000	100	–	0.01	3.5	200	8	–	1611
BST122	50	20	250	1000	100	–	0.01	3.5	125	8	–	1615
PMBF170	60	20	250	300	10	–	0.001	–	100	10	–	1779
PMBF4391	40	40	–	250	1	50	150	10	–	3.5	–	1783
PMBF4392	40	40	–	250	1	25	75	5	–	3.5	–	1783
PMBF4393	40	40	–	250	1	5	30	3	–	3.5	–	1783
PMBF4416	30	30	–	250	1	5	15	6	4.5	0.8	–	1787
PMBF4416A	35	35	–	250	1	5	15	6	4.5	0.8	–	1787
PMBF5484	25	25	5	250	1	1	5	3	3	1	–	1793
PMBF5485	25	25	10	250	1	4	10	4	3.5	1	–	1793
PMBF5486	25	25	20	250	1	8	20	6	4	1	–	1793
PMBFJ108	25	25	–	250	3	80	–	–	–	15	–	1801
PMBFJ109	25	25	–	250	3	40	–	–	–	15	–	1801
PMBFJ110	25	25	–	250	3	10	–	–	–	15	–	1801
PMBFJ111	40	40	–	300	1	20	–	–	–	–	–	1805
PMBFJ112	40	40	–	300	1	5	–	–	–	–	–	1805
PMBFJ113	40	40	–	300	1	2	–	–	–	–	–	1805
PMBFJ174	30	30	–	300	1	20	135	10	–	4	–	1809
PMBFJ175	30	30	–	300	1	7	70	6	–	4	–	1809
PMBFJ176	30	30	–	300	1	2	35	4	–	4	–	1809
PMBFJ177	30	30	–	300	1	1.5	20	2.25	–	4	–	1809
PMBFJ308	25	25	60	250	1	12	60	6.5	10	2.5	–	1813
PMBFJ309	25	25	30	250	1	12	30	4	10	2.5	–	1813
PMBFJ310	25	25	60	250	1	24	60	6.5	10	2.5	–	1813
2N7002	60	–	180	300	–	–	–	–	–	–	–	2043

SPECIAL TRANSISTORS (see Index for package outline details)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP												
BCV62	30	30	100	250	100	800	2	5	0.65	100/5	150	427
BCV64	30	30	100	250	100	900	2	5	0.3	100/0.5	200	435
NPN												
BCV61	30	30	100	250	110	800	2	5	0.6	100/5	300	423
BCV63	30	30	100	250	100	900	2	5	0.65	100/5	200	431
NPN/PNP												
BCV65	30	30	100	250	75	800	2	5	0.3	10/0.5	100	439

TRIGGER DEVICES

TYPE	ENVELOPE	RATINGS		CHARACTERISTICS		PAGE
		V_{GA} max. (V)	I_A max. (mA)	I_P (μA)	I_V (μA)	
BRY61	SOT23	70	175	5/1	30/50	1373
BRY62	SOT143	70	175	–	–	1379

DIODES (see Index for package outline details)

TYPE NUMBER	DESCRIPTION	RATINGS		CHARACTERISTICS				PAGE
		V_R (V)	I_F (mA)	t_{rr} max. (ns)	V_F (V)	at I_F (mA)	C_d max. (pF)	
BA582	band switch	35	100	–	1.1	100	1.1	99
BA682	band switch	35	100	–	1	100	1.5	101
BA683	band switch	35	100	–	1	100	1.5	101
BAL74	high-speed switch	50	250	6	1.25	150	2	103
BAL99	high-speed switch	70	250	6	1.25	150	1.5	107
BAS16	high-speed switch	75	250	6	1.25	150	2	113
BAS16W	high-speed switch	–	–	–	0.96	100	140	117
BAS17	low-voltage stabilizer	–	250	–	0.87 - 0.96	100	140	121
BAS19	high-speed switch	100	200	50	1.25	200	5	125
BAS20	high-speed switch	150	200	50	1.25	200	5	125
BAS21	high-speed switch	200	200	50	1.25	200	5	125
BAS28	fast switch double diode	75	250	6	1.25	150	2	133

DIODES (see Index for package outline details) *(Continued)*

TYPE NUMBER	DESCRIPTION	RATINGS		CHARACTERISTICS				PAGE
		V_R (V)	I_F (mA)	t_{rr} max. (ns)	V_F (V)	at I_F (mA)	C_d max. (pF)	
BAS29	switch	90	250	50	1.25	400	35	137
BAS31	two diodes in series	90	250	50	1.25	400	35	137
BAS32L	high-speed switch	75	200	4	1	100	2	139
BAS35	common anode double diode	90	250	50	1.25	400	35	137
BAS55	high-speed switch	60	250	6	1	200	2.5	147
BAS56	ultra-high speed switch double diode	60	200	6	1.25	500	2.5	153
BAS70	high-speed switch	70	70	–	0.410	1	2	157
BAS70-01	high-speed switch	70	70	–	0.410	1	2	161
BAS70-04	two diodes in series	70	70	–	0.410	1	2	157
BAS70-05	common cathode double diode	70	70	–	0.410	1	2	157
BAS70-06	common anode double diode	70	70	–	0.410	1	2	157
BAS70-07	two diodes	70	70	–	0.410	1	2	165
BAS81	Schottky barrier	40	30	–	1	15	1.6	169
BAS82	Schottky barrier	50	30	–	1	15	1.6	169
BAS83	Schottky barrier	60	30	–	1	15	1.6	169
BAS85	Schottky barrier	30	200	5	0.8	100	10	173
BAS86	Schottky barrier	50	200	4	0.9	100	-	177
BAS216	high-speed switch	75	250	4	1.25	150	2	181
BAS678	high-speed switch	80	250	6	1	200	2	187
BAT17	Schottky barrier	4	30	-	0.6	10	1	193
BAT18	band switch	35	100		1.2	100	1	197
BAT54	Schottky barrier	30	200	5	1	100	10	201
BAT54A;C;S	Schottky barrier	30	200	5	1	100	10	205
BAT74	Schottky barrier double diode	30	200	5	1	100	10	211
BAV23	double diodes	200	200	50	2.5	200	2.5	215
BAV23S	two diodes in series	200	200	50	1.25	200	5	217
BAV70	common cathode double diode	70	250	6	1.25	150	1.5	221
BAV70W	common cathode double diode	70	175/100	6	0.715 - 1.25	1 - 150	1.5	225
BAV74	common cathode double diode	50	250	4	1	100	2	229
BAV99	two diodes in series	70	250	6	1.25	150	1.5	233
BAV99W	two diodes in series	75	150/130	4	0.715 - 1.25	1 - 150	1.5	237
BAV100	general purpose	50	250	50	1.25	200	5	241
BAV101	general purpose	100	250	50	1.25	200	5	241
BAV102	general purpose	150	250	50	1.25	200	5	241
BAV103	general purpose	200	250	50	1.25	200	5	241

DIODES (see Index for package outline details) *(Continued)*

TYPE NUMBER	DESCRIPTION	RATINGS		CHARACTERISTICS				PAGE
		V_R (V)	I_F (mA)	t_{rr} max. (ns)	V_F (V)	at I_F (mA)	C_d max. (pF)	
BAV105	ultra high speed	60	300	6	1.25	500	2.5	249
BAW56	common anode double diode	70	250	6	1.25	150	2	257
BAW56W	common anode double diode	75	150/130	4	0.715 - 1.25	1 - 150	1.5	261
PLVA600A	low-voltage avalanche	–	–	–	0.9	10	–	1751
PMBD914	high speed switch	70	200	15	1	10	4	1755
PMBD2835	common anode double diode	35	100	6	1.2	100	4	1759
PMBD2836	common anode double diode	75	100	6	1.2	100	4	1759
PMBD2837	common cathode double diode	30	150	6	1.2	100	4	1763
PMBD2838	common cathode double diode	50	150	6	1.2	100	4	1763
PMBD6050	high speed switch	70	200	15	1.1	100	2.5	1767
PMBD6100	common cathode double diode	70	200	6	1.1	100	2.5	1771
PMBD7000	two diodes in series	100	200	15	1.1	100	1.5	1775
PMLL4148	general purpose	75	200	4	1	10	4	1891
PMLL4150	general purpose	50	300	6	1	200	2.5	1895
PMLL4151	general purpose	50	200	2	1	50	2	1895
PMLL4153	general purpose	50	200	2	0.88	20	2	1895
PMLL4446	general purpose	75	200	4	1	20	4	1891
PMLL4448	general purpose	70	200	4	1	100	4	1891
1PS181	common anode double diode	80	215	4	1	50	1.5	2027
1PS184	common cathode double diode	80	215	6	1	50	1.5	2031
1PS193	high-speed switch	80	215	4	1	50	1.5	2035
1PS226	common anode double diode	80	215	4	1	50	1.5	2039

VARIABLE CAPACITANCE DIODES

TYPE NUMBER	ENVELOPE	RATINGS		CHARACTERISTICS					PAGE
		V_R (V)	I_F (mA)	C_d (pF)	at V_R (V)	C_d ratio (f=1 MHz)	at V_R	r_D (Ω)	PAGE
BB131	SOD323	30	20	17/1.055	0.5/28	16	0.5/28	3	265
BB132	SOD323	30	20	75/2.75	0.5/28	30	0.5/28	2	267
BB133	SOD323	30	20	46/2.6	0.5/28	21	0.5/28	0.9	269
BB134	SOD323	30	20	21/2.1	0.5/28	12	0.5/28	0.75	271
BB135	SOD323	30	20	21/2.1	0.5/28	12	0.5/28	0.75	273
BB215	SOD80	30	20	1.8 - 2.2	28	typ. 8.3	1/28	typ. 0.63	275
BB515	SOD123	30	20	19.5/2.25	1/28	9.6	1/28	0.5	277
BB619	SOD123	30	20	41/2.9	1/28	14	1/28	0.7	279
BB620	SOD123	30	20	76/3.4	1/28	25	1/28	1.3	281
BB804	SOT23	18	50	42 - 47.5	2	1.65 - 1.75	2/8	typ. 0.2	283
BB811	SOD123	30	20	9.8/1.2	1/28	9.5	1/28	1.45	285
BB901	SOT23	28	20	1.055	28	12	0.5/28	3	287
BBY31	SOT23	28	20	1.6 - 2	28	typ. 9.7	1/28	max. 1.2	291
BBY39	SOT23	30	20	1 - 2	28	min. 7.6	1/28	max. 0.75	295
BBY40	SOT23	28	20	3.8 - 4.8	28	8 - 12	1/28	max. 0.7	297
BBY42	SOT23	32	20	2.4 - 3	28	12 - 16	1/28	max. 1	301
BBY62	SOT143	28	20	1.6 - 2	28	typ. 9.7	1/28	max. 1.2	303

VOLTAGE REGULATOR DIODES

TYPE NUMBER	ENVELOPE	RATINGS					CHARACTERISTICS		PAGE
		VOLTAGE RANGE (V)	VOLTAGE TOLERANCE (%)	P_{tot} (mW)	I_{ZRM} (mA)	I_{FRM} (mA)	V_F max. (V)	at I_F (mA)	
BZD27	SOD87	7.5 to 510	5	2300	–	–	1.2	200	1669
BZV49	SOT89	2.4 to 75	5	1000	note 1	250	1	50	1679
BZV55	SOD80	2.4 to 75	2, 3, 5	500	-	250	0.9	10	1689
BZV80	SOD80	5.89 to 6.51	–	400	50	–	–	–	1703
BZV81	SOD80	5.89 to 6.51	–	400	50	–	–	–	1703
BZV87	SOD80	1.4 - 3.2	–	350	–	250/150	1.5 - 3.45	5	1705
BZV90	SOT223	2.4 - 75	5	1300	–	400	1	50	1709
BZX84	SOT23	2.4 to 75	2.5	350	250	250	0.9	10	1719
PMBZ5226B to PMBZ5257B	SOT23	3.3 to 33	5	300	250	250	1.1	200	1887
PMLL5225B to PMLL5267B	SOD80	3.0 to 75	5	500	–	250	1.1	200	1899

Note

1. I_{ZRM} limited by $P_{ZRM\ max}$.

TRANSIENT SUPPRESSION DIODES

TYPE NUMBER	ENVELOPE	CHARACTERISTICS				PAGE
		V_R (V)	$V_{(CL)R}$ (V)	I_{RSM} (A)	P_{RSM} (W)	
BZD27	SOD87	6.2 to 430	11.3 to 707	13.3 to 0.21 note 1	150 note 1	1669

Note

1. Pulse according to IEC60-2, section 6: 10/1000 µs exponential; T_j = 25 °C prior to the pulse.

RECTIFIER DIODES

TYPE NUMBER	ENVELOPE	RATINGS					CHARACTERISTICS			PAGE
		$I_{F(AV)}$ (A)	V_{RRM} (V)	V_R (V)	I_{FRM} (A)	I_{FSM} (A)	T_{rr} (ns)	V_F (V)	at I_F (A)	
BYD17D	SOD87	1.5	200*	200	5.5	20	–	1.05	1	1639
BYD17G	SOD87	1.5	400*	400	5.5	20	–	1.05	1	1639
BYD17J	SOD87	1.5	600*	600	5.5	20	–	1.05	1	1639
BYD17K	SOD87	1.5	800*	800	5.5	20	–	1.05	1	1639
BYD17M	SOD87	1.5	1000*	1000	5.5	20	–	1.05	1	1639
BYD37D	SOD87	1.5	200	200	12	20	250	1.3	1	1647
BYD37G	SOD87	1.5	400	400	12	20	250	1.3	1	1647
BYD37J	SOD87	1.5	600	600	12	20	250	1.3	1	1647
BYD37K	SOD87	1.5	800	800	12	20	300	1.3	1	1647
BYD37M	SOD87	1.5	1000	1000	12	20	300	1.3	1	1647
BYD77A	SOD87	2.0	50	50	15	25	25	0.95	1	1659
BYD77B	SOD87	2.0	100	100	15	25	25	0.95	1	1659
BYD77C	SOD87	2.0	150	150	15	25	25	0.95	1	1659
BYD77D	SOD87	2.0	200	200	15	25	25	0.95	1	1659
BYD77E	SOD87	1.85	250	250	13	25	50	1.05	1	1659
BYD77F	SOD87	1.85	300	300	13	25	50	1.05	1	1659
BYD77G	SOD87	1.85	400	400	13	25	50	1.05	1	1659
PRLL4001	SOD87	1.6	50	50	10	20	–	–	–	1943
PRLL4002	SOD87	1.6	100	100	10	20	–	–	–	1943

Note

* V_{RWM}.

TEMPERATURE SENSORS

TYPE NUMBER	TEMPERATURE RANGE °C	RESISTANCE R at T_{amb} (Ω) note1	SENSOR CURRENT (mA)	PAGE
KTY82-110	–55 to 150	1000 ±1%	1	1731
KTY82-120	–55 to 150	1000 ±2%	1	1731
KTY82-150	–55 to 150	1000 ±5%	1	1731
KTY82-210	–55 to 150	1000 ±1%	1	1737
KTY82-220	–55 to 150	1000 ±2%	1	1737
KTY82-250	–55 to 150	1000 ±5%	1	1737
KTY85-110	–40 to 125	1000 ±1%	1	1743
KTY85-120	–40 to 125	1000 ±2%	1	1743
KTY85-150	–40 to 125	1000 ±5%	1	1743

Note

1. T_{amb} = 25 °C.

CONVERSION LIST

CONVERSION LIST FROM LEADED TO SMD TYPE

LEADED	SMD
BA243	BAT18
BA314	BAS17
BA480	BAT17
BA481	BAT17
BA482	BA582
BA482	BA682
BA483	BA683
BAT81	BAS81
BAT82	BAS82
BAT83	BAS83
BAT85	BAT54
BAT85	BAT54A; C; S
BAT85	BAT54W;AW;CW;SW
BAT85	BAT74
BAT85	BAS85
BAT86	BAS86
BAV10	BAS55
BAV10	BAS56
BAV10	BAV105
BAV18	BAV100
BAV19	BAS19
BAV19	BAV101
BAV20	BAS20
BAV20	BAV102
BAV21	BAS21
BAV21	BAV23
BAV21	BAV23S
BAV21	BAV103
BAW62	BAL74
BAW62	BAL99
BAW62	BAS16
BAW62	BAS16W
BAW62	BAS28
BAW62	BAS216
BAW62	BAV70
BAW62	BAV70W
BAW62	BAV74
BAW62	BAV99
BAW62	BAV99W

LEADED	SMD
BAW62	BAW56
BAW62	BAW56W
BAX12	BAS29
BAX12	BAS31
BAX12	BAS35
BB405	BBY31
BB405B	BB215
BB809	BBY40
BC107	BC847
BC107	BCW71/72
BC107A	BC847A
BC107A	BCW71
BC107B	BC847B
BC107B	BCW72
BC108	BC848
BC108	BCW31/32/33
BC108A	BC848A
BC108B	BC848B
BC109	BC849
BC109	BCF32/33
BC109B	BC849B
BC109C	BC849C
BC156	BCV26
BC157	BCV27
BC177	BC857
BC177	BCW69/70
BC177A	BC857A
BC177B	BC857B
BC178	BC858
BC178	BCW29/30
BC178A	BC858A
BC178A	BCW29
BC178B	BC858B
BC179	BC859
BC179	BCF29/30
BC179A	BC859A
BC179B	BC859B
BC200/01	BC859B
BC200/01	BCF29

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BC200/02	BC859B/C
BC200/02	BCF29/30
BC200/03	BC859C
BC200/03	BCF30
BC327	BC807
BC327	BC807W
BC327	BC817W
BC327	BCX17
BC327-16	BC807-16
BC327-16	BC807-16W
BC327-25	BC807-25
BC327-40	BC807-40
BC327-40	BC807-40W
BC327-16	BC807-16W
BC327	2PB710/A
BC328	BC808
BC328	BC808W
BC328	BCX18
BC328	BCX20
BC328-16	BC808-16
BC328-16	BC808-16W
BC328-25	BC808-25
BC328-25	BC808-25W
BC328-40	BC808-40
BC328-40	BC808-40W
BC337	BCX19
BC337	BC817
BC337-16	BC817-16
BC337-16	BC817-16W
BC337-25	BC817-25
BC337-25	BC817-25W
BC337-40	BC817-40
BC337-40	BC817-40W
BC337	2PD602/A
BC338	BC818
BC338	BC818W
BC338	BCX20
BC338-16	BC818-16

LEADED	SMD
BC338-16	BC818-16W
BC338-25	BC818-25
BC338-25	BC818-25W
BC338-40	BC818-40
BC338-40	BC818-40W
BC368	BCP68
BC368	BC868
BC369	BC869
BC369	BCP69
BC516	BCV26
BC516	BCV28
BC517	BCV27
BC517	BCV29
BC517	BCV47
BC546	BC846
BC546	BC846AW
BC546	BC846W
BC546	BCV71/72
BC546A	BC846A
BC546A	BCV71
BC546B	BC846B
BC546B	BC846BW
BC546B	BCV72
BC547	BC847
BC547	BC847W
BC547	BCV63
BC547	BCV65
BC547 series	BCV61 series
BC547 series	BCX70 series
BC547	2PD601/A
BC547A	BC847A
BC547A	BC847AW
BC547B	BCV63B
BC547B	BC847B
BC547B	BC847BW
BC547B	BCV63B
BC547B	BCV65B
BC547C	BC847C

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BC547C	BC847CW
BC547C	BCW81
BC548	BC848
BC548	BC848W
BC548	BCW31/32/33
BC548A	BC848A
BC548A	BC848AW
BC548B	BC848B
BC548B	BC848BW
BC548C	BC848C
BC548C	BC848CW
BC549	BC849
BC549	BC849W
BC549	BC850W
BC549	BCF32/33
BC549B	BC849B
BC549B	BC849BW
BC549C	BC849C
BC549C	BC849CW
BC550	BC850
BC550	BC850W
BC550	BCF81
BC550B	BC850B
BC550B	BC850BW
BC550C	BC850C
BC550C	BC850CW
BC556	BC856W
BC556	BC856A
BC556	BCW89
BC556	BC856A
BC556A	BC856A
BC556A	BCW89
BC556A	BCW856AW
BC556B	BC856B
BC556B	BC856BW
BC557	BCW69/70
BC557	BC857
BC557	BC857W

LEADED	SMD
BC557 series	BCV62 series
BC557	BCV64
BC557	BCX71 series
BC557	2PB709/A
BC557A	BC857A
BC557A	BC857AW
BC557B	BC857B
BC557B	BC857BW
BC557B	BCV64B
BC557C	BC857C
BC557C	BC857CW
BC557C	BCV62C
BC558	BC858
BC558	BC858W
BC558	BCW29/30
BC558A	BC858A
BC558A	BC858AW
BC558A	BCW29
BC558B	BC858B
BC558B	BC858BW
BC558C	BC858C
BC558C	BC858CW
BC559	BC859
BC559	BC859W
BC559	BC860
BC559	BCW29/30
BC559A	BC859A
BC559A	BC859AW
BC559B	BC859B
BC559B	BC859BW
BC559C	BC859C
BC559C	BC859CW
BC560	BC860W
BC560	BC860
BC560	BCF70
BC560A	BC860A
BC560A	BC860AW
BC560B	BC860B

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BC560B	BC860BW
BC560B	BCF70
BC560C	BC860C
BC560C	BC860CW
BC635	BCP54
BC635	BCX54
BC635-10	BCX54-10
BC635-10	BCP54-10
BC635-16	BCX54-16
BC635-16	BCP54-16
BC636	BCP51
BC636	BCX51
BC636-10	BCP51-10
BC636-10	BCX51-10
BC636-16	BCP51-16
BC636-16	BCX51-16
BC637	BCP55
BC637	BCX55
BC637-10	BCX55-10
BC637-10	BCP55-10
BC637-16	BCX55-16
BC637-16	BCP55-16
BC638	BCP52
BC638	BCX52
BC638-10	BCX52-10
BC638-10	BCP52-10
BC638-16	BCX52-16
BC638-16	BCP52-16
BC639	BCP56
BC639	BCX56
BC639-10	BCP56-10
BC639-10	BCX56-10
BC639-16	BCP56-16
BC639-16	BCX56-16
BC640	BCP53
BC640	BCX53
BC640-10	BCP53-10
BC640-10	BCX53-10

LEADED	SMD
BC640-16	BCP53-16
BC640-16	BCX53-16
BCX58	BCW60
BCX59	BCX70 series
BCX78	BCW61
BCX79	BCX71
BCY56	BC850B
BCY56	BCF70
BCY57	BC849
BCY58	BCW60 series
BCY58	BC849
BCY58-IX	BCW60C
BCY58-VII	BCW60A
BCY58-VIII	BCW60B
BCY58-VIII	BC849B
BCY58-X	BCW60D
BCY59	BCX70 fam.
BCY59-IX	BCX70J
BCY59-VII	BCX70G
BCY59-VIII	BCX70H
BCY59-X	BCX70K
BCY65	BCV71
BCY65	BCV72
BCY70	BCF70
BCY71	BCF70
BCY72	BCF29/30
BCY78	BCW61 series
BCY78-IX	BCW61C
BCY78-VIII	BCW61B
BCY78-X	BCW61D
BCY79	BCX71 series
BCY79-IX	BCX71J
BCY79-VII	BCX71G
BCY79-VIII	BCX71H
BD135	BCP54
BD135	BCX54
BD135-10	BCP54-10
BD135-10	BCX54-10

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BD135-16	BCP54-16
BD135-16	BCX54-16
BD136	BCP51
BD136	BCP54
BD136	BCX51
BD136-10	BCP51-10
BD136-10	BCX51-10
BD136-16	BCP51-16
BD136-16	BCX51-16
BD137	BCP55
BD137	BCX55
BD137-10	BCP55-10
BD137-10	BCX55-10
BD137-16	BCP55-16
BD137-16	BCX55-16
BD138	BCP52
BD138	BCX52
BD138-10	BCP52-10
BD138-10	BCX52-10
BD138-16	BCP52-16
BD138-16	BCX52-16
BD139	BCP56
BD139	BCX56
BD139-10	BCP56-10
BD139-10	BCX56-10
BD139-16	BCP56-16
BD139-16	BCX56-16
BD140	BCP53
BD140	BCX53
BD140-10	BCP53-10
BD140-10	BCX53-10
BD140-16	BCP53-16
BD140-16	BCX53-16
BDX42	BSP50
BDX42	BST50
BDX43	BSP51
BDX43	BST51
BDX44	BSP52

LEADED	SMD
BDX44	BST52
BDX45	BSP60
BDX45	BST60
BDX46	BSP61
BDX46	BST61
BDX47	BSP61
BDX47	BST61
BF199	BFS20
BF240	BF840
BF241	BF841
BF245A	BF545A
BF245B	BF545B
BF345C	BF545C
BF256A	BF556A
BF256B	BF556B
BF256C	BF556C
BF324	BF824
BF370	BF570
BF410A	BF510
BF410B	BF511
BF410C	BF512
BF410D	BF513
BF419	BST40
BF420	BF620
BF420	BF720
BF420	BF820
BF421	BF621
BF421	BF721
BF421	BF821
BF422	BF622
BF422	BF722
BF422	BF822
BF423	BF623
BF423	BF723
BF423	BF823
BF450	BF550
BF451	BF550
BF457	BST40

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BF458	BST40
BF459	BST39
BF459C	BFS18
BF459D	BFS18
BF469	BF622
BF469	BF722
BF470	BF623
BF470	BF723
BF471	BF620
BF471	BF720
BF472	BF621
BF472	BF721
BF483	BF720
BF483	BF722
BF484	BF723
BF485	BF720
BF486	BF721
BF494	BFS19
BF494B	BFS19
BF495	BFS18
BF606A	BF660
BF819	BSP20
BF819	BST40
BF857	BSP20
BF857	BST40
BF858	BSP20
BF858	BST40
BF859	BST39
BF869	BF622
BF869	BF722
BF870	BF623
BF870	BF723
BF871	BF620
BF871	BF720
BF872	BF621
BF872	BF721
BF926	BF660
BF960	BF989

LEADED	SMD
BF960	BF989
BF964	BF994
BF964S	BF994S
BF965	BF997
BF966S	BF996S
BF980	BF990
BF980A	BF990A
BF980A	BF990AR
BF981	BF991
BF982	BF992
BF982	BF992
BF988	BF998
BF998	BF998R
BFG195	BFG198
BFG65	BFG67
BFQ135	BFG135
BFQ135	BFG135
BFQ23	BFT93
BFQ24	BFT93
BFQ34	BFQ18A
BFQ34T	BFG35
BFQ34T	BFG135
BFQ34T	BFQ18A
BFQ51	BFT92
BFQ51	BFT92W
BFQ52	BFT92
BFQ65	BFQ67
BFQ65	BFQ67W
BFR54	BSV52
BFR90	BFR92
BFR90	BFR92A
BFR90	BFR92AW
BFR91	BFR93
BFR91	BFR93A
BFR91	BFR93AW
BFR96	BFG97
BFR96	BFQ19
BFR96S	BFQ19

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BFT24	BFT25
BFT44	BSP16
BFT44	BST16
BFT45	BSP15/16
BFT45	BST15/16
BFW11	BFR30
BFW12	BFR31
BFW13	BFT46
BFW16A	BFQ17
BFW30	BFR53
BFW30	BFR53
BFW92	BFS17
BFW93	BFR53
BFX29	BSR16
BFX30	BSR16
BFX84	BSR40
BFX85	BSP41
BFX85	BSR41
BFX86	BSP41
BFX86	BSR41
BFX87	BSR16
BFX88	BSR15
BFY50	BSR40
BFY51	BSP40
BFY51	BSR40
BFY52	BSP40
BFY52	BSR40
BFY55	BSP40
BFY55	BSR40
BFY90	BFS17
BRY39	BRY62
BRY56	BRY61
BSR50	BSP50
BSR50	BST50
BSR51	BSP51
BSR51	BST51
BSR52	BSP52
BSR52	BST52

LEADED	SMD
BSR60	BSP60
BSR60	BST60
BSR61	BSP61
BSR61	BST61
BSR62	BSP62
BSR62	BST62
BSS38	BSS64
BSS50	BSP50
BSS50	BST50
BSS51	BSP51
BSS51	BST51
BSS52	BSP52
BSS52	BST52
BSS60	BSP60
BSS60	BST60
BSS61	BSP61
BSS61	BST61
BSS62	BSP62
BSS62	BST62
BSS68	BSS63
BSS89	BSP89
BSS92	BSP92
BST70A	BST80
BST72A	BST82
BST74A	BST84
BST76A	BST86
BSV15	BSP30/31
BSV15	BSR30/31
BSV15-10	BSP30/31
BSV15-10	BSR30/31
BSV15-16	BSP31
BSV15-16	BSR31
BSV15-6	BSP30
BSV15-6	BSR30
BSV16	BSP30/31
BSV16	BSR30/31
BSV16-10	BSP30/31
BSV16-10	BSR30/31

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
BSV16-16	BSP31
BSV16-16	BSR31
BSV16-6	BSP30
BSV16-6	BSR30
BSV17	BSP32/33
BSV17	BSR32/33
BSV17-10	BSP32/33
BSV17-10	BSR32/33
BSV17-6	BSP32
BSV17-6	BSR32
BSX20	BSV52
BSX45	BSP40/41
BSX45	BSR40/41
BSX45-10	BSP40/41
BSX45-10	BSR40/41
BSX45-16	BSP41
BSX45-16	BSR41
BSX45-6	BSP40
BSX45-6	BSR40
BSX46	BSP40/41
BSX46	BSR40/41
BSX46-10	BSR40/41
BSX46-16	BSR41
BSX46-6	BSP40
BSX46-6	BSR40
BSX47	BSR42/43
BSX47-10	BSR42-43
BSX47-6	BSR42
BSY50	BSP40
BSY95A	BSV52
BYD13 series	BYD17 series
BYD33 series	BYD37D-M
BYD73 series	BYD77 series
BZV85	BZV49 series
BZV85	BZV90 series
BZX55	BZV55
BZX79	BZV55
BZX79	BZX84

LEADED	SMD
KTY81/1	KTY82/1
KTY81/1	KTY85-1..
KTY81/2	KTY82/2
MPS3904	PMSS3904
MPS3906	PMSS3906
MPS3906	PMST3904
MPS3904	PMST3906
MPS6513	BC848A
MPS6514	BC848A
MPS6515	BC848B
MPS6517	BC858A
MPS6518	BC858A
MPS6519	BC858B
MPS6520	BC859B
MPS6521	BC859C
MPS6522	BC859B
MPS6523	BC859C
MPSA05	PMBTA05
MPSA05	PZTA05
MPSA06	PMBTA06
MPSA06	PZTA06
MPSA13	PMBTA13
MPSA13	PZTA13
MPSA14	PMBTA14
MPSA14	PXTA14
MPSA14	PZTA14
MPSA27	PXTA27
MPSA42	PMBTA42
MPSA42	PZTA42
MPSA43	PMBTA43
MPSA43	PZTA43
MPSA44	PZTA44
MPSA55	PMBTA55
MPSA55	PZTA55
MPSA56	PMBTA56
MPSA56	PZTA56
MPSA63	PMBTA63
MPSA63	PZTA63

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
MPSA64	PMBTA64
MPSA64	PXTA64
MPSA64	PZTA64
MPSA77	PXTA77
MPSA92	PMBTA92
MPSA92	PXTA92
MPSA92	PZTA92
MPSA93	PMBTA93
MPSA93	PXTA93
MPSA93	PZTA93
MPSH10	PMBTH10
MPSH81	PMBTH81
PH2222	BSR13
PH2222	PMBT2222
PH2222	PXT2222
PH2222	PZT2222
PH2222	BSR14
PH2222A	PMBT2222A
PH2222A	PXT2222A
PH2222A	PZT2222A
PH2369	BSV52
PH2369	PMBT2369
PH2907	BSR15
PH2907	PMBT2907
PH2907	PZT2907
PH2907A	BSR16
PH2907A	PMBT2907A
PH2907A	PZT2907A
PH2909	PXT2907/A
PM2907	PMBT2907A
PM2907A	BSR16
PM2907A	PMBT2907A
PN2222A	PMBT2222A
PN2369	BSV52
PN2369	PMBT2369
PN2907	BSR15
PN2907	PMBT2907
PN3439	BSP19

LEADED	SMD
PN3439	BST39
PN3440	BSP20
PN3440	BST40
PN5415	BSP15
PN5415	BST15
PN5416	BSP16
PN5416	BST16
1N4001ID	PRLL4001/4002
1N4148	PMLL4148
1N4148	BAL74
1N4148	BAL99
1N4148	BAS16
1N4148	BAS16W
1N4148	BAS32L
1N4148	BAS216
1N4148	BAV70
1N4148	BAV70W
1N4148	BAV74
1N4148	BAV99
1N4148	BAV99W
1N4148	BAW56
1N4148	BAW56W
1N4148	1PS181
1N4148	1PS184
1N4148	1PS193
1N4148	1PS226
1N4150	PMLL4150
1N4151	PMLL4151
1N4153	PMLL4153
1N4446	PMLL4446
1N5225B to 1N5267B	PMLL5225B to PMLL5267B
1N5226B to 1N5267B	PMBZ5226B to PMBZ5257B
1N5817	PRLL5817
1N5818	PRLL5818
1N5819	PRLL5819
2N700	2N7002

CONVERSION LIST FROM LEADED TO SMD TYPE *(Continued)*

LEADED	SMD
2N1613	BSR40
2N1711	BSR41
2N1893	BSR42
2N2219A	PZT2222A/PXT2222A
2N2222	PMBT2222
2N2222	BSR13/BSR14
2N2222A	PMBT2222A
2N2297	BSR40
2N2369	BSV52
2N2369	PMBT2369
2N2369A	BSV52
2N2483	BC850B
2N2484	BC850B/C
2N2894A	PMBT3640
2N2894A	BSR12
2N2905	PXT2907
2N2905	PZT2907
2N2905A	PXT2907A
2N2905A	PZT2907A
2N2907	PMBT2907
2N2907	BSR15
2N2907A	PMBT2907A
2N2907A	BSR16
2N3019	BSR43
2N3019	BSP43
2N3020	BSR42
2N3053	BSR40/41
2N3904	PMBT3904
2N3904	PZT3904
2N3904	PXT3904
2N3904	BSR17A
2N3906	PMBT3906
2N3906	PZT3906
2N3906	PXT3906
2N3906	BSR18A
2N4030	BSR30
2N4031	BSR32
2N4032	BSR31

LEADED	SMD
2N4033	BSR33
2N4124	BSR18A
2N4391	PMBF4391
2N4392	PMBF4392
2N4393	PMBF4393
2N4401	PMBT4401
2N4401	PMST4401
2N4401	PXT4401
2N4403	PMBT4403
2N4403	PMST4403
2N4403	PXT4403
2N4856	BSR56
2N4857	BSR57
2N4858	BSR58
2N5088	PMBT5088
2N5088	PMST5088
2N5089	PMST5089
2N5400	BSR20/20A
2N5401	PMBT5401
2N5401	BSR20/20A
2N5415	BST15
2N5416	BST16
2N5550	PMBT5550
2N5550	BSR19/19A
2N5551	PMBT5551
2N5551	BSR19/19A
2N6428	PMBT6428
2N6429	PMBT6429
2N929	BC850
2N930	BC850
2N930	BCF81

MARKING

MARKING LIST

Types in SOT23, SOT89, SOT143, SOT323, SOD123 and SOD323 envelopes are marked with a code as listed in the following tables. The actual type number and data code are on the packing.

An exception to this is the BZV49 series. The envelope number is shown in those cases where the same marking code applies to more than one type number.

MARK	TYPE NO.
A1	BAW56W
A1p	BAW56
A2p	BAT18
A3p	BAT17
A3t	1PS181
A4	BAV70W
A4p	BAV70
A5p	BRY61
A51	BRY62
A6	BAS16W
A6	BAS216
A6p	BAS16
A7	BAV99W
A7p	BAV99
A91	BAS17
AA	BCX51
AAp	BCW60A
ABp	BCW60B
AC	BCX51-10
ACp	BCW60C
AD	BCX51-16
ADp	BCW60D
AE	BCX52
AG	BCX52-10
AGp	BCX70G
AH	BCX53
AHp	BCX70H
AJp	BCX70J
AK	BCX53-10
AKp	BCX70K
AL	BCX53-16
AM	BCX52-16
AMp	BSS64
AR	2PB709R

MARK	TYPE NO.
AR1	BSR40
AR2	BSR41
AR3	BSR42
AR4	BSR43
ASt	2PB709S
AS1	BST50
AS2	BST51
AS3	BST52
AQt	2PB709Q
AT1	BST39
AT2	BST40
B2p	BSV52
B3t	1PS184
B5p	BSR12
B26	BF570
BAp	BCW61A
BA	BCX54
BBp	BCW61B
BCp	BCW61C
BC	BCX54-10
BD	BCX54-16
BDp	BCW61D
BE	BCX55
BG	BCX55-10
BGp	BCX71G
BH	BCX56
BHp	BCX71H
BJp	BCX71J
BK	BCX56-10
BKp	BCX71K
BL	BCX56-16
BM	BCX55-16
BMp	BSS63
BQt	2PB709AQ

MARK	TYPE NO.
BR	2PB709AR
BR1	BSR30
BR2	BSR31
BR3	BSR32
BR4	BSR33
BSt	2PB709AS
BS1	BST60
BS2	BST61
BS3	BST62
BT1	BST15
BT2	BST16
C1p	BCW29
C2p	BCW30
C3T	1PS226
C7p	BCF29
C8p	BCF30
C95	BCV64
C96	BCV64B
CAC	BC868
CBC	BC868-10
CCC	BC868-16
CDC	BC868-25
CEC	BC869
CGC	BC869-10
CQt	2PB710Q
CRt	2PB710R
CSt	2PB710S
D1p	BCW31
D2p	BCW32
D3p	BCW33
D7p	BCF32
D8p	BCF33
D95	BCV63
D96	BCV63B

MARK	TYPE NO.
DA	BF622
DB	BF623
DC	BF620
DF	BF621
DQt	2PB710AQ
DRt	2PB710AR
DSt	2PB710AS
E1	BFS17W
E1p	BFS17
E16	BF547
E16	BF547W
F1p	BFS18
F2p	BFS19
F8p	BF824
FA	BFQ17
FB	BFQ19
FDp	BCV26
FEp	BCV46
FF	BFQ18A
FFp	BCV27
FGp	BCV47
FSt	1PS193
G1p	BFS20
H1p	BCW69
H2p	BCW70
H3p	BCW89
H7p	BCF70
JAp	BAV74
JCp	BAL74
JFp	BAL99
JPp	BAS19
JRp	BAS20
JSp	BAS21
JTp	BAS28
K1p	BCW71
K2p	BCW72
K3p	BCW81
K7p	BCV71
K8p	BCV72
K9p	BCF81

MARK	TYPE NO.
KM	BST80
KN	BST84
KO	BST86
L4p	BAT54
L5p	BAS55
L20	BAS29
L21	BAS31
L22	BAS35
L30	BAV23
L31	BAV23S
L41	BAT74
L42	BAT54A
L43	BAT54C
L44	BAT54S
L51	BAS56
L52	BAS678
LAp	BF550
LEp	BF660
LHp	BF569
LJp	BF579
LM	BST120
LN	BST122
LOp	BSR174
LPp	BSR175
LQp	BSR176
LRp	BSR177
MAp	BF989
MGp	BF994S
MOp	BF998R
M01	BF901
M02	BF901R
M04	BF904
M06	BF904R
M08	PMBFJ308
M09	PMBFJ309
M10	PMBFJ310
M16	PMBF4461A
M1p	BFR30
M2p	BFR31
M3p	BFT46

MARK	TYPE NO.
M4p	BSR56
M5p	BSR57
M6p	BSR58
M31	BSD20
M32	BSD22
M65	BF545A
M66	BF545B
M67	BF545C
M74	BSS83
M84	BF556A
M85	BF556B
M85	BF990AR
M86	BF556C
M87	BF990A
M91	BF991
M92	BF992
M97	BFR101A
M98	BFR101B
MAp	BF989
MGp	BF994S
MKp	BF997
MWp	BF996S
N1p	BFR53
N0	BFS505
N2	BFS520
N4	BFS540
N6	BFS25A
N28	BFR520
N30	BFR505
N33	BFG505
N39	BFG505/X
N45	BFG505/XR
N36	BFG520
N42	BFG520/X
N48	BFG520/XR
N37	BFG540
N43	BFG540/X
N49	BFG540/XR
NCp	BF840
NDp	BF841

MARK	TYPE NO.
P	BB515
P	BB619
P	BB620
P	BA582
P1	BB131
P1p	BFR92
P2	BB132
	(SOD323)
P2	BFR92AW
	(SOT323)
P3	BB133
P4	BB134
P5	BB135
p6A	PMBF4416
pA3	PMBD2835
pA2	PMBD2836
pA5	PMBD2837
pA6	PMBD2838
p5B	PMBD6100
p1A	PMBT3904
	(SOT23)
	PXT3904
	(SOT89)
p1B	PMBT2222
	(SOT23)
	PXT2222
	(SOT89)
p1D	PMBTA42
p1E	PMBTA43
p1F	PMBT5550
p1H	PMBTA05
p1J	PMBT2369
p1G	PMBTA06
p1K	PMBT6428
p1L	PMBT6429
p1M	PMBTA13
p1N	PMBTA14
	(SOT23)
	PXTA14
	(SOT89)

MARK	TYPE NO.
p1P	PMBT2222A
	(SOT23)
	PXT2222A
	(SOT89)
p1Q	PMBT5088
p1Y	PMBT3903
p2A	PMBT3906
	(SOT23)
	PXT3906
	(SOT89)
p2B	PMBT2907
	(SOT23)
	PXT2907
	(SOT89)
p2D	PMBTA92
p2E	PMBTA93
p2F	PMBT2907A
	(SOT23)
	PXT2907A
	(SOT89)
p2G	PMBTA56
p2H	PMBTA55
p2L	PMBT5401
p2P	BFR92A
p2T	PMBT4403
	(SOT23)
	PXT4403
	(SOT89)
p2V	PBMTA63
p2V	PBMTA64
	(SOT23)
	PXTA64
	(SOT89)
p2X	PMBT4401
	(SOT23)
	PXT4401
	(SOT89)
p6B	PMBF5484
p6G	PMBF4393
p6H	PMBF5486

MARK	TYPE NO.
p6J	PMBF4391
p6K	PMBF4392
p6M	PMBF5485
p6S	PMBFJ176
p6W	PMBFJ175
p6X	PMBFJ174
p6Y	PMBFJ177
p8A	PMBZ52226B
p8B	PMBZ52227B
p8C	PMBZ52228B
p8D	PMBZ52229B
p8E	PMBZ52230B
p8F	PMBZ52231B
p8G	PMBZ52232B
p8H	PMBZ52233B
p8J	PMBZ52234B
p8K	PMBZ52235B
p8L	PMBZ52236B
p8M	PMBZ52237B
p8N	PMBZ52238B
p8P	PMBZ52239B
p8Q	PMBZ52240B
p8R	PMBZ52241B
p8S	PMBZ52242B
p8T	PMBZ52243B
p8U	PMBZ52244B
p8V	PMBZ52245B
p8W	PMBZ52246B
p8X	PMBZ52247B
p8Y	PMBZ52248B
p8Z	PMBZ52249B
p9A	PLVA650A
p9B	PLVA653A
p9C	PLVA656A
p9D	PLVA659A
p9E	PLVA662A
p9F	PLVA665A
p9G	PLVA668A
pG1	PMBT5551
R1p	BFR93

MARK	TYPE NO.
R2	BFR93AW
R2p	BFR93A
SF	BB804
S1p	BBY31
S2p	BBY40
S4p	BBY62
S6p	BF510
S7p	BF511
S8p	BF512
S9p	BF513
S12	BBY39
S13	BBY42
S14	BB901
T	BB811
T1p	BCX17
T2p	BCX18
T7p	BSR15
T8p	BSR16
T9p	BSR18
T35	BSR20
T36	BSR20A
T92	BSR18A
U1p	BCX19
U2p	BCX20
U7p	BSR13
U8p	BSR14
U9p	BSR17
U35	BSR19
U36	BSR19A
U92	BSR17A
V1p	BFT25
V2p	BFQ67
V2	BFQ67W
V3p	BFG67
V12	BFG67X
V25	PMBT3640
V30	PMBTH10
V31	PMBTH81
V32	BF750
V34	BF749

MARK	TYPE NO.
V38	BF752
WQ	2PD602Q
WR	2PD602R
WS	2PD602S
W1	BFT92W
W1p	BFT92
XQt	2PD602AQ
XRt	2PD602AR
XSt	2PD602AS
X1	BFT93W
X1p	BFT93
YQt	2PD601Q
YRt	2PD601R
YSt	2PD601S
Y1	BZX84-C11
Y2	BZX84-C12
Y3	BZX84-C13
Y4	BZX84-C15
Y5	BZX84-C16
Y6	BZX84-C18
Y7	BZX84-C20
Y8	BZX84-C22
Y9	BZX84-C24
Y10	BZX84-C27
Y11	BZX84-C30
Y12	BZX84-C33
Y13	BZX84-C36
Y14	BZX84-C39
Y15	BZX84-C43
Y16	BZX84-C47
Y17	BZX84-C51
Y18	BZX84-C56
Y19	BZX84-C62
Y20	BZX84-C68
Y21	BZX84-C75
ZQ	2PD601AQ
ZR	2PD601AR
ZS	2PD601AS
Z1	BZX84-C4V7
Z2	BZX84-C5V1

MARK	TYPE NO.
Z3	BZX84-C5V6
Z4	BZX84-C6V2
Z5	BZX84-C6V8
Z6	BZX84-C7V5
Z7	BZX84-C8V2
Z8	BZX84-C9V1
Z9	BZX84-C10
Z11	BZX84-C2V4
Z12	BZX84-C2V7
Z13	BZX84-C3V0
Z14	BZX84-C3V3
Z15	BZX84-C3V6
Z16	BZX84-C3V9
Z17	BZX84-C4V3
04	PMSS3904
06	PMSS3906
02p	BST82
1A	BC846AW
1A	PMST3904
1Ap	BC846A
1B	BC846BW
1Bp	BC846B
1D	BC846W
1Dp	BC846
1E	BC847AW
1Ep	BC847A
1F	BC847BW
1Fp	BC847B
1G	BC847CW
1Gp	BC847C
1H	BC847W
1Hp	BC847
1J	BC848AW
1Jp	BC848A
	(SOT23)
1Jp	BCV61A
	(SOT143)
1K	BC848BW
1Kp	BC848B
	(SOT23)

MARK	TYPE NO.
1Kp	BCV61B
	(SOT143)
1L	BC848CW
1Lp	BC848C
	(SOT23)
1Lp	BCV61C
	(SOT143)
1M	BC848W
1Mp	BC848
	(SOT23)
1Mp	BCV61
	(SOT143)
1Q	PMST5088
1R	PMST5089
1Vp	BF820
1Wp	BF821
1Xp	BF822
1Yp	BF823
2A	PMST3906
2B	BC849BW
2Bp	BC849B
2C	BC849CW
2Cp	BC849C
2D	BC849W
2Dp	BC849
2F	BC850BW
2Fp	BC850B
2G	BC850CW
2Gp	BC850C
2H	BC850W
2Hp	BC850
2T	PMST4403
2X	PMST4401
2Y4	BZV49-C2V4
2Y7	BZV49-C2V7
3A	BC856AW
3Ap	BC856A
3B	BC856BW
3Bp	BC856B
3BR	BC856BR

MARK	TYPE NO.
3D	BC856W
3Dp	BC856
3E	BC857AW
3Ep	BC857A
3F	BC857BW
3Fp	BC857B
3G	BC857CW
3Gp	BC857C
3H	BC857W
3Hp	BC857
3J	BC858AW
3Jp	BC858A
3K	BC858BW
3Kp	BC858B
3L	BC858CW
3Lp	BC858C
3lp	BCV62A
3Kp	BCV62B
3Lp	BCV62C
3M	BC858W
3Mp	BCV62
3Mp	BC858
3Y0	BZV49-C3V0
3Y3	BZV49-C3V3
3Y6	BZV49-C3V6
3Y9	BZV49-C3V9
4A	BC859AW
4Ap	BC859A
4B	BC859BW
4Bp	BC859B
4C	BC859CW
4Cp	BC859C
4D	BC859W
4Dp	BC859
4E	BC860AW
4Ep	BC860A
4F	BC860BW
4Fp	BC860B
4G	BC860CW
4Gp	BC860C

MARK	TYPE NO.
4H	BC860W
4Hp	BC860
4Y3	BZV49-C4V3
4Y7	BZV49-C4V7
5A	BC807-16W
5Ap	BC807-16
5B	BC807-25W
5Bp	BC807-25
5C	BC807-40W
5Cp	BC807-40
5D	BC807W
5Dp	BC807
5E	BC808-16W
5Ep	BC808-16
5F	BC808-25W
5Fp	BC808-25
5G	BC808-40W
5Gp	BC808-40
5H	BC808W
5Hp	BC808
5Y1	BZV49-C5V1
5Y6	BZV49-C5V6
6A	BC817-16W
6Ap	BC817-16
6B	BC817-25W
6Bp	BC817-25
6C	BC817-40W
6Cp	BC817-40
6D	BC817W
6Dp	BC817
6E	BC818-16W
6Ep	BC818-16
6F	BC818-25W
6Fp	BC818-25
6G	BC818-40W
6Gp	BC818-40
6H	BC818W
6Hp	BC818
6Y2	BZV49-C6V2
6Y8	BZV49-C6V8

MARK	TYPE NO.
7Y5	BZV49-C7V5
8Y2	BZV49-C8V2
9Y1	BZV49-C9V1
10Y	BZV49-C10
11Y	BZV49-C11
12Y	BZV49-C12
13Y	BZV49-C13
15Y	BZV49-C15
16Y	BZV49-C16
18Y	BZV49-C18
20Y	BZV49-C20
22Y	BZV49-C22
24Y	BZV49-C24
27Y	BZV49-C27
30Y	BZV49-C30
33Y	BZV49-C33
36Y	BZV49-C36
39Y	BZV49-C39
43Y	BZV49-C43
47Y	BZV49-C47
51Y	BZV49-C51
56Y	BZV49-C56
62Y	BZV49-C62
68Y	BZV49-C68
73p	BAS70
74p	BAS70-04
75p	BAS70-05
76p	BAS70-06
77p	BAS70-07
75Y	BZV49-C75
81A	PMBZ52250B
81B	PMBZ52251B
81C	PMBZ52252B
81D	PMBZ52253B
81E	PMBZ52254B
81F	PMBZ52255B
81G	PMBZ52256B
81H	PMBZ52257B
97p	BCV65
98p	BCV65B

MARK	TYPE NO.
110	KTY82-110
120	KTY82-120
121	KTY82-121
122	KTY82-122
150	KTY82-150
151	KTY82-151
152	KTY82-152
210	KTY82-210
220	KTY82-220
221	KTY82-221
222	KTY82-222
250	KTY82-250
251	KTY82-251
252	KTY82-252

GENERAL

QUALITY

Total Quality Management

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

QUALITY ASSURANCE

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

PARTNERSHIPS WITH CUSTOMERS

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

PARTNERSHIPS WITH SUPPLIERS

Ship-to-stock, statistical process control and ISO 9000 audits.

QUALITY IMPROVEMENT PROGRAMME

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

Advanced quality planning

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

Product conformance

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

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

Product reliability

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

Customer responses

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

PRO ELECTRON TYPE NUMBERING SYSTEM

Basic type number

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

FIRST LETTER

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

A germanium or other material with a band gap of 0.6 to 1 eV

B silicon or other material with a band gap of 1 to 1.3 eV

C gallium arsenide (GaAs) or other material with a band gap of 1.3 eV or more

R compound materials, e.g. cadmium sulphide.

SECOND LETTER

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

A diode; signal, low power

B diode; variable capacitance

C transistor; low power, audio frequency

D transistor; power, audio frequency

E diode; tunnel

F transistor; low power, high frequency

G multiple of dissimilar devices/miscellaneous devices; e.g. oscillators. Also with special third letter, see under '*Serial number*'

H diode; magnetic sensitive

L transistor; power, high frequency

N photocoupler

P radiation detector; e.g. high sensitivity photo-transistor; with special third letter

Q radiation generator; e.g. LED, laser; with special third letter

R control or switching device; e.g. thyristor, low power; with special third letter

S transistor; low power, switching

T control and switching device; e.g. thyristor, power; with special third letter

U transistor; power, switching

W surface acoustic wave device

X diode; multiplier, e.g. varactor, step recovery

Y diode; rectifying, booster

Z diode; voltage reference or regulator, transient suppressor diode; with special third letter.

SERIAL NUMBER

The number comprises three figures running from 100 to 999 for devices primarily intended for consumer equipment, or one letter (Z, Y, X, etc.) and two figures running from 10 to 99 for devices primarily intended for industrial or professional equipment.(1)

Version letter

A letter may be added to the basic type number to indicate minor electrical or mechanical variants of the basic type.

RATING SYSTEMS

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

Definitions of terms used

ELECTRONIC DEVICE

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

CHARACTERISTIC

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

BOGEY ELECTRONIC DEVICE

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

RATING

A value that establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and

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

operation, and may be stated in any suitable terms. Limiting conditions may be either maxima or minima.

RATING SYSTEM

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

Absolute maximum rating system

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

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

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

Design maximum rating system

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

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

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

Design centre rating system

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

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

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

LETTER SYMBOLS

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

Basic letters

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

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

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

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

Subscripts

Upper-case subscripts are used for the indication of:

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

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

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

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

A, a	anode
amb	ambient
(AV), (av)	average value
B, b	base
(BO)	breakover
(BR)	breakdown
case	case
C, c	collector
C	controllable
D, d	drain
E, e	emitter
F, f	fall, forward (or forward transfer)
G, g	gate
H	holding
h	heatsink
I, i	input
j-a	junction to ambient
j-mb	junction to mounting base
K, k	cathode
L	load
M, m	peak value
(min)	minimum
(max)	maximum
mb	mounting base
O, o	as third subscript: the terminal not mentioned is open-circuit
(OV)	overload
P, p	pulse
Q, q	turn-off
R, r	as first subscript: reverse (or reverse transfer), rise. As second subscript: repetitive, recovery. As third subscript: with a specified resistance between the terminal not mentioned and the reference terminal
(RMS), (rms)	root-mean-square value

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

S, s	as first subscript: series, source, storage, stray, switching. As second subscript: surge (non-repetitive). As third subscript: short circuit between the terminal not mentioned and the reference terminal
stg	storage
th	thermal
TO	threshold
tot	total
W	working
X, x	specified circuit
Z, z	reference or regulator (zener)
1	input (four-pole matrix)
2	output (four-pole matrix).

Applications and examples

TRANSISTOR CURRENTS

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

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

TRANSISTOR VOLTAGES

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

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

SUPPLY VOLTAGES OR CURRENTS

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

Examples: V_D=C_C, I_{EE}.

A reference terminal is indicated by a third subscript.

Example: V_{CCE}.

DEVICES WITH MORE THAN ONE TERMINAL OF THE SAME KIND

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

Examples:

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

MULTIPLE DEVICES

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

Examples:

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

ELECTRICAL PARAMETERS

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

Examples:

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

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

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

Examples:

h_{fe}	small-signal value of the short-circuit forward current transfer in common-emitter configuration
$Z_i = R_i + jX_i$	small-signal value of the input impedance.

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

Examples: h_{FE}, y_{RE}, h_{fe}, g_{FS}.

FOUR-POLE MATRIX PARAMETERS

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

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

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

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

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

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

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

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

Examples:

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

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

S-PARAMETER DEFINITIONS

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

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

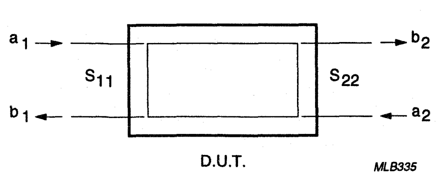


Fig.1 Two-port network with reflection coefficients S_{11} and S_{22}.

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

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

where

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

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

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

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

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

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

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

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

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

Measurement

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

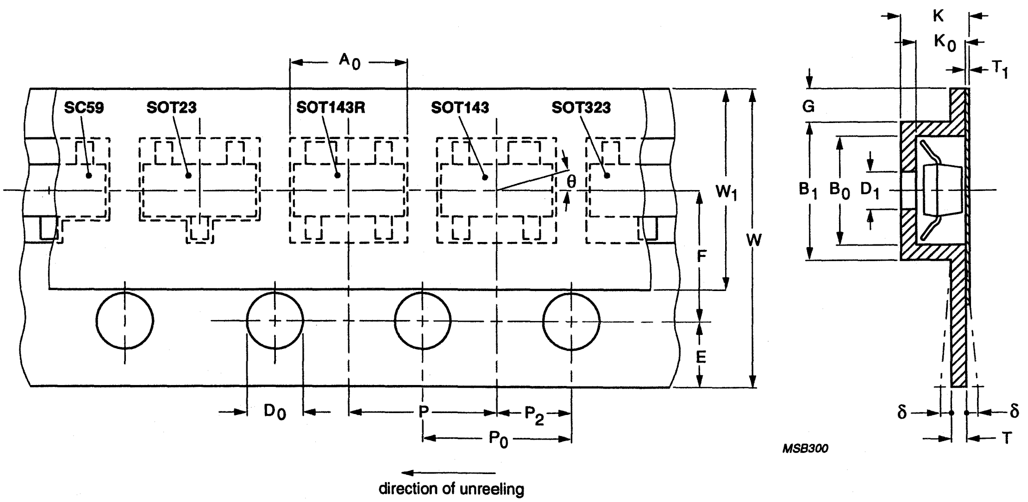
The network analyzer must have a directivity of at least 40 dB to obtain an accuracy of 0.5 dB when measuring return loss figures of 20 dB. A full two-port correction method can be used to improve the accuracy.

TAPE and REEL PACKING

Tape and reel packing meets the feed requirements of automatic pick and place equipment (packing conforms to IEC publication 286-3). The tape is an ideal shipping container, making handling easy and providing secure blister cavities in which the transistors are sealed with peel-off cover tape.

Table 1 Packing quantities per reel

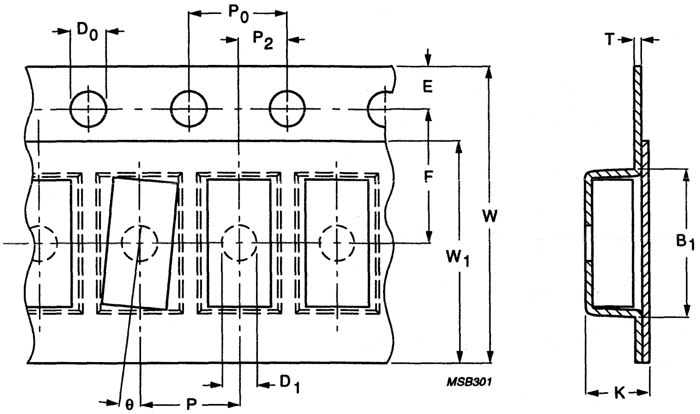
PACKAGE	7-INCH REEL	LARGE REEL
SOD80	2500	10 000
SOD80C	2500	10 000
SOD87	2000	8000
SOD106A	1500	not defined
SOD110	3000	not defined
SOD123	3000	10 000
SOD323	3000	10 000
SOT23	3000	10 000
SOT89	1000	4000
SOT143	3000	10 000
SOT143R	3000	10 000
SOT223	1000	4000
SOT323	3000	10 000
SC59	3000	10 000



For dimensions see Table 3.

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

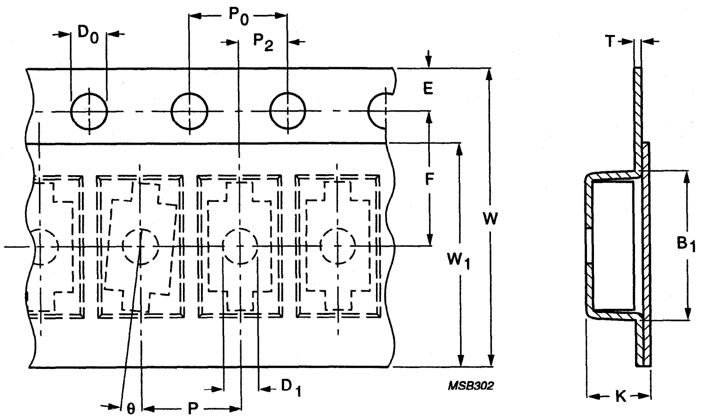
Fig.2 Specification for 8 mm tape (SC59, SOT23 SOT143, SOT143R and SOT323).



For dimensions see Table 3.

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

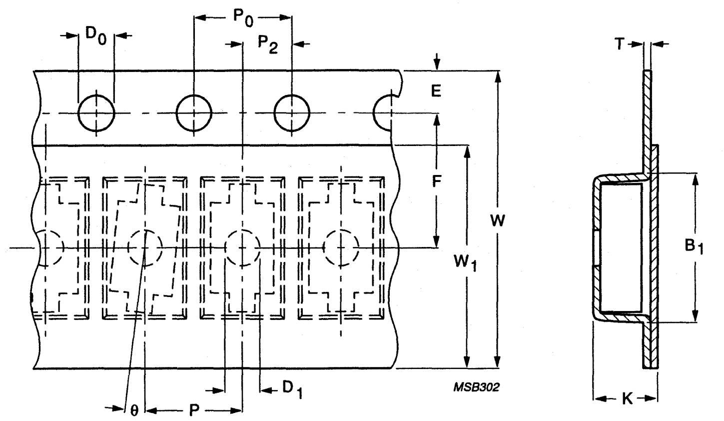
Fig.3 Specification for 8 mm tape (SOD80, SOD80C, SOD87 and SOD110).



For dimensions see Table 3.

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

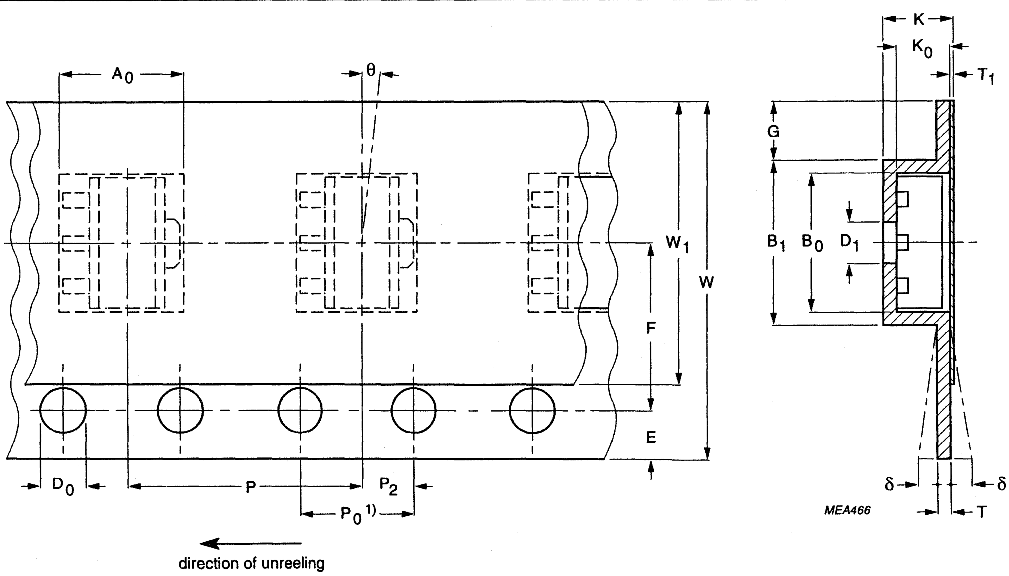
Fig.4 Specification for 8 mm tape (SOD123 and SOD323).



For dimensions see Table 3.

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

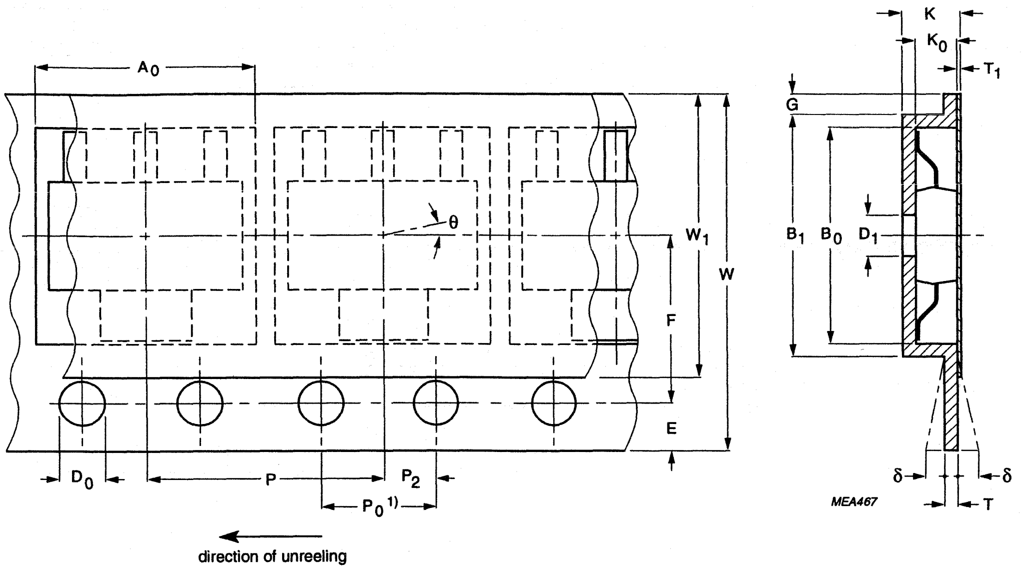
Fig.5 Specification for 12 mm tape (SOD106A).



For dimensions see Table 3.

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

Fig.6 Specification for 12 mm tape (SOT89).



For dimensions see Table 3.

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

Fig.7 Specification for 12 mm tape (SOT223).

Table 2 Carrier tape widths for package outlines

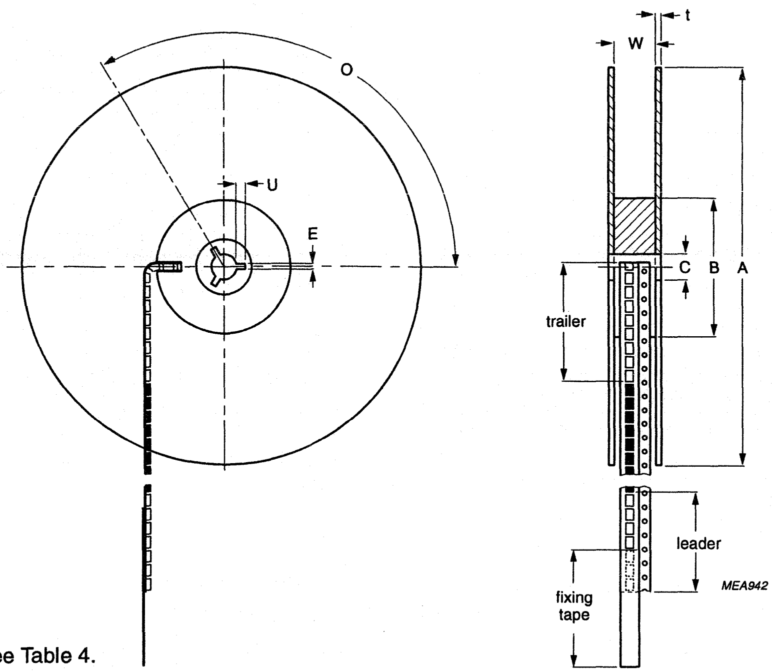
8 mm	12 mm
SC59	SOD106A
SOD80	SOT89
SOD80C	SOT223
SOD87	
SOD110	
SOD123	
SOD323	
SOT23	
SOT143(R)	
SOT323	

Table 3 Tape dimensions (in mm)

DIMENSION (Figs 2 to 7)	CARRIER TAPE FOR:		TOLERANCE
	8 mm	12 mm	
Overall dimensions			
W	8.0	12.0	±0.2
K	1.5	2.4	max.
G	0.75	0.75	min.
Sprocket holes (note 1)			
D_0	1.5	1.5	+0.1/−0
E	1.75	1.75	±0.1
P_0	4.0	4.0	±0.1
Relative placement compartment			
P_2	2.0	2.0	±0.1
F	3.5	5.5	±0.05
Compartment			
A_0 B_0 B_1 K_0	Compartment dimensions depend on package size. Maximum clearance between device and compartment is 0.3 mm; the minimum clearance ensures that the device is not totally restrained within the compartment.		
D_1	1.0	1.5	min.
P	4.0	8.0	±0.1
θ	15°	15°	max.
Cover tape (note 2)			
W_1	5.7	9.5	max.
T_1	0.1	0.1	max.
Carrier tape			
W	8.0	12.0	±0.2
T	0.4	0.4	max.
δ	0.3	0.3	max.

Notes

1. Tolerance over any 10 pitches ±0.2mm.
2. The cover tape shall not overlap the tape or sprocket holes.



For dimensions see Table 4.

Fig.8 Reel specification.

Table 4 Reel dimensions (in mm)

DIMENSION (Fig.8)	8 mm tape	12 mm tape	TOLERANCE
Flange			
A	180 (note 1)	180 or 286	±0.5
t	1.5	1.5	+0.5/–0.1
W	8.4	12.4	18.0+0.2
Hub			
B	62	62	±1.5
C	12.75	12.75	+0.15/–0.2
Key slot			
E	2	2	±0.2
U	4	4	±0.5
O	120°	120°	–

Note

1. Large reel diameter depends on individual package (286 or 350).

MOUNTING AND SOLDERING

Mounting methods

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

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

Reflow soldering

SOLDER PASTE

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

Screen printing

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

Stencilling

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

Dispensing

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

Pin transfer

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

REFLOW TECHNIQUES

Thermal conduction

The prepared substrates are carried on a conveyor belt, first through a preheating stage and then through a soldering stage. Heat is transferred to the substrate by conduction through the belt. Figure 9 shows a theoretical time/temperature relationship for thermal conduction reflow soldering. This method is particularly suited to thick film substrates and is often combined with infrared heating.

Infrared

An infrared oven has several heating elements giving a broad spectrum of infrared radiation, normally above and below a closed loop belt system. There are separate zones for preheating, soldering and cooling. Dwell time in the soldering zone is kept as short as possible to prevent damage to components and substrate. A typical heating profile is shown in Fig.10. This reflow method is often applied in double-sided prints.

Vapour phase

A substrate is immersed in the vapours of a suitable boiling liquid. The vapours transfer latent heat of condensation to the substrate and solder reflow takes place. Temperature is controlled precisely by the boiling point of the liquid at a given pressure. Some systems employ two vapour zones, one above the other. An elevator tray, suspended from a hoist mechanism passes

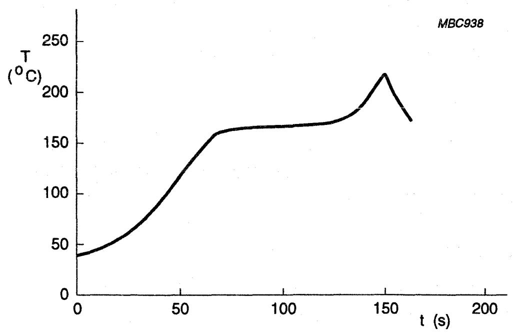


Fig.9 Theoretical time/temperature curve for a typical thermal conduction reflow cycle.

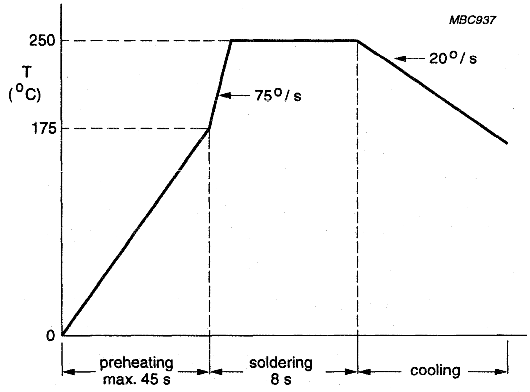


Fig.10 Typical temperature profile of an infrared oven operating at a belt speed of 0.41 m/min.

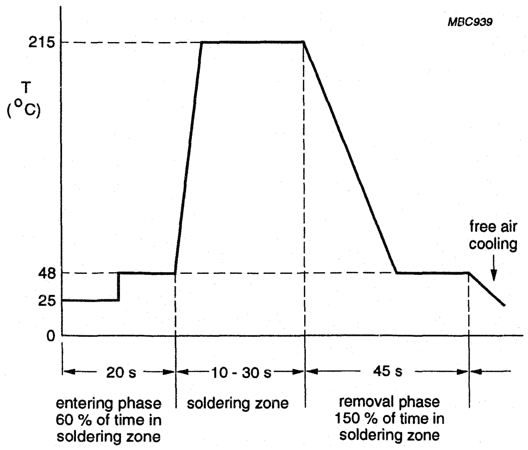


Fig.11 Theoretical time/temperature curve relationship for dual vapour reflow soldering.

the substrate vertically through the first vapour zone into the secondary soldering zone and then hoists it out of the vapour to be cooled. A theoretical time/temperature relationship for this method is shown in Fig.11.

Wave soldering

This soldering technique is not recommended for SOT89.

ADHESIVE APPLICATION

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

Pin transfer method

A pin is used to transfer a droplet of adhesive from a reservoir to a precise position on the surface where it is required. The size of the droplet depends on pin diameter, depth to which the pin is dipped in the reservoir, rheology of the adhesive, and the temperature of adhesive and surrounds. The pin can be part of a pin array (bed of nails) that corresponds exactly with the required adhesive positions on the substrate. With this method, adhesive can be applied to the whole of one side of a substrate in one operation and is therefore suitable for high-volume production and can be used with pre-loaded mixed prints.

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

Screen printing method

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

Pressure syringe method

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

FLUXING

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

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

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

Foam

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

Spray

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

Wave

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

PRE-HEATING

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

SOLDERING

Wave soldering is usually the best method to use when high throughput rates are required. The single-wave soldering principle (Fig.12) is the most straight forward method and can be used on simple substrates with two-terminal SMD components. More complex substrates with increased circuit density and closer spacing of conductors can pose the problems of nonwetting (dry joints) and solder bridging. Bridging can occur across the closely spaced leads of multi-leaded devices as well as across adjacent leads on neighbouring components. Nonwetting is usually caused by components with plastic bodies. The plastic is not wetted by solder and creates a depression in the solder wave, which is augmented by surface tension. This can cause a shadow behind the component and prevent solder from reaching the joint surfaces. A smooth laminar solder wave is required to avoid bridging and a high pressure wave is needed to completely cover the areas that are difficult to wet. These conflicting demands are difficult to attain in a single wave but dual wave techniques go a long way in overcoming the problem.

In a dual wave machine (Fig.13), the substrate first comes into contact with a turbulent wave which has a high vertical velocity. This ensures good solder contact with both edges of the components and prevents joints from being missed. The second smooth laminar wave completes the formation of the solder fillet, removes excess solder and prevents bridging. Figure 14 indicates the time/temperature relationship measured at the soldering site in dual wave soldering.

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

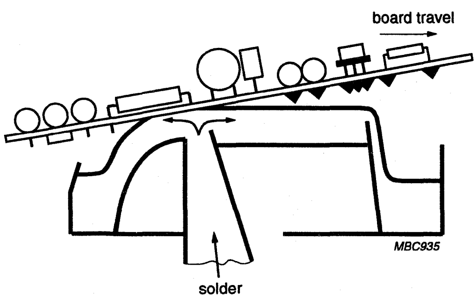


Fig.12 Single wave soldering principle.

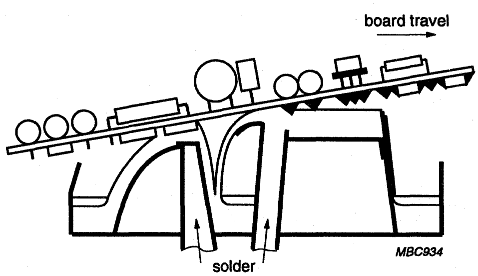


Fig.13 Dual wave soldering principle.

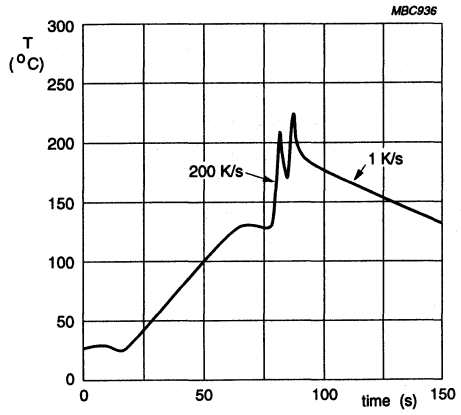


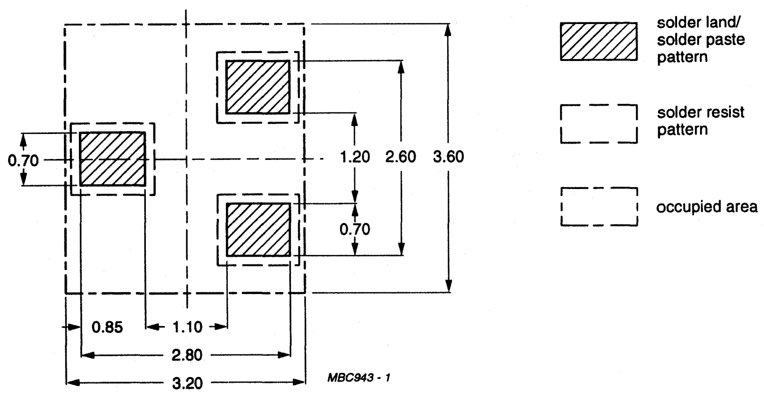
Fig.14 Typical time-temperature curve measured at the soldering site.

Footprint design

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

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

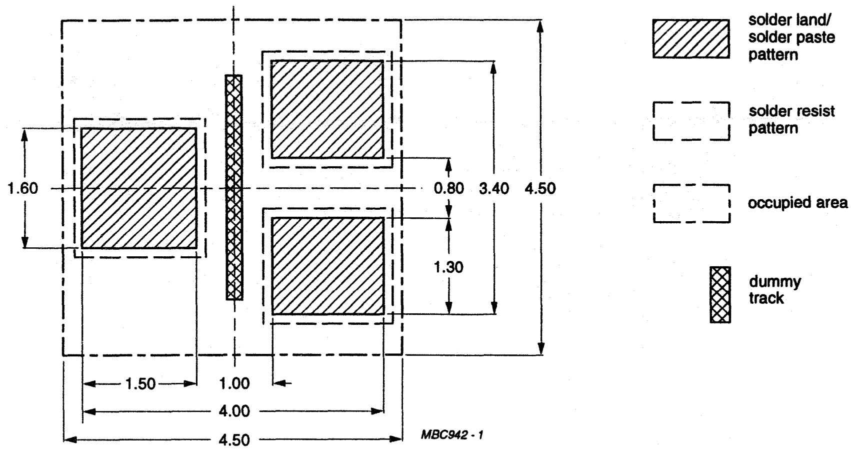
SOT23 FOOTPRINTS



Dimensions in mm.

Placement accuracy: ±0.25 mm.

Fig.15 Reflow soldering footprint for SOT23; typical dimensions.



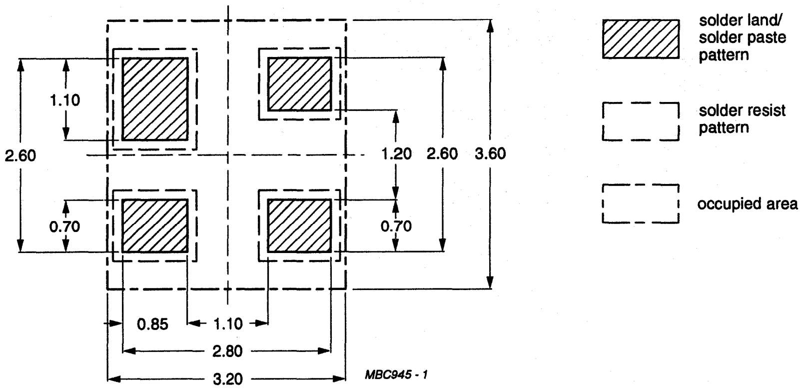
Dimensions in mm.

Dummy track dimensions: 0.40 × 3.00 mm.

Placement accuracy: ±0.25 mm.

Fig.16 Wave soldering footprint for SOT23; typical dimensions.

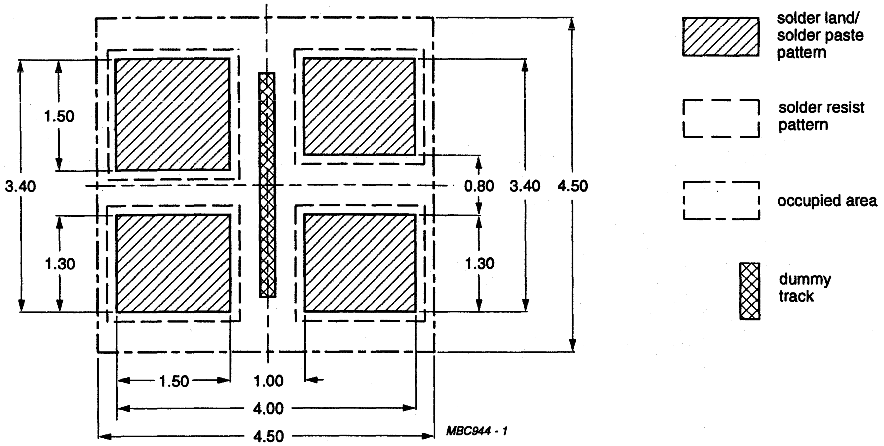
SOT143 FOOTPRINTS



Dimensions in mm.

Placement accuracy: ±0.25 mm.

Fig.17 Reflow soldering footprint for SOT143; typical dimensions.



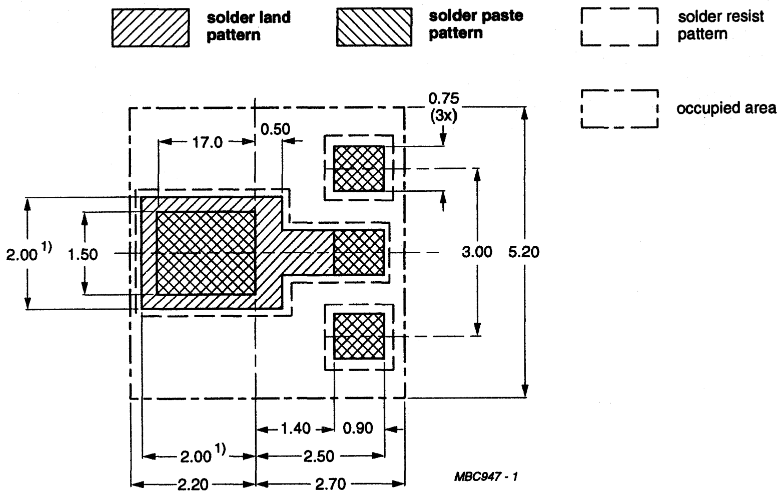
Dimensions in mm.

Dummy track dimensions: 0.40 × 3.00 mm.

Placement accuracy: ±0.25 mm.

Fig.18 Wave soldering footprint for SOT143; typical dimensions.

SOT89 FOOTPRINTS

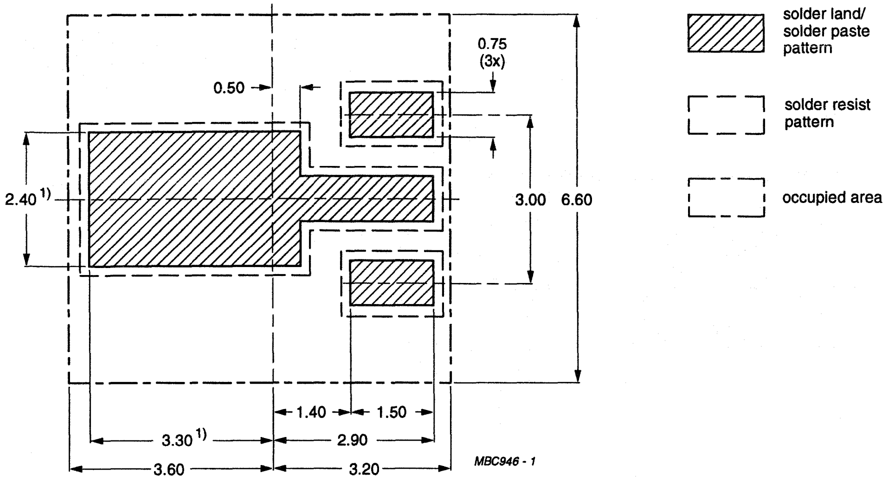


Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.19 Reflow soldering footprint for SOT89; typical dimensions.



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

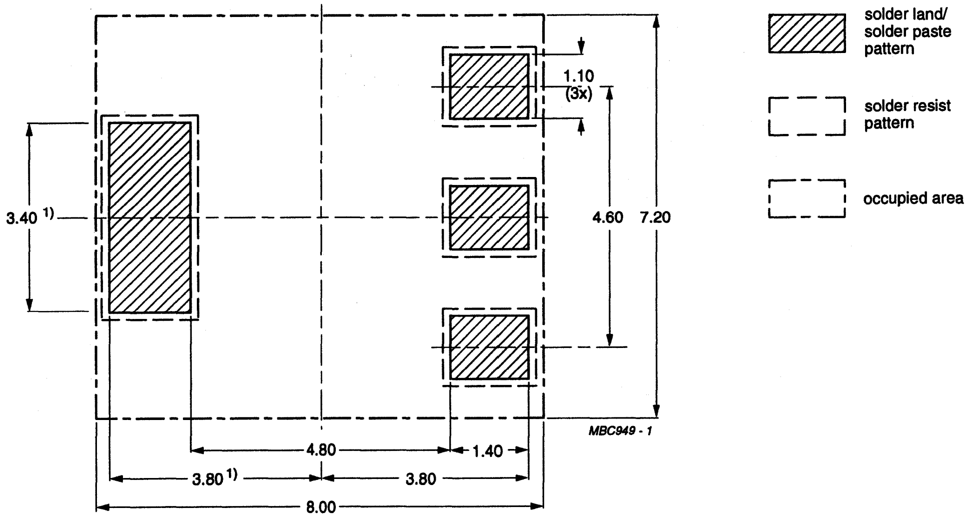
Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.20 Wave soldering footprint for SOT89; typical dimensions.

SOT223 footprints

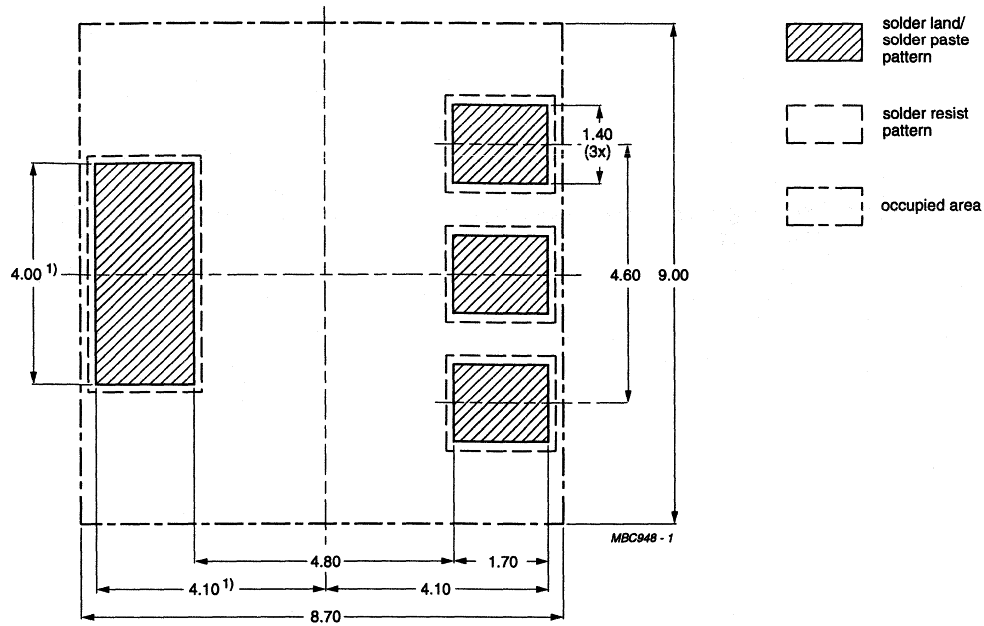


Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.21 Reflow soldering footprint for SOT223; typical dimensions.



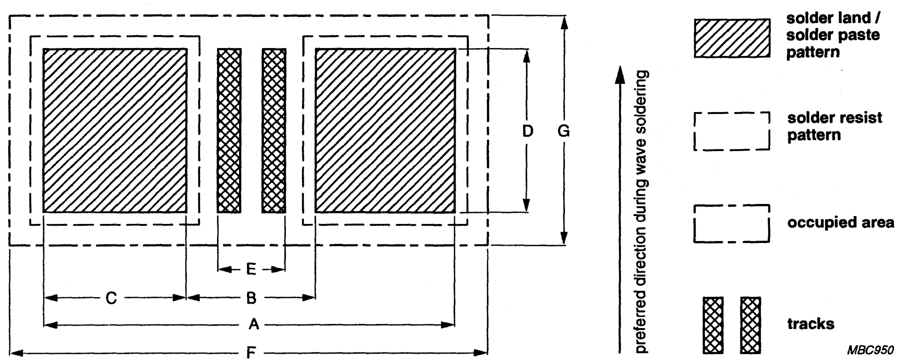
Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.22 Wave soldering footprint for SOT223; typical dimensions.

SOD80, SOD87 and SOD123 footprints



See Table 5 for dimensions

Fig.23 Footprint basis for SOD80, SOD87 and SOD123.

Table 5 Typical footprint dimensions for Fig.23; placement accuracy = ±0.25 mm

OUTLINE	DIMENSIONS (mm)						
	A	B	C	D	E	F	G
Reflow soldering							
SOD80C	4.30	2.30	1.00	1.70	1.90	4.70	2.50
SOD87	4.30	2.30	1.00	2.10	1.90	4.70	2.90
SOD123	4.00	2.40	0.80	0.80	2.00	4.60	2.30
Wave soldering							
SOD80C	4.90	2.70	1.10	1.70	2.10	6.30	2.90
SOD87	4.90	2.70	1.10	2.10	2.10	6.90	3.50
SOD123	5.50	2.90	1.30	1.80	2.30	6.00	3.50

SOD106A footprints

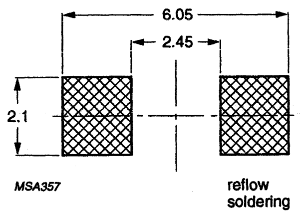


Fig.24 Reflow soldering footprint for SOD106A; typical dimensions.

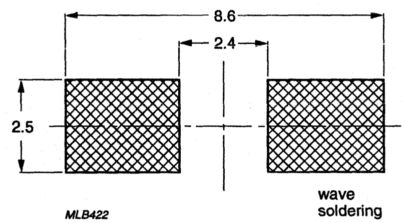


Fig.25 Wave soldering footprint for SOD106A; typical dimensions.

SOD110 footprint

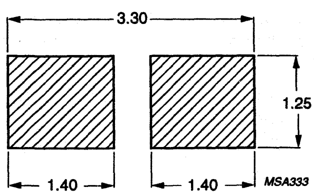


Fig.26 Reflow soldering footprint for SOD110; typical dimensions.

SOT323 footprint

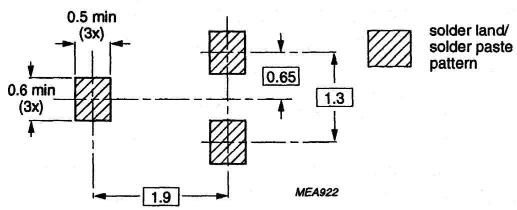


Fig.27 Reflow soldering footprint for SOT323; typical dimensions.

SC59 footprint

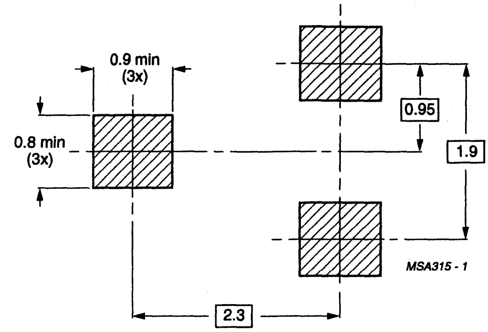


Fig.28 Reflow soldering footprint for SC59; typical dimensions.

Hand soldering microminiature components

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

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

SOT103

Transistors in SOT103 packages may be mounted with leads bent for surface mounting.

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

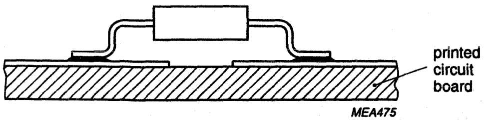


Fig.29 SOT103 leads bent for surface mounting.

THERMAL CONSIDERATIONS

Thermal resistance

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

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

Devices lose most of their heat by conduction when mounted on a substrate. Referring to Fig.30, heat conducts from its source (the junction) via the package leads and soldered connections to the substrate. Some heat radiates from the package into the surrounding air where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The elements of thermal resistance shown in Fig.31 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 packages)
- $R_{th\ j\text{-}a}$ thermal resistance from junction to ambient.

The temperature at the junction depends on the ability of the package 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

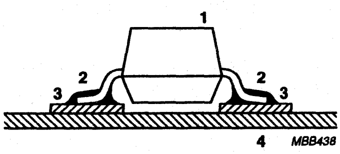
- $T_{j\ max}$ is the maximum junction temperature
- T_{amb} is the ambient temperature
- $P_{tot\ max}$ is the maximum power handling capability of the device, including the effects of external loads when applicable.

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 package 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 32 and 33. Standard mounting conditions to set the maximum power ratings of the various packages are shown in Figs 34 to 37. 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.



Heat radiates from the package (1) to ambient.

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

Fig.30 Heat losses.

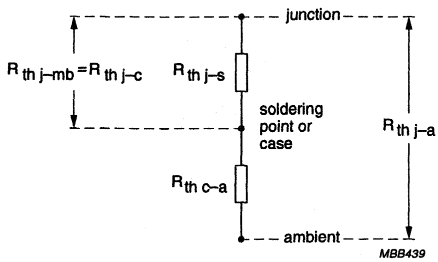
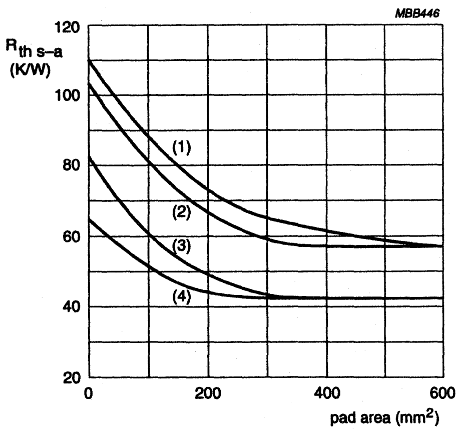


Fig.31 Representation of thermal resistance paths of a device mounted on a substrate or printed board.



(1) single-sided, unplated
(2) single-sided, plated
(3) double-sided, unplated
(4) double-sided, plated.

Fig.32 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of pad area on different configurations of FR4 epoxy fibre-glass circuit board.

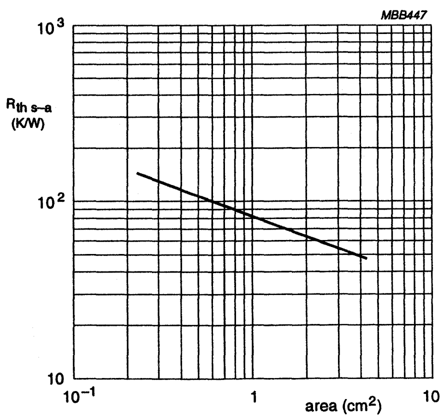
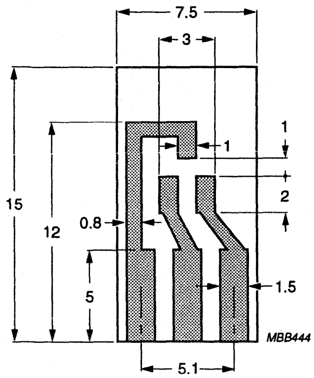
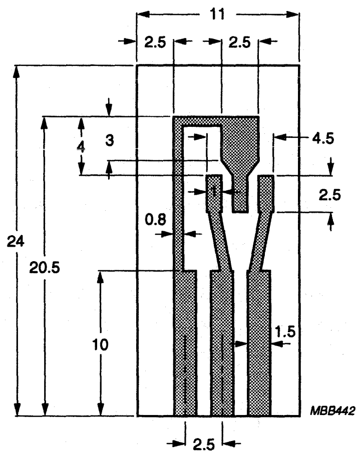


Fig.33 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of area of ceramic substrate.



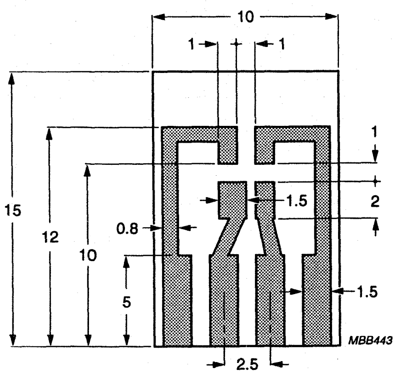
Dimensions in mm.

Fig.34 Standard mounting conditions for SOT23.



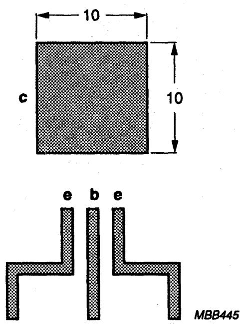
Dimensions in mm.

Fig.35 Standard mounting conditions for SOT89.



Dimensions in mm.

Fig.36 Standard mounting conditions for SOT143.



Dimensions in mm.

Fig.37 Standard mounting conditions for SOT223.

DEVICE DATA
in alphanumeric sequence

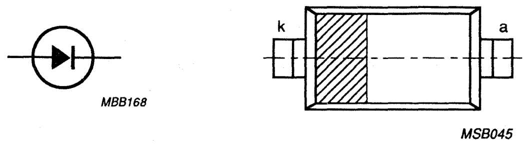
Silicon planar diode — BA582

DESCRIPTION

The BA582 is a silicon planar high performance band switching diode, intended for low loss band switching applications in VHF TV tuners. The device has a low diode capacitance and low series resistance and is encapsulated in a microminiature plastic SOD123 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		35	V
I_F	forward current		100	mA
T_j	junction temperature		150	°C
C_d	diode capacitance	V_R = 3 V; f = 1 to 100 MHz	1.1	pF
r_d	series resistance	I_F = 3 mA; f = 200 MHz	0.7	Ω



Cathode indicated by a blue band

Marking code: Sp

Fig.1 Simplified outline and symbol.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	35	V
I_F	forward current	DC value	–	100	mA
T_{stg}	storage temperature range		−65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}a}$	from junction to ambient	note 1	430	K/W

Note

1. Mounted on a printed circuit board; 15 x 10 x 0.7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_F	forward voltage	I_F = 100 mA	–	1.1	V
I_R	reverse current	V_R = 20 V	–	10	nA
		V_R = 20 V; T_{amb} = 75 °C	–	1	µA
C_d	diode capacitance	V_R = 3 V; f = 1 to 100 MHz	–	1.1	pF
r_d	series resistance	I_F = 3 mA; f = 200 MHz	–	0.7	Ω

BAND-SWITCHING DIODES FOR SURFACE MOUNTING

Switching diodes in a SOD-80 envelope, intended for band switching in v.h.f. television tuners. A special feature of these diodes is their low capacitance.

These SM diodes are leadless diodes in an hermetically sealed micro-miniature glass envelope with tin-plated metal discs at each end. They are suitable for Automatic Placement and as such they can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

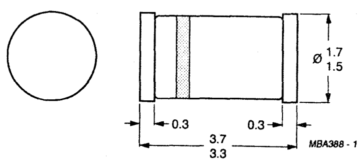
QUICK REFERENCE DATA

			BA682	BA683	
Continuous reverse voltage	V_R	max.	35	35	V
Forward current (d.c.)	I_F	max.	100	100	mA
Junction temperature	T_j	max.	150	150	^oC
Diode capacitance $V_R = 3$ V; f = 1 MHz	C_d	<	1,25	1,2	pF
Series resistance at f = 200 MHz					
$I_F = 3$ mA	r_D	<	0,7	1,2	Ω
$I_F = 10$ mA	r_D	<	0,5	0,9	Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a red band

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	35	V
Forward current (d.c.)	I_F	max.	100	mA
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j		150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$ =	0,6	K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 100 mA	V_F	<	1,0	V
Reverse current				
V_R = 20 V	I_R	<	50	nA
V_R = 20 V; T_{amb} = 75 °C	I_R	<	1	μA

			BA682	BA683	
Diode capacitance at f = 1 MHz					
V_R = 1 V	C_d	<	1,5	1,5	pF
V_R = 3 V	C_d	<	1,25	1,2	pF
Series resistance at f = 200 MHz					
I_F = 3 mA	r_D	<	0,7	1,2	Ω
I_F = 10 mA	r_D	<	0,5	0,9	Ω

Silicon planar epitaxial high-speed diode

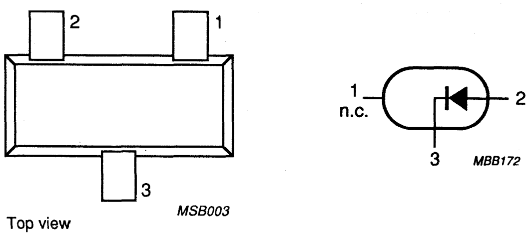
BAL74

DESCRIPTION

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching applications.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		50	V
V_{RRM}	repetitive peak reverse voltage		50	V
I_{FRM}	repetitive peak forward current		500	mA
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns
Q_s	recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	45	pC
T_j	junction temperature		150	°C



Marking code: BAL74 = JCp.

Fig.1 Simplified outline (SOT23) and symbol.

Silicon planar epitaxial high-speed diode

BAL74

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	50	V
V_{RRM}	repetitive peak reverse voltage		–	50	V
I_F	forward current	DC value	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 µs	–	4	A
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	mounted on FR4 printboard	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 μA	50	V
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1000	mV
		I_F = 150 mA	1250	mV
I_R	reverse current	V_R = 50 V; T_j = 150 °C	100	μA
		V_R = 50 V	0.1	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz	2	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns
Q_s	recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	45	pC

Silicon planar epitaxial high-speed diode

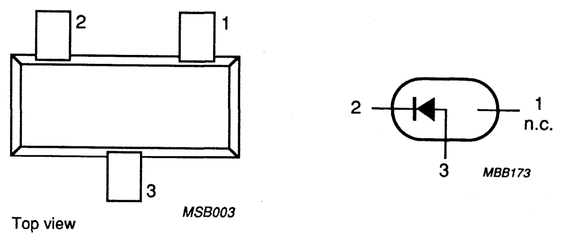
BAL99

DESCRIPTION

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching applications.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		70	V
V_{RRM}	repetitive peak reverse voltage		70	V
I_{FRM}	repetitive peak forward current		500	mA
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns
Q_s	recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	45	pC
T_j	junction temperature		150	°C



Marking code: BAL99 = JFp.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
V_{RRM}	repetitive peak reverse voltage		–	70	V
I_F	forward current	DC value	–	215	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 μs	–	4.5	A
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

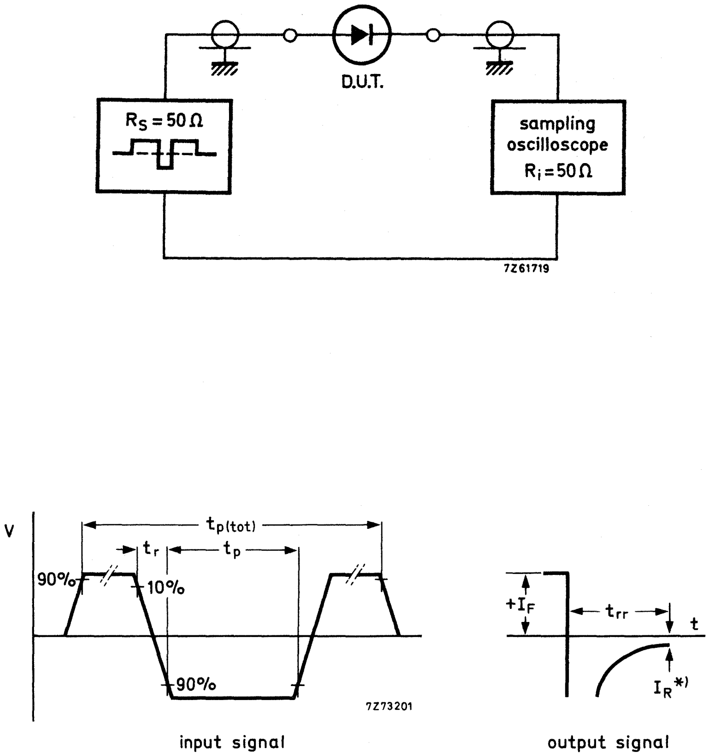
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	mounted on FR4 printboard	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 μA	70	–	V
V_F	forward voltage	I_F = 1 mA	–	715	mV
		I_F = 10 mA	–	855	mV
		I_F = 50 mA	–	1000	mV
		I_F = 150 mA	–	1250	mV
I_R	reverse current	V_R = 25 V; T_j = 150 °C	–	30	μA
		V_R = 70 V	–	1	μA
		V_R = 70 V; T_j = 150 °C	–	50	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz	–	1.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.2	–	4	ns
Q_s	recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω; see Fig.3	–	45	pC

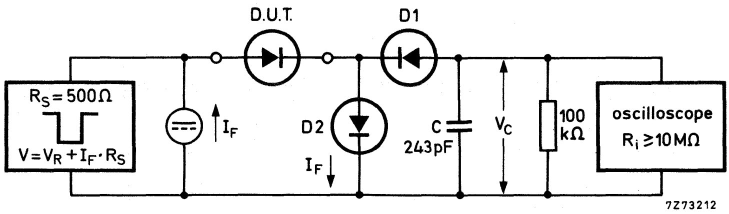


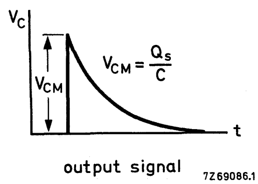
Input signal:
rise time of reverse pulse (t_r) = 0.6 ns
reverse pulse duration (t_p) = 30 ns
duty factor (δ) = 0.0025
total pulse duration ($t_{p(tot)}$) = 0.2 µs.

Circuit capacitance:
C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Oscilloscope:
rise time (t_r) = 0.35 ns.

Fig.2 Reverse recovery time test circuit and waveforms.





D1 = BAW62
D2 = diode with minority carrier life time (10 mA: < 200 ps).

Input signal:
rise time of reverse pulse (t_r) = 2 ns
reverse pulse duration (t_p) = 400 ns
duty factor (δ) = 0.02.

Circuit capacitance:
C ≤ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

Fig.3 Recovery charge test circuit and waveforms.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching in hybrid thick and thin-film circuits.

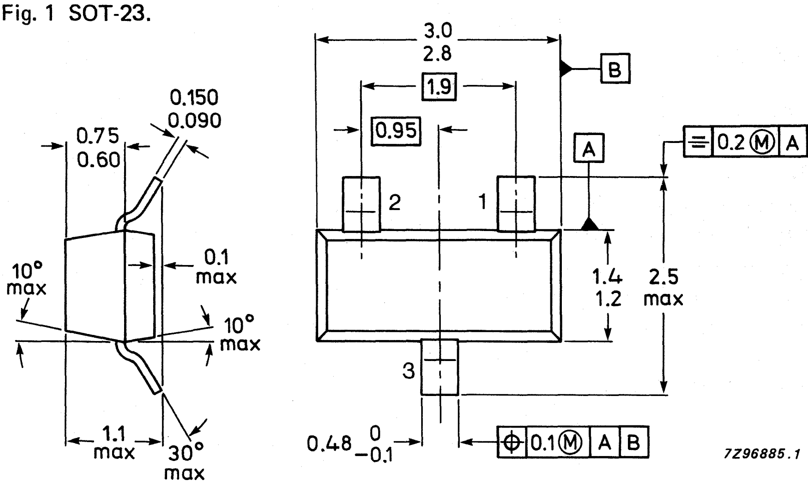
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	500	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

MECHANICAL DATA

Dimensions in mm

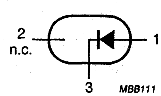
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS16 = A6p



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	500	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	4	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE*

From junction to ambient▲	$R_{th\,j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	30	μA
V_R = 75 V	I_R	<	1	μA
V_R = 75 V; T_j = 150 °C	I_R	<	50	μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	<	2	pF
Forward recovery voltage (see also Fig. 2) when switched to I_F = 10 mA; t_p = 20 ns	V_{fr}	<	1,75	V
Reverse recovery time (see also Fig. 3) when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge (see also Fig. 4) when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

* See *Thermal characteristics.*

▲ Mounted on an FR4 printed-circuit board.

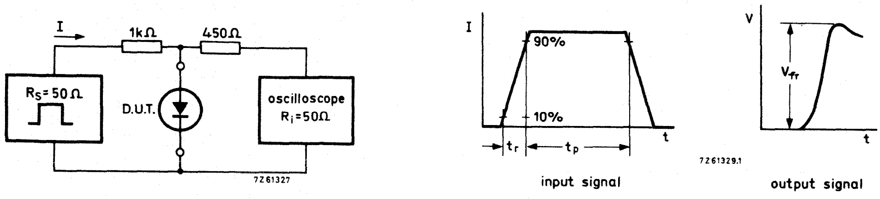


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal: forward pulse rise time = t_r = 20 ns; forward current pulse duration t_p = 120 ns; duty factor = δ = 0,01.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

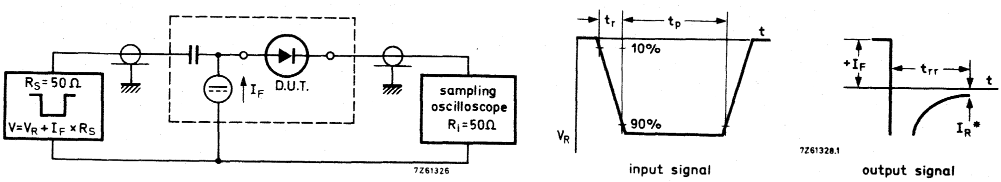


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal: reverse pulse rise time = t_r = 0,6 ns; reverse pulse duration = t_p = 100 ns; duty factor = δ = 0,05.
* t_{rr} up to I_R = 1 mA.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

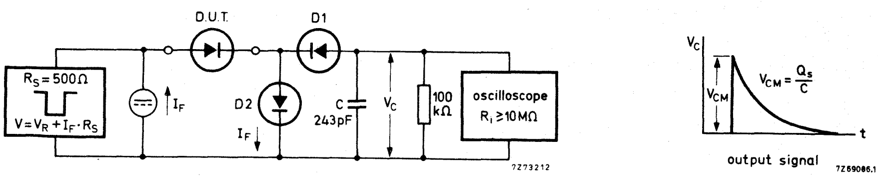


Fig. 4 Recovery charge test circuit and waveform.

D1 = BAW62; D2 = diode with minority carrier life time at 10 mA: < 200 ps
Input signal

Rise time of the reverse pulse	t_r	=	2 ns
Reverse pulse duration	t_p	=	400 ns
Duty factor	δ	=	0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

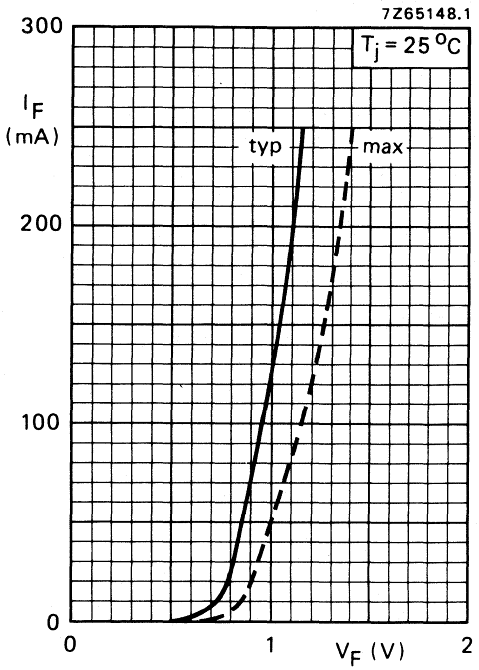


Fig. 5.

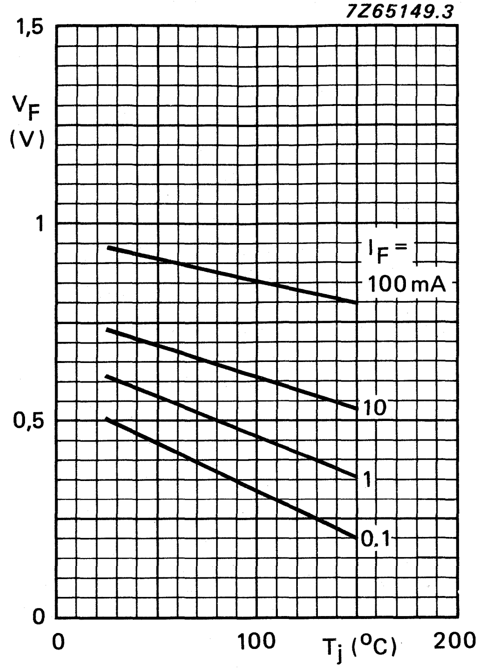


Fig. 6 Typical values.

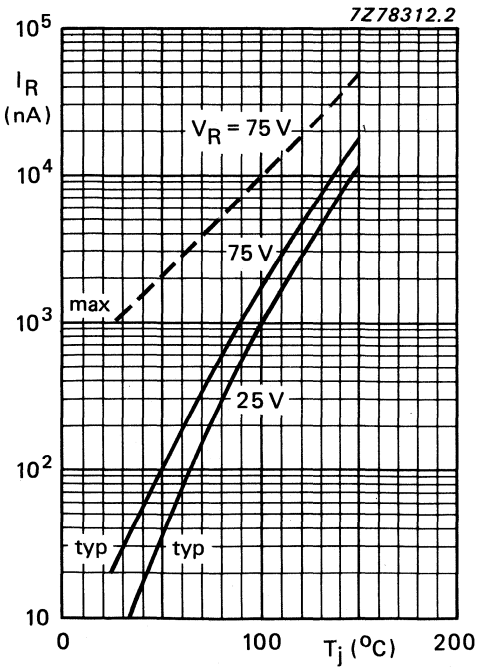


Fig. 7.

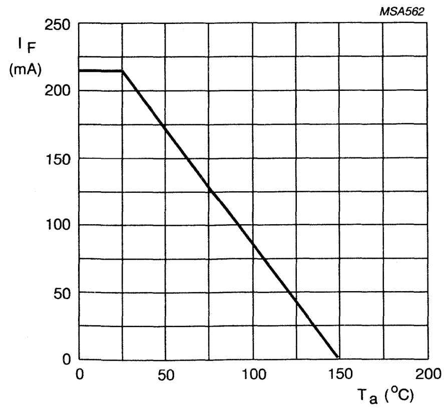


Fig. 8 Current derating curve.

Silicon planar epitaxial high-speed diode

BAS16W

FEATURES

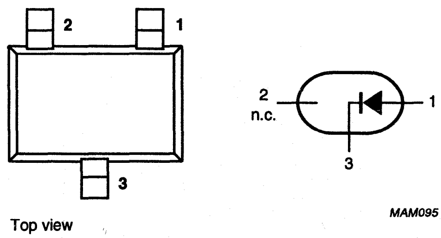
- Plastic SMD envelope
- High switching speed
- General application.

DESCRIPTION

Epitaxial high-speed switching diode in a small rectangular SMD SOT323 envelope. The diode is intended for high-speed switching applications in surface mounted circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		75	V
V_{RRM}	repetitive peak reverse voltage		85	V
I_{FRM}	repetitive peak forward current		500	mA
T_j	junction temperature		150	°C
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns



Marking code: A6

Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	75	V
V_{RRM}	repetitive peak reverse voltage		–	85	V
I_F	DC forward current		–	175	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note (1)	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	note (1)	625 K/W

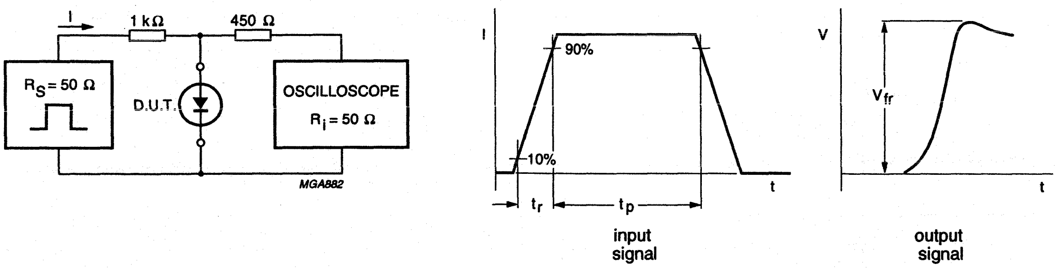
Note

1. Device mounted on FR4 printed-circuit board.

CHARACTERISTICS

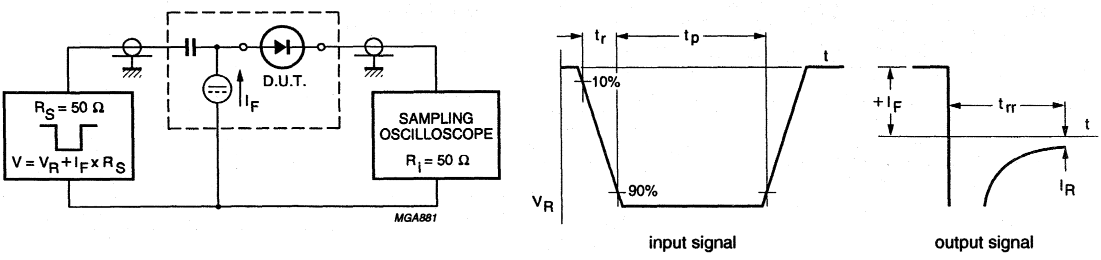
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	V_R = 25 V	30	nA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V	1	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz	1.5	pF
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_p = 20 ns; see Fig.2	1.75	V
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1mA; see Fig.3	4	ns



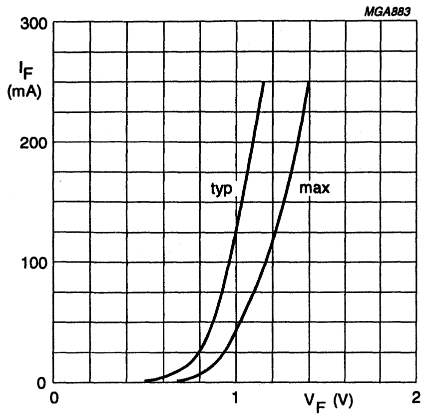
Input signal: forward pulse rise time t_r = 20 ns; forward pulse duration t_p = 120 ns; duty factor δ = 0.01.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



Input signal: reverse pulse rise time t_r = 0.6 ns; reverse pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.3 Reverse recovery time test circuit and waveforms.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage.

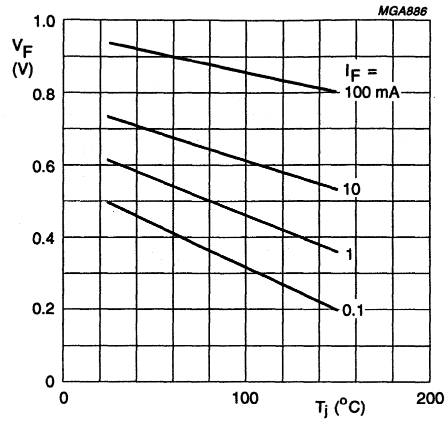


Fig.5 Forward voltage as a function of junction temperature; typical values.

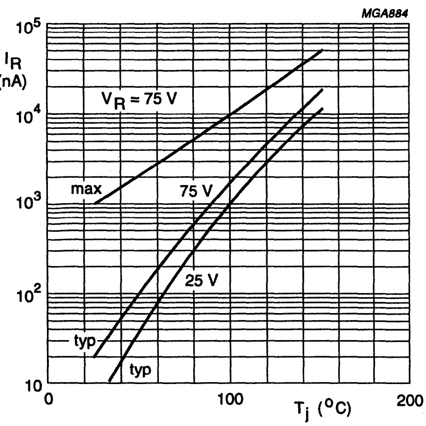
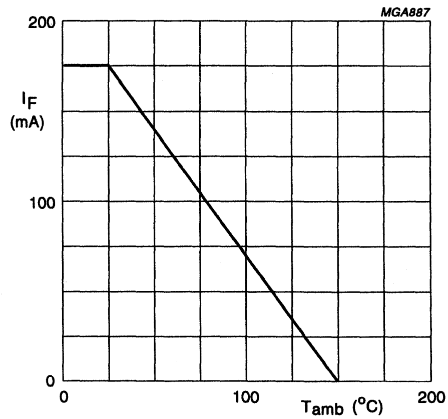


Fig.6 Reverse current as a function of junction temperature.



Device mounted on a FR4 printed circuit board.

Fig.7 Forward current derating curve.

LOW VOLTAGE STABISTOR

Silicon planar epitaxial diode in SOT-23 envelope. This diode is intended for low voltage stabilizing e.g. bias stabilizer in class-B output stages, clipping, clamping and meter protection.

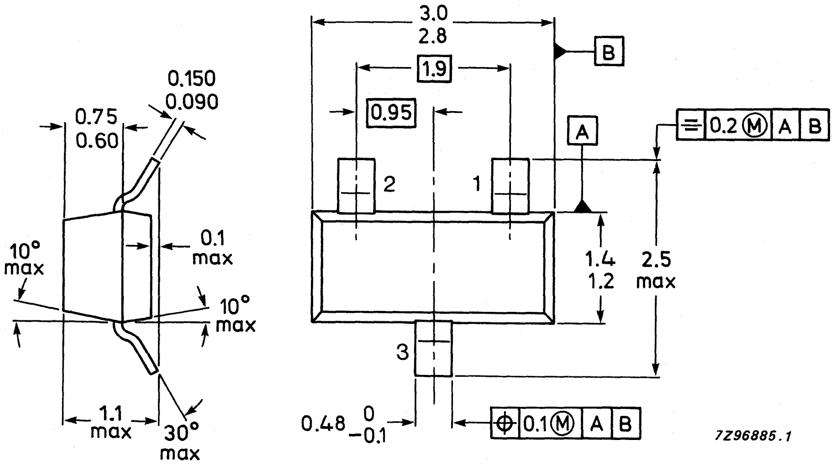
QUICK REFERENCE DATA

Repetitive peak forward current	I_{FRM}	max.	250	mA
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C
Forward voltage				
I_F = 0,1 mA	V_F		580 to 660	mV
I_F = 1,0 mA	V_F		665 to 745	mV
I_F = 10 mA	V_F		750 to 830	mV
I_F = 100 mA	V_F		870 to 960	mV
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	140	pF

MECHANICAL DATA

Dimensions in mm

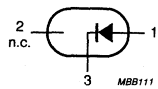
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS17 = A91



See also chapter *Soldering Recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak forward current *	I_{FRM}	max.	250 mA
Storage temperature	T_{stg}	−65 to + 150	°C
Junction temperature	T_j	max.	150 °C

THERMAL CHARACTERISTICS **

From junction to ambient *	$R_{th\ j\text{-}t}$	=	420 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 0,1 mA	V_F		580 to 660 mV
I_F = 1,0 mA	V_F		665 to 745 mV
I_F = 5,0 mA	V_F		725 to 805 mV
I_F = 10 mA	V_F		750 to 830 mV
I_F = 100 mA	V_F		870 to 960 mV
Reverse current			
V_R = 4 V	I_R	<	5 μA
Temperature coefficient			
I_F = 1 mA	S_F	typ.	−1,8 mV/K
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	140 pF

* Mounted on a ceramic substrate of 7 mm x 5 mm x 0,5 mm.
** See *Thermal characteristics.*

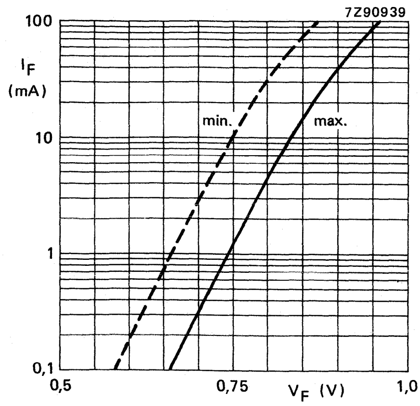


Fig. 2 Forward current as a function of forward voltage.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

Silicon epitaxial high-speed diodes in a microminiature plastic envelope. They are intended for switching and general purposes.

QUICK REFERENCE DATA

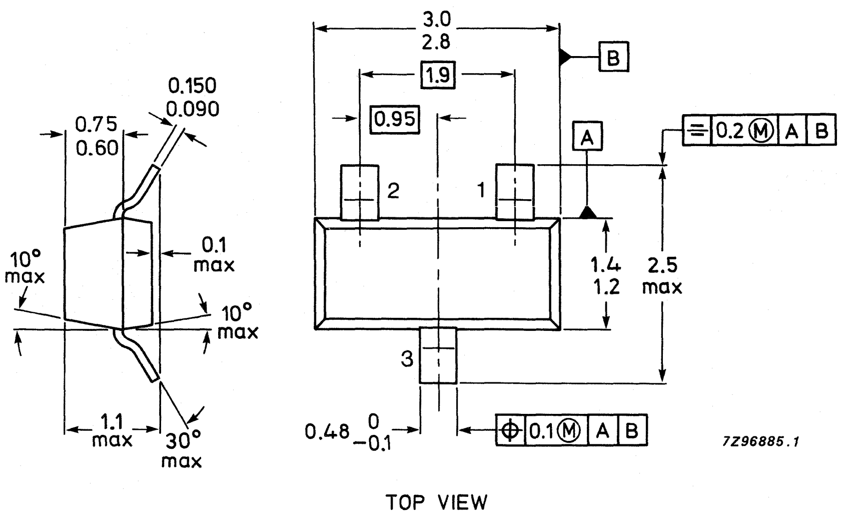
			BAS19	BAS20	BAS21	
Continuous reverse voltage	V_R	max.	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	120	200	250	V
Repetitive peak forward current	I_{FRM}	max.		625		mA
Junction temperature	T_j	max.		150		°C
Forward voltage at I_F = 100 mA	V_F	<		1		V
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω measured at I_R = 3 mA	t_{rr}	<		50		ns

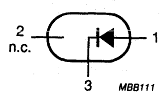
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code
BAS19 = JPp
BAS20 = JRp
BAS21 = JSp





See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BAS19	BAS20	BAS21	
Continuous reverse voltage	V_R	max.	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	120	200	250	V
Non-repetitive peak forward current (per crystal)						
t = 1 μs	I_{FSM}	max.		2,5		A
t = 1 s	I_{FSM}	max.		0,5		A
Average rectified forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.		200		mA
Forward current (DC) up to T_{amb} = 25 °C*	I_F	max.		200		mA
Repetitive peak forward current	I_{FRM}	max.		625		mA
Storage temperature range	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		250		mW

THERMAL RESISTANCE**

From junction to ambient*	$R_{th\,j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 100 mA	V_F	<	1,0	V
I_F = 200 mA	V_F	<	1,25	V
Reverse breakdown voltage				
BAS19; I_R = 100 μA	$V_{(BR)R}$	>	120	V
BAS20; I_R = 100 μA	$V_{(BR)R}$	>	200	V
BAS21; I_R = 100 μA	$V_{(BR)R}$	>	250	V
Reverse current				
$V_R = V_{Rmax}$	I_R	<	100	nA
$V_R = V_{Rmax}$; T_j = 150 °C	I_R	<	100	μA
Differential resistance				
I_F = 10 mA	r_{diff}	typ.	5	Ω

* Mounted on an FR4 printed-circuit board.
** See *Thermal characteristics.*

Diode capacitance			
$V_R = 0$; f = 1 MHz	C_d	<	5 pF
Reverse recovery time (see Figs 2 and 3) when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	<	50 ns

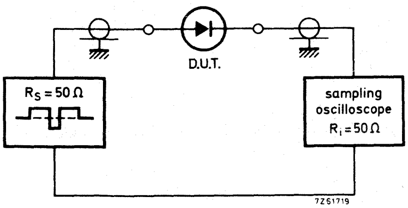


Fig. 2 Test circuit.

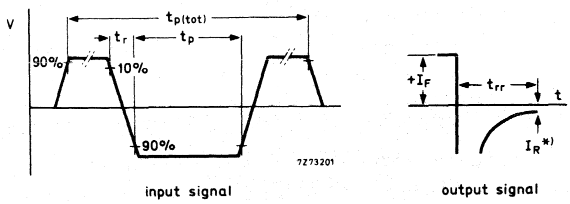


Fig. 3 Waveforms; I_R = 3 mA.

Input signal

total pulse duration	$t_{p(tot)}$	= 2 μs
duty factor	δ	= 0,0025
rise time of reverse pulse	t_r	= 0,6 ns
reverse pulse duration	t_p	= 100 ns

Oscilloscope

rise time	t_r	= 0,35 ns
circuit capacitance*	C	< 1 pF

*C = oscilloscope input capacitance + parasitic capacitance.

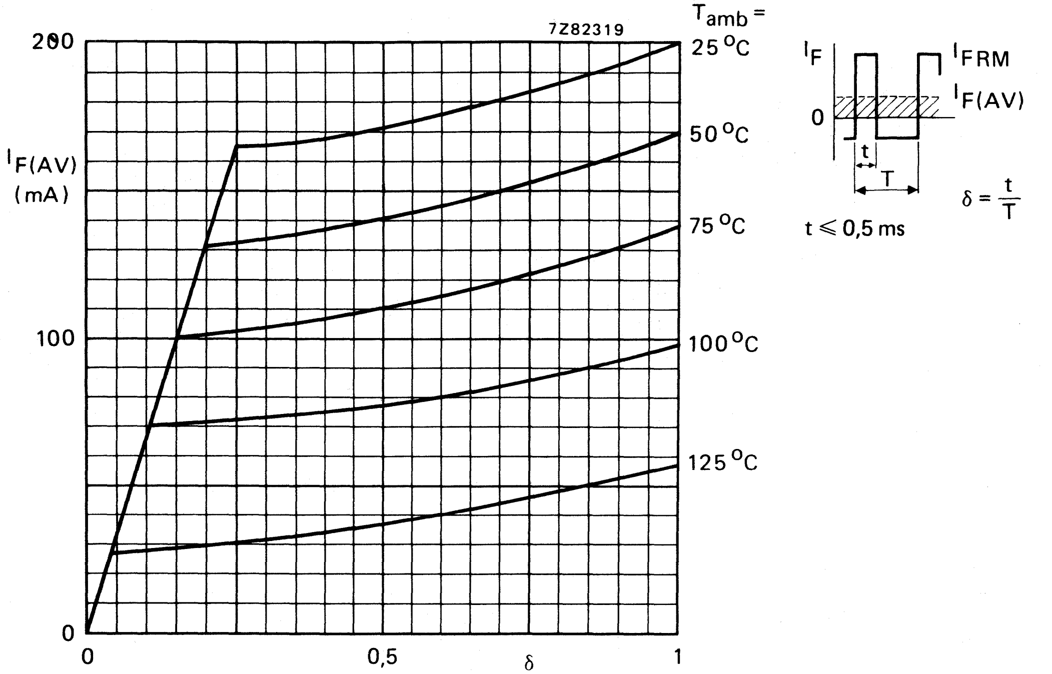


Fig. 4 BAS19; maximum permissible average rectified forward current for pulse operation as a function of the duty factor at V_R = 100 V.

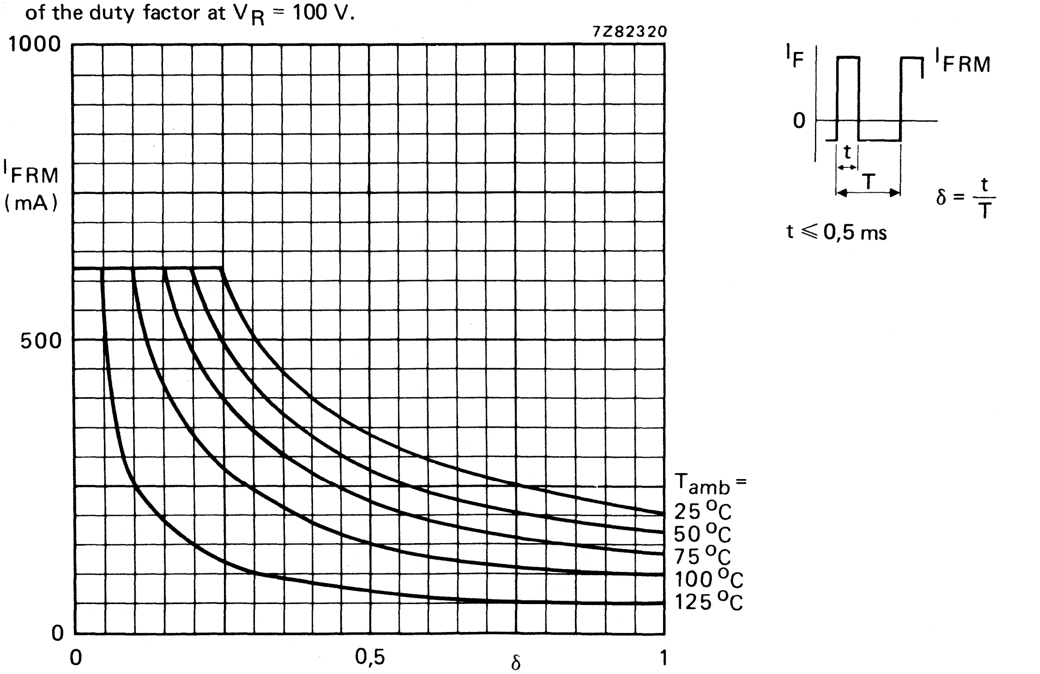


Fig. 5 BAS19; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor at V_R = 100 V.

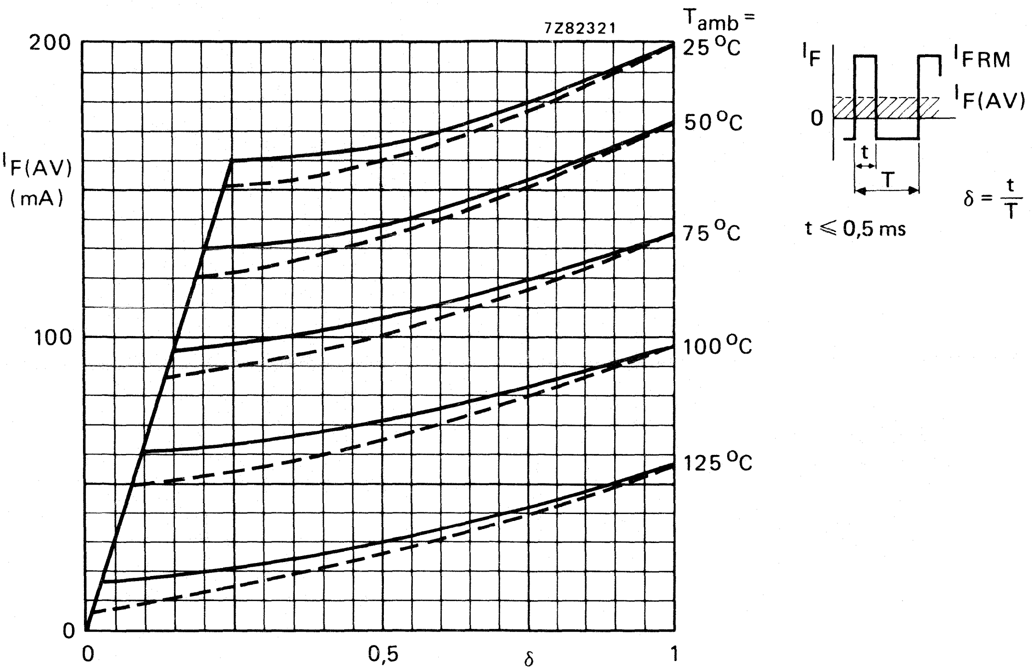


Fig. 6 BAS20/21; maximum permissible average rectified forward current for pulse operation as a function of the duty factor.

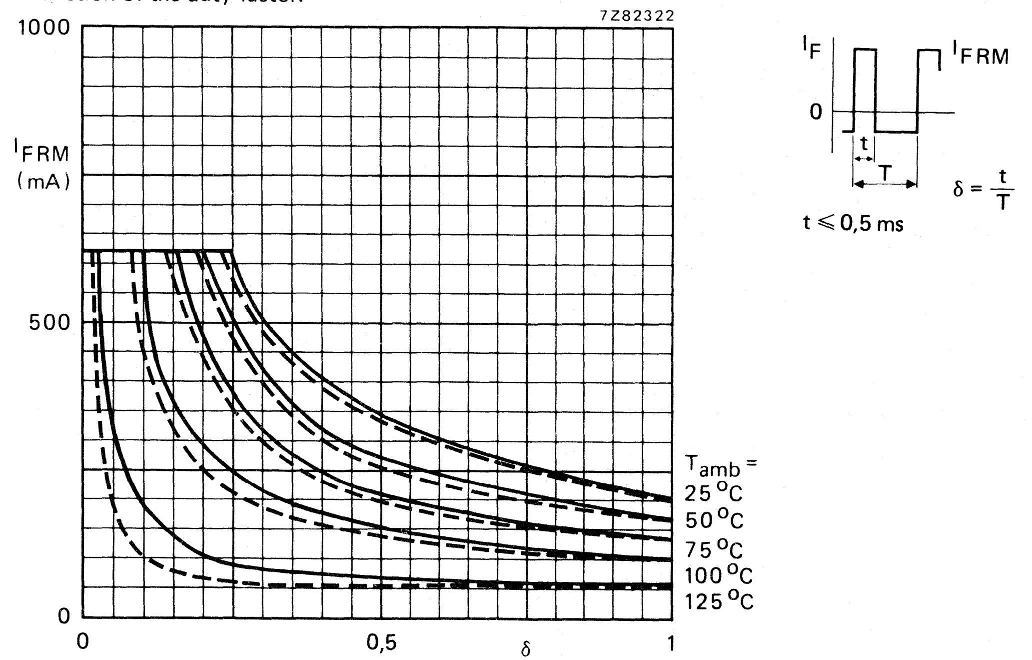


Fig. 7 BAS20/21; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor.

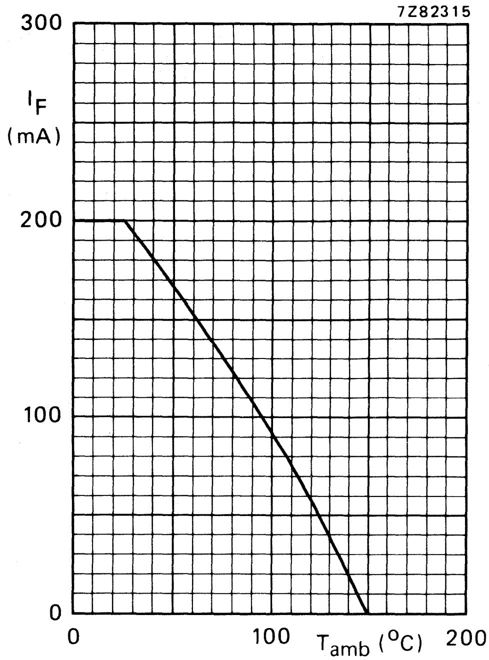


Fig. 8.

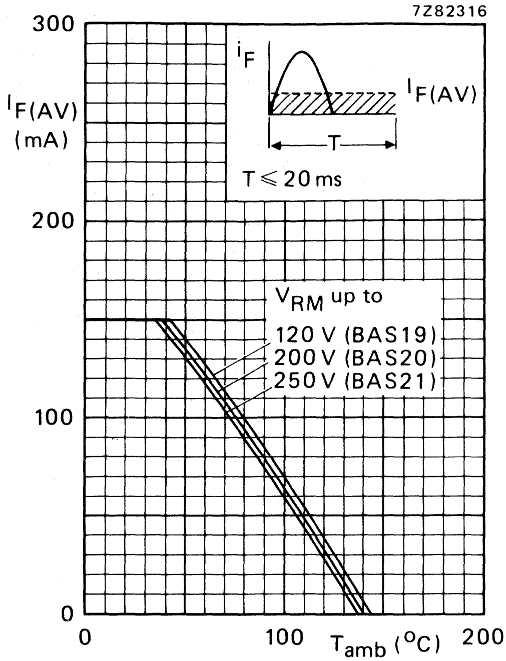


Fig. 9.

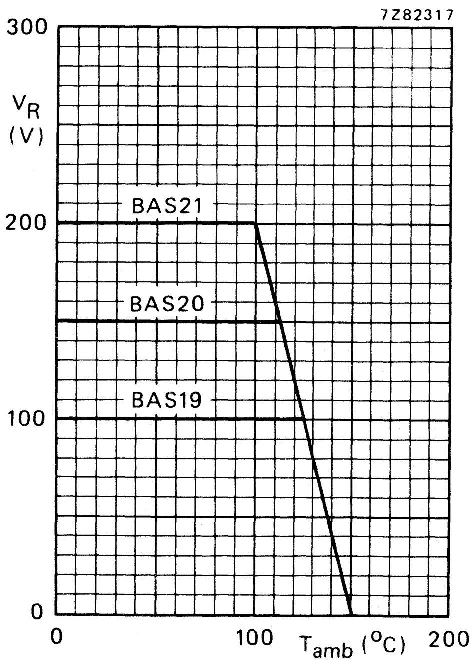


Fig. 10.

Fig. 8 Maximum permissible continuous forward current as a function of the ambient temperature.

Fig. 9 Maximum permissible average rectified forward current as a function of the ambient temperature.

Fig. 10 Maximum permissible continuous reverse voltage as a function of the ambient temperature.

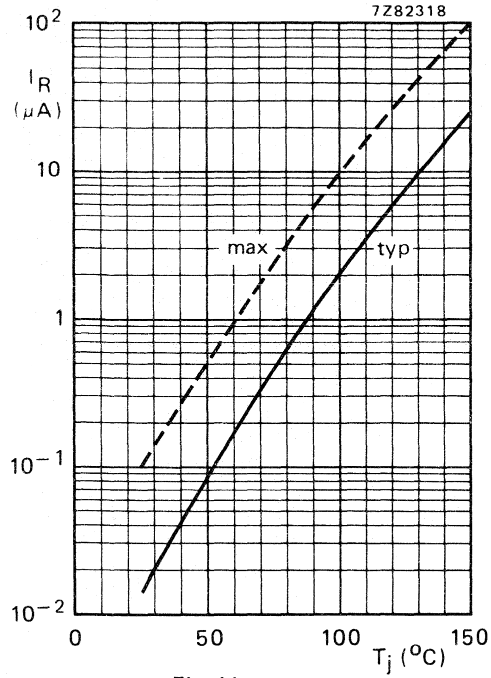


Fig. 11.

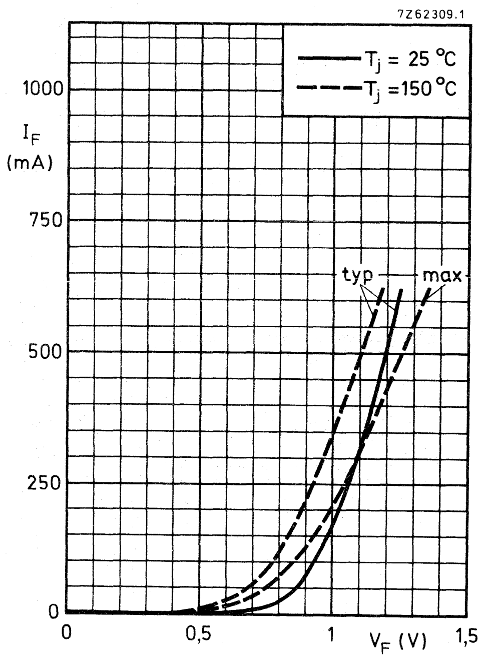


Fig. 12.

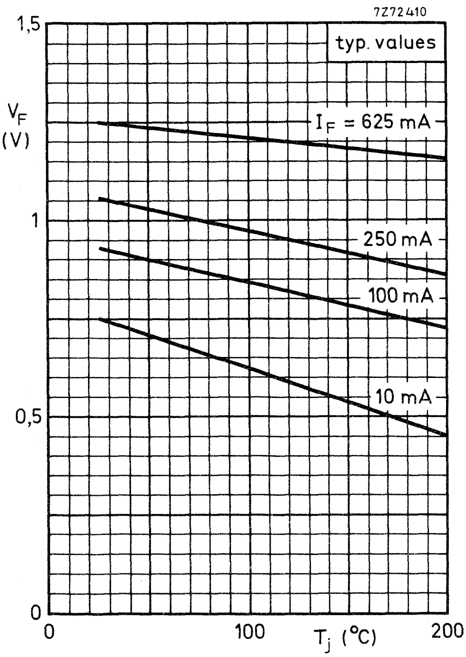


Fig. 13.

Fig. 11 Continuous reverse current as a function of the junction temperature.

Fig. 12 Forward current as a function of forward voltage.

Fig. 13 Forward voltage as a function of the junction temperature.

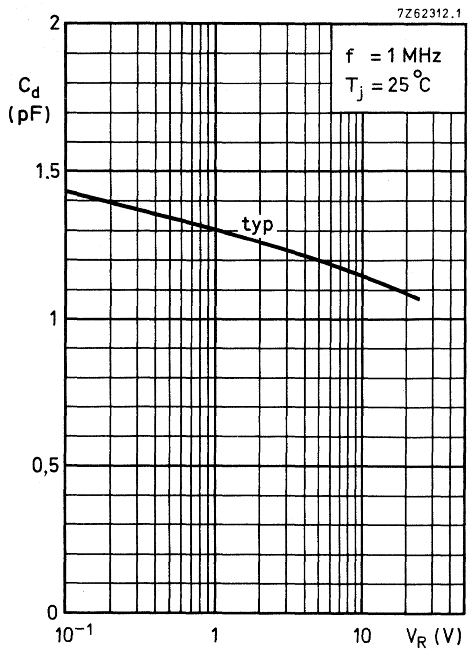

7Z62312.1
f = 1 MHz
T_j = 25 °C
C_d (pF)
2
1.5
1
0,5
0
typ
10^{-1}
1
10
V_R (V)

Fig. 14.

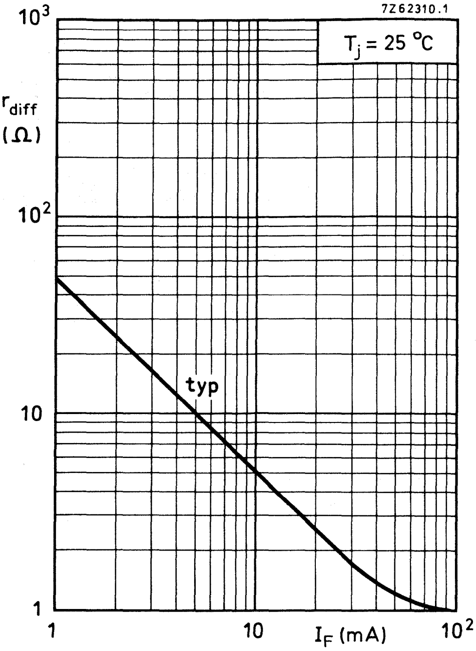

7Z62310.1
T_j = 25 °C
r_{diff} (Ω)
10^3
10^2
10
1
typ
1
10
I_F (mA)
10^2

Fig. 15.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

The BAS28 consists of two separate diodes in one microminiature envelope intended for surface mounting.

It concerns fast-switching general-purpose diodes.

QUICK REFERENCE DATA

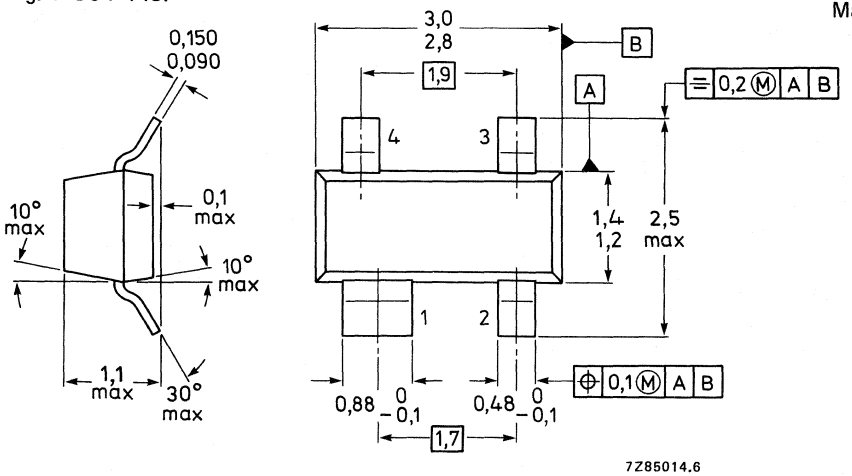
Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	500	mA
Junction temperature	T_j	max.	150	^oC
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω, measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

MECHANICAL DATA

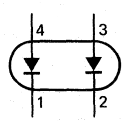
Dimensions in mm

Fig. 1 SOT-143.

Marking code: JT_p



TOP VIEW



Product approved to CECC 50 001-074.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	500	mA
Non-repetitive peak forward current (per crystal)				
$t = 1\ \mu s$	I_{FSM}	max.	4	A
$t = 1$ ms	I_{FSM}	max.	1	A
$t = 1$ s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltage				
$I_F = 1$ mA	V_F	$<$	715	mV
$I_F = 10$ mA	V_F	$<$	855	mV
$I_F = 50$ mA	V_F	$<$	1000	mV
$I_F = 150$ mA	V_F	$<$	1250	mV
Reverse current				
$V_R = 25$ V; $T_j = 150$ °C	I_R	$<$	30	μA
$V_R = 75$ V	I_R	$<$	1	μA
$V_R = 75$ V; $T_j = 150$ °C	I_R	$<$	50	μA
Diode capacitance				
$V_R = 0$; f = 1 MHz	C_d	$<$	2	pF
Forward recovery voltage (see also Fig. 2) when switched to $I_F = 10$ mA; $t_p = 20$ ns	V_{fr}	$<$	1,75	V
Reverse recovery time (see also Fig. 3) when switched from $I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	$<$	4	ns
Recovery charge (see also Fig. 4) when switched from $I_F = 10$ mA to $V_R = 5$ V; $R_L = 100\ \Omega$	Q_s	$<$	45	pC

* Mounted on an FR4 printed-circuit board.

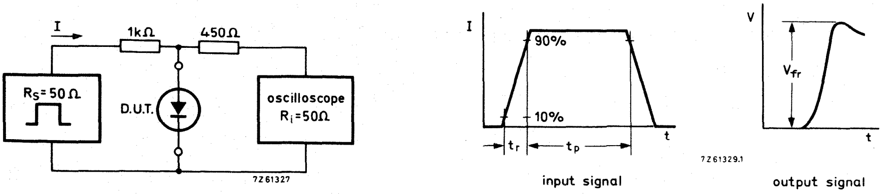


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal: forward pulse rise time = t_r = 20 ns; forward current pulse duration t_p = 120 ns; duty factor = δ = 0,01.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

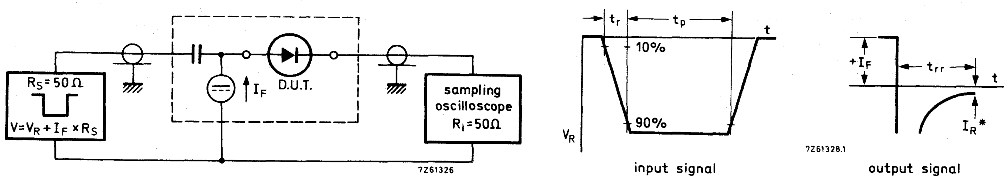


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal: reverse pulse rise time = t_r = 0,6 ns; reverse pulse duration = t_p = 100 ns; duty factor = δ = 0,05. * t_{rr} up to I_R = 1 mA.
Oscilloscope: rise time = t_r = 0,35 ns.
Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

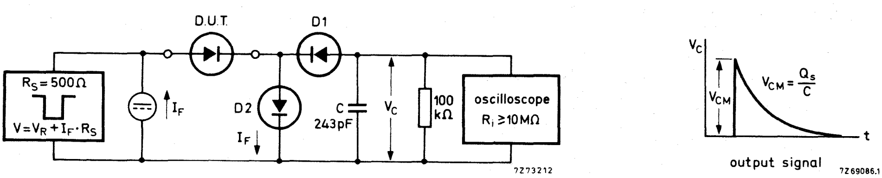


Fig. 4 Recovery charge test circuit and waveform.

D1 = BAW62; D2 = diode with minority carrier life time at 10 mA: < 200 ps

Input signal

Rise time of the reverse pulse	t_r	=	2 ns
Reverse pulse duration	t_p	=	400 ns
Duty factor	δ	=	0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

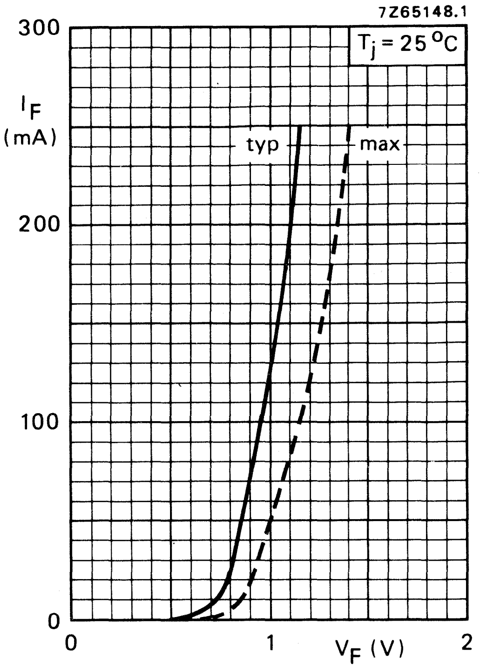


Fig. 5.

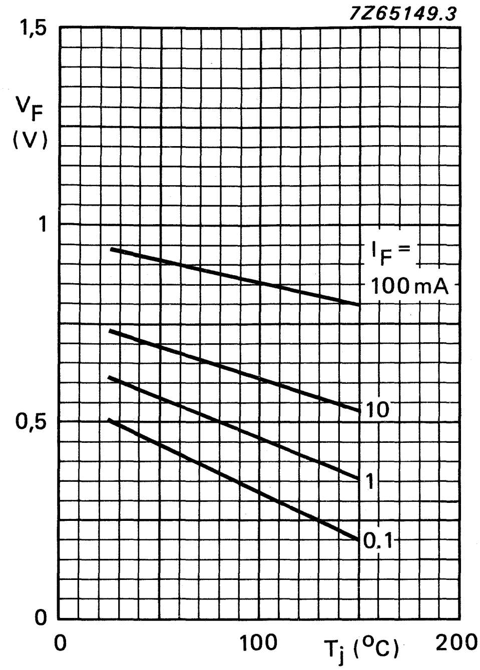


Fig. 6 Typical values.

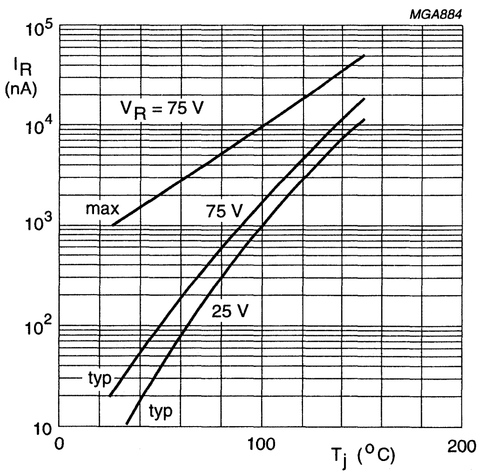


Fig. 7.

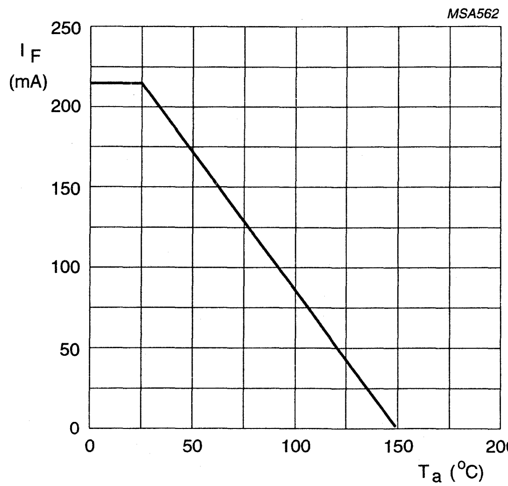


Fig. 8 Current derating curve.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAS29, BAS31 and the BAS35 are silicon planar epitaxial diodes encapsulated in a SOT-23 envelope.

The BAS29 consists of a single diode. The BAS31 has two diodes in series and the BAS35 has two diodes with a common anode. All diodes are designed for switching inductive loads in semi-electronic telephone exchanges.

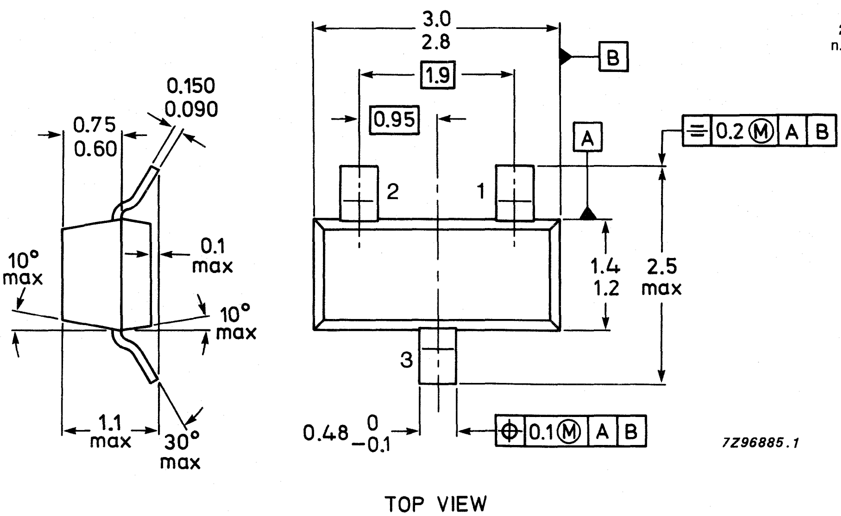
QUICK REFERENCE DATA (per diode)

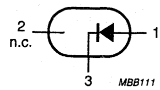
Continuous reverse voltage	V_R	max.	90	V
Repetitive peak forward current	I_{FRM}	max.	600	mA
Forward current	I_F	max.	250	mA
Junction temperature	T_j	max.	150	^oC
Forward voltage at I_F = 50 mA	V_F	$<$	0,84	V
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	$<$	50	ns

MECHANICAL DATA

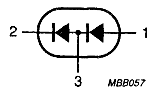
Fig. 1 SOT-23. Dimensions in mm

Marking code:
BAS29 = L20
BAS31 = L21
BAS35 = L22

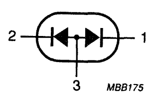




BAS29



BAS31



BAS35

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	90	V
Repetitive peak forward current	I_{FRM}	max.	600	mA
Repetitive peak reverse current	I_{RRM}	max.	600	mA
Average rectified forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	250	mA
Non-repetitive peak forward current				
$t = 1\ \mu s$; $T_j = 25\ ^oC$ prior to surge; per crystal	I_{FSM}	max.	3	A
$t = 1\ s$; $T_j = 25\ ^oC$ prior to surge; per crystal	I_{FSM}	max.	0,75	A
Forward current (DC)	I_F	max.	250	mA
Repetitive peak reverse energy $t_p \geqslant 50\ \mu s$; $f \leqslant 20$ Hz; $T_j = 25\ ^oC$	E_{RRM}	max.	5,0	mJ
Storage temperature	T_{stg}		−65 to + 150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS (per diode)

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage				
$I_F = 10$ mA	V_F	<	0,75	V
$I_F = 50$ mA	V_F	<	0,84	V
$I_F = 100$ mA	V_F	<	0,90	V
$I_F = 200$ mA	V_F	<	1,00	V
$I_F = 400$ mA	V_F	<	1,25	V
Reverse current				
$V_R = 90$ V	I_R	<	100	nA
$V_R = 90$ V; $T_j = 150\ ^oC$	I_R	<	100	μA
Reverse avalanche breakdown voltage $I_R = 1$ mA	$V_{(BR)R}$		120 to 175	V
Diode capacitance $V_R = 0$; $f = 1$ MHz	C_d	<	35	pF
Reverse recovery time when switched from $I_F = 30$ mA to $I_R = 30$ mA; $R_L = 100\ \Omega$; measured at $I_R = 3$ mA	t_{rr}	<	50	ns

* See Thermal Characteristics.

** When mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

HIGH-SPEED SILICON DIODE FOR SURFACE MOUNTING

The BAS32L is a planar epitaxial high-speed diode designed for fast logic applications.

This SM diode is a leadless diode in a hermetically sealed SOD-80C glass envelope with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

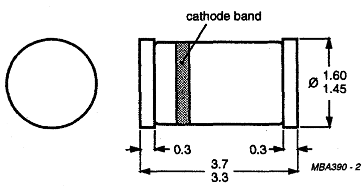
The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	200	°C
Forward voltage I_F = 100 mA	V_F	<	1.0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4.0	ns

MECHANICAL DATA

Dimensions in mm



The cathode is indicated by a black band

Fig. 1 SOD-80C.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	75 V
Average rectified forward current *	$I_{F(AV)}$	max.	150 mA
Forward current (DC)	I_F	max.	200 mA
Repetitive peak forward current	I_{FRM}	max.	450 mA
Non-repetitive peak forward current			
t = 1 μs	I_{FSM}	max.	2000 mA
t = 1 s	I_{FSM}	max.	500 mA
Storage temperature range	T_{stg}	−65 to + 200 °C	
Junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0.6 K/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltages			
I_F = 5 mA	V_F		0.62 to 0.75 V
I_F = 100 mA	V_F	<	1.0 V
I_F = 100 mA; T_j = 100 °C	V_F	<	0.93 V
Reverse breakdown voltage			
I_R = 100 μA	$V_{(BRR)}$	>	100 V
Reverse currents			
V_R = 20 V	I_R	<	25 nA
V_R = 20 V; T_j = 150 °C	I_R	<	50 μA
V_R = 75 V	I_R	<	5.0 μA
V_R = 75 V; T_j = 150 °C	I_R	<	100 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	2.0 pF
Forward recovery voltage when switched to			
I_F = 50 mA; t_r = 20 ns	V_{fr}	<	2.5 V

* For sinusoidal operation see Fig. 6. For pulse operation see Figs 4 and 5.

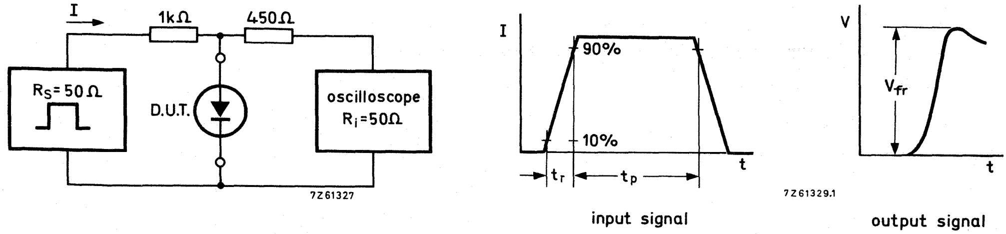


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal : Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns
Duty factor δ = 0.01

Oscilloscope: Rise time t_r = 0.35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA t_{rr} < 4 ns

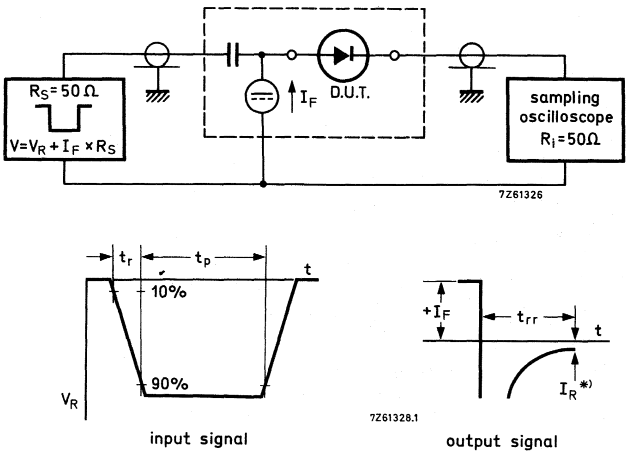


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal : Rise time of the reverse pulse t_r = 0.6 ns * I_R = 1 mA
Reverse pulse duration t_p = 100 ns
Duty factor δ = 0.05

Oscilloscope: Rise time t_r = 0.35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

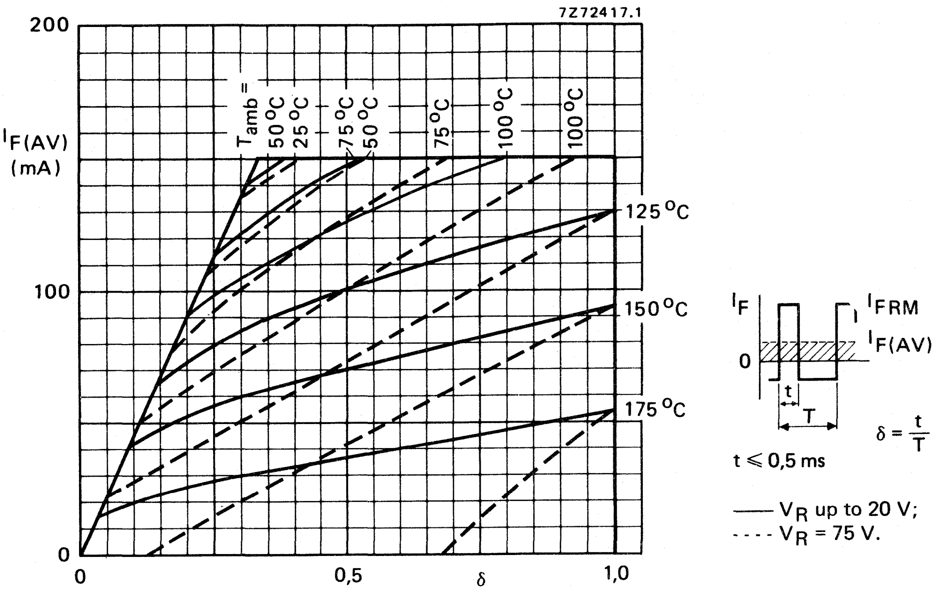


Fig. 4 Maximum permissible average rectified forward current as a function of duty factor (pulse operated).

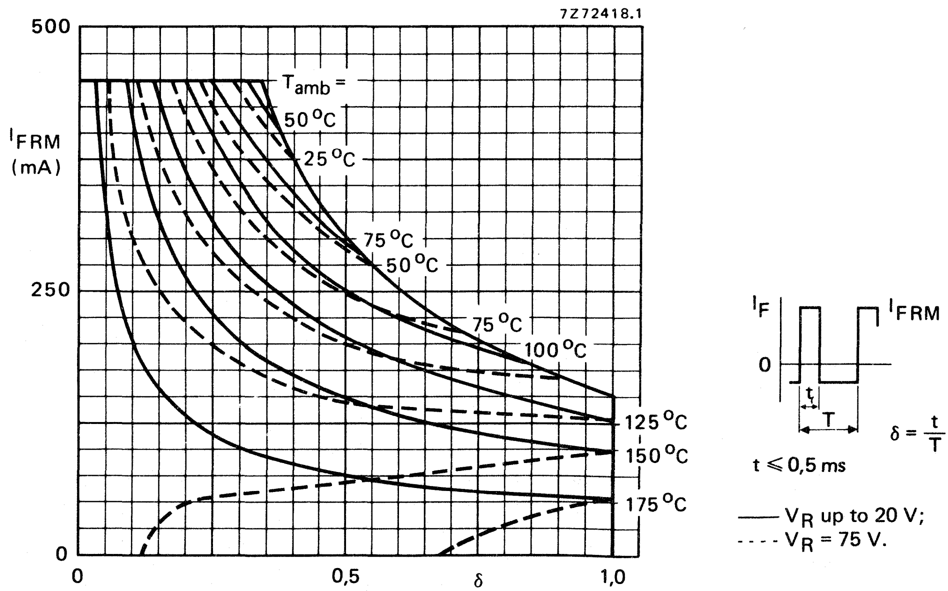


Fig. 5 Maximum permissible repetitive peak forward current as a function of duty factor (pulse operated).

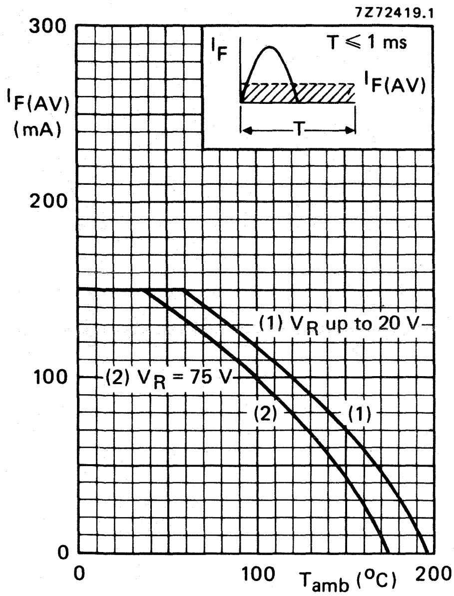


Fig. 6 Maximum permissible average rectified forward current as a function of ambient temperature.

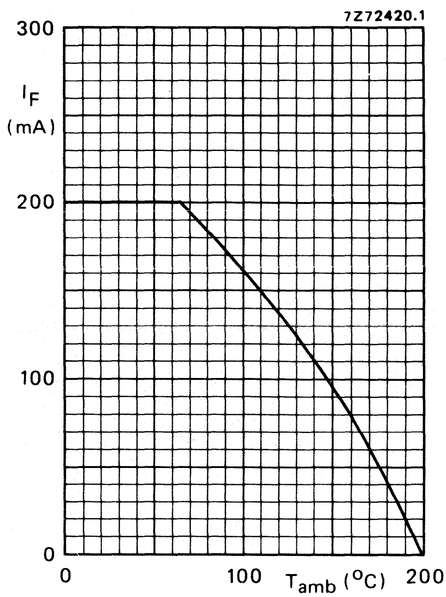


Fig. 7 Maximum permissible continuous forward current as a function of ambient temperature.

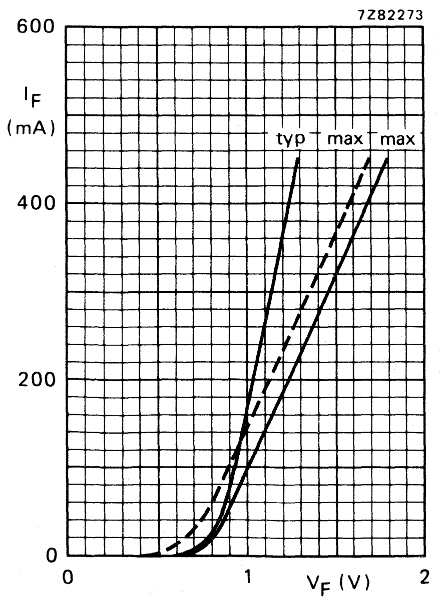


Fig. 8 Forward current as a function of forward voltage; —— T_j = 25 °C; – – – T_j = 175 °C.

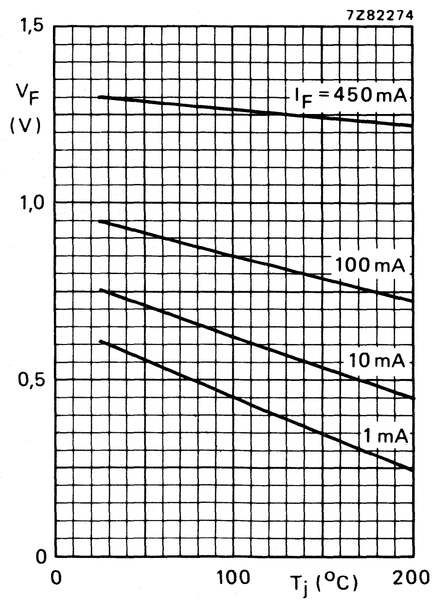


Fig. 9 Forward voltage as a function of junction temperature; typical values.

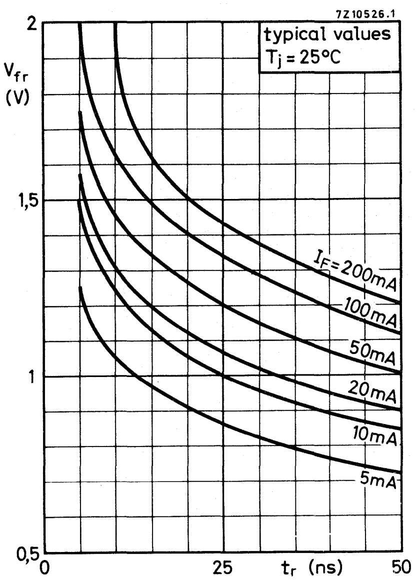


Fig. 10 Forward recovery voltage as a function of rise time.

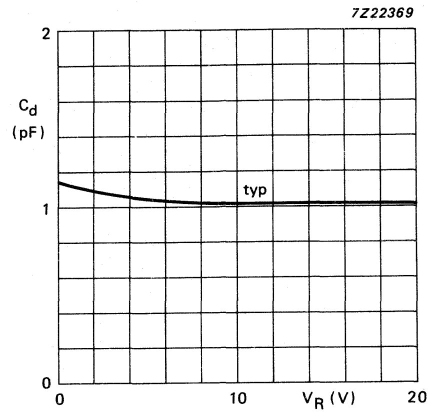


Fig. 11 Diode capacitance as a function of reverse voltage.

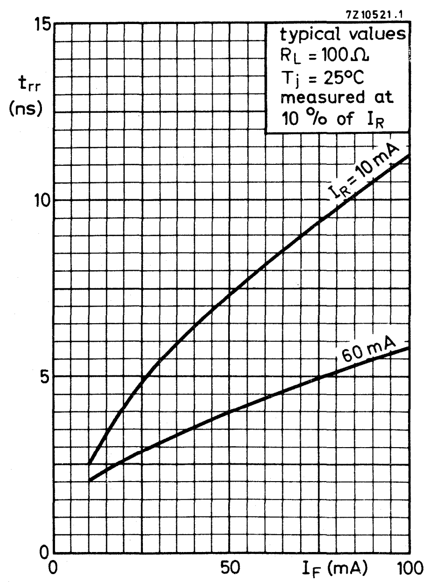


Fig. 12 Reverse recovery time as a function of forward current.

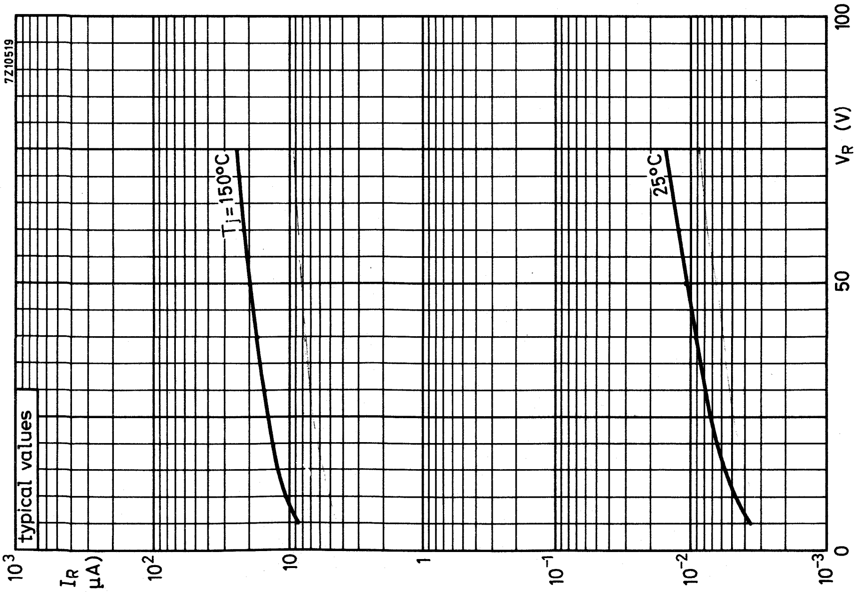


Fig. 13 Reverse current as a function of reverse voltage.

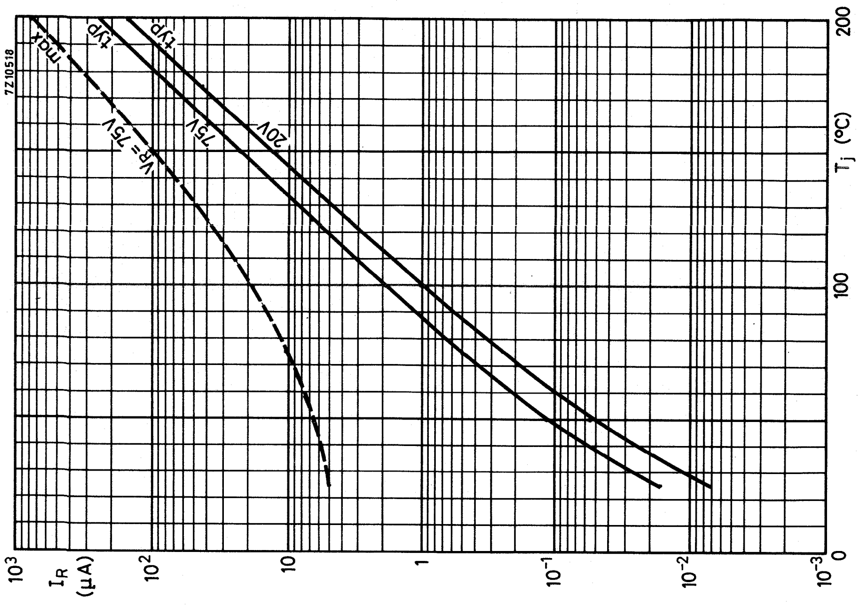


Fig. 14 Reverse current as a function of junction temperature.

Silicon planar epitaxial high-speed diode

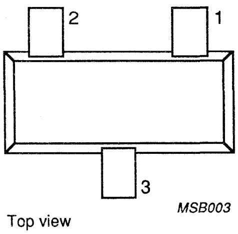
BAS55

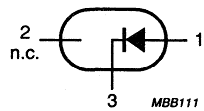
DESCRIPTION

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching applications.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		60	V
V_{RRM}	repetitive peak reverse voltage		60	V
I_{FRM}	repetitive peak forward current		600	mA
V_F	forward voltage	$I_F = 200$ mA	1	V
t_{rr}	reverse recovery time	when switched from $I_F = 400$ mA to $I_R = 400$ mA; $R_L = 100\ \Omega$; measured at $I_R = 40$ mA	6	ns
Q_s	reverse recovery charge	when switched from $I_F = 10$ mA to $V_R = 5$ V; $R_L = 500\ \Omega$	50	pC
T_j	junction temperature		150	°C





Marking code: BAS55 = L5p.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	60	V
V_{RRM}	repetitive peak reverse voltage		–	60	V
I_F	forward current	DC value	–	250	mA
I_{FRM}	repetitive peak forward current		–	600	mA
I_{FSM}	non-repetitive peak forward current	t = 1 μs	–	4	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	mounted on FR4 printboard; T_{amb} = 25 °C	–	250	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	mounted on FR4 printboard	500 K/W

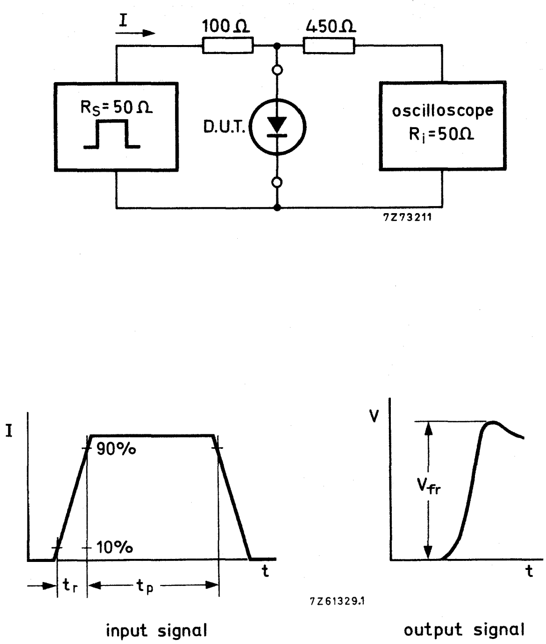
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	DC value; I_F = 200 mA; T_{amb} = 25 °C; note 1	–	1	V
I_R	reverse current	V_R = 60 V	–	100	nA
		V_R = 60 V; T_j = 150 °C	–	100	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz	–	2.5	pF
V_{fr}	forward recovery voltage	when switched to I_F = 400 mA; t_{r1} = 30 ns; see Fig.2	–	2	V
		when switched to I_F = 400 mA; t_{r2} = 100 ns; see Fig.2	–	1.5	V
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA; see Fig.3	–	6	ns
Q_s	reverse recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω; see Fig.4	–	50	pC

Note

1. V_F is measured with diode at thermal equilibrium while mounted on FR4 printboard.

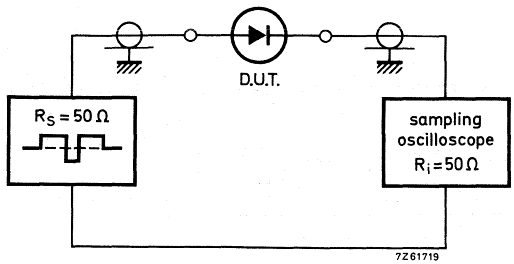


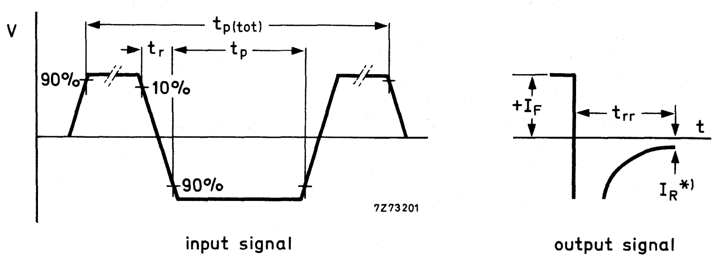
Input signal:
1st rise time of forward pulse (t_{r1}) = 30 ns
2nd rise time of forward pulse (t_{r2}) = 100 ns
forward current pulse duration (t_p) = 300 ns
duty factor (δ) = 0.01.

Oscilloscope:
rise time (t_r) = 0.35 ns
input capacitance (C_i) ≤ 1 pF.

Circuit capacitance:
C ≤ 20 pF (C = C_i + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



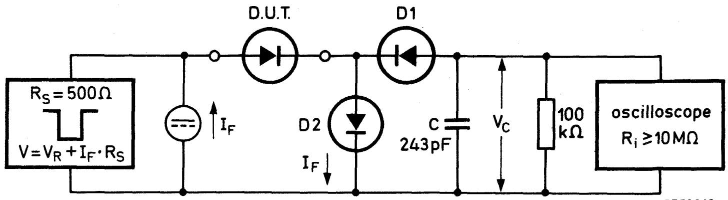


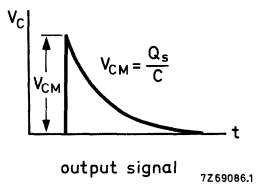
Input signal:
rise time of reverse pulse (t_r) = 0.6 ns
reverse pulse duration (t_p) = 30 ns
duty factor (δ) = 0.0025
total pulse duration ($t_{p(tot)}$) = 0.2 µs.

Circuit capacitance:
C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Oscilloscope:
rise time (t_r) = 0.35 ns.

Fig.3 Reverse recovery time test circuit and waveforms.





D1 = BAW62
D2 = diode with minority carrier life time (10 mA: < 200 ps).

Input signal:
rise time of reverse pulse (t_r) = 2 ns
reverse pulse duration (t_p) = 400 ns
duty factor (δ) = 0.02.

Circuit capacitance:
C ≤ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

Fig.4 Recovery charge test circuit and waveforms.

SILICON PLANAR EPITAXIAL ULTRA-HIGH SPEED DIODE

The BAS56 consists of two separate planar epitaxial ultra-high speed, high conductance diodes in one microminiature plastic envelope intended for surface mounting.

The device is primarily intended for core gating in very fast memories using the Surface Mounted Devices (SMD) technology.

QUICK REFERENCE DATA

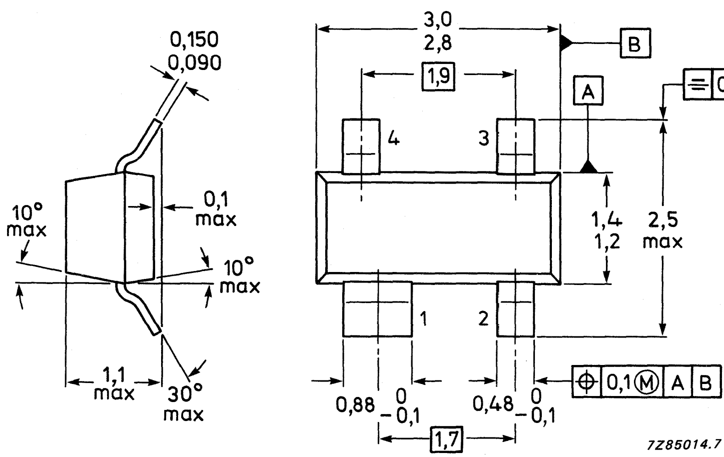
			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	V
Forward current	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA	t_{rr}	<	6		ns

MECHANICAL DATA

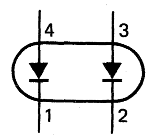
Dimensions in mm

Fig. 1 SOT-143.

Marking code: L51



TOP VIEW



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	V
Forward current (DC)	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Non-repetitive peak forward current (per crystal)					
t = 1 μs	I_{FSM}	max.	2000		mA
t = 1 s	I_{FSM}	max.	500		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS, per diode

T_j = 25 °C unless otherwise specified

Forward voltage* I_F = 200 mA DC; T_{amb} = 25 °C**	V_F	$<$	1,00	V
Reverse current				
V_R = 60 V	I_R	$<$	100	nA
V_R = 60 V; T_j = 150 °C	I_R	$<$	100	μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	$<$	2,5	pF

* Mounted on FR-4 printboard.

** Based on thermal equilibrium.

Forward recovery voltage when switched to

I_F = 400 mA; t_r1 = 30 ns	V_{fr}	<	2,0	V
I_F = 400 mA; t_r2 = 100 ns		<	1,5	V

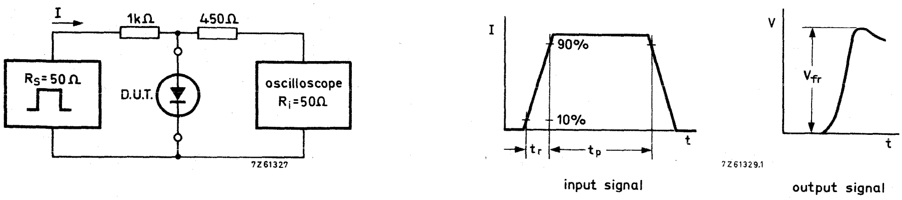


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal:	1st rise time of the forward pulse	t_r1	=	30	ns
	2nd rise time of the forward pulse	t_r2	=	100	ns
	Forward current pulse duration	t_p	=	300	ns
	Duty factor	δ	=	0,01	
Oscilloscope:	Rise time	t_r	=	0,35	ns
	Input capacitance	C_i	$\leqslant$	1	pF

Circuit capacitance C $\leqslant$ 20 pF (C = C_i + parasitic capacitance)

Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA	t_{rr}	<	6	ns

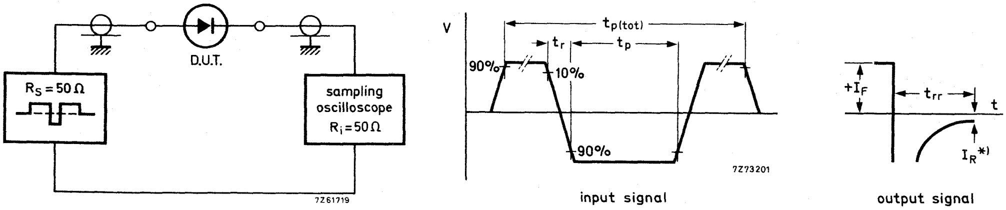
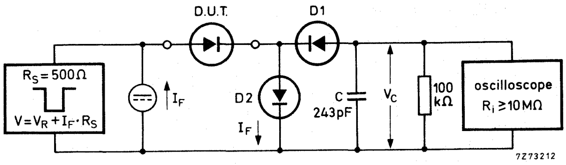


Fig. 3 Test circuits and waveforms; reverse recovery time. *I_R = 40 mA

Input signal:	Total pulse duration	$t_{p(tot)}$	=	0,2	μs
	Duty factor	δ	=	0,0025	
	Rise time of the reverse pulse	t_r	=	0,6	ns
	Reverse pulse duration	t_p	=	30	ns
Oscilloscope:	Rise time	t_r	=	0,35	ns

Circuit capacitance C $\leqslant$ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	50	pC



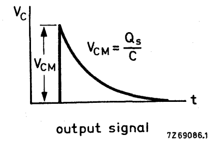


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

D2 = diode with minority carrier life time at 10 mA		<	200	ps
Input signal: Rise time of the reverse pulse	t_r	=	2	ns
Reverse pulse duration	t_p	=	400	ns
Duty factor	δ	=	0,02	

Circuit capacitance C ≤ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

Schottky barrier diodes

BAS70 series

FEATURES

- Low leakage current
- Low turn-on and high breakdown voltage
- Ultra fast switching speed.

DESCRIPTION

The BAS70 series are silicon epitaxial Schottky barrier diodes with an integrated guard ring for stress protection. Single diodes (BAS70) and double diodes with different pinning (BAS70–04; –05; –06) are available. They are intended for high speed switching, circuit protection and voltage clamping applications.

The diodes are encapsulated in a SOT23 SMD plastic package.

PIN CONFIGURATION

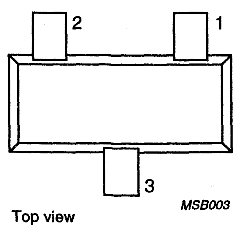


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		70	V
I_F	continuous forward current		70	mA
V_F	forward voltage	$I_F = 1$ mA	410	mV
I_R	reverse current	$V_R = 50$ V	100	nA
T_j	junction temperature		150	°C
C_d	diode capacitance	$V_R = 0$	2	pF

SYMBOLS

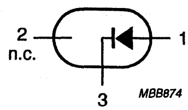


Fig.2 BAS70.

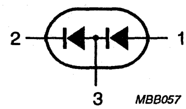


Fig.3 BAS70-04.

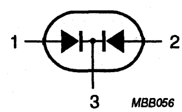


Fig.4 BAS70-05.

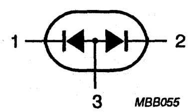


Fig.5 BAS70-06.

PINNING/MARKING CODES

PIN	BAS70	BAS70-04	BAS70-05	BAS70-06
1	a	a1	a1	k1
2	n.c.	k2	a2	k2
3	k	k1/a2	k1/k2	a1/a2
Marking code	73p	74p	75p	76p

LIMITING VALUES (per diode)

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient; note 1	500 K/W

Note

1. PCB mounting (SOT23 standard conditions).

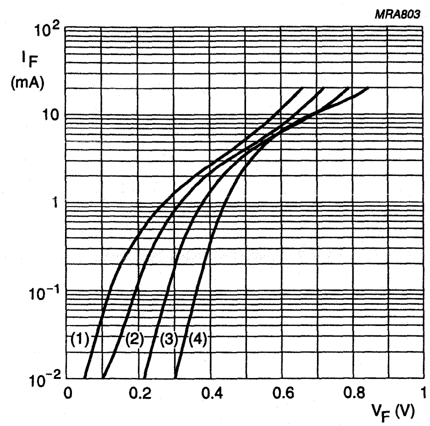
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	$I_F = 1$ mA	–	410	mV
		$I_F = 10$ mA	–	750	mV
		$I_F = 15$ mA	–	1	V
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 10$ µA	70	–	V
I_R	reverse current	$V_R = 50$ V; note 1	–	100	nA
		$V_R = 70$ V; note 1	–	10	µA
C_d	diode capacitance	$V_R = 0$ V; f = 1 MHz	–	2	pF
τ	charge carrier life-time; Krakauer method	$I_F = 5$ mA	–	100	ps

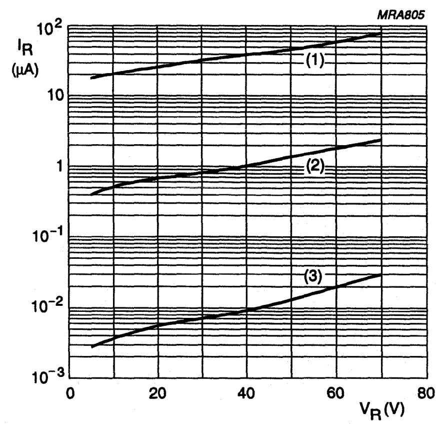
Note

1. Pulsed test: pulse width = 300 µs ; $\delta = 0.02$.



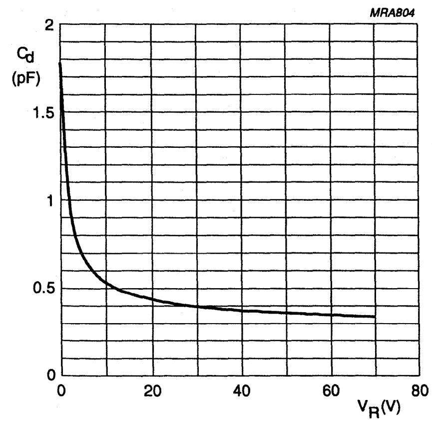
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.6 Forward current as a function of forward voltage.



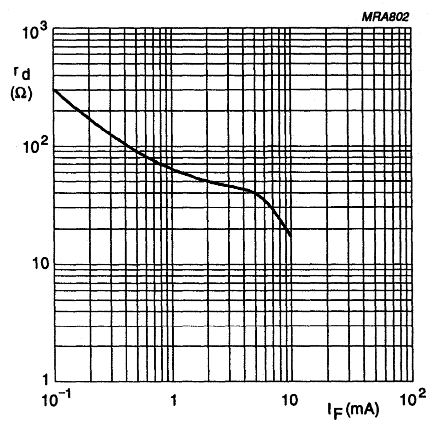
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage.



f = 1 MHz.

Fig.8 Diode capacitance as a function of reverse voltage.



f = 10 kHz.

Fig.9 Differential resistance as a function of forward current.

Schottky barrier diode BAS70-01

FEATURES

- Low leakage current
- Low turn-on and high breakdown voltage
- Ultra-fast switching speed.

DESCRIPTION

Silicon epitaxial Schottky barrier diode with an integrated guard ring for stress protection. Intended for high speed switching, circuit protection and voltage clamping applications. The diode is encapsulated in a SOD123 SMD plastic package.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		70	V
I_F	continuous forward current		70	mA
V_F	forward voltage	$I_F = 1$ mA	410	mV
I_R	reverse current	$V_R = 50$ V	100	nA
T_j	junction temperature		150	°C
C_d	diode capacitance	$V_R = 0$	2	pF

PIN CONFIGURATION

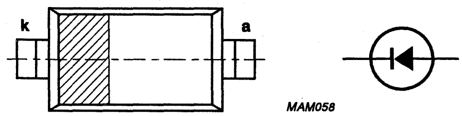


Fig.1 Simplified outline SOD123.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient; note 1	500 K/W

Note

1. Printed-circuit board mounting (SOD123 standard conditions).

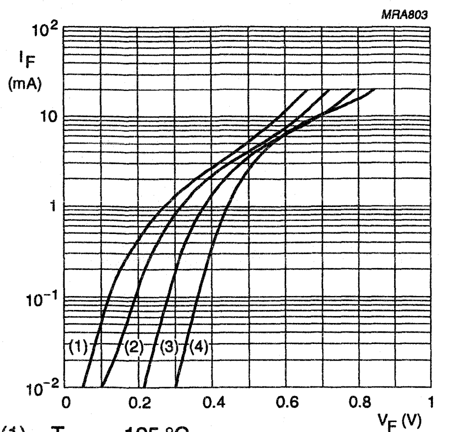
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	$I_F = 1$ mA	–	410	mV
		$I_F = 10$ mA	–	750	mV
		$I_F = 15$ mA	–	1	V
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 10$ μA	70	–	V
I_R	reverse current	$V_R = 50$ V; note 1	–	100	nA
		$V_R = 70$ V; note 1	–	10	μA
C_d	diode capacitance	$V_R = 0$; f = 1 MHz	–	2	pF
τ	charge carrier life time (Krakauer method)	$I_F = 5$ mA	–	100	ps

Note

1. Pulsed test: $t_p = 300$ μs ; $\delta = 0.02$.



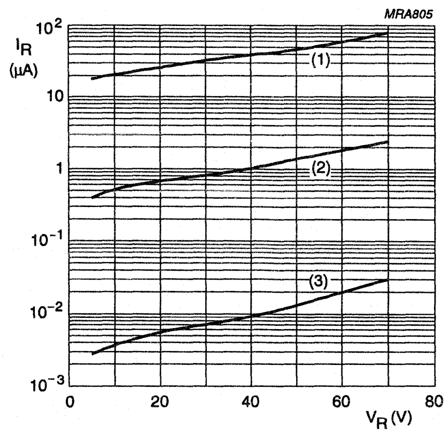
(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage.

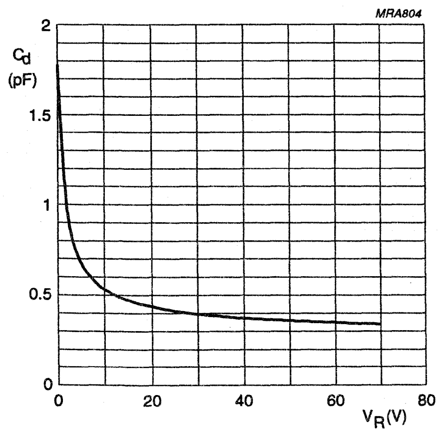


(1) T_{amb} = 150 °C.

(2) T_{amb} = 85 °C.

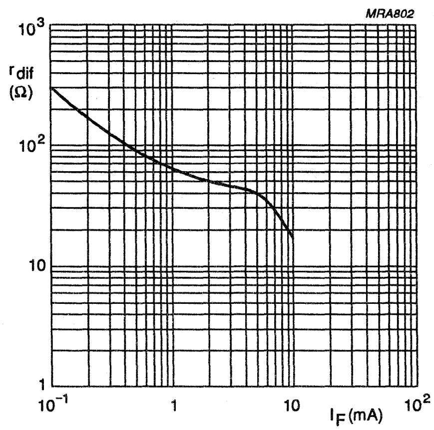
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage.



f = 1 MHz.

Fig.4 Diode capacitance as a function of reverse voltage.



f = 10 MHz.

Fig.5 Differential forward resistance as a function of forward current.

Schottky barrier diodes BAS70-07

FEATURES

- Low leakage current
- Low turn-on and high breakdown voltage
- Ultra fast switching speed.

DESCRIPTION

The BAS70-70 contains two separate silicon epitaxial Schottky barrier diodes, each with an integrated guard ring for stress protection. They are intended for high speed switching, circuit protection and voltage clamping applications.

The diodes are encapsulated in a SOT143 SMD plastic package.

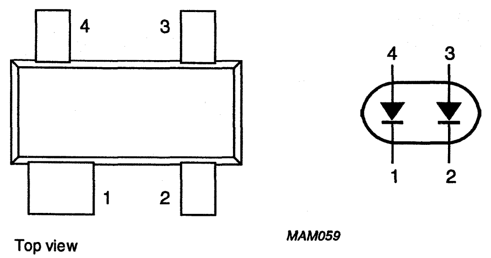
PINNING - SOT143

PIN	DESCRIPTION
1	k1
2	k2
3	a2
4	a1

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		70	V
I_F	continuous forward current		70	mA
V_F	forward voltage	$I_F = 1$ mA	410	mV
I_R	reverse current	$V_R = 50$ V	100	nA
T_j	junction temperature		150	°C
C_d	diode capacitance	$V_R = 0$	2	pF

PIN CONFIGURATION



Marking code: BAS70-07 = 77p.

Fig.1 Simplified outline (SOT143) and symbol.

LIMITING VALUES (per diode)

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	70	V
I_F	continuous forward current		–	70	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	70	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	100	mA
T_{stg}	storage temperature		–65	+150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient; note 1	500 K/W

Note

1. PCB mounting (SOT143 standard conditions).

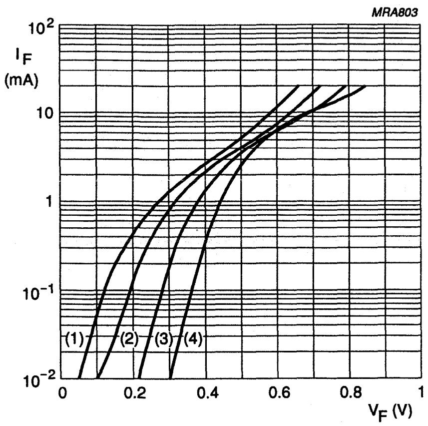
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_F	forward voltage	$I_F = 1$ mA	–	410	mV
		$I_F = 10$ mA	–	750	mV
		$I_F = 15$ mA	–	1	V
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 10$ µA	70	–	V
I_R	reverse current	$V_R = 50$ V; note 1	–	100	nA
		$V_R = 70$ V; note 1	–	10	µA
C_d	diode capacitance	$V_R = 0$ V; f = 1 MHz	–	2	pF
τ	charge carrier life-time; Krakauer method	$I_F = 5$ mA	–	100	ps

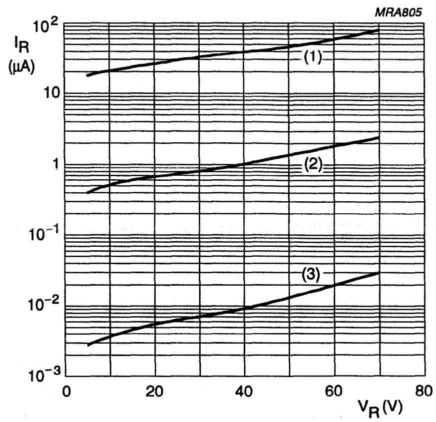
Note

1. Pulsed test: pulse width = 300 µs ; $\delta = 0.02$.



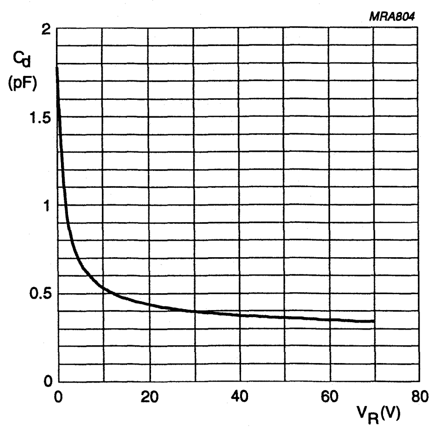
(1) T_{amb} = 125 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.
(4) T_{amb} = −40 °C.

Fig.2 Forward current as a function of forward voltage.



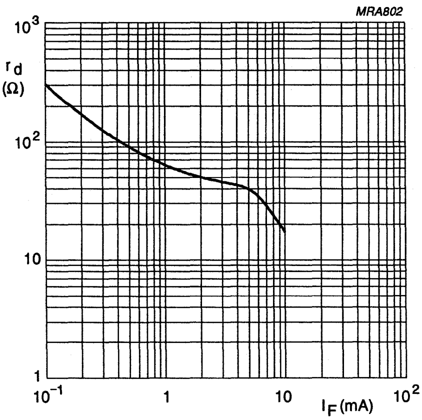
(1) T_{amb} = 150 °C.
(2) T_{amb} = 85 °C.
(3) T_{amb} = 25 °C.

Fig.3 Reverse current as a function of reverse voltage.



f = 1 MHz.

Fig.4 Diode capacitance as a function of reverse voltage.



f = 10 kHz.

Fig.5 Differential resistance as a function of forward current.

Data sheet	
status	Preliminary specification
date of issue	April 1992

BAS81/82/83
Schottky barrier diodes

DESCRIPTION

General purpose and switching Schottky barrier diodes, with an integrated protection ring against static discharges. They feature a low forward voltage drop, low leakage current and a low capacitance and as such can be used in very fast switching applications.

This surface mounted diode is a packaged in a hermetically sealed SOD80C glass envelope with tin-plated metal discs at each end. It is suitable for "automatic placement" and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage			
	BAS81		40	V
	BAS82		50	V
	BAS83		60	V
V_F	forward voltage	$I_F = 1$ mA	410	mV
I_R	reverse current	$V_R = V_{R\,max.}$	200	nA
I_F	forward current	DC value	30	mA
C_d	diode capacitance		1.6	pF
T_j	junction temperature		150	°C

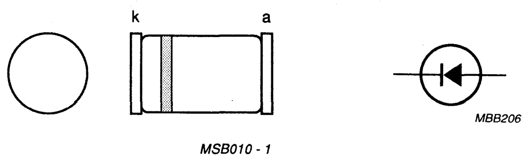


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	BAS81		–	40	V
	BAS82		–	50	V
	BAS83		–	60	V
I_F	forward current	DC value	–	30	mA
I_{FRM}	repetitive peak forward current		–	150	mA
I_{FSM}	non-repetitive forward current	t = 1 s	–	500	mA
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}a}$	from junction to ambient	note 1	320	K/W

Note

1. Device mounted on a 1.5 mm thick epoxy-glass PCB; Cu-thickness 40 µm (see Fig.2).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 0.1 mA I_F = 1 mA I_F = 15 mA	330 410 1	mV mV V
I_R	reverse current	V_R = V_R max.	200	nA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz	1.6	pF

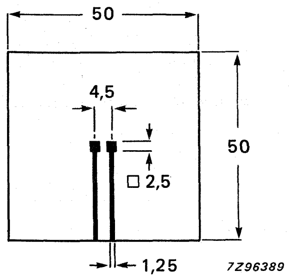


Fig.2 PCB mounting.

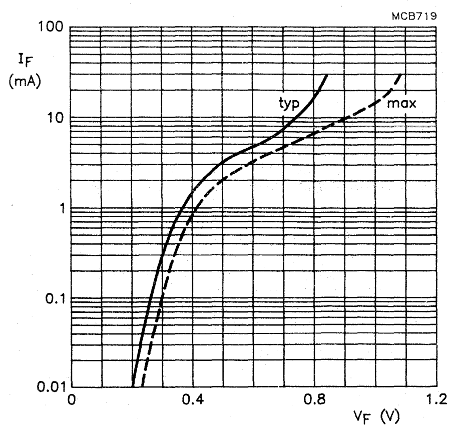


Fig.3 Forward current as a function of forward voltage; T_j = 25 °C.

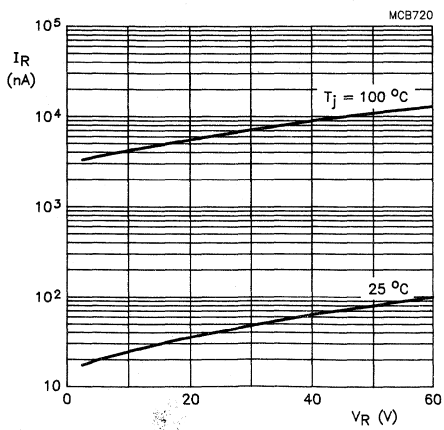


Fig.4 Reverse current as a function of reverse voltage; typical values.

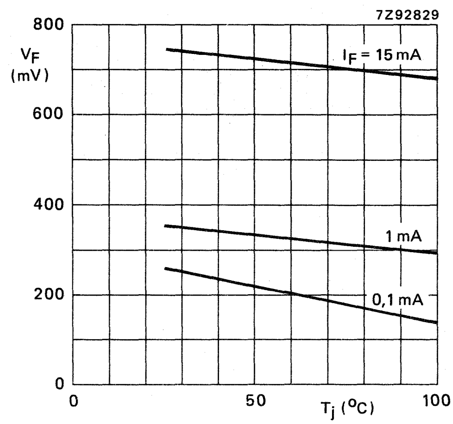


Fig.5 Forward voltage as a function of junction temperature; typical values.

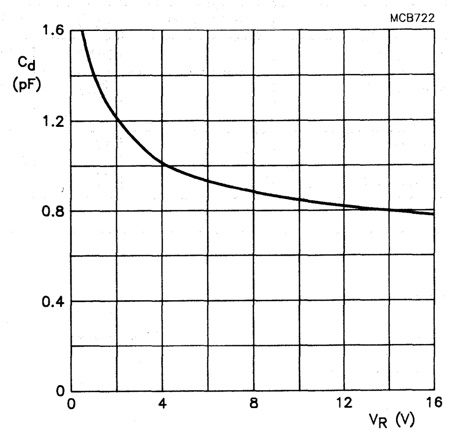


Fig.6 Diode capacitance as a function of reverse voltage; f = 1 MHz; typical values.

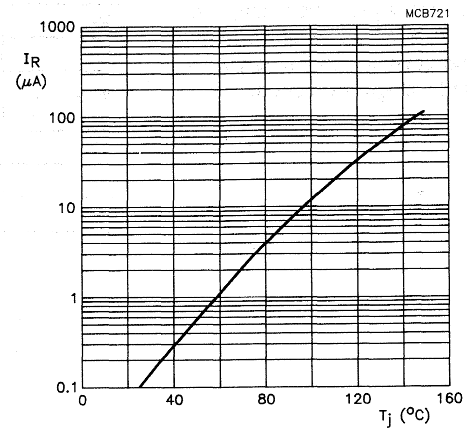


Fig.7 Reverse current as a function of junction temperature; $V_R = V_{R\ max.}$; typical values.

Schottky barrier diode | BAS85

DESCRIPTION

A Schottky barrier diode with an integrated protection ring against static discharges. This diode, in a SOD80C SMD envelope, is intended for applications where a very low forward voltage is required.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		30	V
V_F	forward voltage	I_F = 10 mA	400	mV
I_F	DC forward current		200	mA
I_{FRM}	repetitive peak forward current		300	mA
C_d	diode capacitance		10	pF
T_j	junction temperature		125	°C

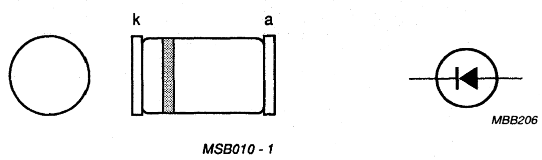


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_F	DC forward current		–	200	mA
I_{FRM}	repetitive peak forward current		–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p \leq 10$ ms	–	5	A
$I_{F(AV)}$	average rectified forward current	see note 1 and Fig.2	–	200	mA
T_j	junction temperature		–	125	°C
T_{amb}	operating ambient temperature range		–40	125	°C
T_{stg}	storage temperature range		–65	150	°C

Note

1. PCB mounting (see note under 'Thermal Resistance'); T_{amb} = 50 °C; V_{RWM} = 25 V; a = 1.57; δ = 0.5.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$ (note 1)	from junction to ambient	320 K/W

Note

1. PCB mounting with 1.5 mm epoxy glass; 6.25 mm² copper each terminal; thickness of copper minimum 40 μm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 0.1 mA	240	mV
		I_F = 1 mA	320	mV
		I_F = 10 mA	400	mV
		I_F = 30 mA	500	mV
		I_F = 100 mA	800	mV
I_R	reverse current	V_R = 25 V	2	μA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz	10	pF

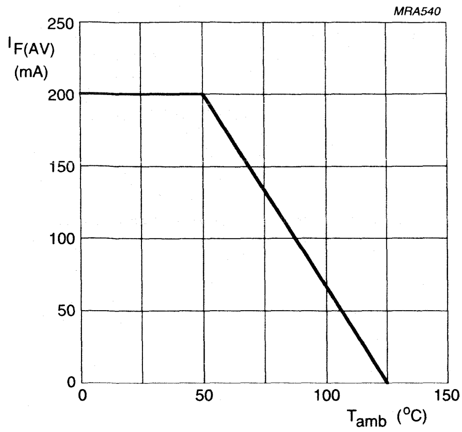


Fig.2 Derating curve.

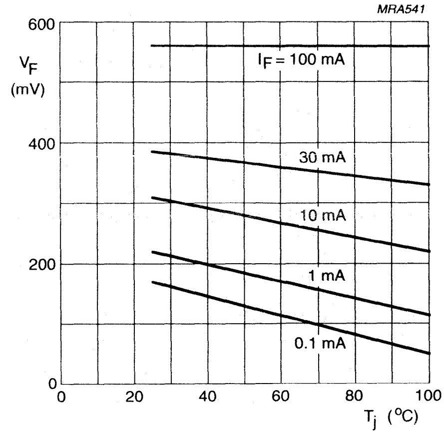
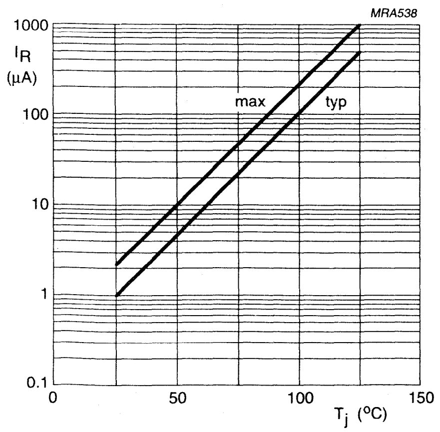
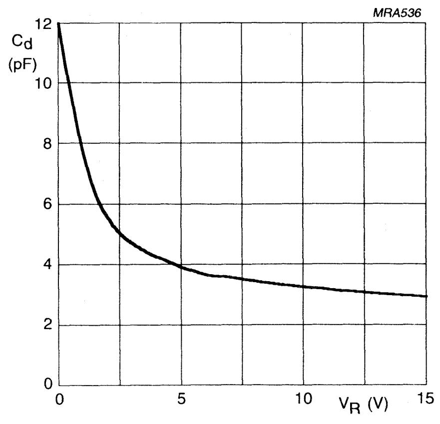


Fig.3 Forward voltage as a function of junction temperature, typical values.



V_R = 25 V.

Fig.4 Reverse current as a function of junction temperature.



f = 1 MHz.

Fig.5 Diode capacitance as a function of reverse voltage, typical values.

Schottky barrier diode BAS85

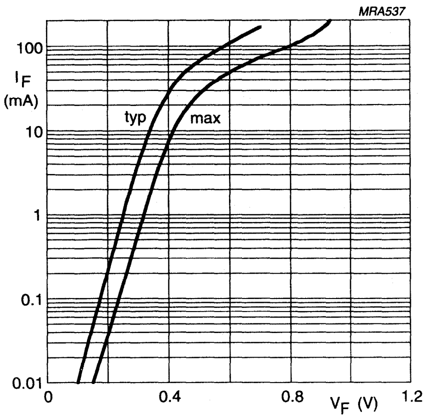


Fig.6 Forward current as a function of forward voltage.

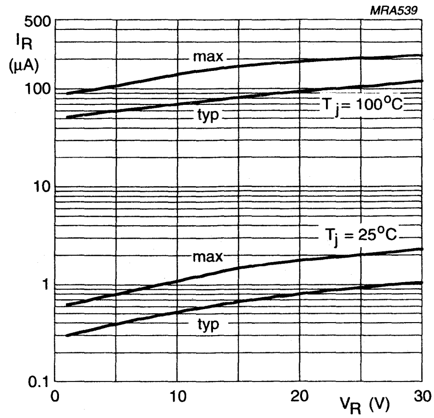


Fig.7 Reverse current as a function of reverse voltage.

SCHOTTKY BARRIER DIODE

Schottky Barrier diode with an integrated protection ring against extremely high static discharges. This diode, in a SOD80C envelope, is intended for applications where a very low forward voltage is required.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	50	V
Forward current (DC)	I_F	max.	200	mA
Peak forward current	I_{FM}	max.	250	mA
Junction temperature	T_j	max.	125	^oC
Forward voltage $I_F = 10$ mA	V_F	max.	450	mV
Diode capacitance	C_d	max.	8	pF

MECHANICAL DATA

Dimensions in mm

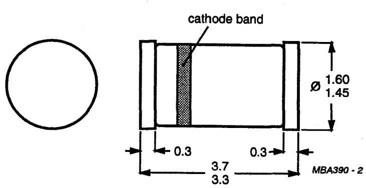


Fig.1 SOD80C.

The cathode is indicated by grey band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	50	V
Forward current				
DC	I_F	max.	200	mA
peak value	I_{FM}	max.	250	mA
peak value; $t_p < 1$ s	I_{FM}	max.	500	mA
Average rectified forward current (see Fig. 2)	$I_{F(AV)}$	max.	200	mA
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

Device mounted on a 1.5 mm thick epoxy-glass PCB	$R_{th\ j\text{-}a}$	=	320	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltage				
$I_F = 0.1$ mA	V_F	max.	300	mV
$I_F = 1$ mA	V_F	max.	380	mV
$I_F = 10$ mA	V_F	max.	450	mV
$I_F = 30$ mA	V_F	max.	600	mV
$I_F = 100$ mA	V_F	typ.	600	mV
		max.	900	mV
Reverse current $V_R = 40$ V	I_R	max.	5	μA
Reverse breakdown voltage $I_R = 10$ μA	$V_{(BR)R}$	min.	50	V
Diode capacitance $V_R = 1$ V; f = 1 MHz	C_d	max.	8	pF
Reverse recovery time when switched from $I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$; measured at $I_R = 1$ mA	t_{rr}	max.	4	ns

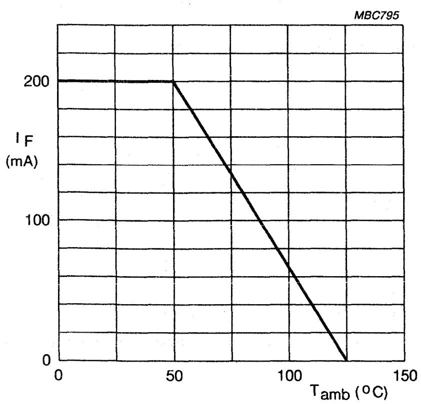


Fig. 2 Derating curve.

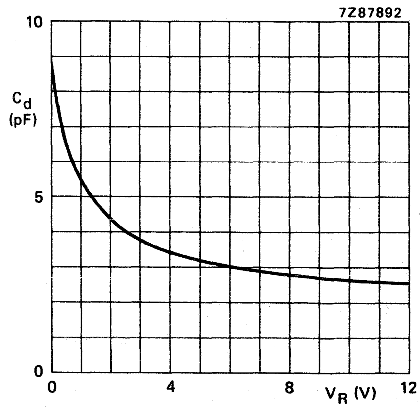


Fig. 3 f = 1 MHz; typ. values.

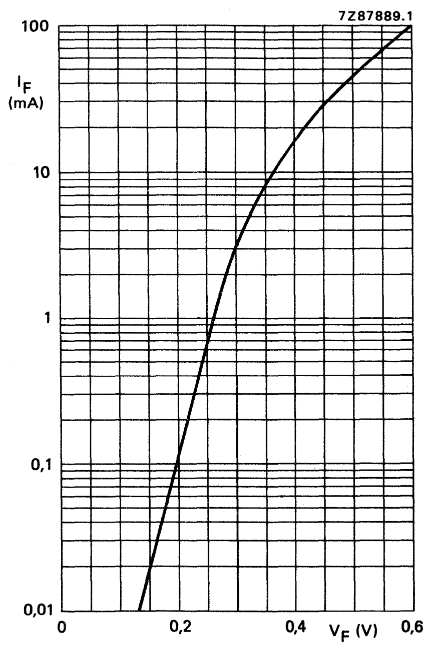


Fig. 4 Typical values.

Silicon planar epitaxial high-speed switching diode

BAS216

FEATURES

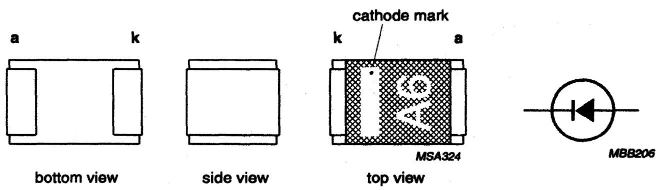
- SMD envelope
- High speed
- General application.

DESCRIPTION

The BAS216 is a silicon, epitaxial, high-speed switching diode in a small, rectangular SMD package, SOD110. It is intended for high-speed switching surface mount circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		75	V
V_{RRM}	repetitive peak reverse voltage		85	V
I_{FRM}	repetitive peak forward current		500	mA
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns
T_j	operating junction temperature		150	°C



Marking code: A6

Fig.1 Simplified outline (SOD110) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	75	V
V_{RRM}	repetitive peak reverse voltage		–	85	V
I_F	forward current	DC value	–	250	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current (per crystal)	t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	note 1	–	400	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. Device mounted on printed-circuit board, 11 x 25 x 1.6 mm.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	315 K/W

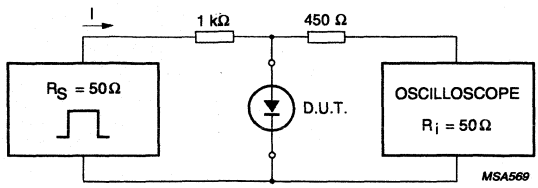
Note

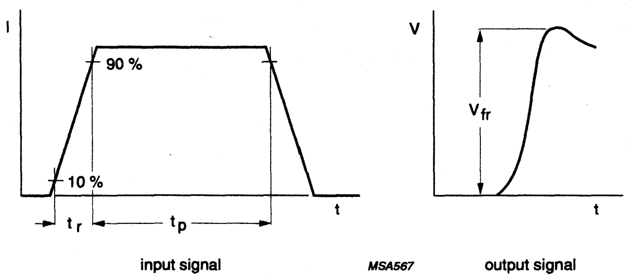
1. Device mounted on printed circuit board, 11 x 25 x 1.6 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	V_R = 25 V	30	nA
		V_R = 75 V	1	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0; f = 1 MHz	2	pF
V_{fr}	forward recovery voltage	when switched to I_F = 10 mA; t_p = 20 ns; see Fig.2	1.75	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA; see Fig.3	4	ns



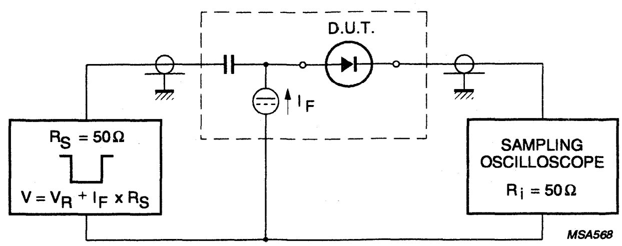


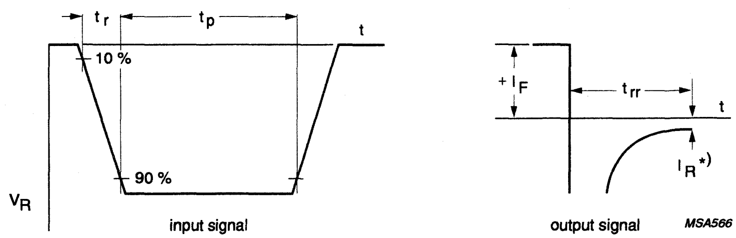
Input signal:
forward pulse rise time (t_r) = 20 ns
forward current pulse duration (t_p) = 120 ns
duty factor (δ) = 0.01.

Circuit capacitance:
$C \leq 1$ pF (C = oscilloscope input capacitance + parasitic capacitance).

Oscilloscope:
rise time (t_r) = 0.35 ns.

Fig.2 Forward recovery voltage test circuit and waveforms.



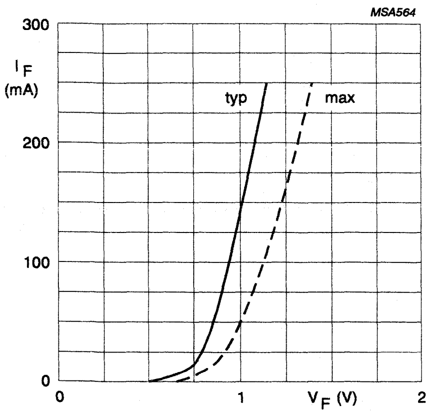


Input signal:
rise time of reverse pulse (t_r) = 0.6 ns
reverse pulse duration (t_p) = 100 ns
duty factor (δ) = 0.05

Circuit capacitance:
C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Oscilloscope:
rise time (t_r) = 0.35 ns.

Fig.3 Reverse recovery time test circuit and waveforms.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage; typical values.

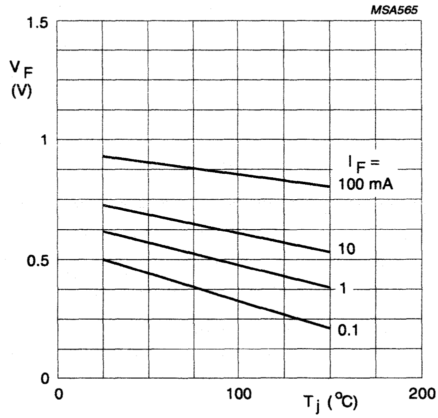


Fig.5 Forward voltage as a function of junction temperature; typical values.

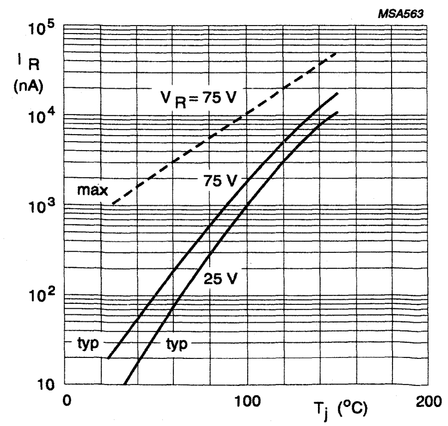
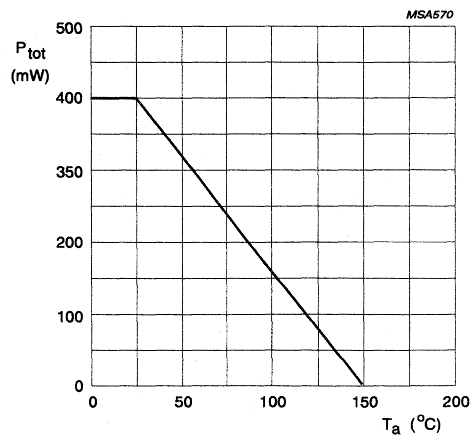


Fig.6 Reverse current as a function of junction temperature; typical values.



Mounted on printed-circuit board, 11 x 25 x 1.6 mm.

Fig.7 Power derating curve.

Silicon planar epitaxial high-speed diode

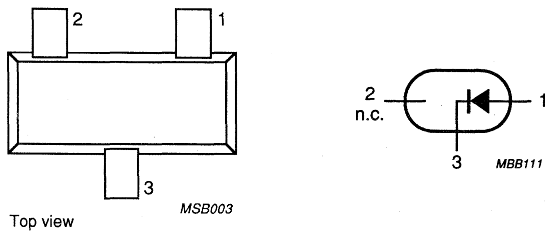
BAS678

DESCRIPTION

Silicon epitaxial high-speed diode in a microminiature plastic envelope. It is intended for high-speed switching applications.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage		80	V
V_{RRM}	repetitive peak reverse voltage		100	V
I_{FRM}	repetitive peak forward current		600	mA
V_F	forward voltage	I_F = 200 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA	6	ns
Q_s	reverse recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	50	pC
T_j	junction temperature		150	°C



Marking code: BAS678 = L52.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	80	V
V_{RRM}	repetitive peak reverse voltage		–	100	V
I_F	forward current	DC value	–	250	mA
I_{FRM}	repetitive peak forward current		–	600	mA
I_{FSM}	non-repetitive peak forward current	t = 1 µs	–	4	A
		t = 1 s	–	1	A
P_{tot}	total power dissipation	mounted on FR4 printboard	–	250	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	mounted on FR4 printboard	500 K/W

Silicon planar epitaxial high-speed diode

BAS678

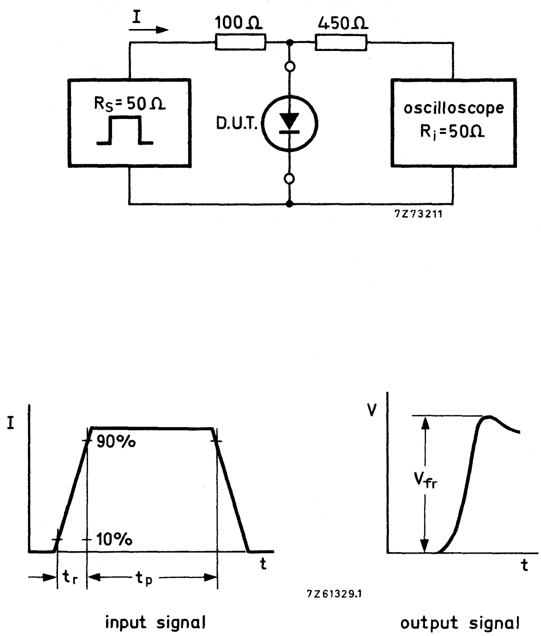
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 μA	100	–	V
V_F	forward voltage	DC value; I_F = 200 mA; T_{amb} = 25 °C; note 1	–	1	V
I_R	reverse current	V_R = 10 V	–	15	nA
		V_R = 75 V	–	100	nA
		V_R = 75 V; T_j = 150 °C	–	50	μA
C_d	diode capacitance	V_R = 0; f = 1 MHz	–	2	pF
V_{fr}	forward recovery voltage	when switched to I_F = 10 mA; t_r = 20 ns; see Fig.2	–	2	V
t_{rr}	reverse recovery time	when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA; see Fig.3	–	6	ns
Q_s	reverse recovery charge	when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω; see Fig.4	–	50	pC

Note

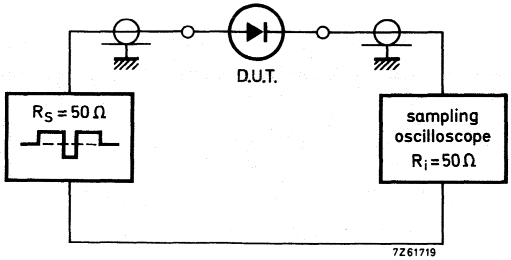
1. V_F is measured with diode at thermal equilibrium while mounted on FR4 printboard.

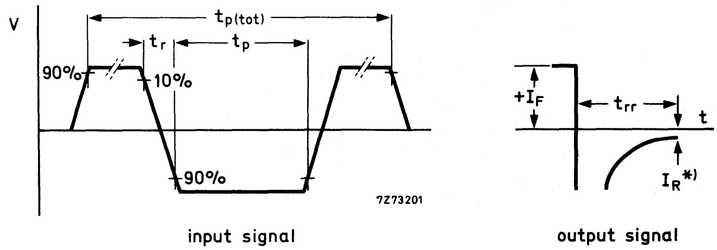


Input signal:
forward pulse rise time (t_r) = 20 ns
forward current pulse duration (t_p) = 120 ns
duty factor (δ) = 0.01.

Circuit capacitance:
C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



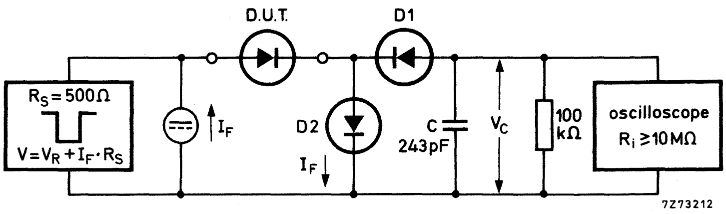


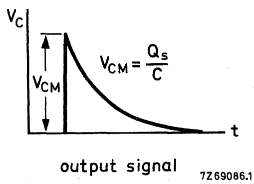
Input signal:
rise time of reverse pulse (t_r) = 0.6 ns
reverse pulse duration (t_p) = 30 ns
duty factor (δ) = 0.0025
total pulse duration ($t_{p(tot)}$) = 0.2 µs.

Circuit capacitance:
C ≤ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Oscilloscope:
rise time (t_r) = 0.35 ns.

Fig.3 Reverse recovery time test circuit and waveforms.





D1 = BAW62

D2 = diode with minority carrier life time (10 mA: < 200 ps).

Input signal:

rise time of reverse pulse (t_r) = 2 ns

reverse pulse duration (t_p) = 400 ns

duty factor (δ) = 0.02.

Circuit capacitance:

$C \leq 7$ pF (C = oscilloscope input capacitance + parasitic capacitance).

Fig.4 Recovery charge test circuit and waveforms.

SCHOTTKY BARRIER DIODE

Silicon epitaxial diode in a microminiature plastic envelope. Intended for u.h.f. mixer and fast switching applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	4	V
Forward current (d.c.)	I_F	max.	30	mA
Junction temperature	T_j	max.	100	°C
Forward voltage at I_F = 10 mA	V_F	<	600	mV
Diode capacitance at V_R = 0; f = 1 MHz	C_d	<	1,0	pF
Noise figure at f = 900 MHz	F	<	8,0	dB

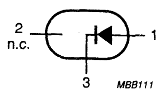
MECHANICAL DATA

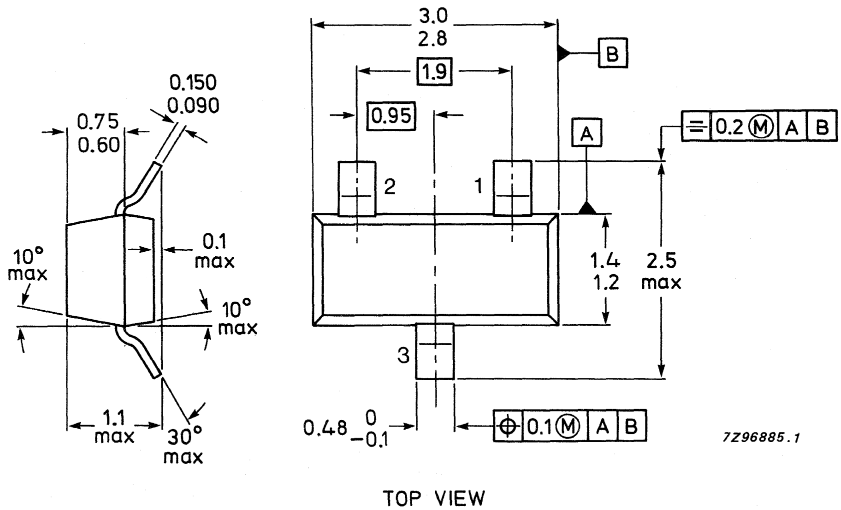
Dimensions in mm

Marking code

BAT17 = A3p

Fig.1 SOT-23.





Product approved to CECC 50 001-062.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	4	V
Forward current (d.c.)**	I_F	max.	30	mA
Storage temperature	T_{stg}	−65 to +100		^oC
Junction temperature	T_j	max.	100	^oC

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 ^oC unless otherwise specified

Reverse current				
V_R = 3 V	I_R	<	0,25	μA
V_R = 3 V; T_{amb} = 60 ^oC	I_R	<	1,25	μA
Reverse breakdown voltage				
I_R = 10 μA	$V_{(BR)R}$	>	4	V
Forward voltage				
I_F = 0,1 mA	V_F	<	350	mV
I_F = 1,0 mA	V_F	<	450	mV
I_F = 10 mA	V_F	<	600	mV
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	1,0	pF
Noise figure at f = 900 MHz▲	F	<	8,0	dB
Series resistance at f = 1 kHz				
I_F = 5 mA	r_D	<	15	Ω

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ The local oscillator is adjusted for a diode current of 2 mA. I.F. amplifier noise F_{if} = 1,5 dB; f = 35 MHz.

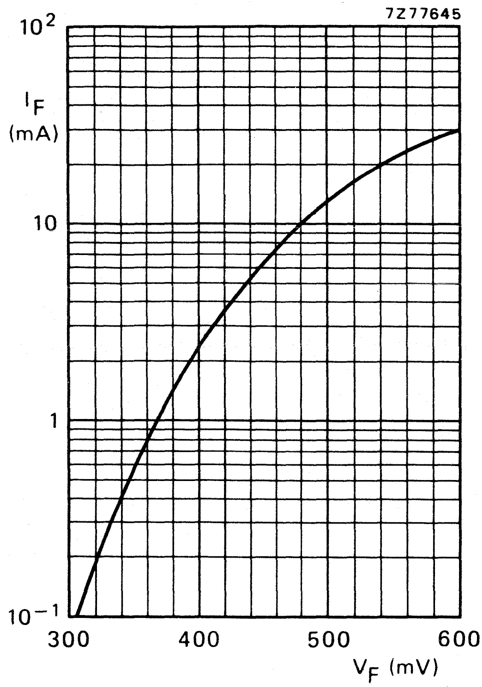


Fig. 2 Typical values.

SILICON PLANAR DIODE

Band switching diode in a microminiature plastic envelope. Intended for thick and thin-film circuits.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	35	V
Forward current (d.c.)	I_F	max.	100	mA
Junction temperature	T_j	max.	100	°C
Diode capacitance at f = 1 MHz V_R = 20 V	C_d	typ.	0,8	pF
		<	1,0	pF
Series resistance at f = 200 MHz I_F = 5 mA	r_D	typ.	0,5	Ω
		<	0,7	Ω

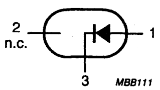
MECHANICAL DATA

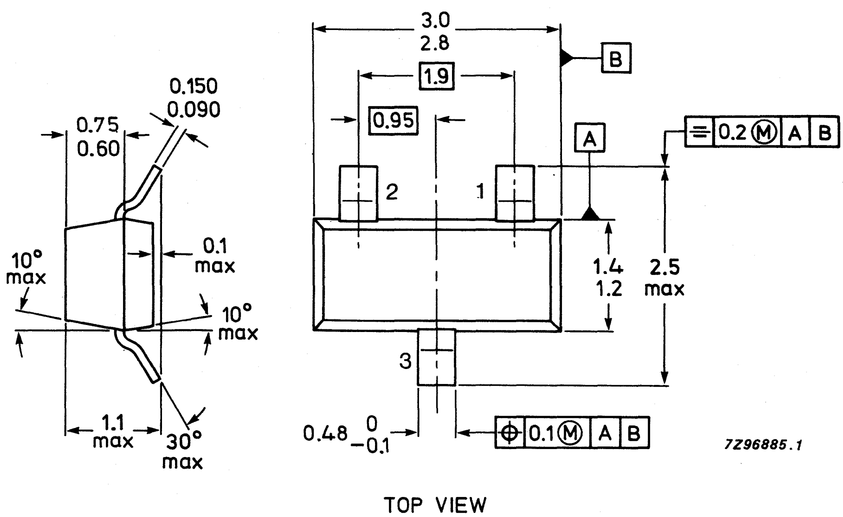
Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAT18 = A2





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	35	V
Forward current (d.c.)	I_F	max.	100	mA
Storage temperature	T_{stg}	−55 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE*

From junction to ambient**	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage at I_F = 100 mA	V_F	<	1,2	V
Reverse current				
V_R = 20 V	I_R	<	100	nA
V_R = 20 V; T_j = 60 °C	I_R	<	1	μA
Diode capacitance at f = 1 MHz				
V_R = 20 V	C_d	typ.	0,8	pF
		<	1,0	pF
Series resistance at f = 200 MHz				
I_F = 5 mA	r_D	typ.	0,5	Ω
		<	0,7	Ω

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

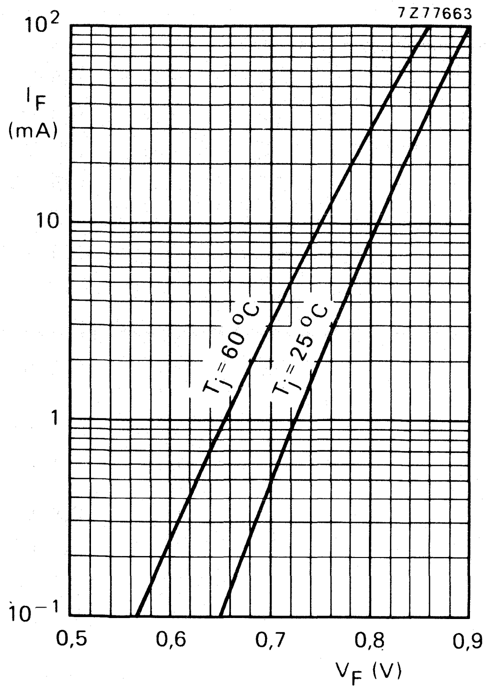


Fig. 2 Typical values.

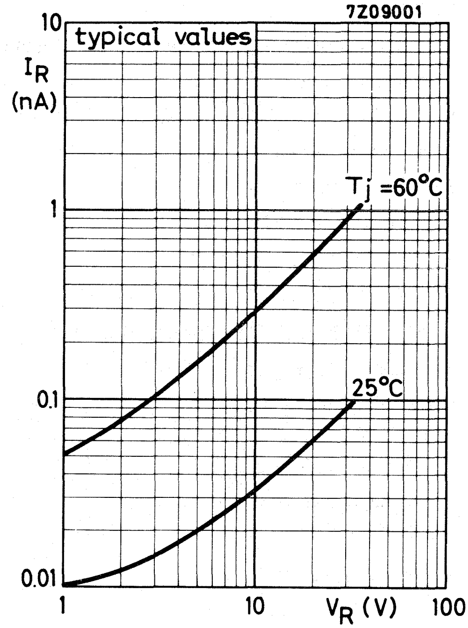


Fig. 3.

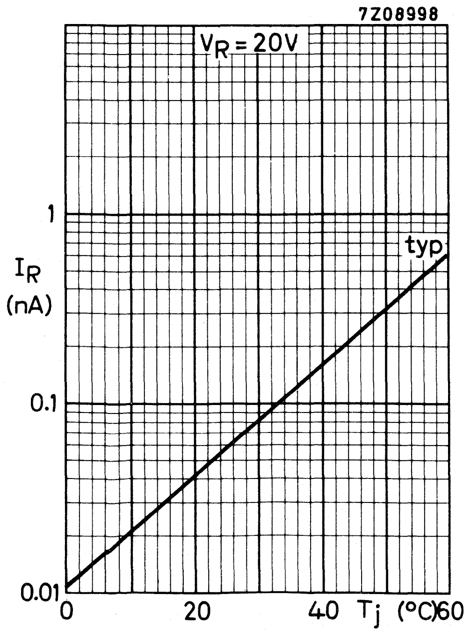


Fig. 4.

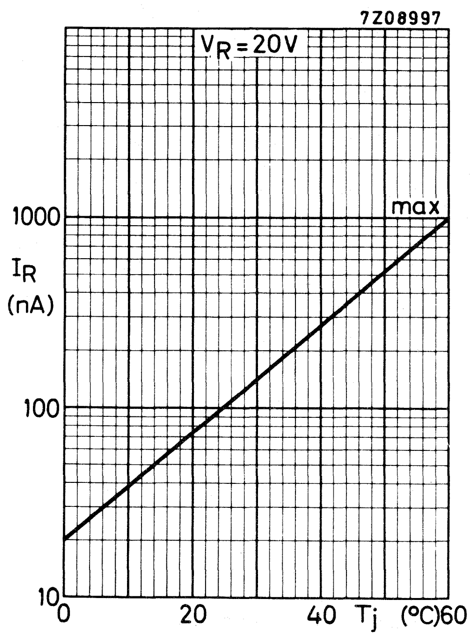


Fig. 5.

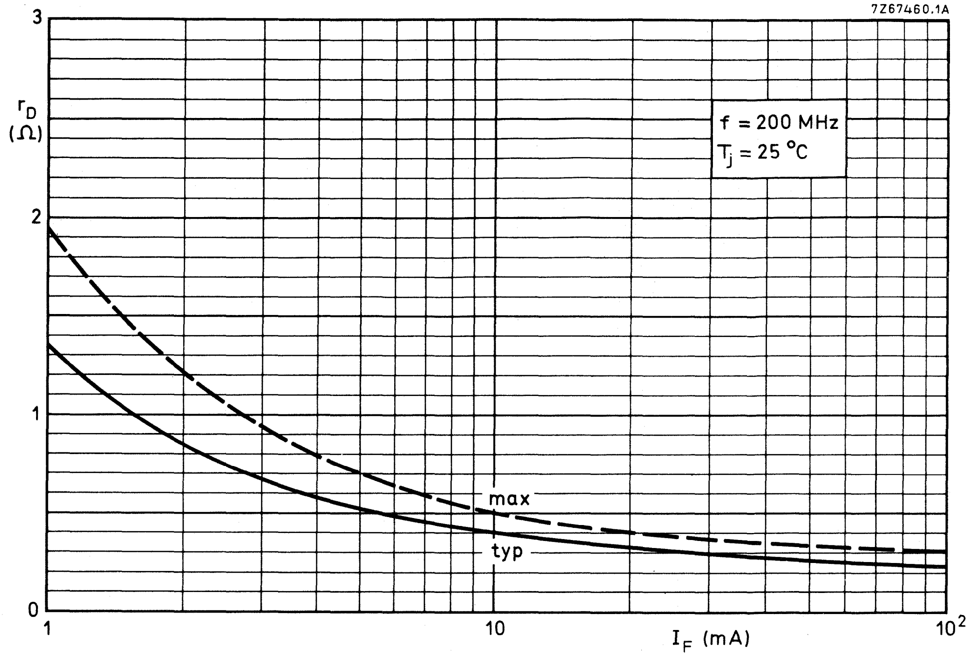


Fig. 6.

SCHOTTKY BARRIER DIODE

Silicon epitaxial Schottky barrier diode with an integrated p-n junction protection ring in a micro-miniature SOT-23 envelope intended for surface mounting.

The diode features especially a low forward voltage.

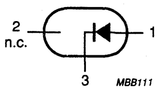
QUICK REFERENCE DATA

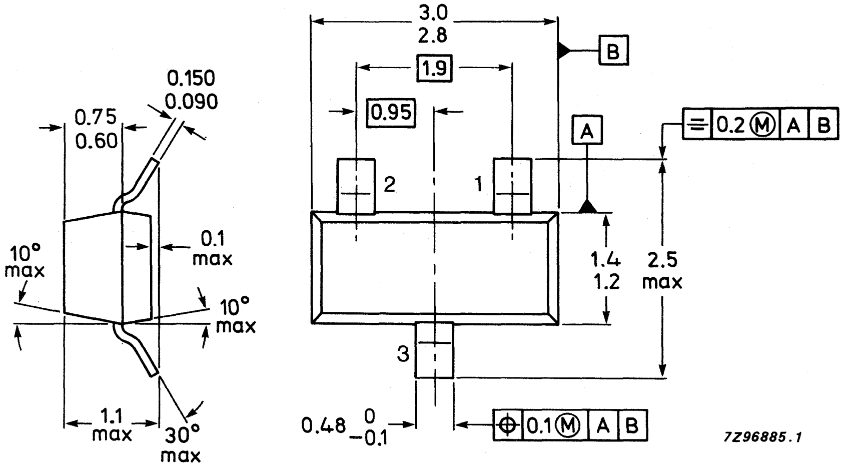
Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.)	I_F	max.	200	mA
Forward voltage at I_F = 10 mA	V_F	max.	400	mV
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230	mW
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	≤	5	ns
Junction temperature	T_j	max.	125	°C

Fig. 1 SOT-23

Dimensions in mm

Marking code: L4p





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.) see Fig. 2	I_F	max.	200	mA
Repetitive peak forward current	I_{FRM}	max.	300	mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230	mW
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage				
I_F = 0,1 mA	V_F	⩽	240	mV
I_F = 1 mA*	V_F	⩽	320	mV
I_F = 10 mA	V_F	⩽	400	mV
I_F = 30 mA*	V_F	⩽	500	mV
I_F = 100 mA	V_F	=	500	mV
	V_F	<	1000	mV
Reverse current V_R = 25 V	I_R	⩽	2	μA
Reverse breakdown voltage	$V_{(BR)R}$	>	30	V
Diode capacitance V_R = 1 V; f = 1 MHz	C_d	⩽	10	pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	⩽	5	ns

* Temperature coefficient of forward voltage:
−0,6 %/K at I_F = 1 mA
−0,3 %/K at I_F = 30 mA

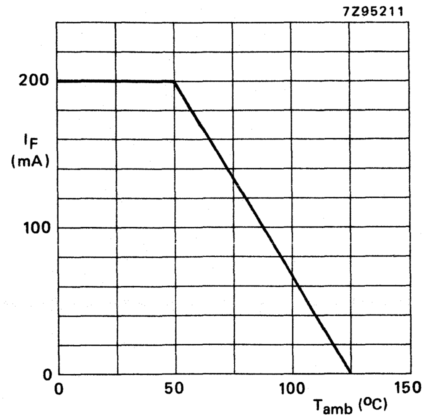


Fig. 2 Derating curve maximum ambient temperature.

SCHOTTKY BARRIER DIODE

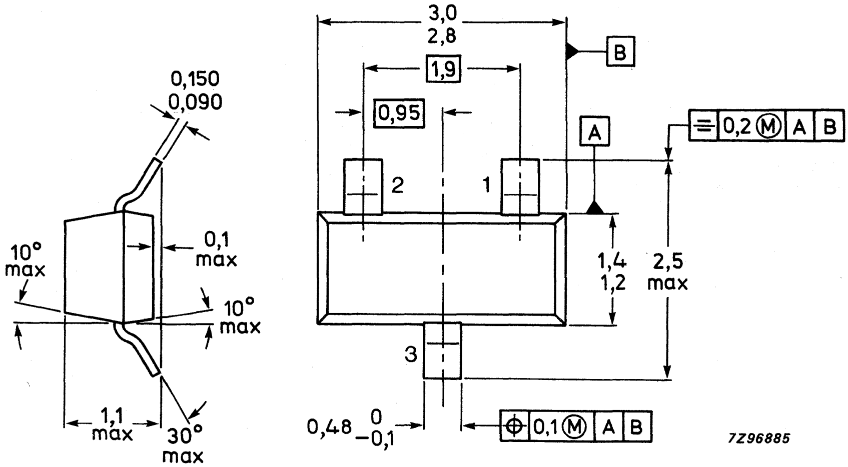
Silicon epitaxial Schottky Barrier double diodes with an integrated p-n junction protection ring in a microminiature SOT-23 envelope intended for surface mounting.

The diodes feature an especially low forward voltage.

QUICK REFERENCE DATA

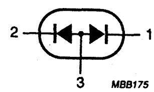
Continuous reverse voltage	V_R	max.	30	V
Forward current (DC)	I_F	max.	200	mA
Forward voltage at I_F = 10 mA	V_F	max.	400	mV
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100; measured at I_R = 1 mA	t_{rr}	<	5	ns
Junction temperature	T_j	max.	125	°C

Dimensions in mm

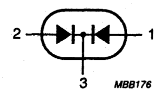


TOP VIEW

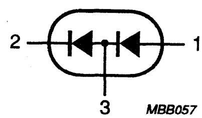
Fig. 1 SOT-23.



BAT54A
Marking code: L42



BAT54C
Marking code: L43



BAT54S
Marking code: L44

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Repetitive peak reverse voltage	V_{RRM}	max.	30 V
Forward current (DC)	I_F	max.	200 mA
Repetitive peak forward current	I_{FRM}	max.	300 mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600 mA
Storage temperature	T_{stg}	−50 to + 150 °C	
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient; mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\,j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage			
I_F = 0,1 mA	V_F	max.	240 mV
I_F = 1 mA	V_F	max.	320 mV
I_F = 10 mA	V_F	max.	400 mV
I_F = 30 mA	V_F	max.	500 mV
I_F = 100 mA	V_F	typ.	500 mV
		max.	1000 mV
Reverse current V_R = 25 V	I_R	<	2 μA
Reverse breakdown voltage	$V_{(BR)R}$	>	30 V
Diode capacitance V_R = 1 V; f = 1 MHz	C_d	<	10 pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100; measured at I_R = 1 mA	t_{rr}	<	5 ns

Schottky barrier diodes BAT54W series

FEATURES

- Ultra-fast switching speed
- Low forward voltage
- Three-pin s-mini SMD package.

DESCRIPTION

Silicon epitaxial Schottky barrier diodes with an integrated guard ring for stress protection.
Intended for high speed switching, circuit protection and voltage clamping applications.

The diodes are encapsulated in a SOT323 SMD plastic package.

PIN CONFIGURATION

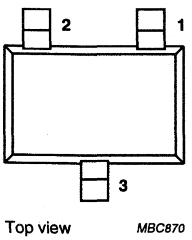


Fig.1 Simplified outline SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_R	continuous reverse voltage		30	V
I_F	continuous forward current		200	mA
V_F	forward voltage	I_F = 10 mA	400	mV
I_R	reverse current	V_R = 25 V	2	μA
T_j	junction temperature		150	°C
C_d	diode capacitance	V_R = 1 V	10	pF

SYMBOLS

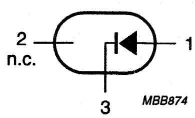


Fig.2 BAT54W

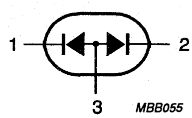


Fig.3 BAT54AW

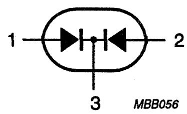


Fig.4 BAT54CW

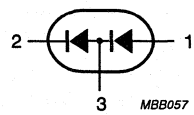


Fig.5 BAT54SW

PINNING / MARKING CODES

PIN	BAT54W	BAT54AW	BAT54CW	BAT54SW
1	A	C1	A1	A1
2	n.c.	C2	A2	C2
3	C	A1/A2	C1/C2	C1/A2
Marking code	L4	42	43	44

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	30	V
I_F	continuous forward current		–	200	mA
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ s; $\delta \leq 0.5$	–	300	mA
I_{FSM}	non-repetitive peak forward current	$t_p < 10$ ms	–	600	mA
T_{stg}	storage temperature		–65	+150	°C
T_{amb}	operating ambient temperature		–65	+150	°C
P_{tot}	total power dissipation (per package)	$T_{amb} \leq 25$ °C	–	200	mW
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient; note 1	625 K/W

Note

1. Printed-circuit board mounting (SOT323 standard conditions).

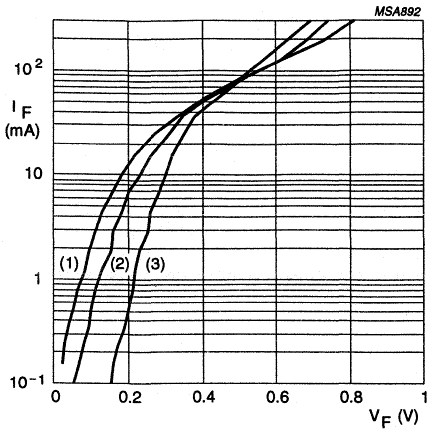
CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_F	forward voltage	$I_F = 0.1$ mA	–	240	mV
		$I_F = 1$ mA	–	320	mV
		$I_F = 10$ mA	–	400	mV
		$I_F = 30$ mA	–	500	mV
		$I_F = 100$ mA	–	800	mV
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 10$ µA	30	–	V
I_R	reverse current	$V_R = 25$ V; note 1	–	2	µA
C_d	diode capacitance	$V_R = 1$ V; f = 1 MHz	–	10	pF
t_{rr}	reverse recovery time	when switched from $I_F = 10$ mA to $I_R = 10$ mA; $R_L = 100\ \Omega$ measured at $I_R = 1$ mA	–	5	ns

Note

1. Pulsed test: $t_p = 300$ µs; $\delta = 0.02$.

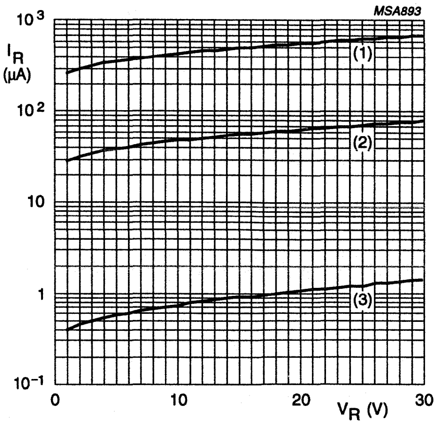


(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

Fig.6 Forward current as a function of forward voltage.



(1) T_{amb} = 125 °C.

(2) T_{amb} = 85 °C.

(3) T_{amb} = 25 °C.

Fig.7 Reverse current as a function of reverse voltage.

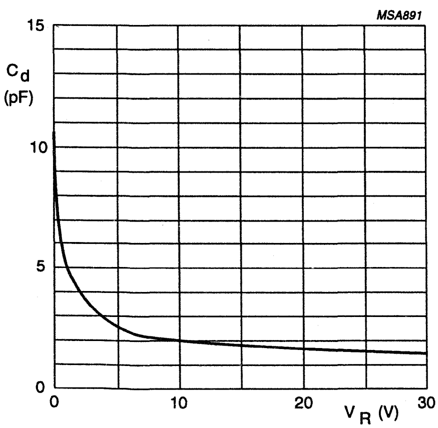


Fig.8 Diode capacitance as a function of reverse voltage.

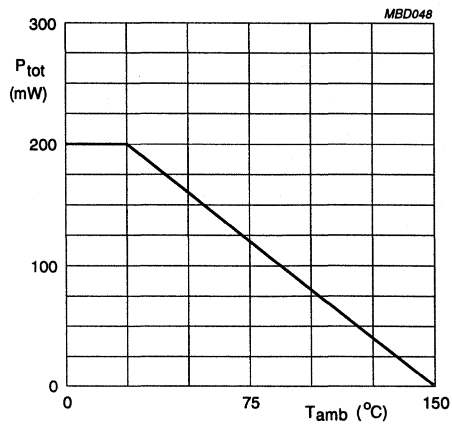


Fig.9 Power derating curve.

SCHOTTKY BARRIER DIODE

Two separate silicon epitaxial Schottky barrier diodes with an integrated p-n junction protection ring in one microminiature SOT-143 envelope, intended for surface mounting (SMD technology).

The device features a low forward voltage drop.

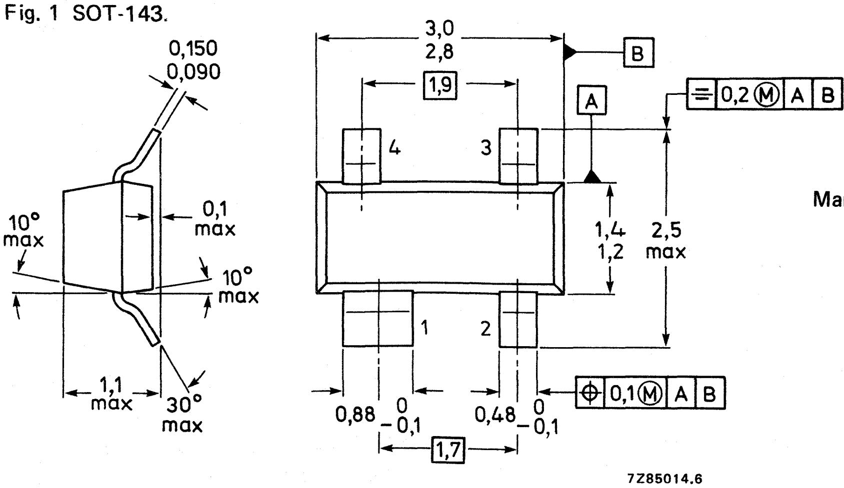
QUICK REFERENCE DATA

			single diode	double-diode operation	
Continuous reverse voltage	V_R	max.	30	30	V
Continuous reverse voltage series connection	V_R	max.	–	60	V
Forward current	I_F	max.	200	110	mA
Repetitive peak forward current	I_{FRM}	max.	300	200	mA
Non-repetitive peak forward current	I_{FSM}	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230		mW
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	≤	5		ns

MECHANICAL DATA

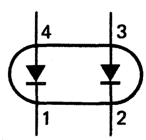
Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

Marking code : L41



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	double-diode operation	
Continuous reverse voltage	V_R	max.	30	30	V
Continuous reverse voltage series connection	V_R	max.	–	60	V
Forward current (see Fig. 2)	I_F	max.	200	110*	mA
Repetitive peak forward current	I_{FRM}	max.	300	200	mA
Non-repetitive peak forward current $t < 1$ s	I_{FSM}	max.	600		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	125		°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm	$R_{th\ j\text{-}a}$	430	K/W

CHARACTERISTICS, per diode

T_{amb} = 25 °C unless otherwise specified

Forward voltage				
I_F = 0,1 mA	V_F	⩽	240	mV
I_F = 1 mA**	V_F	⩽	320	mV
I_F = 10 mA	V_F	⩽	400	mV
I_F = 30 mA**	V_F	⩽	500	mV
I_F = 100 mA	V_F	=	500	mV
		<	1000	mV
Reverse current V_R = 25 V	I_R	⩽	2	μA
Reverse breakdown voltage	$V_{(BR)R}$	>	30	V
Diode capacitance V_R = 1 V; f = 1 MHz	C_d	⩽	10	pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	⩽	5	ns

* If both diodes are in forward operation at the same moment, total device current max. 110 mA. If one diode is in reverse and the other in forward operation at the same moment, total device current max. 200 mA.

** Temperature coefficient of forward voltage: −0,6%/K at I_F = 1 mA.

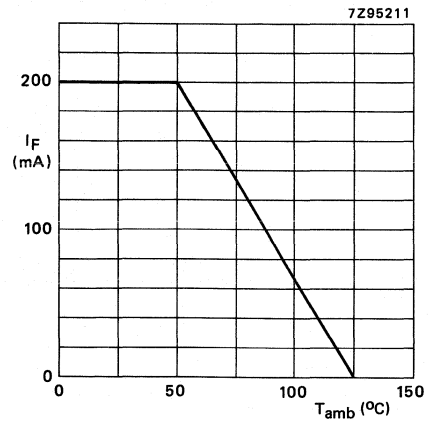


Fig. 2 Derating curve maximum ambient temperature.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

The BAV23 consists of two separate planar epitaxial high-speed diodes in one microminiature plastic envelope intended for surface mounting.

The device is designed for switching and general applications where high breakdown voltages are required.

QUICK REFERENCE DATA

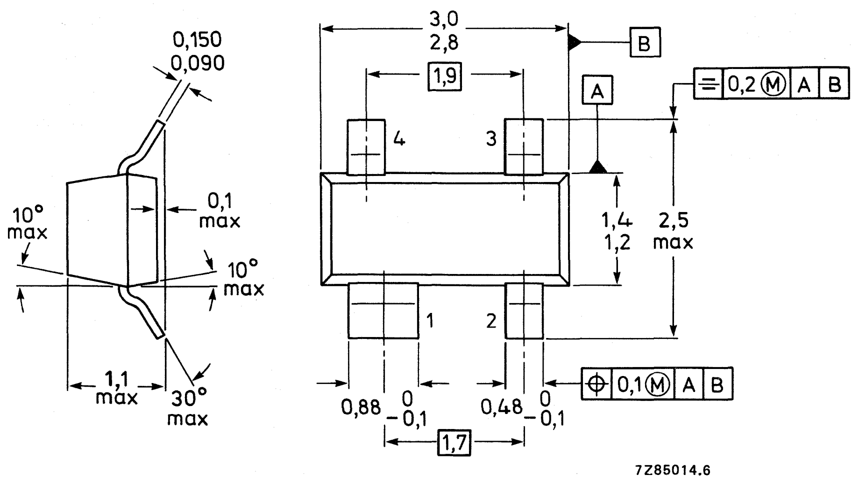
			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak rerverse voltage	V_{RRM}	max.	250	500	V
Forward current (DC)	I_F	max.	225	125	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	<	50		ns

MECHANICAL DATA

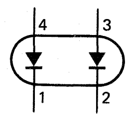
Dimensions in mm

Fig. 1 SOT-143.

Marking code: L30



TOP VIEW



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak reverse voltage	V_{RRM}	max.	250	500	V
Forward current (DC)	I_F	max.	225	125	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Non-repetitive peak forward current t = 1 μs;	I_{FSM}	max.	2,5	1,5	A
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		^oC
Junction temperature	T_j	max.	150		^oC

THERMAL RESISTANCE

From junction to ambient on an FR4 printed-circuit board	$R_{th\ j\text{-}a}$	500	K/W

CHARACTERISTICS

T_j = 25 ^oC unless otherwise specified

			single diode	series connection	
Forward voltage I_F = 100 mA	V_F	$<$	1000	2000	mV
I_F = 200 mA	V_F	$<$	1250	2500	mV
Reverse current $V_R = V_{Rmax}$	I_R	$<$	100	100	nA
Reverse breakdown voltage I_R = 100 μA	$V_{(BR)R}$	$>$	250	500	V
Differential forward resistance I_F = 10 mA	r_f	typ.	5	10	Ω
Diode capacitance V_R = 0; f = 1 MHz	C_d	$<$	5	2,5	pF
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	$<$	50	50	ns

Silicon planar epitaxial high-speed diode

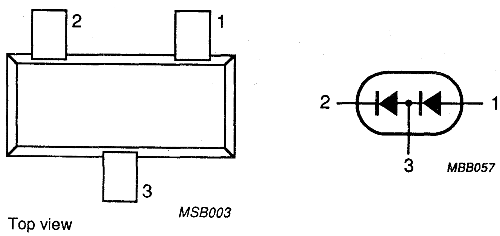
BAV23S

DESCRIPTION

The BAV23S consists of two planar epitaxial high-speed diodes in one microminiature plastic envelope intended for surface mounting. The device is designed for switching and general applications where high breakdown voltages are required.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_R	continuous reverse voltage			
	single diode		200	V
	series connection		400	V
V_{RRM}	repetitive peak reverse voltage			
	single diode		250	V
	series connection		500	V
I_{FRM}	repetitive peak forward current			
	single diode		625	mA
	series connection		450	mA
$I_{F(AV)}$	forward current (DC)			
	single diode		225	mA
	series connection		125	mA
P_{tot}	total power dissipation	T_{amb} = 25 °C	300	mW
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	50	ns



Marking code: L31.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage				
	single diode		–	200	V
	series connection		–	400	V
V_{RRM}	repetitive peak reverse voltage				
	single diode		–	250	V
	series connection		–	500	V
$I_{F(AV)}$	forward current (DC)				
	single diode		–	225	mA
	series connection		–	125	mA
I_{FRM}	repetitive peak forward current				
	single diode		–	625	mA
	series connection		–	450	mA
I_{FSM}	non-repetitive peak forward current	t = 1 s			
	single diode		–	0.5	A
	series connection		–	0.4	A
		t = 1 µs			
	single diode		–	2.5	A
	series connection		–	1.5	A
P_{tot}	total power dissipation		–	250	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	mounted on FR4 printboard	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)R}$	reverse breakdown voltage	I_R = 100 µA			
	single diode		250	–	V
	series connection		500	–	V
V_F	forward voltage	I_F = 100 mA			
	single diode		–	1	V
	series connection		–	2	V
		I_F = 200 mA			
	single diode		–	1.25	V
	series connection		–	2.5	V
I_R	reverse current	$V_R = V_{R\,max}$	–	100	nA
C_d	diode capacitance	V_R = 0; f = 1 MHz			
	single diode		–	5	pF
	series connection		–	2.5	pF
t_{rr}	reverse recovery time	when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	–	50	ns

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAV70 consists of two diodes in a microminiature plastic envelope. The cathodes are commoned and the unit is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA (per diode)

Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

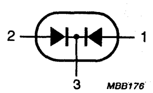
MECHANICAL DATA

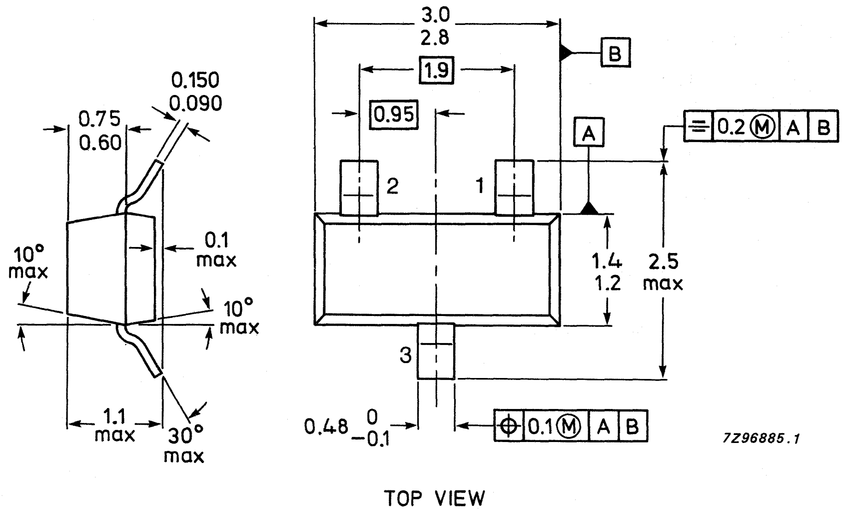
Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAV70 = A4p





RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	4	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		–65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	60	μA
V_R = 70 V	I_R	<	2.5	μA
V_R = 70 V; T_j = 150 °C	I_R	<	100	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	1,5	pF
Forward recovery voltage when switched to				
I_F = 10 mA; t_r = 20 ns see Fig. 2	V_{fr}	<	1,75	V

* Mounted on an FR4 printed-circuit board.

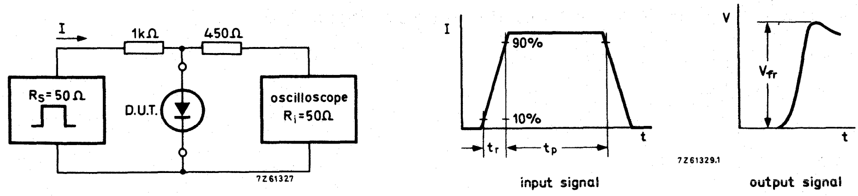


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal : Rise time of the forward pulse t_r = 20 ns; Forward current pulse duration t_p = 120 ns;
Duty factor δ = 0,01

Oscilloscope : Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA see Fig. 3 — t_{rr} < 4 ns

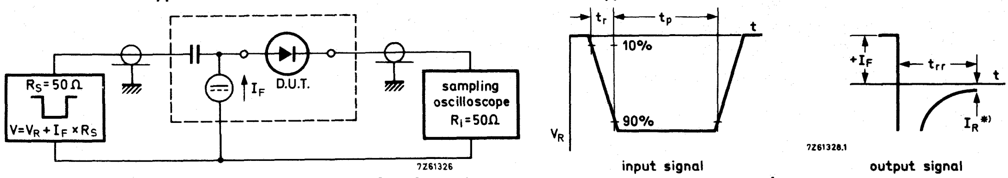


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

Input signal : Rise time of the reverse pulse t_r = 0,6 ns; reverse pulse
duration t_p = 100 ns; duty factor δ = 0,05

Oscilloscope : Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 100 Ω see Fig. 4 — Q_s < 45 pC

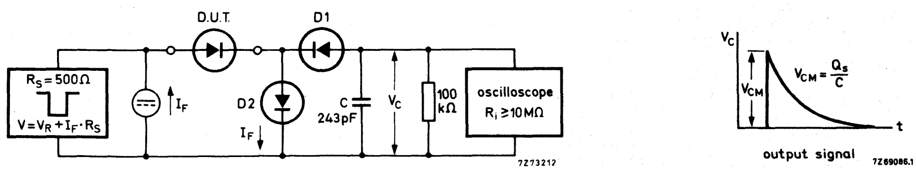


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

D2 = diode with minority carrier life time at 10 mA: < 200 ps

Input signal : Rise time of the reverse pulse = t_r = 2 ns; Reverse pulse duration = t_p = 400 ns;
Duty factor = δ = 0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

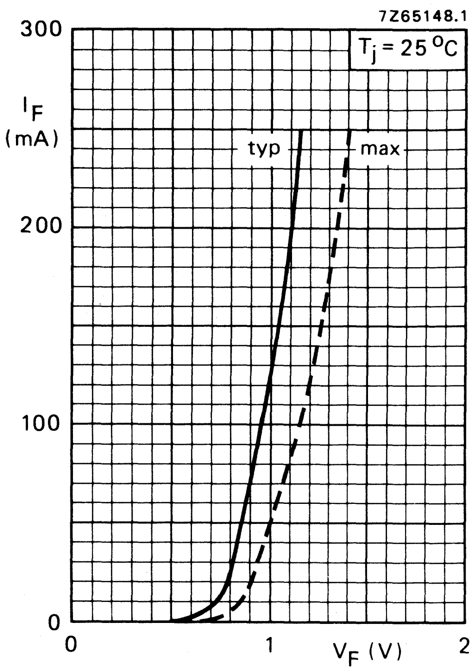


Fig. 5

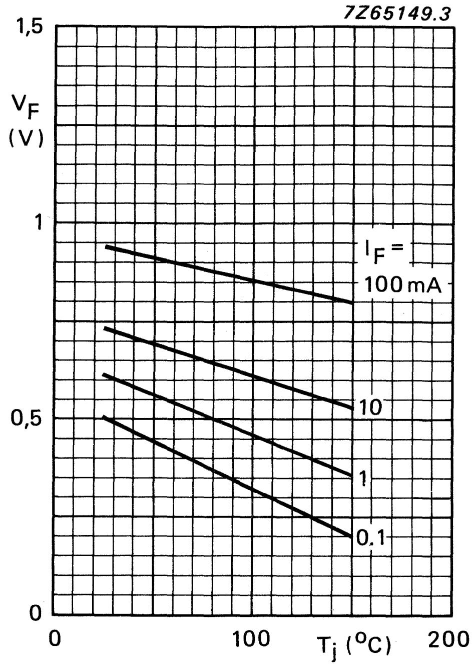


Fig. 6

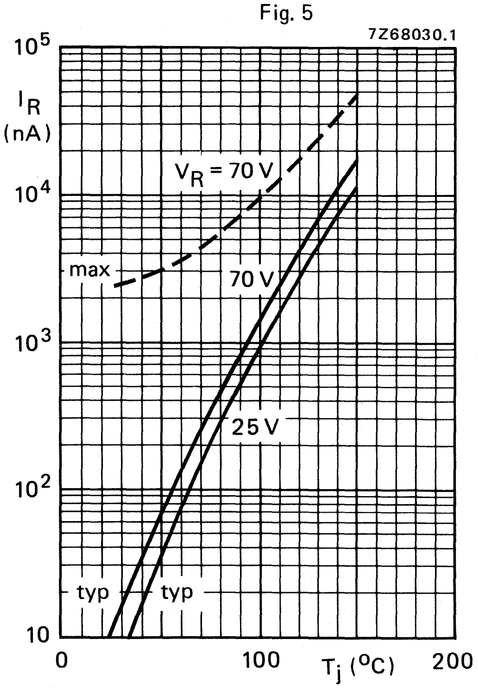


Fig. 7

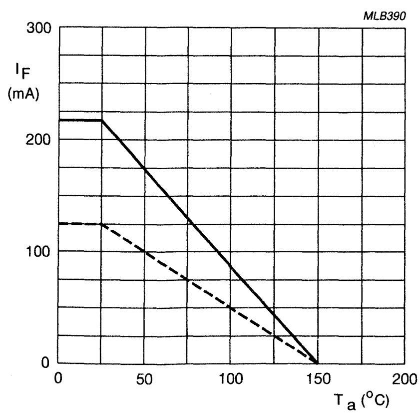


Fig. 8 ——— single diode
– – – – – double diode, equally loaded.

Silicon planar epitaxial high-speed double diode

BAV70W

FEATURES

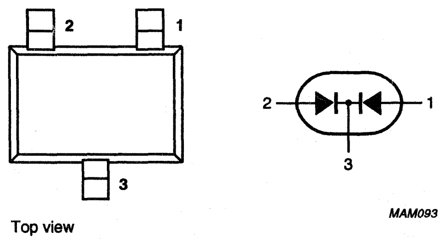
- Plastic SMD envelope
- High switching speed
- General application.

DESCRIPTION

Two epitaxial high-speed switching diodes in a small rectangular SMD SOT323 envelope. The cathodes are common. This unit is intended for high-speed switching applications in surface mounted circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_R	continuous reverse voltage		70	V
V_{RRM}	repetitive peak reverse voltage		75	V
I_{FRM}	repetitive peak forward current		500	mA
T_j	junction temperature		150	°C
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns



Marking code: A4

Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	70	V
V_{RRM}	repetitive peak reverse voltage		–	75	V
I_F	DC forward current	single diode loaded	–	175	mA
		double diode loaded	–	100	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 μs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note (1)	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	note (1)	625 K/W

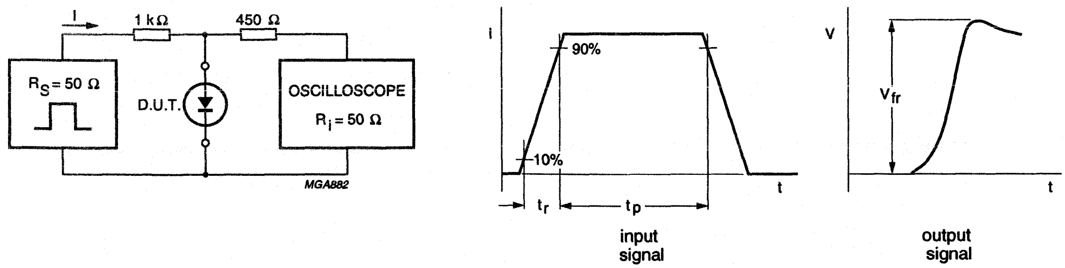
Note

1. Device mounted on FR4 printed-circuit board.

CHARACTERISTICS

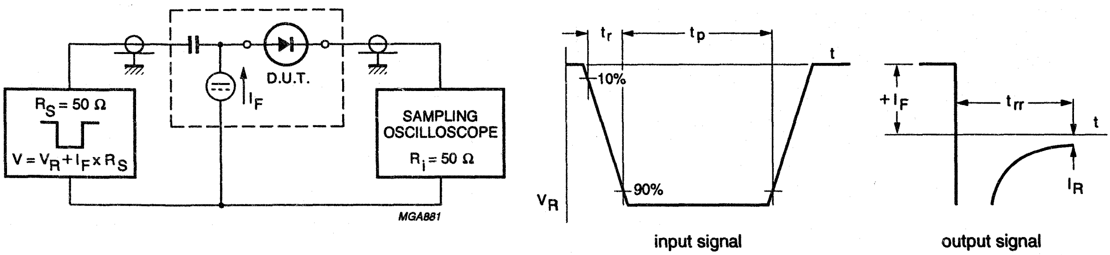
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	V_R = 25 V	30	nA
		V_R = 25 V; T_j = 150 °C	60	μA
		V_R = 70 V	2.5	μA
		V_R = 70 V; T_j = 150 °C	100	μA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz	1.5	pF
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_p = 20 ns; see Fig.2	1.75	V
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1mA; see Fig.3	4	ns



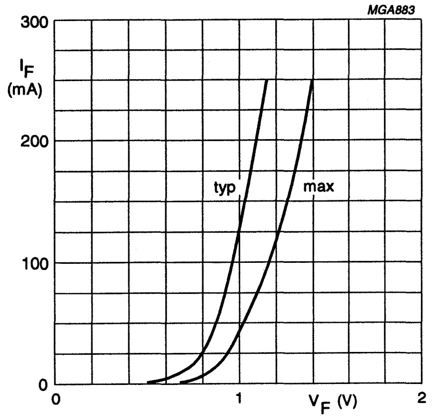
Input signal: forward pulse rise time t_r = 20 ns; forward pulse duration t_p = 120 ns; duty factor δ = 0.01.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



Input signal: reverse pulse rise time t_r = 0.6 ns; reverse pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.3 Reverse recovery time test circuit and waveforms.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage.

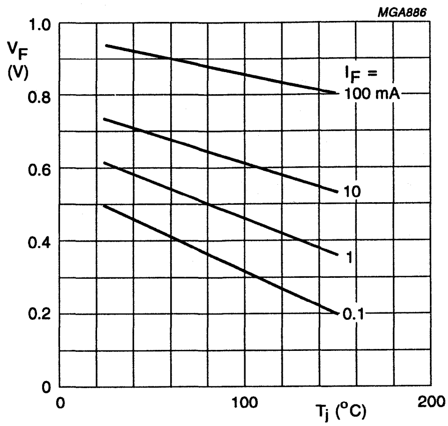


Fig.5 Forward voltage as a function of junction temperature; typical values.

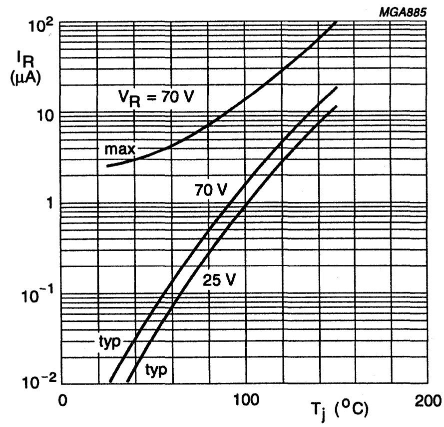
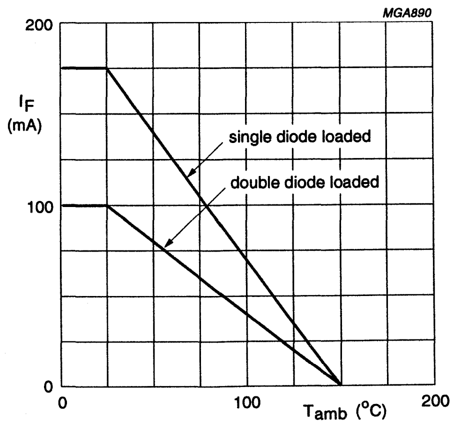


Fig.6 Reverse current as a function of junction temperature.



Device mounted on a FR4 printed circuit board.

Fig.7 Forward current derating curves.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

The device consists of two diodes in a microminiature plastic envelope. The cathodes are commoned and the device is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	50	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	V
Repetitive peak forward current	I_{FRM}	max.	250	mA
Junction temperature	T_j	max.	150	°C
Forward voltage I_F = 100 mA	V_F	$\leqslant$	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	$\leqslant$	4	ns

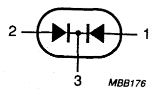
MECHANICAL DATA

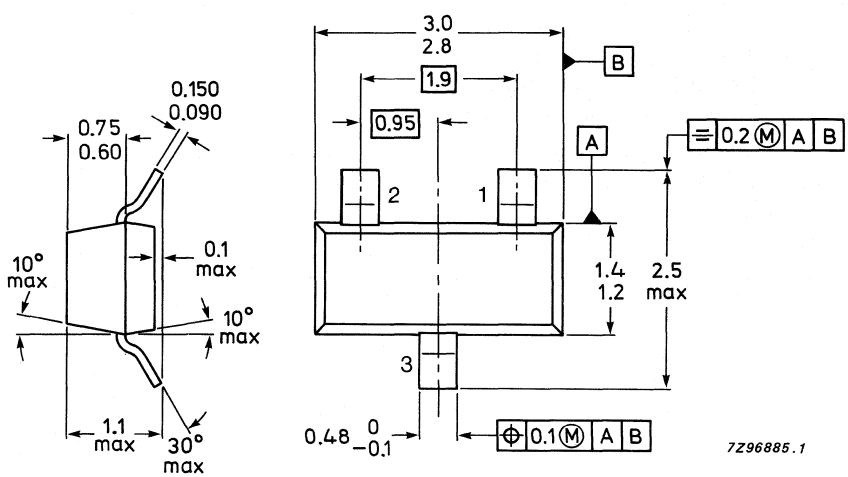
Fig. 1 SOT-23.

Dimensions in mm

Marking code

BAV74 = JAp





TOP VIEW

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	50 V
Repetitive peak reverse voltage	V_{RRM}	max.	50 V
Forward current (DC)	I_F	max.	215 mA
Repetitive peak forward current	I_{FRM}	max.	250 mA
Non-repetitive peak forward current t = 1 μs	I_{FSM}	max.	4,5 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Breakdown voltage at I_R = 100 μA	$V_{(BR)R}$	⩾	50 V
Forward voltage I_F = 100 mA	V_F	⩽	1,0 V
Reverse currents V_R = 50 V V_R = 50 V; T_{amb} = 150 °C	I_R	⩽ ⩽	0,1 μA 100 μA
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA See Fig. 2	t_{rr}	⩽	4 ns
Diode capacitance at V_R = 0; f = 1 MHz	C_d	⩽	2 pF

* Mounted on an FR4 printed-circuit board.

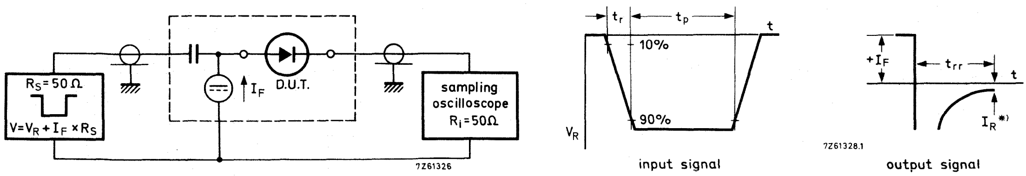


Fig. 2 Reverse recovery time test circuit and waveforms.

* $I_R = 1$ mA

Input signal :	Rise time of the reverse pulse	t_r	= 0,6 ns
	Reverse pulse duration	t_p	= 100 ns
	Duty factor	δ	= 0,05
Oscilloscope :	Rise time	t_r	= 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

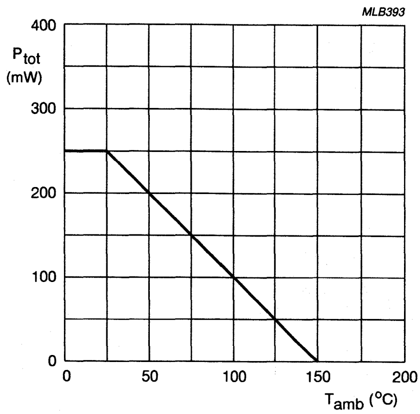


Fig. 3 Power derating curve.

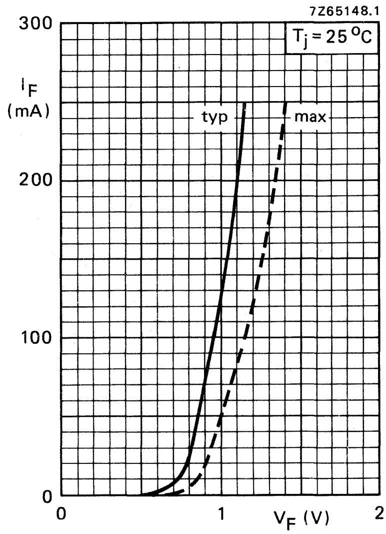


Fig. 4 Forward current as a function of forward voltage.

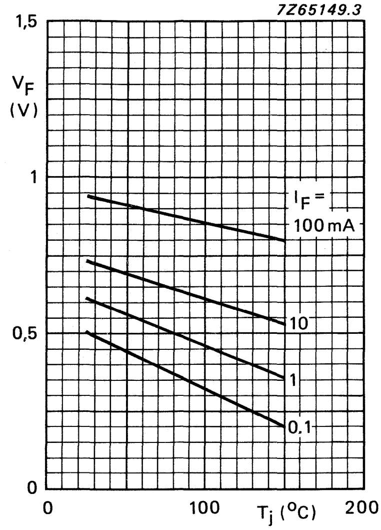


Fig. 5 Forward voltage as a function of junction temperature.

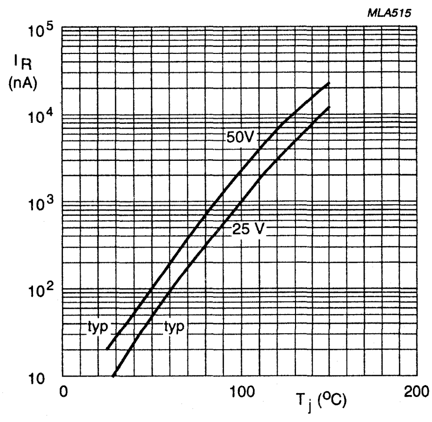


Fig. 6 Reverse current as a function of junction temperature.

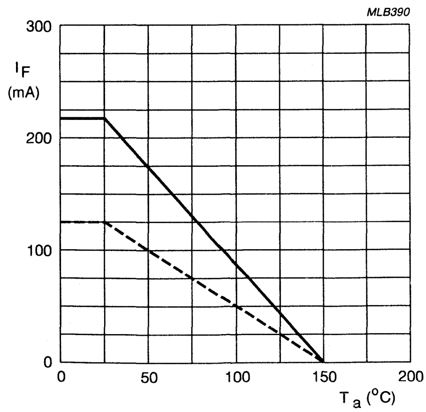


Fig. 7 Average current as a function of ambient temperature: ——— single diode; ----------- double diode, equally loaded.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAV99 consists of two diodes in a microminiature plastic envelope. The diodes are connected in series and the unit is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA (per diode)

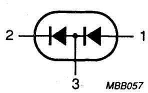
Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

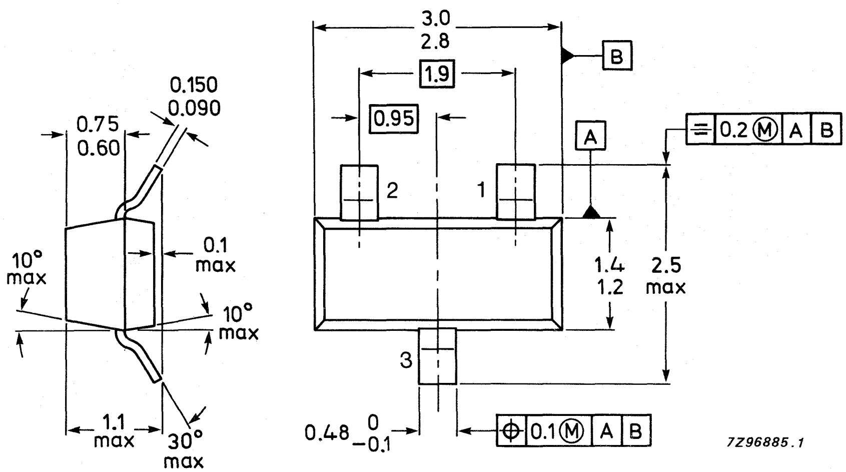
MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAV99 = A7p





TOP VIEW

See also *Soldering recommendations.*

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Forward current (d.c.)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	4	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient▲	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	30	μA
V_R = 75 V	I_R	<	1,0	μA
V_R = 75 V; T_j = 150 °C	I_R	<	50	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	1,5	pF
Forward recovery voltage when switched to				
I_F = 10 mA; t_r = 20 ns	V_{fr}	<	1,75	V

▲ Mounted on an FR4 printed-circuit board.

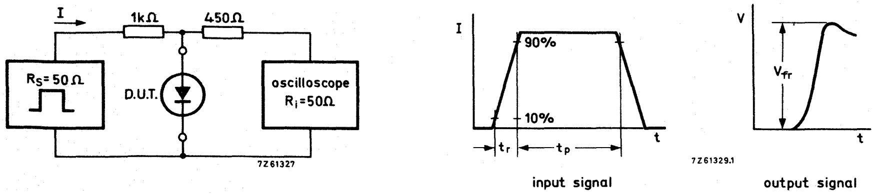


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal: Rise time of the forward pulse t_r = 20 ns;
Forward current pulse duration = t_p = 120 ns. Duty factor = δ = 0,01.
Oscilloscope: Rise time t_r = 0,35 ns.

Circuit capacitance C $\leqslant$ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA t_{rr} < 4 ns

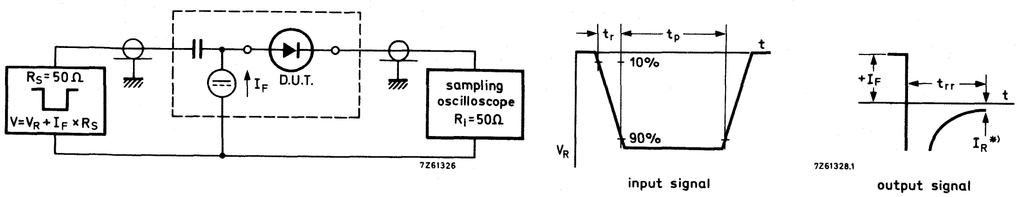


Fig. 3 Test circuit and waveforms; reverse recovery time.

Input signal: Rise time of the reverse pulse t_r = 0,6 ns
Reverse pulse duration t_p = 100 ns. Duty factor δ = 0,05.
Oscilloscope: Rise time t_r = 0,35 ns.

*) I_R = 1 mA

Circuit capacitance C $\leqslant$ 1 pF (C = oscilloscope input capacitance + parasitic capacitance).

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 100 Ω Q_s < 45 pC

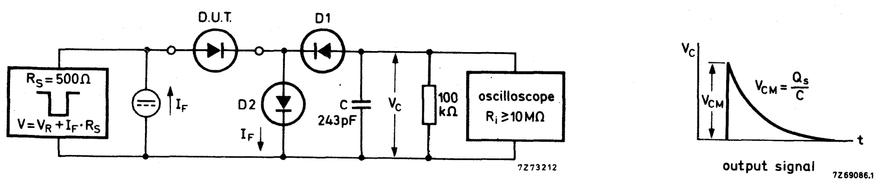


Fig. 4 Test and waveform; recovery charge.

D2 = diode with minority carrier life time at 10 mA: < 200 ps; D1 = BAW62.

Input signal: Rise time of the reverse pulse t_r = 2 ns
Reverse pulse duration t_p = 400 ns. Duty factor δ = 0,02.

Circuit capacitance C $\leqslant$ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

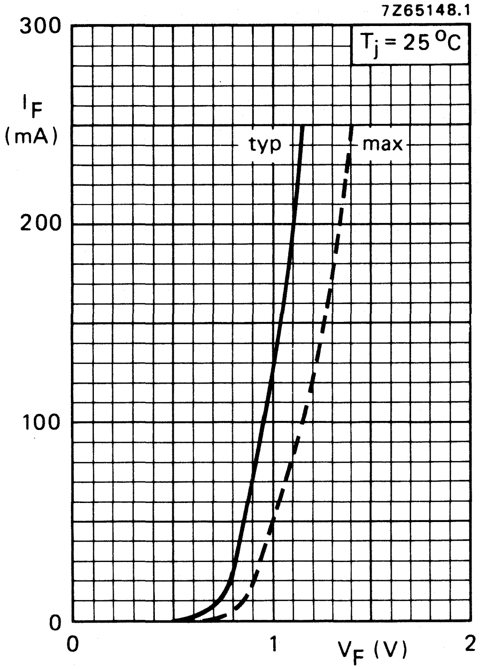


Fig. 5.

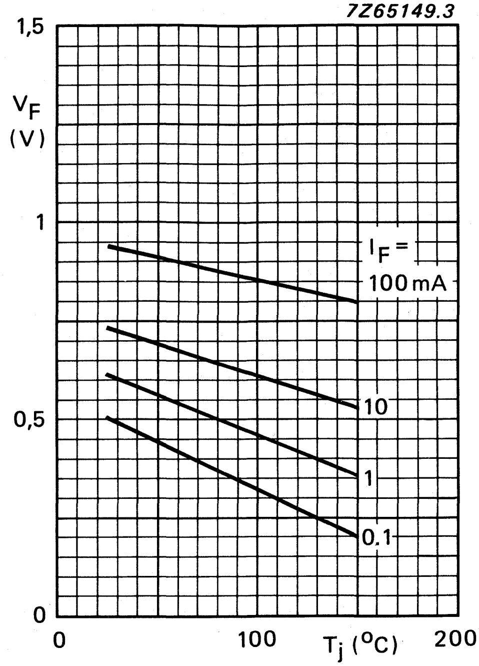


Fig. 6 Typical values.

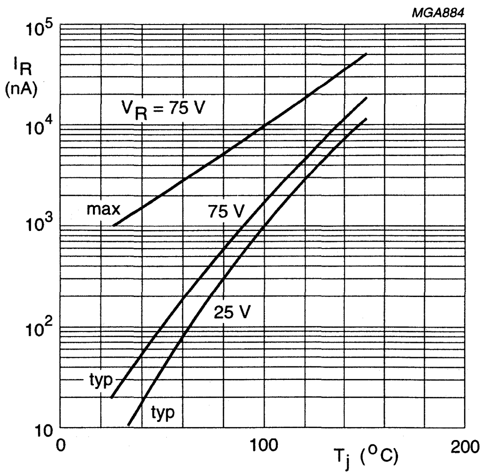


Fig. 7.

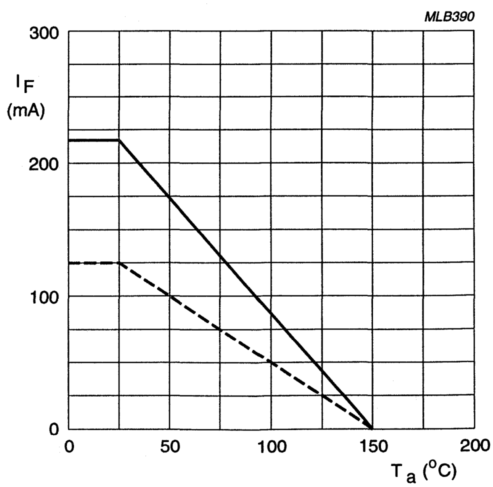


Fig. 8 ——— single diode
– – – – double diode; equally loaded.

Silicon planar epitaxial high-speed double diode

BAV99W

FEATURES

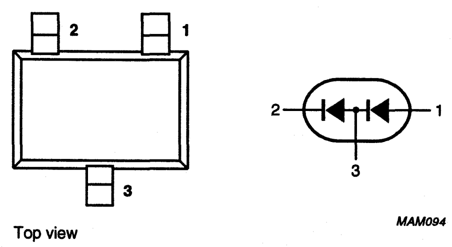
- Plastic SMD envelope
- High switching speed
- General application.

DESCRIPTION

Two epitaxial high-speed switching diodes in a small rectangular SMD SOT323 envelope. The anodes are connected in series. The unit is intended for high-speed switching applications in surface mounted circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_R	continuous reverse voltage		75	V
V_{RRM}	repetitive peak reverse voltage		85	V
I_{FRM}	repetitive peak forward current		500	mA
T_j	junction temperature		150	°C
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns



Marking code: A7

Fig.1 Simplified outline (SOT323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	75	V
V_{RRM}	repetitive peak reverse voltage		–	85	V
I_F	DC forward current	single diode loaded	–	150	mA
		double diode loaded	–	130	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note (1)	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	note (1)	625 K/W

Note

1. Device mounted on FR4 printed-circuit board.

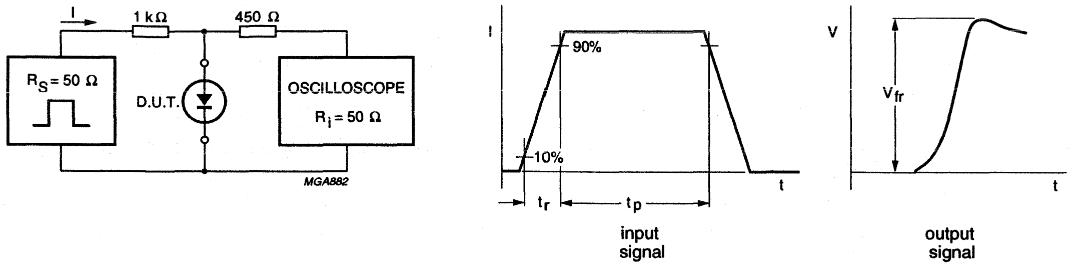
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	V_R = 25 V	30	nA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V	1	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz	1.5	pF
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_p = 20 ns; see Fig.2	1.75	V
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1mA; see Fig.3	4	ns

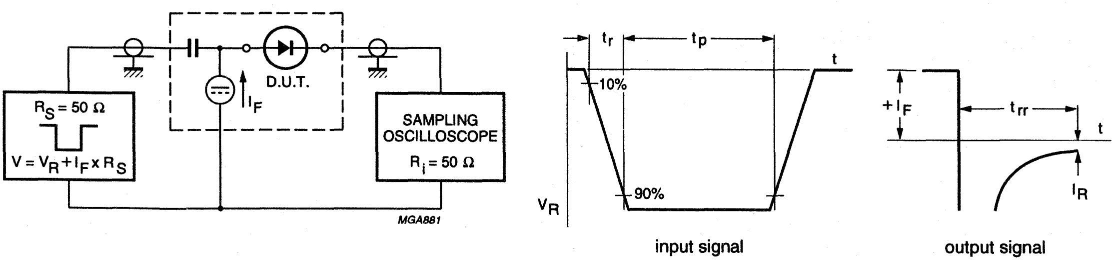
Silicon planar epitaxial high-speed double diode

BAV99W



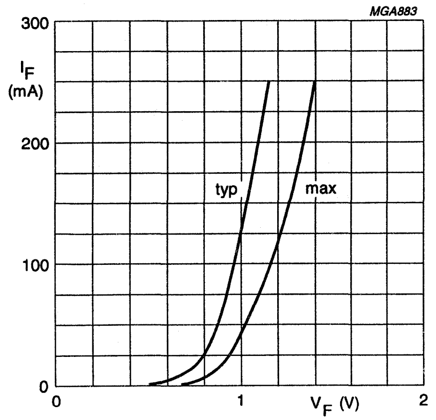
Input signal: forward pulse rise time t_r = 20 ns; forward pulse duration t_p = 120 ns; duty factor δ = 0.01.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



Input signal: reverse pulse rise time t_r = 0.6 ns; reverse pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.3 Reverse recovery time test circuit and waveforms.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage.

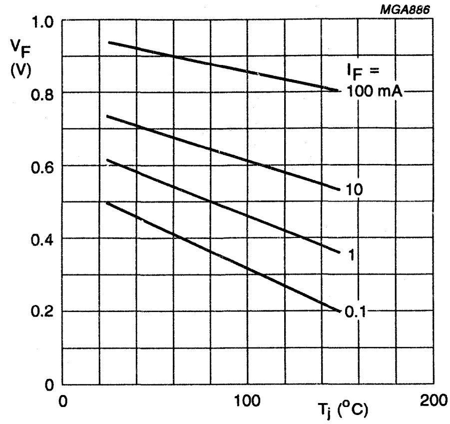


Fig.5 Forward voltage as a function of junction temperature; typical values.

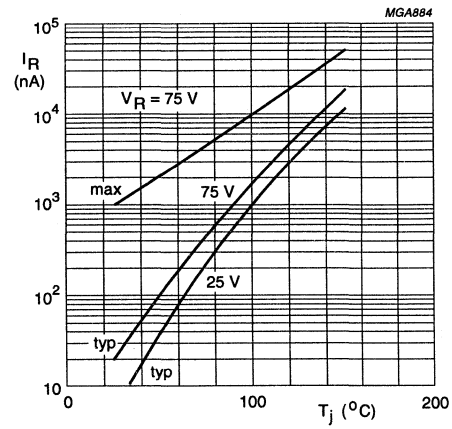
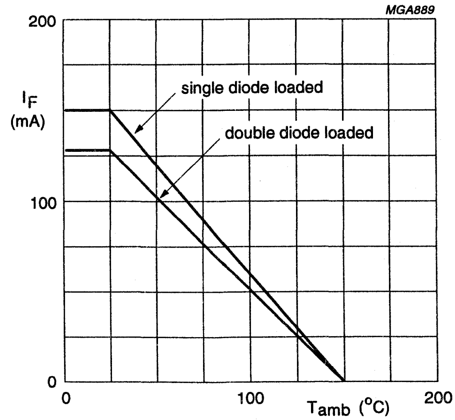


Fig.6 Reverse current as a function of junction temperature.



Device mounted on a FR4 printed circuit board.

Fig.7 Forward current derating curves.

GENERAL PURPOSE DIODES FOR SURFACE MOUNTING

Silicon planar epitaxial diodes; intended for switching and general purposes in industrial equipment e.g. oscilloscopes, digital voltmeters and video output stages in colour television.

The SM DIODE is a leadless diode in an hermetically sealed glass envelope with tin plated metal discs at each end. It is suitable for Automatic Placement and as such it can withstand immersion soldering.

The diodes are delivered in "super 8" tape.

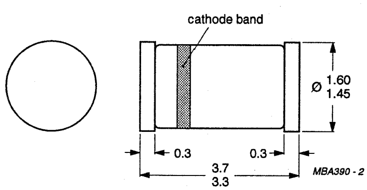
QUICK REFERENCE DATA

			BAV100	BAV101	BAV102	BAV103	
Continuous reverse voltage	V_R	max.	50	100	150	200	V
Forward current (d.c.)	I_F	max.	250				mA
Junction temperature	T_j	max.	175				°C
Thermal resistance from junction to ambient	$R_{th\,j\text{-}a}$	=	0,375				K/mW
Forward voltage at $I_F = 100$ mA	V_F	<	1,0				V
Reverse current at $V_R = V_{Rmax}$	I_R	<	100				nA
Diode capacitance at $V_R = 0$; f = 1 MHz	C_d	typ.	1,5				pF
		<	5,0				pF
Reverse recovery time when switched from $I_F = 30$ mA to $I_R = 30$ mA; $R_L = 100\ \Omega$; measured at $I_R = 3$ mA	t_{rr}	<	50				ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80C.



The cathode is indicated by a green band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BAV100	BAV101	BAV102	BAV103	
Continuous reverse voltage	V_R	max.	50	100	150	200	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	200	250	V

Average rectified forward current	$I_{F(AV)}$	max.	250	mA[1])
Forward current (d.c.)	I_F	max.	250	mA
Repetitive peak forward current	I_{FRM}	max.	625	mA
Non-repetitive peak forward current				
$t < 1$ s; $T_j = 25$ °C	I_{FSM}	max.	1	A
$t = 1$ µs; $T_j = 25$ °C	I_{FSM}	max.	5	A
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	400	mW
Storage temperature	T_{stg}		−65 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,375	K/mW

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Forward voltage				
$I_F = 100$ mA	V_F	<	1,0	V
$I_F = 200$ mA	V_F	<	1,25	V

			BAV100	BAV101	BAV102	BAV103	
Reverse breakdown voltage $I_R = 100$ µA	$V_{(BR)R}$	>	60	120	200	250	V

Reverse current				
$V_R = V_{Rmax}$	I_R	<	100	nA
$V_R = V_{Rmax}$; $T_j = 150$ °C	I_R	<	100	µA
Differential resistance				
$I_F = 10$ mA	r_{diff}	typ.	5	Ω
Diode capacitance				
$V_R = 0$; f = 1 MHz	C_d	typ.	1,5	pF
		<	5,0	pF
Reverse recovery time when switched from $I_F = 30$ mA to $I_R = 30$ mA; $R_L = 100$ Ω; measured at $I_R = 3$ mA	t_{rr}	<	50	ns

[1]) For sinusoidal operation see Figs 7 to 10. For pulse operation see Figs 3 to 6.

Test circuit and waveforms:

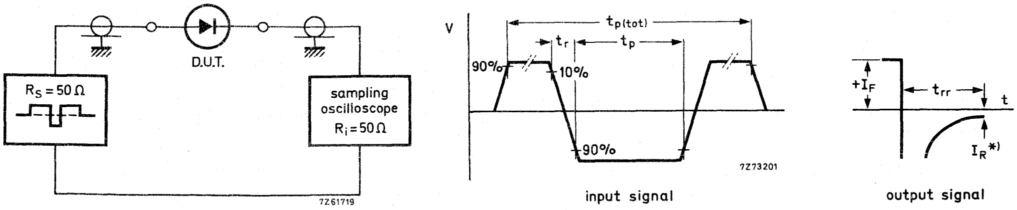


Fig. 2.

*) $I_R = 3$ mA

Input signal:	Total pulse duration	$t_{p(tot)}$	=	2	μs
	Duty factor	δ	=	0,0025	
	Rise time of the reverse pulse	t_r	=	0,6	ns
	Reverse pulse duration	t_p	=	100	ns
Oscilloscope:	Rise time	t_r	=	0,35	ns

Circuit capacitance $C \leqslant 1$ pF (C = oscilloscope input capacitance + parasitic capacitance)

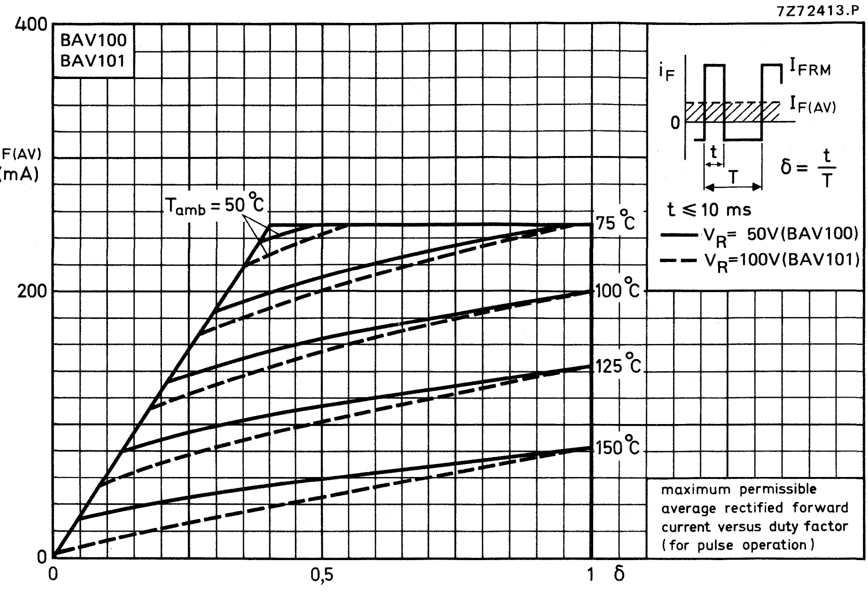

7Z72413.P
400
200
0
BAV100
BAV101
$I_{F(AV)}$
(mA)
T_{amb} = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
δ = t/T
t ⩽ 10 ms
V_R= 50V(BAV100)
V_R=100V(BAV101)
maximum permissible
average rectified forward
current versus duty factor
(for pulse operation)

Fig. 3.

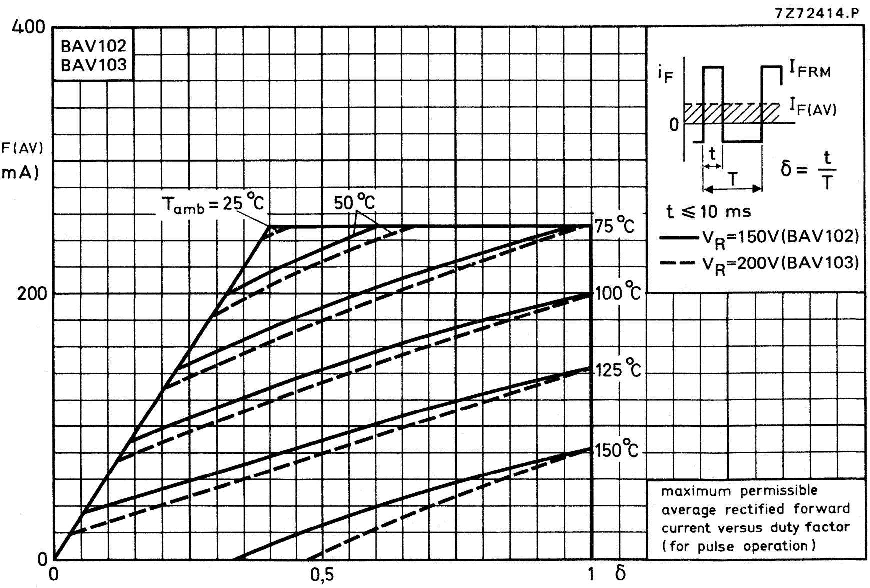

7Z72414.P
400
200
0
BAV102
BAV103
$I_{F(AV)}$
(mA)
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
δ = t/T
t ⩽ 10 ms
V_R=150V(BAV102)
V_R=200V(BAV103)
maximum permissible
average rectified forward
current versus duty factor
(for pulse operation)

Fig. 4.

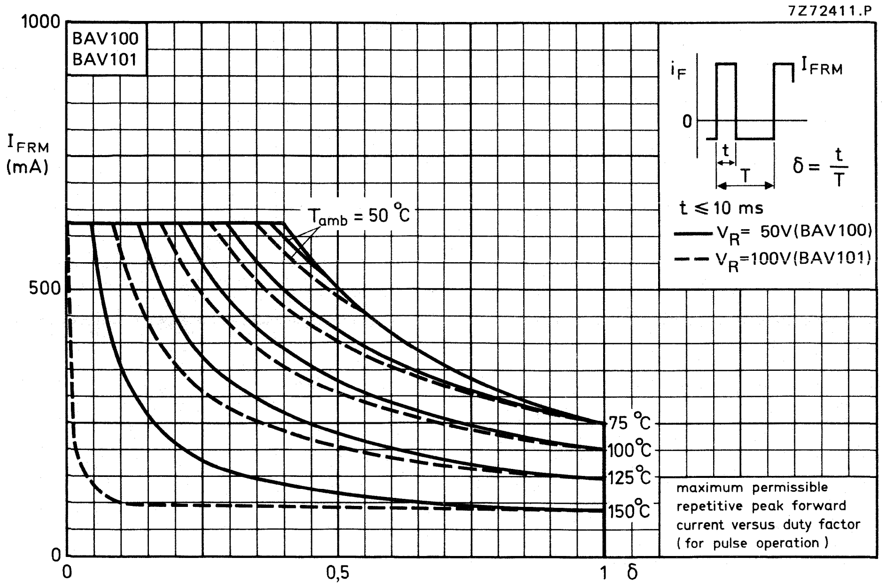

7Z72411.P
1000
500
0
IFRM
(mA)
BAV100
BAV101
Tamb = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
iF
IFRM
0
t
T
δ = t/T
t ≤ 10 ms
VR= 50V(BAV100)
VR=100V(BAV101)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 5.

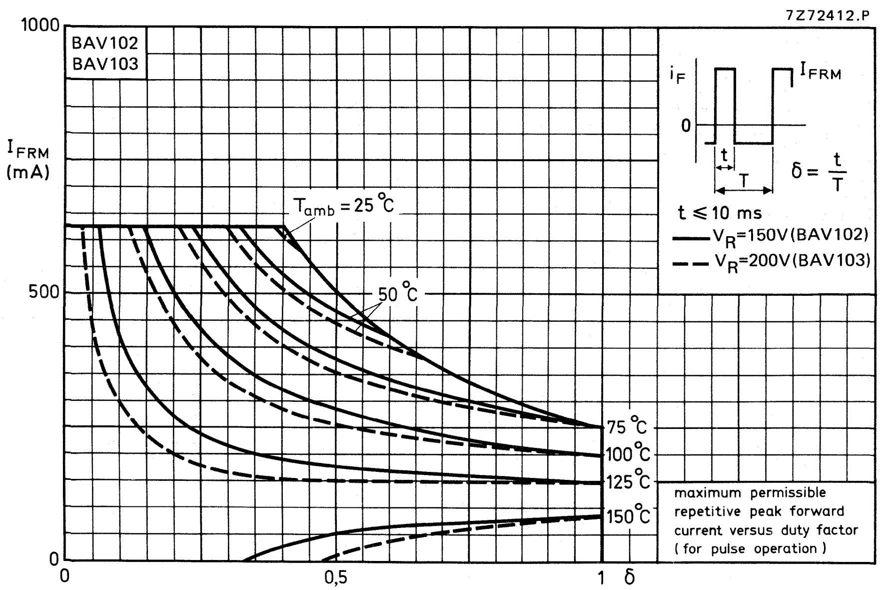

7Z72412.P
1000
500
0
IFRM
(mA)
BAV102
BAV103
Tamb = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
iF
IFRM
0
t
T
δ = t/T
t ≤ 10 ms
VR=150V(BAV102)
VR=200V(BAV103)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 6.

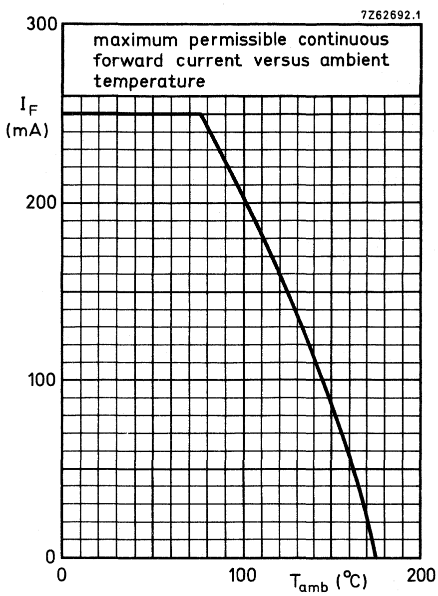


Fig. 7.

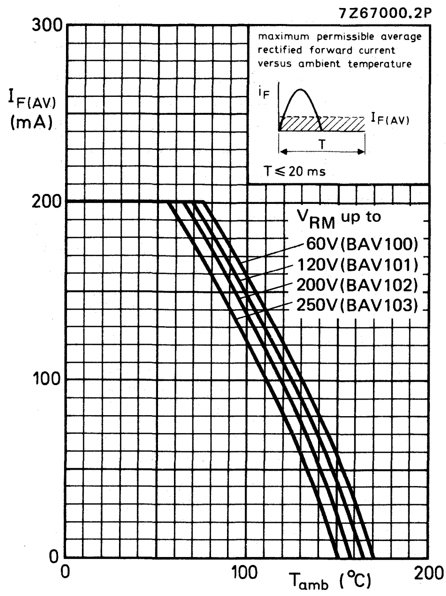


Fig. 8.

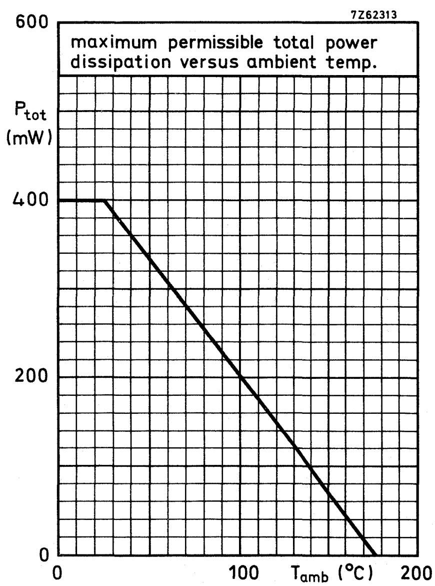


Fig. 9.

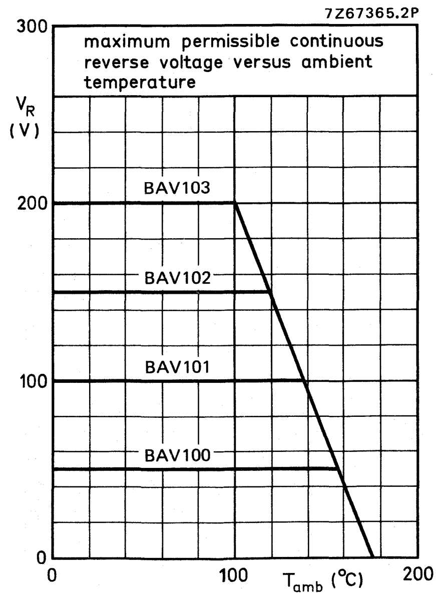


Fig. 10.

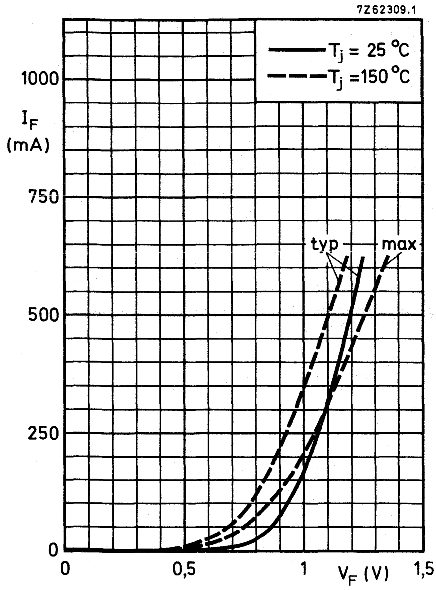


Fig. 11.

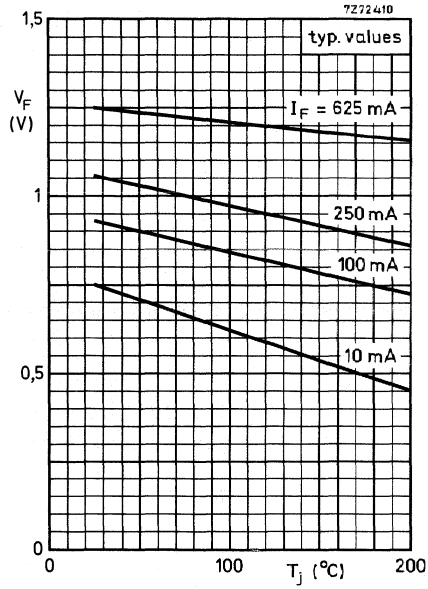


Fig. 12.

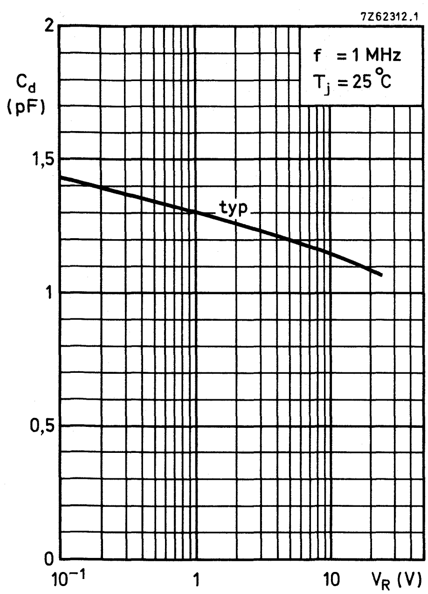


Fig. 13.

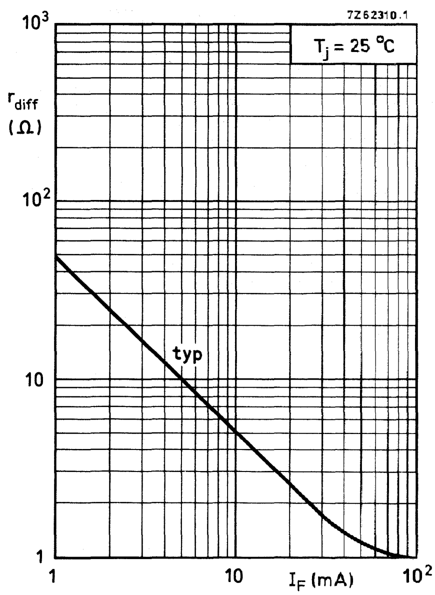


Fig. 14.

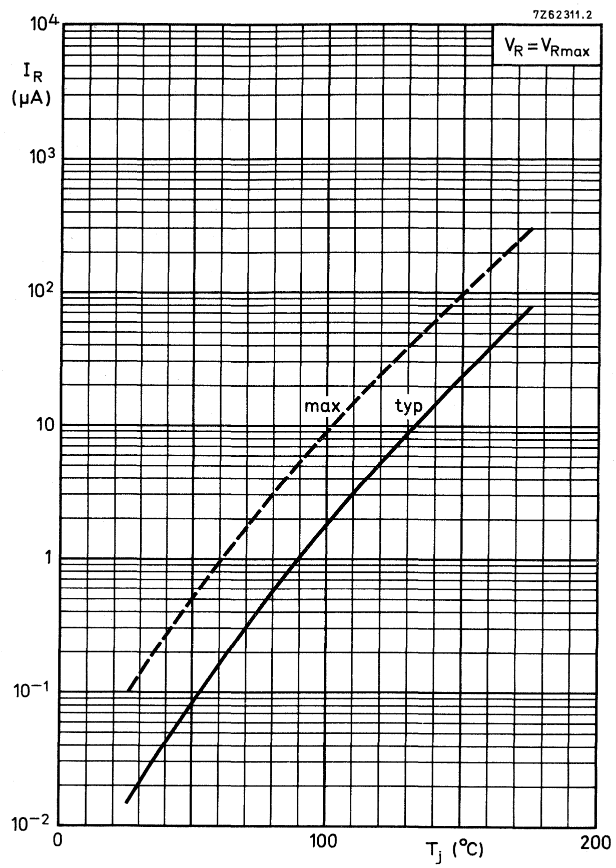

7Z62311.2
$V_R = V_{Rmax}$
I_R (μA)
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
max
typ
0
100
200
T_j (°C)

Fig. 15.

ULTRA HIGH-SPEED DIODE

Silicon planar epitaxial, ultra-high speed, high conductance diode in a SOD80C envelope.

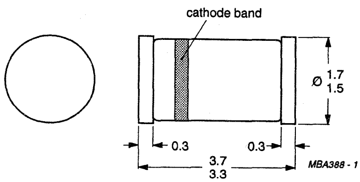
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	60	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	V
Repetitive peak forward current	I_{FRM}	max.	600	mA
Junction temperature	T_j	max.	200	°C
Forward voltage at I_F = 200 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	50	pC

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD80C.



The cathode is indicated by a black band

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	60	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	V
Average rectified forward current	$I_{F(AV)}$	max.	300	mA
Forward current	I_F	max.	300	mA
Repetitive peak forward current	I_{FRM}	max.	600	mA
Non-repetitive peak forward current				
t = 1 μs	I_{FSM}	max.	4000	mA
t = 1 s		max.	1000	mA
Storage temperature	T_{stg}	−65 to + 200		^oC
Junction temperature	T_j	max.	200	^oC

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j-a}$		375	K/W

CHARACTERISTICS

T_j = 25 ^oC unless otherwise specified

Forward voltage				
I_F = 10 mA	V_F	<	0,75	V
I_F = 200 mA		<	1,00	V
I_F = 200 mA; T_j = 100 ^oC	V_F	<	0,95	V
I_F = 500 mA		<	1,25	V
Reverse current				
V_R = 60 V	I_R	<	100	nA
V_R = 60 V; T_j = 100 ^oC		<	100	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	2,5	pF
Forward recovery voltage when switched to				
I_F = 400 mA; t_r1 = 30 ns	V_{fr}	<	2,0	V
I_F = 400 mA; t_r2 = 100 ns		<	1,5	V
(see Fig. 2)				

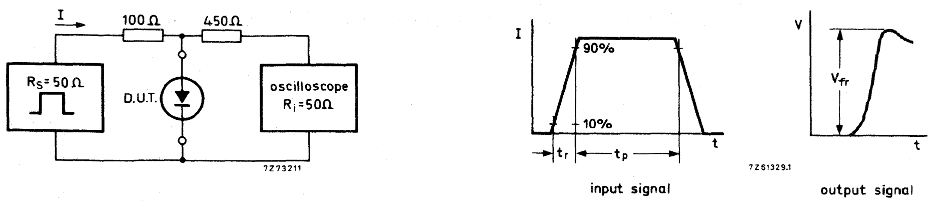


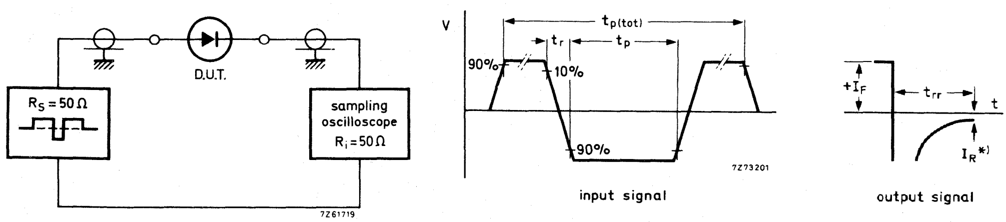
Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal: 1st rise time of the forward pulse t_r1 = 30 ns
2nd rise time of the forward pulse t_r2 = 100 ns
Forward current pulse duration t_p = 300 ns
Duty factor δ = 0,01

Oscilloscope: Rise time t_r = 0,35 ns
Input capacitance C_i = 1 pF

Circuit capacitance C ⩽ 20 pF (C = C_i + parasitic capacitance)

Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA (see Fig. 3) t_{rr} < 6 ns



*) I_R = 40 mA

Fig. 3 Test circuit and waveforms; reverse recovery time.

Input signal: Total pulse duration $t_{p(tot)}$ = 0,2 µs
Duty factor δ = 0,0025
Rise time of the reverse pulse t_r = 0,6 ns
Reverse pulse duration t_p = 30 ns

Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω (see Fig. 4) — Q_s < 50 pC

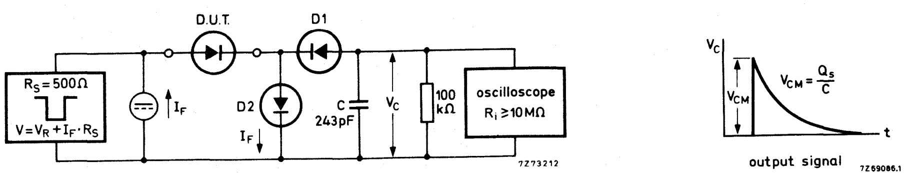


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62
D2 = diode with minority carrier life time at 10 mA: < 200 ps

Input signal:	Rise time of the reverse pulse	t_r	= 2 ns
	Reverse pulse duration	t_p	= 400 ns
	Duty factor	δ	= 0,02

Circuit capacitance C ≤ 7 pF (C = oscilloscope input capacitance + parasitic capacitance)

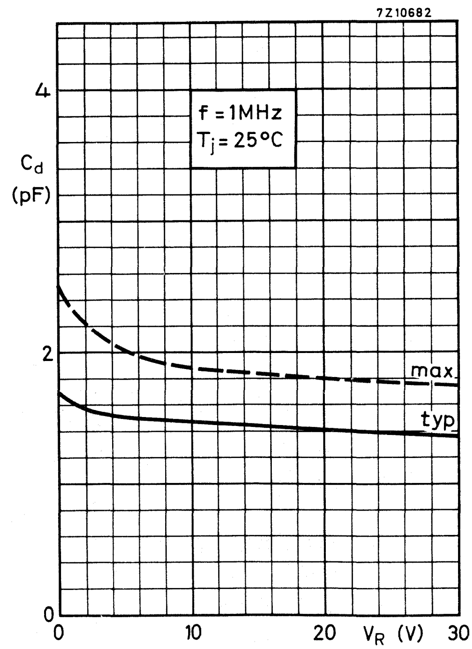


Fig. 5.

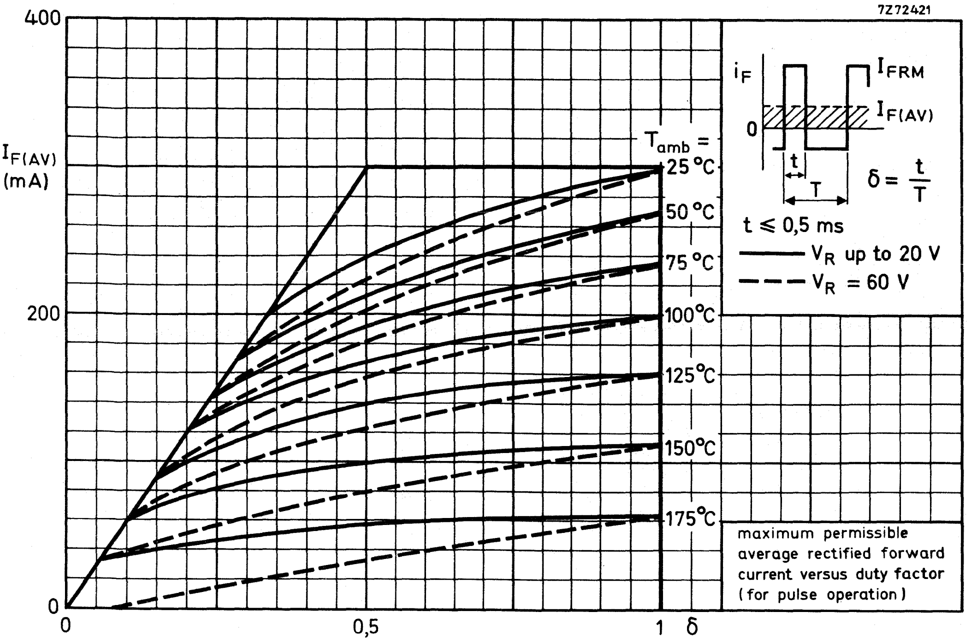

7Z72421
400
200
0
$I_{F(AV)}$
(mA)
0
0,5
1
δ
T_{amb} =
25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
175 °C
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
$\delta = \frac{t}{T}$
t ≤ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 6.

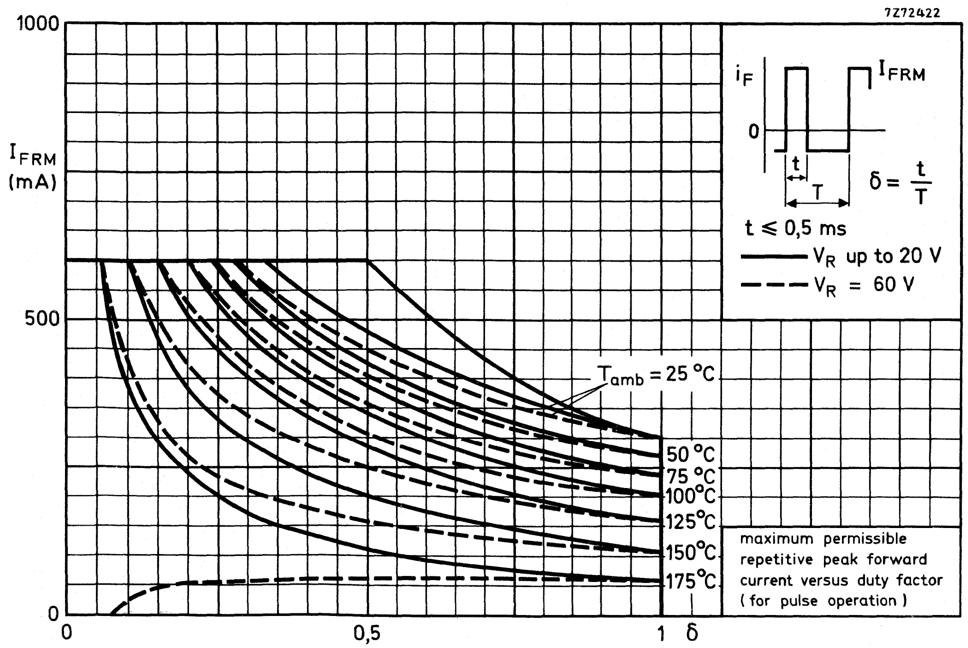

7Z72422
1000
500
0
I_{FRM}
(mA)
0
0,5
1
δ
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
175 °C
i_F
I_{FRM}
0
t
T
$\delta = \frac{t}{T}$
t ≤ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 7.

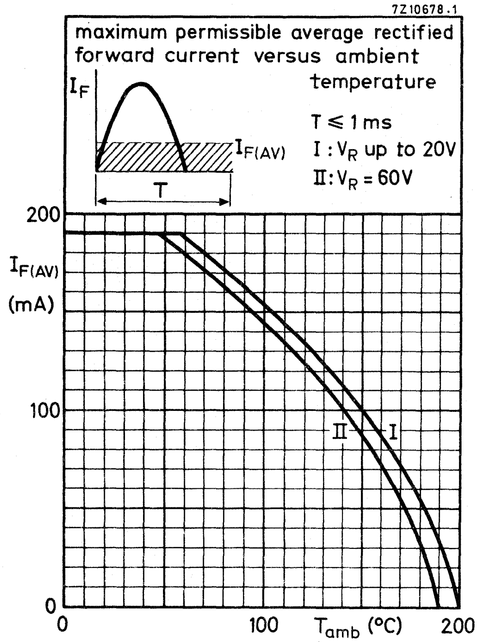


Fig. 8.

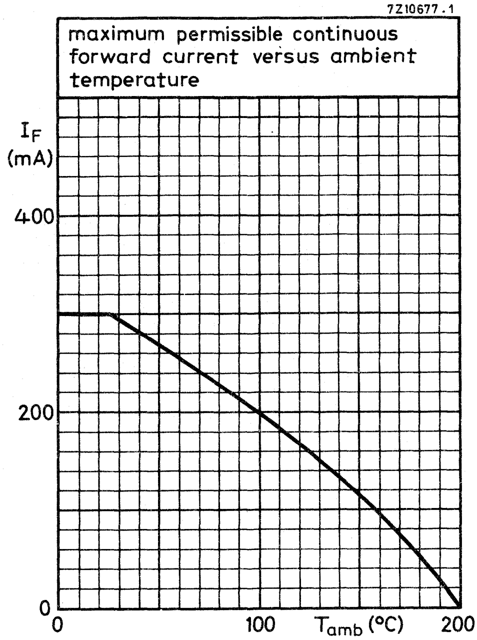


Fig. 9.

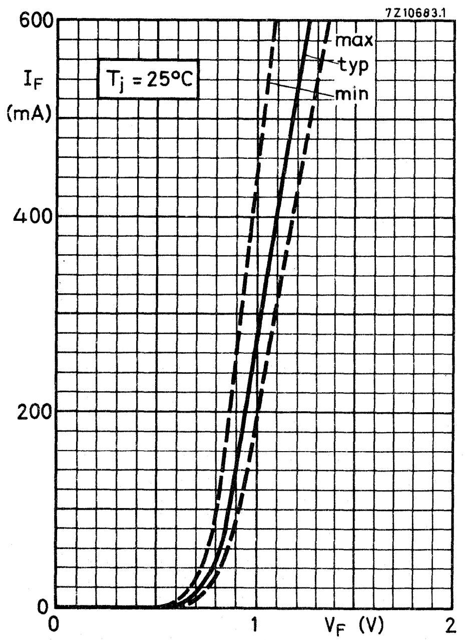


Fig. 10.

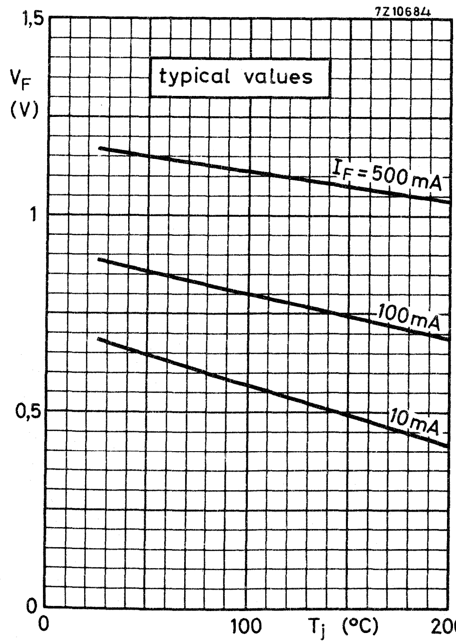


Fig. 11.

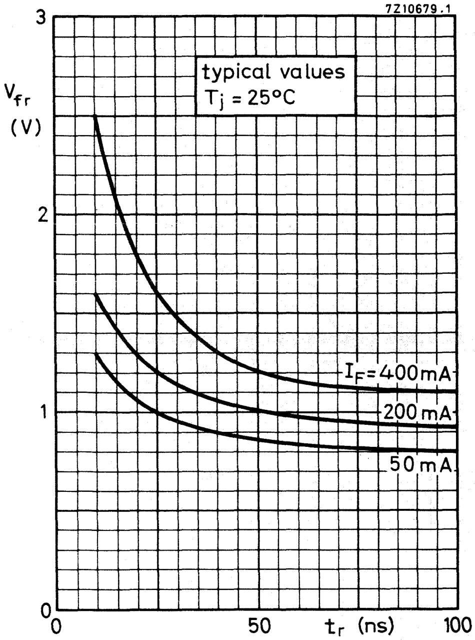


Fig. 12.

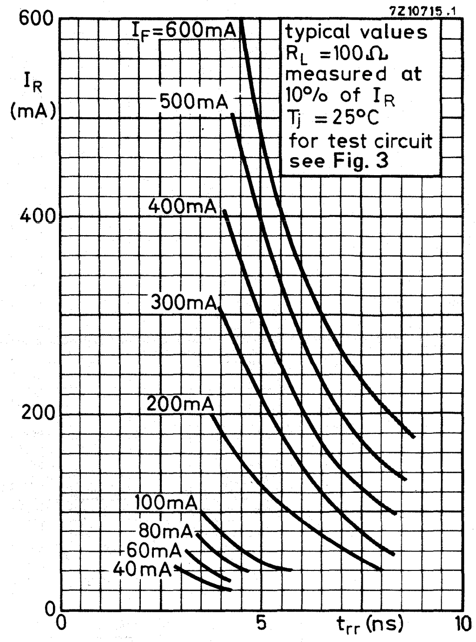


Fig. 13.

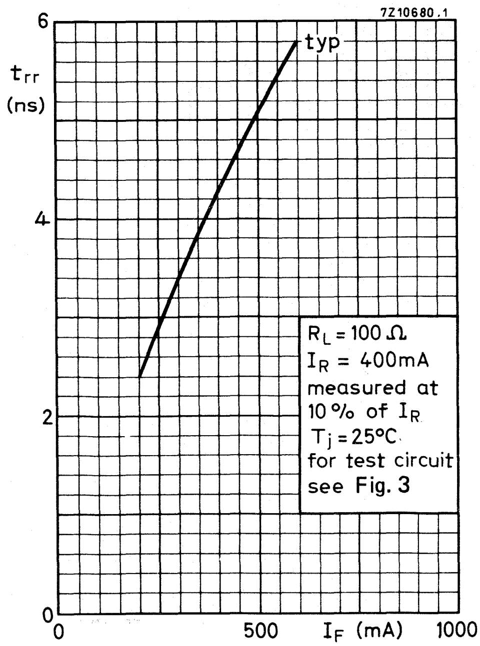


Fig. 14.

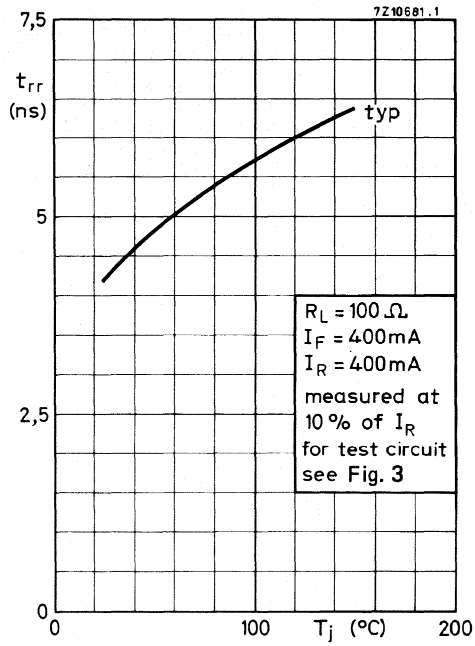


Fig. 15.

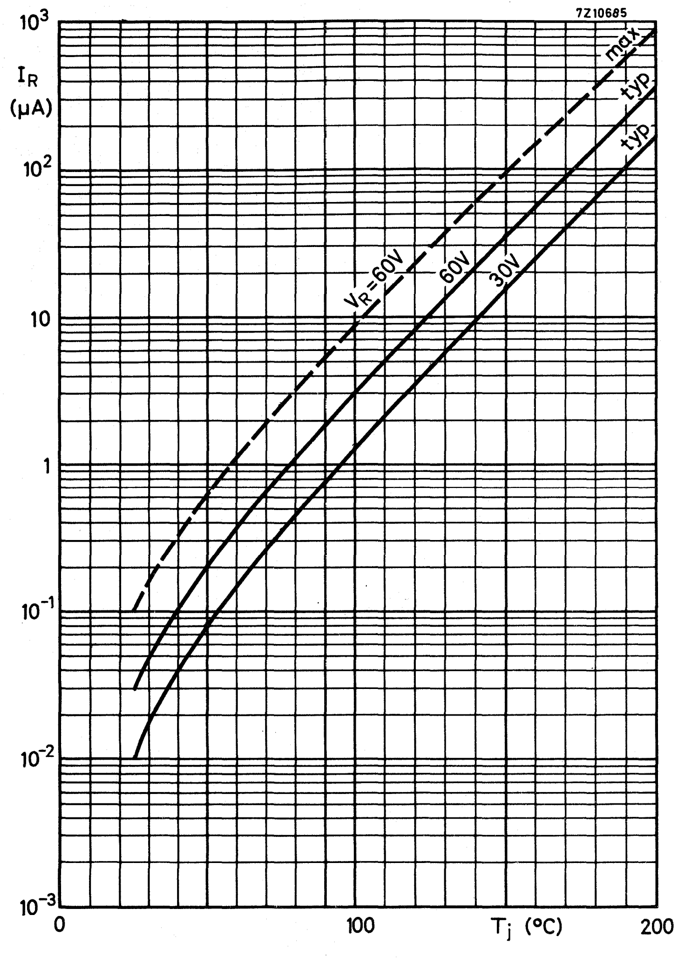

7Z10685
10^3
I_R
(μA)
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
0
100
T_j (°C)
200
max
typ
typ
V_R=60V
60V
30V

Fig. 16.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

The BAW56 consists of two diodes in a microminiature plastic envelope. The anodes are commoned and the unit is intended for high-speed switching in thick and thin-film circuits.

QUICK REFERENCE DATA (per diode)

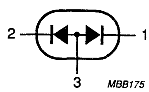
Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	^oC
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 100 Ω	Q_s	<	45	pC

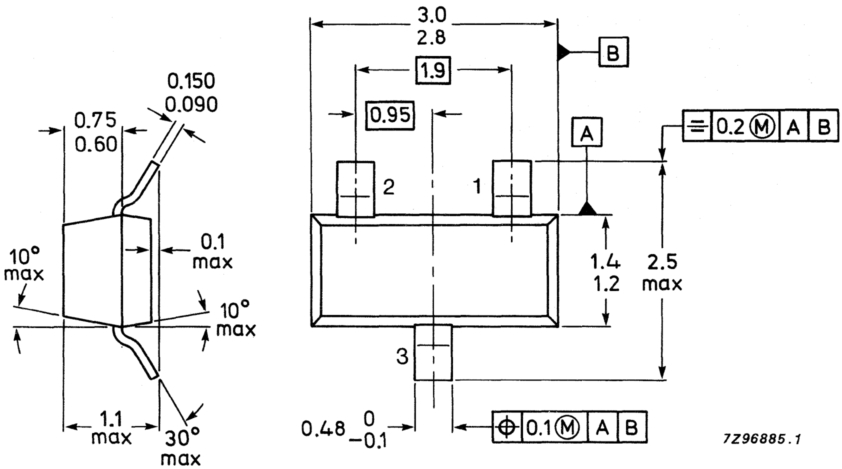
MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAW56 = A1p





TOP VIEW

See also *Soldering recommendations*.

RATINGS (per diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	75 V
Repetitive peak reverse voltage	V_{RRM}	max.	85 V
Forward current (DC)	I_F	max.	215 mA
Repetitive peak forward current	I_{FRM}	max.	450 mA
Non-repetitive peak forward current (per crystal)			
t = 1 μs	I_{FSM}	max.	4 A
t = 1 ms	I_{FSM}	max.	1 A
t = 1 s	I_{FSM}	max.	0,5 A
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient ▲	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 1 mA	V_F	<	715 mV
I_F = 10 mA	V_F	<	855 mV
I_F = 50 mA	V_F	<	1000 mV
I_F = 150 mA	V_F	<	1250 mV
Reverse current			
V_R = 25 V; T_j = 150 °C	I_R	<	30 μA
V_R = 75 V	I_R	<	1,0 μA
V_R = 75 V; T_j = 150 °C	I_R	<	50 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	2 pF
Forward recovery voltage when switched to I_F = 10 mA; t_r = 20 ns see Fig. 2	V_{fr}	<	1,75 V

▲ Mounted on an FR4 printed-circuit board.

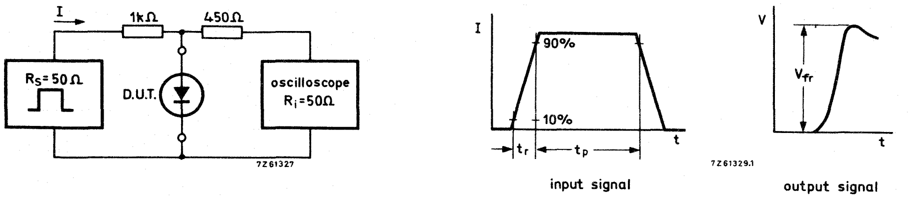


Fig. 2 Test circuit and waveforms; forward recovery voltage.

Input signal: Rise time of the forward pulse t_r = 20 ns
Forward current pulse duration t_p = 120 ns. Duty factor δ = 0,01
Oscilloscope: Rise time t_r = 0,35 ns.

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA see Fig. 3 t_{rr} < 4 ns

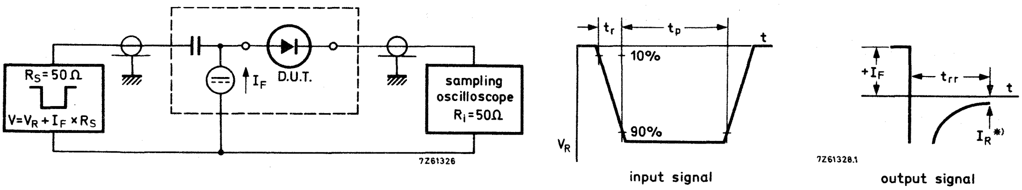


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

Input signal: Rise time of the reverse pulse t_r = 0,6 ns
Reverse pulse duration t_p = 100 ns. Duty factor δ = 0,05.
Oscilloscope: Rise time t_r = 0,35 ns

Circuit capacitance C ⩽ 1 pF (C = oscilloscope input capacitance + parasitic capacitance)

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 100 Ω see Fig. 4 Q_s < 45 pC

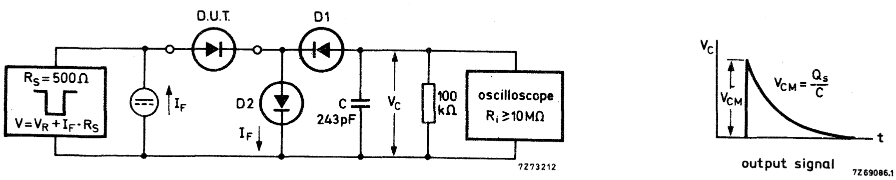


Fig. 4 Test circuit and waveform; recovery charge.

D2 = diode with minority carrier life time at 10 mA: < 200 ps. D1 = BAW62.

Input signal: Rise time of the reverse pulse t_r = 2 ns
Reverse pulse duration t_p = 400 ns. Duty factor δ = 0,02

Circuit capacitance C ⩽ 7 pF (C = oscilloscope input capacitance + parasitic capacitance).

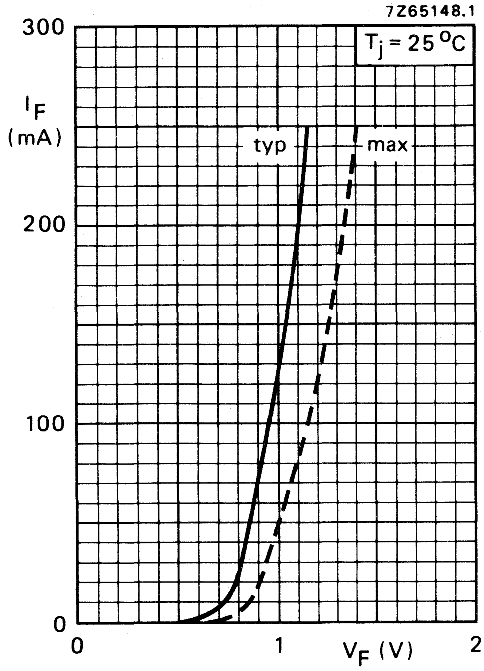


Fig. 5.

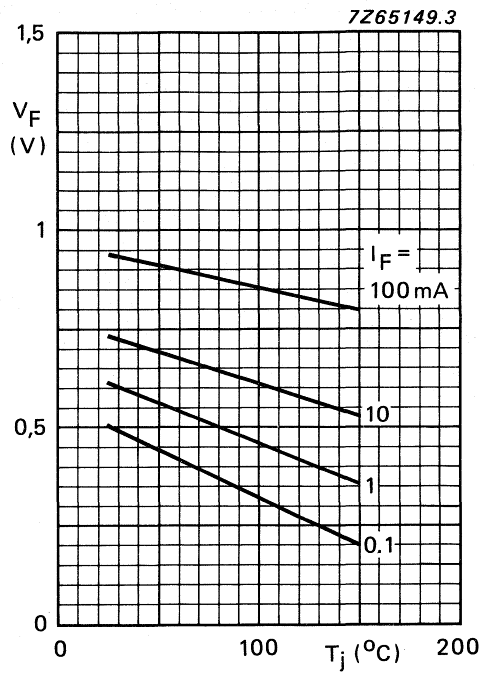


Fig. 6 Typical values.

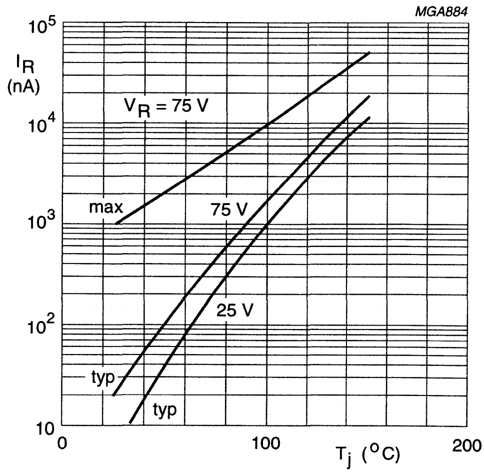


Fig. 7.

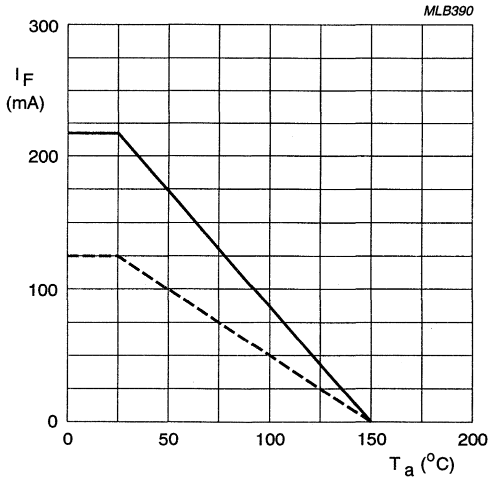


Fig. 8 ——— single diode;
– – – – double diode, equally loaded.

Silicon planar epitaxial high-speed double diode

BAW56W

FEATURES

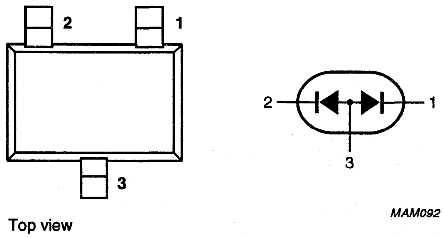
- Plastic SMD envelope
- High switching speed
- General application.

DESCRIPTION

Two epitaxial high-speed switching diodes in a small rectangular SMD SOT323 envelope. The anodes are common. This unit is intended for high-speed switching applications in surface mounted circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_R	continuous reverse voltage		75	V
V_{RRM}	repetitive peak reverse voltage		85	V
I_{FRM}	repetitive peak forward current		500	mA
T_j	junction temperature		150	°C
V_F	forward voltage	I_F = 50 mA	1	V
t_{rr}	reverse recovery time	when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	4	ns



Marking code: A1

Fig.1 Simplified outline (SOT323) and symbol.

Silicon planar epitaxial high-speed double diode

BAW56W

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	75	V
V_{RRM}	repetitive peak reverse voltage		–	85	V
I_F	DC forward current	single diode loaded	–	150	mA
		double diode loaded	–	130	mA
I_{FRM}	repetitive peak forward current		–	500	mA
I_{FSM}	non-repetitive peak forward current	t = 1 µs	–	4	A
		t = 1 ms	–	1	A
		t = 1 s	–	0.5	A
P_{tot}	total power dissipation	T_{amb} = 25 °C; note (1)	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient	note (1)	625 K/W

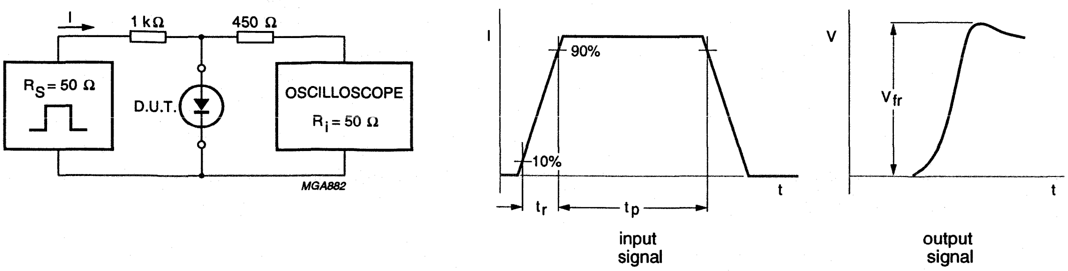
Note

1. Device mounted on FR4 printed-circuit board.

CHARACTERISTICS

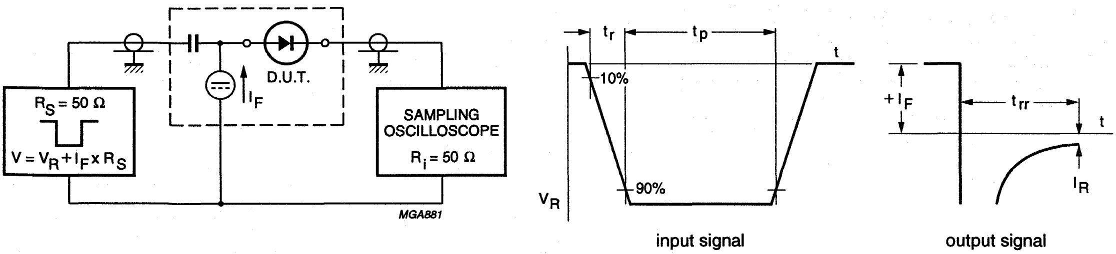
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
Per diode				
V_F	forward voltage	I_F = 1 mA	715	mV
		I_F = 10 mA	855	mV
		I_F = 50 mA	1	V
		I_F = 150 mA	1.25	V
I_R	reverse current	V_R = 25 V	30	nA
		V_R = 25 V; T_j = 150 °C	30	µA
		V_R = 75 V	1	µA
		V_R = 75 V; T_j = 150 °C	50	µA
C_d	diode capacitance	V_R = 0 ; f = 1 MHz	1.5	pF
V_{fr}	forward recovery voltage	switched to I_F = 10 mA; t_p = 20 ns; see Fig.2	1.75	V
t_{rr}	reverse recovery time	switching from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1mA; see Fig.3	4	ns



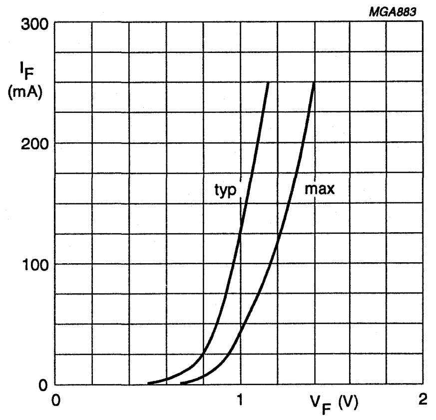
Input signal: forward pulse rise time t_r = 20 ns; forward pulse duration t_p = 120 ns; duty factor δ = 0.01.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.2 Forward recovery voltage test circuit and waveforms.



Input signal: reverse pulse rise time t_r = 0.6 ns; reverse pulse duration t_p = 100 ns; duty factor δ = 0.05.
Oscilloscope: rise time t_r = 0.35 ns.
Circuit capacitance: C ≤1 pF (oscilloscope input capacitance + parasitic capacitance).

Fig.3 Reverse recovery time test circuit and waveforms.



T_j = 25 °C.

Fig.4 Forward current as a function of forward voltage.

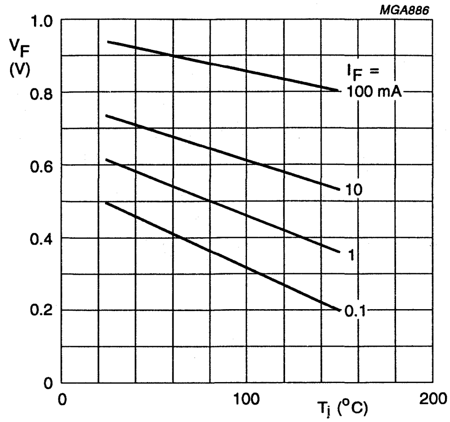


Fig.5 Forward voltage as a function of junction temperature; typical values.

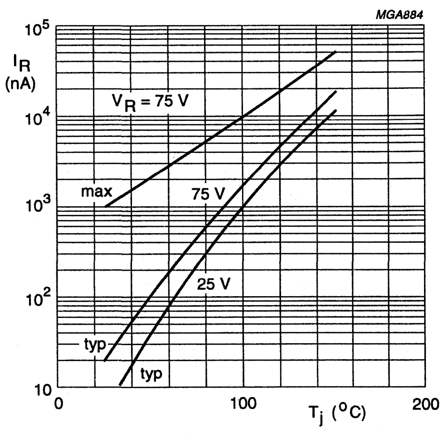
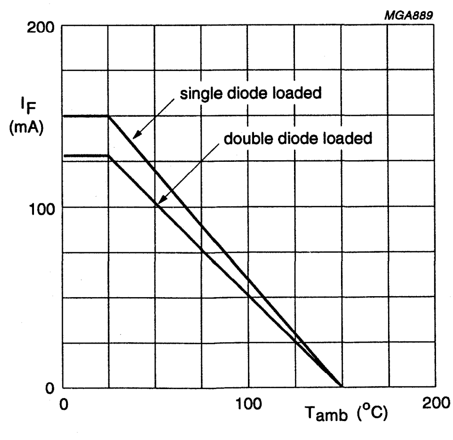


Fig.6 Reverse current as a function of junction temperature.



Device mounted on a FR4 printed circuit board.

Fig.7 Forward current derating curves.

VHF variable capacitance diode BB131

DESCRIPTION

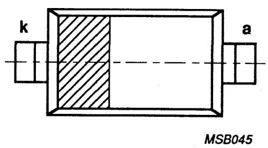
The BB131 is a silicon variable capacitance diode in planar technology, intended for use as a coupling diode in VHF tuners. The device is encapsulated in the ultra-small plastic SMD package, SOD323.

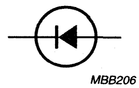
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_R	reverse current	V_R = 30 V	–	10	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	8	17	pF
		V_R = 28 V; f = 1 MHz	0.7	1.055	pF
$C_{0.5\,V}/C_{28\,V}$	capacitance ratio	f = 1 MHz	12	16	
R_s	series resistance	f = 470 MHz; note 1	–	3	Ω

Note

1. V_R is the value at which C_d = 9 pF.





Marking code: BB131 = P1.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	125	°C

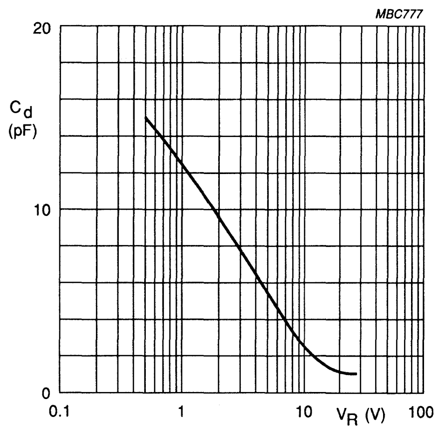
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 30 V	–	10	nA
		V_R = 30 V; T_{amb} = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	8	17	pF
		V_R = 28 V; f = 1 MHz	0.7	1.055	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	12	16	
R_s	series resistance	f = 470 MHz; note 1	–	3	Ω

Note

1. V_R is the value at which C_d = 9 pF.



f = 1 MHz; T_{amb} = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

VHF variable capacitance diode BB132

DESCRIPTION

The BB132 is a silicon variable capacitance diode in planar technology, with a very high capacitance ratio. It is intended for application in VHF tuners. The device is encapsulated in the ultra-small plastic SMD package, SOD323. A feature of this diode is the excellent matching performance, achieved by the Direct Matching Assembly procedure.

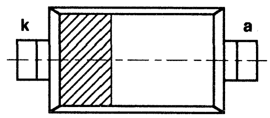
The diodes are delivered on tape in several matched groups, and are also available unmatched upon request.

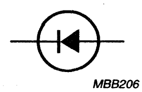
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_R	reverse current	V_R = 30 V	–	10	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	60	75	pF
		V_R = 28 V; f = 1 MHz	2.3	2.75	pF
$C_{0.5\,V}/C_{28\,V}$	capacitance ratio	f = 1 MHz	24	30	
R_s	series resistance	f = 100 MHz; note 1	–	2	Ω

Note

1. V_R is the value at which C_d = 30 pF.





Marking code: BB132 = P2.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	125	°C

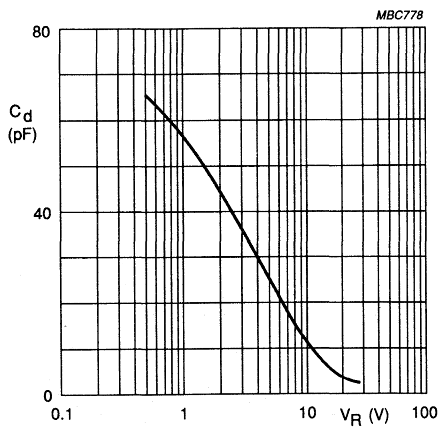
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 30 V	–	10	nA
		V_R = 30 V; T_{amb} = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	60	75	pF
		V_R = 28 V; f = 1 MHz	2.3	2.75	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	24	30	
R_s	series resistance	f = 100 MHz; note 1	–	2	Ω
ΔC/C	capacitance matching	V_R = 0.5 to 28 V; in a sequence of 4 diodes (gliding)	–	1	%
		V_R = 0.5 to 28 V; in a sequence of 15 diodes (gliding)	–	2	%

Note

1. V_R is the value at which C_d = 30 pF.



f = 1 MHz; T_{amb} = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

VHF variable capacitance diode BB133

DESCRIPTION

The BB133 is a silicon, double-implanted variable capacitance diode in planar technology, intended for use in VHF tuners with a CATV range up to 460 MHz. It has a high linearity and is encapsulated in the ultra-small plastic SMD package, SOD323. A feature of this diode is the excellent matching performance, achieved by the Direct Matching Assembly procedure.

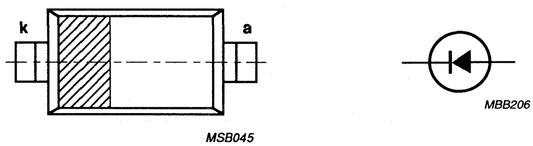
The diodes are delivered on tape in several matched groups, and are also available unmatched upon request.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_R	reverse current	V_R = 30 V	–	10	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	38	46	pF
		V_R = 28 V; f = 1 MHz	2.2	2.6	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	14	21	
R_s	series resistance	f = 100 MHz; note 1	–	0.9	Ω

Note

1. V_R is the value at which C_d = 30 pF.



Marking code: BB133 = P3.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	125	°C

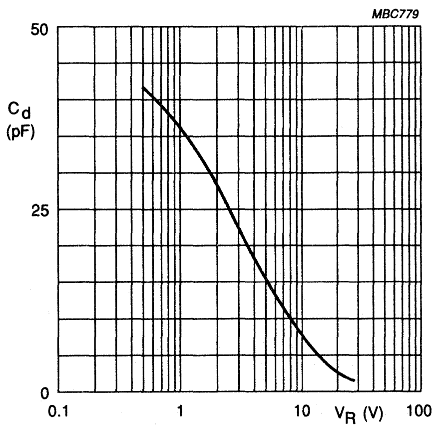
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 30 V	–	10	nA
		V_R = 30 V; T_{amb} = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	38	46	pF
		V_R = 28 V; f = 1 MHz	2.2	2.6	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	14	21	
R_s	series resistance	f = 100 MHz; note 1	–	0.9	Ω
ΔC/C	capacitance matching	V_R = 0.5 to 28 V; in a sequence of 4 diodes (gliding)	–	0.7	%
		V_R = 0.5 to 28 V; in a sequence of 15 diodes (gliding)	–	2	%

Note

1. V_R is the value at which C_d = 30 pF.



f = 1 MHz; T_{amb} = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

UHF variable capacitance diode BB134

DESCRIPTION

The BB134 is a silicon, double-implanted variable capacitance diode in planar technology, intended for use in UHF tuners. It has a high linearity and is encapsulated in the ultra-small plastic SMD package, SOD323. A feature of this diode is the excellent matching performance, achieved by the Direct Matching Assembly procedure.

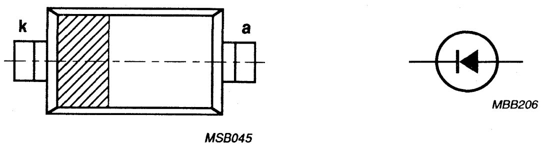
The diodes are delivered on tape in several matched groups. The unmatched type, BB135, has the same specification.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_R	reverse current	$V_R = 30$ V	–	10	nA
C_d	diode capacitance	$V_R = 0.5$ V; f = 1 MHz	17.5	21	pF
		$V_R = 28$ V; f = 1 MHz	1.7	2.1	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	8.9	12	
R_s	series resistance	f = 470 MHz; note 1	–	0.75	Ω

Note

1. V_R is the value at which $C_d = 9$ pF.



Marking code: BB134 = P4.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	125	°C

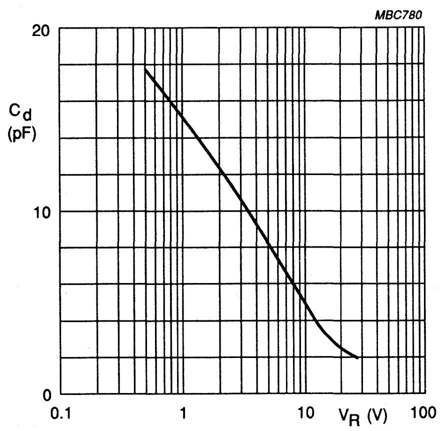
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 30 V	–	10	nA
		V_R = 30 V; T_{amb} = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	17.5	21	pF
		V_R = 28 V; f = 1 MHz	1.7	2.1	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	8.9	12	
R_s	series resistance	f = 470 MHz; note 1	–	0.75	Ω
ΔC/C	capacitance matching	V_R = 0.5 to 28 V; in a sequence of 4 diodes (gliding)	–	0.5	%
		V_R = 0.5 to 28 V; in a sequence of 15 diodes (gliding)	–	2	%

Note

1. V_R is the value at which C_d = 9 pF.



f = 1 MHz; T_{amb} = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

UHF variable capacitance diode BB135

DESCRIPTION

The BB135 is a silicon, double-implanted variable capacitance diode in planar technology, intended for use in UHF tuners. It has a high linearity and is encapsulated in the ultra-small plastic SMD package, SOD323.

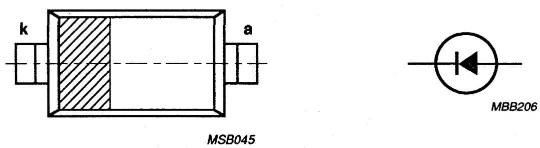
The diodes are delivered on tape (3000 or 10 000 pieces), without gaps.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
I_R	reverse current	V_R = 30 V	–	10	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	17.5	21	pF
		V_R = 28 V; f = 1 MHz	1.7	2.1	pF
$C_{0.5\,V}/C_{28\,V}$	capacitance ratio	f = 1 MHz	8.9	12	
R_s	series resistance	f = 470 MHz; note 1	–	0.75	Ω

Note

1. V_R is the value at which C_d = 9 pF.



Marking code: BB135 = P5.

Fig.1 Simplified outline (SOD323) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	30	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	125	°C

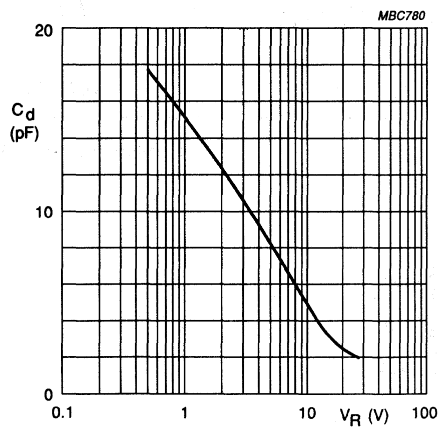
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 30 V	–	10	nA
		V_R = 30 V; T_{amb} = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 0.5 V; f = 1 MHz	17.5	21	pF
		V_R = 28 V; f = 1 MHz	1.7	2.1	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	8.9	12	
R_s	series resistance	f = 470 MHz; note 1	–	0.75	Ω

Note

1. V_R is the value at which C_d = 9 pF.



f = 1 MHz; T_{amb} = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

UHF VARIABLE CAPACITANCE DIODE

The BB215 is a silicon variable capacitance diode in a hermetically sealed glass envelope (SOD-80) and intended for application in UHF tuners. The leadless SOD-80 encapsulation is intended for surface mounting.
The diode features a capacitance characteristic with a good linearity.

Diodes are supplied in matched sets and the capacitance difference between any two diodes in one set is less than 3% over the voltage range from 0,5 V to 28 V.

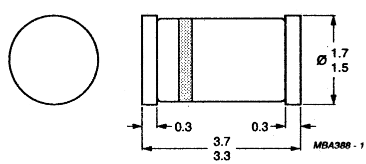
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 500 kHz V_R = 28 V	C_d		1,8 to 2,2 pF
Capacitance ratio at f = 500 kHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	>	7,6
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	0,75 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a white band on the body and a second green band indicates the BB215 type.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature	T_{stg}		−55 to +150 °C
Operating junction temperature	T_j	max.	100 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200 nA
Diode capacitance at f = 500 kHz			
V_R = 1 V	C_d	typ.	17 pF
		<	18 pF
V_R = 28 V	C_d		1,8 to 2,2 pF
Capacitance ratio at f = 500 kHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	>	7,6
		typ.	8,3
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	typ.	0,63 Ω

UHF VARIABLE CAPACITANCE DIODE

The BB515 is a silicon variable capacitance diode in a hermetically sealed glass envelope and intended intended for application in UHF tuners.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current at V_R = 30 V	I_R	max.	10 nA
Diode capacitance at f = 1 MHz at V_R = 28 V	C_d		1.85 to 2.25 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 9.6
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	typ.	0.5 Ω

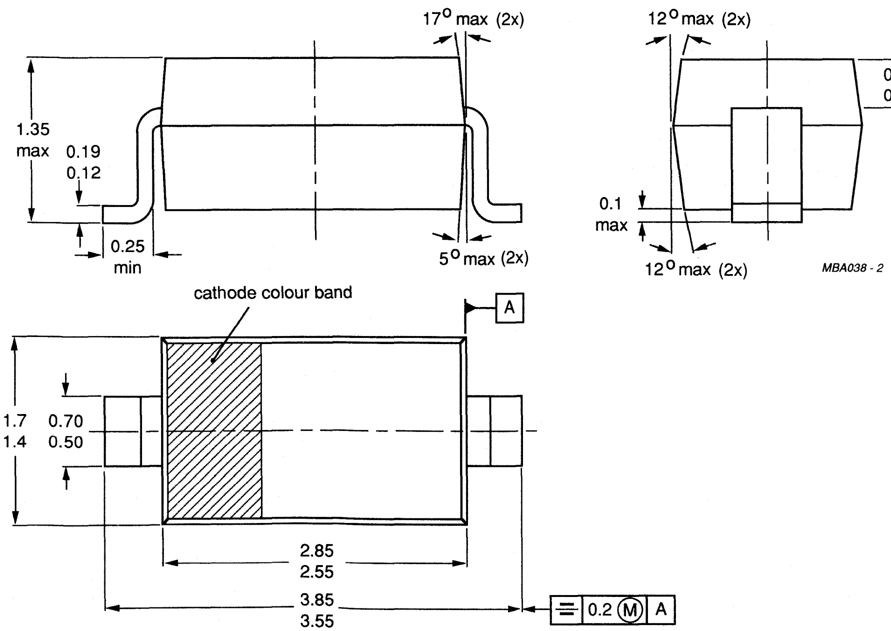
MECHANICAL DATA

Dimensions in mm

Fig.1 SOD123.

Marking code

BB515 = P



Cathode indicated by a white band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−55 to + 125 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 30 V	I_R	max.	10 nA
V_R = 30 V; T_{amb} = 85 °C	I_R	max.	200 nA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	min.	30 V
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		16 to 19.5 pF
V_R = 28 V	C_d		1.85 to 2.25 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 9.6
Tolerance of capacitance difference between two diodes of V_R = 0.5 V to 28 V	$\frac{\Delta C}{C}$	max.	3 %
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	typ.	0.5 Ω
Series inductance	L_s	typ.	2.8 nH

VHF VARIABLE CAPACITANCE DIODE

The BB619 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band B up to 460 MHz in all-band tuners.
The diode is encapsulated in a hermetically sealed SOD123 plastic envelope suitable for surface mounting.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current at V_R = 30 V	I_R	max.	10 nA
Diode capacitance at f = 1 MHz at V_R = 28 V	C_d		2.4 to 2.9 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 1\ V)}{C_d (V_R = 28\ V)}$	min. / typ.	12.5 / 14
Series resistance at f = 100 MHz, V_R is that value at which C_d = 30 pF	r_s	typ.	0.7 Ω

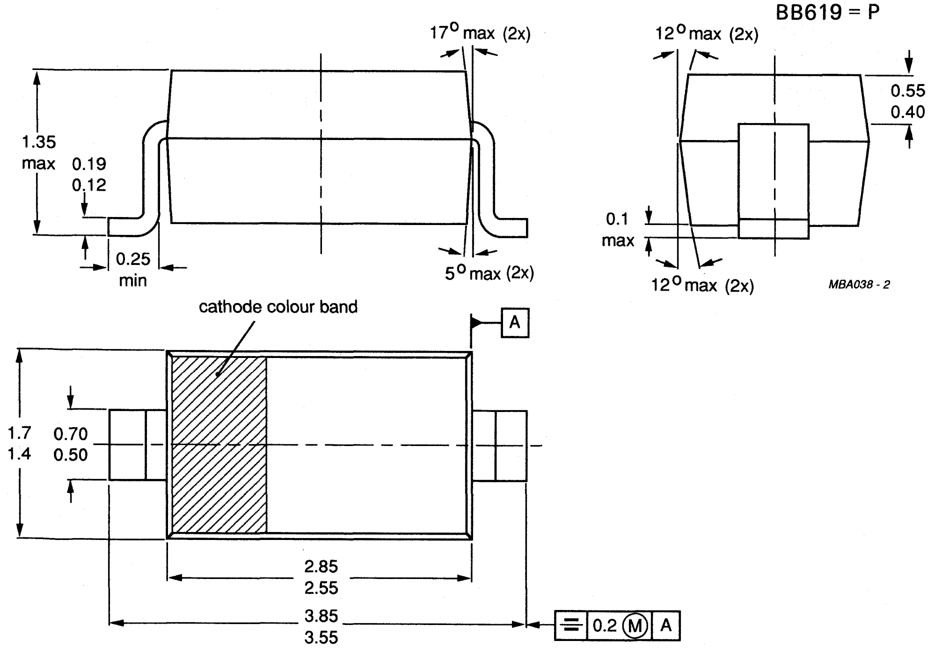
MECHANICAL DATA

Dimensions in mm

Fig.1 SOD123.

Marking code

BB619 = P



Cathode indicated by a yellow band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}		–55 to + 150 °C
Operating ambient temperature range	T_{amb}		–55 to + 125 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 30 V	I_R	max.	10 nA
V_R = 30 V; T_{amb} = 85 °C	I_R	max.	200 nA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	min.	30 V
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		33.5 to 41 pF
V_R = 28 V	C_d		2.4 to 2.9 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	min. / typ.	12.5 / 14
Tolerance of capacitance difference between two diodes of V_R = 1.0 V to 28 V	$\frac{\Delta C}{C}$	max.	2.5 %
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	0.7 Ω
Series inductance	L_s	typ.	2.8 nH

VHF VARIABLE CAPACITANCE DIODE

The BB620 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band A up to 160 MHz in all-band tuners.
The diode is encapsulated in a hermetically sealed SOD123 envelope suitable for surface mounting.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current at V_R = 30 V	I_R	max.	10 nA
Diode capacitance at f = 1 MHz at V_R = 28 V	C_d		2.9 to 3.4 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		19.5 to 25
Series resistance at f = 100 MHz V_R is that value at which C_d = 30 pF	r_s	typ.	1.3 Ω

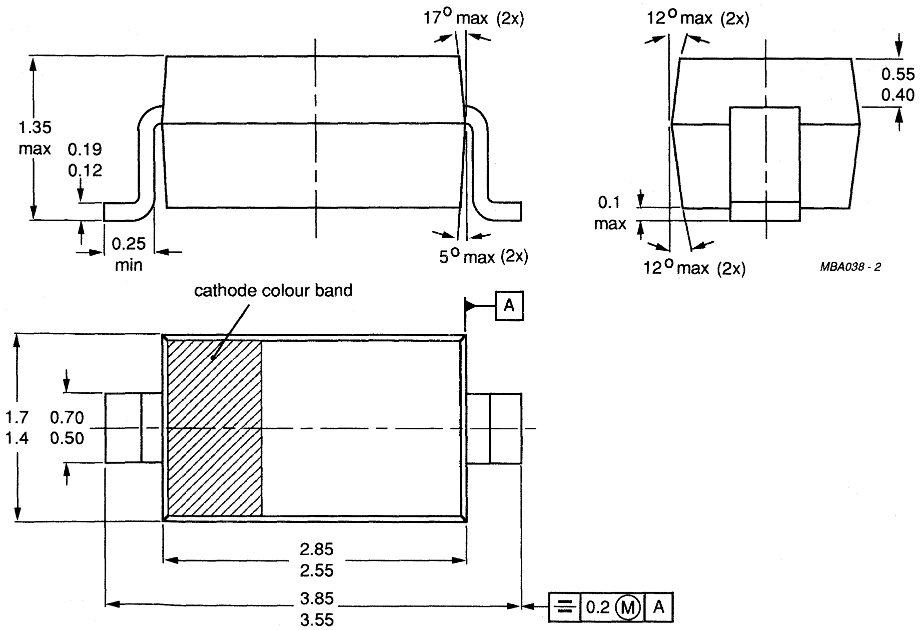
MECHANICAL DATA

Dimensions in mm

Fig.1 SOD123.

Marking code

BB620 = P



Cathode indicated by a red band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−55 to + 125 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 30 V	I_R	max.	10 nA
V_R = 30 V; T_{amb} = 85 °C	I_R	max.	200 nA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	min.	30 V
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		62 to 76 pF
V_R = 28 V	C_d		2.9 to 3.4 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		19.5 to 25
Tolerance of the capacitance difference between two diodes of V_R = 1.0 V to 28 V	$\frac{\Delta C}{C}$	max.	2.5 %
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	1.3 Ω
Series inductance	L_s	typ.	2.8 nH

VHF VARIABLE CAPACITANCE DOUBLE DIODE

The BB804 is a variable capacitance double diode in planar technology with common cathode in a plastic SOT23 envelope. It is intended for FM tuning especially for car radios.

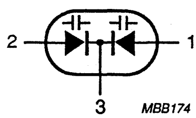
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	18	V
Repetitive peak reverse voltage	V_{RRM}	max.	20	V
Forward current (DC)	I_F	max.	50	mA
Operating junction temperature	T_j	max.	100	°C
Reverse current	I_R	max.	20	nA
Diode capacitance at f = 1 MHz V_R = 2 V	C_d		42 to 47.5	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75	
Series resistance at f = 100 MHz V_R is that value at which C_d = 38 pF	r_s	typ.	0.20	Ω

MECHANICAL DATA

Dimensions in mm

Marking SF



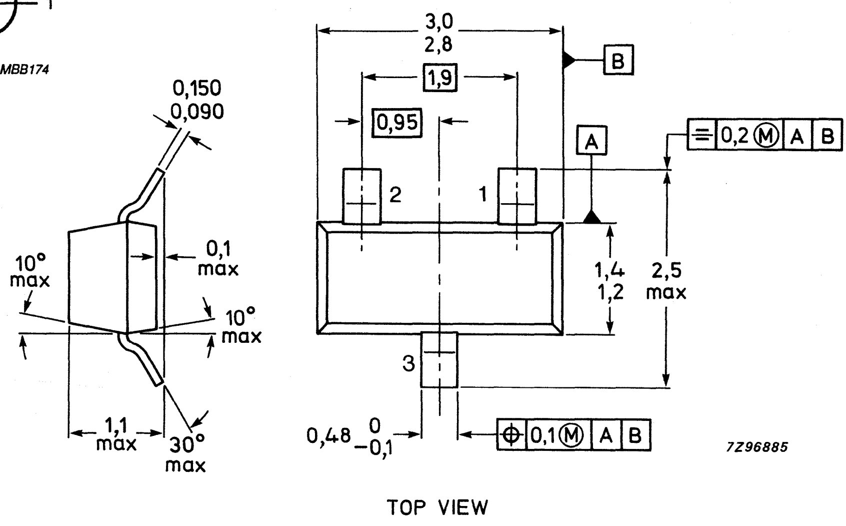


Fig.1 SOT23.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	18 V
Forward current (DC)	I_F	max.	50 mA
Repetitive peak reverse voltage	V_{RRM}	max.	20 V
Storage temperature range	T_{stg}		−55 to + 100 °C
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\,j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 16 V	I_R	<	20 nA
V_R = 16 V; T_{amb} = 60 °C	I_R	<	200 nA
Diode capacitance at f = 1.0 MHz			
V_R = 2 V			
red 0	C_d		42 to 43.5 pF
yellow 1	C_d		43 to 44.5 pF
white 2	C_d		44 to 45.5 pF
green 3	C_d		45 to 46.5 pF
blue 4	C_d		46 to 47.5 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75
Series resistance at f = 100 MHz, V_R is that value at which C_d = 38 pF	r_s	typ.	0.20 Ω

UHF VARIABLE CAPACITANCE DIODE

The BB811 is a silicon variable capacitance diode in a hermetically sealed SOD123 envelope and intended for application in TV-SAT tuners up to 2 GHz

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30 V
Reverse current at V_R = 30 V	I_R	max.	20 nA
Diode capacitance at f = 1 MHz at V_R = 28 V	C_d		0.85 to 1.2 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		7.8 to 9.5
Series resistance at f = 100 MHz V_R is that value at which C_d = 9 pF	r_s	max.	1.45 Ω

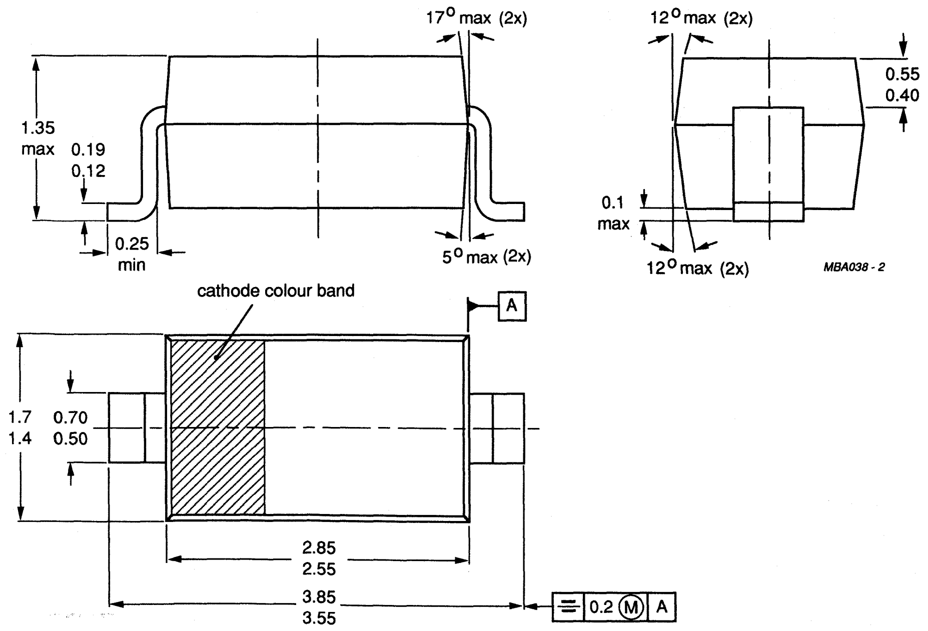
MECHANICAL DATA

Dimensions in mm

Fig.1 SOD123.

Marking code

BB811 = T



Cathode indicated by a white band.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−55 to + 125 °C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 30 V	I_R	max.	20 nA
V_R = 30 V; T_{amb} = 85 °C	I_R	max.	500 nA
Reverse breakdown voltage			
I_R = 10 μA	$V_{(BR)R}$	min.	30 V
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		7.8 to 9.8 pF
V_R = 28 V	C_d		0.85 to 1.2 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		7.8 to 9.5
Tolerance of capacitance difference between two diodes of V_R = 0.5 V to 28 V	$\frac{\Delta C}{C}$	max.	3 %
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 9 pF	r_s	max.	1.45 Ω
Series inductance	L_s	typ.	2.8 nH

Variable capacitance diode BB901

DESCRIPTION

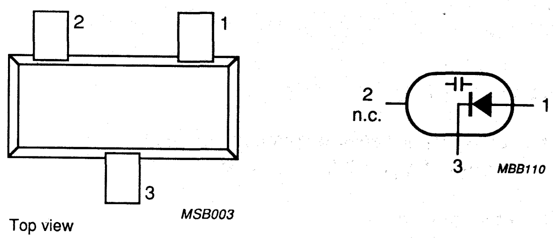
The BB901 is a silicon planar variable capacitance diode in a microminiature SOT23 envelope. It is intended as a tunable coupling diode in VHF all-band tuners.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	reverse voltage		–	28	V
I_R	reverse current	V_R = 28 V	–	10	nA
C_d	diode capacitance	V_R = 28 V; f = 1 MHz	–	1.055	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	12	–	
R_s	series resistance	f = 100 MHz; note 1	–	3	Ω

Note

1. V_R is the value at which C_d = 10 pF.



Marking code: BB901 = S14.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	28	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–65	100	°C
T_j	junction operating temperature		–	85	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	430 K/W

Note

1. Device mounted on a ceramic substrate, 8 x 10 x 0.7 mm.

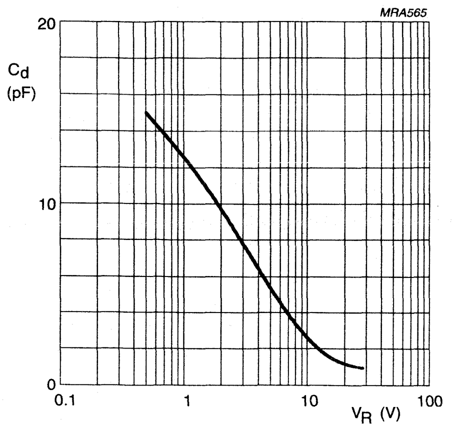
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 28 V	–	10	nA
		V_R = 28 V; T_j = 85 °C	–	200	nA
C_d	diode capacitance	V_R = 28 V; f = 1 MHz	–	1.055	pF
$C_{0.5\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	12	–	
R_s	series resistance	f = 100 MHz; note 1	–	3	Ω

Note

1. V_R is the value at which C_d = 10 pF.



f = 1 MHz; T_j = 25 °C.

Fig.2 Diode capacitance as a function of reverse voltage, typical values.

Variable capacitance diode BBY31

DESCRIPTION

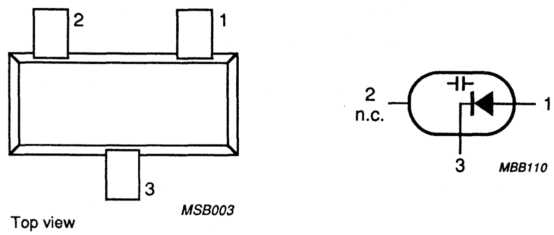
The BBY31 is a silicon planar variable capacitance diode in a microminiature SOT23 envelope. It is intended for electronic tuning applications in thick and thin film circuits.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_R	reverse voltage		–	–	28	V
I_R	reverse current	V_R = 28 V	–	–	10	nA
C_d	diode capacitance	V_R = 28 V; f = 1 MHz	1.6	–	2	pF
$C_{1\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	–	8.3	–	
R_s	series resistance	f = 470 MHz; note 1	–	–	1.2	Ω

Note

1. V_R is the value at which C_d = 9 pF.



Marking code: BBY31 = S1.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	28	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–65	100	°C
T_j	junction operating temperature		–	85	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	430 K/W

Note

1. Device mounted on a ceramic substrate, 7 x 5 x 0.5 mm.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_R	reverse current	V_R = 28 V	–	–	10	nA
		V_R = 28 V; T_j = 85 °C	–	–	1	μA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz	–	15	–	pF
		V_R = 28 V; f = 1 MHz	1.6	–	2	pF
$C_{1\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	–	8.3	–	
R_s	series resistance	f = 470 MHz; note 1	–	–	1.2	Ω

Note

1. V_R is the value at which C_d = 9 pF.

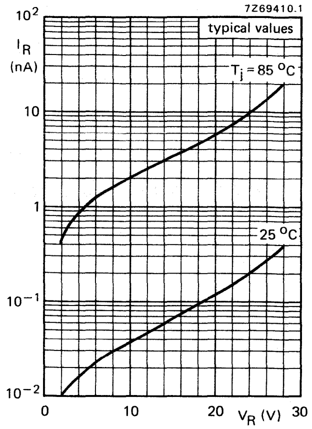


Fig.2 Reverse current as a function of reverse voltage, typical values.

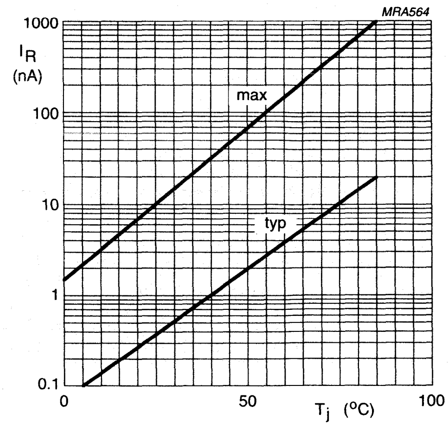


Fig.3 Reverse current as a function of junction temperature.

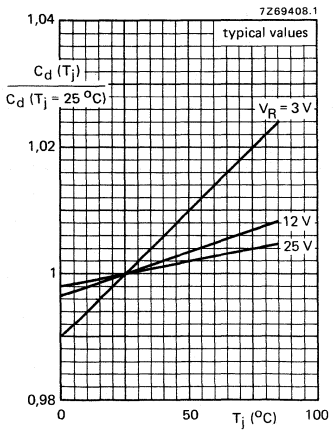


Fig.4 Diode capacitance as a function of junction temperature, typical values.

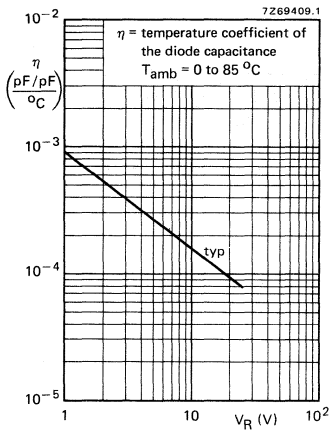
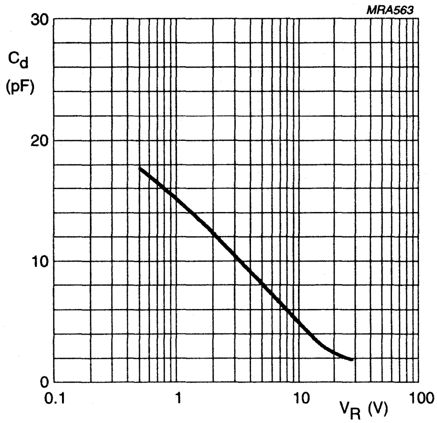


Fig.5 Temperature coefficient of diode capacitance.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage, typical values.

DOUBLE VARIABLE CAPACITANCE DIODE

The BBY39 is a double variable capacitance diode with a common cathode and mounted in a micro-miniature envelope (SOT-23), suitable for surface mounting. The two diodes in one envelope are matched.

The device is intended for application in electronic tuners in satellite TV systems.

QUICK REFERENCE DATA

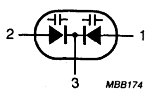
For each diode:			
Continuous reverse voltage	V_R	max.	30 V
Operating junction temperature	T_j	max.	85 °C
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	8,0
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	1,2 Ω

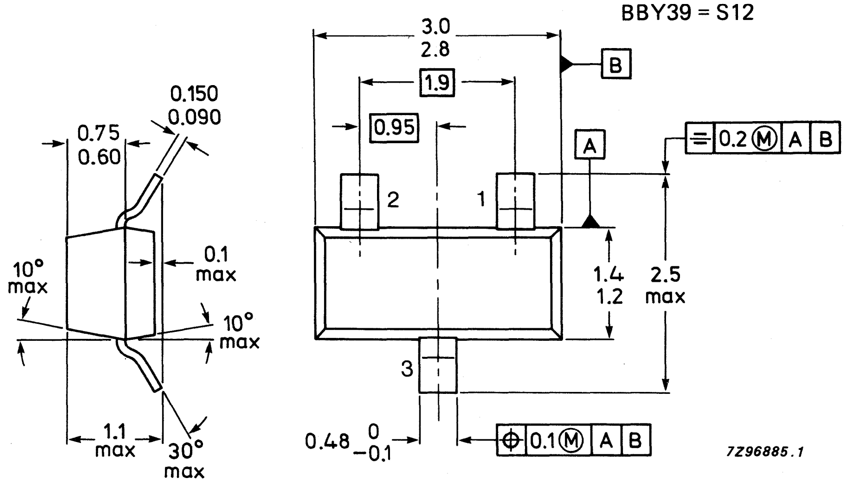
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code:
BBY39 = S12





TOP VIEW

RATINGS (for each diode)

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	30	V
Reverse voltage (peak value)	V_{RM}	max.	30	V
Forward current (d.c.)	I_F	max.	20	mA
Storage temperature	T_{stg}		−65 to +100	°C
Operating junction temperature	T_j	max.	85	°C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS (for each diode)

T_j = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_j = 85 °C	I_R	<	100	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d	typ.	17.5	pF
V_R = 28 V	C_d		1.6 to 2.0	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	8.0	
Series resistance at f = 470 MHz and that value of V_R at which C_d = 9 pF	r_s	<	1.2	Ω

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Variable capacitance diode BBY40

DESCRIPTION

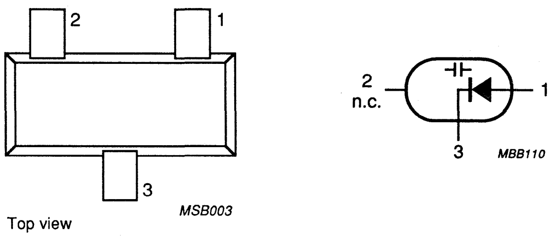
The BBY40 is a variable capacitance diode in a plastic SOT23 envelope. It is intended for electronic tuning in VHF television tuners with extended band I (FCC and OIRT norm).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	reverse voltage		–	28	V
I_R	reverse current	V_R = 28 V	–	10	nA
C_d	diode capacitance	V_R = 3 V; f = 1 MHz	26	32	pF
		V_R = 25 V; f = 1 MHz	4.3	6	pF
$C_{3\,V}/C_{25\,V}$	capacitance ratio	f = 1 MHz	5	6.5	
R_s	series resistance	f = 200 MHz; note 1	–	0.7	Ω

Note

1. V_R is the value at which C_d = 25 pF.



Marking code: BBY40 = S2.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_R	continuous reverse voltage		–	28	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		–55	100	°C
T_j	junction operating temperature		–	85	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	430 K/W

Note

1. Device mounted on a ceramic substrate, 7 x 5 x 0.5 mm.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_R	reverse current	V_R = 28 V	–	10	nA
		V_R = 28 V; T_j = 85 °C	–	100	nA
C_d	diode capacitance	V_R = 3 V; f = 1 MHz	26	32	pF
		V_R = 25 V; f = 1 MHz	4.3	6	pF
$C_{3\ V}/C_{25\ V}$	capacitance ratio	f = 1 MHz	5	6.5	
R_s	series resistance	f = 200 MHz; note 1	–	0.7	Ω

Note

1. V_R is the value at which C_d = 25 pF.

Variable capacitance diode BBY40

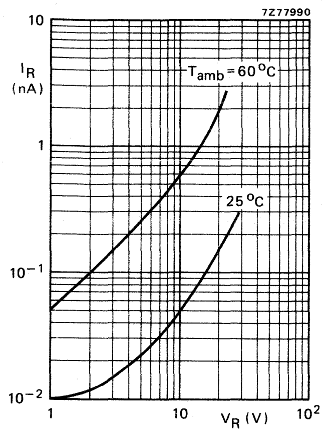
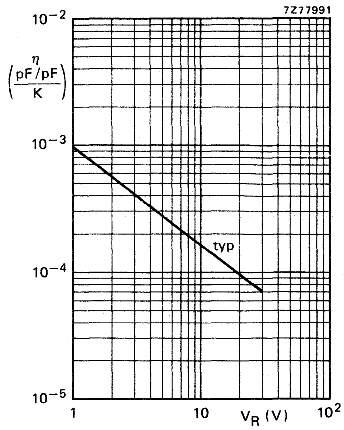
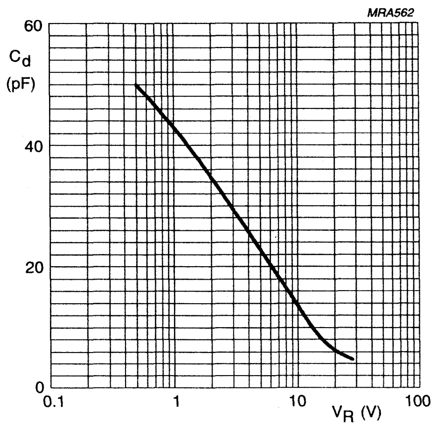


Fig.2 Reverse current as a function of reverse voltage, typical values.



T_{amb} = 0 to 85 °C.

Fig.3 Temperature coefficient of diode capacitance.



f = 1 MHz; T_j = 25 °C.

Fig.4 Diode capacitance as a function of reverse voltage, typical values.

V.H.F. VARIABLE CAPACITANCE DIODE

The BBY42 is a variable capacitance diode in a microminiature plastic envelope SOT-23. It is intended for use in v.h.f. TV tuners and CATV applications using SMD technology.

QUICK REFERENCE DATA

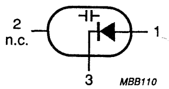
Reverse voltage, peak value	V_{RM}	max.	32 V
Reverse current $V_R = 28$ V	I_R	max.	10 nA
Diode capacitance at f = 1 MHz $V_R = 28$ V	C_d		2,4 to 3,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 1\ V)}{C_d (V_R = 28\ V)}$		12 to 16
Series resistance at f = 100 MHz V_R is that value at which $C_d = 30$ pF	r_s	typ. / max.	0,9 Ω / 1,0 Ω

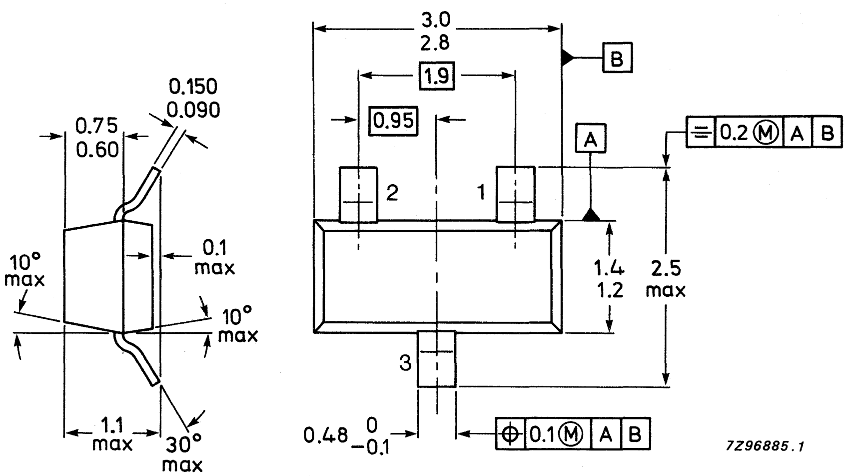
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code: S13





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage (peak value)	V_{RM}	max.	32 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}	−65 to + 100	°C
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_j = 85 °C	I_R	<	200 nA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d	>	31 pF
V_R = 3 V	C_d	typ.	24 pF
V_R = 28 V	C_d		2,4 to 3,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$		12 to 16
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	0,9 Ω
	r_s	<	1,0 Ω

Double variable capacitance diode BBY62

DESCRIPTION

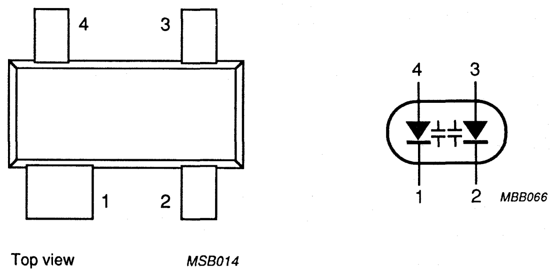
The BBY62 is a double variable capacitance diode in a microminiature SOT143 envelope. It is intended for application in electronic tuners using SMD technology.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
V_R	reverse voltage		–	–	28	V
I_R	reverse current	V_R = 28 V	–	–	10	nA
C_d	diode capacitance	V_R = 28 V; f = 1 MHz	1.6	–	2	pF
$C_{1\,V}/C_{28\,V}$	capacitance ratio	f = 1 MHz	–	8.3	–	
R_s	series resistance	f = 470 MHz; note 1	–	–	1.2	Ω

Note

1. V_R is the value at which C_d = 9 pF.



Marking code: BBY62 = S4.

Fig.1 Simplified outline (SOT143) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per diode					
V_R	continuous reverse voltage		–	28	V
V_{RM}	reverse voltage	peak value	–	30	V
I_F	forward current	DC value	–	20	mA
T_{stg}	storage temperature range		−65	100	°C
T_j	junction operating temperature		–	85	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	430 K/W

Note

1. Device mounted on a ceramic substrate, 8 x 10 x 0.7 mm.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per diode						
I_R	reverse current	V_R = 28 V	–	–	10	nA
		V_R = 28 V; T_j = 85 °C	–	–	1	µA
C_d	diode capacitance	V_R = 1 V; f = 1 MHz	–	15	–	pF
		V_R = 28 V; f = 1 MHz	1.6	–	2	pF
$C_{1\ V}/C_{28\ V}$	capacitance ratio	f = 1 MHz	–	8.3	–	
R_s	series resistance	f = 470 MHz; note 1	–	–	1.2	Ω

Note

1. V_R is the value at which C_d = 9 pF.

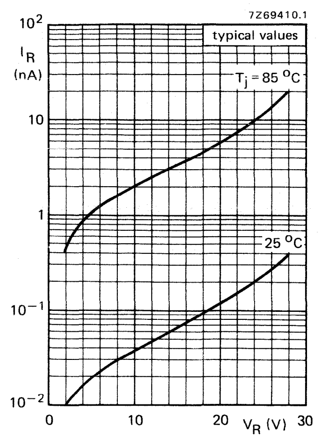


Fig.2 Reverse current as a function of reverse voltage, typical values.

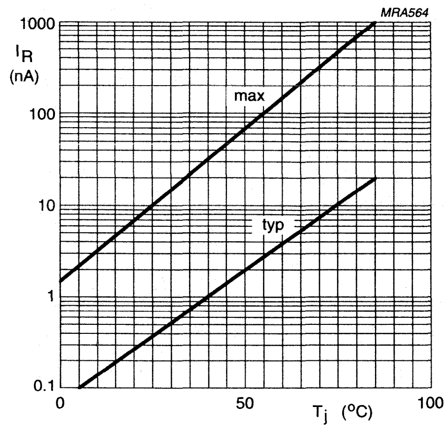


Fig.3 Reverse current as a function of junction temperature.

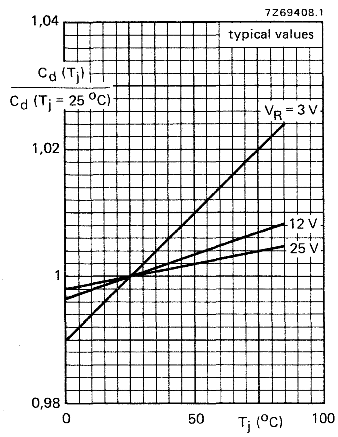


Fig.4 Diode capacitance as a function of junction temperature, typical values.

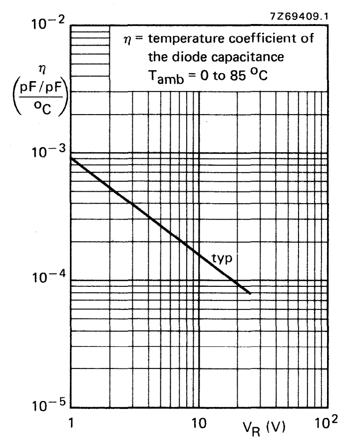
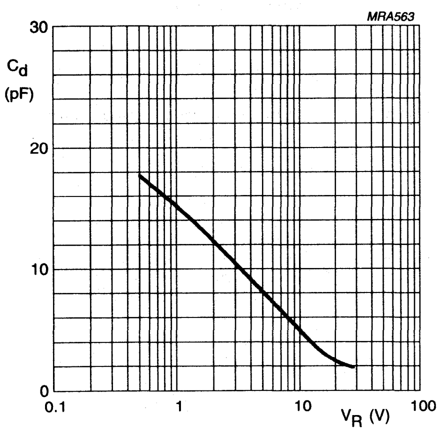


Fig.5 Temperature coefficient of diode capacitance.



f = 1 MHz; T_j = 25 °C.

Fig.6 Diode capacitance as a function of reverse voltage, typical values.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic package for use in driver and output stages of aufio amplifiers in thick and thin-film hybrid circuits.

N-P-N complements are BC817; R and BC818; R respectively.

QUICK REFERENCE DATA

			BC807	BC808	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	>	80		MHz

MECHANICAL DATA

Dimensions in mm

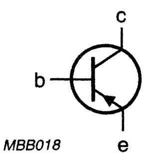
Fig. 1 SOT-23.

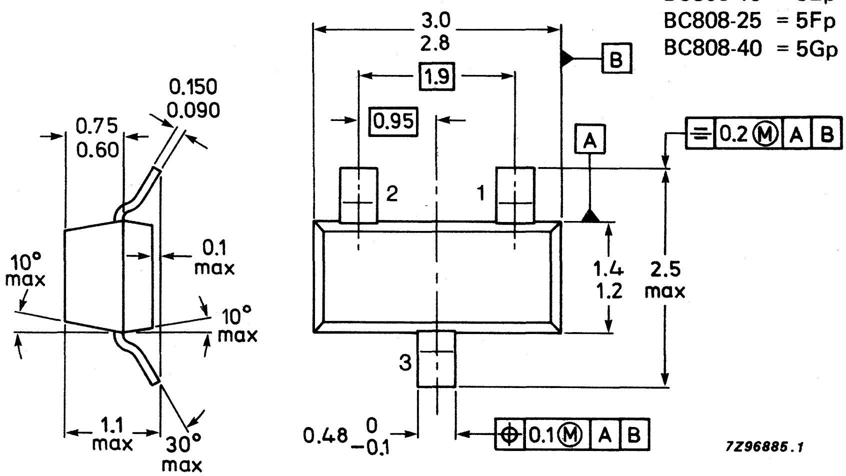
Marking code:

BC807 = 5Dp
BC807-16 = 5Ap
BC807-25 = 5Bp
BC807-40 = 5Cp
BC808 = 5Hp
BC808-16 = 5Ep
BC808-25 = 5Fp
BC808-40 = 5Gp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC807	BC808	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base) $-I_C$ = 10 mA	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (DC)	$-I_C$	max.	500		mA
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Emitter current (peak value)	I_{EM}	max.	1000		mA
Base current (DC)	$-I_B$	max.	100		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
Total power dissipation at T_{amb} = 25 °C *	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

From junction to ambient	$R_{th\ j\text{-}a}$	=	500	K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 25$ °C	$-I_{CBO}$	max.	100 nA
$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 150$ °C	$-I_{CBO}$	max.	5 μA
Emitter cut-off current			
$I_C = 0$; $V_{EB} = 5$ V	$-I_{EBO}$	max.	10 μA
Base emitter voltage *			
$-I_C = 500$ mA; $-V_{CE} = 1$ V	$-V_{BE}$	max.	1,2 V
Saturation voltage			
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	max.	700 mV
D.C. current gain			
$-I_C = 500$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	40
$-I_C = 100$ mA; $-V_{CE} = 1$ V; BC807; BC808	h_{FE}		100 to 600
BC807-16, BC808-16	h_{FE}		100 to 250
BC807-25, BC808-25	h_{FE}		160 to 400
BC807-40, BC808-40	h_{FE}		250 to 600
Transition frequency at f = 100 MHz			
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	>	80 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	8 pF

* $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

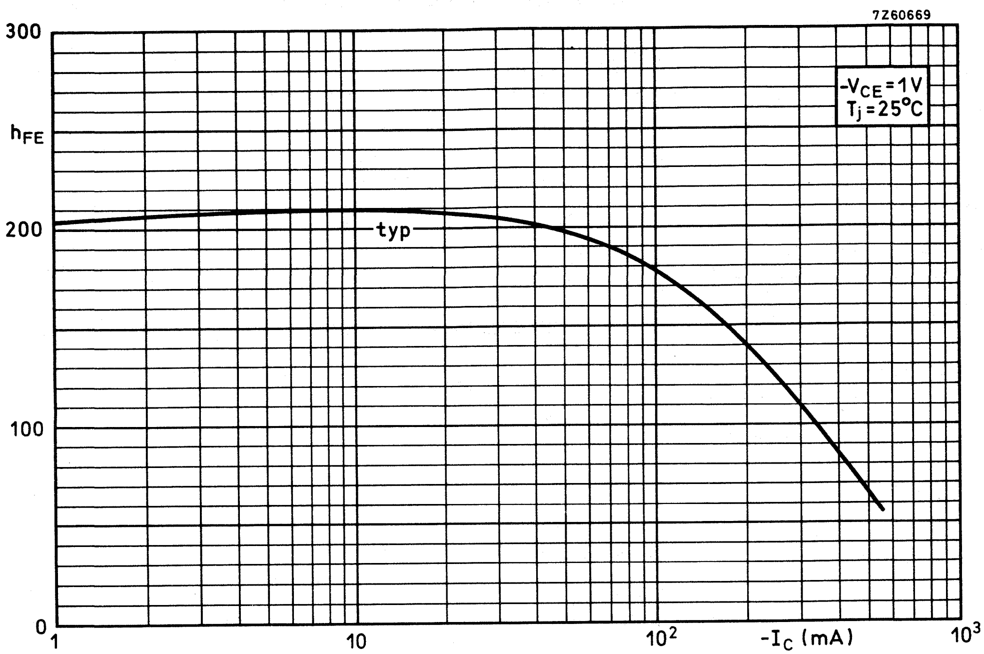


Fig. 2 DC current gain.

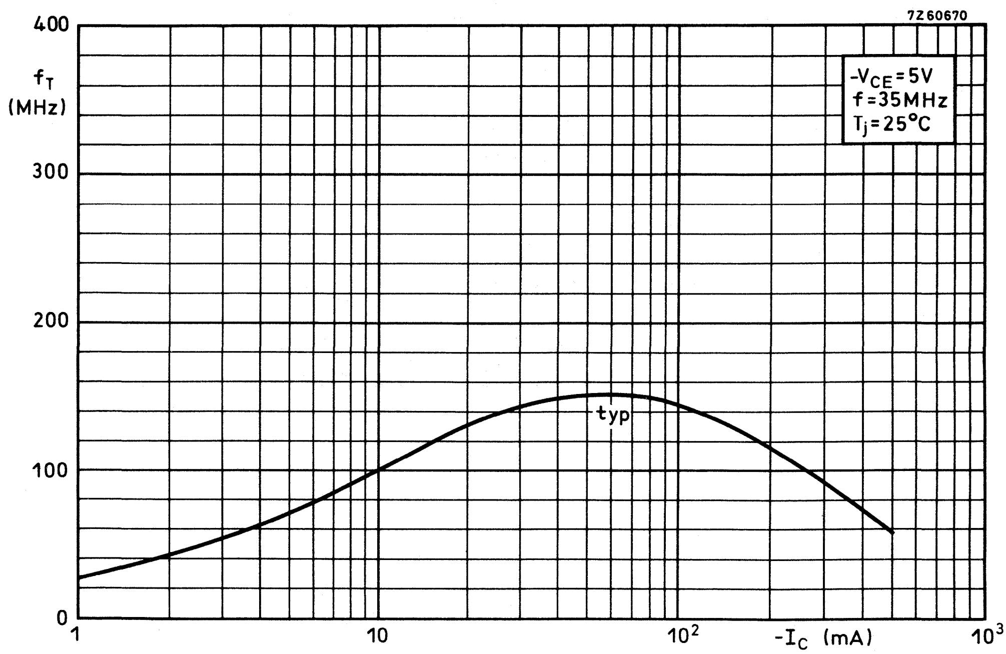


Fig. 3 Typical values transition frequency.

PNP general purpose transistor — BC807W; BC808W

FEATURES

- High current
- S- mini package.

DESCRIPTION

PNP transistor in a plastic SOT323 package, for general switching and amplification.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

MARKING CODES

BC807W:	5D
BC807-16W:	5A
BC807-25W:	5B
BC807-40W:	5C
BC808W:	5H
BC808-16W:	5E
BC808-25W:	5F
BC808-40W:	5G

PIN CONFIGURATION

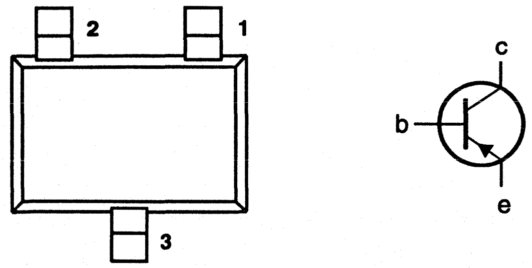


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC807W		–	–50	V
	BC808W		–	–30	V
V_{CEO}	collector-emitter voltage	open base			
	BC807W		–	–45	V
	BC808W		–	–25	V
I_{CM}	peak collector current		–	–1	A
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C	–	200	mW
h_{FE}	DC current gain	$I_C = -100$ mA; $V_{CE} = -1$ V; $T_{amb} = 25$ °C	100	600	
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; $T_{amb} = 25$ °C	80	–	MHz

PNP general purpose transistor BC807W; BC808W

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC807W		–	–50	V
	BC808W		–	–30	V
V_{CEO}	collector-emitter voltage	open base; $I_C = -10$ mA			
	BC807W		–	–45	V
	BC808W		–	–25	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	DC collector current		–	–500	mA
I_{CM}	peak collector current		–	–1	A
I_{EM}	peak emitter current		–	1	A
I_B	DC base current		–	–100	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = -20$ V	–	–100	nA
		$I_E = 0$; $V_{CB} = -20$ V; $T_j = 150$ °C	–	–5	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	–100	nA
V_{BE}	base-emitter voltage	$I_C = -500$ mA; $V_{CE} = -1$ V (note 1)	–	–1.2	V
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = -500$ mA; $I_B = -50$ mA (note 1)	–	–700	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	10	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 100 MHz	80	–	MHz
h_{FE}	DC current gain	$I_C = -500$ mA; $V_{CE} = -1$ V (note 1)	40	–	
		$I_C = -100$ mA; $V_{CE} = -1$ V (note 1)			
	BC807W; BC808W		100	600	
	BC807-16W; BC808-16W		100	250	
	BC807-25W; BC808-25W		160	400	
	BC807-40W; BC808-40W		250	600	

Note

1. Pulse test : $t_p \leq 300$ μs; $\delta \leq 0.02$

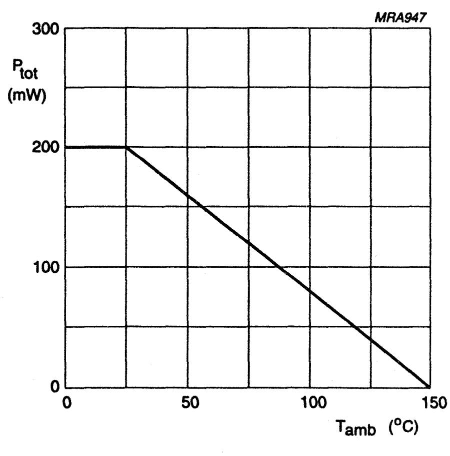


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic package for use in driver and output stages of audio amplifiers in thick and thin-film hybrid circuits.

P-N-P complements are BC807; R and BC808; R respectively.

QUICK REFERENCE DATA

			BC817	BC818	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	>	100		MHz

MECHANICAL DATA

Dimensions in mm

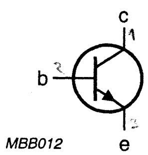
Fig. 1 SOT-23.

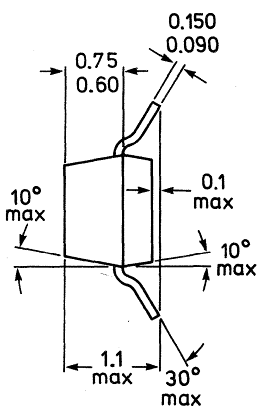
Pinning:

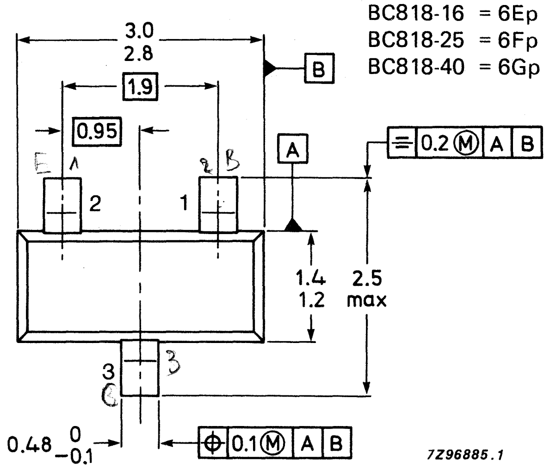
1 = base
2 = emitter
3 = collector

Marking code:

BC817 = 6Dp
BC817-16 = 6Ap
BC817-25 = 6Bp
BC817-40 = 6Cp
BC818 = 6Hp
BC818-16 = 6Ep
BC818-25 = 6Fp
BC818-40 = 6Gp







TOP VIEW

Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC817	BC818	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) I_C = 10 mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 25$ °C	I_{CBO}	<	100 nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	I_{CBO}	<	5 μA
Emitter cut-off current			
$I_C = 0$; $V_{EB} = 5$ V	I_{EBO}	<	10 μA
Base emitter voltage *			
$I_C = 500$ mA; $V_{CE} = 1$ V	V_{BE}	<	1,2 V
Saturation voltage			
$I_C = 500$ mA; $I_B = 50$ mA	V_{CEsat}	<	700 mV
D.C. current gain			
$I_C = 500$ mA; $V_{CE} = 1$ V	h_{FE}	>	40
$I_C = 100$ mA; $V_{CE} = 1$ V; BC817; BC818	h_{FE}		100 to 600
BC817-16, BC818-16	h_{FE}		100 to 250
BC817-25, BC818-25	h_{FE}		160 to 400
BC817-40, BC818-40	h_{FE}		250 to 600
Transition frequency at f = 100 MHz			
$I_C = 10$ mA; $V_{CE} = 5$ V	f_T	>	100 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	5 pF

* V_{BE} decreases by about 2 mV/K with increasing temperature.

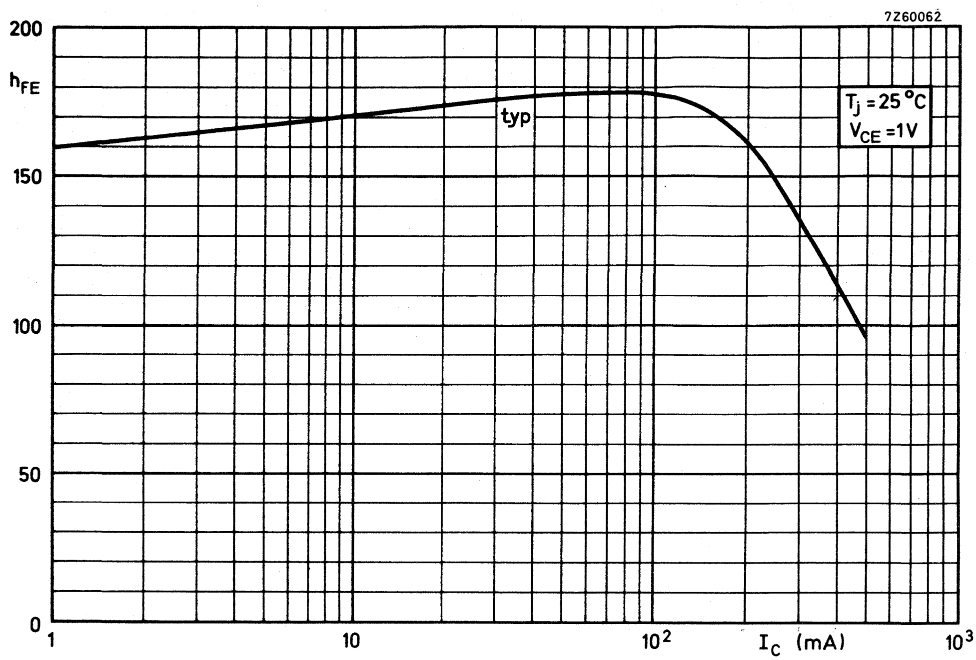


Fig. 2 DC current gain.

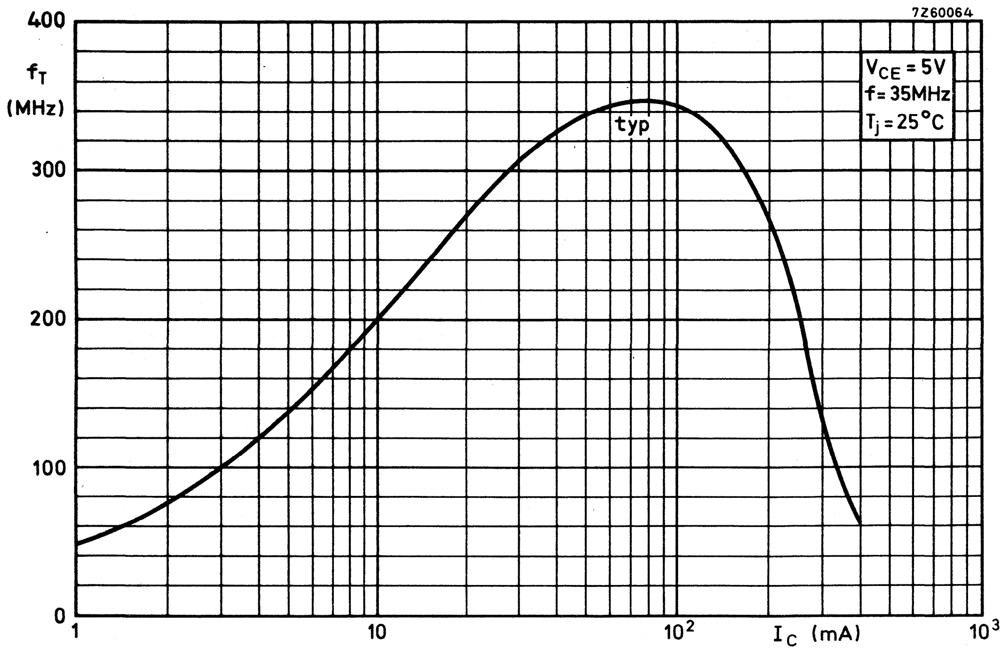


Fig. 7 Typical values transition frequency.

NPN general purpose transistor | BC817W; BC818W

FEATURES

- High current
- S- mini package.

DESCRIPTION

NPN transistor in a plastic SOT323 (SC70) package.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

PIN CONFIGURATION

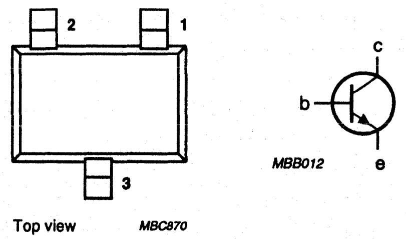


Fig.1 Simplified outline and symbol.

MARKING CODES

BC817W:	6D
BC817-16W:	6A
BC817-25W:	6B
BC817-40W:	6C
BC818W:	6H
BC818-16W:	6E
BC818-25W:	6F
BC818-40W:	6G

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC817W		–	50	V
	BC818W		–	30	V
V_{CEO}	collector-emitter voltage	open base			
	BC817W		–	45	V
	BC818W		–	25	V
I_{CM}	peak collector current		–	1	A
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C	–	200	mW
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 1$ V; $T_{amb} = 25$ °C	100	600	
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	100	–	MHz

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC817W		–	50	V
	BC818W		–	30	V
V_{CEO}	collector-emitter voltage	open base; $I_C = 10$ mA			
	BC817W		–	45	V
	BC818W		–	25	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	DC collector current		–	500	mA
I_{CM}	peak collector current		–	1	A
I_{EM}	peak emitter current		–	–1	A
I_B	DC base current		–	100	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = 20$ V	–	100	nA
		$I_E = 0$; $V_{CB} = 20$ V; $T_j = 150$ °C	–	5	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	100	nA
V_{BE}	base-emitter voltage	$I_C = 500$ mA; $V_{CE} = 1$ V (note 1)	–	1.2	V
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = 500$ mA; $I_B = 50$ mA (note 1)	–	700	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	5	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; f = 100 MHz	100	–	MHz
h_{FE}	DC current gain	$I_C = 500$ mA; $V_{CE} = 1$ V (note 1)	40	–	
		$I_C = 100$ mA; $V_{CE} = 1$ V (note 1)			
	BC817W; BC818W		100	600	
	BC817-16W; BC818-16W		100	250	
	BC817-25W; BC818-25W		160	400	
	BC817-40W; BC818-40W		250	600	

Note

1. Pulse test : $t_p \leq 300$ μs; $\delta \leq 0.02$

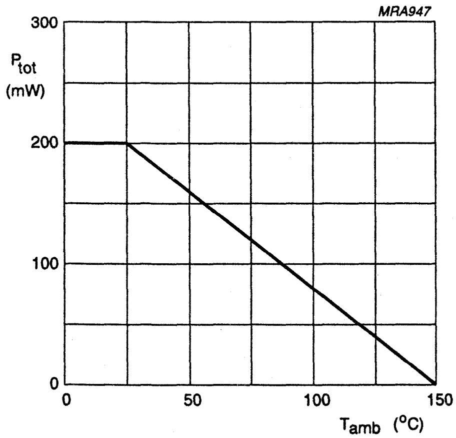


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

General purpose n-p-n transistors in a plastic SOT-23 package.

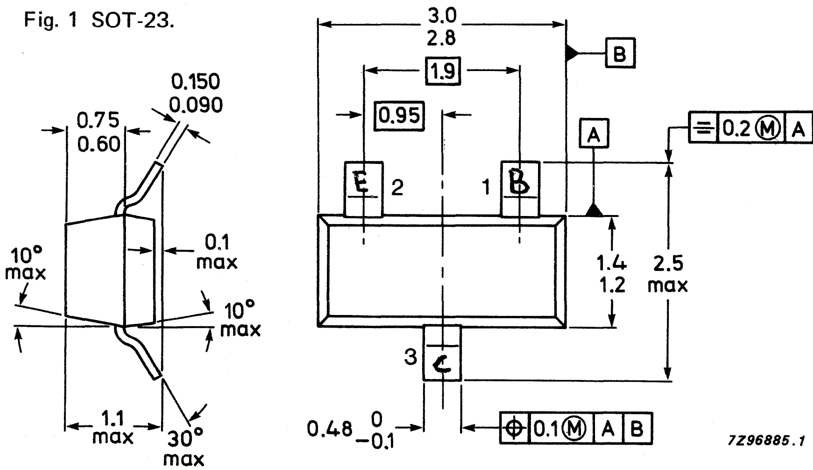
QUICK REFERENCE DATA

			BC846	BC847	BC848	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Collector current (peak value)	I_{CM}	max.	200	200	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	250	250	mW
Junction temperature	T_j	max.	150	150	150	°C
Small-signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	>	125	125	125	
		<	500	900	900	
Transition frequency at f = 100 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	>	100	> 100	> 100	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F	typ.	2	2	2	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



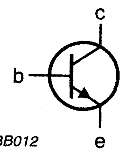
TOP VIEW

Marking code:

BC846 = 1Dp
BC846A = 1Ap
BC846B = 1Bp
BC847 = 1Hp
BC847A = 1Ep
BC847B = 1Fp
BC847C = 1Gp
BC848 = 1Mp
BC848A = 1Jp
BC848B = 1Kp
BC848C = 1Lp

Pinning:

1 = base
2 = emitter
3 = collector



Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC846	BC847	BC848	
Collector-base voltage (open emitter)	V_{CBO}	max.	80	50	30	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	6	5	V

Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Emitter current (peak value)	$-I_{EM}$	max.	200	mA
Base current (peak value)	I_{BM}	max.	200	mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 30$ V	I_{CBO}	<	15	nA
$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	I_{CBO}	<	5	μA
Base-emitter voltage*				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	typ.	660	mV
		580 to	700	mV
$I_C = 10$ mA; $V_{CE} = 5$ V	V_{BE}	<	770	mV
Saturation voltage**				
$I_C = 10$ mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
$I_C = 100$ mA; $I_B = 5$ mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5	pF
Transition frequency at f = 100 MHz				
$I_C = 10$ mA; $V_{CE} = 5$ V	f_T	>	100	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.

** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz

I_C = 2 mA; V_{CE} = 5 V	h_{fe}		110 – 800

Noise figure at R_S = 2 kΩ

I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2 dB
		<	10 dB

DC current gain

			BC846	BC847 BC848	BC846A BC847A BC848A	BC846B BC847B BC848B	BC847C BC848C
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.			90	150	270
		>	110	110	110	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.			180	290	520
		<	450	800	220	450	800

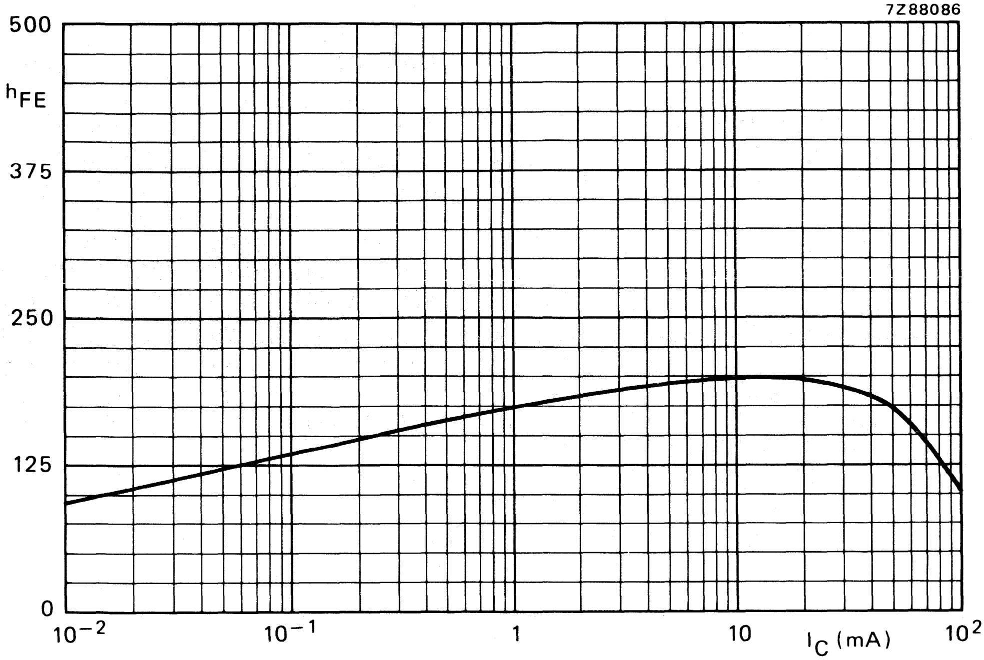


Fig. 2 Typical D.C. current gain for A-selections. V_{CE} = 5 V; T_j = 25 °C.

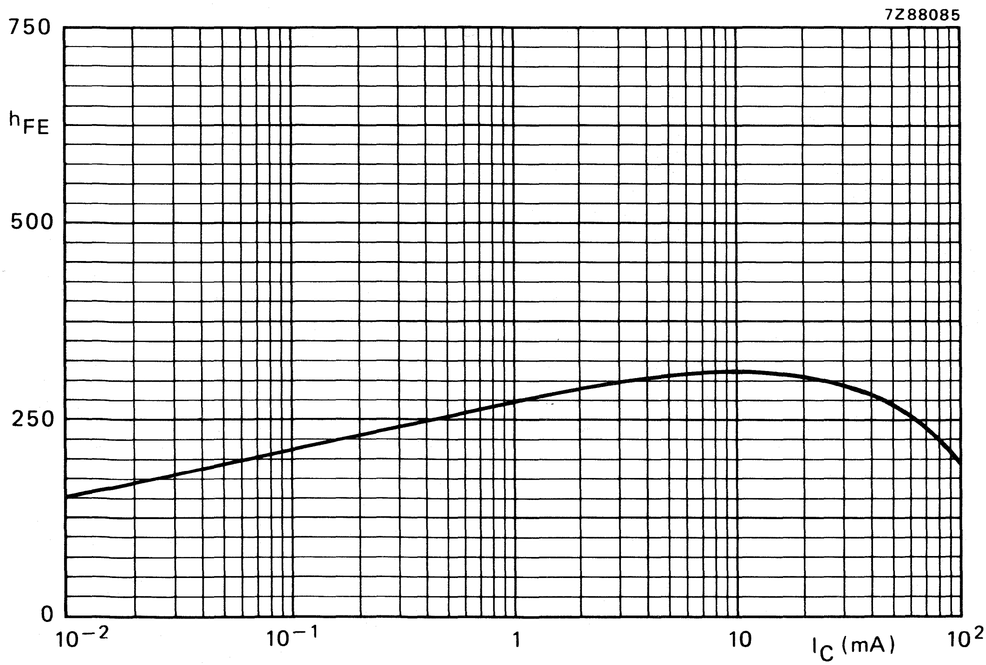


Fig. 3 Typical D.C. current gain for B-selections. V_{CE} = 5 V; T_j = 25 °C.

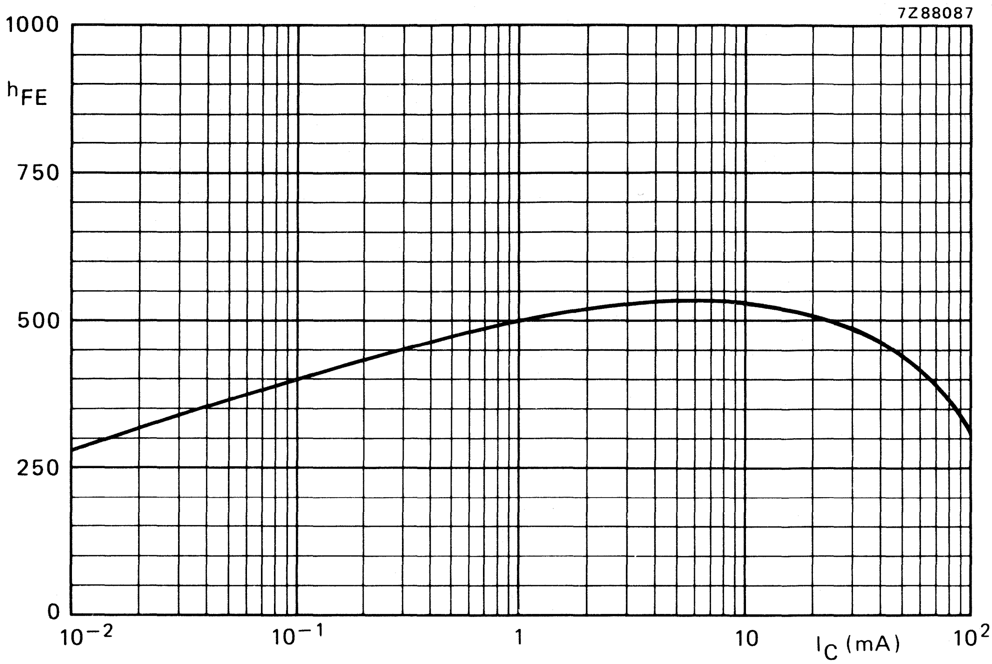


Fig. 4 Typical D.C. current gain for C-selections. V_{CE} = 5 V; T_j = 25 °C.

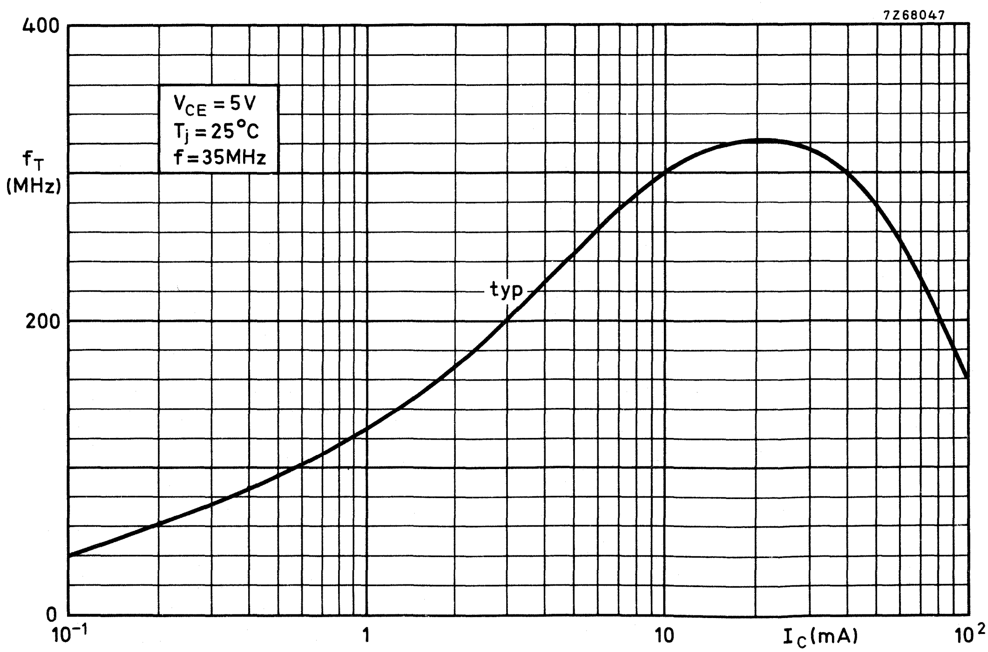


Fig. 5 Typical values transition frequency.

NPN general purpose transistor BC846W; BC847W; BC848W

FEATURES

- S- mini package.

DESCRIPTION

NPN transistor in a plastic SOT323 (SC70) package.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

PIN CONFIGURATION

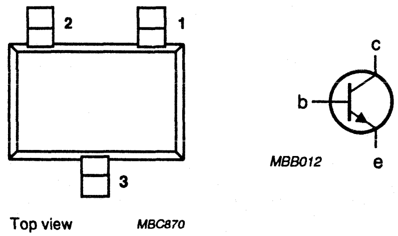


Fig.1 Simplified outline and symbol.

MARKING CODES

BC846W:	1D
BC846AW:	1A
BC846BW:	1B
BC847W:	1H
BC847AW:	1E
BC847BW:	1F
BC847CW:	1G
BC848W:	1M
BC848AW:	1J
BC848BW:	1K
BC848CW:	1L

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC846W		–	80	V
	BC847W		–	50	V
	BC848W		–	30	V
V_{CEO}	collector-emitter voltage	open base			
	BC846W		–	65	V
	BC847W		–	45	V
	BC848W		–	30	V
I_{CM}	peak collector current		–	200	mA
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C	–	200	mW
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C			
	BC846W		110	450	
	BC847W		110	800	
	BC848W		110	800	
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	100	–	MHz

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC846W		–	80	V
	BC847W		–	50	V
	BC848W		–	30	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC846W		–	80	V
	BC847W		–	50	V
	BC848W		–	30	V
V_{CEO}	collector-emitter voltage	open base			
	BC846W		–	65	V
	BC847W		–	45	V
	BC848W		–	30	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	DC collector current		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{EM}	peak emitter current		–	–200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = 30$ V	–	15	nA
		$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	–	5	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	100	nA
V_{BE}	base-emitter voltage	$I_C = 2$ mA; $V_{CE} = 5$ V	580	700	mV
		$I_C = 10$ mA; $V_{CE} = 5$ V	–	770	mV
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	250	mV
		$I_C = 100$ mA; $I_B = 5$ mA (note 1)	–	600	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	3	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; f = 100 MHz	100	–	MHz
F	noise figure	$I_C = 200$ μA; $V_{CE} = 5$ V; $R_S = 2$ kΩ f = 1 kHz; B = 200 Hz	–	10	dB
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 5$ V;			
	BC846W		110	450	
	BC847W; BC848W		110	800	
	BC846AW; BC847AW; BC848AW		110	220	
	BC846BW; BC847BW; BC848BW		200	450	
	BC847CW; BC848CW		420	800	

Note

1. Pulse test : $t_p \leq 300$ μs; $\delta \leq 0.02$

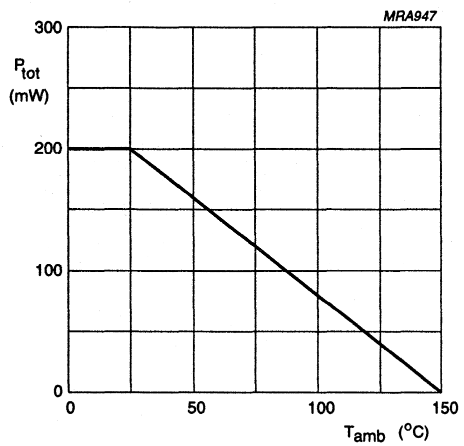


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a plastic SOT-23 package.

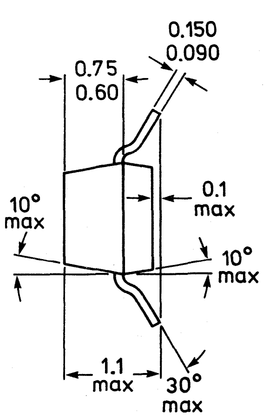
QUICK REFERENCE DATA

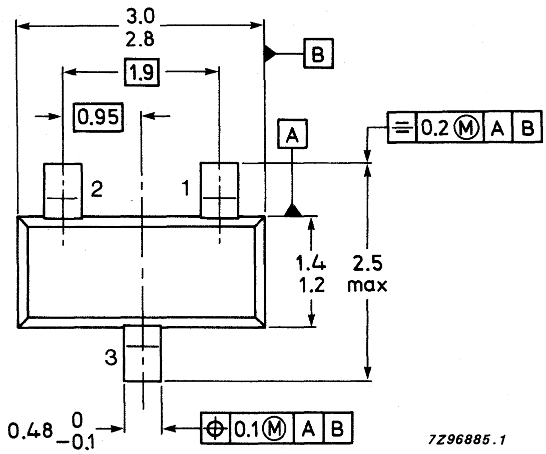
			BC849	BC850	
Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Collector current (peak value)	I_{CM}	max.	200	200	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250	250	mW
Junction temperature	T_j	max.	150	150	^oC
Small-signal current gain $I_C = 2$ mA; $V_{CE} = 5$ V; f = 1 kHz	h_{fe}	> <	240 900	240 900	
Transition frequency $I_C = 10$ mA; $V_{CE} = 5$ V, f = 100 MHz	f_T	>	100	> 100	MHz
Noise figure at $R_S = 2\ k\Omega$ $I_C = 200\ \mu A$; $V_{CE} = 5$ V f = 30 Hz to 15 kHz	F	typ. <	1,4 4	1,4 3	dB dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
f = 10 Hz to 50 Hz (equivalent noise voltage)	V_n	<	–	0,135	μV

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm





TOP VIEW

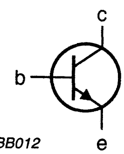
Reverse pinning types are available on request.

Marking code:

BC849 = 2Dp
BC849B = 2Bp
BC849C = 2Cp
BC850 = 2Hp
BC850B = 2Fp
BC850C = 2Gp

Pinning:

1 = base
2 = emitter
3 = collector



MBB012

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC849	BC850	
Collector-base voltage (open emitter)	V_{CBO}	max.	30	50	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Emitter current (peak value)	$-I_{EM}$	max.	200		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15	nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5	μA
Base emitter voltage*				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660	mV
		580 to	700	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770	mV
Saturation voltages**				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 100 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	>	100	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.
** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

			BC849	BC850	
Small signal current gain at f = 1 kHz I_C = 2 mA; V_{CE} = 5 V	h_{fe}	110 – 800			
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 30 Hz to 15 kHz	F	typ.	1,4	1,4	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
		<	4	4	dB
Equivalent noise voltage at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	max.	–	0,135	μV

			BC849B BC850B	BC849C BC850C
D.C. current gain I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	150	270
		>	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.	290	520
		<	450	800

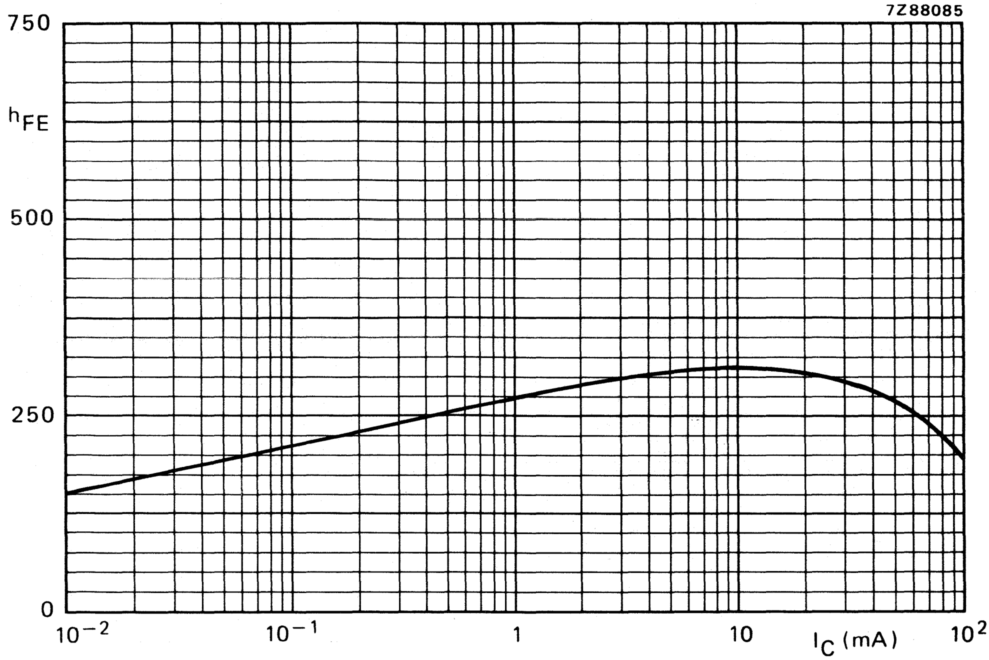


Fig. 2 Typical D.C. current gain B selections. V_{CE} = 5 V; T_j = 25 °C.

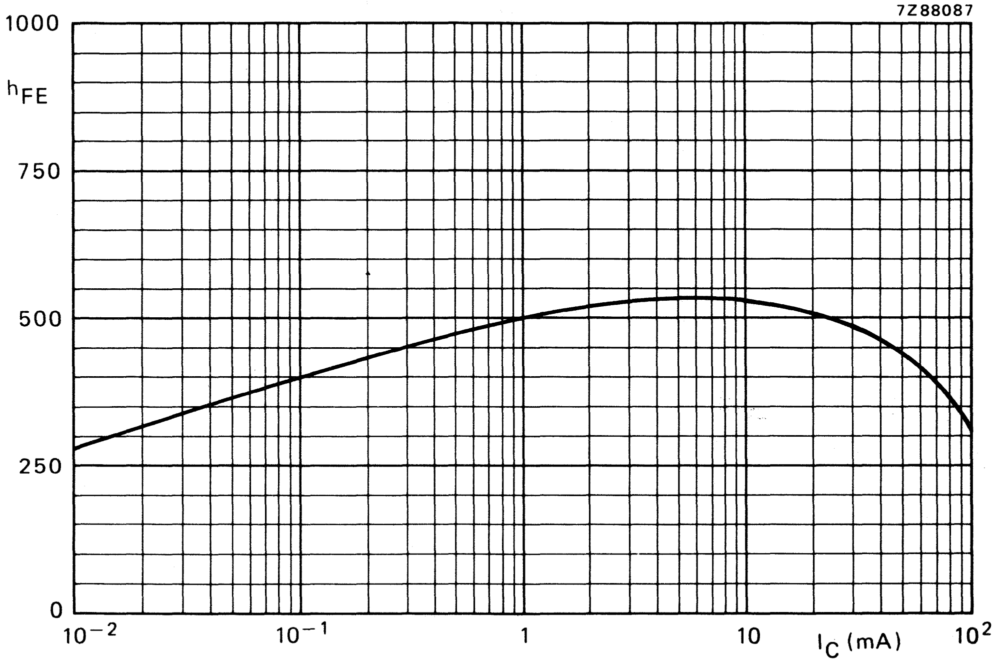


Fig. 3 Typical D.C. current gain C selections. V_{CE} = 5 V; T_j = 25 °C.

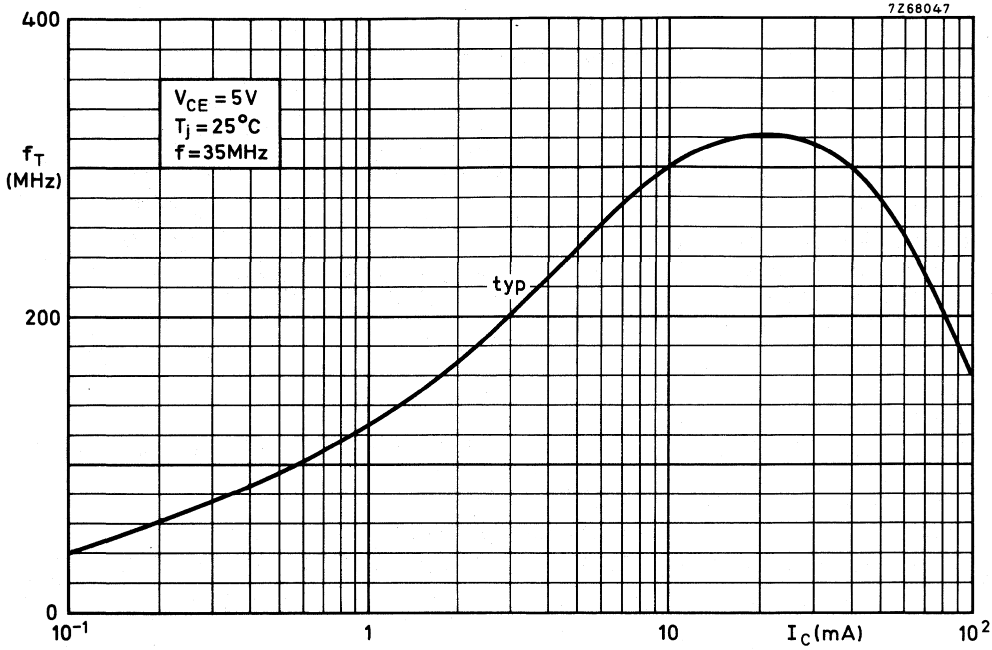

7Z68047
400
200
0
f_T
(MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 4.

NPN general purpose transistor BC849W; BC850W

FEATURES

- S- mini package.
- Low noise

DESCRIPTION

NPN transistor in a plastic SOT323 package, primarily intended for low noise stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

MARKING CODES

BC849W:	2D
BC849BW:	2B
BC849CW:	2C
BC850W:	2H
BC850BW:	2F
BC850CW:	2G

PIN CONFIGURATION

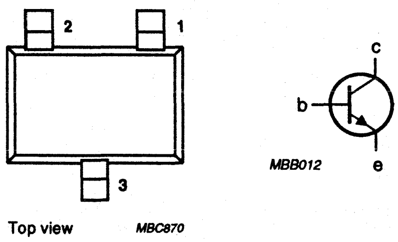


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC849W		–	30	V
	BC850W		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC849W		–	30	V
	BC850W		–	45	V
I_{CM}	peak collector current		–	200	mA
P_{tot}	total power dissipation	up to $T_{amb} = 25$ °C	–	200	mW
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	200	800	
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	100	–	MHz
F	noise figure	$I_C = 200$ μA; $V_{CE} = 5$ V; $R_S = 2$ kΩ; f = 1 kHz; B = 200 Hz	–	4	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC849W		–	30	V
	BC850W		–	50	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$			
	BC849W		–	30	V
	BC850W		–	50	V
V_{CEO}	collector-emitter voltage	open base			
	BC849W		–	30	V
	BC850W		–	45	V
V_{EBO}	emitter-base voltage	open collector	–	5	V
I_C	DC collector current		–	100	mA
I_{CM}	peak collector current		–	200	mA
I_{EM}	peak emitter current		–	–200	mA
I_{BM}	peak base current		–	200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = 30$ V	–	15	nA
		$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	–	5	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	–	100	nA
V_{BE}	base-emitter voltage	$I_C = 2$ mA; $V_{CE} = 5$ V	580	700	mV
		$I_C = 10$ mA; $V_{CE} = 5$ V	–	770	mV
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = 10$ mA; $I_B = 0.5$ mA	–	250	mV
		$I_C = 100$ mA; $I_B = 5$ mA (note 1)	–	600	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	3	pF
f_T	transition frequency	$I_C = 10$ mA; $V_{CE} = 5$ V; f = 100 MHz	100	–	MHz
F	noise figure	$I_C = 200$ µA; $V_{CE} = 5$ V; $R_S = 2$ kΩ			
	BC849W	f = 30 Hz to 15 kHz	–	4	dB
	BC850W		–	3	dB
	BC849W	f = 1 kHz; B = 200 Hz	–	4	dB
	BC850W		–	4	dB
h_{FE}	DC current gain	$I_C = 2$ mA; $V_{CE} = 5$ V			
	BC849W; BC850W		200	800	
	BC849BW; BC850BW		200	450	
	BC849CW; BC850CW		420	800	

Note

1. Pulse test : $t_p \leq 300$ µs; $\delta \leq 0.02$.

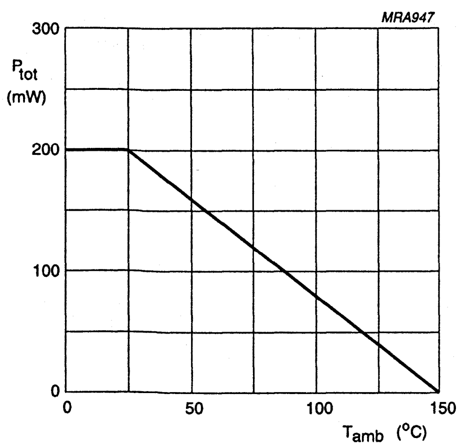


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistros, in a SOT-23 plastic package.

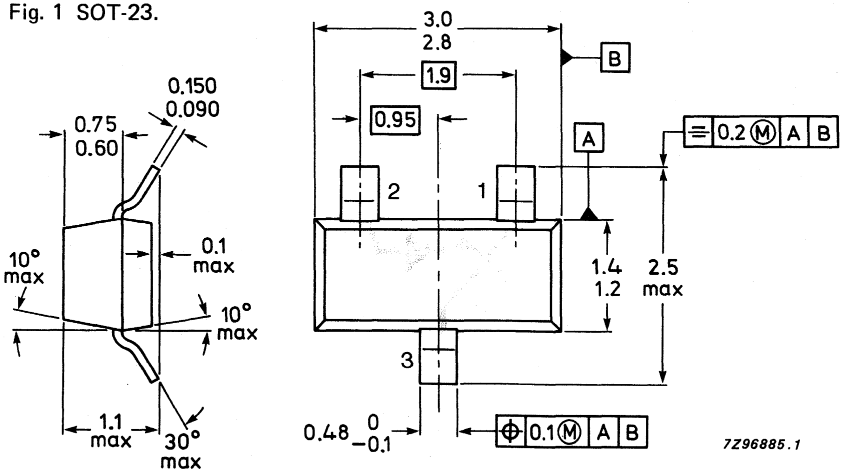
QUICK REFERENCE DATA

			BC856	BC857	BC858	
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.		250		mW
Junction temperature	T_j	max.		150		°C
Small-signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}			75 to 900		
Transition frequency at f = 100 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	>		100		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



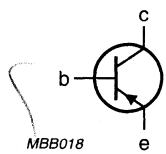
TOP VIEW

Marking code:

BC856 = 3Dp
BC856A = 3Ap
BC856B = 3Bp
BC857 = 3Hp
BC857A = 3Ep
BC857B = 3Fp
BC857C = 3Gp
BC858 = 3Mp
BC858A = 3Jp
BC858B = 3Kp
BC858C = 3Lp

Pinning:

1 = base
2 = emitter
3 = collector



Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC856	BC857	BC858	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	50	30	V
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		100		mA
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Emitter current (peak value)	I_{EM}	max.		200		mA
Base current (peak value)	$-I_{BM}$	max.		200		mA
Total power dissipation ** up to T_{amb} = 60 °C	P_{tot}	max.		250		mW
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL CHARACTERISTICS*

$T_j = Px\ (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\ j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\ s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 30 V; T_j 25 °C	$-I_{CBO}$	typ.	1	nA
		<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA
Base-emitter voltage▲				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
			600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Saturation voltages *

$-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	typ.	75 mV
		<	300 mV
	$-V_{BEsat}$	typ.	700 mV
$-I_C = 100$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	typ.	250 mV
		<	650 mV
	$-V_{BEsat}$	typ.	850 mV

Knee voltage

$-I_C = 10$ mA; $-I_B$ = value for which $-I_C = 11$ mA at $-V_{CE} = 1$ V	$-V_{CEK}$	typ.	250 mV
		<	600 mV

Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	4,5 pF
Transition frequency at f = 100 MHz $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	>	100 MHz
Small-signal current gain at f = 1 kHz $-I_C = 2$ mA; $-V_{CE} = 5$ V	h_{fe}		125 to 800
Noise figure at $R_S = 2$ kΩ $-I_C = 200$ μA; $-V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	typ.	2 dB
		<	10 dB

D.C. current gain

$-I_C = 2$ mA; $-V_{CE} = 5$ V	BC856/857 BC858	h_{FE}	125 to 800
	BC856A/857A/858A	h_{FE}	125 to 250
	BC856B/857B/858B	h_{FE}	220 to 475
	BC857C/858C	h_{FE}	420 to 800

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

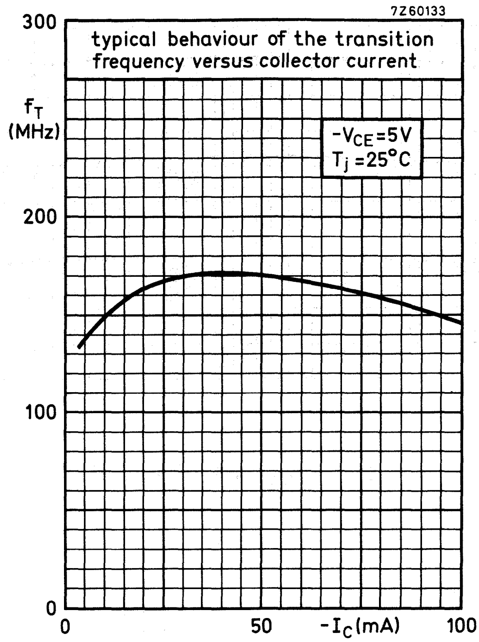


Fig. 2 Typical values. f = 35 MHz.

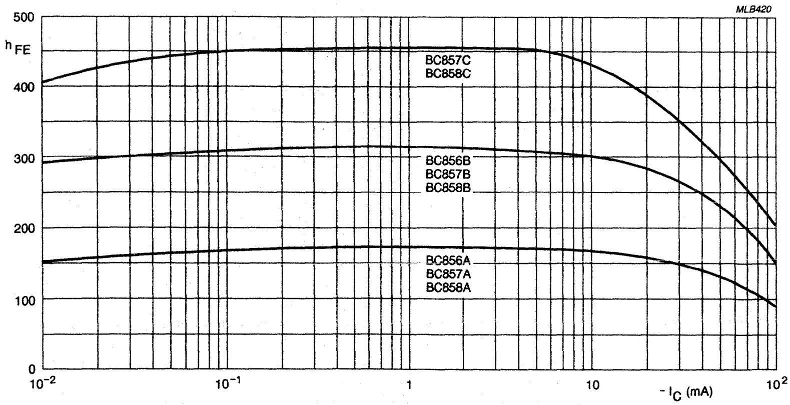


Fig. 3 $-V_{CE} = 5$ V; $T_j = 25$ °C.

PNP general purpose transistor

BC856W; BC857W; BC858W

FEATURES

- S- mini package.

DESCRIPTION

PNP transistor in a plastic SOT323 (SC70) package.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

PIN CONFIGURATION

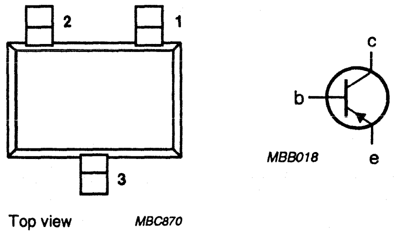


Fig.1 Simplified outline and symbol.

MARKING CODES

BC856W:	3D
BC856AW:	3A
BC856BW:	3B
BC857W:	3H
BC857AW:	3E
BC857BW:	3F
BC857CW:	3G
BC858W:	3M
BC858AW:	3J
BC858BW:	3K
BC858CW:	3L

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEX}	collector-emitter voltage	V_{BE} = 1 V			
	BC856W		–	−80	V
	BC857W		–	−50	V
	BC858W		–	−30	V
V_{CEO}	collector-emitter voltage	open base			
	BC856W		–	−65	V
	BC857W		–	−45	V
	BC858W		–	−30	V
I_{CM}	peak collector current		–	−200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
h_{FE}	DC current gain	I_C = −2 mA; V_{CE} = −5 V; T_{amb} = 25 °C	125	800	
f_T	transition frequency	I_C = −10 mA; V_{CE} = −5 V; T_{amb} = 25 °C	100	–	MHz

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC856W		–	–80	V
	BC857W		–	–50	V
	BC858W		–	–30	V
V_{CEX}	collector-emitter voltage	V_{BE} = 1 V			
	BC856W		–	–80	V
	BC857W		–	–50	V
	BC858W		–	–30	V
V_{CEO}	collector-emitter voltage	open base			
	BC856W		–	–65	V
	BC857W		–	–45	V
	BC858W		–	–30	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{EM}	peak emitter current		–	200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = -30$ V	–	−15	nA
		$I_E = 0$; $V_{CB} = -30$ V; $T_j = 150$ °C	–	−4	µA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	−500	nA
V_{BE}	base-emitter voltage	$I_C = -2$ mA; $V_{CE} = -5$ V	−600	−750	mV
		$I_C = -10$ mA; $V_{CE} = -5$ V	–	−820	mV
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	−300	mV
		$I_C = -100$ mA; $I_B = -5$ mA (note 1)	–	−650	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = -10$ V f = 1 MHz	–	5	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 100 MHz	100	–	MHz
F	noise figure	$I_C = -200$ µA; $V_{CE} = -5$ V; $R_S = 2$ kΩ; f = 1 kHz; B = 200 Hz	–	10	dB
h_{FE}	DC current gain	$I_C = -2$ mA; $V_{CE} = -5$ V;			
	BC856W; BC857W; BC858W		125	800	
	BC856AW; BC857AW; BC858AW		125	250	
	BC856BW; BC857BW; BC858BW		220	475	
	BC856CW; BC857CW; BC858CW		420	800	

Note

1. Pulse test : $t_p \leq 300$ µs; $\delta \leq 0.02$

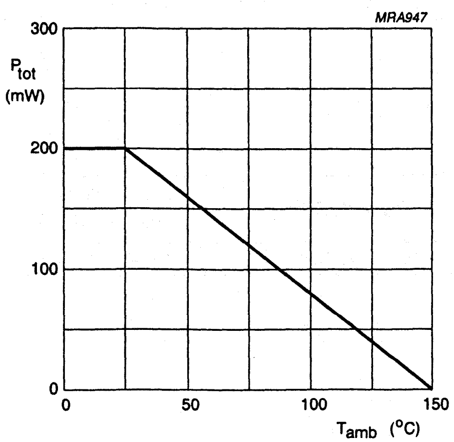


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in a plastic SOT-23 package primarily intended for low-noise input stages in tape recorders, hi-fi amplifiers and other audio frequency equipment in thick and thin-film hybrid circuits.

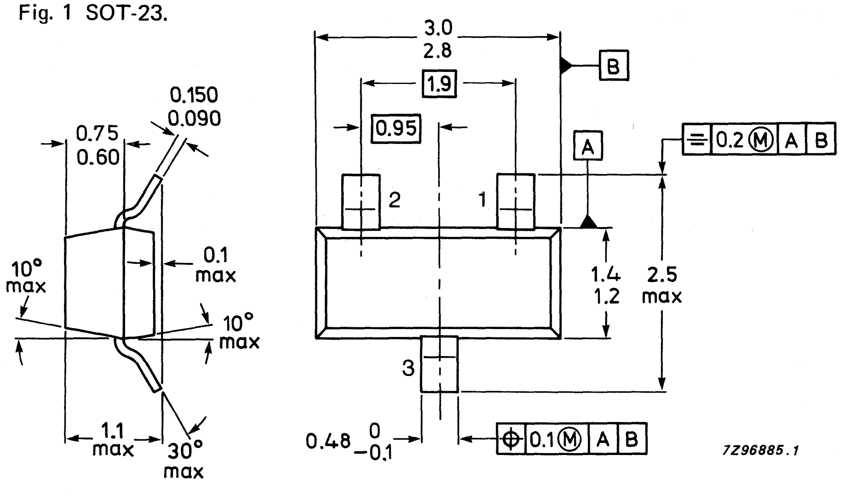
QUICK REFERENCE DATA

			BC859	BC860	
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	200	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	250	250	mW
Junction temperature	T_j	max.	150	150	°C
Small-signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}	>	125	125	
		<	900	900	
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 100 MHz	f_T	>	100	100	MHz
Noise figure at R_s = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 30 Hz to 15 kHz	F	typ.	1,2	1	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	<	4	4	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

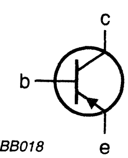


Marking code:

BC859 = 4Dp
BC859A = 4Ap
BC859B = 4Bp
BC859C = 4Cp
BC860 = 4Hp
BC860A = 4Ep
BC860B = 4Fp
BC860C = 4Gp

Pinning:

1 = base
2 = emitter
3 = collector



See also *Soldering recommendations.* Reverse pinning types are available on request.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BC859	BC860	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	50	V
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V

Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Emitter current (peak value)	I_{EM}	max.	200	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to T_{amb} = 60 °C**	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		–65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL CHARACTERISTICS*

$T_j = P x (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\ j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\ s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $-V_{CB}$ = 30 V; T_j = 25 °C	$-I_{CBO}$	typ.	1	nA
		<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA

Base-emitter voltage▲

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
			600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

* See *Thermal characteristics.*

** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Saturation voltages*					
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75		mV
		<	300		mV
	$-V_{BEsat}$	typ.	700		mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250		mV
		<	650		mV
	$-V_{BEsat}$	typ.	850		mV
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	4,5		pF
Transition frequency at f = 100 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	>	100		MHz
Small-signal current gain at f = 1 kHz					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{fe}		125 to 800		
Noise figure at R_S = 2 kΩ					
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V			BC859	BC860	
f = 30 Hz to 15 kHz	F	typ.	1,2	1	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1	1	dB
		<	4	4	dB
Equivalent noise voltage at R_S = 2 kΩ					
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	<	–	0,11	μV
D.C. current gain					
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; total range	h_{FE}		125 to 800		
A selections	h_{FE}		125 to 250		
B selections	h_{FE}		220 to 475		
C selections	h_{FE}		420 to 800		

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

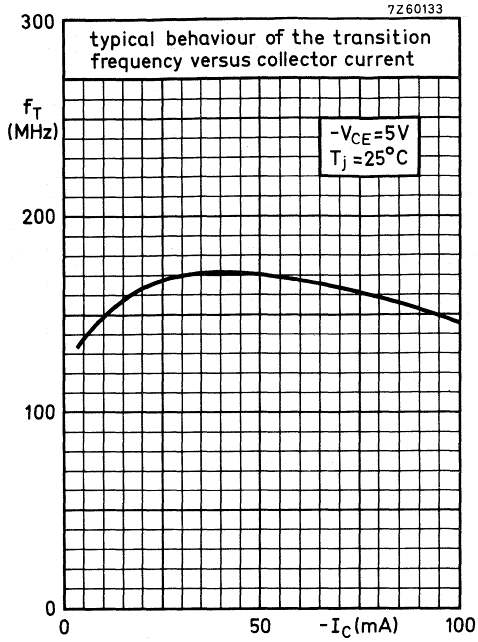


Fig. 2 Typical values; f = 35 MHz.

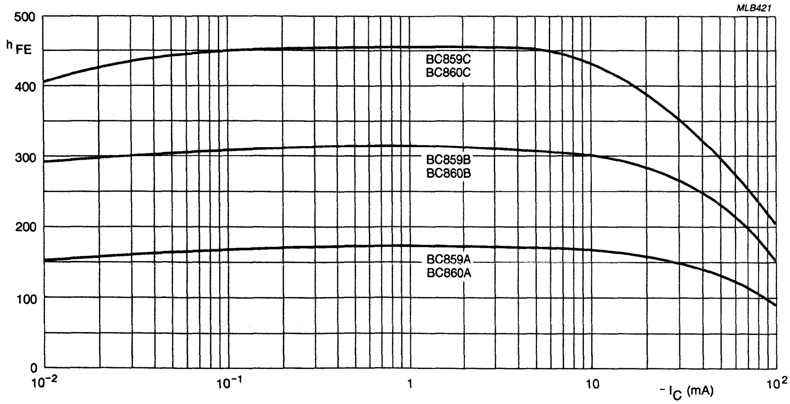


Fig. 3 $-V_{CE} = 5$ V; $T_j = 25$ °C.

PNP general purpose transistor BC859W; BC860W

FEATURES

- S- mini package.
- Low noise

DESCRIPTION

PNP transistor in a plastic SOT323 package, primarily intended for low noise stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment.

PINNING - SOT323

PIN	DESCRIPTION
1	base
2	emitter
3	collector

MARKING CODES

BC859W:	4D
BC859AW:	4A
BC859BW:	4B
BC859CW:	4C
BC860W:	4H
BC860AW:	4E
BC860BW:	4F
BC860CW:	4G

PIN CONFIGURATION

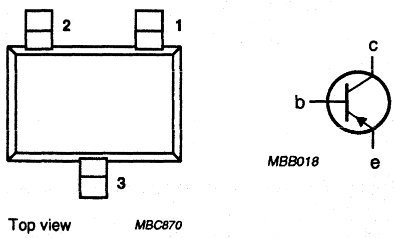


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEX}	collector-emitter voltage	V_{BE} = 1 V			
	BC859W		–	–30	V
	BC860W		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC859W		–	–30	V
	BC860W		–	–45	V
I_{CM}	peak collector current		–	–200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
h_{FE}	DC current gain	I_C = –2 mA; V_{CE} = –5 V; T_{amb} = 25 °C	125	800	
f_T	transition frequency	I_C = –10 mA; V_{CE} = –5 V; T_{amb} = 25 °C	100	–	MHz
F	noise figure	I_C = –200 μA; V_{CE} = –5 V; R_S = 2 kΩ; f = 1 kHz; B = 200 Hz	–	4	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BC859W		–	–30	V
	BC860W		–	–50	V
V_{CEX}	collector-emitter voltage	V_{BE} = 1 V			
	BC859W		–	–30	V
	BC860W		–	–50	V
V_{CEO}	collector-emitter voltage	open base			
	BC859W		–	–30	V
	BC860W		–	–45	V
V_{EBO}	emitter-base voltage	open collector	–	–5	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current		–	–200	mA
I_{EM}	peak emitter current		–	200	mA
I_{BM}	peak base current		–	–200	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1) see Fig.2	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C
T_{amb}	operating ambient temperature	see Fig.2	–65	150	°C

Note

1. Refer to SOT323 standard mounting conditions.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air (note 1)	max. 625 K/W

Note

1. Refer to SOT323 standard mounting conditions.

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector-base cut-off current	$I_E = 0$; $V_{CB} = -30$ V	–	−15	nA
		$I_E = 0$; $V_{CB} = -30$ V; $T_j = 150$ °C	–	−4	μA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = -5$ V	–	−100	nA
V_{BE}	base-emitter voltage	$I_C = -2$ mA; $V_{CE} = -5$ V	600	750	mV
		$I_C = -10$ mA; $V_{CE} = -5$ V	–	820	mV
$V_{CE(sat)}$	collector-emitter saturation voltage	$I_C = -10$ mA; $I_B = -0.5$ mA	–	−300	mV
		$I_C = -100$ mA; $I_B = -5$ mA (note 1)	–	−650	mV
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = -10$ V; f = 1 MHz	–	5	pF
f_T	transition frequency	$I_C = -10$ mA; $V_{CE} = -5$ V; f = 100 MHz	100	–	MHz
F	noise figure	$I_C = -200$ μA; $V_{CE} = -5$ V; $R_S = 2$ kΩ			
	BC859W	f = 30 Hz to 15 kHz	–	4	dB
	BC860W		–	3	dB
	BC859W	f = 1 kHz; B = 200 Hz	–	4	dB
	BC860W		–	4	dB
h_{FE}	DC current gain	$I_C = -2$ mA; $V_{CE} = -5$ V			
	BC859W; BC860W		125	800	
	BC859AW; BC860AW		125	250	
	BC859BW; BC860BW		220	475	
	BC859CW; BC860CW		420	800	

Note

1. Pulse test : $t_p \leq 300$ μs; $\delta \leq 0.02$.

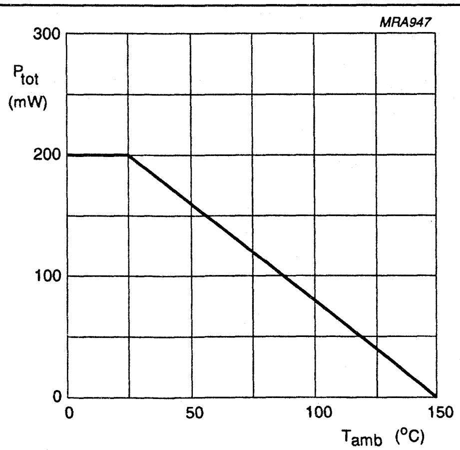


Fig.2 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a microminiature plastic envelope intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

QUICK REFERENCE DATA

Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (peak value)	I_{CM}	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60	MHz

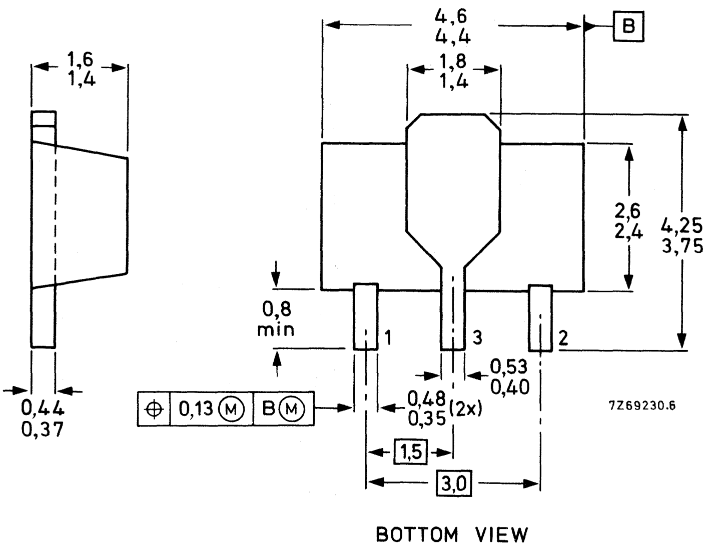
MECHANICAL DATA

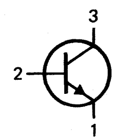
Dimensions in mm

Fig. 1 SOT-89.

Marking code

BC868 = CAC
BC868-10 = CBC
BC868-16 = CCC
BC868-25 = CDC





See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	20 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	1 A
Collector current (peak value)	I_{CM}	max.	2 A
Base current (d.c.)	I_B	max.	100 mA
Base current (peak value)	I_{BM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125 K/W
From junction to tab	$R_{th\ j\text{-}t}$	=	10 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 25 V		I_{CBO}	<	10 μA
I_E = 0; V_{CB} = 25 V; T_j = 150 °C		I_{CBO}	<	1 mA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V		I_{EBO}	<	10 μA
Base-emitter voltage				
I_C = 5 mA; V_{CE} = 10 V		V_{BE}	typ.	0,62 V
I_C = 1 A; V_{CE} = 1 V		V_{BE}	<	1 V
Collector-emitter saturation voltage				
I_C = 1 A; I_B = 100 mA		V_{CEsat}	<	0,5 V
DC current gain				
I_C = 5 mA; V_{CE} = 10 V	BC868	h_{FE}	>	50
I_C = 500 mA; V_{CE} = 1 V	BC868	h_{FE}		85 to 375
	BC868-10	h_{FE}	⩽	160
	BC868-16	h_{FE}		100 to 250
	BC868-25	h_{FE}	⩾	160
I_C = 1 A; V_{CE} = 1 V	BC868	h_{FE}	>	60
Collector capacitance at f = 450 kHz				
I_E = I_e = 0; V_{CB} = 5 V		C_c	typ.	27 pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V		f_T	typ.	60 MHz

* Mounted on a ceramic substrate, area = 2,5 cm^2; thickness = 0,7 mm.

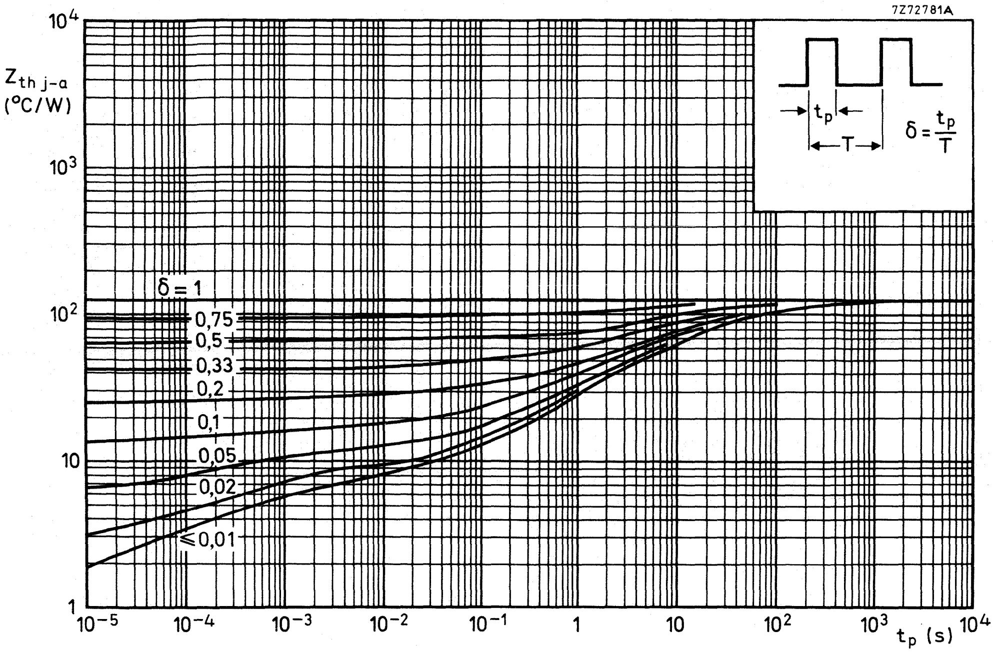


Fig. 2 Pulse power rating chart.

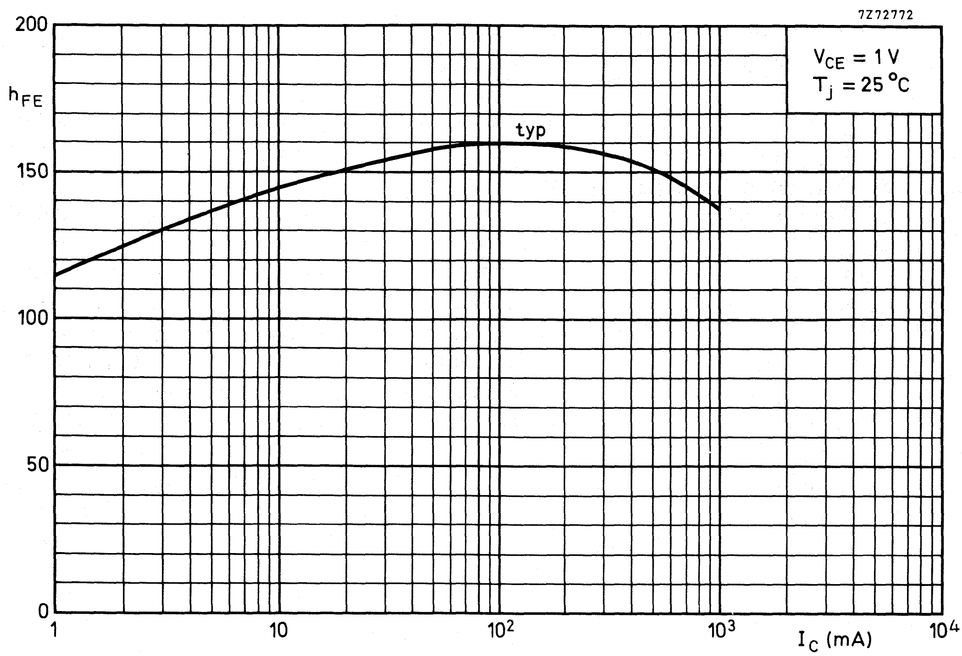


Fig. 3 D.C. current gain.

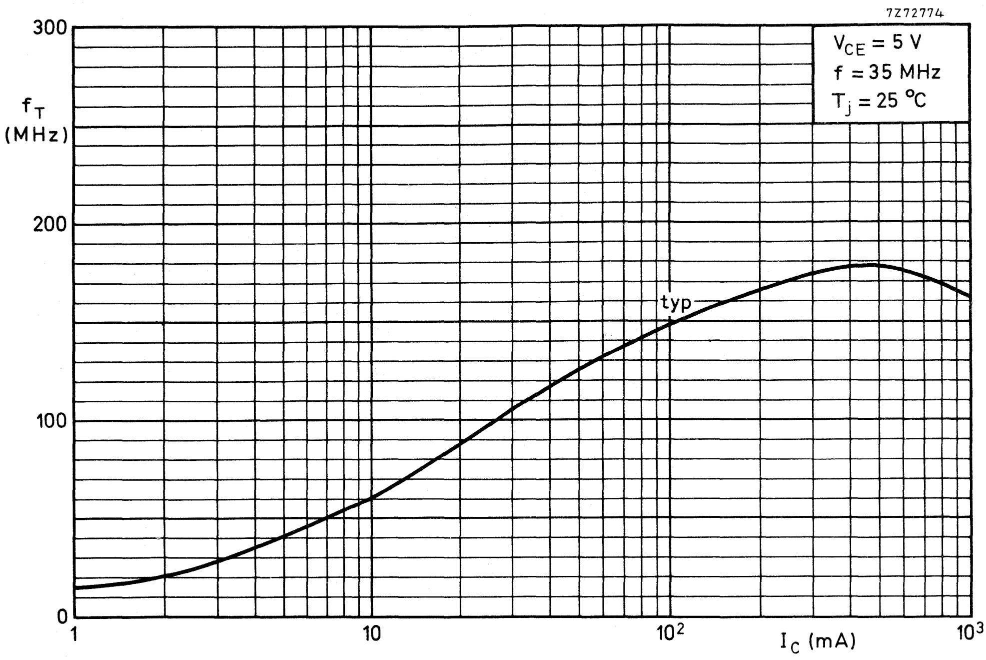


Fig. 4 Typical values transition frequency as a function of collector current.

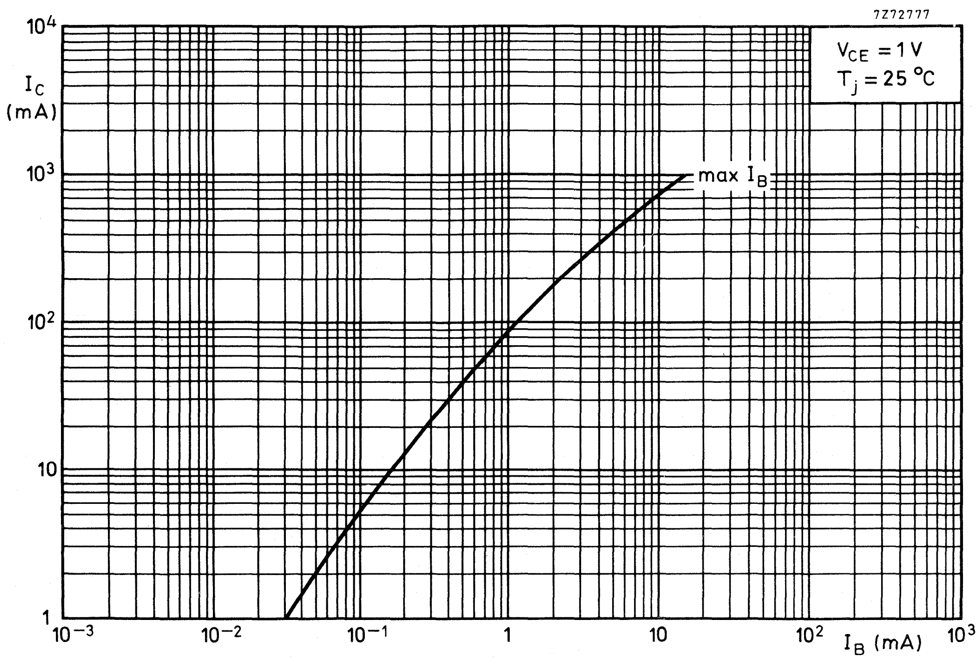


Fig. 5 Typical values collector current as a function of maximum base current.

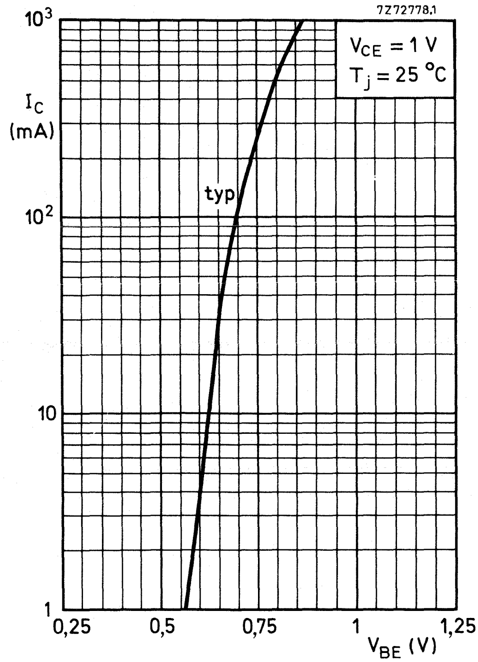


Fig. 6 Typical values collector current as a function of base-emitter voltage.

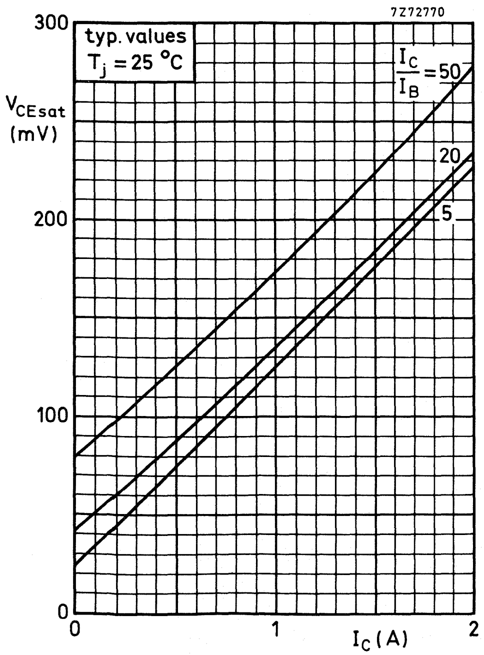


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

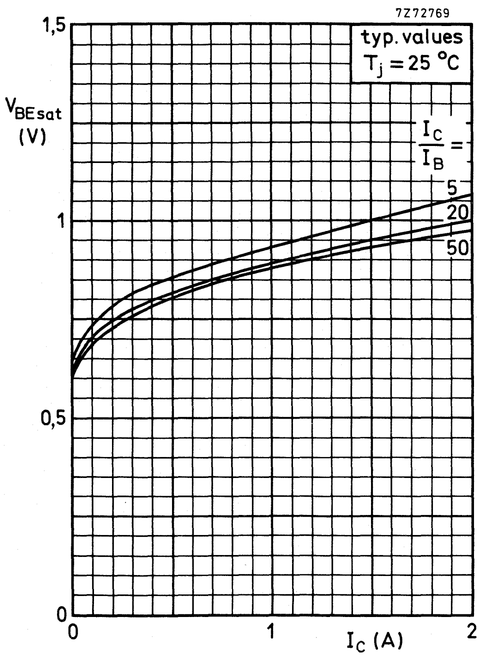


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic microminiature envelope, intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current (peak value)	$-I_{CM}$	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	150	°C
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60	MHz

MECHANICAL DATA

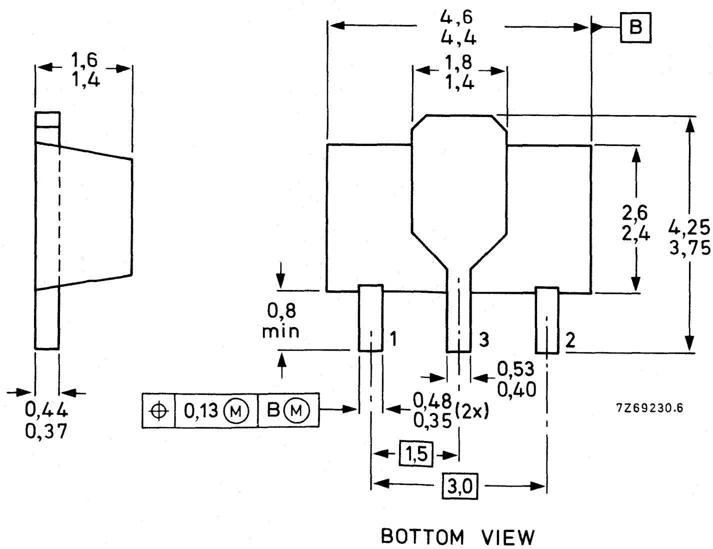
Dimensions in mm

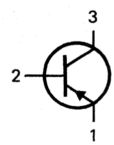
Fig. 1 SOT-89.

Marking code

BC869 = CEC

BC869-10 = CFC





See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	1	A
Collector current (peak value)	$-I_{CM}$	max.	2	A
Base current (d.c.)	$-I_B$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1	W
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125	K/W
From junction to tab	$R_{th\ j\text{-}t}$	=	10	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
I_E = 0; $-V_{CB}$ = 25 V		$-I_{CBO}$	<	10	µA
I_E = 0; $-V_{CB}$ = 25 V; T_j = 150 °C		$-I_{CBO}$	<	1	mA
Emitter cut-off current					
I_C = 0; $-V_{EB}$ = 5 V		$-I_{EBO}$	<	10	µA
Base-emitter voltage					
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V		$-V_{BE}$	typ.	0,62	V
$-I_C$ = 1 A; $-V_{CE}$ = 1 V		$-V_{BE}$	<	1	V
Collector-emitter saturation voltage					
$-I_C$ = 1 A; $-I_B$ = 100 mA		$-V_{CEsat}$	<	0,5	V
D.C. current gain					
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	BC869	h_{FE}	>	50	
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	BC869	h_{FE}		85 to 375	
	BC869-10	h_{FE}	⩽	160	
	BC869-16	h_{FE}		100 to 250	
	BC869-25	h_{FE}	⩾	160	
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	BC869	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
$I_E = I_e$ = 0; $-V_{CB}$ = 5 V		C_c	typ.	45	pF
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V		f_T	typ.	60	MHz

* Mounted on a ceramic substrate, area = 2,5 cm²; thickness = 0,7 mm.

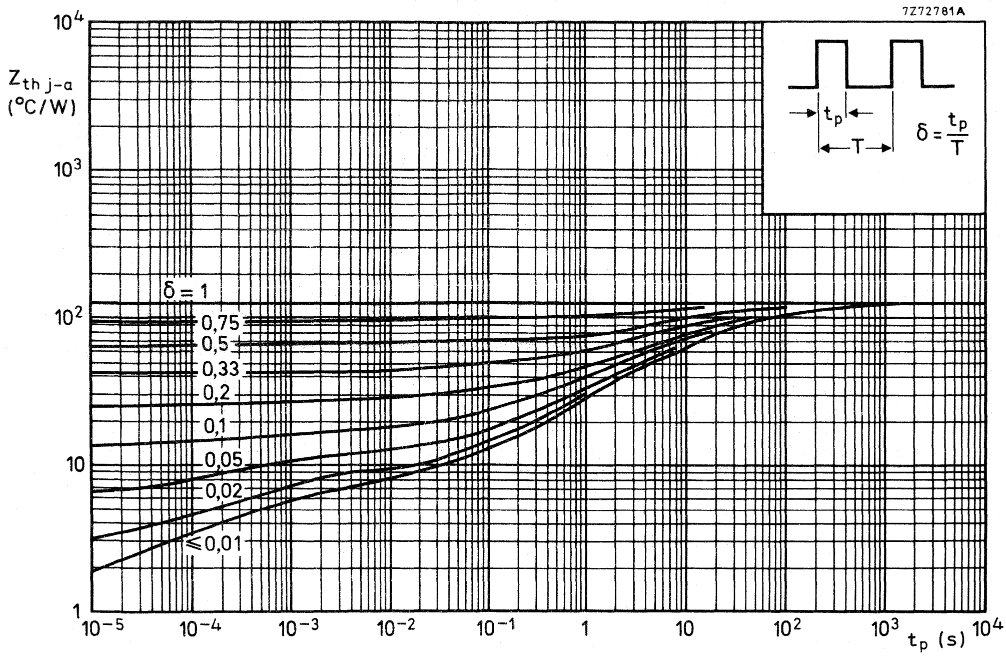


Fig. 2 Pulse power rating chart.

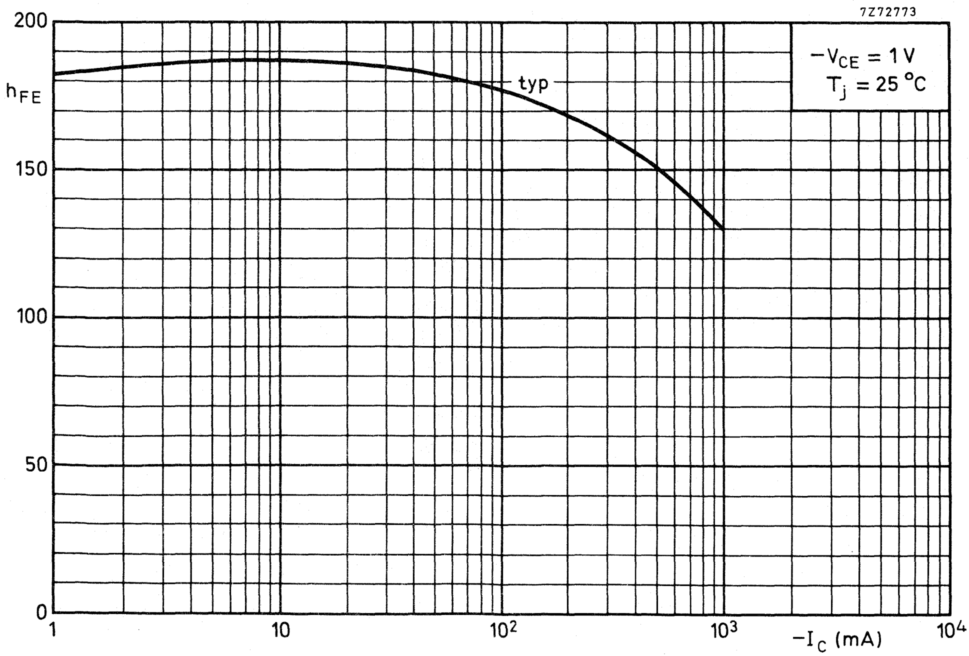


Fig. 3 D.C. current gain.

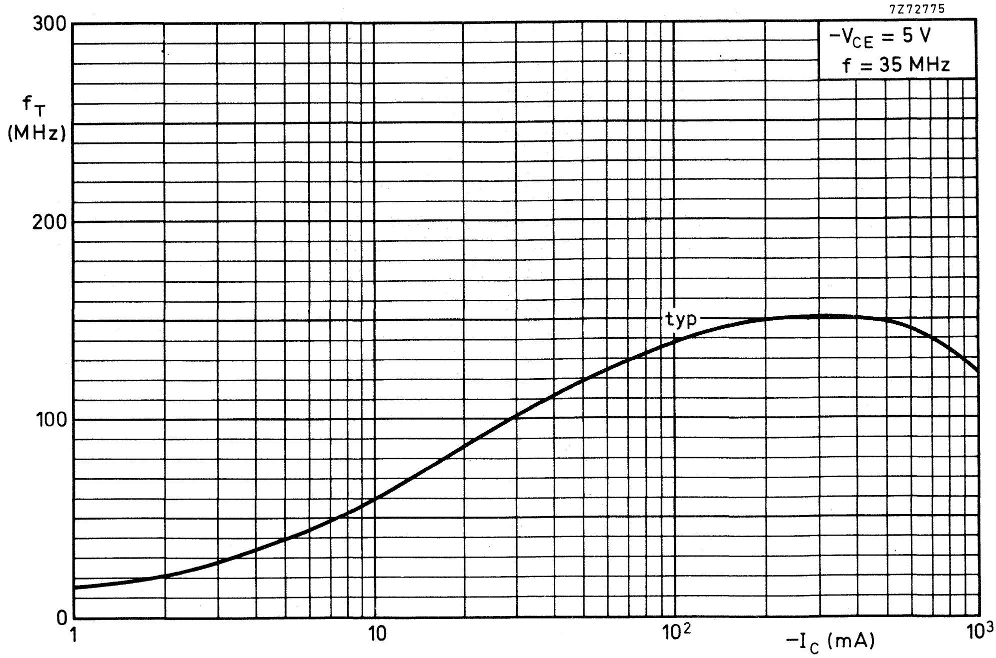


Fig. 4 Typical values transition frequency as a function of collector current.

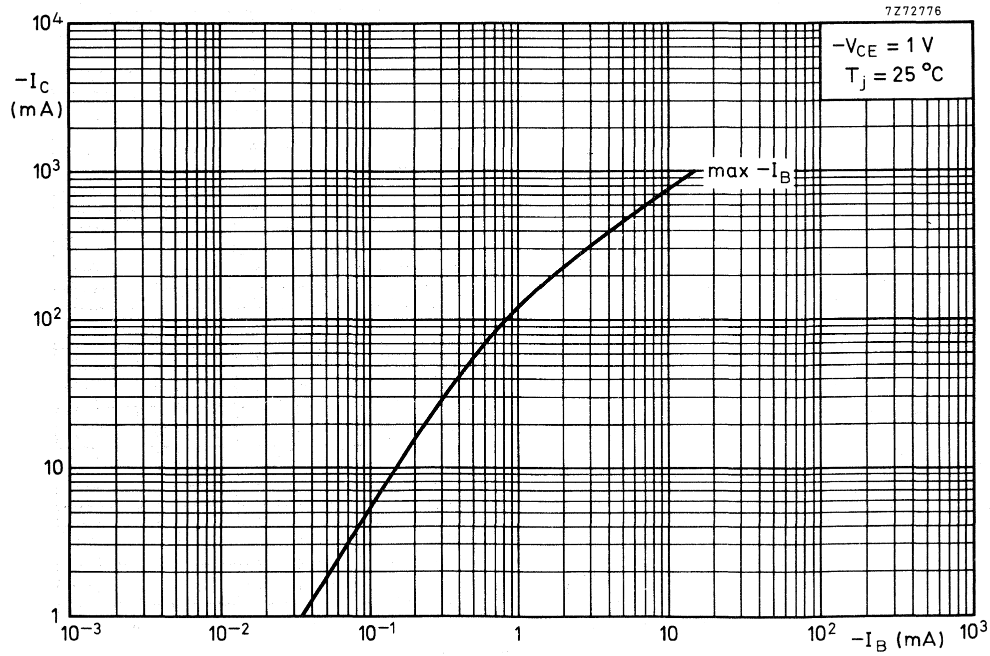


Fig. 5 Typical values collector current as a function of maximum base current.

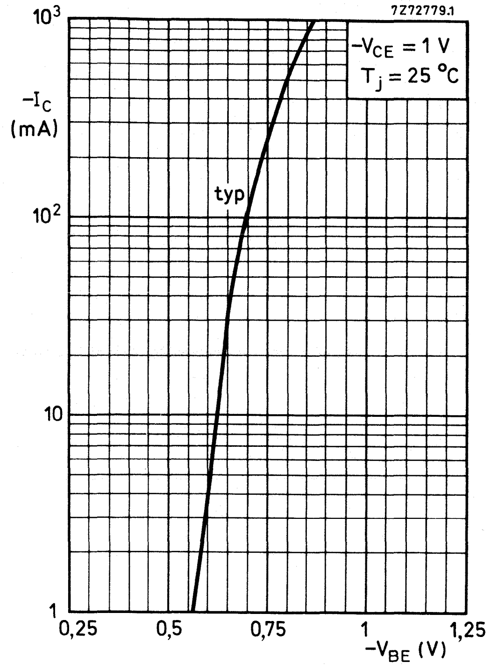


Fig. 6 Typical values collector current as a function of base-emitter voltage.

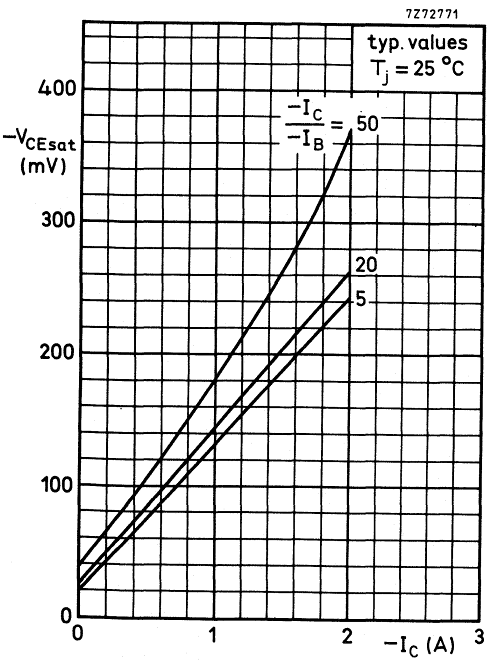


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

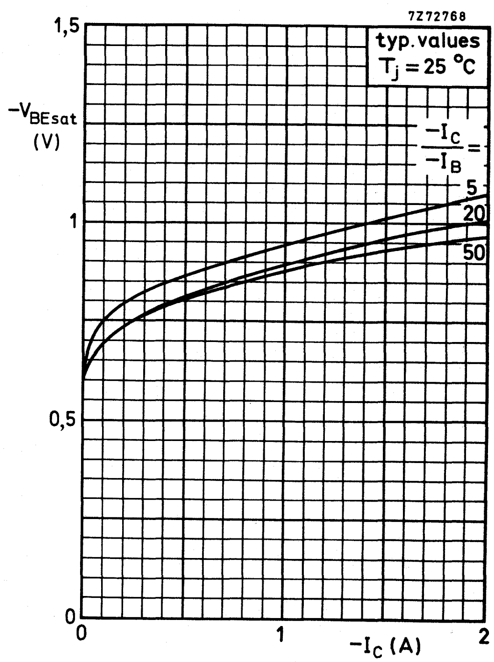


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCF29	BCF30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

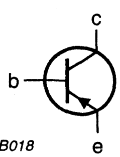
MECHANICAL DATA

Dimensions in mm

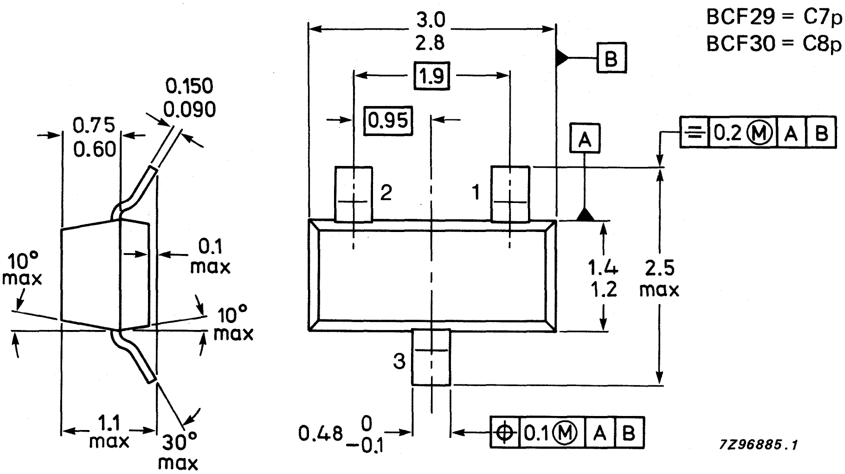
Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector



MBB018



7Z96885.1

TOP VIEW

Marking code

BCF29 = C7p
BCF30 = C8p

Reverse pinning types are available on request.
See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C = 2$ mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 32$ V	$-I_{CBO}$	<	100 nA
$I_E = 0$; $-V_{CB} = 32$ V; $T_j = 100\ ^oC$	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C = 50$ mV; $-I_B = 2{,}5$ mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain

			BCF29	BCF30	
$-I_C = 10\ \mu A$; $-V_{CE} = 5$ V	h_{FE}	typ.	90	150	
$-I_C = 2$ mA; $-V_{CE} = 5$ V	h_{FE}	>	120	215	
		<	260	500	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	150		MHz
Noise figure at $R_S = 2\ k\Omega$ $-I_C = 200\ \mu A$; $-V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	<	4		dB
		typ.	1		dB

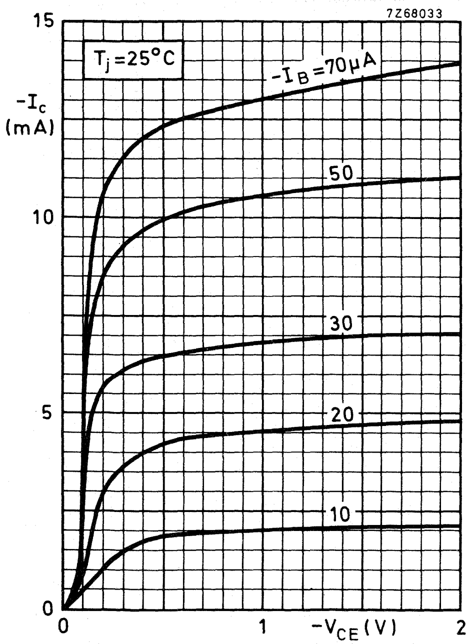


Fig. 2

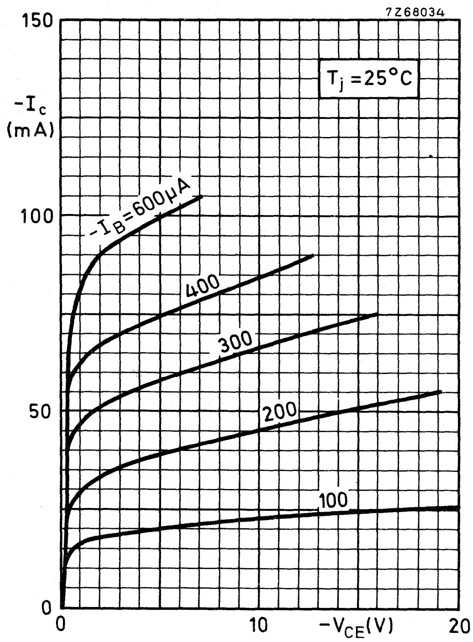


Fig. 3

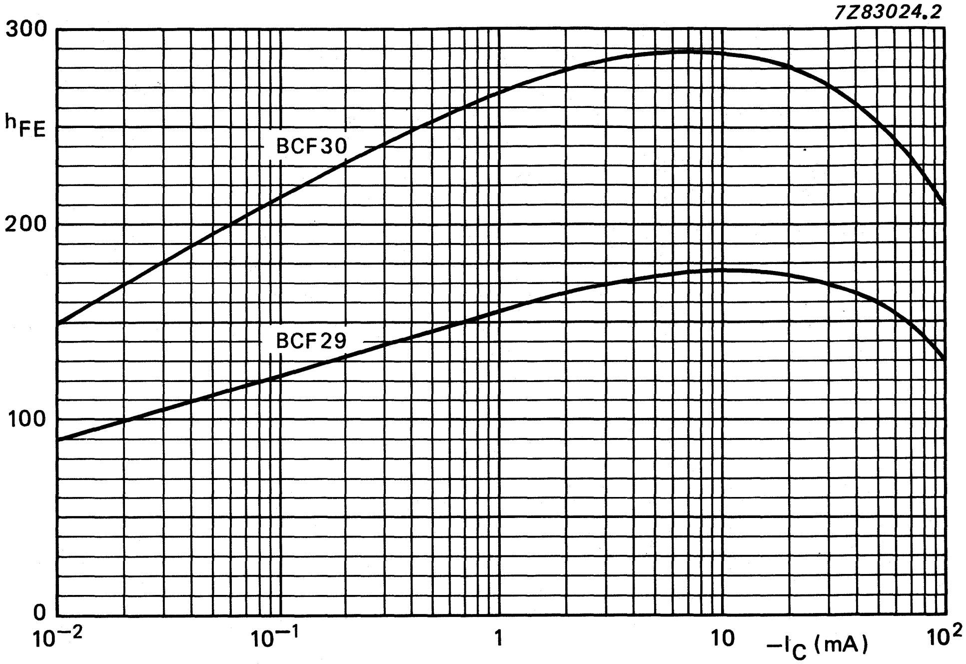


Fig. 4 Typical values of d.c. current gain. $-V_{CE} = 5$ V; $T_j = 25$ °C.

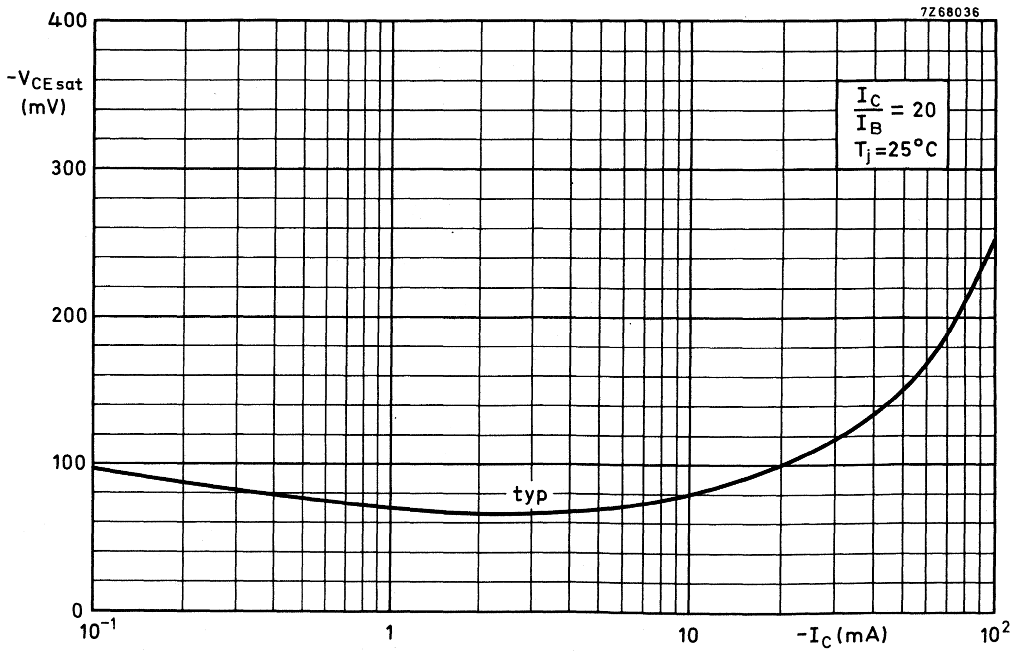


Fig. 5

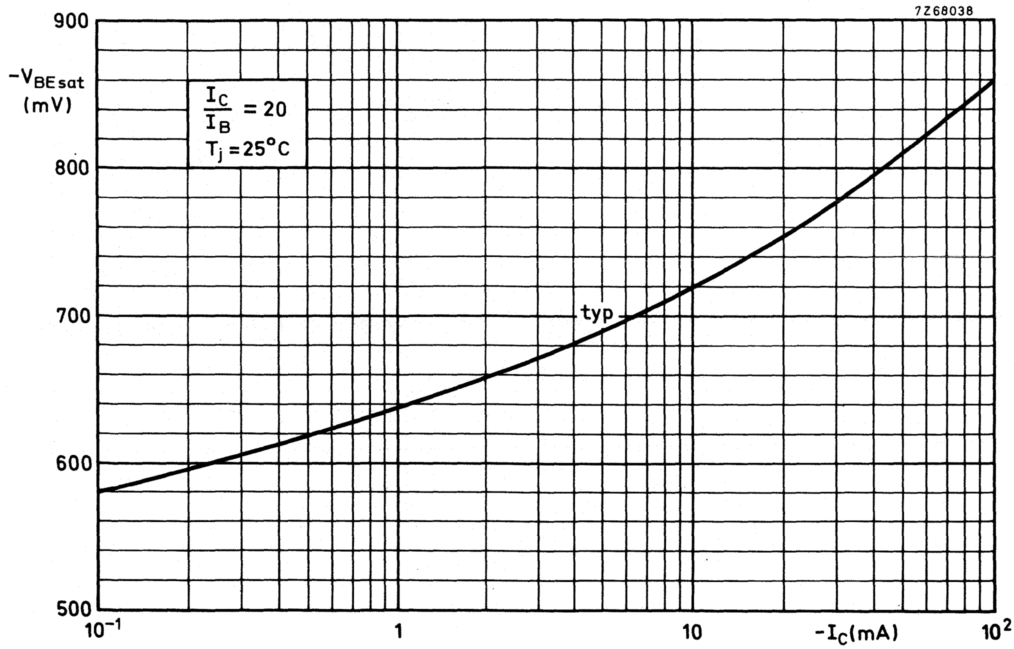

7Z68038
900
$-V_{BEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
800
typ
700
600
500
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

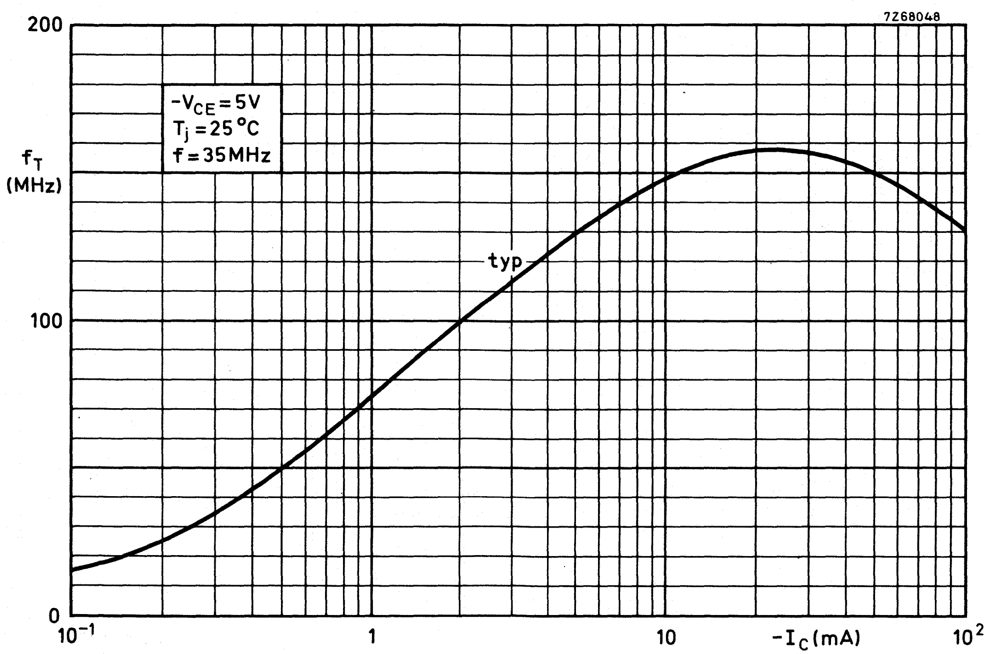

7Z68048
200
$-V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
f_T
(MHz)
typ
100
0
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

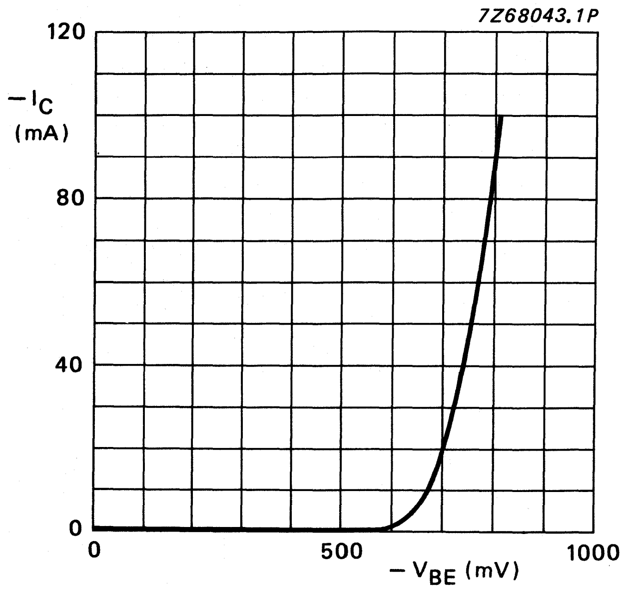


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

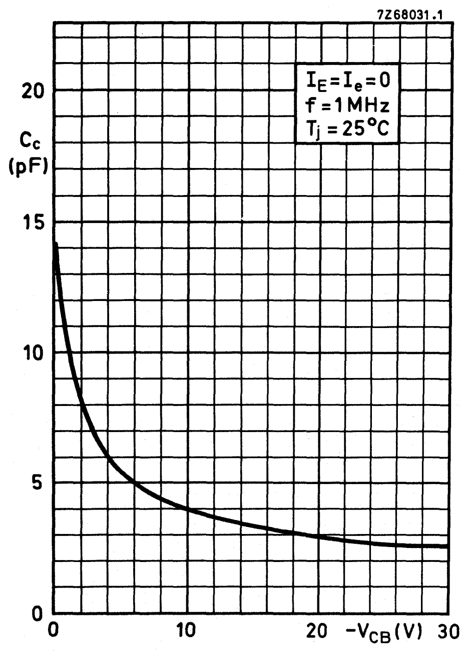


Fig. 9

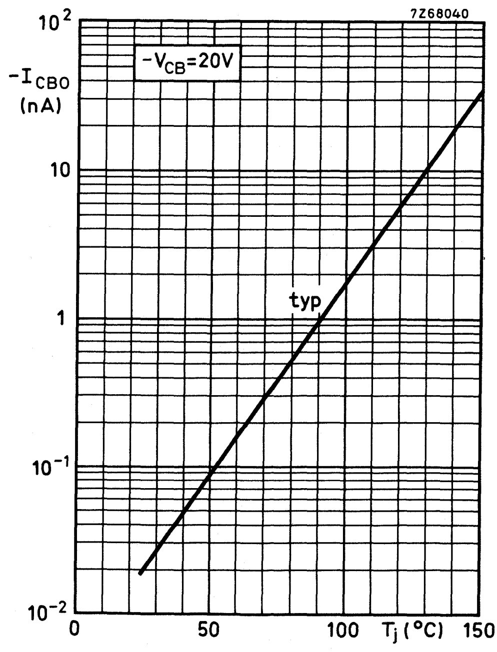


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCF32	BCF33	
D.C. current gain at T_j = 25 °C; I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	200	420	
		<	450	800	
Collector-base voltage (open emitter)	V_{CBO}	max.	32		V
Collector-emitter voltage (open base)	V_{CEO}	max.	32		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz; I_C = 2 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ; I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

MECHANICAL DATA

Fig. 1 SOT-23.

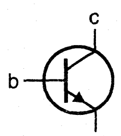
Dimensions in mm

Marking code

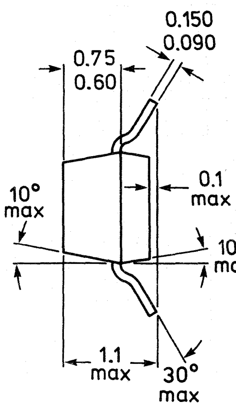
BCF32 = D7p
BCF33 = D8p

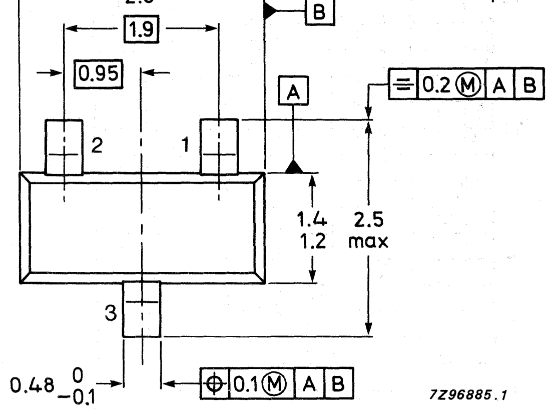
Pinning:

1 = base
2 = emitter
3 = collector



MBB012





7Z96885.1

TOP VIEW

Reverse pinning types are available on request.
See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	32	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipatation up to $T_{amb} = 25$ °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	–65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 32$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 32$ V; $T_j = 100$ °C	I_{CBO}	<	10	μA
Base-emitter voltage				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	550 to 700		mV
Saturation voltages				
$I_C = 10$ mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCF32	BCF33
D.C. current gain				
$I_C = 10\ \mu A$; $V_{CE} = 5\ V$	h_{FE}	typ.	150	270
		>	200	420
$I_C = 2\ mA$; $V_{CE} = 5\ V$	h_{FE}	<	450	800
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10\ V$	C_c	typ.	2,5 pF	
Transition frequency at f = 35 MHz $I_C = 10\ mA$; $V_{CE} = 5\ V$	f_T	typ.	300 MHz	
Noise figure at $R_S = 2\ k\Omega$ $I_C = 200\ \mu A$; $V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	<	4 dB	
		typ.	1,2 dB	

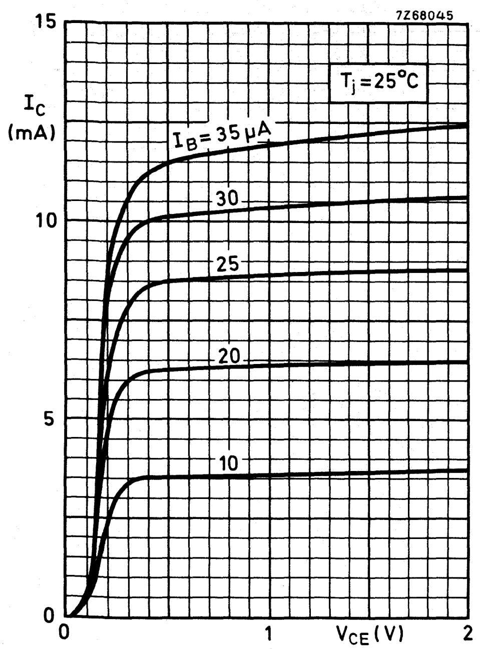


Fig. 2

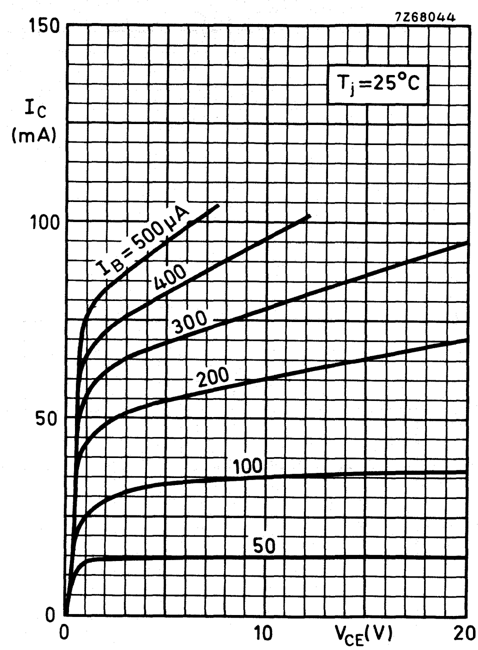


Fig. 3

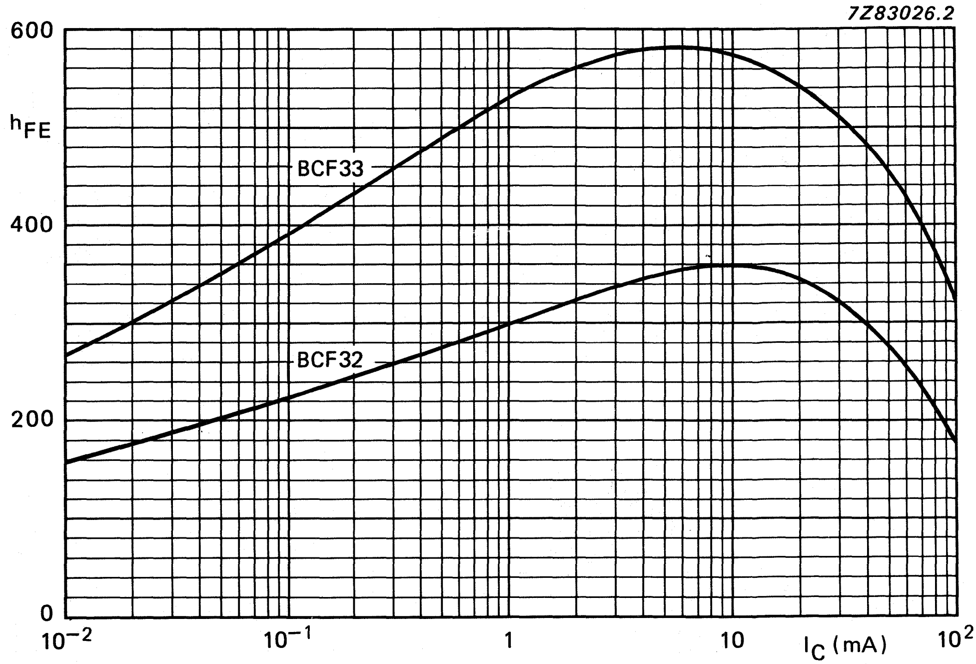


Fig. 4 Typical values d.c. current gain. V_{CE} = 5 V; T_j = 25 °C.

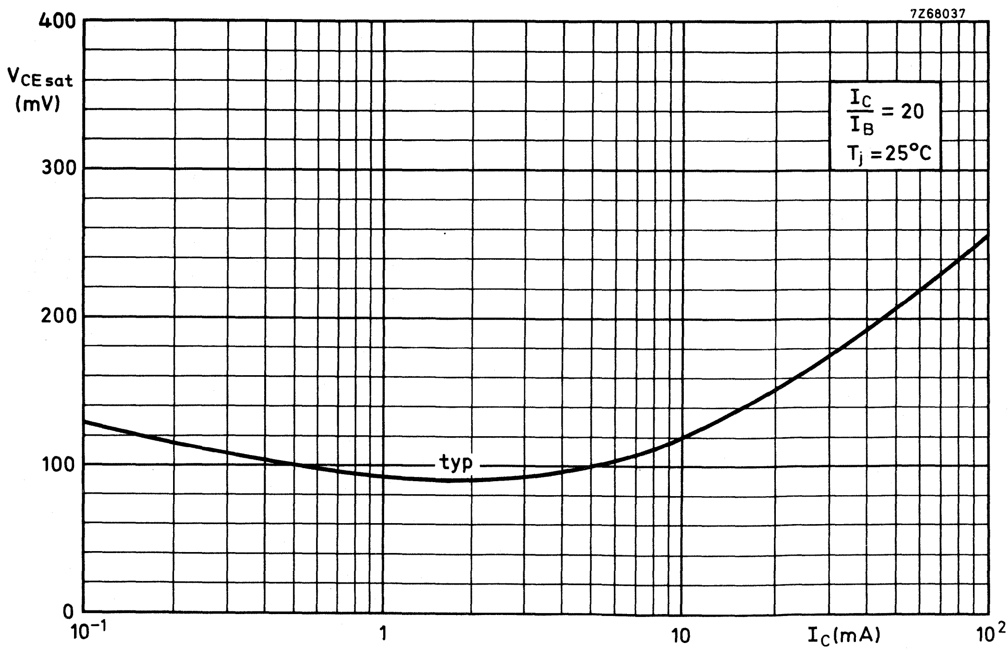


Fig. 5

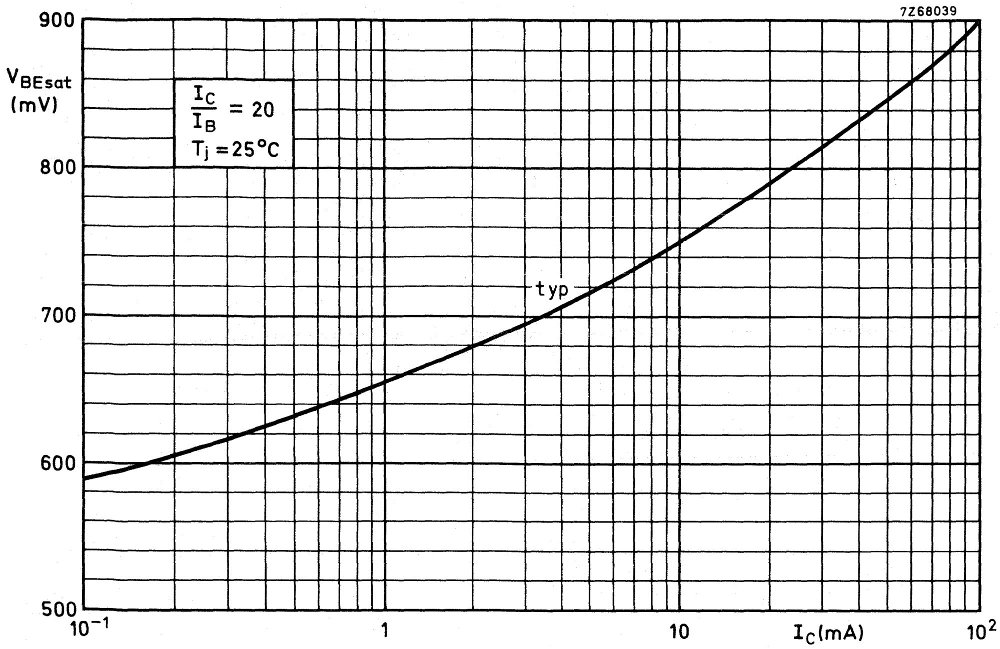

7Z68039
900
800
700
600
500
V_{BEsat}
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

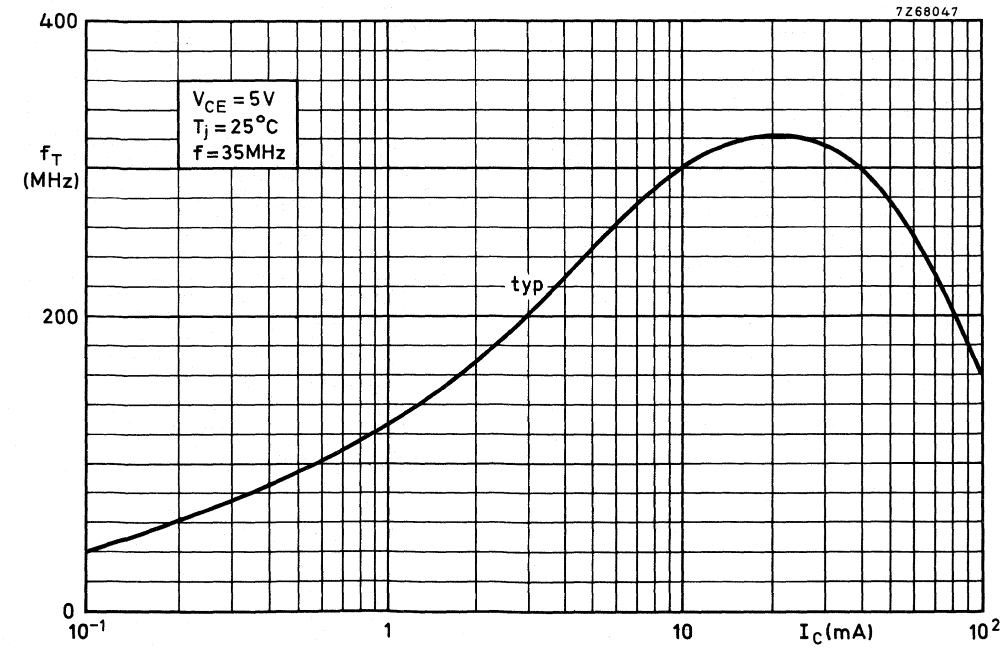

7Z68047
400
200
0
f_T
(MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

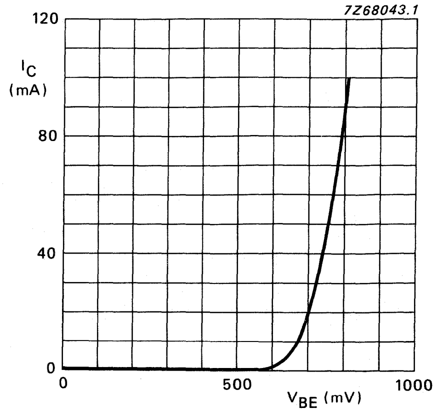


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

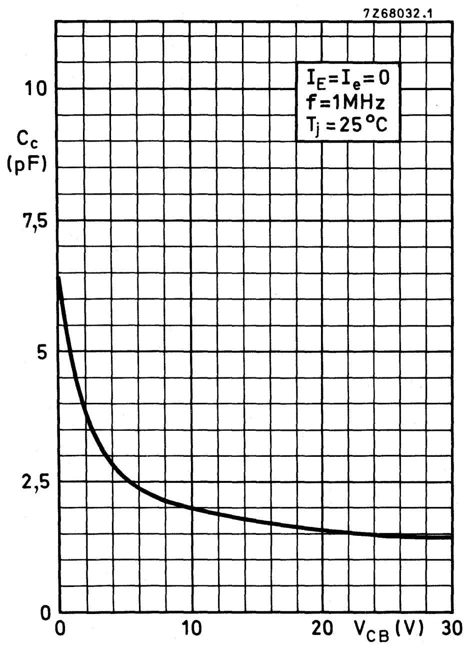


Fig. 9

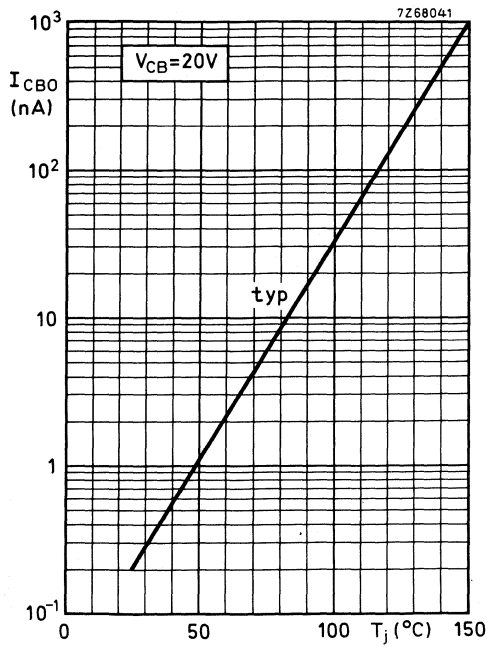


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise applications in thick and thin-film circuits.

QUICK REFERENCE DATA

D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Dimensions in mm

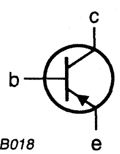
Fig. 1 SOT-23.

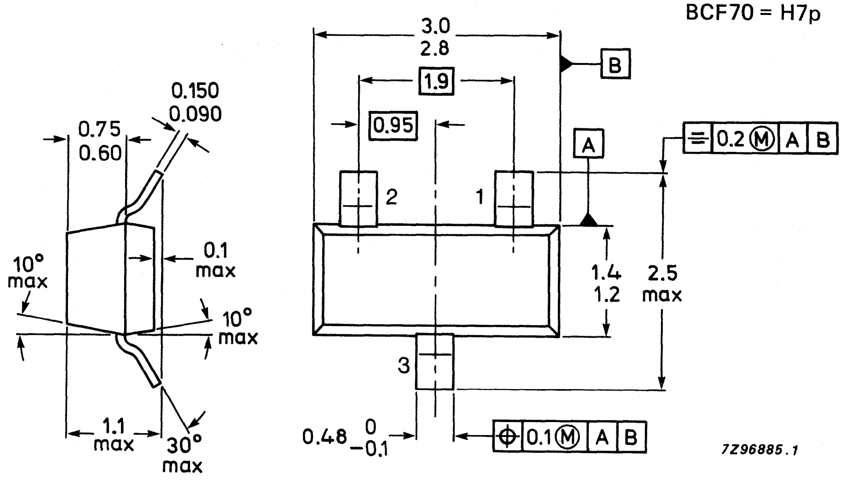
Marking code

BCF70 = H7p

Pinning:

1 = base
2 = emitter
3 = collector





Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50	V
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	50	V
Collector-emitter voltage (open base) $-I_C = 2$ mA	$-V_{CEO}$	max.	45	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 25$ °C	$-I_{CBO}$	<	100	nA
$T_j = 100$ °C	$-I_{CBO}$	<	10	μA
Base-emitter voltage $-I_C = 2$ mA; $-V_{CE} = 5$ V; $T_j = 25$ °C	$-V_{BE}$	600 to	750	mV
Saturation voltages $-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	typ.	80	mV
		<	300	mV
	$-V_{BEsat}$	typ.	720	mV
$-I_C = 50$ mA; $-I_B = 2,5$ mA	$-V_{CEsat}$	typ.	150	mV
	$-V_{BEsat}$	typ.	810	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

D.C. current gain			
$-I_C = 10\ \mu A$; $-V_{CE} = 5$ V	h_{FE}	typ.	150
$-I_C = 2$ mA; $-V_{CE} = 5$ V	h_{FE}	>	215
		<	500
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz			
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	150 MHz
Noise figure at $R_S = 2\ k\Omega$			
$-I_C = 200\ \mu A$; $-V_{CE} = 5$ V		<	4 dB
f = 1 kHz; B = 200 Hz	F	typ.	1 dB

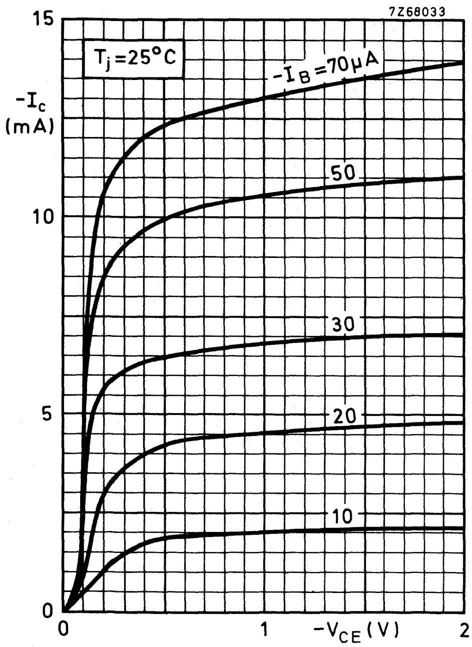


Fig. 2

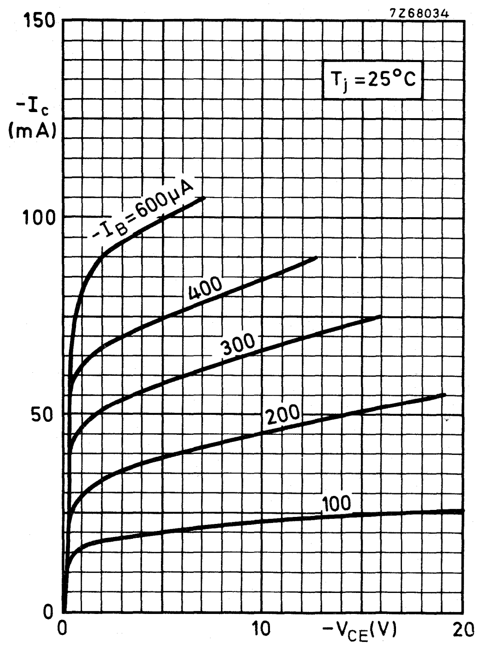


Fig. 3

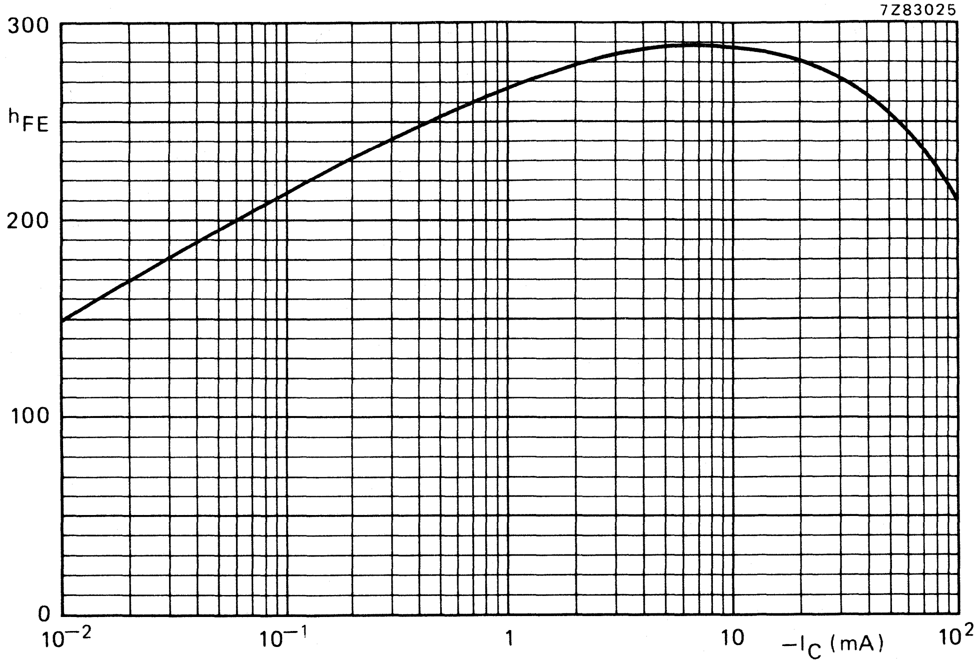


Fig. 4 Typical values of d.c. current gain. $-V_{CE}$ = 5 V; T_j = 25 °C.

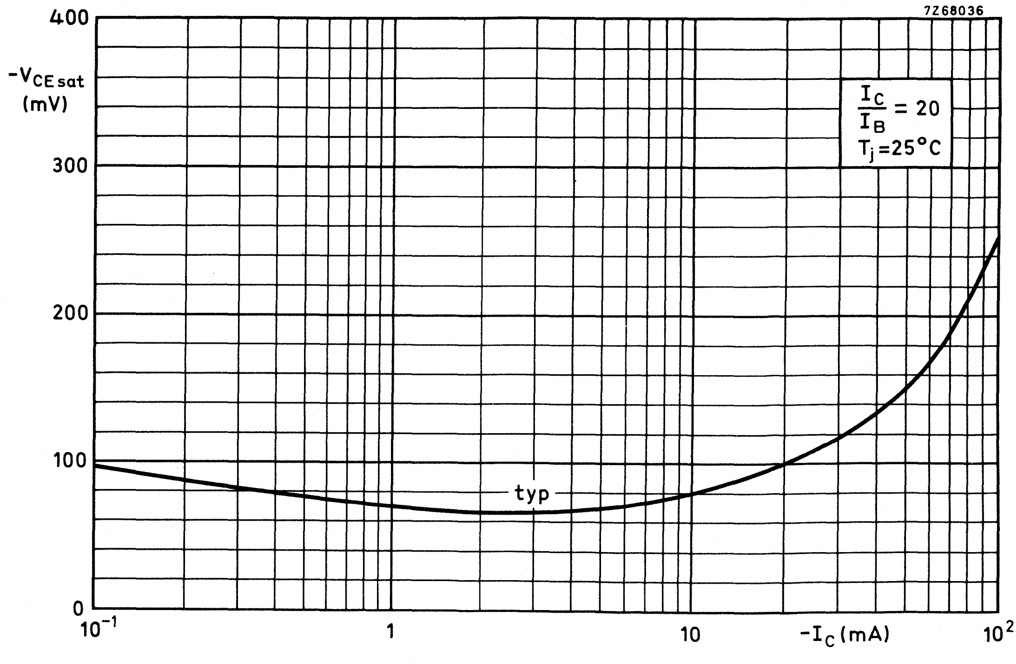


Fig. 5

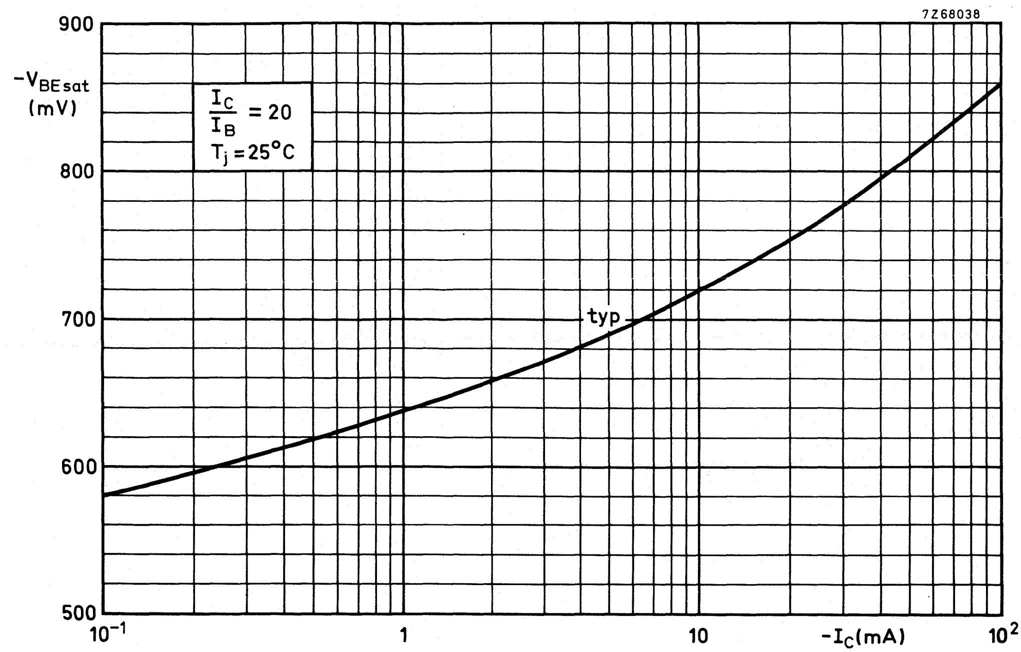

7Z68038
900
$-V_{BEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
800
700
typ
600
500
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

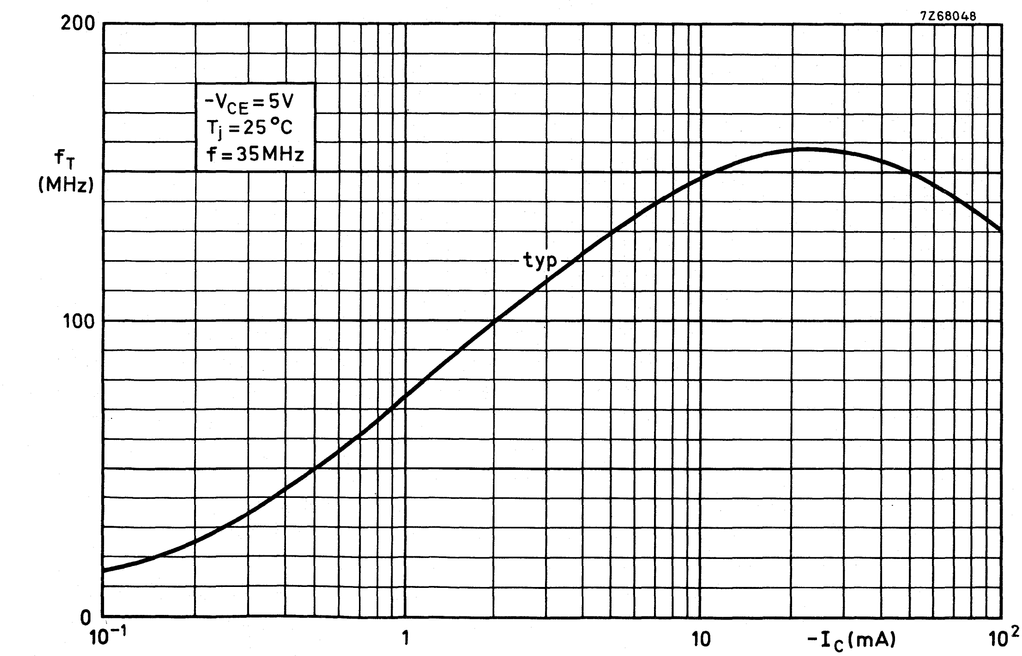

7Z68048
200
$-V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
f_T
(MHz)
typ
100
0
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

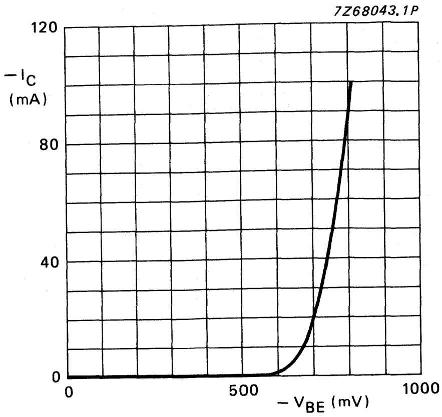


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

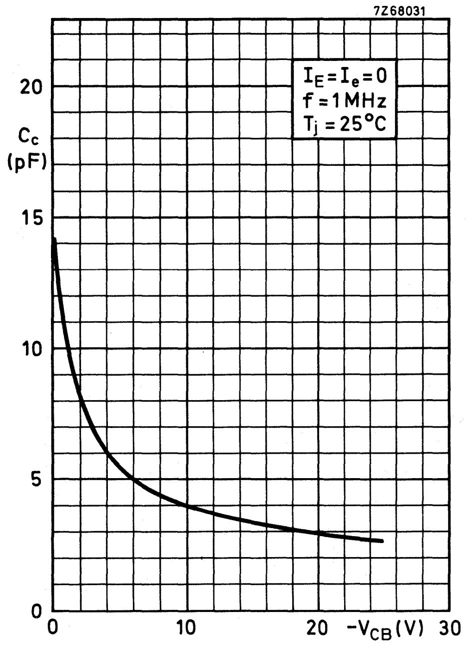


Fig. 9

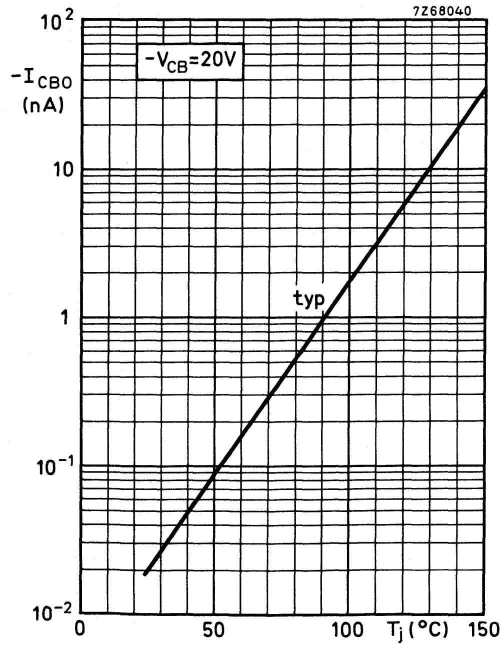


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	420 800	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Dimensions in mm

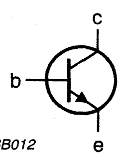
Fig. 1 SOT-23.

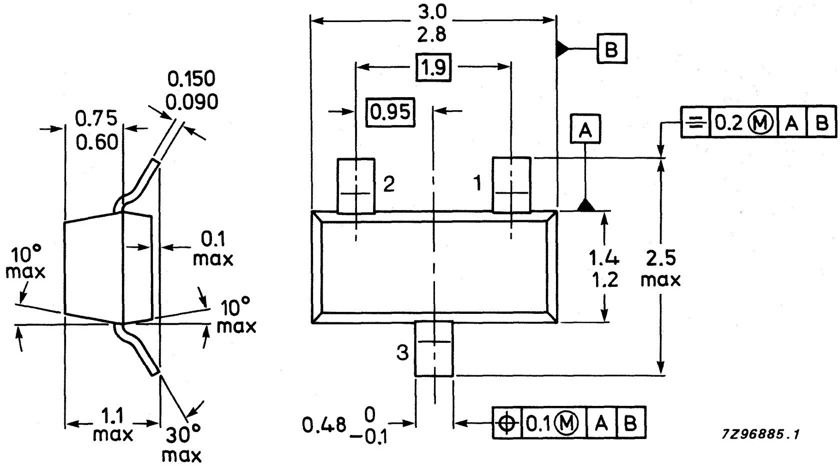
Marking code

BCF81 = K9p

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base) I_C = 2 mA	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10	μA
Base emitter voltage				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to 700		mV
Saturation voltages				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV
D.C. current gain				
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	420	
		<	800	
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB
		typ.	1,2	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power pnp transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

NPN complements are BCP54, BCP55 and BCP56 respectively.

QUICK REFERENCE DATA

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

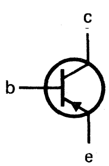
MECHANICAL DATA

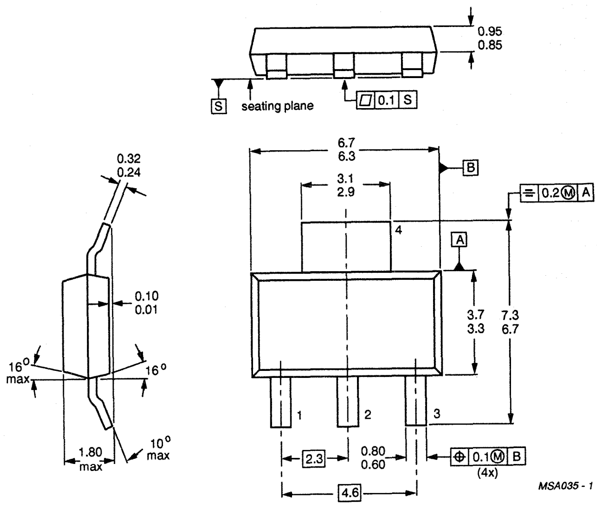
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V

Collector current (DC)	$-I_C$	max.	1,0	A
Collector current (peak value)	$-I_{CM}$	max.	1,5	A
Base current (DC)	$-I_B$	max.	0,1	A
Base current (peak value)	$-I_{BM}$	max.	0,2	A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\,j\text{-}tab}$	=	10	K/W
From junction to ambient*	$R_{th\,j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB} = 30$ V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB} = 30$ V; $T_j = 125$ °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
$I_C = 0$; $-V_{EB} = 5$ V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C = 500$ mA; $-V_{CE} = 2$ V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	<	0,5	V
DC current gain				
$-I_C = 5$ mA; $-V_{CE} = 2$ V	h_{FE}	>	25	
$-I_C = 150$ mA; $-V_{CE} = 2$ V	h_{FE}		40 to 250	
$-I_C = 500$ mA; $-V_{CE} = 2$ V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	50	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

CHARACTERISTICS (continued)

			BCP51-10 52-10 53-10	BCP51-16 52-16 53-16
DC current gain I_C = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	>	63	100
		<	160	250

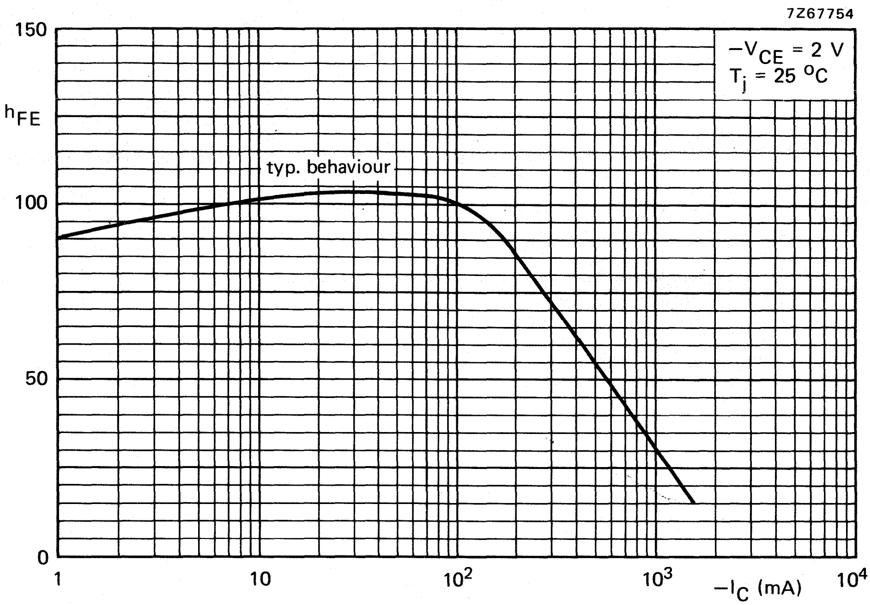


Fig. 2.

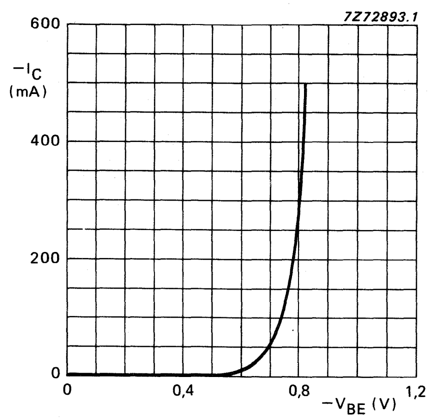


Fig. 3 $-V_{CE}$ = 2 V; T_j = 25 °C; typical values.

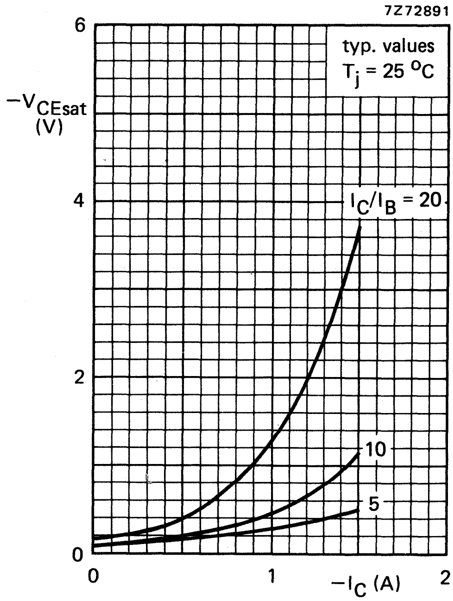


Fig. 4.

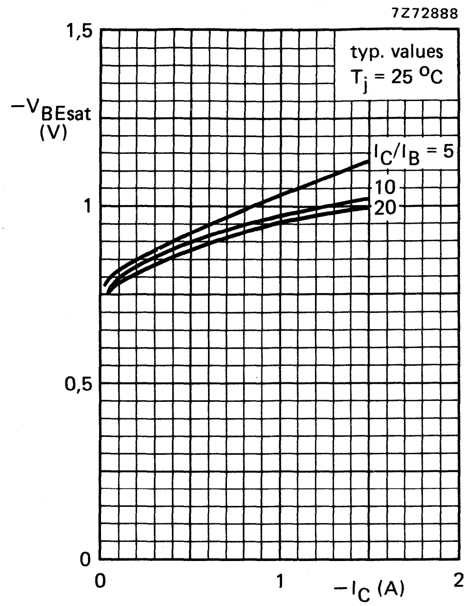


Fig. 5.

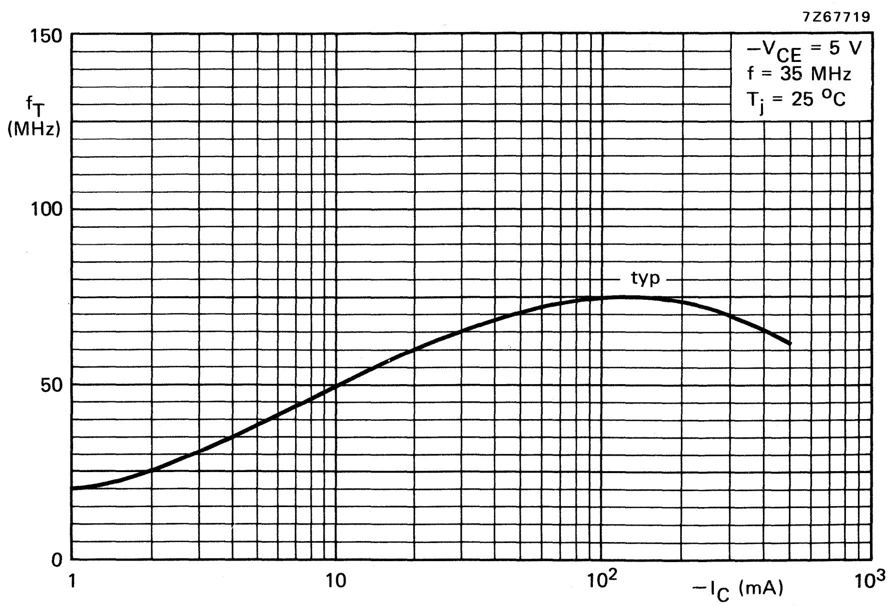


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power npn transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

PNP complements are BCP51, BCP52 and BCP53 respectively.

QUICK REFERENCE DATA

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

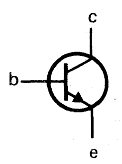
MECHANICAL DATA

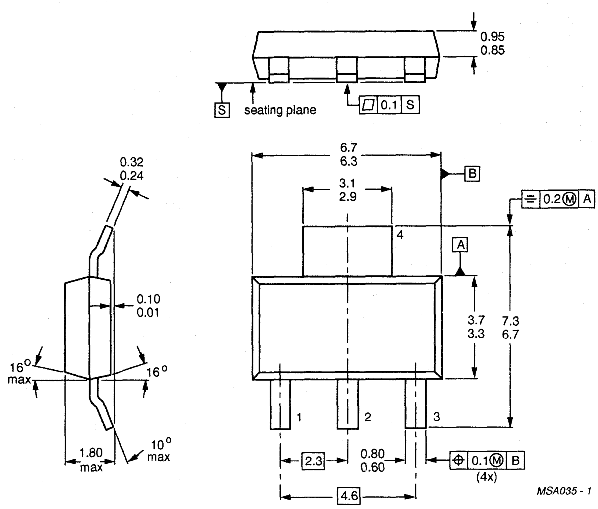
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V
Collector current (DC)	I_C	max.		1,0		A
Collector current (peak value)	I_{CM}	max.		1,5		A
Base current (DC)	I_B	max.		0,1		A
Base current (peak value)	I_{BM}	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; V_{CB} = 30 V	I_{CBO}	<	100	nA
$I_E = 0$; V_{CB} = 30 V; T_j = 125 °C	I_{CBO}	<	10	μA
Emitter cut-off current				
$I_C = 0$; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base-emitter voltage				
I_C = 500 mA; V_{CE} = 2 V	V_{BE}	<	1	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	V
DC current gain				
I_C = 5 mA; V_{CE} = 2 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 2 V	h_{FE}		40 to 250	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	130	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS (continued)

			BCP54-10 55-10 56-10	BCP54-16 55-16 56-16
DC current gain		>	63	100
I_C = 150 mA; V_{CE} = 2 V	h_{FE}	<	160	250

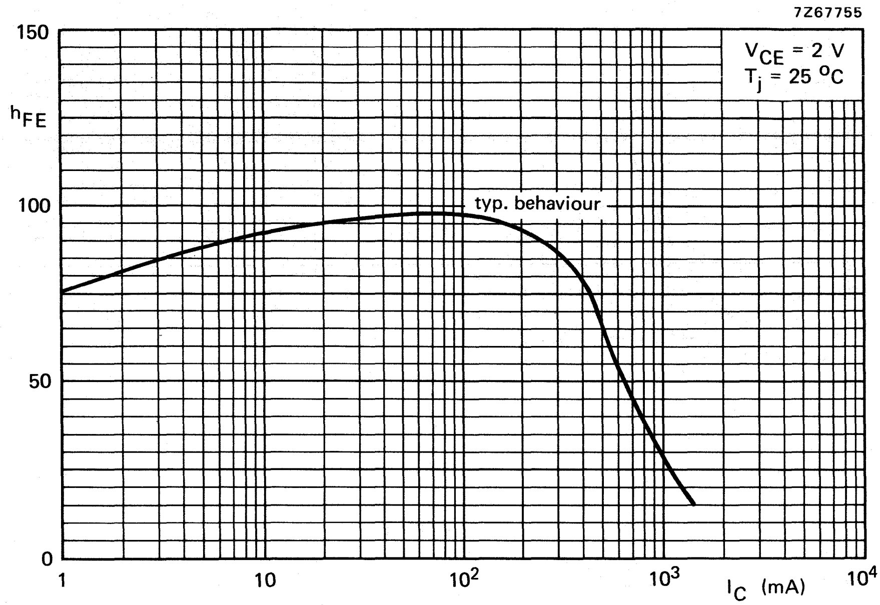


Fig. 2.

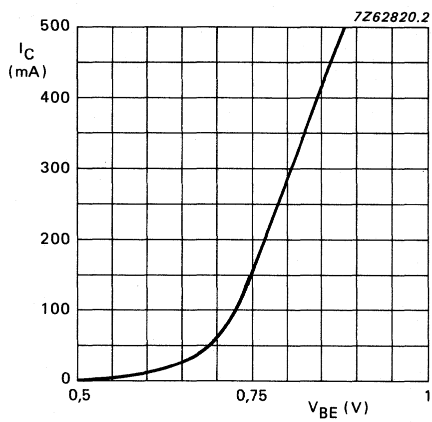


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

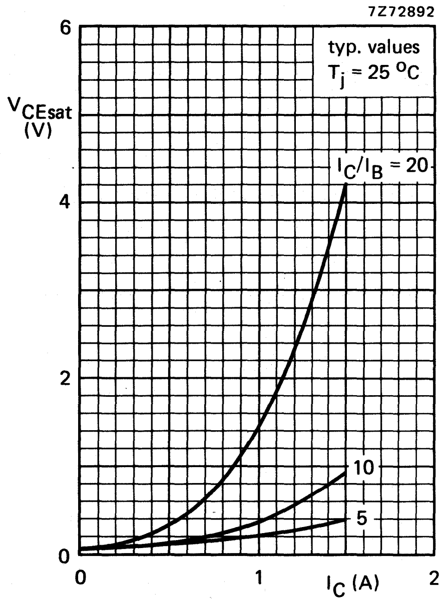


Fig. 4.

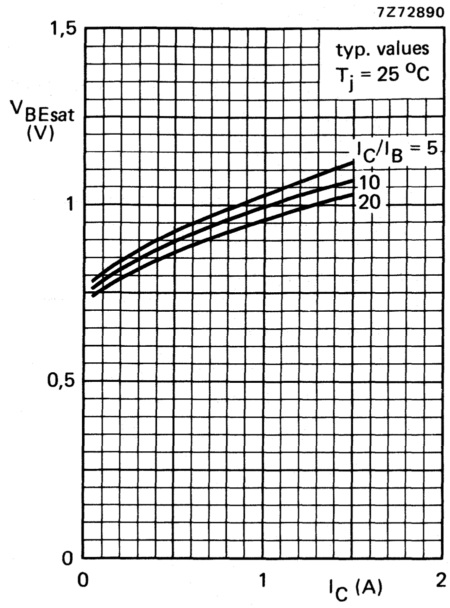


Fig. 5.

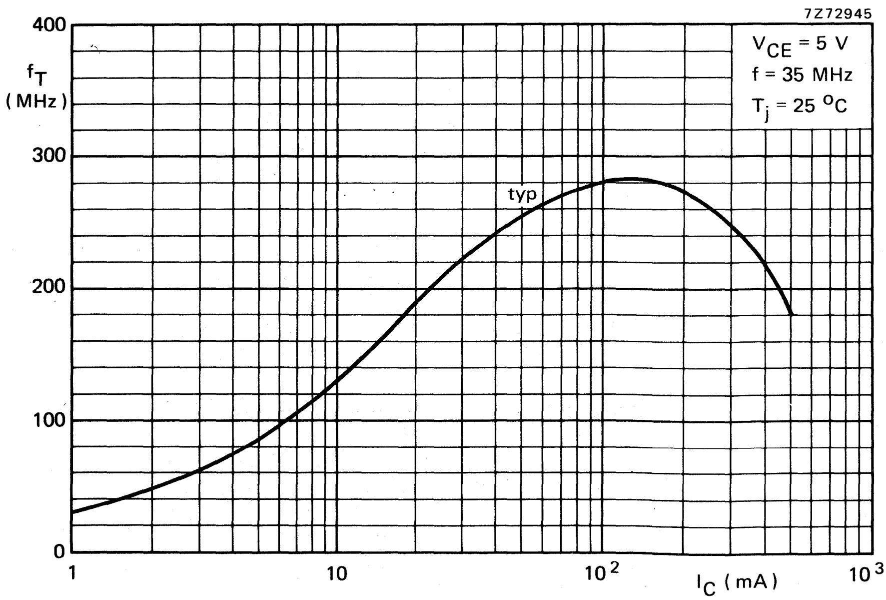


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN transistor in a microminiature plastic envelope intended for low-voltage, high-current LF applications.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (peak value)	I_{CM}	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	150	°C
DC current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60	MHz

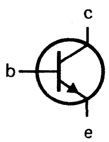
MECHANICAL DATA

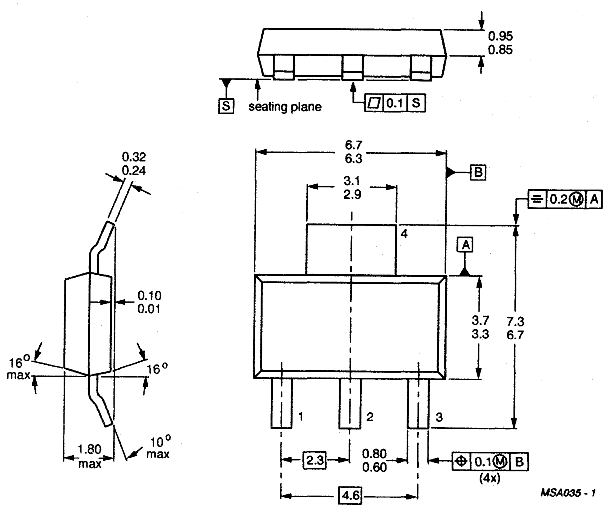
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (DC)	I_C	max.	1	A
Collector current (peak value)	I_{CM}	max.	2	A
Base current (DC)	I_B	max.	100	mA
Base current (peak value)	I_{BM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}	−65 to + 150		^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current					
$I_E = 0$; $V_{CB} = 25$ V		I_{CBO}	<	10	μA
$I_E = 0$; $V_{CB} = 25$ V; $T_j = 150\ ^oC$		I_{CBO}	<	1	mA
Emitter cut-off current					
$I_C = 0$; $V_{EB} = 5$ V		I_{EBO}	<	10	μA
Base-emitter voltage					
$I_C = 5$ mA; $V_{CE} = 10$ V		V_{BE}	typ.	0,62	V
$I_C = 1$ A; $V_{CE} = 1$ V		V_{BE}	<	1	V
Collector-emitter saturation voltage					
$I_C = 1$ A; $I_B = 100$ mA		V_{CEsat}	<	0,5	V
DC current gain					
$I_C = 5$ mA; $V_{CE} = 10$ V	BCP68	h_{FE}	>	50	
$I_C = 500$ mA; $V_{CE} = 1$ V	BCP68	h_{FE}		85 to 375	
	BCP68-10	h_{FE}	⩽	160	
	BCP68-16	h_{FE}		100 to 250	
	BCP68-25	h_{FE}	⩾	250	
$I_C = 1$ A; $V_{CE} = 1$ V	BCP68	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
$I_E = I_e = 0$; $V_{CB} = 5$ V		C_c	typ.	27	pF
Transition frequency at f = 35 MHz					
$I_C = 10$ mA; $V_{CE} = 5$ V		f_T	typ.	60	MHz

* Device mounted on an epoxy printed-circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

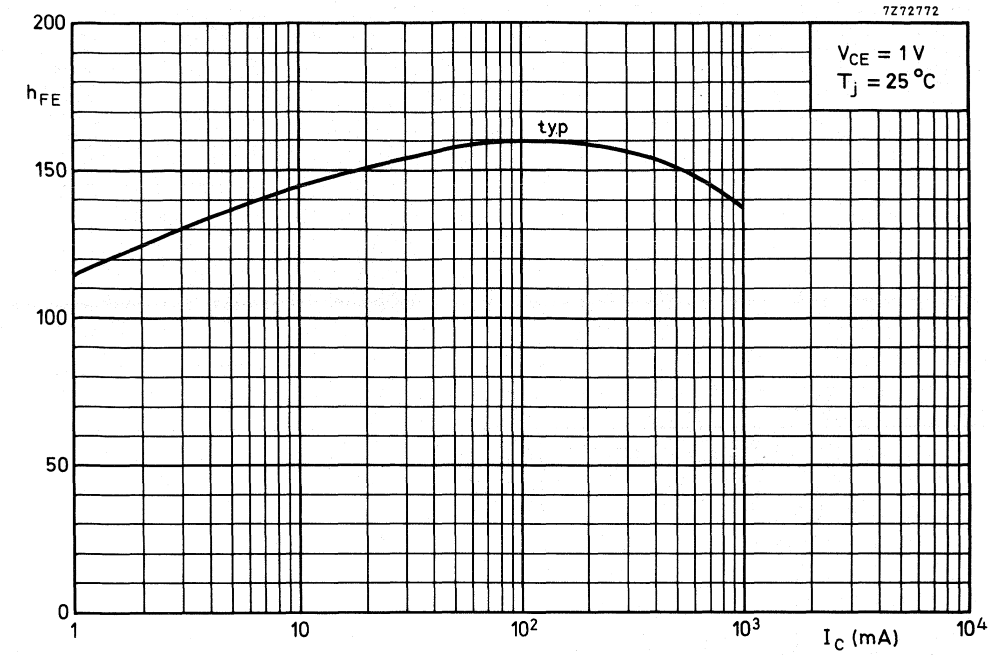


Fig.2 DC current gain.

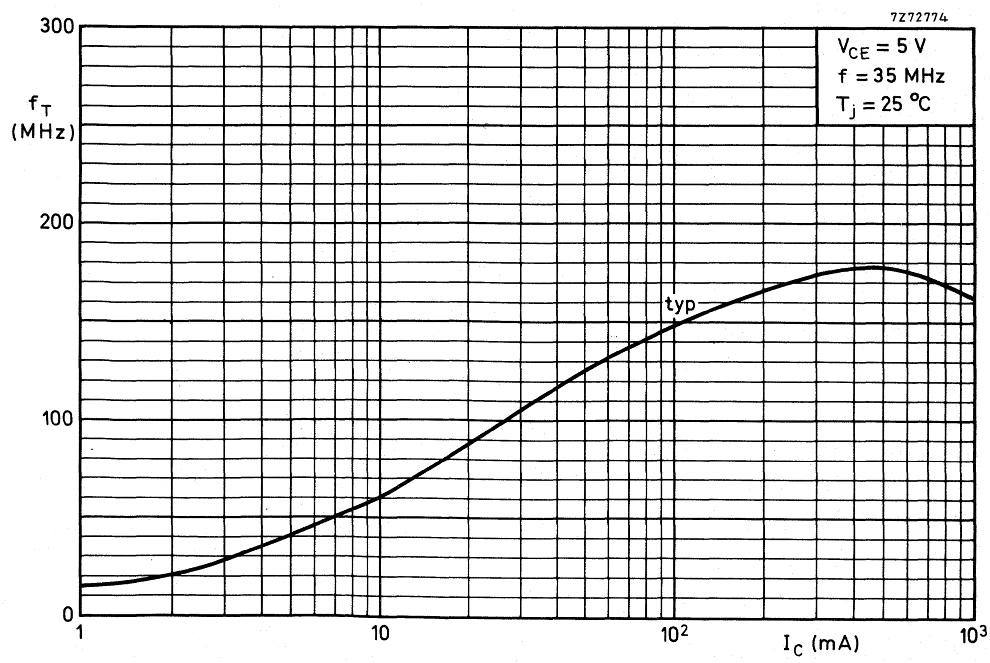


Fig.3 Typical values transition frequency as a function of collector current.

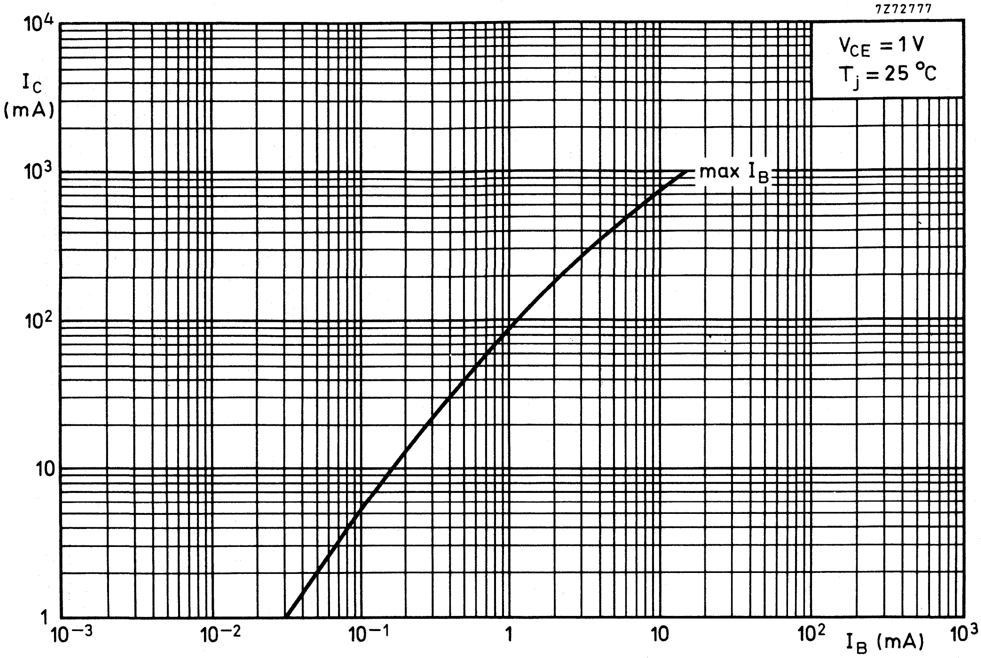


Fig.4 Typical values collector current as a function of maximum base current.

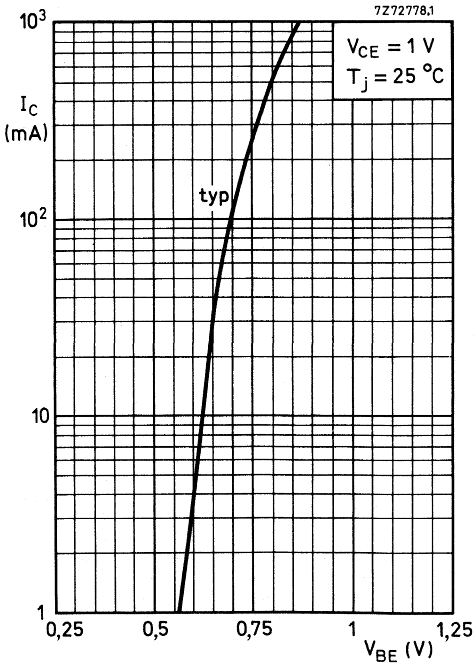


Fig.5 Typical values collector current as a function of base-emitter voltage.

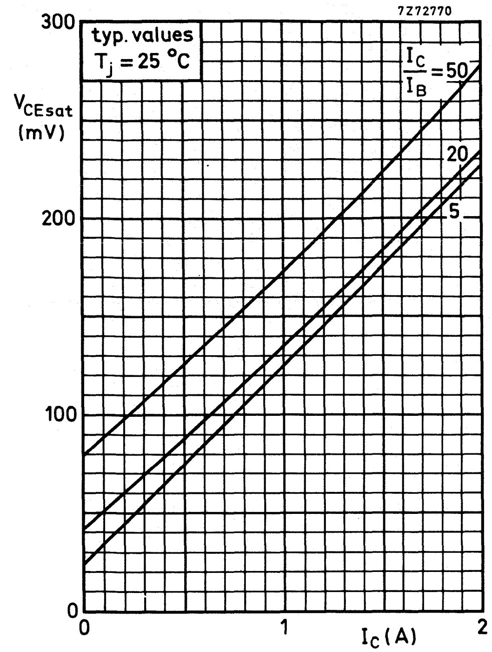


Fig.6 Collector-emitter saturation voltage as a function of collector current.

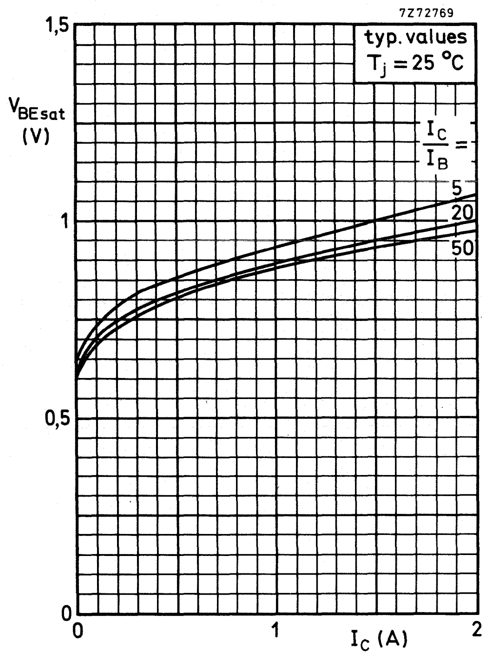


Fig.7 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP transistor in a plastic microminiature envelope, intended for low-voltage, high-current LF applications.

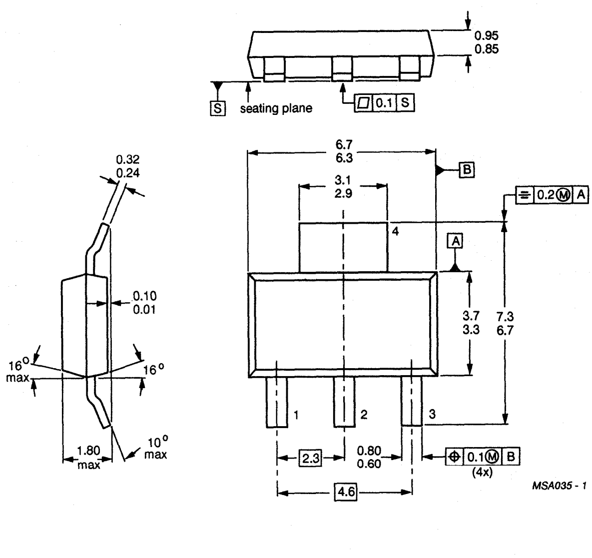
QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current (peak value)	$-I_{CM}$	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	150	°C
DC current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60	MHz

MECHANICAL DATA

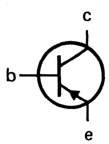
Dimensions in mm

Fig. 1 SOT-223



Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (DC)	$-I_C$	max.	1	A
Collector current (peak value)	$-I_{CM}$	max.	2	A
Base current (DC)	$-I_B$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}	–65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
$I_E = 0; -V_{CB} = 25$ V		$-I_{CBO}$	<	10	μA
$I_E = 0; -V_{CB} = 25$ V; $T_j = 150$ °C		$-I_{CBO}$	<	1	mA
Emitter cut-off current					
$I_C = 0; -V_{EB} = 5$ V		$-I_{EBO}$	<	10	μA
Base-emitter voltage					
$-I_C = 5$ mA; $-V_{CE} = 10$ V		$-V_{BE}$	typ.	0,62	V
$-I_C = 1$ A; $-V_{CE} = 1$ V		$-V_{BE}$	<	1	V
Collector-emitter saturation voltage					
$-I_C = 1$ A; $-I_B = 100$ mA		$-V_{CEsat}$	<	0,5	V
DC current gain					
$-I_C = 5$ mA; $-V_{CE} = 10$ V	BCP69	h_{FE}	>	50	
$-I_C = 500$ mA; $-V_{CE} = 1$ V	BCP69	h_{FE}		85 to 375	
	BCP69-10	h_{FE}	≤	160	
	BCP69-16	h_{FE}		100 to 250	
	BCP69-25	h_{FE}	≥	250	
$-I_C = 1$ A; $-V_{CE} = 1$ V	BCP69	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
$I_E = I_e = 0; -V_{CB} = 5$ V		C_c	typ.	45	pF
Transition frequency at f = 35 MHz					
$-I_C = 10$ mA; $-V_{CE} = 5$ V		f_T	typ.	60	MHz

* Device mounted on an epoxy printed-circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

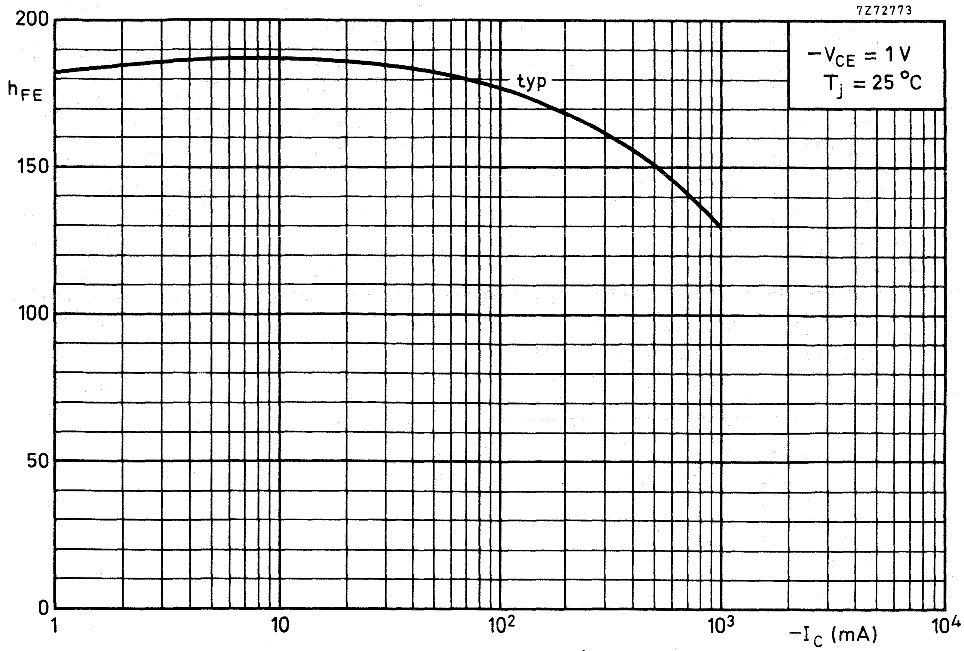


Fig. 2 DC current gain.

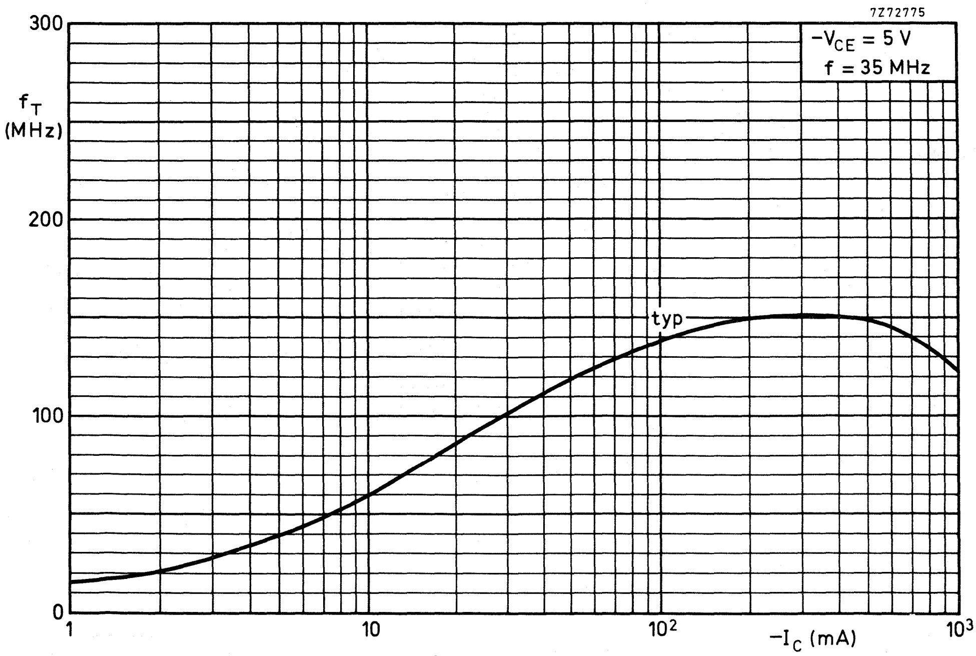


Fig.3 Typical values transition frequency as a function of collector current.

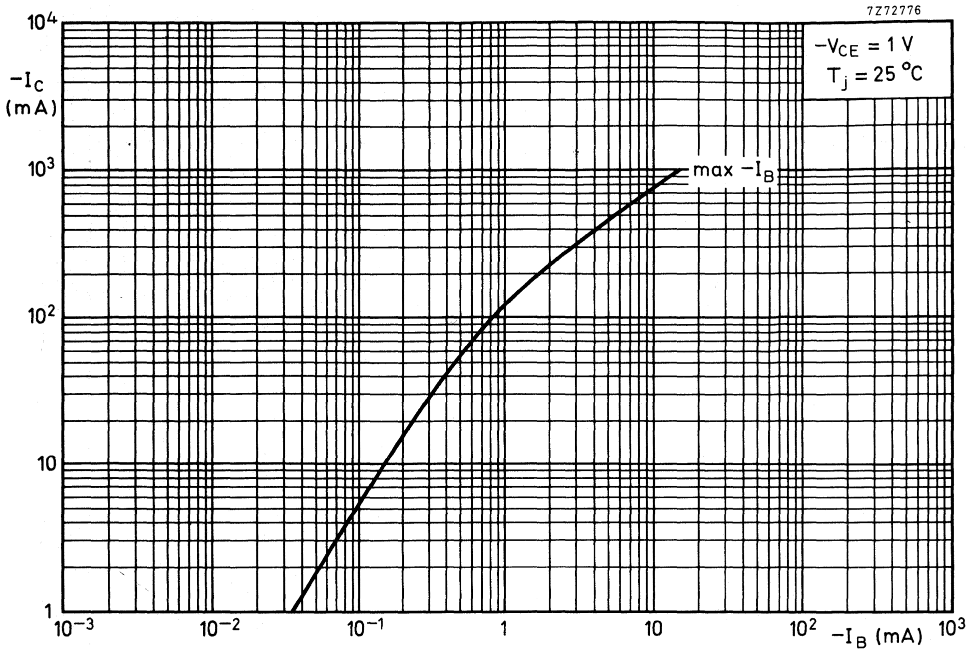


Fig.4 Typical values collector current as a function of maximum base current.

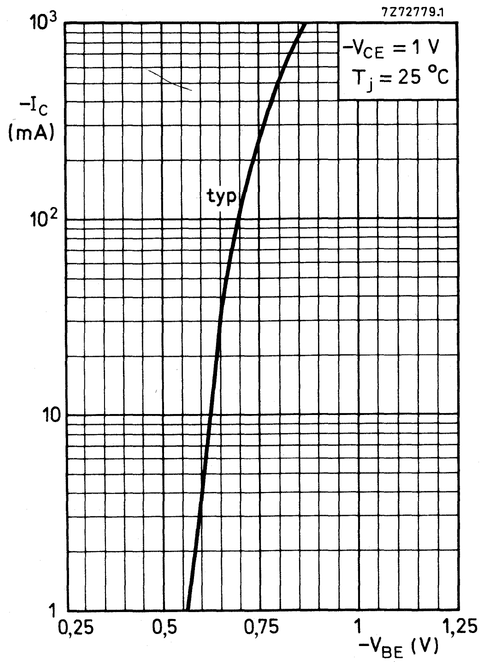


Fig.5 Typical values collector current as a function of base-emitter voltage.

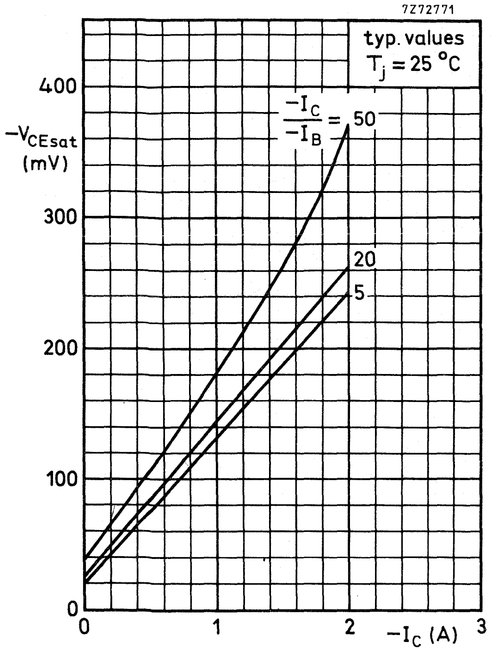


Fig.6 Collector-emitter saturation voltage as a function of collector current.

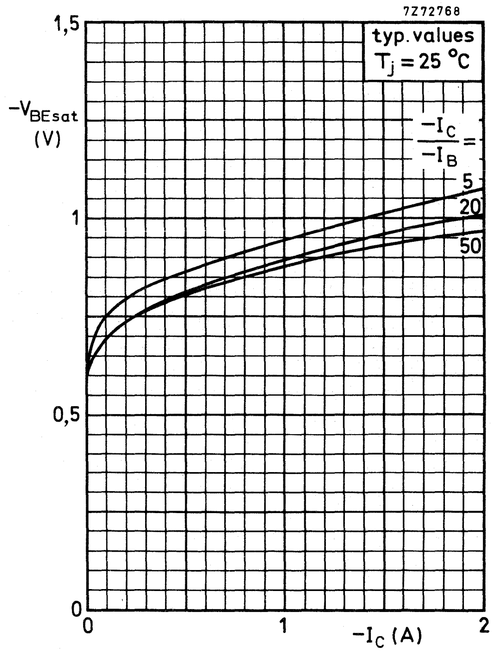


Fig.7 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR DARLINGTON TRANSISTOR

P-N-P silicon planar darlington transistor in a plastic SOT23 envelope.
N-P-N complement is BCV27/47.

QUICK REFERENCE DATA

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Collector current	$-I_C$	max.	300	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	>	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	>	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

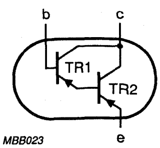
MECHANICAL DATA

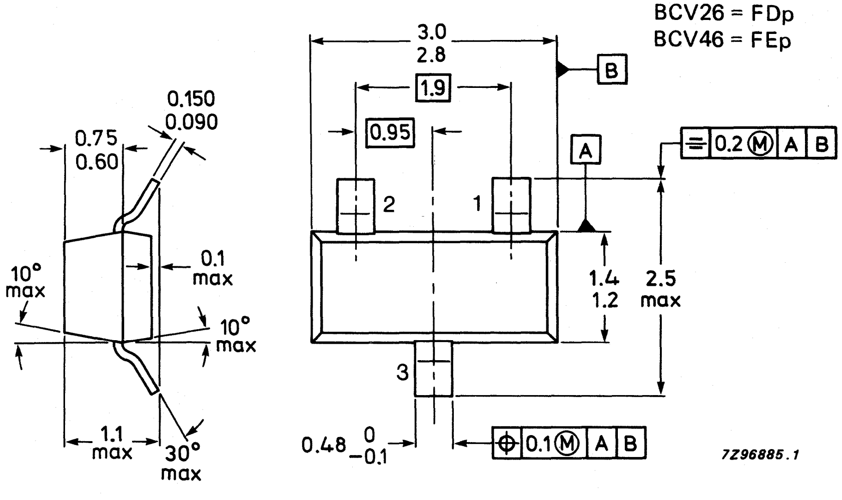
Dimensions in mm

Fig. 1 SOT23

Marking code:
BCV26 = FDp
BCV46 = FEp

Pinning:
1 = base
2 = emitter
3 = collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10	10	V
Collector current	$-I_C$	max.	300	500	mA
Collector current (peak value)	$-I_{CM}$	max.	800		mA
Base current	$-I_B$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

			BCV26	BCV46	
Collector-base current $-V_{CBO}$ = 30 V	$-I_{CBO}$	max.	0.1	0.1	μA
Emitter-base current $-V_{EB}$ = 10 V	$-I_{EBO}$	max.	0.1	0.1	μA
Collector-emitter break-down voltage $-I_C$ = 10 mA	$-V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage $-I_E$ = 100 nA	$-V_{(BR)EBO}$	min.	10	10	V
DC current gain $-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz I_E = 0; $-V_{CB}$ = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON PLANAR DARLINGTON TRANSISTOR

N-P-N silicon planar darlington transistor in a plastic SOT23 envelope.
P-N-P complement is BCV26/46.

QUICK REFERENCE DATA

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Collector current	I_C	max.	300	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	>	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	>	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Collector-emitter saturation voltage					
I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Transition frequency at f = 100 MHz					
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

MECHANICAL DATA

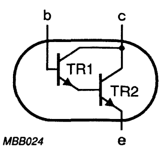
Dimensions in mm

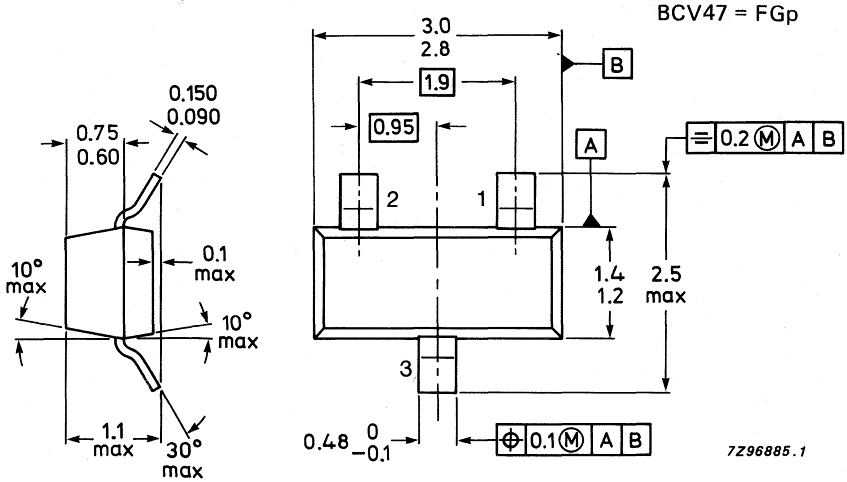
Fig. 1 SOT23

Marking code:
BCV27 = FFp
BCV47 = FGp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	10	10	V
Collector current	I_C	max.	300	500	mA
Collector current (peak value)	I_{CM}	max.	800		mA
Base current	I_B	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated			BCV27	BCV47	
Collector-base current V_{CBO} = 30 V	I_{CBO}	max.	0.1	0.1	μA
Emitter-base current V_{EB} = 10 V	I_{EBO}	max.	0.1	0.1	μA
Collector-emitter break-down voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage I_E = 100 nA	$V_{(BR)EBO}$	min.	10	10	V
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Base-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5		V
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz I_E = 0; V_{CB} = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

PNP small-signal darlington transistors, housed in a microminiature envelope (SOT89).
NPN complementary types are BCV29/49.

QUICK REFERENCE DATA

			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

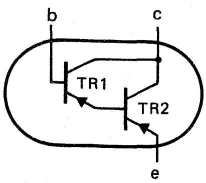
MECHANICAL DATA

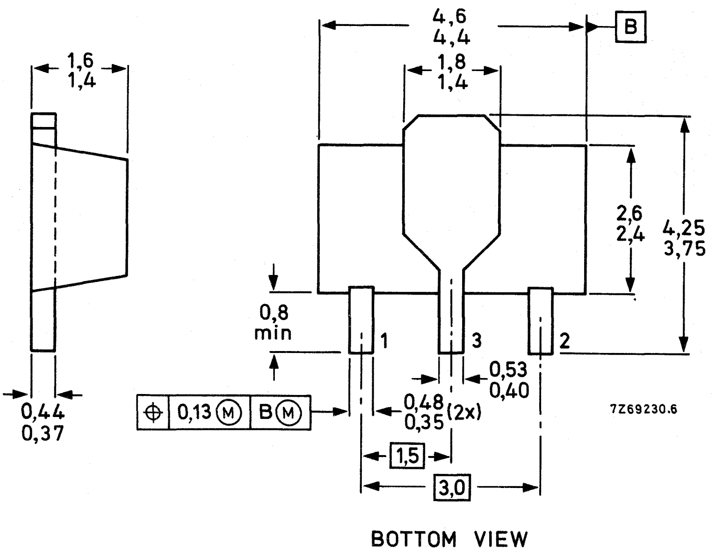
Dimensions in mm

Fig.1 SOT89

Pinning

1 = emitter
2 = base
3 = collector





* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV28	BCV48	
Collector-emitter breakdown voltage $-I_C$ = 10 mA	$-V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage $-I_C$ = 10 μA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage $-I_E$ = 0.1 μA	$-V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current $-V_{BE}$ = 4 V; I_C = 0	$-I_{EBO}$	max.	0.1	0.1	μA
Collector-base cut-off current $-V_{CB}$ = 30/60 V; I_E = 0	$-I_{CBO}$	max.	0.1	0.1	μA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Output capacitance $-V_{CB}$ = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

NPN small-signal darlington transistors, housed in a microminiature envelope (SO89).
PNP complementary types are BCV28/48.

QUICK REFERENCE DATA

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz, I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

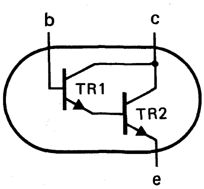
MECHANICAL DATA

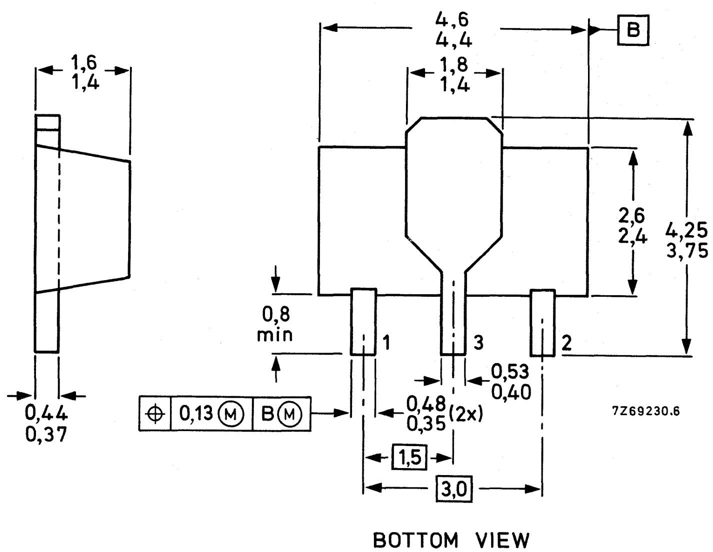
Dimensions in mm

Fig.1 SOT89.

Pinning

1 = emitter
2 = base
3 = collector





* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV29	BCV49	
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage I_E = 0.1 μA	$V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current V_{BE} = 4 V; I_C = 0	I_{EBO}	max.	0.1	0.1	μA
Collector-base cut-off current V_{CB} = 30/60 V; I_E = 0	I_{CBO}	max.	0.1	0.1	μA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0	1.0	V
Base-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5	1.5	V
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Output capacitance V_{CB} = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double n-p-n transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in p-n-p configuration is the BCV62.

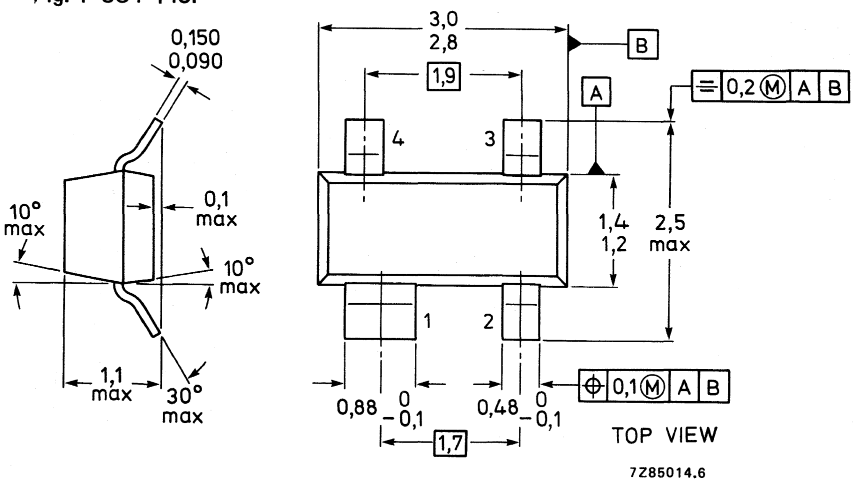
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30 V
Collector current d.c.	I_C	max.	100 mA
peak	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

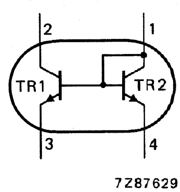
Fig. 1 SOT-143.

Dimensions in mm



Marking code:

BCV61 = 1Mp
BCV61A = 1Jp
BCV61B = 1Kp
BCV61C = 1Lp



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30 V
Base current (transistor T1) peak value	I_{BM1}	max.	200 mA
Emitter-base voltage	V_{EBS}	max.	6 V
Collector current d.c.	I_C	max.	100 mA
peak	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C
Storage temperature	T_{stg}		−65 to +150 °C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm

from junction to ambient	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current			
$I_E = 0$; $V_{CB} = 30$ V	I_{CBO}	<	15 nA
$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	I_{CBO}	<	5 μA
Base-emitter voltage			
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	typ.	660 mV*
			580 to 700 mV*
$I_C = 10$ mA; $V_{CE} = 5$ V	V_{BE}	<	770 mV*
Saturation voltages			
$I_C = 10$ mA; $I_B = 0,5$ mA	V_{CEsat}	typ.	90 mV
		<	250 mV
	V_{BEsat}	typ.	700 mV**
$I_C = 100$ mA; $I_B = 5$ mA	V_{CEsat}	typ.	200 mV
		<	600 mV
	V_{BEsat}	typ.	900 mV**

* Decreasing 2 mV/°C with increasing temperature.
** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V		f_T	typ.	300 MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; V_{CB} = 10 V		C_c	typ.	2,5 pF
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V		F	typ.	2 dB
f = 1 kHz; B = 200 Hz			<	10 dB
D.C. current gain				
I_C = 100 μA; V_{CE} = 5 V		h_{FE}	>	100
I_C = 2 mA; V_{CE} = 5 V		h_{FE}		110 to 800

Transistor T2

Base-emitter forward voltage				
I_E = 250 mA		V_{BES}	<	1,8 V
I_E = 10 μA		V_{BES}	>	400 mV
Matching of transistor T1 and transistor T2 at I_{E2} = 0,5 mA and V_{CE1} = 5 V				
T_{amb} = 25 °C		I_{C1}/I_{C2}		0,7 to 1,3
T_{amb} = 150 °C		I_{C1}/I_{C2}		0,7 to 1,3
Thermal coupling of transistor T1 and Transistor T2*				
T1 : V_{CE} = 5 V				
Maximum current for thermal stability of I_{C1}		I_{E2}	max.	5 mA
D.C. current gain				
I_C = 2 mA; V_{CE} = 5 V	BCV61A	h_{FE}	min.	110
			max.	220
	BCV61B	h_{FE}	min.	200
			max.	450
	BCV61C	h_{FE}	min.	420
			max.	800

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (See Fig. 2)

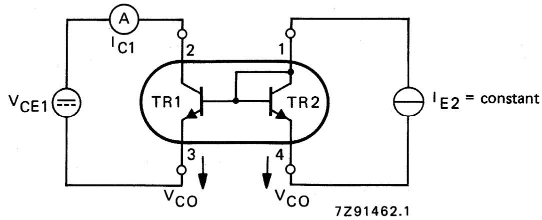


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3} U_T \triangleq 16$ mV.

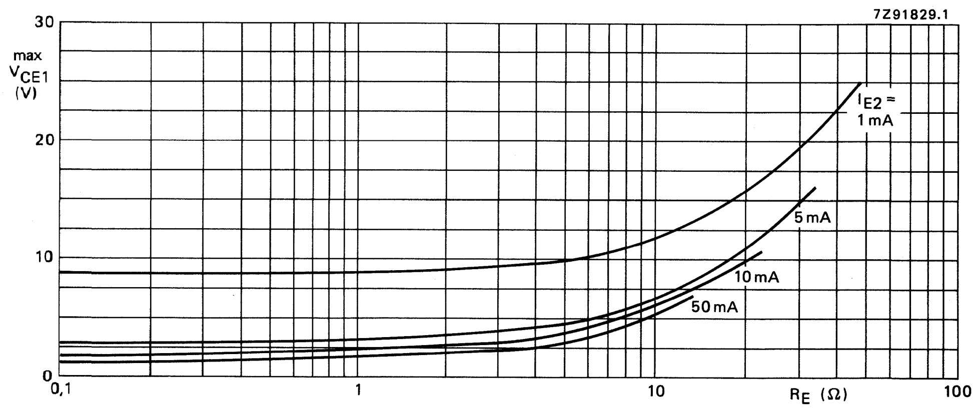


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

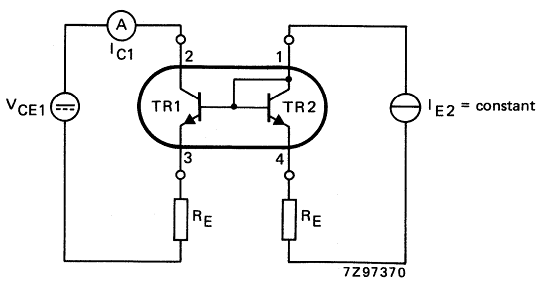


Fig. 4 BCV61 with emitter resistors.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double p-n-p transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in n-p-n configuration is the BCV61.

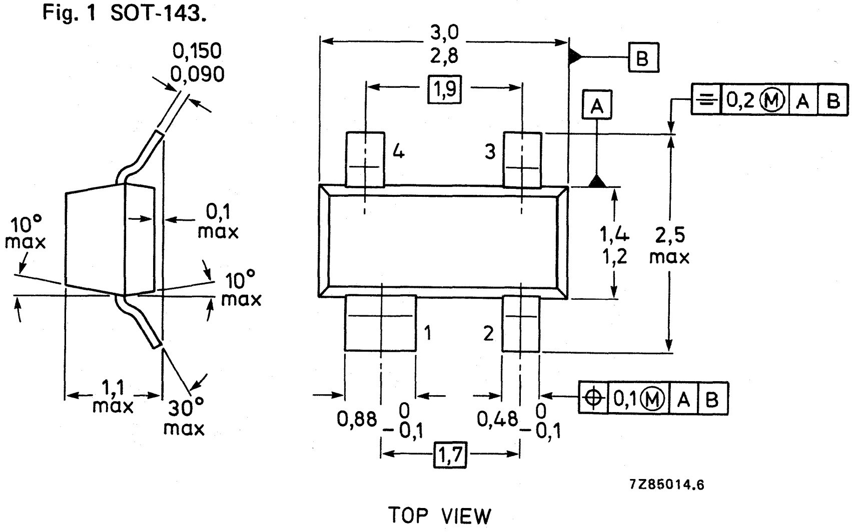
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max	30 V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30 V
Collector current d.c.	$-I_C$	max.	100 mA
peak	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

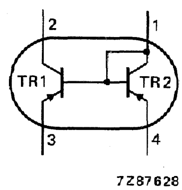
Fig. 1 SOT-143.

Dimensions in mm



Marking code:

BCV62 : 3Mp
BCV62A: 3Jp
BCV62B: 3Kp
BCV62C: 3Lp



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30 V
Base current (transistor T1) peak value	$-I_{BM1}$	max.	200 mA
Emitter-base voltage	$-V_{EBS}$	max.	6 V
Collector current d.c.	$-I_C$	max.	100 mA
peak	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C
Storage temperature	T_{stg}		−65 to + 150 °C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm

from junction to ambient	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current			
$-I_E = 0; -V_{CB} = 30$ V	$-I_{CBO}$	<	15 nA
$-I_E = 0; -V_{CB} = 30$ V; $T_j = 150$ °C	$-I_{CBO}$	<	5 μA
Base-emitter voltage			
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	typ.	650 mV*
			600 to 750 mV*
$-I_C = 10$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	<	820 mV*
Saturation voltages			
$-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	typ.	75 mV
		<	300 mV
	$-V_{BEsat}$	typ.	700 mV**
$-I_C = 100$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	typ.	250 mV
		<	650 mV
	$-V_{BEsat}$	typ.	850 mV**

* Decreasing 2 mV/°C with increasing temperature.
** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF
Noise figure at R_S = 2 kΩ				
$-I_C$ = 200 µA; $-V_{CE}$ = 5 V	F	typ.	2	dB
f = 1 kHz; B = 200 Hz	F	<	10	dB
D.C. current gain				
$-I_C$ = 100 µA; $-V_{CE}$ = 5 V	h_{FE}	>	100	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}		100 to 800	

Transistor T2

Base-emitter forward voltage					
$-I_E$ = 250 mA		$-V_{BES}$	<	1,5	V
$-I_E$ = 10 µA		$-V_{BES}$	>	400	mV
Matching of transistor T1 and transistor T2 at I_{E2} = 0,5 mA and V_{CE1} = 5 V					
T_{amb} = 25 °C		I_{C1}/I_{C2}	0,7 to 1,3		
T_{amb} = 150 °C		I_{C1}/I_{C2}	0,7 to 1,3		
Thermal coupling of transistor T1 and transistor T2*					
T1 : $-V_{CE}$ = 5 V					
Maximum current for thermal stability of $-I_{C1}$		I_{E2}	max.	5	mA
D.C. current gain			min.	125	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	BCV62A	h_{FE}	max.	250	
			min.	220	
	BCV62B	h_{FE}	max.	475	
			min.	420	
	BCV62C	h_{FE}	max.	800	

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (see Fig. 2)

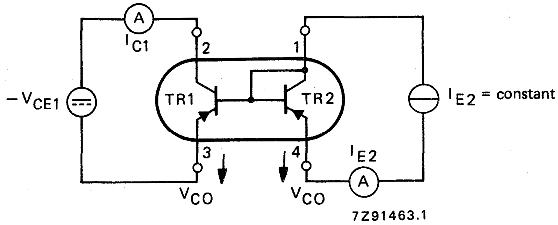


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3}\, U_T \triangleq 16$ mV.

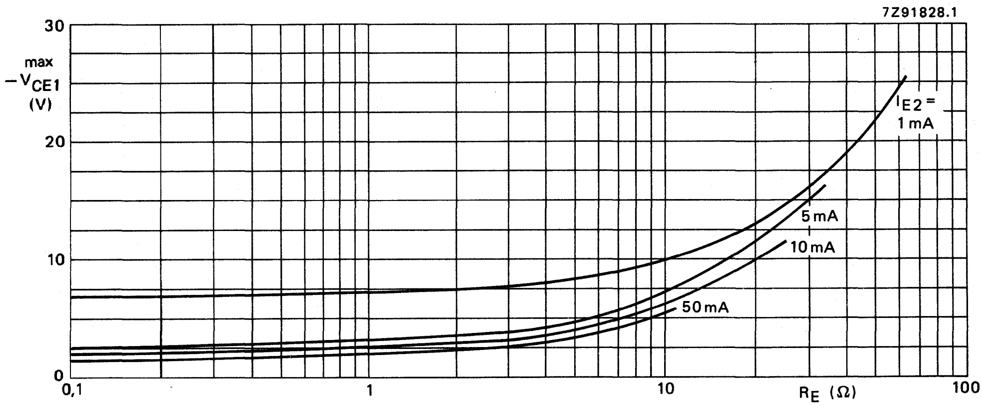


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

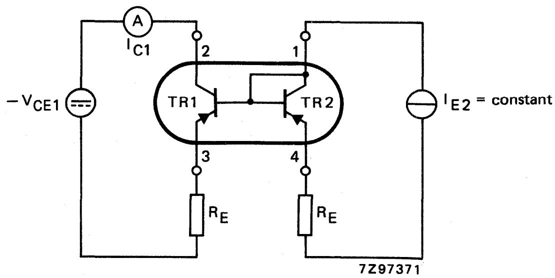


Fig. 4 BCV62 with emitter resistors.

SILICON PLANAR TRANSISTOR

Double N-P-N transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications. P-N-P complement is the BCV64.

QUICK REFERENCE DATA

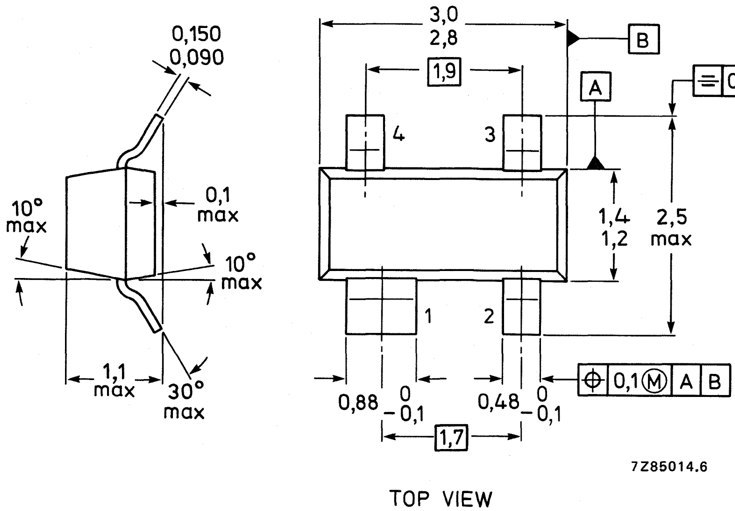
	transistor		T1	T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Collector current	I_C	max.	100		mA
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Collector-emitter saturation voltage I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	–	MHz

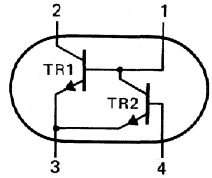
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code
BCV63 : D95
BCV63B : D96





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

	transistor		T1	T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

	transistor		T1	T2	
Collector cut-off current					
$I_E = 0$; V_{CBO} = 30 V	I_{CBO}	max.	15	15	nA
$I_E = 0$; V_{CBO} = 30 V; T_j = 150 °C	I_{CBO}	max.	5	5	μA
Saturation voltage**					
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	75	75	mV
	V_{CEsat}	max.	300	300	mV
	V_{BEsat}	typ.	700	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250	250	mV
	V_{CEsat}	max.	650	–	mV
	V_{BEsat}	typ.	850	–	mV
Base-emitter voltage ▲					
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	min.	600	–	mV
	V_{BE}	typ.	650	–	mV
	V_{BE}	max.	750	–	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820	–	mV
I_C = 2 mA; V_{CE} = 700 mV	V_{BE}	typ.		700	mV
Collector capacitance at f = 1 MHz					
$I_E = i_e = 0$; V_{CE} = 10 V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz
I_C = 2 mA; T1 : V_{CE} = 5 V
T2 : V_{CE} = 700 mV — h_{fe} 100 to 900

Transistor 1

D.C. current gain

I_C = 2 mA; V_{CE} = 5 V

h_{FE}		BCV63	BCV63B
	min.	110	200
	max.	800	450

Transistor 2

D.C. current gain
I_C = 2 mA; V_{CE} = 700 mV

Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

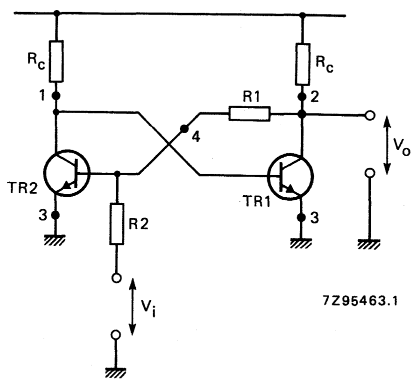


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTOR

Double P-N-P transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications.
N-P-N complement is the BCV63.

QUICK REFERENCE DATA

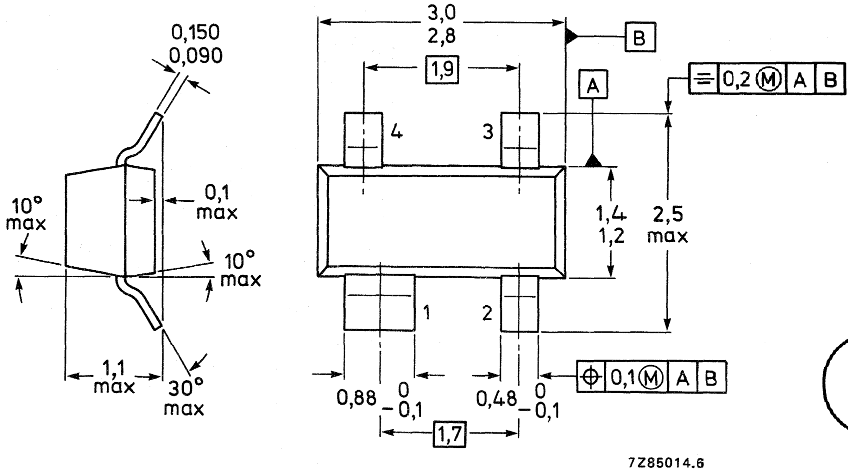
			transistor T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Collector current	$-I_C$	max.	100		mA
Junction temperature	T_j	max.	150		^oC
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250		mW
Collector-emitter saturation voltage $-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	200	—	MHz

MECHANICAL DATA

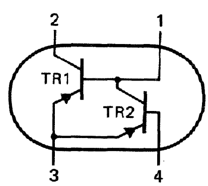
Dimensions in mm

Fig. 1 SOT-143.

Marking code
BCV64 : C95
BCV64B : C96



TOP VIEW



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

	transistor		T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	6	6	V
Collector current (d.c.)	$-I_C$	max.	6		mA
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

	transistor		T1	T2	
Collector cut-off current					
$-I_E = 0$; $-V_{CBO} = 30$ V	$-I_{CBO}$	max.	15	15	nA
$-I_E = 0$; $-V_{CBO} = 30$ V; $T_j = 150$ °C	$-I_{CBO}$	max.	5	5	μA
Saturation voltage**					
$-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	typ.	75	75	mV
	$-V_{CEsat}$	max.	300	300	mV
	$-V_{BEsat}$	typ.	700	700	mV
$-I_C = 100$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	typ.	250	250	mV
	$-V_{CEsat}$	max.	650	–	mV
	$-V_{BEsat}$	typ.	850	–	mV
Base-emitter voltage ▲					
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	typ.	650	–	mV
			600/750	–	mV
$-I_C = 10$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	max.	820	–	mV
$-I_C = 2$ mA; $-V_{CE} = 700$ mV	$-V_{BE}$	typ.		700	mV
Collector capacitance at f = 1 MHz					
$-I_E = i_e = 0$; $-V_{CE} = 10$ V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz
$-I_C$ = 2 mA; T1 : $-V_{CE}$ = 5 V
T2 : $-V_{CE}$ = 700 mV — h_{fe} — 100 to 900

Transistor 1

D.C. current gain
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V

		BCV64	BCV64B
h_{FE}	min.	110	220
	max.	800	475

Transistor 2

D.C. current gain
$-I_C$ = 2 mA; $-V_{CE}$ = 700 mV

Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

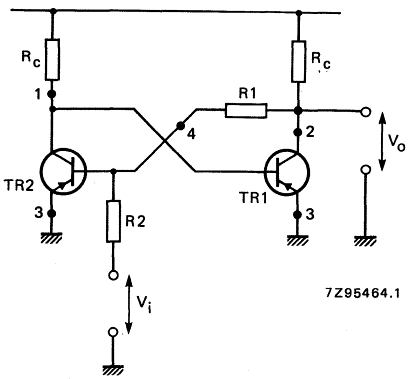


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTORS

A matched pair of P-N-P and N-P-N crystal, based on the BC557 and BC547, in a microminiature SOT-143 envelope.

Complementary crystals give advantages in P.C.B. layout using S.M.D. technology.

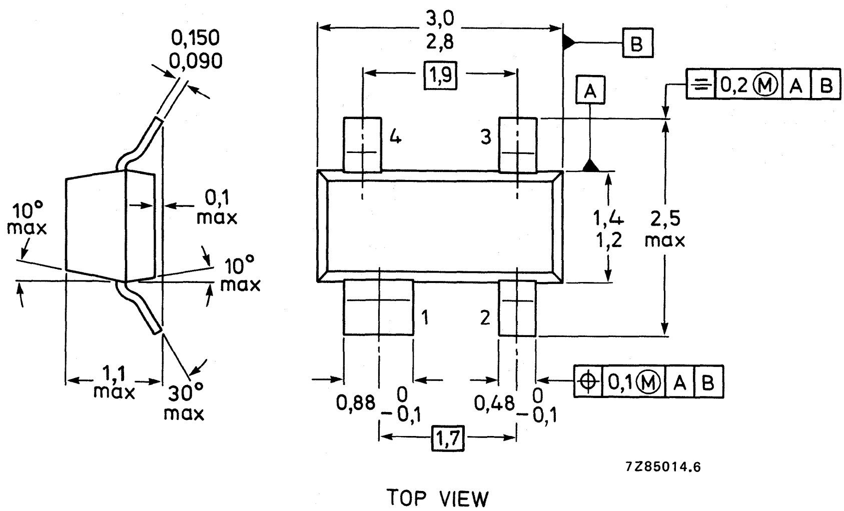
QUICK REFERENCE DATA

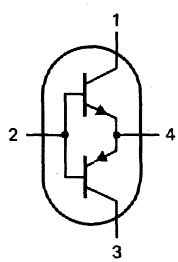
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector current (DC)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C

MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm
Marking code
BCV65: 97p
BCV65B: 98p





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Per transistor:

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Collector current (DC)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation (per device) up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_s		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

Per transistor:

T_j = 25 °C unless otherwise stated

Collector cut-off current			
$I_E = 0$; V_{CB} = 30 V	I_{CBO}	max.	15 nA
$I_E = 0$; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	max.	5 μA
Base-emitter voltage**			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	650 mV
			580 to 750 mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820 mV
Saturation voltage▲			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90 mV
		max.	300 mV
	V_{BEsat}	typ.	700 mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250 mV
		max.	650 mV
	V_{BEsat}	typ.	900 mV

D.C. current gain
I_C = 2 mA; V_{CE} = 5 V

		BCV65	BCV65B
h_{FE}	min.	75	200
h_{FE}	max.	800	475

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

** $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

▲ V_{BEsat} decreases by approx. 1,7 mV/K with increasing temperature.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCV71	BCV72	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	110 220	200 450	
Collector-base voltage (open emitter)	V_{CBO}	max.	80		V
Collector-emitter voltage (open base)	V_{CEO}	max.	60		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

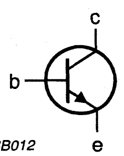
MECHANICAL DATA

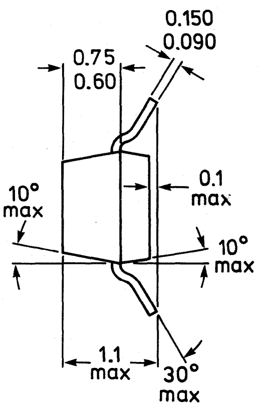
Fig. 1 SOT-23.

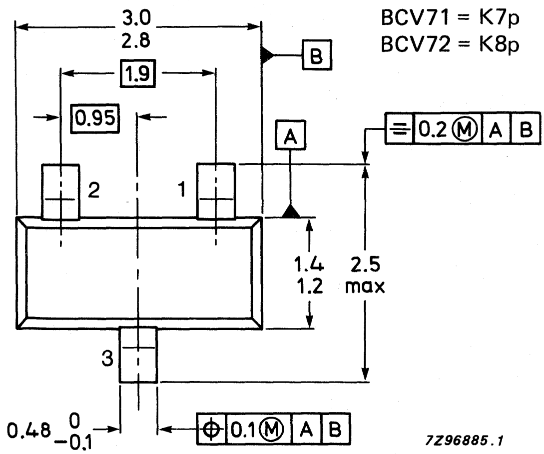
Dimensions in mm

Pinning:

1 = base
2 = emitter
3 = collector







TOP VIEW

Marking code

BCV71 = K7p
BCV72 = K8p

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	80	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	60	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100$ °C	I_{CBO}	<	10	μA
Base emitter voltage $I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}		550 to 700	mV
Saturation voltages $I_C = 10$ mA; $I_B = 0,5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2,5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

			BCV71	BCV72	
D.C. current gain $I_C = 10$ μA; $V_{CE} = 5$ V	h_{FE}	typ.	90	150	
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5		pF
Transition frequency at f = 35 MHz $I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300		MHz
Noise figure at $R_S = 2$ kΩ $I_C = 200$ μA; $V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	<	10		dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW29	BCW30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

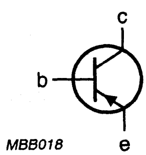
Dimensions in mm

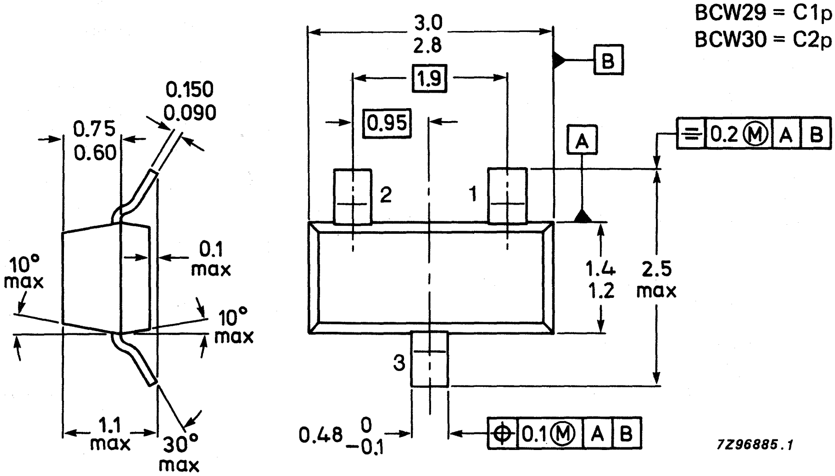
Fig. 1 SOT-23.

Marking code
BCW29 = C1p
BCW30 = C2p

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 32 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 32 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCW29	BCW30	
D.C. current gain					
$-I_C = 10\ \mu A$; $-V_{CE} = 5$ V	h_{FE}	typ.	90	150	
$-I_C = 2$ mA; $-V_{CE} = 5$ V	h_{FE}	>	120	215	
		<	260	500	
Collector-capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	150		MHz
Noise figure at $R_S = 2\ k\Omega$ $-I_C = 200\ \mu A$; $-V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	<	10		dB

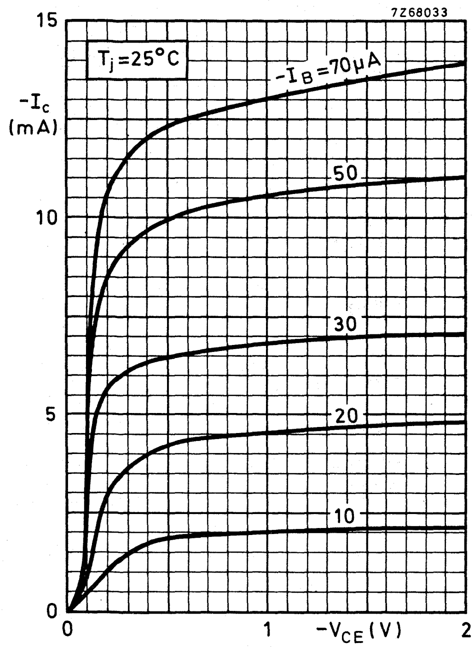


Fig. 2

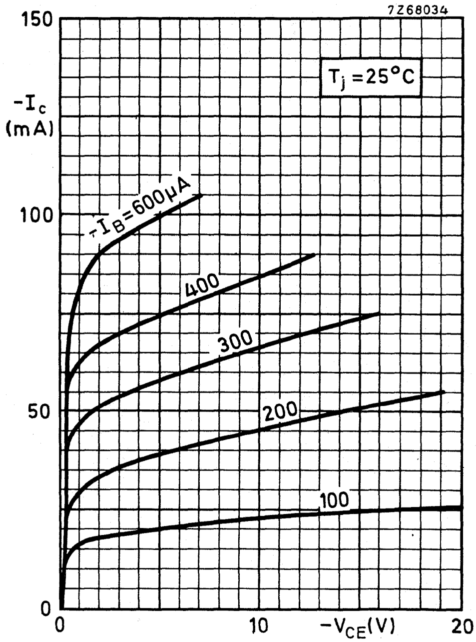


Fig. 3

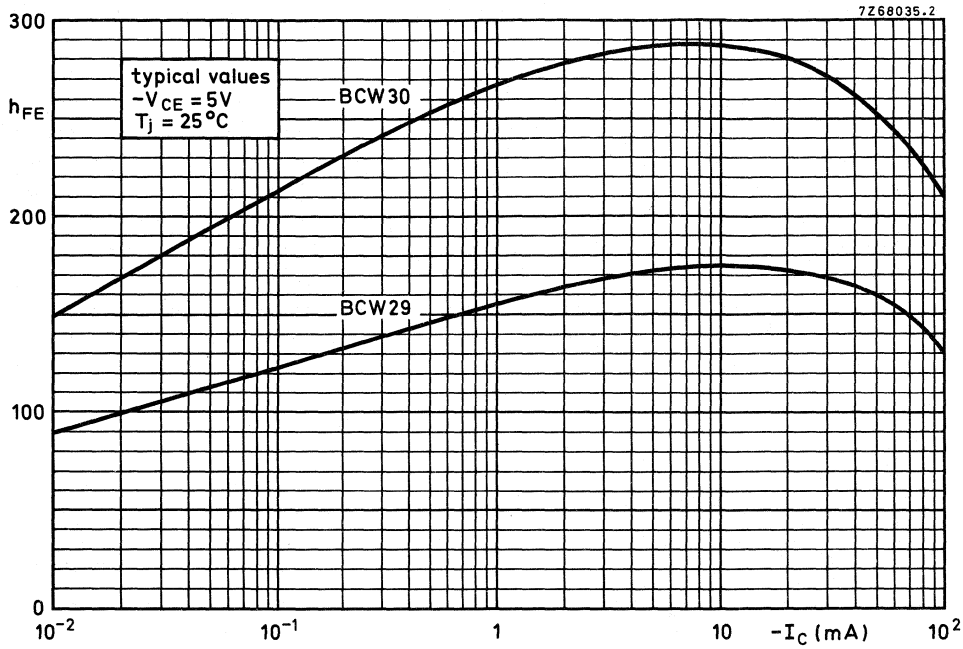

7Z68035.2
typical values
$-V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
BCW30
BCW29
300
200
100
0
10^{-2}
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 4

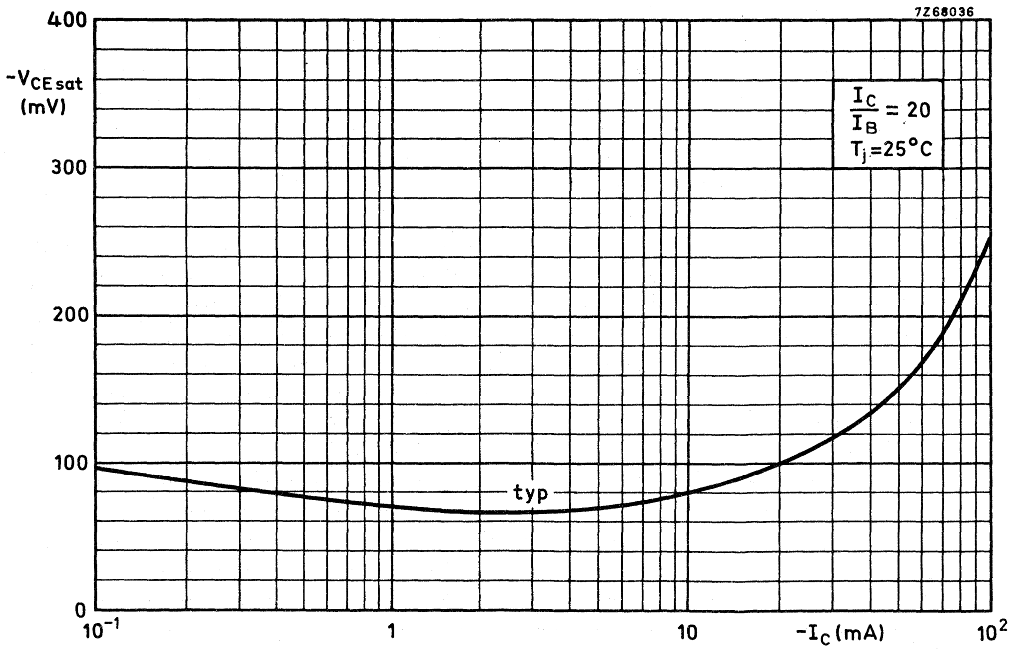

7Z68036
$-V_{CEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
400
300
200
100
0
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5

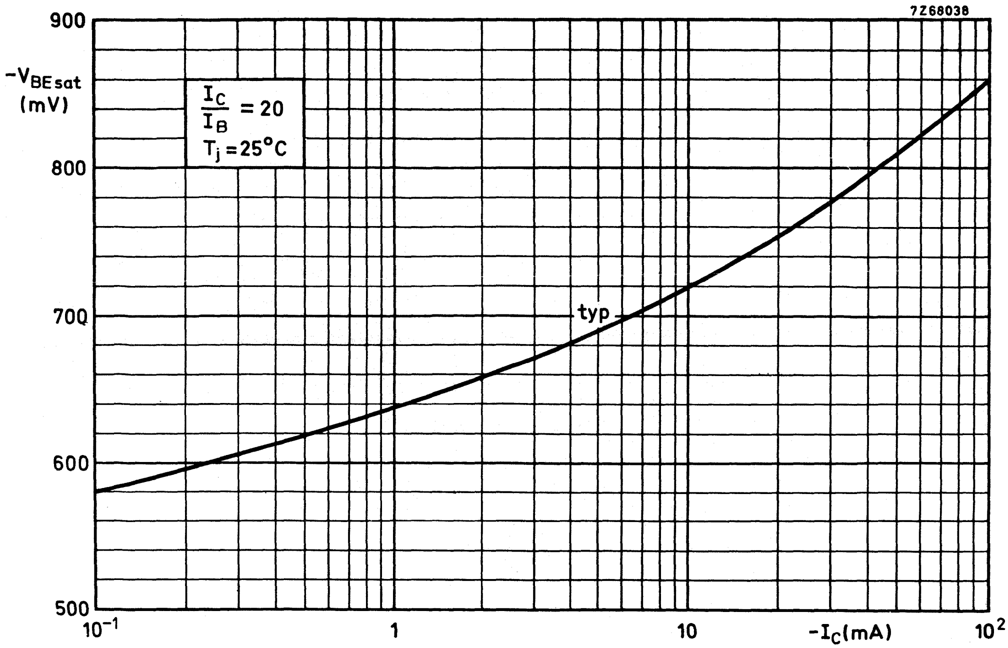

7Z68038
900
800
700
600
500
$-V_{BEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25 °C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

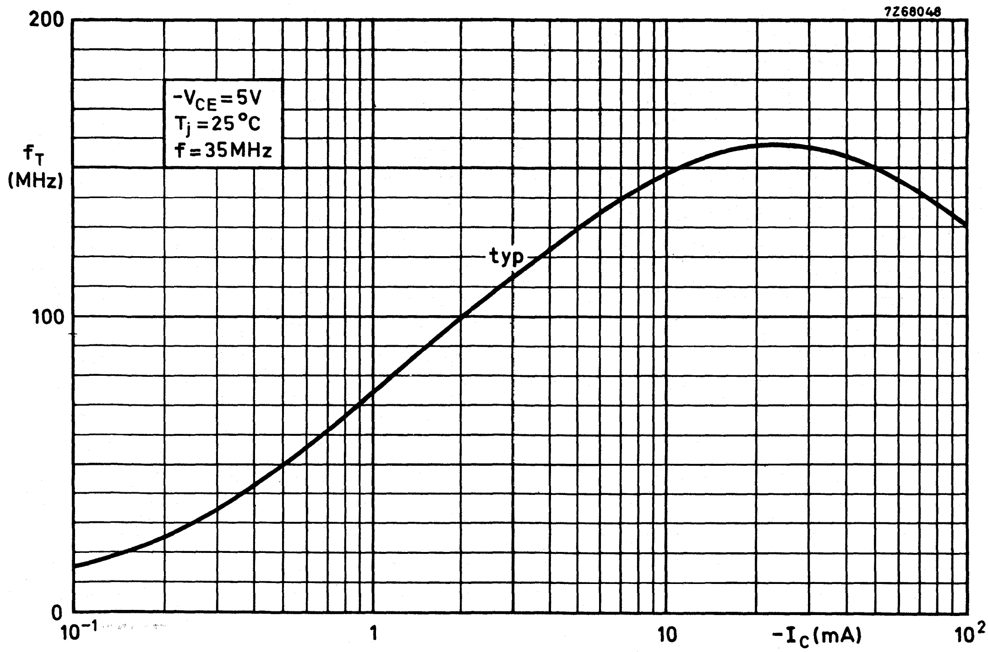

7Z68048
200
100
0
f_T
(MHz)
$-V_{CE} = 5V$
$T_j = 25 °C$
f = 35MHz
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

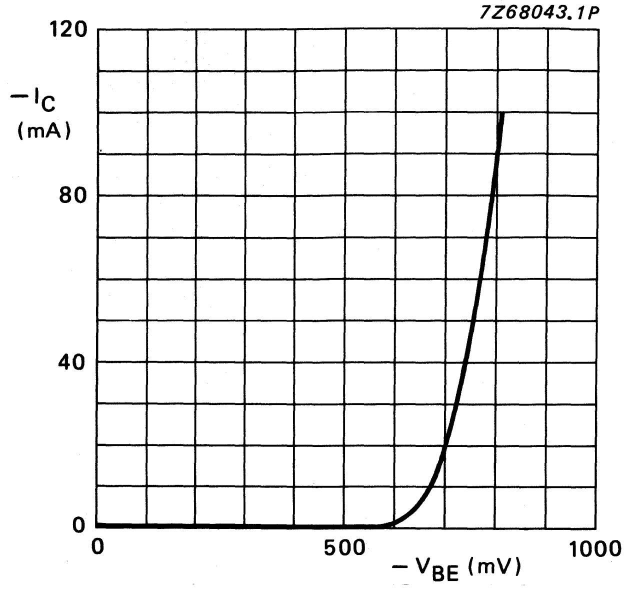


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

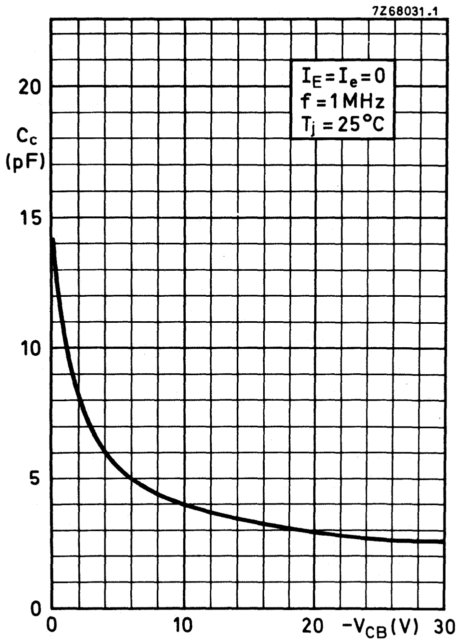


Fig. 9

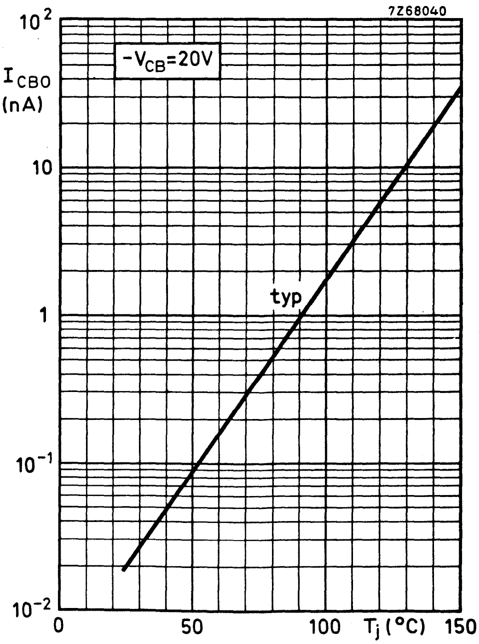


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW31	BCW32	BCW33	
D.C. current gain at T_j = 25 °C; I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector-base voltage (open emitter)	V_{CBO}	max.		32		V
Collector-emitter voltage (open base)	V_{CEO}	max.		32		V
Collector current (peak value)	I_{CM}	max.		200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		250		mW
Junction temperature	T_j	max.		150		°C
Transition frequency at f = 35 MHz; I_C = 2 mA; V_{CE} = 5 V	f_T	typ.		300		MHz
Noise figure at R_S = 2 kΩ; I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Dimensions in mm

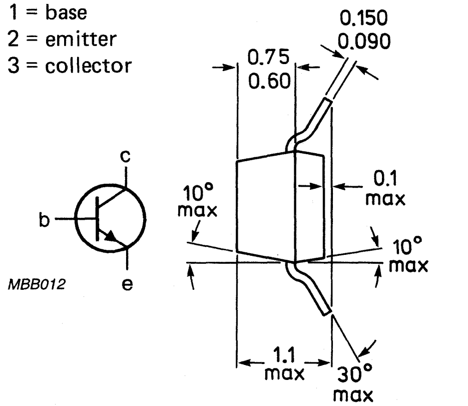
Fig. 1 SOT-23.

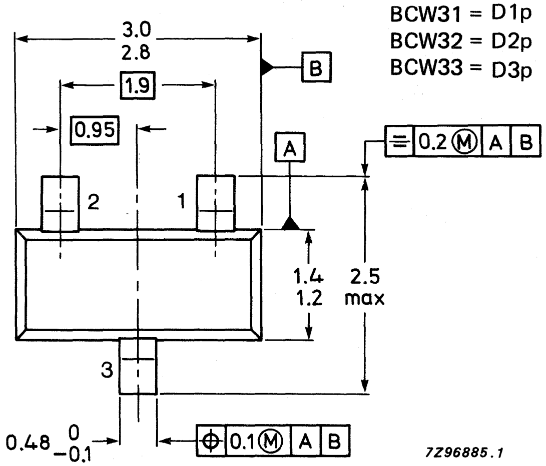
Pinning:

1 = base
2 = emitter
3 = collector

Marking code

BCW31 = D1p
BCW32 = D2p
BCW33 = D3p





TOP VIEW

Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		–65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 32$ V	I_{CBO}	<	100 nA
$I_E = 0$; $V_{CB} = 32$ V; $T_j = 100\ ^oC$	I_{CBO}	<	10 μA
Base-emitter voltage			
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}		550 to 700 mV
Saturation voltages			
I_C 10 mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCW31	BCW32	BCW33	
D.C. current gain						
I_C = 10 μA, V_{CE} = 5 V	h_{FE}	typ.	90	150	270	
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c		typ.	2,5		pF
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T		typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F		<	10		dB

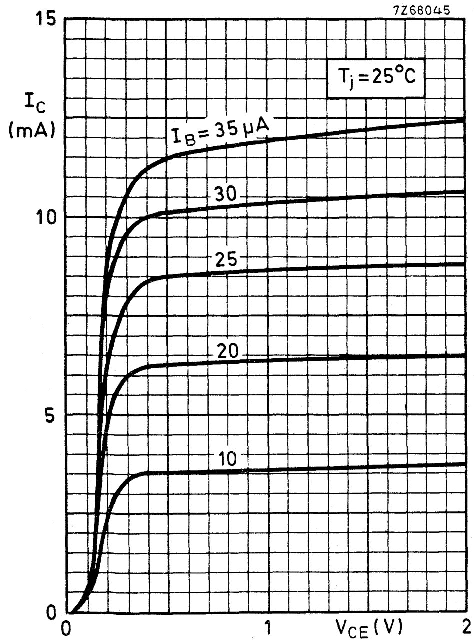


Fig. 2

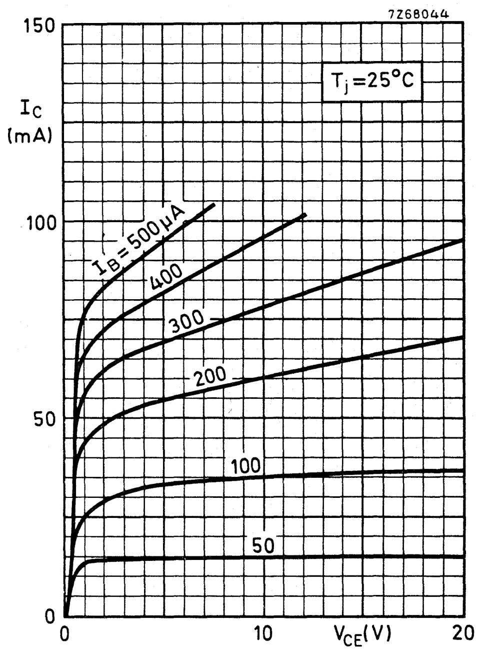


Fig. 3

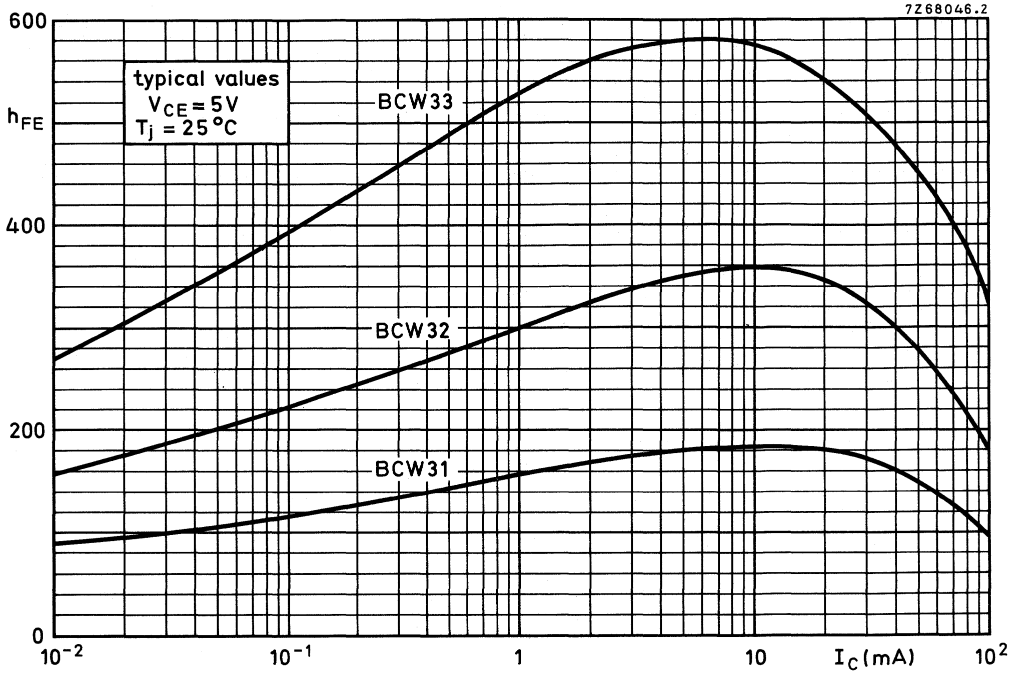

7Z68046.2
600
400
200
0
typical values
$V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
BCW33
BCW32
BCW31
10^{-2}
10^{-1}
1
10
I_C (mA)
10^2

Fig. 4

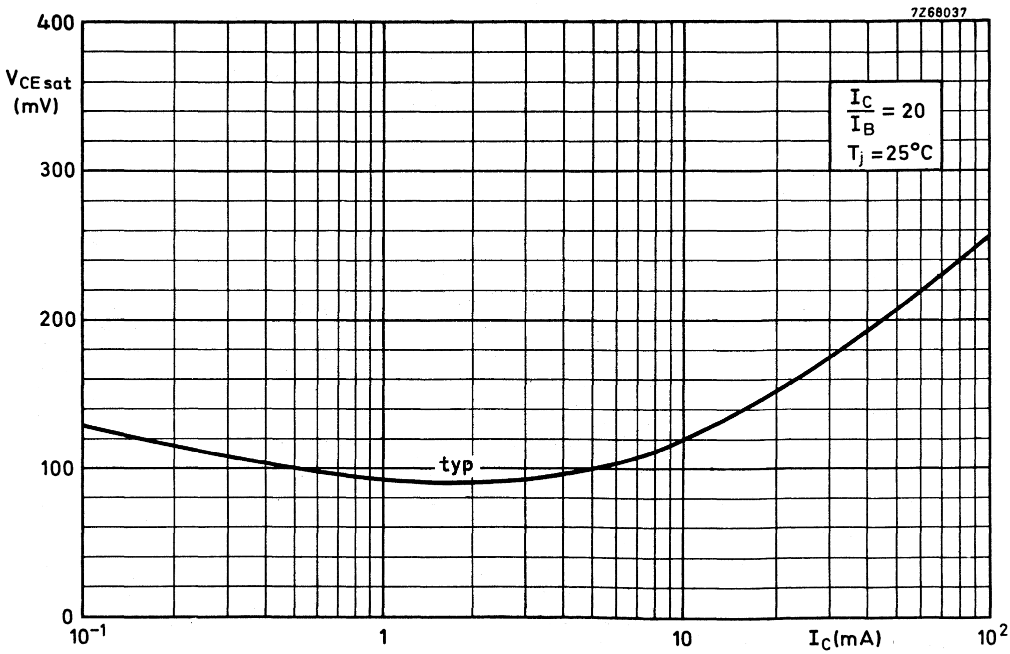

7Z68037
400
V_{CEsat}
(mV)
300
200
100
0
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 5

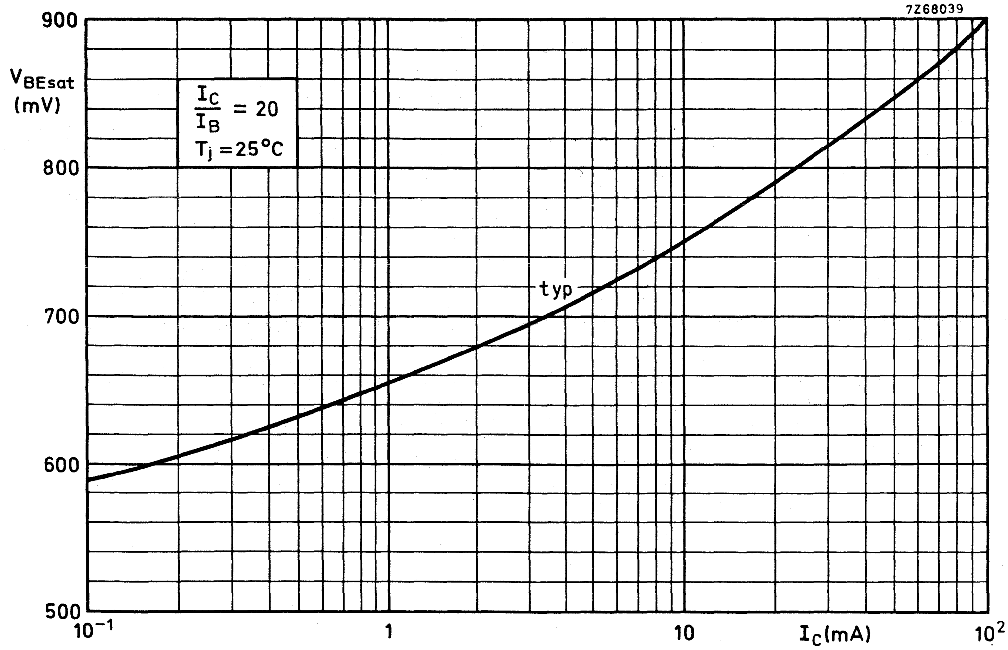

7Z68039
900
800
700
600
500
V_BEsat (mV)
I_C/I_B = 20
T_j = 25 °C
typ
10^-1
1
10
I_C (mA)
10^2

Fig. 6

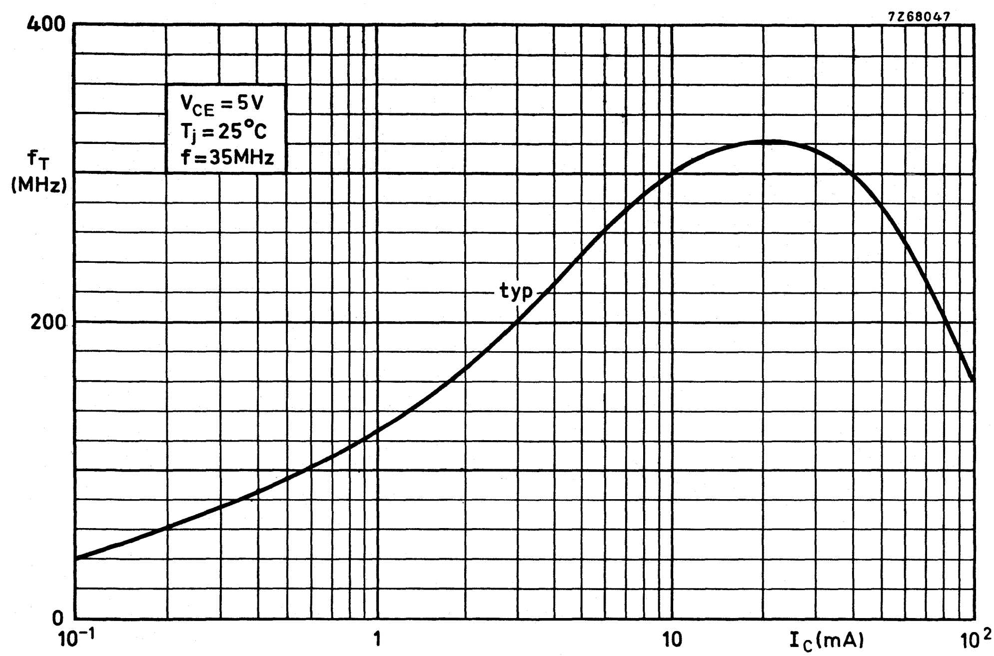

7Z68047
400
200
0
f_T (MHz)
V_CE = 5 V
T_j = 25 °C
f = 35 MHz
typ
10^-1
1
10
I_C (mA)
10^2

Fig. 7

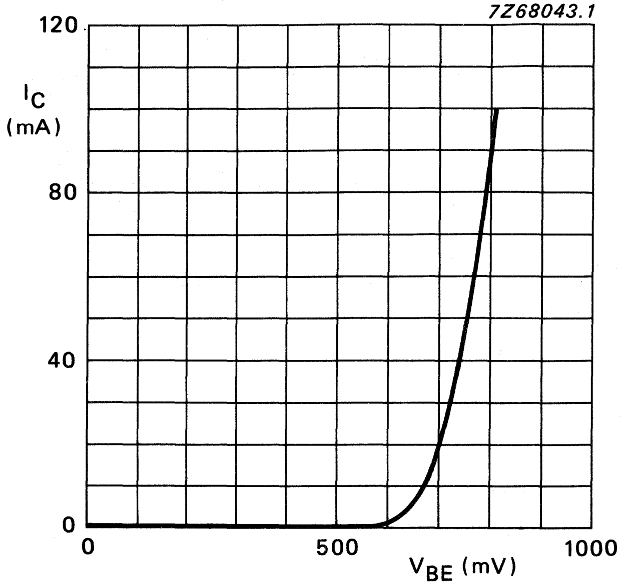


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

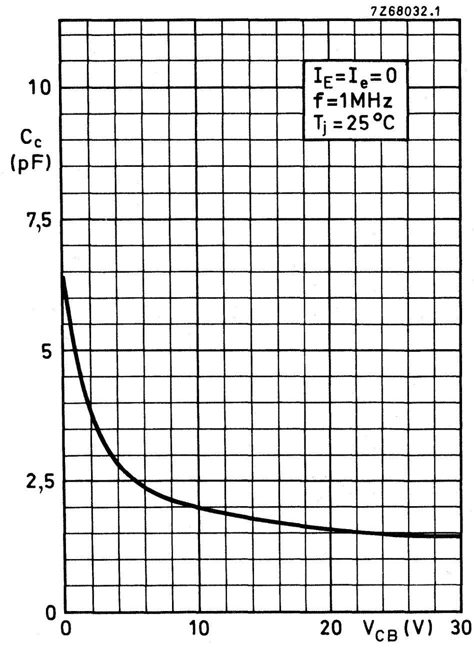


Fig. 9

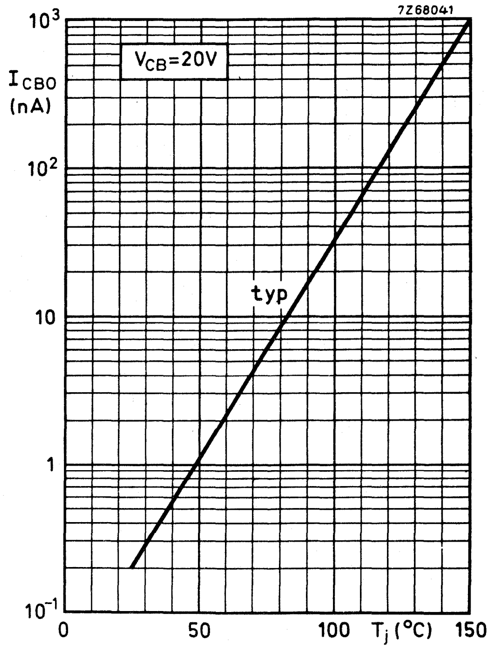


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz V_{CE} = 5 V; I_C = 10 mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz V_{CE} = 5 V; I_C = 200 μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

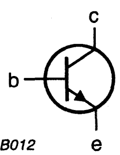
Fig. 1 SOT-23.

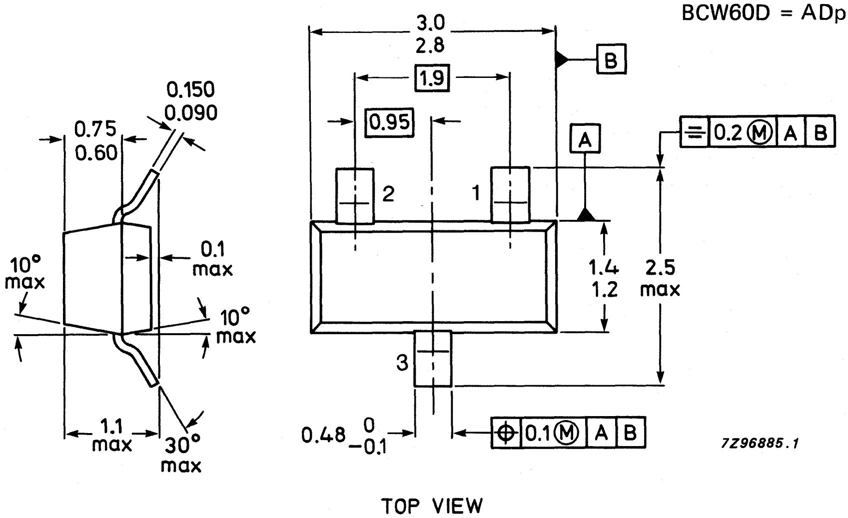
Marking code

BCW60A = AAp
BCW60B = ABp
BCW60C = ACp
BCW60D = ADp

Pinning:

1 = base
2 = emitter
3 = collector





See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	200	mA
Base current	I_B	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	– 65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{BE} = 0; V_{CE} = 32 V	I_{CES}	<	20	nA
V_{BE} = 0; V_{CE} = 32 V; T_{amb} = 150 °C	I_{CES}	<	20	μA
Emitter-base cut-off current				
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20	nA
Saturation voltages				
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}	0,05 to 0,35		V
	V_{BEsat}	0,6 to 0,85		V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}	0,1 to 0,55		V
	V_{BEsat}	0,7 to 1,05		V
Transition frequency at f = 100 MHz ▲				
I_C = 10 mA; V_{CE} = 5 V	f_T	>	125	MHz
		typ.	250	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0,5 V	C_e	typ.	8	pF
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2	dB
		<	6	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.
▲ Measured under pulse conditions.

			BCW60A	60B	60C	60D	
D.C. current gain							
V_{CE} = 5 V; I_C = 10 μA	h_{FE}	>	–	20	40	100	
V_{CE} = 5 V; I_C = 2 mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
V_{CE} = 1 V; I_C = 50 mA	h_{FE}	>	50	70	90	100	
Input impedance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μs
Base-emitter voltage							
V_{CE} = 5 V; I_C = 2 mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
V_{CE} = 5 V; I_C = 10 μA	V_{BE}	typ.	0,52				V
V_{CE} = 1 V; I_C = 50 mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; $I_{Bon} = -I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

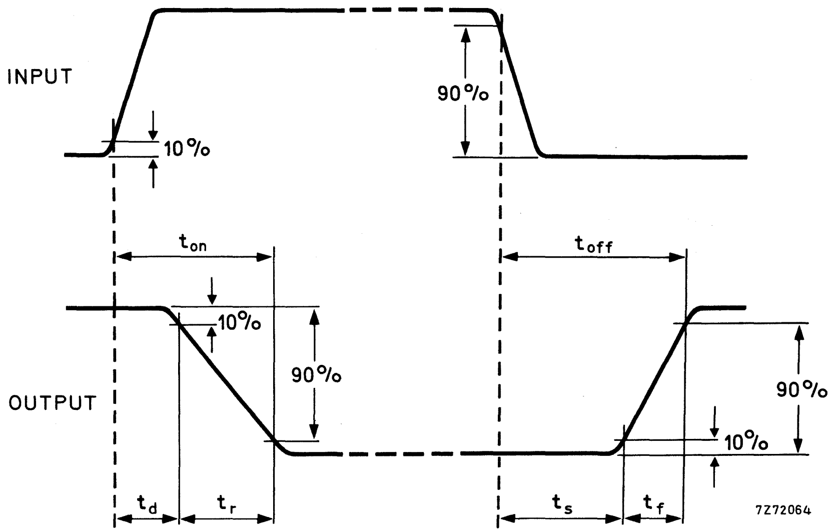


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	^oC
Transition frequency at f = 100 MHz $-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180	MHz
Noise figure at f = 1 kHz $-V_{CE}$ = 5 V; $-I_C$ = 200 μA	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

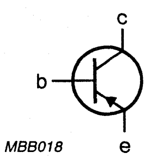
Fig. 1 SOT-23.

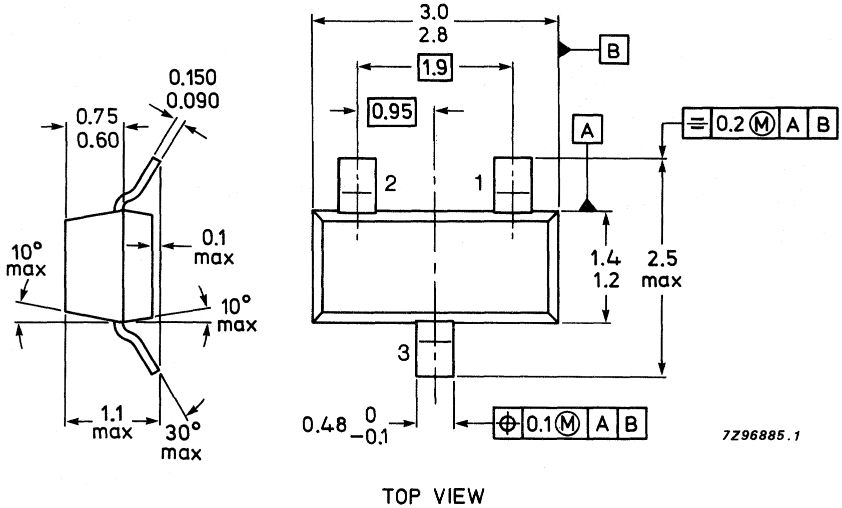
Marking code

BCW61A = BAp
BCW61B = BBp
BCW61C = BCp
BCW61D = BDp

Pinning:

1 = base
2 = emitter
3 = collector





See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Base current	$-I_B$	max.	50 mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient *	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

$T_{amb} = 25$ °C unless otherwise specified

Collector-emitter cut-off current			
$V_{EB} = 0$; $-V_{CE} = 32$ V	$-I_{CES}$	<	20 nA
$V_{EB} = 0$; $-V_{CE} = 32$ V; $T_{amb} = 150$ °C	$-I_{CES}$	<	20 μA
Emitter-base cut-off current			
$I_C = 0$; $-V_{EB} = 4$ V	$-I_{EBO}$	<	20 nA
Saturation voltages			
$-I_C = 10$ mA; $-I_B = 0{,}25$ mA	$-V_{CEsat}$		0,06 to 0,25 V
	$-V_{BEsat}$		0,6 to 0,85 V
$-I_C = 50$ mA; $-I_B = 1{,}25$ mA	$-V_{CEsat}$		0,12 to 0,55 V
	$-V_{BEsat}$		0,68 to 1,05 V
Transition frequency at f = 100 MHz ▲			
$-V_{CE} = 5$ V; $-I_C = 10$ mA	f_T	typ.	180 MHz
Collector capacitance at f = 1 MHz			
$-V_{CB} = 10$ V; $I_E = I_e = 0$	C_c	typ.	4,5 pF
Emitter capacitance at f = 1 MHz			
$-V_{EB} = 0{,}5$ V; $I_C = I_c = 0$	C_e	typ.	11 pF
Noise figure at $R_S = 2$ kΩ			
$-V_{CE} = 5$ V; $-I_C = 200$ μA; B = 200 Hz	F	typ.	2 dB
		<	6 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			BCW61A	61B	61C	61D	
D.C. current gain							
$-V_{CE} = 5\ V; -I_C = 10\ \mu A$	h_{FE}	>	–	30	40	100	
$-V_{CE} = 5\ V; -I_C = 2\ mA$	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
$-V_{CE} = 1\ V; -I_C = 50\ mA$	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE} = 5\ V; -I_C = 2\ mA; f = 1\ kHz$	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE} = 5\ V; -I_C = 2\ mA; f = 1\ kHz$	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE} = 5\ V; -I_C = 2\ mA; f = 1\ kHz$	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE} = 5\ V; -I_C = 2\ mA; f = 1\ kHz$	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
$-V_{CE} = 5\ V; -I_C = 2\ mA$	V_{BE}		0,6 to 0,75				V
		typ.	0,65				V
$-V_{CE} = 5\ V; -I_C = 10\ \mu A$	V_{BE}	typ.	0,55				V
$-V_{CE} = 1\ V; -I_C = 50\ mA$	V_{BE}	typ.	0,72				V

Switching times

$-I_{Con}$ = 10 mA; $-I_{Bon}$ = I_{Boff} = 1 mA
$-V_{CC}$ = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

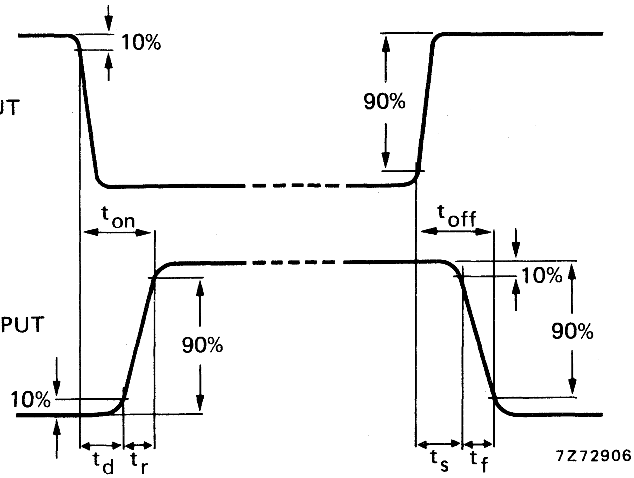


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW69	BCW70	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

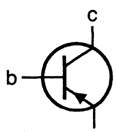
MECHANICAL DATA

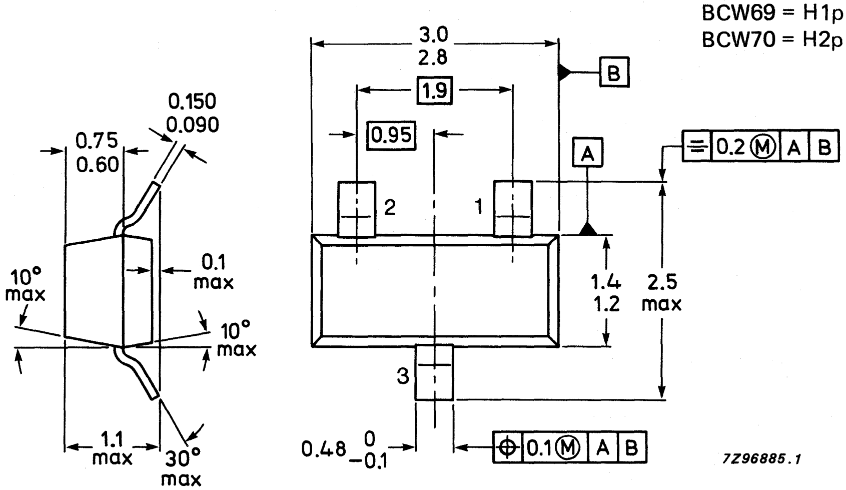
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BCW69 = H1p
BCW70 = H2p

Pinning:
1 = base
2 = emitter
3 = collector





Reverse pinning types are available on request.

TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

			BCW69	BCW70	
D.C. current gain					
$-I_C$ = 10 μA; $-V_{CE}$ = 5 V	h_{FE}	typ.	90	150	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<	10		dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

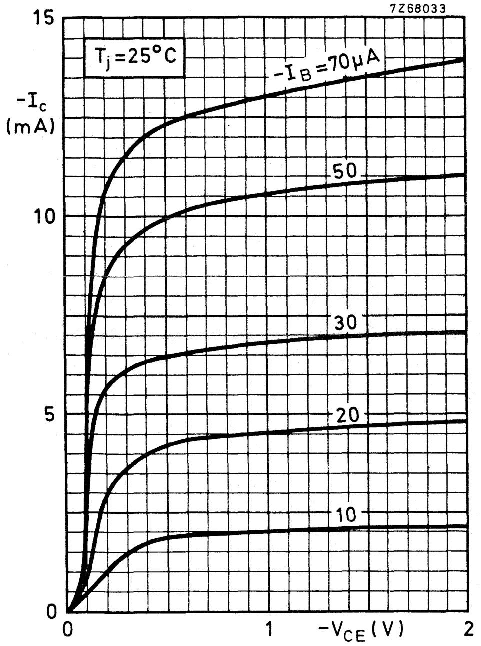


Fig. 2.

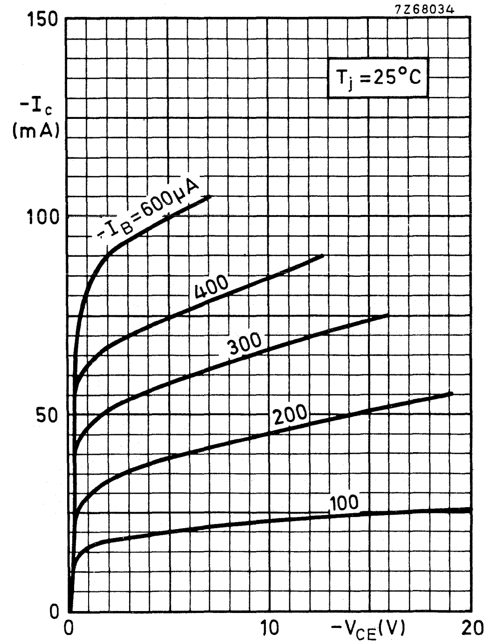


Fig. 3.

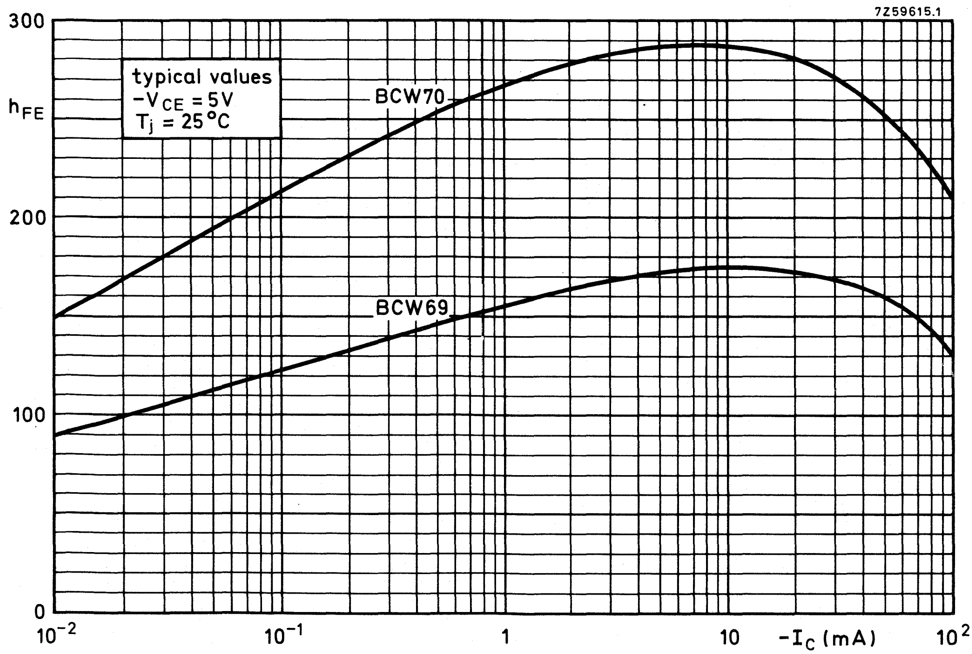


Fig. 4 D.C. current gain.

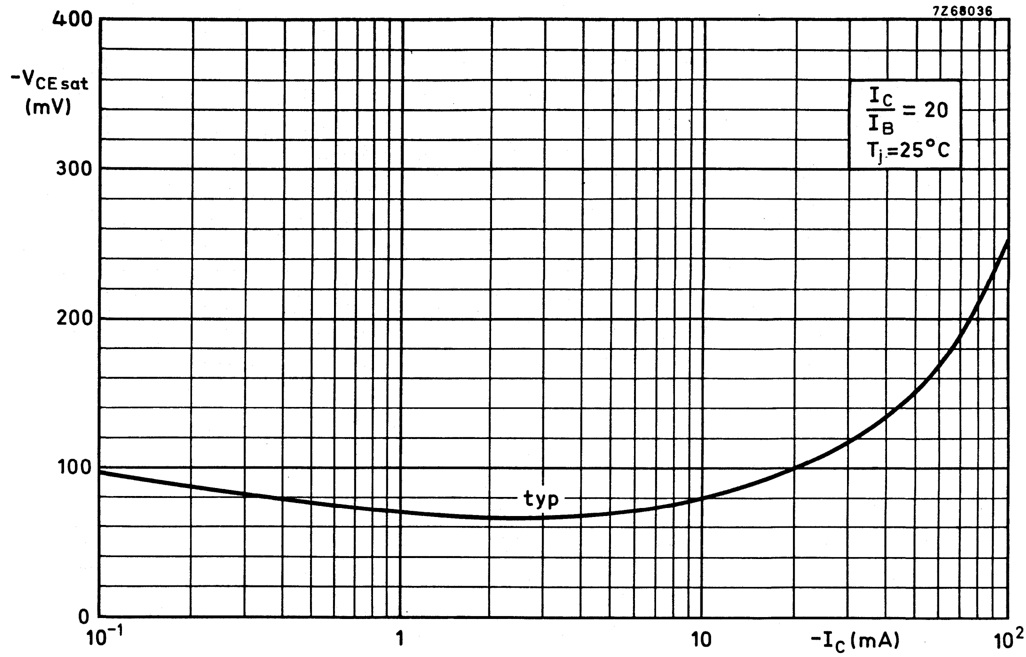

7Z68036
400
300
200
100
0
$-V_{CEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5.

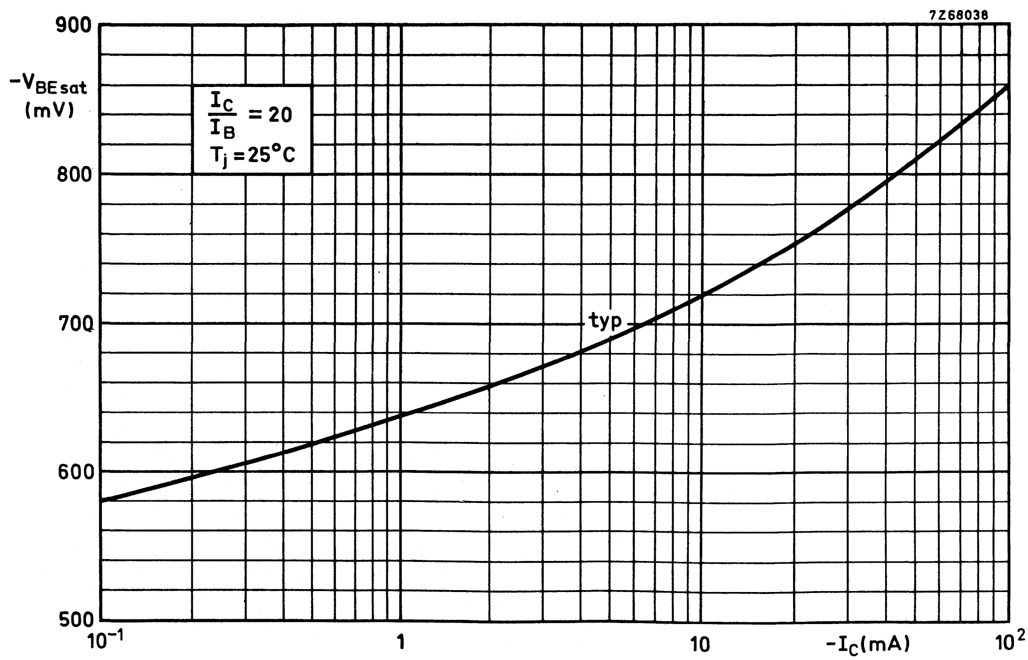

7Z68038
900
800
700
600
500
$-V_{BEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 6.

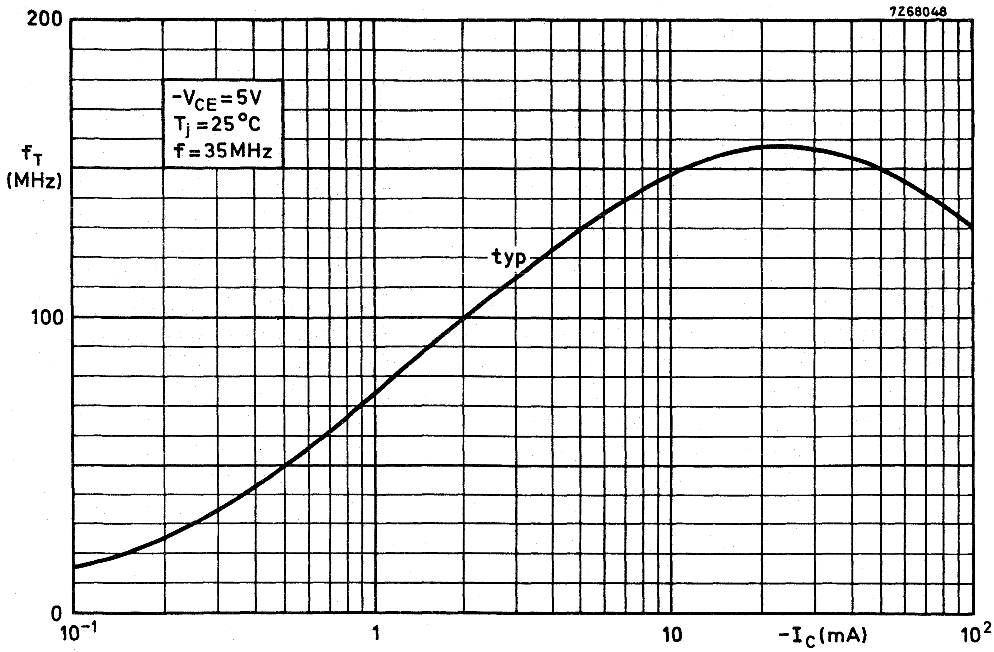


Fig. 7.

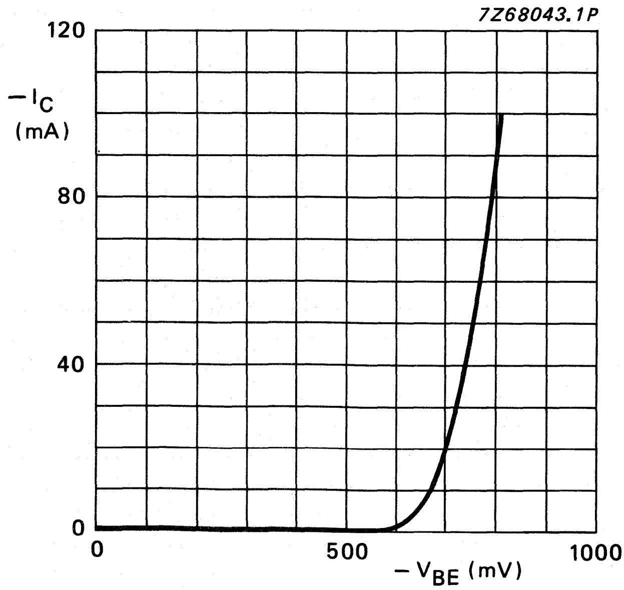


Fig. 8.; $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

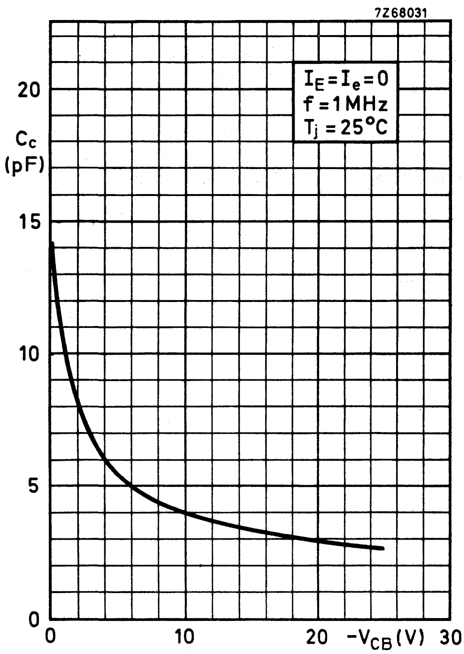

7Z68031
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c (pF)
0
5
10
15
20
0
10
20
$-V_{CB}$ (V)
30

Fig. 9.

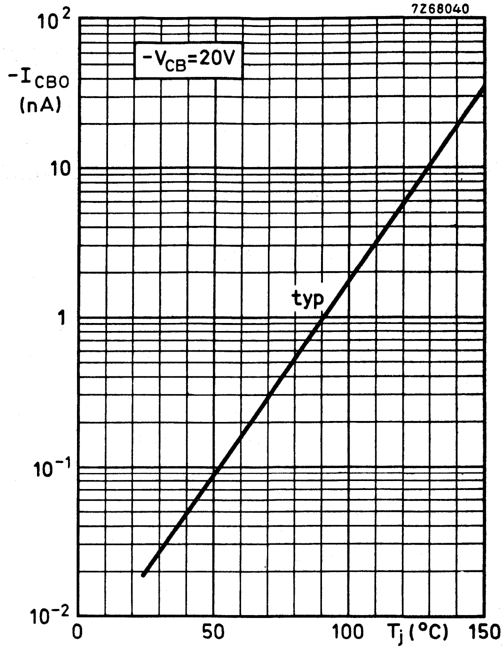

7Z68040
$-V_{CB}$=20V
$-I_{CBO}$ (nA)
10^2
10
1
10^{-1}
10^{-2}
typ
0
50
100
T_j (°C)
150

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW71	BCW72	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	110 220	200 450	
Collector-base voltage (open emitter)	V_{CBO}	max.	50		V
Collector-emitter voltage (open base)	V_{CEO}	max.	45		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

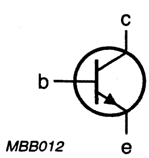
MECHANICAL DATA

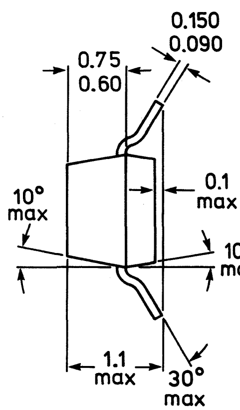
Dimensions in mm

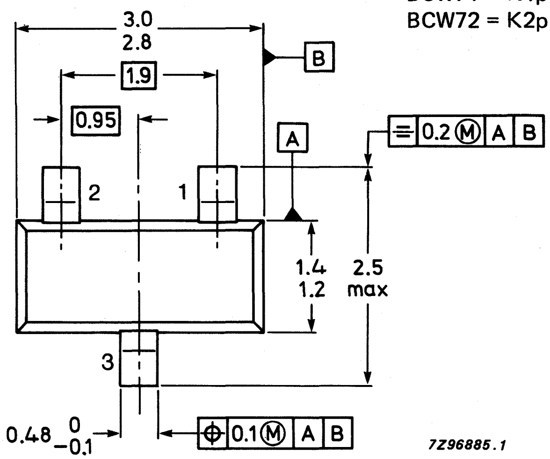
Fig. 1 SOT-23.

Marking code
BCW71 = K1p
BCW72 = K2p

Pinning:
1 = base
2 = emitter
3 = collector







TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100\ ^oC$	I_{CBO}	<	10	μA
Base emitter voltage				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}		550 to 700	mV
Saturation voltages				
$I_C = 10$ mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

			BCW71	BCW72	
D.C. current gain					
$I_C = 10\ \mu A$; $V_{CE} = 5$ V	h_{FE}	typ.	90	150	
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz; $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5		pF
Transition frequency at f = 35 MHz; $I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300		MHz
Noise figure at $R_S = 2\ k\Omega$; $I_C = 200\ \mu A$; $V_{CE} = 5$ V; f = 1 kHz; B = 200 Hz	F	<	10		dB

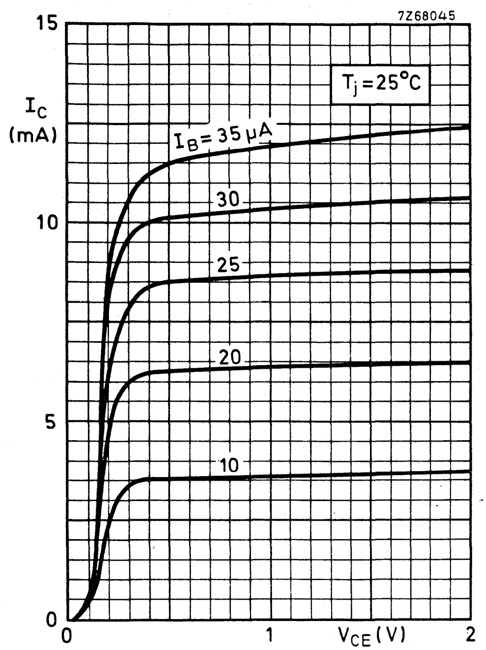


Fig. 2

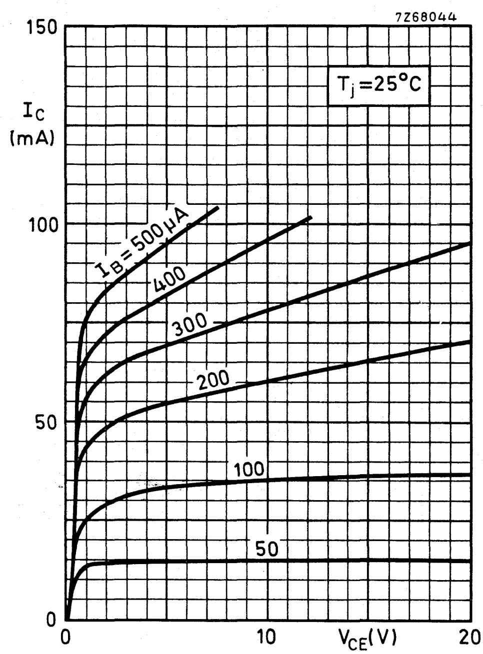


Fig. 3

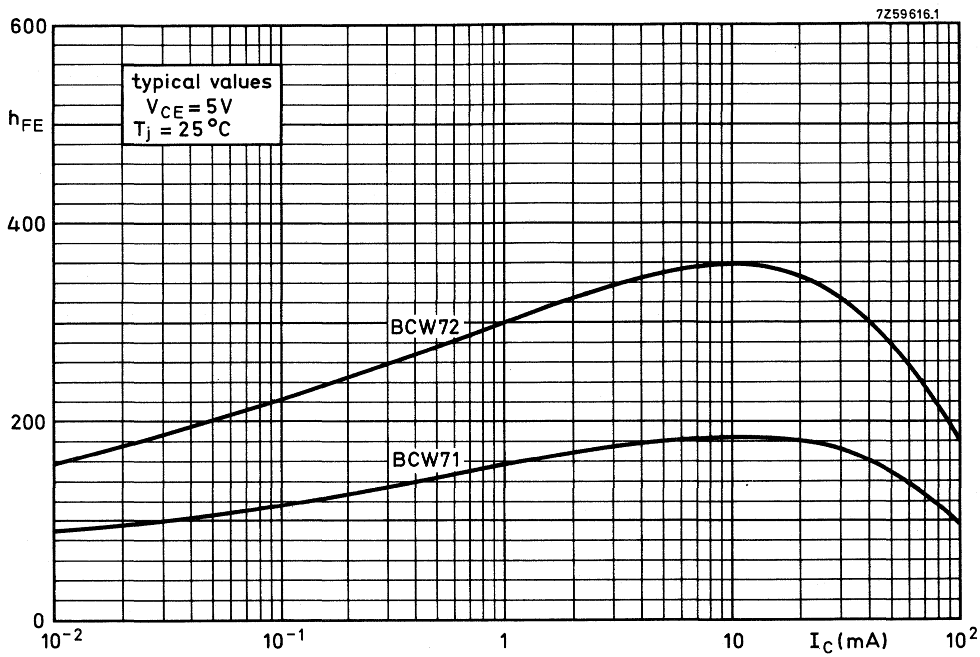


Fig. 4 D.C. current gain.

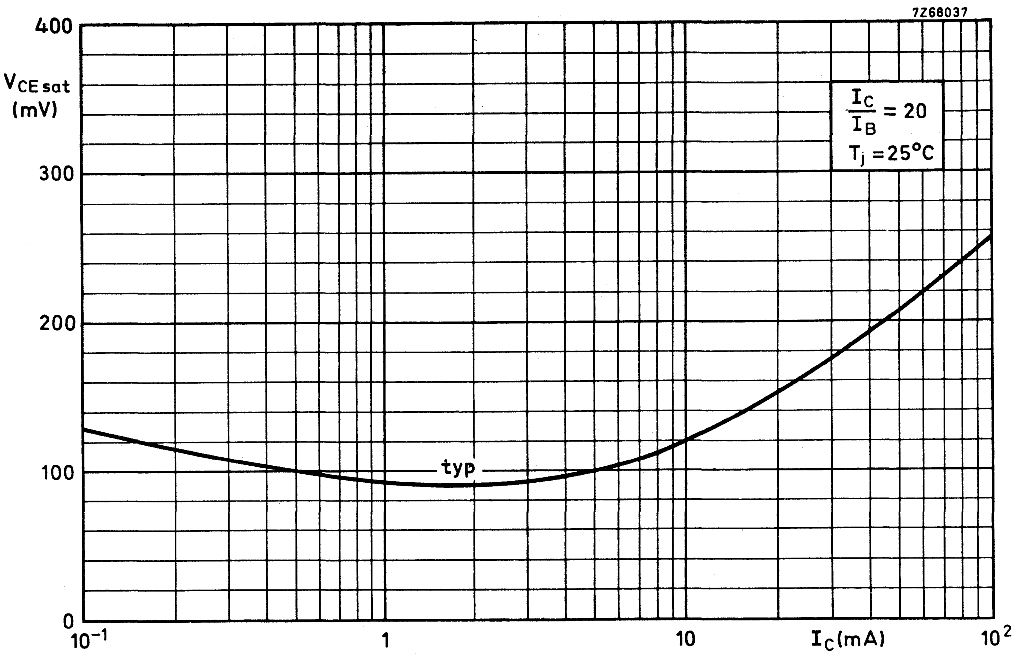


Fig. 5

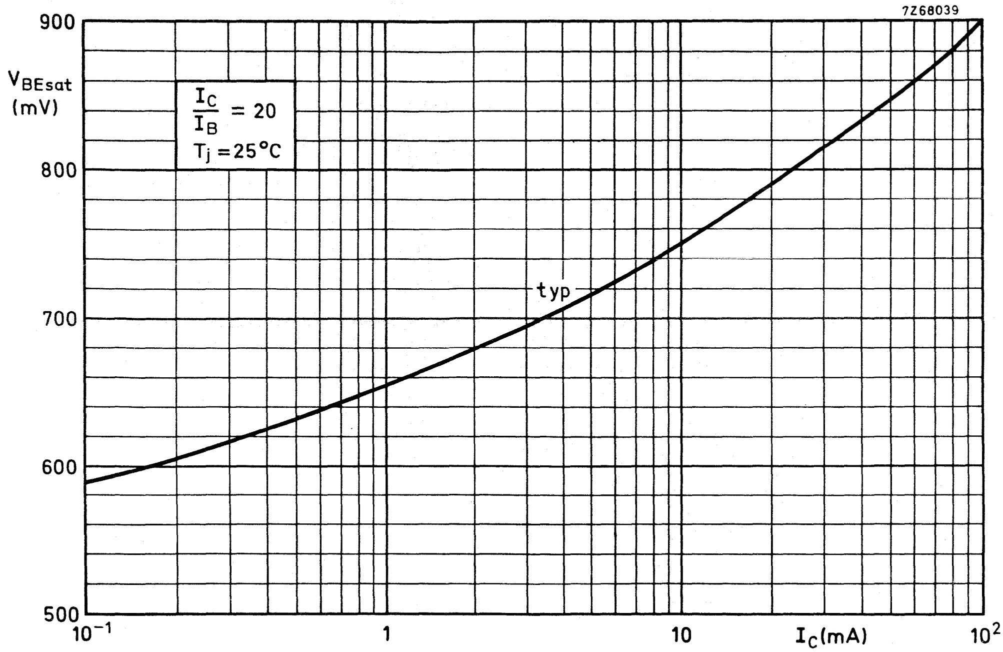

7Z68039
900
800
700
600
500
V_{BEsat}
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

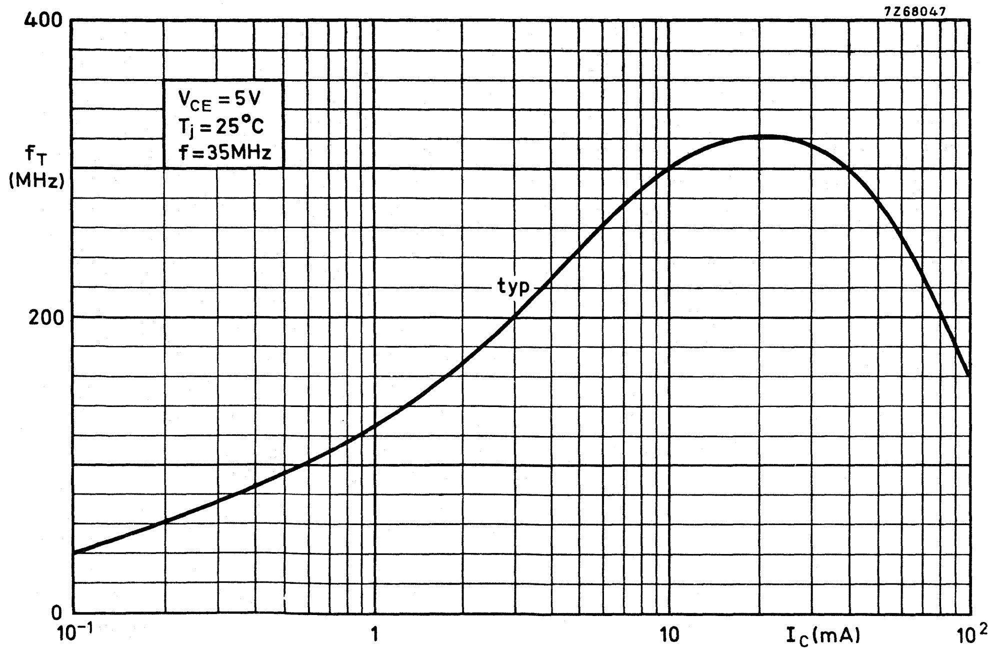

7Z68047
400
200
0
f_T
(MHz)
$V_{CE} = 5\,V$
$T_j = 25\,°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

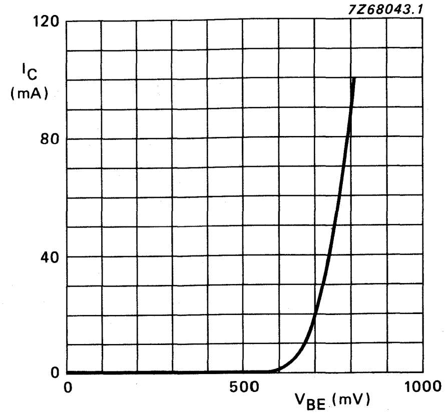


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

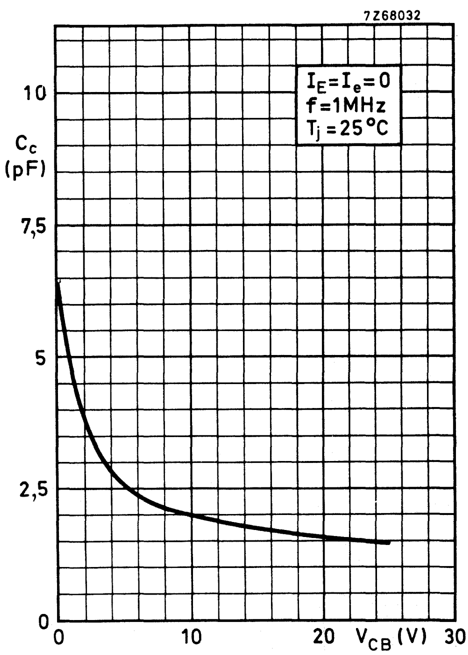


Fig. 9

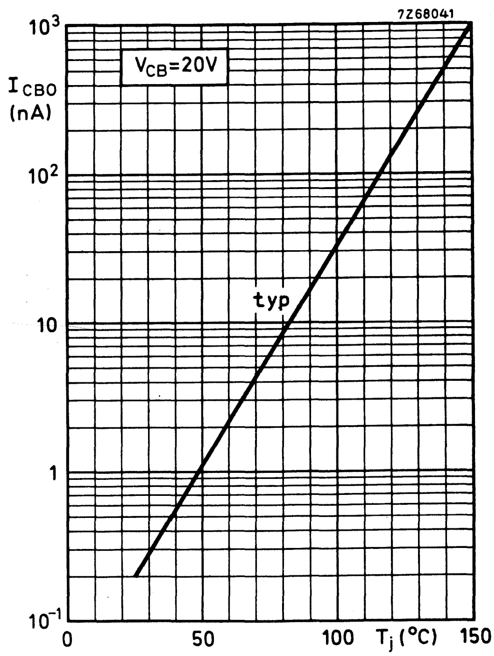


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C; I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	420 800	
Transition frequency at f = 35 MHz; I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ; I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

MECHANICAL DATA

Dimensions in mm

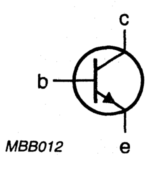
Fig. 1 SOT-23.

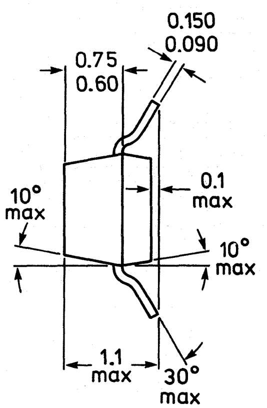
Marking code

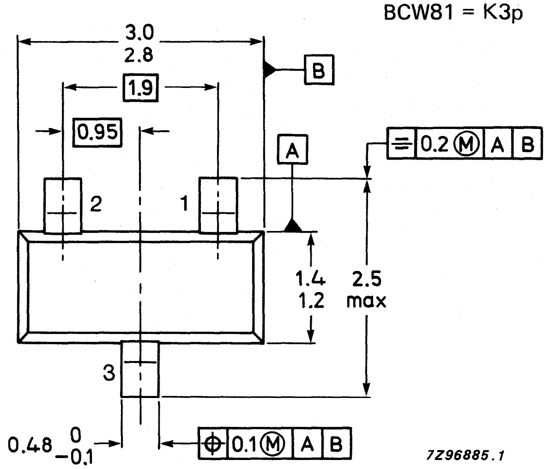
BCW81 = K3p

Pinning:

1 = base
2 = emitter
3 = collector







TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100$ °C	I_{CBO}	<	10	µA
Base emitter voltage				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	550 to 700		mV
Saturation voltages				
$I_C = 10$ mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV
D.C. current gain				
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	420	
		<	800	
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
$I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300	MHz
Noise figure at $R_S = 2$ kΩ				
$I_C = 200$ µA; $V_{CE} = 5$ V				
f = 1 kHz; B = 200 Hz	F	<	10	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	$>$ $<$	120 260	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	$<$	10	dB

MECHANICAL DATA

Dimensions in mm

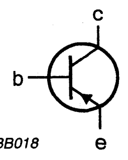
Fig. 1 SOT-23.

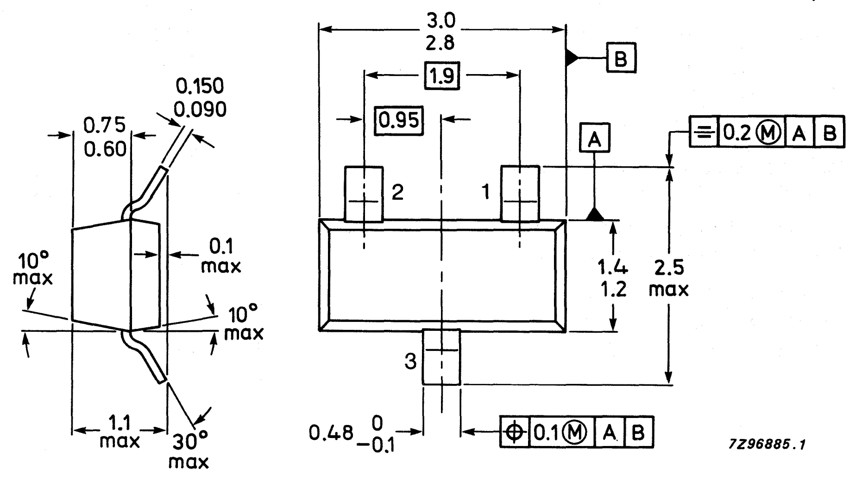
Marking code

BCW89 = H3p

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	60	V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100	nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 100 °C	$-I_{CBO}$	<	10	µA
Base-emitter voltage				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; T_j = 25 °C	$-V_{BE}$		600 to 750	mV
Saturation voltages				
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80	mV
		<	300	mV
	$-V_{BEsat}$	typ.	720	mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150	mV
	$-V_{BEsat}$	typ.	810	mV
D.C. current gain				
$-I_C$ = 10 µA; $-V_{CE}$ = 5 V	h_{FE}	typ.	90	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	
		<	260	
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ				
$-I_C$ = 200 µA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
N-P-N complements are BCX19 and BCX20 respectively.

QUICK REFERENCE DATA

			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}		100 to 600		
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 35 MHz	f_T	typ.	100		MHz

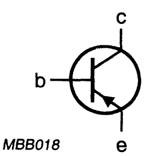
MECHANICAL DATA

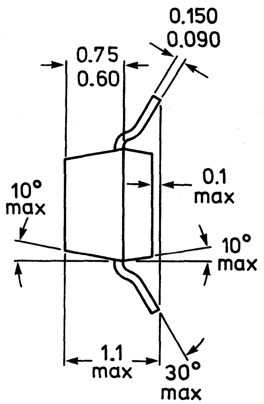
Dimensions in mm

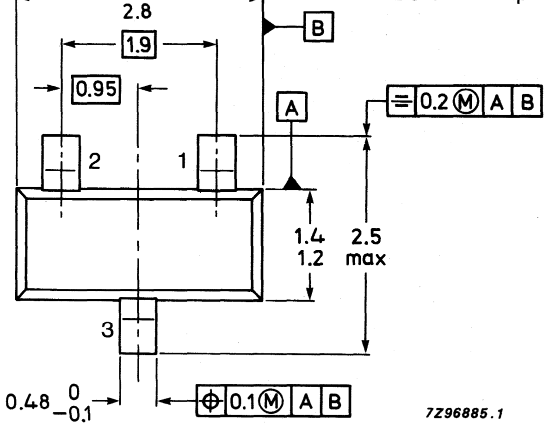
Fig. 1 SOT-23.

Marking code
BCX17 = T1p
BCX18 = T2p

Pinning:
1 = base
2 = emitter
3 = collector







TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage $-I_C$ = 10 mA (see Fig. 2)	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (d.c.)	$-I_C$	max.	500		mA
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Emitter current (peak value)	I_{EM}	max.	1000		mA
Base current (d.c.)	$-I_B$	max.	100		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient $R_{th\ j\text{-}a}$ = 500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100	nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 150 °C	$-I_{CBO}$	<	5	μA
Emitter cut-off current				
I_C = 0; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage ▲				
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	$-V_{BE}$	<	1,2	V
Saturation voltage				
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	620	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ $-V_{BE}$ decreases by about 2 mV/°C with increasing temperature.

D.C. current gain			
$-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}		100 to 600
$-I_C$ = 300 mA; $-V_{CE}$ = 1 V	h_{FE}	>	70
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}	>	40
Transition frequency at f = 35 MHz			
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	100 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	8 pF

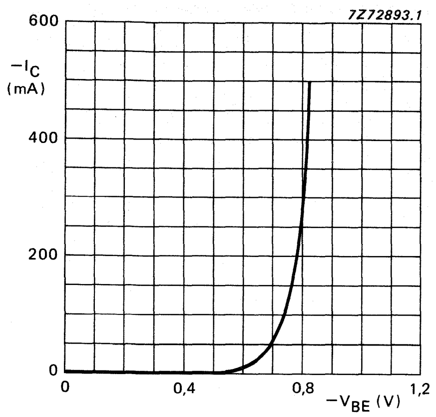


Fig. 2 $-V_{CE}$ = 1 V; T_j = 25 °C; typical values.

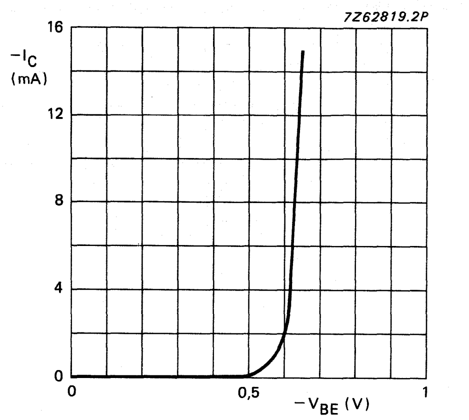


Fig. 3 V_{CE} = 5 V; T_j = 25 °C; typical values.

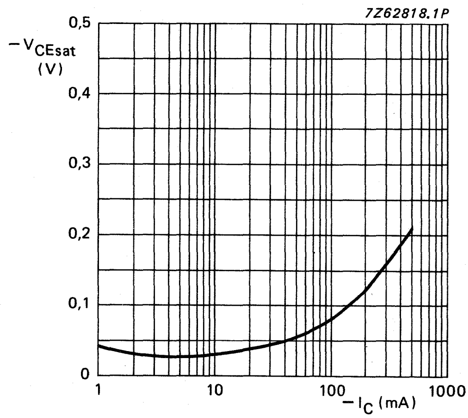


Fig. 4 I_C/I_B = 10; T_j = 25 °C; typical values.

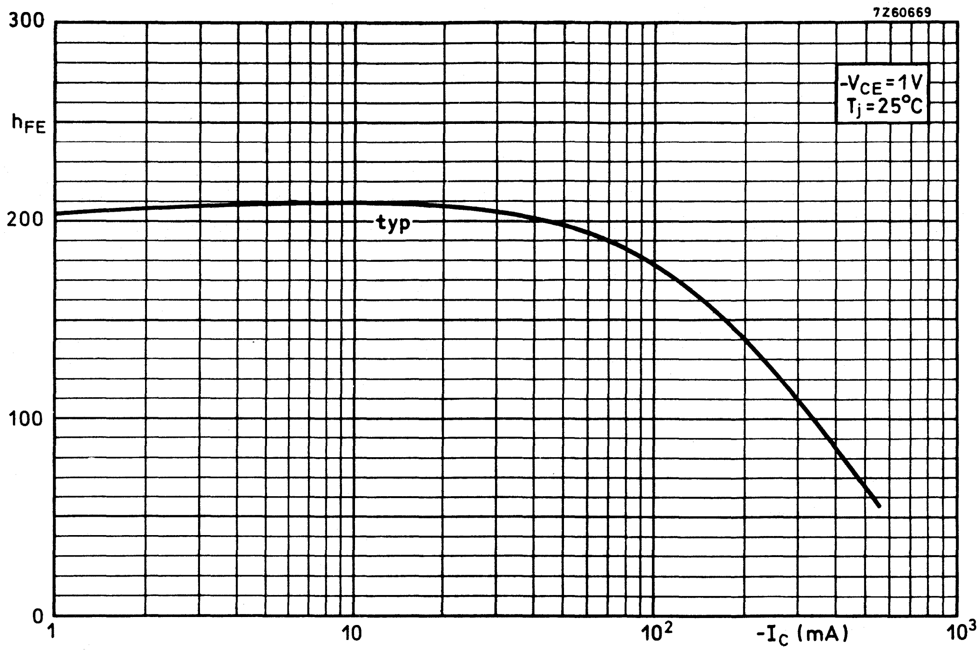

7Z60669
300
h_{FE}
200
100
0
1
10
10^2
$-I_C$ (mA)
10^3
$-V_{CE} = 1$ V
$T_j = 25$ °C
typ

Fig. 5

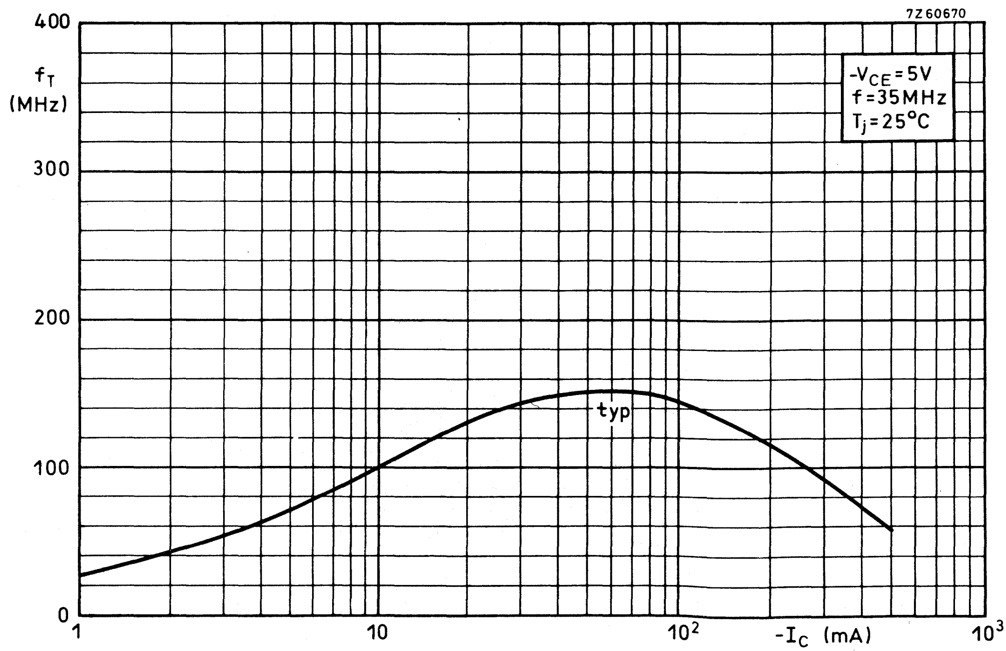

7Z60670
400
f_T
(MHz)
300
200
100
0
1
10
10^2
$-I_C$ (mA)
10^3
$-V_{CE} = 5$ V
$f = 35$ MHz
$T_j = 25$ °C
typ

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
P-N-P complements are BCX17and BCX18 respectively.

QUICK REFERENCE DATA

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 100 mA; V_{CE} = 1 V	h_{FE}		100 to 600		
Transition frequency I_C = 10 mA; V_{CE} = 5 V; f = 35 MHz	f_T	typ.	200		MHz

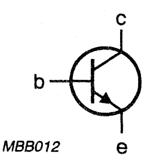
MECHANICAL DATA

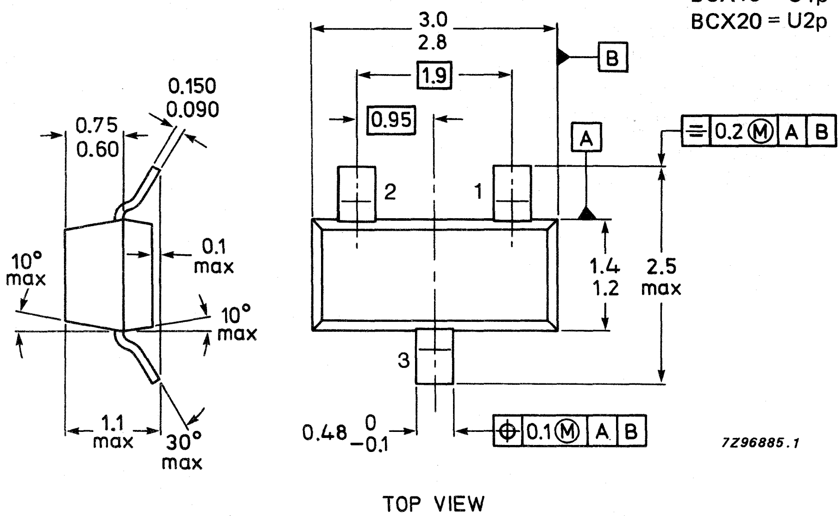
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BCX19 = U1p
BCX20 = U2p

Pinning:
1 = base
2 = emitter
3 = collector





Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) I_C = 10 mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	5	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base emitter voltage ▲				
I_C = 500 mA; V_{CE} = 1 V	V_{BE}	<	1,2	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	620	mV

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ V_{BE} decreases by about 2 mV/°C with increasing temperature.

D.C. current gain			
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	100 to 600	
I_C = 300 mA; V_{CE} = 1 V	h_{FE}	>	70
I_C = 500 mA; V_{CE} = 1 V	h_{FE}	>	40
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	5 pF

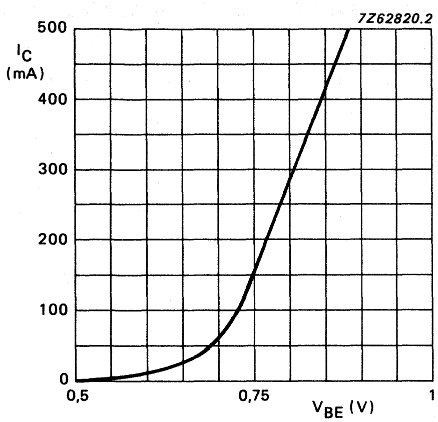


Fig. 2 V_{CE} 1 V; T_j = 25 °C; typical values.

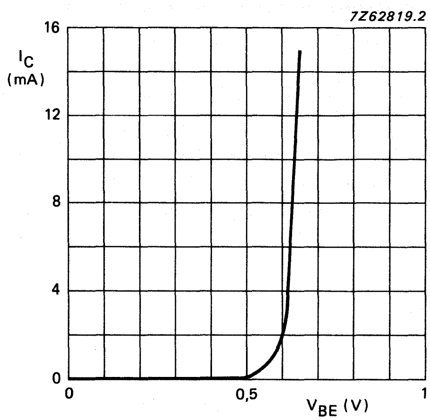


Fig. 3 V_{CE} = 5 V; T_j = 25 °C; typical values.

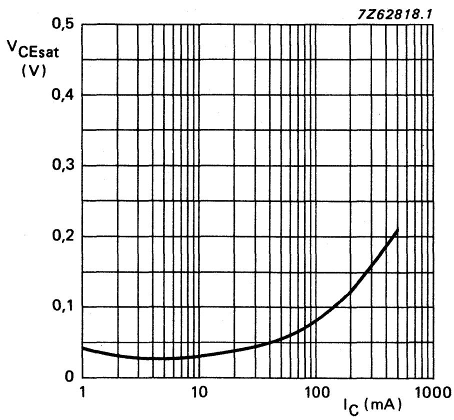


Fig. 4 I_C/I_B = 10; T_j = 25 °C; typical values.

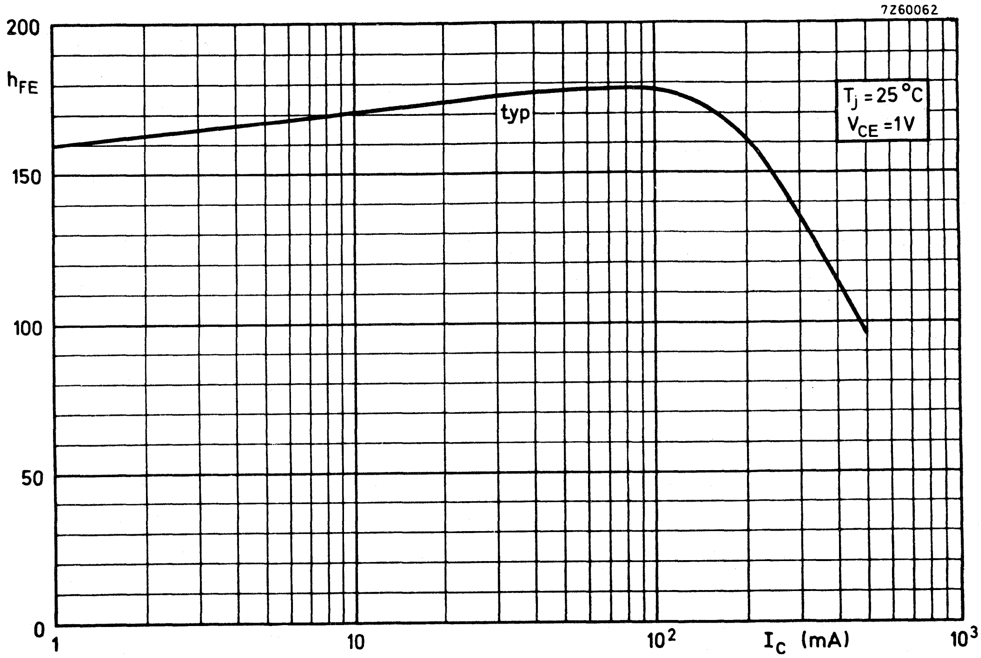

7Z60062
200
h_{FE}
150
100
50
0
1
10
10^2
I_C (mA)
10^3
typ
$T_j = 25\,^{\circ}C$
$V_{CE} = 1V$

Fig. 5

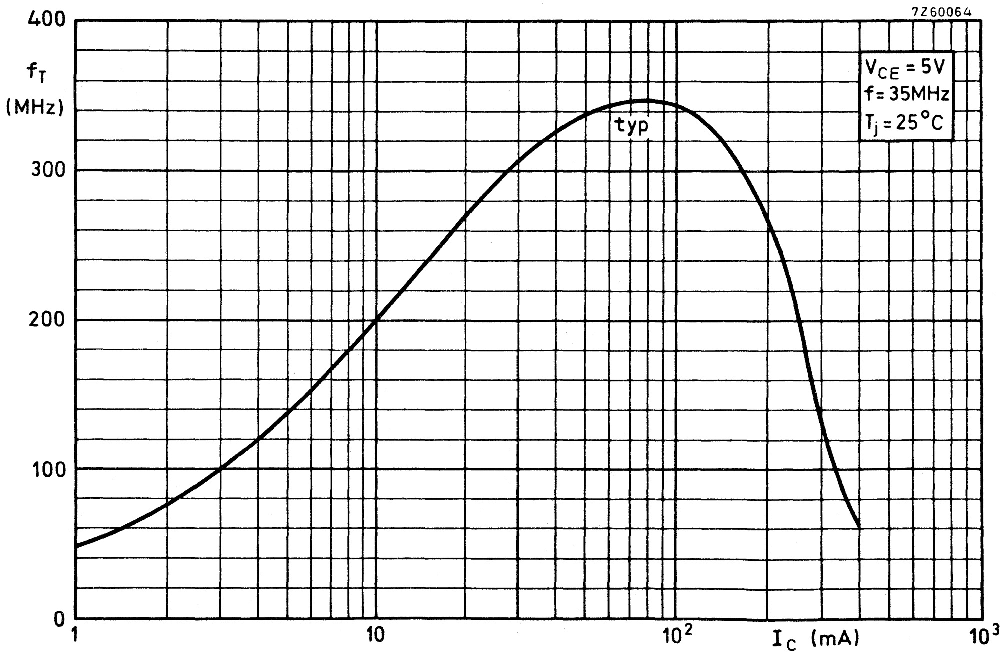

7Z60064
400
f_T
(MHz)
300
200
100
0
1
10
10^2
I_C (mA)
10^3
typ
$V_{CE} = 5V$
f = 35MHz
$T_j = 25\,^{\circ}C$

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power p-n-p transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

N-P-N complements are BCX54, BCX55 and BCX56 respectively.

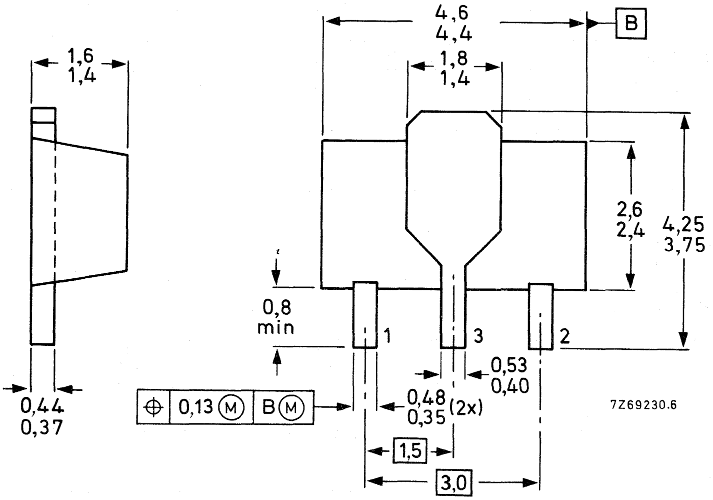
QUICK REFERENCE DATA

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.

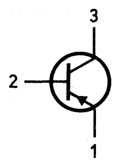


BOTTOM VIEW

See also *Soldering recommendations.*

Marking code

BCX51	=AA
BCX51-10	=AC
BCX51-16	=AD
BCX52	=AE
BCX52-10	=AG
BCX52-16	=AM
BCX53	=AH
BCX53-10	=AK
BCX53-16	=AL



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V

Collector current (d.c.)	$-I_C$	max.	1,0	A
Collector current (peak value)	$-I_{CM}$	max.	1,5	A
Base current (d.c.)	$-I_B$	max.	0,1	A
Base current (peak value)	$-I_{BM}$	max.	0,2	A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1,0	W
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB} = 30$ V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB} = 30$ V; $T_j = 125$ °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
$I_C = 0$; $-V_{EB} = 5$ V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C = 500$ mA; $-V_{CE} = 2$ V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	<	0,5	V
D.C. current gain				
$-I_C = 5$ mA; $-V_{CE} = 2$ V	h_{FE}	>	25	
$-I_C = 150$ mA; $-V_{CE} = 2$ V	h_{FE}		40 to 250	
$-I_C = 500$ mA; $-V_{CE} = 2$ V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	50	MHz

CHARACTERISTICS (continued)

			BCX51-10 52-10 53-10	BCX51-16 52-16 53-16
D.C. current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	>	63	100
		<	160	250

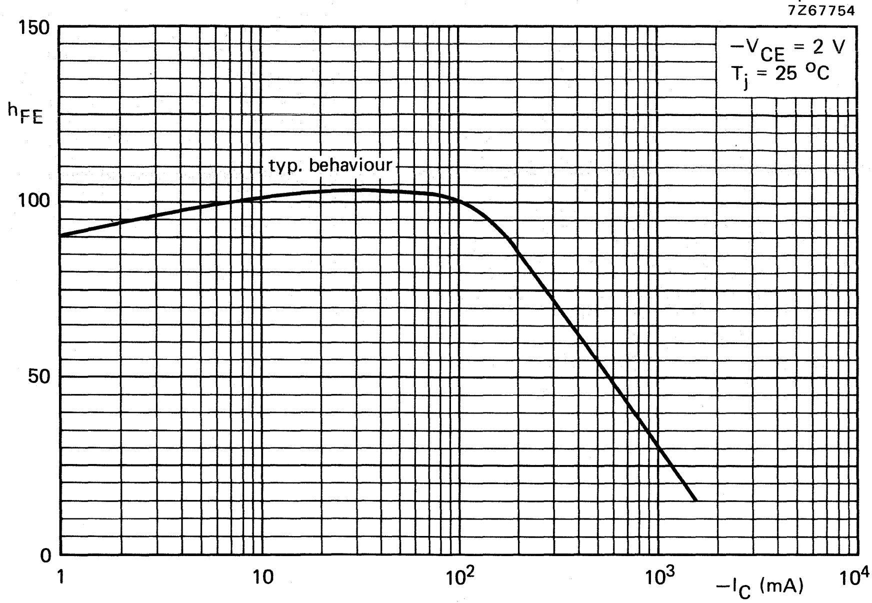


Fig. 2.

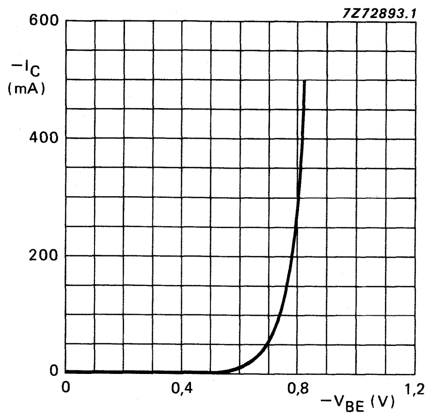


Fig. 3 $-V_{CE}$ = 2 V; T_j = 25 °C; typical values.

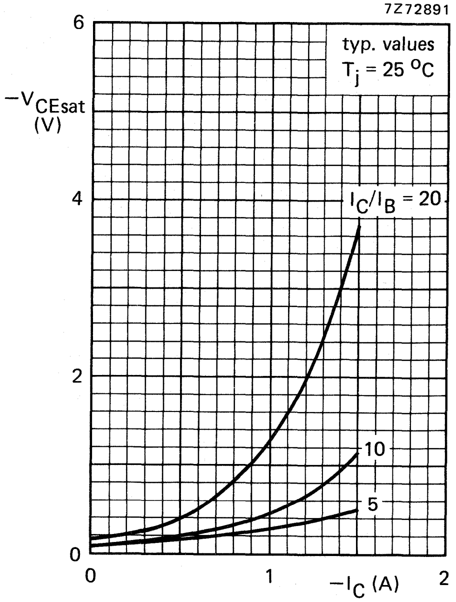


Fig. 4.

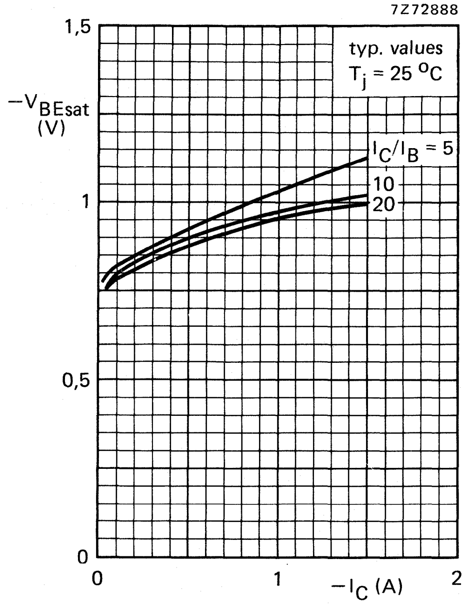


Fig. 5.

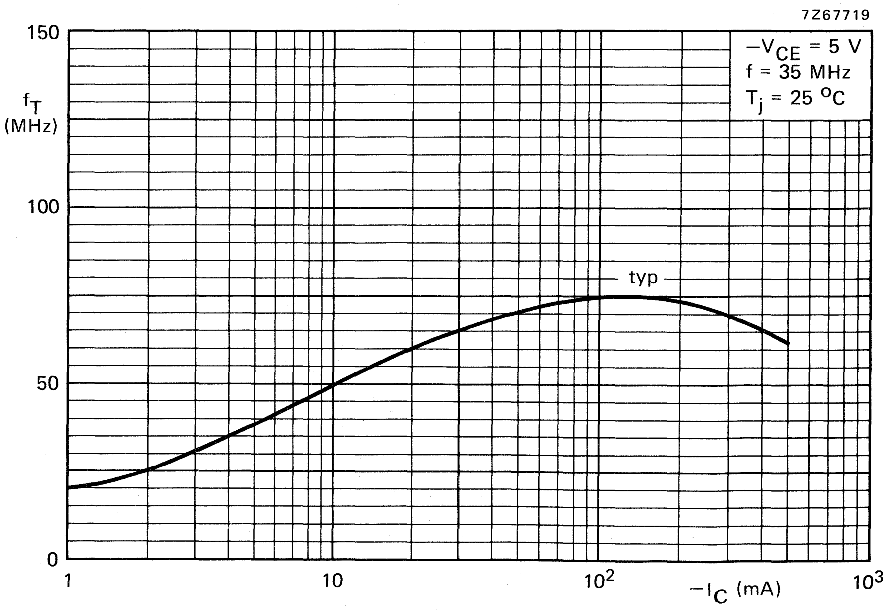


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power n-p-n transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

P-N-P complements are BCX51, BCX52 and BCX53 respectively.

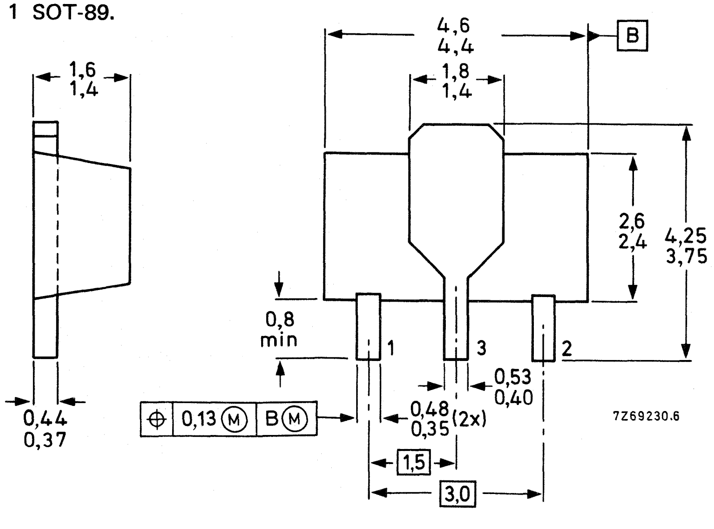
QUICK REFERENCE DATA

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

MECHANICAL DATA

Dimensions in mm

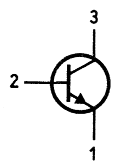
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BCX54 = BA
BCX54-10 = BC
BCX54-16 = BD
BCX55 = BE
BCX55-10 = BG
BCX55-16 = BM
BCX56 = BH
BCX56-10 = BK
BCX56-16 = BL



See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V
Collector current (d.c.)	I_C	max.		1,0		A
Collector current (peak value)	I_{CM}	max.		1,5		A
Base current (d.c.)	I_B	max.		0,1		A
Base current (peak value)	I_{BM}	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.		1,0		W
Storage temperature	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; V_{CB} = 30 V	I_{CBO}	<	100	nA
$I_E = 0$; V_{CB} = 30 V; T_j = 125 °C	I_{CBO}	<	10	μA
Emitter cut-off current				
$I_C = 0$; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base-emitter voltage				
I_C = 500 mA; V_{CE} = 2 V	V_{BE}	<	1	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	V
D.C. current gain				
I_C = 5 mA; V_{CE} = 2 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 2 V	h_{FE}		40 to 250	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	130	MHz

CHARACTERISTICS (continued)

			BCX54-10 55-10 56-10	BCX54-16 55-16 56-16
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}	>	63	100
		<	160	250

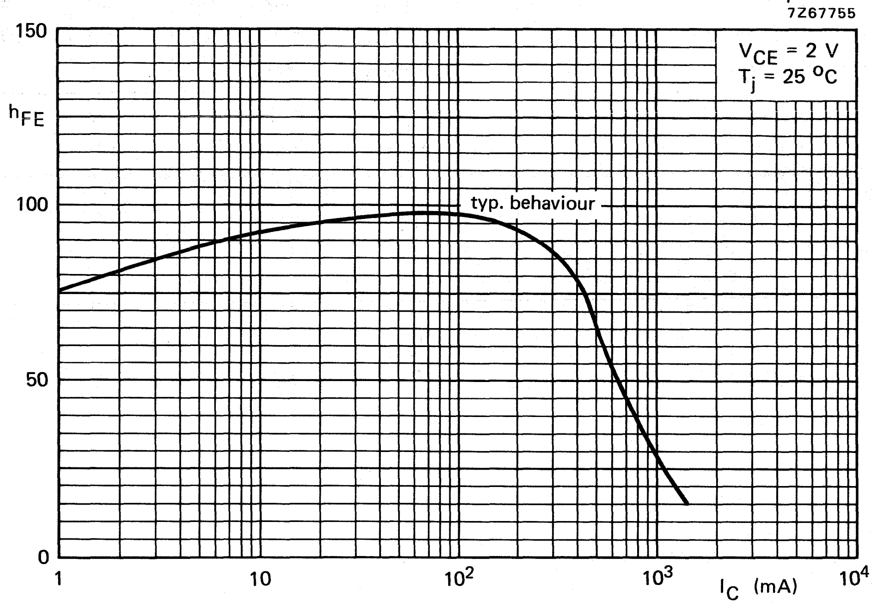


Fig. 2.

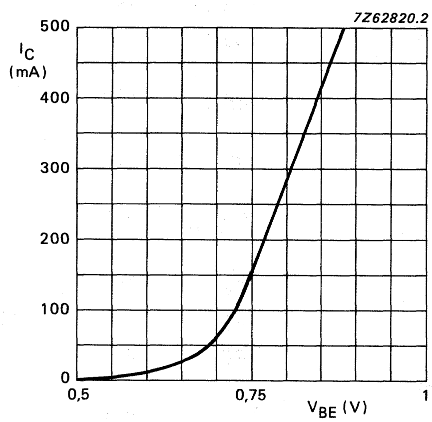


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

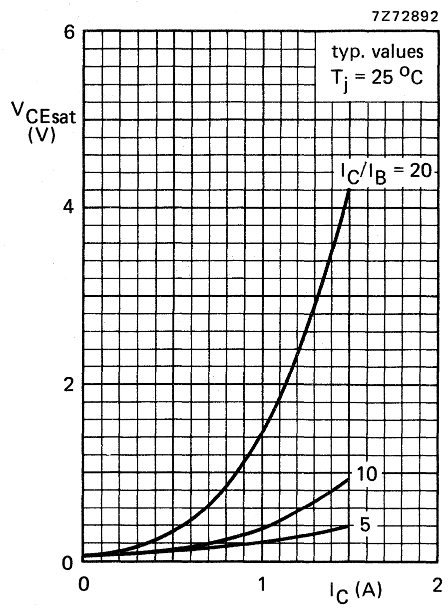


Fig. 4.

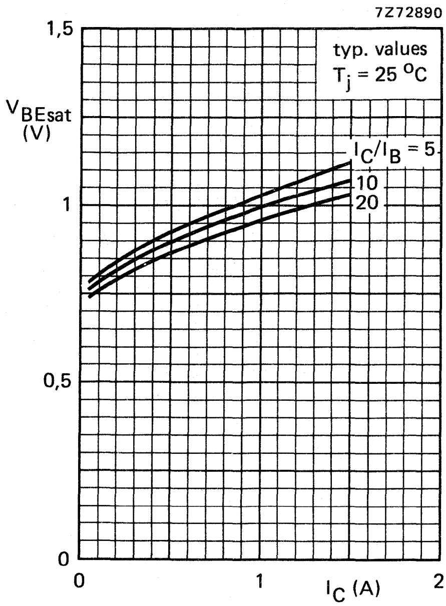


Fig. 5.

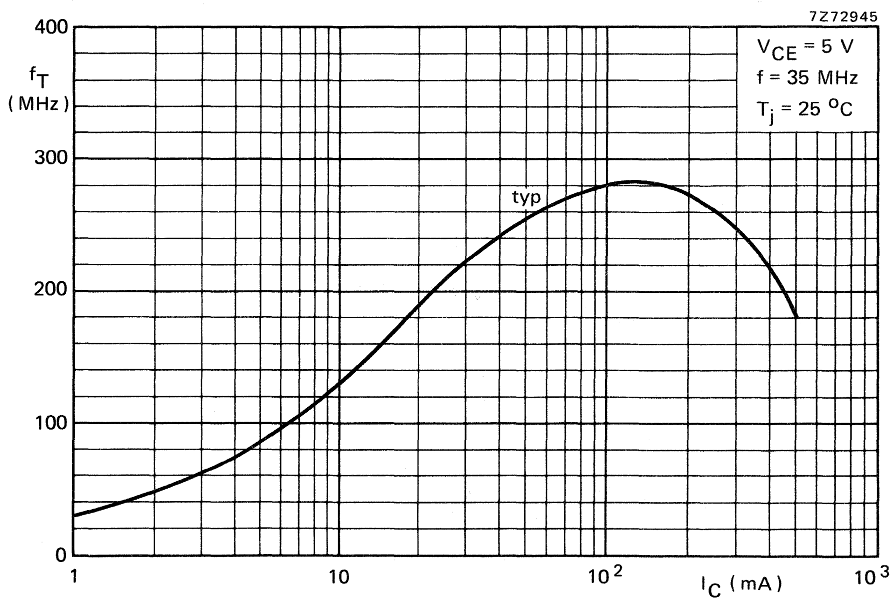


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz V_{CE} = 5 V; I_C = 10 mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz V_{CE} = 5 V; I_C = 200 μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

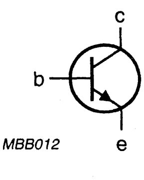
Fig. 1 SOT-23.

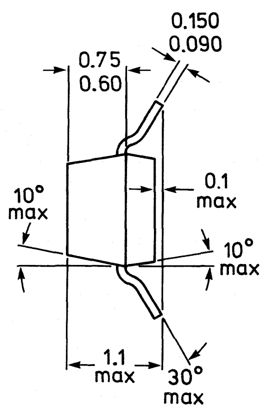
Marking code

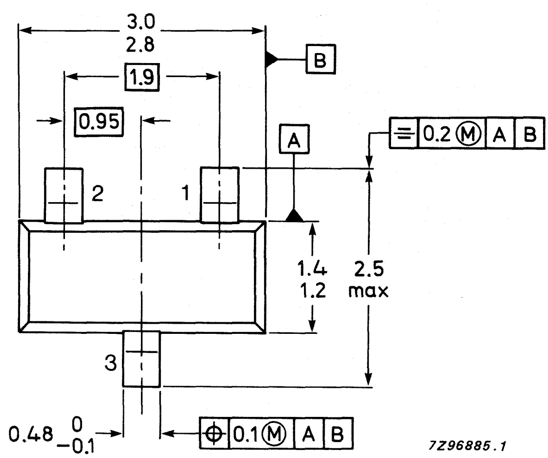
BCX70G = AGp
BCX70H = AHp
BCX70J = AJp
BCX70K = AKp

Pinning:

1 = base
2 = emitter
3 = collector







TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	200	mA
Base current	I_B	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{BE} = 0; V_{CE} = 45 V	I_{CES}	<	20	nA
V_{BE} = 0; V_{CE} = 45 V; T_{amb} = 150 °C	I_{CES}	<	20	μA
Emitter-base cut-off current				
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20	nA
Saturation voltages				
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}	0,05 to 0,35		V
	V_{BEsat}	0,6 to 0,85		V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}	0,1 to 0,55		V
	V_{BEsat}	0,7 to 1,05		V
Transition frequency at f = 100 MHz▲				
I_C = 10 mA; V_{CE} = 5 V	f_T	>	125	MHz
		typ.	250	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0,5 V	C_e	typ.	8	pF
Noise figure at R_S = 2 kΩ				
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2	dB
		<	6	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			BCX70G	70H	70J	70K	
D.C. current gain							
V_{CE} = 5 V; I_C = 10 μA	h_{FE}	>	–	40	30	100	
V_{CE} = 5 V; I_C = 2 mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
V_{CE} = 1 V; I_C = 50 mA	h_{FE}	>	50	70	90	100	
Input impedance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
V_{CE} = 5 V; I_C = 2 mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
V_{CE} = 5 V; I_C = 10 μA	V_{BE}	typ.	0,52				V
V_{CE} = 1 V; I_C = 50 mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

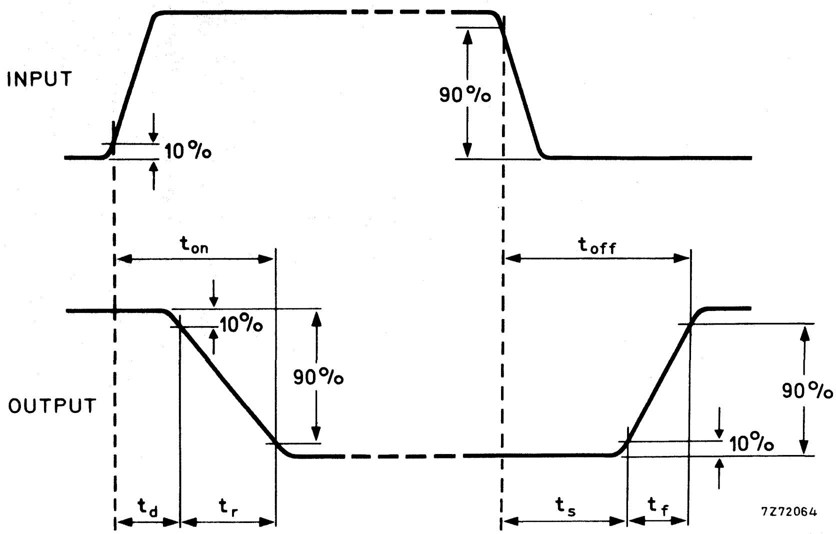


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	45	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	^oC
Transition frequency at f = 100 MHz $-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180	MHz
Noise figure at f = 1 kHz $-V_{CE}$ = 5 V; $-I_C$ = 200 μA	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

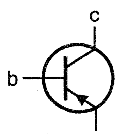
Fig. 1 SOT-23.

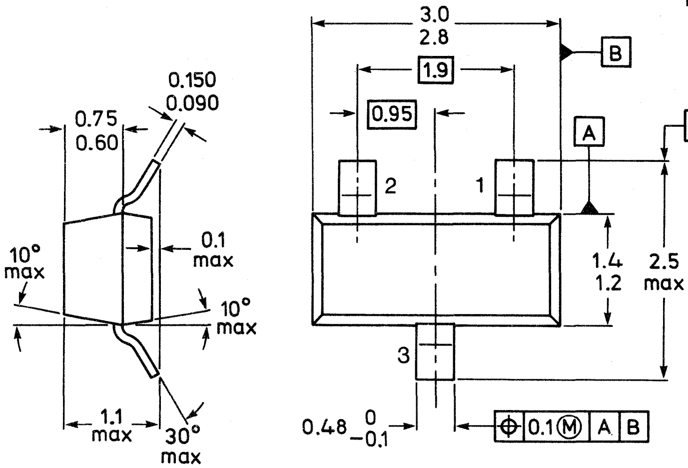
Marking code

BCX71G = BGp
BCX71H = BHp
BCX71J = BJp
BCX71K = BKp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	45 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	200 mA
Base current	$-I_B$	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current			
$V_{EB} = 0$; $-V_{CE} = 45$ V	$-I_{CES}$	<	20 nA
$V_{EB} = 0$; $-V_{CE} = 45$ V; T_{amb} = 150 °C	$-I_{CES}$	<	20 μA
Emitter-base cut-off current			
$I_C = 0$; $-V_{EB} = 4$ V	$-I_{EBO}$	<	20 nA
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,25 mA	$-V_{CEsat}$	0,06 to 0,25	V
	$-V_{BEsat}$	0,6 to 0,85	V
$-I_C$ = 50 mA; $-I_B$ = 1,25 mA	$-V_{CEsat}$	0,12 to 0,55	V
	$-V_{BEsat}$	0,68 to 1,05	V
Transition frequency at f = 100 MHz▲			
$-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180 MHz
Collector capacitance at f = 1 MHz			
$-V_{CB}$ = 10 V; $I_E = I_e = 0$	C_c	typ.	4,5 pF
Emitter capacitance at f = 1 MHz			
$-V_{EB}$ = 0,5 V; $I_C = I_c = 0$	C_e	typ.	11 pF
Noise figure at R_S = 2 kΩ			
$-V_{CE}$ = 5 V; $-I_C$ = 200 μA; B = 200 Hz	F	typ.	2 dB
		<	6 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

▲ Measured under pulse conditions.

			BCX71G	71H	71J	71K	
D.C. current gain							
$-V_{CE} = 5$ V; $-I_C = 10\ \mu A$	h_{FE}	>	–	30	40	100	
$-V_{CE} = 5$ V; $-I_C = 2$ mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
$-V_{CE} = 1$ V; $-I_C = 50$ mA	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS

Base-emitter voltage				
$-V_{CE} = 5$ V; $-I_C = 2$ mA	V_{BE}		0,6 to 0,75	V
		typ.	0,65	V
$-V_{CE} = 5$ V; $-I_C = 10\ \mu A$	V_{BE}	typ.	0,55	V
$-V_{CE} = 1$ V; $-I_C = 50$ mA	V_{BE}	typ.	0,72	V

Switching times

$-I_{Con}$ = 10 mA; $-I_{Bon} = I_{Boff}$ = 1 mA
$-V_{CC}$ = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85 ns
		$<$	150 ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480 ns
		$<$	800 ns

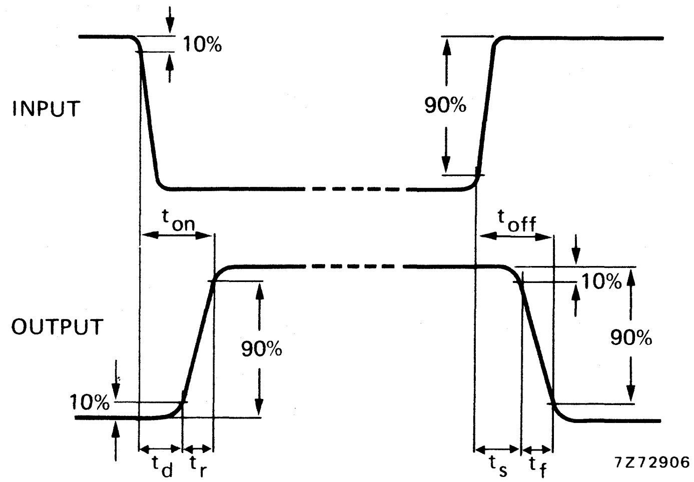


Fig. 2 Switching waveforms.

N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Asymmetrical N-channel planar epitaxial junction field-effect transistors in the miniature plastic envelope intended for applications up to the v.h.f. range in hybrid thick and thin-film circuits. Special features are the low feedback capacitance and the low noise figure. These features make the product very suitable for applications such as the r.f. stages in f.m. portables (BF510), car radios (BF511) and mains radios (BF512) or the mixer stage (BF513).

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.		20			V
Drain current (DC or average)	I_D	max.		30			mA
Total power dissipation up to T_{amb} = 40 °C	P_{tot}	max.		250			mW
			BF510	511	512	513	
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0.7	2.5	6	10	mA
		<	3.0	7.0	12	18	mA
Transfer admittance (common source) V_{DS} = 10 V; V_{GS} = 0; f = 1 kHz	$\|y_{fs}\|$	>	2.5	4	6	7	mS
Feedback capacitance V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ.	0.3	0.3	–	–	pF
V_{DS} = 10 V; I_D = 5 mA	C_{rs}	typ.	–	–	0.3	0.3	pF
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz							
V_{DS} = 10 V; V_{GS} = 0	F	typ.	1.5	1.5	–	–	dB
V_{DS} = 10 V; I_D = 5 mA	F	typ.	–	–	1.5	1.5	dB

MECHANICAL DATA

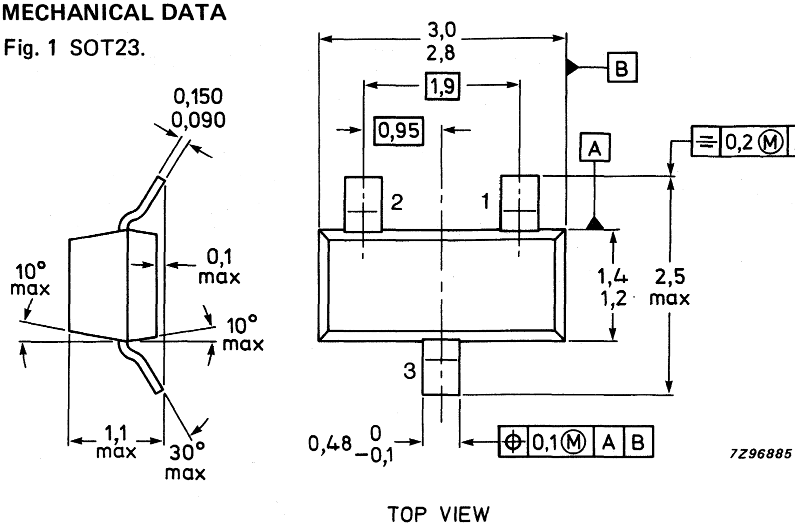
SOT23.

See also *Soldering recommendations.*

MECHANICAL DATA

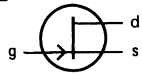
Fig. 1 SOT23.

Dimensions in mm



Pinning

1 = gate
2 = drain
3 = source



Marking code

BF510 = S6p
BF511 = S7p
BF512 = S8p
BF513 = S9p

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain-gate voltage (open source)	V_{DGO}	max.	20	V
Drain current (DC or average)	I_D	max.	30	mA
Gate current	$\pm I_G$	max.	10	mA
Total power dissipation up to T_{amb} = 40 °C (note 1)	P_{tot}	max.	250	mW
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient (note 1)	$R_{th\ j\text{-}a}$	=	430 K/W

Note

1. Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_{amb} = 25 °C

			BF510	511	512	513	
Gate cut-off current $-V_{GS}$ = 0.2 V; V_{DS} = 0	$-I_{GSS}$	<	10	10	10	10	nA
Gate-drain breakdown voltage I_S = 0; $-I_D$ = 10 μA	$-V_{(BR)GDO}$	>	20	20	20	20	V
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0.7	2.5	6	10	mA
		<	3.0	7.0	12	18	mA
Gate-source cut-off voltage I_D = 10 μA; V_{DS} = 10 V	$-V_{(P)GS}$	typ.	0.8	1.5	2.2	3	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C for BF510 and BF511
V_{DS} = 10 V; I_D = 5 mA; T_{amb} = 25 °C for BF512 and BF513

y-parameters (common source)			BF510	511	512	513	
Input capacitance at f = 1 MHz	C_{is}	<	5	5	5	5	pF
Input conductance at f = 100 MHz	g_{is}	typ.	100	90	60	50	μS
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	0.3	0.3	0.3	0.3	pF
		<	0.4	0.4	0.4	0.4	pF
Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	>	2.5	4.0	4.0	3.5	mS
V_{GS} = 0 instead of I_D = 5 mA	$\|y_{fs}\|$	>	–	–	6.0	7.0	mS
Transfer admittance at f = 100 MHz	$\|y_{fs}\|$	typ.	3.5	5.5	5.0	5.0	mS
Output capacitance at f = 1 MHz	C_{os}	<	3	3	3	3	pF
Output conductance at f = 1 MHz	g_{os}	<	60	80	100	120	μS
Output conductance at f = 100 MHz	g_{os}	typ.	35	55	70	90	μS
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz	F	typ.	1.5	1.5	1.5	1.5	dB

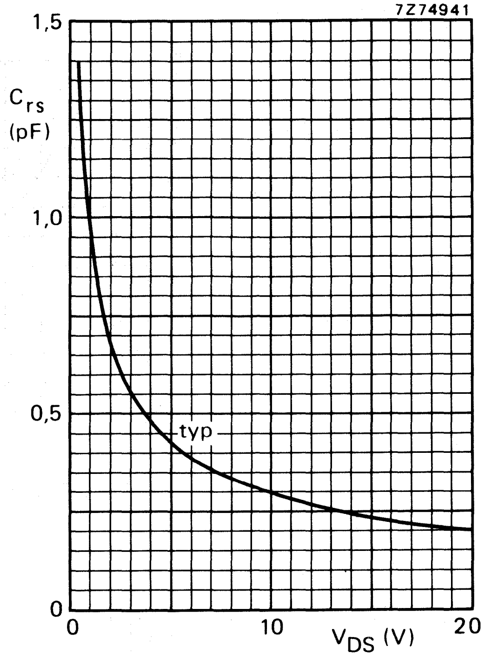


Fig. 2 V_{GS} = 0 for BF510 and BF511;
I_D = 5 mA for BF512 and BF513;
f = 1 MHz; T_{amb} = 25 °C.

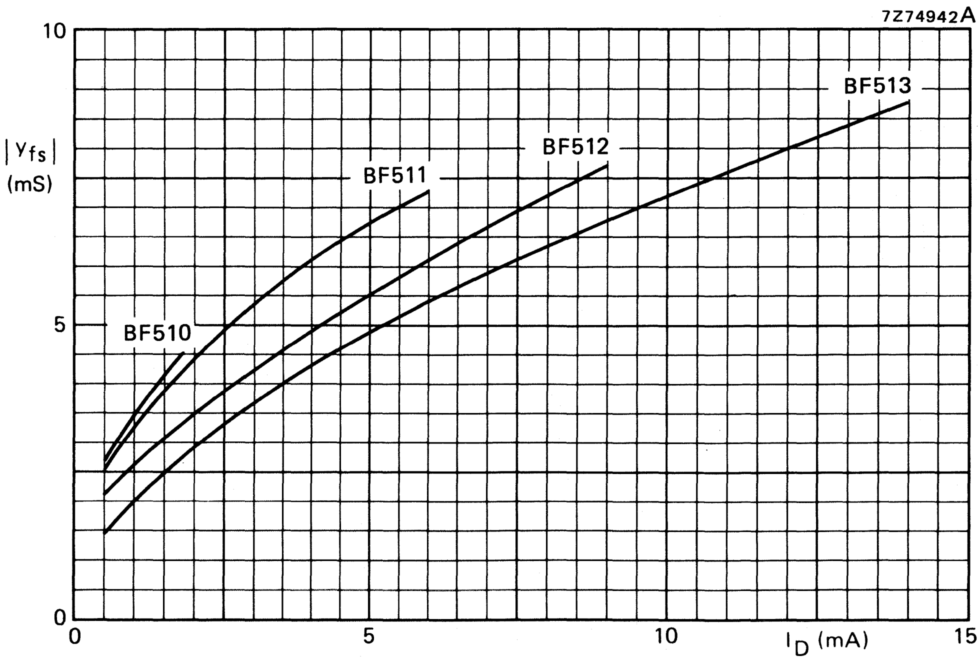


Fig. 3 V_{DS} = 10 V; f = 1 kHz; T_{amb} = 25 °C; typical values.

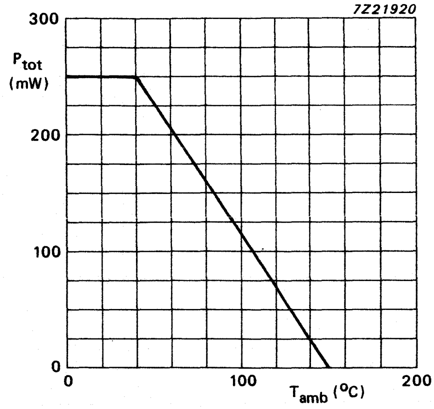


Fig.4 Power derating curve.

N-channel silicon junction field-effect transistor

BF545A; BF545B; BF545C

FEATURES

- Low leakage level (typ. 500 fA)
- High gain
- Low cut-off voltage (max. 2.2 V for BF545A).

DESCRIPTION

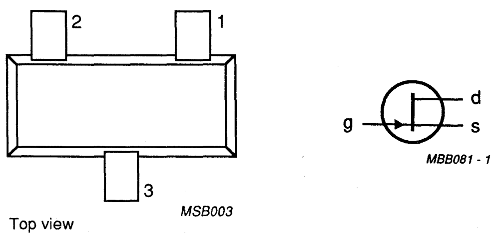
N-channel symmetrical silicon junction FETs in a surface-mountable SOT23 envelope. These devices are specially designed for use as impedance converters in (for example) electret microphones and infra-red detectors, and as VHF amplifiers in oscillators and mixers.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm V_{DS}$	drain-source voltage		–	30	V
I_{DSS}	drain current	V_{DS} = 15 V; V_{GS} = 0			
	BF545A		2	6.5	mA
	BF545B		6	15	mA
	BF545C		12	25	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	250	mW
$-V_{GS(off)}$	gate-source cut-off voltage	V_{DS} = 15 V; I_D = 1 μA	0.4	7.8	V
Y_{fs}	common source transfer admittance	V_{DS} = 15 V; V_{GS} = 0	3	6.5	mS



Marking codes:
BF545A: M65.
BF545B: M66.
BF545C: M67.

Fig.1 Simplified outline (SOT23) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm V_{DS}$	drain-source voltage		–	30	V
$-V_{GSO}$	gate-source voltage		–	30	V
$-V_{GDO}$	gate-drain voltage		–	30	V
I_G	DC forward gate current		–	10	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1)	–	250	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	500 K/W

Note

1. Mounted on an FR-4 printboard.

STATIC CHARACTERISTICS

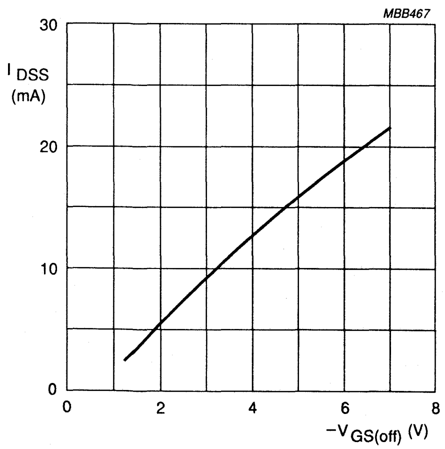
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{GSS}$	reverse gate current	$-V_{DS}$ = 0; $-V_{GS}$ = 20 V	–	0.5	1000	pA
		$-V_{DS}$ = 0; $-V_{GS}$ = 20 V; T_j = 125 °C	–	–	100	nA
I_{DSS}	drain current	V_{DS} = 15 V; V_{GS} = 0				
	BF545A		2	–	6.5	mA
	BF545B		6	–	15	mA
	BF545C		12	–	25	mA
$-V_{(BR)GSS}$	gate-source breakdown voltage	V_{DS} = 0; $-I_G$ = 1 µA	30	–	–	V
$-V_{GS(off)}$	gate-source cut-off voltage	V_{DS} = 15 V; I_D = 200 µA				
	BF545A		0.4	–	2.2	V
	BF545B		1.6	–	3.8	V
	BF545C		3.2	–	7.8	V
		V_{DS} = 15 V; I_D = 1 µA	0.4	–	7.8	V
Y_{fs}	common source transfer admittance	V_{DS} = 15 V; V_{GS} = 0	3	–	6.5	mS
Y_{os}	common source output admittance	V_{DS} = 15 V; V_{GS} = 0	–	40	–	µS

DYNAMIC CHARACTERISTICS

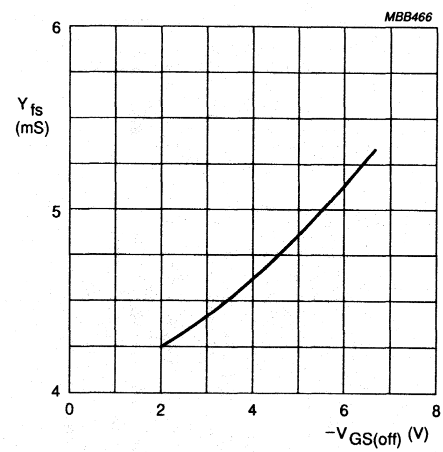
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
C_{is}	input capacitance	V_{DS} = 15 V; $-V_{GS}$ = 10 V; f = 1 MHz	1.7	pF
		V_{DS} = 15 V; $-V_{GS}$ = 0; f = 1 MHz	3	pF
C_{rs}	feedback capacitance	V_{DS} = 15 V; $-V_{GS}$ = 10 V; f = 1 MHz	0.8	pF
		V_{DS} = 15 V; $-V_{GS}$ = 0; f = 1 MHz	0.9	pF
g_{is}	common source input conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	15	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	300	µS
g_{fs}	common source transfer conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	2	mS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	1.8	mS
$-g_{rs}$	common source feedback conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	6	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	40	µS
g_{os}	common source output conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	30	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	60	µS



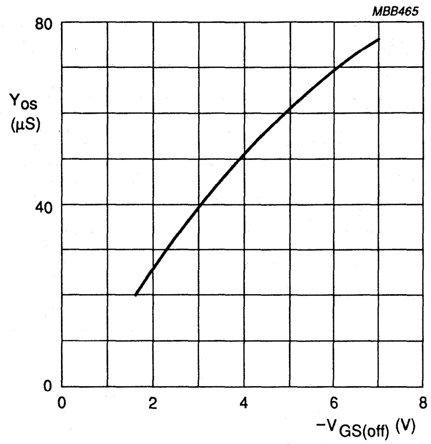
V_{DS} = 15 V; T_j = 25 °C.

Fig.2 Drain current as a function of gate-source cut-off voltage.



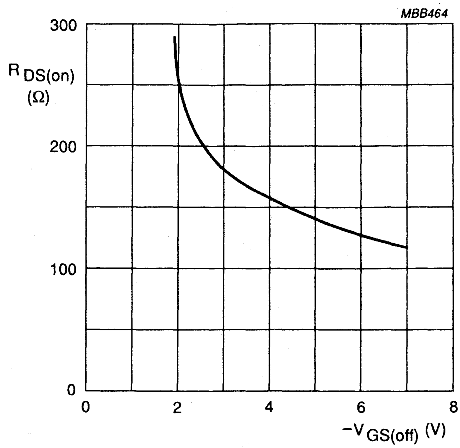
V_{DS} = 15 V; V_{GS} = 0; T_j = 25 °C.

Fig.3 Common source transfer admittance as a function of gate-source cut-off voltage.



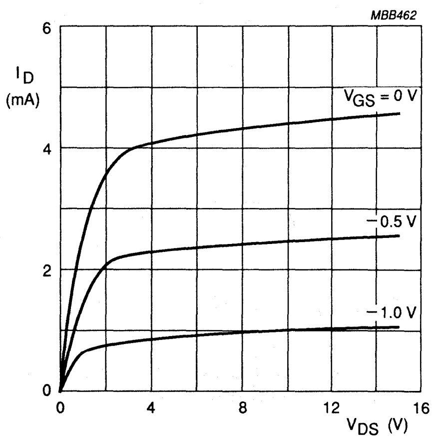
V_{DS} = 15 V; V_{GS} = 0; T_j = 25 °C.

Fig.4 Common source output admittance as a function of gate-source cut-off voltage.



V_{DS} = 100 mV; V_{GS} = 0; T_j = 25 °C.

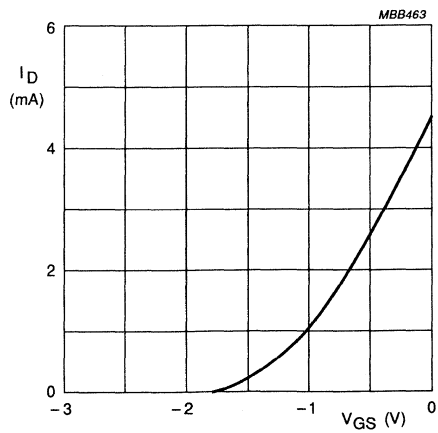
Fig.5 Drain-source on-resistance as a function of gate-source cut-off voltage.



BF545A

T_j = 25 °C.

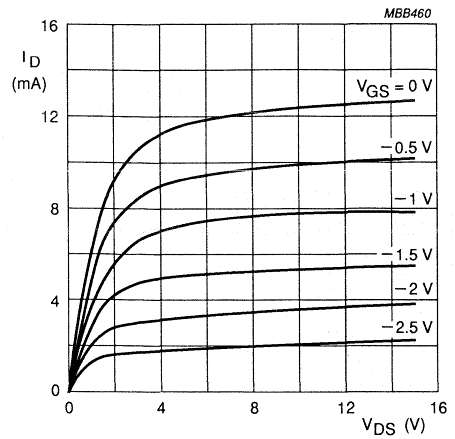
Fig.6 Typical output characteristics.



BF545A

V_{DS} = 15 V; T_j = 25 °C.

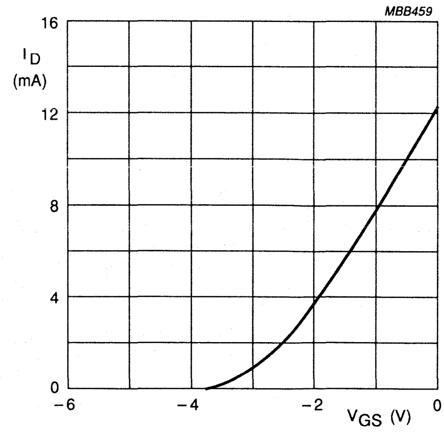
Fig.7 Typical input characteristics.



BF545B

T_j = 25 °C.

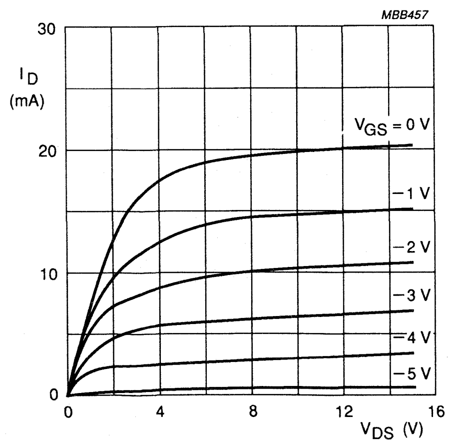
Fig.8 Typical output characteristics.



BF545B

V_{DS} = 15 V; T_j = 25 °C.

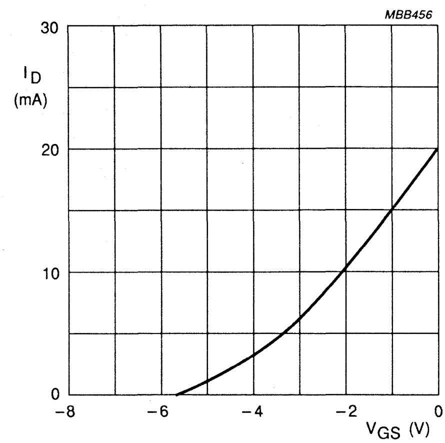
Fig.9 Typical input characteristics.



BF545C

T_j = 25 °C.

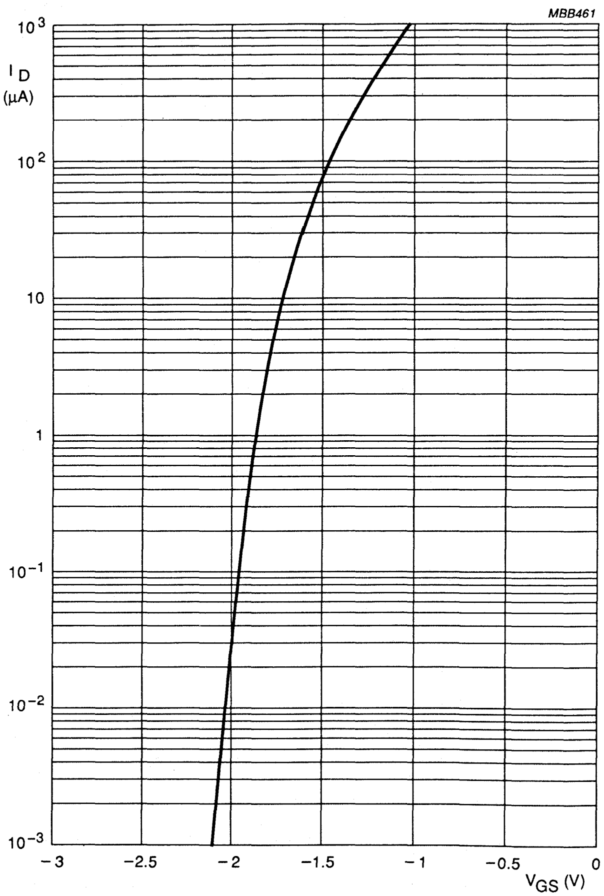
Fig.10 Typical output characteristics.



BF545C

V_{DS} = 15 V; T_j = 25 °C.

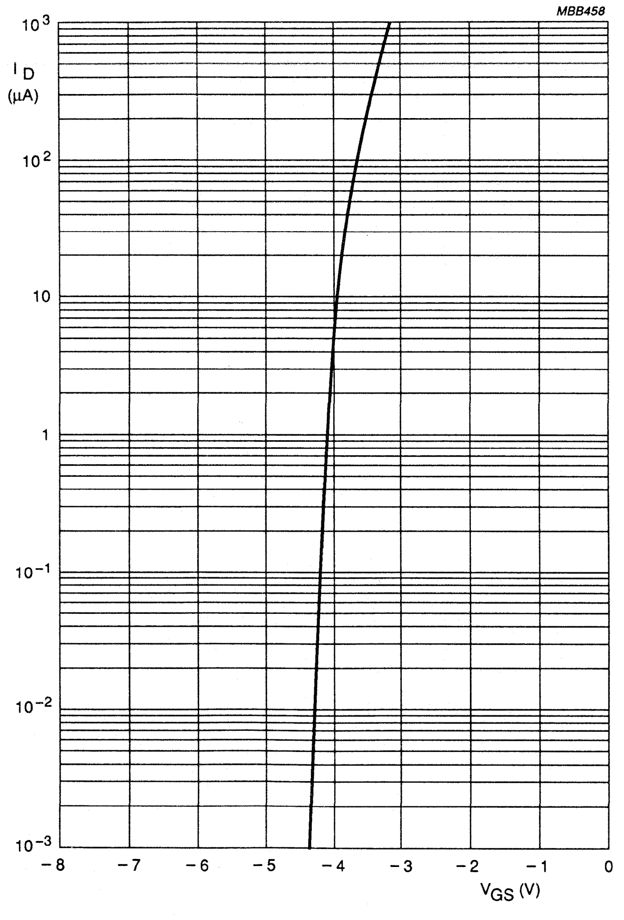
Fig.11 Typical input characteristics.



BF545A

V_{DS} = 15 V; T_j = 25 °C.

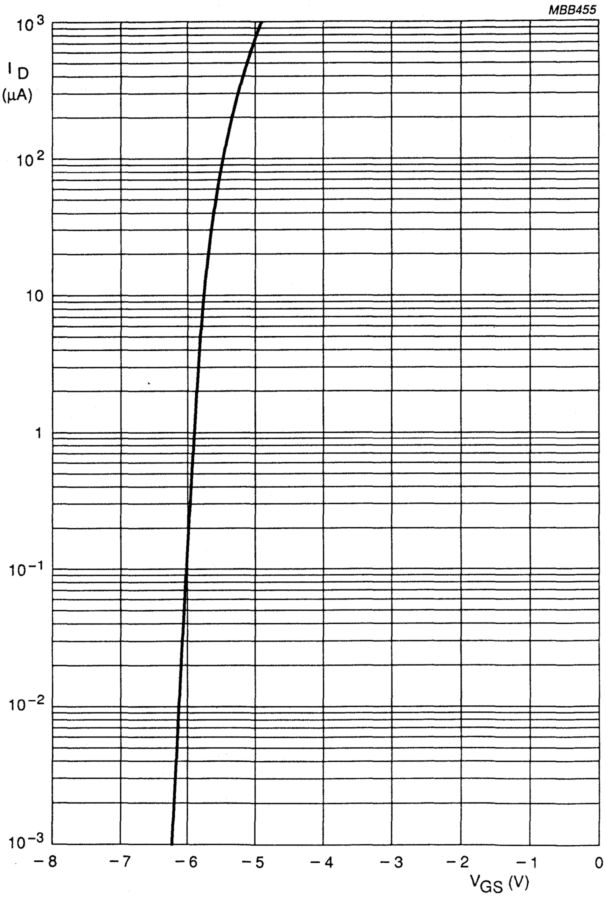
Fig.12 Drain current as a function of gate-source voltage; typical values.



BF545B

V_{DS} = 15 V; T_j = 25 °C.

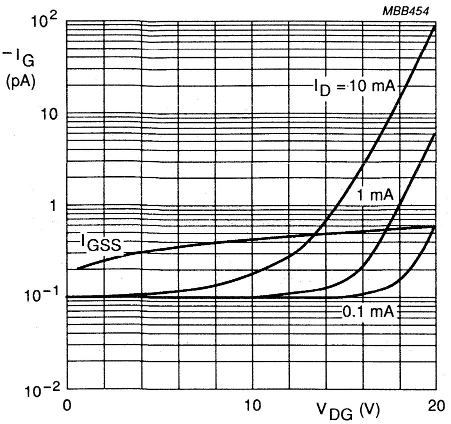
Fig.13 Drain current as a function of gate-source voltage; typical values.



BF545C

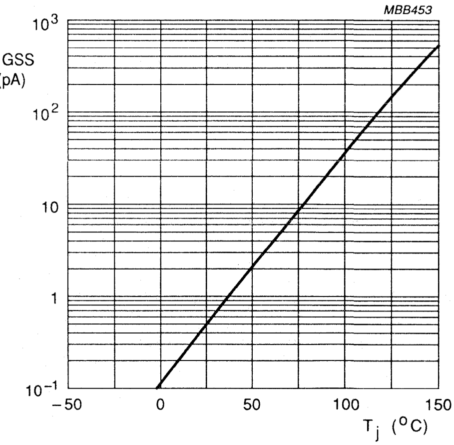
V_{DS} = 15 V; T_j = 25 °C.

Fig.14 Drain current as a function of gate-source voltage; typical values.



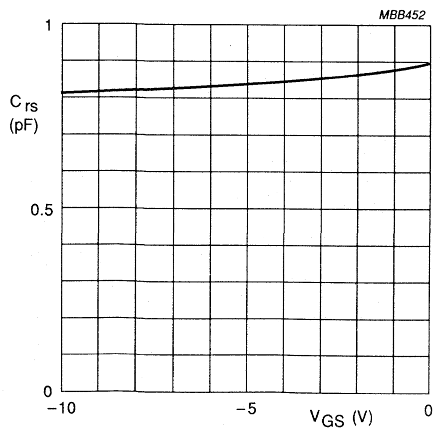
I_D = 10 mA (BF545B and C only); T_j = 25 °C.

Fig.15 Gate current as a function of drain-gate voltage, typical values.



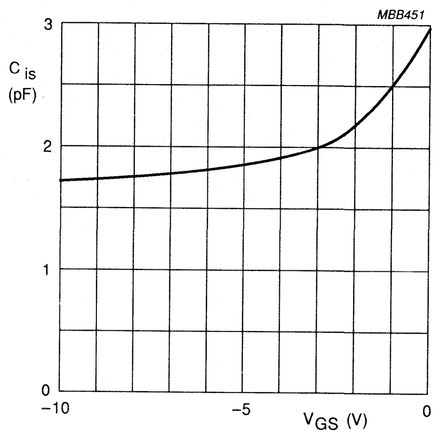
V_{DS} = 0; $-V_{GS}$ = 20 V.

Fig.16 Gate current as a function of junction temperature, typical values.



V_{DS} = 15 V; T_j = 25 °C.

Fig.17 Typical feedback capacitance.



V_{DS} = 15 V; T_j = 25 °C.

Fig.18 Typical input capacitance.

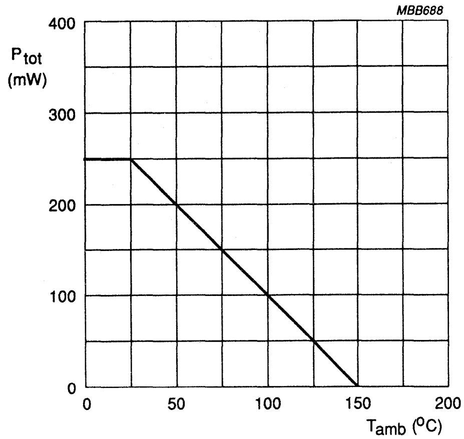
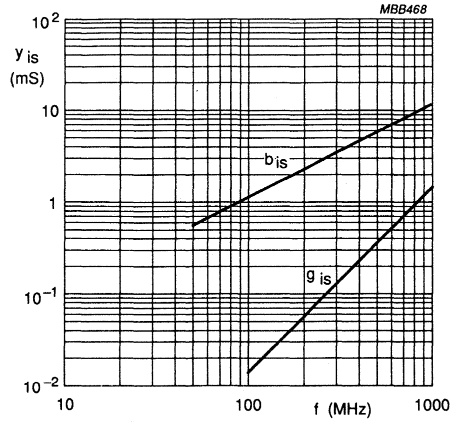
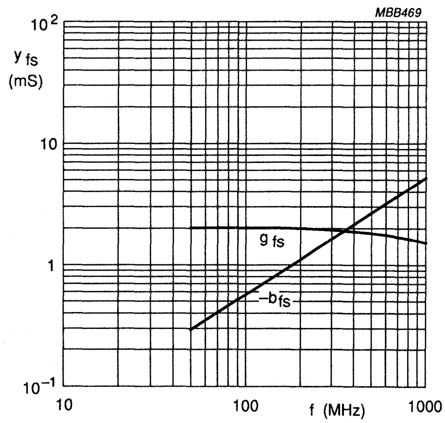


Fig.19 Power derating curve.



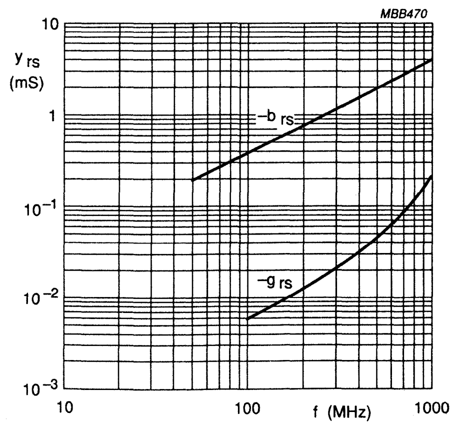
V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.20 Common source input conductance.



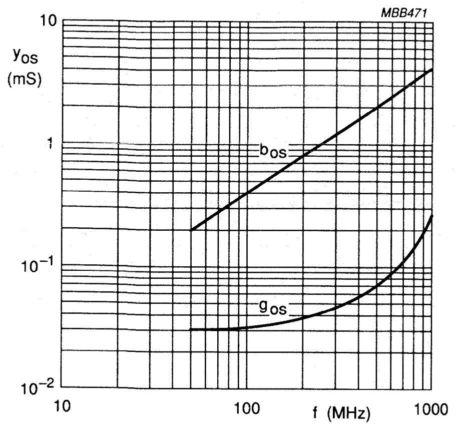
V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.21 Common source transfer conductance.



V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.22 Common source feedback conductance.



V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.23 Common source output conductance.

NPN 1 GHz wideband transistor BF547

FEATURES

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

DESCRIPTION

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

PINNING

PIN	DESCRIPTION
	Code: E16
1	base
2	emitter
3	collector

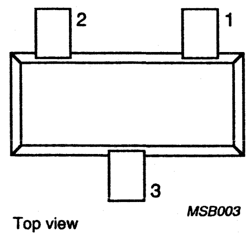


Fig.1 SOT23.

LIMITING VALUES

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

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

Note

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

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

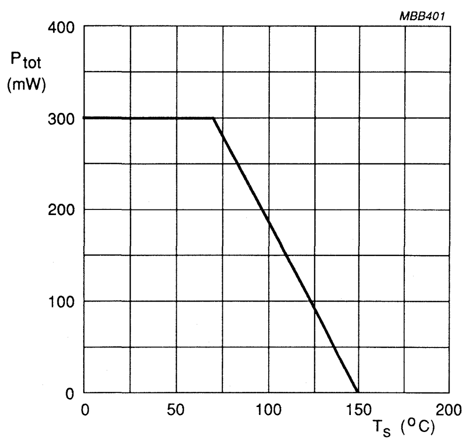
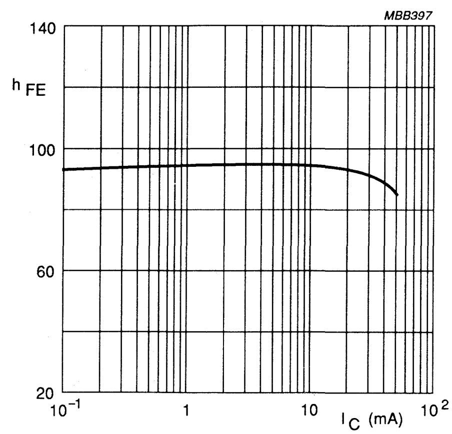
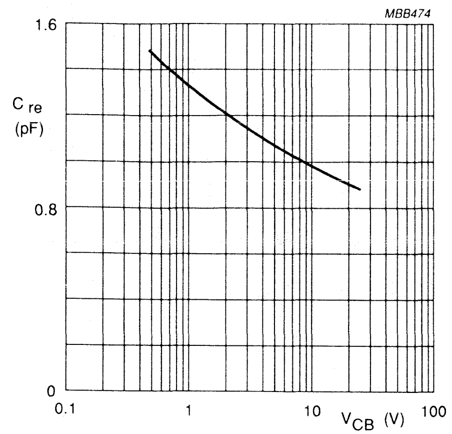


Fig.2 Power derating curve.



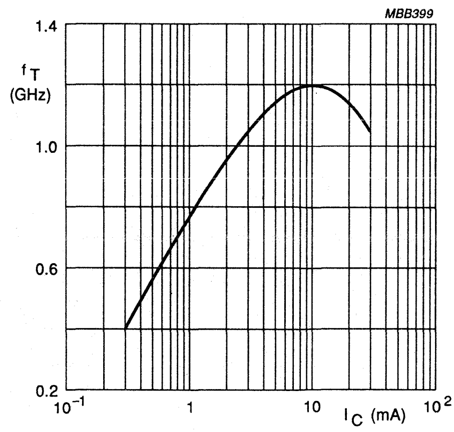
V_{CE} = 10 V.

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



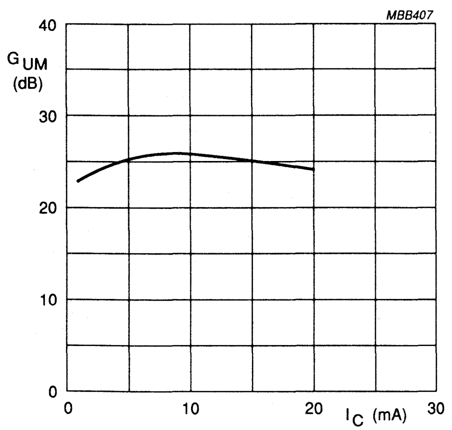
$I_E = i_e = 0$; f = 1 MHz.

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



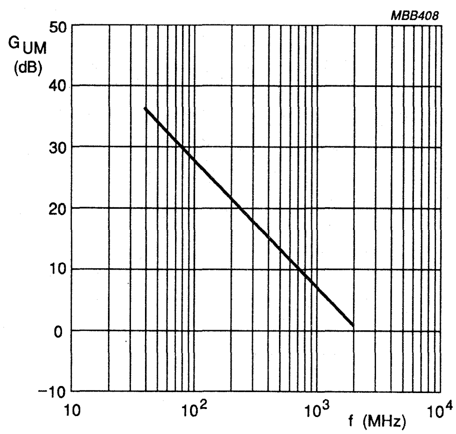
V_{CE} = 10 V; f = 500 MHz.

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



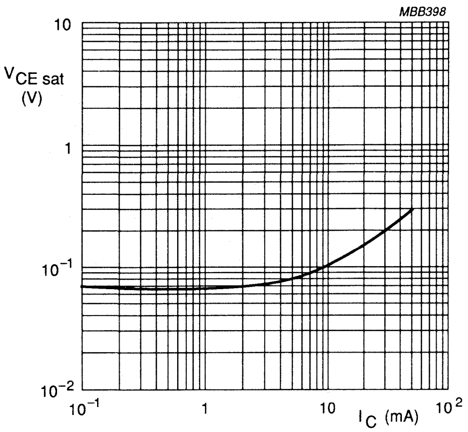
V_{CE} = 10 V; f = 100 MHz.

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



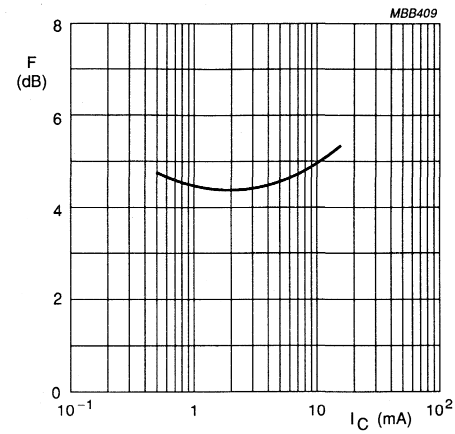
V_{CE} = 10 V; I_C = 15 mA.

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



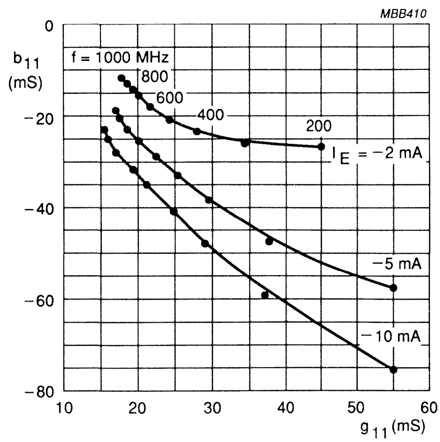
$I_C/I_B = 10$.

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



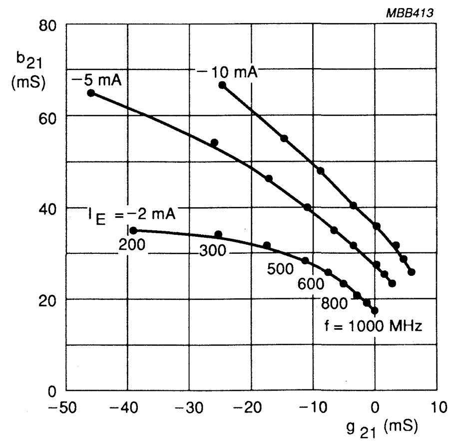
$V_{CE} = 10$ V; $Z_S = Z_L = 50\ \Omega$; f = 100 MHz.

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



$V_{CB} = 10$ V.

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



$V_{CB} = 10$ V.

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

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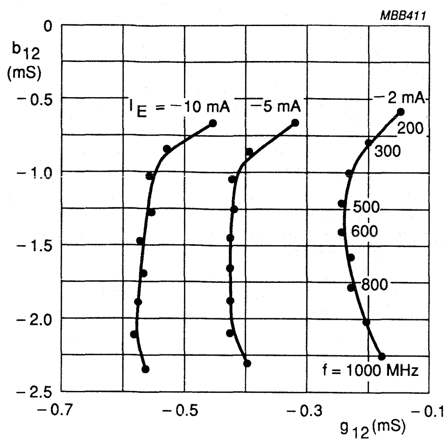
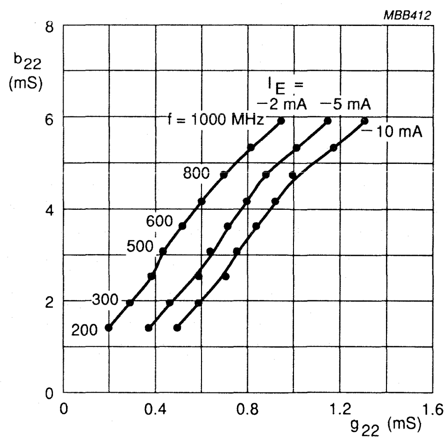


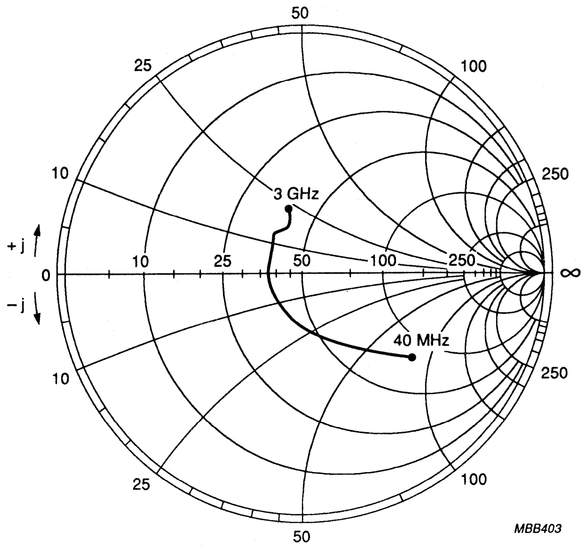
V_{CB} = 10 V.

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



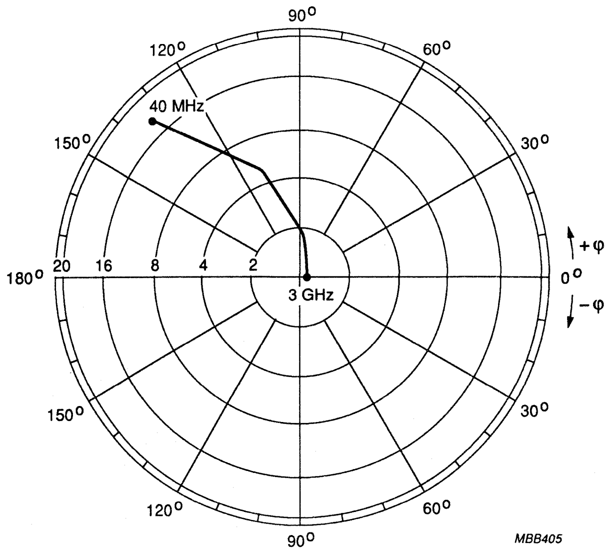
V_{CB} = 10 V.

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



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

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



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

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

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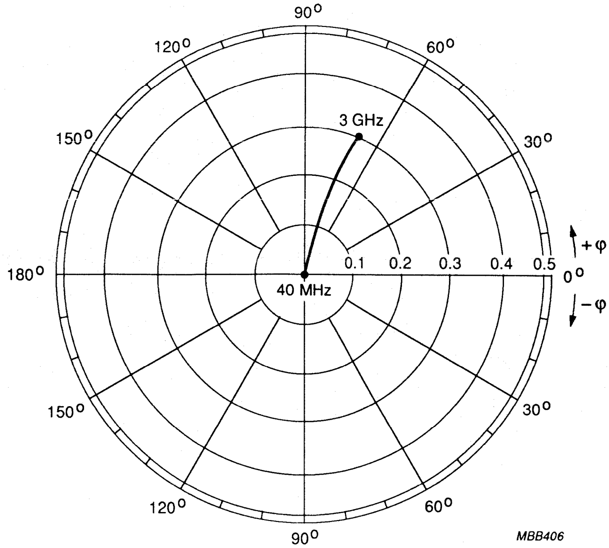
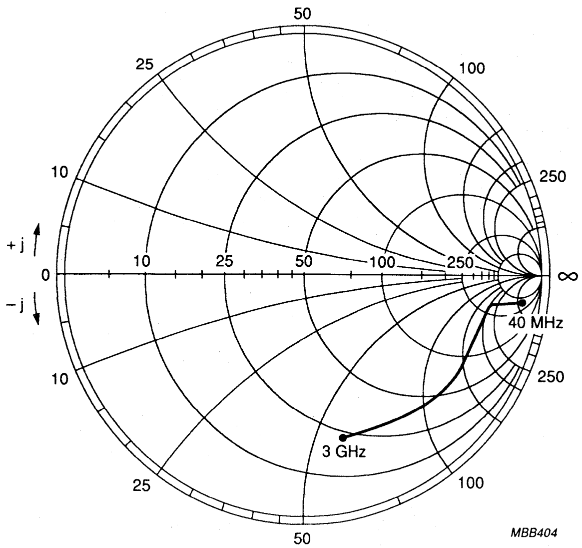


V_{CE} = 10 V; I_C = 15 mA.

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 7 Common base 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	0.637	−34.1	15.486	139.3	0.010	72.5	0.921	−7.2	34.2
100	0.416	−54.7	8.908	114.1	0.020	68.8	0.837	−8.4	25.1
200	0.283	−71.9	4.955	99.0	0.033	68.5	0.802	−9.4	18.7
300	0.236	−84.7	3.421	91.5	0.046	68.2	0.790	−11.0	15.2
400	0.204	−97.6	2.644	85.3	0.057	68.0	0.785	−13.2	12.8
500	0.186	−108.3	2.144	80.6	0.068	68.5	0.781	−15.4	10.9
600	0.173	−117.8	1.818	76.1	0.077	68.8	0.780	−17.7	9.4
700	0.155	−127.4	1.586	72.3	0.087	69.1	0.781	−20.0	8.2
800	0.151	−134.7	1.404	68.8	0.096	69.4	0.781	−22.4	7.1
900	0.143	−143.3	1.266	65.2	0.106	69.2	0.778	−24.6	6.2
1000	0.139	−152.2	1.168	62.3	0.115	69.4	0.779	−27.0	5.5
1200	0.135	−170.8	1.011	55.5	0.134	69.3	0.773	−31.6	4.1
1400	0.139	177.5	0.891	50.3	0.152	69.2	0.768	−36.6	3.0
1600	0.143	167.3	0.807	46.4	0.170	69.3	0.766	−41.4	2.1
1800	0.146	152.1	0.745	42.5	0.188	69.3	0.762	−45.8	1.3
2000	0.161	140.1	0.695	37.5	0.205	68.3	0.746	−50.4	0.5

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

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

NPN 1 GHz wideband transistor BF547W

DESCRIPTION

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

PINNING

PIN	DESCRIPTION
	Code: E16
1	base
2	emitter
3	collector

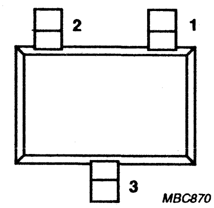


Fig.1 SOT323.

QUICK REFERENCE DATA

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

Note

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

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope, intended for applications in thick and thin-film circuits. This transistor is primarily intended for use in i.f. detection applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C
D.C. current gain at T_j = 25 °C $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50
Transition frequency at f = 100 MHz $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	325 MHz
Noise figure at R_S = 300 Ω $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 100 kHz	F	typ.	2 dB

MECHANICAL DATA

Dimensions in mm

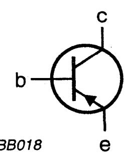
Marking code

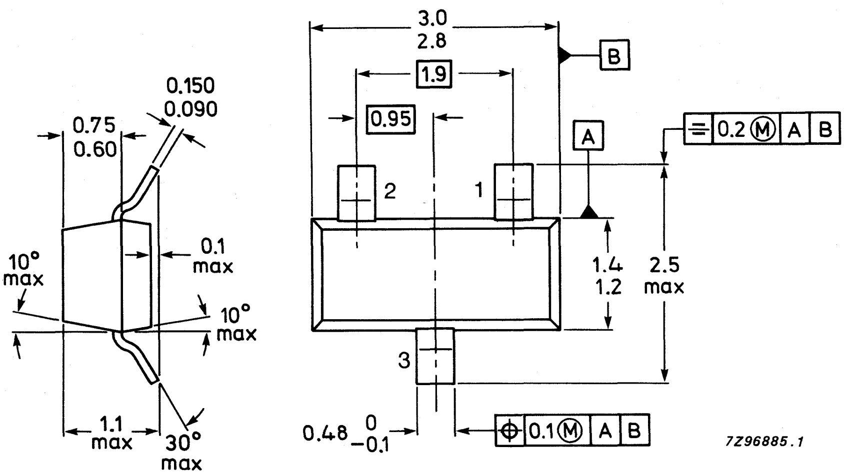
Fig. 1 SOT-23

BF550 = LAp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering Recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 30$ V	$-I_{CBO}$	<	50 nA
Emitter cut-off current $I_C = 0; -V_{EB} = 3$ V	$-I_{EBO}$	<	100 μA
Base-emitter voltage $-I_C = 1$ mA; $-V_{CE} = 10$ V	$-V_{BE}$	typ.	750 mV
D.C. current gain $-I_C = 1$ mA; $-V_{CE} = 10$ V	h_{FE}	>	50
Transition frequency at f = 100 MHz $-I_C = 1$ mA; $-V_{CE} = 10$ V	f_T	typ.	325 MHz
Feedback capacitance at f = 1 MHz $-I_C = 1$ mA; $-V_{CE} = 10$ V	C_{re}	typ.	0,5 pF
Noise figure at R_S = 300 Ω $-I_C = 1$ mA; $-V_{CE} = 10$ V; f = 100 kHz	F	typ.	2 dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

FEATURES

- Low leakage level (typ. 500 fA)
- High gain
- Low cut-off voltage.

DESCRIPTION

N-channel symmetrical silicon junction FETs in a surface-mountable SOT23 envelope. These devices are specially designed for use as impedance converters in (for example) electret microphones and infra-red detectors, and as VHF amplifiers in oscillators and mixers.

PINNING - SOT23

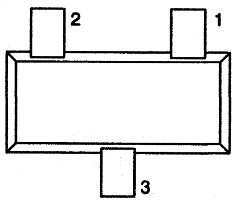
PIN	DESCRIPTION
1	source
2	drain
3	gate

CAUTION

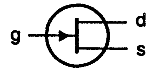
The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm V_{DS}$	drain-source voltage		–	30	V
I_{DSS}	drain current	V_{DS} = 15 V; V_{GS} = 0			
	BF556A		3	7	mA
	BF556B		6	13	mA
	BF556C		11	18	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	250	mW
$-V_{GS(off)}$	gate-source cut-off voltage	V_{DS} = 15 V; I_D = 200 μA	0.5	7.5	V
$\|Y_{fs}\|$	common source transfer admittance	V_{DS} = 15 V; V_{GS} = 0	4.5	–	mS



Top view



MAM036

Marking codes:
BF556A: M84.
BF556B: M85.
BF556C: M86.

Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm V_{DS}$	drain-source voltage		–	30	V
$-V_{GSO}$	gate-source voltage		–	30	V
$-V_{GDO}$	gate-drain voltage		–	30	V
I_G	DC forward gate current		–	10	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (note 1)	–	250	mW
T_{stg}	storage temperature		–65	150	°C
T_j	operating junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	500 K/W

Note

1. Device mounted on a printed circuit board, maximum lead length 4 mm; mounting pad for the drain lead 10 mm^2.

STATIC CHARACTERISTICS

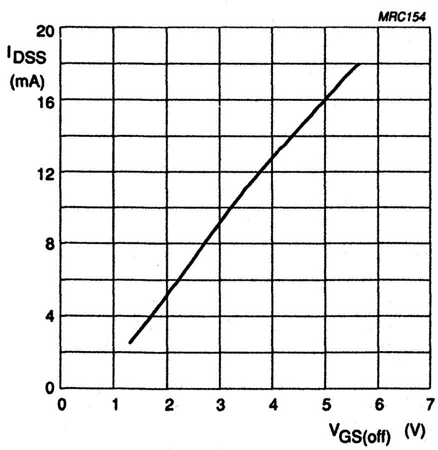
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)GSS}$	gate-source breakdown voltage	V_{DS} = 0; $-I_G$ = 1 μA	30	–	–	V
I_{DSS}	drain current	V_{DS} = 15 V; V_{GS} = 0				
	BF556A		3	–	7	mA
	BF556B		6	–	13	mA
	BF556C		11	–	18	mA
$-I_{GSS}$	reverse gate leakage current	V_{DS} = 0; $-V_{GS}$ = 20 V	–	0.5	5000	pA
$-V_{GS(off)}$	gate-source cut-off voltage	V_{DS} = 15 V; I_D = 200 μA	0.5	–	7.5	V
$\lvert Y_{fs}\rvert$	common source transfer admittance	V_{DS} = 15 V; V_{GS} = 0	4.5	–	–	mS
$\lvert Y_{os}\rvert$	common source output admittance	V_{DS} = 15 V; V_{GS} = 0	–	40	–	μS

DYNAMIC CHARACTERISTICS

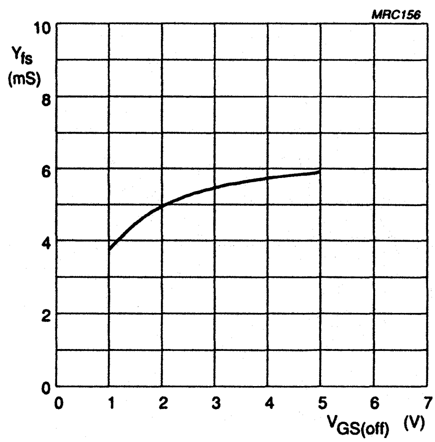
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	UNIT
C_{is}	input capacitance	V_{DS} = 15 V; $-V_{GS}$ = 10 V; f = 1 MHz	1.7	pF
		V_{DS} = 15 V; $-V_{GS}$ = 0; f = 1 MHz	3	pF
C_{rs}	feedback capacitance	V_{DS} = 15 V; $-V_{GS}$ = 10 V; f = 1 MHz	0.8	pF
		V_{DS} = 15 V; $-V_{GS}$ = 0; f = 1 MHz	0.9	pF
g_{is}	common source input conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	15	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	300	µS
g_{fs}	common source transfer conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	2	mS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	1.8	mS
$-g_{rs}$	common source feedback conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	6	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	40	µS
g_{os}	common source output conductance	V_{DS} = 10 V; I_D = 1 mA; f = 100 MHz	30	µS
		V_{DS} = 10 V; I_D = 1 mA; f = 450 MHz	60	µS
V_n	equivalent input noise voltage	VDS = 10 V; I_D = 1 mA; f = 100 Hz	40	nV/√Hz



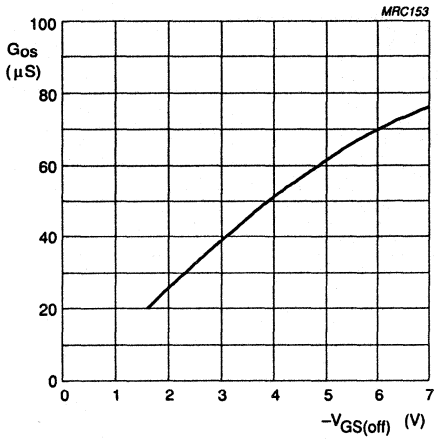
V_{DS} = 15 V.

Fig.2 Drain current as a function of gate-source cut-off voltage; typical values.



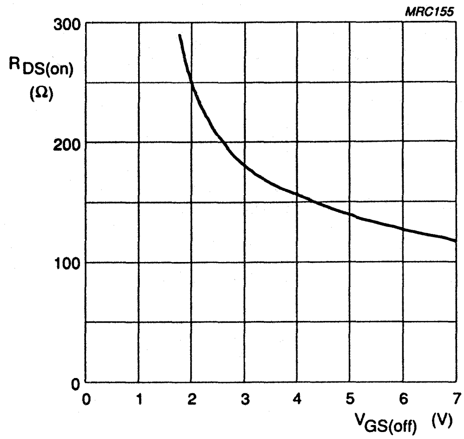
V_{DS} = 15 V; I_D = 1 µA.

Fig.3 Common source transfer admittance as a function of gate-source cut-off voltage; typical values.



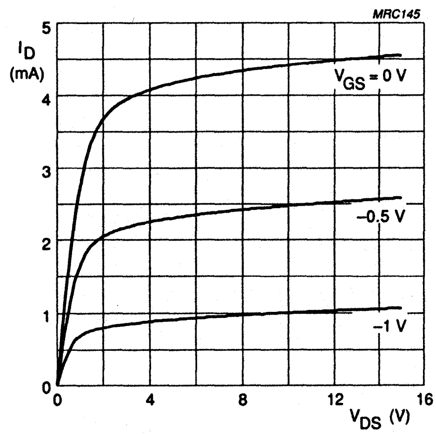
V_{DS} = 15 V.

Fig.4 Common source output conductance as a function of gate-source cut-off voltage; typical values.



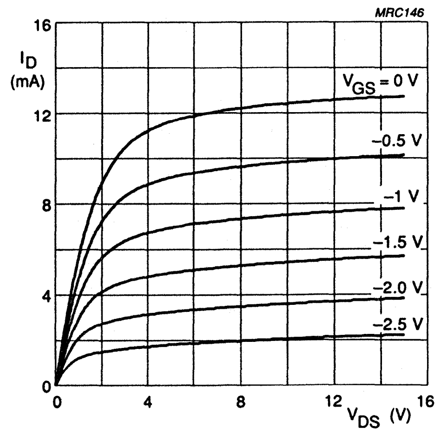
V_{DS} = 100 mV; V_{GS} = 0.

Fig.5 Drain-source on-resistance as a function of gate-source cut-off voltage; typical values.



BF556A

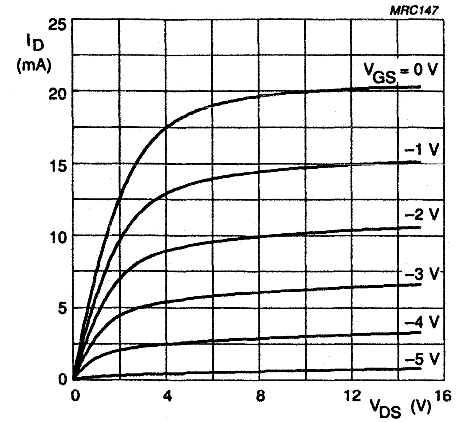
Fig.6 Typical output characteristics.



BF556B

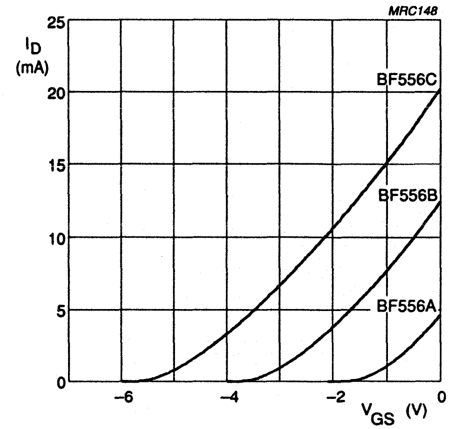
Fig.7 Typical output characteristics.

N-channel field-effect transistors BF556A;BF556B;BF556C



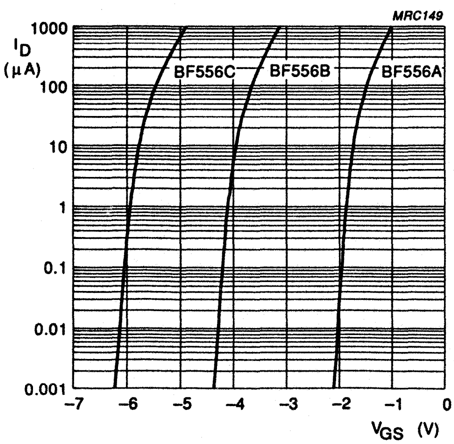
BF556C

Fig.8 Typical output characteristics.



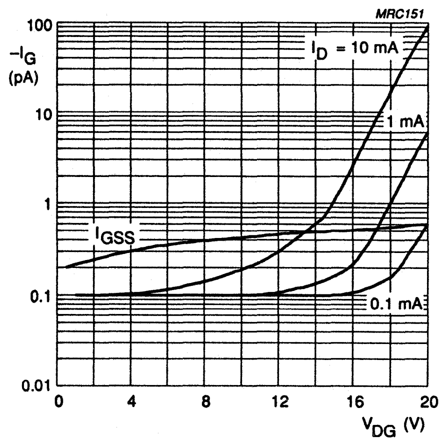
V_{DS} = 15 V.

Fig.9 Typical input characteristics.



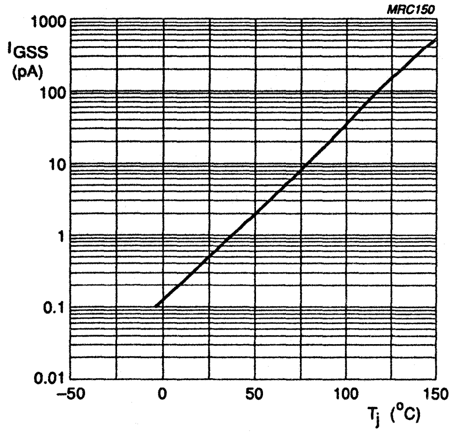
V_{DS} = 15 V.

Fig.10 Drain current as a function of gate-source voltage; typical values.



(I_D = 10 mA only for BF556B and BF556C).

Fig.11 Gate current as a function of drain-gate voltage; typical values.



$V_{DS} = 0$; $-V_{GS} = 20$ V.

Fig.12 Gate current as a function of junction temperature; typical values.

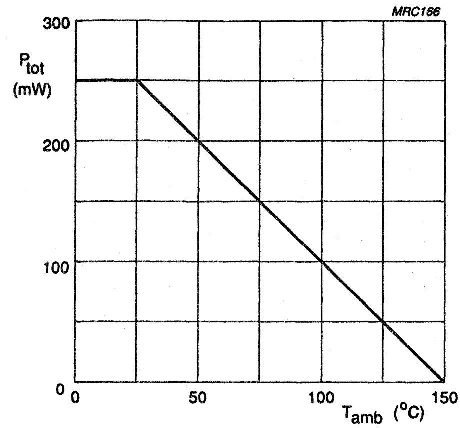
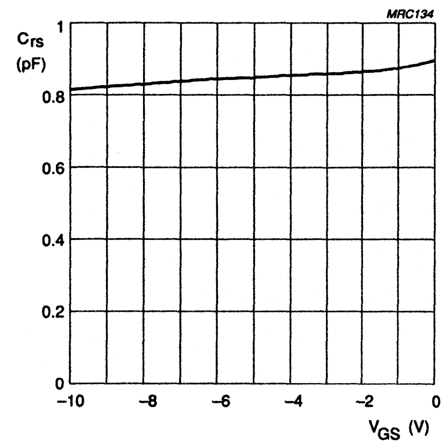
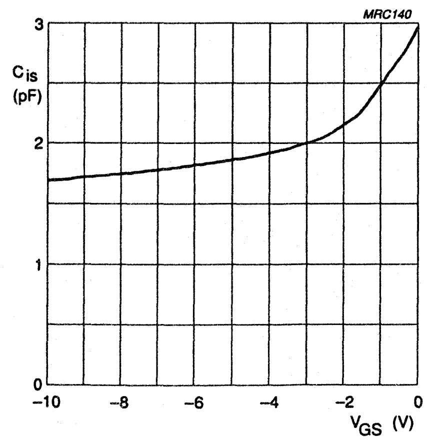


Fig.13 Power derating curve.



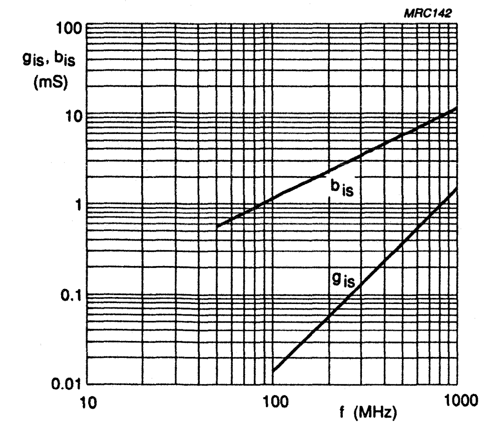
$V_{DS} = 15$ V.

Fig.14 Typical feedback capacitance.



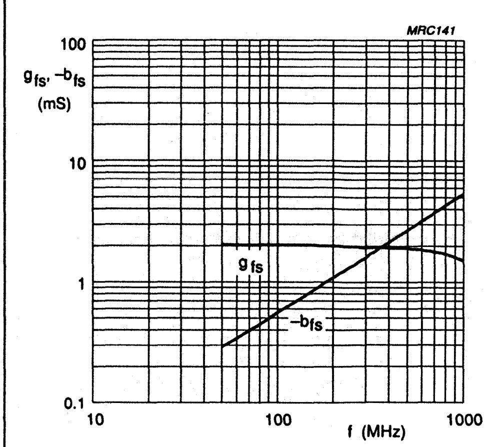
$V_{DS} = 15$ V.

Fig.15 Typical input capacitance.



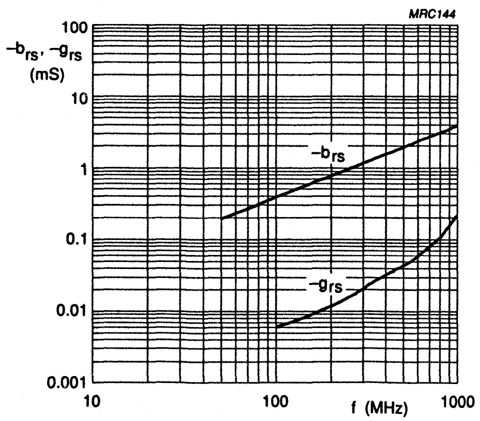
V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.16 Common source input conductance; typical values.



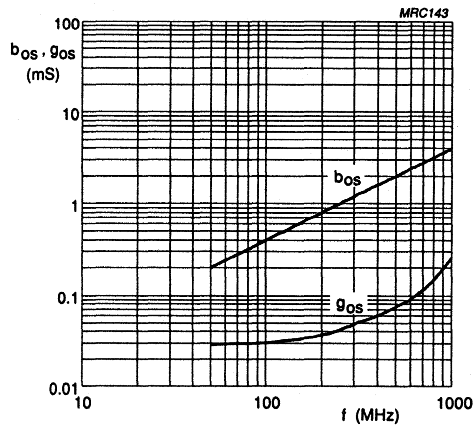
V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.17 Common source transfer conductance; typical values.



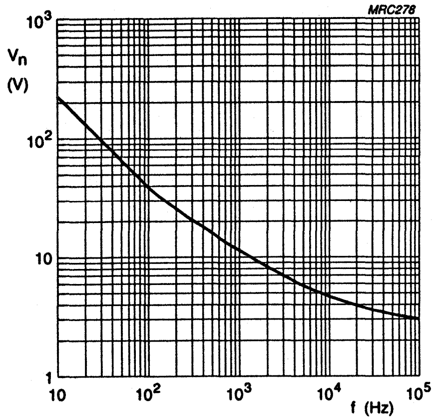
V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.18 Common source feedback conductance; typical values.



V_{DS} = 10 V; I_D = 1 mA; T_{amb} = 25 °C.

Fig.19 Common source output conductance; typical values.



V_{DS} = 10 V; I_D = 1 mA.

Fig.20 Equivalent noise voltage as a function of frequency.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic SOT-23 variant envelope, intended for use in large-signal handling i.f. pre-amplifiers of TV receivers in combination with surface acoustic wave filters.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	40	
Transition frequency at f = 100 MHz I_C = 40 mA; V_{CE} = 10 V	f_T	>	490	MHz
Voltage gain at f = 36 MHz (see Fig. 4) I_C = 20 mA; V_{CE} ≈ 10,4 V	G_v	typ.	24	dB
Interference voltage for K = 1% (see Fig. 3)	$V_{(int)rms}$	typ.	120	mV

MECHANICAL DATA

Dimensions in mm

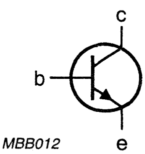
Fig. 1 SOT-23.

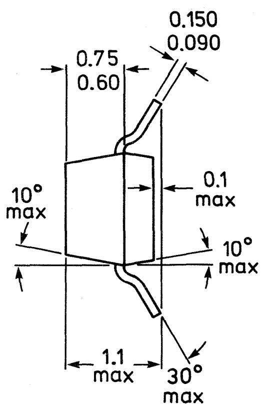
Pinning:

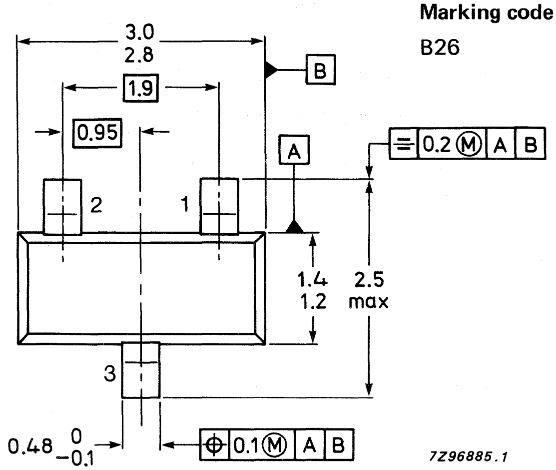
1 = base
2 = emitter
3 = collector

Marking code

B26







TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,5	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to tab	$R_{th\ j\text{-}t}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	400	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 125$ °C	I_{CBO}	<	30	μA
Emitter cut-off current				
$I_C = 0$; $V_{EB} = 2$ V	I_{EBO}	<	100	nA
D.C. current gain				
$I_C = 10$ mA; $V_{CE} = 1$ V	h_{FE}	>	40	
Transition frequency at f = 100 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V	f_T	>	500	MHz
$I_C = 40$ mA; $V_{CE} = 10$ V	f_T	>	490	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,2	pF
		<	3,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 1$ V	C_e	<	4,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	1,6	pF
		<	2,2	pF

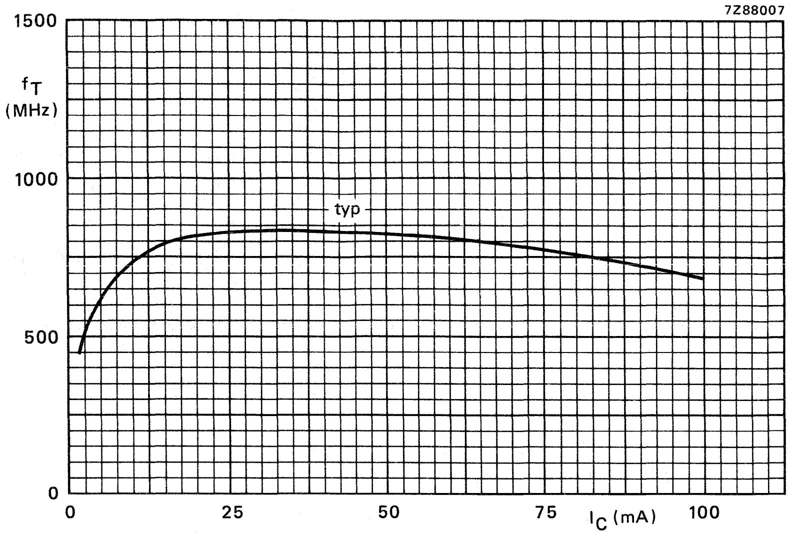
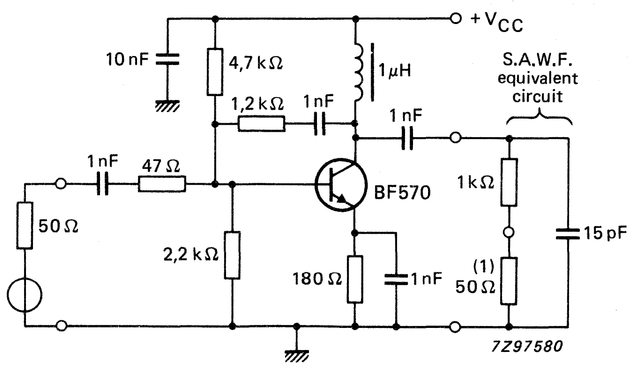


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

APPLICATION INFORMATION



(1) Test instrument load.

Fig. 3 Large-signal handling i.f. preamplifier for surface acoustic wave filter.

Performance

Supply voltage	V_{CC}	=	12	V
Collector current	I_C	=	20	mA
Measuring frequency	f_i	=	36	MHz
Input impedance	Z_i	typ.	50 Ω//1	pF
Output impedance	Z_o	<	100	Ω
Voltage gain G_V (in dB) = $20 \log \frac{V_o}{V_i}$	G_V	typ.	24	dB
Interference voltage for K = 1%*	$V_{(int)rms}$	typ.	120	mV

* Input terminal voltage at 50 Ω internal resistance of signal generator, interference frequency 40 MHz, 80% modulated with 1 kHz.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

N-P-N transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers.

P-N-P complements are BF621 and BF623 respectively.

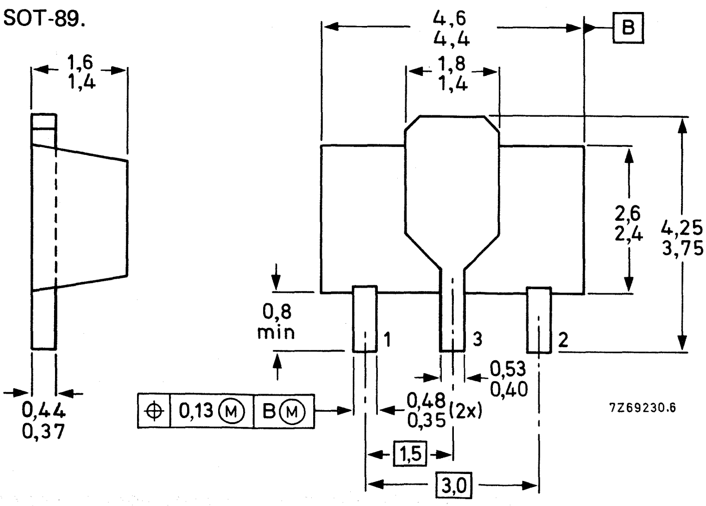
QUICK REFERENCE DATA

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-89.

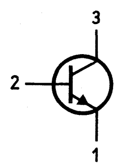


See also *Soldering recommendations.*

BOTTOM VIEW

Marking code

BF620 = DC
BF622 = DA



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF620	BF622	
Collector cut-off current I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	µA
Saturation voltage I_C = 30 mA; I_B = 5 mA	$V_{CE\,sat}$	<	0,6		V
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

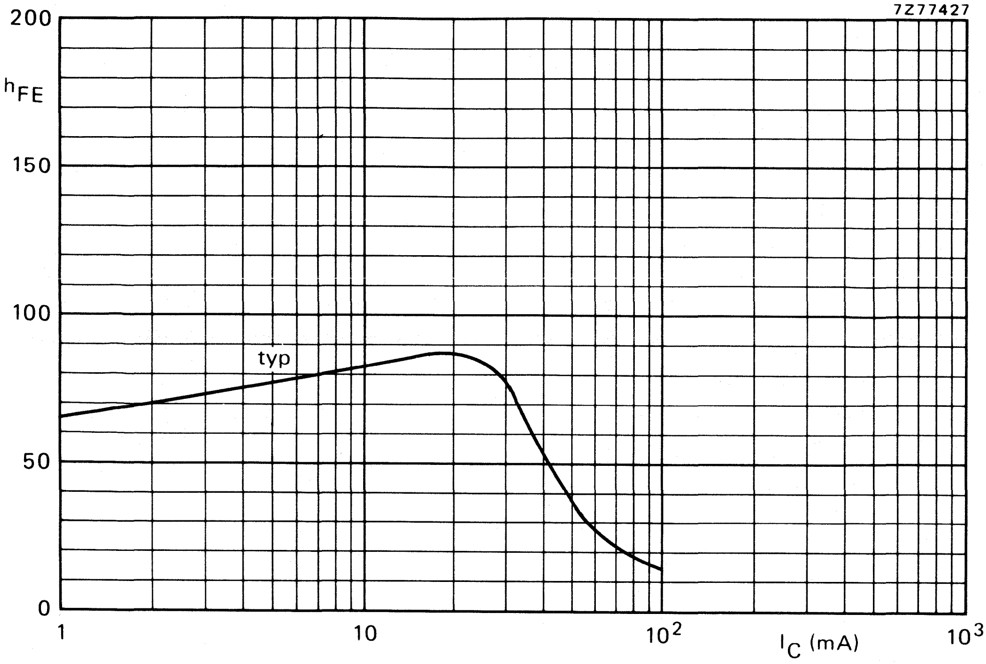


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

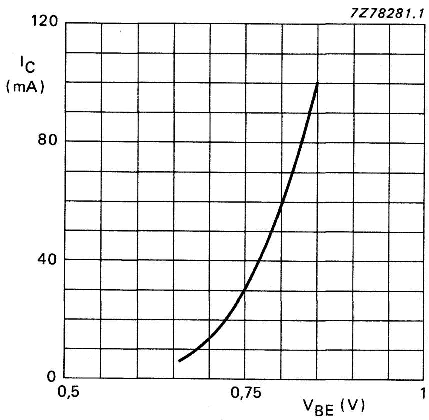


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

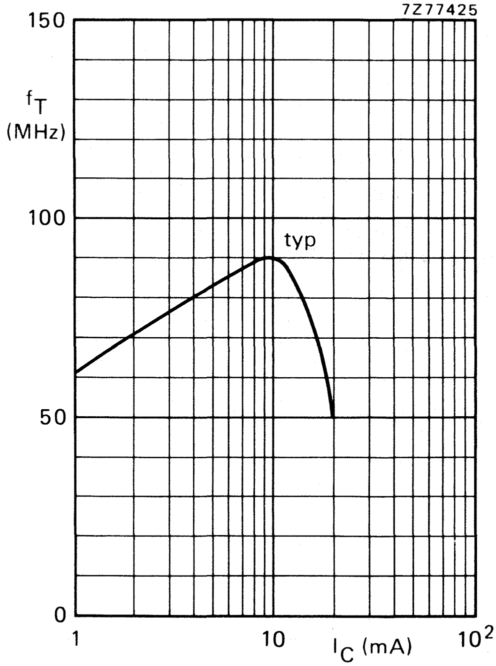


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

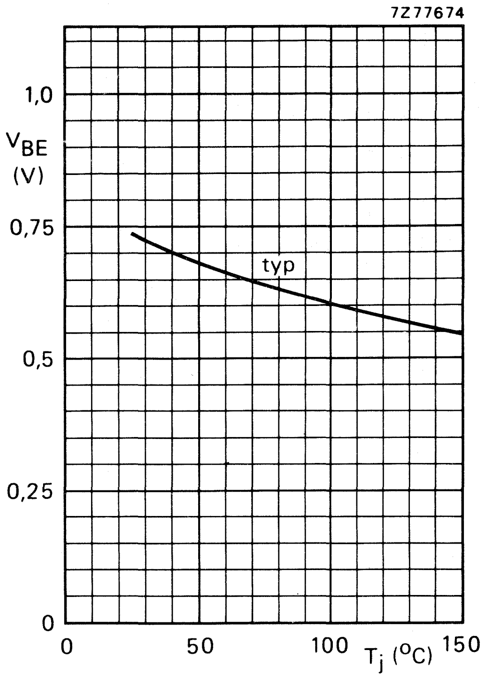


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

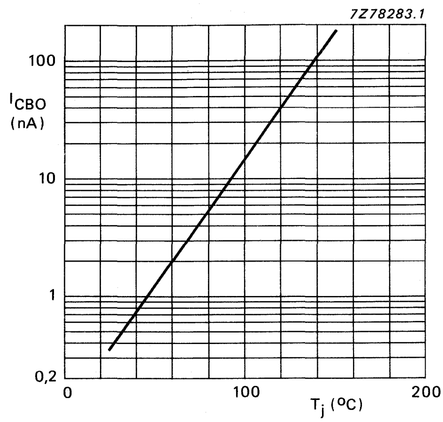


Fig. 6 V_{CB} = 200 V; typical values.

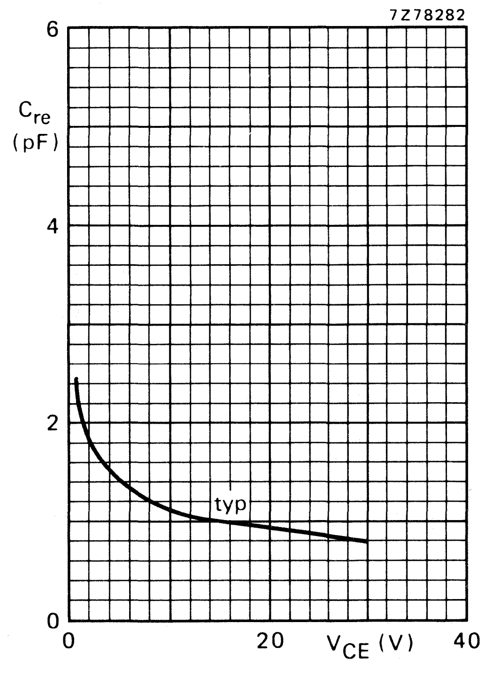


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

P-N-P transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers.

N-P-N complements are BF620 and BF622 respectively.

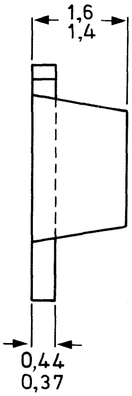
QUICK REFERENCE DATA

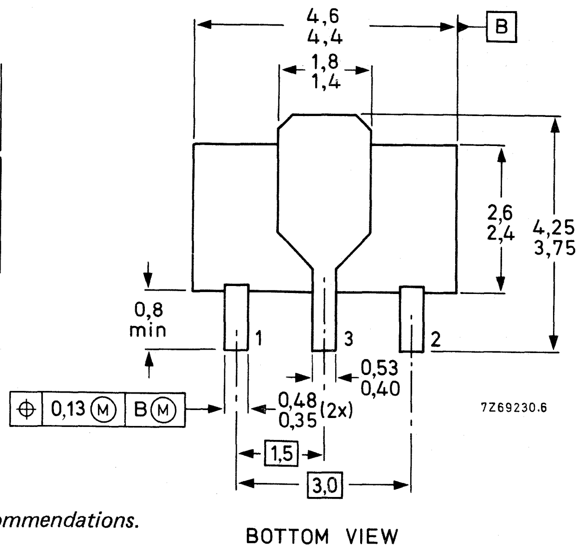
			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Dimensions in mm

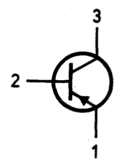
Fig. 1 SOT-89.





Marking code

BF621 = DF
BF623 = DB



See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		–65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE *

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF621	BF623	
Collector cut-off current I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage $-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

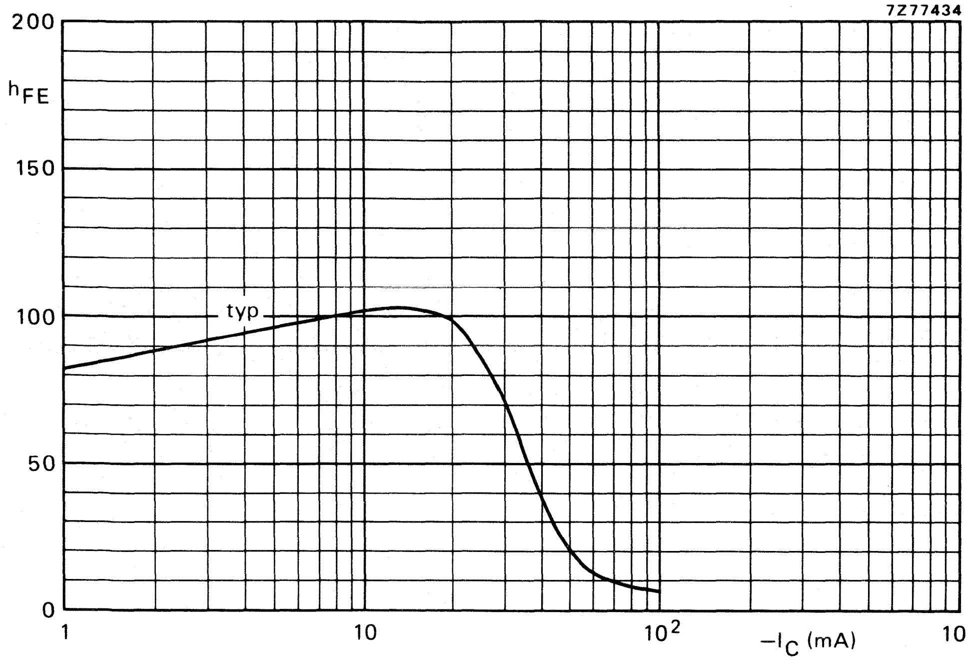


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

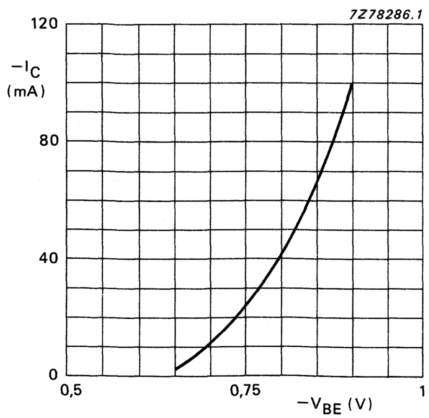


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

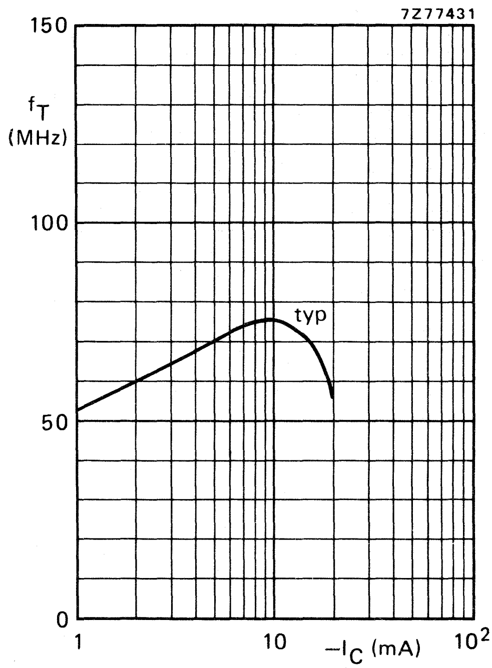


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

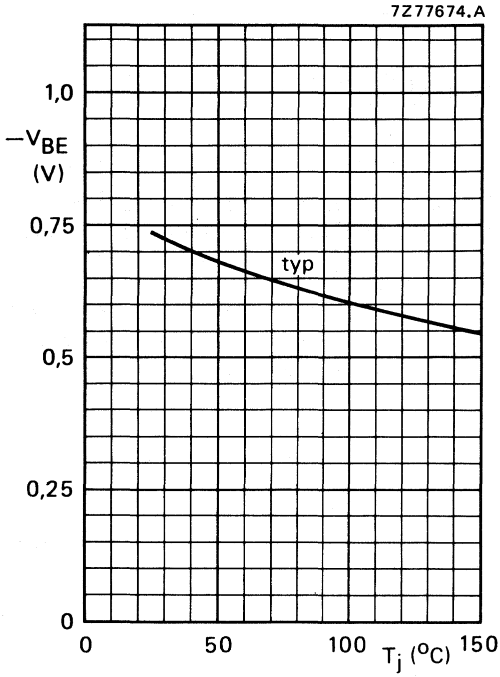


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

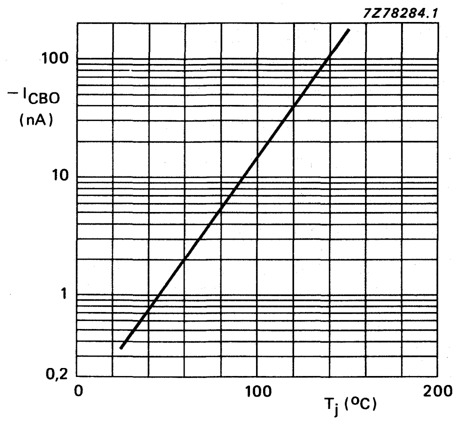


Fig. 6 $-V_{CB}$ = 200 V ; typical values.

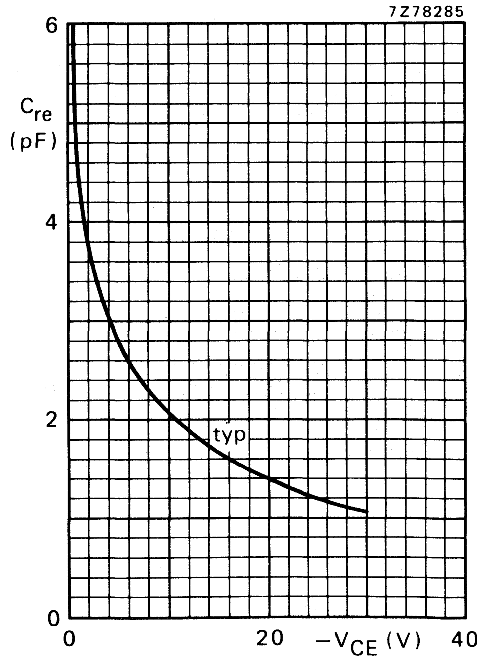


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON PLANAR TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope; intended for use as oscillator in v.h.f. tuners with extended frequency range and/or in conjunction with MOS-FETs in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Collector current (peak value)	$-I_{CM}$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 5 mA; $-V_{CB}$ = 10 V	f_T	typ.	650	MHz

MECHANICAL DATA

Dimensions in mm

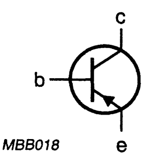
Marking code

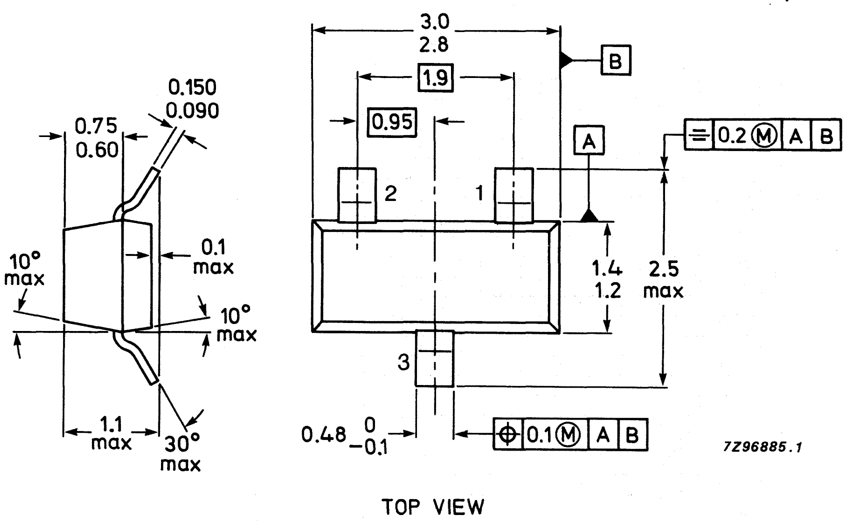
BF660 = LEp

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4 V
Collector current (peak value)	$-I_{CM}$	max.	25 mA
Base current (d.c.)	$-I_B$	max.	10 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current $I_E = 0; -V_{CB} = 20$ V	$-I_{CBO}$	<	50 nA
D.C. current gain $I_E = 3$ mA; $-V_{CE} = 10$ V	h_{FE}	>	30
Transition frequency at f = 100 MHz $I_E = 5$ mA; $-V_{CB} = 10$ V	f_T	typ.	650 MHz
Feedback capacitance at f = 1 MHz $I_E = 1$ mA; $-V_{CB} = 10$ V	C_{re}	typ.	0,65 pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

SILICON EPITAXIAL TRANSISTORS

NPN transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers, and general purpose high voltage circuits.

PNP complements are BF721 and BF723 respectively.

QUICK REFERENCE DATA

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

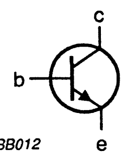
MECHANICAL DATA

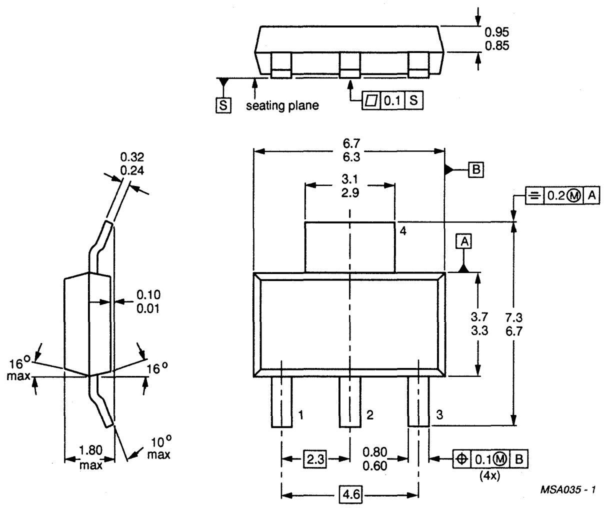
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (DC)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF720	BF722	
Collector cut-off current					
I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage					
I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
DC current gain					
I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

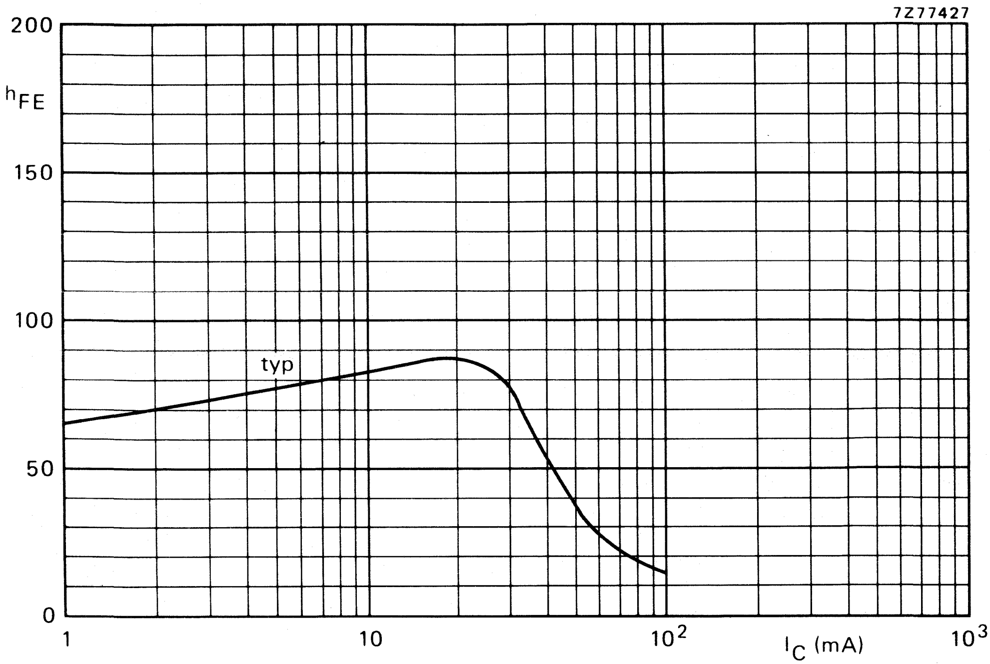


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

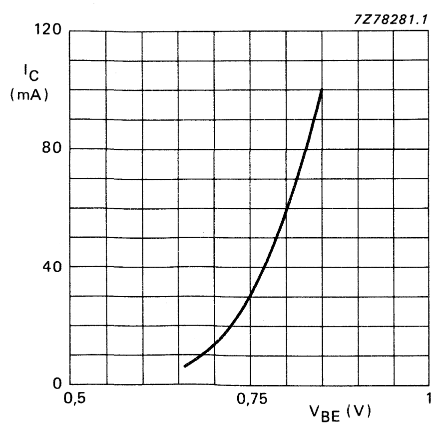


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

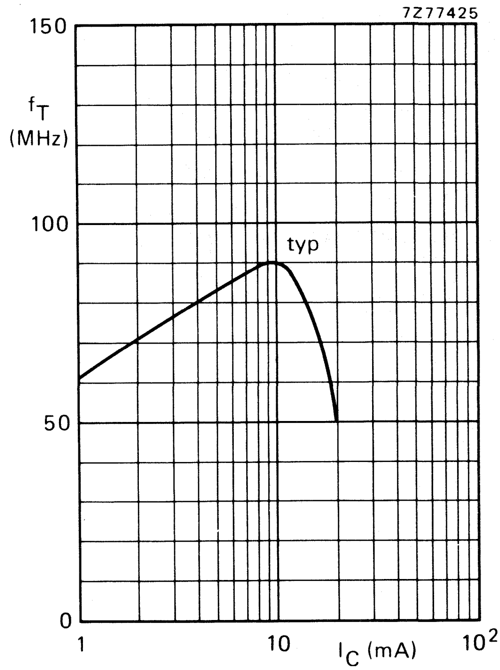


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

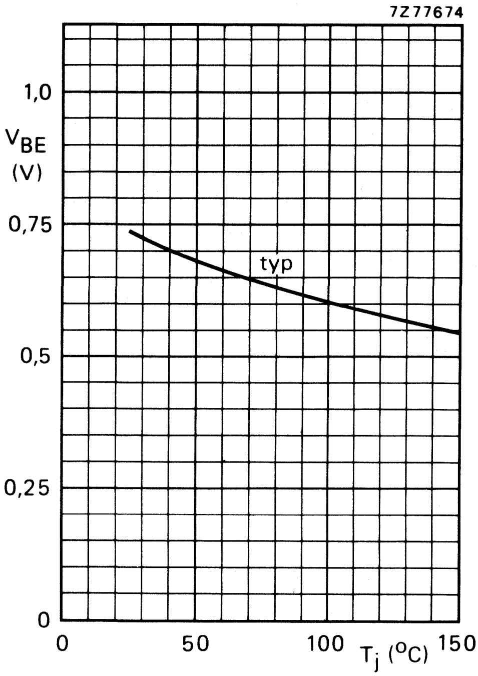


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

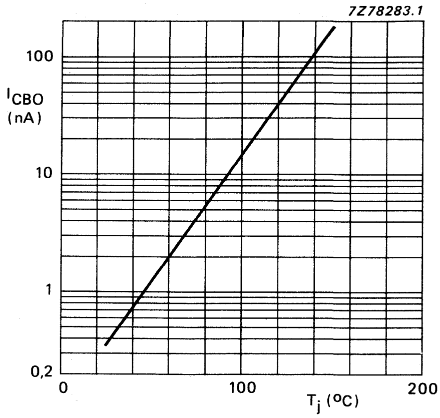


Fig. 6 V_{CB} = 200 V ; typical values.

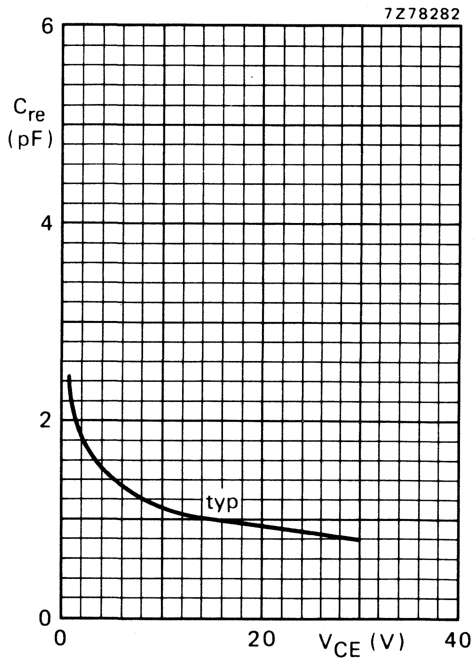


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

PNP transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers, and general purpose high voltage circuits.

NPN complements are BF720 and BF722 respectively.

QUICK REFERENCE DATA

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

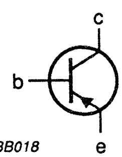
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



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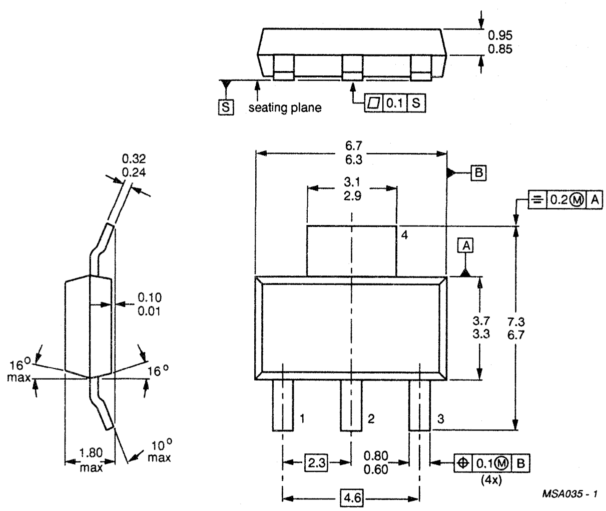


MSA035 - 1

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (DC)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		–65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF721	BF723	
Collector cut-off current					
$I_E = 0$; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage					
R_{BE} = 2.7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage					
$-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
DC current gain					
$-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz					
$I_C = 0$; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

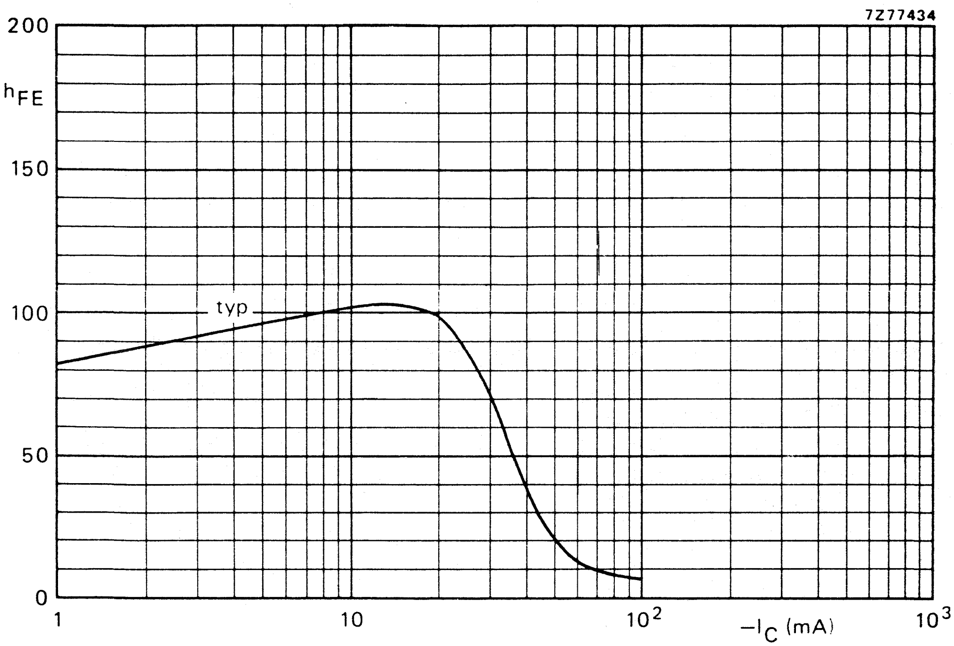


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

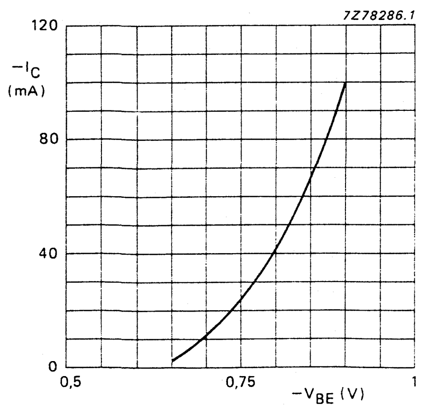


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

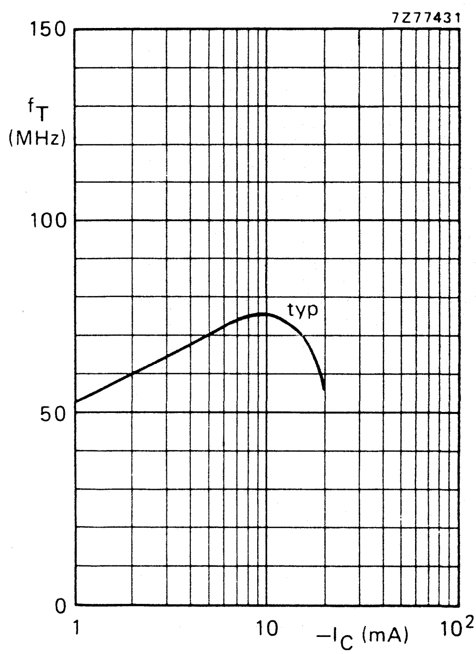


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

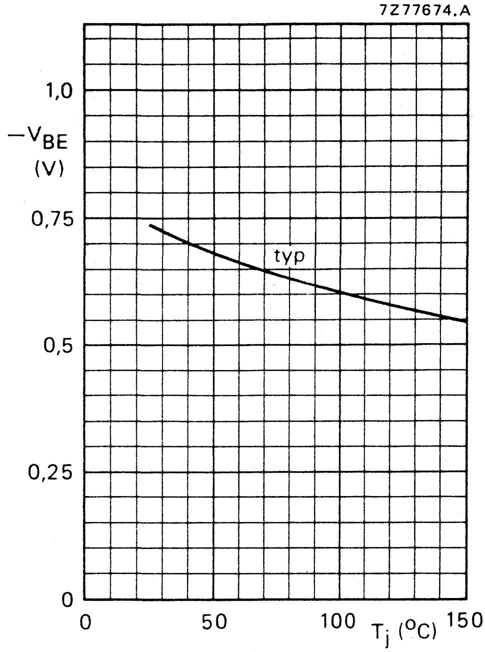


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

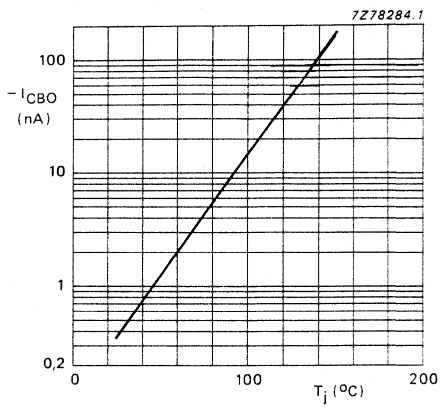


Fig. 6 $-V_{CB}$ = 200 V; typical values.

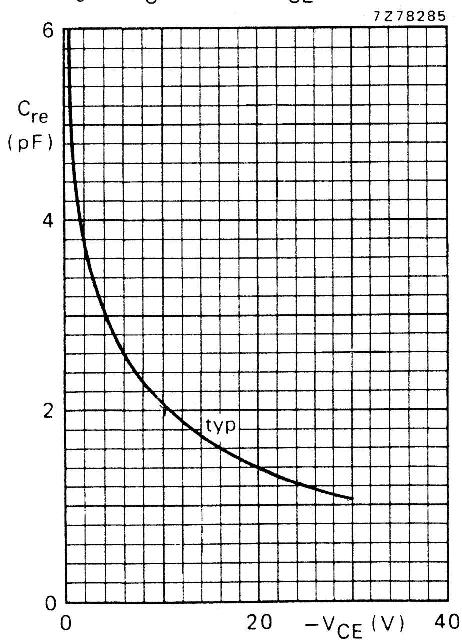


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

NPN 1 GHz wideband transistor BF747

FEATURES

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

DESCRIPTION

Low cost NPN transistor in a plastic SOT23 envelope.

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

PINNING

PIN	DESCRIPTION
Code: E15	
1	base
2	emitter
3	collector

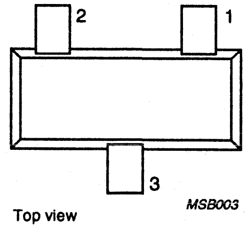


Fig.1 SOT23.

QUICK REFERENCE DATA

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

LIMITING VALUES

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

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

Note

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

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

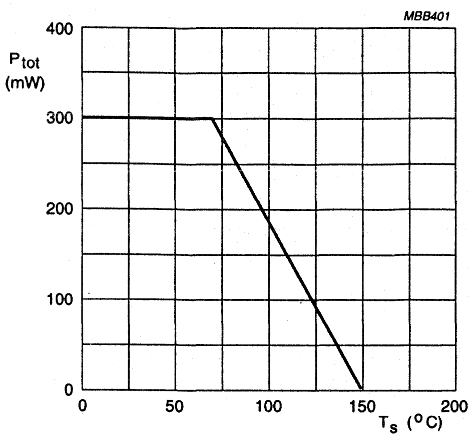
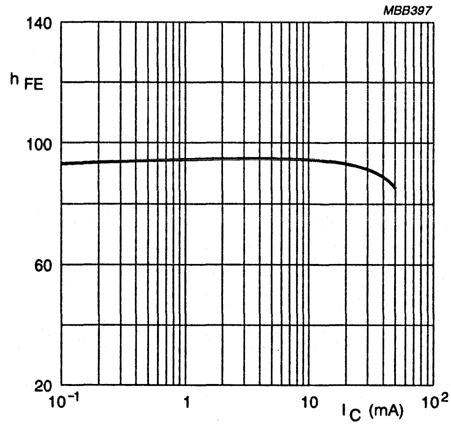
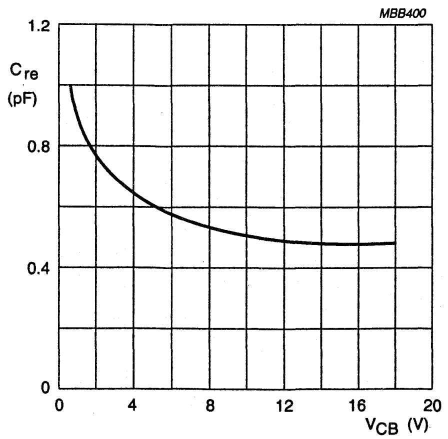


Fig.2 Power derating curve.



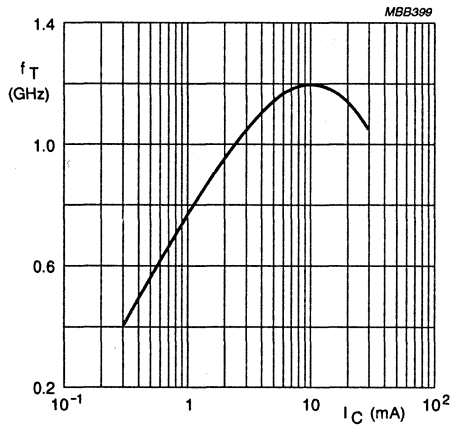
V_{CE} = 10 V.

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



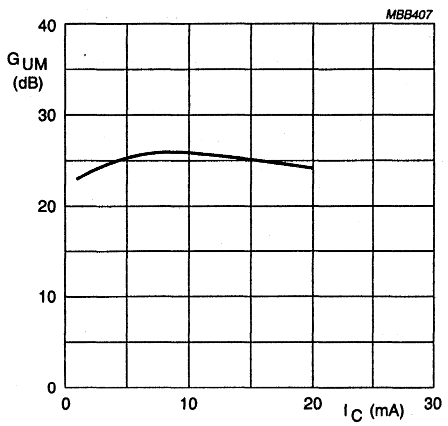
$I_E = i_e = 0$; f = 1 MHz.

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



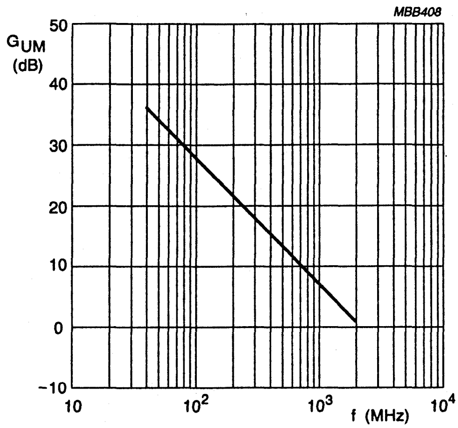
V_{CE} = 10 V; f = 500 MHz.

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



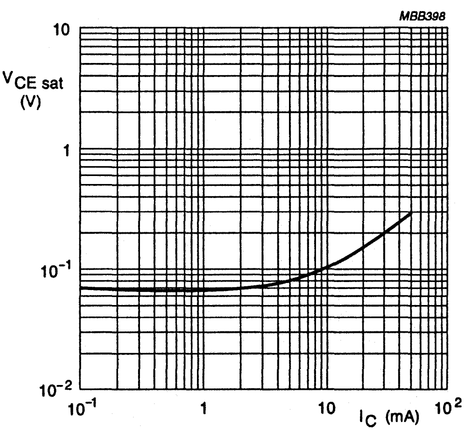
V_{CE} = 10 V; f = 100 MHz.

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



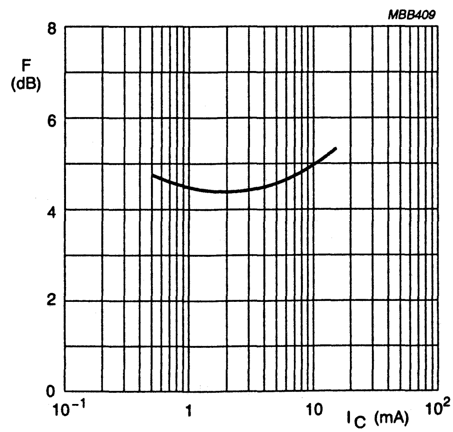
I_C = 15 mA; V_{CE} = 10 V.

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



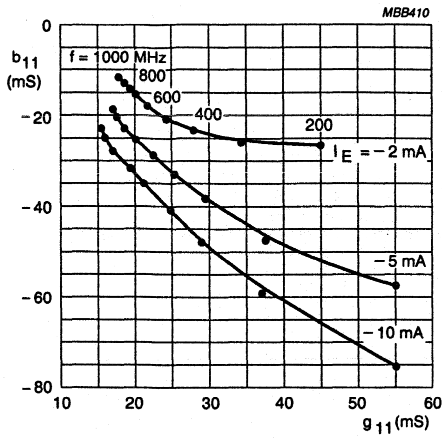
I_C/I_B = 10.

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



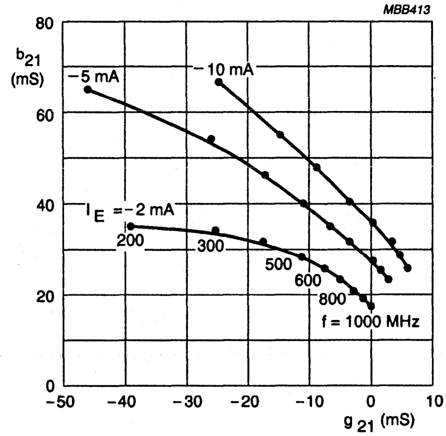
V_{CE} = 10 V; f = 100 MHz; $Z_S = Z_L$ = 50 Ω

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



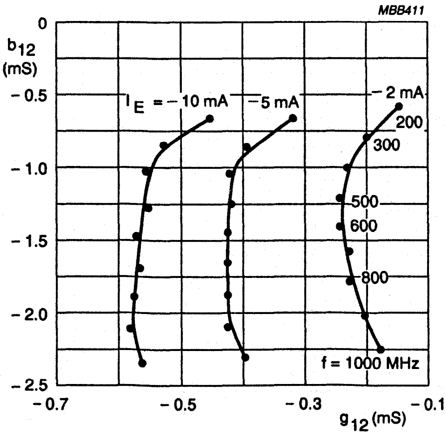
V_{CB} = 10 V.

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



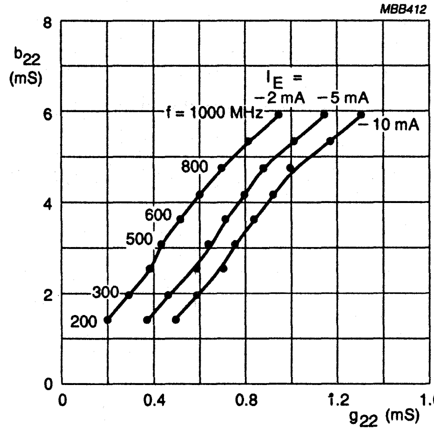
V_{CB} = 10 V.

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



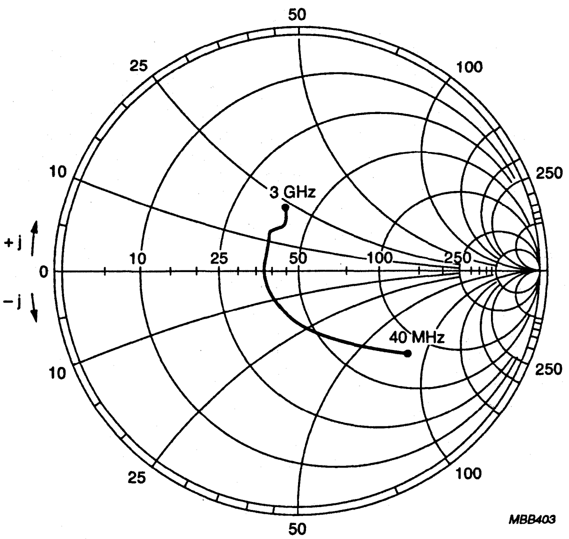
V_{CB} = 10 V.

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



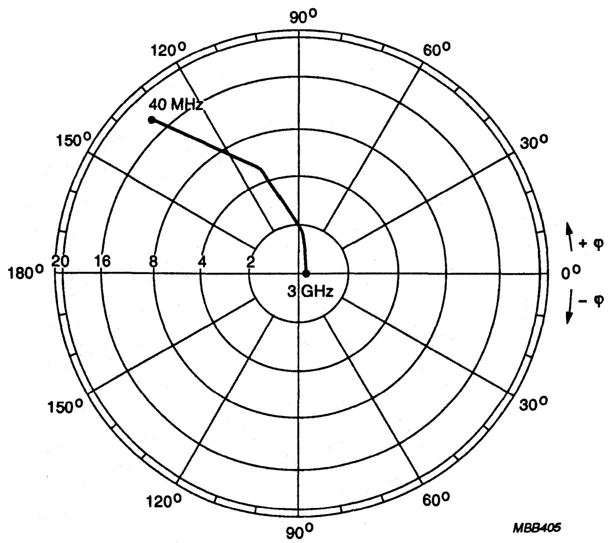
V_{CB} = 10 V.

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



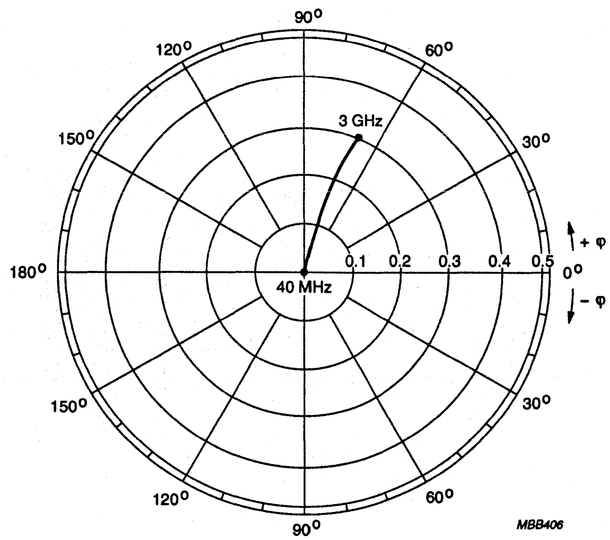
I_C = 15 mA; V_{CE} = 10 V

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



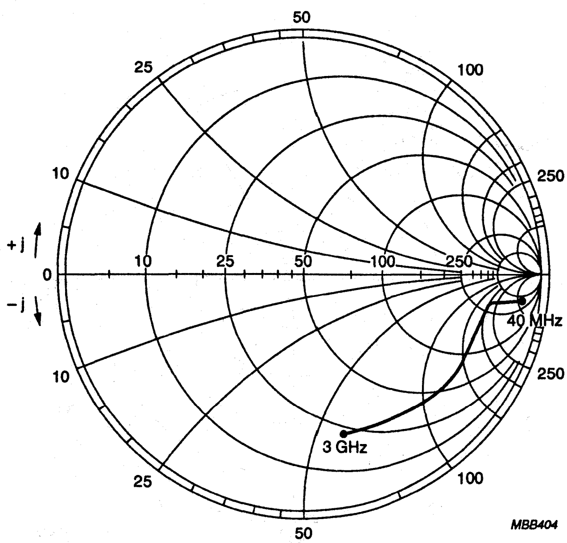
I_C = 15 mA; V_{CE} = 10 V.

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



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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NPN 5 GHz wideband transistor BF749

FEATURES

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

DESCRIPTION

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

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

PINNING

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

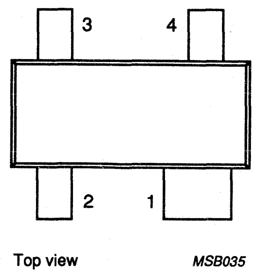


Fig.1 SOT143R.

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

FEATURES

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

DESCRIPTION

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

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

PINNING

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

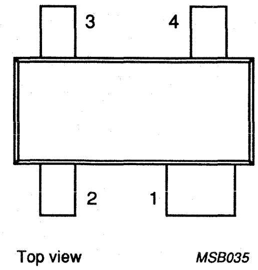


Fig.1 SOT143R.

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

NPN 7 GHz wideband transistor BF752

FEATURES

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

DESCRIPTION

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

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

PINNING

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

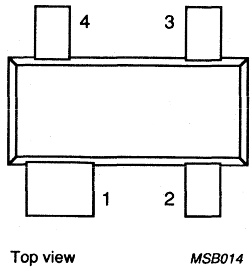


Fig.1 SOT143.

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

NPN 5 GHz wideband transistor — BF753

FEATURES

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

DESCRIPTION

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

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

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

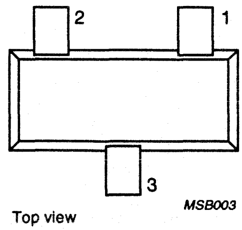


Fig.1 SOT23.

QUICK REFERENCE DATA

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

Note

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

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. P-N-P components are BF821, BF823 respectively.

QUICK REFERENCE DATA

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz

MECHANICAL DATA

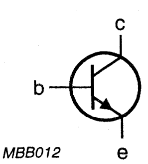
Dimensions in mm

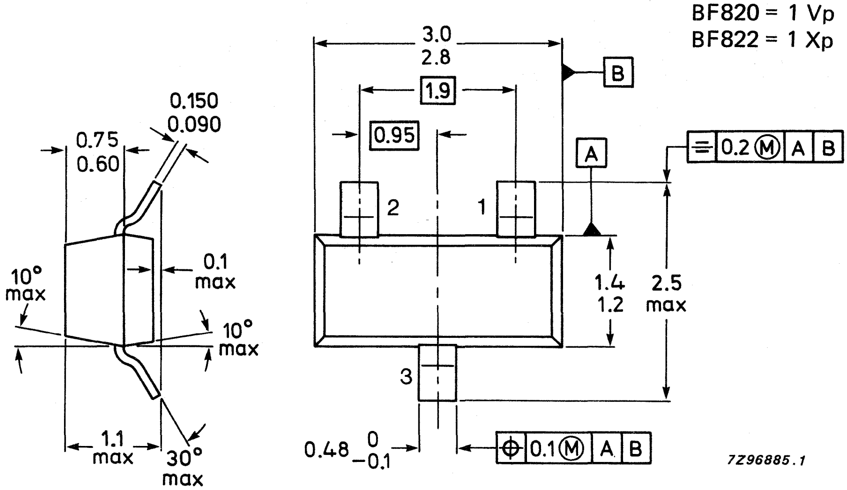
Fig. 1 SOT-23.

Marking code
BF820 = 1 Vp
BF822 = 1 Xp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations*.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF820	BF822	
Collector cut-off current $I_E = 0$; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	50	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm^2; thickness = 0,7 mm.

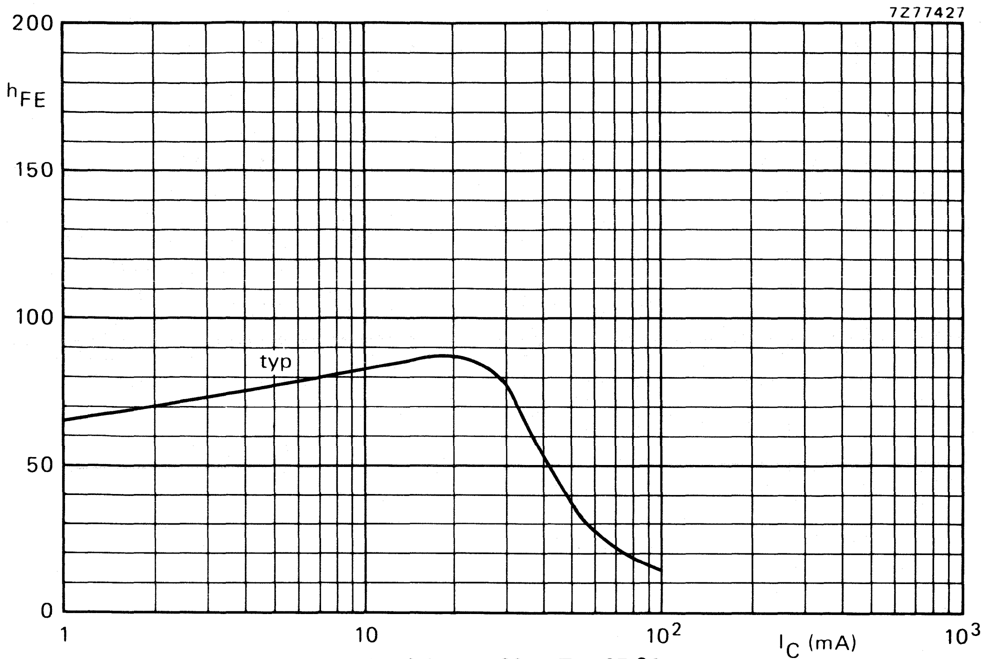


Fig. 2 V_{CE} = 20 V; T_j = 25 °C.

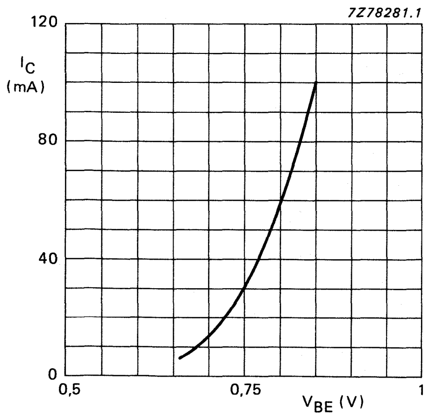


Fig. 3 V_{CE} = 20 V; T_j = 25 °C; typical values.

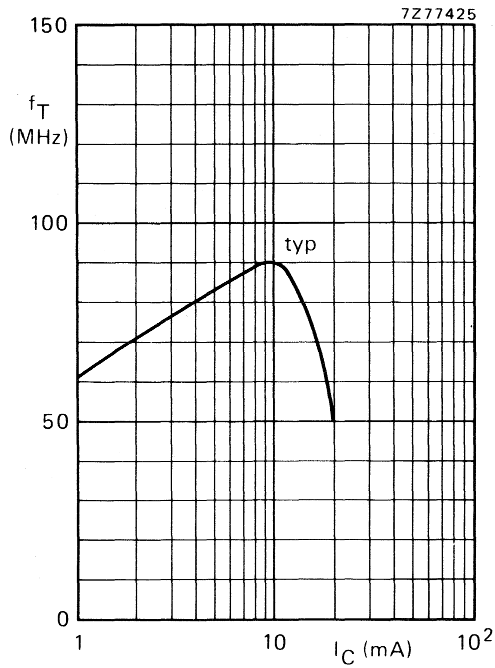


Fig. 4 V_{CE} = 10 V; T_j = 25 °C, f = 35 MHz.

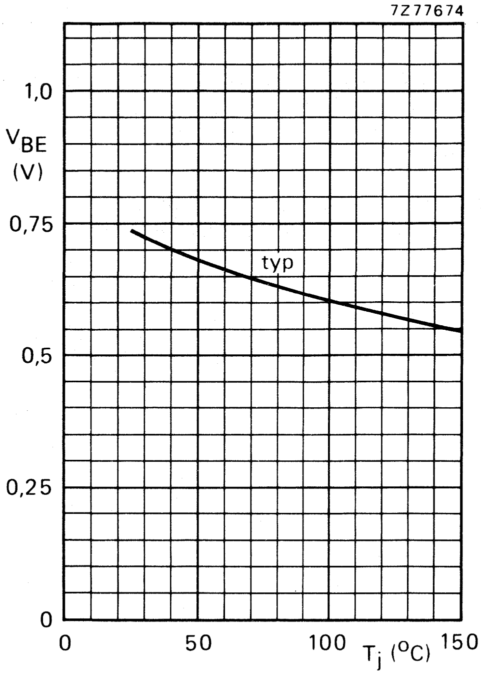


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

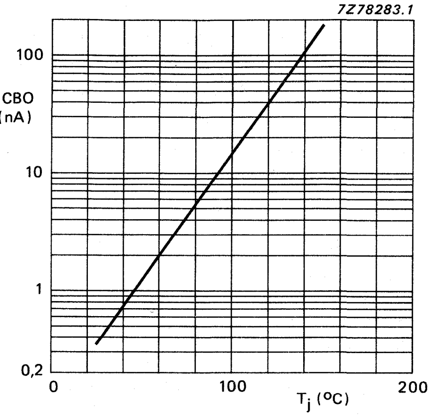


Fig. 6 V_{CB} = 200 V; typical values.

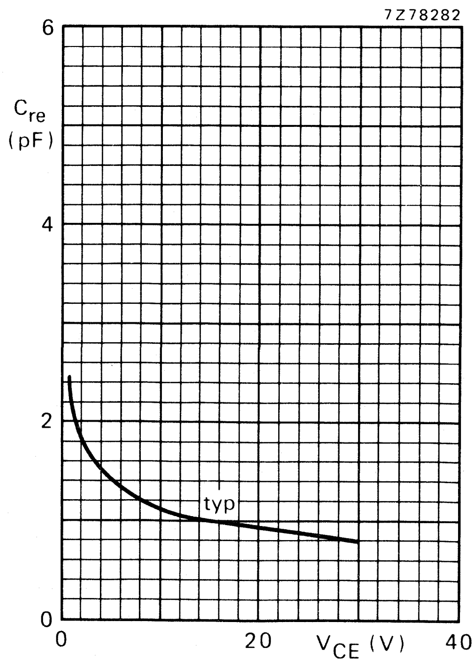


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

P-N-P transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. N-P-N complements are BF820, BF822 respectively.

QUICK REFERENCE DATA

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz

MECHANICAL DATA

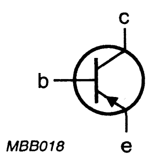
Dimensions in mm

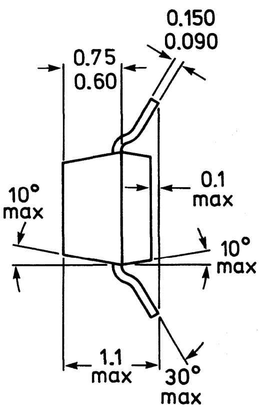
Fig. 1 SOT-23.

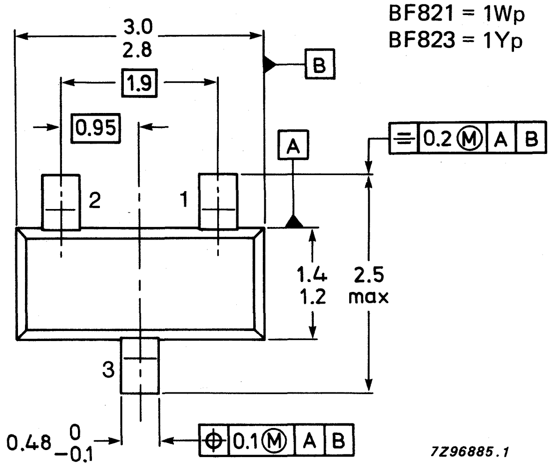
Marking code
BF821 = 1Wp
BF823 = 1Yp

Pinning:

1 = base
2 = emitter
3 = collector







TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		–65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF821	BF823	
Collector cut-off current $I_E = 0$; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	50	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	µA
Saturation voltage $-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz $I_C = 0$; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm^2; thickness = 0,7 mm.

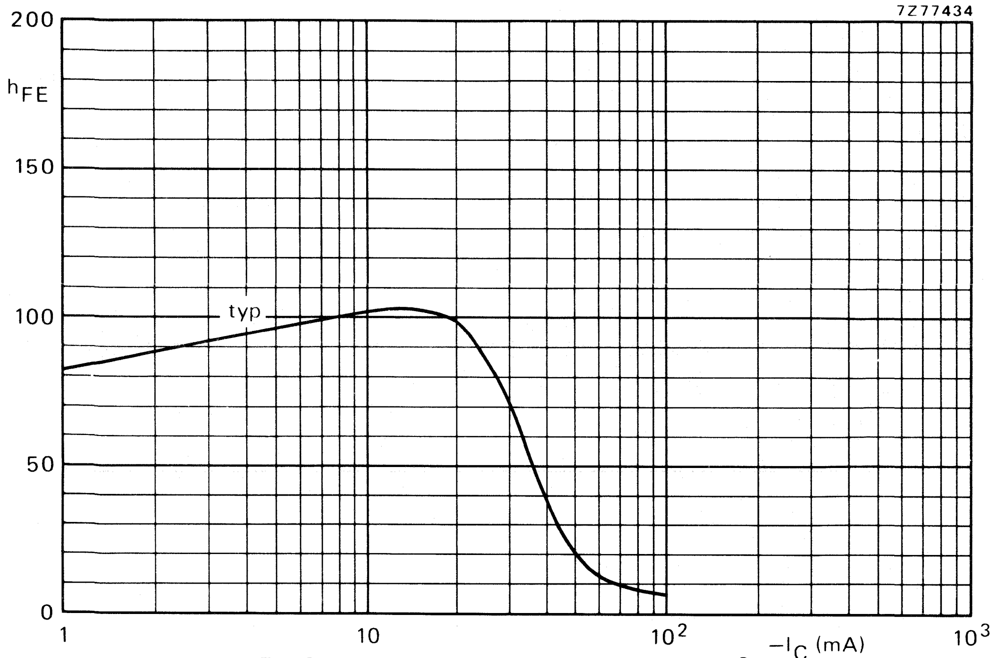


Fig. 2 D.C. current gain. $-V_{CE}$ = 20 V; T_j = 25 °C.

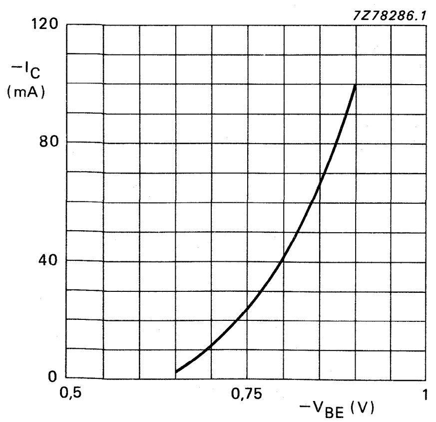


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

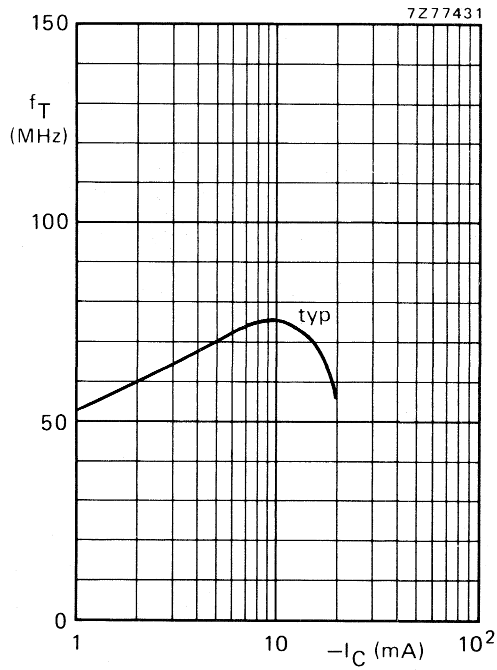


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

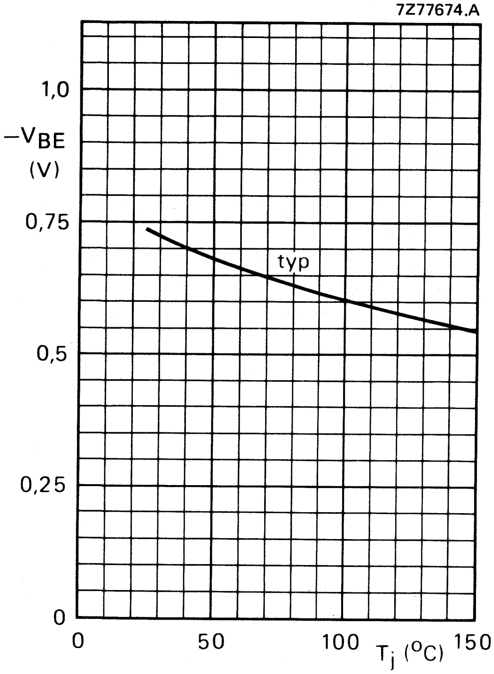


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

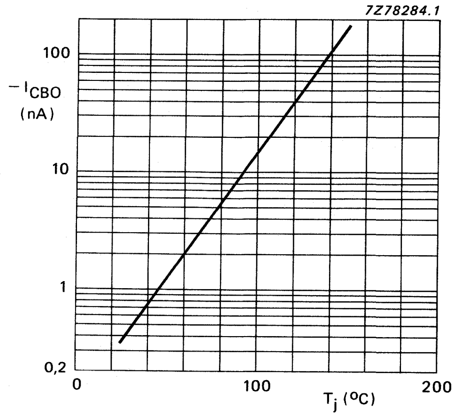


Fig. 6 $-V_{CB}$ = 200 V; typical values.

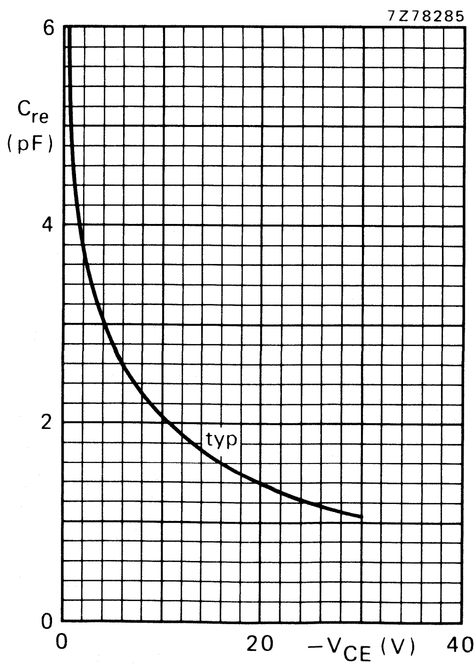


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

H.F. SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic SOT-23 envelope especially intended for r.f. stages in f.m. front-ends in common base configuration for SMD applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C
Base current $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-I_B$	typ. <	80 μA 160 μA
Transition frequency $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	f_T	typ.	450 MHz
Noise figure at f = 100 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; G_s = 16,7 mS	F	typ.	3 dB
Feedback capacitance at f = 1 MHz V_{EB} = 0; $-V_{CB}$ = 10 V	C_{rb}	typ.	0,1 pF

MECHANICAL DATA

Dimensions in mm

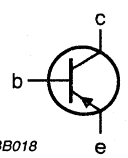
Fig. 1 SOT-23.

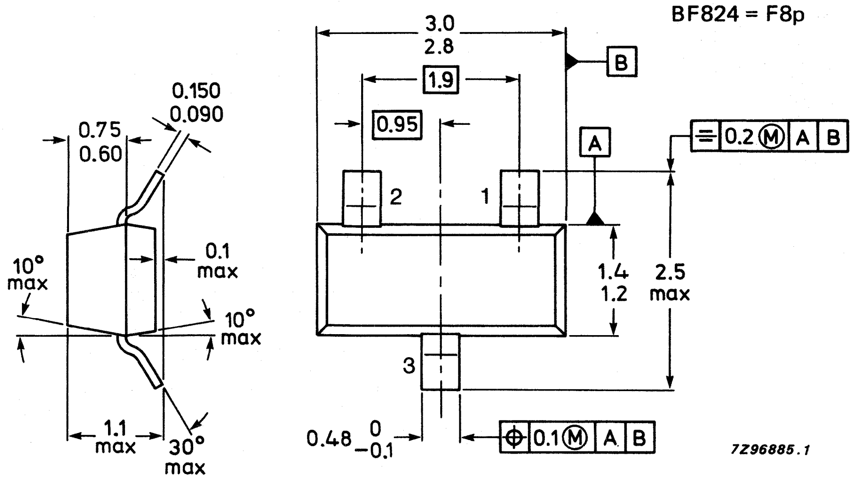
Marking code

BF824 = F8p

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4 V
Collector current (d.c.)	$-I_C$	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 30$ V	$-I_{CBO}$	<	50 nA
Emitter cut-off current			
$I_C = 0$; $-V_{EB} = 4$ V	$-I_{EBO}$	<	10 μA
Base current			
$-I_C = 4$ mA; $-V_{CE} = 10$ V	$-I_B$	typ.	80 μA
		<	160 μA
$-I_C = 1$ mA; $-V_{CE} = 10$ V	$-I_B$	typ.	22 μA
Base-emitter voltage			
$-I_C = 4$ mA; $-V_{CE} = 10$ V	$-V_{BE}$	typ.	0,76 V
Transition frequency at f = 100 MHz			
$-I_C = 1$ mA; $-V_{CE} = 10$ V	f_T	typ.	350 MHz
$-I_C = 4$ mA; $-V_{CE} = 10$ V	f_T	typ.	450 MHz
$-I_C = 8$ mA; $-V_{CE} = 10$ V	f_T	typ.	440 MHz
Feedback capacitance at f = 1 MHz			
$V_{EB} = 0$; $-V_{CB} = 10$ V	C_{rb}	typ.	0,1 pF
Noise factor at f = 100 MHz			
$-I_C = 2$ mA; $-V_{CE} = 10$ V; $G_s = 16{,}7$ mS	F	typ.	3 dB
$-I_C = 5$ mA; $-V_{CE} = 10$ V; $G_s = 6{,}7$ mS; $-jB_s = 5$ mS	F	typ.	3,5 dB

* Mounted on ceramic substrate of 8 mm x 10 mm x 0,7 mm.

y-parameters (common base) at f = 100 MHz

$-I_C$ = 4 mA; $-V_{CB}$ = 10 V

Input conductance	g_{ib}	typ.	125 mS
Input capacitance	C_{ib}	typ.	64 pF
Transfer admittance	$\|y_{fb}\|$	typ.	100 mS
Phase angle of transfer admittance	φ_{fb}	typ.	147^o
Output conductance	g_{ob}	typ.	40 μS
Output capacitance	C_{ob}	typ.	1,25 pF
Feedback admittance	$\|y_{rb}\|$	typ.	220 μS
Phase angle of feedback admittance	φ_{rb}	typ.	85^o

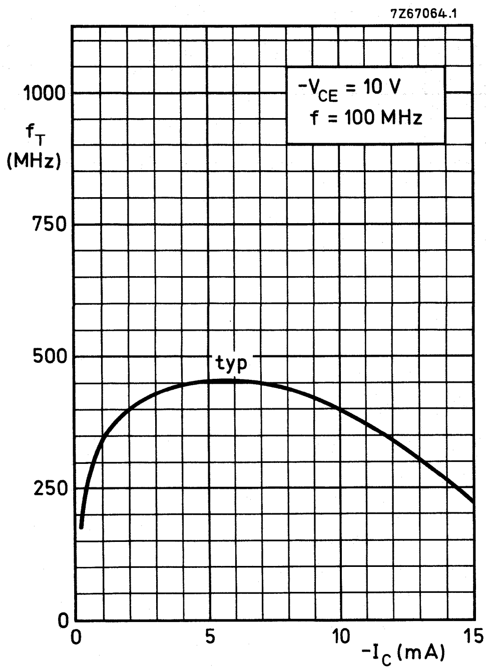


Fig. 2.

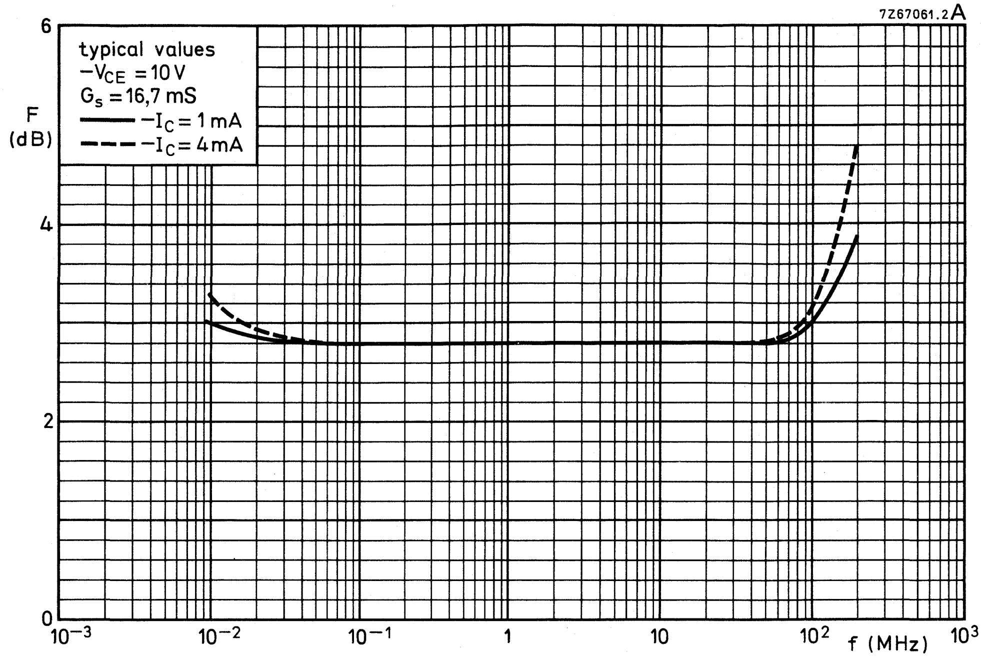


Fig. 3.

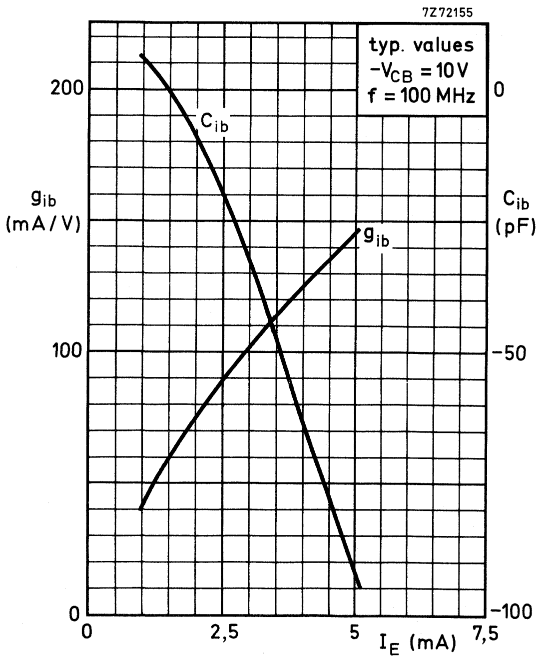


Fig. 4.

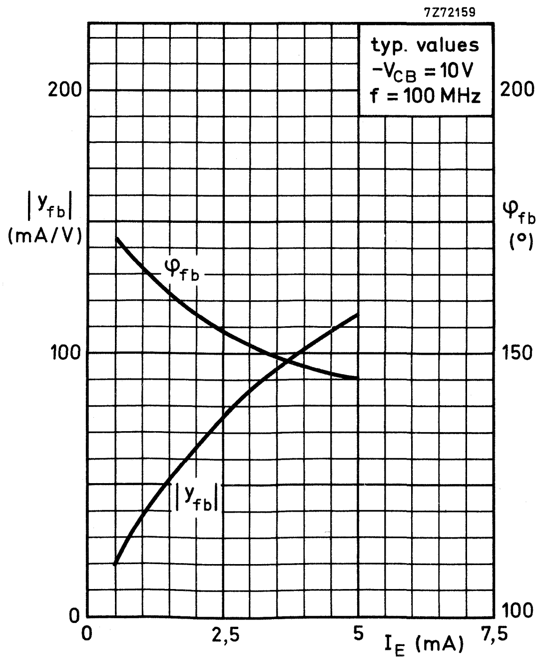


Fig. 5.

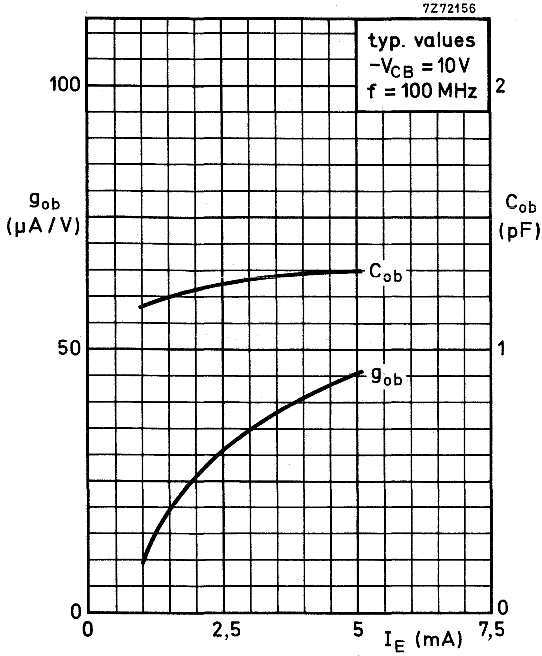


Fig. 6.

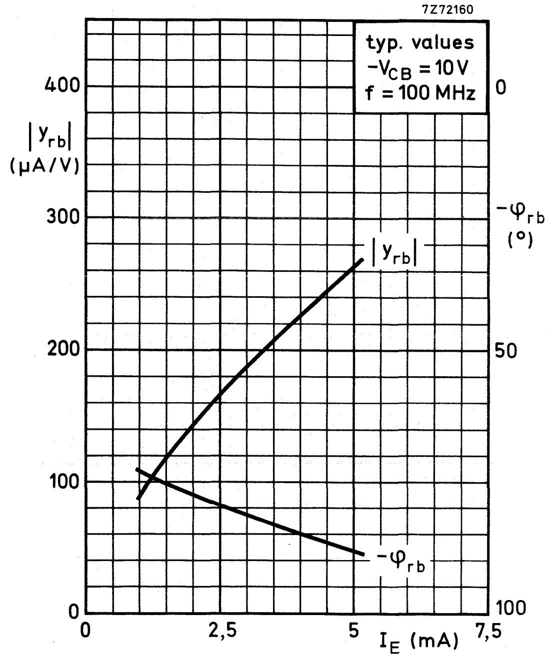


Fig. 7.

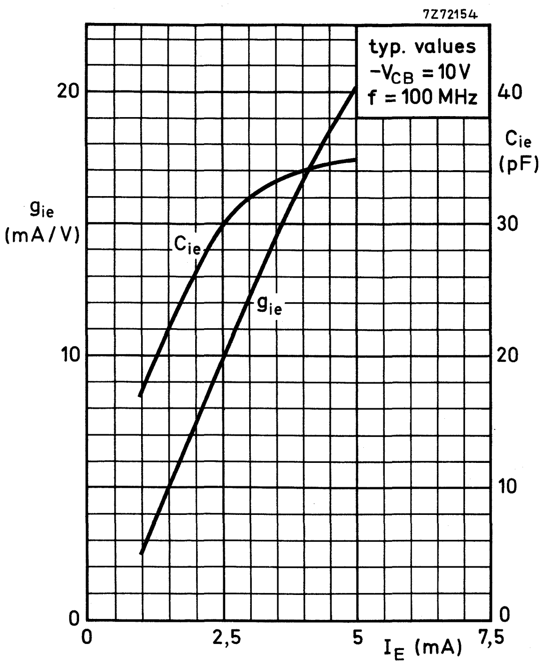


Fig. 8.

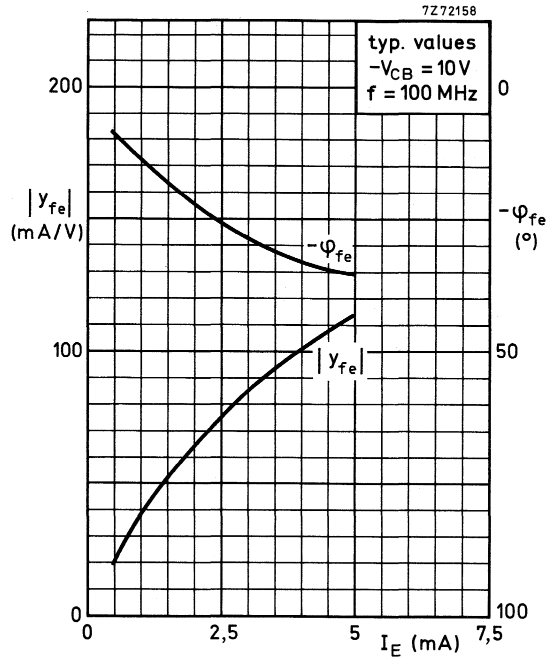


Fig. 9.

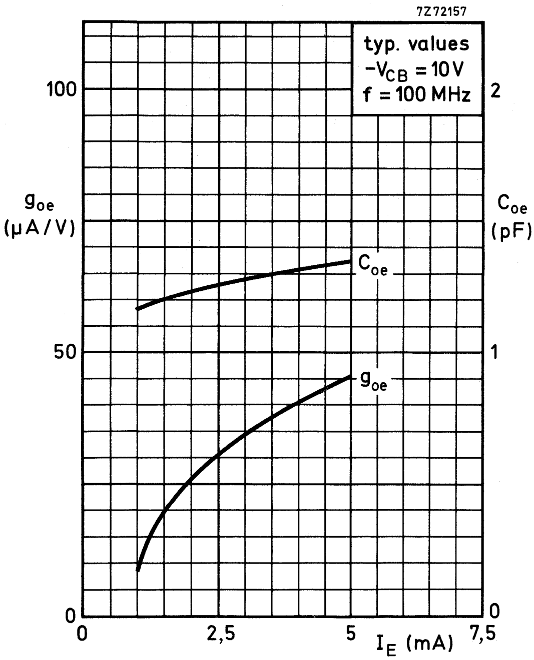

7Z72157
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
g_{oe}
(µA/V)
C_{oe}
(pF)
100
50
0
2
1
0
0
2,5
5
7,5
I_E (mA)

Fig. 10.

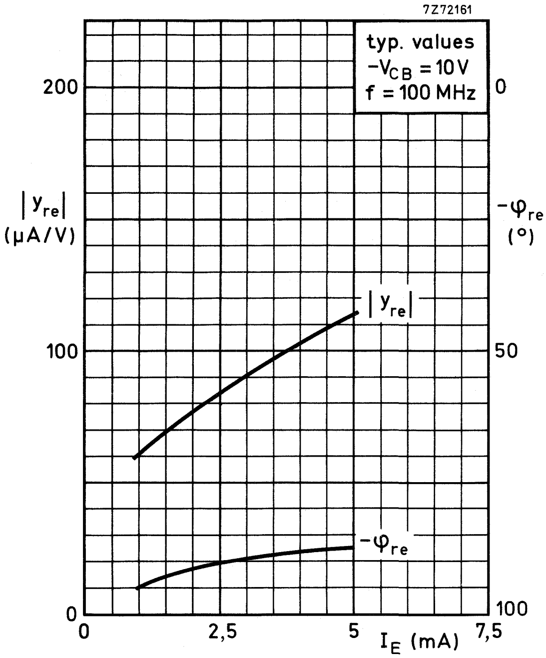

7Z72161
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
$|y_{re}|$
(µA/V)
$-\varphi_{re}$
(°)
200
100
0
0
50
100
0
2,5
5
7,5
I_E (mA)

Fig. 11.

SILICON PLANAR TRANSISTORS

N-P-N transistors in a plastic SOT-23 envelope.

Primarily intended for a.m. mixers and i.f. amplifiers in a.m./f.m. receivers using SMD technology.

QUICK REFERENCE DATA

			BF840 | BF841	
Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Collector current (d.c.)	I_C	max.	25	mA
Base current I_C = 1 mA; V_{CE} = 10 V	I_B		4,5–15 | 8–28	μA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ.	0,3	pF

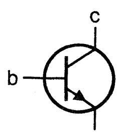
MECHANICAL DATA

Dimensions in mm

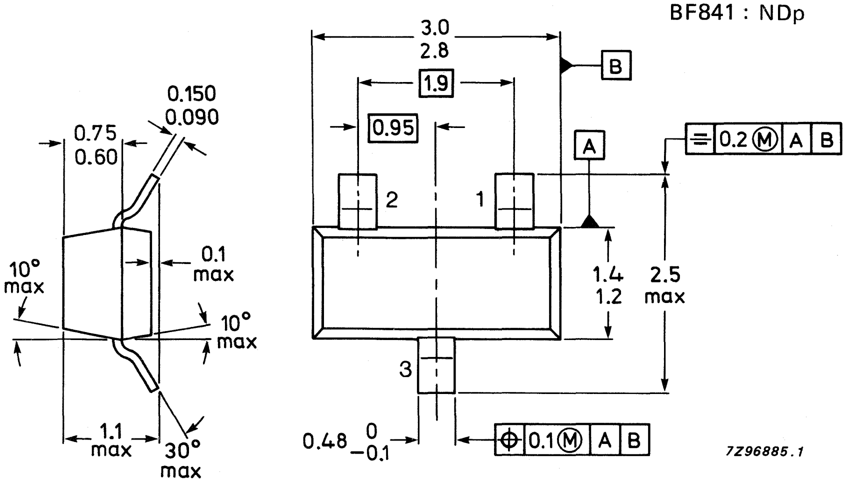
Fig. 1 SOT-23.

Marking code:
BF840 : NCp
BF841 : NDp

Pinning:
1 = base
2 = emitter
3 = collector



MBB012



7Z96885.1

TOP VIEW

See also Soldering recommendations.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	max.	100	nA
Base-emitter voltage $I_C = 1$ mA; $V_{CE} = 10$ V	V_{BE}	typ. 650 to	700 740	mV mV

			BF840	BF841	
Base current $I_C = 1$ mA; $V_{CE} = 10$ V	I_B		4,5–15	8–28	μA
Transition frequency at f = 100 MHz $I_C = 1$ mA; $V_{CE} = 10$ V	f_T	typ.	380	380	MHz
Feedback capacitance at f = 1 MHz $I_C = 1$ mA; $V_{CE} = 10$ V	C_{re}	typ.	0,3	0,3	pF
Noise figure $I_C = 1$ mA; $V_{CE} = 10$ V; f = 0,2 MHz; $R_S = 200\ \Omega$	F	typ.	1,5	2,0	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Silicon n-channel dual gate MOS-FETs

BF901; BF901R

FEATURES

- Intended for low voltage operation
- Short channel transistor with high ratio $|Y_{fs}|:C_{is}$
- Low noise gain-controlled amplifier to 1 GHz
- BF901R has reverse pinning.

DESCRIPTION

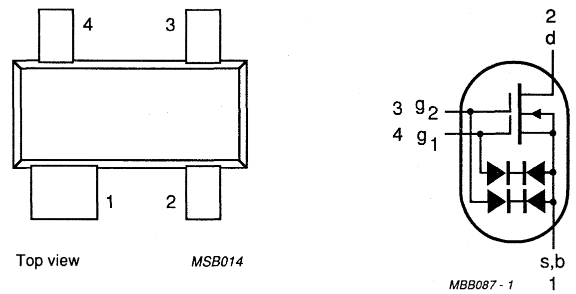
Enhancement type field-effect transistors in plastic microminiature SOT143 and SOT143R envelopes, with source and substrate interconnected. They are intended for UHF and VHF applications, such as television tuners and professional communications equipment especially suited for low voltage operation. These MOS-FET tetrodes are protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

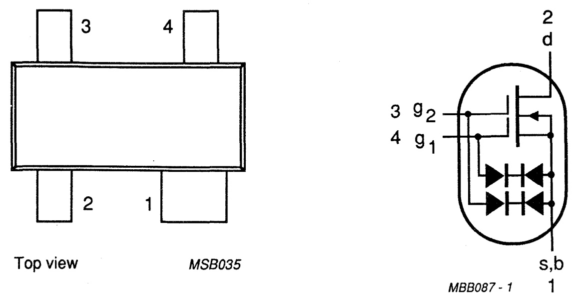
QUICK REFERENCE DATA

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	–	12	V
I_D	drain current	–	30	mA
P_{tot}	total power dissipation	–	200	mW
T_j	junction temperature	–	150	°C
$\|Y_{fs}\|$	transfer admittance	28	35	mS
C_{ig1-s}	input capacitance at gate 1	2.35	2.75	pF
C_{rs}	feedback capacitance	25	–	fF
F	noise figure at 800 MHz	1.7	–	dB



Marking code: MO1.

Fig.1 Simplified outline (SOT143) and symbol.



Marking code: MO2.

Fig.2 Simplified outline (SOT143R) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	12	V
$V_{D\text{-}G2}$	drain-gate 2 voltage		–	6	V
I_D	DC drain current		–	30	mA
$\pm I_{G1\text{-}S}$	gate 1-source current		–	10	mA
$\pm I_{G2\text{-}S}$	gate 2-source current		–	10	mA
P_{tot}	total power dissipation				
	BF901	up to T_{amb} = 50 °C (note 1)	–	200	mW
	BF901R	up to T_{amb} = 40 °C (note 1)	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (note 1)	
	BF901	500 K/W
	BF901R	550 K/W

Note

1. Device mounted on an FR4 printboard.

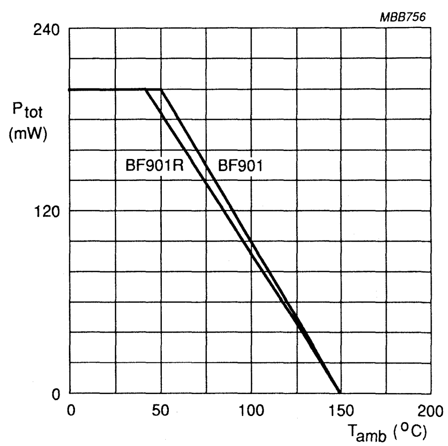


Fig.3 Power derating curve.

STATIC CHARACTERISTICS

$T_j = 25\ °C$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm I_{G1\text{-}SS}$	gate 1 cut-off current	$\pm V_{G1\text{-}S} = 5$ V; $V_{G2\text{-}S} = V_{DS} = 0$	–	50	nA
$\pm I_{G2\text{-}SS}$	gate 2 cut-off current	$\pm V_{G2\text{-}S} = 5$ V; $V_{G1\text{-}S} = V_{DS} = 0$	–	50	nA
$\pm V_{(BR)G1\text{-}SS}$	gate 1-source breakdown voltage	$\pm I_{G1\text{-}SS} = 10$ mA; $V_{G2\text{-}S} = V_{DS} = 0$	6	20	V
$\pm V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$\pm I_{G2\text{-}SS} = 10$ mA; $V_{G1\text{-}S} = V_{DS} = 0$	6	20	V
$V_{G1\text{-}S(th)}$	gate 1-source threshold voltage	$I_D = 20\ \mu$A; $V_{DS} = 8$ V; $V_{G2\text{-}S} = 4$ V	0	0.7	V
$V_{G2\text{-}S(th)}$	gate 2-source threshold voltage	$I_D = 20\ \mu$A; $V_{DS} = 8$ V; $V_{G1\text{-}S} = 0$	0.3	1	V
I_{DSX}	drain-source current	$V_{DS} = 4$ V; $V_{G1\text{-}S} = 1.1$ V; $V_{G2\text{-}S} = 3.4$ V	2	18	mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): $I_D = 14$ mA; $V_{DS} = 5$ V; $V_{G2\text{-}S} = 4$ V; $T_{amb} = 25\ °C$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert Y_{fs} \rvert$	transfer admittance	pulsed; $T_j = 25\ °C$	25	28	35	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	–	2.35	2.75	pF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	–	1.2	–	pF
C_{os}	output capacitance	f = 1 MHz	–	1.4	–	pF
C_{rs}	feedback capacitance	f = 1 MHz	–	25	–	fF
F	noise figure	f = 200 MHz; $G_s = 2$ mS; $B_s = B_{sopt.}$	–	0.7	–	dB
		f = 800 MHz; $G_s = 3.3$ mS; $B_s = B_{sopt.}$	–	1.7	–	dB

FEATURES

- Specially designed for use at 5 V supply voltage
- Short channel transistor with high $|Y_{fs}| : C_{is}$ ratio
- Low-noise gain-controlled amplifier to 1 GHz
- Superior cross-modulation performance during AGC.

DESCRIPTION

Enhancement type field-effect transistors in plastic microminiature SOT143 and SOT143R envelopes. They are intended for UHF and VHF applications, such as television tuners and professional communications equipment. These transistors consist of an amplifier MOS-FET with source and substrate interconnected and an internal bias circuit to ensure good cross-modulation performance during AGC.

PINNING

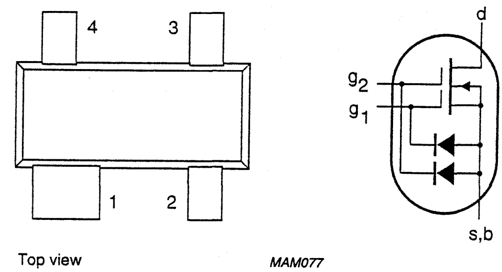
PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

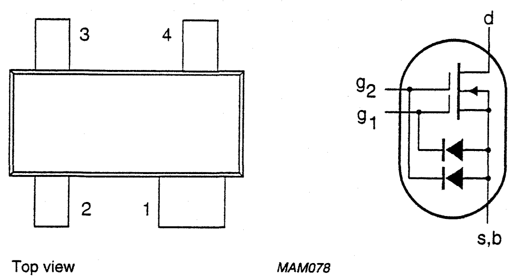
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	–	–	7	V
I_D	drain current	–	–	30	mA
P_{tot}	total power dissipation	–	–	200	mW
T_j	junction temperature	–	–	150	°C
$\|Y_{fs}\|$	transfer admittance	22	25	30	mS
C_{ig1-s}	input capacitance at gate 1	–	2.2	2.6	pF
C_{rs}	feedback capacitance	–	25	35	pF
F	noise figure at 800 MHz	–	2	–	dB



BF904 Marking code: MO4.

Fig.1 Simplified outline (SOT143) and symbol.



BF904R Marking code: MO6.

Fig.2 Simplified outline (SOT143R) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	7	V
I_D	DC drain current		–	30	mA
$\pm I_{G1\text{-}S}$	gate 1-source current		–	10	mA
$\pm I_{G2\text{-}S}$	gate 2-source current		–	10	mA
P_{tot}	total power dissipation				
	BF904	up to T_{amb} = 50 °C (note 1)	–	200	mW
	BF904R	up to T_{amb} = 40 °C (note 1)	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}a}$	from junction to ambient (note 1)	
	BF904	500 K/W
	BF904R	550 K/W

Note

1. Device mounted on a printed-circuit board.

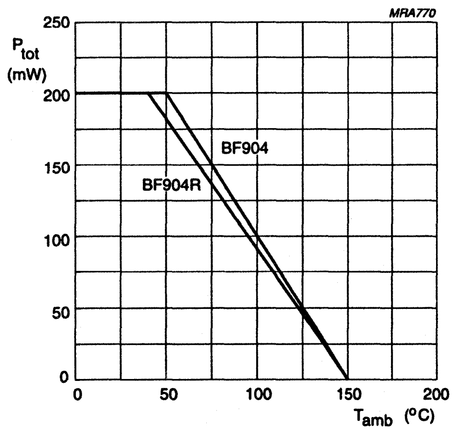
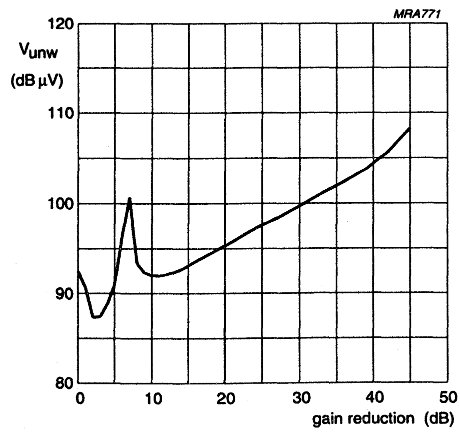


Fig.3 Power derating curve.



f_w = 50 MHz; f_{unw} = 60 MHz.

Fig.4 Unwanted voltage for 1 % cross-modulation as a function of gain reduction, typical values.

STATIC CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{G1-S}	gate 1 cut-off current	V_{G1-S} = 5 V; $V_{G2-S} = V_{DS}$ = 0	–	50	nA
I_{G2-S}	gate 2 cut-off current	V_{G2-S} = 5 V; $V_{G1-S} = V_{DS}$ = 0	–	50	nA
$V_{(BR)G1-S}$	gate 1-source breakdown voltage	I_{G1-S} = 10 mA; $V_{G2-S} = V_{DS}$ = 0	6	15	V
$V_{(BR)G2-S}$	gate 2-source breakdown voltage	I_{G2-S} = 10 mA; $V_{G1-S} = V_{DS}$ = 0	6	15	V
$V_{(F)S-G1}$	source-gate 1 forward voltage	I_{S-G1} = 10 mA; $V_{G2-S} = V_{DS}$ = 0	0.5	1.5	V
$V_{(F)S-G2}$	source-gate 2 forward voltage	I_{S-G2} = 10 mA; $V_{G1-S} = V_{DS}$ = 0	0.5	1.5	V
$V_{G1-S(th)}$	gate 1-source threshold voltage	I_D = 20 µA; V_{DS} = 5 V; V_{G2-S} = 4 V	0.3	1	V
$V_{G2-S(th)}$	gate 2-source threshold voltage	I_D = 20 µA; V_{DS} = 5 V; V_{G1-S} = 5 V	0.3	1.2	V
I_{DSX}	drain-source cut-off current	V_{DS} = 5 V; V_{G2-S} = 4 V; R_G = 120 kΩ (note 1)	8	13	mA

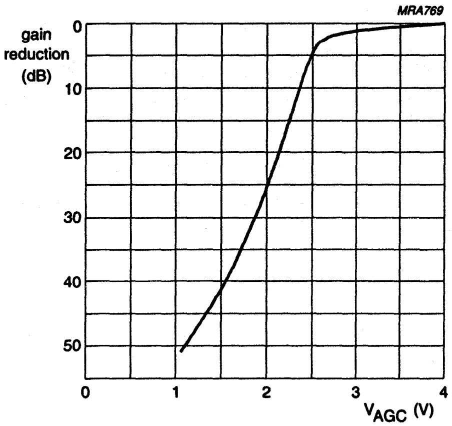
Note

1. R_G connects gate 1 to 5 V.

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 5 V; V_{G2-S} = 4 V; T_{amb} = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\|Y_{fs}\|$	transfer admittance	pulsed; T_j = 25 °C	22	25	30	mS
C_{ig1-s}	input capacitance at gate 1	f = 1 MHz	–	2.2	2.6	pF
C_{ig2-s}	input capacitance at gate 2	f = 1 MHz	1	1.5	2	pF
C_{os}	output capacitance	f = 1 MHz	1	1.3	1.6	pF
C_{rs}	feedback capacitance	f = 1 MHz	–	25	35	fF
F	noise figure	f = 200 MHz; G_S = 2 mS; $B_S = B_{opt.}$	–	1	1.5	dB
		f = 800 MHz; G_S = 3.3 mS; $B_S = B_{opt.}$	–	2	2.8	dB



f = 50 MHz.

Fig.5 Gain reduction as a function of AGC voltage, typical values.

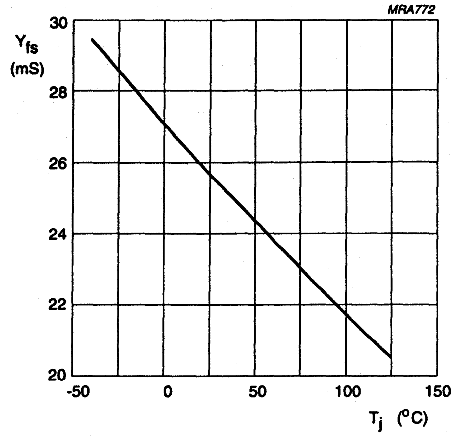


Fig.6 Transfer admittance as a function of junction temperature, typical values.

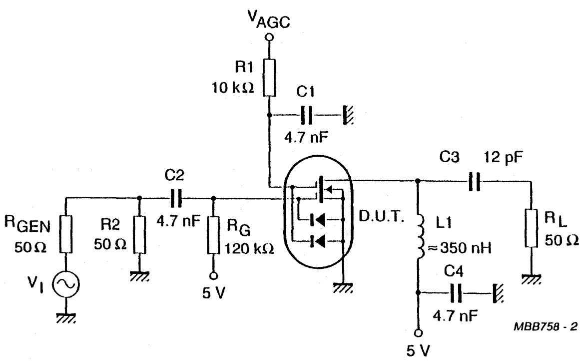


Fig.7 Cross-modulation test set-up.

Table 1 Scattering parameters.
V_{DS} = 5 V; I_D = 10 mA; V_{G2-S} = 4 V; R_{G1} = 120 KΩ.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)
40	0.989	−3.4	2.420	175.7	0.000	79.9	0.993	−1.6
100	0.985	−8.3	2.414	169.1	0.001	78.3	0.992	−3.9
200	0.976	−16.4	2.368	158.8	0.003	80.3	0.987	−7.8
300	0.958	−24.1	2.301	148.5	0.004	73.7	0.980	−11.4
400	0.942	−32.0	2.251	138.8	0.005	70.7	0.974	−15.2
500	0.918	−39.3	2.170	129.5	0.005	67.2	0.966	−18.7
600	0.899	−46.0	2.080	120.7	0.005	67.8	0.958	−22.2
700	0.876	−52.6	2.001	112.1	0.005	68.6	0.951	−25.5
800	0.852	−58.8	1.924	103.2	0.005	72.9	0.944	−28.9
900	0.823	−64.9	1.829	94.7	0.005	78.7	0.937	−32.1
1000	0.800	−70.9	1.747	86.5	0.005	88.3	0.933	−35.2
1200	0.750	−82.4	1.621	70.7	0.005	120.5	0.928	−41.7
1400	0.719	−92.7	1.535	54.6	0.008	139.8	0.930	−48.4
1600	0.682	−102.5	1.424	39.4	0.010	137.8	0.924	−54.9
1800	0.642	−109.8	1.349	22.5	0.013	156.8	0.928	−62.9
2000	0.602	−116.5	1.283	1.1	0.018	175.1	0.928	−73.1
2200	0.547	−124.9	1.130	−15.1	0.014	172.6	0.887	−81.0
2400	0.596	−128.7	1.018	−49.1	0.040	−163.9	0.837	−95.8
2600	0.682	−132.6	0.979	−79.4	0.077	−164.0	0.778	−109.6
2800	0.771	−142.5	0.804	−116.2	0.120	178.8	0.629	−119.5
3000	0.793	−157.5	0.541	−153.5	0.149	158.3	0.479	−119.9

Table 2 Noise data.
V_{DS} = 5 V; I_D = 10 mA; V_{G2-S} = 4 V; R_{G1} = 120 KΩ.

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
800	2.00	0.686	49.6	50.40

Dual gate MOS-FETs BF908; BF908R

FEATURES

- High $|Y_{fs}|$ dual gate MOS-FET
- Short channel transistor with high $|Y_{fs}| : C_{is}$ ratio
- Low noise gain-controlled amplifier to 1 GHz

DESCRIPTION

Depletion type field-effect transistors in plastic microminiature SOT143 and SOT143R envelopes. They are intended for UHF and VHF applications with 12 V supply voltage such as television tuners and professional communications equipment. These transistors are protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

PINNING

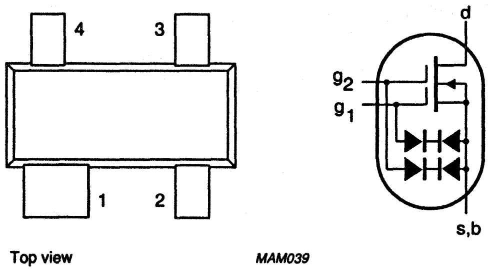
PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

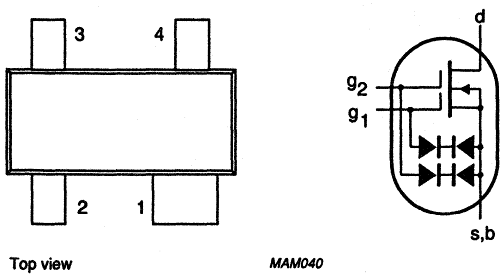
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	–	–	12	V
I_D	drain current	–	–	40	mA
P_{tot}	total power dissipation	–	–	200	mW
T_j	junction temperature	–	–	150	°C
$\|Y_{fs}\|$	transfer admittance	36	43	50	mS
C_{ig1-s}	input capacitance at gate 1	2.4	3.1	4	pF
C_{rs}	feedback capacitance	20	30	45	pF
F	noise figure at 800 MHz	–	1.5	2.5	dB



BF908

Fig.1 Simplified outline (SOT143) and symbol.



BF908R

Fig.2 Simplified outline (SOT143R) and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	12	V
I_D	DC drain current		–	40	mA
$\pm I_{G1-S}$	gate 1-source current		–	10	mA
$\pm I_{G2-S}$	gate 2-source current		–	10	mA
P_{tot}	total power dissipation				
	BF908	up to T_{amb} = 50 °C (note 1)	–	200	mW
	BF908R	up to T_{amb} = 40 °C (note 1)	–	200	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-a}$	from junction to ambient (note 1)	
	BF908	500 K/W
	BF908R	550 K/W

Note

1. Device mounted on a printed-circuit board.

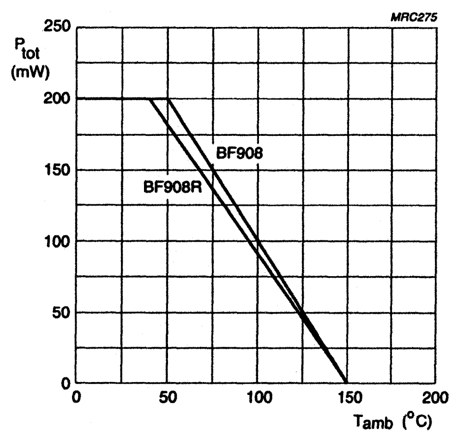


Fig.3 Power derating curve.

STATIC CHARACTERISTICS

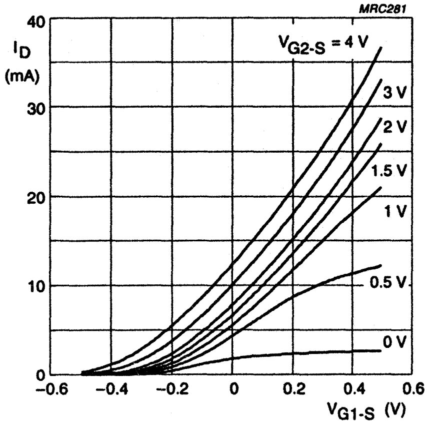
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\pm I_{G1\text{-}S}$	gate 1 cut-off current	$V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S} = V_{DS}$ = 0	–	–	50	nA
$\pm I_{G2\text{-}S}$	gate 2 cut-off current	$V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S} = V_{DS}$ = 0	–	–	50	nA
$V_{(BR)G1\text{-}S}$	gate 1-source breakdown voltage	$I_{G1\text{-}S}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	8	–	20	V
$V_{(BR)G2\text{-}S}$	gate 2-source breakdown voltage	$I_{G2\text{-}S}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	8	–	20	V
$-V_{(P)G1\text{-}S}$	gate 1-source cut-off voltage	I_D = 20 μA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V	–	–	2	V
$-V_{(P)G2\text{-}S}$	gate 2-source cut-off voltage	I_D = 20 μA; V_{DS} = 8 V; $V_{G1\text{-}S}$ = 4 V	–	–	1.5	V
I_{DSS}	drain current	V_{DS} = 8 V; $V_{G1\text{-}S}$ = 0; $V_{G2\text{-}S}$ = 4 V	3	15	27	mA

DYNAMIC CHARACTERISTICS

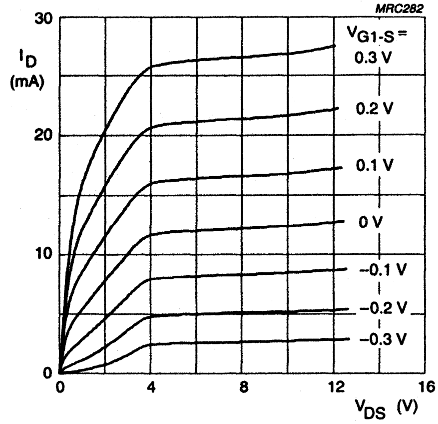
Measuring conditions (common source): I_D = 15 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\|Y_{fs}\|$	transfer admittance	pulsed; T_j = 25 °C; f = 1 kHz	36	43	50	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	2.4	3.1	4	pF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	1.2	1.8	2.5	pF
C_{os}	output capacitance	f = 1 MHz	1.2	1.7	2.2	pF
C_{rs}	feedback capacitance	f = 1 MHz	20	30	45	fF
F	noise figure	f = 200 MHz; G_S = 2 mS; $B_S = B_{Sopt.}$	–	0.6	1.2	dB
		f = 800 MHz; $G_S = G_{Sopt}$; $B_S = B_{Sopt.}$	–	1.5	2.5	dB



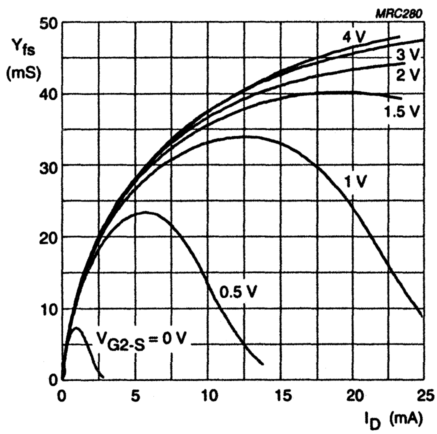
V_{DS} = 8 V; T_j = 25 °C.

Fig.4 Typical transfer characteristics.



V_{G2-S} = 4 V; T_j = 25 °C.

Fig.5 Typical output characteristics.



V_{DS} = 8 V; T_j = 25 °C.

Fig.6 Transfer admittance as a function of drain current, typical values.

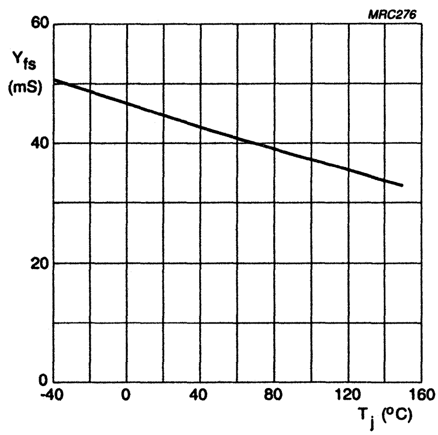


Fig.7 Transfer admittance as a function of junction temperature, typical values.

Table 1 Scattering parameters.
I_D = 10 mA; V_{DS} = 8 V; V_{G2-S} = 4 V; T_{amb} = 25 °C.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)
50	0.998	−5.1	3.537	173.5	0.001	98.2	0.996	−2.4
100	0.994	−10.4	3.502	167.7	0.001	88.8	0.994	−4.9
200	0.979	−20.8	3.450	154.9	0.003	74.6	0.987	−9.5
300	0.962	−30.3	3.318	143.7	0.004	69.5	0.983	−13.9
400	0.939	−40.1	3.234	131.9	0.005	65.6	0.980	−18.5
500	0.914	−49.1	3.093	120.7	0.006	64.4	0.974	−22.8
600	0.892	−57.1	2.912	111.1	0.005	63.1	0.969	−27.0
700	0.865	−64.4	2.774	101.0	0.005	65.2	0.966	−31.2
800	0.837	−71.6	2.616	91.4	0.004	70.8	0.965	−35.4
900	0.811	−78.1	2.479	81.9	0.004	87.4	0.965	−39.4
1000	0.785	−84.5	2.329	72.5	0.003	108.0	0.966	−43.7

Table 2 Noise data.
I_D = 10 mA; V_{DS} = 8 V; V_{G2-S} = 4 V; T_{amb} = 25 °C.

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
800	1.50	0.720	56.7	0.580

Table 3 Scattering parameters.
I_D = 15 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)
50	0.998	−5.3	3.983	173.4	0.001	95.5	0.994	−2.4
100	0.994	−10.9	3.943	167.5	0.001	93.6	0.991	−5.0
200	0.976	−21.6	3.878	154.7	0.003	74.3	0.984	−9.7
300	0.957	−31.7	3.722	143.3	0.004	70.0	0.979	−14.2
400	0.934	−41.7	3.614	131.6	0.005	63.5	0.975	−18.8
500	0.907	−51.1	3.446	120.4	0.006	62.2	0.969	−23.2
600	0.885	−59.1	3.240	110.9	0.005	59.6	0.964	−27.4
700	0.851	−66.8	3.072	100.9	0.005	64.8	0.961	−31.6
800	0.826	−73.9	2.891	91.3	0.004	67.8	0.959	−35.9
900	0.797	−80.7	2.733	81.9	0.004	85.0	0.958	−40.0
1000	0.773	−87.0	2.569	72.8	0.004	102.9	0.958	−44.2

Table 4 Noise data.
I_D = 15 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
800	1.50	0.700	59.2	0.520

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in u.h.f. applications in television tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	20	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	12	mS
Input capacitance at gate 1; f = 1 MHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	1.8	pF
Feedback capacitance at f = 1 MHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	2.8	dB

MECHANICAL DATA

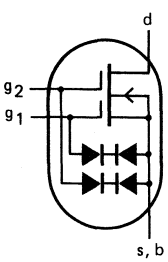
Dimensions in mm

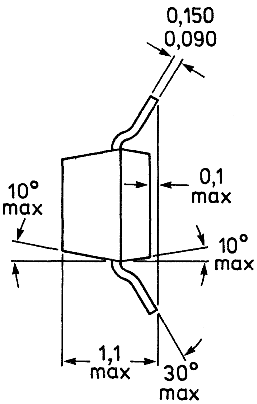
Marking code:
BF989 = MAp

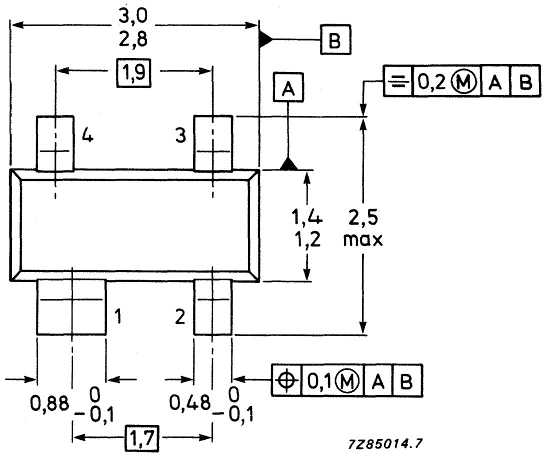
Fig.1 SOT143.

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1







TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (DC or average)	I_D	max.	20 mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}	−65 to + 150	°C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

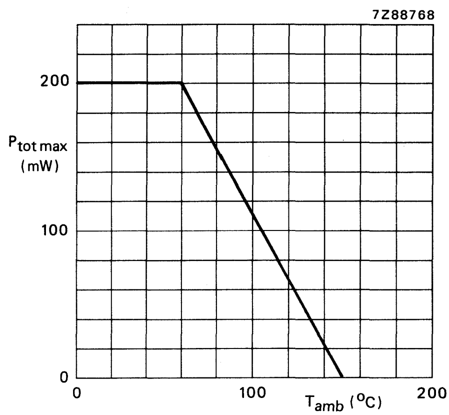


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents				
$\pm V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	50	nA
$\pm V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	50	nA
Drain current				
V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0; + $V_{G2\text{-}S}$ = 4 V	I_{DSS}		2 to 20	mA
Gate-source breakdown voltages				
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		6 to 20	V
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		6 to 20	V
Gate-source cut-off voltages				
I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	2.7	V
I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	2.7	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	9.5	mS
		typ.	12	mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	1.8	pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.0	pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25	fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0.9	pF
Noise figure at G_S = 2 mS; $B_S = B_S$ opt				
f = 200 MHz	F	typ.	1.6	dB
f = 800 MHz	F	typ.	2.8	dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for UHF applications, such as UHF television tuners with 12 V supply voltage and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	18	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz; I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\|y_{fs}\|$	typ.	19	mS
Input capacitance at gate; f = 1 MHz; I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	2.6	pF
		max.	3.0	pF
Feedback capacitance at f = 1 MHz; I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at optimum source admittance; I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	2.0	dB
		max.	3.0	dB

MECHANICAL DATA

Marking code

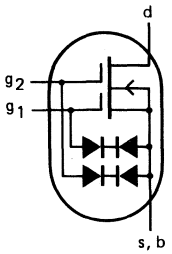
BF990A = M87

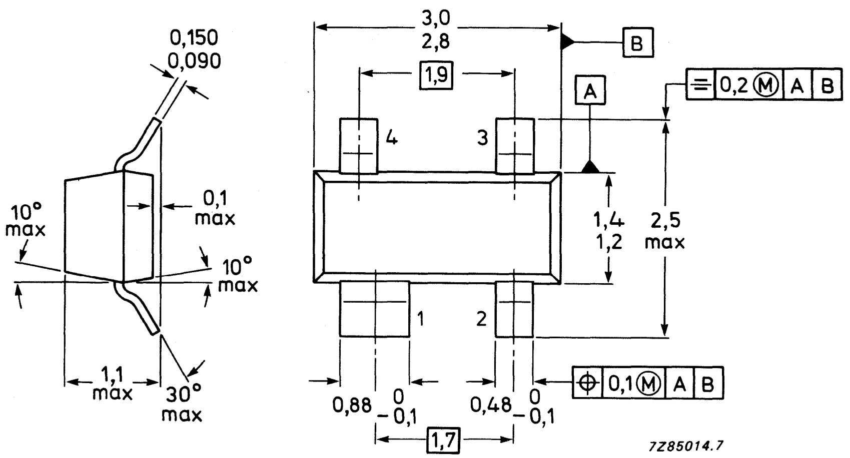
Dimensions in mm

Fig.1 SOT143.

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	18 V
Drain current	I_D	max.	30 mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

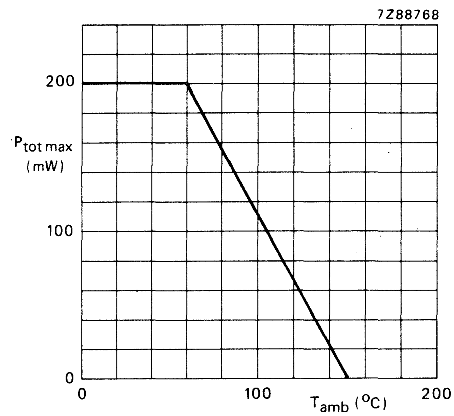


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
gate 1;			
$\pm V_{G1\text{-}S}$ = 7 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	25 nA
gate 2;			
$\pm V_{G2\text{-}S}$ = 7 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	25 nA
Gate-source breakdown voltages			
gate 1;			
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		8 to 20 V
gate 2;			
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		8 to 20 V
Gate-source cut-off voltages			
gate 1;			
I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	1.3 V
gate 2;			
I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	1.1 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min. typ.	18 mS 19 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ. max.	2.6 pF 3.0 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.4 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.2 pF
Noise figure at f = 800 MHz; G_S = 5 mS; $B_S = B_S$ opt	F	typ. max.	2.0 dB 3.0 dB

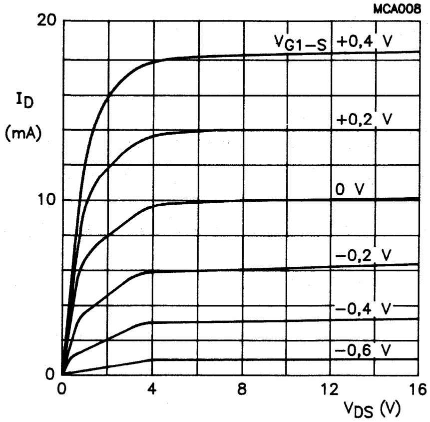


Fig.3 Output characteristics.
$V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

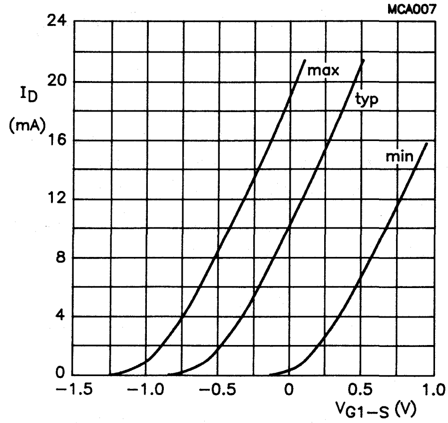


Fig.4 Transfer characteristics.
V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143R microminiature envelope with source and substrate interconnected, intended for UHF applications, such as UHF television tuners and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	18	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 50 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	19	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; 3 $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.6 3.0	pF pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	2.0	dB

MECHANICAL DATA

Fig.1 SOT143R.

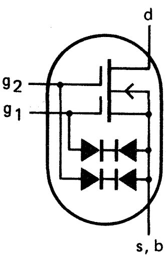
Marking code

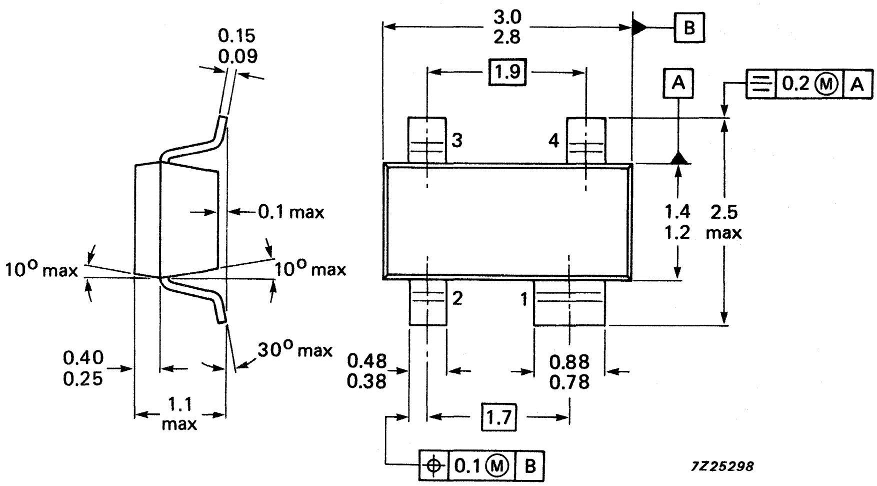
BF990AR = M85

Dimensions in mm

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	18 V
Drain current	I_D	max.	30 mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 50 °C*	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	500 K/W

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
gate 1; $\pm V_{G1\text{-}S}$ = 7 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	25 nA
gate 2; $\pm V_{G2\text{-}S}$ = 7 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	25 nA
Gate-source breakdown voltages			
gate 1; $\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$	min.	8 to 20 V
gate 2; $\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$	min.	8 to 20 V
Gate-source cut-off voltages			
gate 1; I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	1.3 V
gate 2; I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	1.1 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	18 mS
		typ.	19 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.6 pF
		max.	3.0 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.4 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.2 pF
Noise figure at f = 800 MHz; G_S = 5 mS; $B_S = B_S$ opt	F	typ.	2.0 dB

* Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners and f.m. tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	20	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	14	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	2,1	pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	20	fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	0,7	dB

MECHANICAL DATA

Dimensions in mm

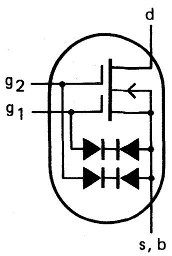
Fig.1 SOT143.

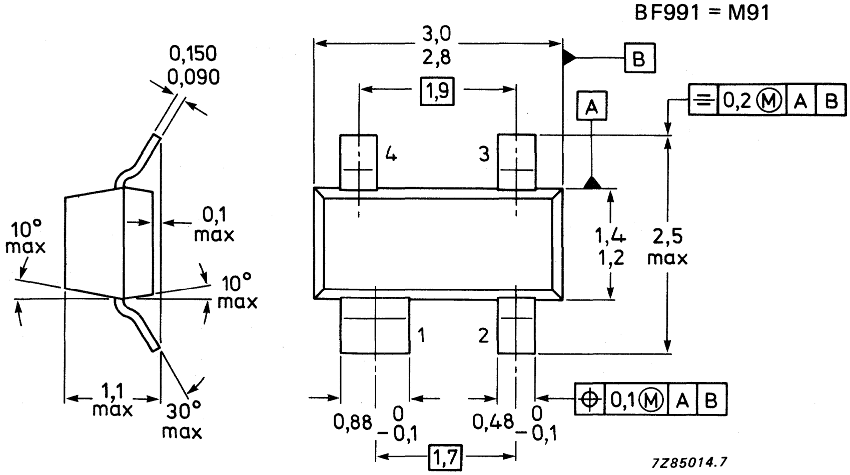
Marking code

BF991 = M91

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	20	mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

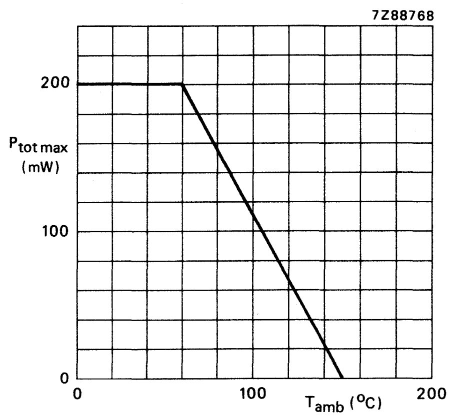


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
± $V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S}$ = V_{DS} = 0	± $I_{G1\text{-}SS}$	<	50 nA
± $V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S}$ = V_{DS} = 0	± $I_{G2\text{-}SS}$	<	50 nA
Drain current			
V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0; + $V_{G2\text{-}S}$ = 4 V	I_{DSS}		4 to 25 mA
Gate-source breakdown voltages			
± $I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S}$ = V_{DS} = 0	± $V_{(BR)G1\text{-}SS}$		6 to 20 V
± $I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S}$ = V_{DS} = 0	± $V_{(BR)G2\text{-}SS}$		6 to 20 V
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	<	2,5 V
I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	<	2,5 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	>	10 mS
		typ.	14 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2,1 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1,0 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	20 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1,1 pF
Noise figure			
f = 100 MHz; G_S = 1 mS; B_S = B_S opt	F	typ.	0,7 dB
		<	1,7 dB
f = 200 MHz; G_S = 2 mS; B_S = B_S opt	F	typ.	1,0 dB
		<	2,0 dB
Transducer gain (note 1)			
f = 100 MHz; G_S = 1 mS; B_S = B_S opt; G_L = 0,5 mS; B_L = B_L opt	G_{tr}	typ.	29 dB
f = 200 MHz; G_S = 2 mS; B_S = B_S opt; G_L = 0,5 mS; B_L = B_L opt	G_{tr}	typ.	26 dB

Note

1. Crystal mounted in a SOT103 envelope.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners, FM tuners with a 12 volt supply voltage. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	40	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs}\rvert$	typ.	25	mS
Input capacitance at gate 1; f = 1 MHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	4	pF
Feedback capacitance at f = 1 MHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	30	fF
Noise figure at G_S = 2 mS I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.2	dB

MECHANICAL DATA

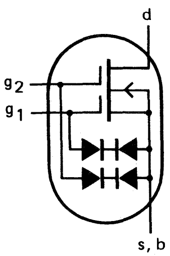
Dimensions in mm

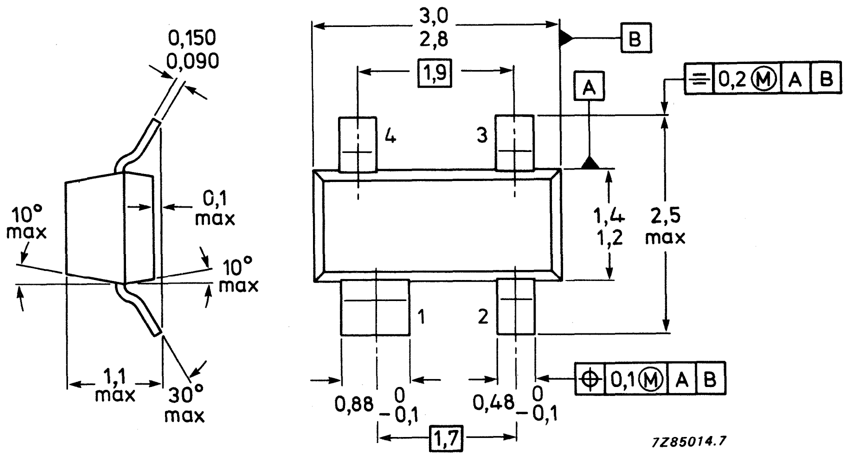
Marking code:
BF992 = M92

Fig.1 SOT143.

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (DC or average)	I_D	max.	40 mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

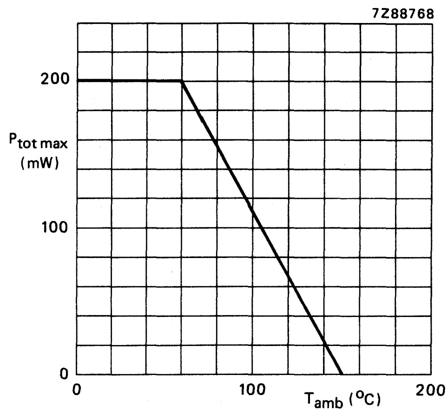


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents				
$\pm V_{G1\text{-}S}$ = 7 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	25	nA
$\pm V_{G2\text{-}S}$ = 7 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	25	nA
Gate-source breakdown voltages				
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		8 to 20	V
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		8 to 20	V
Gate-source cut-off voltages				
I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$		0.2 to 1.3	V
I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$		0.2 to 1.1	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	min.	20	mS
		typ.	25	mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	4	pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.7	pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	30	fF
		max.	40	fF
Output capacitance at f = 1 MHz	C_{os}	typ.	2	pF
Noise figure at f = 200 MHz; G_S = 2 mS	F	typ.	1.2	dB

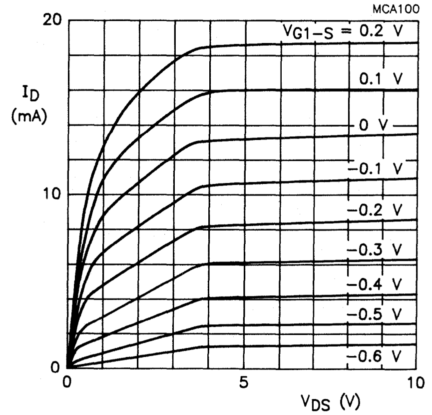


Fig.2 Output characteristics.

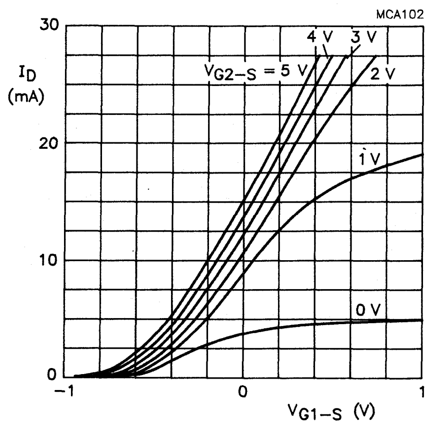


Fig.3 Transfer characteristics.

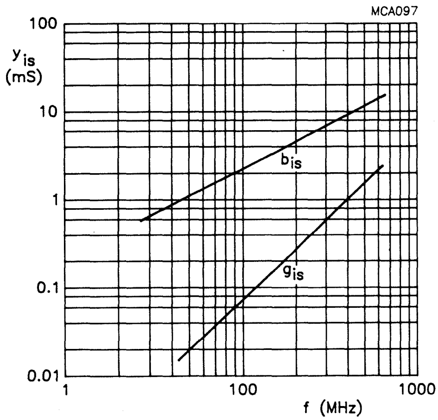


Fig.4 Input admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

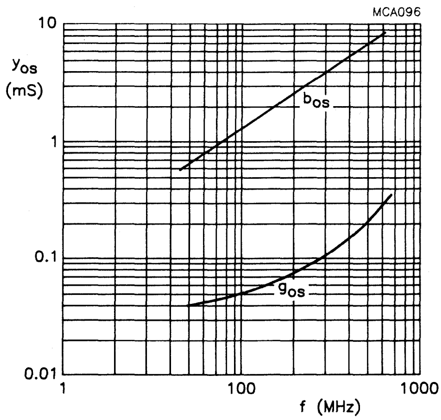


Fig.5 Output admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

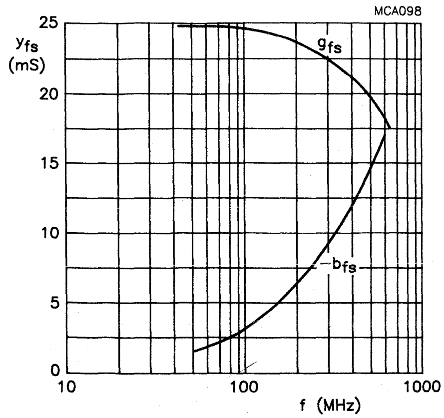


Fig.6 Transfer admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

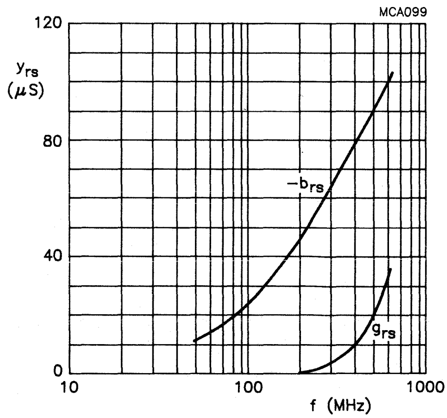


Fig.7 Feedback admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

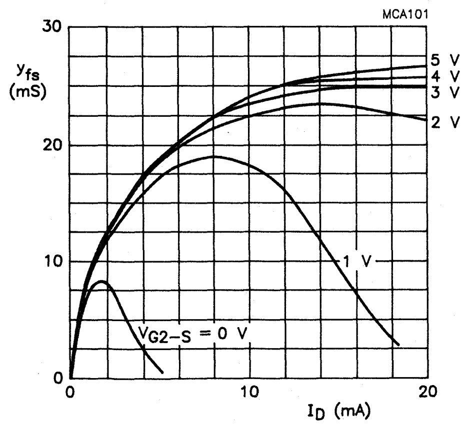


Fig.8 Transfer admittance as a function of drain current.

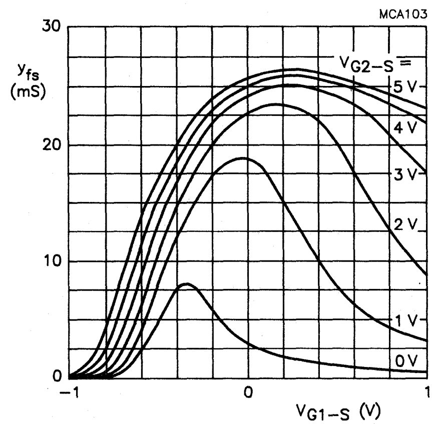


Fig.9 Transfer admittance as a function of gate 2 source voltage.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected and intended for VHF applications in television tuners.
The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	18	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.5 3.0	pF pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.0	dB

MECHANICAL DATA

Dimensions in mm

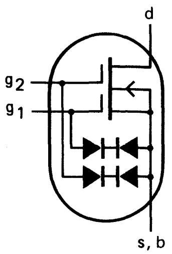
Fig.1 SOT143.

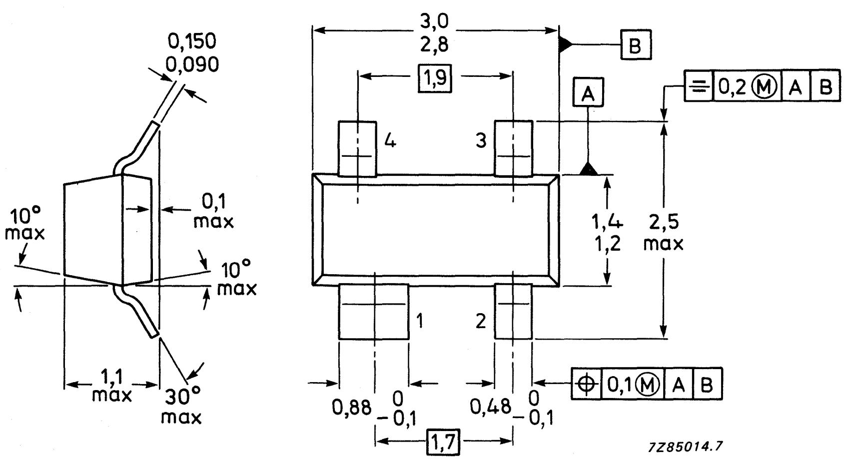
Marking code

BF994S = MGp

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20 V
Drain current (DC or average)	I_D	max.	30 mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature	T_{stg}	–65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

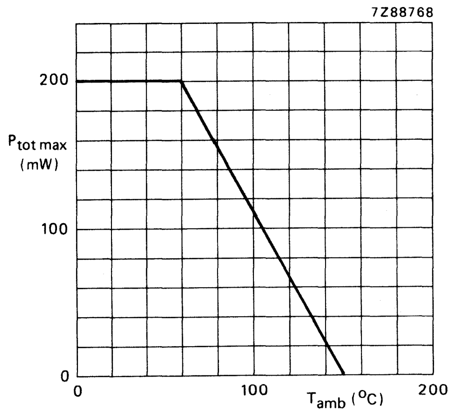


Fig. 2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Gate cut-off currents			
$\pm V_{G1\text{-}S} = 5$ V; $V_{G2\text{-}S} = V_{DS} = 0$	$\pm I_{G1\text{-}SS}$	max.	50 nA
$\pm V_{G2\text{-}S} = 5$ V; $V_{G1\text{-}S} = V_{DS} = 0$	$\pm I_{G2\text{-}SS}$	max.	50 nA
Gate-source breakdown voltages			
$\pm I_{G1\text{-}S} = 10$ mA; $V_{G2\text{-}S} = V_{DS} = 0$	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
$\pm I_{G2\text{-}S} = 10$ mA; $V_{G1\text{-}S} = V_{DS} = 0$	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Drain current			
$V_{DS} = 15$ V; $V_{G1\text{-}S} = 0$; $V_{G2\text{-}S} = 4$ V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
$I_D = 20\ \mu A$; $V_{DS} = 15$ V; $+V_{G2\text{-}S} = 4$ V	$-V_{(P)G1\text{-}S}$	max.	2.5 V
$I_D = 20\ \mu A$; $V_{DS} = 15$ V; $V_{G1\text{-}S} = 0$	$-V_{(P)G2\text{-}S}$	max.	2.0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): $I_D = 10$ mA; $V_{DS} = 15$ V; $+V_{G2\text{-}S} = 4$ V; $T_{amb} = 25\ ^oC$.

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.5 pF
		max.	3.0 pF
Input capacitance at gate 2: f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.0 pF
Noise figure at $G_S = 2$ mS; $B_S = B_S$ opt; f = 200 MHz	F	typ.	1.0 dB
Power gain at $G_S = 2$ mS; $B_S = B_S$ opt			
$G_L = 0.5$ mS; $B_L = B_L$ opt; f = 200 MHz	G_p	typ.	25 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected and intended for UHF applications in television tuners.
The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates ans source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	18	mS
Input capacitance at gate 1 : f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.3 2.6	pF pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.8	dB

MECHANICAL DATA

Dimensions in mm

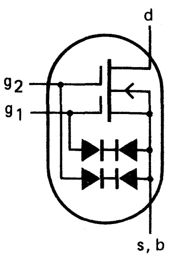
Fig.1 SOT143.

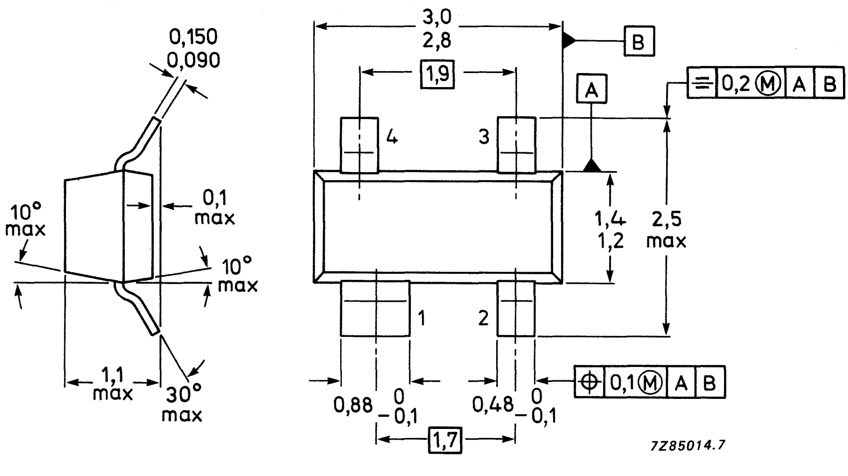
Marking code

BF996S = MHp

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	30	mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

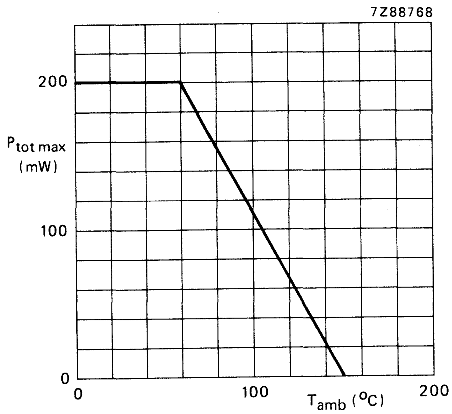


Fig. 2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S}$ = 5 V; $V_{G2-S} = V_{DS}$ = 0	$\pm I_{G1-SS}$	max.	50 nA
$\pm V_{G2-S}$ = 5 V; $V_{G1-S} = V_{DS}$ = 0	$\pm I_{G2-SS}$	max.	50 nA
Gate-source breakdown voltages			
$\pm I_{G1-S}$ = 10 mA; $V_{G2-S} = V_{DS}$ = 0	$\pm V_{(BR)G1-SS}$		6 to 20 V
$\pm I_{G2-S}$ = 10 mA; $V_{G1-S} = V_{DS}$ = 0	$\pm V_{(BR)G2-SS}$		6 to 20 V
Drain current			
V_{DS} = 15 V; V_{G1-S} = 0; V_{G2-S} = 4 V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V	$-V_{(P)G1-S}$	max.	2.5 V
I_D = 20 μA; V_{DS} = 15 V; V_{G1-S} = 0	$-V_{(P)G2-S}$	max.	2.0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; $+V_{G2-S}$ = 4 V; T_{amb} = 25 °C.

Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	min.	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	C_{ig1-s}	typ.	2.3 pF
		max.	2.6 pF
Input capacitance at gate 2: f = 1 MHz	C_{ig2-s}	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0.8 pF
Noise figure			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt	F	typ.	1.0 dB
f = 800 MHz; G_S = 3.3 mS; $B_S = B_S$ opt		typ.	1.8 dB
Power gain			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt; G_L = 0.5 mS; $B_L = B_L$ opt	G_p	typ.	25 dB
f = 800 MHz; G_S = 3.3 mS; $B_S = B_S$ opt; G_L = 1.0 mS; $B_L = B_L$ opt		typ.	18 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for u.h.f. and v.h.f. applications, such as u.h.f./v.h.f. television tuners and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source and has an integrated drain resistance to suppress oscillation in the frequency range higher than 1 GHz.

This device is especially intended for use in pre-amplifiers in CATV tuners with a large tuning range up to 500 MHz.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + V_{G2-S} = 4 V	$\|y_{fs}\|$	typ.	18	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + V_{G2-S} = 4 V	C_{ig1-s}	typ.	2.5	pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + V_{G2-S} = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + V_{G2-S} = 4 V; f = 200 MHz	F	typ.	1.0	dB

MECHANICAL DATA

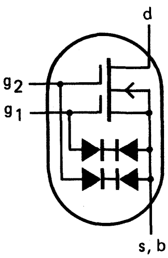
Dimensions in mm

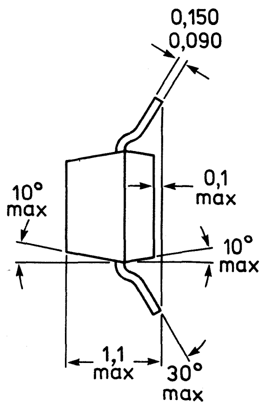
Marking code: MKp

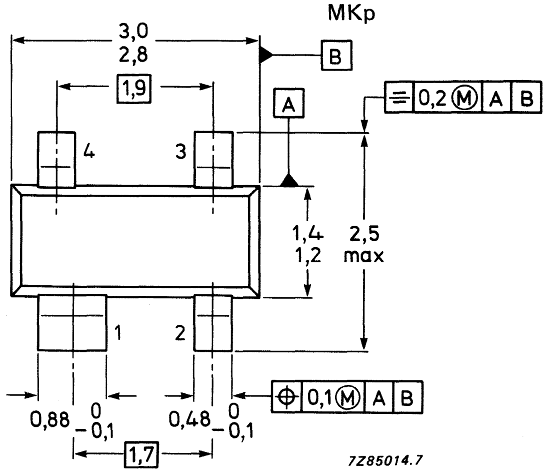
Fig.1 SOT143.

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1







TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	30	mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

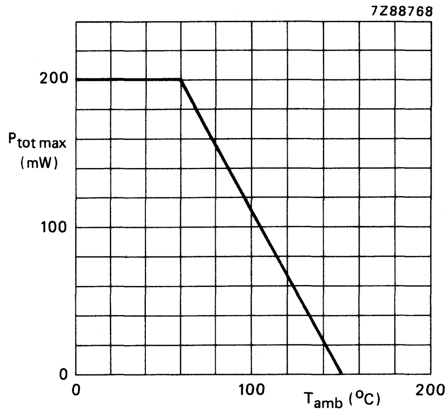


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
gate 1;			
$\pm V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	50 nA
gate 2;			
$\pm V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	50 nA
Gate-source breakdown voltages			
gate 1;			
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
gate 2;			
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Gate-source cut-off voltages			
gate 1;			
I_D = 20 μA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	2.5 V
gate 2;			
I_D = 20 μA; V_{DS} = 15 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	2.0 V
Drain-source cut-off voltage			
V_{DS} = 15 V; $V_{G2\text{-}S}$ = 4 V; $V_{G1\text{-}S}$ = 0	I_{DSS}		2 to 20 mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min. typ.	15 mS 18 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.5 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.0 pF
Noise figure at f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt	F	typ.	1.0 dB
Power gain at G_S = 2 mS; $B_S = B_S$ opt G_L = 0.5 mS; $B_L = B_L$ opt; f = 200 MHz	G_p	typ.	25 dB

Data sheet	
status	Product specification
date of issue	April 1991

BF998

Silicon n-channel dual gate MOS-FET

FEATURES

- Short channel transistor with high ratio $|Y_{fs}|/C_{is}$.
- Low noise gain controlled amplifier to 1 GHz.

DESCRIPTION

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for VHF and UHF applications, such as television tuners, with 12 V supply voltage and professional communication equipment. This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

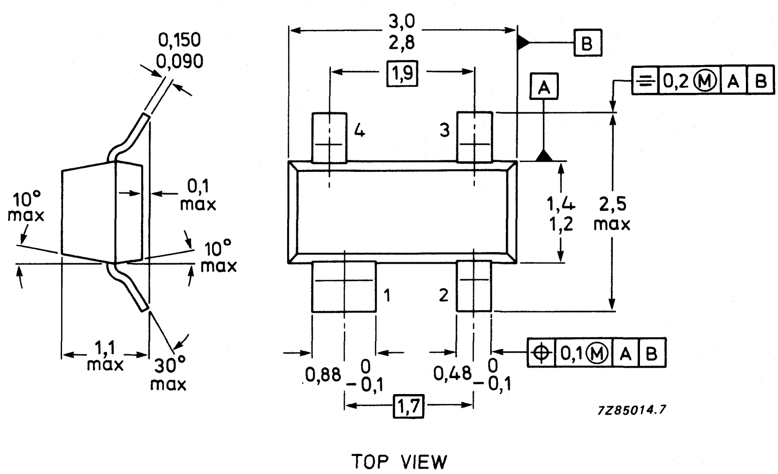
SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	-	12	V
I_D	drain current	-	30	mA
P_{tot}	total power dissipation	-	200	mW
T_j	junction temperature	-	150	°C
$\|Y_{fs}\|$	transfer admittance	24	-	mS
C_{ig1-s}	input capacitance at gate 1	2.1	-	pF
C_{rs}	feedback capacitance	25	-	fF
F	noise figure at 800 MHz	1	-	dB

MECHANICAL DATA

Dimensions in mm

Marking code

BF998 = MOp



See also soldering recommendations.

Fig.1 SOT143.

PIN CONFIGURATION

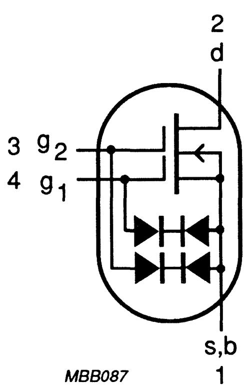


Fig.2 Pin configuration.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

Silicon n-channel dual gate MOS-FET — BF998

LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		-	12	V
I_D	drain current (DC or average)		-	30	mA
$\pm I_{G1-S}$	gate 1-source current		-	10	mA
$\pm I_{G2-S}$	gate 2-source current		-	10	mA
P_{tot}	total power dissipation	T_{amb} = 60 °C (note 1)	-	200	mW
P_{tot}	total power dissipation	T_{amb} = 50 °C (note 2)	-	200	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	from junction to ambient in free air (note 1)	460	K/W
$R_{th\ j-a}$	from junction to ambient in free air (note 2)	500	K/W

Notes

1. Device mounted on a ceramic substrate, 8 mm x 10 mm x 0.7 mm.
2. Device mounted on printed circuit board.

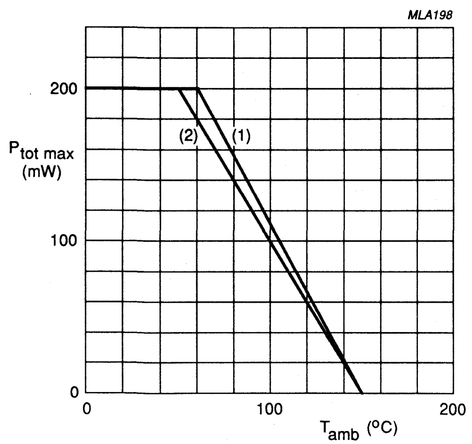


Fig.3 Power derating curve;
(1) ceramic substrate;
(2) printed-circuit board.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm I_{G1\text{-}SS}$	gate 1 cut-off current	$\pm V_{G1\text{-}S}$ = 5 V $V_{G2S} = V_{DS}$ = 0	-	50	nA
$\pm I_{G2\text{-}SS}$	gate 2 cut-off current	$\pm V_{G2\text{-}S}$ = 5 V $V_{G1S} = V_{DS}$ = 0	-	50	nA
$\pm V_{(BR)G1\text{-}SS}$	gate 1-source breakdown voltage	$\pm I_{G1\text{-}SS}$ = 10 mA $V_{G2\text{-}S} = V_{DS}$ = 0	6	20	V
$\pm V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$\pm I_{G2\text{-}SS}$ = 10 mA $V_{G1\text{-}S} = V_{DS}$ = 0	6	20	V
$-V_{(P)G1\text{-}S}$	gate 1-source cut-off voltage	I_D = 20 μA V_{DS} = 8 V $+V_{G2\text{-}S}$ = 4 V	-	2.5	V
$-V_{(P)G2\text{-}S}$	gate 2-source cut-off voltage	I_D = 20 μA V_{DS} = 8 V $V_{G1\text{-}S}$ = 0	-	2.0	V
I_{DSS}	drain current (measured under pulse condition)	V_{DS} = 8 V $V_{G1\text{-}S}$ = 0 $+V_{G2\text{-}S}$ = 4 V	2	18	mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source) I_D = 10 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert Y_{fs} \rvert$	transfer admittance	f = 1 kHz	21	24	-	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	-	2.1	2.5	pF
C_{os}	output capacitance	f = 1 MHz	-	1.05	-	pF
C_{rs}	feedback capacitance	f = 1 MHz	-	25	-	fF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	-	1.2	-	pF
F	noise figure	f = 200 MHz G_s = 2 mS $B_s = B_{sopt}$	-	0.6	-	dB
F	noise figure	f = 800 MHz G_s = 3.3 mS $B_s = B_{sopt}$	-	1	-	dB

Silicon n-channel dual gate MOS-FET **BF998**

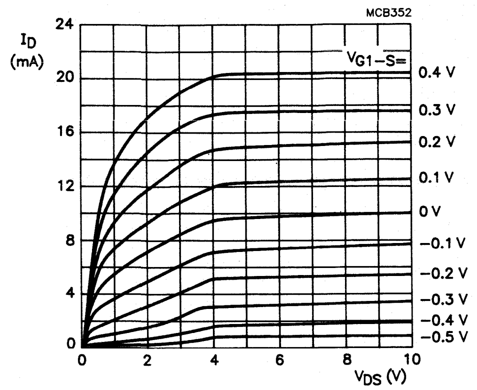


Fig.4 Output characteristics; V_{G2-S} = 4 V; T_{amb} = 25 °C.

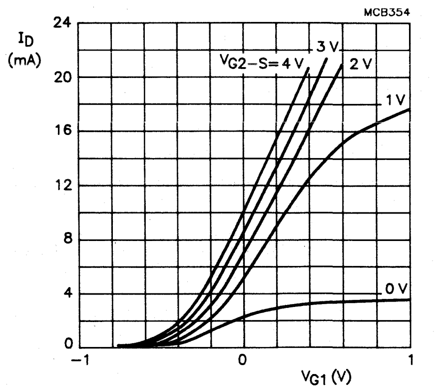


Fig.5 Transfer characteristics; V_{DS} = 8 V; T_{amb} = 25 °C.

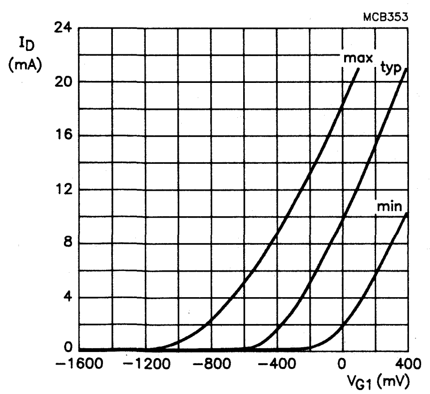


Fig.6 Drain current as a function of gate 1 voltage; V_{DS} = 8 V; V_{G2-S} = 4 V; T_{amb} = 25 °C.

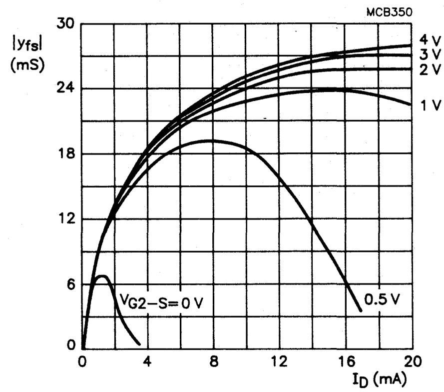


Fig.7 Transfer admittance as a function of drain current; V_{DS} = 8 V; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET BF998

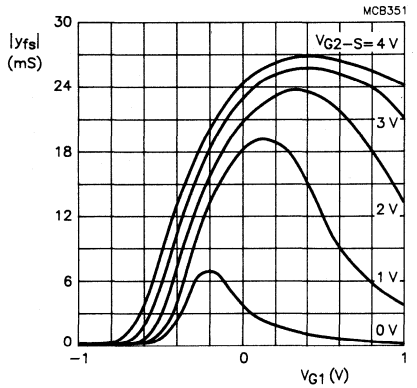


Fig.8 Transfer admittance as a function of gate 1 voltage; V_{DS} = 8 V; T_{amb} = 25 °C.

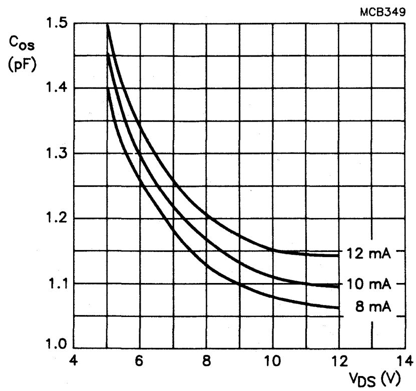


Fig.9 Output capacitance as a function of drain-source voltage; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

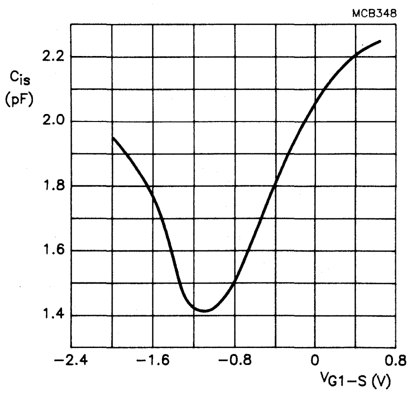


Fig.10 Gate 1 input capacitance as a function of gate 1-source voltage; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

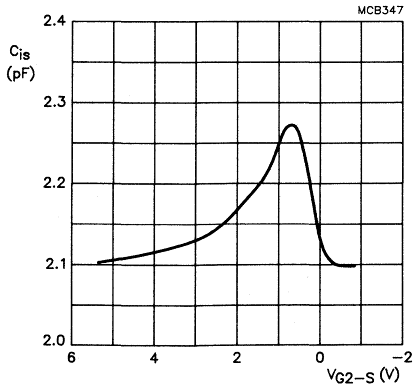


Fig.11 Gate 1 input capacitance as a function of gate 2-source voltage; V_{DS} = 8 V; $V_{G1\text{-}S}$ = 0; f = 1 MHz; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET

BF998

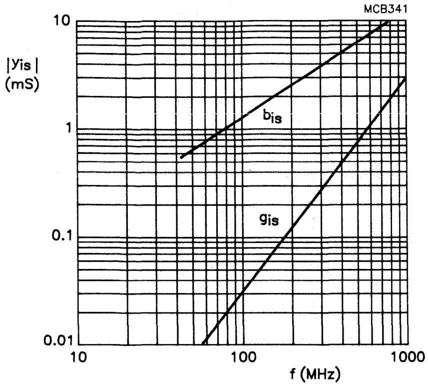


Fig.12 Input admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

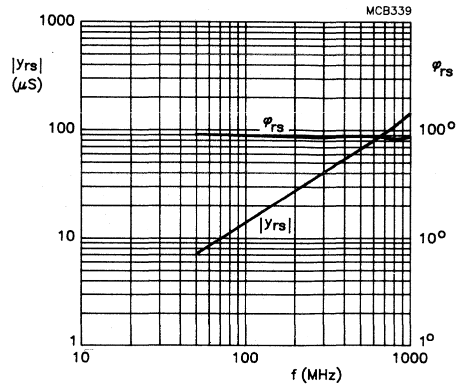


Fig.13 Feedback admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

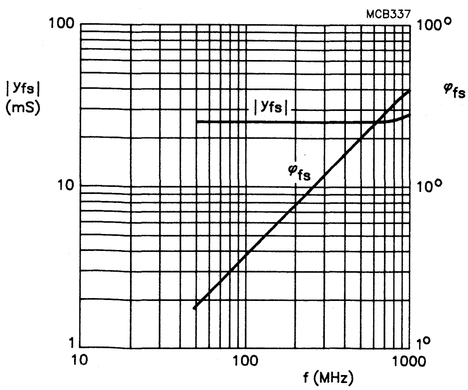


Fig.14 Transfer admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

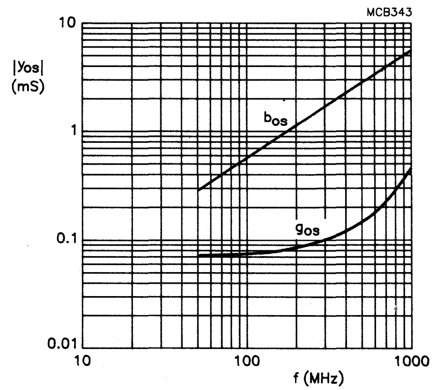
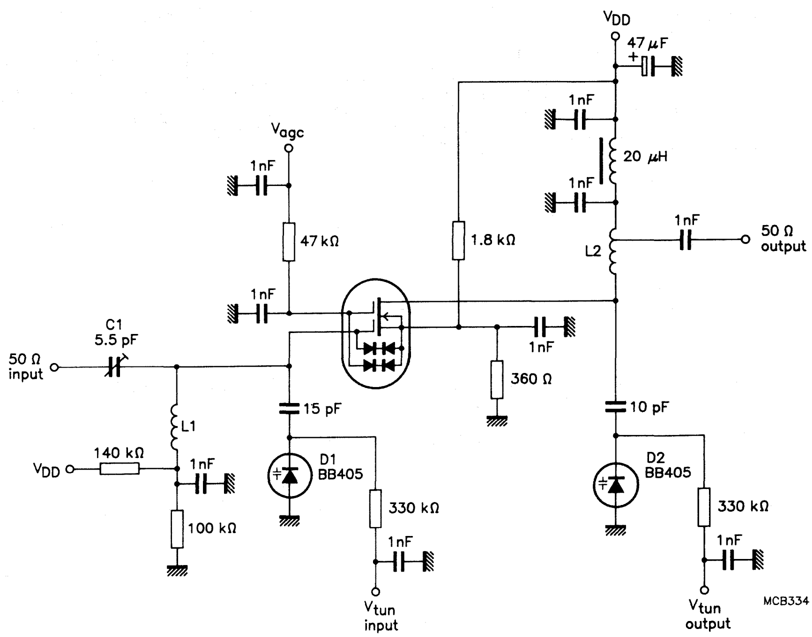


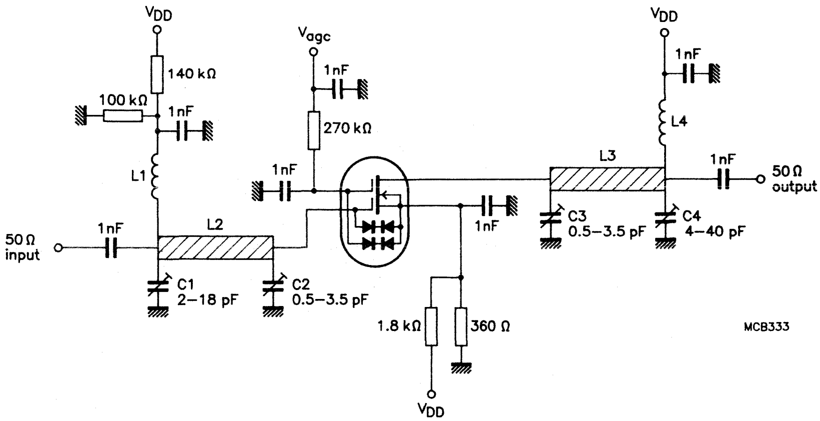
Fig.15 Output admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.



L1 = 45 nH, 4 turns, internal diameter 4 mm, 0.8 mm copper wire.
L2 = 160 nH, 3 turns, internal diameter 8 mm, 0.8 mm copper wire.
Tapped at approximately half a turn from the cold side, to adjust G_L = 0.5 mS.
C1 adjusted for G_S = 2 mS.

Fig.16 Gain control test circuit at f = 200 MHz; V_{DD} = 12 V; G_S = 2 mS; G_L = 0.5 mS.

Silicon n-channel dual gate MOS-FET — BF998



L1 = L4 = 11 turns, internal diameter 3 mm, 0.5 mm copper wire, without spacing; ≈200 nH.
L2 = 2 cm, silvered 0.8 mm copper wire, 4 mm above ground plane.
L3 = 2 cm, silvered 0.5 mm copper wire, 4 mm above ground plane.

Fig.17 Gain control test circuit at f = 800 MHz; V_{DD} = 12 V; G_S = 3.3 mS; G_L = 1 mS.

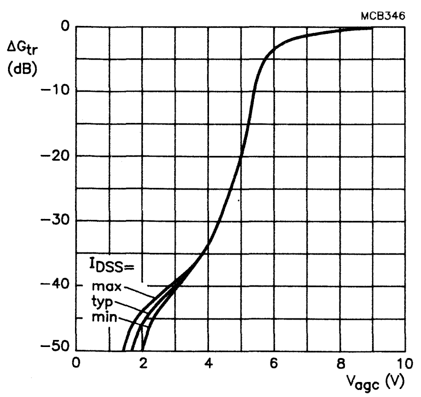


Fig.18 Automatic gain control characteristics measured in circuit of Fig.16; V_{DD} = 12 V; f = 200 MHz; T_{amb} = 25 °C.

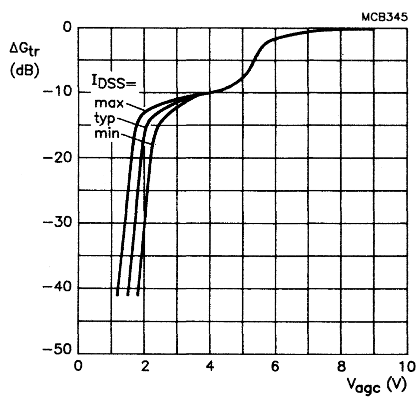


Fig.19 Automatic gain control characteristics measured in circuit of Fig.17; V_{DD} = 12 V; f = 800 MHz; T_{amb} = 25 °C.

Philips Semiconductors

Data sheet	
status	Product specification
date of issue	October 1990

BF998R

Silicon n-channel dual gate MOS-FET

FEATURES

- Short channel transistor with high ratio $|Y_{fs}|/C_{is}$.
- Low noise gain controlled amplifier to 1 GHz.

DESCRIPTION

Depletion type field-effect transistor in a plastic SOT143R microminiature envelope with source and substrate interconnected, intended for VHF and UHF applications, such as UHF television tuners, with 12 V supply voltage and professional communication equipment. This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	-	12	V
I_D	drain current	-	30	mA
P_{tot}	total power dissipation	-	200	mW
T_j	junction temperature	-	150	°C
$\|Y_{fs}\|$	transfer admittance	24	-	mS
C_{ig1-s}	input capacitance at gate 1	2.1	-	pF
C_{rs}	feedback capacitance	25	-	pF
F	noise figure at 800 MHz	1	-	dB

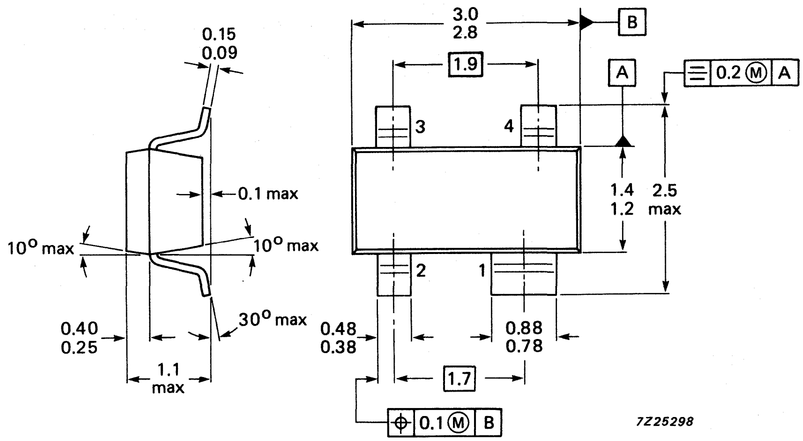
Silicon n-channel dual gate MOS-FET **BF998R**

MECHANICAL DATA

Dimensions in mm

Marking code

BF998R = MO$\overline{p}$



See also soldering recommendations.

Fig.1 SOT143R.

PIN CONFIGURATION

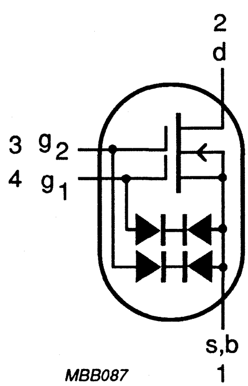


Fig.2 Pin configuration.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

Silicon n-channel dual gate MOS-FET BF998R

LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		-	12	V
I_D	drain current (DC or average)		-	30	mA
$\pm I_{G1-S}$	gate 1-source current		-	10	mA
$\pm I_{G2-S}$	gate 2-source current		-	10	mA
P_{tot}	total power dissipation	T_{amb} = 50 °C (note 1)	-	200	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	from junction to ambient in free air (note 1)	500	K/W

Notes

1. Device mounted on a ceramic substrate, 8 mm x 10 mm x 0.7 mm.

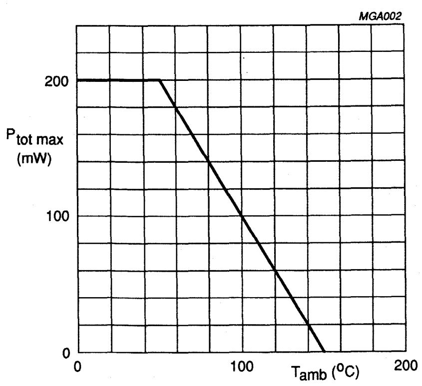


Fig.3 Power derating curve.

Silicon n-channel dual gate MOS-FET BF998R

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm I_{G1\text{-}SS}$	gate 1 cut-off current	$\pm V_{G1\text{-}S} = 5$ V $V_{G2S} = V_{DS} = 0$	-	50	nA
$\pm I_{G2\text{-}SS}$	gate 2 cut-off current	$\pm V_{G2\text{-}S} = 5$ V $V_{G1S} = V_{DS} = 0$	-	50	nA
$\pm V_{(BR)G1\text{-}SS}$	gate 1-source breakdown voltage	$\pm I_{G1\text{-}SS} = 10$ mA $V_{G2\text{-}S} = V_{DS} = 0$	6	20	V
$\pm V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$\pm I_{G2\text{-}SS} = 10$ mA $V_{G1\text{-}S} = V_{DS} = 0$	6	20	V
$-V_{(P)G1\text{-}S}$	gate 1-source cut-off voltage	$I_D = 20$ µA $V_{DS} = 8$ V $+V_{G2\text{-}S} = 4$ V	-	2.5	V
$-V_{(P)G2\text{-}S}$	gate 2-source cut-off voltage	$I_D = 20$ µA $V_{DS} = 8$ V $V_{G1\text{-}S} = 0$	-	2.0	V
I_{DSS}	drain current	$V_{DS} = 8$ V $V_{G1\text{-}S} = 0$ $+ V_{G2\text{-}S} = 4$ V	2	18	mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source) I_D = 10 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert Y_{fs} \rvert$	transfer admittance	f = 1 kHz	21	24	-	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	-	2.1	2.5	pF
C_{os}	output capacitance	f = 1 MHz	-	1.05	-	pF
C_{rs}	feedback capacitance	f = 1 MHz	-	25	-	fF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	-	1.2	-	pF
F	noise figure	f = 200 MHz $G_s = 2$ mS $B_s = B_{sopt}$	-	0.6	-	dB
F	noise figure	f = 800 MHz $G_s = 3.3$ mS $B_s = B_{sopt}$	-	1	-	dB

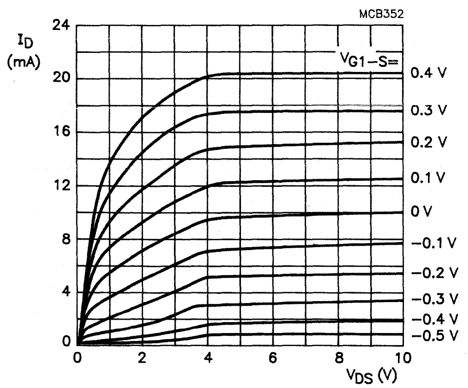


Fig.4 Output characteristics; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

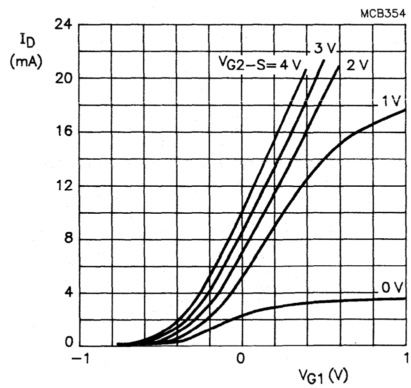


Fig.5 Transfer characteristics; V_{DS} = 8 V; T_{amb} = 25 °C.

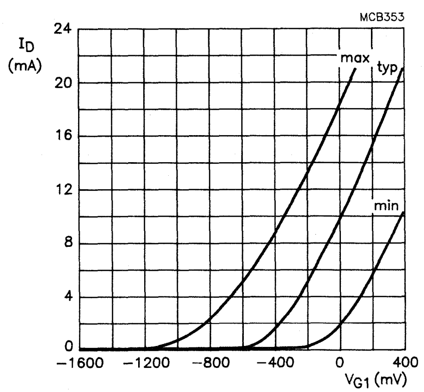


Fig.6 Drain current as a function of gate 1 voltage; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

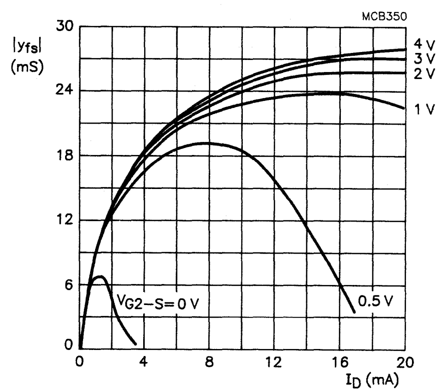


Fig.7 Transfer admittance as a function of drain current; V_{DS} = 8 V; T_{amb} = 25 °C.

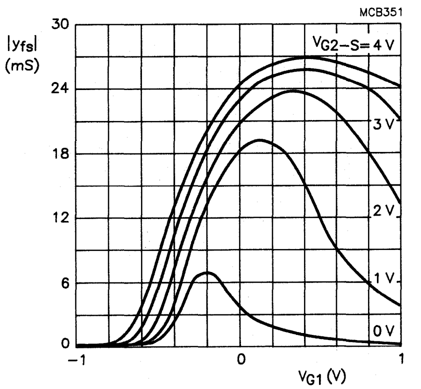


Fig.8 Transfer admittance as a function of gate 1 voltage; V_{DS} = 8 V; T_{amb} = 25 °C.

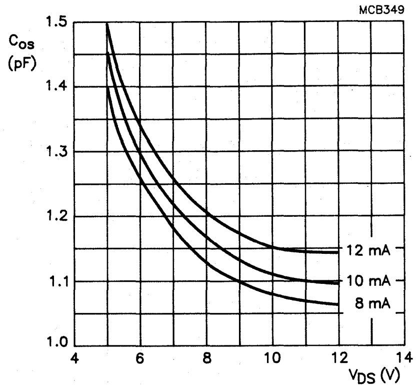


Fig.9 Output capacitance as a function of drain-source voltage; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

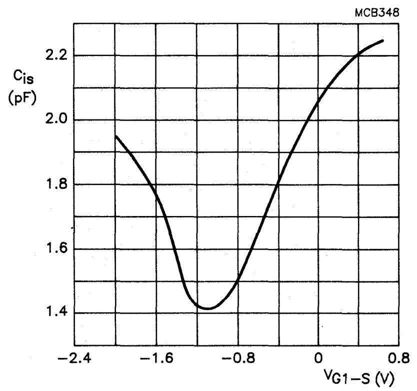


Fig.10 Gate 1 input capacitance as a function of gate 1-source voltage; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

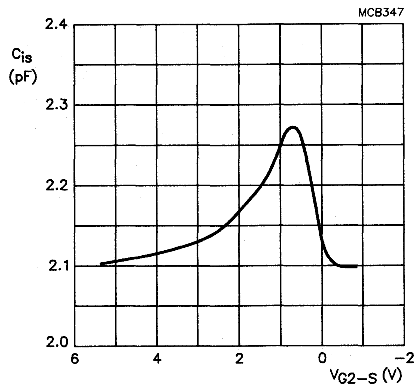


Fig.11 Gate 1 input capacitance as a function of gate 2-source voltage; V_{DS} = 8 V; $V_{G1\text{-}S}$ = 0; f = 1 MHz; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET

BF998R

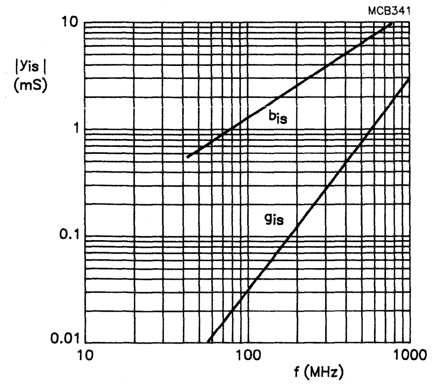


Fig.12 Input admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

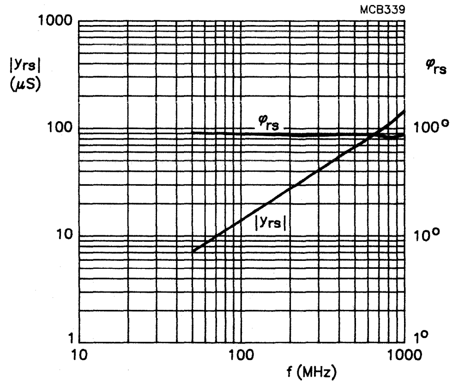


Fig.13 Feedback admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

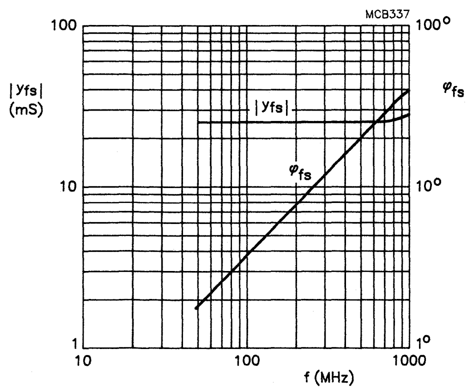


Fig.14 Transfer admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

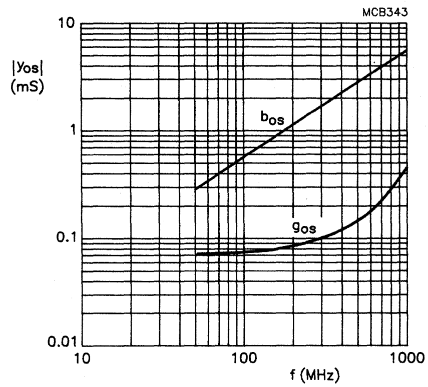
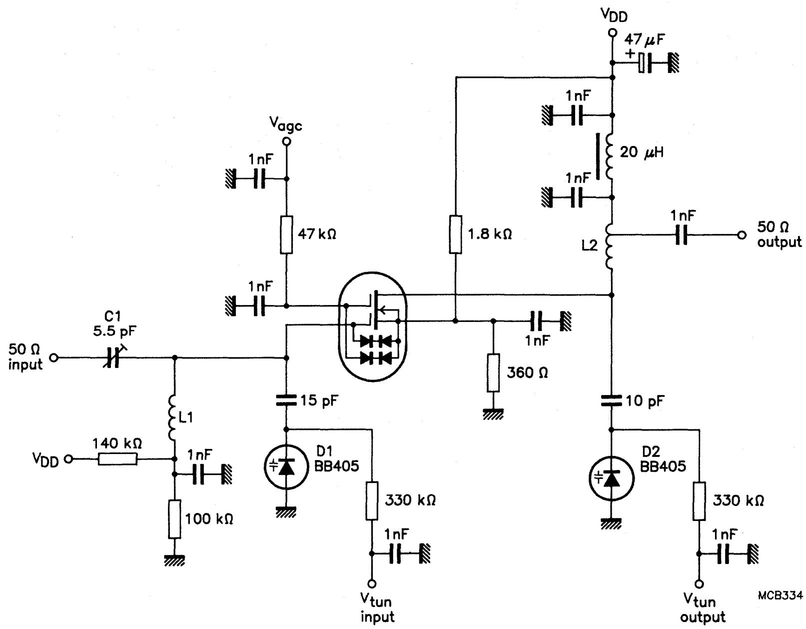


Fig.15 Output admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.



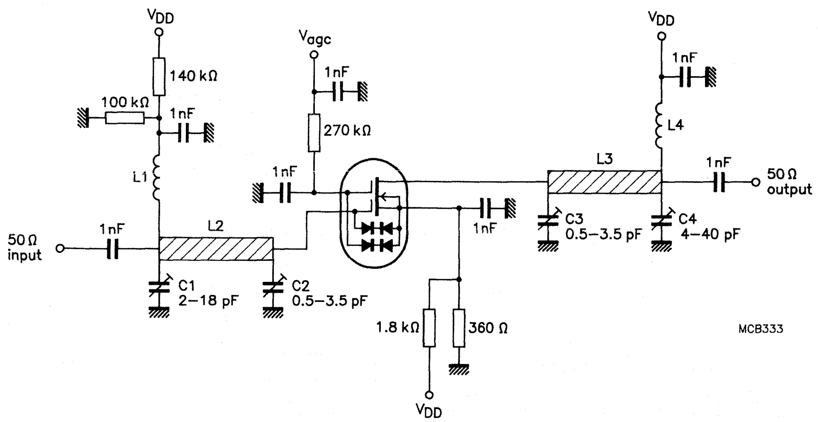
L1 = 45 nH, 4 turns, internal diameter 4 mm, 0.8 mm copper wire.

L2 = 160 nH, 3 turns, internal diameter 8 mm, 0.8 mm copper wire.

Tapped at approximately half a turn from the cold side, to adjust G_L = 0.5 mS.

C1 adjusted for G_S = 2 mS.

Fig.16 Gain control test circuit at f = 200 MHz; V_{DD} = 12 V; G_S = 2 mS; G_L = 0.5 mS.



L1 = L4 = 11 turns, internal diameter 3 mm, 0.5 mm copper wire, without spacing; ≈200 nH.

L2 = 2 cm, silvered 0.8 mm copper wire, 4 mm above ground plane.

L3 = 2 cm, silvered 0.5 mm copper wire, 4 mm above ground plane.

Fig.17 Gain control test circuit at f = 800 MHz; V_{DD} = 12 V; G_S = 3.3 mS; G_L = 1 mS.

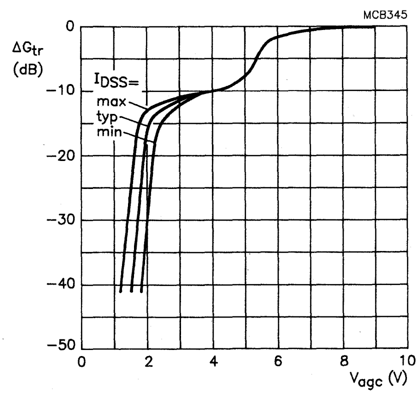


Fig.18 Automatic gain control characteristics measured in circuit of Fig.16; V_{DD} = 12 V; f = 200 MHz; T_{amb} = 25 °C.

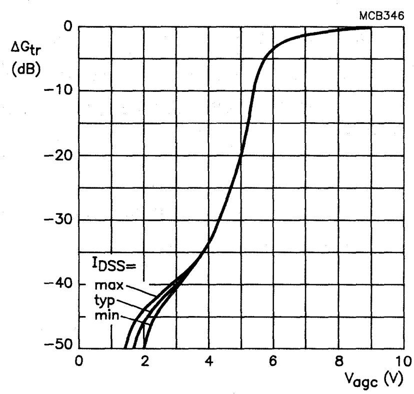


Fig.19 Automatic gain control characteristics measured in circuit of Fig.17; V_{DD} = 12 V; f = 800 MHz; T_{amb} = 25 °C.

NPN 2 GHz wideband transistor — BFG16A

FEATURES

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

DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope.

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

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

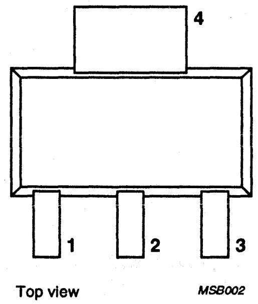


Fig.1 SOT223.

QUICK REFERENCE DATA

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

LIMITING VALUES

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

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

Note

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

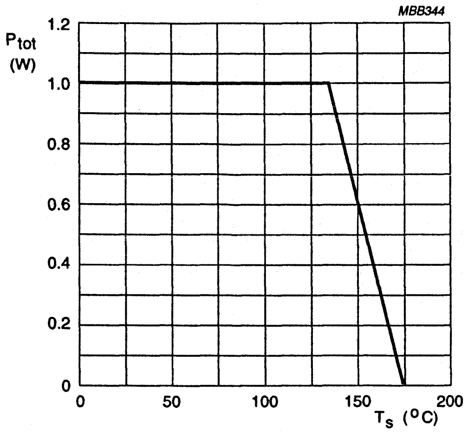
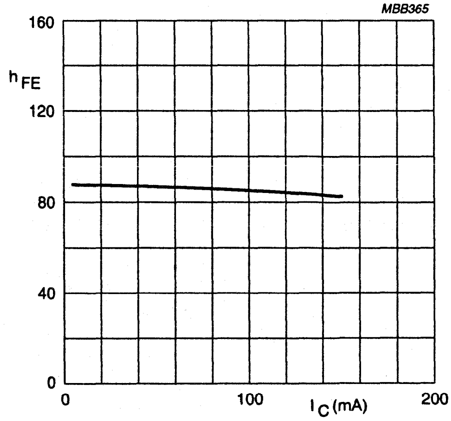
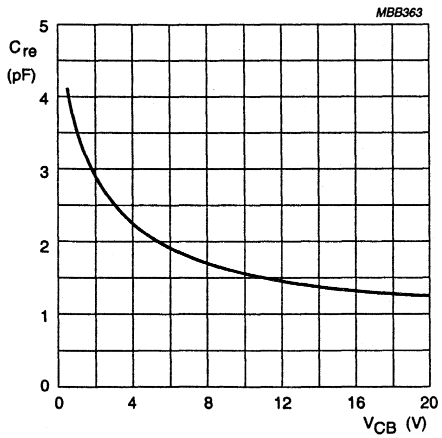


Fig.2 Power derating curve.



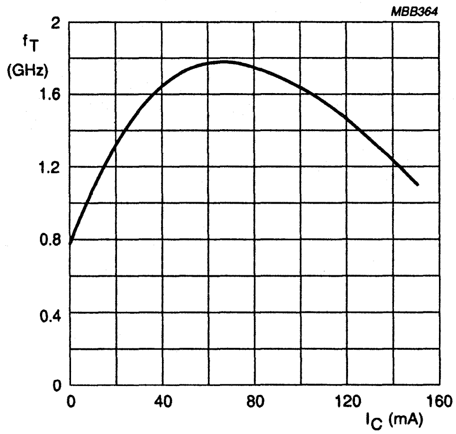
V_{CE} = 10 V; T_j = 25 °C.

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



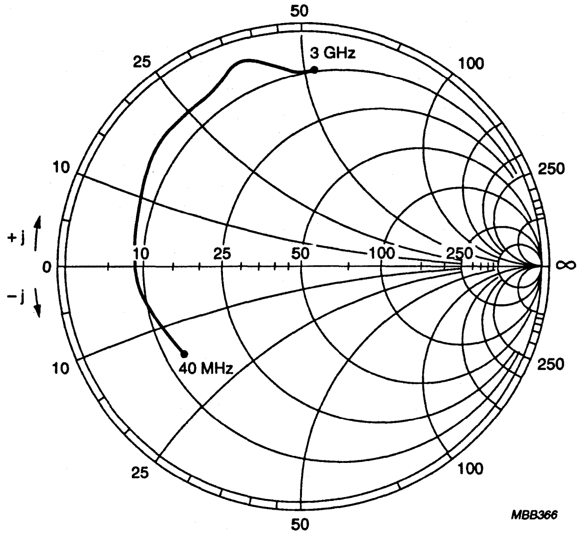
$I_C = i_c = 0$; f = 1 MHz.

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



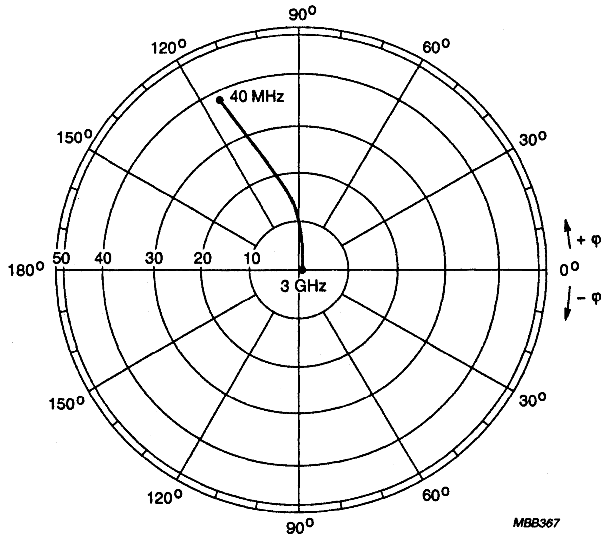
V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

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



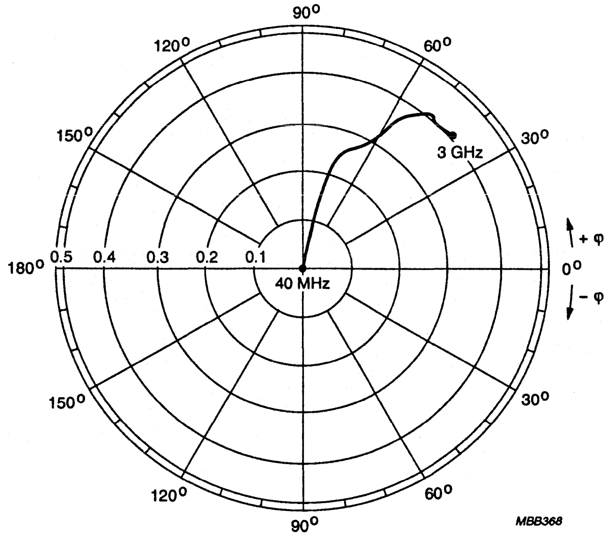
I_C = 70 mA; V_{CE} = 15 V.

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



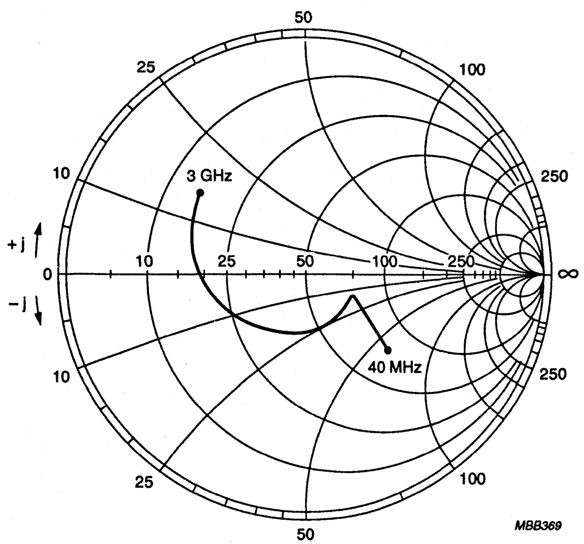
I_C = 70 mA; V_{CE} = 15 V.

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



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

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



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

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

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

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

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

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

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

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

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

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

NPN 3 GHz wideband transistor — BFG17A

DESCRIPTION

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

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

PINNING

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

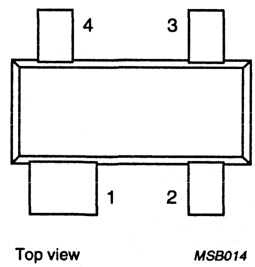


Fig.1 SOT143.

QUICK REFERENCE DATA

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

LIMITING VALUES

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

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

Note

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

THERMAL RESISTANCE

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

Note

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

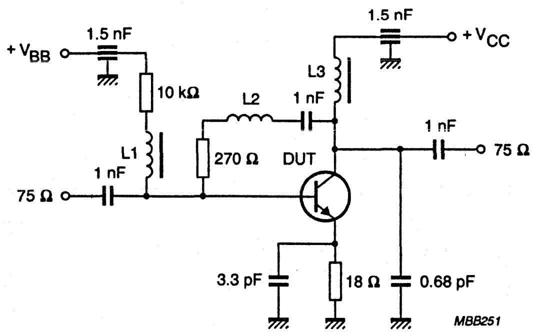
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Notes

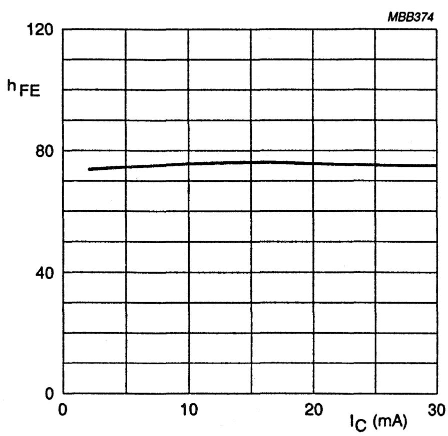
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B, para. 6 3: 3-tone); I_C = 14 mA; V_{CE} = 10 V; Z_L = 75 Ω
   $V_p = V_O$; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25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



L1 = L3 = 5 μH Ferroxcube choke.

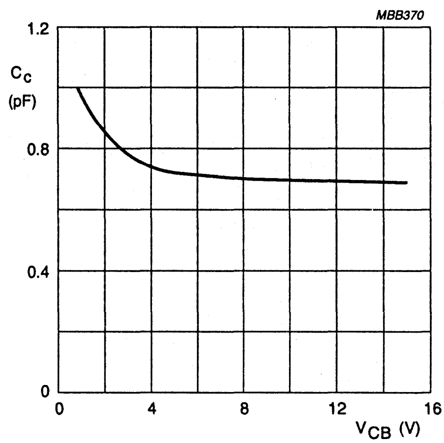
L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

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



V_{CE} = 1 V; T_{amb} = 25 °C.

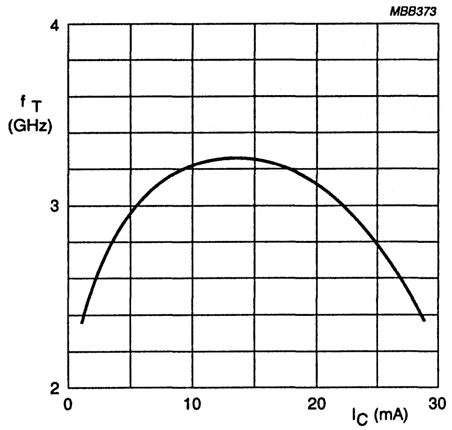
Fig.3 DC current gain as function of collector current.



I_E = 0; f = 1 MHz; T_{amb} = 25 °C

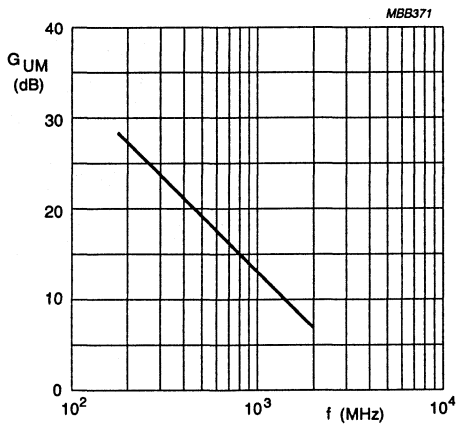
Fig.4 Collector capacitance as a function of collector-base voltage.

Capability approved CECC 50 000 (issue 4), 1986



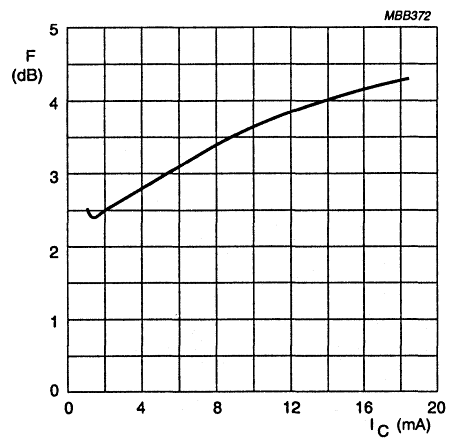
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

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



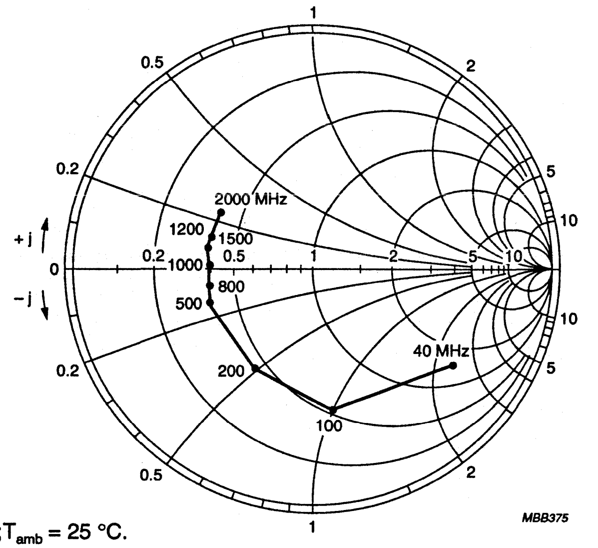
I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



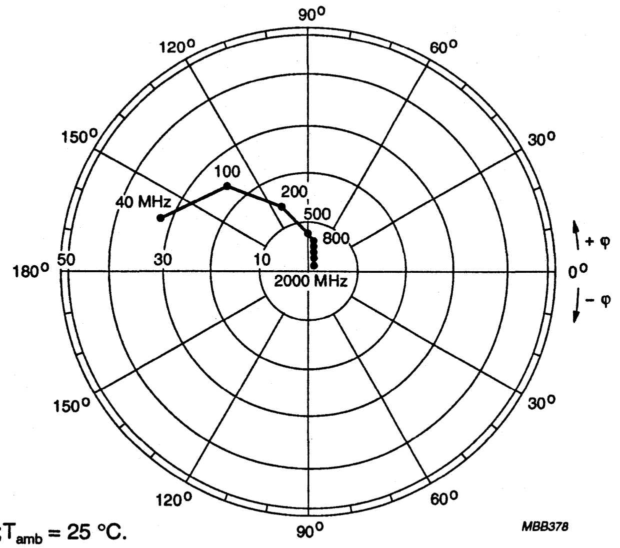
V_{CE} = 5 V; f = 800 MHz; T_{amb} = 25 °C; Z_S = 60 Ω; b_s = opt.

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



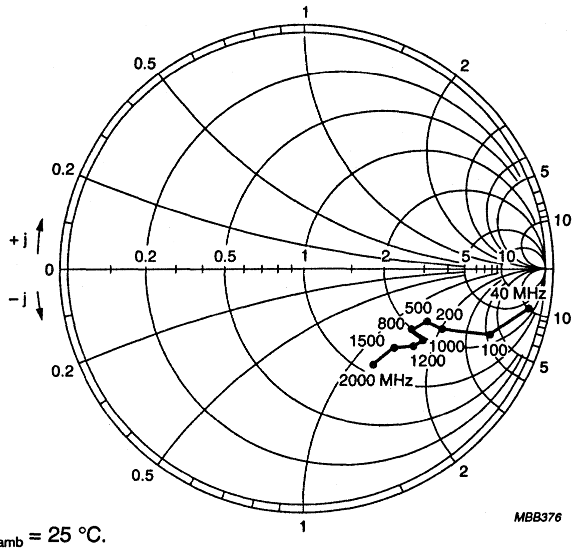
I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



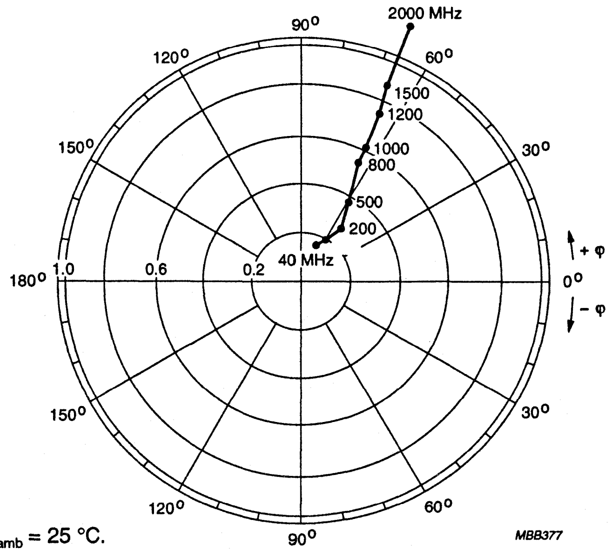
I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



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

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



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

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

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

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

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

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

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

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

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

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

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

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

NPN 5 GHz wideband transistor — BFG25A/X

FEATURES

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

DESCRIPTION

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

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

PINNING

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

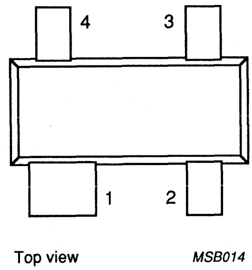


Fig.1 SOT143.

QUICK REFERENCE DATA

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

Note

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

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

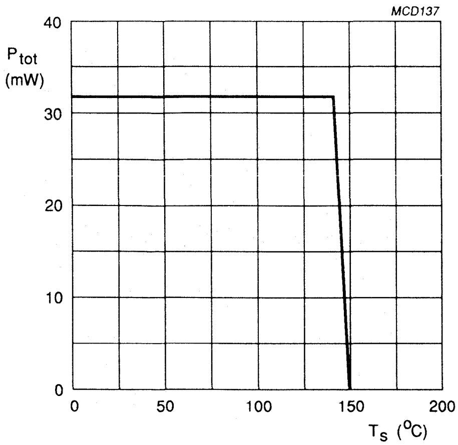
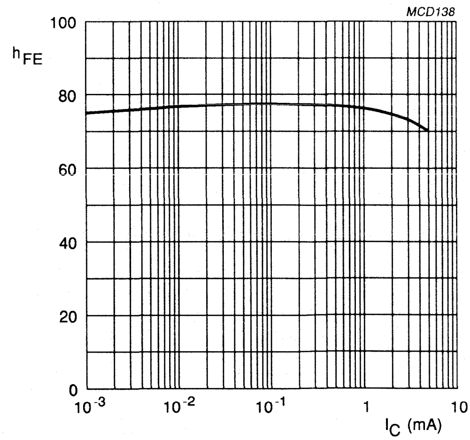
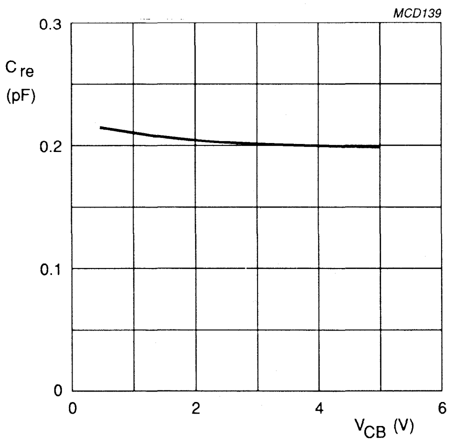


Fig.2 Power derating curve.



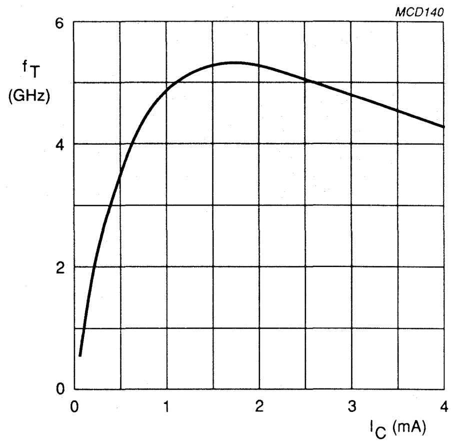
V_{CE} = 1 V.

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



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

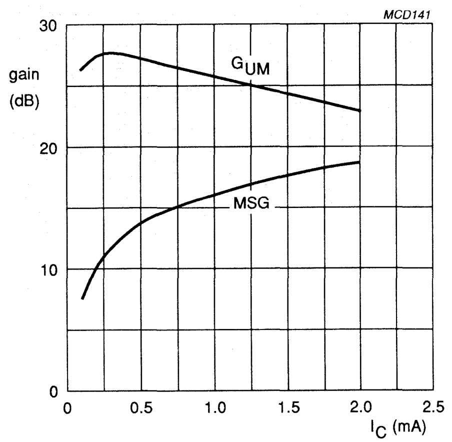
Fig.4 Feedback capacitance as a function of collector-base voltage.



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

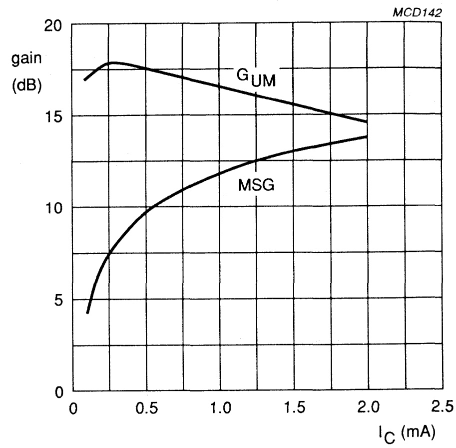
Fig.5 Transition frequency as a function of collector current.

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



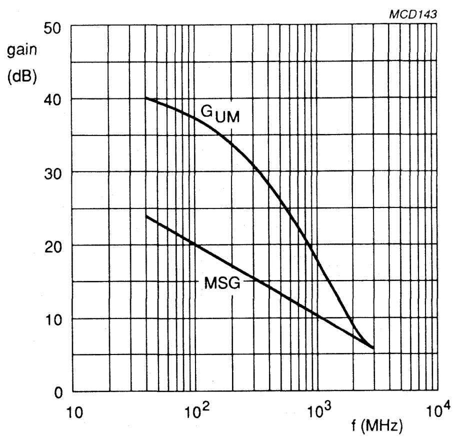
V_{CE} = 1 V; f = 500 MHz.

Fig.6 Gain as a function of collector current.



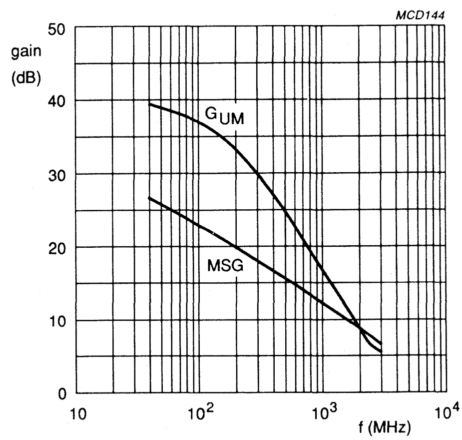
V_{CE} = 1 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



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

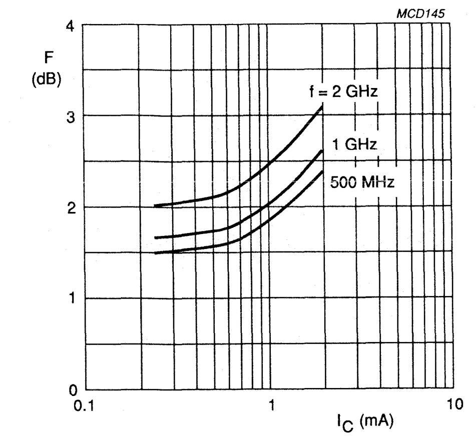
Fig.8 Gain as a function of frequency.



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

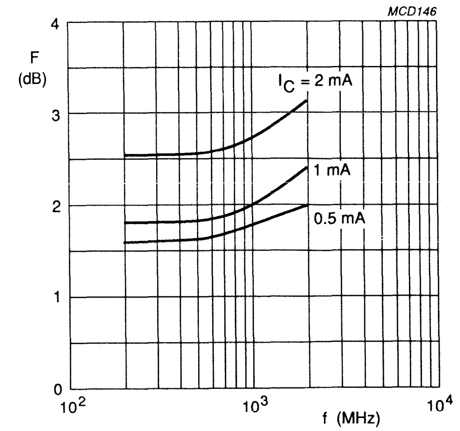
Fig.9 Gain as a function of frequency.

NPN 5 GHz wideband transistor | BFG25A/X



V_{CE} = 1 V.

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



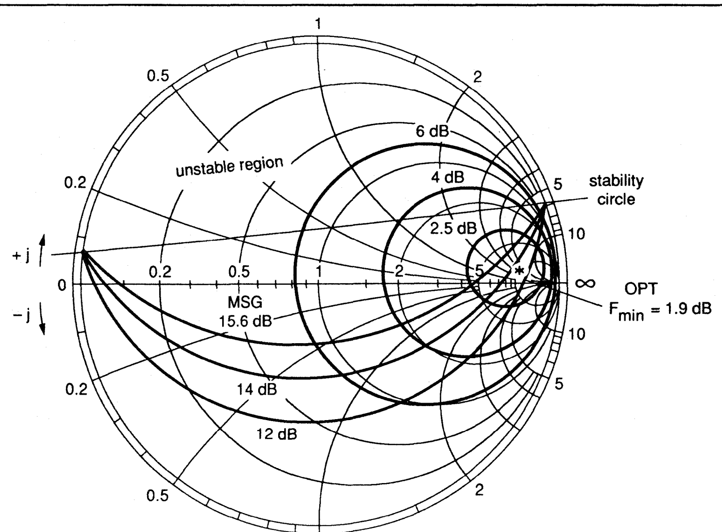
V_{CE} = 1 V.

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_0 = 50 Ω.

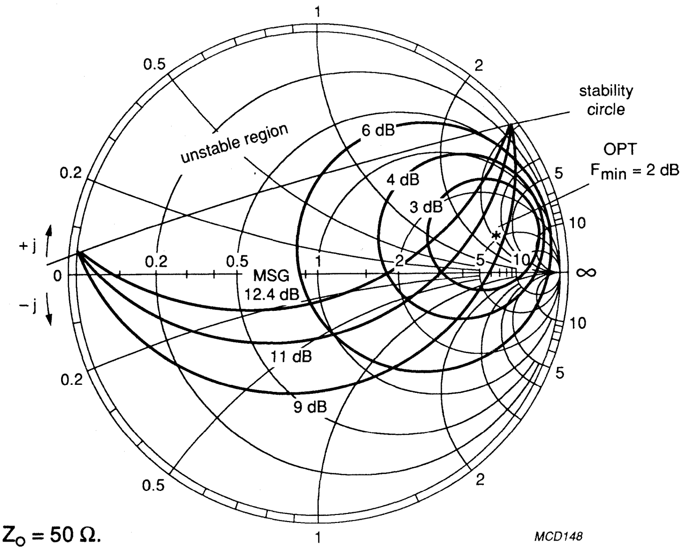
Maximum stable gain = 15.6 dB.

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



$Z_O = 50\ \Omega$.

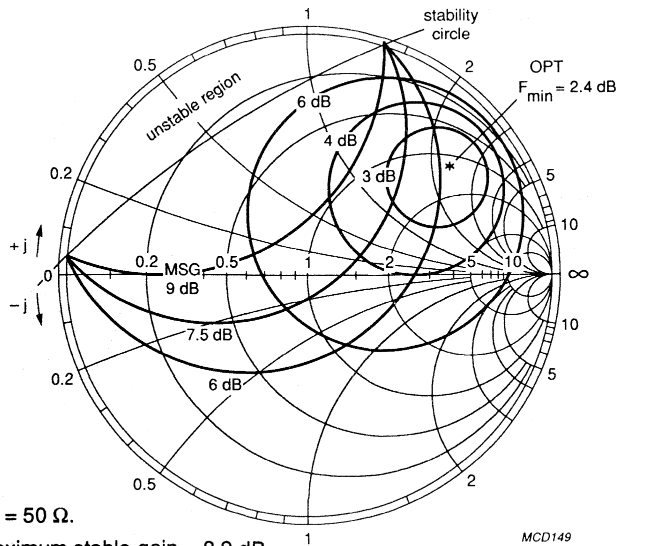
Maximum stable gain = 12.4 dB.

Fig.13 Noise circle figure.

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

Noise Parameters

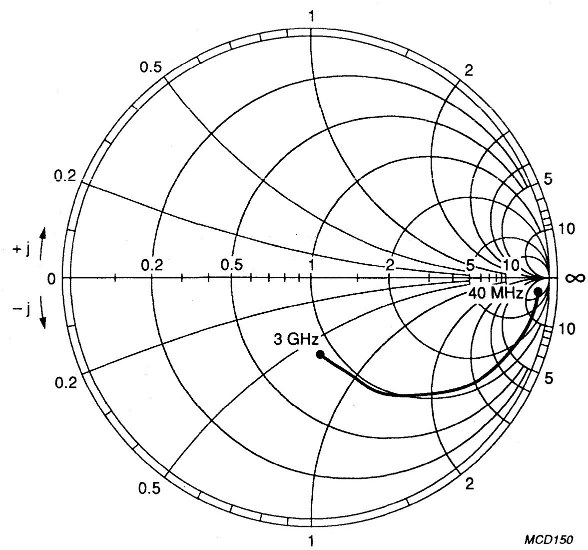
F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.4	0.72	38	1.9



$Z_O = 50\ \Omega$.

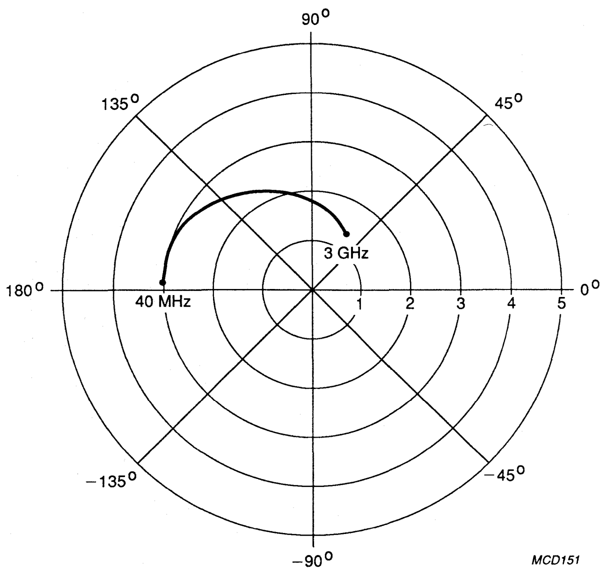
Maximum stable gain = 8.9 dB.

Fig.14 Noise circle figure.



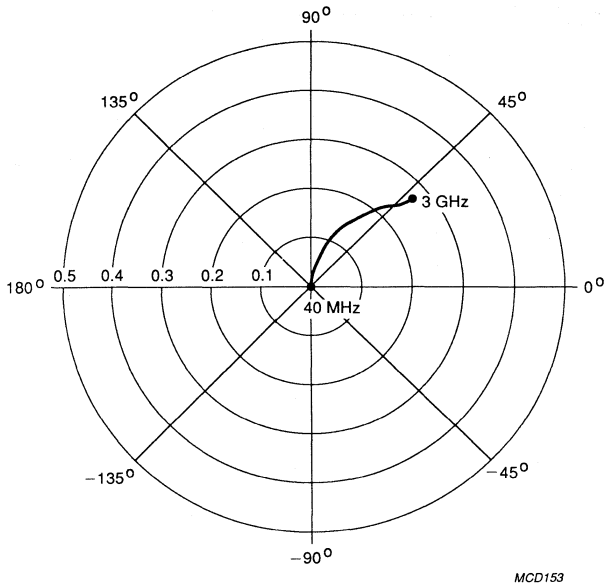
V_{CE} = 1 V; I_C = 1 mA.

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



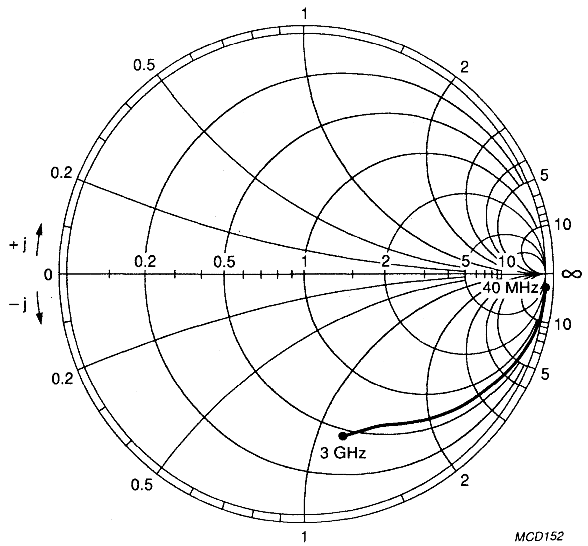
V_{CE} = 1 V; I_C = 1 mA.

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}).

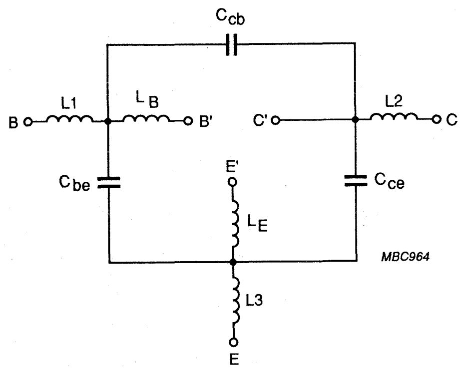


V_{CE} = 1 V; I_C = 1 mA.

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

Table 4 Noise data

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

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

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

Table 6 Noise data

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

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

f (MHz)	S_{11}		S_{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	0.970	−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}		R_n
		(RAT)	(DEG)	
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}		S_{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	0.895	−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}		R_n
		(RAT)	(DEG)	
500	2.5	0.79	5	2.3
1000	2.5	0.74	14	2.5
2000	3.0	0.70	37	1.8

PNP 5 GHz wideband transistor BFG31

FEATURES

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

DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope.

It is intended for wideband amplifier applications.

NPN complement is the BFG97.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

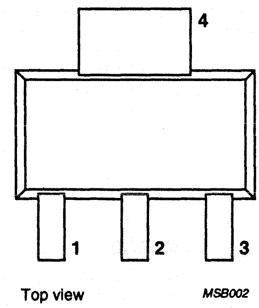


Fig.1 SOT223.

QUICK REFERENCE DATA

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

LIMITING VALUES

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

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

Note

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Notes

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

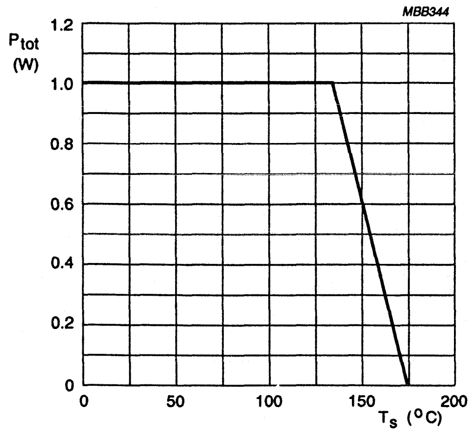
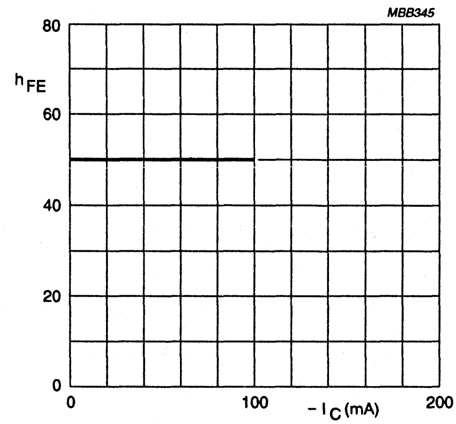
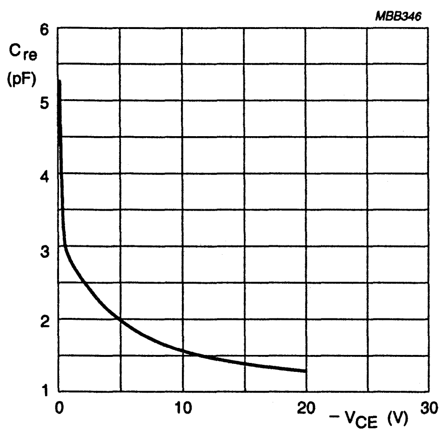


Fig.2 Power derating curve.



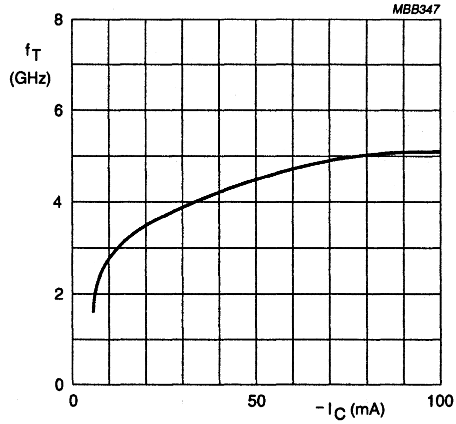
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

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



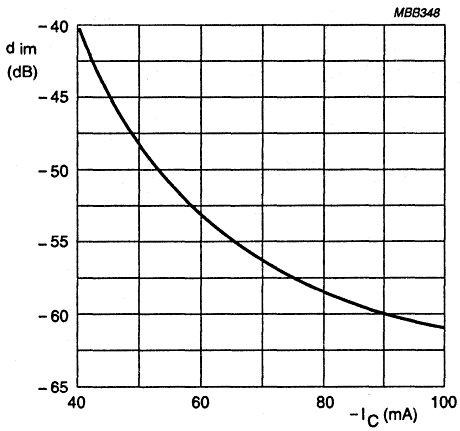
f = 1 MHz; $T_{amb} = 25$ °C.

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



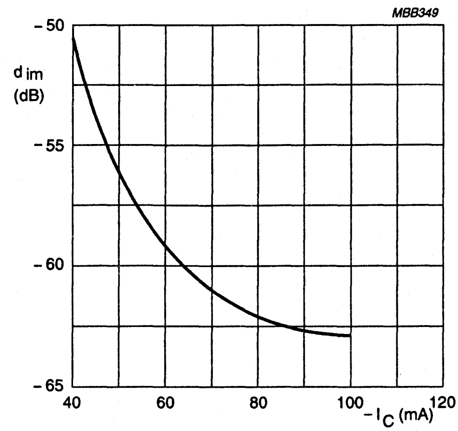
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

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



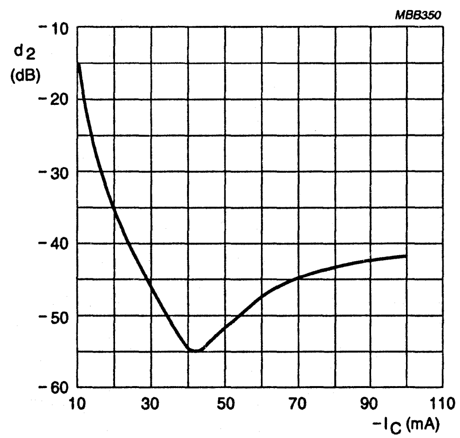
$V_{CE} = -10$ V; $V_O = 650$ mV; $T_{amb} = 25$ °C;
$f_{(p+q-r)} = 443.25$ MHz.

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



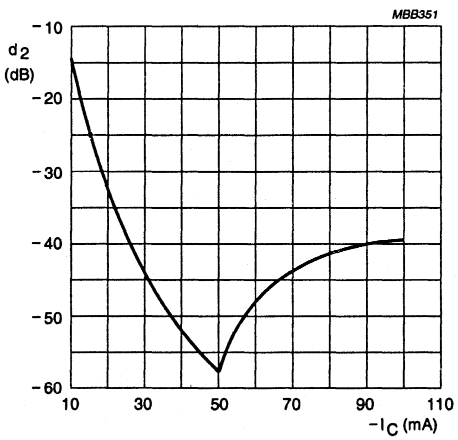
$V_{CE} = -10$ V; $V_O = 550$ mV; $T_{amb} = 25$ °C;
$f_{(p+q-r)} = 848.25$ MHz.

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



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

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



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

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

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

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

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

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

NPN 12 GHz wideband transistor — BFG33; BFG33/X

FEATURES

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

DESCRIPTION

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

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

PINNING

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

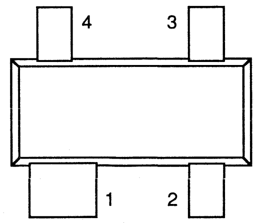


Fig.1 SOT143.

QUICK REFERENCE DATA

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

Note

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

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Note

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

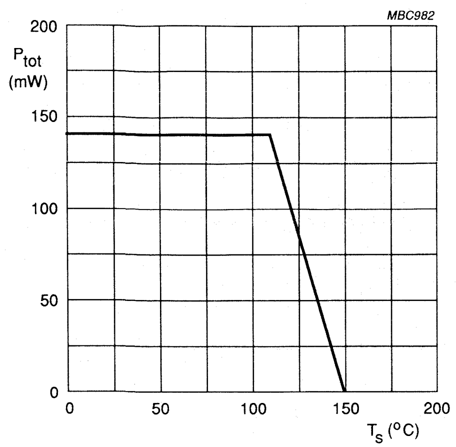
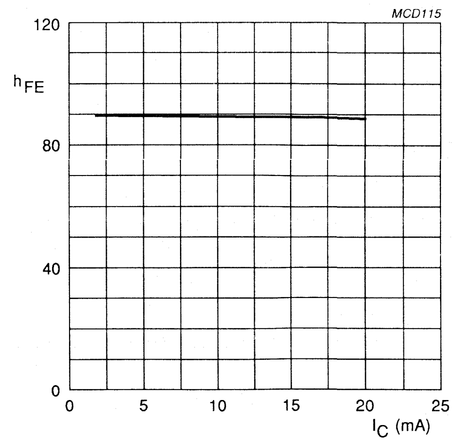
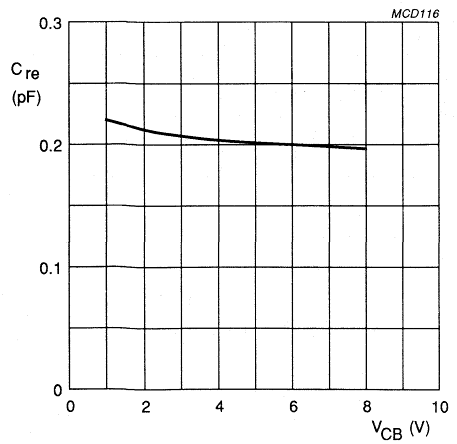


Fig.2 Power derating curve.



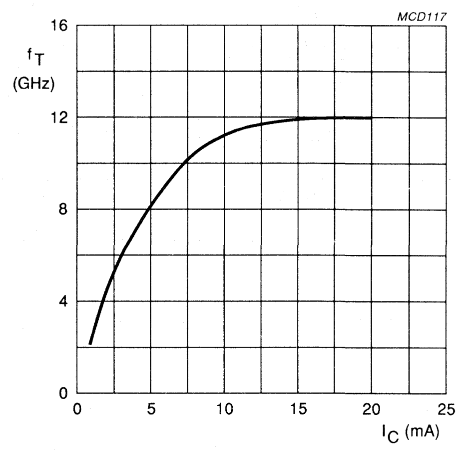
V_{CE} = 5 V.

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



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

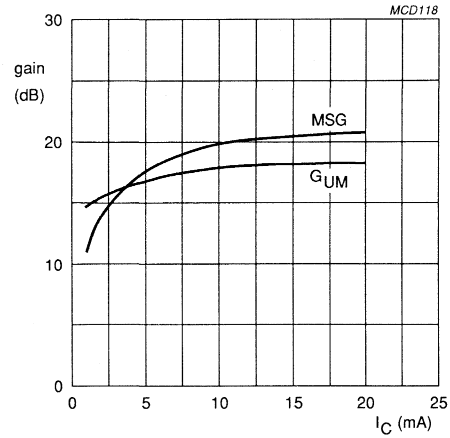
Fig.4 Feedback capacitance as a function of collector-base voltage.



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

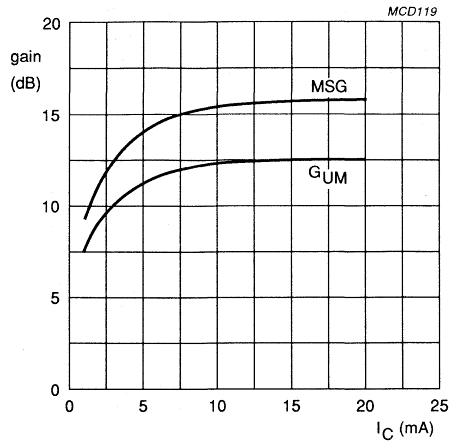
Fig.5 Transition frequency as a function of collector current.

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



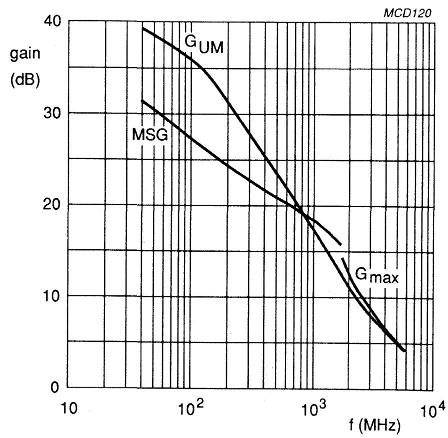
V_{CE} = 5 V; f = 1 GHz.

Fig.6 Gain as a function of collector current.



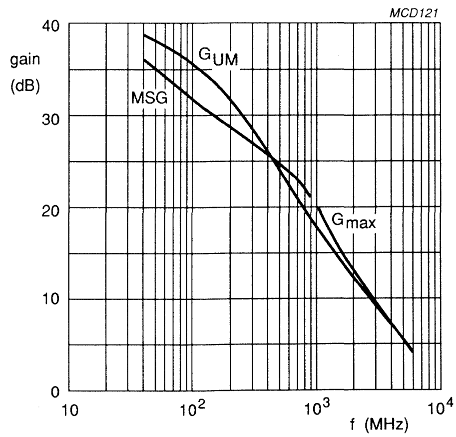
V_{CE} = 5 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



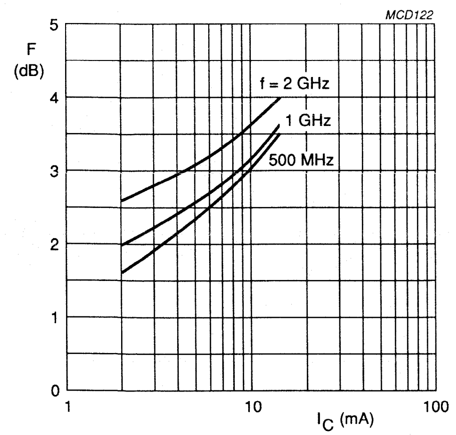
V_{CE} = 5 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



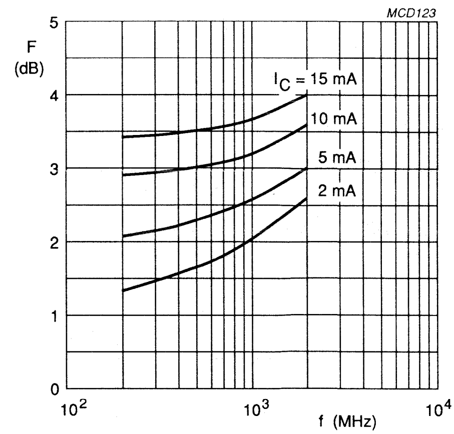
V_{CE} = 5 V; I_C = 15 mA.

Fig.9 Gain as a function of frequency.



V_{CE} = 5 V.

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



V_{CE} = 5 V.

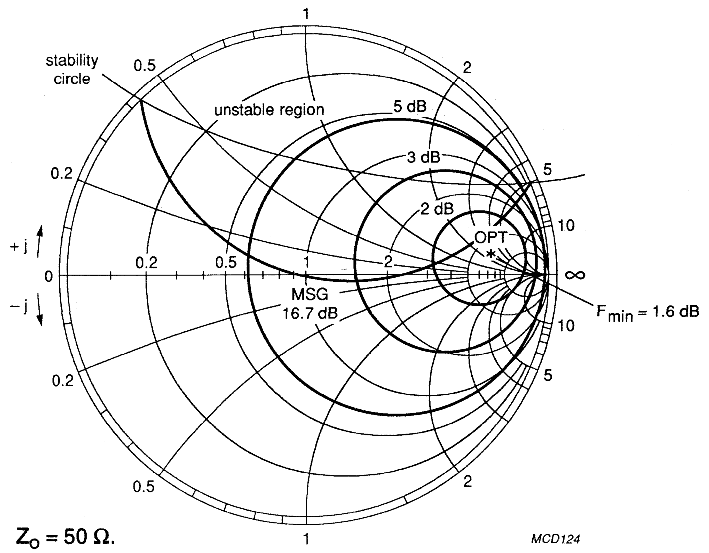
Fig.11 Minimum noise figure as a function of frequency.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
500	5	2

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
1.6	0.774	6.2	1.254



Z_O = 50 Ω.
Maximum stable gain = 16.7 dB.

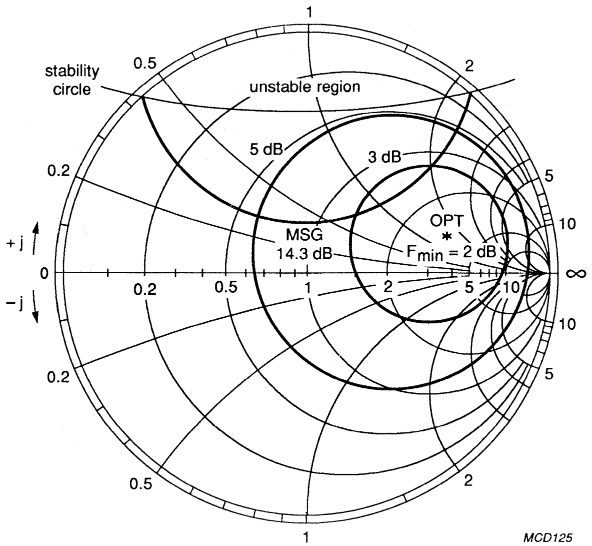
Fig.12 Noise circle figure.

BFG33/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	5	2

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.627	13.6	1.458



$Z_O = 50\ \Omega$.

Maximum stable gain = 14.3 dB.

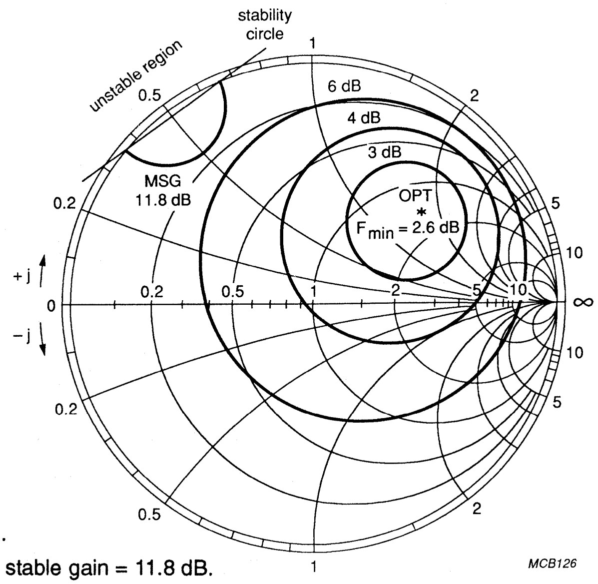
Fig.13 Noise circle figure.

BFG33/X

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

Noise Parameters

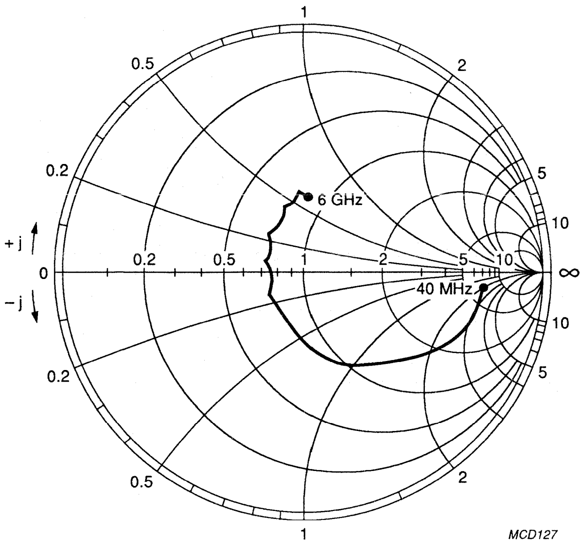
F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.6	0.58	40.2	1.064



$Z_O = 50\ \Omega$.

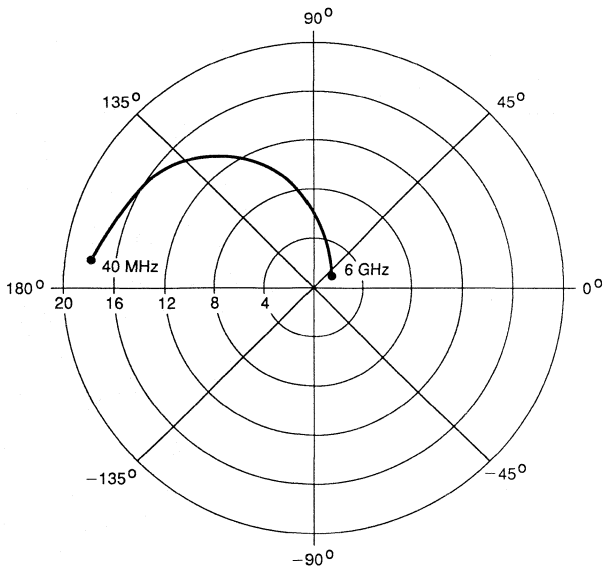
Maximum stable gain = 11.8 dB.

Fig.14 Noise circle figure.



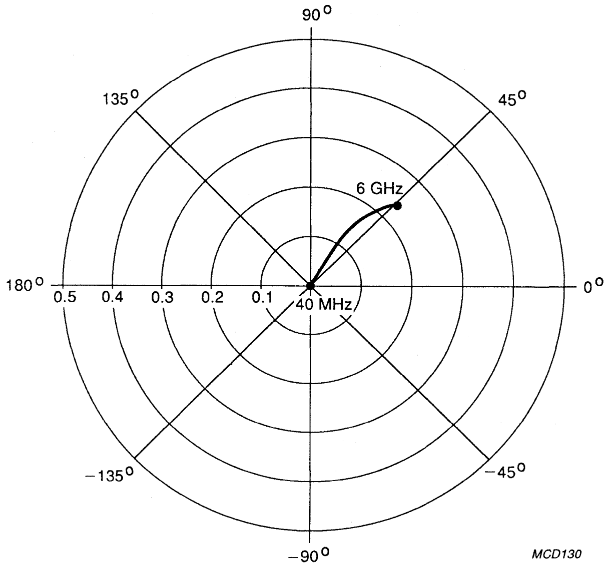
V_{CE} = 5 V; I_C = 15 mA.

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



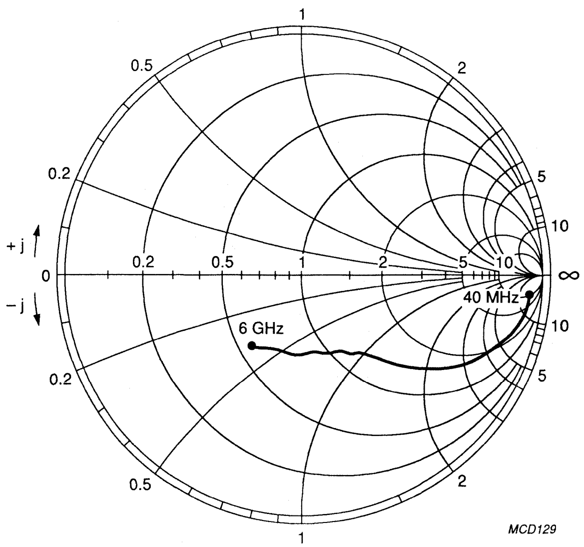
V_{CE} = 5 V; I_C = 15 mA.

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



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

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



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

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

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}		S_{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	−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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.908	−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)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
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} (RAT)	Γ_{opt} (DEG)	R_n
500	3.1	0.528	5.3	1.18
1000	3.1	0.477	12.7	1.33
2000	3.6	0.418	39.1	0.98

Table 7 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 15 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.760	−6.2	18.053	171.9	0.005	81.2	0.948	−5.3	38.9
100	0.740	−15.2	17.102	162.0	0.011	77.5	0.916	−13.4	36.0
200	0.657	−30.0	16.185	147.4	0.021	70.4	0.821	−24.2	31.5
300	0.563	−44.3	14.989	135.7	0.028	66.2	0.724	−31.4	28.4
400	0.472	−57.3	13.618	126.0	0.034	63.7	0.647	−36.3	26.1
500	0.400	−68.0	12.164	118.5	0.039	62.6	0.587	−39.7	24.3
600	0.340	−77.8	10.943	112.4	0.044	62.4	0.541	−41.8	22.8
700	0.294	−85.4	9.810	107.5	0.048	62.4	0.509	−43.3	21.5
800	0.258	−91.9	8.829	103.4	0.053	62.6	0.483	−44.3	20.4
900	0.228	−98.1	7.983	100.0	0.057	62.8	0.464	−44.9	19.3
1000	0.203	−104.8	7.279	97.1	0.062	62.9	0.447	−45.7	18.4
1200	0.170	−120.1	6.203	92.0	0.070	63.0	0.419	−47.4	16.8
1400	0.157	−134.6	5.444	87.6	0.079	62.7	0.401	−49.7	15.6
1600	0.149	−144.1	4.812	83.8	0.088	62.5	0.394	−51.9	14.5
1800	0.133	−153.6	4.313	80.8	0.097	62.3	0.389	−53.4	13.5
2000	0.119	−168.7	3.900	77.6	0.105	61.8	0.378	−54.4	12.6
2200	0.125	172.8	3.580	74.7	0.112	61.0	0.360	−56.3	11.8
2400	0.146	162.2	3.305	71.3	0.120	60.1	0.344	−60.2	11.0
2600	0.161	157.6	3.056	68.9	0.128	59.3	0.339	−65.2	10.3
2800	0.163	152.5	2.894	66.2	0.136	58.2	0.346	−69.2	9.9
3000	0.166	144.3	2.703	63.5	0.143	57.7	0.350	−71.1	9.3
3250	0.187	134.2	2.517	60.5	0.152	56.9	0.340	−72.9	8.7

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
3500	0.210	130.0	2.348	57.6	0.160	55.8	0.322	−77.7	8.1
3750	0.215	126.2	2.239	54.3	0.168	54.8	0.320	−84.7	7.7
4000	0.222	118.1	2.086	51.4	0.176	53.8	0.332	−89.6	7.1
4250	0.248	111.1	2.006	49.1	0.184	52.6	0.337	−92.2	6.8
4500	0.273	109.5	1.889	45.7	0.191	51.8	0.327	−95.8	6.4
4750	0.274	107.9	1.813	43.3	0.198	51.0	0.321	−102.3	6.0
5000	0.270	101.3	1.742	40.7	0.204	49.2	0.333	−108.7	5.7
5250	0.292	93.7	1.684	37.9	0.210	48.7	0.350	−112.8	5.5
5500	0.323	91.4	1.576	35.9	0.220	46.8	0.356	−115.9	5.0
5750	0.329	91.2	1.533	33.4	0.222	47.2	0.356	−120.4	4.8
6000	0.318	87.2	1.466	30.0	0.231	45.0	0.369	−126.1	4.4

Table 8 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	3.6	0.463	5.5	1.180
1000	3.6	0.420	13.2	1.34
2000	4.0	0.350	39.2	0.984

NPN 4 GHz wideband transistor BFG35

DESCRIPTION

NPN planar epitaxial transistor mounted in a plastic SOT223 envelope, intended for wideband amplifier applications. It features high output voltage capabilities.

PNP complement is the BFG55.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

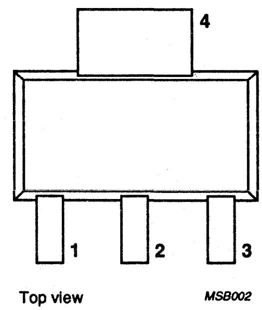


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	18	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	I_C = 100 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	–	750	–	mV

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; V_{CB} = 10 V	–	–	1	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	70	–	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; V_{EB} = 0.5 V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	$I_C = 0$; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	800	–	mV
d_2	second order intermodulation distortion	note 4	–	–55	–	dB
		note 5	–	–57	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
4. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 450 MHz.
5. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

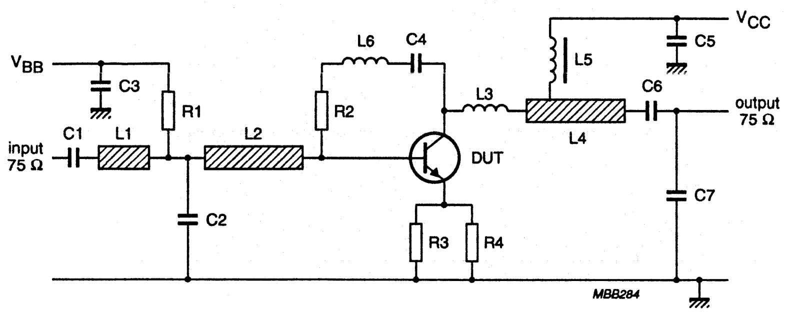


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C5, C6	multilayer ceramic capacitor	10 nF		2222 590 08627
C2, C7	multilayer ceramic capacitor	1 pF		2222 851 12108
C4 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1	microstripline	75 Ω	length 7 mm; width 2.5 mm	
L2	microstripline	75 Ω	length 22mm; width 2.5 mm	
L3 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L5	Ferroxcube choke	5 μH		3122 108 20153
L6 (note 1)	0.4 mm copper wire	≈25 nH	length 30 mm	
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	200 Ω		2322 180 73201
R3, R4	metal film resistor	27 Ω		2322 180 73279

Notes

The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 1⁄32 inch.

1. Components C4, L3, L6 and R2 are mounted on the underside of the PCB.

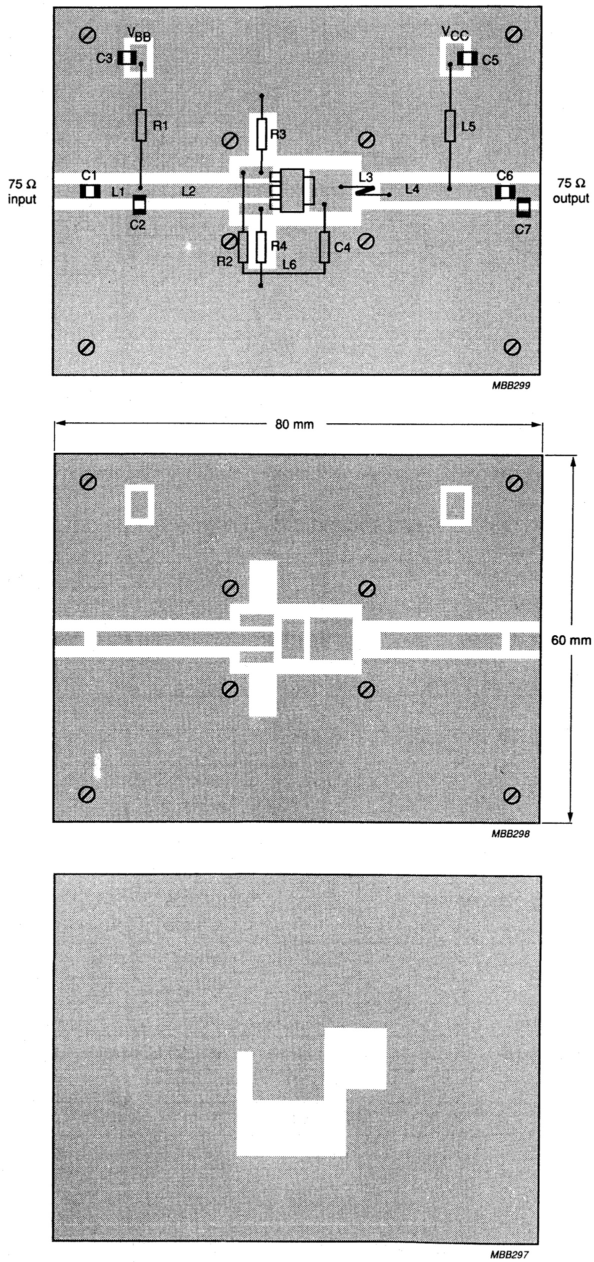


Fig.3 Intermodulation test circuit printed circuit board.

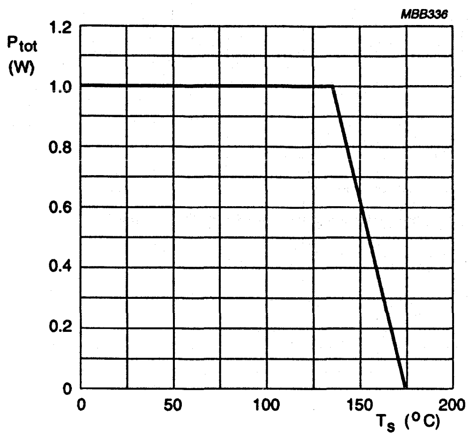
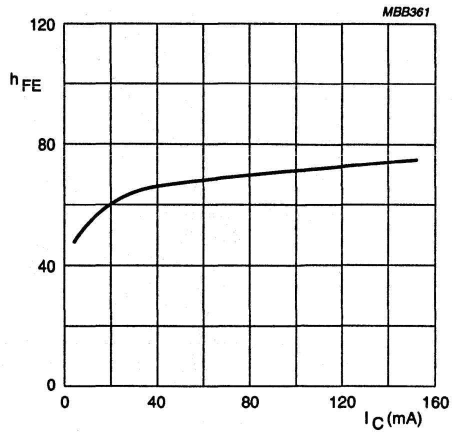
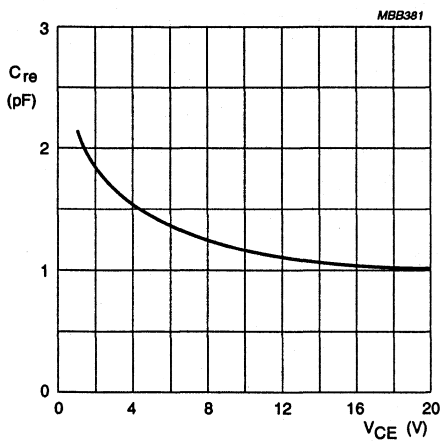


Fig.4 Power derating curve.



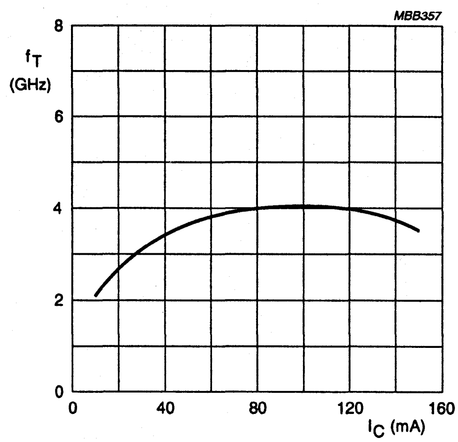
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



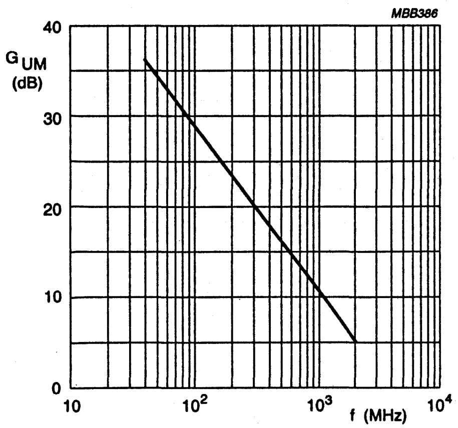
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



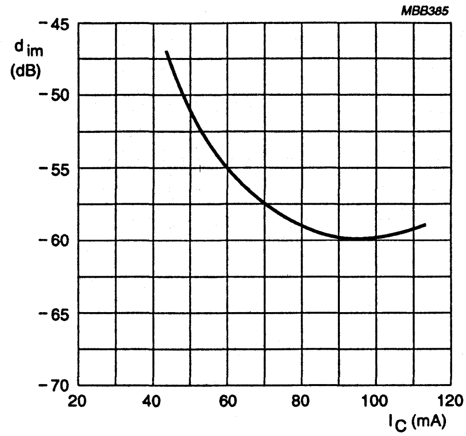
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C

Fig.7 Transition frequency as a function of collector current.



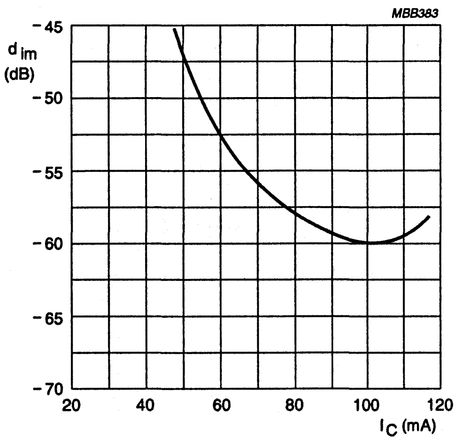
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



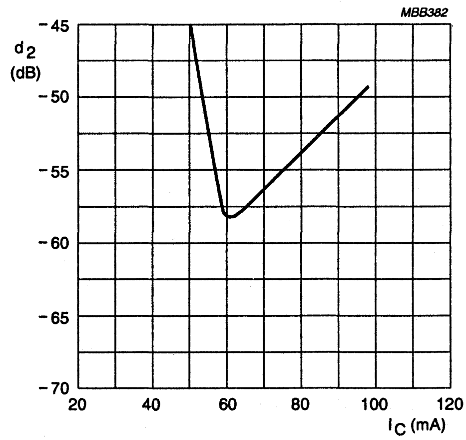
V_{CE} = 10 V; V_O = 800 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

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



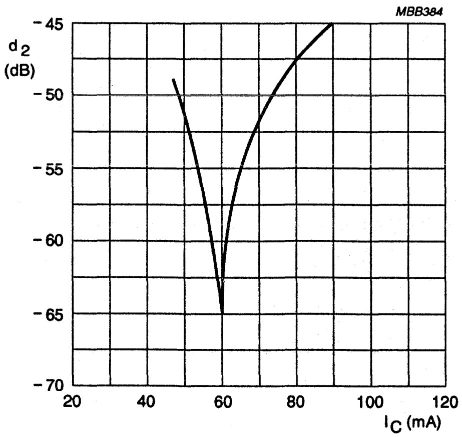
V_{CE} = 10 V; V_O = 750 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.10 Intermodulation distortion as a function of collector current.



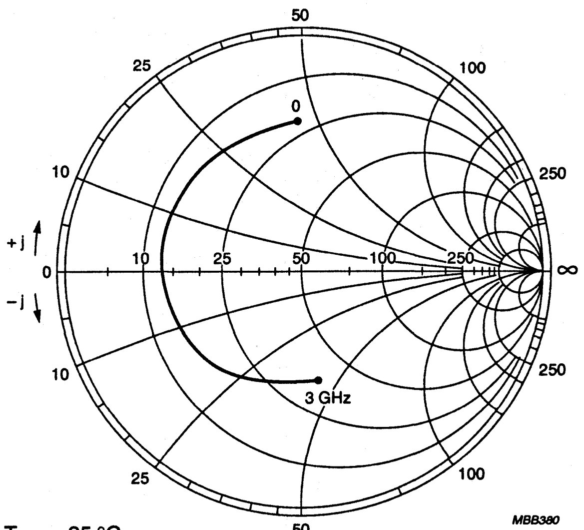
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

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



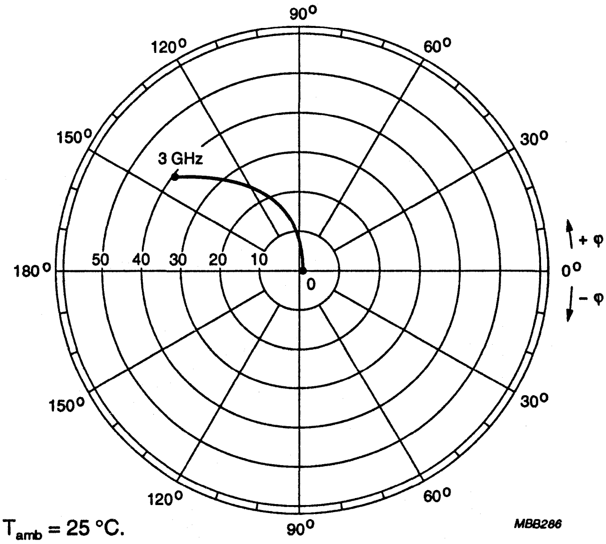
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.12 Second order intermodulation distortion as a function of collector current.



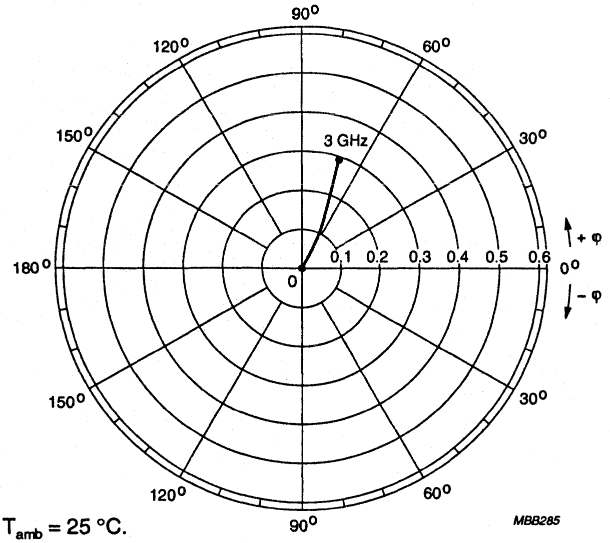
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



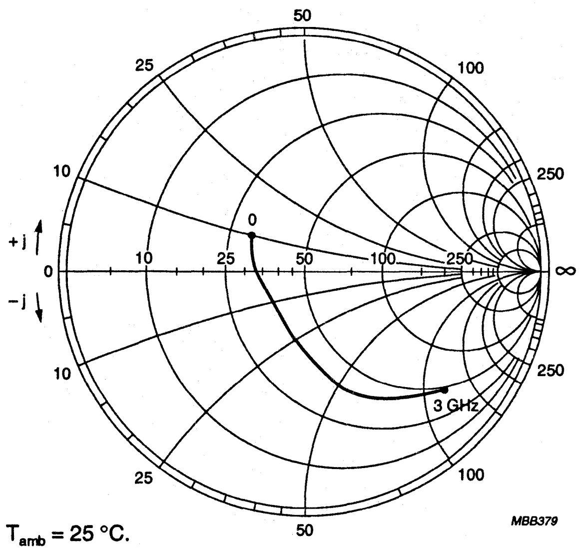
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



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

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



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

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

Table 1 Common emitter scattering parameters, $I_C = 20$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.537	−61.9	23.791	150.4	0.0230	69.3	0.874	−26.6	35.3
100	0.585	−115.	16.161	122.5	0.0380	51.2	0.610	−50.0	28.0
200	0.626	−148.	9.600	102.5	0.0490	44.5	0.384	−64.9	22.5
300	0.625	−163.	6.598	92.0	0.0560	47.1	0.292	−71.5	18.9
400	0.641	−172.	5.032	85.1	0.0640	50.2	0.249	−76.9	16.6
500	0.645	−180.	4.092	79.0	0.0730	55.2	0.228	−82.8	14.8
600	0.642	175.2	3.457	73.1	0.0810	58.3	0.217	−88.4	13.3
700	0.646	170.6	3.017	68.3	0.0910	60.5	0.213	−94.6	12.1
800	0.650	165.3	2.634	63.5	0.102	62.6	0.210	−101.	11.0
900	0.658	161.3	2.391	60.4	0.113	63.7	0.209	−108.	10.2
1000	0.668	157.4	2.156	55.5	0.126	65.7	0.214	−115.	9.44
1200	0.680	149.5	1.824	48.0	0.153	66.2	0.230	−131.	8.15
1400	0.713	143.7	1.567	40.0	0.178	66.0	0.263	−146.	7.30
1600	0.720	137.0	1.359	33.6	0.208	65.4	0.300	−159.	6.25
1800	0.746	130.9	1.253	27.2	0.245	61.4	0.333	−171.	6.00
2000	0.755	122.8	1.124	21.9	0.275	59.1	0.372	176.1	5.33
2200	0.782	116.9	1.028	14.4	0.301	55.9	0.424	164.1	5.21
2400	0.798	112.3	0.883	12.9	0.323	53.7	0.473	154.2	4.42
2600	0.811	107.8	0.838	8.30	0.360	48.6	0.508	143.9	4.42
2800	0.783	98.9	0.755	1.60	0.375	42.2	0.532	133.1	3.13
3000	0.804	91.4	0.727	−0.200	0.396	39.6	0.568	122.5	3.44

Table 2 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.494	−70.4	30.261	147.2	0.0210	68.5	0.836	−34.0	36.0
100	0.548	−123.	19.381	119.3	0.0350	50.9	0.549	−63.3	28.9
200	0.598	−153.	11.140	101.0	0.0470	49.9	0.328	−86.1	23.4
300	0.597	−167.	7.647	91.4	0.0570	53.7	0.241	−99.1	19.8
400	0.605	−174.	5.805	85.2	0.0670	55.3	0.201	−110.	17.4
500	0.617	178.9	4.716	79.7	0.0780	59.8	0.181	−119.	15.7
600	0.610	174.6	3.971	74.3	0.0880	61.0	0.171	−127.	14.1
700	0.606	169.6	3.471	69.9	0.101	62.5	0.167	−134.	12.9
800	0.625	164.6	3.024	65.6	0.114	62.7	0.166	−140.	11.9
900	0.624	160.3	2.742	62.6	0.126	63.1	0.167	−147.	11.0
1000	0.630	157.0	2.483	58.1	0.139	63.9	0.173	−154.	10.2
1200	0.648	149.5	2.116	51.3	0.165	62.8	0.193	−167.	9.04
1400	0.685	142.6	1.784	43.9	0.190	61.9	0.223	−176.	8.00
1600	0.686	137.4	1.587	37.9	0.216	60.4	0.256	175.9	7.07
1800	0.709	131.3	1.461	31.6	0.247	56.7	0.284	167.0	6.69
2000	0.722	124.1	1.312	26.4	0.275	54.8	0.318	157.5	6.02
2200	0.749	118.0	1.213	18.7	0.296	51.7	0.366	149.3	5.88
2400	0.767	112.1	1.062	16.7	0.314	50.5	0.410	142.2	5.18
2600	0.779	108.9	1.012	11.8	0.347	45.8	0.440	134.2	5.09
2800	0.780	101.6	0.918	4.40	0.360	40.0	0.464	125.3	4.38
3000	0.774	93.0	0.874	1.10	0.379	38.0	0.502	116.4	4.06

Table 3 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.496	−72.9	31.926	145.8	0.021	64.6	0.823	−36.4	36.2
100	0.556	−124.3	20.080	118.8	0.035	50.7	0.530	−67.6	29.1
200	0.590	−154.4	11.397	100.7	0.046	50.0	0.317	−92.9	23.5
300	0.601	−167.3	7.828	91.4	0.056	53.8	0.237	−109.0	20.1
400	0.609	−175.4	5.952	85.0	0.067	57.1	0.201	−121.4	17.7
500	0.612	178.7	4.814	79.6	0.078	59.5	0.185	−131.3	15.8
600	0.616	173.9	4.048	74.8	0.090	61.0	0.177	−139.4	14.4
700	0.617	169.4	3.507	70.4	0.102	62.0	0.174	−146.6	13.1
800	0.619	165.1	3.093	66.4	0.115	62.5	0.173	−153.4	12.0
900	0.625	161.0	2.767	62.7	0.127	63.1	0.176	−160.0	11.1
1000	0.633	157.0	2.522	59.2	0.140	63.0	0.181	−166.5	10.4
1200	0.652	150.1	2.129	52.3	0.166	62.2	0.203	−177.9	9.2
1400	0.671	144.3	1.834	45.1	0.188	60.5	0.234	173.7	8.1
1600	0.680	138.4	1.623	38.7	0.216	59.7	0.264	166.8	7.2
1800	0.692	131.6	1.479	32.0	0.244	55.6	0.292	159.2	6.6
2000	0.716	124.7	1.355	26.6	0.268	53.8	0.325	151.1	6.2
2200	0.748	119.2	1.235	21.0	0.289	50.7	0.367	143.8	6.0
2400	0.771	114.9	1.113	17.8	0.303	49.7	0.405	137.6	5.6
2600	0.770	109.8	1.044	12.1	0.335	45.1	0.433	130.5	5.2
2800	0.767	103.0	0.936	6.6	0.345	39.6	0.451	122.1	4.3
3000	0.788	95.9	0.895	2.7	0.363	37.7	0.479	113.6	4.4

NPN 4 GHz wideband transistor BFG35

Table 4 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.517	−73.1	33.002	145.4	0.0210	65.2	0.809	−38.2	36.3
100	0.548	−124.	20.327	117.2	0.0350	51.3	0.511	−70.2	29.0
200	0.579	−155.	11.501	100.6	0.0460	51.2	0.307	−95.9	23.4
300	0.599	−168.	7.894	90.4	0.0570	54.3	0.233	−112.	20.1
400	0.600	−176.	5.972	84.6	0.0690	58.2	0.199	−124.	17.6
500	0.601	177.0	4.868	79.2	0.0810	60.5	0.184	−134.	15.8
600	0.607	172.9	4.080	74.5	0.0940	61.4	0.175	−143.	14.3
700	0.603	168.3	3.534	69.6	0.105	62.3	0.172	−150.	13.1
800	0.608	163.9	3.106	66.1	0.120	63.0	0.173	−157.	12.0
900	0.611	159.8	2.753	62.4	0.132	63.2	0.175	−164.	11.0
1000	0.622	155.1	2.511	58.8	0.146	62.8	0.184	−170.	10.3
1200	0.642	148.5	2.138	51.7	0.173	61.5	0.204	−179.	9.09
1400	0.677	142.3	1.841	44.1	0.196	59.2	0.231	172.5	8.20
1600	0.675	136.7	1.634	38.7	0.223	58.8	0.257	165.0	7.20
1800	0.677	129.3	1.475	31.3	0.252	54.4	0.283	157.2	6.40
2000	0.714	121.6	1.394	26.4	0.276	52.4	0.315	149.4	6.44
2200	0.748	116.0	1.242	21.1	0.298	49.8	0.354	142.0	6.02
2400	0.773	112.2	1.119	16.9	0.313	48.4	0.394	135.8	5.66
2600	0.758	107.1	1.059	10.9	0.347	43.9	0.426	128.3	5.08
2800	0.751	100.4	0.952	5.00	0.356	38.7	0.447	120.6	4.15
3000	0.786	92.9	0.908	2.20	0.376	37.1	0.479	112.8	4.47

PNP 4 GHz wideband transistor — BFG55

FEATURES

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

DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope. It is intended for wideband amplifier applications.

NPN complement is the BFG35.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

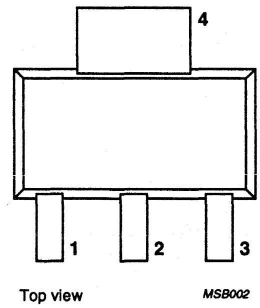


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	–25	V
V_{CEO}	collector-emitter voltage	open base	–	–	–18	V
I_C	DC collector current		–	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = –100 mA; V_{CE} = –10 V; T_{amb} = 25 °C	25	70	–	
f_T	transition frequency	I_C = –100 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –100 mA; V_{CE} = –10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	I_C = –100 mA; V_{CE} = –10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 848.25 MHz; T_{amb} = 25 °C	–	750	–	mV

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–25	V
V_{CEO}	collector-emitter voltage	open base	–	–18	V
V_{EBO}	emitter-base voltage	open collector	–	–2	V
I_C	DC collector current		–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	35 K/W

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = −0.1 mA	−25	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = −10 mA	−18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = −0.1 mA	−3	–	–	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	1	μA
h_{FE}	DC current gain	I_C = −100 mA; V_{CE} = −10 V; T_{amb} = 25 °C	25	70	–	
C_c	collector capacitance	I_C = 0; V_{CB} = −10 V; f = 1 MHz	–	2.3	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = −10 V; f = 1 MHz	–	8	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz; T_{amb} = 25 °C	–	1.5	–	pF
f_T	transition frequency	I_C = −100 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = −100 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = −100 mA; V_{CE} = −10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	800	–	mV

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = −60 dB (DIN 45004B); I_C = −100 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 850.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 858.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 860.25 MHz;
   measured at $f_{(p+q-r)}$ = 848.25 MHz.
3. d_{im} = −60 dB (DIN 45004B); I_C = −100 mA; V_{CE} = −10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.

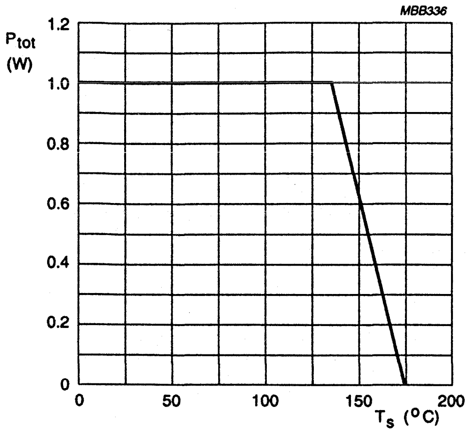
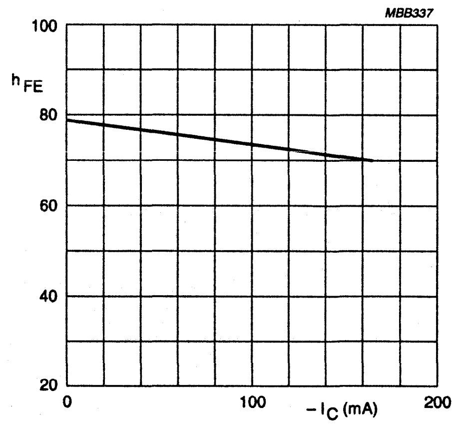
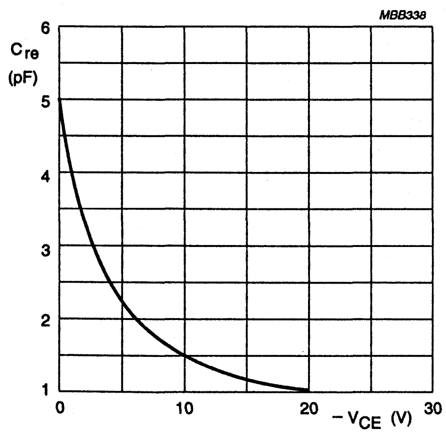


Fig.2 Power derating curve.



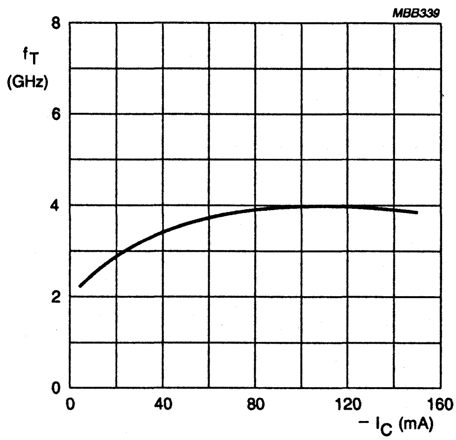
$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

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



f = 1 MHz; $T_{amb} = 25$ °C.

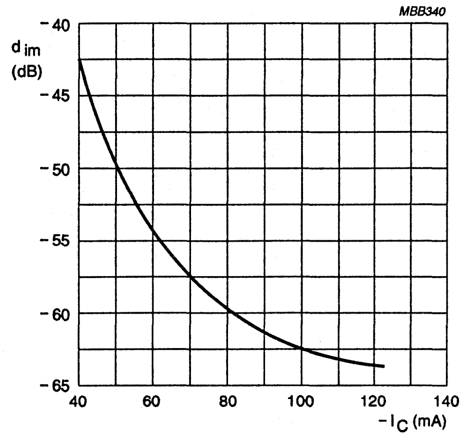
Fig.4 Feedback capacitance as a function of collector-emitter voltage.



$V_{CE} = -10$ V; $T_{amb} = 25$ °C.

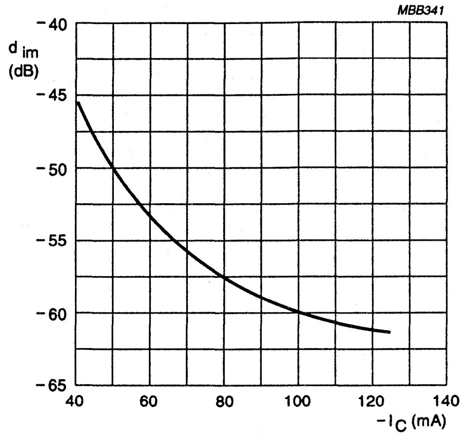
Fig.5 Transition frequency as a function of collector current.

PNP 4 GHz wideband transistor BFG55



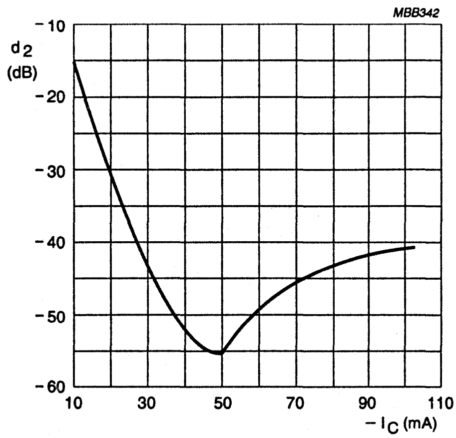
$V_{CE} = -10$ V; $V_O = 650$ mV; $f_{(p+q-r)} = 443.25$ MHz; $T_{amb} = 25$ °C

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



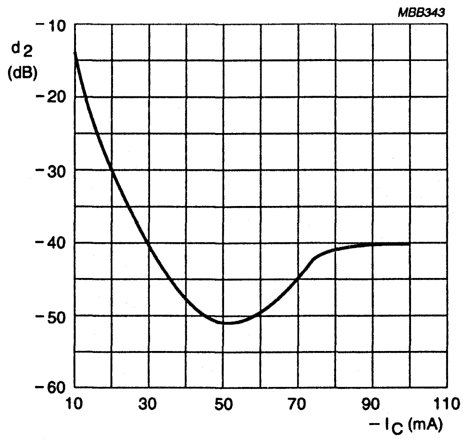
$V_{CE} = -10$ V; $V_O = 600$ mV; $f_{(p+q-r)} = 848.25$ MHz; $T_{amb} = 25$ °C

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



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

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



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

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

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

f (MHz)	S_{11}		S_{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	0.356	−115.4	26.280	144.9	0.020	64.8	0.781	−41.8	33.1
100	0.555	−147.7	16.367	117.6	0.034	53.6	0.516	−79.4	27.2
200	0.628	−166.9	9.224	99.3	0.047	54.0	0.344	−111.5	22.0
300	0.649	−176.1	6.333	89.8	0.060	57.8	0.290	−130.4	18.8
400	0.659	177.7	4.812	82.9	0.073	60.8	0.270	−142.9	16.4
500	0.666	172.7	3.890	77.2	0.086	62.7	0.264	−151.9	14.7
600	0.669	168.2	3.277	72.0	0.100	63.5	0.263	−158.9	13.2
700	0.670	164.2	2.837	67.3	0.115	64.1	0.266	−164.9	12.0
800	0.674	160.1	2.505	62.8	0.129	64.1	0.272	−170.2	10.9
900	0.676	156.3	2.246	59.0	0.143	64.1	0.280	−175.3	10.0
1000	0.684	152.4	2.043	55.3	0.159	63.6	0.291	−138.0	9.3
1200	0.703	145.8	1.730	47.8	0.189	61.8	0.319	172.0	8.2
1400	0.721	139.7	1.487	40.5	0.214	59.4	0.350	165.0	7.2
1600	0.728	133.6	1.318	34.1	0.244	58.0	0.382	158.2	6.4
1800	0.738	126.9	1.203	27.3	0.276	53.2	0.413	151.0	5.8
2000	0.760	120.2	1.099	22.1	0.301	50.6	0.449	143.7	5.6

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

f (MHz)	S_{11}		S_{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	0.384	−114.3	28.507	141.8	0.020	58.1	0.720	−47.5	33.0
100	0.556	−148.7	17.103	115.5	0.034	52.1	0.472	−88.2	27.4
200	0.624	−169.1	9.272	98.4	0.048	55.0	0.332	−122.4	22.0
300	0.655	−177.4	6.447	89.1	0.061	59.4	0.295	−141.2	19.0
400	0.663	176.6	4.782	82.3	0.076	60.7	0.286	−153.4	16.5
500	0.669	172.6	3.953	76.8	0.089	62.7	0.284	−161.3	14.9
600	0.664	169.5	3.293	71.1	0.104	63.3	0.285	−167.9	13.2
700	0.660	163.5	2.854	67.1	0.119	63.5	0.286	−173.4	12.0
800	0.655	160.3	2.493	62.9	0.133	63.5	0.292	−178.6	10.8
900	0.676	155.5	2.254	59.2	0.148	63.0	0.298	176.6	10.1
1000	0.686	151.7	2.056	54.8	0.163	62.5	0.308	172.4	9.5
1200	0.695	144.7	1.760	47.6	0.194	60.7	0.337	164.6	8.3
1400	0.731	137.9	1.499	40.9	0.217	57.7	0.364	158.5	7.5
1600	0.734	133.5	1.349	34.2	0.248	56.5	0.390	152.0	6.7
1800	0.763	126.2	1.219	27.7	0.278	51.5	0.418	145.5	6.3
2000	0.765	119.3	1.136	23.4	0.305	49.3	0.453	138.8	5.9

NPN 8 GHz wideband transistor

BFG67; BFG67/X; BFG67R; BFG67/XR

FEATURES

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

DESCRIPTION

The BFG67 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is available as in-line emitter pinning (BFG67) and cross emitter pinning (BFG67/X). Versions with reverse pinning (BFG67R and BFG67/XR) are available upon request.

This transistor is designed for wideband applications in the GHz range, such as satellite TV tuners and portable RF communications equipment.

PINNING

PIN	DESCRIPTION
BFG67 (Fig.1) Code: V3	
1	collector
2	base
3	emitter
4	emitter
BFG67/X (Fig.1) Code: V12	
1	collector
2	emitter
3	base
4	emitter
BFG67R (Fig.2) Code: V27	
1	collector
2	base
3	emitter
4	emitter
BFG67/XR (Fig.2) Code: V26	
1	collector
2	emitter
3	base
4	emitter

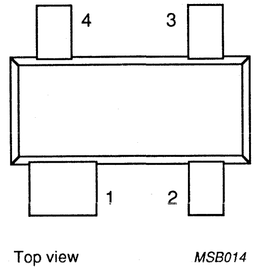


Fig.1 SOT143.

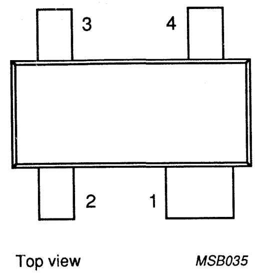


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	2.2	–	dB

Note

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

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 65 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V; f= 500 MHz	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	17	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	3	–	dB

Note

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

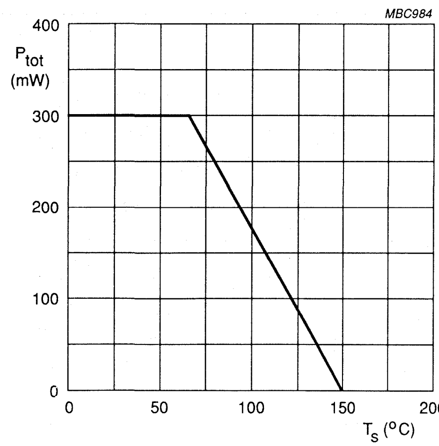
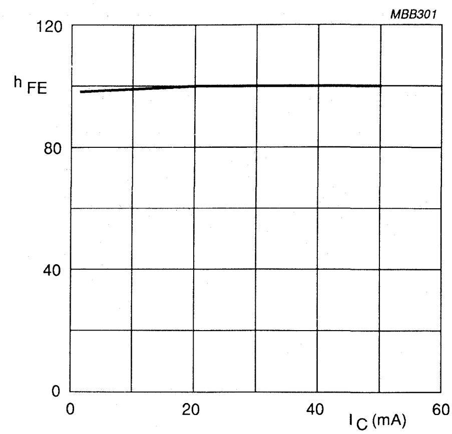
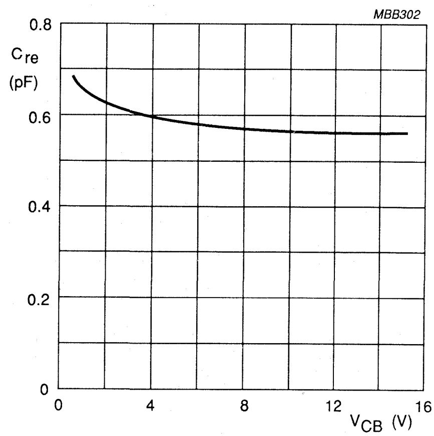


Fig.3 Power derating curve.



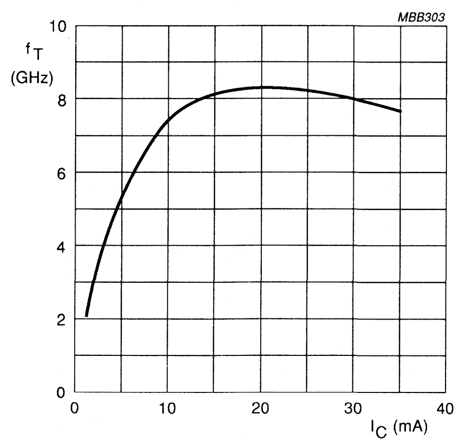
V_{CE} = 5 V.

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



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

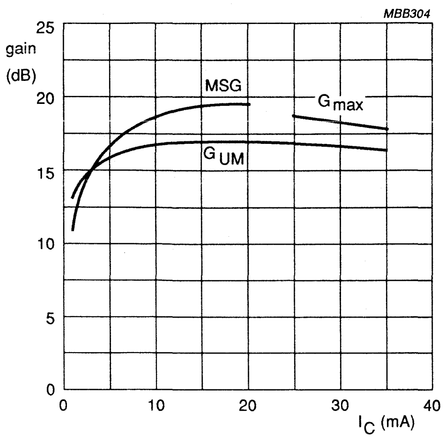
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

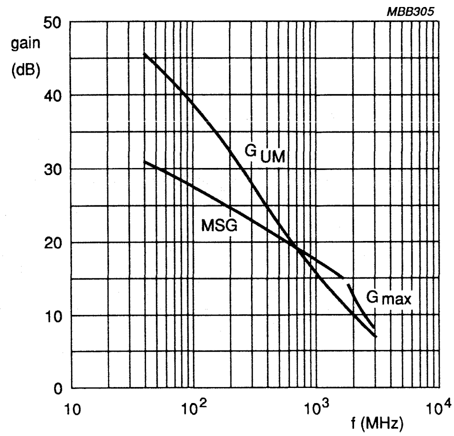
Fig.6 Transition frequency as a function of collector current.

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



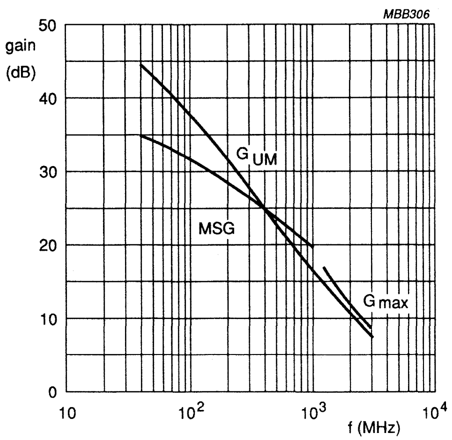
V_{CE} = 8 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



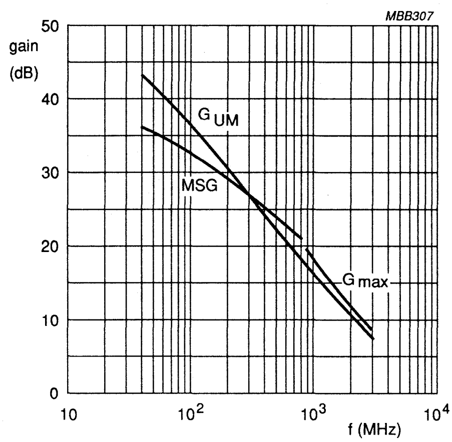
V_{CE} = 8 V; I_C = 5 mA.

Fig.8 Gain as a function of frequency.



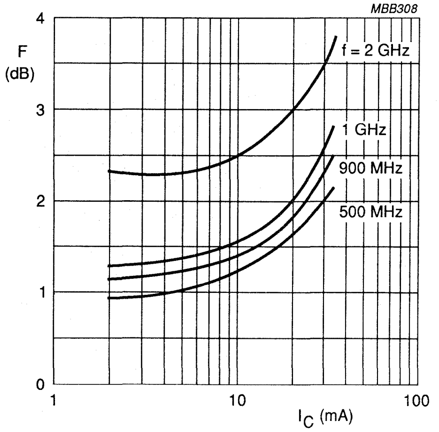
V_{CE} = 8 V; I_C = 15 mA.

Fig.9 Gain as a function of frequency.



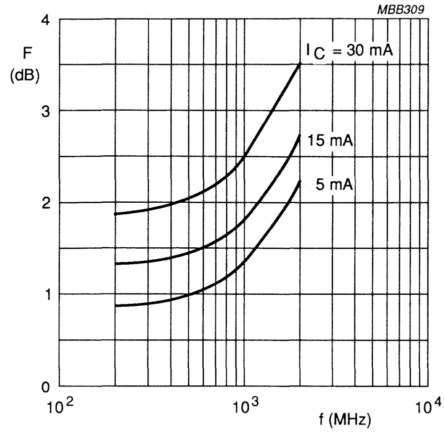
V_{CE} = 8 V; I_C = 30 mA.

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.

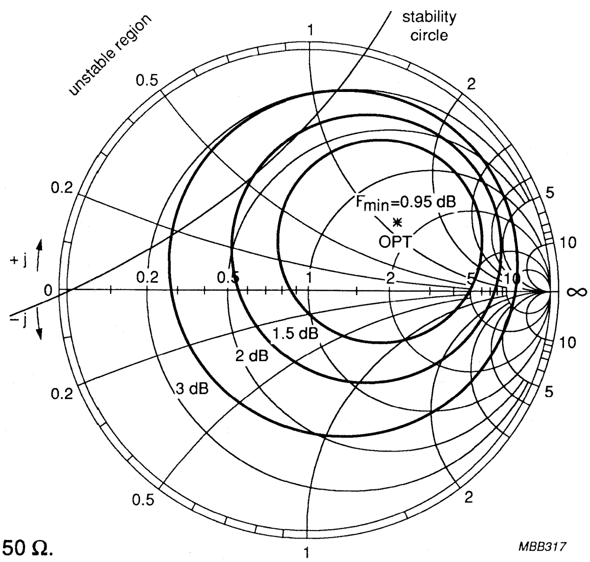
Fig.12 Minimum noise figure as a function of frequency.

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

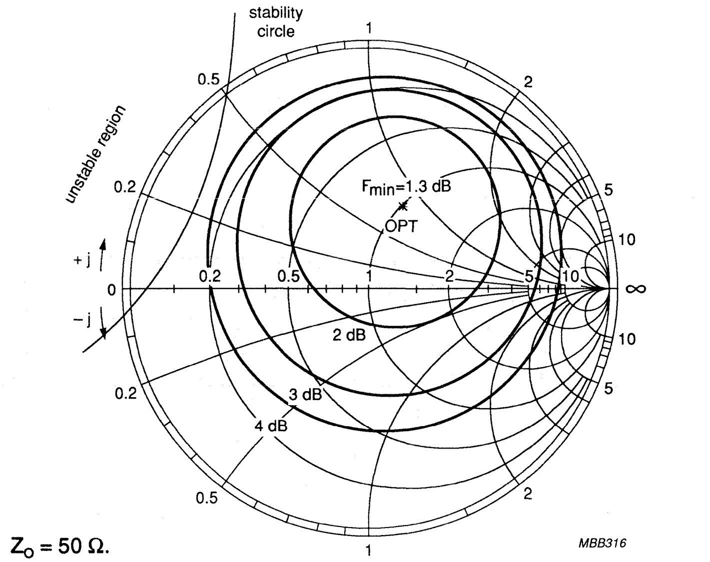


Fig.14 Noise circle figure.

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

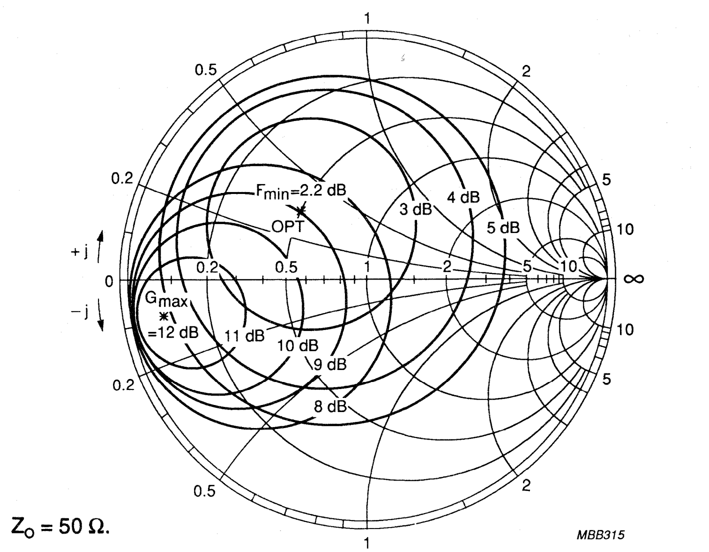
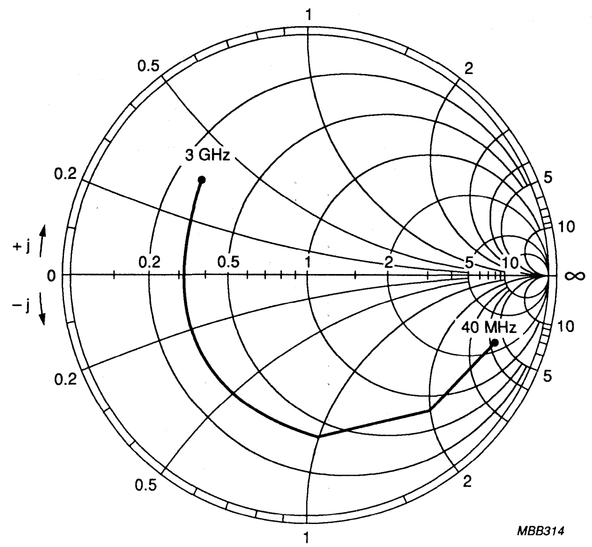
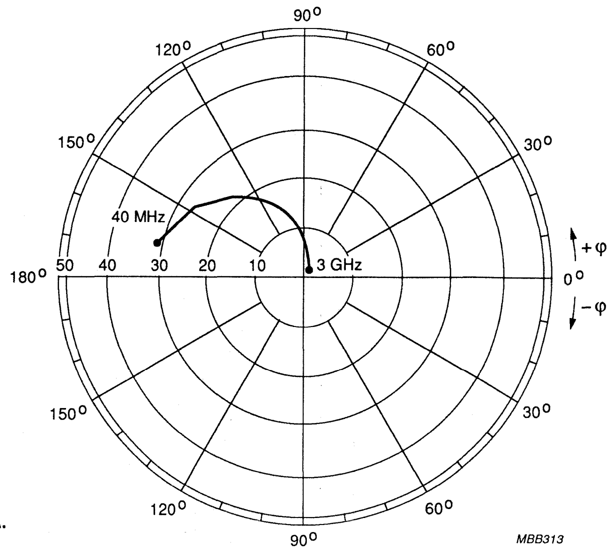


Fig.15 Noise circle figure.



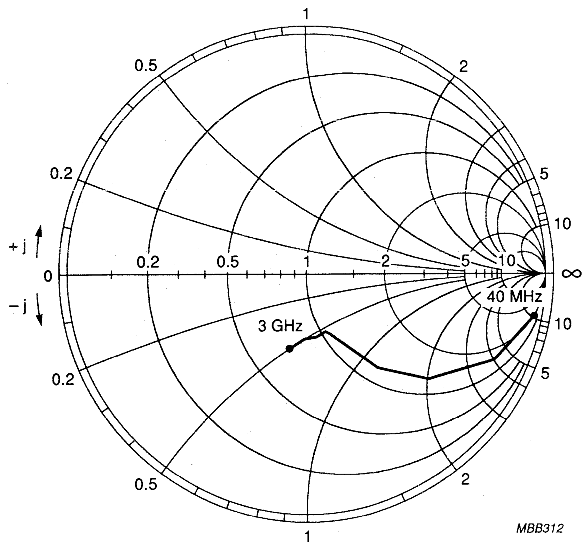
V_{CE} = 8 V; I_C = 15 mA.

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



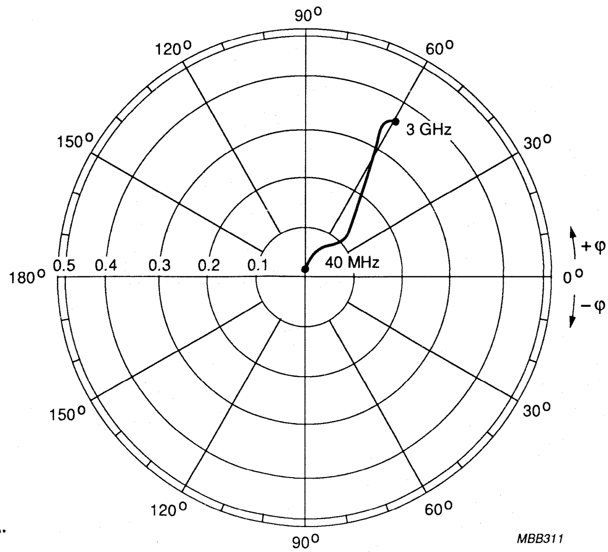
V_{CE} = 8 V; I_C = 15 mA.

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



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

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

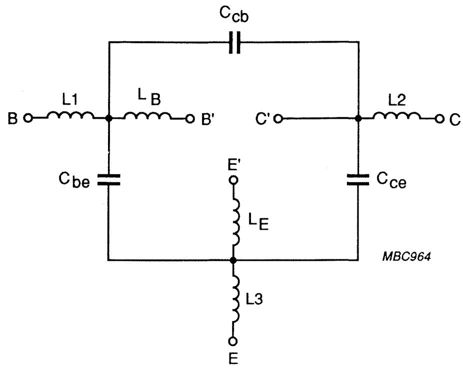


V_{CE} = 8 V; I_C = 15 mA.

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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.726	−28.4	37.780	162.4	0.009	77.7	0.933	−14.2	43.7
100	0.668	−64.5	31.514	142.0	0.020	62.1	0.792	−31.4	36.8
200	0.603	−103.9	22.228	121.5	0.029	50.6	0.575	−46.6	30.6
300	0.576	−127.1	16.475	109.8	0.034	46.8	0.446	−53.4	27.1
400	0.563	−141.7	12.907	102.4	0.038	46.9	0.370	−56.8	24.5
500	0.556	−151.6	10.538	97.1	0.042	47.8	0.324	−58.6	22.5
600	0.555	−158.9	8.904	93.0	0.044	49.3	0.295	−59.8	21.0
700	0.549	−164.7	7.715	89.5	0.048	50.9	0.278	−60.7	19.7
800	0.548	−169.9	6.795	86.3	0.052	52.9	0.266	−61.4	18.5
900	0.547	−174.4	6.065	83.5	0.056	54.2	0.258	−62.0	17.5
1000	0.547	−178.4	5.467	81.0	0.060	55.8	0.251	−62.4	16.6
1200	0.553	174.7	4.574	76.3	0.068	57.5	0.241	−64.4	15.1
1400	0.562	169.4	3.944	71.9	0.076	58.3	0.237	−67.8	13.8
1600	0.567	164.7	3.462	67.6	0.084	59.8	0.241	−71.0	12.7
1800	0.565	160.0	3.095	63.9	0.093	60.2	0.248	−72.8	11.8
2000	0.568	154.8	2.804	60.2	0.101	60.9	0.244	−74.2	10.9
2200	0.581	150.1	2.562	57.0	0.109	61.1	0.237	−78.4	10.2
2400	0.600	146.8	2.343	53.4	0.117	61.3	0.236	−85.1	9.6
2600	0.609	143.9	2.154	50.2	0.126	61.4	0.248	−91.1	9.0
2800	0.612	140.8	2.019	46.5	0.133	60.2	0.264	−95.0	8.5
3000	0.617	136.9	1.888	43.2	0.140	60.6	0.274	−97.7	7.9

Table 6 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	0.908	−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}		R_n
		(RAT)	(DEG)	
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}		S_{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	0.784	−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

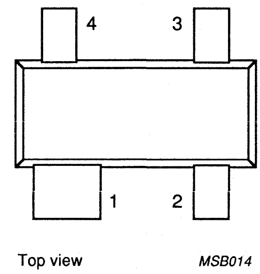


Fig.1 SOT143.

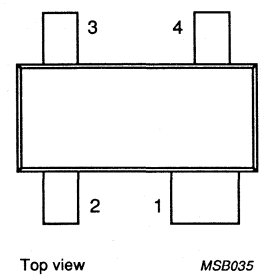


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	25	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 10 V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	17	–	dB
		I_C = 15 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 2 GHz	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; f = 1 GHz	–	2.1	–	dB

Note

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

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	25	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 10$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 10$ V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 500 MHz	3.5	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	17	–	dB
		$I_C = 15$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	2.1	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB

Note

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

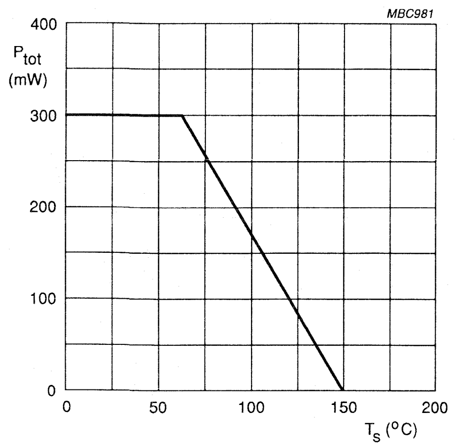
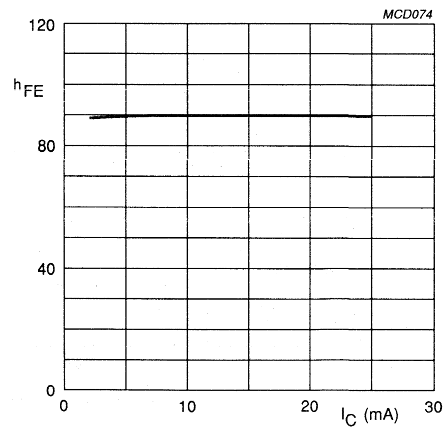
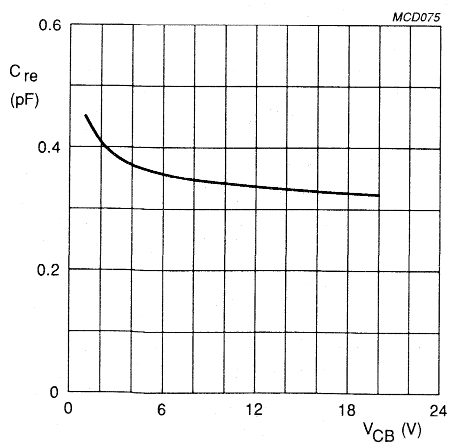


Fig.3 Power derating curve.



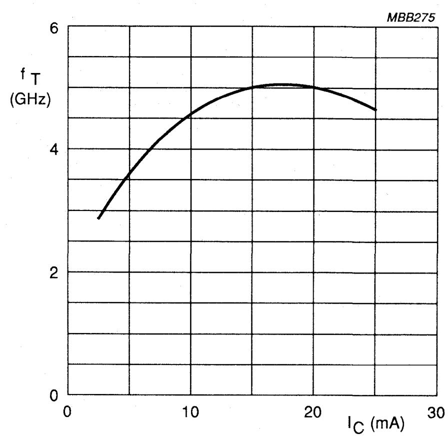
V_{CE} = 10 V.

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



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

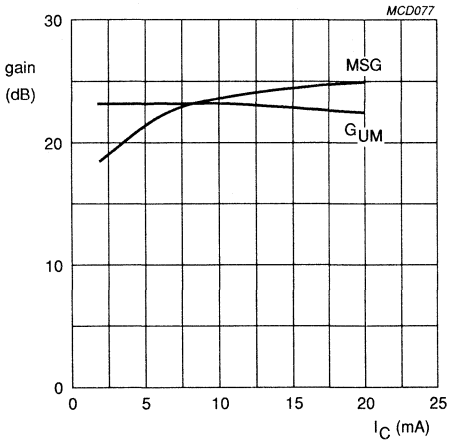
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

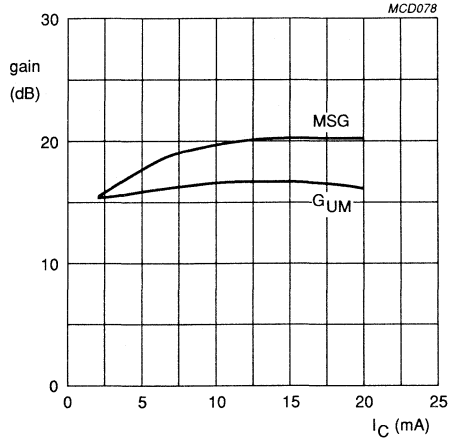
Fig.6 Transition frequency as a function of collector current.

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



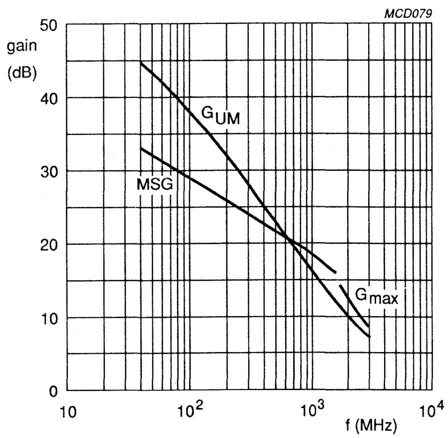
V_{CE} = 10 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



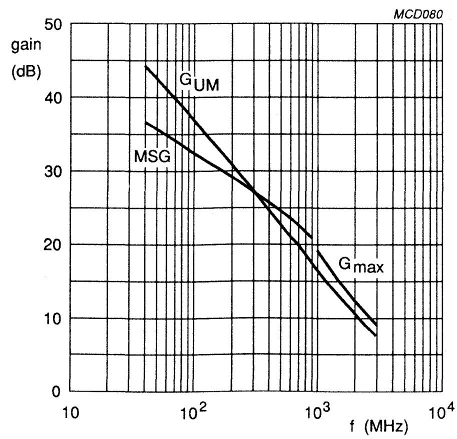
V_{CE} = 10 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



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

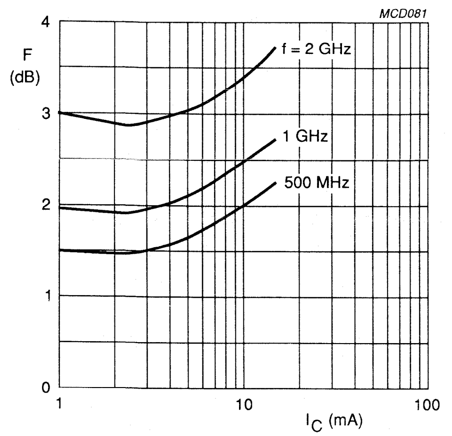
Fig.9 Gain as a function of frequency.



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

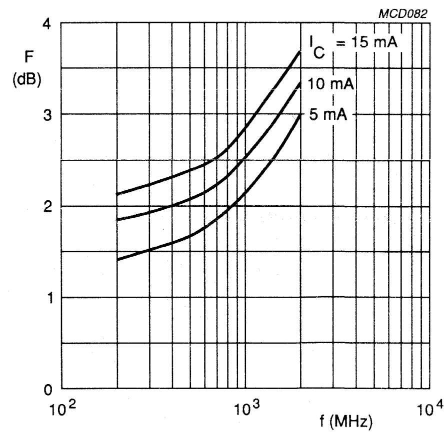
Fig.10 Gain as a function of frequency.

NPN 5 GHz wideband transistors BFG92A; BFG92A/X; BFG92A/XR



V_{CE} = 10 V.

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



V_{CE} = 10 V.

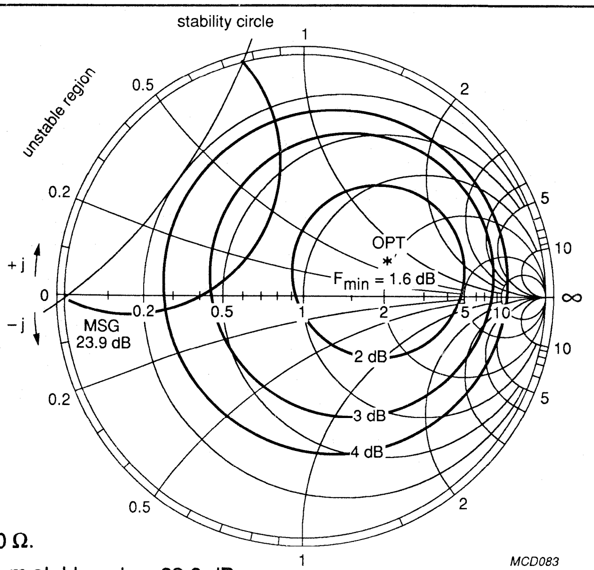
Fig.12 Minimum noise figure as a function of frequency.

BFG92A/X

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

Noise Parameters

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



Z_O = 50 Ω.

Maximum stable gain = 23.9 dB.

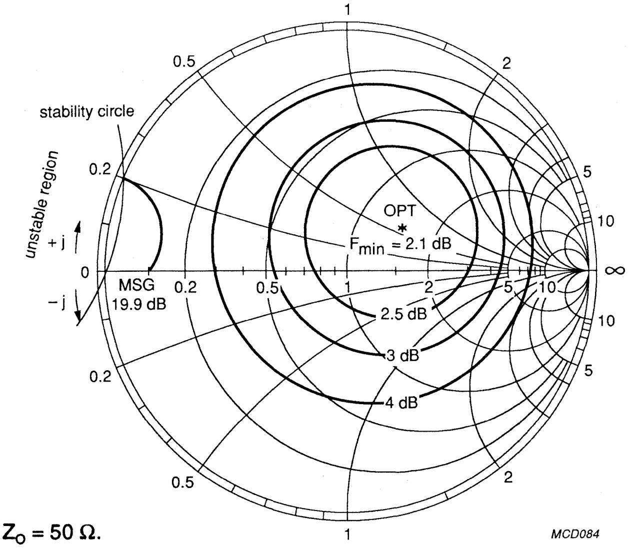
Fig.13 Noise circle figure.

BFG92A/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	10	5

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2.1	0.288	39.9	0.45



Z_O = 50 Ω.

Maximum stable gain = 19.9 dB.

Fig.14 Noise circle figure.

BFG92A/X

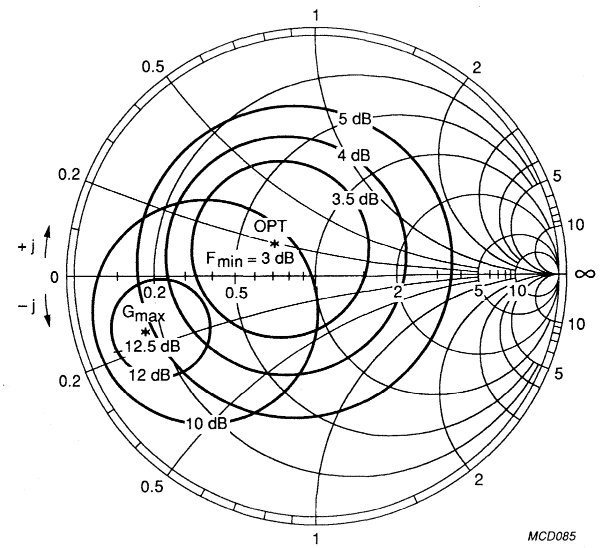
f (MHz)	V_{CE} (V)	I_C (mA)
2000	10	5

Noise Parameters

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

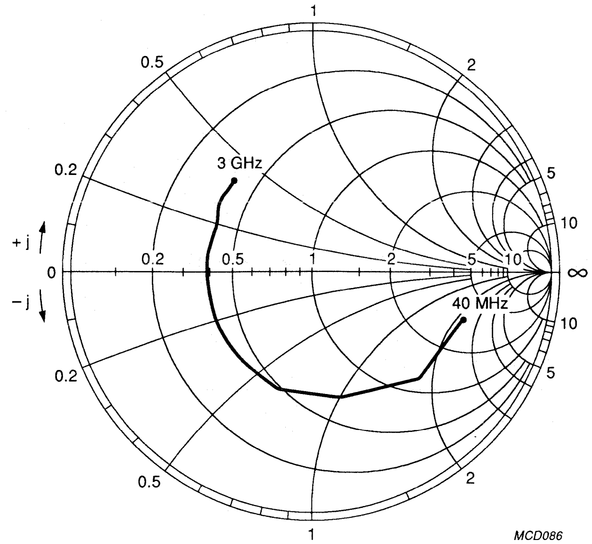
Average Gain Parameters

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



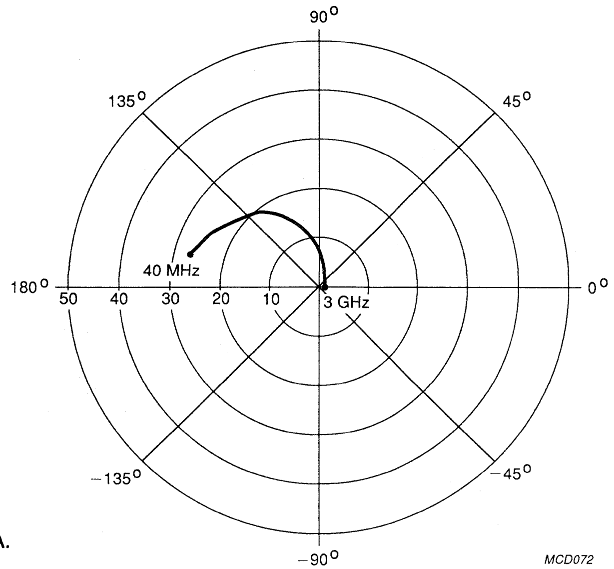
Z_O = 50 Ω.

Fig.15 Noise circle figure.



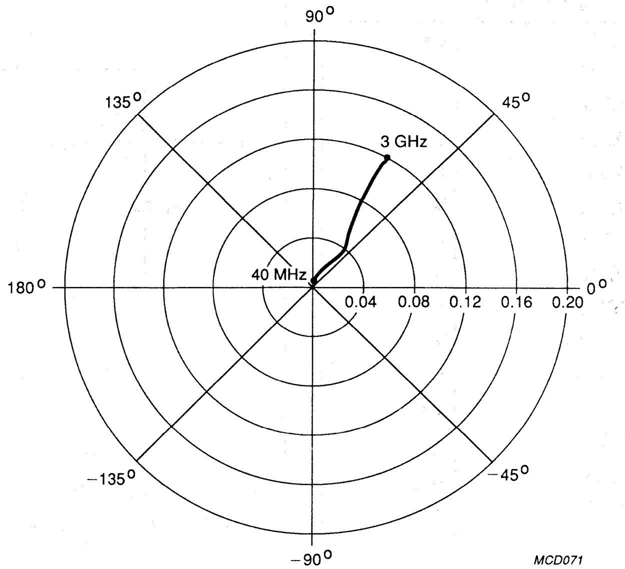
V_{CE} = 10 V; I_C = 15 mA.

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



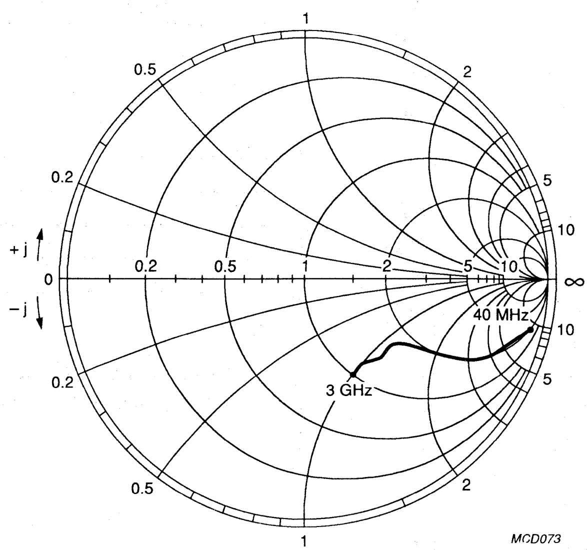
V_{CE} = 10 V; I_C = 15 mA.

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



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

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

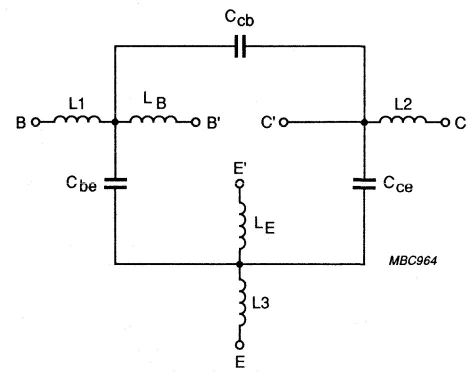


V_{CE} = 10 V; I_C = 15 mA.

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

SPICE parameters for BFR90A crystal

1	IS = 411.8	aA
2	BF = 102.6	–
3	NF = 997.2	m
4	VAF = 62.67	V
5	IKF = 3.200	A
6	ISE = 4.010	fA
7	NE = 1.577	–
8	BR = 18.10	–
9	NR = 996.2	m
10	VAR = 3.369	V
11	IKR = 1.281	A
12	ISC = 279.9	aA
13	NC = 1.075	–
14	RB = 10.00	Ω
15	IRB = 1.000	uA
16	RBM = 10.00	Ω
17	RE = 1.164	Ω
18	RC = 2.320	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 890.5	fF
23	VJE = 600.0	mV
24	MJE = 258.5	m
25	TF = 15.49	ps
26	XTF = 39.14	
27	VTF = 2.152	V
28	ITF = 213.7	mA
29	PTF = 0.000	deg
30	CJC = 546.5	fF
31	VJC = 380.8	mV
32	MJC = 202.9	m
33	XCJC = 150.0	m
34	TR = 5.618	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	
38	FC = 850.0	m



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

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

Fc = scaling frequency = 100 MHz.

Fig.20 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.20)

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

Note

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

Table 1 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 2 mA

f (MHz)	S_{11}		S_{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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.581	−22.4	28.521	166.5	0.006	81.4	0.969	−8.0	43.1
100	0.554	−53.0	25.474	149.4	0.014	69.0	0.888	−18.1	36.5
200	0.514	−91.3	19.658	129.4	0.023	57.7	0.732	−27.5	30.5
300	0.495	−116.1	15.275	116.8	0.028	53.3	0.622	−31.2	27.0
400	0.488	−132.4	12.229	108.4	0.032	52.2	0.555	−32.5	24.5
500	0.483	−144.1	10.134	102.2	0.035	53.1	0.513	−33.1	22.6
600	0.481	−152.6	8.632	97.6	0.038	54.2	0.488	−33.5	21.0
700	0.478	−159.6	7.515	93.7	0.042	55.5	0.472	−33.8	19.7
800	0.475	−165.6	6.635	90.1	0.045	56.6	0.461	−34.2	18.6
900	0.473	−170.9	5.932	87.1	0.048	57.9	0.454	−34.7	17.6
1000	0.473	−175.6	5.346	84.3	0.052	59.0	0.448	−35.3	16.6
1200	0.482	176.4	4.479	79.4	0.059	60.6	0.437	−37.1	15.1
1400	0.491	170.2	3.875	74.8	0.066	61.6	0.432	−39.8	13.9
1600	0.492	165.1	3.402	70.4	0.073	62.8	0.433	−42.7	12.7
1800	0.487	159.5	3.027	66.9	0.080	63.2	0.437	−44.9	11.7
2000	0.493	153.4	2.735	63.1	0.087	63.8	0.435	−46.7	10.9
2200	0.509	148.0	2.498	59.9	0.094	63.8	0.423	−49.4	10.1
2400	0.526	144.1	2.296	56.0	0.100	64.1	0.413	−53.7	9.4
2600	0.532	141.1	2.097	53.1	0.109	64.2	0.413	−58.9	8.7
2800	0.533	137.6	1.979	49.7	0.115	63.4	0.424	−63.0	8.2
3000	0.538	132.9	1.839	46.4	0.121	63.7	0.433	−65.7	7.7

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.3	0.136	30.6	0.35
1000	2.8	0.102	75.6	0.42
2000	3.7	0.237	−173.5	0.30

Table 8 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.521	−28.0	32.499	164.2	0.006	79.0	0.958	−9.2	42.5
100	0.504	−64.3	27.978	145.0	0.013	67.1	0.854	−19.8	35.9
200	0.484	−104.8	20.406	124.4	0.021	56.7	0.685	−28.0	30.1
300	0.480	−128.2	15.371	112.5	0.025	54.0	0.582	−30.1	26.7
400	0.479	−142.8	12.121	104.7	0.028	54.2	0.525	−30.6	24.2
500	0.481	−152.8	9.955	99.1	0.032	55.7	0.492	−30.7	22.3
600	0.480	−160.1	8.440	94.9	0.035	57.4	0.473	−31.0	20.8
700	0.480	−166.1	7.323	91.2	0.039	58.7	0.461	−31.4	19.5
800	0.479	−171.3	6.452	87.9	0.042	60.2	0.454	−31.9	18.3
900	0.478	−176.1	5.760	85.1	0.046	61.3	0.449	−32.5	17.3
1000	0.480	179.8	5.188	82.5	0.050	62.6	0.445	−33.2	16.4
1200	0.490	172.6	4.338	77.8	0.057	63.8	0.438	−35.4	14.9
1400	0.499	167.0	3.752	73.4	0.064	64.5	0.434	−38.3	13.6
1600	0.499	162.4	3.292	69.1	0.071	65.5	0.436	−41.5	12.5
1800	0.496	157.0	2.927	65.7	0.079	65.7	0.441	−43.9	11.5
2000	0.503	151.2	2.645	61.9	0.086	66.0	0.439	−45.9	10.6
2200	0.518	146.3	2.416	58.9	0.093	65.9	0.428	−48.7	9.9
2400	0.536	142.6	2.221	54.9	0.100	66.0	0.418	−53.2	9.2
2600	0.542	139.7	2.027	52.1	0.108	66.0	0.419	−58.4	8.5
2800	0.544	136.1	1.913	48.7	0.115	65.2	0.430	−62.6	8.0
3000	0.547	131.8	1.777	45.4	0.121	65.5	0.439	−65.4	7.5

Table 9 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 2 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.810	−10.4	13.548	172.4	0.007	84.1	0.991	−4.0	44.8
100	0.789	−25.6	13.055	162.2	0.016	77.0	0.966	−9.8	38.3
200	0.732	−49.0	11.828	147.2	0.030	66.2	0.899	−17.8	32.0
300	0.674	−69.4	10.464	134.9	0.040	58.3	0.824	−23.6	28.0
400	0.626	−86.4	9.130	125.1	0.047	52.7	0.758	−27.5	25.1
500	0.588	−100.6	7.995	117.2	0.052	49.5	0.706	−30.1	22.9
600	0.560	−112.4	7.067	111.0	0.056	47.2	0.667	−32.0	21.2
700	0.535	−122.4	6.311	105.6	0.059	45.9	0.637	−33.3	19.7
800	0.515	−131.1	5.668	100.8	0.061	45.3	0.615	−34.4	18.5
900	0.498	−139.0	5.125	96.7	0.064	45.1	0.598	−35.2	17.4
1000	0.487	−146.0	4.662	92.9	0.066	45.4	0.583	−36.1	16.4
1200	0.481	−158.8	3.961	86.5	0.071	45.9	0.561	−38.1	14.7
1400	0.481	−168.7	3.465	80.8	0.075	46.6	0.547	−40.6	13.5
1600	0.479	−176.2	3.062	75.5	0.079	48.2	0.542	−43.2	12.4
1800	0.471	176.2	2.731	71.4	0.085	49.5	0.541	−45.3	11.3
2000	0.468	168.3	2.472	66.9	0.089	50.9	0.535	−47.1	10.4
2200	0.480	161.1	2.264	63.4	0.094	51.8	0.520	−49.6	9.6
2400	0.494	155.5	2.085	58.7	0.098	52.8	0.508	−53.6	8.9
2600	0.504	151.2	1.904	55.5	0.105	53.8	0.509	−58.2	8.2
2800	0.504	146.6	1.809	51.8	0.110	53.9	0.518	−61.9	7.8
3000	0.507	141.6	1.680	48.2	0.115	55.1	0.525	−64.5	7.2

Table 11 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.6	0.384	21.6	0.40
1000	2.1	0.288	39.9	0.45
2000	3.0	0.210	142.8	0.28

Table 12 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.716	−15.4	22.004	169.4	0.006	82.3	0.981	−6.0	44.3
100	0.684	−37.3	20.510	155.6	0.015	72.8	0.931	−14.0	37.7
200	0.612	−68.4	17.161	137.3	0.026	61.5	0.815	−23.3	31.5
300	0.558	−92.4	14.099	124.3	0.032	54.6	0.713	−28.3	27.7
400	0.523	−110.3	11.662	115.0	0.037	51.6	0.641	−30.8	25.0
500	0.500	−124.1	9.849	108.1	0.041	50.5	0.591	−32.2	23.0
600	0.485	−134.7	8.495	102.8	0.044	50.4	0.559	−33.1	21.4
700	0.475	−143.3	7.449	98.3	0.047	50.8	0.537	−33.8	20.0
800	0.465	−150.7	6.613	94.2	0.050	51.6	0.521	−34.3	18.8
900	0.456	−157.5	5.929	90.9	0.052	52.6	0.510	−34.8	17.8
1000	0.453	−163.3	5.359	87.7	0.055	53.6	0.501	−35.4	16.8
1200	0.457	−173.4	4.508	82.3	0.062	55.2	0.485	−37.1	15.3
1400	0.463	178.6	3.914	77.4	0.068	56.2	0.477	−39.5	14.0
1600	0.464	172.7	3.445	72.7	0.074	57.8	0.476	−42.2	12.9
1800	0.458	166.5	3.065	69.1	0.081	58.6	0.478	−44.3	11.9
2000	0.460	159.2	2.769	65.1	0.087	59.5	0.474	−45.9	11.0
2200	0.475	153.1	2.532	61.8	0.093	59.8	0.462	−48.4	10.2
2400	0.493	148.7	2.331	57.6	0.099	60.2	0.450	−52.5	9.5
2600	0.501	145.2	2.128	54.7	0.107	60.7	0.451	−57.3	8.8
2800	0.502	141.1	2.013	51.3	0.113	60.2	0.461	−61.2	8.4
3000	0.502	136.6	1.870	47.8	0.118	60.7	0.469	−63.8	7.8

Table 13 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.0	0.287	21.9	0.40
1000	2.5	0.209	43.8	0.48
2000	3.4	0.194	158.0	0.30

Table 14 Common emitter scattering parameters, V_{CE} = 10 V, I_C = 15 mA

f (MHz)	S_{11}		S_{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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.634	−22.2	31.001	165.5	0.006	72.4	0.967	−8.0	43.9
100	0.593	−52.8	27.210	147.7	0.014	69.3	0.879	−17.9	37.0
200	0.523	−90.5	20.627	127.3	0.022	59.0	0.723	−26.2	30.9
300	0.486	−114.5	15.771	115.2	0.027	54.9	0.621	−28.9	27.2
400	0.470	−130.9	12.572	107.0	0.029	53.7	0.559	−29.7	24.7
500	0.462	−142.5	10.361	101.1	0.033	55.4	0.524	−30.1	22.7
600	0.455	−151.4	8.817	96.7	0.037	56.1	0.502	−30.3	21.2
700	0.449	−158.2	7.661	92.7	0.041	57.3	0.489	−30.8	19.9
800	0.448	−164.2	6.783	89.8	0.043	59.2	0.481	−31.3	18.7
900	0.444	−169.7	6.038	86.6	0.047	59.9	0.476	−31.9	17.7
1000	0.444	−174.6	5.436	83.8	0.051	60.5	0.470	−32.5	16.7
1200	0.449	177.4	4.562	79.2	0.059	61.6	0.463	−34.5	15.2
1400	0.463	170.7	3.951	74.9	0.065	62.4	0.457	−37.1	14.0
1600	0.461	165.5	3.460	70.5	0.072	65.2	0.460	−40.1	12.8
1800	0.455	160.1	3.081	67.0	0.080	63.8	0.465	−42.4	11.8
2000	0.463	153.7	2.770	63.3	0.087	64.7	0.463	−44.2	10.9
2200	0.479	148.0	2.540	60.2	0.094	64.7	0.453	−47.0	10.2
2400	0.498	144.9	2.326	56.2	0.101	65.2	0.443	−51.1	9.5
2600	0.504	141.5	2.130	53.5	0.110	64.7	0.443	−55.9	8.8
2800	0.507	137.8	2.002	50.4	0.115	63.8	0.454	−60.0	8.3
3000	0.508	132.8	1.866	47.0	0.120	64.2	0.463	−62.6	7.8

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

FEATURES

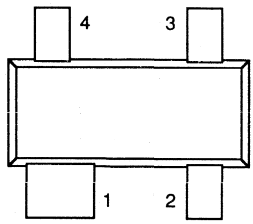
- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG93 is a silicon npn transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is intended for wideband applications in the UHF and microwave range.

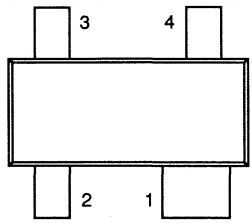
PINNING

PIN	DESCRIPTION
BFG93A (Fig.1) Code: R8	
1	collector
2	base
3	emitter
4	emitter
BFG93A/X (Fig.1) Code: V15	
1	collector
2	emitter
3	base
4	emitter
BFG93A/XR (Fig.2) Code: V33	
1	collector
2	emitter
3	base
4	emitter



Top view MSB014

Fig.1 SOT143.



Top view MSB035

Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	35	mA
P_{tot}	total power dissipation	up to T_s = 60 °C (note 1)	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 5 V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.9	–	dB

Note

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

Capability approved CECC 50 000 (issue 4), 1986

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.9	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.9	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 5$ V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	$I_C = 30$ mA; $V_{CE} = 5$ V; f = 500 MHz	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	16	–	dB
		$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.9	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	3	–	dB

Note

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

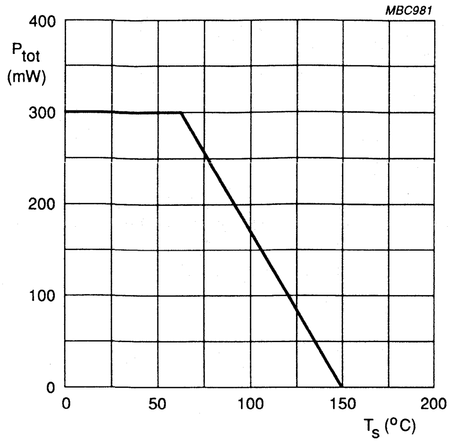
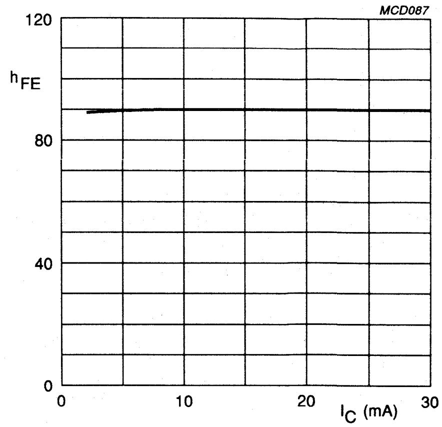
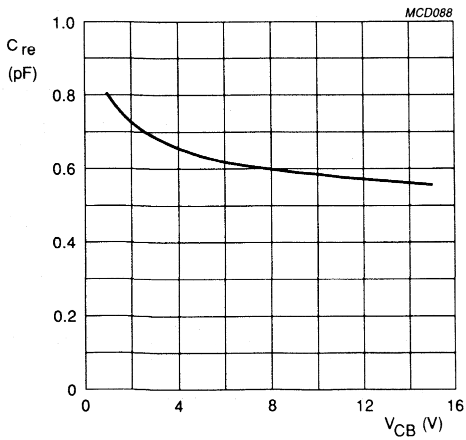


Fig.3 Power derating curve.



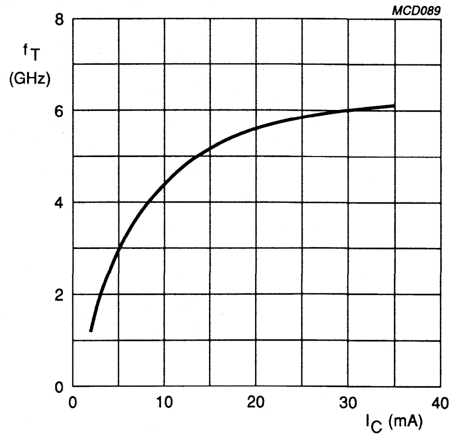
V_{CE} = 5 V.

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



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

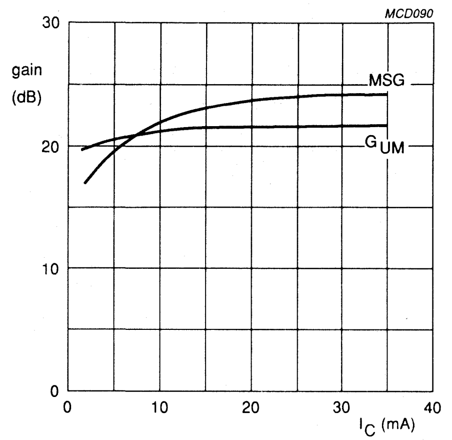
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

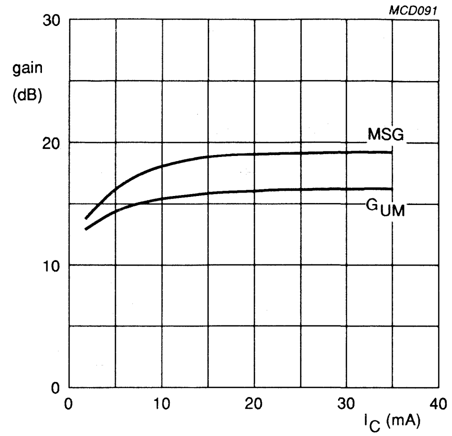
Fig.6 Transition frequency as a function of collector current.

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



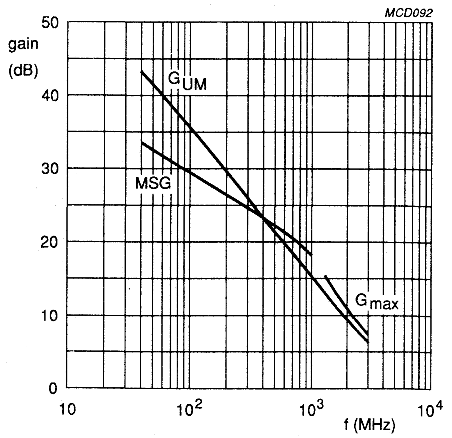
V_{CE} = 8 V; f = 500 MHz.

Fig.7 Gain as a function of collector current.



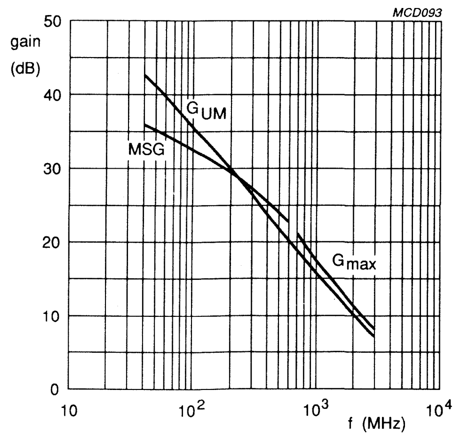
V_{CE} = 8 V; f = 1 GHz.

Fig.8 Gain as a function of collector current.



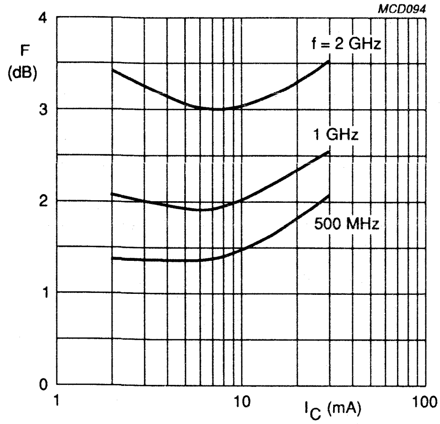
V_{CE} = 8 V; I_C = 10 mA.

Fig.9 Gain as a function of frequency.



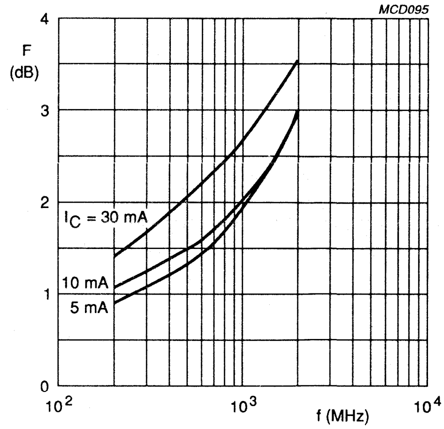
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



$V_{CE} = 8$ V.

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



$V_{CE} = 8$ V.

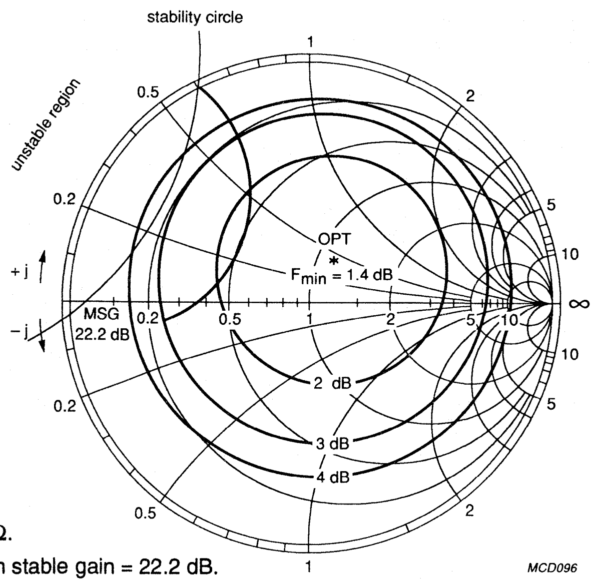
Fig.12 Minimum noise figure as a function of frequency.

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



$Z_O = 50\ \Omega$.

Maximum stable gain = 22.2 dB.

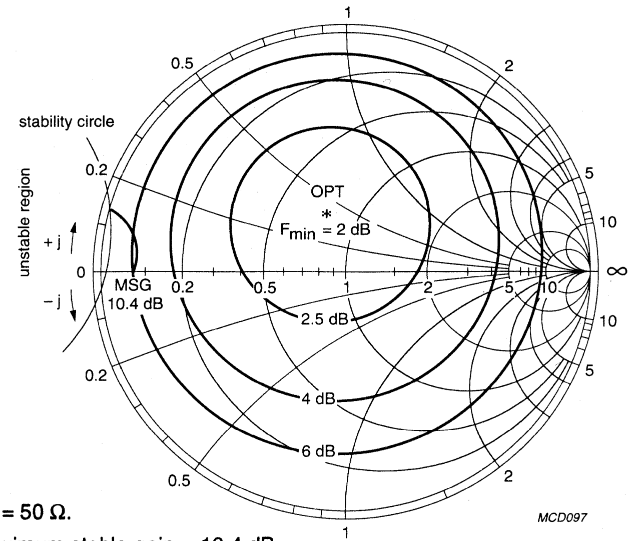
Fig.13 Noise circle figure.

BFG93A/X

f (MHz)	V_{CE} (V)	I_C (mA)
1000	8	10

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
2	0.249	107.9	0.25



$Z_O = 50\ \Omega$.

Maximum stable gain = 10.4 dB.

Fig.14 Noise circle figure.

BFG93A/X

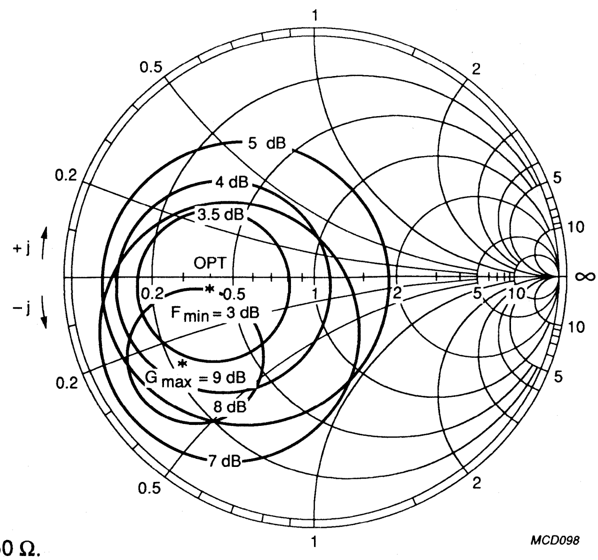
f (MHz)	V_{CE} (V)	I_C (mA)
2000	8	10

Noise Parameters

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

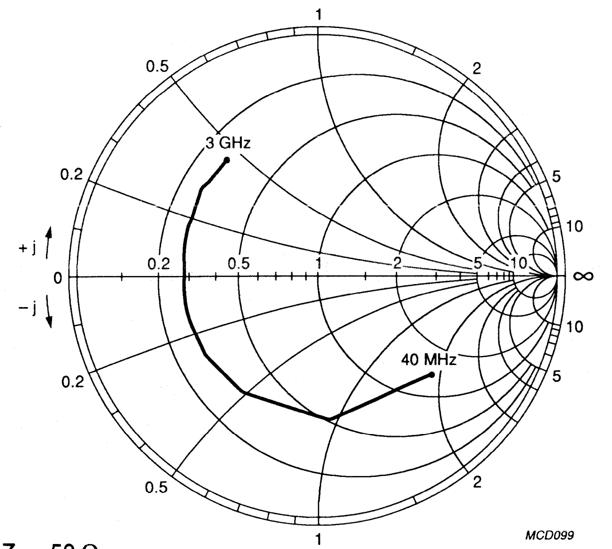
Average Gain Parameters

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



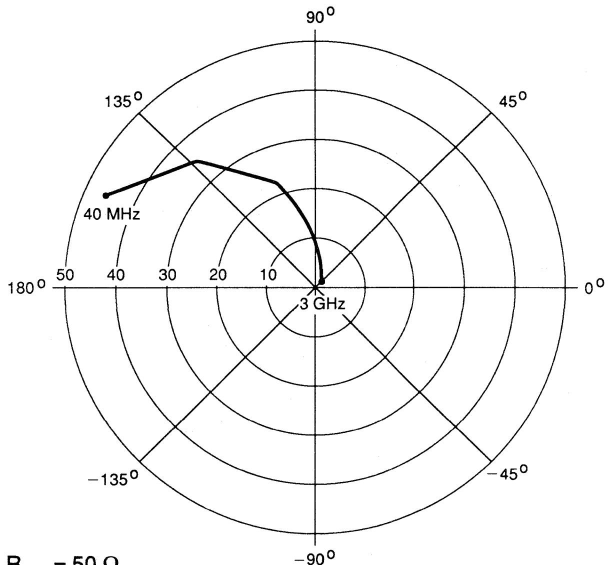
$Z_O = 50\ \Omega$.

Fig.15 Noise circle figure.



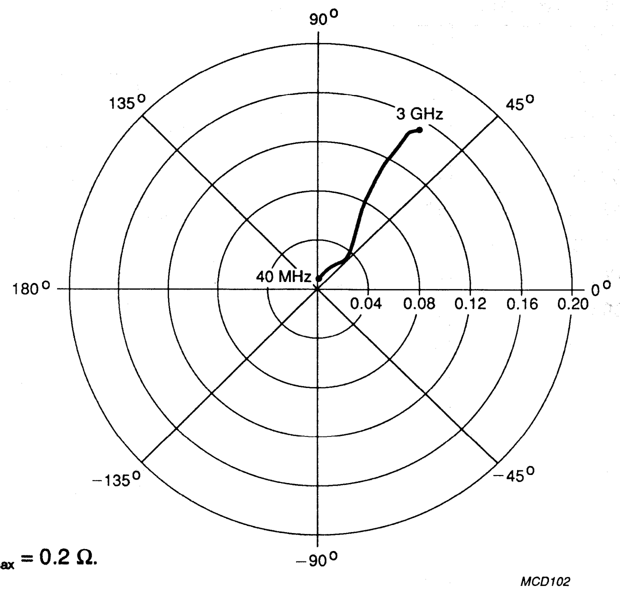
V_{CE} = 8 V; I_C = 30 mA; Z_O = 50 Ω.

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



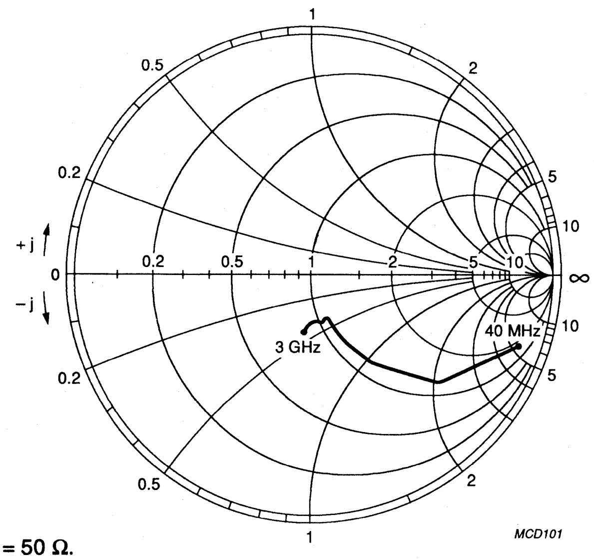
V_{CE} = 8 V; I_C = 30 mA; R_{max} = 50 Ω.

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



V_{CE} = 8 V; I_C = 30 mA; R_{max} = 0.2 Ω.

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

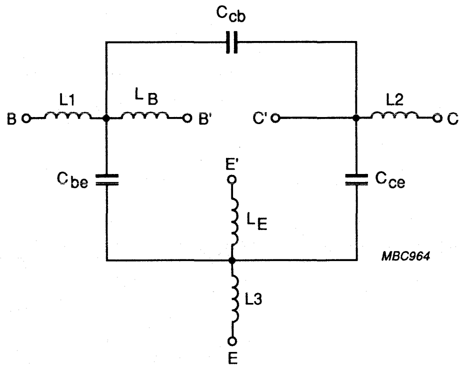


V_{CE} = 8 V; I_C = 30 mA; Z_O = 50 Ω.

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

SPICE parameters for BFR91A crystal

1	IS = 1.328	fA
2	BF = 102.0	–
3	NF = 1.000	–
4	VAF = 51.90	V
5	IKF = 8.155	A
6	ISE = 13.90	fA
7	NE = 1.512	–
8	BR = 17.69	–
9	NR = 994.0	m
10	VAR = 3.280	V
11	IKR = 10.00	A
12	ISC = 1.043	fA
13	NC = 1.189	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 763.6	mΩ
18	RC = 9.000	Ω
19 (note 1)	XTB = 0.000	
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 2.032	pF
23	VJE = 600.0	mV
24	MJE = 290.0	m
25	TF = 6.557	ps
26	XTF = 38.97	–
27	VTF = 10.93	V
28	ITF = 521.0	mA
29	PTF = 0.000	deg
30	CJC = 1.003	pF
31	VJC = 340.8	mV
32	MJC = 194.2	m
33	XCJC = 120.0	m
34	TR = 3.073	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	
38	FC = 800.0	m



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

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

Fc = scaling frequency = 1000 MHz.

Fig.20 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.20)

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

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

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

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.837	−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} (RAT)	Γ_{opt} (DEG)	R_n
500	1.2	0.290	53.4	0.204
1000	1.9	0.307	109.7	0.228
2000	3.0	0.484	−174.6	0.138

Table 3 Common emitter scattering parameters, V_{CE} = 5 V, I_C = 10 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.553	−46.7	47.367	156.3	0.010	71.5	0.893	−21.8	42.0
100	0.560	−95.5	35.212	131.9	0.019	56.3	0.673	−44.1	35.2
200	0.579	−133.8	22.209	112.2	0.026	47.9	0.433	−60.7	29.6
300	0.588	−151.0	15.635	102.7	0.030	49.1	0.319	−67.8	26.2
400	0.589	−161.1	12.005	97.0	0.034	51.0	0.259	−72.2	23.7
500	0.593	−167.8	9.745	92.6	0.038	53.6	0.225	−74.6	21.9
600	0.593	−172.8	8.161	89.1	0.043	55.7	0.206	−76.5	20.3
700	0.591	−177.2	7.024	86.1	0.047	57.7	0.194	−77.5	19.0
800	0.593	179.2	6.160	83.4	0.052	59.4	0.186	−77.7	17.8
900	0.591	175.8	5.499	81.5	0.057	60.4	0.179	−77.9	16.8
1000	0.593	172.7	4.986	78.8	0.061	61.4	0.172	−78.2	16.0
1200	0.603	166.8	4.143	74.7	0.071	62.9	0.164	−81.1	14.4
1400	0.606	162.2	3.561	71.2	0.081	63.8	0.165	−86.3	13.1
1600	0.607	158.5	3.107	67.0	0.090	63.7	0.175	−88.0	12.0
1800	0.600	153.2	2.801	63.3	0.099	63.8	0.182	−87.1	11.0
2000	0.607	148.1	2.522	60.0	0.109	64.0	0.177	−88.6	10.2
2200	0.617	143.8	2.298	57.4	0.120	63.3	0.169	−94.1	9.4
2400	0.623	140.9	2.109	54.4	0.127	63.4	0.177	−101.7	8.8
2600	0.624	137.1	1.944	51.1	0.135	63.5	0.196	−106.5	8.1
2800	0.621	133.3	1.794	47.4	0.145	63.1	0.213	−108.0	7.4
3000	0.620	129.4	1.696	44.9	0.154	60.3	0.218	−109.5	6.9

Table 7 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.1	0.137	135.1	0.200
1000	2.6	0.242	144.1	0.240
2000	3.4	0.480	−161.4	0.183

Table 8 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 5 mA

f (MHz)	S_{11}		S_{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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.630	−40.2	45.838	157.6	0.010	73.9	0.905	−19.5	42.8
100	0.595	−85.7	34.915	133.8	0.019	57.5	0.699	−39.6	35.7
200	0.578	−125.7	22.478	113.8	0.027	48.7	0.461	−54.3	29.8
300	0.573	−144.9	15.925	103.9	0.031	48.5	0.345	−59.7	26.3
400	0.573	−156.3	12.289	97.8	0.035	50.4	0.284	−62.5	23.9
500	0.573	−163.8	9.980	93.3	0.039	52.8	0.249	−63.9	22.0
600	0.573	−169.2	8.362	89.8	0.043	54.7	0.229	−65.2	20.4
700	0.569	−174.3	7.183	86.7	0.047	56.7	0.217	−65.2	19.0
800	0.569	−177.9	6.311	83.9	0.052	58.3	0.210	−65.2	17.9
900	0.568	178.2	5.637	82.0	0.057	59.5	0.204	−65.1	16.9
1000	0.571	174.7	5.122	79.2	0.061	60.3	0.198	−65.2	16.1
1200	0.578	168.8	4.244	75.1	0.070	61.9	0.189	−67.4	14.5
1400	0.581	163.7	3.636	71.3	0.080	62.6	0.188	−72.1	13.2
1600	0.583	159.9	3.204	67.4	0.089	62.7	0.198	−74.6	12.1
1800	0.577	154.8	2.867	63.6	0.098	62.8	0.208	−74.7	11.1
2000	0.586	149.9	2.593	60.1	0.107	63.1	0.204	−75.9	10.3
2200	0.595	145.3	2.348	57.9	0.117	62.6	0.194	−80.4	9.5
2400	0.603	142.2	2.165	54.5	0.124	62.6	0.197	−87.7	8.8
2600	0.599	138.8	1.992	51.0	0.132	62.9	0.214	−93.3	8.1
2800	0.604	134.6	1.849	47.1	0.141	62.8	0.231	−95.9	7.5
3000	0.611	130.2	1.749	44.6	0.150	59.9	0.237	−97.6	7.1

Table 14 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.1	0.123	87.3	0.263
1000	2.6	0.216	121.4	0.309
2000	3.6	0.444	−169.0	0.190

NPN 6 GHz wideband transistor — BFG94

FEATURES

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

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

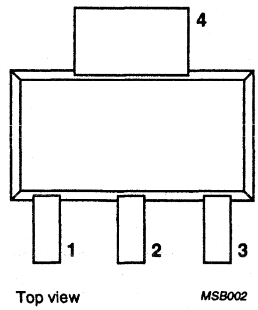


Fig.1 SOT223.

DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope. It is primarily intended for use in communication and instrumentation systems.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	DC collector current		–	–	60	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	–	700	mW
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	–	0.8	pF
f_T	transition frequency	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	4	6	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	11.5	13.5	–	dB
V_O	output voltage	I_C = 45 mA; V_{CE} = 10 V; d_{im} = −60 dB; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	–	500	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	21.5	–	dBm

Note

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	60	mA
P_{tot}	total power dissipation	up to T_s = 140 °C (note 1)	–	700	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 140 °C (note 1)	50 K/W

Note

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

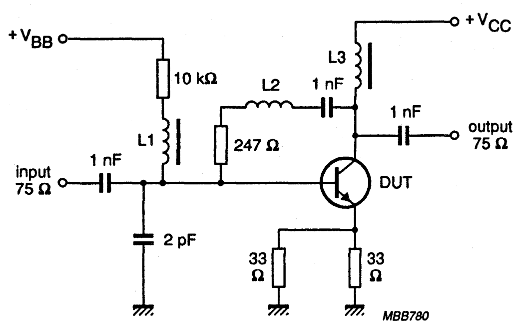
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 30$ mA; $V_{CE} = 5$ V	45	90	–	
		$I_C = 45$ mA; $V_{CE} = 10$ V	–	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	–	0.9	2	pF
C_e	emitter capacitance	$I_C = i_e = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2.9	4.5	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10$ V; f = 1 MHz	–	0.5	0.8	pF
f_T	transition frequency	$I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz; $T_{amb} = 25$ °C	4	–	–	GHz
		$I_C = 30$ mA; $V_{CE} = 5$ V; f = 1 GHz; $T_{amb} = 25$ °C	4	6	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz; $T_{amb} = 25$ °C	11.5	13.5	–	dB
F	minimum noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 45$ mA; $V_{CE} = 10$ V; f = 500 MHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 45$ mA; $V_{CE} = 10$ V; f = 1 GHz	–	3	–	dB
V_O	output voltage	note 2	–	500	–	mV
d_2	second order intermodulation distortion	note 3	–	–51	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C; measured at f = 1 GHz	–	21.5	–	dBm
ITO	third order intercept point	note 4	–	34	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. $d_{im} = -60$ dB (DIN 45004B, par 6.3: 3-tone); $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_p = V_O$ at $d_{im} = -60$ dB; $f_p = 795.25$ MHz;
   $V_q = V_O - 6$ dB; $V_r = V_O - 6$ dB;
   $f_q = 803.25$ MHz; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz.
3. $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $T_{amb} = 25$ °C;
   $V_q = V_O = 280$ mV;
   $f_p = 250$ MHz; $f_q = 560$ MHz;
   measured at $f_{(p+q)} = 810$ MHz.
4. $I_C = 45$ mA; $V_{CE} = 10$ V; $R_L = 50\ \Omega$; $T_{amb} = 25$ °C;
   $f_p = 1000$ MHz; $f_q = 1001$ MHz;
   measured at $f_{(2p-q)}$ and $f_{(2q-p)}$.



L1 = L3 = 5 μH micro-choke.

L2 = 1 turn copper wire (0.4 mm), internal diameter 4 mm.

Fig.2 Test circuit for second and third order intermodulation distortion.

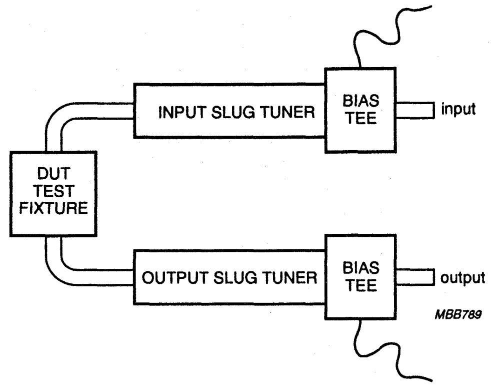


Fig.3 Measurement set-up for third order intercept point and 1 dB gain compression.

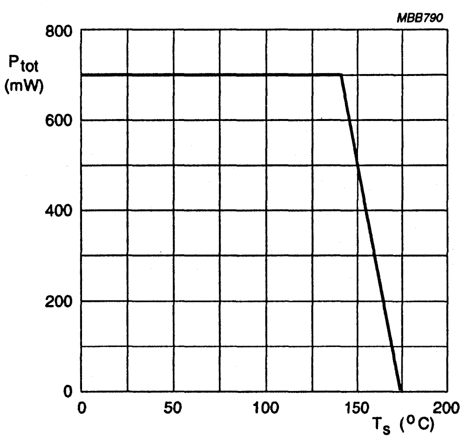
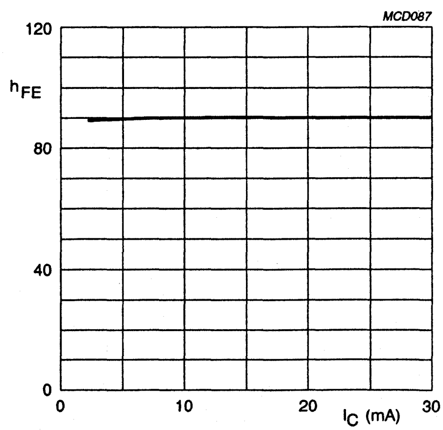
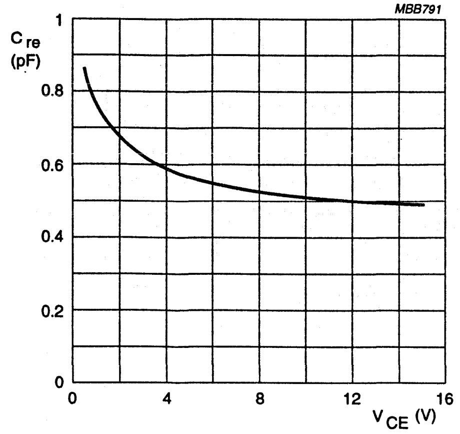


Fig.4 Power derating curve.



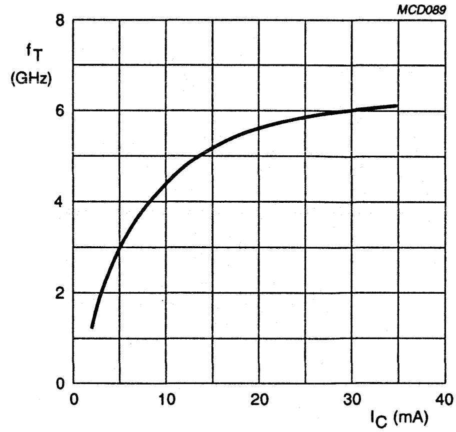
V_{CE} = 10 V; T_j = 25 °C

Fig.5 DC current gain as a function of collector current.



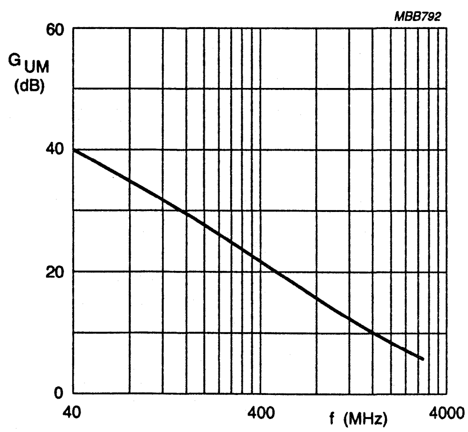
$I_C = i_c = 0$; f = 1 MHz.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



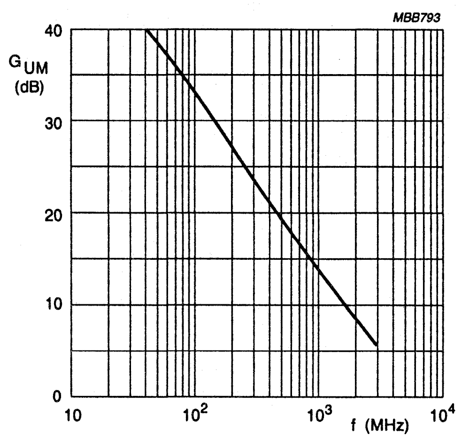
$V_{CE} = 10$ V; f = 1 GHz.

Fig.7 Transition frequency as a function of collector current.



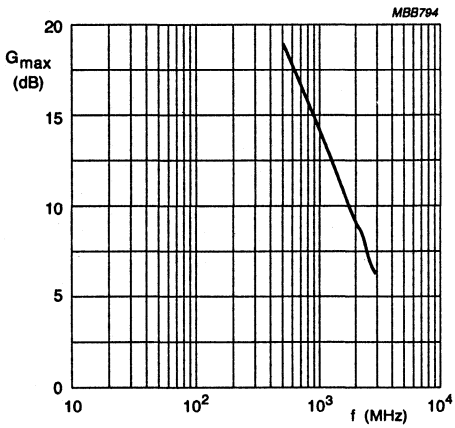
$I_C = 45$ mA; $V_{CE} = 10$ V.

Fig.8 Maximum unilateral power gain as a function of frequency.



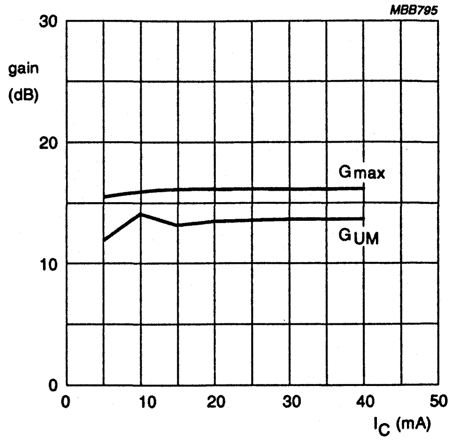
$I_C = 20$ mA; $V_{CE} = 8$ V.

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



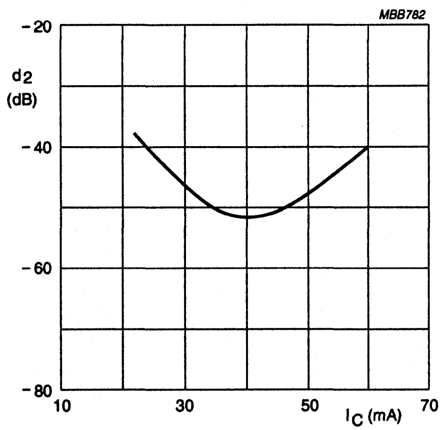
I_C = 20 mA; V_{CE} = 8 V.

Fig.10 Maximum available stable gain as a function of frequency.



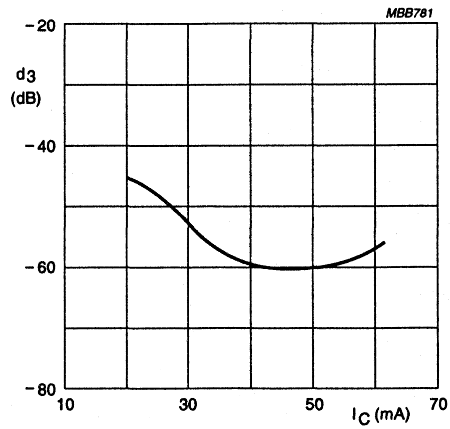
V_{CE} = 8 V; f = 1 GHz.
G_{max} = maximum available stable gain.
G_{UM} = maximum unilateral power gain.

Fig.11 Gain as a function of collector current.



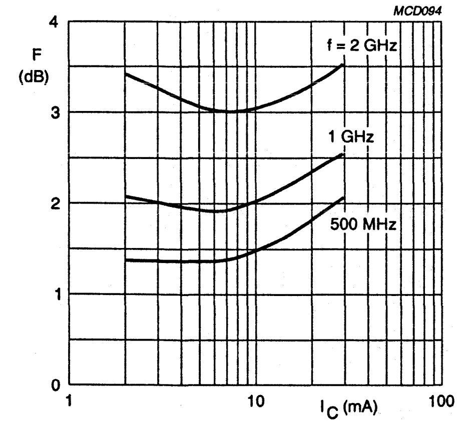
I_C = 45 mA; V_{CE} = 10 V; $f_{(p+q)}$ = 810 MHz.
See test circuit, Fig.2

Fig.12 Second order intermodulation distortion as a function of collector current.



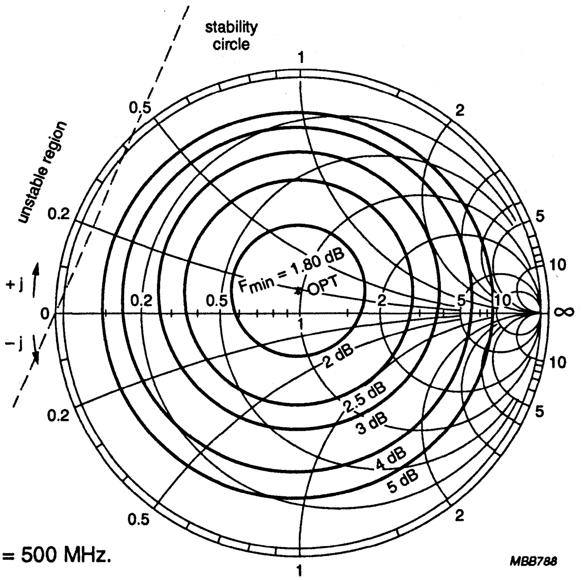
I_C = 45 mA; V_{CE} = 10 V; $f_{(p+q-r)}$ = 793.25 MHz.
See test circuit, Fig.2

Fig.13 Third order intermodulation distortion as a function of collector current.



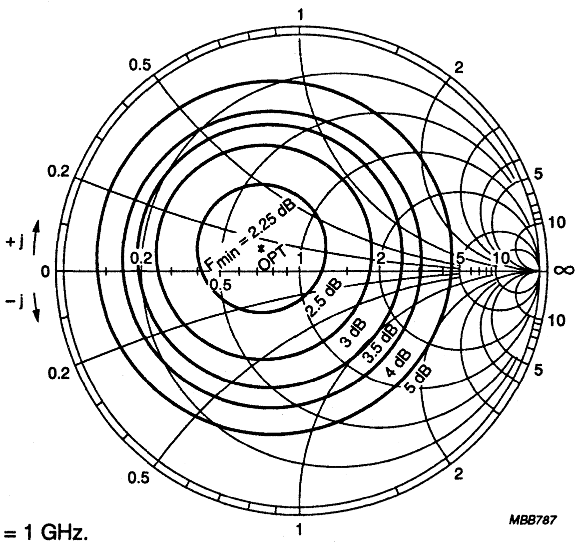
V_{CE} = 8 V.

Fig.14 Minimum noise figure as a function of collector current.



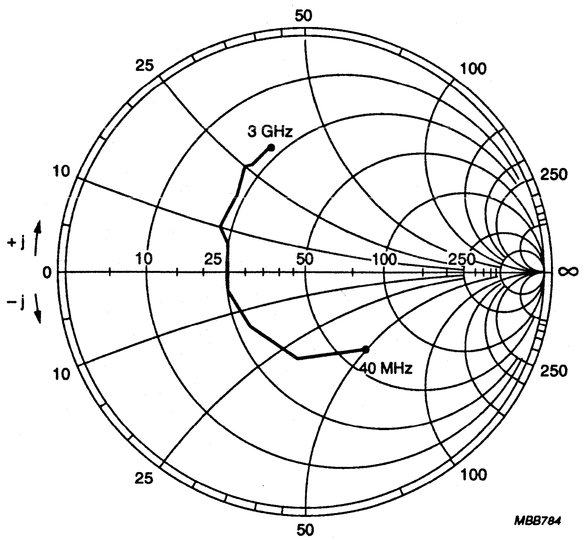
I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz.

Fig.15 Noise circle.



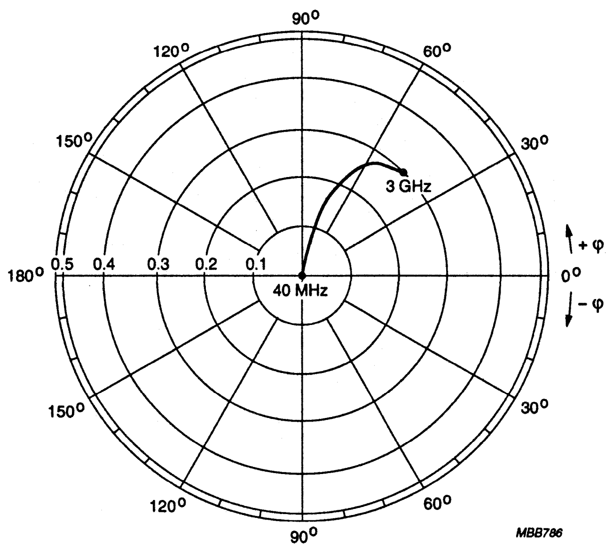
I_C = 15 mA; V_{CE} = 10 V; f = 1 GHz.

Fig.16 Noise circle.



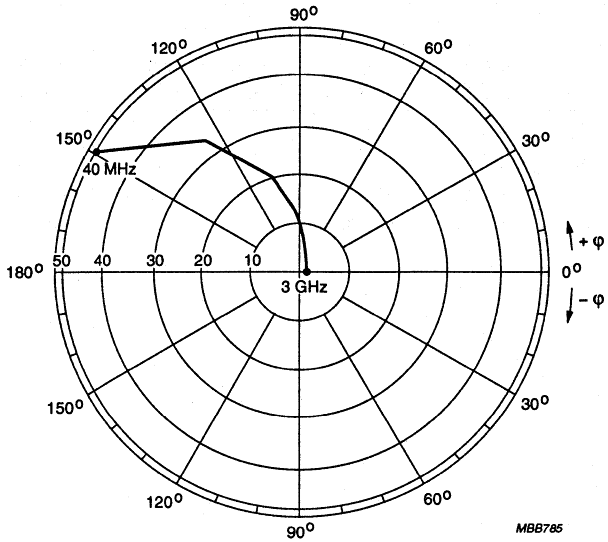
I_C = 45 mA; V_{CE} = 10 V.

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



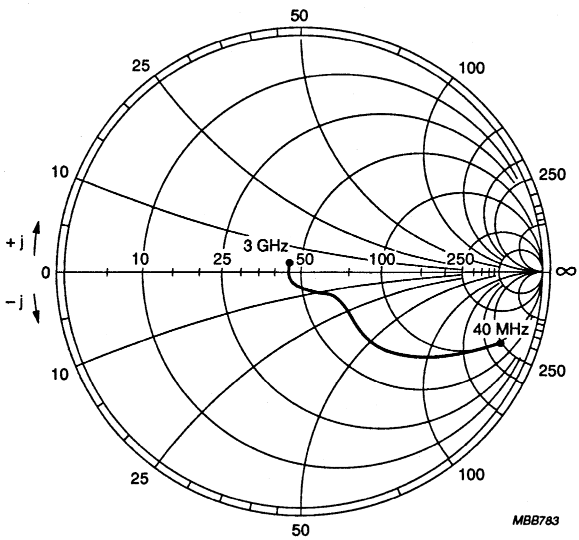
I_C = 45 mA; V_{CE} = 10 V.

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



I_C = 45 mA; V_{CE} = 10 V.

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



I_C = 45 mA; V_{CE} = 10 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

Table 1 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.61	−29.1	32.10	159.5	0.01	76.7	0.93	−14.6	40.6
100	0.53	−65.4	25.66	136.9	0.02	65.5	0.76	−30.1	33.3
200	0.43	−104.2	17.25	115.9	0.03	59.5	0.54	−40.5	27.1
300	0.39	−128.2	12.43	104.5	0.04	60.7	0.43	−43.1	23.5
400	0.37	−143.8	9.72	96.9	0.05	62.2	0.36	−43.4	21.0
500	0.36	−154.5	7.91	91.4	0.06	63.6	0.32	−43.7	19.1
600	0.36	−163.1	6.66	87.0	0.07	64.7	0.30	−43.6	17.5
700	0.35	−169.8	5.78	83.1	0.08	65.6	0.28	−43.5	16.2
800	0.35	−176.3	5.08	79.8	0.09	65.6	0.27	−44.1	15.0
900	0.35	177.6	4.55	76.4	0.10	66.0	0.25	−44.7	14.0
1000	0.36	171.6	4.13	73.3	0.10	65.5	0.24	−45.8	13.2
1200	0.37	162.4	3.48	67.2	0.12	65.6	0.22	−49.3	11.7
1400	0.39	155.5	2.99	61.7	0.14	64.2	0.20	−54.9	10.4
1600	0.40	150.1	2.65	56.6	0.16	63.0	0.18	−61.1	9.4
1800	0.41	143.3	2.40	51.3	0.18	61.8	0.17	−66.8	8.6
2000	0.43	135.8	2.21	46.5	0.20	60.2	0.15	−73.9	7.9
2200	0.47	130.3	2.03	42.4	0.21	57.4	0.13	−86.9	7.3
2400	0.49	125.5	1.87	37.8	0.23	56.1	0.12	−104.2	6.7
2600	0.51	121.9	1.73	32.9	0.25	55.0	0.11	−119.0	6.1
2800	0.51	117.2	1.61	28.3	0.27	52.5	0.10	−129.7	5.5
3000	0.53	109.4	1.55	24.0	0.28	47.7	0.09	−144.9	5.3

Table 2 Noise data, I_C = 15 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.80	0.11	98.1	0.21
1000	2.25	0.20	152.1	0.21

Table 3 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{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	0.44	−41.5	44.41	153.0	0.01	74.6	0.87	−19.7	39.9
100	0.37	−87.1	31.75	128.2	0.02	66.3	0.64	−36.3	33.0
200	0.32	−126.9	19.27	108.7	0.03	66.9	0.43	−43.2	27.1
300	0.31	−147.0	13.58	99.2	0.04	68.6	0.34	−43.0	23.6
400	0.32	−158.3	10.38	92.9	0.05	69.9	0.29	−41.7	21.2
500	0.31	−166.3	8.38	88.3	0.06	70.6	0.26	−40.5	19.2
600	0.32	−174.1	7.05	84.3	0.07	71.6	0.25	−40.1	17.7
700	0.32	−178.9	6.08	80.8	0.08	71.3	0.23	−40.4	16.4
800	0.32	175.3	5.35	77.7	0.09	70.7	0.22	−40.8	15.2
900	0.32	170.3	4.79	74.8	0.10	70.1	0.21	−41.6	14.3
1000	0.33	165.1	4.36	71.9	0.11	69.3	0.20	−43.1	13.5
1200	0.35	157.1	3.66	66.2	0.13	68.4	0.18	−46.7	12.0
1400	0.37	150.9	3.14	61.1	0.15	66.6	0.16	−51.8	10.7
1600	0.39	146.8	2.79	56.0	0.17	64.5	0.14	−57.8	9.7
1800	0.39	139.1	2.52	51.4	0.19	62.8	0.12	−63.8	8.8
2000	0.41	132.5	2.29	46.2	0.21	60.7	0.10	−73.7	8.1
2200	0.46	126.1	2.12	42.3	0.22	57.6	0.08	−92.2	7.6
2400	0.48	122.7	1.96	38.2	0.24	55.7	0.08	−113.2	7.0
2600	0.49	118.3	1.81	33.0	0.26	54.4	0.08	−130.0	6.4
2800	0.50	113.4	1.67	29.1	0.28	51.8	0.07	−149.4	5.8
3000	0.51	106.1	1.60	24.3	0.29	46.7	0.06	−179.0	5.5

Table 4 Noise data, I_C = 30 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.30	0.13	155.2	0.22
1000	2.70	0.25	175.6	0.22

Table 5 Common emitter scattering parameters, I_C = 45 mA; V_{CE} = 10 V

f (MHz)	S_{11}		S_{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	0.40	−48.4	50.03	150.0	0.01	74.3	0.84	−22.0	40.0
100	0.35	−97.6	33.55	124.0	0.02	66.9	0.59	−38.4	32.9
200	0.32	−134.5	19.73	105.9	0.03	67.6	0.39	−43.0	27.1
300	0.32	−152.0	13.62	97.2	0.04	70.5	0.30	−41.8	23.6
400	0.32	−162.4	10.46	91.3	0.05	71.4	0.26	−40.1	21.2
500	0.33	−169.4	8.42	86.8	0.06	72.1	0.24	−39.2	19.3
600	0.33	−175.0	7.07	83.3	0.07	72.3	0.22	−38.5	17.7
700	0.32	179.8	6.10	80.1	0.08	72.2	0.21	−38.6	16.4
800	0.33	175.1	5.37	77.0	0.08	71.4	0.20	−38.8	15.3
900	0.33	170.0	4.81	74.2	0.10	70.8	0.19	−39.4	14.3
1000	0.34	164.9	4.37	71.2	0.11	69.9	0.18	−40.1	13.5
1200	0.36	157.5	3.65	65.7	0.13	68.8	0.16	−43.1	12.0
1400	0.39	152.6	3.15	60.9	0.15	66.8	0.14	−48.2	10.8
1600	0.39	147.8	2.79	55.6	0.17	64.9	0.12	−54.1	9.7
1800	0.41	140.5	2.51	50.4	0.19	63.0	0.10	−60.5	8.8
2000	0.43	133.4	2.31	45.9	0.20	60.7	0.08	−70.5	8.2
2200	0.47	127.8	2.11	41.8	0.22	57.7	0.06	−92.9	7.6
2400	0.49	124.8	1.95	37.8	0.24	56.1	0.05	−125.7	7.0
2600	0.51	121.6	1.79	33.0	0.26	54.6	0.05	−155.3	6.4
2800	0.51	115.7	1.68	27.9	0.28	52.0	0.05	179.9	5.8
3000	0.53	108.7	1.61	23.7	0.29	46.8	0.66	154.9	5.6

Table 6 Noise data, I_C = 45 mA; V_{CE} = 10 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	2.7	0.17	159.1	0.24
1000	3.0	0.30	−177.3	0.20

NPN 5 GHz wideband transistor — BFG97

DESCRIPTION

NPN planar epitaxial transitor mounted in a plastic SOT223 envelope.
It features excellent output voltage capabilities, and is primarily intended for use in MATV applications.

PNP complement is the BFG31.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

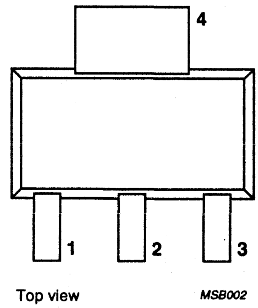


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V; T_j = 25 °C	25	80	–	
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	5.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	I_C = 70 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	–	700	–	mV

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 125 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 125 °C (note 1)	50 K/W

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	80	–	
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	5.5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	6.5	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 70 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	700	–	mV
d_2	second order intermodulation distortion	note 4	–	–56	–	dB
		note 5	–	–53	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 445.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 453.25 MHz; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 795.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 410 MHz.
5. I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_q = V_O$ = 50 dBmV; $f_{(p+q)}$ = 810 MHz.

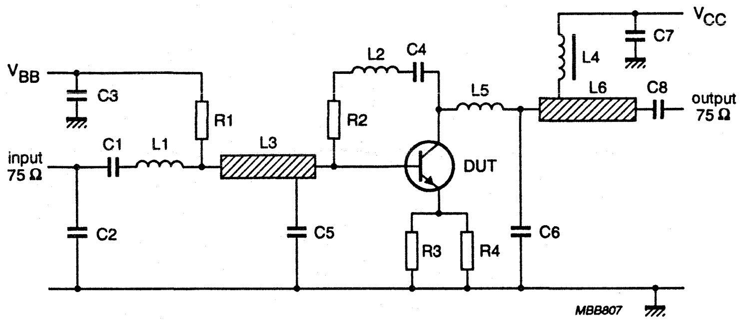


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C2, C3, C7, C8	multilayer ceramic capacitor	10 nF		2222 590 08627
C1, C4, C6	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C5 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1 (note 1)	0.5 turns 0.4 mm copper wire		int. dia. 3 mm	
L2	microstripline	75 Ω	length 14 mm; width 2.5 mm	
L3	microstripline	75 Ω	length 8 mm; width 2.5 mm	
L4, L5 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L6	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L7	Ferroxcube choke	5 μH		3122 108 20153
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	220 Ω		2322 180 73221
R3, R4	metal film resistor	30 Ω		2322 180 73309

Notes

The circuit has been built on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 2 x 35 μm.

1. Components C5, L1, L4, L5, and R2 are mounted on the underside of the PCB.

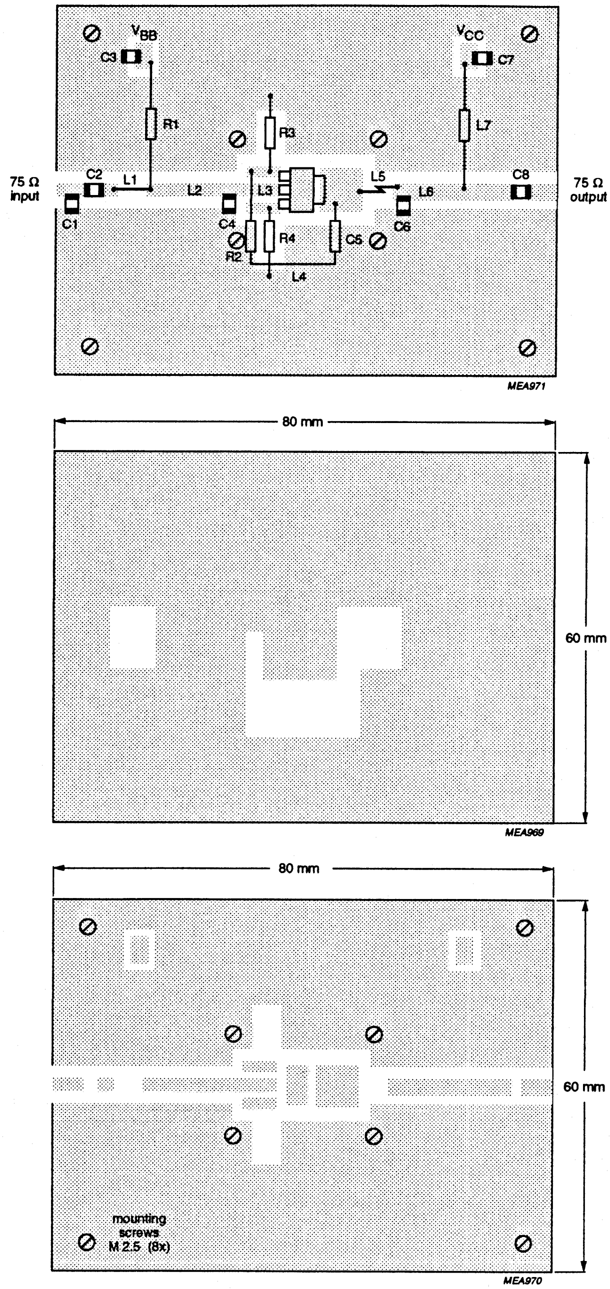


Fig.3 Intermodulation distortion and second order intermodulation distortion printed circuit board.

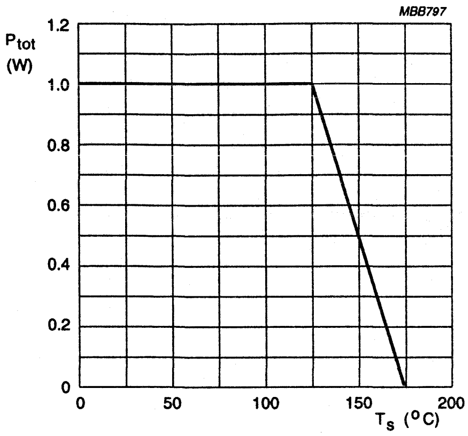
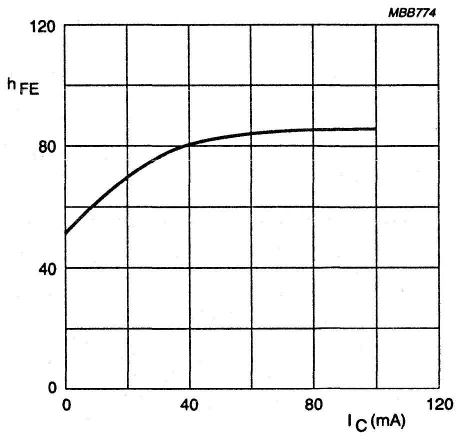
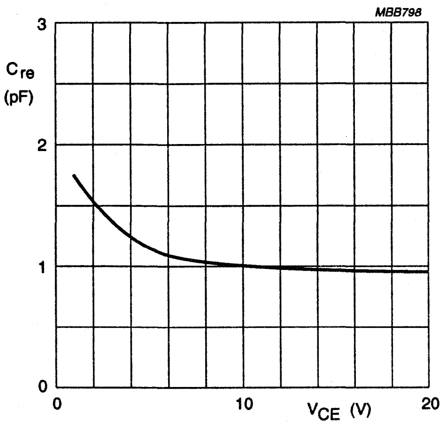


Fig.4 Power derating curve.



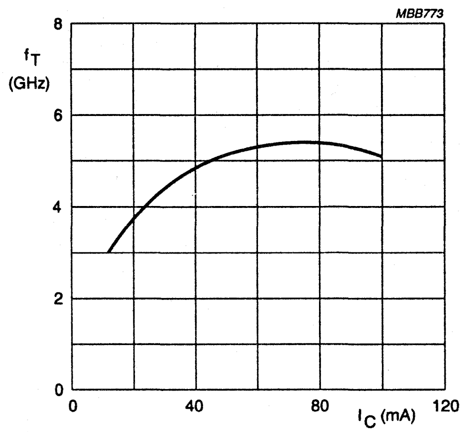
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



I_E = 0; f = 1 MHz; T_j = 25 °C.

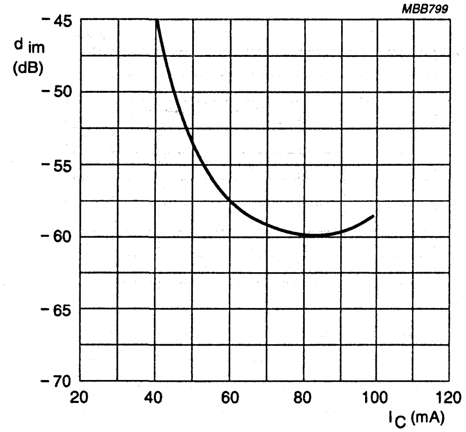
Fig.6 Feedback capacitance as a function of collector-emitter voltage.



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

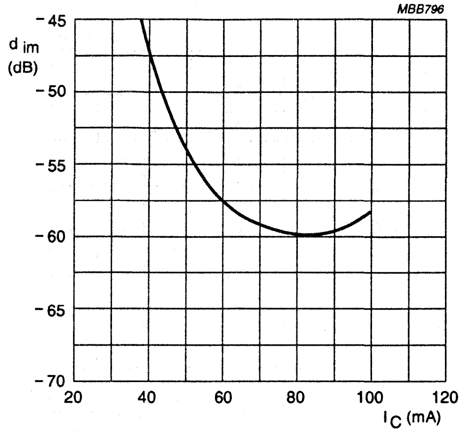
Fig.7 Transition frequency as a function of collector current.

NPN 5 GHz wideband transistor BFG97



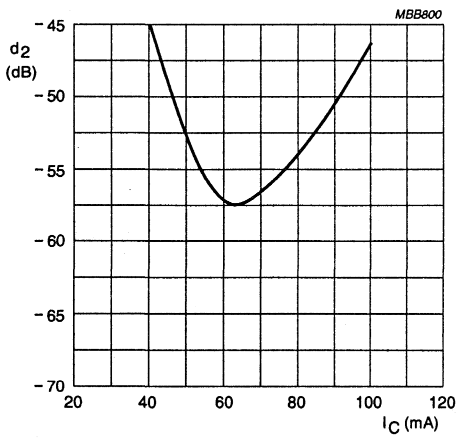
V_{CE} = 10 V; V_O = 750 mV; $f_{(p+q-r)}$ = 443.25 MHz;
T_{amb} = 25 °C.

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



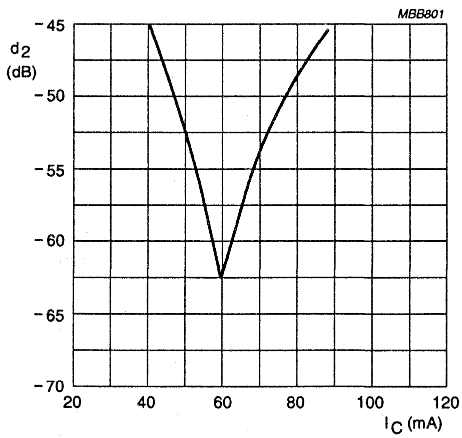
V_{CE} = 10 V; V_O = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz;
T_{amb} = 25 °C.

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



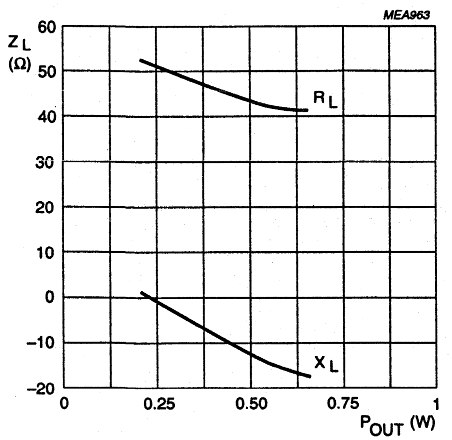
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 450 MHz;
T_{amb} = 25 °C.

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



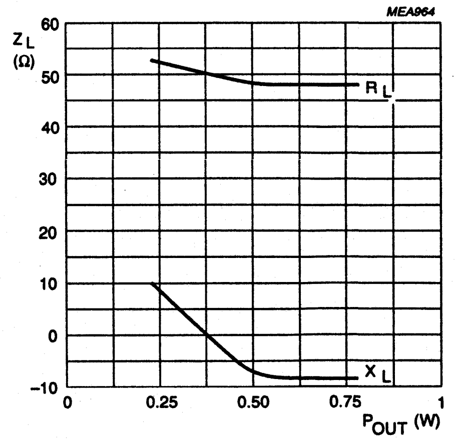
V_{CE} = 10 V; V_O = 50 dBmV; $f_{(p+q)}$ = 810 MHz;
T_{amb} = 25 °C.

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



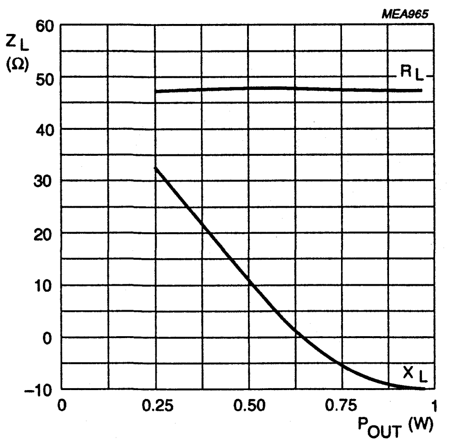
V_{CE} = 6 V; f = 900 MHz.

Fig.12 Load impedance as a function of output power.



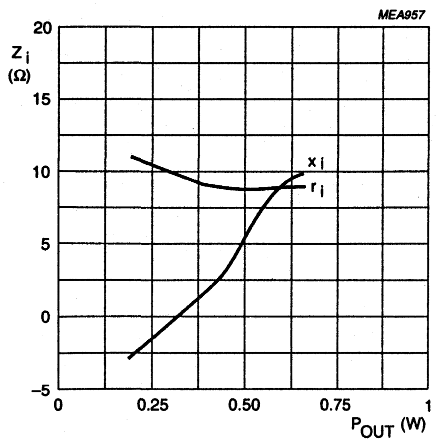
V_{CE} = 7.5 V; f = 900 MHz.

Fig.13 Load impedance as a function of output power.



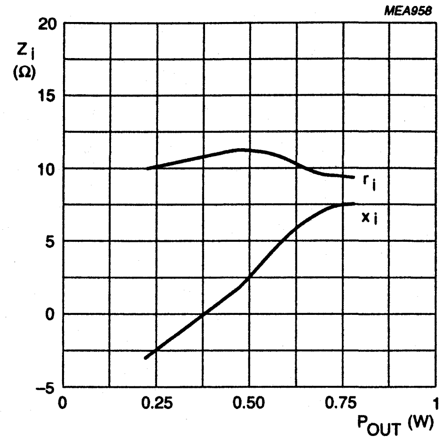
V_{CE} = 10 V; f = 900 MHz.

Fig.14 Load impedance as a function of output power.



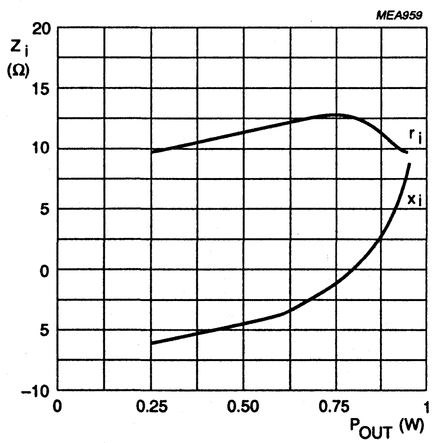
V_{CE} = 6 V; f = 900 MHz.

Fig.15 Input impedance as a function of output power.



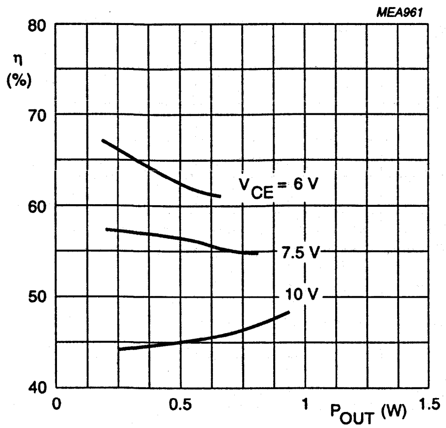
V_{CE} = 7.5 V; f = 900 MHz.

Fig.16 Input impedance as a function of output power.



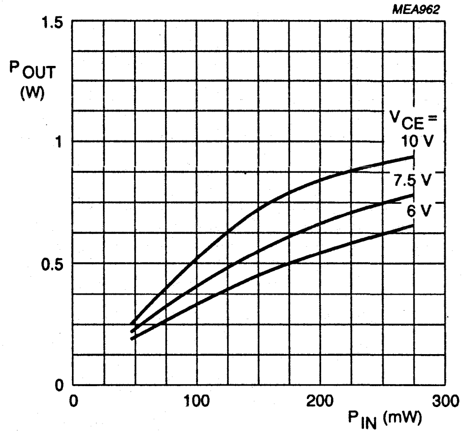
V_{CE} = 10 V; f = 900 MHz.

Fig.17 Input impedance as a function of output power.



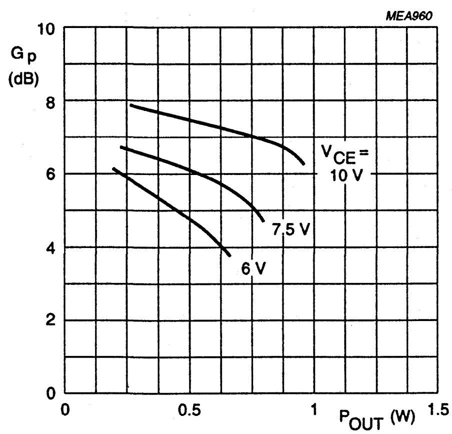
f = 900 MHz.

Fig.18 Efficiency as a function of output power.



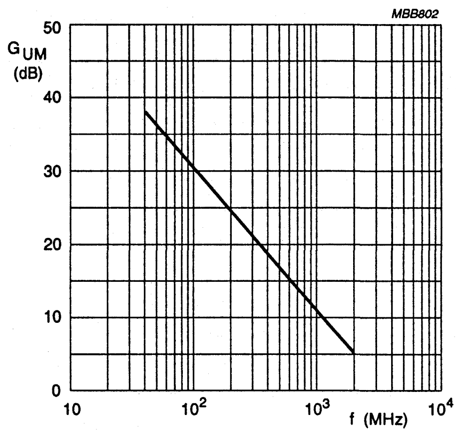
f = 900 MHz.

Fig.19 Output power as a function of input power.



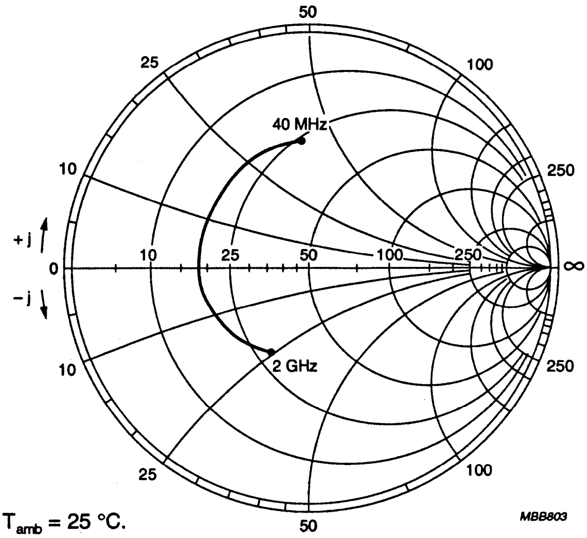
f = 900 MHz.

Fig.20 Power gain as a function of output power.



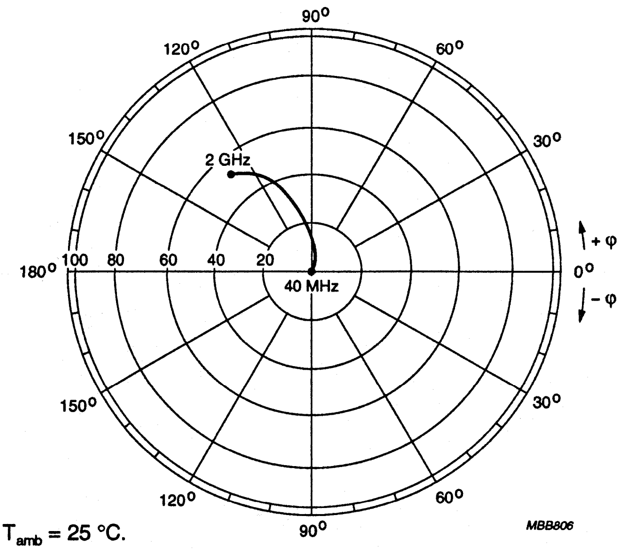
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.21 Maximum unilateral power gain as a function of frequency.



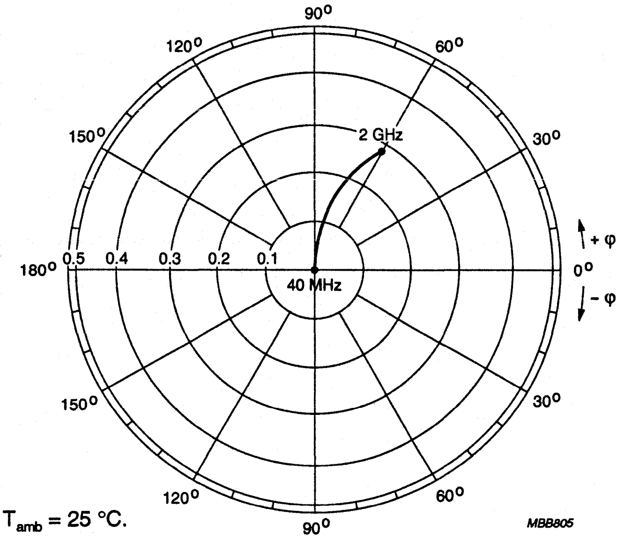
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



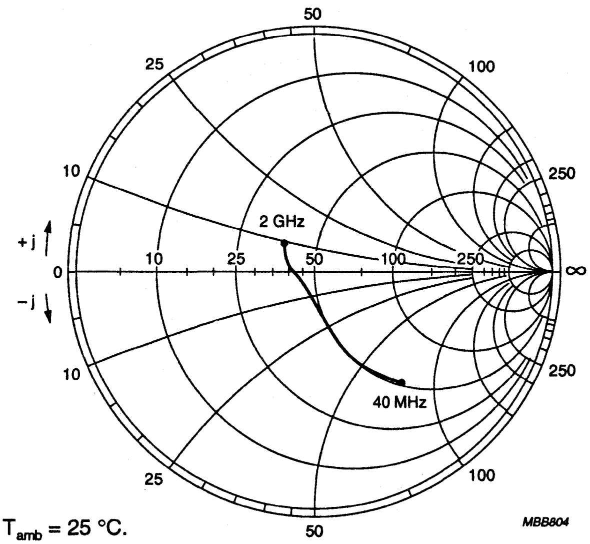
I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.23 Common emitter forward transmission coefficient (S_{21}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.24 Common emitter reverse transmission coefficient (S_{12}).



I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.25 Common emitter output reflection coefficient (S_{22}).

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

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.437	−102.2	53.674	130.5	0.013	61.1	0.629	−49.8	37.7
100	0.474	−146.2	27.244	106.8	0.021	60.7	0.326	−76.3	30.3
200	0.482	−166.9	14.286	95.1	0.035	67.9	0.175	−95.5	24.4
300	0.496	−174.8	9.637	88.4	0.048	69.1	0.124	−110.5	21.0
400	0.505	179.5	7.339	82.9	0.062	69.9	0.103	−123.7	18.6
500	0.491	174.2	5.901	79.2	0.077	70.3	0.091	−133.9	16.7
600	0.511	169.7	4.931	75.9	0.090	69.9	0.085	−143.1	15.2
700	0.513	166.5	4.261	72.5	0.103	69.3	0.082	−152.8	13.9
800	0.519	163.6	3.772	69.2	0.117	67.9	0.077	−162.6	12.9
900	0.521	159.0	3.344	66.0	0.129	67.0	0.078	−172.4	11.9
1000	0.539	155.1	3.030	63.3	0.142	65.6	0.084	−179.9	11.2
1200	0.554	148.2	2.534	56.6	0.169	63.5	0.102	164.6	9.7
1400	0.571	143.4	2.259	51.3	0.187	60.3	0.122	157.5	8.9
1600	0.585	139.3	1.947	45.8	0.213	58.6	0.139	152.0	7.7
1800	0.592	130.7	1.767	39.1	0.237	53.9	0.157	145.6	6.9
2000	0.622	124.8	1.630	34.7	0.256	52.2	0.182	138.3	6.5
2200	0.649	118.4	1.474	29.5	0.275	49.4	0.213	132.7	5.9
2400	0.655	115.2	1.360	27.1	0.286	48.5	0.241	128.3	5.4
2600	0.674	111.2	1.285	21.2	0.312	44.2	0.266	123.5	5.1
2800	0.675	104.4	1.170	16.0	0.319	39.7	0.280	117.3	4.4
3000	0.698	97.2	1.130	12.1	0.335	38.1	0.302	109.8	4.4

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

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.421	−112.5	57.018	126.8	0.011	60.6	0.575	−54.9	37.7
100	0.470	−152.3	27.744	104.6	0.021	61.0	0.287	−81.8	30.3
200	0.483	−169.6	14.399	94.0	0.033	69.8	0.157	−103.7	24.4
300	0.490	−177.5	9.723	87.6	0.048	71.9	0.116	−120.3	21.0
400	0.490	178.8	7.379	82.3	0.063	71.2	0.101	−134.4	18.6
500	0.495	172.9	5.943	78.7	0.078	71.6	0.093	−145.7	16.7
600	0.507	169.7	4.950	75.6	0.091	70.7	0.089	−154.2	15.2
700	0.508	166.5	4.283	72.1	0.104	70.2	0.089	−163.4	14.0
800	0.506	164.4	3.784	69.2	0.118	68.3	0.086	−172.8	12.9
900	0.512	159.1	3.367	65.8	0.131	67.8	0.088	178.6	11.9
1000	0.535	155.0	3.038	63.1	0.144	65.7	0.094	171.6	11.2
1200	0.545	148.4	2.556	56.4	0.169	63.7	0.115	159.1	9.7
1400	0.577	142.1	2.270	51.5	0.190	60.2	0.138	153.0	9.0
1600	0.569	138.2	1.955	46.1	0.215	58.8	0.154	147.9	7.6
1800	0.592	131.6	1.767	38.9	0.239	54.3	0.171	141.3	6.9
2000	0.626	122.8	1.644	34.7	0.258	51.7	0.196	135.2	6.6
2200	0.641	118.2	1.483	29.7	0.276	49.4	0.226	129.6	5.9
2400	0.678	115.3	1.366	27.3	0.289	48.1	0.255	125.2	5.7
2600	0.684	110.5	1.284	21.1	0.314	44.0	0.277	120.7	5.3
2800	0.673	103.3	1.171	16.3	0.321	39.7	0.290	114.8	4.4
3000	0.702	97.1	1.140	12.1	0.336	38.0	0.313	107.2	4.5

NPN 7 GHz wideband transistor — BFG135

DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The small emitter structures, with integrated emitter-ballasting resistors, ensure high output voltage capabilities at a low distortion level.

The distribution of the active areas across the surface of the device gives an excellent temperature profile.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

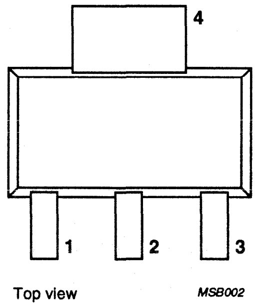


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	80	130	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	850	–	mV

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	1	µA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	130	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	7	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	note 1	–	900	–	mV
		note 2	–	850	–	mV
d_2	second order intermodulation distortion	I_C = 90 mA; V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 450 MHz	–	–58	–	dB
		I_C = 90 mA; V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 810 MHz	–	–53	–	dB

Notes

1. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 445.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 453.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
2. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.

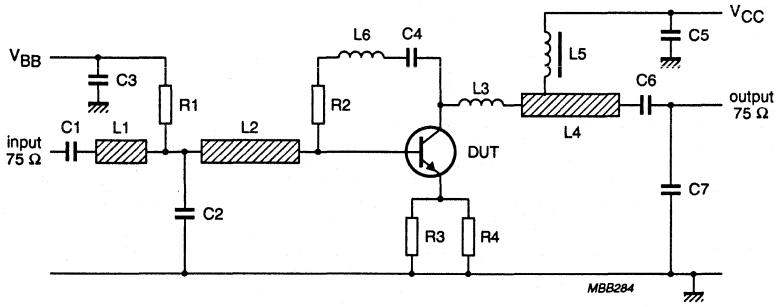


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

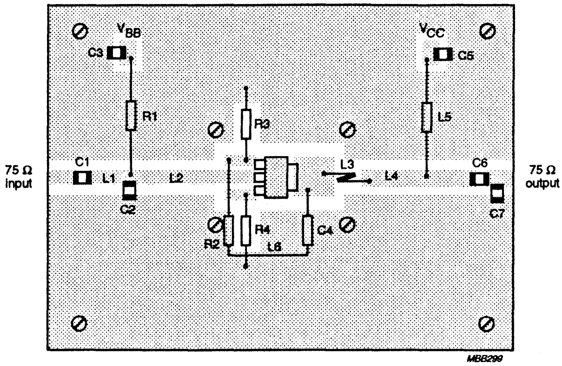
List of components (see test circuit)

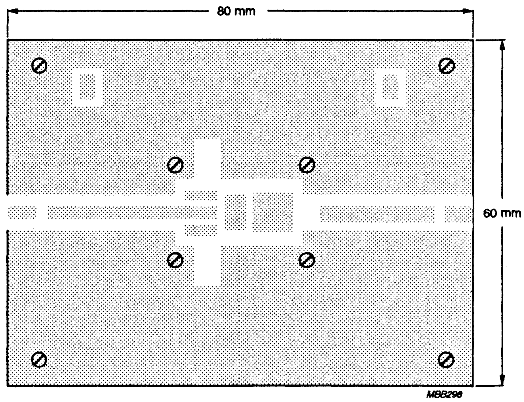
DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C5, C6	multilayer ceramic capacitor	10 nF		2222 590 08627
C2, C7	multilayer ceramic capacitor	1 pF		2222 851 12108
C4 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1	microstripline	75 Ω	length 7 mm; width 2.5 mm	
L2	microstripline	75 Ω	length 22mm; width 2.5 mm	
L3 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L5	Ferroxcube choke	5 μH		3122 108 20153
L6 (note 1)	0.4 mm copper wire	≈25 nH	length 30 mm	
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	200 Ω		2322 180 73201
R3, R4	metal film resistor	27 Ω		2322 180 73279

Notes

The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric ($\varepsilon_r = 2.2$); thickness 1⁄16 inch; thickness of copper sheet 1⁄32 inch.

1. Components C4, L3, L6 and R2 are mounted on the underside of the PCB.





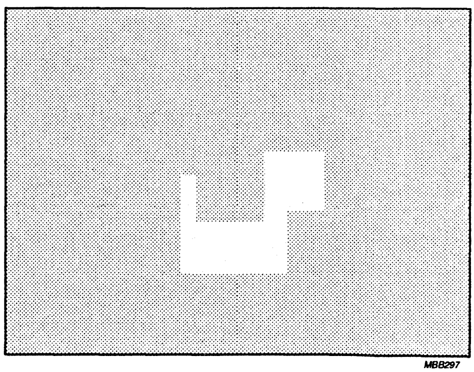


Fig.3 Intermodulation distortion test printed circuit board.

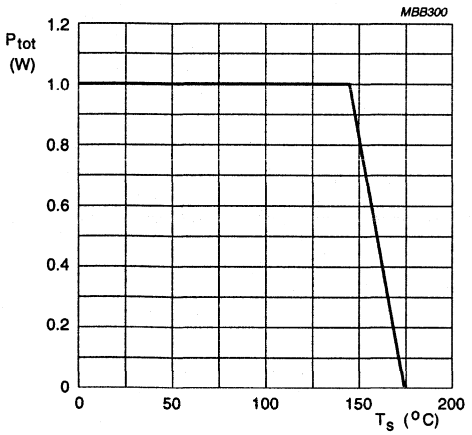
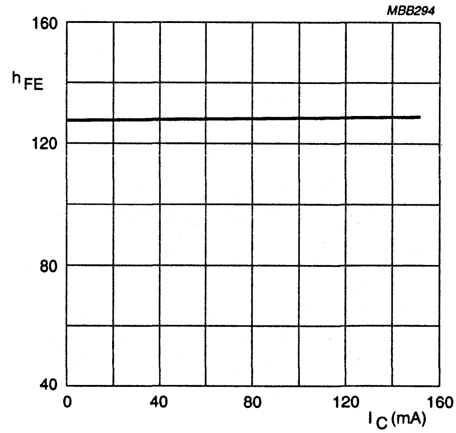
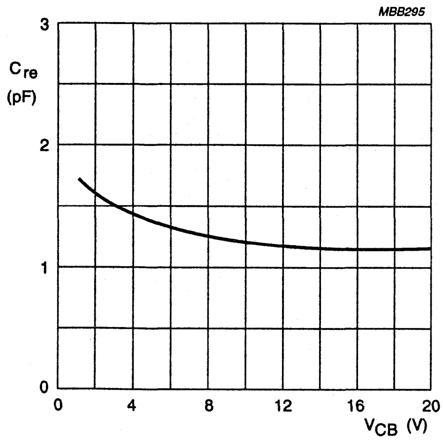


Fig.4 Power derating curve.



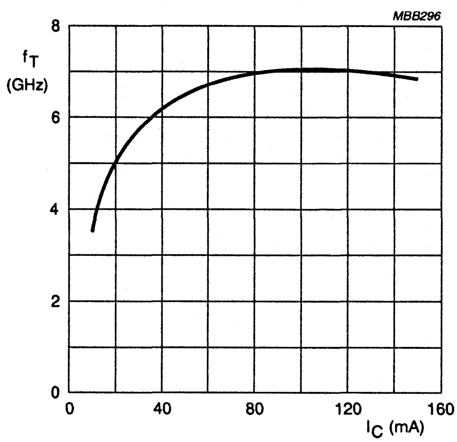
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



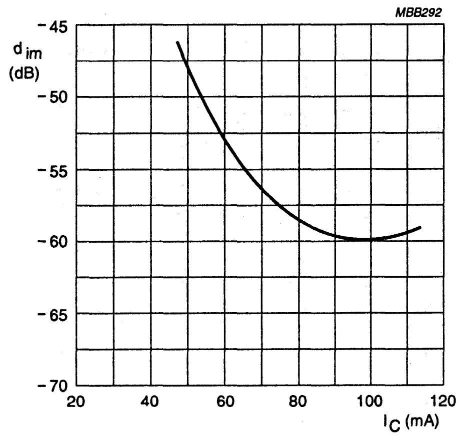
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-base voltage.



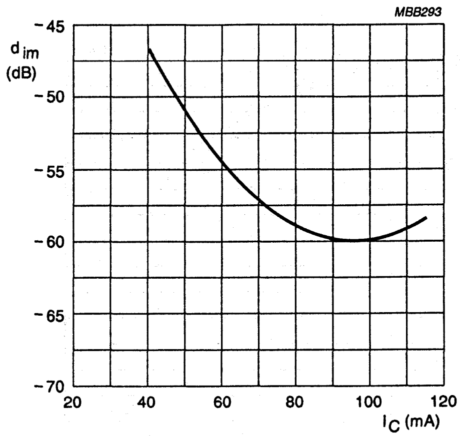
V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.



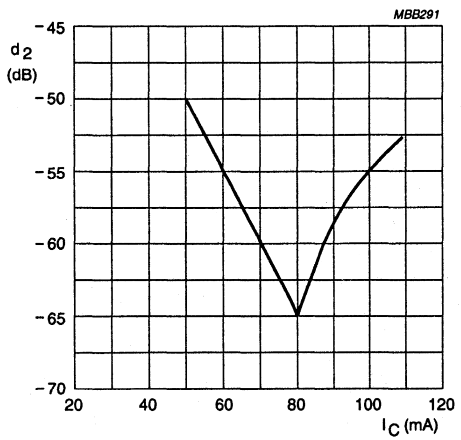
V_{CE} = 10 V; V_O = 900 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

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



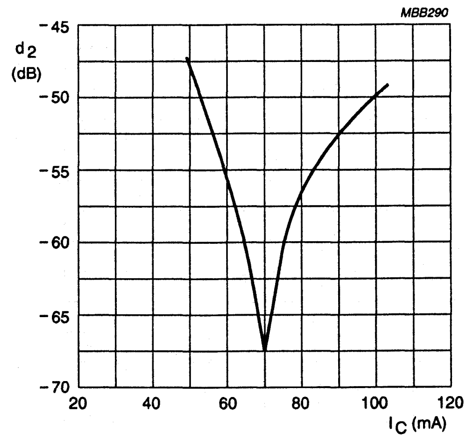
V_{CE} = 10 V; V_O = 850 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 793.25 MHz.

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



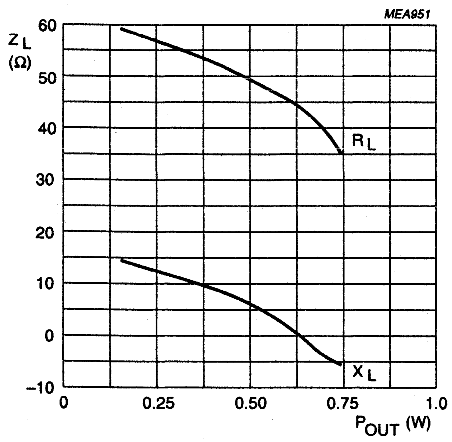
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 450 MHz.

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



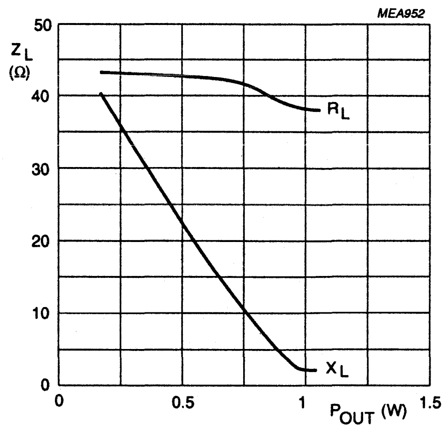
V_{CE} = 10 V; V_O = 50 dBmV; T_{amb} = 25 °C
$f_{(p+q)}$ = 810 MHz.

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



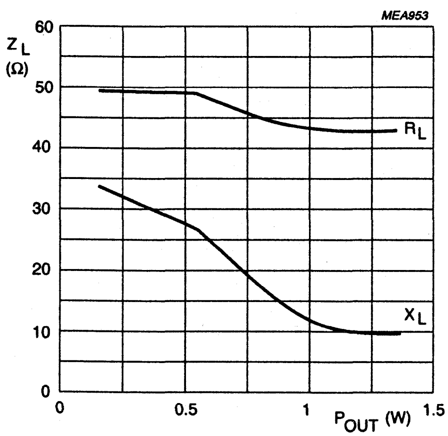
V_{CE} = 7.5 V; f = 900 MHz.

Fig.12 Load impedance as a function of output power.



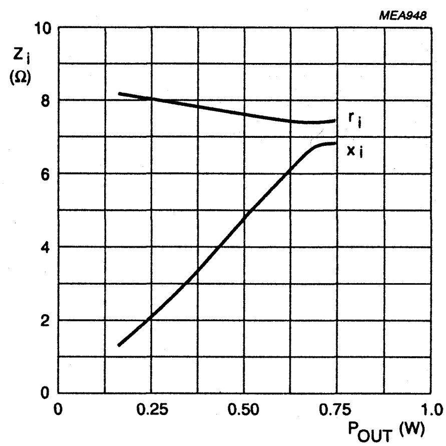
V_{CE} = 10 V; f = 900 MHz.

Fig.13 Load impedance as a function of output power.



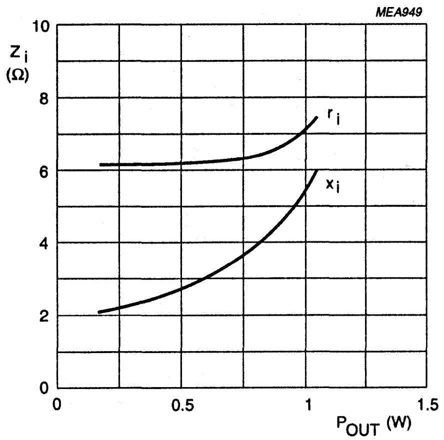
V_{CE} = 12.5 V; f = 900 MHz.

Fig.14 Load impedance as a function of output power.



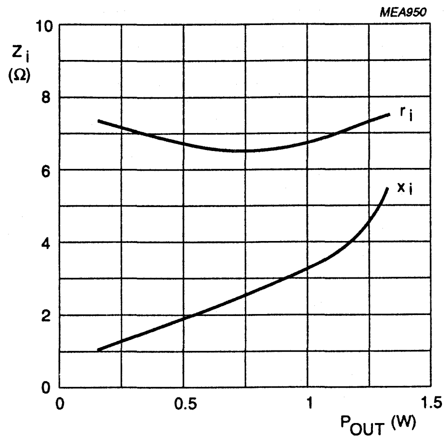
V_{CE} = 7.5 V; f = 900 MHz.

Fig.15 Input impedance as a function of output power.



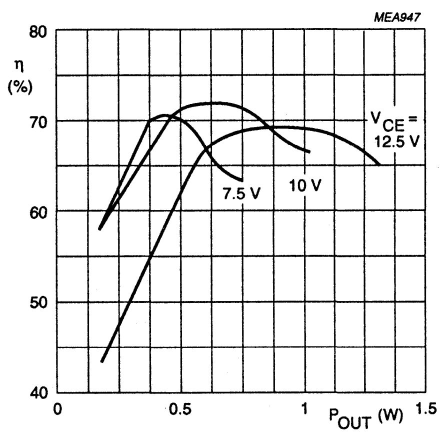
V_{CE} = 10 V; f = 900 MHz.

Fig.16 Input impedance as a function of output power.



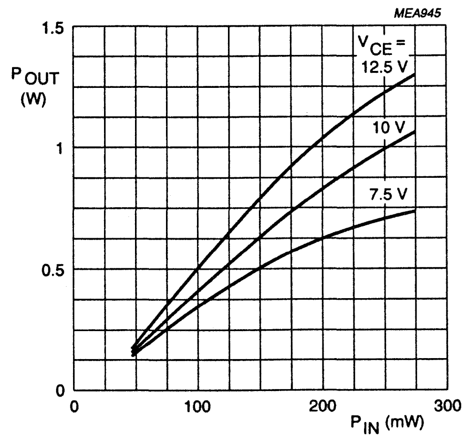
V_{CE} = 12.5 V; f = 900 MHz.

Fig.17 Input impedance as a function of output power.



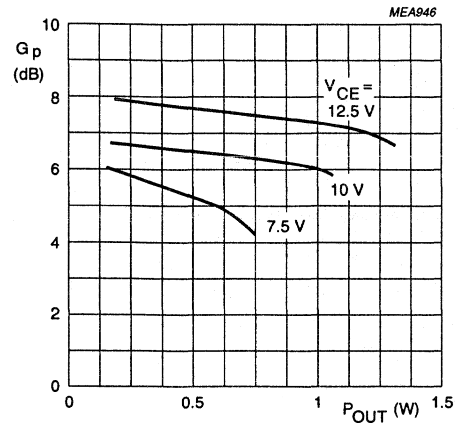
f = 900 MHz.

Fig.18 Efficiency as a function of output power.



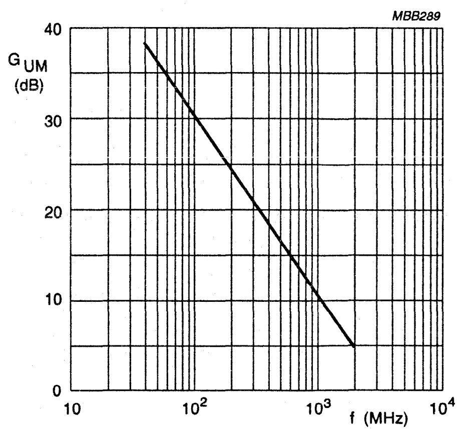
f = 900 MHz.

Fig.19 Output power as a function of input power.



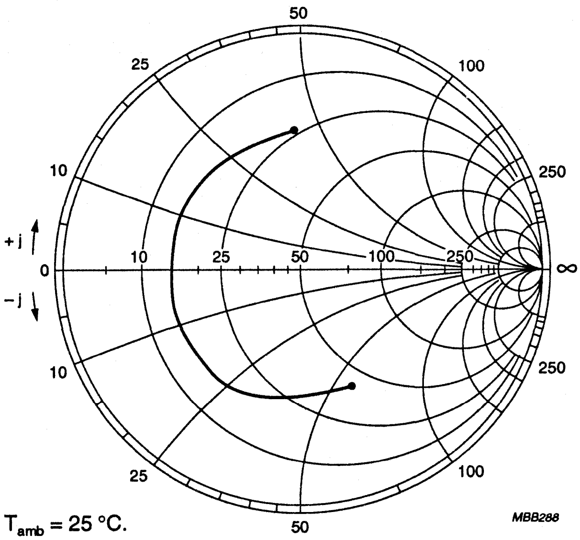
f = 900 MHz.

Fig.20 Power gain as a function of output power.



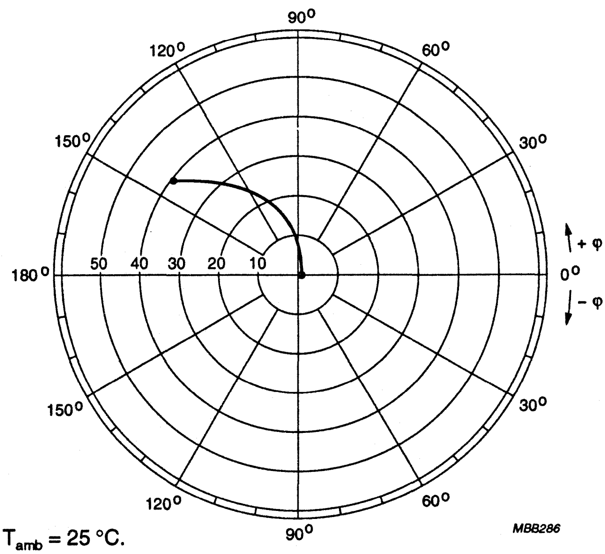
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.21 Maximum unilateral power gain as a function of frequency.



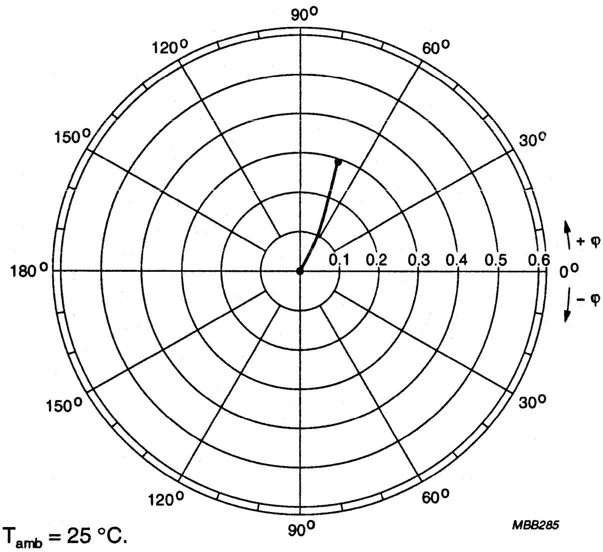
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



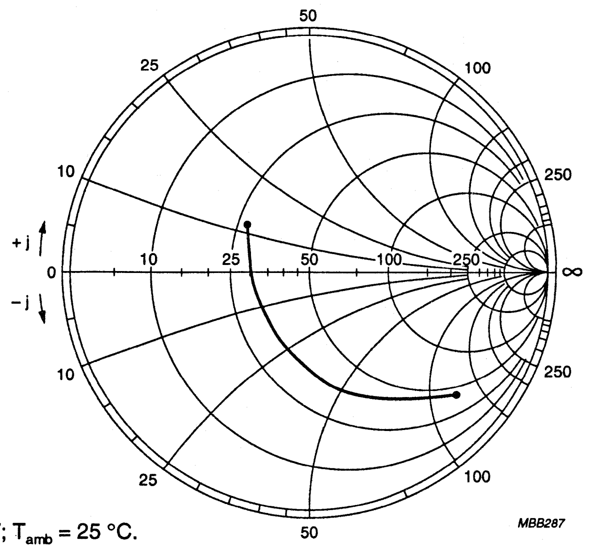
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.23 Common emitter forward transmission coefficient (S_{21}).



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

Fig.24 Common emitter reverse transmission coefficient (S_{12}).



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

Fig.25 Common emitter output reflection coefficient (S_{22}).

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.664	−52.8	34.530	148.0	0.022	67.1	0.833	−36.3	38.4
100	0.565	−104.1	22.367	120.3	0.038	51.3	0.561	−69.8	30.3
200	0.534	−140.8	12.969	102.0	0.052	49.2	0.353	−98.9	24.3
300	0.509	−157.7	8.879	92.9	0.062	52.4	0.276	−116.8	20.6
400	0.514	−168.4	6.794	86.8	0.074	55.4	0.243	−130.0	18.2
500	0.521	−175.8	5.501	81.4	0.085	58.0	0.230	−140.3	16.4
600	0.520	178.3	4.640	76.1	0.097	59.1	0.223	−148.5	14.9
700	0.516	174.1	4.048	71.9	0.109	60.4	0.221	−155.3	13.7
800	0.532	167.2	3.530	67.8	0.124	60.9	0.221	−161.7	12.6
900	0.520	163.7	3.201	65.2	0.136	60.7	0.225	−167.4	11.7
1000	0.538	160.0	2.885	61.0	0.150	60.6	0.232	−173.1	10.9
1200	0.553	151.3	2.466	54.3	0.176	59.9	0.252	176.9	9.7
1400	0.595	144.5	2.085	47.5	0.201	58.0	0.279	169.5	8.6
1600	0.589	137.9	1.850	41.7	0.226	57.2	0.308	162.9	7.6
1800	0.618	130.8	1.696	35.4	0.257	52.9	0.331	155.2	7.2
2000	0.632	124.8	1.538	30.3	0.282	50.7	0.364	147.6	6.6
2200	0.658	117.9	1.439	22.0	0.303	48.2	0.405	140.9	6.4
2400	0.688	113.0	1.260	20.5	0.319	46.6	0.440	134.9	5.7
2600	0.702	109.3	1.202	14.7	0.350	42.4	0.466	128.1	5.6
2800	0.695	101.8	1.108	7.2	0.361	37.2	0.487	120.1	4.9
3000	0.707	93.7	1.071	4.2	0.379	35.3	0.519	112.3	5.0

Table 2 Common emitter scattering parameters, $I_C = 75$ mA; $V_{CE} = 10$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.650	−56.2	36.130	146.2	0.022	64.7	0.815	−38.7	38.3
100	0.551	−106.4	22.936	119.3	0.038	51.1	0.535	−73.0	30.2
200	0.513	−142.7	13.020	101.2	0.051	50.2	0.340	−103.3	24.2
300	0.505	−159.1	8.969	92.2	0.062	54.4	0.270	−122.1	20.7
400	0.506	−169.3	6.847	85.9	0.075	57.1	0.244	−135.7	18.3
500	0.508	−177.1	5.533	80.7	0.088	59.1	0.232	−146.2	16.4
600	0.510	177.0	4.655	75.9	0.101	60.0	0.226	−154.2	14.9
700	0.512	171.2	4.025	71.7	0.114	61.1	0.227	−161.0	13.6
800	0.512	166.4	3.536	67.7	0.128	61.1	0.227	−167.6	12.5
900	0.518	161.5	3.183	64.2	0.141	60.9	0.233	−173.5	11.7
1000	0.525	157.0	2.891	60.5	0.156	60.6	0.241	−179.2	10.9
1200	0.550	148.6	2.439	53.8	0.183	59.1	0.263	171.1	9.6
1400	0.573	142.0	2.110	46.8	0.208	57.1	0.290	163.7	8.6
1600	0.583	136.4	1.865	40.7	0.236	55.8	0.318	157.2	7.7
1800	0.600	129.2	1.702	33.9	0.265	51.5	0.341	149.9	7.1
2000	0.626	122.5	1.557	28.6	0.289	49.1	0.370	142.5	6.6
2200	0.663	115.8	1.422	22.9	0.309	46.0	0.407	135.8	6.4
2400	0.683	111.4	1.300	19.8	0.324	44.6	0.444	129.7	6.0
2600	0.696	106.2	1.228	13.7	0.350	40.4	0.467	123.1	5.7
2800	0.701	99.6	1.099	8.3	0.360	34.9	0.480	115.0	4.9
3000	0.721	92.5	1.052	3.8	0.377	32.6	0.505	107.1	4.9

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.674	−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

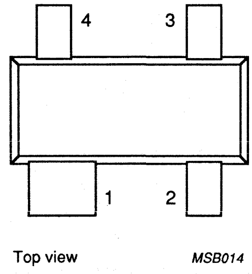


Fig.1 SOT143.

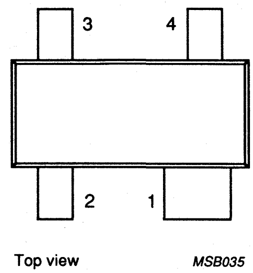


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	–	500	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 4 V; T_{amb} = 25 °C; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.7	–	dB

Note

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current	continuous	–	100	mA
P_{tot}	total power dissipation	up to T_s = 45 °C (note 1)	–	500	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 5$ V	40	110	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	3.3	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 4$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	16	–	dB
		$I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 50$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	2.3	–	dB
d_2	second order intermodulation distortion	$V_{CE} = 8$ V; $V_O = 50$ dBmV; $f_{(p+q)} = 810$ MHz; $I_C = 40$ mA	–	–51	–	dB

Note

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

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

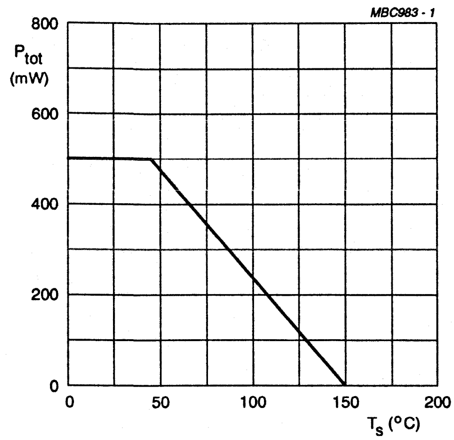
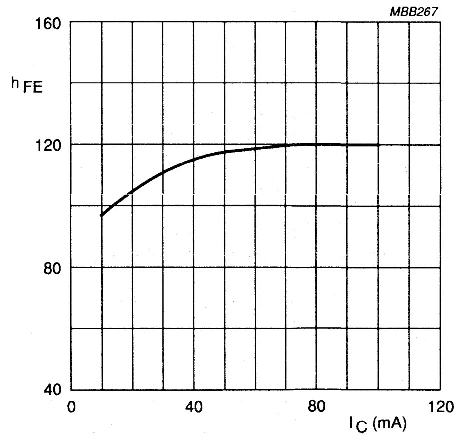
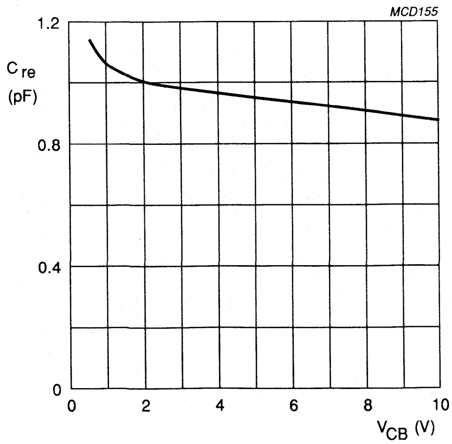


Fig.3 Power derating curve.



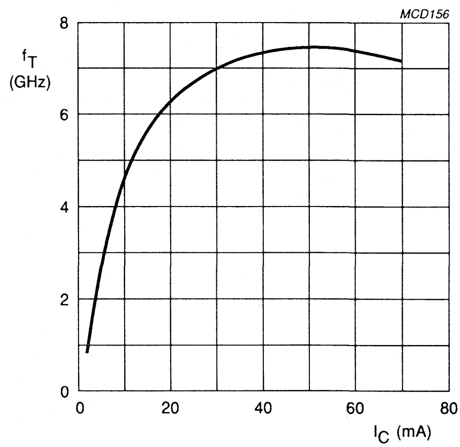
V_{CE} = 5 V.

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



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

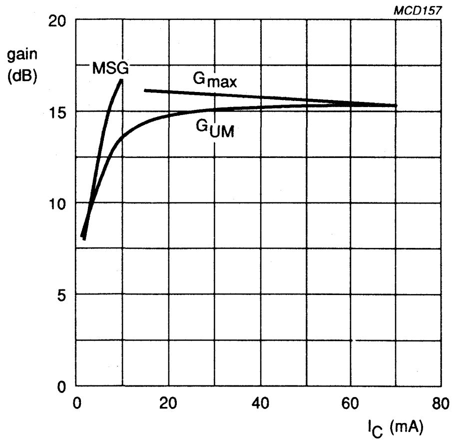
Fig.5 Feedback capacitance as a function of collector-base voltage.



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

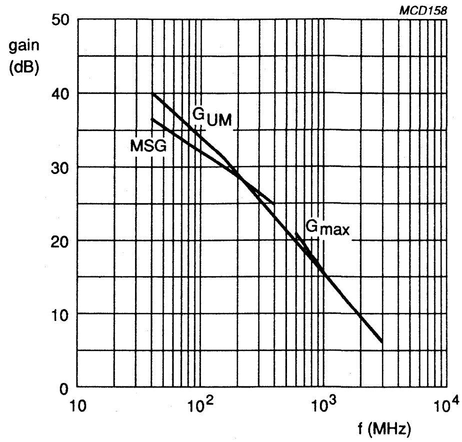
Fig.6 Transition frequency as a function of collector current.

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



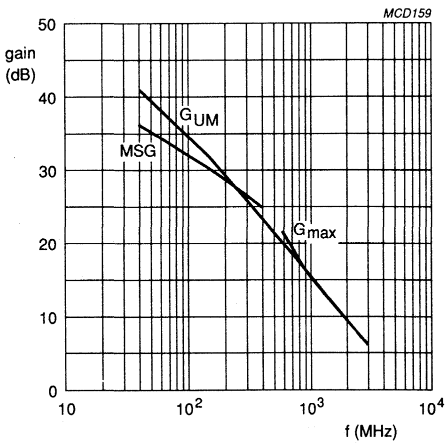
V_{CE} = 4 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



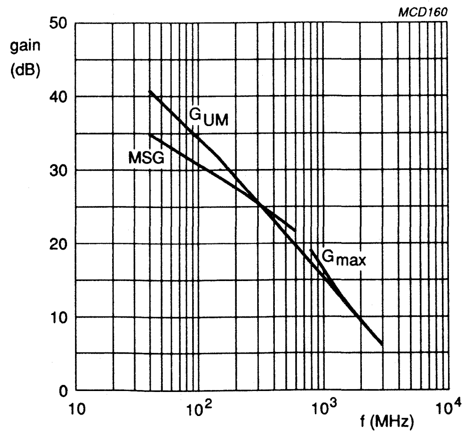
V_{CE} = 4 V; I_C = 50 mA.

Fig.8 Gain as a function of frequency.



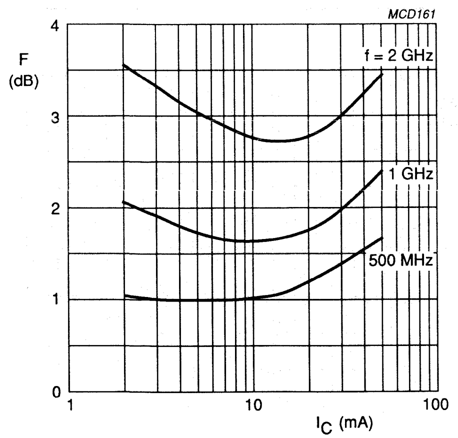
V_{CE} = 6 V; I_C = 50 mA.

Fig.9 Gain as a function of frequency.



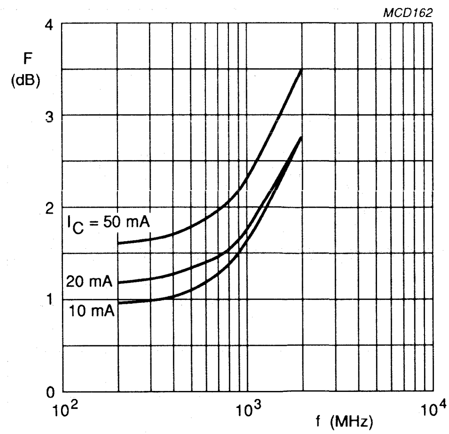
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



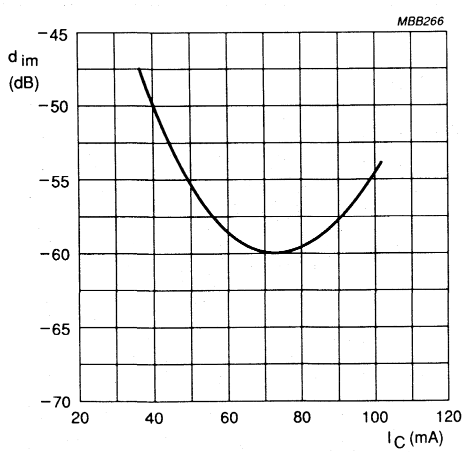
V_{CE} = 6 V.

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



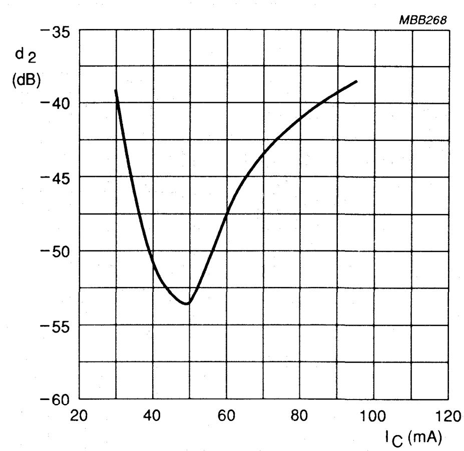
V_{CE} = 6 V.

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.

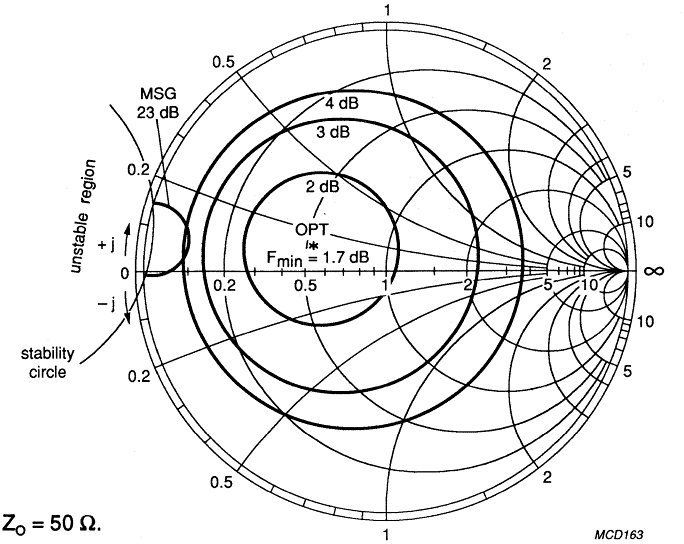
Fig.14 Second order intermodulation distortion, typical values.

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)

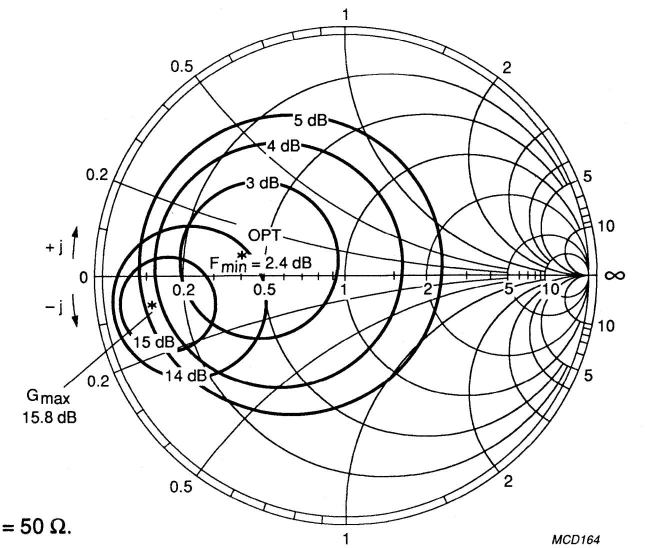
f (MHz)	V_{CE} (V)	I_C (mA)
1000	6	50

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.

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

BFG197(/X)

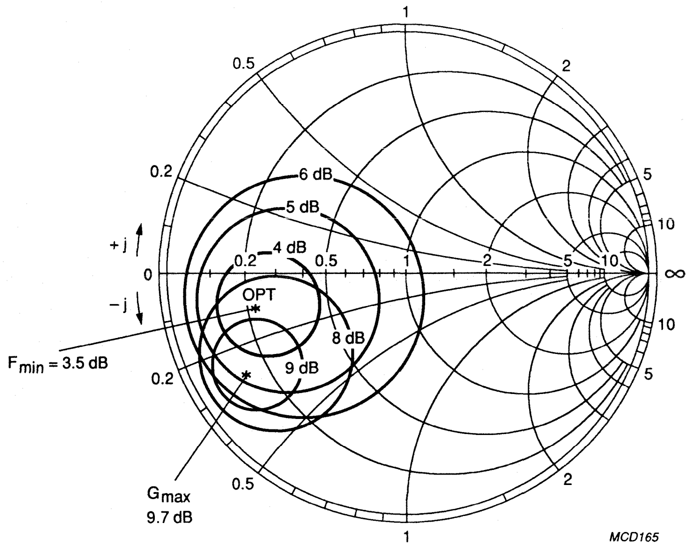
f (MHz)	V_{CE} (V)	I_C (mA)
2000	6	50

Noise Parameters

F_{min} (dB)	Gamma (opt)		$R_n/50$
	(mag)	(ang)	
3.5	0.644	−168	0.134

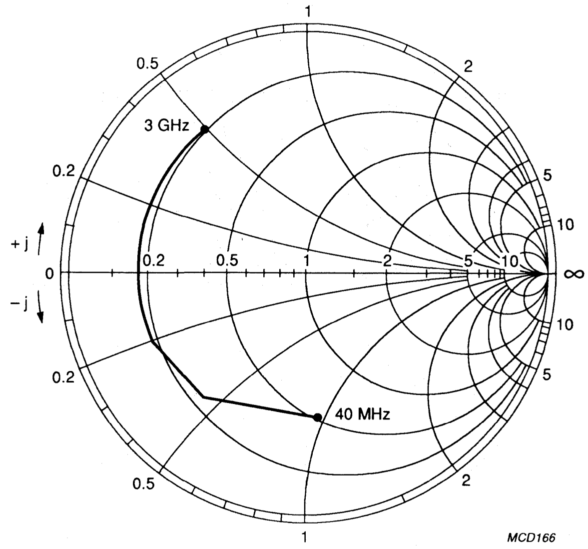
Average Gain Parameters

G_{max} (dB)	Gamma (max)	
	(mag)	(ang)
9.7	0.797	−149



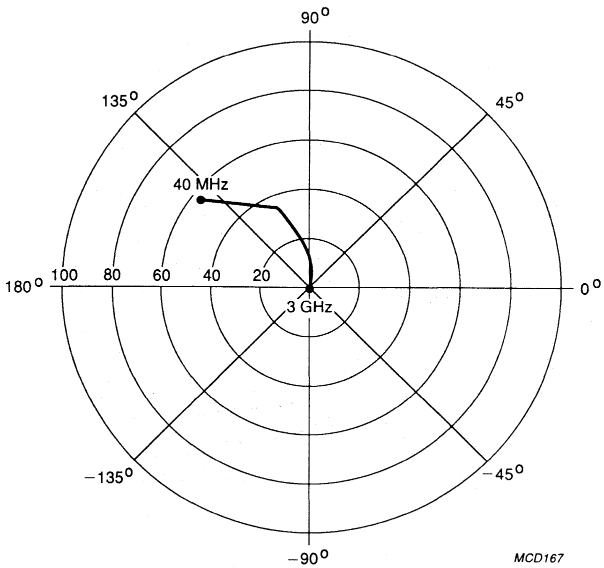
$Z_O = 50\ \Omega$.

Fig.17 Noise circle figure.



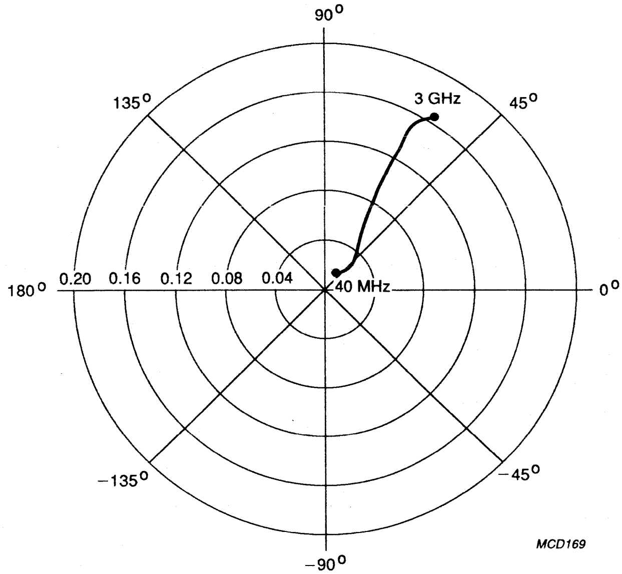
V_{CE} = 6 V; I_C = 50 mA.

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



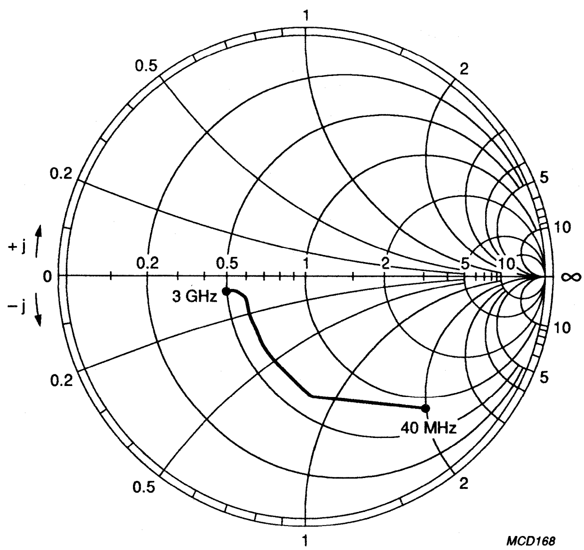
V_{CE} = 6 V; I_C = 50 mA.

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



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

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

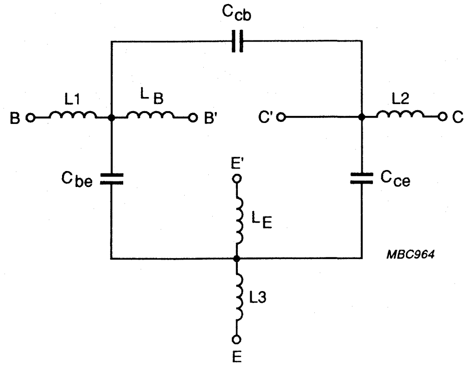


V_{CE} = 6 V; I_C = 50 mA.

Fig.21 Common emitter output reflection coefficient (S_{22}).

SPICE parameters of the BFQ195 crystal

1	IS = 1.972	fA
2	BF = 150.0	–
3	NF = 990.8	m
4	VAF = 54.72	V
5	IKF = 30.00	A
6	ISE = 47.82	fA
7	NE = 1.580	–
8	BR = 165.4	–
9	NR = 993.9	m
10	VAR = 2.351	V
11	IKR = 9.967	A
12	ISC = 3.510	fA
13	NC = 1.124	–
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 368.1	mΩ
18	RC = 937.2	mΩ
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 3.388	pF
23	VJE = 600.0	mV
24	MJE = 302.9	m
25	TF = 11.06	ps
26	XTF = 30.02	–
27	VTF = 1.649	V
28	ITF = 401.9	mA
29	PTF = 0.000	deg
30 (note 1)	CJC = 1.190	pF
31 (note 1)	VJC = 160.1	mV
32 (note 1)	MJC = 89.44	m
33	XCJC = 130.0	m
34	TR = 2.148	ns
35	CJS = 0.000	F
36	VJS = 750.0	mV
37	MJS = 0.000	–
38	FC = 785.9	m



$QL_B = 50$; $QL_E = 50$.
$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.
Fc = scaling frequency = 1000 MHz.

Fig.22 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.22)

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

Note

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

Table 1 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 10 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.727	−39.8	26.035	159.2	0.0195	71.3	0.927	−21.4	40.1
100	0.723	−85.0	20.536	135.8	0.0383	52.0	0.739	−46.2	32.9
200	0.731	−126.0	13.680	114.7	0.0511	36.4	0.507	−69.5	27.3
300	0.736	−145.0	9.804	103.6	0.0554	31.0	0.390	−82.8	23.9
400	0.739	−157.0	7.581	96.6	0.0576	29.1	0.330	−91.6	21.5
500	0.741	−164.0	6.168	91.3	0.0597	29.1	0.298	−98.2	19.7
600	0.744	−170.0	5.182	87.0	0.0609	30.1	0.281	−102.0	18.2
700	0.742	−175.0	4.454	83.2	0.0627	31.2	0.271	−106.0	16.8
800	0.740	−179.0	3.915	79.9	0.0646	32.9	0.267	−108.0	15.6
900	0.743	177.5	3.502	77.4	0.0670	34.7	0.266	−110.0	14.7
1000	0.741	173.8	3.172	74.1	0.0681	36.6	0.265	−112.0	13.8
1200	0.747	168.2	2.624	68.9	0.0724	40.9	0.272	−116.0	12.3
1400	0.753	163.2	2.252	63.9	0.0776	44.5	0.286	−120.0	11.1
1600	0.754	158.5	1.969	58.8	0.0829	47.7	0.303	−123.0	9.96
1800	0.753	153.7	1.761	53.9	0.0886	50.8	0.317	−125.0	9.01
2000	0.762	149.3	1.583	50.2	0.0973	53.9	0.326	−128.0	8.25
2200	0.765	144.3	1.448	47.0	0.1060	55.9	0.339	−133.0	7.57
2400	0.774	141.0	1.316	43.2	0.1120	58.1	0.362	−137.0	6.96
2600	0.772	137.2	1.202	39.0	0.1200	60.0	0.391	−141.0	6.25
2800	0.774	133.4	1.100	35.8	0.1310	61.3	0.417	−143.0	5.62
3000	0.776	129.4	1.043	32.8	0.1420	59.4	0.431	−145.0	5.25

Table 2 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.0	0.299	135.8	0.089
1000	1.6	0.429	159.3	0.117
2000	2.7	0.660	−171.2	0.085

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

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}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.594	−85.0	57.889	141.4	0.0142	58.6	0.738	−48.6	40.6
100	0.675	−133.0	33.628	115.7	0.0211	43.2	0.478	−88.7	34.3
200	0.712	−158.0	18.540	100.9	0.0258	41.3	0.340	−120.0	29.0
300	0.723	−168.0	12.583	94.1	0.0295	45.2	0.302	−136.0	25.6
400	0.727	−175.0	9.514	89.9	0.0337	49.8	0.289	−144.0	23.2
500	0.728	−179.0	7.661	86.3	0.0383	52.7	0.285	−149.0	21.3
600	0.730	177.6	6.395	83.4	0.0431	55.7	0.283	−153.0	19.8
700	0.728	174.3	5.496	80.8	0.0479	57.8	0.280	−155.0	18.4
800	0.728	171.6	4.828	78.2	0.0536	59.9	0.279	−156.0	17.3
900	0.733	168.9	4.308	76.4	0.0585	60.7	0.277	−157.0	16.4
1000	0.731	166.2	3.909	73.8	0.0633	61.5	0.277	−159.0	15.5
1200	0.733	161.4	3.237	69.8	0.0740	63.4	0.280	−161.0	13.9
1400	0.739	157.3	2.772	65.9	0.0843	64.1	0.288	−162.0	12.7
1600	0.733	153.6	2.430	61.7	0.0952	64.0	0.291	−162.0	11.4
1800	0.732	149.2	2.177	57.6	0.1050	63.9	0.292	−163.0	10.5
2000	0.738	145.0	1.968	54.1	0.1170	64.4	0.294	−164.0	9.69
2200	0.740	140.8	1.794	51.6	0.1280	63.5	0.303	−167.0	8.94
2400	0.751	137.7	1.648	47.7	0.1350	63.6	0.320	−169.0	8.41
2600	0.743	134.4	1.508	44.6	0.1440	63.7	0.338	−169.0	7.59
2800	0.749	130.3	1.389	41.3	0.1560	63.2	0.352	−169.0	7.00
3000	0.747	126.9	1.324	38.1	0.1660	59.7	0.356	−170.0	6.58

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.7	0.317	161.0	0.123
1000	2.4	0.408	169.9	0.170
2000	3.5	0.644	−168.0	0.134

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.774	−35.7	25.550	160.5	0.0188	72.6	0.931	−19.7	40.8
100	0.747	−78.2	20.632	137.9	0.0380	53.8	0.758	−43.0	33.6
200	0.737	−120.0	14.073	116.6	0.0518	37.8	0.528	−65.5	27.8
300	0.734	−140.0	10.181	105.2	0.0568	31.8	0.404	−78.2	24.3
400	0.732	−153.0	7.888	97.9	0.0592	29.3	0.340	−86.7	21.8
500	0.732	−161.0	6.437	92.5	0.0612	29.0	0.303	−92.8	19.9
600	0.733	−167.0	5.416	88.1	0.0629	29.9	0.284	−97.2	18.4
700	0.733	−173.0	4.669	84.2	0.0643	30.8	0.272	−101.0	17.1
800	0.729	−177.0	4.094	80.9	0.0664	32.4	0.267	−103.0	15.9
900	0.732	179.3	3.655	78.1	0.0681	33.8	0.264	−105.0	14.9
1000	0.732	176.1	3.321	74.9	0.0696	35.5	0.262	−107.0	14.1
1200	0.735	169.7	2.744	69.8	0.0733	40.0	0.266	−111.0	12.5
1400	0.739	164.5	2.363	64.9	0.0785	43.0	0.279	−115.0	11.2
1600	0.739	159.6	2.064	59.8	0.0834	46.1	0.294	−118.0	10.1
1800	0.737	155.1	1.854	54.9	0.0888	49.2	0.305	−120.0	9.19
2000	0.750	150.3	1.665	51.2	0.0972	52.5	0.314	−123.0	8.47
2200	0.755	145.9	1.511	48.1	0.1050	54.5	0.326	−128.0	7.73
2400	0.755	142.1	1.380	44.2	0.1110	56.5	0.346	−133.0	7.01
2600	0.762	138.0	1.263	40.5	0.1190	58.7	0.375	−137.0	6.45
2800	0.763	134.4	1.155	36.6	0.1290	60.1	0.400	−139.0	5.80
3000	0.762	130.4	1.092	33.5	0.1390	58.7	0.414	−141.0	5.36

Table 11 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.694	−51.7	39.502	153.5	0.0170	67.0	0.867	−30.0	40.8
100	0.696	−102.0	28.085	128.1	0.0303	47.4	0.634	−61.2	34.1
200	0.711	−139.0	17.156	108.9	0.0383	36.3	0.417	−89.1	28.6
300	0.718	−155.0	11.948	99.7	0.0416	35.5	0.326	−105.0	25.2
400	0.720	−164.0	9.125	93.9	0.0444	36.7	0.288	−116.0	22.8
500	0.721	−170.0	7.389	89.5	0.0476	38.7	0.270	−123.0	20.9
600	0.720	−175.0	6.193	86.0	0.0504	40.9	0.259	−128.0	19.3
700	0.723	−180.0	5.331	82.9	0.0536	43.6	0.253	−131.0	18.0
800	0.722	177.2	4.671	80.0	0.0572	45.5	0.249	−133.0	16.9
900	0.721	173.8	4.172	77.7	0.0612	47.7	0.246	−135.0	15.9
1000	0.723	171.0	3.780	74.7	0.0642	49.2	0.245	−137.0	15.0
1200	0.726	165.3	3.129	70.4	0.0723	52.7	0.249	−140.0	13.4
1400	0.731	161.0	2.686	66.2	0.0809	55.0	0.259	−142.0	12.2
1600	0.727	156.7	2.350	61.6	0.0894	56.1	0.268	−143.0	11.0
1800	0.730	152.0	2.103	57.3	0.0975	57.7	0.273	−143.0	10.1
2000	0.736	147.8	1.905	53.6	0.1080	59.2	0.278	−146.0	9.34
2200	0.743	143.2	1.748	50.7	0.1190	59.6	0.287	−149.0	8.71
2400	0.748	139.6	1.589	47.1	0.1250	60.3	0.307	−152.0	8.01
2600	0.746	136.2	1.454	43.3	0.1330	61.2	0.330	−154.0	7.28
2800	0.746	132.5	1.345	40.3	0.1440	61.5	0.349	−155.0	6.68
3000	0.744	128.7	1.279	36.9	0.1530	58.7	0.359	−156.0	6.24

Table 12 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11}		S_{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

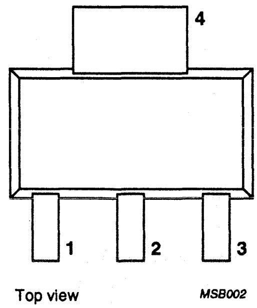


Fig.1 SOT223.

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	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C $f_{(p+q-r)}$ = 793.25 MHz	–	700	–	mV

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 5 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	8	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 8 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 8 V; f = 1 MHz	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
V_O	output voltage	note 2	–	750	–	mV
		note 3	–	700	–	mV
d_2	second order intermodulation distortion	note 4	–	–55	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 445.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 453.25 MHz; f_r = 445.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB;
   $V_q = V_O$ –6 dB; f_p = 795.25 MHz;
   $V_r = V_O$ –6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. I_C = 50 mA; V_{CE} = 8 V; V_O = 50 dBmV;
   $f_{(p+q)}$ = 810 MHz.

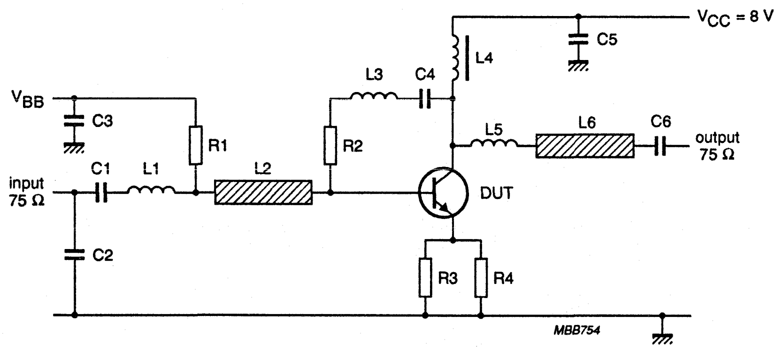


Fig.2 Intermodulation and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C2	multilayer ceramic capacitor	1.2 pF		2222 851 12128
C1, C4, C6, C7	multilayer ceramic capacitor	10 nF		2222 590 08627
C3	multilayer ceramic capacitor	10 nF		2222 851 12128
C5 (note 1)	multilayer ceramic capacitor	10 nF		2222 629 08103
C8	multilayer ceramic capacitor	1.5 pF		2222 851 12158
L1 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L2	microstripline	75 Ω	length 22 mm; width 2.5 mm	
L3 (note 1)	0.4 mm copper wire	≈ 24 nH	length 30 mm	
L4 (note 1)	0.4 mm copper wire	≈ 3.6 nH	length 4 mm	
L5	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L6	Ferroxcube choke	5 µH		3122 108 20153
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	220 Ω		2322 180 73221
R3, R4	metal film resistor	30 Ω		2322 180 73309

Notes

The circuit has been built on a double copper-clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1⁄16 inch; thickness of copper sheet 2 x 35 µm; see Fig.2.

1. Components C5, L1, L3, L4, and R2 are mounted on the underside of the PCB.

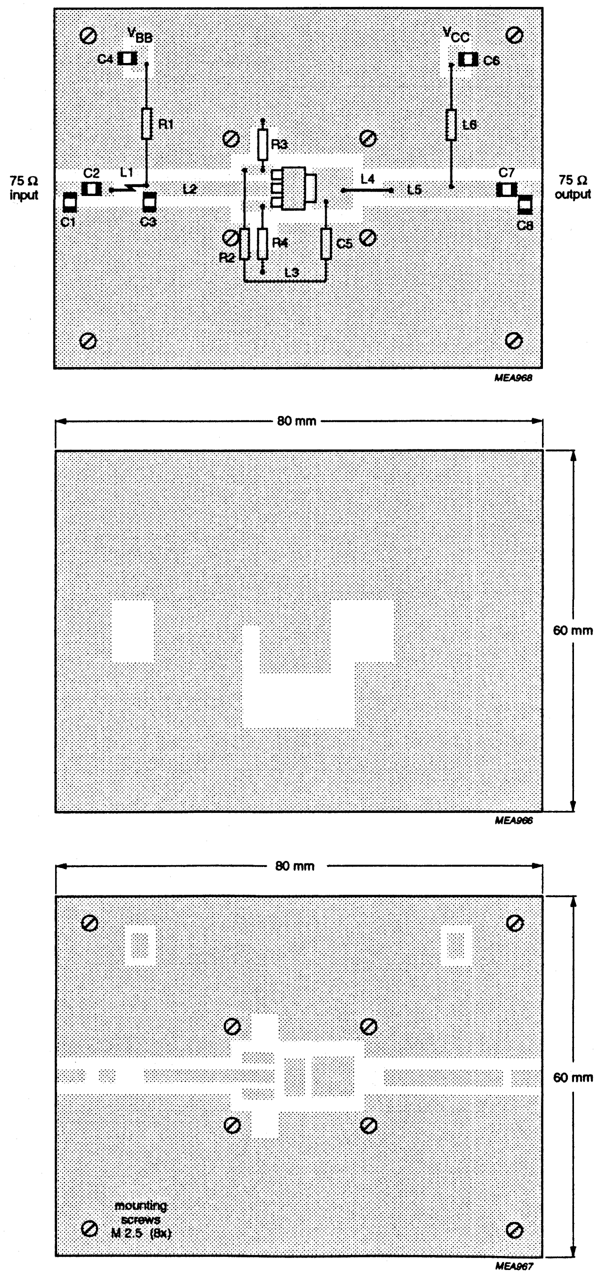


Fig.3 Intermodulation distortion and second order intermodulation distortion printed circuit board.

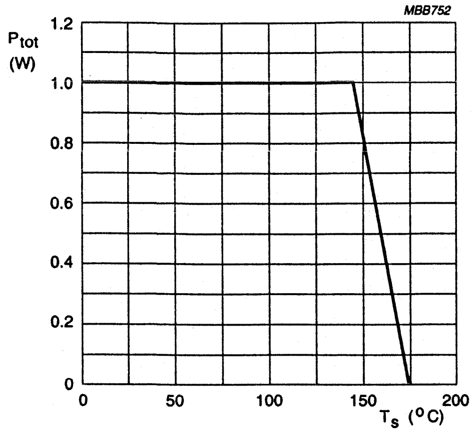
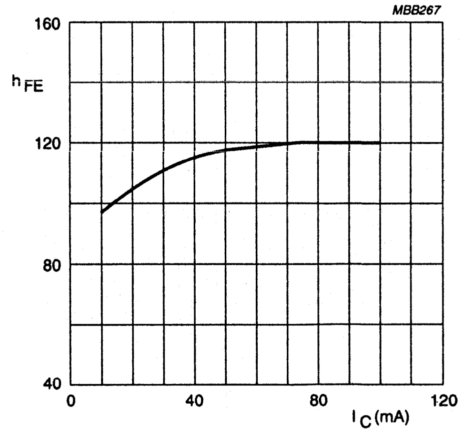
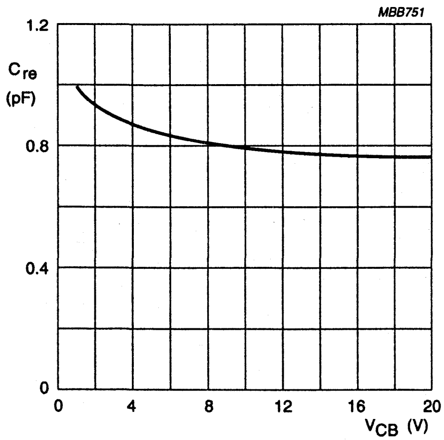


Fig.4 Power derating curve.



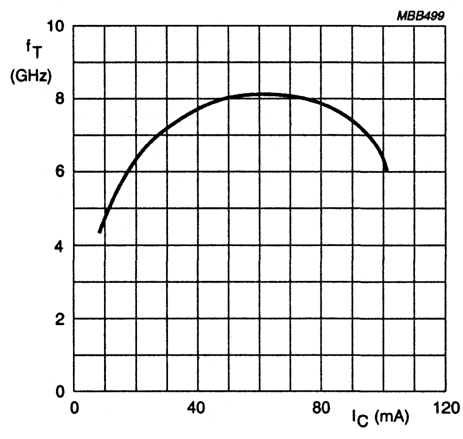
V_{CE} = 5 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



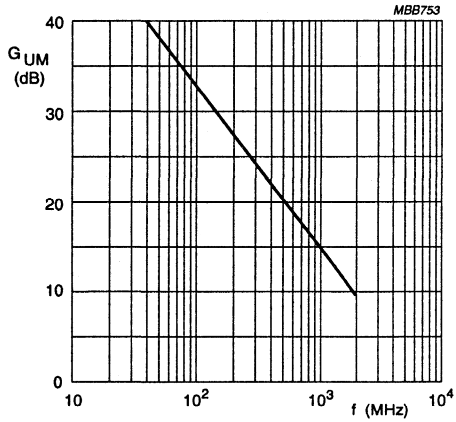
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-base voltage.



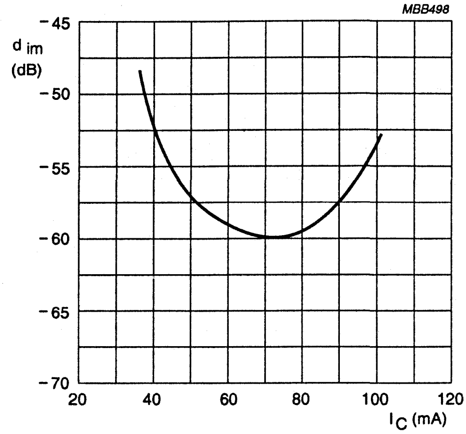
V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.7 Transition frequency as a function of collector current.



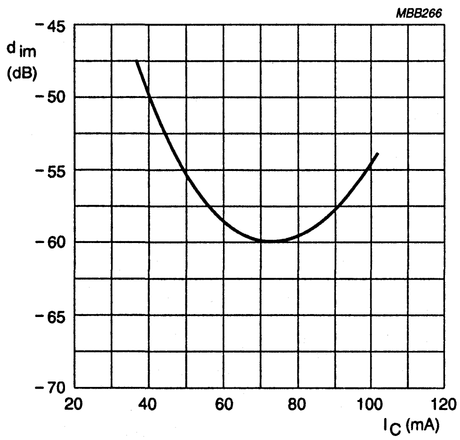
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



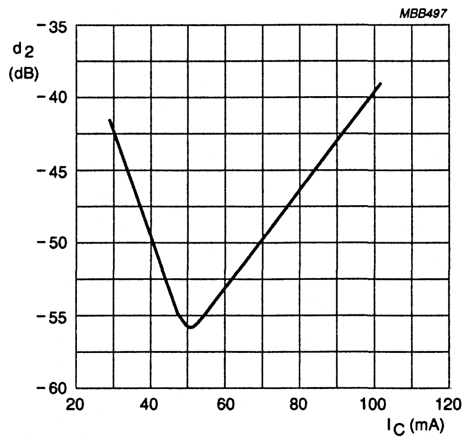
V_{CE} = 8 V; V_O = 750 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

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



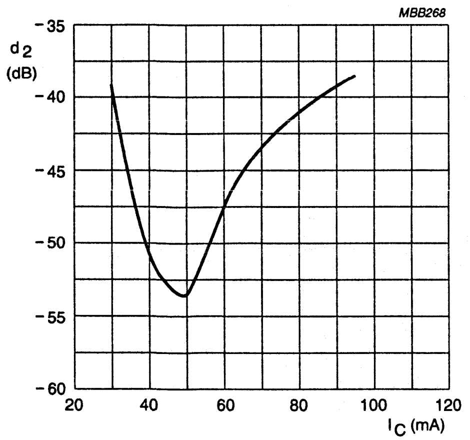
V_{CE} = 8 V; V_O = 700 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 793.25 MHz.

Fig.10 Intermodulation distortion as a function of collector current.



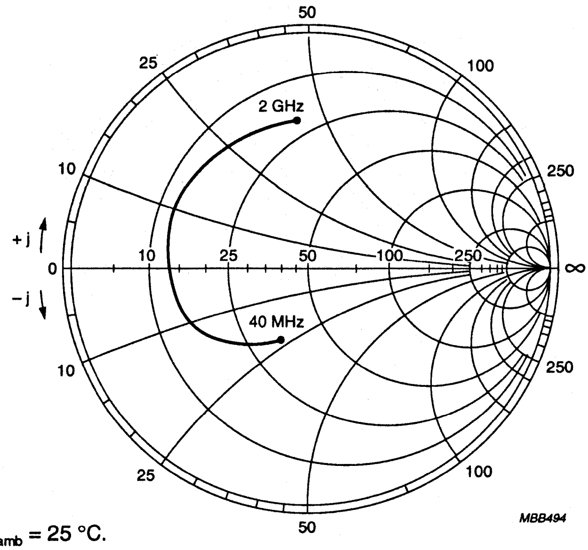
V_{CE} = 8 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 450 MHz.

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



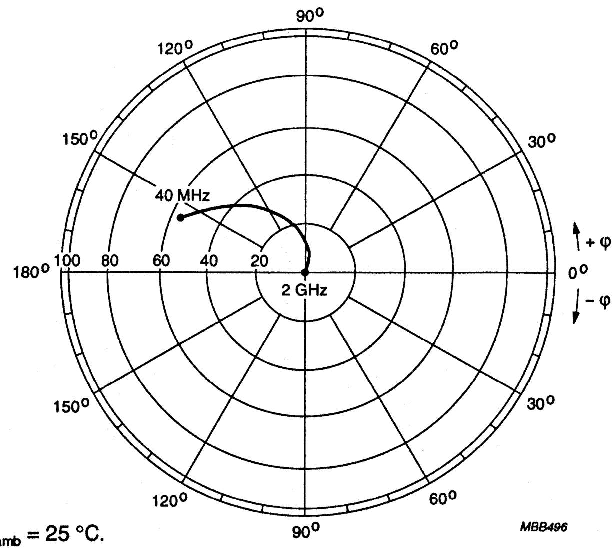
V_{CE} = 8 V; V_O = 50 dBmV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 810 MHz.

Fig.12 Second order intermodulation distortion as a function of collector current.



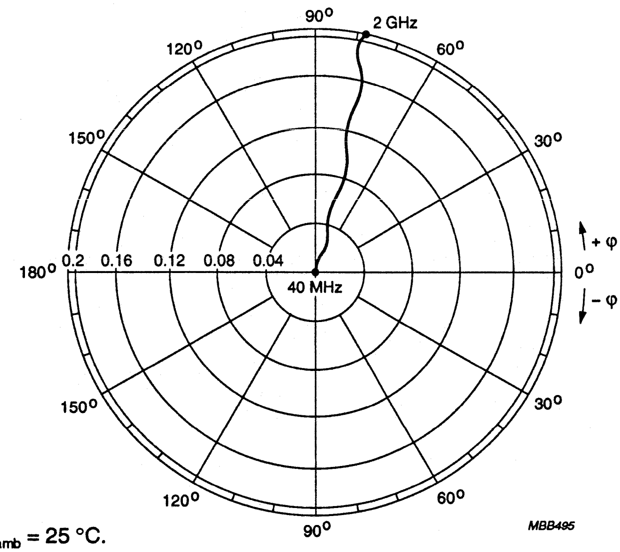
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

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



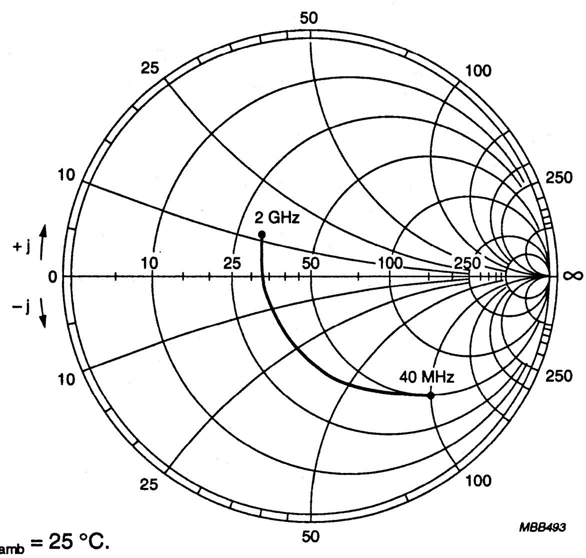
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

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



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

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



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

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

Table 1 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 8$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{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, I_C = 70 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.357	−122.	60.320	139.1	0.00885	69.9	0.687	−46.7	39.0
100	0.508	−153.	33.731	113.3	0.0164	64.7	0.407	−81.8	32.6
200	0.561	−169.	18.605	98.4	0.0266	65.9	0.253	−110.	27.3
300	0.574	−177.	12.479	91.8	0.0359	69.8	0.205	−128.	23.8
400	0.583	178.5	9.438	86.0	0.0461	71.5	0.184	−142.	21.5
500	0.586	173.0	7.651	82.6	0.0560	71.6	0.176	−151.	19.6
600	0.586	169.9	6.488	79.8	0.0676	71.8	0.173	−159.	18.2
700	0.585	166.0	5.579	76.0	0.0751	70.6	0.172	−165.	16.9
800	0.588	163.1	4.790	73.1	0.0868	71.7	0.173	−171.	15.6
900	0.578	158.4	4.346	69.7	0.0955	71.1	0.176	−177.	14.7
1000	0.606	154.9	3.941	66.8	0.106	69.7	0.181	177.5	14.0
1200	0.613	150.7	3.325	61.4	0.127	68.3	0.198	168.8	12.7
1400	0.633	144.3	2.820	55.9	0.143	66.0	0.217	162.3	11.4
1600	0.639	139.7	2.464	50.9	0.163	64.6	0.235	157.2	10.4
1800	0.646	133.7	2.267	44.7	0.182	60.1	0.249	150.9	9.73
2000	0.685	127.0	2.042	40.2	0.199	57.6	0.272	144.5	9.28
2200	0.695	121.4	1.817	36.4	0.215	55.2	0.303	138.5	8.47
2400	0.741	118.9	1.675	33.4	0.223	55.0	0.329	134.7	8.44
2600	0.744	114.5	1.570	27.6	0.246	51.2	0.351	129.5	7.98
2800	0.728	110.2	1.409	22.3	0.257	46.7	0.362	122.5	6.86
3000	0.743	102.1	1.360	17.2	0.270	45.2	0.382	116.0	6.85

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

FEATURES

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

DESCRIPTION

The BFG505 is an NPN silicon planar epitaxial transistor, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV).

The transistors are mounted in a plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG505 (Fig.1) Code: N33	
1	collector
2	base
3	emitter
4	emitter
BFG505/X (Fig.1) Code: N39	
1	collector
2	emitter
3	base
4	emitter
BFG505/XR (Fig.2) Code: N45	
1	collector
2	emitter
3	base
4	emitter

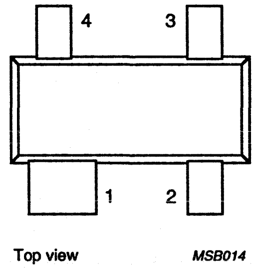


Fig.1 SOT143.

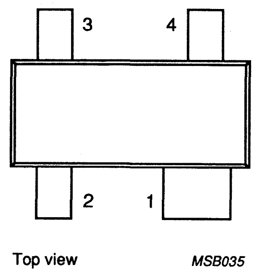


Fig.2 SOT143R.

Capability approved 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	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to $T_s = 105$ °C (note 1)	–	–	150	mW
h_{FE}	DC current gain	$V_{CE} = 6$ V; $I_C = 5$ mA	60	120	250	
C_{re}	feedback capacitance	$V_{CB} = 6$ V; $I_C = i_c = 0$; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	$V_{CE} = 6$ V; $I_C = 5$ mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$V_{CE} = 6$ V; $I_C = 5$ mA; $T_{amb} = 25$ °C; f = 900 MHz	–	20	–	dB
		$V_{CE} = 6$ V; $I_C = 5$ mA; $T_{amb} = 25$ °C; f = 2 GHz	–	13	–	dB
$\vert S_{21}\vert^2$	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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	18	mA
P_{tot}	total power dissipation	up to $T_s = 105$ °C (note 1)	–	150	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 6 V; I_E = 0;	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 5 mA;	60	120	250	
C_e	emitter capacitance	V_{EB} = 0.5 V; $I_C = i_c$ = 0; f = 1 MHz	–	0.4	–	pF
C_c	collector capacitance	V_{CB} = 6 V; $I_E = i_e$ =0; f = 1 MHz	–	0.3	–	pF
C_{re}	feedback capacitance	V_{CB} = 6 V; I_C = 0; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_C = 1.25 mA; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.
2. V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.

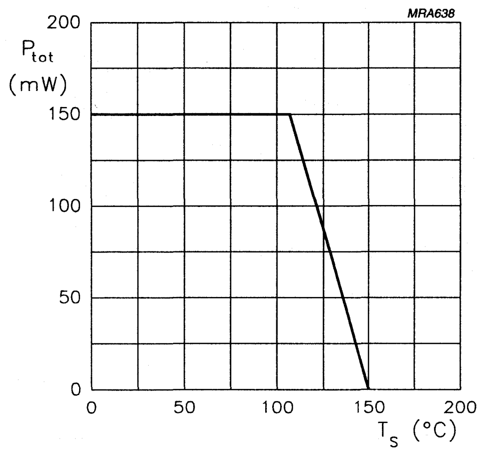
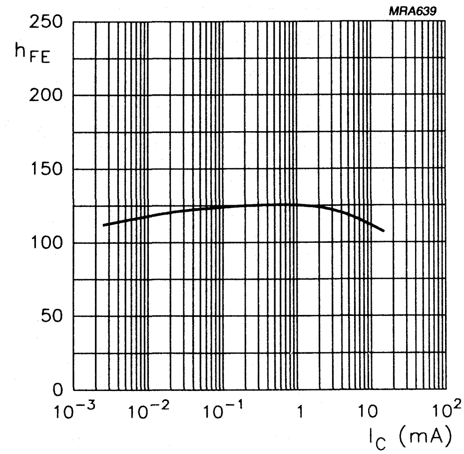
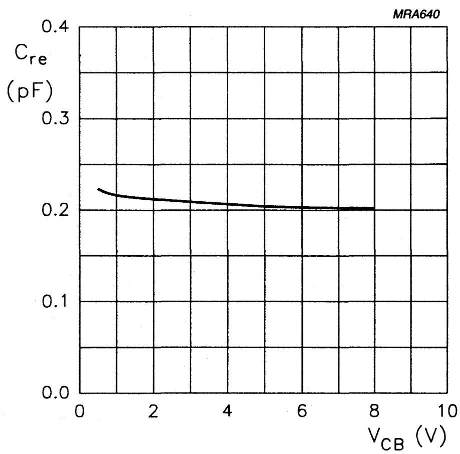


Fig.3 Power derating curve.



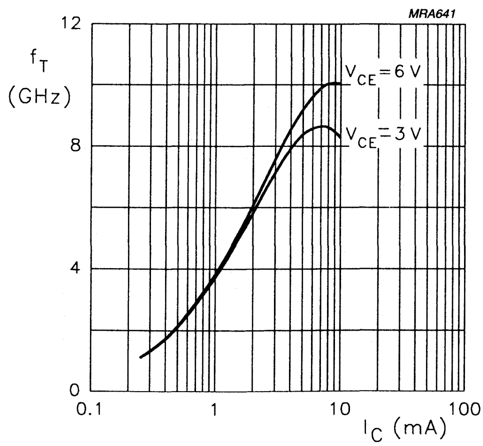
V_{CE} = 6 V.

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



I_C = 0; f = 1 MHz.

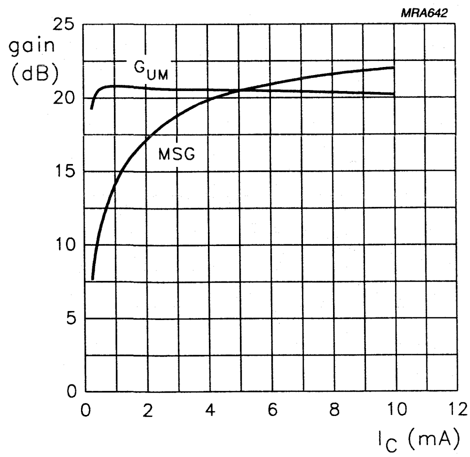
Fig.5 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

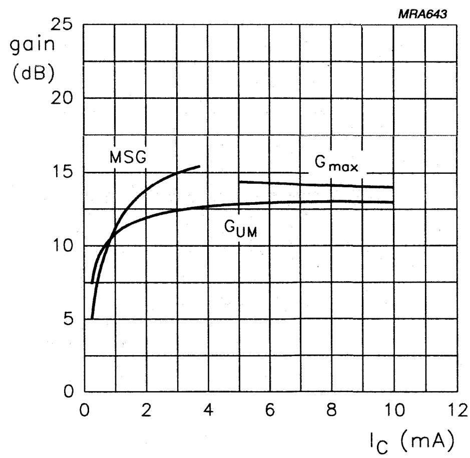
Fig.6 Transition frequency as a function of collector current.

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



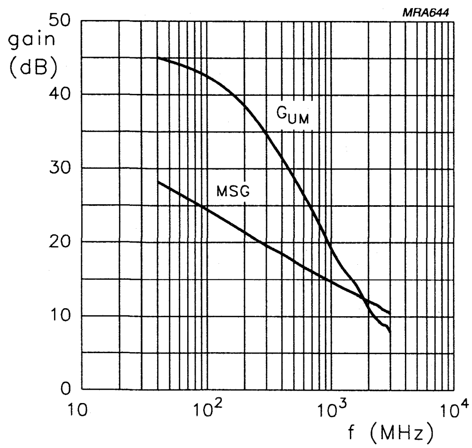
V_{CE} = 6 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



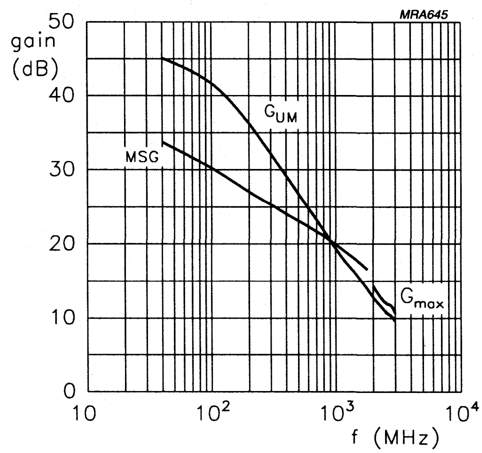
V_{CE} = 6 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



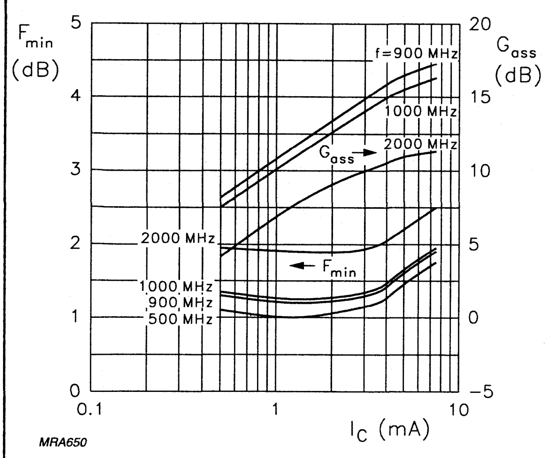
V_{CE} = 6 V; I_C = 1.25 mA.

Fig.9 Gain as a function of frequency.



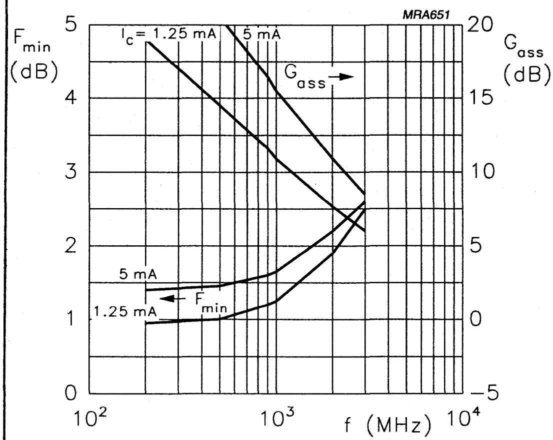
V_{CE} = 6 V; I_C = 5 mA.

Fig.10 Gain as a function of frequency.



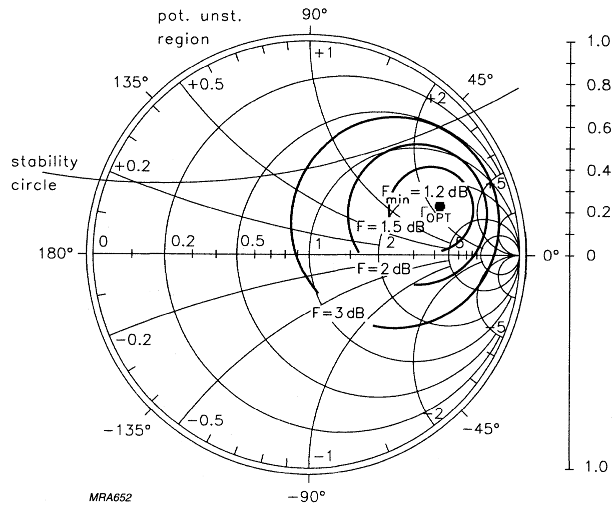
V_{CE} = 6 V.

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



V_{CE} = 6 V.

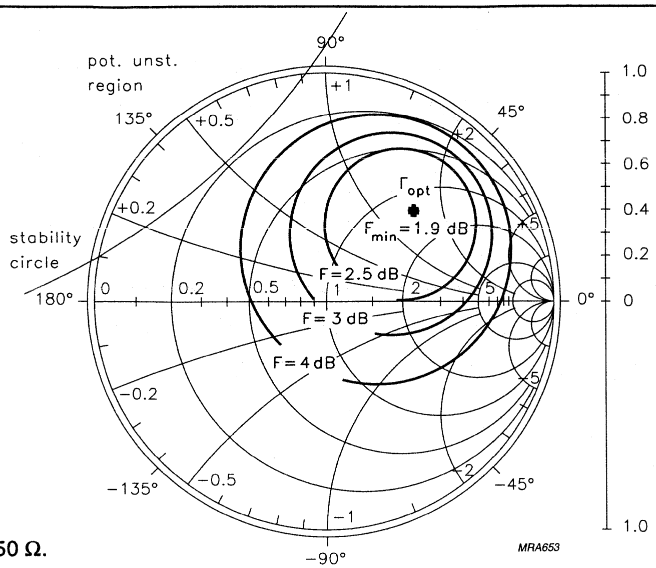
Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_O = 50 Ω.

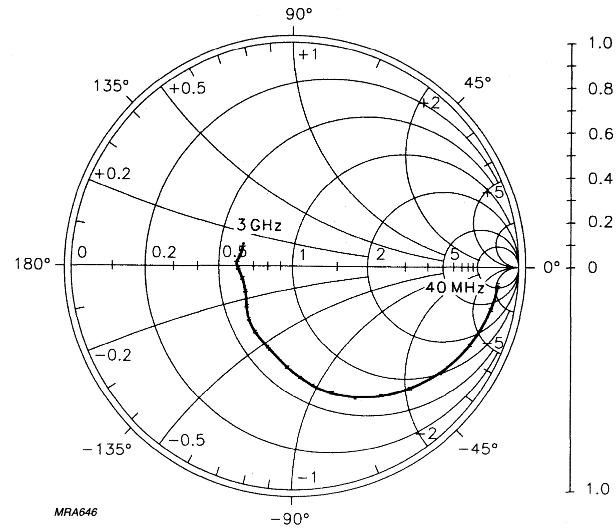
V_{CE} = 6 V; I_C = 1.25 mA; f = 900 MHz.

Fig.13 Noise circle figure.



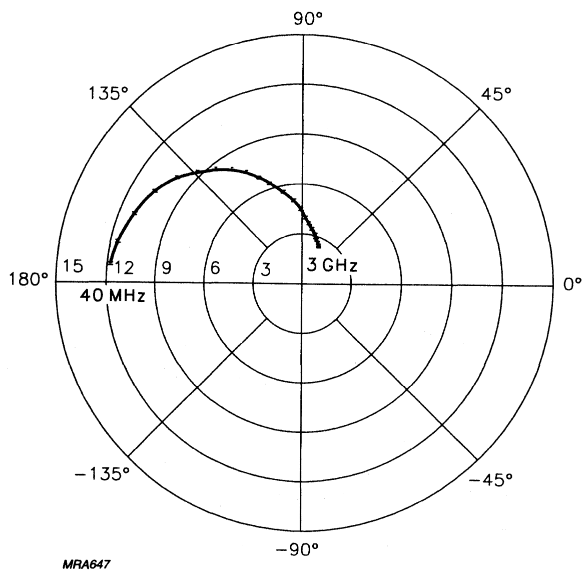
Z_O = 50 Ω.
V_{CE} = 6 V; I_C = 1.25 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



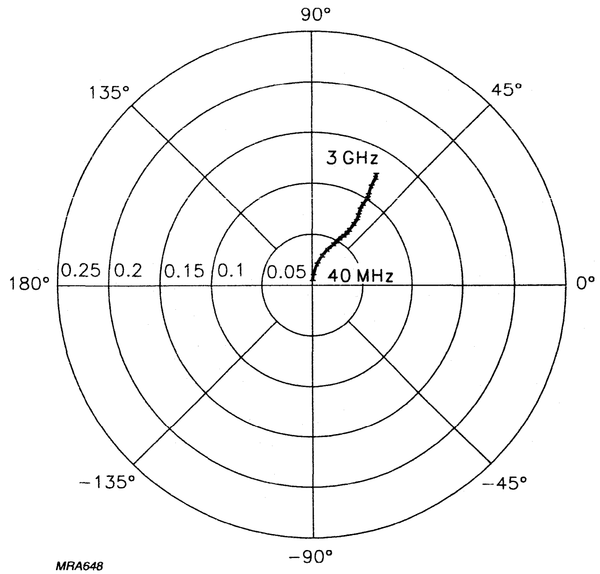
V_{CE} = 6 V; I_C = 5 mA.

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



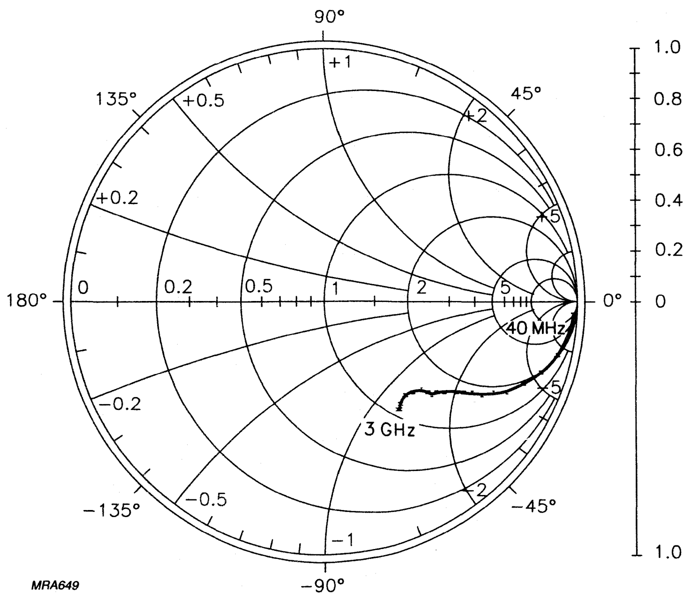
V_{CE} = 6 V; I_C = 5 mA.

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}).

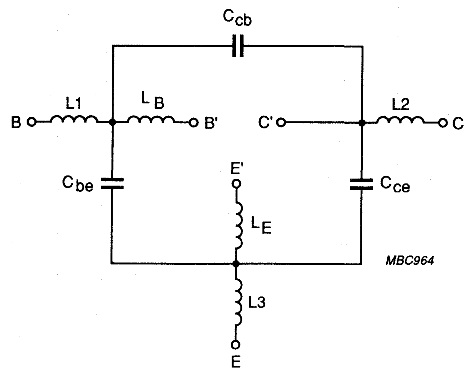


V_{CE} = 6 V; I_C = 5 mA.

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) = $QL_{B,E}$ √ (f/Fc).

Fc = scaling frequency = 1000 MHz.

Fig.19 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.19)

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

Note

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

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.990	−1.7	1.390	177.9	0.005	87.1	0.998	−1.0	43.7
100	0.988	−4.3	1.380	175.0	0.012	87.2	0.997	−2.5	41.0
200	0.984	−8.6	1.371	170.3	0.025	84.3	0.995	−4.9	38.3
300	0.980	−12.9	1.383	165.7	0.037	81.3	0.992	−7.4	35.0
400	0.972	−17.4	1.385	161.5	0.049	78.2	0.988	−9.7	31.6
500	0.964	−21.5	1.366	157.4	0.060	75.7	0.984	−12.1	29.1
600	0.957	−25.4	1.324	153.5	0.072	73.4	0.978	−14.4	26.8
700	0.947	−29.4	1.311	149.8	0.082	70.6	0.971	−16.5	24.6
800	0.932	−33.4	1.312	145.8	0.091	67.9	0.961	−18.7	22.3
900	0.916	−37.2	1.292	141.4	0.101	65.2	0.950	−20.7	20.3
1000	0.896	−41.1	1.268	137.5	0.109	62.7	0.939	−22.9	18.4
1200	0.855	−49.4	1.245	130.1	0.127	58.4	0.923	−27.3	15.9
1400	0.821	−57.8	1.255	123.0	0.143	54.4	0.907	−31.3	14.4
1600	0.789	−66.0	1.242	116.1	0.153	50.8	0.896	−34.6	13.2
1800	0.751	−72.5	1.176	111.0	0.161	48.5	0.873	−37.5	11.2
2000	0.691	−80.0	1.143	104.5	0.168	44.3	0.843	−40.7	9.3
2200	0.636	−89.1	1.126	98.6	0.177	40.5	0.819	−44.9	8.1
2400	0.602	−99.0	1.113	90.8	0.183	36.7	0.809	−49.3	7.5
2600	0.588	−107.3	1.059	86.6	0.190	36.0	0.820	−53.1	7.2
2800	0.564	−113.7	1.062	82.6	0.197	34.9	0.826	−55.4	7.2
3000	0.520	−121.3	1.008	77.5	0.194	33.1	0.811	−57.2	6.1

Table 2 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 1.25 mA

f (MHz)	S_{11}		S_{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

Table 4 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 2.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.949	−3.5	6.588	176.1	0.005	86.6	0.993	−2.0	45.1
100	0.942	−8.7	6.499	170.9	0.012	83.9	0.988	−4.9	42.0
200	0.920	−17.1	6.337	163.0	0.024	79.0	0.972	−9.5	36.8
300	0.892	−25.6	6.226	155.7	0.035	74.1	0.949	−13.8	32.8
400	0.858	−33.9	6.046	149.3	0.045	69.6	0.922	−17.6	29.6
500	0.823	−41.3	5.771	143.5	0.053	65.8	0.893	−21.1	27.1
600	0.788	−48.4	5.529	138.3	0.060	62.9	0.862	−24.1	25.0
700	0.750	−55.5	5.338	133.3	0.066	60.0	0.830	−26.5	23.2
800	0.706	−62.1	5.126	128.1	0.071	57.6	0.801	−28.6	21.6
900	0.663	−68.1	4.858	123.3	0.076	55.6	0.772	−30.5	20.2
1000	0.619	−74.2	4.605	119.0	0.080	53.8	0.745	−32.3	18.9
1200	0.539	−86.9	4.210	111.0	0.088	51.6	0.702	−35.9	16.9
1400	0.480	−99.2	3.910	103.9	0.094	49.9	0.675	−38.8	15.6
1600	0.436	−109.5	3.550	97.7	0.099	49.6	0.656	−40.9	14.4
1800	0.388	−118.1	3.232	93.3	0.104	49.8	0.633	−42.1	13.1
2000	0.337	−129.1	2.967	88.3	0.107	49.2	0.604	−43.8	11.9
2200	0.307	−142.7	2.770	83.9	0.112	48.6	0.577	−46.9	11.0
2400	0.304	−154.6	2.585	78.5	0.115	48.6	0.566	−51.0	10.3
2600	0.304	−163.0	2.386	75.5	0.123	49.7	0.576	−54.8	9.7
2800	0.288	−170.1	2.291	72.2	0.129	50.2	0.588	−56.5	9.4
3000	0.275	179.0	2.125	68.6	0.131	51.1	0.582	−57.3	8.7

Table 5 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.583	19.0	0.69
2000	1.90	0.473	45.0	0.55

Table 6 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 3.75 mA

f (MHz)	S_{11}		S_{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	0.924	−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}		R_n
		(RAT)	(DEG)	
900	1.40	0.563	17.0	0.62
2000	2.00	0.433	46.0	0.48

Table 8 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.898	−5.5	12.035	174.3	0.005	85.2	0.987	−2.9	44.5
100	0.882	−13.6	11.746	166.9	0.012	82.1	0.974	−7.2	40.9
200	0.838	−26.6	11.204	156.1	0.022	74.2	0.936	−13.6	35.3
300	0.782	−39.0	10.618	146.5	0.032	68.2	0.886	−18.9	31.3
400	0.725	−50.7	9.930	138.4	0.039	64.1	0.836	−22.9	28.4
500	0.670	−61.1	9.180	131.5	0.045	60.6	0.788	−26.1	26.1
600	0.615	−70.5	8.520	125.3	0.050	58.7	0.745	−28.4	24.2
700	0.564	−79.3	7.901	119.7	0.054	57.0	0.709	−29.9	22.6
800	0.515	−86.9	7.294	114.6	0.057	55.9	0.677	−31.1	21.3
900	0.471	−93.9	6.705	110.1	0.060	55.1	0.648	−32.2	20.0
1000	0.431	−101.2	6.198	106.2	0.063	55.0	0.624	−33.2	18.9
1200	0.368	−115.7	5.387	99.4	0.069	55.0	0.589	−35.5	17.1
1400	0.335	−128.7	4.800	93.6	0.075	55.1	0.570	−37.8	15.8
1600	0.310	−139.4	4.259	88.6	0.081	56.6	0.560	−39.2	14.7
1800	0.281	−149.4	3.815	85.0	0.087	57.4	0.548	−39.8	13.5
2000	0.256	−162.7	3.456	81.1	0.092	57.9	0.525	−41.1	12.5
2200	0.257	−176.3	3.188	77.5	0.098	58.0	0.503	−44.0	11.6
2400	0.272	174.6	2.949	73.1	0.103	58.7	0.494	−48.3	10.9
2600	0.279	168.8	2.707	70.6	0.111	59.7	0.507	−52.3	10.3
2800	0.271	162.3	2.574	67.8	0.119	59.9	0.522	−54.2	9.9
3000	0.271	152.2	2.384	64.6	0.123	60.8	0.520	−54.9	9.2

Table 9 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.60	0.508	18.0	0.60
2000	2.20	0.370	46.0	0.47

Table 10 Common emitter scattering parameters, V_{CE} = 3 V, I_C = 7.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.849	−7.5	16.291	172.7	0.005	82.9	0.980	−3.6	43.7
100	0.823	−18.5	15.705	163.4	0.011	79.6	0.960	−8.9	39.9
200	0.759	−35.7	14.603	150.4	0.021	71.1	0.899	−16.3	34.2
300	0.685	−51.3	13.379	139.3	0.029	65.4	0.830	−21.5	30.4
400	0.616	−65.3	12.060	130.3	0.035	61.1	0.768	−25.0	27.6
500	0.555	−77.2	10.805	123.0	0.039	58.6	0.716	−27.4	25.4
600	0.502	−87.6	9.721	116.8	0.043	57.8	0.675	−28.8	23.7
700	0.456	−96.7	8.776	111.7	0.047	57.1	0.643	−29.7	22.2
800	0.416	−104.6	7.948	107.1	0.049	57.1	0.616	−30.3	20.9
900	0.381	−112.0	7.201	103.1	0.052	57.1	0.592	−30.9	19.7
1000	0.351	−119.8	6.584	99.8	0.055	57.9	0.573	−31.5	18.7
1200	0.311	−134.9	5.626	93.9	0.062	59.0	0.546	−33.3	17.0
1400	0.294	−147.8	4.947	88.9	0.068	59.8	0.534	−35.5	15.7
1600	0.281	−157.6	4.360	84.4	0.074	61.4	0.530	−36.8	14.6
1800	0.262	−167.8	3.893	81.2	0.081	62.4	0.522	−37.5	13.5
2000	0.253	179.3	3.516	77.6	0.087	62.9	0.503	−38.8	12.5
2200	0.265	167.9	3.232	74.5	0.094	63.0	0.484	−41.8	11.7
2400	0.283	161.3	2.984	70.4	0.099	63.8	0.476	−46.3	11.0
2600	0.292	156.9	2.733	68.1	0.108	64.6	0.490	−50.5	10.3
2800	0.284	151.0	2.593	65.5	0.116	64.5	0.507	−52.6	9.9
3000	0.291	142.0	2.400	62.4	0.121	65.0	0.507	−53.3	9.3

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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	0.992	−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} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
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} (RAT)	Γ_{opt} (DEG)	R_n
900	1.20	0.664	20.0	0.87
2000	1.90	0.550	46.0	0.68

Table 14 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 2.5 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.955	−3.3	6.467	176.2	0.005	86.3	0.993	−1.9	45.2
100	0.948	−8.1	6.385	171.3	0.012	84.9	0.988	−4.7	42.4
200	0.929	−16.1	6.243	163.8	0.023	80.0	0.975	−9.2	37.5
300	0.902	−24.0	6.145	156.7	0.034	75.0	0.953	−13.4	33.5
400	0.871	−31.8	5.989	150.5	0.044	70.7	0.928	−17.0	30.3
500	0.839	−38.8	5.729	144.9	0.052	67.1	0.901	−20.5	27.7
600	0.804	−45.4	5.504	139.8	0.059	64.2	0.871	−23.6	25.5
700	0.767	−52.1	5.323	134.9	0.066	61.5	0.842	−26.1	23.7
800	0.725	−58.3	5.124	129.9	0.071	58.9	0.812	−28.2	22.1
900	0.682	−64.1	4.873	125.0	0.076	56.8	0.783	−30.3	20.6
1000	0.638	−69.9	4.633	120.8	0.080	55.2	0.756	−32.1	19.3
1200	0.557	−81.7	4.251	113.0	0.088	52.7	0.713	−35.9	17.3
1400	0.495	−93.5	3.972	105.8	0.096	50.9	0.685	−38.9	16.0
1600	0.449	−103.0	3.615	99.6	0.100	50.3	0.665	−41.0	14.7
1800	0.398	−111.2	3.300	95.1	0.105	50.5	0.641	−42.3	13.4
2000	0.341	−121.4	3.032	90.1	0.109	49.5	0.610	−44.0	12.2
2200	0.305	−134.5	2.837	85.6	0.114	48.7	0.582	−47.1	11.3
2400	0.296	−146.6	2.652	80.2	0.118	48.6	0.570	−51.2	10.6
2600	0.293	−155.5	2.454	77.1	0.125	49.7	0.579	−55.0	10.0
2800	0.276	−162.4	2.360	73.9	0.131	50.0	0.590	−56.7	9.7
3000	0.257	−173.5	2.190	70.2	0.134	50.6	0.584	−57.4	8.9

Table 15 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.619	17.0	0.74
2000	1.90	0.526	44.0	0.59

Table 16 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 3.75 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.934	−4.1	9.293	175.3	0.005	86.2	0.990	−2.3	45.2
100	0.922	−10.3	9.137	169.4	0.012	83.4	0.983	−5.8	42.2
200	0.893	−20.3	8.842	160.5	0.023	77.5	0.959	−11.3	36.8
300	0.853	−30.0	8.572	152.2	0.033	72.3	0.925	−16.1	32.7
400	0.809	−39.4	8.208	145.1	0.041	67.6	0.886	−20.2	29.6
500	0.764	−47.9	7.737	138.8	0.048	64.1	0.848	−23.8	27.1
600	0.719	−55.7	7.327	133.2	0.054	61.5	0.810	−26.7	25.1
700	0.671	−63.4	6.960	127.8	0.059	59.3	0.775	−28.8	23.4
800	0.621	−70.3	6.569	122.6	0.064	57.4	0.742	−30.6	21.9
900	0.574	−76.4	6.135	117.8	0.067	55.7	0.711	−32.2	20.5
1000	0.527	−82.8	5.745	113.6	0.071	54.9	0.683	−33.6	19.3
1200	0.448	−95.7	5.121	106.1	0.078	53.6	0.641	−36.6	17.5
1400	0.396	−108.0	4.652	99.6	0.084	53.1	0.616	−39.2	16.2
1600	0.357	−118.1	4.165	94.1	0.089	53.7	0.601	−40.8	14.9
1800	0.314	−127.1	3.760	90.1	0.095	54.2	0.582	−41.7	13.8
2000	0.271	−138.7	3.424	85.7	0.099	54.0	0.555	−43.0	12.6
2200	0.252	−153.5	3.175	81.8	0.105	53.8	0.529	−45.9	11.7
2400	0.257	−165.2	2.948	76.9	0.109	54.2	0.518	−50.1	11.0
2600	0.260	−172.8	2.715	74.2	0.117	55.2	0.529	−54.0	10.4
2800	0.248	−179.7	2.591	71.3	0.124	55.6	0.543	−55.8	10.1
3000	0.239	168.8	2.403	67.9	0.128	56.1	0.539	−56.3	9.4

Table 17 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.40	0.579	17.0	0.71
2000	2.00	0.491	43.0	0.55

Table 18 Common emitter scattering parameters, V_{CE} = 6 V, I_C = 5 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.913	−5.0	11.799	174.6	0.005	84.5	0.987	−2.7	45.1
100	0.899	−12.2	11.563	167.8	0.011	82.1	0.976	−6.8	41.7
200	0.859	−24.1	11.087	157.7	0.022	76.1	0.943	−13.1	36.2
300	0.809	−35.4	10.563	148.6	0.031	70.3	0.897	−18.3	32.2
400	0.753	−46.1	9.951	140.7	0.039	65.6	0.850	−22.4	29.2
500	0.700	−55.6	9.248	134.0	0.045	62.1	0.804	−25.9	26.8
600	0.647	−64.3	8.624	128.0	0.050	60.4	0.762	−28.3	24.9
700	0.595	−72.4	8.048	122.4	0.055	58.5	0.724	−30.1	23.2
800	0.544	−79.6	7.469	117.3	0.058	57.0	0.691	−31.5	21.8
900	0.496	−86.0	6.901	112.7	0.062	55.9	0.661	−32.8	20.5
1000	0.452	−92.8	6.394	108.7	0.065	55.7	0.635	−33.9	19.4
1200	0.381	−106.3	5.598	101.8	0.072	55.4	0.597	−36.4	17.6
1400	0.340	−119.2	5.009	95.8	0.078	55.4	0.575	−38.7	16.3
1600	0.309	−129.2	4.452	90.7	0.083	56.4	0.563	−40.1	15.1
1800	0.273	−138.7	3.996	87.1	0.089	57.5	0.548	−40.7	13.9
2000	0.240	−151.8	3.621	83.0	0.094	57.6	0.524	−41.9	12.8
2200	0.233	−166.5	3.345	79.5	0.101	57.2	0.501	−44.8	12.0
2400	0.245	−177.3	3.098	75.0	0.105	57.8	0.491	−49.0	11.3
2600	0.252	176.1	2.847	72.5	0.114	58.9	0.503	−53.0	10.6
2800	0.241	169.5	2.709	69.7	0.122	59.0	0.518	−54.8	10.3
3000	0.239	158.4	2.512	66.5	0.126	59.7	0.515	−55.3	9.6

Table 19 Noise data

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.60	0.546	17.0	0.69
2000	2.20	0.442	44.0	0.54

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

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

NPN silicon planar epitaxial transistors, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV) and repeater amplifiers in fibre-optic systems.

The transistors are encapsulated in 4-pin, dual-emitter plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG520 (Fig.1) Code: N36	
1	collector
2	base
3	emitter
4	emitter
BFG520/X (Fig.1) Code: N42	
1	collector
2	emitter
3	base
4	emitter
BFG520/XR (Fig.2) Code: N48	
1	collector
2	emitter
3	base
4	emitter

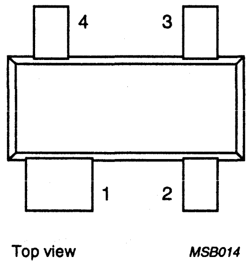


Fig.1 SOT143.

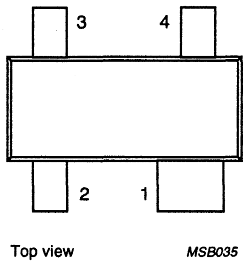


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to T_s = 63 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V; T_j = 25 °C	60	120	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 63 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 63 °C (note 1)	290 K/W

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.6	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	19	–	dB
		$I_C = 20$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	13	–	dB
$\lvert S_{21}\rvert^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 20$ mA; $V_{CE} = 6$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm
V_O	output voltage	note 3	–	275	–	mV
d_2	second order intermodulation distortion	$I_C = 20$ mA; $V_{CE} = 6$ V; $V_O = 75$ mV; $T_{amb} = 25$ °C; $f_{(p+q)} = 810$ MHz	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{\lvert S_{21}\rvert^2}{(1 - \lvert S_{11}\rvert^2)(1 - \lvert S_{22}\rvert^2)}$ dB.
2. $I_C = 20$ mA; $V_{CE} = 6$ V; $R_L = 50\ \Omega$; f = 900 MHz; $T_{amb} = 25$ °C;
   $f_p = 900$ MHz; $f_q = 902$ MHz;
   measured at $f_{(2p-q)} = 898$ MHz and $f_{(2q-p)} = 904$ MHz.
3. $d_{im} = -60$ dB (DIN 45004B);
   $V_p = V_O$; $V_q = V_O - 6$ dB; $V_r = V_O - 6$ dB;
   $f_p = 795.25$ MHz; $f_q = 803.25$ MHz; $f_r = 805.25$ MHz;
   measured at $f_{(p+q-r)} = 793.25$ MHz

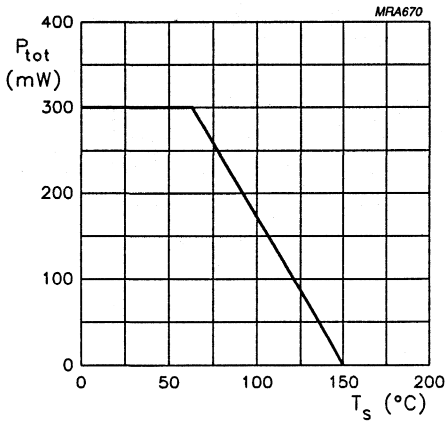
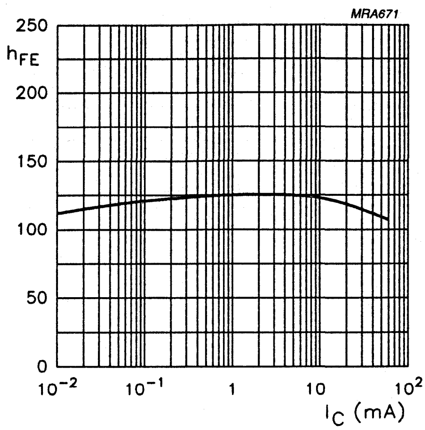
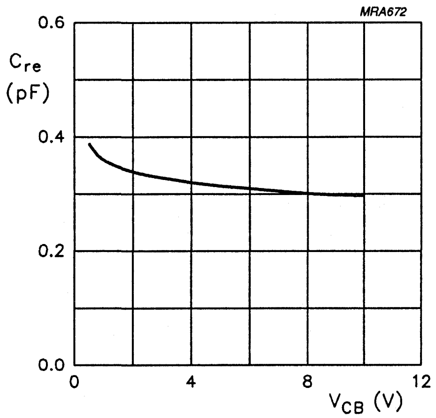


Fig.3 Power derating curve.



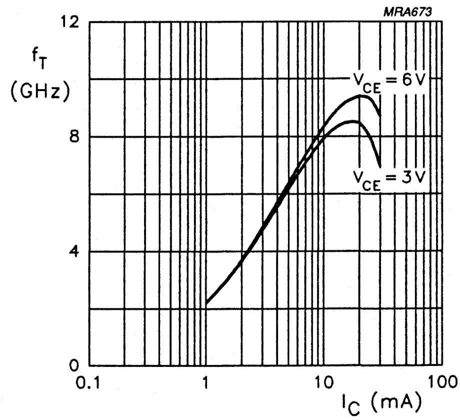
V_{CE} = 6 V; T_j = 25 °C.

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



I_C = 0; f = 1 MHz.

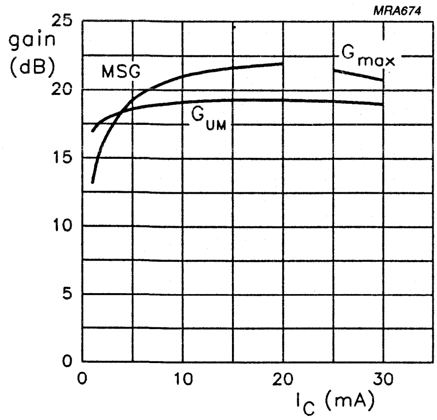
Fig.5 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

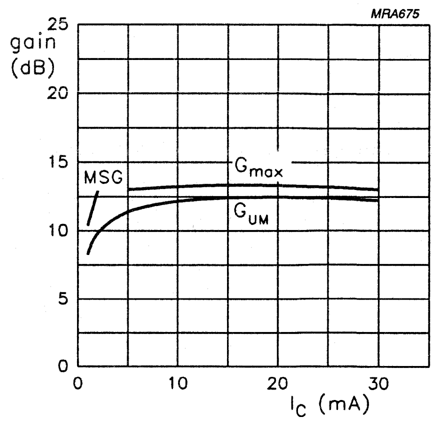
Fig.6 Transition frequency as a function of collector current.

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



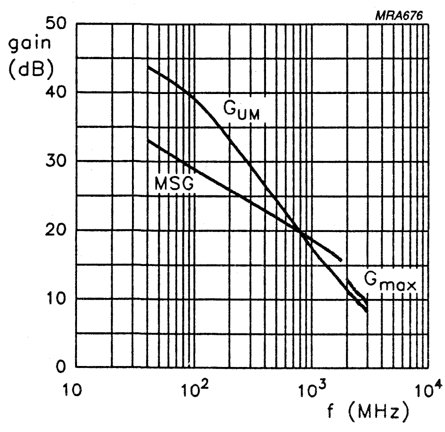
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



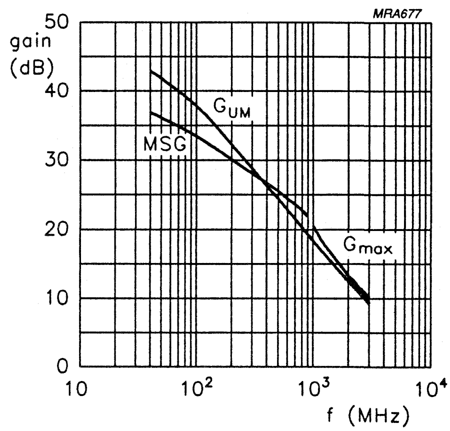
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.8 Gain as a function of collector current.



I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.10 Gain as a function of frequency.

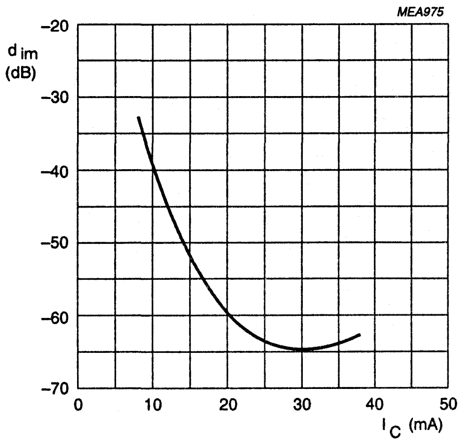


Fig.11 Intermodulation distortion as a function of collector current.

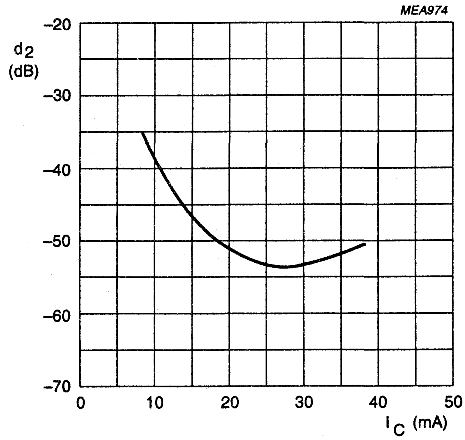
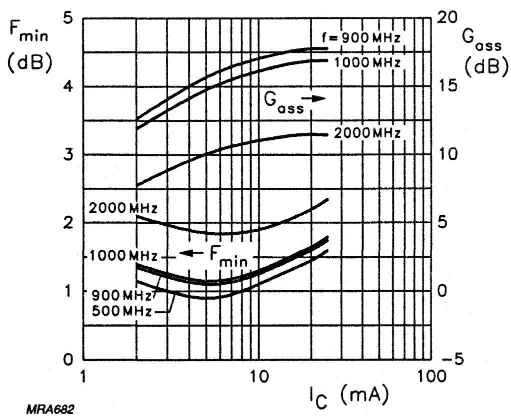
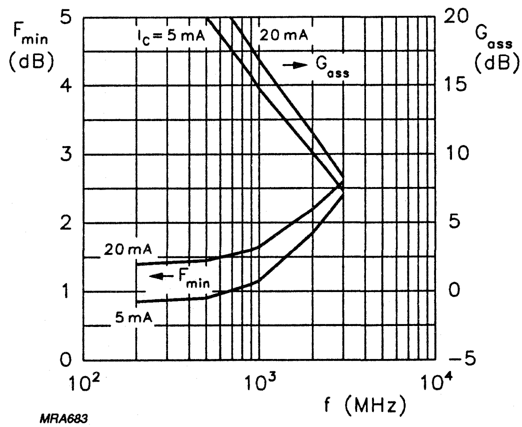


Fig.12 Second order intermodulation distortion as a function of collector current.



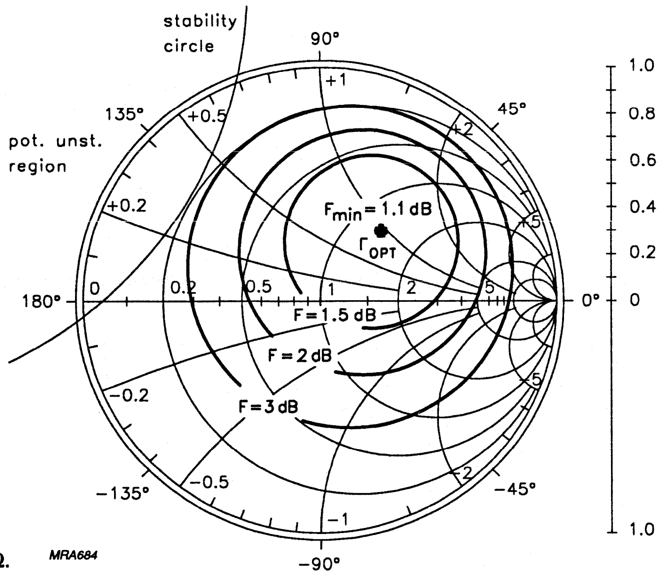
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



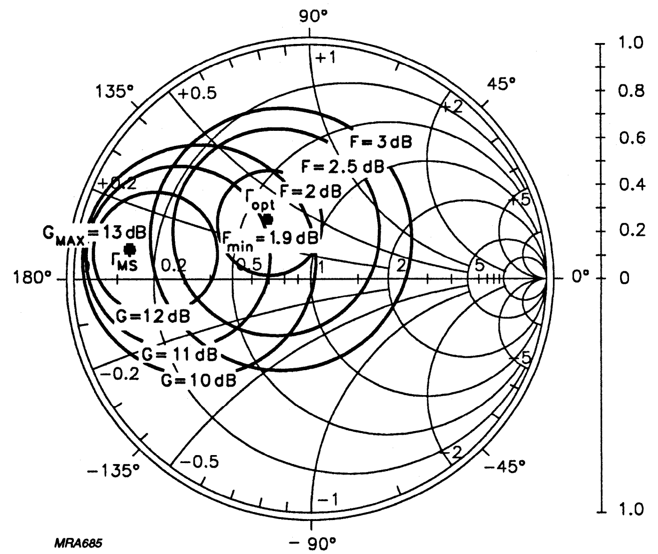
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.



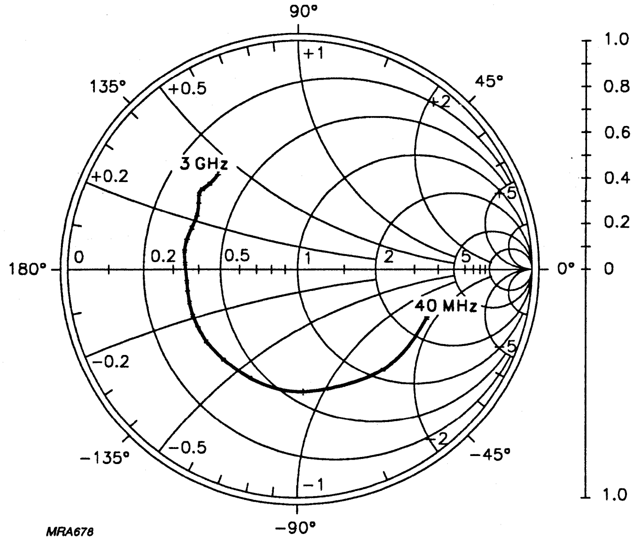
I_C = 5 mA; V_{CE} = 6 V;
f = 900 MHz; Z_O = 50 Ω.

Fig.15 Noise circle figure.



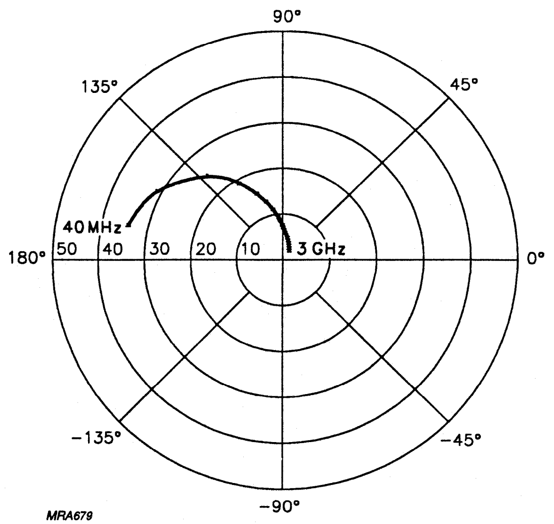
I_C = 5 mA; V_{CE} = 6 V;
f = 2 GHz; Z_O = 50 Ω.

Fig.16 Noise circle figure.



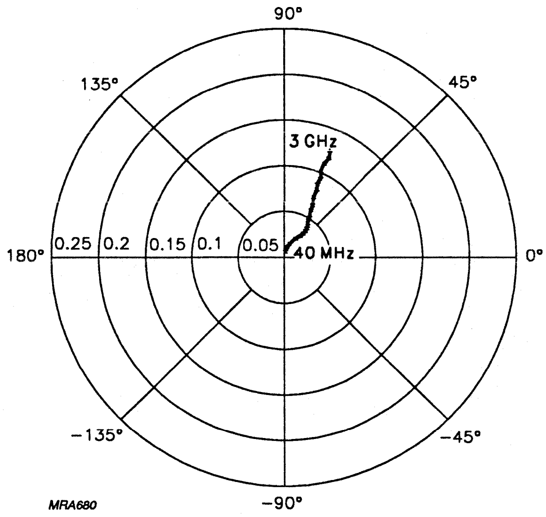
I_C = 20 mA; V_{CE} = 6 V.

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



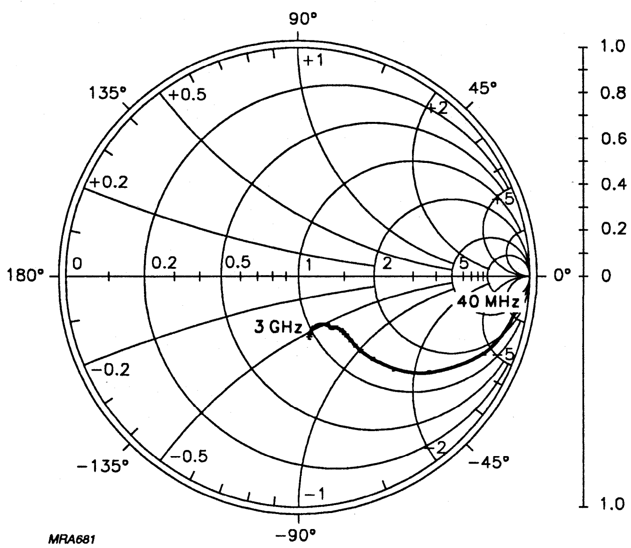
I_C = 20 mA; V_{CE} = 6 V.

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



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

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

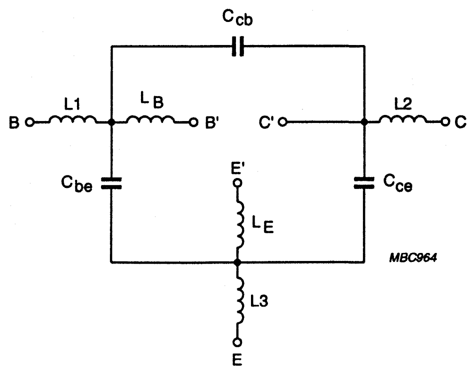


I_C = 20 mA; V_{CE} = 6 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFR520 crystal

1	IS = 1.016	fA
2	BF = 220.1	–
3	NF = 1.000	–
4	VAF = 48.06	V
5	IKF = 510.0	mA
6	ISE = 283.0	fA
7	NE = 2.035	–
8	BR = 100.7	–
9	NR = 988.1	m
10	VAR = 1.692	V
11	IKR = 2.352	mA
12	ISC = 24.48	aA
13	NC = 1.022	
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 775.3	mΩ
18	RC = 2.210	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.245	pF
23	VJE = 600.0	mV
24	MJE = 258.1	m
25	TF = 8.616	ps
26	XTF = 6.788	–
27	VTF = 1.414	V
28	ITF = 110.3	mA
29	PTF = 45.01	deg
30	CJC = 447.6	fF
31	VJC = 189.2	mV
32	MJC = 70.51	m
33	XCJC = 130.0	m
34	TR = 543.7	ps
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 780.2	m



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

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

Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.21)

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

Note

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

Table 1 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.903	−6.4	6.678	175.4	0.008	85.5	0.997	−2.7	46.7
100	0.895	−15.9	6.594	168.8	0.020	81.6	0.989	−7.0	40.1
200	0.873	−31.3	6.344	158.7	0.039	72.5	0.960	−13.4	33.4
300	0.845	−46.3	6.077	149.2	0.055	65.5	0.924	−19.0	29.5
400	0.814	−59.7	5.679	140.6	0.069	59.1	0.883	−24.0	26.4
500	0.788	−72.0	5.290	133.3	0.079	53.5	0.840	−28.1	24.0
600	0.760	−83.0	4.922	126.7	0.088	48.5	0.798	−31.5	22.0
700	0.736	−92.7	4.575	120.8	0.094	44.5	0.760	−34.3	20.4
800	0.707	−101.6	4.242	115.3	0.099	41.4	0.728	−36.6	18.8
900	0.677	−110.1	3.916	110.1	0.102	38.5	0.697	−38.8	17.4
1000	0.654	−117.9	3.633	105.8	0.105	36.3	0.670	−40.8	16.2
1200	0.621	−132.9	3.176	97.6	0.109	32.8	0.627	−44.5	14.3
1400	0.609	−145.6	2.850	90.1	0.111	29.6	0.602	−48.1	13.1
1600	0.601	−155.8	2.536	83.9	0.110	29.1	0.589	−50.7	11.9
1800	0.586	−165.2	2.287	79.1	0.112	28.5	0.572	−52.9	10.7
2000	0.574	−174.6	2.078	74.3	0.109	28.4	0.547	−55.5	9.6
2200	0.579	176.3	1.913	69.9	0.108	28.2	0.525	−60.0	8.8
2400	0.594	169.1	1.748	64.2	0.105	29.7	0.525	−65.5	8.1
2600	0.602	163.4	1.607	60.8	0.107	31.9	0.541	−69.7	7.6
2800	0.600	157.6	1.535	56.7	0.107	32.9	0.553	−71.8	7.2
3000	0.601	150.6	1.420	53.0	0.106	36.2	0.545	−73.9	6.5

Table 2 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.799	−10.3	14.524	173.1	0.008	84.1	0.989	−4.8	44.4
100	0.783	−25.3	14.070	163.5	0.019	77.0	0.965	−11.9	38.8
200	0.743	−48.5	12.891	149.4	0.034	66.6	0.894	−21.9	32.7
300	0.700	−69.2	11.585	137.5	0.046	58.1	0.813	−29.7	28.9
400	0.664	−86.3	10.193	128.0	0.055	52.3	0.736	−35.4	26.1
500	0.638	−100.5	9.020	120.4	0.060	47.6	0.670	−39.5	24.0
600	0.615	−112.1	8.033	114.1	0.065	44.7	0.615	−42.2	22.2
700	0.598	−121.7	7.204	108.9	0.068	42.6	0.571	−44.2	20.8
800	0.577	−130.4	6.491	104.2	0.070	41.7	0.535	−45.8	19.5
900	0.560	−138.4	5.868	100.1	0.072	41.1	0.504	−47.1	18.3
1000	0.546	−145.4	5.356	96.7	0.074	40.9	0.479	−48.4	17.2
1200	0.535	−158.4	4.556	90.3	0.078	40.6	0.442	−51.1	15.6
1400	0.536	−168.8	3.989	84.4	0.080	41.1	0.422	−54.0	14.3
1600	0.534	−176.7	3.507	79.5	0.083	43.4	0.413	−55.8	13.2
1800	0.527	175.3	3.144	75.5	0.088	44.4	0.402	−56.9	12.1
2000	0.524	167.1	2.847	71.7	0.090	46.6	0.380	−58.8	11.2
2200	0.540	159.7	2.610	68.2	0.094	47.7	0.360	−63.5	10.4
2400	0.558	154.5	2.372	63.8	0.096	50.1	0.360	−69.8	9.7
2600	0.565	150.3	2.183	60.9	0.104	51.9	0.380	−74.2	9.1
2800	0.559	145.5	2.065	57.2	0.109	52.4	0.392	−75.7	8.7
3000	0.565	139.3	1.918	54.1	0.113	54.8	0.386	−77.1	8.0

Table 3 Noise data, I_C = 5 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	0.90	0.396	29.0	0.240
900	1.10	0.334	50.0	0.260
1000	1.15	0.355	55.0	0.260
2000	1.85	0.275	130.0	0.160

Table 4 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.668	−15.5	23.878	170.3	0.007	81.8	0.977	−7.2	43.5
100	0.648	−38.0	22.433	157.3	0.017	73.4	0.926	−17.5	37.9
200	0.608	−69.8	19.090	139.8	0.029	61.1	0.801	−30.4	32.1
300	0.578	−94.6	15.944	126.9	0.037	53.9	0.684	−38.7	28.6
400	0.559	−112.5	13.292	117.8	0.042	50.3	0.592	−43.8	26.0
500	0.548	−126.0	11.320	110.9	0.045	47.5	0.524	−46.9	24.0
600	0.538	−136.3	9.809	105.5	0.049	46.9	0.473	−48.6	22.4
700	0.530	−144.3	8.626	101.0	0.051	47.1	0.434	−49.7	21.1
800	0.521	−151.7	7.669	97.2	0.054	47.8	0.405	−50.4	19.8
900	0.513	−158.5	6.874	93.9	0.056	49.0	0.380	−51.1	18.7
1000	0.507	−164.4	6.235	91.1	0.059	50.2	0.360	−51.9	17.8
1200	0.509	−174.9	5.249	85.9	0.064	51.5	0.332	−54.1	16.2
1400	0.517	177.1	4.552	80.9	0.069	53.0	0.320	−56.9	15.0
1600	0.517	170.7	3.987	76.8	0.075	56.2	0.316	−58.3	13.8
1800	0.513	163.7	3.566	73.2	0.082	57.1	0.308	−58.9	12.8
2000	0.514	156.4	3.228	70.0	0.087	59.0	0.289	−60.4	11.9
2200	0.534	150.2	2.952	66.8	0.094	59.6	0.270	−65.9	11.2
2400	0.553	146.2	2.680	63.2	0.098	61.3	0.273	−73.3	10.5
2600	0.559	143.0	2.469	60.5	0.108	61.9	0.294	−78.0	9.9
2800	0.551	138.8	2.324	57.2	0.115	61.5	0.308	−79.1	9.3
3000	0.557	132.8	2.162	54.2	0.121	62.8	0.302	−80.1	8.7

Table 5 Noise data, I_C = 10 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
500	1.10	0.260	27.0	0.220
900	1.25	0.231	54.0	0.220
1000	1.30	0.240	58.0	0.240
2000	1.90	0.245	148.0	0.140

Table 6 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{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, I_C = 15 mA; V_{CE} = 3 V

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, I_C = 20 mA; V_{CE} = 3 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.503	−25.2	34.613	166.5	0.006	78.4	0.950	−10.3	42.1
100	0.501	−59.1	30.839	149.3	0.014	68.8	0.858	−23.8	36.8
200	0.501	−98.9	23.669	129.5	0.023	57.2	0.679	−37.9	31.4
300	0.508	−123.2	18.370	117.0	0.028	53.0	0.547	−44.6	28.1
400	0.513	−138.4	14.678	109.0	0.032	52.7	0.463	−47.8	25.7
500	0.516	−148.9	12.176	103.2	0.035	52.1	0.406	−49.3	23.8
600	0.517	−156.7	10.381	98.7	0.039	53.2	0.368	−49.6	22.3
700	0.515	−162.8	9.027	95.0	0.041	54.8	0.340	−49.8	21.0
800	0.512	−168.5	7.974	91.8	0.044	56.8	0.319	−49.7	19.8
900	0.509	−173.8	7.115	89.0	0.048	59.0	0.303	−49.8	18.8
1000	0.508	−178.5	6.434	86.7	0.051	59.8	0.289	−50.4	17.8
1200	0.516	173.3	5.390	82.2	0.058	62.2	0.270	−52.6	16.3
1400	0.525	167.2	4.652	77.9	0.064	63.3	0.264	−55.5	15.1
1600	0.525	162.0	4.064	74.1	0.072	65.7	0.264	−57.0	13.9
1800	0.523	155.7	3.634	70.8	0.080	65.8	0.261	−57.4	12.9
2000	0.528	149.4	3.289	67.8	0.087	67.1	0.244	−59.1	12.0
2200	0.550	144.1	3.006	64.9	0.095	67.2	0.228	−65.1	11.4
2400	0.566	140.9	2.729	61.6	0.101	68.4	0.232	−73.7	10.6
2600	0.570	138.0	2.511	59.0	0.111	68.4	0.254	−79.0	10.0
2800	0.564	134.1	2.359	55.8	0.119	67.2	0.270	−80.0	9.4
3000	0.570	128.4	2.196	53.0	0.125	67.9	0.265	−80.8	8.8

Table 9 Noise data, I_C = 20 mA; V_{CE} = 3 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.103	38.0	0.210
900	1.60	0.104	84.0	0.220
1000	1.65	0.118	84.0	0.240
2000	2.20	0.231	−177.0	0.160

Table 10 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 3 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.405	−37.6	38.295	163.1	0.007	75.3	0.907	−12.4	40.0
100	0.445	−80.9	32.269	142.8	0.013	64.8	0.781	−27.2	35.2
200	0.494	−120.9	22.824	122.3	0.021	54.9	0.583	−39.4	30.2
300	0.523	−141.4	16.960	110.8	0.024	52.4	0.465	−43.3	27.0
400	0.534	−153.3	13.272	103.6	0.027	54.0	0.399	−44.2	24.7
500	0.541	−161.4	10.877	98.4	0.031	55.0	0.357	−44.3	22.8
600	0.544	−167.4	9.206	94.4	0.034	57.2	0.331	−43.7	21.3
700	0.542	−172.3	7.970	91.1	0.037	59.0	0.314	−43.5	20.0
800	0.541	−177.1	7.019	88.2	0.041	61.1	0.300	−43.2	18.8
900	0.541	178.5	6.255	85.6	0.044	63.2	0.290	−43.4	17.8
1000	0.541	174.6	5.650	83.4	0.048	64.8	0.280	−44.1	16.9
1200	0.551	167.7	4.721	79.1	0.055	66.4	0.269	−46.6	15.4
1400	0.558	162.5	4.070	74.9	0.062	67.7	0.266	−50.1	14.1
1600	0.558	157.8	3.553	71.2	0.070	69.7	0.270	−52.3	13.0
1800	0.555	152.0	3.172	67.8	0.079	69.5	0.270	−53.4	12.0
2000	0.564	146.1	2.871	64.8	0.086	70.9	0.256	−55.5	11.1
2200	0.584	141.4	2.622	61.9	0.094	71.0	0.241	−61.8	10.4
2400	0.602	138.4	2.383	58.5	0.100	72.0	0.245	−70.4	9.8
2600	0.602	135.8	2.189	56.0	0.111	71.6	0.269	−76.2	9.1
2800	0.595	131.8	2.055	52.6	0.119	69.8	0.285	−77.6	8.5
3000	0.602	126.5	1.912	49.8	0.126	70.8	0.281	−78.9	7.9

Table 11 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.910	−6.1	6.548	175.5	0.008	84.5	0.994	−2.6	43.5
100	0.903	−15.2	6.463	169.3	0.019	81.8	0.987	−6.5	39.6
200	0.881	−30.0	6.260	159.5	0.037	73.5	0.963	−12.6	33.8
300	0.853	−44.4	6.009	150.0	0.053	66.4	0.929	−18.1	29.8
400	0.824	−57.5	5.629	141.9	0.066	60.2	0.890	−22.8	26.7
500	0.797	−69.6	5.286	134.6	0.076	54.4	0.850	−26.9	24.4
600	0.768	−80.4	4.922	128.0	0.085	49.7	0.811	−30.3	22.4
700	0.745	−89.9	4.589	122.3	0.092	45.7	0.774	−33.1	20.7
800	0.714	−98.9	4.268	116.6	0.097	42.3	0.742	−35.5	19.2
900	0.684	−107.1	3.941	111.4	0.100	39.5	0.711	−37.6	17.7
1000	0.661	−115.0	3.672	107.1	0.103	37.2	0.684	−39.6	16.5
1200	0.623	−130.0	3.213	98.9	0.107	33.3	0.641	−43.4	14.6
1400	0.609	−143.0	2.888	91.3	0.109	30.1	0.617	−47.0	13.3
1600	0.601	−153.4	2.576	85.0	0.109	29.7	0.602	−49.6	12.1
1800	0.585	−162.9	2.326	80.2	0.110	29.2	0.585	−51.7	11.0
2000	0.570	−172.4	2.111	75.5	0.108	28.8	0.559	−54.3	9.8
2200	0.574	178.1	1.944	71.0	0.107	28.8	0.538	−58.7	9.0
2400	0.589	170.7	1.781	65.2	0.103	29.7	0.537	−64.0	8.3
2600	0.597	164.7	1.640	61.8	0.106	31.9	0.553	−68.2	7.8
2800	0.594	158.8	1.567	57.8	0.106	33.1	0.564	−70.4	7.5
3000	0.595	151.9	1.448	54.0	0.104	36.6	0.558	−72.4	6.7

Table 12 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 6$ V

f (MHz)	S_{11}		S_{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, $I_C = 5$ mA; $V_{CE} = 6$ V

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, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.711	−14.1	23.473	170.8	0.007	82.3	0.974	−6.8	43.5
100	0.690	−34.5	22.218	158.5	0.016	74.0	0.931	−16.3	38.5
200	0.640	−64.3	19.183	141.5	0.029	62.4	0.816	−28.8	32.7
300	0.597	−88.3	16.207	128.8	0.037	54.2	0.703	−37.1	29.1
400	0.569	−106.1	13.627	119.5	0.042	50.9	0.613	−42.4	26.4
500	0.553	−119.9	11.673	112.5	0.046	48.6	0.544	−45.7	24.5
600	0.538	−130.7	10.152	107.0	0.050	47.2	0.493	−47.6	22.8
700	0.526	−139.2	8.947	102.5	0.052	47.1	0.453	−48.8	21.4
800	0.514	−146.7	7.968	98.6	0.055	47.9	0.422	−49.5	20.2
900	0.503	−154.1	7.148	95.1	0.057	48.8	0.396	−50.2	19.1
1000	0.495	−160.2	6.488	92.4	0.059	49.7	0.374	−51.1	18.1
1200	0.494	−171.7	5.468	87.0	0.065	51.3	0.344	−53.4	16.5
1400	0.500	−131.8	4.748	82.0	0.069	52.5	0.331	−56.1	15.3
1600	0.500	173.3	4.159	77.8	0.075	55.2	0.326	−57.3	14.1
1800	0.494	166.0	3.722	74.3	0.082	56.4	0.317	−57.9	13.1
2000	0.496	158.4	3.368	71.0	0.087	58.2	0.297	−59.5	12.2
2200	0.515	151.9	3.080	67.9	0.093	59.0	0.279	−64.4	11.5
2400	0.535	147.6	2.798	64.2	0.097	60.7	0.280	−71.4	10.8
2600	0.540	144.2	2.579	61.6	0.107	61.3	0.298	−76.3	10.1
2800	0.534	139.8	2.428	58.2	0.114	60.9	0.313	−77.7	9.6
3000	0.541	133.9	2.259	55.3	0.120	62.3	0.309	−78.3	9.0

Table 15 Noise data, I_C = 10 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (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, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.642	−17.7	29.807	168.9	0.007	80.7	0.964	−8.4	43.3
100	0.620	−43.0	27.554	154.5	0.015	71.9	0.900	−19.7	38.1
200	0.573	−77.3	22.604	135.9	0.026	60.1	0.753	−33.4	32.4
300	0.544	−102.6	18.314	123.1	0.032	53.2	0.627	−41.5	28.9
400	0.526	−120.0	14.988	114.4	0.037	51.6	0.536	−46.0	26.4
500	0.519	−132.7	12.629	108.0	0.040	50.0	0.471	−48.6	24.5
600	0.510	−142.4	10.858	103.0	0.043	50.0	0.425	−49.9	22.9
700	0.503	−149.9	9.497	98.9	0.046	50.9	0.390	−50.4	21.5
800	0.495	−156.9	8.418	95.3	0.049	52.3	0.364	−50.7	20.3
900	0.488	−163.2	7.526	92.3	0.052	54.1	0.341	−51.1	19.2
1000	0.484	−168.8	6.819	89.8	0.055	55.5	0.323	−51.7	18.3
1200	0.487	−178.8	5.725	85.0	0.061	57.1	0.298	−53.9	16.7
1400	0.496	173.9	4.955	80.4	0.066	58.6	0.289	−56.6	15.5
1600	0.495	167.9	4.335	76.5	0.073	61.1	0.286	−57.8	14.3
1800	0.491	160.9	3.877	73.1	0.082	61.6	0.279	−58.0	13.3
2000	0.495	153.8	3.507	70.1	0.088	63.2	0.260	−59.6	12.4
2200	0.515	147.8	3.205	67.1	0.094	63.3	0.244	−65.0	11.7
2400	0.535	144.1	2.913	63.7	0.099	64.8	0.245	−72.9	11.0
2600	0.540	141.1	2.684	61.1	0.110	64.9	0.266	−78.1	10.4
2800	0.533	136.9	2.522	57.9	0.117	64.2	0.281	−79.1	9.8
3000	0.539	131.1	2.348	55.1	0.123	65.2	0.276	−79.5	9.3

Table 17 Noise data, I_C = 15 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.30	0.256	27.0	0.250
900	1.45	0.228	52.0	0.250
1000	1.50	0.233	57.0	0.280
2000	2.05	0.215	147.0	0.170

Table 18 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.592	−20.9	34.283	167.4	0.007	78.3	0.953	−9.5	43.0
100	0.572	−49.9	31.035	151.5	0.014	70.8	0.874	−22.2	37.8
200	0.536	−87.3	24.483	132.1	0.024	59.1	0.706	−36.1	32.2
300	0.518	−112.5	19.296	119.4	0.030	53.3	0.576	−43.6	28.8
400	0.508	−129.0	15.549	111.2	0.033	52.2	0.488	−47.4	26.3
500	0.506	−140.8	12.978	105.2	0.036	51.5	0.428	−49.4	24.4
600	0.500	−149.6	11.093	100.5	0.040	52.5	0.387	−50.1	22.9
700	0.496	−156.3	9.666	96.7	0.042	53.6	0.356	−50.3	21.5
800	0.490	−162.7	8.549	93.4	0.045	55.7	0.333	−50.3	20.3
900	0.485	−168.6	7.631	90.6	0.049	57.7	0.313	−50.5	19.3
1000	0.482	−173.7	6.909	88.2	0.052	58.5	0.298	−50.9	18.3
1200	0.488	177.1	5.790	83.6	0.059	60.8	0.276	−53.2	16.8
1400	0.496	170.4	5.002	79.3	0.065	61.9	0.269	−56.0	15.5
1600	0.497	164.8	4.374	75.5	0.072	64.3	0.268	−57.0	14.4
1800	0.493	158.1	3.910	72.2	0.081	64.6	0.263	−57.2	13.4
2000	0.496	151.4	3.537	69.3	0.088	66.0	0.245	−58.9	12.5
2200	0.519	145.7	3.233	66.4	0.095	65.7	0.229	−64.6	11.8
2400	0.539	142.3	2.936	63.1	0.101	67.1	0.231	−72.8	11.1
2600	0.543	139.4	2.705	60.6	0.111	67.1	0.252	−78.3	10.4
2800	0.535	135.4	2.542	57.5	0.118	66.0	0.267	−79.3	9.9
3000	0.541	129.7	2.367	54.6	0.125	66.9	0.263	−79.7	9.3

Table 19 Noise data, I_C = 20 mA; V_{CE} = 6 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
500	1.45	0.204	28.0	0.250
900	1.60	0.183	56.0	0.260
1000	1.65	0.190	61.0	0.270
2000	2.20	0.216	156.0	0.170

Table 20 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 6 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.532	−26.6	39.491	165.1	0.006	76.9	0.932	−11.1	42.2
100	0.520	−61.8	34.496	146.9	0.014	67.5	0.828	−25.0	37.1
200	0.505	−101.9	25.639	126.7	0.022	56.6	0.638	−38.4	31.7
300	0.502	−126.0	19.503	114.5	0.026	53.0	0.511	−44.1	28.4
400	0.502	−140.6	15.434	107.0	0.030	53.5	0.433	−46.4	25.9
500	0.504	−150.7	12.756	101.5	0.033	54.3	0.383	−47.2	24.1
600	0.501	−158.4	10.828	97.2	0.036	55.9	0.350	−47.2	22.5
700	0.498	−164.2	9.398	93.8	0.039	57.7	0.326	−46.9	21.2
800	0.495	−169.8	8.287	90.7	0.042	59.8	0.309	−46.5	20.0
900	0.492	−175.0	7.386	88.1	0.046	61.4	0.294	−46.5	19.0
1000	0.491	−179.7	6.680	85.9	0.050	62.7	0.281	−47.0	18.1
1200	0.499	172.3	5.587	81.6	0.057	64.3	0.266	−49.2	16.5
1400	0.507	166.4	4.820	77.4	0.064	65.5	0.261	−52.3	15.3
1600	0.508	161.2	4.210	73.7	0.071	67.8	0.263	−53.7	14.1
1800	0.504	155.0	3.763	70.5	0.080	67.7	0.260	−54.2	13.1
2000	0.511	148.6	3.403	67.6	0.087	68.8	0.244	−55.9	12.2
2200	0.532	143.3	3.110	64.8	0.095	68.7	0.229	−61.7	11.5
2400	0.551	140.2	2.826	61.5	0.100	69.8	0.231	−70.1	10.8
2600	0.554	137.6	2.602	59.0	0.111	69.6	0.252	−75.9	10.2
2800	0.546	133.5	2.442	55.9	0.119	68.1	0.269	−77.2	9.6
3000	0.554	128.0	2.274	53.1	0.125	68.9	0.266	−77.8	9.0

NPN 9 GHz wideband transistor — BFG540; BFG540/X; BFG540/XR

FEATURES

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

DESCRIPTION

NPN silicon planar epitaxial transistors, intended for wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optical systems.

The transistors are mounted in plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG540 (Fig.1) Code: N37	
1	collector
2	base
3	emitter
4	emitter
BFG540/X (Fig.1) Code: N43	
1	collector
2	emitter
3	base
4	emitter
BFG540/XR (Fig.2) Code: N49	
1	collector
2	emitter
3	base
4	emitter

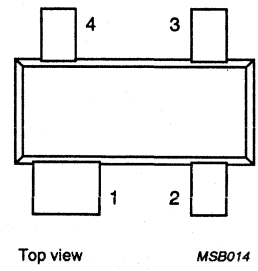


Fig.1 SOT143.

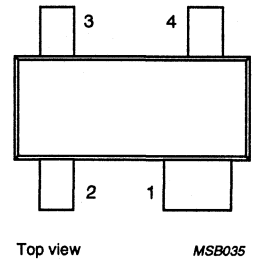


Fig.2 SOT143R.

Capability approved 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	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to $T_s = 35$ °C (note 1)	–	–	500	mW
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V; $T_j = 25$ °C	60	120	250	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	18	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	11	–	dB
$\|S_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	15	16	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to $T_s = 35$ °C (note 1)	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to $T_s = 35$ °C (note 1)	230 K/W

Note

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

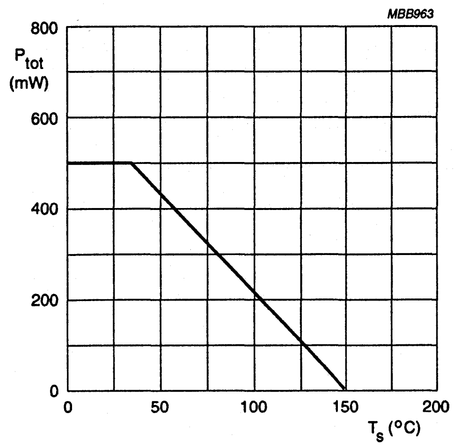
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 8 V;	–	–	50	nA
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e$ =0; V_{CB} = 8 V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 40 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	11	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	15	16	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_O	output voltage	note 3	–	500	–	mV
d_2	second order intermodulation distortion	note 4	–	–50	–	dB

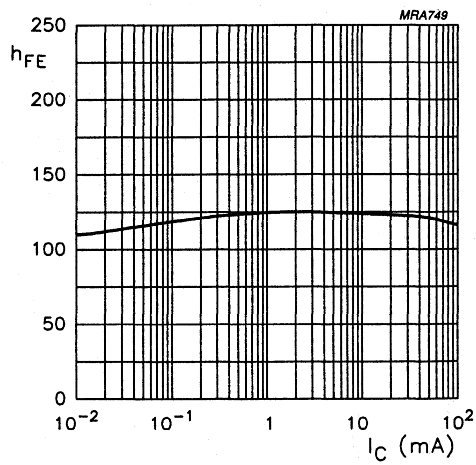
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. V_{CE} = 8 V; I_C = 40 mA; R_L = 50 Ω; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 40 mA; V_{CE} = 8 V; $Z_L = Z_S$ = 75 Ω; T_{amb} = 25 °C
   $V_p = V_O$; $V_q = V_O$ –6 dB; $V_r = V_O$ –6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz
4. I_C = 40 mA; V_{CE} = 8 V; V_O = 275 mV; T_{amb} = 25 °C;
   f_p = 250 MHz; f_q = 560 MHz; measured at $f_{(p+q)}$ = 810 MHz



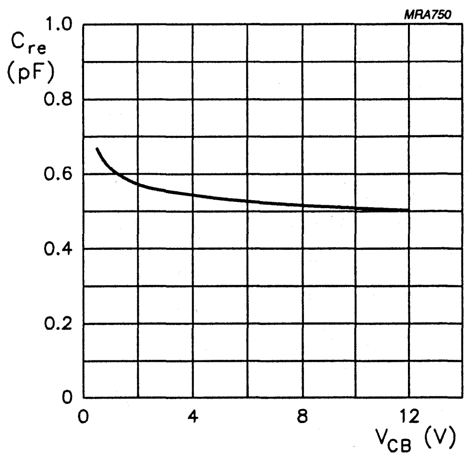
$V_{CE} \leq 10$ V.

Fig.3 Power derating curve.



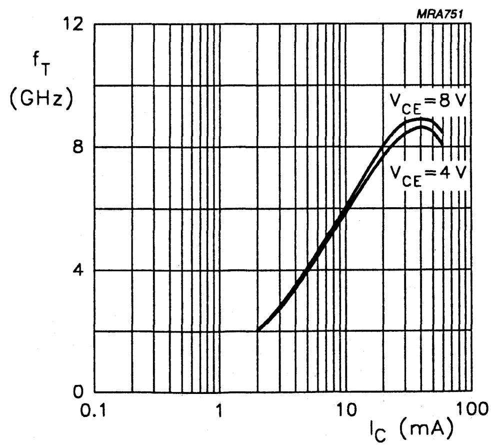
$V_{CE} = 8$ V; $T_j = 25$ °C.

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



$I_C = 0$; f = 1 MHz.

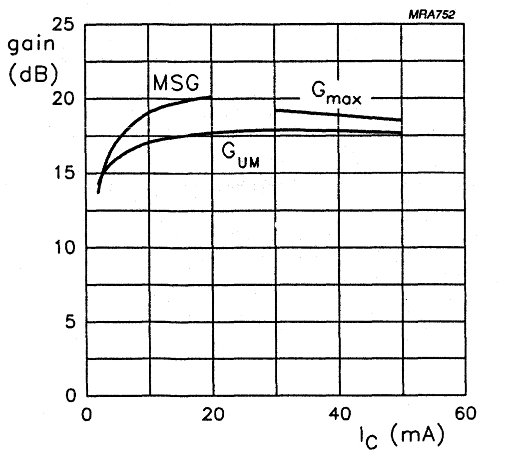
Fig.5 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; $T_{amb} = 25$ °C.

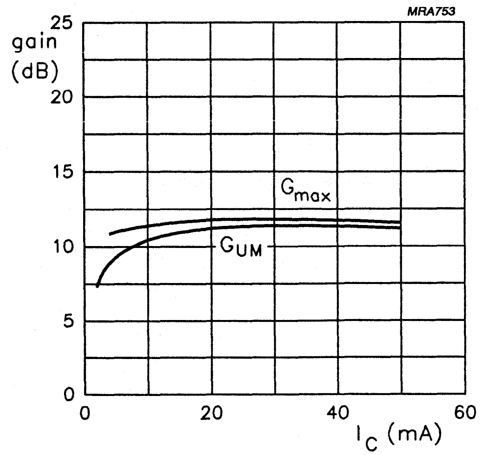
Fig.6 Transition frequency as a function of collector current.

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



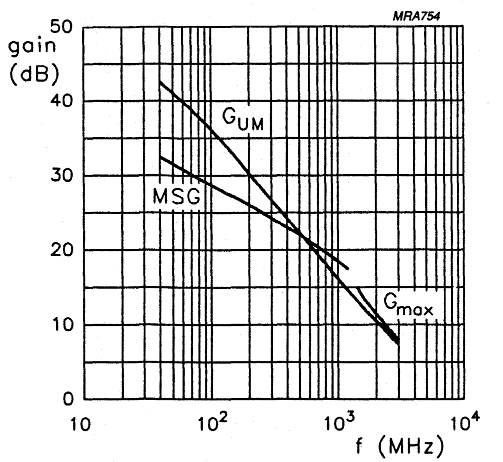
V_{CE} = 8 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



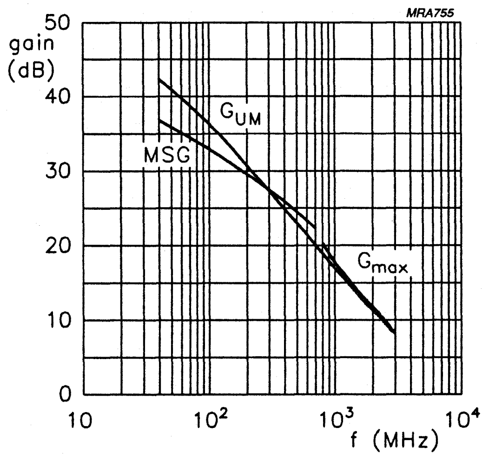
V_{CE} = 8 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



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

Fig.9 Gain as a function of frequency.



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

Fig.10 Gain as a function of frequency.

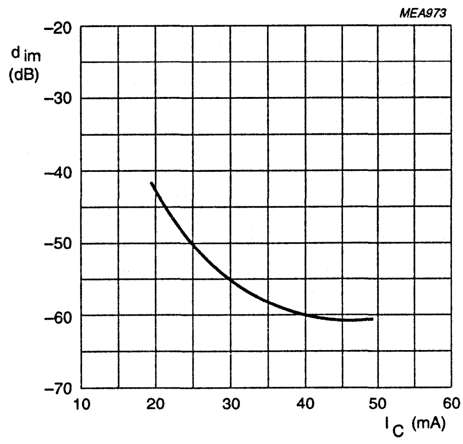


Fig.11 Intermodulation distortion as a function of collector current.

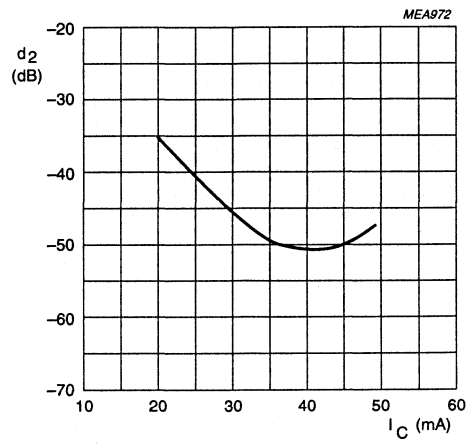
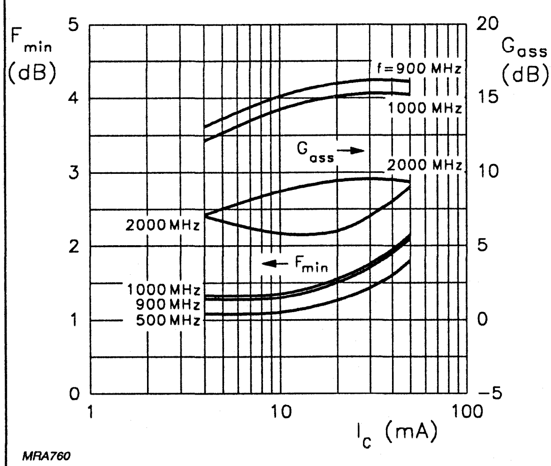
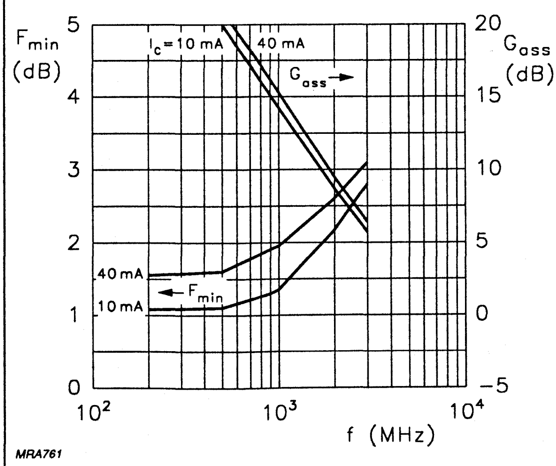


Fig.12 Second order intermodulation distortion as a function of collector current.



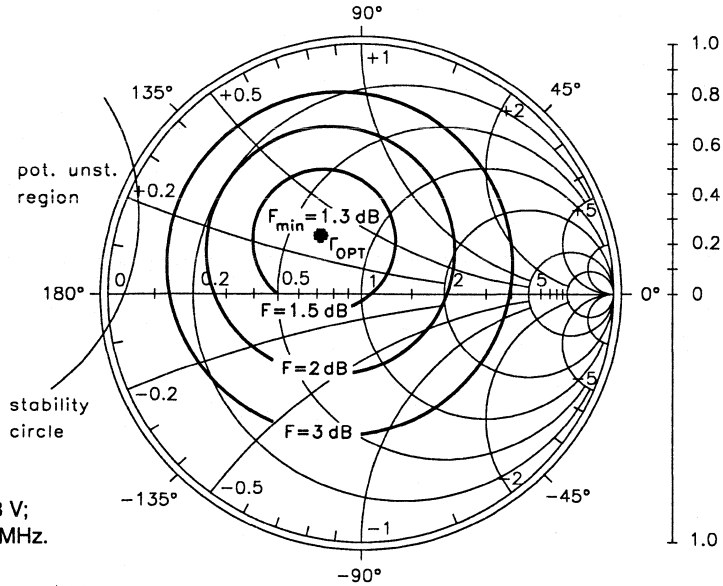
V_{CE} = 8 V.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



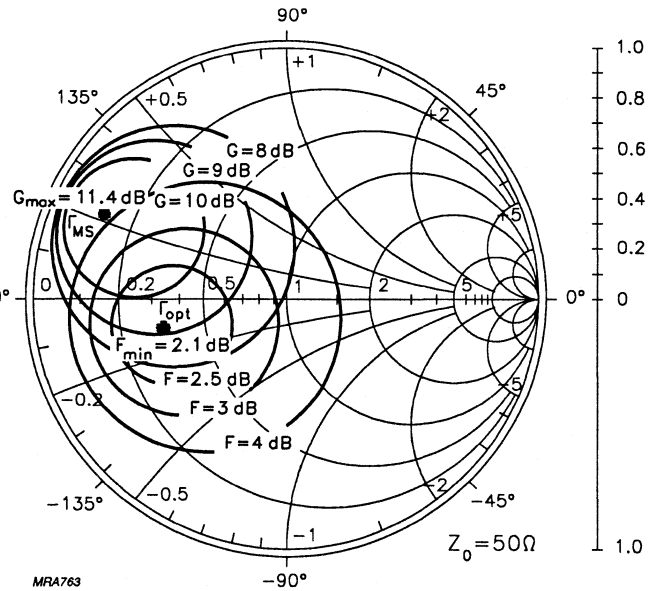
V_{CE} = 8 V.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.



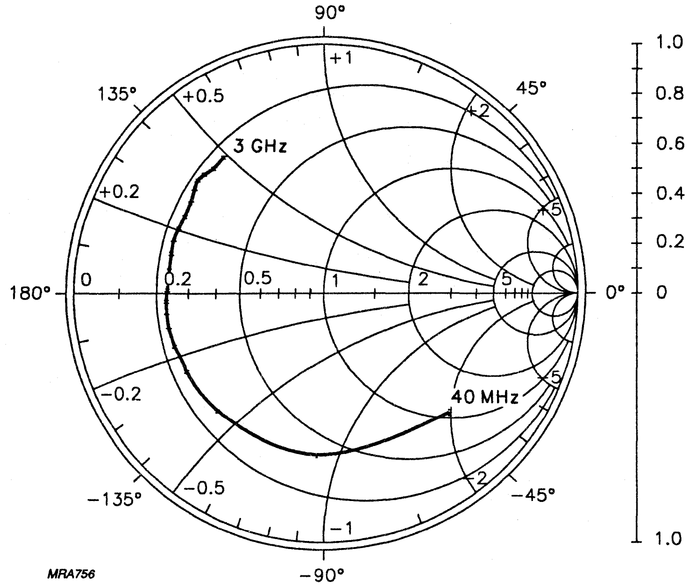
I_C = 10 mA; V_{CE} = 8 V;
Z_O = 50 Ω; f = 900 MHz.

Fig.15 Noise circle figure.



I_C = 10 mA; V_{CE} = 8 V;
Z_O = 50 Ω; f = 2 GHz.

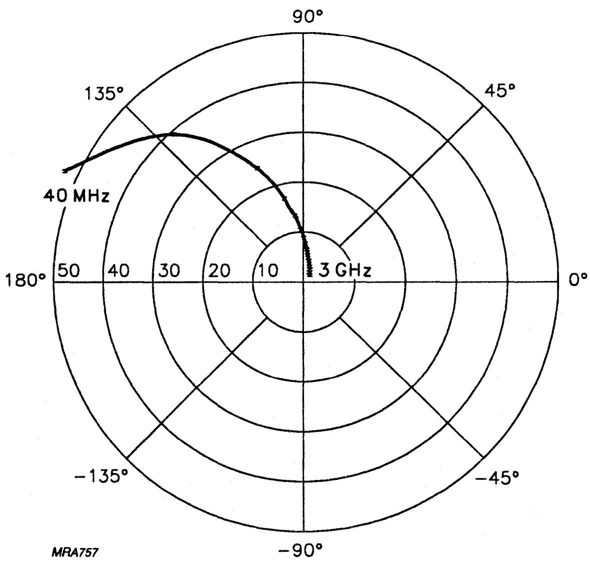
Fig.16 Noise circle figure.



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

MRA756

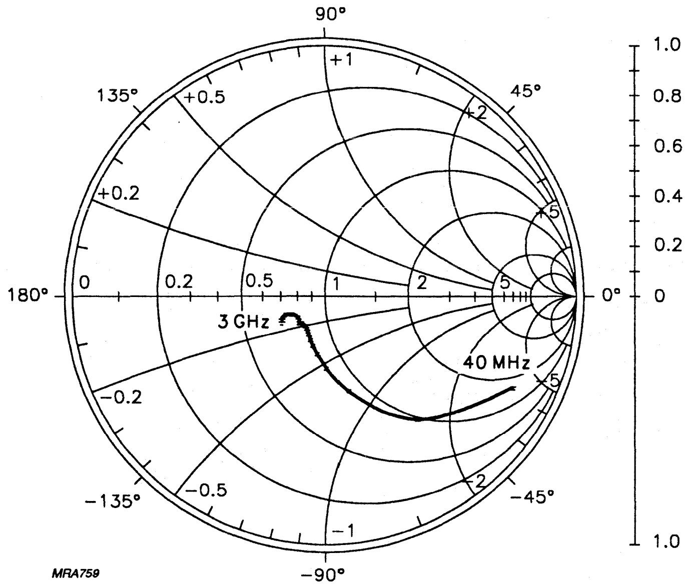
Fig.17 Common emitter input reflection coefficient (S_{11}).



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

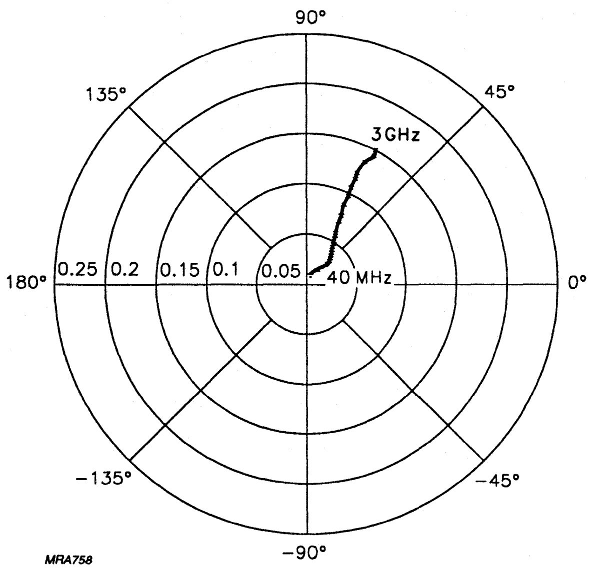
MRA757

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



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

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

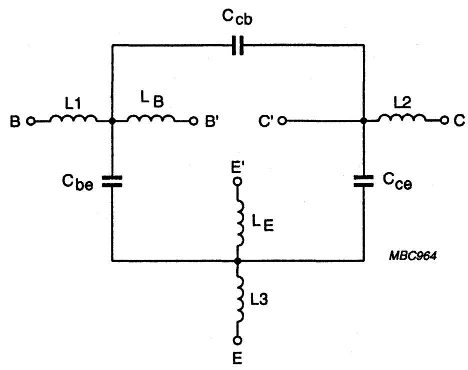


I_C = 40 mA; V_{CE} = 8 V.

Fig.20 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for the BFR540 crystal

1	IS = 1.045	fA
2	BF = 184.3	-
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	-
8	BR = 43.99	-
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	-
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	-
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	-
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.40	-
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	-
38	FC = 814.7	m



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

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

Fc = scaling frequency = 1000 MHz.

Fig.21 Package equivalent circuit, SOT143; SOT143R.

List of components (see Fig.21)

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

Note

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

Table 1 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.909	−14.0	10.705	169.8	0.014	82.2	0.981	−7.1	42.4
100	0.881	−33.9	10.082	157.2	0.033	70.3	0.934	−17.0	35.5
200	0.832	−64.7	9.138	140.4	0.056	55.2	0.814	−29.9	29.1
300	0.790	−90.1	8.025	126.9	0.070	44.9	0.704	−38.1	25.3
400	0.767	−109.2	6.901	116.9	0.078	38.0	0.618	−43.4	22.7
500	0.751	−123.9	5.996	109.2	0.083	33.6	0.555	−47.0	20.8
600	0.737	−135.2	5.269	102.9	0.086	30.7	0.510	−49.3	19.1
700	0.726	−144.2	4.673	97.8	0.088	28.5	0.476	−51.0	17.8
800	0.716	−151.7	4.177	93.3	0.088	27.1	0.450	−52.5	16.5
900	0.707	−158.1	3.748	89.4	0.089	26.4	0.428	−54.0	15.4
1000	0.701	−164.1	3.400	86.1	0.089	26.3	0.411	−55.7	14.4
1200	0.697	−174.2	2.867	80.0	0.089	26.6	0.391	−60.0	12.8
1400	0.703	177.8	2.492	74.1	0.089	27.0	0.386	−64.4	11.6
1600	0.704	170.9	2.181	68.9	0.089	30.0	0.387	−67.6	10.5
1800	0.705	164.4	1.959	65.0	0.091	32.1	0.383	−70.4	9.5
2000	0.713	157.9	1.771	61.1	0.091	35.5	0.371	−74.9	8.7
2200	0.727	152.3	1.617	57.2	0.092	38.6	0.366	−81.6	8.1
2400	0.739	148.0	1.458	52.8	0.092	42.6	0.379	−88.8	7.4
2600	0.739	143.9	1.339	49.9	0.098	45.9	0.406	−94.1	6.7
2800	0.736	138.9	1.262	45.7	0.103	47.8	0.427	−96.9	6.3
3000	0.750	133.3	1.168	42.8	0.108	52.2	0.427	−99.8	5.8

NPN 9 GHz wideband transistor | BFG540; BFG540/X; BFG540/XR

Table 2 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.799	−23.1	23.640	164.6	0.013	77.3	0.950	−13.6	42.0
100	0.760	−54.5	21.010	147.6	0.028	61.7	0.835	−31.1	35.4
200	0.711	−96.6	16.834	126.9	0.042	47.0	0.628	−49.4	29.8
300	0.690	−122.6	13.109	114.0	0.049	39.9	0.490	−59.5	26.3
400	0.683	−138.5	10.481	105.8	0.052	37.6	0.403	−65.4	23.9
500	0.680	−149.5	8.682	99.9	0.055	36.6	0.347	−69.3	22.0
600	0.675	−157.5	7.399	95.2	0.057	37.0	0.309	−71.9	20.5
700	0.671	−163.9	6.429	91.5	0.059	38.0	0.280	−73.7	19.1
800	0.667	−169.4	5.671	88.2	0.061	39.1	0.259	−75.3	17.9
900	0.662	−174.3	5.060	85.4	0.064	40.7	0.241	−77.2	16.9
1000	0.661	−178.9	4.569	82.9	0.066	42.4	0.227	−79.4	15.9
1200	0.663	173.4	3.823	78.3	0.071	45.6	0.214	−84.7	14.4
1400	0.669	167.3	3.288	73.6	0.076	47.6	0.215	−89.1	13.1
1600	0.671	161.9	2.878	69.5	0.082	51.0	0.216	−91.2	12.0
1800	0.672	156.1	2.589	66.0	0.090	52.6	0.211	−92.9	11.1
2000	0.682	150.2	2.349	62.8	0.096	54.9	0.201	−97.9	10.3
2200	0.699	145.5	2.138	59.5	0.102	56.4	0.202	−106.6	9.7
2400	0.709	142.1	1.926	56.2	0.106	58.3	0.221	−114.1	8.9
2600	0.708	138.6	1.780	53.5	0.117	59.0	0.249	−117.2	8.3
2800	0.703	134.1	1.667	49.5	0.125	58.1	0.265	−117.5	7.7
3000	0.716	128.9	1.558	47.0	0.132	59.9	0.263	−119.1	7.3

Table 3 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.30	0.298	143.0	0.10
2000	2.10	0.537	−162.0	0.09

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.680	−35.9	39.017	159.1	0.012	73.1	0.903	−21.0	41.8
100	0.658	−80.2	31.861	137.5	0.023	56.1	0.716	−44.9	35.6
200	0.650	−123.4	21.805	116.5	0.032	44.4	0.480	−66.6	30.3
300	0.652	−143.9	15.757	106.0	0.036	41.8	0.358	−78.4	26.9
400	0.656	−155.6	12.204	99.5	0.039	42.9	0.289	−86.0	24.6
500	0.657	−163.5	9.939	94.9	0.042	44.6	0.248	−91.4	22.7
600	0.656	−169.4	8.383	91.2	0.045	47.4	0.220	−95.4	21.1
700	0.653	−174.4	7.240	88.2	0.049	49.2	0.199	−98.6	19.8
800	0.651	−178.7	6.368	85.5	0.052	51.2	0.183	−101.7	18.6
900	0.648	177.4	5.675	83.2	0.056	53.4	0.171	−105.2	17.6
1000	0.650	173.6	5.117	81.2	0.059	55.2	0.163	−108.8	16.7
1200	0.654	167.1	4.276	77.2	0.067	57.7	0.158	−115.6	15.2
1400	0.661	162.0	3.664	73.2	0.075	59.1	0.164	−119.4	13.9
1600	0.662	157.2	3.206	69.6	0.084	61.6	0.164	−120.4	12.7
1800	0.661	151.9	2.891	66.3	0.094	61.9	0.157	−122.3	11.8
2000	0.672	146.3	2.623	63.5	0.102	63.2	0.152	−129.0	11.1
2200	0.690	142.0	2.385	60.5	0.110	63.4	0.162	−137.9	10.5
2400	0.700	138.9	2.149	57.7	0.116	64.5	0.186	−142.5	9.7
2600	0.698	135.7	1.994	55.0	0.128	63.8	0.211	−141.9	9.1
2800	0.693	131.4	1.857	51.3	0.137	61.9	0.219	−140.0	8.4
3000	0.704	126.3	1.747	48.9	0.145	62.8	0.214	−141.5	8.0

Table 5 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.281	159.0	0.11
2000	2.20	0.518	−157.0	0.12

Table 6 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.610	−46.5	49.003	155.3	0.011	69.0	0.863	−25.9	41.8
100	0.618	−96.6	37.160	131.4	0.020	53.2	0.640	−52.9	35.8
200	0.635	−135.8	23.444	111.8	0.027	45.2	0.410	−76.1	30.4
300	0.645	−152.8	16.534	102.6	0.031	44.8	0.304	−89.0	27.1
400	0.651	−162.5	12.684	96.9	0.034	47.7	0.248	−97.6	24.7
500	0.654	−169.1	10.280	92.8	0.038	50.2	0.216	−103.9	22.9
600	0.653	−174.2	8.647	89.6	0.042	53.4	0.194	−108.7	21.3
700	0.651	−178.5	7.455	86.8	0.046	55.3	0.178	−112.6	20.0
800	0.649	177.7	6.554	84.4	0.050	57.2	0.166	−116.4	18.8
900	0.647	174.1	5.835	82.2	0.054	59.3	0.157	−120.6	17.8
1000	0.647	170.6	5.261	80.4	0.058	60.7	0.152	−124.5	16.9
1200	0.653	164.6	4.395	76.7	0.067	62.8	0.152	−131.2	15.4
1400	0.660	159.9	3.760	72.8	0.075	63.6	0.158	−133.9	14.1
1600	0.660	155.3	3.293	69.3	0.085	65.3	0.158	−134.7	12.9
1800	0.660	150.1	2.973	66.2	0.097	65.2	0.151	−137.1	12.0
2000	0.671	144.7	2.697	63.5	0.105	65.9	0.149	−144.2	11.3
2200	0.690	140.6	2.452	60.5	0.114	65.8	0.163	−151.7	10.7
2400	0.699	137.7	2.207	58.0	0.119	66.5	0.188	−154.4	9.9
2600	0.697	134.6	2.052	55.3	0.132	65.5	0.209	−152.5	9.3
2800	0.690	130.4	1.908	51.6	0.141	63.3	0.214	−150.0	8.6
3000	0.703	125.3	1.796	49.3	0.149	63.9	0.207	−151.7	8.2

Table 7 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.70	0.312	171.0	0.11
2000	2.40	0.543	−155.0	0.12

Table 8 Common emitter scattering parameters, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.565	−56.1	55.755	152.1	0.010	68.6	0.826	−29.6	41.6
100	0.602	−108.2	39.714	127.2	0.018	51.9	0.583	−58.5	35.7
200	0.633	−143.2	23.954	108.9	0.024	46.1	0.364	−82.3	30.4
300	0.646	−158.1	16.688	100.5	0.028	47.3	0.272	−95.8	27.1
400	0.652	−166.5	12.742	95.3	0.032	51.0	0.225	−104.9	24.7
500	0.654	−172.3	10.301	91.5	0.036	53.9	0.198	−111.5	22.9
600	0.654	−177.0	8.651	88.4	0.040	56.7	0.181	−116.4	21.3
700	0.652	179.1	7.453	85.8	0.044	59.0	0.167	−120.7	20.0
800	0.650	175.6	6.547	83.5	0.048	60.9	0.158	−124.6	18.8
900	0.649	172.2	5.831	81.5	0.053	62.5	0.151	−128.8	17.8
1000	0.650	168.8	5.261	79.7	0.058	63.9	0.147	−132.8	16.9
1200	0.656	163.2	4.390	76.1	0.067	65.5	0.150	−139.0	15.4
1400	0.663	158.6	3.756	72.3	0.076	65.8	0.158	−141.1	14.1
1600	0.662	154.2	3.288	69.0	0.086	67.5	0.158	−141.5	13.0
1800	0.661	149.2	2.967	65.9	0.098	66.9	0.151	−144.0	12.0
2000	0.674	143.9	2.696	63.2	0.107	67.5	0.150	−151.1	11.3
2200	0.691	139.8	2.449	60.3	0.115	67.2	0.166	−158.0	10.7
2400	0.702	136.9	2.205	57.8	0.121	67.7	0.191	−159.6	10.0
2600	0.698	134.0	2.049	55.1	0.134	66.5	0.210	−157.1	9.3
2800	0.692	129.8	1.907	51.4	0.143	64.0	0.214	−154.6	8.6
3000	0.704	124.8	1.796	49.2	0.152	64.5	0.207	−156.5	8.3

Table 9 Noise data, I_C = 40 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.351	179.0	0.11
2000	2.60	0.543	−150.0	0.17

Table 10 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.534	−64.6	59.745	149.6	0.010	65.9	0.792	−32.4	41.3
100	0.597	−116.5	40.618	124.2	0.017	50.6	0.538	−62.4	35.6
200	0.636	−148.3	23.837	106.9	0.022	47.2	0.332	−86.3	30.3
300	0.649	−161.6	16.497	99.1	0.026	49.4	0.249	−100.0	27.0
400	0.656	−169.2	12.559	94.2	0.030	53.3	0.208	−109.3	24.6
500	0.658	−174.6	10.137	90.6	0.034	56.2	0.186	−115.8	22.7
600	0.658	−178.8	8.509	87.6	0.039	59.4	0.171	−120.7	21.2
700	0.656	177.6	7.325	85.1	0.043	61.4	0.159	−124.9	19.9
800	0.654	174.2	6.434	82.9	0.048	62.9	0.151	−128.7	18.7
900	0.653	170.9	5.729	80.9	0.052	64.7	0.146	−132.8	17.7
1000	0.654	167.7	5.164	79.1	0.057	65.9	0.144	−136.8	16.8
1200	0.661	162.3	4.312	75.6	0.067	67.2	0.148	−142.5	15.3
1400	0.667	157.9	3.685	71.8	0.076	67.4	0.156	−144.0	14.0
1600	0.666	153.5	3.229	68.5	0.086	68.6	0.156	−144.2	12.8
1800	0.666	148.5	2.912	65.4	0.098	68.1	0.150	−146.8	11.9
2000	0.679	143.3	2.647	62.8	0.107	68.5	0.150	−153.7	11.2
2200	0.696	139.4	2.405	59.8	0.116	68.0	0.167	−160.2	10.6
2400	0.706	136.5	2.166	57.4	0.122	68.4	0.192	−161.4	9.9
2600	0.703	133.7	2.011	54.7	0.135	67.1	0.211	−158.7	9.2
2800	0.696	129.3	1.869	51.0	0.144	64.6	0.214	−156.1	8.5
3000	0.709	124.4	1.763	48.7	0.153	64.9	0.207	−158.1	8.1

Table 11 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.921	−13.3	10.695	170.2	0.013	81.1	0.980	−6.7	42.9
100	0.894	−32.4	10.108	158.0	0.032	70.9	0.938	−16.2	36.3
200	0.843	−61.9	9.196	141.5	0.054	56.4	0.825	−28.6	29.6
300	0.799	−86.8	8.142	128.3	0.069	46.1	0.718	−36.8	25.8
400	0.771	−105.9	7.047	118.2	0.077	39.3	0.633	−42.1	23.1
500	0.751	−120.5	6.137	110.5	0.082	34.5	0.571	−45.7	21.1
600	0.735	−132.1	5.419	104.2	0.085	31.7	0.525	−48.0	19.5
700	0.722	−141.3	4.813	98.9	0.087	29.5	0.490	−49.7	18.0
800	0.711	−149.0	4.306	94.5	0.088	27.8	0.462	−51.2	16.8
900	0.701	−155.7	3.871	90.5	0.088	27.3	0.440	−52.7	15.6
1000	0.693	−161.9	3.511	87.1	0.089	26.9	0.422	−54.3	14.6
1200	0.688	−172.3	2.966	80.9	0.089	27.0	0.401	−58.4	13.0
1400	0.693	179.5	2.580	75.1	0.089	27.4	0.395	−62.6	11.8
1600	0.695	172.5	2.258	69.8	0.089	30.5	0.395	−65.8	10.7
1800	0.693	165.7	2.028	65.9	0.092	32.4	0.390	−68.4	9.7
2000	0.702	158.9	1.834	62.0	0.091	35.5	0.377	−72.6	8.9
2200	0.717	153.3	1.676	58.1	0.092	38.5	0.371	−79.1	8.3
2400	0.727	148.9	1.512	53.7	0.092	42.3	0.382	−86.3	7.5
2600	0.728	144.8	1.387	50.8	0.098	45.5	0.408	−91.6	6.9
2800	0.725	139.7	1.307	46.6	0.103	47.4	0.429	−94.4	6.5
3000	0.738	134.1	1.211	43.7	0.107	51.7	0.429	−97.1	6.0

Table 12 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{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, I_C = 10 mA; V_{CE} = 8 V

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, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.754	−31.1	37.624	160.6	0.012	73.4	0.904	−19.0	42.6
100	0.707	−71.0	31.376	140.0	0.024	57.2	0.738	−41.5	36.4
200	0.661	−114.2	22.110	118.9	0.033	45.2	0.508	−62.8	30.7
300	0.648	−136.6	16.188	107.9	0.038	42.1	0.381	−74.5	27.2
400	0.645	−149.9	12.606	101.1	0.041	42.1	0.308	−82.0	24.8
500	0.643	−158.7	10.292	96.2	0.044	43.2	0.263	−87.2	22.9
600	0.640	−165.4	8.698	92.4	0.048	45.4	0.232	−91.0	21.3
700	0.637	−170.7	7.518	89.2	0.051	47.5	0.209	−94.0	20.0
800	0.633	−175.4	6.617	86.5	0.054	49.3	0.191	−96.9	18.8
900	0.629	−179.8	5.894	84.1	0.057	51.4	0.177	−100.1	17.7
1000	0.629	176.1	5.320	82.0	0.061	53.3	0.167	−103.6	16.8
1200	0.633	169.3	4.445	78.0	0.069	55.7	0.160	−110.5	15.3
1400	0.640	163.7	3.812	73.9	0.076	57.2	0.163	−114.5	14.0
1600	0.641	158.8	3.338	70.2	0.084	59.7	0.163	−115.7	12.9
1800	0.639	153.2	3.004	67.0	0.095	60.0	0.155	−117.3	11.9
2000	0.650	147.5	2.730	64.1	0.103	61.4	0.148	−124.0	11.2
2200	0.668	143.0	2.482	61.1	0.110	61.9	0.156	−133.5	10.6
2400	0.679	139.9	2.236	58.3	0.115	62.9	0.179	−138.6	9.8
2600	0.678	136.7	2.073	55.6	0.127	62.4	0.203	−138.4	9.2
2800	0.673	132.4	1.935	51.8	0.136	60.5	0.213	−136.3	8.6
3000	0.685	127.2	1.818	49.5	0.144	61.3	0.207	−137.7	8.1

Table 15 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.232	140.0	0.14
2000	2.20	0.490	−163.0	0.11

Table 16 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.711	−38.6	46.953	157.3	0.011	71.0	0.866	−23.2	42.5
100	0.668	−84.2	36.734	134.4	0.022	54.4	0.667	−48.7	36.4
200	0.639	−125.6	23.900	114.2	0.029	44.8	0.437	−71.4	30.8
300	0.635	−145.2	17.038	104.4	0.033	43.9	0.324	−83.9	27.3
400	0.635	−156.7	13.125	98.4	0.037	45.6	0.262	−92.2	24.9
500	0.634	−164.3	10.656	94.0	0.040	48.0	0.226	−98.2	23.0
600	0.632	−170.0	8.973	90.6	0.044	50.8	0.202	−102.7	21.5
700	0.629	−174.9	7.740	87.7	0.047	53.0	0.183	−106.5	20.1
800	0.626	−179.1	6.807	85.2	0.051	54.8	0.169	−110.0	18.9
900	0.623	176.9	6.063	83.0	0.055	56.6	0.158	−113.9	17.9
1000	0.623	173.1	5.468	81.1	0.060	58.2	0.151	−118.0	17.0
1200	0.630	166.7	4.567	77.3	0.068	60.5	0.149	−125.2	15.5
1400	0.636	161.7	3.913	73.4	0.076	61.4	0.154	−128.4	14.2
1600	0.635	156.9	3.425	69.9	0.086	63.3	0.153	−129.1	13.0
1800	0.634	151.5	3.088	66.7	0.097	63.3	0.145	−131.1	12.1
2000	0.646	145.9	2.803	64.0	0.105	64.2	0.141	−138.6	11.4
2200	0.664	141.7	2.549	61.1	0.114	64.1	0.153	−147.1	10.8
2400	0.676	138.7	2.297	58.4	0.119	64.7	0.177	−150.5	10.0
2600	0.674	135.6	2.133	55.7	0.132	63.8	0.199	−148.7	9.4
2800	0.668	131.3	1.988	52.0	0.140	61.7	0.204	−146.2	8.7
3000	0.679	126.2	1.869	49.7	0.148	62.4	0.197	−147.6	8.3

Table 17 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.70	0.241	149.0	0.15
2000	2.40	0.479	−163.0	0.12

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.687	−44.2	52.655	154.8	0.011	69.5	0.834	−25.9	42.4
100	0.650	−92.4	39.166	130.8	0.020	53.2	0.617	−52.9	36.3
200	0.632	−132.0	24.429	111.5	0.027	45.1	0.394	−75.9	30.7
300	0.629	−149.9	17.180	102.4	0.031	45.1	0.291	−88.6	27.3
400	0.631	−160.2	13.173	96.8	0.034	48.1	0.237	−97.2	24.8
500	0.632	−167.2	10.670	92.8	0.038	50.7	0.206	−103.3	23.0
600	0.630	−172.5	8.971	89.5	0.042	53.6	0.185	−108.0	21.4
700	0.627	−177.0	7.733	86.8	0.046	55.8	0.169	−111.9	20.1
800	0.624	179.0	6.793	84.3	0.050	57.6	0.157	−115.6	18.9
900	0.621	175.3	6.051	82.2	0.055	59.2	0.148	−119.7	17.9
1000	0.622	171.6	5.458	80.4	0.059	60.9	0.142	−123.8	17.0
1200	0.627	165.4	4.559	76.7	0.069	62.8	0.143	−130.7	15.4
1400	0.634	160.5	3.902	72.8	0.077	63.5	0.149	−133.5	14.2
1600	0.634	155.9	3.417	69.4	0.087	65.1	0.148	−134.0	13.0
1800	0.634	150.7	3.078	66.2	0.098	64.7	0.141	−136.2	12.1
2000	0.645	145.1	2.796	63.5	0.107	65.4	0.137	−143.6	11.4
2200	0.662	141.0	2.542	60.6	0.116	65.2	0.151	−151.9	10.7
2400	0.675	138.1	2.293	58.1	0.121	65.6	0.176	−154.3	10.0
2600	0.673	135.0	2.127	55.3	0.134	64.6	0.196	−152.1	9.3
2800	0.666	130.8	1.981	51.7	0.143	62.3	0.201	−149.2	8.7
3000	0.677	125.7	1.864	49.4	0.150	62.8	0.193	−150.8	8.2

Table 19 Noise data, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.263	155.0	0.14
2000	2.60	0.494	−162.0	0.13

Table 20 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.668	−49.0	56.198	152.8	0.011	68.1	0.805	−27.9	42.1
100	0.638	−98.7	40.134	128.1	0.020	51.1	0.576	−55.6	36.1
200	0.628	−136.4	24.336	109.6	0.025	45.6	0.361	−78.3	30.5
300	0.629	−153.2	16.979	101.0	0.029	46.7	0.267	−90.7	27.1
400	0.630	−162.7	12.976	95.7	0.033	49.8	0.218	−99.0	24.7
500	0.631	−169.2	10.494	91.8	0.037	52.5	0.190	−104.9	22.8
600	0.629	−174.2	8.814	88.7	0.041	55.7	0.171	−109.5	21.2
700	0.627	−178.5	7.593	86.0	0.046	57.7	0.157	−113.2	19.9
800	0.625	177.7	6.670	83.7	0.050	59.5	0.146	−116.8	18.7
900	0.622	174.1	5.941	81.6	0.054	61.2	0.139	−120.9	17.7
1000	0.624	170.6	5.357	79.8	0.059	62.5	0.134	−124.9	16.8
1200	0.628	164.6	4.474	76.1	0.068	64.1	0.136	−131.6	15.3
1400	0.635	159.8	3.829	72.3	0.077	64.6	0.143	−134.1	14.0
1600	0.635	155.3	3.350	68.9	0.087	66.1	0.143	−134.2	12.8
1800	0.634	150.1	3.020	65.6	0.099	65.7	0.136	−136.3	11.9
2000	0.646	144.7	2.745	62.9	0.107	66.1	0.133	−143.6	11.2
2200	0.663	140.5	2.495	60.0	0.116	65.6	0.147	−151.8	10.6
2400	0.676	137.6	2.247	57.4	0.122	66.2	0.172	−154.3	9.8
2600	0.675	134.7	2.086	54.7	0.135	65.1	0.193	−151.8	9.2
2800	0.667	130.4	1.944	51.0	0.144	62.9	0.198	−148.9	8.5
3000	0.678	125.4	1.827	48.7	0.152	63.3	0.191	−150.3	8.1

NPN 9 GHz wideband transistor BFG541

FEATURES

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

DESCRIPTION

NPN silicon planar epitaxial transistor, intended for wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optic systems.

The transistors are mounted in a plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

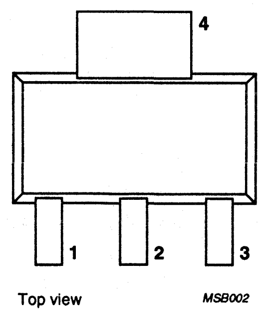


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	650	mW
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V; T_j = 25 °C	60	120	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 40 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.3	1.8	dB
P_{L1}	output power at 1 dB gain compression	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	34	–	dBm

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	650	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 115 °C (note 1)	55 K/W

Note

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

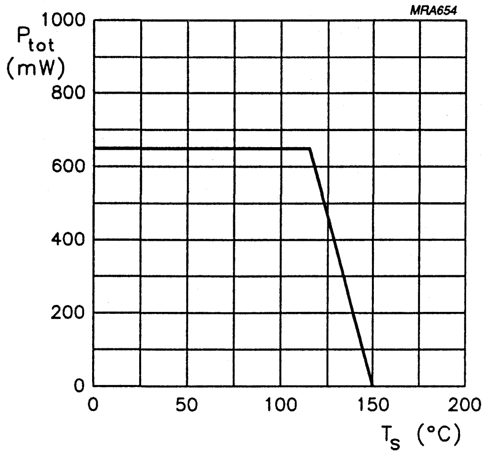
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 8 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 8 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e$ =0; V_{CB} = 8 V; f = 1 MHz	–	1	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	I_C = 40 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 40 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	9	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 40 mA; V_{CE} = 8 V; f = 900 MHz; T_{amb} = 25 °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 10 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_O	output voltage	note 3	–	500	–	mV
d_2	second order intermodulation distortion	note 4	–	–50	–	dB

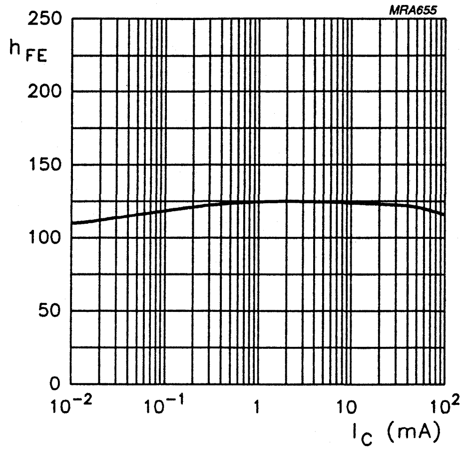
Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. I_C = 40 mA; V_{CE} = 8 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and at $f_{(2p-q)}$ = 904 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 40 mA; V_{CE} = 8 V; $Z_L = Z_S$ = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$; $V_q = V_O$ –6 dB; $V_r = V_O$ –6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz
4. I_C = 40 mA; V_{CE} = 8 V; V_O = 325 mV; T_{amb} = 25 °C;
   f_p = 250 MHz; f_q = 560 MHz;
   measured at $f_{(p+q)}$ = 810 MHz



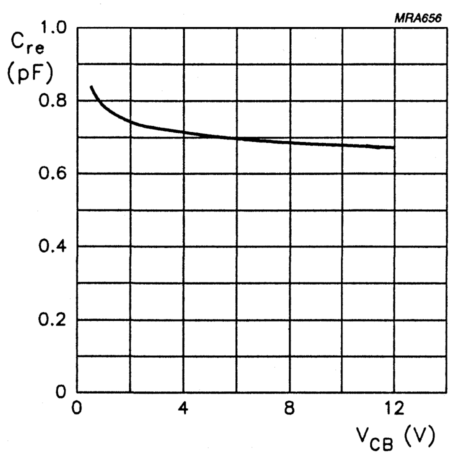
$V_{CE} \leq 10$ V.

Fig.2 Power derating curve.



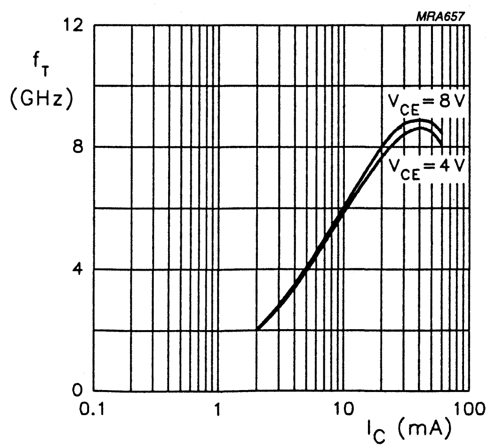
V_{CE} = 8 V; T_j = 25 °C.

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



I_C = 0; f = 1 MHz.

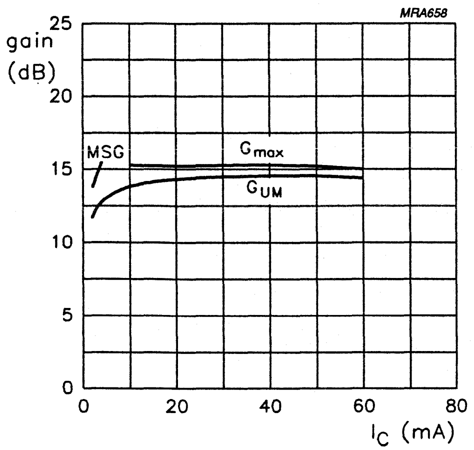
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

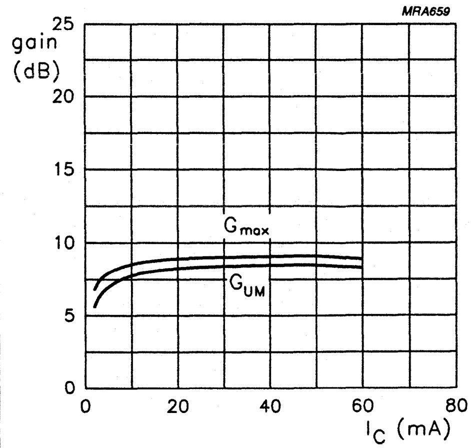
Fig.5 Transition frequency as a function of collector current.

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



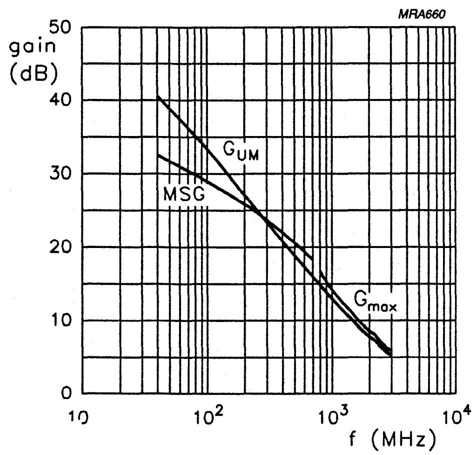
V_{CE} = 8 V; f = 900 MHz.

Fig.6 Gain as a function of collector current.



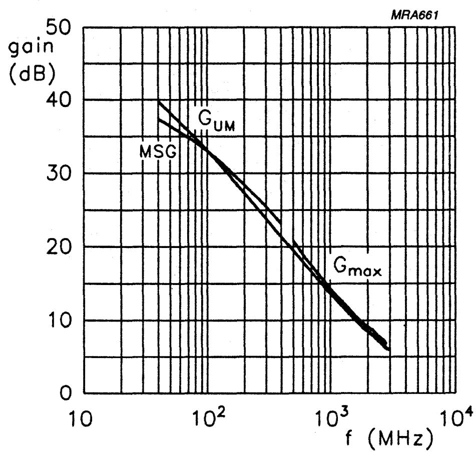
V_{CE} = 8 V; f = 2 GHz.

Fig.7 Gain as a function of collector current.



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

Fig.8 Gain as a function of frequency.



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

Fig.9 Gain as a function of frequency.

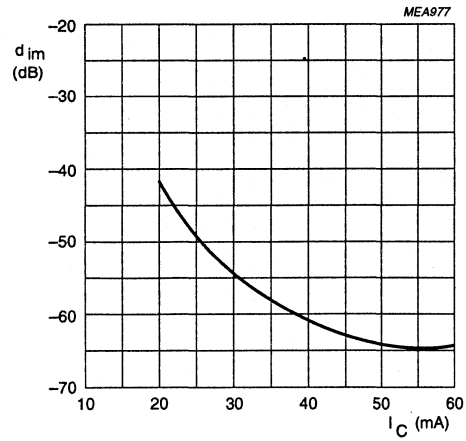


Fig.10 Intermodulation distortion as a function of collector current.

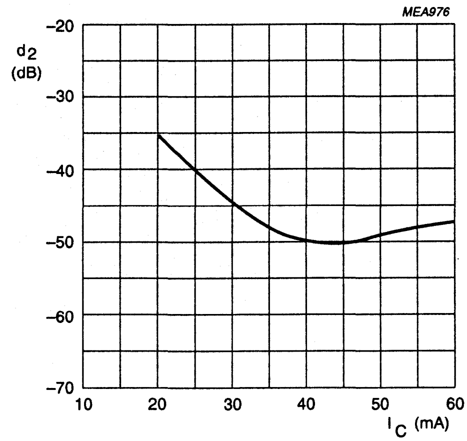
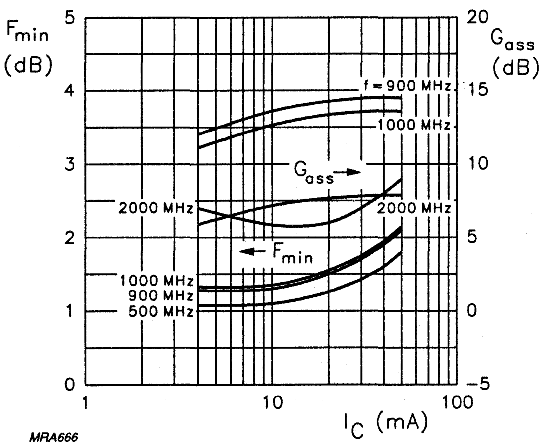
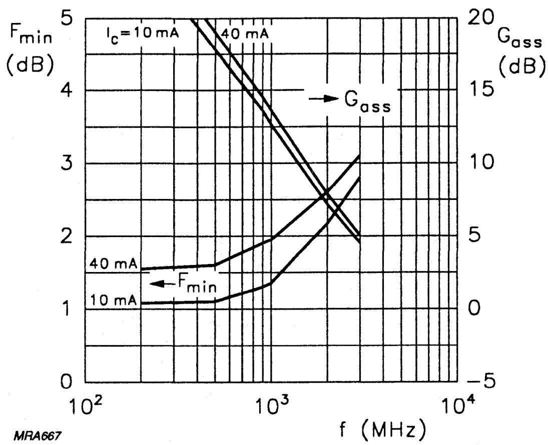


Fig.11 Second order intermodulation distortion as a function of collector current.



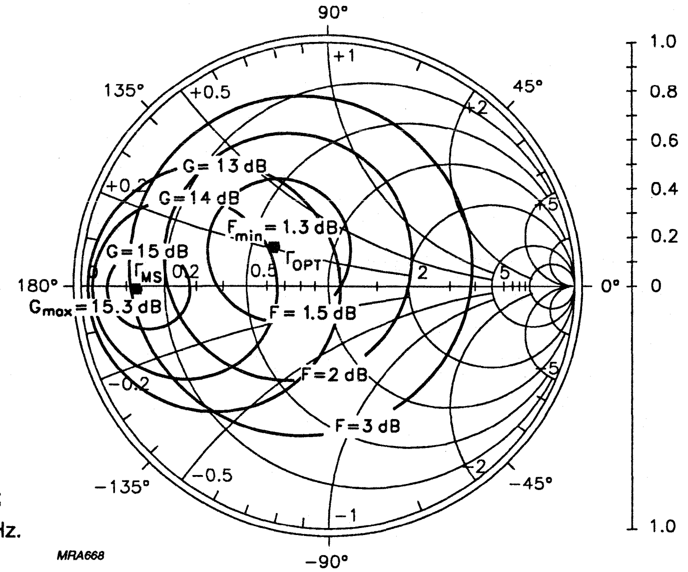
V_{CE} = 8 V.

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



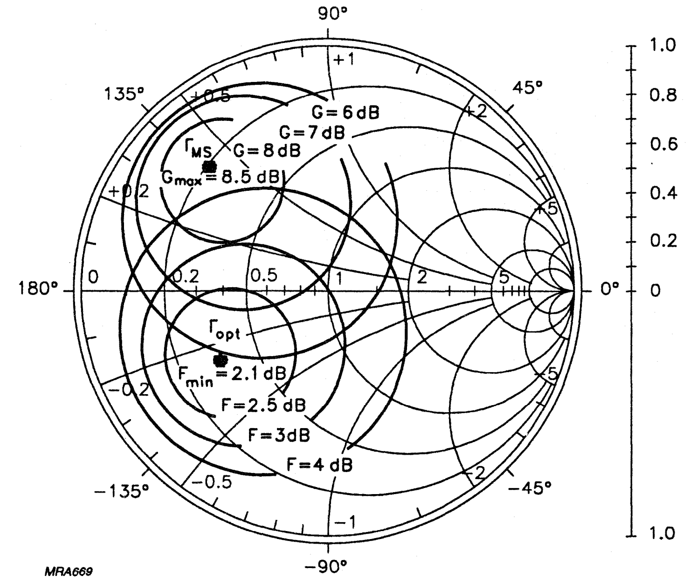
V_{CE} = 8 V.

Fig.13 Minimum noise figure and associated available gain as functions of frequency.



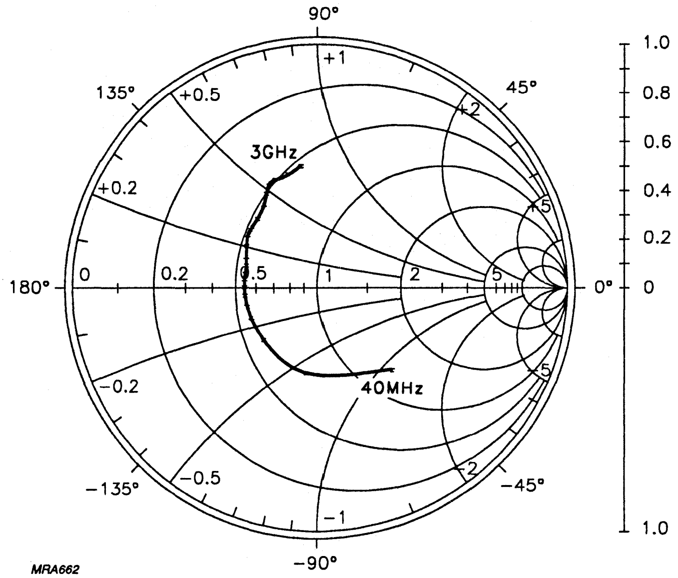
I_C = 10 mA; V_{CE} = 8 V;
Z_o = 50 Ω; f = 900 MHz.

Fig.14 Noise circle figure.



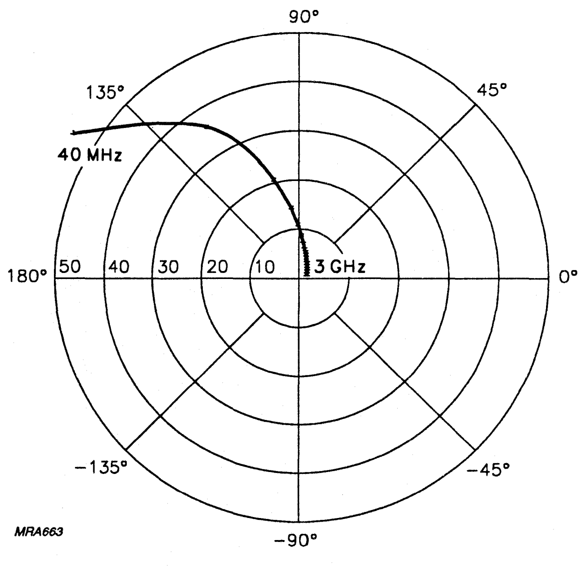
I_C = 10 mA; V_{CE} = 8 V;
Z_o = 50 Ω; f = 2 GHz.

Fig.15 Noise circle figure.



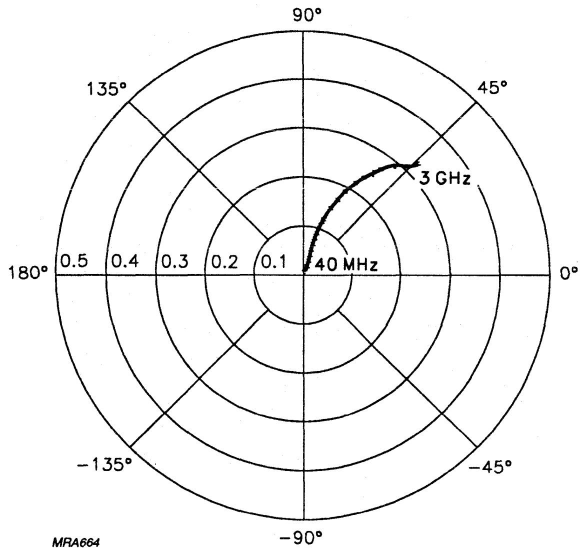
I_C = 40 mA; V_{CE} = 8 V.

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



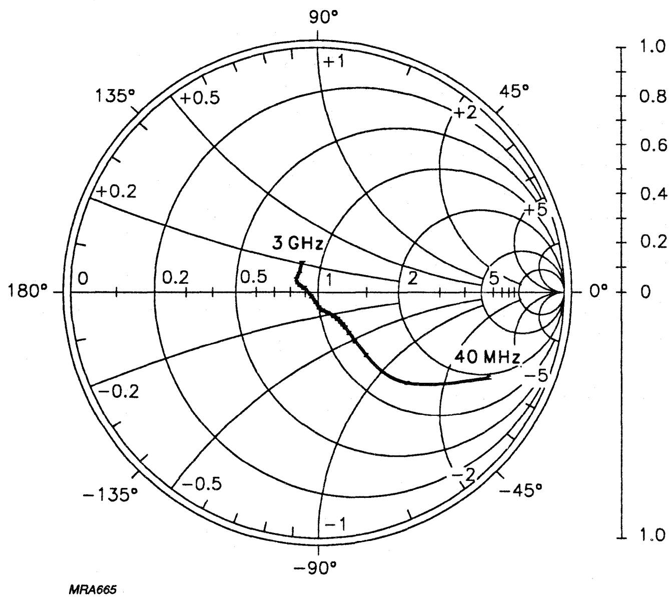
I_C = 40 mA; V_{CE} = 8 V.

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



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

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

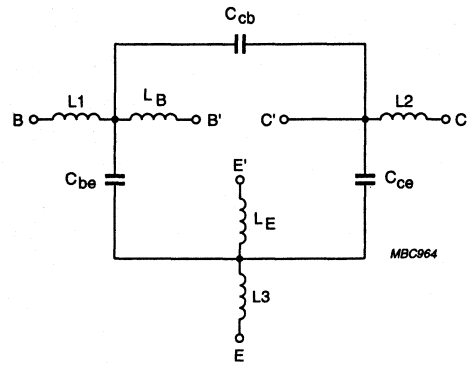


I_C = 40 mA; V_{CE} = 8 V.

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

SPICE parameters for BFR540 crystal

1	IS = 1.045	fA
2	BF = 184.3	–
3	NF = 981.7	m
4	VAF = 41.69	V
5	IKF = 10.00	A
6	ISE = 232.4	fA
7	NE = 2.028	–
8	BR = 43.99	–
9	NR = 992.5	m
10	VAR = 2.097	V
11	IKR = 166.2	mA
12	ISC = 129.8	aA
13	NC = 1.064	–
14	RB = 5.000	Ω
15	IRB = 1.000	μA
16	RBM = 5.000	Ω
17	RE = 353.5	mΩ
18	RC = 1.340	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.978	pF
23	VJE = 600.0	mV
24	MJE = 332.6	m
25	TF = 7.457	ps
26	XTF = 11.40	–
27	VTF = 3.158	V
28	ITF = 156.9	mA
29	PTF = 0.000	deg
30	CJC = 793.7	fF
31	VJC = 185.5	mV
32	MJC = 84.16	m
33	XCJC = 150.0	m
34	TR = 1.598	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 814.7	m



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

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

Fc = scaling frequency = 1000 MHz.

Fig.20 Package equivalent circuit, SOT223.

List of components (see Fig.20)

DESIGNATION	VALUE
C_{be}	182 fF
C_{cb}	16 fF
C_{ce}	249 fF
L1	0.025 nH
L2	1.19 nH
L3	0.60 nH
L_B	1.50 nH
L_E	0.50 nH

Note

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

Table 1 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.891	−14.3	10.848	168.0	0.014	81.7	0.977	−7.6	41.0
100	0.844	−34.5	10.107	153.7	0.033	70.1	0.918	−18.0	33.5
200	0.742	−65.7	8.907	135.0	0.054	57.6	0.777	−30.2	26.5
300	0.652	−91.7	7.631	120.5	0.067	50.2	0.661	−37.0	22.5
400	0.591	−111.9	6.419	109.9	0.075	46.4	0.578	−41.2	19.8
500	0.552	−128.0	5.492	101.9	0.081	45.0	0.519	−43.9	17.7
600	0.525	−141.0	4.800	95.2	0.086	44.9	0.476	−45.9	16.1
700	0.506	−152.0	4.237	89.6	0.091	45.4	0.445	−47.7	14.8
800	0.493	−161.6	3.786	84.6	0.095	46.2	0.420	−49.3	13.6
900	0.485	−170.2	3.411	80.1	0.100	47.6	0.399	−51.2	12.6
1000	0.485	−178.3	3.094	76.1	0.105	48.9	0.381	−53.4	11.7
1200	0.491	168.3	2.637	68.9	0.116	51.6	0.353	−58.6	10.2
1400	0.504	157.9	2.325	61.8	0.128	53.6	0.335	−65.0	9.1
1600	0.510	148.5	2.053	55.3	0.143	56.6	0.318	−71.4	8.0
1800	0.521	139.0	1.866	50.2	0.161	56.9	0.298	−78.3	7.2
2000	0.545	130.2	1.713	44.6	0.178	58.0	0.274	−88.0	6.5
2200	0.576	123.5	1.600	39.4	0.196	57.8	0.260	−101.0	6.1
2400	0.594	118.6	1.456	33.6	0.212	58.6	0.262	−114.2	5.5
2600	0.595	113.1	1.356	29.7	0.242	56.8	0.264	−125.1	4.9
2800	0.597	105.4	1.289	23.8	0.262	53.9	0.253	−135.7	4.4
3000	0.626	97.3	1.220	19.5	0.287	53.2	0.237	−151.2	4.1

Table 2 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.753	−23.0	23.482	161.5	0.013	77.8	0.938	−14.1	40.2
100	0.661	−54.2	20.228	141.8	0.027	65.3	0.789	−30.0	32.8
200	0.519	−95.4	15.119	119.7	0.041	57.3	0.572	−42.8	26.7
300	0.450	−121.8	11.361	107.0	0.050	56.0	0.447	−47.5	23.1
400	0.420	−139.5	8.914	98.8	0.058	57.3	0.376	−49.4	20.5
500	0.406	−152.4	7.317	92.9	0.067	58.6	0.331	−50.4	18.6
600	0.397	−162.3	6.218	88.0	0.076	59.9	0.299	−51.2	17.0
700	0.390	−170.7	5.397	83.7	0.085	60.9	0.277	−52.1	15.7
800	0.388	−178.3	4.770	79.9	0.094	61.6	0.258	−52.9	14.6
900	0.387	174.5	4.271	76.3	0.103	62.3	0.241	−54.3	13.6
1000	0.393	168.1	3.859	73.1	0.113	62.4	0.226	−56.1	12.7
1200	0.409	157.5	3.260	67.1	0.132	62.3	0.202	−61.4	11.2
1400	0.427	149.5	2.843	61.3	0.150	61.5	0.185	−68.4	10.1
1600	0.435	142.1	2.509	55.6	0.171	61.3	0.169	−75.2	9.0
1800	0.448	133.7	2.275	50.8	0.192	59.1	0.147	−82.6	8.2
2000	0.474	125.9	2.082	45.8	0.211	57.8	0.122	−95.6	7.5
2200	0.508	120.2	1.932	41.1	0.230	55.9	0.110	−117.1	7.1
2400	0.530	116.3	1.768	36.3	0.245	55.1	0.119	−137.1	6.4
2600	0.534	111.8	1.648	32.0	0.272	52.2	0.124	−150.7	5.9
2800	0.539	104.9	1.551	26.7	0.288	48.5	0.117	−165.6	5.4
3000	0.567	97.2	1.477	22.3	0.308	47.1	0.118	170.4	5.1

Table 3 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
900	1.30	0.301	158.0	0.09
2000	2.10	0.525	−146.0	0.14

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

f (MHz)	S_{11}		S_{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, $I_C = 20$ mA; $V_{CE} = 4$ V

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, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.457	−46.4	47.782	150.0	0.010	75.0	0.826	−25.3	39.6
100	0.376	−96.6	33.018	123.9	0.020	66.3	0.565	−44.5	32.7
200	0.335	−136.3	19.468	105.7	0.031	67.5	0.354	−53.1	26.9
300	0.330	−155.1	13.548	97.0	0.042	69.5	0.265	−54.5	23.5
400	0.331	−166.6	10.321	91.3	0.053	70.9	0.220	−54.4	21.0
500	0.332	−174.6	8.344	87.0	0.065	71.5	0.192	−54.4	19.1
600	0.333	179.1	7.019	83.2	0.077	71.5	0.172	−54.8	17.6
700	0.334	173.1	6.060	79.9	0.088	71.4	0.157	−55.4	16.3
800	0.335	167.5	5.339	76.7	0.100	70.7	0.144	−56.0	15.2
900	0.340	162.0	4.768	73.8	0.111	70.0	0.131	−57.5	14.2
1000	0.349	157.1	4.307	71.1	0.123	69.3	0.119	−59.9	13.3
1200	0.368	149.0	3.622	65.9	0.146	67.2	0.097	−67.4	11.9
1400	0.387	143.0	3.143	60.6	0.167	64.9	0.084	−79.1	10.7
1600	0.397	136.9	2.776	55.6	0.190	63.2	0.068	−90.8	9.6
1800	0.409	129.6	2.509	51.0	0.214	59.8	0.050	−107.7	8.8
2000	0.437	122.5	2.294	46.4	0.234	57.6	0.040	−151.8	8.1
2200	0.473	117.4	2.115	42.1	0.253	54.9	0.063	171.6	7.6
2400	0.497	114.3	1.940	37.9	0.268	53.4	0.091	161.5	7.0
2600	0.503	110.5	1.813	33.4	0.294	49.8	0.106	152.7	6.5
2800	0.507	103.9	1.692	28.5	0.309	45.8	0.114	137.5	5.9
3000	0.536	96.4	1.615	24.2	0.327	43.8	0.141	120.8	5.7

Table 7 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.70	0.402	−172.0	0.08
2000	2.40	0.581	−134.0	0.21

NPN 9 GHz wideband transistor BFG541

Table 8 Common emitter scattering parameters, $I_C = 40$ mA; $V_{CE} = 4$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.375	−56.7	53.699	146.7	0.010	74.5	0.786	−28.1	39.4
100	0.331	−109.6	34.743	120.3	0.018	68.1	0.513	−47.2	32.6
200	0.320	−145.6	19.848	103.5	0.030	70.4	0.315	−54.5	26.9
300	0.322	−161.7	13.707	95.4	0.041	72.3	0.235	−55.3	23.5
400	0.325	−171.6	10.415	90.1	0.053	73.4	0.195	−55.0	21.0
500	0.329	−178.6	8.409	86.1	0.065	73.4	0.170	−54.9	19.1
600	0.331	175.7	7.065	82.4	0.077	73.4	0.152	−55.3	17.6
700	0.332	170.3	6.097	79.2	0.089	72.6	0.139	−55.9	16.3
800	0.334	165.0	5.368	76.1	0.101	71.8	0.126	−56.6	15.2
900	0.339	160.0	4.799	73.3	0.113	71.1	0.114	−58.2	14.2
1000	0.349	155.1	4.329	70.6	0.125	70.1	0.102	−61.0	13.3
1200	0.368	147.5	3.646	65.5	0.148	67.8	0.081	−69.8	11.9
1400	0.388	142.0	3.160	60.4	0.170	65.2	0.069	−83.6	10.7
1600	0.397	136.0	2.788	55.4	0.193	63.3	0.055	−98.4	9.7
1800	0.410	128.9	2.519	50.8	0.217	59.9	0.039	−122.5	8.8
2000	0.437	121.8	2.305	46.2	0.238	57.5	0.040	−175.2	8.2
2200	0.474	116.8	2.123	41.9	0.256	54.9	0.070	158.3	7.7
2400	0.497	113.8	1.946	37.9	0.271	53.2	0.099	152.7	7.1
2600	0.504	110.1	1.819	33.4	0.297	49.6	0.114	145.1	6.5
2800	0.508	103.5	1.694	28.4	0.312	45.4	0.124	131.0	5.9
3000	0.537	96.2	1.619	24.2	0.330	43.4	0.153	116.2	5.8

Table 9 Noise data, $I_C = 40$ mA; $V_{CE} = 4$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (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, I_C = 50 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.319	−67.1	57.333	144.2	0.009	74.3	0.753	−30.0	39.3
100	0.310	−120.1	35.488	118.0	0.017	70.1	0.475	−48.9	32.6
200	0.315	−152.0	19.920	102.1	0.029	72.3	0.289	−55.3	26.8
300	0.322	−166.1	13.699	94.5	0.041	74.0	0.215	−55.7	23.4
400	0.328	−174.9	10.392	89.4	0.053	74.6	0.178	−55.2	21.0
500	0.331	178.7	8.379	85.4	0.066	74.5	0.156	−55.2	19.1
600	0.333	173.5	7.042	81.8	0.078	74.2	0.140	−55.6	17.5
700	0.335	168.5	6.073	78.7	0.090	73.4	0.127	−56.2	16.3
800	0.338	163.3	5.348	75.6	0.102	72.5	0.115	−57.0	15.1
900	0.343	158.5	4.777	72.9	0.114	71.6	0.103	−58.8	14.2
1000	0.352	153.9	4.312	70.3	0.126	70.6	0.091	−61.8	13.3
1200	0.373	146.7	3.628	65.1	0.150	68.1	0.071	−71.9	11.9
1400	0.391	141.1	3.143	60.1	0.172	65.5	0.059	−87.4	10.7
1600	0.401	135.3	2.775	55.1	0.195	63.4	0.047	−105.8	9.6
1800	0.413	128.3	2.507	50.5	0.219	60.0	0.034	−136.8	8.8
2000	0.441	121.3	2.293	45.9	0.240	57.6	0.043	171.2	8.2
2200	0.477	116.5	2.111	41.6	0.258	54.7	0.076	151.8	7.6
2400	0.501	113.4	1.937	37.7	0.273	53.1	0.105	148.0	7.0
2600	0.507	109.6	1.809	33.1	0.299	49.4	0.120	141.0	6.5
2800	0.511	103.1	1.684	28.3	0.314	45.2	0.131	127.8	5.9
3000	0.540	95.8	1.611	24.0	0.333	43.2	0.161	113.7	5.8

Table 11 Common emitter scattering parameters, I_C = 4 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{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, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.781	−21.5	23.444	162.1	0.013	78.3	0.936	−13.3	40.6
100	0.687	−50.7	20.346	142.9	0.026	65.5	0.797	−28.6	33.3
200	0.532	−90.1	15.425	121.0	0.040	57.8	0.587	−41.2	27.0
300	0.451	−116.3	11.691	108.1	0.050	56.4	0.463	−45.9	23.4
400	0.412	−134.5	9.206	99.8	0.058	57.3	0.390	−47.8	20.8
500	0.393	−147.9	7.570	93.9	0.066	58.7	0.344	−48.8	18.9
600	0.382	−158.2	6.438	88.9	0.075	60.0	0.313	−49.5	17.3
700	0.373	−167.2	5.593	84.6	0.084	61.0	0.290	−50.3	16.0
800	0.368	−175.2	4.945	80.7	0.092	61.6	0.271	−51.1	14.8
900	0.367	177.4	4.428	77.2	0.102	62.2	0.254	−52.4	13.8
1000	0.372	170.5	4.001	74.0	0.111	62.5	0.239	−54.0	12.9
1200	0.388	159.4	3.381	68.0	0.130	62.3	0.214	−59.2	11.5
1400	0.405	151.4	2.951	62.2	0.148	61.6	0.197	−65.5	10.3
1600	0.414	143.5	2.604	56.6	0.168	61.3	0.180	−71.7	9.3
1800	0.426	135.1	2.356	51.9	0.189	59.3	0.159	−78.0	8.4
2000	0.452	127.1	2.159	46.9	0.208	58.1	0.133	−89.5	7.8
2200	0.487	121.3	2.003	42.3	0.226	56.2	0.117	−108.9	7.3
2400	0.508	117.4	1.833	37.3	0.241	55.3	0.121	−128.3	6.6
2600	0.513	113.0	1.710	33.1	0.267	52.5	0.124	−142.0	6.1
2800	0.518	106.0	1.609	27.8	0.284	49.0	0.114	−155.5	5.5
3000	0.547	98.3	1.532	23.5	0.303	47.6	0.109	179.9	5.3

Table 13 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (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, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.627	−32.2	38.486	155.4	0.011	74.9	0.872	−19.8	40.1
100	0.501	−72.3	29.773	131.4	0.022	64.7	0.657	−38.1	33.2
200	0.382	−114.1	19.066	110.9	0.033	63.0	0.435	−48.4	27.2
300	0.344	−137.5	13.551	100.7	0.043	64.5	0.332	−50.7	23.7
400	0.331	−152.5	10.409	94.2	0.053	66.7	0.277	−51.1	21.2
500	0.325	−163.0	8.449	89.5	0.064	67.6	0.243	−51.4	19.3
600	0.322	−171.3	7.125	85.3	0.075	68.2	0.220	−51.5	17.7
700	0.320	−178.5	6.163	81.8	0.086	68.3	0.203	−52.0	16.4
800	0.320	174.7	5.431	78.4	0.096	68.3	0.188	−52.5	15.3
900	0.322	168.4	4.852	75.4	0.107	67.9	0.174	−53.7	14.3
1000	0.330	162.7	4.382	72.5	0.118	67.4	0.161	−55.5	13.4
1200	0.349	153.2	3.693	67.2	0.140	66.0	0.137	−61.3	12.0
1400	0.368	146.6	3.208	61.9	0.160	64.1	0.122	−69.3	10.8
1600	0.378	139.8	2.834	56.8	0.182	62.7	0.105	−76.9	9.8
1800	0.391	132.1	2.559	52.2	0.205	59.8	0.084	−85.2	8.9
2000	0.417	124.6	2.343	47.5	0.225	57.8	0.060	−106.5	8.2
2200	0.454	119.2	2.164	43.1	0.243	55.4	0.057	−146.4	7.7
2400	0.478	116.0	1.984	38.7	0.258	54.0	0.077	−169.5	7.1
2600	0.486	112.1	1.852	34.4	0.283	50.7	0.088	177.2	6.6
2800	0.489	105.5	1.735	29.4	0.299	46.8	0.089	159.1	6.0
3000	0.517	97.9	1.654	25.2	0.317	45.0	0.108	135.4	5.8

Table 15 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.50	0.277	171.0	0.10
2000	2.20	0.514	−144.0	0.15

Table 16 Common emitter scattering parameters, $I_C = 30$ mA; $V_{CE} = 8$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{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, $I_C = 30$ mA; $V_{CE} = 8$ V

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.449	−48.1	54.881	147.6	0.010	73.6	0.778	−26.5	39.8
100	0.351	−97.1	36.115	121.5	0.018	67.0	0.519	−45.1	33.1
200	0.304	−135.7	20.825	104.4	0.030	69.2	0.324	−52.1	27.3
300	0.296	−154.6	14.414	96.2	0.041	71.4	0.245	−52.6	23.8
400	0.296	−166.0	10.964	90.9	0.053	72.6	0.205	−52.1	21.4
500	0.296	−174.1	8.852	86.8	0.065	72.9	0.180	−51.9	19.5
600	0.297	179.5	7.438	83.2	0.076	72.6	0.163	−52.1	17.9
700	0.298	173.6	6.422	80.0	0.088	72.4	0.149	−52.5	16.7
800	0.299	168.0	5.654	76.9	0.100	71.6	0.137	−52.9	15.5
900	0.303	162.5	5.052	74.2	0.112	70.7	0.125	−54.3	14.6
1000	0.313	157.3	4.558	71.5	0.123	69.8	0.113	−56.4	13.7
1200	0.334	149.2	3.835	66.5	0.146	67.6	0.091	−64.0	12.2
1400	0.353	143.4	3.326	61.5	0.168	65.2	0.077	−75.2	11.0
1600	0.364	137.6	2.936	56.6	0.191	63.2	0.061	−86.6	10.0
1800	0.376	130.2	2.653	52.1	0.214	60.0	0.042	−102.8	9.1
2000	0.402	122.8	2.425	47.6	0.234	57.6	0.032	−156.4	8.5
2200	0.440	117.9	2.236	43.3	0.253	55.0	0.057	164.5	7.9
2400	0.466	114.9	2.049	39.2	0.268	53.2	0.086	156.7	7.3
2600	0.474	111.4	1.913	34.8	0.293	49.7	0.101	148.5	6.8
2800	0.477	105.0	1.786	30.0	0.308	45.7	0.109	133.1	6.2
3000	0.506	97.4	1.705	25.7	0.326	43.6	0.137	116.9	6.0

Table 19 Noise data, I_C = 40 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
900	1.90	0.397	−174.0	0.08
2000	2.60	0.530	−138.0	0.21

Table 20 Common emitter scattering parameters, I_C = 50 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{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	0.399	−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 1 GHz wideband transistor — BFQ17

DESCRIPTION

NPN transistor in a SOT89 plastic envelope intended for application in thick and thin-film circuits. The transistor has extremely good intermodulation properties and a high power gain.

PINNING

PIN	DESCRIPTION
	Code: FA
1	emitter
2	base
3	collector

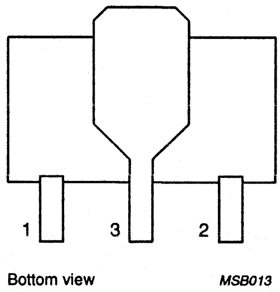


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
I_{CM}	peak collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	1.5	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	1.9	–	pF

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	$R_{BE} \leq 50\ \Omega$	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
I_{CM}	peak collector current	f > 1 MHz	–	300	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

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

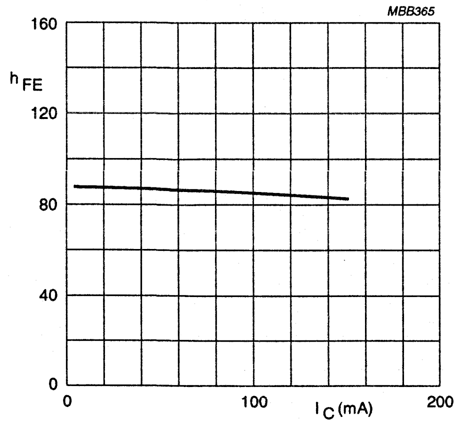
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V; T_j = 50 °C	–	–	20	μA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	–	–	0.5	V
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 15 V; f = 1 MHz	–	–	4	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	–	1.9	–	pF
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	–	1.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 60 mA; V_{CE} = 15 V; f = 200 MHz; T_{amb} = 25 °C	–	16	–	dB
		I_C = 60 mA; V_{CE} = 15 V; f = 800 MHz; T_{amb} = 25 °C	–	6.5	–	dB

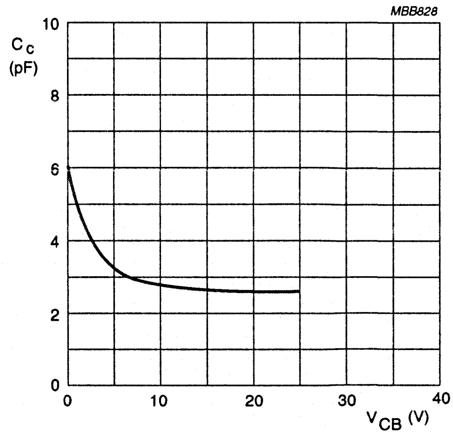
Note

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



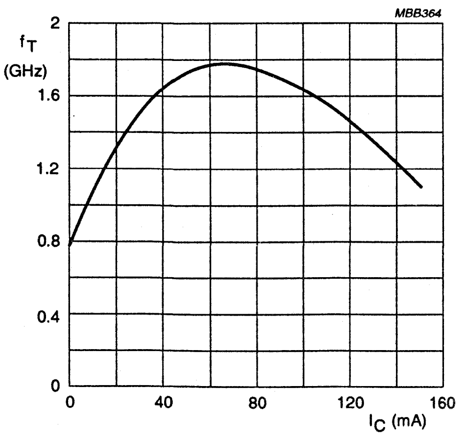
V_{CE} = 5 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



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

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



V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

Fig.4 Transition frequency as a function of collector current.

NPN 4 GHz wideband transistor BFQ18A

DESCRIPTION

NPN transistor in a plastic SOT89 envelope intended for application in thick and thin-film circuits. It is primarily intended for MATV purposes.

PINNING

PIN	DESCRIPTION
Code: FF	
1	emitter
2	base
3	collector

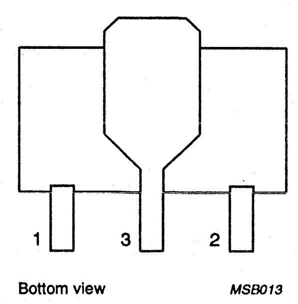


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	4	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 10.7 MHz	1.2	–	pF
d_{im}	intermodulation distortion	I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω; V_O = 700 mV; measured at $f_{(p+q-r)}$ = 793.25 MHz	–	–60	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 155 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 155 °C (note 1)	20 K/W

Note

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

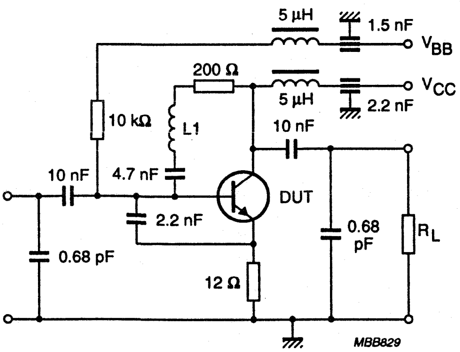
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	UNIT
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 10.7 MHz	–	1.2	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz	–	4	GHz
d_{im}	intermodulation distortion (see Fig.2)	note 1	–	–60	dB

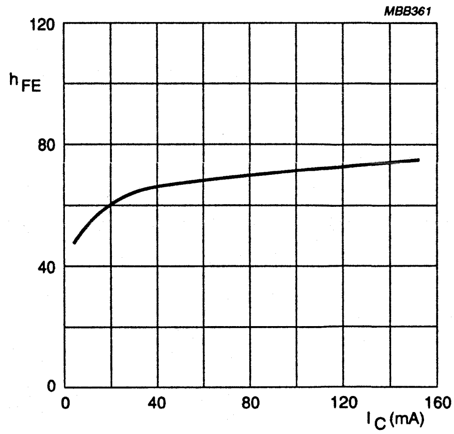
Note

1. I_C = 80 mA; V_{CE} = 10 V; R_L = 75 Ω;
   $V_p = V_O$ = 700 mV; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB;f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.



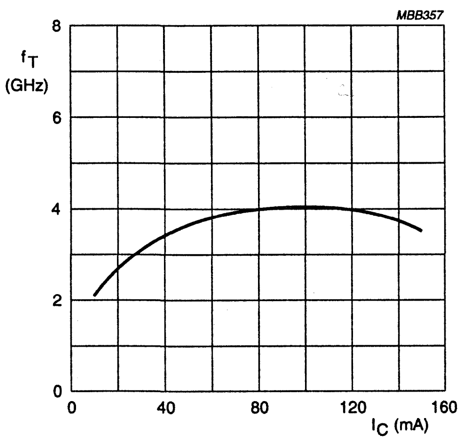
f = 40 - 860 MHz.

Fig.2 Intermodulation distortion MATV test circuit.



V_{CE} = 10 V; T_j = 25 °C.

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



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

Fig.4 Transition frequency as a function of collector current.

Table 1 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.643	−49.9	26.561	143.3	0.027	68.3	0.807	−34.2	35.4
100	0.464	−96.0	16.118	116.8	0.047	57.0	0.509	−59.1	26.5
200	0.362	−135.8	9.205	100.8	0.069	59.2	0.304	−73.3	20.3
300	0.362	−157.6	6.337	90.5	0.090	63.1	0.231	−80.3	16.9
400	0.374	−172.5	4.851	83.9	0.112	65.6	0.199	−85.8	14.5
500	0.391	−177.8	3.946	78.7	0.135	66.5	0.184	−91.5	12.8
600	0.391	176.3	3.342	74.8	0.158	67.0	0.172	−96.5	11.3
700	0.393	171.4	2.915	69.9	0.181	67.6	0.168	−100.4	10.1
800	0.407	165.7	2.597	66.5	0.205	67.0	0.169	−104.5	9.2
900	0.407	160.4	2.383	62.8	0.229	66.1	0.174	−108.0	8.5
1000	0.417	157.7	2.181	59.5	0.250	65.4	0.178	−111.9	7.7
1200	0.458	145.8	1.880	52.5	0.292	63.9	0.194	−120.2	6.7
1400	0.499	139.3	1.662	47.3	0.337	62.4	0.210	−128.5	5.9
1600	0.513	132.1	1.504	40.0	0.378	58.1	0.204	−134.5	5.1
1800	0.531	125.3	1.418	37.2	0.410	57.6	0.244	−135.6	4.7
2000	0.579	121.3	1.333	32.2	0.453	55.4	0.274	−143.6	4.6
2200	0.619	117.5	1.252	29.1	0.489	53.7	0.307	−150.4	4.5
2400	0.626	113.0	1.182	24.7	0.525	50.8	0.344	−155.5	4.2
2600	0.638	110.5	1.088	20.0	0.545	48.1	0.366	−159.4	3.6
2800	0.645	106.5	1.057	16.4	0.575	46.7	0.397	−162.4	3.6
3000	0.672	101.6	1.048	14.0	0.609	43.7	0.427	−167.2	3.9

NPN 5 GHz wideband transistor BFQ19

DESCRIPTION

NPN transistor in a SOT89 plastic envelope intended for application in thick and thin-film circuits. It is primarily intended for use in UHF and microwave amplifiers such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers etc.

The transistor features very low intermodulation distortion and high power gain. Due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PINNING

PIN	DESCRIPTION
Code: FB	
1	emitter
2	base
3	collector

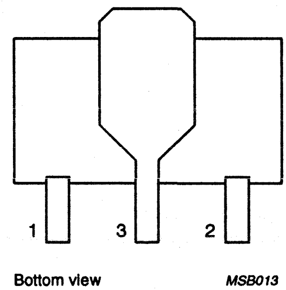


Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	15	V
I_C	DC collector current		–	100	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
f_T	transition frequency	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C	5.5	–	GHz
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	1.3	–	pF
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	3.3	–	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3.3	V
I_C	DC collector current		–	100	mA
I_{CM}	peak collector current	f > 1 MHz	–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

Note

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

 Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

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

CHARACTERISTICS

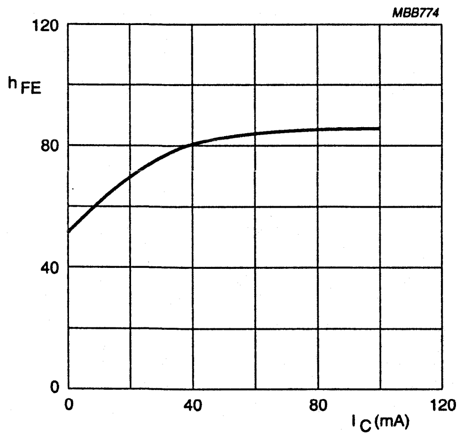
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	80	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	1.6	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	5	–	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 10 V; f = 1 MHz; T_{amb} = 25 °C	–	1.3	–	pF
f_T	transition frequency	I_C = 70 mA; V_{CE} = 10 V; f = 500 MHz	4.4	5.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	11.5	–	dB
		I_C = 50 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	7.5	–	dB
F	noise figure	I_C = 50 mA; V_{CE} = 10 V; Z_S = opt.; f = 500 MHz; T_{amb} = 25 °C	–	3.3	–	dB

Note

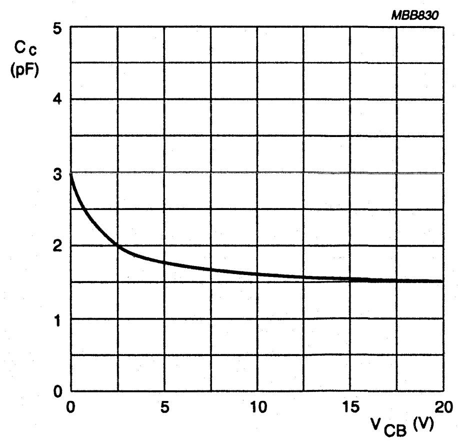
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \dfrac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

Capability approved CECC 50 000 (issue 4), 1986



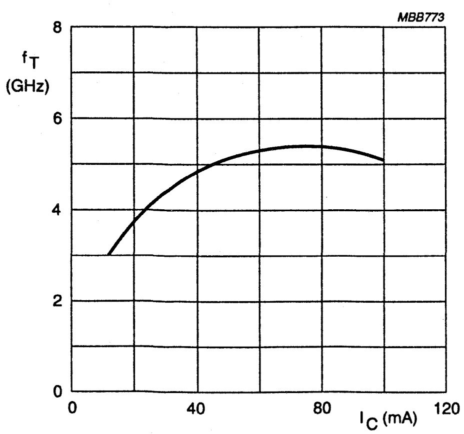
V_{CE} = 10 V; T_j = 25 °C.

Fig.2 DC current gain as a function of collector current.



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

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



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

Fig.4 Transition frequency as a function of collector current.

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

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.289	−94.7	42.853	124.3	0.015	70.0	0.566	−48.2	34.7
100	0.251	−142.7	20.280	103.1	0.030	72.9	0.290	−61.9	26.8
200	0.254	−168.6	10.636	93.0	0.057	75.3	0.172	−63.4	21.0
300	0.285	177.9	7.194	86.2	0.082	76.6	0.137	−63.2	17.6
400	0.294	169.3	5.452	81.6	0.107	76.0	0.123	−64.8	15.2
500	0.316	166.7	4.407	77.7	0.132	75.0	0.119	−68.9	13.4
600	0.326	165.2	3.724	74.9	0.156	74.1	0.114	−73.6	12.0
700	0.325	161.7	3.219	70.9	0.180	72.8	0.113	−77.6	10.7
800	0.342	157.5	2.869	67.9	0.206	71.3	0.112	−83.2	9.7
900	0.338	151.2	2.618	64.8	0.229	69.5	0.117	−88.1	8.9
1000	0.352	149.6	2.397	62.3	0.250	68.0	0.119	−93.1	8.2
1200	0.379	139.3	2.044	55.8	0.291	64.9	0.126	−104.6	7.0
1400	0.419	133.2	1.813	51.6	0.334	63.1	0.132	−115.9	6.1
1600	0.455	127.5	1.650	44.9	0.374	58.0	0.136	−117.4	5.4
1800	0.453	117.6	1.543	41.9	0.401	56.7	0.164	−124.0	4.9
2000	0.507	115.5	1.450	36.6	0.434	54.3	0.178	−135.4	4.7
2200	0.542	114.8	1.359	34.2	0.465	52.7	0.201	−144.5	4.4
2400	0.540	110.0	1.282	30.2	0.497	49.8	0.228	−149.5	3.9
2600	0.556	109.1	1.195	26.9	0.511	47.3	0.249	−153.2	3.4
2800	0.556	105.7	1.154	21.8	0.535	46.1	0.273	−156.2	3.2
3000	0.602	100.6	1.142	19.1	0.563	43.4	0.296	−161.3	3.5

NPN 8 GHz wideband transistor — BFQ67

FEATURES

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

DESCRIPTION

Silicon NPN transistor in a plastic SOT23 envelope. It is designed for wideband applications such as satellite TV tuners and RF portable communications equipment up to 2 GHz.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

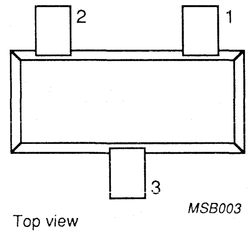


Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	14	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 70 °C (note 1)	–	300	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	260 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	14	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz	–	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 2 GHz; $Z_S = 60\ \Omega$	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

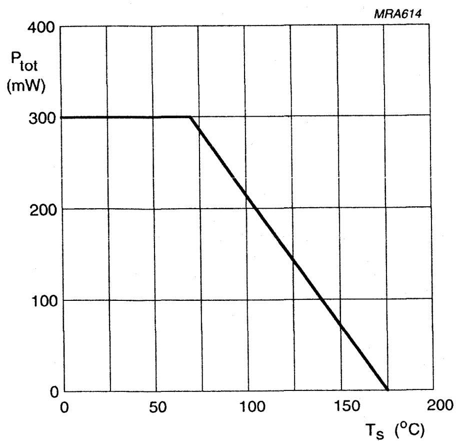
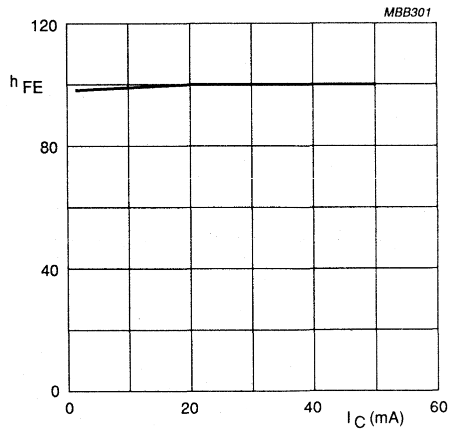
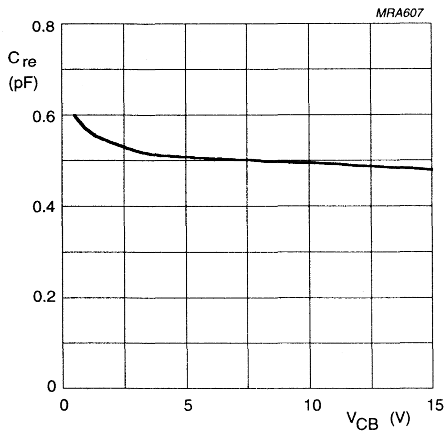


Fig.2 Power derating curve.



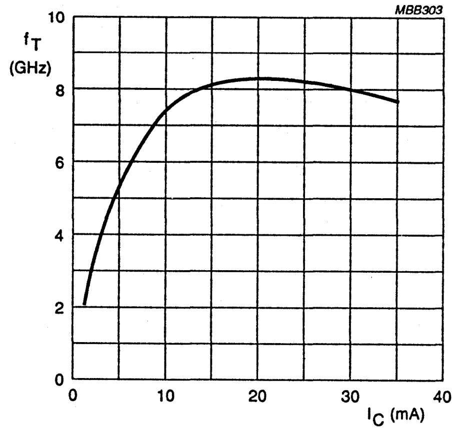
V_{CE} = 5 V.

Fig.3 DC current gain as a function of collector current, typical values.



$I_C = i_c = 0$; f = 1 MHz.

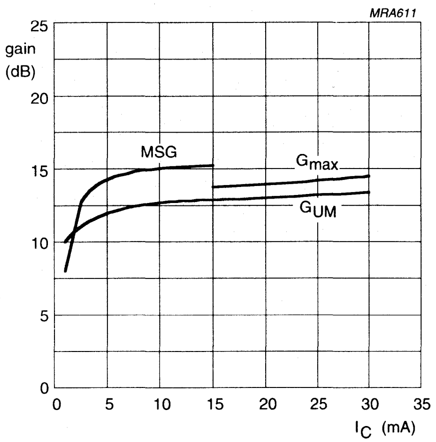
Fig.4 Feedback capacitance as a function of collector-base voltage, typical values.



V_{CE} = 8 V; T_{amb} = 25 °C; f = 2 GHz.

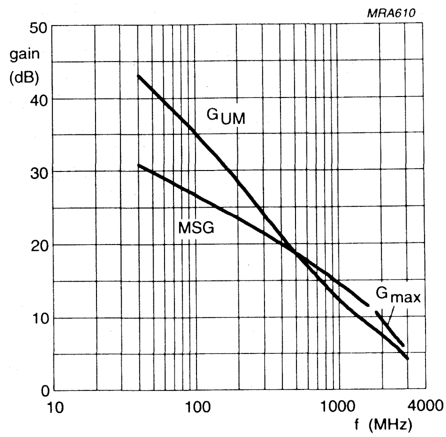
Fig.5 Transition frequency as a function of collector current, typical values.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



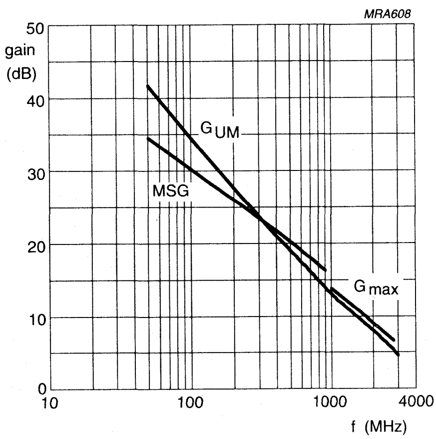
V_{CE} = 8 V; f = 1 GHz.

Fig.6 Gain as a function of collector current, typical values.



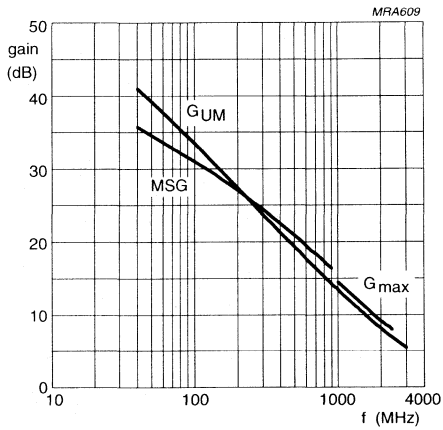
V_{CE} = 8 V; I_C = 5 mA.

Fig.7 Gain as a function of frequency, typical values.



V_{CE} = 8 V; I_C = 15 mA.

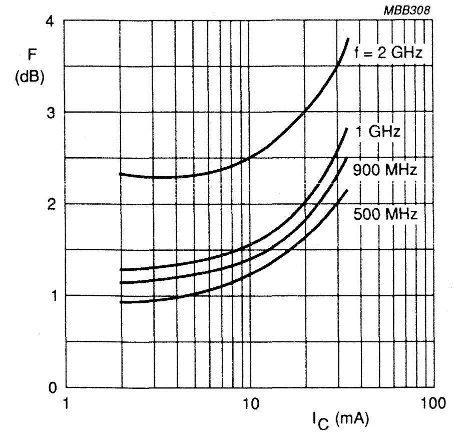
Fig.8 Gain as a function of frequency, typical values.



V_{CE} = 8 V; I_C = 30 mA.

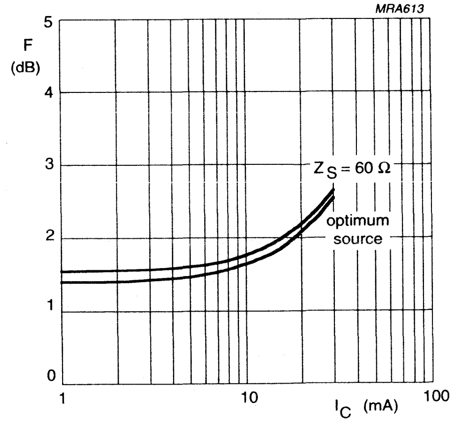
Fig.9 Gain as a function of frequency, typical values.

NPN 8 GHz wideband transistor BFQ67



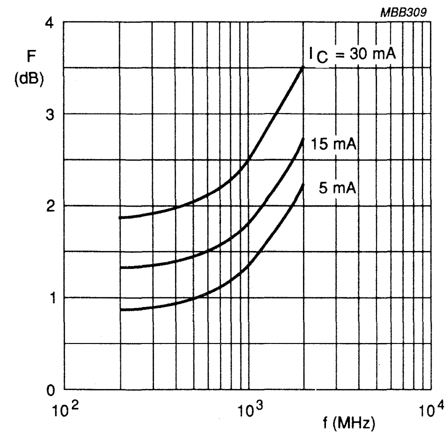
V_{CE} = 8 V.

Fig.10 Minimum noise figure as a function of collector current, typical values.



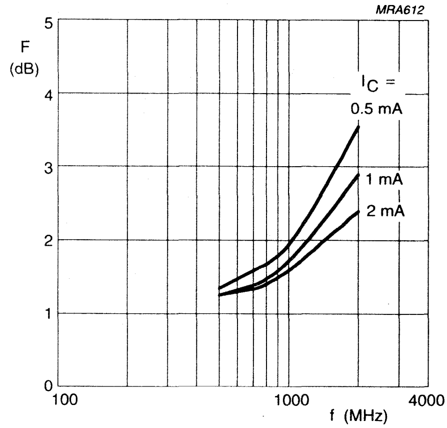
V_{CE} = 6 V; f = 900 MHz.

Fig.11 Noise figure as a function of collector current, typical values.



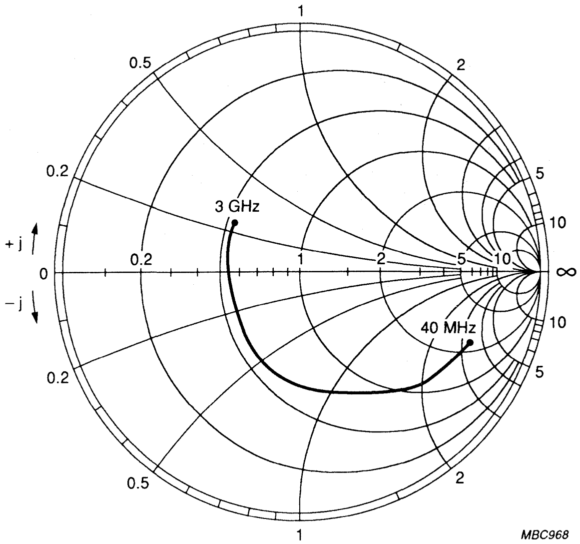
V_{CE} = 8 V.

Fig.12 Minimum noise figure as a function of frequency, typical values.



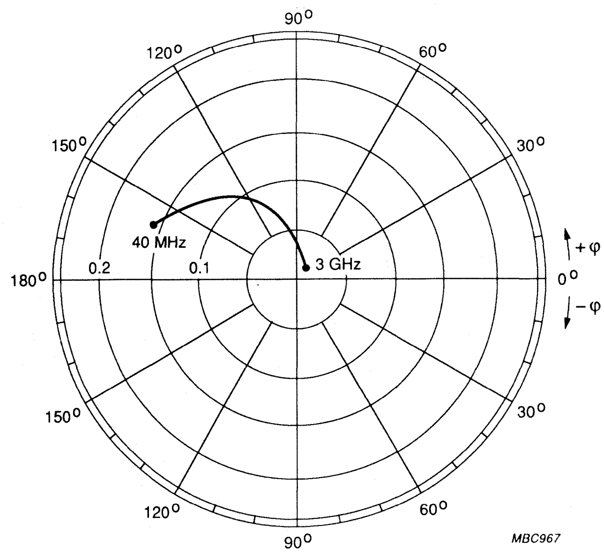
V_{CE} = 1 V.

Fig.13 Minimum noise figure as a function of frequency, typical values.



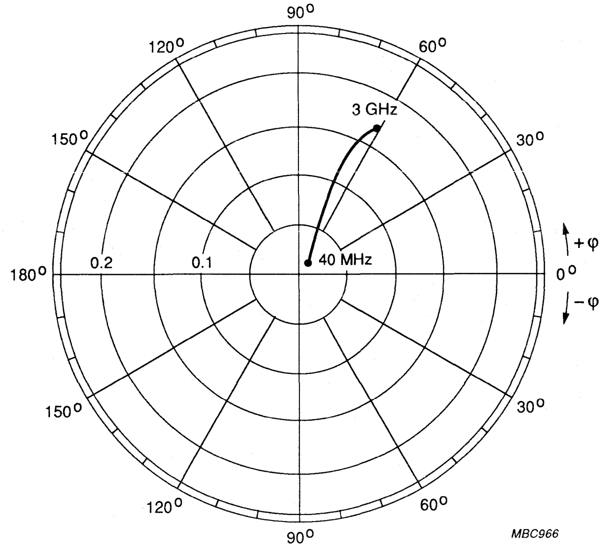
V_{CE} = 8 V; I_C = 15 mA.

Fig.14 Common emitter input reflection coefficient (S_{11}), typical values.



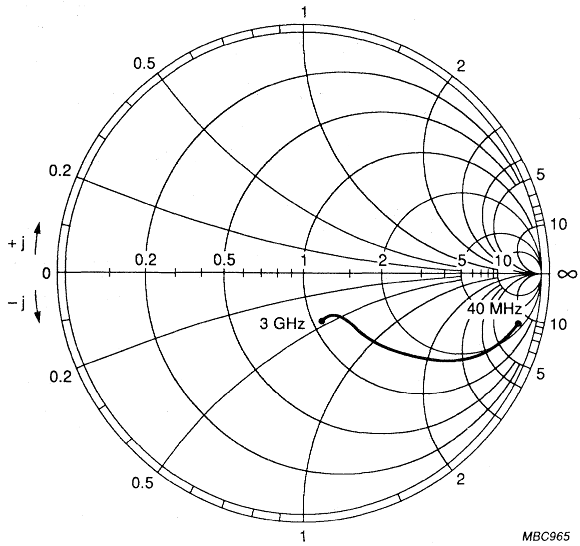
V_{CE} = 8 V; I_C = 15 mA.

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.

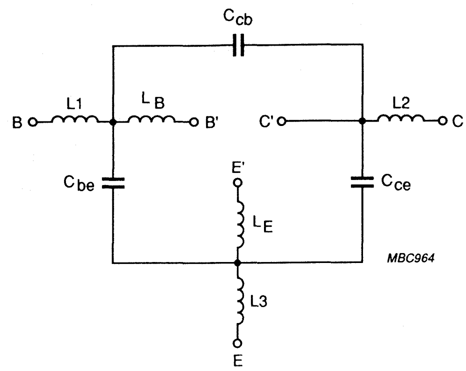


V_{CE} = 8 V; I_C = 15 mA.

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} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
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

Table 5 Common emitter scattering parameters, V_{CE} = 4 V, I_C = 20 mA

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.668	−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}		S_{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	0.895	−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} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.746	−25.9	36.059	157.1	0.011	74.0	0.891	−15.9	41.5
100	0.607	−54.0	27.794	135.8	0.023	66.9	0.722	−31.6	34.1
200	0.447	−92.7	18.491	113.7	0.037	62.7	0.507	−41.5	27.6
300	0.364	−109.2	13.283	104.6	0.047	64.9	0.400	−43.7	23.8
400	0.310	−120.0	9.892	99.2	0.059	67.2	0.346	−43.9	20.9
500	0.287	−133.5	8.181	95.2	0.069	69.2	0.314	−43.7	19.1
600	0.224	−144.1	7.099	89.4	0.080	70.2	0.295	−43.1	17.6
700	0.271	−148.3	6.009	86.5	0.093	71.0	0.283	−42.8	16.3
800	0.205	−129.5	5.424	84.7	0.102	71.6	0.278	−42.3	15.2
900	0.198	−151.6	4.901	83.2	0.115	71.5	0.274	−42.0	14.3
1000	0.212	−165.7	4.204	79.8	0.124	71.1	0.267	−41.7	13.0
1200	0.246	−176.9	3.676	74.6	0.149	70.8	0.255	−42.2	11.9
1400	0.249	−179.8	3.307	67.7	0.172	70.1	0.249	−45.3	10.9
1600	0.206	175.7	2.877	67.0	0.194	69.0	0.251	−46.0	9.7
1800	0.159	163.6	2.559	66.2	0.214	68.1	0.249	−46.8	8.6
2000	0.221	147.8	2.389	60.2	0.237	67.1	0.240	−47.1	8.0
2200	0.295	168.6	2.180	55.0	0.260	66.2	0.220	−48.7	7.4
2400	0.258	164.9	2.094	53.3	0.283	64.3	0.206	−54.3	6.9
2600	0.341	139.8	1.926	49.7	0.298	63.0	0.197	−60.7	6.4
2800	0.277	154.8	1.805	45.1	0.320	62.1	0.201	−63.4	5.7
3000	0.371	147.0	1.824	42.9	0.343	60.3	0.191	−64.6	6.0

Table 10 Common emitter scattering parameters, V_{CE} = 8 V, I_C = 30 mA

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.697	−30.4	41.641	154.7	0.011	74.7	0.857	−18.2	41.0
100	0.538	−64.4	30.643	131.0	0.022	65.3	0.657	−34.6	33.7
200	0.384	−97.4	19.157	112.0	0.034	64.6	0.450	−42.9	27.3
300	0.320	−117.6	13.554	102.7	0.045	66.6	0.355	−43.8	23.7
400	0.292	−130.5	10.444	96.7	0.055	69.0	0.308	−43.2	21.2
500	0.275	−139.7	8.464	92.4	0.066	70.4	0.283	−42.6	19.3
600	0.264	−146.3	7.141	89.0	0.077	71.5	0.269	−42.0	17.7
700	0.256	−151.9	6.174	86.0	0.089	72.0	0.261	−41.7	16.4
800	0.246	−156.7	5.447	83.2	0.100	72.7	0.256	−41.4	15.3
900	0.239	−162.2	4.875	80.6	0.111	72.6	0.253	−41.3	14.3
1000	0.238	−166.6	4.403	78.3	0.123	72.6	0.249	−41.6	13.4
1200	0.243	−174.8	3.713	74.0	0.145	72.0	0.241	−42.5	11.9
1400	0.253	−180.0	3.251	69.9	0.167	71.1	0.238	−44.4	10.8
1600	0.246	177.4	2.875	66.0	0.188	70.5	0.241	−45.4	9.7
1800	0.241	172.5	2.597	62.7	0.210	69.6	0.238	−47.7	8.8
2000	0.244	164.9	2.380	59.4	0.233	68.6	0.228	−47.5	8.0
2200	0.266	157.6	2.207	56.2	0.254	67.2	0.214	−49.8	7.4
2400	0.291	154.9	2.071	52.5	0.276	65.8	0.199	−55.9	6.9
2600	0.299	154.2	1.930	49.3	0.296	64.5	0.193	−62.1	6.3
2800	0.298	150.9	1.845	46.7	0.316	63.3	0.194	−65.3	5.9
3000	0.307	144.0	1.760	43.5	0.337	62.1	0.186	−66.7	5.5

NPN 8 GHz wideband transistor — BFQ67W

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 envelope.

PINNING

PIN	DESCRIPTION
Code: V2	
1	base
2	emitter
3	collector

PIN CONFIGURATION

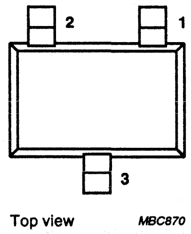


Fig.1 SOT323.

DESCRIPTION

NPN transistor in a plastic SOT323 envelope.

It is designed for wideband applications such as satellite TV tuners and RF portable communications equipment up to 2 GHz.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	–	300	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V; T_j = 25 °C	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.3	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	50	mA
P_{tot}	total power dissipation	up to T_s = 93 °C (note 1)	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 93 °C (note 1)	190 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15$ mA; $V_{CE} = 5$ V	60	100	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	13	–	dB
		$I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	8	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; f = 1 GHz	–	1.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; f = 1 GHz	–	2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; f = 2 GHz	–	2.2	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; f = 2 GHz; $Z_S = 60\ \Omega$	–	2.5	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $Z_S = 60\ \Omega$	–	3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

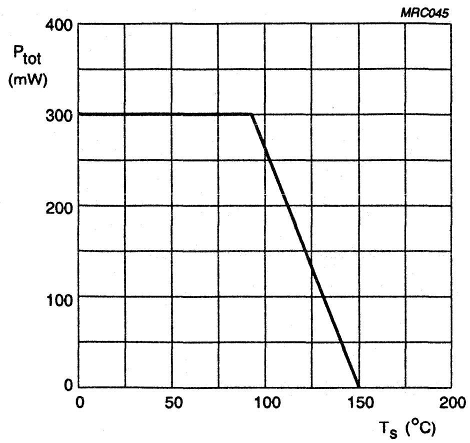
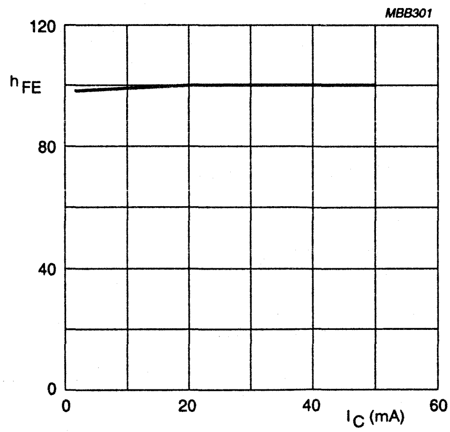
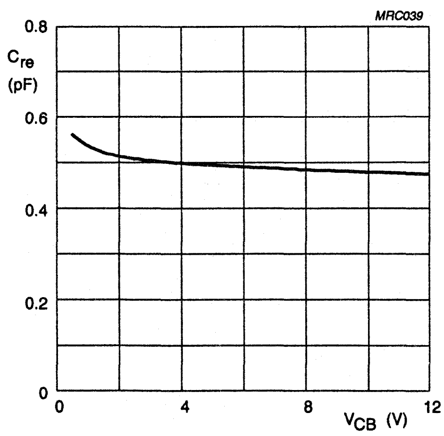


Fig.2 Power derating curve.



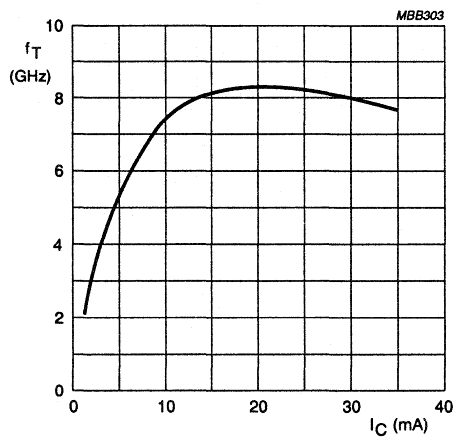
$V_{CE} = 5$ V; $T_j = 25$ °C.

Fig.3 DC current gain as a function of collector current.



$I_C = 0$; f = 1 MHz.

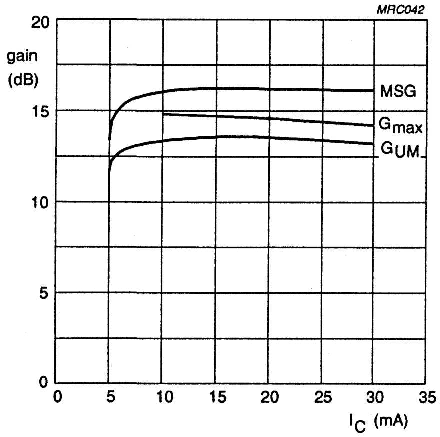
Fig.4 Feedback capacitance as a function of collector-base voltage.



$V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C.

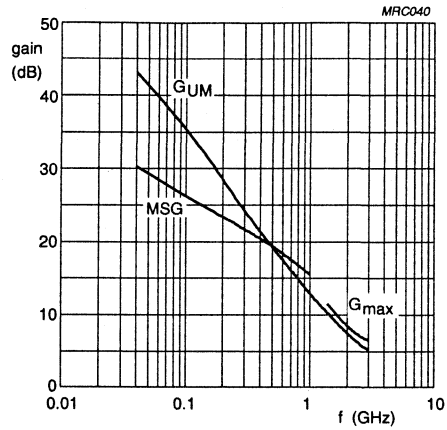
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



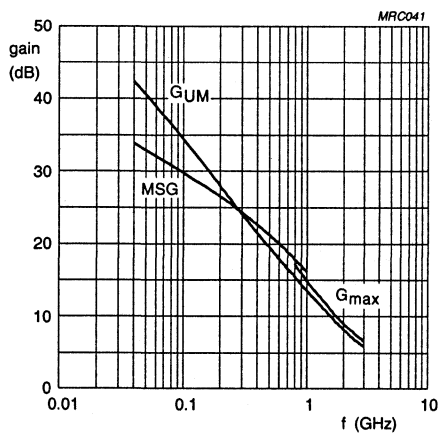
V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C.

Fig.6 Gain as a function of collector current.



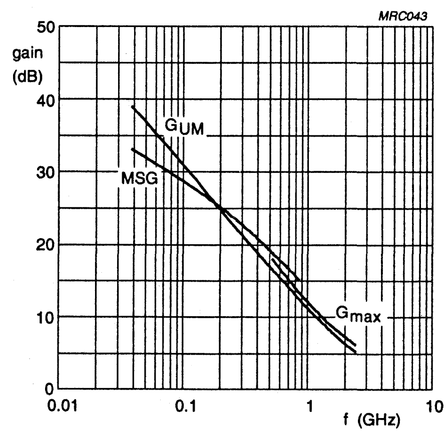
I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.7 Gain as a function of frequency.



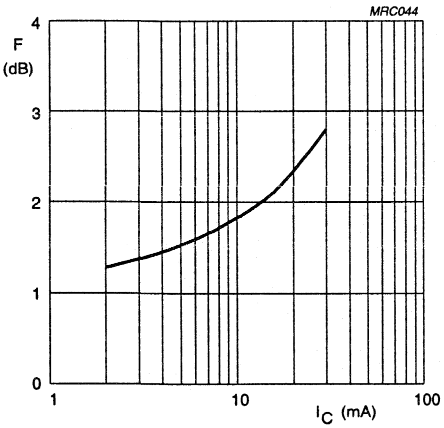
I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



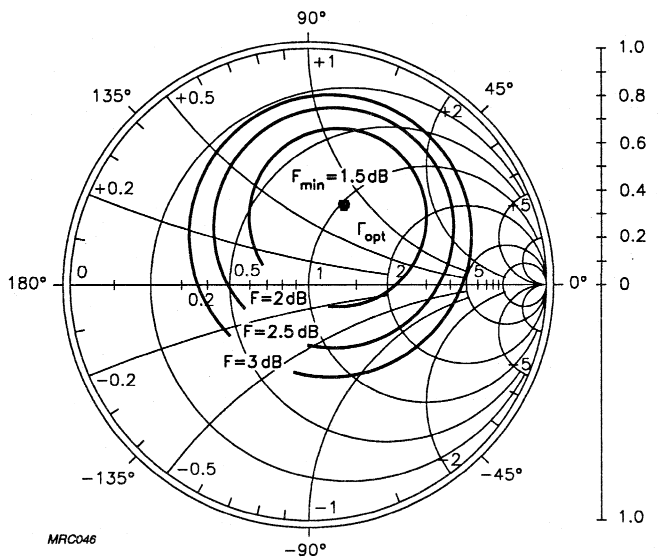
I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



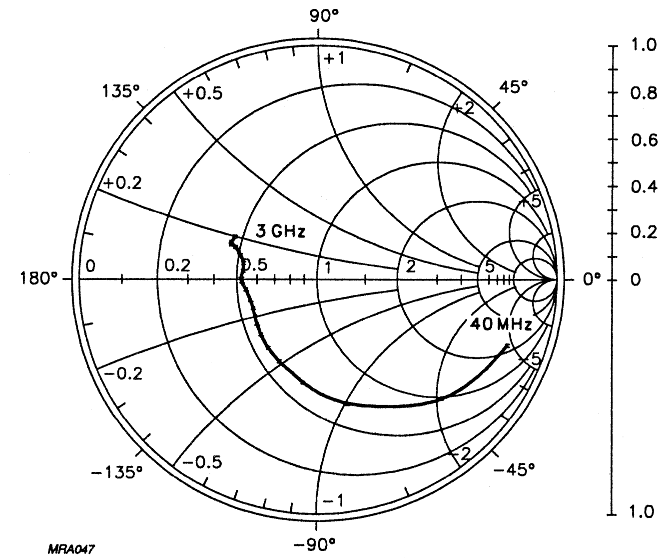
V_{CE} = 8 V.

Fig.10 Minimum noise figure as a function of collector current.



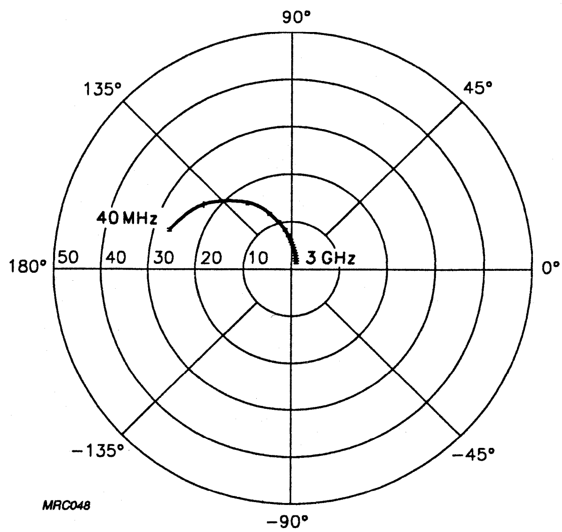
I_C = 5 mA; V_{CE} = 8 V;
f = 1 GHz; Z_o = 50 Ω.

Fig.11 Noise circle.



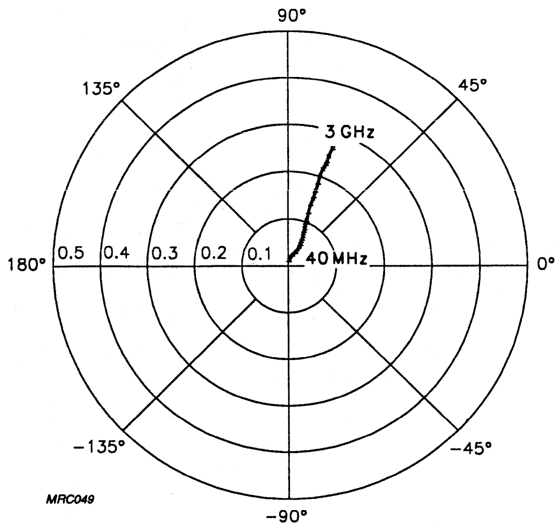
I_C = 15 mA; V_{CE} = 8 V; Z_O = 50 Ω.

Fig.12 Common emitter input reflection coefficient (S_{11}).



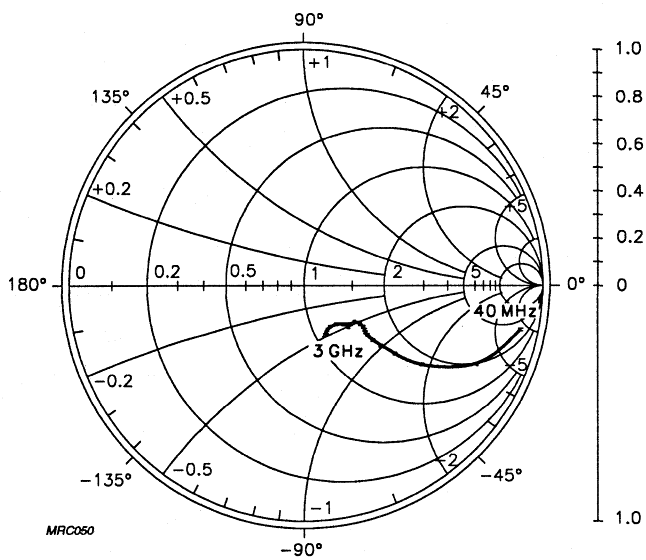
I_C = 15 mA; V_{CE} = 8 V.

Fig.13 Common emitter forward transmission coefficient (S_{21}).



I_C = 15 mA; V_{CE} = 8 V.

Fig.14 Common emitter reverse transmission coefficient (S_{12}).

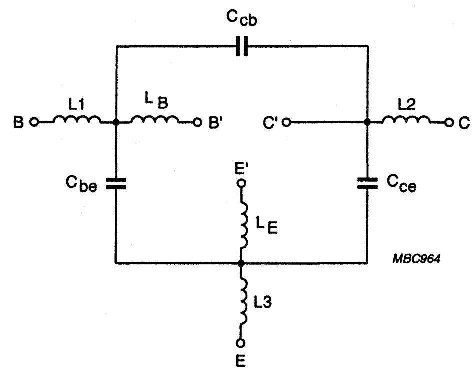


I_C = 15 mA; V_{CE} = 8 V; Z_O = 50 Ω.

Fig.15 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFQ67W crystal

1	IS = 556.4	aA
2	BF = 170.0	–
3	NF = 994.8	m
4	VAF = 48.03	V
5	IKF = 918.1	mA
6	ISE = 10.47	fA
7	NE = 1.479	–
8	BR = 142.1	–
9	NR = 994.1	m
10	VAR = 2.555	V
11	IKR = 9.632	A
12	ISC = 438.2	aA
13	NC = 1.089	–
14	RB = 10.00	Ω
15	IRB = 1.000	μA
16	RBM = 10.00	Ω
17	RE = 655.9	mΩ
18	RC = 2.000	Ω
19 (note 1)	XTB = 0.000	–
20 (note 1)	EG = 1.110	EV
21 (note 1)	XTI = 3.000	–
22	CJE = 1.137	pF
23	VJE = 600.0	mV
24	MJE = 249.4	m
25	TF = 11.97	ps
26	XTF = 25.99	–
27	VTF = 1.223	V
28	ITF = 197.3	mA
29	PTF = 10.03	deg
30	CJC = 515.9	fF
31	VJC = 155.8	mV
32	MJC = 56.02	m
33	XCJC = 130.0	m
34	TR = 1.877	ns
35 (note 1)	CJS = 0.000	F
36 (note 1)	VJS = 750.0	mV
37 (note 1)	MJS = 0.000	–
38	FC = 870.0	m



$QL_B = 50$; $QL_E = 50$.

$QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$.

Fc = scaling frequency = 100 MHz.

Fig.16 Package equivalent circuit, SOT323.

List of components (see Fig.16)

DESIGNATION	VALUE
C_{be}	2 fF
C_{cb}	100 fF
C_{ce}	100 fF
L1	0.34 nH
L2	0.10 nH
L3	0.34 nH
L_B	0.60 nH
L_E	0.60 nH

Note

1. These parameters have not been extracted, the default values are shown.

Table 1 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.960	−7.1	5.547	172.8	0.012	84.9	0.990	−3.7	43.1
100	0.938	−17.3	5.366	163.7	0.030	77.8	0.971	−8.9	36.2
200	0.884	−33.8	5.056	150.9	0.055	67.5	0.910	−16.7	28.3
300	0.819	−49.5	4.766	139.9	0.075	59.5	0.839	−22.8	23.7
400	0.756	−63.9	4.403	130.5	0.090	53.5	0.774	−27.7	20.5
500	0.704	−76.4	4.045	122.7	0.100	49.0	0.718	−31.5	18.3
600	0.654	−87.7	3.726	115.7	0.107	46.1	0.674	−34.0	16.5
700	0.608	−97.7	3.441	109.6	0.112	44.5	0.639	−35.7	15.0
800	0.567	−106.4	3.161	104.2	0.116	43.3	0.611	−36.8	13.7
900	0.534	−114.6	2.910	99.4	0.119	42.7	0.586	−37.6	12.6
1000	0.506	−122.4	2.685	95.2	0.120	42.7	0.563	−38.2	11.5
1200	0.477	−137.0	2.351	87.8	0.123	43.4	0.521	−39.9	9.9
1400	0.471	−148.5	2.111	81.4	0.127	45.4	0.493	−42.7	8.8
1600	0.465	−157.2	1.904	76.0	0.132	48.1	0.478	−45.9	7.8
1800	0.457	−164.9	1.739	71.8	0.135	52.0	0.468	−48.2	6.9
2000	0.454	−173.5	1.601	67.5	0.142	55.8	0.455	−50.2	6.1
2200	0.467	178.4	1.492	63.8	0.150	59.9	0.434	−53.4	5.5
2400	0.490	172.4	1.401	59.3	0.161	63.1	0.419	−58.6	5.0
2600	0.509	169.0	1.312	56.3	0.172	65.7	0.419	−64.5	4.5
2800	0.512	165.1	1.273	53.4	0.186	68.9	0.431	−68.6	4.3
3000	0.509	159.9	1.215	50.5	0.204	71.1	0.433	−71.2	3.9

Table 2 Noise data, I_C = 2 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.30	0.750	73.0	0.215

Table 3 Common emitter scattering parameters, I_C = 5 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.910	−11.6	12.647	168.6	0.012	82.7	0.974	−6.7	42.7
100	0.858	−27.7	11.757	155.6	0.028	73.0	0.917	−15.6	35.2
200	0.744	−52.5	10.339	138.7	0.047	61.1	0.781	−26.1	27.9
300	0.638	−73.8	8.913	125.8	0.059	55.4	0.665	−32.0	23.8
400	0.559	−91.0	7.578	116.1	0.068	52.5	0.581	−35.6	21.0
500	0.508	−104.4	6.529	109.0	0.074	51.6	0.522	−37.8	19.0
600	0.468	−115.3	5.701	103.3	0.080	52.0	0.484	−38.8	17.4
700	0.436	−124.4	5.035	98.6	0.086	53.0	0.458	−39.2	16.0
800	0.412	−132.2	4.494	94.6	0.091	54.3	0.439	−39.0	14.8
900	0.394	−139.6	4.050	91.0	0.097	55.6	0.423	−38.7	13.7
1000	0.381	−146.6	3.683	87.9	0.102	56.9	0.407	−38.3	12.8
1200	0.377	−158.9	3.138	82.4	0.113	59.4	0.376	−38.7	11.3
1400	0.385	−167.5	2.764	77.6	0.125	61.7	0.355	−41.0	10.1
1600	0.386	−173.8	2.463	73.2	0.139	63.2	0.345	−44.3	9.1
1800	0.381	−179.8	2.229	69.7	0.150	65.2	0.341	−46.2	8.2
2000	0.386	172.8	2.045	66.1	0.164	66.7	0.332	−47.5	7.4
2200	0.406	166.2	1.897	63.2	0.178	68.3	0.313	−50.0	6.8
2400	0.432	162.1	1.777	59.3	0.194	69.2	0.297	−55.8	6.3
2600	0.449	160.6	1.654	56.6	0.207	69.4	0.296	−62.9	5.7
2800	0.450	158.3	1.596	54.0	0.222	70.6	0.310	−67.4	5.5
3000	0.448	153.7	1.523	51.0	0.240	71.0	0.316	−69.7	5.1

Table 4 Noise data, I_C = 5 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.50	0.308	74.0	0.277

Table 5 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.844	−17.5	21.739	164.0	0.011	79.8	0.948	−10.2	42.1
100	0.751	−40.9	19.105	146.9	0.025	68.1	0.836	−22.3	34.4
200	0.589	−73.2	14.965	126.8	0.039	58.9	0.644	−32.6	27.7
300	0.486	−96.4	11.644	114.5	0.048	56.6	0.521	−36.4	23.9
400	0.430	−113.2	9.326	106.5	0.056	57.2	0.446	−38.1	21.2
500	0.400	−125.2	7.742	100.8	0.063	58.4	0.401	−38.8	19.3
600	0.378	−134.6	6.607	96.4	0.070	60.2	0.375	−38.9	17.7
700	0.361	−142.3	5.754	92.8	0.077	62.0	0.359	−38.6	16.4
800	0.348	−149.0	5.091	89.6	0.085	63.6	0.348	−37.8	15.3
900	0.339	−155.6	4.566	86.8	0.092	64.7	0.338	−37.0	14.2
1000	0.334	−161.7	4.131	84.1	0.100	65.7	0.328	−36.3	13.3
1200	0.343	−171.8	3.495	79.6	0.114	67.4	0.303	−36.1	11.8
1400	0.355	−178.2	3.060	75.5	0.130	68.8	0.286	−38.4	10.7
1600	0.358	177.3	2.716	71.6	0.147	69.1	0.279	−42.3	9.6
1800	0.356	172.0	2.453	68.5	0.160	70.0	0.277	−44.2	8.7
2000	0.362	165.4	2.247	65.2	0.177	70.5	0.270	−45.2	8.0
2200	0.385	160.0	2.082	62.7	0.192	71.2	0.252	−47.5	7.4
2400	0.414	156.8	1.947	59.1	0.210	71.2	0.236	−53.9	6.9
2600	0.429	156.4	1.807	56.5	0.223	70.7	0.234	−62.4	6.3
2800	0.430	154.9	1.743	54.1	0.239	71.2	0.249	−67.4	6.0
3000	0.424	150.4	1.661	51.1	0.257	70.9	0.256	−69.7	5.6

Table 6 Noise data, I_C = 10 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.70	0.230	86.5	0.260

Table 7 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 4 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.790	−22.3	28.448	160.6	0.011	77.9	0.923	−12.8	41.6
100	0.671	−51.0	23.726	140.7	0.023	66.3	0.773	−26.0	34.0
200	0.503	−86.2	16.929	120.3	0.035	59.3	0.566	−34.8	27.5
300	0.422	−109.0	12.580	109.4	0.044	59.2	0.452	−37.0	23.8
400	0.383	−124.2	9.869	102.3	0.052	61.1	0.389	−37.6	21.3
500	0.364	−135.7	8.104	97.4	0.059	62.9	0.352	−37.6	19.4
600	0.349	−144.0	6.867	93.6	0.067	64.4	0.332	−37.4	17.8
700	0.338	−151.0	5.962	90.3	0.075	66.2	0.320	−37.0	16.5
800	0.330	−157.1	5.263	87.5	0.084	67.7	0.313	−36.1	15.4
900	0.325	−163.0	4.713	84.9	0.092	68.6	0.306	−35.2	14.4
1000	0.323	−168.5	4.261	82.5	0.100	69.3	0.298	−34.5	13.5
1200	0.336	−177.1	3.598	78.3	0.117	70.4	0.277	−34.2	12.0
1400	0.350	177.6	3.142	74.5	0.133	71.3	0.261	−36.6	10.8
1600	0.354	173.6	2.785	70.7	0.151	71.1	0.256	−40.7	9.8
1800	0.350	169.2	2.510	67.8	0.165	71.7	0.254	−43.0	8.9
2000	0.355	163.3	2.293	64.8	0.182	71.9	0.247	−43.9	8.1
2200	0.380	158.3	2.133	62.5	0.199	72.5	0.232	−46.0	7.5
2400	0.411	155.2	1.998	58.8	0.217	72.1	0.216	−53.0	7.0
2600	0.427	154.5	1.850	56.3	0.230	71.4	0.212	−62.0	6.4
2800	0.429	153.1	1.783	54.0	0.246	71.7	0.226	−67.3	6.1
3000	0.425	149.1	1.701	51.0	0.265	71.2	0.236	−69.8	5.7

Table 8 Noise data, I_C = 15 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.95	0.200	100.0	0.251

Table 9 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{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	0.744	−26.5	33.373	157.8	0.011	77.0	0.900	−14.5	41.2
100	0.608	−59.0	26.488	136.1	0.022	65.3	0.725	−28.2	33.7
200	0.451	−95.3	17.750	116.3	0.033	60.1	0.517	−35.4	27.3
300	0.387	−117.6	12.887	106.3	0.041	61.5	0.413	−36.3	23.7
400	0.358	−132.6	10.013	99.9	0.050	63.9	0.357	−36.2	21.2
500	0.345	−142.6	8.179	95.4	0.058	65.8	0.326	−36.0	19.3
600	0.336	−150.0	6.912	91.9	0.066	67.4	0.310	−35.7	17.8
700	0.328	−156.5	5.992	88.8	0.075	69.0	0.302	−35.2	16.5
800	0.321	−162.1	5.283	86.1	0.084	69.9	0.297	−34.4	15.3
900	0.319	−167.5	4.728	83.7	0.093	70.8	0.292	−33.4	14.3
1000	0.320	−172.5	4.269	81.4	0.101	71.3	0.285	−32.7	13.4
1200	0.334	179.7	3.601	77.4	0.118	72.2	0.266	−32.6	12.0
1400	0.348	174.9	3.145	73.6	0.136	72.9	0.251	−35.1	10.8
1600	0.351	171.3	2.786	70.0	0.153	72.4	0.246	−39.4	9.7
1800	0.348	167.0	2.510	67.1	0.168	72.7	0.246	−42.0	8.8
2000	0.355	161.3	2.294	64.2	0.186	72.9	0.239	−42.9	8.1
2200	0.381	156.7	2.134	61.9	0.203	73.2	0.225	−44.9	7.5
2400	0.411	153.7	1.995	58.4	0.221	72.8	0.208	−52.2	7.0
2600	0.427	153.4	1.849	55.9	0.234	72.0	0.204	−61.7	6.4
2800	0.430	152.0	1.780	53.5	0.251	72.2	0.219	−67.2	6.1
3000	0.427	148.1	1.698	50.6	0.270	71.7	0.229	−69.6	5.7

Table 10 Noise data, I_C = 20 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	2.20	0.820	117.0	0.245

Table 11 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	S_{11}		S_{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	0.675	−34.1	38.831	153.5	0.010	75.5	0.859	−16.9	40.2
100	0.531	−71.9	28.464	130.0	0.020	63.5	0.656	−30.2	33.0
200	0.407	−109.0	17.813	111.6	0.030	61.6	0.459	−34.6	26.8
300	0.368	−129.9	12.662	102.7	0.039	63.8	0.372	−33.8	23.3
400	0.354	−143.1	9.753	97.0	0.048	66.6	0.328	−33.1	20.9
500	0.347	−151.6	7.930	93.0	0.056	68.6	0.305	−32.8	19.0
600	0.342	−158.0	6.683	89.7	0.065	70.1	0.293	−32.7	17.4
700	0.337	−163.5	5.784	86.9	0.074	71.4	0.289	−32.4	16.1
800	0.334	−168.4	5.096	84.4	0.083	72.3	0.287	−31.8	15.0
900	0.333	−173.1	4.559	82.0	0.092	72.9	0.284	−31.2	14.1
1000	0.336	−177.5	4.117	79.9	0.101	73.3	0.278	−30.7	13.2
1200	0.352	176.0	3.471	76.0	0.118	73.8	0.262	−30.9	11.7
1400	0.367	171.9	3.027	72.3	0.136	74.3	0.248	−33.9	10.5
1600	0.371	168.6	2.681	68.7	0.154	73.7	0.244	−38.6	9.5
1800	0.370	164.5	2.416	65.8	0.169	73.9	0.243	−41.5	8.6
2000	0.378	159.3	2.208	62.9	0.187	74.0	0.237	−42.7	7.8
2200	0.405	155.1	2.053	60.7	0.204	74.3	0.223	−45.2	7.2
2400	0.435	152.2	1.919	57.1	0.223	73.7	0.207	−52.9	6.8
2600	0.451	151.7	1.778	54.7	0.237	73.0	0.204	−62.6	6.2
2800	0.454	150.3	1.711	52.3	0.253	73.1	0.219	−68.3	5.9
3000	0.451	146.2	1.632	49.4	0.273	72.5	0.229	−71.0	5.5

Table 12 Noise data, I_C = 30 mA; V_{CE} = 4 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	2.50	0.158	140.0	0.290

Table 13 Common emitter scattering parameters, I_C = 2 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.966	−6.7	5.396	173.1	0.012	85.5	0.990	−3.5	43.5
100	0.946	−16.3	5.244	164.3	0.029	78.5	0.972	−8.5	36.7
200	0.894	−31.9	4.957	151.8	0.054	68.3	0.916	−16.0	28.8
300	0.831	−46.8	4.685	141.1	0.074	60.8	0.850	−22.0	24.1
400	0.768	−60.5	4.352	131.8	0.089	54.9	0.787	−26.9	20.9
500	0.715	−72.5	4.012	124.0	0.100	50.5	0.732	−30.8	18.5
600	0.662	−83.5	3.716	117.1	0.108	47.4	0.687	−33.4	16.7
700	0.613	−93.2	3.442	110.9	0.114	45.6	0.652	−35.2	15.2
800	0.570	−101.7	3.168	105.5	0.118	44.5	0.623	−36.2	13.9
900	0.533	−109.7	2.919	100.8	0.121	43.7	0.597	−37.1	12.7
1000	0.504	−117.6	2.701	96.5	0.123	43.4	0.573	−37.8	11.6
1200	0.469	−132.3	2.372	88.8	0.126	43.9	0.529	−39.6	10.0
1400	0.457	−144.1	2.134	82.4	0.130	45.6	0.500	−42.1	8.8
1600	0.449	−153.1	1.925	76.9	0.135	47.9	0.485	−45.2	7.8
1800	0.438	−160.9	1.757	72.7	0.138	51.5	0.474	−47.4	6.9
2000	0.430	−169.3	1.613	68.5	0.145	55.3	0.459	−49.3	6.1
2200	0.442	−177.6	1.513	65.0	0.153	59.5	0.439	−52.2	5.5
2400	0.465	175.5	1.424	60.2	0.164	62.2	0.423	−57.3	5.0
2600	0.485	171.4	1.334	57.1	0.174	64.7	0.421	−63.0	4.5
2800	0.490	167.6	1.294	54.3	0.187	68.0	0.433	−66.9	4.3
3000	0.488	162.3	1.236	51.3	0.204	70.3	0.436	−69.5	3.9

Table 14 Noise data, I_C = 2 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.30	0.690	65.0	0.320

Table 15 Common emitter scattering parameters, $I_C = 5$ mA; $V_{CE} = 8$ V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.926	−10.7	12.221	169.3	0.012	82.5	0.974	−6.2	43.1
100	0.877	−25.5	11.435	156.9	0.027	73.9	0.923	−14.7	35.8
200	0.767	−48.3	10.145	140.4	0.047	62.7	0.797	−25.1	28.4
300	0.660	−68.2	8.835	127.8	0.060	56.7	0.684	−31.3	24.1
400	0.576	−84.5	7.584	118.0	0.070	53.6	0.600	−35.2	21.3
500	0.517	−97.5	6.571	110.8	0.077	52.4	0.539	−37.6	19.2
600	0.469	−108.3	5.758	104.9	0.083	52.5	0.498	−38.8	17.5
700	0.432	−117.3	5.103	100.0	0.089	53.4	0.470	−39.3	16.1
800	0.403	−125.1	4.560	96.0	0.094	54.4	0.449	−39.1	14.9
900	0.381	−132.8	4.116	92.4	0.100	55.3	0.431	−38.8	13.9
1000	0.365	−140.1	3.748	89.1	0.105	56.6	0.415	−38.5	12.9
1200	0.355	−153.2	3.201	83.5	0.116	58.7	0.381	−38.8	11.4
1400	0.359	−162.3	2.818	78.6	0.129	61.0	0.359	−40.7	10.2
1600	0.359	−169.0	2.513	74.1	0.142	62.2	0.349	−43.8	9.2
1800	0.352	−175.4	2.272	70.6	0.153	64.2	0.343	−45.7	8.2
2000	0.351	177.2	2.078	67.2	0.167	65.8	0.332	−46.7	7.4
2200	0.371	170.3	1.937	64.4	0.181	67.5	0.315	−48.8	6.8
2400	0.398	165.2	1.818	60.2	0.197	68.1	0.299	−54.4	6.3
2600	0.417	163.2	1.693	57.5	0.209	68.3	0.295	−61.2	5.8
2800	0.422	160.9	1.635	54.9	0.224	69.4	0.307	−65.5	5.6
3000	0.419	156.3	1.559	51.9	0.242	69.8	0.314	−67.8	5.1

Table 16 Noise data, $I_C = 5$ mA; $V_{CE} = 8$ V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	1.50	0.370	66.0	0.330

Table 17 Common emitter scattering parameters, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{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	0.877	−15.7	20.874	165.0	0.011	80.1	0.949	−9.5	42.8
100	0.788	−36.8	18.559	148.8	0.025	69.8	0.849	−21.0	35.1
200	0.623	−66.0	14.808	129.2	0.040	60.4	0.668	−31.7	28.1
300	0.507	−87.7	11.695	116.7	0.050	57.3	0.543	−36.2	24.2
400	0.437	−103.9	9.441	108.4	0.058	57.6	0.465	−38.4	21.5
500	0.396	−116.1	7.877	102.5	0.066	58.4	0.415	−39.4	19.5
600	0.366	−125.7	6.734	97.9	0.073	59.8	0.386	−39.6	17.9
700	0.344	−133.8	5.874	94.1	0.080	61.4	0.367	−39.3	16.6
800	0.327	−140.9	5.205	90.9	0.088	62.9	0.355	−38.5	15.4
900	0.313	−147.9	4.668	87.9	0.096	64.0	0.343	−37.6	14.4
1000	0.306	−154.6	4.224	85.3	0.103	64.9	0.331	−36.8	13.4
1200	0.310	−165.8	3.580	80.6	0.118	66.4	0.306	−36.5	11.9
1400	0.321	−173.0	3.134	76.4	0.134	67.7	0.287	−38.3	10.8
1600	0.323	−178.1	2.781	72.5	0.150	67.8	0.279	−41.8	9.7
1800	0.318	176.7	2.509	69.4	0.164	68.7	0.276	−43.8	8.8
2000	0.320	169.8	2.292	66.3	0.180	69.3	0.268	−44.4	8.0
2200	0.343	163.5	2.135	63.8	0.196	70.0	0.252	−46.0	7.4
2400	0.372	159.7	2.000	60.0	0.214	69.8	0.235	−52.4	6.9
2600	0.390	158.9	1.858	57.5	0.226	69.3	0.230	−60.6	6.3
2800	0.394	157.3	1.789	55.1	0.241	69.8	0.243	−65.4	6.0
3000	0.390	153.2	1.706	52.1	0.260	69.6	0.252	−67.6	5.6

Table 18 Noise data, I_C = 10 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	1.80	0.363	70.0	0.290

Table 19 Common emitter scattering parameters, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{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	0.842	−19.4	26.813	162.2	0.011	79.0	0.926	−11.5	42.4
100	0.726	−44.6	22.819	143.4	0.024	67.7	0.796	−24.4	34.8
200	0.543	−76.2	16.779	123.2	0.037	59.9	0.596	−34.1	27.9
300	0.440	−97.9	12.669	111.7	0.046	59.3	0.476	−37.2	24.1
400	0.384	−113.7	10.011	104.3	0.054	60.3	0.407	−38.3	21.5
500	0.354	−125.1	8.254	99.2	0.062	62.1	0.366	−38.7	19.5
600	0.332	−134.1	7.010	95.1	0.070	63.6	0.342	−38.6	18.0
700	0.315	−141.7	6.095	91.7	0.079	65.1	0.328	−38.1	16.6
800	0.302	−148.4	5.381	88.7	0.087	66.5	0.320	−37.1	15.5
900	0.293	−154.8	4.820	86.1	0.095	67.4	0.311	−36.1	14.5
1000	0.290	−161.1	4.362	83.6	0.103	68.0	0.302	−35.1	13.6
1200	0.298	−171.3	3.684	79.3	0.120	69.1	0.279	−34.6	12.1
1400	0.312	−177.5	3.220	75.4	0.137	69.9	0.262	−36.7	10.9
1600	0.314	178.2	2.855	71.6	0.154	69.6	0.255	−40.4	9.9
1800	0.310	173.4	2.572	68.7	0.168	70.1	0.254	−42.6	8.9
2000	0.313	166.8	2.349	65.7	0.185	70.3	0.246	−43.0	8.1
2200	0.339	161.2	2.187	63.3	0.201	70.8	0.231	−44.6	7.6
2400	0.368	157.7	2.046	59.7	0.219	70.4	0.213	−51.3	7.0
2600	0.387	157.3	1.897	57.2	0.232	69.7	0.208	−60.2	6.5
2800	0.389	156.0	1.828	54.8	0.247	70.0	0.222	−65.3	6.2
3000	0.385	152.0	1.742	51.9	0.266	69.6	0.231	−67.7	5.8

Table 20 Noise data, I_C = 15 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	2.00	0.300	77.0	0.330

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Table 21 Common emitter scattering parameters, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.817	−22.3	30.844	160.0	0.011	78.5	0.908	−12.9	42.1
100	0.682	−50.2	25.281	139.7	0.023	66.5	0.757	−26.3	34.5
200	0.497	−82.9	17.607	119.6	0.035	60.4	0.552	−34.9	27.7
300	0.405	−104.4	12.993	108.9	0.044	60.6	0.440	−36.9	24.0
400	0.359	−120.0	10.167	102.0	0.052	62.4	0.377	−37.4	21.4
500	0.335	−130.8	8.336	97.3	0.061	63.9	0.342	−37.4	19.5
600	0.317	−139.1	7.061	93.5	0.069	65.8	0.322	−37.1	17.9
700	0.304	−146.3	6.127	90.3	0.078	67.1	0.311	−36.6	16.6
800	0.293	−152.5	5.405	87.5	0.087	68.2	0.305	−35.6	15.5
900	0.287	−158.8	4.842	84.9	0.095	68.9	0.298	−34.6	14.5
1000	0.285	−164.7	4.373	82.6	0.104	69.5	0.290	−33.7	13.6
1200	0.297	−174.1	3.690	78.4	0.121	70.3	0.269	−33.2	12.1
1400	0.311	−179.7	3.226	74.6	0.138	70.9	0.253	−35.3	10.9
1600	0.313	176.3	2.858	70.9	0.156	70.4	0.247	−39.3	9.8
1800	0.309	171.9	2.573	68.0	0.170	70.7	0.246	−41.5	8.9
2000	0.316	165.4	2.351	65.1	0.187	70.9	0.238	−42.1	8.1
2200	0.340	160.1	2.187	62.8	0.204	71.2	0.224	−43.7	7.6
2400	0.370	156.7	2.048	59.1	0.222	70.7	0.206	−50.7	7.1
2600	0.389	156.5	1.897	56.7	0.234	70.0	0.201	−59.8	6.5
2800	0.393	155.3	1.827	54.4	0.250	70.2	0.215	−65.2	6.2
3000	0.390	151.3	1.740	51.4	0.268	69.8	0.224	−67.6	5.8

Table 22 Noise data, I_C = 20 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt}		R_n
		(RAT)	(DEG)	
1000	2.30	0.271	83.0	0.297

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Table 23 Common emitter scattering parameters, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.780	−27.0	35.290	156.9	0.011	76.8	0.877	−14.5	41.4
100	0.623	−58.4	27.212	134.6	0.022	65.2	0.702	−27.8	33.8
200	0.447	−92.2	17.771	115.3	0.033	61.1	0.503	−34.1	27.2
300	0.374	−113.5	12.817	105.6	0.042	62.2	0.405	−34.5	23.6
400	0.340	−128.4	9.936	99.3	0.050	64.5	0.354	−34.1	21.1
500	0.323	−138.3	8.110	94.9	0.059	66.3	0.326	−33.9	19.1
600	0.312	−145.9	6.847	91.5	0.068	67.7	0.311	−33.7	17.6
700	0.302	−152.5	5.933	88.5	0.077	69.0	0.304	−33.3	16.3
800	0.295	−158.1	5.229	85.8	0.086	70.0	0.300	−32.5	15.2
900	0.291	−163.9	4.680	83.3	0.095	70.5	0.295	−31.8	14.2
1000	0.291	−169.2	4.226	81.1	0.103	71.0	0.290	−31.1	13.3
1200	0.305	−177.5	3.569	77.0	0.121	71.5	0.271	−31.0	11.8
1400	0.321	177.7	3.114	73.3	0.138	71.9	0.256	−33.4	10.6
1600	0.326	173.9	2.758	69.7	0.156	71.3	0.251	−37.7	9.6
1800	0.324	169.7	2.485	66.7	0.170	71.6	0.250	−40.3	8.7
2000	0.331	163.8	2.270	63.8	0.187	71.6	0.244	−41.2	7.9
2200	0.357	158.8	2.111	61.5	0.204	71.9	0.229	−43.1	7.3
2400	0.389	155.5	1.975	57.9	0.222	71.5	0.212	−50.2	6.8
2600	0.407	155.3	1.830	55.5	0.234	70.7	0.207	−59.3	6.2
2800	0.412	153.8	1.762	53.1	0.250	70.9	0.221	−64.9	5.9
3000	0.409	149.8	1.679	50.2	0.269	70.5	0.230	−67.5	5.5

Table 24 Noise data, I_C = 30 mA; V_{CE} = 8 V

f (MHz)	F_{min} (dB)	Γ_{opt} (RAT)	Γ_{opt} (DEG)	R_n
1000	2.80	0.230	97.0	0.332

PNP 5 GHz wideband transistor

BFQ149

DESCRIPTION

PNP transistor in a SOT89 envelope. It is intended for use in UHF applications such as broadband aerial amplifiers (30 to 860 MHz) and in microwave amplifiers such as radar systems, spectrum analyzers, etc., using SMD technology.

PINNING

PIN	DESCRIPTION
Code: FG	
1	emitter
2	base
3	collector

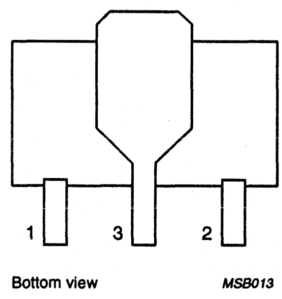

Fig.1 SOT89.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	–	–15	V
I_C	DC collector current		–	–	–100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = –70 mA; V_{CE} = –10 V; T_j = 25 °C	20	50	–	
f_T	transition frequency	I_C = –75 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	4	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = –50 mA; V_{CE} = –10 V; f = 500 MHz; T_{amb} = 25 °C	–	12	–	dB
F	noise figure	I_C = –50 mA; V_{CE} = –10 V; R_s = 60 Ω; f = 500 MHz; T_{amb} = 25 °C	–	3.75	–	dB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–20	V
V_{CEO}	collector-emitter voltage	open base	–	–15	V
V_{EBO}	emitter-base voltage	open collector	–	–3	V
I_C	DC collector current		–	–100	mA
I_{CM}	peak collector current	f > 1 MHz	–	–150	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the collector tab.

Capability approved CECC 50 000 (issue 4), 1986

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 135 °C (note 1)	40 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = −10 V	–	–	100	nA
h_{FE}	DC current gain	I_C = −70 mA; V_{CE} = −10 V	20	50	–	
f_T	transition frequency	I_C = −70 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	4	5	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = −10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = −0.5 V; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = −10 V; f = 1 MHz	–	1.7	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = −50 mA; V_{CE} = −10 V; f = 500 MHz; T_{amb} = 25 °C	–	12	–	dB
F	noise figure	I_C = −50 mA; V_{CE} = −10 V; R_s = 60 Ω; f = 500 MHz; T_{amb} = 25 °C	–	3.75	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

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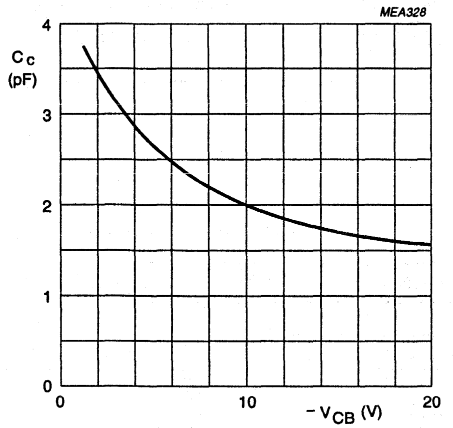
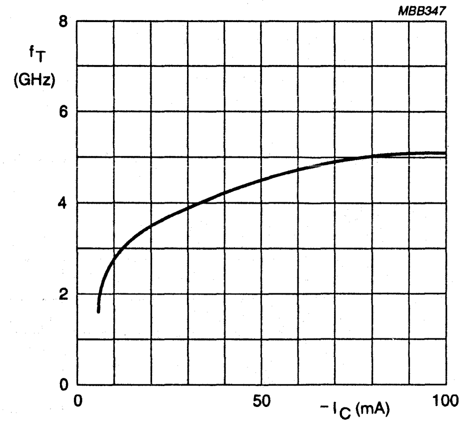


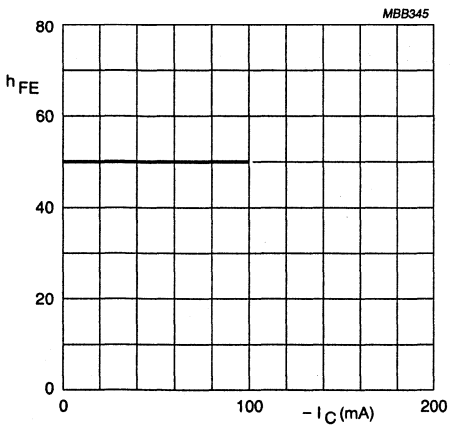
$I_E = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.2 Collector capacitance as a function of collector-base voltage.



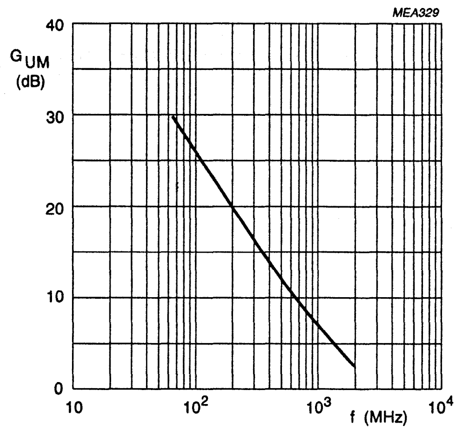
$V_{CE} = -10$ V; f = 500 MHz; $T_{amb} = 25$ °C.

Fig.3 Transition frequency as a function of collector current.



$V_{CE} = -10$ V; $T_j = 25$ °C.

Fig.4 DC current gain as a function of collector current.



$I_C = -50$ mA; $V_{CE} = -10$ V; $T_{amb} = 25$ °C.

Fig.5 Maximum unilateral power gain as a function of frequency.

Table 1 Common emitter scattering parameters, I_C = –70 mA; V_{CE} = –10 V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.286	–137.8	33.887	131.9	0.015	75.2	0.576	–45.6	32.7
100	0.350	–163.5	17.349	106.1	0.032	76.3	0.307	–65.3	25.8
200	0.368	–179.7	9.099	93.6	0.057	77.9	0.180	–72.8	20.0
300	0.387	174.5	6.167	86.0	0.085	77.7	0.142	–77.4	16.6
400	0.397	167.3	4.752	80.3	0.111	76.2	0.126	–81.4	14.4
500	0.396	163.4	3.775	75.9	0.138	75.5	0.118	–86.0	12.3
600	0.405	159.0	3.211	72.2	0.163	73.3	0.115	–91.6	11.0
700	0.413	152.5	2.758	68.0	0.188	72.0	0.116	–95.9	9.7
800	0.428	148.0	2.468	64.6	0.213	70.3	0.120	–101.3	8.8
900	0.424	143.6	2.230	61.2	0.234	68.3	0.124	–107.1	7.9
1000	0.441	137.6	2.042	57.5	0.258	66.6	0.128	–113.0	7.2
1200	0.487	132.7	1.744	51.5	0.298	63.5	0.141	–122.1	6.1
1400	0.509	126.4	1.573	45.0	0.343	60.9	0.155	–133.5	5.3
1600	0.526	119.5	1.425	40.1	0.381	56.7	0.151	–133.1	4.6
1800	0.559	111.0	1.336	36.1	0.411	54.7	0.189	–139.1	4.3
2000	0.561	105.9	1.235	31.4	0.442	52.3	0.207	–150.4	3.7
2200	0.610	102.7	1.167	28.3	0.472	50.1	0.235	–157.2	3.6
2400	0.604	100.0	1.096	24.2	0.502	47.4	0.268	–162.9	3.1
2600	0.645	98.2	1.027	20.9	0.516	44.9	0.290	–166.4	3.0
2800	0.617	94.0	0.991	19.7	0.541	43.2	0.314	–169.3	2.5
3000	0.650	90.7	0.951	14.7	0.566	40.3	0.333	–174.2	2.5

NPN 1 GHz video transistor BFQ166

FEATURES

- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- High current applicability
- Surface mounting.

DESCRIPTION

NPN silicon epitaxial transistor in a plastic SOT223 envelope and intended for use as a surface-mounted cascode driver in video amplifiers in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

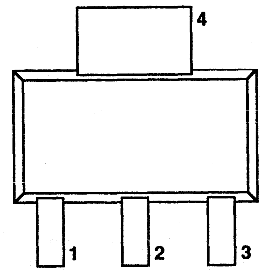


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	2	W
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 100 MHz	1	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	19	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	up to T_s = 105 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	T_s = 105 °C; P_{tot} = 2 W (notes 1 and 2)	35 K/W

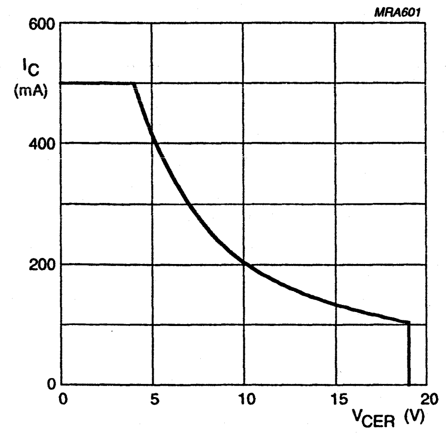
Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. Device mounted on a printed circuit board measuring 40 x 40 x 1 mm (collector pad 35 x 17 mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 100 μA	20	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 100 Ω	19	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
I_{CES}	collector-emitter cut-off current	V_{CE} = 10 V; V_{BE} = 0	–	–	100	μA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	50	60	–	
C_c	collector capacitance	$I_C = i_c$ = 0; V_{CB} = 5 V; f = 1 MHz	–	4.5	–	pF
C_{cb}	collector-base capacitance	$I_C = i_c$ = 0; V_{CB} = 5 V; f = 1 MHz	–	3.2	–	pF
f_T	transition frequency	I_C = 300 mA; V_{CE} = 5 V; T_{amb} = 25 °C; f = 100 MHz	1	–	–	GHz



$R_{BE} \leq 100\ \Omega$.

Fig.2 DC SOAR.

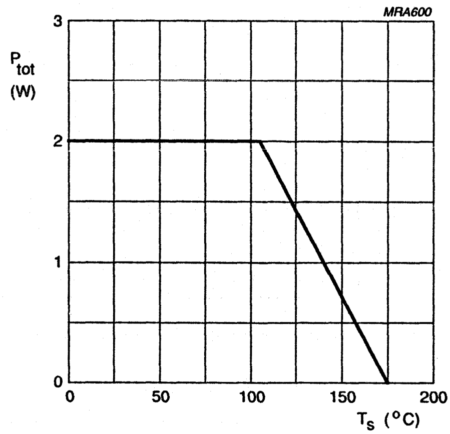
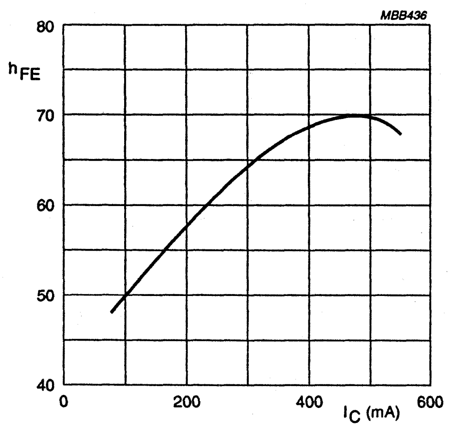
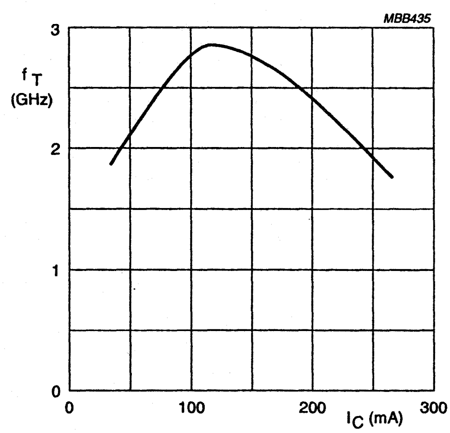


Fig.3 Power derating curve.



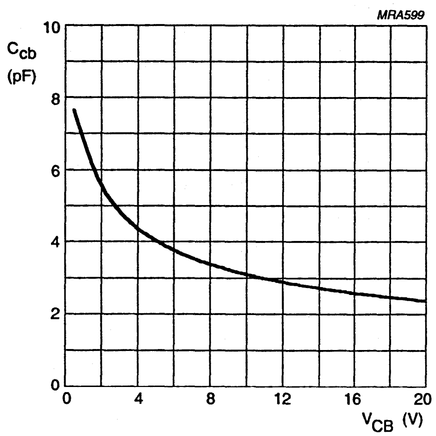
$V_{CE} = 5$ V.

Fig.4 DC current gain as a function of collector current, typical values.



$V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.5 Transition frequency as a function of collector current, typical values.



$I_C = 0$; f = 1 MHz.

Fig.6 Collector-base capacitance as a function of collector-base voltage, typical values.

PNP 1 GHz video transistors | BFQ256; BFQ256A

FEATURES

- High breakdown voltages
- Low output capacitance
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary NPN types BFQ236 and BFQ236A
- Surface mounting.

DESCRIPTION

PNP silicon epitaxial transistor in a plastic SOT223 envelope and intended for use as a surface-mounted buffer in video amplifiers in high-resolution colour graphics monitors.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

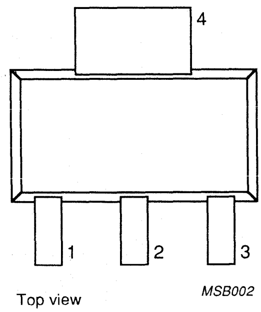


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter				
	BFQ256		–	–	100	V
	BFQ256A		–	–	115	V
$-V_{CER}$	collector-emitter voltage	R_{BE} = 100 Ω				
	BFQ256		–	–	95	V
	BFQ256A		–	–	110	V
$-I_C$	DC collector current		–	–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	–	2	W
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 100 MHz				
	BFQ256		1	1.3	–	GHz
	BFQ256A		0.8	1.2	–	GHz

Note

1. T_s is the temperature at the soldering point of the collector tab.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BFQ256		–	100	V
	BFQ256A		–	115	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BFQ256		–	65	V
	BFQ256A		–	95	V
$-V_{CER}$	collector-emitter voltage	R_{BE} = 100 Ω			
	BFQ256		–	95	V
	BFQ256A		–	110	V
$-V_{EBO}$	emitter-base voltage	open collector	–	3	V
$-I_C$	DC collector current		–	300	mA
P_{tot}	total power dissipation	up to T_s = 115 °C (note 1)	–	2	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point	T_s = 115 °C; P_{tot} = 2 W (notes 1 and 2)	30 K/W

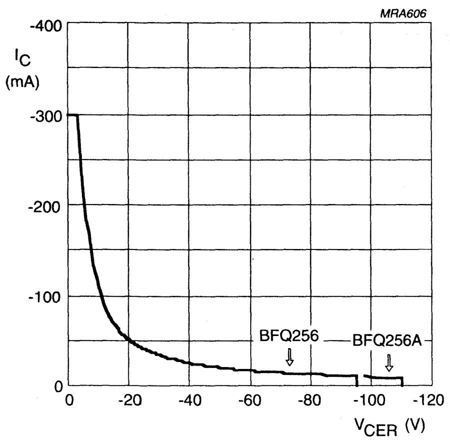
Notes

1. T_s is the temperature at the soldering point of the collector tab.
2. Device mounted on a printed circuit board measuring 40 x 40 x 1 mm (collector pad 35 x 17 mm).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $-I_C$ = 100 μA				
	BFQ256		100	–	–	V
	BFQ256A		115	–	–	V
$-V_{(BR)CER}$	collector-emitter breakdown voltage	$-I_C$ = 1 mA; R_{BE} = 100 Ω				
	BFQ256		95	–	–	V
	BFQ256A		110	–	–	V
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $-I_C$ = 10 mA				
	BFQ256		65	–	–	V
	BFQ256A		95	–	–	V
$-I_{CES}$	collector-emitter cut-off current	$-V_{CE}$ = 50 V; $-I_B$ = 0	–	–	100	μA
$-I_{CBO}$	collector-base cut-off current	$-V_{CB}$ = 50 V; $-I_E$ = 0	–	–	20	μA
h_{FE}	DC current gain	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V	20	30	–	
C_c	collector capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.9	–	pF
C_{cb}	collector-base capacitance	$I_C = i_c = 0$; $-V_{CB}$ = 10 V; f = 1 MHz	–	1.6	–	pF
f_T	transition frequency	$-I_C$ = 50 mA; $-V_{CE}$ = 10 V; f = 100 MHz				
	BFQ256		1	1.3	–	GHz
	BFQ256A		0.8	1.2	–	GHz



R_{BE} ≤ 100 Ω.

Fig.2 DC SOAR.

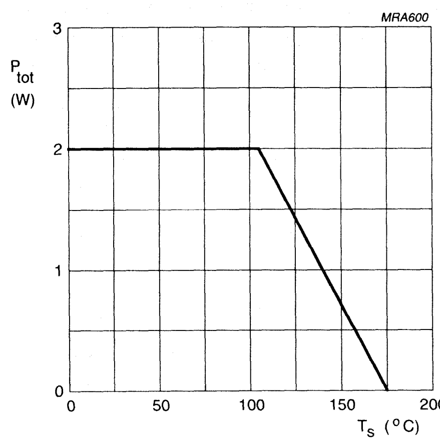
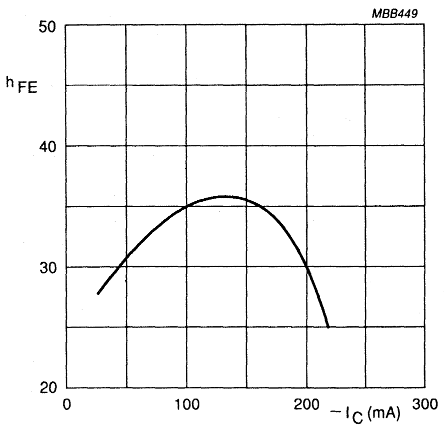
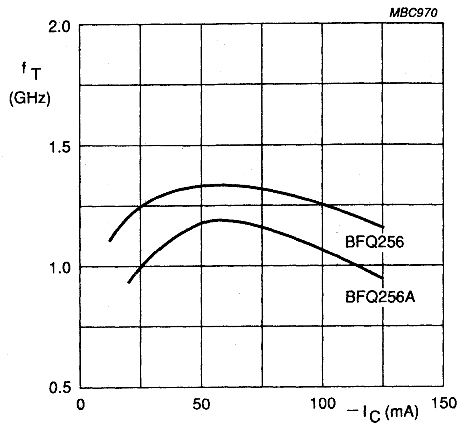


Fig.3 Power derating curve.



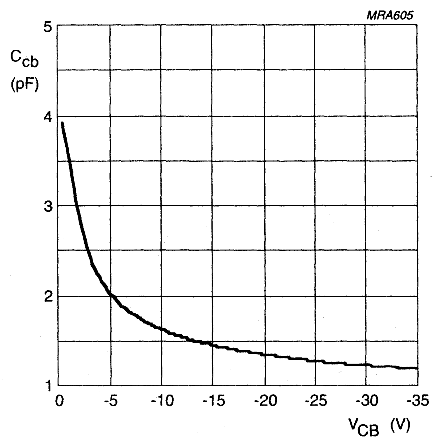
$-V_{CE}$ = 10 V.

Fig.4 DC current gain as a function of collector current, typical values.



$-V_{CE}$ = 10 V; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current, typical values.



I_C = 0; f = 1 MHz.

Fig.6 Collector-base capacitance as a function of collector-base voltage, typical values.

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