SIEMENS

Discrete Semiconductors for Surface Mounting

Data Book 1985/86

Siemens Aktiengesellschaft

Table of Contents

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Summary of Types

Schottky diodes

Type	V_R V	I_F mA	T_j °C	P_{tot} mW	V_F mV	$V_{(BR)}$ V	I_R nA	Page
BAS 40–04	40	> 40	150	100	< 380	> 40	< 1000	67
BAS 40–05	40	> 40	150	100	< 380	> 40	< 1000	67
BAS 40–06	40	> 40	150	100	< 380	> 40	< 1000	67
BAS 70–04	70	> 15	150	100	< 410	> 70	< 200	69
BAS 70–05	70	> 15	150	100	< 410	> 70	< 200	69
BAS 70–06	70	> 15	150	100	< 410	> 70	< 200	69
BAT 17	4	30	150	–	< 600	> 4	< 1250	71

Switching diodes

Type	V_R V	I_F mA	T_j °C	P_{tot} mW	V_F V	I_F mA	t_{rr} ns	Page
BAL 74	50	250	175	330	≤ 1,0	100	≤ 4	44
BAL 99	70	250	175	330	≤ 1,25	150	≤ 6	48
BAR 74	50	250	175	330	≤ 1,0	100	≤ 4	55
BAR 99	70	250	175	330	≤ 1,25	150	≤ 6	59
BAS 16	75	250	175	330	≤ 1,25	150	≤ 6	63
BAV 70	70	250	175	330	≤ 1,25	150	≤ 6	74
BAV 74	50	250	175	330	≤ 1,0	100	≤ 4	78
BAV 99	70	250	175	330	≤ 1,25	150	≤ 6	82
BAW 56	70	250	175	330	≤ 1,25	150	≤ 6	86
BAW 78 A	50	1000	150	1000	≤ 1,6	1000	1000	90
BAW 78 B	100	1000	150	1000	≤ 1,6	1000	1000	90
BAW 78 C	200	1000	150	1000	≤ 1,6	1000	1000	90
BAW 78 D	400	1000	150	1000	≤ 1,6	1000	1000	90
BAW 79 A	50	1000	150	1000	≤ 1,6	1000	1000	93
BAW 79 B	100	1000	150	1000	≤ 1,6	1000	1000	93
BAW 79 C	200	1000	150	1000	≤ 1,6	1000	1000	93
BAW 79 D	400	1000	150	1000	≤ 1,6	1000	1000	93
BAW 100	70	250	175	330	≤ 1,25	150	≤ 6	96
BAW 101	300	50	150	280	≤ 1,3	100	–	100
BGX 50 A	50	140	150	280	≤ 2,6	100	1	106

Tuning diode

Type	V_R V	I_F mA	I_R µA	V_R V	C_{D2V} pF	$\frac{C_{D2V}}{C_{D8V}}$ –	f MHz	Page
BB 804	18	50	≤ 0,2	16	42 … 47,5	1,7	1	103

PIN diodes

Type	V_R V	T_j °C	P_{tot} mW	τ_L µs	r_{F1} kΩ	r_{F2} kΩ	r_{F3} Ω	r_{F4} Ω	Page
BAR 14–1	100	150	100	1,5	3,0	0,4	50	9,0	52
BAR 15–1	100	150	100	1,5	3,0	0,4	50	9,0	52
BAR 16–1	100	150	100	1,5	3,0	0,4	50	9,0	52

MOS field-effect transistors

Type	V_{DS} V	I_D mA	T_{ch} °C	P_{tot} mW	g_{fs} mS	G_{ps} dB	NF dB	V_{DS} V	I_D mA	f MHz	Page
BF 989	20	30	150	200	12	16,5	2,8	15	7	800	226
BF 989 S	20	30	150	200	12	16,5	2,2	15	7	800	234
BF 993	20	50	150	200	25	25	1,5	15	10	200	241
BF 994	20	30	150	200	17	25	1,5	15	10	200	247
BF 994 S	20	30	150	200	18	25	1	15	10	200	253
BF 995	20	30	150	200	17	23	1,8	15	10	200	259
BF 996	20	30	150	200	17	18	2,8	15	10	800	268
BF 996 S	20	30	150	200	18	18	1,8	15	10	800	275
BF 997	20	30	150	200	18	25	1	15	10	200	282

RF transistors

Type		V_{CE0} V	I_C mA	P_{tot} mW	h_{FE} –	I_C mA	V_{CE} V	I_{CB0} nA	f_T MHz	Page
BF 554	N	20	30	280	> 60	1	10	< 100	250	200
BF 599	N	25	25	280	> 38	7	10	< 100	550	209
BF 799	N	20	35	280	> 40	20	10	< 100	800	223
BF 550	P	40	25	280	> 50	1	10	–	350	196
BF 569	P	35	30	280	> 20	3	10	< 100	925	203
BF 579	P	20	30	280	> 20	10	10	< 100	1600	206
BF 660	P	30	25	280	> 30	3	10	< 50	700	220

Switching transistors

Type		V_{CE0} V	I_C mA	P_{tot} mW	h_{FE} –	I_C mA	V_{CE} V	V_{CEsat} V	f_T MHz	Page
BSS 64	N	80	100	330	80	10	1	≤ 3,0	100	172
BSS 79	N	40	800	330	40 … 300	150	10	≤ 0,3	250	356
BSS 81	N	35	800	330	40 … 300	150	10	≤ 1,3	250	356
BSS 63	P	100	800	330	≥ 30	10	5	≤ 0,9	150	176
BSS 80	P	40	800	330	40 … 300	150	10	≤ 1,6	250	361
BSS 82	P	60	800	330	40 … 300	150	10	≤ 1,6	250	361
SMBT 2222	N	30	600	330	100 … 300	150	10	≤ 0,4	≥ 250	377
SMBT 2222 A	N	40	600	330	100 … 300	150	10	≤ 0,3	≥ 300	377
SMBT 3904	N	40	200	330	100 … 300	10	1	≤ 0,3	≥ 300	389
SMBT 2907	P	40	600	330	100 … 300	150	10	≤ 0,4	≥ 200	383
SMBT 2907 A	P	60	600	330	100 … 300	150	10	≤ 0,4	≥ 200	383
SMBT 3906	P	40	200	330	100 … 300	10	1	≤ 0,4	≥ 250	395

Summary of Types

High voltage transistors

Type		V_{CE0} V	I_C mA	P_{tot} mW	h_{FE} –	I_C mA	V_{CE} V	V_{CEsat} V	f_T MHz	Page
BF 622	N	250	50	1000	≥50	25	20	≤0,5	100	212
BFN 16	N	250	200	1000	≥40	10	10	≤0,4	70	288
BFN 18	N	300	200	1000	≥40	10	10	≤0,5	70	288
BFN 20	N	300	50	1000	≥40	25	20	≤0,5	100	296
BFN 22	N	250	50	360	≥50	25	20	≤0,5	100	304
BFN 24	N	250	200	360	≥40	10	10	≤0,4	60	312
BFN 26	N	300	200	360	≥40	10	10	≤0,5	60	312
BF 623	P	250	50	1000	≥50	25	20	≤0,5	100	216
BFN 17	P	250	200	1000	≥40	10	10	≤0,4	100	292
BFN 19	P	300	200	1000	≥40	10	10	≤0,5	100	292
BFN 21	P	300	50	1000	≥40	25	20	≤0,5	100	300
BFN 23	P	250	50	360	≥50	25	20	≤0,5	100	308
BFN 25	P	250	200	360	≥40	10	10	≤0,4	100	316
BFN 27	P	300	200	360	≥40	10	10	≤0,5	100	316
SMBTA 42	N	300	500	360	≥40	10	10	≤0,5	≥50	409
SMBTA 43	N	200	500	360	≥40	10	10	≤0,4	≥50	409
SMBTA 92	P	300	500	360	≥40	10	10	≤0,5	≥50	413
SMBTA 93	P	200	500	360	≥40	10	10	≤0,4	≥50	413

SIPMOS small-signal transistors

Type	V_{DS} V	I_D mA	P_{tot} mW	I_{DSS} µA	V_{DS} V	$R_{DS(on)}$ Ω	$V_{GS(th)}$ V	Page
● BSS 87	200	280	1000	< 200	200	≤ 6	0,8 ··· 2,8	367
● BSS 123	100	170	360	≤ 15	100	≤ 6	0,8 ··· 2,8	372

Darlington transistors

Type		V_{CE0} V	I_C mA	P_{tot} mW	h_{FE} –	I_C mA	V_{CE} V	V_{CEsat} V	f_T MHz	Page
BCV 27	N	30	500	360	≥20 000	100	5	≤1,0	170	138
BCV 29	N	30	500	1000	≥20 000	100	5	≤1,0	170	146
BCV 47	N	60	500	360	≥10 000	100	5	≤1,0	170	138
BCV 49	N	60	500	1000	≥10 000	100	5	≤1,0	170	146
BCV 26	P	30	500	360	≥20 000	100	5	≤1,0	200	134
BCV 28	P	30	500	1000	≥20 000	100	5	≤1,0	200	142
BCV 46	P	60	500	360	≥10 000	100	5	≤1,0	200	134
BCV 48	P	60	500	1000	≥10 000	100	5	≤1,0	200	142
SMBTA 13	N	30	300	360	≥10 000	100	5	≤1,5	≥125	401
SMBTA 14	N	30	300	360	≥20 000	100	5	≤1,5	≥125	401

● Subject to export licensing

AF transistors

Type	V_{CE0} V	I_C mA	P_{tot} mW	h_{FE} –	I_C mA	V_{CE} V	V_{CEsat} V	f_T MHz	Page
BC 817 N	45	800	330	100 … 630	100	1	≤0,7	170	116
BC 818 N	25	800	330	100 … 630	100	1	≤0,7	170	116
BC 846 N	65	100	330	110 … 450	2	5	≤0,6	200	120
BC 847 N	45	100	330	110 … 800	2	5	≤0,6	200	120
BC 848 N	30	100	330	110 … 800	2	5	≤0,6	200	120
BC 849 N	30	100	330	200 … 800	2	5	≤0,6	200	120
BC 850 N	45	100	330	200 … 800	2	5	≤0,6	200	120
BC 807 P	45	800	330	100 … 630	100	1	≤0,7	200	112
BC 808 P	25	800	330	100 … 630	100	1	≤0,7	200	112
BC 856 P	65	100	330	125 … 475	2	5	≤0,65	250	127
BC 857 P	45	100	330	125 … 800	2	5	≤0,65	250	127
BC 858 P	30	100	330	125 … 800	2	5	≤0,65	250	127
BC 859 P	30	100	330	220 … 800	2	5	≤0,65	250	127
BC 860 P	45	100	330	220 … 800	2	5	≤0,65	250	127
BCW 60 N	32	100	330	120 … 630	2	5	≤0,55	200	150
BCW 65 N	32	800	330	100 … 630	10	5	≤0,70	170	164
BCW 66 N	45	800	330	100 … 630	10	5	≤0,70	170	164
BCX 41 N	125	800	330	≥63	100	1	≤0,90	100	172
BCX 54 N	45	1000	1000	40 … 250	150	2	≤0,5	100	184
BCX 55 N	60	1000	1000	40 … 160	150	2	≤0,5	100	184
BCX 56 N	80	1000	1000	40 … 160	150	2	≤0,5	100	184
BCX 68 N	20	1000	1000	63 … 400	5	10	≤0,50	100	188
BCX 70 N	45	100	330	120 … 630	2	5	≤0,55	200	150
BCW 61 P	32	100	330	120 … 630	2	5	≤0,55	250	157
BCW 67 P	32	800	330	100 … 630	100	5	≤0,70	200	168
BCW 68 P	45	800	330	100 … 630	100	5	≤0,70	200	168
BCX 42 P	125	800	330	≥63	100	1	≤0,90	150	176
BCX 51 P	45	1000	1000	40 … 250	150	2	≤0,5	125	180
BCX 52 P	60	1000	1000	40 … 160	150	2	≤0,5	125	180
BCX 53 P	80	1000	1000	40 … 160	150	2	≤0,5	125	180
BCX 69 P	20	1000	1000	63 … 400	500	1	≤0,50	100	192
BCX 71 P	45	100	330	100 … 630	2	5	≤0,55	250	157
SMBTA 20 N	40	100	330	≥40	5	10	≤0,25	≥125	405

RF broadband transistors

Type	V_{CE0} V	I_C mA	P_{tot} mW	f_T GHz	NF dB	I_C mA	V_{CE} V	G_p dB	I_C mA	V_{CE} V	f MHz	R_g Ω	Page
BFQ 17 P N	25	150	1000	1,4	–	70	5	–	–	–	–	–	320
BFQ 19 P N	15	75	1000	4,8	3,8	50	10	11,5	70	10	800	R_{opt}	323
BFQ 29 P N	15	30	280	4,7	0,9	3	6	–	–	–	10	75	326
BFQ 64 N	20	200	1000	3,0	–	–	–	10	100	10	800	R_{opt}	329
BFQ 81 N	16	30	280	5,8	1,5	5	10	15	5	10	800	50	332
BFR 35 AP N	12	30	280	4,9	2,0	2	6	14	15	6	800	50	335
BFR 92 P N	15	30	280	5,0	2,0	2	6	14	15	6	800	50	339
BFR 93 P N	15	50	280	5,0	2,8	10	8	13	25	8	800	50	342
BFS 17 P N	15	25	280	2,5	3,8	22	5	–	–	–	800	50	345
BFT 92 P	15	25	200	5,0	2,7	2	10	18	14	10	500	R_{opt}	348
BFT 93 P	12	35	200	5,0	2,4	2	5	16,5	30	5	500	R_{opt}	352

Summary of Types

Light emitting diodes

Type	V_R V	I_F mA	P_{tot} mW	Color	λ_{peak} nm	λ_{dom} nm	φ Degrees	V_F V	I_R µA	I_V mcd	Page
LS S210 (CQV 231)	5,0	30	100	super-red	635 ± 15	628	140	2,0	0,01	≥ 0,4	418
LY S210 (CQV 232)	5,0	30	100	yellow	590 ± 10	592	140	2,0	0,01	≥ 0,4	418
LG S210 (CQV 233)	5,0	30	100	green	560 ± 15	561	140	2,0	0,01	≥ 0,4	418
LU S210 (CQV 234)	5,0	30	200	super-red/green	635/560	628/561	140	2,0	0,01	≥ 0,4	418

Position sensor

Type	V_{20} mV	V_{R0} mV	I_{1N} mA	R_{10} Ω	Page
● KSY 13	≈ 100	< ± 30	5	900 … 1200	424

Temperature sensors

Type	$R_{25(max)}$ Ω	R_{25}-Tol. %	I_{max} 25 °C mA	τ Air s	τ Oil s	T_A °C	Page
KTY 13 A	2020	± 1	8	7	1	− 50 … + 150	426
KTY 13 B	2040	± 2	8	7	1	− 50 … + 150	426
KTY 13 C	2100	± 5	8	7	1	− 50 … + 150	426
KTY 13 D	2200	± 10	8	7	1	− 50 … + 150	426

● Subject to export licensing

Index of Ordering Codes
Marking System
Cross Reference Index

Bulk goods

Taped versions

Marking System

Mark	Type	Package
AA	BCW 60 A	SOT 23
AB	BCW 60 B	SOT 23
AB	BCX 51–6	SOT 89
AC	BCW 60 C	SOT 23
AC	BCX 51–10	SOT 89
AD	BCW 60 D	SOT 23
AD	BCX 51–16	SOT 89
AF	BCX 52–6	SOT 89
AF	BCW 60 FF	SOT 23
AG	BCX 52–10	SOT 89
AG	BCX 70 G	SOT 23
AH	BCX 70 H	SOT 23
AJ	BCX 53–6	SOT 89
AJ	BCX 70 J	SOT 23
AK	BCX 53–10	SOT 89
AK	BCX 70 K	SOT 23
AM	BSS 64	SOT 23
AN	BCW 60 FN	SOT 23
BA	BCW 61 A	SOT 23
BB	BCW 61 B	SOT 23
BB	BCX 54–6	SOT 89
BC	BCW 61 C	SOT 23
BC	BCX 54–10	SOT 89
BD	BCW 61 D	SOT 23
BD	BCW 54–16	SOT 89
BF	BCX 55–6	SOT 89
BF	BCW 61 FF	SOT 23
BG	BCX 55–10	SOT 89
BG	BCX 71 G	SOT 23
BH	BCX 71 H	SOT 23
BJ	BCX 56–6	SOT 89
BJ	BCX 71 J	SOT 23
BK	BCX 56–10	SOT 89
BK	BCX 71 K	SOT 23
BM	BSS 63	SOT 23
BN	BCW 61 FN	SOT 23
CB	BCX 68–10	SOT 89
CC	BCX 68–16	SOT 23
CC	BF 554	SOT 23
CD	BCX 68–25	SOT 89
CD	BSS 81 B	SOT 23
CE	BSS 79 B	SOT 23
F	BCX 69–10	SOT 89
CF	BSS 79 C	SOT 23
CG	BCX 69–16	SOT 89
CG	BSS 81 C	SOT 23
CH	BCX 69–25	SOT 89
CH	BSS 80 B	SOT 23
CJ	BSS 80 C	SOT 23
CL	BSS 82 B	SOT 23
CM	BSS 82 C	SOT 23
DA	BCW 67 A	SOT 23
DA	BF 622	SOT 89

Mark	Type	Package
DB	BCW 67 B	SOT 23
DB	BF 623	SOT 89
DC	BCW 67 C	SOT 23
DC	BFN 20	SOT 89
DD	BFN 16	SOT 89
DE	BFN 18	SOT 89
DF	BCW 68 F	SOT 23
DF	BFN 21	SOT 89
DG	BCW 68 G	SOT 23
DG	BFN 17	SOT 89
DH	BCW 68 H	SOT 23
DH	BFN 19	SOT 89
DK	BCX 42	SOT 23
EA	BCW 65 A	SOT 23
EB	BCW 65 B	SOT 23
EC	BCW 65 C	SOT 23
ED	BCV 28	SOT 89
EE	BCV 48	SOT 89
EF	BCV 29	SOT 89
EF	BCW 66 F	SOT 23
EG	BCV 49	SOT 89
EG	BCW 66 G	SOT 23
EH	BCW 66 H	SOT 23
EK	BCX 41	SOT 23
FD	BFQ 17 P	SOT 89
FC	BFQ 64	SOT 89
FD	BCV 26	SOT 23
FE	BCV 46	SOT 23
FE	BFQ 19 P	SOT 89
FF	BCV 27	SOT 23
FG	BCV 47	SOT 23
FH	BFN 24	SOT 23
FJ	BFN 26	SOT 23
FK	BFN 25	SOT 23
FL	BFN 27	SOT 23
FM	BB 804	SOT 89
GA	BAW 78 A	SOT 89
GB	BAW 78 B	SOT 89
GC	BAW 78 C	SOT 89
GD	BAW 78 D	SOT 89
GE	BAW 79 A	SOT 89
GE	BFR 35 AP	SOT 23
GF	BAW 79 B	SOT 89
GF	BFR 92 P	SOT 23
GG	BAW 79 C	SOT 89
GG	BFR 93 P	SOT 23
GH	BAW 79 D	SOT 89
HB	BFN 22	SOT 23
HC	BFN 23	SOT 23
JA	BAV 74	SOT 23
JB	BAR 74	SOT 23
JC	BAL 74	SOT 23
JD	BAW 56	SOT 23

Mark	Type	Package
JE	BAV 99	SOT 23
JF	BAL 99	SOT 23
JG	BAR 99	SOT 23
JJ	BAV 70	SOT 23
JP	BAW 101	SOT 143
JS	BAW 100	SOT 143
JU	BAS 16	SOT 23
KA	BSS 87	SOT 89
KC	BFQ 29 P	SOT 23
L7	BAR 14–1	SOT 23
L8	BAR 15–1	SOT 23
L9	BAR 16–1	SOT 23
LA	BF 550	SOT 23
LE	BF 660	SOT 23
LH	BF 569	SOT 23
LJ	BF 579	SOT 23
LK	BF 799	SOT 23
M1	BAT 14–39	SOT 23
M2	BAT 14–38	SOT 23
MA	BF 989	SOT 143
MB	BF 995	SOT 143
MC	BF 994	SOT 143
MC	BFS 17 P	SOT 23
MD	BF 996	SOT 143
ME	BF 993	SOT 143
MF	BF 989 S	SOT 143
MG	BF 994 S	SOT 143
MH	BF 996 S	SOT 143
NB	BF 599	SOT 23
RA	BFQ 81	SOT 23
SA	BSS 123	SOT 23
SB	SMBT 2222	SOT 23
SC	SMBT 2222 A	SOT 23
SD	SMBT 2907	SOT 23
SE	SMBT 2907 A	SOT 23
SF	SMBTA 13	SOT 23
SG	SMBTA 14	SOT 23
SH	SMBTA 20	SOT 23
SJ	SMBTA 92	SOT 23
SK	SMBTA 93	SOT 23
SL	SMBTA 42	SOT 23
SM	SMBTA 43	SOT 23
SN	SMBT 3904	SOT 23
SO	SMBT 3906	SOT 23
TA	KTY 13 A	SOT 23
TB	KTY 13 B	SOT 23
TC	KTY 13 C	SOT 23
TD	KTY 13 D	SOT 23

Mark	Type	Package
S13	KSY 13	SOT 143
U1	BGX 50 A	SOT 143
W1	BFT 92	SOT 23
X1	BFT 93	SOT 23
1A	BC 846 A	SOT 23
1B	BC 846 B	SOT 23
1E	BC 847 A	SOT 23
1F	BC 847 B	SOT 23
1G	BC 847 C	SOT 23
1J	BC 848 A	SOT 23
1K	BC 848 B	SOT 23
1L	BC 848 C	SOT 23
2B	BC 849 B	SOT 23
2C	BC 849 C	SOT 23
2F	BC 850 B	SOT 23
2G	BC 850 C	SOT 23
3A	BC 856 A	SOT 23
3B	BC 856 B	SOT 23
3E	BC 857 A	SOT 23
3F	BC 857 B	SOT 23
3G	BC 957 G	SOT 23
3J	BC 858 A	SOT 23
3K	BC 858 B	SOT 23
3L	BC 858 C	SOT 23
4A	BC 859 A	SOT 23
4B	BC 859 B	SOT 23
4C	BC 859 C	SOT 23
4F	BC 860 B	SOT 23
4G	BC 860 C	SOT 23
44	BAS 40–04	SOT 23
45	BAS 40–05	SOT 23
46	BAS 40–06	SOT 23
5A	BC 807–16	SOT 23
5B	BC 807–25	SOT 23
5C	BC 807–40	SOT 23
5F	BC 808–16	SOT 23
5G	BC 808–25	SOT 23
5H	BC 808–40	SOT 23
53	BAT 17	SOT 23
6A	BC 817–16	SOT 23
6B	BC 817–25	SOT 23
6C	BC 817–40	SOT 23
6F	BC 818–16	SOT 23
6G	BC 818–25	SOT 23
6H	BC 818–40	SOT 23
74	BAS 70–04	SOT 23
75	BAS 70–05	SOT 23
76	BAS 70–06	SOT 23

Cross Reference Index

Conventional technology	SM technology
1N 4148	BAL 99/BAR 99
1N 4148 (2x)	BAV 74/BAV 70
	BAV 99/BAW 56
2N 2222	BSS79
2N 2907	BSS80
2N 3904	SMBT 3904
2N 3906	SMBT 3906
BB 304	BB 804
BC 237	BC 847
BC 238	BC 848
BC 239	BC 849
BC 307	BC 857
BC 308	BC 858
BC 309	BC 859
BC 327	BC 807
BC 328	BC 808
BC 337	BC 817
BC 338	BC 818
BC 368	BCX 68
BC 369	BCX 69
BC 413	BC 850
BC 414	BC 850
BC 415	BC 860
BC 416	BC 860
BC 516	BCV 26/46
BC 517	BCV 27
BC 546	BC 846
BC 547	BC 847
BC 548	BC 848
BC 549	BC 849
BC 550	BC 850
BC 556	BC 856
BC 557	BC 857
BC 558	BC 858
BC 559	BC 859
BC 560	BC 860
BC 617	BCV 47
BC 618	BCV 47
BC 635	BCX 54
BC 636	BCX 51
BC 637	BCX 55
BC 638	BCX 52
BC 639	BCX 56
BC 640	BCX 53
BCX 22	BCX 41
BCX 23	BCX 42
BCX 58	BCW 60
BCX 59	BCX 70
BCX 78	BCW 61
BCX 79	BCX 71
BCX 58	BCW 60
BCY 59	BCX 70
BCY 66	BCW 60 F

Conventional technology	SM technology
BCY 67	BCW 61 F
BCY 78	BCW 61
BCY 79	BCX 71
BF 199	BF 599
BF 254	BF 554
BF 420	BFN 20
BF 421	BFN 21
BF 422	BFN 22/BF 622
BF 423	BFN 23/BF 623
BF 450	BF 550
BF 606 A	BF 660
BF 959	BF 799
BF 960	BF 989
BF 960 S	FB 989 S
BF 961	BF 995
BF 963	BF 993
BF 964	BF 994
BF 964 S	BF 994 S
BF 966	BF 996
BF 966 S	BF 996 S
BF 968	BF 568
BF 970	BF 569
BF 979 S	BF 579
BFP 22	BFN 24/17 SMBTA 43
BFP 23	BFN 25/17 SMBTA 93
BFP 25	BFN 26/18 SMBTA 42
BFP 26	BFN 27/19 SMBTA 92
BFW 16 A	BFQ 17
BFQ 23	BFT 93
BFQ 51	BFT 92
BFR 34 A	BFR 35 A
BFR 90	BFR 92
BFR 91	BFR 93
BFR 96	BFQ 19
BFT 65	BFT 75
BFT 97	BFQ 29
BFT 98 T	BFQ 64
BFW 92	BFS 17
BFX 89	BFS 17
BSS 89	BSS 87
BSS 91	BSS 87
CQV 11/21	LS S 210
CQV 13/23	LY S 210
CQV 15/25	LG S 210
LD 100	LU S 210
KTY 10	KTY 13A/B/
KSY 10	KSY 13
MPSA 42	SMBTA 42
MPSA 43	SMBTA 43
MPSA 92	SMBTA 92
MPSA 93	SMBTA 93
MPS 2222/A	SMBT 2222/A
MPS 2907/A	SMBT 2907/A

Technical Information
Packages
Quality

Symbols and terms

Diodes

C	Capacitance
C_D	Diode capacitance
C_{D2V}/C_{D8V}	Capacitance ratio
C_j	Junction capacitance
D	Duty cycle
f	Frequency
I_F	Forward current
I_{FM}	Peak forward current
I_{FAV}	Max. mean forward current
I_{FRMS}	Max. rms forward current
I_{FSM}	Max. surge forward current
I_R	Reverse current
NF	Noise figure
P_{tot}	Total power dissipation
Q	Quality factor
R	Resistance
R_F	RF forward resistance
R_i	Internal resistance
R_{thJA}	Thermal resistance, junction - ambient
r_f	Differential forward resistance
r_S	Series resistance
T	Temperature
T_C	Case temperature
TC_C	Temperature coefficient of junction capacitance
T_j	Junction temperature
T_{stg}	Storage temperature range
t	Time
t_p	Pulse duration
t_{rr}	Reverse recovery time
V	Voltage
$V_{(BR)}$	Breakdown voltage
V_F	Forward voltage
V_{FR}	Forward recovery voltage
V_R	Reverse voltage
V_{RRM}	Max. repetitive peak reverse voltage
τ_L	Charge carrier life time

Transistors

C_{dg1}	Drain-gate 1 capacitance
C_{dss}	Output capacitance
C_{g1ss}	Gate 1 input capacitance
C_{g2ss}	Gate 2 input capacitance
C_{ib}	Input capacitance, common-base configuration
C_{iss}	Input capacitance, common-source configuration

C_{ob}	Output capacitance, common-base configuration
C_{oss}	Output capacitance, common-source configuration
C_{re}	Collector-base feedback capacitance
C_{rb}	Collector-emitter feedback capacitance
C_{rss}	Reverse transfer capacitance
C_{11e}	Capacitance of short-circuit input admittance (of parameter y_{21})
C_{22e}	Capacitance of short-circuit output admittance (of parameter y_{22})
D	Duty cycle
d_{IM}	Intermodulation distortion
dv/dt	Voltage transconductance
f	Frequency
f_{IF}	Intermediate frequency
f_T	Transition frequency
G_{FSC}	Mixer gain (multiplicative)
G_G	Intrinsic generator inductance
G_L	Load conductance
G_P	Power gain
G_{Popt}	Optimum power gain
G_{ps}	Power gain
ΔG_{ps}	Control range
G_{psC}	Mixer gain additive
g_{fs}	Forward transconductance
g_{fs1}	Gate 1 forward transconductance
g_{11e}	Effective short-circuit input transconductance (of parameter y_{11})
g_{22e}	Effective short-circuit output transconductance (of parameter y_{22})
h_{FE}	DC current gain
h_{11e}	Short-circuit input impedance
h_{12e}	Open-circuit reverse voltage transfer ratio
h_{21e}	Short-circuit forward current transfer ratio
h_{22e}	Open-circuit output admittance
I_B	Base current
I_{BM}	Peak base current
I_C	Collector current
I_{CB0}	Collector cutoff current
I_{CER}	Collector cutoff current with resistance between base and emitter
I_{CES}	Collector cutoff current with short-circuited emitter diode
I_{CM}	Peak collector current
I_D	Drain current
I_{Dpuls}	Pulsed drain current
I_{DR}	DC current
I_{DRM}	Pulsed dc current
I_{DSS}	Zero gate voltage drain current
I_E	Emitter current
I_{EB0}	Emitter cutoff current
I_{EM}	Peak emitter current
I_F	Forward current
I_{GSS}	Gate-source leakage current
$+I_{G1/2SM}$	Gate 1/gate 2 peak source current

$\pm I_{G1SS}$	Gate 1 source leakage current
$\pm I_{G2SS}$	Gate 2 source leakage current
I_R	Reverse current
NF	Noise figure
P_{tot}	Total power dissipation
Q_{rr}	Reverse recovery charge
r_{th}	Thermal resistance
$R_{DS\,(on)}$	Drain source on-state resistance
R_G	Internal resistance of generator
R_{GS}	Gate-source resistance
R_L	Load resistance
R_s	Series resistance
R_{thJA}	Thermal resistance, junction - ambient
τ_{CB}	Collector-base time constant
T_A	Ambient temperature
T_C	Case temperature
T_{ch}	Channel temperature
T_j	Junction temperature
T_{stg}	Storage temperature
t_d	Delay time
t_f	Fall time
t_r	Rise time
t_{stg}	Storage time
t_{off}	Turn-off time
t_{on}	Turn-on time
V_B	Base voltage
V_{BE}	Base-emitter voltage
$V_{BE\,(on)}$	Base-emitter voltage
$V_{BE\,(off)}$	Base-emitter voltage
V_{BEsat}	Base-emitter saturation voltage
$V_{(BR)\,CBO}$	Collector-base breakdown voltage
$V_{(BR)\,CEO}$	Collector-emitter breakdown voltage
$V_{(BR)\,CER}$	Collector-emitter breakdown voltage with resistance between base and emitter
$V_{(BR)\,DSS}$	Drain-source breakdown voltage
$V_{(BR)\,EBO}$	Emitter-base breakdown voltage
$\pm V_{(BR)\,G1SS}$	Gate 1 source breakdown voltage
$\pm V_{(BR)\,G2SS}$	Gate 2 source breakdown voltage
V_{CB}	Collector-base voltage
V_{CBO}	Collector-base voltage
V_{CC}	Collector supply voltage
V_{CE}	Collector-emitter voltage
V_{CEM}	Peak collector-emitter voltage
V_{CEO}	Collector-base voltage
V_{CER}	Collector-emitter voltage with resistance between base and emitter
V_{CES}	Collector-emitter voltage with short-circuited emitter diode
V_{CEsat}	Collector-emitter saturation voltage
V_{DGR}	Drain-gate voltage
V_{DS}	Drain-source voltage

V_{EBO}	Emitter-base reverse voltage
V_F	Forward voltage
V_{GS}	Gate-source voltage
$V_{GS\,(th)}$	Gate threshold voltage
$-V_{G1S(p)}$	Gate 1 source pinch-off voltage
$-V_{G2S(p)}$	Gate 2 source pinch-off voltage
V_{neq}	Equivalent noise voltage
V_{SD}	Diode forward on-voltage
V_0, V_{01}, V_{02}	Open-circuit output voltage
y_{11s}	Gate 1 input admittance
y_{12}	Reverse transfer admittance
$\|y_{21e}\|$	Short-circuit forward transfer admittance
y_{21s}	Gate 1 forward transfer admittance
y_{22}	Gate 1 output admittance

Light emitting diodes

D	Duty cycle
I_F	Forward current
I_R	Reverse current
I_V	Luminous intensity
i_{FS}	Surge current
P_{tot}	Total power dissipation
R_{thJA}	Thermal resistance, junction - ambient
T_j	Junction temperature
T_{stg}	Storage temperature range
V_F	Forward voltage
V_R	Reverse voltage
λ_{peak}	Wavelength at peak emission
λ_{dom}	Dominant wavelength
φ	Viewing angle

Sensors

$\hat{I}$	Peak current
I	Operating dc current
R_{thJA}	Thermal resistance, junction - ambient
R_{25}	Rated resistance
T_A	Ambient temperature
T_{stg}	Storage temperature range
τ	Thermal time constant

Maximum ratings

The maximum ratings specified in the individual data sheets are absolute ratings and apply to a temperature of 25 °C, unless otherwise specified. Exceeding the maximum ratings may result in the destruction of the component, even if other ratings remain below the specified maximums.

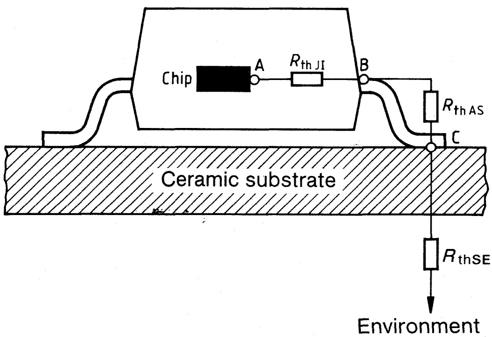
Characteristics

The characteristics in the data sheets are subdivided into maximum, typical and minimum values which apply to 25 °C as well. The typical values correspond in general to the median.
Characteristics describe the component behavior at defined operating points. Static characteristics describe the behavior at dc operation, and dynamic characteristics at ac and pulse operation.
The numerical values and diagrams characterize component types; for reasons of device deviation, they should not be understood as ratings for an individual component. The spread is either specified by way of figures or by characteristic curves.

Thermal resistance

The heat dissipation of SMCs depends on material and thickness of the PC board and of the conductor paths (inherent heating), as well as on the packing density (external heating). Hence, inherent and external heating determine the junction temperature, and thus the permissible thermal stress of SMCs.
The values for thermal resistance given in the data sheets should only be used for rough estimations of the junction temperature T_j, since they were measured under certain laboratory conditions, where no regard was paid to specific applications.
The thermal resistance can be calculated by:

$$R_{thJA} = R_{thJI} + R_{thAS} + R_{thSE}$$



R_{thJI} = Thermal resistance between junction and terminals of the component

R_{thAS} = Thermal resistance between terminals and soldering surfaces of the substrate

R_{thSE} = Thermal resistance between substrate and environment, e.g. air or cooling area

The **internal thermal resistance** R_{thJI} is determined by the constructional design of the component and can therefore be exactly specified, whereas the **external thermal resistance,** being the sum of $R_{thAS} + R_{thSE}$, depends on the individual application.

Groups according to total power dissipation

SMCs are grouped according to their max. permissible power dissipation P_{tot}:

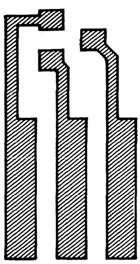
Group	Package: SOT 23, SOT 143
I	RF transistors, small-signal diodes, MOSFETs, sensors
II	AF and switching transistors, LEDs
III	Darlington and power transistors

Group	Package: SOT 89
I	RF transistors
II	AF transistors

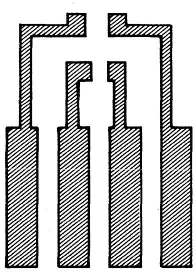
Groups according to thermal resistances

Thermal resistance	Package: SOT 23, SOT 143			SOT 89	
	Group I	II	III	I	II
R_{thJI}	355 K/W	280 K/W	255 K/W	20 K/W	20 K/W
R_{thAS}	30 K/W	30 K/W	30 K/W	15 K/W	15 K/W
R_{thSE}	65 K/W	65 K/W	65 K/W	90 K/W	90 K/W
R_{thJA}[1])	450 K/W	375 K/W[2])	350 K/W	125 K/W	125 K/W

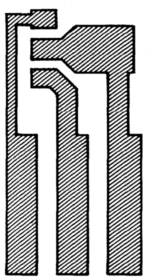
In order to obtain a reduced thermal resistance, the metallic surface for the connection of the collector is enlarged. This is particularly effective when epoxy PCBs with low heat conductivity are used.



SOT 23



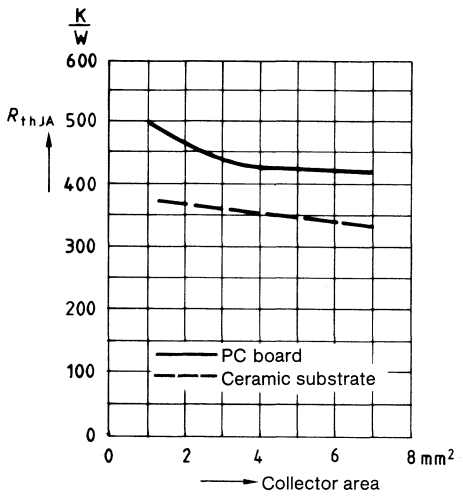
SOT 143



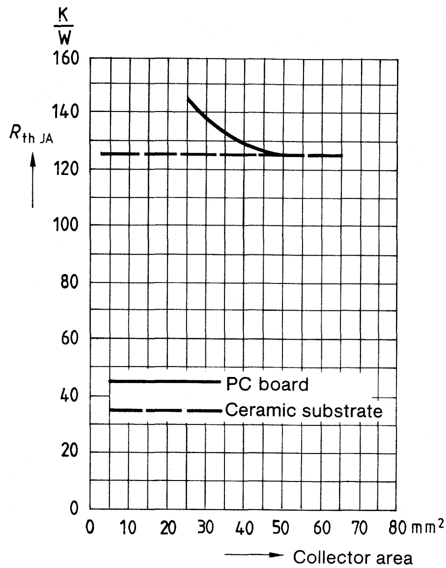
SOT 89

[1]) The data represents a typical value for the various component groups, which relates to a uniform alumina substrate, 15 mm × 16.7 mm × 0.7 mm in size.
[2]) The value applies to LEDs when operated with two systems (in case of one system: 750 K/W).

Thermal resistance for SOT 23/SOT 143



Thermal resistance for SOT 89



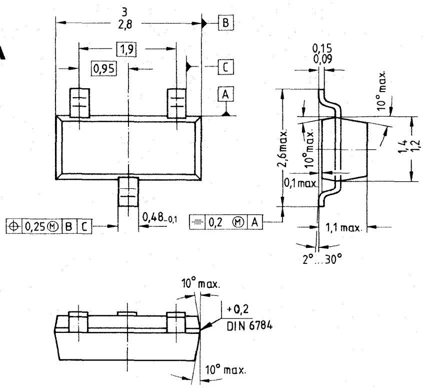
Generally, these specifications suffice to determine the junction temperature T_j.
The determination of the junction temperature via the temperature dependence of the diode path is more exact, however, it is extremely complicated.
If it becomes nevertheless necessary to exactly determine the junction temperature T_j, the temperature T_A of the component connections has to be measured. Then T_j can be calculated by:

$$T_j = T_A + R_{thJl} \times P_{tot}$$

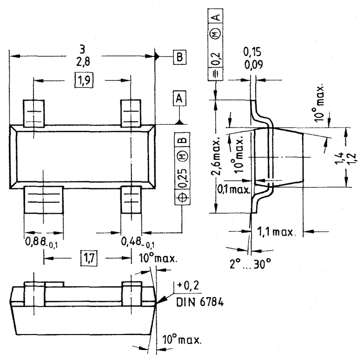
Methods for measuring the temperature at component connections

- **Measuring with thermocouple element** (e.g. Thermocoax)
  For this method a miniature coated thermocouple element with low thermal capacitance is used. The element, which is coated with a heat-conducting paste, is pressed against the connection with the collector. There is hardly any influence on the device under measurement and deviations do not exceed a few percent.
- **Measuring with temperature indicators** (e.g. thermopaper)
  Temperature indicators do not cause heat dissipation and thus allow an almost exact determination of temperature. A certain degree of deviations can only result from the rough grade indication of the temperature indicators. This method is quite easy and provides sufficient accuracy. It is particularly suitable for measurement on PC boards.

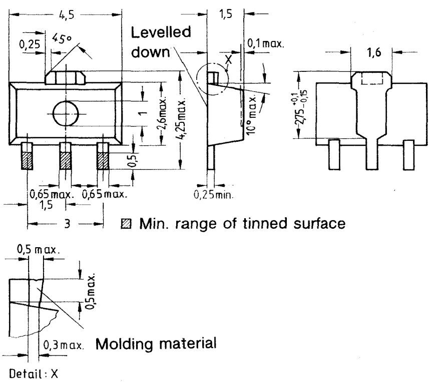
Package: Version A (SOT 23)



Package: Version B (SOT 143)



Package: Version C (SOT 89)



Dimensions in mm

AQL values and definitions of defects for electronic components

Explanations

AQL (**a**cceptable **q**uality **l**evel) agreements specify the sampling conditions for the incoming inspection of consignments (conformance test). AQL values in conjunction with the standard sampling inspection plans determine the acceptance or rejection of delivery lots. The size and maximum permissible number of defects of the samples is based on DIN 40080 (identical with MIL Standard 105D and IEC 410), single sampling plan for normal inspection, inspection level II. The sampling instructions of this standard are such that a delivery lot will most probably be accepted (>90%) if the defect percentage is equal or less than the specified AQL value. Generally, the average defect percentage of the products we deliver is far below the AQL value.

Definition of defects

A component is considered defective if it does not comply with the characteristics specified in the data sheet or in an agreed upon delivery specification. Defects can be divided into inoperatives, which generally exclude a functional application of the component, and defects of less significance.

Inoperatives are:

- open or short circuit,
- broken component, package, terminals or encapsulation,
- missing or incorrect marking,
- incorrect identification of terminals,
- intermixing with other component types,
- alternating orientation in a packaging tube or tape.

The remaining defects can be divided into:

- electrical defects
  (maximum ratings exceeded),
- mechanical defects, e.g. dimensions not adhered to, package damaged, illegible marking, bent leads.

Grouping into major defects and minor defects according to DIN 40080 has been purposely avoided here because these terms are defined primarily on the basis of applications and not specifications. In contrast to this the defect classes that we use – for which AQL values are given below – are clearly outlined by the specification and the mentioned inoperatives.

AQL values

The AQL values valid for the different product families are comprised in the following table:

Defect type	AQL values
Inoperative (mechanical and electrical)	0.1
Σ electrical defects	0.4
Σ mechanical defects	0.4

for switching times and noise measurements an AQL of 1.5 applies.

Incoming inspection
If the user wants to carry out an incoming inspection, the use of a sampling inspection plan is recommended. The test method that is applied must be agreed upon between the user and the supplier.
The following information is necessary for judging any claims that may arise: test circuit, sample size, number of defective items found, sample of evidence, packing list.

Sampling plan for normal inspection
in accordance with DIN 40080 or ABC-Std 105D, inspection level II

Lot size	Sample size	AQL value										
		0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5
		A R	A R	A R	A R	A R	A R	A R	A R	A R	A R	A R
2 to 8	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1
9 to 15	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑
16 to 25	5	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓
26 to 50	8	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2
51 to 90	13	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3
91 to 150	20	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4
151 to 280	32	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6
281 to 500	50	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8
501 to 1200	80	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11
1201 to 3200	125	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15
3201 to 10000	200	0 1	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22
10001 to 35000	315	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑
35001 to 150000	500	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑
150001 to 500000	800	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
500001 and more	1250	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑

A = Acceptance number, i.e. maximum number of defective units in a sample up to which a lot is accepted.
R = Rejection number, i.e. the number of defective units which must be found in a sample as a minimum for rejection of the lot.

Additional conditions:

As the combination "Acceptance 0/Rejection 1" is not particularly clear, the next largest sample should be taken.

Notes

Stating AQL values is no assurance of characteristics in a legal sense. The agreement of sampling inspections and AQL values does not prevent the customer from carrying out more extensive tests in incoming inspection and claiming replacements for individual defective components under the terms of sale. Any further liability, especially as regards the consequences of component defects, cannot be recognized.

Mounting Instructions

Supply for automatic assembly

In contrast to leaded components practically all leadless types can be supplied in two package forms:

- Bulk
- Tapes

Bulk

The most straightforward and low-cost form of how SMCs can be delivered is in bulk. Contrary to leaded components, leadless components can be supplied in this type of packaging for automatic assembly as no bending or interlocking of their terminals can occur. At the assembly machine the components are suitably positioned. In case of need a large quantity of components can thus be supplied in line, i.e. without interrupting the assembly procedure.

Packaging units

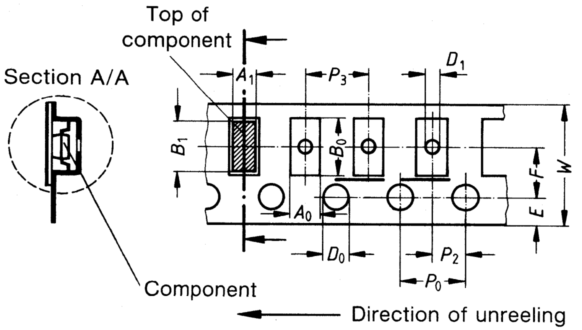
Component	Unit	Packing
Diodes Transistors LEDs Sensors	1000 pieces	Plastic container
MOSFETs	2000 pieces	Antistatic container

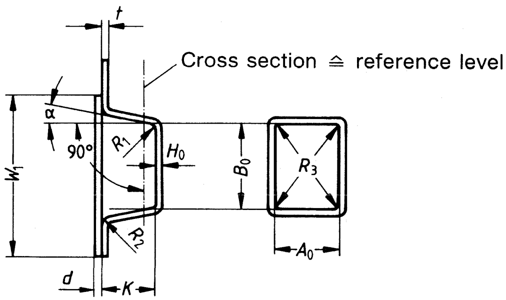
Tape

The tape is a very frequently used form of supplying surface mounted components. The major benefit of the tape method is that it permits non-interchangeable keeping and meets the requirements of most assembly machines. Cardboard and blister tapes are available tape forms.

The blister tape has preformed compartments corresponding to the component size, which are covered with fixing tape. Blister tapes consist either of plastic material or of plastic-clad aluminum foil. The advantages of the aluminum foil are i.a. its high dimensional stability and its protection against electrostatic charge. For this reason we exclusively use aluminum tapes for packaging our discrete semiconductors. The tapes are internationally standardized in accordance with DIN IEC 286 (at present only draft). This ensures that the tapes are accepted by all machines designed for this kind of assembly. The tape width is generally between 8 mm and 12 mm.

Blister tape





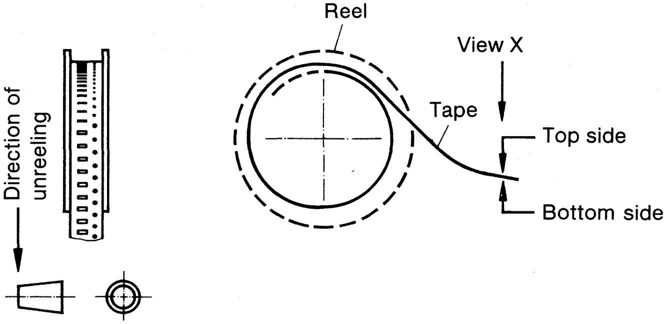
Dimensional table for blister tape

The following table contains only dimensions which are important for taping the components.

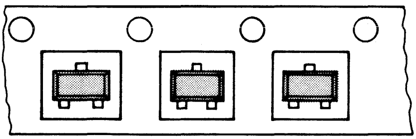
Designation	Symbol	Dimensions (mm)		Notes
		SOT 23 SOT 143	SOT 89	
Tape width	W	8 ± 0.3	12 ± 0.3	
Carrier tape thickness	t	0.3 max	0.3 max	
Pitch of sprocket holes	P_0	4 ± 0.1	4 ± 0.1	Cumulative pitch error $+ 0.2$ mm/10 pitches
Diameter of sprocket holes	D_0	$1 + 0.2$	$1.5 + 0.1$	
Distance of sprocket holes	E	1.75 ± 0.1	1.75 ± 0.1	
Distance of components	F	3.5 ± 0.05	5.5 ± 0.1	Center hole to center compartment
	P_2	2 ± 0.05	2 ± 0.05	
Distance compartment to compartment	P_3	4	8	Every two pitches (SOT 89)
Compartment dimensions	K	2.5 max	4.5 max	Exact dimensions are given with the component dimensions
	α	15° max	15° max	
	R_1, R_2	0.3 max	0.5 max	
	H_0	$0.3^{+0.1}_{-0.05}$	$0.3^{+0.1}_{-0.05}$	Between inner side of the compartment bottom and the reference level for measuring A_0, B_0
Compartment	A_0 B_0	The tolerances are chosen such that the components can change their orientation only within permissible tolerances, but can easily be removed from the tape.		
Hole in compartment	D_1	$1^{+0.2}_{-0.05}$	$1.5 + 0.2$	Tolerance to the center of the sprocket hole: 0.1 mm
Width of fixing tape	W_1 d	5.5 typ 0.1 max	9.5 typ 0.1 max	The fixing tape shall not cover the sprocket holes, nor protrude beyond the carrier tape so that the max. tape width will not be exceeded.
Device tilt in the compartment	–	15° max	15° max	
Minimum bending radius	–	30 min	30 min	

Polarity and orientation of components

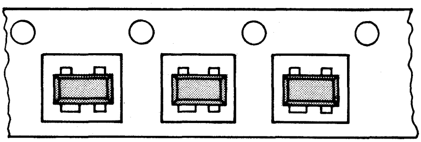
All polarized components are oriented in one direction. The mounting side is oriented to the bottom side of the component compartment. The bottom side is defined as the invisible side of the tape during unreeling.



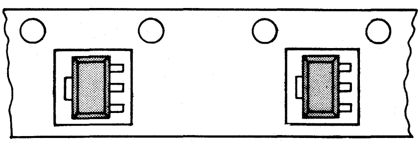
View X (Top side)



Package
SOT 23



Package
SOT 143



Package
SOT 89

Fixing of components

Components are prevented from falling out of the component compartment by a transparent fixing tape.

Storage of tapes

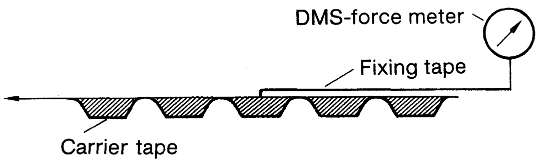
The permissible storage temperature is +45 °C at a relative humidity of ≤ 95%.

Break force of fixing tape

The maximum break force of the tape is ≥10 N.

Peel force of fixing tape

During peel-off the angle between the fixing tape and the direction of unreeling is 180°. The peel force of the fixing tape ranges from 0.2 N to 1.0 N; the peel speed is about 300 mm/min.



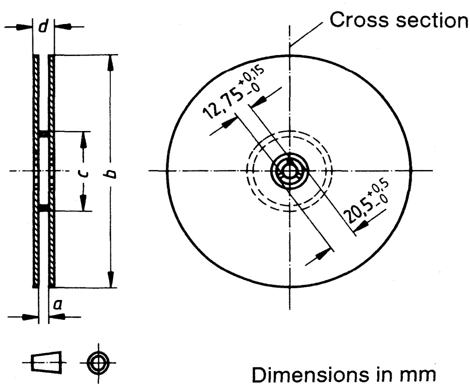
Peel speed of fixing tape

The fixing tape can be peeled off up to a max. speed of 5 divisions ≙ 20 mm/s.

Reel dimensions

Tapes are delivered on reels as shown in the adjacent illustration. The reels are packed in covers for protection from damage.

Dimensions (mm)	SOT 23 SOT 143	SOT 89
a	8.4+1.5	12.4+1.5
b	180 max	180 max
c	60 min	60 min
d	14.4 max	18,4 max



Mounting Instructions

Packaging units

Package	Components per reel
SOT 23, SOT 143 SOT 89	3000 pieces 1000 pieces

Labelling

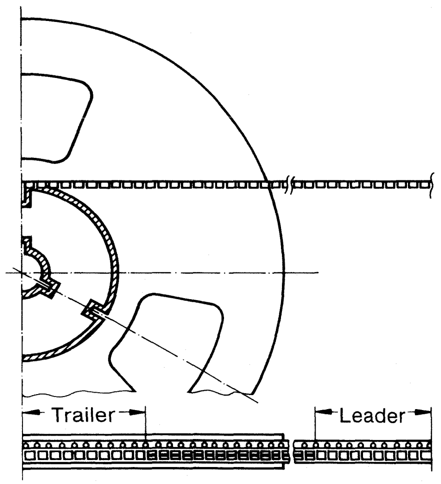
Each reel is labelled with manufacturer, type, series number, and date.

Missing components

A maximum of two consecutive components may be missing, provided that this gap is followed by six components. The number of empty places shall not exceed 0.25% of the total number of components per reel. Upon request, other agreements are possible.

Leader and trailer

Fixing tape with carrier tape without components	
Leader	Trailer
min. 200 mm (50 pitches) max. 1400 mm (100 pitches)	min. 40 mm (10 pitches) max. 100 mm (25 pitches)



Tape packaging of ESD components

SMCs can also be supplied on tapes including protection against electrostatic charges. When packaging the reel has therefore to be electrically connected with the assembly machine.
The assembly machine has to be grounded.
This method of taping complies with IEC/T 640.

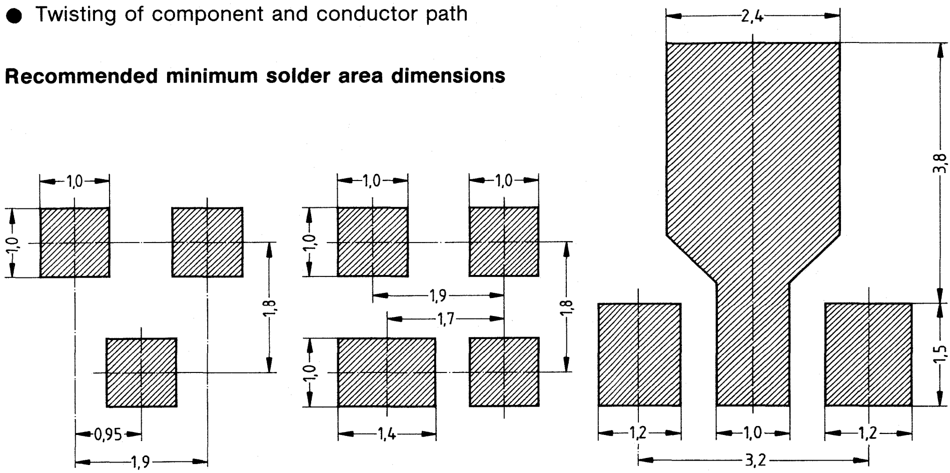
ESD = **E**lectrostatically **S**ensitive **D**evices

PCB layout

Upon introduction of surface-mounted components, the PCB layout has to be accomodated to this new technology. This demand should be fulfilled not only to better utilize the packing density but also to meet the requirements resulting from the new inserting and processing system. Some reference points for the PCB design are:

- Distance between conductor paths
- Component tolerances
- Distance between components
- Twisting of component and conductor path

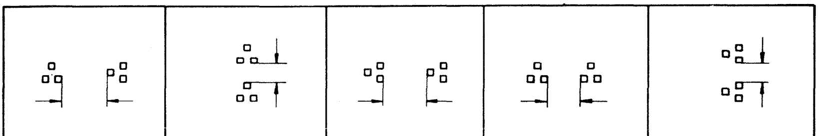
Recommended minimum solder area dimensions



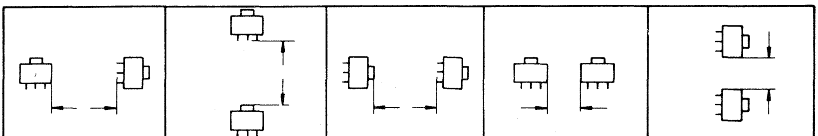
SOT 23 SOT 143 SOT 89

Recommended mounting position for wave soldering

Distance of mounting positions (mm)
Direction of waving



SOT 23 (SOT 143)	1,5	0,6	1,5	1	0,6



SOT 89	2	2	2	1	1

 Undue mounting position

Glueing

Prior to wave soldering, SMCs must be fixed to the PCB by means of an appropriate adhesive. The adhesive (in most cases a multicomponent adhesive) has to fulfill the following demands:

- Uniform viscosity to ensure easy coating
- No chemical reactions upon hardening in order not to deteriorate component and PC board
- Straightforward exchange of components in case of repair

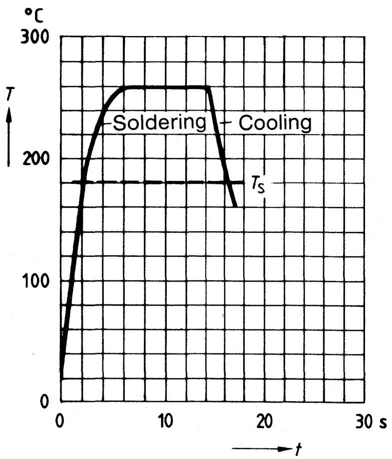
Soldering methods

The soldering method is particularly important for obtaining good electrical connections and inhibiting short circuits. The choice of the soldering method largely depends on the design of the PC board (single, double-clad, multilayer board, etc.), on the supplied components and the production facilities.
In addition to hand soldering, which should only be used for laboratory and repair purposes, there are mechanical soldering methods such as wave and reflow soldering.

Wave soldering

Wave soldering is the soldering method which is at present applied in most cases. There are a number of powerful machines which are suitable for the most diversified applications. With a maximum bath temperature of 260 °C the soldering time should not exceed 8 s (see diagram). Prior to the wave the flux is attached by a fluxer.
The previous wave soldering method will be improved by a double-wave solder bath. Under high pressure the first wave then deposits the solder onto all joints to be soldered regardless of possible short circuits. The immediately following second wave now removes the remaining solder and clears the existing short circuits.

Max. perm. temperature stress at the component (soldering without preheating)



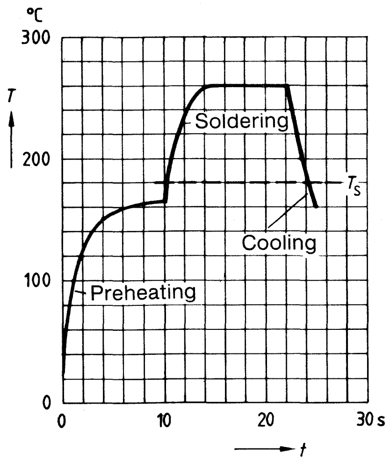
T_S = Melting point of the solder

Reflow soldering

If reflow soldering is used, the components and soldering pads must at least at one side be wetted or covered with solder or solder paste. In the form of paste the solder can be applied to the footprint pads; this is done in most cases by screen printing or in pattern technique. The most important reflow soldering methods are:

- Vapor phase soldering
- Hot gas soldering
- Solder bridge

Max. perm. temperature stress at the component (soldering with preheating)



Iron soldering

Soldering with a temperature-controlled miniature iron, for example, is permissible. It is, however, important to ensure that the tip does not come into contact with the component. This method should nevertheless only be used in exceptional cases (repairs, etc.).

Soldering flux

- The soldering flux used for wave soldering is not subject to changes, i. e. use of collophony (F-SW 32 in acc. with DIN 8511).
- If solder pastes are used, however, most of them contain aggressive fluxes, the residues of which must be removed in any case by cleaning.

PCB cleaning

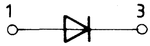
- Cleaning in solvents is permitted at approx. 70 °C to 80 °C for about 15 seconds. Detailed information is available upon request.
- Ultrasonic cleaning (double half-wave operation)
  Ultrasonic cleaning is less advisable; should it, however, be used, the following have to be taken into account:

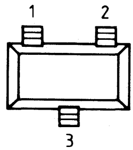
Cleaning agent:	Isopropanol, Freon
Bath temperature:	approx. 30 °C
Duration of cleaning:	max. 30 s
Ultrasonic frequency:	40 kHz
Ultrasonic changing pressure:	approx. 0.5 bar

Diodes

Silicon planar epitaxial diode

- For high-speed switching applications
- Peak reverse voltage 50 V





Top view

Type	Marking	Ordering code	Package
BAL 74	JC	Refer to index	Version A

Maximum ratings

Reverse voltage	V_R	50 V
Repetitive peak reverse voltage	V_{RRM}	50 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25$ °C	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

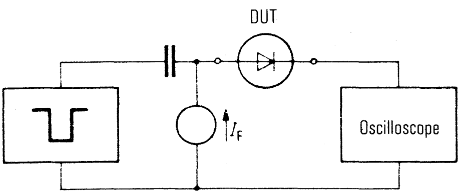
Characteristics

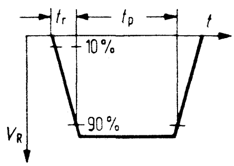
at $T_A = 25\,°C$, unless otherwise specified

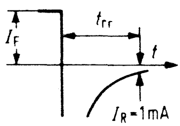
Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	50	–	–	V
Max. forward voltage $I_F = 100\,mA$	V_F	–	–	1,0	V
Reverse current $V_R = 50\,V$ $V_R = 50\,V$, $T_A = 150\,°C$	I_R	 – –	 – –	 0,1 100	 µA µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0\,V$, $f = 1\,MHz$	C_0	–	–	2,0	pF
Reverse recovery time $I_F = 10\,mA$, $I_R = 10\,mA$, $R_L = 100\,\Omega$, measured at $I_R = 1\,mA$	t_{rr}	–	–	4	ns

Test circuit for reverse recovery time



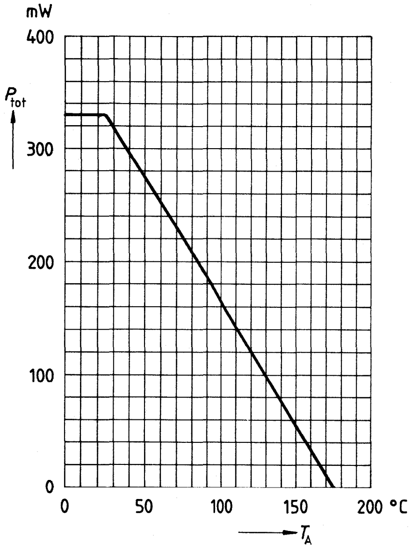




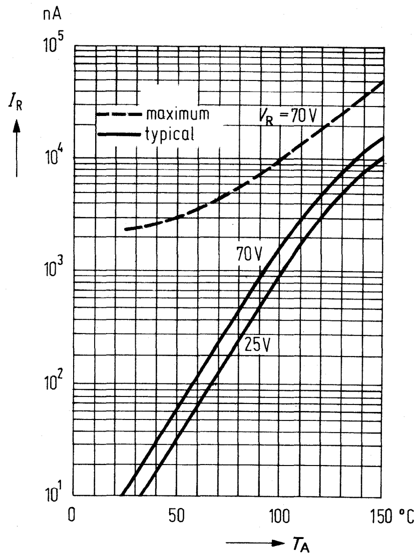
Pulse generator: $t_p = 100\,ns$, $D = 0{,}05$
$t_r = 0{,}6\,ns$, $R_i = 50\,\Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35\,ns$
$C \leq 1\,pF$

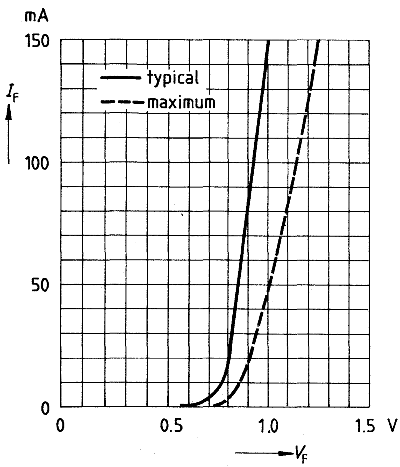
Total power dissipation $P_{tot} = f(T_A)$



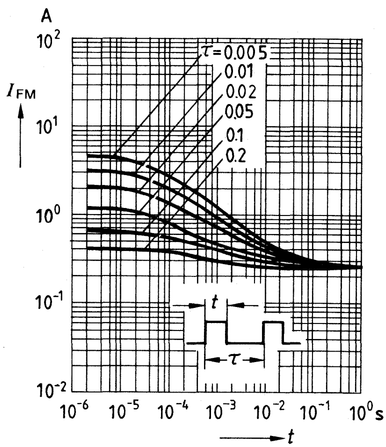
Reverse current $I_R = f(T_A)$



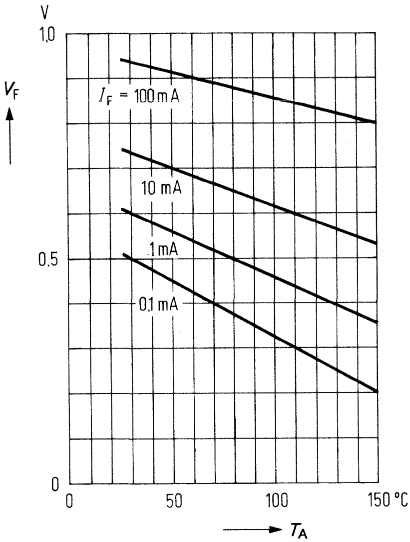
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

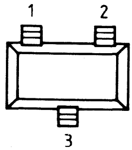


Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial diode

- For high-speed switching applications
- Peak reverse voltage 70 V



Top view

Type	Marking	Ordering code	Package
BAL 99	JF	Refer to index	Version A

Maximum ratings

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current	I_{FAV}	250 mA
$t = 20$ ms, $t_p = 10$ ms Surge forward current	I_{FSM}	4,5 A
$t = 1$ µs Total power dissipation	P_{tot}	330 mW
$T_A = 25\,°C$ Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.5 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

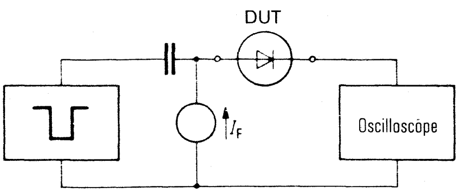
Characteristics

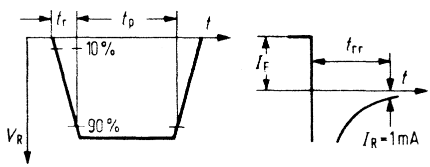
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time

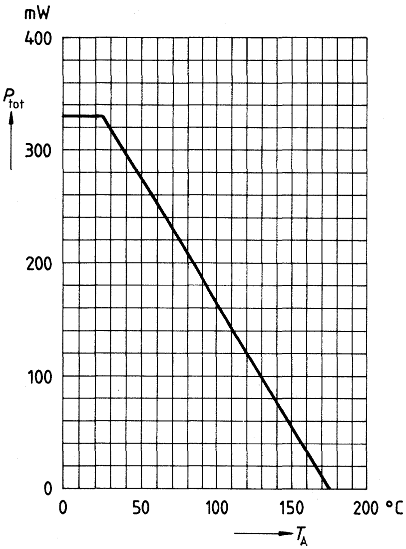




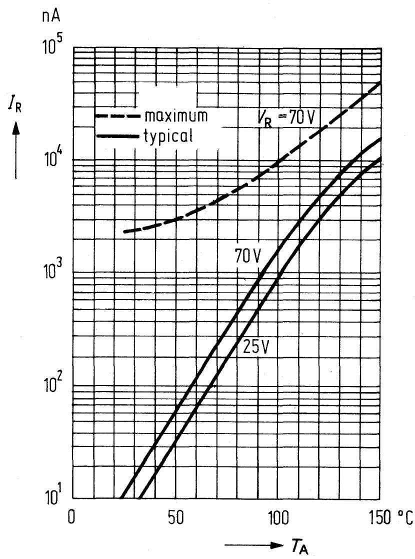
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

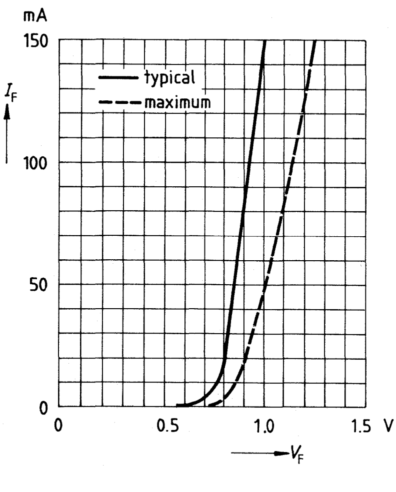
Total power dissipation $P_{tot} = f(T_A)$



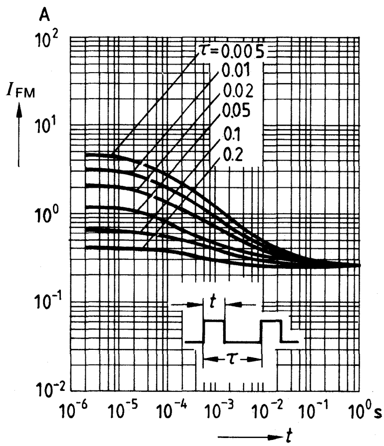
Reverse current $I_R = f(T_A)$



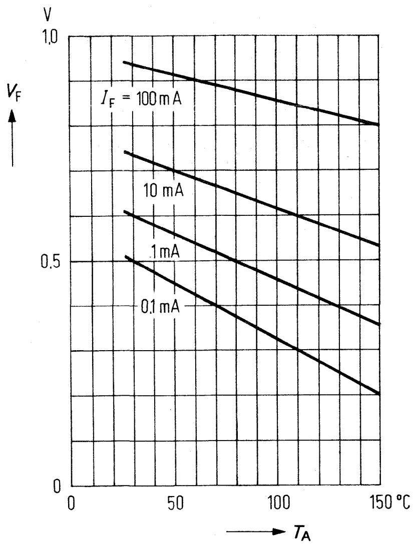
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

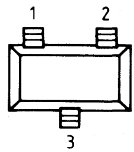


Forward voltage $V_F = f(T_A)$

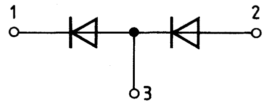
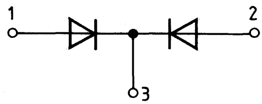
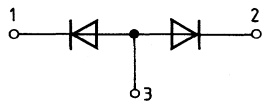


Silicon planar epitaxial dual diodes

- For general-purpose switching applications
- Low distortion factor
- High long-term stability of electrical characteristics



Top view

Type	Marking	Ordering code	Package	Circuit
BAR 14–1	L7	Refer to index	Version A	
BAR 15–1	L8			
BAR 16–1	L9			

Maximum ratings[1])

Reverse voltage	V_R	100 V
Total power dissipation $T_A = 25\,°C$	P_{tot}	100 mW
Junction temperature range	T_j	$-55 \cdots +150\,°C$
Storage temperature range	T_{stg}	$-55 \cdots +125\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

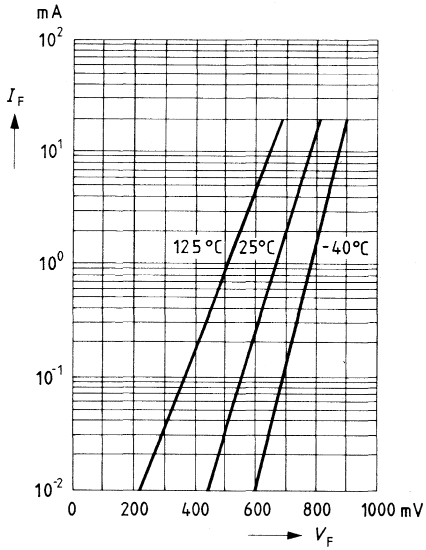
Characteristics[1])

at T_A = 25 °C, unless otherwise specified

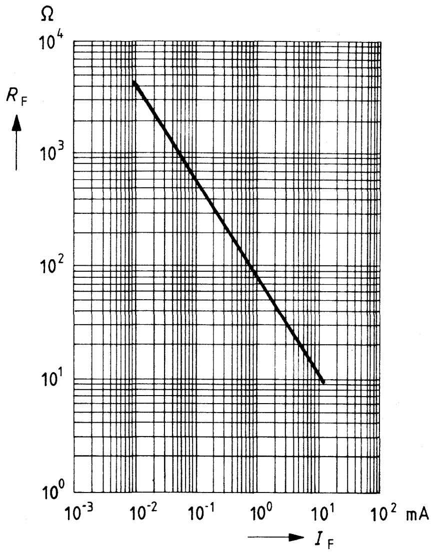
Characteristics	Symbol	min	typ	max	Unit
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	100	–	–	V
Reverse current V_R = 50 V	I_R	–	–	100	nA
Diode capacitance V_R = 50 V, f = 1 MHz	C_D	–	0,35	0,5	pF
Charge carrier life time[2]) I_F = 10 mA, I_R = 6 mA	τ_L	1,0	1,5	–	µs
RF forward resistance					
f = 100 MHz, I_F = 10 µA	r_{F1}	–	3,0	–	kΩ
I_F = 100 µA	r_{F2}	–	0,4	–	kΩ
I_F = 1 mA	r_{F3}	–	50	–	Ω
I_F = 10 mA	r_{F4}	–	9,0	–	Ω

[1]) Ratings per diode.
[2]) Real charge carrier life time, measured by Krakau method.

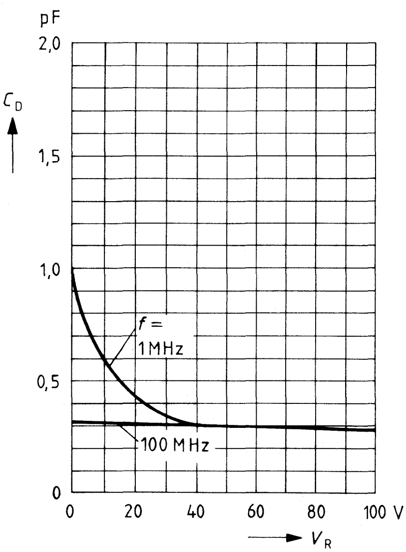
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Typical RF forward resistance $R_F = f(I_F)$

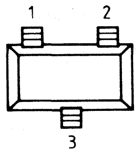


Diode capacitance $C_D = f(V_R)$



Silicon planar epitaxial diode

- For high-speed switching applications
- Peak reverse voltage 50 V



Top view

Type	Marking	Ordering code	Package
BAR 74	JB	Refer to index	Version A

Maximum ratings

Reverse voltage	V_R	50 V
Repetitive peak reverse voltage	V_{RRM}	50 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25$ °C	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

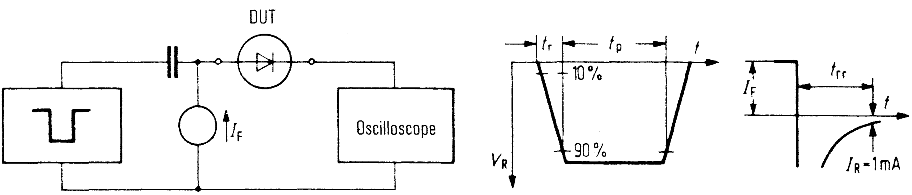
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	50	–	–	V
Max. forward voltage $I_F = 100$ mA	V_F	–	–	1,0	V
Reverse current $V_R = 50$ V $V_R = 50$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 0,1 100	 µA µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

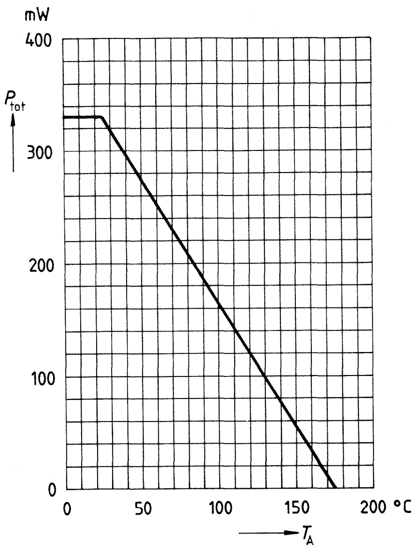
Test circuit for reverse recovery time



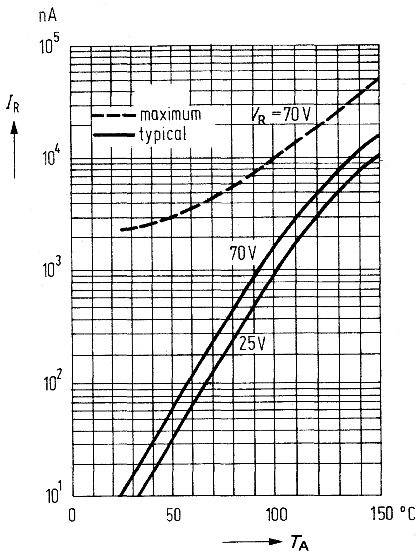
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

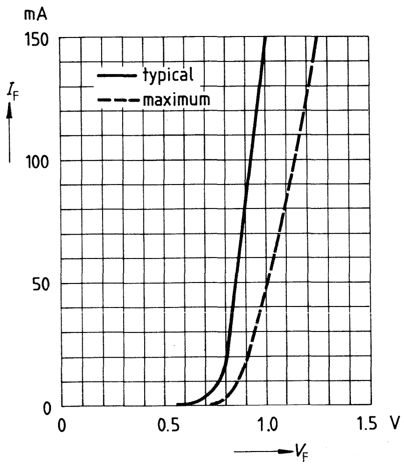
Total power dissipation $P_{tot} = f(T_A)$



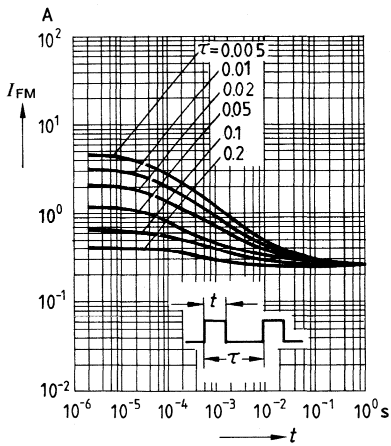
Reverse current $I_R = f(T_A)$



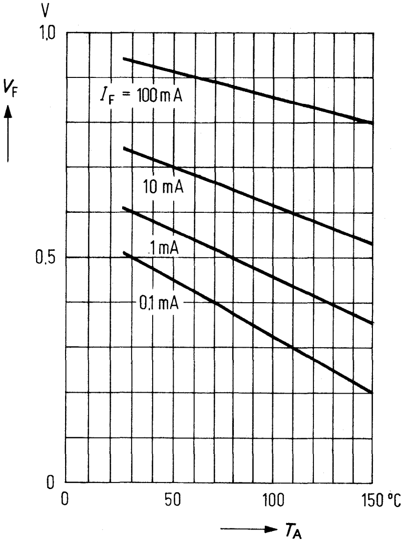
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

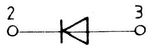


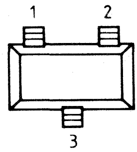
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial diode

- For high-speed switching applications
- Peak reverse voltage 70 V





Top view

Type	Marking	Ordering code	Package
BAR 99	JG	Refer to index	Version A

Maximum ratings

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25$ °C	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

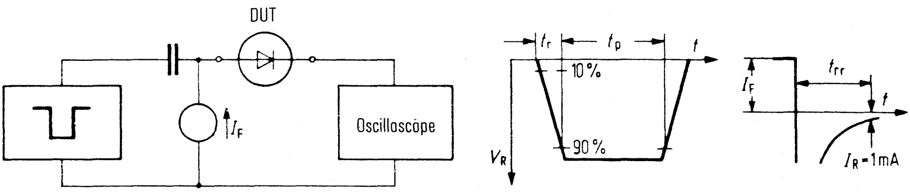
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1\ mA$		–	–	715	mV
$I_F = 10\ mA$		–	–	855	mV
$I_F = 50\ mA$		–	–	1000	mV
$I_F = 150\ mA$		–	–	1250	mV
Reverse current	I_R				
$V_R = 70\ V$		–	–	2,5	µA
$V_R = 25\ V$, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70\ V$, $T_A = 150\,°C$		–	–	50	µA

Dynamic chracteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0\ V$, $f = 1\ MHz$	C_0	–	–	1,5	pF
Reverse recovery time $I_F = 10\ mA$, $I_R = 10\ mA$, $R_L = 100\ \Omega$, measured at $I_R = 1\ mA$	t_{rr}	–	–	6	ns

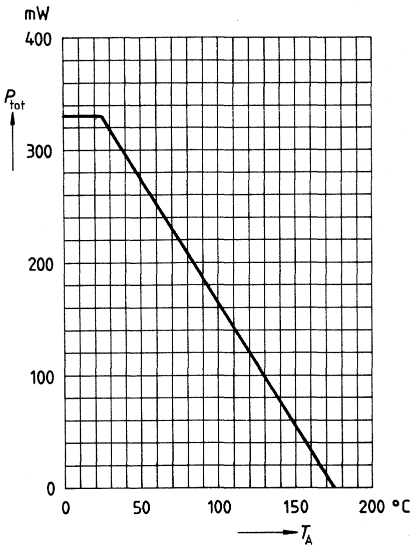
Test circuit for reverse recovery time



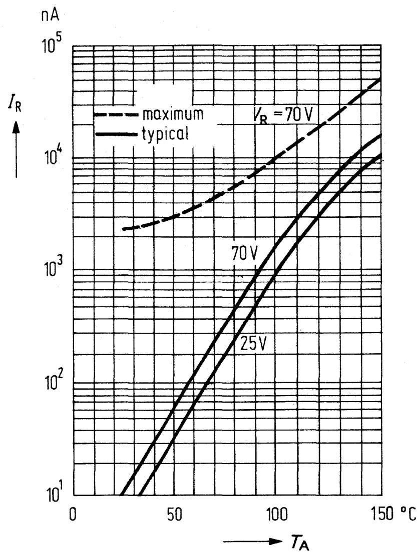
Pulse generator: $t_p = 100\ ns$, D = 0,05
$t_r = 0{,}6\ ns$, $R_i = 50\ \Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35\ ns$
$C \leq 1\ pF$

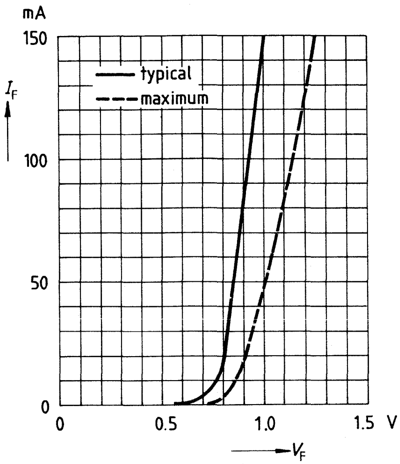
Total power dissipation $P_{tot} = f(T_A)$



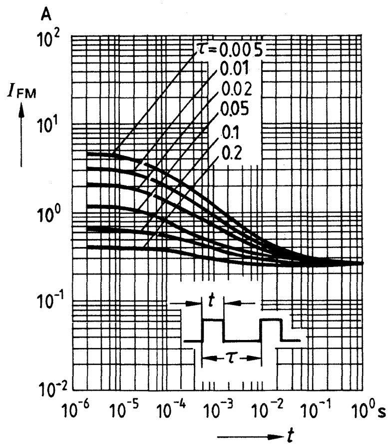
Reverse current $I_R = f(T_A)$



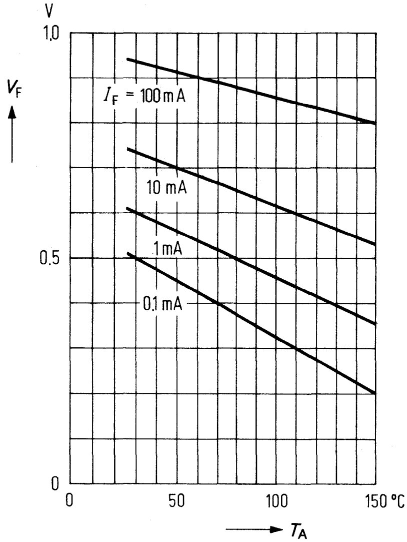
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

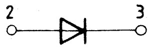


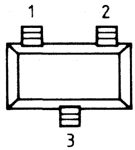
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial diode

- For high-speed switching applications
- Peak reverse voltage 85 V





Top view

Type	Marking	Ordering code	Package
BAS 16	JU	Refer to index	Version A

Maximum ratings

Reverse voltage	V_R	75 V
Repetitive peak reverse voltage	V_{RRM}	85 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \dots +150\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

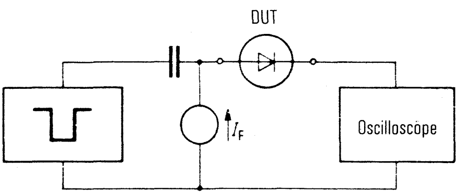
Characteristics

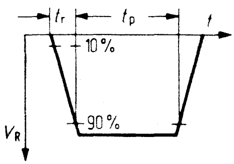
at $T_A = 25\,°C$, unless otherwise specified

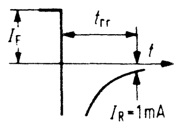
Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	75	–	–	V
Max. forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 75$ V		–	–	1,0	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 75$ V, $T_A = 150\,°C$		–	–	50	µA
Forward recovery voltage $I_F = 10$ mA, $t_p = 20$ ns	V_{FR}	–	–	1,75	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	–	2,0	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time



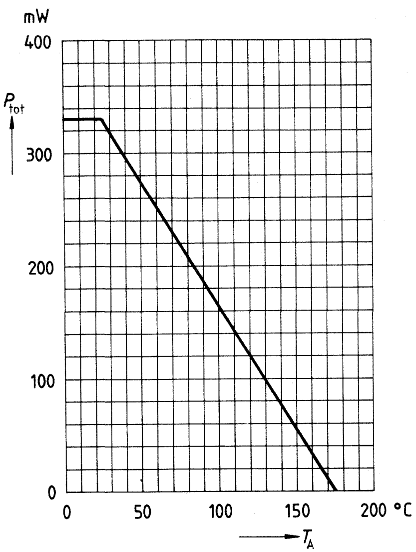




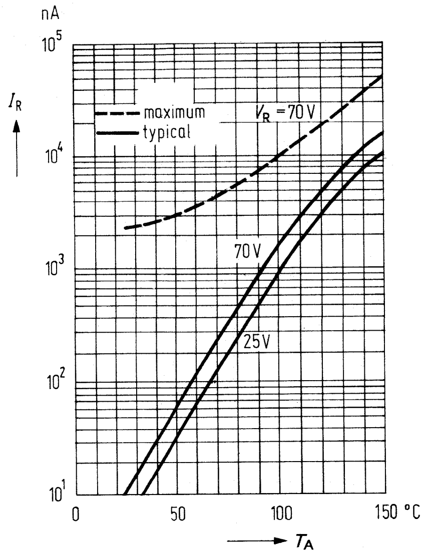
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

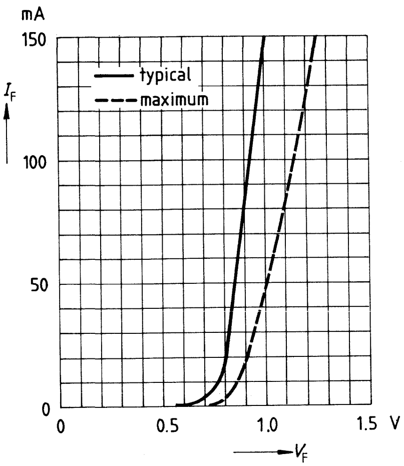
Total power dissipation $P_{tot} = f(T_A)$



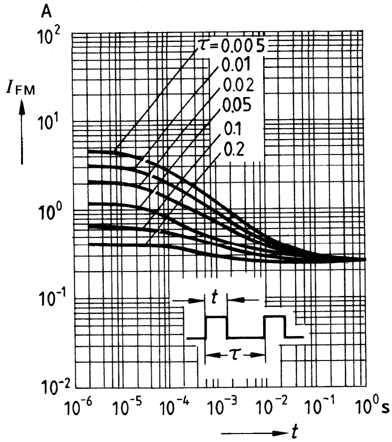
Reverse current $I_R = f(T_A)$



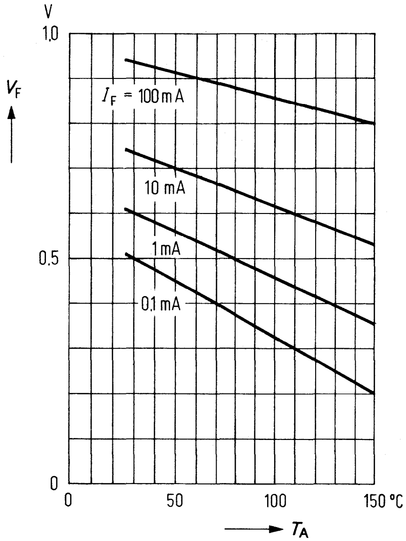
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

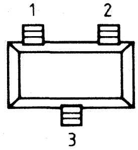


Forward voltage $V_F = f(T_A)$

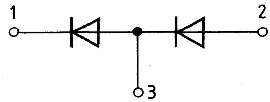
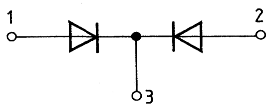
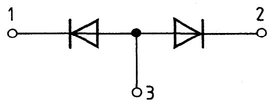


Silicon Schottky dual diodes

- For ultrafast switching and protecting applications
- High reliability due to titanium-platinum-gold metallization
- Nitride over oxide passivation provides for long-term stability of electrical characteristics
- Single chips are available



Top view

Type	Marking	Ordering code	Package	Circuit
BAS 40–04	44	Refer to index	Version A	
BAS 40–05	45			
BAS 40–06	46			

Maximum ratings[1])

Reverse voltage	V_R	40 V
Total power dissipation $T_A = 25\,°C$	P_{tot}	100 mW
Junction temperature range	T_j	$-55 \cdots +150\,°C$
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

Characteristics[1])

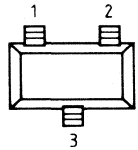
at $T_A = 25\,°C$, unless otherwise specified

Characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_R = 10\ \mu A$	$V_{(BR)}$	40	–	–	V
Reverse current $V_R = 30\ V$	I_R	–	–	1000	nA
Forward current $V_F = 1\ V$	I_F	40	–	–	mA
Forward voltage $I_F = 1\ mA$	V_F	–	–	380	mV
Diode capacitance $V_R = 0\ V$, $f = 1\ MHz$	C_D	–	4,0	5,0	pF
Charge carrier life time[2]) $I_F = 5\ mA$	τ_L	–	–	100	ps

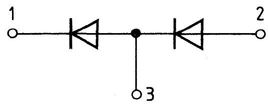
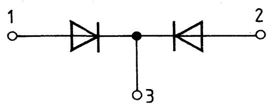
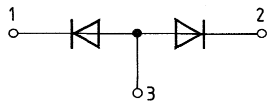
[1]) Ratings per diode.
[2]) Real charge carrier life time, measured by Krakau method.

Silicon Schottky dual diodes

- For ultrafast switching and protecting applications
- High reliability due to titanium-platinum-gold metallization
- Nitride over oxide passivation provides for long-term stability of electrical characteristics
- Single chips are available



Top view

Type	Marking	Ordering code	Package	Circuit
BAS 70–04	74	Refer to index	Version A	
BAS 70–05	75			
BAS 70–06	76			

Maximum ratings[1])

Reverse voltage	V_R	70 V
Total power dissipation $T_A = 25\,°C$	P_{tot}	100 mW
Junction temperature range	T_j	$-55 \cdots +150\,°C$
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

Characteristics[1])

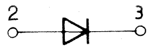
at $T_A = 25\,°C$, unless otherwise specified

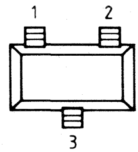
Characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_R = 10\ \mu A$	$V_{(BR)}$	70	–	–	V
Reverse current $V_R = 50\ V$	I_R	–	–	200	nA
Forward current $V_F = 1\ V$	I_F	15	–	–	mA
Forward voltage $I_F = 1\ mA$	V_F	–	–	410	mV
Diode capacitance $V_R = 0\ V$; $f = 1\ MHz$	C_D	–	1,5	2,0	pF
Charge carrier life time[2]) $I_F = 5\ mA$	τ_L	–	–	100	ps

[1]) Ratings per diode.
[2]) Real charge carrier life time, measured by Krakau method.

Silicon Schottky diode

- UHF mixer diode
- For high-speed switching applications





Top view

Type	Marking	Ordering code	Package
BAT 17	53	Refer to index	Version A

Maximum ratings

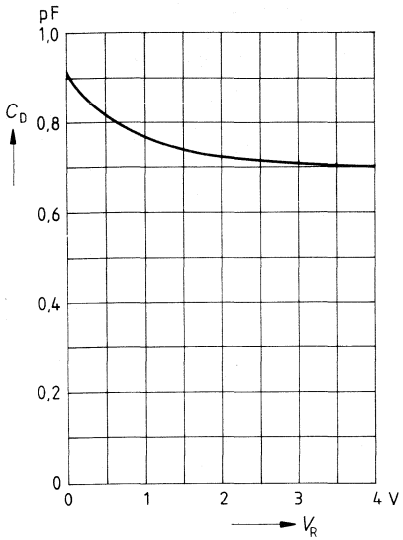
Reverse voltage	V_R	4 V
Forward current	I_F	30 mA
Junction temperature range	T_j	$-55 \cdots +150\,°C$
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 450 K/W

Characteristics

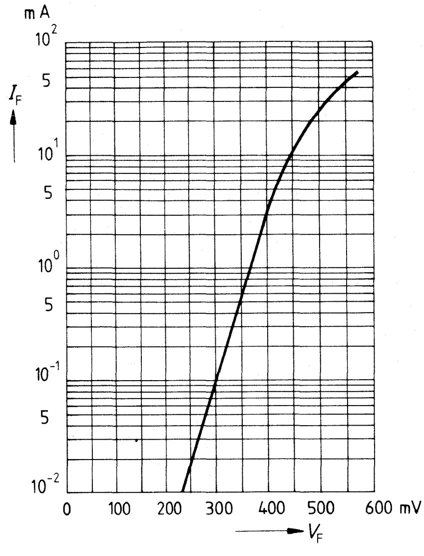
at $T_A = 25\,°C$, unless otherwise specified

Characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_R = 10\ \mu A$	$V_{(BR)}$	4	–	–	V
Reverse current $V_R = 3$ V, $T_A = 25°C$ $V_R = 3$ V, $T_A = 60\,°C$	I_R	 – –	 – –	 0,25 1,25	 µA µA
Forward voltage $I_F = 100\ \mu A$ $I_F =$ 1 mA $I_F =$ 10 mA	V_F	 – – –	 – – –	 400 450 600	 mV mV mV
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	0,6	–	1	pF
Differential forward resistance $I_F = 5$ mA, $f = 1$ kHz	r_f	–	8	15	Ω
Noise figure $f = 900$ MHz, $I_F = 2$ mA, IF amplifier noise: $NF = 1{,}5$ dB, $f = 35$ MHz	NF	–	–	8	dB

Diode capacitance $C_D = f(V_R)$

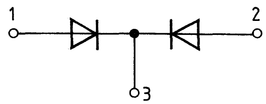


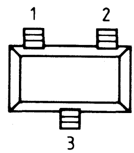
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Silicon planar epitaxial dual diode

- For high-speed switching applications
- Peak reverse voltage 70 V
- With common cathode





Top view

Type	Marking	Ordering code	Package
BAV 70	JJ	Refer to index	Version A

Maximum ratings[1])

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25$ °C	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	−65 ··· +150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

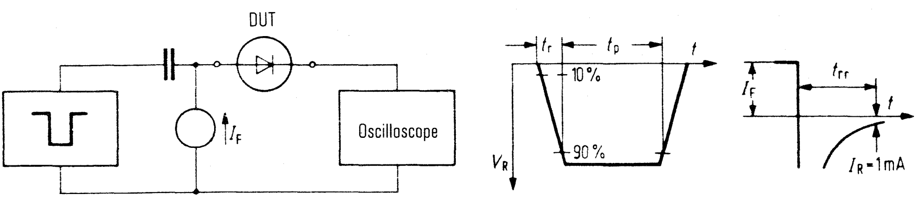
Characteristics[1])

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1\ mA$		–	–	715	mV
$I_F = 10\ mA$		–	–	855	mV
$I_F = 50\ mA$		–	–	1000	mV
$I_F = 150\ mA$		–	–	1250	mV
Reverse current	I_R				
$V_R = 70\ V$		–	–	2,5	µA
$V_R = 25\ V$, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70\ V$, $T_A = 150\,°C$		–	–	50	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0\ V$, $f = 1\ MHz$	C_0	–	–	1,5	pF
Reverse recovery time $I_F = 10\ mA$, $I_R = 10\ mA$, $R_L = 100\ \Omega$, measured at $I_R = 1\ mA$	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time

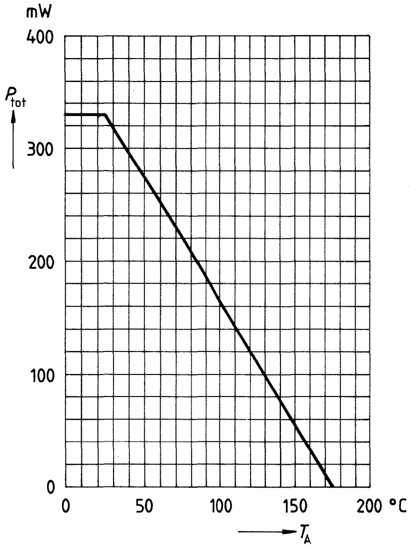


Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$
$V_p = V_R + I_F \times R_i$

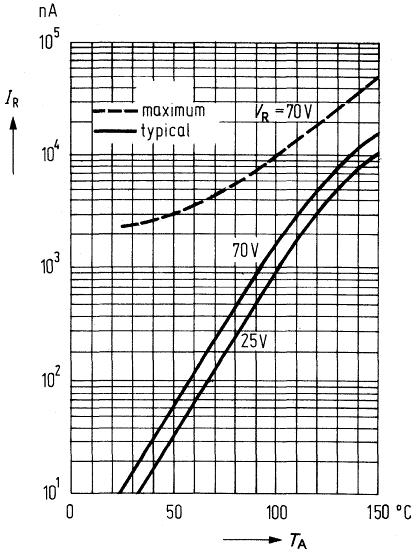
Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

[1]) Ratings per diode

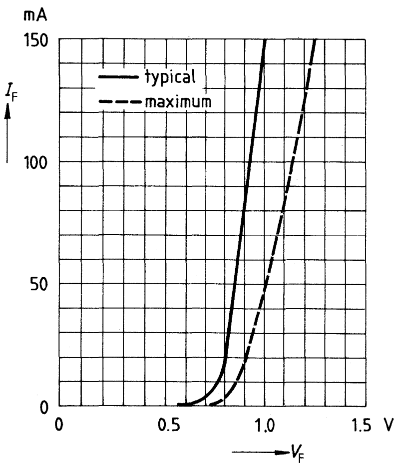
Total power dissipation $P_{tot} = f(T_A)$



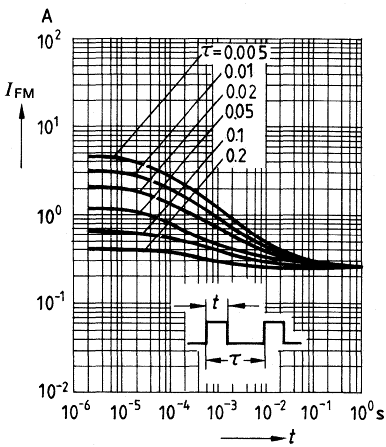
Reverse current $I_R = f(T_A)$



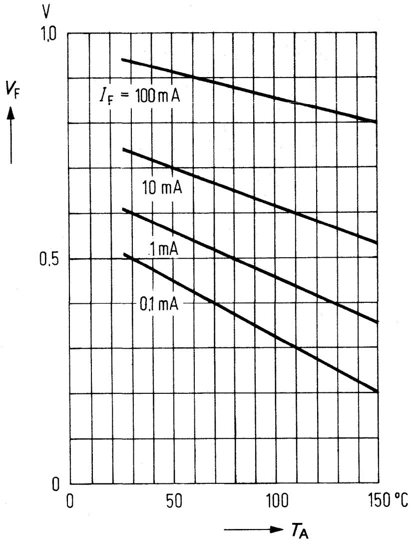
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$

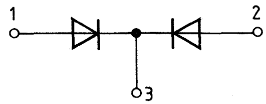


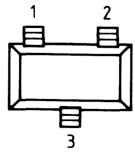
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial dual diode

- For high-speed switching applications
- Peak reverse voltage 50 V
- With common cathode





Top view

Type	Marking	Ordering code	Package
BAV 74	JA	Refer to index	Version A

Maximum ratings[1])

Reverse voltage	V_R	50 V
Repetitive peak reverse voltage	V_{RRM}	50 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	−65 ··· +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

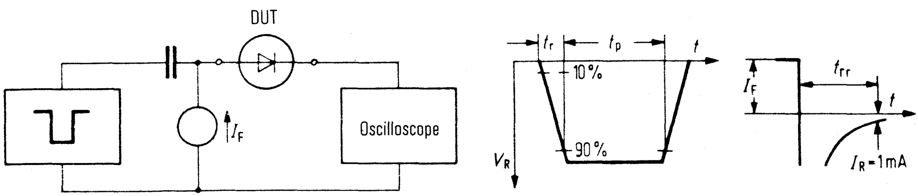
Characteristics[1])

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	50	–	–	V
Max. forward voltage $I_F = 100$ mA	V_F	–	–	1,0	V
Reverse current $V_R = 50$ V $V_R = 50$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 0,1 100	 µA µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	–	2,0	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

Test circuit for reverse recovery time

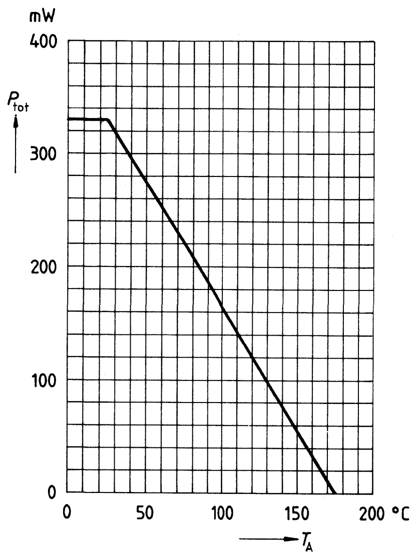


Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$
$V_p = V_R + I_F \times R_i$

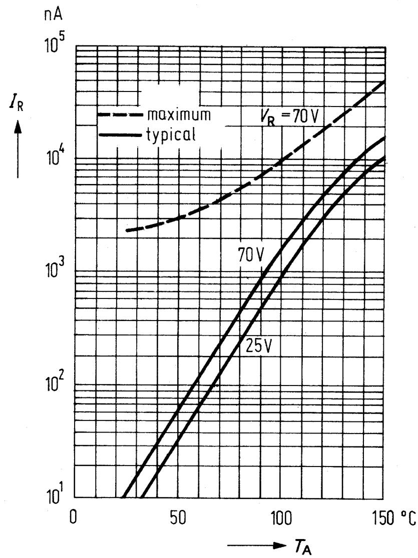
Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

[1]) Ratings per diode

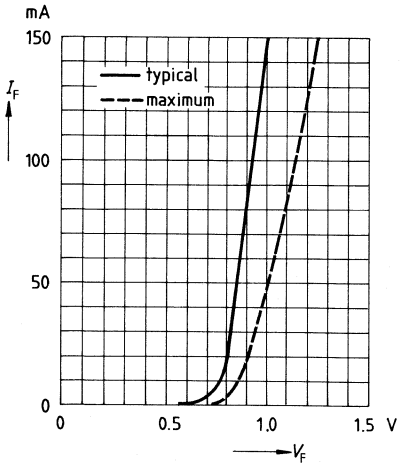
Total power dissipation $P_{tot} = f(T_A)$



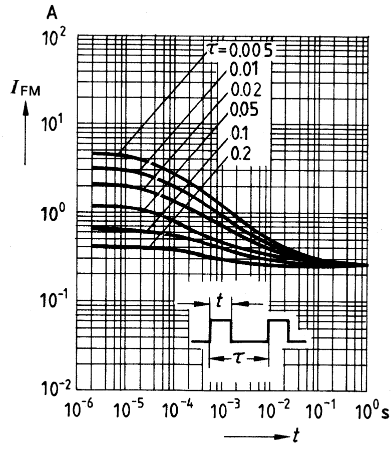
Reverse current $I_R = f(T_A)$



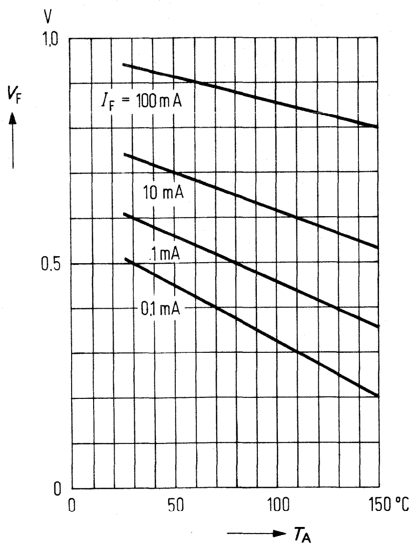
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$

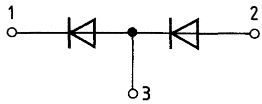


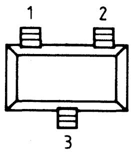
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial dual diode

- For high-speed switching applications
- Peak reverse voltage 70 V
- Series-connected





Top view

Type	Marking	Ordering code	Package
BAV 99	JE	Refer to index	Version A

Maximum ratings[1])

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	−65 ... +150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

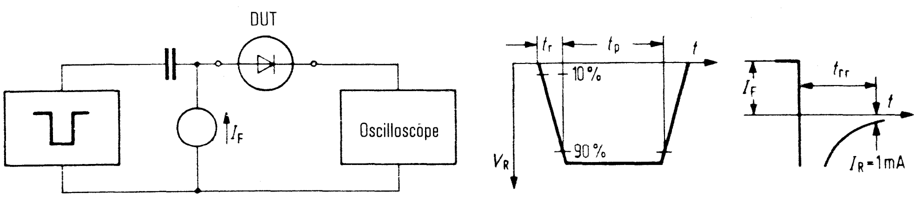
Characteristics[1]

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time

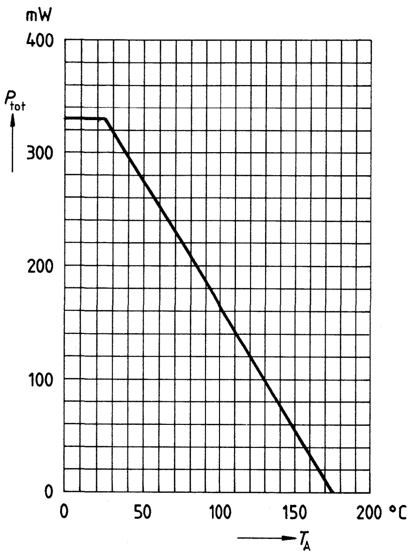


Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$
$V_p = V_R + I_F \times R_i$

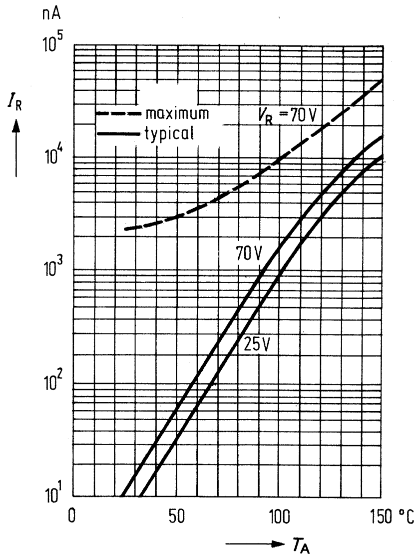
Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

[1]) Ratings per diode

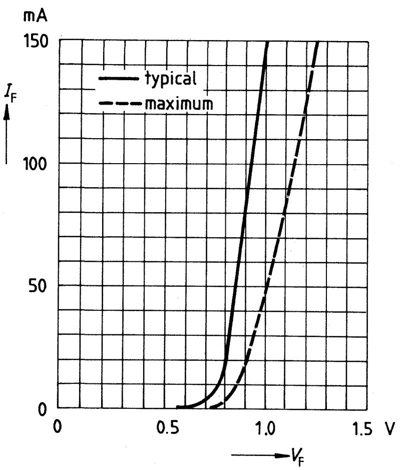
Total power dissipation $P_{tot} = f(T_A)$



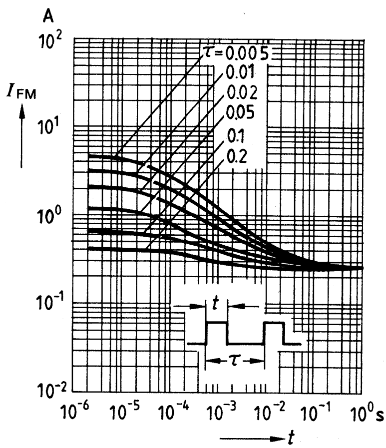
Reverse current $I_R = f(T_A)$



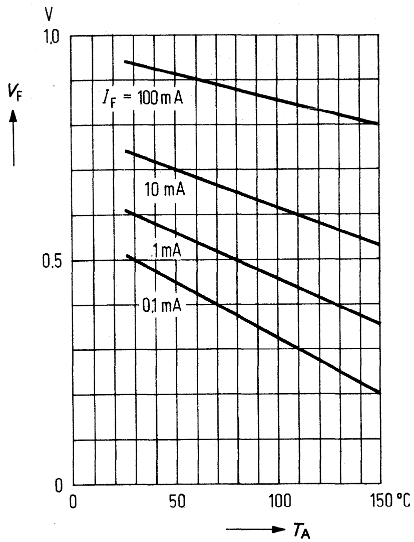
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$

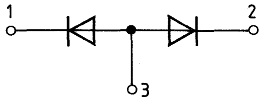


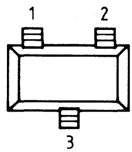
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial dual diode

- For high-speed switching applications
- Peak reverse voltage 70 V
- With common anode





Top view

Type	Marking	Ordering code	Package
BAW 56	JD	Refer to index	Version A

Maximum ratings[1])

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

[1]) Ratings per diode

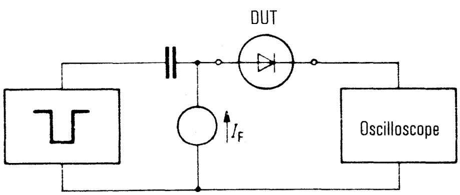
Characteristics[1])

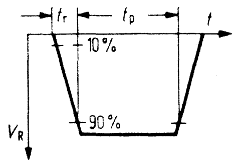
at $T_A = 25\,°C$, unless otherwise specified

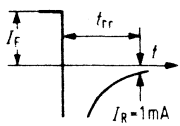
Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1\ mA$		–	–	715	mV
$I_F = 10\ mA$		–	–	855	mV
$I_F = 50\ mA$		–	–	1000	mV
$I_F = 150\ mA$		–	–	1250	mV
Reverse current	I_R				
$V_R = 70\ V$		–	–	2,5	µA
$V_R = 25\ V$, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70\ V$, $T_A = 150\,°C$		–	–	50	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0\ V$, $f = 1\ MHz$	C_0	–	–	2,0	pF
Reverse recovery time $I_F = 10\ mA$, $I_R = 10\ mA$, $R_L = 100\ \Omega$, measured at $I_R = 1\ mA$	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time





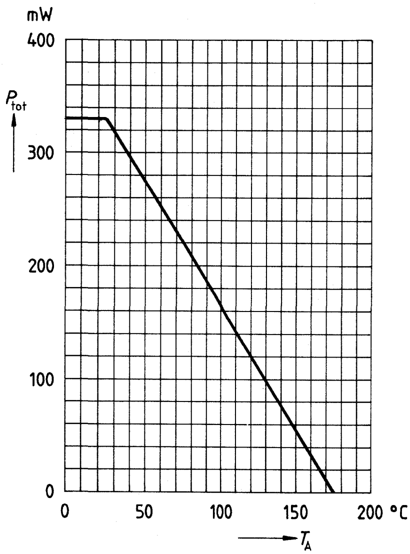


Pulse generator: $t_p = 100\ ns$, $D = 0{,}05$
$t_r = 0{,}6\ ns$, $R_i = 50\ \Omega$
$V_p = V_R + I_F \times R_i$

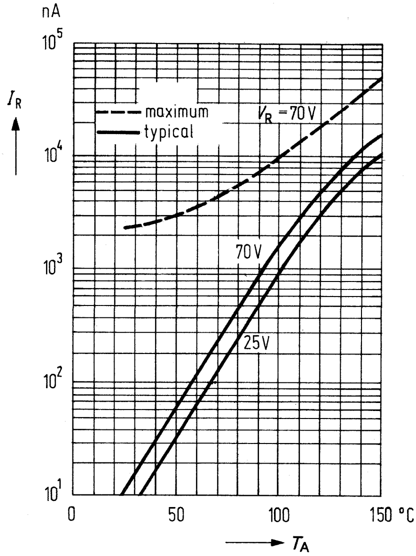
Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35\ ns$
$C \le 1\ pF$

[1]) Ratings per diode

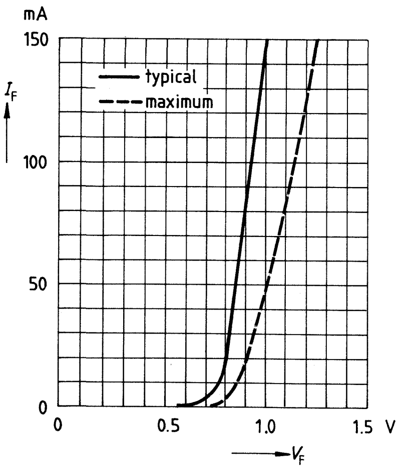
Total power dissipation $P_{tot} = f(T_A)$



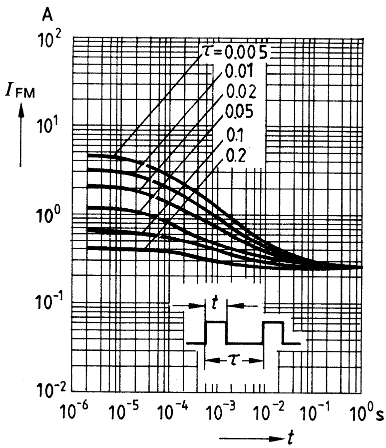
Reverse current $I_R = f(T_A)$



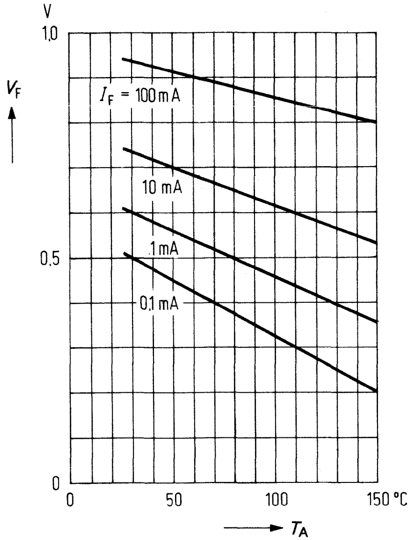
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$

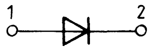


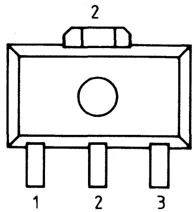
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial diodes

- High reverse voltage: up to 400 V
- High forward current





Top view

Type	Marking	Type	Marking	Ordering code	Package
BAW 78 A	GA	BAW 78 C	GC	Refer to index	Version C
BAW 78 B	GB	BAW 78 D	GD		

Maximum ratings		BAW 78 A	BAW 78 B	BAW 78 C	BAW 78 D
Reverse voltage	V_R	50 V	100 V	200 V	400 V
Repetitive peak reverse voltage	V_{RRM}	50 V	100 V	200 V	400 V
Forward current	I_F	1,0 A			
RMS forward current	I_{FRMS}	–			
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	500 mA			
Surge forward current $t = 1$ µs	I_{FSM}	10 A			
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W			
Junction temperature	T_j	150 °C			
Storage temperature range	T_{stg}	−65 ... +150 °C			
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W			

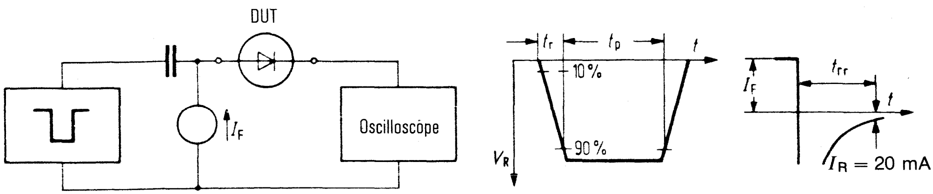
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$				
BAW 78 A		50	–	–	V
BAW 78 B		100	–	–	V
BAW 78 C		200	–	–	V
BAW 78 D		400	–	–	V
Max. forward voltage	V_F				
$I_F = 1$ A		–	–	1,6	
$I_F = 2$ A		–	–	2,0	V
Reverse current	I_R				
$V_R = V_{Rmax}$		–	–	1	µA
$V_R = V_{Rmax}$, $T_A = 150\,°C$		–	–	50	µA

Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Capacitance $V_R = 0$ V, $f = 1$ MHz	C_0	–	10	–	pF
Reverse recovery time $I_F = 200$ mA, $I_R = 200$ mA, $R_L = 100\ \Omega$, measured at $I_R = 20$ mA	t_{rr}	–	1	–	µs

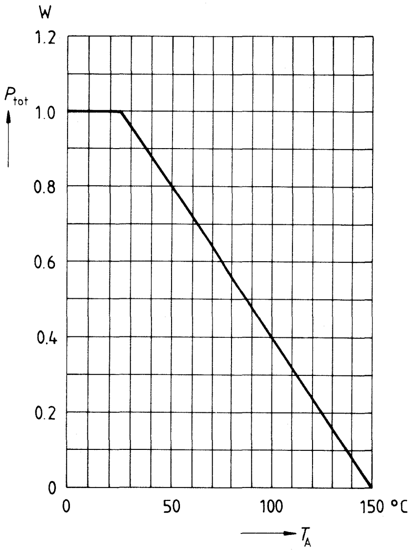
Test circuit for reverse recovery time



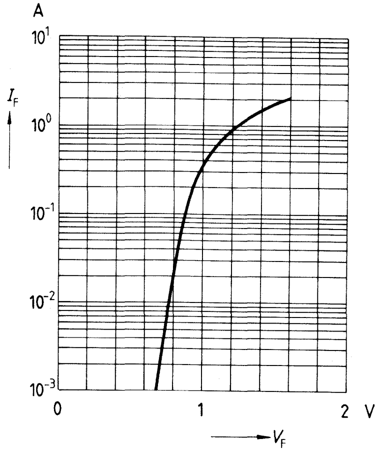
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

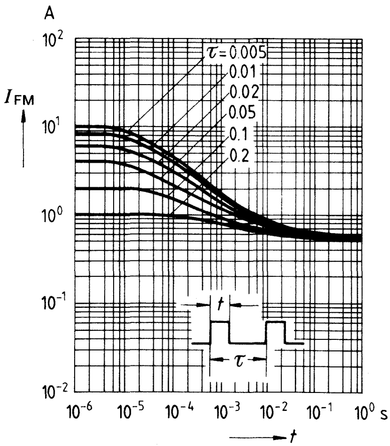
Total power dissipation $P_{tot} = f(T_A)$



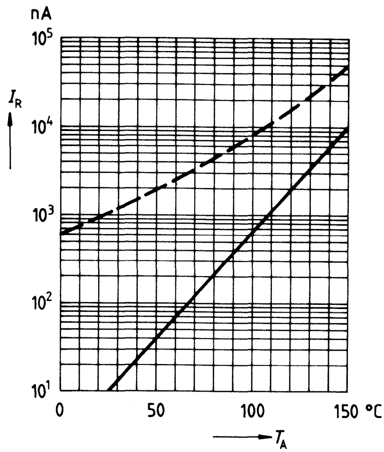
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

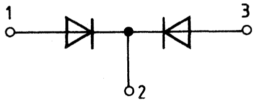


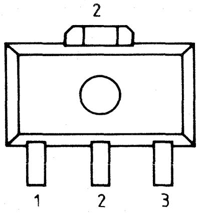
Reverse current $I_R = f(T_A)$
$V_R = V_{R\,max}$



Silicon planar epitaxial dual diodes

- High reverse voltage: up to 400 V
- High forward current
- With common cathode





Top view

Type	Marking	Type	Marking	Ordering code	Package
BAW 79 A	GE	BAW 79 C	GG	Refer to index	Version C
BAW 79 B	GF	BAW 79 D	GH		

Maximum ratings[1])

		BAW 79 A	BAW 79 B	BAW 79 C	BAW 79 D
Reverse voltage	V_R	50 V	100 V	200 V	400 V
Repetitive peak reverse voltage	V_{RRM}	50 V	100 V	200 V	400 V
Forward current	I_F	1,0 A			
RMS forward current	I_{FRMS}	–			
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	500 mA			
Surge forward current $t = 1$ µs	I_{FSM}	10 A			
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W			
Junction temperature	T_j	150 °C			
Storage temperature range	T_{stg}	−65 ... +150 °C			
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤125 K/W			

[1]) Ratings per diode

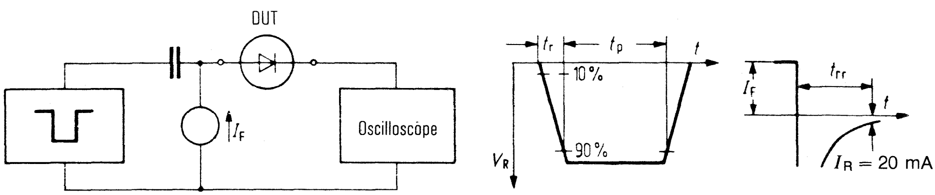
Characteristics[1])

at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)}$ = 100 µA	$V_{(BR)}$				
BAW 79 A		50	–	–	V
BAW 79 B		100	–	–	V
BAW 79 C		200	–	–	V
BAW 79 D		400	–	–	V
Max. forward voltage	V_F				
I_F = 1 A		–	–	1,6	V
I_F = 2 A		–	–	2,0	V
Reverse current	I_R				
V_R = V_{Rmax}		–	–	1	µA
V_R = V_{Rmax}, T_A = 150 °C		–	–	50	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance V_R = 0 V, f = 1 MHz	C_0	–	10	–	pF
Reverse recovery time I_F = 200 mA, I_R = 200 mA, R_L = 100 Ω, measured at I_R = 20 mA	t_{rr}	–	1	–	µs

Test circuit for reverse recovery time

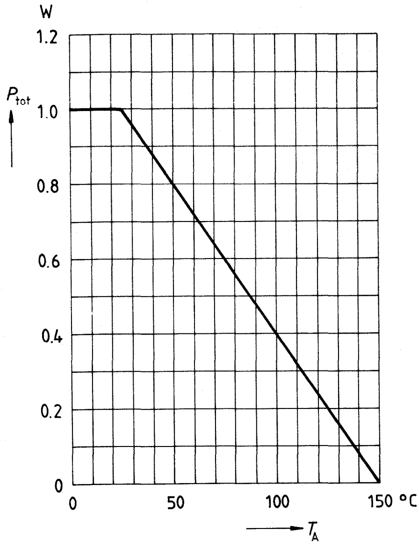


Pulse generator: t_p = 100 ns, D = 0,05
t_r = 0,6 ns, R_i = 50
$V_p = V_R + I_F \times R_i$

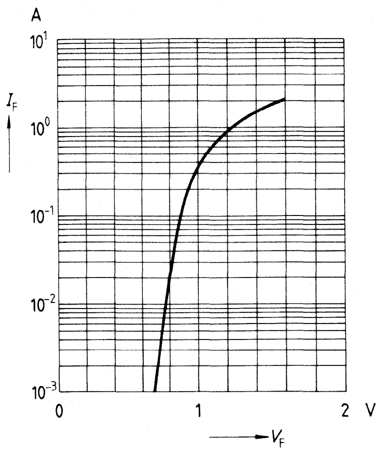
Oscilloscope: R = 50 Ω
t_r = 0,35 ns
$C \leq 1$ pF

[1]) Ratings per diode

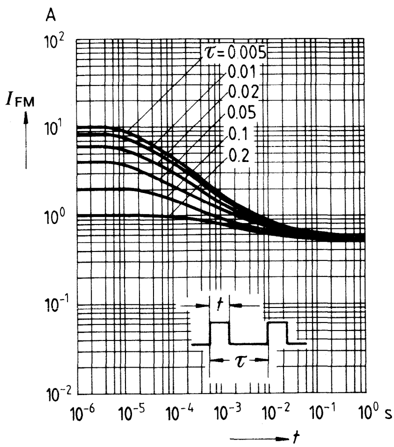
Total power dissipation $P_{tot} = f(T_A)$



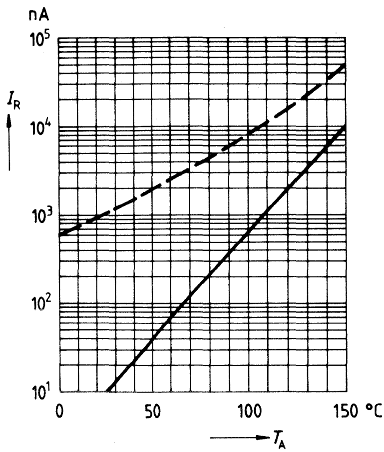
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$

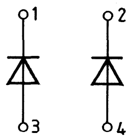


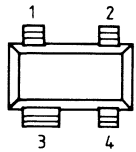
Reverse current $I_R = f(T_A)$
$V_R = V_{R\,max}$



Silicon planar epitaxial dual diode

- For high-speed switching applications
- Peak reverse voltage 70 V
- Electrically isolated diodes





Top view

Type	Marking	Ordering code	Package
BAW 100	JS	Refer to index	Version B

Maximum ratings

Reverse voltage	V_R	70 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	250 mA
RMS forward current	I_{FRMS}	250 mA
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	250 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	175 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

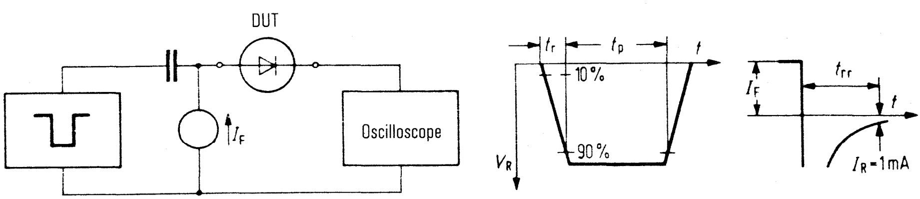
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	70	–	–	V
Max. forward voltage	V_F				
$I_F = 1\,mA$		–	–	715	mV
$I_F = 10\,mA$		–	–	855	mV
$I_F = 50\,mA$		–	–	1000	mV
$I_F = 150\,mA$		–	–	1250	mV
Reverse current	I_R				
$V_R = 70\,V$		–	–	5	µA
$V_R = 25\,V$, $T_A = 150\,°C$		–	–	60	µA
$V_R = 70\,V$, $T_A = 150\,°C$		–	–	100	µA

Dynamic characteristics	Symbol	min	typ	max	Unit
Capacitance $V_R = 0\,V$, $f = 1\,MHz$	C_0	–	–	1,5	pF
Reverse recovery time $I_F = 10\,mA$, $I_R = 10\,mA$, $R_L = 100\,\Omega$, measured at $I_R = 1\,mA$	t_{rr}	–	–	6	ns

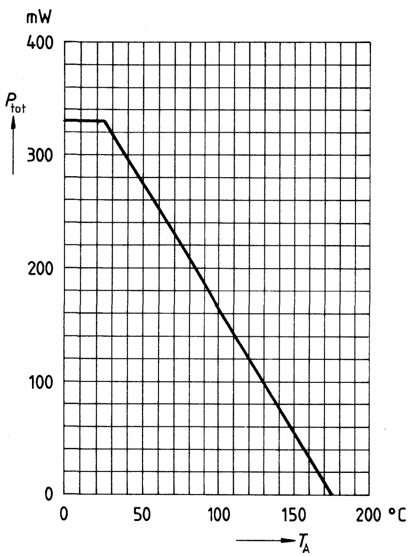
Test circuit for reverse recovery time



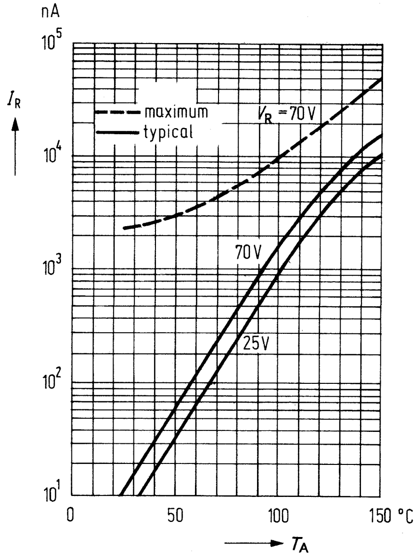
Pulse generator: $t_p = 100\,ns$, $D = 0{,}05$
$t_r = 0{,}6\,ns$, $R_i = 50\,\Omega$
$V_p = V_R + I_F \times R_i$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35\,ns$
$C \leq 1\,pF$

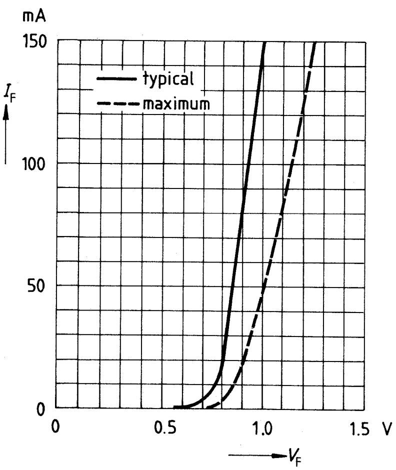
Total power dissipation $P_{tot} = f(T_A)$



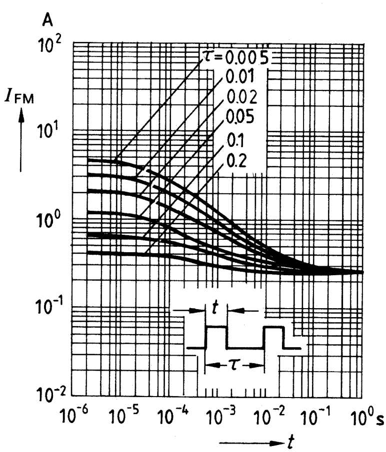
Reverse current $I_R = f(T_A)$



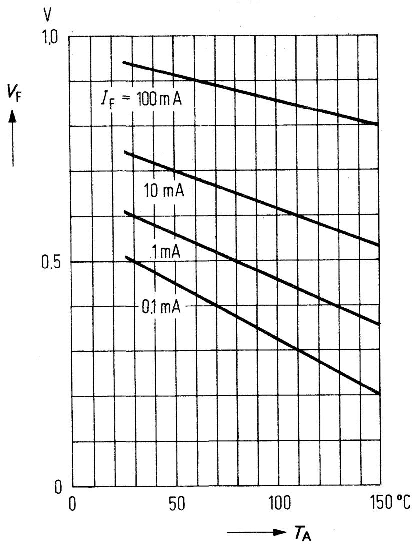
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$

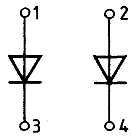


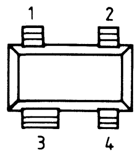
Forward voltage $V_F = f(T_A)$



Silicon planar epitaxial dual diode

- High reverse voltage: 300 V
- Electrically isolated diodes





Type	Marking	Ordering code	Package
BAW 101	JP	Refer to index	Version B

Maximum ratings

Reverse voltage	V_R	300 V
Repetitive peak reverse voltage	V_{RRM}	300 V
Forward current	I_F	50 mA
RMS forward current	I_{FRMS}	–
Mean forward current $t = 20$ ms, $t_p = 10$ ms	I_{FAV}	35 mA
Surge forward current $t = 1$ µs	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

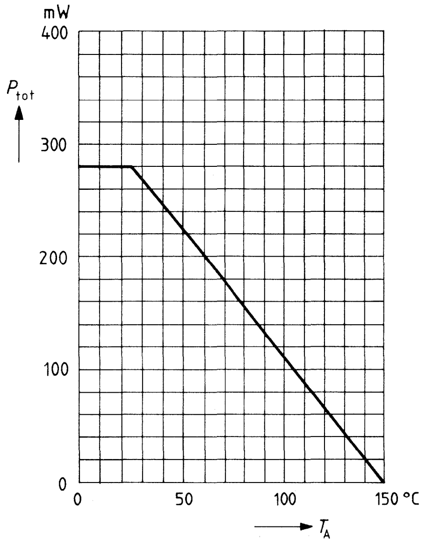
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

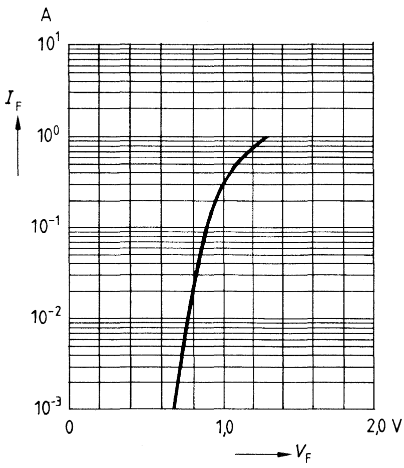
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	300	–	–	V
Max. forward voltage $I_F = 100$ mA	V_F	–	–	1,3	V
Reverse current $V_R = 250$ V $V_R = 250$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 150 50	 nA µA

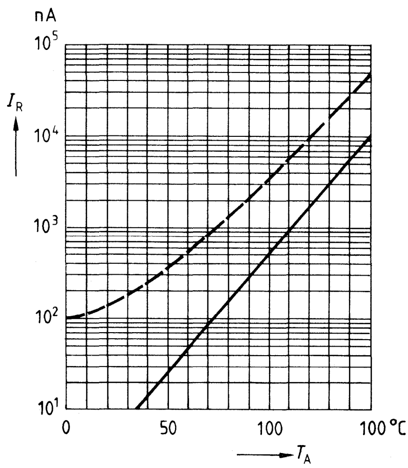
Total power dissipation $P_{tot} = f(T_A)$



Forward current $I_F = f(V_F)$

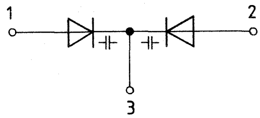


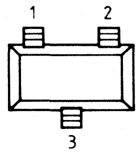
Reverse current $I_R = f(T_A)$



Silicon planar epitaxial dual diode

- For FM tuner applications
- With common cathode





Top view

Type	Marking	Ordering code	Package
BB 804	FM	Refer to index	Version A

Maximum ratings[1])

Reverse voltage	V_R	18 V
Repetitive peak reverse voltage	V_{RRM}	20 V
Forward current $T_A \leq 60\,°C$	I_F	50 mA
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 … +150 °C

[1]) Ratings per diode

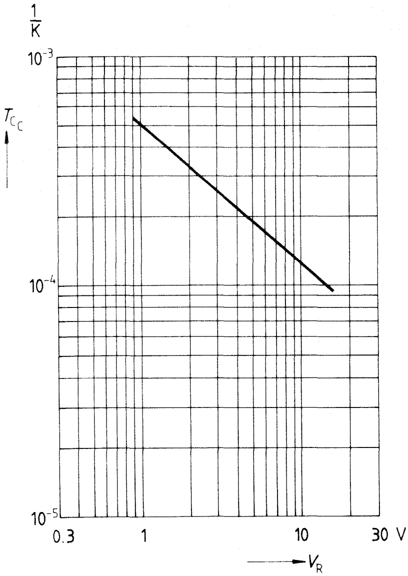
Characteristics[1])

at T_A = 25 °C, unless otherwise specified

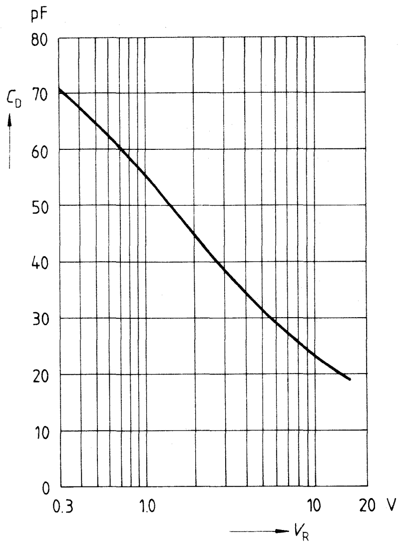
Characteristics	Symbol	min	typ	max	Unit
Reverse current	I_R				
V_R = 16 V		–	–	20	nA
V_R = 16 V, T_A = 60 °C		–	–	0,2	µA
Diode capacitance V_R = 2 V, f = 1 MHz	C_D	42	–	47,5	pF
Capacitance ratio V_R = 2 V, 8 V, f = 1 MHz	C_{D2V}/C_{D8V}	–	1,7	–	–
Series resistance C = 38 pF, f = 100 MHz	r_s	–	0,25	–	Ω
Quality factor C = 38 pF, f = 100 MHz	Q	–	170	–	–
Temperature coefficient of junction capacitance V_R = 2 V, f = 1 MHz	TC_C	–	330	–	ppm/K
Capacitance groups V_R = 2 V, f = 1 MHz	C_D				
Group –0		42 … 43,5			pF
Group –1		43 … 44,5			pF
Group –2		44 … 45,5			pF
Group –3		45 … 46,5			pF
Group –4		46 … 47,5			pF

1) Ratings per diode

Temperature coefficient $TC_C = f(V_R)$
of diode capacitance
$f = 1$ MHz

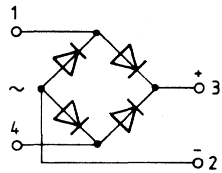


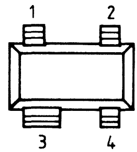
Diode capacitance $C_D = f(V_R)$
$f = 1$ MHz



Silicon planar epitaxial diode

- Peak reverse voltage 70 V
- Forward current 140 mA
- For bridge configuration





Top view

Type	Marking	Ordering code	Package
BGX 50 A	U1	Refer to index	Version B

Maximum ratings[1])

Reverse voltage	V_R	50 V
Repetitive peak reverse voltage	V_{RRM}	70 V
Forward current	I_F	140 mA
Surge forward current $t = 1\ \mu s$	I_{FSM}	4,5 A
Total power dissipation $T_A = 25\ °C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \ldots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

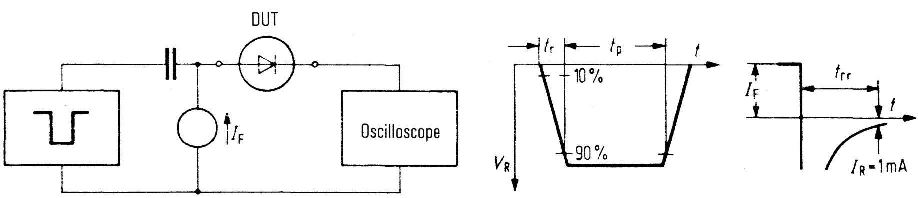
[1]) Ratings per diode

Characteristics[1])
at T_A = 25 °C, unless otherwise specified

Static characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Forward voltage (two diodes connected in series) I_F = 100 mA	V_F	–	–	2,6	V
Reverse current V_R = 50 V V_R = 50 V, T_A = 150 °C	I_R	 – –	 – –	 0,1 100	 µA µA

Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Capacitance V_R = 0, f = 1 MHz	C_0	–	–	1,5	pF
Reverse recovery time I_F = 10 mA, I_R = 10 mA, R_L = 100 Ω measured at I_R = 1 mA	t_{rr}	–	1	–	ns

Test circuit for reverse recovery time

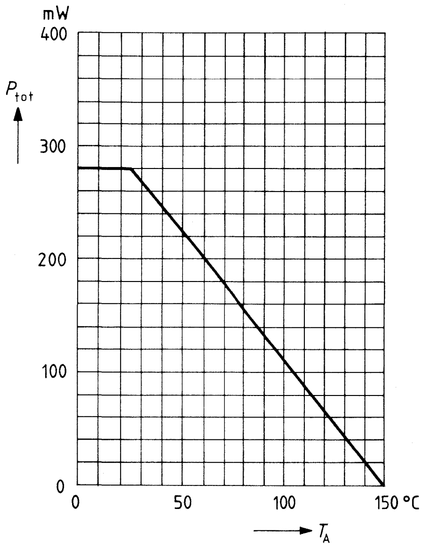


Pulse generator: t_p = 100 ns, D = 0,05
t_r = 0,6 ns, R_i = 50 Ω
$V_p = V_R + I_F \times R_i$

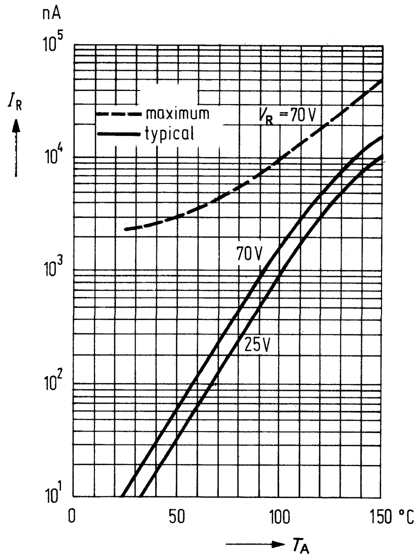
Oscilloscope: R = 50 Ω
t_r = 0,35 ns
$C \leq 1$ pF

[1]) Ratings per diode

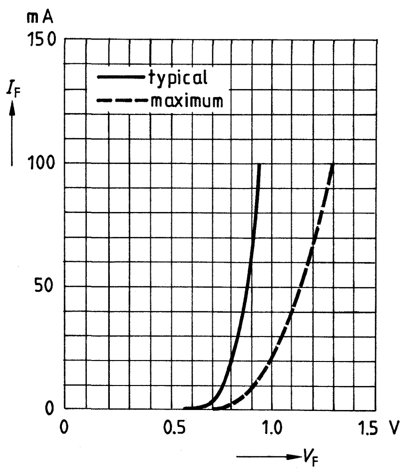
Total power dissipation $P_{tot} = f(T_A)$



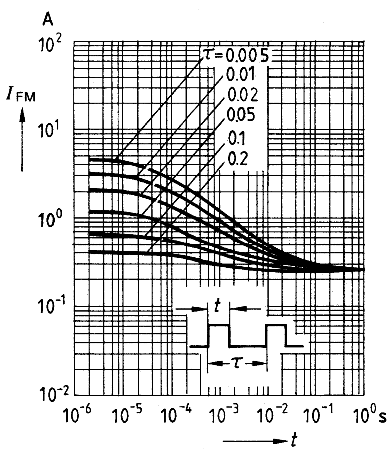
Reverse current $I_R = f(T_A)$



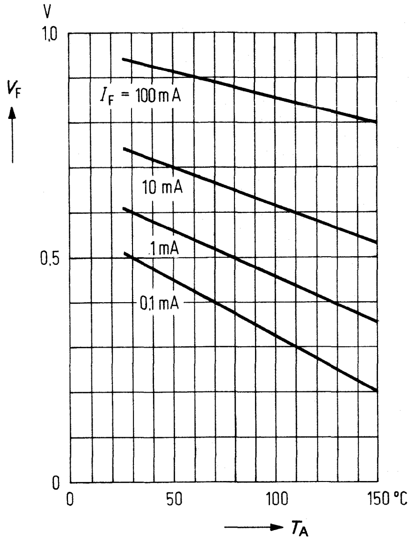
Forward current $I_F = f(V_F)$



Peak forward current $I_{FM} = f(t)$



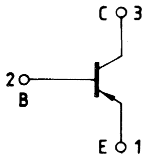
Forward voltage $V_F = f(T_A)$

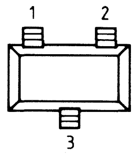


Transistors

PNP silicon planar epitaxial transistors

- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BC 817, BC 818 (NPN)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BC 807–16	5A	BC 808–16	5F	Refer to index	Version A
BC 807–25	5B	BC 808–25	5G		
BC 807–40	5C	BC 808–40	5H		

Maximum ratings		BC 807	BC 808
Collector-emitter voltage	V_{CEO}	45 V	25 V
Collector-base voltage	V_{CBO}	50 V	30 V
Emitter-base voltage	V_{EBO}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\ °C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 375 K/W	

Characteristics

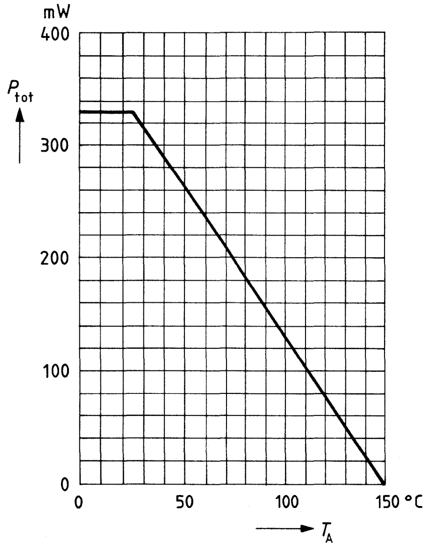
at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 10 mA BC 807 BC 808	$V_{(BR)CE0}$	 45 25	 – –	 – –	 V V
Collector-base breakdown voltage I_C = 100 μA BC 807 BC 808	$V_{(BR)CB0}$	 50 30	 – –	 – –	 V V
Emitter-base breakdown voltage I_E = 10 μA	$V_{(BR)EB0}$	5	–	–	V
Collector cutoff current V_{CB} = 25 V V_{CB} = 25 V, T_A = 150 °C	I_{CB0}	 – –	 – –	 100 5	 nA μA
Emitter cutoff current V_{EB} = 4 V	I_{EB0}	–	–	100	nA
DC current gain[1]) I_C = 100 mA, V_{CE} = 1 V BC 807–16, BC 808–16 BC 807–25, BC 808–25 BC 807–40, BC 808–40 I_C = 300 mA, V_{CE} = 1 V BC 807–16, BC 808–16 BC 807–25, BC 808–25 BC 807–40, BC 808–40	h_{FE}	 100 160 250 60 100 170	 160 250 350 – – –	 250 400 630 – – –	 – – – – – –
Collector-emitter saturation voltage[1]) I_C = 500 mA, I_B = 50 mA	V_{CEsat}	–	–	0,7	V
Base-emitter saturation voltage[1]) I_C = 500 mA, I_B = 50 mA	V_{BEsat}	–	–	2,0	V

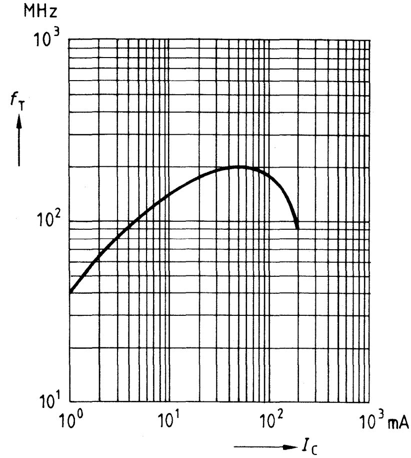
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 5 V, f = 20 MHz	f_T	–	200	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	10	–	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: t = 300 μs, D = 2%.

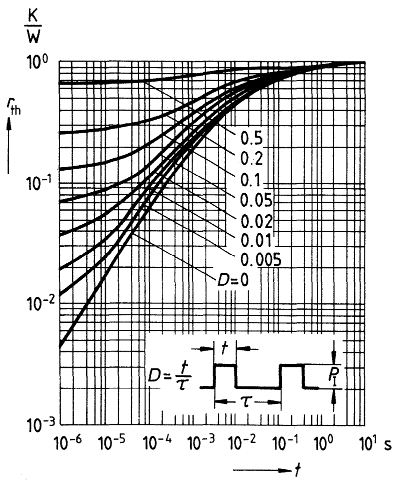
Total power dissipation $P_{tot} = f(T_A)$



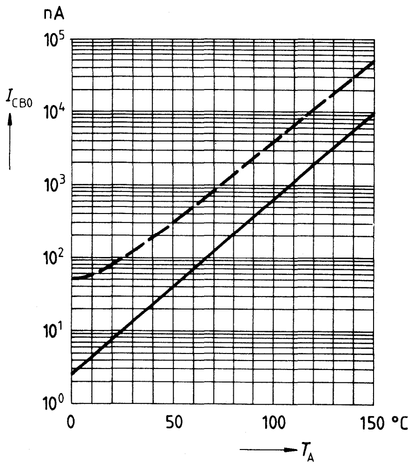
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



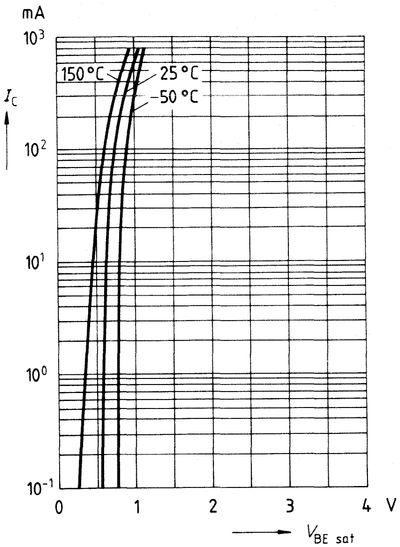
Pulse handling capability $r_{th} = f(t)$
(standardized)



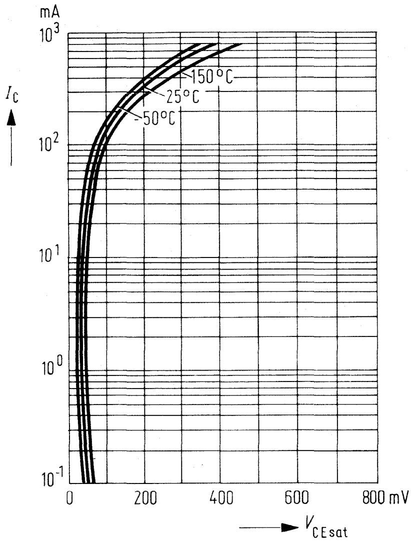
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB0} = 60$ V



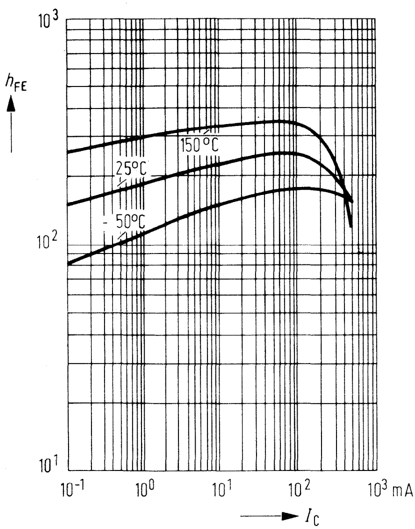
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

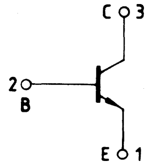


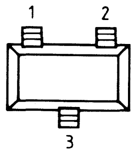
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN silicon planar epitaxial transistors

- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BC 807, BC 808 (PNP)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BC 817–16	6A	BC 818–16	6F	Refer to index	Version A
BC 817–25	6B	BC 818–25	6G		
BC 817–40	6C	BC 818–40	6H		

Maximum ratings		BC 817	BC 818
Collector-emitter voltage	V_{CEO}	45 V	25 V
Collector-base voltage	V_{CBO}	50 V	30 V
Emitter-base voltage	V_{EBO}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

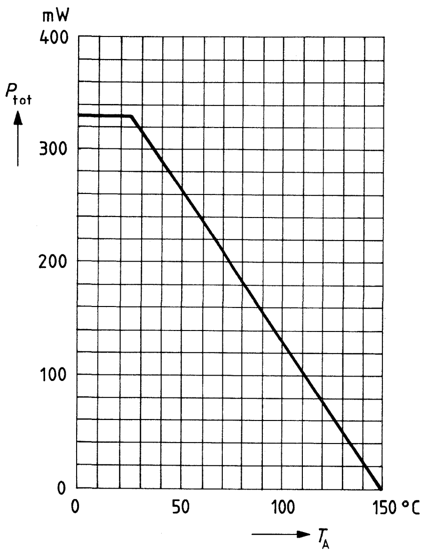
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
$I_C = 10$ mA					
BC 817		45	–	–	V
BC 818		25	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
$I_C = 100$ µA					
BC 817		50	–	–	V
BC 818		30	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 25$ V		–	–	100	nA
$V_{CB} = 25$ V, $T_A = 150\,°C$		–	–	5	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	100	nA
DC current gain[1])	h_{FE}				
$I_C = 100$ mA, $V_{CE} = 1$ V					
BC 817–16, BC 818–16		100	160	250	–
BC 817–25, BC 818–25		160	250	400	–
BC 817–40, BC 818–40		250	350	630	–
$I_C = 300$ mA, $V_{CE} = 1$ V					
BC 817–16, BC 818–16		60	–	–	–
BC 817–25, BC 818–25		100	–	–	–
BC 817–40, BC 818–40		170	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,7	V
Base-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{BEsat}	–	–	2,0	V

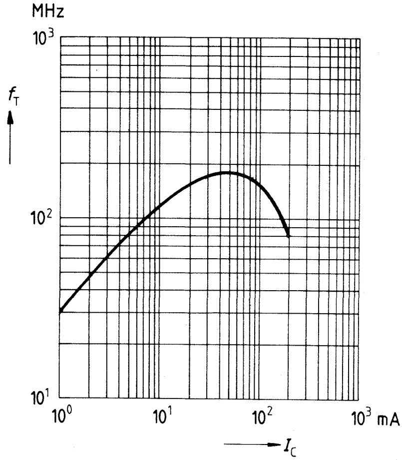
Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0,5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t = 300$ µs, D = 2%.

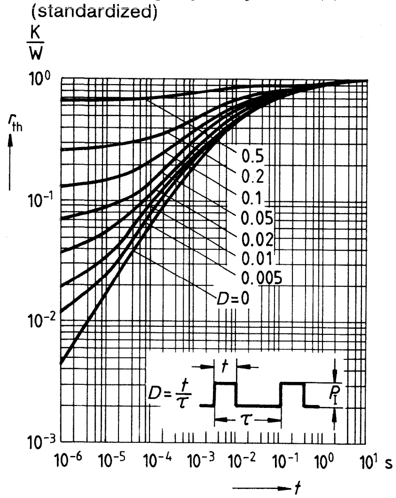
Total power dissipation $P_{tot} = f(T_A)$



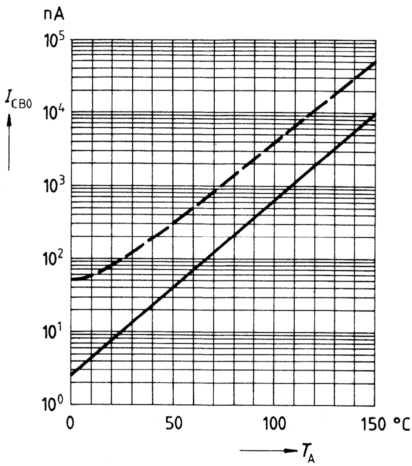
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



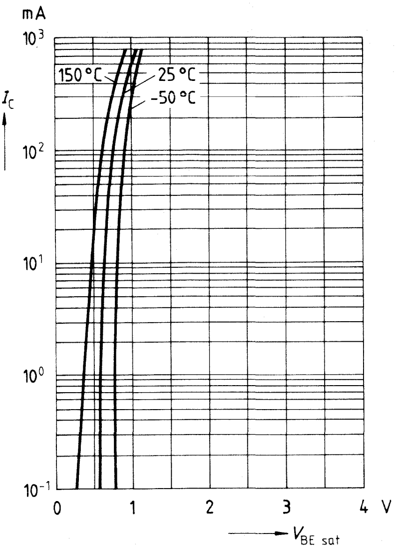
Pulse handling capability $r_{th} = f(t)$
(standardized)



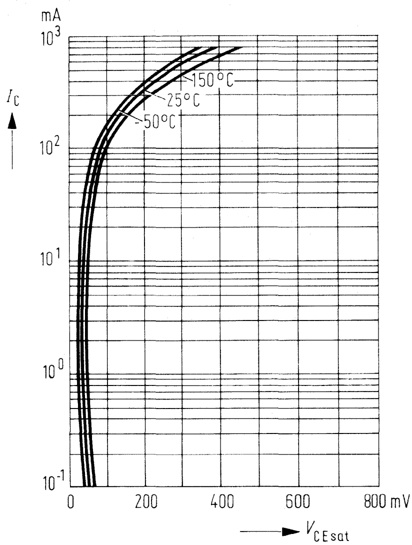
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB0} = 60$ V



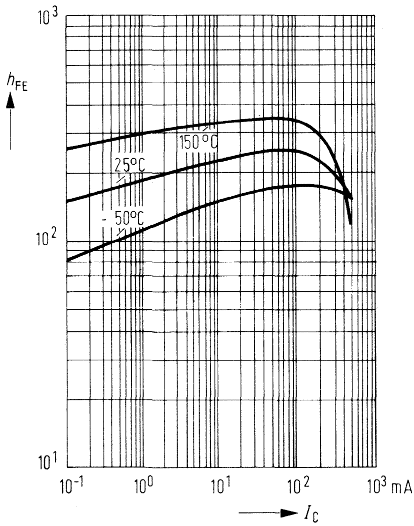
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

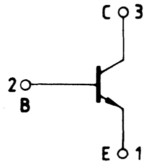


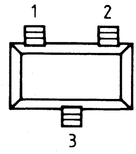
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1\ V$



NPN silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary to BC 856, BC 857, BC 859, BC 860 (PNP)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BC 846 A	1A	BC 848 B	1K	Refer to index	Version A
BC 846 B	1B	BC 848 C	1L		
BC 847 A	1E	BC 849 B	2B		
BC 847 B	1F	BC 849 C	2C		
BC 847 C	1G	BC 850 B	2F		
BC 848 A	1J	BC 850 C	2G		

Maximum ratings		BC 846	BC 847, BC 850	BC 848, BC 849
Collector-emitter-voltage	V_{CEO}	65 V	45 V	30 V
Collector-base voltage	V_{CBO}	80 V	50 V	30 V
Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	80 V	50 V	30 V
Emitter-base voltage	V_{EBO}	6 V	6 V	5 V
Collector current	I_C		100 mA	
Peak collector current	I_{CM}		200 mA	
Peak base current	I_{BM}		200 mA	
Peak emitter current	I_{EM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		330 mW	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375 K/W	

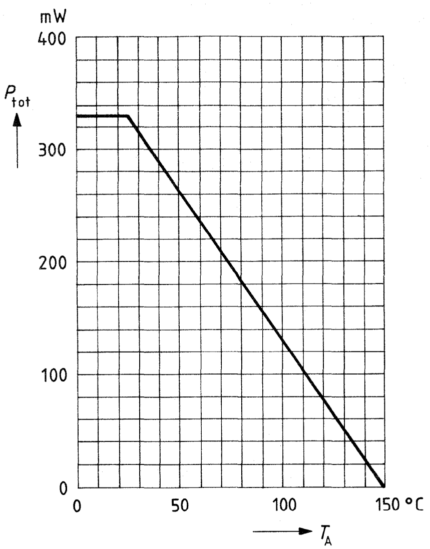
Characteristics
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
$I_C = 10$ mA					
BC 846		65	–	–	V
BC 847, BC 850		45	–	–	V
BC 848, BC 849		30	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
$I_C = 10\ \mu A$					
BC 846		80	–	–	V
BC 847, BC 850		50	–	–	V
BC 848, BC 849		30	–	–	V
Collector-emitter breakdown voltage	$V_{(BR)\,CES}$				
$I_C = 10\ \mu A$, $V_{BE} = 0$					
BC 846		80	–	–	V
BC 847, BC 850		50	–	–	V
BC 848, BC 849		30	–	–	V
Emitter-base breakdown voltage	$V_{(BR)\,EBO}$				
$I_E = 1\ \mu A$					
BC 846, BC 847		6	–	–	V
BC 848, BC 849, BC 850		5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	–	15	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	5	µA
DC current gain[1])	h_{FE}				
$I_C = 10\ \mu A$, $V_{CE} = 5$ V					
BC 846 A, BC 847 A, BC 848 A		–	90	–	–
BC 846 B ··· BC 850 B		–	150	–	–
BC 847 C, BC 848 C, BC 849 C, BC 850 C		–	270	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V					
BC 846 A, BC 847 A, BC 848 A		110	180	220	–
BC 846 B ··· BC 850 B		200	290	450	–
BC 847 C, BC 848 C, BC 849 C, BC 850 C		420	520	800	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	90	250	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	200	600	mV
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	700	–	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	900	–	mV
Base-emitter voltage	$V_{BE\,(on)}$				
$I_C = 2$ mA, $V_{CE} = 5$ V		580	660	700	mV
$I_C = 10$ mA, $V_{CE} = 5$ V		–	–	770	mV

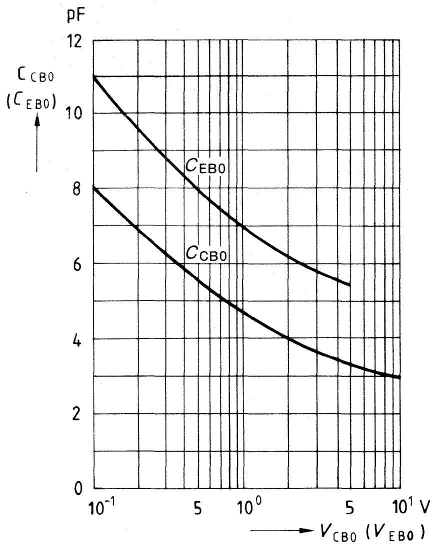
[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	200	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{11e}				
BC 846 A ··· BC 848 A		–	2,7	–	kΩ
BC 846 B ··· BC 850 B		–	4,5	–	kΩ
BC 847 C ··· BC 850 C		–	8,7	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BC 846 A ··· BC 848 A		–	1,5	–	10^{-4}
BC 846 B ··· BC 850 B		–	2,0	–	10^{-4}
BC 847 C ··· BC 850 C		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BC 846 A ··· BC 848 A		–	200	–	–
BC 846 B ··· BC 850 B		–	330	–	–
BC 847 C ··· BC 850 C		–	600	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BC 846 A ··· BC 848 A		–	18	–	µS
BC 846 B ··· BC 850 B		–	30	–	µS
BC 847 C ··· BC 850 C		–	60	–	µS
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ	NF				
f = 30 Hz ··· 15 kHz BC 849		–	1,4	4	dB
BC 850		–	1,4	3	dB
f = 1 kHz, Δf = 200 Hz BC 849		–	1,2	4	dB
BC 850		–	1,0	4	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ f = 10 Hz ··· 50 Hz BC 850	V_{neq}	–	–	0,135	µV

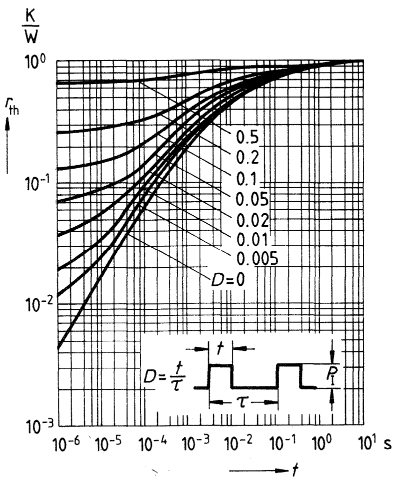
Total power dissipation $P_{tot} = f(T_A)$



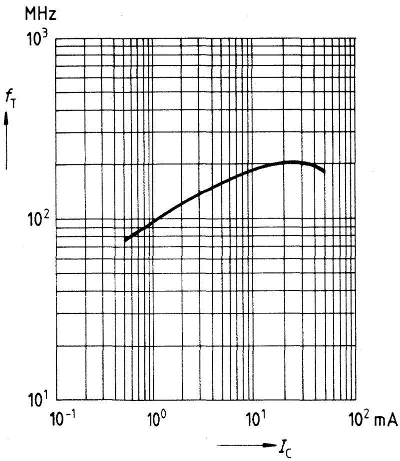
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



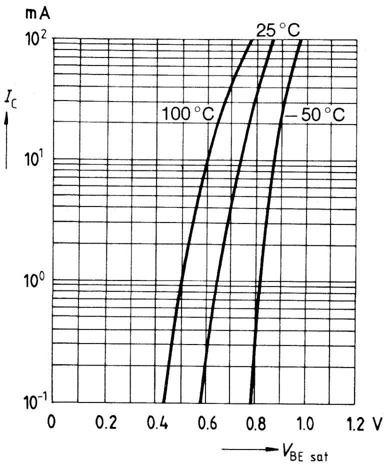
Pulse handling capability $r_{th} = f(t)$
(standardized)



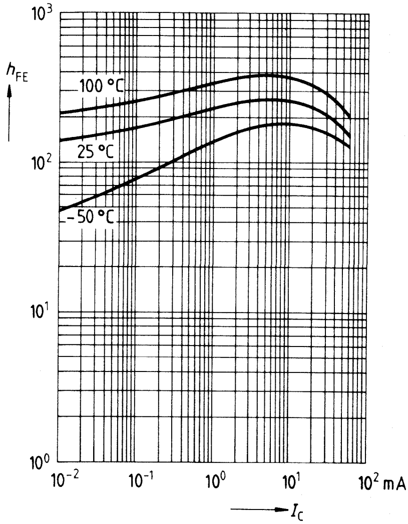
Transition frequency $f_T = f(I_C)$



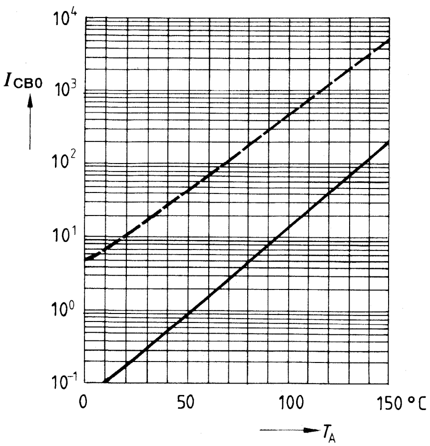
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 20$



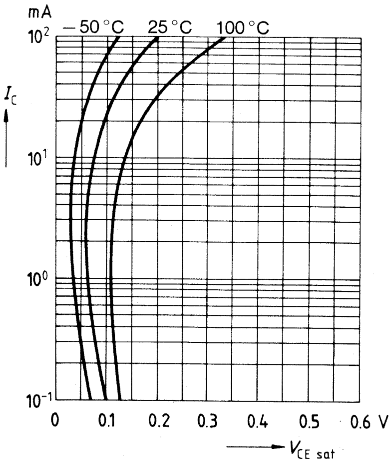
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



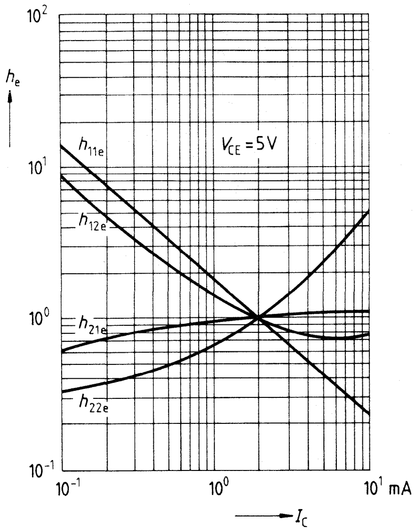
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 30$ V



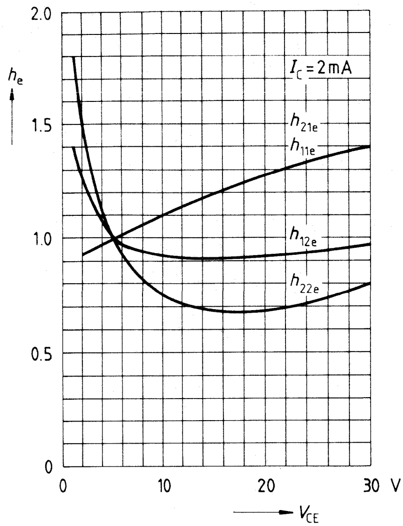
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 20$



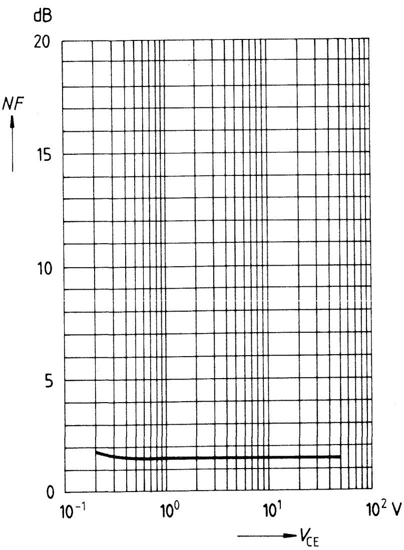
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



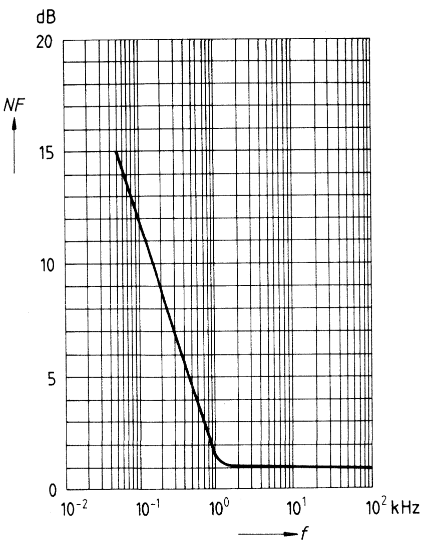
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



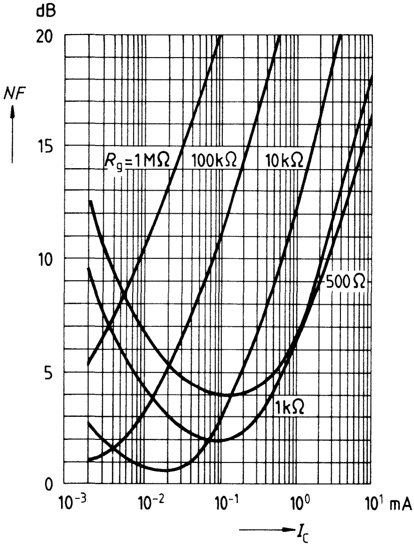
Noise figure $NF = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $f = 1$ kHz



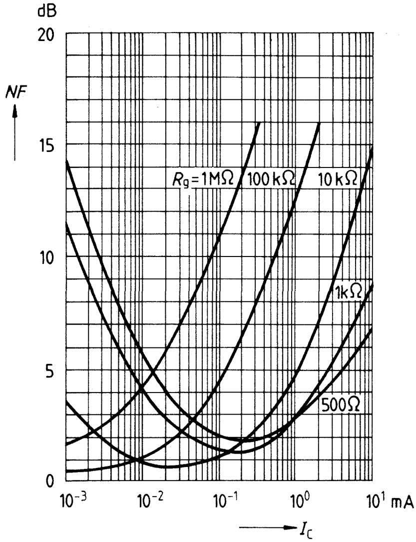
Noise figure $NF = f(f)$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ



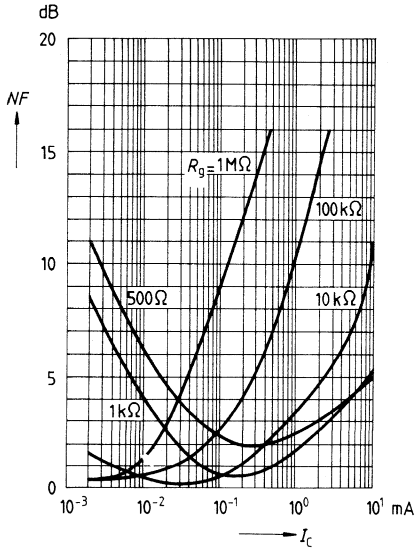
Noise figure $NF = f(I_c)$
$V_{CE} = 5\ V$, $f = 120\ Hz$



Noise figure $NF = f(I_c)$
$V_{CE} = 5\ V$, $f = 1\ kHz$

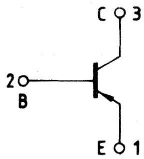


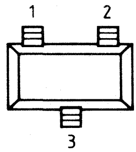
Noise figure $NF = f(I_c)$
$V_{CE} = 5\ V$, $f = 10\ kHz$



PNP silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary to BC 846, BC 847, BC 849, BC 850 (NPN)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BC 856 A	3A	BC 858 C	3L	Refer to index	Version A
BC 856 B	3B	BC 859 A	4A		
BC 857 A	3E	BC 859 B	4B		
BC 857 B	3F	BC 859 C	4C		
BC 857 C	3G	BC 860 B	4F		
BC 858 A	3J	BC 860 C	4G		
BC 858 B	3K				

Maximum ratings		BC 856	BC 857, BC 860	BC 858, BC 859
Collector-emitter voltage	V_{CEO}	65 V	45 V	30 V
Collector-base voltage	V_{CBO}	80 V	50 V	30 V
Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	80 V	50 V	30 V
Emitter-base voltage	V_{EBO}	5 V	5 V	5 V
Collector current	I_C		100 mA	
Peak collector current	I_{CM}		200 mA	
Peak base current	I_{BM}		200 mA	
Peak emitter current	I_{EM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		330 mW	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375 K/W	

Characteristics

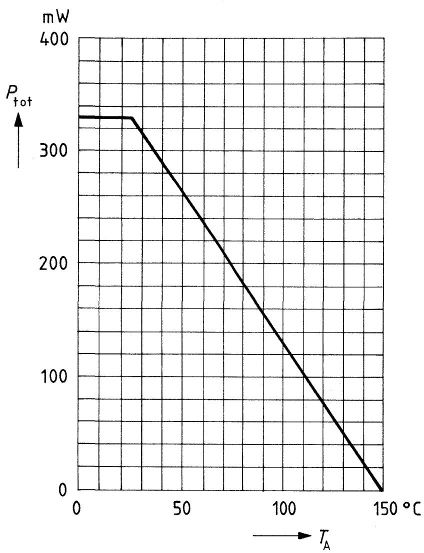
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
$I_C = 10$ mA					
BC 856		65	–	–	V
BC 857, BC 860		45	–	–	V
BC 858, BC 859		30	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
$I_C = 10\,\mu A$					
BC 856		80	–	–	V
BC 857, BC 860		50	–	–	V
BC 858, BC 859		30	–	–	V
Collector-emitter breakdown voltage	$V_{(BR)\,CES}$				
$I_C = 10\,\mu A$, $V_{BE} = 0$					
BC 856		80	–	–	V
BC 857, BC 860		50	–	–	V
BC 858, BC 859		30	–	–	V
Emitter-base breakdown voltage	$V_{(BR)\,EBO}$	5	–	–	V
$I_E = 1\,\mu A$					
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	1	15	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	4	µA
DC current gain[1]	h_{FE}				
$I_C = 10\,\mu A$, $V_{CE} = 5$ V					
BC 856 A ··· BC 858 A		–	90	–	–
BC 856 B ··· BC 860 B		–	150	–	–
BC 857 C ··· BC 860 C		–	270	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V					
BC 856 A ··· BC 858 A		125	180	250	–
BC 856 B ··· BC 860 B		220	290	475	–
BC 857 C ··· BC 860 C		420	520	800	–
Collector-emitter saturation voltage[1]	V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	75	300	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	250	650	mV
Base-emitter saturation voltage[1]	V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	700	–	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	850	–	mV
Base-emitter voltage	$V_{BE\,(on)}$				
$I_C = 2$ mA, $V_{CE} = 5$ V		600	650	750	mV
$I_C = 10$ mA, $V_{CE} = 5$ V		–	–	820	mV

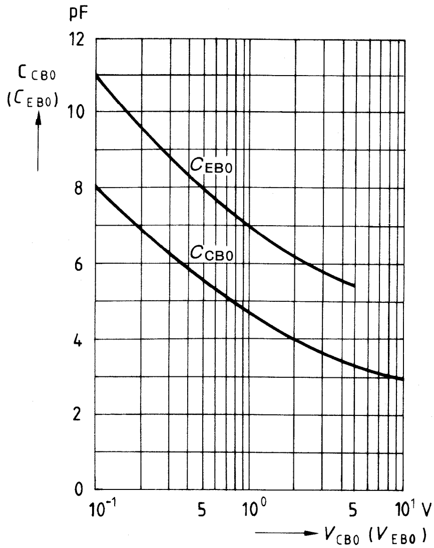
[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	250	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{11e}				
BC 856 A ··· BC 858 A		–	2,7	–	kΩ
BC 856 B ··· BC 860 B		–	4,5	–	kΩ
BC 857 C ··· BC 860 C		–	8,7	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BC 856 A ··· BC 858 A		–	1,5	–	10^{-4}
BC 856 B ··· BC 860 B		–	2,0	–	10^{-4}
BC 857 C ··· BC 860 C		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BC 856 A ··· BC 858 A		–	200	–	–
BC 856 B ··· BC 860 B		–	330	–	–
BC 857 C ··· BC 860 C		–	600	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BC 856 A ··· BC 858 A		–	18	–	µS
BC 856 B ··· BC 860 B		–	30	–	µS
BC 857 C ··· BC 860 C		–	60	–	µS
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ	NF				
f = 30 Hz ··· 15 kHz BC 859		–	1,2	4	dB
BC 860		–	1,0	3	dB
f = 1 kHz, Δf = 200 Hz BC 859		–	1,0	4	dB
BC 860		–	1,0	4	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ f = 10 Hz ··· 50 Hz BC 860	V_{neq}	–	–	0,110	µV

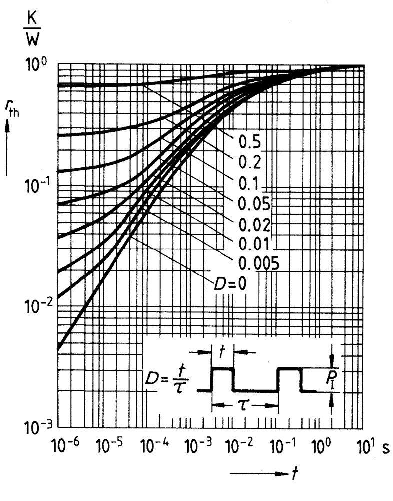
Total power dissipation $P_{tot} = f(T_A)$



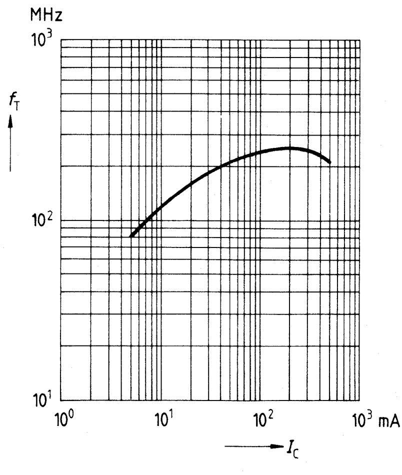
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



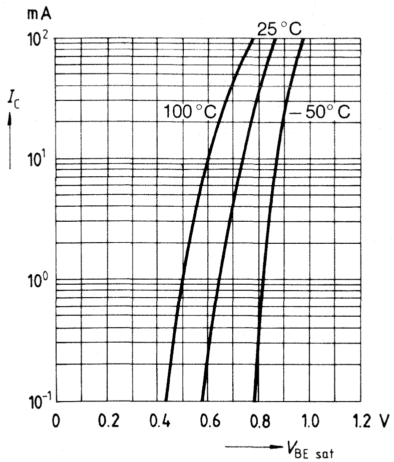
Pulse handling capability $r_{th} = f(t)$
(standardized)



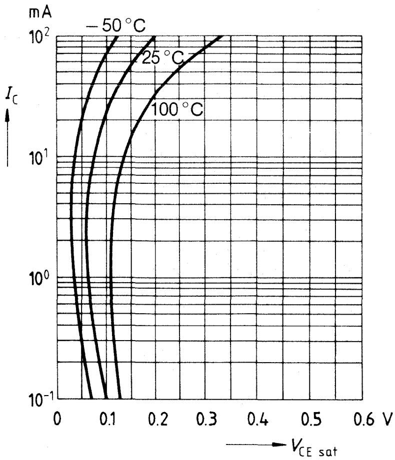
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



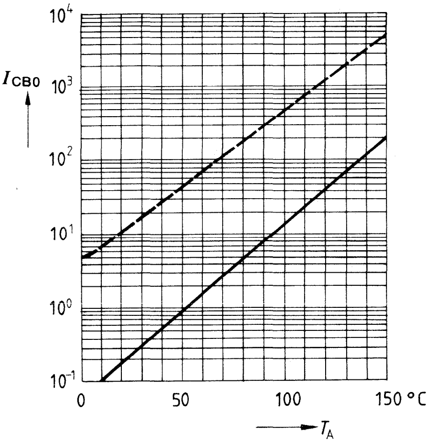
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 20$



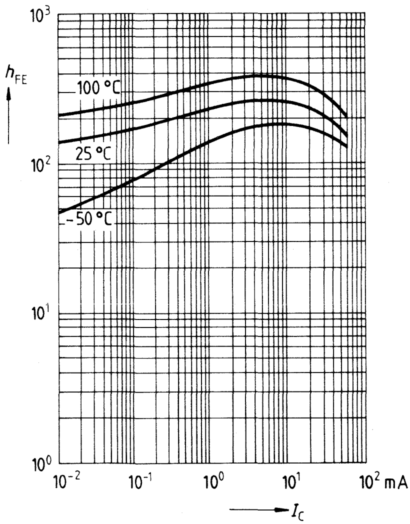
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 20$



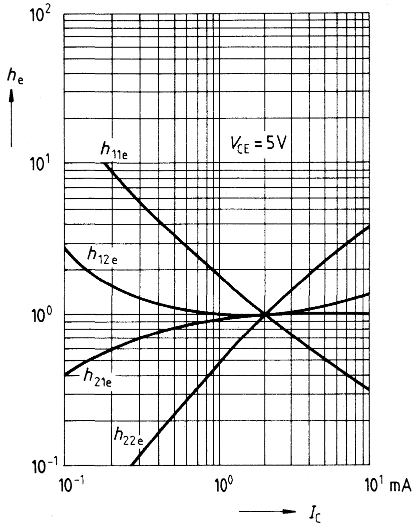
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



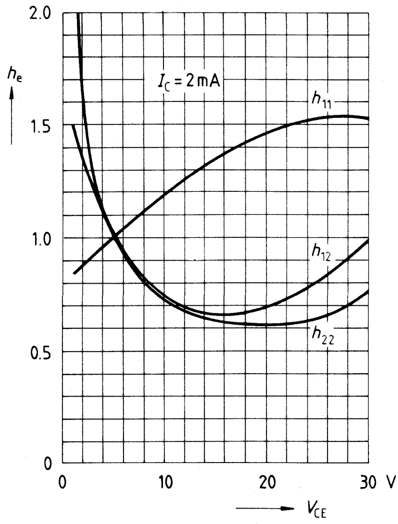
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



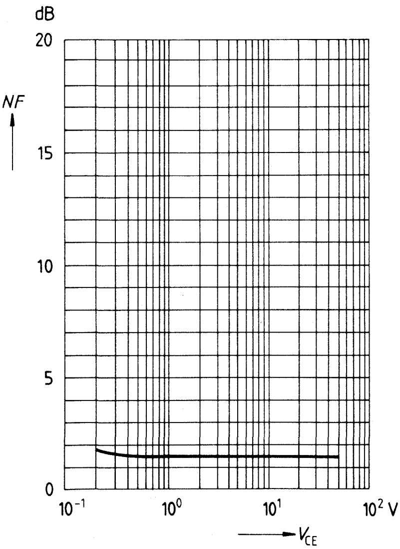
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



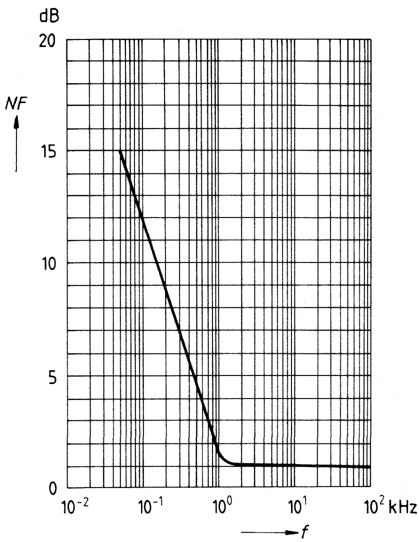
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



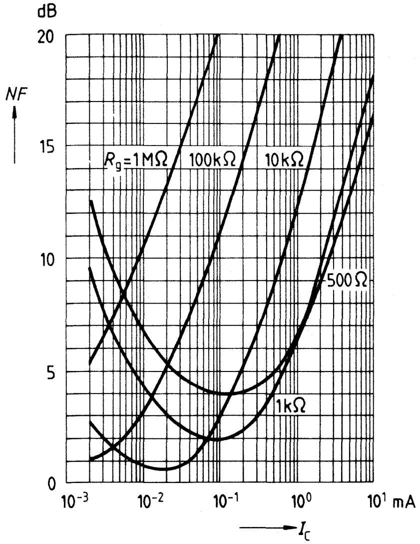
Noise figure $NF = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $f = 1$ kHz



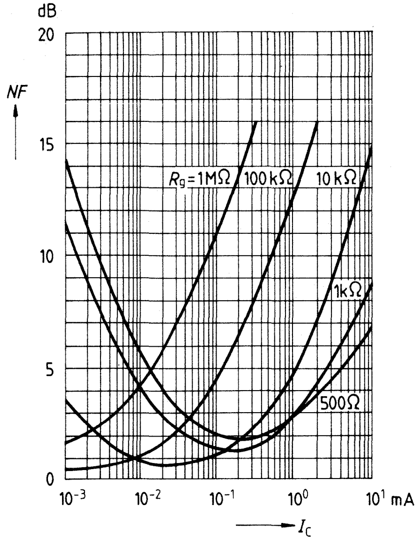
Noise figure $NF = f(f)$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $V_{CE} = 5$ V



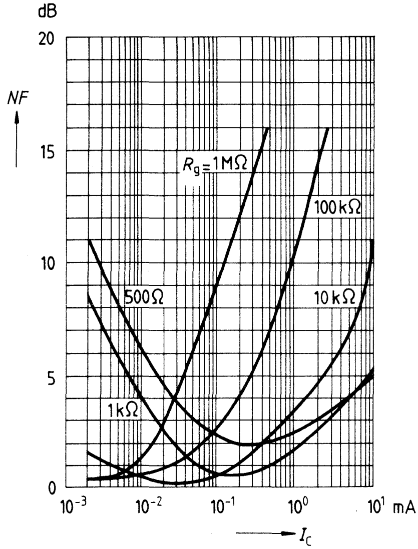
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz

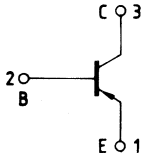


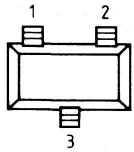
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz



PNP silicon planar epitaxial transistors

- High collector current
- High current gain
- Complementary types: BCV 27, BCV 47 (NPN)





Top view

Type	Marking	Ordering code	Package
BCV 26	FD	Refer to index	Version A
BCV 46	FE		

Maximum ratings		BCV 26	BCV 46
Collector-emitter voltage	V_{CEO}	30 V	60 V
Collector-base voltage	V_{CBO}	40 V	80 V
Emitter-base voltage	V_{EBO}	10 V	10 V
Collector current	I_C	500 mA	
Peak collector current	I_{CM}	800 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\ °C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	−65 ··· +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W	

Characteristics

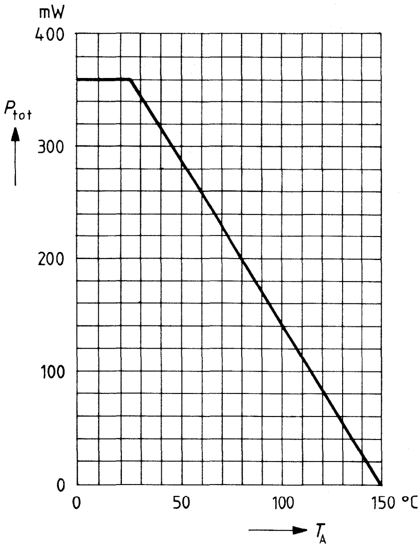
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CEO}$				
BCV 26			30	–	–	V
BCV 46			60	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)\,CBO}$				
BCV 26			40	–	–	V
BCV 46			80	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$		$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 30$ V	BCV 26		–	–	100	nA
$V_{CB} = 60$ V	BCV 46		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 26		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 46		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 1$ V	BCV 26		4000	–	–	–
	BCV 46		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 26		10000	–	–	–
	BCV 46		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 26		20000	–	–	–
	BCV 46		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 26		4000	–	–	–
	BCV 46		2000	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1,0	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

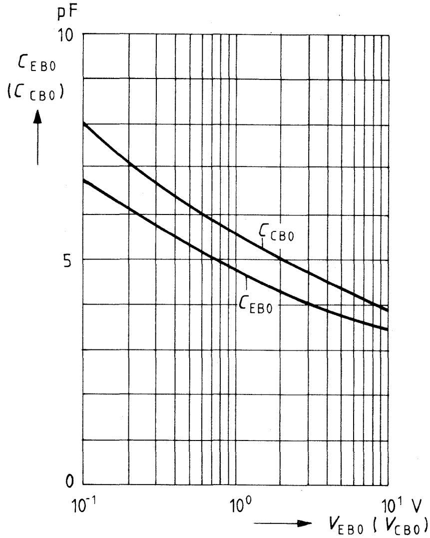
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	4,5	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%

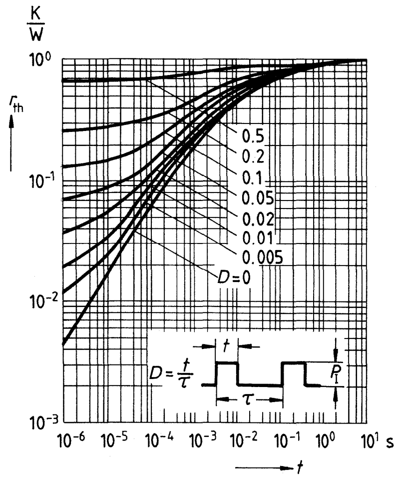
Total power dissipation $P_{tot} = f(T_A)$



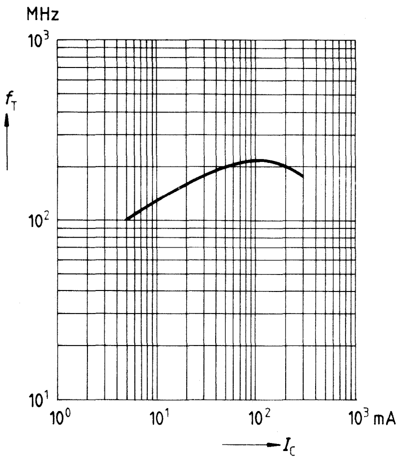
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



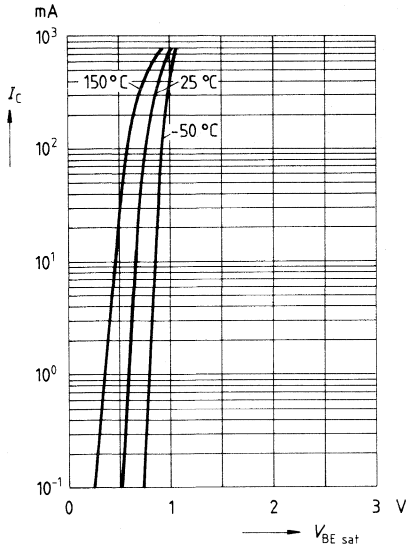
Pulse handling capability $r_{th} = f(t)$
(standardized)



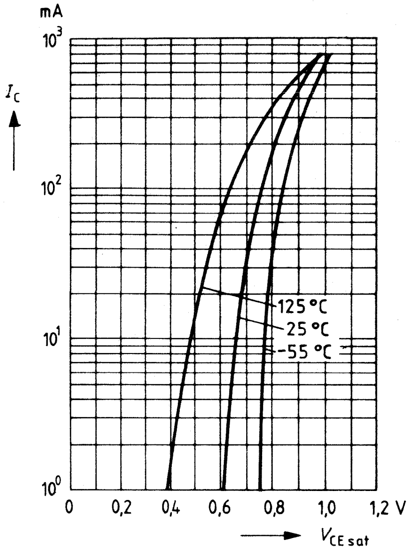
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



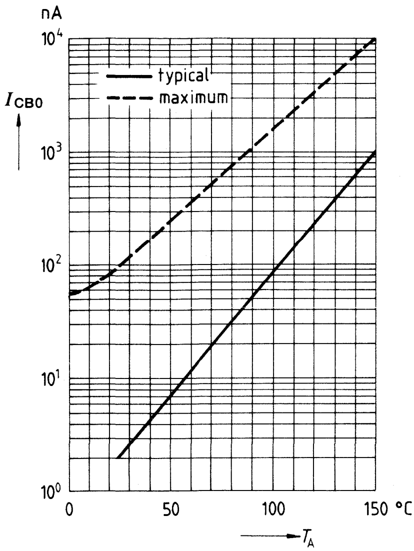
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



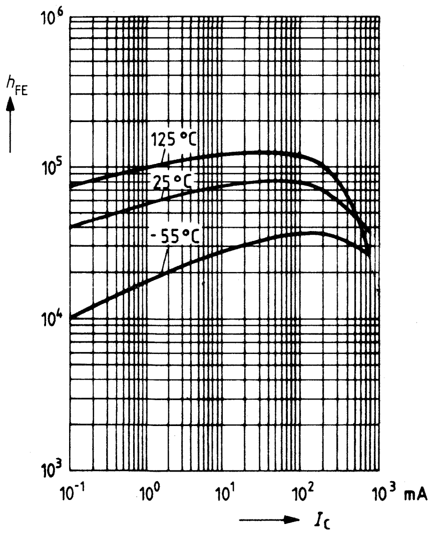
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$

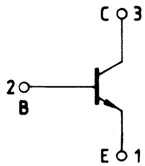


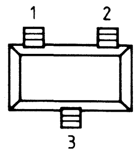
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5\,V$



NPN silicon planar epitaxial transistors

- High collector current
- High current gain
- Complementary types: BCV 26, BCV 46 (PNP)





Top view

Type	Marking	Ordering code	Package
BCV 27	FF	Refer to index	Version A
BCV 47	FG		

Maximum ratings		BCV 27	BCV 47
Collector-emitter voltage	V_{CEO}	30 V	60 V
Collector-base voltage	V_{CBO}	40 V	80 V
Emitter-base voltage	V_{EBO}	10 V	10 V
Collector current	I_C	500 mA	
Peak collector current	I_{CM}	800 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	−65 … +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W	

Characteristics

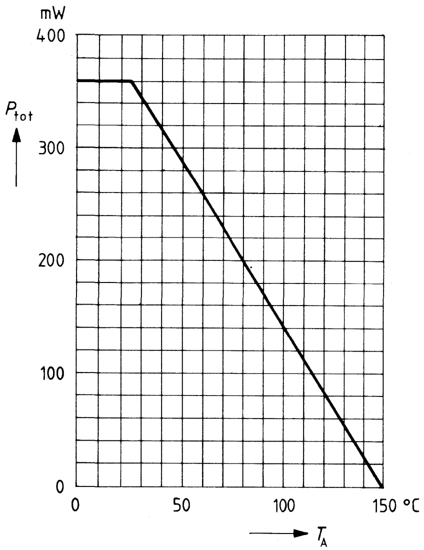
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CEO}$				
BCV 27			30	–	–	V
BCV 47			60	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)\,CBO}$				
BCV 27			40	–	–	V
BCV 47			80	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$		$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 30$ V	BCV 27		–	–	100	nA
$V_{CB} = 60$ V	BCV 47		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 27		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 47		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 1$ V	BCV 27		4000	–	–	–
	BCV 47		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 27		10000	–	–	–
	BCV 47		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 27		20000	–	–	–
	BCV 47		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 27		4000	–	–	–
	BCV 47		2000	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1,0	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

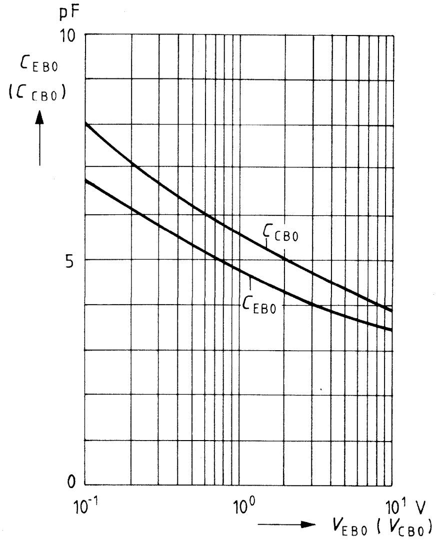
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3,5	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

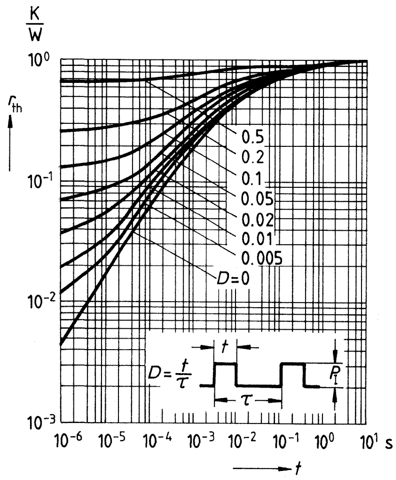
Total power dissipation $P_{tot} = f(T_A)$



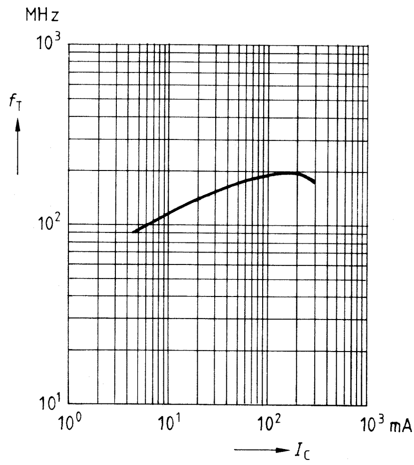
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



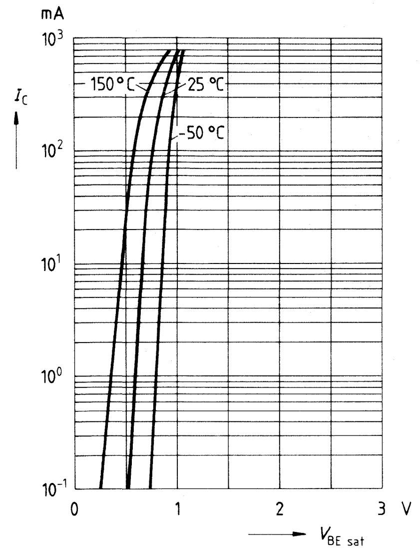
Pulse handling capability $r_{th} = f(t)$
(standardized)



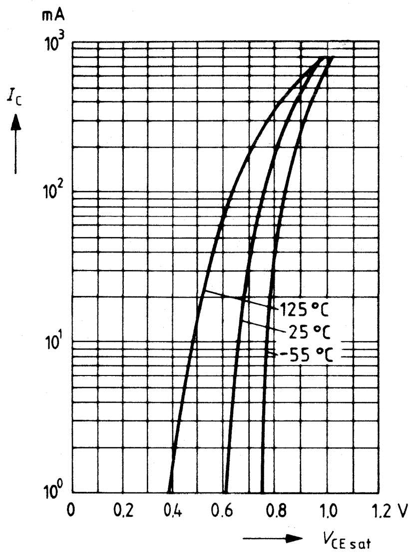
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



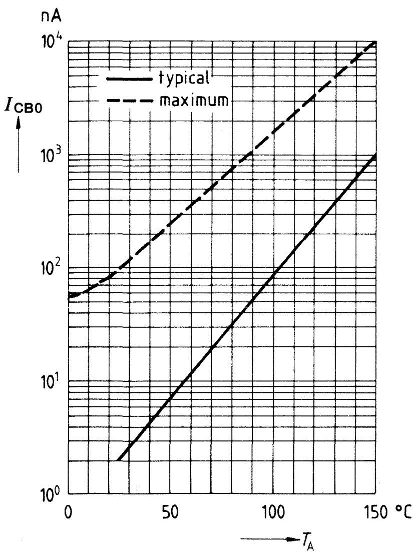
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



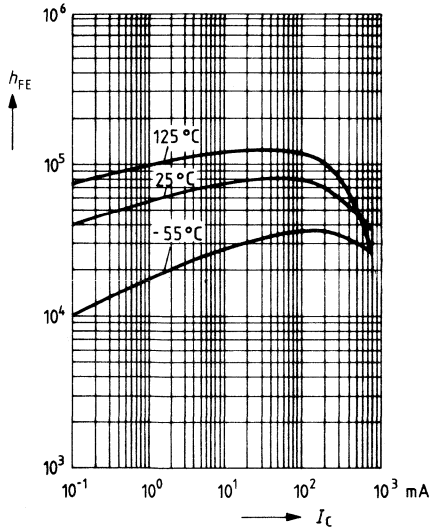
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$

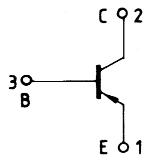


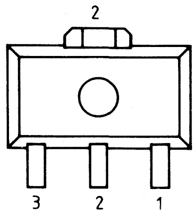
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



PNP silicon planar epitaxial transistors

- High collector current
- High current gain
- Complementary types: BCV 29, BCV 49 (NPN)





Top view

Type	Marking	Ordering code	Package
BCV 28	ED	Refer to index	Version C
BCV 48	EE		

Maximum ratings		BCV 28	BCV 48
Collector-emitter voltage	V_{CEO}	30 V	60 V
Collector-base voltage	V_{CBO}	40 V	80 V
Emitter-base voltage	V_{EBO}	10 V	10 V
Collector current	I_C	500 mA	
Peak collector current	I_{CM}	800 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\ °C$	P_{tot}	1,0 W	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	−65 ... +150 °C	

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

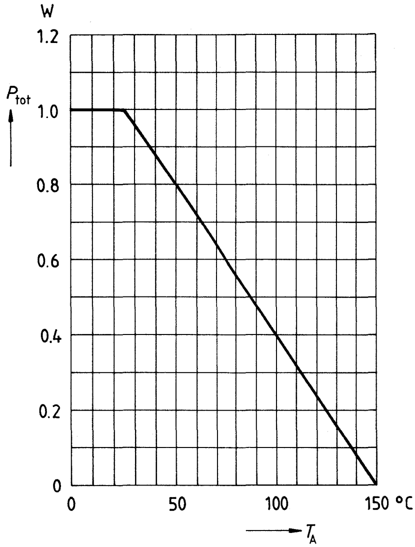
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CE0}$				
BCV 28			30	–	–	V
BCV 48			60	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA		$V_{(BR)\,CB0}$				
BCV 28			40	–	–	V
BCV 48			80	–	–	V
Emitter base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EB0}$	10	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 30$ V	BCV 28		–	–	100	nA
$V_{CB} = 60$ V	BCV 48		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 28		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 48		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EB0}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V	BCV 28		4000	–	–	–
	BCV 48		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 28		10000	–	–	–
	BCV 48		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 28		20000	–	–	–
	BCV 48		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 28		4000	–	–	–
	BCV 48		2000	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1,0	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

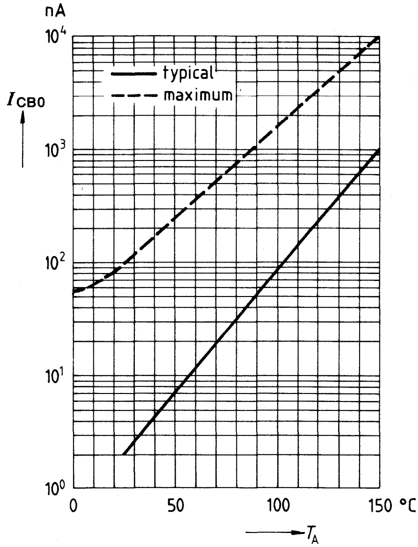
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	4,5	–	pF

[1]) Pulse test: $t = 300$ µs, D = 2%.

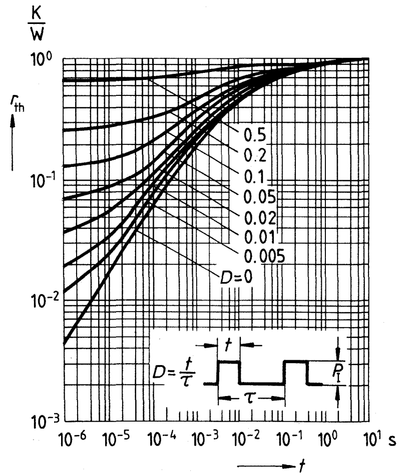
Total power dissipation $P_{tot} = f(T_A)$



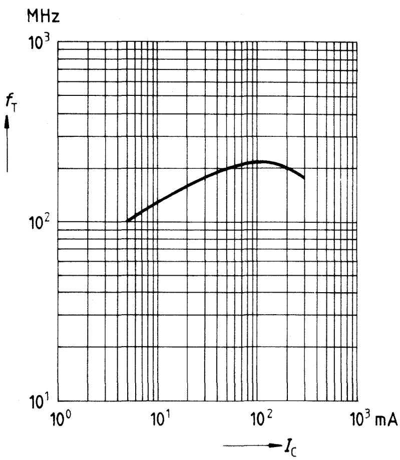
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



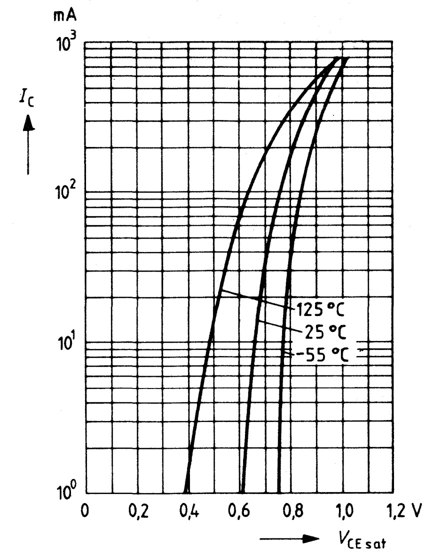
Pulse handling capability $r_{th} = f(t)$
(standardized)



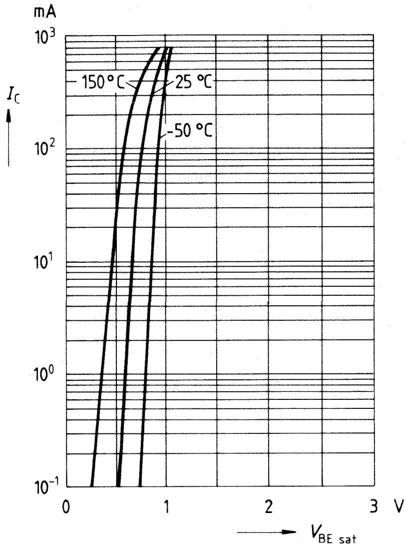
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



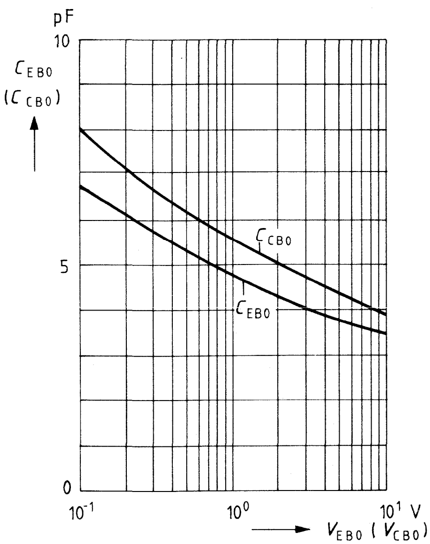
Collector-emitter saturation voltage $V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



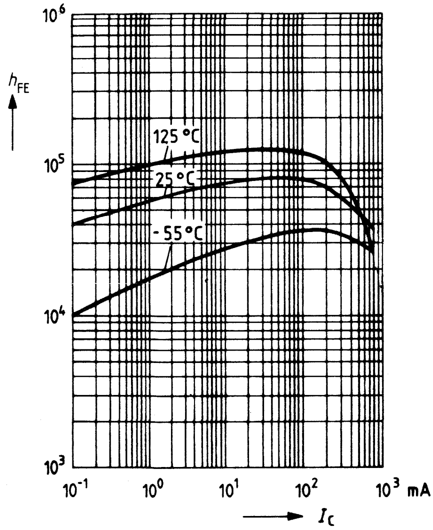
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V

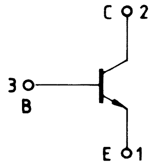


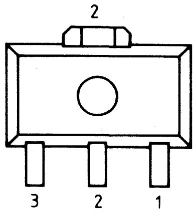
Darlington Transistors

BCV 29
BCV 49

NPN silicon planar epitaxial transistors

- High collector current
- High current gain
- Complementary to: BCV 28, BCV 48 (PNP)





Top view

Type	Marking	Ordering code	Package
BCV 29	EF	Refer to index	Version C
BCV 49	EG		

<table>
<tr><th>Maximum ratings</th><th></th><th>BCV 29</th><th>BCV 49</th></tr>
<tr><td>Collector-emitter voltage</td><td>V_{CEO}</td><td>30 V</td><td>60 V</td></tr>
<tr><td>Collector-base voltage</td><td>V_{CBO}</td><td>40 V</td><td>80 V</td></tr>
<tr><td>Emitter-base voltage</td><td>V_{EBO}</td><td>10 V</td><td>10 V</td></tr>
<tr><td>Collector current</td><td>I_C</td><td colspan="2">500 mA</td></tr>
<tr><td>Peak collector current</td><td>I_{CM}</td><td colspan="2">800 mA</td></tr>
<tr><td>Base current</td><td>I_B</td><td colspan="2">100 mA</td></tr>
<tr><td>Peak base current</td><td>I_{BM}</td><td colspan="2">200 mA</td></tr>
<tr><td>Total power dissipation $T_A = 25\,°C$</td><td>P_{tot}</td><td colspan="2">1,0 W</td></tr>
<tr><td>Junction temperature</td><td>T_j</td><td colspan="2">150 °C</td></tr>
<tr><td>Storage temperature range</td><td>T_{stg}</td><td colspan="2">$-65 \cdots +150$ °C</td></tr>
<tr><td>Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm</td><td>R_{thJA}</td><td colspan="2">≤ 125 K/W</td></tr>
</table>

Characteristics

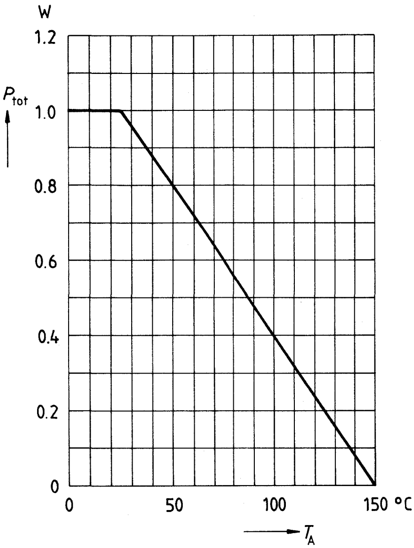
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA BCV 29 BCV 49	$V_{(BR)\,CEO}$	 30 60	 – –	 – –	 V V
Collector-base breakdown voltage $I_C = 100$ µA BCV 29 BCV 49	$V_{(BR)\,CBO}$	 40 80	 – –	 – –	 V V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current $V_{CB} = 30$ V BCV 29 $V_{CB} = 60$ V BCV 49 $V_{CB} = 30$ V, $T_A = 150\,°C$ BCV 29 $V_{CB} = 60$ V, $T_A = 150\,°C$ BCV 49	I_{CBO}	 – – – –	 – – – –	 100 100 10 10	 nA nA µA µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	100	nA
DC current gain[1] $I_C = 100$ µA, $V_{CE} = 1$ V BCV 29 BCV 49 $I_C = 10$ mA, $V_{CE} = 5$ V BCV 29 BCV 49 $I_C = 100$ mA, $V_{CE} = 5$ V BCV 29 BCV 49 $I_C = 0{,}5$ A, $V_{CE} = 5$ V BCV 29 BCV 49	h_{FE}	 4000 2000 10000 4000 20000 10000 4000 2000	 – – – – – – – –	 – – – – – – – –	 – – – – – – – –
Collector-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA	V_{CEsat}	–	–	1,0	V
Base-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA	V_{BEsat}	–	–	1,5	V

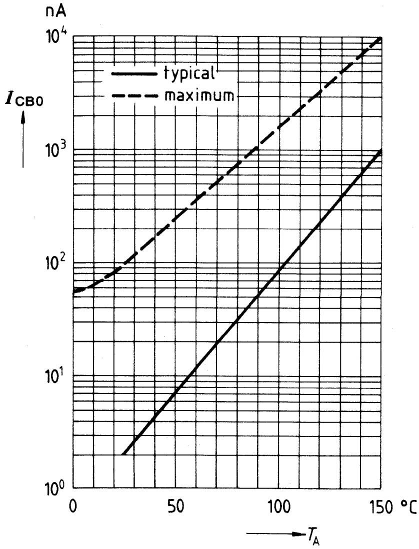
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	150	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3,5	–	pF

[1]) Pulse test: $t = 300$ µs, D = 2%.

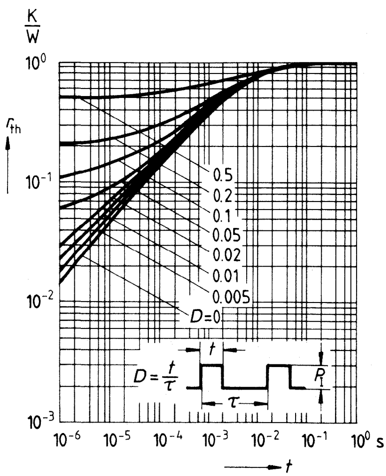
Total power dissipation $P_{tot} = f(T_A)$



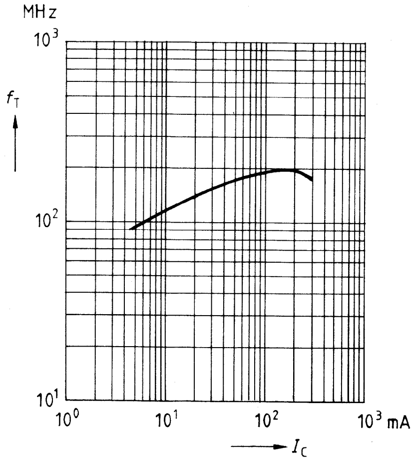
Collector cutoff current $I_{CBO} = f(T_A)$



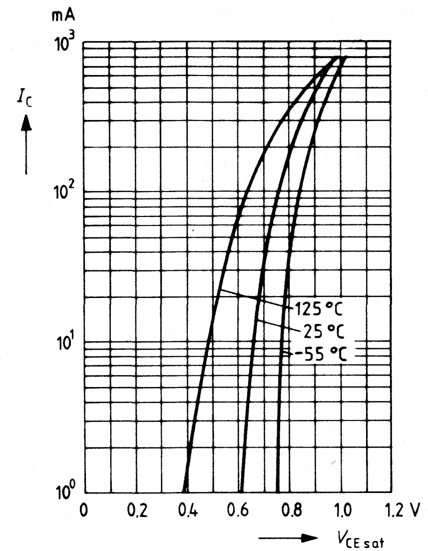
Pulse handling capability $r_{th} = f(t)$
(standardized)



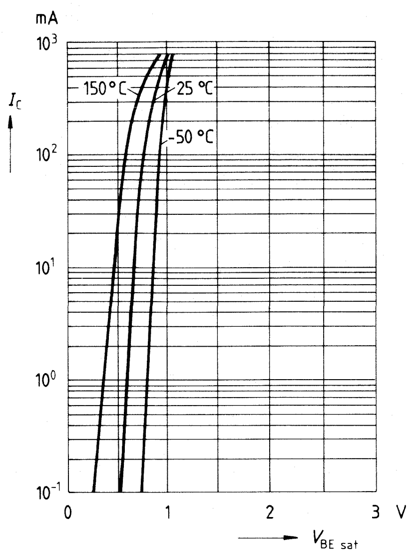
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



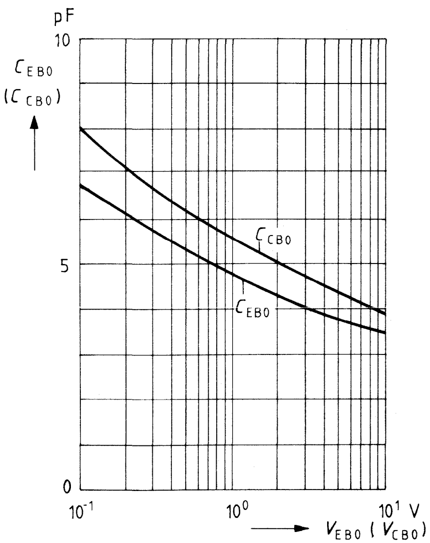
Collector-emitter saturation voltage $V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



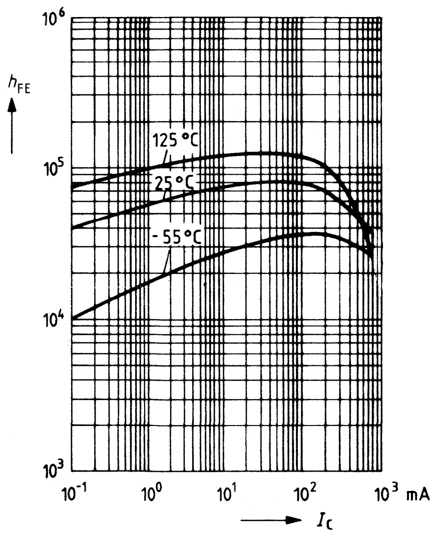
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$

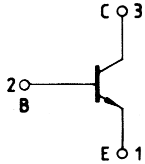


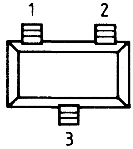
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



NPN silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary to BCW 61, BCX 71 (PNP)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCW 60 A	AA	BCW 60 FN	AN	Refer to index	Version A
BCW 60 B	AB	BCX 70 G	AG		
BCW 60 C	AC	BCX 70 H	AH		
BCW 60 D	AD	BCX 70 J	AJ		
BCW 60 FF	AF	BCX 70 K	AK		

Maximum ratings		BCW 60	BCW 60 F	BCX 70
Collector-emitter voltage	V_{CEO}	32 V	32 V	45 V
Collector-base voltage	V_{CBO}	32 V	32 V	45 V
Emitter-base voltage	V_{EBO}	5 V	5 V	5 V
Collector current	I_C		100 mA	
Peak collector current	I_{CM}		200 mA	
Peak base current	I_{BM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		330 mW	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		−65 ··· +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375 K/W	

Characteristics

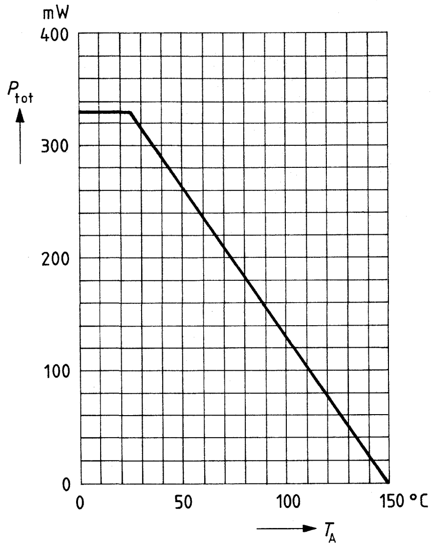
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CE0}$				
$I_C = 10$ mA	BCW 60, BCW 60 F		32	–	–	V
	BCX 70		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CB0}$				
$I_C = 10$ µA	BCW 60, BCW 60 F		32	–	–	V
	BCX 70		45	–	–	V
Emitter-base breakdown voltage $I_E = 1$ µA		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 32$ V	BCW 60, BCW 60 F		–	–	20	nA
$V_{CB} = 45$ V	BCX 70		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 60, BCW 60 F		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCX 70		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EB0}	–	–	20	nA
DC current gain[1])		h_{FE}				
$I_C = 10$ µA, $V_{CE} = 5$ V						
BCW 60 A, BCX 70 G			20	78	–	–
BCW 60 B, BCX 70 H			20	145	–	–
BCW 60 FF, BCW 60 C, BCX 70 J			40	220	–	–
BCW 60 FN, BCW 60 D, BCX 70 K			100	300	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V						
BCW 60 A, BCX 70 G			120	170	220	–
BCW 60 B, BCX 70 H			180	250	310	–
BCW 60 FF, BCW 60 C, BCX 70 J			250	350	460	–
BCW 60 FN, BCW 60 D, BCX 70 K			380	500	630	–
$I_C = 50$ mA, $V_{CE} = 1$ V						
BCW 60 A, BCX 70 G			50	–	–	–
BCW 60 B, BCX 70 H			70	–	–	–
BCW 60 FF, BCW 60 C, BCX 70 J			90	–	–	–
BCW 60 FN, BCW 60 D, BCX 70 K			100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,12	0,25	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,20	0,55	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,70	0,85	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,83	1,05	V
Base-emitter voltage		$V_{BE\,(on)}$				
$I_C = 10$ µA, $V_{CE} = 5$ V			–	0,52	–	V
$I_C = 2$ mA, $V_{CE} = 5$ V			0,55	0,65	0,75	V
$I_C = 50$ mA, $V_{CE} = 1$ V[1])			–	0,78	–	V

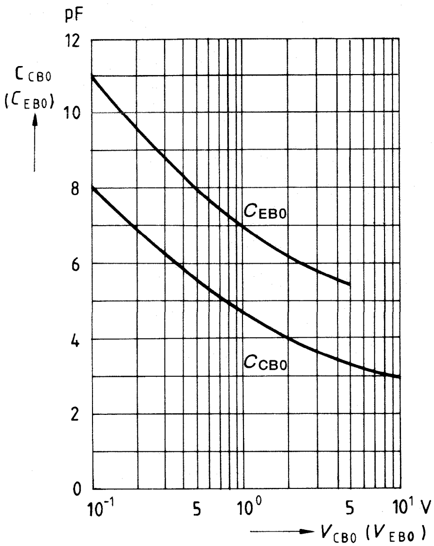
[1]) Pulse test: $t = 300$ µs, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	200	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 MHz	h_{11e}				
BCW 60 A, BCX 70 G		–	2,7	–	kΩ
BCW 60 B, BCX 70 H		–	3,6	–	kΩ
BCW 60 FF, BCW 60 C, BCX 70 J		–	4,5	–	kΩ
BCW 60 FN, BCW 60 D, BCX 70 K		–	7,5	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BCW 60 A, BCX 70 G		–	1,5	–	10^{-4}
BCW 60 B, BCX 70 H		–	2,0	–	10^{-4}
BCW 60 FF, BCW 60 C, BCX 70 J		–	2,0	–	10^{-4}
BCW 60 FN, BCW 60 D, BCX 70 K		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BCW 60 A, BCX 70 G		–	200	–	–
BCW 60 B, BCX 70 H		–	260	–	–
BCW 60 FF, BCW 60 C, BCX 70 J		–	330	–	–
BCW 60 FN, BCW 60 D, BCX 70 K		–	520	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BCW 60 A, BCX 70 G		–	18	–	µS
BCW 60 B, BCX 70 H		–	24	–	µS
BCW 60 FF, BCW 60 C, BCX 70 J		–	30	–	µS
BCW 60 FN, BCW 60 D, BCX 70 K		–	50	–	µS
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ f = 1 kHz, Δf = 200 Hz	NF	–	2	–	dB
I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ f = 1 kHz; Δf = 200 Hz BCW 60 FF, BCW 60 FN		–	1	2	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_G = 2 kΩ f = 10 Hz ··· 50 Hz BCW 60 FF, BCW 60 FN	V_{neq}	–	–	0,135	µV

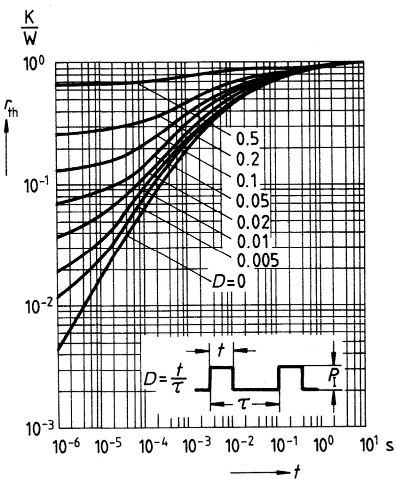
Total power dissipation $P_{tot} = f(T_A)$



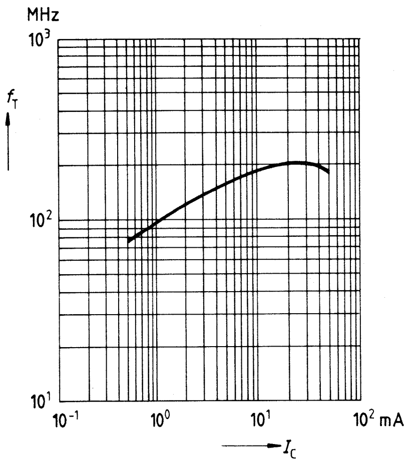
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$



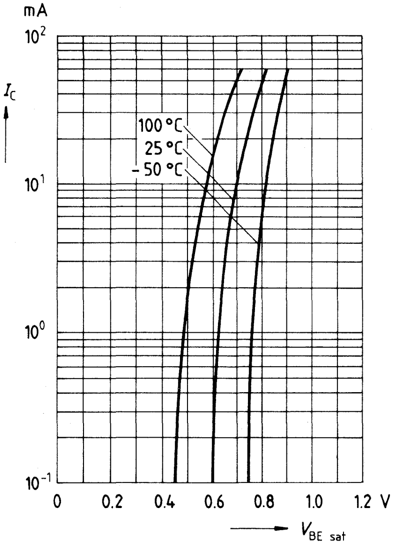
Pulse handling capability $r_{th} = f(t)$
(standardized)



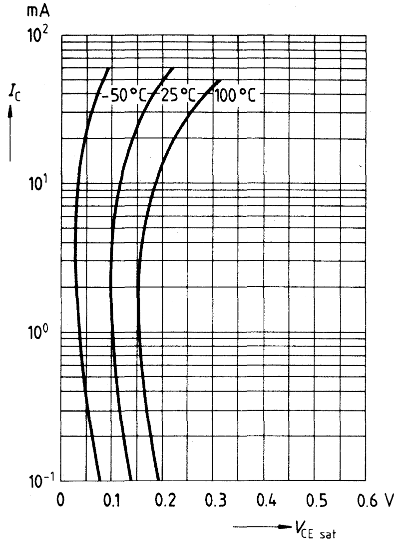
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



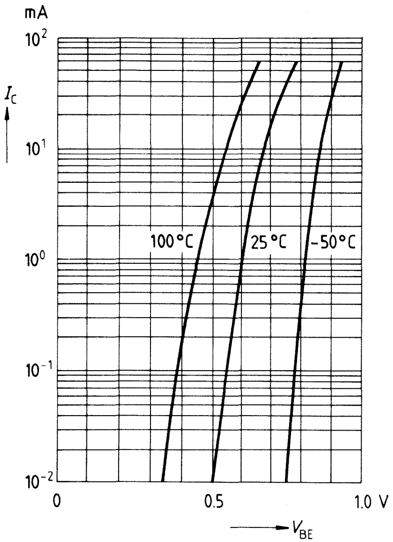
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 40$



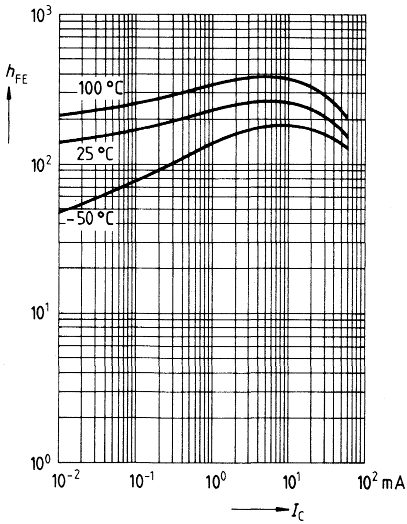
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 40$



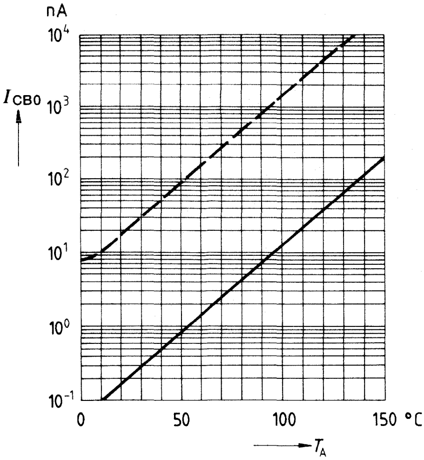
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



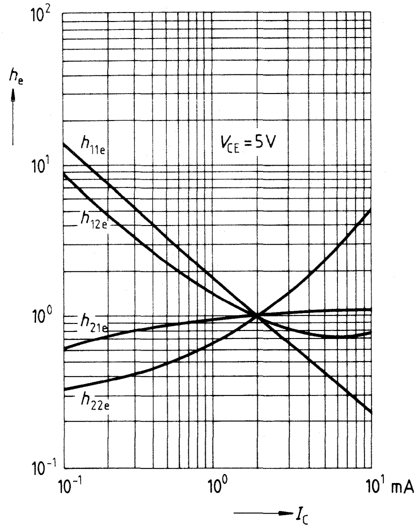
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



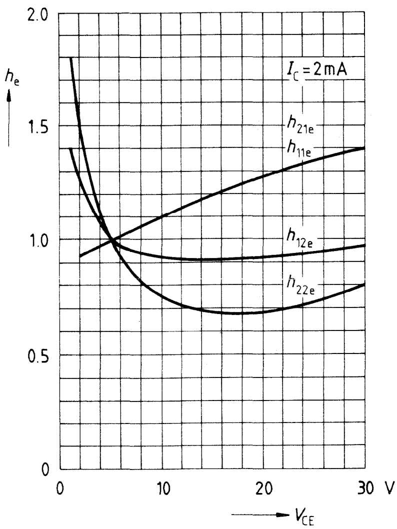
Collector cutoff current $I_{CBO} = f(T_A)$



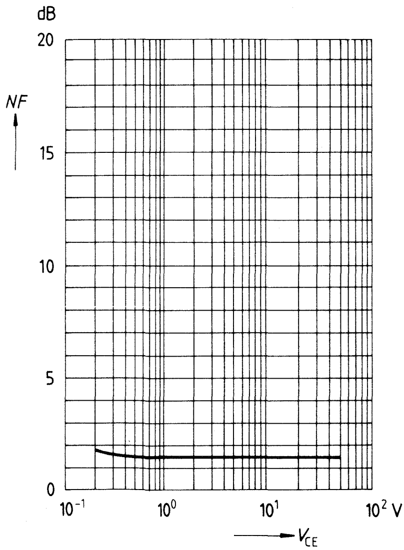
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



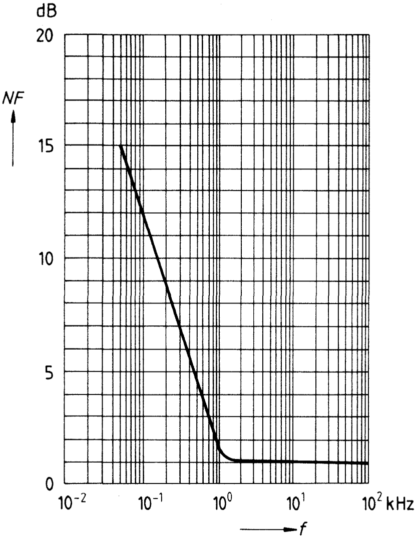
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



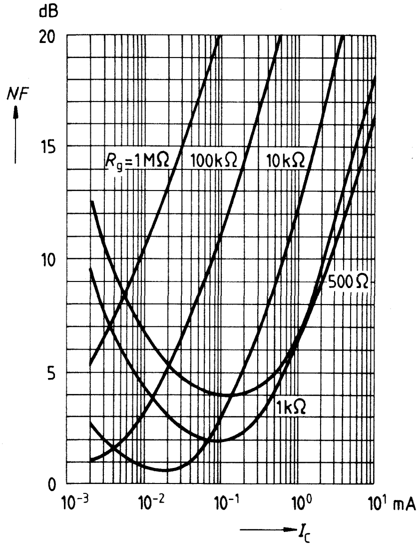
Noise figure $NF = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $f = 1$ kHz



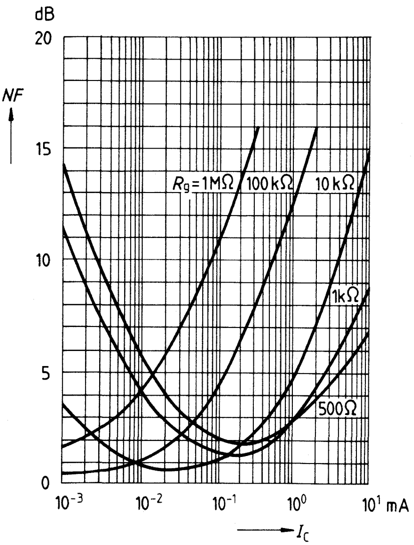
Noise figure $NF = f(f)$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $V_{CE} = 5$ V



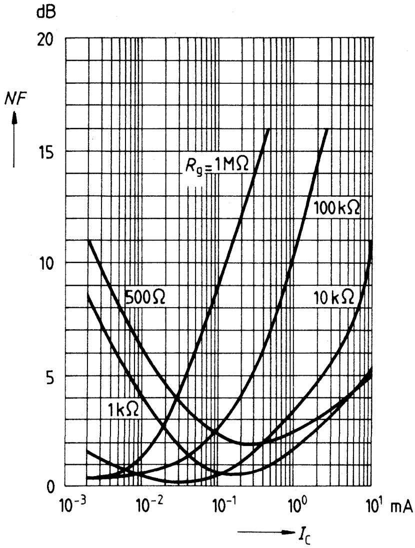
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz

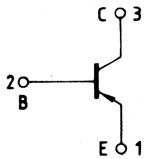


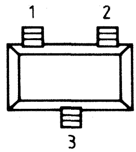
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz



PNP silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary to BCW 60, BCX 70 (NPN)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCW 61 A	BA	BCX 61 FN	BN	Refer to index	Version A
BCW 61 B	BB	BCX 71 G	BG		
BCW 61 C	BC	BCX 71 H	BH		
BCW 61 D	BD	BCX 71 J	BJ		
BCW 61 FF	BF	BCX 71 K	BK		

Maximum ratings		BCW 61	BCW 61 F	BCX 71
Collector-emitter voltage	V_{CEO}	32 V	32 V	45 V
Collector-base voltage	V_{CBO}	32 V	32 V	45 V
Emitter-base voltage	V_{EBO}	5 V	5 V	5 V
Collector current	I_C		100 mA	
Peak collector current	I_{CM}		200 mA	
Peak base current	I_{BM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		330 mW	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375 K/W	

Characteristics

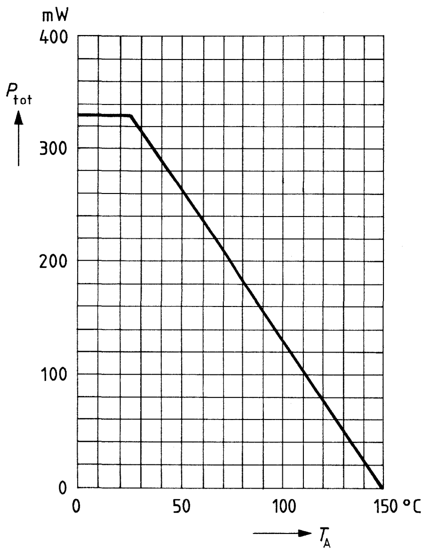
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BCW 61, BCW 61 F		32	–	–	V
	BCX 71		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10\ \mu A$	BCW 61, BCW 61 F		32	–	–	V
	BCX 71		45	–	–	V
Emitter-base breakdown voltage $I_E = 1\ \mu A$		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 32$ V	BCW 61, BCW 61 F		–	–	20	nA
$V_{CB} = 45$ V	BCX 71		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 61, BCW 61 F		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCX 71		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	20	nA
DC current gain¹)		h_{FE}				
$I_C = 10\ \mu A$, $V_{CE} = 5$ V						
BCW 61 A, BCX 71 G			20	140	–	–
BCW 61 B, BCX 71 H			30	200	–	–
BCW 61 FF, BCW 61 C, BCX 71 J			40	270	–	–
BCW 61 FN, BCW 61 D, BCX 71 K			100	340	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V						
BCW 61 A, BCX 71 G			120	170	220	–
BCW 61 B, BCX 71 H			180	250	310	–
BCW 61 FF, BCW 61 C, BCX 71 J			250	350	460	–
BCW 61 FN, BCW 61 D, BCX 71 K			380	500	630	–
$I_C = 50$ mA, $V_{CE} = 1$ V						
BCW 61 A, BCX 71 G			60	–	–	–
BCW 61 B, BCX 71 H			80	–	–	–
BCW 61 FF, BCW 61 C, BCX 71 J			100	–	–	–
BCW 61 FN, BCW 61 D, BCX 71 K			110	–	–	–
Collector-emitter saturation voltage¹)		V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,12	0,25	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,20	0,55	V
Base-emitter saturation voltage¹)		V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,70	0,85	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,83	1,05	V
Base-emitter voltage¹)		$V_{BE\,(on)}$				
$I_C = 10\ \mu A$, $V_{CE} = 5$ V			–	0,52	–	V
$I_C = 2$ mA, $V_{CE} = 5$ V			0,55	0,65	0,75	V
$I_C = 50$ mA, $V_{CE} = 1$ V			–	0,78	–	V

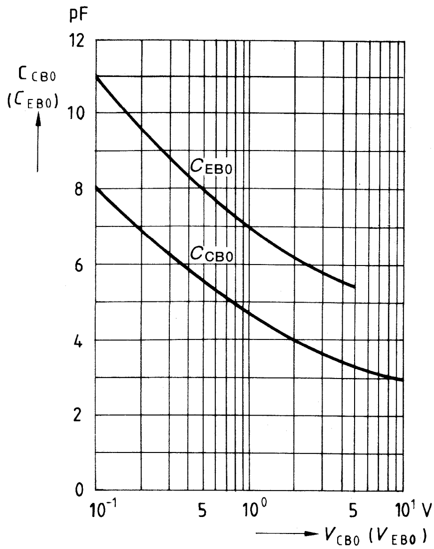
¹) Pulse test: $t = 300\ \mu s$, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3	–	pF
Input capacitance $V_{CB} = 0,5$ V, $f = 1$ MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ MHz	h_{11e}				
BCW 61 A, BCX 71 G		–	2,7	–	kΩ
BCW 61 B, BCX 71 H		–	3,6	–	kΩ
BCW 61 FF, BCW 61 C, BCX 71 J		–	4,5	–	kΩ
BCW 61 FN, BCW 61 D, BCX 71 K		–	7,5	–	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{12e}				
BCW 61 A, BCX 71 G		–	1,5	–	10^{-4}
BCW 61 B, BCX 71 H		–	2,0	–	10^{-4}
BCW 61 FF, BCW 61 C, BCX 71 J		–	2,0	–	10^{-4}
BCW 61 FN, BCW 61 D, BCX 71 K		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{21e}				
BCW 61 A, BCX 71 G		–	200	–	–
BCW 61 B, BCX 71 H		–	260	–	–
BCW 61 FF, BCW 61 C, BCX 71 J		–	330	–	–
BCW 61 FN, BCW 61 D, BCX 71 K		–	520	–	–
Open-circuit output admittance $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{22e}				
BCW 61 A, BCX 71 G		–	18	–	µS
BCW 61 B, BCX 71 H		–	24	–	µS
BCW 61 FF, BCW 61 C, BCX 71 J		–	30	–	µS
BCW 61 FN, BCW 61 D, BCX 71 K		–	50	–	µS
Noise figure	NF				
$I_C = 0,2$ mA, $V_{CE} = 5$ V, $R_G = 2$ kΩ $f = 1$ kHz, $\Delta f = 200$ Hz		–	2	–	dB
$I_C = 0,2$ mA, $V_{CE} = 5$ V, $R_G = 2$ kΩ $f = 1$ kHz, $\Delta f = 200$ Hz BCW 61 F, BCW 61 FN		–	1	2	dB
Equivalent noise voltage $I_C = 0,2$ mA, $V_{CE} = 5$ V, $R_G = 2$ kΩ $f = 10$ Hz … 50 Hz BCW 61 F, BCW 61 FN	V_{neq}	–	–	0,110	µV

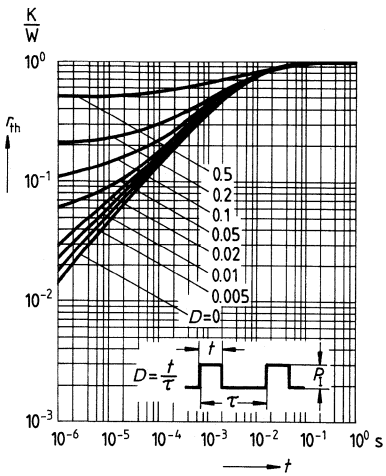
Total power dissipation $P_{tot} = f(T_A)$



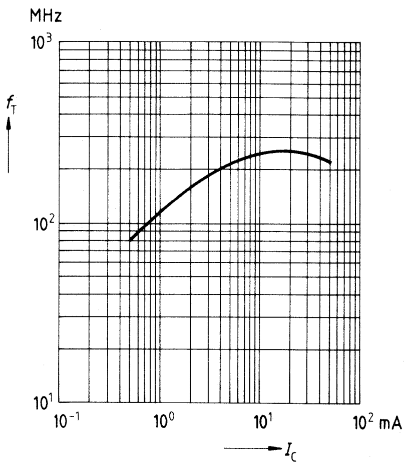
Capacitance $C_{CBO} = f(V_{CBO})$
$C_{EBO} = f(V_{EBO})$



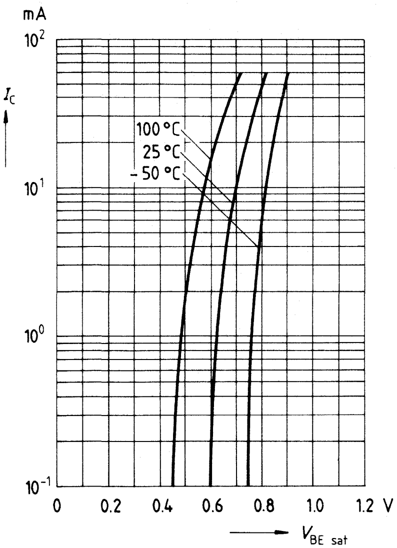
Pulse handling capability $r_{th} = f(t)$
(standardized)



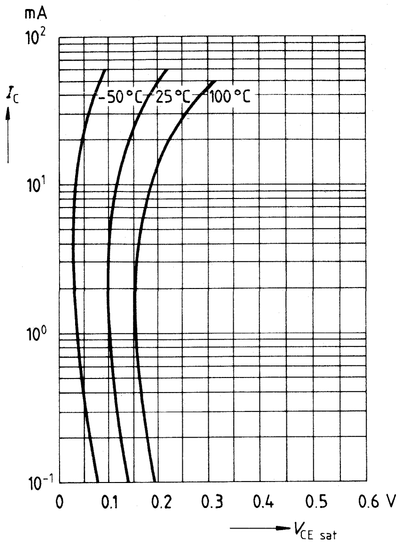
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



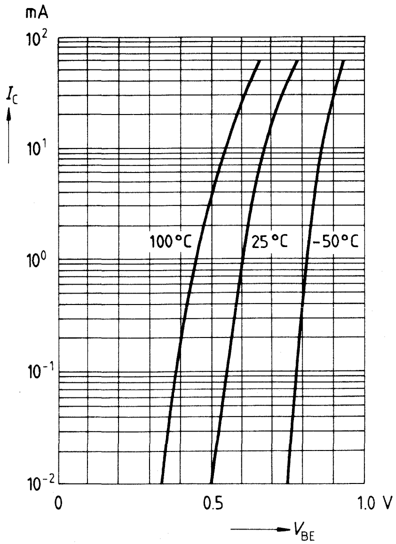
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 40$



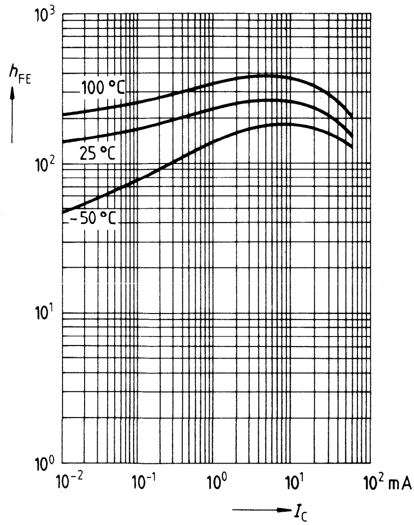
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 40$



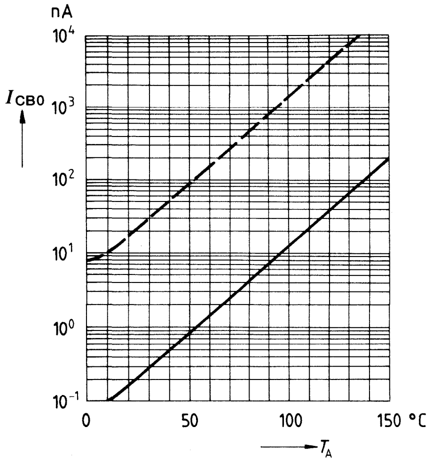
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



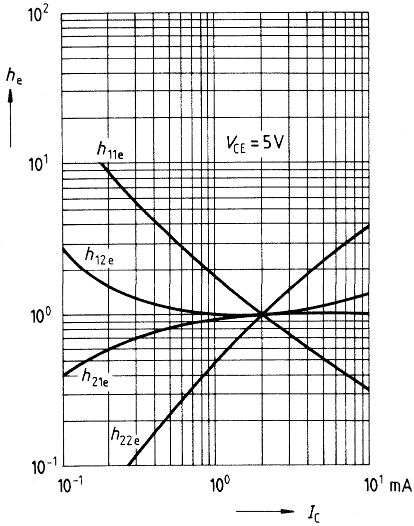
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



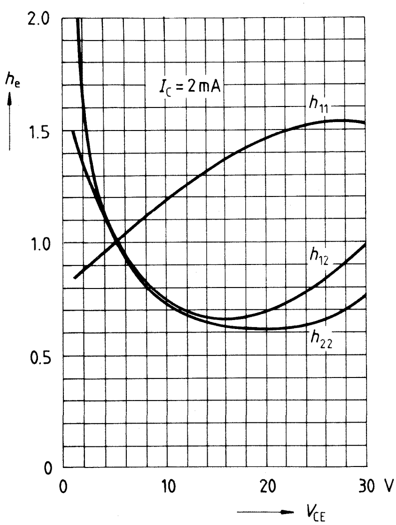
Collector cutoff current $I_{CBO} = f(T_A)$



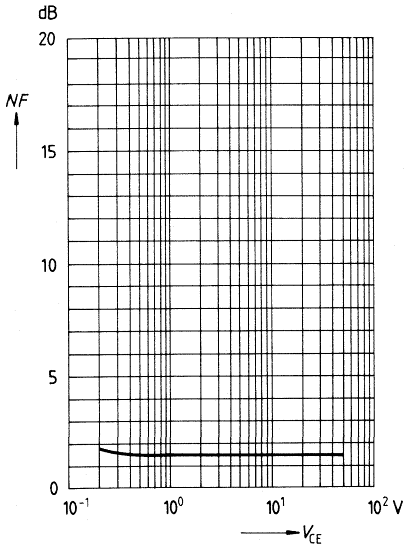
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



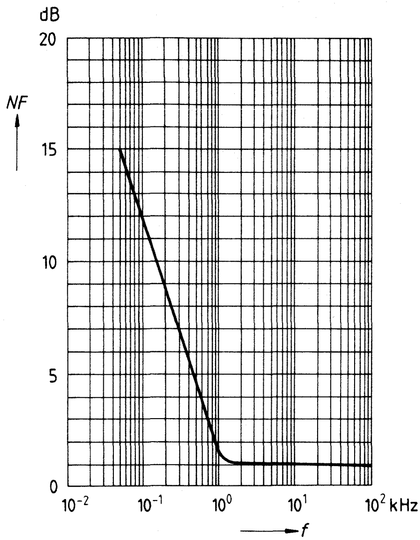
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



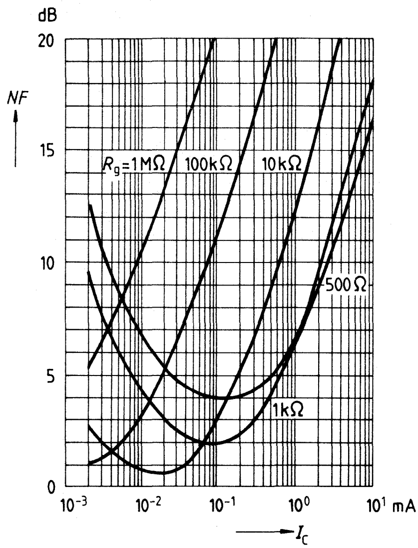
Noise figure $NF = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $f = 1$ kHz



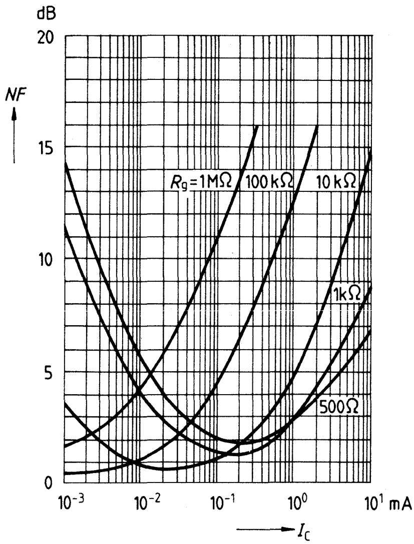
Noise figure $NF = f(f)$
$I_C = 0{,}2$ mA, $R_G = 2$ kΩ, $V_{CE} = 5$ V



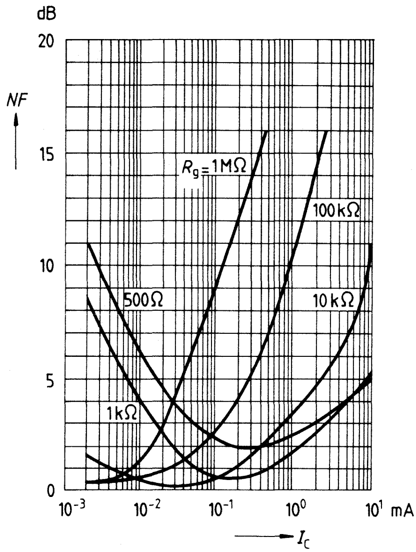
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz



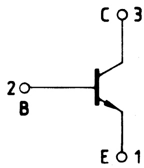
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz

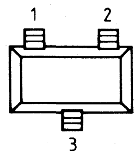


BCW 65
BCW 66

NPN silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Complementary to BCW 67, BCW 68 (PNP)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCW 65 A	EA	BCW 66 F	EF	Refer to index	Version A
BCW 65 B	EB	BCW 66 G	EG		
BCW 65 C	EC	BCW 66 H	EH		

Maximum ratings

		BCW 65	BCW 66
Collector-emitter voltage	V_{CE0}	32 V	45 V
Collector-base voltage	V_{CB0}	60 V	75 V
Emitter-base voltage	V_{EB0}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 375 K/W	

Characteristics

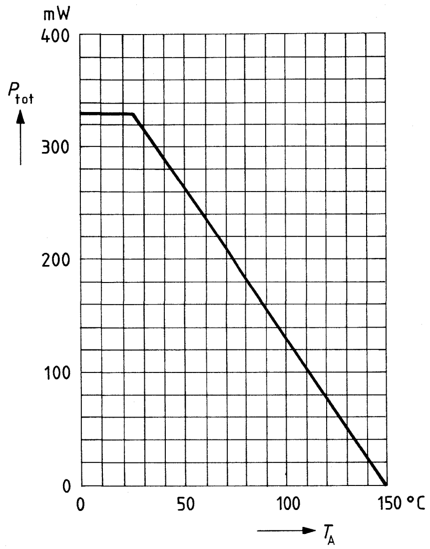
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CE0}$				
$I_C = 10$ mA	BCW 65		32	–	–	V
	BCW 66		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CB0}$				
$I_C = 10$ µA	BCW 65		60	–	–	V
	BCW 66		75	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 32$ V	BCW 65		–	–	20	nA
$V_{CB} = 45$ V	BCW 66		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 65		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCW 66		–	–	20	µA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 10$ V						
BCW 65 A, BCW 66 F			35	–	–	–
BCW 65 B, BCW 66 G			50	–	–	–
BCW 65 C, BCW 66 H			80	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V						
BCW 65 A, BCW 66 F			75	–	–	–
BCW 65 B, BCW 66 G			110	–	–	–
BCW 65 C, BCW 66 H			180	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V						
BCW 65 A, BCW 66 F			100	160	250	–
BCW 65 B, BCW 66 G			160	250	400	–
BCW 65 C, BCW 66 H			250	350	630	–
$I_C = 500$ mA, $V_{CE} = 2$ V						
BCW 65 A, BCW 66 F			35	–	–	–
BCW 65 B, BCW 66 G			60	–	–	–
BCW 65 C, BCW 66 H			100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	0,7	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	1,25	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	2,00	V

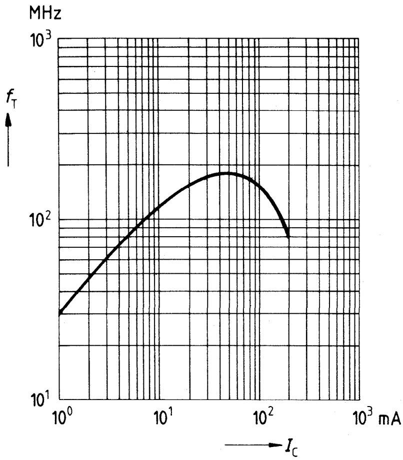
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t = 300$ µs, D = 2%.

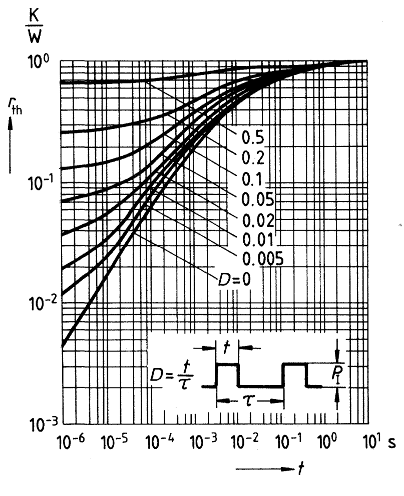
Total power dissipation $P_{tot} = f(T_A)$



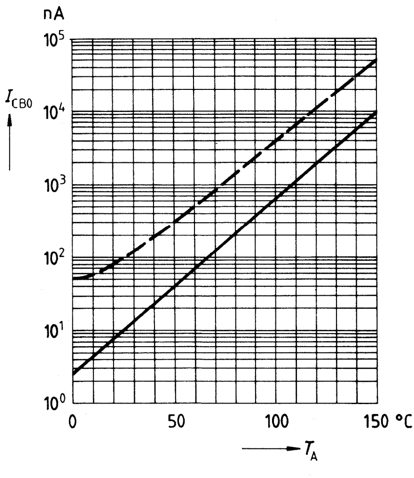
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



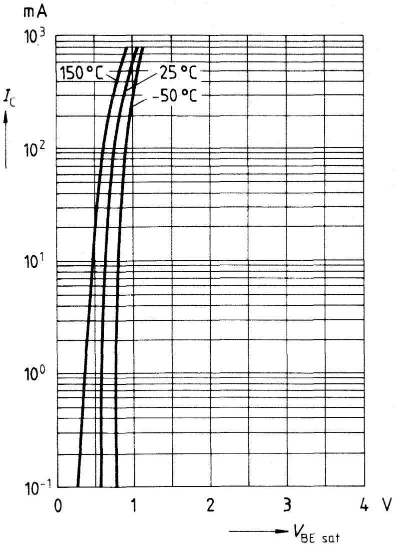
Pulse handling capability $r_{th} = f(t)$
(standardized)



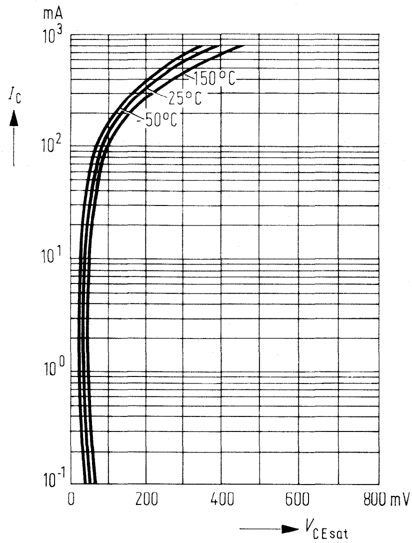
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



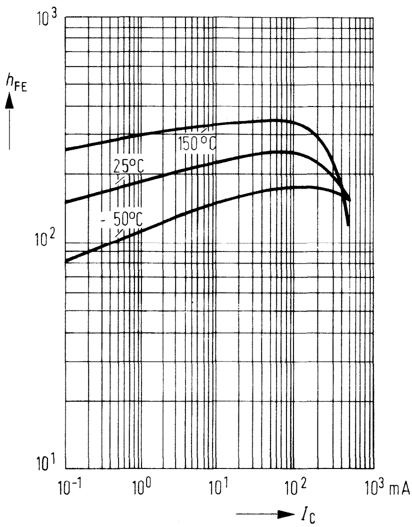
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

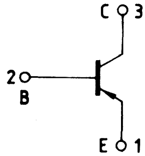


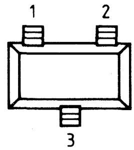
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



PNP silicon planar epitaxial transistors

- High current gain
- Low collector-emitter saturation voltage
- Complementary to BCW 65, BCW 66 (NPN)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCW 67 A	DA	BCW 68 F	DF	Refer to index	Version A
BCW 67 B	DB	BCW 68 G	DG		
BCW 67 C	DC	BCW 68 H	DH		

Maximum ratings		BCW 67	BCW 68
Collector-emitter voltage	V_{CEO}	32 V	45 V
Collector-base voltage	V_{CBO}	45 V	60 V
Emitter-base voltage	V_{EBO}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

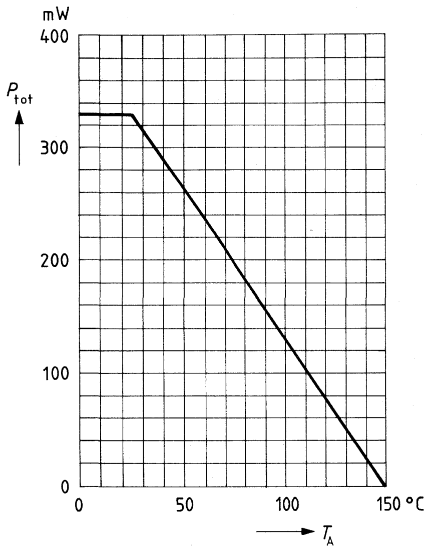
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CE0}$				
$I_C = 10$ mA	BCW 67		32	–	–	V
	BCW 68		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CB0}$				
$I_C = 10\,\mu A$	BCW 67		45	–	–	V
	BCW 68		60	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 32$ V	BCW 67		–	–	20	nA
$V_{CB} = 45$ V	BCW 68		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 67		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCW 68		–	–	20	µA
DC current gain[1])		h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 10$ V						
BCW 67 A, BCW 68 F			35	–	–	–
BCW 67 B, BCW 68 G			50	–	–	–
BCW 67 C, BCW 68 H			40	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V						
BCW 67 A, BCW 68 F			75	–	–	–
BCW 67 B, BCW 68 G			120	–	–	–
BCW 67 C, BCW 68 H			180	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V						
BCW 67 A, BCW 68 F			100	160	250	–
BCW 67 B, BCW 68 G			160	250	400	–
BCW 67 C, BCW 68 H			250	350	630	–
$I_C = 500$ mA, $V_{CE} = 2$ V						
BCW 67 A, BCW 68 F			35	–	–	–
BCW 67 B, BCW 68 G			60	–	–	–
BCW 67 C, BCW 68 H			100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	0,7	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	1,25	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	2,00	V

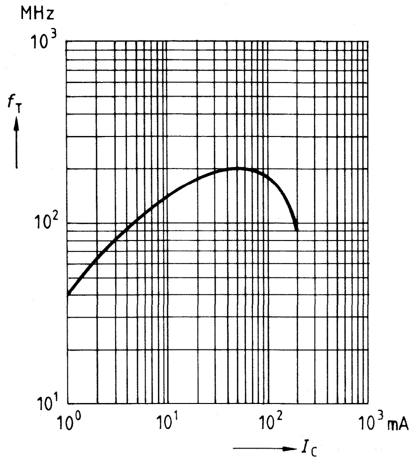
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

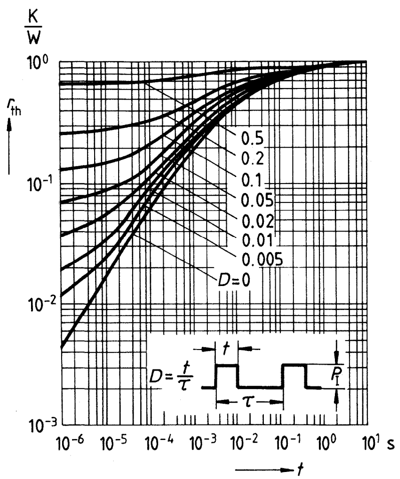
Total power dissipation $P_{tot} = f(T_A)$



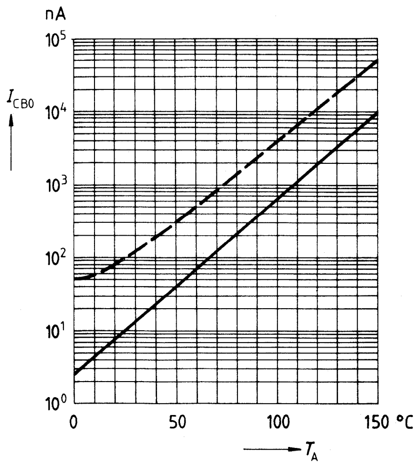
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



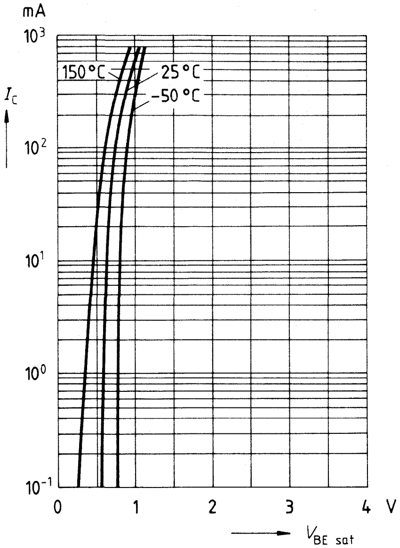
Pulse handling capability $r_{th} = f(t)$
(standardized)



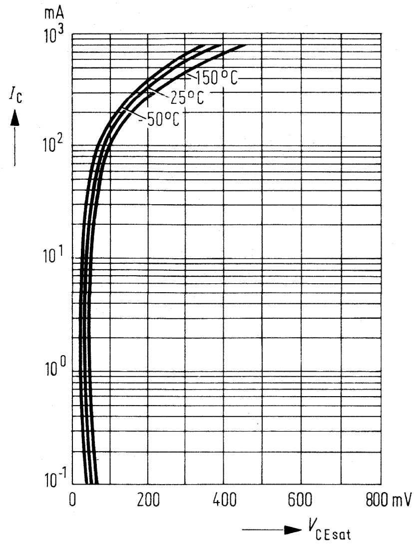
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



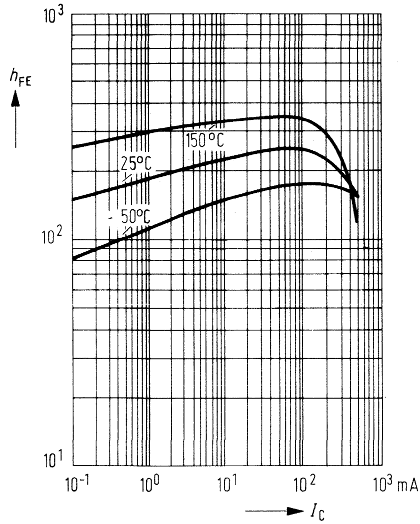
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

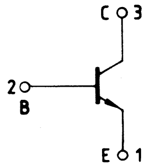


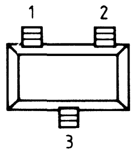
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary to BCX 42, BSS 63 (PNP)





Top view

Type	Marking	Ordering code	Package
BCX 41	EK	Refer to index	Version A
BSS 64	AM		

Maximum ratings		BSS 64	BCX 41
Collector-emitter voltage	V_{CEO}	80 V	125 V
Collector-base voltage	V_{CBO}	120 V	125 V
Emitter-base voltage	V_{EBO}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

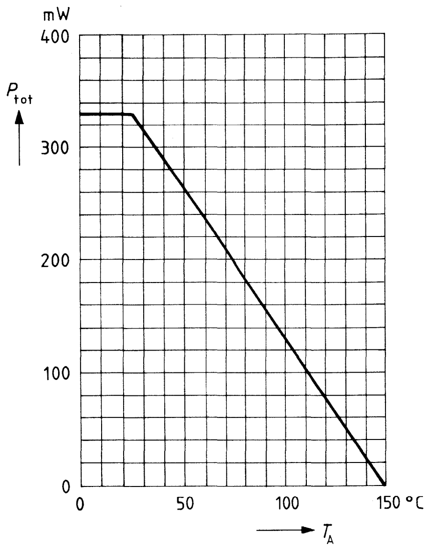
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CE0}$				
$I_C = 10$ mA	BSS 64		80	–	–	V
	BCX 41		125	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CB0}$				
$I_C = 100\ \mu A$	BSS 64		120	–	–	V
	BCX 41		125	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 80$ V	BSS 64		–	–	100	nA
$V_{CB} = 100$ V	BCX 41		–	–	100	nA
$V_{CB} = 80$ V, $T_A = 150\,°C$	BSS 64		–	–	20	µA
$V_{CB} = 100$ V, $T_A = 150\,°C$	BCX 41		–	–	20	µA
Collector cutoff current $V_{CE} = 100$ V, $V_{BE} = 0{,}2$ V		I_{CEX}				
$T_A = 85\,°C$	BSS 64		–	–	10	µA
$T_A = 125\,°C$	BCX 41		–	–	75	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EB0}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 1$ V	BCX 41		25	–	–	–
$I_C = 1$ mA, $V_{CE} = 1$ V	BSS 64		–	60	–	–
$I_C = 4$ mA, $V_{CE} = 1$ V	BSS 64		20	80	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V	BSS 64		–	80	–	–
$I_C = 20$ mA, $V_{CE} = 1$ V	BSS 64		–	55	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V	BCX 41		63	–	–	–
$I_C = 200$ mA, $V_{CE} = 1$ V	BCX 41		40	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 300$ mA, $I_B = 30$ mA	BCX 41		–	–	0,9	V
$I_C = 4$ mA, $I_B = 0{,}4$ mA	BSS 64		–	–	0,7	V
$I_C = 50$ mA, $I_B = 15$ mA	BSS 64		–	–	3,0	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 300$ mA, $I_B = 30$ mA	BCX 41		–	–	1,4	V

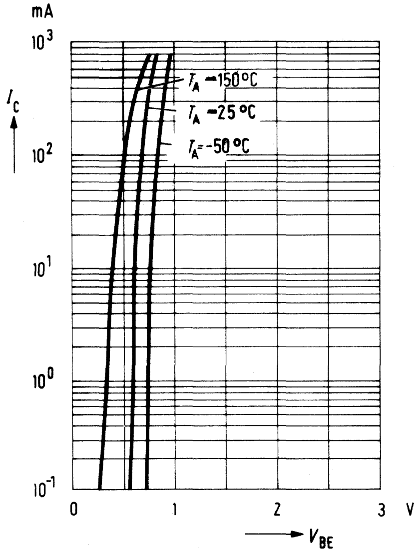
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 200$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	12	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

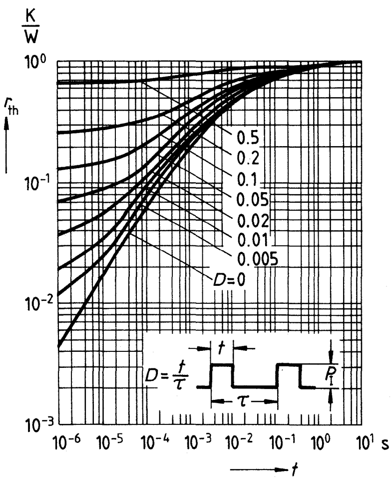
Total power dissipation $P_{tot} = f(T_A)$



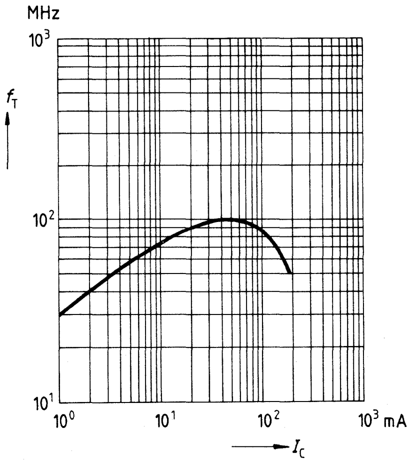
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



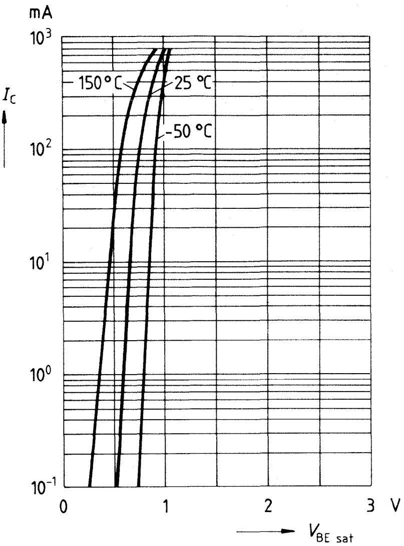
Pulse handling capability $r_{th} = f(t)$
(standardized)



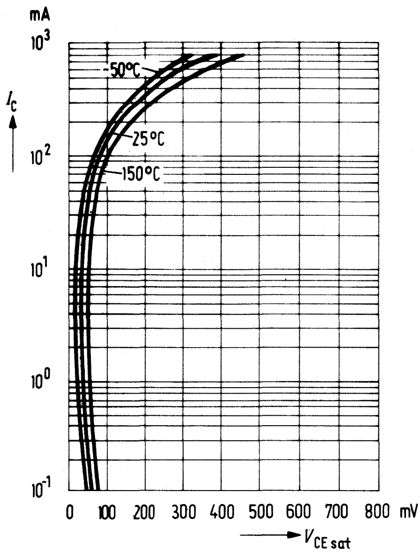
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



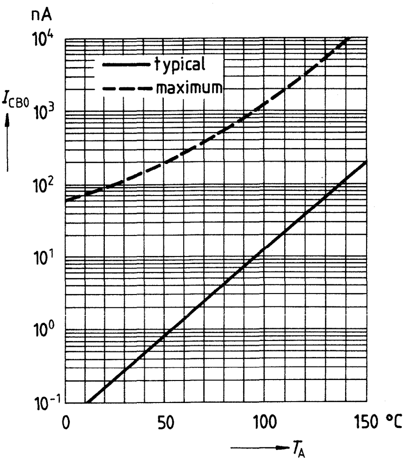
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



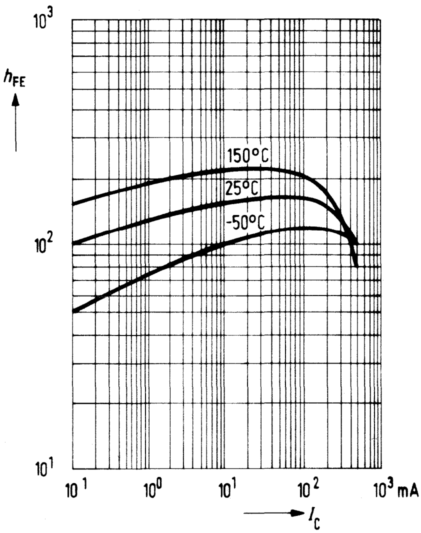
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$

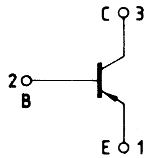


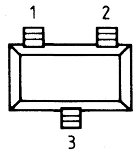
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



PNP silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary to BCX 41, BSS 64 (NPN)





Top view

Type	Marking	Ordering code	Package
BCX 42	BM	Refer to index	Version A
BSS 63	DK		

Maximum ratings		BSS 63	BCX 42
Collector-emitter voltage	V_{CEO}	100 V	125 V
Collector-base voltage	V_{CBO}	110 V	125 V
Emitter-base voltage	V_{EBO}	5 V	5 V
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

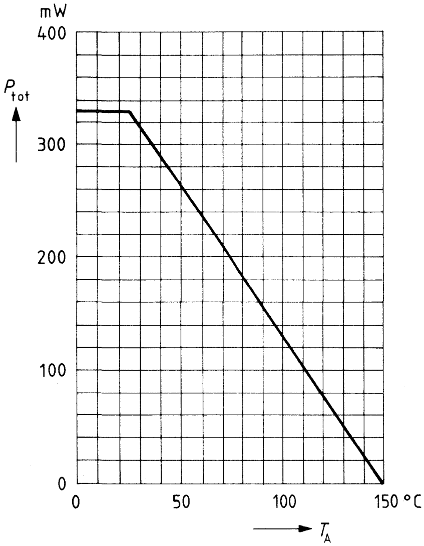
at T_A = 25 °C, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
I_C = 10 mA	BCX 42		125	–	–	V
	BSS 63		100	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
I_C = 100 µA	BCX 42		125	–	–	V
	BSS 63		110	–	–	V
Emitter-base breakdown voltage I_E = 10 µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 80 V	BSS 63		–	–	100	nA
V_{CB} = 100 V	BCX 42		–	–	100	nA
V_{CB} = 80 V, T_A = 150 °C	BSS 63		–	–	20	µA
V_{CB} = 100 V, T_A = 150 °C	BCX 42		–	–	20	µA
Collector cutoff current V_{CE} = 100 V, V_{BE} = 0,2 V		I_{CEX}				
T_A = 85 °C	BCX 42		–	–	10	µA
T_A = 125 °C	BCX 42		–	–	75	µA
Emitter cutoff current V_{EB} = 4 V		I_{EBO}	–	–	100	nA
DC current gain[1])		h_{FE}				
I_C = 100 µA, V_{CE} = 1 V	BCX 42		25	–	–	–
I_C = 10 mA, V_{CE} = 5 V	BSS 63		30	–	–	–
I_C = 20 mA, V_{CE} = 5 V	BSS 63		30	–	–	–
I_C = 100 mA, V_{CE} = 1 V	BCX 42		63	–	–	–
I_C = 20 mA, V_{CE} = 1 V	BCX 42		40	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
I_C = 300 mA, I_B = 30 mA	BCX 42		–	–	0,9	V
I_C = 35 mA, I_B = 7,5 mA	BSS 63					
Base-emitter saturation voltage[1])		V_{BEsat}				
I_C = 300 mA, I_B = 30 mA	BCX 42		–	–	1,4	V

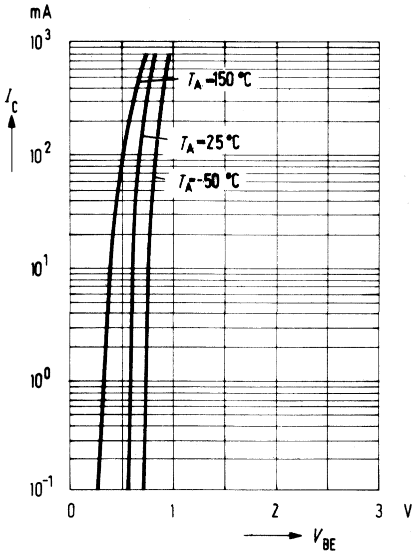
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 20 MHz	f_T	–	150	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	12	–	pF

[1]) Pulse test: t = 300 µs, D = 2%.

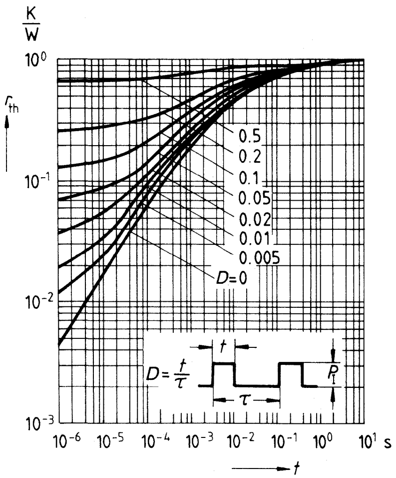
Total power dissipation $P_{tot} = f(T_A)$



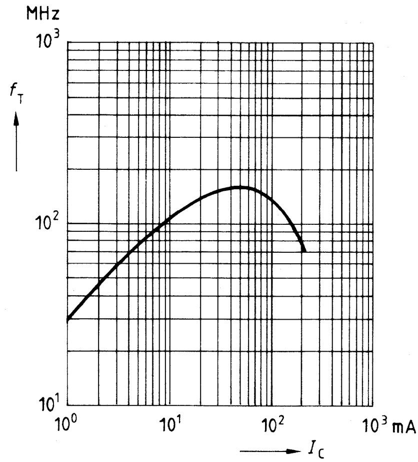
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



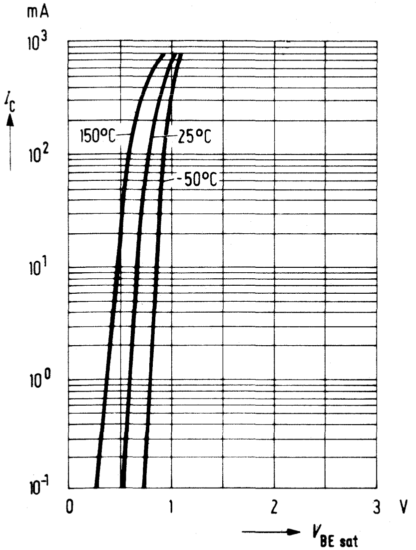
Pulse handling capability $r_{th} = f(t)$
(standardized)



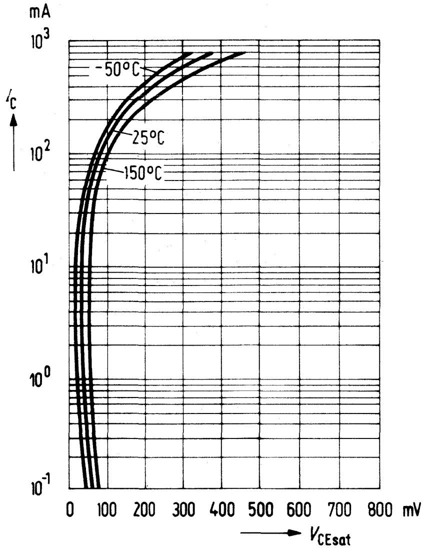
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



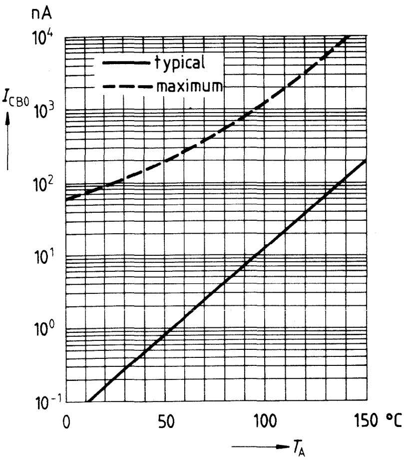
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



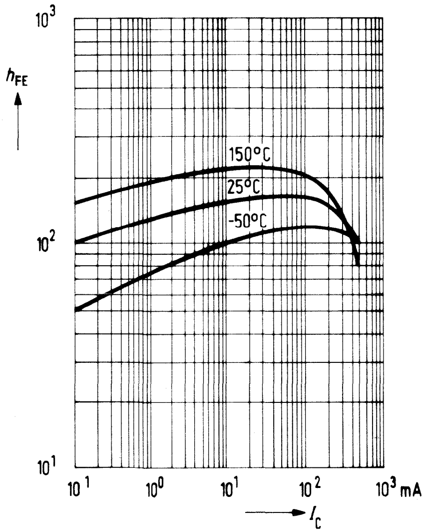
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$

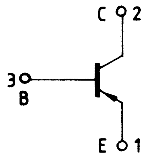


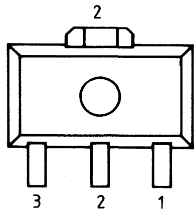
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



PNP silicon planar epitaxial transistors

- High collector current
- Low collector-emitter saturation voltage
- Complementary to BCX 54 ... BCX 56 (NPN)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCX 51–6	AB	BCX 52–10	AG	Refer to index	Version C
BCX 51–10	AC	BCX 53–6	AJ		
BCX 51–16	AD	BCX 53–10	AK		
BCX 52–6	AF				

Maximum ratings		BCX 51	BCX 52	BCX 53
Collector-emitter voltage	V_{CEO}	45 V	60 V	80 V
Collector-base voltage	V_{CBO}	45 V	60 V	100 V
Emitter-base voltage	V_{EBO}	5 V	5 V	5 V
Collector current	I_C		1 A	
Peak collector current	I_{CM}		1,5 A	
Base current	I_B		100 mA	
Peak base current	I_{BM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		1,0 W	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		−65 ... +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 125 K/W	

Characteristics

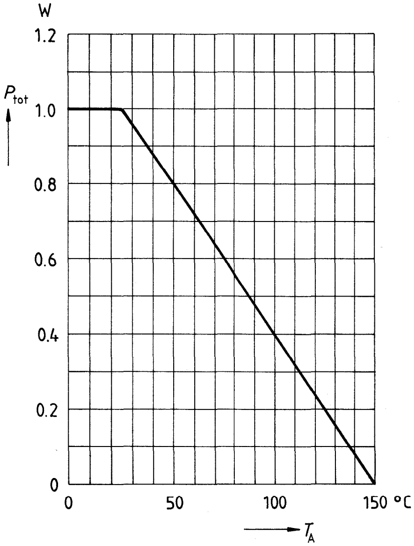
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BCX 51		45	–	–	V
BCX 52		60	–	–	V
BCX 53		80	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$	$V_{(BR)\,CBO}$				
BCX 51		45	–	–	V
BCX 52		60	–	–	V
BCX 53		100	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	20	nA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	20	nA
DC current gain[1]	h_{FE}				
$I_C =$ 5 mA, $V_{CE} = 2$ V		25	–	–	–
$I_C = 150$ mA, $V_{CE} = 2$ V					
BCX 51, BCX 52, BCX 53–6		40	63	100	–
BCX 51, BCX 52, BCX 53–10		63	100	160	–
BCX 51–16		100	160	250	–
$I_C = 500$ mA, $V_{CE} = 2$ V		25	–	–	–
Collector-emitter saturation voltage[1] $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1] $I_C = 500$ mA, $V_{CE} = 2$ V	V_{BE}	–	–	1,0	V

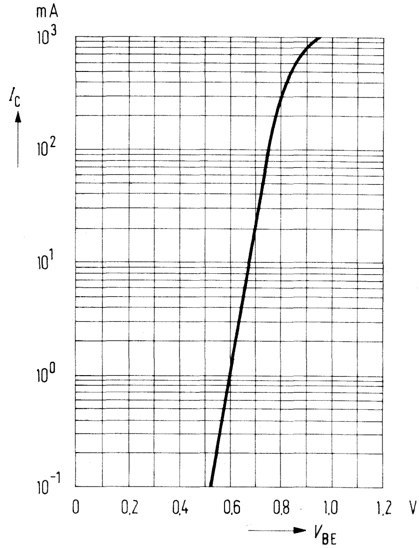
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	125	–	MHz

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

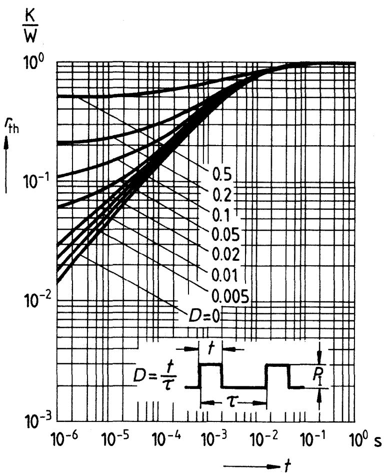
Total power dissipation $P_{tot} = f(T_A)$



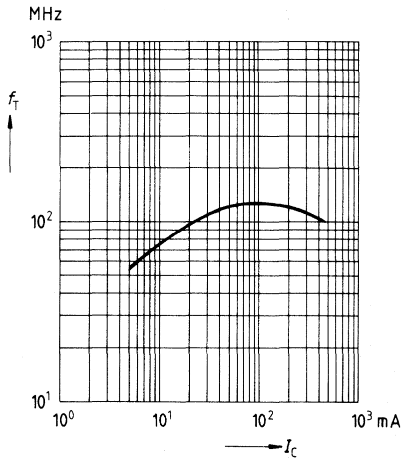
Collector current $I_C = f(V_{BE})$
$V_{CE} = 2$ V



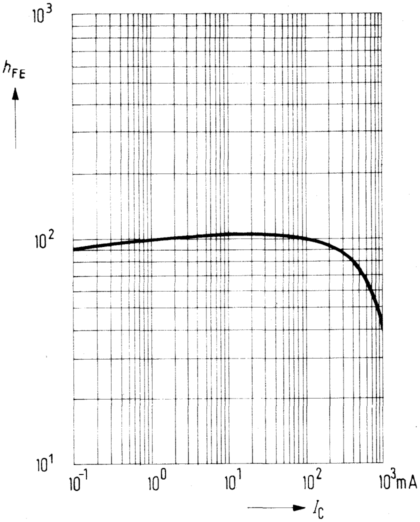
Pulse handling capability $r_{th} = f(t)$
(standardized)



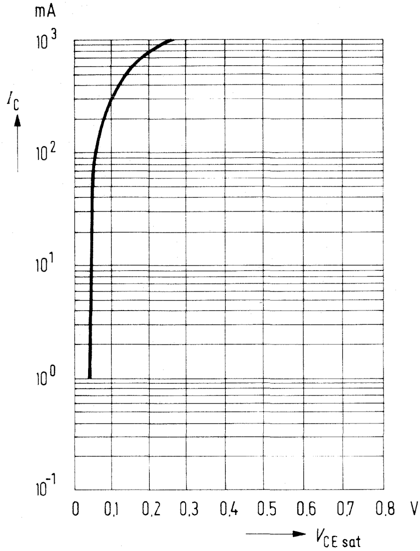
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



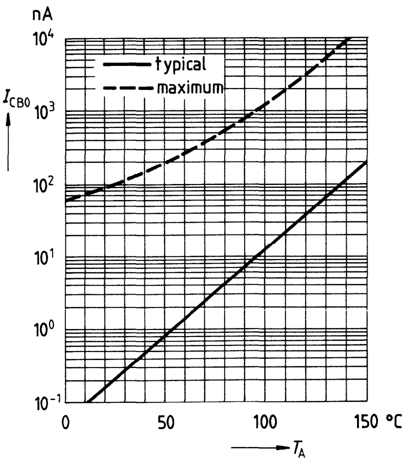
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 2\ V$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

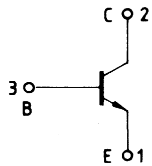


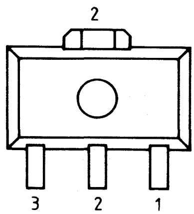
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30\ V$



NPN silicon planar epitaxial transistors

- High collector current
- Low collector-emitter saturation voltage
- Complementary to BCX 51 ... BCX 53 (PNP)





Top view

Type	Marking	Type	Marking	Ordering code	Package
BCX 54–6	BB	BCX 55–10	BG	Refer to index	Version A
BCX 54–10	BC	BCX 56–6	BJ		
BCX 54–16	BD	BCX 56–10	BK		
BCX 55–6	BF				

Maximum ratings		BCX 54	BCX 55	BCX 56
Collector-emitter voltage	V_{CE0}	45 V	60 V	80 V
Collector-base voltage	V_{CB0}	45 V	60 V	100 V
Emitter-base voltage	V_{EB0}	5 V	5 V	5 V
Collector current	I_C		1 A	
Peak collector current	I_{CM}		1,5 A	
Base current	I_B		100 mA	
Peak base current	I_{BM}		200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}		1,0 W	
Junction temperature	T_j		150 °C	
Storage temperature range	T_{stg}		−65 ... +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 125 K/W	

Characteristics

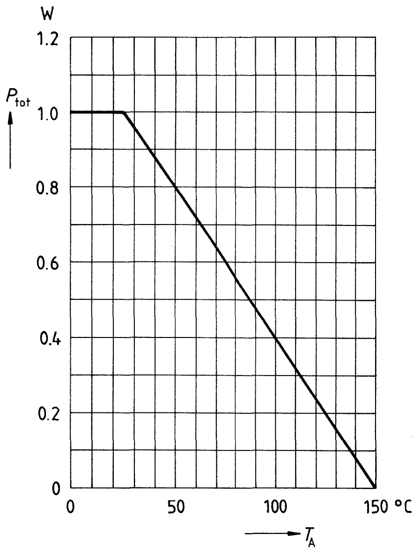
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
$I_C = 10$ mA					
BCX 54		45	–	–	V
BCX 55		60	–	–	V
BCX 56		80	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
$I_C = 100\ \mu A$					
BCX 54		45	–	–	V
BCX 55		60	–	–	V
BCX 56		100	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	20	nA
DC current gain[1])	h_{FE}				
$I_C = 5$ mA, $V_{CE} = 2$ V		25	–	–	–
$I_C = 150$ mA, $V_{CE} = 2$ V					
BCX 54, BCX 55, BCX 56–6		40	63	100	–
BCX 54, BCX 55, BCX 56–10		63	100	160	–
BCX 54–16		100	160	250	–
$I_C = 500$ mA, $V_{CE} = 2$ V		25	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1]) $I_C = 500$ mA, $V_{CE} = 2$ V	V_{BE}	–	–	1,0	V

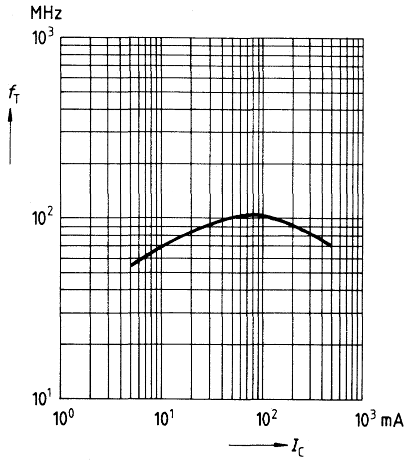
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

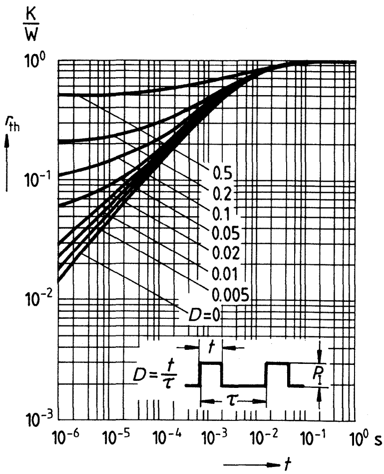
Total power dissipation $P_{tot} = f(T_A)$



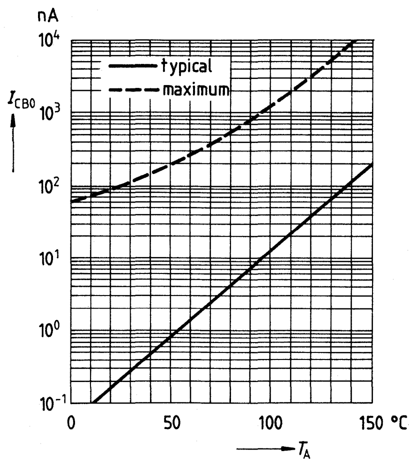
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



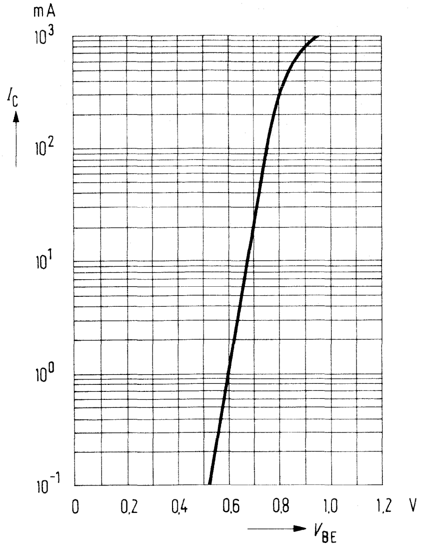
Pulse handling capability $r_{th} = f(t)$
(standardized)



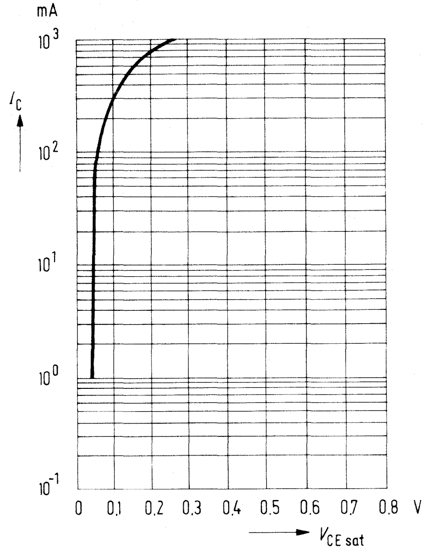
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



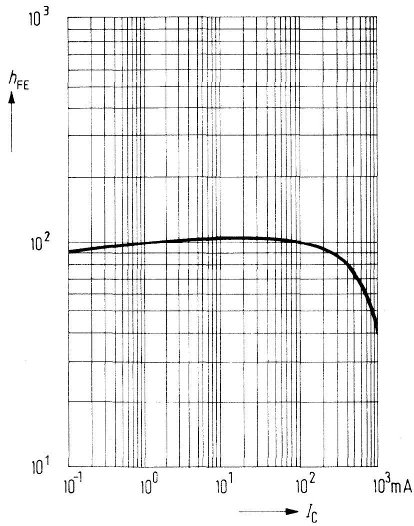
Collector current $I_C = f(V_{BE})$
$V_{CE} = 2$ V



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

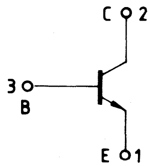


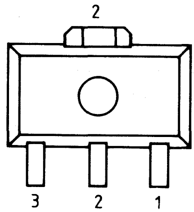
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 2$ V



NPN silicon planar epitaxial transistors

- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary to BCX 69 (PNP)





Top view

Type	Marking	Ordering code	Package
BCX 68–10	CB	Refer to index	Version C
BCX 68–16	CC		
BCX 68–25	CD		

Maximum ratings

Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	25 V
Emitter-base-voltage	V_{EBO}	5 V
Collector current	I_C	1 A
Peak collector current	I_{CM}	2 A
Base current	I_B	100 mA
Peak base current	I_{BM}	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

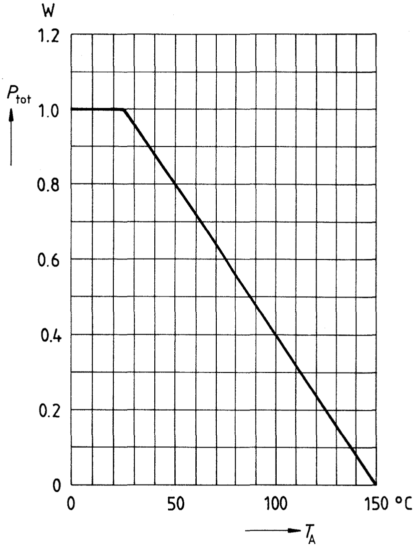
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 30$ mA	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	25	–	–	V
Emitter-base breakdown voltage $I_E = 1\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 10	 nA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1] $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 1$ V BCX 68–10 BCX 68–16 BCX 68–25 $I_C = 1$ A, $V_{CE} = 1$ V	h_{FE}	 50 63 100 160 60	 – 100 160 250 –	 – 160 250 400 –	 – – – – –
Collector-emitter saturation voltage[1] $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1] $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 1$ A, $V_{CE} = 1$ V	V_{BE}	 – –	 0,6 –	 – 1	 V V

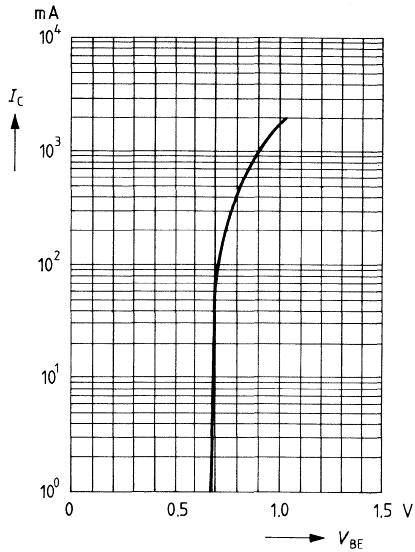
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

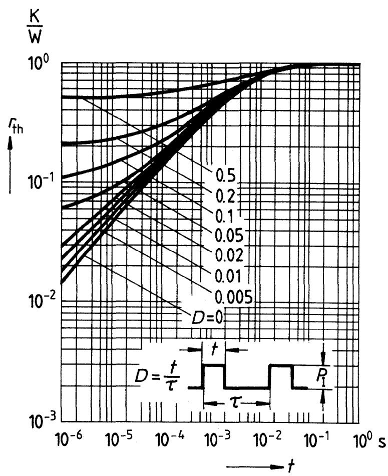
Total power dissipation $P_{tot} = f(T_A)$



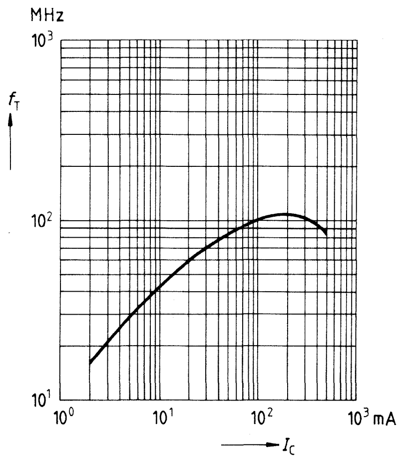
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



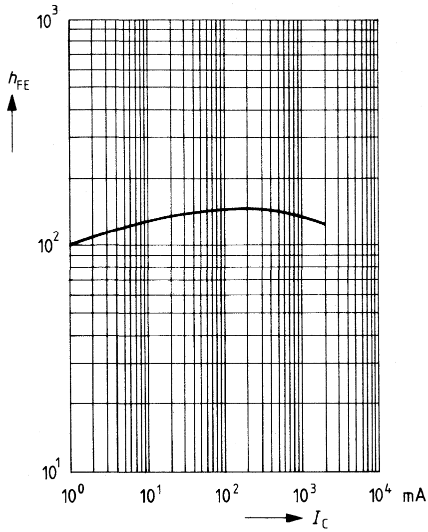
Pulse handling capability $r_{th} = f(t)$
(standardized)



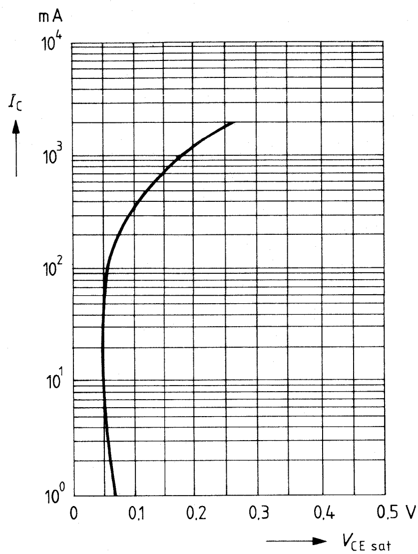
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



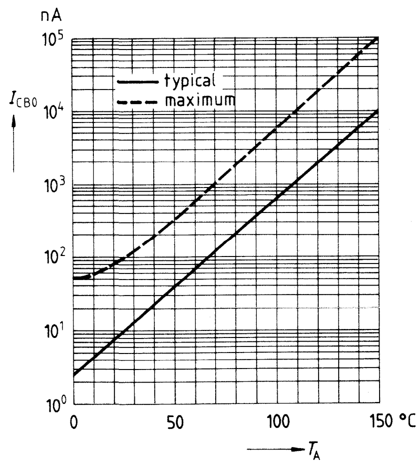
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$

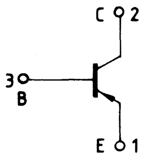


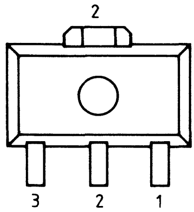
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 25$ V



PNP silicon planar epitaxial transistors

- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary to BCX 68 (NPN)





Top view

Type	Marking	Ordering code	Package
BCX 69–10	CF	Refer to index	Version C
BCX 69–16	CG		
BCX 69–25	CH		

Maximum ratings

Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	25 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	1 A
Peak collector current	I_{CM}	2 A
Base current	I_B	100 mA
Peak base current	I_{BM}	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

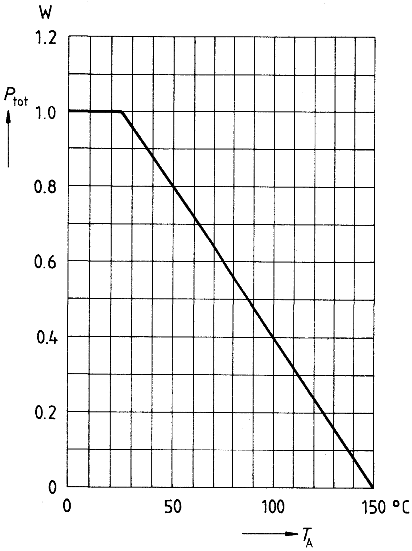
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 30$ mA	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)\,CBO}$	25	–	–	V
Emitter-base breakdown voltage $I_E = 1$ µA	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 10	 nA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C =$ 5 mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} =$ 1 V BCX 69–10 BCX 69–16 BCX 69–25 $I_C = 1$ A, $V_{CE} = 1$ V	h_{FE}	 50 63 100 160 60	 – 100 160 250 –	 – 160 250 400 –	 – – – – –
Collector-emitter saturation voltage[1]) $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1]) $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 1$ A, $V_{CE} = 1$ V	V_{BE}	 – –	 0,6 –	 – 1,0	 V V

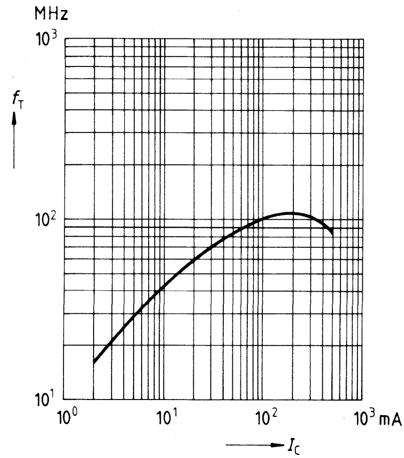
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t = 300$ µs, D = 2%.

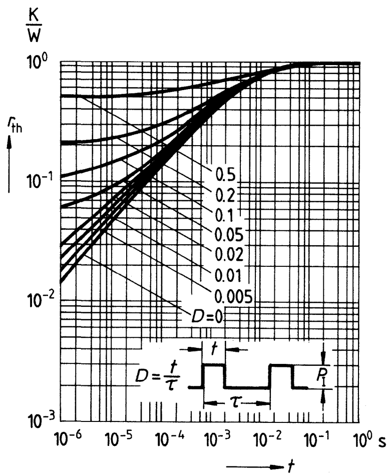
Total power dissipation $P_{tot} = f(T_A)$



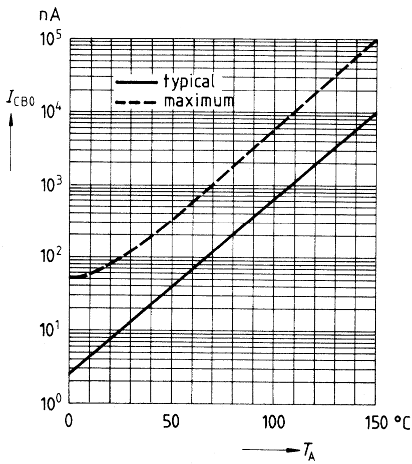
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



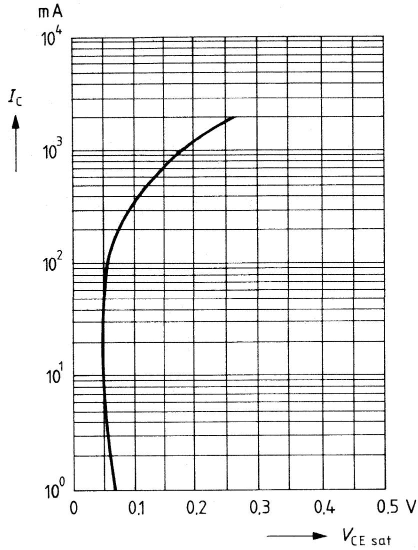
Pulse handling capability $r_{th} = f(t)$
(standardized)



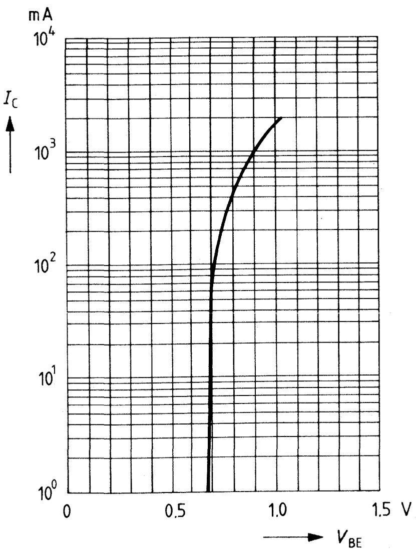
Collector cutoff current
$I_{CB0} = f(T_A)$
$V_{CB} = 25$ V



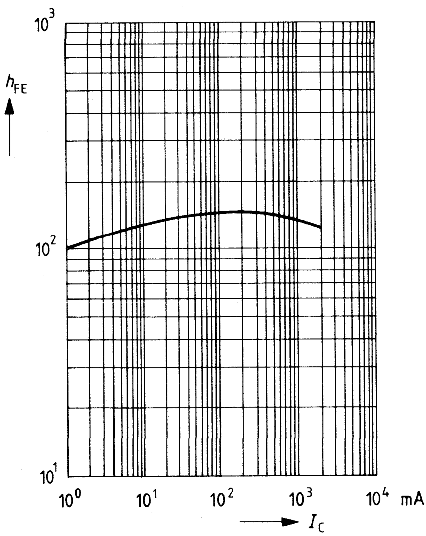
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector current $I_C = f(V_{BE})$
$V_{CE} = 1\ V$

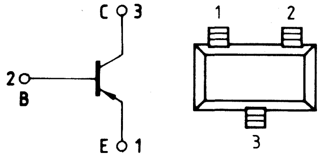


DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1\ V$



PNP silicon planar epitaxial transistor

- Low collector-base capacitance
- Low output admittance
- Suitable for IF/RF amplifiers in common emitter configuration and for mixer applications in AM/FM radios and VHF/TV tuners



Top view

Type	Marking	Ordering code	Package
BF 550	LA	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	40 V
Collector-base voltage	V_{CBO}	40 V
Emitter-base voltage	V_{EBO}	4 V
Collector current	I_C	25 mA
Base current	I_B	5 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

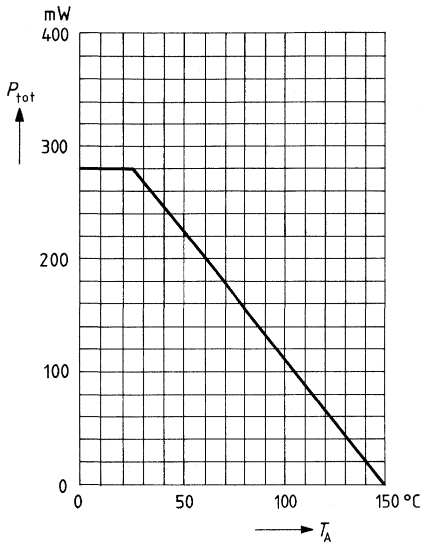
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

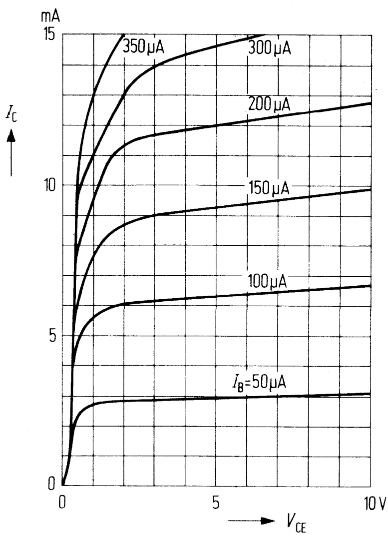
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)\,CB0}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EB0}$	4	–	–	V
DC current gain $I_C = 1$ mA, $V_{CE} = 10$ V	h_{FE}	50	–	250	–
Base-emitter voltage $I_C = 1$ mA, $V_{CE} = 10$ V	V_{BE}	–	0,72	–	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	350	–	MHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,33	–	pF
Collector-emitter feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,67	–	pF
Noise figure	NF				
$I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ kHz, $R_G = 300\,\Omega$		–	2	–	dB
$I_C = 2$ mA, $V_{CE} = 10$ V, $f = 100$ kHz, $R_G = 60\,\Omega$		–	3,4	–	dB
Four-pole characteristics $I_C = 1$ mA, $V_{CE} = 10$ V					
$f = 0{,}45 \cdots 10$ MHz	g_{11e}	–	550	–	µs
	c_{11e}	–	17	–	pF
	$\lvert y_{21e}\rvert$	–	35	–	ms
	c_{22e}	–	1,3	–	pF
$f = 450$ kHz	g_{22e}	–	5	8	µs
$f = 10$ MHz	g_{22e}	–	5	10	µs

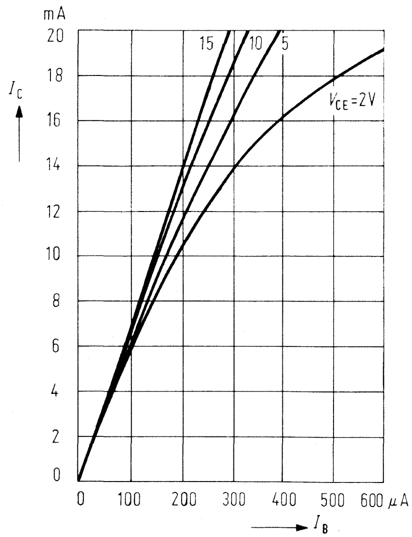
Total power dissipation $P_{tot} = f(T_A)$



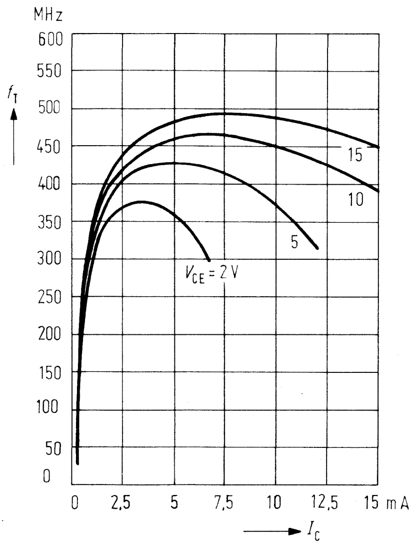
Output characteristics $I_C = f(V_{CE})$



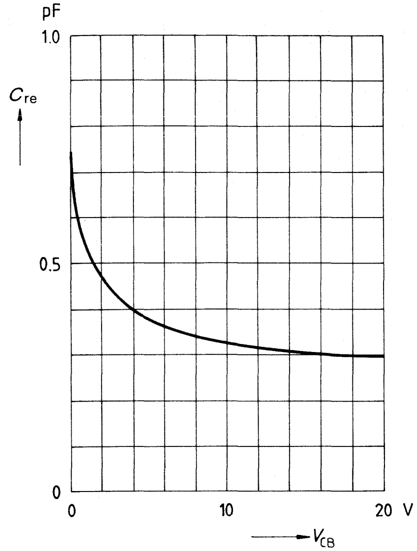
Collector current $I_C = f(I_B)$



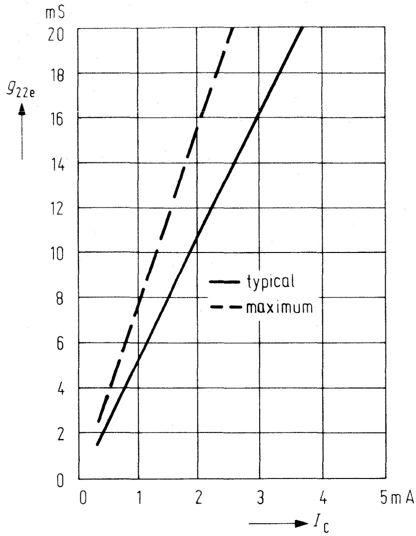
Transition frequency $f_T = f(I_C)$
f = 100 MHz



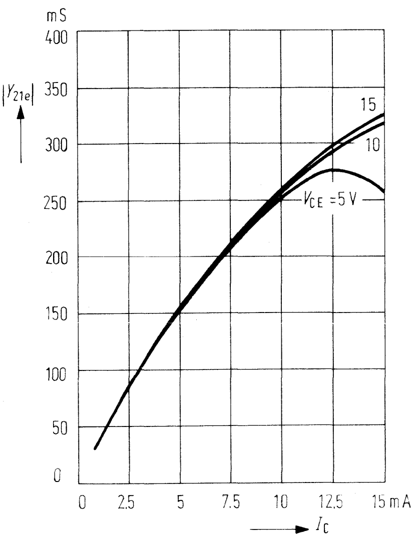
Feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



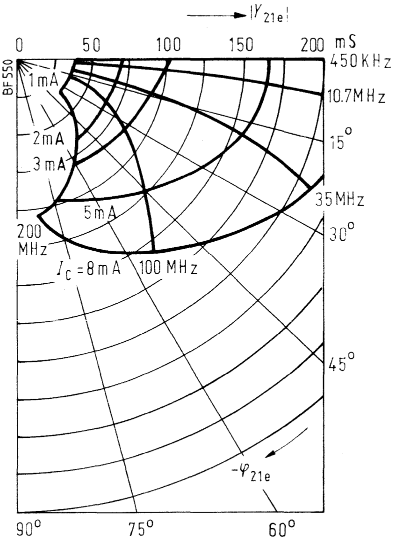
Output transconductance $g_{22e} = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ kHz



Forward transfer admittance $|Y_{21e}| = f(I_C)$
$f = 10{,}7$ MHz

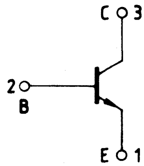


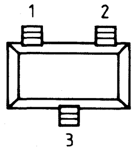
Forward transfer admittance $|Y_{21e}|$
$V_{CE} = 10$ V



NPN silicon planar epitaxial transistor

- General RF applications up to 300 MHz





Top view

Type	Marking	Ordering code	Package
BF 554	CC	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	30 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	30 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

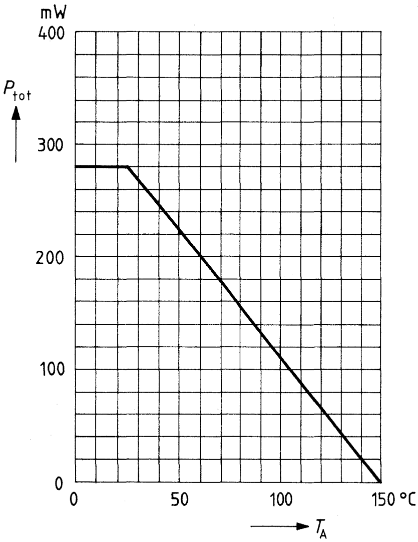
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 1$ mA, $V_{CE} = 10$ V	h_{FE}	60	–	250	–
Base-emitter voltage $I_C = 1$ mA, $V_{CE} = 10$ V	V_{BE}	–	0,68	–	V

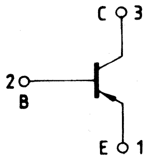
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Noise figure $V_{CE} = 10$ V, $I_C = 1$ mA $f = 200$ kHz, $g_S = 2$ mS $f = 1$ MHz, $g_S = 1{,}5$ mS $f = 100$ kHz, $g_S = 10$ mS	NF	 – – –	 1,5 1,2 4	 – – –	 dB dB dB
Collector-base feedback capacitance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 450$ kHz	C_{re}	–	0,85	–	pF
Output transconductance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 0{,}5 \cdots 10$ MHz	g_{22e}	–	4	–	µS

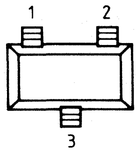
Total power dissipation $P_{tot} = f(T_A)$



PNP silicon planar epitaxial transistor

- Suitable for oscillators, mixers and self-oscillating mixer stages in UHF TV tuners





Top view

Type	Marking	Ordering code	Package
BF 569	LH	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	35 V
Collector-base voltage	V_{CBO}	40 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	30 mA
Base current	I_B	5 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-55 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

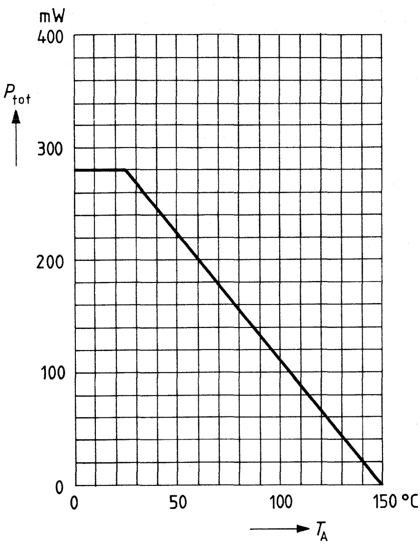
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

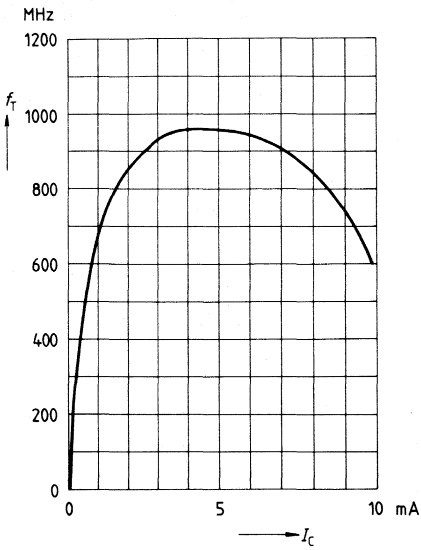
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	35	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 3$ mA, $V_{CE} = 10$ V	h_{FE}	20	50	–	–

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 1$ MHz	f_T	–	925	–	MHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,32	–	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,15	–	pF
Power gain, common base $I_C = 3$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_L = 500\,\Omega$	G_p	–	14	–	dB
Noise figure $I_C = 3$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_G = 60\,\Omega$	NF	–	4,5	–	dB

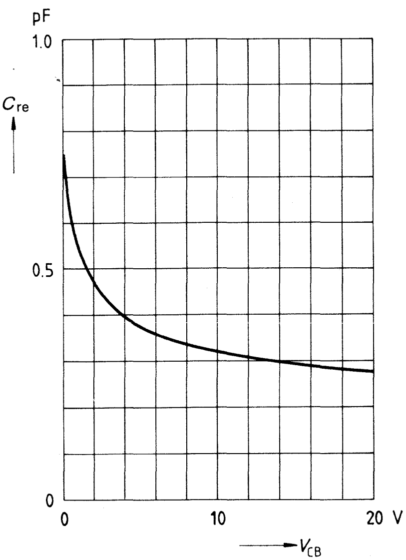
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$f = 100$ MHz, $V_{CE} = 10$ V

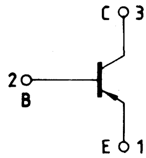


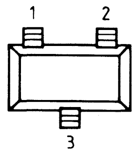
Feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



PNP silicon planar epitaxial transistor

- High transition frequency
- Suitable for low distortion, low noise VHF/UHF amplifier and mixer applications and for UHF oscillator applications in TV tuners
- High collector current, $I_C = 10$ mA typ





Top view

Type	Marking	Ordering code	Package
BF 579	LJ	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	25 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	30 mA
Base current	I_B	5 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-55 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

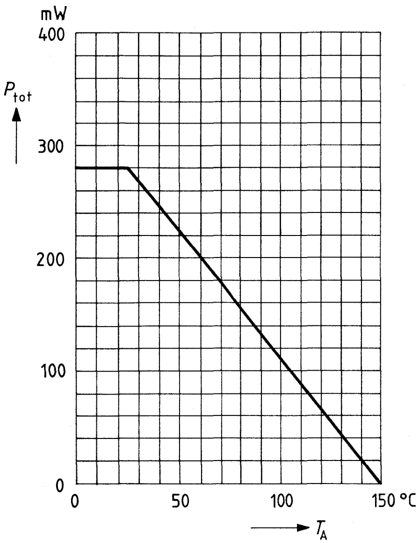
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

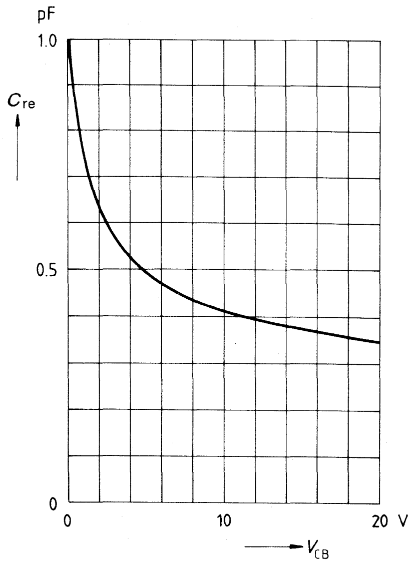
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 10$ mA, $V_{CE} = 10$ V	h_{FE}	20	–	–	–

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	1,6	–	GHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,41	–	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,16	–	pF
Power gain, common base $I_C = 10$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_L = 500\,\Omega$	G_p	–	16	–	dB
Noise figure	NF				
$I_C = 10$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_G = 60\,\Omega$		–	4	–	dB
$I_C = 10$ mA, $V_{CB} = 10$ V, $f = 200$ MHz $R_G = 60\,\Omega$		–	2,9	–	dB

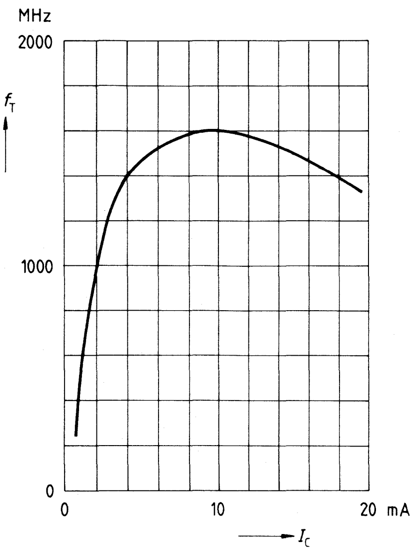
Total power dissipation $P_{tot} = f(T_A)$



Feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz

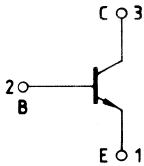


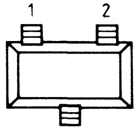
Transition frequency $f_T = f(I_c)$
$f = 100$ MHz, $V_{CE} = 10$ V



NPN silicon planar epitaxial transistor

- Suitable for RF amplifiers in common emitter configuration
- Low collector-base capacitance due to contact shield diffusion





Top view

Type	Marking	Ordering code	Package
BF 599	NB	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	25 V
Collector-base voltage	V_{CBO}	40 V
Emitter-base voltage	V_{EBO}	4 V
Collector current	I_C	25 mA
Base current	I_B	5 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

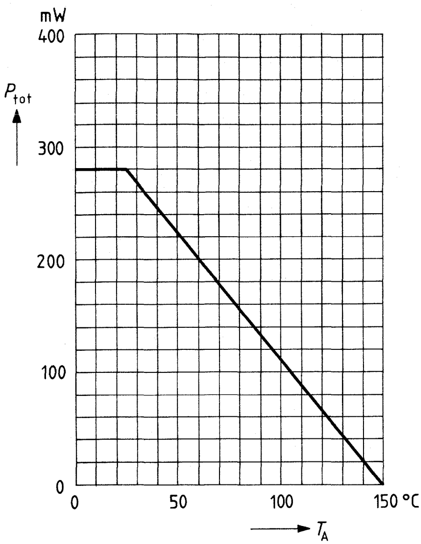
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CE0}$	25	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CB0}	–	–	100	nA
DC current gain $I_C = 7$ mA, $V_{CE} = 10$ V	h_{FE}	38	70	–	–
Collector-emitter saturation voltage $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	0,2	–	V
Base-emitter voltage $I_C = 7$ mA, $V_{CE} = 10$ V	$V_{BE(on)}$	–	0,78	–	V

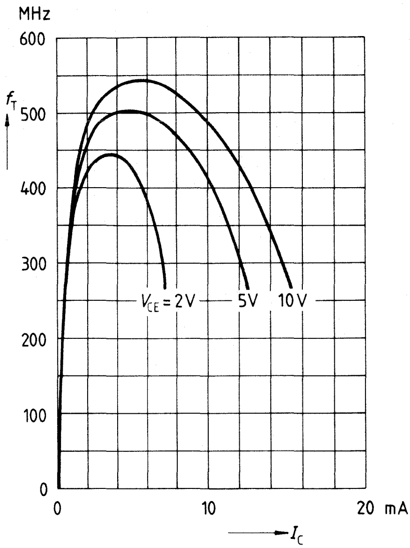
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	550	–	MHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,35	–	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,68	–	pF
Optimum power gain[1]) $I_C = 7$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	G_{pe}opt	–	43	–	dB
Forward transfer admittance $I_C = 7$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	$\|Y_{21e}\|$	–	175	–	dB

[1]) $G_{pe}\text{opt} = \dfrac{|Y_{21e}|^2}{4g_{11e} \cdot g_{22e}}$

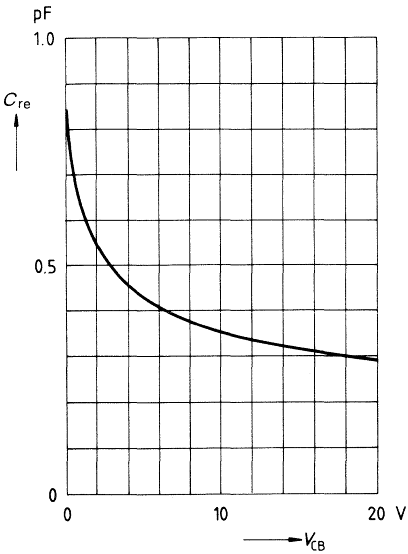
Total power dissipation $P_{tot} = f(T_A)$



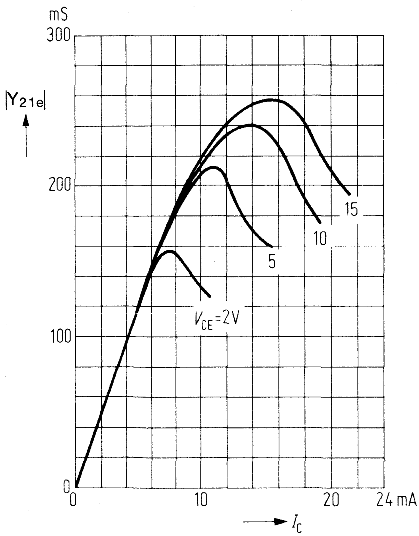
Transition frequency $f_T = f(I_c)$



Feedback capacitance $C_{re} = f(V_{CB})$

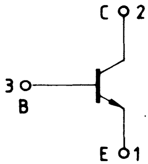


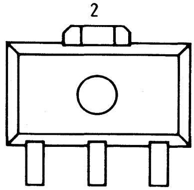
Forward transfer admittance $|Y_{21e}| = f(I_c)$
f = 35 MHz



NPN silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary to BF 623 (PNP)





Type	Marking	Ordering code	Package
BF 622	DA	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CEO}	250 V
Collector-base voltage	V_{CBO}	250 V
Collector-emitter voltage ($R_{BE} = 2{,}7\ k\Omega$)	V_{CER}	250 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

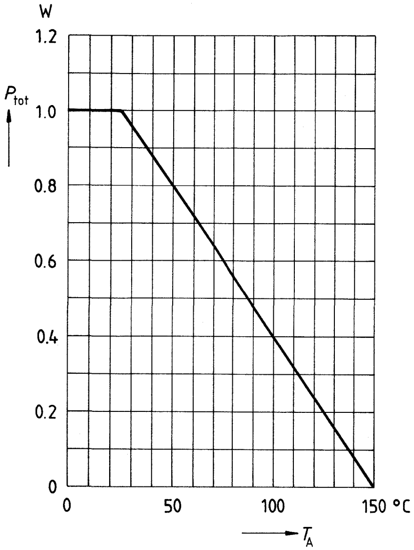
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage					
$I_C = 1$ mA	$V_{(BR)\,CEO}$	250	–	–	V
$I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$		–	–	20	µA
Collector cutoff current	I_{CER}				
$V_{CE} = 200$ V, $R_{BE} = 2{,}7\,k\Omega$		–	–	1	µA
$V_{CE} = 200$ V, $R_{BE} = 2{,}7\,k\Omega$, $T_A = 150\,°C$		–	–	50	µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	nA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

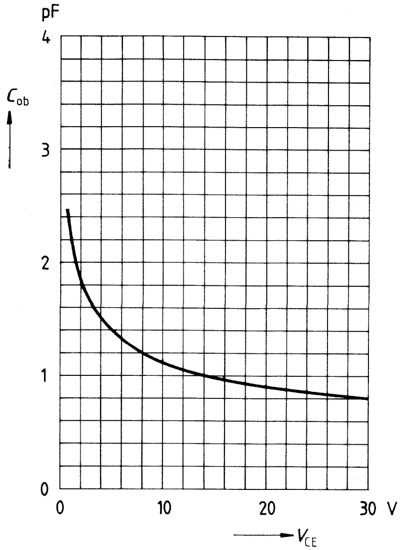
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

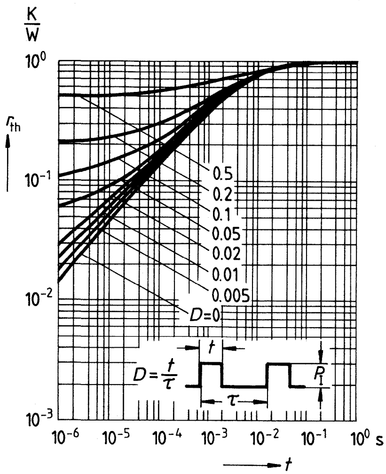
Total power dissipation $P_{tot} = f(T_A)$



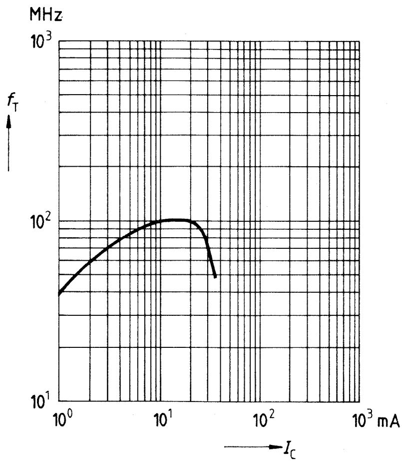
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



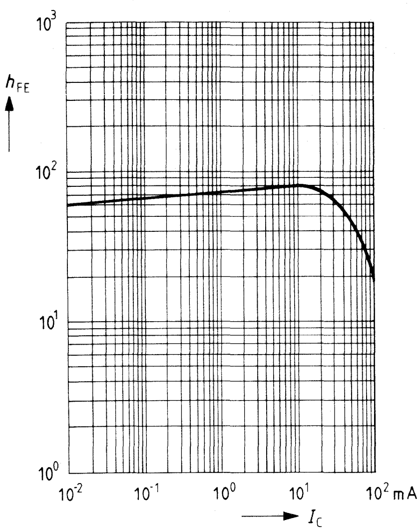
Pulse handling capability $r_{th} = f(t)$
(standardized)



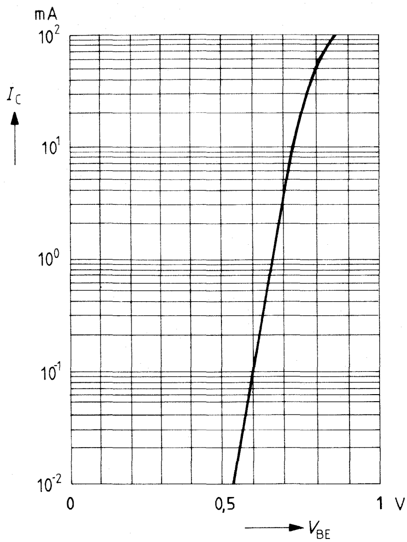
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 20$ MHz



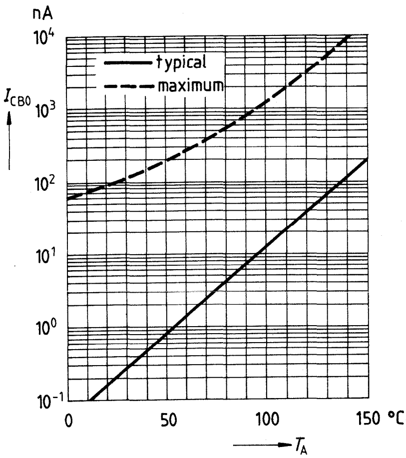
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V

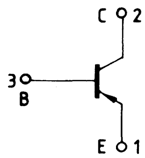


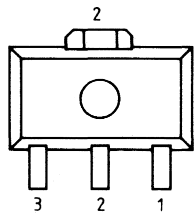
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



PNP silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary to BF 622 (NPN)





Top view

Type	Marking	Ordering code	Package
BF 623	DB	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CEO}	250 V
Collector-base voltage	V_{CBO}	250 V
Collector-emitter voltage ($R_{BE} = 2{,}7\ k\Omega$)	V_{CER}	250 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\ °C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

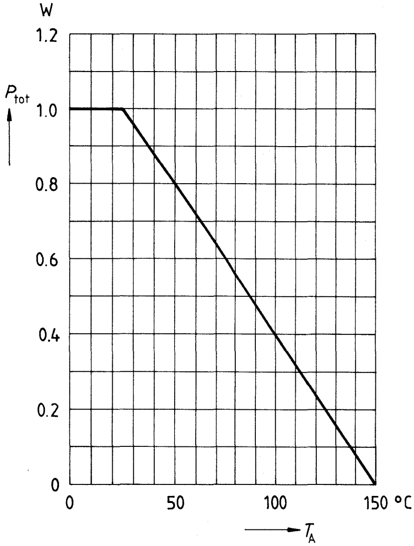
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA $I_C = 10\ \mu A$, $V_{BE} = 2{,}7\ k\Omega$	 $V_{(BR)\ CEO}$ $V_{(BR)\ CER}$	 250 250	 – –	 – –	 V V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\ CBO}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\ EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V $V_{CB} = 200$ V, $T_A = 150\ °C$	I_{CBO}	 – –	 – –	 100 20	 µA µA
Collector cutoff current $V_{CE} = 200$ V, $R_{BE} = 2{,}7\ k\Omega$ $V_{CE} = 200$ V, $R_{BE} = 2{,}7\ k\Omega$, $T_A = 150\ °C$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

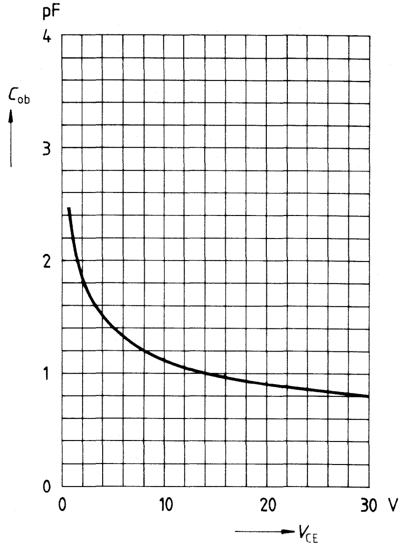
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

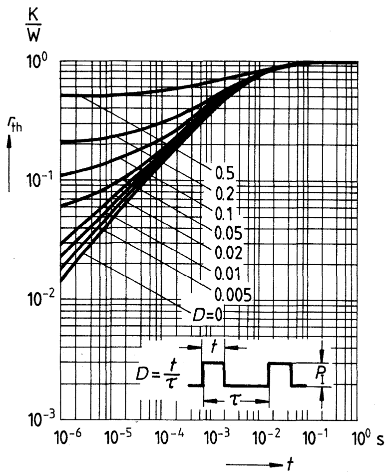
Total power dissipation $P_{tot} = f(T_A)$



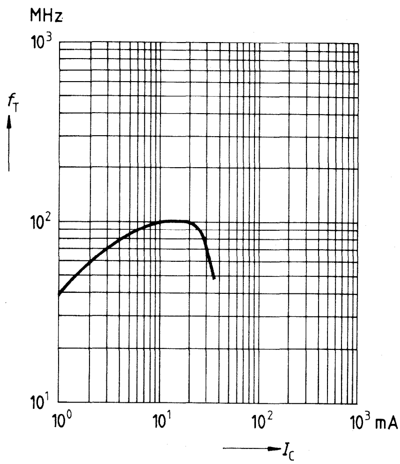
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



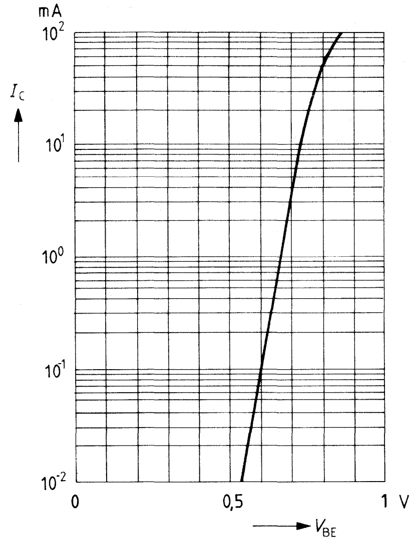
Pulse handling capability $r_{th} = f(t)$
(standardized)



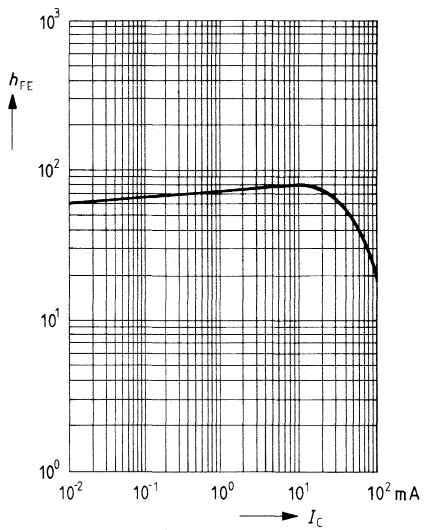
Transition frequency $f_T = f(I_c)$
$V_{CE} = 10$ V, $f = 20$ MHz



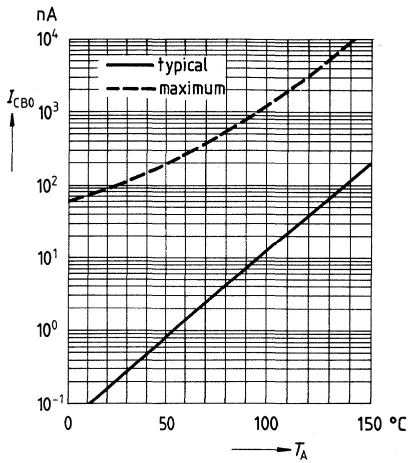
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V

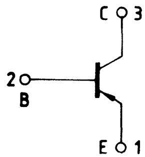


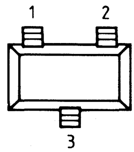
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



PNP silicon planar epitaxial transistor

- For general-purpose RF amplifier applications up to 300 MHz
- Particularly suitable for application in VHF tuner oscillators





Top view

Type	Marking	Ordering code	Package
BF 660	LE	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	30 V
Collector-base voltage	V_{CBO}	40 V
Emitter-base voltage	V_{EBO}	4 V
Collector current	I_C	25 mA
Emitter current	I_E	30 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 … +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

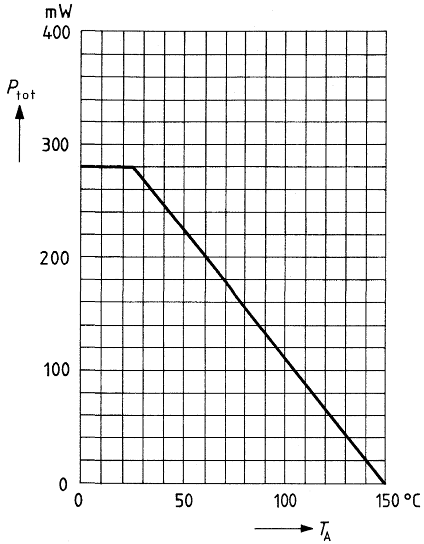
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

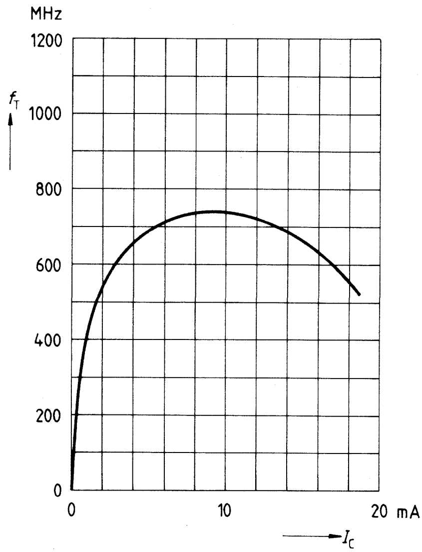
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_E = 0$	$V_{(BR)\,CE0}$	30	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_E = 0$	$V_{(BR)\,CB0}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)\,EB0}$	4	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CB0}	–	–	50	nA
DC current gain $I_C = 3$ mA, $V_{CE} = 10$ V	h_{FE}	30	–	–	–

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	700	–	MHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,6	–	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,28	–	pF

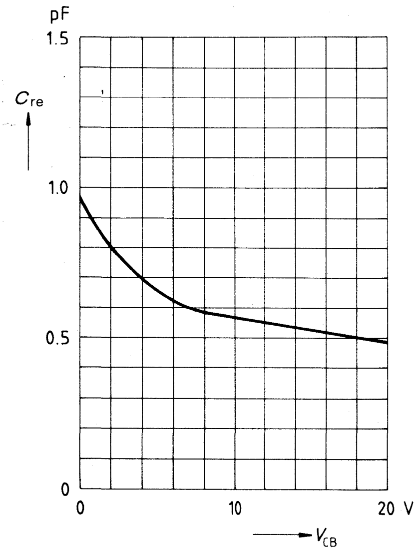
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_c)$
$V_{CE} = 10$ V, $f = 100$ MHz

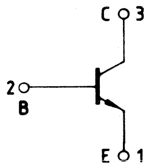


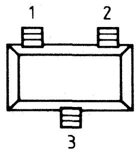
Feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



NPN silicon planar epitaxial transistor

- Suitable for linear broadband RF amplifiers up to 500 MHz and for TV tuners
- Particularly suitable for SAW filter drivers





Top view

Type	Marking	Ordering code	Package
BF 799	LK	Refer to index	Version A

Maximum ratings

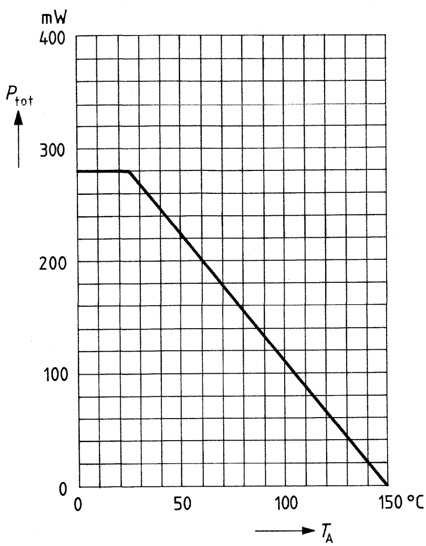
Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	30 V
Collector-emitter voltage	V_{CES}	30 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	35 mA
Peak collector current	I_{CM}	50 mA
Peak base current	I_{BM}	15 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \ldots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 450 K/W

Characteristics
at $T_A = 25\,°C$, unless otherwise specified

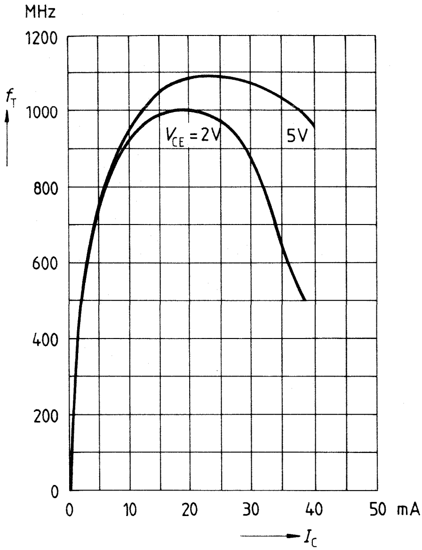
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_E = 0$	$V_{(BR)\,CBO}$	30	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	3	–	–	V
Collector cutoff current $V_{CB} = 20$ V	I_{CBO}	–	–	100	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 20$ mA, $V_{CE} = 10$ V	h_{FE}	 35 40	 95 100	 – 250	 – –
Collector-emitter saturation voltage $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}	–	0,15	0,5	V
Base-emitter saturation voltage $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,95	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz $I_C = 20$ mA, $V_{CE} = 8$ V, $f = 100$ MHz	f_T	 – –	 800 1100	 – –	 MHz MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz, $V_{BE} = 0$ V	C_{ob}	–	0,96	–	pF
Collector-base feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$ V, $f = 1$ MHz	C_{re}	–	0,7	–	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$ V, $f = 1$ MHz	C_{rb}	–	0,28	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz, $R_G = 50\,\Omega$	NF	–	3	–	dB
Output transconductance $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	g_{22e}	–	60	–	µS

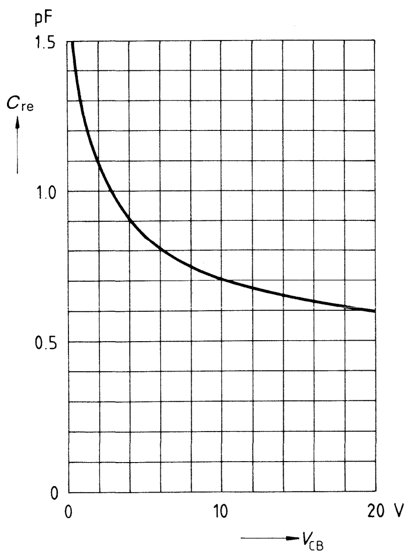
Total power dissipation $P_{tot} = f(T_A)$



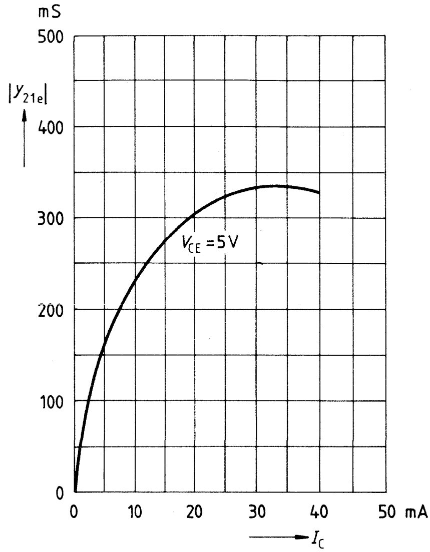
Transition frequency $f_T = f(I_C)$
f = 100 MHz



Feedback capacitance $C_{re} = f(V_{CB})$
f = 1 MHz

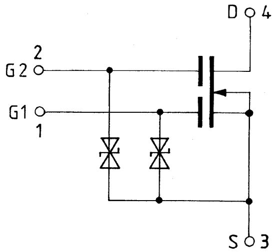


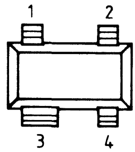
Forward transfer admittance $|Y_{21e}| = f(I_C)$
f = 35 MHz



Silicon dual-gate MOS field-effect tetrode

- For UHF input stages and for applications throughout the frequency range between 200 MHz and 1 GHz





Top view

Type	Marking	Ordering code	Package
BF 989	MA	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \dots +150\,°C$
Channel temperature	T_{ch}	150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

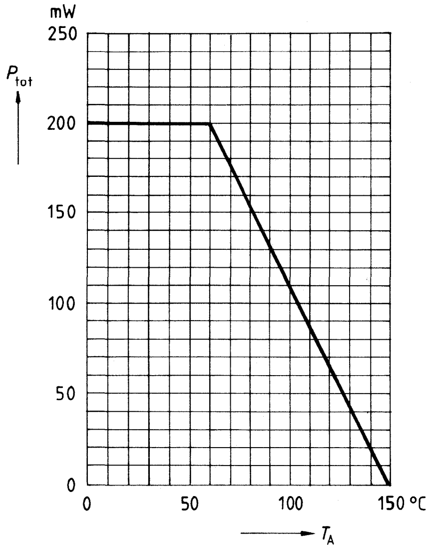
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\,\mu A$, $-V_{G1S} = -V_{G2S} = 4\,V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\,mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\,mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\,V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\,V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\,V$, $V_{G1S} = 0$, $V_{G2S} = 4\,V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G2S} = 4\,V$, $I_D = 20\,\mu A$	$-V_{G1S\,(p)}$	–	–	2,7	V
Gate 2 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G1S} = 0$, $I_D = 20\,\mu A$	$-V_{G2S\,(p)}$	–	–	2,7	V

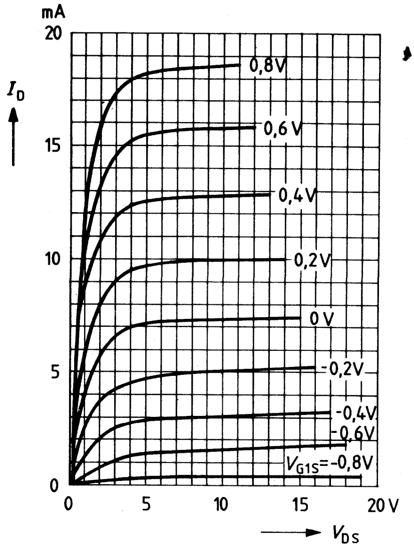
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,kHz$	g_{fs}	9,5	12	–	mS
Gate 1 input capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g1ss}	1,3	1,8	2,3	pF
Gate 2 input capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g2ss}	–	1	–	pF
Reverse transfer capacitance[1] $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dss}	0,65	0,8	1,2	pF
Power gain $V_{DS} = 15\,V$, $I_D = 7\,mA$, $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$ $f = 800\,MHz$, $G_G = 3{,}3\,mS$, $G_L = 1\,mS$	G_{ps}	 – 13	 23 16,5	 – 20	 dB dB
Noise figure $V_{DS} = 15\,V$, $I_D = 7\,mA$ $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$ $f = 800\,MHz$, $G_G = 3{,}3\,mS$, $G_L = 1\,mS$	NF	 – –	 1,6 2,8	 2,8 3,9	 dB dB
Control range $V_{DS} = 15\,V$, $V_{G2S} = 4 \cdots -2\,V$, $f = 800\,MHz$	ΔG_{ps}	40	–	–	dB
Mixer gain $V_{DS} = 15\,V$, $V_{G2S} = 4\,V$, $f = 800\,MHz$, $f_{IF} = 36\,MHz$, $2\,\Delta f_{IF} = 5\,MHz$, $V_{OSC} = 800\,mV$	G_{psc}	–	16	–	dB

[1]) G2 and S on screen potential.

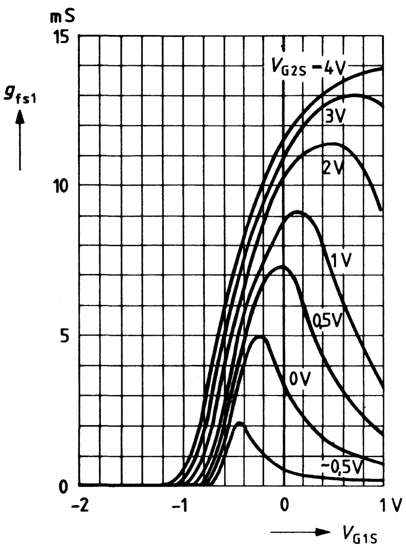
Total power dissipation
$P_{tot} = f(T_A)$



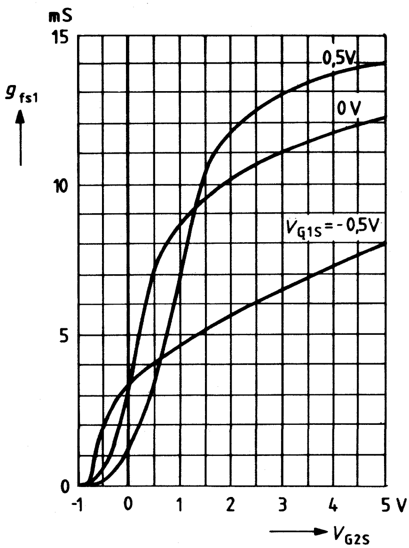
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



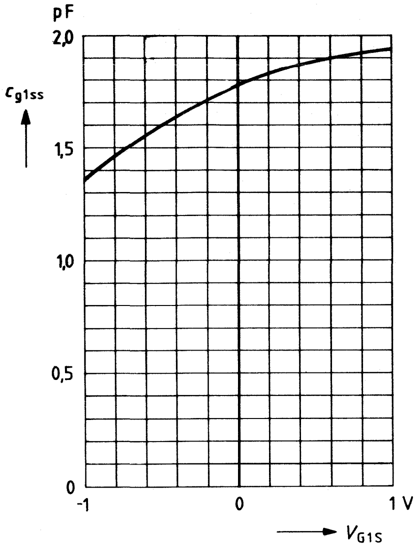
Gate 1 forward transconductance $g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ kHz



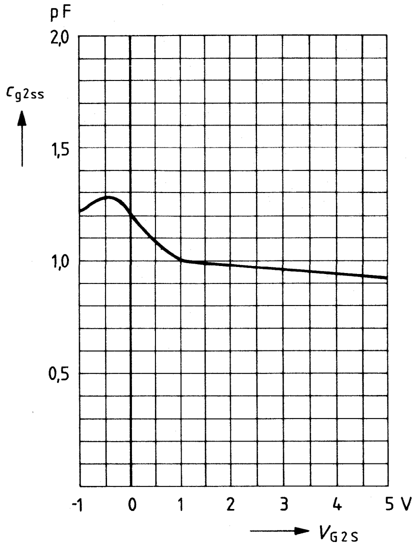
Gate 1 forward transconductance $g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ kHz



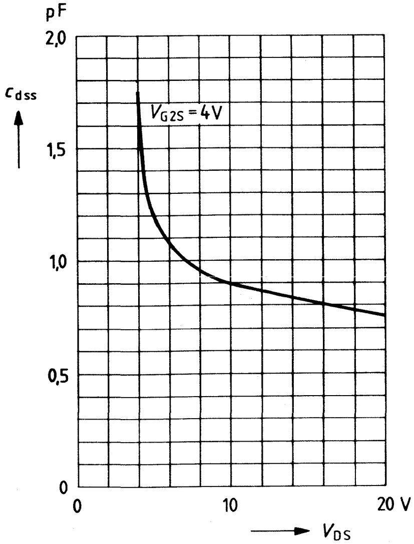
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4\ V$, $V_{DS} = 15\ V$
$I_{DSS} = 7\ mA$, $f = 1\ MHz$



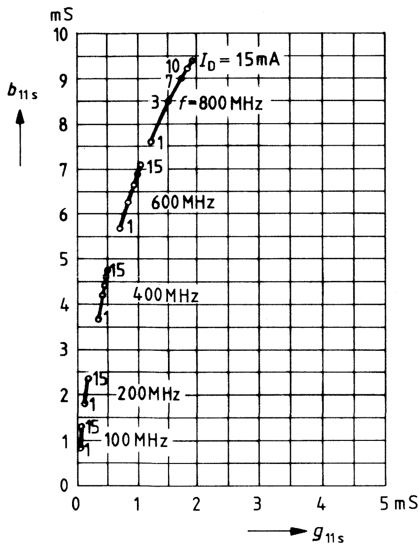
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0\ V$, $V_{DS} = 15\ V$
$I_{DSS} = 7\ mA$, $f = 1\ MHz$



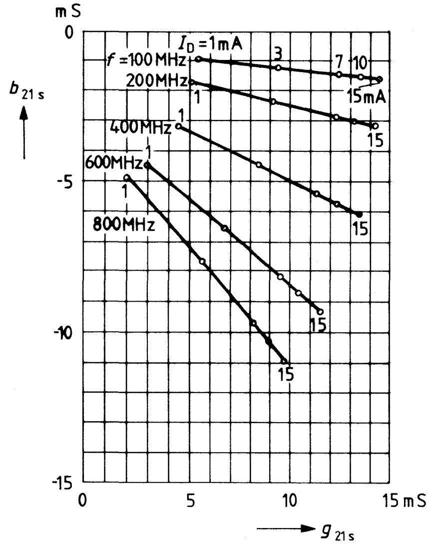
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0\ V$, $V_{G2S} = 4\ V$
$I_{DSS} = 7\ mA$, $f = 1\ MHz$



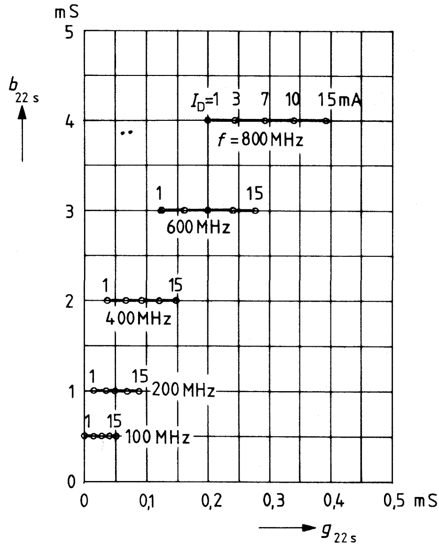
Gate 1 input admittance y_{11s}
$V_{DS} = 15\ V$, $V_{G2S} = 4\ V$
(common-source)



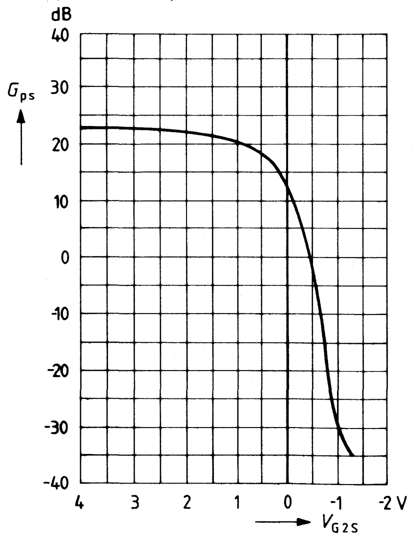
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



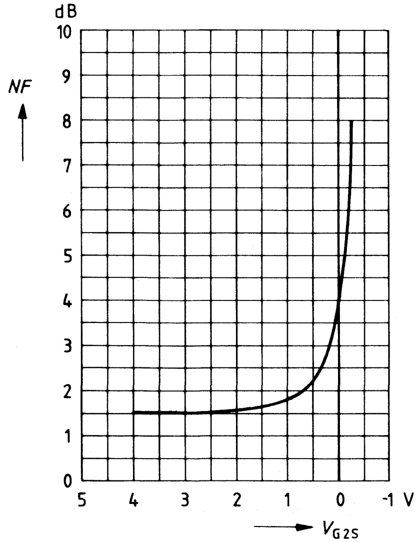
Output admittance Y_{22s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



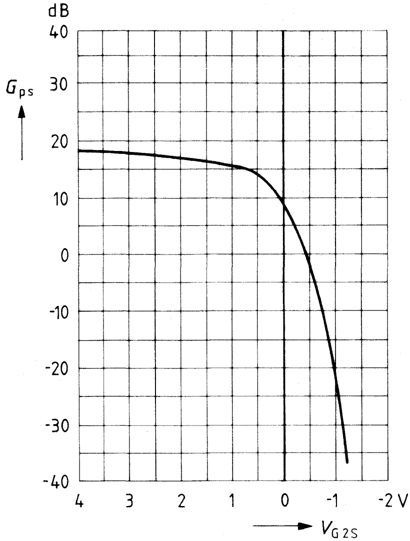
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 200$ MHz
(test circuit 1)



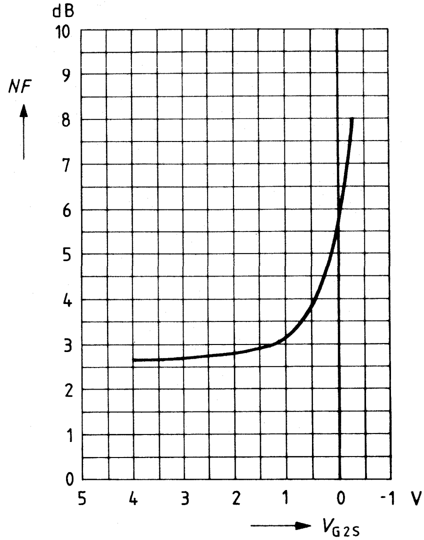
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 200$ MHz
(test circuit 1)



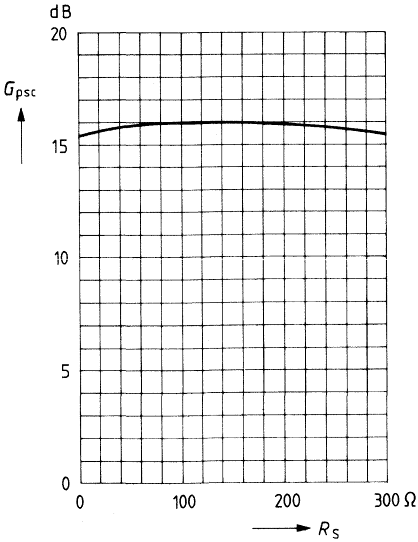
Power gain $G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 800$ MHz; $R_S = 0$
(test circuit 2)



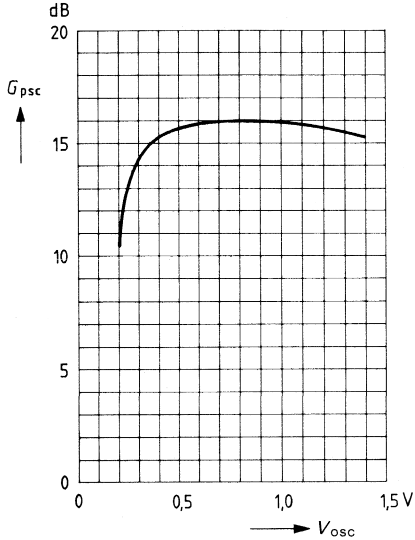
Noise figure $NF = f(V_{G2S})$
$V_{DS} = 15$ V; $V_{G1S} = 0$;
$I_{DSS} = 7$ mA; $f = 800$ MHz; $R_S = 0$
(test circuit 2)



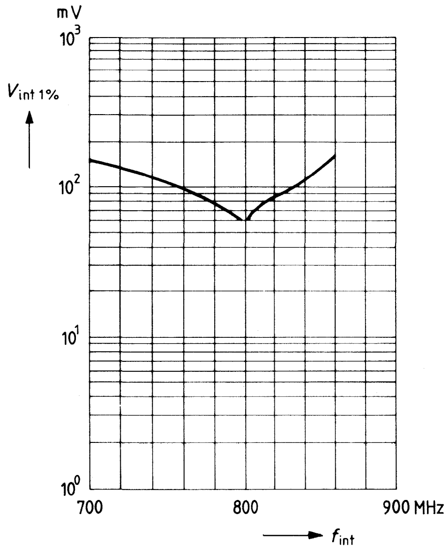
Mixer gain $G_{psc} = f(R_S)$
$f_e = 800$ MHz; $f_{osc} = 836$ MHz
$V_{osc} = 800$ mV; $V_{DS} = 15$ V
$V_{G2S} = 4$ V; $I_{DSS} = 7$ mA
(test circuit 3)



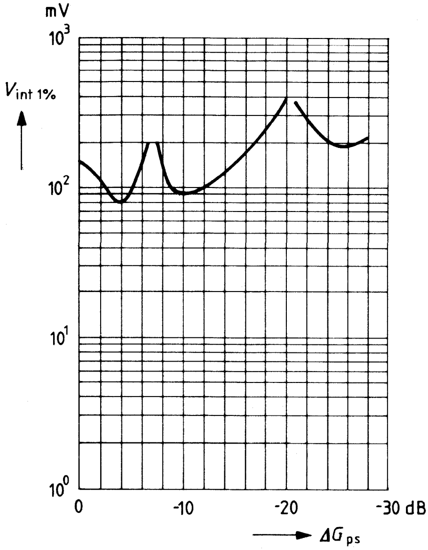
Mixer gain $G_{psc} = f(V_{osc})$
$f_e = 800$ MHz; $f_{osc} = 836$ MHz
$V_{DS} = 15$ V; $V_{G2S} = 4$ V;
$I_{DSS} = 7$ mA; $R_S = 150$
(test circuit 3)



Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(f_{int})$[1]; $m_{int} = 100\%$;
$V_{DS} = 15$ V; $V_{G2S} = 4$ V,
$V_{G1S} = 1$ V; $R_S = 150\ \Omega$
(test circuit 2)

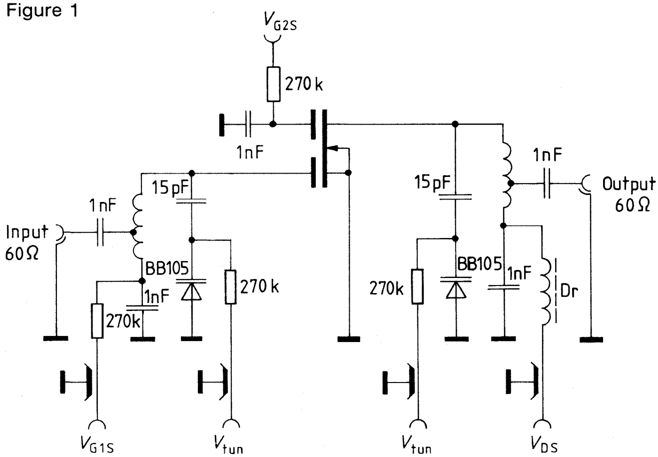


Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(\Delta G_{ps})$[1]; $f_e = 800$ MHz;
$f_{int} = 700$ MHz; $m_{int} = 100\%$;
$V_{DS} = 15$ V; $V_{G1S} = 1$ V; $R_S = 150\ \Omega$
(test circuit 2)



Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ ms, $G_L = 0{,}5$ mS

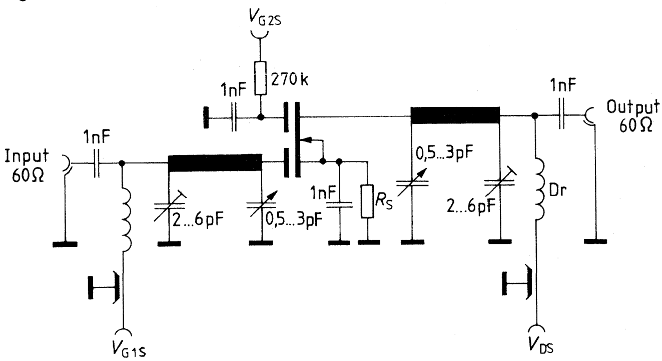
Figure 1



[1]) $V_{int\ (1\%)}$ is the rms value of half the EMC (terminal voltage at matching) of a 100% sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1% amplitude modulation on the active carrier.

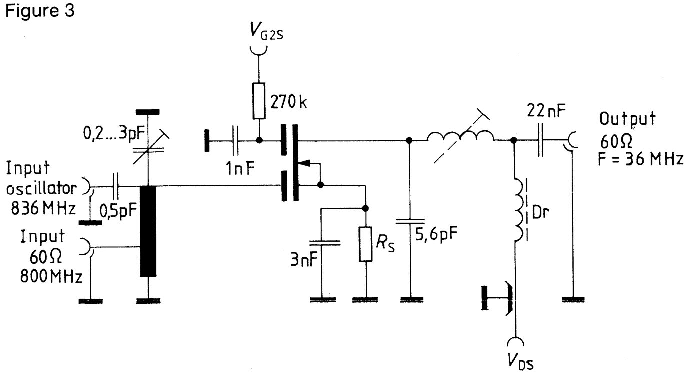
Test circuit for power gain, noise figure and cross modulation
$f = 800$ MHz, $G_G = 3{,}3$ mS, $G_L = 1$ mS

Figure 2



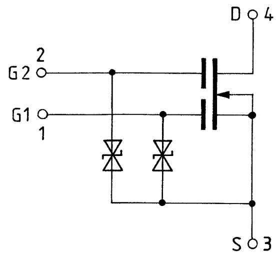
Test circuit for mixer gain
$f = 800/36$ MHz

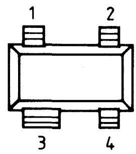
Figure 3



Silicon dual-gate-MOS field-effect tetrode

- For UHF input stages and for applications throughout the frequency range between 200 MHz and 1 GHz





Top view

Type	Marking	Ordering code	Package
BF 989 S	MF	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \dots +150\,°C$
Channel temperature	T_{ch}	150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

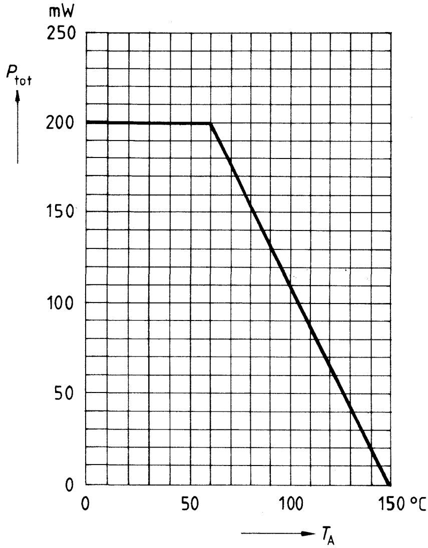
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,7	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,7	V

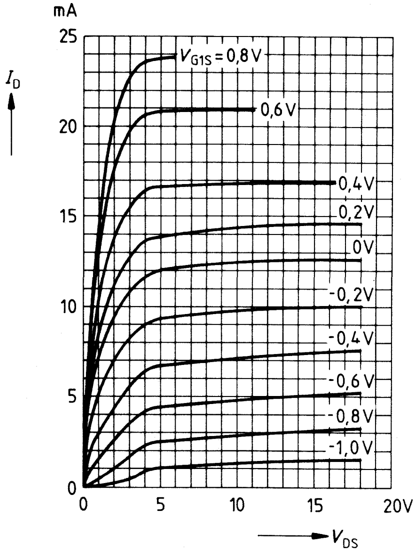
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V$, $I_D = 7\ mA$, $V_{G2S} = 4\ V$, $f = 1\ kHz$	g_{fs}	10	12	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V$, $I_D = 7\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g1ss}	–	1,8	–	pF
Gate 2 input capacitance $V_{DS} = 15\ V$, $I_D = 7\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g2ss}	–	1	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15\ V$, $I_D = 7\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\ V$, $I_D = 7\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dss}	–	0,8	–	pF
Power gain $V_{DS} = 15\ V$, $I_D = 7\ mA$, $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	G_{ps}	 – –	 23 16,5	 – –	 dB dB
Noise figure $V_{DS} = 15\ V$, $I_D = 7\ mA$ $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	NF	 – –	 1,3 2,2	 – –	 dB dB
Control range $V_{DS} = 15\ V$, $V_{G2S} = 4 \cdots -2\ V$, $f = 800\ MHz$	ΔG_{ps}	40	–	–	dB

[1]) G2 and S on screen potential.

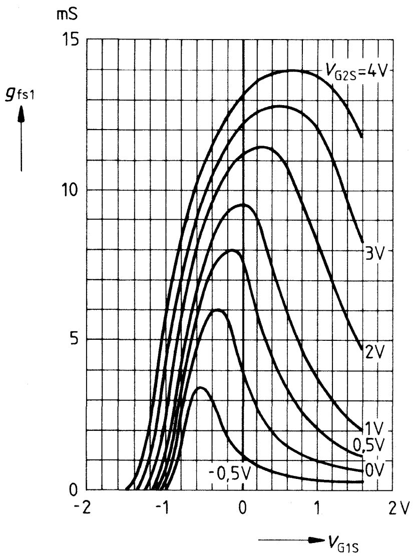
Total power dissipation
$P_{tot} = f(T_A)$



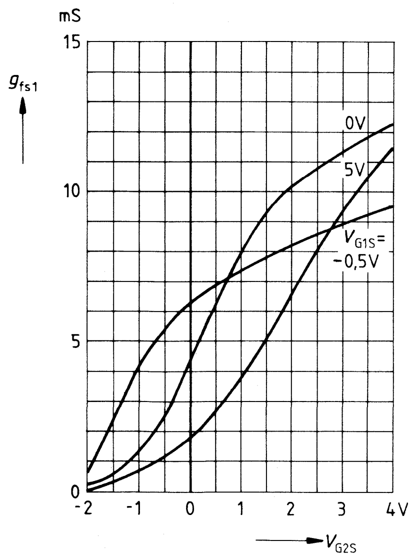
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4\ V$



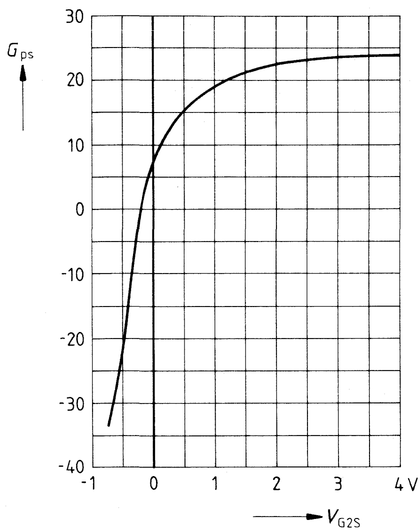
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15\ V$
$I_{DSS} = 7\ mA$, $f = 1\ kHz$



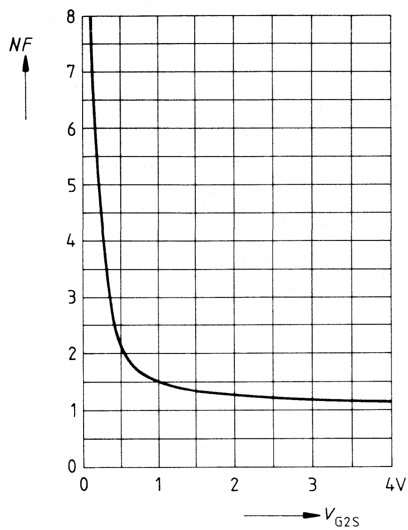
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15\ V$
$I_{DSS} = 7\ mA$, $f = 1\ kHz$



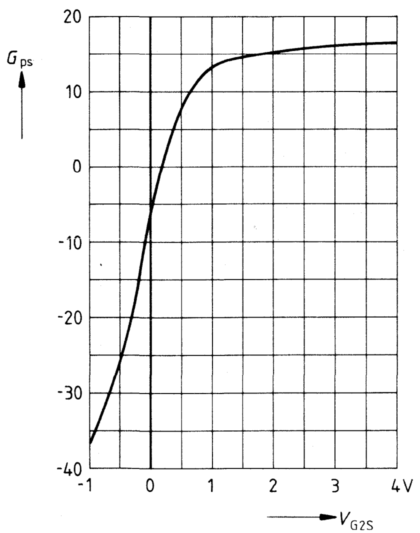
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 7$ mA, $f = 200$ MHz
(test circuit 1)



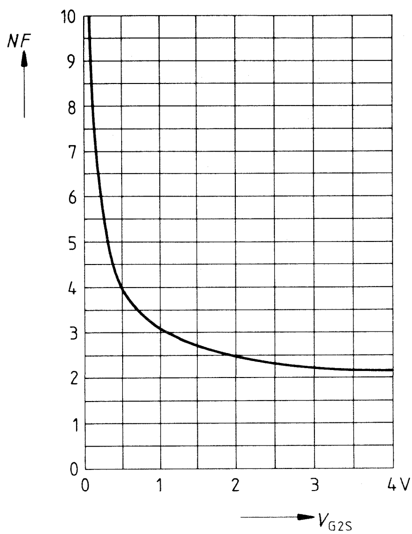
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 7$ mA, $f = 200$ MHz
(test circuit 1)



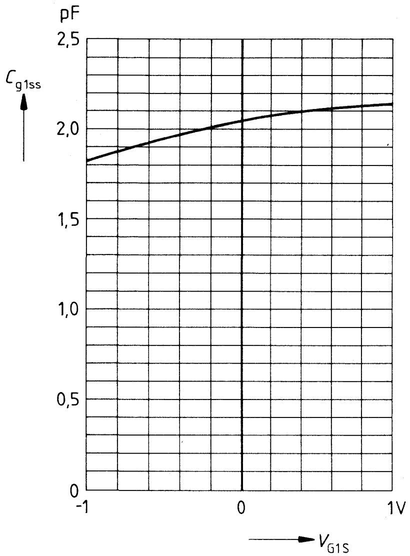
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 7$ mA, $f = 800$ MHz
(test circuit 2)



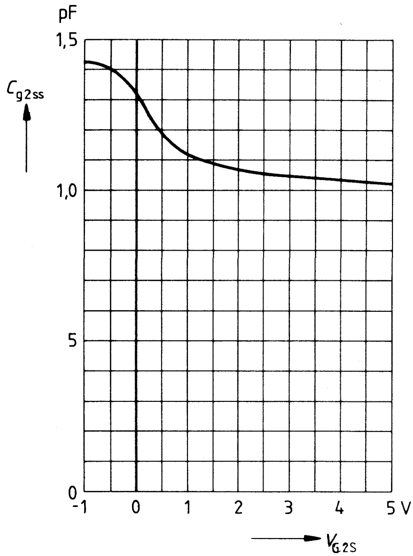
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V; $V_{G1S} = 0$ V
$I_{DSS} = 7$ mA; $f = 800$ MHz
(test circuit 2)



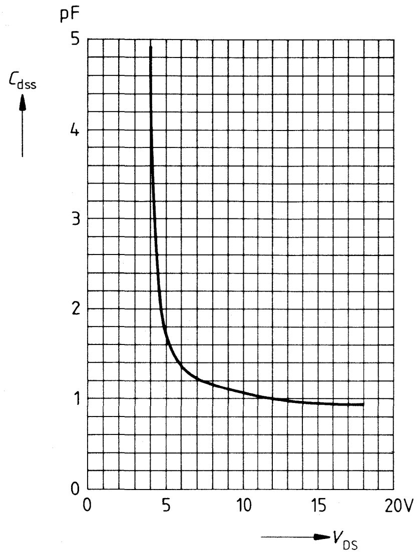
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



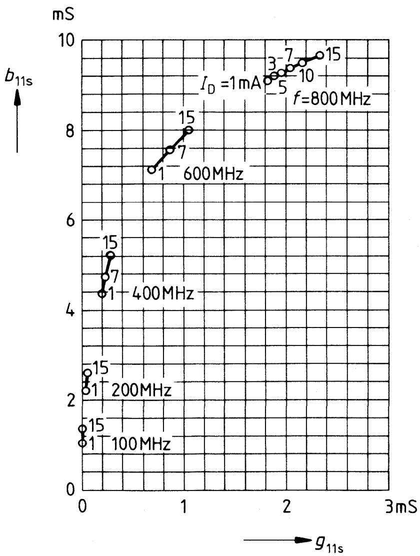
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



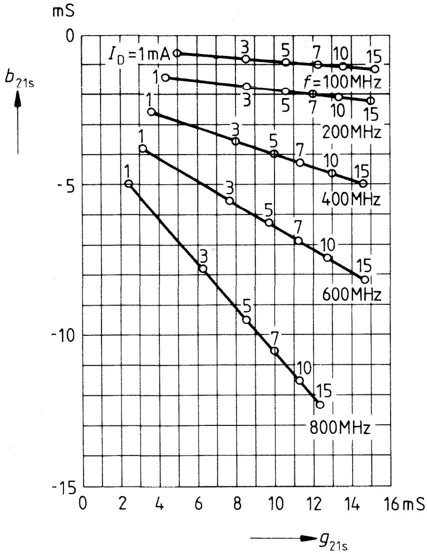
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



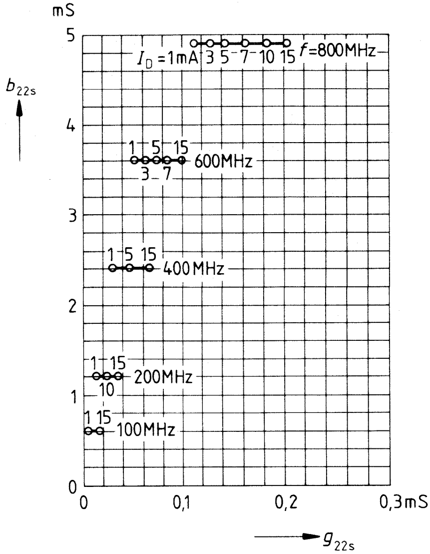
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



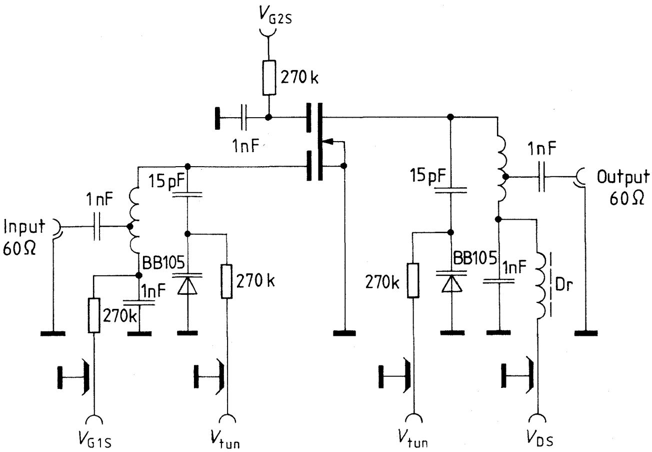
Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



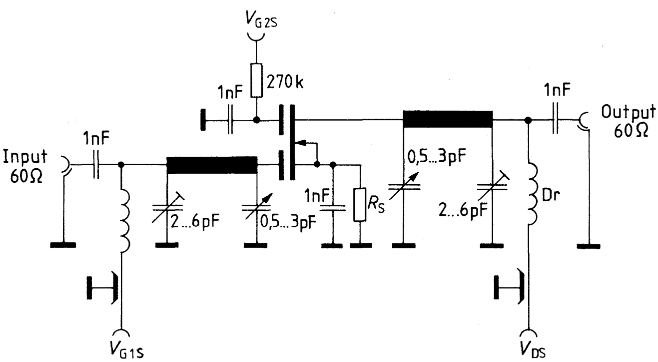
Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0{,}5$ mS
Figure 1

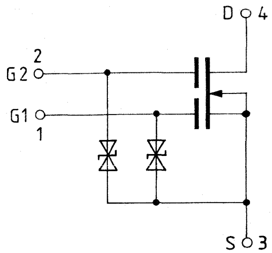


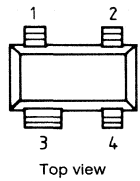
Test circuit for power gain, noise figure and cross modulation
$f = 800$ MHz, $G_G = 3{,}3$ mS, $G_L = 1$ mS.
Figure 2



Silicon dual-gate MOS field-effect tetrode

- For FM/TV and VHF input stages





Type	Marking	Ordering code	Package
BF 993	ME	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	50 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

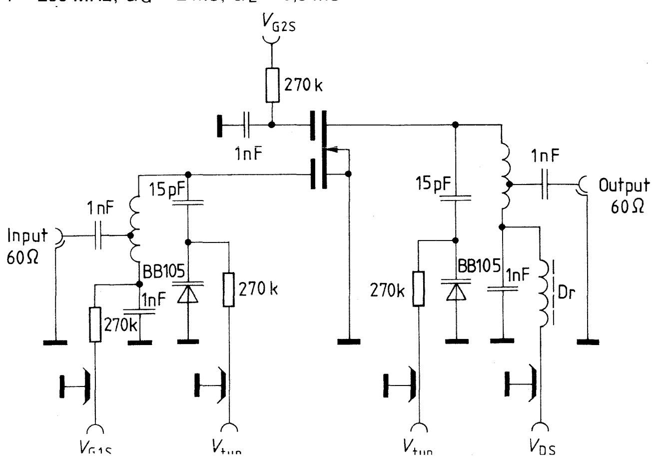
at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage I_D = 10 µA, $-V_{G1S}$ = $-V_{G2S}$ = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S}$ = 10 mA, V_{G2S} = V_{DS} = 0	$\pm V_{(BR)\,G1SS}$	6	–	–	V
Gate 2 source breakdown voltage $\pm I_{G2S}$ = 10 mA, V_{G1S} = V_{DS} = 0	$\pm V_{(BR)\,G2SS}$	6	–	–	V
Gate 1 source leakage current $\pm V_{G1S}$ = 5 V, V_{G2S} = V_{DS} = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S}$ = 5 V, V_{G1S} = V_{DS} = 0	$\pm I_{G2SS}$	–	–	50	nA
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	6	–	40	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	$-V_{G1S\,(p)}$	–	–	3,5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	$-V_{G2S\,(p)}$	–	–	3,0	V

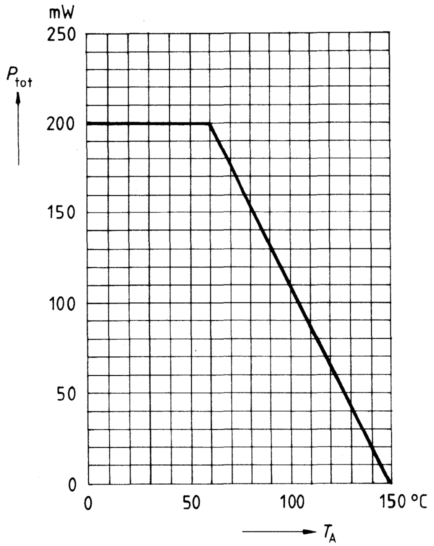
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ kHz	g_{fs}	16	25	–	mS
Gate 1 input capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{g1ss}	–	6	–	pF
Gate 2 input capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{g2ss}	–	2,5	–	pF
Reverse transfer capacitance[1] $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{dg1}	–	50	–	fF
Output capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{dss}	–	2,5	–	pF
Power gain $V_{DS} = 15$ V, $I_D = 10$ mA, $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0,5$ mS $2\,\Delta f = 12$ MHz (test circuit)	G_{ps}	–	25	–	dB
Noise figure $V_{DS} = 15$ V, $I_D = 10$ mA $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0,5$ mS (test circuit)	NF	–	1,5	–	dB

[1]) G2 and S on screen potential.

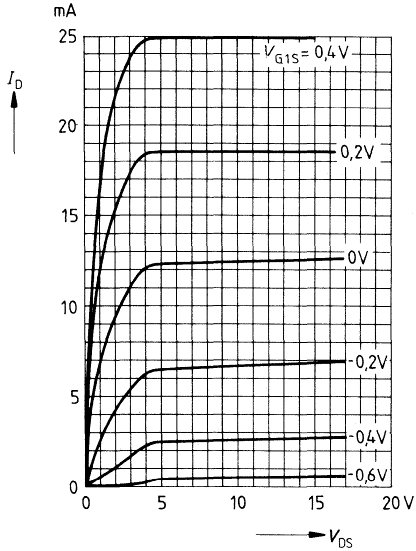
Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0,5$ mS



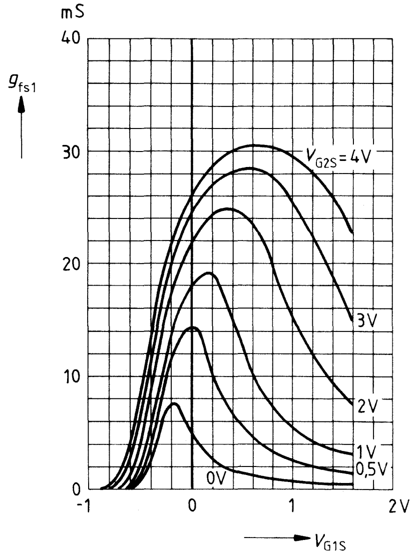
Total power dissipation
$P_{tot} = f(T_A)$



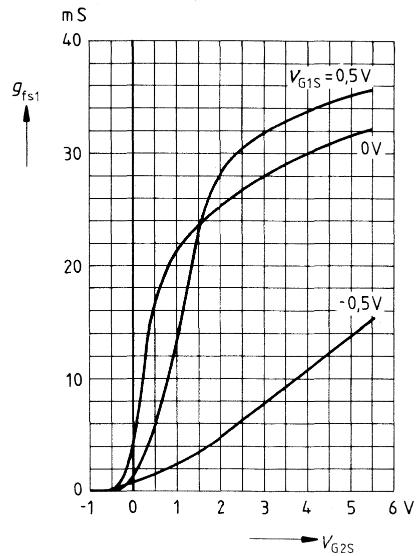
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



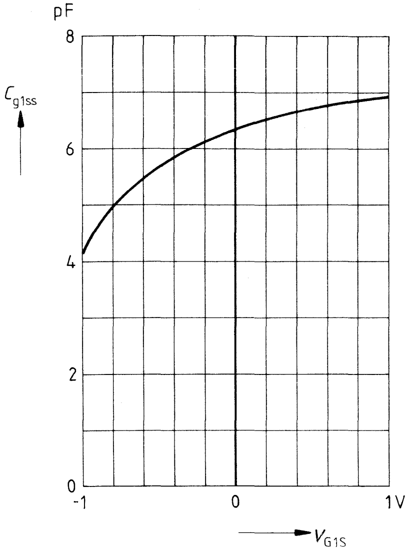
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



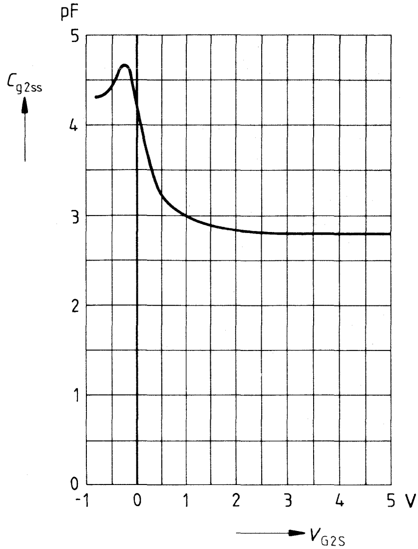
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



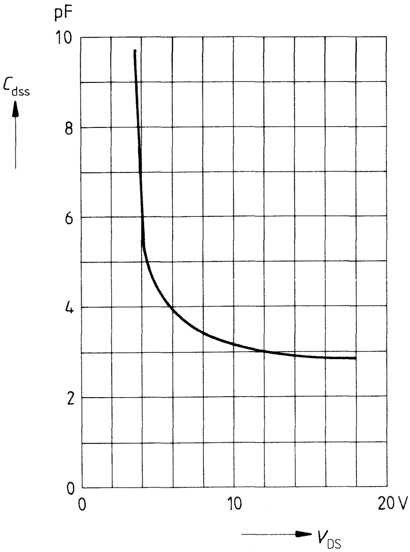
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



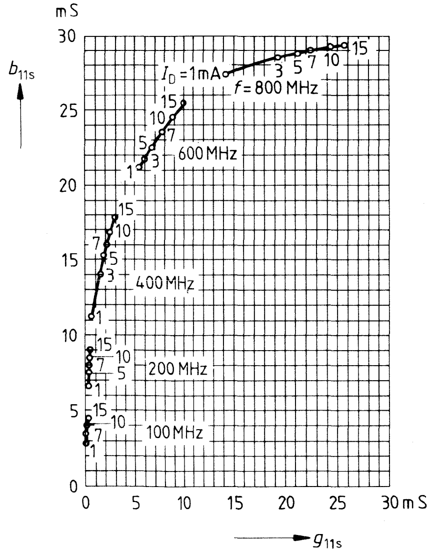
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



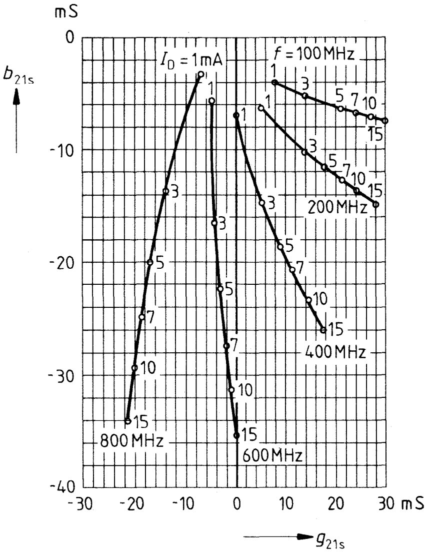
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



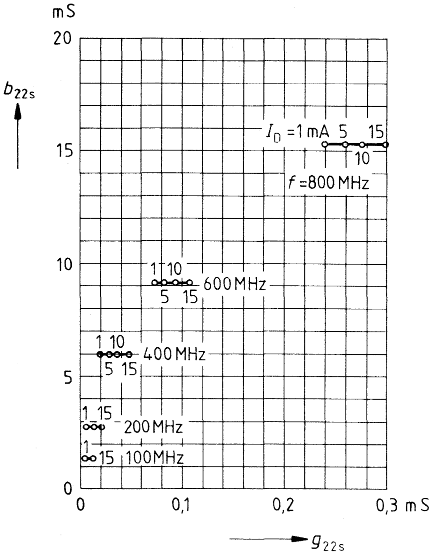
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



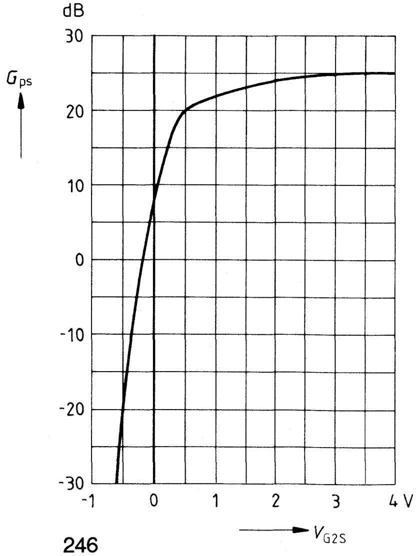
Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



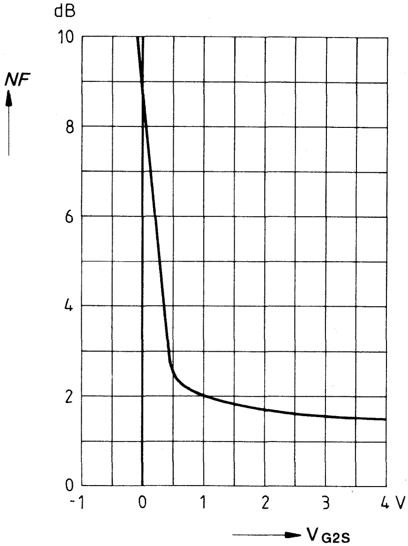
Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



Power gain
$G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)

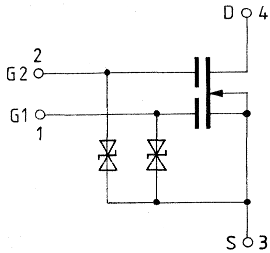


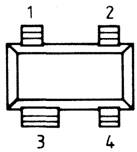
Noise figure
$NF = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)



Silicon dual-gate MOS field-effect tetrode

- For use in VHF input and mixer stages featuring a wide tuning range (CATV tuners)





Top view

Type	Marking	Ordering code	Package
BF 994	MC	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 450 K/W

Characteristics

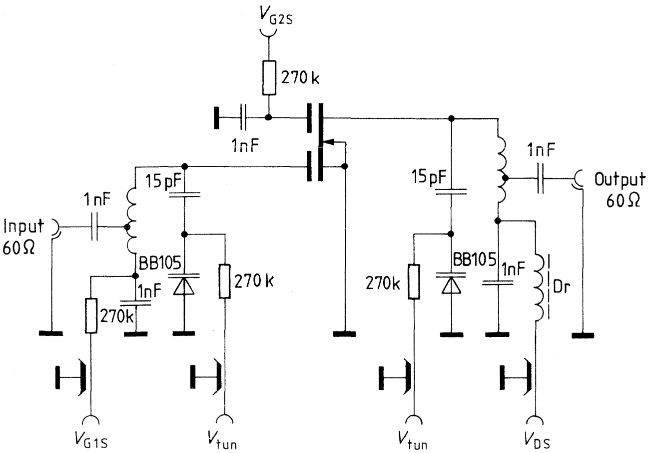
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A,\ -V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA,\ V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA,\ V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V,\ V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V,\ V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V,\ V_{G1S} = 0,\ V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G2S} = 4\ V,\ I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G1S} = 0,\ I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

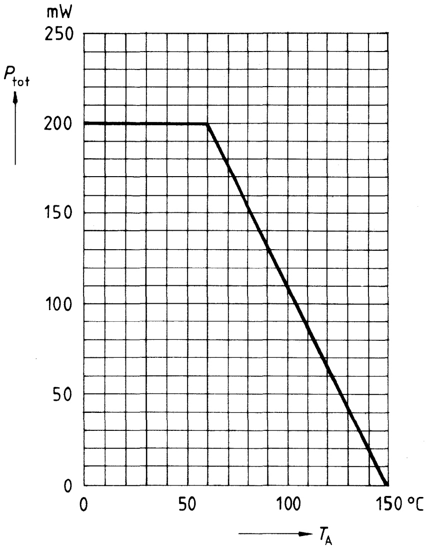
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	17	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2,5	3	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1,2	–	pF
Reverse transfer capacitance[1] V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	1,3	pF
Power gain V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS (test circuit)	NF	–	1,5	2,8	dB
Control range V_{DS} = 15 V, V_{G2S} = 4 ··· −2 V, f = 200 MHz	ΔG_{ps}	50	–	–	dB

[1]) G2 and S on screen potential.

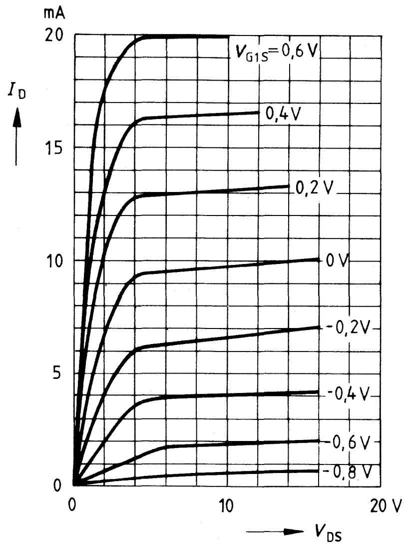
Test circuit for power gain and noise figure
f = 200 MHz; G_G = 2 mS, G_L = 0,5 mS



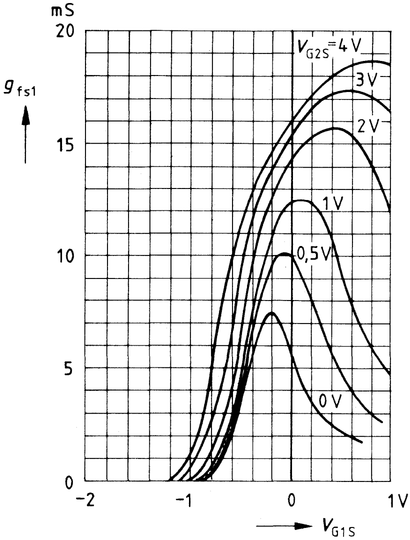
Total power dissipation
$P_{tot} = f(T_A)$



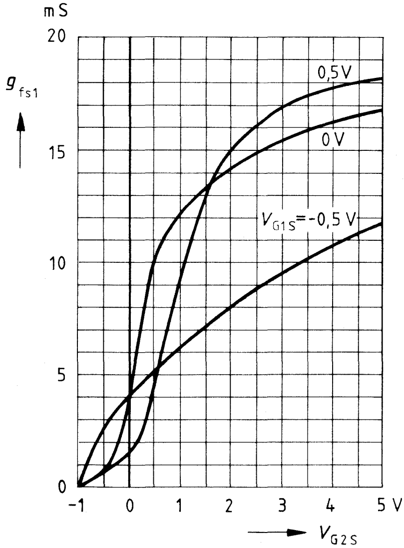
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



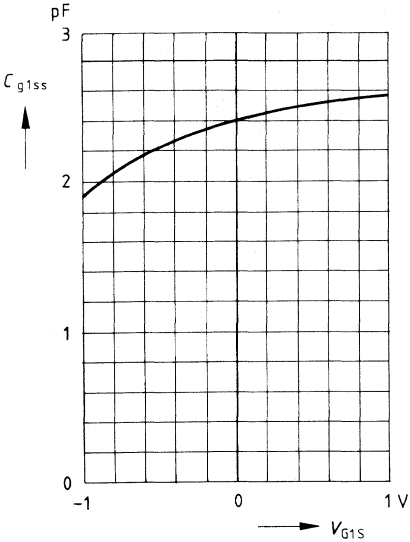
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



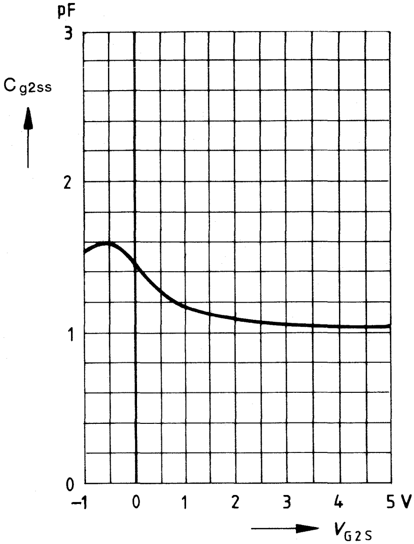
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



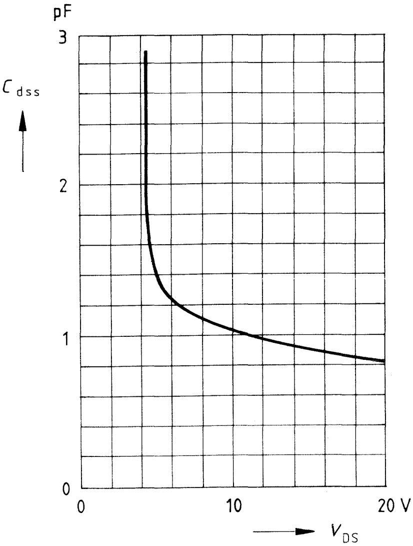
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4\ V$, $V_{DS} = 15\ V$
$I_{DSS} = 10\ mA$, $f = 1\ MHz$



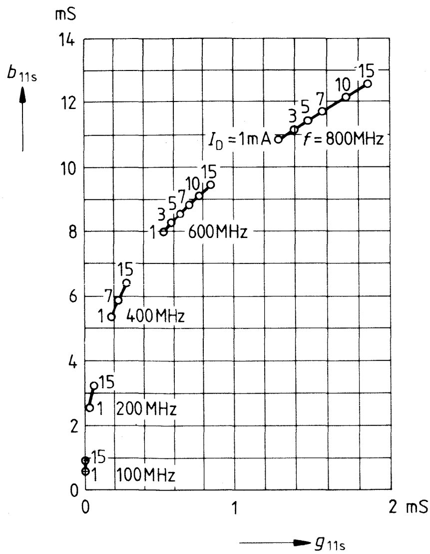
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0\ V$, $V_{DS} = 15\ V$
$I_{DSS} = 10\ mA$, $f = 1\ MHz$



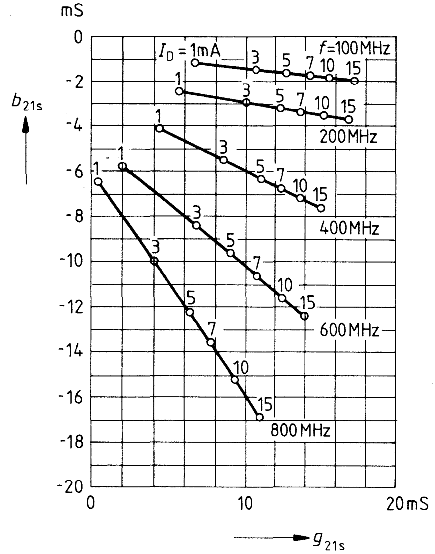
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0\ V$, $V_{G2S} = 4\ V$
$I_{DSS} = 10\ mA$, $f = 1\ MHz$



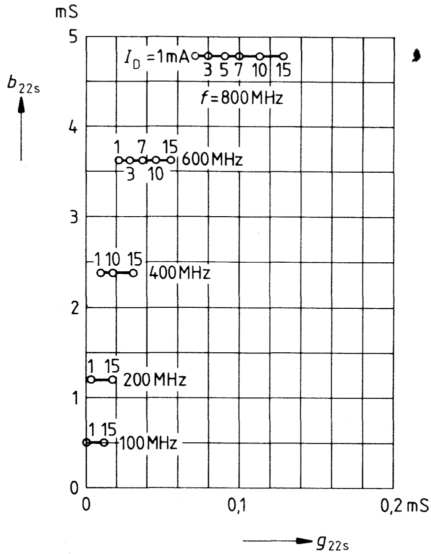
Gate 1 input admittance y_{11s}
$V_{DS} = 15\ V$, $V_{G2S} = 4\ V$
(common-source)



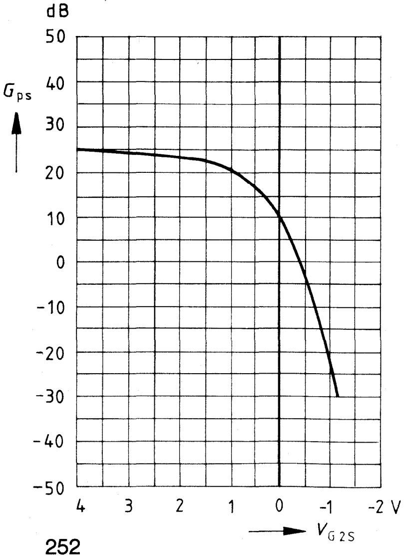
Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



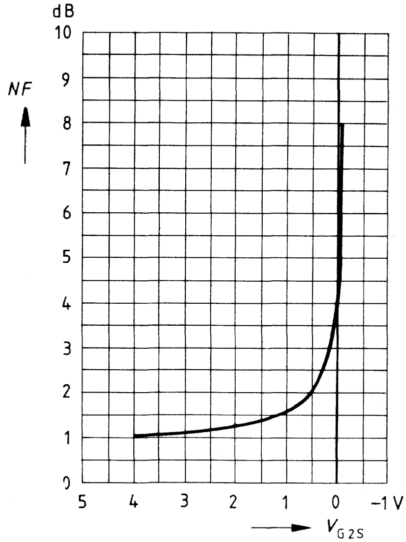
Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



Power gain
$G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)

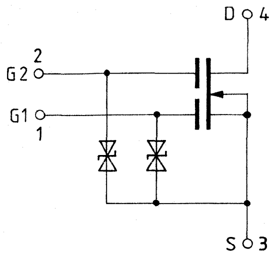


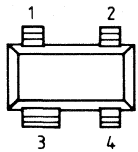
Noise figure
$NF = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)



Silicon dual-gate MOS field-effect tetrode

- For use in VHF input and mixer stages featuring a wide tuning range (CATV tuners)





Top view

Type	Marking	Ordering code	Package
BF 994 S	MG	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

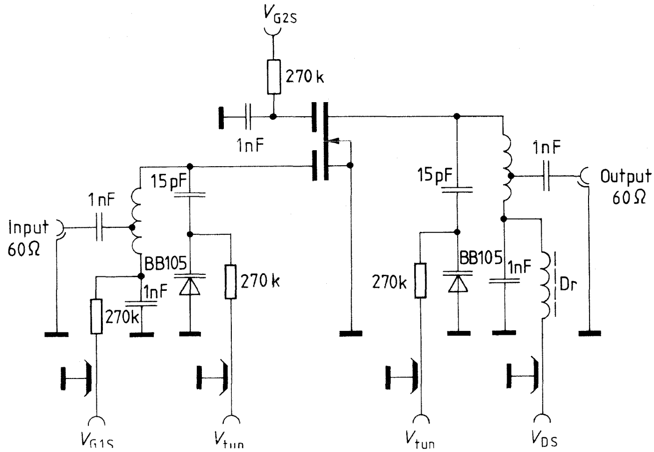
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A,\ -V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA,\ V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA,\ V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V,\ V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V,\ V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V,\ V_{G1S} = 0,\ V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G2S} = 4\ V,\ I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G1S} = 0,\ I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

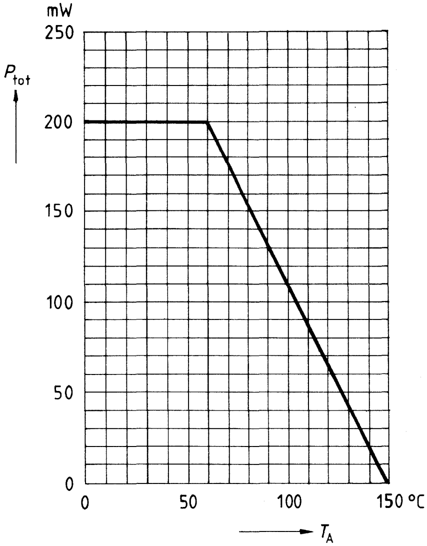
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2,5	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1,2	–	pF
Reverse transfer capacitance[1]) V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS (test circuit)	NF	–	1	–	dB
Control range V_{DS} = 15 V, V_{G2S} = 4 ··· −2 V, f = 200 MHz	ΔG_{ps}	50	–	–	dB

[1]) G2 and S on screen potential.

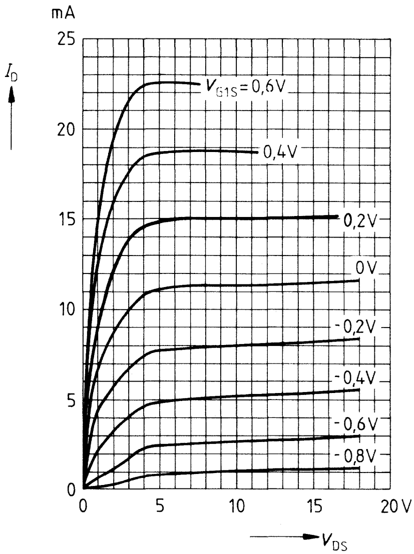
Test circuit for power gain and noise figure
f = 200 MHz; G_G = 2 mS, G_L = 0,5 mS



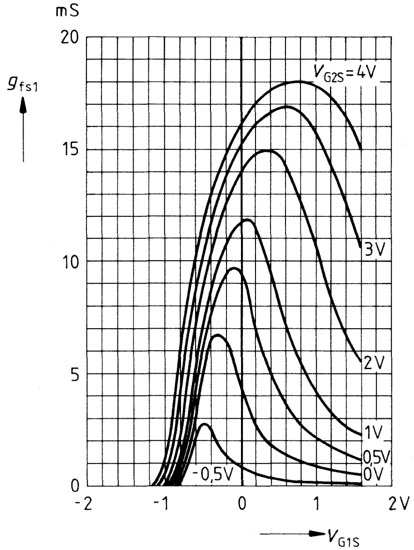
Total power dissipation
$P_{tot} = f(T_A)$



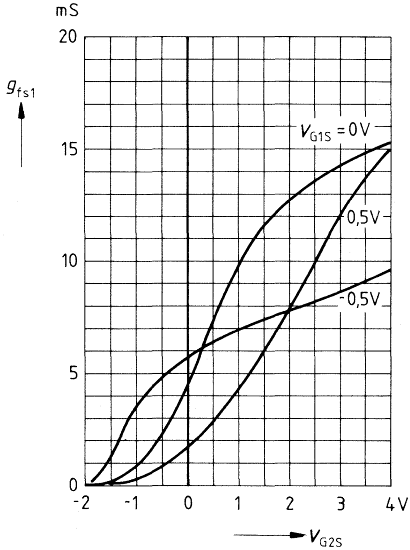
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



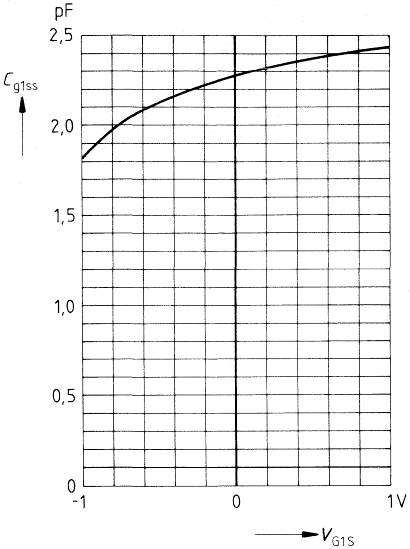
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



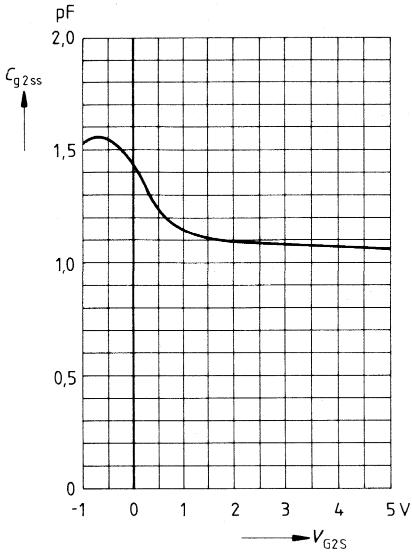
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



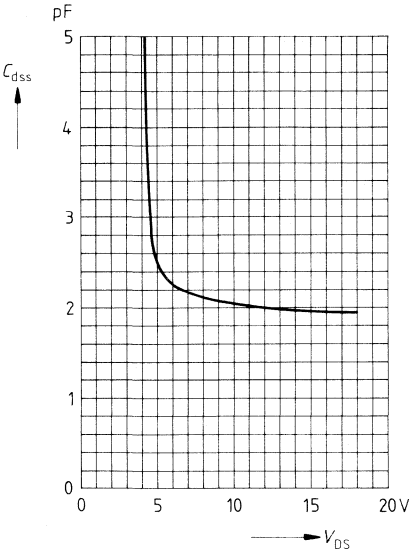
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



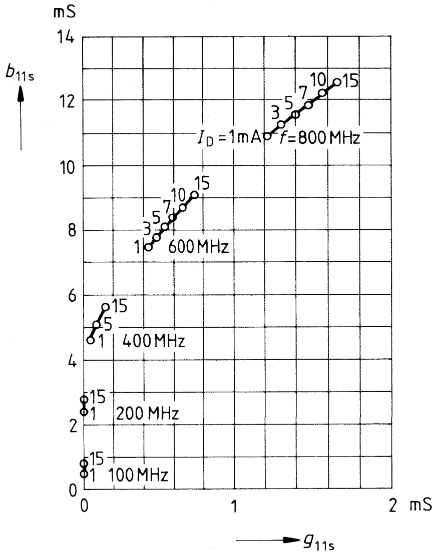
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



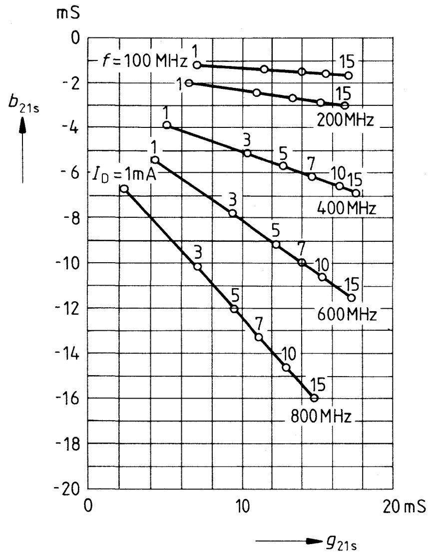
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



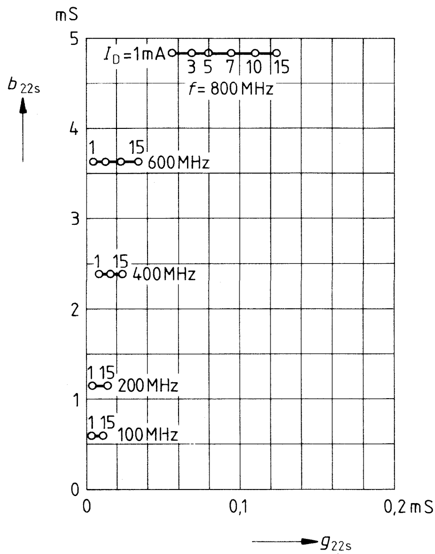
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



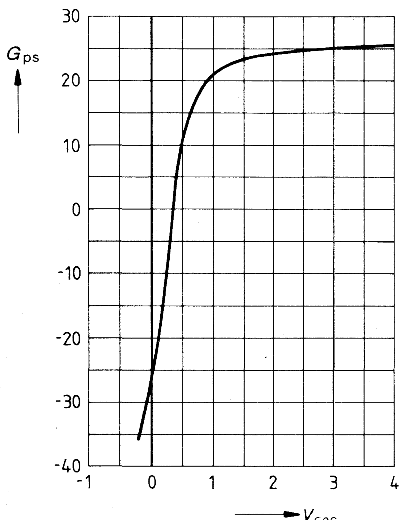
Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



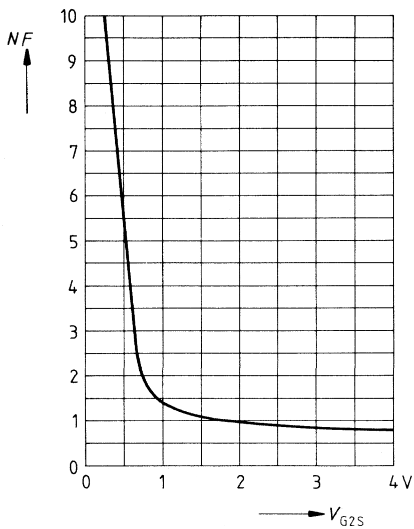
Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



Power gain
$G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)

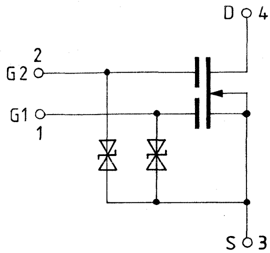


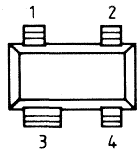
Noise figure
$NF = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V
I_{DSS} = 10 mA, f = 200 MHz
(test circuit)



Silicon dual-gate MOS field-effect tetrode

- For FM and VHF input and mixer stages





Top view

Type	Marking	Ordering code	Package
BF 995	MB	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \dots +150\,°C$
Channel temperature	T_{ch}	150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

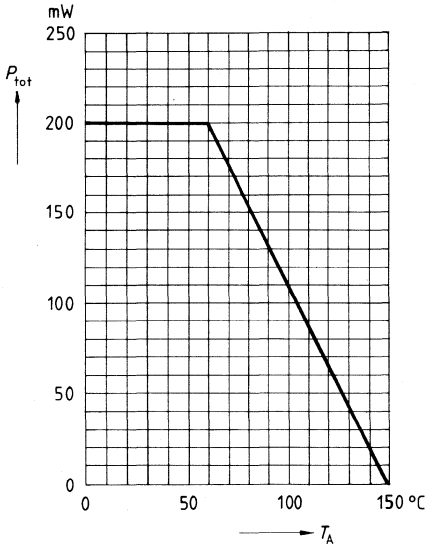
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\ DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\ G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\ G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	4	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\ (p)}$	–	–	3,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\ (p)}$	–	–	3,5	V

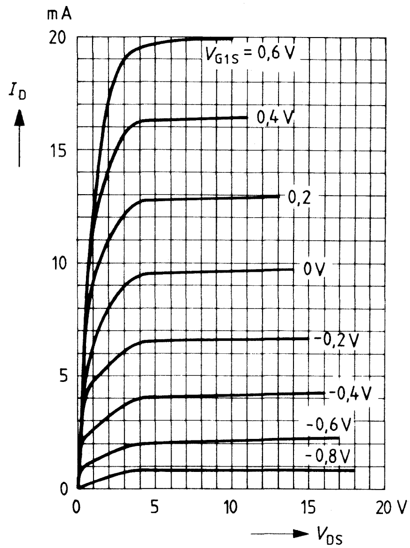
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	12	17	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	3	3,6	4,5	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1,6	–	pF
Reverse transfer capacitance[1]) V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	1,2	1,6	2,2	pF
Power gain V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS 2 Δf = 12 MHz	G_{ps}	19	23	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS (test circuit 1)	NF	–	1,8	2,8	dB
Control range V_{DS} = 15 V, V_{G2S} = 4 ... –2 V, f = 200 MHz (test circuit 1)	ΔG_{ps}	–	50	–	dB
Mixer gain (additive) V_{DS} = 15 V, V_{G2S} = 6 V, R_S = 220 Ω f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{OSC} = 0,5 V (test circuit 2)	G_{psc}	–	16	–	dB
Mixer gain (multiplicative) V_{DS} = 15 V, V_{G1S} = 1,7 V, V_{G2S} = 2,5 V R_S = 220 Ω, f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{OSC} = 2 V (test circuit 3)	G_{FSC}	–	18	–	dB

[1]) G2 and S on screen potential.

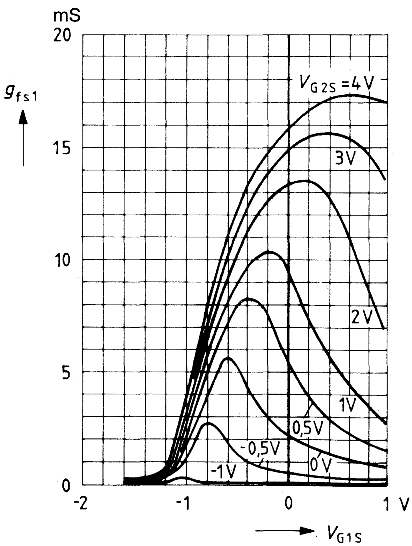
Total power dissipation
$P_{tot} = f(T_A)$



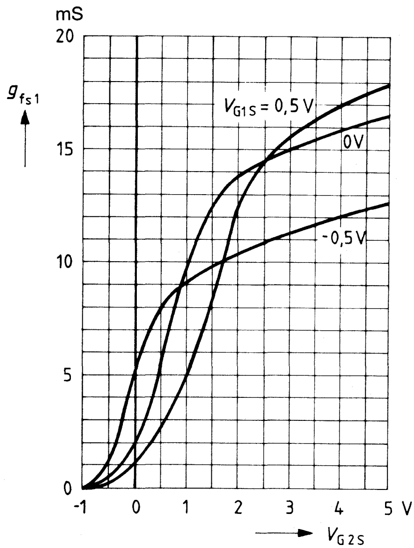
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



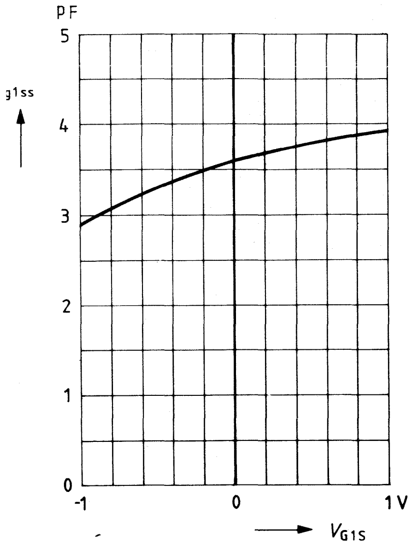
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



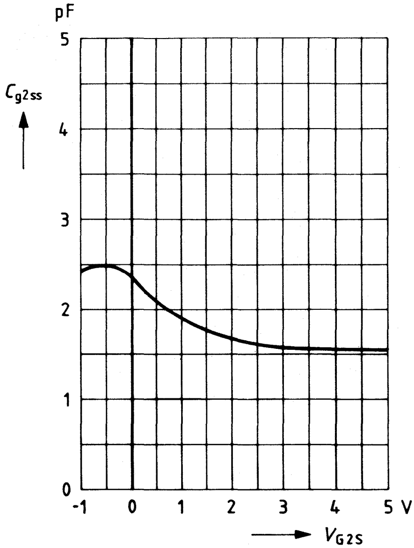
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



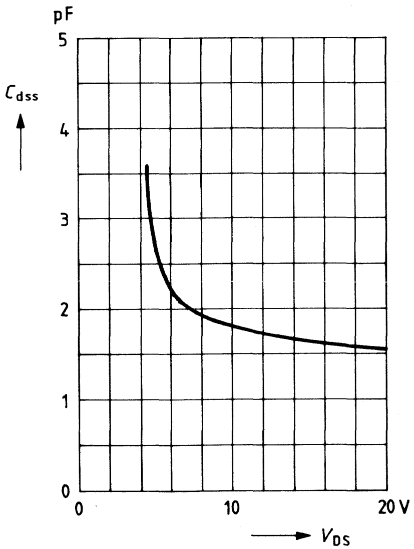
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



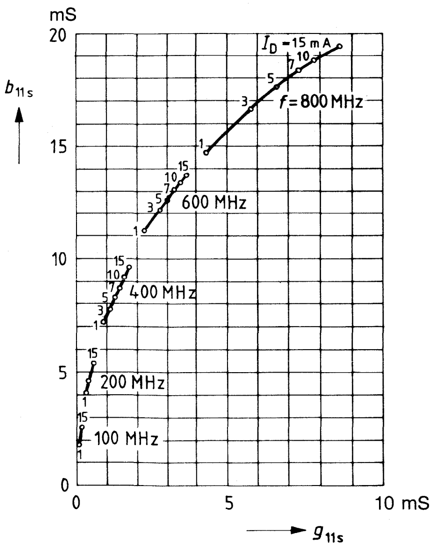
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



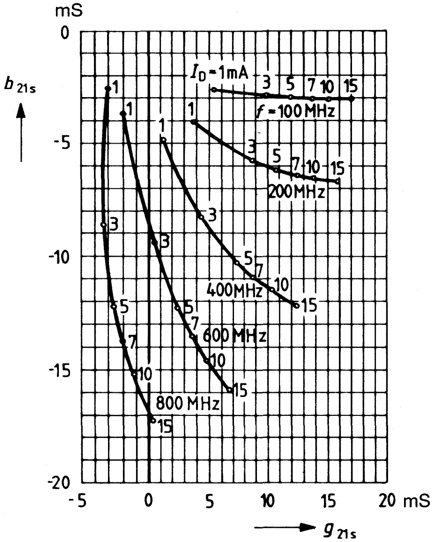
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



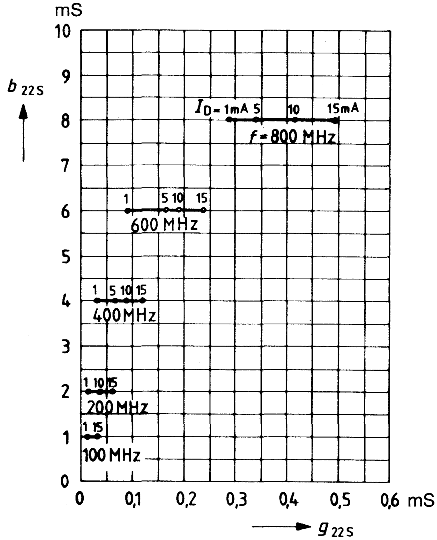
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V, $I_{DS} = 10$ mA
(common-source circuit)



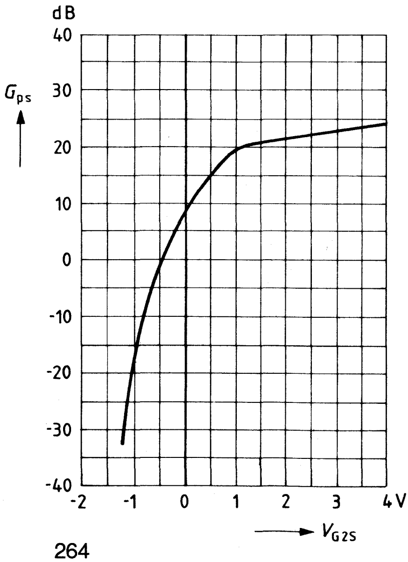
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V; $I_{DS} = 10$ mA
(common-source)



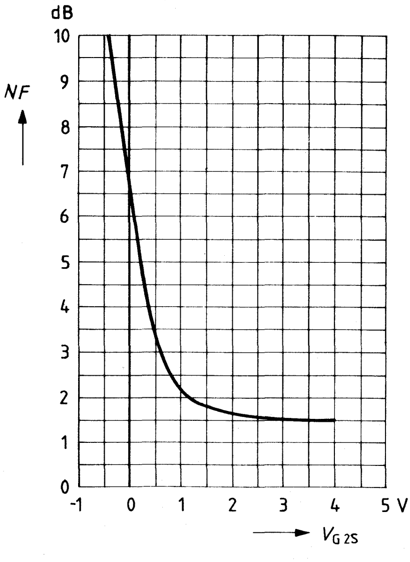
Output admittance Y_{22s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V; $I_{DS} = 10$ mA
(common-source)



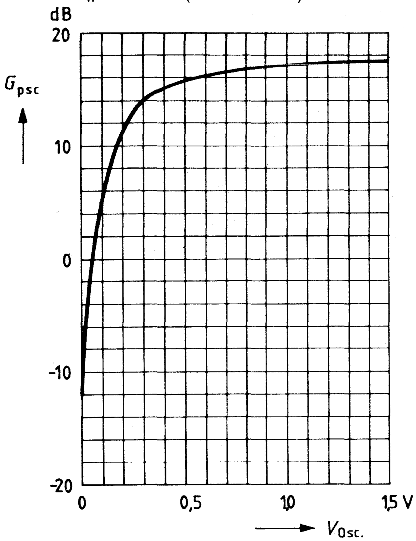
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



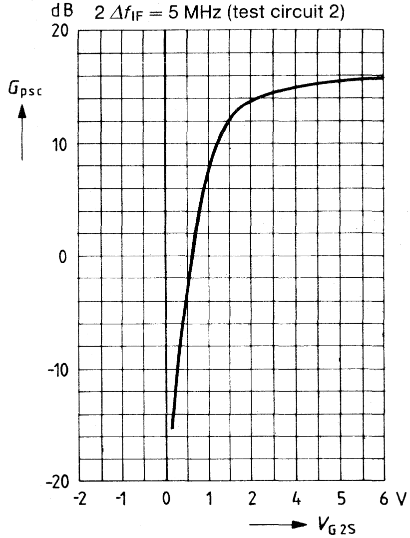
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



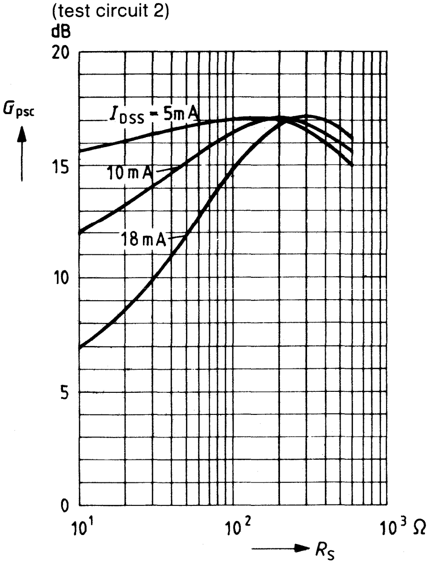
Mixer gain (additive)
$G_{psc} = f(V_{osc})$; $V_D = 15$ V; $V_{G1S} = 0$;
$V_{G2S} = 6$ V; $R_S = 220\ \Omega$; $I_{DSS} = 10$ mA;
$f = 200$ MHz; $f_{IF} = 36$ MHz;
$2\ \Delta f_{IF} = 5$ MHz (test circuit 2)



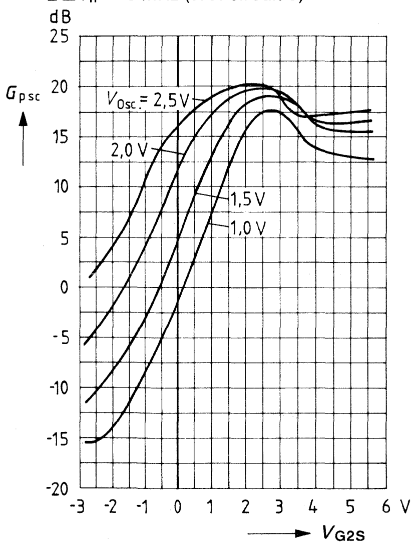
Mixer gain (additive)
$G_{psc} = f(V_{G2S})$; $V_D = 15$ V; $V_{G1S} = 0$;
$R_S = 220\ \Omega$; $V_{osc} = 0{,}5$ V;
$I_{DSS} = 10$ mA; $f = 200$ MHz;
$f_{IF} = 36$ MHz;
$2\ \Delta f_{IF} = 5$ MHz (test circuit 2)



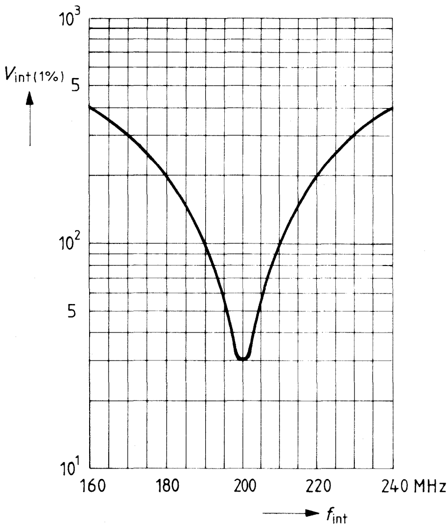
Mixer gain (additive)
$G_{psc} = f(R_S)$; $V_D = 15$ V; $V_{G1S} = 0$;
$V_{G2S} = 6$ V; $V_{osc} = 0{,}5$ V; $f = 200$ MHz;
$f_{IF} = 36$ MHz; $2\ \Delta f_{IF} = 5$ MHz
(test circuit 2)



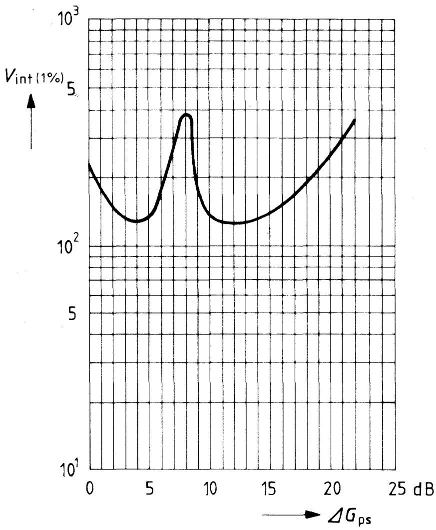
Mixer gain (multiplicative)
$G_{psc} = f(V_{G2S})$; $V_D = 15$ V; $V_{G1S} = 1{,}7$ V;
$R_S = 200\ \Omega$; $I_{DSS} = 10$ mA;
$f = 200$ MHz; $f_{IF} = 36$ MHz;
$2\ \Delta\ f_{IF} = 5$ MHz (test circuit 3)



Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(f_{int})$[1]; $m_{int} = 100\%$;
$f_e = 200$ MHZ; $V_{DS} = 15$ V; $V_{G2S} = 4$ V,
$V_{G1S} = 0$; $I_{DSS} = 10$ mA
(test circuit 1)

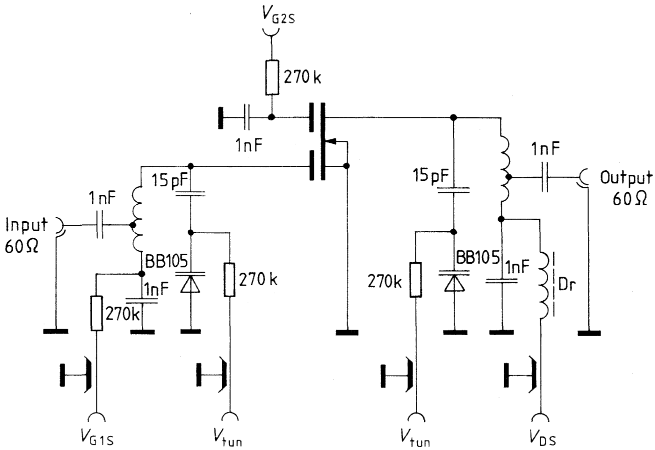


Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(\Delta G_{ps})$[1]; $f_e = 200$ MHz;
$f_{int} = 221$ MHz; $m_{int} = 100\%$;
$V_{DS} = 15$ V; $V_{G1S} = 0$; $I_{DSS} = 10$ mA
(test circuit 1)



Test circuit for power gain, noise figure and cross modulation at $f = 200$ MHz; $G_G = 2$ mS, $G_L = 0{,}5$ mS

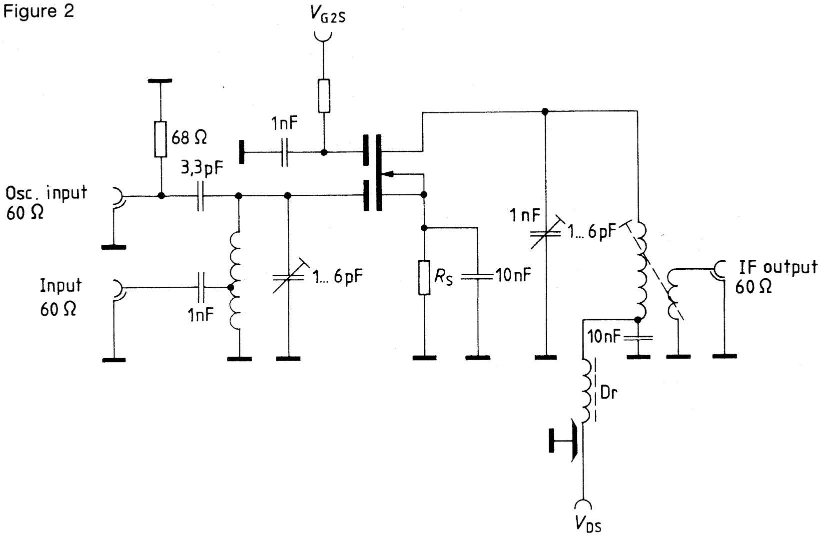
Figure 1



[1]) $V_{int\ (1\%)}$ is the rms value of half the EMC (terminal voltage at matching) of a 100% sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1% amplitude modulation on the active carrier.

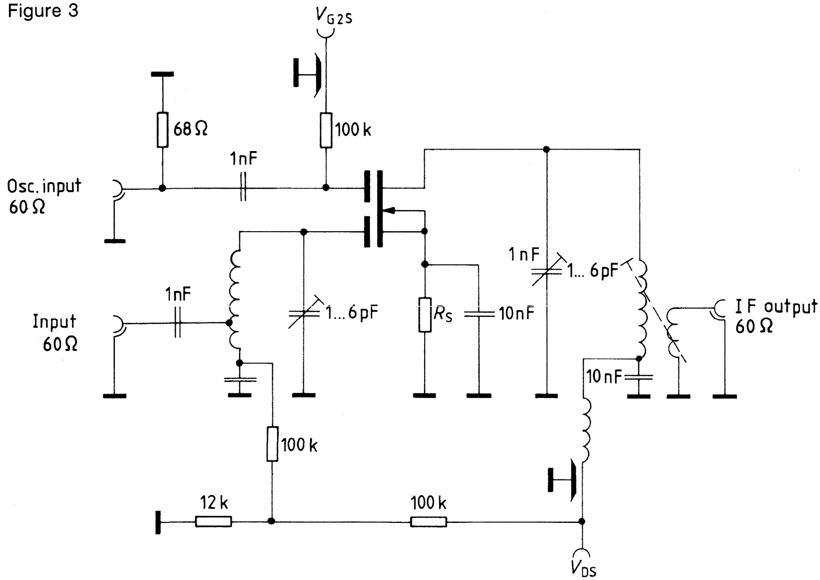
Test circuit for mixer gain (additive)
$f = 200$ MHz; $f_{osc} = 236$ MHz; $2\,\Delta f_{IF} = 5$ MHz

Figure 2



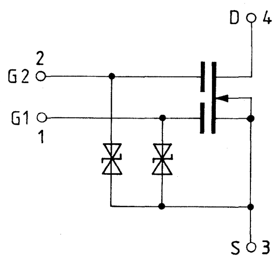
Test circuit for mixer gain (multiplicative)
$f = 200$ MHz; $f_{osc} = 236$ MHz; $2\,\Delta f_{IF} = 5$ MHz

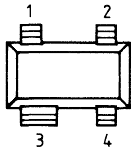
Figure 3



Silicon dual-gate MOS field-effect tetrode

- For input stages in UHF/TV tuners





Top view

Type	Marking	Ordering code	Package
BF 996	MD	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

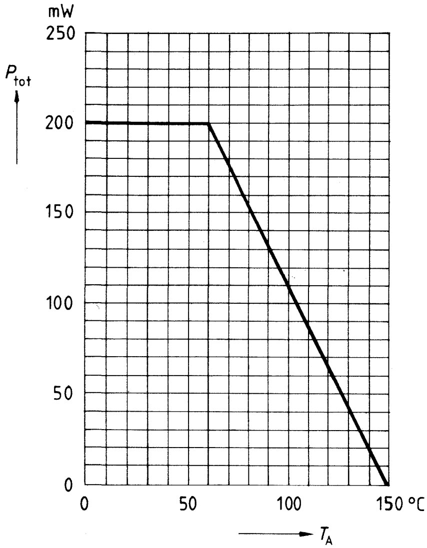
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

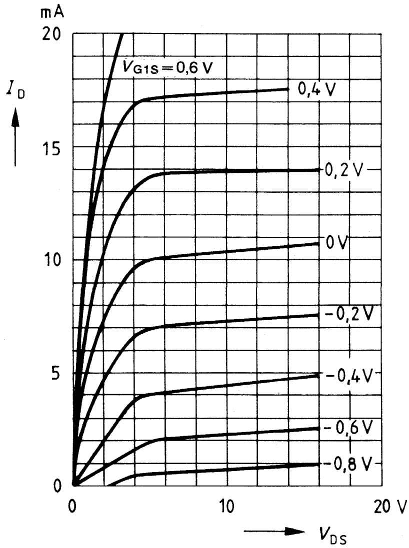
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ kHz$	g_{fs}	15	17	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g1ss}	–	2,2	2,6	pF
Gate 2 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g2ss}	–	1,1	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dss}	–	0,8	1,2	pF
Power gain $V_{DS} = 15\ V$, $I_D = 10\ mA$, $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	G_{ps}	 – –	 25 18	 – –	 dB dB
Noise figure $V_{DS} = 15\ V$, $I_D = 10\ mA$ $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	NF	 – –	 1,5 2,8	 – 3,9	 dB dB
Control range $V_{DS} = 15\ V$, $V_{G2S} = 4 \cdots -2\ V$, $f = 800\ MHz$	ΔG_{ps}	40	–	–	dB

[1]) G2 and S on screen potential.

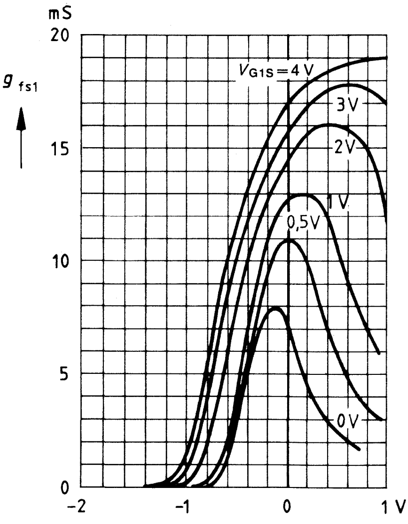
Total power dissipation
$P_{tot} = f(T_A)$



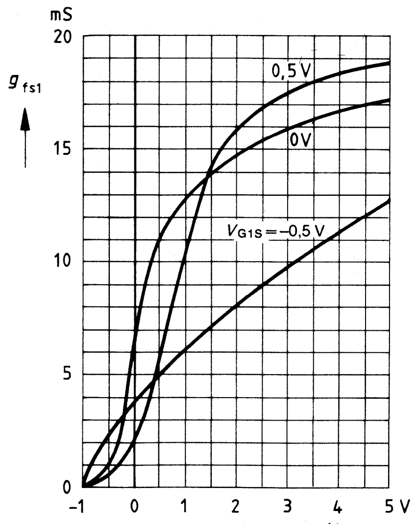
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



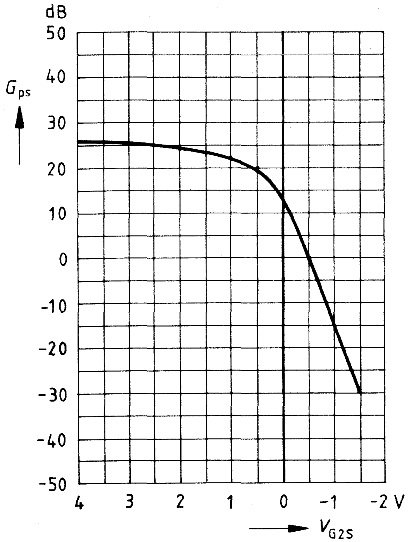
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



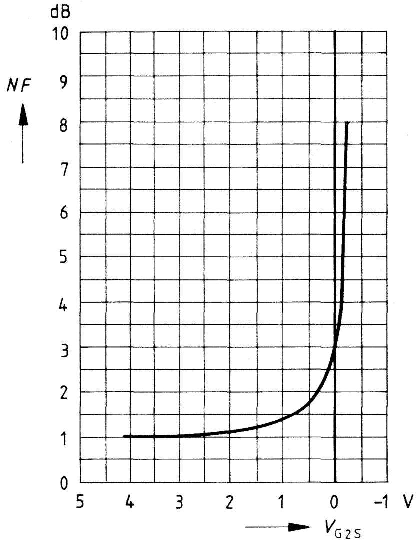
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



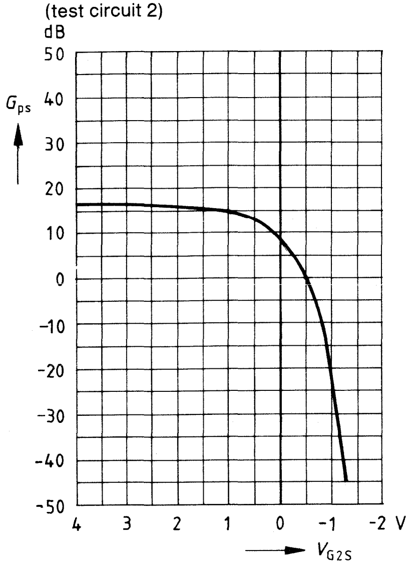
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



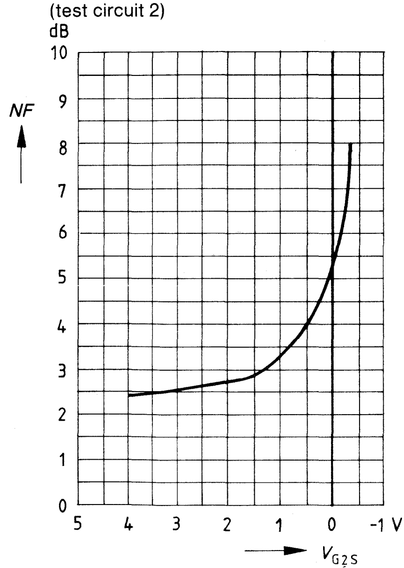
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



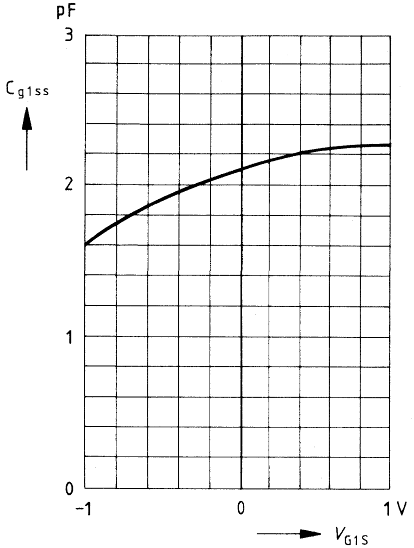
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 800$ MHz
(test circuit 2)



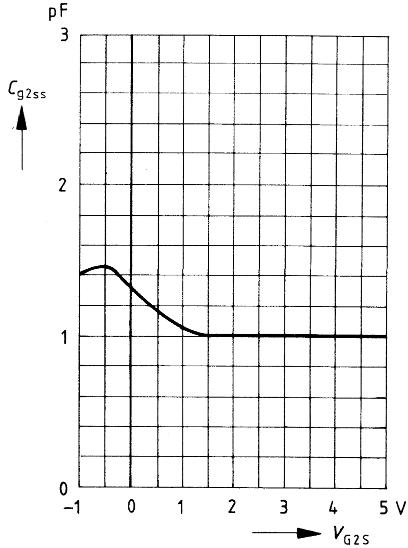
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 800$ MHz
(test circuit 2)



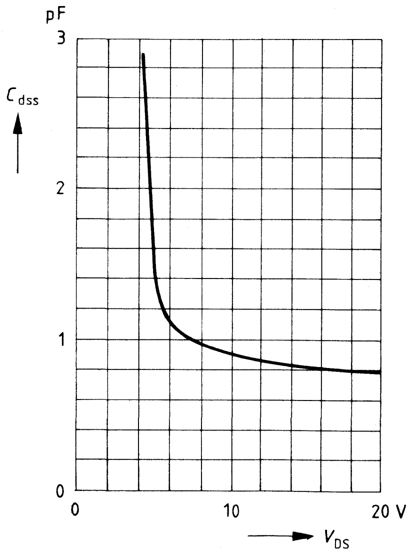
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



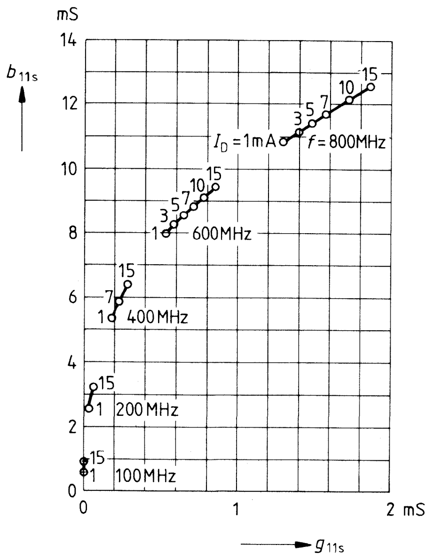
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



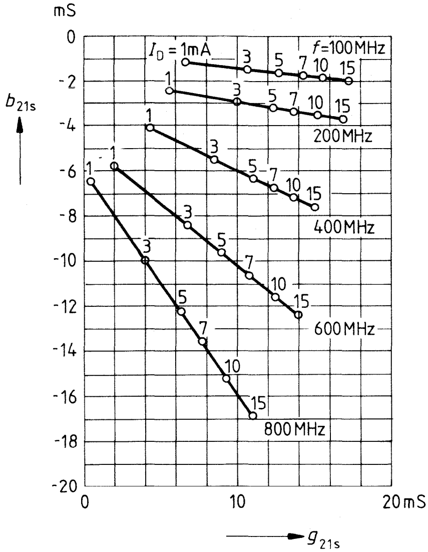
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



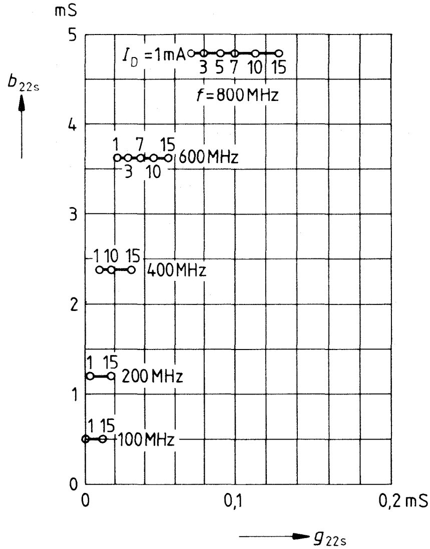
Gate 1 input admittance Y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)

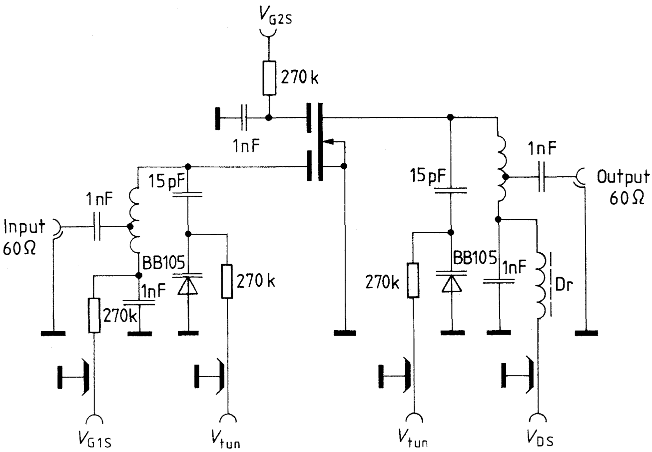


Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



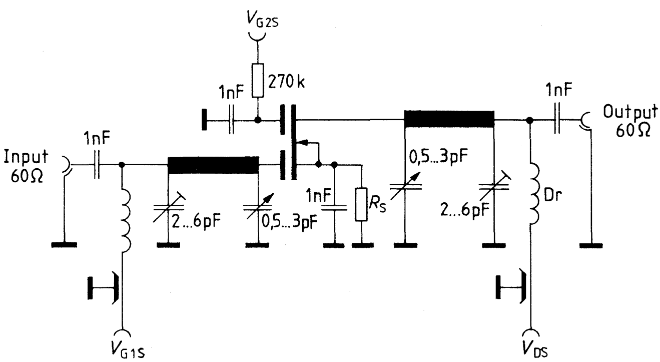
Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0{,}5$ mS

Figure 1



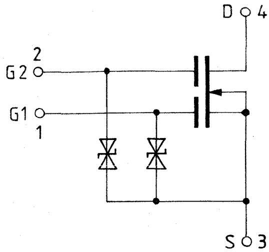
Test circuit for power gain, noise figure and cross modulation
$f = 800$ MHz, $G_G = 3{,}3$ mS, $G_L = 1$ mS

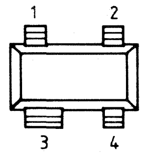
Figure 2



Silicon dual-gate MOS field-effect tetrode

- For input stages in UHF/TV tuners





Top view

Type	Marking	Ordering code	Package
BF 996 S	MH	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 450 K/W

Characteristics

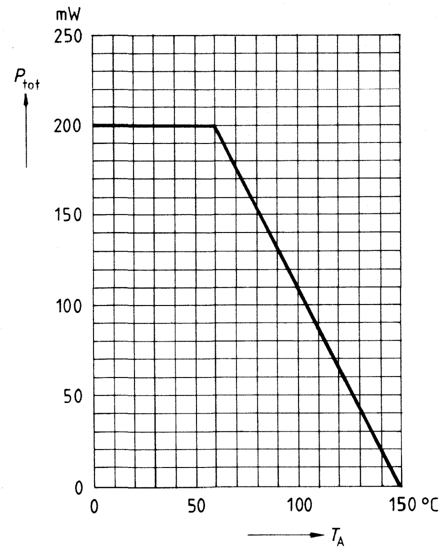
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

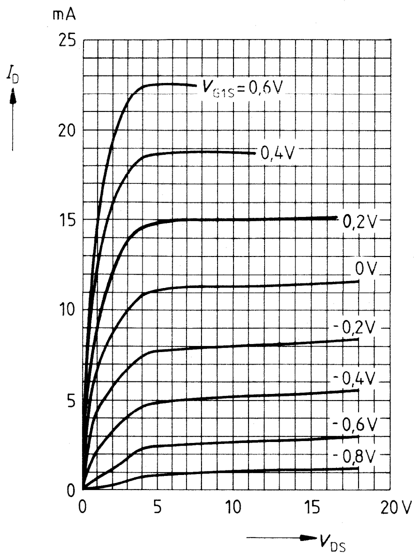
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ kHz$	g_{fs}	15	18	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g1ss}	–	2,3	–	pF
Gate 2 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g2ss}	–	1,1	–	pF
Reverse transfer capacitance[1] $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dss}	–	0,8	–	pF
Power gain $V_{DS} = 15\ V$, $I_D = 10\ mA$, $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	G_{ps}	 – –	 25 18	 – –	 dB dB
Noise figure $V_{DS} = 15\ V$, $I_D = 10\ mA$ $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	NF	 – –	 1 1,8	 – –	 dB dB
Control range $V_{DS} = 15\ V$, $V_{G2S} = 4 \cdots -2\ V$, $f = 800\ MHz$	ΔG_{ps}	40	–	–	dB

[1]) G2 and S on screen potential.

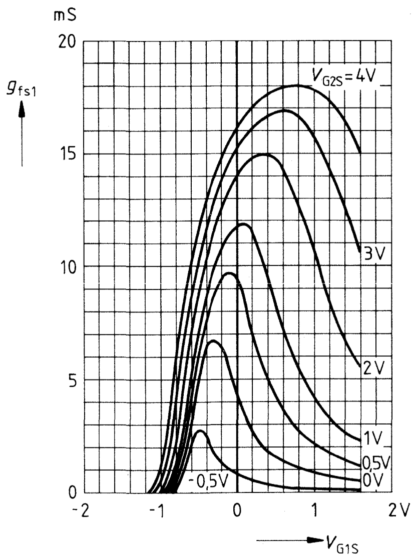
Total power dissipation
$P_{tot} = f(T_A)$



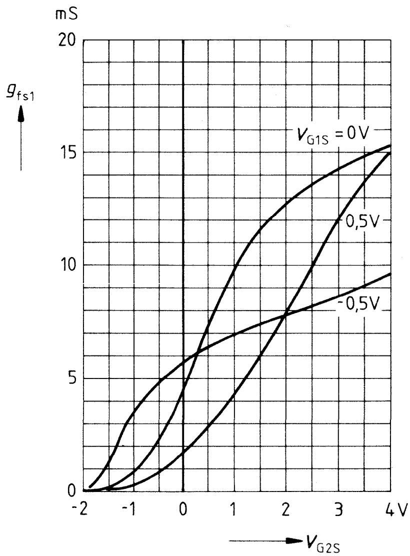
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



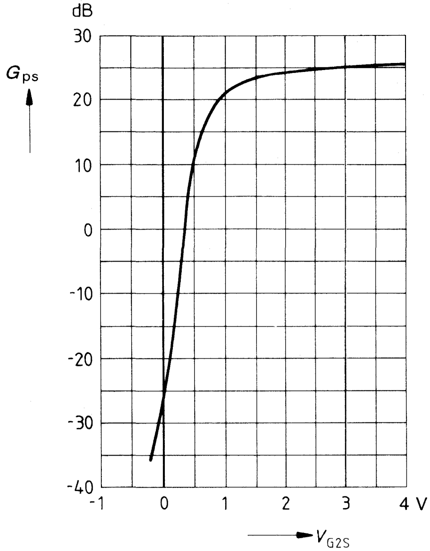
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



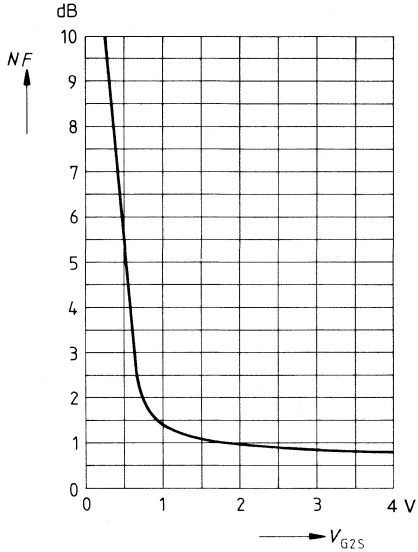
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



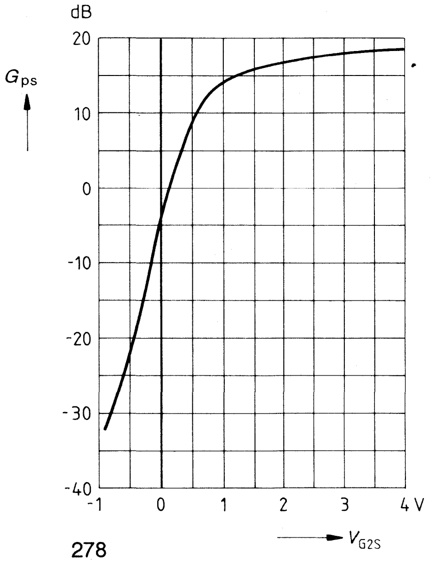
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



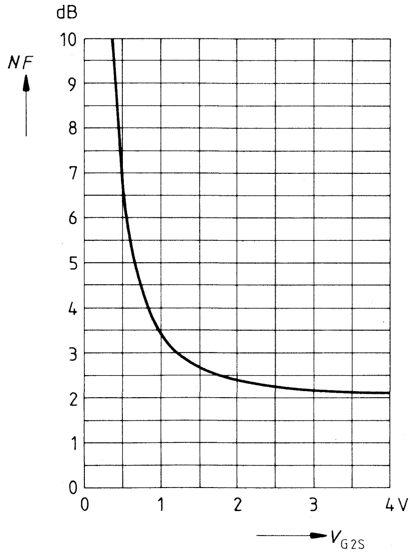
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit 1)



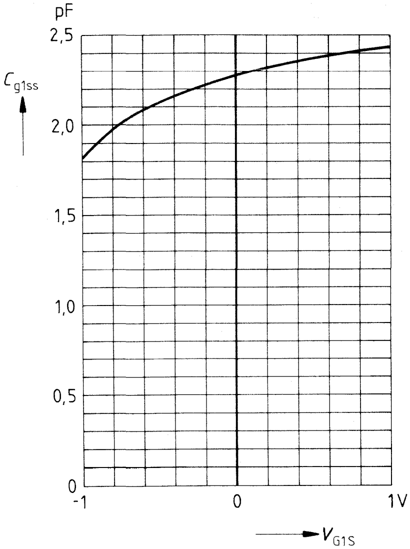
Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 800$ MHz
(test circuit 2)



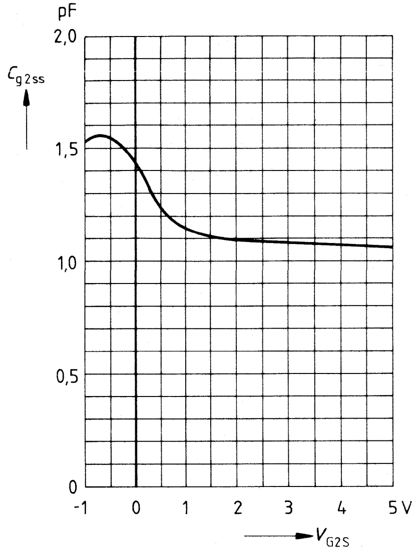
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 800$ MHz
(test circuit 2)



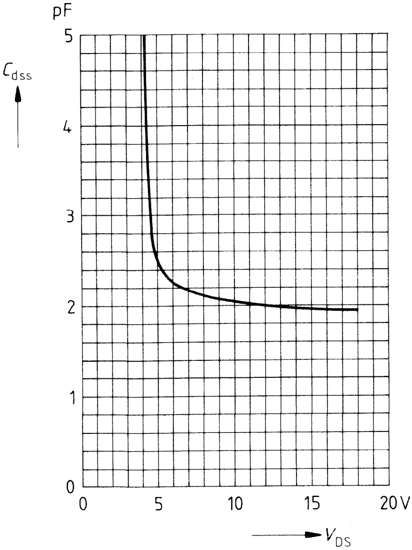
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



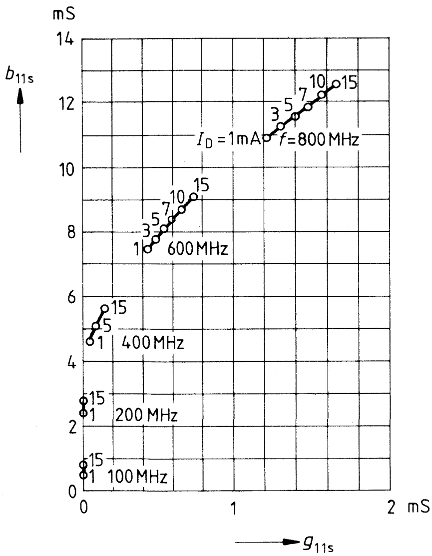
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



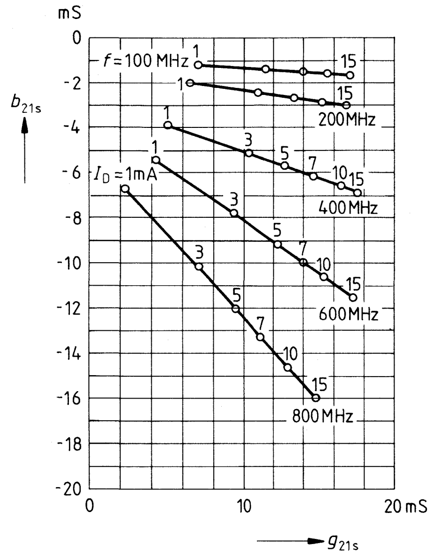
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



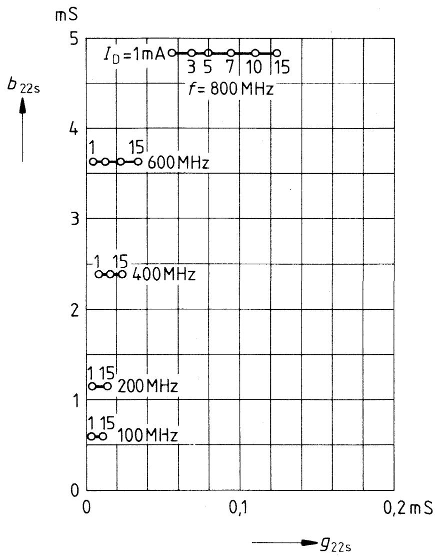
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)

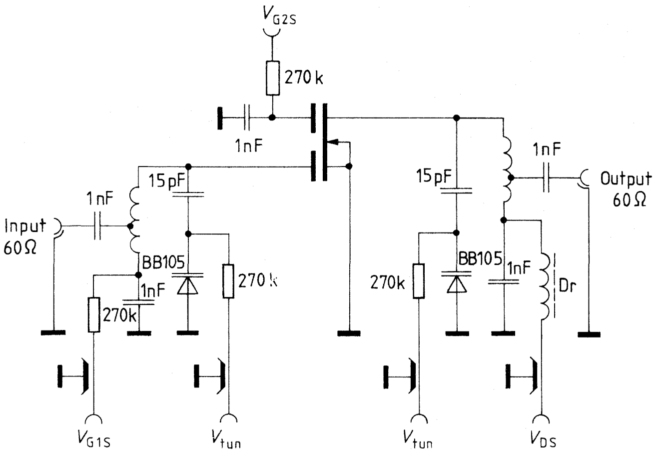


Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



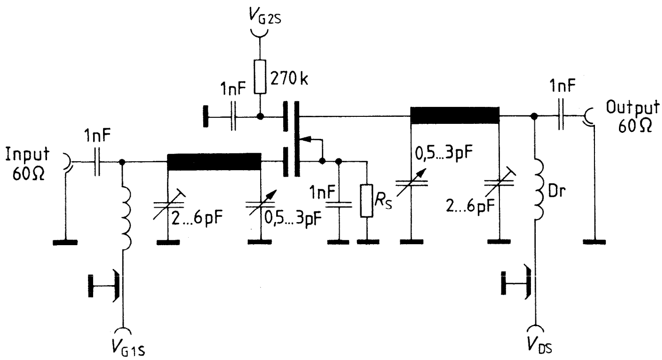
Test circuit for power gain and noise figure
$f = 200$ MHz, $G_G = 2$ mS, $G_L = 0.5$ mS

Figure 1



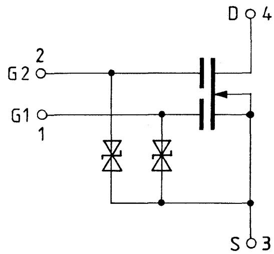
Test circuit for power gain, noise figure and cross modulation
$f = 800$ MHz, $G_G = 2$ mS, $G_L = 1$ mS

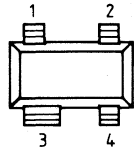
Figure 2



Silicon dual-gate MOS field-effect tetrode

- For applications in VHF input and mixer stages, covering a wide tuning range up to approx. 500 MHz (CATV tuners);
- Integrated oscillation rejection for frequencies exceeding 1 GHz





Top view

Type	Marking	Ordering code	Package
BF 997	MK	Refer to index	Version B

Maximum ratings

Drain-source voltage	V_{DS}	20 V
Drain current	I_D	30 mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10 mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200 mW
Storage temperature range	T_{stg}	$-55 \cdots +150\,°C$
Channel temperature	T_{ch}	150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

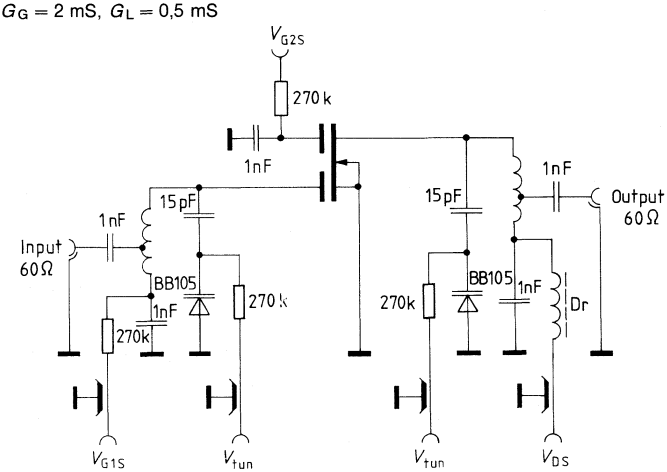
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\ DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\ G1SS}$	6	–	20	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\ G2SS}$	6	–	20	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\ (p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\ (p)}$	–	–	2,0	V

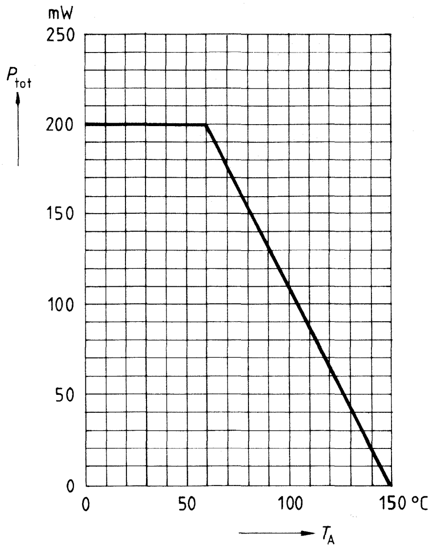
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{g1ss}	–	2,5	–	pF
Gate 2 input capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{g2ss}	–	1,2	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15$ V, $I_D = 10$ mA, $V_{G2S} = 4$ V, $f = 1$ MHz	C_{dss}	–	1	–	pF
Power gain $V_{DS} = 15$ V, $I_D = 10$ mA, $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0,5$ mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure $V_{DS} = 15$ V, $I_D = 10$ mA, $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0,5$ mS (test circuit)	NF	–	1	–	dB
Control range $V_{DS} = 15$ V, $V_{G2S} = 4 \cdots -2$ V, $f = 200$ MHz	ΔG_{ps}	50	–	–	dB

[1]) G2 and S on screen potential.

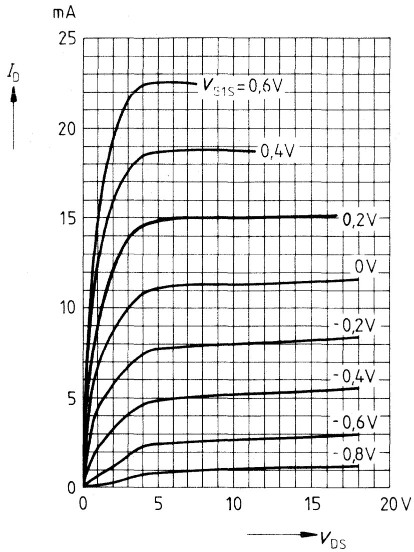
Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0,5$ mS



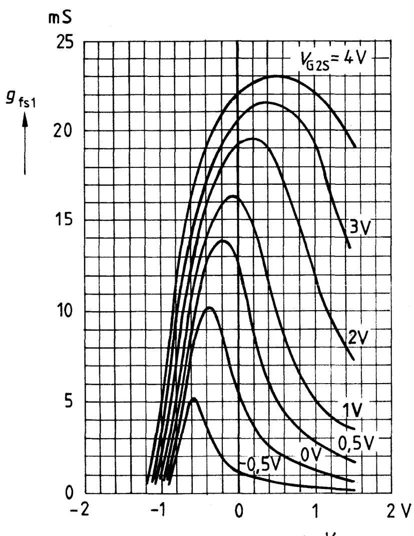
Total power dissipation
$P_{tot} = f(T_A)$



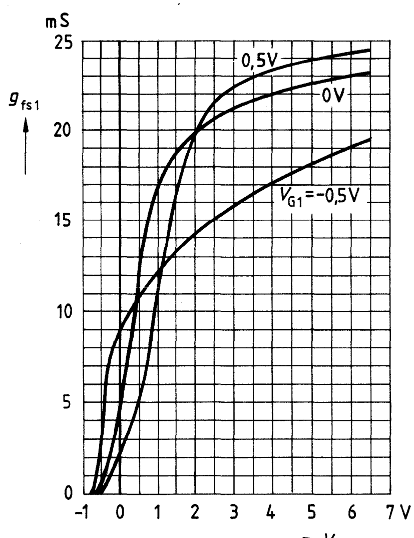
Family of output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



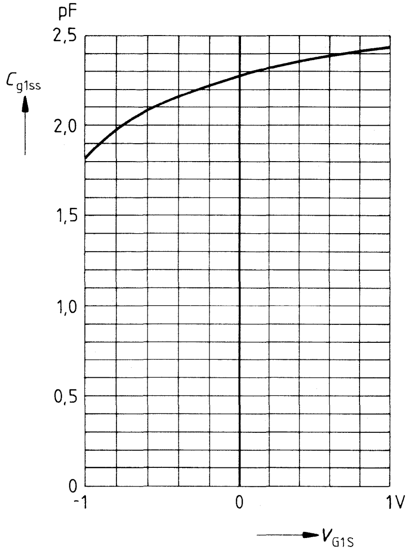
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



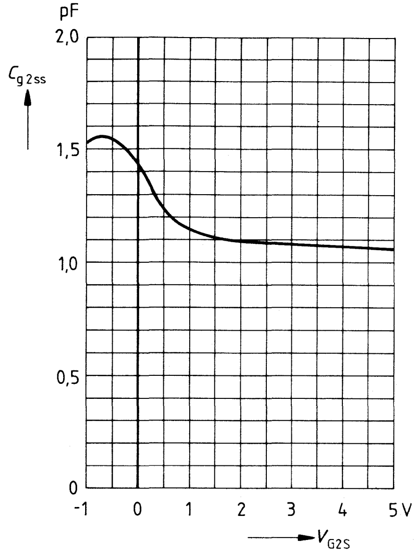
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



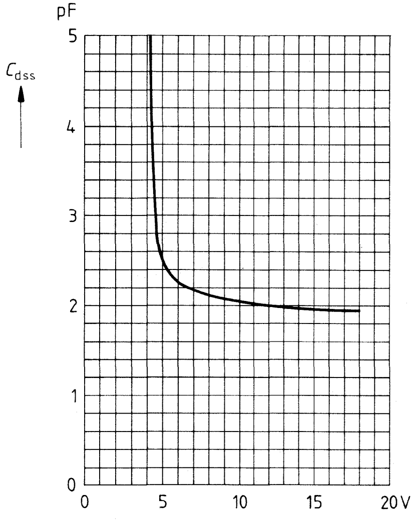
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



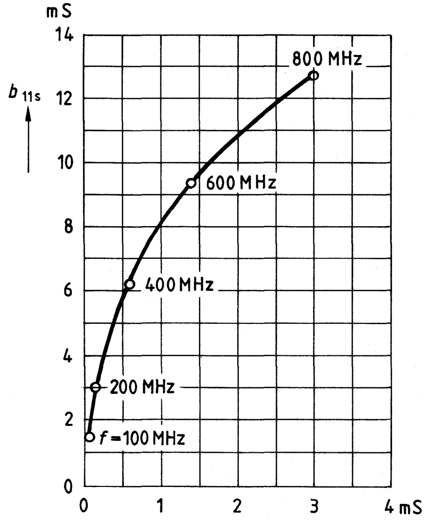
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



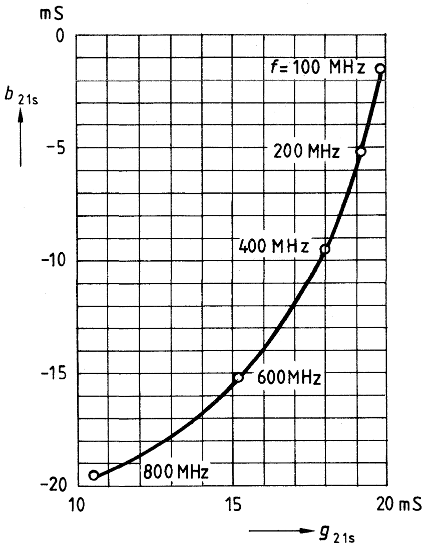
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



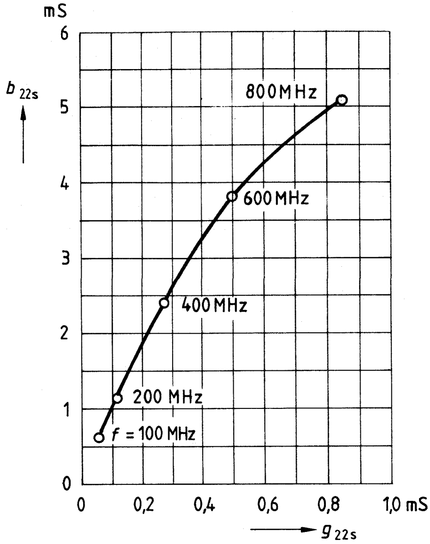
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$ V, $I_{DSS} = 10$ mA
(common-source)



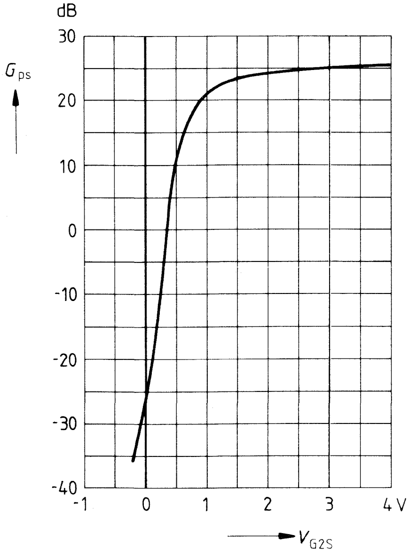
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$ V, $I_{DSS} = 10$ mA
(common-source)



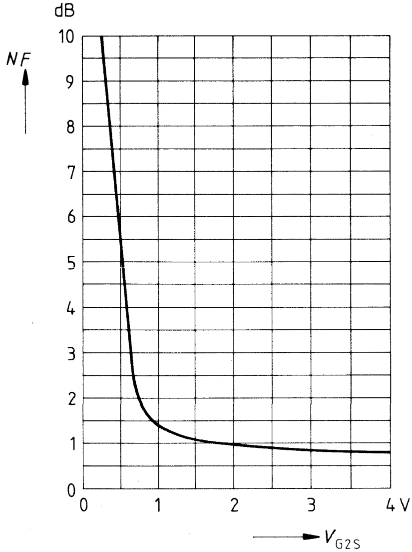
Output admittance Y_{22s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$ V, $I_{DDS} = 10$ mA
(common-source)



Power gain
$G_{ps} = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit)

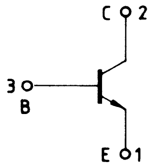


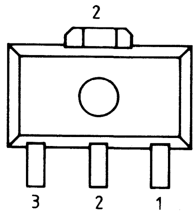
Noise figure
$NF = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz
(test circuit)



NPN silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary PNP types: BFN 17, BFN 19





Top view

Type	Marking	Ordering code	Package
BFN 16	DD	Refer to index	Version C
BFN 18	DE		

Maximum ratings		BFN 16	BFN 18
Collector-emitter voltage	V_{CEO}	250 V	300 V
Collector-base voltage	V_{CBO}	250 V	300 V
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	200 mA	
Peak collector current	I_{CM}	500 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W	

Characteristics

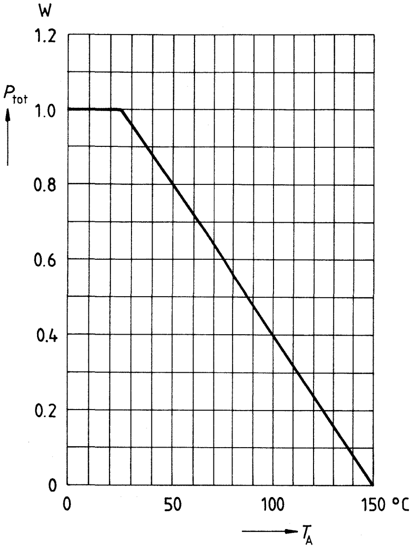
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$				
BFN 16		250	–	–	V
BFN 18		300	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$	$V_{(BR)\,CB0}$				
BFN 16		250	–	–	V
BFN 18		300	–	–	V
Emitter-base breakdown voltage $I_E = 100\,\mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current	I_{CB0}				
$V_{CB} = 200$ V BFN 16		–	–	100	nA
$V_{CB} = 250$ V BFN 18		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$ BFN 16		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$ BFN 18		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EB0}	–	–	100	nA
DC current gain	h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]		40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1] BFN 16		40	–	–	–
BFN 18		30	–	–	–
Collector-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}				
BFN 16		–	–	0,4	V
BFN 18		–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,9	V

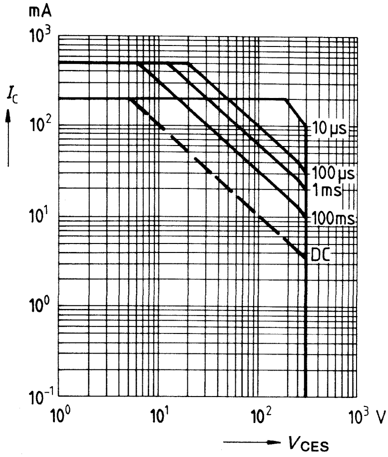
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	70	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,5	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

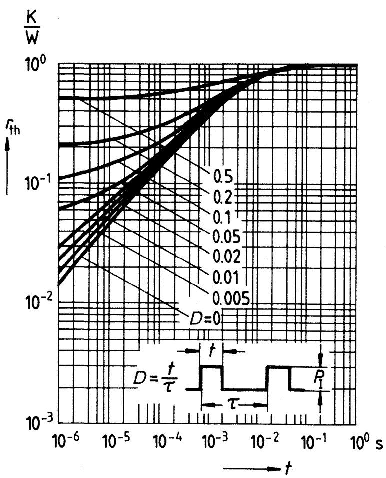
Total power dissipation $P_{tot} = f(T_A)$



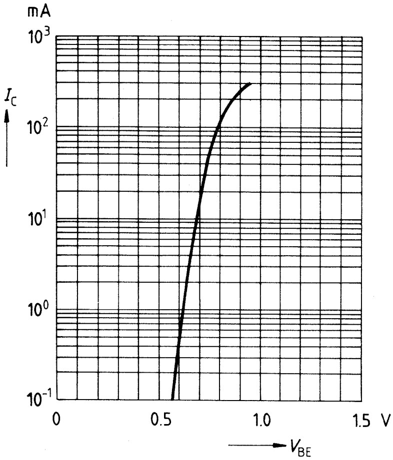
Operating range $I_C = f(V_{CES})$
$T_A = 25\,°C$, $D = 0$



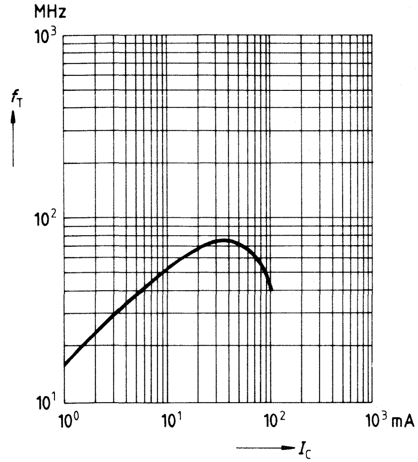
Pulse handling capability $r_{th} = f(t)$



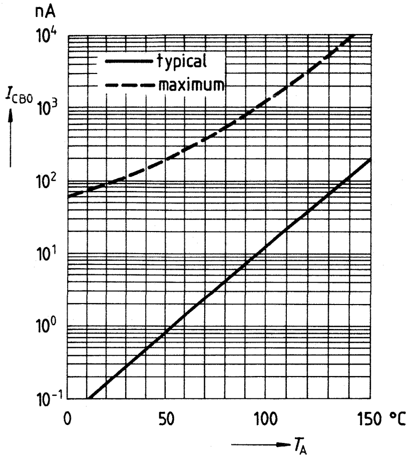
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\ V$



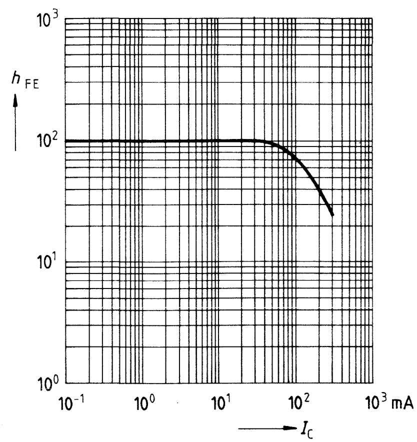
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10\ V$



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200\ V$

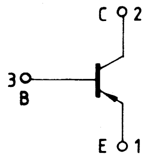


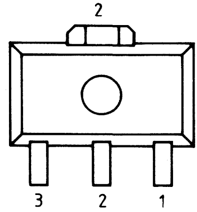
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10\ V$



PNP silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary NPN types: BFN 16, BFN 18





Top view

Type	Marking	Ordering code	Package
BFN 17	DG	Refer to index	Version C
BFN 19	DH		

Maximum ratings		BFN 17	BFN 19
Collector-emitter voltage	V_{CEO}	250 V	300 V
Collector-base voltage	V_{CBO}	250 V	300 V
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	200 mA	
Peak collector current	I_{CM}	500 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W	

Characteristics

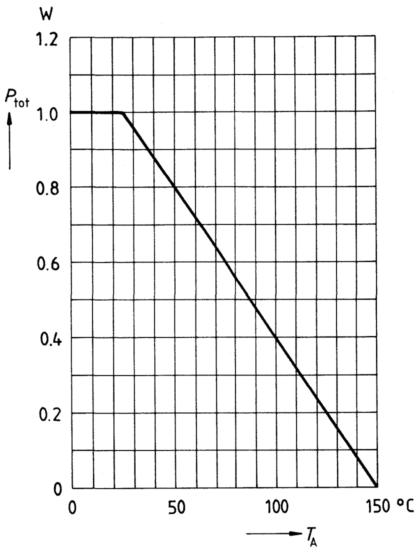
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA		$V_{(BR)\,CEO}$				
	BFN 17		250	–	–	V
	BFN 19		300	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)\,CBO}$				
	BFN 17		250	–	–	V
	BFN 19		300	–	–	V
Emitter-base breakdown voltage $I_E = 100\ \mu A$		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 200$ V	BFN 17		–	–	100	nA
$V_{CB} = 250$ V	BFN 19		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$	BFN 17		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$	BFN 19		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	100	nA
DC current gain		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]			40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1]	BFN 17		40	–	–	–
	BFN 19		30	–	–	–
Collector-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA		V_{CEsat}				
	BFN 17		–	–	0,4	V
	BFN 19		–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA		V_{BEsat}	–	–	0,9	V

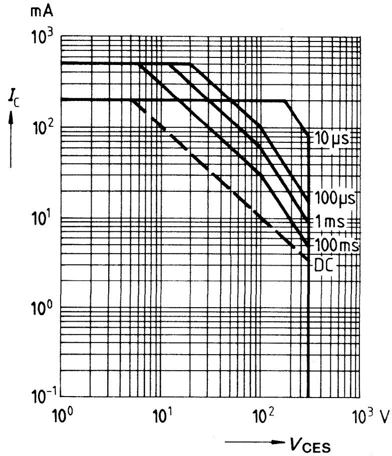
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	2,5	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

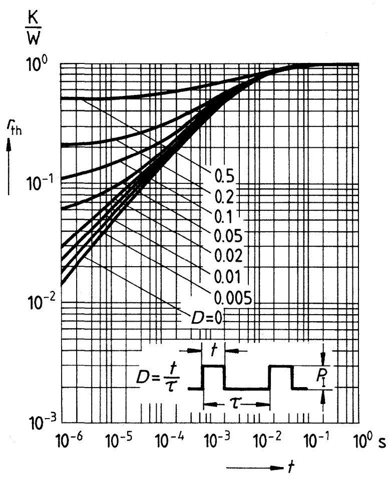
Total power dissipation $P_{tot} = f(T_A)$



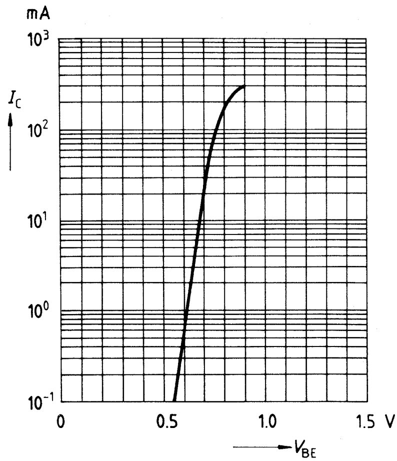
Operating range $I_C = f(V_{CES})$
$T_A = 25\,°C$, $D = 0$



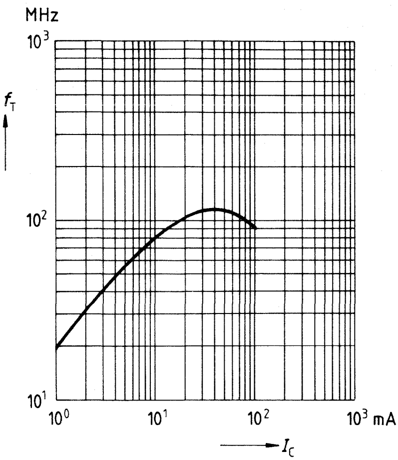
Pulse handling capability $r_{th} = f(t)$



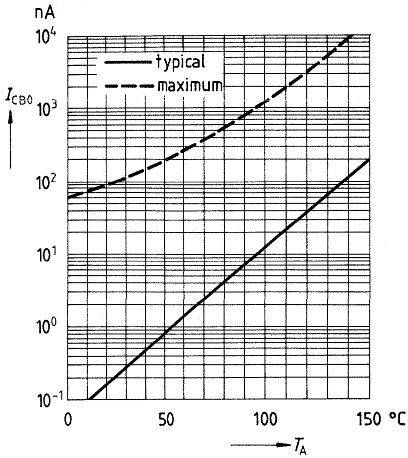
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\,V$



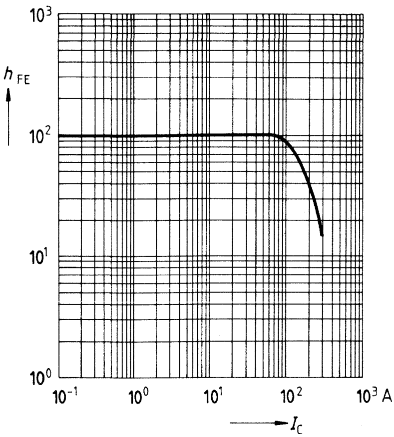
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V

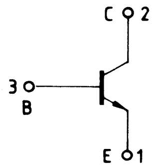


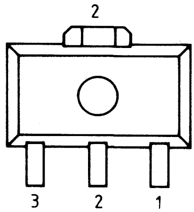
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



NPN silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary PNP type: BFN 21





Top view

Type	Marking	Ordering code	Package
BFN 20	DC	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CEO}	300 V
Collector-base voltage	V_{CBO}	300 V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	300 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

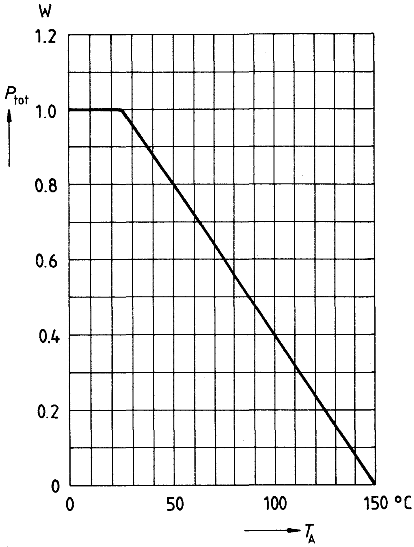
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$	300	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CB0}$	300	–	–	V
Collector-emitter breakdown voltage $I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	300	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current $V_{CB} = 250$ V $V_{CB} = 250$ V, $T_A = 150\,°C$	I_{CB0}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 300$ V, $R_{BE} = 2{,}7\,k\Omega$ $V_{CE} = 300$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\,k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EB0}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	40	–	–	–
Collector-emitter-saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

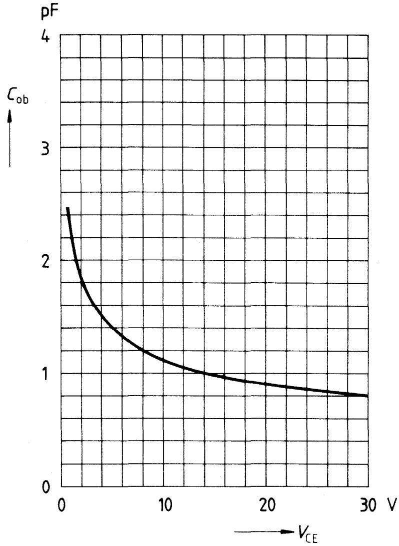
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

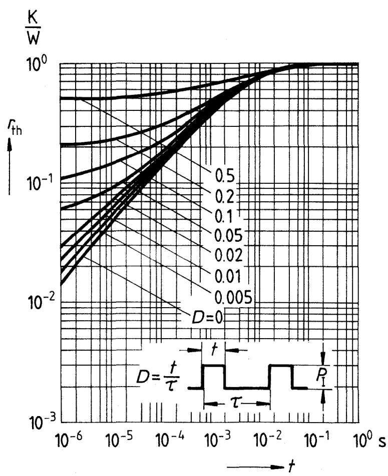
Total power dissipation $P_{tot} = f(T_A)$



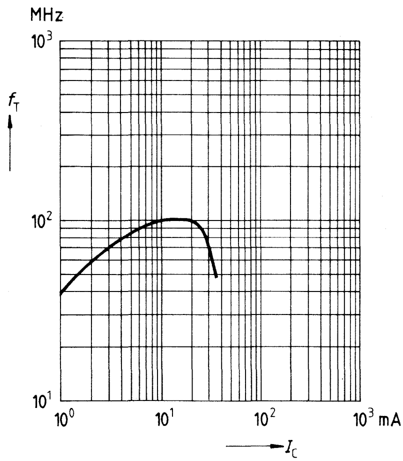
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



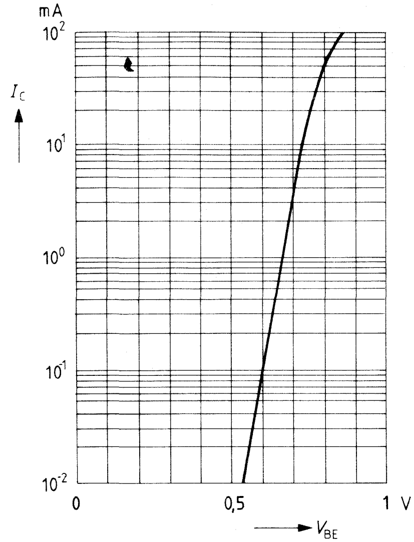
Pulse handling capability $r_{th} = f(t)$
(standardized)



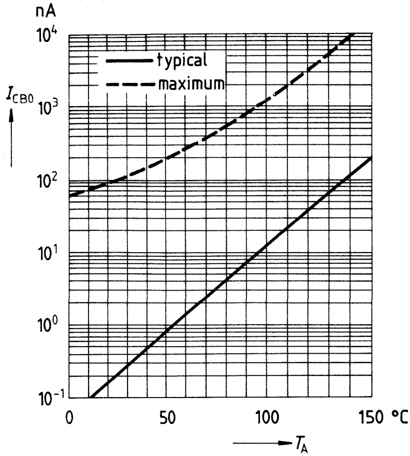
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



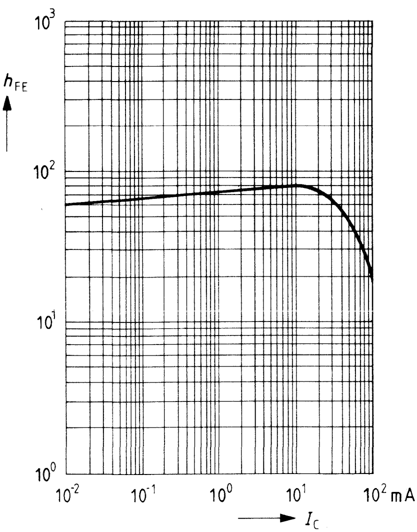
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 250$ V

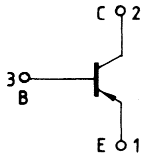


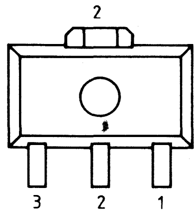
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



PNP silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary NPN type: BFN 20





Top view

Type	Marking	Ordering code	Package
BFN 21	DF	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CEO}	300 V
Collector-base voltage	V_{CBO}	300 V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	300 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

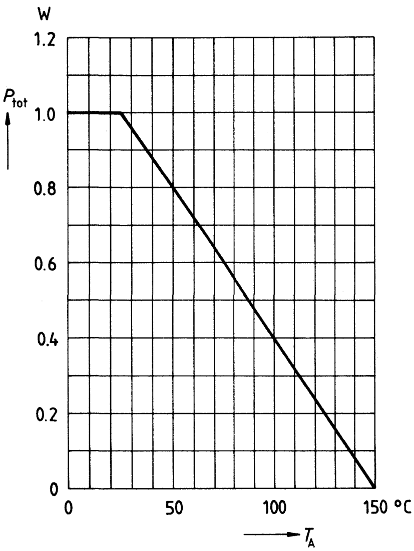
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	300	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	300	–	–	V
Collector-emitter breakdown voltage $I_C = 10\ \mu A$, $R_{BE} = 2{,}7\ k\Omega$	$V_{(BR)\,CER}$	300	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 250$ V $V_{CB} = 250$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 300$ V, $R_{BE} = 2{,}7\ k\Omega$ $V_{CE} = 300$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\ k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	40	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

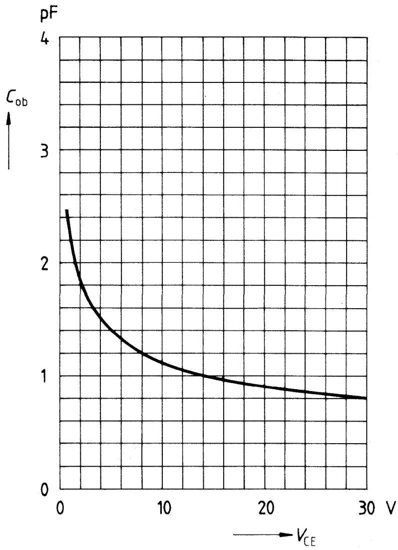
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

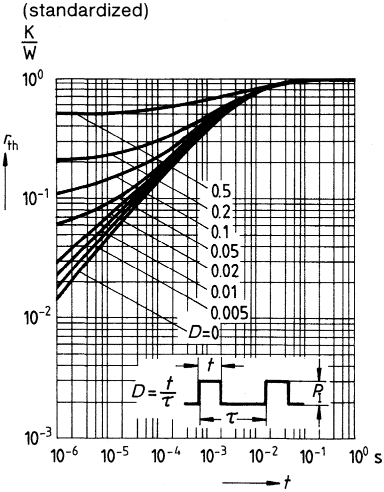
Total power dissipation $P_{tot} = f(T_A)$



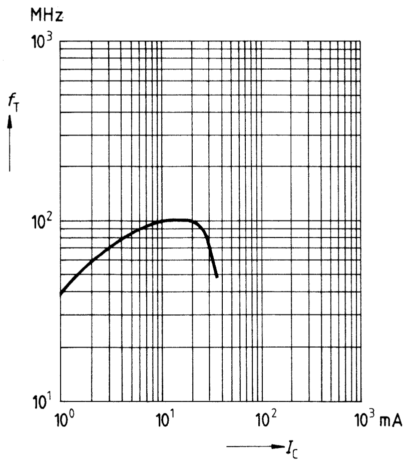
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



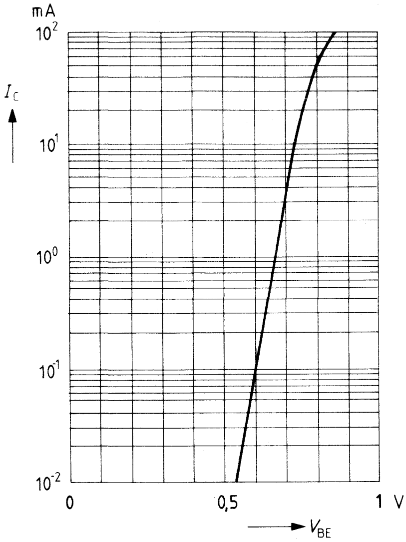
Pulse handling capability $r_{th} = f(t)$
(standardized)



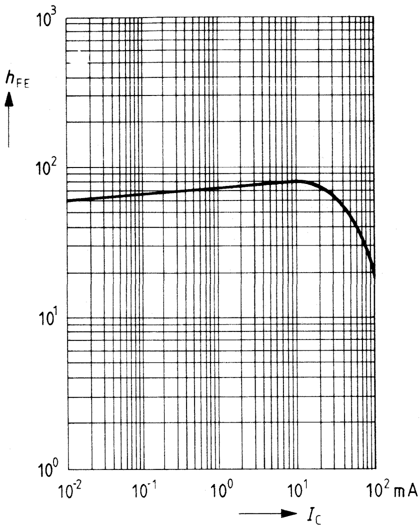
Transition frequency $f_T = f(I_c)$
$V_{CE} = 10$ V



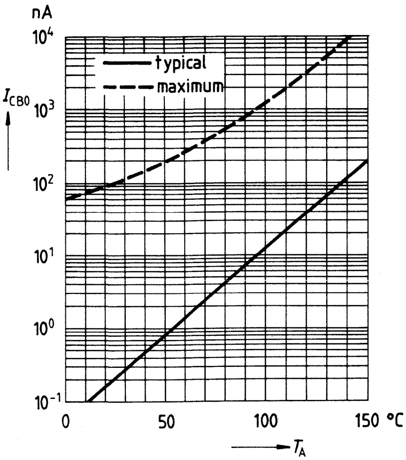
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V

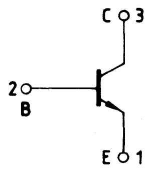


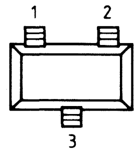
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 250$ V



NPN silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary PNP type: BFN 23





Top view

Type	Marking	Ordering code	Package
BFN 22	HB	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	250 V
Collector-base voltage	V_{CBO}	250 V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	250 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	360 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W

Characteristics

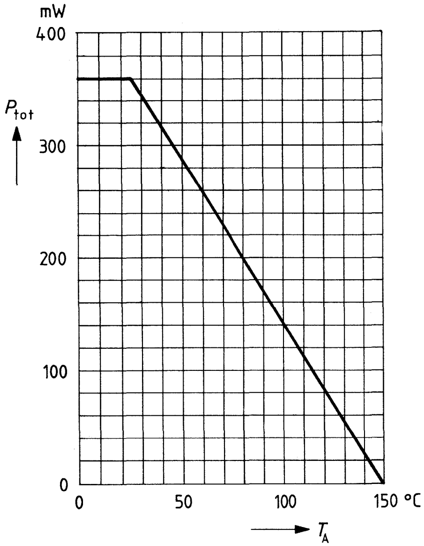
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CB0}$	250	–	–	V
Collector-emitter breakdown voltage $I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V $V_{CB} = 200$ V, $T_A = 150\,°C$	I_{CB0}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 250$ V, $R_{BE} = 2{,}7\,k\Omega$ $V_{CE} = 250$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\,k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EB0}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

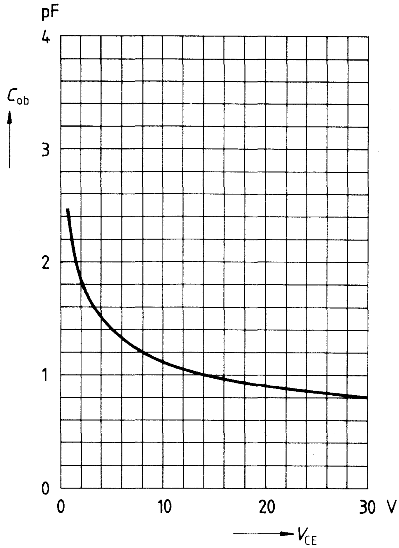
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

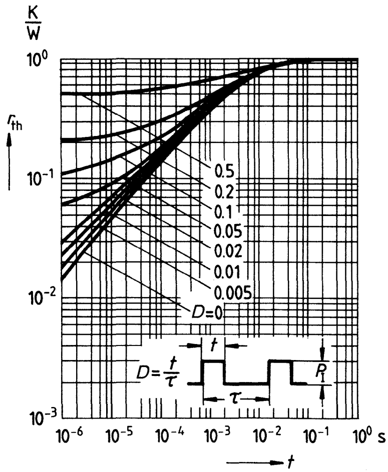
Total power dissipation $P_{tot} = f(T_A)$



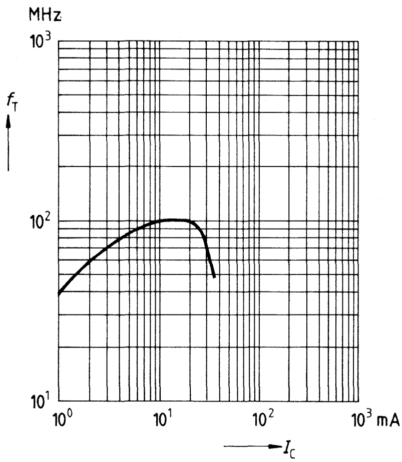
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



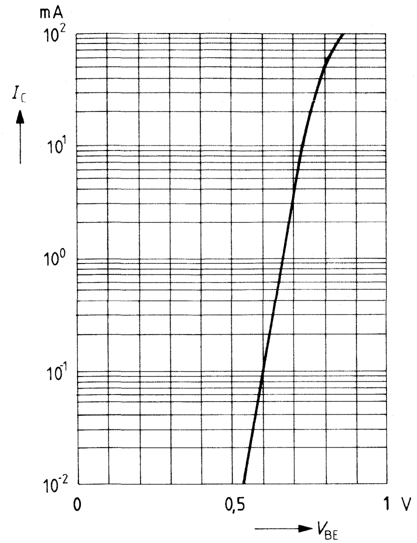
Pulse handling capability $r_{th} = f(t)$
(standardized)



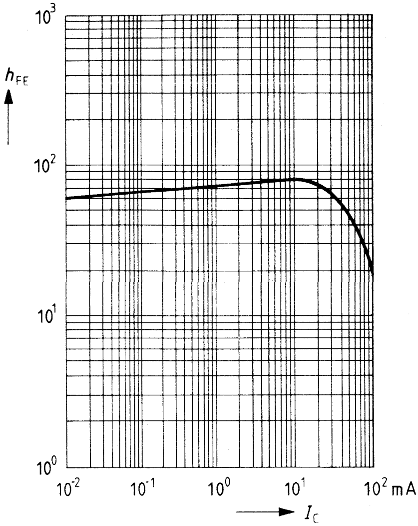
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



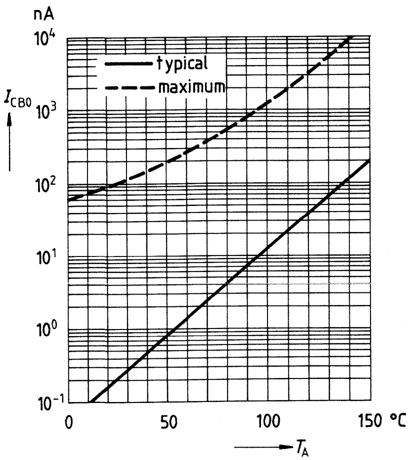
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V

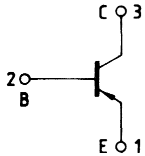


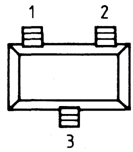
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



PNP silicon planar epitaxial transistor

- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary NPN type: BFN 22





Top view

Type	Marking	Ordering code	Package
BFN 23	HC	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	250 V
Collector-base voltage	V_{CBO}	250 V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	250 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	50 mA
Peak collector current	I_{CM}	100 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	360 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 350 K/W

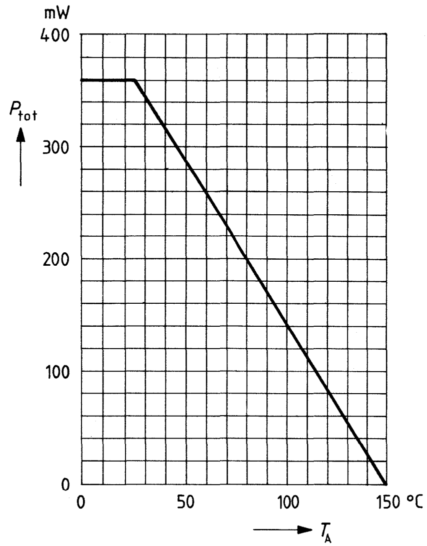
Characteristics
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	250	–	–	V
Collector-emitter breakdown voltage $I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V $V_{CB} = 200$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 250$ V, $R_{BE} = 2{,}7\,k\Omega$ $V_{CE} = 250$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\,k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1] $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

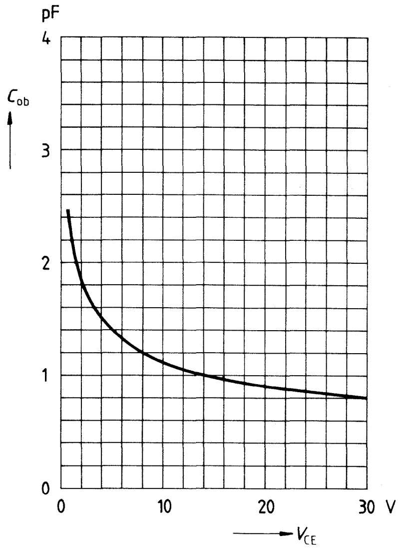
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

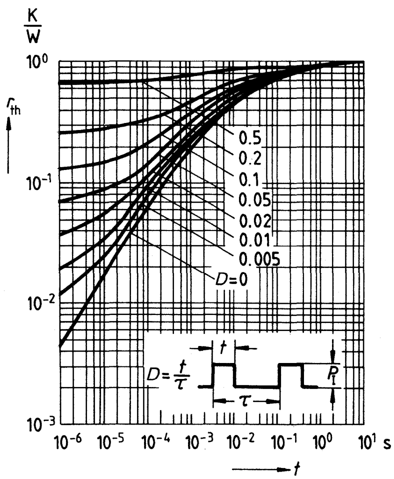
Total power dissipation $P_{tot} = f(T_A)$



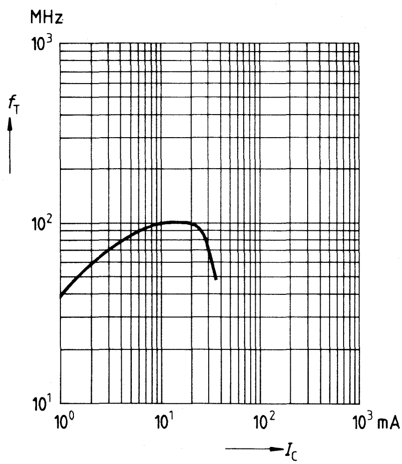
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



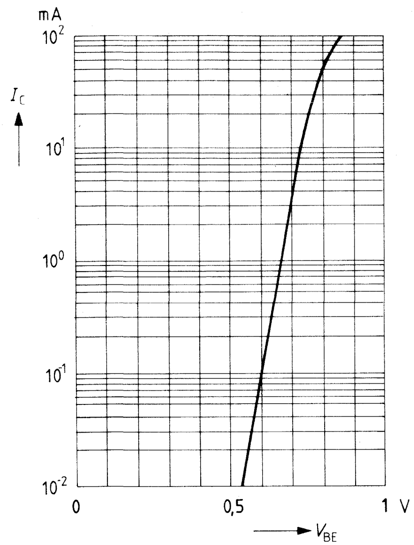
Pulse handling capability $r_{th} = f(t)$
(standardized)



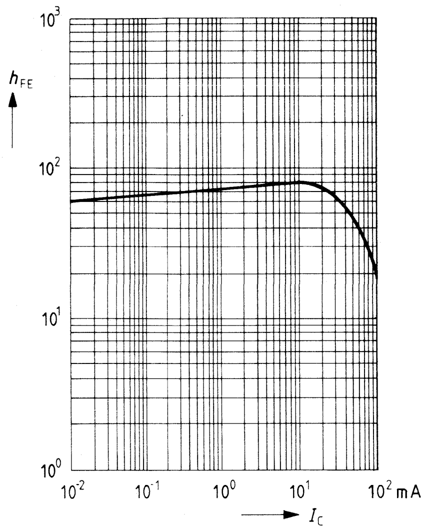
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



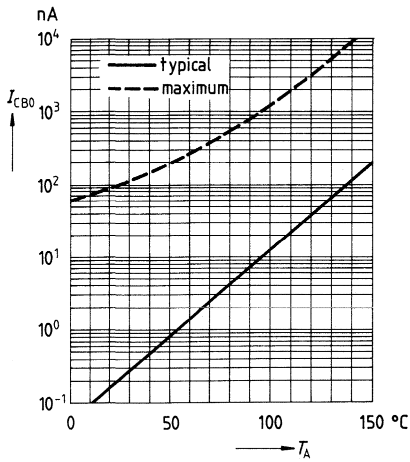
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V

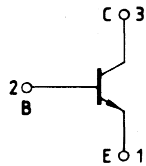


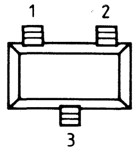
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



NPN silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary PNP types: BFN 25, BFN 27





Top view

Type	Marking	Ordering code	Package
BFN 24	FH	Refer to index	Version A
BFN 26	FJ		

Maximum ratings		BFN 24	BFN 26
Collector-emitter voltage	V_{CEO}	250 V	300 V
Collector-base voltage	V_{CBO}	250 V	300 V
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	200 mA	
Peak collector current	I_{CM}	500 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	$\leq$ 350 K/W	

Characteristics

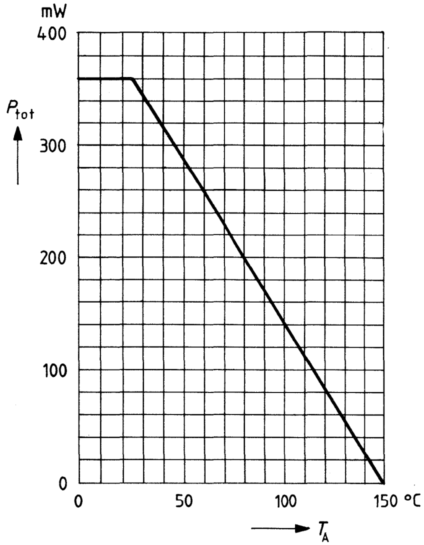
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA		$V_{(BR)\,CE0}$				
BFN 24			250	–	–	V
BFN 26			300	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA		$V_{(BR)\,CB0}$				
BFN 24			250	–	–	V
BFN 26			300	–	–	V
Emitter-base breakdown voltage $I_E = 100$ µA		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 200$ V	BFN 24		–	–	100	nA
$V_{CB} = 250$ V	BFN 26		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$	BFN 24		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$	BFN 26		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EB0}	–	–	100	nA
DC current gain		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V¹)			40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V¹)	BFN 24		40	–	–	–
	BFN 26		30	–	–	–
Collector-emitter saturation voltage¹) $I_C = 20$ mA, $I_B = 2$ mA		V_{CEsat}				
BFN 24			–	–	0,4	V
BFN 26			–	–	0,5	V
Base-emitter saturation voltage¹) $I_C = 20$ mA, $I_B = 2$ mA		V_{BEsat}	–	–	0,9	V

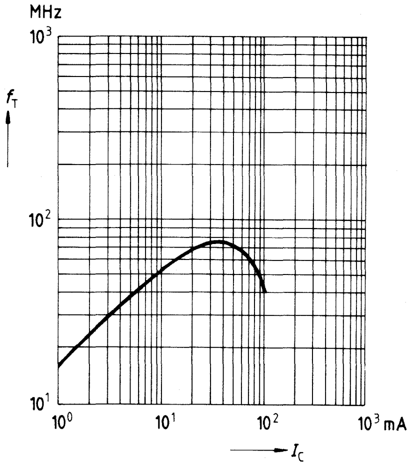
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	70	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,5	–	pF

¹) Pulse test: $t = 300$ µs, D = 2%.

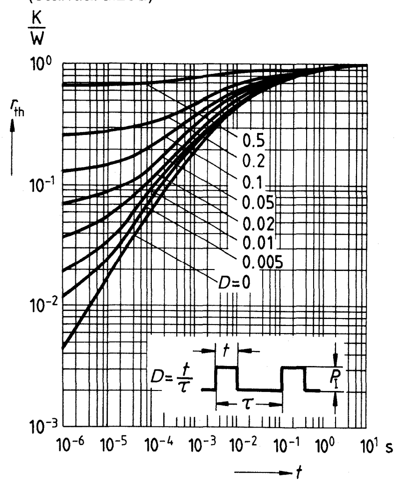
Total power dissipation $P_{tot} = f(T_A)$



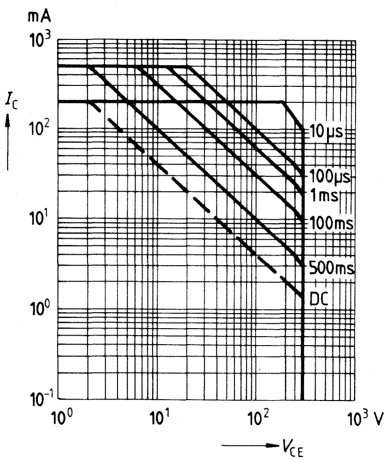
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10\ \text{V}$



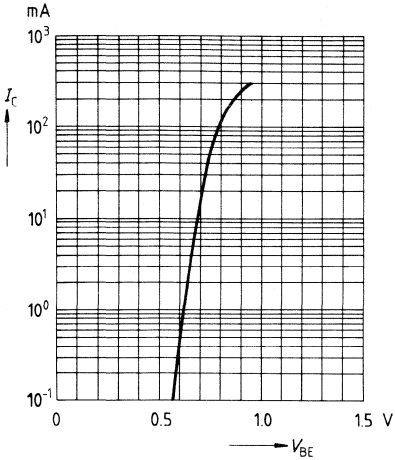
Pulse handling capability $r_{th} = f(t)$
(standardized)



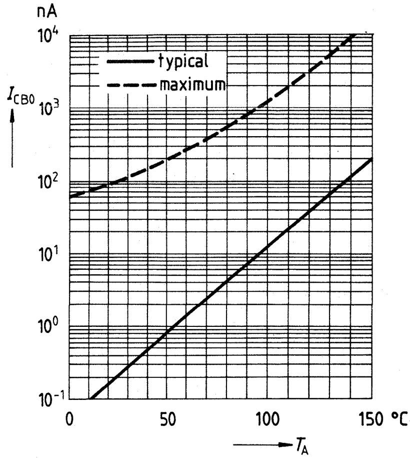
Operating range $I_C = f(V_{CE})$
$T_A = 25\ °\text{C}$, D = 0



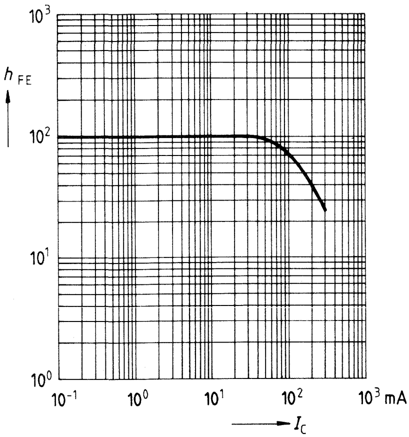
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V

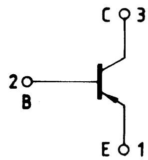


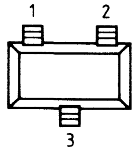
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary NPN types: BFN 24, BFN 26





Top view

Type	Marking	Ordering code	Package
BFN 25	FK	Refer to index	Version A
BFN 27	FL		

Maximum ratings		BFN 25	BFN 27
Collector-emitter voltage	V_{CEO}	250 V	300 V
Collector-base voltage	V_{CBO}	250 V	300 V
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	200 mA	
Peak collector current	I_{CM}	500 mA	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	−65 … +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W	

Characteristics

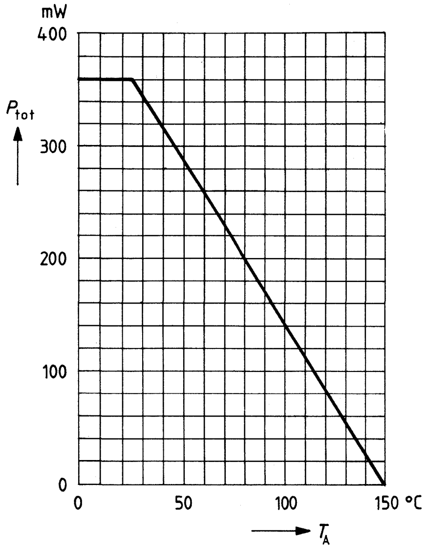
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA BFN 25 BFN 27	$V_{(BR)\,CEO}$	 250 300	 – –	 – –	 V V
Collector-base breakdown voltage $I_C = 100\ \mu A$ BFN 25 BFN 27	$V_{(BR)\,CBO}$	 250 300	 – –	 – –	 V V
Emitter-base breakdown voltage $I_E = 100\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V BFN 25 $V_{CB} = 250$ V BFN 27 $V_{CB} = 200$ V, $T_A = 150\,°C$ BFN 25 $V_{CB} = 250$ V, $T_A = 150\,°C$ BFN 27	I_{CBO}	 – – – –	 – – – –	 100 100 20 20	 nA nA µA µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	100	nA
DC current gain $I_C = 1$ mA, $V_{CE} = 10$ V $I_C = 10$ mA, $V_{CE} = 10$ V[1] $I_C = 30$ mA, $V_{CE} = 10$ V[1] BFN 25 BFN 27	h_{FE}	 25 40 40 30	 – – – –	 – – – –	 – – – –
Collector-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA BFN 25 BFN 27	V_{CEsat}	 – –	 – –	 0,4 0,5	 V V
Base-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,9	V

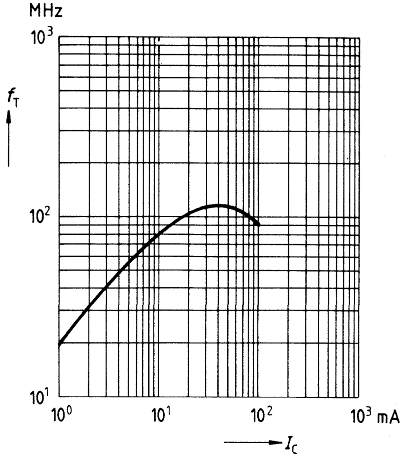
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	2,5	–	pF

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

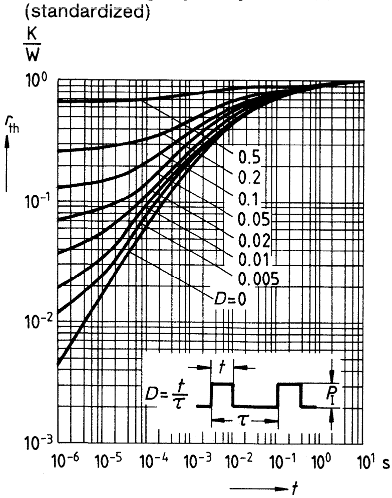
Total power dissipation $P_{tot} = f(T_A)$



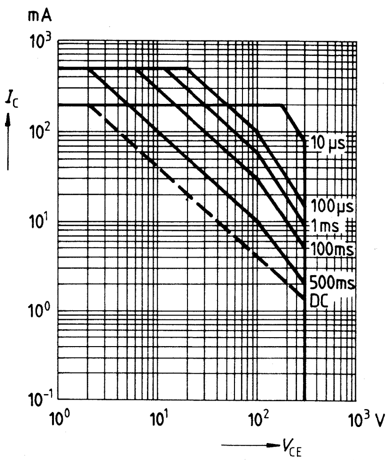
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



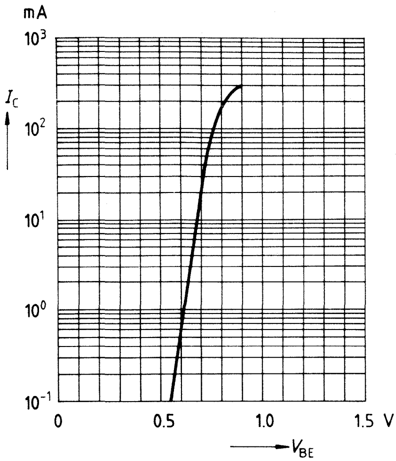
Pulse handling capability $r_{th} = f(t)$
(standardized)



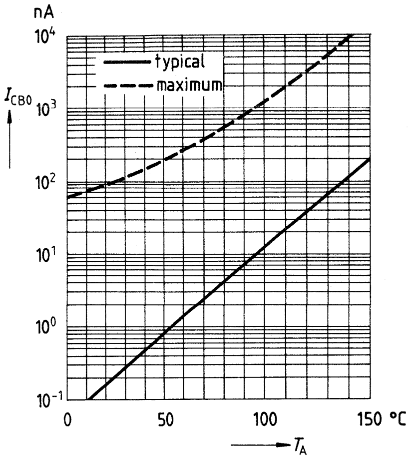
Operating range $I_C = f(V_{CE})$
$T_A = 25\,°C$, D = 0



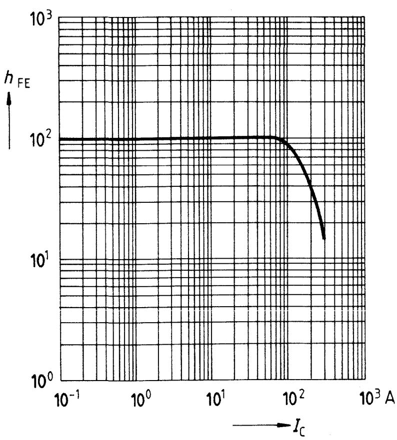
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V

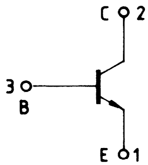


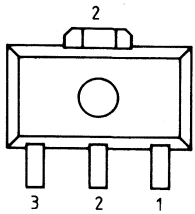
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



NPN silicon planar epitaxial transistor

- For VHF and UHF broadband amplifier output stages





Top view

Type	Marking	Ordering code	Package
BFQ 17 P	FA	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CE0}	25 V
Collector-base voltage	V_{CB0}	40 V
Collector-emitter voltage $R_{BE} \leq 50\ \Omega$	V_{CER}	40 V
Emitter-base voltage	V_{EB0}	2 V
Collector current	I_C	150 mA
Peak collector current $f \geq 1$ MHz	I_{CM}	300 mA
Total power dissipation $T_A \leq 25\ °C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

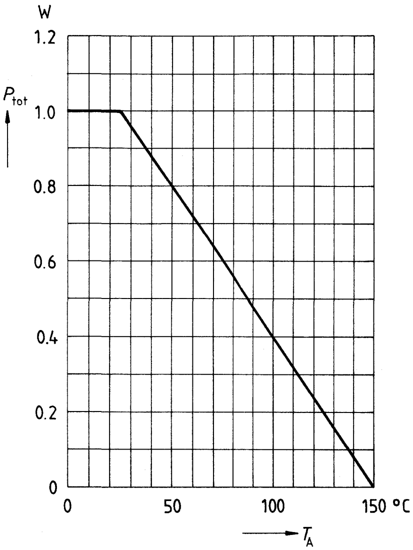
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

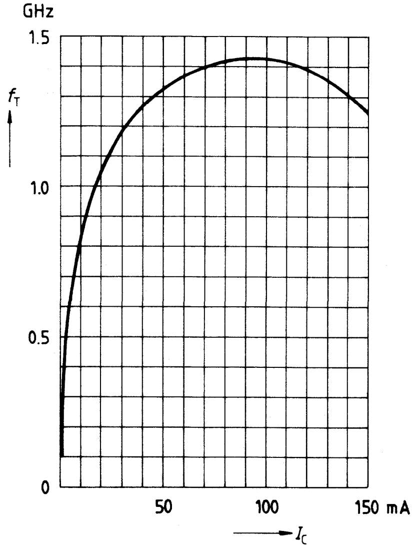
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA, $V_B = 0$	$V_{(BR)\,CEO}$	25	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$ $V_{CB} = 20$ V, $I_E = 0$, $T_A = 125\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Emitter cutoff current $V_{EB} = 1$ V, $I_C = 0$	I_{EBO}	–	–	100	nA
DC current gain $I_C = 50$ mA, $V_{CE} = 5$ V $I_C = 150$ mA, $V_{CE} = 5$ V	h_{FE}	 25 25	 – –	 – –	 – –
Collector-emitter saturation voltage $I_C = 100$ mA, $I_B = 10$ mA	V_{CEsat}	–	0,2	0,5	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 70$ mA, $V_{CE} = 5$ V, $f = 200$ MHz $I_C = 150$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	 – –	 1,4 1,2	 – –	 GHz GHz
Output capacitance $V_{CB} = 15$ V, $f = 1$ MHz $I_E = i_e = 0$	C_{ob}	–	–	4	pF
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	1,9	–	pF
Output voltage (two tone intermodulation test) $d_{IM} = 60$ dB, $I_C = 60$ mA, $V_{CE} = 15$ V, $R_G = R_L = 50\,\Omega$, $f_1 = 206$ MHz, $f_2 = 210$ MHz	$V_{01} = V_{02}$	–	480	–	mV

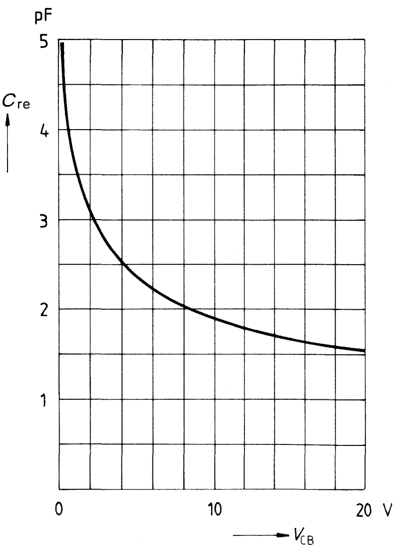
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_c)$
$V_{CE} = 5$ V, $f = 200$ MHz

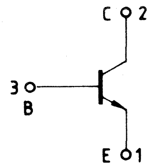


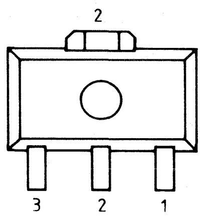
Collector-base feedback capacitance $C_{re} = f(V_{CB})$



NPN silicon planar epitaxial transistor

- For broadband amplifier stages up to 1 GHz





Top view

Type	Marking	Ordering code	Package
BFQ 19 P	FE	Refer to index	Version C

Maximum ratings

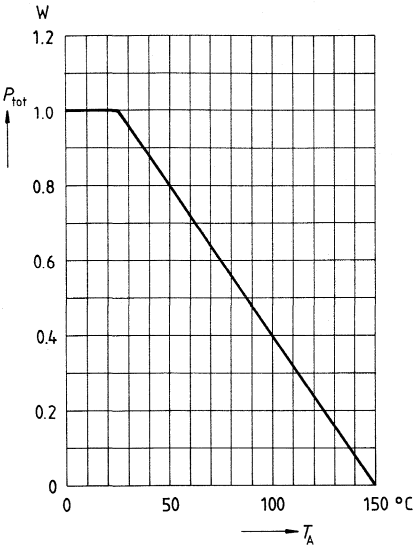
Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	20 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	75 mA
Peak collector current $f \geq 1$ MHz	I_{CM}	150 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics
at $T_A = 25\,°C$, unless otherwise specified

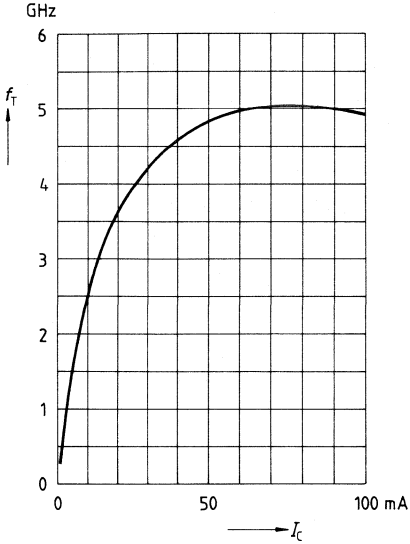
Static characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	15	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 50$ mA, $V_{CE} = 10$ V	h_{FE}	25	70	–	–
Collector-emitter saturation voltage $I_C = 75$ mA, $I_B = 7{,}5$ mA	V_{CEsat}	–	0,2	0,5	V

Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 200$ MHz $I_C = 75$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	 4 4,4	 4,8 5,1	 – –	 GHz GHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz, $I_E = i_e = 0$	C_{ob}	–	1,5	–	pF
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	1,1	1,5	pF
Power gain $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	G_{pe}	–	11,5	–	dB
Noise figure $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 800$ MHz $R_{G\,opt}$	NF	–	3,8	–	dB
Output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{IM} = 60$ dB, $I_C = 70$ mA, $V_{CE} = 10$ V $R_G = R_L = 50\,\Omega$	$V_{01} = V_{02}$	–	500	–	mV

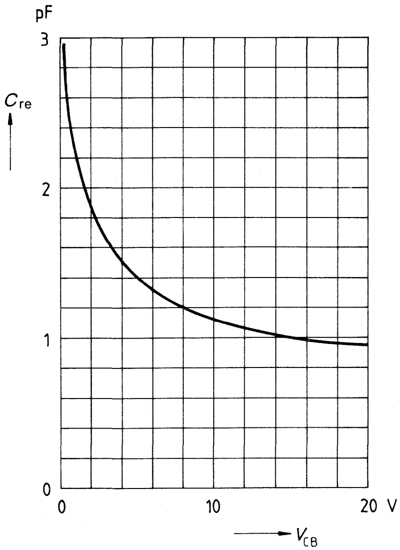
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V

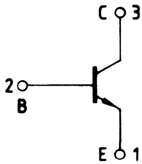


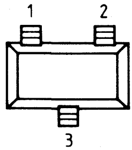
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



NPN silicon planar epitaxial transistor

- For low noise IF and broadband amplifiers up to 1 GHz
- Low noise version (typ. 0.9 dB at 10 MHz)
- High transition frequency





Top view

Type	Marking	Ordering code	Package
BFQ 29 P	KC	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	20 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	30 mA
Base current	I_B	4 mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

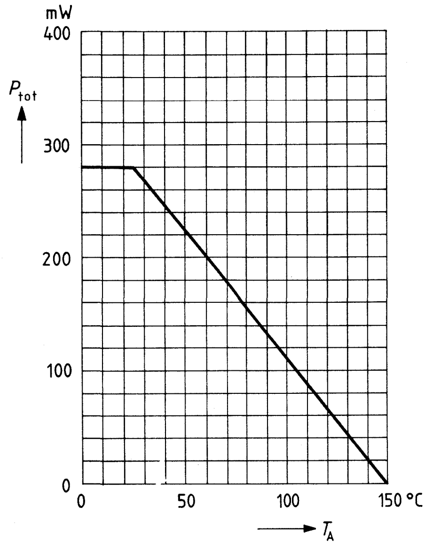
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

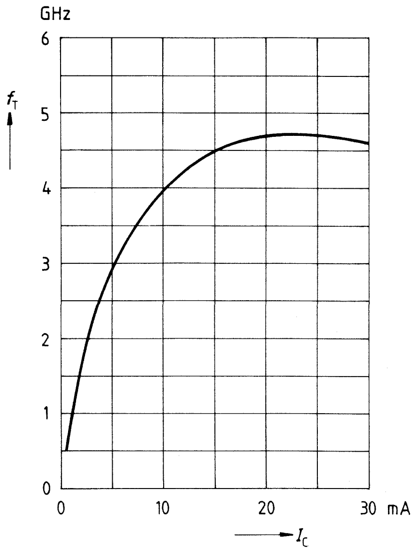
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CE0}$	15	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$, $I_E = 0$	$V_{(BR)\,CB0}$	20	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CB0}	–	–	50	nA
DC current gain $I_C = 3$ mA, $V_{CE} = 6$ V $I_C = 10$ mA, $V_{CE} = 6$ V	h_{FE}	 50 50	 – 140	 250 –	 – –
Collector-emitter saturation voltage $I_C = 20$ mA, $I_B = 1$ mA	V_{CEsat}	–	0,1	0,4	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 200$ MHz	f_T	3,6	4,7	–	GHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,5	0,65	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,28	–	pF
Noise figure $I_C = 3$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $R_G = 75\,\Omega$ $I_C = 4$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $R_G = 50\,\Omega$	NF	 – – 	 0,9 1,8 	 1,2 – 	 dB dB
Linear output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{IM} = 60$ dB, $I_C = 20$ mA, $V_{CE} = 6$ V, $R_S = R_L = 50\,\Omega$	$V_{01} = V_{02}$	–	180	–	mV

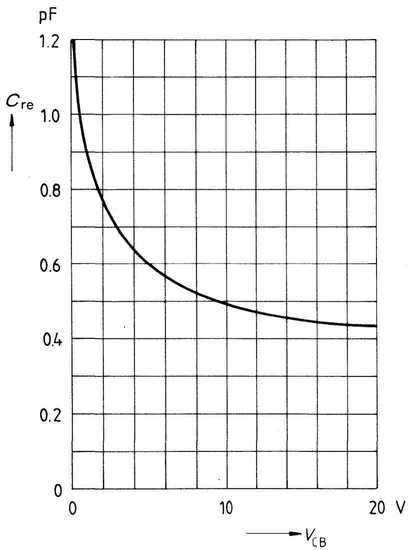
Total power dissipation $P_{tot} = f(T_A)$



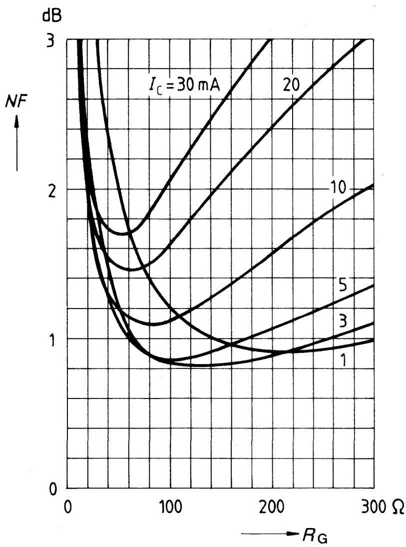
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V



Collector-base feedback capacitance $C_{re} = f(V_{CB})$

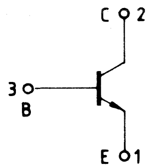


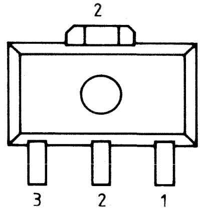
Noise figure $NF = f(R_G)$
$V_{CE} = 6$ V



NPN silicon planar epitaxial transistor

- For low-distortion broadband amplifiers, preferably in antenna amplifiers up to 1 GHz





Top view

Type	Marking	Ordering code	Package
BFQ 64	FC	Refer to index	Version C

Maximum ratings

Collector-emitter voltage	V_{CEO}	20 V
Collector-base voltage	V_{CBO}	30 V
Emitter-base voltage	V_{EBO}	3 V
Collector current	I_C	200 mA
Peak collector current	I_{CM}	250 mA
Peak base current	I_{BM}	25 mA
Total power dissipation $T_A \leq 25\,°C$	P_{tot}	1,0 W
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 ... +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

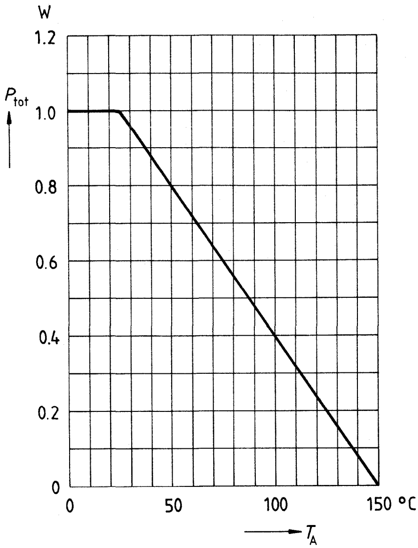
Characteristics

at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	200	nA
Collector cutoff current V_{CE} = 30 V, V_{BE} = 0	I_{CES}	–	–	1	mA
DC current gain I_C = 120 mA, V_{CE} = 5 V	h_{FE}	25	–	–	–

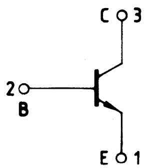
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 100 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	3	–	GHz
Collector-base feedback capacitance V_{CB} = 10 V, V_{BE} = 0, f = 1 MHz	C_{re}	–	0,9	–	pF
Optimum power gain I_C = 100 mA, V_{CE} = 10 V, f = 800 MHz	$G_{p\,opt}$	–	10	–	dB
Output voltage (two tone intermodulation test) f_1 = 806 MHz, f_2 = 810 MHz, d_{IM} = 60 dB, I_C = 100 mA, V_{CE} = 10 V $R_G = R_L$ = 50 Ω	V_0	–	0,6	–	V

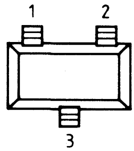
Total power dissipation $P_{tot} = f\,(T_A)$



NPN silicon planar epitaxial transistor

- For low noise broadband amplifiers up to 2 GHz
- High transition frequency, $f_T = 5.8$ GHz typ
- Low noise figure $NF = 2.8$ dB at 2 GHz
- Low collector capacitance





Top view

Type	Marking	Ordering code	Package
BFQ 81	RA	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	16 V
Collector-base voltage	V_{CBO}	25 V
Emitter-base voltage	V_{EBO}	2 V
Collector current	I_C	30 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

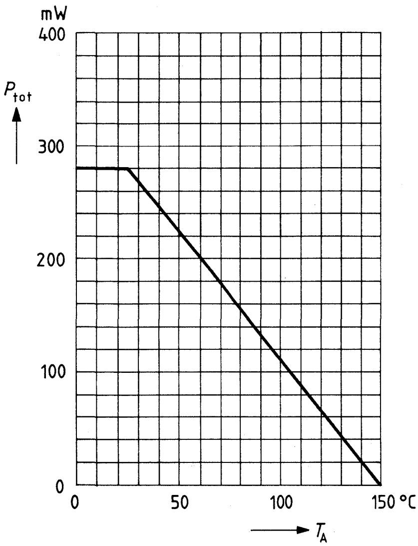
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	16	–	–	V
Collector cutoff current $V_{CB} = 15$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 15$ mA, $V_{CE} = 10$ V	h_{FE}	 50 50	 – –	 – –	 – –
Collector-emitter saturation voltage $I_C = 30$ mA, $I_B = 3$ mA	V_{CEsat}	–	0,2	0,5	V

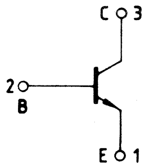
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 200$ MHz $I_C = 15$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	 – –	 4,2 5,8	 – –	 GHz GHz
Collector base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,4	–	pF
Power gain $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	G_{pe}	–	15	–	dB
Noise figure $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 10$ MHz, $R_G = 75\,\Omega$ $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $R_G = 50\,\Omega$ $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 2$ GHz, $R_{G\,opt}$	NF	 – – –	 0,9 1,5 2,8	 – – –	 dB dB dB

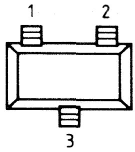
Total power dissipation $P_{tot} = f(T_A)$



NPN silicon planar epitaxial transistor

- For broadband amplifier input stages up to 2 GHz and fast non-saturated switching applications
- Collector-current range 0.5 mA ··· 20 mA





Top view

Type	Marking	Ordering code	Package
BFR 35 AP	GE	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	12 V
Collector-emitter voltage	V_{CES}	20 V
Emitter-base voltage	V_{EBO}	2,5 V
Collector current	I_C	30 mA
Base current	I_B	4 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 ··· +150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	12	–	–	V
Collector-emitter breakdown voltage $I_C = 100$ µA, $V_{BE} = 0$	$V_{(BR)\,CES}$	20	–	–	V
Emitter-base breakdown voltage $I_E = 100$ µA, $I_C = 0$	$V_{(BR)\,EBO}$	2,5	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 6$ V $I_C = 20$ mA, $V_{CE} = 6$ V	h_{FE}	 40 40	 90 100	 – –	 – –
Collector-emitter saturation voltage $I_C = 30$ mA, $I_B = 3$ mA	V_{CEsat}	–	0,16	0,4	V

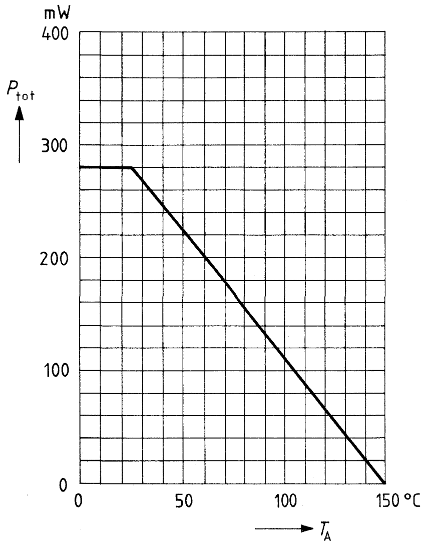
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 200$ MHz $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 200$ MHz	f_T	 – 3,6	 3,8 4,9	 – –	 GHz GHz
Collector-base feedback capacitance $V_{CB} = 6$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,55	0,7	pF
Collector-emitter feedback capacitance $V_{CE} = 6$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,27	–	pF
Power gain $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 800$ MHz $R_G = 50\,\Omega$	G_{pe}	–	14	–	dB
Noise figure $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $R_G = 75\,\Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $R_G = 60\,\Omega$ $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 2$ GHz, $R_{G\,opt}$	NF	 – – –	 1,5 2 3,9	 – 3 –	 dB dB dB
Output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{iM} = 60$ dB, $I_C = 15$ mA, $V_{CE} = 10$ V, $R_G = R_L = 50\,\Omega$	$V_{01} = V_{02}$	–	110	–	mV

S parameters

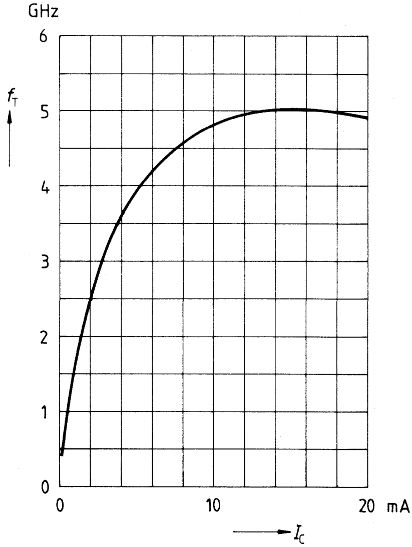
common emitter, $V_{CE} = 6$ V; $I_C = 5$ mA; $Z_0 = 50\ \Omega$

f (GHz)	$\|S_{11}\|$	φ	$\|S_{21}\|$	φ	$\|S_{12}\|$	φ	$\|S_{22}\|$	φ
0,1	0,771	– 29	12,75	150	0,025	73	0,971	–14
0,2	0,639	– 55	10,70	130	0,041	63	0,807	–21
0,3	0,486	– 72	8,34	115	0,052	57	0,697	–27
0,4	0,400	– 87	6,92	104	0,063	57	0,650	–26
0,5	0,326	– 97	5,78	97	0,071	57	0,582	–29
0,6	0,289	–105	4,88	91	0,079	57	0,591	–31
0,7	0,232	–112	4,30	85	0,089	56	0,585	–25
0,8	0,206	–123	3,79	80	0,098	56	0,501	–27
0,9	0,180	129	3,47	76	0,109	57	0,527	–34
1,0	0,168	–142	3,12	73	0,116	57	0,560	–31
1,1	0,151	–146	2,88	68	0,125	56	0,505	–29
1,2	0,124	–163	2,65	64	0,136	55	0,512	–39
1,3	0,131	–174	2,50	60	0,147	54	0,541	–35
1,4	0,124	173	2,34	57	0,157	54	0,474	–36
1,5	0,128	164	2,20	53	0,167	53	0,521	–45
1,6	0,132	148	2,08	49	0,174	51	0,539	–38
1,7	0,160	142	1,98	47	0,188	51	0,425	–40
1,8	0,158	140	1,83	43	0,192	49	0,460	–60
1,9	0,160	131	1,81	40	0,207	47	0,586	–51
2,0	0,180	123	1,73	37	0,216	47	0,480	–43

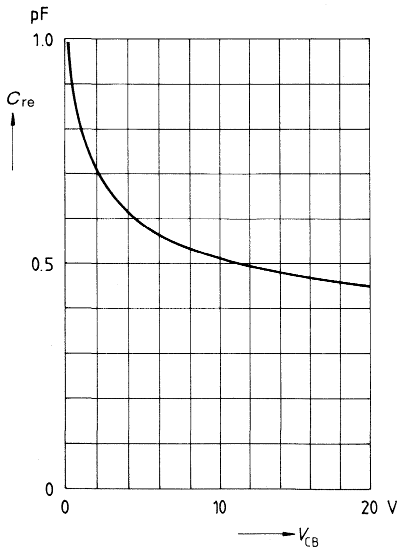
Total power dissipation $P_{tot} = f(T_A)$



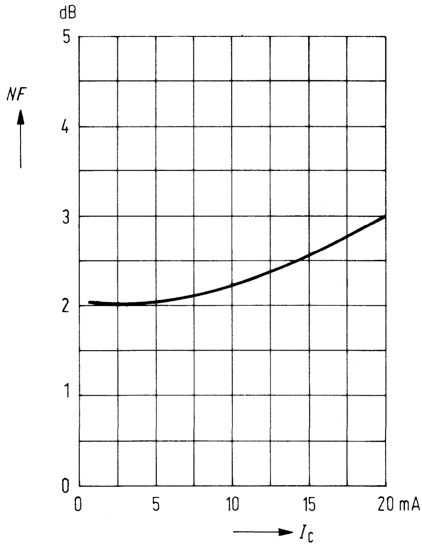
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz

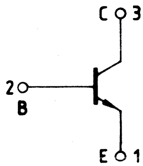


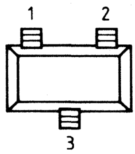
Noise figure $NF = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz,
$R_G = 60\ \Omega$



NPN silicon planar epitaxial transistor

- For broadband amplifiers up to 2 GHz and non-saturated switching applications





Top view

Type	Marking	Ordering code	Package
BFR 92 P	GF	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	20 V
Emitter-base voltage	V_{EBO}	2,5 V
Collector current	I_C	30 mA
Base current	I_B	4 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

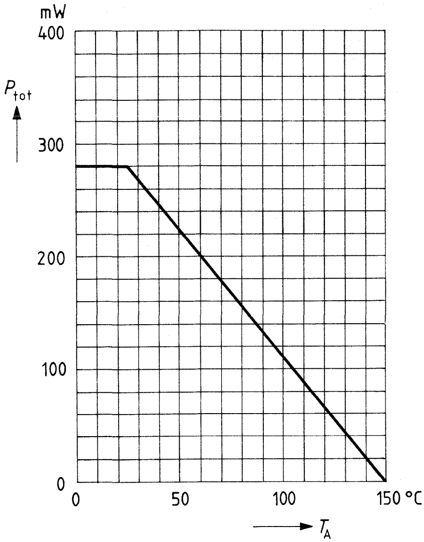
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	12	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_E = 0$	$V_{(BR)\,CBO}$	20	–	–	V
Emitter-base breakdown voltage $I_E = 100$ µA, $I_C = 0$	$V_{(BR)\,EBO}$	2,5	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 14$ mA, $V_{CE} = 10$ V	h_{FE}	40	100	–	–
Collector-emitter saturation voltage $I_C = 30$ mA, $I_B = 3$ mA	V_{CEsat}	–	–	0,4	V

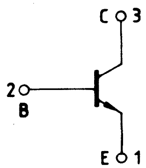
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 200$ MHz $I_C = 14$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	 – –	 3,8 5	 – –	 GHz GHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,5	0,7	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,27	–	pF
Power gain $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 800$ MHz $R_G = 50\,\Omega$	G_{pe}	–	14	–	dB
Noise figure $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $R_G = 75\,\Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $R_G = 60\,\Omega$ $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 2$ GHz, $R_{G\,opt}$	NF	 – – –	 1,5 2 3,9	 – 3 –	 dB dB dB
Output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{IM} = 60$ dB, $I_C = 15$ mA, $V_{CE} = 10$ V, $R_G = R_L = 50\,\Omega$	$V_{01} = V_{02}$	–	110	–	mV

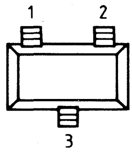
Total power dissipation $P_{tot} = f(T_A)$



NPN silicon planar epitaxial transistor

- For broadband amplifiers up to 1 GHz
- Low intermodulation distortion





Top view

Type	Marking	Ordering code	Package
BFR 93 P	GG	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	20 V
Emitter-base voltage	V_{EBO}	2,5 V
Collector current	I_C	50 mA
Base current	I_B	10 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

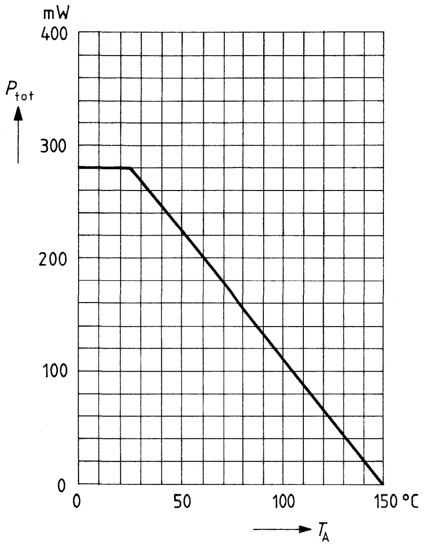
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

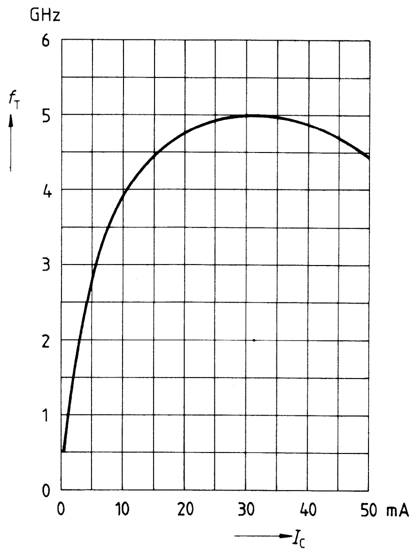
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	15	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$, $I_E = 0$	$V_{(BR)CBO}$	20	–	–	V
Emitter-base breakdown voltage $I_E = 100\ \mu A$, $I_C = 0$	$V_{(BR)EBO}$	2,5	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 25$ mA, $V_{CE} = 5$ V	h_{FE}	30	100	–	–
Collector-emitter saturation voltage $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	–	0,2	0,5	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	–	5	–	GHz
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,6	0,75	pF
Collector-emitter feedback capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{rb}	–	0,28	–	pF
Power gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	G_p	–	13	–	dB
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $R_G = 50\ \Omega$ $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 500$ MHz, $R_{G\,opt}$ $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $R_G = 50\ \Omega$	NF	 – – –	 1,8 1,9 2,8	 – – –	 dB dB dB
Output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{IM} = 60$ dB, $I_C = 25$ mA, $V_{CE} = 8$ V, $R_G = R_L = 50\ \Omega$	$V_{01} = V_{02}$	–	240	–	mV

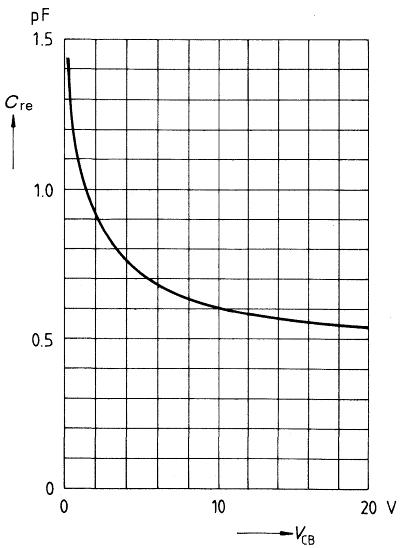
Total power dissipation $P_{tot} = f(T_A)$



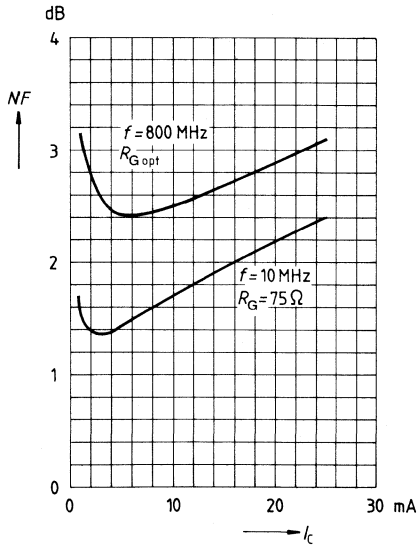
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz

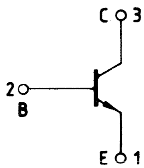


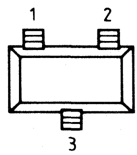
Noise figure $NF = f(I_C)$
$V_{CE} = 8$ V



NPN silicon planar epitaxial transistor

- For broadband amplifiers up to 1 GHz





Top view

Type	Marking	Ordering code	Package
BFS 17 P	MC	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	25 V
Emitter-base voltage	V_{EBO}	2,5 V
Collector current	I_C	25 mA
Peak collector current	I_{CM}	50 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450 K/W

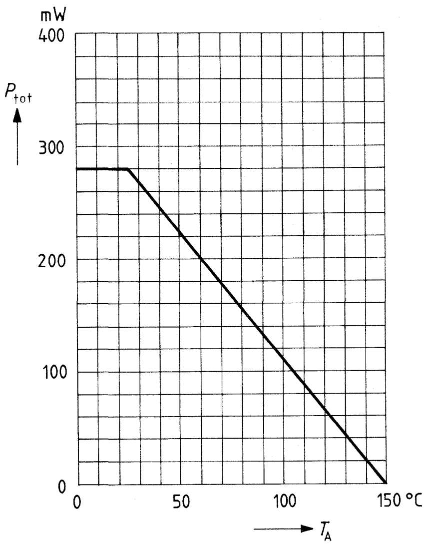
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

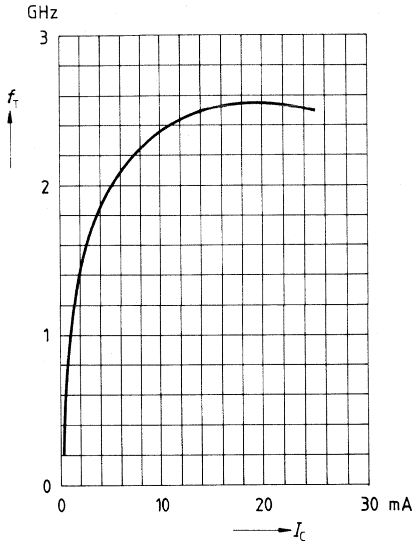
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	15	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_E = 0$	$V_{(BR)\,CBO}$	25	–	–	V
Emitter-base breakdown voltage $I_E = 100$ µA, $I_C = 0$	$V_{(BR)\,EBO}$	2,5	–	–	V
Collector cutoff current $V_{CB} = 15$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 2$ mA, $V_{CE} = 1$ V $I_C = 25$ mA, $V_{CE} = 1$ V	h_{FE}	 20 20	 – 70	 150 –	 – –
Collector-emitter saturation voltage $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	0,1	0,4	V

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 100$ MHz $I_C = 25$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	 1 1,3	 1,4 2,5	 – –	 GHz GHz
Output capacitance $V_{CB} = 10$ V, $I_E = i_e = 0$, $f = 1$ MHz	C_{ob}	–	–	1,5	pF
Collector-base feedback capacitance $V_{CB} = 5$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,55	0,8	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 800$ MHz, $R_G = 50\,\Omega$	NF	–	3,8	5	dB
Output voltage (two tone intermodulation test) $f_1 = 806$ MHz, $f_2 = 810$ MHz, $d_{IM} = 60$ dB, $I_C = 14$ mA, $V_{CE} = 5$ V, $R_G = R_L = 50\,\Omega$	$V_{01} = V_{02}$	–	100	–	mV

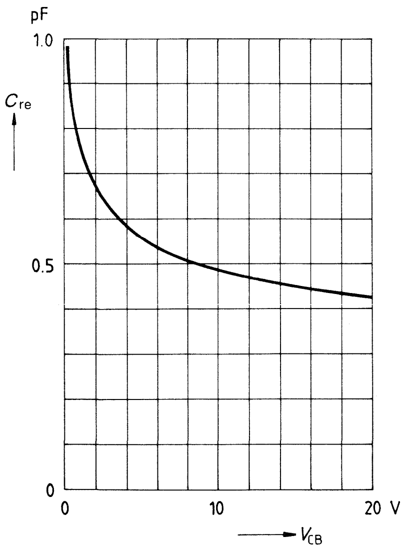
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz

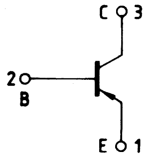


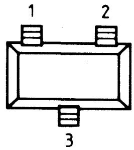
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



PNP silicon planar epitaxial transistor

- For UHF broadband amplifiers
- Complementary NPN type: BFR 92 P





Top view

Type	Marking	Ordering code	Package
BFT 92	W1	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	15 V
Collector-base voltage	V_{CBO}	20 V
Emitter-base voltage	V_{EBO}	2 V
Collector current	I_C	25 mA
Peak collector current $f \geq 1$ MHz	I_{CM}	35 mA
Total power dissipation $T_A \leq 60\,°C$	P_{tot}	200 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 … +150 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 440 K/W

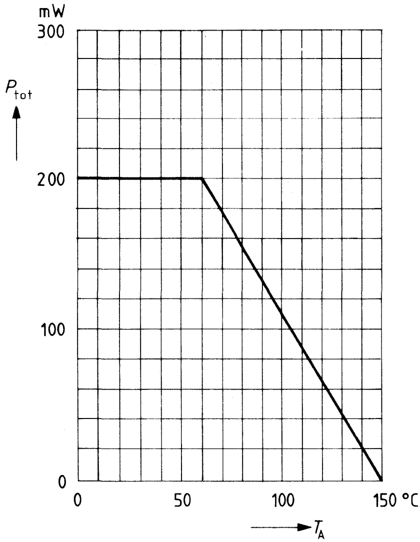
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

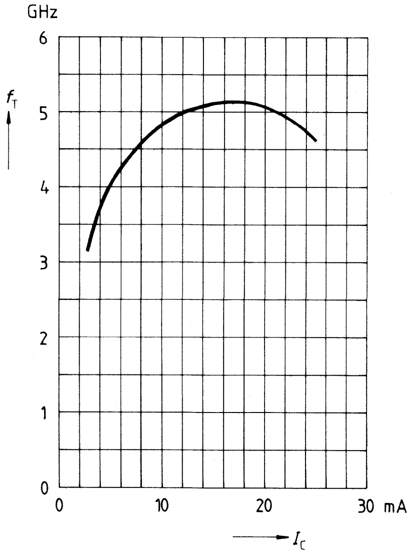
Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CE0}$	15	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CB0}	–	–	50	nA
DC current gain $I_C = 14$ mA, $V_{CE} = 10$ V	h_{FE}	20	50	–	–

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 14$ mA, $V_{CE} = 10$ V, $f = 500$ MHz	f_T	–	5	–	GHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz, $I_E = i_e = 0$	C_{ob}	–	0,75	–	pF
Input capacitance $V_{CB} = 0{,}5$ V, $f = 1$ MHz, $I_C = i_C = 0$	C_{ib}	–	0,8	–	pF
Collector-base feedback capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{re}	–	0,7	–	pF
Optimum power gain $I_C = 14$ mA, $V_{CE} = 10$ V, $f = 500$ MHz	$G_{p\,opt}$	–	18	–	dB
Noise figure $I_C = 2$ mA, $V_{CE} = 10$ V, $f = 500$ MHz $R_{G\,opt}$	NF	–	2,7	–	dB
Intermodulation distortion (three tone intermodulation test) $f_1 = 495{,}25$ MHz, $f_2 = 503{,}25$ MHz, $f_3 = 505{,}25$ MHz, $V_1 = 150$ mV, $I_C = 14$ mA, $V_{CE} = 10$ V, $R_G = R_L = 75\,\Omega$	d_{IM}	–	60	–	dB

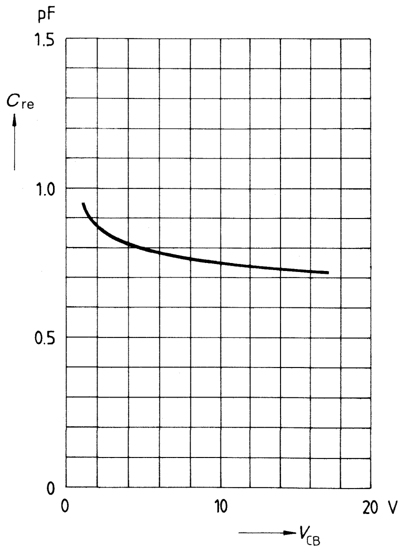
Total power dissipation $P_{tot} = f(T_A)$



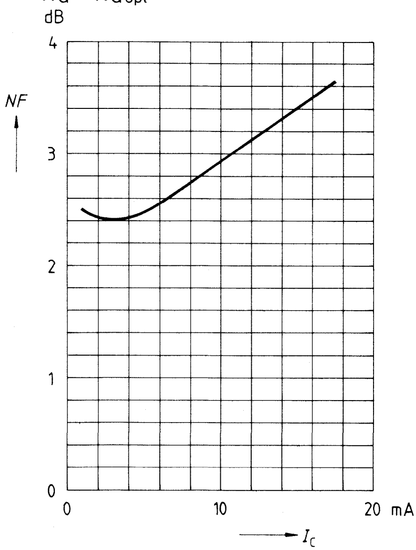
Transition frequency $f_T = f(I_c)$
$V_{CE} = 10$ V, $f = 500$ MHz



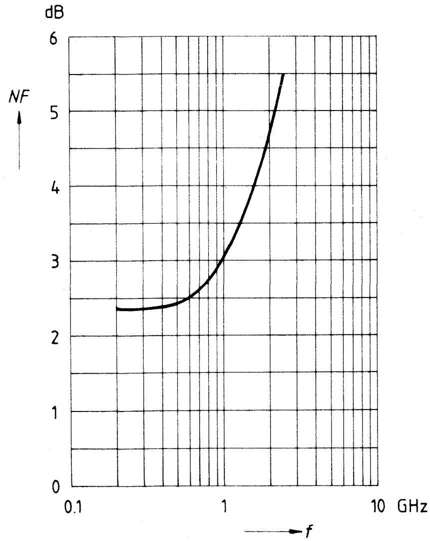
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz, $I_E = 0$



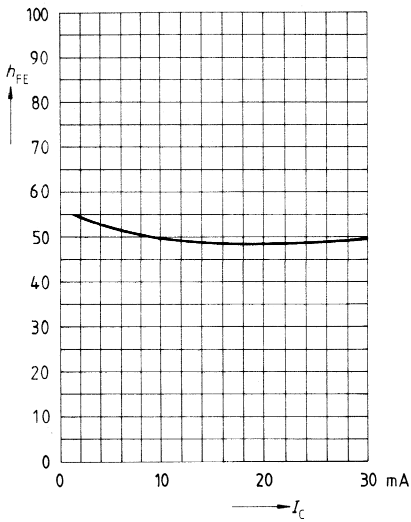
Noise figure $NF = f(I_c)$
$V_{CE} = 10$ V, $f = 500$ MHz,
$R_G = R_{G\,opt}$



Noise figure $NF = f(f)$
$V_{CE} = 10$ V, $I_C = 2$ mA
$R_G = R_{G\,opt}$

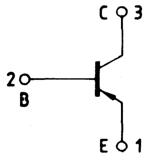


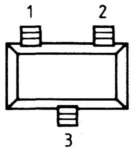
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP silicon planar epitaxial transistor

- For UHF broadband amplifiers
- Complementary NPN type: BFR 93 P





Top view

Type	Marking	Ordering code	Package
BFT 93	X1	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	12 V
Collector-base voltage	V_{CBO}	15 V
Emitter-base voltage	V_{EBO}	2 V
Collector current	I_C	35 mA
Peak collector current $f \geq 1$ MHz	I_{CM}	50 mA
Total power dissipation $T_A \leq 60\,°C$	P_{tot}	200 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 … +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 440 K/W

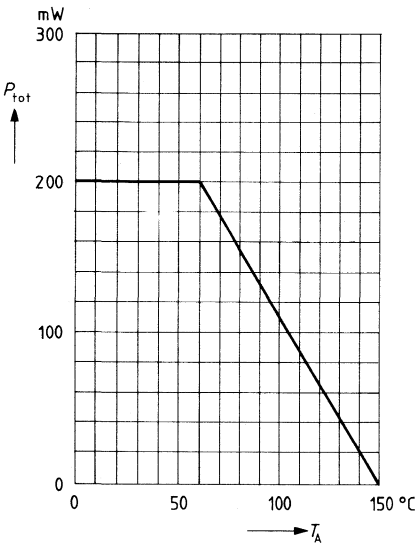
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

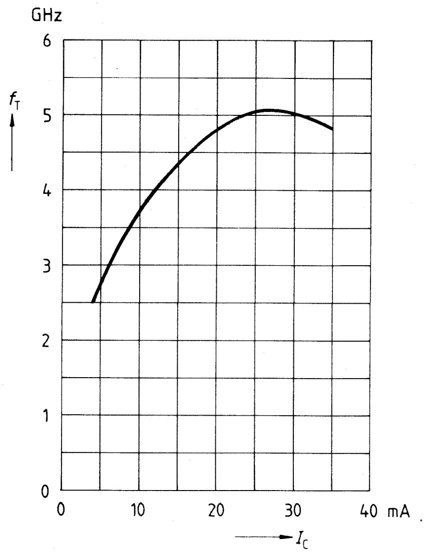
Static characteristics	Symbol	min	typ	max	Unit
Collector cutoff current $V_{CB} = 5\,V$, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 30\,mA$, $V_{CE} = 5\,V$	h_{FE}	20	50	–	–

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 30\,mA$, $V_{CE} = 5\,V$, $f = 500\,MHz$	f_T	–	5	–	GHz
Output capacitance $V_{CB} = 10\,V$, $f = 1\,MHz$, $I_E = i_e = 0$	C_{ob}	–	0,95	–	pF
Input capacitance $V_{CB} = 10\,V$, $f = 1\,MHz$, $I_C = i_C = 0$	C_{ib}	–	1,8	–	pF
Collector-base feedback capacitance $I_C = 2\,mA$, $V_{CE} = 5\,V$, $f = 1\,MHz$	C_{re}	–	1	–	pF
Optimum power gain $I_C = 30\,mA$, $V_{CE} = 5\,V$, $f = 500\,MHz$	$G_{p\,opt}$	–	16,5	–	dB
Noise figure $I_C = 2\,mA$, $V_{CE} = 5\,V$, $f = 500\,MHz$ $R_{G\,opt}$	NF	–	2,4	–	dB
Intermodulation distortion (three tone intermodulation test) $f_1 = 495{,}25\,MHz$, $f_2 = 503{,}25\,MHz$, $f_3 = 505{,}25\,MHz$, $V_1 = 300\,mV$, $I_C = 30\,mA$, $V_{CE} = 5\,V$, $R_G = R_L = 75\,\Omega$	d_{IM}	–	60	–	dB

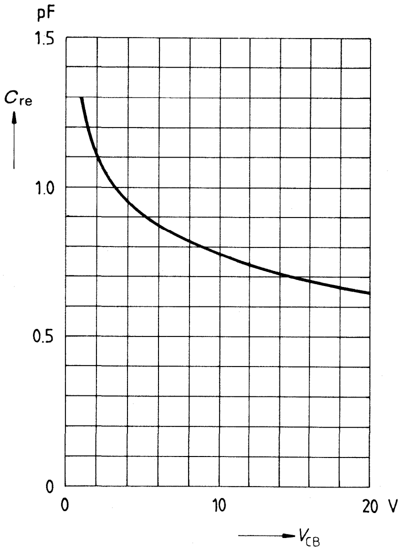
Total power dissipation $P_{tot} = f(T_A)$



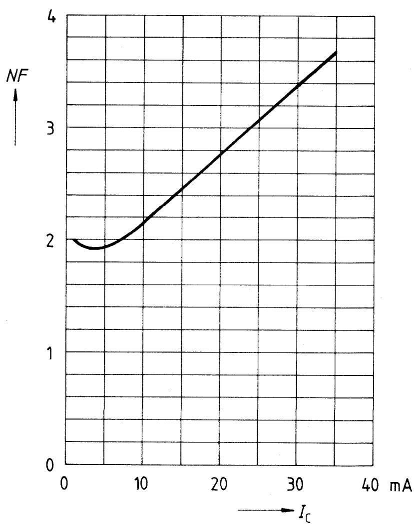
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz



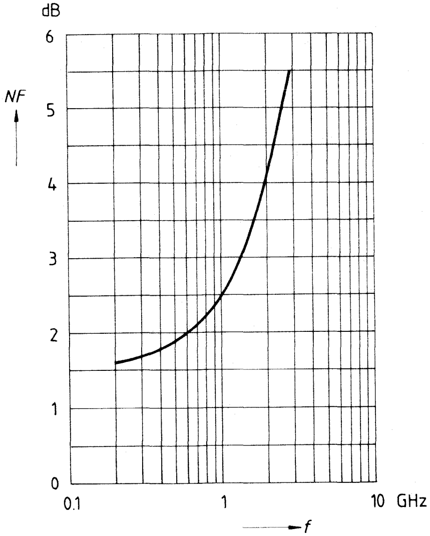
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz, $I_C = 0$



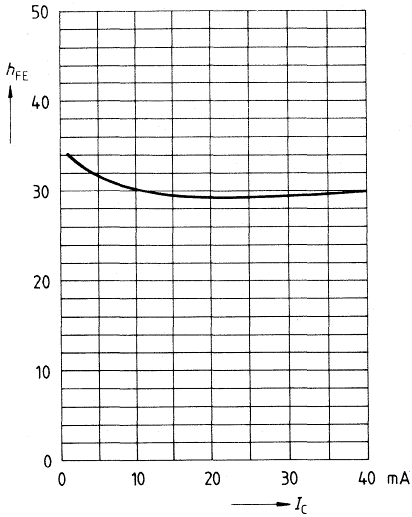
Noise figure $NF = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz,
$R_G = R_{G\,opt}$



Noise figure $NF = f(f)$
$V_{CE} = 5$ V, $I_C = 2$ mA,
$R_G = R_{G\,opt}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz

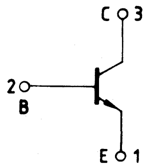


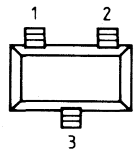
Switching Transistors

BSS 79
BSS 81

NPN silicon planar epitaxial transistors

- High DC current gain
- Low collector-emitter saturation voltage
- Complementary PNP types: BSS 80, BSS 82





Top View

Type	Marking	Type	Marking	Ordering code	Package
BSS 79 B	CE	BSS 81 B	CD	Refer to index	Version A
BSS 79 C	CF	BSS 81 C	CG		

Maximum ratings		BSS 79	BSS 81
Collector-emitter voltage	V_{CEO}	40 V	35 V
Collector-base voltage	V_{CBO}	75 V	
Emitter-base voltage	V_{EBO}	6 V	
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

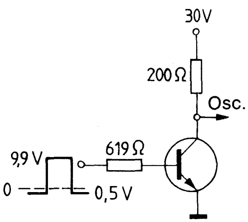
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BSS 79		40	–	–	V
BSS 81		35	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	75	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 60$ V		–	–	10	nA
$V_{CB} = 60$ V, $T_A = 150\,°C$		–	–	10	μA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	10	nA
DC current gain	h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 10$ V					
BSS 79 B/81 B		20	–	–	–
BSS 79 C/81 C		35	–	–	–
$I_C = 1$ mA, $V_{CE} = 10$ V					
BSS 79 B/81 B		25	–	–	–
BSS 79 C/81 C		50	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1])					
BSS 79 B/81 B		35	–	–	–
BSS 79 C/81 C		75	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1])					
BSS 79 B/81 B		40	–	120	–
BSS 79 C/81 C		100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1])					
BSS 79 B/81 B		25	–	–	–
BSS 79 C/81 C		40	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	1,3	V
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	1,2	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	2,0	V

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

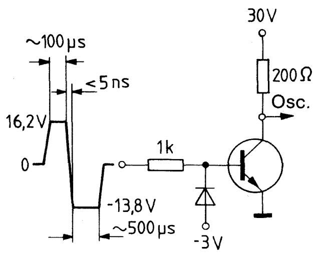
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Open-circuit output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA, $V_{BE} = 0{,}5$ V					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	25	ns
Storage time	t_s	–	–	250	ns
Fall time	t_f	–	–	60	ns

Test circuit for delay time and rise time

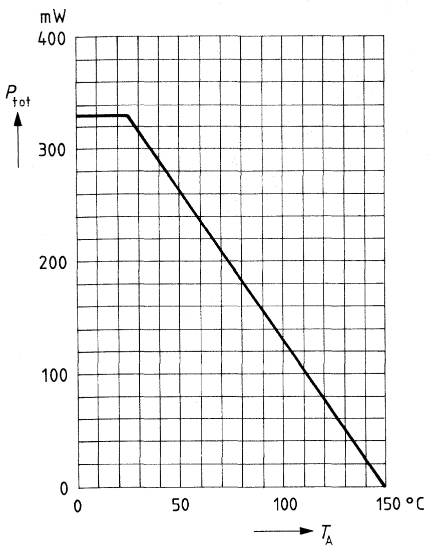


Oscilloscope: $R > 100$ kΩ
$C < 12$ pF
$t_r < 5$ ns

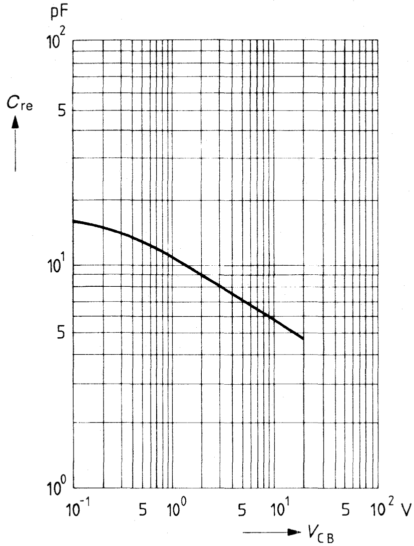
Test circuit for storage time and fall time



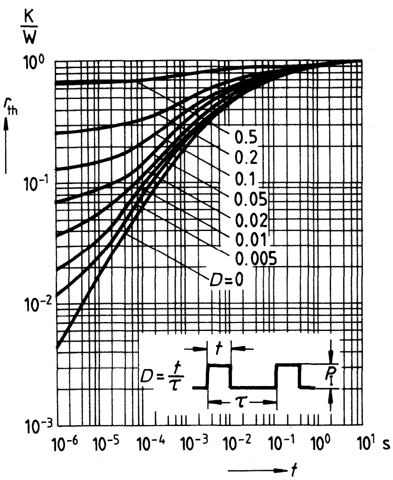
Total power dissipation $P_{tot} = f(T_A)$



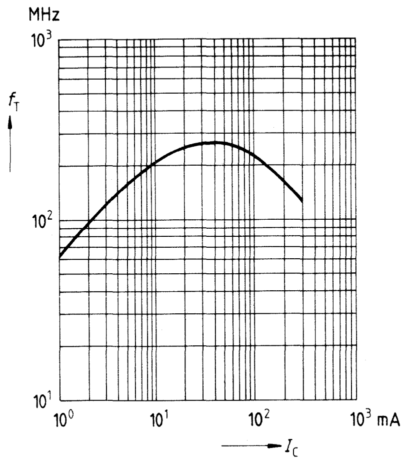
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
$f = 1$ MHz



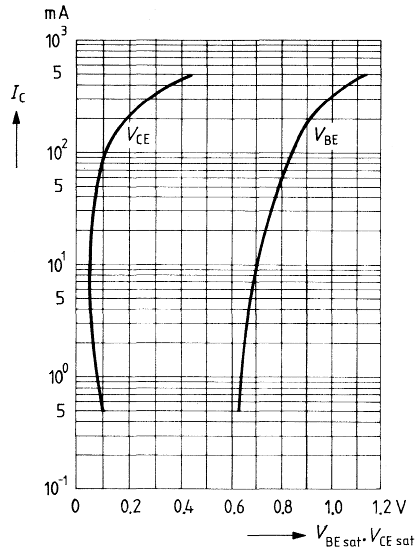
Pulse handling capability $r_{th} = f(t)$
(standardized)



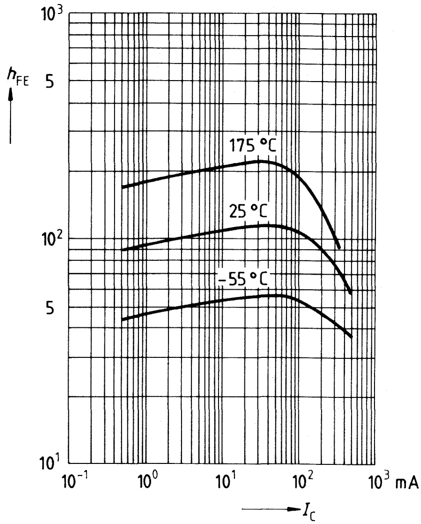
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V



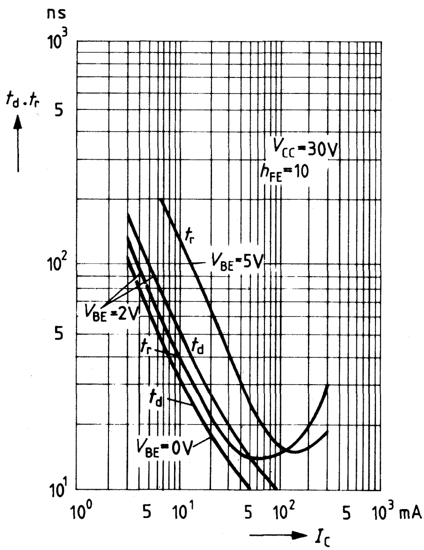
Saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$ $V_{CE\,sat} = f(I_C)$



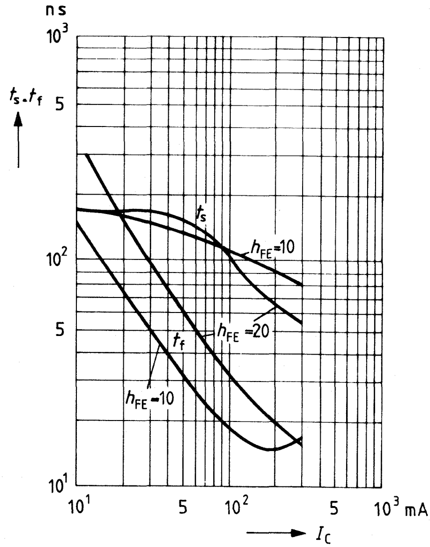
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



Turn-on time $t_{on} = f(I_C)$
$h_{FE} = 10$; $V_{CC} = 30$ V

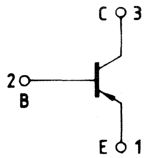


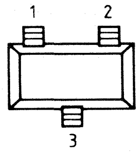
Storage time $t_s = f(I_C)$
Fall time $t_f = f(I_C)$



PNP silicon planar epitaxial transistors

- High DC current gain
- Low collector-emitter saturation voltage
- Complementary NPN types: BSS 79, BSS 81





Top view

Type	Marking	Type	Marking	Ordering code	Package
BSS 80 B	CH	BSS 82 B	CL	Refer to index	Version A
BSS 80 C	CJ	BSS 82 C	CM		

Maximum ratings		BSS 80	BSS 82
Collector-emitter voltage	V_{CEO}	40 V	60 V
Collector-base voltage	V_{CBO}	60 V	
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	800 mA	
Peak collector current	I_{CM}	1 A	
Base current	I_B	100 mA	
Peak base current	I_{BM}	200 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

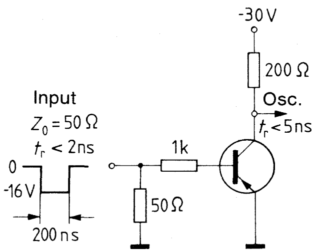
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BSS 80		40	–	–	V
BSS 82		60	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	60	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 50$ V		–	–	10	nA
$V_{CB} = 50$ V, $T_A = 150\,°C$		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	10	nA
DC current gain	h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 10$ V					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		75	–	–	–
$I_C = 1$ mA, $V_{CE} = 10$ V					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		100	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		100	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	120	–
BSS 80 C/82 C		100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		50	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	0,4	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	1,6	V
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	1,3	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	2,6	V

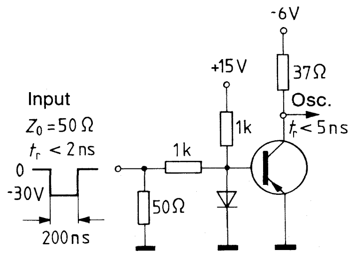
[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Open-circuit output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 150$ mA					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	40	ns
$V_{CC} = 6$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA					
Storage time	t_s	–	–	80	ns
Fall time	t_f	–	–	30	ns

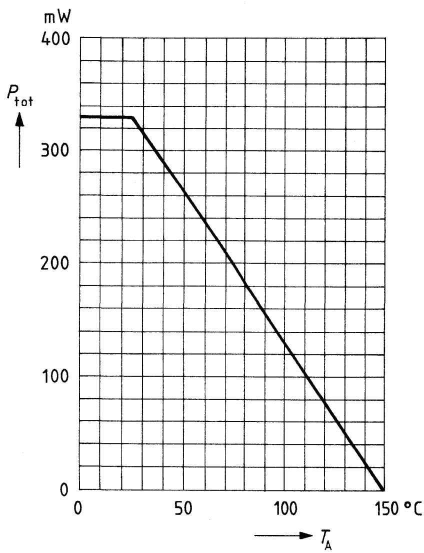
Test circuit for delay time and rise time



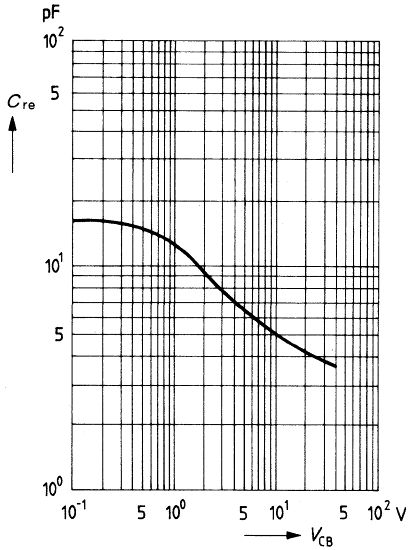
Test circuit for storage time and fall time



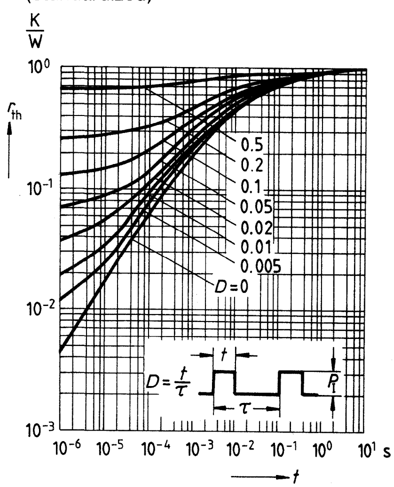
Total power dissipation $P_{tot} = f(T_A)$



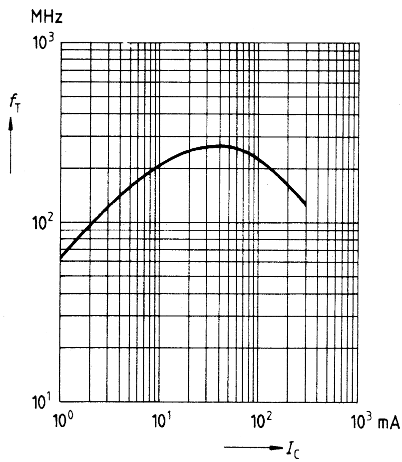
Collector-base feedback capacitance $C_{re} = f(V_{CB})$
f = 1 MHz



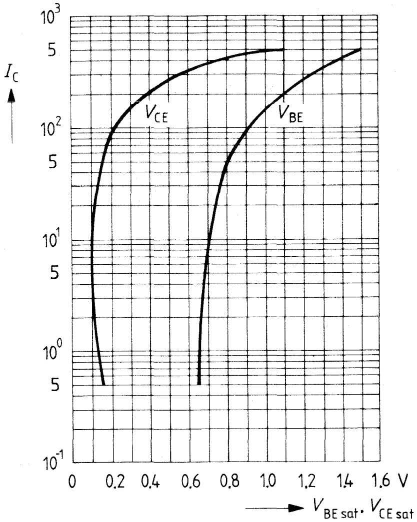
Pulse handling capability $r_{th} = f(t)$
(standardized)



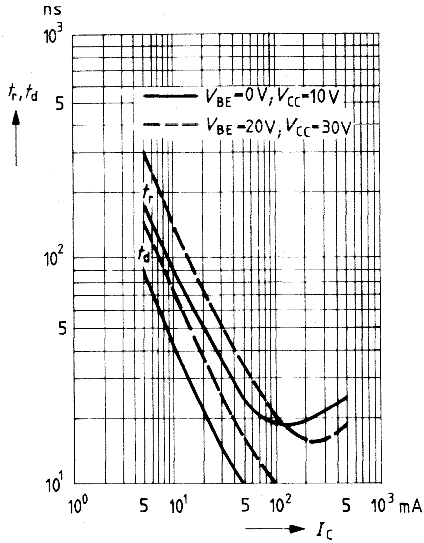
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V



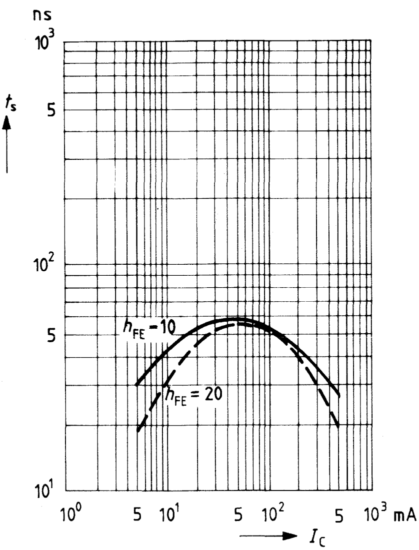
Saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$ $V_{CE\,sat} = f(I_C)$



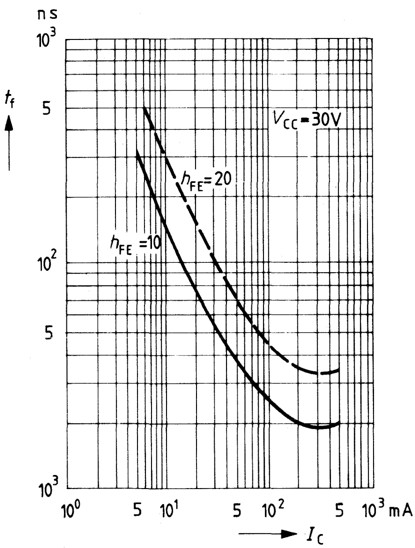
Turn-on time $t_{on} = f(I_C)$



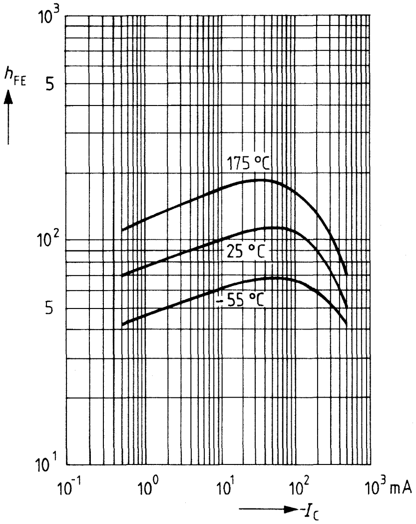
Storage time $t_s = f(I_C)$



Fall time $t_f = f(I_C)$

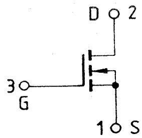


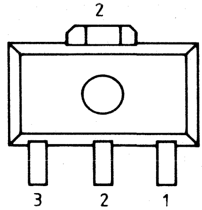
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



MOSFET in N channel enhancement mode

- Drain-source voltage V_{DS} = 200 V
- Continuous drain current I_D = 0,28 A
- Drain-source on-resistance $R_{DS(on)}$ = 5,5 Ω





Top view

Type	Marking	Ordering code	Package
BSS 87	KA	Refer to index	Version C

Maximum ratings

Drain-source voltage	V_{DS}	200 V
Drain-gate voltage R_{GS} = 20 kΩ	V_{DGR}	200 V
Continuous drain current T_A = 30 °C	I_D	0,28 A
Pulsed drain current T_A = 25 °C	I_{Dpuls}	1,1 A
Gate-source voltage	V_{GS}	± 20 V
Total power dissipation T_A = 25 °C	P_{tot}	1 W
Operating and storage temperature range	T_j T_{stg}	−55 °C … +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125 K/W

Characteristics

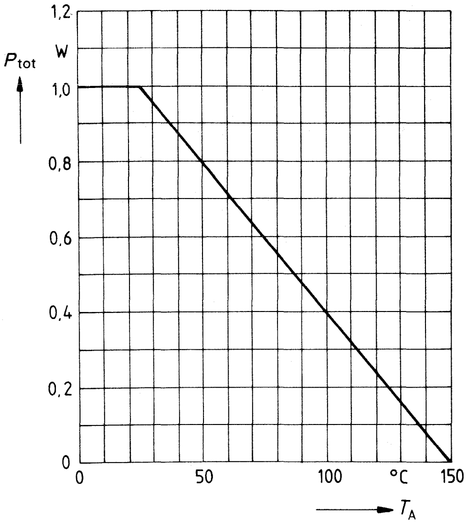
at $T_C = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $V_{GS} = 0\,V$, $I_D = 0{,}5\,mA$	$V_{(BR)\,DSS}$	200	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1\,mA$	$V_{GS\,(th)}$	0,8	2,2	2,8	V
Zero gate voltage drain current $T_j = 25\,°C$ $T_j = 125\,°C$ $V_{DS} = 200\,V$, $V_{GS} = 0\,V$ $T_j = 25\,°C$ $V_{DS} = 60\,V$ $V_{GS} = 0\,V$	I_{DSS}	 – – – – –	 4 8 – – –	 60 200 200 – –	 µA µA nA nA nA
Gate-source leakage current $V_{GS} = 20\,V$, $V_{DS} = 0\,V$	I_{GSS}	–	10	100	nA
Drain-source on-state resistance $V_{GS} = 10\,V$, $I_D = 0{,}4\,A$	$R_{DS\,(on)}$	–	5,5	6,0	Ω

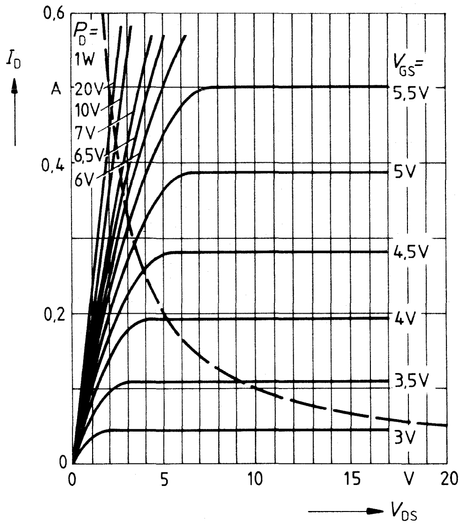
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 25\,V$, $I_D = 0{,}4\,A$	g_{fs}	0,14	0,2	–	S
Input capacitance Output capacitance Reverse transfer capacitance $V_{GS} = 0\,V$, $V_{DS} = 25\,V$, $f = 1\,MHz$	C_{iss} C_{oss} C_{rss}	– – –	110 20 5	– – –	pF pF pF
Turn-on time t_{on} ($t_{on} = t_{d\,(on)} + t_r$) Turn-off time t_{off} ($t_{off} = t_{d\,(off)} + t_f$) $V_{CC} = 30\,V$, $I_D = 0{,}28\,A$ $V_{GS} = 10\,V$, $R_{GS} = 50\,\Omega$	$t_{d\,(on)}$ t_r $t_{d\,(off)}$ t_f	– – – –	15 40 70 40	20 60 90 55	ns ns ns ns

Reverse diode	Symbol	min	typ	max	Unit
Continuous reverse drain current $T_C = 25\,°C$	I_{DR}	–	–	0,28	A
Pulsed reverse drain current $T_C = 25\,°C$	I_{DRM}	–	–	1,1	A
Diode forward on-voltage $I_F = 2 \times I_{DR}$, $V_{GS} = 0\,V$, $T_j = 25\,°C$	V_{SD}	–	1,0	1,4	V
Reverse recovery time Reverse recovery charge $T_j = 25\,°C$, $I_F = I_{DR}$, $d_{iF/dt} = 100\,A/\mu s$	t_{rr} Q_{rr}	– –	– –	– –	ns µC

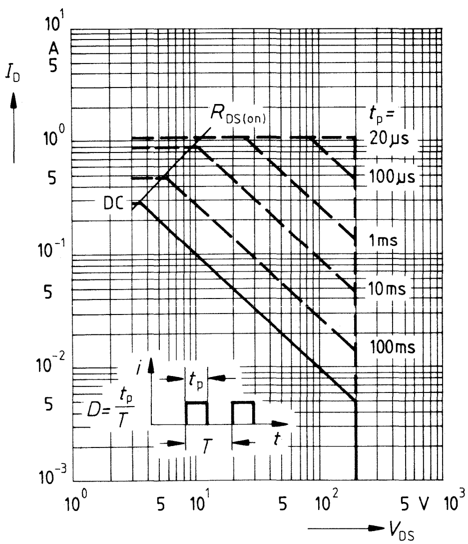
Total power dissipation $P_{tot} = f(T_A)$



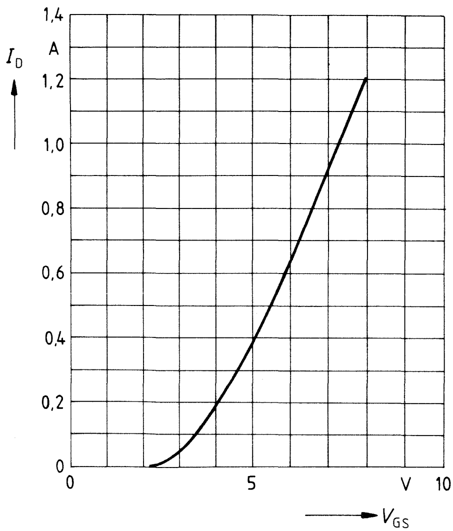
Typical output characteristics $I_D = f(V_{DS})$
parameter: 80 µs pulse test,
$T_j = 25\,°C$



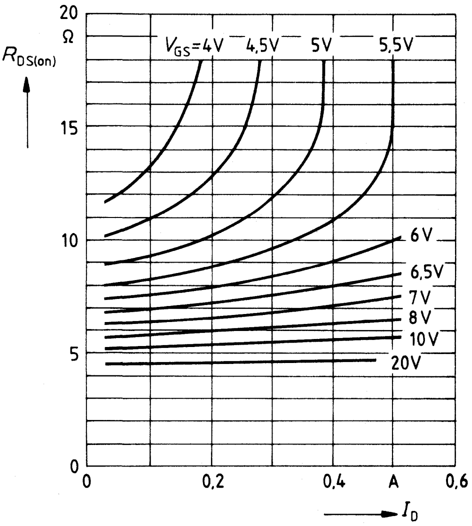
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0{,}01$, $T_c = 25\,°C$



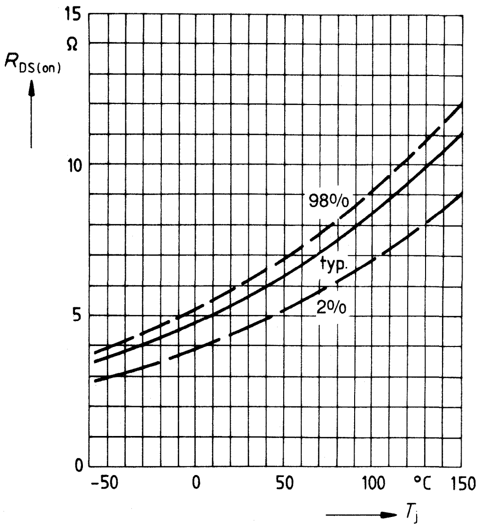
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: 80 µs pulse test,
$V_{DS} = 25\,V$, $T_j = 25\,°C$



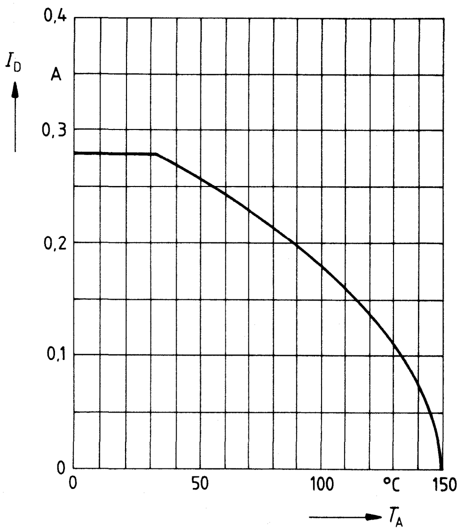
Typical drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}; $T_j = 25\,°C$



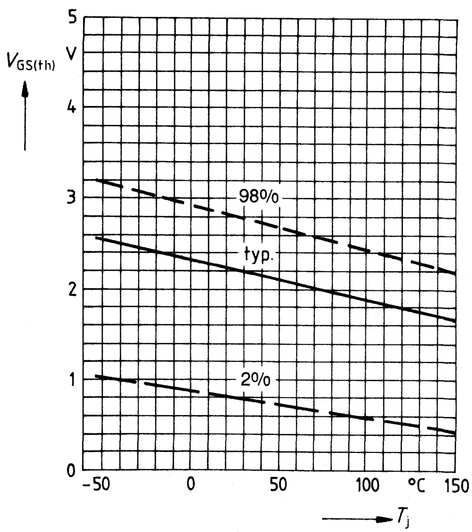
Drain-source on-state resistance $R_{DS(on)} = f(T_j)$
(spread)
$I_D = 0{,}4$ A, $V_{GS} = 10$ V



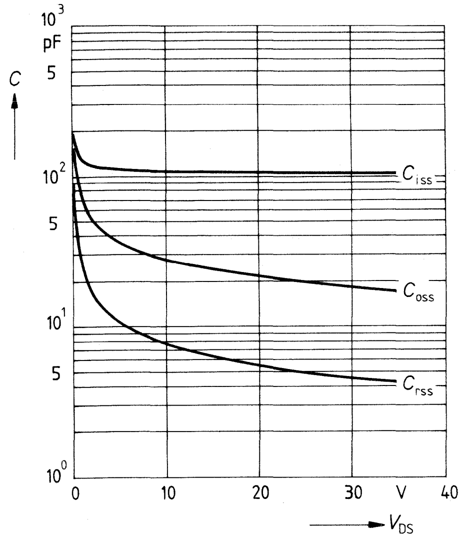
Continuous drain current $I_D = f(T_A)$



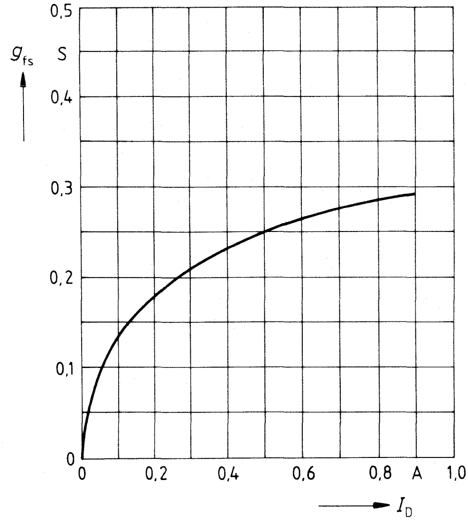
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA



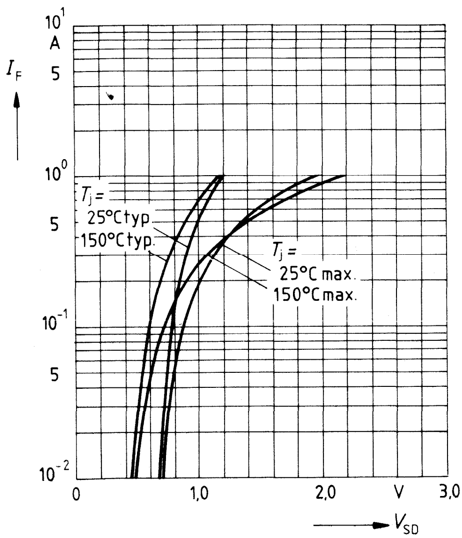
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Typical transconductance $g_{fs} = f(I_D)$
parameter: 80 µs pulse test,
$V_{DS} = 25$ V, $T_j = 25$ °C

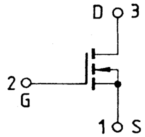


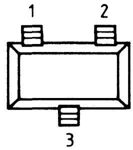
Forward characteristic of reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs



MOSFET in N channel enhancement mode

- Drain-source voltage V_{DS} = 100 V
- Continuous drain current I_D = 0,17 A
- Drain-source on-resistance $R_{DS(on)}$ = 5,0 Ω





Top view

Type	Marking	Ordering code	Package
BSS 123	SA	Refer to index	Version A

Maximum ratings

Drain-source voltage	V_{DS}	100 V
Drain-gate voltage R_{GS} = 20 kΩ	V_{DGR}	100 V
Continuous drain current T_{SR} = 60 °C	I_D	0,16 A
Pulsed drain current T_{SR} = 25 °C	I_{Dpuls}	0,68 A
Gate-source voltage	V_{GS}	± 20 V
Total power dissipation T_A = 25 °C	P_{tot}	0,33 W
Operating and storage temperature range	T_j T_{stg}	– 55 °C … + 150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W

Characteristics

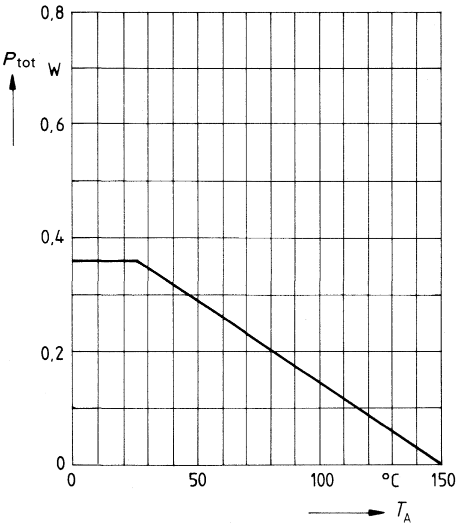
at $T_C = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $V_{GS} = 0$ V, $I_D = 0{,}5$ mA	$V_{(BR)\,DSS}$	100	–	–	V
Gate threshold voltage $V_{DS} = V_{GS}$, $I_D = 1$ mA	$V_{GS\,(th)}$	0,8	2,2	2,8	V
Zero gate voltage drain current	I_{DSS}				
$T_j = 25\,°C$		–	1	15	µA
$T_j = 125\,°C$		–	2	60	µA
$V_{DS} = 100$ V, $V_{GS} = 0$ V					
$T_j = 25\,°C$		–	–	10	nA
$V_{DS} = 20$ V		–	–	–	nA
$V_{GS} = 0$ V		–	–	–	nA
Gate-source leakage current $V_{GS} = 20$ V, $V_{DS} = 0$ V	I_{GSS}	–	10	50	nA
Drain-source on-state resistance $V_{GS} = 10$ V, $I_D = 100$ mA	$R_{DS\,(on)}$	–	5,0	6,0	Ω

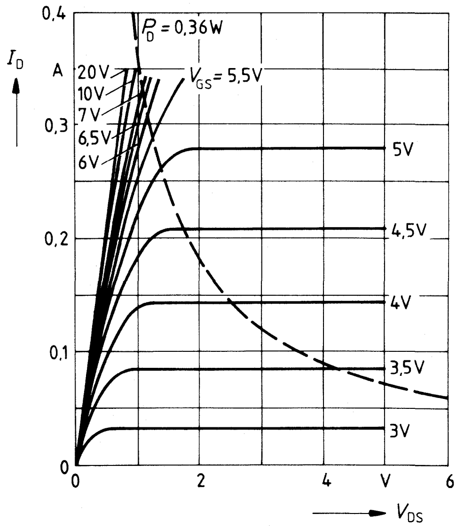
Dynamic characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 25$ V, $I_D = 100$ mA	g_{fs}	0,08	0,12	–	S
Input capacitance	C_{iss}	–	20	–	pF
Output capacitance	C_{oss}	–	9	–	pF
Reverse transfer capacitance $V_{GS} = 0$ V, $V_{DS} = 25$ V, $f = 1$ MHz	C_{rss}	–	4	–	pF
Turn-on time t_{on}	$t_{d\,(on)}$	–	10	–	ns
($t_{on} = t_{d\,(on)} + t_r$)	t_r	–	10	–	ns
Turn-off time t_{off}	$t_{d\,(off)}$	–	15	–	ns
($t_{off} = t_{d\,(off)} + t_f$) $V_{CC} = 30$ V, $I_D = 0{,}28$ A $V_{GS} = 10$ V, $R_{GS} = 50\,\Omega$	t_f	–	25	–	ns

Reverse diode	Symbol	min	typ	max	Unit
Continuous reverse drain current $T_C = 25\,°C$	I_{DR}	–	–	0,17	A
Pulsed reverse drain current $T_C = 25\,°C$	I_{DRM}	–	–	0,68	A
Diode forward on-voltage $I_F = 2 \times I_{DR}$, $V_{GS} = 0$ V, $T_j = 25\,°C$	V_{SD}	–	1,1	1,3	V
Reverse recovery time	t_{rr}	–	–	–	ns
Reverse recovery charge $T_j = 25\,°C$, $I_F = I_{DR}$, $d_{iF/dt} = 100$ A/µs	Q_{rr}	–	–	–	µC

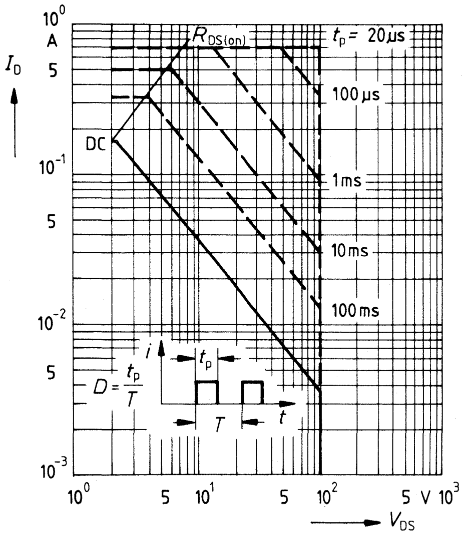
Total power dissipation $P_{tot} = f(T_A)$



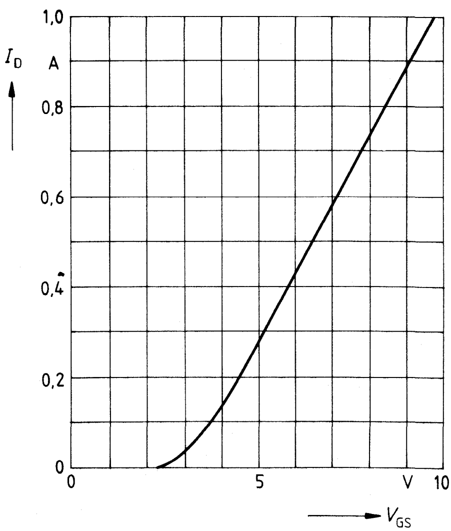
Typical output characteristics $I_D = f(V_{DS})$
parameter: 80 µs pulse test,
$T_j = 25\,°C$



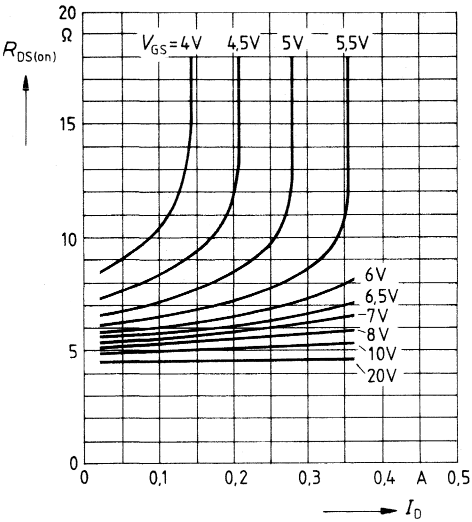
Safe operating area $I_D = f(V_{DS})$
parameter: $D = 0{,}01$, $T_c = 25\,°C$



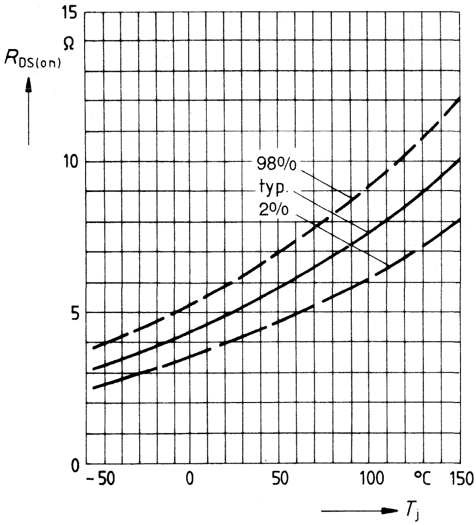
Typical transfer characteristic $I_D = f(V_{GS})$
parameter: 80 µs pulse test,
$V_{DS} = 25$ V, $T_j = 25\,°C$



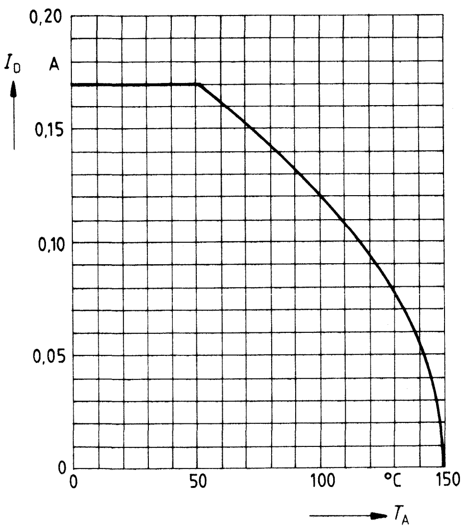
Typical drain-source on-state resistance
$R_{DS\,(on)} = f(I_D)$
parameter: V_{GS}; $T_j = 25\,°C$



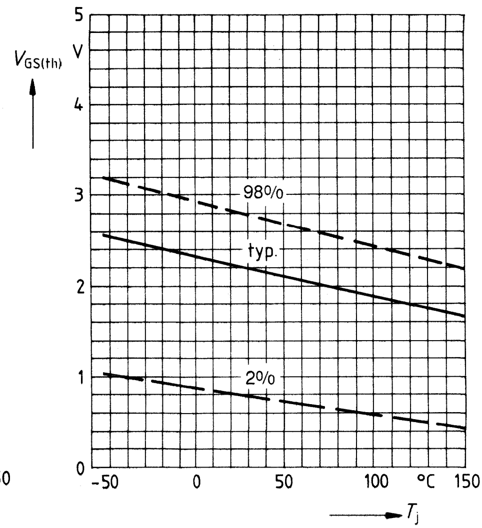
Drain-source on-state resistance $R_{DS\,(on)} = f(T_j)$
(spread)
$I_D = 100$ mA, $V_{GS} = 10$ V



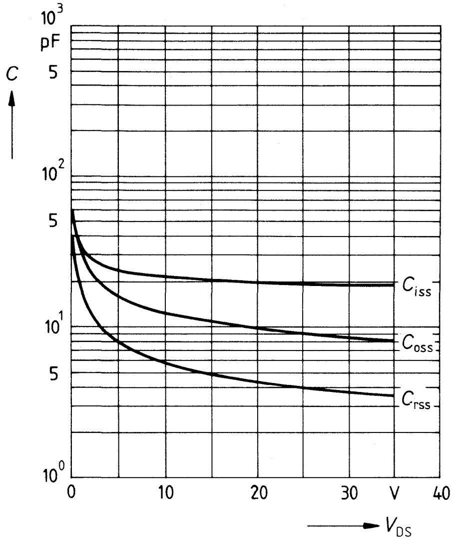
Continuous drain current $I_D = f(T_A)$



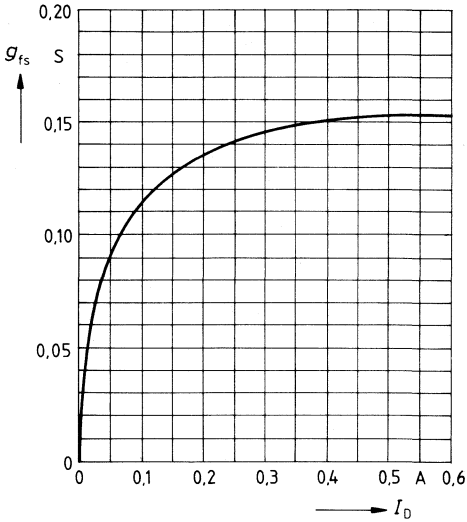
Gate threshold voltage $V_{GS\,(th)} = f(T_j)$
parameter: $V_{DS} = V_{GS}$, $I_D = 1$ mA



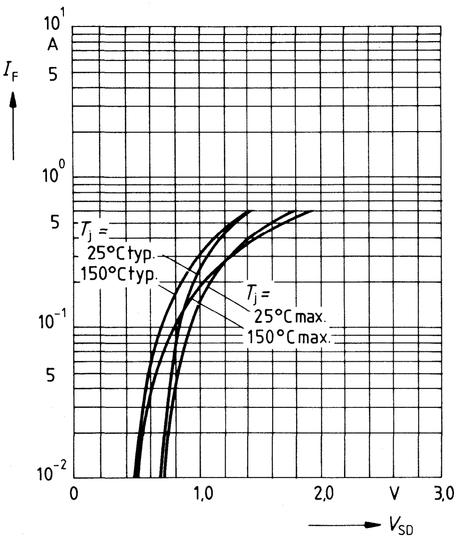
Typical capacitances $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Typical transconductance $g_{fs} = f(I_D)$
parameter: 80 µs pulse test,
$V_{DS} = 25$ V, $T_j = 25$ °C

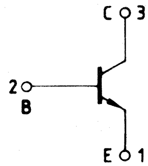


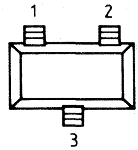
Forward characteristic of reverse diode $I_F = f(V_{SD})$
parameter: T_j, $t_p = 80$ µs



NPN silicon planar epitaxial transistors

- High DC current gain: 0.1 ⋯ 500 mA
- Low collector-emitter saturation voltage
- Complementary PNP types: SMBT 2907, SMBT 2907 A





Top view

Type	Marking	Ordering code	Package
SMBT 2222	SB	Refer to index	Version A
SMBT 2222 A	SC		

Maximum ratings		SMBT 2222	SMBT 2222 A
Collector-emitter voltage	V_{CEO}	30 V	40 V
Collector-base voltage	V_{CBO}	60 V	75 V
Emitter-base voltage	V_{EBO}	5 V	6 V
Collector current	I_C	600 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	– 65 ⋯ + 150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

at $T_A = 25\,°C$, unless otherwise specified

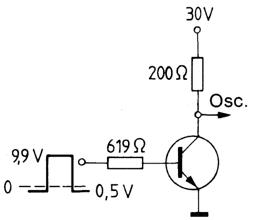
Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	SMBT 2222		30	–	–	V
	SMBT 2222 A		40	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10\,\mu A$	SMBT 2222		60	–	–	V
	SMBT 2222 A		75	–	–	V
Emitter-base breakdown voltage		$V_{(BR)\,EBO}$				
$I_E = 10\,\mu A$	SMBT 2222		5	–	–	V
	SMBT 2222 A		6	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 50$ V	SMBT 2222		–	–	10	nA
$V_{CB} = 60$ V	SMBT 2222 A		–	–	10	nA
$V_{CB} = 50$ V, $T_A = 150\,°C$	SMBT 2222		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	SMBT 2222 A		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	10	nA
DC current gain		h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 10$ V			35	–	–	–
$I_C = 1$ mA, $V_{CE} = 10$ V			50	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]			75	–	–	–
$I_C = 150$ mA, $V_{CE} = 1$ V[1]			50	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1]			100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1]	SMBT 2222		30	–	–	–
	SMBT 2222 A		40	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V, $T_A = 55\,°C$	SMBT 2222 A		35	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA	SMBT 2222		–	–	0,4	V
	SMBT 2222 A		–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA	SMBT 2222		–	–	1,6	V
	SMBT 2222 A		–	–	1,0	V
Base-emitter saturation voltage[1]		V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA	SMBT 2222		–	–	1,3	V
	SMBT 2222 A		0,6	–	1,2	V
$I_C = 500$ mA, $I_B = 50$ mA	SMBT 2222		–	–	2,6	V
	SMBT 2222 A		–	–	2,0	V

[1]) Pulse test: $t = 300\,\mu s$, D = 2%.

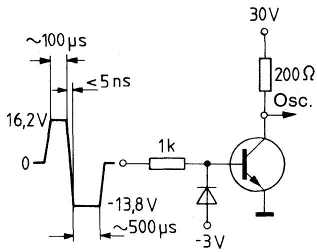
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz SMBT 2222 SMBT 2222 A	f_T	 250 300	 – –	 – –	 MHz MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	–	8	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz SMBT 2222 SMBT 2222 A	C_{ib}	 – –	 – –	 30 25	 pF pF
Short-circuit input impedance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{11e}	 2,0 0,25	 – –	 8,0 1,25	 kΩ kΩ
Open-circuit reverse voltage transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{12e}	 – –	 – –	 8,0 4,0	 10^{-4} 10^{-4}
Short-circuit forward current transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{21e}	 50 75	 – –	 300 375	 – –
Open-circuit output admittance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{22e}	 5,0 25	 – –	 35 200	 µS µS
Collector-base time constant I_E = 20 mA, V_{CB} = 10 V, f = 31,8 MHz SMBT 2222 A	$r_b'C_C$	–	–	150	ps
Noise figure I_C = 100 µA, V_{CE} = 10 V, R_G = 1 kΩ f = 1 kHz SMBT 2222 A	NF	–	–	4,0	dB

Dynamic characteristics	Symbol	min	typ	max	Unit
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 15$ mA					
$V_{BE(off)} = 0{,}5$ V					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	25	ns
$V_{CC} = 30$ V, $I_C = 150$ mA,					
$I_{B1} = I_{B2} = 15$ mA					
Storage time	t_s	–	–	225	ns
Fall time	t_f	–	–	60	ns

Test circuit for delay time and rise time

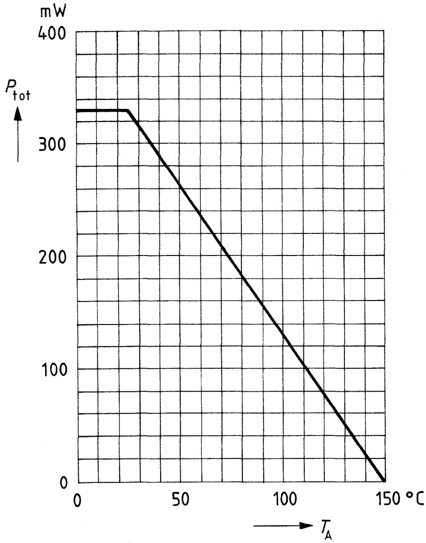


Test circuit for storage time and fall time

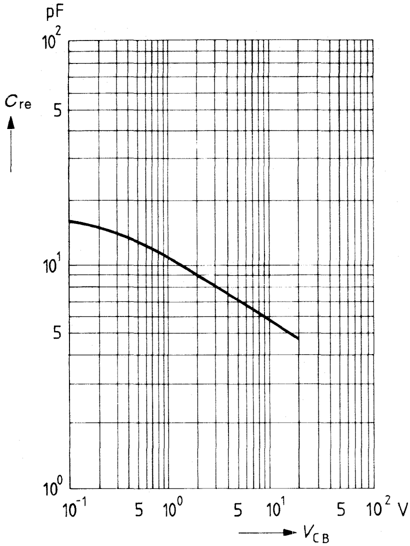


Oscillograph: $R > 100$ kΩ
$C < 12$ pF
$t_r < 5$ ns

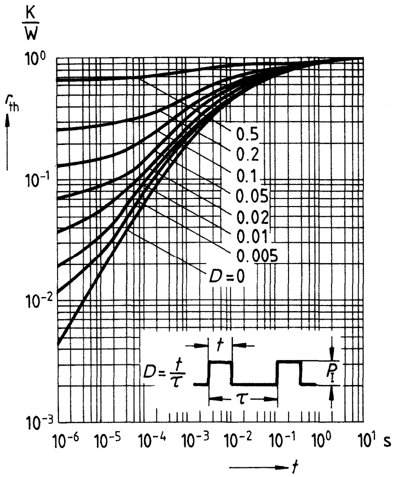
Total power dissipation $P_{tot} = f(T_A)$



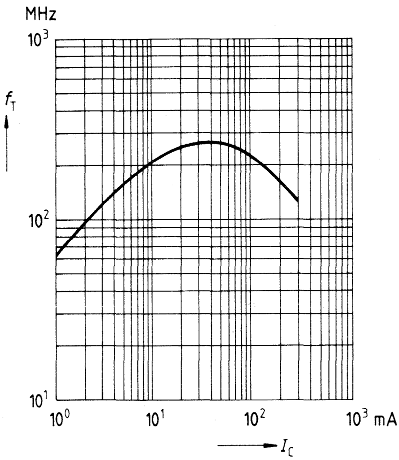
Collector-base feedback capacitance
$C_{re} = f(V_{CB})$
$f = 1$ MHz



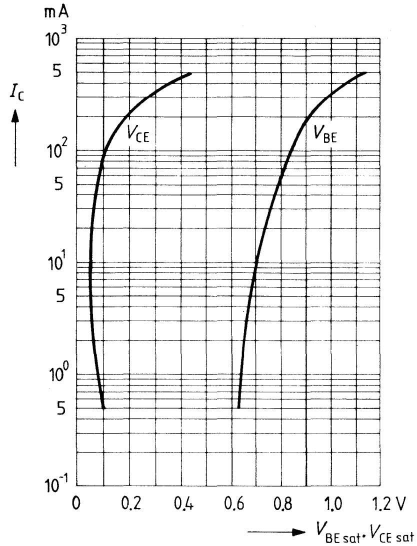
Pulse handling capability $r_{th} = f(t)$
(standardized)



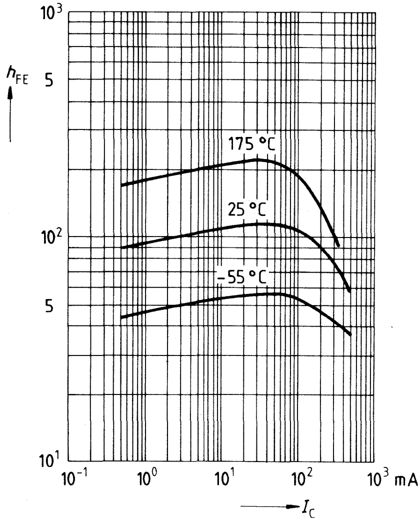
Transition frequency $f_T = f(I_C)$
$C_{CE} = 20$ V



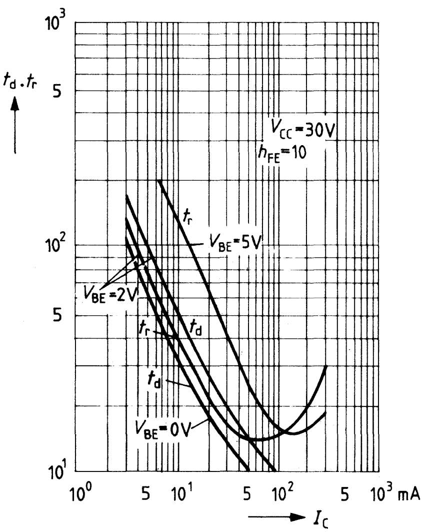
Saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$ $V_{CE\,sat} = f(I_C)$



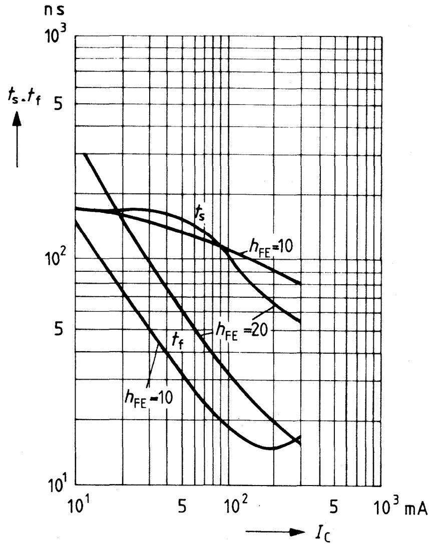
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



Turn-on time $t_d = f(I_C)$
$t_r = f(I_C)$

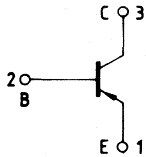


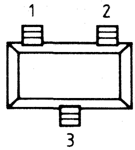
Storage time $t_s = f(I_C)$
Fall time $t_f = f(I_C)$



PNP silicon planar epitaxial transistors

- High DC current gain: 0.1 ··· 500 mA
- Low collector-emitter saturation voltage
- Complementary NPN types: SMBT 2222, SMBT 2222 A





Top view

Type	Marking	Ordering code	Package
SMBT 2907	SD	Refer to index	Version A
SMBT 2907 A	SE		

Maximum ratings		SMBT 2907	SMBT 2907 A
Collector-emitter voltage	V_{CEO}	40 V	60 V
Collector-base voltage	V_{CBO}	60 V	
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	600 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	−65 ··· +150 °C	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W	

Characteristics

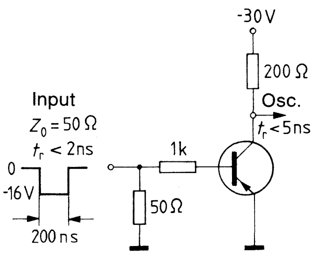
at T_A = 25 °C, unless otherwise specified

Static characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CE0}$				
I_C = 10 mA	SMBT 2907		40	–	–	V
	SMBT 2907 A		60	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CB0}$				
I_C = 10 µA	SMBT 2907		60	–	–	V
	SMBT 2907 A		60	–	–	V
Emitter-base breakdown voltage I_E = 10 µA		$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current		I_{CB0}				
V_{CB} = 50 V	SMBT 2907		–	–	20	nA
V_{CB} = 50 V	SMBT 2907 A		–	–	10	nA
V_{CB} = 50 V, T_A = 150 °C	SMBT 2907		–	–	20	µA
V_{CB} = 50 V, T_A = 150 °C	SMBT 2907 A		–	–	10	µA
Emitter cutoff current V_{EB} = 3 V		I_{EB0}	–	–	10	nA
DC current gain		h_{FE}				
I_C = 100 µA, V_{CE} = 10 V	SMBT 2907		35	–	–	–
	SMBT 2907 A		75	–	–	–
I_C = 1 mA, V_{CE} = 10 V	SMBT 2907		50	–	–	–
	SMBT 2907 A		100	–	–	–
I_C = 10 mA, V_{CE} = 10 V[1]	SMBT 2907		75	–	–	–
	SMBT 2907 A		100	–	–	–
I_C = 150 mA, V_{CE} = 10 V[1]	SMBT 2907		100	–	300	–
	SMBT 2907 A		100	–	300	–
I_C = 500 mA, V_{CE} = 10 V[1]	SMBT 2907		30	–	–	–
	SMBT 2907 A		50	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
I_C = 150 mA, I_B = 15 mA			–	–	0,4	V
I_C = 500 mA, I_B = 50 mA			–	–	1,6	V
Base-emitter saturation voltage[1]		V_{BEsat}				
I_C = 150 mA, I_B = 15 mA			–	–	1,3	V
I_C = 500 mA, I_B = 50 mA			–	–	2,6	V

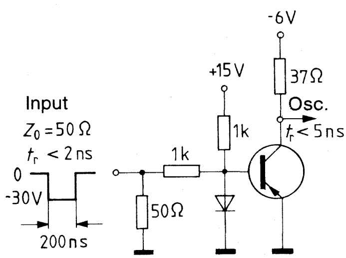
[1]) Pulse test: t = 300 µs, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	f_T	200	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	–	8	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz	C_{ib}	–	–	30	pF
V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA Delay time Rise time	 t_d t_r	 – –	 – –	 10 40	 ns ns
V_{CC} = 6 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA Storage time Fall time	 t_s t_f	 – –	 – –	 80 30	 ns ns

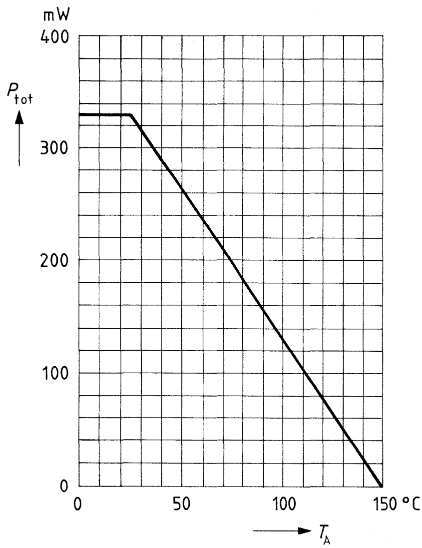
Test circuit for delay time and rise time



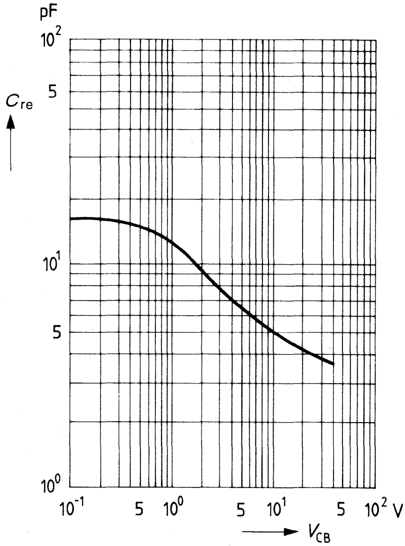
Test circuit for storage time and fall time



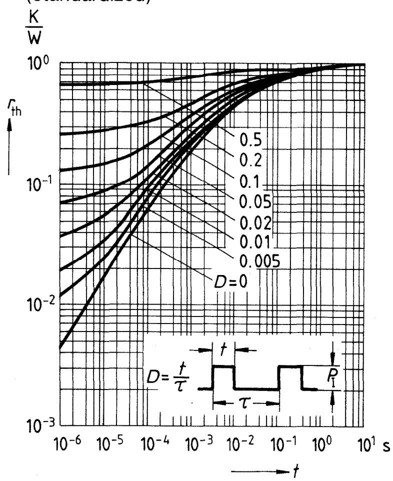
Total power dissipation $P_{tot} = f(T_A)$



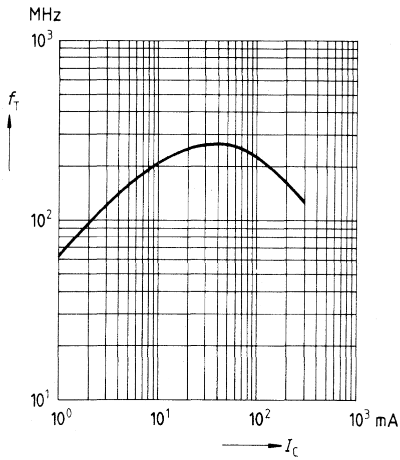
Collector-base feedback capacitance
$C_{re} = f(V_{CB})$
f = 1 MHz



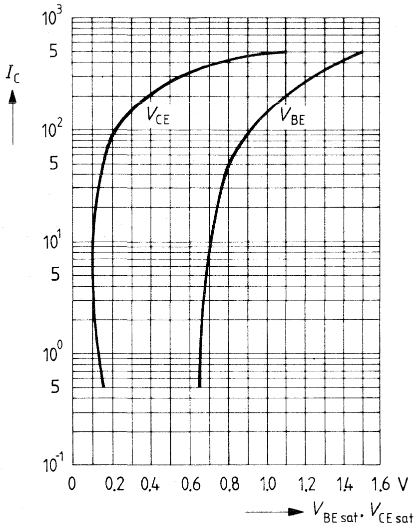
Pulse handling capability $r_{th} = f(t)$
(standardized)



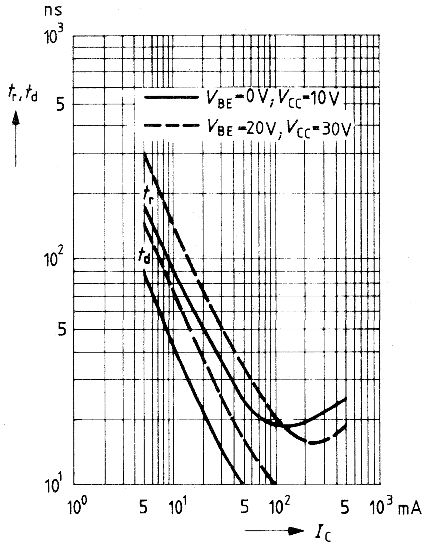
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V



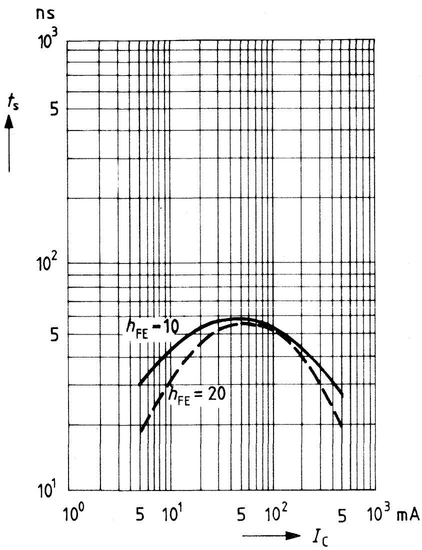
Saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$ $V_{CE\,sat} = f(I_C)$



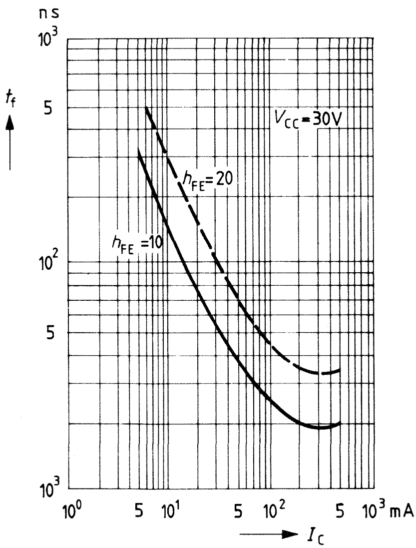
Turn-on time t_r, $t_d = f(I_C)$



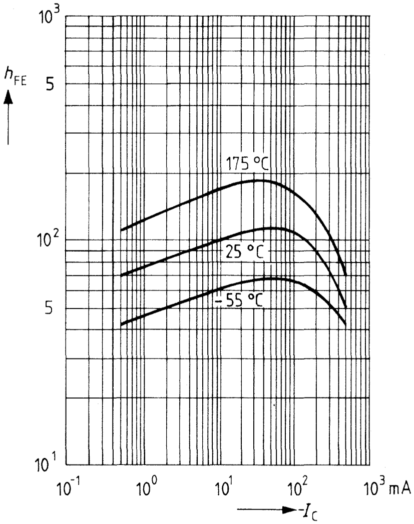
Storage time $t_s = f(I_C)$



Fall time $t_f = f(I_C)$

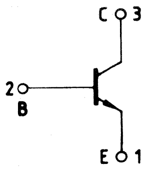


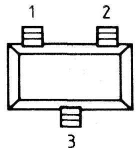
DC current gain $h_{FE} = f(I_C)$



NPN silicon planar epitaxial transistor

- High DC current gain: 0.1 ··· 100 mA
- Low collector-emitter saturation voltage
- Complementary PNP type: SMBT 3906





Top view

Type	Marking	Ordering code	Package
SMBT 3904	SN	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	40 V
Collector-base voltage	V_{CBO}	60 V
Emitter-base voltage	V_{EBO}	6 V
Collector current	I_C	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W

Characteristics

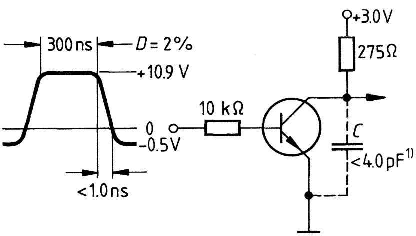
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CB0}$	60	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EB0}$	6	–	–	V
Collector cutoff current $V_{CB} = 30$ V	I_{CB0}	–	–	50	nA
DC current gain $I_C = 100\ \mu A$, $V_{CE} = 1$ V $I_C = 1$ mA, $V_{CE} = 1$ V $I_C = 10$ mA, $V_{CE} = 1$ V[1] $I_C = 50$ mA, $V_{CE} = 1$ V[1] $I_C = 100$ mA, $V_{CE} = 1$ V[1]	h_{FE}	 40 70 100 60 30	 – – – – –	 – – 300 – –	 – – – – –
Collector-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	 – –	 – –	 0,2 0,3	 V V
Base-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA, $I_B = 5$ mA	V_{BEsat}	 0,65 –	 – –	 0,85 0,95	 V V

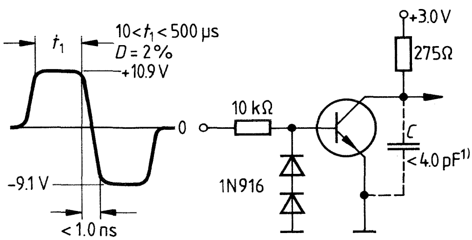
[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	300	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{ob}	–	–	4	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz	C_{ib}	–	–	8	pF
Short-circuit input impedance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{11e}	1,0	–	10	kΩ
Open-circuit reverse voltage transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{12e}	0,5	–	8,0	10^{-4}
Short-circuit forward current transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{21e}	100	–	400	–
Open-circuit output admittance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{22e}	1,0	–	40	µS
Noise figure I_C = 100 µA, V_{CE} = 5 V, R_G = 1 kΩ f = 1 kHz	NF	–	–	5,0	dB
V_{CC} = 3 V, I_C = 10 mA, I_{B1} = 1 mA $V_{BE\,(off)}$ = 0,5 V					
Delay time	t_d	–	–	35	ns
Rise time	t_r	–	–	35	ns
V_{CC} = 3 V, I_C = 10 mA, I_{B1} = I_{B2} = 1 mA					
Storage time	t_s	–	–	200	ns
Fall time	t_f	–	–	50	ns

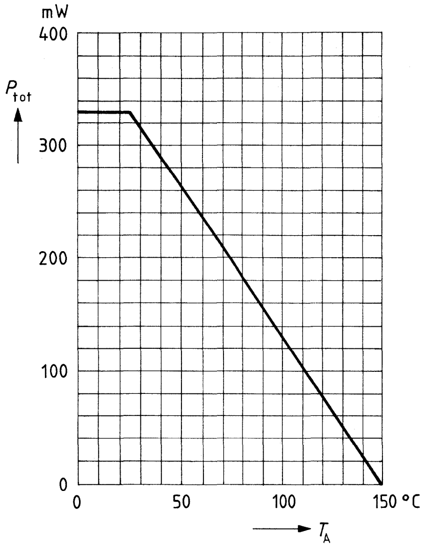
Test circuit for delay time and rise time



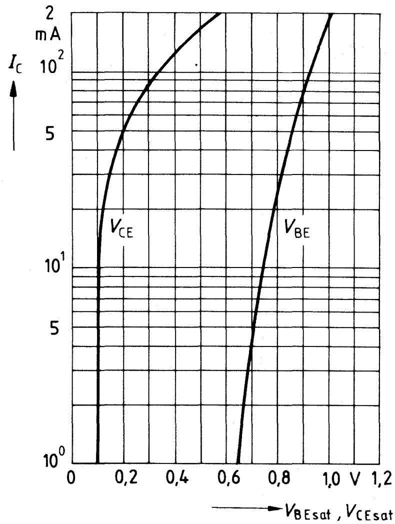
Test circuit for storage time and fall time



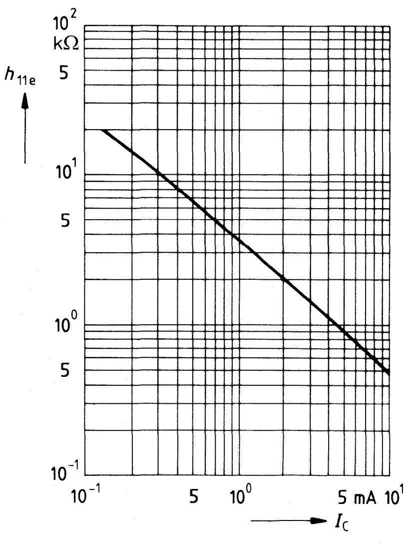
Total power dissipation $P_{tot} = f(T_A)$



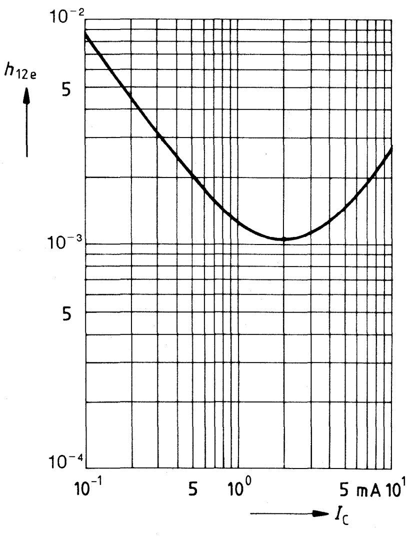
Saturation voltage $V_{BE\,sat} = f(I_C)$
$V_{CE\,sat} = f(I_C)$



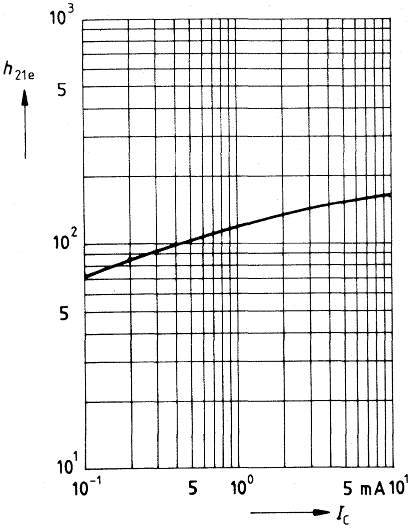
Short-circuit input impedance
$h_{11e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ kHz



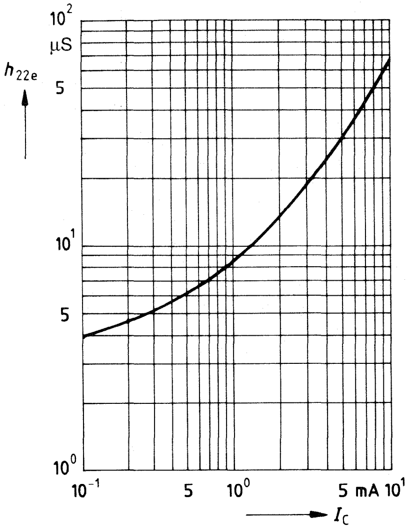
Open-circuit reverse voltage transfer ratio $h_{12e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ kHz



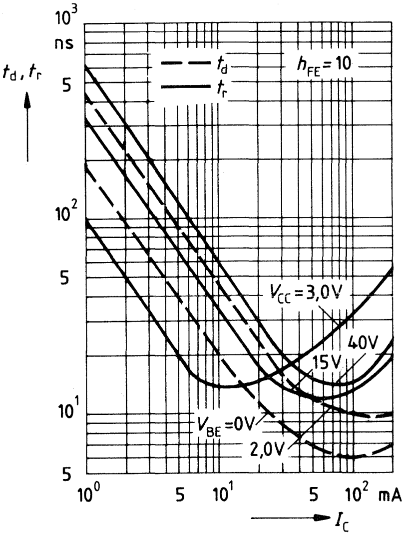
Short-circuit forward current transfer ratio $h_{21e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ MHz



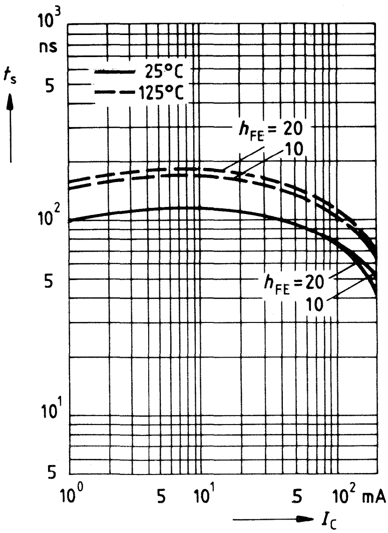
Open-circuit output admittance $h_{22e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ MHz



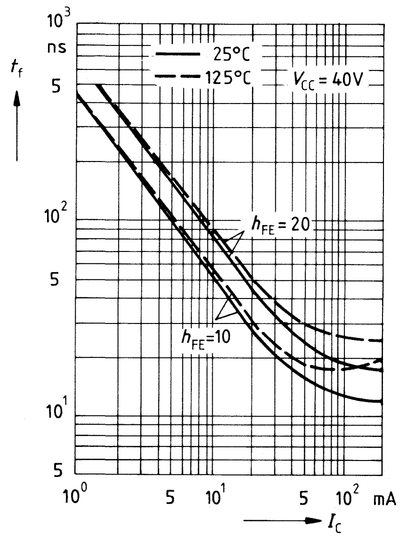
Turn-on time t_d, $t_r = f(I_C)$



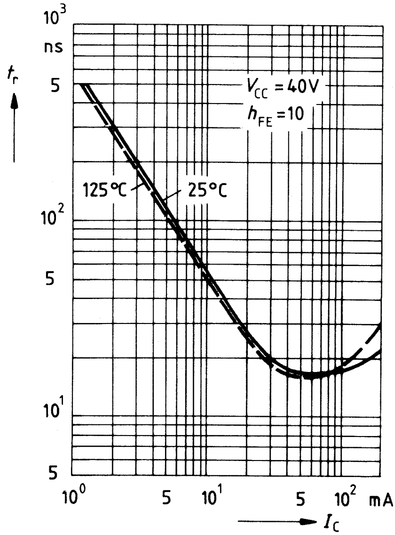
Storage time $t_s = f(I_C)$



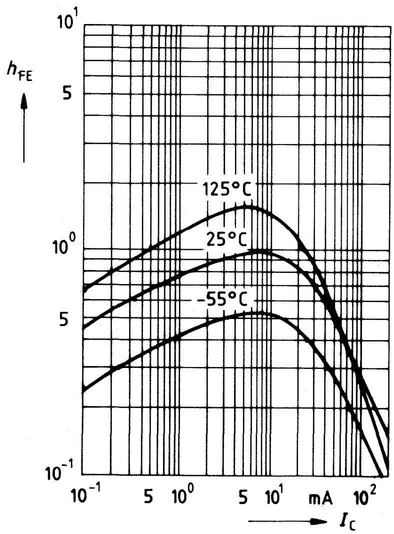
Fall time $t_f = f(I_C)$



Rise time $t_r = f(I_C)$

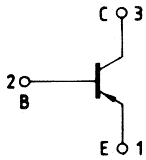


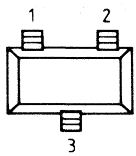
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP silicon planar epitaxial transistor

- High DC current gain: 0.1 ··· 100 mA
- Low collector-emitter saturation voltage
- Complementary NPN type: SMBT 3904





Top view

Type	Marking	Ordering code	Package
SMBT 3906	SO	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	40 V
Collector-base voltage	V_{CBO}	40 V
Emitter-base voltage	V_{EBO}	5 V
Collector current	I_C	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	−65 ··· +150 °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W

Characteristics

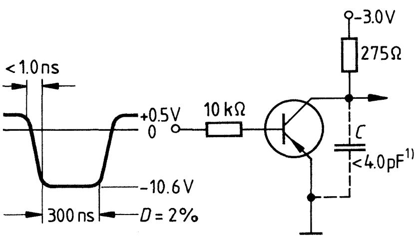
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 30$ V	I_{CBO}	–	–	50	nA
DC current gain	h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 1$ V		60	–	–	–
$I_C = 1$ mA, $V_{CE} = 1$ V		80	–	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V[1])		100	–	300	–
$I_C = 50$ mA, $V_{CE} = 1$ V[1])		60	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V[1])		30	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 10$ mA, $I_B = 1$ mA		–	–	0,25	V
$I_C = 50$ mA, $I_B = 5$ mA		–	–	0,4	V
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 10$ mA, $I_B = 1$ mA		0,65	–	0,85	V
$I_C = 50$ mA, $I_B = 5$ mA		–	–	0,95	V

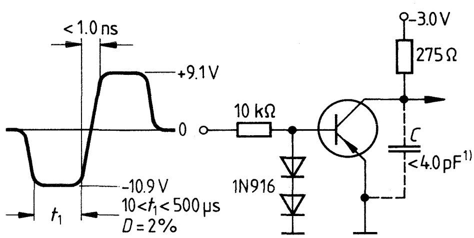
[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	250	–	–	MHz
Output capacitance $V_{CB} = 5$ V, $f = 1$ MHz	C_{ob}	–	–	4,5	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	–	10	pF
Short-circuit input impedance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{11e}	2,0	–	12	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{12e}	0,1	–	10	10^{-4}
Short-circuit forward current transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{21e}	100	–	400	–
Open-circuit output admittance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{22e}	3,0	–	60	µS
Noise figure $I_C = 100$ µA, $V_{CE} = 5$ V, $R_G = 1$ kΩ $f = 1$ kHz	NF	–	–	4,0	dB
$V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = 1$ mA $V_{BE(off)} = 0{,}5$ Vdc					
Delay time	t_d	–	–	35	ns
Rise time	t_r	–	–	35	ns
$V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = I_{B2} = 1$ mA					
Storage time	t_s	–	–	225	ns
Fall time	t_f	–	–	75	ns

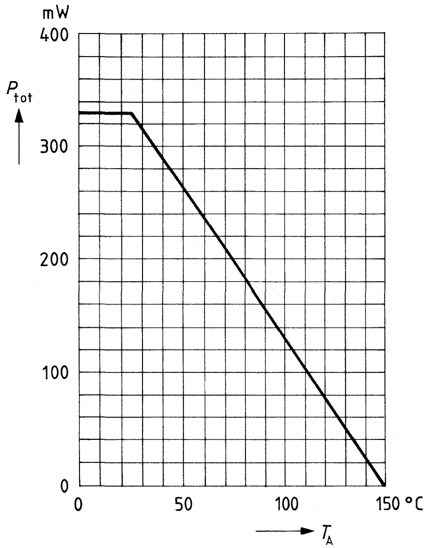
Test circuit for delay time and rise time



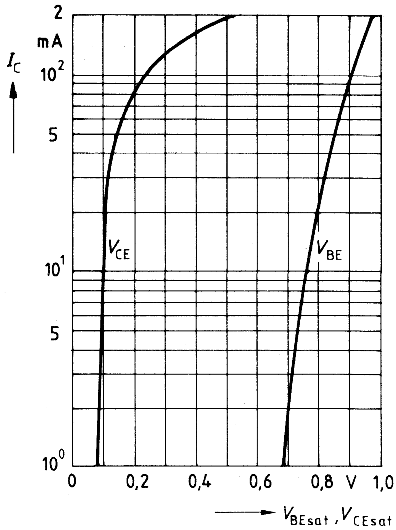
Test circuit for storage time and fall time



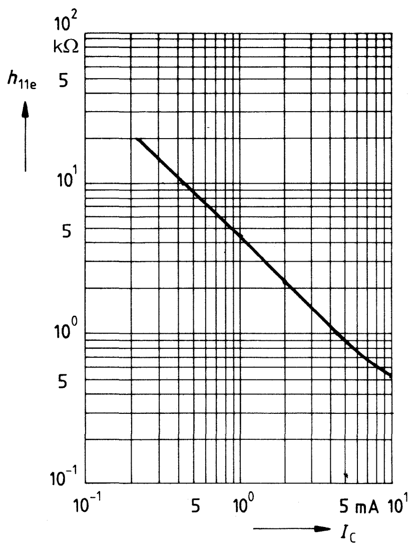
Total power dissipation $P_{tot} = f(T_A)$



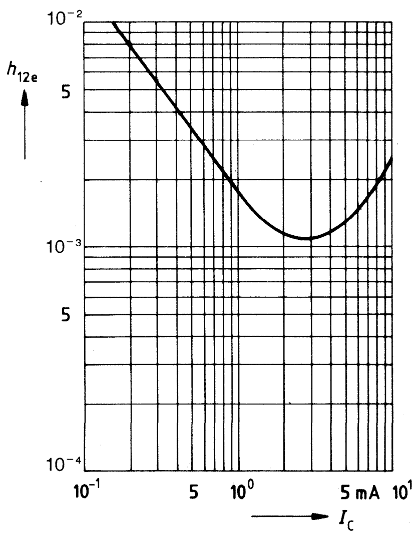
Saturation voltage $V_{BE\,sat} = f(I_C)$
$V_{CE\,sat} = f(I_C)$



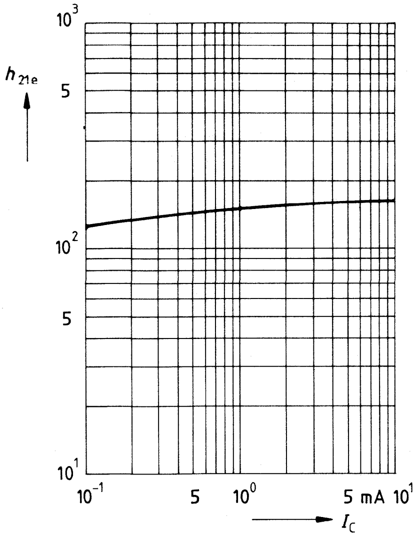
Short-circuit input impedance $h_{11e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ kHz



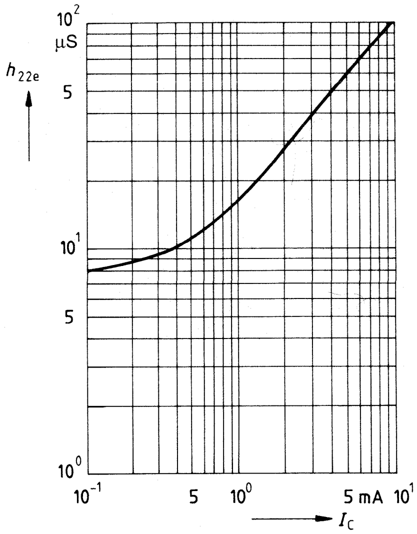
Open-circuit reverse voltage transfer ratio $h_{12e} = f(I_C)$



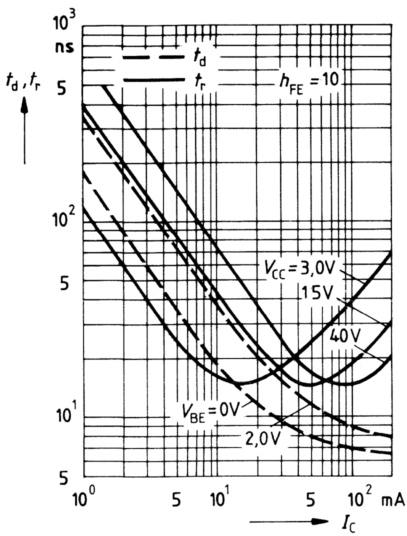
Short-circuit forward current transfer ratio $h_{21e} = f(I_C)$
$V_{CE} = 10\ V$, $f = 1\ MHz$



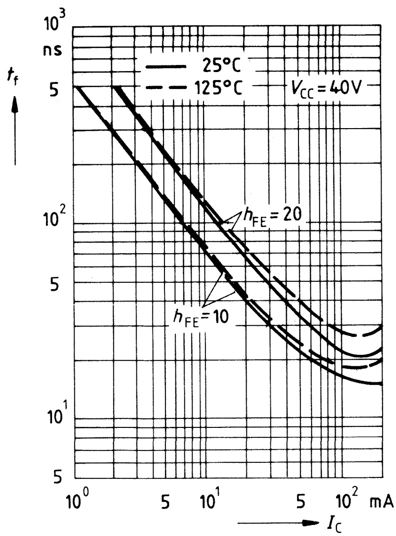
Open-circuit output admittance $h_{22e} = f(I_C)$
$V_{CE} = 10\ V$, $f = 1\ MHz$



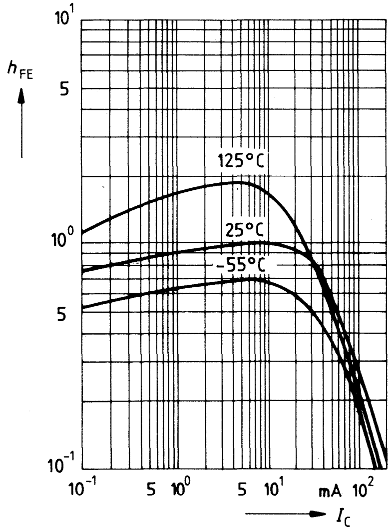
Turn-on time t_d, $t_r = f(I_C)$



Fall time $t_f = f(I_C)$

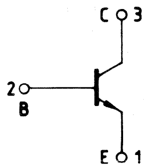


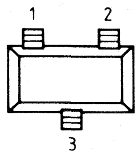
DC current gain $h_{FE} = f(I_C)$



NPN silicon planar epitaxial transistors

- High DC current gain
- High collector current





Top view

Type	Marking	Ordering code	Package
SMBTA 13	SF	Refer to index	Version A
SMBTA 14	SG		

Maximum ratings

Collector-emitter voltage	V_{CE0}	30 V
Collector-base voltage	V_{CB0}	30 V
Emitter-base voltage	V_{EB0}	10 V
Collector current	I_C	300 mA
Peak collector current	I_{CM}	500 mA
Base current	I_B	100 mA
Peak base current	I_{BM}	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W

Characteristics

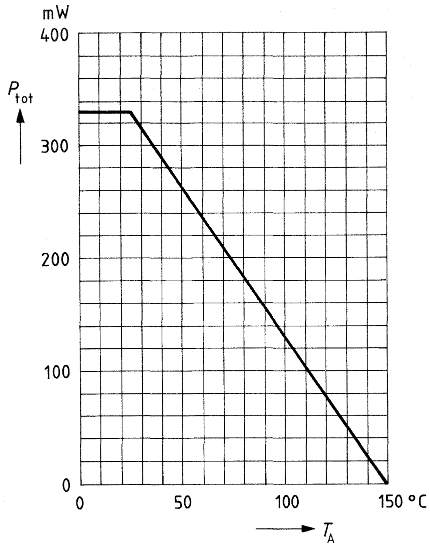
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CEO}$	30	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	30	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current $V_{CB} = 30$ V	I_{CBO}	–	–	100	nA
Emitter cutoff current $V_{EB} = 10$ V	I_{EBO}	–	–	100	nA
DC current gain $I_C = 10$ mA, $V_{CE} = 5$ V[1]) SMBTA 13 SMBTA 14 $I_C = 100$ mA, $V_{CE} = 5$ V[1]) SMBTA 13 SMBTA 14	h_{FE}	 5000 10000 10000 20000	 – – – –	 – – – –	 – – – –
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA	V_{CEsat}	–	–	1,5	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA	V_{BEsat}	–	–	2,0	V

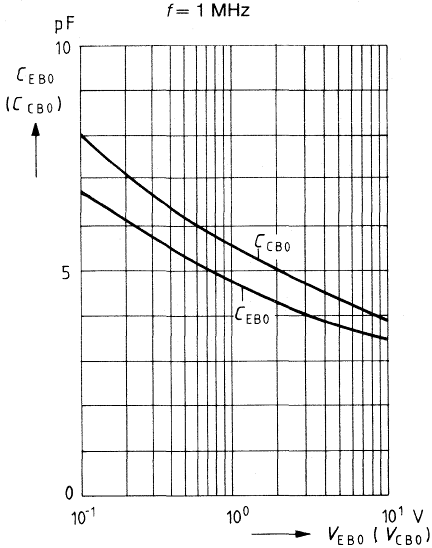
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	125	–	–	MHz

[1]) Pulse test: $t = 300\ \mu s$, D = 2%.

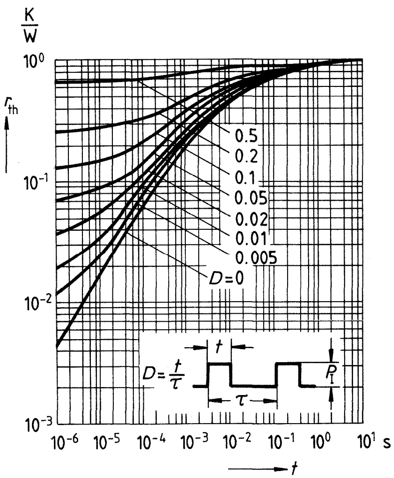
Total power dissipation $P_{tot} = f(T_A)$



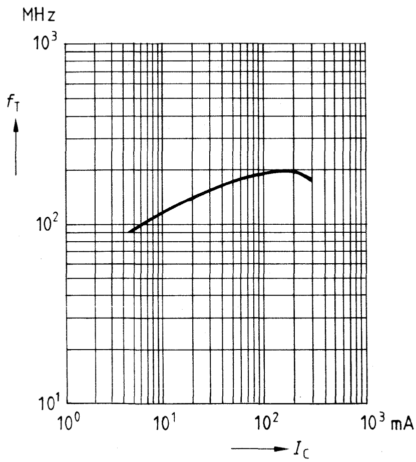
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$
$f = 1$ MHz



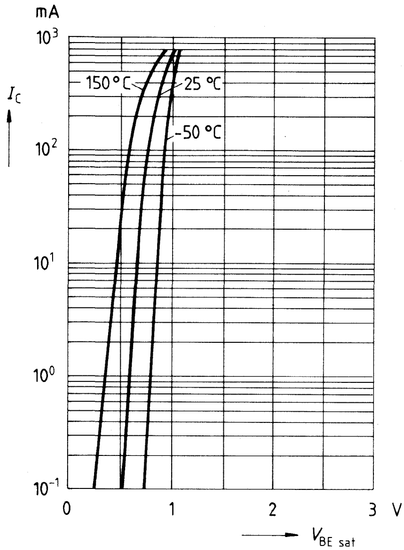
Pulse handling capability $r_{th} = f(t)$
standardized)



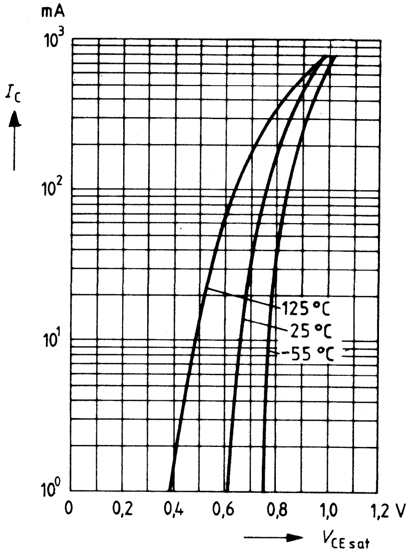
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 20$ MHz



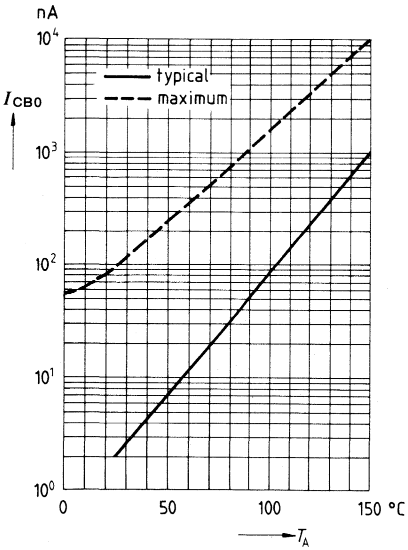
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



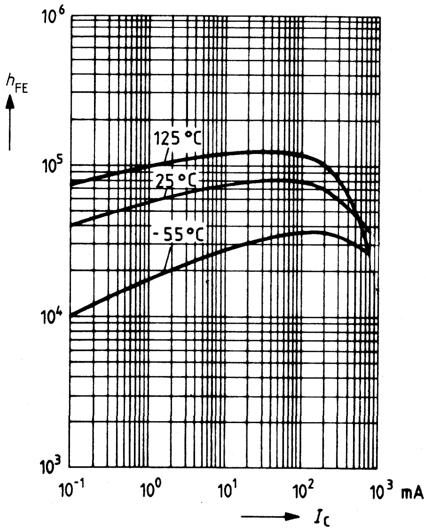
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V

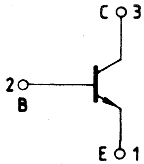


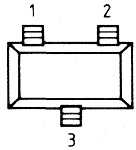
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



NPN silicon planar epitaxial transistor

- High DC current gain
- Low collector-emitter saturation voltage





Top view

Type	Marking	Ordering code	Package
SMBTA 20	SA	Refer to index	Version A

Maximum ratings

Collector-emitter voltage	V_{CEO}	40 V
Emitter-base voltage	V_{EBO}	4 V
Collector current	I_C	100 mA
Peak collector current	I_{CM}	200 mA
Peak base current	I_{BM}	200 mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330 mW
Junction temperature	T_j	150 °C
Storage temperature range	T_{stg}	$-65 \cdots +150$ °C

Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375 K/W

Characteristics

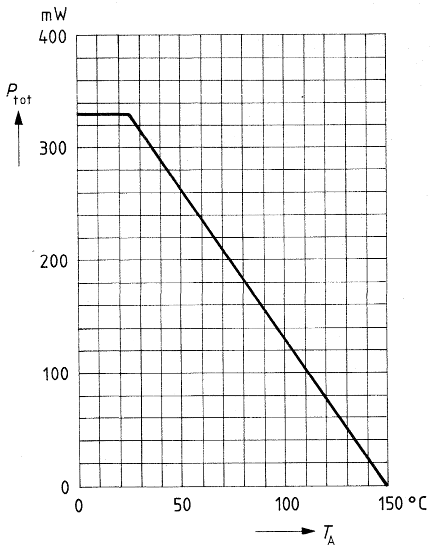
at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)\,CE0}$	40	–	–	V
Emitter-base breakdown voltage I_E = 100 µA	$V_{(BR)\,EB0}$	4	–	–	V
Collector cutoff current V_{CB} = 30 V V_{CB} = 30 V, T_A = 150 °C	I_{CB0}	 – –	 – –	 100 20	 nA µA
Emitter cutoff current V_{EB} = 4 V	I_{EB0}	–	–	20	nA
DC current gain I_C = 5 mA, V_{CE} = 10 V	h_{FE}	40	–	400	–
Collector-emitter saturation voltage[1]) I_C = 10 mA, I_B = 1 mA	V_{CEsat}	–	–	0,25	V

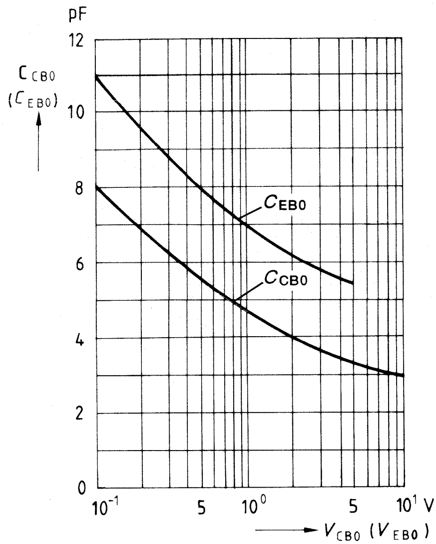
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	125	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	–	4	pF

[1]) Pulse test: t = 300 µs, D = 2%.

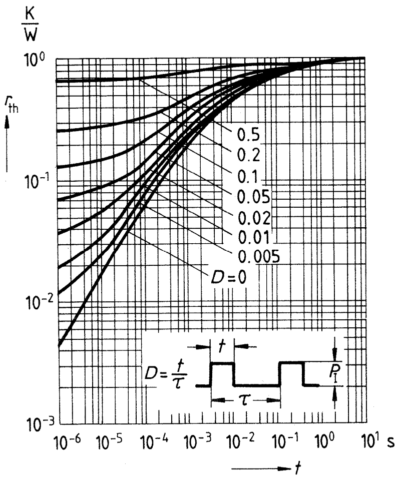
Total power dissipation $P_{tot} = f(T_A)$



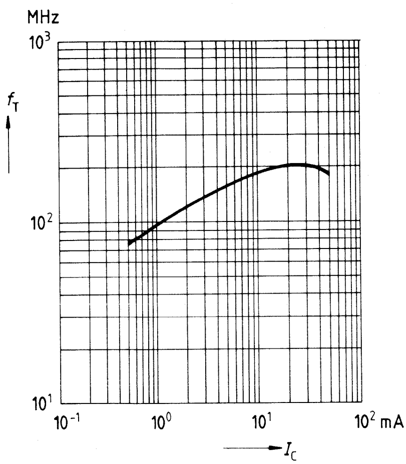
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$
$f = 1$ MHz



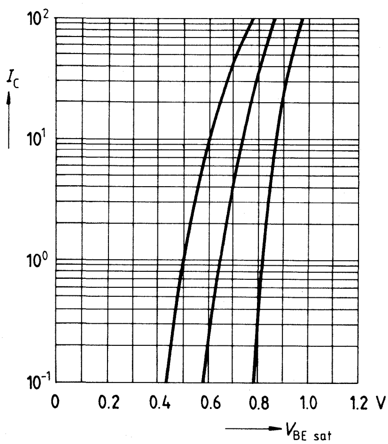
Pulse handling capability $r_{th} = f(t)$
(standardized)



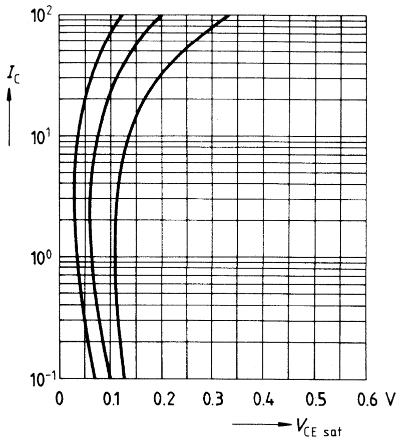
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 100$ MHz



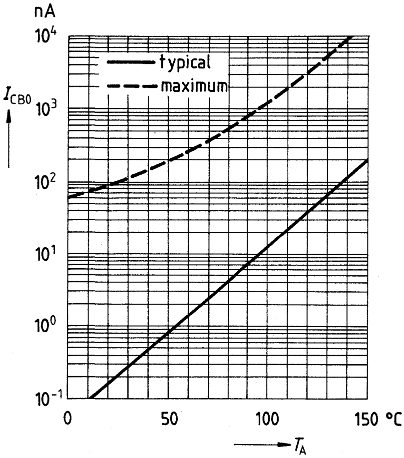
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 20$



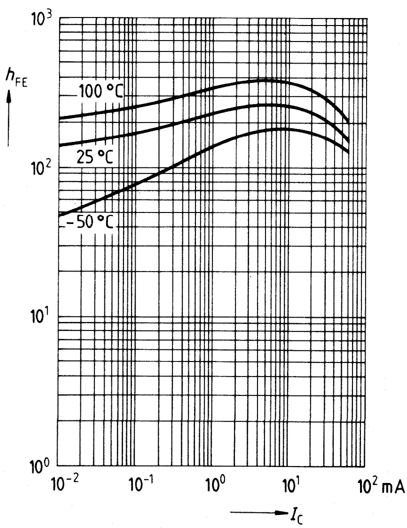
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 20$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V

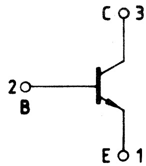


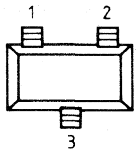
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary PNP types: SMBTA 92, SMBTA 93





Top view

Type	Marking	Ordering code	Package
SMBTA 42	SL	Refer to index	Version A
SMBTA 43	SM		

Maximum ratings		SMBTA 42	SMBTA 43
Collector-emitter voltage	V_{CEO}	300 V	200 V
Collector-base voltage	V_{CBO}	300 V	200 V
Emitter-base voltage	V_{EBO}	6 V	
Collector current	I_C	500 mA	
Base current	I_B	100 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \cdots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W	

Characteristics

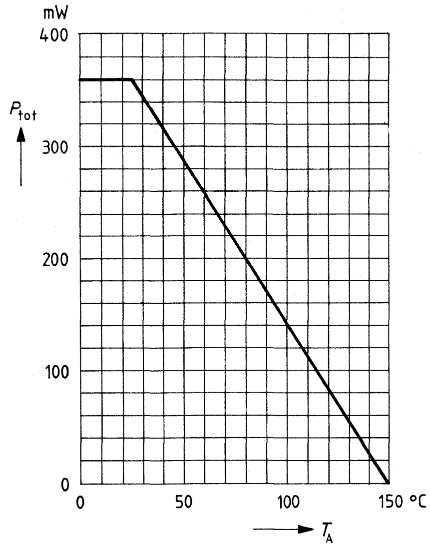
at $T_A = 25\,°C$, unless otherwise specified

Static characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
$I_C = 1$ mA					
SMBTA 42		300	–	–	V
SMBTA 43		200	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
$I_C = 100$ µA					
SMBTA 42		300	–	–	V
SMBTA 43		200	–	–	V
Emitter-base breakdown voltage	$V_{(BR)\,EBO}$	6	–	–	V
$I_E = 100$ µA					
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V SMBTA 42		–	–	100	nA
$V_{CB} = 160$ V SMBTA 43		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$ SMBTA 42		–	–	20	µA
$V_{CB} = 160$ V, $T_A = 150\,°C$ SMBTA 43		–	–	20	µA
Emitter cutoff current	I_{EBO}	–	–	100	nA
$V_{EB} = 3$ V					
DC current gain	h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1])		40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1]) SMBTA 42		40	–	–	–
SMBTA 43		40	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 20$ mA, $I_B = 2$ mA					
SMBTA 42		–	–	0,5	V
SMBTA 43		–	–	0,4	V
Base-emitter saturation voltage[1])	V_{BEsat}	–	–	0,9	V
$I_C = 20$ mA, $I_B = 2$ mA					

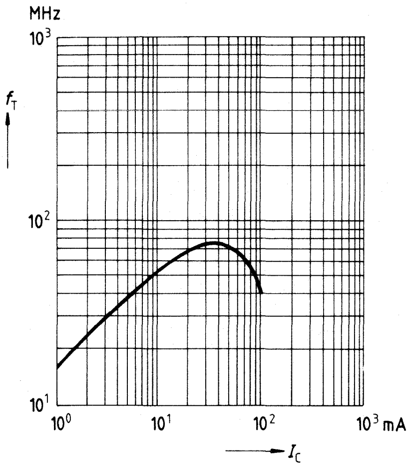
Dynamic characteristics	**Symbol**	**min**	**typ**	**max**	**Unit**
Transition frequency	f_T	50	–	–	MHz
$I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz					
Output capacitance	C_{ob}				
$V_{CB} = 20$ V, $f = 1$ MHz					
SMBTA 42		–	–	3	pF
SMBTA 43		–	–	4	pF

[1]) Pulse test: $t = 300$ µs, D = 2%.

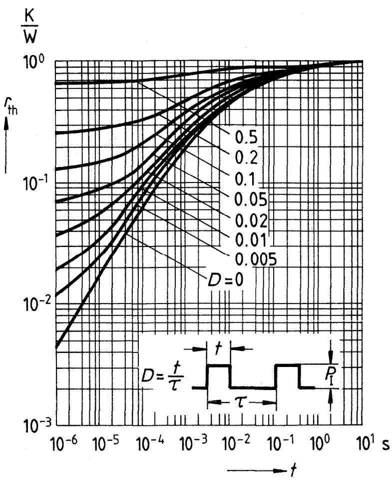
Total power dissipation $P_{tot} = f(T_A)$



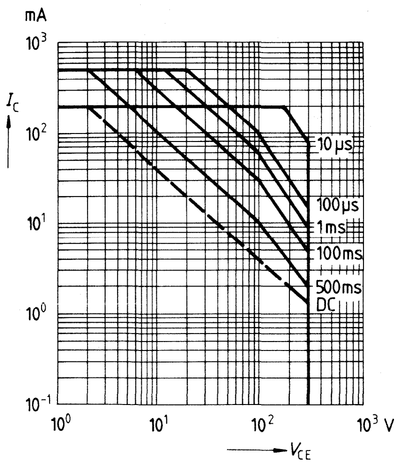
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



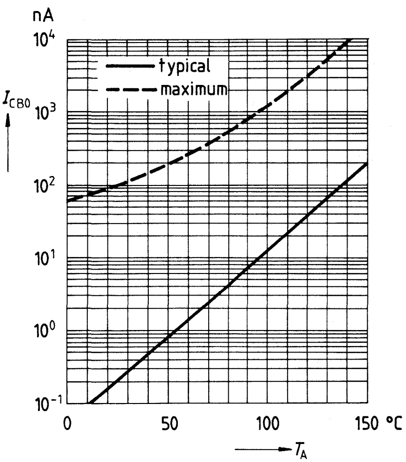
Pulse handling capability $r_{th} = f(t)$
(standardized)



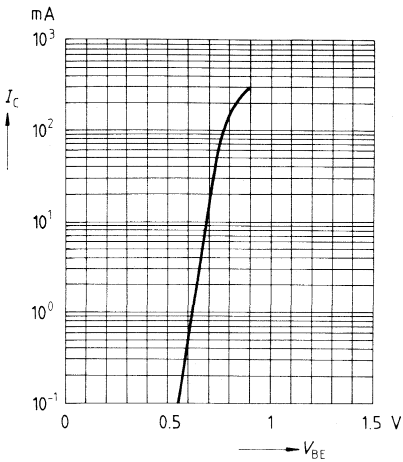
Operating range $I_C = f(V_{CE})$
T_A = 25 °C, D = 0



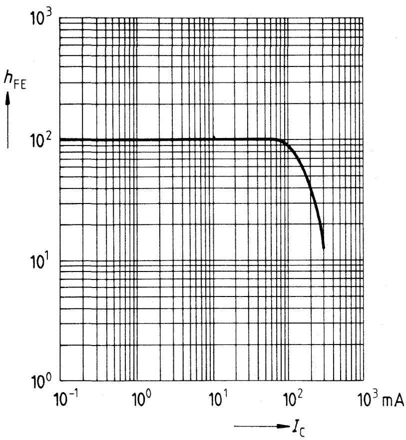
Collector cutoff current $I_{CB0} = f(T_A)$
V_{CB} = 160 V



Collector current $I_C = f(V_{BE})$
V_{CE} = 10 V

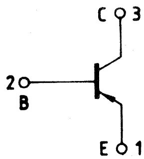


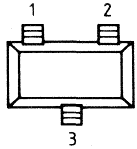
DC current gain $h_{FE} = f(I_c)$
V_{CE} = 10 V



PNP silicon planar epitaxial transistors

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary NPN types: SMBTA 42, SMBTA 43





Top view

Type	Marking	Ordering code	Package
SMBTA 92	SJ	Refer to index	Version A
SMBTA 93	SK		

Maximum ratings		SMBTA 92	SMBTA 93
Collector-emitter voltage	V_{CEO}	300 V	200 V
Collector-base voltage	V_{CBO}	300 V	200 V
Emitter-base voltage	V_{EBO}	5 V	
Collector current	I_C	500 mA	
Base current	I_B	100 mA	
Total power dissipation $T_A = 25\,°C$	P_{tot}	360 mW	
Junction temperature	T_j	150 °C	
Storage temperature range	T_{stg}	$-65 \dots +150\,°C$	
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350 K/W	

Characteristics

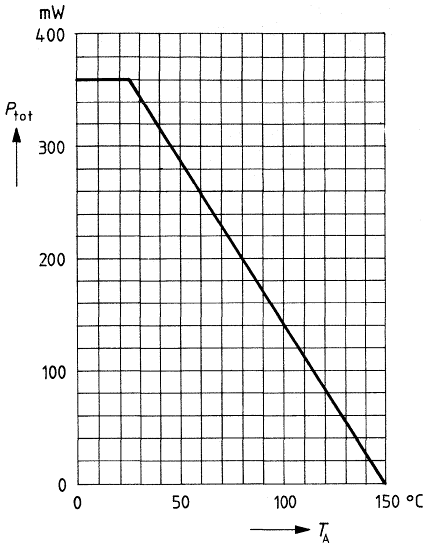
at T_A = 25 °C, unless otherwise specified

Static characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA SMBTA 92 SMBTA 93	$V_{(BR)CEO}$	 300 200	 – –	 – –	 V V
Collector-base breakdown voltage I_C = 100 µA SMBTA 92 SMBTA 93	$V_{(BR)CBO}$	 300 200	 – –	 – –	 V V
Emitter-base breakdown voltage I_E = 100 µA	$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current V_{CB} = 200 V SMBTA 92 V_{CB} = 160 V SMBTA 93 V_{CB} = 200 V, T_A = 150 °C SMBTA 92 V_{CB} = 160 V, T_A = 150 °C SMBTA 93	I_{CBO}	 – – – –	 – – – –	 250 250 20 20	 nA nA µA µA
Emitter cutoff current V_{EB} = 3 V	I_{EBO}	–	–	100	nA
DC current gain I_C = 1 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V[1]) I_C = 30 mA, V_{CE} = 10 V[1]) SMBTA 92 SMBTA 93	h_{FE}	 25 40 25 25	 – – – –	 – – – –	 – – – –
Collector-emitter saturation voltage[1]) I_C = 20 mA, I_B = 2 mA SMBTA 92 SMBTA 93	V_{CEsat}	 – –	 – –	 0,5 0,4	 V V
Base-emitter saturation voltage[1]) I_C = 20 mA, I_B = 2 mA	V_{BEsat}	–	–	0,9	V

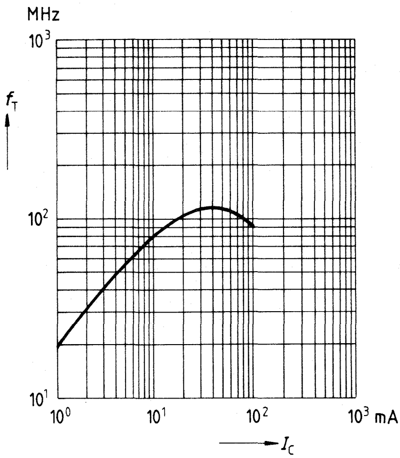
Dynamic characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	50	–	–	MHz
Output capacitance V_{CB} = 20 V, f = 1 MHz SMBTA 92 SMBTA 93	C_{ob}	 – –	 – –	 6 8	 pF pF

[1]) Pulse test: t = 300 µs, D = 2%.

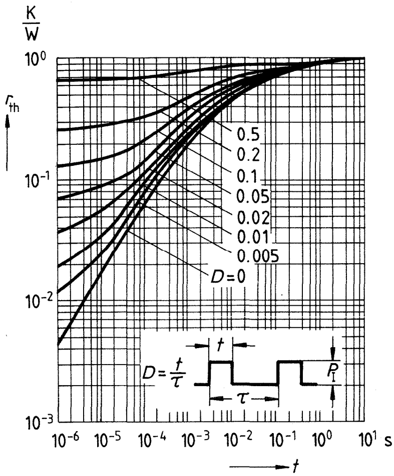
Total power dissipation $P_{tot} = f(T_A)$



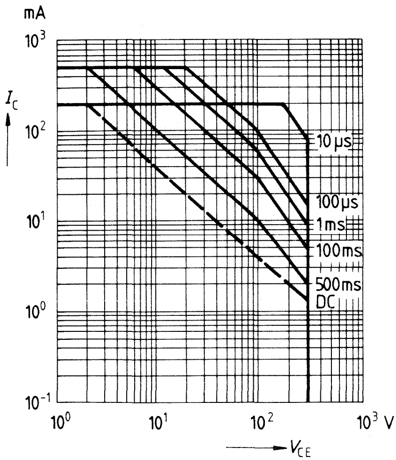
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V, $f = 100$ MHz



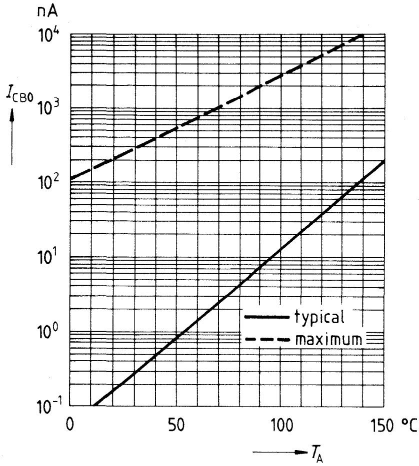
Pulse handling capability $r_{th} = f(t)$
(standardized)



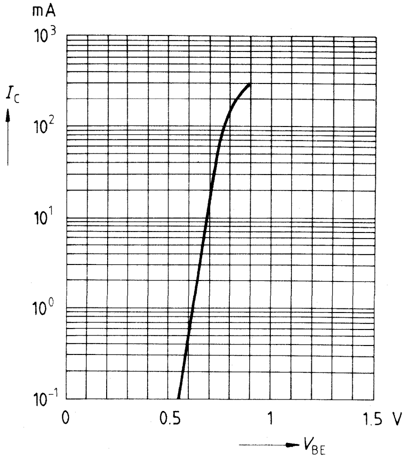
Operating range $I_C = f(V_{CE})$
$T_A = 25$ °C, D = 0



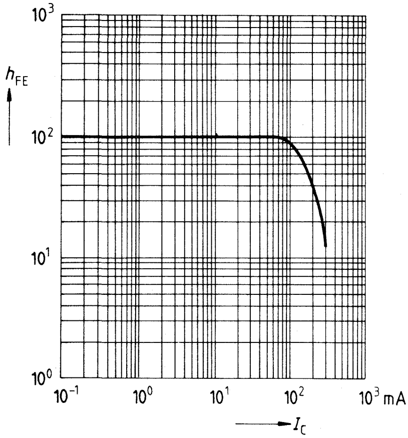
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 160\ V$



Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\ V$



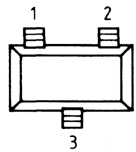
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10\ V$



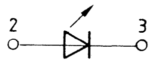
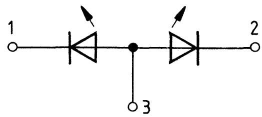
LEDs

LEDs – single and double diodes

- Backlighting of LCDs
- Proximity switches
- Touch keyboards
- Failure indicators on SMC PC boards
- Electronic scales
- Moving sign



Top view

Type	Color	Ordering code	Package	Circuit
LS S210 (CQV 231) LY S210 (CQV 232) LG S210 (CQV 233)	super-red yellow green	Refer to index	Version A	
LU S210 (CQV 234)	super-red/ green			

Maximum ratings

		LU S210	LS S210 LG S210 LY S210
Reverse voltage	V_R	5 V	5 V
Forward current	I_F	30 mA	30 mA
Surge current $\tau = 10\ \mu s / D = 0$	I_{FS}	0,5 A	0,5 A
Total power dissipation	P_{tot}	200 mW[1])	100 mW
Junction temperature	T_j	100 °C	100 °C
Storage temperature range	T_{stg}	– 55 ... + 100 °C	– 55 ... + 100 °C
Thermal resistance junction-ambient package mounted on Al_2O_3 ceramic substrate 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	375 K/W[1])	750 K/W

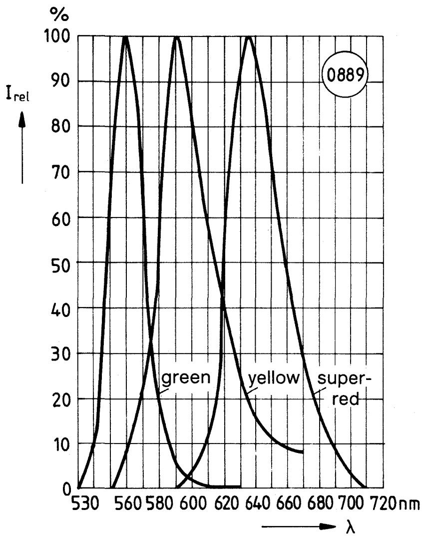
[1]) In case of parallel operation of both chips.
In case of only 1 color being lit on, the characteristics of single color LEDs are applicable.

Characteristics

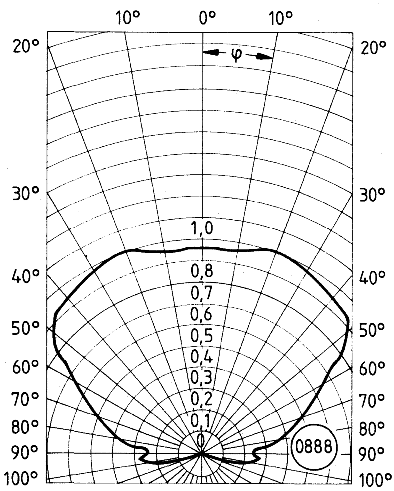
at $T_A = 25\,°C$, unless otherwise specified

Characteristics	Symbol	min	typ	max	Unit
Wavelength at peak emission	λ_{peak}				
LS S210		620	635	650	nm
LY S210		580	590	600	nm
LG S210		545	560	575	nm
Dominant wavelength	λ_{dom}				
LS S210		–	628	–	nm
LY S210		–	592	–	nm
LG S210		–	561	–	nm
Viewing angle Limits for 50% of luminous intensity I_V	φ	–	140	–	degrees
Forward voltage $I_F = 10$ mA	V_F	–	2,0	2,7	V
Reverse current $V_R = 5$ V	I_R	–	0,01	10	µA
Luminous intensity $I_F = 10$ mA	I_V	0,4	1,0	–	mcd

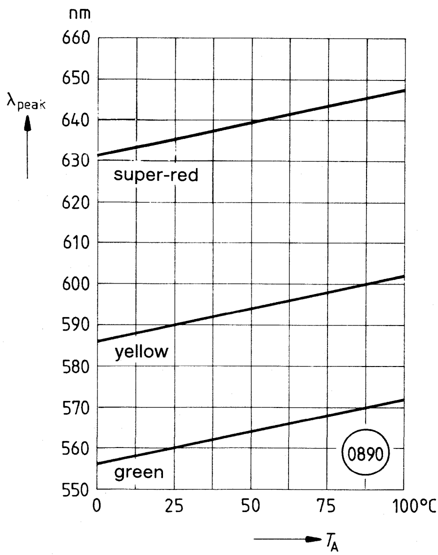
Relative spectral emission
$I_{rel} = f(\lambda)$



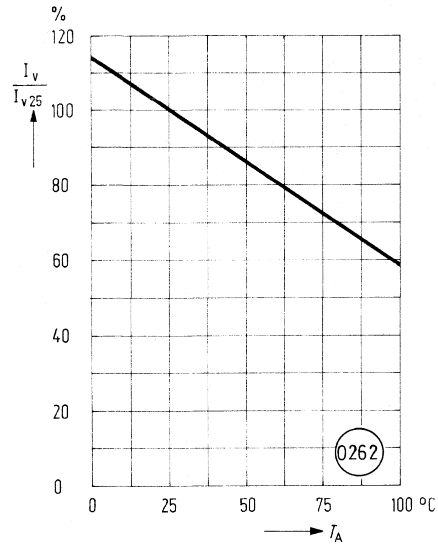
Radiation characteristic
$I_{rel} = f(\varphi)$



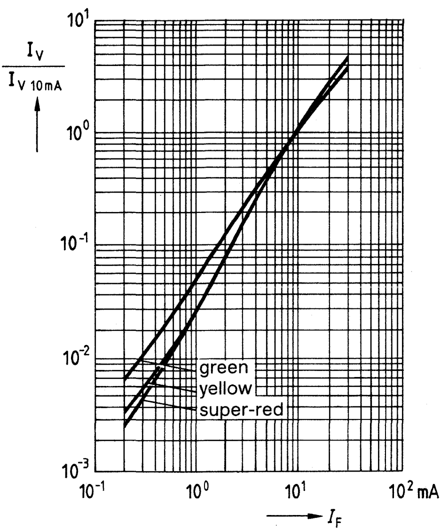
Wavelength at peak emission
$\lambda_{peak} = f(T_A)$



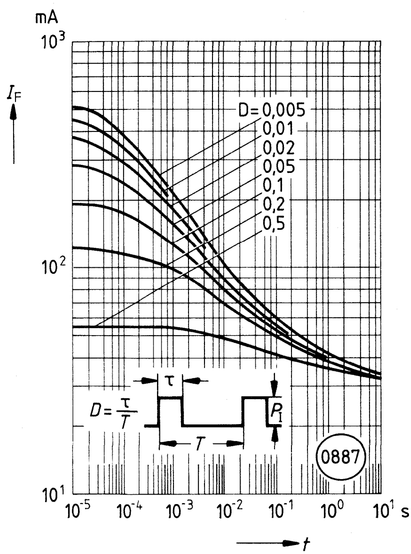
Rel. luminous intensity $\frac{I_V}{I_{V25}} = f(T_A)$



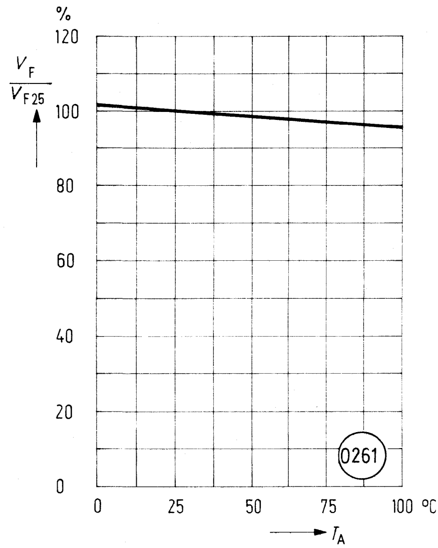
Rel. luminous intensity $\frac{I_V}{I_{V\,10\,mA}} = f(I_F)$



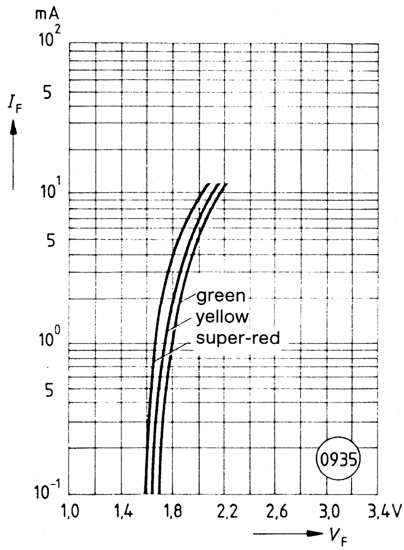
Permissible pulse handling capability $I_F = f(t)$
Duty cycle D, $T_A = 25\,°C$



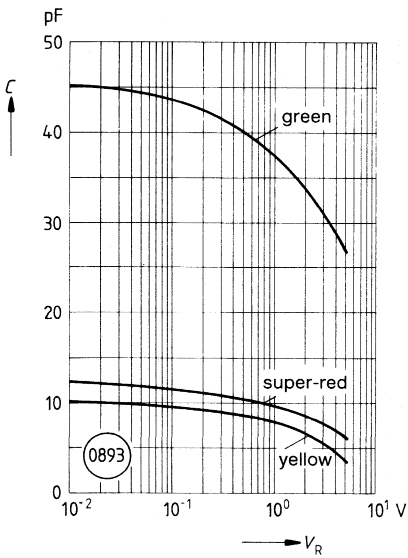
Forward voltage $\frac{V_F}{V_{F25}} = f(T_A)$



Forward current $I_F = f(V_F)$



Capacitance $C = f(V_R)$

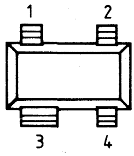


Sensors

GaAs Hall Sensor

- For digital speed and position measurement
- High sensitivity and operating temperature
- Low offset voltage
- Low *TC* of sensitivity and internal resistance

1 } Hall voltage
4 } terminals
3+ } Control current
2− } terminals



Top view

Type	Marking	Ordering code	Package
KSY 13	S13	Refer to index	Version B

Maximum ratings

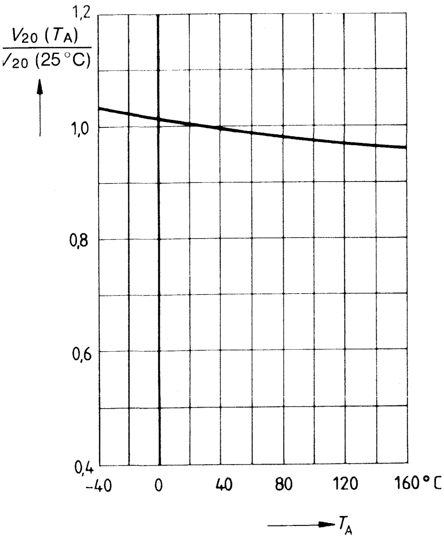
Control current	I_{1max}	7 mA
Operating temperature range	T_A	−40 … +150 °C
Storage temperature range	T_{stg}	−50 … +160 °C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≈ 375 K/W

Characteristics

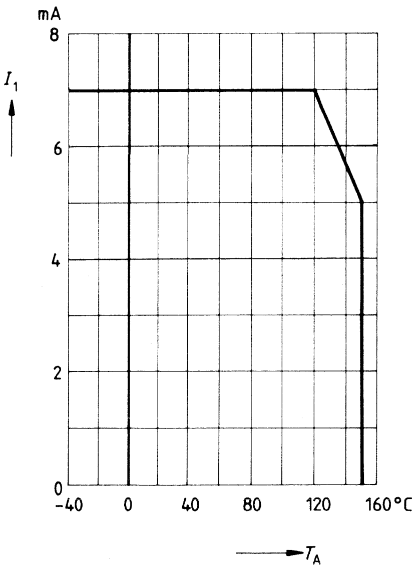
at $T_A = 25\,°C$, unless otherwise specified

Characteristics	Symbol	Values	Unit
Rated control current	I_{1N}	5	mA
Open-circuit Hall voltage $I_1 = I_{1N}$, $B = 0{,}1$ T	V_{20}	95 … 145	mV
Ohmic offset voltage[1]) $I_{1N} = 5$ mA, $B = 0$	V_{RO}	$\leq \pm 30$	mV
Internal resistance at the control side at the Hall side	 R_{10} R_{20}	 900 … 1200 900 … 1200	 Ω Ω
Temperature coefficient of V_{20} $I_1 = I_{1N}$, $B = 0{,}2$ T	TC_{V20}	$\approx -0{,}05$	%/K
Temperature coefficient of R_{10}, R_{20} $I_1 = 1$ mA, $B = 0{,}2$ T	$TC_{R10/R20}$	$\approx 0{,}08$	%/K

Open-circuit Hall voltage
$\frac{V_{20(TA)}}{V_{20(25\,°C)}} = f(T_A)$



Max. control current $I_1 = f(T_A)$

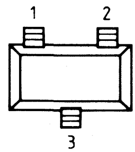


[1]) Grouping upon request.

NPN silicon planar epitaxial sensors

- Suitable for measuring, controlling and regulating air, non-aggressive gases and liquids
- To be used as element for temperature compensation
- High reliability due to multilayer gold contacts

1 ≙ } Contact area
2 ≙ }
3 ≙ Chip substrate



Top view

Type	Marking	Type	Marking	Ordering code	Package
KTY 13 A	TA	KTY 13 C	TC	Refer to index	Version A
KTY 13 B	TB	KTY 13 D	TD		

Maximum ratings

Max. dc control current	I	3 mA
Peak current $t = 10$ ms	$\hat{I}$	8 mA
Ambient temperature range	T_A	$-50 \cdots +150$ °C
Storage temperature range	T_{stg}	$-50 \cdots +160$ °C

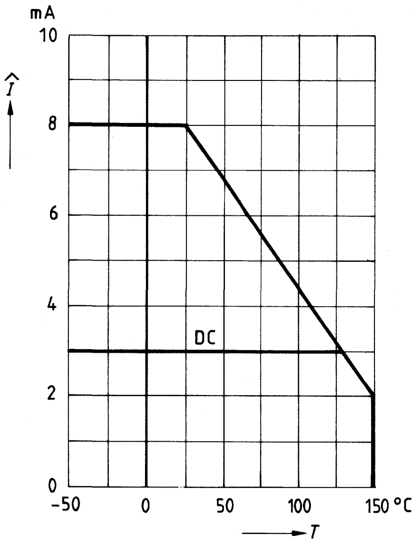
Characteristics

at $T_A = 25\,°C$, unless otherwise specified

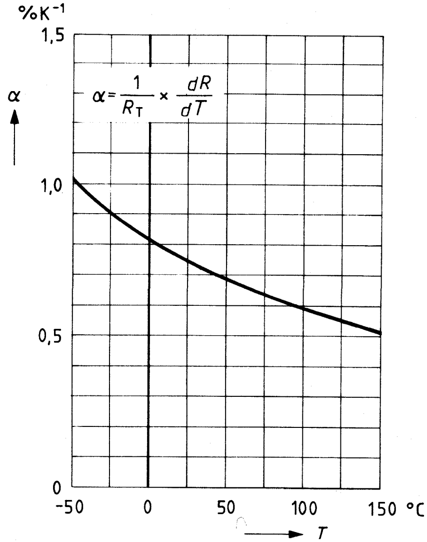
Characteristics	Symbol	Values	Unit
Basic resistance[1]	R_{25}		
$I_N = 1$ mA			
KTY 13 A		1980 ··· 2020	Ω
KTY 13 B		1960 ··· 2040	Ω
KTY 13 C		1900 ··· 2100	Ω
KTY 13 D		1800 ··· 2200	Ω
Tolerance of basic resistance R_{25}	$R_{25\text{-tol.}}$		
referred to $R_{25} = 2000\ \Omega$			
KTY 13 A		± 1	%
KTY 13 B		± 2	%
KTY 13 C		± 5	%
KTY 13 D		± 10	%
Resistance unbalance	M		
at polarity change			
$I_N = 1$ mA		≤ 0,3	%
$I_N = 0,1$ mA		≤ 0,1	%
Thermal time constant			
63% value			
in air	τ_{Air}	7	s
in oil	τ_{Oil}	1	s

[1]) An operating current of 0.1 mA is recommended for precision measurements, as the inherent temperature rise becomes negligible and the unbalance decreases.

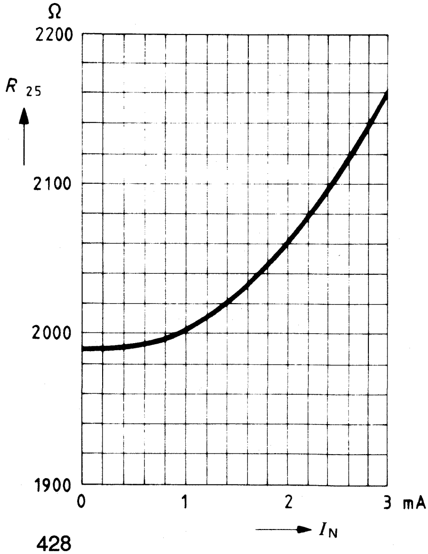
Limited charging current versus ambient temperature $\hat{I} = f(T)$
Parameter: air, $t \leq 10$ ms



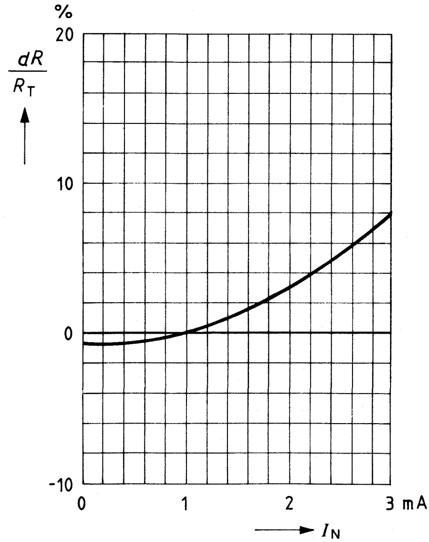
Temperature coefficient versus ambient temperature $\alpha = f(T)$



Typical resistance of the sensor versus impressed operating current
$R_{25} = f(I_N)$



Typical difference of the sensor resistance $\frac{dR}{R_T} = f(I_N)$ from the base resistance R_T at $I_N = 1$ mA versus impressed operating current
$T_A = 25 \cdots 100$ °C



Analytic expression of the regression parabola for the median temperature factor ($I_N = 1$ mA)

$$k_T = \frac{R_T}{R_{25}} = [1 \pm \alpha(\Delta T) + \beta(\Delta T)^2]$$

Analytic expression for calculating the sensor temperature

$$T(°C) = 25 + \frac{\sqrt{\alpha^2 - 4\beta + 4\beta \cdot k_T} - \alpha}{2\beta}$$

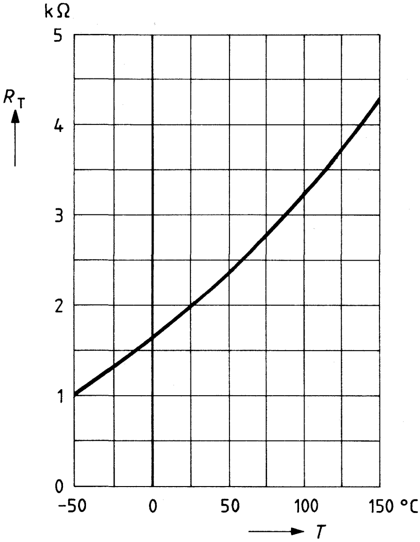
α = $7{,}64 \cdot 10^{-3}$ (K^{-1})
β = $1{,}66 \cdot 10^{-5}$ (K^{-1})
R_{25} = resistance value at T_A = 25 °C (e.g. 2000 Ω)
R_T = resistance value at temperature T (°C)
ΔT = temperature difference between T_{25} and T

Tolerance of the temperature factor

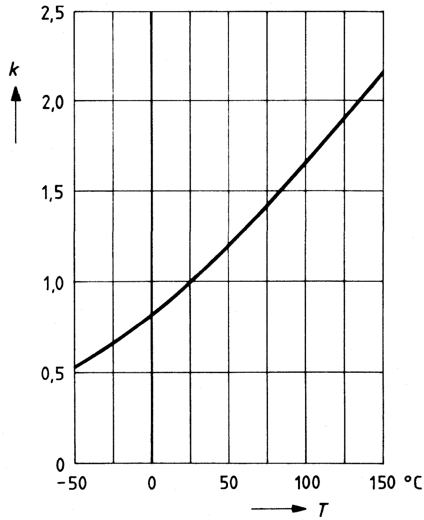
Temperature T	Temperature factor k (I_N = 1 mA)
+150 °C	2,18 ··· 2,25
+125 °C	1,90 ··· 1,96
+100 °C	1,65 ··· 1,69[1])
+ 75 °C	1,41 ··· 1,43
+ 50 °C	1,19 ··· 1,21
+ 25 °C	1,00
0 °C	0,81 ··· 0,83
− 25 °C	0,65 ··· 0,67
− 50 °C	0,51 ··· 0,53

[1]) AQL = 0,65

Resistance of the sensor versus temperature
$R_T = f(T)$
Parameter: $I_R = 1$ mA



Typical behavior of the temperature factor
$k = \frac{R_T}{R_{25}} = f(T)$



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