DISCRETE SEMICONDUCTORS

Surface mounted semiconductors

BOOK SC10a 1991

Philips Semiconductors

PHILIPS

Surface mounted semiconductors

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PART A

Surface mounted semiconductors

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PART B

Selection guide

GENERAL PURPOSE TRANSISTORS in SOT23/SOT89*/SOT143/SOT223Δ**

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BC817	45	45	500	250	100	600	100	1	0.7	500/50	200	229
BC818	25	25	500	250	100	600	100	1	0.7	500/50	200	229
BC846	65	65	100	250	220	800	2	5	0.25	10/0.5	300	235
BC847	45	45	100	250	220	800	2	5	0.25	10/0.5	300	235
BC848	30	30	100	250	220	800	2	5	0.25	10/0.5	300	235
BC868*	20	20	1000	1000	85	375	500	1	0.5	1000/100	60	275
BCP54Δ	45	45	1000	1500	40	250	150	2	0.5	500/50	130	311
BCP55Δ	60	60	1000	1500	40	250	150	2	0.5	500/50	130	311
BCP56Δ	100	80	1000	1500	40	250	150	2	0.5	500/50	130	311
BCP68Δ	-	20	1000	1500	85	375	500	1	0.5	1000/100	60	315
BCV27	40	30	300	250	20000	-	100	5	1.0	100/0.1	220	329
BCV29*	40	30	500	1000	20000	-	100	5	1.0	100/0.1	220	333
BCV47	80	60	500	250	4000	-	10	5	1.0	100/0.1	220	329
BCV49*	80	60	500	1000	10000	-	100	5	1.0	100/0.1	220	333
BCV71	80	60	100	250	110	220	2	5	0.25	10/0.5	300	353
BCV72	80	60	100	250	200	450	2	5	0.25	10/0.5	300	353
BCW31	32	32	100	250	110	220	2	5	0.25	10/0.5	300	361
BCW32	32	32	100	250	200	450	2	5	0.25	10/0.5	300	361
BCW33	32	32	100	250	420	800	2	5	0.25	10/0.5	300	361
BCW60A	32	32	200	250	120	220	2	5	0.35	10/0.25	250	367
BCW60B	32	32	200	250	180	310	2	5	0.35	10/0.25	250	367
BCW60C	32	32	200	250	250	460	2	5	0.35	10/0.25	250	367
BCW60D	32	32	200	250	380	630	2	5	0.35	10/0.25	250	367
BCW71	50	45	100	250	110	220	2	5	0.25	10/0.5	300	381
BCW72	50	45	100	250	220	450	2	5	0.25	10/0.5	300	381
BCW81	50	45	100	250	450	800	2	5	0.25	10/0.5	300	387
BCX19	50	45	500	250	100	600	100	1	0.62	500/50	200	395
BCX20	30	25	500	250	100	600	100	1	0.62	500/50	200	395
BCX54*	45	45	1000	1000	45	250	150	2	0.5	500/50	130	403
BCX55*	60	60	1000	1000	40	160	150	2	0.5	500/50	130	403
BCX56*	100	80	1000	1000	40	160	150	2	0.5	500/50	130	403
BCX70G	45	45	200	250	120	220	2	5	0.35	10/0.25	250	407
BCX70H	45	45	200	250	180	310	2	5	0.35	10/0.25	250	407

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BCX70J	45	45	200	250	250	460	2	5	0.35	10/0.25	250	407
BCX70K	45	45	200	250	380	630	2	5	0.35	10/0.25	250	407
BSP40Δ	70	60	1000	1500	40	120	100	5	0.25	150/15	100	905
BSP41Δ	70	60	1000	1500	100	300	100	5	0.25	150/15	100	905
BSP42Δ	90	80	1000	1500	40	120	100	5	0.25	150/15	100	905
BSP43Δ	90	80	1000	1500	100	300	100	5	0.25	150/15	100	905
PMBT4401	60	40	600	250	100	300	150	1	0.75	500/50	250	1233
PMBT5550	160	140	600	300	60	250	10	5	0.25	50/5	200	1247
PMBT6428	60	50	200	350	250	650	-	-	0.2	10/0.5	300	1251
PMBT6429	55	45	200	350	500	1250	-	-	0.2	10/0.5	300	1251
PMBTA05	60	60	500	300	50	-	10	1	0.25	100/10	100	1255
PMBTA06	80	80	500	300	50	-	10	1	0.25	100/10	100	1255
PMBTA13	30	30	300	300	5000	-	10	5	1.5	100/0.1	125	1257
PMBTA14	30	30	300	300	10000	-	10	5	1.5	100/0.1	125	1257
PXT4401*	60	40	600	1000	100	300	150	1	0.75	500/50	250	1313
PXTA14*	30	30	300	1000	20000	-	100	5	1.5	100/0.1	125	1321
PXTA27*	-	60	500	1000	10000	-	100	5	1.5	100/0.1	125	1323
PZTA05Δ	60	60	500	1500	50	-	100	1	0.25	100/10	100	1347
PZTA06Δ	80	80	500	1500	50	-	100	1	0.25	100/10	100	1347
PZTA13Δ	30	30	300	1500	5000	-	10	5	1.5	100/0.1	125	1351
PZTA14Δ	30	30	300	1500	10000	-	10	5	1.5	100/0.1	125	1351
PZTA42Δ	300	300	500	1500	40	-	10	10	0.5	20/2	50	1353
PZTA43Δ	200	200	500	1500	40	-	10	10	0.5	20/2	50	1353
PNP												
BC807	45	45	500	250	100	600	100	1	0.7	500/50	100	223
BC808	25	25	500	250	100	600	100	1	0.7	500/50	100	223
BC856	65	65	100	250	75	475	2	5	0.3	10/0.5	150	257
BC857	45	45	100	250	75	800	2	5	0.3	10/0.5	150	257

Notes

- * Types in SOT89 package.
- ** Types in SOT143 package.
- Δ Types in SOT223 package.

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP												
BC858	30	30	100	250	75	800	2	5	0.3	10/0.5	150	257
BC869*	20	20	1000	1000	85	375	500	1	0.5	1000/100	60	281
BCP51Δ	45	45	1000	1500	40	250	150	2	0.5	500/50	50	307
BCP52Δ	60	60	1000	1500	40	250	150	2	0.5	500/50	50	307
BCP53Δ	100	80	1000	1500	40	250	150	2	0.5	500/50	50	307
BCP69Δ	-	25	1000	1500	85	375	500	1	0.5	1000/100	60	321
BCV26	40	30	250	350	20000	-	100	5	1.0	100/0.1	220	327
BCV28*	40	30	500	1000	20000	-	100	5	1.0	100/0.1	220	331
BCV46	80	60	250	300	4000	-	10	5	1.0	100/0.1	220	327
BCV48*	80	60	500	1000	10000	-	100	5	1.0	100/0.1	220	331
BCW29	32	32	100	250	120	260	2	5	0.3	10/0.5	150	355
BCW30	32	32	100	250	215	500	2	5	0.3	10/0.5	150	355
BCW61A	32	32	200	250	120	220	2	5	0.25	10/0.25	180	371
BCW61B	32	32	200	250	180	310	2	5	0.25	10/0.25	180	371
BCW61C	32	32	200	250	250	460	2	5	0.25	10/0.25	180	371
BCW61D	32	32	200	250	380	630	2	5	0.25	10/0.25	180	371
BCW69	50	45	100	250	120	260	2	5	0.3	10/0.5	150	375
BCW70	50	45	100	250	120	500	2	5	0.3	10/0.5	150	375
BCW89	80	60	100	250	120	260	2	5	0.3	10/0.5	150	389
BCX17	50	45	500	250	100	600	100	1	0.62	500/50	100	391
BCX18	30	25	500	250	100	600	100	1	0.62	500/50	100	391
BCX51*	45	45	1000	1000	40	250	150	2	0.5	500/50	50	399
BCX52*	60	60	1000	1000	40	160	150	2	0.5	500/50	50	399
BCX53*	100	80	1000	1000	40	160	150	2	0.5	500/50	50	399
BCX71G	45	45	200	250	120	220	2	5	0.25	10/0.25	180	411
BCX71H	45	45	200	250	180	310	2	5	0.25	10/0.25	180	411
BCX71J	45	45	200	250	250	460	2	5	0.25	10/0.25	180	411
BCX71K	45	45	200	250	380	630	2	5	0.25	10/0.25	180	411

Notes

* Types in SOT89 package.

** Types in SOT143 package.

Δ Types in SOT223 package.

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
BSP30Δ	70	60	1000	1500	40	120	100	5	0.25	150/15	100	901
BSP31Δ	70	60	1000	1500	100	300	100	5	0.25	150/15	100	901
BSP32Δ	90	80	1000	1500	40	120	100	5	0.25	150/15	100	901
BSP33Δ	90	80	1000	1500	100	300	100	5	0.25	150/15	100	901
PMBT4403	40	40	600	250	100	300	150	2	0.75	500/50	200	1237
PMBTA55	60	60	500	250	50	-	10	1	0.25	100/10	50	1263
PMBTA56	80	80	500	250	50	-	10	1	0.25	100/10	50	1263
PMBTA63	30	30	500	250	5000	-	10	5	1.5	100/0.1	125	1265
PMBTA64	30	30	500	250	5000	-	10	5	1.5	100/0.1	125	1265
PXT4403*	40	40	600	1000	100	300	150	2	0.4	150/15	200	1317
PXTA64*	30	30	300	1000	20000	-	100	5	1.5	100/0.1	125	1325
PXTA77*	-	60	500	1000	10000	-	100	5	1.5	100/0.1	125	1327
PXTA92*	300	300	500	1500	40	-	10	10	0.5	20/2	50	1329
PXTA93*	200	200	500	1500	40	-	10	10	0.5	20/2	50	1329
PZTA55Δ	60	60	500	1500	50	-	100	1	0.25	100/10	50	1357
PZTA56Δ	80	80	500	1500	50	-	100	1	0.25	100/10	50	1357
PZTA63Δ	30	30	500	1500	10000	-	100	5	1.5	100/0.1	125	1361
PZTA64Δ	30	30	500	1500	10000	-	100	5	1.5	100/0.1	125	1361
PZTA92Δ	300	300	500	1500	40	-	10	10	0.5	20/2	50	1363
PZTA93Δ	200	200	500	1500	40	-	10	10	0.5	20/2	50	1363

Notes

* Types in SOT89 package.

** Types in SOT143 package.

Δ Types in SOT223 package.

HIGH-FREQUENCY TRANSISTORS in SOT23

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	F typ. (dB)	at f (MHz)	f_T typ. (MHz)	C_{re} typ. (pF)	
NPN													
BF570	40	15	100	250	40	-	10	1	-	-	> 490	1.6	497
BF840	40	40	25	250	-	-	-	-	-	-	380	0.3	549
BF841	40	40	25	250	-	-	-	-	-	-	380	0.3	549
BFS18	30	20	20	250	35	125	1	10	4	100	200	0.85	839
BFS19	30	20	30	250	65	225	1	10	4	100	260	0.85	839
BFS20	30	20	25	250	40	85	7	10	-	-	450	-	845
PNP													
BF550	40	40	25	250	50	-	1	10	2	0.1	325	0.5	493
BF569	40	35	30	250	25	-	3	10	4.5	800	900	0.33	495
BF579	20	20	25	250	20	-	10	10	4.5	800	1350	0.46	501
BF660	40	30	25	250	30	-	3	10	-	-	650	0.65	513
BF824	30	30	25	250	-	-	-	-	3	100	450	0.1	543

BROADBAND TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223Δ

TYPE NUMBER	RATINGS				CHARACTERISTICS								PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	d_{im} typ. (dB)	at f (MHz)	f_T typ. (GHz)	C_{re} typ. (pF)	
NPN													
BF747	30	20	50	150	40	250	2	10	-	-	1.2	0.5	523
BFG16AΔ	40	25	150	1000	25	-	50	5	-	-	1.5	1.8	591
BFG17A**	25	15	50	300	20	-	2	1	60	793.25	2.8	0.6	599
BFG25AX**	8	5	6.5	32	50	200	0.5	1	-	-	5	0.22	607
BFG33**	9	7	20	300	50	-	14	5	-	-	12	-	617
BFG33X**	9	7	20	300	50	-	14	5	-	-	12	-	617
BFG35Δ	25	18	150	1000	25	-	100	10	60	793.25	4	1.2	619
BFG67**	20	10	50	300	60	100	15	5	-	-	7.5	0.5	637
BFG67X**	20	10	50	300	60	-	15	5	-	-	7.5	0.5	637
BFG92A**	20	15	25	300	40	-	14	10	-	-	5	0.35	641
BFG92AX**	20	15	25	300	40	-	14	10	-	-	5	0.35	641
BFG93A**	15	12	35	300	40	-	30	5	-	-	6	0.6	647
BFG93AX**	15	12	35	300	40	-	30	5	-	-	6	0.6	647
BFG94Δ	15	12	60	700	45	-	30	5	60	793.25	6	0.5	653
BFG97Δ	20	15	100	1000	25	-	70	10	60	793.25	5.5	1.0	665

TYPE NUMBER	RATINGS				CHARACTERISTICS									PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	d_{im} typ. (dB)	at f (MHz)	f_T typ. (GHz)	C_{re} typ. (pF)	
NPN													
BFG135Δ	25	15	150	1000	80	-	100	10	60	793.25	7.0	1.2	675
BFG197**	20	10	100	300	40	-	50	5	-	-	7.5	0.85	687
BFG197X**	20	10	100	300	40	-	50	5	-	-	7.5	0.85	687
BFG198Δ	20	10	100	1000	40	-	50	5	60	793.25	8.0	0.8	721
BFQ17*	40	25	150	1000	25	-	150	5	-	-	1.2	1.9	731
BFQ18A	25	15	150	1000	25	-	100	10	60	793.25	3.6	1.2	737
BFQ19*	20	15	75	500	25	-	75	10	-	-	5.0	1.3	741
BFQ67	20	10	50	180	100	-	15	5	-	-	7.5	0.5	747
BFR53	18	10	50	250	25	-	50	5	60	217	2.0	0.9	767
BFR92	20	15	25	200	25	-	14	10	60	493.25	5.0	0.7	775
BFR92A	20	15	25	200	40	-	14	10	60	793.25	5.0	0.35	783
BFR93	15	12	35	200	25	-	30	5	60	493.25	5.0	0.8	795
BFR93A	15	12	35	250	40	-	30	5	60	793.25	5.0	0.6	803
BFR106	20	15	100	350	-	-	-	-	-	-	3.7	1.2	817
BFS17	25	15	25	250	20	150	2	1	45	217	1.3	0.65	827
BFS17A	25	15	25	300	20	150	2	1	-	-	2.8	0.6	833
BFT25	8	5	2.5	50	20	-	1	1	-	-	2.3	0.45	851
BFT25A	8	5	6.5	50	-	-	-	-	-	-	5	0.22	859
PNP													
BFG31Δ	20	15	100	1000	25	-	100	10	60	848.25	5	1.6	611
BFG55Δ	25	18	150	1000	25	-	100	10	60	848.25	4	1.7	631
BFQ149*	20	15	75	1000	20	-	50	10	-	-	4.2	1.7	751
BFT92	20	15	25	200	20	-	14	10	60	493.25	5	0.7	869
BFT93	15	12	35	200	20	-	30	5	60	493.25	5	1.0	875

Notes

* Types in SOT89 package.

** Types in SOT143 package.

Δ Types in SOT223 package.

SWITCHING TRANSISTORS in SOT23/SOT89*/SOT223Δ

TYPE NUMBER	RATINGS				CHARACTERISTICS									PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ (V) max.	at I_C/I_B (mA)	t_{on}/t_{off} (ns) max.	at I_C/I_B (mA)	
NPN													
BSP50Δ	60	45	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	909
BSP51Δ	80	60	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	909
BSP52Δ	90	80	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	909
BSR13	60	30	800	250	100	300	150	10	1.6	500/50	35/285	150/-	991
BSR14	75	40	800	250	100	300	150	10	1.0	500/50	-	-	991
BSR17A	60	40	200	250	100	300	10	1	0.3	50/5	70/250	10/1	999
BSR40*	70	60	1000	1000	40	120	100	5	0.5	500/50	250/1000	100/5	1019
BSR41*	70	60	1000	1000	100	300	100	5	0.5	500/50	250/1000	100/5	1019
BSR42*	90	80	1000	1000	40	120	100	5	0.5	500/50	250/1000	100/5	1019
BSR43*	90	80	1000	1000	100	300	100	5	0.5	500/50	250/1000	100/5	1019
BSS64	120	80	100	250	20	80	10	1	0.2	50/15	-/1000	15/1	1033
BST50*	60	45	500	1000	1000	-	150	10	1.3	500/50	400/1500	500/0.5	1067
BST51*	80	60	500	1000	1000	-	150	10	1.3	500/50	400/1500	500/0.5	1067
BST52*	90	80	500	1000	1000	-	150	10	1.3	500/50	400/1500	500/0.5	1067
BSV52	20	12	100	250	40	120	10	1	0.2	50/5	12/18	10/3	1099
PMBT2222	60	30	600	250	100	300	150	10	0.4	150/15	10/225	150/-	1215
PMBT2222A	75	40	600	250	100	300	150	10	0.3	150/15	10/225	150/-	1215
PMBT2369	40	40	500	250	40	120	10	1	0.25	10/1	12/18	10/3	1219
PMBT3904	60	40	200	300	100	300	10	1	0.3	50/5	35/200	10/1	1225
PXT2222*	60	30	600	1000	100	300	150	10	0.4	150/15	10/225	150/15	1297
PXT2222A*	75	40	600	1000	100	300	150	10	0.4	150/15	10/225	150/15	1297
PXT3904*	60	40	200	1000	100	300	10	1	0.3	50/5	35/200	10/1	1305
PZT2222Δ	60	30	600	1500	100	300	150	10	0.4	150/15	-	-	1331
PZT2222AΔ	75	40	600	1500	100	300	150	10	0.3	150/10	10/225	150/15	1331
PZT3904Δ	60	40	200	1500	100	300	10	1	0.3	10/1	35/200	10/1	1339

TYPE NUMBER	RATINGS				CHARACTERISTICS									PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\ sat}$ (V) max.	at I_C/I_B (mA)	t_{on}/t_{off} (ns) max.	at I_C/I_B (mA)	
PNP													
BSP60Δ	60	45	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	913
BSP61Δ	80	60	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	913
BSP62Δ	90	80	500	1500	2000	-	500	10	1.3	500/0.5	400/1500	500/0.5	913
BSR12	15	15	100	250	30	120	50	1	0.45	100/10	20/30	30/3	985
BSR15	60	40	600	250	100	300	150	10	1.6	500/50	45/100	150/15	995
BSR16	60	60	600	250	100	300	150	10	1.6	500/50	45/100	150/15	995
BSR18A	40	40	200	250	100	300	10	1	0.4	50/5	70/300	10/1	1003
BSR30*	70	60	1000	1000	40	120	100	5	0.5	500/50	500/650	100/5	1015
BSR31*	70	60	1000	1000	100	300	100	5	0.5	500/50	500/650	100/5	1015
BSR32*	90	80	1000	1000	40	120	100	5	0.5	500/50	500/650	100/5	1015
BSR33*	90	80	1000	1000	100	300	100	5	0.5	500/50	500/650	100/5	1015
BSS63	110	100	100	250	30	-	25	1	0.25	25/2.5	-	-	1027
BST60*	60	45	500	1000	1000	-	150	10	1.3	500/0.5	400/1500	500/0.5	1071
BST61*	80	60	500	1000	1000	-	150	10	1.3	500/0.5	400/1500	500/0.5	1071
BST62*	90	80	500	1000	1000	-	150	10	1.3	500/0.5	400/1500	500/0.5	1071
PMBT2907	60	40	600	250	30	50	500	10	0.4	150/15	45/100	150/15	1221
PMBT2907A	60	60	600	250	30	50	500	10	0.4	150/15	45/100	150/15	1221
PMBT3906	40	40	200	250	100	300	10	1	0.25	10/1	35/225	10/1	1229
PXT2907*	60	40	600	1000	100	300	150	10	0.4	150/10	45/100	150/15	1301
PXT2907A*	60	60	600	1000	100	300	150	10	0.4	150/10	45/100	150/15	1301
PXT3906*	40	40	200	1000	100	300	10	1	0.25	10/1	35/225	10/1	1309
PZT2907Δ	60	40	600	1500	100	300	150	10	0.4	150/15	45/100	150/15	1335
PZT2907AΔ	60	60	600	1500	100	300	150	10	0.4	150/15	45/100	150/15	1335
PZT3906Δ	40	40	200	1500	100	300	10	1	0.4	50/5	35/225	10/1	1343

Notes

* Types in SOT89 package.

** Types in SOT143 package.

Δ Types in SOT223 package.

POWER TRANSISTORS FOR SWITCHING in SOT223

TYPE NUMBER	RATINGS				CHARACTERISTICS										PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min.	at I_C (A)	at V_{CE} (V)	$V_{CE\,sat}$ (V) max.	at I_C (A)	at I_B (mA)	t_{on} max.	t_{off} max.	at I_C (A)	at I_B (mA)	
NPN															
BDS61	60	60	4	8	1000	1.5	3	1.6	1.5	6	2	8	1.5	6000	421
BDS61A	80	80	4	8	1000	1.5	3	1.6	1.5	6	2	8	1.5	6000	421
BDS61B	100	100	4	8	1000	1.5	3	1.6	1.5	6	2	8	1.5	6000	421
BDS61C	120	120	4	8	1000	1.5	3	1.6	1.5	6	2	8	1.5	6000	421
BDS77	100	80	3	8	30	2	2	1.8	6	600	1	3	2	200	427
BDS201	60	45	3	8	40	3	2	1.8	6	600	1	3	2	200	427
BDS203	60	60	3	8	30	2	2	1.8	6	600	1	3	2	200	427
BDS643	60	45	3	8	1000	3	3	1.8	5	50	2	10	3	12	439
BDS645	80	60	3	8	1000	3	3	1.8	5	50	2	10	3	12	439
BDS647	100	80	3	8	1000	3	3	1.8	5	50	2	10	3	12	439
BDS649	120	100	3	8	1000	3	3	1.8	5	50	1	10	3	12	439
BDS651	140	120	3	8	1000	3	3	1.8	5	50	2	10	3	12	439
BDS933	45	45	3	8	25	1	2	0.5	1	100	1	3	1	100	451
BDS935	60	60	3	8	25	1	2	0.5	1	100	1	3	1	100	451
BDS937	100	80	3	8	25	1	2	0.5	1	100	1	3	1	100	451
BDS939	120	100	3	8	25	1	2	0.5	1	100	1	3	1	100	451
BDS941	140	120	3	8	25	1	2	0.5	1	100	1	3	1	100	451
BDS943	22	22	3	8	50	2	1	0.5	2	200	-	-	-	-	463
BDS945	32	32	3	8	50	2	1	0.5	2	200	-	-	-	-	463
BDS947	45	45	3	8	40	0.25	1	0.5	2	200	-	-	-	-	463
BDS949	60	60	3	8	20	2	4	1	2	200	-	-	-	-	475
BDS951	80	80	3	8	20	2	4	1	2	200	-	-	-	-	475
BDS953	100	100	3	8	20	2	4	1	2	200	-	-	-	-	475
BDS955	120	120	3	8	20	2	4	1	2	200	-	-	-	-	475
PNP															
BDS60	60	60	4	8	1000	1.5	3	1.6	1.5	6	1.5	5	1.5	6000	415
BDS60A	80	80	4	8	1000	1.5	3	1.6	1.5	6	1.5	5	1.5	6000	415
BDS60B	100	100	4	8	1000	1.5	3	1.6	1.5	6	1.5	5	1.5	6000	415
BDS60C	120	120	4	8	1000	1.5	3	1.6	1.5	6	1.5	5	1.5	6000	415
BDS78	100	80	3	8	40	3	2	1.8	6	600	1	3	2	200	433
BDS202	60	45	3	8	40	3	2	1.8	6	600	1	3	2	200	433
BDS204	60	60	3	8	40	3	2	1.8	6	600	1	3	2	200	433
BDS644	60	45	3	8	1000	3	3	1.8	5	50	2	10	3	12	445
BDS646	80	60	3	8	1000	3	3	1.8	5	50	2	10	3	12	445

TYPE NUMBER	RATINGS				CHARACTERISTICS										PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min.	at I_C (A)	at V_{CE} (V)	$V_{CE\,sat}$ (V) max.	at I_C (A)	at I_B (mA)	t_{on} max.	t_{off} max.	at I_C (A)	at I_B (mA)	
PNP															
BDS648	100	80	3	8	1000	3	3	1.8	5	50	2	10	3	12	445
BDS650	120	100	3	8	1000	3	3	1.8	5	50	2	10	3	12	445
BDS652	140	120	3	8	1000	3	3	1.8	5	50	2	10	3	12	445
BDS934	45	45	3	8	25	1	2	0.5	1	100	0.6	2.4	1	100	457
BDS936	60	60	3	8	25	1	2	0.5	1	100	0.6	2.4	1	100	457
BDS938	100	80	3	8	25	1	2	0.5	1	100	0.6	2.4	1	100	457
BDS940	120	100	3	8	25	1	2	0.5	1	100	0.6	2.4	1	100	457
BDS942	140	120	3	8	25	1	2	0.5	1	100	0.6	2.4	1	100	457
BDS944	22	22	3	8	50	2	1	0.5	2	200	-	-	-	-	469
BDS946	32	32	3	8	50	2	1	0.5	2	200	-	-	-	-	469
BDS948	45	45	3	8	40	2	1	0.5	2	200	-	-	-	-	469
BDS950	60	60	3	8	20	2	4	1	2	200	-	-	-	-	481
BDS952	80	80	3	8	20	2	4	1	2	200	-	-	-	-	481
BDS954	100	100	3	8	20	2	4	1	2	200	-	-	-	-	481
BDS956	120	120	3	8	20	2	4	1	2	200	-	-	-	-	481

LOW-NOISE TRANSISTORS in SOT23 (F > 4 dB at f = 1 kHz; B = 200 Hz)

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BC849	30	30	100	250	-	800	2	5	0.25	10/0.5	300	245
BC850	45	45	100	250	-	800	2	5	0.25	10/0.5	300	245
BCF32	32	32	100	250	200	450	2	5	0.25	10/0.5	300	293
BCF33	32	32	100	250	420	800	2	5	0.25	10/0.5	300	293
BCF81	50	45	100	250	420	800	2	5	0.25	10/0.5	300	305
PMBT5088	35	30	50	250	350	-	1	5	0.5	10/1	200	1241
PNP												
BC859	30	30	100	250	125	800	2	5	0.3	10/0.5	150	265
BC860	45	45	100	250	125	800	2	5	0.3	10/0.5	150	265
BCF29	32	32	100	250	120	260	2	5	0.3	10/0.5	150	287
BCF30	32	32	100	250	215	500	2	5	0.3	10/0.5	150	287
BCF70	50	45	100	250	215	500	2	5	0.3	10/0.5	150	299

HIGH-VOLTAGE TRANSISTORS in SOT23/SOT89*/SOT223Δ

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
NPN												
BF620*	300	-	50	1000	50	-	25	20	0.6	30/5	60	505
BF622*	250	250	50	1000	50	-	25	20	0.6	30/5	60	505
BF720Δ	300	-	50	1500	50	-	25	20	0.6	30/5	60	515
BF722Δ	250	250	50	1500	50	-	25	20	0.6	30/5	60	515
BF820	300	-	50	310	50	-	25	20	0.6	30/5	60	535
BF822	250	250	50	310	50	-	25	20	0.6	30/5	60	535
BSP19Δ	400	350	1000	1500	40	-	10	20	1.3	50/4	70	899
BSP20Δ	300	250	1000	1500	40	-	10	20	1.3	50/4	70	899
BSR19	160	140	600	350	60	250	10	5	0.25	50/5	100	1007
BSR19A	180	160	600	360	80	250	10	5	0.2	50/5	100	1007
BST39*	400	350	1000	1000	40	160	20	10	0.5	50/4	70	1063
BST40*	300	250	1000	1000	40	160	20	10	0.5	50/4	70	1063
PMBT5551	180	160	600	250	80	250	10	5	0.2	50/5	100	1249
PMBTA42	300	300	500	250	40	-	30	10	0.5	20/2	50	1259
PMBTA43	200	200	500	250	40	-	30	10	0.5	20/2	50	1259

HIGH-VOLTAGE TRANSISTORS in SOT23/SOT89*/SOT223Δ

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP												
BF621*	300	-	20	1000	50	-	25	20	0.8	30/5	60	509
BF623*	250	250	20	1000	50	-	25	20	0.8	30/5	60	509
BF721Δ	300	-	50	1500	50	-	25	20	0.8	30/5	60	519
BF723Δ	250	250	50	1500	50	-	25	20	0.8	30/5	60	519
BF821	300	-	50	250	50	-	25	20	0.8	30/5	60	539
BF823	250	250	50	250	50	-	25	20	0.8	30/5	60	539
BSP15Δ	200	200	1000	1500	30	150	10	50	2.5	50/5	15	897
BSP16Δ	350	300	1000	1500	30	120	10	50	2.0	50/5	15	897
BSR20	130	120	600	250	40	180	10	5	0.5	50/5	100	1011
BSR20A	160	150	600	250	60	240	10	5	0.5	50/5	100	1011
BST15*	200	200	1000	1000	30	150	50	10	2.5	50/5	15	1059
BST16*	350	300	1000	1000	30	120	50	10	2.0	50/5	15	1059
PMBT5401	160	150	500	250	60	240	10	5	0.5	50/5	100	1245
PMBTA92	300	300	500	250	40	-	10	10	0.5	20/2	50	1267
PMBTA93	200	200	500	250	40	-	10	10	0.5	20/2	50	1267

Notes

* * Types in SOT89 package.
* ** Types in SOT143 package.
* Δ Types in SOT223 package.

FIELD-EFFECT TRANSISTORS in SOT23/SOT89*/SOT143**/SOT223Δ

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ (nA) max.	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ (V) max.	$\lvert Y_{fs} \rvert$ (ms) min.	C_{rs} (pF) max.	V_n (μv) max.	
BF510	20	-	30	250	10	0.7	3	0.8	2.5	0.4	-	487
BF511	20	-	30	250	10	2.5	7	1.5	4	0.4	-	487
BF512	20	-	30	250	10	6	12	2.2	6	0.4	-	487
BF513	20	-	30	250	10	10	18	3	7	0.4	-	487
BF989**	20	-	20	200	50	2	20	2.7	9.5	0.025	-	551
BF990A**	18	-	30	200	25	-	-	1.3	17	0.025	-	555
BF991**	20	-	20	200	50	4	25	2.5	10	0.020	-	559
BF992**	20	-	40	200	25	-	-	1.3	20	0.04	-	563

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ (nA) max.	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ (V) max.	$\lvert Y_{fs} \rvert$ (ms) min.	C_{rs} (pF) max.	V_n (μv) max.	
BF994S**	20	-	50	300	50	4	20	2.5	15	0.025	-	569
BF996S**	20	-	30	300	50	4	20	2.5	15	0.025	-	573
BF997**	20	-	30	300	10	2	20	2.5	15	0.025	-	577
BF998**	12	-	30	200	50	2	18	2.5	21	-	-	581
BFR30	25	25	10	250	0.2	4	10	5	1	1.5	0.5	757
BFR31	25	-	-	-	-	1	5	2.5	1.5	1.5	0.5	757
BFR101A**	30	30	10	200	5	0.2	1.5	1.0	1.2	-	-	815
BFR101B**	30	30	10	200	5	1	5	2.5	2.5	-	-	815
BFR200**	30	30	20	250	.003	0.2	3.5	-	1.3	-	-	823
BFT46	25	25	10	250	0.2	0.2	1.5	1.2	1.0	1.5	0.5	861
BSD22**	20	-	50	230	1	-	-	2.0	-	0.6	-	893
BSP103Δ	35	20	700	1500	-	-	-	-	-	-	-	917
BSP105Δ	60	20	500	1500	-	-	-	-	-	-	-	917
BSP106Δ	60	20	425	1500	10	-	0.001	-	100	10	-	921
BSP107Δ	200	20	200	1500	10	-	.00003	-	90	10	-	929
BSP108Δ	80	20	500	1500	100	-	0.001	-	150	12	-	937
BSP109Δ	90	20	450	1500	-	-	-	-	-	-	-	917
BSP110Δ	80	20	325	1500	100	-	0.001	-	75	6	-	941
BSP120Δ	200	20	250	1500	100	-	0.001	-	125	10	-	945
BSP121Δ	200	20	350	1500	100	-	0.001	-	200	10	-	949
BSP126Δ	250	20	350	1500	100	-	0.001	-	200	15	-	955
BSP205Δ	60	20	275	1500	100	-	0.001	-	60	10	-	961
BSP206Δ	60	20	350	1500	100	-	0.001	-	100	12	-	965
BSP220Δ	200	20	225	1500	100	-	0.001	-	100	15	-	969
BSP225Δ	250	20	225	1500	100	-	0.001	-	100	15	-	977
BSR56	40	40	-	250	1	50	-	10	-	5	-	1023
BSR57	40	40	-	250	1	20	100	6	-	5	-	1023
BSR58	40	40	-	250	1	8	80	4	-	5	-	1023
BSS83**	10	-	50	230	10	-	-	2	-	0.6	-	1037
BSS84	50	20	130	360	6000	-	0.06	-	50	-	-	1041
BSS87	200	20	280	1000	100	-	0.06	-	140	10	-	1045
BSS131	240	20	100	360	10	-	0.06	-	60	-	-	1049

Notes

* Types in SOT89 package.

** Types in SOT143 package.

Δ Types in SOT223 package.

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	$\pm V_{DS}$ (V)	$-V_{GSO}$ (V)	I_D (mA)	P_{tot} (mW)	$-I_{GSS}$ (nA) max.	I_{DSS} (mA) min.	I_{DSS} (mA) max.	$-V_{(P)GS}$ (V) max.	$\lvert Y_{fs} \rvert$ (ms) min.	C_{rs} (pF) max.	V_n (μv) max.	
BSS192*	200	20	150	1000	100	-	0.06	-	60	15	-	1053
BST80*	80	20	500	1000	100	-	0.01	3.5	300	8	-	1075
BST82	80	20	175	300	100	-	0.001	3.5	150	3	-	1079
BST84*	200	20	250	1000	100	-	0.01	2.8	250	5	-	1083
BST86*	180	20	300	1000	100	-	0.01	2.4	250	6	-	1087
BST120*	60	20	300	1000	100	-	0.01	3.5	200	8	-	1091
BST122*	50	20	250	1000	100	-	0.01	3.5	125	8	-	1095
PMBF170	60	20	250	300	10	-	0.001	-	100	10	-	1191
PMBF4391	40	40	-	250	1	50	150	10	-	3.5	-	1195
PMBF4392	40	40	-	250	1	25	75	5	-	3.5	-	1195
PMBF4393	40	40	-	250	1	5	30	3	-	3.5	-	1195
PMBFJ108	25	25	-	250	3	80	-	-	-	15	-	1199
PMBFJ109	25	25	-	250	3	40	-	-	-	15	-	1199
PMBFJ110	25	25	-	250	3	10	-	-	-	15	-	1199
PMBFJ111	40	40	-	300	1	20	-	-	-	-	-	1205
PMBFJ112	40	40	-	300	1	5	-	-	-	-	-	1205
PMBFJ113	40	40	-	300	1	2	-	-	-	-	-	1205
PMBFJ174	30	30	-	300	1	20	135	10	-	4	-	1211
PMBFJ175	30	30	-	300	1	7	70	6	-	4	-	1211
PMBFJ176	30	30	-	300	1	2	35	4	-	4	-	1211
PMBFJ177	30	30	-	300	1	1.5	20	2.25	-	4	-	1211
2N7002	60	-	180	300	-	-	-	-	-	-	-	1365

Notes

* Types in SOT89 package.

** Types in SOT143 package.

SPECIAL TRANSISTORS IN SOT143

TYPE NUMBER	RATINGS				CHARACTERISTICS							PAGE
	V_{CBO} (V)	V_{CEO} (V)	I_C (mA)	P_{tot} (mW)	h_{FE} min.	h_{FE} max.	at I_C (mA)	at V_{CE} (V)	$V_{CE\,sat}$ max. (V)	at I_C/I_B (mA)	f_T typ. (MHz)	
PNP												
BCV62	30	30	100	250	100	800	2	5	0.65	100/5	150	339
BCV64	30	30	100	250	100	900	2	5	0.3	100/0.5	200	347
NPN												
BCV61	30	30	100	250	110	800	2	5	0.6	100/5	300	335
BCV63	30	30	100	250	100	900	2	5	0.65	100/5	200	343
NPN/PNP												
BCV65	30	30	100	250	75	800	2	5	0.3	10/0.5	100	351

TRIGGER DEVICES

TYPE	ENVELOPE	RATINGS		CHARACTERISTICS		PAGE
		V_{GA} (V) max.	I_A (mA) max.	I_P (μA)	I_V (μA)	
BRY61	SOT23	70	175	5/1	30/50	881
BRY62	SOT143	70	175	-	-	887

DIODES in SOT23/SOD80*/SOT143**

TYPE NUMBER	DESCRIPTION	RATINGS		CHARACTERISTICS				PAGE
		V_R (V)	I_F (MA)	t_{rr} max. (ns)	V_F (V)	at I_F (mA)	C_d max. (pF)	
BA423L*	band switch	20	50	-	0.9	50	2.5	89
BA682*	band switch	35	100	-	1	100	1.5	91
BA683*	band switch	35	100	-	1	100	1.5	91
BAS16	high-speed switch	75	250	6	1.25	150	2	93
BAS17	low-voltage stabilizer	-	250	-	0.87-0.96	100	140	97
BAS19	high-speed switch	100	200	50	1.25	200	5	101
BAS20	high-speed switch	150	200	50	1.25	200	5	101
BAS21	high-speed switch	200	200	50	1.25	200	5	101
BAS28**	fast switch double diode	75	250	6	1.25	150	2	109
BAS29	switch	90	250	50	1.25	400	35	113
BAS31	two diodes in series	90	250	50	1.25	400	35	113
BAS32*	high-speed switch	75	200	4	1	100	2	115
BAS32L*	high-speed switch	75	200	4	1	100	2	123

TYPE NUMBER	DESCRIPTION	RATINGS		CHARACTERISTICS				PAGE
		V_R (V)	I_F (MA)	t_{rr} max. (ns)	V_F (V)	at I_F (mA)	C_d max. (pF)	
BAS35	common diode double diode	90	250	50	1.25	400	35	113
BAS56**	ultra-high speed switch double diode	60	200	6	1.25	500	2.5	131
BAS85*	Schottky barrier	30	200	5	0.8	100	10	135
BAS86	Schottky barrier	50	200	4	0.9	100	-	139
BAT17	Schottky barrier	4	30	-	0.6	10	1	143
BAT18	band switch	35	100		1.2	100	1	147
BAT54	Schottky barrier	30	200	5	1	100	10	151
BAT54A;C;S	Schottky barrier	30	200	5	1	100	10	155
BAT74**	Schottky barrier double diode	30	200	5	1	100	10	157
BAV23**	two diodes	200	200	50	2.5	200	2.5	161
BAV70	common cathode double diode	70	250	6	1.25	150	1.5	163
BAV74	two diodes	50	250	4	1	100	2	167
BAV99	two diodes in series	70	250	6	1.25	150	1.5	171
BAV100*	general purpose	50	250	50	1.25	200	5	175
BAV101*	general purpose	100	250	50	1.25	200	5	175
BAV102*	general purpose	150	250	50	1.25	200	5	175
BAV103*	general purpose	200	250	50	1.25	200	5	175
BAV105*	ultra high speed	60	300	6	1.25	500	2.5	183
BAW56	common anode double diode	70	250	6	1.25	150	2	191
PMBD914	high speed switch	70	200	15	1	10	4	1179
PMBD6050	high speed switch	70	200	15	1.1	100	2.5	1183
PMBD7000	two diodes in series	100	200	15	1.1	100	1.5	1187
PMLL4148*	general purpose	75	200	4	1	10	4	1273
PMLL4150*	general purpose	50	300	6	1	200	2.5	1277
PMLL4151*	general purpose	50	200	2	1	50	2	1277
PMLL4153*	general purpose	50	200	2	0.88	20	2	1277
PMLL4446*	general purpose	75	200	4	1	20	4	1273
PMLL4448*	general purpose	70	200	4	1	100	4	1273

Notes

* Types in SOD80 package.

** Types in SOT143 package.

VARIABLE CAPACITANCE DIODES

TYPE NUMBER	ENVELOPE	RATINGS		CHARACTERISTICS					PAGE
		V_R (V)	I_F (mA)	C_d (pF)	at V_R (V)	C_d ratio (f = 1 MHz)	at V_R	r_D (Ω)	
BB215	SOD80	30	20	1.8 - 2.2	28	typ. 8.3	1/28	typ. 0.63	195
BB219	SOD80	30	20	2.6 - 3.2	28	12 - 15	1/28	typ. 0.7	197
BB240	SOD80	32	20	2.4 - 2.7	28	min. 14	0.5/28	max. 1	199
BB241	SOD80	32	20	2.5 - 3.0	28	min. 21	0.5/28	max. 2	201
BB249	SOD80	30	20	4 - 5	28	8 - 10	1/28	max. 0.6	203
BB804	SOT23	18	50	42 - 47.5	2	1.65 - 1.75	2/8	typ. 0.2	207
BBY31	SOT23	28	20	1.6 - 2	28	typ. 9.7	1/28	max. 1.2	209
BBY39	SOT23	30	20	1 - 2	28	min. 7.6	1/28	max. 0.75	213
BBY40	SOT23	28	20	3.8 - 4.8	28	8 - 12	1/28	max. 0.7	215
BBY42	SOT23	32	20	2.4 - 3	28	12 - 16	1/28	max. 1	219
BBY62	SOT143	28	20	1.6 - 2	28	typ. 9.7	1/28	max. 1.2	221

VOLTAGE REGULATOR DIODES

TYPE NUMBER	ENVELOPE	RATINGS					CHARACTERISTICS		PAGE
		VOLTAGE RANGE (V)	VOLTAGE TOLERANCE (%)	P_{tot} (mW)	I_{ZRM} (mA)	I_{FRM} (mA)	V_F max. (V)	at I_F (mA)	
BZD27	SOD87	7.5 to 510	5	2300	-	-	1.2	200	1125
BZV49	SOT89	2.4 to 75	5	1000	note 1	250	1	50	1131
BZV55	SOD80	2.4 to 75	2, 3, 5	500	-	250	0.9	10	1141
BZV80	SOD80	5.89 to6.51	-	400	50	-	-	-	1155
BZV81	SOD80	5.89 to 6.51	-	400	50	-	-	-	1155
BZX84	SOT23	2.4 to 75	2.5	350	250	250	0.9	10	1161
PMLL5225B to PMLL5267B	SOD80	3.0 to 75	5	500	-	250	1.1	200	1281

Note

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

TRANSIENT SUPPRESSION DIODES

TYPE NUMBER	ENVELOPE	CHARACTERISTICS				PAGE
		V_R (V)	$V_{(CL)R}$ (V)	I_{RSM} (A)	P_{RSM} (W)	
BZD27	SOD87	6.2 to 430	11.3 to 707	13.3 to 0.21 note 1	150 note 1	1125

Note

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

RECTIFIER DIODES

TYPE NUMBER	ENVELOPE	RATINGS					CHARACTERISTICS			PAGE
		$I_{F(AV)}$ (A)	V_{RRM} (V)	V_R (V)	I_{FRM} (A)	I_{FSM} (A)	t_{rr} (ns)	V_F (V)	at I_F (A)	
BYD17D	SOD87	1.5	200*	200	5.5	20	-	1.05	1	1107
BYD17G	SOD87	1.5	400*	400	5.5	20	-	1.05	1	1107
BYD17J	SOD87	1.5	600*	600	5.5	20	-	1.05	1	1107
BYD17K	SOD87	1.5	800*	800	5.5	20	-	1.05	1	1107
BYD17M	SOD87	1.5	1000*	1000	5.5	20	-	1.05	1	1107
BYD37D	SOD87	1.5	200	200	12	20	250	1.3	1	1115
BYD37G	SOD87	1.5	400	400	12	20	250	1.3	1	1115
BYD37J	SOD87	1.5	600	600	12	20	250	1.3	1	1115
BYD37K	SOD87	1.5	800	800	12	20	300	1.3	1	1115
BYD37M	SOD87	1.5	1000	1000	12	20	300	1.3	1	1115
BYD77A	SOD87	2.0	50	50	15	25	25	0.95	1	1121
BYD77B	SOD87	2.0	100	100	15	25	25	0.95	1	1121
BYD77C	SOD87	2.0	150	150	15	25	25	0.95	1	1121
BYD77D	SOD87	2.0	200	200	15	25	25	0.95	1	1121
BYD77E	SOD87	1.85	250	250	13	25	50	1.05	1	1121
BYD77F	SOD87	1.85	300	300	13	25	50	1.05	1	1121
BYD77G	SOD87	1.85	400	400	13	25	50	1.05	1	1121

Note

* V_{RWM}.

TEMPERATURE SENSORS

TYPE NUMBER	TEMPERATURE RANGE °C	RESISTANCE R at T_{amb} (Ω) note 1	SENSOR CURRENT (mA)	PAGE
KTY85-110	–40 to 125	1000 ± 1%	1	1173
KTY85-120	–40 to 125	1000 ± 2%	1	1173
KTY85-150	–40 to 125	1000 ± 5%	1	1173

Note

1. T_{amb} = 25 °C.

Type number survey

Surface mounted semiconductors — Type number survey

In this alphanumeric list we present all surface mounted devices mentioned in this handbook.

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BA423L	SOD80	diode			89
BA682	SOD80	diode	BA482		91
BA683	SOD80	diode	BA483		91
BAS16	SOT23	diode	BAW62, 1N4148		93
BAS17	SOT23	diode	BA314		97
BAS19	SOT23	diode	BAV19		101
BAS20	SOT23	diode	BAV20		101
BAS21	SOT23	diode	BAV21		101
BAS28	SOT143	2 diodes	1N4148		109
BAS29	SOT23	diode	BAX12		113
BAS31	SOT23	2 diodes	BAX12		113
BAS32	SOD80	diode	1N4148		115
BAS32L	SOD80C	diode			123
BAS35	SOT23	2 diodes	BAX12		113
BAS56	SOT143	2 diodes	BAV10		131
BAS85	SOD80	diode			135
BAS86	SOD80	diode			139
BAT17	SOT23	diode	BA480		143
BAT18	SOT23	diode	BA482		147
BAT54	SOT23	diode	BAT85		151
BAT54A	SOT23	2 diodes	BAT85 (double)		155
BAT54C	SOT23	2 diodes	BAT85 (double)		155
BAT54S	SOT23	2 diodes	BAT85 (double)		155
BAT74	SOT143	2 diodes	BAT85		157
BAV23	SOT143	2 diodes	BAV21		161
BAV70	SOT23	2 diodes	BAW62, 1N4148 (double)		163
BAV74	SOT23	2 diodes			167
BAV99	SOT23	2 diodes	BAW62, 1N4148 (double)		171
BAV100	SOD80	diode	BAV10		175
BAV101	SOD80	diode	BAV19		175
BAV102	SOD80	diode	BAV20		175
BAV103	SOD80	diode	BAV21		175
BAV105	SOD80	diode	BAV10		183
BAW56	SOT23	diode	BAW62, 1N4148 (double)		191
BB215	SOD80	diode	BB405B		195
BB219	SOD80	diode	BB909		197

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BB240	SOD80	diode			199
BB241	SOD80	diode			201
BB249	SOD80	diode			203
BB804	SOT23	diode			207
BBY31	SOT23	diode	BB405		209
BBY39	SOT23	2 diodes			213
BBY40	SOT23	diode	BB809		215
BBY42	SOT23	diode			219
BBY62	SOT143	2 diodes			221
BC807	SOT23	pnp			223
BC807-16	SOT23	pnp	BC327-16	BC817-16	223
BC807-25	SOT23	pnp	BC327-25	BC817-25	223
BC807-40	SOT23	pnp	BC327-40	BC817-40	223
BC808	SOT23	pnp			223
BC808-16	SOT23	pnp	BC328-16	BC818-16	223
BC808-25	SOT23	pnp	BC328-25	BC818-25	223
BC808-40	SOT23	pnp	BC328-40	BC818-40	223
BC817	SOT23	npn			229
BC817-16	SOT23	npn	BC337-16	BC807-16	229
BC817-25	SOT23	npn	BC337-25	BC807-25	229
BC817-40	SOT23	npn	BC337-40	BC807-40	229
BC818	SOT23	npn			229
BC818-16	SOT23	npn	BC328-16	BC808-16	229
BC818-25	SOT23	npn	BC328-25	BC808-25	229
BC818-40	SOT23	npn	BC328-40	BC808-40	229
BC846	SOT23	npn			235
BC846A	SOT23	npn	BC546A	BC856A	235
BC846B	SOT23	npn	BC546B	BC856B	235
BC847	SOT23	npn			235
BC847A	SOT23	npn	BC547A, BC107A	BC857A	235
BC847B	SOT23	npn	BC547B, BC107B	BC857B	235
BC847C	SOT23	npn	BC547C	BC857C	235
BC848	SOT23	npn			235
BC848A	SOT23	npn	BC584A, BC108A	BC858A	235
BC848B	SOT23	npn	BC548B, BC108B	BC858B	235
BC848C	SOT23	npn	BC548C, BC108C	BC858C	235
BC849	SOT23	npn			245
BC849B	SOT23	npn	BC549B, BC109B	BC859B	245

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BC849C	SOT23	npn	BC549C, BC109C	BC859C	245
BC850	SOT23	npn			245
BC850B	SOT23	npn	BC550B, BCY59	BC860B	245
BC850C	SOT23	npn	BC550C, BCY59	BC860C	245
BC856	SOT23	pnp			257
BC856A	SOT23	pnp	BC556A	BC846A	257
BC856B	SOT23	pnp	BC556B	BC846C	257
BC857	SOT23	pnp			257
BC857A	SOT23	pnp	BC557A, BC177A	BC847A	257
BC857B	SOT23	pnp	BC557B, BC177B	BC847B	257
BC857C	SOT23	pnp	BC557C	BC847C	257
BC858	SOT23	pnp			257
BC858A	SOT23	pnp	BC558A, BC178A	BC848A	257
BC858B	SOT23	pnp	BC558B, BC158B	BC848B	257
BC858C	SOT23	pnp	BC558C	BC848C	257
BC859	SOT23	pnp			265
BC859A	SOT23	pnp	BC559A, BC179A, BCY78		265
BC859B	SOT23	pnp	BC559B, BCY79	BC849B	265
BC859C	SOT23	pnp	BC559C, BCY79	BC849C	265
BC860	SOT23	pnp			265
BC860A	SOT23	pnp	BC560A, BCY79		265
BC860B	SOT23	pnp	BC560B, BCY79	BC850B	265
BC860C	SOT23	pnp	BC560C, BCY79	BC850C	265
BC868	SOT89	npn	BC368, BD329	BC869	275
BC868-10	SOT89	npn			275
BC868-16	SOT89	npn			275
BC868-25	SOT89	npn			275
BC869	SOT89	pnp	BC369, BD330	BC868	281
BC869-10	SOT89	pnp			281
BC869-16	SOT89	pnp			281
BC869-25	SOT89	pnp			281
BCF29	SOT23	pnp	BC559A, BCY78, BC179		287
BCF30	SOT23	pnp	BC559B, BCY78	BCF32	287
BCF32	SOT23	npn	BC549B, BCY58, BC109	BCF30	293
BCF33	SOT23	npn	BC549C, BCY58		293
BCF70	SOT23	pnp	BC560B, BCY79		299
BCF81	SOT23	npn	BC550C		305
BCP51	SOT223	pnp		BCP54	307

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BCP51-10	SOT223	pnp		BCP54-10	307
BCP51-16	SOT223	pnp		BCP54-16	307
BCP52	SOT223	pnp		BCP55	307
BCP52-10	SOT223	pnp		BCP55-10	307
BCP52-16	SOT223	pnp		BCP55-16	307
BCP53	SOT223	pnp		BCP56	307
BCP53-10	SOT223	pnp		BCP56-10	307
BCP53-16	SOT223	pnp		BCP56-16	307
BCP54	SOT223	npn		BCP51	311
BCP54-10	SOT223	npn		BCP51-10	311
BCP54-16	SOT223	npn		BCP51-16	311
BCP55	SOT223	npn		BCP52	311
BCP55-10	SOT223	npn		BCP52-10	311
BCP55-16	SOT223	npn		BCP52-16	311
BCP56	SOT223	npn		BCP53	311
BCP56-10	SOT223	npn		BCP53-10	311
BCP56-16	SOT223	npn		BCP53-16	311
BCP68	SOT223	npn			315
BCP69	SOT223	pnp			321
BCV26	SOT23	pnp	BC516	BCV27	327
BCV27	SOT23	npn	BC517	BCV26	329
BCV28	SOT89	pnp		BCV29	331
BCV29	SOT89	npn		BCV28	333
BCV46	SOT23	pnp		BCV47	327
BCV47	SOT23	npn		BCV46	329
BCV48	SOT89	pnp		BCV49	331
BCV49	SOT89	npn		BVC48	333
BCV61	SOT143	npn	BC547	BCV62	335
BCV61A	SOT143	npn			335
BCV61B	SOT143	npn			335
BCV61C	SOT143	npn			335
BCV62	SOT143	pnp	BC557	BCV61	339
BCV62A	SOT143	pnp			339
BCV62B	SOT143	pnp			339
BCV62C	SOT143	pnp			339
BCV63	SOT143	npn		BCV64	343
BCV63B	SOT143	npn			343
BCV64	SOT143	pnp		BCV63	347

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BCV64B	SOT143	pnp			347
BCV65	SOT143	pnp			351
BCV65B	SOT143	npn			351
BCV71	SOT23	npn	BC546A	BCW89	353
BCV72	SOT23	npn	BC546B		353
BCW29	SOT23	pnp	BC178A, BC558A	BCW31	355
BCW30	SOT23	pnp	BC178B, BC558B	BCW32	355
BCW31	SOT23	npn	BC108A, BC548A	BCW29	361
BCW32	SOT23	npn	BC108B, BC548B	BCW30	361
BCW33	SOT23	npn	BC108C, BC548C		361
BCW60A	SOT23	npn	BC548A	BCW61A	367
BCW60B	SOT23	npn	BC548B	BCW61B	367
BCW60C	SOT23	npn	BC548B	BCW61C	367
BCW60D	SOT23	npn	BC548C	BCW61D	367
BCW61A	SOT23	pnp	BC558A	BCW60A	371
BCW61B	SOT23	pnp	BC558B	BCW60B	371
BCW61C	SOT23	pnp	BC558B	BCW60C	371
BCW61D	SOT23	pnp	BC558C	BCW60D	371
BCW69	SOT23	pnp	BC557A	BCW71	375
BCW70	SOT23	pnp	BC557B	BCW72	375
BCW71	SOT23	npn	BC547A	BCW69	381
BCW72	SOT23	npn	BC547B	BCW70	381
BCW81	SOT23	npn	BC547C		387
BCW89	SOT23	pnp	BC556A	BCV71	389
BCX17	SOT23	pnp	BC327	BCX19	391
BCX18	SOT23	pnp	BC328	BCX20	391
BCX19	SOT23	npn	BC337	BCX17	395
BCX20	SOT23	npn	BC338	BCX18	395
BCX51	SOT89	pnp	BC636, BD136	BCX54	399
BCX51-10	SOT89	pnp		BCX54-10	399
BCX51-16	SOT89	pnp		BCX54-16	399
BCX52	SOT89	pnp	BC638, BD138	BCX55	399
BCX52-10	SOT89	pnp		BCX55-10	399
BCX52-16	SOT89	pnp		BCX55-16	399
BCX53	SOT89	pnp	BC640, BD140	BCX56	399
BCX53-10	SOT89	pnp		BXC56-10	399
BCX53-16	SOT89	pnp		BCX56-16	399
BCX54	SOT89	npn	BC635, BD135	BCX51	403

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BCX54-10	SOT89	npn		BCX51-10	403
BCX54-16	SOT89	npn		BCX51-16	403
BCX55	SOT89	npn	BC637, BD137	BCX52	403
BCX55-10	SOT89	npn		BCX52-10	403
BCX55-16	SOT89	npn		BCX52-16	403
BCX56	SOT89	npn	BC639, BD139	BCX53	403
BCX56-10	SOT89	npn		BCX53-10	403
BCX56-16	SOT89	npn		BCX53-16	403
BCX70G	SOT23	npn	BC107A, BC547A	BCX71G	407
BCX70H	SOT23	npn	BC107B, BC547B	BCX71H	407
BCX70J	SOT23	npn	BC107B, BC547B	BCX71J	407
BCX70K	SOT23	npn	BC107C, BC547C	BCX71K	407
BCX71G	SOT23	pnp	BC177A, BC557A	BCX70G	411
BCX71H	SOT23	pnp	BC177B, BC557B	BCX70H	411
BCX71J	SOT23	pnp	BC177B, BC557B	BCX70J	411
BCX71K	SOT23	pnp	BC557C	BCX70K	411
BDS60	SOT223	pnp		BDS61	415
BDS60A	SOT223	pnp		BDS61A	415
BDS60B	SOT223	pnp		BDS61B	415
BDS60C	SOT223	pnp		BDS61C	415
BDS61	SOT223	npn		BDS60	421
BDS61A	SOT223	npn		BDS60A	421
BDS61B	SOT223	npn		BDS60B	421
BDS61C	SOT223	npn		BDS60C	421
BDS77	SOT223	npn		BDS78	427
BDS78	SOT223	pnp		BDS77	433
BDS201	SOT223	npn		BDS202	427
BDS202	SOT223	pnp		BDS201	433
BDS203	SOT223	npn		BDS204	427
BDS204	SOT223	pnp		BDS203	433
BDS643	SOT223	npn		BDS644	439
BDS644	SOT223	pnp		BDS643	445
BDS645	SOT223	npn		BDS646	439
BDS646	SOT223	pnp		BDS645	445
BDS647	SOT223	npn		BDS648	439
BDS648	SOT223	pnp		BDS647	445
BDS649	SOT223	npn		BDS650	439
BDS650	SOT223	pnp		BDS649	445

TYPE NUMBER	PACKAGE	DEVICE TYPE	NEAREST CONVENTIONAL TYPE(S)	COMPLEMENT	PAGE
BDS651	SOT223	npn		BDS652	439
BDS652	SOT223	pnp		BDS651	445
BDS933	SOT223	npn		BDS934	451
BDS934	SOT223	pnp		BDS933	457
BDS935	SOT223	npn		BDS936	451
BDS936	SOT223	pnp		BDS935	457
BDS937	SOT223	npn		BDS938	451
BDS938	SOT223	pnp		BDS937	457
BDS939	SOT223	npn		BDS940	451
BDS940	SOT223	pnp		BDS939	457
BDS941	SOT223	npn		BDS942	451
BDS942	SOT223	pnp		BDS941	457
BDS943	SOT223	npn		BDS944	463
BDS944	SOT223	pnp		BDS943	469
BDS945	SOT223	npn		BDS946	463
BDS946	SOT223	pnp		BDS945	469
BDS947	SOT223	npn		BDS948	463
BDS948	SOT223	pnp		BDS947	469
BDS949	SOT223	npn		BDS950	475
BDS950	SOT223	pnp		BDS949	481
BDS951	SOT223	npn		BDS952	475
BDS952	SOT223	pnp		BDS951	481
BDS953	SOT223	npn		BDS954	475
BDS954	SOT223	pnp		BDS953	481
BDS955	SOT223	npn		BDS956	475
BDS956	SOT223	pnp		BDS955	481
BF510	SOT23	FET	BF410A		487
BF511	SOT23	FET	BF410B		487
BF512	SOT23	FET	BF410C		487
BF513	SOT23	FET	BF410D		487
BF550	SOT23	pnp	BF450		493
BF569	SOT23	pnp	BF970		495
BF570	SOT23	npn	BF370		497
BF579	SOT23	pnp	BF979		501
BF620	SOT89	npn	BF420, BF471, BF871	BF621	505
BF621	SOT89	pnp	BF421, BF472, BF872	BF620	509
BF622	SOT89	npn	BF422, BF469, BF869	BF623	505
BF623	SOT89	pnp	BF423, BF470, BF870	BF622	509

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BF660	SOT23	pnp	BF606A		513
BF720	SOT223	npn			515
BF721	SOT223	pnp			519
BF722	SOT223	npn			515
BF723	SOT223	pnp			519
BF747	SOT23	npn			523
BF820	SOT23	npn	BF420	BF821	535
BF821	SOT23	pnp	BF421	BF820	539
BF822	SOT23	npn	BF422	BF823	535
BF823	SOT23	pnp	BF423	BF822	539
BF824	SOT23	pnp	BF324		543
BF840	SOT23	npn	BF240		549
BF841	SOT23	npn	BF241		549
BF989	SOT143	FET	BF960		551
BF990A	SOT143	FET	BF980A		555
BF991	SOT143	FET	BF981		559
BF992	SOT143	FET	BF982		563
BF994S	SOT143	FET	BF964S		569
BF996S	SOT143	FET	BF966S		573
BF997	SOT143	FET	BF965		577
BF998	SOT143	FET			581
BFG16A	SOT223	npn			591
BFG17A	SOT143	npn			599
BFG25AX	SOT143	npn			607
BFG31	SOT223	pnp			611
BFG33	SOT143	npn			617
BFG33X	SOT143	npn			617
BFG35	SOT223	npn	BFQ34T, BFG34	BFG55	619
BFG55	SOT223	pnp		BFG35	631
BFG67	SOT143	npn	BFG65		637
BFG67X	SOT143	npn			637
BFG92A	SOT143	npn			641
BFG92AX	SOT143	npn			641
BFG93A	SOT143	npn			647
BFG93AX	SOT143	npn			647
BFG94	SOT223	npn			653
BFG97	SOT223	npn	BFR96		665
BFG135	SOT223	npn	BFQ135		675

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BFG197	SOT143	npn			687
BFG197X	SOT143	npn			687
BFG198	SOT223	npn	BFG195		721
BFQ17	SOT89	npn	BFW16A		731
BFQ18A	SOT89	npn	BFQ34		737
BFQ19	SOT89	npn	BFR96		741
BFQ67	SOT23	npn	BFQ65		747
BFQ149	SOT89	pnp			751
BFR30	SOT23	FET	BFW11, BF245		757
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BFR53	SOT23	npn	BFW30, BFW93		767
BFR92	SOT23	npn	BFR90	BFT92	775
BFR92A	SOT23	npn	BFR90		783
BFR93	SOT23	npn	BFR91	BFT93	795
BFR93A	SOT23	npn	BFR91		803
BFR101A	SOT143	FET			815
BFR101B	SOT143	FET			815
BFR106	SOT23	npn			817
BFR200	SOT143	FET			823
BFS17	SOT23	npn	BFY90, BFW92		827
BFS17A	SOT23	npn			833
BFS18	SOT23	npn	BF495		839
BFS19	SOT23	npn	BF494		839
BFS20	SOT23	npn	BF199		845
BFT25	SOT23	npn	BFT24		851
BFT25A	SOT23	npn			859
BFT46	SOT23	FET	BFW13, BF245		861
BFT92	SOT23	pnp	BFQ51; 52	BFR92	869
BFT93	SOT23	pnp	BFQ23; 24	BFR93	875
BRY61	SOT23	Pnpn	BRY56, BRY39		881
BRY62	SOT89	Pnpn	BRY39		887
BSD22	SOT89	FET			893
BSP15	SOT223	pnp	BSP19		897
BSP16	SOT223	pnp	BSP20		897
BSP19	SOT223	npn	BSP15		899
BSP20	SOT223	npn	BSP16		899
BSP30	SOT223	pnp			901
BSP31	SOT223	pnp			901

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BSP32	SOT223	pnp			901
BSP33	SOT223	pnp			901
BSP40	SOT223	npn			905
BSP41	SOT223	npn			905
BSP42	SOT223	npn			905
BSP43	SOT223	npn			905
BSP50	SOT223	npn	BSP60		909
BSP51	SOT223	npn	BSP61		909
BSP52	SOT223	npn	BSP62		909
BSP60	SOT223	pnp		BSP50	913
BSP61	SOT223	pnp		BSP51	913
BSP62	SOT223	pnp		BSP52	913
BSP103	SOT223	FET			917
BSP105	SOT223	FET			917
BSP106	SOT223	FET			921
BSP107	SOT223	FET			929
BSP108	SOT223	FET			937
BSP109	SOT223	FET			917
BSP110	SOT223	FET			941
BSP120	SOT223	FET			945
BSP121	SOT223	FET			949
BSP126	SOT223	FET			955
BSP205	SOT223	FET			961
BSP206	SOT223	FET			965
BSP220	SOT223	FET			969
BSP225	SOT223	FET			977
BSR12	SOT23	pnp	2N2894A	BSV52	985
BSR13	SOT23	npn	2N2222, PH2222	BSR15	991
BSR14	SOT23	npn	2N2222A,PH2222A	BSR16	991
BSR15	SOT23	pnp	2N2907, PH2907	BSR13	995
BSR16	SOT23	pnp	2N2907A,PH2907A	BSR14	995
BSR17A	SOT23	npn	2N3904	BSR18A	999
BSR18A	SOT23	pnp	2N3906	BSR17A	1003
BSR19	SOT23	npn	2N5550	BSR20	1007
BSR19A	SOT23	npn	2N5551	BSR20A	1007
BSR20	SOT23	pnp	2N5400	BSR19	1011
BSR20A	SOT23	pnp	2N5401	BSR19A	1011
BSR30	SOT89	pnp	2N4030	BSR40	1015

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BSR32	SOT89	pnp	2N4031	BSR42	1015
BSR33	SOT89	pnp	2N4033	BSR43	1015
BSR40	SOT89	npn	BSX466	BSR30	1019
BSR41	SOT89	npn	BSX4616	BSR31	1019
BSR42	SOT89	pnp	2N3020	BSR32	1019
BSR43	SOT89	npn	2N3019	BSR33	1019
BSR56	SOT23	FET	2N4856		1023
BSR57	SOT23	FET	2N4857		1023
BSR58	SOT23	FET	2N4858		1023
BSS63	SOT23	pnp	BSS68	BSS64	1027
BSS64	SOT23	npn	BSS38	BSS33	1033
BSS83	SOT143	FET			1037
BSS84	SOT23	FET			1041
BSS87	SOT89	FET			1045
BSS131	SOT23	FET			1049
BSS192	SOT89	FET			1053
BST15	SOT89	pnp	2N5415	BST40	1059
BST16	SOT89	pnp	2N5416	BST39	1059
BST39	SOT89	npn	2N3439	BST16	1063
BST40	SOT89	npn	2N3440	BST15	1063
BST50	SOT89	npn	BSR50, BSS50, BDX42		1067
BST51	SOT89	npn	BSR51, BSS51, BDX43		1067
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BST60	SOT89	pnp	BSR60, BSS60, BDX45		1071
BST61	SOT89	pnp	BSR61, BSS61, BDX46		1071
BST62	SOT89	pnp	BSR62, BSS62, BDX47		1071
BST80	SOT89	FET	BST70A		1075
BST82	SOT23	FET	BST72A		1079
BST84	SOT89	FET	BST74A		1083
BST86	SOT89	FET	BST76A		1087
BST120	SOT89	FET			1091
BST122	SOT89	FET			1095
BSV52	SOT23	npn	PH2369, BSX20	BSR12	1099
BYD17D	SOD87	diode	BYD13D		1107
BYD17G	SOD87	diode	BYD13G	BYD17J	1107
BYD17J	SOD87	diode	BYD13J		1107
BYD17K	SOD87	diode	BYD13K		1107

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BYD17M	SOD87	diode	BYD13M		1107
BYD37D	SOD87	diode	BYD33D		1115
BYD37G	SOD87	diode	BYD33G		1115
BYD37J	SOD87	diode	BYD33J		1115
BYD37K	SOD87	diode	BYD33K		1115
BYD37M	SOD87	diode	BYD33M		1115
BYD77A	SOD87	diode	BYD73A		1121
BYD77B	SOD87	diode	BYD73B		1121
BYD77C	SOD87	diode	BYD73C		1121
BYD77D	SOD87	diode	BYD73D		1121
BYD77E	SOD87	diode	BYD73E		1121
BYD77F	SOD87	diode	BYD73F		1121
BYD77G	SOD87	diode	BYD73G		1121
BZD27	SOD87	diode			1125
BZV49	SOT89	diode	BZV85		1131
BZV55	SOD80	diode	BZX79, BZX55		1141
BZV80	SOD80	diode			1155
BZV81	SOD81	diode			1155
BZV87	SOD80	diode			1157
BZX84	SOT23	diode	BZX79, BZX55		1161
KTY85-110	SOD80	sensor			1173
KTY85-120	SOD80	sensor			1173
KTY85-150	SOD80	sensor			1173
PMBD914	SOT23	diode			1179
PMBD6050	SOT23	diode			1183
PMBD7000	SOT23	diode			1187
PMBF170	SOT23	FET			1191
PMBF4391	SOT23	FET	2N4391		1195
PMBF4392	SOT23	FET	2N4392		1195
PMBF4393	SOT23	FET	2N4393		1195
PMBFJ108	SOT23	FET			1199
PMBFJ109	SOT23	FET			1199
PMBFJ110	SOT23	FET			1199
PMBFJ111	SOT23	FET			1205
PMBFJ112	SOT23	FET			1205
PMBFJ113	SOT23	FET			1205
PMBFJ174	SOT23	FET			1211
PMBFJ175	SOT23	FET			1211

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PMBFJ176	SOT23	FET			1211
PMBFJ177	SOT23	FET			1211
PMBT2222	SOT23	npn	2N2222, PM2222	PMBT2907	1215
PMBT2222A	SOT23	npn	2N2222A,PM2222A	PMBT2907A	1215
PMBT2369	SOT23	npn			1219
PMBT2907	SOT23	pnp	2N2907, PM2907	PMBT2222	1221
PMBT2907A	SOT23	pnp	2N2907A,PM2907A	PMBT2222A	1221
PMBT3904	SOT23	npn	2N3904	PMBT3906	1225
PMBT3906	SOT23	pnp	2N3906	PMBT3904	1229
PMBT4401	SOT23	npn			1233
PMBT4403	SOT23	pnp			1237
PMBT5088	SOT23	npn			1241
PMBT5401	SOT23	pnp			1245
PMBT5550	SOT23	npn			1247
PMBT5551	SOT23	npn			1249
PMBT6428	SOT23	npn	2N6428		1251
PMBT6429	SOT23	npn	2N6429		1251
PMBTA05	SOT23	npn	MPSA05	PMBTA55	1255
PMBTA06	SOT23	npn	MPSA06	PMBTA56	1255
PMBTA13	SOT23	npn	MPSA13	PMBTA63	1257
PMBTA14	SOT23	npn	MPSA14	PMBTA64	1257
PMBTA42	SOT23	npn	MPSA42	PMBTA94	1259
PMBTA43	SOT23	npn	MPSA43	PMBTA93	1259
PMBTA55	SOT23	npn	MPSA55	PMBTA05	1263
PMBTA56	SOT23	npn	MPSA56	PMBTA06	1263
PMBTA63	SOT23	pnp	MPSA63	PMBTA13	1265
PMBTA64	SOT23	pnp	MPSA63	PMBTA14	1265
PMBTA92	SOT23	pnp	MPSA92	PMBTA42	1267
PMBTA93	SOT23	pnp	MPSA93	PMBTA43	1267
PMBZ5226B -PMBZ5257B	SOT23	diode			1269
PMLL4148	SOD80	diode			1273
PMLL4446	SOD80	diode			1273
PMLL4448	SOD80	diode			1273
PMLL4150	SOD80	diode			1277
PMLL4151	SOD80	diode			1277
PMLL4153	SOD80	diode			1277
PMLL5225B -PMLL5267B	SOD80	diode	1N5225B -1N5267B		1281

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PRLL4001	SOD87	diode			1285
PRLL4002	SOD87	diode			1285
PRLL5817	SOD87	diode			1289
PRLL5818	SOD87	diode			1289
PRLL5819	SOD87	diode			1289
PXT2222	SOT89	npn		PXT2907	1297
PXT2222A	SOT89	npn		PXT2907A	1297
PXT2907	SOT89	pnp		PXT2222	1301
PXT2907A	SOT89	pnp		PXT2222A	1301
PXT3904	SOT89	npn	2N3904	PXT3906	1305
PXT3906	SOT89	pnp	2N3906	PXT3904	1309
PXT4401	SOT89	npn		PXT4403	1313
PXT4403	SOT89	pnp		PXT4401	1317
PXTA14	SOT89	npn		PXTA64	1321
PXTA27	SOT89	npn		PXTA77	1323
PXTA64	SOT89	pnp		PXTA14	1325
PXTA77	SOT89	pnp		PXTA27	1327
PXTA92	SOT89	pnp			1329
PXTA93	SOT89	pnp			1329
PZT2222	SOT223	npn		PZT2907	1331
PZT2222A	SOT223	npn		PZT2907A	1331
PZT2907	SOT223	pnp		PZT2222	1335
PZT2907A	SOT223	pnp		PZT222A	1335
PZT3904	SOT223	npn			1339
PZT3906	SOT223	pnp			1343
PZTA05	SOT223	npn			1347
PZTA06	SOT223	npn			1347
PZTA13	SOT223	npn		PZTA63	1351
PZTA14	SOT223	pnp		PZTA64	1351
PZTA42	SOT223	npn			1353
PZTA43	SOT223	npn			1353
PZTA55	SOT223	pnp			1357
PZTA56	SOT223	pnp			1357
PZTA63	SOT223	pnp		PZTA13	1361
PZTA64	SOT223	pnp		PZTA14	1361
PZTA92	SOT223	pnp			1363
PZTA93	SOT223	pnp			1363
2N7002	SOT23	FET			1365

Conversion list

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(conventional type number to SMD type number)

conven.[1]	micro.[2]	conven.[1]	micro.[2]	conven.[1]	micro.[2]
BA243	BAT18	BC177	BC857	BC546B	BC846B
BA314	BAS17		BCW69/70		BCV72
BA480	BAT17	BC177A	BC857A	BC547	BC847
BA481	BAT17		BCW69		BCW71/72/81
BA482	BA682	BC177B	BC857B	BC547A	BC847A
BA483	BA683		BCW70		BCW71
BAT85	BAT54	BC178	BC858	BC547B	BC847B
	BAT74		BCW29/30		BCW72
BAV10	BAS56	BC178A	BC858A	BC547C	BC847C
BAV18	BAV100		BCW29		BCW81
BAV19	BAS19	BC178B	BC858B	BC548	BC848
	BAV101		BCW30		BCW31-33
BAV20	BAS20	BC179	BC859	BC548A	BC848A
	BAV102		BCF29/30		BCW31
BAV21	BAS21	BC179A	BC859A	BC548B	BC848B
BAW62	BAS16		BCF29		BCW32
	BAS28	BC179B	BC859B	BC548C	BC848C
	BAS32		BCF30		BCW33
	BAV70	BC200/01	BC859B	BC549	BC849
	BAV99		BCF29		BCF32-33
	BAW56	BC200/02	BC859B/C	BC549B	BC849B
BAX12	BAS29		BCF29/30		BCF32
	BAS31	BC200/03	BC859C	BC549C	BC849C
	BAS35		BCF30		BCF33
BB405	BBY31	BC327	BC807	BC550	BC850
BB809	BBY40		BCX17		BCF81
BC107	BC847	BC327-16	BC807-16	BC550B	BC850B
	BCW71/72	BC327-25	BC807-25	BC550C	BC850C
BC107A	BC847A	BC327-40	BC807-40	BC556	BC856
	BCW71	BC327A			BCW89
BC107B	BC847B	BC328	BC808	BC556A	BC856A
	BCW72	BC328-16	BC808-16		BCW89
BC108	BC848	BC328-25	BC808-25	BC556B	BC856B
	BCW31-33	BC328-40	BC808-40	BC557	BC857
BC108A	BC848A	BC337	BC817		BCW69/70
	BCW31		BCX19	BC557A	BC857A
BC108B	BC848B	BC337-16	BC817-16		BCW69
	BCW32	BC337-25	BC817-25	BC557B	BC857B
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	BCFC33	BC338-40	BC818-40		BCW29
BC146/01	BC849B	BC368	BC868	BC558B	BC858B
	BCF32	BC369	BC869		BCW30
BC146/02	BC849B/C	BC516	BCV26	BC558C	BC858C
	BCF32/33	BC517	BCV27	BC559	BC859
BC146/03	BC849C	BC546	BC846		BCF29/30
	BCF33		BCV71/72	BC559A	BC859A
BC156	BCV26	BC546A	BC846A		BCF29
BC157	BCV27		BCV71		

[1] = conventional type
[2] = microminiature type

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conven.[1]	micro.[2]	conven.[1]	micro.[2]	conven.[1]	micro.[2]
BC559B	BC859B	BCY57	BC849	BD136	BCX51
	BCF30		BCF32/33		BCP54
BC559C	BC859C	BCY58	BC849	BD136-10	BCX51-10
BC560	BC860		BCW60 fam.		BCP51-10
	BCF70	BCY58-VII	BCW60A	BD136-16	BCX51-16
BC560A	BC860A	BCY58-VIII	BC849B		BCP51-16
BC560B	BC860B		BCW60B	BD137	BCX55
	BCF70	BCY58-IX	BC849B		BCP55
BC560C	BC860C		BCW60C	BD137-10	BCX55-10
BC635	BCX54	BCY58-X	BC849C		BCP55-10
	BCP54		BCW60D	BD137-16	BCX55-16
BC635-10	BCX54-10	BCY59	BC850		BCP55-16
	BCP54-10		BCX70 fam.	BD138	BCX52
BC635-16	BCX54-16	BCY59-VII	BCX70G		BCP52
	BCP54-16	BCY59-VIII	BC850B	BD138-10	BCX52-10
BC636	BCX51		BCX70H		BCP52-10
	BCP51	BCY59-IX	BC850B	BD138-16	BCX52-16
BC636-10	BCX51-10		BCX70J		BCP52-16
	BCP51-10	BCY59-X	BC850C	BD139	BCX56
BC636-16	BCX51-16		BCX70K		BCP56
	BCP51-16	BCY65	BCV71	BD139-10	BCX56-10
BC637	BCX55		BCV72		BCP56-10
	BCP55	BCY70	BC860	BD139-16	BCX56-16
BC637-10	BCX55-10		BCF70		BCP56-16
	BCP55-10	BCY71	BC860	BD140	BCX53
BC637-16	BCX55-16		BCF70		BCP53
	BCP55-16	BCY72	BC859	BD140-10	BCX53-10
BC638	BCX52		BCF29/30		BCP53-10
	BCP52	BCY78	BC859	BD140-16	BCX53-16
BC638-10	BCX52-10		BCW61 fam.		BCP53-16
	BCP52-10	BCY78-VII	BC859A	BDX42	BST50
BC638-16	BCX52-16		BCW61A		BSP50
	BCP52-16	BCY78-VIII	BCY859A/B	BDX43	BST51
BC639	BCX56		BCW61B		BSP51
	BCP56	BCY78-IX	BC859B	BDX44	BST52
BC639-10	BCX56-10		BCW61C		BSP52
	BCP56-10	BCY78-X	BV859C	BDX45	BST60
BC639-16	BCX56-16		BCW61D		BSP60
	BCP56-16	BCY79	BC860	BDX46	BST61
BC640	BCX53		BCX71 fam.		BSP61
	BCP53	BCY79-VII	BC860A	BDX47	BST61
BC640-10	BCX53-10		BCX71G		BSP61
	BCP53-10	BCY79-VIII	BC860A/B	BF199	BFS20
BC640-16	BCX53-16		BCX71H	BF240	BF840
	BCP53-16	BCY79-IX	BC860B	BF241	BF841
BCX58	BCW60		BCX71J	BF324	BF824
BCX59	BCX70	BD135	BCX54	BF370	BSV52
BCX78	BCW61		BCP54		BF570
BCX79	BCX71	BD135-10	BCX54-10	BF410A	BF510
BCY56	BC850B		BCP54-10	BF410B	BF511
	BCF70	BD135-16	BCX54-16	BF410C	BF512
			BCP54-16	BF410D	BF513

[1] = *conventional type*
[2] = *microminiature type*

conven.[1]	micro.[2]
BF419	BST40
BF420	BF620
	BF720
	BF820
BF421	BF621
	BF721
	BF821
BF422	BF622
	BF722
	BF822
BF423	BF623
	BF723
	BF823
BF450	BF550
BF457	BST40
BF458	BST40
BF459	BST39
BF469	BF622
	BF722
BF470	BF623
	BF723
BF471	BF620
	BF720
BF472	BF621
	BF721
BF483	BF720
BF484	BF723
BF486	BF721
BF494	BFS19
BF494B	BFS19
BF495	BFS18
BF459C	BFS18
BF459D	BFS18
BF606A	BF660
BF819	BST40
	BSP20
BF857	BST40
	BSP20
BF858	BST40
	BSP20
BF859	BST39
BF869	BF622
	BF722
BF870	BF623
	BF723
BF871	BF620
	BF720
BF872	BF621
	BF721
BF926	BF660
BF960	BF989
BF964	BF994
	BF994S
BF966	BF996
	BF996S

conven.[1]	micro.[2]
BF970	BF569
BF970A	BF569
BF979	BF579
BF980	BF990
BF981	BF991
BF982	BF992
BFG65	BFG67
BFQ23	BFT93
BFQ24	BFT93
BFQ34	BFQ18A
	BF935
BFQ34T	BFQ18A
	BF935
BFQ51	BFT92
BFQ52	BFT92
BFQ65	BFQ67
BFR54	BSV52
BFR90	BFR92A
BFR91	BFR93A
BFR96	BFQ19
	BF927
BFR96S	BFQ19
	BF927
BFT24	BFT25
BFT44	BST16
	BSP16
BFT45	BST15/16
	BSP15/16
BFW11	BFR30
BFW12	BFR31
BFW13	BFT46
BFW16A	BFQ17
BFW30	BFR53
BFW92	BFS17
BFW93	BFR53
BFX29	BSR16
BFX30	BSR16
BFX84	BSR40
	BSP40
BFX85	BSR41
	BSP41
BFX86	BSR41
	BSP41
BFX87	BSR16
BFX88	BSR15
BFY50	BSR40
	BSP40
BFY51	BSR40
	BSP40
BFY52	BSR40
	BSP40

conven.[1]	micro.[2]
BFY55	BSR40
	BSP40
BFY90	BFS17
BR101	BRY62
BRY39	BRY62
BRY56	BRY61
BSR50	BST50
	BSP50
BSR51	BST51
	BSP51
BSR52	BST52
	BSP52
BSR60	BST60
	BSP60
BSR61	BST61
	BSP61
BSR62	BST62
	BSP62
BSS38	BSS64
BSS50	BST50
	BSP50
BSS51	BST51
	BSP51
BSS52	BST52
	BSP52
BSS60	BST60
	BSP60
BSS61	BST61
	BSP61
BSS62	BST62
	BSP62
BSS68	BSS63
BSV15	BSR30/31
	BSP30/31
BSV15-6	BSR30
	BSP30
BSV15-10	BSR30/31
	BSP30/31
BSV15-16	BSR31
	BSP31
BSV16	BSR30/31
	BSP30/31
BSV16-6	BSR30
	BSP30
BSV16-10	BSR30/31
	BSP30/31
BSV16-16	BSR31
	BSP31
BSV17	BSR32/33
	BSP32/33
BSV17-6	BSR32
	BSP32

[1] = *conventional type*
[2] = *microminiature type*

CONVERSION LIST

conven.[1]	micro.[2]
BSV17-10	BSR32/33
	BSP32/33
BSX20	BSV52
BSX45	BSR40/41
	BSP40/41
BSX45-6	BSR40
	BSP40
BSX45-10	BSR40/41
	BSP40/41
BSX45-16	BSR41
	BSP41
BSX46	BSR40/41
	BSP40/41
BSX46-6	BSR40
	BSP40
BSX46-10	BSR40/41
BSX46-16	BSR41
BSX47	BSR42/43
BSX47-6	BSR42
BSX47-10	BSR42-43
BSY95A	BSV52
BZX55	BZX84
BZX79	BZX84
	BZV55
BZV85	BZV49
MPS6513	BC848A
MPS6514	BC848A
MPS6515	BC848B
MPS6517	BC858A
MPS6518	BC858A
MPS6519	BC858B
MPS6520	BC859B
MPS6521	BC859C
MPS6522	BC859B
MPS6523	BC859C
MPSA05	PMBTA05
MPSA06	PMBTA06
MPSA13	PMBTA13
MPSA14	PMBTA14
MPSA42	PMBTA42
MPSA43	PMBTA43
MPSA55	PMBTA55
MPSA56	PMBTA56
MPSA63	PMBTA63
MPSA64	PMPTA64
MPSA92	PMBTA92
MPSA93	PMBTA93
PH2222	BSR13
PH2222A	BSR14
PH2369	BSV52
PH2907	BSR15

conven.[1]	micro.[2]
PH2907A	BSR16
PN2222	PMBT2222
	BSR13
PN2222A	PMBT 2222A
	BSR14
PN2369	PMBT 2369
	BSV52
PN2369A	PMBT 2369A
PN2907	PMBT2907
	BSR15
PM2907A	PMBT2907A
	BSR16
PN3439	BST39
	BSP19
PN3440	BST40
	BSP20
PN5415	BST15
	BSP15
PN5416	BST16
	BSP16
1N4148	BAS16
	BAV90
	BAV99
	BAW56
1N5225B	PMLL5225B
to	to
1N5267B	PMLL5267B
2N894A	BSR12
2N929	BC850
2N930	BNC850
	BCF81
2N1613	BDSR40
2N1711	BSR41
2N1893	BSR42
2N2219	BSR13
2N2219A	BSR14
2N2222	BSR13
	PMBT2222
2N2222A	BSR14
	PMBT2222A
2N2297	BSR40
2N2368	BSV52
2N2369	BSV52
2N2369A	BSV52
2N2483	BC850B
2N2484	BC850B/C
2N2905	BSR15
2N2905A	BSR16
2N2907	BSR15
	PMBT2907
2N2907A	BSR16
	PMBT2907A

conven.[1]	micro.[2]
2N3019	BSR43
2N3020	BSR42
2N3053	BSR40/41
2N3904	BSR17A
	PMBT3904
2N3906	BSR18A
	PMBT3906
2N4030	BSR30
2N4031	BSR32
2N4032	BSR31
2N4033	BSR33
2N4124	BSR18 A
2N4400	PMBT4400
2N4401	PMBT4401
2N4402	PMBT4402
2N4403	PMBT4403
2N4856	BSR56
2N4857	BSR57
2N4858	BSR58
2N5086	PMBT5086
2N5087	PMBT5087
2N5088	PMBT5088
2N5415	BST15
2N5416	BST16
2N6428	PMBT6428
2N6429	PMBT6429

[1] = *conventional type*
[2] = *microminiature type*

Marking list

MARKING LIST

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

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

MARK	TYPE NO.
A1p	BAW56
A2p	BAT18
A3p	BAT17
A4p	BAV70
A5p	BRY61
A51	BRY62
A6p	BAS16
A7p	BAV99
A91	BAS17
AAp	BCW60A
AA	BCX51
ABp	BCW60B
ACp	BCW60C
AC	BCX51-10
ADp	BCW60D
AD	BCX51-16
AE	BCX52
AGp	BCX70G
AG	BCX52-10
AHp	BCX70H
AH	BCX53
AJp	BCX70J
AKp	BCX70K
AK	BCX53-10
AL	BCX53-16
AM	BCX52-16
AMp	BSS64
AR1	BSR40
AR2	BSR41
AR3	BSR42
AR4	BSR43
AS1	BST50
AS2	BST51
AS3	BST52
AT1	BST39

MARK	TYPE NO.
AT2	BST40
B2p	BSV52
B5p	BSR12
B26	BF570
BAp	BCW61A
BA	BCX54
BBp	BCW61B
BCp	BCW61C
BC	BCX54-10
BDp	BCW61D
BD	BCX54-16
BE	BCX55
BGp	BCX71G
BG	BCX55-10
BHp	BCX71H
BH	BCX56
BJp	BCX71J
BKp	BCX71K
BK	BCX56-10
BL	BCX56-16
BM	BCX55-16
BMp	BSS63
BR1	BSR30
BR2	BSR31
BR3	BSR32
BR4	BSR33
BS1	BST60
BS2	BST61
BS3	BST62
BT1	BST15
BT2	BST16
C1p	BCW29
C2p	BCW30
C7p	BCF29
C8p	BCF30

MARK	TYPE NO.
C91	BCV62
C92	BCV62A
C93	BCV62B
C94	BCV62C
C95	BCV64
C96	BCV64B
CAC	BC868
CBC	BC868-10
CCC	BC868-16
CDC	BC868-25
CEC	BC869
CGC	BC869-10
D1p	BCW31
D2p	BCW32
D3p	BCW33
D7p	BCF32
D8p	BCF33
D95	BCV63
D96	BCV63B
DA	BF622
DB	BF623
DC	BF620
DF	BF621
E1p	BFS17
F1p	BFS18
F2p	BFS19
F8p	BF824
FA	BFQ17
FB	BFQ19
FDp	BCV26
FEp	BCV46
FFp	BCV27
FF	BFQ18A
FGp	BCV47
G1p	BFS20
H1p	BCW69
H2p	BCW70
H3p	BCW89
H7p	BCF70
JAp	BAV74

MARK	TYPE NO.
JPp	BAS19
JRp	BAS20
JSp	BAS21
JTp	BAS28
K1p	BCW71
K2p	BCW72
K3p	BCW81
K7p	BCV71
K8p	BCV72
K9p	BCF81
KM	BST80
KN	BST84
KO	BST86
L20	BAS29
L21	BAS31
L22	BAS35
L30	BAV23
L4p	BAT54
L41	BAT74
L42	BAT54A
L43	BAT54C
L44	BAT54S
L51	BAS56
LEp	BF660
LAp	BF550
LHp	BF569
LJp	BF579
LM	BST120
LN	BST122
LOp	BSR174
LPp	BSR175
LQp	BSR176
LRp	BSR177
M1p	BFR30
M2p	BFR31
M3p	BFT46
M31	BSD20
M32	BSD22
M4p	BSR56
M5p	BSR57

MARK	TYPE NO.
M6p	BSR58
M74	BSS83
M87	BF990A
M91	BF991
M92	BF992
M97	BFR101A
M98	BFR101B
MAp	BF989
MGp	BF994S
MKp	BF997
MWp	BF996S
N1p	BFR53
NCp	BF840
NDp	BF841
P1p	BFR92
p1A	PMBT3904
	(SOT23)
	PXT3904
	(SOT89)
p1B	PMBT2222
	(SOT23)
	PXT2222
	(SOT89)
p1D	PMBTA42
p1E	PMBTA43
p1F	PMBT5550
p1H	PMBTA05
p1J	PMBT2369
p1G	PMBTA06
p1K	PMBT6428
p1L	PMBT6429
p1M	PMBTA13
p1N	PMBTA14
	(SOT23)
	PXTA14
	(SOT89)
p1P	PMBT2222A
	(SOT23)
	PXT2222A
	(SOT89)

MARK	TYPE NO.
p1Q	PMBT5088
p1Y	PMBT3903
p2P	BFR92A
p2A	PMBT3906
	(SOT23)
	PXT3906
	(SOT89)
p2B	PMBT2907
	(SOT23)
	PXT2907
	(SOT89)
p2D	PMBTA92
p2E	PMBTA93
p2F	PMBT2907A
	(SOT23)
	PXT2907A
	(SOT89)
p2H	PMBTA55
p2L	PMBT5401
p2G	PMBTA56
p2T	PMBT4403
	(SOT23)
	PXT4403
	(SOT89)
p2V	PBMTA63
p2V	PBMTA64
	(SOT23)
	PXTA64
	(SOT89)
p2X	PMBT4401
	(SOT23)
	PXT4401
	(SOT89)
p6J	PMBF4391
p6K	PMBF4392
p6G	PMBF4393
p6S	PMBFJ176
p6W	PMBFJ175
p6X	PMBFJ174
p6Y	PMBFJ177

MARK	TYPE NO.
pG1	PMBT5551
R1p	BFR93
R2p	BFR93A
SF	BB804
S1p	BBY31
S2	BBY40
S4	BBY62
S6p	BF510
S7p	BF511
S8p	BF512
S9p	BF513
S12	BBY39
S13	BBY42
T1p	BCX17
T2p	BCX18
T7p	BSR15
T8p	BSR16
T9p	BSR18
T35	BSR20
T36	BSR20A
T92	BSR18A
U1p	BCX19
U2p	BCX20
U7p	BSR13
U8p	BSR14
U9p	BSR17
U35	BSR19
U36	BSR19A
U92	BSR17A
V1p	BFT25
V2p	BFQ67
V3	BFG67
V12	BFG67X
W1p	BFT92
X1p	BFT93
Y1	BZX84-C11
Y2	BZX84-C12
Y3	BZX84-C13
Y4	BZX84-C15
Y5	BZX84-C16

MARK	TYPE NO.
Y6	BZX84-C18
Y7	BZX84-C20
Y8	BZX84-C22
Y9	BZX84-C24
Y10	BZX84-C27
Y11	BZX84-C30
Y12	BZX84-C33
Y13	BZX84-C36
Y14	BZX84-C39
Y15	BZX84-C43
Y16	BZX84-C47
Y17	BZX84-C51
Y18	BZX84-C56
Y19	BZX84-C62
Y20	BZX84-C68
Y21	BZX84-C75
Z1	BZX84-C4V7
Z2	BZX84-C5V1
Z3	BZX84-C5V6
Z4	BZX84-C6V2
Z5	BZX84-C6V8
Z6	BZX84-C7V5
Z7	BZX84-C8V2
Z8	BZX84-C9V1
Z9	BZX84-C10
Z11	BZX84-C2V4
Z12	BZX84-C2V7
Z13	BZX84-C3V0
Z14	BZX84-C3V3
Z15	BZX84-C3V6
Z16	BZX84-C3V9
Z17	BZX84-C4V3
O2p	BST82
1Ap	BC846A
1Bp	BC846B
1Dp	BC846
1Ep	BC847A
1Fp	BC847B
1Gp	BC847C
1Hp	BC847

MARK	TYPE NO.
1Jp	BC848A
	(SOT23)
1Jp	BCV61A
	(SOT143)
1Kp	BC848B
	(SOT23)
1Kp	BCV61B
	(SOT143)
1Lp	BC848C
	(SOT23)
1Lp	BCV61C
	(SOT143)
1Mp	BC848
	(SOT23)
1Mp	BCV61
	(SOT143)
1Vp	BF820
1Wp	BF821
1Xp	BF822
1Yp	BF823
2Bp	BC849B
2Cp	BC849C
2Dp	BC849
2Fp	BC850B
2Gp	BC850C
2Hp	BC850
2Y4	BZV49-C2V4
2Y7	BZV49-C2V7
3Ap	BC856A
3Bp	BC856B
3BR	BC856BR
3Dp	BC856
3Ep	BC857A
3Fp	BC857B
3Jp	BC858A
3Gp	BC857C
3Hp	BC857
3Kp	BC858B
3Lp	BC858C
3Mp	BC858

MARK	TYPE NO.
3Y0	BZV49-C3V0
3Y3	BZV49-C3V3
3Y6	BZV49-C3V6
3Y9	BZV49-C3V9
4Ap	BC859A
4Bp	BC859B
4Cp	BC859C
4Dp	BC859
4Ep	BC860A
4Fp	BC860B
4Gp	BC860C
4Hp	BC860
4Y3	BZV49-C4V3
4Y7	BZV49-C4V7
5Ap	BC807-16
5Bp	BC807-25
5Cp	BC807-40
5Dp	BC807
5Ep	BC808-16
5Fp	BC808-25
5Gp	BC808-40
5Hp	BC808
5Y1	BZV49-C5V1
5Y6	BZV49-C5V6
6Ap	BC817-16
6Bp	BC817-25
6Cp	BC817-40
6Dp	BC817
6Ep	BC818-16
6Fp	BC818-25
6Gp	BC818-40
6Hp	BC818
6Y2	BZV49-C6V2
6Y8	BZV49-C6V8
7Y5	BZV49-C7V5
8Y2	BZV49-C8V2
9Y1	BZV49-C9V1
10Y	BZV49-C10
11Y	BZV49-C11
12Y	BZV49-C12

MARK	TYPE NO.
13Y	BZV49-C13
15Y	BZV49-C15
16Y	BZV49-C16
18Y	BZV49-C18
20Y	BZV49-C20
22Y	BZV49-C22
24Y	BZV49-C24
27Y	BZV49-C27
30Y	BZV49-C30
33Y	BZV49-C33
36Y	BZV49-C36
39Y	BZV49-C39
43Y	BZV49-C43
47Y	BZV49-C47
51Y	BZV49-C51
56Y	BZV49-C56
62Y	BZV49-C62
68Y	BZV49-C68
75Y	BZV49-C75
97p	BCV65
98p	BCV65B

General

TAPE AND REEL SPECIFICATION

Semiconductors in SOT23 and SOT143 encapsulations can be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.

Separate reel packing for SOT89, SOD87, SOT223 and SOD80 encapsulations are given in Figs 2 to 5 respectively.

The configuration of the reel and flange is given in Fig. 6.

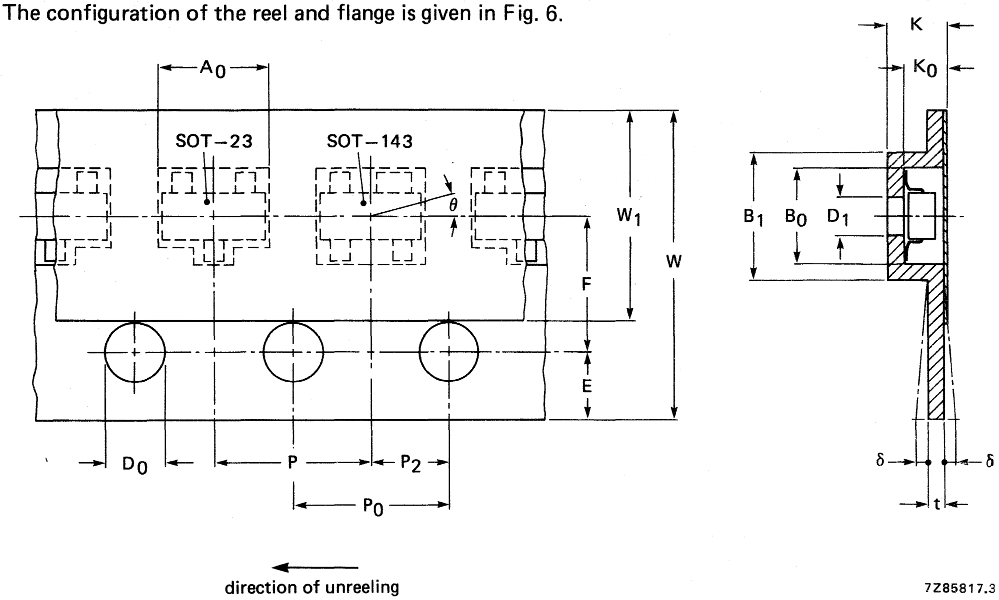


Fig.1 Configuration of bandolier. Dimensions in mm.

Compartment			tol.
length	A_0	component length	+0,2
width	B_0	component width	+0,2
depth	K_0	0,95	+0,2
width outside	B_1	3,3	max.
pitch	P	4,0	±0,1
deviation	Θ	15°	max.
hole diameter	D_1	1	min.
Sprocket hole			
diameter	D_0	1,5	+0,1
pitch	P_0	4,0	±0,1
distance	E	1,75	±0,1
cumulative (10) pitch error		±0,1	

Centre line dimensions			tol.
length direction	P_2	2,0	±0,05
width direction	F	3,5	±0,05
Fixing tape			
width	W_1	5,5	±0,25
thickness	—	0,1	max.
Carrier tape			
width	W	8,0	±0,2
bending	δ	0,3	max.
thickness	t	0,4	max.
Overall thickness	K	1,5	max.

Semiconductors in SOT89 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.

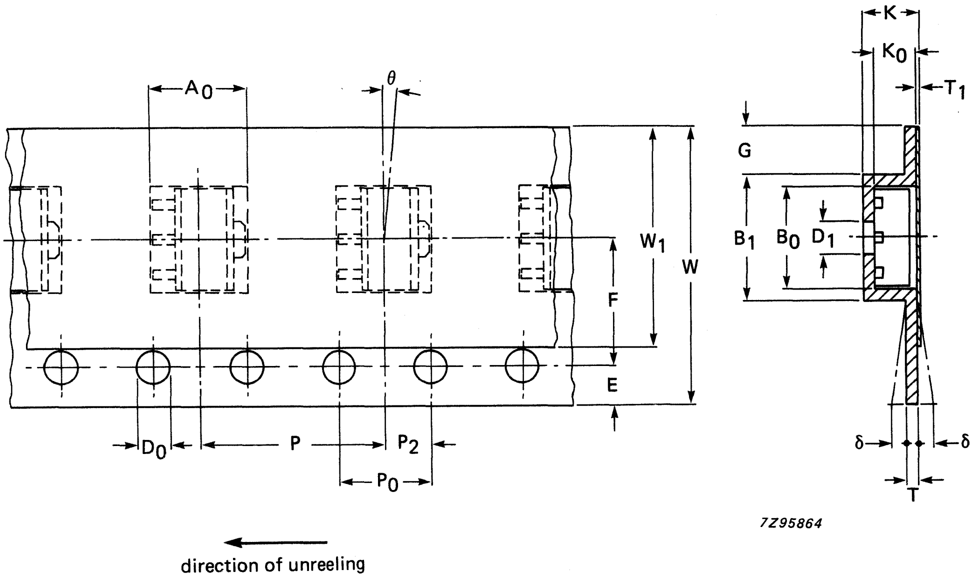


Fig.2 Configuration of bandolier. Dimensions in mm.

Compartment			tol.
length	A_0 component length		
width	B_0 component width		
depth	K_0 component depth		
width outside	B_1	5,7	max.
pitch	P	8,0	±0,1
deviation	Θ	± 5°	max.
hole diam.	D_1	1,5	min.
Sprocket hole			
diameter	D_0	1,5	+0,1
pitch	P_0	4,0	±0,1
distance	E	1,75	±0,1
cumulative (10) pitch error		±0,1	

Centre line dimensions			tol.
length direction	P_2	2,0	± 0,05
width direction	F	5,5	± 0,1
Fixing tape			
width	W_1	9,5	max.
thickness	T_1	0,1	max.
Carrier tape			
width	W	12	± 0,2
bending	δ	0,3	max.
thickness	T	0,4	max.
Overall thickness	K	2,4	max.
distance	G	1,8	min.

Semiconductors in SOD87 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments. Total number of devices per reel is 2000.

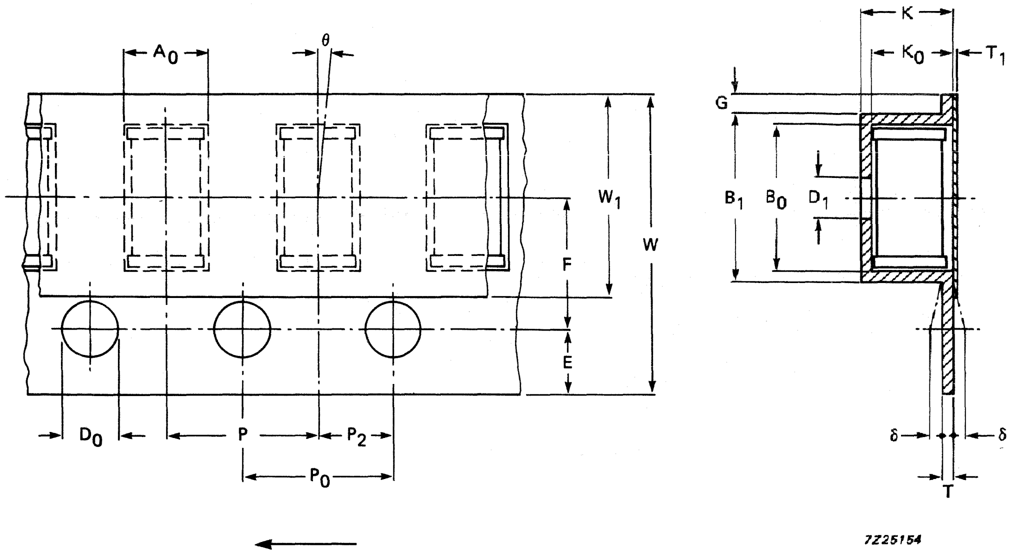


Fig.3 Configuration of bandolier. Dimensions in mm.

Note: Testing of SOD87 devices is not possible in this tape. Total number of devices per reel is 2000.

Compartment			tolerance
length	A_0	2.1	+0.3
width	B_0	3.8	min.
depth	K_0	2.1	+0.3
width outside	B_1	4.5	max.
pitch	P	4.0	± 0.1
deviation	θ	± 5°	max.
hole diameter	D_1	1.0	+0.1
Sprocket hole			
diameter	D_0	1.5	+0.1
pitch	P_0	4.0	±0.1
distance	E	1.75	±0.1
cumulative (10) pitch error		± 0.1	

Centre line dimensions			tolerance
length direction	P_2	2.0	± 0.05
width direction	F	3.5	± 0.1
Fixing tape			
width	W_1	5.5	max.
thickness	T_1	0.1	max
Carrier tape			
width	W	8	± 0.2
bending	δ	0.3	max.
thickness	T	0.4	max.
Overall thickness	K	2.5	max.

Semiconductors in SOT223 encapsulations can also be delivered in reel packing for automatic placement on hybrid circuits and printed-circuit boards. The devices are placed with the mounting side downwards in compartments.

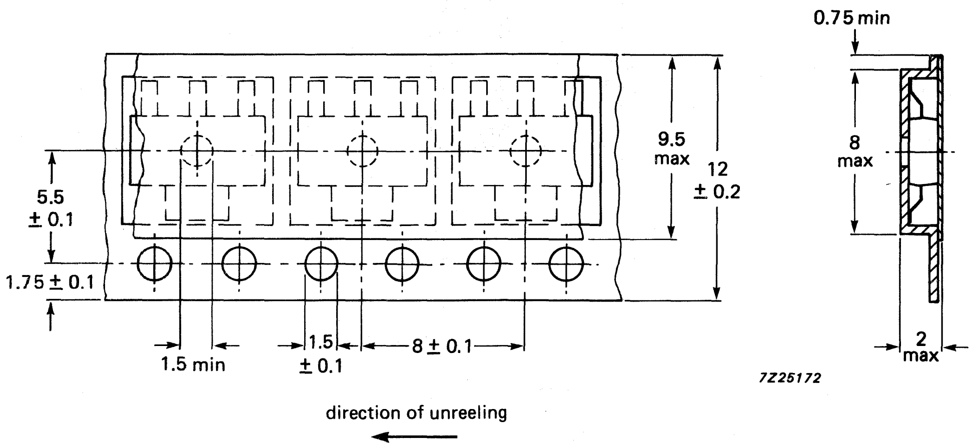


Fig.4 Configuration of bandolier. Dimensions in mm.

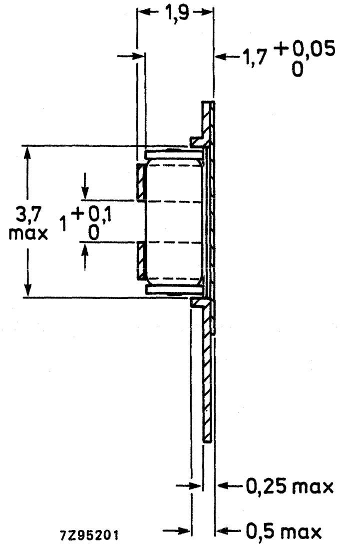


Fig.5 Cross-sectional view of bandolier with **SOD80** devices.

Note: Testing of SOD80 devices is possible in this tape. The cathode is directed towards the sprocket hole. The total number of devices per reel is 2500.

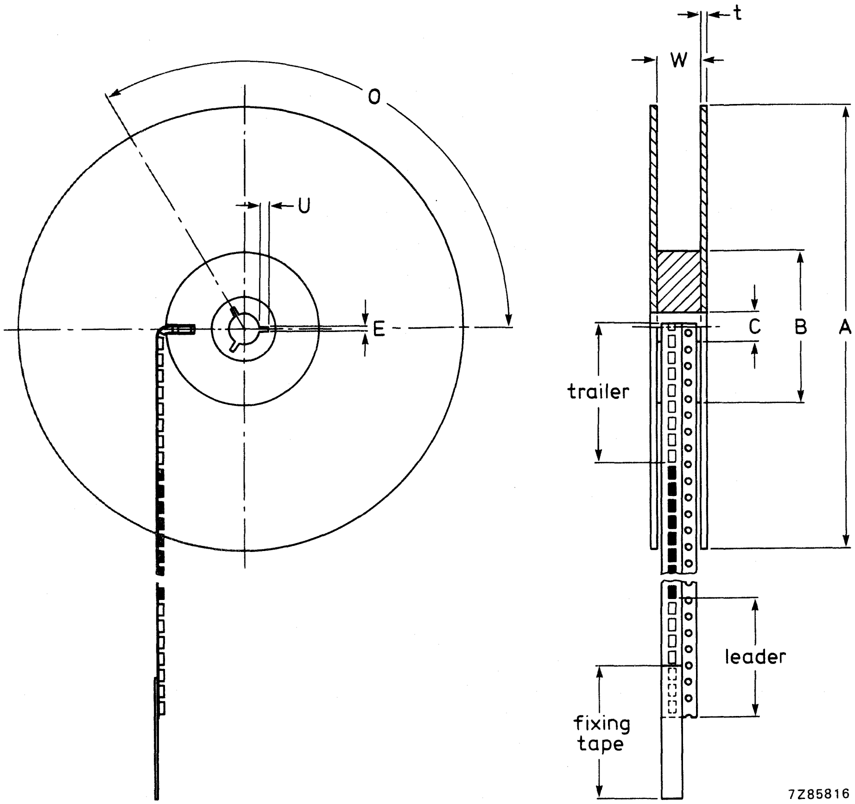


Fig.6 Configuration of reel and flange (dimensions in mm).

Flange			tol.
diameter	A	180	+0 −2
thickness	t	1,5	+0,5 −0,1
space between flanges	W	9,5	± 0,5

Hub			tol.
diameter	B	62	± 1,5
spindle hole	C	12,75	+0,15 −0
key slit			
width	E	2	± 0,5
depth	U	4	± 0,5
location	O	120	degrees

Amount of devices per reel

The bandolier of a 180 mm reel contains at least 3000 devices with no more than 15 empty compartments (0,5%). Three consecutive empty places might be found provided this gap is followed by 6 consecutive devices.

The carrier tape (leader) starts with at least 75 empty positions (equivalent to 300 mm); the covering foil is at least 300 mm. In order to fix the carrier tape a self-adhesive tape of 20 to 50 mm is applied.

At the end of the bandolier (trailer) at least 75 empty positions (equivalent to a length of 300 mm) and 300 mm foil. For fixing onto the reel a self-adhesive tape of 20 to 50 mm is applied.

SOLDERING RECOMMENDATIONS

SMD devices are ideally suited for placement onto thick and thin film substrates and printed boards.

To assure reliable and consistent connections particular attention should be paid to:

1. **Flux**

   A non-active flux is recommended. Where active fluxes are employed, great care in subsequent substrate cleaning must be exercised.

2. **Metal-alloy solder or solder paste**

   Correct choice of solder alloy or solder paste to be employed e.g. 62% Sn, 36% Pb, 2% Ag or 60% Sn/40% Pb. Any paste used should contain at least 85% metal dry weight.

3. **Soldering temperature**

   This will vary according to the actual method employed.

REFLOW SOLDERING

The preferred techique for mounting microminiature components on hybrid thick and thin-film is the method of reflow soldering.

The tags of SOT23, SOT143 and SOT89 envelopes are pre-tinned and the best results are obtained if a similar solder is applied to the corresponding soldering areas on the substrate. This can be done by either dipping the substrate in a solder bath or by screen printing a solder paste.
The maximum temperature of the leads or tab during the soldering cycle should not exceed 285 ^{o}C.
The most economic method of soldering is a process in which all different components are soldered simultaneously for example SOT23, SOT143 or SOT89 devices, capacitors and resistors.

Having first been fluxed, all components are positioned on the substrate. The slight adhesive force of the flux is sufficient to keep the components in place. Solder paste contains a flux and has therefore good inherent adhesive properties which eases positioning of the components.

With the components in position the substrate is heated to a point where the solder begins to flow. This can be done on a heating plate or on a conveyor belt running through an infrared tunnel. The maximum allowed temperature of the plastic body of a device must be kept below 280 ^{o}C during the soldering cycle. For further temperature behaviour during the soldering process see Figs 2 and 3.

The surface tension of the liquid solder tends to draw the tags of the device towards the centre of the soldering area and has thus a correcting affect on slight mispositionings. However, if the layout leaves something to be desired the same effect can result in undesirable shifts; particularly if the soldering areas on the substrate and the components are not concentrally arranged. This problem can be solved using a standard contact pattern, which leaves sufficient scope for the self-positioning effect (see Figs 4 to 9).

After cooling the connections may be visually inspected and, where necessary, repaired with a light soldering iron. Finally any remaining flux must be removed carefully.

WAVE SOLDERING

The normal (dual) wave soldering process can also be applied to SOD80, SOT23, SOD87 and SOT143 envelopes. We do not recommend SOT89 to be used with wave soldering process.

IMMERSION SOLDERING

Where a complete substrate or printed circuit board is immersed in solder:

a. The temperature of the soldering bath should not exceed 280 °C.
b. The duration of the soldering cycle should not exceed 10 seconds.
c. Forced cooling may be applied (see Fig. 1).

HAND SOLDERING

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

1. It is time-consuming and expensive.
2. The device cannot be positioned accurately and therefore the connecting tags may come into contact with the substrate and damage it.
3. There is a great risk of breaking either substrate or even internal connections inside the encapsulation.
4. The envelope may be damaged by the iron.

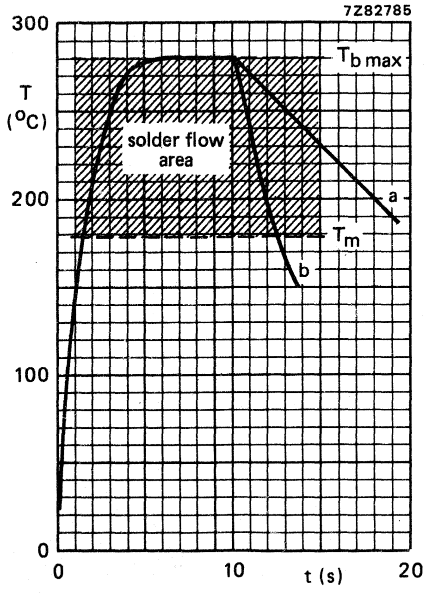
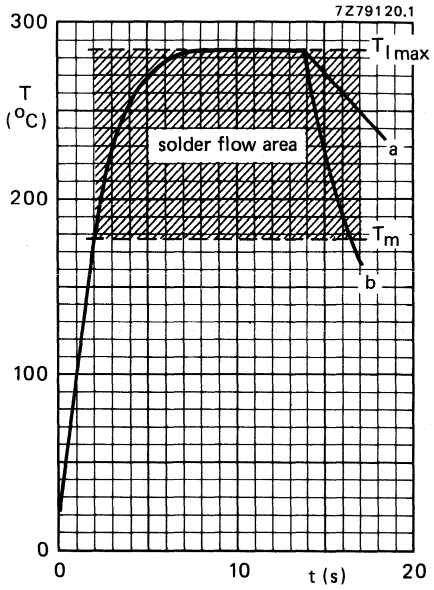


Fig.1 Device temperature during *immersion* soldering.

Maximum time of immersion in soldering bath is 10 seconds at an ambient temperature of 25 °C.

a = free convection cooling; b = forced cooling.
$T_{b\,max}$ = maximum bath temperature (280 °C).
T_m = melting temperature of solder (179 °C).



a = free convection cooling

b = permissible forced cooling

$T_{l\,max}$ = maximum lead or tab temperature = 285 °C

T_m = melting point of the solder is 179 °C

T_{amb} = 25 °C

Time of heat supply:
without preheating max. 14 s
with preheating max. 10 s

Maximum time of preheating 45 s

Fig.2 Reflow soldering without preheating.

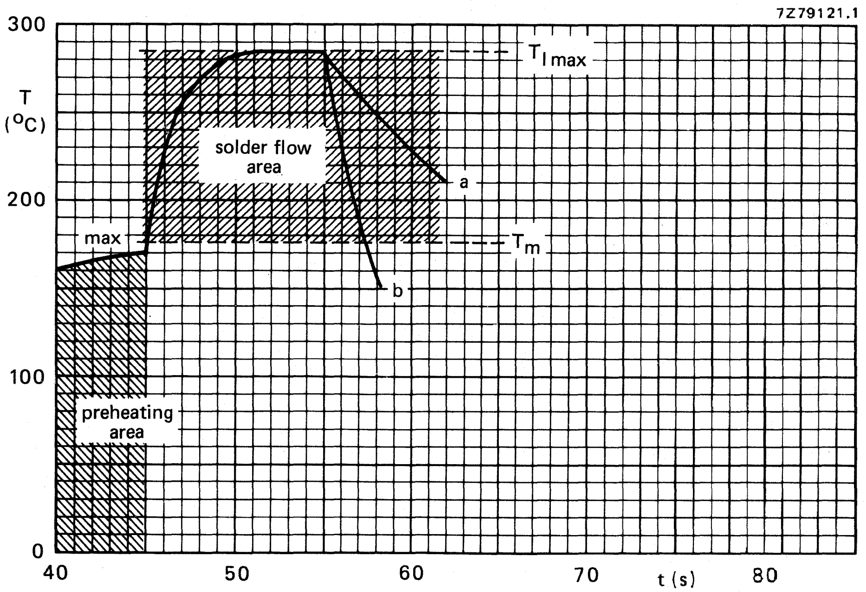


Fig.3 Reflow soldering with preheating.

Minimum required dimensions of metal connection pads on hybrid thick and thin-film substrates.

Dimensions in mm

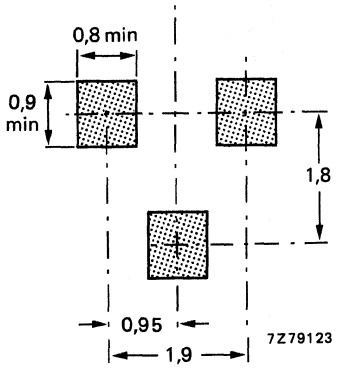


Fig.4 SOT23 pattern.

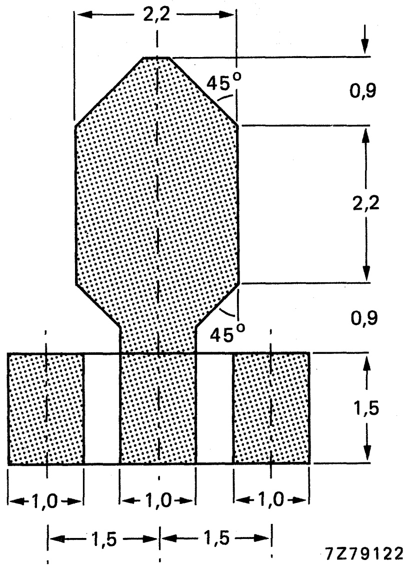


Fig.5 SOT89 pattern.

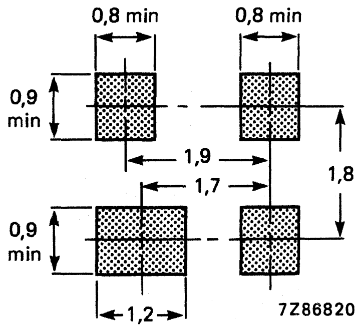


Fig.6 SOT143 pattern.

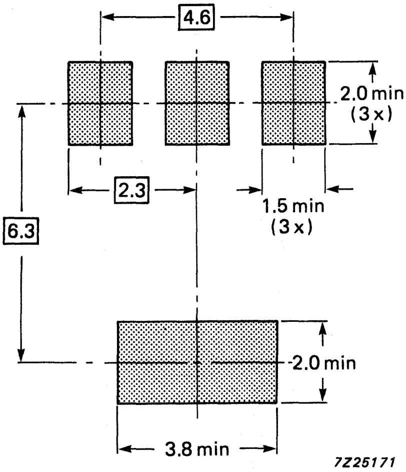


Fig.7 SOT223 pattern.

Minimum required dimensions of metal connection pads on hybrid thick and thin-film substrates.

Dimensions in mm

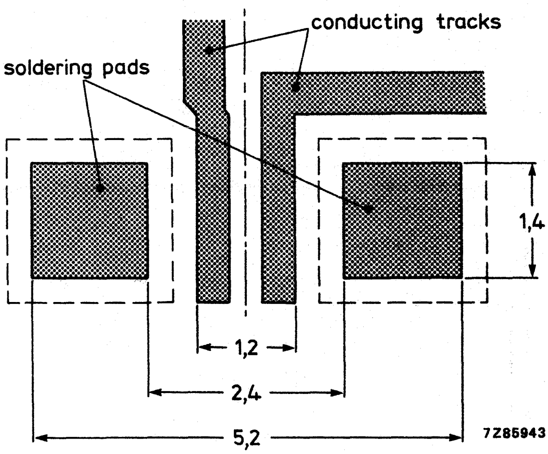


Fig.8 SOD80 pattern.

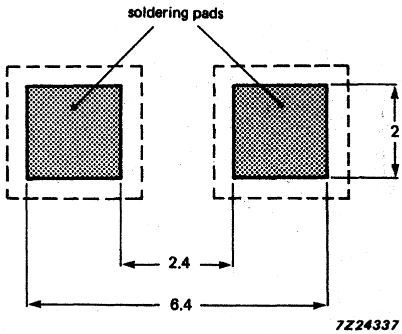


Fig. 9 SOD87 pattern.

THERMAL CHARACTERISTICS

The heat generated in a semiconductor chip normally flows by various paths to the surroundings (ambient).

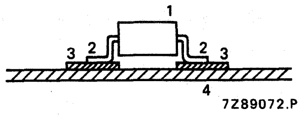


Fig.1.

1. Heat radiation from the envelope to ambient (1).
   This heat transfer can be neglected when the envelope is mounted on a substrate or printed board.
2. Heat transmission via leads (2) soldering points (3) and substrate (4).

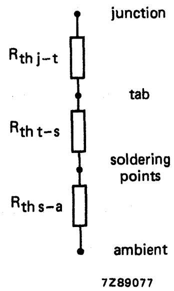


Fig.2 Thermal behaviour of heat flow when the device is mounted on a substrate or printed board.

$R_{th\,j\text{-}t}$ = Thermal resistance from junction to tab.

$R_{th\,t\text{-}s}$ = Thermal resistance from tab to soldering points.

$R_{th\,s\text{-}a}$ = Thermal resistance from soldering points to ambient.

Internal $R_{th} = R_{th\,j\text{-}t} + R_{th\,t\text{-}s}$ = 320 K/W (SOT23/143).

Heat transfer from soldering points to ambient (Fig.3)

This depends on the shape and material of tracks and substrate. In Figures 4 to 8 standard mounting conditions are given to set up the maximum power ratings for SOT23, SOT143, SOT89, SOD87 and SOT223 encapsulations.

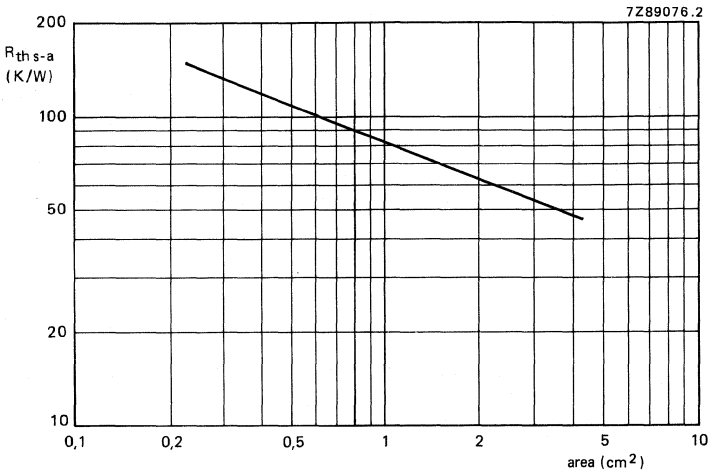


Fig.3 Heat transfer from soldering points to ambient.

Ceramic substrate

The $R_{th\ s\text{-}a}$ depends on the size of the ceramic substrate due to good conductive properties.

Printed board

$R_{th\ s\text{-}a}$ = 150 K/W for SOT23 and SOT143 envelopes mounted on a printed board.
P_{tot} = 250 mW for SOT23 and SOT143 envelopes mounted on a printed board.

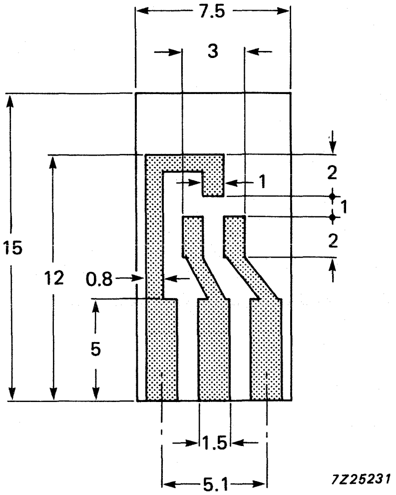


Fig.4 Test circuit for SOT23.

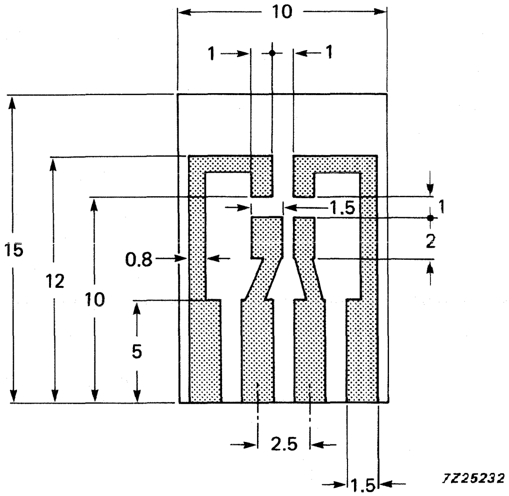


Fig.5 Test circuit for SOT143.

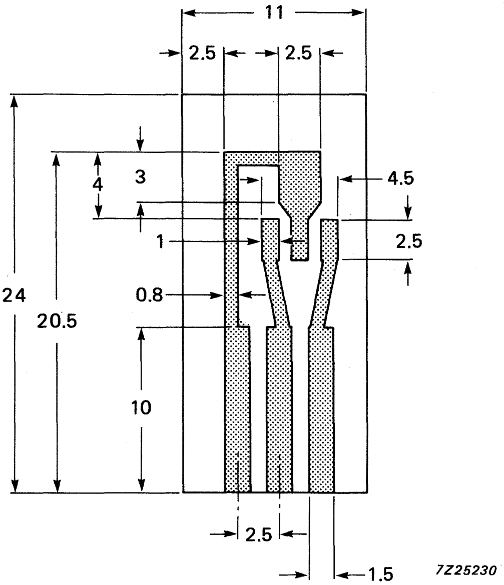


Fig.6 Test circuit for SOT89.

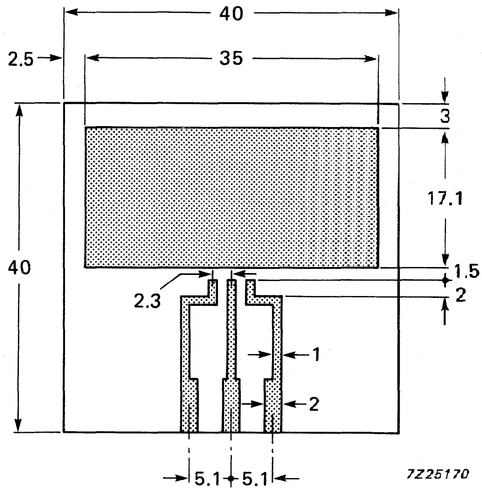


Fig.7 Test circuit for SOT223.

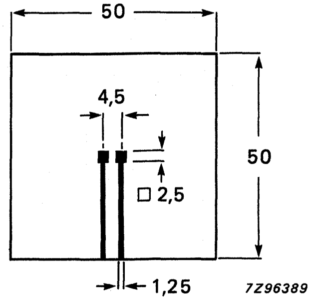


Fig.8 Test circuit for SOD87.

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

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

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

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

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

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

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

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

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

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

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

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

DESIGN MAXIMUM RATING SYSTEM

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

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

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

DESIGN CENTRE RATING SYSTEM

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

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

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

TRANSISTOR RATINGS

The ratings are presented as voltage, current, power and temperature ratings. The list of these ratings and their definitions is given as follows:

Transistor voltage ratings

Collector to base voltage ratings

V_{CBmax} — The maximum permissible instantaneous voltage between collector and base terminals. The collector voltage is negative with respect to base in PNP transistors and positive with respect to base in NPN types.

V_{CBmax} (IE = 0) — The maximum permissible instantaneous voltage between collector and base terminals, when the emitter terminal is open circuited.

Emitter to base voltage ratings

V_{EBmax} — The maximum permissible instantaneous reverse voltage between emitter and base terminal. The emitter voltage is negative with respect to base for PNP transistor and positive with respect to base for NPN types.

V_{EBmax} ($I_C = 0$) — The maximum permissible instantaneous reverse voltage between emitter and base terminals when the collector terminal is open circuited.

Collector to emitter voltage ratings

V_{CEmax} — The maximum permissible instantaneous voltage between collector and emitter terminals. The collector voltage is negative with respect to emitter in PNP transistors and positive with respect to emitter in NPN types. This rating is very dependent on circuit conditions and collector current and it is necessary to refer to the curve of V_{CE} versus I_C for the appropriate circuit condition in order to obtain the correct rating.

V_{CEmax} (Cut-off) — The maximum permissible instantaneous voltage between collector and emitter terminals when the emitter current is reduced to zero by means of a reverse emitter base voltage, i.e. the base voltage is normally positive with respect to emitter for PNP transistor and negative with respect to emitter for NPN types.

NOTE: The term "cut-off" is sometimes replaced by $V_{BE} > x$ volts, or $\frac{R_B}{R_E}, \leqslant y$ which are equivalent conditions under which the device may be cut-off.

V_{CEmax} ($I_C = x$ mA) — The maximum permissible instantaneous voltage between collector and emitter terminals when the collector current is at a high value, often the max. rated value.

V_{CEmax} ($I_B = 0$) — The maximum permissible instantaneous voltage between collector and emitter terminals when the base terminal is open circuited or when a very high resistance is in series with the base terminal. Special care must be taken to ensure that thermal runaway due to excessive collector leakage current does not occur in this condition.

Due to the current dependency of V_{CE} it is usual to present this information as a voltage rating chart which is a curve of collector current versus collector to emitter voltage (see Fig. 1).

This curve is divided into two areas:

A permissible area of operation under all conditions of base drive provided the dissipation rating is not exceeded (area 1) and an area where operation is allowable under certain specified conditions (area 2). To assist in determining the rating in this second area, further curves are provided relating the voltage rating to external circuit conditions, for example:

$$\frac{R_B}{R_E},\ R_B,\ Z_{Bg},\ V_{BE},\ I_B \text{ or } \frac{V_{BB}}{R_B}.$$

An example of this type of curve is given in Fig. 2 as V_{CE} versus $\frac{R_B}{R_E}$ for two different values of collector current.

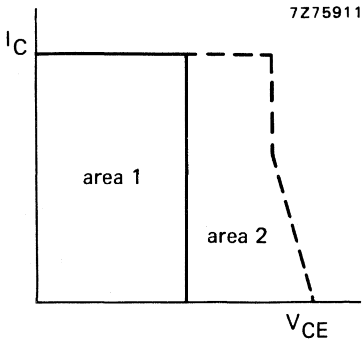


Fig. 1.

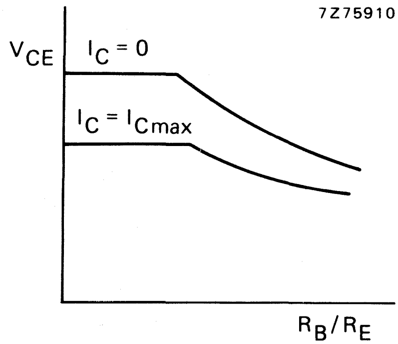


Fig. 2.

It should be noted that when R_E is shunted by a capacitor, the collector voltage V_{CE} during switching must be restricted to a value which does not rely on the effect of R_E.
In the case of an inductive load and when an energy rating is given, it may be permissible to operate outside the rated area provided the spcified energy rating is not exceeded.

Transistor current ratings

Collector current ratings

I_{Cmax}	The maximum permissible collector current. Without further qualification, the d.c. value is implied.
$I_{C(AV)max}$	The maximum permissible average value of the total collector current
I_{CM}	The maximum permissible instantaneous value of the total collector current.

Emitter current ratings

I_{Emax}	The maximum permissible emitter current. Without further qualification, the d.c. value is implied.
$I_{E(AV)max}$	The maximum permissible average value of the total emitter current.
$I_{ER(AV)max}$	The maximum permissible average value of the total emitter current when operating in the reverse emitter-base breakdown region.
I_{EM}	The maximum permissible instantaneous value of the total emitter current.
I_{ERM}	The maximum permissible instantaneous value of the total reverse emitter current allowable in the reverse breakdown region.

Base current ratings

I_{Bmax}	The maximum permissible base current. Without further qualification, the d.c. value is implied.
$I_{B(AV)max}$	The maximum permissible average value of the total base current.
$I_{BR(AV)max}$	The maximum permissible average value of the total reverse base current allowable in the reverse breakdown region.
I_{BM}	The maximum permissible instantaneous value of the total base current. The rating also includes the switch off current.
I_{BRM}	The maximum permissible instantaneous value of the total reverse current allowable in the reverse breakdown region.

Transistor power ratings

P_{tot} max: The total maximum permissible continuous power dissipation in the transistor and includes both the collector-base dissipation and the emitter-base dissipation. Under steady state conditions the total power is given by the expression:

$$P_{tot} = V_{CE} \times I_C + V_{BE} \times I_B.$$

In order to distinguish between "steady state" and "pulse" conditions the terms "steady state power (P_S)" and "pulse power (P_P)" are often used. The permissible total power dissipation is dependent upon temperature and its relationship is shown by means of a chart as shown in Fig. 3.

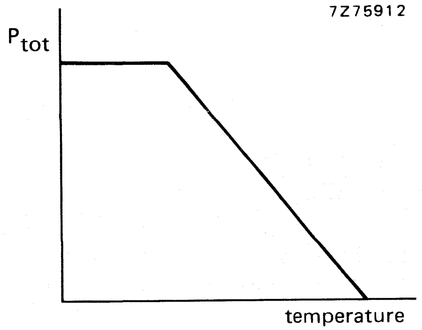


Fig. 3.

The temperature may be ambient, case or mounting base temperatures. Where a cooling clip or a heatsink is attached to the device, the allowable power dissipation is also dependent on the efficiency of the heatsink.

The efficiency of this clip or heatsink is measured in terms of its thermal resistance ($R_{th\ h}$) normally expressed in degrees kelvin per watt (K/W). For mounting base rated devices, the added effect of the contact resistance ($R_{th\ i}$) must be taken into account.

The effect of heatsinks of various thermal resistance and contact resistance is often included in the above chart.

Thus for any heatsink of known thermal resistance and any given ambient temperature, the maximum permissible power dissipation can be established. Alternatively, knowing the power dissipation which will occur and the ambient temperature, the necessary heatsink thermal resistance can be calculated.

A general expression from which the total permissible steady state power dissipation can be calculated is:

$$P_{tot} = \frac{T_j - T_{amb}}{R_{th\,j\text{-}a}}$$

where $R_{th\,j\text{-}a}$ is the thermal resistance from the transistor junction to the ambient. For case rated or mounting base rated devices, the thermal resistance $R_{th\,j\text{-}a}$ is made up of the thermal resistance junction to case or mounting base ($R_{th\,j\text{-}mb}$), the contact thermal resistance ($R_{th\,i}$) and the heatsink thermal resistance $R_{th\,h}$.

For the calculation of pulse power operation P_p, the maximum pulse power is obtained by the aid of a chart as shown in Fig. 4.

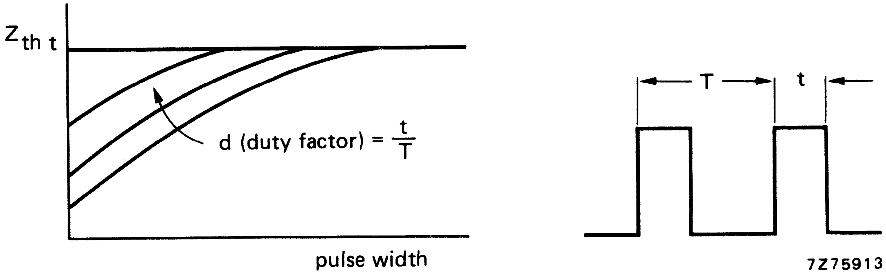


Fig. 4.

The general expression from which the maximum pulse power dissipation can be calculated is:

$$P_p = \frac{T_j - T_{amb} - P_s \times R_{th\,j\text{-}a}}{Z_{th\,t} + d\,(R_{th\,c\text{-}a})}$$

where $Z_{th\,t}$ and d are given in the above chart and $R_{th\,c\text{-}a}$ is the thermal resistance between case and ambient for case rated device. For mounting base rated device, it is equal to $R_{th\,h} + R_{th\,i}$ and is zero for free air rated device because the effect of the temperature rise of the case over the ambient for a pulse train is already included in $Z_{th\,t}$.

Temperature ratings

T_{jmax}	The maximum permissible junction temperature which is used as the basis for the calculation of power ratings. Unless otherwise stated, the continuous value is implied.
T_{jmax} (continuous operation)	The maximum permissible continuous value.
T_{jmax} (intermittent operation)	The maximum permissible instantaneous junction temperature usually allowed for a total duration of 200 hours.
T_{mb}	The temperature of the surface making contact with a heatsink. This is confined to devices where a flange or stud for fixing onto a heatsink forms an integral part of the envelope.
T_{case}	The temperature of the envelope. This is confined to devices to which may be attached a clip-on cooling fin.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	Root-mean-square value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for DC values.

Upper-case subscripts shall be used for the indication of:

a) continuous (DC) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

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

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

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

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

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

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

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

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (DC) current flowing into the second base terminal

V_{B2-E} = continuous (DC) voltage between the terminals of second base and emitter

Subscripts for multiple devices

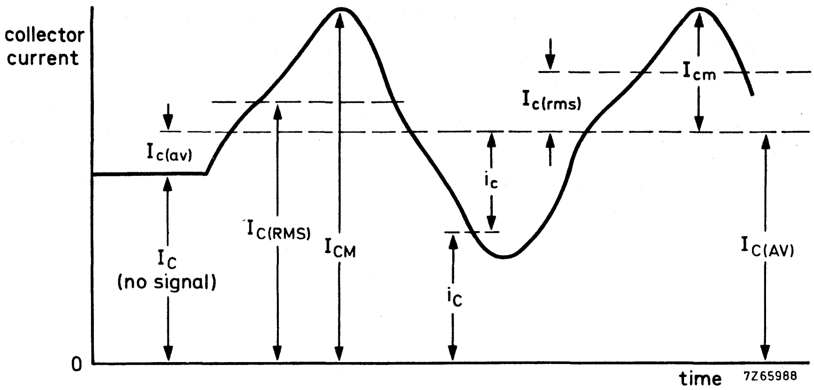
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (DC) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (DC) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (DC) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Defenition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward; forward transfer
I, i (or 1) = input
L, l = load
O, o (or 2) = output
R, r = reverse; reverse transfer
S, s = source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration **(DC current gain)**

R_E = **DC value of the external emitter resistance**

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

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

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

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

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

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

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

Distinction between real and imaginary parts

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

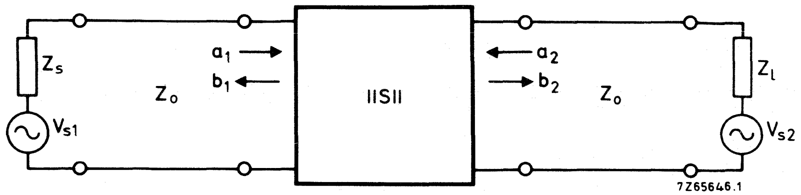
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

SCATTERING PARAMETERS

In distinction to the conventional h, y and z-parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.



$$a_1 = \frac{V_{i1}}{\sqrt{Z_o}} \qquad a_2 = \frac{V_{i2}}{\sqrt{Z_o}} \qquad ^{1)}$$

$$b_1 = \frac{V_{r1}}{\sqrt{Z_o}} \qquad b_2 = \frac{V_{r2}}{\sqrt{Z_o}}$$

Z_o = characteristic impedance of the transmission line in which the two-port is connected.

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, r for 12, f for 21 and o for 22, it follows that:

$$s_i = s_{11} = \left.\frac{b_1}{a_1}\right| a_2 = 0$$

$$s_r = s_{12} = \left.\frac{b_1}{a_2}\right| a_1 = 0$$

$$s_f = s_{21} = \left.\frac{b_2}{a_1}\right| a_2 = 0$$

$$s_o = s_{22} = \left.\frac{b_2}{a_2}\right| a_1 = 0$$

1) The squares of these quantities have the dimension of power.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_r = s_{12}$ = Reverse transmission coefficient.
The complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

$s_f = s_{21}$ = Forward transmission coefficient.
The complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_l = Z_o = 50\ \Omega$ and $V_{s2} = 0$.

$s_o = s_{22}$ = Output reflection coefficient.
The complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_s = Z_o = 50\ \Omega$ and $V_{s1} = 0$.

Device data

SILICON AM BAND SWITCHING DIODE FOR SURFACE MOUNTING

The BA423L is a switching diode intended for band switching in AM radio receivers.

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

The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	20 V
Forward current (DC)	I_F	max.	50 mA
Junction temperature	T_j	max.	100 °C
Diode capacitance at f = 1 MHz V_R = 3 V	C_d	<	2.5 pF
Series resistance at f = 1 MHz I_F = 10 mA	r_s	<	1.2 Ω

MECHANICAL DATA

Dimensions in mm

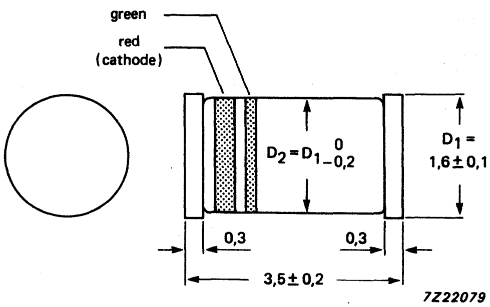


Fig. 1 SOD-80.

RATINGS

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

Continuous reverse voltage	V_R	max.	20	V
Forward current (DC)	I_F	max.	50	mA
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient on a ceramic substrate of 8 mm x 10 mm x 0.7 mm (see soldering recommendations SOD-80)	$R_{th\ j\text{-}a}$	max.	400	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage I_F = 50 mA	V_F	$<$	0.9	V
Reverse current V_R = 20 V	I_R	$<$	100	nA
V_R = 20 V; T_j = 125 °C	I_R	$<$	5.0	μA
Diode capacitance at f = 1 MHz V_R = 3 V	C_d	$<$	2.5	pF
Series resistance at f = 1 MHz I_F = 10 mA	r_s	$<$	1.2	Ω

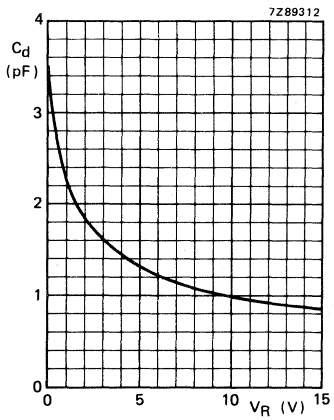


Fig. 2 Diode capacitance as a function of continuous reverse voltage; f = 1 MHz; T_j = 25 °C; typical values.

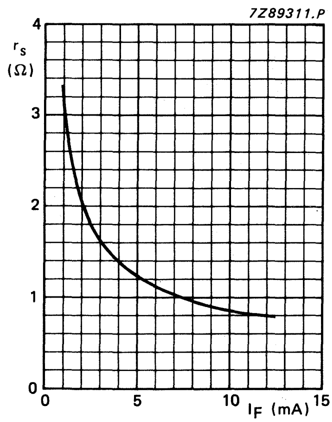


Fig. 3 Series resistance as a function of forward current; f = 1 MHz; T_j = 25 °C; typical values.

BAND-SWITCHING DIODES FOR SURFACE MOUNTING

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

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

The diodes are delivered in "super 8" tape.

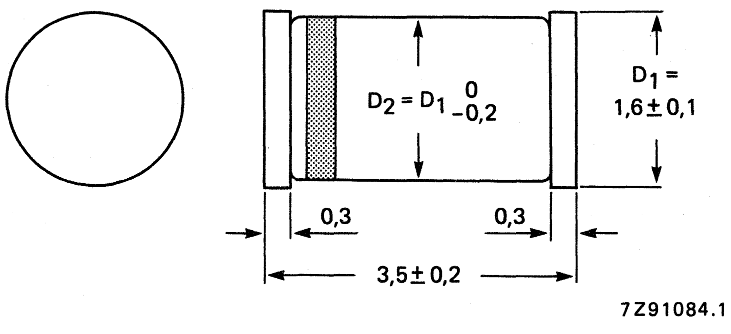
QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a red band.
The BA683 cathode has an additional orange band.

RATINGS

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

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

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

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

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

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

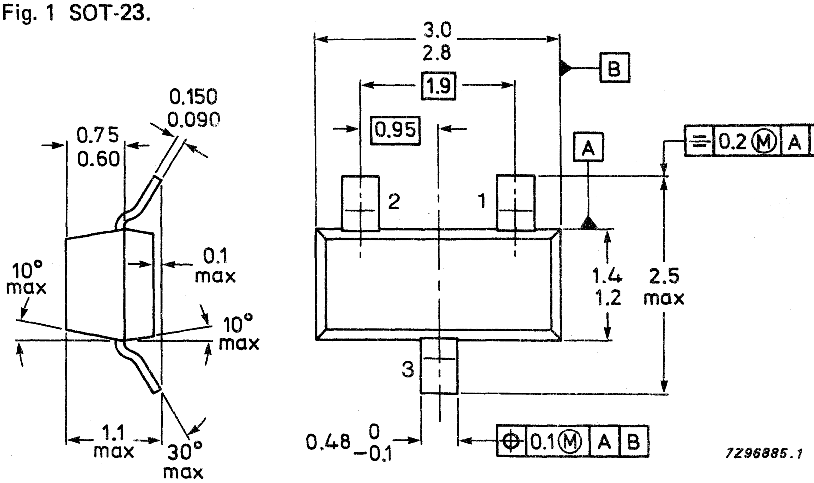
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	500	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

MECHANICAL DATA

Dimensions in mm

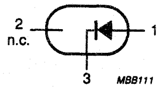
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS16 = A6p



See also *Soldering recommendations.*

RATINGS

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

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Average rectified forward current* (averaged over any 20 ms period) up to T_{amb} = 25 °C	$I_{F(AV)}$	max.	250	mA
Forward current (DC)	I_F	max.	250	mA
Repetitive peak froward current	I_{FRM}	max.	500	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	2	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE**

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 1 mA	V_F	$<$	715	mV
I_F = 10 mA	V_F	$<$	855	mV
I_F = 50 mA	V_F	$<$	1000	mV
I_F = 150 mA	V_F	$<$	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	$<$	30	μA
V_R = 75 V	I_R	$<$	1	μA
V_R = 75 V; T_j = 150 °C	I_R	$<$	50	μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	$<$	2	pF
Forward recovery voltage (see also Fig. 2) when switched to I_F = 10 mA; t_p = 20 ns	V_{fr}	$<$	1,75	V
Reverse recovery time (see also Fig. 3) when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	$<$	6	ns
Recovery charge (see also Fig. 4) when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	$<$	45	pC

* Measured under pulse conditions. $t_p \leq$ 0,5 ms. $I_{F(AV)}$ = 150 mA, $t_{(AV)} \leq$ 1 ms, for sinusoidal operation.

** See *Thermal characteristics.*

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

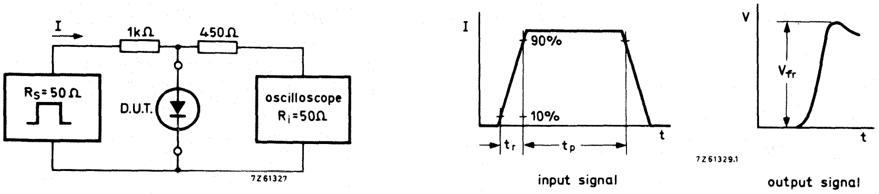


Fig. 2 Forward recovery voltage test circuit and waveforms.

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

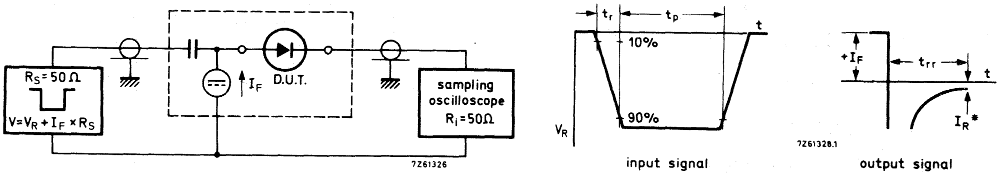


Fig. 3 Reverse recovery time test circuit and waveforms.

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

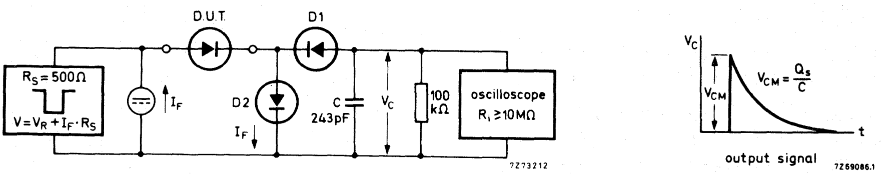


Fig. 4 Recovery charge test circuit and waveform.

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

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

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

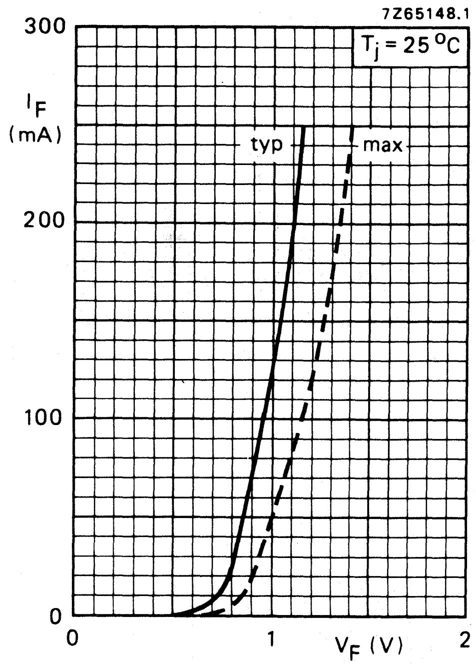


Fig. 5.

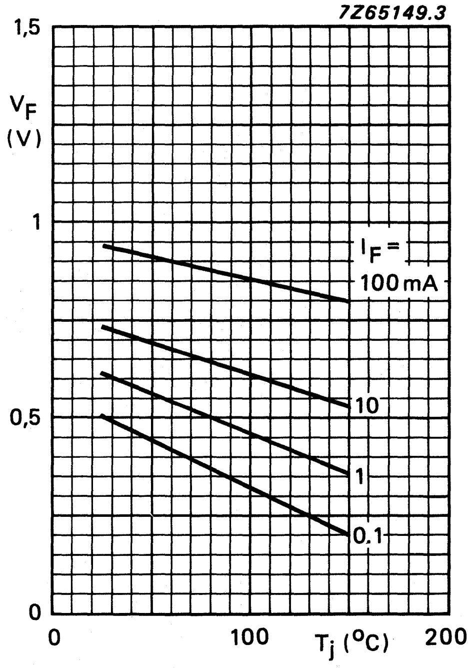


Fig. 6 Typical values.

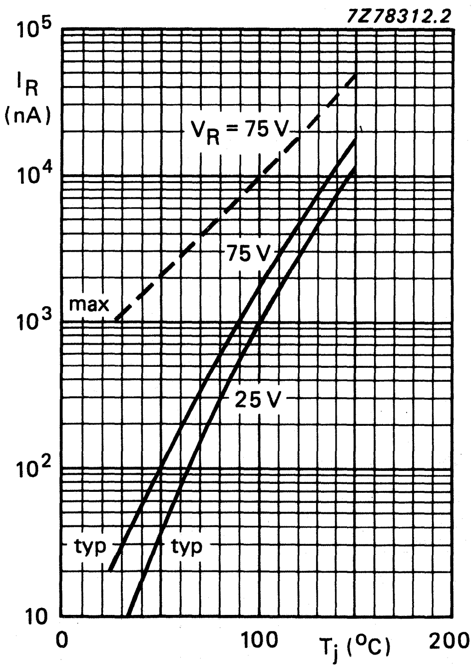


Fig. 7.

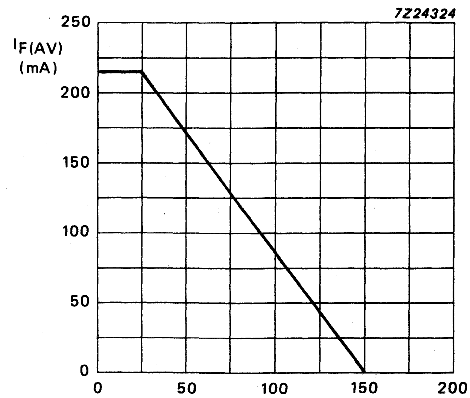


Fig. 8 Current derating curve.

LOW VOLTAGE STABISTOR

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

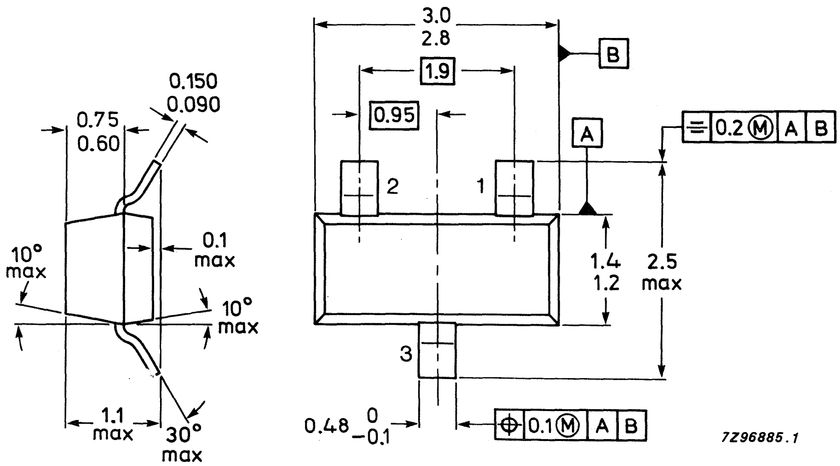
QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

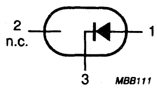
Fig. 1 SOT-23.



TOP VIEW

Marking code

BAS17 = A91



See also chapter *Soldering Recommendations*.

RATINGS

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

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

THERMAL CHARACTERISTICS **

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

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

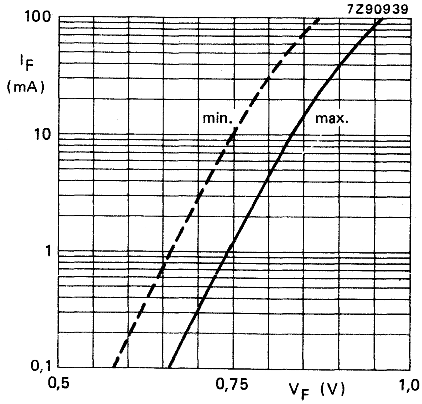


Fig. 2 Forward current as a function of forward voltage.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

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

QUICK REFERENCE DATA

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

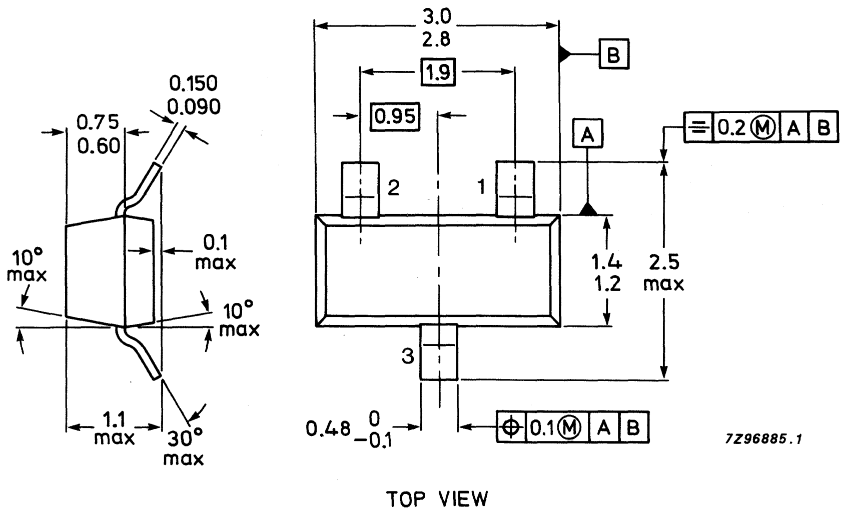
MECHANICAL DATA

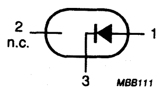
Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAS19 = JPp
BAS20 = JRp
BAS21 = JSp





See also *Soldering recommendations.*

RATINGS

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

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

THERMAL RESISTANCE**

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Forward voltage				
I_F = 100 mA	V_F	<	1,0	V
I_F = 200 mA	V_F	<	1,25	V
Reverse breakdown voltage (1)				
BAS19; I_R = 100 μA	$V_{(BR)R}$	>	120	V
BAS20; I_R = 100 μA	$V_{(BR)R}$	>	200	V
BAS21; I_R = 100 μA (2)	$V_{(BR)R}$	>	250	V
Reverse current				
$V_R = V_{Rmax}$	I_R	<	100	nA
$V_R = V_{Rmax}$; T_j = 150 °C	I_R	<	100	μA
Differential resistance				
I_F = 10 mA	r_{diff}	typ.	5	Ω

(1) Measured under pulse conditions; Pulse time = $t_p \leq$ 0,3 ms.
(2) At zero life time, measured under pulse conditions to avoid excessive dissipation and voltage limited to 275 V.
* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.
** See *Thermal characteristics.*

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

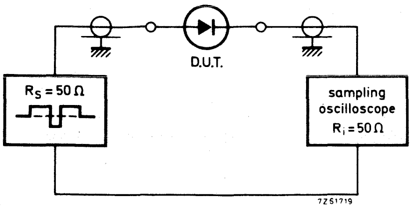


Fig. 2 Test circuit.

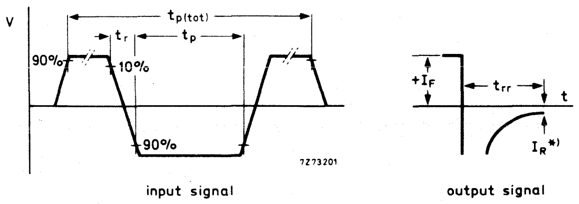


Fig. 3 Waveforms; I_R = 3 mA.

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

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

*C = oscilloscope input capacitance + parasitic capacitance.

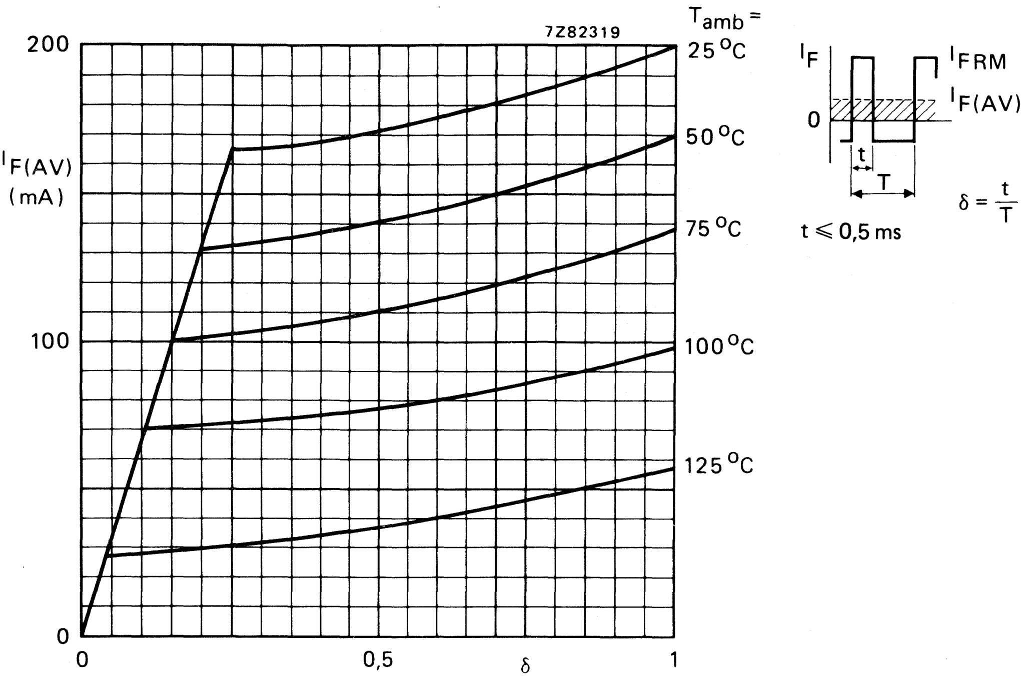


Fig. 4 BAS19; maximum permissible average rectified forward current for pulse operation as a function of the duty factor at V_R = 100 V.

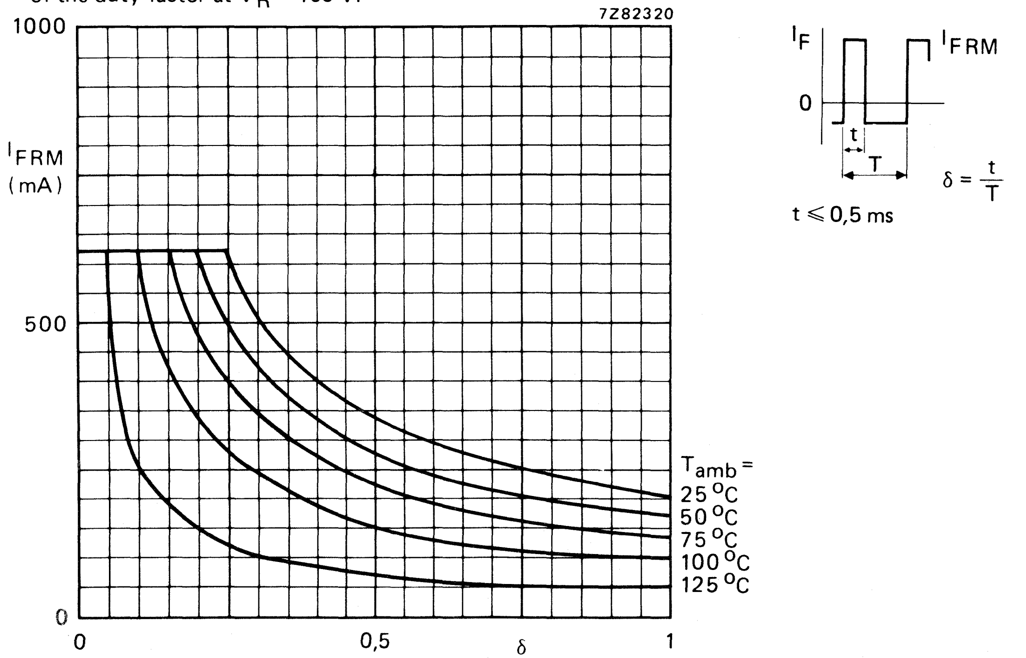


Fig. 5 BAS19; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor at V_R = 100 V.

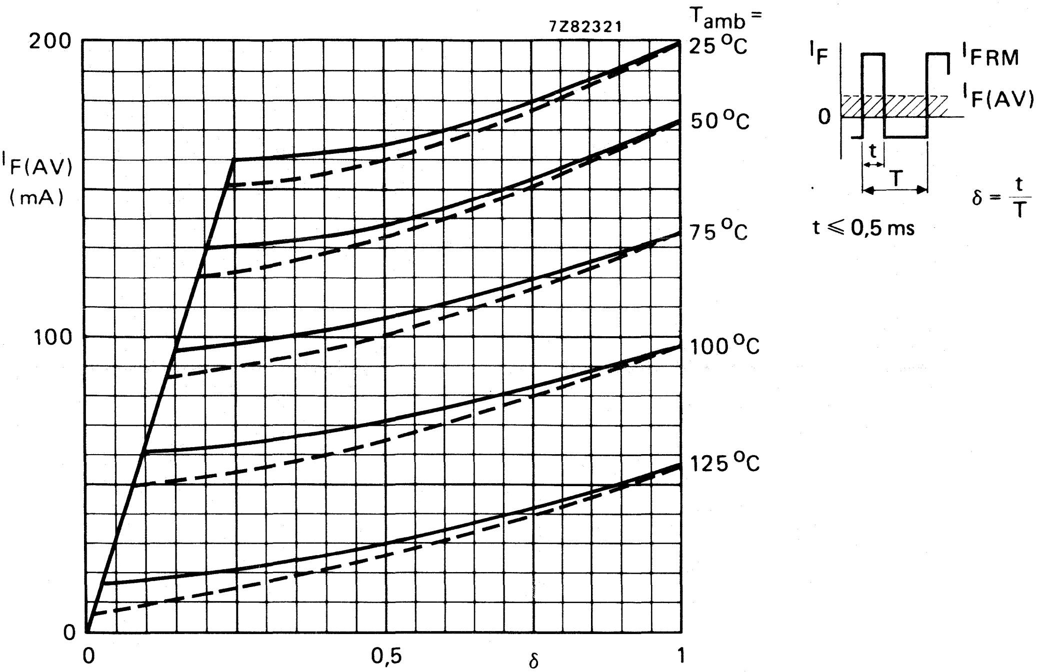


Fig. 6 BAS20/21; maximum permissible average rectified forward current for pulse operation as a function of the duty factor.

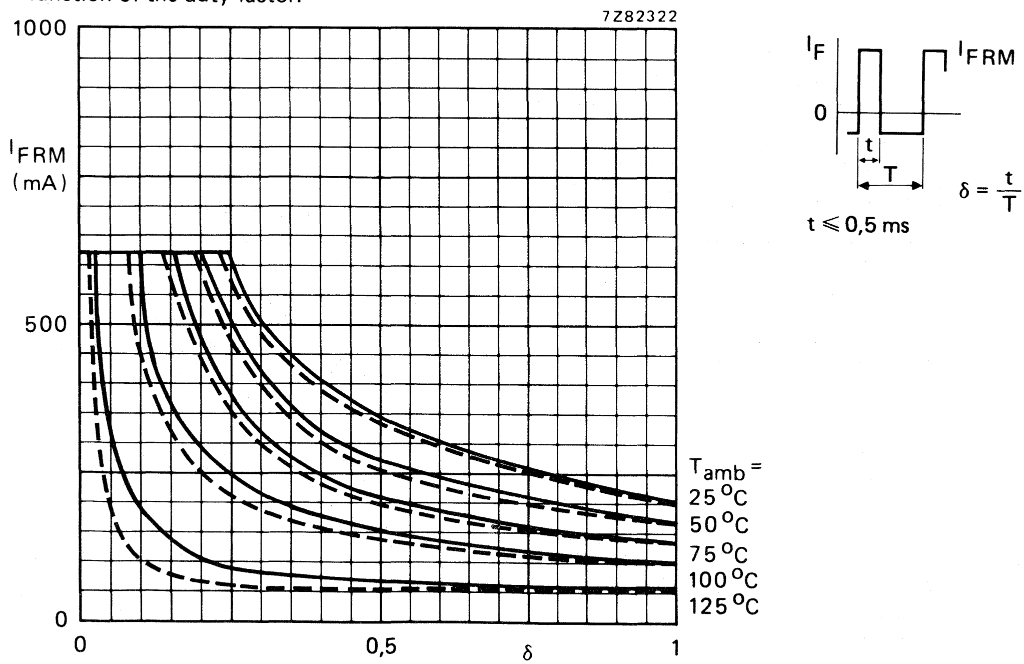


Fig. 7 BAS20/21; maximum permissible repetitive peak forward current for pulse operation as a function of the duty factor.

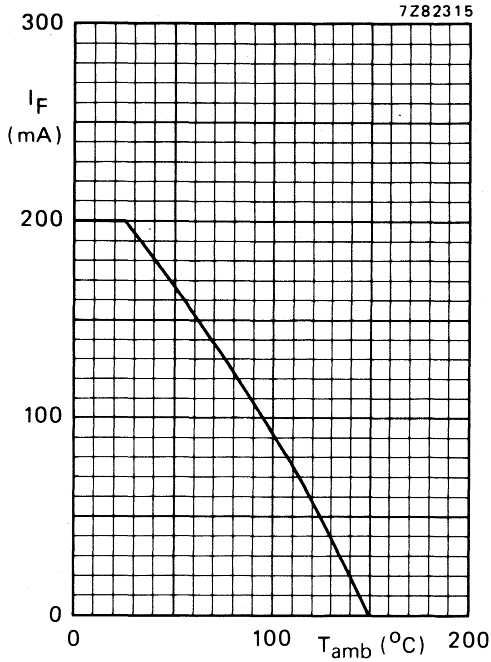


Fig. 8.

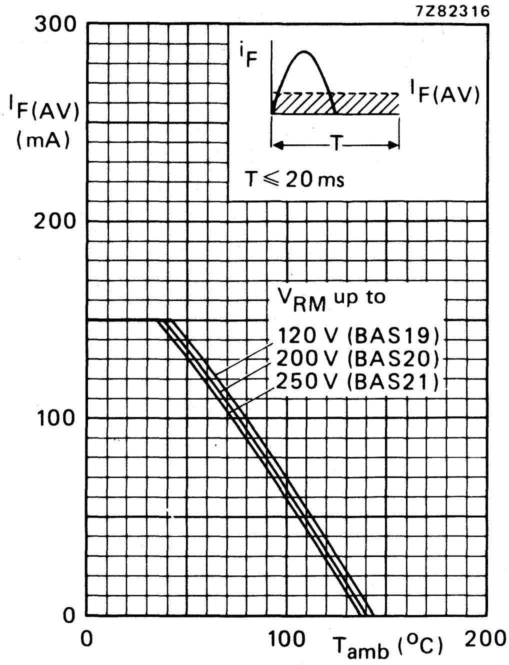


Fig. 9.

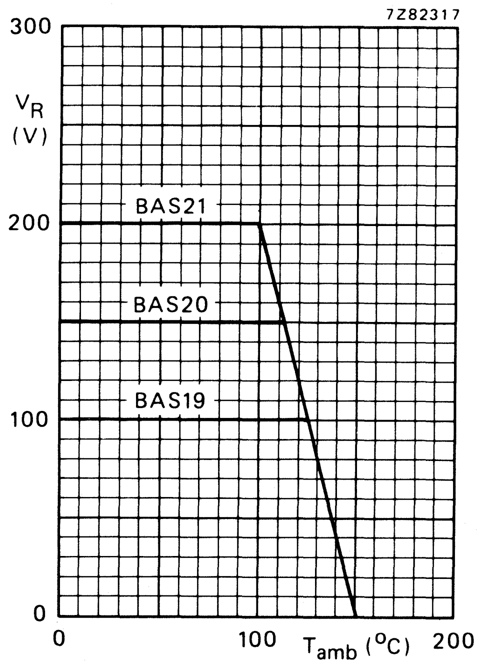


Fig. 10.

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

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

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

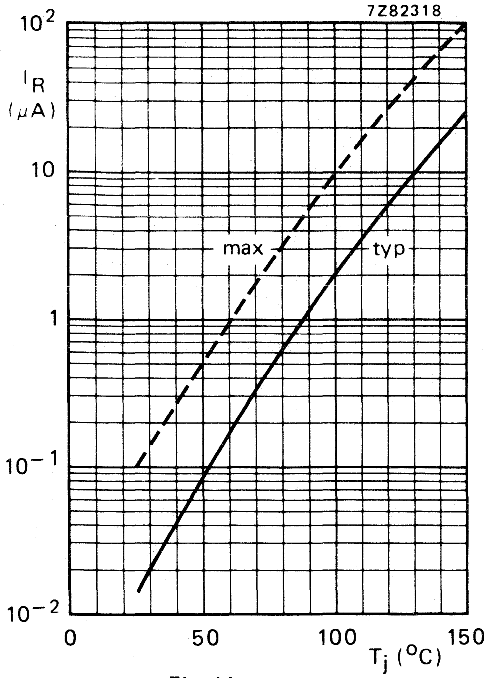


Fig. 11.

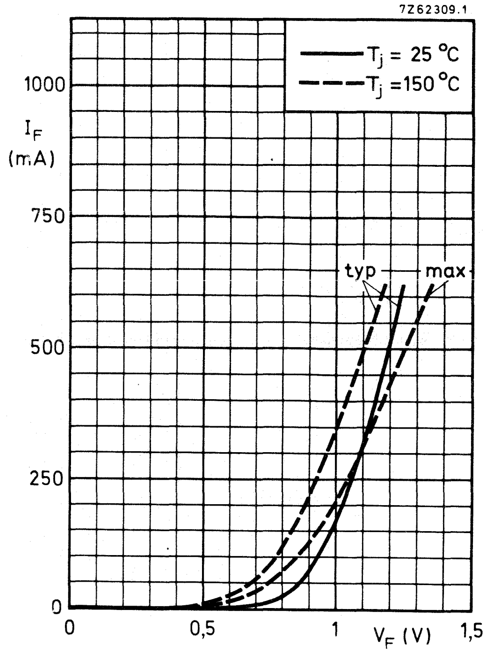


Fig. 12.

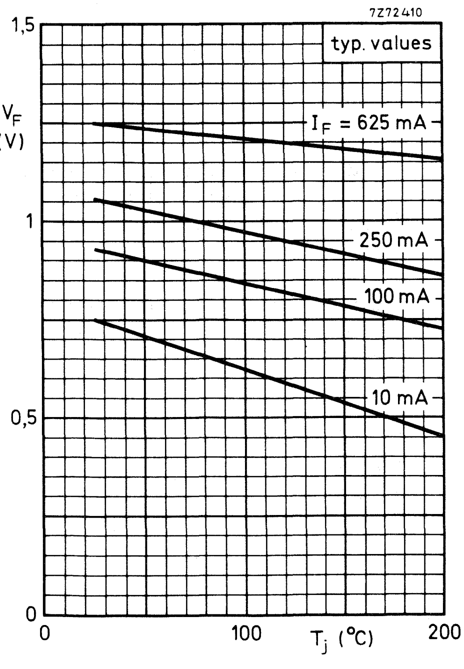


Fig. 13.

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

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

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

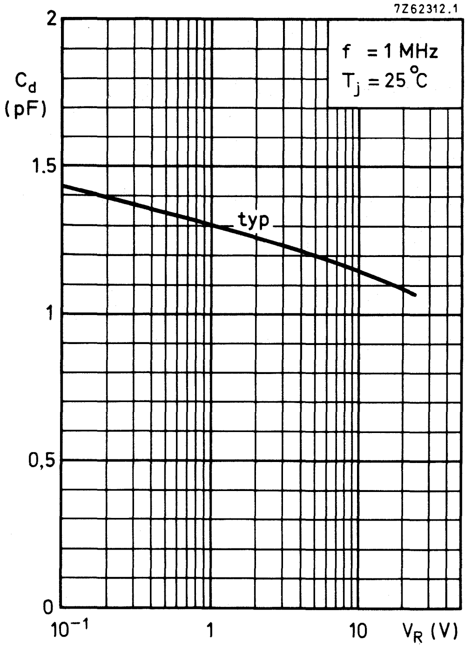

7Z62312.1
f = 1 MHz
T_j = 25 °C
C_d
(pF)
typ
2
1.5
1
0,5
0
10^{-1}
1
10
V_R (V)

Fig. 14.

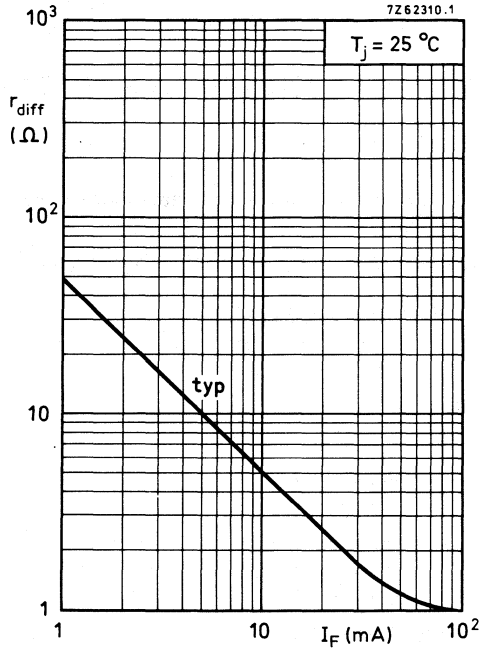

7Z62310.1
T_j = 25 °C
r_{diff}
(Ω)
typ
10^3
10^2
10
1
1
10
I_F (mA)
10^2

Fig. 15.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

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

It concerns fast-switching general-purpose diodes.

QUICK REFERENCE DATA

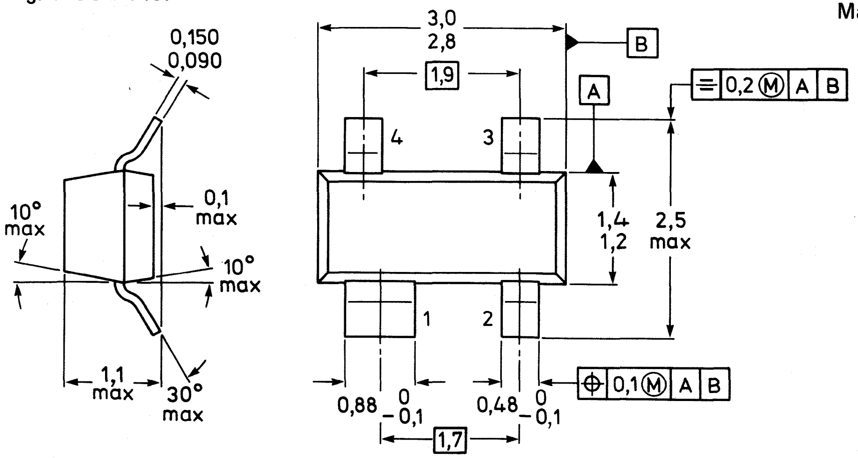
Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Repetitive peak forward current	I_{FRM}	max.	250	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω, measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

MECHANICAL DATA

Dimensions in mm

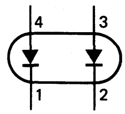
Fig. 1 SOT-143.

Marking code: JT_P



7Z85014.6

TOP VIEW



RATINGS

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

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	85	V
Average rectified forward current* (averaged over any 20 ms period) up to T_{amb} = 25 °C	$I_{F(AV)}$	max.	215	mA
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	215	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	2	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	30	μA
V_R = 75 V	I_R	<	1	μA
V_R = 75 V; T_j = 150 °C	I_R	<	50	μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	<	2	pF
Forward recovery voltage (see also Fig. 2) when switched to I_F = 10 mA; t_p = 20 ns	V_{fr}	<	1,75	V
Reverse recovery time (see also Fig. 3) when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge (see also Fig. 4) when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

* Measured under pulse conditions. $t_p \leqslant$ 0,5 ms. $I_{F(AV)}$ = 150 mA, $t_{(av)} \leqslant$ 1 ms, for sinusoidal operation.

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

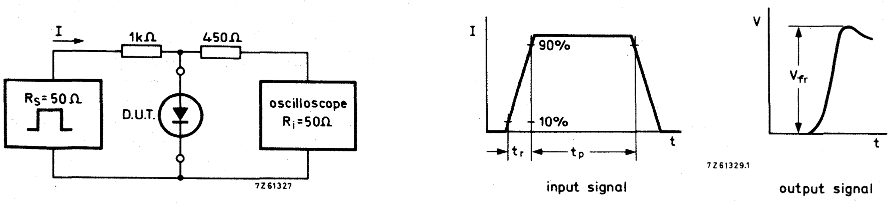


Fig. 2 Forward recovery voltage test circuit and waveforms.

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

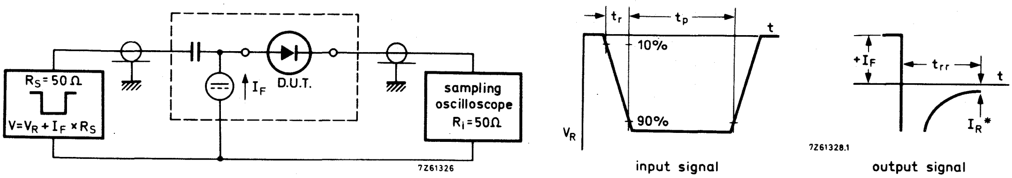


Fig. 3 Reverse recovery time test circuit and waveforms.

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

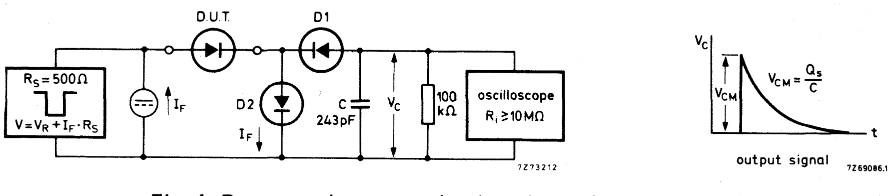


Fig. 4 Recovery charge test circuit and waveform.

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

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

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

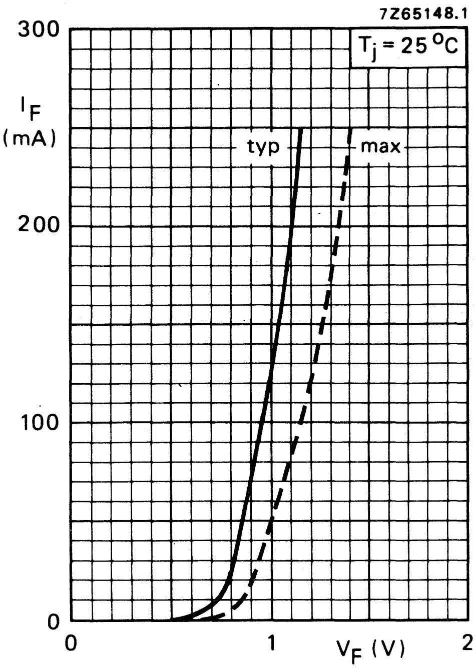


Fig. 5.

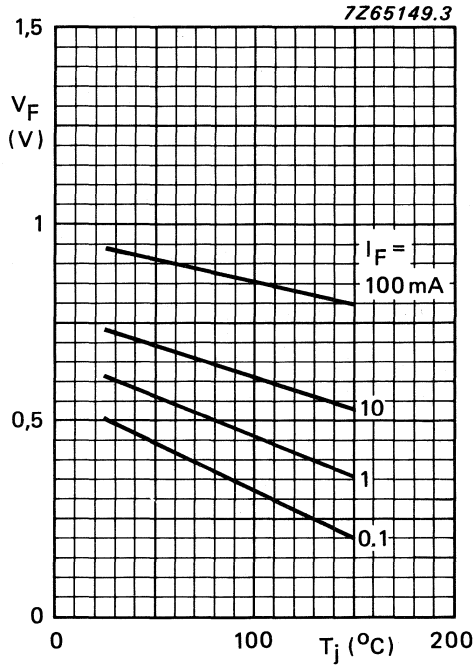


Fig. 6 Typical values.

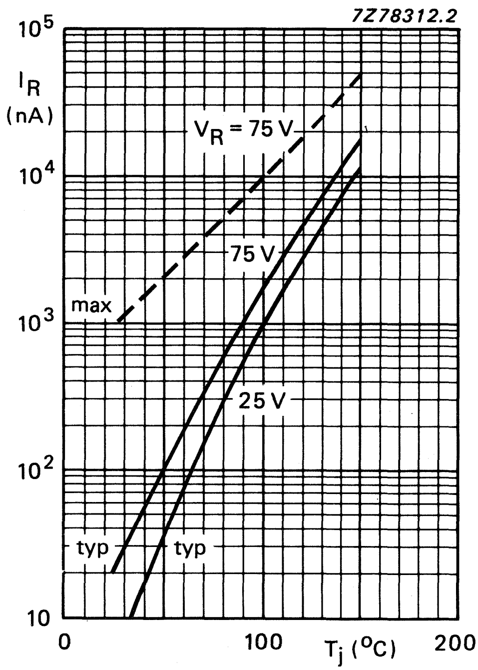


Fig. 7.

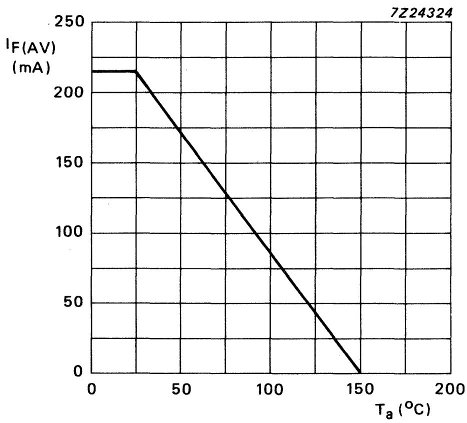


Fig. 8 Current derating curve.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

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

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

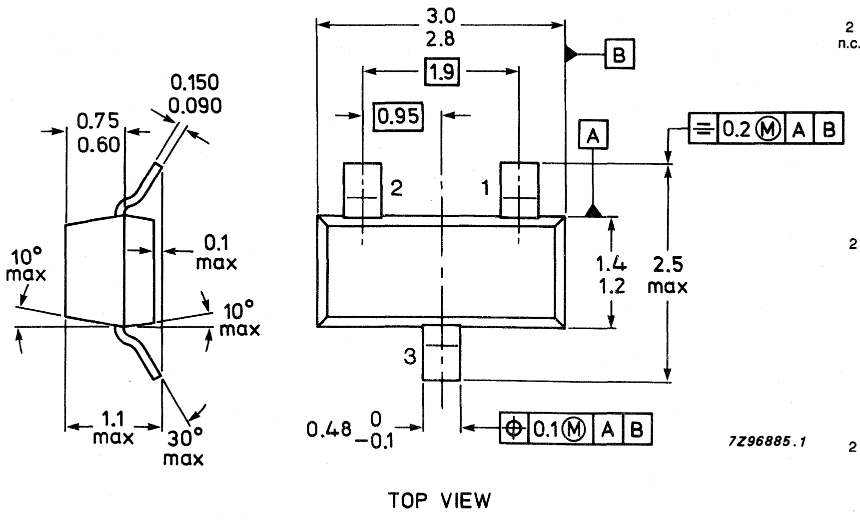
QUICK REFERENCE DATA (per diode)

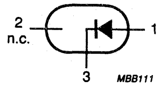
Continuous reverse voltage	V_R	max.	90	V
Repetitive peak forward current	I_{FRM}	max.	600	mA
Forward current	I_F	max.	250	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	0,84	V
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R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

MECHANICAL DATA

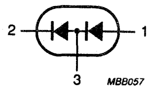
Fig. 1 SOT-23. Dimensions in mm

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

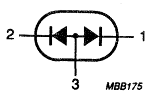




BAS29



BAS31



BAS35

RATINGS (per diode)

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

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

THERMAL RESISTANCE*

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

CHARACTERISTICS (per diode)

$T_j = 25\ ^oC$ unless otherwise specified

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

* See Thermal Characteristics.

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

HIGH-SPEED SILICON DIODE FOR SURFACE MOUNTING

The BAS32 is a planar epitaxial high-speed diode designed for fast logic applications.

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

The diodes are delivered in "super 8" tape.

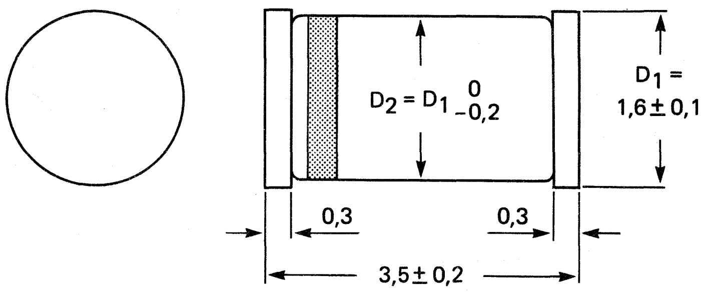
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	75	V
Repetitive peak reverse voltage	V_{RRM}	max.	75	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	200	°C
Forward voltage I_F = 100 mA	V_F	<	1	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	4	ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



Cathode indicated by black band.

RATINGS

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

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

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	600	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltages				
I_F = 5 mA	V_F	0,62 to	0,75	V
I_F = 100 mA	V_F	<	1,00	V
I_F = 100 mA; T_j = 100 °C	V_F	<	0,93	V
Reverse currents				
V_R = 20 V	I_R	<	25	nA
V_R = 20 V; T_j = 150 °C	I_R	<	50	μA
V_R = 75 V	I_R	<	5	μA
V_R = 75 V; T_j = 150 °C	I_R	<	100	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	2	pF
Forward recovery voltage when switched to				
I_F = 50 mA; t_r = 20 ns	V_{fr}	<	2,5	V

* Measured at zero life time at I_R = 100 μA; V_R > 100 V.

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

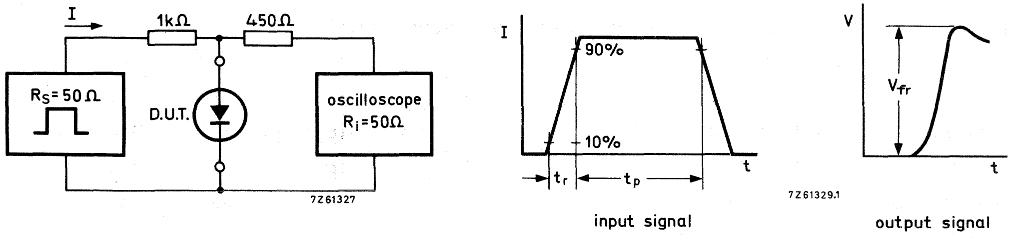


Fig. 2 Forward recovery voltage test circuit and waveforms.

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

Oscilloscope: Rise time t_r = 0,35 ns

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

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

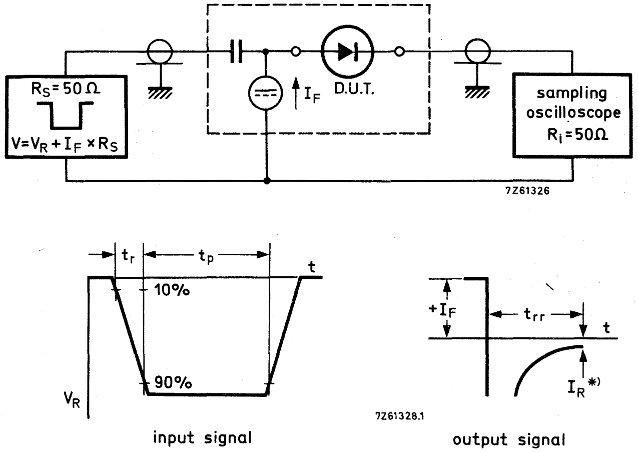


Fig. 3 Reverse recovery time test circuit and waveforms.

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

* I_R = 1 mA

Oscilloscope: Rise time t_r = 0,35 ns

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

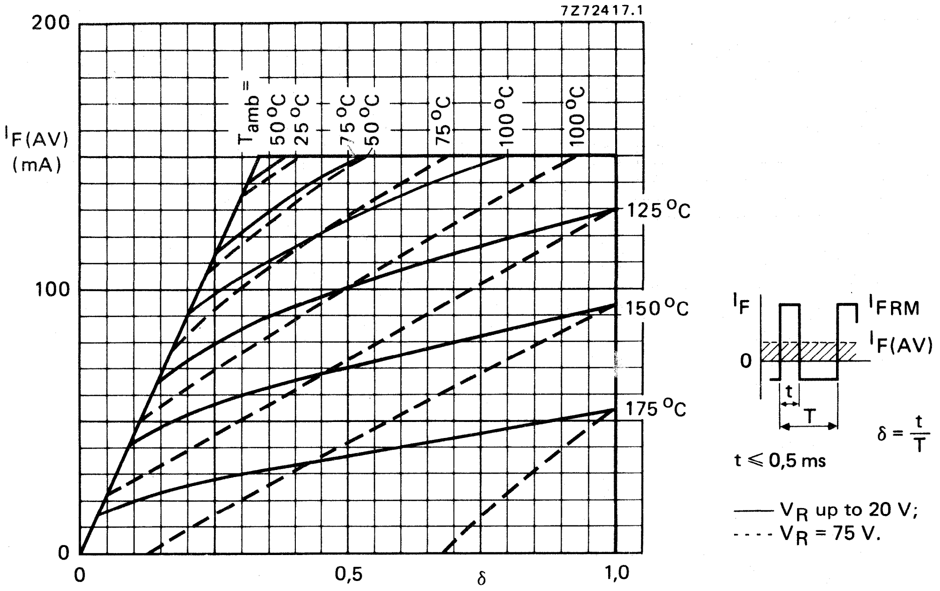


Fig. 4 Maximum permissible average rectified forward current versus duty factor (pulse operated).

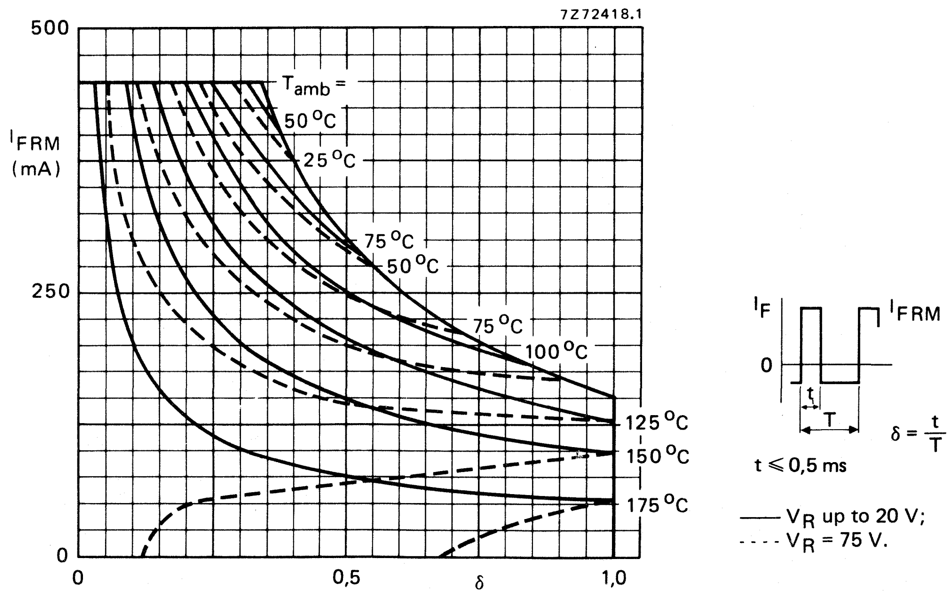


Fig. 5 Maximum permissible repetitive peak forward current versus duty factor (pulse operated).

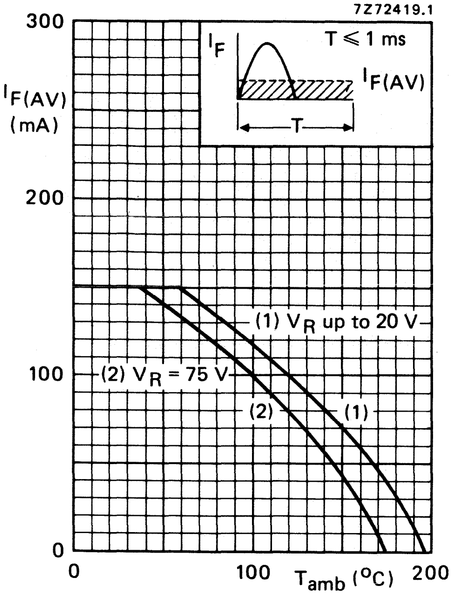


Fig. 6 Maximum permissible average rectified forward current versus ambient temperature.

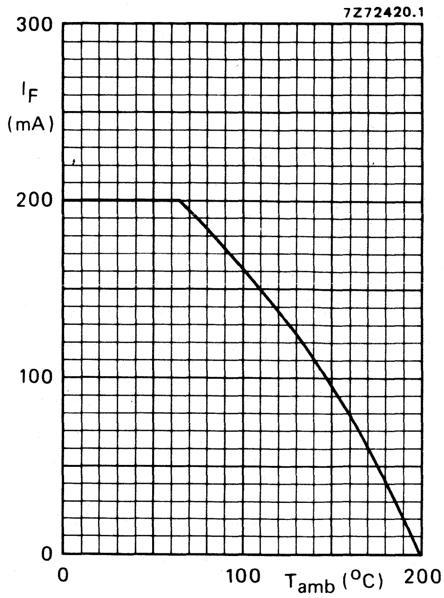


Fig. 7 Maximum permissible continuous forward current versus ambient temperature.

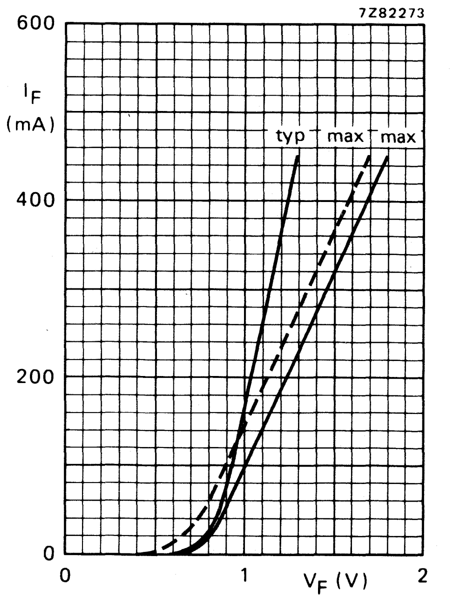


Fig. 8 Forward current versus forward voltage; ——— T_j = 25 °C; – – – T_j = 175 °C.

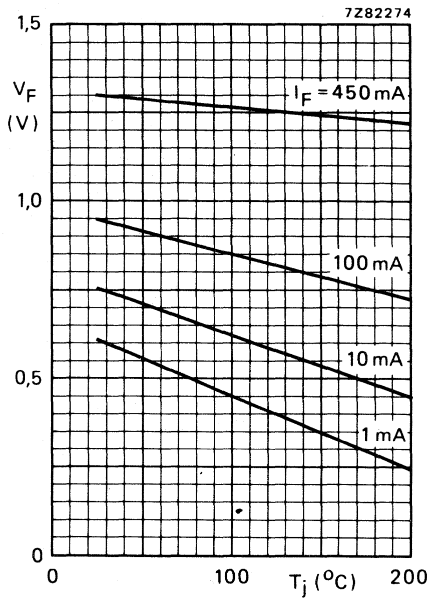


Fig. 9 Forward voltage versus junction temperature; typical values.

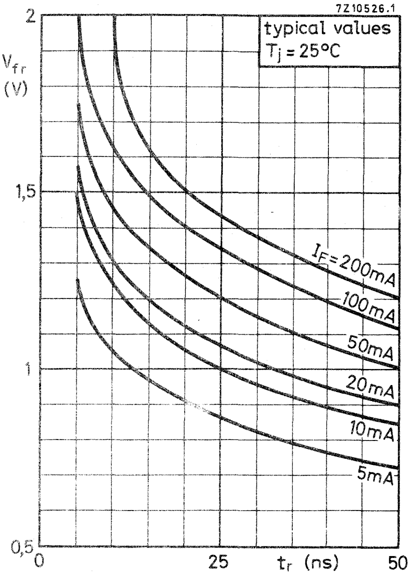


Fig. 10 Forward recovery voltage versus rise time.

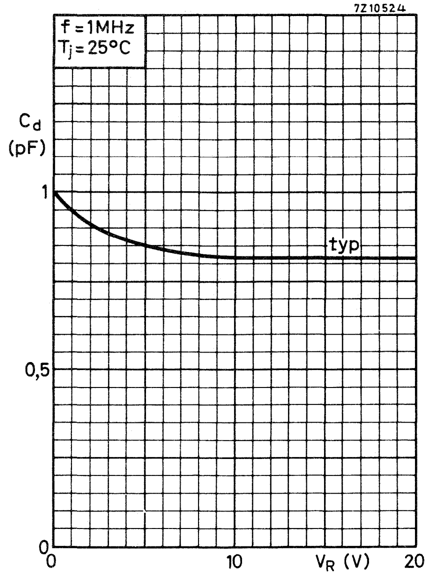


Fig. 11 Diode capacitance versus reverse voltage.

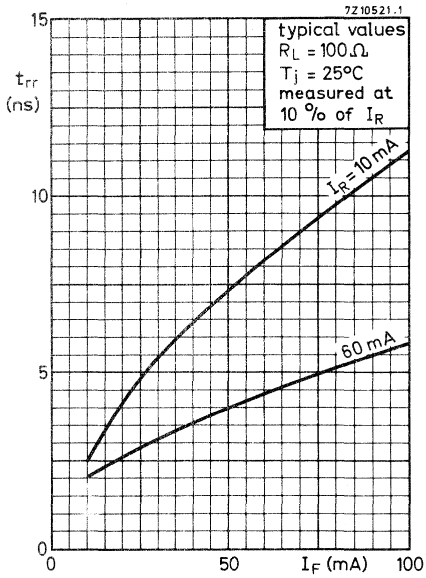


Fig. 12 Reverse recovery time versus forward current.

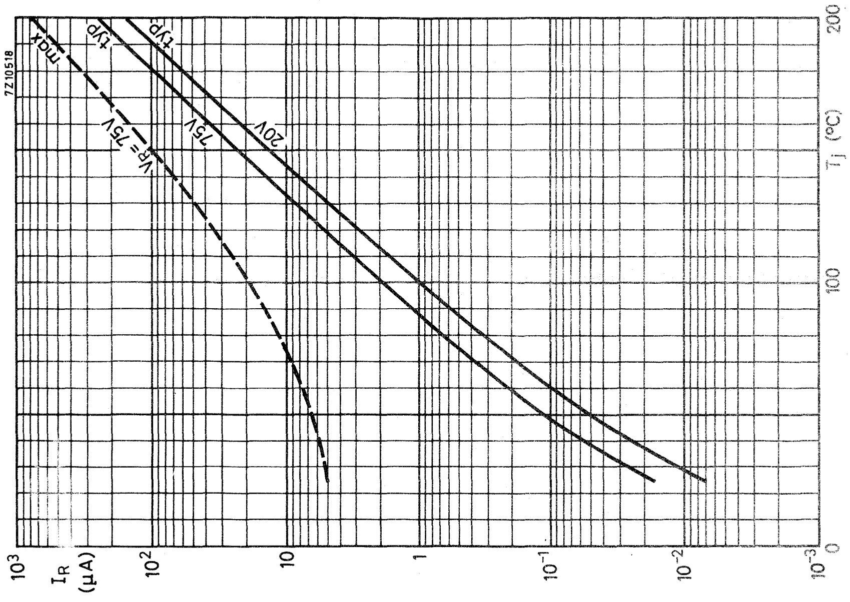


Fig. 14 Reverse current versus junction temperature.

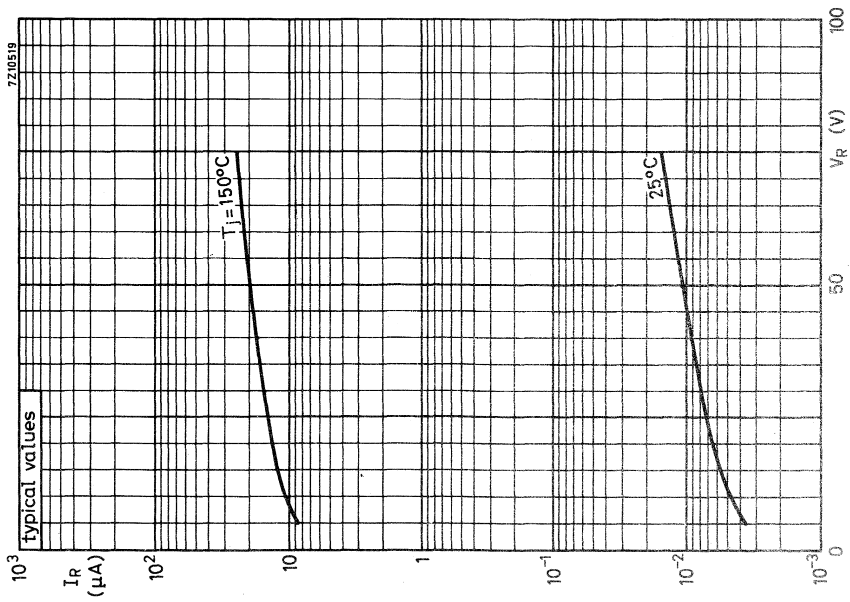


Fig. 13 Reverse current versus reverse voltage.

HIGH-SPEED SILICON DIODE FOR SURFACE MOUNTING

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

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

The diodes are delivered in "super 8" tape.

QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

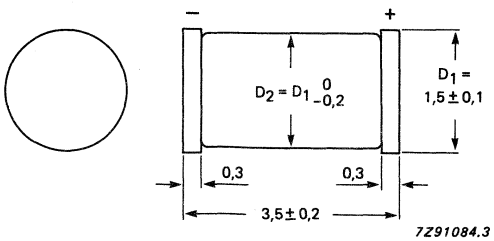


Fig. 1 SOD-80C.

RATINGS

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

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

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\,j\text{-}a}$	=	600	K/W

CHARACTERISTICS

T_j = 25 ^oC unless otherwise specified

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

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

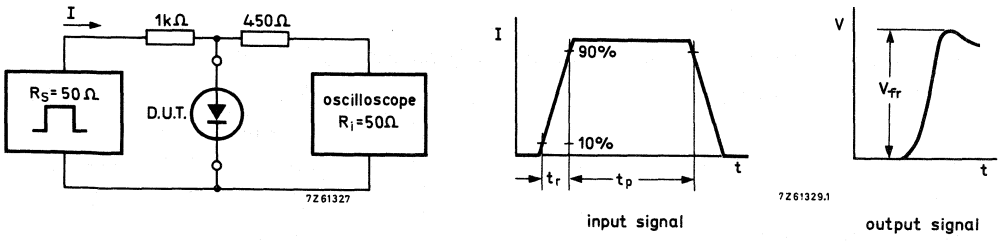


Fig. 2 Forward recovery voltage test circuit and waveforms.

Input signal :	Rise time of the forward pulse	t_r = 20 ns
	Forward current pulse duration	t_p = 120 ns
	Duty factor	δ = 0.01
Oscilloscope:	Rise time	t_r = 0.35 ns

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

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

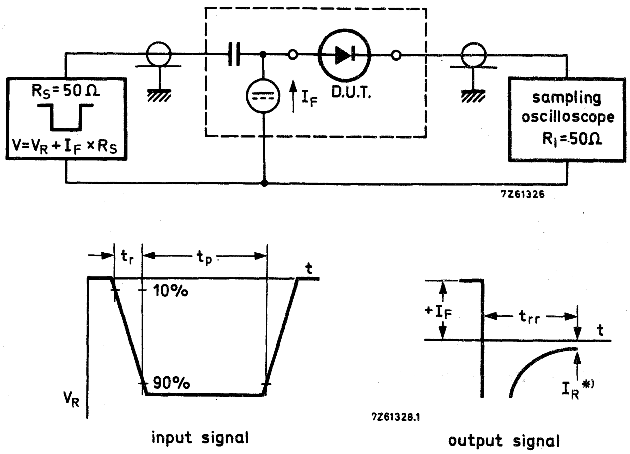


Fig. 3 Reverse recovery time test circuit and waveforms.

Input signal :	Rise time of the reverse pulse	t_r = 0.6 ns	* I_R = 1 mA
	Reverse pulse duration	t_p = 100 ns	
	Duty factor	δ = 0.05	
Oscilloscope:	Rise time	t_r = 0.35 ns	

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

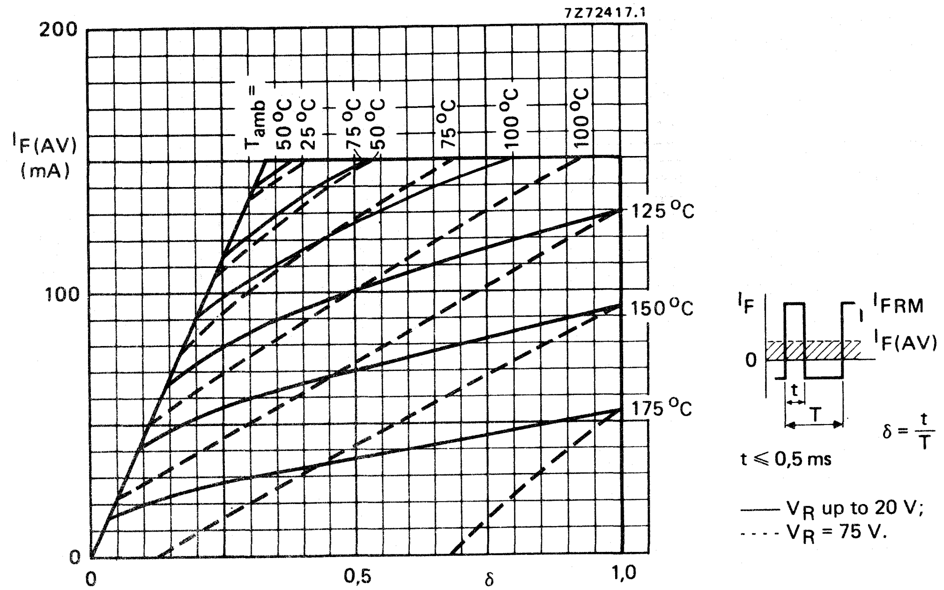


Fig. 4 Maximum permissible average rectified forward current as a function of duty factor (pulse operated).

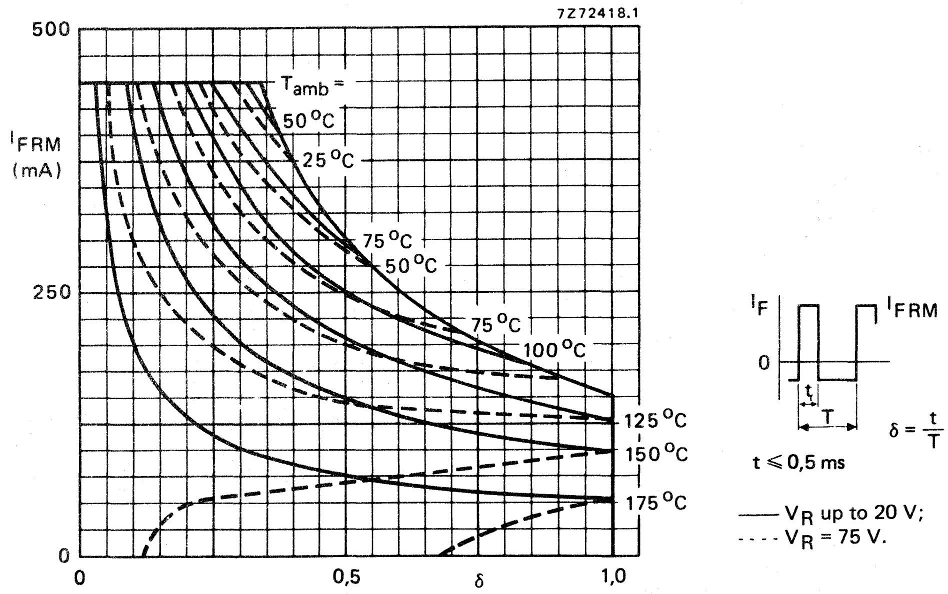


Fig. 5 Maximum permissible repetitive peak forward current as a function of duty factor (pulse operated).

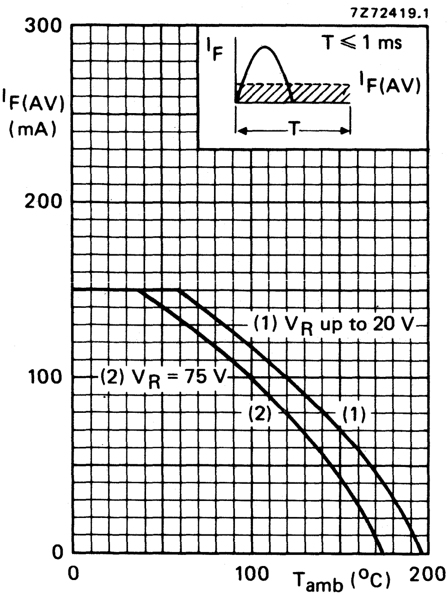


Fig. 6 Maximum permissible average rectified forward current as a function of ambient temperature.

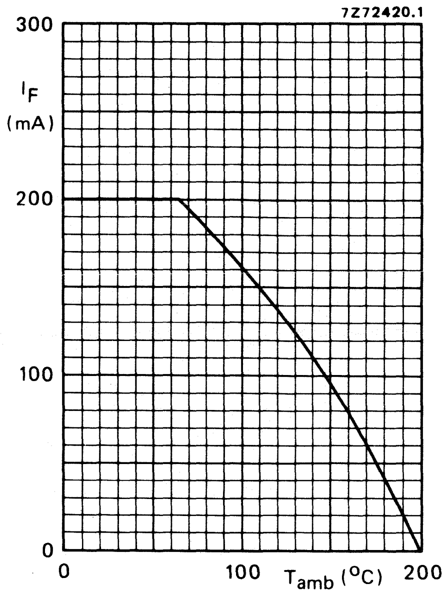


Fig. 7 Maximum permissible continuous forward current as a function of ambient temperature.

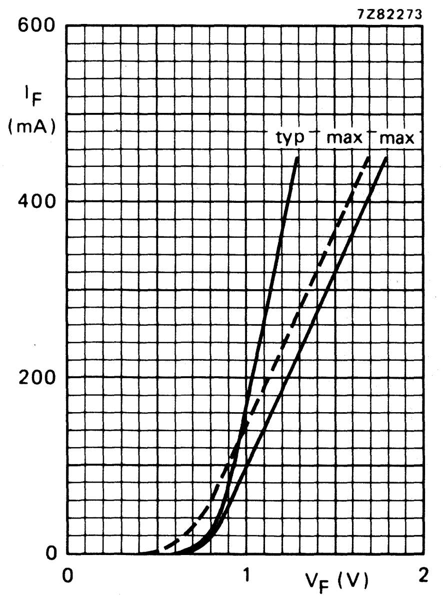


Fig. 8 Forward current as a function of forward voltage; —— T_j = 25 °C; – – – T_j = 175 °C.

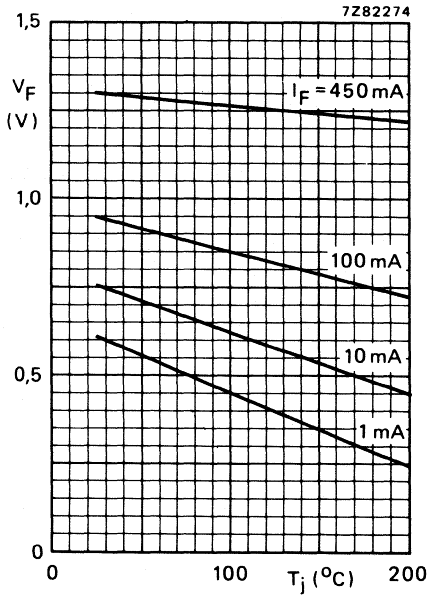


Fig. 9 Forward voltage as a function of junction temperature; typical values.

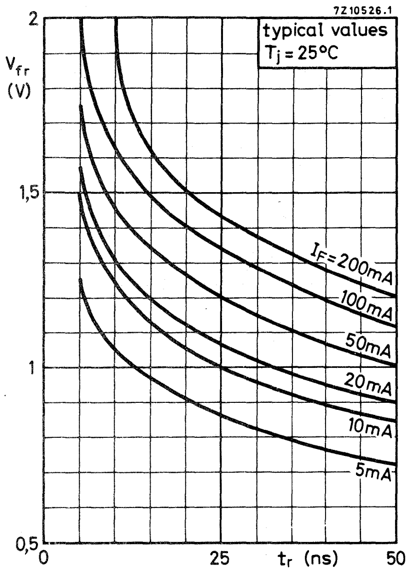


Fig. 10 Forward recovery voltage as a function of rise time.

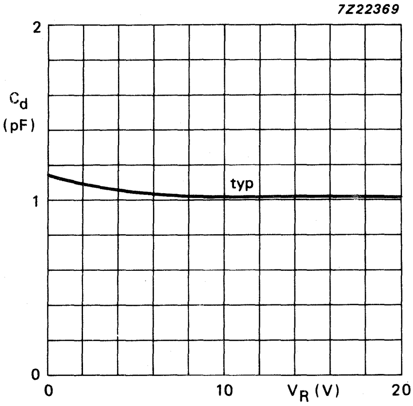


Fig. 11 Diode capacitance as a function of reverse voltage.

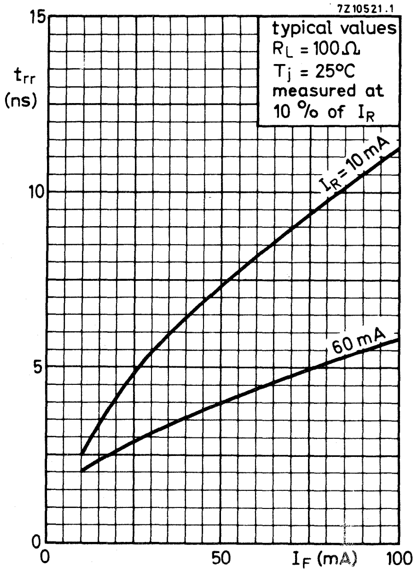


Fig. 12 Reverse recovery time as a function of forward current.

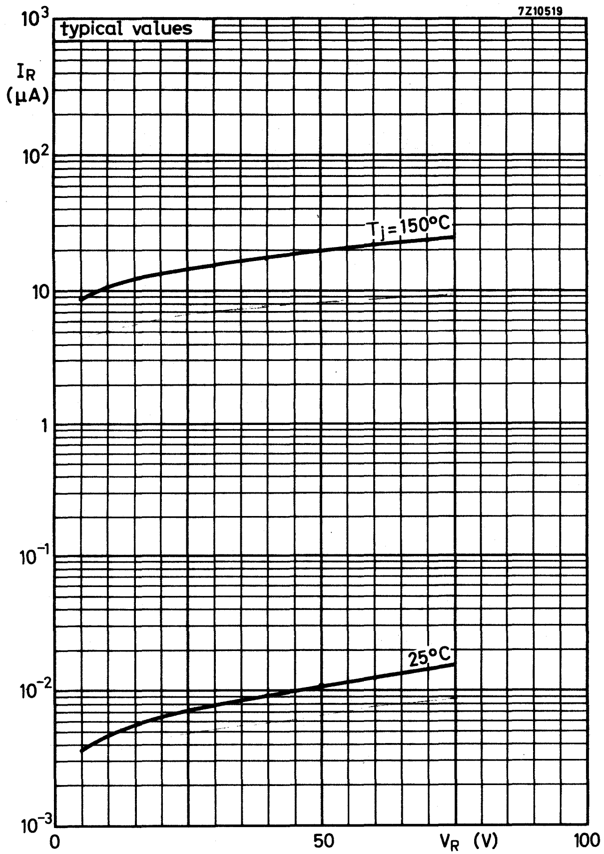


Fig. 13 Reverse current as a function of reverse voltage.

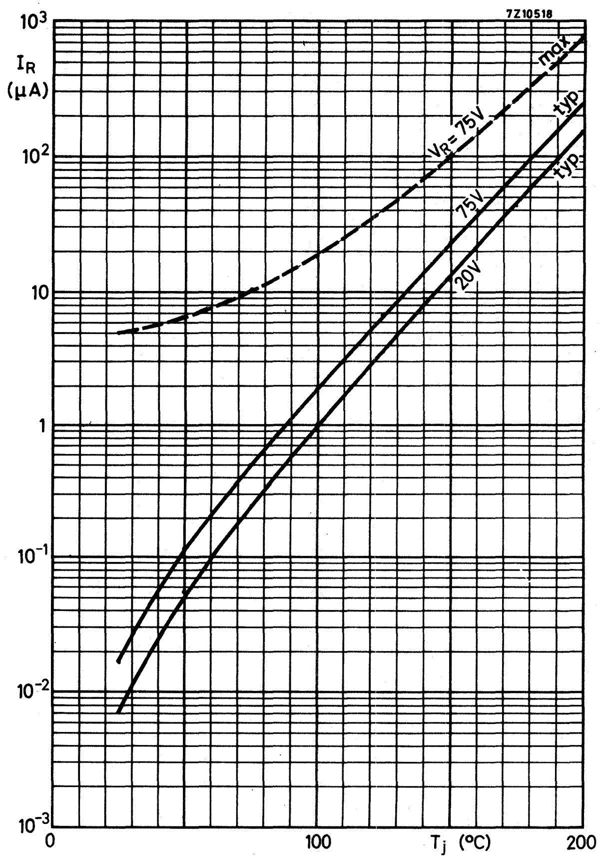


Fig. 14 Reverse current as a function of junction temperature.

SILICON PLANAR EPITAXIAL ULTRA-HIGH SPEED DIODE

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

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

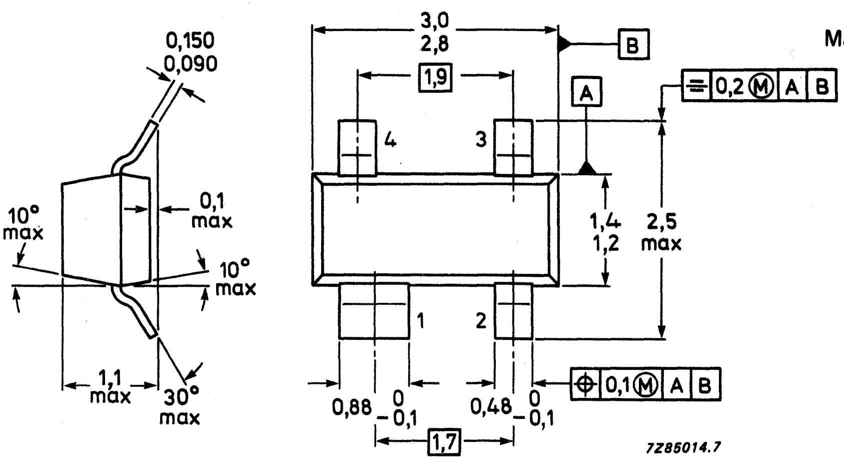
QUICK REFERENCE DATA

			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	120	V
Forward current	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Reverse recovery time when switched from I_F = 400 mA to I_R = 400 mA; R_L = 100 Ω; measured at I_R = 40 mA	t_{rr}	<	6		ns

MECHANICAL DATA

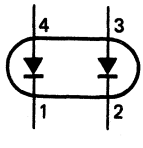
Dimensions in mm

Fig. 1 SOT-143.



TOP VIEW

Marking code: L51



RATINGS

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

			single diode	series connection	
Continuous reverse voltage	V_R	max.	60	120	V
Repetitive peak reverse voltage*	V_{RRM}	max.	60	120	V
Forward current	I_F	max.	200	150	mA
Repetitive peak forward current	I_{FRM}	max.	600	430	mA
Non-repetitive peak forward current (per crystal)					
t = 1 μs	I_{FSM}	max.	2000		mA
t = 1 s	I_{FSM}	max.	500		mA
Total power dissipation**					
up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS, per diode

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA	V_F	<	0,75	V
I_F = 200 mA	V_F	<	1,00	V
I_F = 200 mA; T_j = 100 °C	V_F	<	0,95	V
I_F = 500 mA	V_F	<	1,25	V
Reverse current				
V_R = 60 V	I_R	<	100	nA
V_R = 60 V; T_j = 150 °C	I_R	<	100	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	2,5	pF

* Measured at zero life time at I_R = 10 μA; V_R = 75 V.

** Mounted on a ceramic substrate of 10 mm x 8 mm x 0,6 mm.

Forward recovery voltage when switched to

I_F = 400 mA; t_r1 = 30 ns	V_{fr}	<	120	V
I_F = 400 mA; t_r2 = 100 ns		<	1,5	V

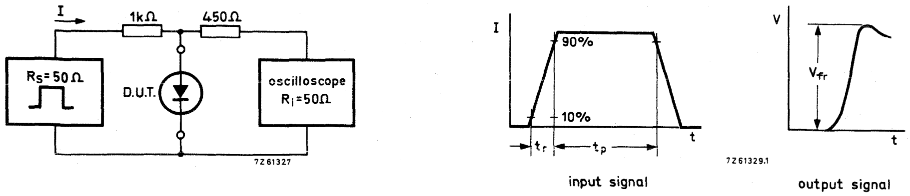


Fig. 2 Test circuit and waveforms; forward recovery voltage.

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

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

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

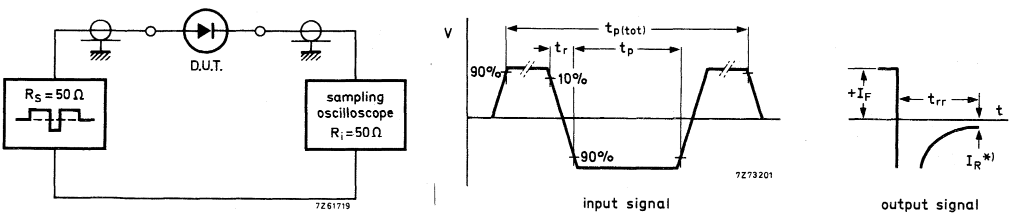


Fig. 3 Test circuits and waveforms; reverse recovery time. *I_R = 40 mA

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

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

Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	50	pC

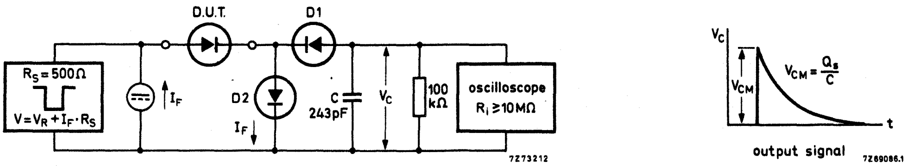


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

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

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

SCHOTTKY BARRIER DIODE

Schottky Barrier diode with an integrated protection ring against extremely high static discharges.

This diode, in a SOD-80 envelope, is intended for applications where a very low forward voltage is required.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.)	I_F	max.	200	mA
Peak forward current	I_{FM}	max.	300	mA
Junction temperature	T_j	max.	125	°C
Forward voltage I_F = 10 mA	V_F	<	400	mV
Diode capacitance	C_d	<	10	pF

MECHANICAL DATA

Dimensions in mm

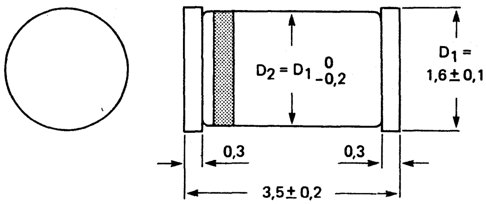


Fig. 1 SOD-80.

The cathode is indicated by a grey band.

RATINGS

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

Continuous reverse voltage	V_R	max.	30	V
Forward current				
d.c.	I_F	max.	200	mA
peak value	I_{FM}	max.	300	mA
peak value; $t_p < 1$ s		max.	600	mA
Average rectified forward current (see Fig. 2)	$I_{F(AV)}$	max.	200	mA
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	125	°C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage*				
I_F = 0,1 mA	V_F	<	240	mV
I_F = 1 mA		<	320	mV
I_F = 10 mA	V_F	<	400	mV
I_F = 30 mA		<	500	mV
I_F = 100 mA	V_F	typ.	500	mV
		max.	800	mV
Reverse current				
V_R = 25 V	I_R	<	2,0	μA
Reverse breakdown voltage				
I_R = 10 μA	$V_{(BR)R}$	>	30	V
Diode capacitance				
V_R = 1 V; f = 1 MHz	C_d	<	10	pF
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 measured at I_R = 1 mA	t_{rr}	<	5,0	ns

* Temperature coefficient

I_F = 1 mA	S_F	typ.	−0,2	%/K
I_F = 15 mA		typ.	−0,04	%/K

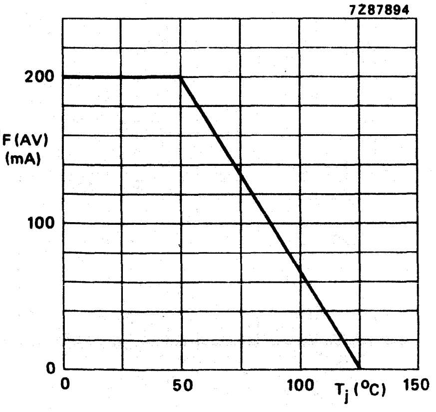


Fig. 2 Power derating curve; typical values.

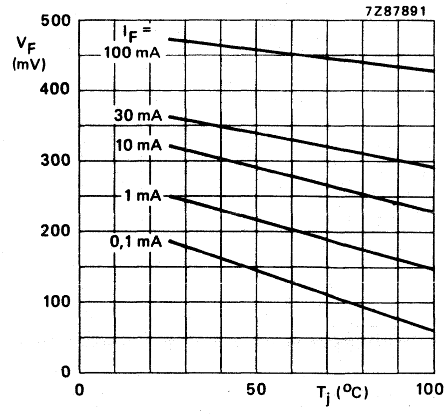


Fig. 3 Forward voltage as a function of temperature; typical values.

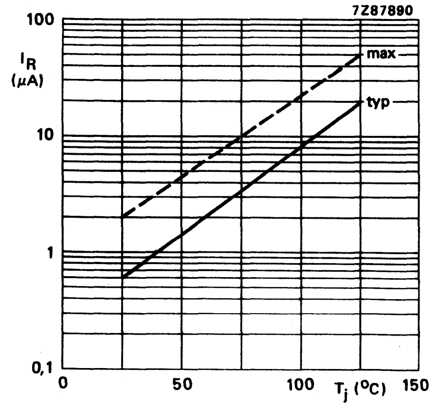


Fig. 4 Reverse current as a function of temperature; V_R = 25 V; typical values.

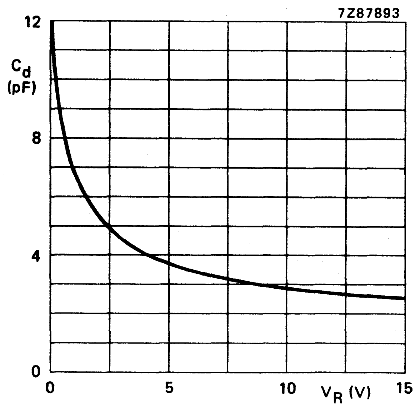


Fig. 5 Diode capacitance as a function of reverse voltage; f = 1 MHz; typical values.

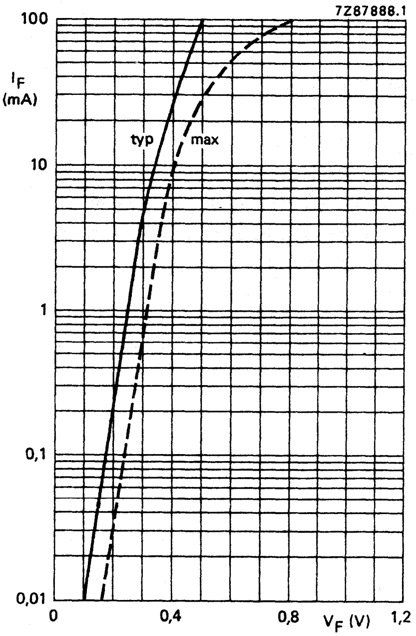


Fig. 6 Forward current as a function of forward voltage.

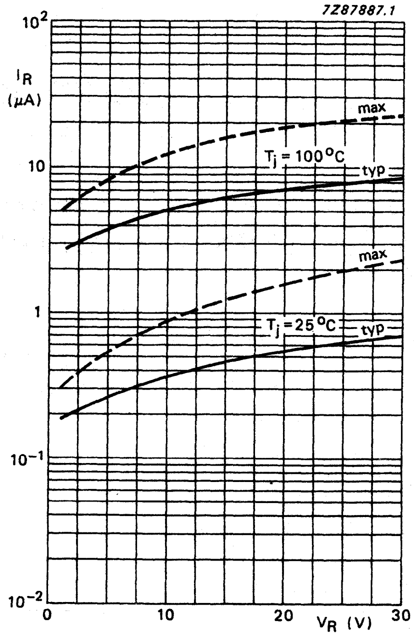


Fig. 7 Reverse current as a function of reverse voltage.

SCHOTTKY BARRIER DIODE

Schottky Barrier diode with an integrated protection ring against extremely high static discharges.
This diode, in a SOD80 envelope, is intended for applications where a very low forward voltage is required.

QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

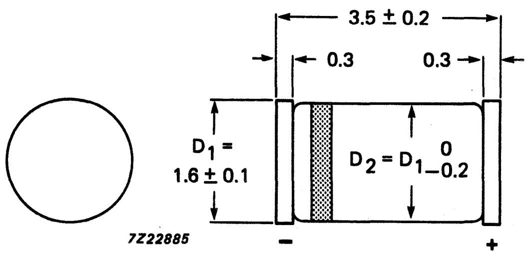


Fig.1 SOD80.

The cathode is indicated by coloured band.

RATINGS

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

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

THERMAL RESISTANCE

From junction to ambient when mounted on a printed circuit board at a lead length of 4 mm	$R_{th\ j\text{-}a}$	=	320	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

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

Note

1. Temperature coefficient

I_F = 1 mA	S_F	typ.	−0.2	%/K
I_F = 15 mA	S_F	typ.	−0.04	%/K

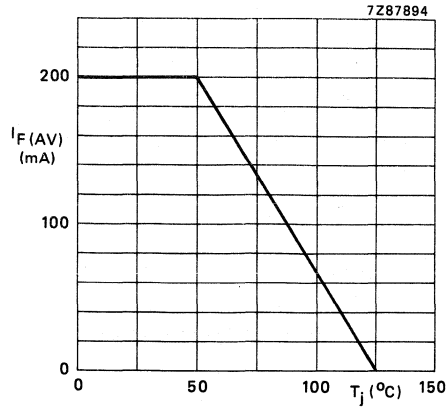


Fig. 2 Derating curve.

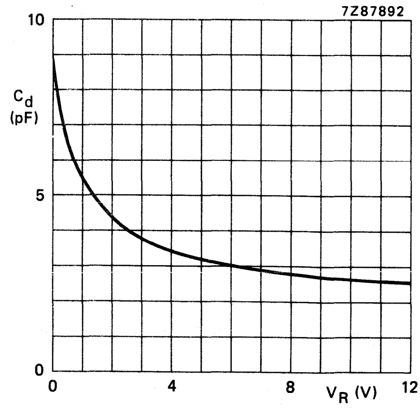


Fig. 3 f = 1 MHz; typ. values.

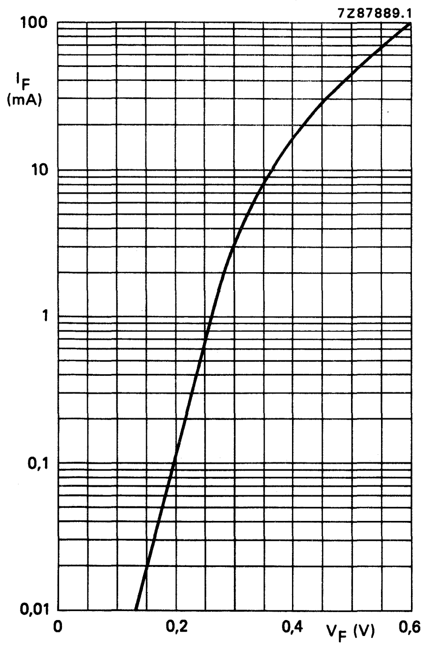


Fig. 4 Typical values.

SCHOTTKY BARRIER DIODE

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

QUICK REFERENCE DATA

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

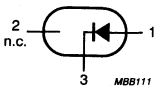
MECHANICAL DATA

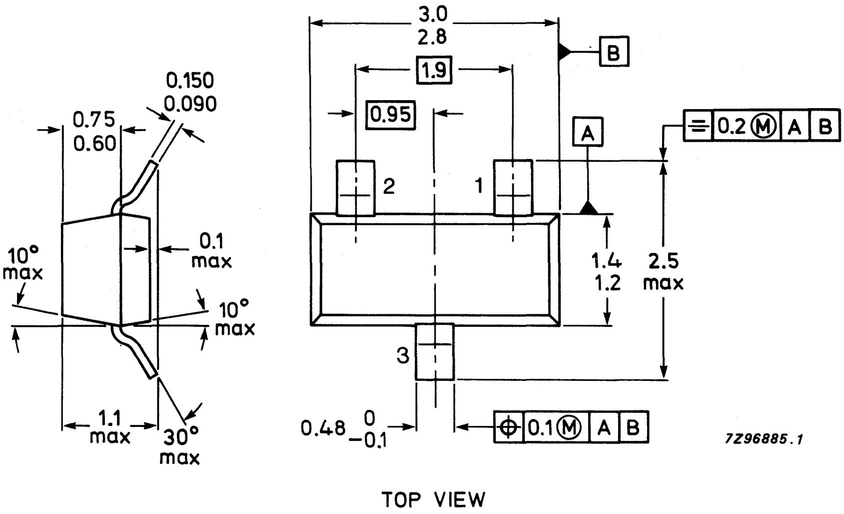
Dimensions in mm

Marking code

BAT17 = A3p

Fig.1 SOT-23.





See also *Soldering recommendations.*

RATINGS

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

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

THERMAL RESISTANCE*

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

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

* See *Thermal characteristics.*

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

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

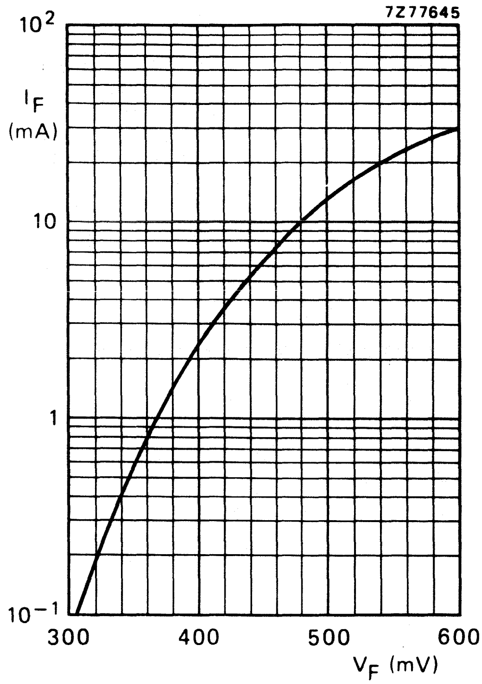


Fig. 2 Typical values.

SILICON PLANAR DIODE

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

QUICK REFERENCE DATA

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

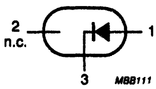
MECHANICAL DATA

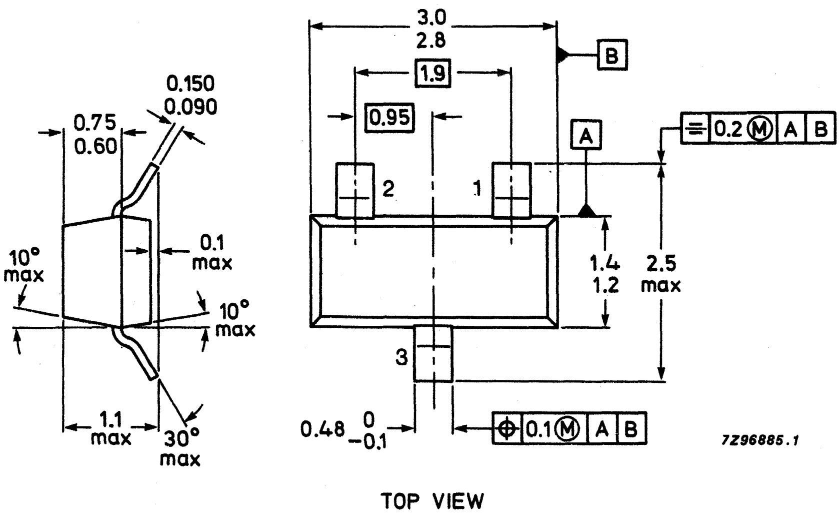
Dimensions in mm

Marking code

BAT18 = A2

Fig. 1 SOT-23.





RATINGS

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

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

THERMAL RESISTANCE*

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

* See *Thermal characteristics.*

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

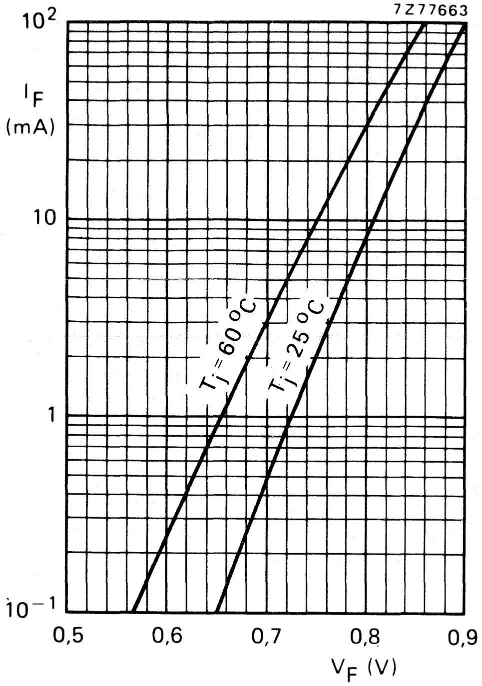


Fig. 2 Typical values.

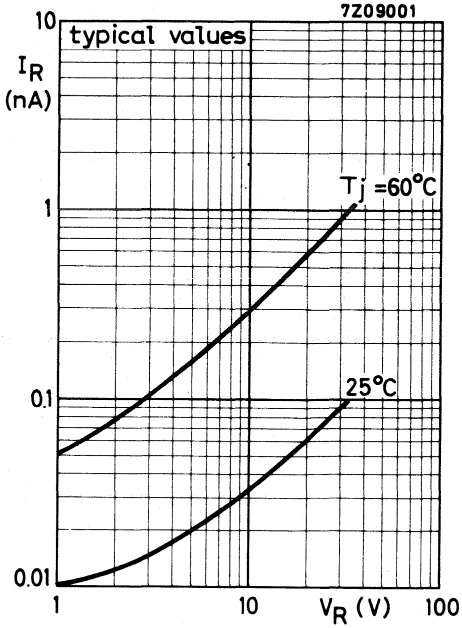


Fig. 3.

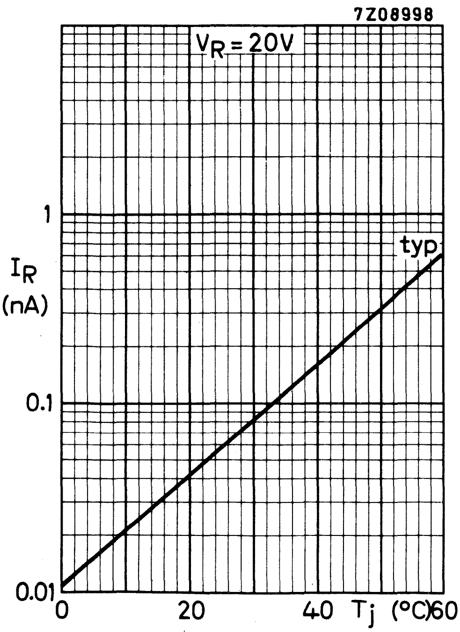


Fig. 4.

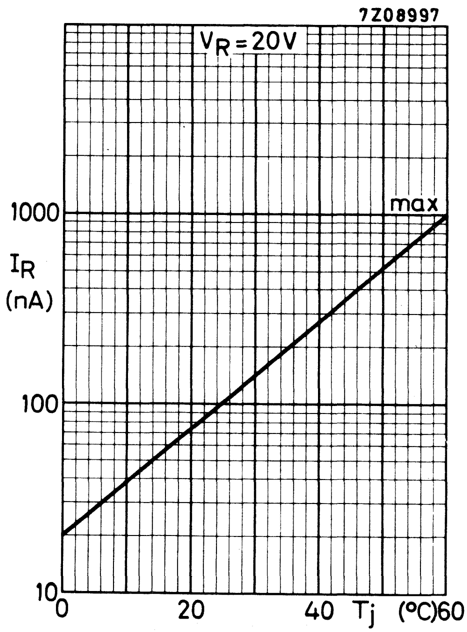


Fig. 5.

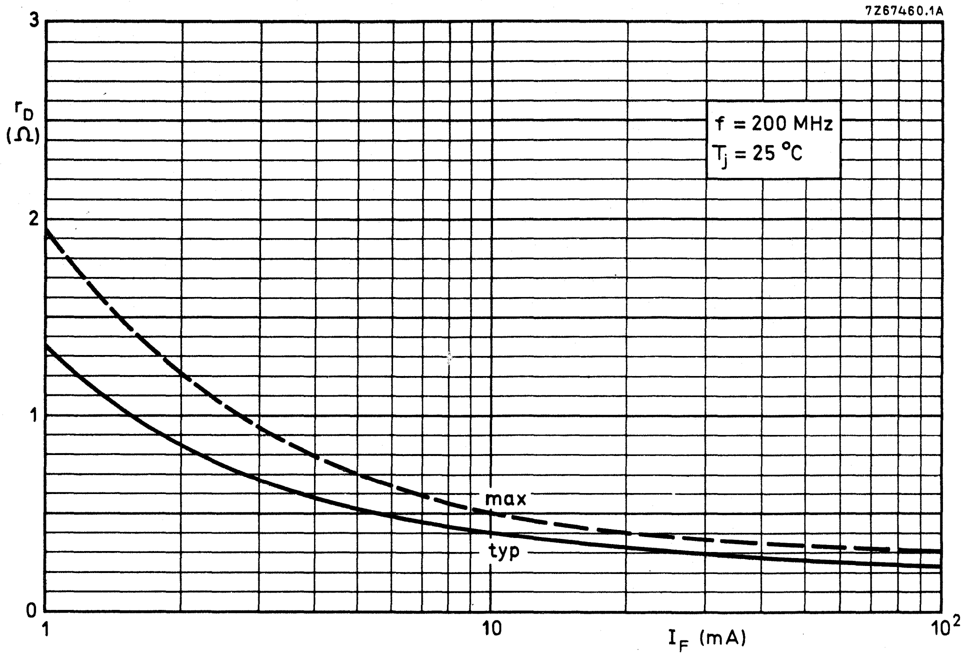


Fig. 6.

SCHOTTKY BARRIER DIODE

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

The diode features especially a low forward voltage.

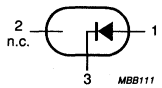
QUICK REFERENCE DATA

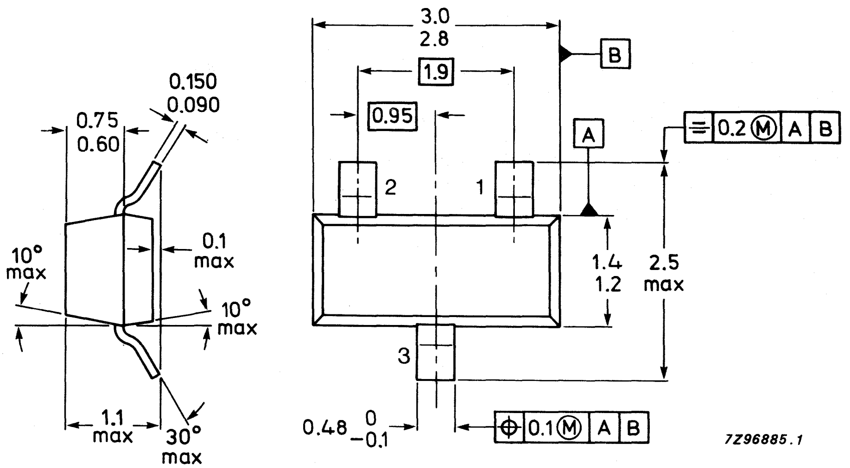
Continuous reverse voltage	V_R	max.	30	V
Forward current (d.c.)	I_F	max.	200	mA
Forward voltage at I_F = 10 mA	V_F	max.	400	mV
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	230	mW
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}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

Fig. 1 SOT-23

Dimensions in mm

Marking code: L4p





TOP VIEW

RATINGS

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

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

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

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

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

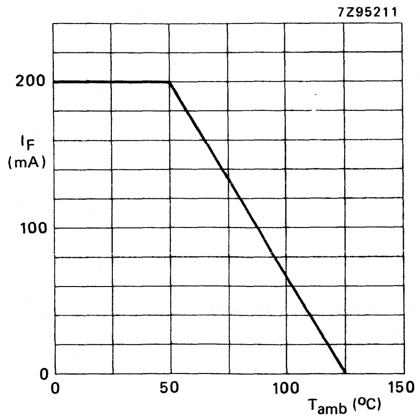


Fig. 2 Derating curve maximum ambient temperature.

SUPERSEDES DATA OF JUNE 1989

SCHOTTKY BARRIER DIODE

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

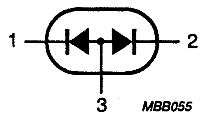
The diodes feature an especially low forward voltage.

QUICK REFERENCE DATA

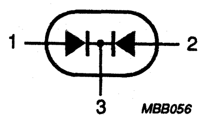
Continuous reverse voltage	V_R	max.	30	V
Forward current (DC)	I_F	max.	200	mA
Forward voltage at I_F = 10 mA	V_F	max.	400	mV
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100; measured at I_R = 1 mA	t_{rr}	<	5	ns
Junction temperature	T_j	max.	125	°C

Marking code:
BAT54A = L42
BAT54C = L43
BAT54S = L44

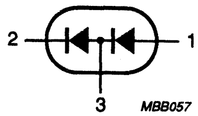
Dimensions in mm



BAT54A



BAT54C



BAT54S

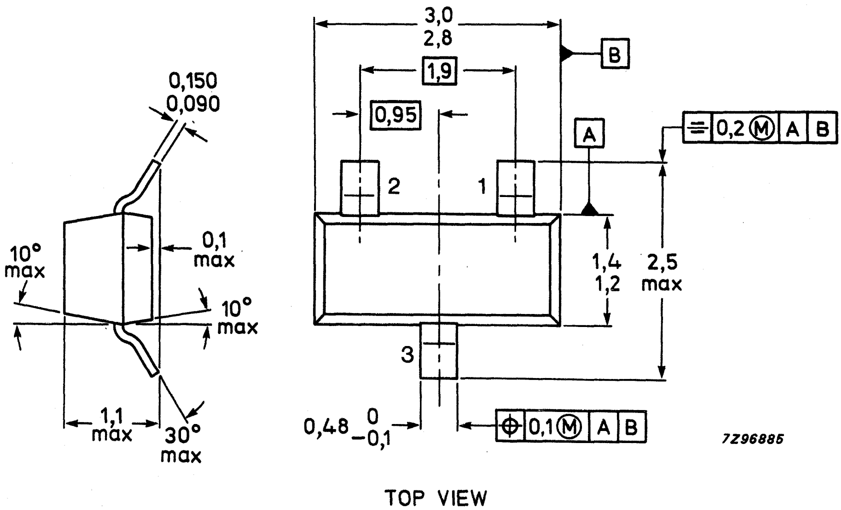


Fig. 1 SOT-23.

RATINGS

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

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

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

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

SCHOTTKY BARRIER DIODE

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

The device features a low forward voltage drop.

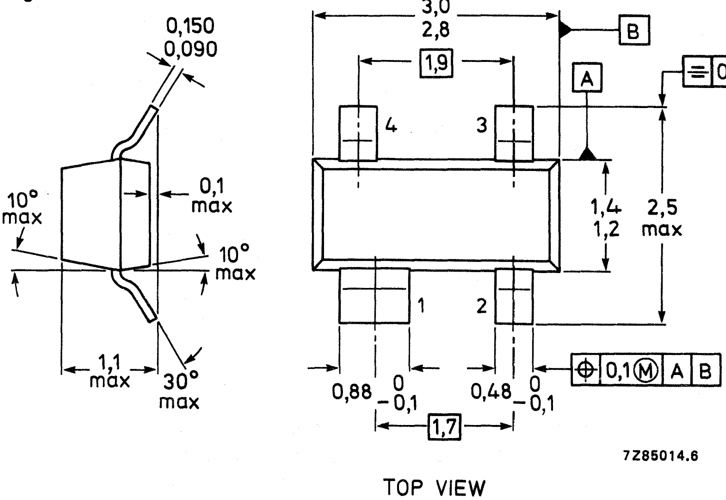
QUICK REFERENCE DATA

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

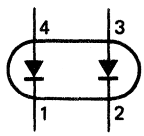
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.



Marking code : L41



RATINGS

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

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

THERMAL RESISTANCE

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

CHARACTERISTICS, per diode

T_{amb} = 25 °C unless otherwise specified

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

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

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

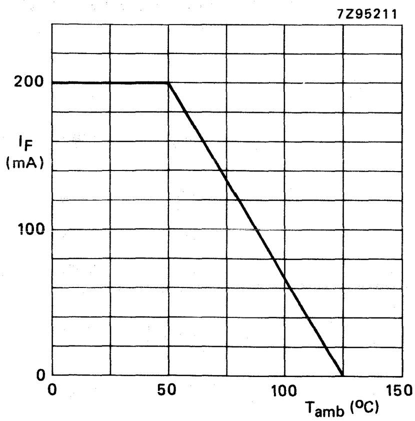


Fig. 2 Derating curve maximum ambient temperature.

DEVELOPMENT DATA

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

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

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

QUICK REFERENCE DATA

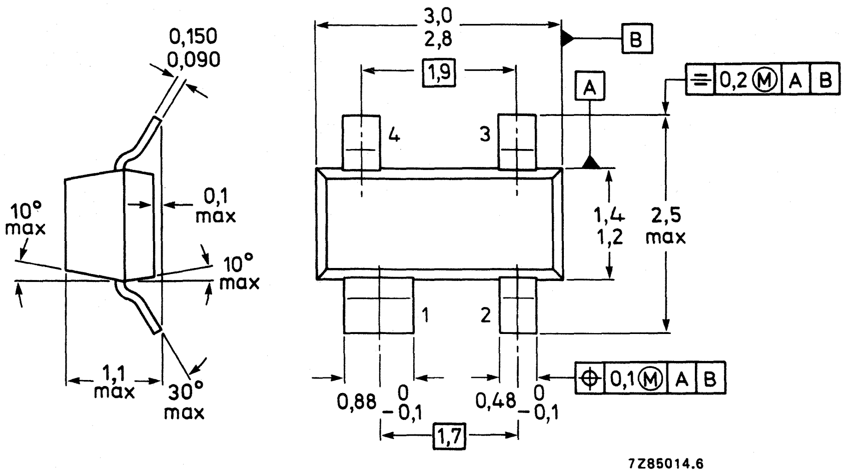
			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak rerverse voltage	V_{RRM}	max.	250	500	V
Average forward current	$I_{F(AV)}$	max.	200	120	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Reverse recovery time when switched from I_F = 30 mA to I_R = 30 mA; R_L = 100 Ω; measured at I_R = 3 mA	t_{rr}	<	50		ns

MECHANICAL DATA

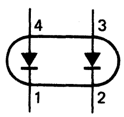
Dimensions in mm

Fig. 1 SOT-143.

Marking code: L30



TOP VIEW



RATINGS

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

			single diode	series connection	
Continuous reverse voltage	V_R	max.	200	400	V
Repetitive peak reverse voltage	V_{RRM}	max.	250	500	V
Average forward current	$I_{F(AV)}$	max.	200	120	mA
Repetitive peak forward current	I_{FRM}	max.	625	450	mA
Non-repetitive peak forward current t = 1 μs;	I_{FSM}	max.	2,5	1,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

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

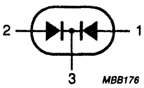
QUICK REFERENCE DATA (per diode)

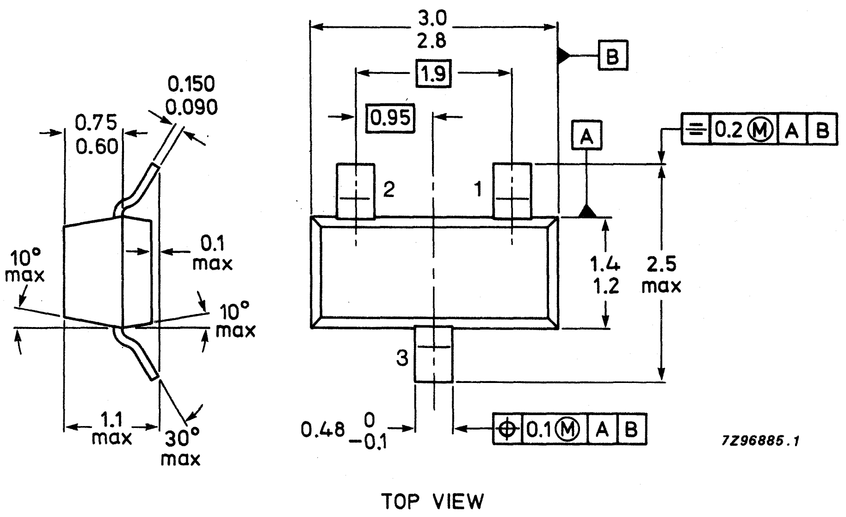
Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

MECHANICAL DATA — Dimensions in mm

Fig. 1 SOT-23.

Marking code
BAV70 = $A4_p$





RATINGS (per diode)

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

Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215	mA
Forward current (DC)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	2	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}	−65 to + 150		^{o}C
Junction temperature	T_j	max.	150	^{o}C

THERMAL RESISTANCE

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

CHARACTERISTICS (per diode)

T_j = 25 ^{o}C unless otherwise specified

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

* Measured under pulse conditions : pulse time $t_p \leqslant$ 0,5 ms.
For sinusoidal operation $I_{F(AV)}$ = 150 mA; averaging time $t_{(AV)} \leqslant$ 1 ms.

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

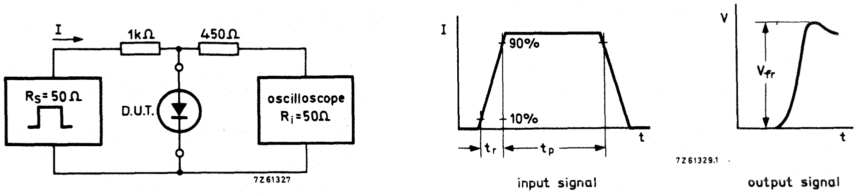


Fig. 2 Test circuit and waveforms; forward recovery voltage.

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

Oscilloscope : Rise time t_r = 0,35 ns

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

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA see Fig. 3 t_{rr} < 6 ns

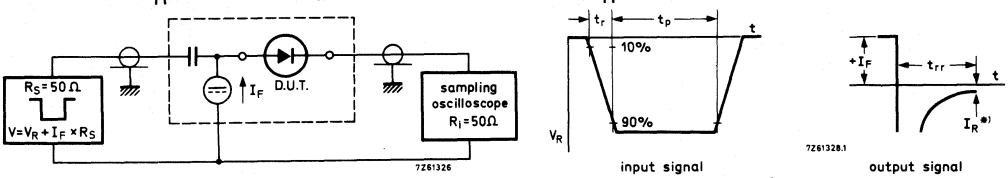


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

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

Oscilloscope : Rise time t_r = 0,35 ns

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

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω see Fig. 4 Q_s < 45 pC

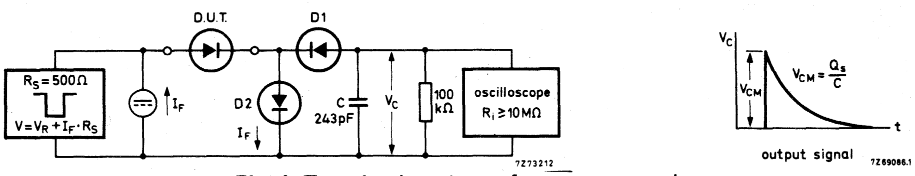


Fig. 4 Test circuit and waveform; recovery charge.

D1 = BAW62

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

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

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

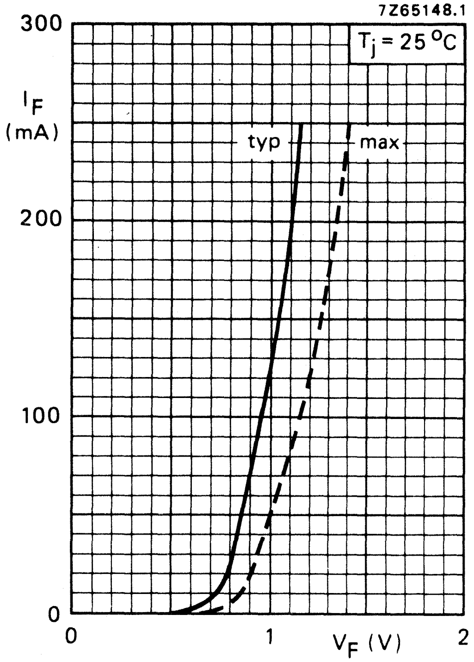


Fig. 5

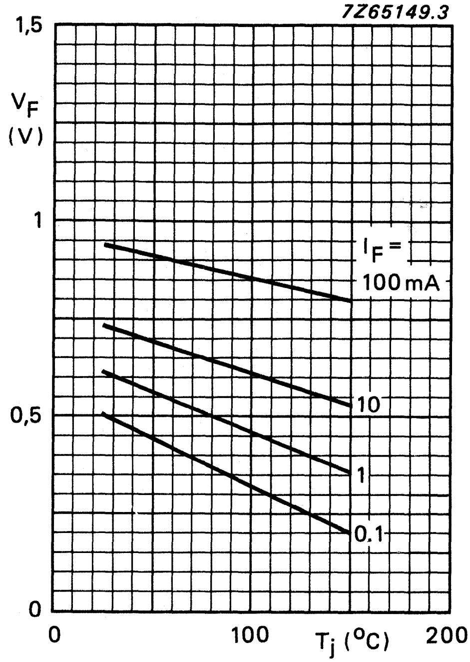


Fig. 6

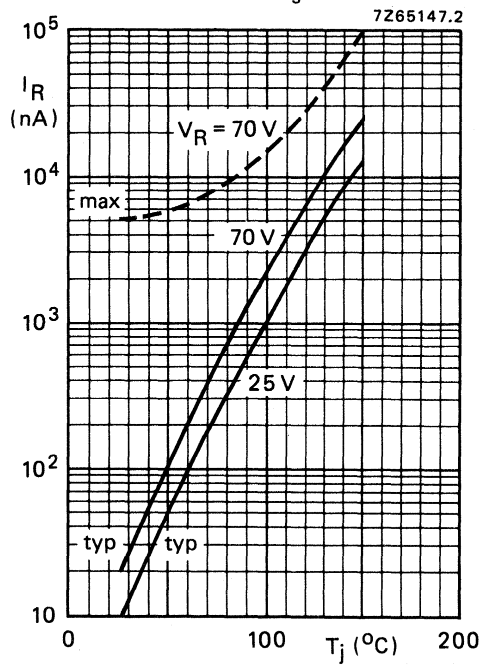


Fig. 7

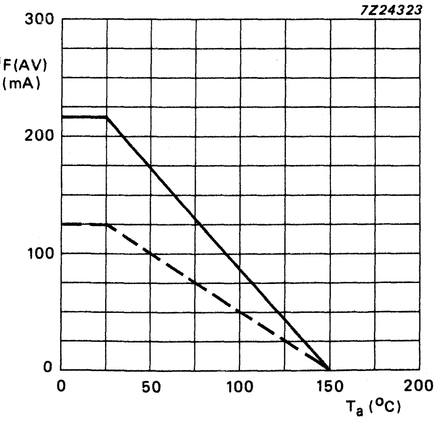


Fig. 8 ——— single diode
– – – – – double diode, equally loaded.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODE

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

QUICK REFERENCE DATA

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

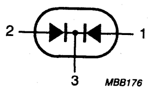
MECHANICAL DATA

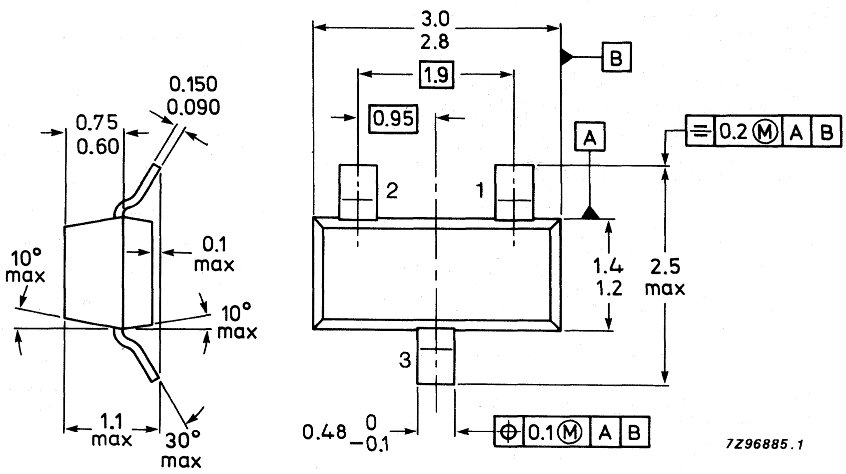
Dimensions in mm

Marking code

BAV74 = JAp

Fig. 1 SOT-23.





TOP VIEW

RATINGS (per diode)

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

Continuous reverse voltage	V_R	max.	50	V
Repetitive peak reverse voltage	V_{RRM}	max.	50	V
Average rectified forward current (averaged over any 20 ms period; t_p = 10 ms)	$I_{F(AV)}$	max.	250	mA
Forward current (d.c. or average)	I_F	max.	250	mA
Repetitive peak forward current	I_{FRM}	max.	250	mA
Non-repetitive peak forward current t = 1 μs	I_{FSM}	max.	4,5	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE*

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

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

* See Thermal Characteristics.

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

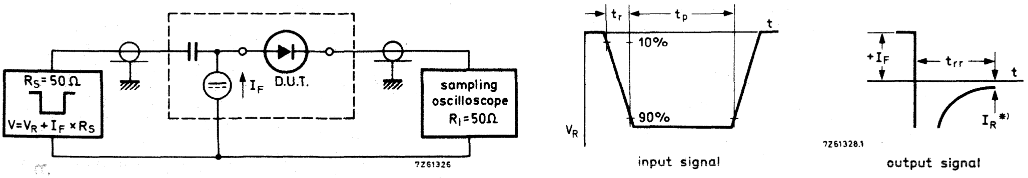


Fig. 2 Reverse recovery time test circuit and waveforms.

* $I_R = 1$ mA

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

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

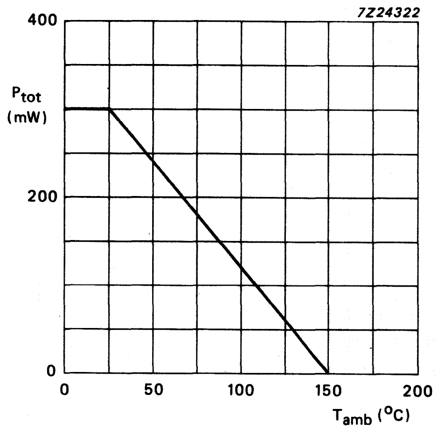


Fig. 3 Power derating curve.

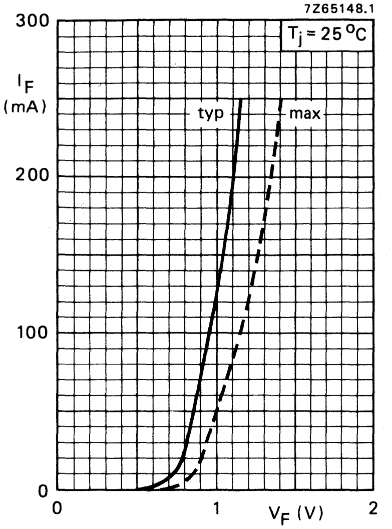


Fig. 4 Forward current as a function of forward voltage.

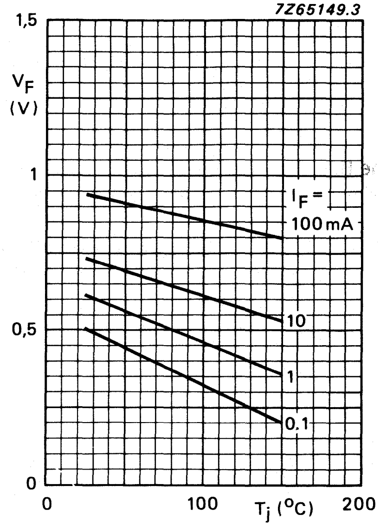


Fig. 5 Forward voltage as a function of junction temperature.

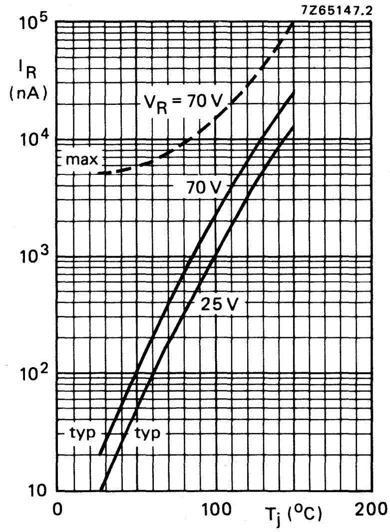


Fig. 6 Reverse current as a function of junction temperature.

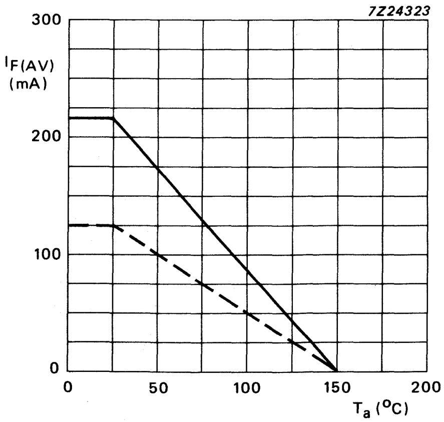


Fig. 7 Average current as a function of ambient temperature: ——— single diode; ----------- double diode, equally loaded.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

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

QUICK REFERENCE DATA (per diode)

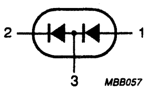
Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	^oC
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

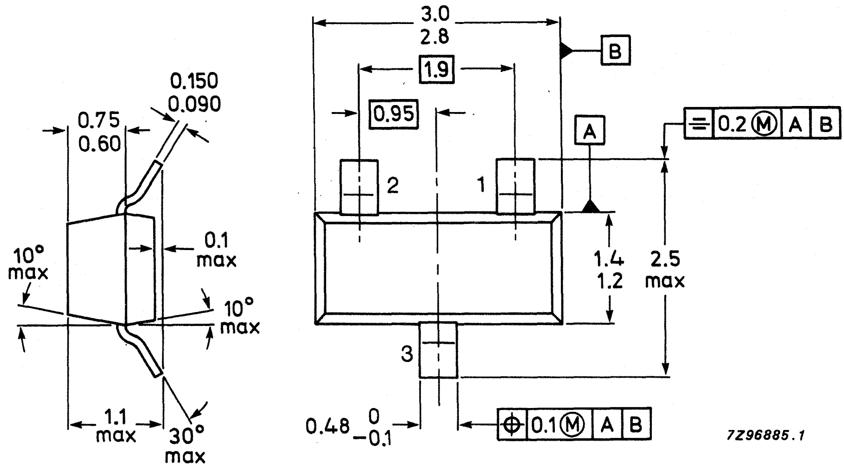
MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code

BAV99 = A7p





TOP VIEW

See also *Soldering recommendations.*

RATINGS (per diode)

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

Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215	mA
Forward current (d.c.)	I_F	max.	215	mA
Repetitive peak forward current	I_{FRM}	max.	450	mA
Non-repetitive peak forward current (per crystal)				
t = 1 μs	I_{FSM}	max.	2	A
t = 1 ms	I_{FSM}	max.	1	A
t = 1 s	I_{FSM}	max.	0,5	A
Storage temperature range	T_{stg}		–65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE**

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

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 1 mA	V_F	<	715	mV
I_F = 10 mA	V_F	<	855	mV
I_F = 50 mA	V_F	<	1000	mV
I_F = 150 mA	V_F	<	1250	mV
Reverse current				
V_R = 25 V; T_j = 150 °C	I_R	<	30	μA
V_R = 70 V	I_R	<	2,5	μA
V_R = 70 V; T_j = 150 °C	I_R	<	50	μA
Diode capacitance				
V_R = 0; f = 1 MHz	C_d	<	1,5	pF
Forward recovery voltage when switched to I_F = 10 mA; t_r = 20 ns	V_{fr}	<	1,75	V

* Measured under pulse conditions: pulse time $t_p \leq$ 0,5 ms.
For sinusoidal operation $I_{F(AV)}$ = 150 mA; averaging time $t_{(av)} \leq$ 1 ms.

** See *Thermal characteristics.*

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

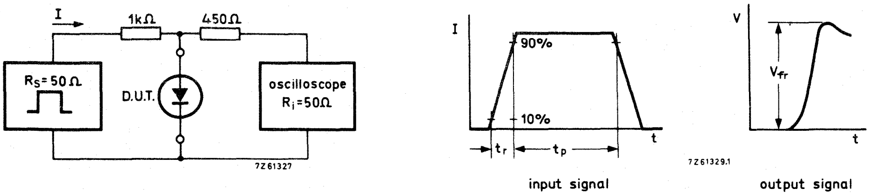


Fig. 2 Test circuit and waveforms; forward recovery voltage.

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

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

Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6 ns

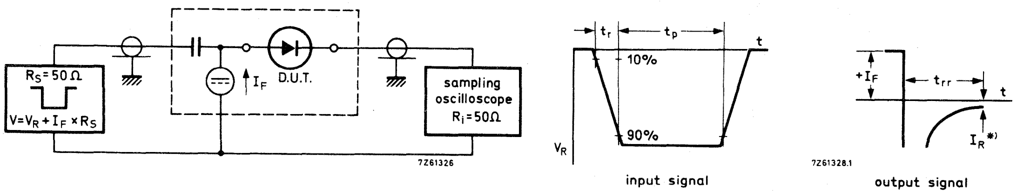


Fig. 3 Test circuit and waveforms; reverse recovery time.

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

*) I_R = 1 mA

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

Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45 pC

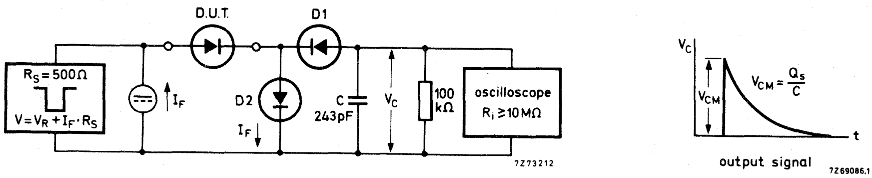


Fig. 4 Test and waveform; recovery charge.

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

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

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

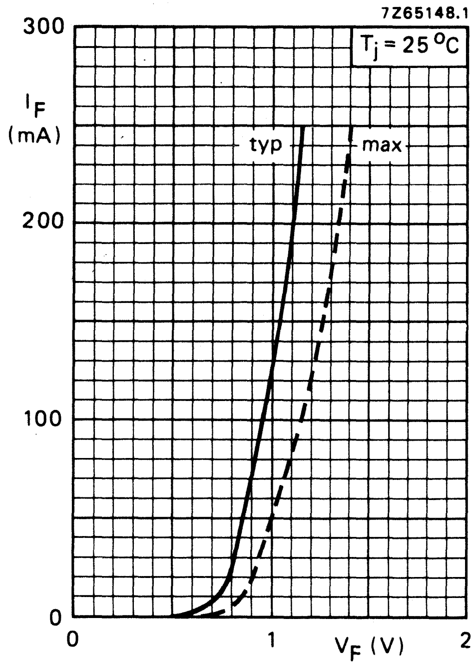


Fig. 5.

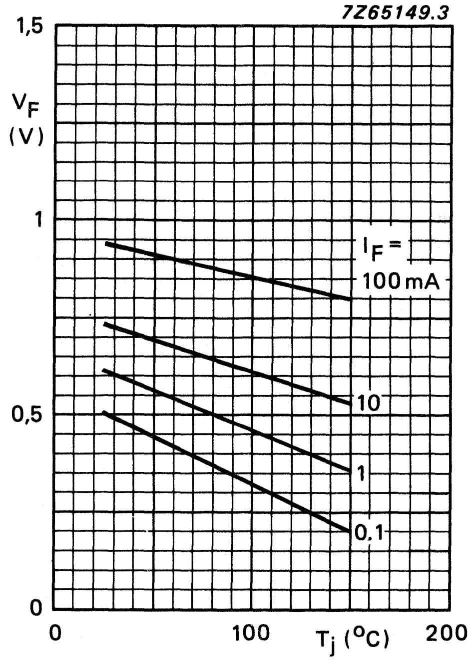


Fig. 6 Typical values.

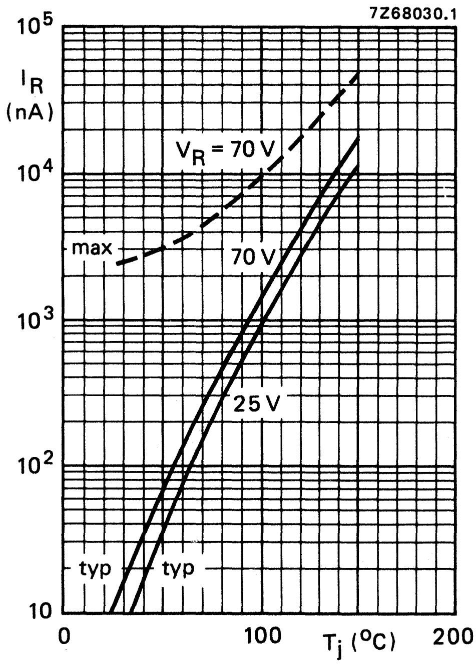


Fig. 7.

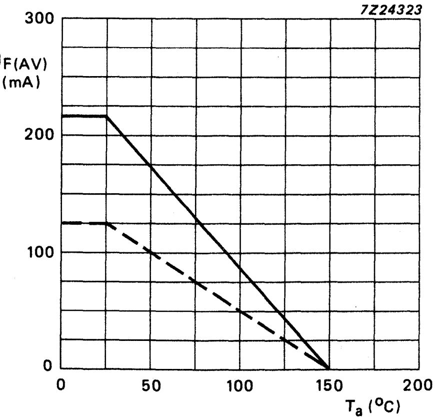


Fig. 8 ——— single diode
– – – – double diode; equally loaded.

GENERAL PURPOSE DIODES FOR SURFACE MOUNTING

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

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

The diodes are delivered in "super 8" tape.

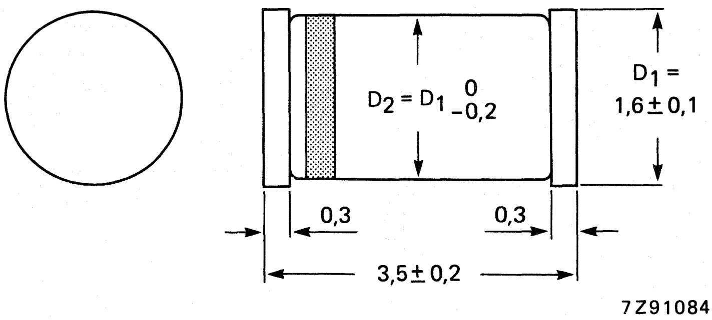
QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The BAV100 cathode is indicated by a green and a black band.
The BAV101 cathode is indicated by a green and a brown band.
The BAV102 cathode is indicated by a green and a red band.
The BAV103 cathode is indicated by a green and an orange band.

RATINGS

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

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

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

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

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

			BAV100	BAV101	BAV102	BAV103	
Reverse breakdown voltage $I_R = 100$ µA	$V_{(BR)R}$	>	60	120	200	250	V[2]

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

1) For sinusoidal operation see Figs 7 to 10. For pulse operation see Figs 3 to 6.
2) At zero life time, measured under pulse conditions to avoid excessive dissipation and voltage limited at 275 V.

Test circuit and waveforms:

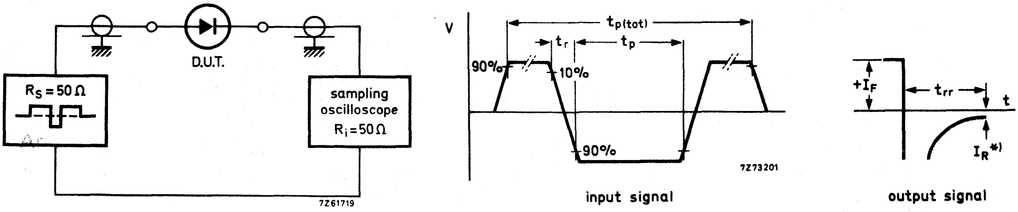


Fig. 2.

*) $I_R = 3$ mA

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

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

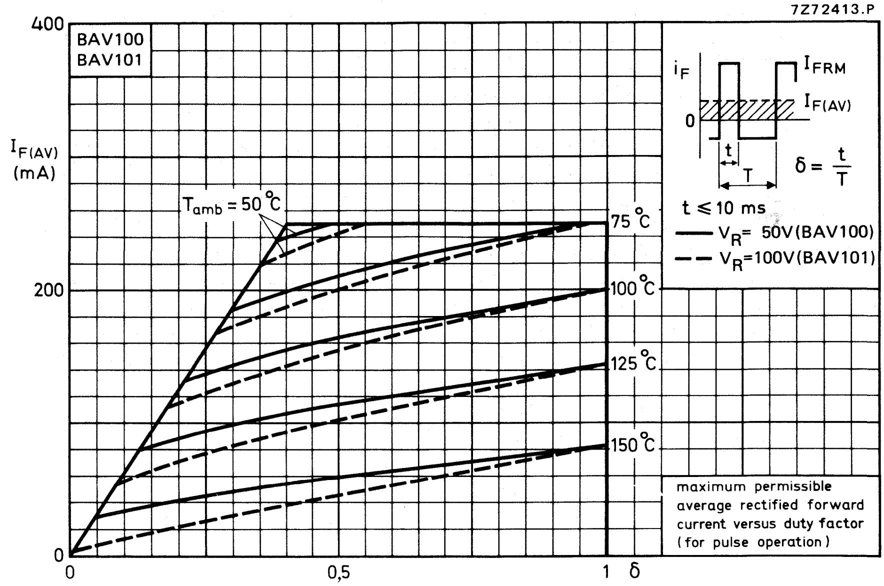

7Z72413.P
400
200
0
$I_{F(AV)}$ (mA)
BAV100
BAV101
T_{amb} = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
δ = t/T
t ⩽ 10 ms
V_R= 50V(BAV100)
V_R=100V(BAV101)
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 3.

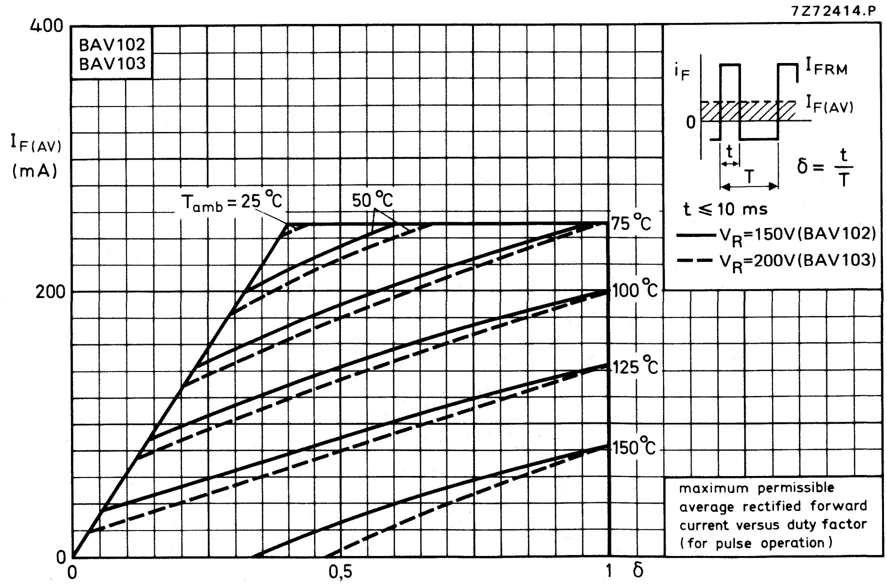

7Z72414.P
400
200
0
$I_{F(AV)}$ (mA)
BAV102
BAV103
T_{amb} = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
δ = t/T
t ⩽ 10 ms
V_R=150V(BAV102)
V_R=200V(BAV103)
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 4.

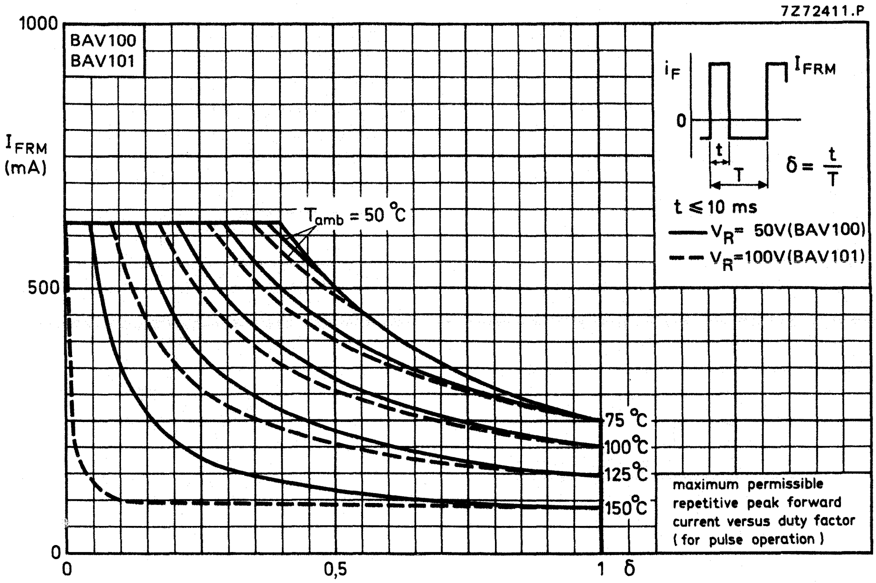

7Z72411.P
1000
500
0
IFRM (mA)
BAV100
BAV101
Tamb = 50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
iF
IFRM
0
t
T
δ = t/T
t ≤ 10 ms
VR= 50V(BAV100)
VR=100V(BAV101)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 5.

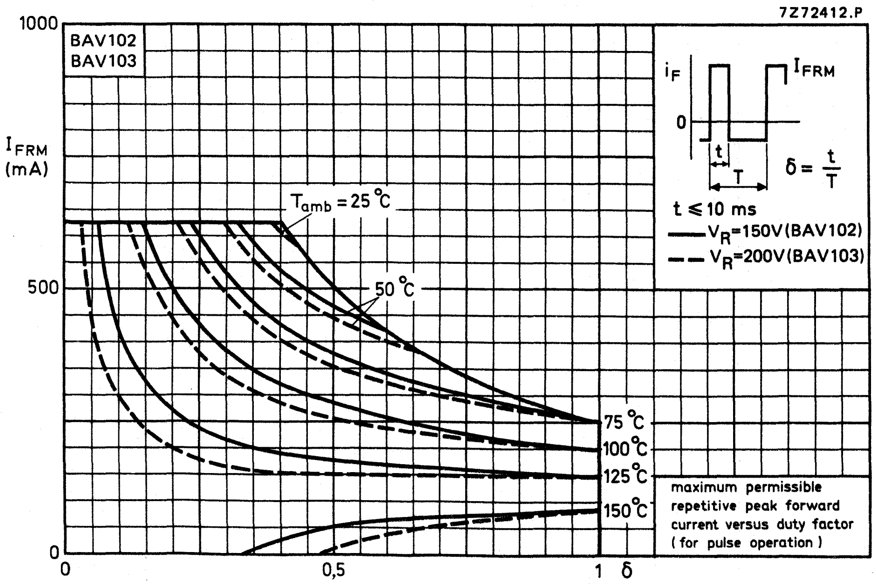

7Z72412.P
1000
500
0
IFRM (mA)
BAV102
BAV103
Tamb = 25 °C
50 °C
75 °C
100 °C
125 °C
150 °C
0
0,5
1 δ
iF
IFRM
0
t
T
δ = t/T
t ≤ 10 ms
VR=150V(BAV102)
VR=200V(BAV103)
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 6.

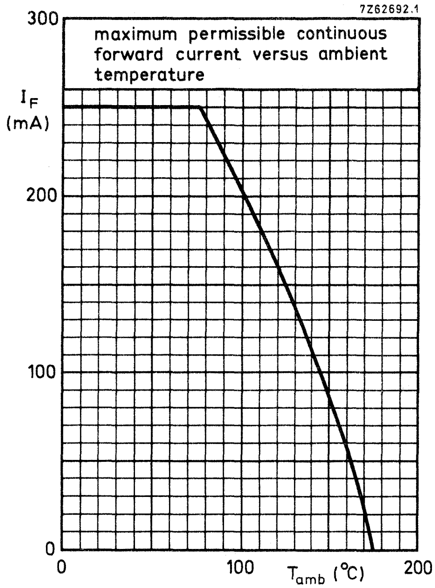


Fig. 7.

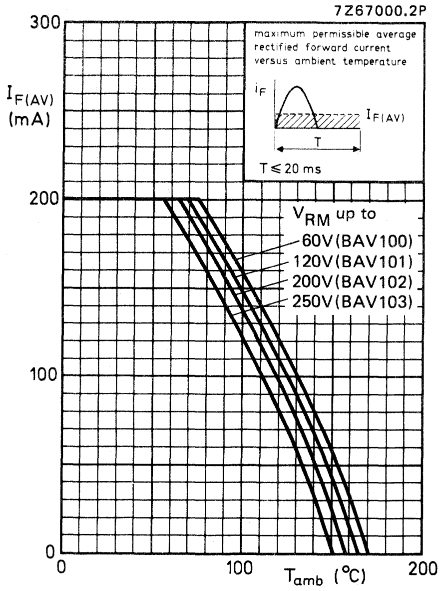


Fig. 8.

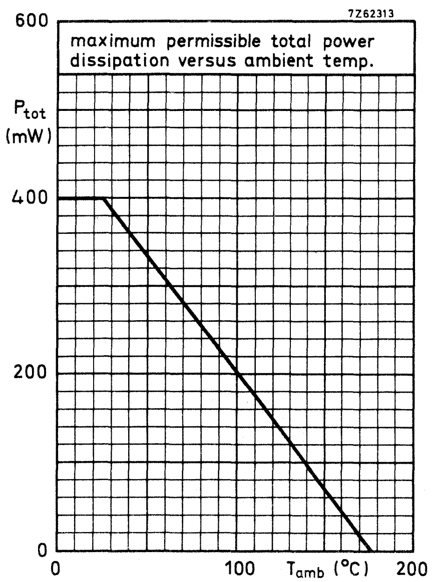


Fig. 9.

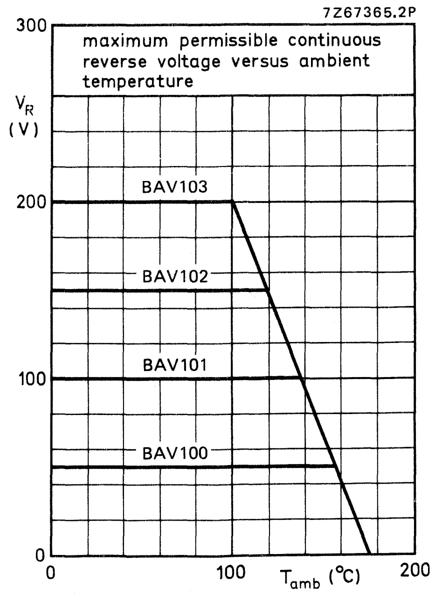


Fig. 10.

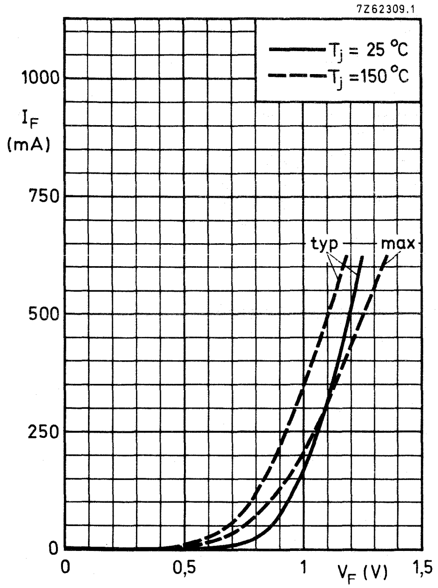


Fig. 11.

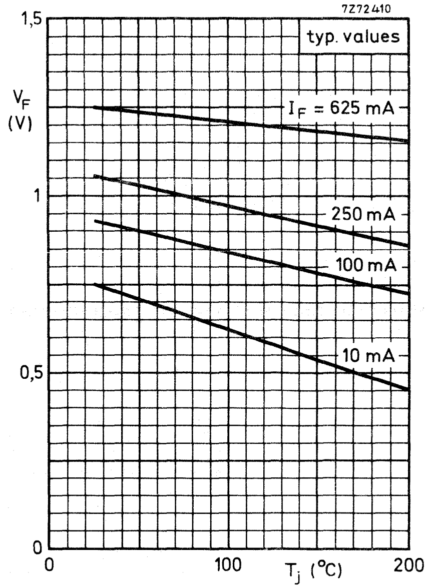


Fig. 12.

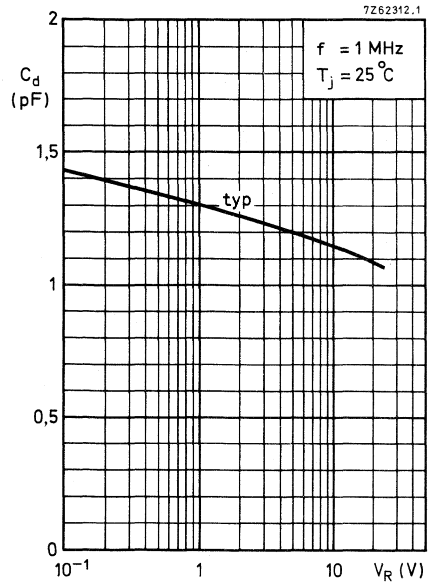


Fig. 13.

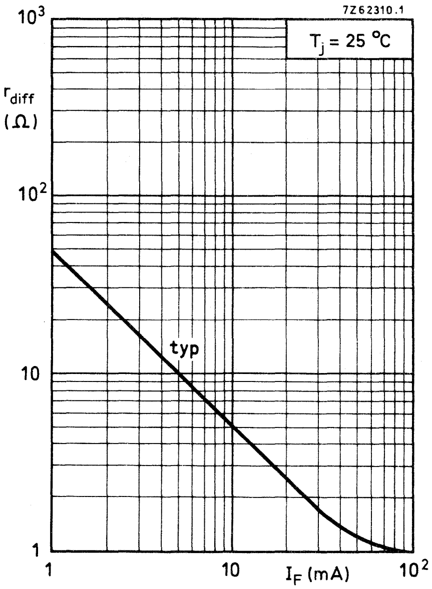


Fig. 14.

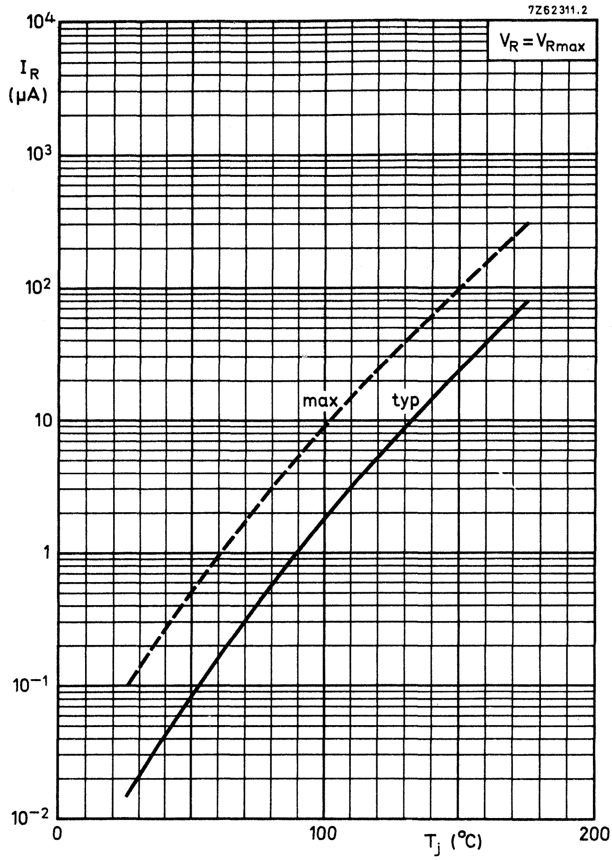

7Z62311.2
$V_R = V_{Rmax}$
I_R (μA)
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
0
100
200
T_j (°C)
max
typ

Fig. 15.

ULTRA HIGH-SPEED DIODE

Silicon planar epitaxial, ultra-high speed, high conductance diode in a SOD-80 envelope.

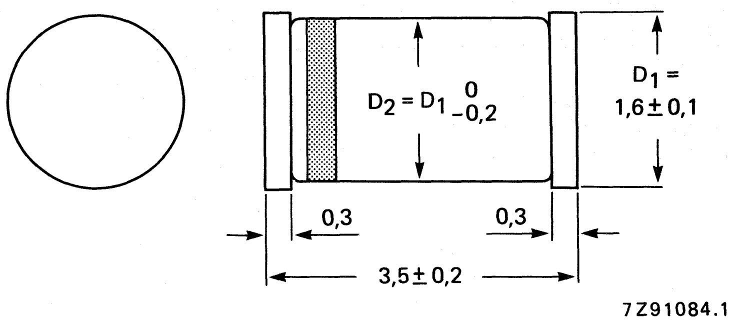
QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



A green band indicates the cathode side and identifies the type BAV105.

RATINGS

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

Continuous reverse voltage	V_R	max.	60	V
Repetitive peak reverse voltage	V_{RRM}	max.	60	V
Average rectified forward current	$I_{F(AV)}$	max.	300	mA
Forward current	I_F	max.	300	mA
Repetitive peak forward current	I_{FRM}	max.	600	mA
Non-repetitive peak forward current				
t = 1 μs	I_{FSM}	max.	4000	mA
t = 1 s	I_{FSM}	max.	1000	mA
Storage temperature	T_{stg}		−65 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

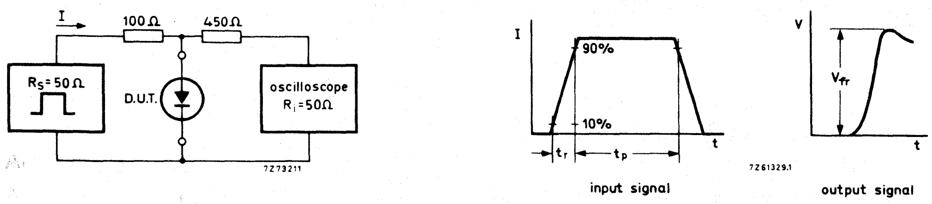
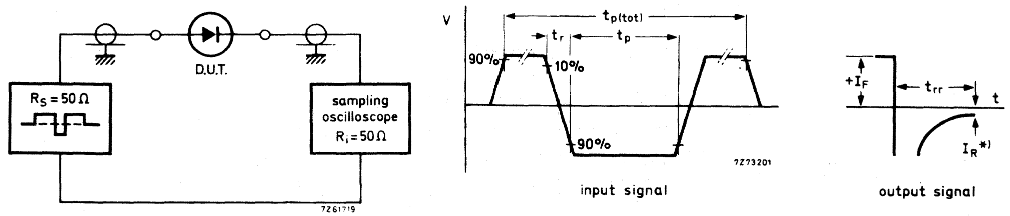


Fig. 2 Test circuit and waveforms; forward recovery voltage.

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

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

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



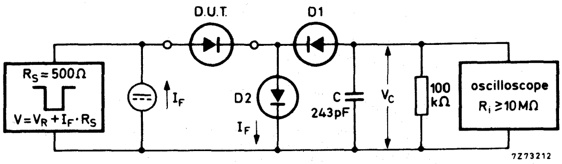
*) I_R = 40 mA

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

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

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

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



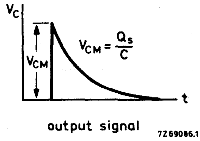


Fig. 4 Test circuit and waveform; recovery charge.

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

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

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

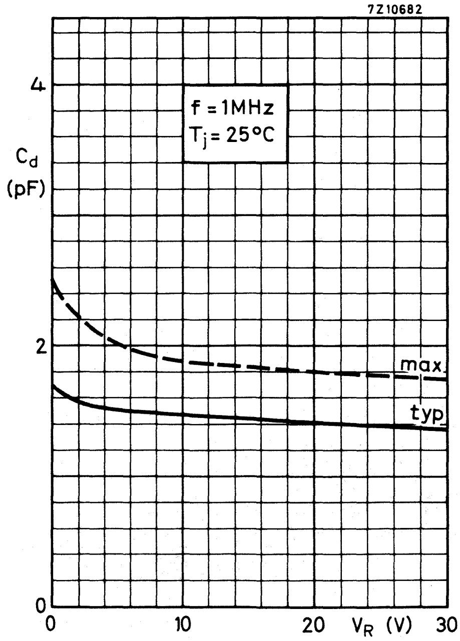


Fig. 5.

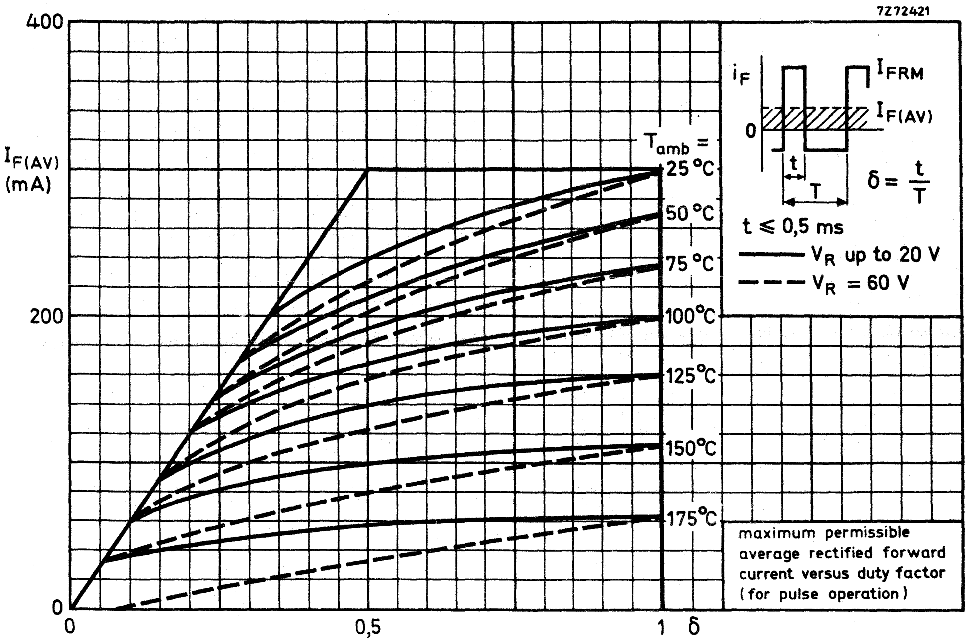

7Z72421
400
200
0
$I_{F(AV)}$ (mA)
0
0,5
1 δ
T_{amb} =
25 °C
50 °C
75 °C
100°C
125°C
150°C
175°C
i_F
I_{FRM}
$I_{F(AV)}$
0
t
T
δ = t/T
t ⩽ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible average rectified forward current versus duty factor (for pulse operation)

Fig. 6.

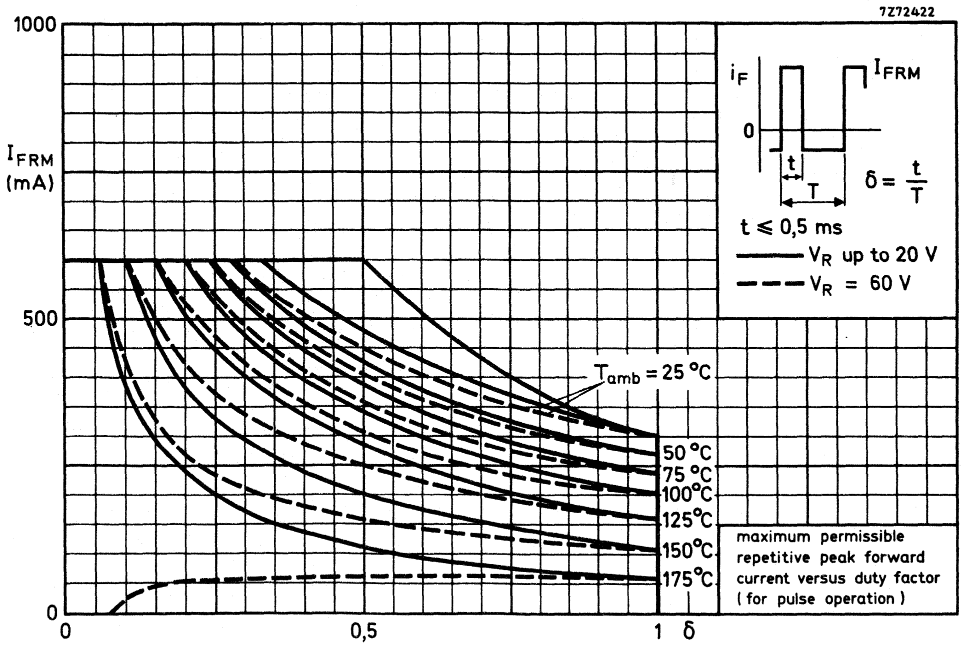

7Z72422
1000
500
0
I_{FRM} (mA)
0
0,5
1 δ
T_{amb} = 25 °C
50 °C
75 °C
100°C
125°C
150°C
175°C
i_F
I_{FRM}
0
t
T
δ = t/T
t ⩽ 0,5 ms
V_R up to 20 V
V_R = 60 V
maximum permissible repetitive peak forward current versus duty factor (for pulse operation)

Fig. 7.

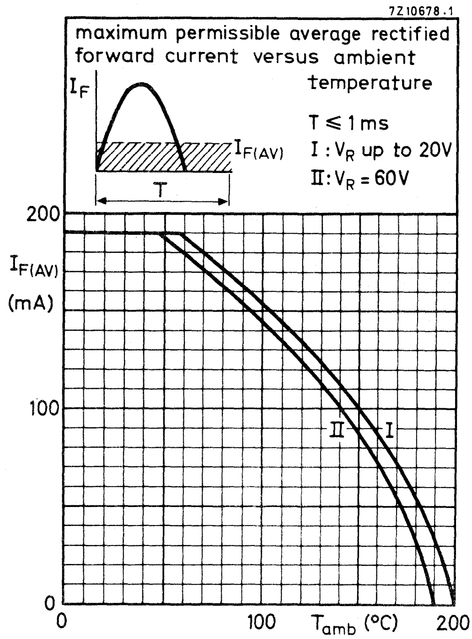


Fig. 8.

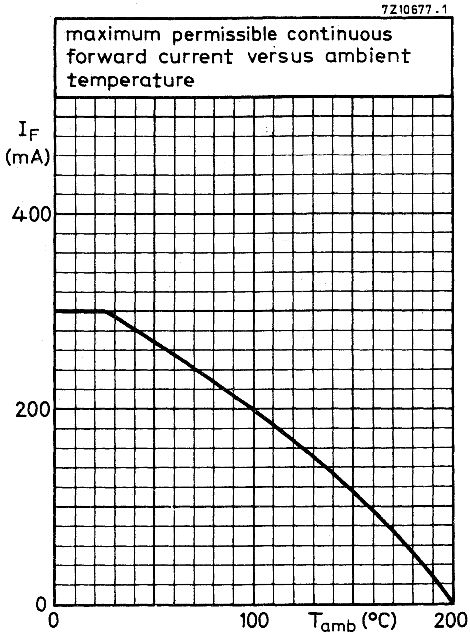


Fig. 9.

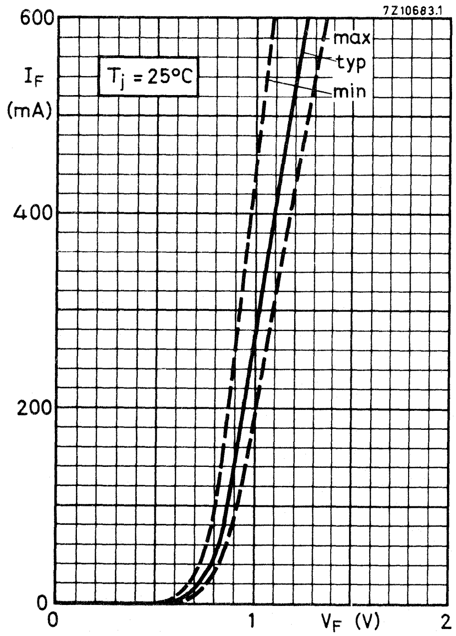


Fig. 10.

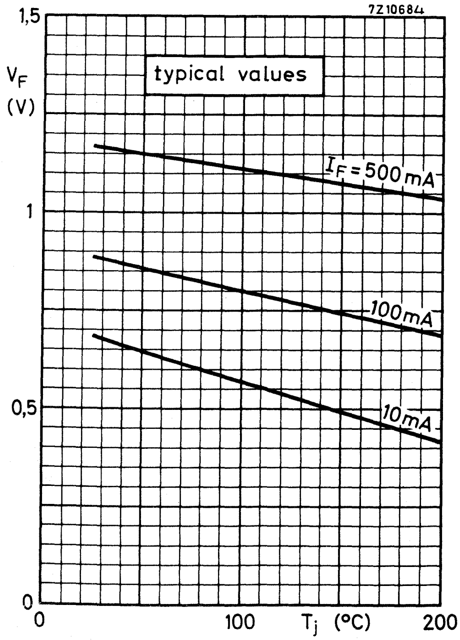


Fig. 11.

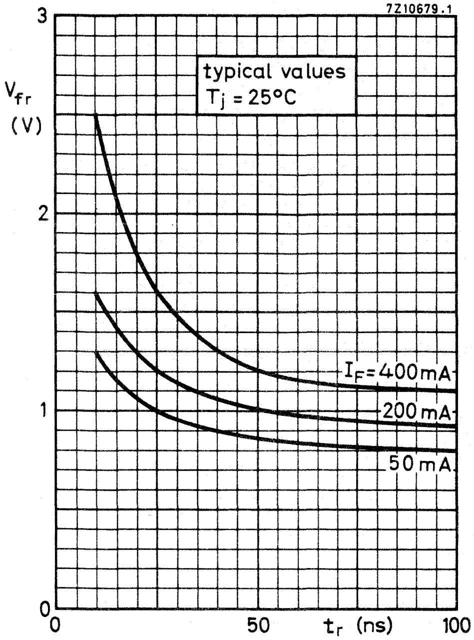


Fig. 12.

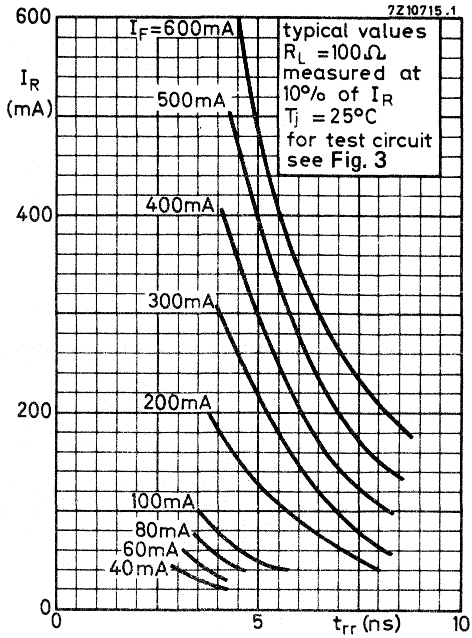


Fig. 13.

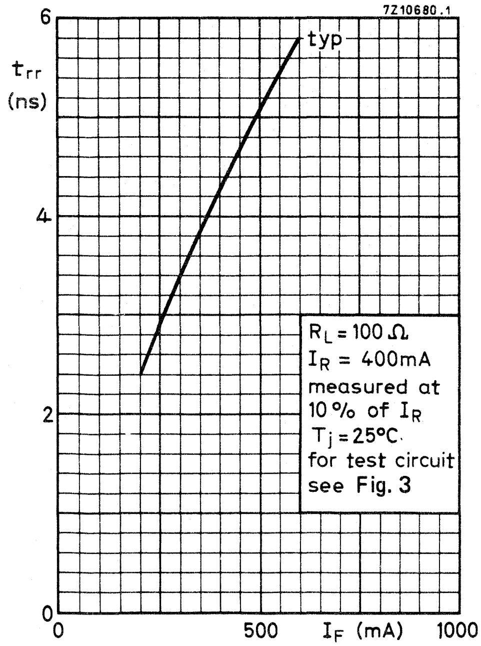


Fig. 14.

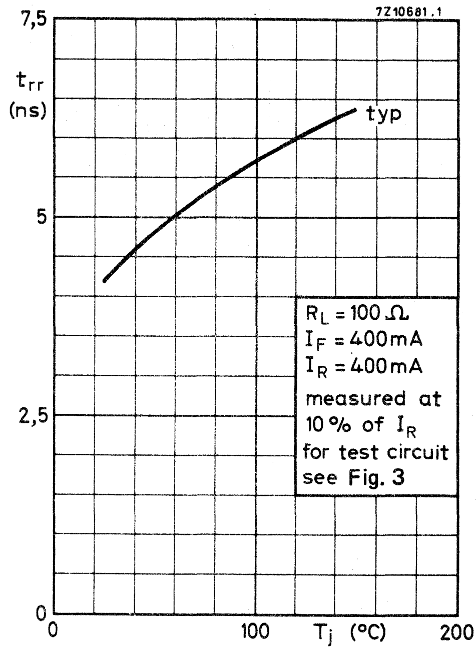


Fig. 15.

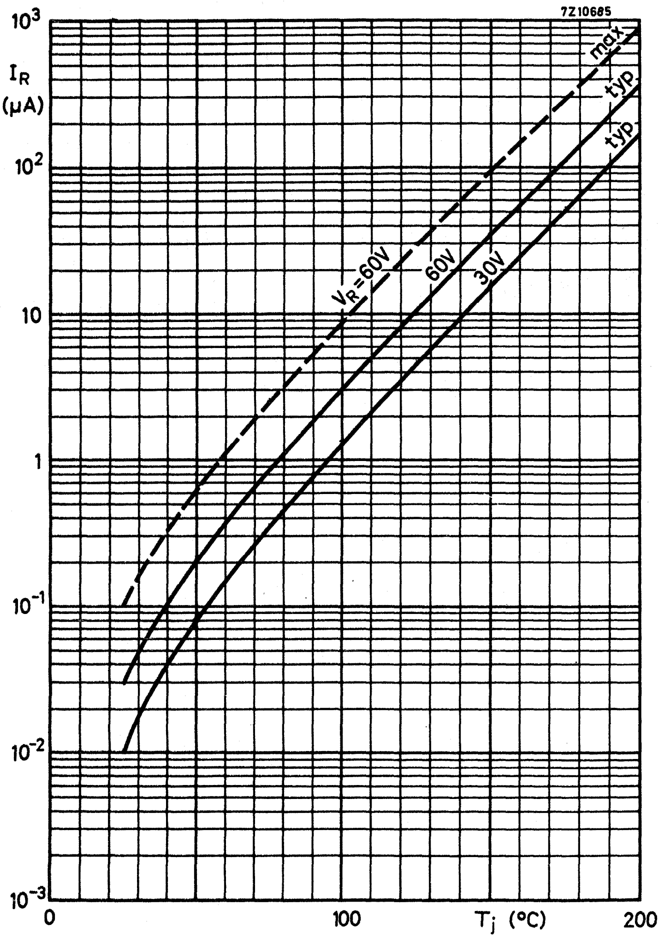

7Z10685
10^3
I_R
(μA)
10^2
10
1
10^-1
10^-2
10^-3
0
100
T_j (°C)
200
max
typ
typ
V_R=60V
60V
30V

Fig. 16.

SILICON PLANAR EPITAXIAL HIGH-SPEED DIODES

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

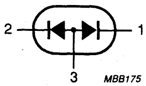
QUICK REFERENCE DATA (per diode)

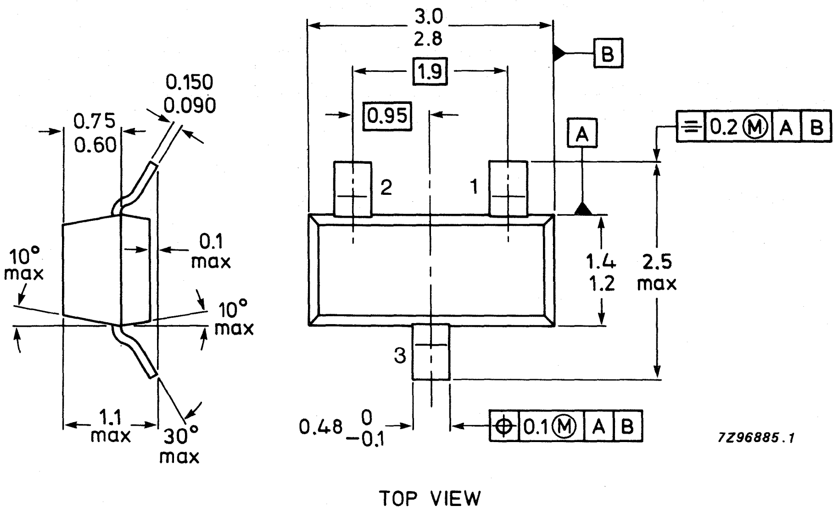
Continuous reverse voltage	V_R	max.	70	V
Repetitive peak reverse voltage	V_{RRM}	max.	70	V
Repetitive peak forward current	I_{FRM}	max.	450	mA
Junction temperature	T_j	max.	150	°C
Forward voltage at I_F = 50 mA	V_F	<	1,0	V
Reverse recovery time when switched from I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω; measured at I_R = 1 mA	t_{rr}	<	6	ns
Recovery charge when switched from I_F = 10 mA to V_R = 5 V; R_L = 500 Ω	Q_s	<	45	pC

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-23.

Marking code
BAW56 = A1p





See also *Soldering recommendations.*

RATINGS (per diode)

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

Continuous reverse voltage	V_R	max.	70 V
Repetitive peak reverse voltage	V_{RRM}	max.	70 V
Average rectified forward current* (averaged over any 20 ms period)	$I_{F(AV)}$	max.	215 mA
Forward current (DC)	I_F	max.	215 mA
Repetitive peak forward current	I_{FRM}	max.	450 mA
Non-repetitive peak forward current (per crystal)			
t = 1 μs	I_{FSM}	max.	2 A
t = 1 ms	I_{FSM}	max.	1 A
t = 1 s	I_{FSM}	max.	0,5 A
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE**

From junction to ambient**	$R_{th\ j\text{-}t}$	=	430 K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	2 x 280 K/W
From soldering points to ambient ▲	$R_{th\ s\text{-}a}$	=	2 x 90 K/W

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 1 mA	V_F	<	715 mV
I_F = 10 mA	V_F	<	855 mV
I_F = 50 mA	V_F	<	1000 mV
I_F = 150 mA	V_F	<	1250 mV
Reverse current			
V_R = 25 V; T_j = 150 °C	I_R	<	30 μA
V_R = 70 V	I_R	<	2,5 μA
V_R = 70 V; T_j = 150 °C	I_R	<	50 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	<	2 pF
Forward recovery voltage when switched to I_F = 10 mA; t_r = 20 ns see Fig. 2	V_{fr}	<	1,75 V

* Measured under pulse conditions: pulse time $t_p \leqslant 0{,}5$ ms.
For sinusoidal operation $I_{F(AV)}$ = 150 mA; averaging time $t_{(AV)} \leqslant 1$ ms.

** See *Thermal characteristics.*

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

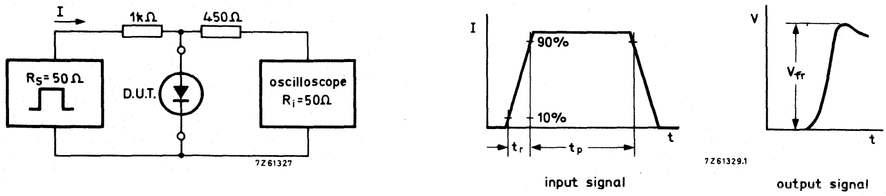


Fig. 2 Test circuit and waveforms; forward recovery voltage.

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

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

Reverse recovery time when switched from
I_F = 10 mA to I_R = 10 mA; R_L = 100 Ω;
measured at I_R = 1 mA see Fig. 3 t_{rr} < 6 ns

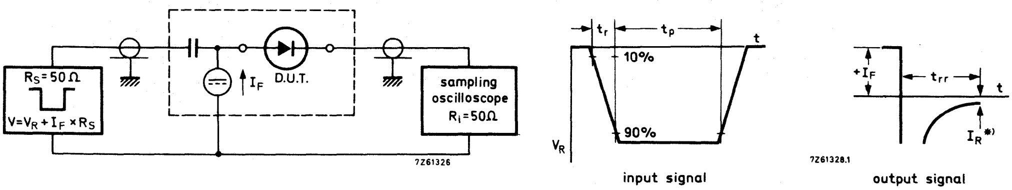


Fig. 3 Test circuit and waveforms; reverse recovery time.

*) I_R = 1 mA

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

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

Recovery charge when switched from
I_F = 10 mA to V_R = 5 V; R_L = 500 Ω see Fig. 4 Q_s < 45 pC

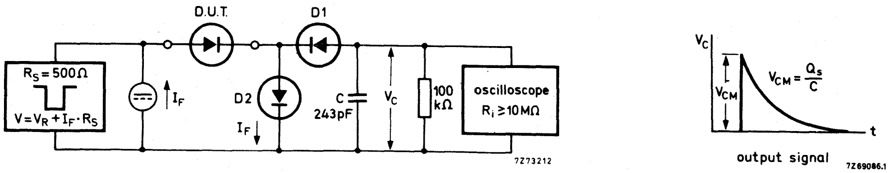


Fig. 4 Test circuit and waveform; recovery charge.

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

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

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

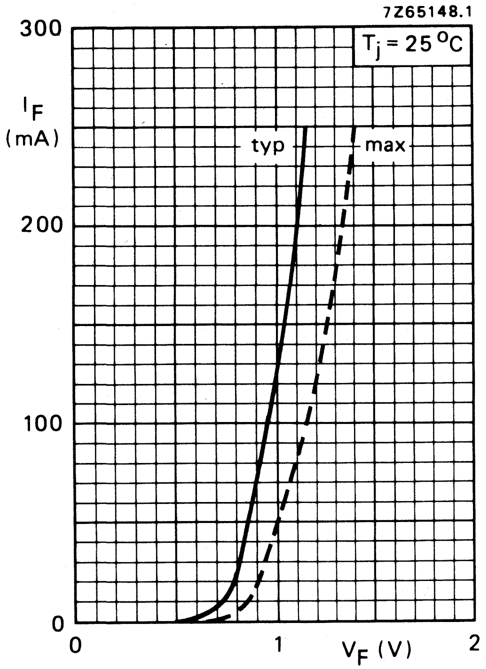


Fig. 5.

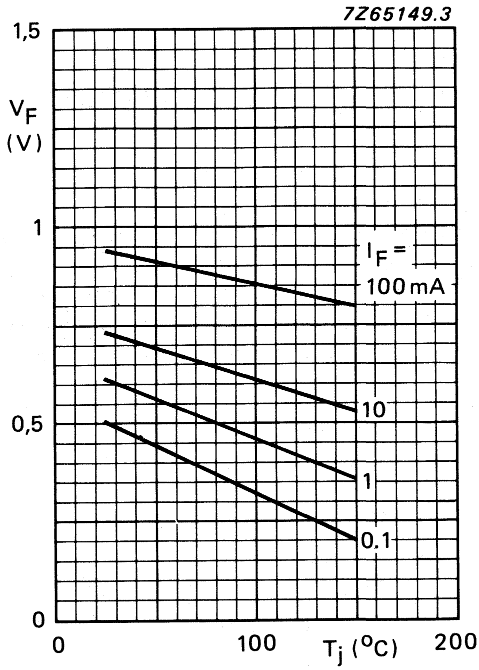


Fig. 6 Typical values.

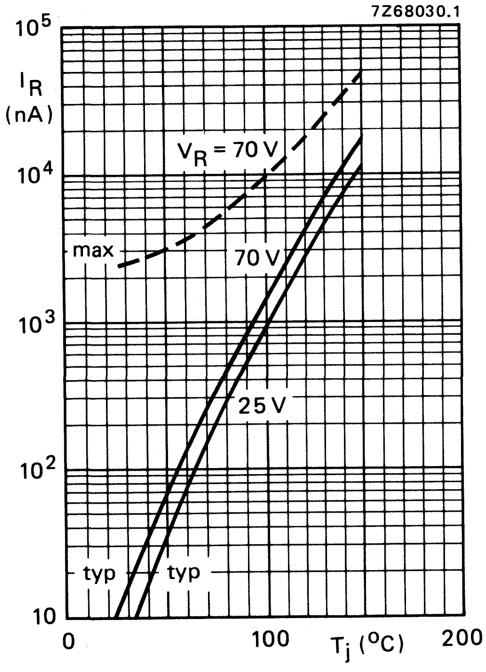


Fig. 7.

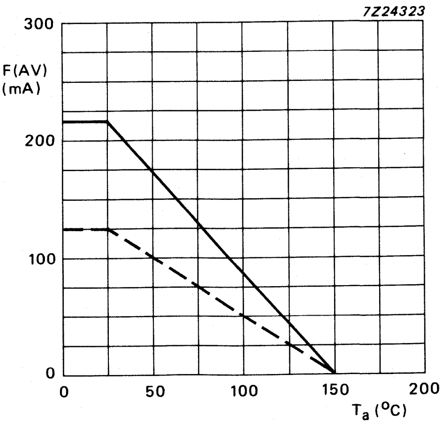


Fig. 8 ——— single diode;
– – – – double diode, equally loaded.

UHF VARIABLE CAPACITANCE DIODE

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

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

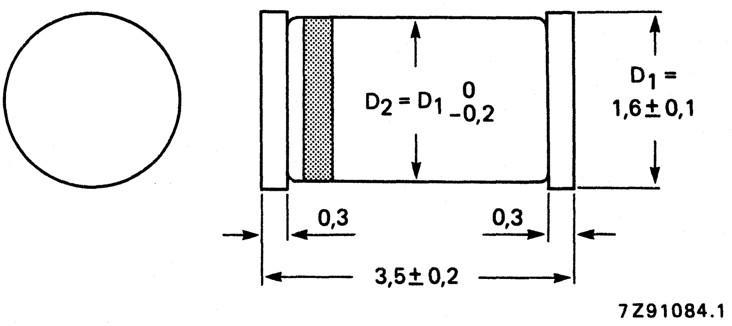
QUICK REFERENCE DATA

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



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

RATINGS

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

Continuous reverse voltage	V_R	max.	30	V
Forward current (DC)	I_F	max.	20	mA
Storage temperature	T_{stg}		−55 to +150	°C
Operating junction temperature	T_j	max.	100	°C

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current				
V_R = 28 V	I_R	<	10	nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200	nA
Diode capacitance at f = 500 kHz				
V_R = 1 V	C_d	typ.	17	pF
		<	18	pF
V_R = 28 V	C_d		1,8 to 2,2	pF
Capacitance ratio at f = 500 kHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	>	7,6	
		typ.	8,3	
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	typ.	0,63	Ω

VHF VARIABLE CAPACITANCE DIODE

The BB219 is a silicon variable capacitance diode in a hermetically sealed glass envelope (SOD-80) and intended for electronic tuning in VHF television tuners for C.A.T.V. applications.
The SOD-80 envelope is suitable for surface mounting.

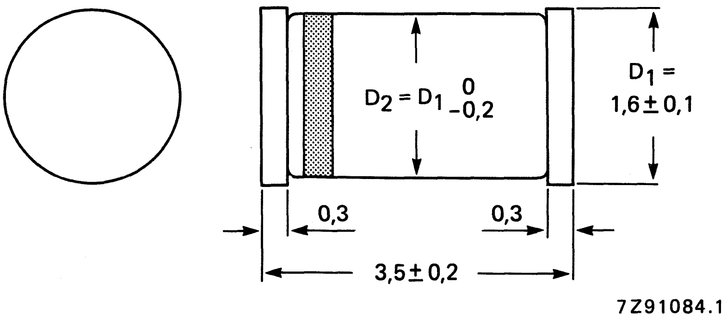
QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	30 V
Reverse current $V_R = 28$ V	I_R	<	10 nA
Diode capacitance at f = 1 MHz $V_R = 1$ V	C_d	>	31 pF
$V_R = 28$ V			2,6 to 3,2 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$		12 to 15
Series resistance at f = 100 MHz V_R is that value at which $C_d = 30$ pF	r_s	typ.	0,7 Ω
		<	0,9 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-80.



The cathode is indicated by a white band on the body.

RATINGS

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

Reverse voltage, peak value	V_{RM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature	T_{stg}		−55 to +150 °C
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200 nA
Diode capacitance at f = 0,5 MHz			
V_R = 1 V	C_d	>	31 pF
V_R = 28 V	C_d		2,6 to 3,2 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$		12 to 15
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	0,7 Ω
		<	0,9 Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2,5 %

VHF VARIABLE CAPACITANCE DIODE

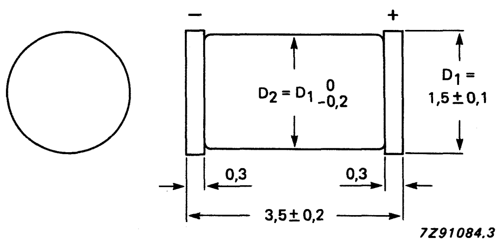
The BB240 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band B up to 460 MHz in all-band tuners.
The diode is encapsulated in the hermetically sealed glass envelope SOD-80 suitable for surface mounting.

QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	32 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 0.5 V	C_d	>	38 pF
V_R = 28 V	C_d		2.4 to 2.7 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 0.5\ V)}{C_d\ (V_R = 28\ V)}$	>	14
Series resistance at f = 100 MHz V_R is that value at which C_d = 40 pF	r_s	<	1.0 Ω

MECHANICAL DATA

Dimensions in mm



The cathode is indicated by a green band on the body.

Fig. 1 SOD-80.

RATINGS

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

Reverse voltage, peak value	V_{RM}	max.	32 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}	−55 to + 150 °C	
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200 nA
Diode capacitance at f = 1 MHz			
V_R = 0.5 V	C_d	>	38 pF
V_R = 28 V	C_d		2.4 to 2.7 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 0.5\ V)}{C_d\ (V_R = 28\ V)}$	>	14
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 40 pF	r_s	<	1.0 Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2.5 %

VHF VARIABLE CAPACITANCE DIODE

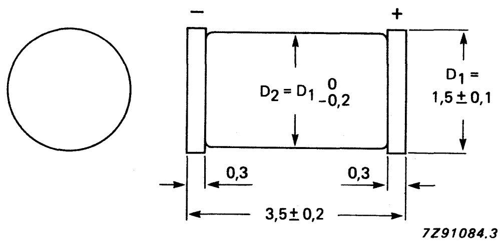
The BB241 is a VHF variable capacitance diode in planar technology with a very high capacitance ratio intended for VHF-band A up to 160 MHz in all-band tuners.
The diode is encapsulated in the hermetically sealed glass envelope SOD-80 suitable for surface mounting.

QUICK REFERENCE DATA

Reverse voltage, peak value	V_{RM}	max.	32 V
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 0.5 V	C_d	>	63 pF
V_R = 28 V	C_d		2.5 to 3.0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 0.5\ V)}{C_d (V_R = 28\ V)}$	>	21
Series resistance at f = 100 MHz V_R is that value at which C_d = 40 pF	r_s	<	2.0 Ω

MECHANICAL DATA

Dimensions in mm



The cathode is indicated by a black band on the body.

Fig. 1 SOD-80.

RATINGS

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

Reverse voltage, peak value	V_{RM}	max.	32 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature range	T_{stg}		−55 to + 150 °C
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_{amb} = 85 °C	I_R	<	200 nA
Diode capacitance at f = 1 MHz			
V_R = 0.5 V	C_d	>	63 pF
V_R = 28 V	C_d		2.5 to 3.0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 0.5\ V)}{C_d\ (V_R = 28\ V)}$	>	21
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 40 pF	r_s	<	2.0 Ω
Tolerance of capacitance difference between two diodes at V_R = 1 to 28 V	$\frac{\Delta C}{C}$	<	2.5 %

SILICON PLANAR VARIABLE CAPACITANCE DIODE

The BB249 is a variable capacitance diode in a miniature glass envelope intended for electronic tuning in v.h.f. television tuners with extended band I (FCC and OIRT-norm).

Diodes are supplied in matched sets (minimum 120 pieces and divisible by 12) and the capacitance difference between any two diodes in one set is less than 3% over the voltage range from 0,5 V to 28 V.

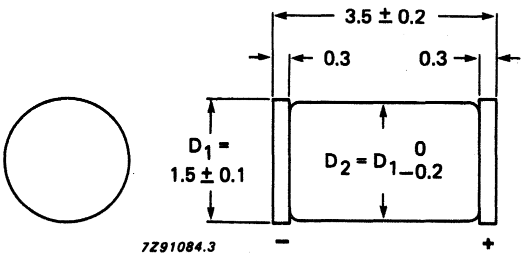
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	28	V
Reverse current at V_R = 28 V	I_R	max.	10	nA
Diode capacitance at f = 500 kHz				
V_R = 1 V	C_d		39 to 46	pF
V_R = 28 V	C_d		4,0 to 5,0	pF
Capacitance ratio at f = 500 kHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 10	
Series resistance at f = 200 MHz V_R is that value at which C_d = 25 pF	r_s	max.	0,6	Ω

MECHANICAL DATA

Dimensions in mm

Fig.1 SOD-80.



Cathode indicated by black band.

RATINGS

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

Continuous reverse voltage	V_R	max.	28 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}		−55 to + 150 °C
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	max.	10 nA
V_R = 28 V; T_{amb} = 85 °C	I_R	max.	200 nA
Diode capacitance at f = 500 kHz			
V_R = 1 V	C_d		39 to 46 pF
V_R = 28 V	C_d		4,0 to 5,0 pF
Capacitance ratio at f = 500 kHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 10
Series resistance at f = 200 MHz			
V_R is that value at which C_d = 25 pF	r_s	max.	0,6 Ω
Relative capacitance difference between two diodes; V_R = 0,5 to 28 V	$\frac{\Delta C}{C}$	max.	3 %

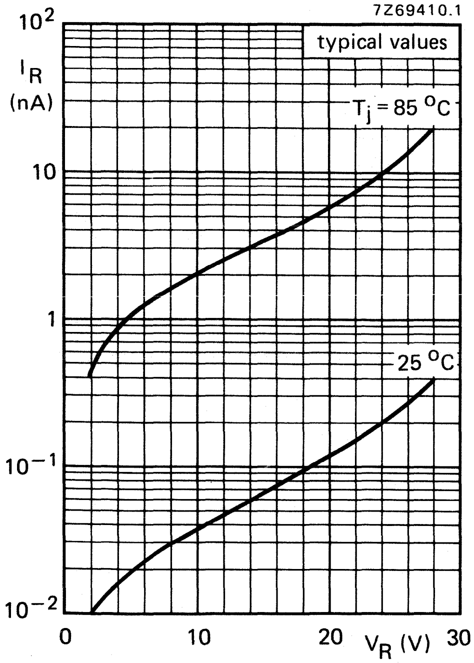


Fig. 2 Typical values.

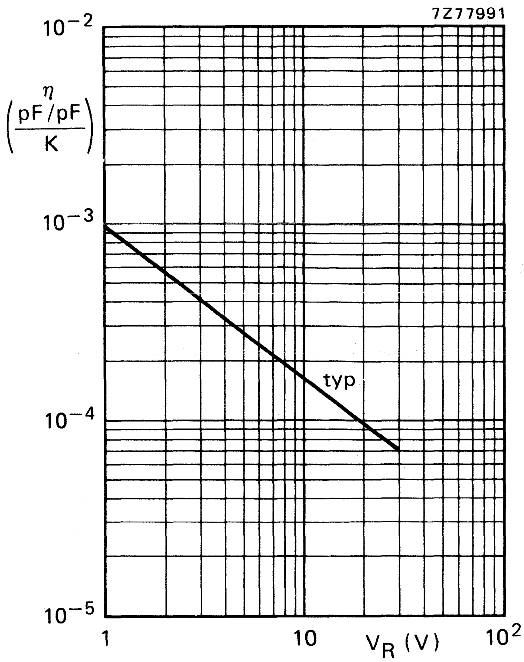


Fig. 3 Temperature coefficient of the diode capacitance; T_{amb} = 0 to 85 °C.

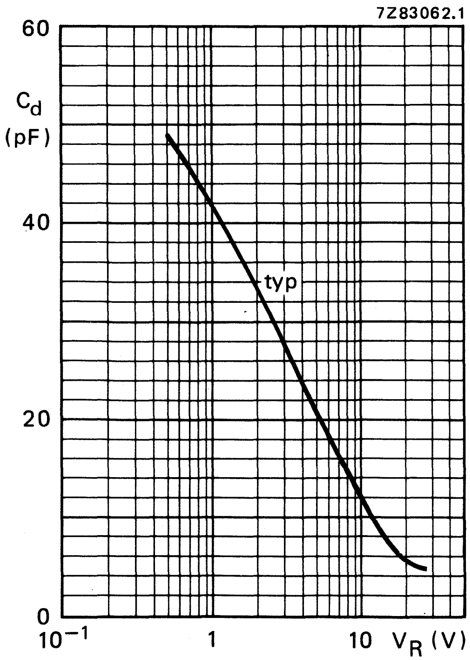


Fig. 4 f = 500 kHz; T_{amb} = 25 °C.

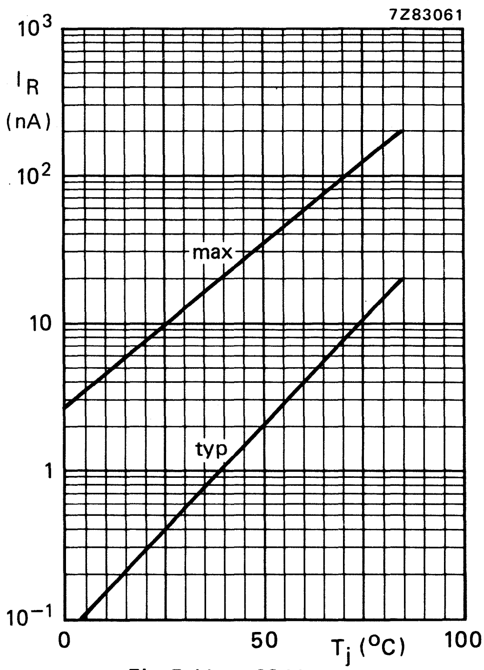


Fig. 5 V_R = 28 V.

VHF VARIABLE CAPACITANCE DOUBLE DIODE

The BB804 is a variable capacitance double diode in planar technology with common cathode in a plastic SOT23 envelope. It is intended for FM tuning especially for car radios.

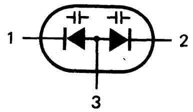
QUICK REFERENCE DATA

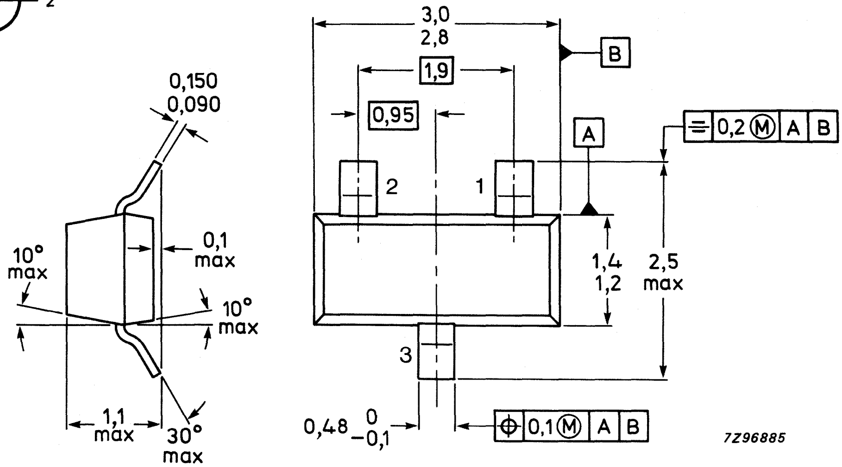
Continuous reverse voltage	V_R	max.	18	V
Repetitive peak reverse voltage	V_{RRM}	max.	20	V
Forward current (DC)	I_F	max.	50	mA
Operating junction temperature	T_j	max.	100	°C
Reverse current	I_R	max.	20	nA
Diode capacitance at f = 1 MHz $V_R = 2$ V	C_d		42 to 47.5	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75	
Series resistance at f = 100 MHz V_R is that value at which $C_d = 38$ pF	r_s	typ.	0.20	Ω

MECHANICAL DATA

Dimensions in mm

Marking SF





TOP VIEW

Fig.1 SOT23.

RATINGS

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

Continuous reverse voltage	V_R	max.	18 V
Forward current (DC)	I_F	max.	50 mA
Repetitive peak reverse voltage	V_{RRM}	max.	20 V
Storage temperature range	T_{stg}		−55 to + 100 °C
Operating junction temperature	T_j	max.	100 °C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 16 V	I_R	<	20 nA
V_R = 16 V; T_{amb} = 60 °C	I_R	<	200 nA
Diode capacitance at f = 1.0 MHz			
V_R = 2 V			
red 0	C_d		42 to 43.5 pF
yellow 1	C_d		43 to 44.5 pF
white 2	C_d		44 to 45.5 pF
green 3	C_d		45 to 46.5 pF
blue 4	C_d		46 to 47.5 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 2\ V)}{C_d\ (V_R = 8\ V)}$		1.65 to 1.75
Series resistance at f = 100 MHz, V_R is that value at which C_d = 38 pF	r_s	typ.	0.20 Ω

VARIABLE CAPACITANCE DIODE

Silicon planar variable capacitance diode in a microminiature envelope. It is intended for electronic tuning applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Reverse voltage	V_R	max.	28 V
Reverse current at V_R = 28 V	I_R	<	50 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz V_R = that value at which C_d = 9 pF	r_D	<	1,2 Ω

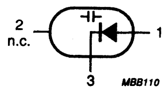
MECHANICAL DATA

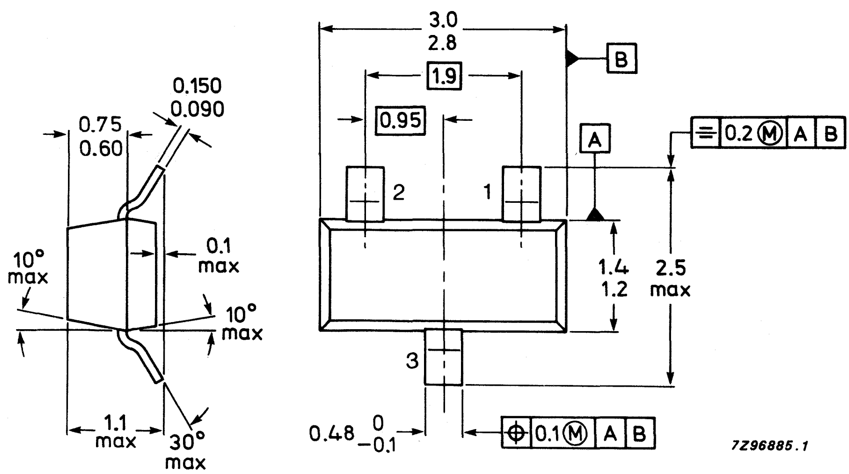
Dimensions in mm

Fig. 1 SOT-23.

Marking code

BBY31 = $S1_p$





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Continuous reverse voltage	V_R	max.	28	V
Reverse voltage (peak value)	V_{RM}	max.	30	V
Forward current (d.c.)**	I_F	max.	20	mA
Storage temperature	T_{stg}	−65 to + 100		°C
Operating junction temperature	T_j	max.	85	°C

THERMAL RESISTANCE

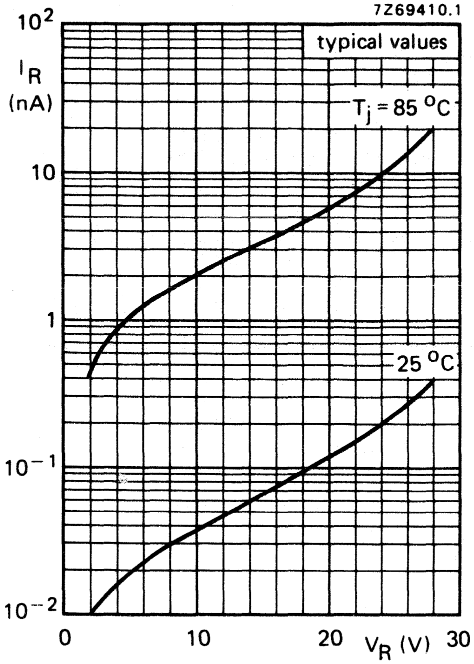
From junction to ambient*	$R_{th\ j\text{-}a}$	=	430	K/W

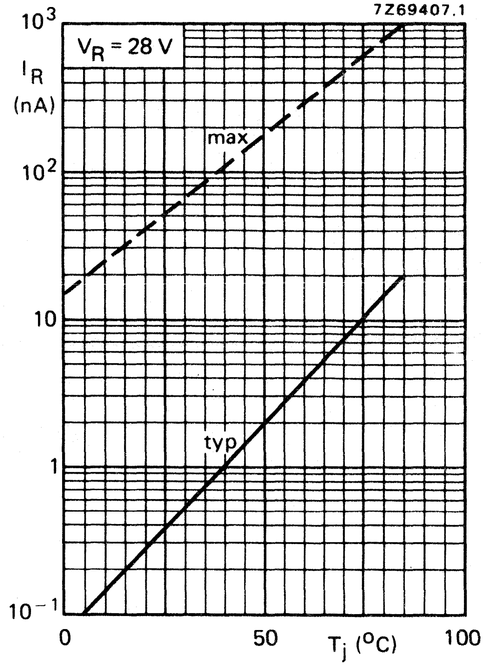
CHARACTERISTICS

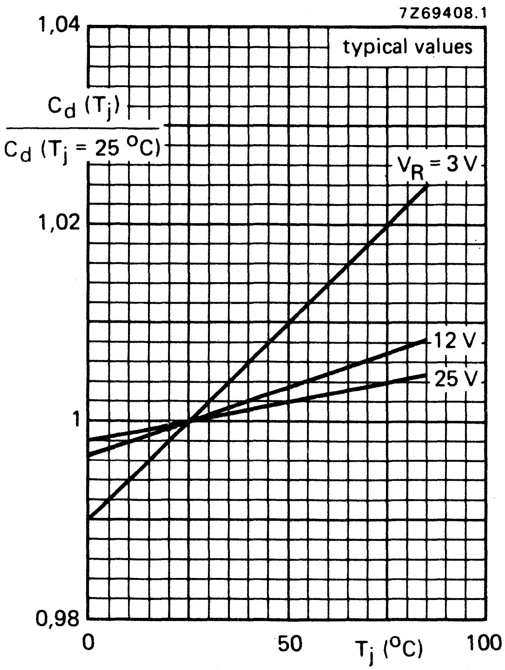
T_j = 25 °C unless otherwise specified

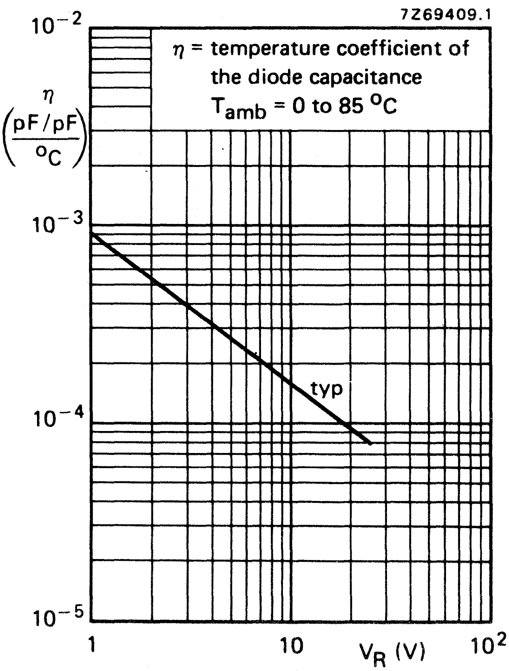
Reverse current				
V_R = 28 V	I_R	<	50	nA
V_R = 28 V; T_j = 85 °C	I_R	<	1000	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d	typ.	17,5	pF
V_R = 28 V	C_d	1,6 to 2,0		pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	typ.	9,7	
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_D	<	1,2	Ω

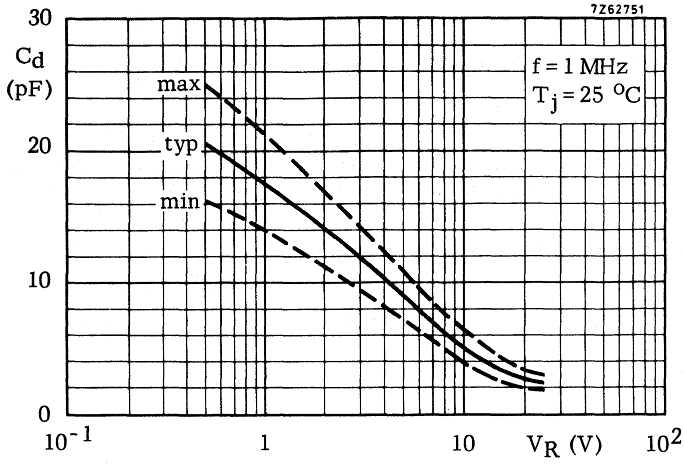
* Mounted on a ceramic substrate of 7 mm x 5 mm x 0,5 mm.


7Z69410.1
typical values
I_R (nA)
T_j = 85 °C
25 °C
V_R (V)
10^2
10
1
10^{-1}
10^{-2}
0
10
20
30


7Z69407.1
V_R = 28 V
I_R (nA)
max
typ
T_j (°C)
10^3
10^2
10
1
10^{-1}
0
50
100


7Z69408.1
typical values
$\frac{C_d (T_j)}{C_d (T_j = 25\ °C)}$
V_R = 3 V
12 V
25 V
T_j (°C)
1,04
1,02
1
0,98
0
50
100


7Z69409.1
η = temperature coefficient of the diode capacitance
T_{amb} = 0 to 85 °C
η $\left(\frac{pF/pF}{°C}\right)$
typ
V_R (V)
10^{-2}
10^{-3}
10^{-4}
10^{-5}
1
10
10^2


7Z62751
30
C_d
(pF)
20
10
0
max
typ
min
f = 1 MHz
T_j = 25 °C
10^{-1}
1
10
V_R (V)
10^2

DOUBLE VARIABLE CAPACITANCE DIODE

The BBY39 is a double variable capacitance diode with a common cathode and mounted in a micro-miniature envelope (SOT-23), suitable for surface mounting. The two diodes in one envelope are matched.

The device is intended for application in electronic tuners in satellite TV systems.

QUICK REFERENCE DATA

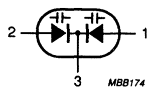
For each diode:			
Continuous reverse voltage	V_R	max.	30 V
Operating junction temperature	T_j	max.	85 °C
Reverse current V_R = 28 V	I_R	<	10 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	8,0
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	1,2 Ω

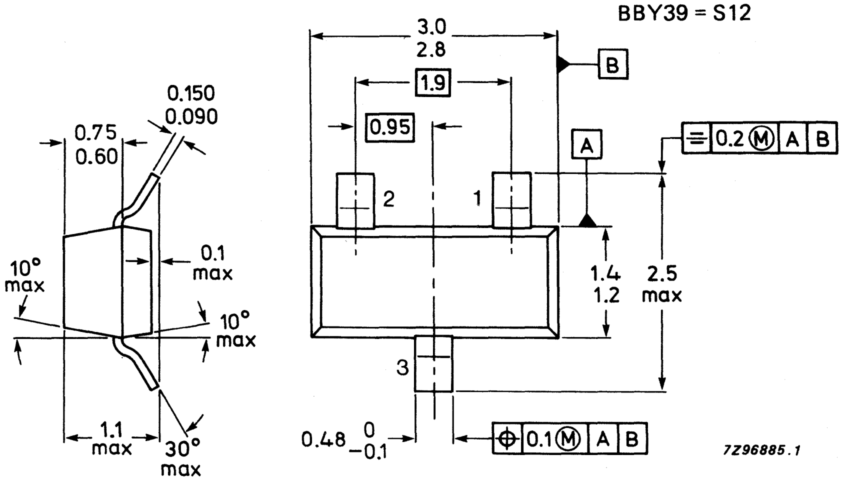
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code:
BBY39 = S12





TOP VIEW

RATINGS (for each diode)

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

Continuous reverse voltage	V_R	max.	30 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}	–65 to +100	°C
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

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

CHARACTERISTICS (for each diode)

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_j = 85 °C	I_R	<	100 nA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d	typ.	17.5 pF
V_R = 28 V	C_d	1.6 to 2.0	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$	>	8.0
Series resistance at f = 470 MHz and that value of V_R at which C_d = 9 pF	r_s	<	1.2 Ω

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

SILICON PLANAR VARIABLE CAPACITANCE DIODE

The BBY40 is a variable capacitance diode in a plastic envelope intended for electronic tuning in VHF television tuners with extended band I (FCC and OIRT-norm).

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	28	V
Reverse current at V_R = 28 V	I_R	<	10	nA
Diode capacitance at f = 1 MHz				
V_R = 1 V	C_d		39 to 46	pF
V_R = 28 V	C_d		3.8 to 4.8	pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 12	
Series resistance at f = 200 MHz V_R is that value at which C_d = 25 pF	r_S	<	0.7	Ω

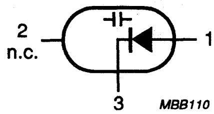
MECHANICAL DATA

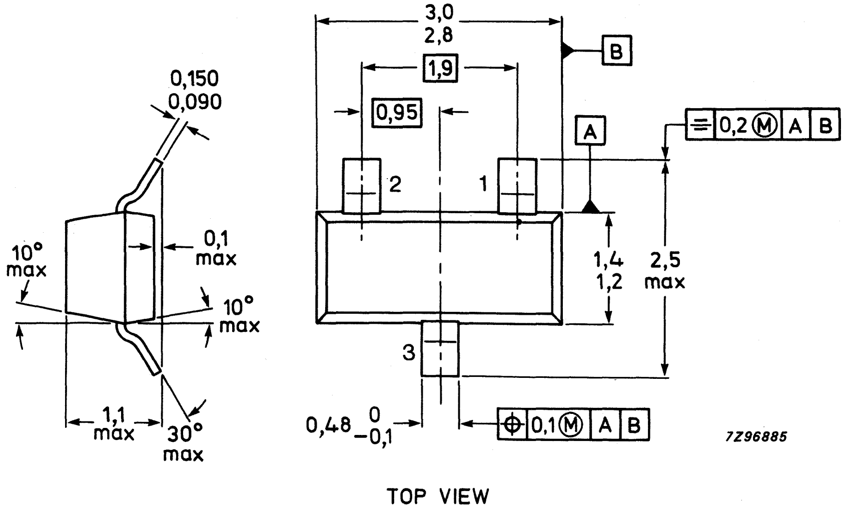
Dimensions in mm

Marking code

BBY40 = S2

Fig. 1 SOT-23.





See also *Soldering recommendations.*

RATINGS

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

Continuous reverse voltage	V_R	max.	28 V
Reverse voltage (repetitive peak value)	V_{RRM}	max.	30 V
Forward current (DC)	I_F	max.	20 mA
Storage temperature	T_{stg}		−55 to +100 °C
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	typ.	0.1 nA
		<	10 nA
V_R = 28 V; T_{amb} = 60 °C	I_R	<	100 nA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d		39 to 46 pF
V_R = 3 V	C_d	typ.	29.0 pF
V_R = 28 V	C_d		3.8 to 4.8 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d\ (V_R = 1\ V)}{C_d\ (V_R = 28\ V)}$		8 to 12
Series resistance at f = 200 MHz			
V_R is that value at which C_d = 25 pF	r_s	<	0.7 Ω

* Mounted on a ceramic substrate of 7 mm x 5 mm x 0.5 mm.

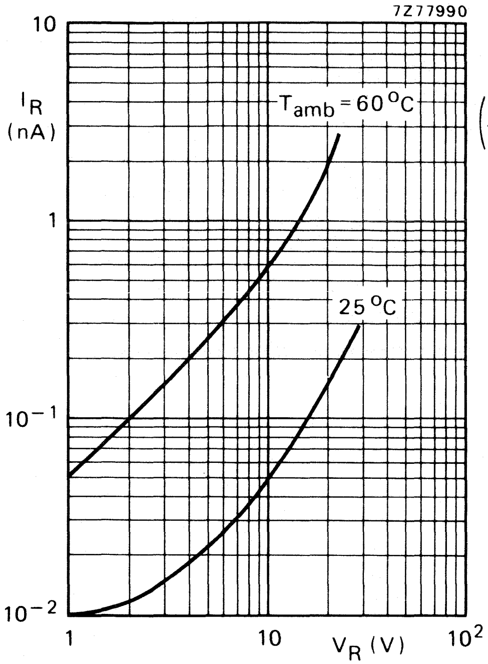


Fig. 2 Typical values

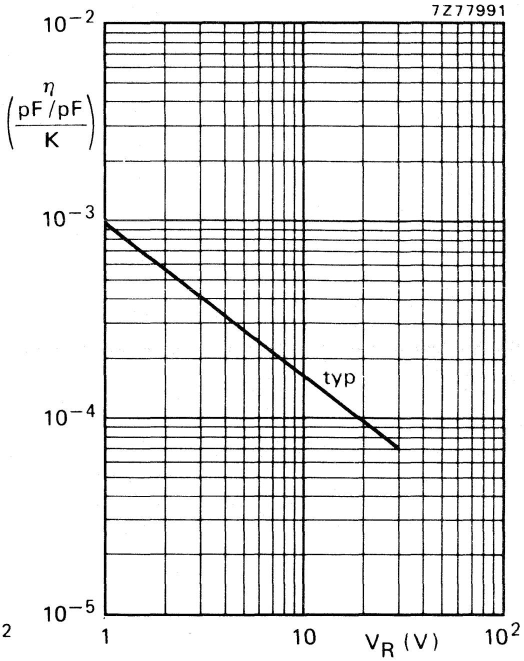


Fig. 3 Temperature coefficient of the diode capacitance; T_{amb} = 0 to 85 °C.

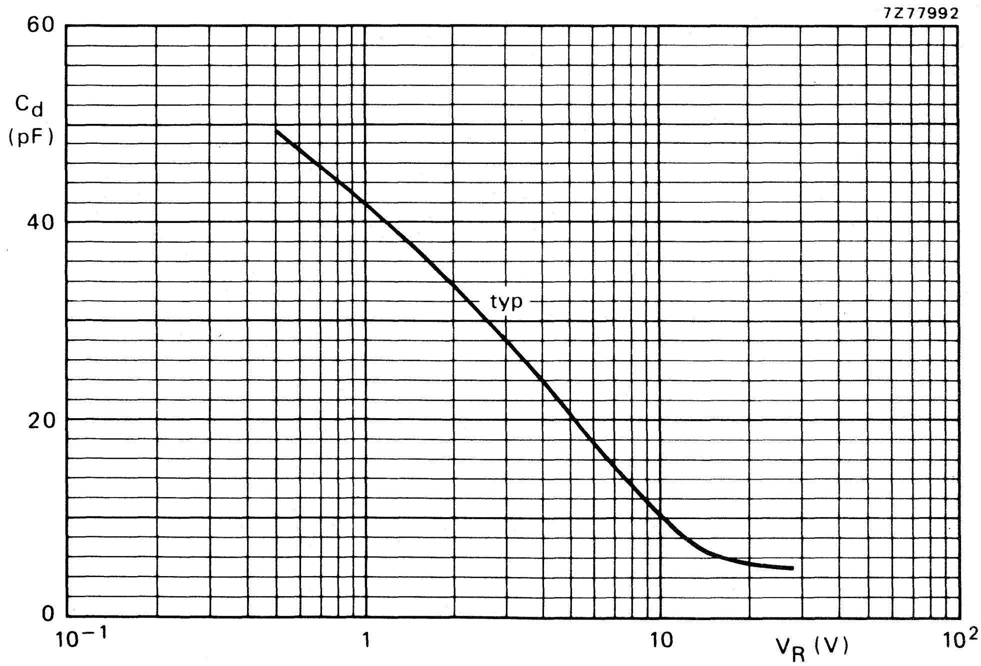


Fig. 4 f = 1 MHz; T_{amb} = 25 °C.

V.H.F. VARIABLE CAPACITANCE DIODE

The BBY42 is a variable capacitance diode in a microminiature plastic envelope SOT-23. It is intended for use in v.h.f. TV tuners and CATV applications using SMD technology.

QUICK REFERENCE DATA

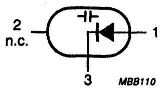
Reverse voltage, peak value	V_{RM}	max. 32 V
Reverse current V_R = 28 V	I_R	max. 10 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d	2,4 to 3,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 1\ V)}{C_d (V_R = 28\ V)}$	12 to 16
Series resistance at f = 100 MHz V_R is that value at which C_d = 30 pF	r_s	typ. 0,9 Ω max. 1,0 Ω

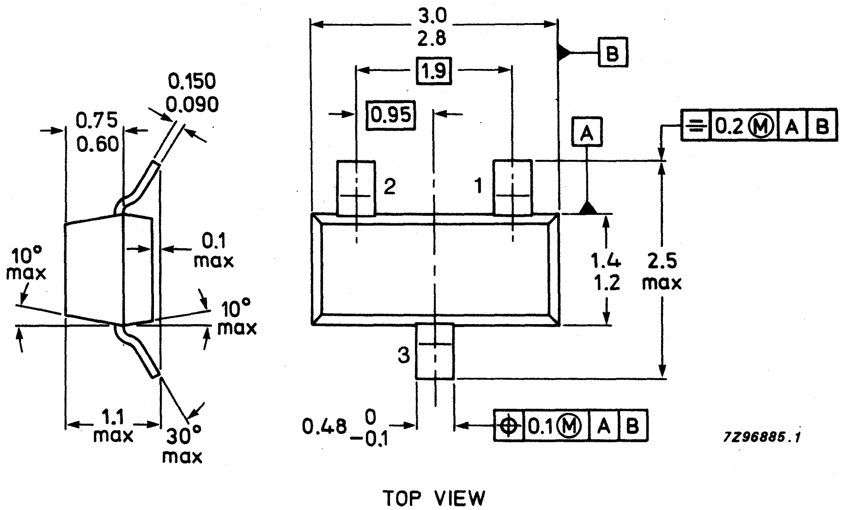
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.

Marking code: S13





RATINGS

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

Reverse voltage (peak value)	V_{RM}	max.	32 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}	–65 to + 100 °C	
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	10 nA
V_R = 28 V; T_j = 85 °C	I_R	<	200 nA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d	>	31 pF
V_R = 3 V	C_d	typ.	24 pF
V_R = 28 V	C_d	2,4 to 3,0 pF	
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 1\ V)}{C_d (V_R = 28\ V)}$	12 to 16	
Series resistance at f = 100 MHz and at that value of V_R at which C_d = 30 pF	r_s	typ.	0,9 Ω
	r_s	<	1,0 Ω

DOUBLE VARIABLE CAPACITANCE DIODE

The BBY62 is a double variable capacitance diode and mounted in a microminiature envelope (SOT-143).

The device is intended for application in electronic tuners using SMD technology.

QUICK REFERENCE DATA

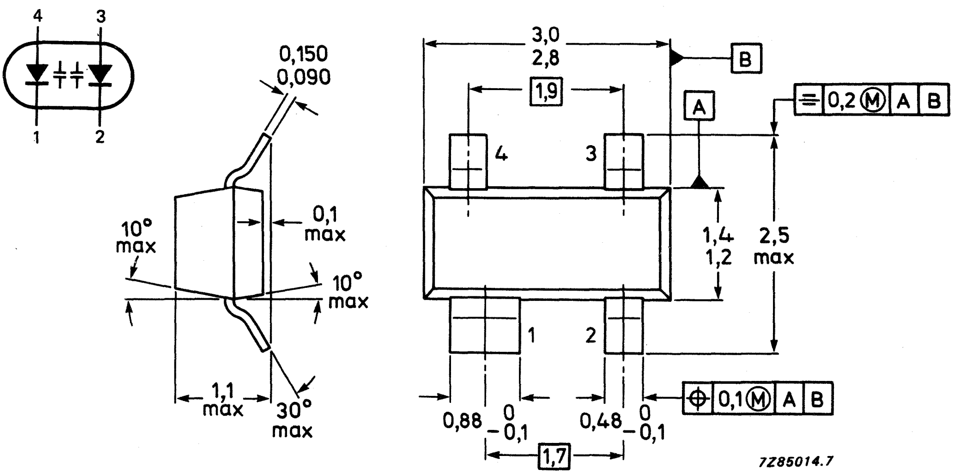
For each diode:			
Continuous reverse voltage	V_R	max.	28 V
Reverse current V_R = 28 V	I_R	<	50 nA
Diode capacitance at f = 1 MHz V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d (V_R = 1\ V)}{C_d (V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz V_R is that value at which C_d = 9 pF	r_s	<	1,2 Ω

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-143.

Marking code: S4



TOP VIEW

RATINGS (for each diode)

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

Continuous reverse voltage	V_R	max.	28 V
Reverse voltage (peak value)	V_{RM}	max.	30 V
Forward current (d.c.)	I_F	max.	20 mA
Storage temperature	T_{stg}		−65 to + 100 °C
Operating junction temperature	T_j	max.	85 °C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS (for each diode)

T_j = 25 °C unless otherwise specified

Reverse current			
V_R = 28 V	I_R	<	50 nA
V_R = 28 V; T_j = 85 °C	I_R	<	1 μA
Diode capacitance at f = 1 MHz			
V_R = 1 V	C_d	typ.	17,5 pF
V_R = 28 V	C_d		1,6 to 2,0 pF
Capacitance ratio at f = 1 MHz	$\frac{C_d(V_R = 1\ V)}{C_d(V_R = 28\ V)}$	typ.	9,7
Series resistance at f = 470 MHz and at that value of V_R at which C_d = 9 pF	r_s	<	1,2 Ω

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film hybrid circuits.

N-P-N complements are BC817; R and BC818; R respectively.

QUICK REFERENCE DATA

			BC807	BC808	
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to $T_{amb} = 25\ °C$	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz; $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	100		MHz

MECHANICAL DATA

Dimensions in mm

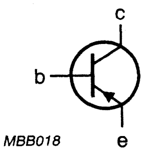
Fig. 1 SOT-23.

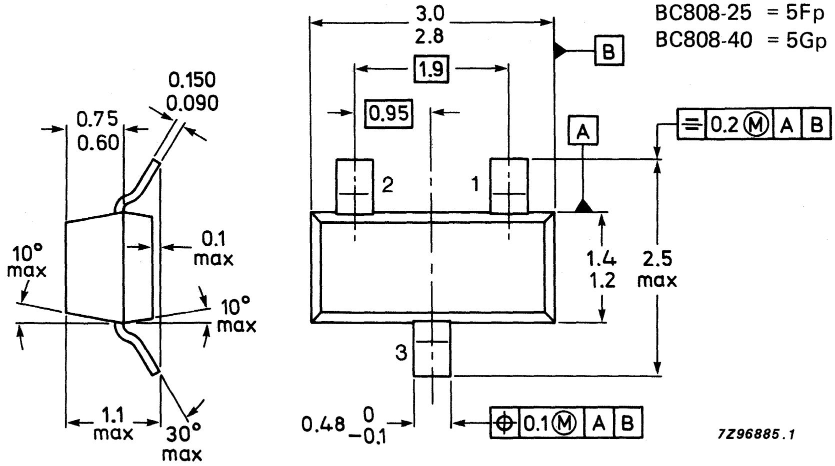
Pinning:

1 = base
2 = emitter
3 = collector

Marking code:

BC807 = 5Dp
BC807-16 = 5Ap
BC807-25 = 5Bp
BC807-40 = 5Cp
BC808 = 5Hp
BC808-16 = 5Ep
BC808-25 = 5Fp
BC808-40 = 5Gp





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TOP VIEW

Reverse pinning types are available on request.

RATINGS

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

			BC807	BC808	
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base) $-I_C = 10$ mA	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (DC)	$-I_C$	max.	500		mA
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Emitter current (peak value)	I_{EM}	max.	1000		mA
Base current (DC)	$-I_B$	max.	100		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
Total power dissipation at $T_{amb} = 25$ °C *	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

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

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0; -V_{CB} = 20$ V; T_j = 25 °C	$-I_{CBO}$	max.	100	nA
$I_E = 0; -V_{CB} = 20$ V; T_j = 150 °C	$-I_{CBO}$	max.	5	μA
Emitter cut-off current				
$I_C = 0; V_{EB} = 5$ V	$-I_{EBO}$	max.	10	μA
Base emitter voltage *				
$-I_C = 500$ mA; $-V_{CE} = 1$ V	$-V_{BE}$	max.	1,2	V
Saturation voltage				
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	max.	700	mV
D.C. current gain				
$-I_C = 500$ mA; $-V_{CE} = 1$ V	h_{FE}	min.	40	
$-I_C = 100$ mA; $-V_{CE} = 1$ V; BC807; BC808	h_{FE}	100 to 600		
BC807-16, BC808-16	h_{FE}	100 to 250		
BC807-25, BC808-25	h_{FE}	160 to 400		
BC807-40, BC808-40	h_{FE}	250 to 600		
Transition frequency at f = 35 MHz				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	100	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0; -V_{CB} = 10$ V	C_c	typ.	8	pF

* $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

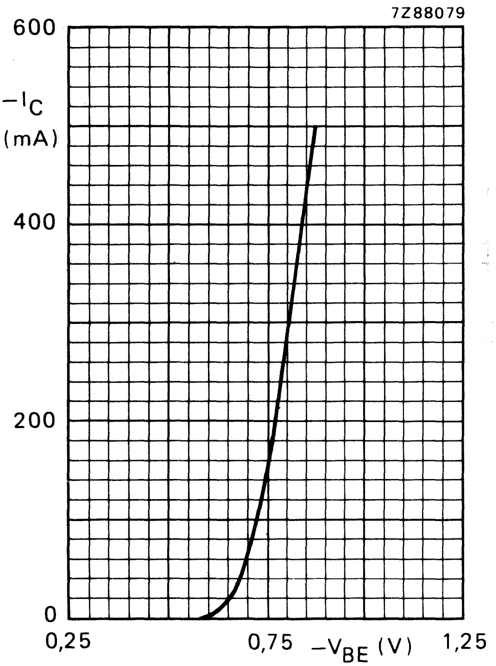


Fig. 2 $-V_{CE}$ = 1 V; T_j = 25 °C.
Typical values.

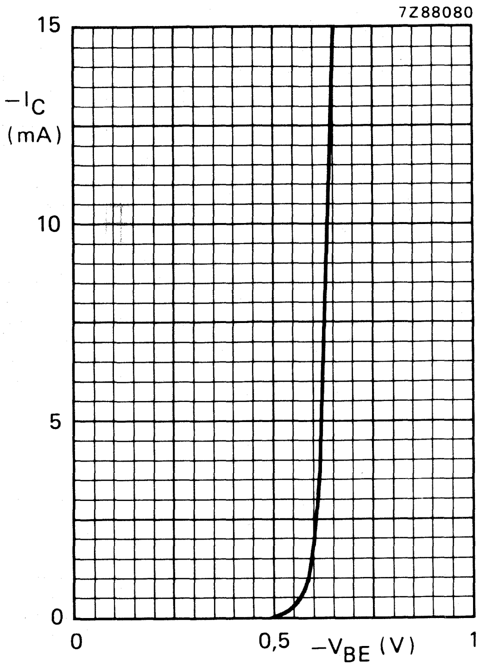


Fig. 3 $-V_{CE}$ = 5 V; T_j = 25 °C.
Typical values.

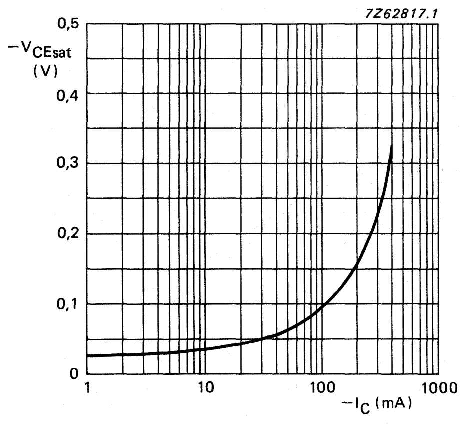


Fig. 4 typical values.

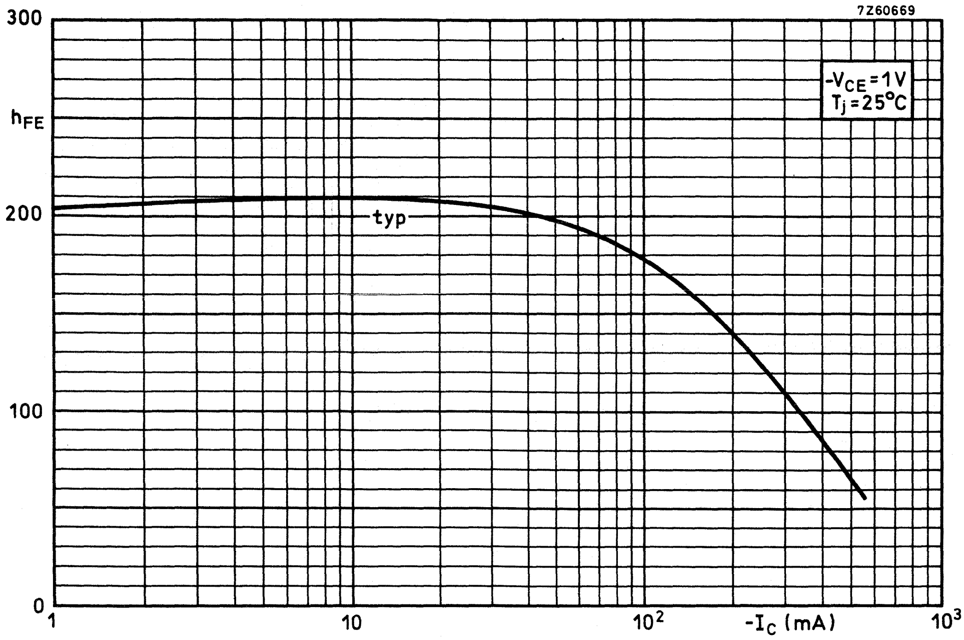


Fig. 5 D.C. current gain.

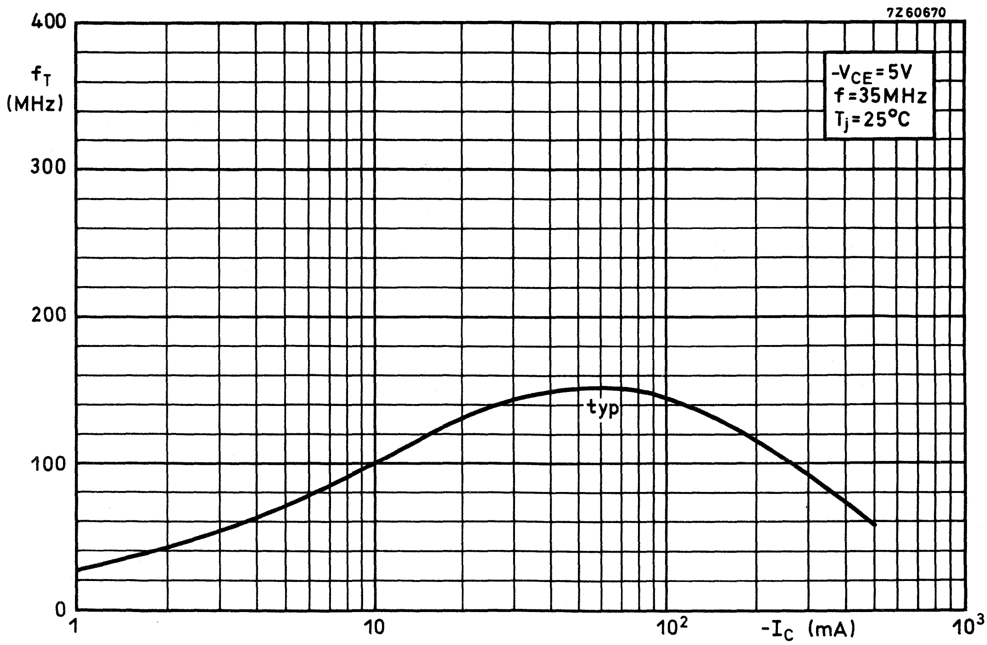


Fig. 6 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film hybrid circuits.

P-N-P complements are BC807; R and BC808; R respectively.

QUICK REFERENCE DATA

			BC817	BC818	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200		MHz

MECHANICAL DATA

Dimensions in mm

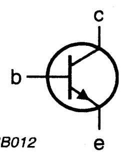
Fig. 1 SOT-23.

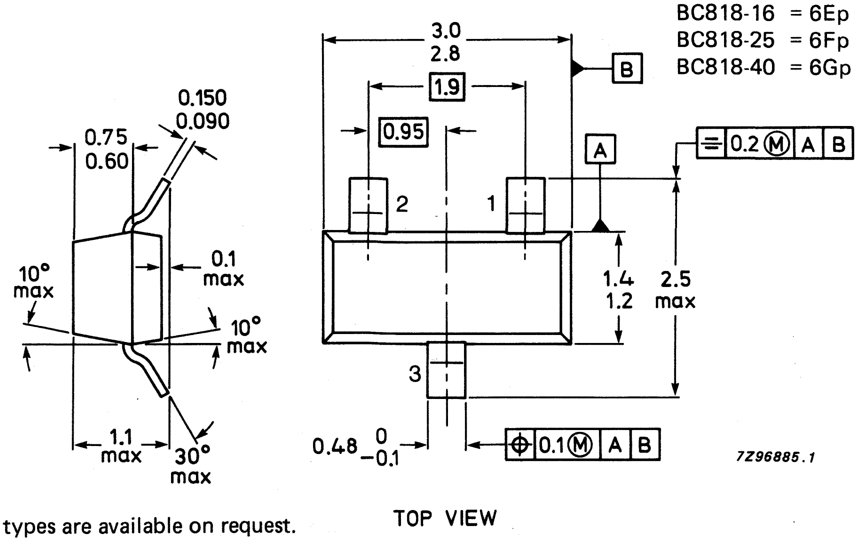
Pinning:

1 = base
2 = emitter
3 = collector

Marking code:

BC817 = 6Dp
BC817-16 = 6Ap
BC817-25 = 6Bp
BC817-40 = 6Cp
BC818 = 6Hp
BC818-16 = 6Ep
BC818-25 = 6Fp
BC818-40 = 6Gp





Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

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

			BC817	BC818	
Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) $I_C = 10$ mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; V_{CB} = 20 V; T_j = 25 °C	I_{CBO}	<	100 nA
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	5 μA
Emitter cut-off current			
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10 μA
Base emitter voltage *			
I_C = 500 mA; V_{CE} = 1 V	V_{BE}	<	1,2 V
Saturation voltage			
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	700 mV
D.C. current gain			
I_C = 500 mA; V_{CE} = 1 V	h_{FE}	>	40
I_C = 100 mA; V_{CE} = 1 V; BC817; BC818	h_{FE}	100 to 600	
BC817-16, BC818-16	h_{FE}	100 to 250	
BC817-25, BC818-25	h_{FE}	160 to 400	
BC817-40, BC818-40	h_{FE}	250 to 600	
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200 MHz
Collector capacitance at f = 1 MHz			
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	5 pF

* V_{BE} decreases by about 2 mV/K with increasing temperature.

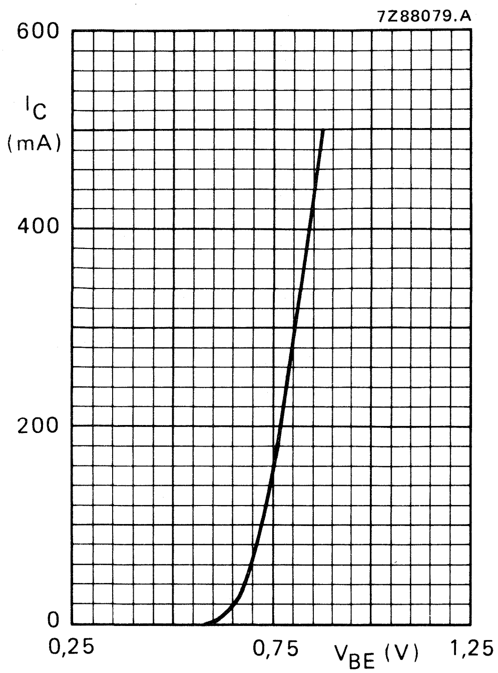


Fig. 2 V_{CE} = 1 V; T_j = 25 °C. Typical values.

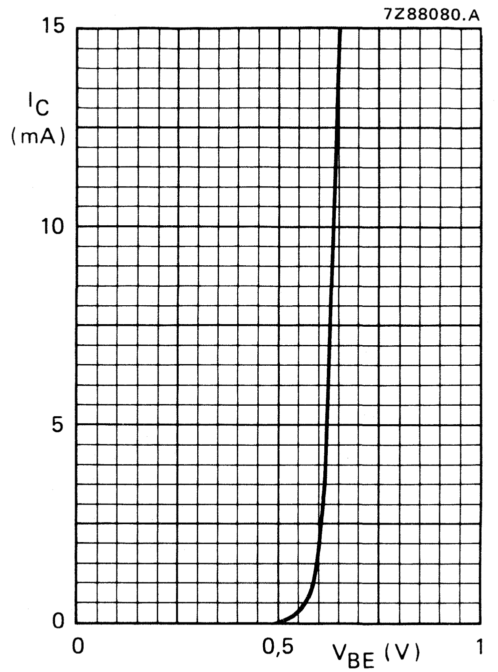


Fig. 3 V_{CE} = 5 V; T_j = 25 °C. Typical values.

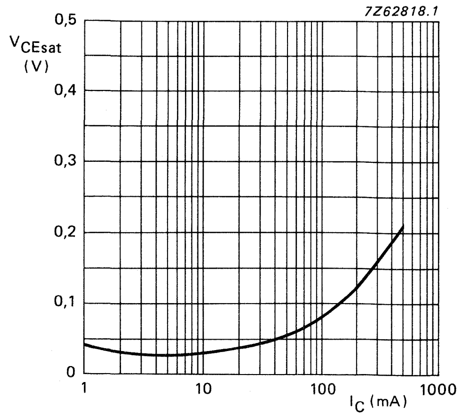


Fig. 4 I_C/I_B = 10; T_j = 25 °C.

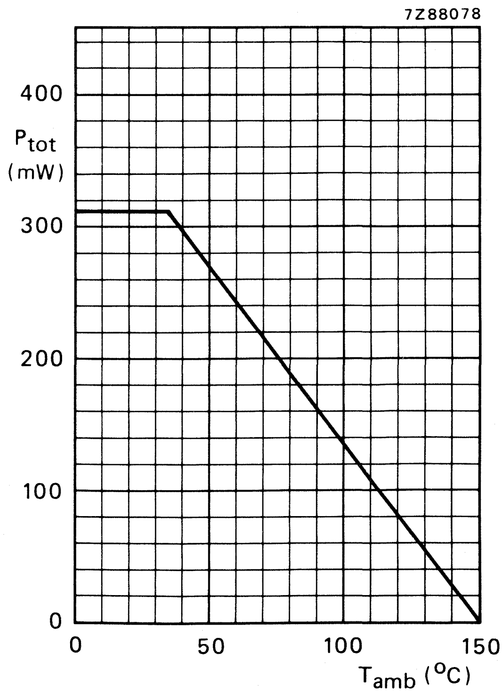


Fig. 5 Power derating curve.

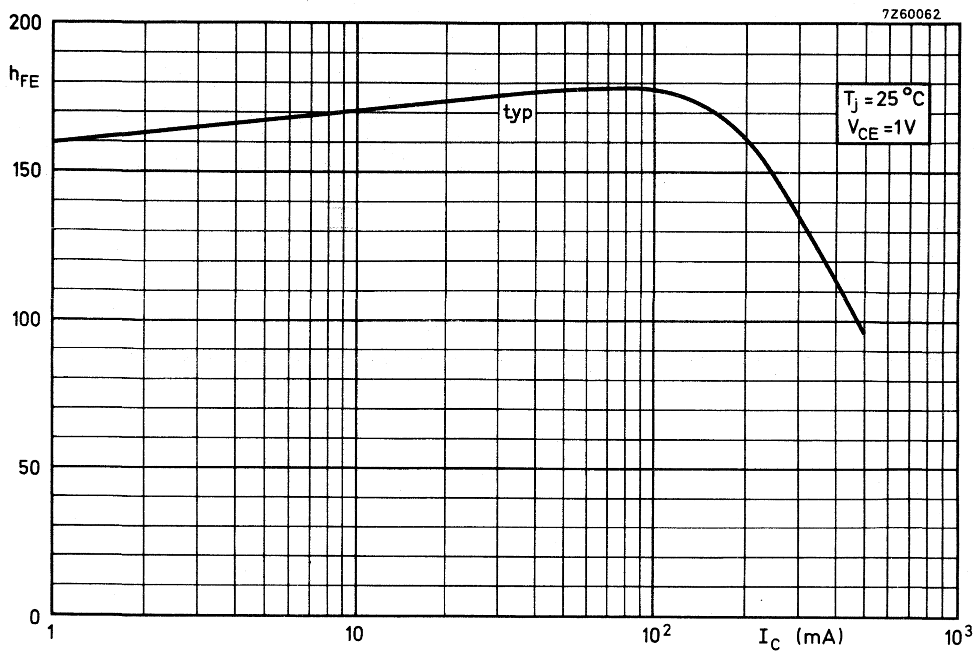


Fig. 6 D.C. current gain.

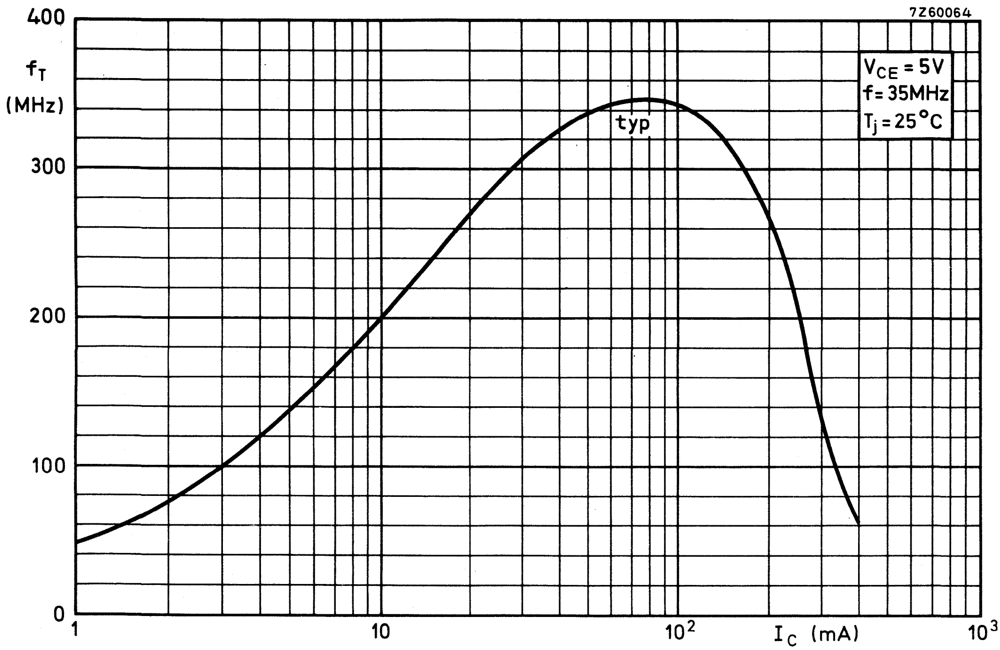


Fig. 7 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

General purpose n-p-n transistors in a plastic SOT-23 variant, especially suitable for use in driver stages of audio amplifiers in thick and thin-film hybrid circuits.

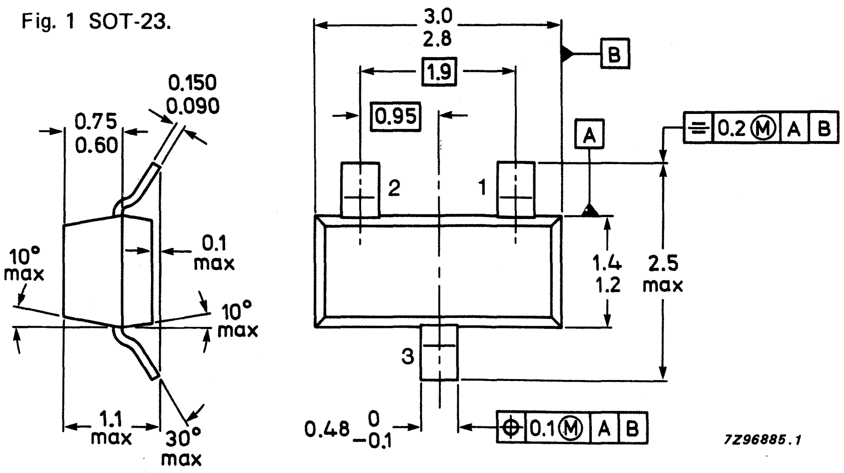
QUICK REFERENCE DATA

			BC846	BC847	BC848	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Collector current (peak value)	I_{CM}	max.	200	200	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	250	250	mW
Junction temperature	T_j	max.	150	150	150	°C
Small-signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	>	125	125	125	
		<	500	900	900	
Transition frequency I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	300	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F	typ.	2	2	2	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



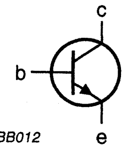
TOP VIEW

Marking code:

BC846 = 1Dp
BC846A = 1Ap
BC846B = 1Bp
BC847 = 1Hp
BC847A = 1Ep
BC847B = 1Fp
BC847C = 1Gp
BC848 = 1Mp
BC848A = 1Jp
BC848B = 1Kp
BC848C = 1Lp

Pinning:

1 = base
2 = emitter
3 = collector



Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

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

			BC846	BC847	BC848	
Collector-base voltage (open emitter)	V_{CBO}	max.	80	50	30	V
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	80	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	65	45	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	6	5	V
Collector current (d.c.)	I_C	max.		100		mA
Collector current (peak value)	I_{CM}	max.		200		mA
Emitter current (peak value)	$-I_{EM}$	max.		200		mA
Base current (peak value)	I_{BM}	max.		200		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.		250		mW
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

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

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15	nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5	μA
Base-emitter voltage*				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660	mV
		580 to	700	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770	mV
Saturation voltage**				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.

** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

			BC846	BC847	BC848	
Small signal current gain at f = 1 kHz						
I_C = 2 mA; V_{CE} = 5 V	h_{fe}	>	125	125	125	
		<	500	900	900	
Noise figure at R_S = 2 kΩ						
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2	2	2	dB
		<	10	10	10	dB

			BC846A BC847A BC848A	BC846B BC847B BC848B	BC847C BC848C
D.C. current gain					
I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	90	150	270
		>	110	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.	180	290	520
		<	220	450	800

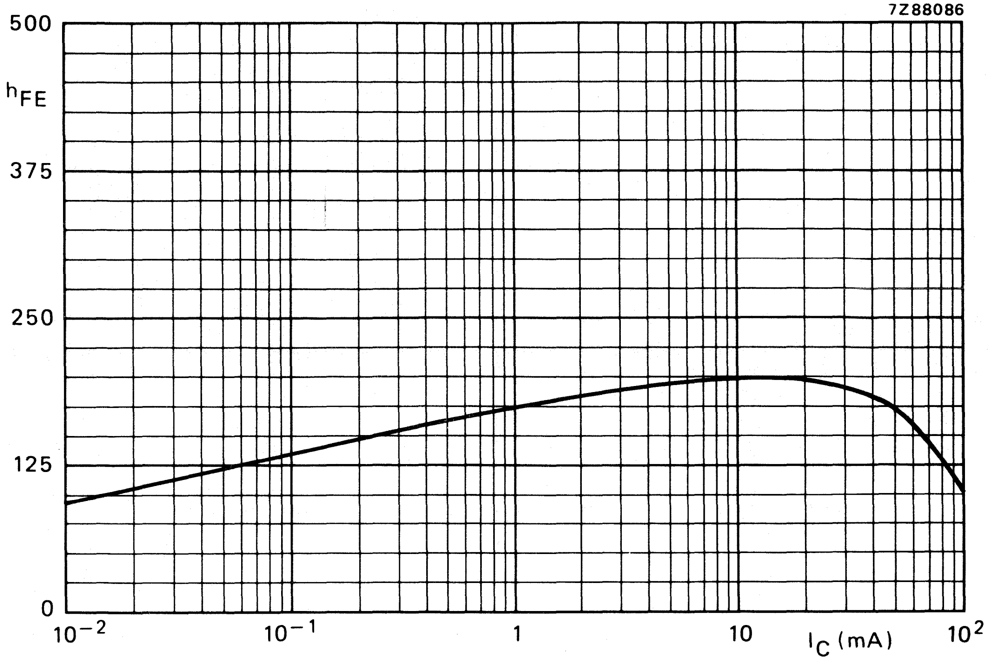


Fig. 3 Typical D.C. current gain for A-selections. V_{CE} = 5 V; T_j = 25 °C.

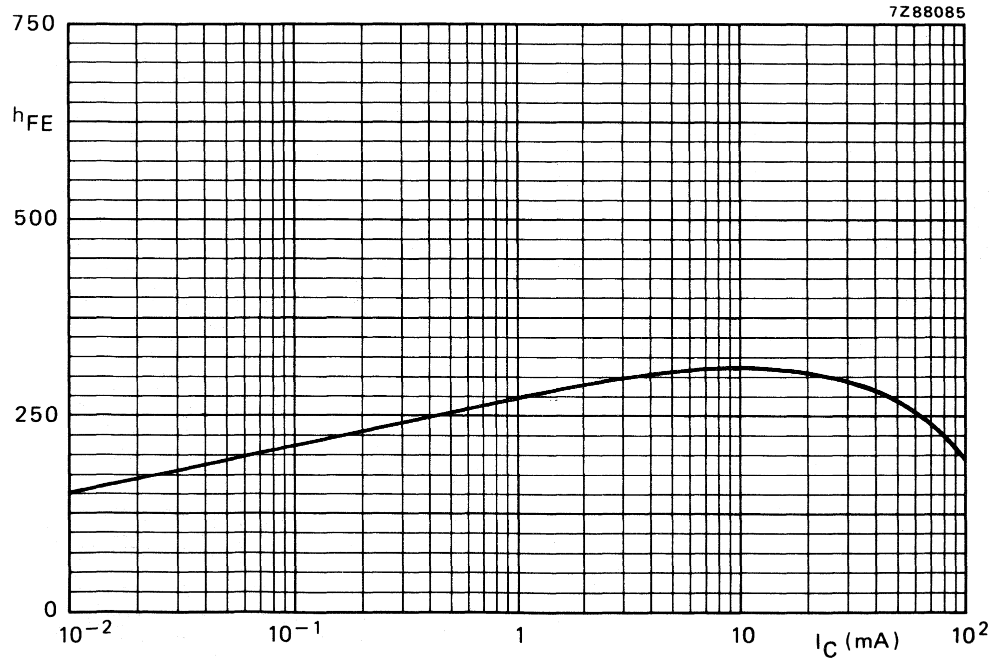


Fig. 4 Typical D.C. current gain for B-selections. V_{CE} = 5 V; T_j = 25 °C.

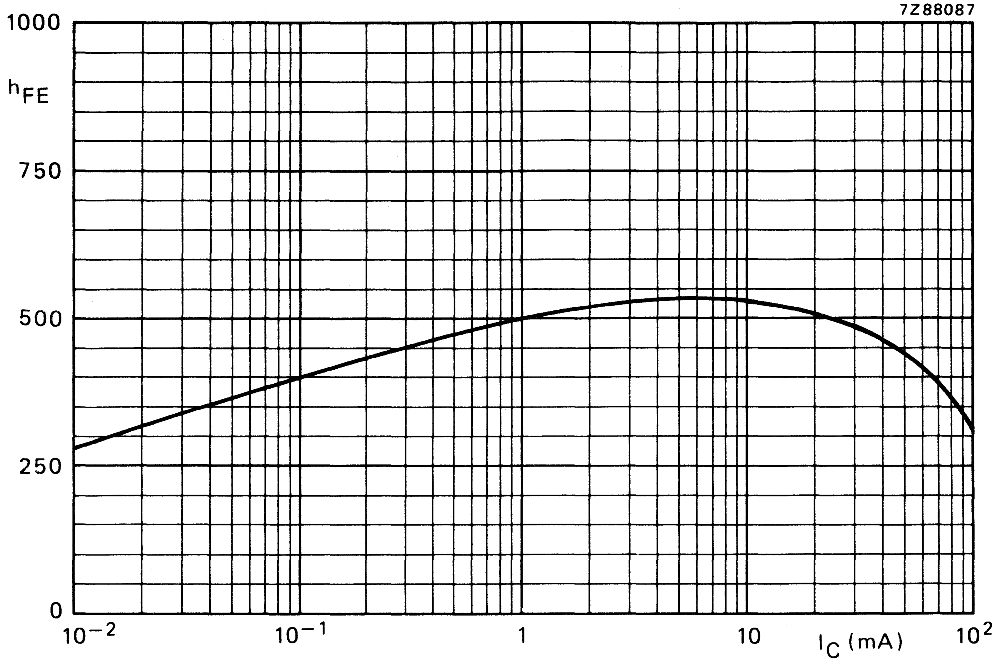


Fig. 5 Typical D.C. current gain for C-selections. V_{CE} = 5 V; T_j = 25 °C.

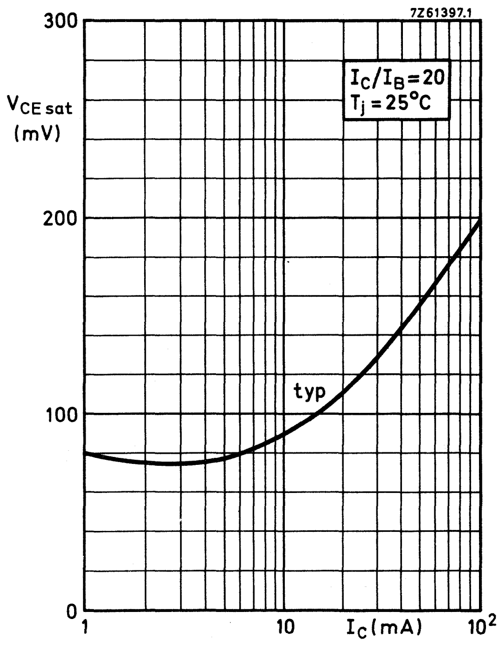


Fig. 6 Typical values.

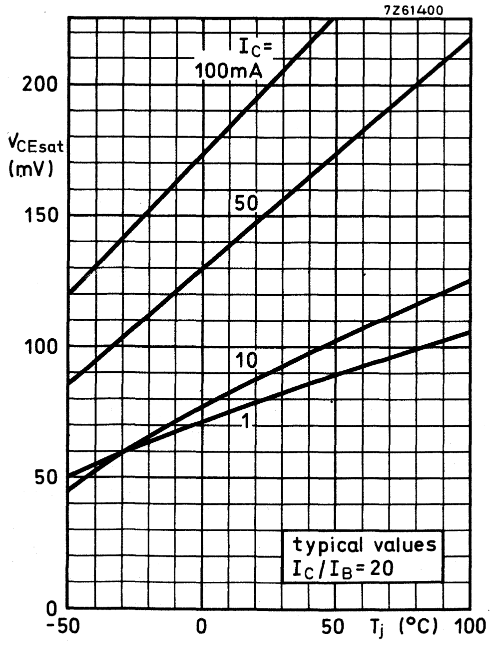


Fig. 7 Typical values.

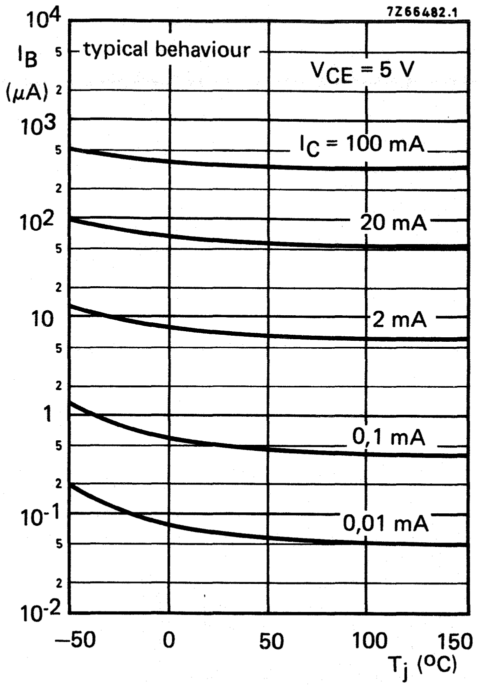


Fig. 8 Typical behaviour of base current versus junction temperature.

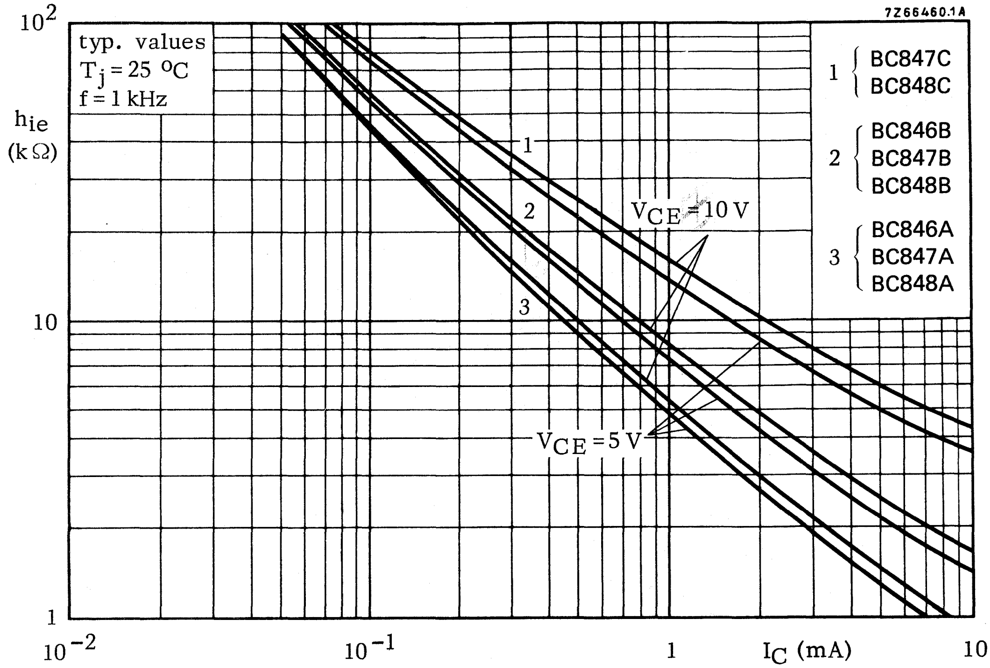


Fig. 9 Input impedance. 1 = C selections; 2 = B selections; 3 = A selections.

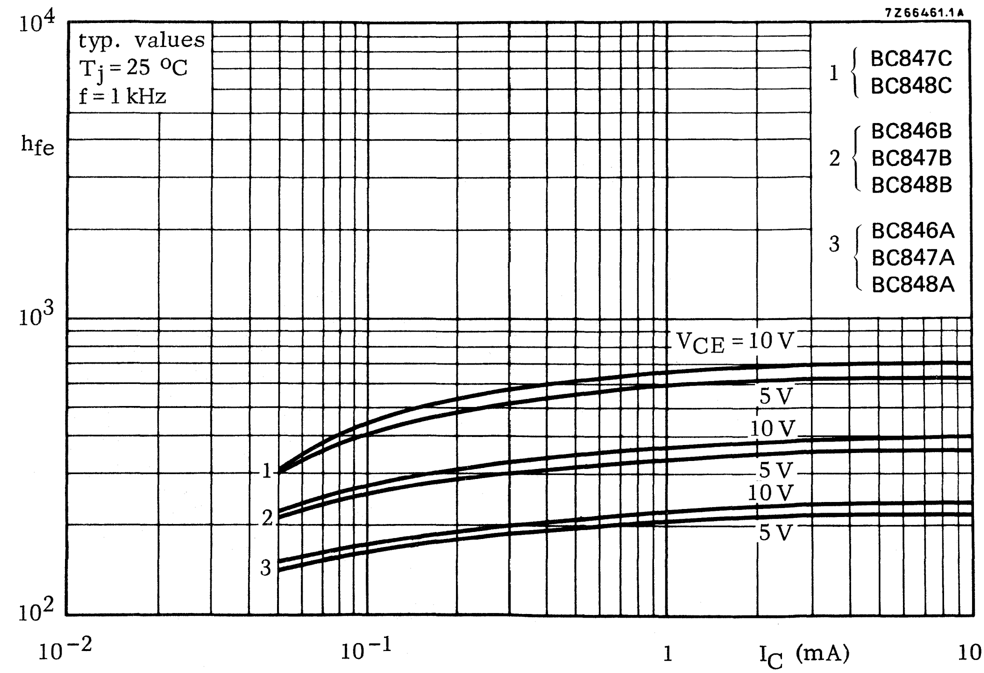


Fig. 10 Small signal current gain. 1 = C-; 2 = B- and 3 = A-selections.

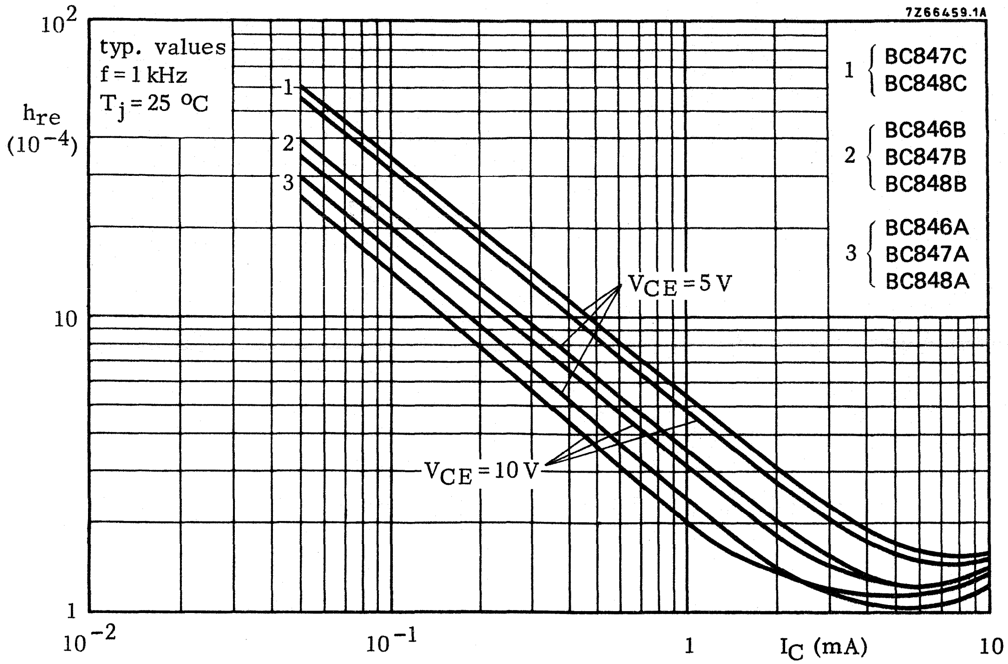


Fig. 11 Reverse voltage transfer ratio. 1 = C-; 2 = B- and 3 = A-selections.

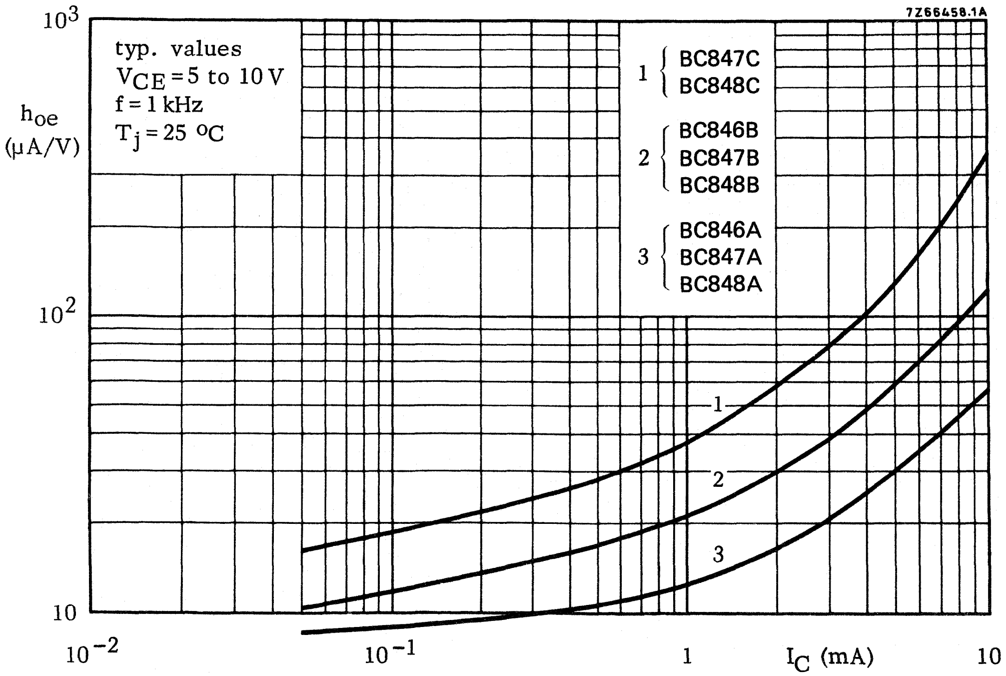


Fig. 12 Output admittance. 1 = C-; 2 = B- and 3 = A-selections.

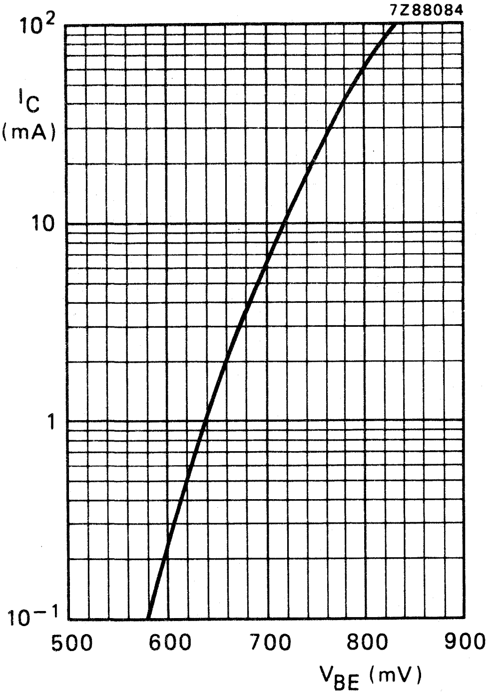


Fig. 13 Typical values at V_{CE} = 5 V; T_j = 25 °C.

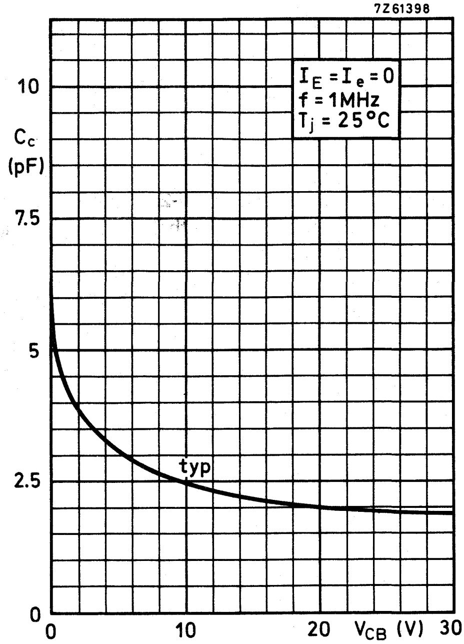


Fig. 14 Typical values.

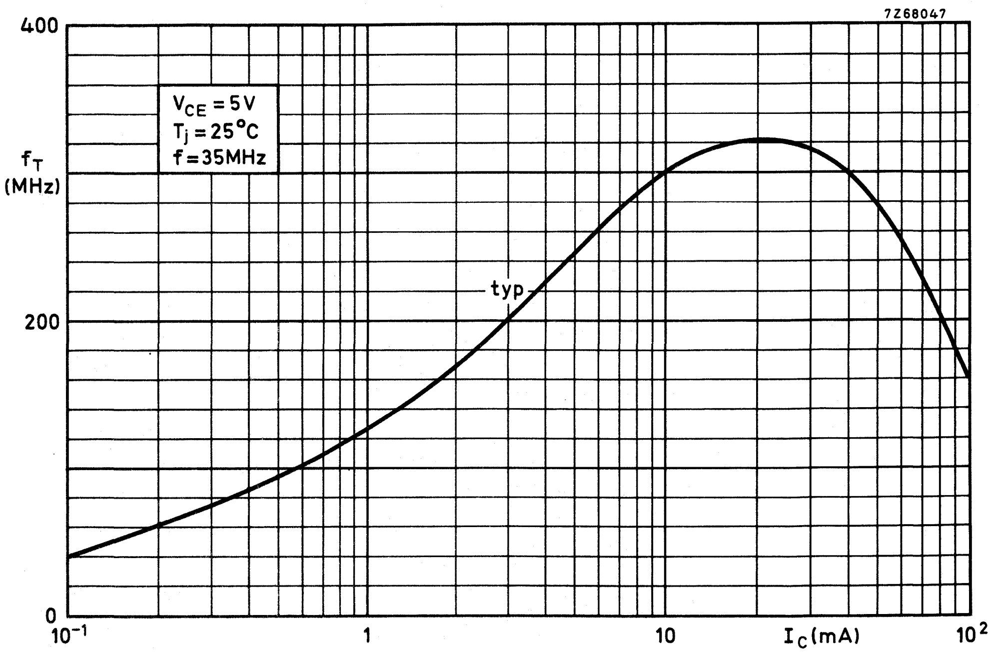


Fig. 15 Typical values transition frequency.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a plastic SOT-23 envelope, primarily intended for low-noise input stages in tape recorders, hi-fi amplifiers and other audio-frequency equipment in thick and thin-film hybrid circuits.

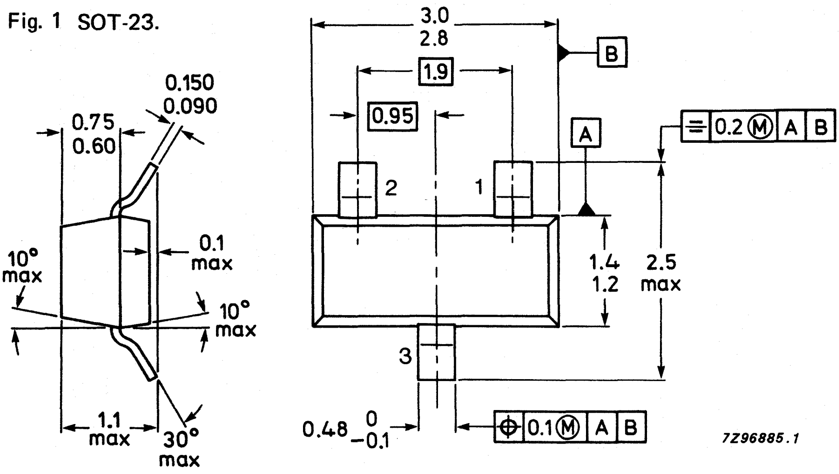
QUICK REFERENCE DATA

			BC849	BC850	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Collector current (peak value)	I_{CM}	max.	200	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	250	mW
Junction temperature	T_j	max.	150	150	°C
Small-signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}	> <	240 900	240 900	
Transition frequency I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 30 Hz to 15 kHz	F	typ. <	1,4 4	1,4 3	dB dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
f = 10 Hz to 50 Hz (equivalent noise voltage)	V_n	<	–	0,135	μV

MECHANICAL DATA

Fig. 1 SOT-23.

Dimensions in mm



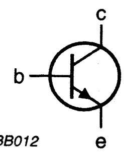
Reverse pinning types are available on request.

Marking code:

BC849 = 2Dp
BC849B = 2Bp
BC849C = 2Cp
BC850 = 2Hp
BC850B = 2Fp
BC850C = 2Gp

Pinning:

1 = base
2 = emitter
3 = collector



RATINGS

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

			BC849	BC850	
Collector-base voltage (open emitter)	V_{CBO}	max.	30	50	V
Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	30	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Emitter current (peak value)	$-I_{EM}$	max.	200		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		^oC
Junction temperature	T_j	max.	150		^oC

THERMAL RESISTANCE

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

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	15	nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	<	5	μA
Base emitter voltage*				
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	660	mV
		580 to	700	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	<	770	mV
Saturation voltages**				
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz

* V_{BE} decreases by about 2 mV/K with increasing temperature.
** V_{BEsat} decreases by about 1,7 mV/K with increasing temperature.

			BC849	BC850	
Small signal current gain at f = 1 kHz I_C = 2 mA; V_{CE} = 5 V	h_{fe}	>	240	240	
		<	900	900	
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 30 Hz to 15 kHz	F	typ.	1,4	1,4	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1,2	1	dB
		<	4	4	dB
Equivalent noise voltage at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	max.	–	0,135	μV

			BC849B BC850B	BC849C BC850C
D.C. current gain I_C = 10 μA; V_{CE} = 5 V	h_{FE}	typ.	150	270
		>	200	420
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	typ.	290	520
		<	450	800

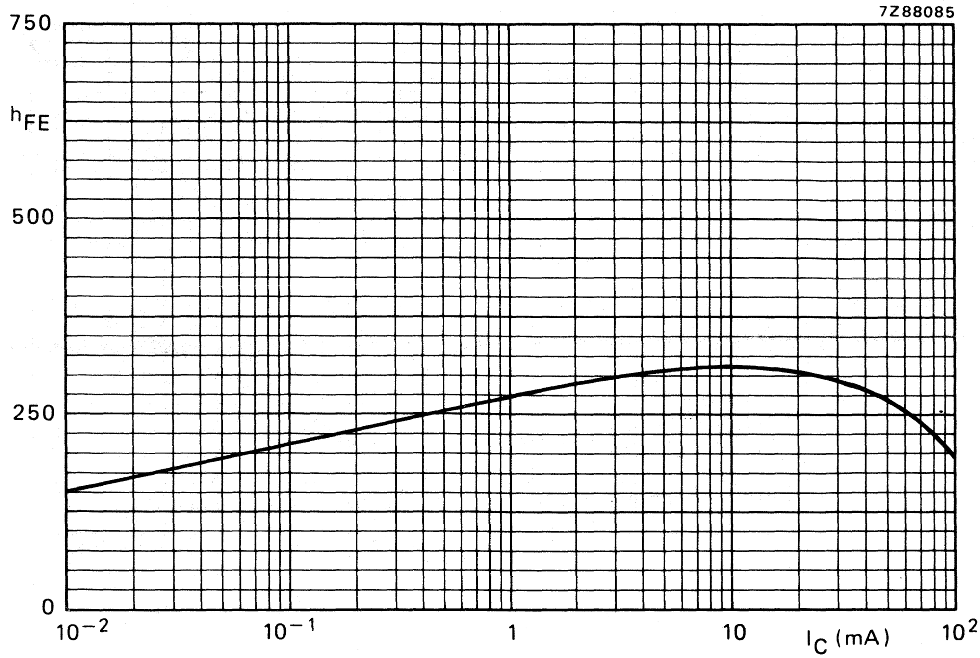


Fig. 3 Typical D.C. current gain B selections. V_{CE} = 5 V; T_j = 25 °C.

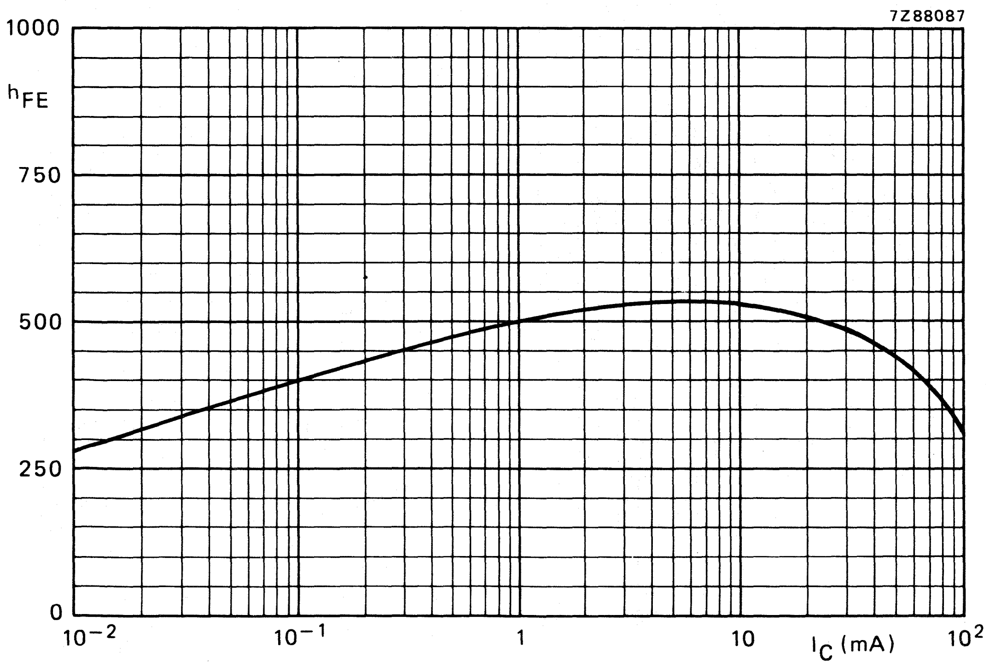


Fig. 4 Typical D.C. current gain C selections. V_{CE} = 5 V; T_j = 25 °C.

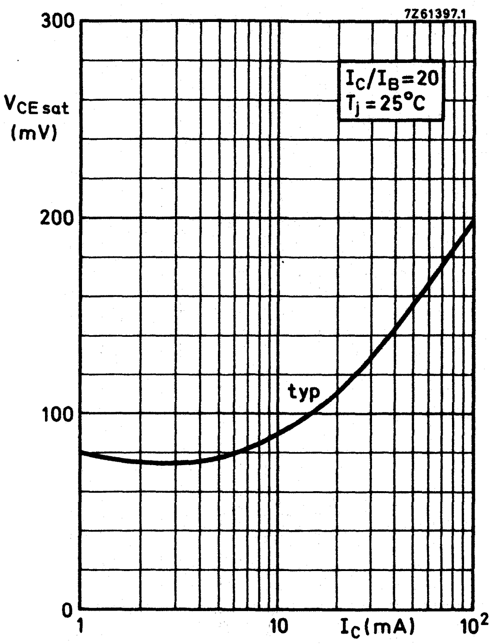


Fig. 5 Typical values.

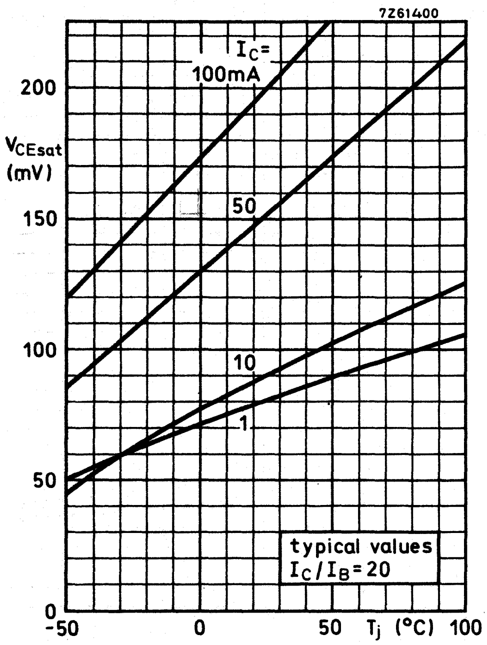


Fig. 6 Typical values; $I_C/I_B = 20$.

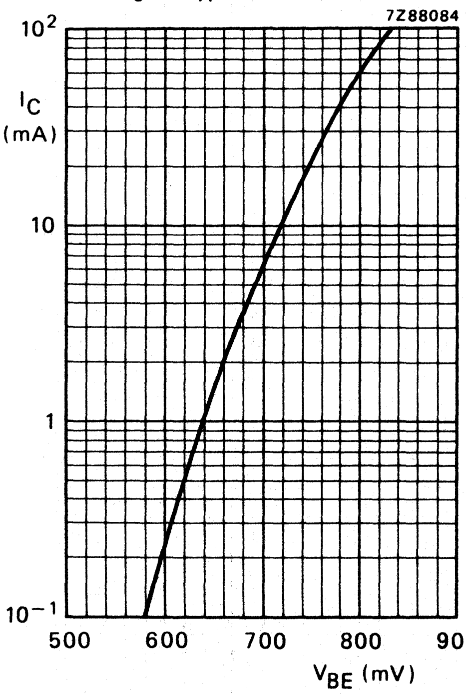


Fig. 7 Typical values V_{BE}. $V_{CE} = 5$ V; $T_j = 25\,^\circ C$.

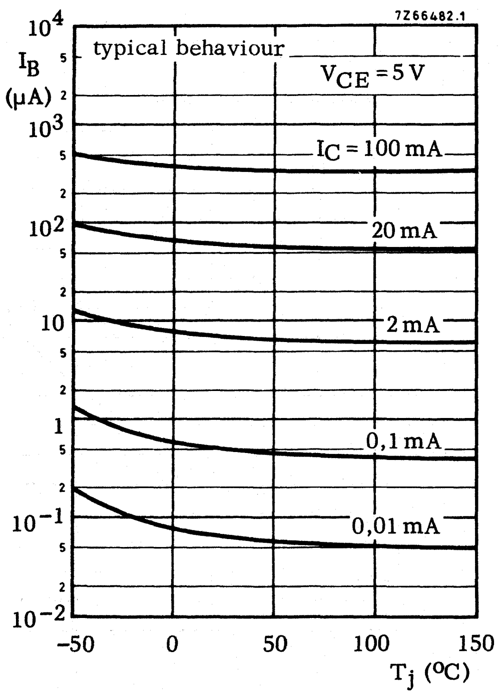


Fig. 8 Typical values.

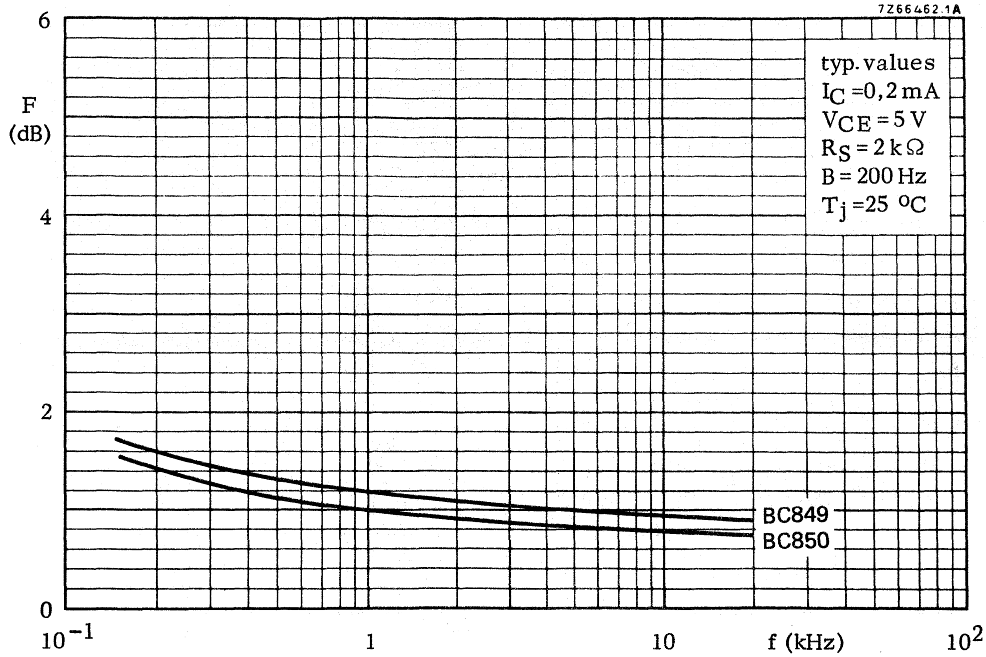

7Z66462.1A
6
F
(dB)
4
2
0
typ. values
I_C =0,2 mA
V_{CE} = 5 V
R_S = 2 kΩ
B = 200 Hz
T_j =25 °C
BC849
BC850
10^{-1}
1
10
f (kHz)
10^2

Fig. 9.

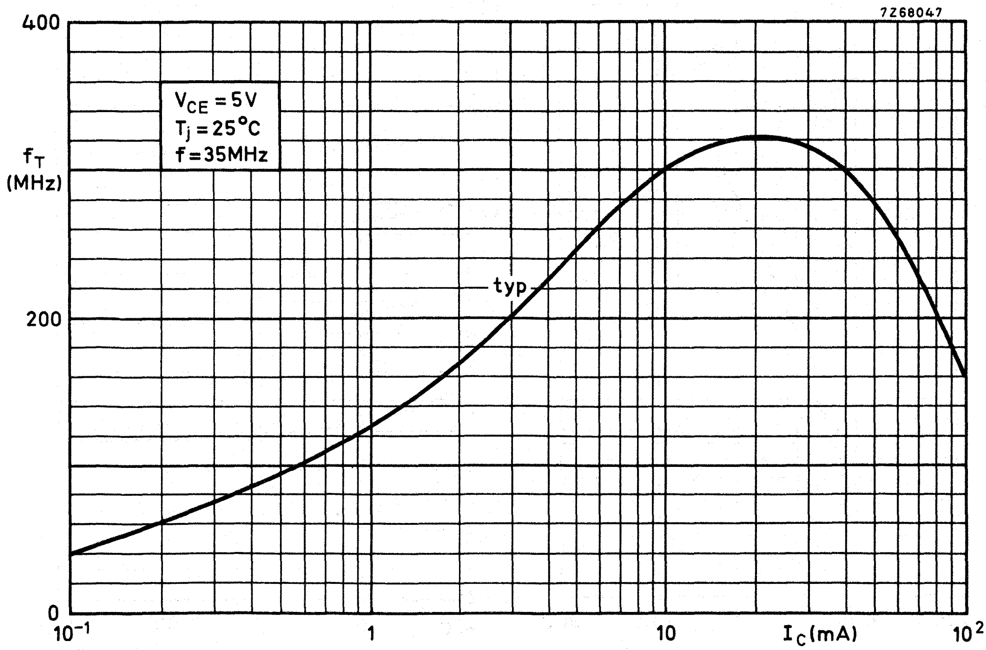

7Z68047
400
f_T
(MHz)
200
0
V_{CE} = 5 V
T_j = 25 °C
f = 35 MHz
typ
10^{-1}
1
10
I_C (mA)
10^2

Fig. 10.

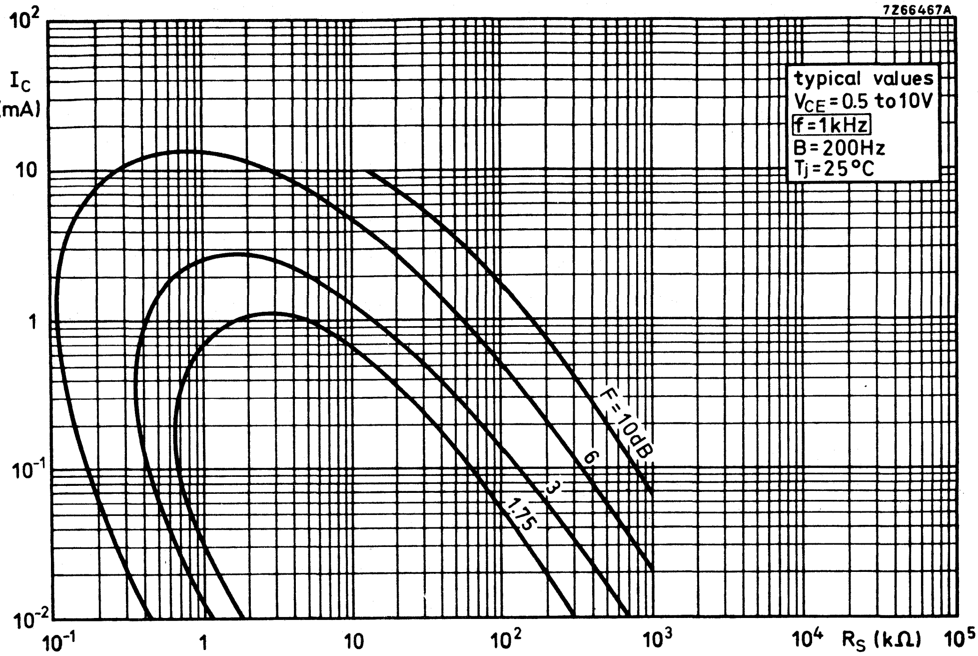


Fig. 11 Curves of constant noise figure for BC849.

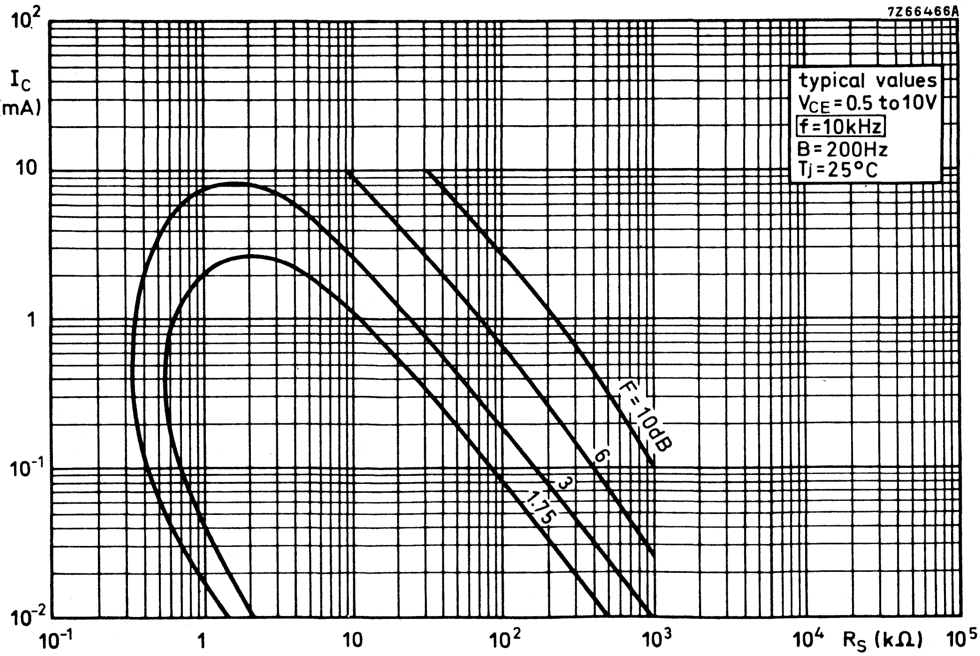


Fig. 12 Curves of constant noise figure for BC849.

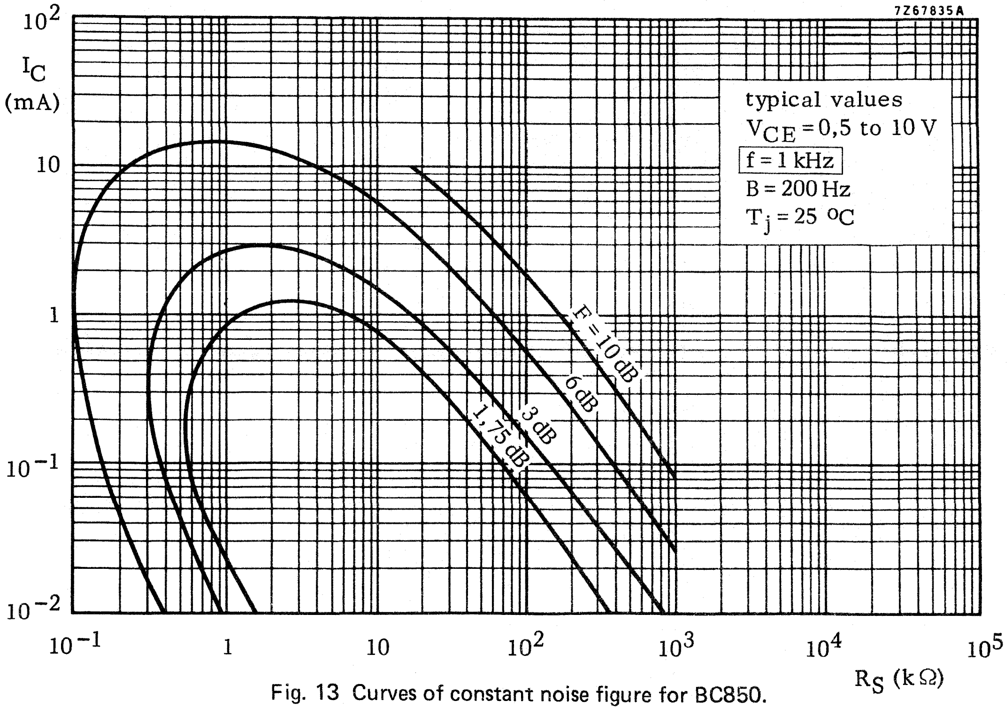


Fig. 13 Curves of constant noise figure for BC850.

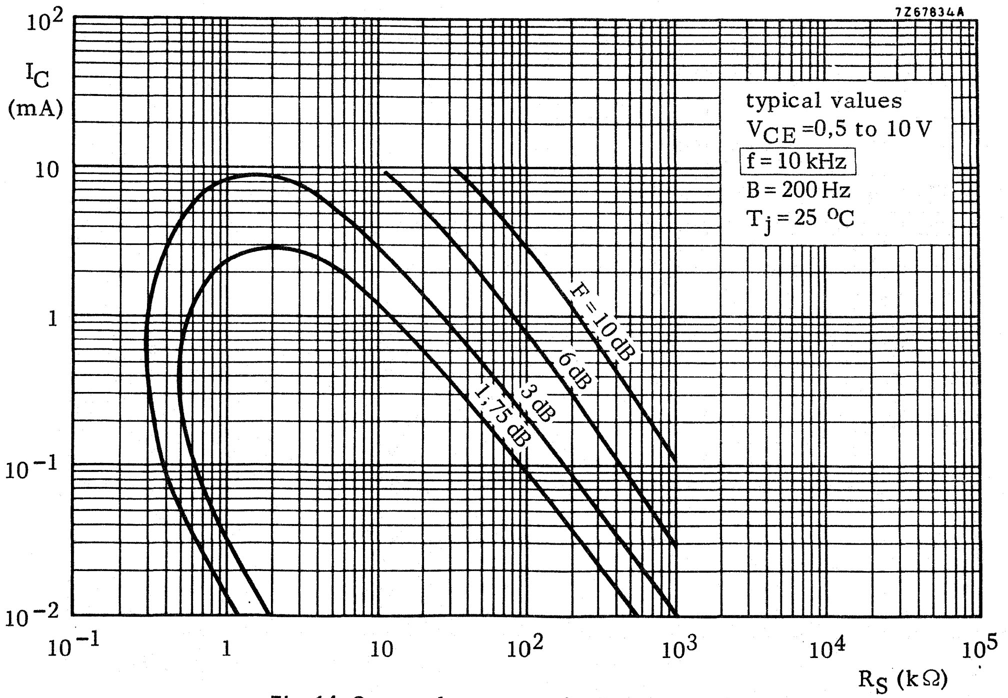


Fig. 14 Curves of constant noise figure for BC850.

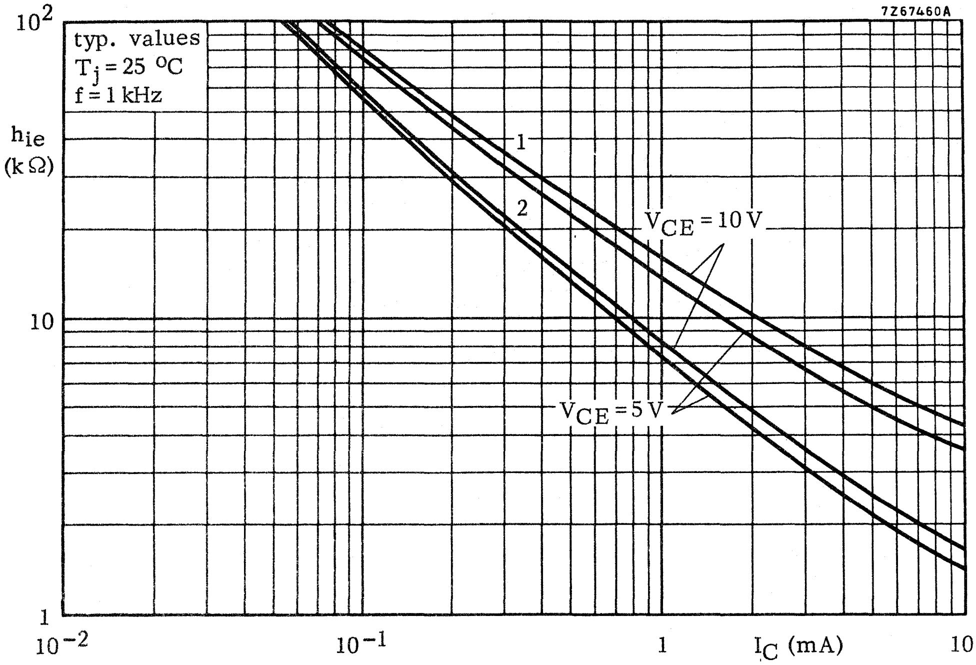


Fig. 15 Typical values. 1 = C selections; 2 = B selections.

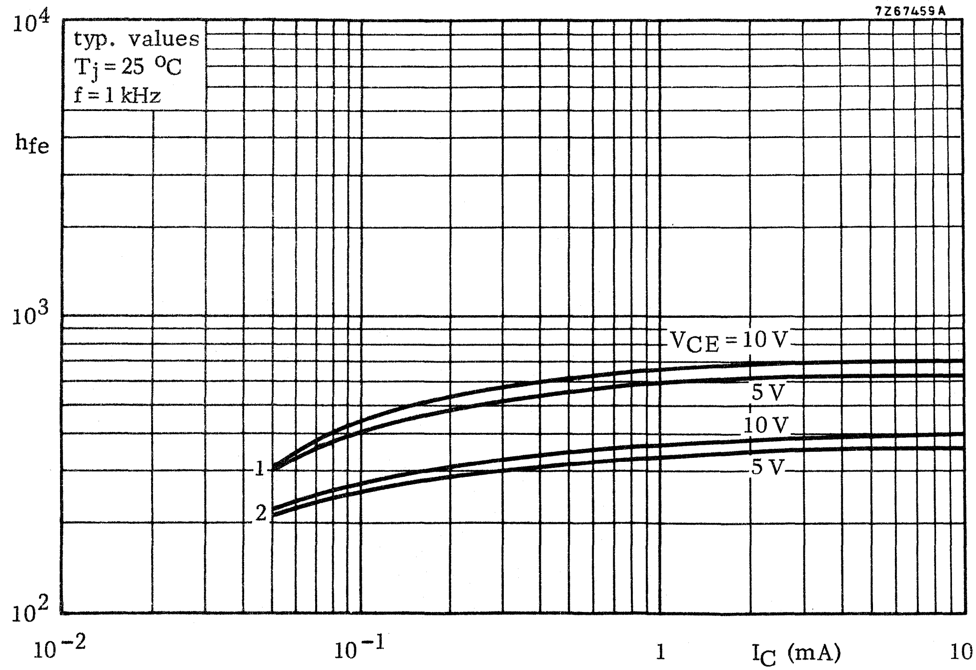


Fig. 16 Typical values. 1 = C selections; 2 = B selections.

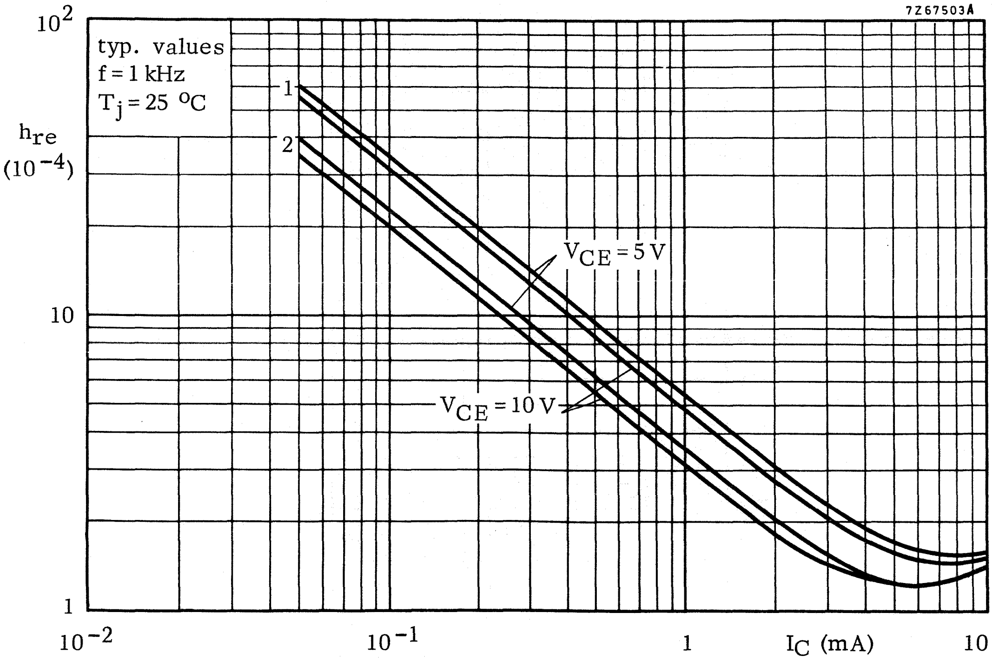


Fig. 17 Typical values. 1 = C selections; 2 = B selections.

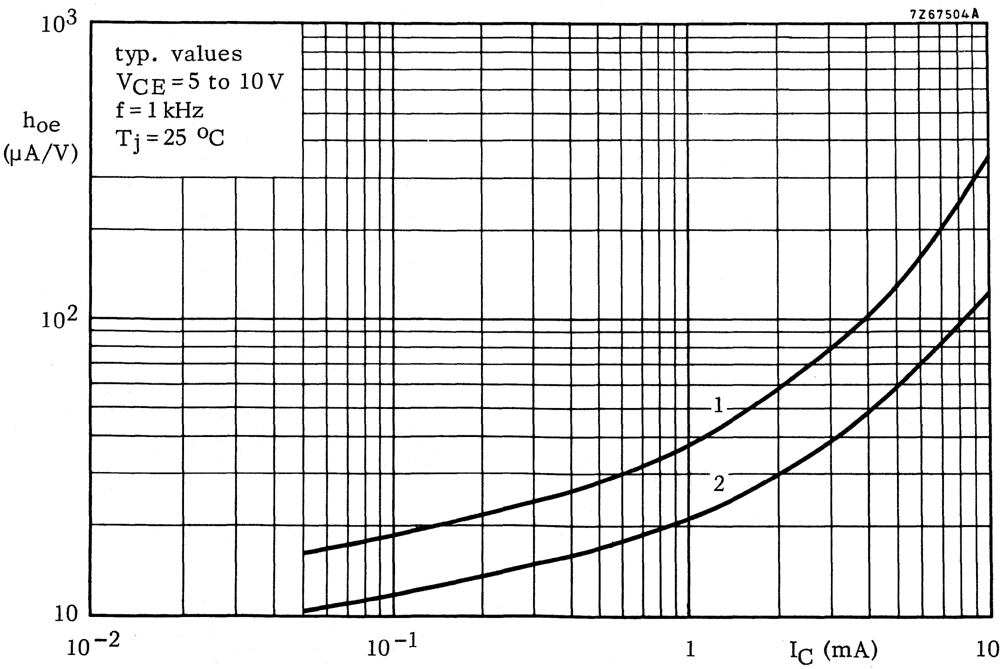


Fig. 18 Typical values. 1 = C selections; 2 = B selections.

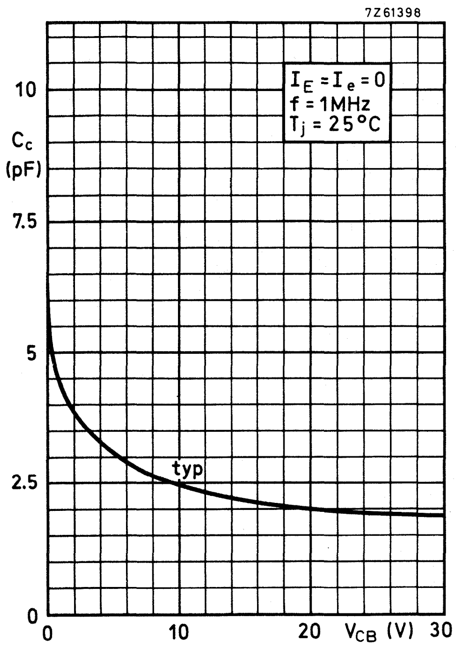


Fig. 19 Typical values.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope for use in driver and output stages of audio amplifiers in thick and thin-film circuits.

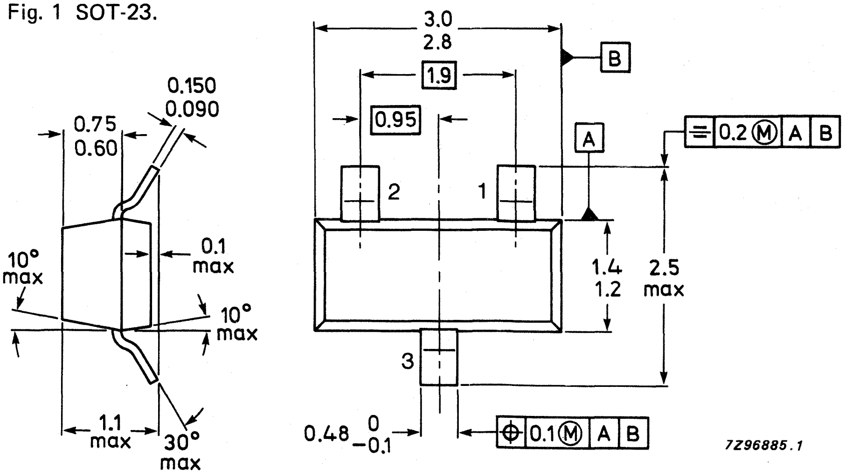
QUICK REFERENCE DATA

			BC856	BC857	BC858	
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.		250		mW
Junction temperature	T_j	max.		150		°C
Small-signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}			75 to 900		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



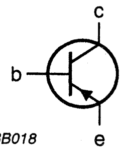
TOP VIEW

Marking code:

BC856 = 3Dp
BC856A = 3Ap
BC856B = 3Bp
BC857 = 3Hp
BC857A = 3Ep
BC857B = 3Fp
BC857C = 3Gp
BC858 = 3Mp
BC858A = 3Jp
BC858B = 3Kp
BC858C = 3Lp

Pinning:

1 = base
2 = emitter
3 = collector



MBB018

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

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

			BC856	BC857	BC858	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	50	30	V
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	80	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	65	45	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		100		mA
Collector current (peak value)	$-I_{CM}$	max.		200		mA
Emitter current (peak value)	I_{EM}	max.		200		mA
Base current (peak value)	$-I_{BM}$	max.		200		mA
Total power dissipation ** up to T_{amb} = 60 °C	P_{tot}	max.		250		mW
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL CHARACTERISTICS*

$T_j = P \times (R_{th\,j\text{-}t} + R_{th\,t\text{-}s} + R_{th\,s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\,j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\,t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\,s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 30 V; T_j 25 °C	$-I_{CBO}$	typ.	1	nA
		<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA
Base-emitter voltage▲				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
			600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.
* See *Thermal characteristics.*
** Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.

Saturation voltages *			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75 mV
		<	300 mV
	$-V_{BEsat}$	typ.	700 mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250 mV
		<	650 mV
	$-V_{BEsat}$	typ.	850 mV
Knee voltage			
$-I_C$ = 10 mA; $-I_B$ = value for which $-I_C$ = 11 mA at $-V_{CE}$ = 1 V	$-V_{CEK}$	typ.	250 mV
		<	600 mV
Collector capacitance at f = 1 MHz; $I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz; $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150 MHz
Small-signal current gain at f = 1 kHz; $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{fe}		75 to 900
Noise figure at R_S = 2 kΩ; $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	typ.	2 dB
		<	10 dB
D.C. current gain			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V BC856/857	h_{FE}		75 to 800
BC858	h_{FE}		75 to 800
BC856A/857A/858A	h_{FE}		125 to 250
BC856B/857B/858B	h_{FE}		220 to 475
BC857C/858C	h_{FE}		420 to 800

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

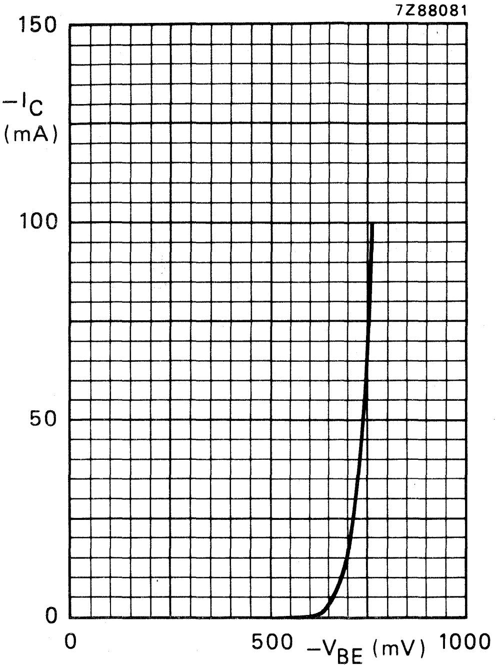


Fig. 3 Typical values. $-V_{CE}$ = 5 V; T_j = 25 °C.

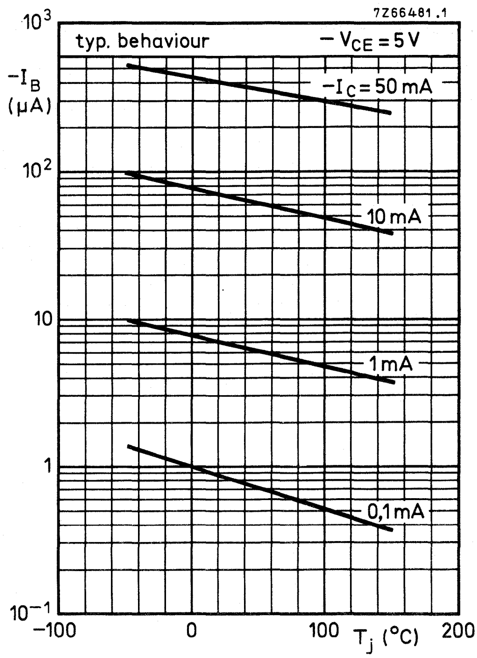


Fig. 4 Typical values.

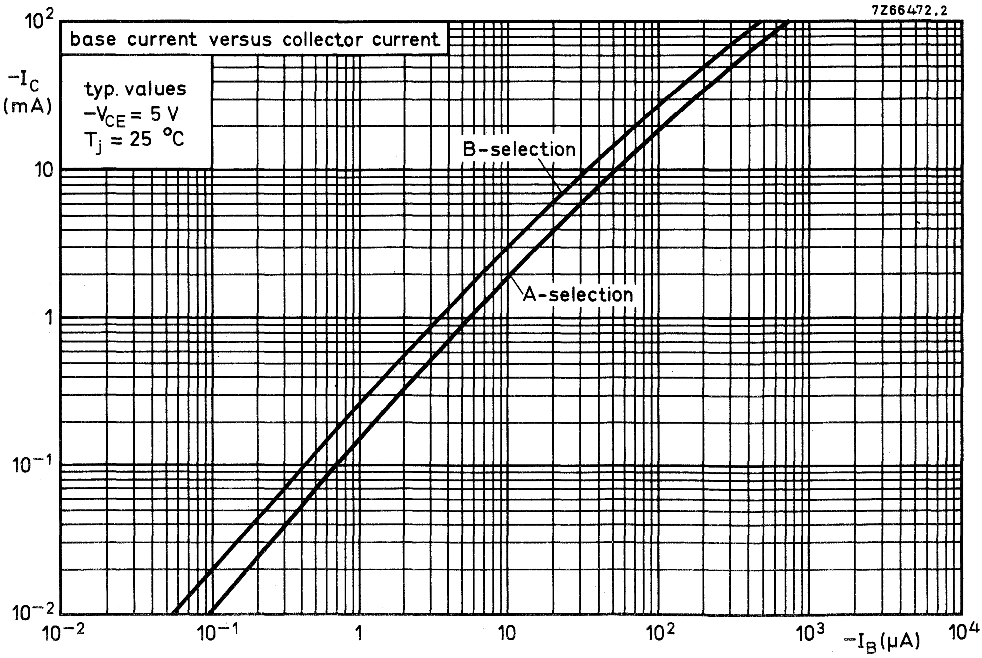


Fig. 5.

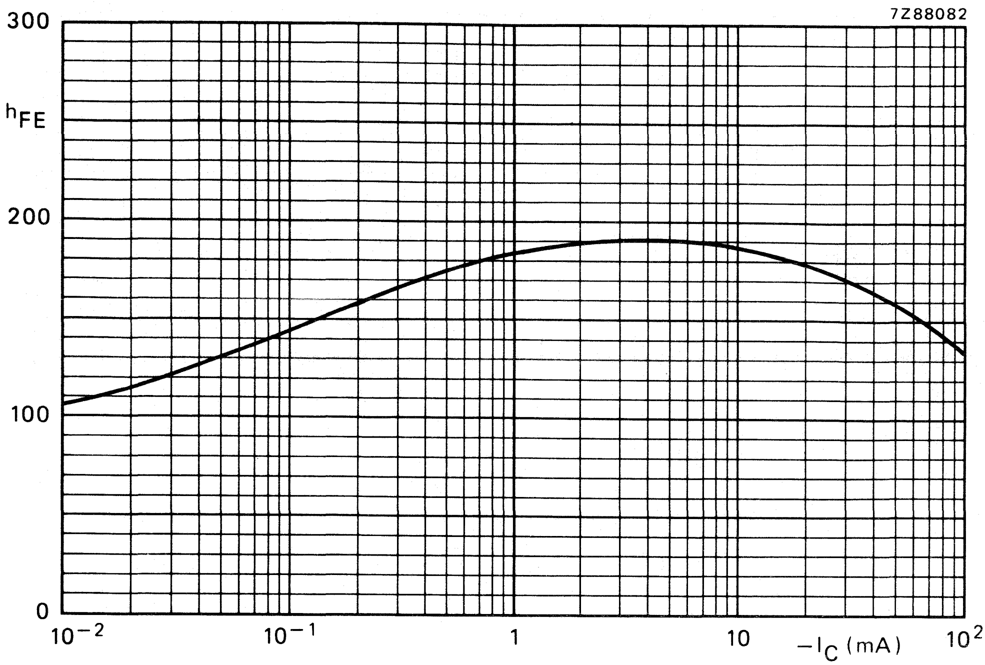


Fig. 6 Typical values D.C. current gain A-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

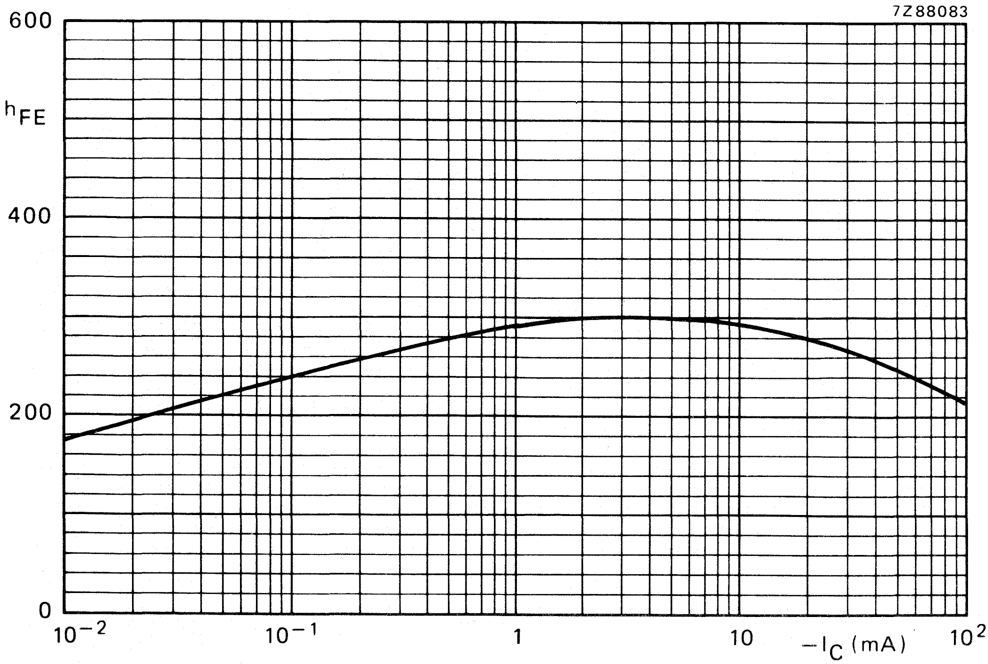


Fig. 7 Typical values D.C. current gain B-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

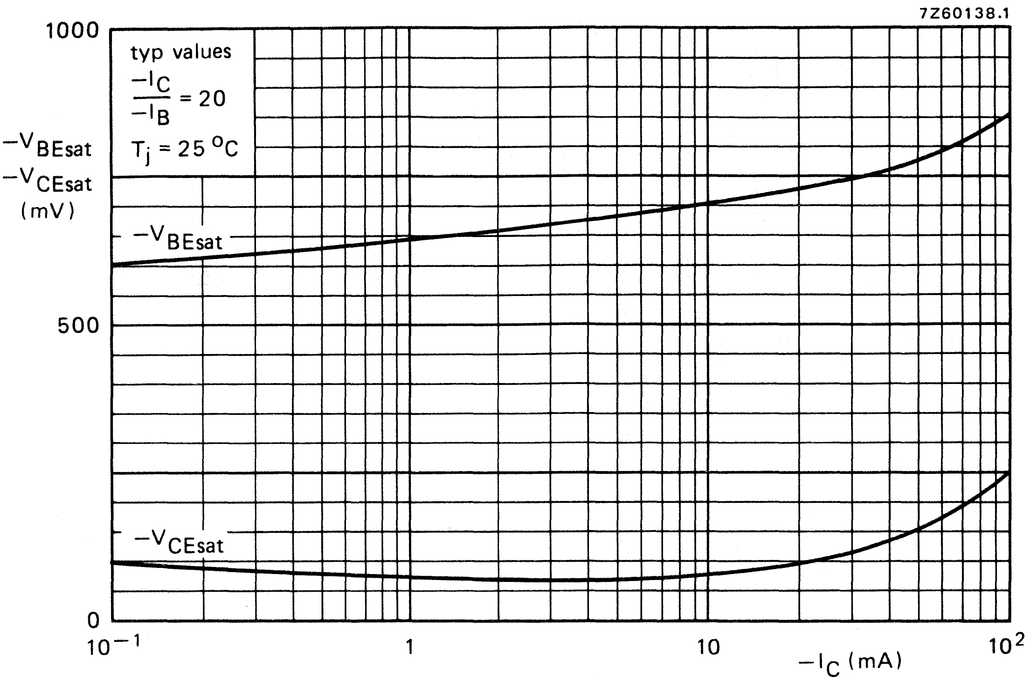


Fig. 8 Typical values base-emitter and collector-emitter saturation voltage.

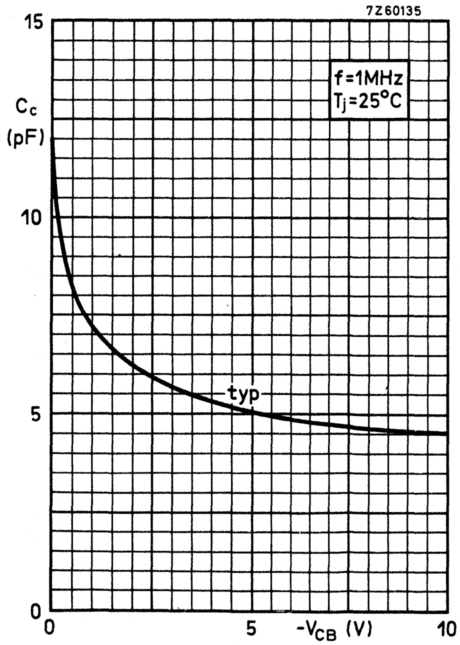


Fig. 9 Typical values.

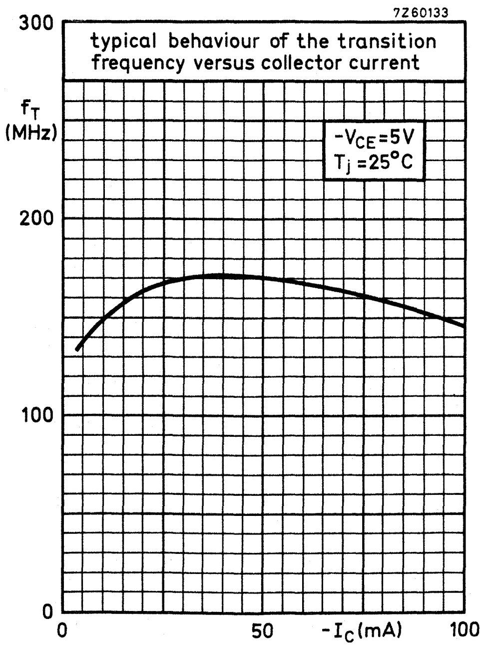


Fig. 10 Typical values. f = 35 MHz.

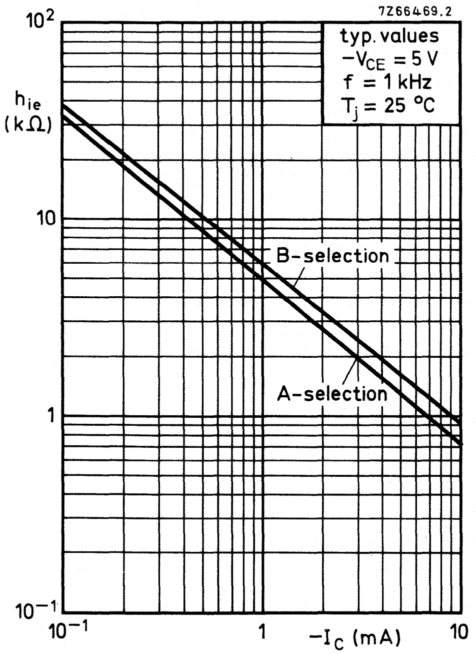


Fig. 11.

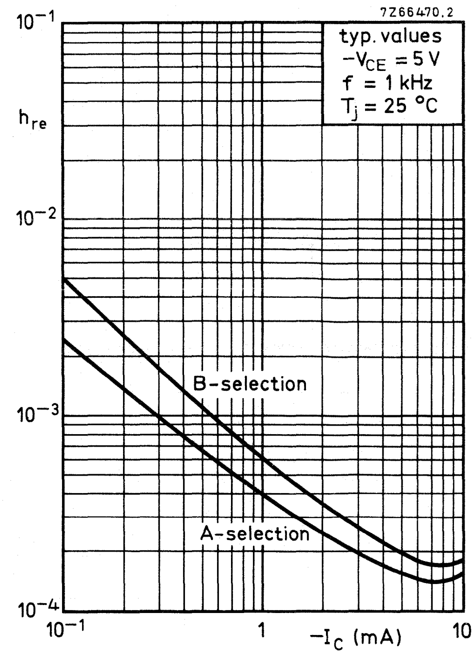


Fig. 12.

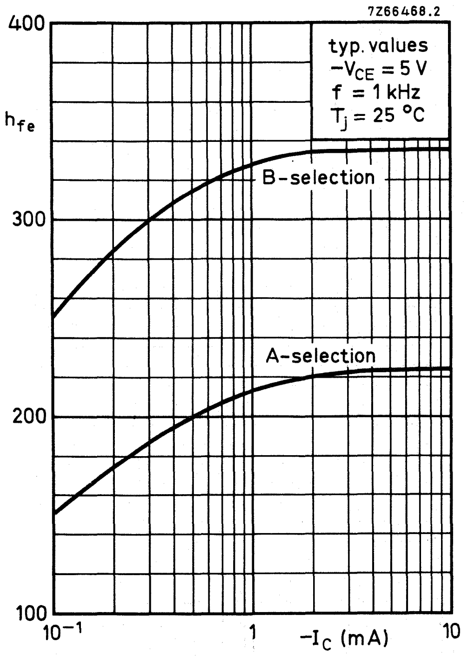


Fig. 13.

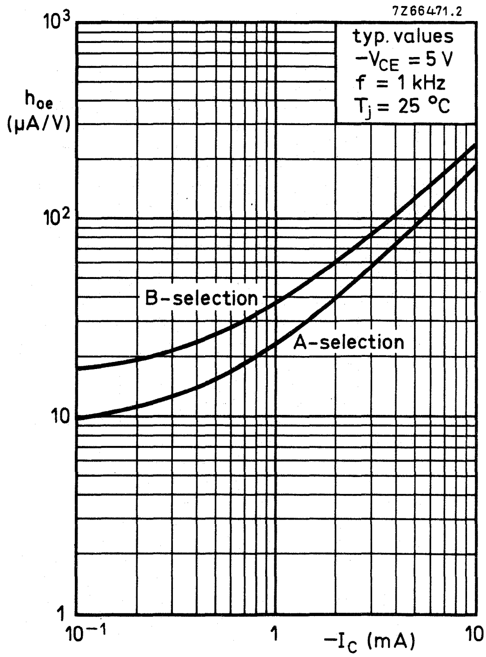


Fig. 14.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in a plastic SOT-23 envelope, primarily intended for low-noise input stages in tape recorders, hi-fi amplifiers and other audio frequency equipment in thick and thin-film hybrid circuits.

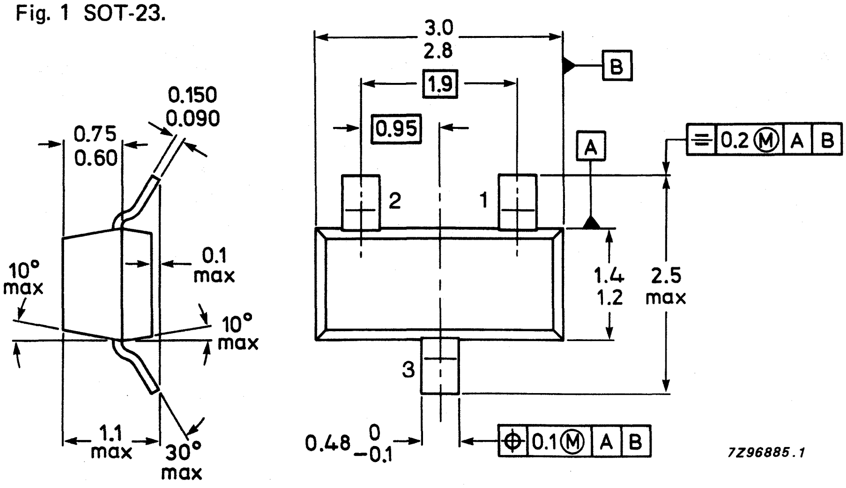
QUICK REFERENCE DATA

			BC859	BC860	
Collector-emitter voltage ($+V_{BE}$ = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	200	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	250	250	mW
Junction temperature	T_j	max.	150	150	°C
Small-signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz	h_{fe}	> <	125 900	125 900	
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 30 Hz to 15 kHz	F	typ. <	1,2 4	1 3	dB dB
f = 1 kHz; B = 200 Hz	F	<	4	4	dB

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-23.



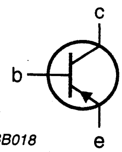
TOP VIEW

Marking code:

BC859 = 4Dp
BC859A = 4Ap
BC859B = 4Bp
BC859C = 4Cp
BC860 = 4Hp
BC860A = 4Ep
BC860B = 4Fp
BC860C = 4Gp

Pinning:

1 = base
2 = emitter
3 = collector



MBB018

See also *Soldering recommendations.* Reverse pinning types are available on request.

RATINGS

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

			BC859	BC860	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	50	V
Collector-emitter voltage (+ V_{BE} = 1 V)	$-V_{CEX}$	max.	30	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	45	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V
Collector current (d.c.)	$-I_C$	max.	100		mA
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Emitter current (peak value)	I_{EM}	max.	200		mA
Base current (peak value)	$-I_{BM}$	max.	200		mA
Total power dissipation up to T_{amb} = 60 °C**	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL CHARACTERISTICS*

$T_j = P \times (R_{th\ j\text{-}t} + R_{th\ t\text{-}s} + R_{th\ s\text{-}a}) + T_{amb}$

Thermal resistance

From junction to tab	$R_{th\ j\text{-}t}$	=	60	K/W
From tab to soldering points	$R_{th\ t\text{-}s}$	=	280	K/W
From soldering points to ambient**	$R_{th\ s\text{-}a}$	=	90	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current

$I_E = 0$; $-V_{CB} = 30$ V; T_j = 25 °C	$-I_{CBO}$	typ.	1	nA
		<	15	nA
T_j = 150 °C	$-I_{CBO}$	<	4	μA

Base-emitter voltage▲

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	typ.	650	mV
			600 to 750	mV
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	$-V_{BE}$	<	820	mV

* See *Thermal characteristics.*

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

▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Saturation voltages*

$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	75	mV
		<	300	mV
	$-V_{BEsat}$	typ.	700	mV
$-I_C$ = 100 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	typ.	250	mV
		<	650	mV
	$-V_{BEsat}$	typ.	850	mV

Collector capacitance at f = 1 MHz

$I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF

Transition frequency at f = 35 MHz

$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz

Small-signal current gain at f = 1 kHz

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{fe}	125 to 900

Noise figure at R_S = 2 kΩ

$-I_C$ = 200 μA; $-V_{CE}$ = 5 V			BC859	BC860	
f = 30 Hz to 15 kHz	F	typ.	1,2	1	dB
		<	4	3	dB
f = 1 kHz; B = 200 Hz	F	typ.	1	1	dB
		<	4	4	dB

Equivalent noise voltage at R_S = 2 kΩ

			BC859	BC860	
$-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 10 Hz to 50 Hz; T_{amb} = 25 °C	V_n	<	–	0,11	μV

D.C. current gain

$-I_C$ = 2 mA; $-V_{CE}$ = 5 V; total range	h_{FE}	125 to 800
A selections	h_{FE}	125 to 250
B selections	h_{FE}	220 to 475
C selections	h_{FE}	420 to 800

* $-V_{BEsat}$ decreases by about 1,7 mV/K with increasing temperature.

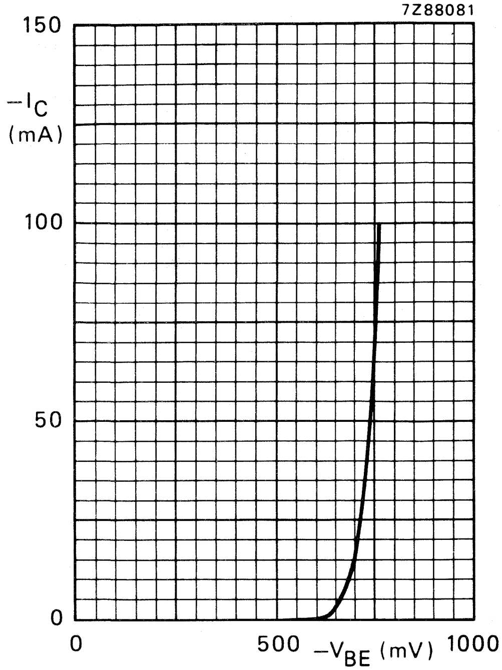


Fig. 3 Typical values. $-V_{CE}$ = 5 V; T_j = 25 °C.

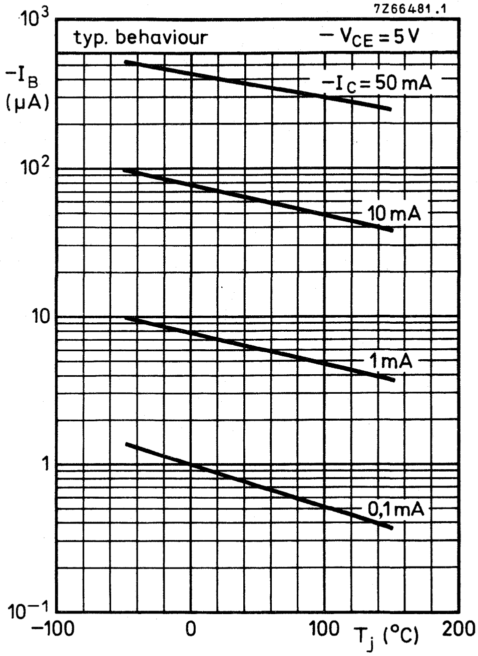


Fig. 4 Typical values.

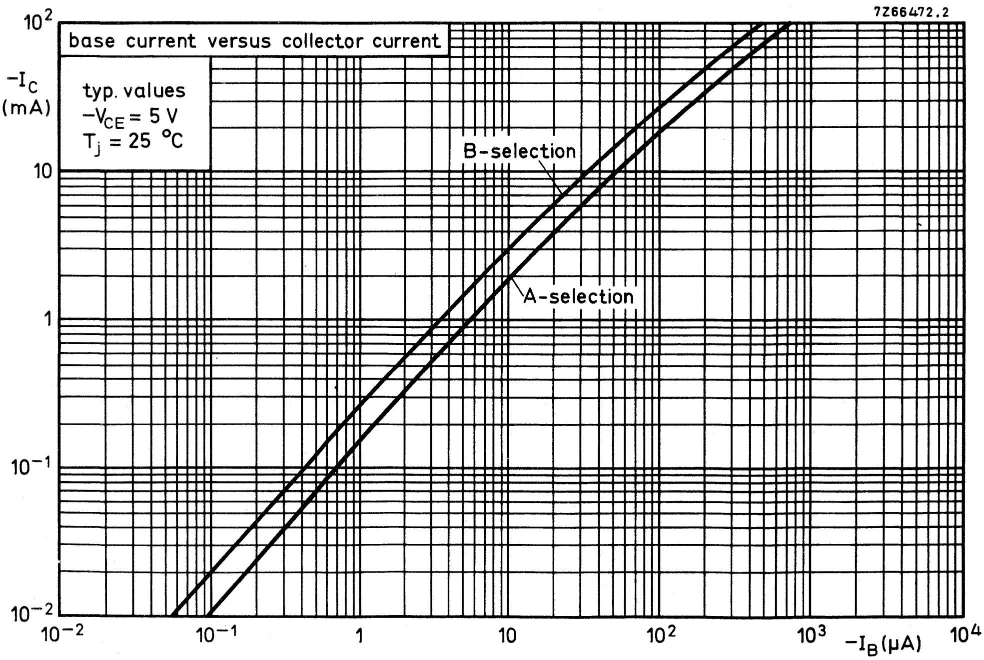


Fig. 5.

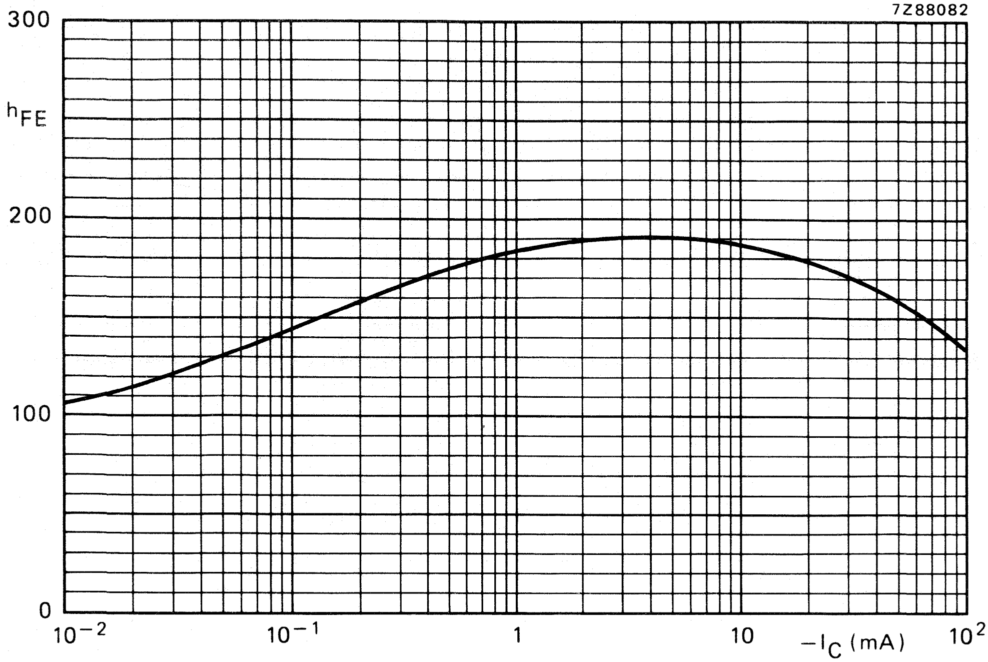


Fig. 6 Typical values. D.C. current gain A-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

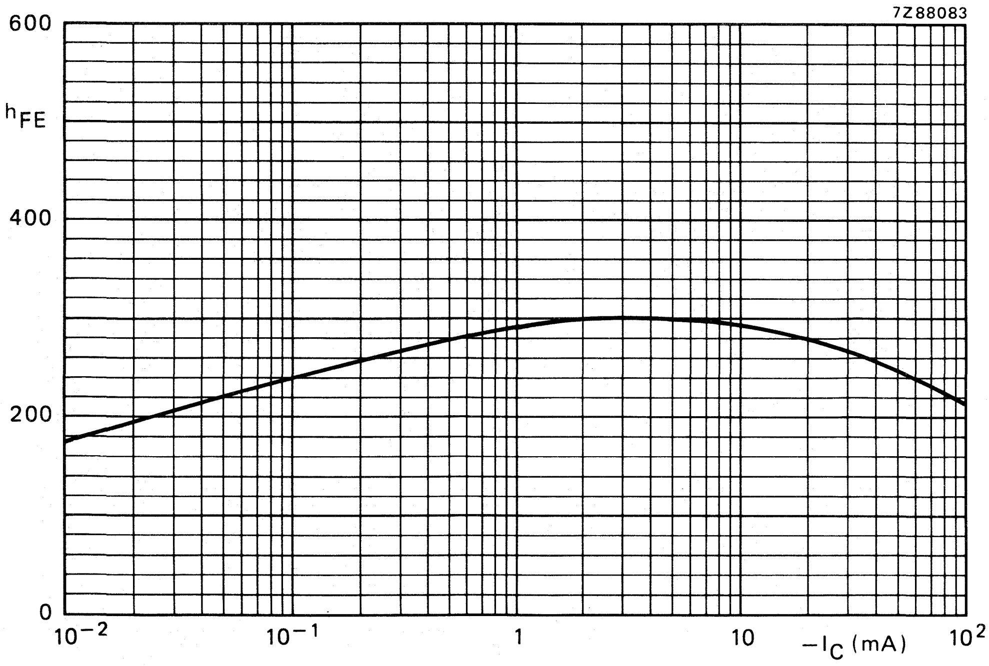


Fig. 7 Typical values. D.C. current gain B-selections. $-V_{CE}$ = 5 V; T_j = 25 °C.

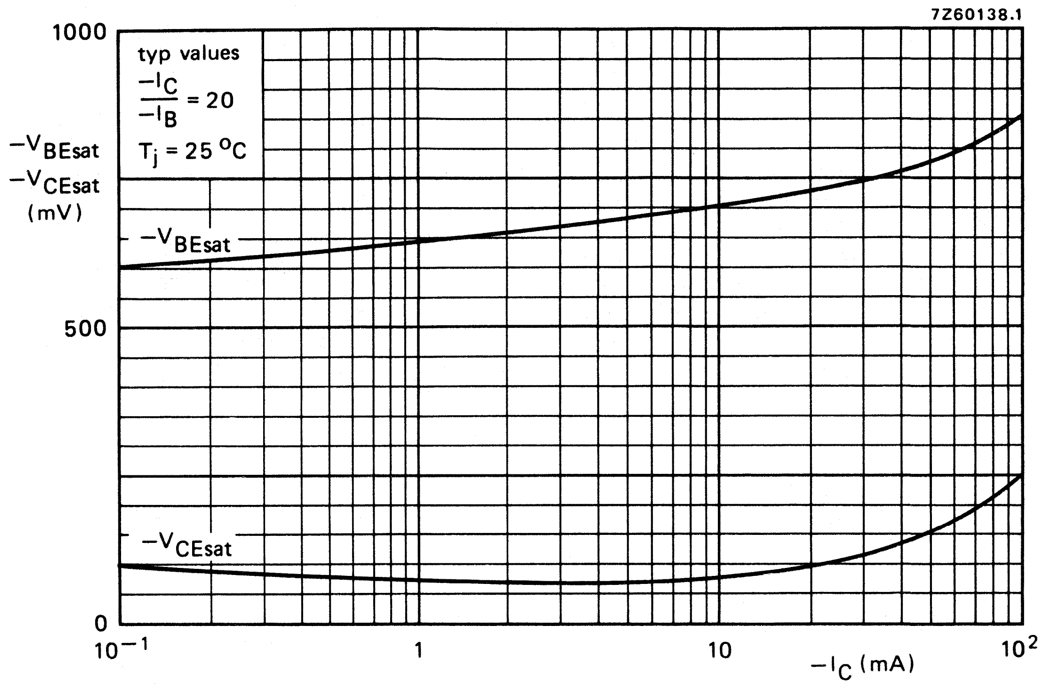


Fig. 8 Typical values base-emitter and collector-emitter saturation voltage.

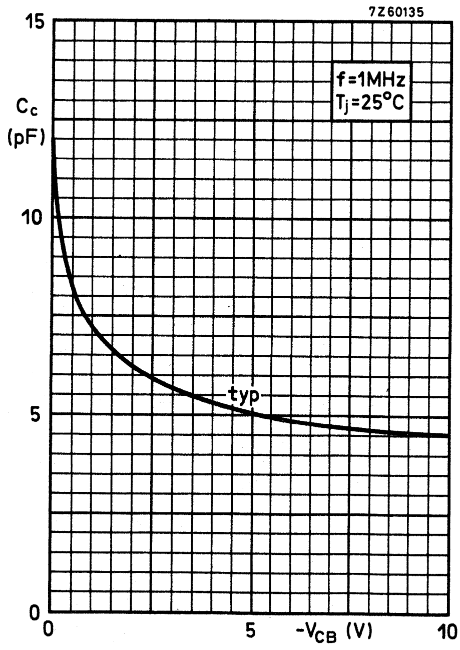


Fig. 9 Typical values.

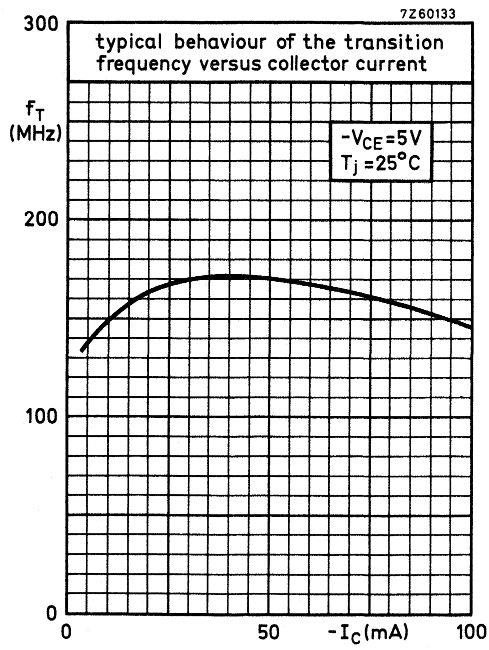


Fig. 10 Typical values. f = 35 MHz.

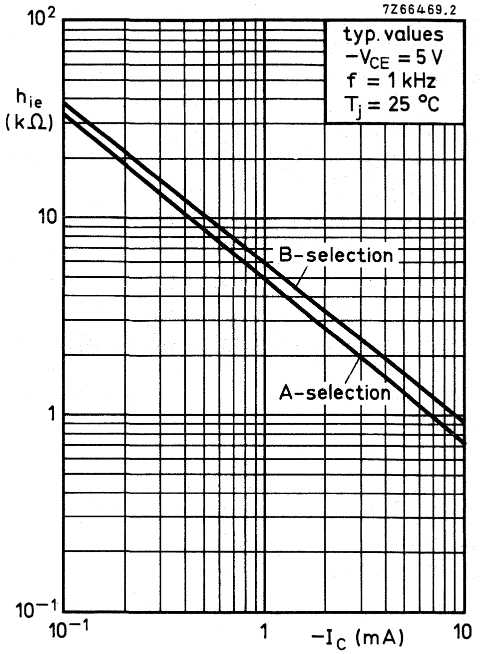


Fig. 11 Typical values.

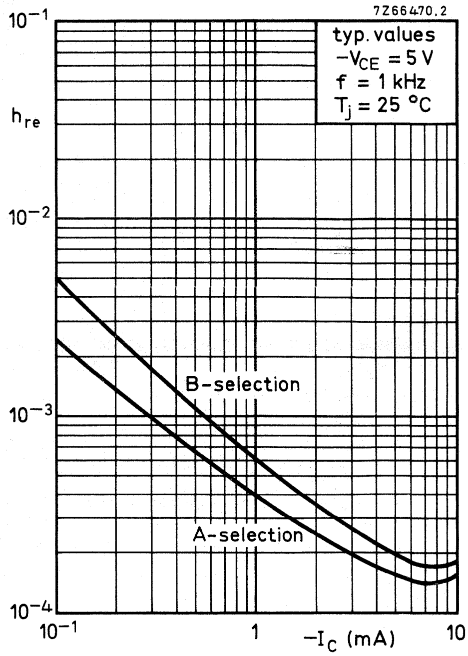


Fig. 12 Typical values.

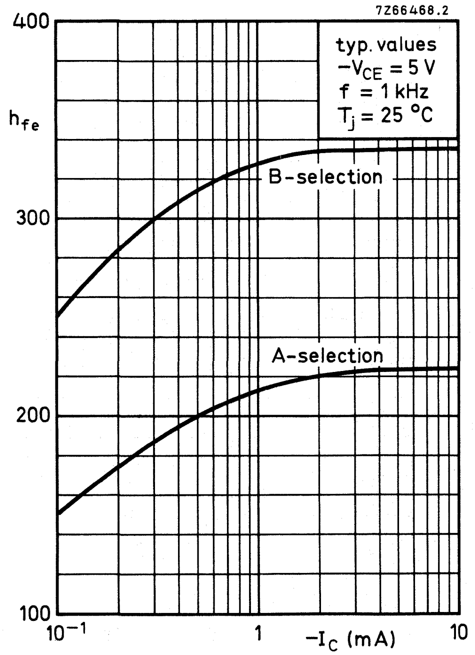


Fig. 13 Typical values.

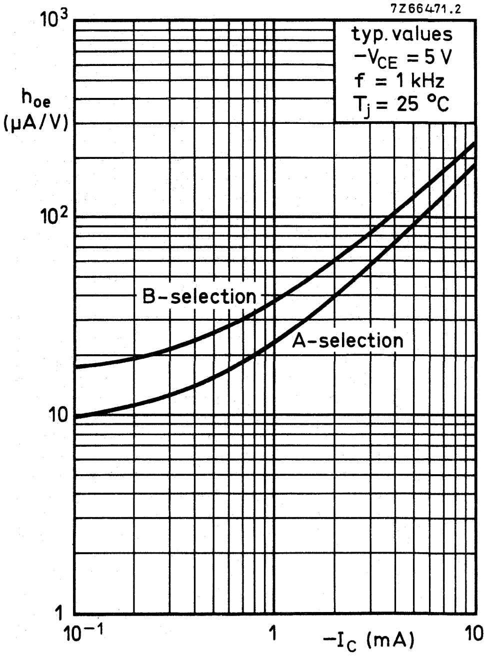


Fig. 14 Typical values.

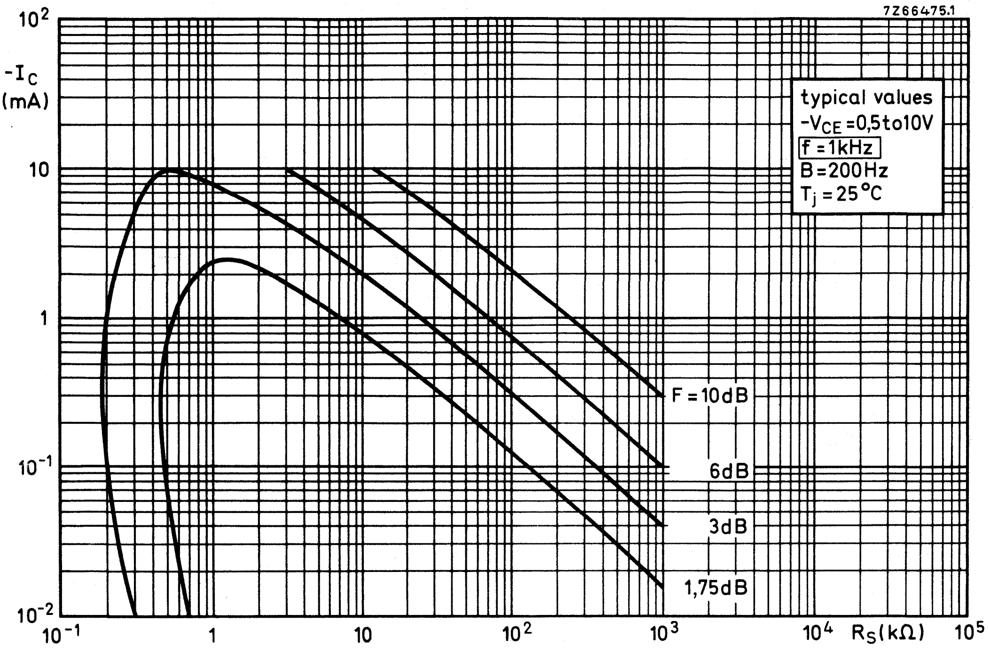


Fig. 15 Curves of constant noise figure at f = 1 kHz.

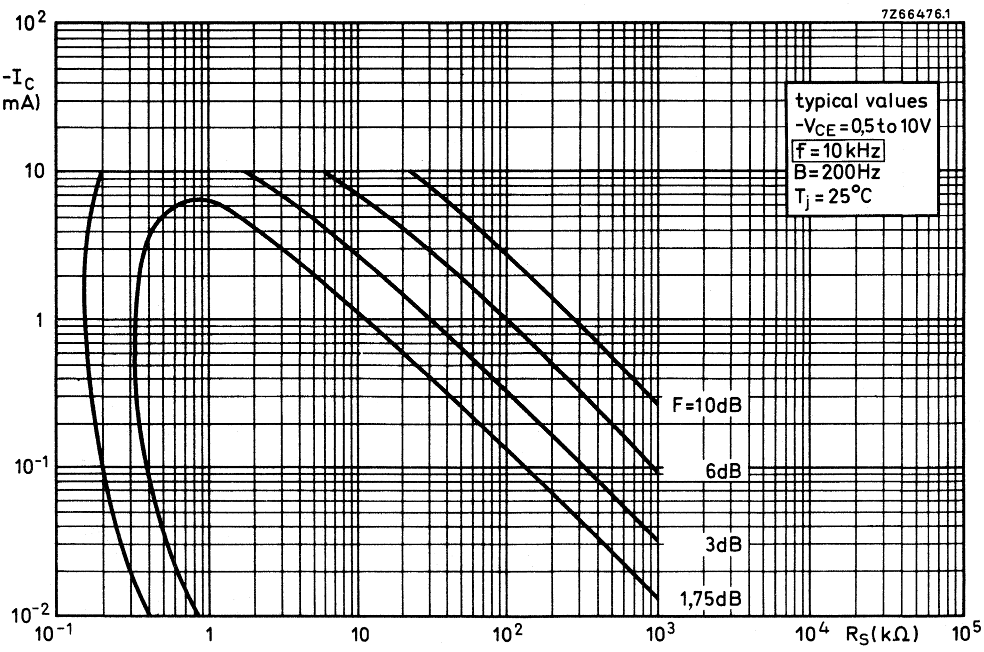


Fig. 16 Curves of constant noise figure at f = 10 kHz.

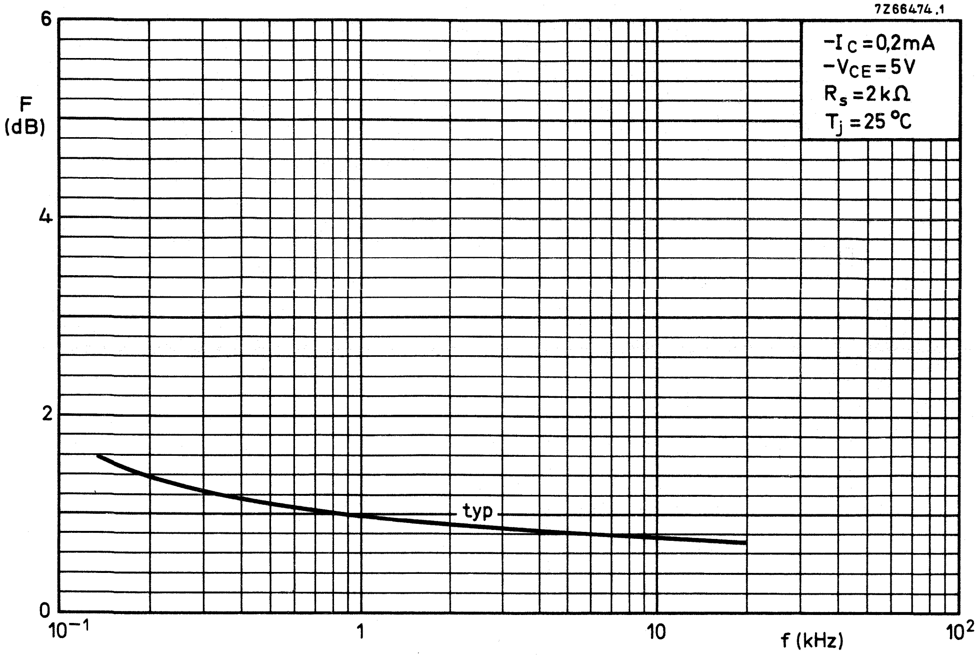


Fig. 17 Typical values noise figure.

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a microminiature plastic envelope intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (peak value)	I_{CM}	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60	MHz

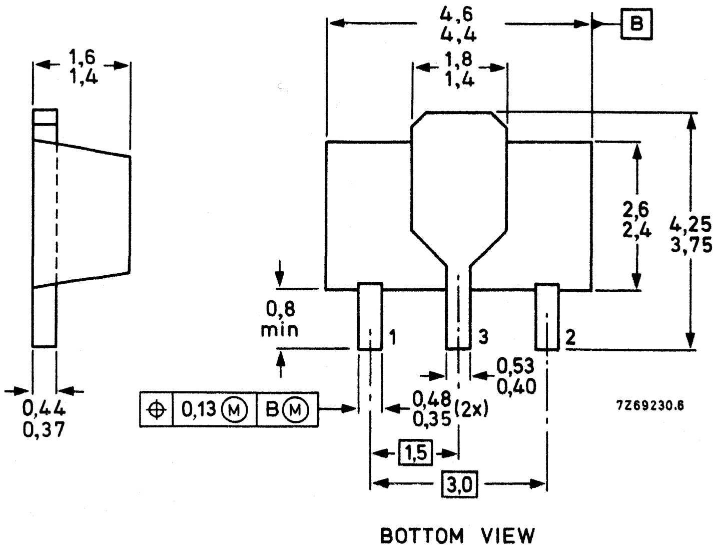
MECHANICAL DATA

Dimensions in mm

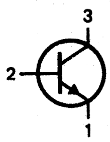
Fig. 1 SOT-89.

Marking code

BC868 = CAC
BC868-10 = CBC
BC868-16 = CCC
BC868-25 = CDC



BOTTOM VIEW



See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	1	A
Collector current (peak value)	I_{CM}	max.	2	A
Base current (d.c.)	I_B	max.	100	mA
Base current (peak value)	I_{BM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1	W
Storage temperature	T_{stg}	–65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	125	K/W
From junction to tab	$R_{th\ j\text{-}t}$	=	10	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
I_E = 0; V_{CB} = 25 V		I_{CBO}	<	10	μA
I_E = 0; V_{CB} = 25 V; T_j = 150 °C		I_{CBO}	<	1	mA
Emitter cut-off current					
I_C = 0; V_{EB} = 5 V		I_{EBO}	<	10	μA
Base-emitter voltage					
I_C = 5 mA; V_{CE} = 10 V		V_{BE}	typ.	0,62	V
I_C = 1 A; V_{CE} = 1 V		V_{BE}	<	1	V
Collector-emitter saturation voltage					
I_C = 1 A; I_B = 100 mA		V_{CEsat}	<	0,5	V
DC current gain					
I_C = 5 mA; V_{CE} = 10 V	BC8681	h_{FE}	50		
DC current gain					
I_C = 5 mA; V_{CE} = 10 V	BC868	h_{FE}	>	50	
I_C = 500 mA; V_{CE} = 1 V	BC868	h_{FE}		85 to 375	
	BC868-10	h_{FE}	⩽	160	
	BC868-16	h_{FE}		100 to 250	
	BC868-25	h_{FE}	⩾	160	
I_C = 1 A; V_{CE} = 1 V	BC868	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
I_E = I_e = 0; V_{CB} = 5 V		C_c	typ.	27	pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V		f_T	typ.	60	MHz

* Mounted on a ceramic substrate, area = 2,5 cm^2; thickness = 0,7 mm.

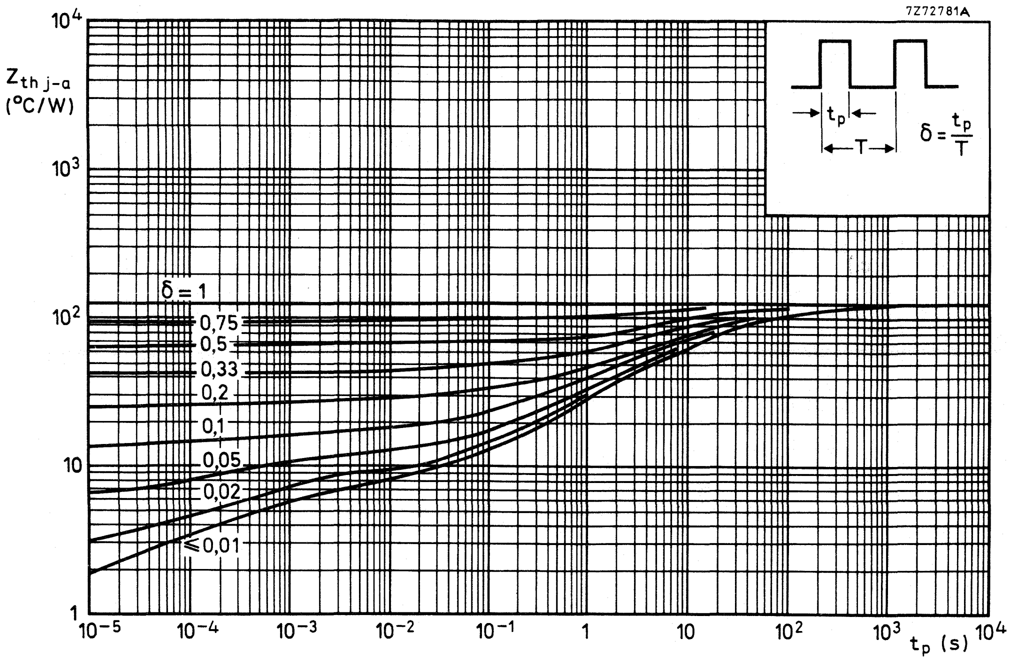


Fig. 2 Pulse power rating chart.

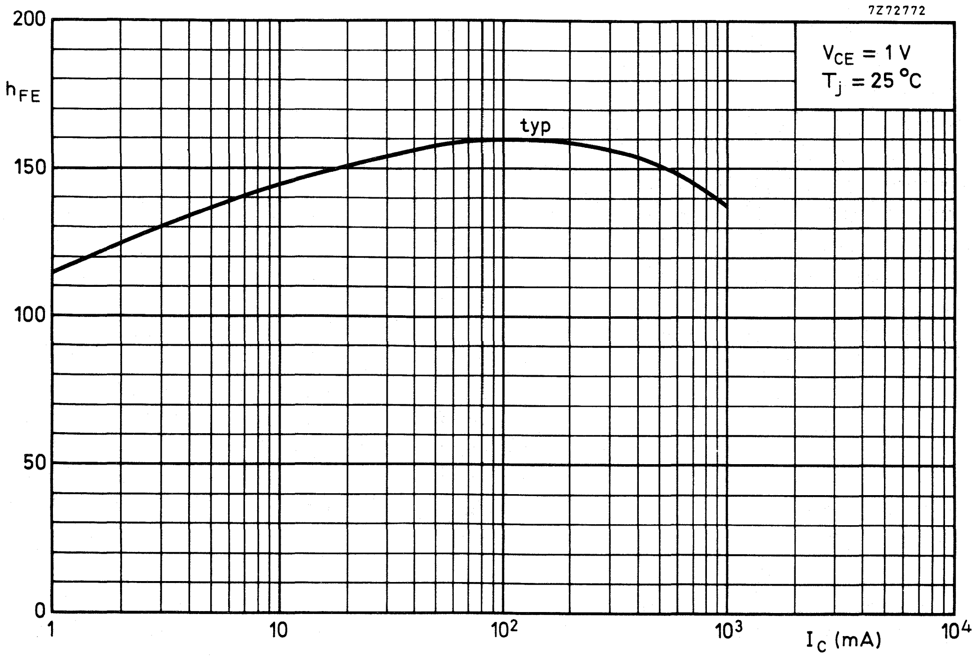


Fig. 3 D.C. current gain.

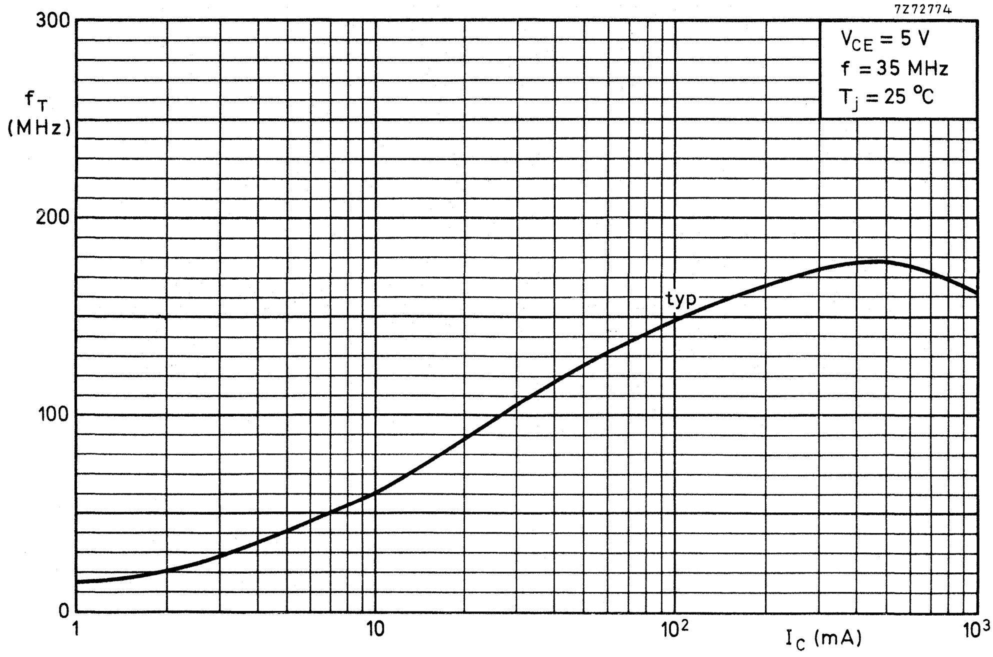


Fig. 4 Typical values transition frequency as a function of collector current.

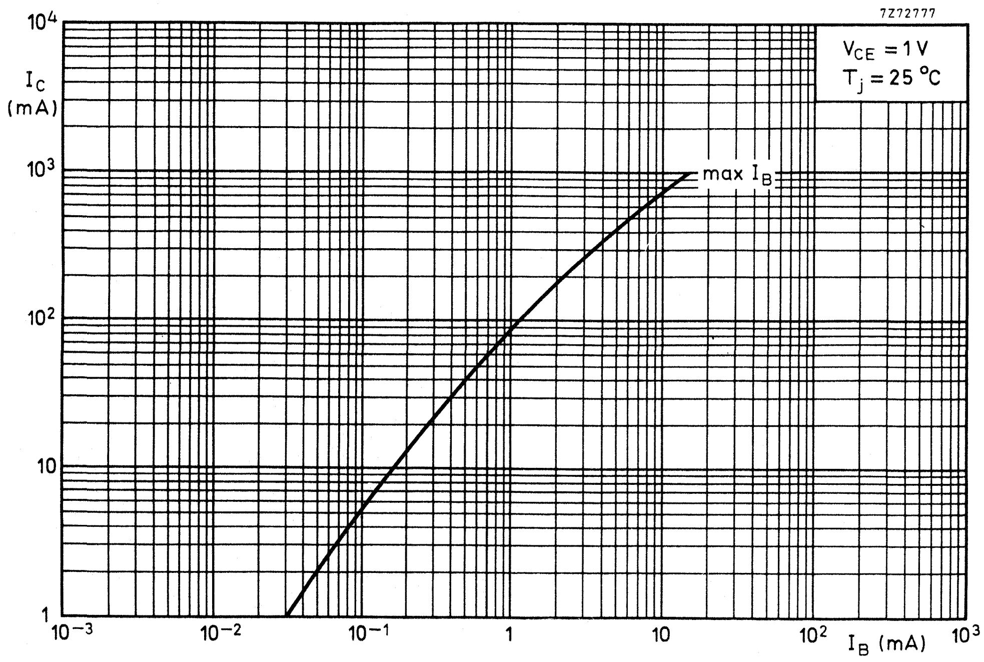


Fig. 5 Typical values collector current as a function of maximum base current.

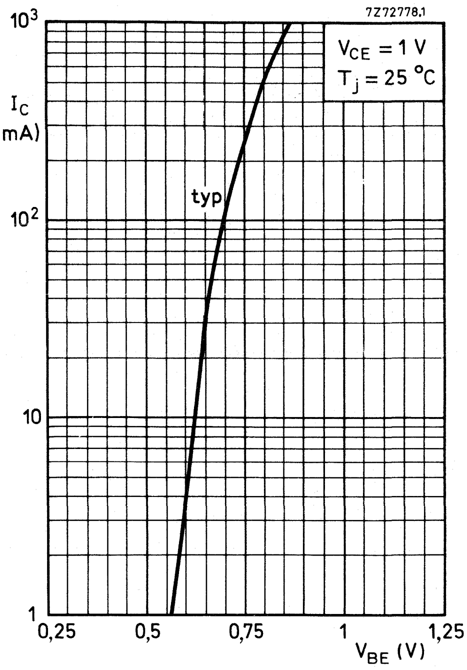


Fig. 6 Typical values collector current as a function of base-emitter voltage.

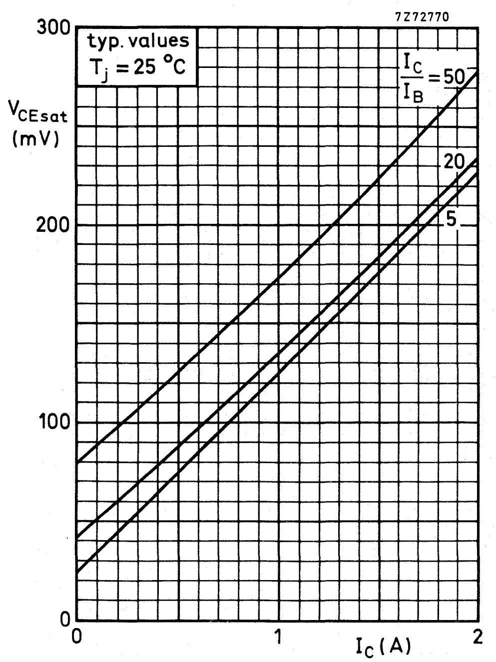


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

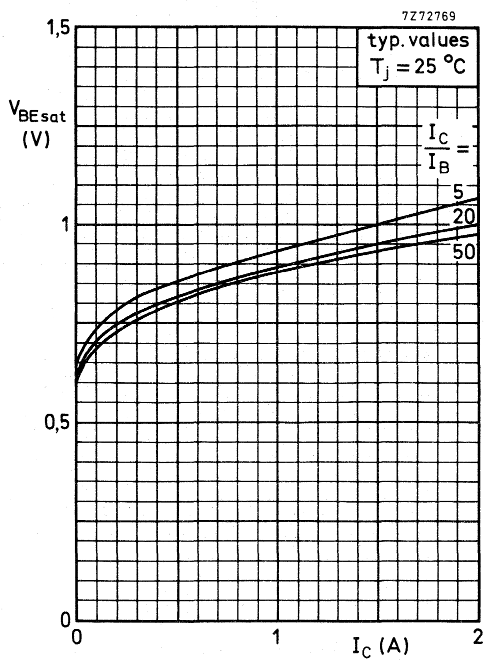


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic microminiature envelope, intended for low-voltage, high-current l.f. applications. BC868/BC869 is the matched complementary pair suitable for class-B audio output stages up to 3 W.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current (peak value)	$-I_{CM}$	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1	W
Junction temperature	T_j	max.	150	°C
D.C. current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60	MHz

MECHANICAL DATA

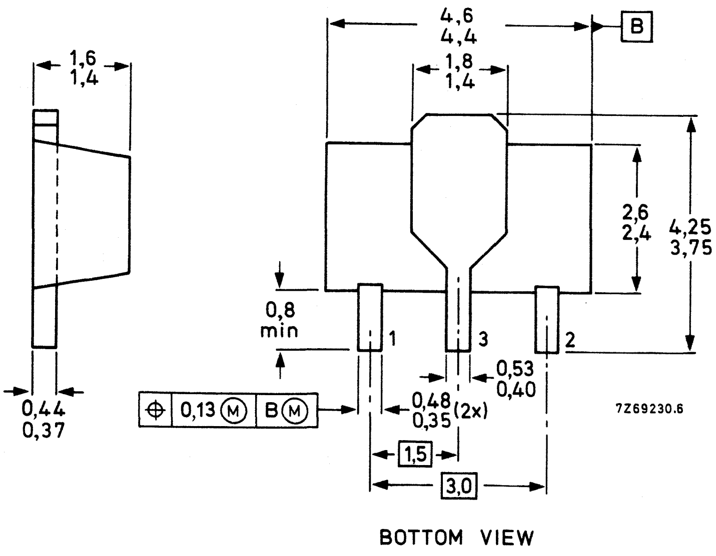
Dimensions in mm

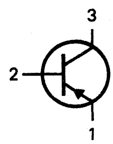
Fig. 1 SOT-89.

Marking code

BC869 = CEC

BC869-10 = CGC





See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25 V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	1 A
Collector current (peak value)	$-I_{CM}$	max.	2 A
Base current (d.c.)	$-I_B$	max.	100 mA
Base current (peak value)	$-I_{BM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j-a}$	=	125 K/W
From junction to tab	$R_{th\ j-t}$	=	10 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0; -V_{CB} = 25$ V		$-I_{CBO}$	<	10 μA
$I_E = 0; -V_{CB} = 25$ V; $T_j = 150$ °C		$-I_{CBO}$	<	1 mA
Emitter cut-off current				
$I_C = 0; -V_{EB} = 5$ V		$-I_{EBO}$	<	10 μA
Base-emitter voltage				
$-I_C = 5$ mA; $-V_{CE} = 10$ V		$-V_{BE}$	typ.	0,62 V
$-I_C = 1$ A; $-V_{CE} = 1$ V		$-V_{BE}$	<	1 V
Collector-emitter saturation voltage				
$-I_C = 1$ A; $-I_B = 100$ mA		$-V_{CEsat}$	<	0,5 V
D.C. current gain				
$-I_C = 5$ mA; $-V_{CE} = 10$ V	BC869	h_{FE}	>	50
$-I_C = 500$ mA; $-V_{CE} = 1$ V	BC869	h_{FE}		85 to 375
	BC869-10	h_{FE}	⩽	160
	BC869-16	h_{FE}		100 to 250
	BC869-25	h_{FE}	⩾	160
$-I_C = 1$ A; $-V_{CE} = 1$ V	BC869	h_{FE}	>	60
Collector capacitance at f = 450 kHz				
$I_E = I_e = 0; -V_{CB} = 5$ V		C_c	typ.	45 pF
Transition frequency at f = 35 MHz				
$-I_C = 10$ mA; $-V_{CE} = 5$ V		f_T	typ.	60 MHz

* Mounted on a ceramic substrate, area = 2,5 cm²; thickness = 0,7 mm.

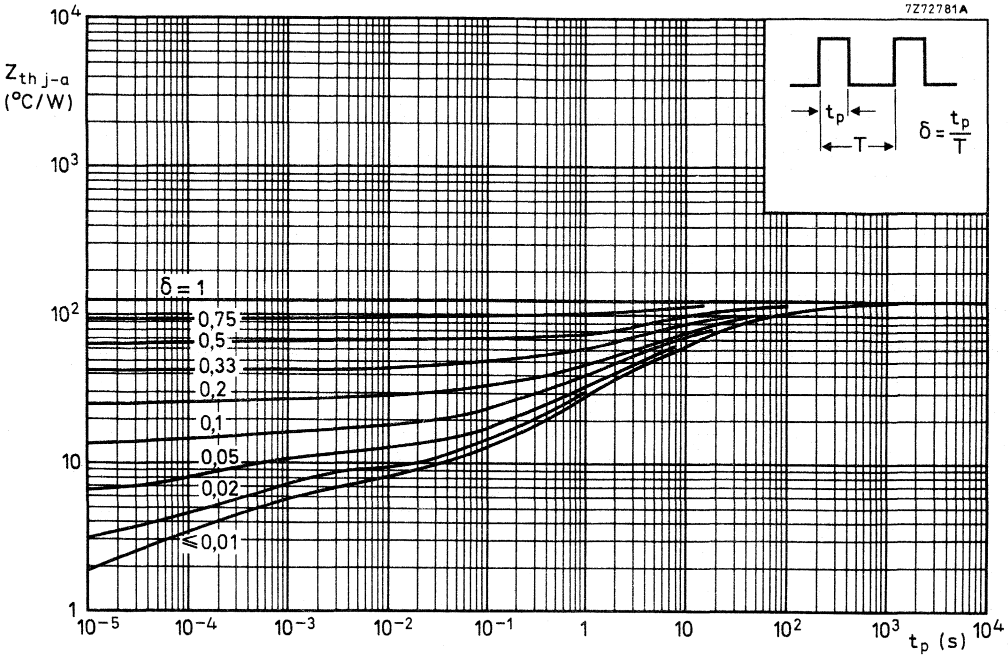


Fig. 2 Pulse power rating chart.

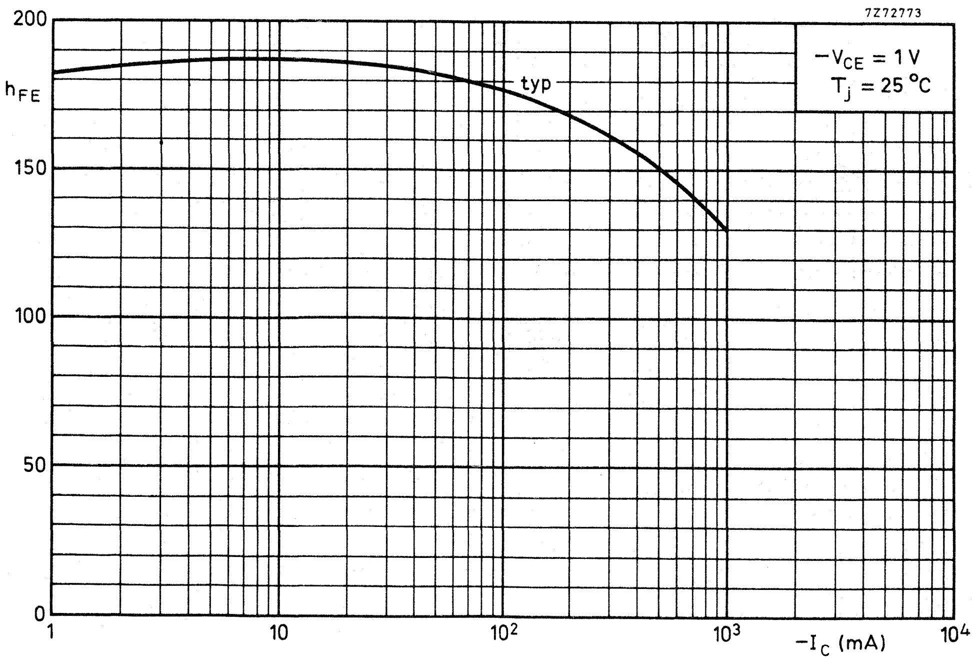


Fig. 3 D.C. current gain.

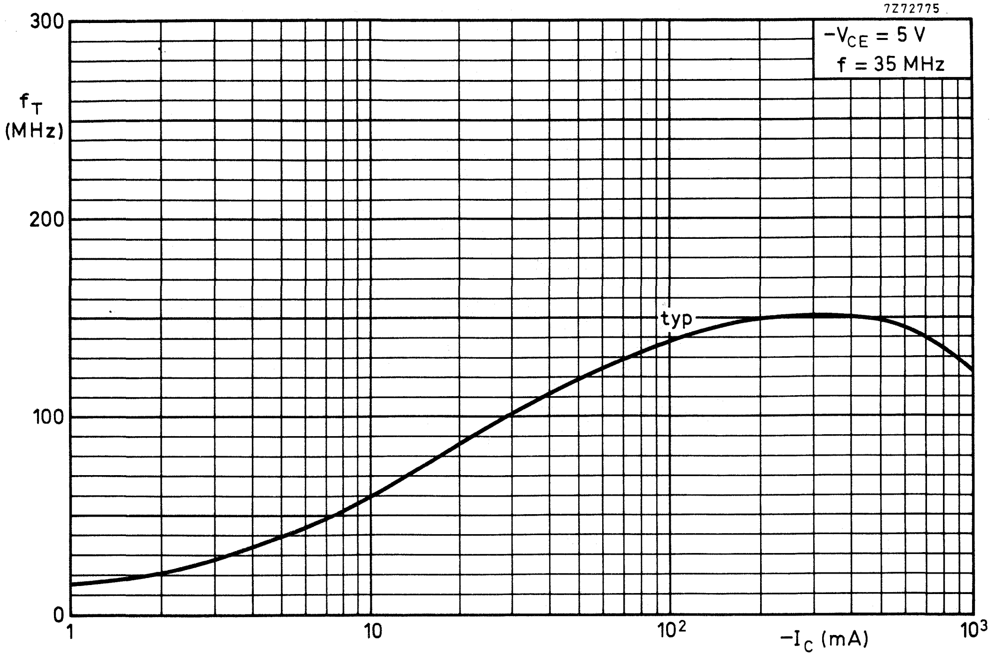


Fig. 4 Typical values transition frequency as a function of collector current.

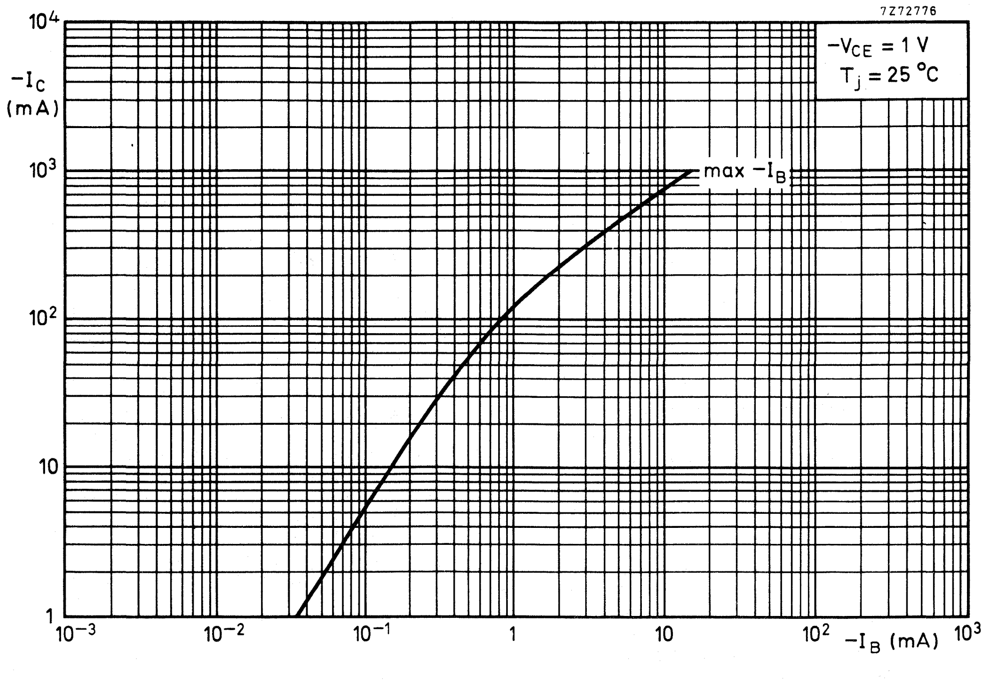


Fig. 5 Typical values collector current as a function of maximum base current.

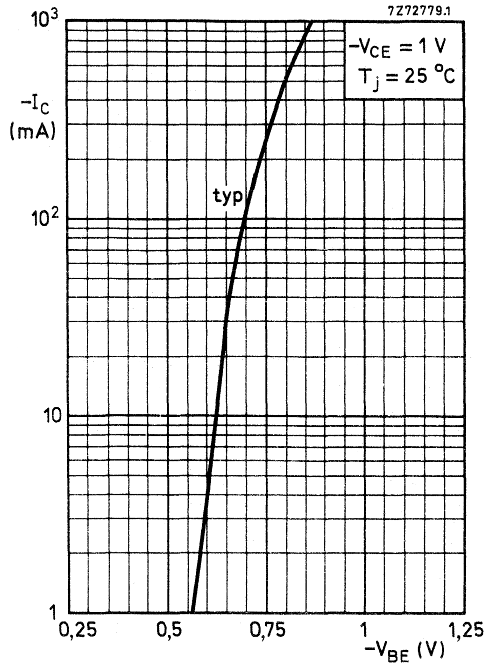


Fig. 6 Typical values collector current as a function of base-emitter voltage.

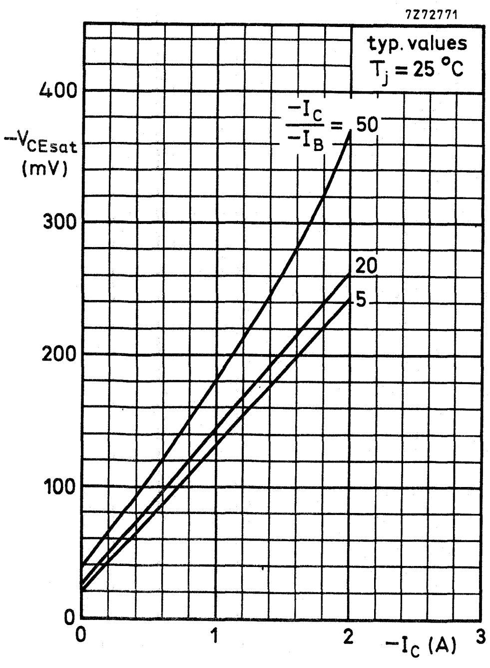


Fig. 7 Collector-emitter saturation voltage as a function of collector current.

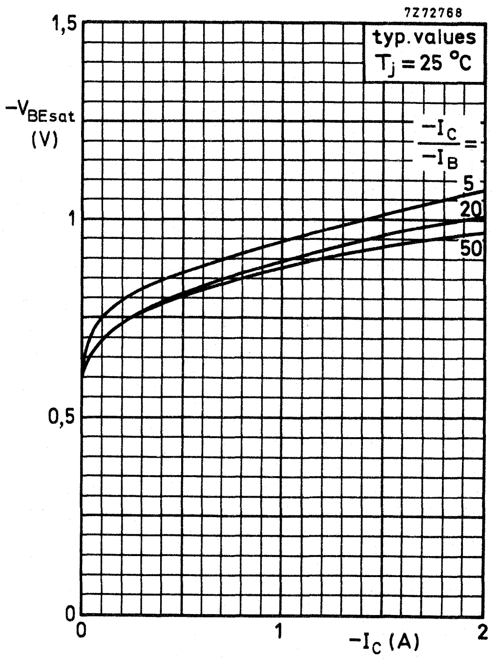


Fig. 8 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCF29	BCF30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

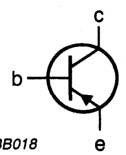
MECHANICAL DATA

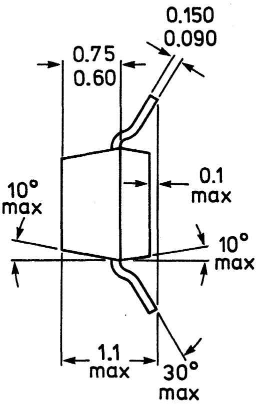
Dimensions in mm

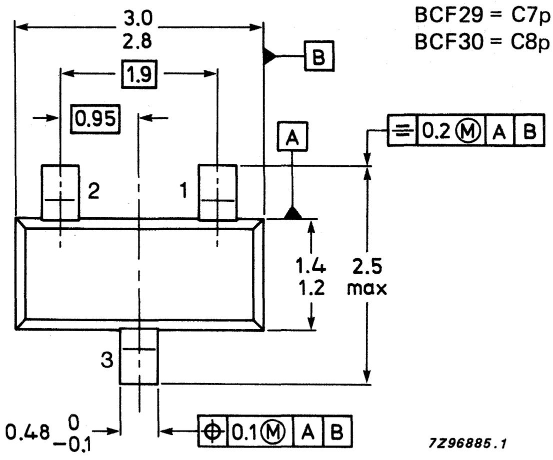
Fig. 1 SOT-23.

Marking code
BCF29 = C7p
BCF30 = C8p

Pinning:
1 = base
2 = emitter
3 = collector







TOP VIEW

Reverse pinning types are available on request.
See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C = 2$ mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$**	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB} = 32$ V	$-I_{CBO}$	<	100 nA
$I_E = 0$; $-V_{CB} = 32$ V; $T_j = 100\ ^oC$	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C = 50$ mV; $-I_B = 2{,}5$ mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

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

D.C. current gain

			BCF29	BCF30	
$-I_C = 10\ \mu A$; $-V_{CE} = 5\ V$	h_{FE}	typ.	90	150	
$-I_C = 2\ mA$; $-V_{CE} = 5\ V$	h_{FE}	>	120	215	
		<	260	500	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB} = 10\ V$	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C = 10\ mA$; $-V_{CE} = 5\ V$	f_T	typ.	150		MHz
Noise figure at $R_S = 2\ k\Omega$ $-I_C = 200\ \mu A$; $-V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	<	4		dB
		typ.	1		dB

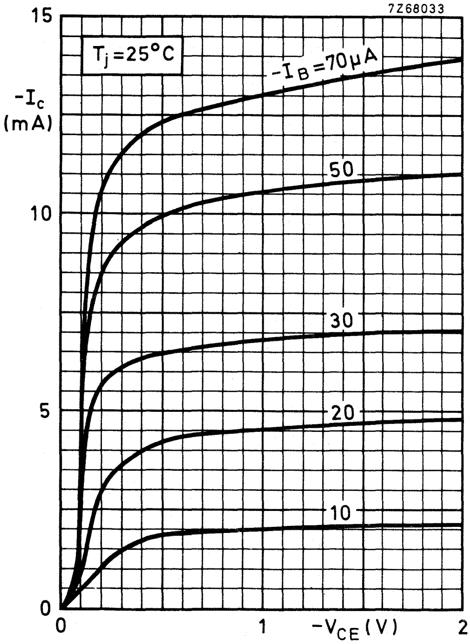


Fig. 2

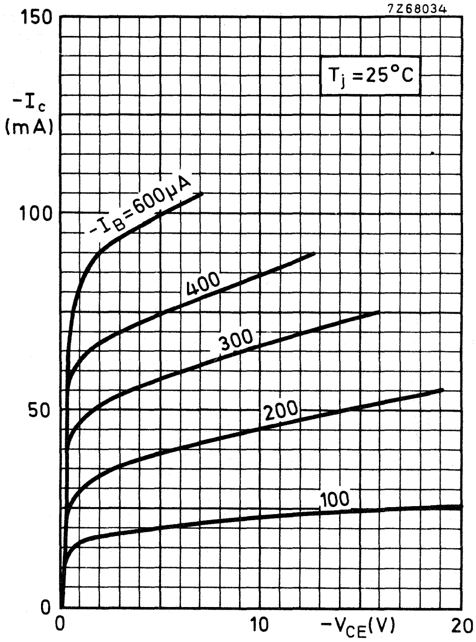


Fig. 3

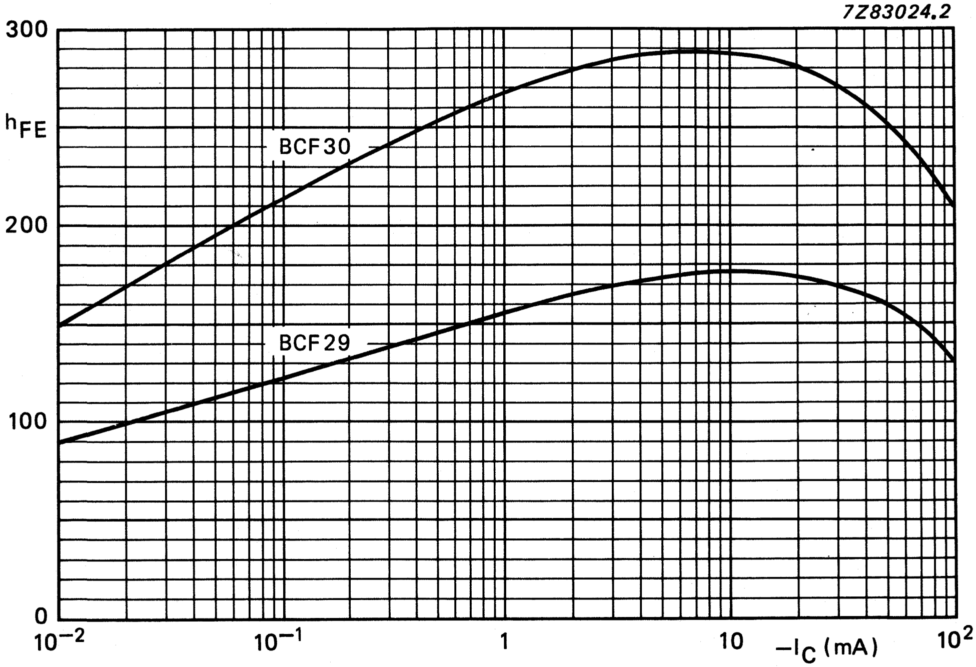


Fig. 4 Typical values of d.c. current gain. $-V_{CE}$ = 5 V; T_j = 25 °C.

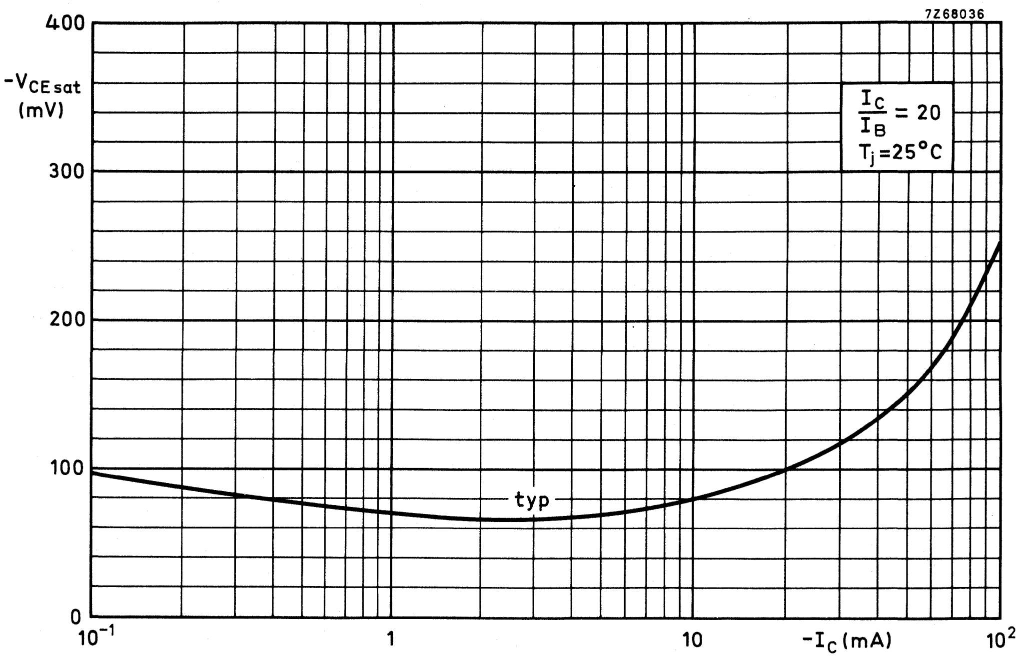


Fig. 5

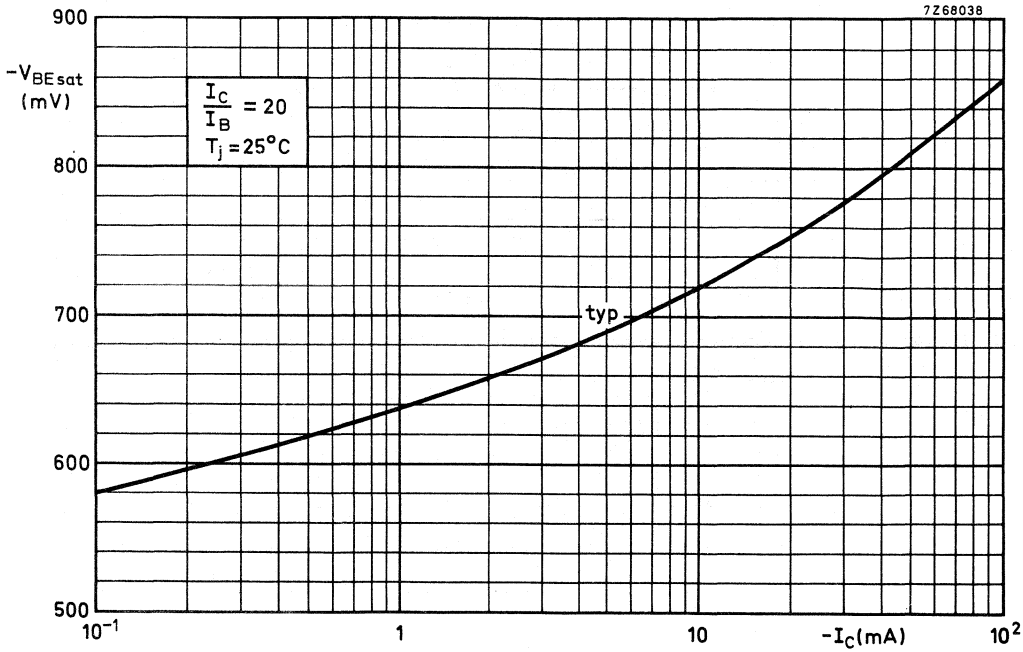

7Z68038
900
800
700
600
500
$-V_{BEsat}$
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

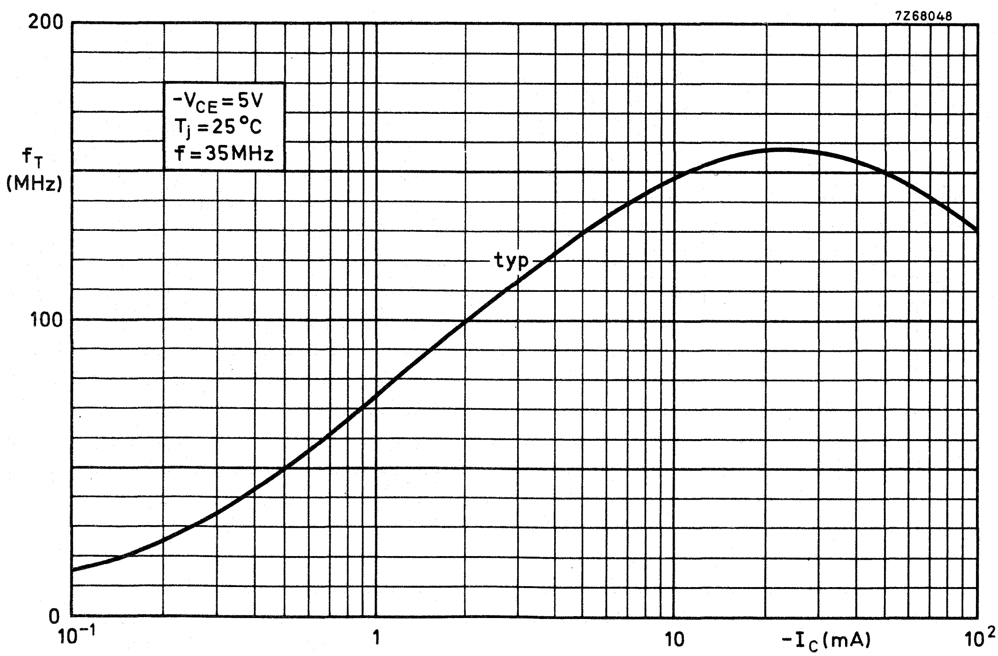

7Z68048
200
100
0
f_T
(MHz)
$-V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

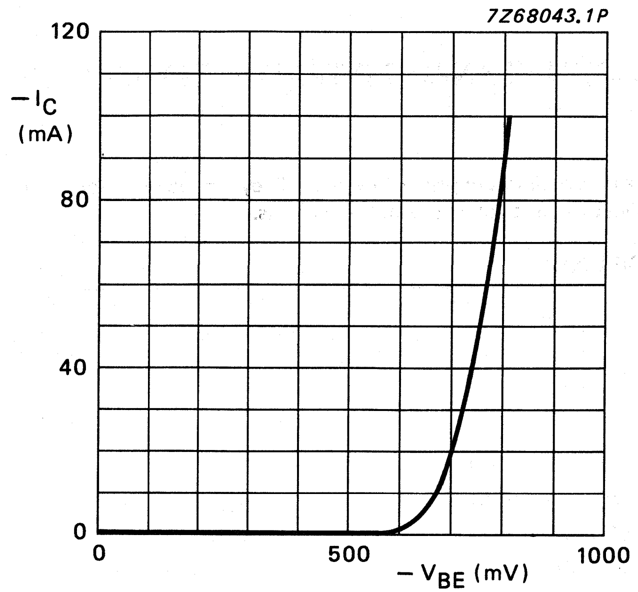


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

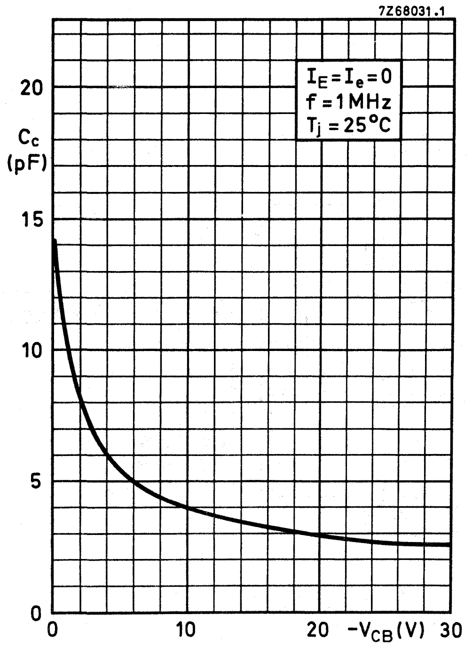


Fig. 9

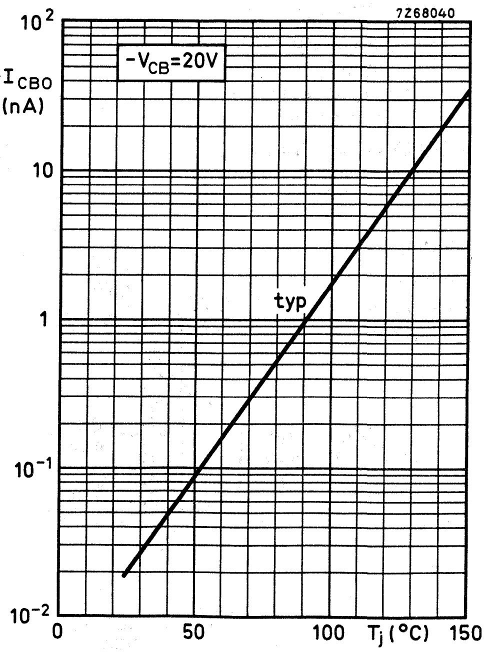


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCF32	BCF33	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	200 450	420 800	
Collector-base voltage (open emitter)	V_{CBO}	max.	32		V
Collector-emitter voltage (open base)	V_{CEO}	max.	32		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 2 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4		dB

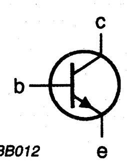
MECHANICAL DATA

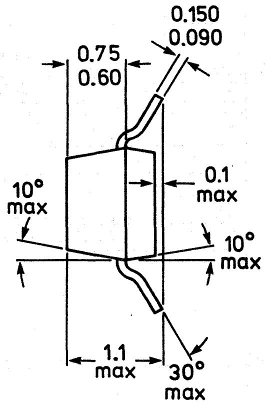
Dimensions in mm

Fig. 1 SOT-23.

Pinning:

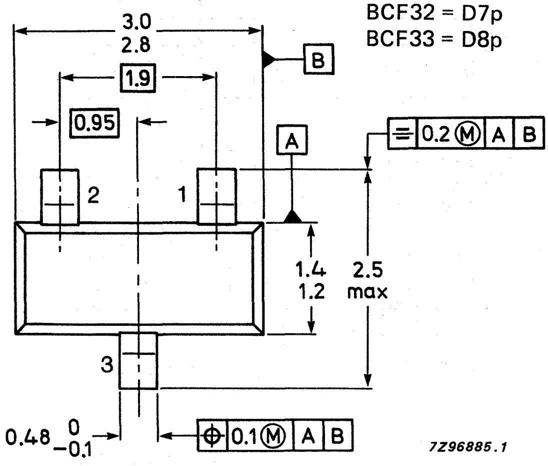
1 = base
2 = emitter
3 = collector





Marking code

BCF32 = D7p
BCF33 = D8p



Reverse pinning types are available on request.
See also *Soldering recommendations*.

TOP VIEW

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base) I_C = 2 mA	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipatation up to T_{amb} = 25 °C**	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; V_{CB} = 32 V	I_{CBO}	<	100 nA
$I_E = 0$; V_{CB} = 32 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base-emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to 700 mV	
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

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

			BCF32	BCF33
D.C. current gain				
$I_C = 10\ \mu A$; $V_{CE} = 5\ V$	h_{FE}	typ.	150	270
		>	200	420
$I_C = 2\ mA$; $V_{CE} = 5\ V$	h_{FE}	<	450	800
Collector capacitance at f = 1 MHz; $I_E = I_e = 0$; $V_{CB} = 10\ V$	C_c	typ.	2,5 pF	
Transition frequency at f = 35 MHz; $I_C = 10\ mA$; $V_{CE} = 5\ V$	f_T	typ.	300 MHz	
Noise figure at $R_S = 2\ k\Omega$; $I_C = 200\ \mu A$; $V_{CE} = 5\ V$; f = 1 kHz; B = 200 Hz	F	<	4 dB	
		typ.	1,2 dB	

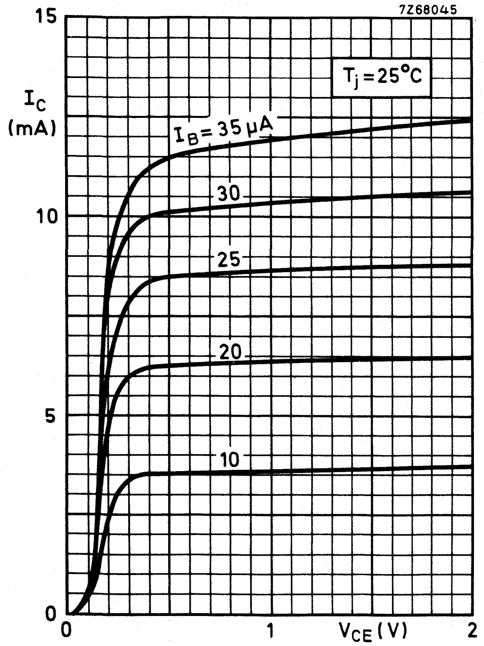


Fig. 2

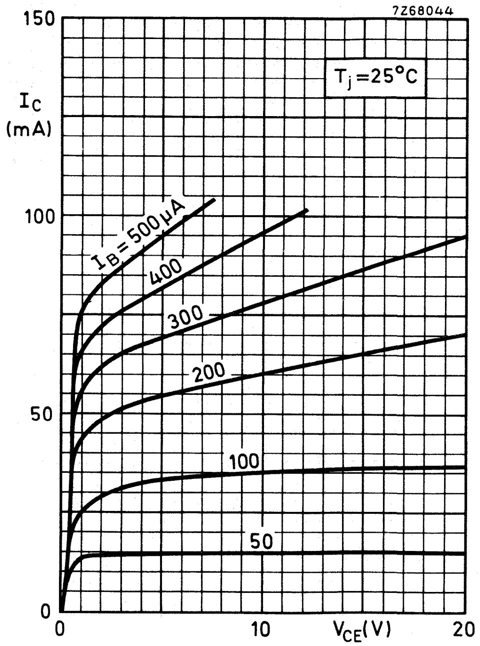


Fig. 3

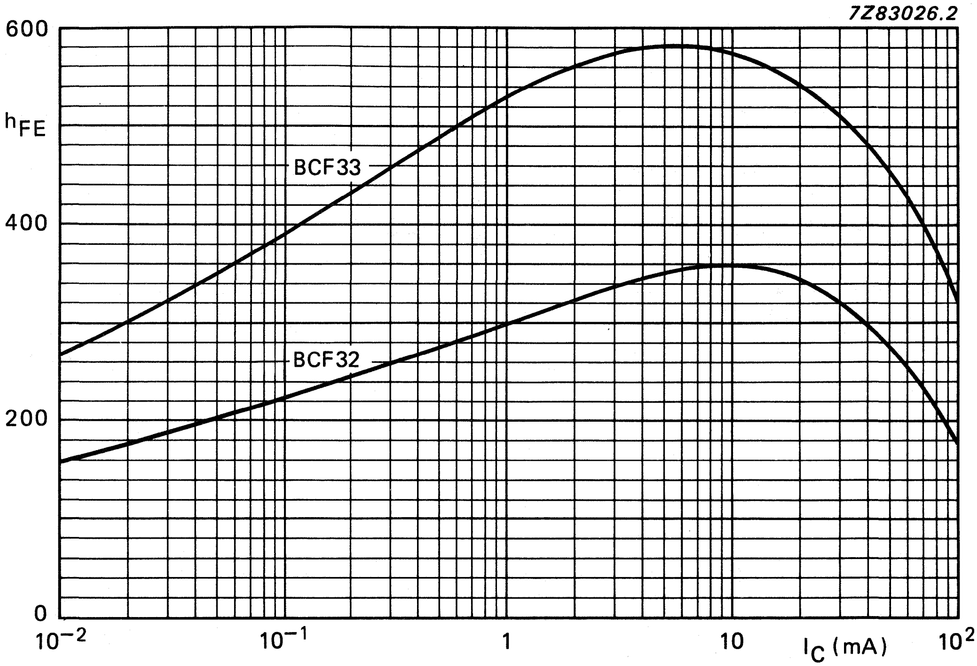


Fig. 4 Typical values d.c. current gain. V_{CE} = 5 V; T_j = 25 °C.

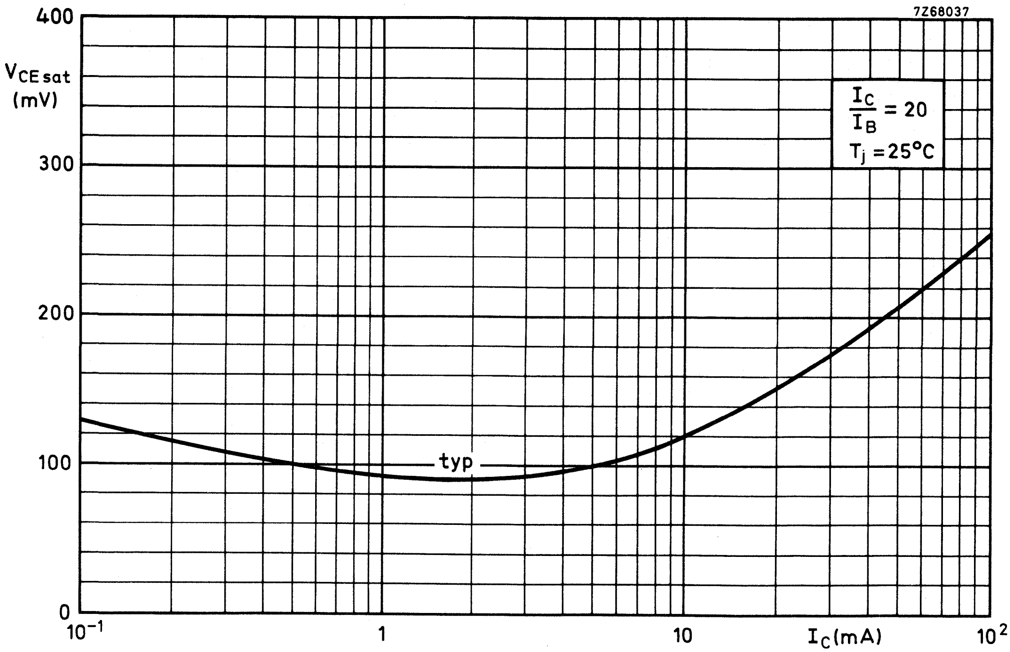


Fig. 5

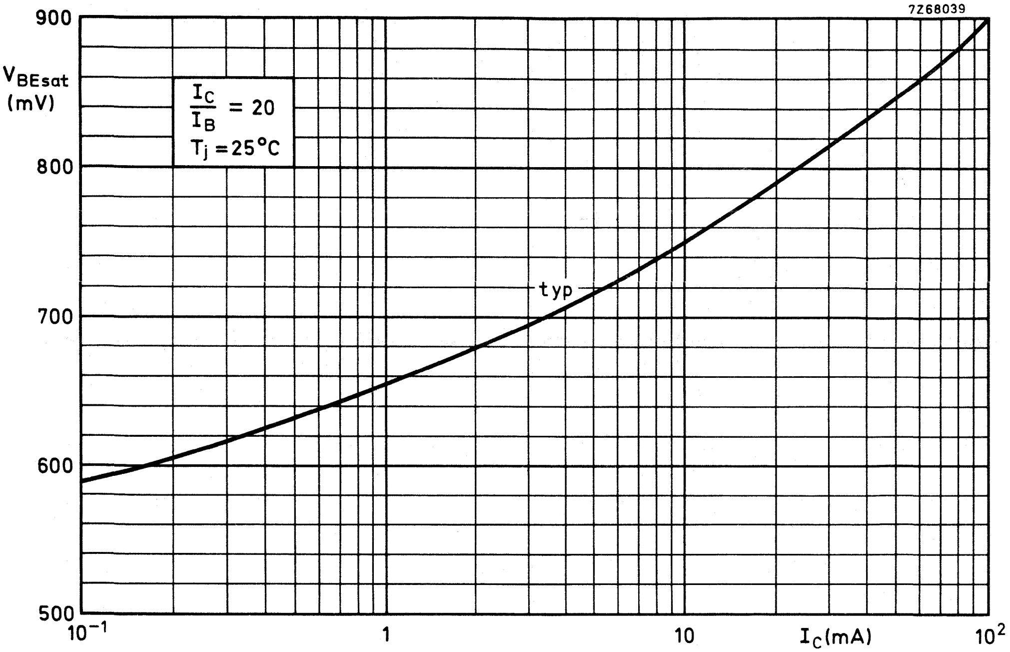

7Z68039
900
800
700
600
500
VBEsat
(mV)
IC/IB = 20
Tj = 25°C
typ
10−1
1
10
IC(mA)
10²

Fig. 6

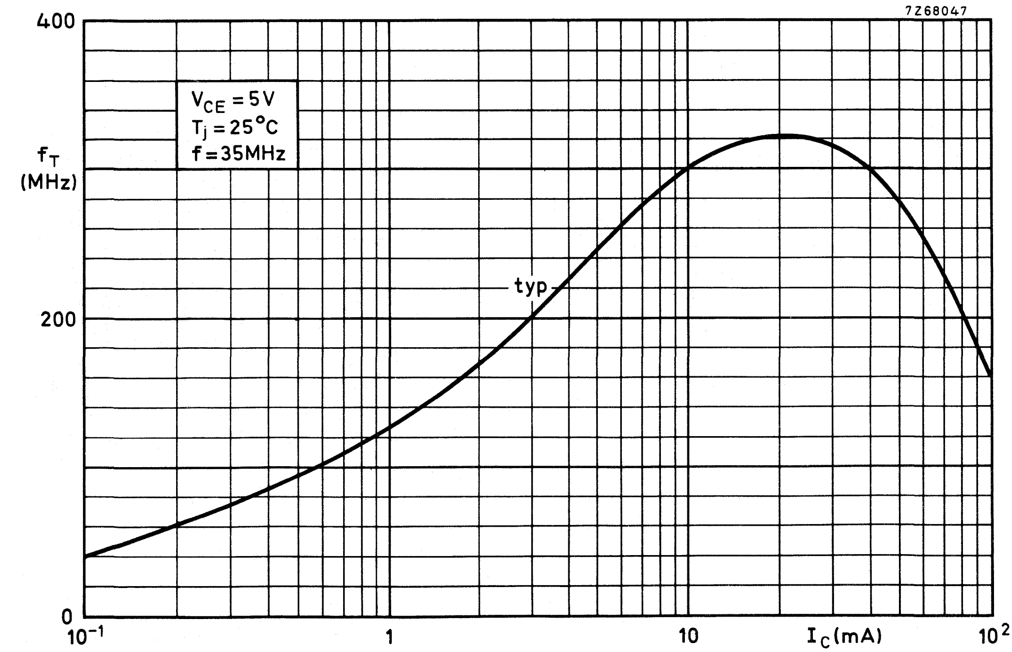

7Z68047
400
200
0
fT
(MHz)
VCE = 5 V
Tj = 25°C
f = 35MHz
typ
10−1
1
10
IC(mA)
10²

Fig. 7

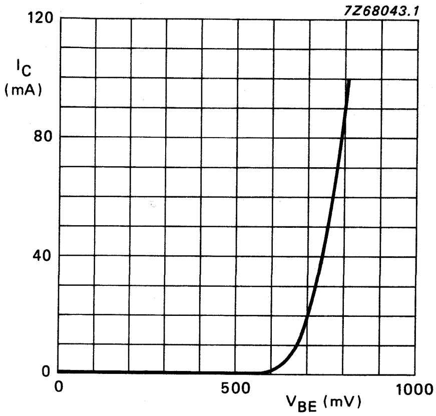


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

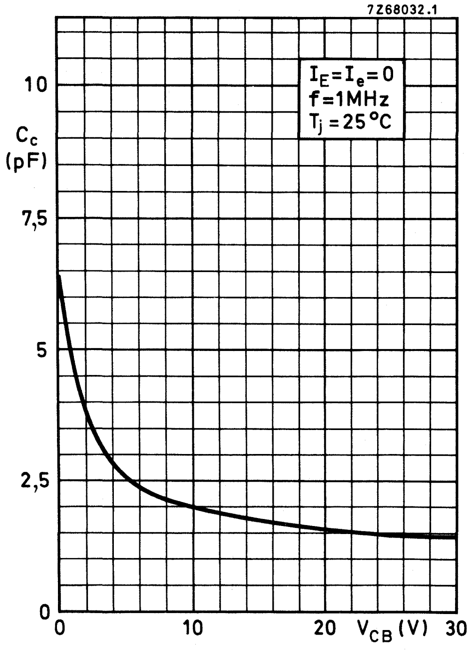


Fig. 9

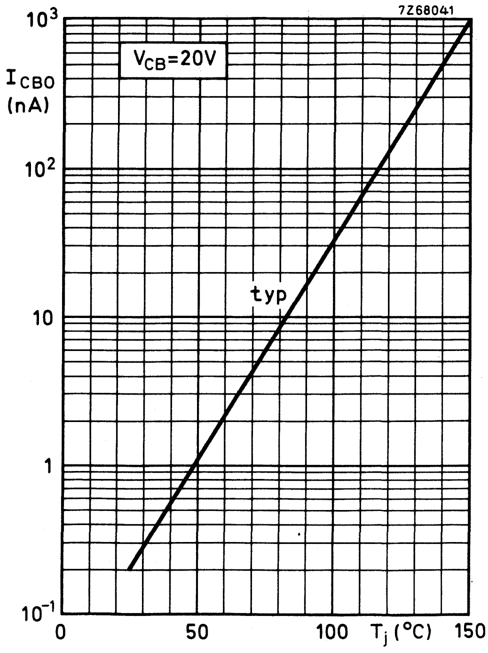


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level, low noise applications in thick and thin-film circuits.

QUICK REFERENCE DATA

D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Dimensions in mm

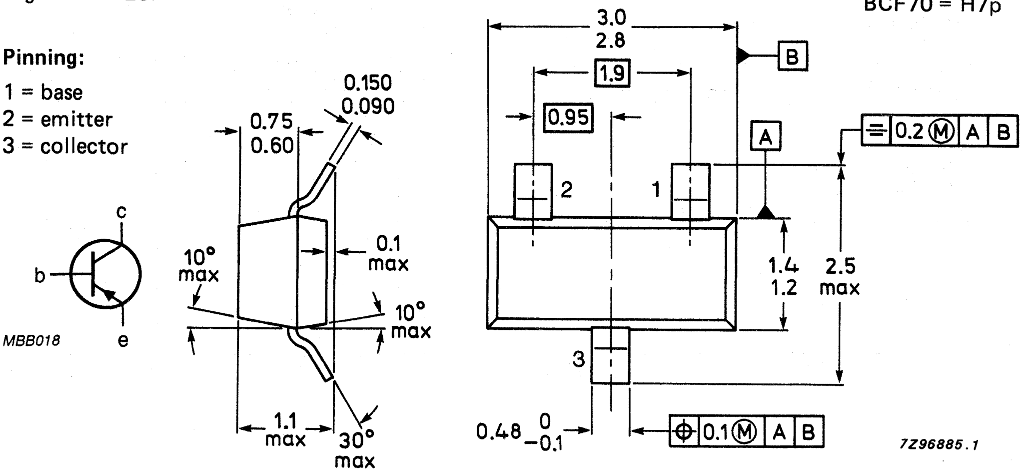
Marking code

BCF70 = H7p

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector



TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50 V
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	50 V
Collector-emitter voltage (open base) $-I_C = 2$ mA	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		–65 to + 150 ^oC
Junction temperature	T_j	max.	150 ^oC

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 25\ ^oC$	$-I_{CBO}$	<	100 nA
$T_j = 100\ ^oC$	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C = 2$ mA; $-V_{CE} = 5$ V; $T_j = 25\ ^oC$	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C = 50$ mA; $-I_B = 2,5$ mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

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

D.C. current gain			
$-I_C = 10\ \mu A; -V_{CE} = 5\ V$	h_{FE}	typ.	150
$-I_C = 2\ mA; -V_{CE} = 5\ V$	h_{FE}	> <	215 500
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0; -V_{CB} = 10\ V$	C_c	typ.	4,5 pF
Transition frequency at f = 35 MHz			
$-I_C = 10\ mA; -V_{CE} = 5\ V$	f_T	typ.	150 MHz
Noise figure at $R_S = 2\ k\Omega$			
$-I_C = 200\ \mu A; -V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	< typ.	4 dB 1 dB

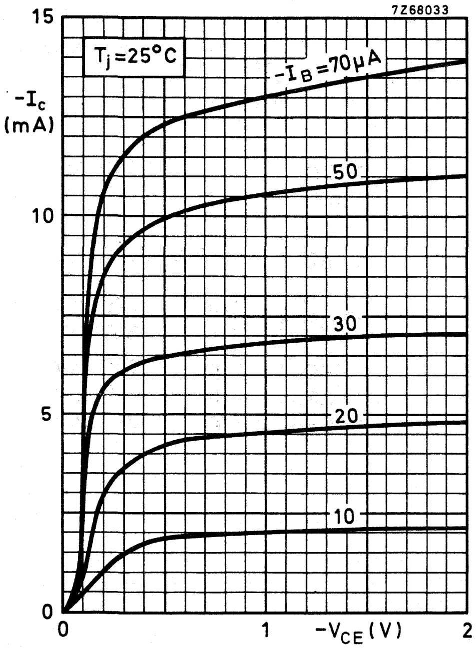


Fig. 2

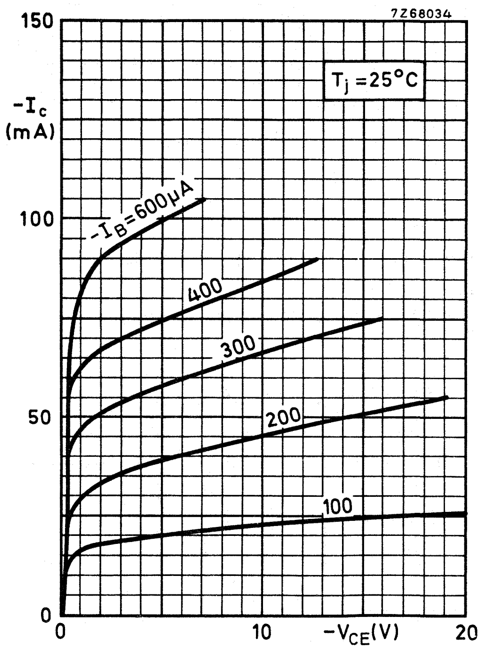


Fig. 3

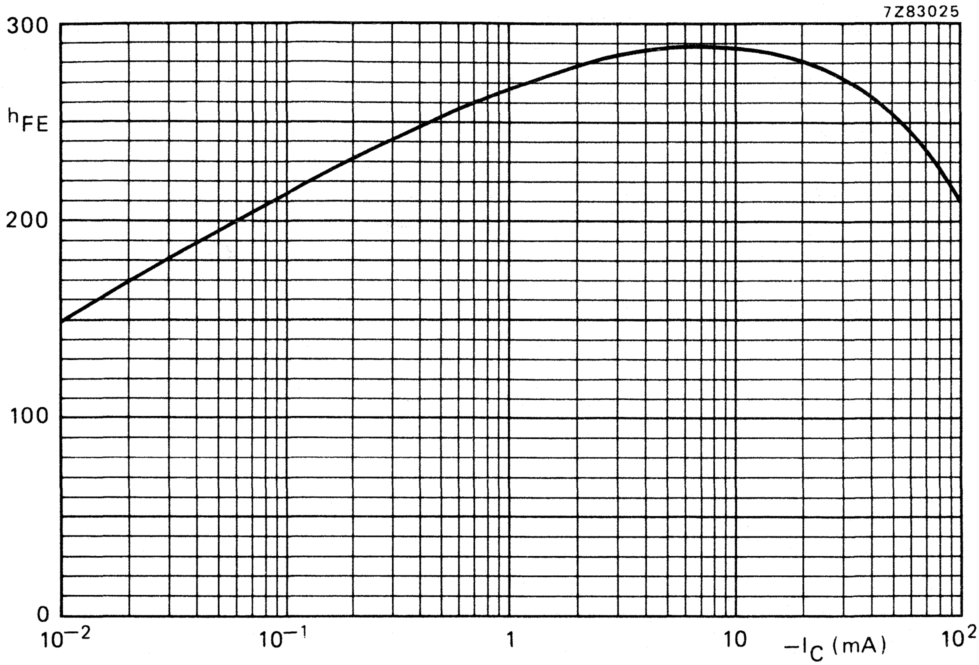


Fig. 4 Typical values of d.c. current gain. $-V_{CE}$ = 5 V; T_j = 25 °C.

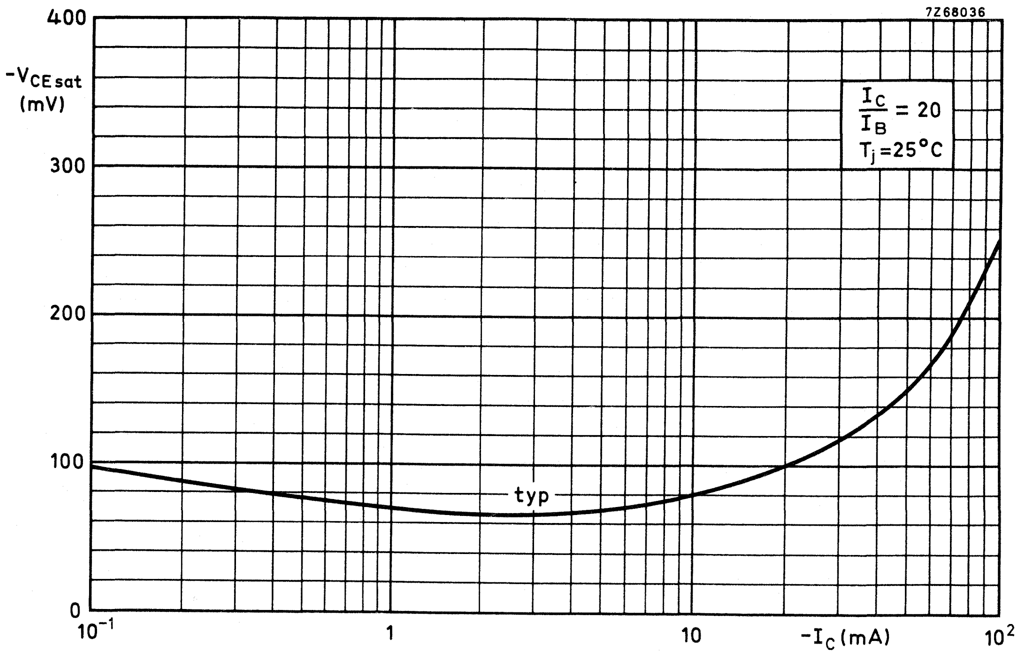


Fig. 5

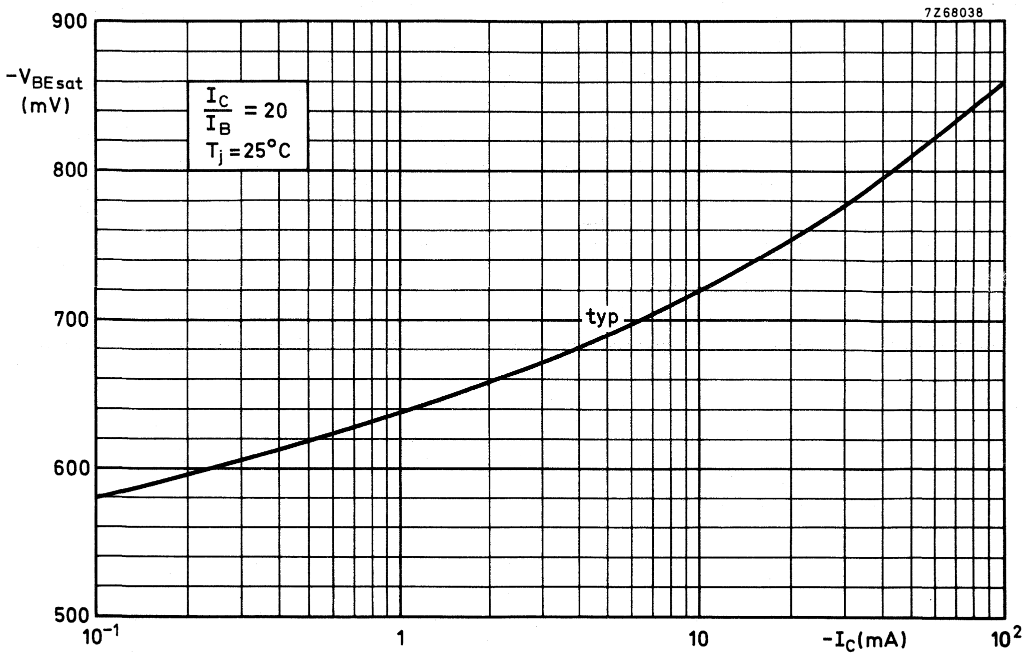

7Z68038
900
800
700
600
500
$-V_{BEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

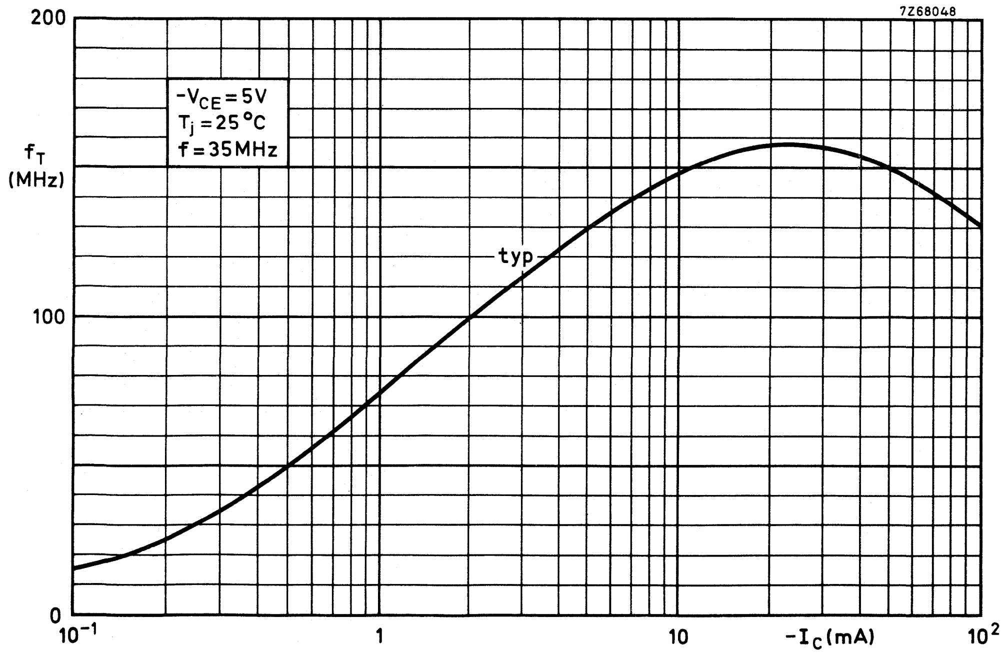

7Z68048
200
100
0
f_T (MHz)
$-V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

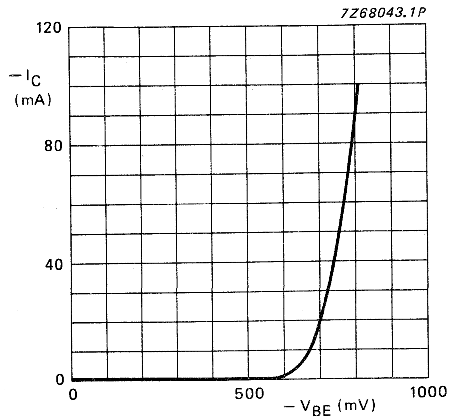


Fig. 8 $-V_{CE}$ = 5 V; T_j = 25 °C; typical values.

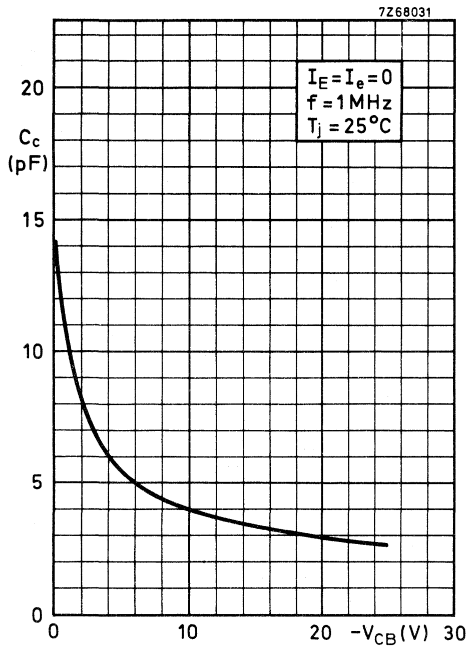


Fig. 9

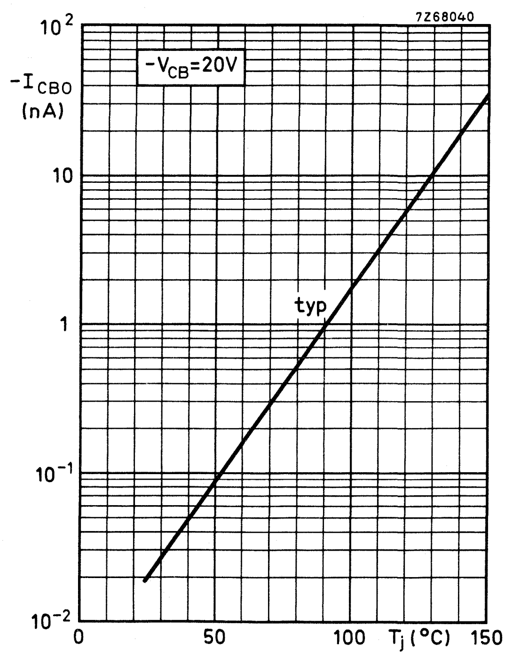


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level, low noise general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	420 800	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	4	dB

MECHANICAL DATA

Dimensions in mm

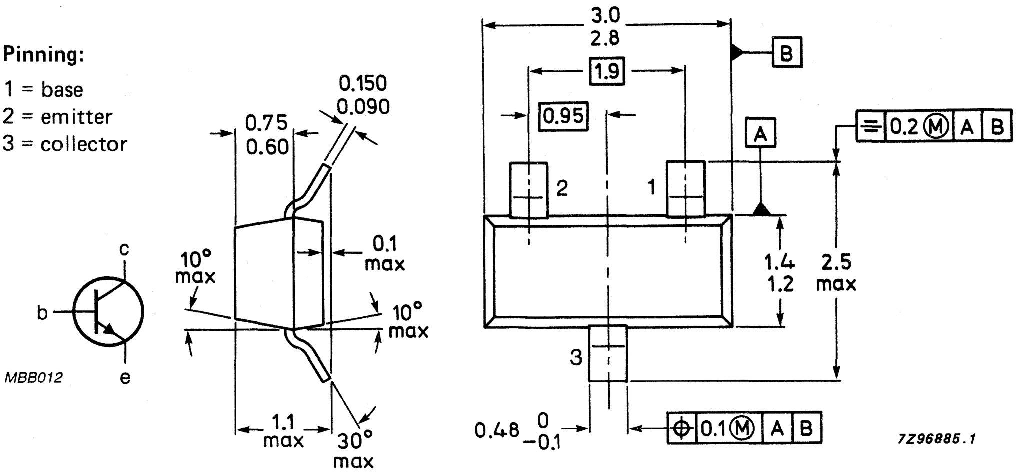
Marking code

BCF81 = K9p

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector



TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	50 V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$**	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	–65 to + 150	^oC
Junction temperature	T_j	max.	150 ^oC

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100 nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100\ ^oC$	I_{CBO}	<	10 μA
Base emitter voltage			
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	550 to 700	mV
Saturation voltages			
$I_C = 10$ mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV
D.C. current gain			
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	420
		<	800
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5 pF
Transition frequency at f = 35 MHz			
$I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300 MHz
Noise figure at $R_S = 2\ k\Omega$			
$I_C = 200\ \mu$A; $V_{CE} = 5$ V			
f = 1 kHz; B = 200 Hz	F	<	4 dB
		typ.	1,2 dB

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

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power pnp transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

NPN complements are BCP54, BCP55 and BCP56 respectively.

QUICK REFERENCE DATA

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

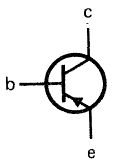
MECHANICAL DATA

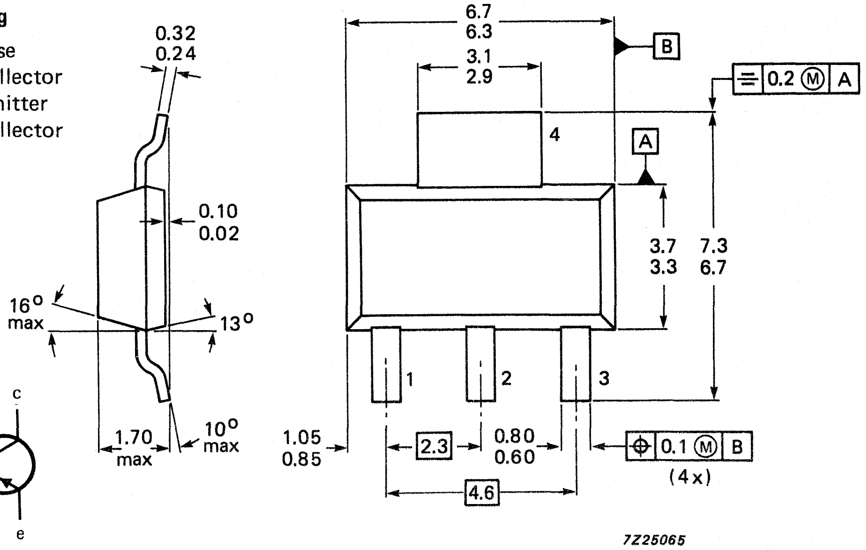
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

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

			BCP51	BCP52	BCP53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (DC)	$-I_C$	max.		1,0		A
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Base current (DC)	$-I_B$	max.		0,1		A
Base current (peak value)	$-I_{BM}$	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB}$ = 30 V; T_j = 125 °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
$I_C = 0$; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	0,5	V
DC current gain				
$-I_C$ = 5 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		40 to 250	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	50	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

CHARACTERISTICS (continued)

			BCP51-10 52-10 53-10	BCP51-16 52-16 53-16
DC current gain I_C = 150 mA; $-V_{CE}$ = 2 V	h_{FE}	> <	63 160	100 250

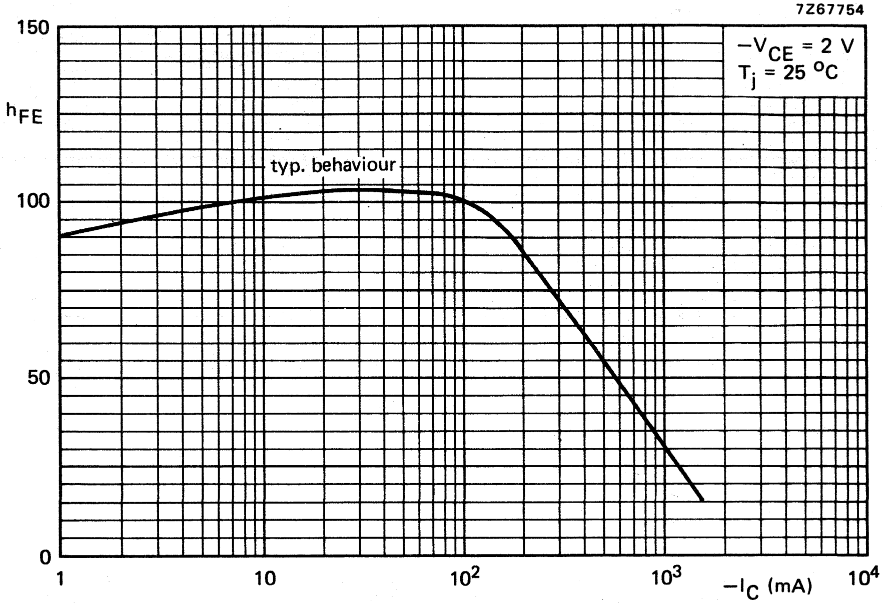


Fig. 2.

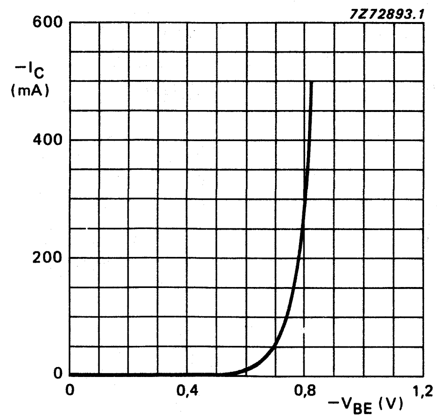


Fig. 3 $-V_{CE}$ = 2 V; T_j = 25 °C; typical values.

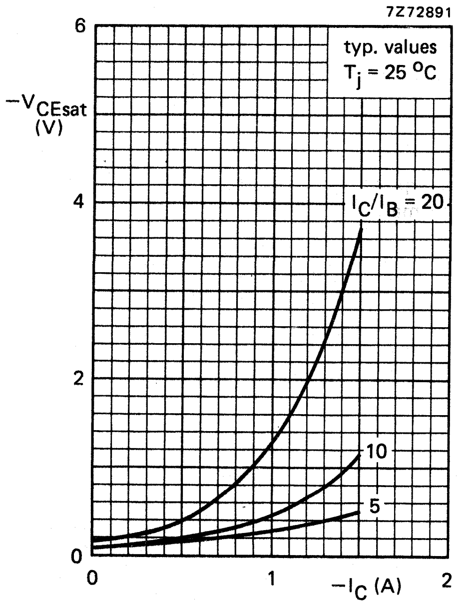


Fig. 4.

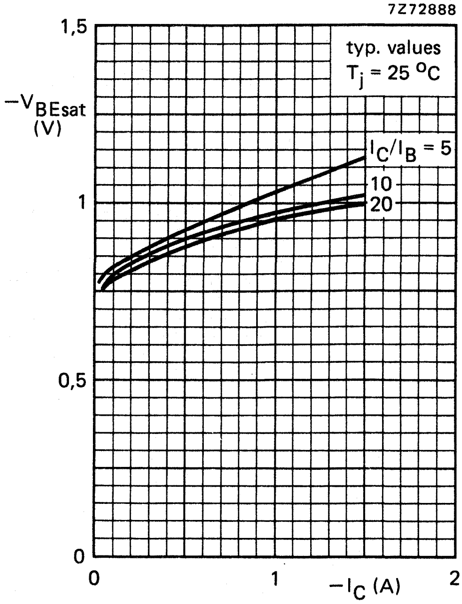


Fig. 5.

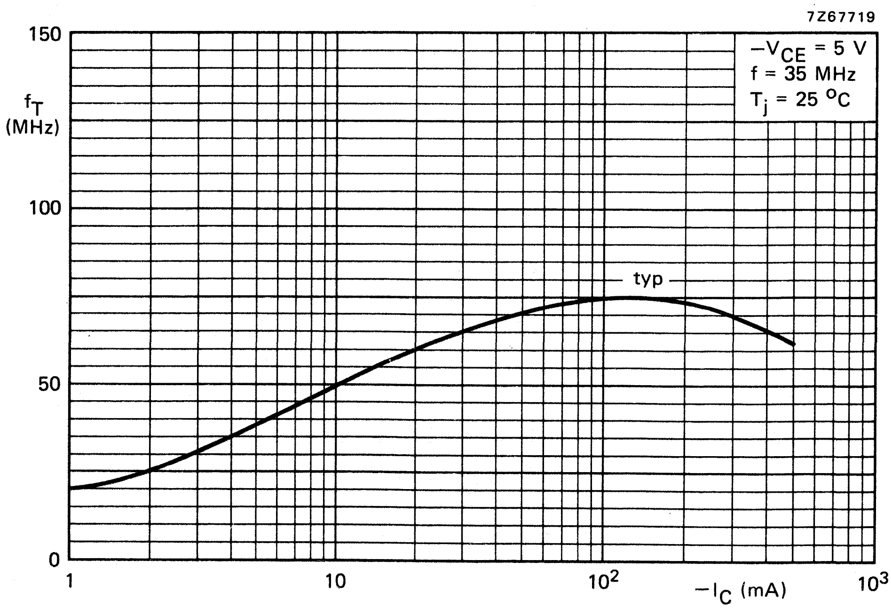


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power npn transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. They are general purpose transistors, primarily designed for audio amplifier output stages.

PNP complements are BCP51, BCP52 and BCP53 respectively.

QUICK REFERENCE DATA

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1,5		W
Junction temperature	T_j	max.		150		°C
DC current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

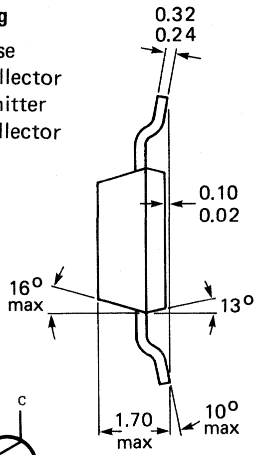
MECHANICAL DATA

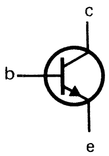
Dimensions in mm

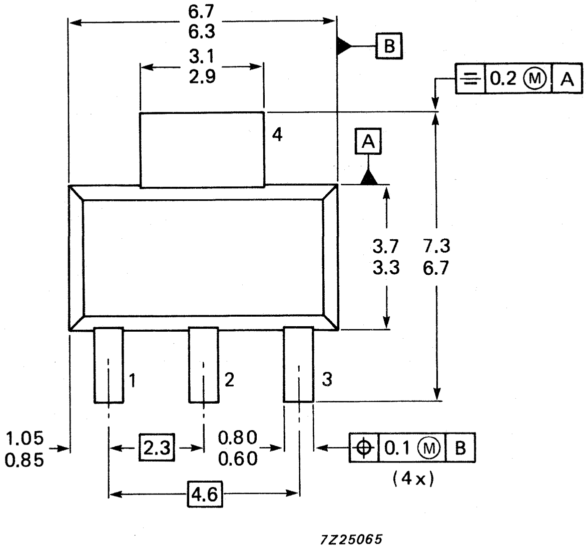
Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector







RATINGS

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

			BCP54	BCP55	BCP56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V
Collector current (DC)	I_C	max.		1,0		A
Collector current (peak value)	I_{CM}	max.		1,5		A
Base current (DC)	I_B	max.		0,1		A
Base current (peak value)	I_{BM}	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.		1,5		W
Storage temperature range	T_{stg}			−65 to +150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 30$ V	I_{CBO}	$<$	100	nA
$I_E = 0$; $V_{CB} = 30$ V; $T_j = 125$ °C	I_{CBO}	$<$	10	μA
Emitter cut-off current				
$I_C = 0$; $V_{EB} = 5$ V	I_{EBO}	$<$	10	μA
Base-emitter voltage				
$I_C = 500$ mA; $V_{CE} = 2$ V	V_{BE}	$<$	1	V
Saturation voltage				
$I_C = 500$ mA; $I_B = 50$ mA	V_{CEsat}	$<$	0,5	V
DC current gain				
$I_C = 5$ mA; $V_{CE} = 2$ V	h_{FE}	$>$	25	
$I_C = 150$ mA; $V_{CE} = 2$ V	h_{FE}		40 to 250	
$I_C = 500$ mA; $V_{CE} = 2$ V	h_{FE}	$>$	25	
Transition frequency at f = 35 MHz				
$I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	130	MHz

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm².

CHARACTERISTICS (continued)

			BCP54-10 55-10 56-10	BCP54-16 55-16 56-16
DC current gain		>	63	100
I_C = 150 mA; V_{CE} = 2 V	h_{FE}	<	160	250

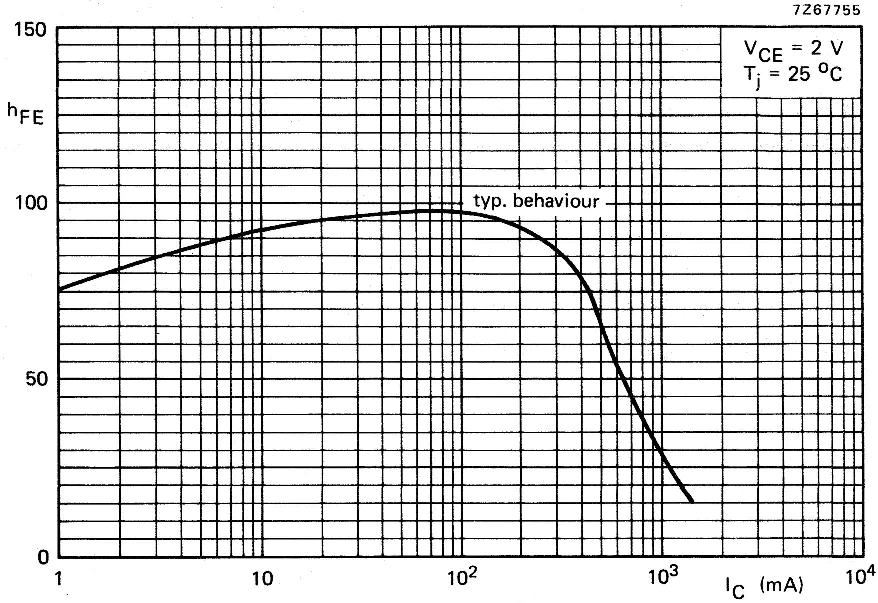


Fig. 2.

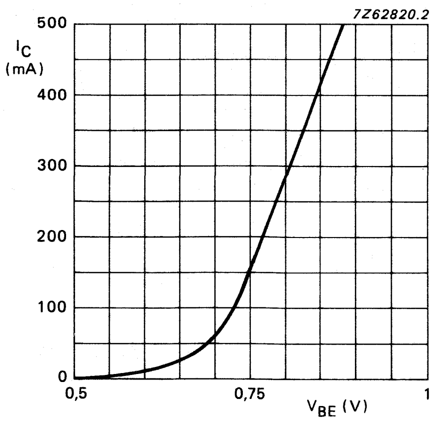


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

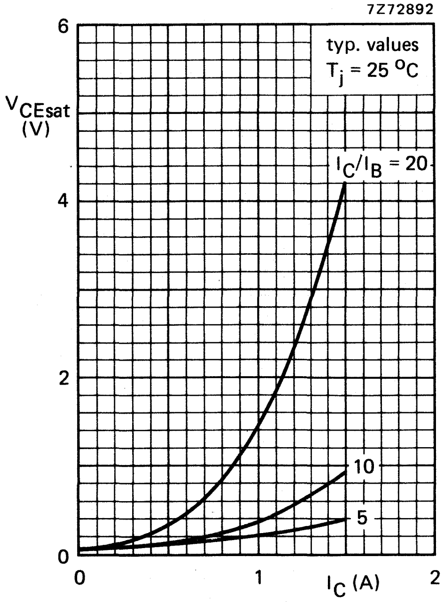


Fig. 4.

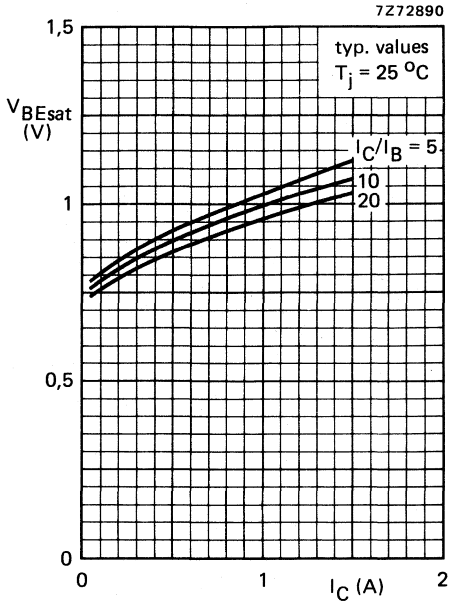


Fig. 5.

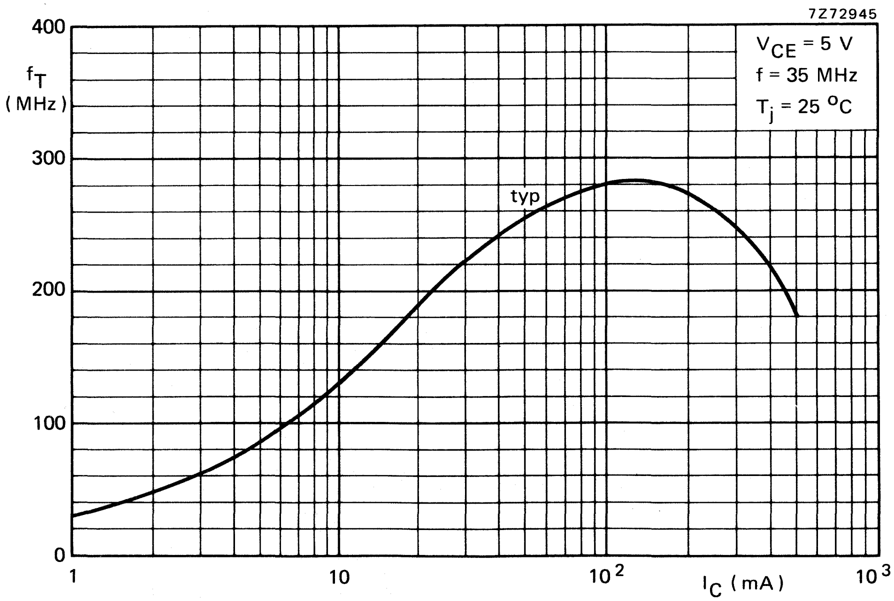


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTOR

NPN transistor in a microminiature plastic envelope intended for low-voltage, high-current LF applications.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Collector current (peak value)	I_{CM}	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	150	°C
DC current gain I_C = 500 mA; V_{CE} = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	60	MHz

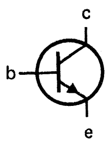
MECHANICAL DATA

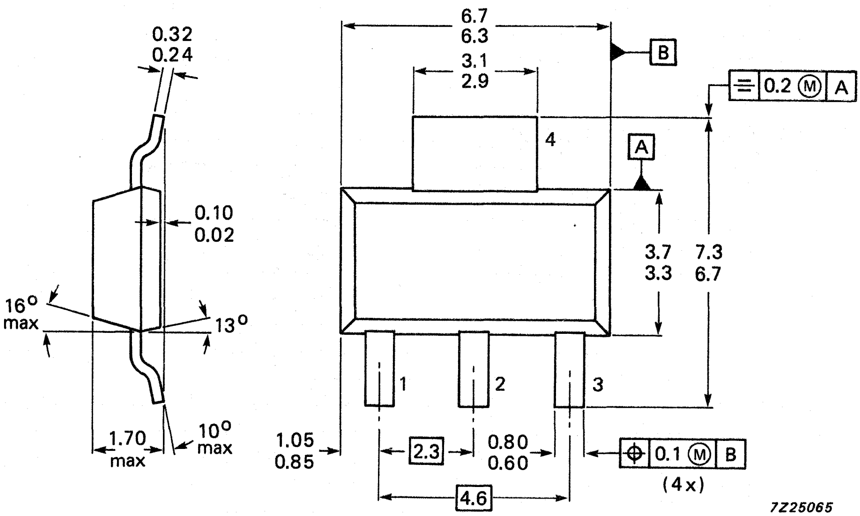
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (DC)	I_C	max.	1	A
Collector current (peak value)	I_{CM}	max.	2	A
Base current (DC)	I_B	max.	100	mA
Base current (peak value)	I_{BM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
I_E = 0; V_{CB} = 25 V		I_{CBO}	<	10	μA
I_E = 0; V_{CB} = 25 V; T_j = 150 °C		I_{CBO}	<	1	mA
Emitter cut-off current					
I_C = 0; V_{EB} = 5 V		I_{EBO}	<	10	μA
Base-emitter voltage					
I_C = 5 mA; V_{CE} = 10 V		V_{BE}	typ.	0,62	V
I_C = 1 A; V_{CE} = 1 V		V_{BE}	<	1	V
Collector-emitter saturation voltage					
I_C = 1 A; I_B = 100 mA		V_{CEsat}	<	0,5	V
DC current gain					
I_C = 5 mA; V_{CE} = 10 V	BCP68	h_{FE}	>	50	
I_C = 500 mA; V_{CE} = 1 V	BCP68	h_{FE}		85 to 375	
	BCP68-10	h_{FE}	⩽	160	
	BCP68-16	h_{FE}		100 to 250	
	BCP68-25	h_{FE}	⩾	250	
I_C = 1 A; V_{CE} = 1 V	BCP68	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
I_E = I_e = 0; V_{CB} = 5 V		C_c	typ.	27	pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V		f_T	typ.	60	MHz

* Device mounted on an epoxy printed-circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

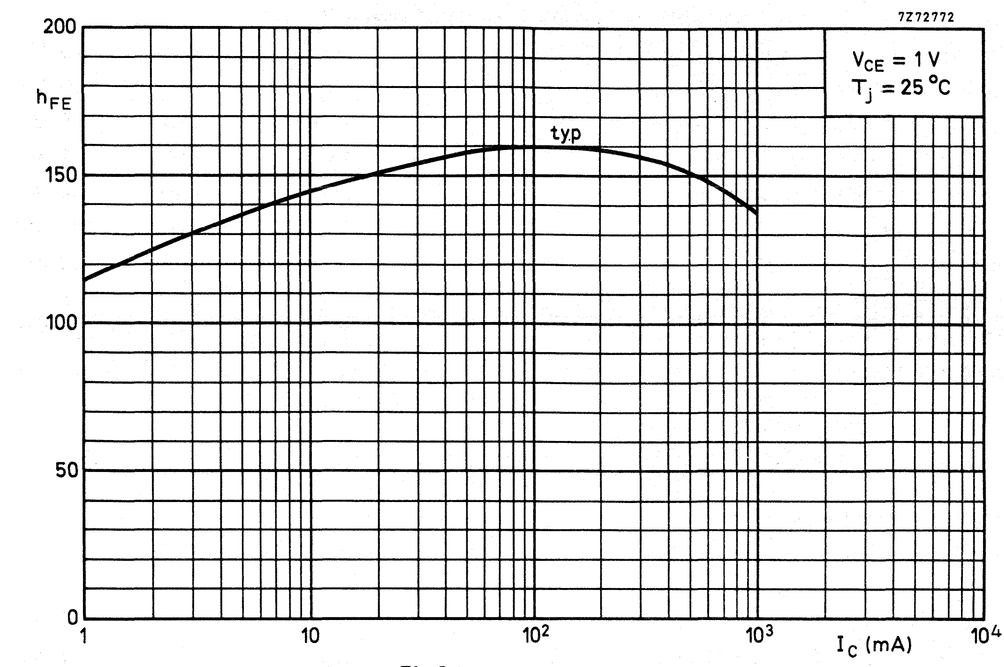


Fig.2 DC current gain.

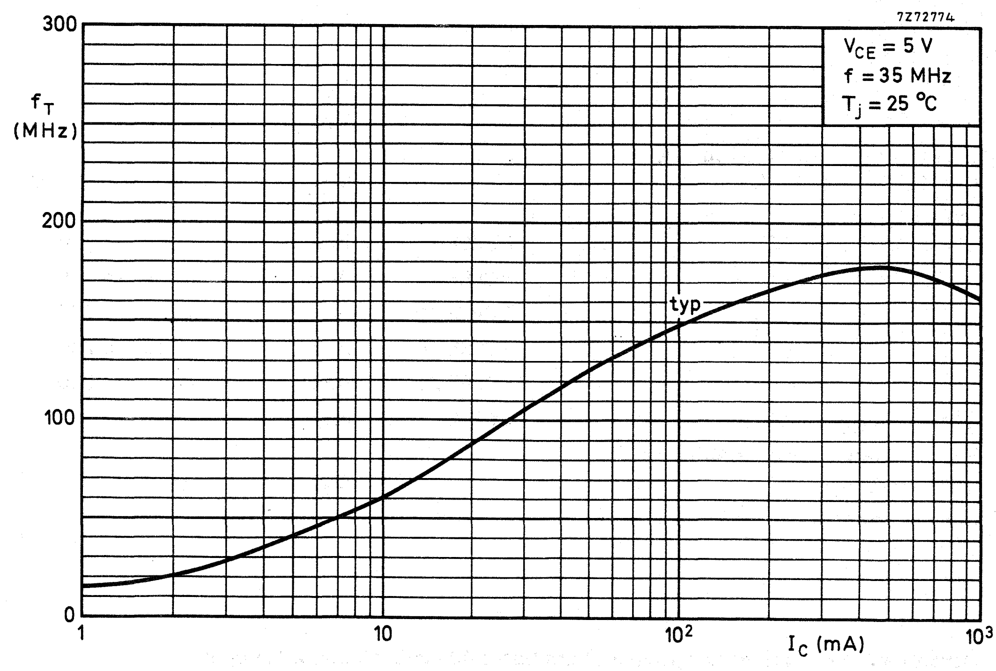


Fig.3 Typical values transition frequency as a function of collector current.

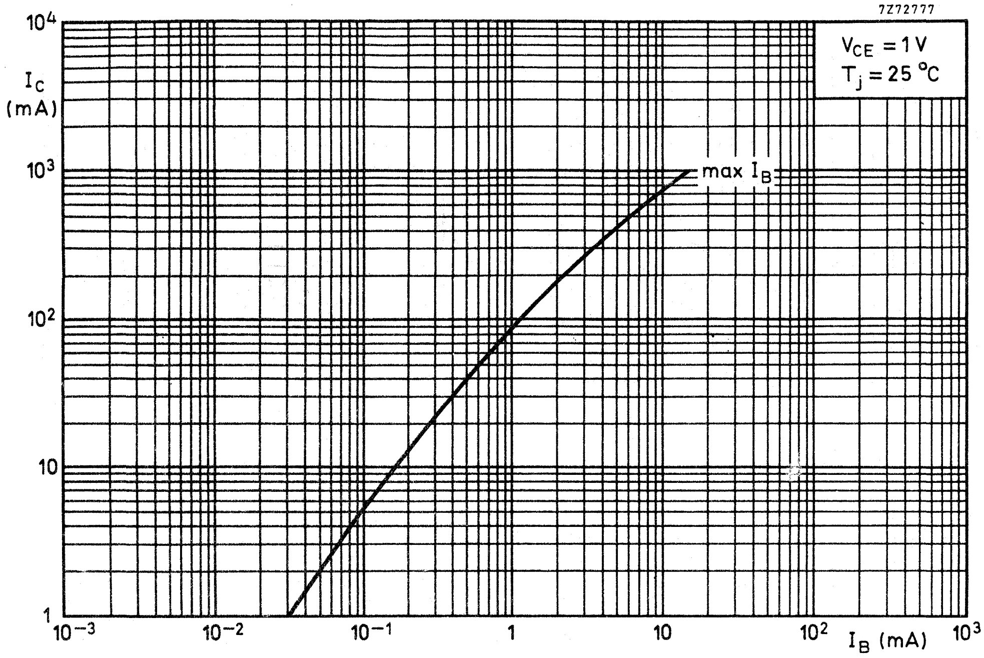


Fig.4 Typical values collector current as a function of maximum base current.

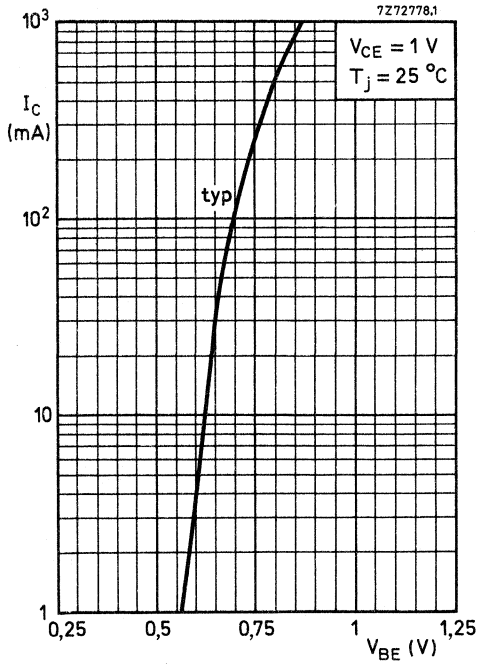


Fig.5 Typical values collector current as a function of base-emitter voltage.

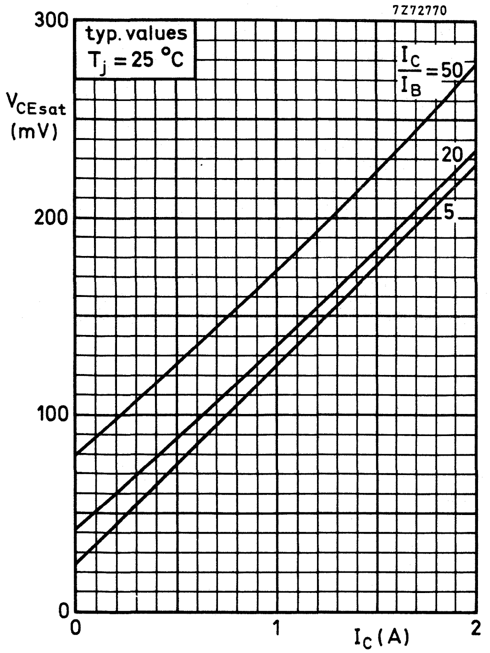


Fig.6 Collector-emitter saturation voltage as a function of collector current.

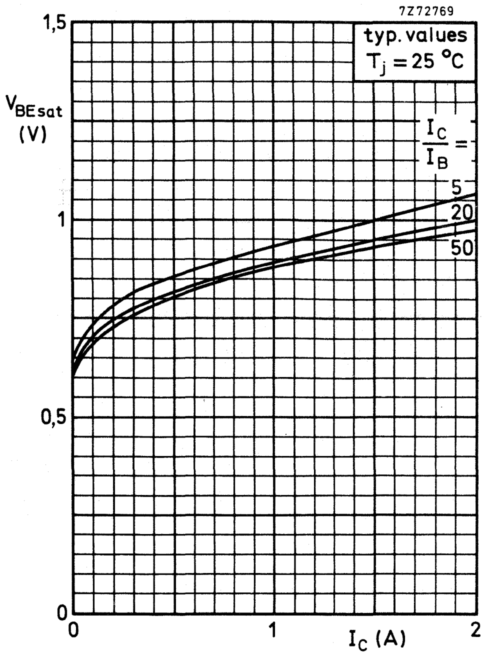


Fig.7 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR EPITAXIAL TRANSISTOR

PNP transistor in a plastic microminiature envelope, intended for low-voltage, high-current LF applications.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current (peak value)	$-I_{CM}$	max.	2	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5	W
Junction temperature	T_j	max.	150	°C
DC current gain $-I_C$ = 500 mA; $-V_{CE}$ = 1 V	h_{FE}		85 to 375	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	60	MHz

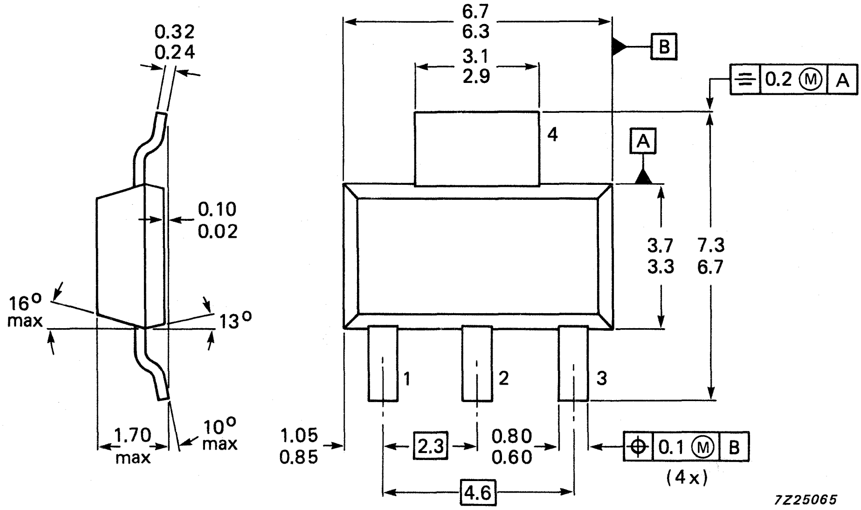
MECHANICAL DATA

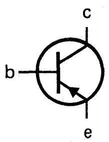
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	25	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (DC)	$-I_C$	max.	1	A
Collector current (peak value)	$-I_{CM}$	max.	2	A
Base current (DC)	$-I_B$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5	W
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current					
$I_E = 0$; $-V_{CB}$ = 25 V		$-I_{CBO}$	<	10	μA
$I_E = 0$; $-V_{CB}$ = 25 V; T_j = 150 °C		$-I_{CBO}$	<	1	mA
Emitter cut-off current					
$I_C = 0$; $-V_{EB}$ = 5 V		$-I_{EBO}$	<	10	μA
Base-emitter voltage					
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V		$-V_{BE}$	typ.	0,62	V
$-I_C$ = 1 A; $-V_{CE}$ = 1 V		$-V_{BE}$	<	1	V
Collector-emitter saturation voltage					
$-I_C$ = 1 A; $-I_B$ = 100 mA		$-V_{CEsat}$	<	0,5	V
DC current gain					
$-I_C$ = 5 mA; $-V_{CE}$ = 10 V	BCP69	h_{FE}	>	50	
$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	BCP69	h_{FE}		85 to 375	
	BCP69-10	h_{FE}	⩽	160	
	BCP69-16	h_{FE}		100 to 250	
	BCP69-25	h_{FE}	⩾	250	
$-I_C$ = 1 A; $-V_{CE}$ = 1 V	BCP69	h_{FE}	>	60	
Collector capacitance at f = 450 kHz					
$I_E = I_e = 0$; $-V_{CB}$ = 5 V		C_c	typ.	45	pF
Transition frequency at f = 35 MHz					
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V		f_T	typ.	60	MHz

* Device mounted on an epoxy printed-circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

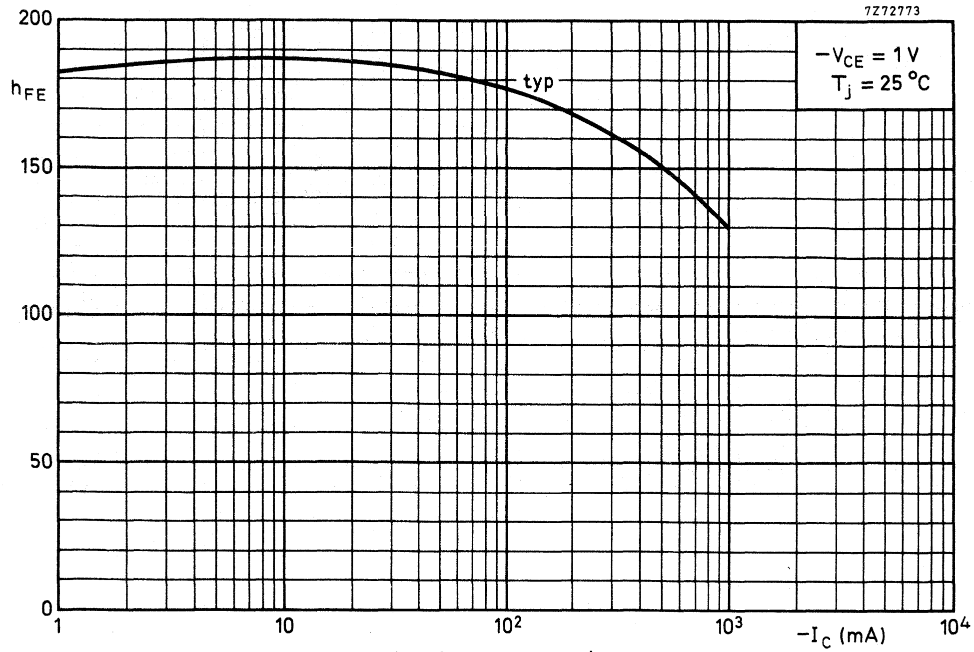


Fig. 2 DC current gain.

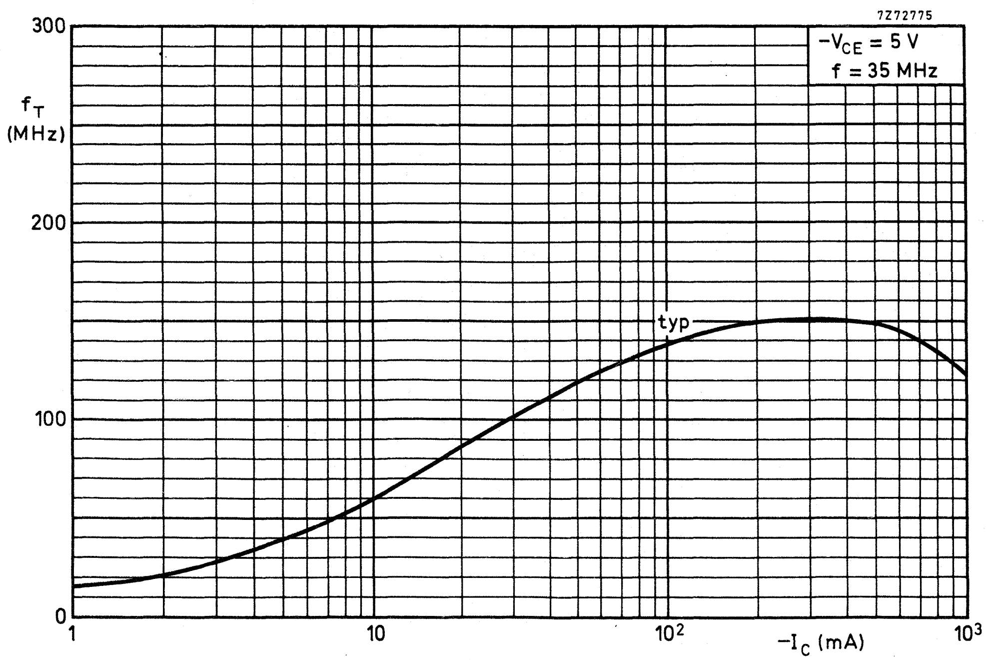


Fig.3 Typical values transition frequency as a function of collector current.

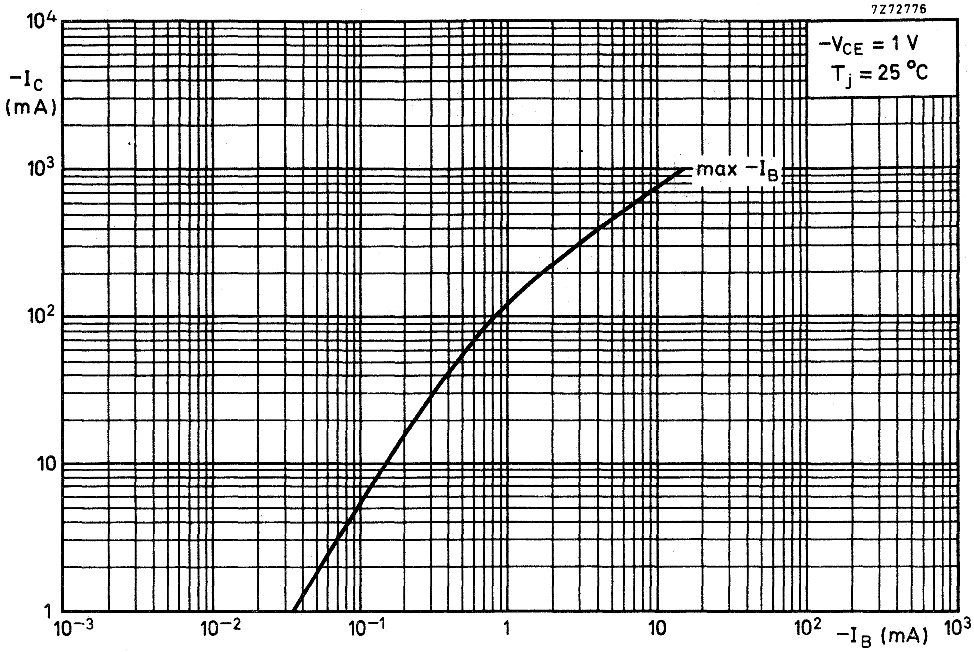


Fig.4 Typical values collector current as a function of maximum base current.

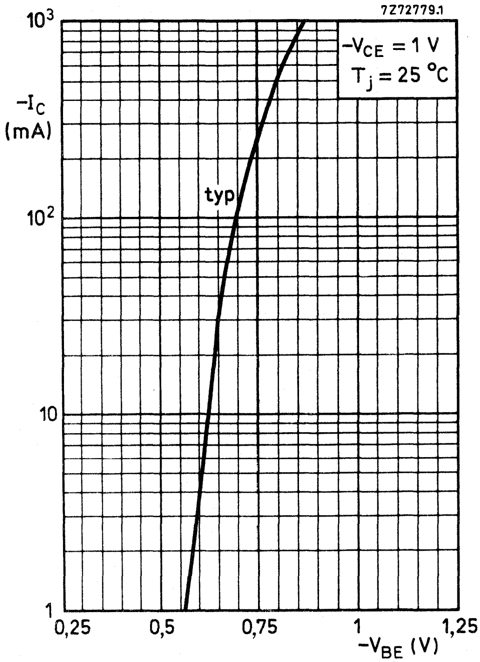


Fig.5 Typical values collector current as a function of base-emitter voltage.

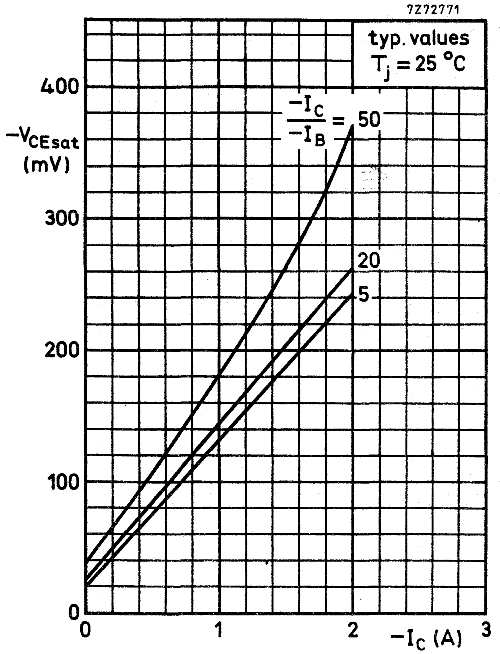


Fig.6 Collector-emitter saturation voltage as a function of collector current.

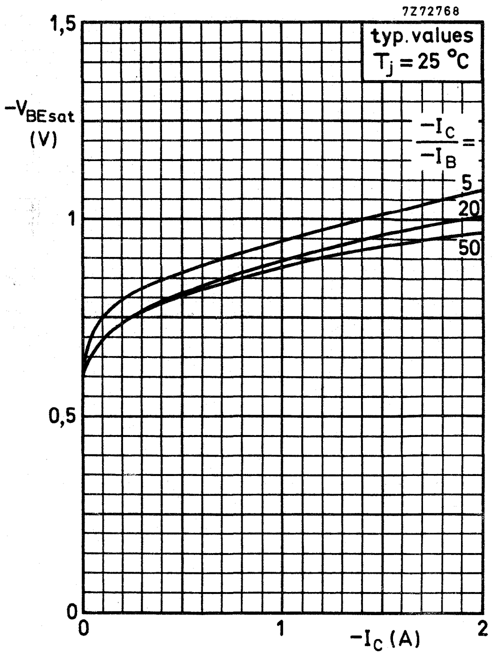


Fig.7 Base-emitter saturation voltage as a function of collector current.

SILICON PLANAR DARLINGTON TRANSISTOR

P-N-P silicon planar darlington transistor in a plastic SOT23 envelope.
N-P-N complement is BCV27/47.

QUICK REFERENCE DATA

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Collector current	$-I_C$	max.	300	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	>	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	>	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Collector-emitter saturation voltage					
$-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Transition frequency at f = 100 MHz					
$-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

MECHANICAL DATA

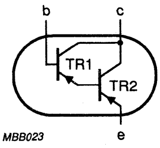
Fig. 1 SOT23

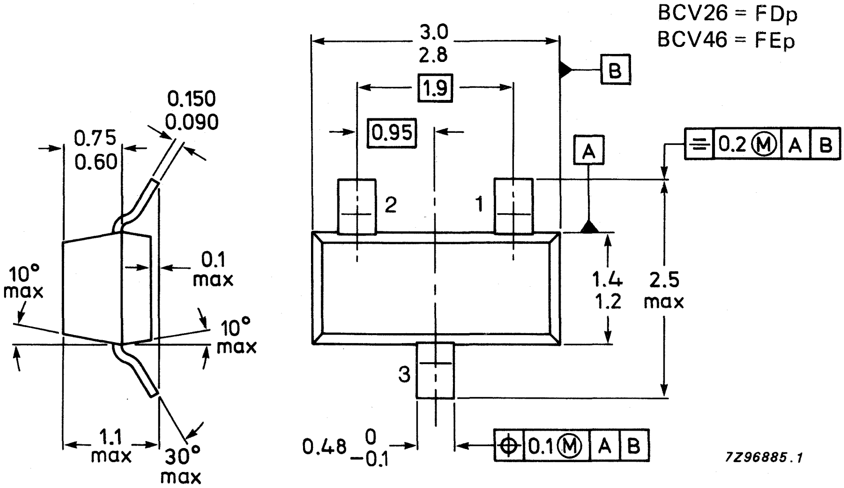
Dimensions in mm

Pinning:

1 = base
2 = emitter
3 = collector

Marking code:
BCV26 = FDp
BCV46 = FEp





TOP VIEW

RATINGS

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

			BCV26	BCV46	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	60	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	10	10	V
Collector current	$-I_C$	max.	300	500	mA
Collector current (peak value)	$-I_{CM}$	max.	800		mA
Base current	$-I_B$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

			BCV26	BCV46	
Collector-base current $-V_{CBO}$ = 30 V	$-I_{CBO}$	max.	0.1	0.1	µA
Emitter-base current $-V_{EB}$ = 10 V	$-I_{EBO}$	max.	0.1	0.1	µA
Collector-emitter break-down voltage $-I_C$ = 10 mA	$-V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 µA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage $-I_E$ = 100 nA	$-V_{(BR)EBO}$	min.	10	10	V
DC current gain $-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4 000	2 000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10 000	4 000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz I_E = 0; $-V_{CB}$ = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SILICON PLANAR DARLINGTON TRANSISTOR

N-P-N silicon planar darlington transistor in a plastic SOT23 envelope.
P-N-P complement is BCV26/46.

QUICK REFERENCE DATA

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Collector current	I_C	max.	300	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	>	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	>	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	20 000	10 000	
Junction temperature	T_j	max.	150		°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Collector-emitter saturation voltage					
I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Transition frequency at f = 100 MHz					
I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

MECHANICAL DATA

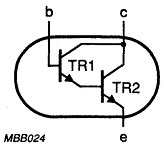
Dimensions in mm

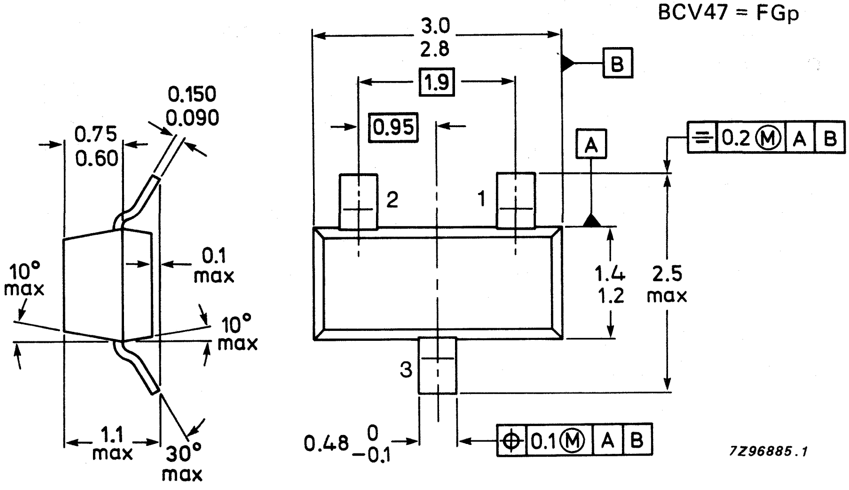
Fig. 1 SOT23

Marking code:
BCV27 = FFp
BCV47 = FGp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

RATINGS

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

			BCV27	BCV47	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	60	V
Collector-base voltage (open emitter)	V_{CBO}	max.	40	80	V
Emitter-base voltage (open collector)	V_{EBO}	max.	10	10	V
Collector current	I_C	max.	300	500	mA
Collector current (peak value)	I_{CM}	max.	800		mA
Base current	I_B	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		–65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated			BCV27	BCV47	
Collector-base current V_{CBO} = 30 V	I_{CBO}	max.	0.1	0.1	μA
Emitter-base current V_{EB} = 10 V	I_{EBO}	max.	0.1	0.1	μA
Collector-emitter break-down voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage I_E = 100 nA	$V_{(BR)EBO}$	min.	10	10	V
DC current gain I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4 000	2 000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10 000	4 000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20 000	10 000	
Collector-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0		V
Base-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5		V
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Collector capacitance at f = 1 MHz I_E = 0; V_{CB} = 30 V	C_c	typ.	3.5		pF

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

PNP small-signal darlington transistors, housed in a microminiature envelope (SOT89).
NPN complementary types are BCV29/49.

QUICK REFERENCE DATA

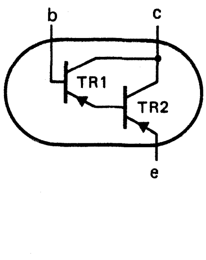
			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
DC current gain					
$-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz

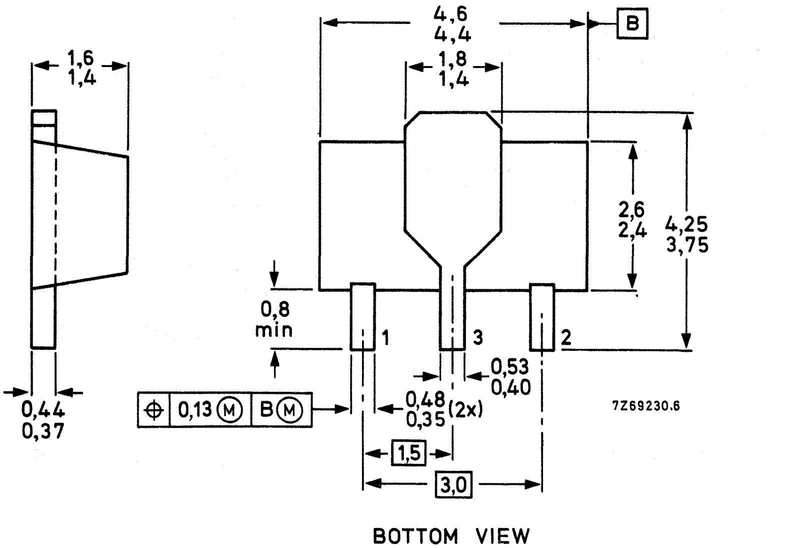
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT89

Pinning
1 = emitter
2 = base
3 = collector





* Mounted on a ceramic substrate; area = 2.5 cm²; thickness = 0.7 mm.

RATINGS

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

			BCV28	BCV48	
Collector-base voltage	$-V_{CBO}$	max.	40	80	V
Collector-emitter voltage	$-V_{CEO}$	max.	30	60	V
Emitter-base voltage	$-V_{EBO}$	max.	10	10	V
Collector current (DC)	$-I_C$	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV28	BCV48	
Collector-emitter breakdown voltage $-I_C$ = 10 mA	$-V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage $-I_C$ = 10 μA	$-V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage $-I_E$ = 0.1 μA	$-V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current $-V_{BE}$ = 4 V; I_C = 0	$-I_{EBO}$	max.	0.1	0.1	μA
Collector-base cut-off current $-V_{CB}$ = 30/60 V; I_E = 0	$-I_{CBO}$	max.	0.1	0.1	μA
DC current gain $-I_C$ = 1 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	10000	4000	
$-I_C$ = 100 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	20000	10000	
$-I_C$ = 500 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{CEsat}$	max.	1.0		V
Base-emitter saturation voltage $-I_C$ = 100 mA; $-I_B$ = 0.1 mA	$-V_{BEsat}$	max.	1.5		V
Transition frequency at f = 100 MHz $-I_C$ = 30 mA; $-V_{CE}$ = 5 V	f_T	typ.	220		MHz
Output capacitance $-V_{CB}$ = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SMALL-SIGNAL DARLINGTON TRANSISTOR

NPN small-signal darlington transistors, housed in a microminiature envelope (SO89).
PNP complementary types are BCV28/48.

QUICK REFERENCE DATA

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz

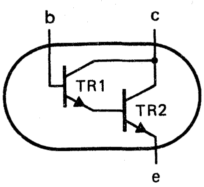
MECHANICAL DATA

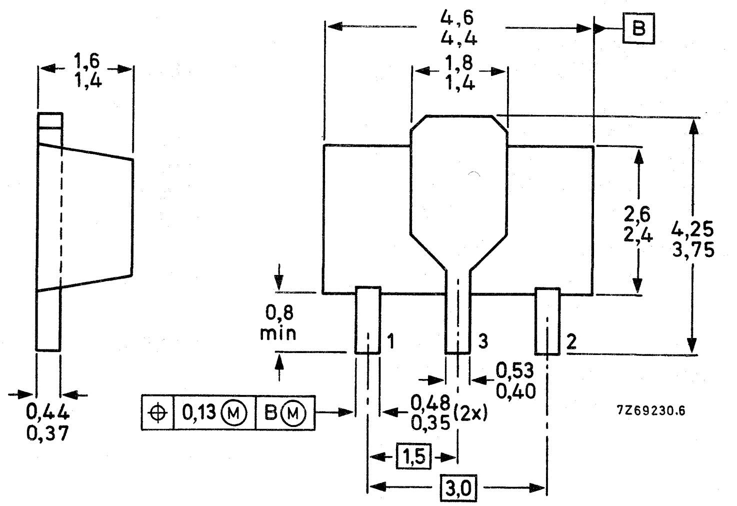
Dimensions in mm

Fig.1 SOT89.

Pinning

1 = emitter
2 = base
3 = collector





BOTTOM VIEW

* Mounted on a ceramic substrate; area = 2.5 cm^2 ; thickness = 0.7 mm.

RATINGS

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

			BCV29	BCV49	
Collector-base voltage	V_{CBO}	max.	40	80	V
Collector-emitter voltage	V_{CEO}	max.	30	60	V
Emitter-base voltage	V_{EBO}	max.	10	10	V
Collector current (DC)	I_C	max.	500	500	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1.0		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\,j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

			BCV29	BCV49	
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CES}$	min.	30	60	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	40	80	V
Emitter-base breakdown voltage I_E = 0.1 μA	$V_{(BR)EBO}$	min.	10	10	V
Emitter-base cut-off current V_{BE} = 4 V; I_C = 0	I_{EBO}	max.	0.1	0.1	μA
Collector-base cut-off current V_{CB} = 30/60 V; I_E = 0	I_{CBO}	max.	0.1	0.1	μA
DC current gain					
I_C = 1 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	min.	10000	4000	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}	min.	20000	10000	
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	min.	4000	2000	
Collector-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{CEsat}	max.	1.0	1.0	V
Base-emitter saturation voltage I_C = 100 mA; I_B = 0.1 mA	V_{BEsat}	max.	1.5	1.5	V
Transition frequency at f = 100 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	220		MHz
Output capacitance V_{CB} = 30 V; I_E = 0	C_{ob}	typ.	3.5		pF

* Mounted on a ceramic substrate; area = 2.5 cm^2; thickness = 0.7 mm.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double n-p-n transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in p-n-p configuration is the BCV62.

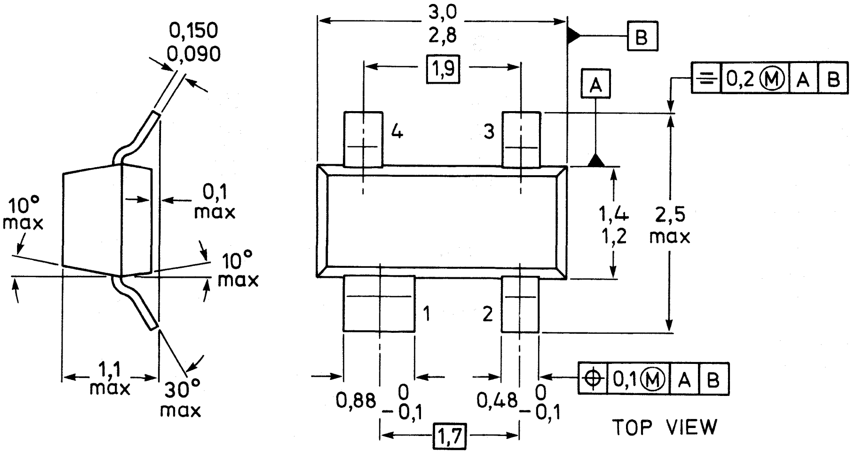
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30 V
Collector current			
d.c.	I_C	max.	100 mA
peak	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

Fig. 1 SOT-143.

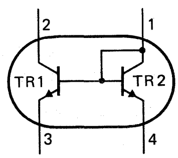
Dimensions in mm



7Z85014.6

Marking code:

BCV61 = 1Mp
BCV61A = 1Jp
BCV61B = 1Kp
BCV61C = 1Lp



7Z87629

See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (open base) regarding transistor T1	V_{CEO}	max.	30	V
Collector-base voltage (open emitter) regarding transistor T1	V_{CBO}	max.	30	V
Base current (transistor T1) peak value	I_{BM1}	max.	200	mA
Emitter-base voltage	V_{EBS}	max.	6	V
Collector current d.c.	I_C	max.	100	mA
Collector current peak	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_{stg}		−65 to +150	°C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current $I_E = 0$; $V_{CB} = 30$ V	I_{CBO}	<	15	nA
$I_E = 0$; $V_{CB} = 30$ V; $T_j = 150$ °C	I_{CBO}	<	5	μA
Base-emitter voltage $I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	typ.	660	mV*
			580 to 700	mV*
$I_C = 10$ mA; $V_{CE} = 5$ V	V_{BE}	<	770	mV*
Saturation voltages $I_C = 10$ mA; $I_B = 0,5$ mA	V_{CEsat}	typ.	90	mV
		<	250	mV
	V_{BEsat}	typ.	700	mV**
$I_C = 100$ mA; $I_B = 5$ mA	V_{CEsat}	typ.	200	mV
		<	600	mV
	V_{BEsat}	typ.	900	mV**

* Decreasing 2 mV/°C with increasing temperature.
** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300 MHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	2,5 pF
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V f = 1 kHz; B = 200 Hz	F	typ. <	2 dB 10 dB
D.C. current gain I_C = 100 μA; V_{CE} = 5 V I_C = 2 mA; V_{CE} = 5 V	h_{FE} h_{FE}	>	100 110 to 800
Input impedance I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{ie}	typ.	5 kΩ
Reverse voltage transfer ratio I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{re}	typ.	2×10^{-4}
Small signal current gain I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{fe}		100 to 900
Output admittance I_C = 2 mA; V_{CE} = 5 V; f = 1 kHz	h_{oe}	typ.	30 μS

Transistor T2

Base-emitter forward voltage I_E = 250 mA I_E = 10 μA		V_{BES}	< >	1,8 V 400 mV
Matching of transistor T1 and transistor T2 at I_{E2} = 0,5 mA and V_{CE1} = 5 V T_{amb} = 25 °C T_{amb} = 150 °C		I_{C1}/I_{C2} I_{C1}/I_{C2}		0,7 to 1,3 0,7 to 1,3
Thermal coupling of transistor T1 and Transistor T2* T1 : V_{CE} = 5 V Maximum current for thermal stability of I_{C1}		I_{E2}	typ.	5 mA
D.C. current gain I_C = 2 mA; V_{CE} = 5 V	BCV61A	h_{FE}	min. max.	110 220
	BCV61B	h_{FE}	min. max.	200 450
	BCV61C	h_{FE}	min. max.	420 800

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (See Fig. 2)

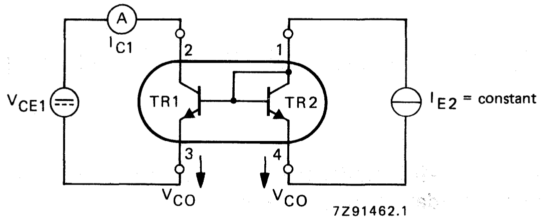


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3}\ U_T \triangleq 16$ mV.

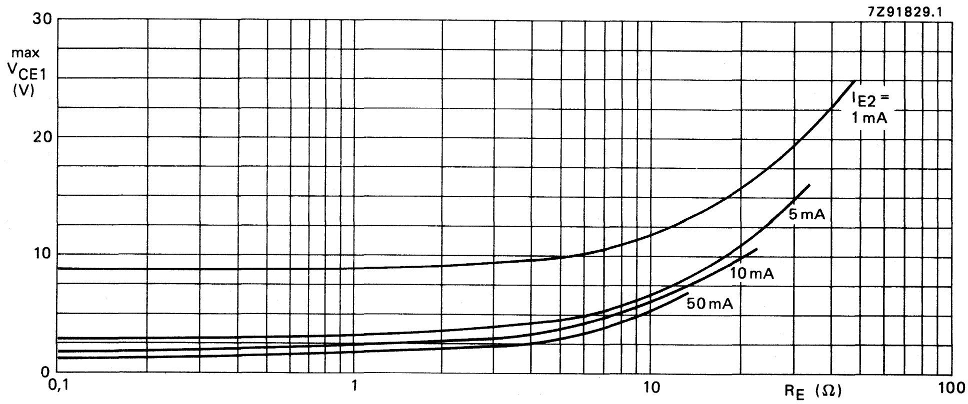


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

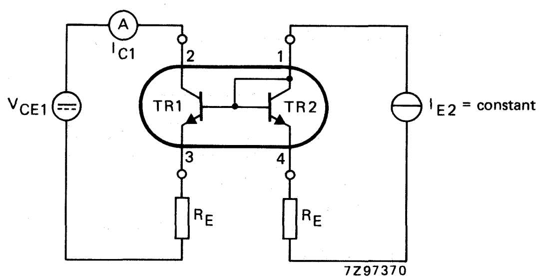


Fig. 4 BCV61 with emitter resistors.

SILICON PLANAR EPITAXIAL TRANSISTOR

Double p-n-p transistor, in SOT-143 plastic envelope, designed for use in applications where the working point must be independent of temperature.

Owing to application of two similar crystals of one slice this device has a good thermal coupling and V_{BE} matching. Special interconnection of the two transistor crystals allows the device to be used as a current mirror and the separated emitter leads allow connection to different sources.

A similar device in n-p-n configuration is the BCV61.

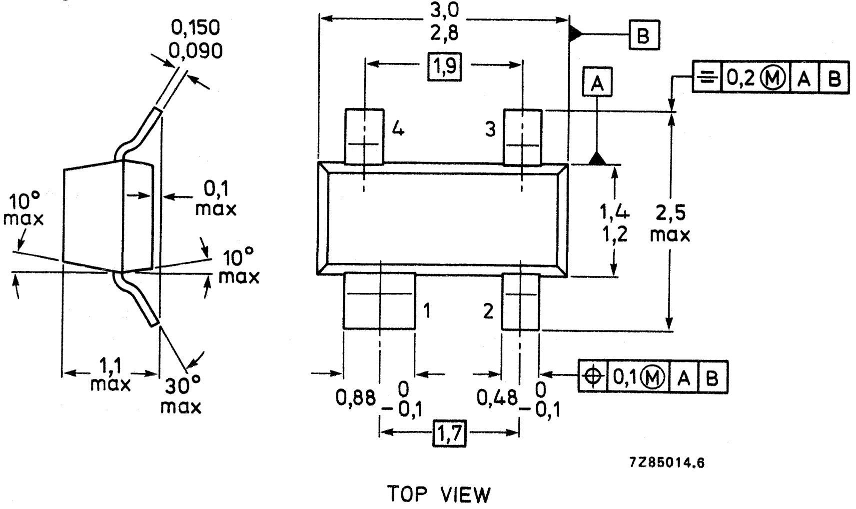
QUICK REFERENCE DATA

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max	30 V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30 V
Collector current d.c.	$-I_C$	max.	100 mA
peak	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Junction temperature	T_j	max.	150 °C

MECHANICAL DATA

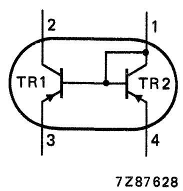
Fig. 1 SOT-143.

Dimensions in mm



Marking code:

BCV62 : 3Mp
BCV62A: 3Jp
BCV62B: 3Kp
BCV62C: 3Lp



See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (open base) regarding transistor T1	$-V_{CEO}$	max.	30	V
Collector-base voltage (open emitter) regarding transistor T1	$-V_{CBO}$	max.	30	V
Base current (transistor T1) peak value	$-I_{BM1}$	max.	200	mA
Emitter-base voltage	$-V_{EBS}$	max.	6	V
Collector current d.c.	$-I_C$	max.	100	mA
peak	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Storage temperature	T_{stg}		–65 to + 150	°C

THERMAL RESISTANCE

Device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm from junction to ambient	$R_{th\ j\text{-}a}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Transistor T1

Collector cut-off current				
$-I_E = 0; -V_{CB} = 30$ V	$-I_{CBO}$	<	15	nA
$-I_E = 0; -V_{CB} = 30$ V; $T_j = 150$ °C	$-I_{CBO}$	<	5	μA
Base-emitter voltage				
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	typ.	650	mV*
			600 to 750	mV*
$-I_C = 10$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	<	820	mV*
Saturation voltages				
$-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	typ.	75	mV
		<	300	mV
	$-V_{BEsat}$	typ.	700	mV**
$-I_C = 100$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	typ.	250	mV
		<	650	mV
	$-V_{BEsat}$	typ.	850	mV**

* Decreasing 2 mV/°C with increasing temperature.
** Decreasing 1,7 mV/°C with increasing temperature.

Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V		f_T	typ. 150 MHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $-V_{CB}$ = 10 V		C_c	typ. 4,5 pF
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz		F	typ. 2 dB < 10 dB
D.C. current gain $-I_C$ = 100 μA; $-V_{CE}$ = 5 V		h_{FE}	> 100
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V		h_{FE}	100 to 800
Input impedance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{ie}	typ. 3 kΩ
Reverse voltage transfer ratio $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{re}	typ. 3×10^{-4}
Small signal current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{fe}	100 to 900
Output admittance $-I_C$ = 2 mA; $-V_{CE}$ = 5 V; f = 1 kHz		h_{oe}	typ. 50 μS
Transistor T2			
Base-emitter forward voltage $-I_E$ = 250 mA $-I_E$ = 10 μA		$-V_{BES}$	< 1,5 V > 400 mV
Matching of transistor T1 and transistor T2 at I_{E2} = 0,5 mA and V_{CE1} = 5 V T_{amb} = 25 °C		I_{C1}/I_{C2}	0,7 to 1,3
T_{amb} = 150 °C		I_{C1}/I_{C2}	0,7 to 1,3
Thermal coupling of transistor T1 and transistor T2* T1 : $-V_{CE}$ = 5 V Maximum current for thermal stability of $-I_{C1}$		I_{E2}	typ. 5 mA
D.C. current gain $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	BCV62A	h_{FE}	min. 125 max. 250
	BCV62B	h_{FE}	min. 220 max. 475
	BCV62C	h_{FE}	min. 420 max. 800

* Without emitter resistor and device mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm. (see Fig. 2)

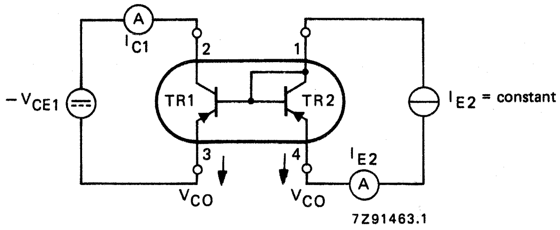


Fig. 2 Test circuit current matching.

Note: Voltage drop at contacts: $V_{CO} < \frac{2}{3}\, U_T \triangleq 16$ mV.

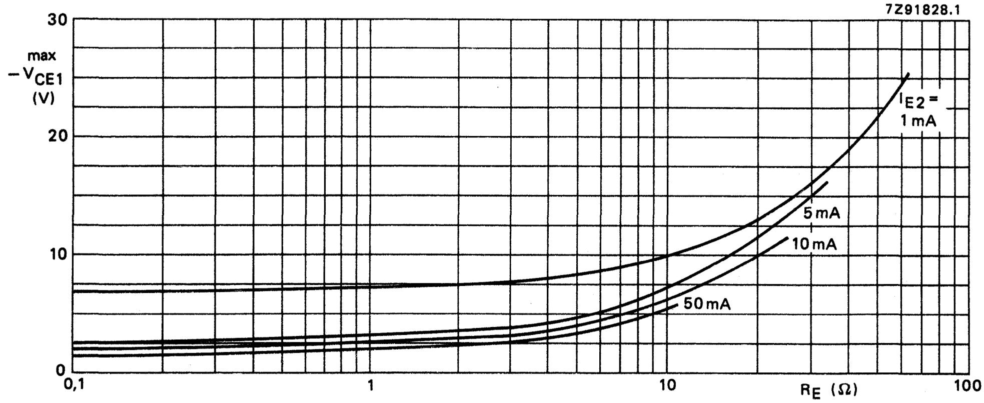


Fig. 3 Characteristic for determination of max. V_{CE1} at specified R_E range with I_{E2} as parameter under condition of $\frac{I_{C1}}{I_{E2}} = 1{,}3$ (see Fig. 4).

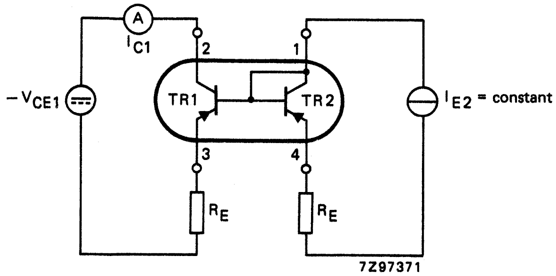


Fig. 4 BCV62 with emitter resistors.

SILICON PLANAR TRANSISTOR

Double N-P-N transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications. P-N-P complement is the BCV64.

QUICK REFERENCE DATA

	transistor		T1	T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Collector current	I_C	max.	100		mA
Junction temperature	T_j	max.	150		^oC
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	250		mW
Collector-emitter saturation voltage I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	—	MHz

MECHANICAL DATA

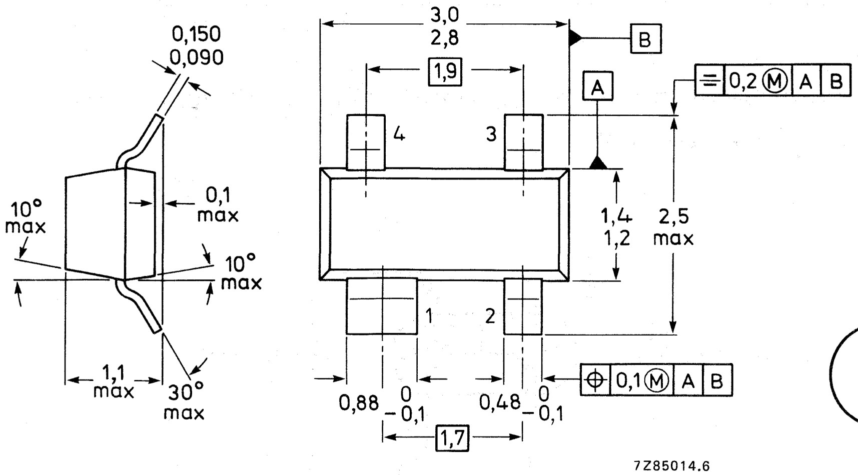
Dimensions in mm

Fig. 1 SOT-143.

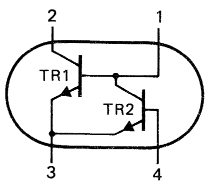
Marking code

BCV63 : D95

BCV63B : D96



TOP VIEW



RATINGS

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

	transistor		T1	T2	
Collector-emitter voltage (open base)	V_{CEO}	max.	30	6	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	6	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6		V
Collector current (d.c.)	I_C	max.	100		mA
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

	transistor		T1	T2	
Collector cut-off current					
$I_E = 0$; V_{CBO} = 30 V	I_{CBO}	max.	15	15	nA
$I_E = 0$; V_{CBO} = 30 V; T_j = 150 °C	I_{CBO}	max.	5	5	μA
Saturation voltage**					
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	75	75	mV
	V_{CEsat}	max.	300	300	mV
	V_{BEsat}	typ.	700	700	mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250	250	mV
	V_{CEsat}	max.	650	–	mV
	V_{BEsat}	typ.	850	–	mV
Base-emitter voltage ▲					
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	min.	600	–	mV
	V_{BE}	typ.	650	–	mV
	V_{BE}	max.	750	–	mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820	–	mV
I_C = 2 mA; V_{CE} = 700 mV	V_{BE}	typ.		700	mV
Collector capacitance at f = 1 MHz					
$I_E = i_e = 0$; V_{CE} = 10 V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.
** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.
▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz
I_C = 2 mA; T1 : V_{CE} = 5 V
T2 : V_{CE} = 700 mV — h_{fe} 100 to 900

Transistor 1

D.C. current gain

I_C = 2 mA; V_{CE} = 5 V

		BCV63	BCV63B
h_{FE}	min.	110	200
	max.	800	450

Transistor 2

D.C. current gain
I_C = 2 mA; V_{CE} = 700 mV

Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

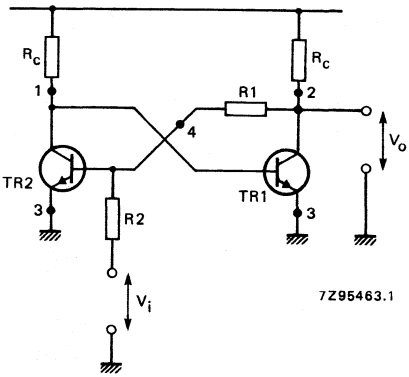


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTOR

Double P-N-P transistor in a plastic SOT-143 envelope. Intended for Schmitt-trigger applications.
N-P-N complement is the BCV63.

QUICK REFERENCE DATA

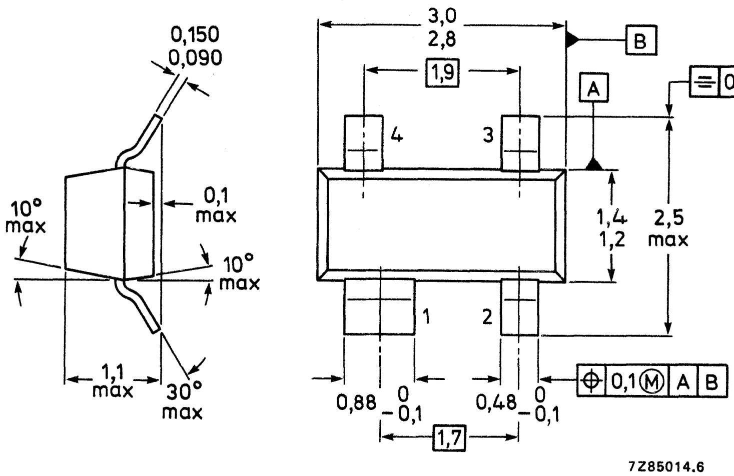
	transistor		T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Collector current	$-I_C$	max.	100		mA
Junction temperature	T_j	max.	150		^oC
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250		mW
Collector-emitter saturation voltage $-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	max.	300		mV
Small signal current gain	h_{fe}		100 to 900		
Transition frequency at f = 35 MHz $-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	200	–	MHz

MECHANICAL DATA

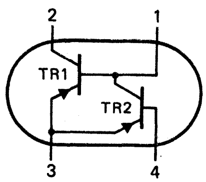
Dimensions in mm

Fig. 1 SOT-143.

Marking code
BCV64 : C95
BCV64B : C96



TOP VIEW



RATINGS

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

	transistor		T1	T2	
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	6	V
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	6	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	6	6	V
Collector current (d.c.)	$-I_C$	max.	6		mA
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_s		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise stated

	transistor		T1	T2	
Collector cut-off current					
$-I_E = 0$; $-V_{CBO} = 30$ V	$-I_{CBO}$	max.	15	15	nA
$-I_E = 0$; $-V_{CBO} = 30$ V; $T_j = 150$ °C	$-I_{CBO}$	max.	5	5	μA
Saturation voltage**					
$-I_C = 10$ mA; $-I_B = 0{,}5$ mA	$-V_{CEsat}$	typ.	75	75	mV
	$-V_{CEsat}$	max.	300	300	mV
	$-V_{BEsat}$	typ.	700	700	mV
$-I_C = 100$ mA; $-I_B = 5$ mA	$-V_{CEsat}$	typ.	250	250	mV
	$-V_{CEsat}$	max.	650	–	mV
	$-V_{BEsat}$	typ.	850	–	mV
Base-emitter voltage ▲					
$-I_C = 2$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	typ.	650	–	mV
			600/750	–	mV
$-I_C = 10$ mA; $-V_{CE} = 5$ V	$-V_{BE}$	max.	820	–	mV
$-I_C = 2$ mA; $-V_{CE} = 700$ mV	$-V_{BE}$	typ.		700	mV
Collector capacitance at f = 1 MHz					
$-I_E = i_e = 0$; $-V_{CE} = 10$ V	C_c	typ.	4	–	pF
Transition frequency at f = 35 MHz					
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	200	–	MHz

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.
** V_{BEsat} decreases by approx 1,7 mV/K with increasing temperature.
▲ $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

Small signal current gain at f = 1 kHz
$-I_C$ = 2 mA; T1 : $-V_{CE}$ = 5 V
T2 : $-V_{CE}$ = 700 mV — h_{fe} 100 to 900

			BCV64	BCV64B
Transistor 1				
D.C. current gain				
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	min.	110	220
		max.	800	475

Transistor 2

D.C. current gain
$-I_C$ = 2 mA; $-V_{CE}$ = 700 mV

Group selection will be done on T1. Due to matched crystals h_{FE} values for T2 are the same as T1.

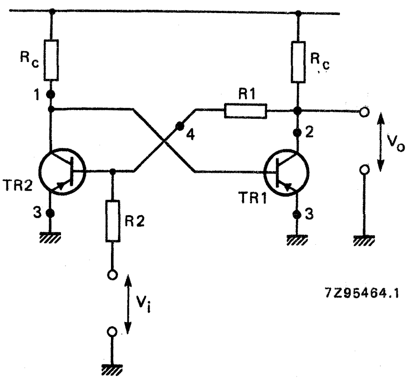


Fig. 2 Schmitt-trigger application.

SILICON PLANAR TRANSISTORS

A matched pair of P-N-P and N-P-N crystal, based on the BC557 and BC547, in a microminiature SOT-143 envelope.

Complementary crystals give advantages in P.C.B. layout using S.M.D. technology.

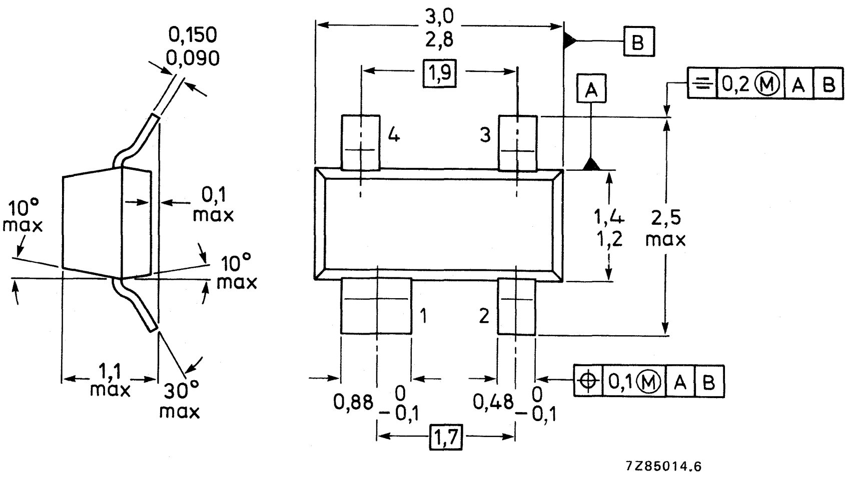
QUICK REFERENCE DATA

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Collector current (DC)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C

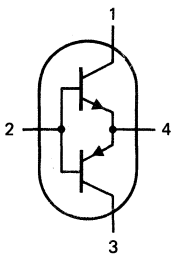
MECHANICAL DATA

Fig. 1 SOT-143.

Dimensions in mm
Marking code
BCV65: 97p
BCV65B: 98p



TOP VIEW



RATINGS

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

Per transistor:

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Collector current (DC)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation (per device) up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_s		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

Per transistor:

T_j = 25 °C unless otherwise stated

Collector cut-off current			
I_E = 0; V_{CB} = 30 V	I_{CBO}	max.	15 nA
I_E = 0; V_{CB} = 30 V; T_j = 150 °C	I_{CBO}	max.	5 μA
Base-emitter voltage**			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	typ.	650 mV
			580 to 750 mV
I_C = 10 mA; V_{CE} = 5 V	V_{BE}	max.	820 mV
Saturation voltage▲			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	90 mV
		max.	300 mV
	V_{BEsat}	typ.	700 mV
I_C = 100 mA; I_B = 5 mA	V_{CEsat}	typ.	250 mV
		max.	650 mV
	V_{BEsat}	typ.	900 mV

D.C. current gain			BCV65	BCV65B
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	min.	75	200
	h_{FE}	max.	800	475

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

** $-V_{BE}$ decreases by about 2 mV/K with increasing temperature.

▲ V_{BEsat} decreases by approx. 1,7 mV/K with increasing temperature.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCV71	BCV72	
D.C. current gain at $T_j = 25\ ^oC$					
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	110	200	
		<	220	450	
Collector-base voltage (open emitter)	V_{CBO}	max.	80		V
Collector-emitter voltage (open base)	V_{CEO}	max.	60		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		^oC
Transition frequency at f = 35 MHz $I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300		MHz
Noise figure at $R_S = 2\ k\Omega$ $I_C = 200\ \mu A$; $V_{CE} = 5$ V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

Dimensions in mm

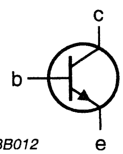
Fig. 1 SOT-23.

Marking code

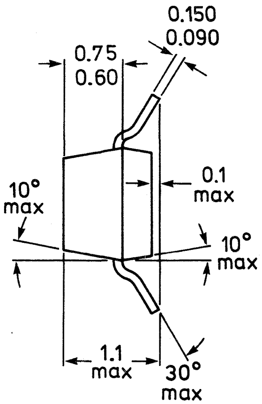
BCV71 = K7p
BCV72 = K8p

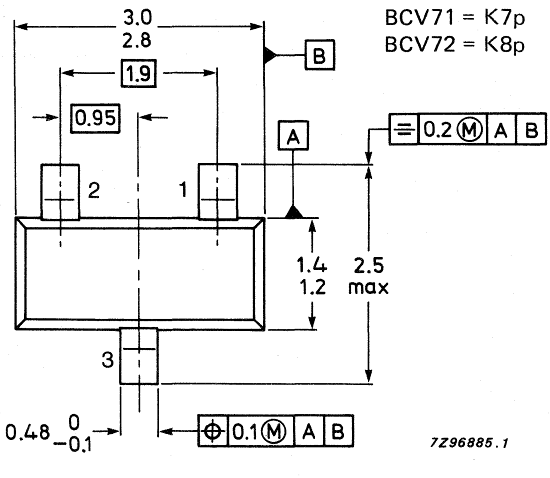
Pinning:

1 = base
2 = emitter
3 = collector



MBB012





7Z96885.1

TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	80	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	60	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25\ ^{o}C$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		^{o}C
Junction temperature	T_j	max.	150	^{o}C

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^{o}C$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100\ ^{o}C$	I_{CBO}	<	10	μA
Base emitter voltage				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}	550 to 700		mV
Saturation voltages				
$I_C = 10$ mA; $I_B = 0,5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2,5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

			BCV71	BCV72	
D.C. current gain					
$I_C = 10\ \mu$A; $V_{CE} = 5$ V	h_{FE}	typ.	90	150	
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,5		pF
Transition frequency at f = 35 MHz $I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.	300		MHz
Noise figure at $R_S = 2$ kΩ $I_C = 200\ \mu$A; $V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	<	10		dB

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

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW29	BCW30	
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	215 500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

MECHANICAL DATA

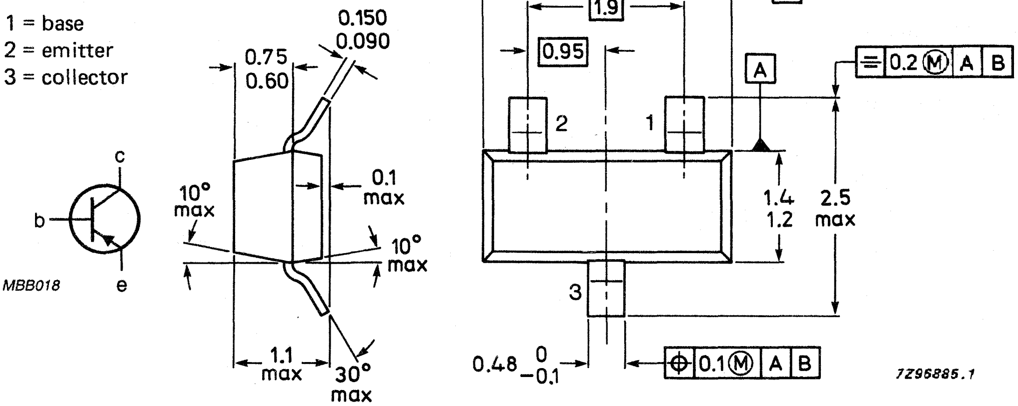
Dimensions in mm

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector

Marking code
BCW29 = C1p
BCW30 = C2p



TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	32 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	32 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	32 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; $-V_{CB}$ = 32 V	$-I_{CBO}$	<	100 nA
$I_E = 0$; $-V_{CB}$ = 32 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages			
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

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

		BCW29	BCW30	
D.C. current gain				
$-I_C$ = 10 μA; $-V_{CE}$ = 5 V	h_{FE}	typ. 90	150	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> 120 < 260	215 500	
Collector-capacitance at f = 1 MHz $I_E = I_e = 0$; $-V_{CB}$ = 10 V	C_c	typ.	4,5	pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<	10	dB

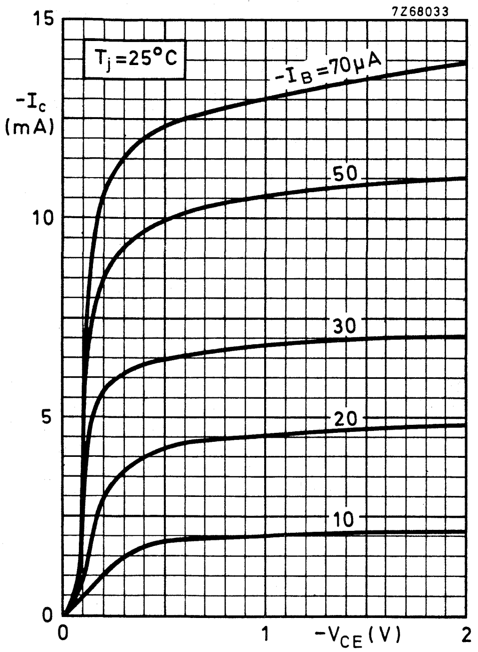


Fig. 2

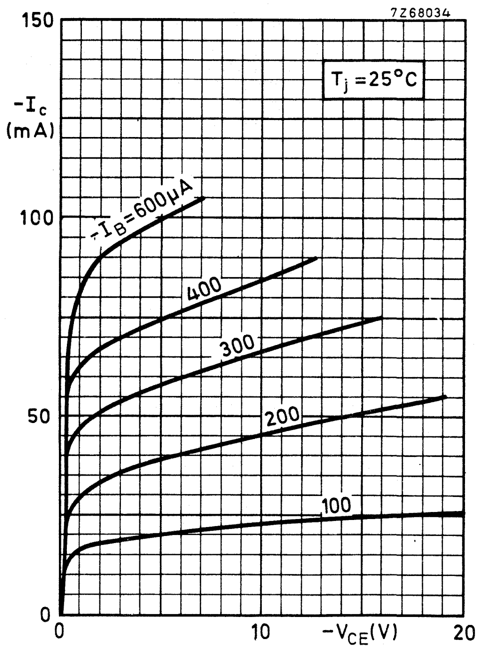


Fig. 3

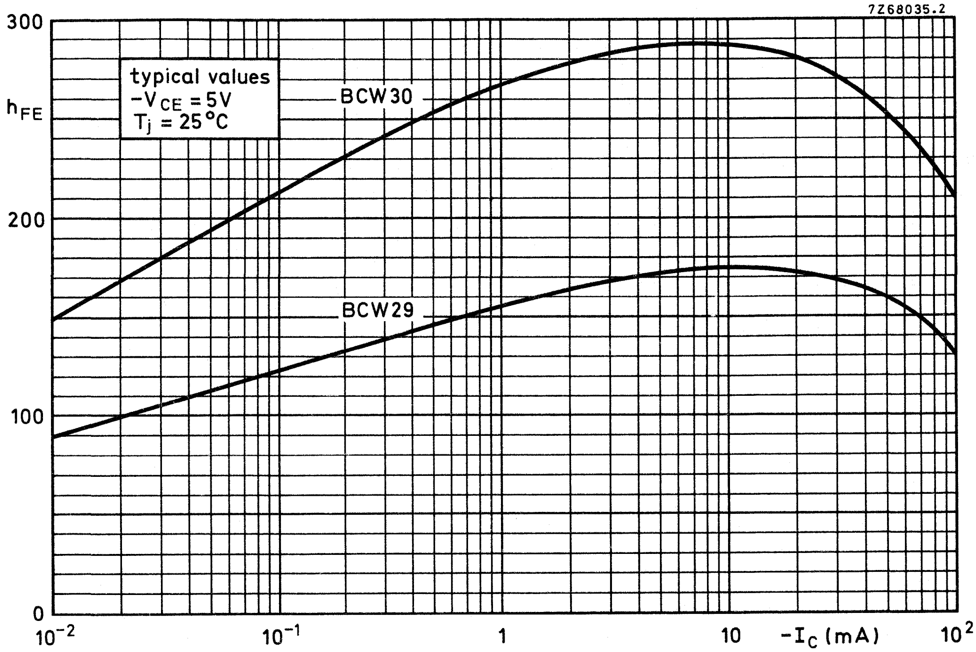

7Z68035.2
typical values
$-V_{CE} = 5V$
$T_j = 25\,°C$
h_{FE}
BCW30
BCW29
300
200
100
0
10^{-2}
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 4

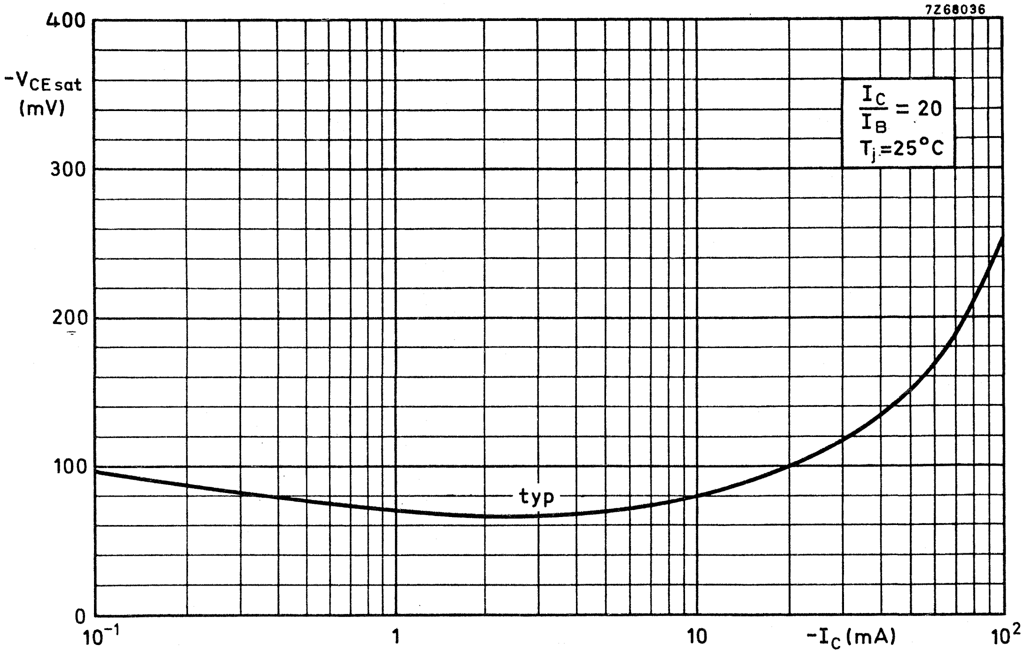

7Z68036
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
$-V_{CEsat}$
(mV)
400
300
200
100
0
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5

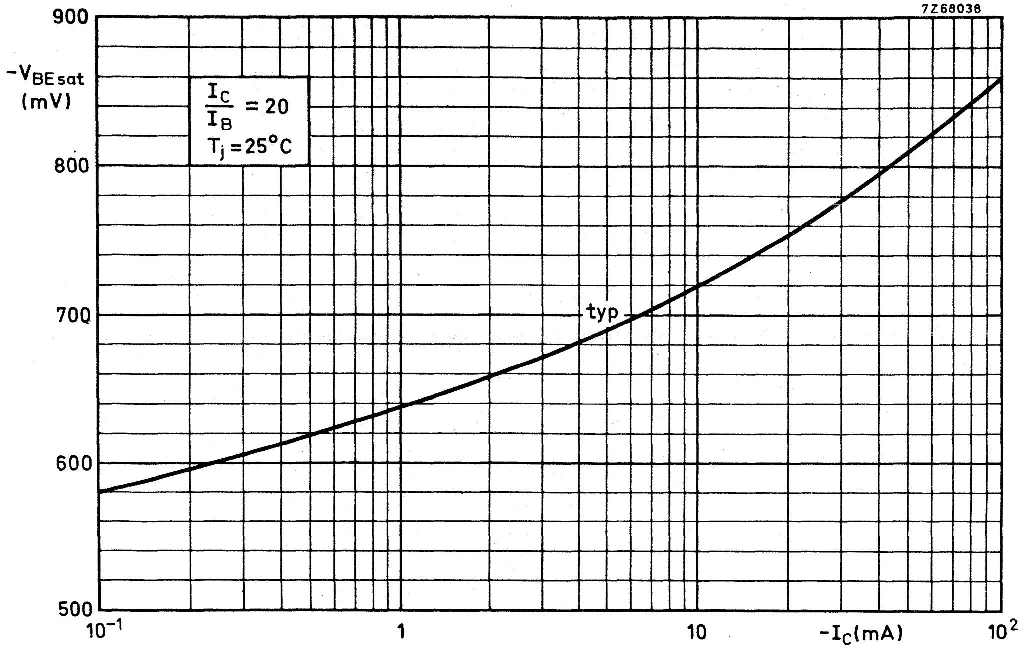

7Z68038
900
800
700
600
500
$-V_{BEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 6

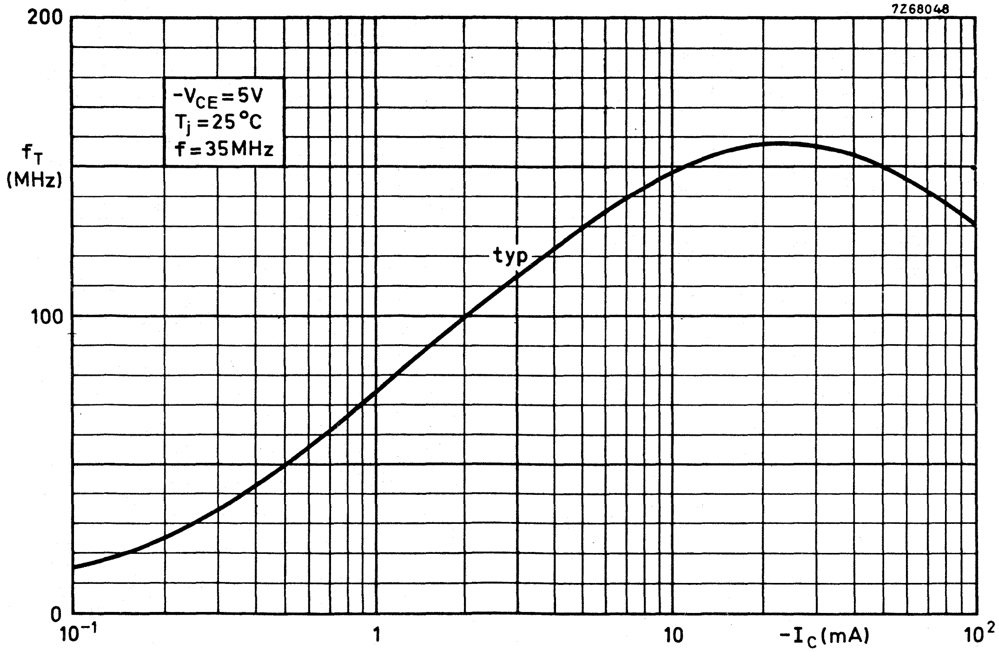

7Z68048
200
100
0
f_T (MHz)
$-V_{CE} = 5\,V$
$T_j = 25\,°C$
f = 35 MHz
typ
10^{-1}
1
10
$-I_C$(mA)
10^2

Fig. 7

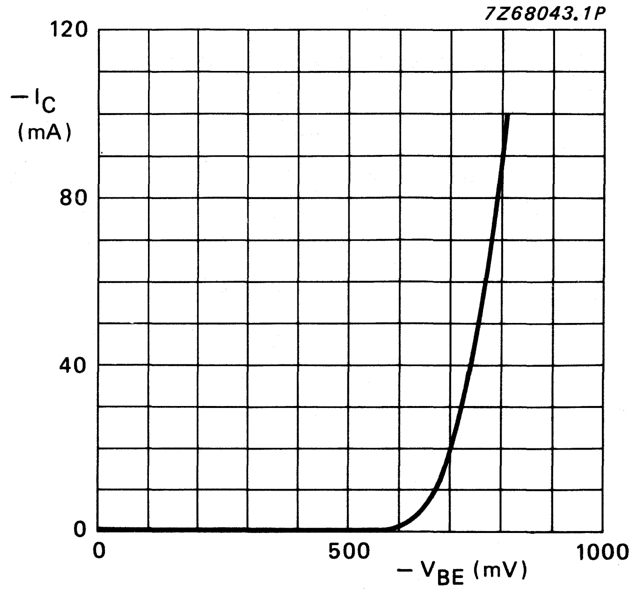


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

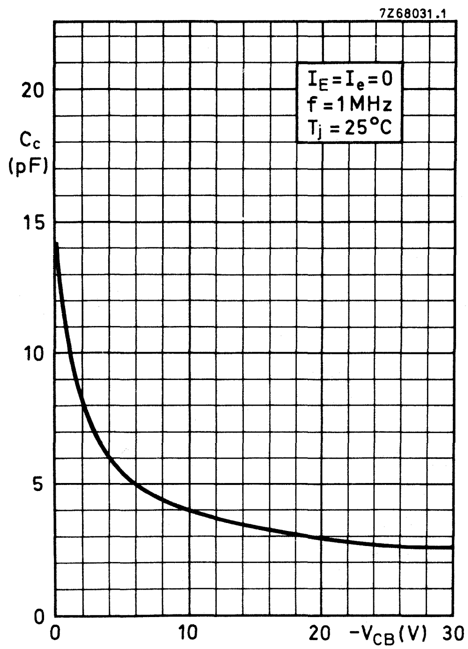


Fig. 9

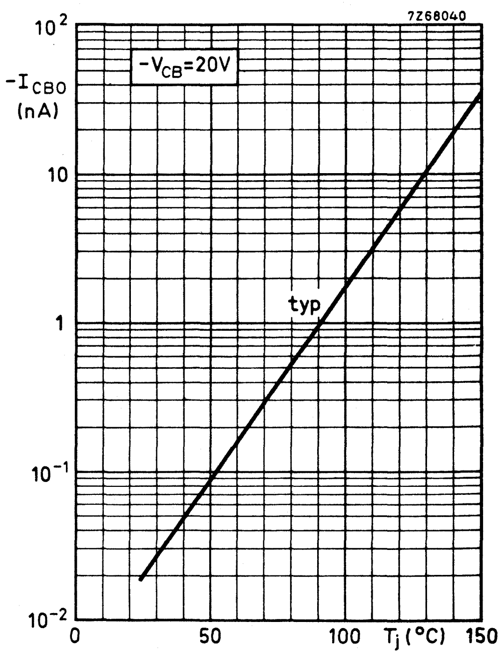


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope. They are intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW31	BCW32	BCW33	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector-base voltage (open emitter)	V_{CBO}	max.		32		V
Collector-emitter voltage (open base)	V_{CEO}	max.		32		V
Collector current (peak value)	I_{CM}	max.		200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		250		mW
Junction temperature	T_j	max.		150		°C
Transition frequency at f = 35 MHz I_C = 2 mA; V_{CE} = 5 V	f_T	typ.		300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<		10		dB

MECHANICAL DATA

Dimensions in mm

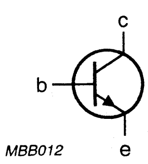
Fig. 1 SOT-23.

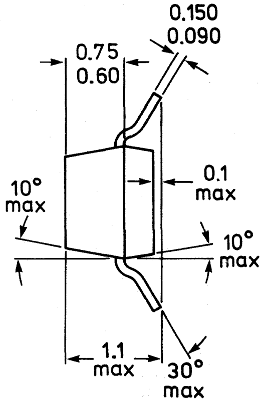
Pinning:

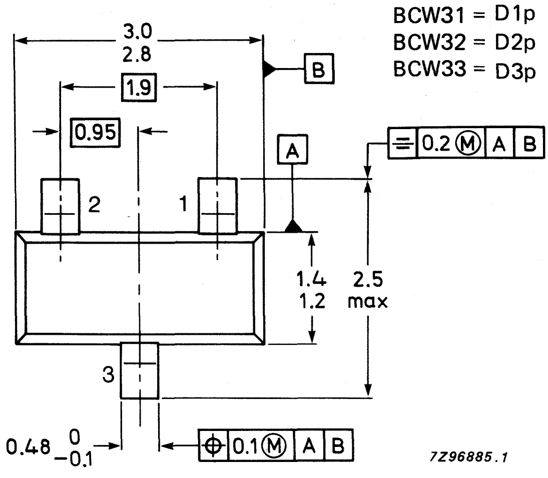
1 = base
2 = emitter
3 = collector

Marking code

BCW31 = D1p
BCW32 = D2p
BCW33 = D3p







TOP VIEW

Reverse pinning types are available on request.
See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	V_{CBO}	max.	32 V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to +150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current			
$I_E = 0$; $V_{CB} = 32$ V	I_{CBO}	$<$	100 nA
$I_E = 0$; $V_{CB} = 32$ V; $T_j = 100\ ^oC$	I_{CBO}	$<$	10 μA
Base-emitter voltage			
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}		550 to 700 mV
Saturation voltages			
I_C 10 mA; $I_B = 0{,}5$ mA	V_{CEsat}	typ.	120 mV
		$<$	250 mV
	V_{BEsat}	typ.	750 mV
$I_C = 50$ mA; $I_B = 2{,}5$ mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV

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

D.C. current gain			BCW31	BCW32	BCW33	
$I_C = 10\ \mu A$, $V_{CE} = 5$ V	h_{FE}	typ.	90	150	270	
$I_C = 2$ mA; $V_{CE} = 5$ V	h_{FE}	>	110	200	420	
		<	220	450	800	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.		2,5		pF
Transition frequency at f = 35 MHz $I_C = 10$ mA; $V_{CE} = 5$ V	f_T	typ.		300		MHz
Noise figure at $R_S = 2\ k\Omega$ $I_C = 200\ \mu A$; $V_{CE} = 5$ V f = 1 kHz; B = 200 Hz	F	<		10		dB

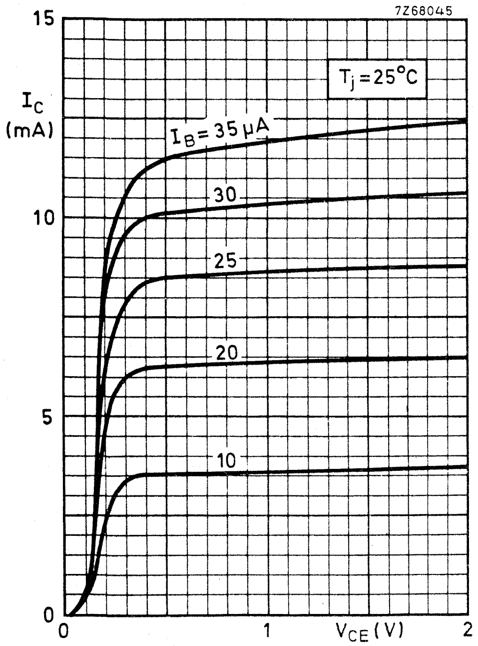


Fig. 2

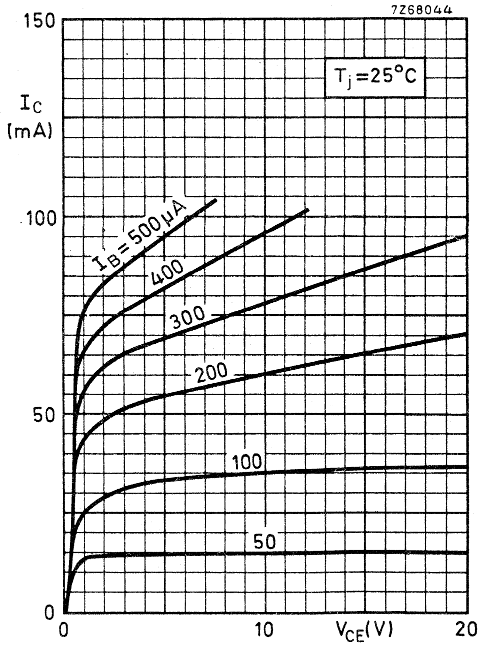


Fig. 3

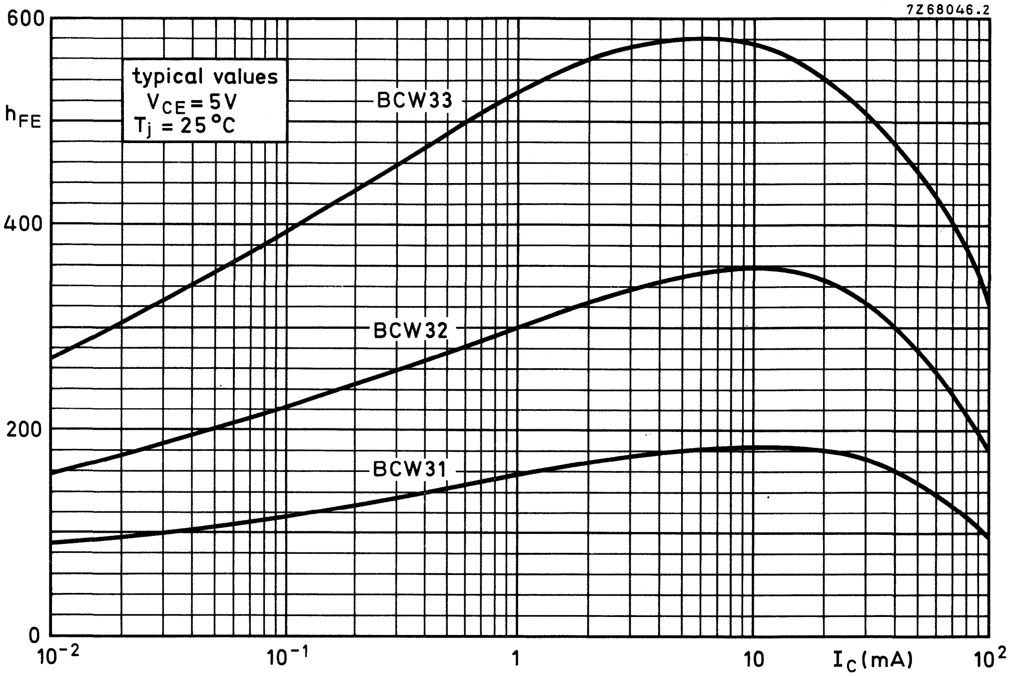

7Z68046.2
typical values
$V_{CE} = 5V$
$T_j = 25°C$
h_{FE}
BCW33
BCW32
BCW31
600
400
200
0
10^{-2}
10^{-1}
1
10
I_C (mA)
10^2

Fig. 4

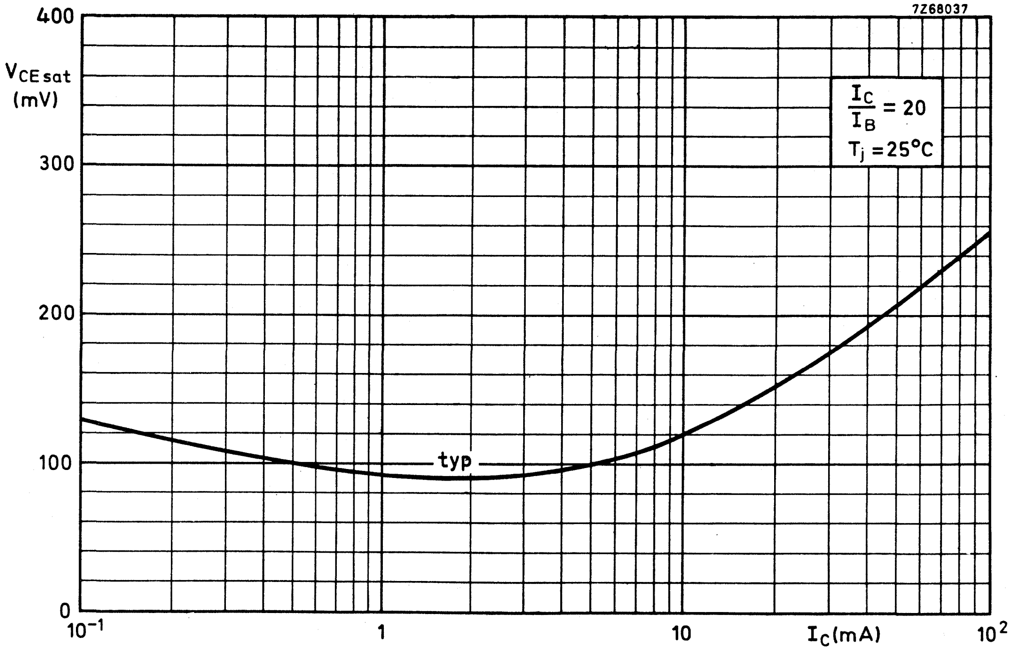

7Z68037
V_{CEsat}
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
400
300
200
100
0
10^{-1}
1
10
I_C (mA)
10^2

Fig. 5

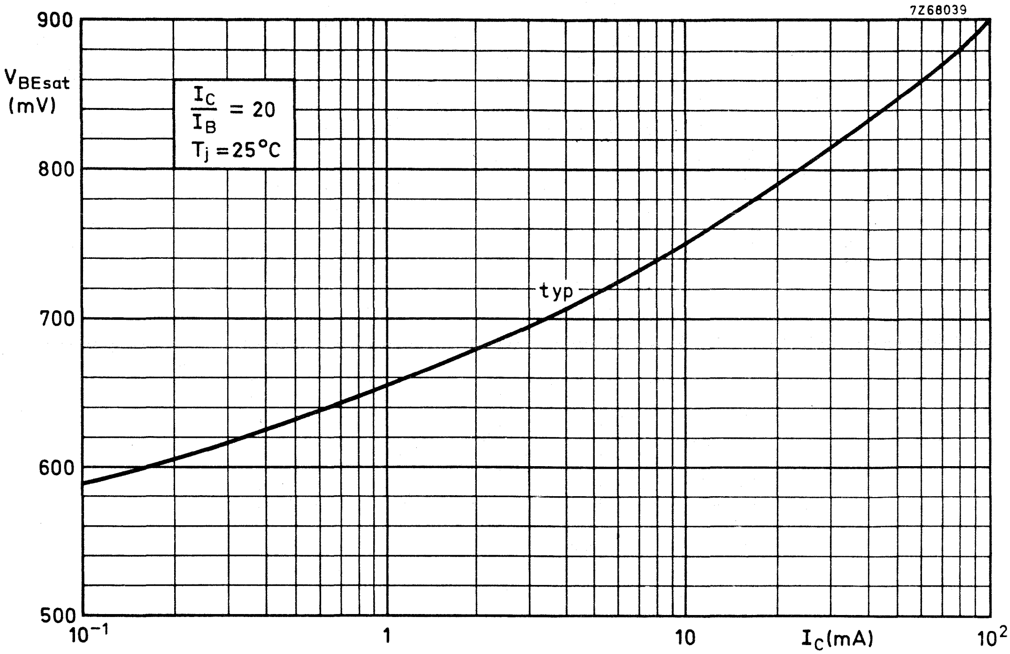

7Z68039
900
800
700
600
500
V_{BEsat} (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

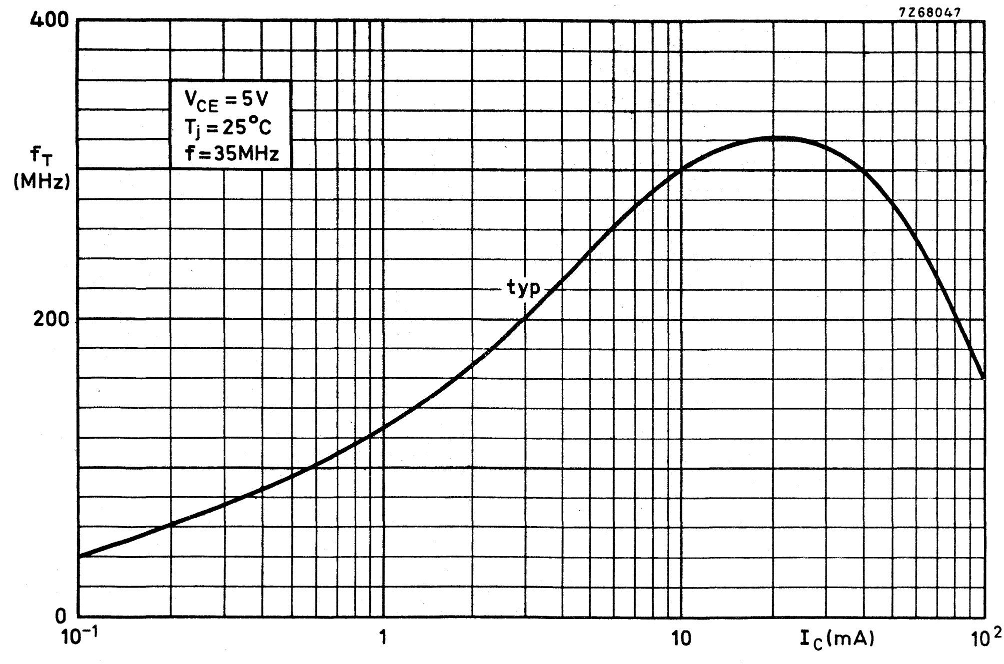

7Z68047
400
200
0
f_T (MHz)
$V_{CE} = 5V$
$T_j = 25°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

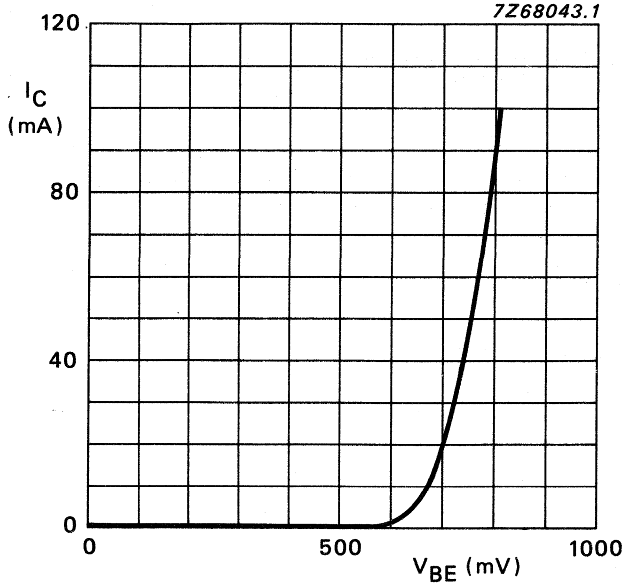


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

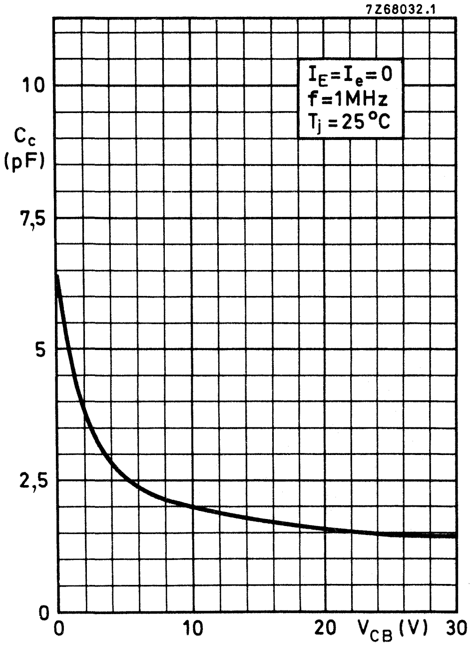


Fig. 9

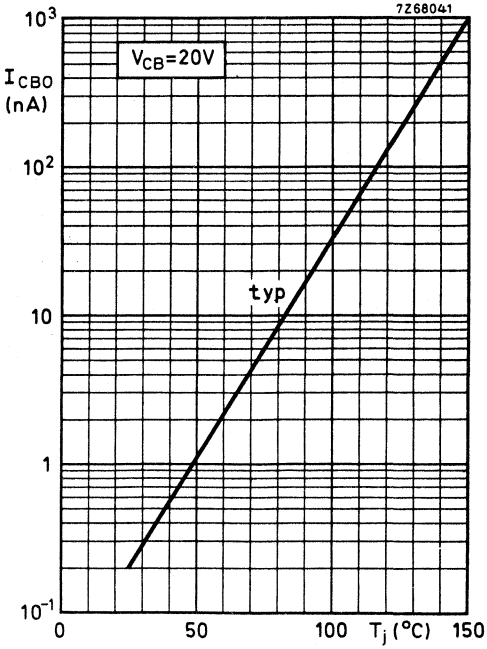


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage ($V_{BE} = 0$)	V_{CES}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz $V_{CE} = 5$ V; $I_C = 10$ mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz $V_{CE} = 5$ V; $I_C = 200$ μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

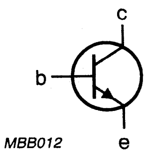
Fig. 1 SOT-23.

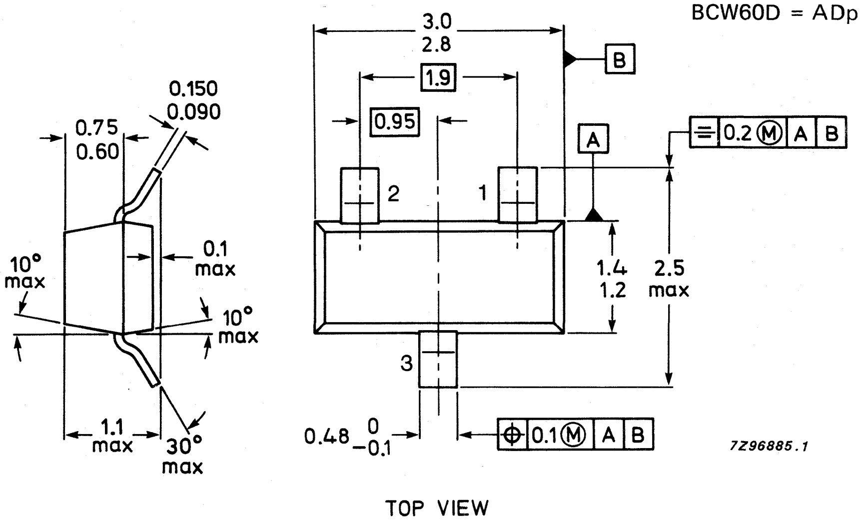
Marking code

BCW60A = AAp
BCW60B = ABp
BCW60C = ACp
BCW60D = ADp

Pinning:

1 = base
2 = emitter
3 = collector





See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	200	mA
Base current	I_B	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	– 65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{BE} = 0; V_{CE} = 32 V	I_{CES}	<	20	nA
V_{BE} = 0; V_{CE} = 32 V; T_{amb} = 150 °C	I_{CES}	<	20	μA
Emitter-base cut-off current				
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20	nA
Saturation voltages				
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}	0,05 to 0,35		V
	V_{BEsat}	0,6 to 0,85		V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}	0,1 to 0,55		V
	V_{BEsat}	0,7 to 1,05		V
Transition frequency at f = 100 MHz ▲		>	125	MHz
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	250	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0,5 V	C_e	typ.	8	pF
Noise figure at R_S = 2 kΩ		typ.	2	dB
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	6	dB

* Mounted on a ceramic substrate of 8 mm x 10 mm x 0,7 mm.
▲ Measured under pulse conditions.

			BCW60A	60B	60C	60D	
D.C. current gain							
$V_{CE} = 5$ V; $I_C = 10\ \mu A$	h_{FE}	>	–	20	40	100	
$V_{CE} = 5$ V; $I_C = 2$ mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
$V_{CE} = 1$ V; $I_C = 50$ mA	h_{FE}	>	50	70	90	100	
Input impedance							
$V_{CE} = 5$ V; $I_C = 2$ mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$V_{CE} = 5$ V; $I_C = 2$ mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$V_{CE} = 5$ V; $I_C = 2$ mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$V_{CE} = 5$ V; $I_C = 2$ mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μs
Base-emitter voltage							
$V_{CE} = 5$ V; $I_C = 2$ mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
$V_{CE} = 5$ V; $I_C = 10\ \mu A$	V_{BE}	typ.	0,52				V
$V_{CE} = 1$ V; $I_C = 50$ mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

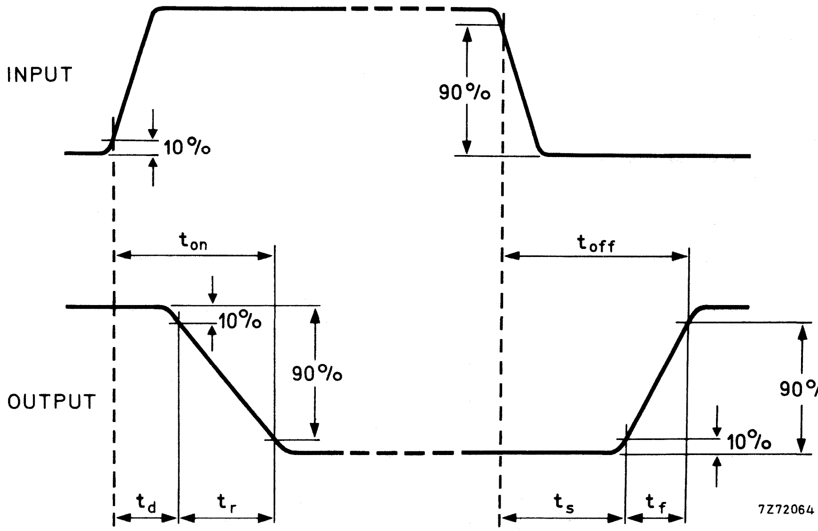


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	32	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz $-V_{CE} = 5$ V; $-I_C = 10$ mA	f_T	typ.	180	MHz
Noise figure at f = 1 kHz $-V_{CE} = 5$ V; $-I_C = 200$ µA	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

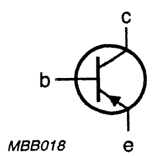
Fig. 1 SOT-23.

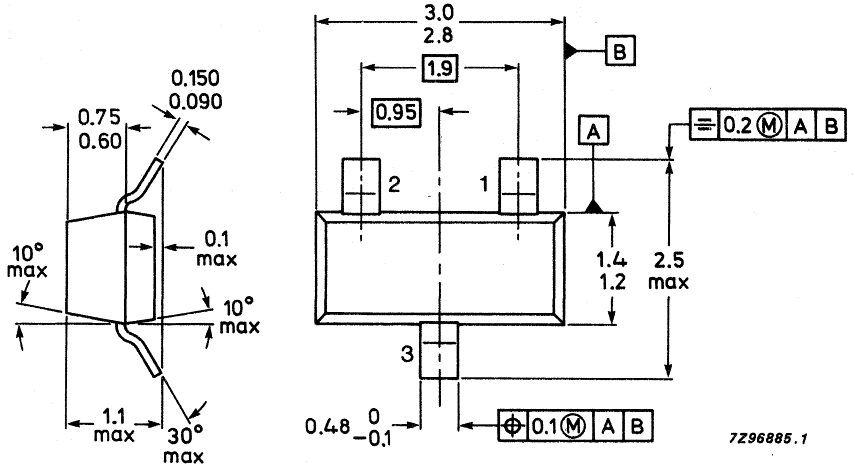
Marking code

BCW61A = BAp
BCW61B = BBp
BCW61C = BCp
BCW61D = BDp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations*.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	32	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	32	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Base current	$-I_B$	max.	50	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector-emitter cut-off current				
$V_{EB} = 0; -V_{CE} = 32$ V	$-I_{CES}$	<	20	nA
$V_{EB} = 0; -V_{CE} = 32$ V; $T_{amb} = 150\ ^oC$	$-I_{CES}$	<	20	µA
Emitter-base cut-off current				
$I_C = 0; -V_{EB} = 4$ V	$-I_{EBO}$	<	20	nA
Saturation voltages				
$-I_C = 10$ mA; $-I_B = 0{,}25$ mA	$-V_{CEsat}$		0,06 to 0,25	V
	$-V_{BEsat}$		0,6 to 0,85	V
$-I_C = 50$ mA; $-I_B = 1{,}25$ mA	$-V_{CEsat}$		0,12 to 0,55	V
	$-V_{BEsat}$		0,68 to 1,05	V
Transition frequency at f = 100 MHz ▲				
$-V_{CE} = 5$ V; $-I_C = 10$ mA	f_T	typ.	180	MHz
Collector capacitance at f = 1 MHz				
$-V_{CB} = 10$ V; $I_E = I_e = 0$	C_c	typ.	4,5	pF
Emitter capacitance at f = 1 MHz				
$-V_{EB} = 0{,}5$ V; $I_C = I_c = 0$	C_e	typ.	11	pF
Noise figure at $R_S = 2\ k\Omega$				
$-V_{CE} = 5$ V; $-I_C = 200\ \mu A$; B = 200 Hz	F	typ.	2	dB
		<	6	dB

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

▲ Measured under pulse conditions.

			BCW61A	61B	61C	61D	
D.C. current gain							
$-V_{CE} = 5$ V; $-I_C = 10\ \mu A$	h_{FE}	>	–	30	40	100	
$-V_{CE} = 5$ V; $-I_C = 2$ mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
$-V_{CE} = 1$ V; $-I_C = 50$ mA	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE} = 5$ V; $-I_C = 2$ mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
$-V_{CE} = 5$ V; $-I_C = 2$ mA	V_{BE}		0,6 to 0,75 (all types)				V
		typ.	0,65 (all types)				V
$-V_{CE} = 5$ V; $-I_C = 10\ \mu A$	V_{BE}	typ.	0,55 (all types)				V
$-V_{CE} = 1$ V; $-I_C = 50$ mA	V_{BE}	typ.	0,72 (all types)				V

Switching times

$-I_{Con} = 10$ mA; $-I_{Bon} = I_{Boff} = 1$ mA
$-V_{CC} = 10$ V; $R_L = 990\ \Omega$

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

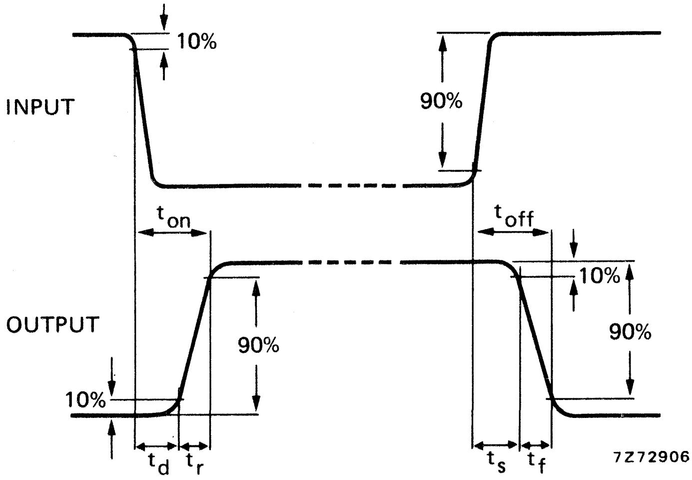


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW69	BCW70	
D.C. current gain at T_j = 25 °C; $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50		V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45		V
Collector current (peak value)	$-I_{CM}$	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz; $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ; $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

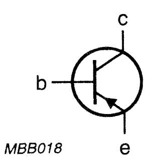
MECHANICAL DATA

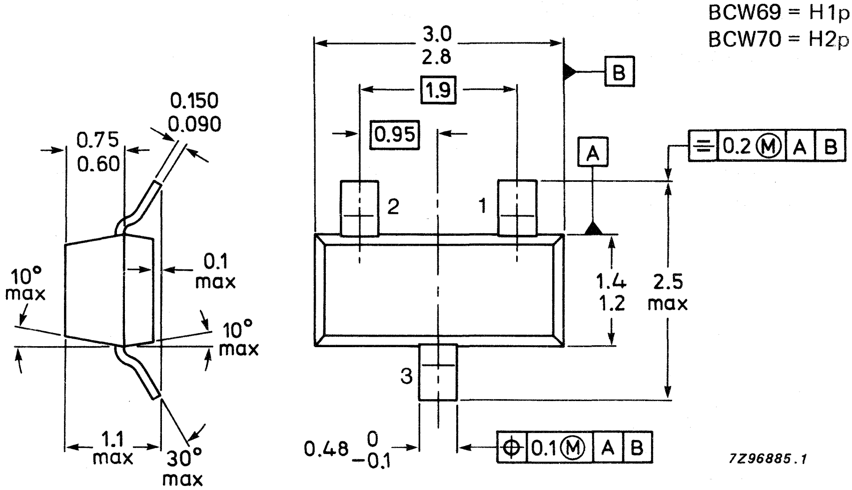
Dimensions in mm

Marking code
BCW69 = H1p
BCW70 = H2p

Fig. 1 SOT-23.

Pinning:
1 = base
2 = emitter
3 = collector





Reverse pinning types are available on request.

TOP VIEW

See also *Soldering recommendations.*

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	50 V
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50 V
Collector-emitter voltage (open base) $-I_C$ = 2 mA	$-V_{CEO}$	max.	45 V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5 V
Collector current (d.c.)	$-I_C$	max.	100 mA
Collector current (peak value)	$-I_{CM}$	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	<	100 nA
I_E = 0; $-V_{CB}$ = 20 V; T_j = 100 °C	$-I_{CBO}$	<	10 μA
Base-emitter voltage			
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	$-V_{BE}$		600 to 750 mV
Saturation voltages	$-V_{CEsat}$	typ.	80 mV
		<	300 mV
$-I_C$ = 10 mA; $-I_B$ = 0,5 mA	$-V_{BEsat}$	typ.	720 mV
$-I_C$ = 50 mA; $-I_B$ = 2,5 mA	$-V_{CEsat}$	typ.	150 mV
	$-V_{BEsat}$	typ.	810 mV

			BCW69	BCW70	
D.C. current gain					
$-I_C$ = 10 μA; $-V_{CE}$ = 5 V	h_{FE}	typ.	90	150	
$-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	>	120	215	
		<	260	500	
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; $-V_{CB}$ = 10 V	C_c	typ.	4,5		pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150		MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V f = 1 kHz; B = 200 Hz	F	<	10		dB

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

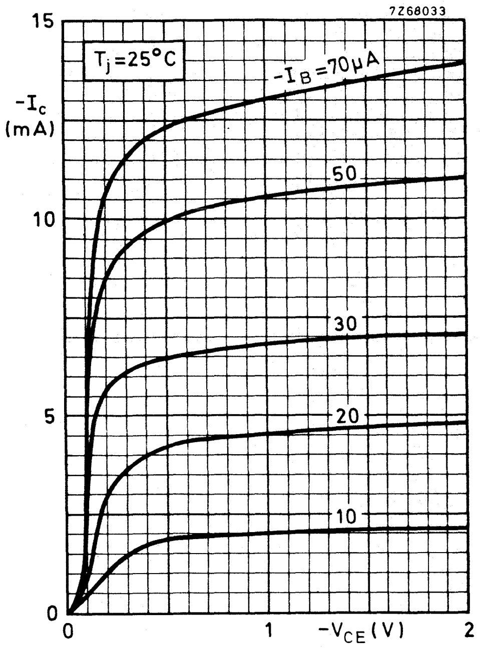


Fig. 2.

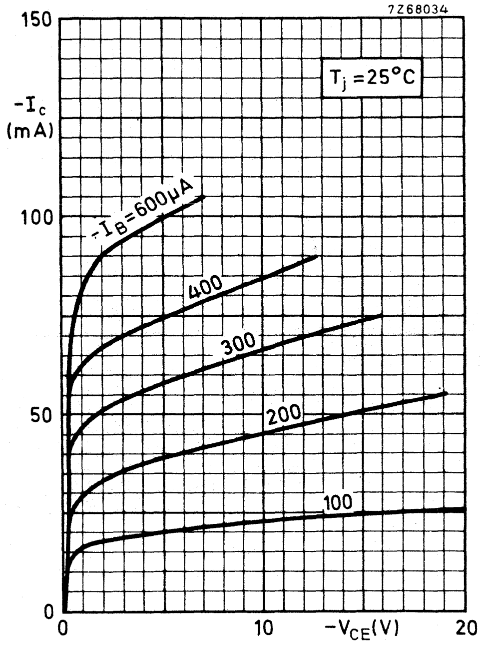


Fig. 3.

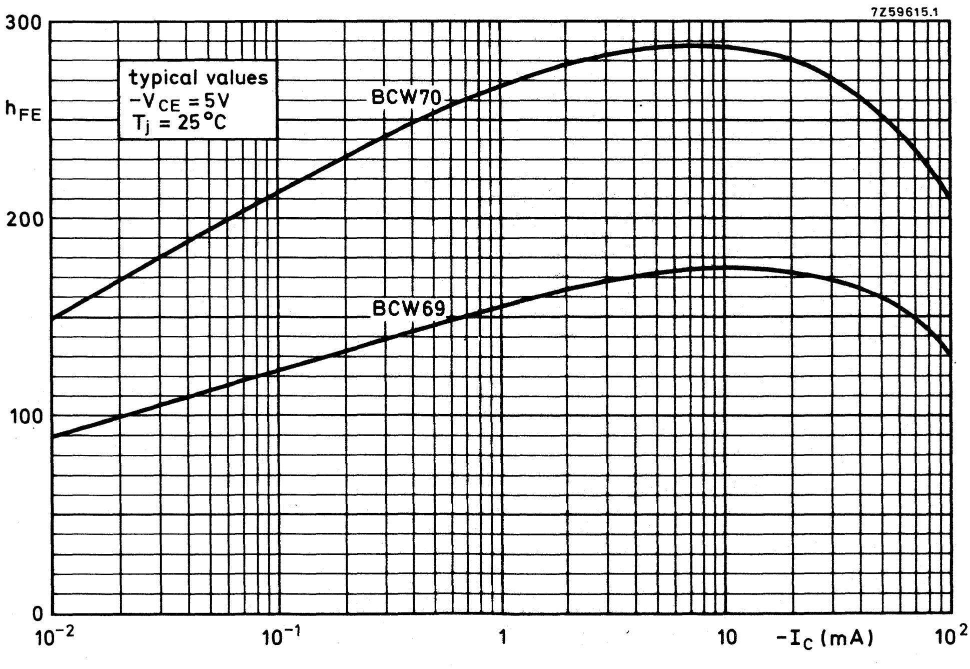


Fig. 4 D.C. current gain.

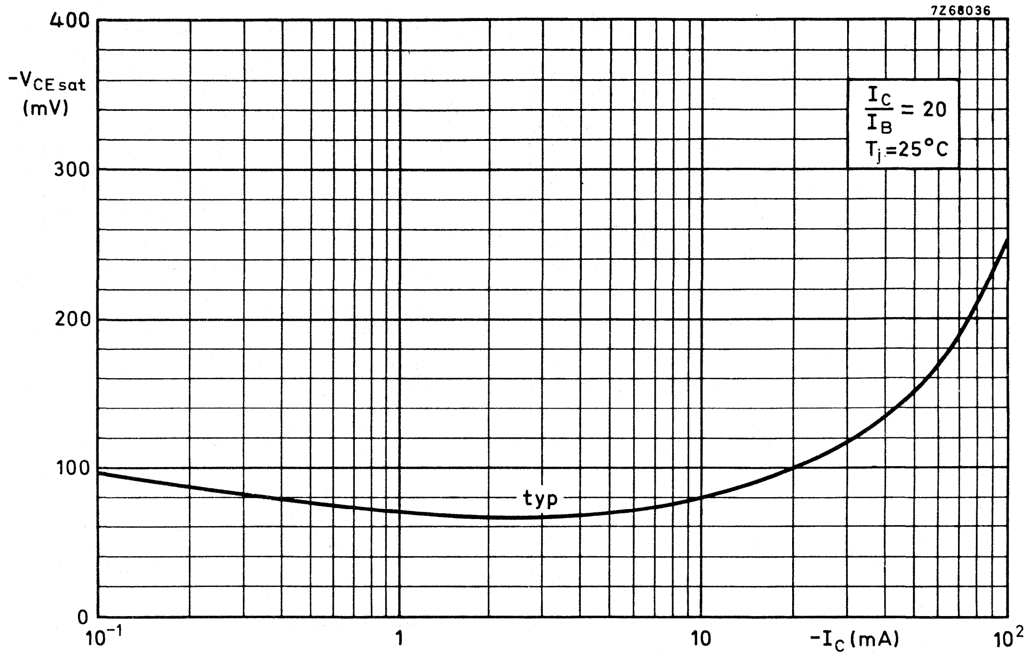

7Z68036
400
300
200
100
0
$-V_{CEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 5.

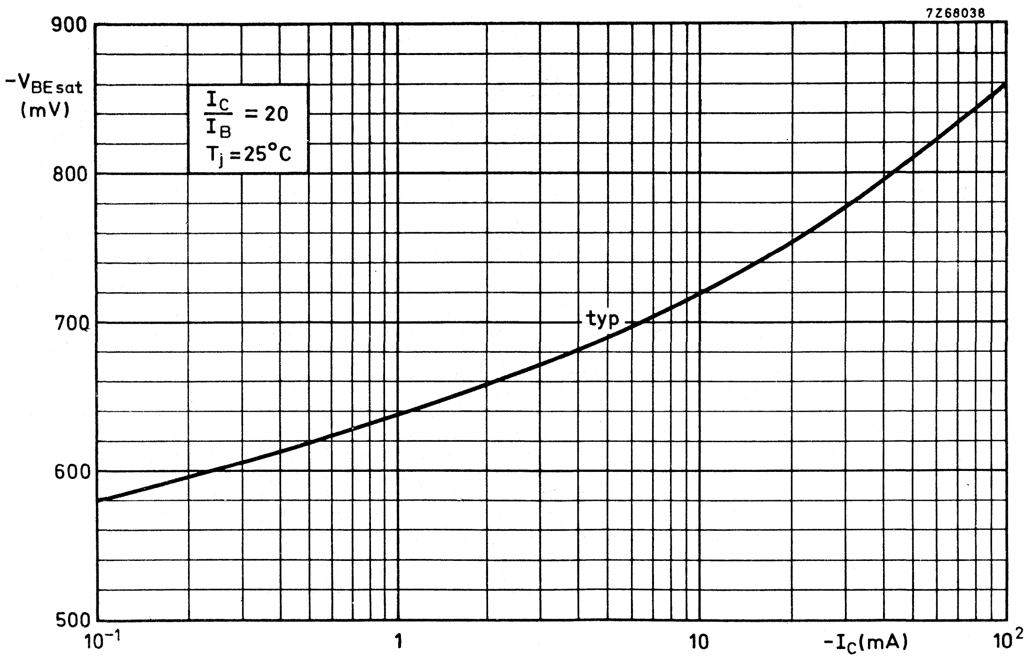

7Z68038
900
800
700
600
500
$-V_{BEsat}$ (mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
typ
10^{-1}
1
10
$-I_C$ (mA)
10^2

Fig. 6.

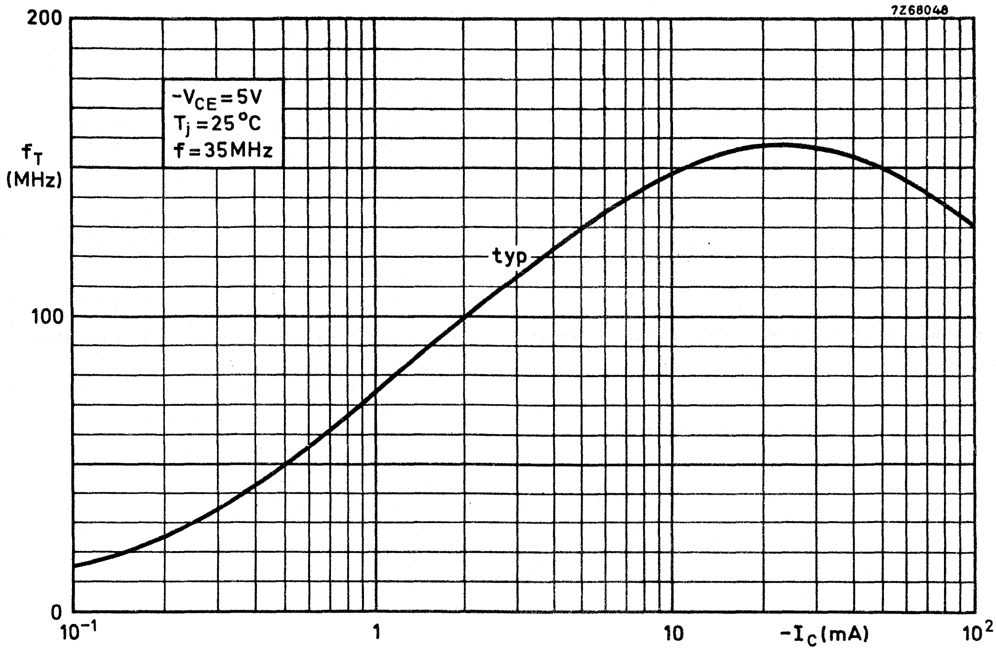


Fig. 7.

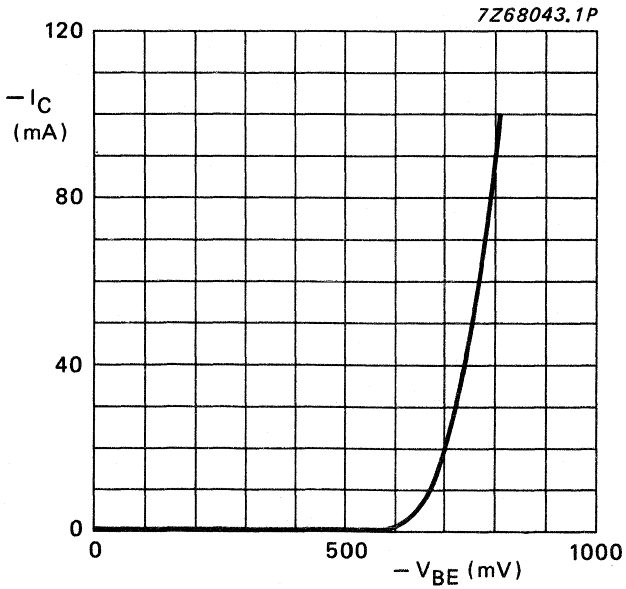


Fig. 8.; $-V_{CE} = 5$ V; $T_j = 25$ °C; typical values.

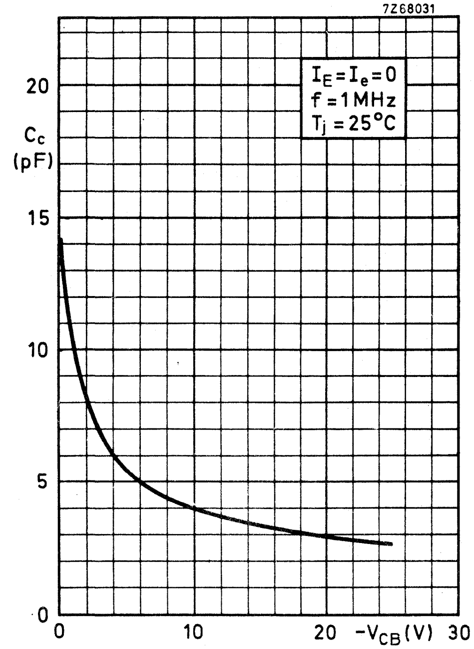

7Z68031
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25$ °C
C_c (pF)
20
15
10
5
0
0
10
20
$-V_{CB}$ (V)
30

Fig. 9.

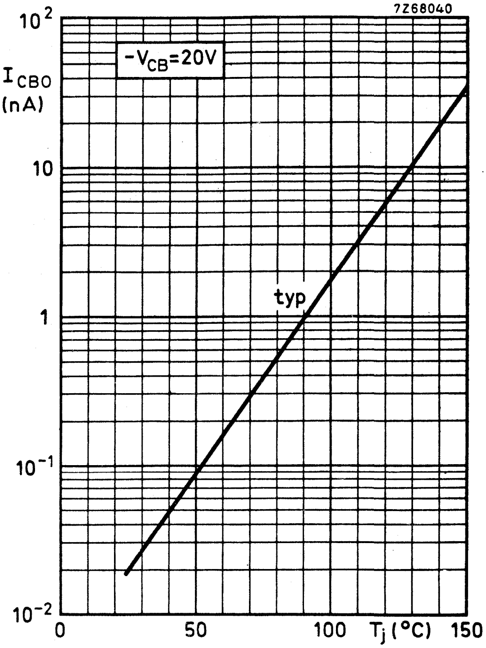

7Z68040
$-V_{CB} = 20$ V
$-I_{CBO}$ (nA)
10^2
10
1
10^{-1}
10^{-2}
typ
0
50
100
T_j (°C)
150

Fig. 10.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

			BCW71	BCW72	
D.C. current gain at T_j = 25 °C I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> <	110 220	200 450	
Collector-base voltage (open emitter)	V_{CBO}	max.	50		V
Collector-emitter voltage (open base)	V_{CEO}	max.	45		V
Collector current (peak value)	I_{CM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300		MHz
Noise figure at R_S = 2 kΩ I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10		dB

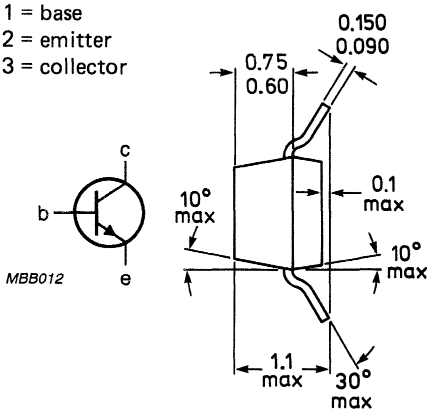
MECHANICAL DATA

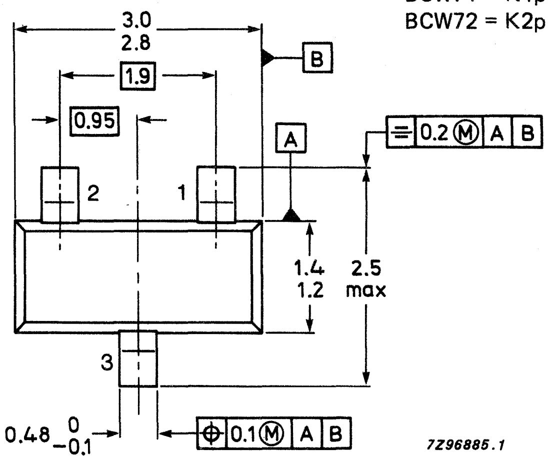
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BCW71 = K1p
BCW72 = K2p

Pinning:
1 = base
2 = emitter
3 = collector





Reverse pinning types are available on request.

TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base) $I_C = 2$ mA	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to $T_{amb} = 25$ °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 100$ °C	I_{CBO}	<	10	μA
Base emitter voltage				
$I_C = 2$ mA; $V_{CE} = 5$ V	V_{BE}		550 to 700	mV
Saturation voltages				
$I_C = 10$ mA; $I_B = 0,5$ mA	V_{CEsat}	typ.	120	mV
		<	250	mV
	V_{BEsat}	typ.	750	mV
$I_C = 50$ mA; $I_B = 2,5$ mA	V_{CEsat}	typ.	210	mV
	V_{BEsat}	typ.	850	mV

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

			BCW71	BCW72	
D.C. current gain					
$I_C = 10\ \mu A$; $V_{CE} = 5\ V$	h_{FE}	typ.	90	150	
$I_C = 2\ mA$; $V_{CE} = 5\ V$	h_{FE}	>	110	200	
		<	220	450	
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10\ V$	C_c	typ.	2,5		pF
Transition frequency at f = 35 MHz $I_C = 10\ mA$; $V_{CE} = 5\ V$	f_T	typ.	300		MHz
Noise figure at $R_S = 2\ k\Omega$ $I_C = 200\ \mu A$; $V_{CE} = 5\ V$ f = 1 kHz; B = 200 Hz	F	<	10		dB

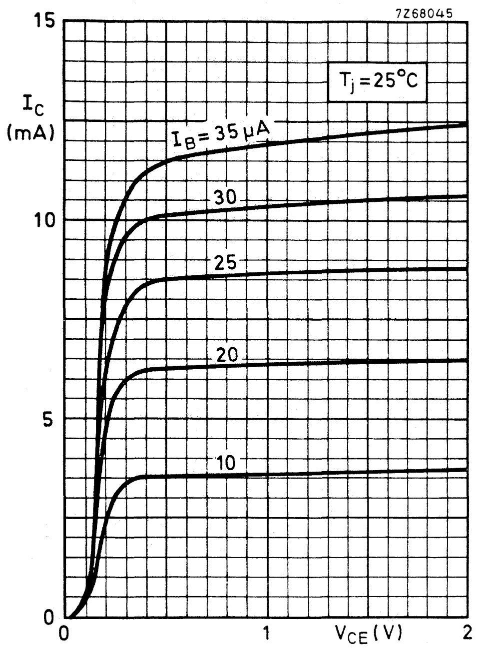


Fig. 2

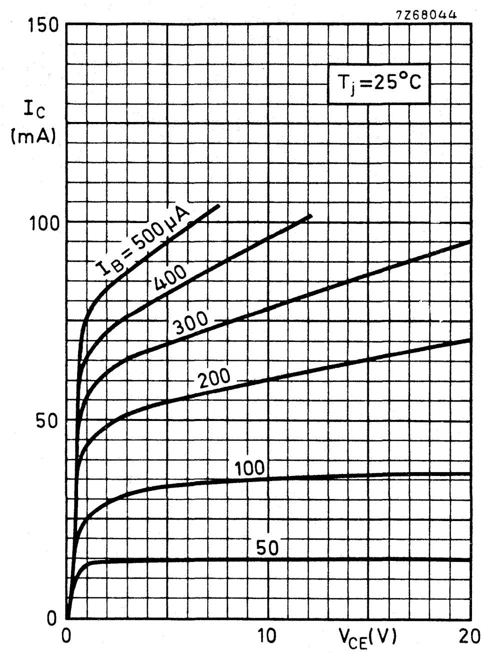


Fig. 3

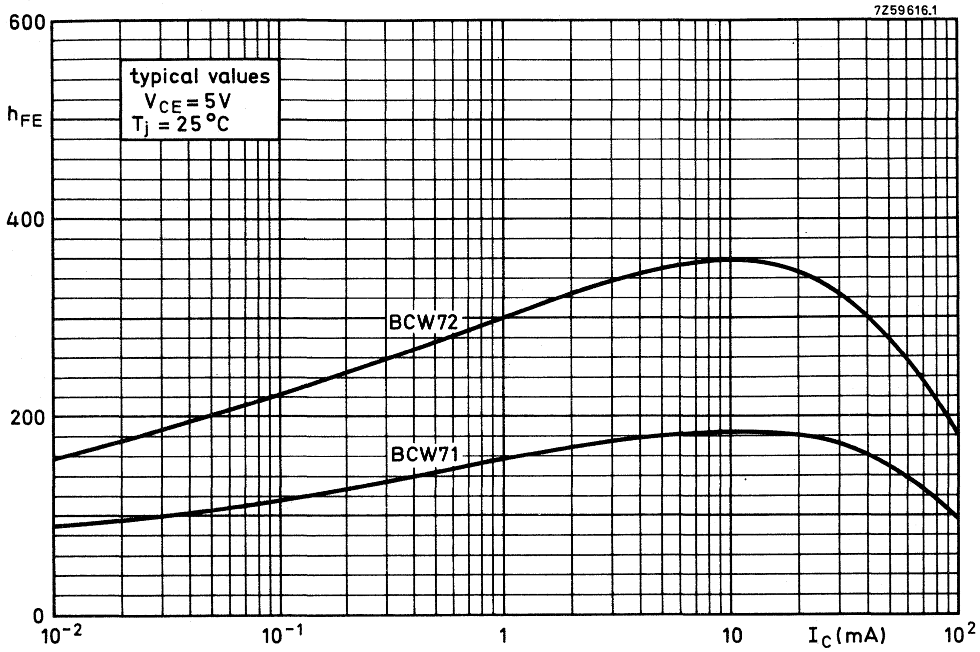


Fig. 4 D.C. current gain.

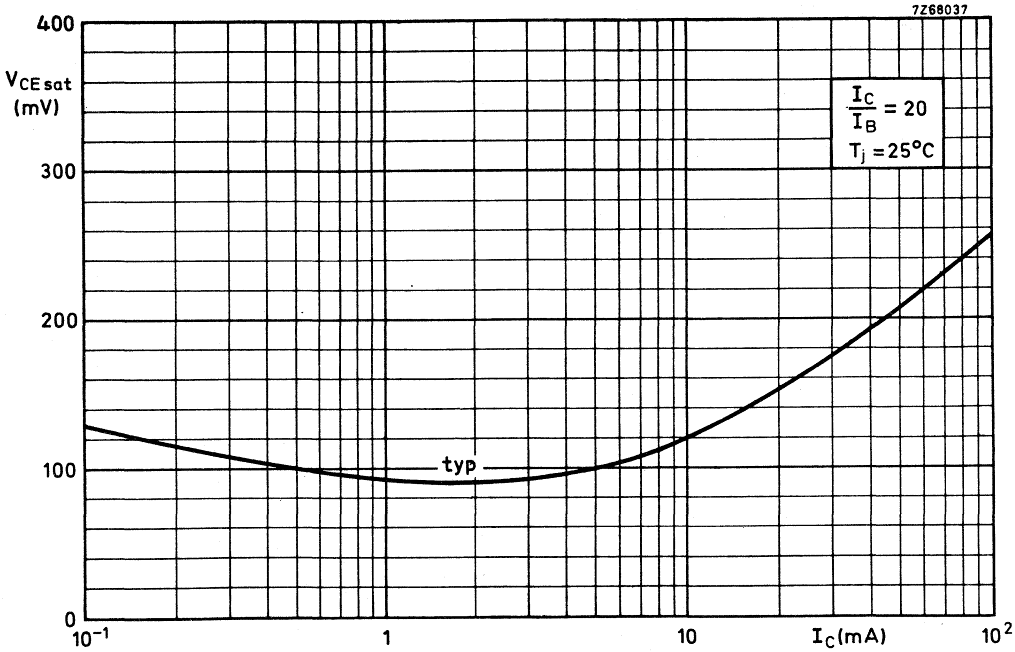


Fig. 5

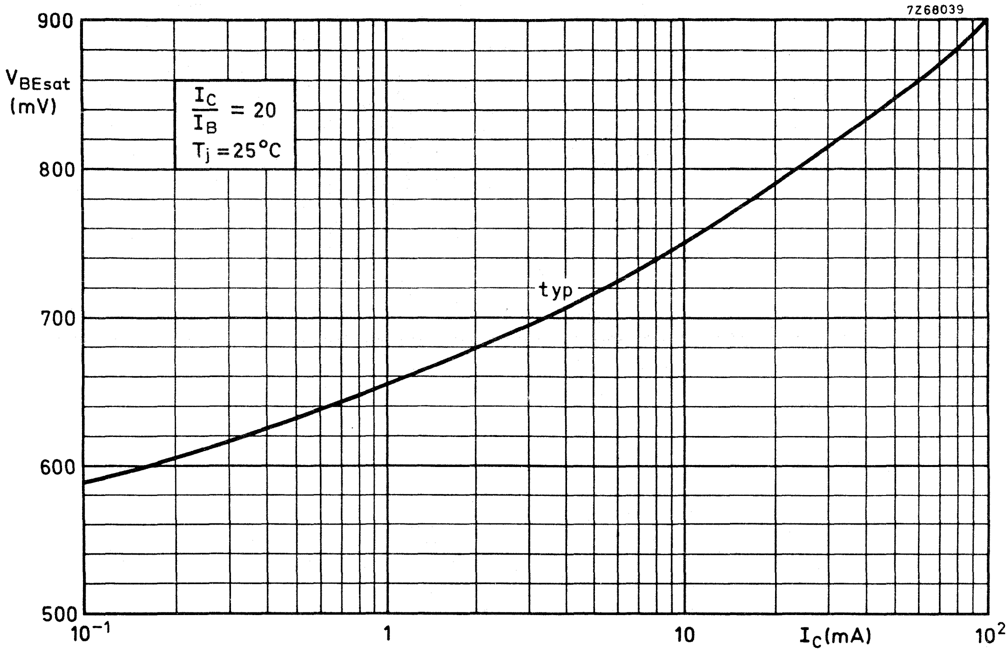

7Z68039
900
800
700
600
500
V_{BEsat}
(mV)
$\frac{I_C}{I_B} = 20$
$T_j = 25\,°C$
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 6

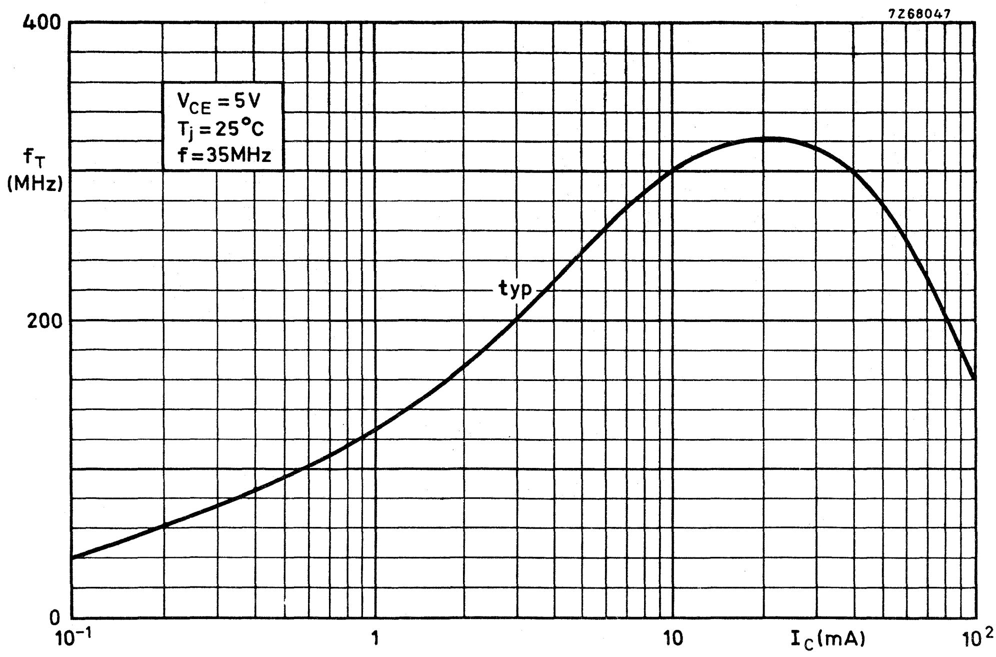

7Z68047
400
200
0
f_T
(MHz)
$V_{CE} = 5\,V$
$T_j = 25\,°C$
f = 35MHz
typ
10^{-1}
1
10
I_C(mA)
10^2

Fig. 7

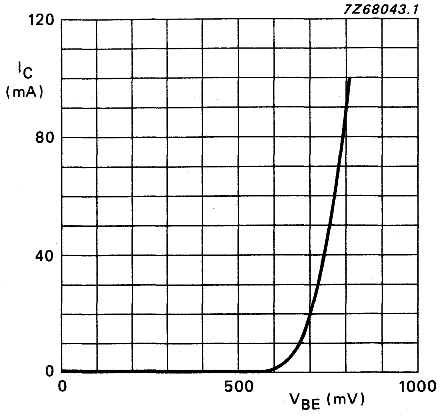


Fig. 8 V_{CE} = 5 V; T_j = 25 °C; typical values.

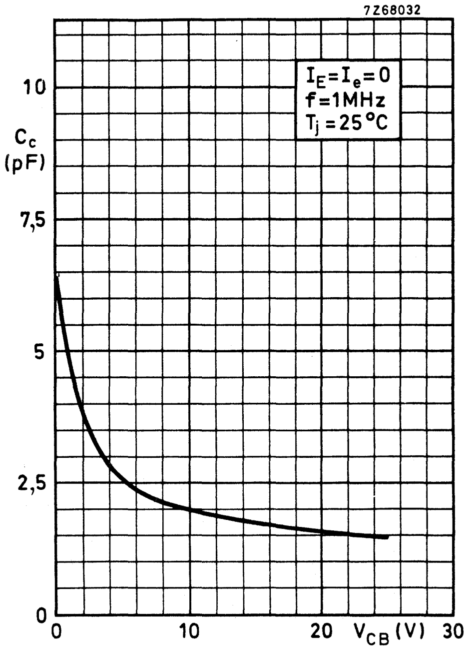


Fig. 9

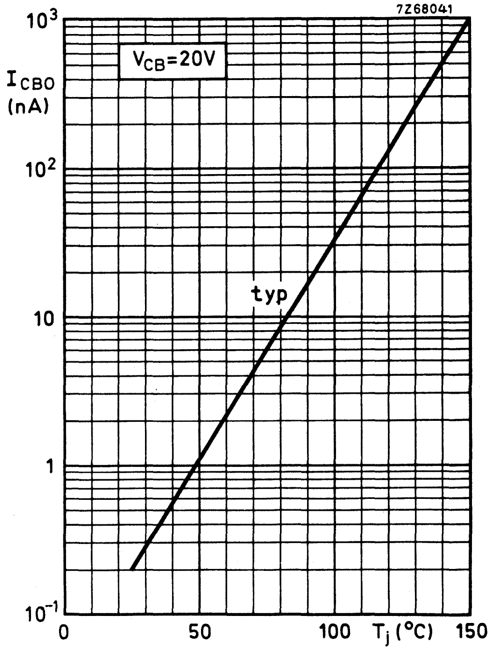


Fig. 10

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (peak value)	I_{CM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C; I_C = 2 mA; V_{CE} = 5 V	h_{FE}	> / <	420 / 800	
Transition frequency at f = 35 MHz; I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300	MHz
Noise figure at R_S = 2 kΩ; I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

MECHANICAL DATA

Dimensions in mm

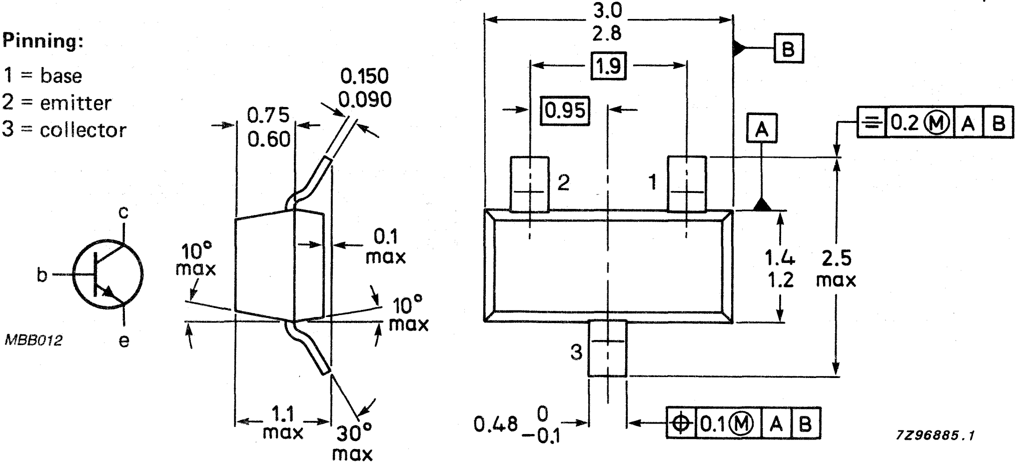
Fig. 1 SOT-23.

Marking code

BCW81 = K3p

Pinning:

1 = base
2 = emitter
3 = collector



TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	50 V
Collector-emitter voltage (open base) I_C = 2 mA	V_{CEO}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	5 V
Collector current (d.c.)	I_C	max.	100 mA
Collector current (peak value)	I_{CM}	max.	200 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current			
$I_E = 0$; V_{CB} = 20 V	I_{CBO}	<	100 nA
$I_E = 0$; V_{CB} = 20 V; T_j = 100 °C	I_{CBO}	<	10 μA
Base emitter voltage			
I_C = 2 mA; V_{CE} = 5 V	V_{BE}	550 to 700 mV	
Saturation voltages			
I_C = 10 mA; I_B = 0,5 mA	V_{CEsat}	typ.	120 mV
		<	250 mV
	V_{BEsat}	typ.	750 mV
I_C = 50 mA; I_B = 2,5 mA	V_{CEsat}	typ.	210 mV
	V_{BEsat}	typ.	850 mV
D.C. current gain			
I_C = 2 mA; V_{CE} = 5 V	h_{FE}	>	420
		<	800
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	2,5 pF
Transition frequency at f = 35 MHz			
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	300 MHz
Noise figure at R_S = 2 kΩ			
I_C = 200 μA; V_{CE} = 5 V			
f = 1 kHz; B = 200 Hz	F	<	10 dB

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

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a microminiature plastic envelope, intended for low level general purpose applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	V
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 2 mA; $-V_{CE}$ = 5 V	h_{FE}	> <	120 260	
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	150	MHz
Noise figure at R_S = 2 kΩ $-I_C$ = 200 μA; $-V_{CE}$ = 5 V; f = 1 kHz; B = 200 Hz	F	<	10	dB

MECHANICAL DATA

Dimensions in mm

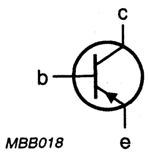
Fig. 1 SOT-23.

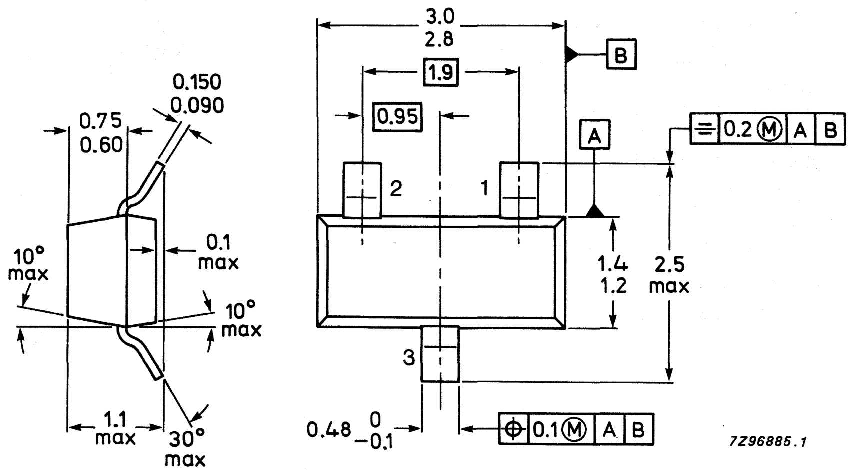
Marking code

BCW89 = H3p

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	80	V
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	60	V
Collector-emitter voltage (open base) $-I_C = 2$ mA	$-V_{CEO}$	max.	60	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	100	mA
Collector current (peak value)	$-I_{CM}$	max.	200	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB} = 20$ V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 100\ ^oC$	$-I_{CBO}$	<	10	μA
Base-emitter voltage				
$-I_C = 2$ mA; $-V_{CE} = 5$ V; $T_j = 25\ ^oC$	$-V_{BE}$		600 to 750	mV
Saturation voltages				
$-I_C = 10$ mA; $-I_B = 0,5$ mA	$-V_{CEsat}$	typ.	80	mV
		<	300	mV
	$-V_{BEsat}$	typ.	720	mV
$-I_C = 50$ mA; $-I_B = 2,5$ mA	$-V_{CEsat}$	typ.	150	mV
	$-V_{BEsat}$	typ.	810	mV
D.C. current gain				
$-I_C = 10\ \mu$A; $-V_{CE} = 5$ V	h_{FE}	typ.	90	
$-I_C = 2$ mA; $-V_{CE} = 5$ V	h_{FE}	>	120	
		<	260	
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	4,5	pF
Transition frequency at f = 35 MHz				
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	150	MHz
Noise figure at $R_S = 2\ k\Omega$				
$-I_C = 200\ \mu$A; $-V_{CE} = 5$ V; f = 1 kHz; B = 200 Hz	F	<	10	dB

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

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
N-P-N complements are BCX19 and BCX20 respectively.

QUICK REFERENCE DATA

			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}		100 to 600		
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 35 MHz	f_T	typ.	100		MHz

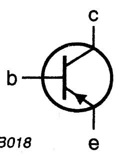
MECHANICAL DATA

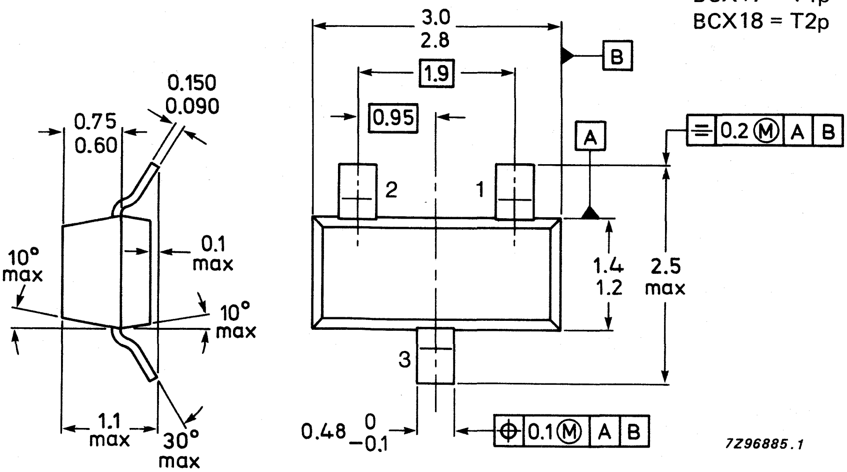
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BCX17 = T1p
BCX18 = T2p

Pinning:
1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

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

			BCX17	BCX18	
Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage $-I_C = 10$ mA (see Fig. 2)	$-V_{CEO}$	max.	45	25	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	V

Collector current (d.c.)	$-I_C$	max.	500	mA
Collector current (peak value)	$-I_{CM}$	max.	1000	mA
Emitter current (peak value)	I_{EM}	max.	1000	mA
Base current (d.c.)	$-I_B$	max.	100	mA
Base current (peak value)	$-I_{BM}$	max.	200	mA
Total power dissipation up to $T_{amb} = 25$ °C*	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB} = 20$ V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB} = 20$ V; $T_j = 150$ °C	$-I_{CBO}$	<	5	μA
Emitter cut-off current				
$I_C = 0$; $-V_{EB} = 5$ V	$-I_{EBO}$	<	10	μA
Base-emitter voltage ▲				
$-I_C = 500$ mA; $-V_{CE} = 1$ V	$-V_{BE}$	<	1,2	V
Saturation voltage				
$-I_C = 500$ mA; $-I_B = 50$ mA	$-V_{CEsat}$	<	620	mV

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

▲ $-V_{BE}$ decreases by about 2 mV/°C with increasing temperature.

D.C. current gain			
$-I_C = 100$ mA; $-V_{CE} = 1$ V	h_{FE}		100 to 600
$-I_C = 300$ mA; $-V_{CE} = 1$ V	h_{FE}	>	70
$-I_C = 500$ mA; $-V_{CE} = 1$ V	h_{FE}	>	40
Transition frequency at f = 35 MHz			
$-I_C = 10$ mA; $-V_{CE} = 5$ V	f_T	typ.	100 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $-V_{CB} = 10$ V	C_c	typ.	8 pF

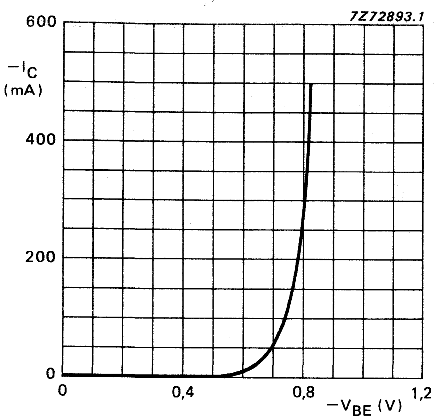


Fig. 2 $-V_{CE} = 1$ V; $T_j = 25$ °C; typical values.

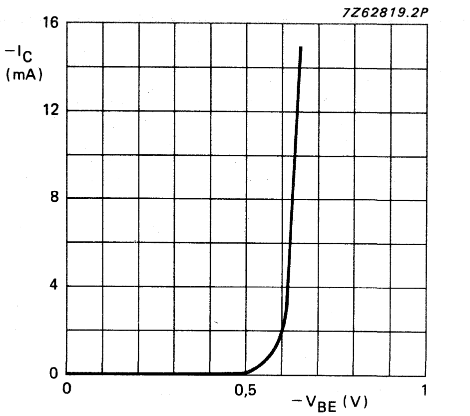


Fig. 3 $V_{CE} = 5$ V; $T_j = 25$ °C; typical values.

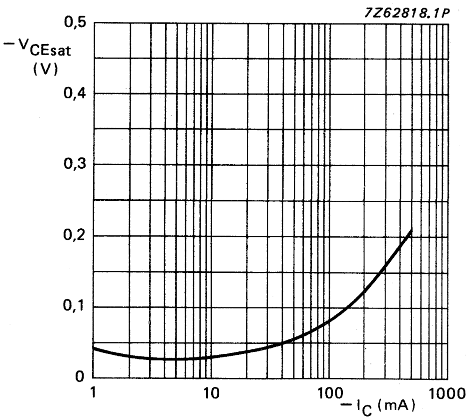


Fig. 4 $I_C/I_B = 10$; $T_j = 25$ °C; typical values.

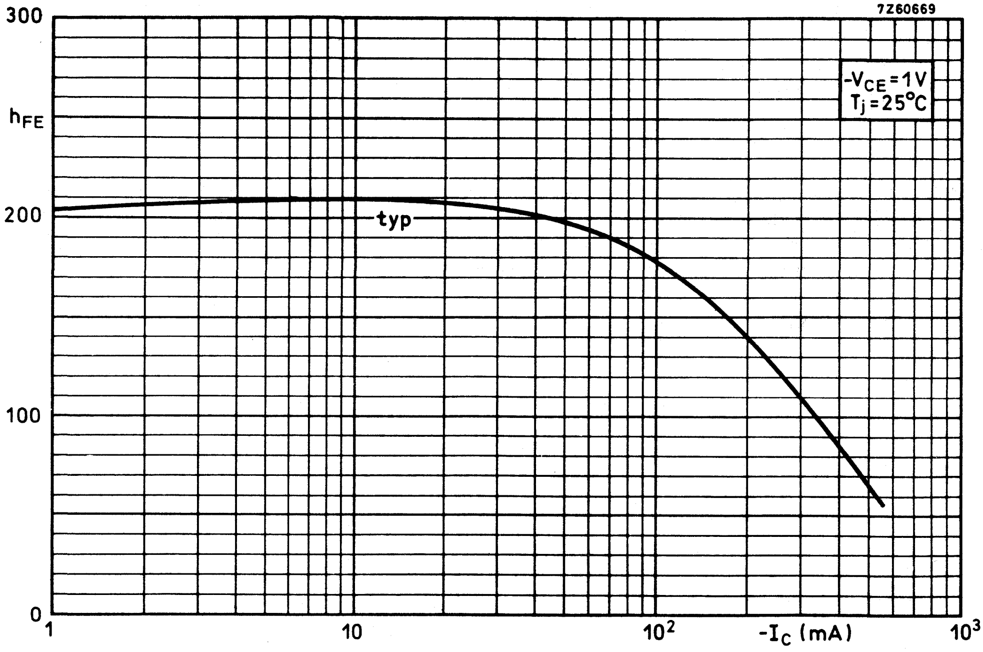

7Z60669
300
h_{FE}
200
100
0
1
10
10^2
$-I_C$ (mA)
10^3
$-V_{CE} = 1 V$
$T_j = 25°C$
typ

Fig. 5

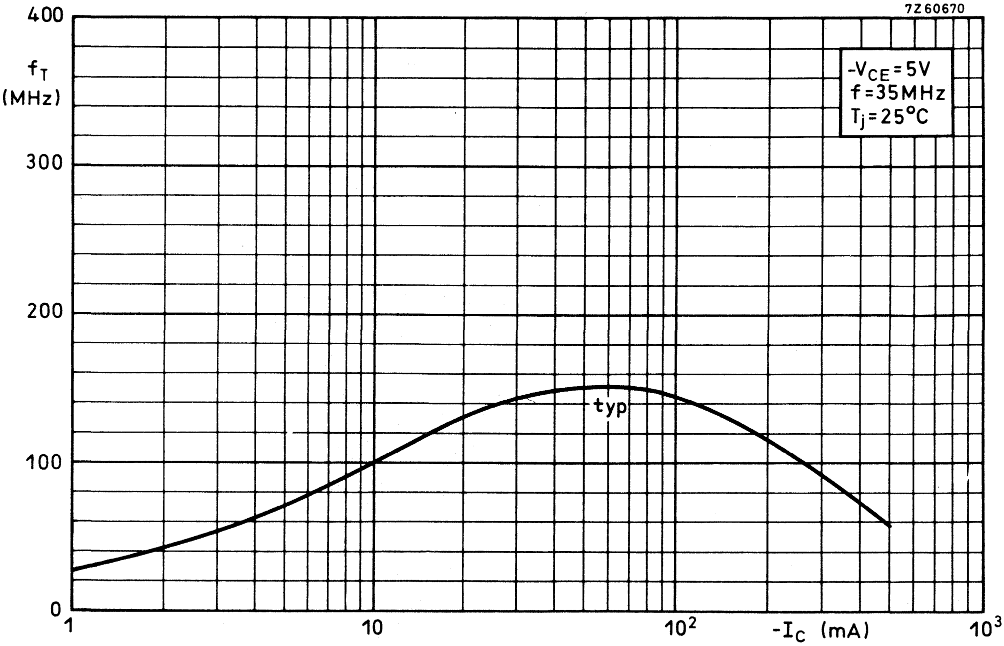

7Z60670
400
f_T (MHz)
300
200
100
0
1
10
10^2
$-I_C$ (mA)
10^3
$-V_{CE} = 5 V$
$f = 35 MHz$
$T_j = 25°C$
typ

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors, in a SOT-23 plastic envelope, intended for application in thick and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
P-N-P complements are BCX17 and BCX18 respectively.

QUICK REFERENCE DATA

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 100 mA; V_{CE} = 1 V	h_{FE}		100 to 600		
Transition frequency I_C = 10 mA; V_{CE} = 5 V; f = 35 MHz	f_T	typ.	200		MHz

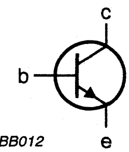
MECHANICAL DATA

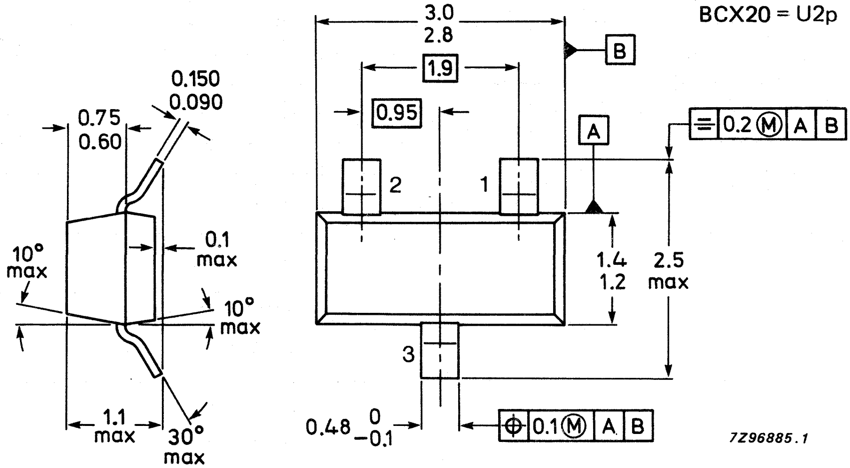
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BCX19 = U1p
BCX20 = U2p

Pinning:
1 = base
2 = emitter
3 = collector





TOP VIEW

Reverse pinning types are available on request.

See also *Soldering recommendations.*

RATINGS

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

			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base) I_C = 10 mA	V_{CEO}	max.	45	25	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	V
Collector current (d.c.)	I_C	max.	500		mA
Collector current (peak value)	I_{CM}	max.	1000		mA
Emitter current (peak value)	$-I_{EM}$	max.	1000		mA
Base current (d.c.)	I_B	max.	100		mA
Base current (peak value)	I_{BM}	max.	200		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 20 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 20 V; T_j = 150 °C	I_{CBO}	<	5	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base emitter voltage ▲				
I_C = 500 mA; V_{CE} = 1 V	V_{BE}	<	1,2	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	620	mV

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

▲ V_{BE} decreases by about 2 mV/°C with increasing temperature.

D.C. current gain		
I_C = 100 mA; V_{CE} = 1 V	h_{FE}	100 to 600
I_C = 300 mA; V_{CE} = 1 V	h_{FE}	> 70
I_C = 500 mA; V_{CE} = 1 V	h_{FE}	> 40
Transition frequency at f = 35 MHz		
I_C = 10 mA; V_{CE} = 5 V	f_T	typ. 200 MHz
Collector capacitance at f = 1 MHz		
$I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ. 5 pF

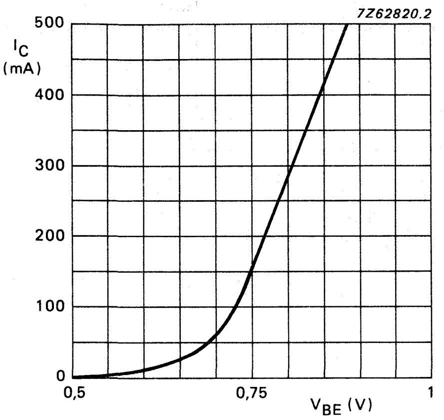


Fig. 2 V_{CE} 1 V; T_j = 25 °C; typical values.

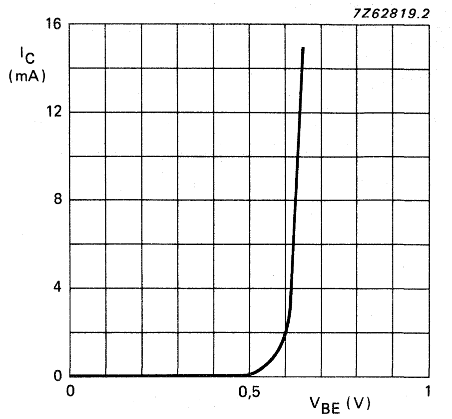


Fig. 3 V_{CE} = 5 V; T_j = 25 °C; typical values.

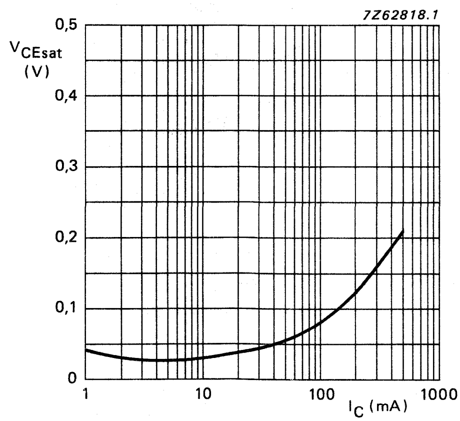


Fig. 4 I_C/I_B = 10; T_j = 25 °C; typical values.

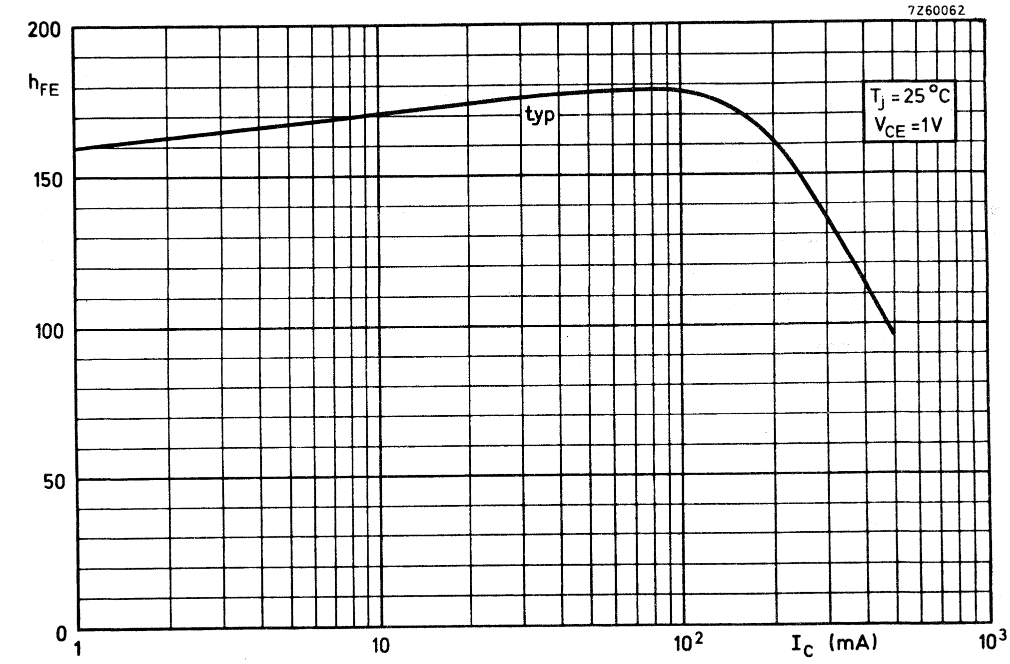

7Z60062
200
h_{FE}
150
100
50
0
1
10
10^2
I_C (mA)
10^3
typ
$T_j = 25\,°C$
$V_{CE} = 1V$

Fig. 5

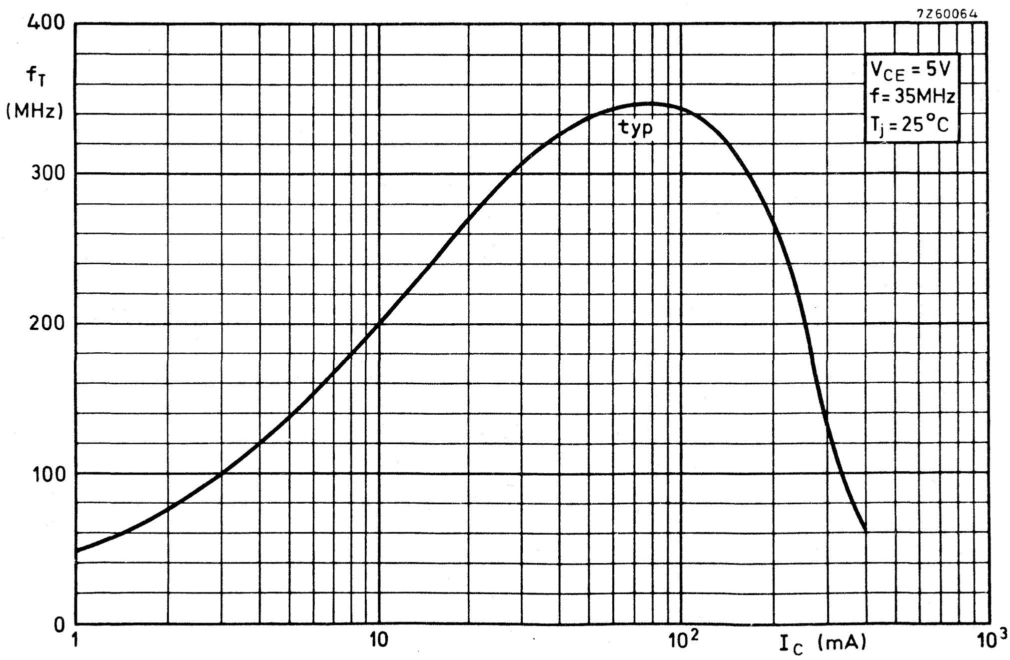

7Z60064
400
f_T
(MHz)
300
200
100
0
1
10
10^2
I_C (mA)
10^3
typ
$V_{CE} = 5V$
f = 35MHz
$T_j = 25\,°C$

Fig. 6

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power p-n-p transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

N-P-N complements are BCX54, BCX55 and BCX56 respectively.

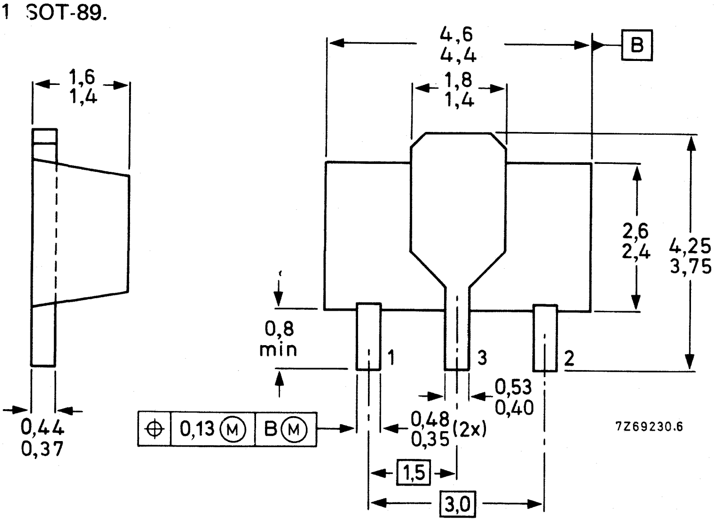
QUICK REFERENCE DATA

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain $-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

MECHANICAL DATA

Dimensions in mm

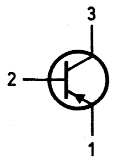
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BCX51	=AA
BCX51-10	=AC
BCX51-16	=AD
BCX52	=AE
BCX52-10	=AG
BCX52-16	=AM
BCX53	=AH
BCX53-10	=AK
BCX53-16	=AL



See also *Soldering recommendations.*

RATINGS

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

			BCX51	BCX52	BCX53	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (d.c.)	$-I_C$	max.		1,0		A
Collector current (peak value)	$-I_{CM}$	max.		1,5		A
Base current (d.c.)	$-I_B$	max.		0,1		A
Base current (peak value)	$-I_{BM}$	max.		0,2		A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	P_{tot}	max.		1,0		W
Storage temperature	T_{stg}			−65 to + 150		°C
Junction temperature	T_j	max.		150		°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm^2; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $-V_{CB}$ = 30 V	$-I_{CBO}$	<	100	nA
$I_E = 0$; $-V_{CB}$ = 30 V; T_j = 125 °C	$-I_{CBO}$	<	10	μA
Emitter cut-off current				
$I_C = 0$; $-V_{EB}$ = 5 V	$-I_{EBO}$	<	10	μA
Base-emitter voltage				
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	$-V_{BE}$	<	1	V
Saturation voltage				
$-I_C$ = 500 mA; $-I_B$ = 50 mA	$-V_{CEsat}$	<	0,5	V
D.C. current gain				
$-I_C$ = 5 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	h_{FE}		40 to 250	
$-I_C$ = 500 mA; $-V_{CE}$ = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.	50	MHz

CHARACTERISTICS (continued)

			BCX51-10 52-10 53-10	BCX51-16 52-16 53-16
D.C. current gain $-I_C = 150$ mA; $-V_{CE} = 2$ V	h_{FE}	> <	63 160	100 250

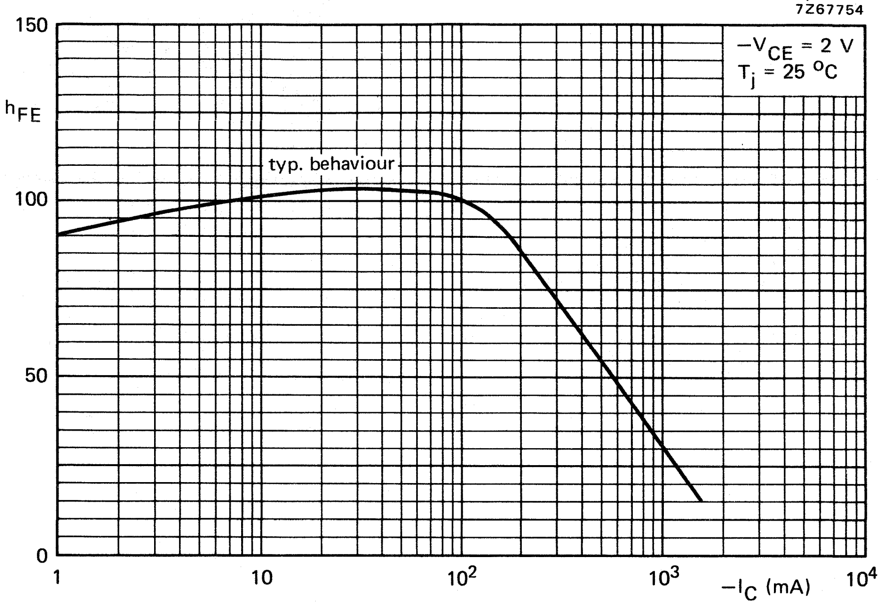


Fig. 2.

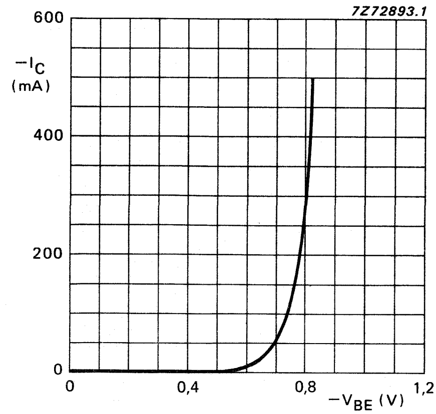


Fig. 3 $-V_{CE} = 2$ V; $T_j = 25$ °C; typical values.

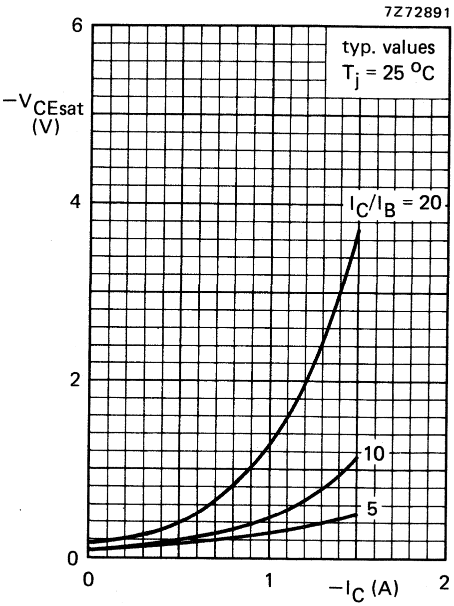


Fig. 4.

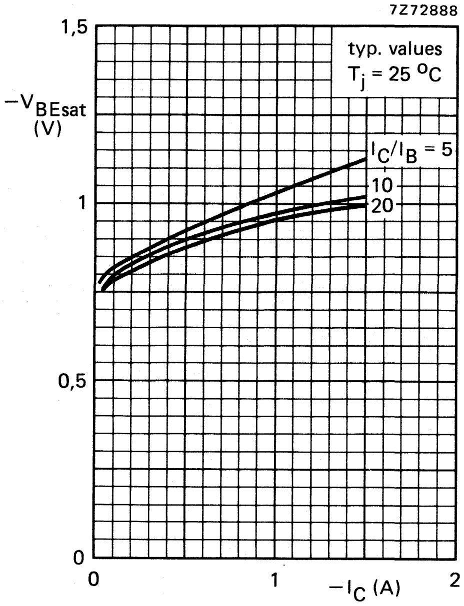


Fig. 5.

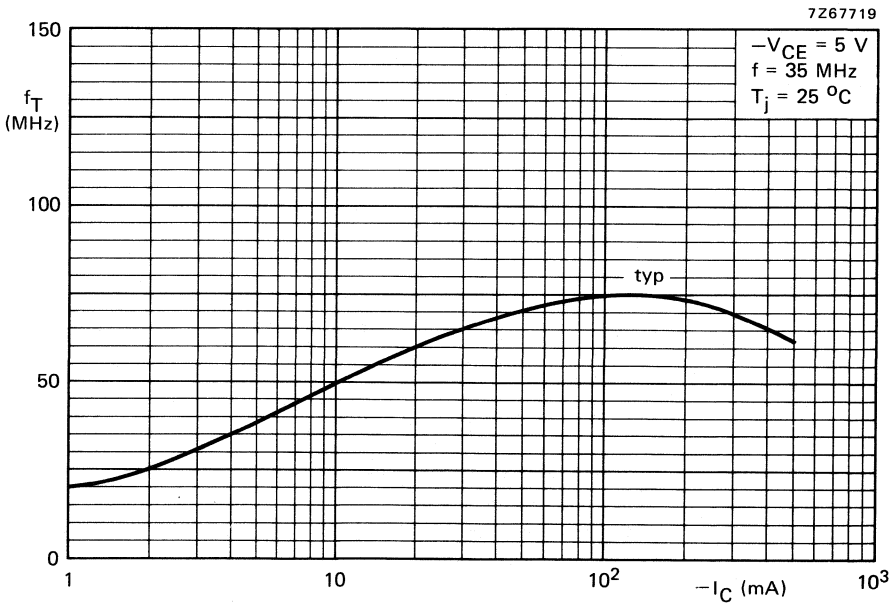


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

Medium power n-p-n transistors in a miniature plastic envelope intended for applications in thick and thin-film circuits. These transistors are intended for general purposes as well as for use in driver stages of audio amplifiers.

P-N-P complements are BCX51, BCX52 and BCX53 respectively.

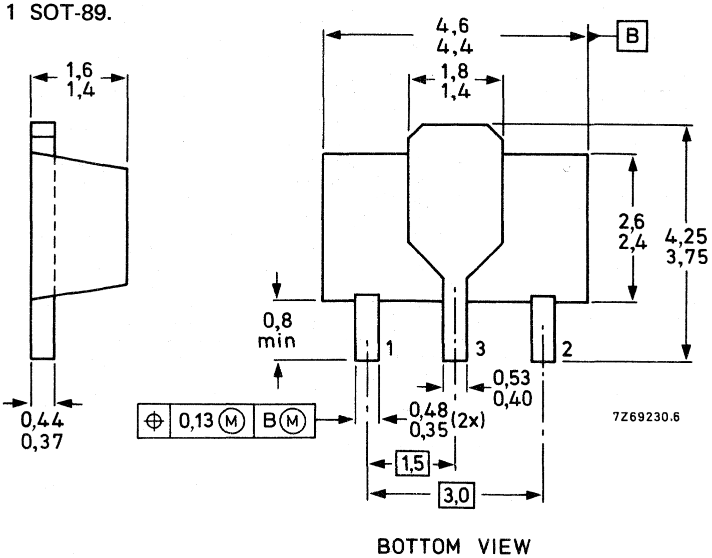
QUICK REFERENCE DATA

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector current (peak value)	I_{CM}	max.		1,5		A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}			40 to 250		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

MECHANICAL DATA

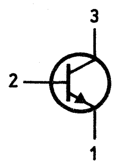
Dimensions in mm

Fig. 1 SOT-89.



Marking code

BCX54	= BA
BCX54-10	= BC
BCX54-16	= BD
BCX55	= BE
BCX55-10	= BG
BCX55-16	= BM
BCX56	= BH
BCX56-10	= BK
BCX56-16	= BL



See also *Soldering recommendations.*

RATINGS

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

			BCX54	BCX55	BCX56	
Collector-base voltage (open emitter)	V_{CBO}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	V

Collector current (d.c.)	I_C	max.	1,0	A
Collector current (peak value)	I_{CM}	max.	1,5	A
Base current (d.c.)	I_B	max.	0,1	A
Base current (peak value)	I_{BM}	max.	0,2	A
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1,0	W
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	10	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current				
I_E = 0; V_{CB} = 30 V	I_{CBO}	<	100	nA
I_E = 0; V_{CB} = 30 V; T_j = 125 °C	I_{CBO}	<	10	μA
Emitter cut-off current				
I_C = 0; V_{EB} = 5 V	I_{EBO}	<	10	μA
Base-emitter voltage				
I_C = 500 mA; V_{CE} = 2 V	V_{BE}	<	1	V
Saturation voltage				
I_C = 500 mA; I_B = 50 mA	V_{CEsat}	<	0,5	V
D.C. current gain				
I_C = 5 mA; V_{CE} = 2 V	h_{FE}	>	25	
I_C = 150 mA; V_{CE} = 2 V	h_{FE}		40 to 250	
I_C = 500 mA; V_{CE} = 2 V	h_{FE}	>	25	
Transition frequency at f = 35 MHz				
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	130	MHz

CHARACTERISTICS (continued)

			BCX54-10 55-10 56-10	BCX54-16 55-16 56-16
D.C. current gain I_C = 150 mA; V_{CE} = 2 V	h_{FE}	>	63	100
		<	160	250

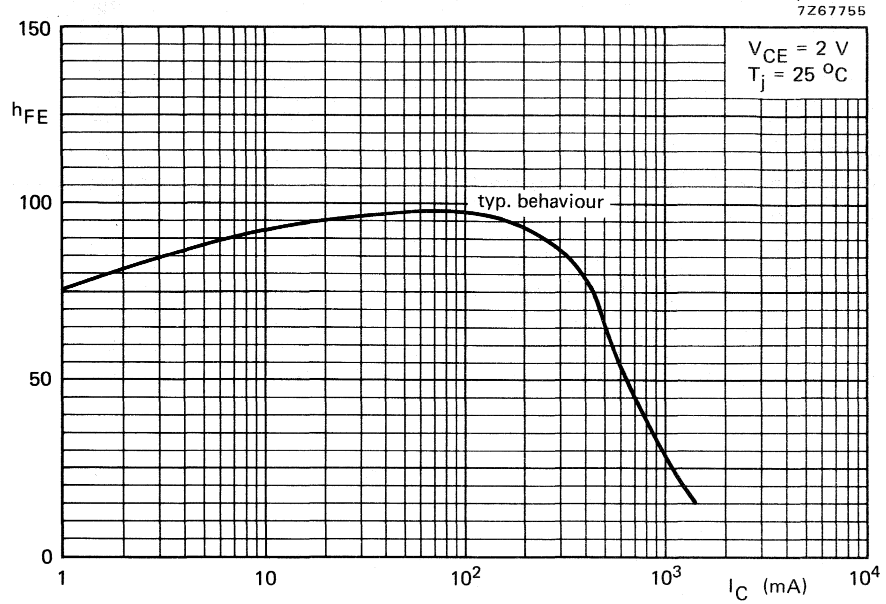


Fig. 2.

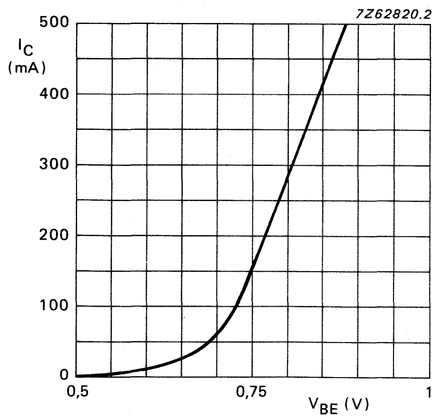


Fig. 3 V_{CE} = 2 V; T_j = 25 °C; typical values.

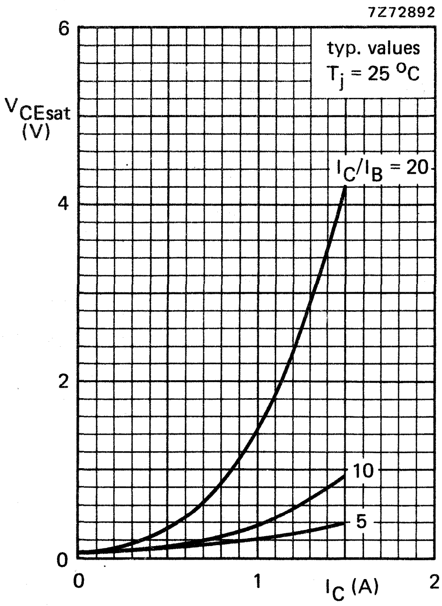


Fig. 4.

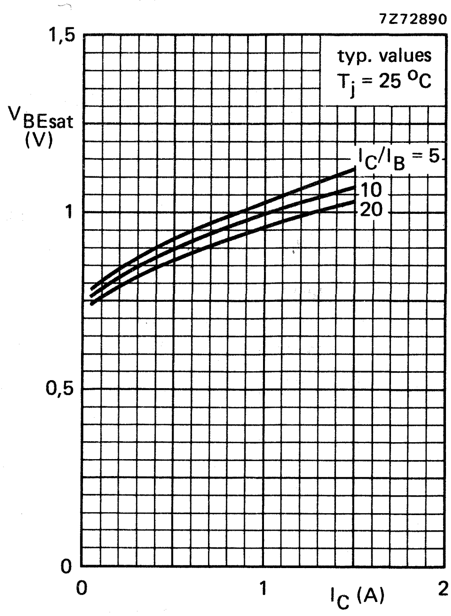


Fig. 5.

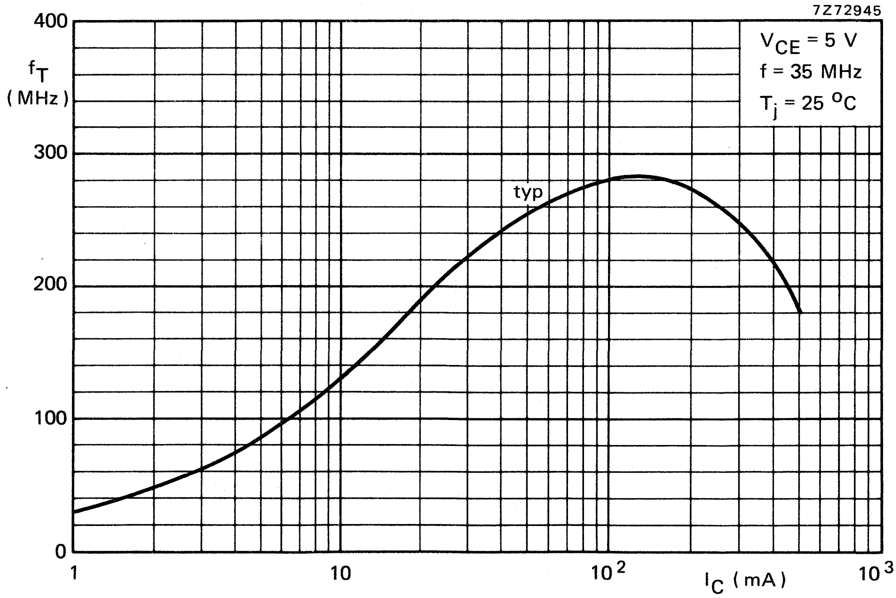


Fig. 6.

SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Collector current (d.c.)	I_C	max.	200	mA
Total power dissipation at T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz V_{CE} = 5 V; I_C = 10 mA	f_T	typ.	250	MHz
Noise figure at f = 1 kHz V_{CE} = 5 V; I_C = 200 μA; B = 200 Hz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

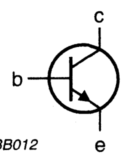
Fig. 1 SOT-23.

Marking code

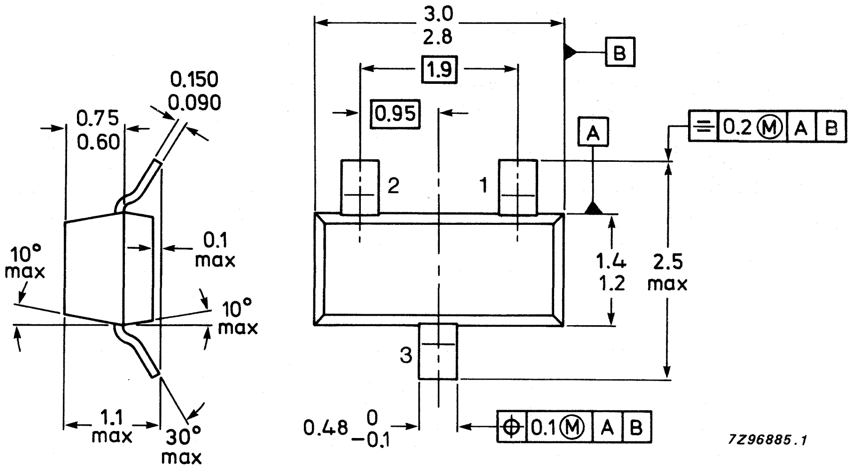
BCX70G = AGp
BCX70H = AHp
BCX70J = AJp
BCX70K = AKp

Pinning:

1 = base
2 = emitter
3 = collector



MBB012



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TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	45	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V
Collector current (d.c.)	I_C	max.	200	mA
Base current	I_B	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector-emitter cut-off current				
V_{BE} = 0; V_{CE} = 45 V	I_{CES}	<	20	nA
V_{BE} = 0; V_{CE} = 45 V; T_{amb} = 150 °C	I_{CES}	<	20	μA
Emitter-base cut-off current				
I_C = 0; V_{EB} = 4 V	I_{EBO}	<	20	nA
Saturation voltages				
at I_C = 10 mA; I_B = 0,25 mA	V_{CEsat}	0,05 to 0,35		V
	V_{BEsat}	0,6 to 0,85		V
at I_C = 50 mA; I_B = 1,25 mA	V_{CEsat}	0,1 to 0,55		V
	V_{BEsat}	0,7 to 1,05		V
Transition frequency at f = 100 MHz▲		>	125	MHz
I_C = 10 mA; V_{CE} = 5 V	f_T	typ.	250	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	2,5	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0,5 V	C_e	typ.	8	pF
Noise figure at R_S = 2 kΩ		typ.	2	dB
I_C = 200 μA; V_{CE} = 5 V; f = 1 kHz; B = 200 Hz	F	<	6	dB

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

▲ Measured under pulse conditions.

			BCX70G	70H	70J	70K	
D.C. current gain							
V_{CE} = 5 V; I_C = 10 μA	h_{FE}	>	–	40	30	100	
V_{CE} = 5 V; I_C = 2 mA	h_{FE}	>	120	250	180	380	
		<	220	460	310	630	
V_{CE} = 1 V; I_C = 50 mA	h_{FE}	>	50	70	90	100	
Input impedance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
V_{CE} = 5 V; I_C = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
V_{CE} = 5 V; I_C = 2 mA	V_{BE}		0,55 to 0,75				V
		typ.	0,65				V
V_{CE} = 5 V; I_C = 10 μA	V_{BE}	typ.	0,52				V
V_{CE} = 1 V; I_C = 50 mA	V_{BE}	typ.	0,78				V

Switching times

I_{Con} = 10 mA; I_{Bon} = $-I_{Boff}$ = 1 mA
V_{CC} = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

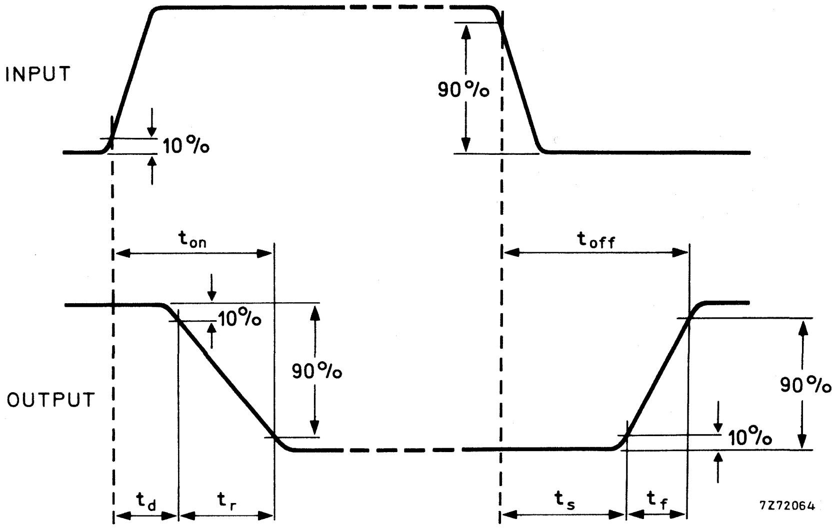


Fig. 2 Switching waveforms.

SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P silicon transistors, in a microminiature plastic envelope, intended for low level, low noise, low frequency purpose applications in hybrid circuits.

QUICK REFERENCE DATA

Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	45	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Total power dissipation	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz $-V_{CE}$ = 5 V; $-I_C$ = 10 mA	f_T	typ.	180	MHz
Noise figure at f = 1 kHz $-V_{CE}$ = 5 V; $-I_C$ = 200 μA	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

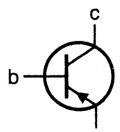
Fig. 1 SOT-23.

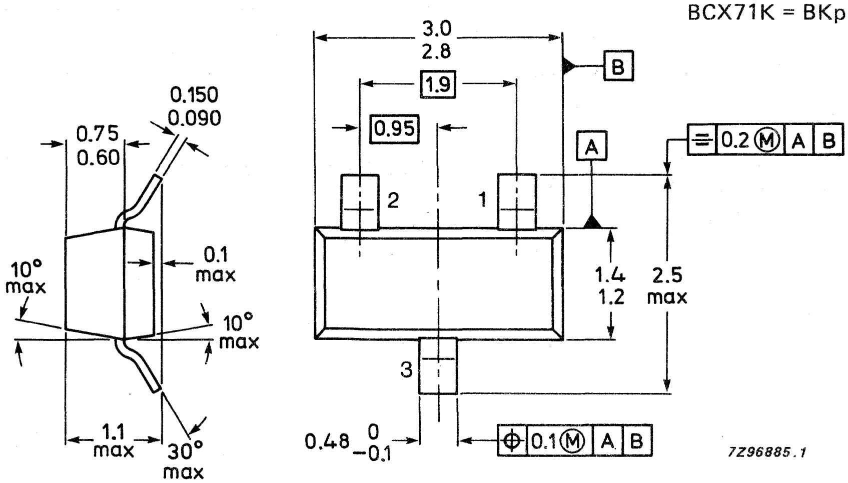
Marking code

BCX71G = BGp
BCX71H = BHp
BCX71J = BJp
BCX71K = BKp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$)	$-V_{CES}$	max.	45	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	V
Collector current (d.c.)	$-I_C$	max.	200	mA
Base current	$-I_B$	max.	50	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to + 150	^oC
Junction temperature	T_j	max.	150	^oC

THERMAL RESISTANCE

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

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector-emitter cut-off current				
$V_{EB} = 0; -V_{CE} = 45$ V	$-I_{CES}$	<	20	nA
$V_{EB} = 0; -V_{CE} = 45$ V; $T_{amb} = 150\ ^oC$	$-I_{CES}$	<	20	μA
Emitter-base cut-off current				
$I_C = 0; -V_{EB} = 4$ V	$-I_{EBO}$	<	20	nA
Saturation voltages				
$-I_C = 10$ mA; $-I_B = 0{,}25$ mA	$-V_{CEsat}$		0,06 to 0,25	V
	$-V_{BEsat}$		0,6 to 0,85	V
$-I_C = 50$ mA; $-I_B = 1{,}25$ mA	$-V_{CEsat}$		0,12 to 0,55	V
	$-V_{BEsat}$		0,68 to 1,05	V
Transition frequency at f = 100 MHz ▲				
$-V_{CE} = 5$ V; $-I_C = 10$ mA	f_T	typ.	180	MHz
Collector capacitance at f = 1 MHz				
$-V_{CB} = 10$ V; $I_E = I_e = 0$	C_c	typ.	4,5	pF
Emitter capacitance at f = 1 MHz				
$-V_{EB} = 0{,}5$ V; $I_C = I_c = 0$	C_e	typ.	11	pF
Noise figure at $R_S = 2\ k\Omega$				
$-V_{CE} = 5$ V; $-I_C = 200\ \mu$A; B = 200 Hz	F	typ.	2	dB
		<	6	dB

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

▲ Measured under pulse conditions.

			BCX71G	71H	71J	71K	
D.C. current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	h_{FE}	>	–	30	40	100	
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	h_{FE}	>	120	180	250	380	
		<	220	310	460	630	
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	h_{FE}	>	60	80	100	110	
Input impedance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{ie}	typ.	2,7	3,6	4,5	7,5	kΩ
Reverse voltage transfer ratio							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{re}	typ.	1,5	2	2	3	10^{-4}
Small-signal current gain							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{fe}	typ.	200	260	330	520	
Output admittance							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA; f = 1 kHz	h_{oe}	typ.	18	24	30	50	μS
Base-emitter voltage							
$-V_{CE}$ = 5 V; $-I_C$ = 2 mA	V_{BE}		0,6 to 0,75				V
		typ.	0,65				V
$-V_{CE}$ = 5 V; $-I_C$ = 10 μA	V_{BE}	typ.	0,55				V
$-V_{CE}$ = 1 V; $-I_C$ = 50 mA	V_{BE}	typ.	0,72				V

Switching times

$-I_{Con}$ = 10 mA; $-I_{Bon}$ = I_{Boff} = 1 mA
$-V_{CC}$ = 10 V; R_L = 990 Ω

turn-on time ($t_d + t_r$)	t_{on}	typ.	85	ns
		<	150	ns
turn-off time ($t_s + t_f$)	t_{off}	typ.	480	ns
		<	800	ns

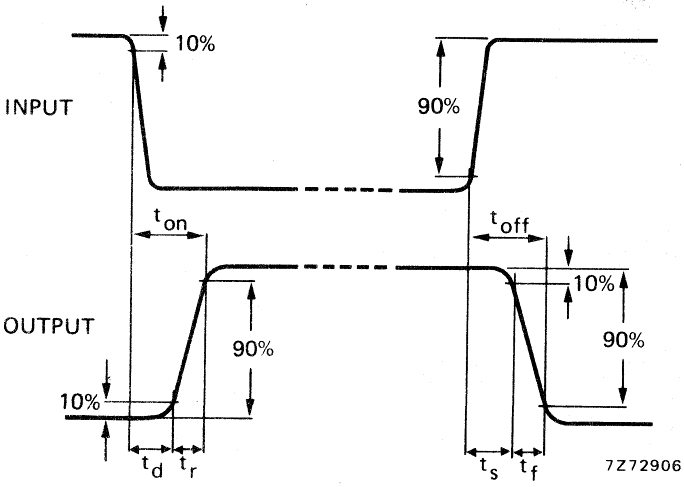


Fig. 2 Switching waveforms.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS60/60A/60B/60C

PNP silicon Darlington power transistors

DESCRIPTION

PNP silicon power transistors in a monolithic Darlington circuit in a miniature SMD envelope (SOT223) intended for switching applications. NPN complements are BDS61/61A/61B/61C.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

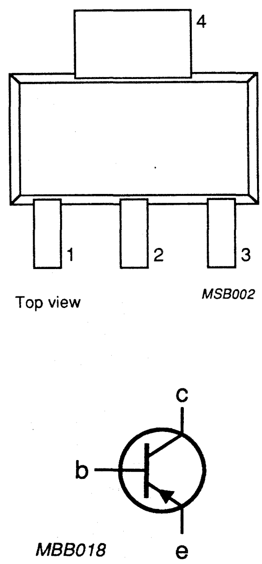


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS60		-	60	V
	BDS60A		-	80	V
	BDS60B		-	100	V
	BDS60C		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS60		-	60	V
	BDS60A		-	80	V
	BDS60B		-	100	V
	BDS60C		-	120	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	6	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 0.5 V $-V_{CE}$ = 3 V;	2200	-	

Note

1. Mounted on PCB.

PNP silicon Darlington power transistors BDS60/60A/60B/60C

R1 typ. 3 kΩ
R2 typ. 80 Ω

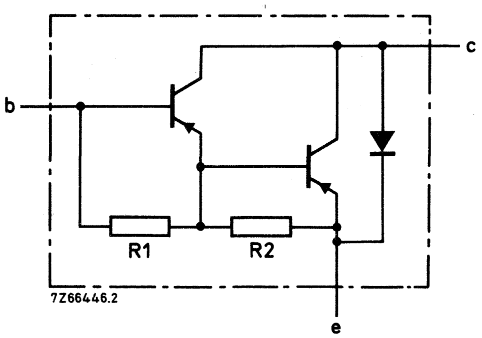


Fig.2 Darlington circuit diagram.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS60		-	60	V
	BDS60A		-	80	V
	BDS60B		-	100	V
	BDS60C		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS60		-	60	V
	BDS60A		-	80	V
	BDS60B		-	100	V
	BDS60C		-	120	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	6	A
$-I_B$	base current		-	100	mA
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

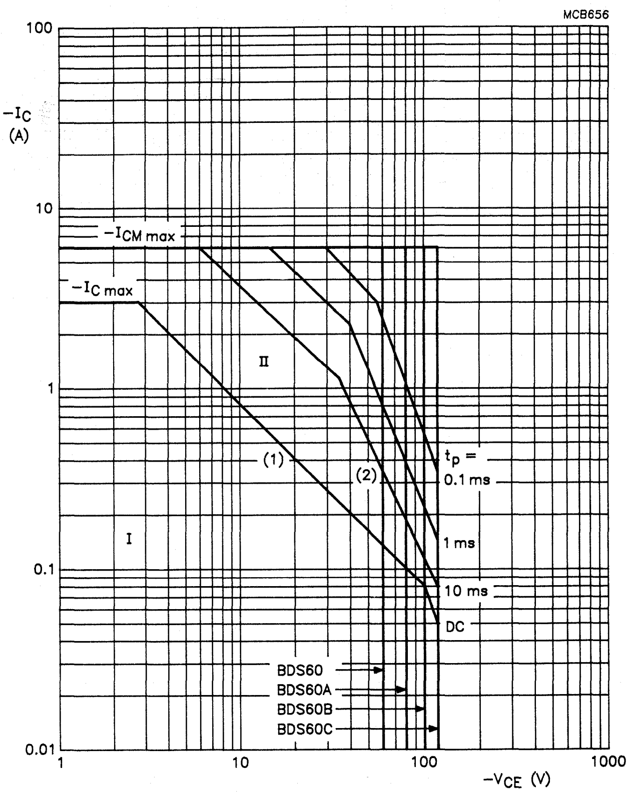
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CEO}$	collector cut-off current	$-I_B = 0$; $V_{CE} = 1/2\ V_{CEO\ max}$	-	-	0.2	mA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CEO\ max}$	-	-	0.2	mA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $V_{CB} = 1/2\ V_{CBO\ max}$; T_j = 150 °C	-	-	0.5	mA
$-I_{EBO}$	emitter cut-off current	$-I_C = 0$; $-V_{EB}$ = 5 V	-	-	5	mA
$-V_{BE}$	base-emitter voltage	$-I_C$ = 1.5 A; $-V_{CE}$ = 3 V; note 1	-	-	2.5	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C$ = 1.5 A; $-I_B$ = 6 mA; note 1	-	-	2.5	V
h_{FE}	DC current gain	$-I_C$ = 0.5 A; $-V_{CE}$ = 3 V note 1	-	2200	-	
h_{FE}	DC current gain	$-I_C$ = 1.5 A; $-V_{CE}$ = 3 V; note 1	750	-	-	
h_{FE}	DC current gain	$-I_C$ = 3 A; $-V_{CE}$ = 3 V; note 1	-	500	-	
V_F	diode forward voltage	I_F = 3 A	-	2.1	-	V
f_{hfe}	cut-off frequency	$-I_C$ = 1.5 A; $-V_{CE}$ = 3 V	-	25	-	kHz
h_{fe}	small signal current gain	f = 1 MHz; $-I_C$ = 1.5 A; $-V_{CE}$ = 3 V	10	-	-	
t_{on}	switching times turn-on time	$-I_{C\ on}$ = 1.5 A; $-I_{B\ on} = I_{Boff}$ = 6 A; $-V_{CC}$ = 30 V	-	0.3	1.5	µs
t_{off}	switching times turn-off time		-	1.5	5	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.
(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines.
(2) Second breakdown limits.

Fig.3 Safe operating area; T_{tab} = 25 °C.

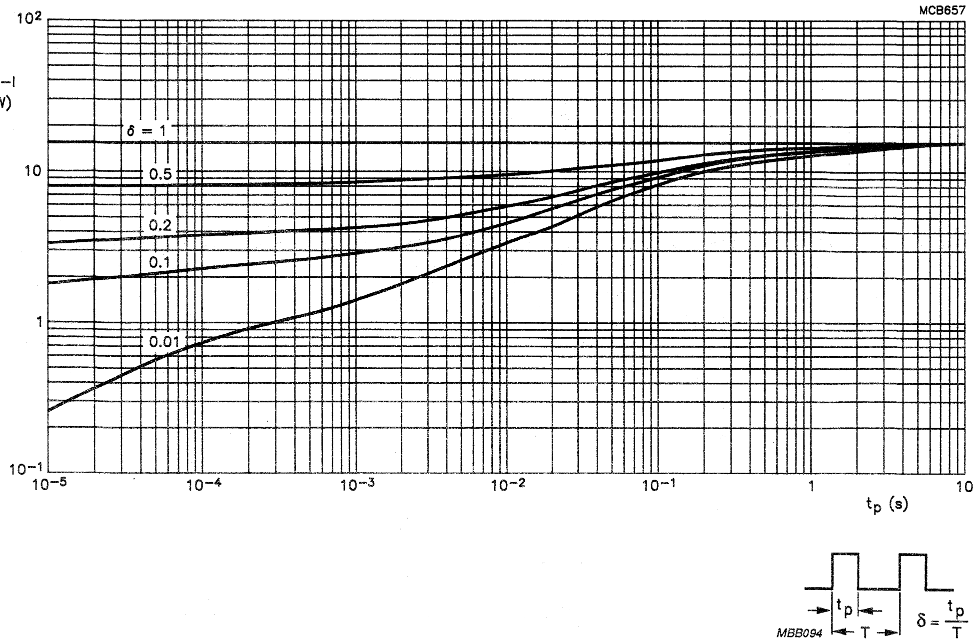


Fig.4 Pulse power rating chart.

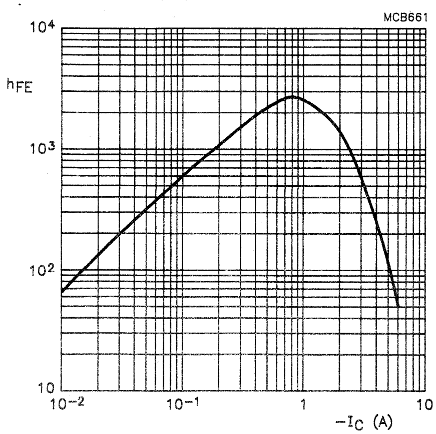


Fig.5 Typical DC current gain; $-V_{CE} = 3$ V; $T_{tab} = 25$ °C.

PNP silicon Darlington power transistors BDS60/60A/60B/60C

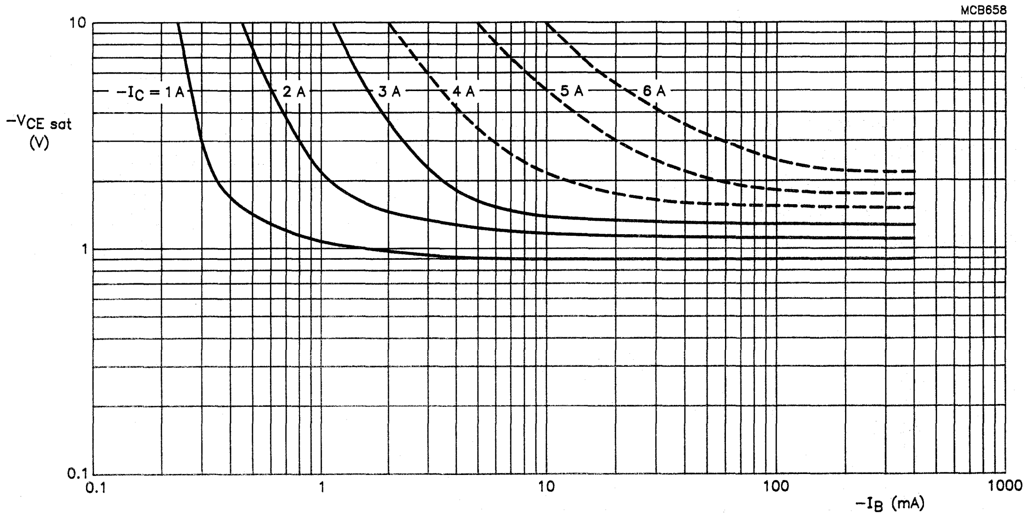


Fig.6 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

Philips Components

Data sheet	
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BDS61/61A/61B/61C
NPN silicon Darlington power transistors

DESCRIPTION

NPN silicon power transistors in a monolithic Darlington circuit in a miniature SMD envelope (SOT223) intended for switching applications. PNP complements are BDS60/60A/60B/60C.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

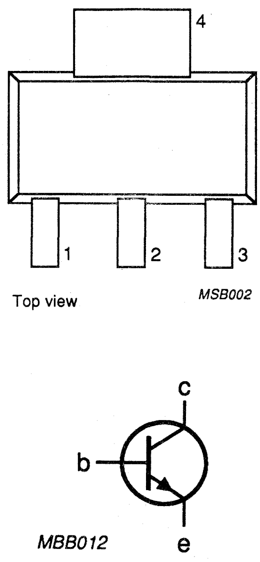


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS61		-	60	V
	BDS61A		-	80	V
	BDS61B		-	100	V
	BDS61C		-	120	V
V_{CEO}	collector-emitter voltage	open base			
	BDS61		-	60	V
	BDS61A		-	80	V
	BDS61B		-	100	V
	BDS61C		-	120	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	6	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 0.5 V $-V_{CE}$ = 3 V;	1150	-	

Note

1. Mounted on PCB.

NPN silicon Darlington power transistors BDS61/61A/61B/61C

R1 typ. 3 kΩ
R2 typ. 120 Ω

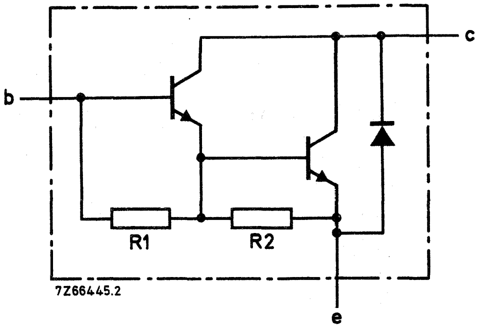


Fig.2 Darlington circuit diagram.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS61		-	60	V
	BDS61A		-	80	V
	BDS61B		-	100	V
	BDS61C		-	120	V
V_{CEO}	collector-emitter voltage	open base			
	BDS61		-	60	V
	BDS61A		-	80	V
	BDS61B		-	100	V
	BDS61C		-	120	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	6	A
I_B	base current		-	100	mA
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

NPN silicon Darlington power transistors BDS61/61A/61B/61C

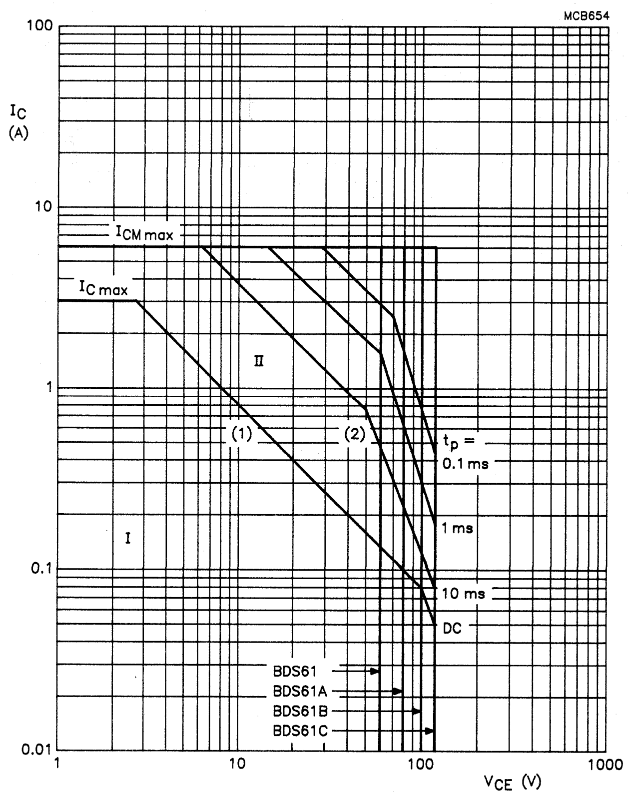
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 1/2\ V_{CEO\ max}$	-	-	0.2	mA
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 1/2\ V_{CBO\ max}$ T_j = 150 °C	-	-	0.5	mA
I_{EBO}	emitter cut-off current	$I_C = 0$; V_{EB} = 5 V	-	-	5	mA
V_{BE}	base-emitter voltage	I_C = 1.5 A; $-V_{CE}$ = 3 V; note 1	-	-	2.5	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 1.5 A; I_B = 6 mA; note 1	-	-	2.5	V
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 3 V note 1	-	1150	-	
h_{FE}	DC current gain	I_C = 1.5 A; V_{CE} = 3 V; note 1	750	-	-	
h_{FE}	DC current gain	I_C = 3 A; V_{CE} = 3 V; note 1	-	1800	-	
V_F	diode forward voltage	I_F = 3 A	-	2.6	-	V
f_{hfe}	cut-off frequency	I_C = 1.5 A; $-V_{CE}$ = 3 V	-	25	-	kHz
h_{fe}	small signal current gain	f = 1 MHz; I_C = 1.5 A; V_{CE} = 3 V	10	-	-	
t_{on}	switching times turn-on time	$I_{C\ on}$ = 1.5 A; $I_{B\ on} = -I_{Boff}$ = 6 A; V_{CC} = 30 V	-	0.8	2	µs
t_{off}	switching times turn-off time		-	4.5	8	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.
(1) $P_{tot\,max}$ and $P_{peak\,max}$ lines.
(2) Second breakdown limits.

Fig.3 Safe operating area; T_{tab} = 25 °C.

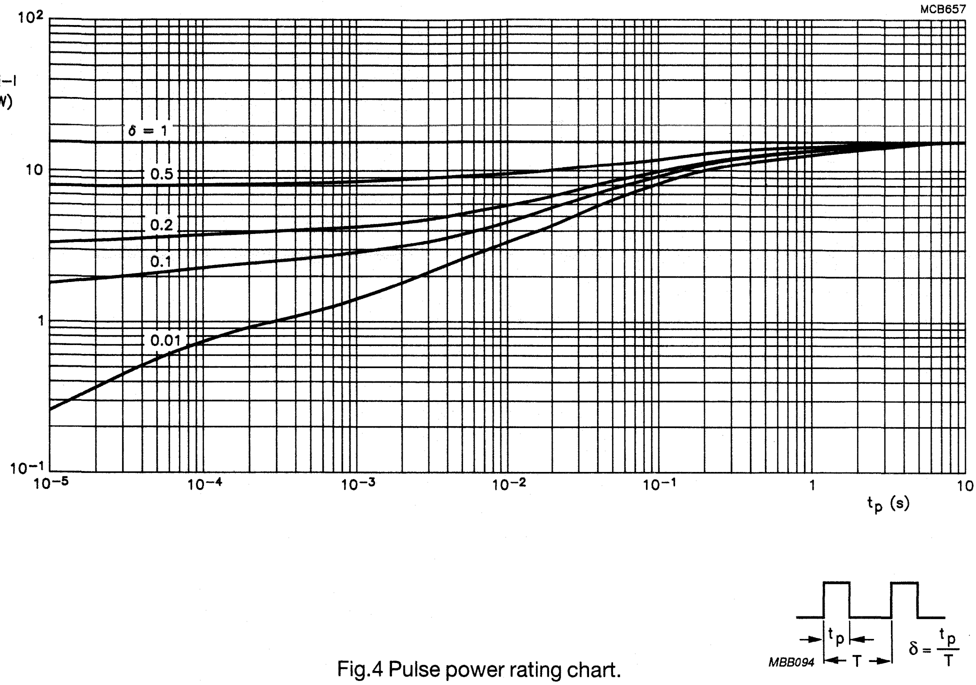


Fig.4 Pulse power rating chart.

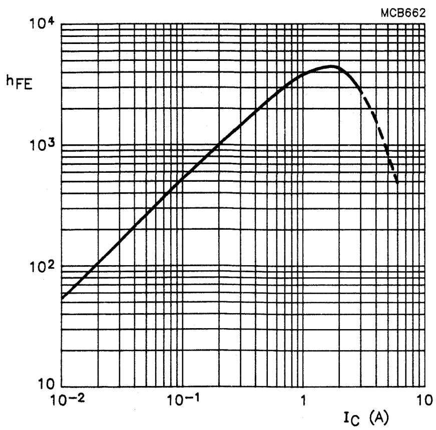


Fig.5 Typical DC current gain; V_{CE} = 3 V; T_{tab} = 25 °C.

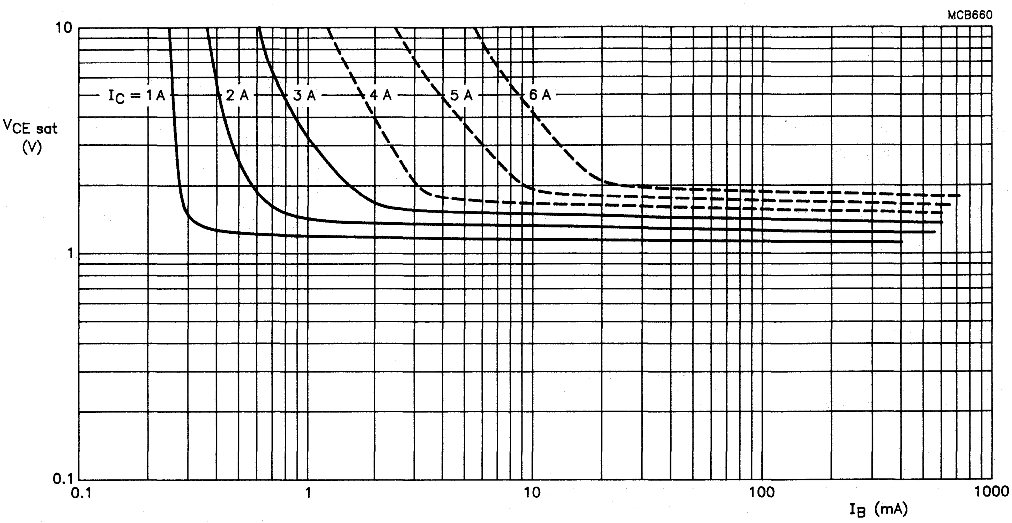


Fig.6 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

Philips Components

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BDS201/203/77

NPN silicon epitaxial base power transistors

DESCRIPTION

NPN silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. PNP complements are BDS202/204/78.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

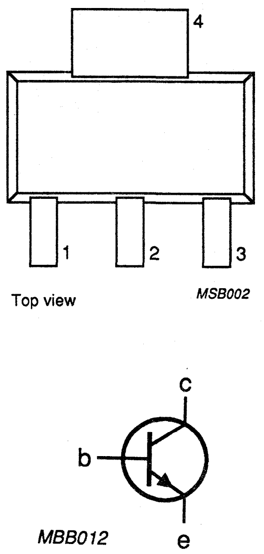


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS201		-	60	V
	BDS203		-	60	V
	BDS77		-	100	V
V_{CEO}	collector-emitter voltage	open base			
	BDS201		-	45	V
	BDS203		-	60	V
	BDS77		-	80	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
f_{hfe}	cut-off frequency	I_C = 0.3 V V_{CE} = 3 V;	25	-	kHz

Note

1. Mounted on PCB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS201		-	60	V
	BDS203		-	60	V
	BDS77		-	100	V
V_{CEO}	collector-emitter voltage	open base			
	BDS201		-	45	V
	BDS203		-	60	V
	BDS77		-	80	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
I_B	base current		-	1	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j-t}$	from junction to tab		15.5	K/W
$R_{th\ j-a}$	from junction to ambient	on PCB	83.3	K/W

NPN silicon epitaxial base power transistors BDS201/203/77

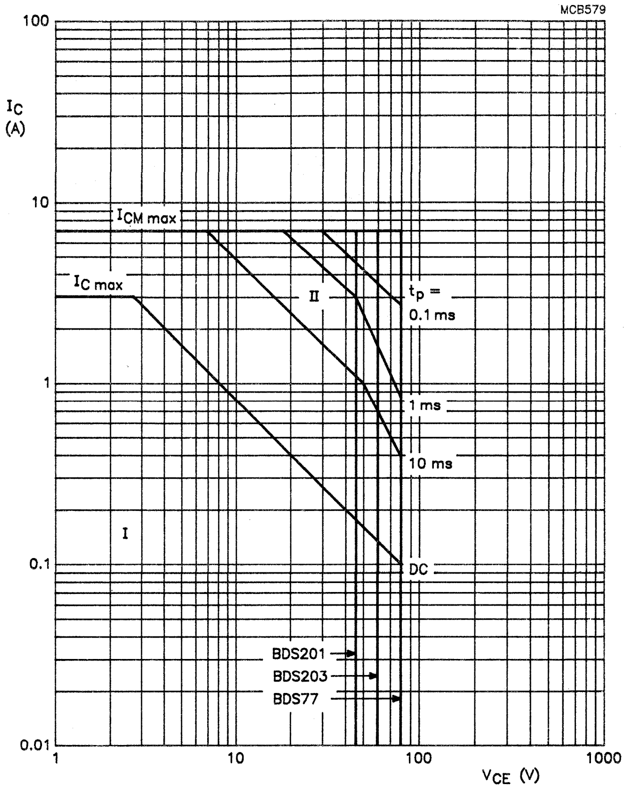
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage BDS201 BDS203 BDS77	I_B = 0; I_C =200 mA	 - - -	 - - -	 45 60 80	 V V V
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 30 V	-	-	0.2	mA
I_{CBO}	collector cut-off current	I_E = 0; V_{CE} = 40 V; T_j = 150 °C	-	-	1	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	-	-	0.5	mA
V_{BE}	base-emitter voltage	I_C = 3 A; $-V_{CE}$ = 2 V; note 1	-	-	1.5	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 3 A; I_B = 0.3 A; note 1	-	-	1	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 6 A; I_B = 0.6 A; note 1	-	-	1.8	V
$V_{BE\ sat}$	collector-emitter saturation voltage	I_C = 6 A; I_B = 0.6 A; note 1	-	-	2.1	V
h_{FE}	DC current gain	I_C = 3 A; V_{CE} = 2 V; note 1 (BDS201)	30	-	-	
h_{FE}	DC current gain	I_C = 2 A; V_{CE} = 2 V; note 1 (BDS203/77)	30	-	-	
f_T	transition frequency	f = 1 MHz; I_C = 0.3 A; $-V_{CE}$ = 3 V	7	-	-	MHz
f_{hfe}	cut-off frequency	I_C = 0.3 A; $-V_{CE}$ = 3 V	25	-	-	kHz
t_{on}	switching times turn-on time	$I_{C\ on}$ = 2 A; $I_{B\ on} = -I_{B\ off}$ = 0.2 A; V_{CC} = 20 V	-	-	1	µs
t_{off}	switching times turn-off time		-	-	3	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.

Fig.2 Safe operating area; T_{tab} = 25 °C.

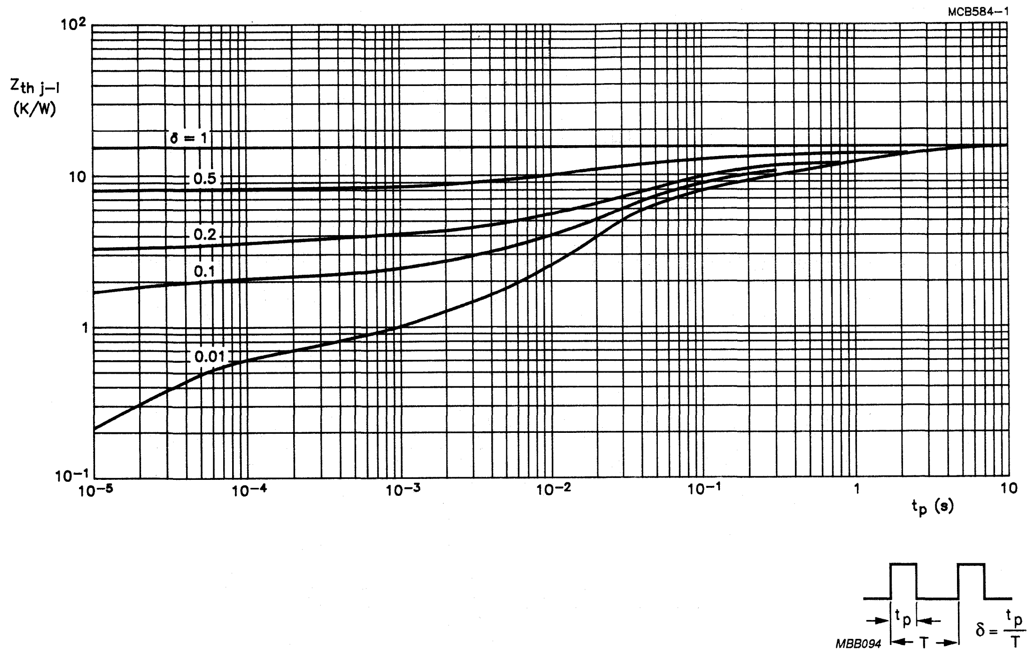


Fig.3 Pulse power rating chart.

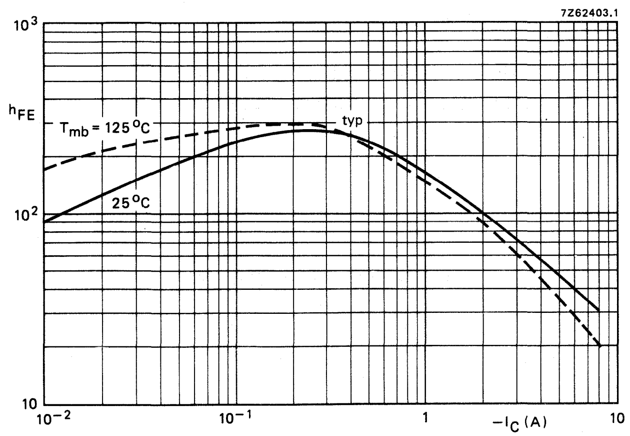


Fig.4 DC current gain; V_{CE} = 2 V.

Philips Components

Data sheet	
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BDS202/204/78

PNP silicon epitaxial base power transistors

DESCRIPTION

PNP silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. NPN complements are BDS201/203/77.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

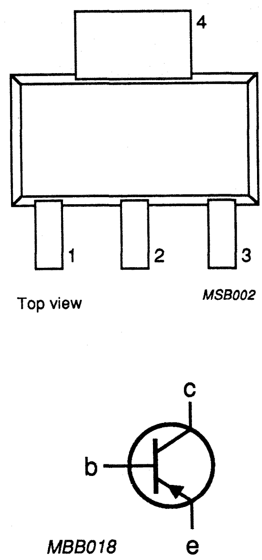


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS202		-	60	V
	BDS204		-	60	V
	BDS78		-	100	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS202		-	45	V
	BDS204		-	60	V
	BDS78		-	80	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
f_{hfe}	cut-off frequency	I_C = 0.3 V; V_{CE} = 3 V;	25	-	kHz

Note

1. Mounted on PCB

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS202		-	60	V
	BDS204		-	60	V
	BDS78		-	100	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS202		-	45	V
	BDS204		-	60	V
	BDS78		-	80	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
$-I_B$	base current		-	1	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

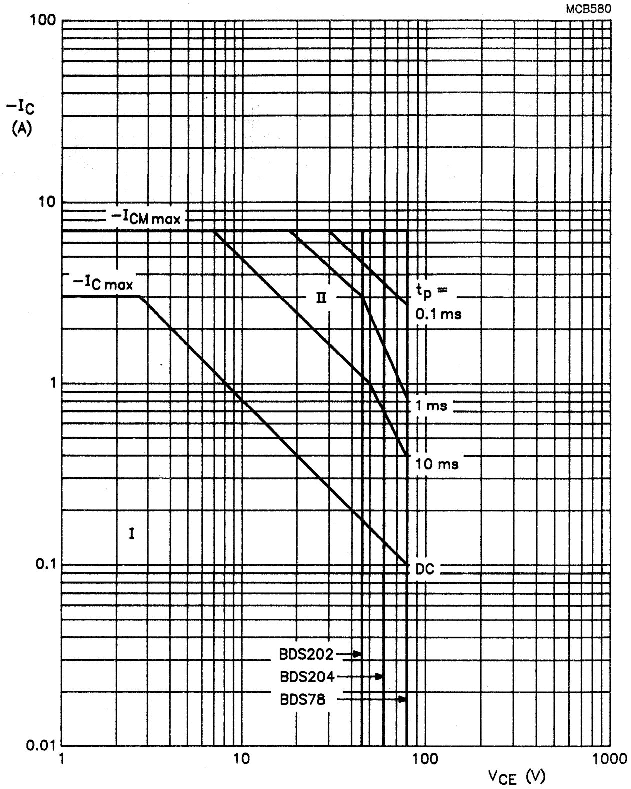
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	I_B = 0; $-I_C$ =200 mA	45	-	60	V
$-I_{CEO}$	collector cut-off current	I_B = 0; $-V_{CE}$ = 30 V	-	-	0.2	mA
$-I_{CBO}$	collector cut-off current	I_E = 0; $-V_{CE}$ = 40 V; T_j = 150 °C	-	-	1	mA
$-I_{EBO}$	emitter cut-off current	I_C = 0; $-V_{EB}$ = 5 V	-	-	0.5	mA
$-V_{BE}$	base-emitter voltage	$-I_C$ = 3 A; $-V_{CE}$ = 2 V; note 1	-	-	1.5	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C$ = 3 A; $-I_B$ = 0.3 A; note 1	-	-	1	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C$ = 6 A; $-I_B$ = 0.6 A; note 1	-	-	1.8	V
$-V_{BE\ sat}$	collector-emitter saturation voltage	$-I_C$ = 6 A; $-I_B$ = 0.6 A; note 1	-	-	2.1	V
h_{FE}	DC current gain	$-I_C$ = 3 A; $-V_{CE}$ = 2 V note 1	30	-	-	
h_{FE}	DC current gain	$-I_C$ = 2 A; $-V_{CE}$ = 2 V; note 1	30	-	-	
f_T	transition frequency	f = 1 MHz; $-I_C$ = 0.3 A; $-V_{CE}$ = 3 V	7	-	-	MHz
f_{hfe}	cut-off frequency	$-I_C$ = 0.3 A; $-V_{CE}$ = 3 V	25	-	-	kHz
t_{on}	switching times turn-on time	$-I_{C\ on}$ = 2 A; $-I_{B\ on}$ = $I_{B\ off}$ = 0.2 A; V_{CC} = 20 V	-	-	1	µs
t_{off}	switching times turn-off time		-	-	3	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.

PNP silicon epitaxial base power transistors

BDS202/204/78



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.

Fig.2 Safe operating area; T_{tab} = 25 °C.

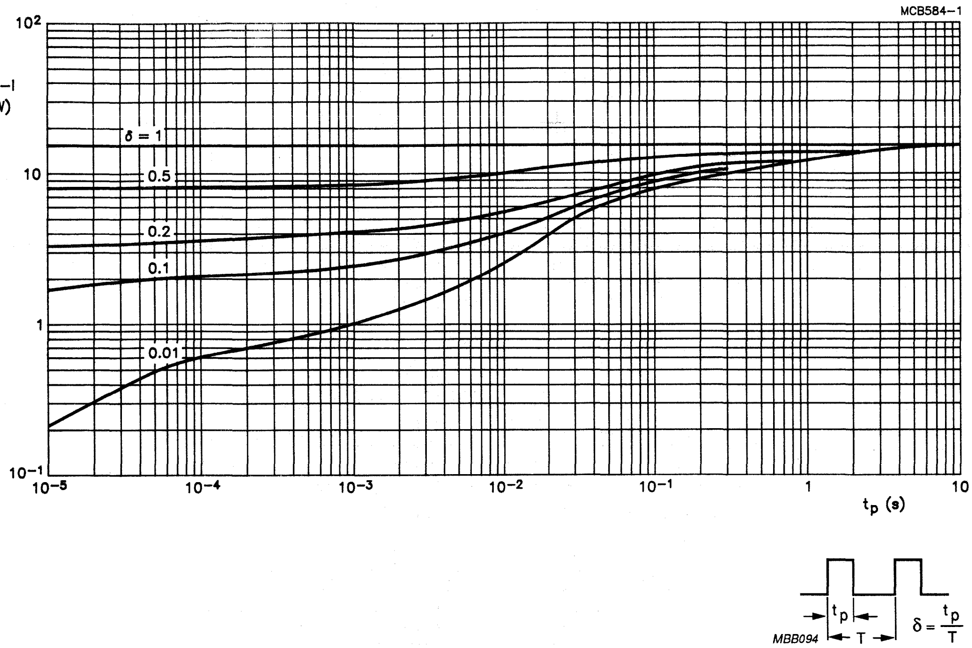


Fig.3 Pulse power rating chart.

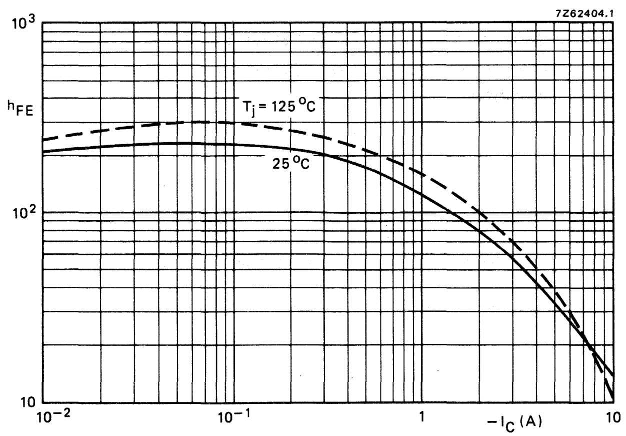


Fig.4 DC current gain; $-V_{CE}$ = 2 V.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS643/645/647/649/651

NPN silicon Darlington power transistors

DESCRIPTION

NPN epitaxial base transistors in a monolithic Darlington circuit in SOT223, intended for general purpose and switching applications. PNP complements are BDS644/646/648/650/652.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

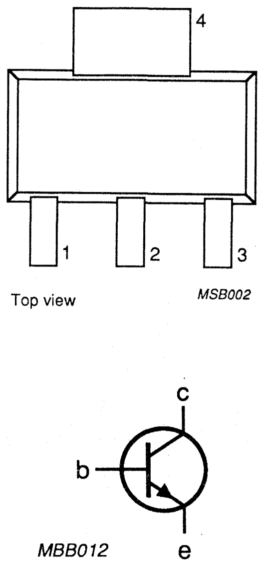


Fig.1 Pin configuration.

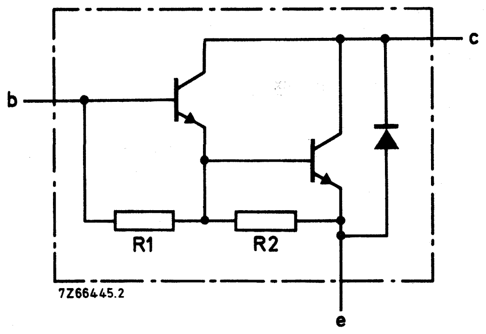
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS643		-	60	V
	BDS645		-	80	V
	BDS647		-	100	V
	BDS649		-	120	V
	BDS651		-	140	V
V_{CEO}	collector-emitter voltage	open base			
	BDS643		-	45	V
	BDS645		-	60	V
	BDS647		-	80	V
	BDS649		-	100	V
	BDS651		-	120	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	I_C = 3 mA; V_{CE} = 3 V;	1000		

Note

1. Mounted on PCB

NPN silicon Darlington power transistors BDS643/645/647/649/651



R1 typ. 4 kΩ

R2 typ. 100 Ω

Fig.2 Darlington circuit diagram.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS643		-	60	V
	BDS645		-	80	V
	BDS647		-	100	V
	BDS649		-	120	V
	BDS651		-	140	V
V_{CEO}	collector-emitter voltage	open base			
	BDS643		-	45	V
	BDS645		-	60	V
	BDS647		-	80	V
	BDS649		-	100	V
	BDS651		-	120	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
I_B	base current		-	150	mA
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

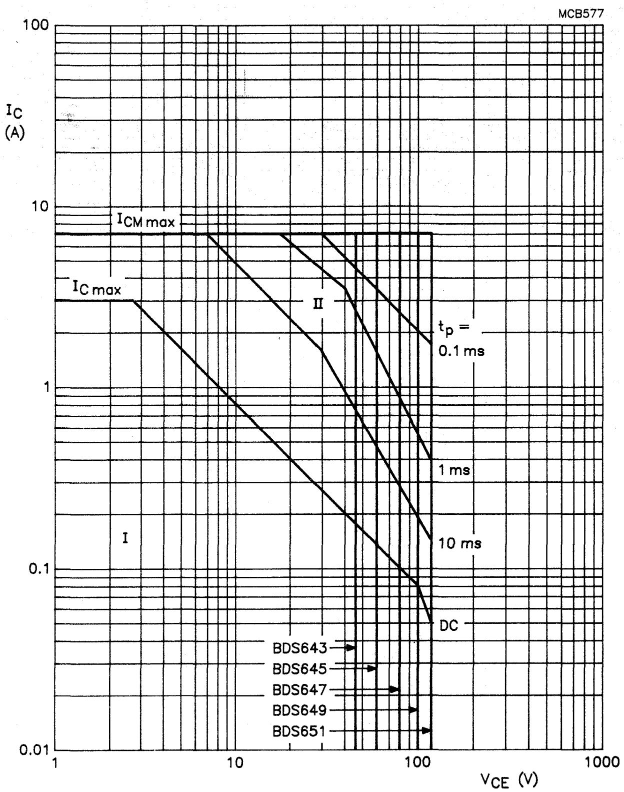
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CEO}	collector cut-off current	I_B = 0; V_{CE} = 1/2 $V_{CEO\ max}$	-	-	0.2	mA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = $V_{CEO\ max}$	-		0.1	mA
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 1/2 $V_{CBO\ max}$; T_j = 150 °C	-	-	1	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 5 V	-	-	5	mA
V_{BE}	base-emitter voltage	I_C = 3 A; V_{CE} = 3 V; note 1	-	-	2.5	V
$V_{CE\ sat}$	saturation voltage	I_C = 3 A; I_B = 12 mA; note 1	-	-	2	V
$V_{CE\ sat}$	saturation voltage	I_C = 5 A; I_B = 50 mA note 1	-	-	2.5	V
$V_{BE\ sat}$	saturation voltage	I_C = 5 A; I_B = 50 mA; note 1	-	-	3	V
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 3 V note 1	-	2000	-	
h_{FE}	DC current gain	I_C = 3 A; V_{CE} = 3 V; note 1	1000	-	-	
V_F	diode forward voltage	I_F = 3 A	-	1.8	-	V
f_{hfe}	cut-off frequency	I_C = 3 A; V_{CE} = 3 V	-	50	-	kHz
h_{fe}	small signal current gain	f = 1 MHz; I_C = 3 A; V_{CE} = 3 V	10	-	-	
C_c	collector capacitance	f = 1 MHz; V_{CB} = 10 V	-	75	-	pF
t_{on}	switching times turn-on time	$I_{C\ on}$ = 3 A; $I_{B\ on}$ = $I_{B\ off}$ = 12 mA	-	-	2	µs
t_{off}	switching times turn-off time		-	-	10	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.

Fig. 3 Safe operating area; T_{tab} = 25 °C.

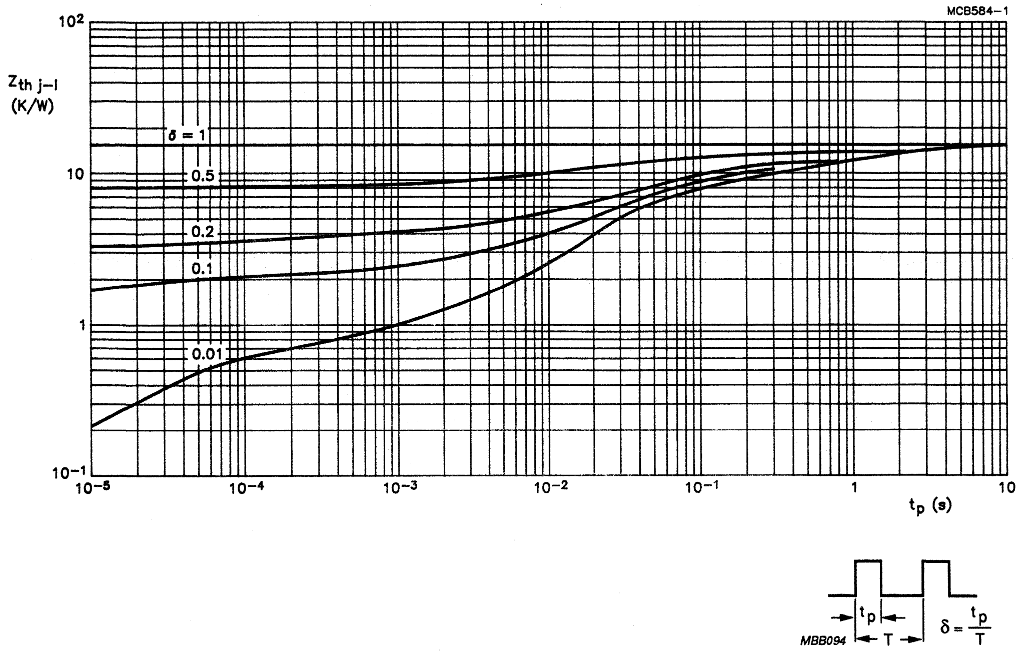


Fig.4 Pulse power rating chart.

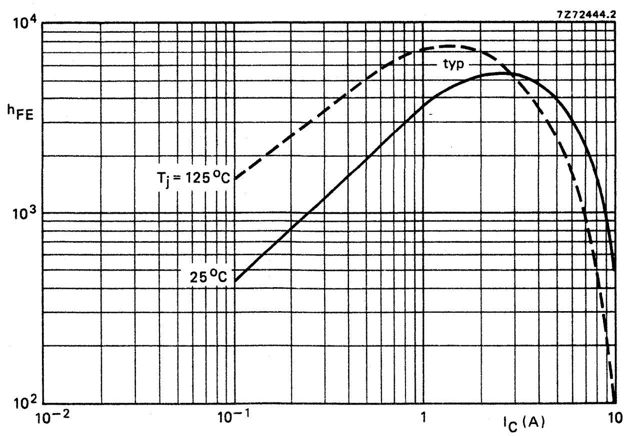


Fig.5 DC current gain; V_{CE} = 3 V; typical values.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS644/646/648/650/652
PNP silicon Darlington power transistors

DESCRIPTION

PNP silicon epitaxial base transistors in a monolithic Darlington circuit in a miniature SMD envelope (SOT223), intended for general purpose and switching applications. NPN complements are BDS643/645/647/649/651.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

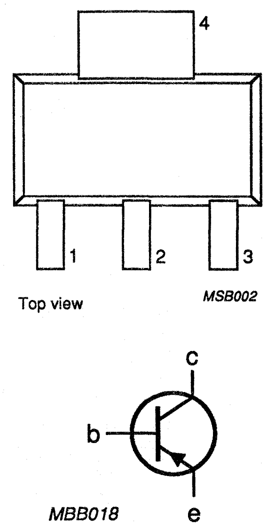


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS644		-	45	V
	BDS646		-	60	V
	BDS648		-	80	V
	BDS650		-	100	V
	BDS652		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS644		-	45	V
	BDS646		-	60	V
	BDS648		-	80	V
	BDS650		-	100	V
	BDS652		-	120	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 3 mA; $-V_{CE}$ = 3 V;	1000		

Note

1. Mounted on PCB

R1 typ. 4 Ω
R2 typ. 100 Ω

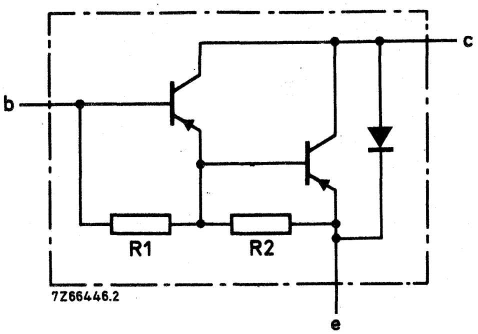


Fig.2 Darlington circuit diagram.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS644		-	45	V
	BDS646		-	60	V
	BDS648		-	80	V
	BDS650		-	100	V
	BDS652		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS644		-	45	V
	BDS646		-	60	V
	BDS648		-	80	V
	BDS650		-	100	V
	BDS652		-	120	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
$-I_B$	base current		-	150	mA
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

PNP silicon Darlington power transistors BDS644/646/648/650/652

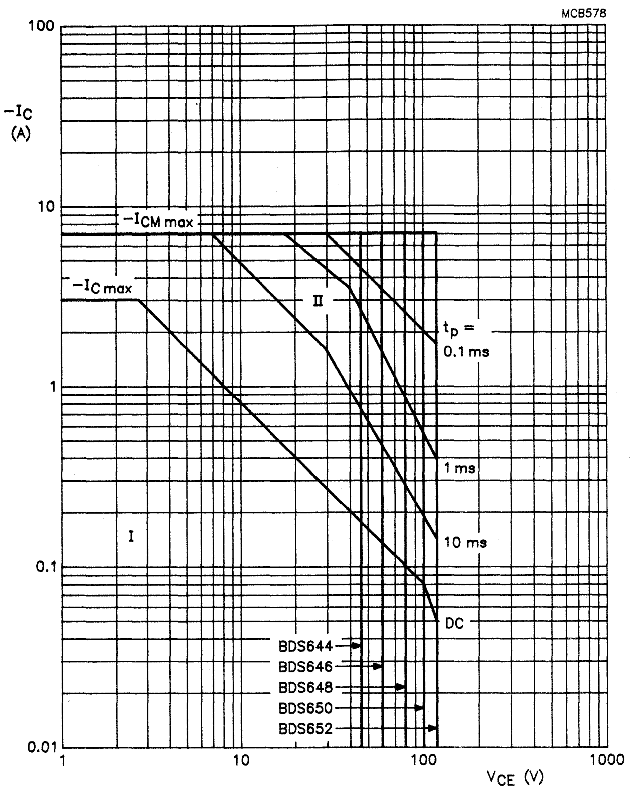
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CEO}$	collector cut-off current	$-I_B = 0$; $-V_{CE} = 1/2\ V_{CEO\ max}$	-	-	0.2	mA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CEO\ max}$	-		0.1	mA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = 1/2\ V_{CBO\ max}$; $T_j = 150$ °C	-	-	1	mA
$-I_{EBO}$	emitter cut-off current	$-I_C = 0$; $-V_{EB} = 5$ V	-	-	5	mA
$-V_{BE}$	base-emitter voltage	$-I_C = 3$ A; $-V_{CE} = 3$ V; note 1	-	-	2.5	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C = 3$ A; $-I_B = 12$ mA; note 1	-	-	2	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C = 5$ A; $-I_B = 50$ mA note 1	-	-	2.5	V
$-V_{BE\ sat}$	base-emitter saturation voltage	$-I_C = 5$ A; $-I_B = 50$ mA; note 1	-	-	3	V
h_{FE}	DC current gain	$-I_C = 0.5$ A; $-V_{CE} = 3$ V note 1	-	2000	-	
h_{FE}	DC current gain	$-I_C = 3$ A; $-V_{CE} = 3$ V; note 1	1000	-	-	
V_F	diode forward voltage	$I_F = 3$ A	-	1.2	-	V
f_{hfe}	cut-off frequency	$-I_C = 3$ A; $-V_{CE} = 3$ V	-	100	-	kHz
h_{fe}	small signal current gain	f = 1 MHz; $-I_C = 3$ A; $-V_{CE} = 3$ V;	10	-	-	
C_c	collector capacitance	f = 1 MHz; $-V_{CB} = 10$ V	-	75	-	pF
t_{on}	switching times turn-on time	$-I_{C\ on} = 3$ A; $-I_{B\ on} = I_{B\ off} = 12$ mA; $-V_{CC} = 10$ V	-	-	2	µs
t_{off}	switching times turn-off time		-	-	10	µs

Note

1. Measured under pulse conditions: $t_p < 300$ µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.

Fig.3 Safe operating area; T_{tab} = 25 °C.

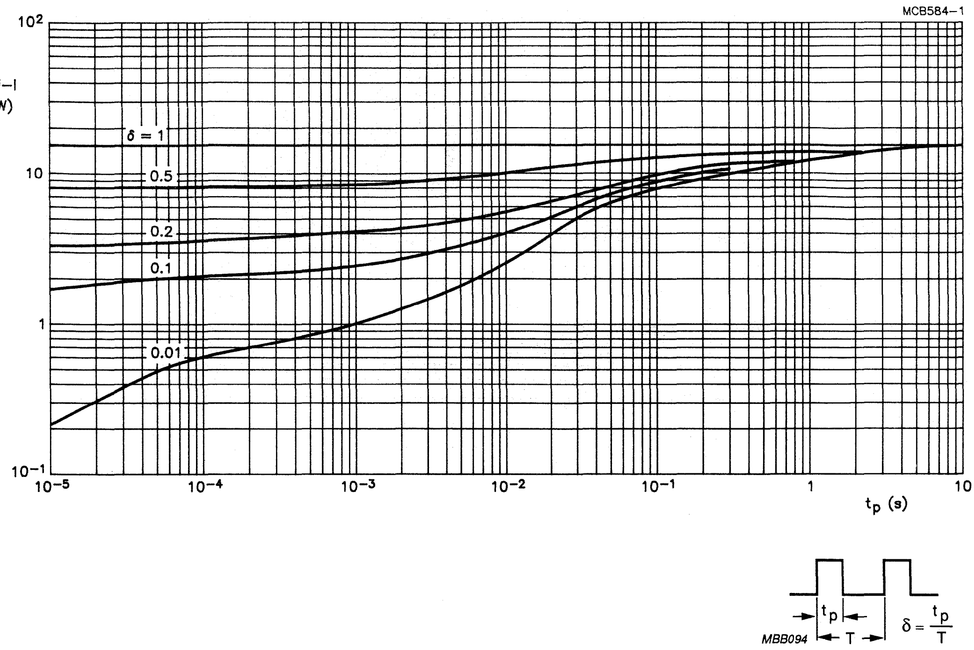


Fig.4 Pulse power rating chart.

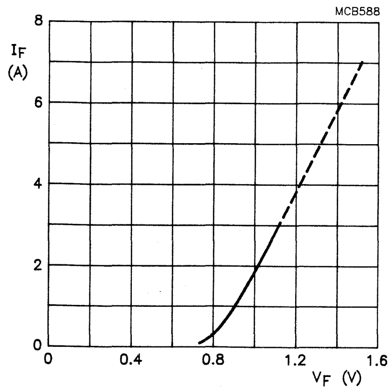


Fig.5 Diode forward current as a function of forward voltage; T_{tab} = 25 °C; typical values.

PNP silicon Darlington power transistors BDS644/646/648/650/652

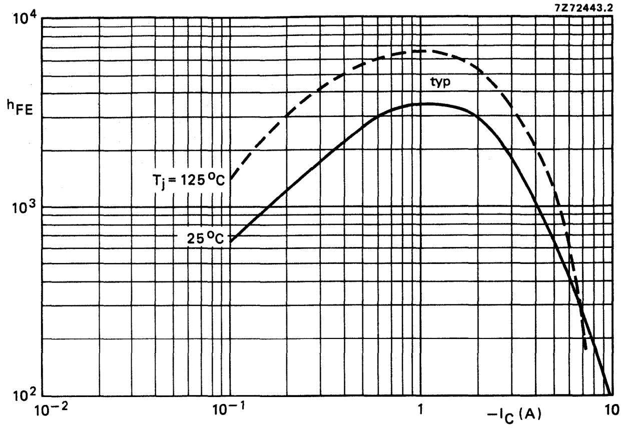


Fig.6 DC current gain; $-V_{CE}$ = 3 V; typical values.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS933/935/937/939/941
NPN silicon epitaxial base power transistors

DESCRIPTION

NPN silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. PNP complements are BDS934/936/938/940/942.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

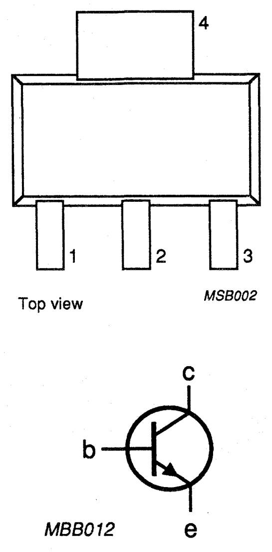


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS933		-	45	V
	BDS935		-	60	V
	BDS937		-	100	V
	BDS939		-	120	V
	BDS941		-	140	V
V_{CEO}	collector-emitter voltage	open base			
	BDS933		-	45	V
	BDS935		-	60	V
	BDS937		-	80	V
	BDS939		-	100	V
	BDS941		-	120	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	6	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 2 V;	40	250	
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 2 V;	25	-	
f_T	transition frequency	I_C = 250 mA; V_{CE} = 10 V	3	-	MHz

Note

1. Mounted on PCB

NPN silicon epitaxial base power transistors

BDS933/935/937/939/941

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS933		-	45	V
	BDS935		-	60	V
	BDS937		-	100	V
	BDS939		-	120	V
	BDS941		-	140	V
V_{CEO}	collector-emitter voltage	open base			
	BDS933		-	45	V
	BDS935		-	60	V
	BDS937		-	80	V
	BDS939		-	100	V
	BDS941		-	120	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	6	A
I_B	base current		-	0.5	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

NPN silicon epitaxial base power transistors

BDS933/935/937/939/941

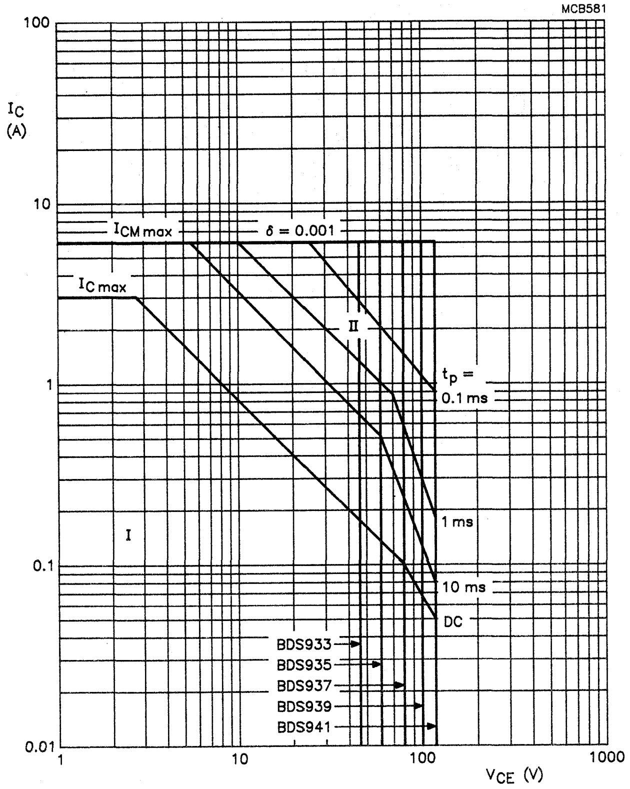
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CBO\ max}$	-	-	50	µA
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CBO\ max}$; T_j = 150 °C	-	-	1	mA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = V_{CEO\ max}$	-	-	0.1	mA
I_{EBO}	emitter cut-off current	$I_C = 0$; V_{EB} = 5 V	-	-	0.2	mA
V_{BE}	base-emitter voltage	I_C = 1 A; V_{CE} = 2 V; note 1	-	-	1.3	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 1 A; I_B = 0.1 A	-	-	0.6	V
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 2 V note 1	40	-	250	
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 2 V; note 1	25	-	-	
f_T	transition frequency	f = 1 MHz; I_C = 250 mA; V_{CE} = 10 V	3	-	-	MHz
t_{on}	switching times turn-on time	$I_{C\ on}$ = 1 A; $I_{B\ on} = -I_{B\ off}$ = 0.1 A	-	0.4	1	µs
t_{off}	switching times turn-off time		-	1.5	3	µs

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.

Fig.2 Safe operating area; T_{tab} = 25 °C.

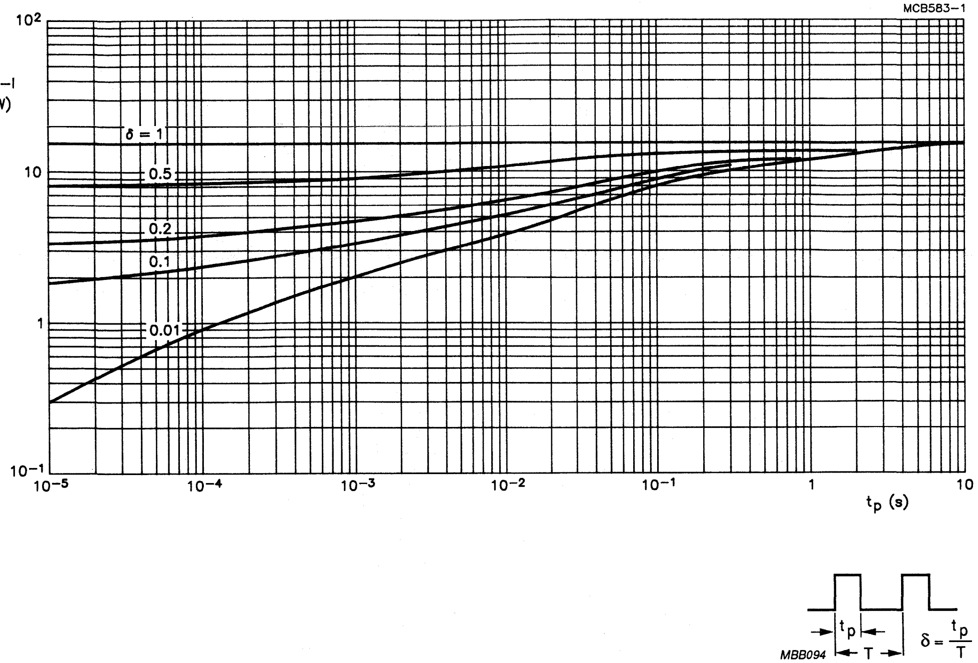


Fig.3 Pulse power rating chart.

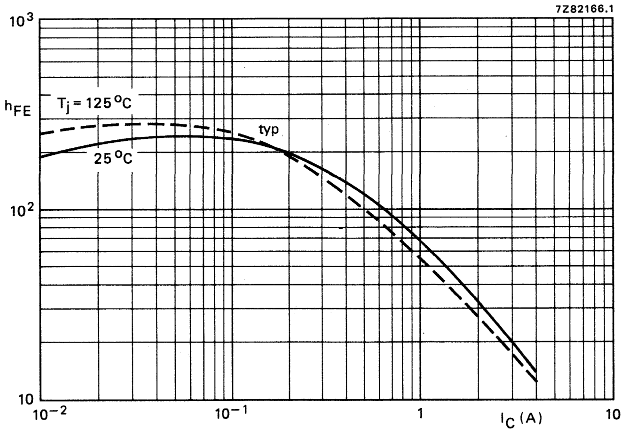


Fig.4 Typical DC current gain; V_{CE} = 2 V.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS934/936/938/940/942
PNP silicon epitaxial base power transistors

DESCRIPTION

PNP silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. NPN complements are BDS933/935/937/939/941.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

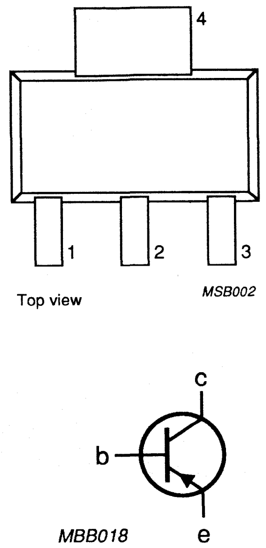


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS934		-	45	V
	BDS936		-	60	V
	BDS938		-	100	V
	BDS940		-	120	V
	BDS942		-	140	V
$-V_{CEO}$	collector-emitter	open base			
	voltage		-	45	V
	BDS934		-	60	V
	BDS936		-	80	V
	BDS938		-	100	V
	BDS940		-	120	V
	BDS942				
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	6	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 150 mA; $-V_{CE}$ = 2 V	40	250	
h_{FE}	DC current gain	$-I_C$ = 1 A; $-V_{CE}$ = 2 V	25	-	
f_T	transition frequency	$-I_C$ = 250 mA; $-V_{CE}$ = 10 V	3	-	MHz

Note

1. When mounted on PCB

PNP silicon epitaxial base power transistors

BDS934/936/938/940/942

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS934		-	45	V
	BDS936		-	60	V
	BDS938		-	100	V
	BDS940		-	120	V
	BDS942		-	140	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS934		-	45	V
	BDS936		-	60	V
	BDS938		-	80	V
	BDS940		-	100	V
	BDS942		-	120	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	6	A
$-I_B$	base current		-	0.5	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j-t}$	from junction to tab		15.5	K/W
$R_{th\ j-a}$	from junction to ambient	on PCB	83.3	K/W

PNP silicon epitaxial base power transistors

BDS934/936/938/940/942

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

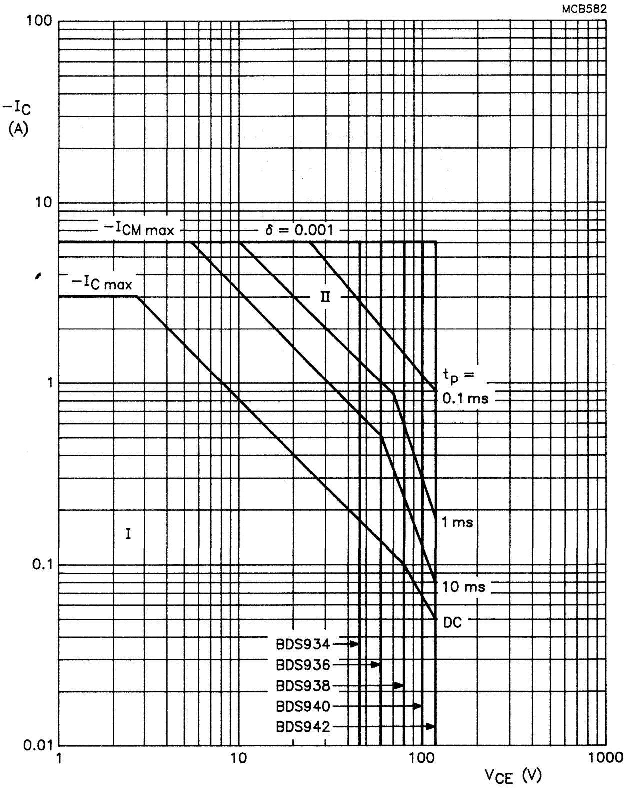
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CBO\ max}$	-	-	50	µA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CBO\ max}$; $T_j = 150$ °C	-	-	1	mA
$-I_{CEO}$	collector cut-off current	$I_B = 0$; $-V_{CE} = -V_{CEO\ max}$	-	-	0.1	mA
$-I_{EBO}$	emitter cut-off current	$-I_C = 0$; $-V_{EB} = 5$ V	-	-	0.2	mA
$-V_{BE}$	base-emitter voltage	$-I_C = 1$ A; $-V_{CE} = 2$ V; note 1	-	-	1.3	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C = 1$ A; $-I_B = 0.1$ A	-	-	0.6	V
h_{FE}	DC current gain	$-I_C = 150$ mA; $-V_{CE} = 2$ V note 1	40	-	250	
h_{FE}	DC current gain	$-I_C = 1$ A; $-V_{CE} = 2$ V; note 1	25	-	-	
f_T	transition frequency	f = 1 MHz; $-I_C = 250$ mA; $-V_{CE} = 10$ V	3	-	-	MHz
t_{on}	switching times turn-on time	$-I_{C\ on} = 1$ A; $I_{B\ on} = I_{B\ off} = 0.1$ A	-	0.2	0.6	µs
t_{off}	switching times	turn-off time	-	0.7	2.4	µs

Note

1. Measured under pulse conditions: $t_p < 300$ µs, duty cycle < 2%.

PNP silicon epitaxial base power transistors

BDS934/936/938/940/942



I. Region of permissible DC operation.

II. Permissible extension for repetitive pulse operation.

Fig.2 Safe operating area; T_{tab} = 25 °C.

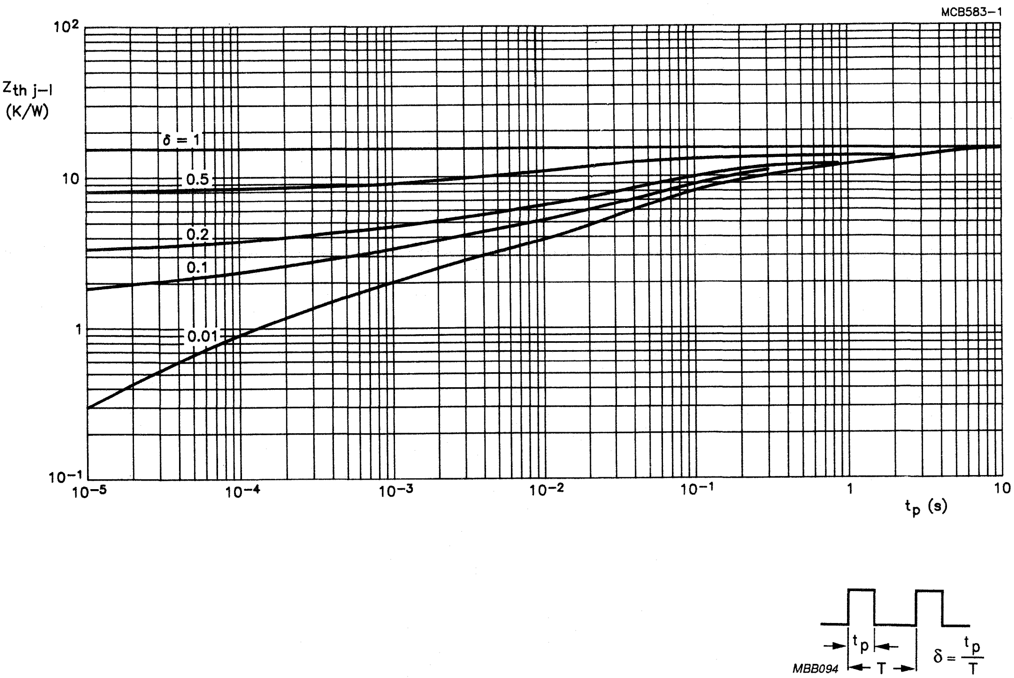


Fig.3 Pulse power rating chart.

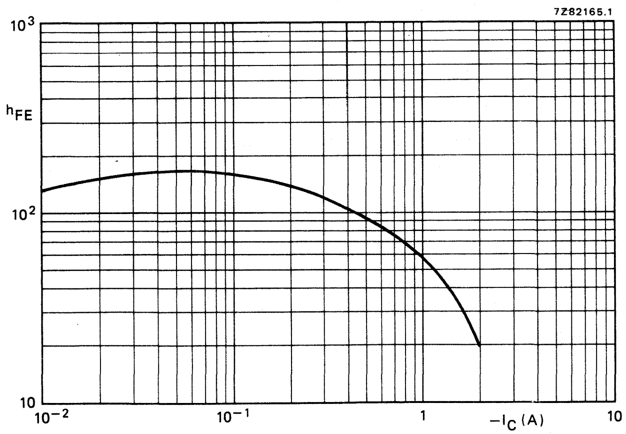


Fig.4 Typical static forward current transfer ratio as a function of the collector current; $-V_{CE} = 2$ V; $T_j \leq 25$ °C.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS943/945/947

NPN silicon epitaxial base power transistors

DESCRIPTION

NPN silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. PNP complements are BDS944/946/948.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

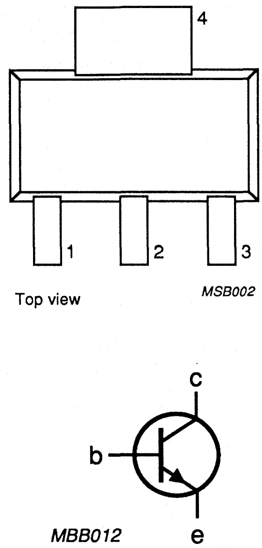


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS943		-	22	V
	BDS945		-	32	V
	BDS947		-	45	V
V_{CEO}	collector-emitter voltage	open base			
	BDS943		-	22	V
	BDS945		-	32	V
	BDS947		-	45	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	25	-	
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 1 V	85	475	
h_{FE}	DC current gain	I_C = 2 A; V_{CE} = 1 V			
	BDS943		50	-	
	BDS945		50	-	
	BDS947		40	-	

Note

1. Mounted on PCB.

NPN silicon epitaxial base power transistors BDS943/945/947

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS943		-	22	V
	BDS945		-	32	V
	BDS947		-	45	V
V_{CEO}	collector-emitter voltage	open base			
	BDS943		-	22	V
	BDS945		-	32	V
	BDS947		-	45	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
I_B	base current		-	1	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

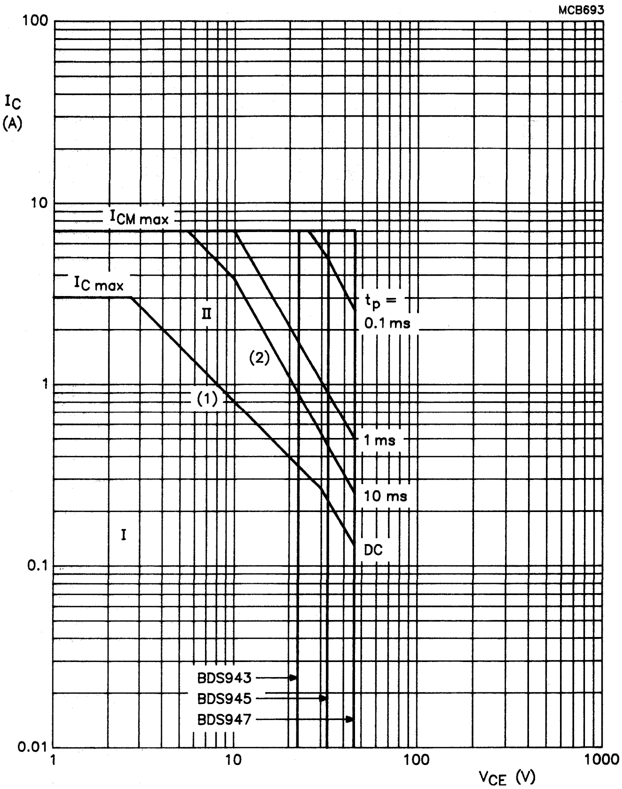
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CBO\ max}$	-	50	μA
I_{CEO}	collector cut-off current	$I_B = 0$; V_{CE} = 15 V (BDS943)	-	0.1	mA
I_{CEO}	collector cut-off current	$I_B = 0$; V_{CE} = 20 V (BDS945)	-	0.1	mA
I_{CEO}	collector cut-off current	$I_B = 0$; V_{CE} = 25 V (BDS947)	-	0.1	mA
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CBO\ max}$; T_j = 150 °C	-	1	mA
I_{EBO}	emitter cut-off current	$I_C = 0$; V_{EB} = 5 V	-	0.2	mA
V_{BE}	base-emitter voltage	I_C = 2 A; V_{CE} = 1 V; note 1	-	1.2	V
$V_{CE\ sat}$	collector-emitter saturation voltage	I_C = 2 A; I_B = 0.2 A; note 1	-	0.5	V
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V note 1	25	-	
h_{FE}	DC current gain	I_C = 500 mA; V_{CE} = 1 V; note 1	85	475	
h_{FE}	DC current gain	I_C = 2 A; V_{CE} = 1 V; note 1 (BDS943/945)	50	-	
h_{FE}	DC current gain	I_C = 250 mA; V_{CE} = 1 V; note 1 (BDS947)	40	-	
f_T	transition frequency	f = 1 MHz; I_C = 250 mA; V_{CE} = 1 V	3	-	MHz

Note

1. Measured under pulse conditions: t_p < 300 μs, duty cycle < 2%.

NPN silicon epitaxial base power transistors

BDS943/945/947



1. Region of permissible DC operation.
2. Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines.
(2) Second breakdown limits.

Fig.2 Safe operating area; T_{tab} = 25 °C.

NPN silicon epitaxial base power transistors BDS943/945/947

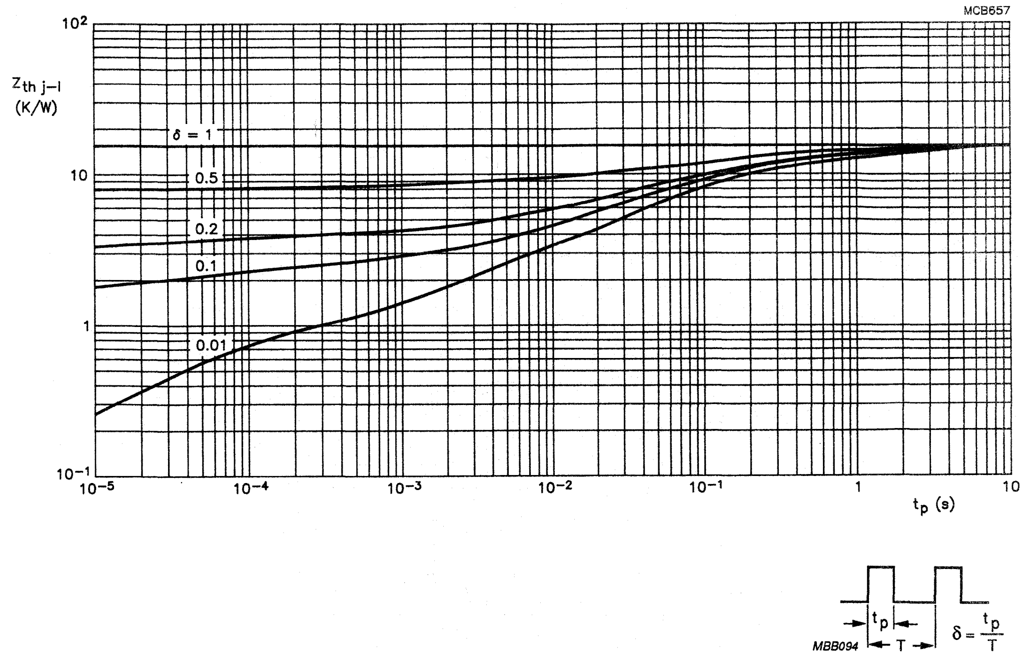


Fig.3 Pulse power rating chart.

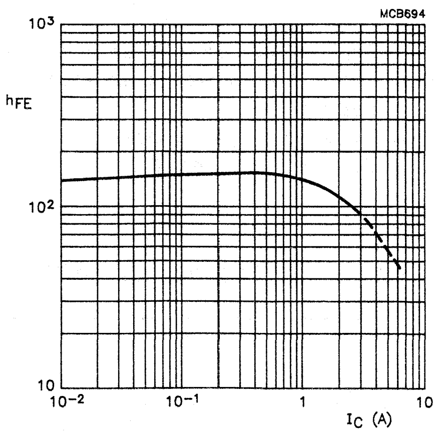


Fig.4 Typical DC current gain; V_{CE} = 1 V; T_{tab} = 25 °C.

NPN silicon epitaxial base power transistors

BDS943/945/947

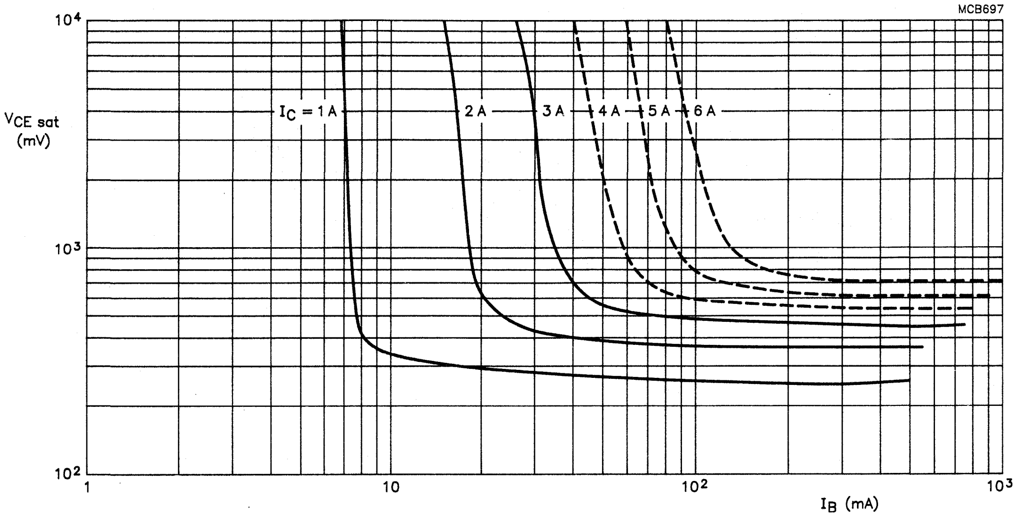


Fig.5 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

Philips Components

Data sheet	
status	Product specification
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BDS944/946/948

PNP silicon epitaxial base power transistors

DESCRIPTION

PNP silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. NPN complements are BDS943/945/947.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

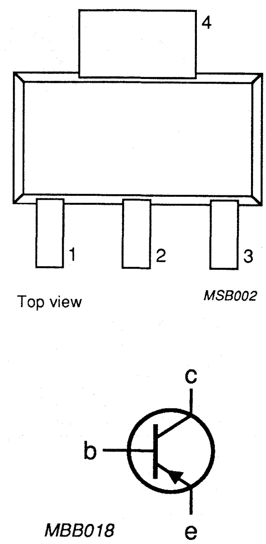


Fig. 1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS944		-	22	V
	BDS946		-	32	V
	BDS948		-	45	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS944		-	22	V
	BDS946		-	32	V
	BDS948		-	45	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V	25	-	
h_{FE}	DC current gain	$-I_C$ = 500 mA; $-V_{CE}$ = 1 V	85	475	
h_{FE}	DC current gain	$-I_C$ = 2 A; $-V_{CE}$ = 1 V			
	BDS944		50	-	
	BDS946		50	-	
	BDS948		40	-	

Note

1. Mounted on PCB.

PNP silicon epitaxial base power transistors

BDS944/946/948

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS944		-	22	V
	BDS946		-	32	V
	BDS948		-	45	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS944		-	22	V
	BDS946		-	32	V
	BDS948		-	45	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
$-I_B$	base current		-	1	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

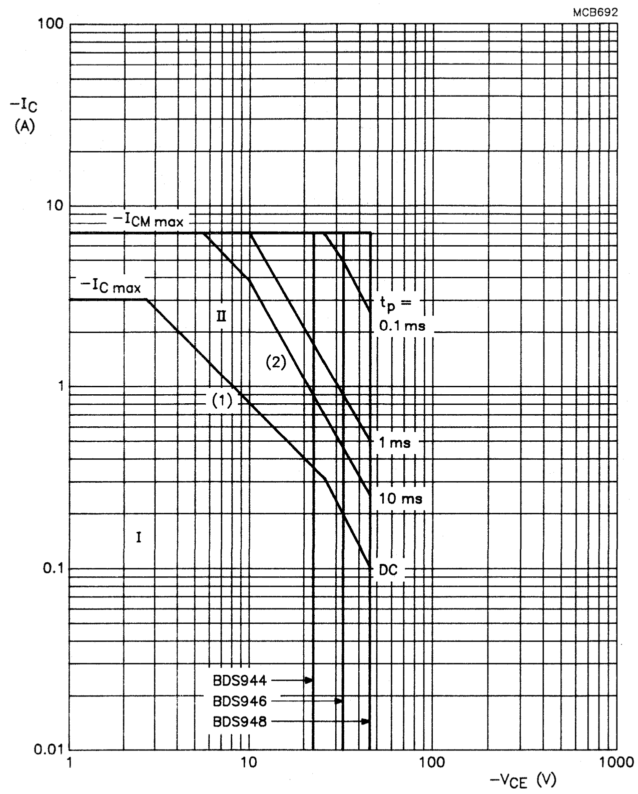
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CBO\ max}$	-	50	µA
$-I_{CEO}$	collector cut-off current	$I_B = 0$; $-V_{CE}$ = 15 V (BDS944)	-	0.1	mA
$-I_{CEO}$	collector cut-off current	$I_B = 0$; $-V_{CE}$ = 20 V (BDS946)	-	0.1	mA
$-I_{CEO}$	collector cut-off current	$I_B = 0$; $-V_{CE}$ = 25 V (BDS948)	-	0.1	mA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CBO\ max}$; T_j = 150 °C	-	1	mA
$-I_{EBO}$	emitter cut-off current	$I_C = 0$; $-V_{EB}$ = 5 V	-	0.2	mA
$-V_{BE}$	base-emitter voltage	$-I_C$ = 2 A; $-V_{CE}$ = 1 V; note 1	-	1.2	V
$-V_{CE\ sat}$	collector-emitter saturation voltage	$-I_C$ = 2 A; $-I_B$ = 0.2 A; note 1	-	0.5	V
h_{FE}	DC current gain	$-I_C$ = 10 mA; $-V_{CE}$ = 5 V note 1	25	-	
h_{FE}	DC current gain	$-I_C$ = 500 mA; $-V_{CE}$ = 1 V; note 1	85	475	
h_{FE}	DC current gain	$-I_C$ = 2 A; $-V_{CE}$ = 1 V; note 1 (BDS944/946)	50	-	
h_{FE}	DC current gain	$-I_C$ = 2 A; $-V_{CE}$ = 1 V; note 1 (BDS948)	40	-	
f_T	transition frequency	f = 1 MHz; $-I_C$ = 250 mA; $-V_{CE}$ = 1 V	3	-	MHz

Note

1. Measured under pulse conditions: t_p < 300 µs, duty cycle < 2%.



1. Region of permissible DC operation.
2. Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines.
(2) Second breakdown limits.

Fig.2 Safe operating area; T_{tab} = 25 °C.

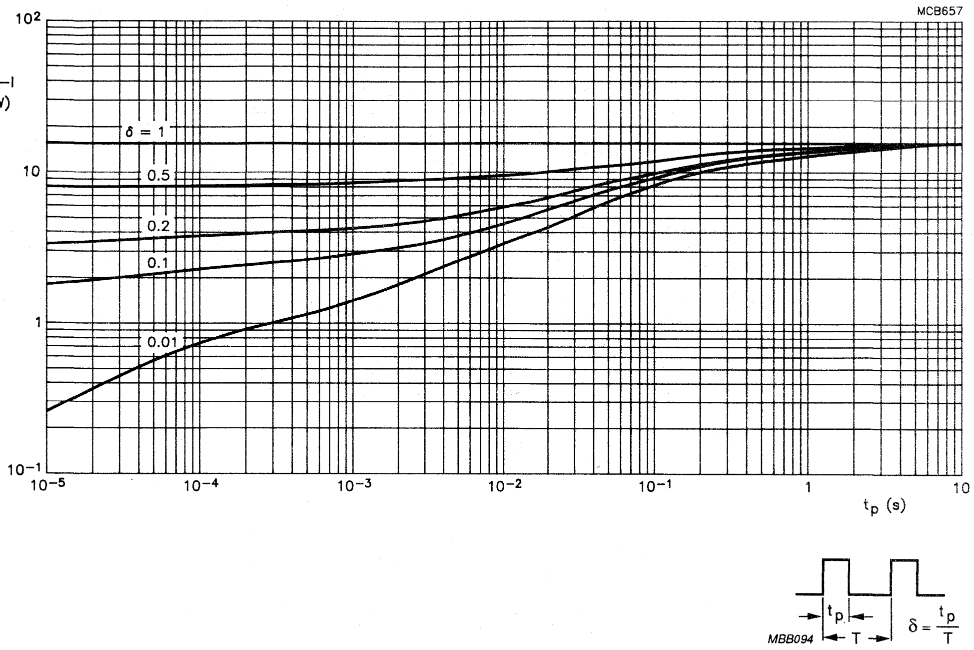


Fig.3 Pulse power rating chart.

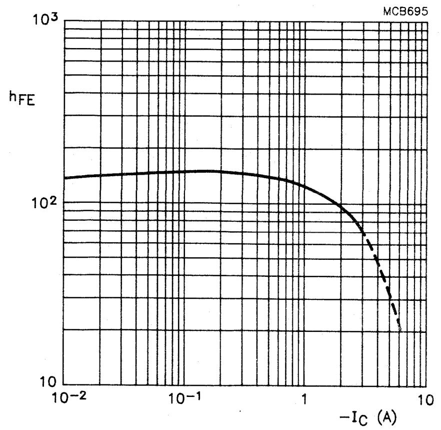


Fig.4 Typical DC current gain; V_{CE} = 1 V; T_{tab} = 25 °C.

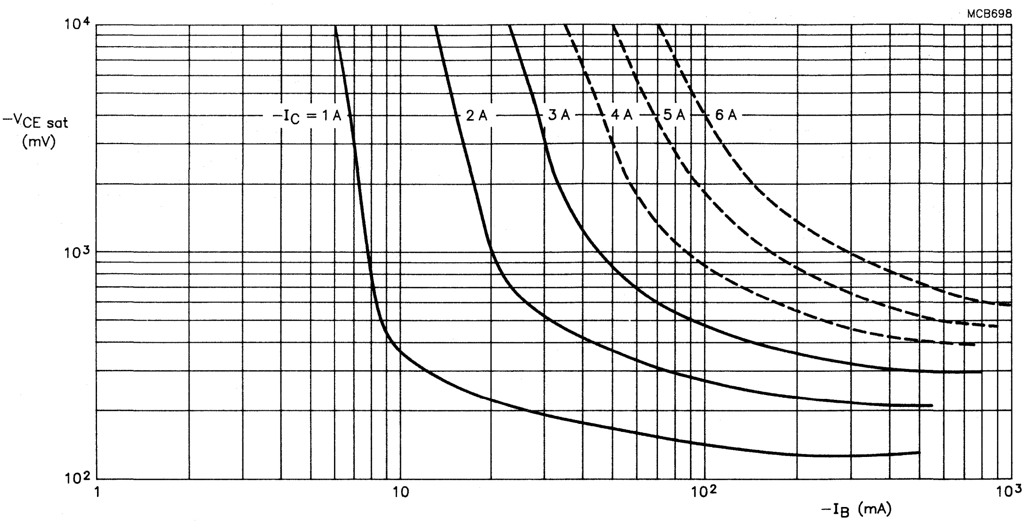


Fig.5 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS949/951/953/955

NPN silicon epitaxial base power transistors

DESCRIPTION

NPN silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. PNP complements are BDS950/952/954/956.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

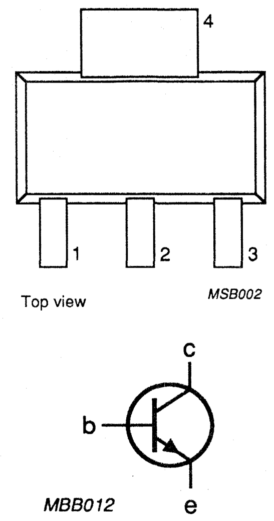


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS949		-	60	V
	BDS951		-	80	V
	BDS953		-	100	V
	BDS955		-	120	V
V_{CEO}	collector-emitter voltage	open base			
	BDS949		-	60	V
	BDS951		-	80	V
	BDS953		-	100	V
	BDS955		-	120	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 4 V	40	-	
h_{FE}	DC current gain	I_C = 2 A; V_{CE} = 4 V	20	-	

Note

1. Mounted on PCB.

NPN silicon epitaxial base power transistors BDS949/951/953/955

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	BDS949		-	60	V
	BDS951		-	80	V
	BDS953		-	100	V
	BDS955		-	120	V
V_{CEO}	collector-emitter voltage	open base			
	BDS949		-	60	V
	BDS951		-	80	V
	BDS953		-	100	V
	BDS955		-	120	V
V_{EBO}	emitter-base voltage	open collector	-	5	V
I_C	collector current	average value	-	3	A
I_{CM}	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

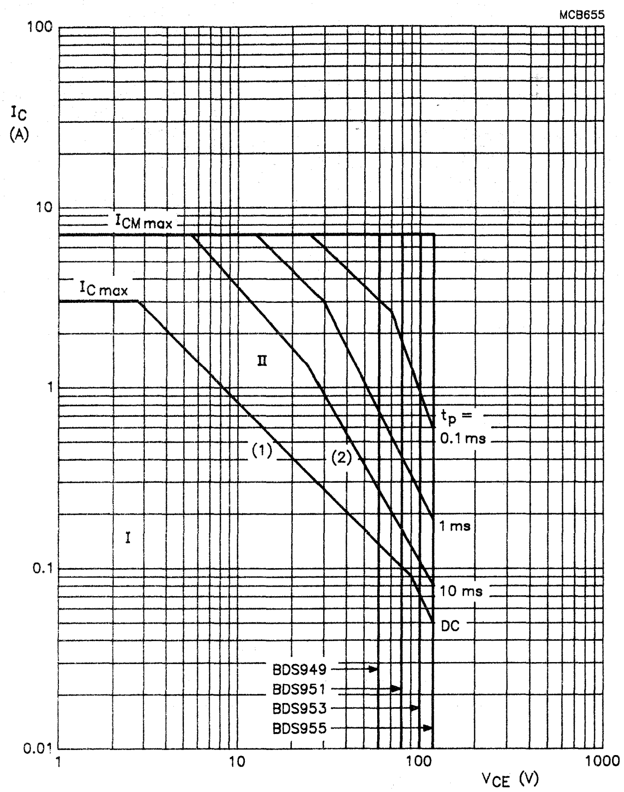
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = V_{CBO\ max}$	-	50	μA
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 1/2\ V_{CBO\ max}$; $T_j = 150$ °C	-	1	mA
I_{CEO}	collector cut-off current	$I_B = 0$; $V_{CE} = 1/2\ V_{CEO\ max}$	-	0.1	mA
I_{EBO}	emitter cut-off current	$I_C = 0$; $V_{EB} = 5$ V	-	0.2	mA
V_{BE}	base-emitter voltage	$I_C = 2$ A; $V_{CE} = 4$ V; note 1	-	1.4	V
$V_{CE\ sat}$	collector-emitter stauration voltage	$I_C = 2$ A; $I_B = 0.2$ A; note 1	-	1	V
h_{FE}	DC current gain	$I_C = 500$ mA; $V_{CE} = 4$ V; note 1	40	-	
h_{FE}	DC current gain	$I_C = 2$ A; $V_{CE} = 4$ V; note 1	20	-	
f_T	transition frequency	f = 1 MHz; $I_C = 500$ mA; $V_{CE} = 4$ V	3	-	MHz

Note

1. Measured under pulse conditions: $t_p < 300$ μs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.
(1) $P_{tot\,max}$ and $P_{peak\,max}$ lines.
(2) Second breakdown limits.

Fig.2 Safe operating area; T_{tab} = 25 °C.

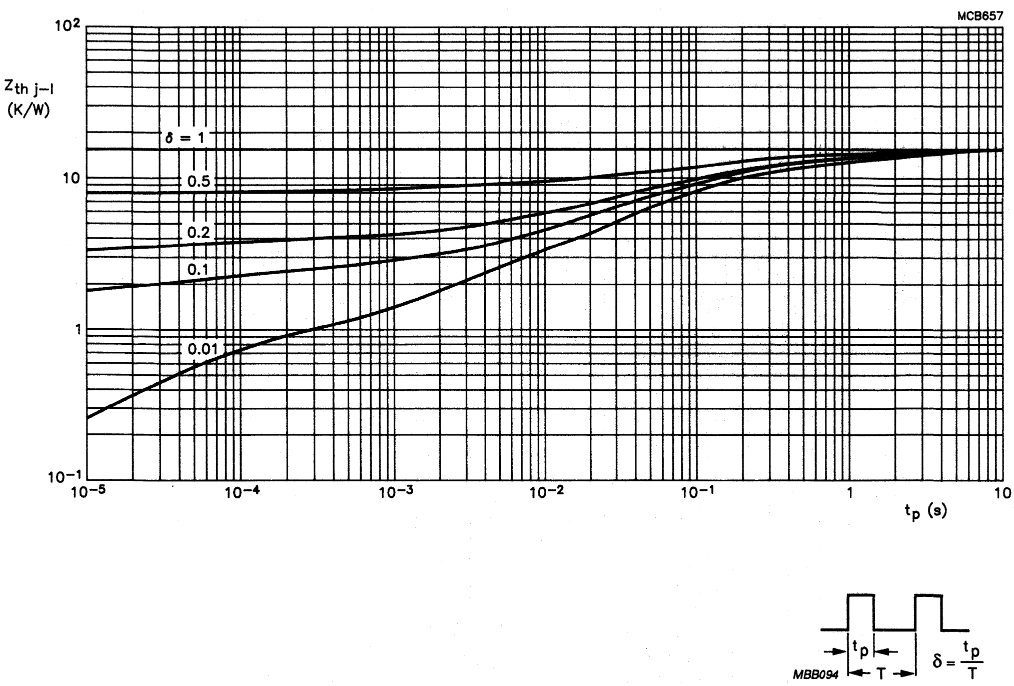


Fig.3 Pulse power rating chart.

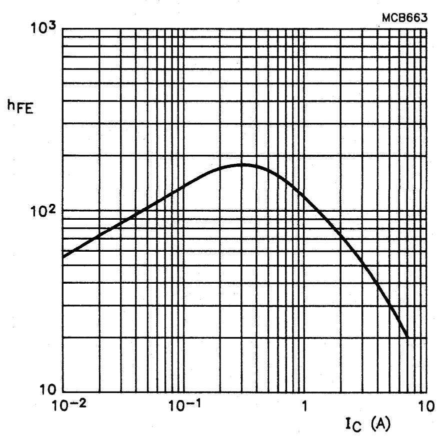


Fig.4 Typical DC current gain; V_{CE} = 4 V; T_{tab} = 25 °C.

NPN silicon epitaxial base power transistors BDS949/951/953/955

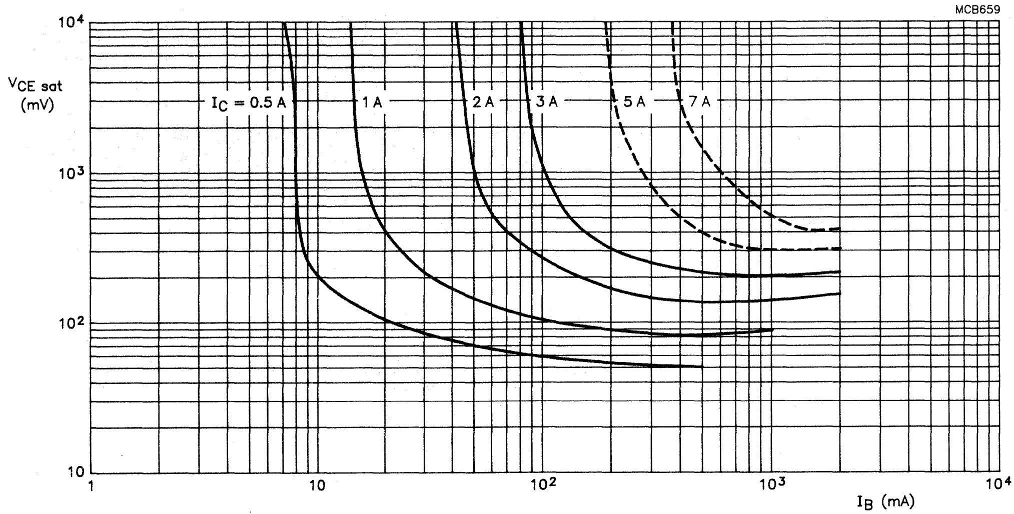


Fig.5 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BDS950/952/954/956

PNP silicon epitaxial base power transistors

DESCRIPTION

PNP silicon epitaxial base transistors in a miniature SMD envelope (SOT223) intended for general purpose and switching applications. NPN complements are BDS949/951/953/955.

PINNING - SOT223

PIN	DESCRIPTION
1	base
2	collector
3	emitter
4	collector

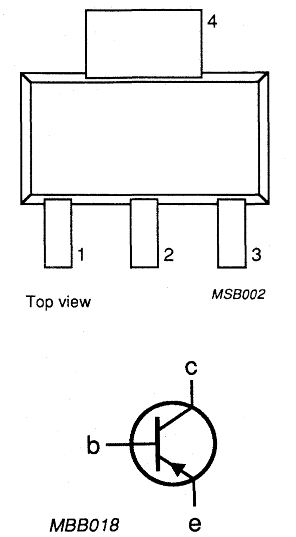


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS950		-	60	V
	BDS952		-	80	V
	BDS954		-	100	V
	BDS956		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS950		-	60	V
	BDS952		-	80	V
	BDS954		-	100	V
	BDS956		-	120	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
		note 1	-	1.5	W
T_j	junction temperature		-	150	°C
h_{FE}	DC current gain	$-I_C$ = 0.5 A; $-V_{CE}$ = 4 V	40	-	
h_{FE}	DC current gain	$-I_C$ = 2 A; $-V_{CE}$ = 4 V	20	-	

Note

1. Mounted on PCB.

PNP silicon epitaxial base power transistors

BDS950/952/954/956

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter			
	BDS950		-	60	V
	BDS952		-	80	V
	BDS954		-	100	V
	BDS956		-	120	V
$-V_{CEO}$	collector-emitter voltage	open base			
	BDS950		-	60	V
	BDS952		-	80	V
	BDS954		-	100	V
	BDS956		-	120	V
$-V_{EBO}$	emitter-base voltage	open collector	-	5	V
$-I_C$	collector current	average value	-	3	A
$-I_{CM}$	collector current	peak value	-	7	A
P_{tot}	total power dissipation	T_{tab} = 25 °C	-	8	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	NOM.	UNIT
$R_{th\ j\text{-}t}$	from junction to tab		15.5	K/W
$R_{th\ j\text{-}a}$	from junction to ambient	on PCB	83.3	K/W

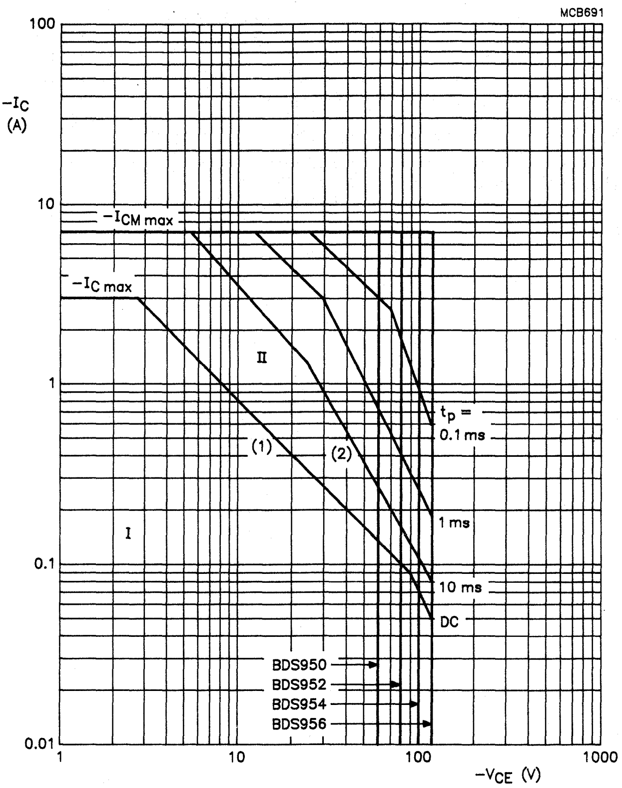
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $-V_{CB} = -V_{CBO\,max}$	-	50	µA
$-I_{CBO}$	collector cut-off current	$I_E = 0$; $V_{CB} = 1/2\ V_{CBO\,max}$; $T_j = 150$ °C	-	1	mA
$-I_{CEO}$	collector cut-off current	$I_B = 0$; $V_{CE} = 1/2\ V_{CEO\,max}$	-	0.1	mA
$-I_{EBO}$	emitter cut-off current	$I_C = 0$; $-V_{EB} = 5$ V	-	0.2	mA
$-V_{BE}$	base-emitter voltage	$-I_C = 2$ A; $-V_{CE} = 4$ V; note 1	-	1.4	V
$-V_{CE\,sat}$	collector-emitter saturation voltage	$-I_C = 2$ A; $-I_B = 0.2$ A; note 1	-	1	V
h_{FE}	DC current gain	$-I_C = 500$ mA; $-V_{CE} = 4$ V note 1	40	-	
h_{FE}	DC current gain	$-I_C = 2$ A; $-V_{CE} = 4$ V; note 1	20	-	
f_T	transition frequency	f = 1 MHz; $-I_C = 500$ mA; $-V_{CE} = 4$ V	3	-	MHz

Note

1. Measured under pulse conditions: $t_p < 300$ µs, duty cycle < 2%.



I. Region of permissible DC operation.
II. Permissible extension for repetitive pulse operation.
(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines.
(2) Second breakdown limits.

Fig.2 Safe operating area; T_{tab} = 25 °C.

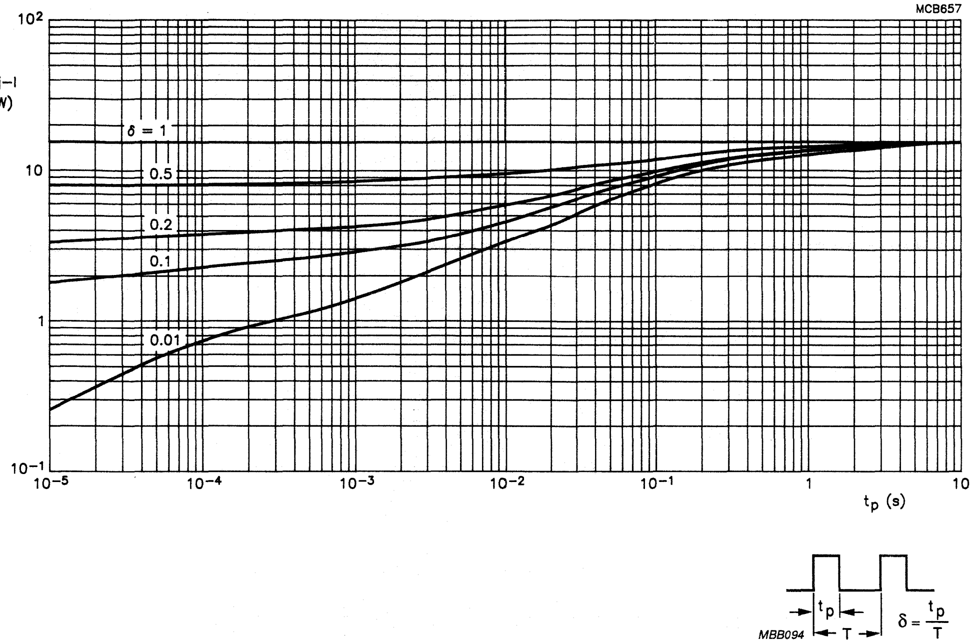


Fig.3 Pulse power rating chart.

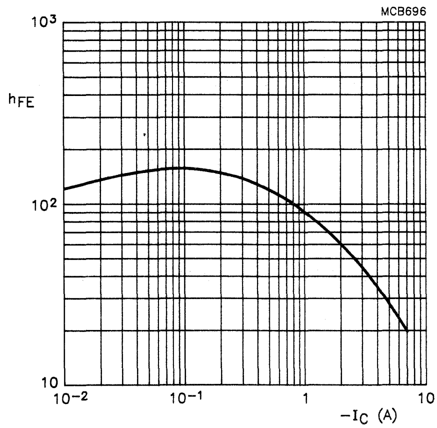


Fig.4 Typical DC current gain; V_{CE} = 4 V; T_{tab} = 25 °C.

PNP silicon epitaxial base power transistors BDS950/952/954/956

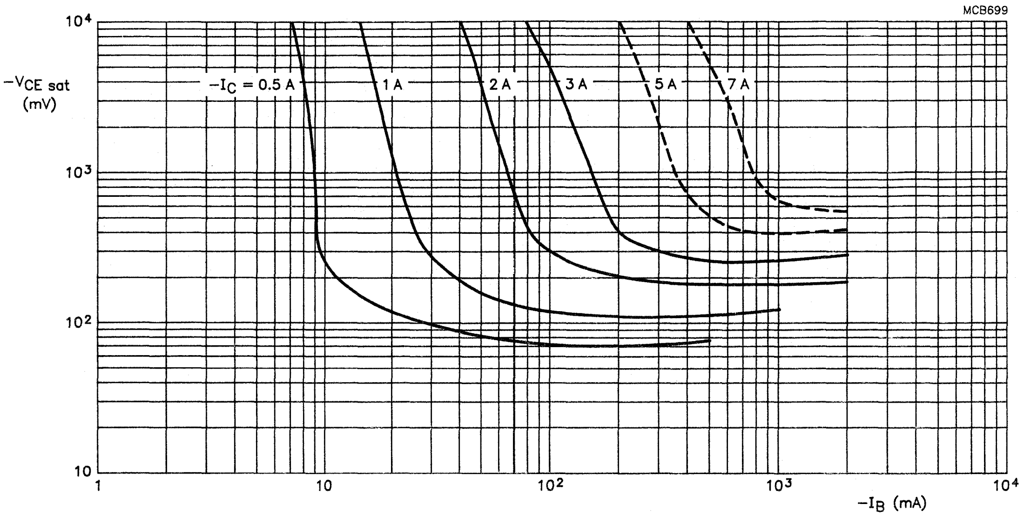


Fig.5 Typical values of collector-emitter saturation voltage at T_{tab} = 25 °C.

N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Asymmetrical N-channel planar epitaxial junction field-effect transistors in the miniature plastic envelope intended for applications up to the v.h.f. range in hybrid thick and thin-film circuits. Special features are the low feedback capacitance and the low noise figure. These features make the product very suitable for applications such as the r.f. stages in f.m. portables (BF510), car radios (BF511) and mains radios (BF512) or the mixer stage (BF513).

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.		20			V
Drain current (DC or average)	I_D	max.		30			mA
Total power dissipation up to T_{amb} = 40 °C	P_{tot}	max.		250			mW
			BF510	511	512	513	
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0.7	2.5	6	10	mA
		<	3.0	7.0	12	18	mA
Transfer admittance (common source) V_{DS} = 10 V; V_{GS} = 0; f = 1 kHz	$\|y_{fs}\|$	>	2.5	4	6	7	mS
Feedback capacitance V_{DS} = 10 V; V_{GS} = 0	C_{rs}	typ.	0.3	0.3	–	–	pF
V_{DS} = 10 V; I_D = 5 mA	C_{rs}	typ.	–	–	0.3	0.3	pF
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz							
V_{DS} = 10 V; V_{GS} = 0	F	typ.	1.5	1.5	–	–	dB
V_{DS} = 10 V; I_D = 5 mA	F	typ.	–	–	1.5	1.5	dB

MECHANICAL DATA

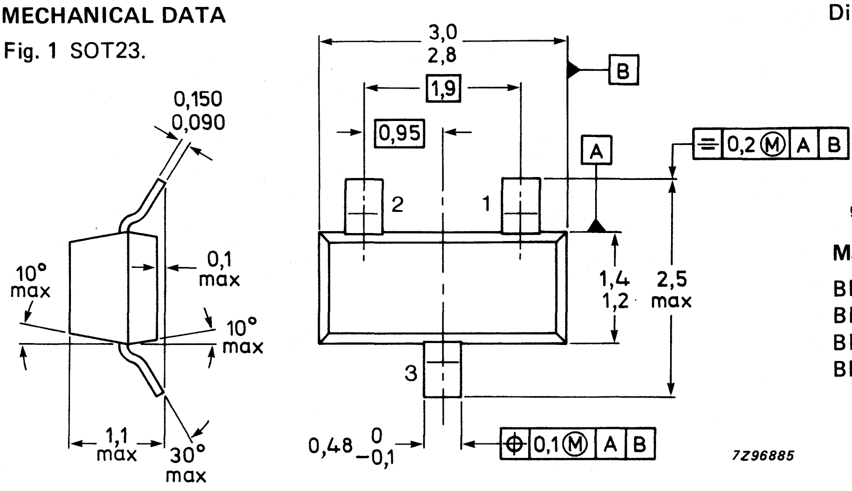
SOT23.

See also *Soldering recommendations.*

MECHANICAL DATA

Fig. 1 SOT23.

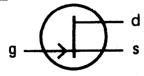
Dimensions in mm



TOP VIEW

Pinning

1 = gate
2 = drain
3 = source



Marking code

BF510 = S6p
BF511 = S7p
BF512 = S8p
BF513 = S9p

RATINGS

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

Drain-source voltage	V_{DS}	max.	20	V
Drain-gate voltage (open source)	V_{DGO}	max.	20	V
Drain current (DC or average)	I_D	max.	30	mA
Gate current	$\pm I_G$	max.	10	mA
Total power dissipation up to T_{amb} = 40 °C (note 1)	P_{tot}	max.	250	mW
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient (note 1)	$R_{th\ j\text{-}a}$	=	430 K/W

Note

1. Mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_{amb} = 25 °C

			BF510	511	512	513	
Gate cut-off current $-V_{GS}$ = 0.2 V; V_{DS} = 0	$-I_{GSS}$	<	10	10	10	10	nA
Gate-drain breakdown voltage I_S = 0; $-I_D$ = 10 μA	$-V_{(BR)GDO}$	>	20	20	20	20	V
Drain current V_{DS} = 10 V; V_{GS} = 0	I_{DSS}	>	0.7	2.5	6	10	mA
		<	3.0	7.0	12	18	mA
Gate-source cut-off voltage I_D = 10 μA; V_{DS} = 10 V	$-V_{(P)GS}$	typ.	0.8	1.5	2.2	3	V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): V_{DS} = 10 V; V_{GS} = 0; T_{amb} = 25 °C for BF510 and BF511
V_{DS} = 10 V; I_D = 5 mA; T_{amb} = 25 °C for BF512 and BF513

y-parameters (common source)			BF510	511	512	513	
Input capacitance at f = 1 MHz	C_{is}	<	5	5	5	5	pF
Input conductance at f = 100 MHz	g_{is}	typ.	100	90	60	50	μS
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	0.3	0.3	0.3	0.3	pF
		<	0.4	0.4	0.4	0.4	pF
Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	>	2.5	4.0	4.0	3.5	mS
V_{GS} = 0 instead of I_D = 5 mA	$\|y_{fs}\|$	>	–	–	6.0	7.0	mS
Transfer admittance at f = 100 MHz	$\|y_{fs}\|$	typ.	3.5	5.5	5.0	5.0	mS
Output capacitance at f = 1 MHz	C_{os}	<	3	3	3	3	pF
Output conductance at f = 1 MHz	g_{os}	<	60	80	100	120	μS
Output conductance at f = 100 MHz	g_{os}	typ.	35	55	70	90	μS
Noise figure at optimum source admittance G_S = 1 mS; $-B_S$ = 3 mS; f = 100 MHz	F	typ.	1.5	1.5	1.5	1.5	dB

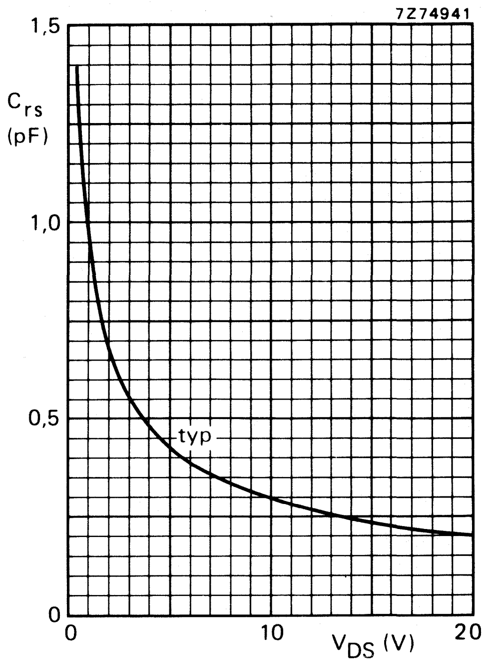


Fig. 2 $V_{GS} = 0$ for BF510 and BF511;
$I_D = 5$ mA for BF512 and BF513;
f = 1 MHz; $T_{amb} = 25$ °C.

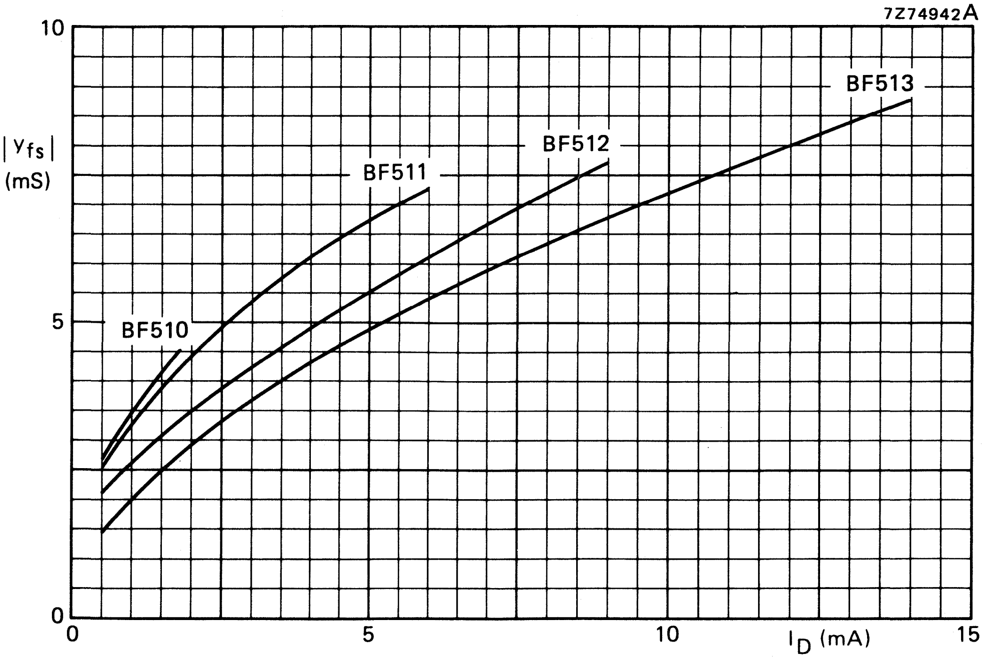


Fig. 3 $V_{DS} = 10$ V; f = 1 kHz; $T_{amb} = 25$ °C; typical values.

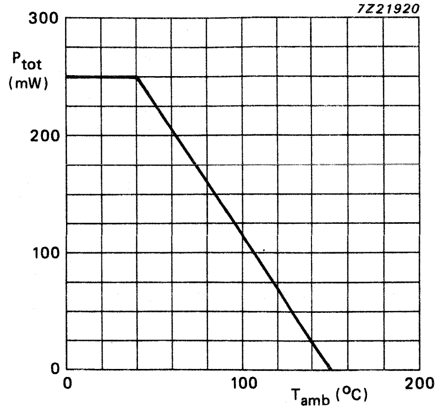


Fig.4 Power derating curve.

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope, intended for applications in thick and thin-film circuits. This transistor is primarily intended for use in i.f. detection applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain at T_j = 25 °C $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	h_{FE}	>	50	
Transition frequency at f = 100 MHz $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	325	MHz
Noise figure at R_S = 300 Ω $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; f = 100 kHz	F	typ.	2	dB

MECHANICAL DATA

Dimensions in mm

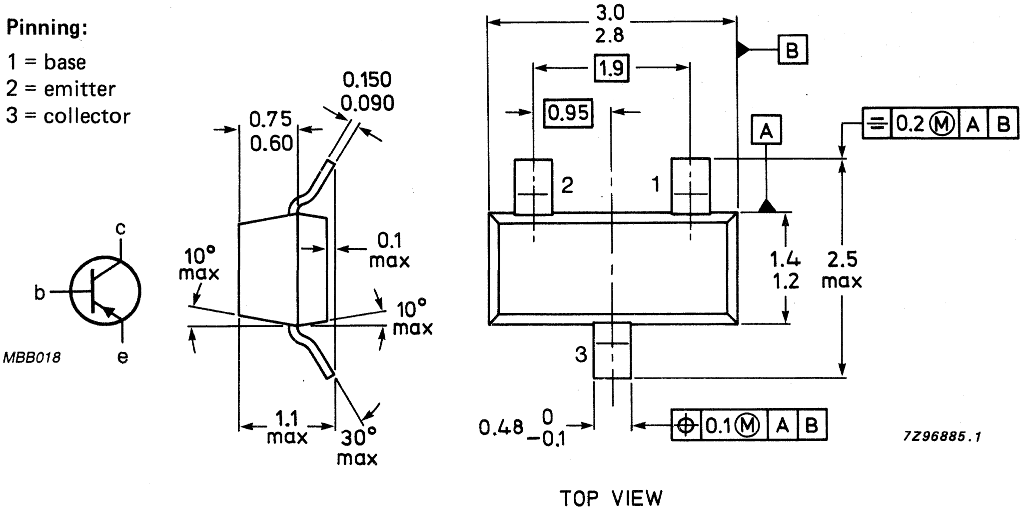
Marking code

Fig. 1 SOT-23

BF550 = LAp

Pinning:

1 = base
2 = emitter
3 = collector



See also *Soldering Recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $-V_{CB} = 30$ V	$-I_{CBO}$	$<$	50	nA
Emitter cut-off current $I_C = 0$; $-V_{EB} = 3$ V	$-I_{EBO}$	$<$	100	μA
Base-emitter voltage $-I_C = 1$ mA; $-V_{CE} = 10$ V	$-V_{BE}$	typ.	750	mV
D.C. current gain $-I_C = 1$ mA; $-V_{CE} = 10$ V	h_{FE}	$>$	50	
Transition frequency at f = 100 MHz $-I_C = 1$ mA; $-V_{CE} = 10$ V	f_T	typ.	325	MHz
Feedback capacitance at f = 1 MHz $-I_C = 1$ mA; $-V_{CE} = 10$ V	C_{re}	typ.	0,5	pF
Noise figure at $R_S = 300\ \Omega$ $-I_C = 1$ mA; $-V_{CE} = 10$ V; f = 100 kHz	F	typ.	2	dB

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

SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a microminiature plastic envelope, intended for applications in thick and thin-film circuits such as self-oscillating mixer in u.h.f. tuners in conjunction with bipolar transistors or with MOS fets.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	35	V
Collector current (d.c)	$-I_C$	max.	30	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 3 mA; $-V_{CB}$ = 10 V	f_T	typ.	900	MHz

MECHANICAL DATA

Dimensions in mm

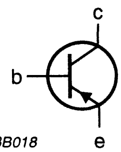
Fig. 1 SOT-23

Pinning:

1 = base
2 = emitter
3 = collector

Marking code

BF569 = LHp



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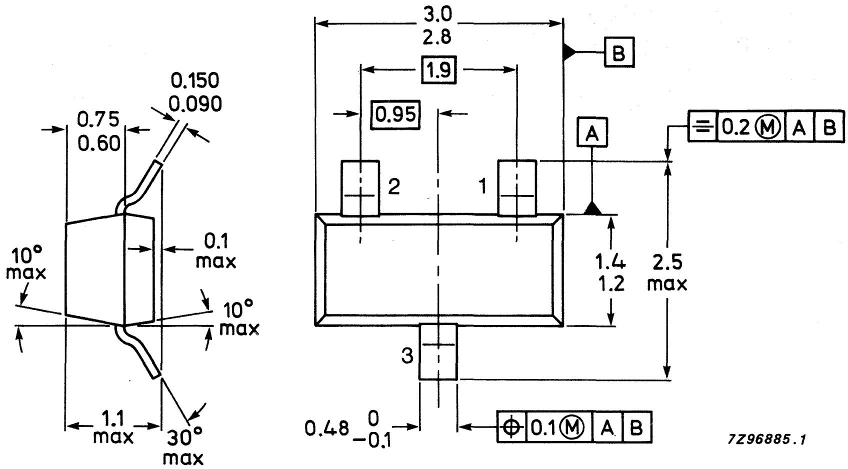


TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	35	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	3	V
Collector current (d.c.)	$-I_C$	max.	30	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to +	150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Collector cut-off current I_E = 0; $-V_{CB}$ = 20 V	$-I_{CBO}$	$<$	100	nA
D.C. current gain I_E = 3 mA; $-V_{CB}$ = 10 V	h_{FE}	$>$ typ.	25 50	
Transition frequency at f = 100 MHz I_E = 3 mA; $-V_{CB}$ = 10 V	f_T	typ.	900	MHz
Feedback capacitance at f = 1 MHz I_E = 1 mA; $-V_{CB}$ = 10 V	C_{re}	typ.	0,33	pF
Noise figure at f = 800 MHz I_E = 3 mA; $-V_{CB}$ = 10 V; R_S = 60 Ω; R_L = 500 Ω	F	typ.	4,5	dB
Power gain at f = 800 MHz I_E = 3 mA; $-V_{CB}$ = 10 V; R_S = 60 Ω; R_L = 500 Ω	G_{pb}	typ.	14,5	dB

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

SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a plastic SOT-23 variant envelope, intended for use in large-signal handling i.f. pre-amplifiers of TV receivers in combination with surface acoustic wave filters.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
D.C. current gain I_C = 10 mA; V_{CE} = 1 V	h_{FE}	>	40	
Transition frequency at f = 100 MHz I_C = 40 mA; V_{CE} = 10 V	f_T	>	490	MHz
Voltage gain at f = 36 MHz (see Fig. 4) I_C = 20 mA; V_{CE} ≈ 10,4 V	G_v	typ.	24	dB
Interference voltage for K = 1% (see Fig. 3)	$V_{(int)rms}$	typ.	120	mV

MECHANICAL DATA

Dimensions in mm

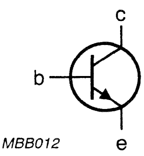
Fig. 1 SOT-23.

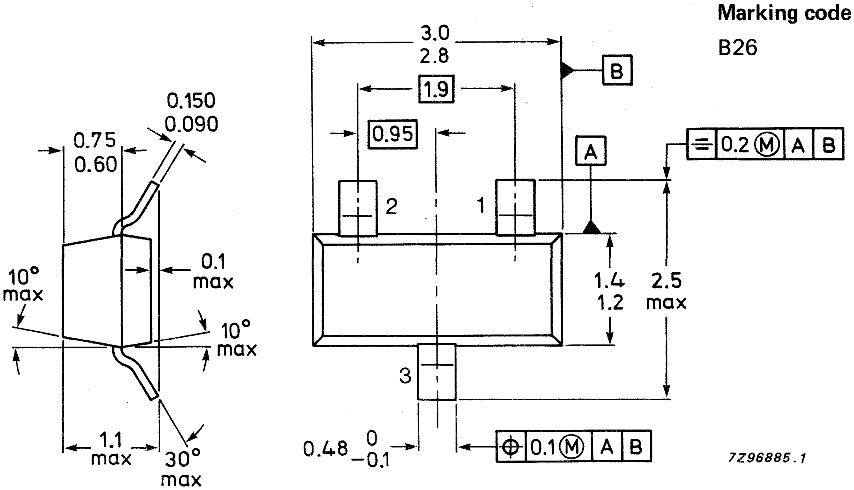
Pinning:

1 = base
2 = emitter
3 = collector

Marking code

B26





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,5	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to tab	$R_{th\ j\text{-}t}$	=	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	400	nA
$I_E = 0$; $V_{CB} = 20$ V; $T_j = 125$ °C	I_{CBO}	<	30	μA
Emitter cut-off current				
$I_C = 0$; $V_{EB} = 2$ V	I_{EBO}	<	100	nA
D.C. current gain				
$I_C = 10$ mA; $V_{CE} = 1$ V	h_{FE}	>	40	
Transition frequency at f = 100 MHz				
$I_C = 10$ mA; $V_{CE} = 10$ V	f_T	>	500	MHz
$I_C = 40$ mA; $V_{CE} = 10$ V	f_T	>	490	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	2,2	pF
		<	3,5	pF
Emitter capacitance at f = 1 MHz				
$I_C = I_c = 0$; $V_{EB} = 1$ V	C_e	<	4,5	pF
Feedback capacitance at f = 1 MHz				
$I_C = 0$; $V_{CE} = 10$ V	C_{re}	typ.	1,6	pF
		<	2,2	pF

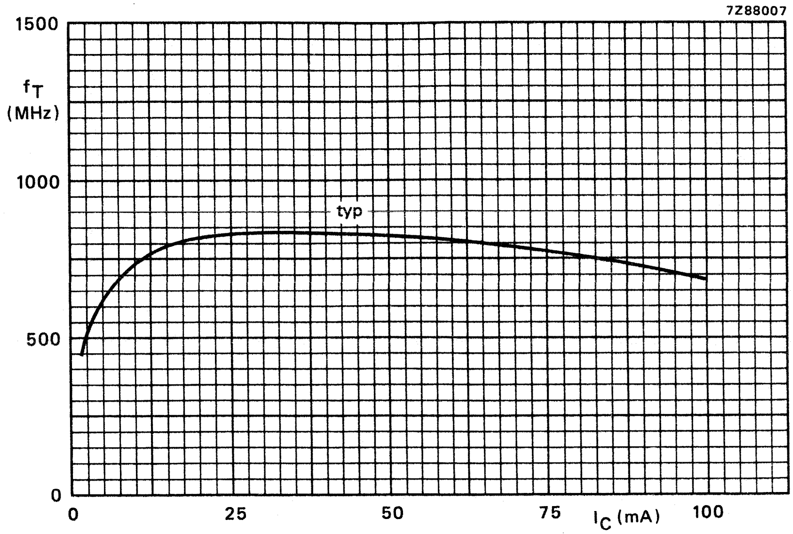
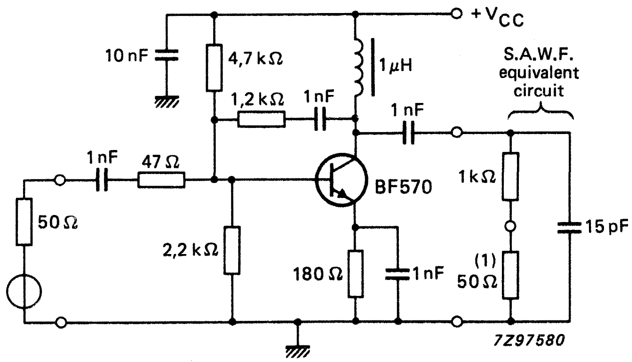


Fig. 2 V_{CE} = 10 V; T_j = 25 °C.

APPLICATION INFORMATION



(1) Test instrument load.

Fig. 3 Large-signal handling i.f. preamplifier for surface acoustic wave filter.

Performance

Supply voltage	V_{CC}	=	12	V
Collector current	I_C	=	20	mA
Measuring frequency	f_i	=	36	MHz
Input impedance	Z_i	typ.	50 Ω//1	pF
Output impedance	Z_o	<	100	Ω
Voltage gain G_V (in dB) $= 20 \log \frac{V_o}{V_i}$	G_V	typ.	24	dB
Interference voltage for K = 1%*	$V_{(int)rms}$	typ.	120	mV

* Input terminal voltage at 50 Ω internal resistance of signal generator, interference frequency 40 MHz, 80% modulated with 1 kHz.

SILICON PLANAR TRANSISTOR

P-N-P transistor in a microminiature envelope primarily intended for u.h.f. applications in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	20	V
Collector current	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 10 mA; $-V_{CB}$ = 10 V	f_T	typ.	1350	MHz
Transducer gain (common base) I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz R_S = 60 Ω; R_L = 500 Ω; T_{amb} = 25 °C	G_{tr}	typ.	16	dB
Noise figure (common base) I_E = 10 mA; $-V_{CB}$ = 10 V; f = 800 MHz R_S = 60 Ω; R_L = 500 Ω	F	typ.	4,5	dB

MECHANICAL DATA

Dimensions in mm

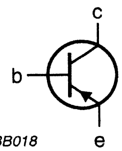
Marking code

BF579 = LJp

Fig. 1 SOT-23.

Pinning:

1 = base
2 = emitter
3 = collector



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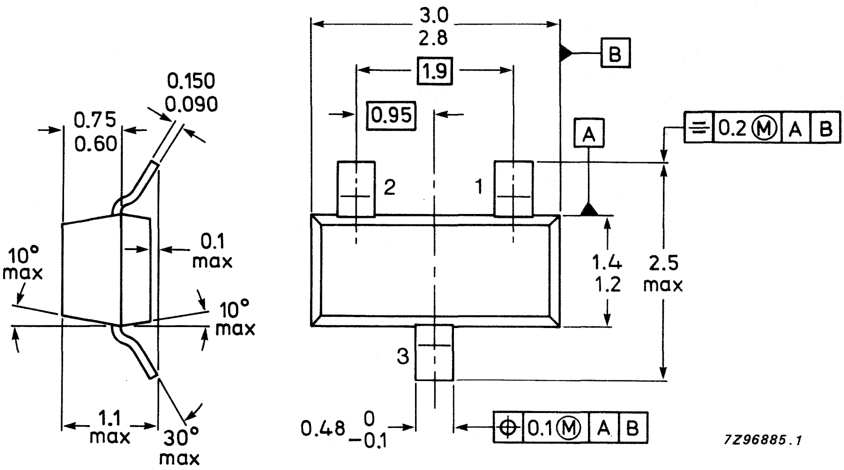


TOP VIEW

See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter) see Fig. 2	$-V_{CBO}$	max.	20	V
Collector-emitter voltage (open base) see Fig. 2	$-V_{CEO}$	max.	20	V
Emitter-base voltage (open collector) see Fig. 2	$-V_{EBO}$	max.	3	V
Collector current	$-I_C$	max.	25	mA
Base current (d.c.)	$-I_B$	max.	10	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current $I_E = 0$; $-V_{CB} = 15$ V	$-I_{CBO}$	<	100	nA
Emitter cut-off current $I_C = 0$; $-V_{EB} = 1$ V	$-I_{EBO}$	<	100	nA
D.C. current gain $I_C = 10$ mA; $-V_{CE} = 10$ V	h_{FE}	>	20	
Transition frequency at f = 100 MHz $I_E = 10$ mA; $-V_{CB} = 10$ V	f_T	typ.	1350	MHz
Feedback capacitance at f = 500 kHz $I_E = 7$ mA; $-V_{CB} = 10$ V	C_{re}	typ.	0,46	pF
$I_E = 0$; $-V_{CB} = 10$ V	C_{rb}	typ.	160	fF
Transducer gain (common base) $I_E = 10$ mA; $-V_{CB} = 10$ V; f = 800 MHz $R_S = 60\ \Omega$; $R_L = 500\ \Omega$	G_{tr}	typ.	16	dB
Noise figure (common base) $I_E = 10$ mA; $-V_{CB} = 10$ V; f = 800 MHz $R_S = 60\ \Omega$; $R_L = 500\ \Omega$	F	typ.	4,5	dB

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

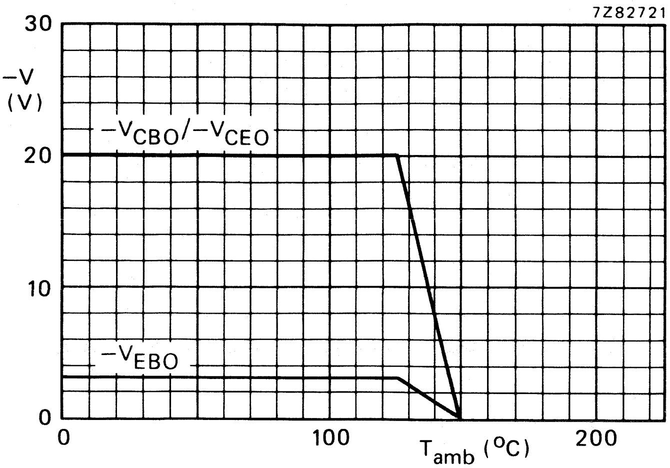


Fig. 2 Voltage derating curves.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

N-P-N transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers.

P-N-P complements are BF621 and BF623 respectively.

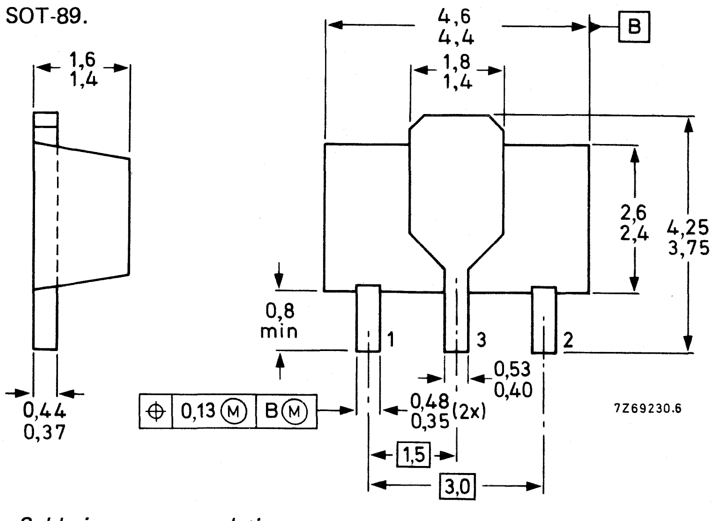
QUICK REFERENCE DATA

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Dimensions in mm

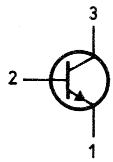
Fig. 1 SOT-89.



BOTTOM VIEW

Marking code

BF620 = DC
BF622 = DA



See also *Soldering recommendations.*

RATINGS

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

			BF620	BF622	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		–65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF620	BF622	
Collector cut-off current $I_E = 0$; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

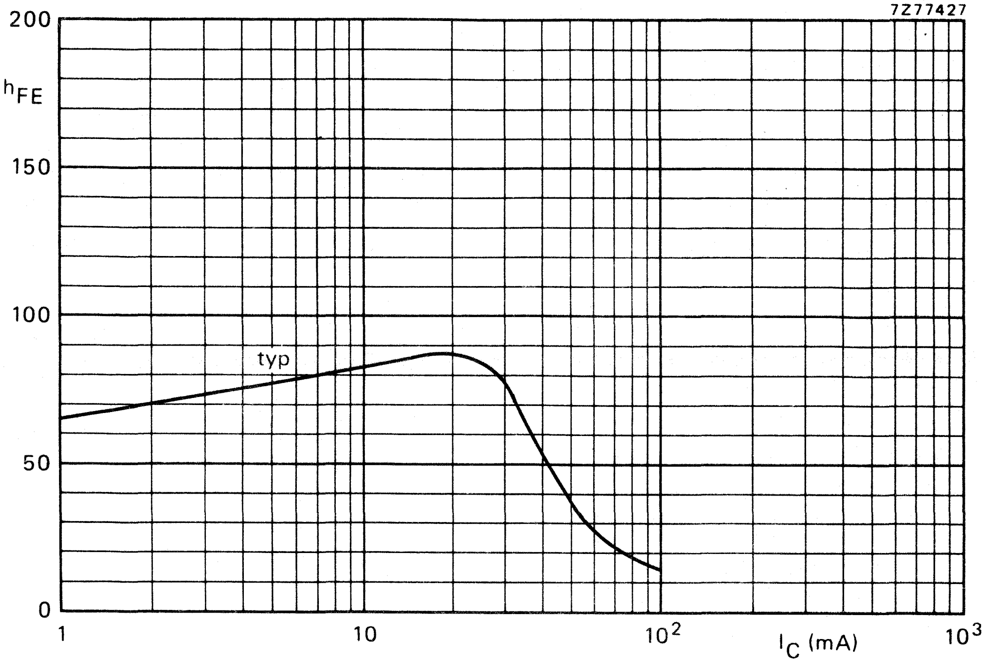


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

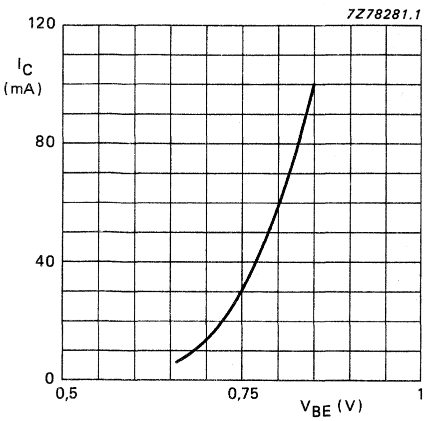


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

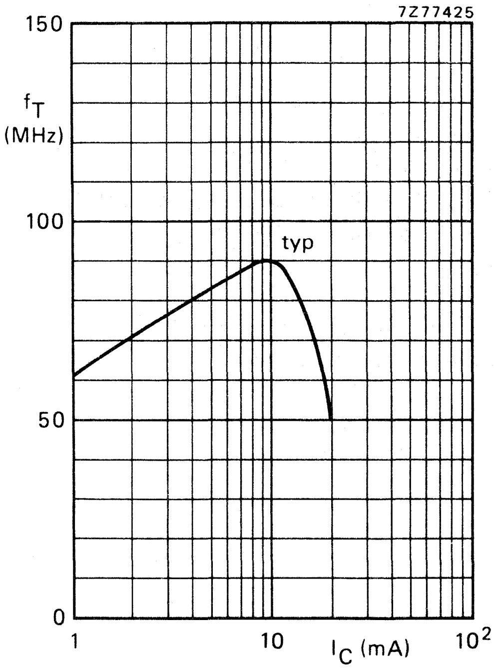


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

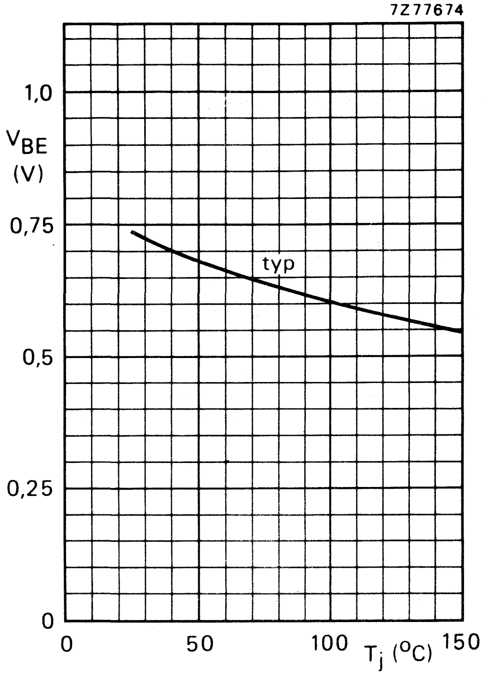


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

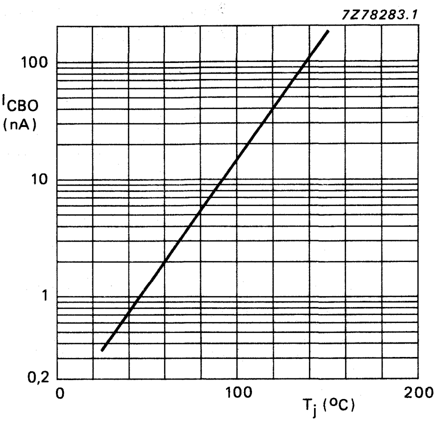


Fig. 6 V_{CB} = 200 V; typical values.

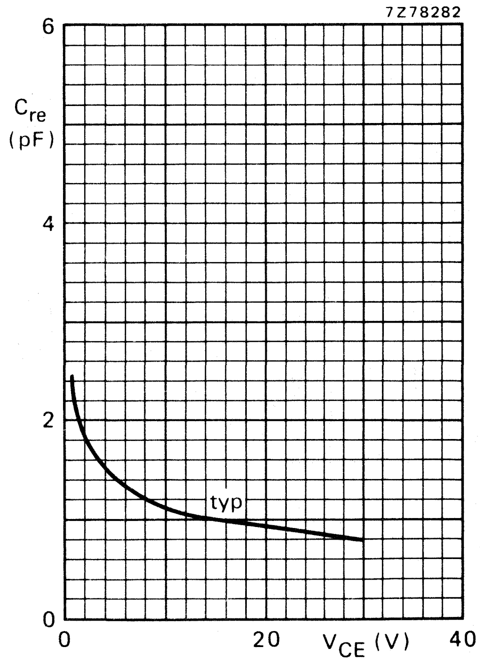


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

- **For video output stages**

P-N-P transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers.

N-P-N complements are BF620 and BF622 respectively.

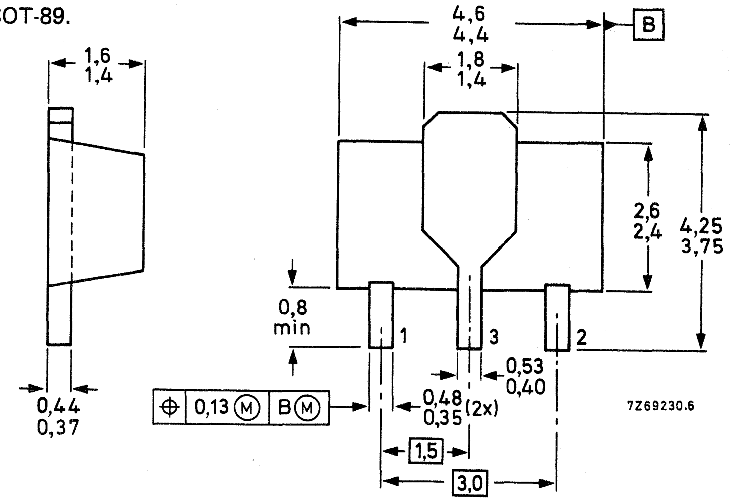
QUICK REFERENCE DATA

			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1		W
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

MECHANICAL DATA

Fig. 1 SOT-89.

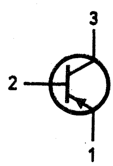
Dimensions in mm



BOTTOM VIEW

Marking code

BF621 = DF
BF623 = DB



See also *Soldering recommendations.*

RATINGS

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

			BF621	BF623	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	P_{tot}	max.	1		W
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE*

From junction to collector tab	$R_{th\ j\text{-}tab}$	=	25	K/W
From junction to ambient in free air mounted on a ceramic substrate area = 2,5 cm²; thickness = 0,7 mm	$R_{th\ j\text{-}a}$	=	125	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF621	BF623	
Collector cut-off current I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage $-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* See *Thermal characteristics.*

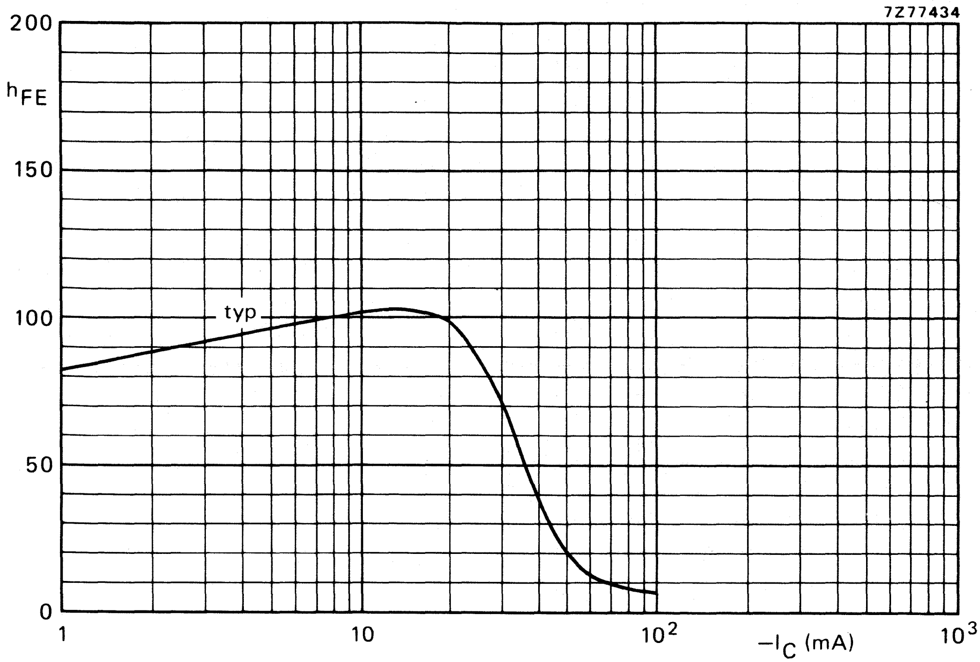


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

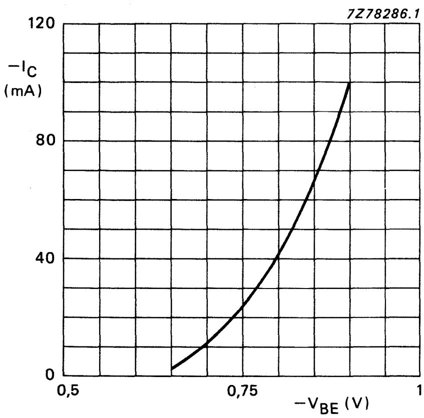


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C ; typical values.

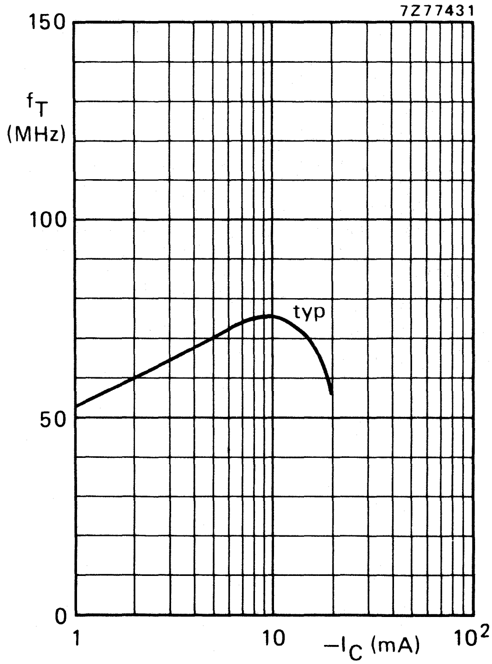


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

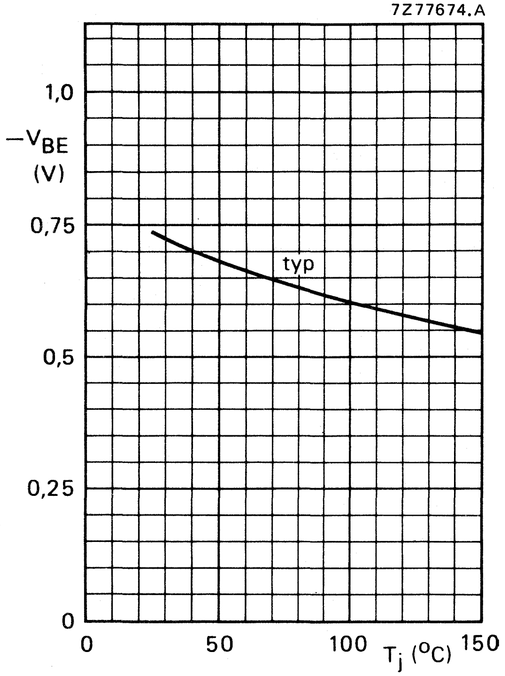


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

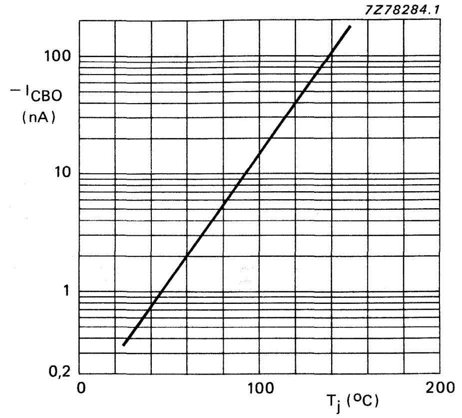


Fig. 6 $-V_{CB}$ = 200 V; typical values.

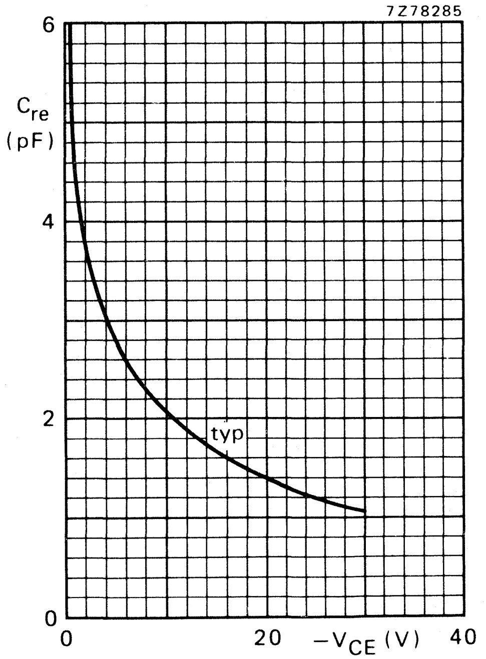


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON PLANAR TRANSISTOR

P-N-P transistor, in a microminiature plastic envelope; intended for use as oscillator in v.h.f. tuners with extended frequency range and/or in conjunction with MOS-FETs in thick and thin-film circuits.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Collector current (peak value)	$-I_{CM}$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 100 MHz I_E = 5 mA; $-V_{CB}$ = 10 V	f_T	typ.	650	MHz

MECHANICAL DATA

Dimensions in mm

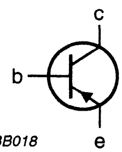
Fig. 1 SOT-23.

Marking code

BF660 = LEp

Pinning:

1 = base
2 = emitter
3 = collector



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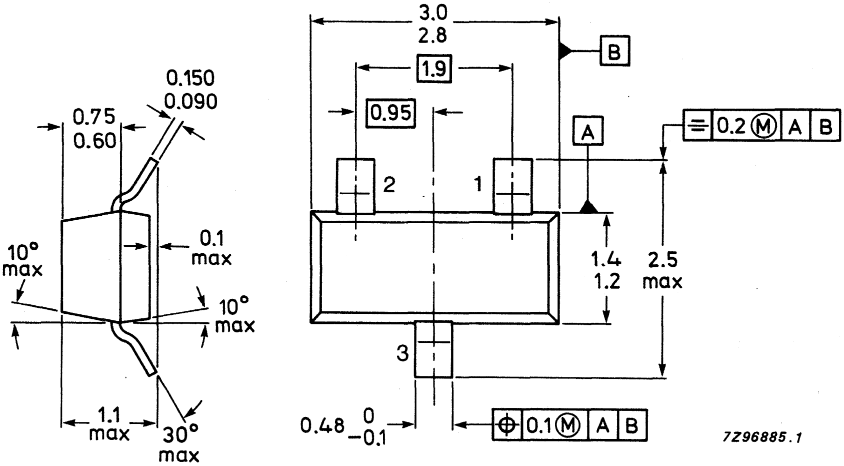


7Z96885.1

TOP VIEW

See also *Soldering recommendations*.

RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	V
Collector current (peak value)	$-I_{CM}$	max.	25	mA
Base current (d.c.)	$-I_B$	max.	10	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_{amb} = 25 °C

Collector cut-off current $I_E = 0$; $-V_{CB} = 20$ V	$-I_{CBO}$	<	50	nA
D.C. current gain $I_E = 3$ mA; $-V_{CE} = 10$ V	h_{FE}	>	30	
Transition frequency at f = 100 MHz $I_E = 5$ mA; $-V_{CB} = 10$ V	f_T	typ.	650	MHz
Feedback capacitance at f = 1 MHz $I_E = 1$ mA; $-V_{CB} = 10$ V	C_{re}	typ.	0,65	pF

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

SILICON EPITAXIAL TRANSISTORS

NPN transistors in a microminiature plastic envelope intended for class-B video output stages in colour television receivers, and general purpose high voltage circuits.

PNP complements are BF721 and BF723 respectively.

QUICK REFERENCE DATA

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

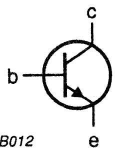
MECHANICAL DATA

Dimensions in mm

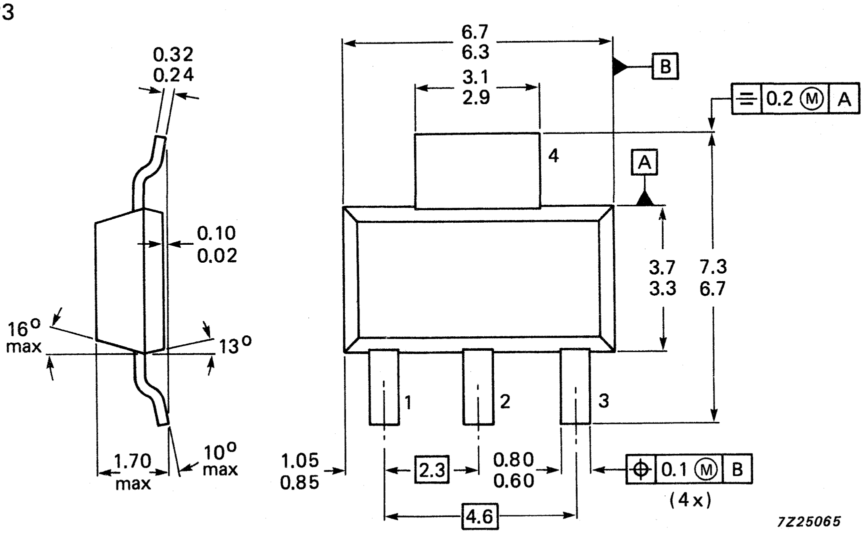
Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector



MBB012



7Z25065

RATINGS

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

			BF720	BF722	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (DC)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient* $R_{th\ j\text{-}a}$ = 83,3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF720	BF722	
Collector cut-off current I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	–	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	μA
Saturation voltage I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
DC current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

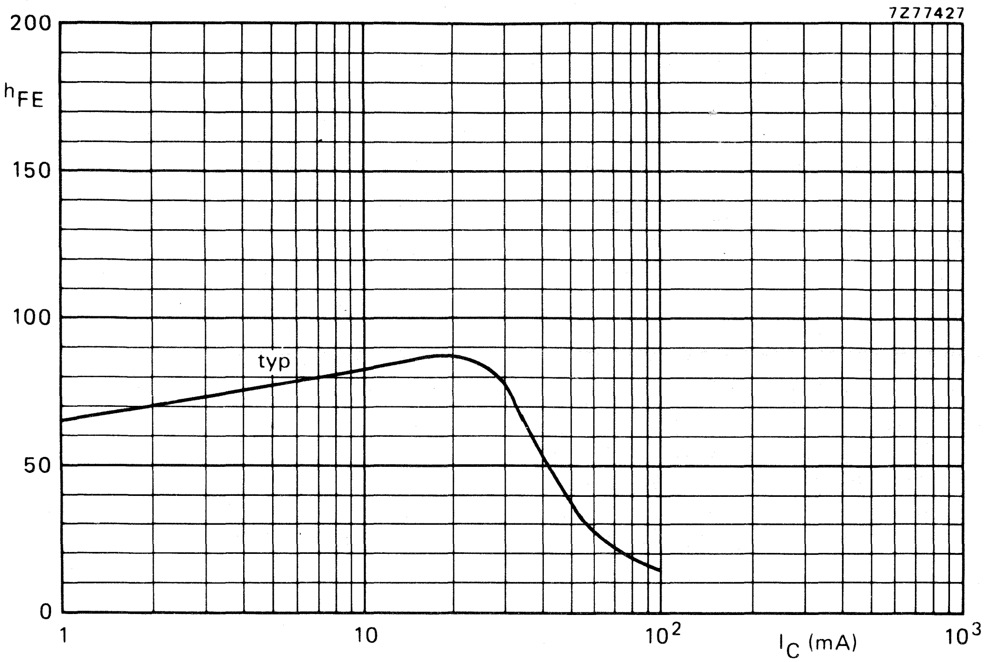


Fig. 2 Typical values at V_{CE} = 20 V; T_j = 25 °C.

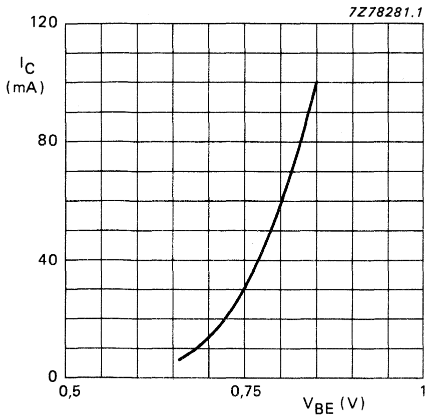


Fig. 3 V_{CE} = 20 V; T_j = 25 °C.

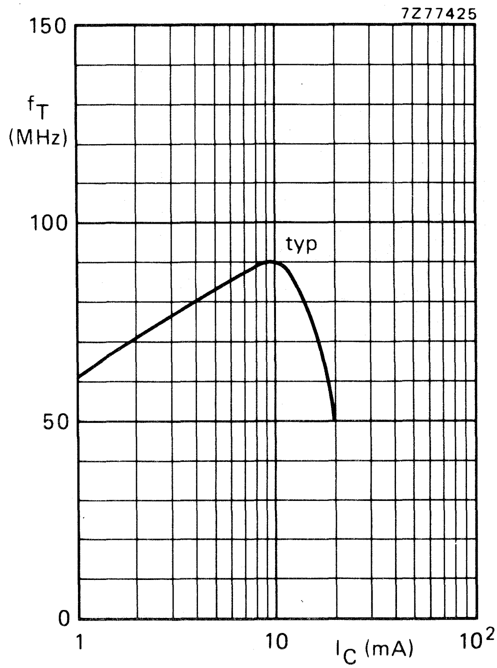


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; f = 35 MHz.

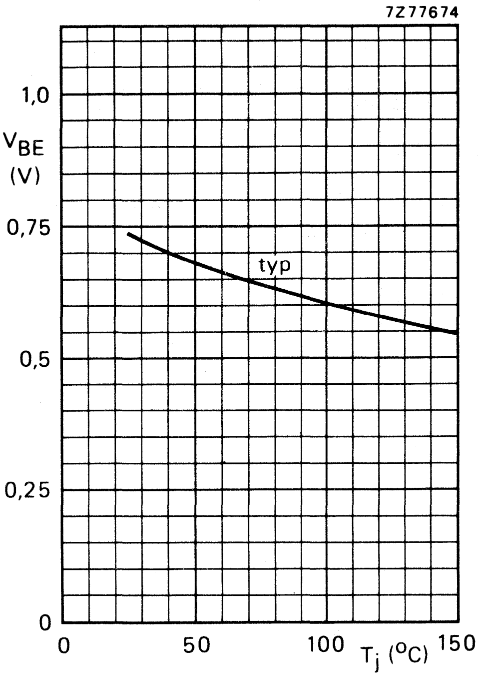


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

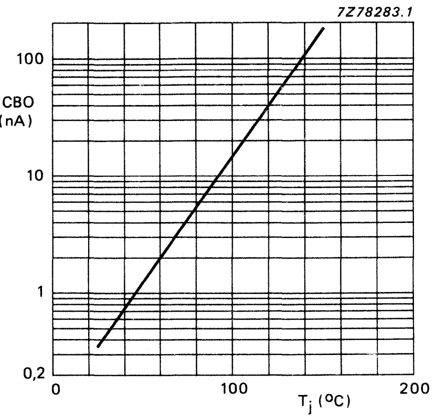


Fig. 6 V_{CB} = 200 V; typical values.

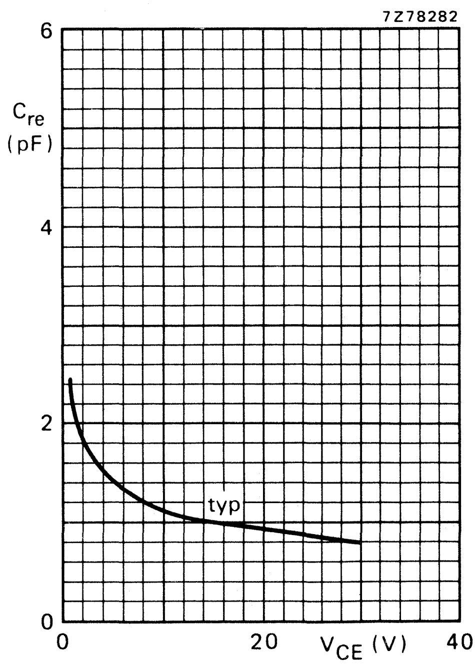


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

PNP transistors in a microminiature plastic envelope intended for application in class-B video output stages in colour television receivers, and general purpose high voltage circuits.

NPN complements are BF720 and BF722 respectively.

QUICK REFERENCE DATA

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Junction temperature	T_j	max.	150		°C
DC current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

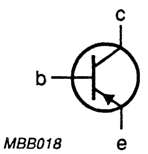
MECHANICAL DATA

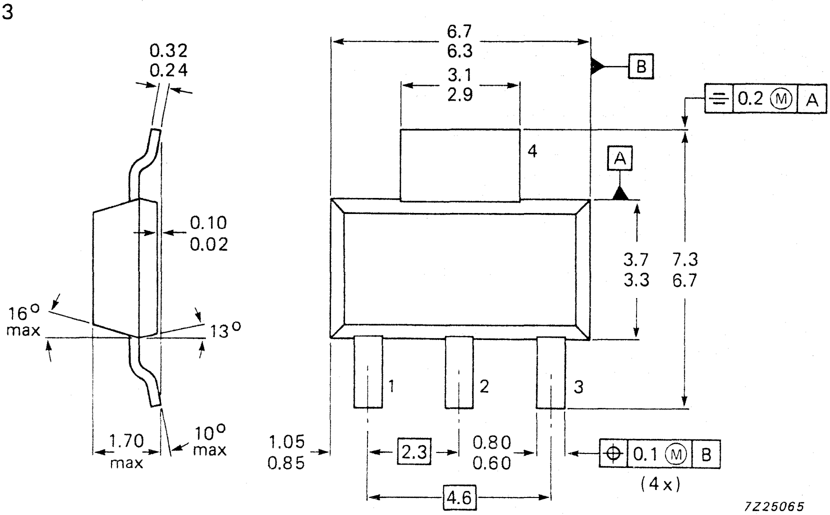
Dimensions in mm

Fig. 1 SOT-223

Pinning

1 = Base
2 = Collector
3 = Emitter
4 = Collector





RATINGS

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

			BF721	BF723	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (DC)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	1,5		W
Storage temperature range	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}a}$	=	83,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF721	BF723	
Collector cut-off current I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage R_{BE} = 2.7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	–	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage $-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
DC current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Device mounted on an epoxy printed circuit board 40 mm x 40 mm x 1,5 mm; mounting pad for the collector lead min. 6 cm^2.

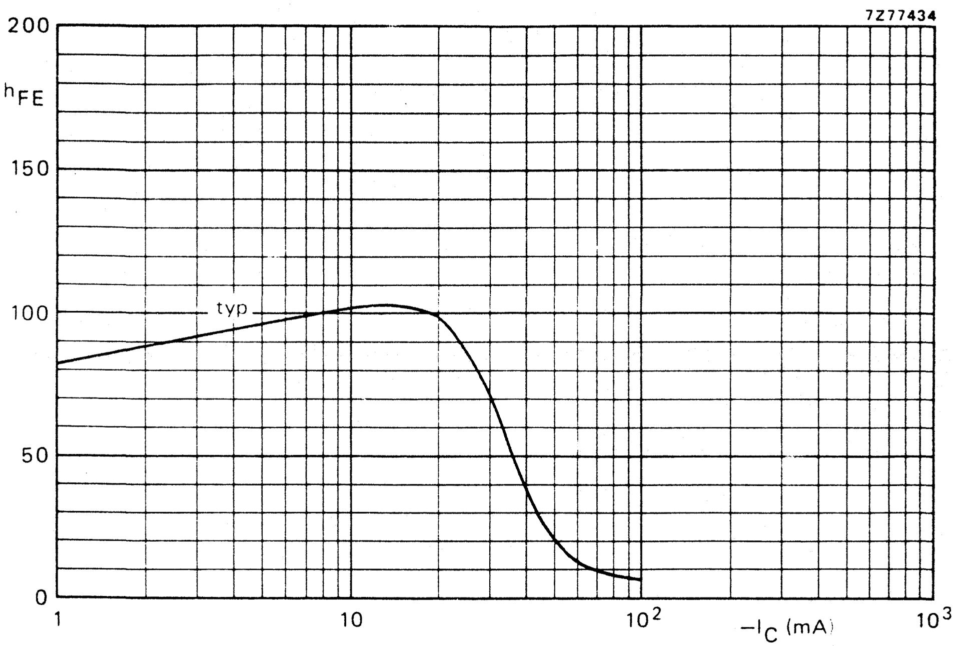


Fig. 2 Typical values at $-V_{CE}$ = 20 V; T_j = 25 °C.

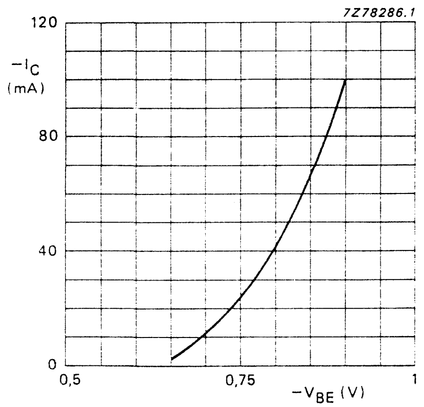


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

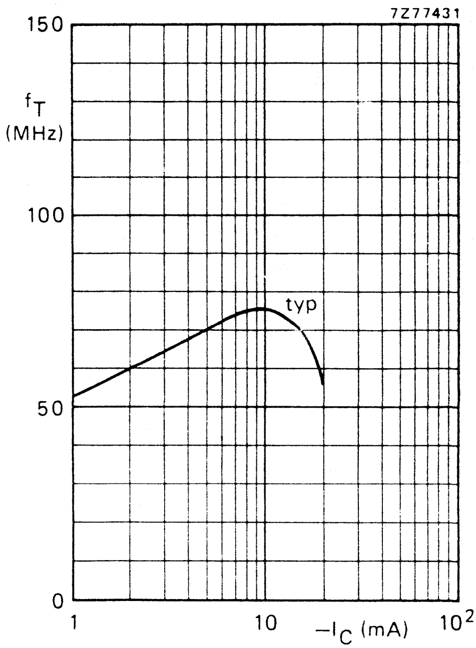


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

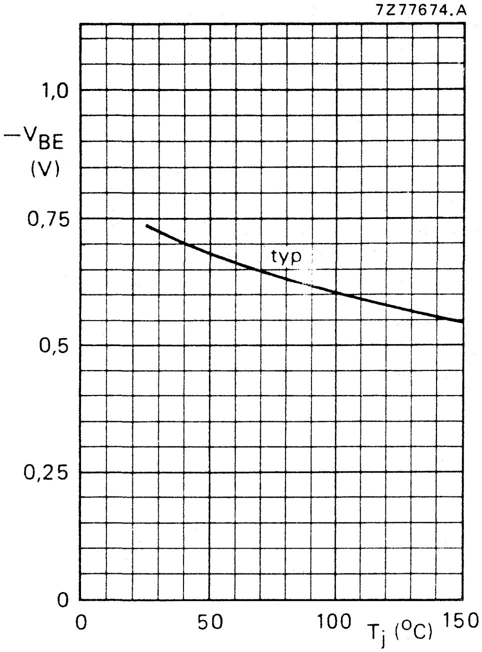


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

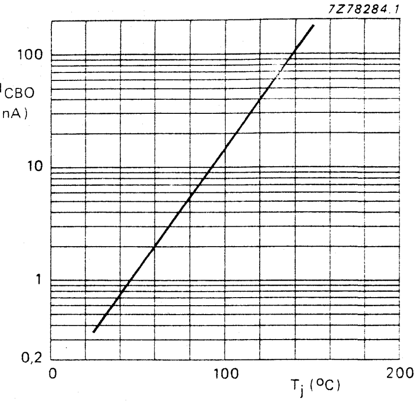


Fig. 6 $-V_{CB}$ = 200 V; typical values.

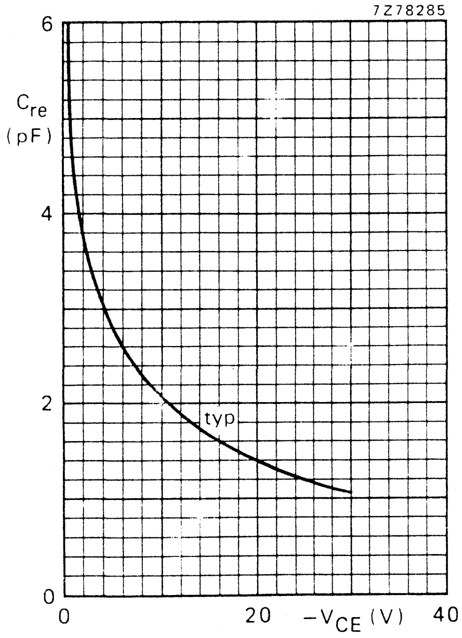


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BF747

NPN 1 GHz wideband transistor

FEATURES

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

DESCRIPTION

The BF747 is a low cost NPN transistor in a plastic SOT23 envelope. It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

MECHANICAL DATA

Plastic SOT23.

PIN	DESCRIPTION
1	base
2	emitter
3	collector

Marking code : E15

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage		-	20	V
V_{CBO}	collector-base voltage		-	30	V
V_{EBO}	emitter-base voltage		-	3	V
I_{CM}	collector current (DC)	peak value	-	50	mA
P_{tot}	total power dissipation	up to $T_s = 100°C$ note 1	-	150	mW
T_{stg}	storage temperature range		–55	+150	°C
T_j	junction temperature		-	+150	°C

Note

1. T_s temperature measured on soldering point of collector tab.

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BF747	SOT23	12 mm reel	3000

NPN 1 GHz wideband transistor BF747

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage		-	20	V
V_{EBO}	emitter-base voltage		-	3	V
V_{CBO}	collector-base voltage		-	30	V
I_{CM}	collector current (DC)	peak value	-	50	mA
P_{tot}	total power dissipation	up to T_s = 100 °C	-	150	mW
T_{stg}	storage temperature range		−55	+150	°C
T_j	operating junction temperature		-	+150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}s}$	from junction to soldering point	320	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

Note

1. Maximum Unilateral Gain (G_{UM}) is defined as:

$$G_{UM} = \frac{1}{1 - |S_{11}|^2} |S_{21}|^2 \frac{1}{1 - |S_{22}|^2}$$

NPN 1 GHz wideband transistor BF747

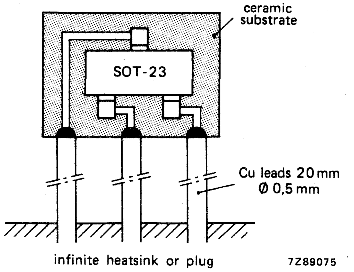


Fig.1 Test circuit for SOT23 $R_{th\ j\text{-}s}$ measurement; ceramic substrate 8 x 10 x 0.7 mm.

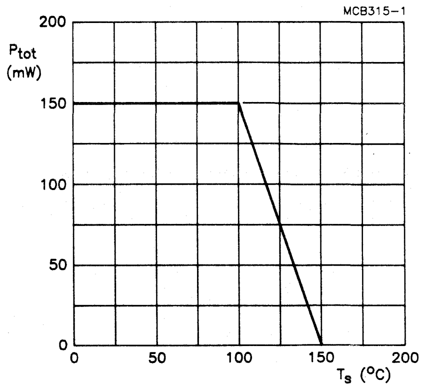


Fig.2 Power derating curve, junction to case.

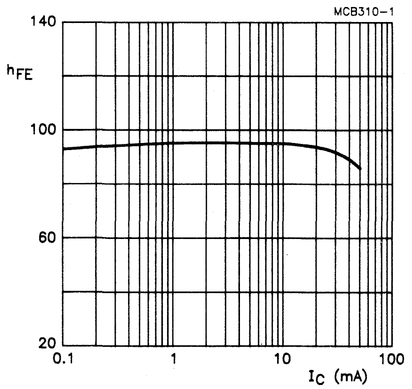


Fig.3 Current gain as a function of collector current; V_{CE} = 10 V.

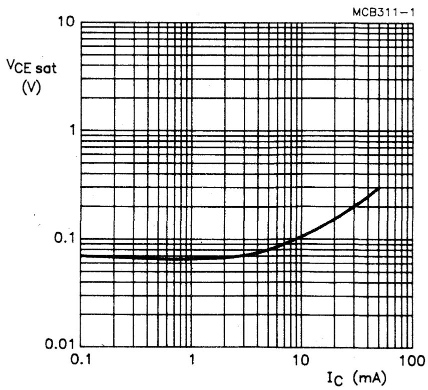


Fig.4 Collector-emitter saturation voltage as a function of collector current; I_C/I_B = 10.

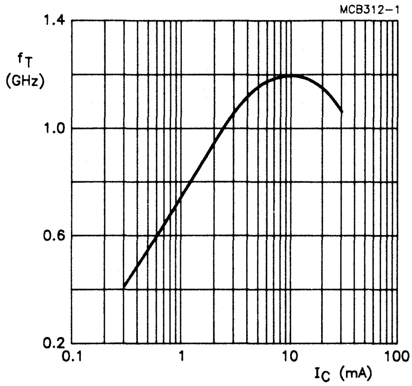


Fig.5 Transition frequency as a function of collector current; V_{CE} = 10 V; f = 500 MHz.

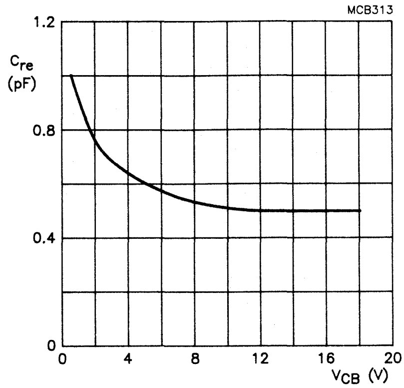


Fig.6 Feedback capacitance as a function of voltage; $I_E = i_e = 0$; f = 1 MHz.

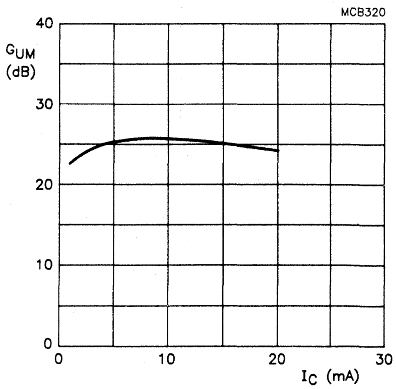


Fig.7 Common-emitter G_{UM} as a function of collector current; V_{CE} = 10 V; f = 100 MHz.

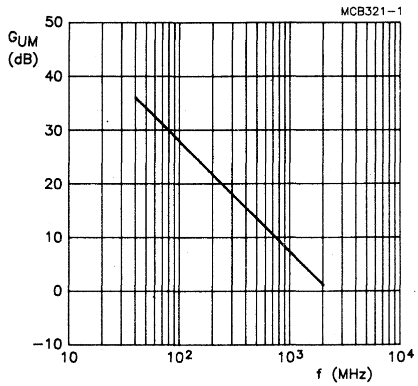


Fig.8 Common-emitter G_{UM} as a function of frequency; V_{CE} = 10 V; I_C = 15 mA.

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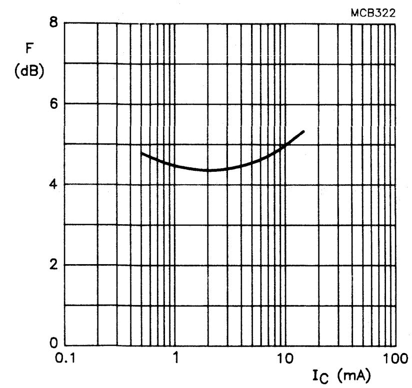

Fig.9 Common-emitter noise figure as a function of collector current; $V_{CE} = 10$ V; f = 100 MHz; $Z_S = Z_L = 50\ \Omega$.

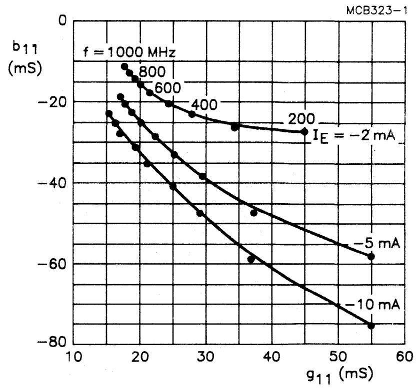

Fig.10 Common-base input admittance, Y_{11}; $V_{CB} = 10$ V.

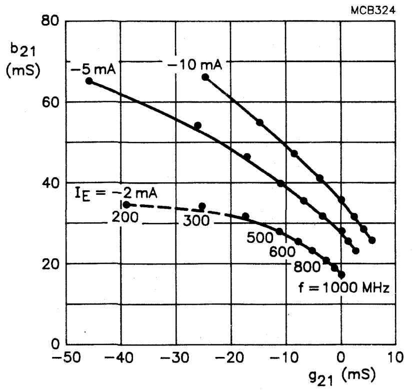

Fig.11 Common-base forward admittance, Y_{21}; $V_{CB} = 10$ V.

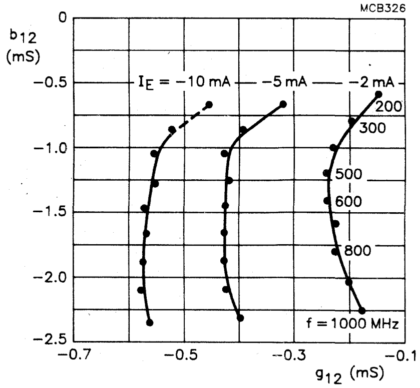

Fig.12 Common-base reverse admittance, Y_{12}; $V_{CB} = 10$ V.

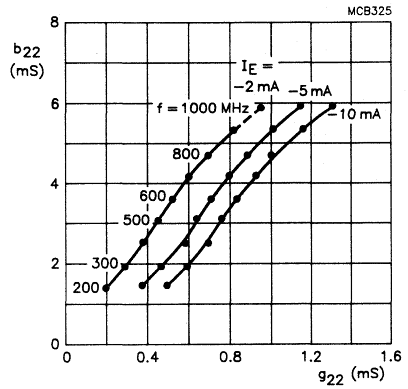

Fig.13 Common-base output admittance, Y_{22}; $V_{CB} = 10$ V.

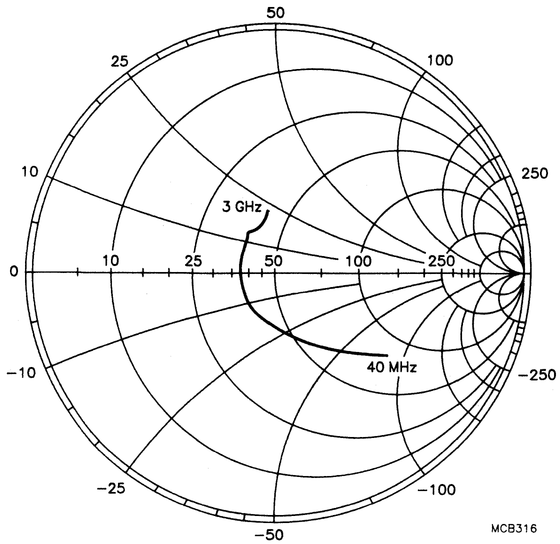

Fig.14 Common-emitter input reflection coefficient, S_{11}; $V_{CE} = 10$ V; $I_C = 15$ mA.

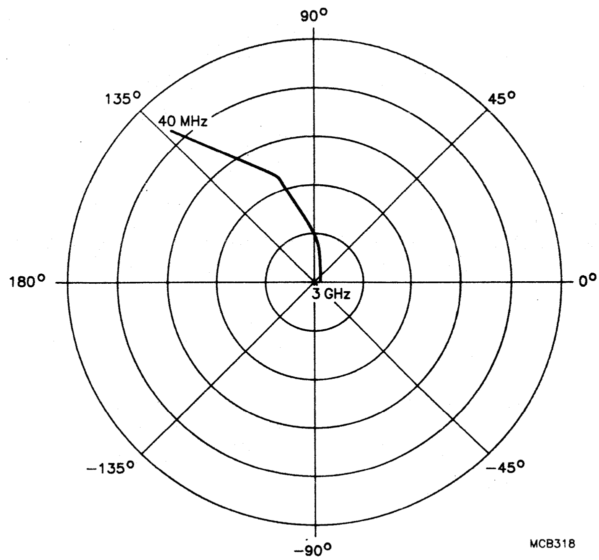

Fig.15 Common-emitter forward transmission coefficient, S_{21}; V_{CE} = 10 V; I_C = 15 mA.

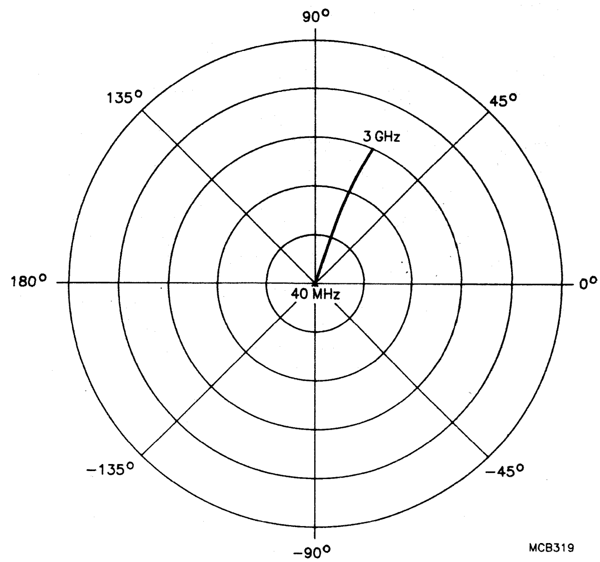

Fig.16 Common-emitter reverse transmission coefficient, S_{12}; V_{CE} = 10 V; I_C = 15 mA.

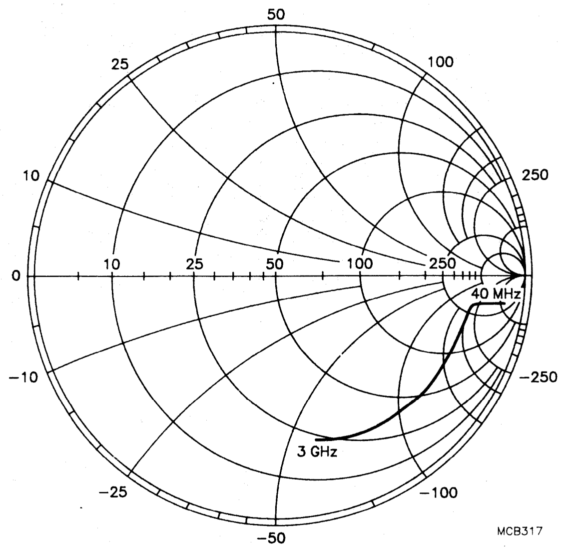

Fig.17 Common-emitter output transmission coefficient, S_{22}; V_{CE} = 10 V; I_C = 15 mA.

Y-Parameters (common-base) at V_{CB} = 10 V; I_E = −2 mA; typical values.

FREQUENCY (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)
40.00	68.9746	−10.271	−67.9160	12.3298	−.0200	− .1000	−.0130	.29080
100.00	60.4233	−20.585	−57.9200	25.6144	−.0600	− .3000	−.0840	.70980
200.00	45.0125	−27.430	−39.0830	34.4796	−.1000	− .6000	.1943	1.35389
300.00	34.2639	−26.441	−25.4210	33.9009	−.2000	− .8000	.2948	1.91811
400.00	27.6753	−23.366	−17.2450	31.1112	−.2000	−1.0036	.3728	2.50881
500.00	23.9258	−20.416	−11.6530	27.6373	−.2000	−1.2020	.4471	3.04457
600.00	21.4986	−17.909	− 7.8471	25.0050	−.2000	−1.4026	.5253	3.59467
700.00	20.0348	−15.630	− 5.3109	22.6341	−.2000	−1.5963	.5974	4.17222
800.00	18.6263	−14.039	− 2.9007	20.1675	−.2000	−1.8013	.6929	4.70894
900.00	18.2579	−12.788	− 1.3647	18.7133	−.2000	−2.0306	.8206	5.29419
1000.00	17.8426	−11.684	− .0660	17.1226	−.2000	−2.2498	.9520	5.88614

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Y-Parameters (common-base) at V_{CB} = 10 V; I_E = –5 mA; typical values.

FREQUENCY (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)
40.00	132.6450	–35.658	–130.47000	38.7532	–.060	– .2000	–.05600	.36870
100.00	96.3278	–62.045	– 91.06400	67.9477	–.200	– .5000	.20970	.83980
200.00	54.7356	–57.831	– 45.98500	64.7007	–.300	– .7000	.37680	1.42279
300.00	37.5006	–46.867	– 26.38900	53.7615	–.400	– .8000	.46800	1.95355
400.00	29.1994	–38.645	– 16.63700	45.7605	–.400	–1.0430	.58050	2.52321
500.00	25.2687	–32.798	– 11.03600	39.7522	–.400	–1.2500	.63100	3.09770
600.00	22.0303	–28.445	– 6.27570	34.9583	–.400	–1.4469	.70520	3.63913
700.00	20.2654	–25.198	– 3.34920	31.4025	–.400	–1.6459	.80310	4.21016
800.00	18.6656	–22.649	– .60000	27.6064	–.400	–1.8593	.87660	4.73938
900.00	17.8189	–20.746	1.38032	25.2334	–.400	–2.0839	1.00727	5.31269
1000.00	17.2772	–19.065	2.92948	23.0084	–.400	–2.3053	1.15011	5.92755

Y-Parameters (common-base) at V_{CB} = 10 V; I_E = –10 mA; typical values.

FREQUENCY (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)
40.00	189.0470	–79.568	–185.47000	82.9150	–.090	– .3000	–.08600	.43550
100.00	108.5130	–99.005	–101.43000	105.3800	–.300	– .5000	.32930	.87400
200.00	55.2449	–76.232	– 44.63200	82.8056	–.500	– .7000	.49110	1.40994
300.00	37.1349	–59.012	– 24.28100	65.6604	–.500	– .9000	.60430	1.96058
400.00	28.8268	–47.567	– 14.57300	54.4220	–.600	–1.0467	.68940	2.52179
500.00	24.6784	–40.178	– 8.56610	46.6501	–.600	–1.2644	.75390	3.09189
600.00	21.2460	–35.017	– 3.39520	40.7817	–.600	–1.4688	.84080	3.63543
700.00	19.2824	–30.939	– .20000	36.2027	–.600	–1.6715	.93220	4.20978
800.00	17.1543	–27.470	2.55300	31.1491	–.600	–1.8634	.99920	4.71616
900.00	16.4469	–25.237	4.57622	28.3362	–.600	–2.1025	1.15185	5.31337
1000.00	15.8137	–23.001	6.03713	25.4579	–.600	–2.3336	1.31127	5.90833

Y-Parameters (common-base) at V_{CB} = 10 V; I_E = –15 mA; typical values.

FREQUENCY (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)	Real (mS)	Imag (mS)
40.00	206.4780	–113.760	–202.64000	118.0530	–.200	– .3000	.18780	.47790
100.00	104.3290	–113.970	– 96.42500	120.0870	–.400	– .5000	.41900	.87720
200.00	53.0622	– 81.120	– 41.70000	87.7035	–.500	– .7000	.57550	1.41575
300.00	35.9283	– 62.076	– 21.91000	68.6039	–.600	– .8000	.65550	1.93670
400.00	28.0704	– 50.027	– 12.48400	56.9216	–.600	–1.0609	.75580	2.52909
500.00	23.4107	– 42.306	– 6.08020	48.2499	–.600	–1.2607	.81790	3.07778
600.00	20.1019	– 36.373	– 1.22150	41.5856	–.600	–1.4610	.89420	3.61247
700.00	18.1804	– 32.035	2.01096	36.6737	–.600	–1.6677	.99970	4.18590
800.00	16.1524	– 28.238	4.48487	31.3273	–.600	–1.8612	1.09358	4.71538
900.00	15.4557	– 25.677	6.45024	28.0793	–.600	–2.1019	1.26238	5.28396
1000.00	14.6838	– 23.452	7.89223	24.8572	–.600	–2.3163	1.39668	5.87286

NPN 1 GHz wideband transistor BF747

S-Parameters (common-base) at V_{CE} = 10 V; I_C = 2 mA; typical values.

FREQUENCY (MHz)	S_{11} Mag (rat)	S_{11} Ang (deg)	S_{21} Mag (rat)	S_{21} Ang (deg)	S_{12} Mag (rat)	S_{12} Ang (deg)	S_{22} Mag (rat)	S_{22} Ang (deg)	G_{UM} (dB)
40	.891	− 17.1	5.90	160.4	.013	79.3	.986	− 4.0	37.7
100	.741	− 37.1	4.89	137.9	.027	69.4	.936	− 7.8	26.2
200	.522	− 55.9	3.38	115.3	.044	64.0	.882	−10.6	18.4
300	.404	− 65.8	2.48	103.2	.057	63.2	.857	−12.6	14.4
400	.332	− 73.3	1.97	94.4	.070	63.0	.847	−14.6	11.8
500	.288	− 78.7	1.62	88.0	.081	63.2	.839	−16.9	9.8
600	.258	− 84.7	1.39	82.5	.092	63.1	.835	−19.3	8.3
700	.233	− 89.2	1.23	77.9	.102	62.7	.833	−21.7	7.1
800	.213	− 95.0	1.10	73.8	.112	62.5	.829	−24.0	6.0
900	.199	−100.3	1.00	70.0	.122	62.0	.827	−26.4	5.1
1000	.184	−106.5	.93	66.6	.131	61.9	.822	−28.8	4.4
1200	.154	−120.2	.82	59.6	.148	61.1	.812	−33.5	3.0
1400	.142	−134.3	.74	53.9	.164	60.8	.807	−38.5	2.0
1600	.131	−146.0	.68	50.0	.178	60.9	.799	−43.2	1.1
1800	.121	−161.9	.64	45.9	.194	60.9	.792	−47.6	.4
2000	.117	−179.8	.60	41.0	.207	60.4	.771	−52.2	−.3

S-Parameters (common-base) at V_{CE} = 10 V; I_C = 5 mA; typical values.

FREQUENCY (MHz)	S_{11} Mag (rat)	S_{11} Ang (deg)	S_{21} Mag (rat)	S_{21} Ang (deg)	S_{12} Mag (rat)	S_{12} Ang (deg)	S_{22} Mag (rat)	S_{22} Ang (deg)	G_{UM} (dB)
40	.767	− 26.3	11.30	149.3	.011	75.8	.956	− 6.0	35.6
100	.542	− 49.1	7.60	123.2	.022	67.6	.875	− 8.8	25.4
200	.359	− 65.2	4.49	104.5	.036	66.7	.827	−10.1	18.6
300	.283	− 75.2	3.14	95.4	.049	66.7	.811	−11.8	14.9
400	.244	− 84.2	2.45	88.6	.061	66.5	.804	−13.9	12.5
500	.214	− 92.4	1.99	83.5	.073	66.5	.798	−16.0	10.5
600	.196	−100.7	1.69	78.7	.083	66.6	.797	−18.5	9.1
700	.180	−108.6	1.48	74.7	.093	66.6	.797	−20.8	7.9
800	.170	−115.6	1.31	71.2	.102	66.5	.796	−23.1	6.8
900	.156	−123.6	1.19	67.7	.112	66.1	.792	−25.4	5.9
1000	.146	−131.7	1.10	64.4	.121	66.0	.790	−27.8	5.2
1200	.132	−150.4	.96	57.6	.138	65.9	.783	−32.5	3.9
1400	.132	−164.8	.85	52.4	.155	65.9	.778	−37.4	2.7
1600	.133	−176.8	.78	48.4	.172	66.2	.776	−42.1	1.9
1800	.132	169.3	.72	44.4	.189	66.3	.770	−46.5	1.2
2000	.140	152.4	.67	39.3	.205	65.5	.752	−50.9	.3

S-Parameters (common-base) at V_{CE} = 10 V; I_C = 10 mA; typical values.

FREQUENCY (MHz)	S_{11} Mag (rat)	S_{11} Ang (deg)	S_{21} Mag (rat)	S_{21} Ang (deg)	S_{12} Mag (rat)	S_{12} Ang (deg)	S_{22} Mag (rat)	S_{22} Ang (deg)	G_{UM} (dB)
40	.637	− 34.1	15.48	139.4	.010	72.6	.921	− 7.3	34.2
100	.416	− 54.7	8.90	114.2	.020	68.9	.837	− 8.5	25.0
200	.283	− 71.9	4.95	99.1	.033	68.5	.802	− 9.4	18.7
300	.236	− 84.8	3.42	91.6	.046	68.3	.790	−11.1	15.1
400	.204	− 97.7	2.64	85.3	.057	68.0	.785	−13.2	12.7
500	.186	−108.3	2.14	80.6	.068	68.5	.781	−15.5	10.8
600	.173	−117.8	1.81	76.1	.077	68.8	.780	−17.7	9.4
700	.155	−127.4	1.58	72.3	.087	69.2	.781	−20.1	8.2
800	.151	−134.7	1.40	68.8	.097	69.4	.781	−22.5	7.1
900	.143	−143.3	1.26	65.3	.106	69.3	.778	−24.7	6.1
1000	.139	−152.2	1.16	62.3	.115	69.4	.779	−27.0	5.4
1200	.135	−170.8	1.01	55.5	.134	69.4	.773	−31.7	4.1
1400	.139	177.6	.89	50.3	.152	69.2	.768	−36.7	2.9
1600	.143	167.4	.80	46.4	.170	69.4	.766	−41.4	2.0
1800	.146	152.2	.74	42.6	.188	69.4	.762	−45.9	1.3
2000	.161	140.1	.69	37.5	.205	68.3	.746	−50.4	.4

S-Parameters (common-base) at V_{CE} = 10 V; I_C = 15 mA; typical values.

FREQUENCY (MHz)	S_{11} Mag (rat)	S_{11} Ang (deg)	S_{21} Mag (rat)	S_{21} Ang (deg)	S_{12} Mag (rat)	S_{12} Ang (deg)	S_{22} Mag (rat)	S_{22} Ang (deg)	G_{UM} (dB)
40	.564	− 37.9	16.88	133.4	.009	73.0	.901	− 7.4	33.4
100	.365	− 57.3	8.99	110.3	.019	69.4	.826	− 7.9	24.7
200	.260	− 75.7	4.93	96.9	.032	69.3	.797	− 8.9	18.5
300	.216	− 91.4	3.41	89.8	.044	69.2	.786	−10.8	15.0
400	.187	−105.1	2.63	83.7	.055	69.3	.781	−12.9	12.6
500	.174	−116.4	2.12	79.0	.066	69.9	.779	−15.1	10.7
600	.160	−126.6	1.80	74.4	.075	70.1	.778	−17.4	9.2
700	.152	−136.3	1.56	70.5	.085	70.7	.781	−19.8	8.1
800	.143	−145.0	1.38	67.0	.095	71.0	.780	−22.1	6.9
900	.138	−152.1	1.24	63.7	.104	70.9	.780	−24.4	6.0
1000	.136	−161.8	1.14	60.5	.113	71.0	.778	−26.7	5.3
1200	.137	−178.2	.99	53.9	.132	70.9	.774	−31.5	3.9
1400	.144	168.8	.87	48.6	.151	70.6	.770	−36.4	2.8
1600	.145	159.4	.78	44.6	.169	70.9	.768	−41.2	1.9
1800	.150	146.2	.73	41.0	.188	70.8	.764	−45.7	1.1
2000	.167	134.2	.67	35.9	.206	69.5	.748	−50.3	.3

SILICON EPITAXIAL TRANSISTORS

N-P-N transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. P-N-P components are BF821, BF823 respectively.

QUICK REFERENCE DATA

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz

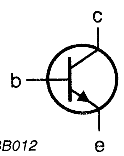
MECHANICAL DATA

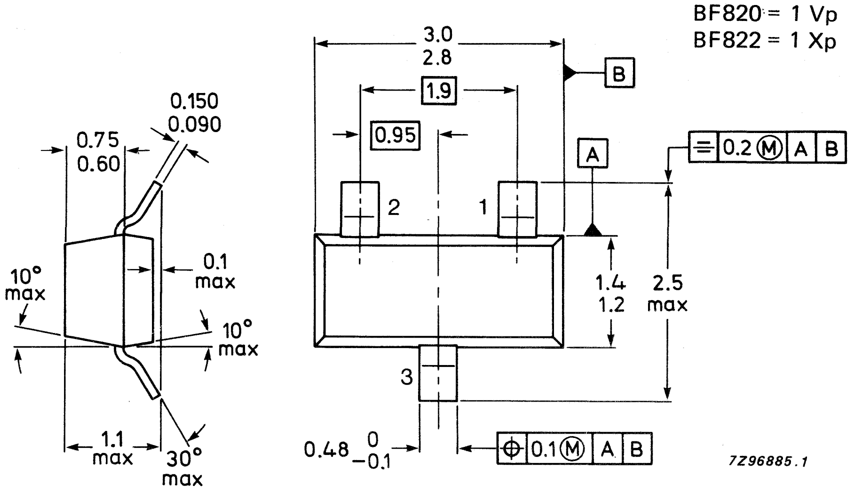
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BF820 = 1 Vp
BF822 = 1 Xp

Pinning:
1 = base
2 = emitter
3 = collector





TOP VIEW

See also *Soldering recommendations*.

RATINGS

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

			BF820	BF822	
Collector-base voltage (open emitter)	V_{CBO}	max.	300	250	V
Collector-emitter voltage (open base)	V_{CEO}	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	max.	300	–	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5		V
Collector current (d.c.)	I_C	max.	50		mA
Collector current (peak value)	I_{CM}	max.	100		mA
Total power dissipation* up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to +150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF820	BF822	
Collector cut-off current I_E = 0; V_{CB} = 200 V	I_{CBO}	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; V_{CE} = 250 V	I_{CER}	<	50	50	nA
R_{BE} = 2,7 kΩ; V_{CE} = 200 V; T_j = 150 °C	I_{CER}	<	10	10	µA
Saturation voltage I_C = 30 mA; I_B = 5 mA	$V_{CE\ sat}$	<	0,6		V
D.C. current gain I_C = 25 mA; V_{CE} = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz I_C = 10 mA; V_{CE} = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm^2; thickness = 0,7 mm.

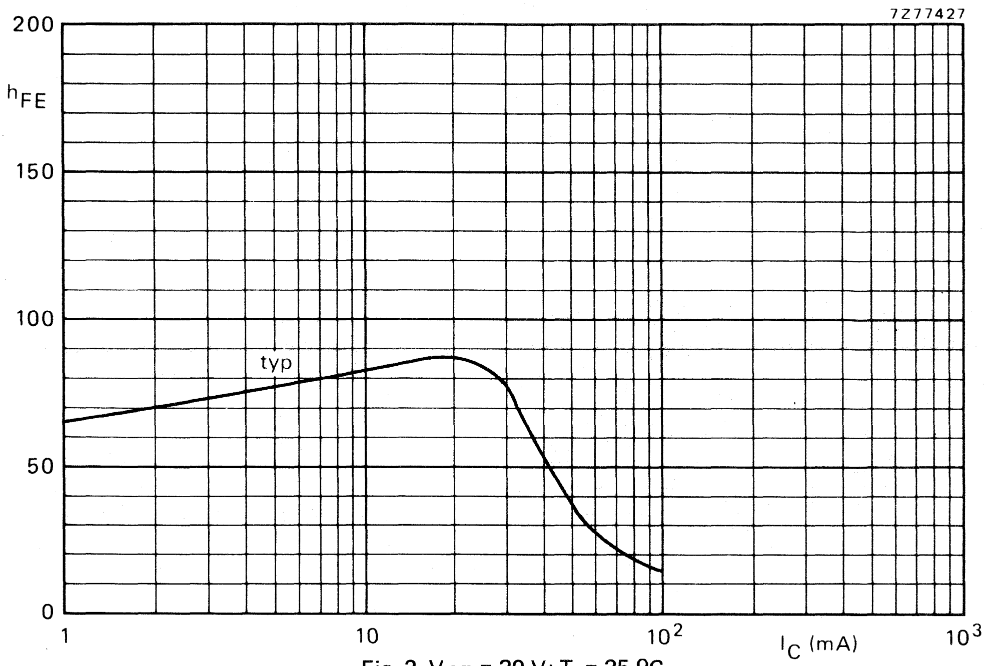
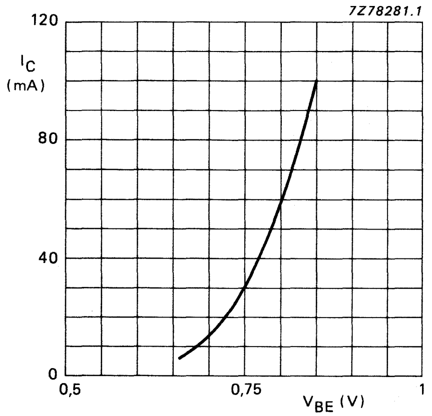


Fig. 2 V_{CE} = 20 V; T_j = 25 °C.



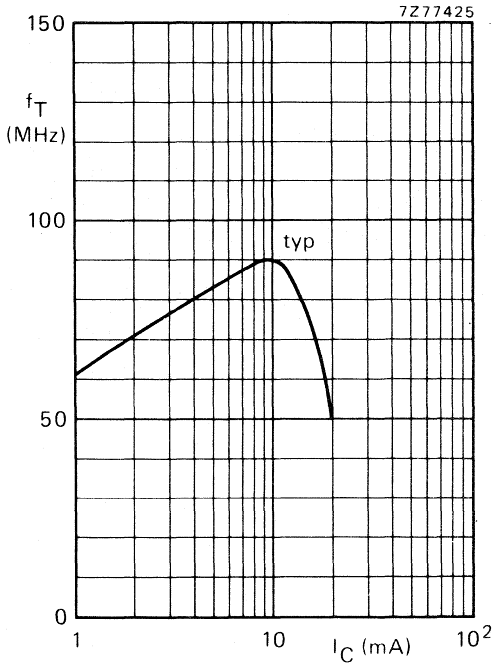


Fig. 3 V_{CE} = 20 V; T_j = 25 °C; typical values.

Fig. 4 V_{CE} = 10 V; T_j = 25 °C, f = 35 MHz.

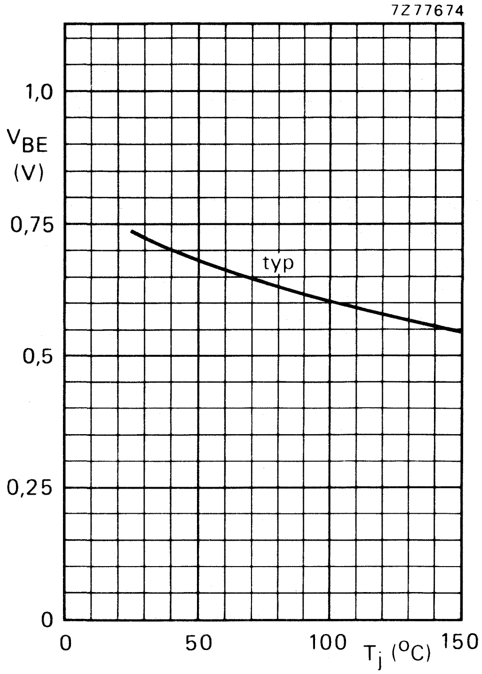


Fig. 5 I_C = 25 mA; V_{CE} = 20 V.

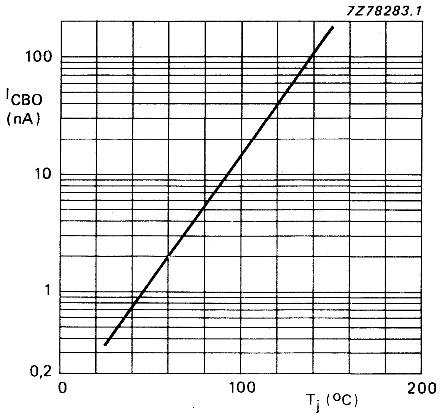


Fig. 6 V_{CB} = 200 V; typical values.

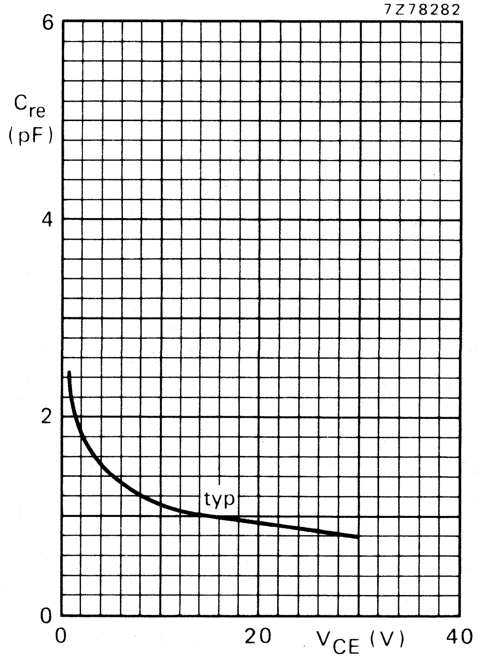


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

SILICON EPITAXIAL TRANSISTORS

P-N-P transistors in a microminiature plastic envelope intended for application in thick and thin-film circuits. Primarily intended for use in telephony and professional communication equipment. N-P-N complements are BF820, BF822 respectively.

QUICK REFERENCE DATA

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Feedback capacitance at f = 1 MHz $-I_C$ = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz

MECHANICAL DATA

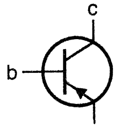
Dimensions in mm

Fig. 1 SOT-23.

Marking code
BF821 = 1Wp
BF823 = 1Yp

Pinning:

1 = base
2 = emitter
3 = collector



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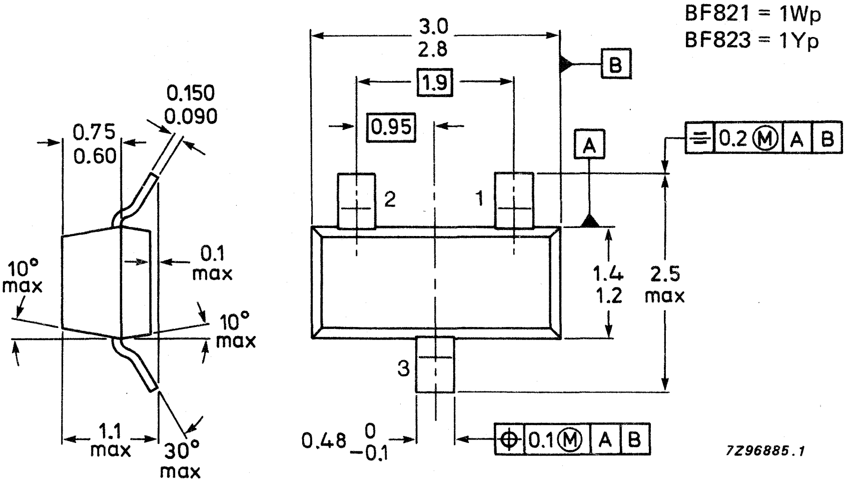

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TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

			BF821	BF823	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	300	250	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	–	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	$-V_{CER}$	max.	300	–	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5		V
Collector current (d.c.)	$-I_C$	max.	50		mA
Collector current (peak value)	$-I_{CM}$	max.	100		mA
Total power dissipation * up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Storage temperature	T_{stg}		−65 to + 150		°C
Junction temperature	T_j	max.	150		°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			BF821	BF823	
Collector cut-off current I_E = 0; $-V_{CB}$ = 200 V	$-I_{CBO}$	<	10	10	nA
Collector-emitter voltage R_{BE} = 2,7 kΩ; $-V_{CE}$ = 250 V	$-I_{CER}$	<	50	50	nA
R_{BE} = 2,7 kΩ; $-V_{CE}$ = 200 V; T_j = 150 °C	$-I_{CER}$	<	10	10	μA
Saturation voltage $-I_C$ = 30 mA; $-I_B$ = 5 mA	$-V_{CEsat}$	<	0,8		V
D.C. current gain $-I_C$ = 25 mA; $-V_{CE}$ = 20 V	h_{FE}	>	50		
Transition frequency at f = 35 MHz $-I_C$ = 10 mA; $-V_{CE}$ = 10 V	f_T	>	60		MHz
Feedback capacitance at f = 1 MHz I_C = 0; $-V_{CE}$ = 30 V	C_{re}	<	1,6		pF

* Mounted on a ceramic substrate: area = 2,5 cm^2; thickness = 0,7 mm.

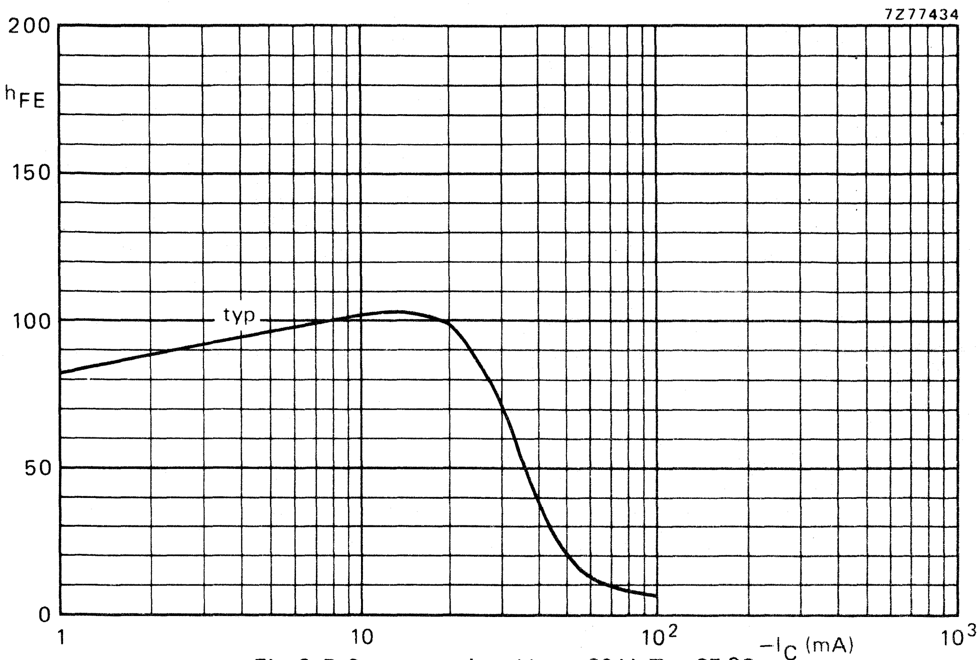


Fig. 2 D.C. current gain. $-V_{CE}$ = 20 V; T_j = 25 °C.

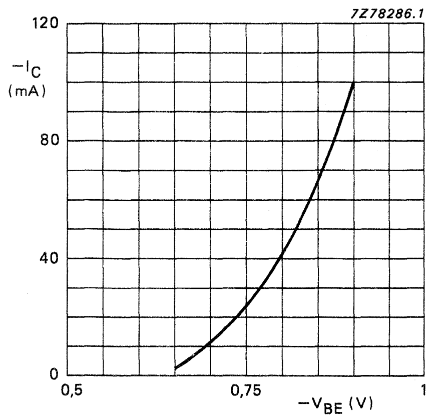


Fig. 3 $-V_{CE}$ = 20 V; T_j = 25 °C; typical values.

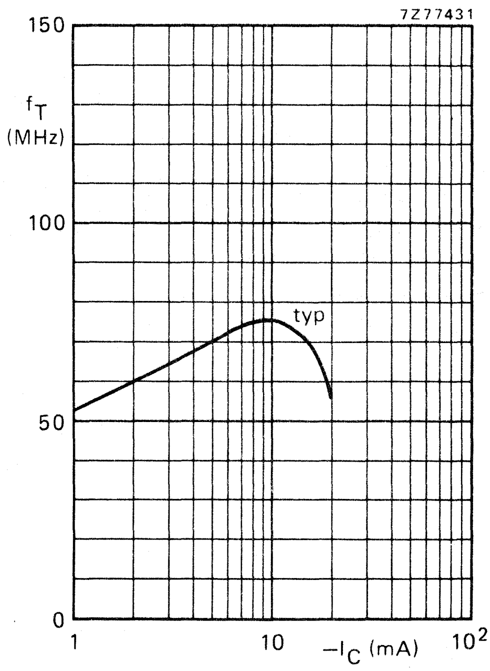


Fig. 4 $-V_{CE}$ = 10 V; T_j = 25 °C; f = 35 MHz.

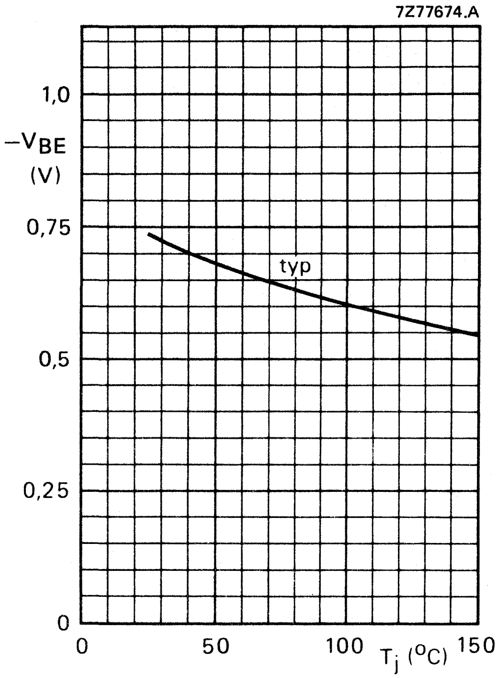


Fig. 5 $-I_C$ = 25 mA; $-V_{CE}$ = 20 V.

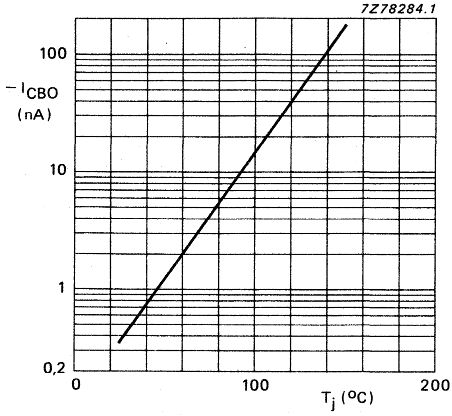


Fig. 6 $-V_{CB}$ = 200 V; typical values.

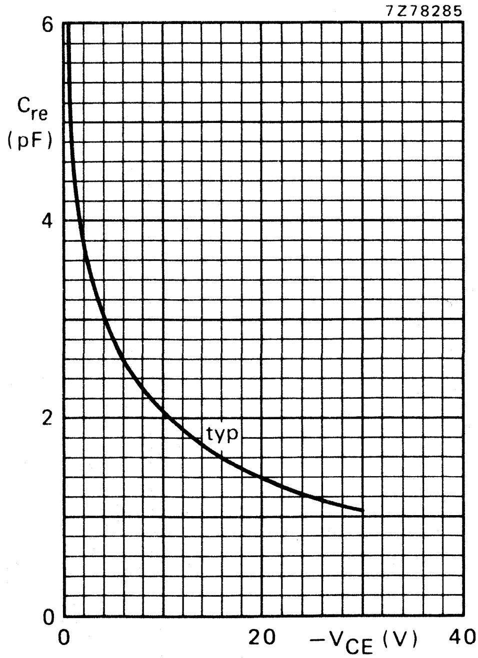


Fig. 7 I_C = 0; f = 1 MHz; T_j = 25 °C.

H.F. SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic SOT-23 envelope especially intended for r.f. stages in f.m. front-ends in common base configuration for SMD applications.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Base current $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-I_B$	typ.	80	μA
		<	160	μA
Transition frequency $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	f_T	typ.	450	MHz
Noise figure at f = 100 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; G_s = 16,7 mS	F	typ.	3	dB
Feedback capacitance at f = 1 MHz V_{EB} = 0; $-V_{CB}$ = 10 V	C_{rb}	typ.	0,1	pF

MECHANICAL DATA

Dimensions in mm

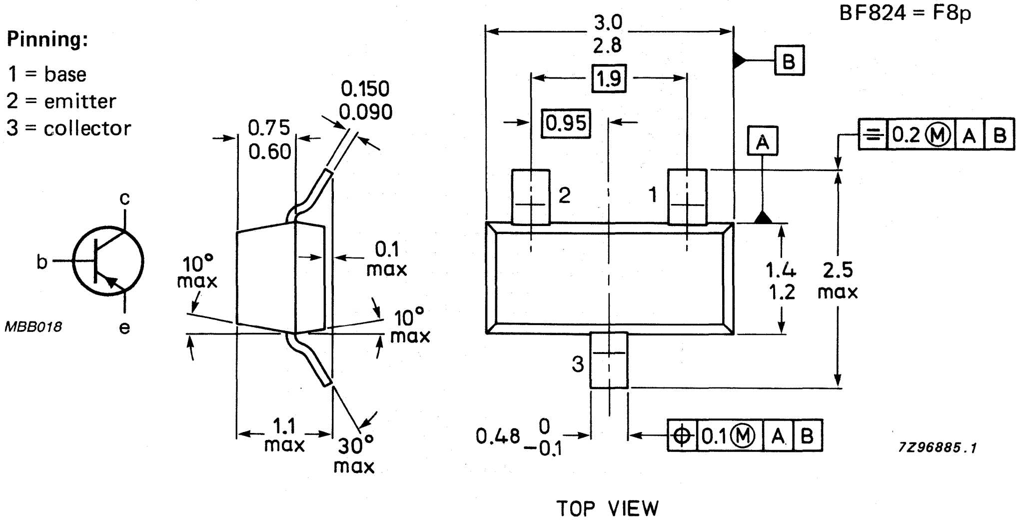
Fig. 1 SOT-23.

Marking code

BF824 = F8p

Pinning:

1 = base
2 = emitter
3 = collector



RATINGS

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

Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	4	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C *	P_{tot}	max.	250	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0; -V_{CB} = 30$ V	$-I_{CBO}$	<	50	nA
Emitter cut-off current $I_C = 0; -V_{EB} = 4$ V	$-I_{EBO}$	<	10	μA
Base current $-I_C = 4$ mA; $-V_{CE} = 10$ V	$-I_B$	typ. <	80 160	μA μA
$-I_C = 1$ mA; $-V_{CE} = 10$ V	$-I_B$	typ.	22	μA
Base-emitter voltage $-I_C = 4$ mA; $-V_{CE} = 10$ V	$-V_{BE}$	typ.	0,76	V
Transition frequency at f = 100 MHz $-I_C = 1$ mA; $-V_{CE} = 10$ V	f_T	typ.	350	MHz
$-I_C = 4$ mA; $-V_{CE} = 10$ V	f_T	typ.	450	MHz
$-I_C = 8$ mA; $-V_{CE} = 10$ V	f_T	typ.	440	MHz
Feedback capacitance at f = 1 MHz $V_{EB} = 0; -V_{CB} = 10$ V	C_{rb}	typ.	0,1	pF
Noise factor at f = 100 MHz $-I_C = 2$ mA; $-V_{CE} = 10$ V; $G_s = 16{,}7$ mS	F	typ.	3	dB
$-I_C = 5$ mA; $-V_{CE} = 10$ V; $G_s = 6{,}7$ mS; $-jB_s = 5$ mS	F	typ.	3,5	dB

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

y-parameters (common base) at f = 100 MHz

$-I_C$ = 4 mA; $-V_{CB}$ = 10 V

Input conductance	g_{ib}	typ.	125 mS
Input capacitance	C_{ib}	typ.	64 pF
Transfer admittance	$\|y_{fb}\|$	typ.	100 mS
Phase angle of transfer admittance	φ_{fb}	typ.	147°
Output conductance	g_{ob}	typ.	40 μS
Output capacitance	C_{ob}	typ.	1,25 pF
Feedback admittance	$\|y_{rb}\|$	typ.	220 μS
Phase angle of feedback admittance	φ_{rb}	typ.	85°

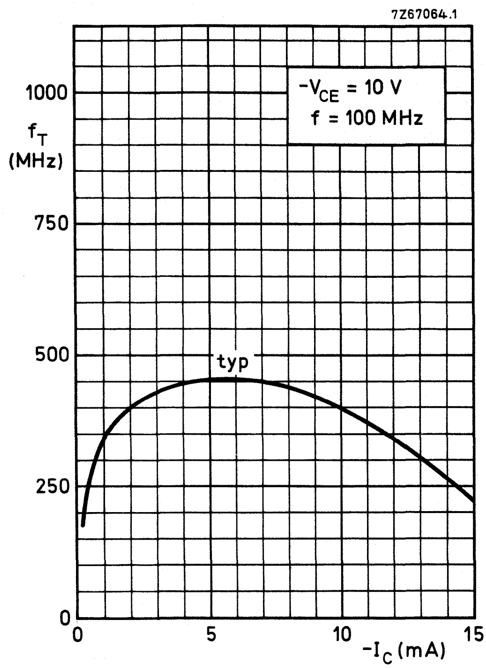


Fig. 2.

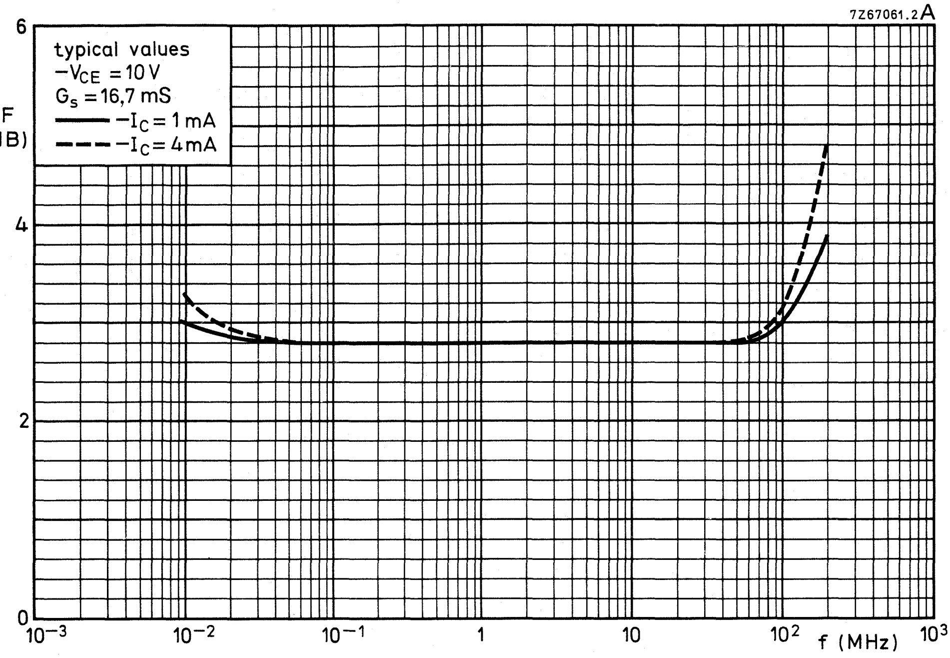


Fig. 3.

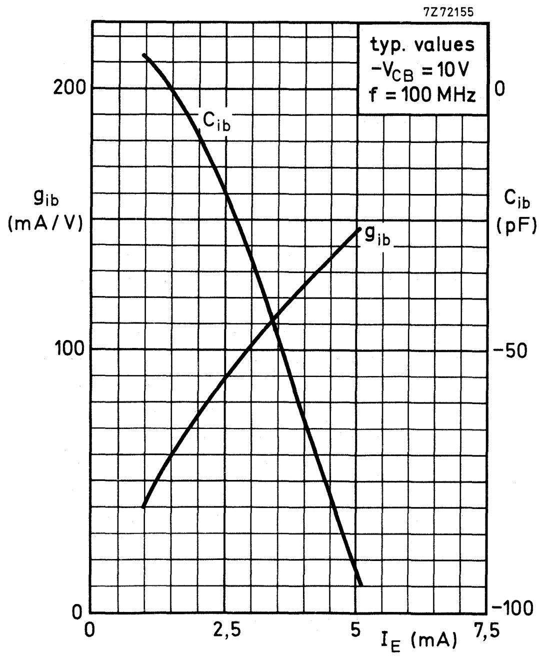


Fig. 4.

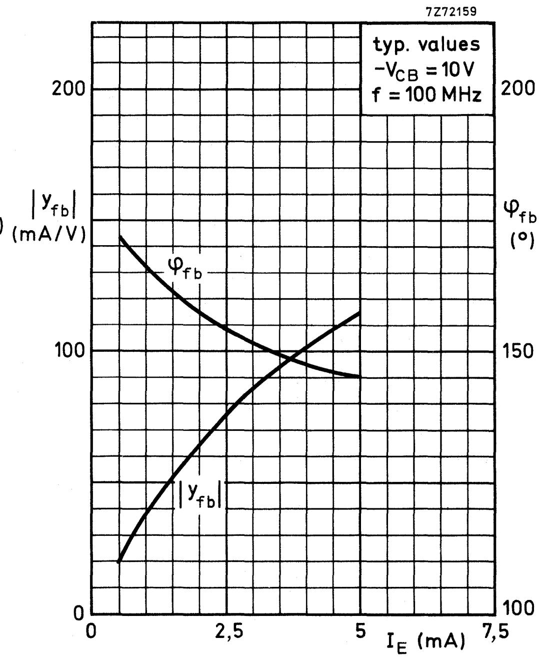


Fig. 5.

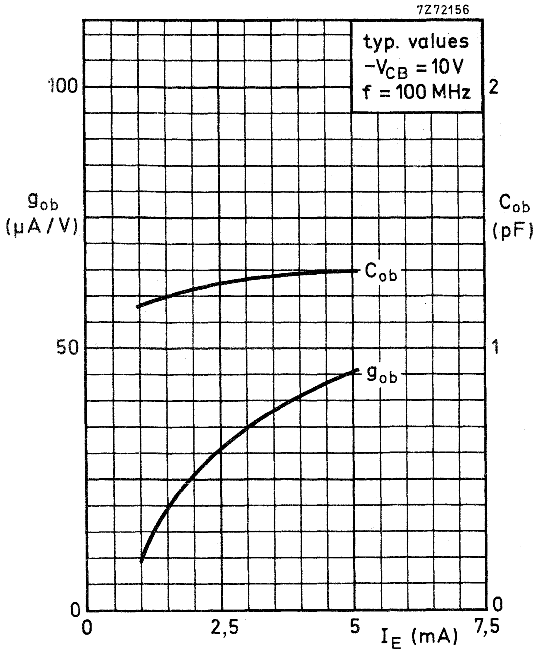


Fig. 6.

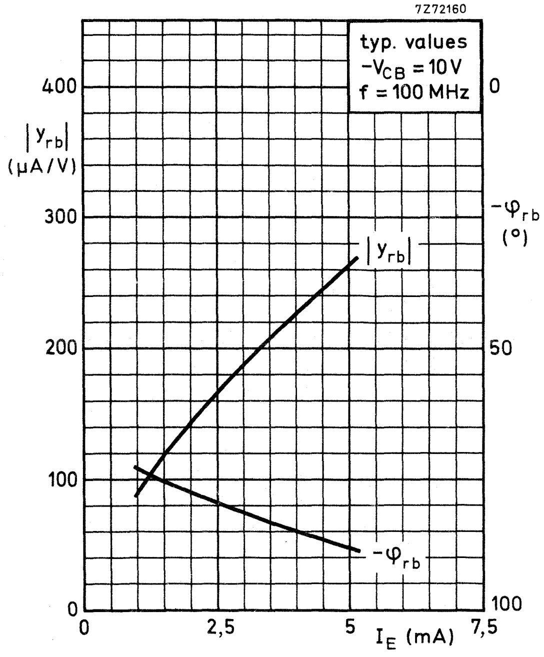


Fig. 7.

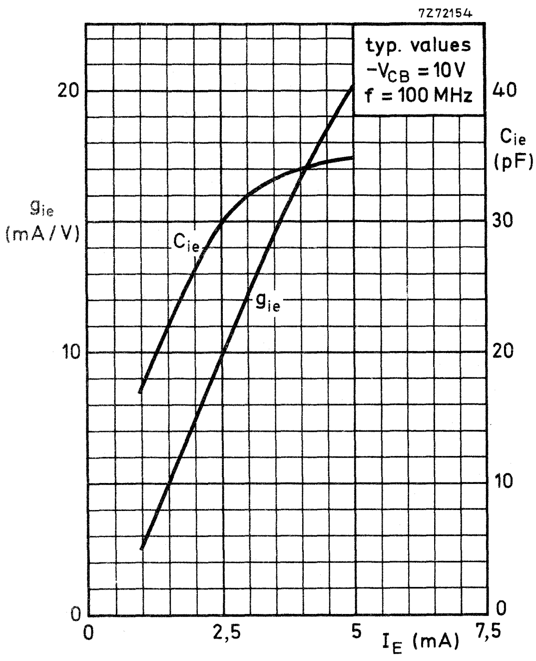


Fig. 8.

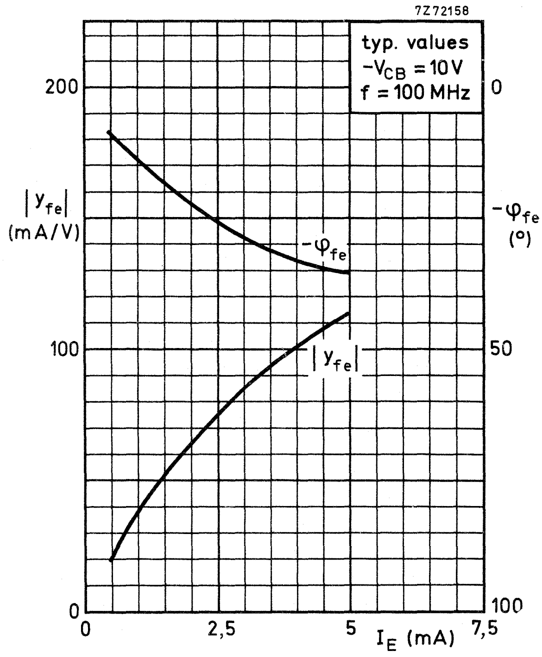


Fig. 9.

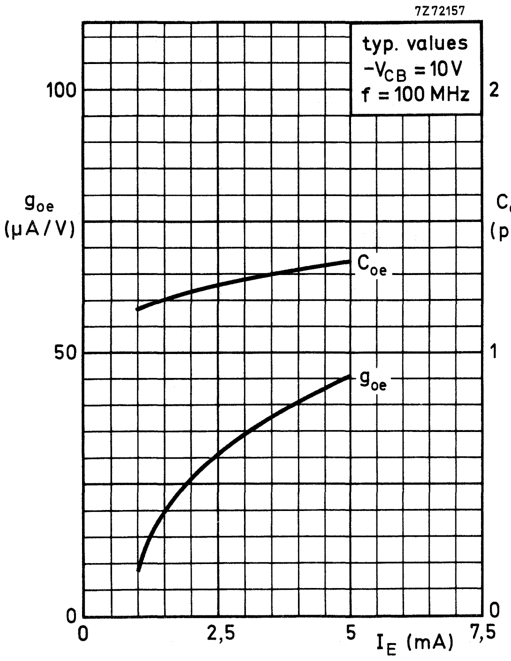

7Z72157
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
g_{oe} (μA/V)
C_{oe} (pF)
C_{oe}
g_{oe}
100
50
0
2
1
0
0
2,5
5
7,5
I_E (mA)

Fig. 10.

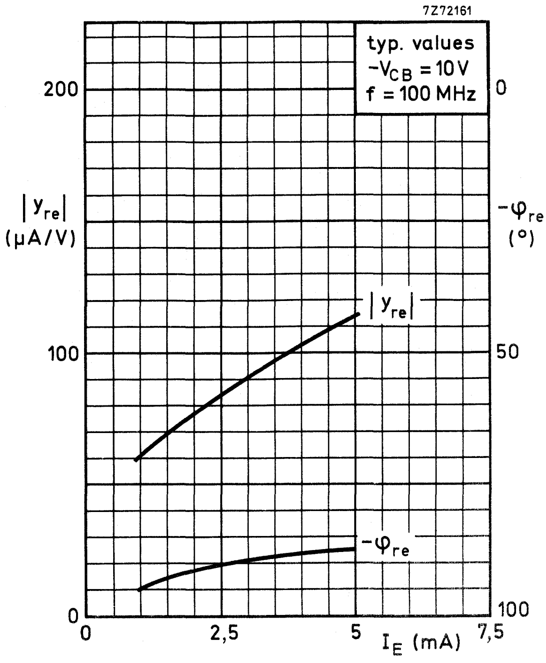

7Z72161
typ. values
$-V_{CB}$ = 10 V
f = 100 MHz
$|y_{re}|$ (μA/V)
$-\varphi_{re}$ (°)
$|y_{re}|$
$-\varphi_{re}$
200
100
0
0
50
100
0
2,5
5
7,5
I_E (mA)

Fig. 11.

SILICON PLANAR TRANSISTORS

N-P-N transistors in a plastic SOT-23 envelope.

Primarily intended for a.m. mixers and i.f. amplifiers in a.m./f.m. receivers using SMD technology.

QUICK REFERENCE DATA

			BF840	BF841	
Collector-base voltage (open emitter)	V_{CBO}	max.	40		V
Collector-emitter voltage (open base)	V_{CEO}	max.	40		V
Collector current (d.c.)	I_C	max.	25		mA
Base current I_C = 1 mA; V_{CE} = 10 V	I_B		4,5–15	8–28	μA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	150		°C
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ.	0,3		pF

MECHANICAL DATA

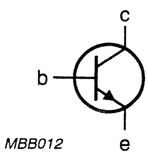
Dimensions in mm

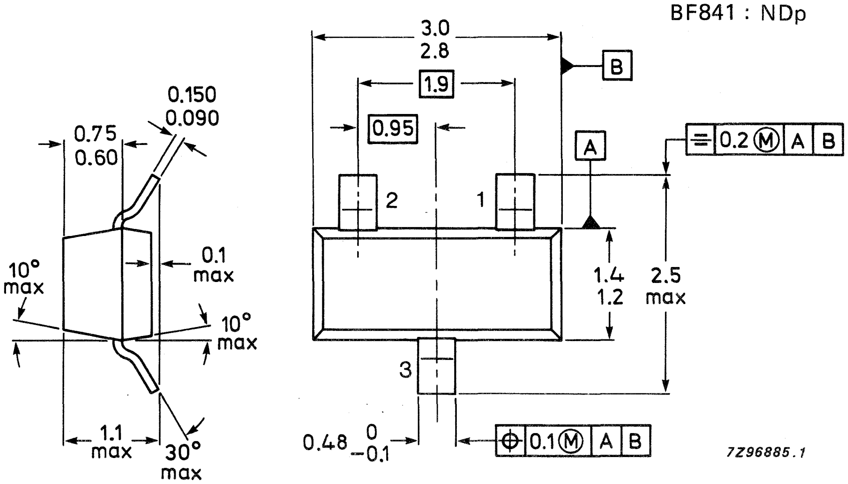
Fig. 1 SOT-23.

Marking code:
BF840 : NCp
BF841 : NDp

Pinning:

1 = base
2 = emitter
3 = collector





TOP VIEW

See also Soldering recommendations.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C*	P_{tot}	max.	250	mW
Storage temperature	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 20 V	I_{CBO}	max.	100	nA
Base-emitter voltage I_C = 1 mA; V_{CE} = 10 V	V_{BE}	typ. 650 to	700 740	mV mV

		BF840	BF841	
Base current I_C = 1 mA; V_{CE} = 10 V	I_B	4,5–15	8–28	μA
Transition frequency at f = 100 MHz I_C = 1 mA; V_{CE} = 10 V	f_T	typ. 380	380	MHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	C_{re}	typ. 0,3	0,3	pF
Noise figure I_C = 1 mA; V_{CE} = 10 V; f = 0,2 MHz; R_S = 200 Ω	F	typ. 1,5	2,0	dB

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

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in u.h.f. applications in television tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	20 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	12 mS
Input capacitance at gate 1; f = 1 MHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	1.8 pF
Feedback capacitance at f = 1 MHz I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ.	2.8 dB

MECHANICAL DATA

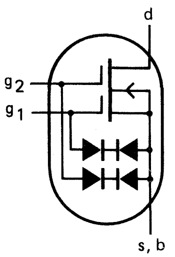
Dimensions in mm

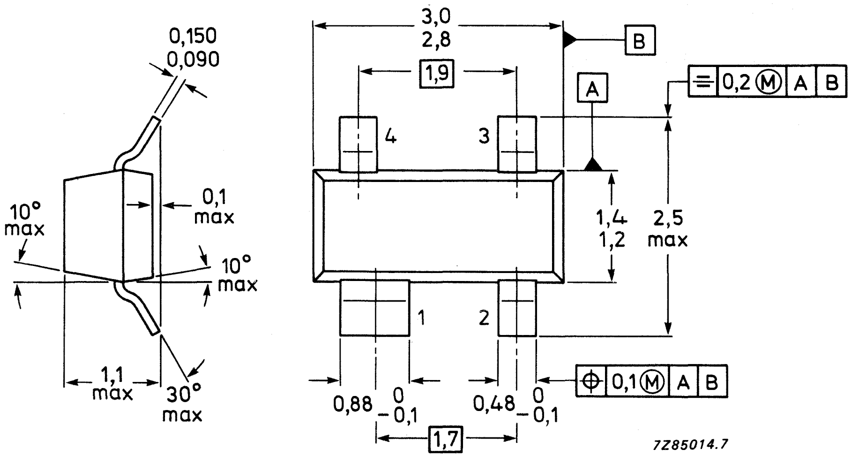
Fig.1 SOT143.

Marking code:
BF989 = MAp

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	20	mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

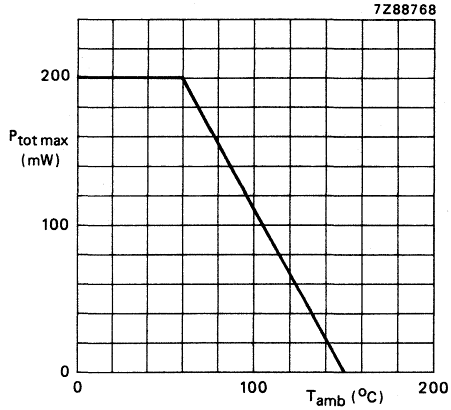


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	50 nA
$\pm V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	50 nA
Drain current			
V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0; + $V_{G2\text{-}S}$ = 4 V	I_{DSS}		2 to 20 mA
Gate-source breakdown voltages			
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	2.7 V
I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	2.7 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 7 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\vert y_{fs}\vert$	min.	9.5 mS
		typ.	12 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	1.8 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.0 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0.9 pF
Noise figure at G_S = 2 mS; $B_S = B_S$ opt			
f = 200 MHz	F	typ.	1.6 dB
f = 800 MHz	F	typ.	2.8 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for UHF applications, such as UHF television tuners with 12 V supply voltage and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	18	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	19	mS
Input capacitance at gate; f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.6 3.0	pF pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 800 MHz	F	typ. max.	2.0 3.0	dB dB

MECHANICAL DATA

Fig.1 SOT143.

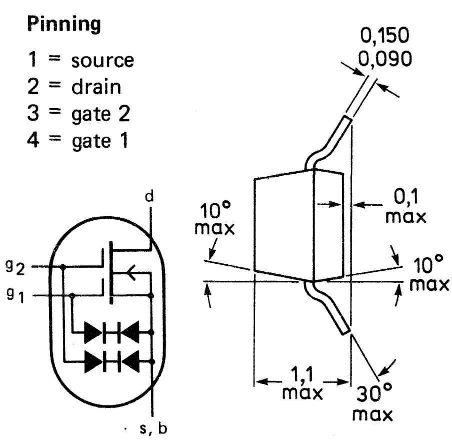
Marking code

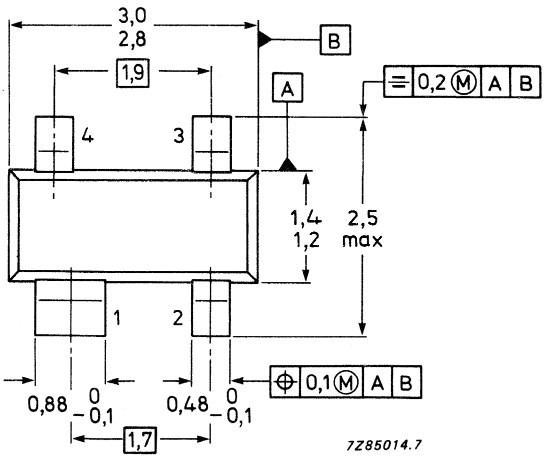
BF990A = M87

Dimensions in mm

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

TOP VIEW

RATINGS

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

Drain-source voltage	V_{DS}	max.	18 V
Drain current	I_D	max.	30 mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}		−65 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

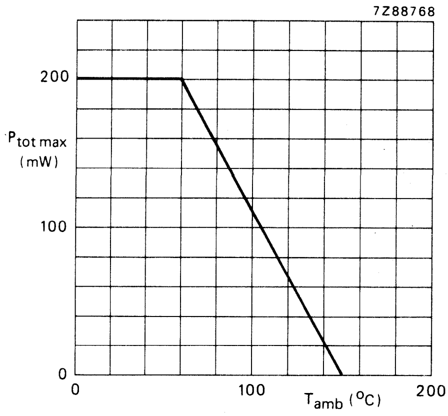


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
gate 1; $\pm V_{G1\text{-}S}$ = 7 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	25 nA
gate 2; $\pm V_{G2\text{-}S}$ = 7 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	25 nA
Gate-source breakdown voltages			
gate 1; $\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		8 to 20 V
gate 2; $\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		8 to 20 V
Gate-source cut-off voltages			
gate 1; I_D = 20 μA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	1.3 V
gate 2; I_D = 20 μA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	1.1 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\|y_{fs}\|$	min.	18 mS
		typ.	19 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.6 pF
		max.	3.0 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.4 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.2 pF
Noise figure at f = 800 MHz; G_S = 5 mS; $B_S = B_S$ opt	F	typ.	2.0 dB
		max.	3.0 dB

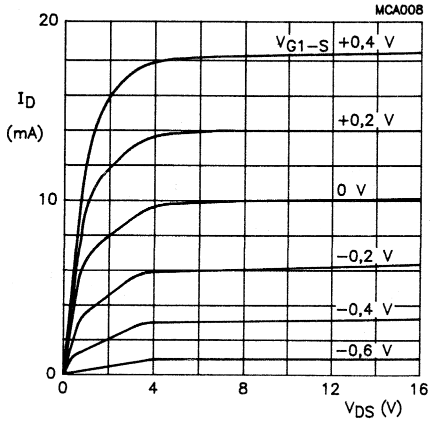


Fig.3 Output characteristics.
$V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

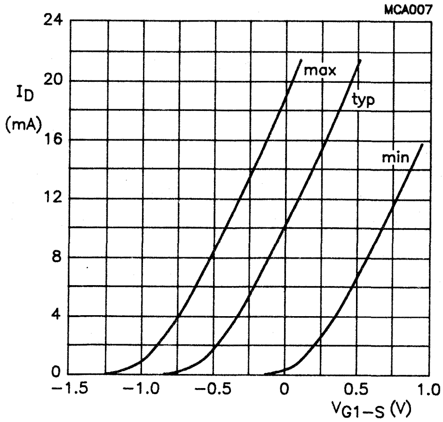


Fig.4 Transfer characteristics.
V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners and f.m. tuners. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	20	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\|y_{fs}\|$	typ.	14	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	2,1	pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	20	fF
Noise figure at optimum source admittance I_D = 10 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	0,7	dB

MECHANICAL DATA

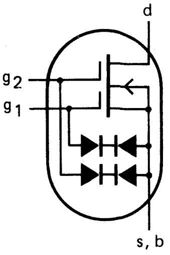
Dimensions in mm

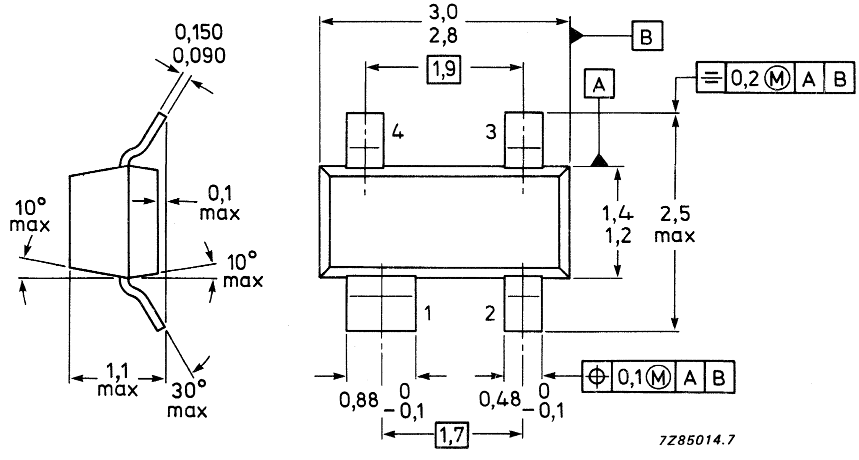
Marking code
BF991 = M91

Fig.1 SOT143.

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Drain-source voltage	V_{DS}	max.	20 V
Drain current (DC or average)	I_D	max.	20 mA
Gate 1 - source current	$\pm I_{G1-S}$	max.	10 mA
Gate 2 - source current	$\pm I_{G2-S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j-a}$	=	460 K/W

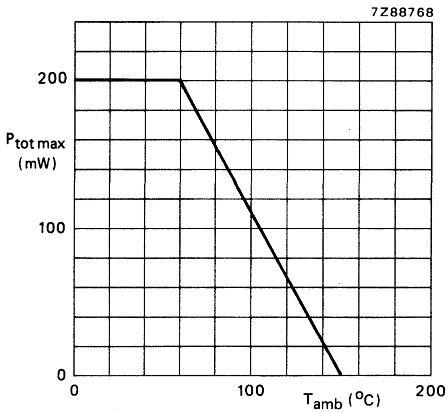


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1-S} = 5$ V; $V_{G2-S} = V_{DS} = 0$	$\pm I_{G1-SS}$	<	50 nA
$\pm V_{G2-S} = 5$ V; $V_{G1-S} = V_{DS} = 0$	$\pm I_{G2-SS}$	<	50 nA
Drain current			
$V_{DS} = 10$ V; $V_{G1-S} = 0$; $+V_{G2-S} = 4$ V	I_{DSS}		4 to 25 mA
Gate-source breakdown voltages			
$\pm I_{G1-SS} = 10$ mA; $V_{G2-S} = V_{DS} = 0$	$\pm V_{(BR)G1-SS}$		6 to 20 V
$\pm I_{G2-SS} = 10$ mA; $V_{G1-S} = V_{DS} = 0$	$\pm V_{(BR)G2-SS}$		6 to 20 V
Gate-source cut-off voltages			
$I_D = 20\ \mu$A; $V_{DS} = 10$ V; $+V_{G2-S} = 4$ V	$-V_{(P)G1-S}$	<	2,5 V
$I_D = 20\ \mu$A; $V_{DS} = 10$ V; $V_{G1-S} = 0$	$-V_{(P)G2-S}$	<	2,5 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): $I_D = 10$ mA; $V_{DS} = 10$ V; $+V_{G2-S} = 4$ V; $T_{amb} = 25$ °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	> typ.	10 mS 14 mS
Input capacitance at gate 1; f = 1 MHz	C_{ig1-s}	typ.	2,1 pF
Input capacitance at gate 2; f = 1 MHz	C_{ig2-s}	typ.	1,0 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	20 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1,1 pF
Noise figure			
f = 100 MHz; $G_S = 1$ mS; $B_S = B_S$ opt	F	typ. <	0,7 dB 1,7 dB
f = 200 MHz; $G_S = 2$ mS; $B_S = B_S$ opt	F	typ. <	1,0 dB 2,0 dB
Transducer gain (note 1)			
f = 100 MHz; $G_S = 1$ mS; $B_S = B_S$ opt; $G_L = 0,5$ mS; $B_L = B_L$ opt	G_{tr}	typ.	29 dB
f = 200 MHz; $G_S = 2$ mS; $B_S = B_S$ opt; $G_L = 0,5$ mS; $B_L = B_L$ opt	G_{tr}	typ.	26 dB

Note

1. Crystal mounted in a SOT103 envelope.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected. This MOS-FET tetrode is intended for use in v.h.f. applications, such as v.h.f. television tuners, FM tuners with a 12 volt supply voltage. The device is also suitable for use in professional communication equipment.

The device is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	40	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs}\rvert$	typ.	25	mS
Input capacitance at gate 1; f = 1 MHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	4	pF
Feedback capacitance at f = 1 MHz I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	30	fF
Noise figure at G_S = 2 mS I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.2	dB

MECHANICAL DATA

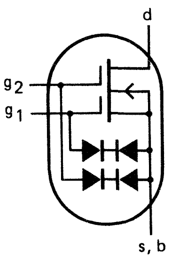
Dimensions in mm

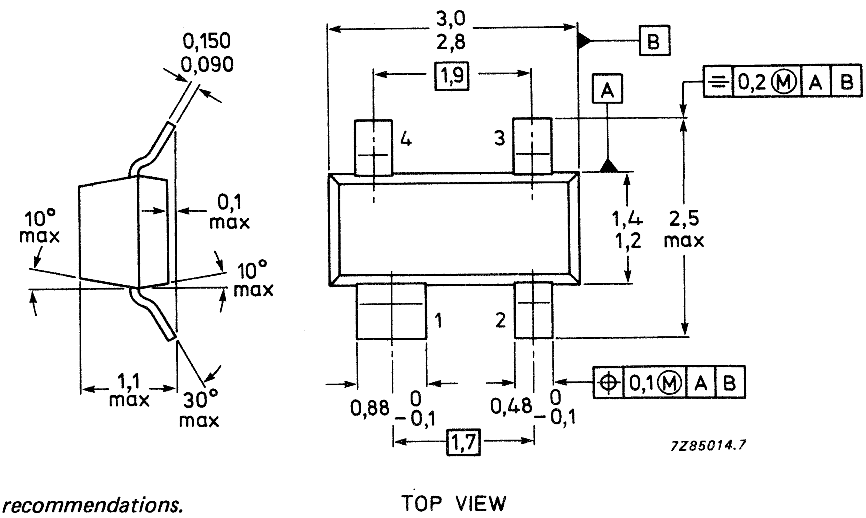
Fig.1 SOT143.

Marking code:
BF992 = M92

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

RATINGS

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

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	40	mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

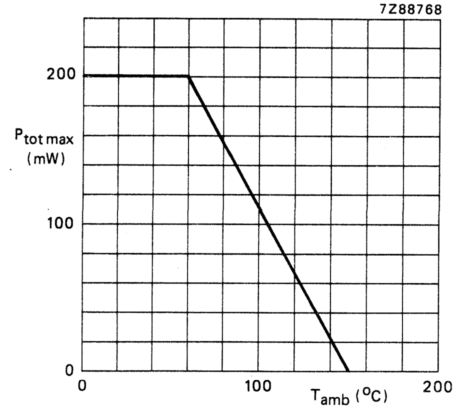


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1\text{-}S}$ = 7 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	25 nA
$\pm V_{G2\text{-}S}$ = 7 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	25 nA
Gate-source breakdown voltages			
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		8 to 20 V
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		8 to 20 V
Gate-source cut-off voltages			
I_D = 20 µA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$		0.2 to 1.3 V
I_D = 20 µA; V_{DS} = 10 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$		0.2 to 1.1 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 15 mA; V_{DS} = 10 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	20 mS
		typ.	25 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	4 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.7 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	30 fF
		max.	40 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	2 pF
Noise figure at f = 200 MHz; G_S = 2 mS	F	typ.	1.2 dB

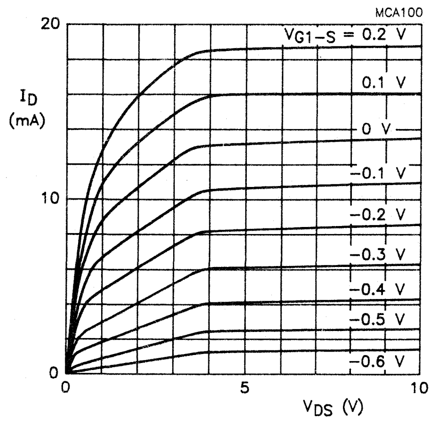


Fig.2 Output characteristics.

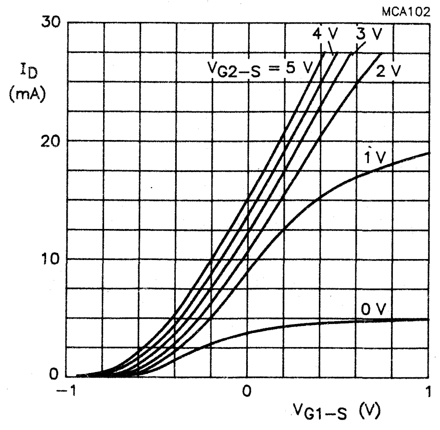


Fig.3 Transfer characteristics.

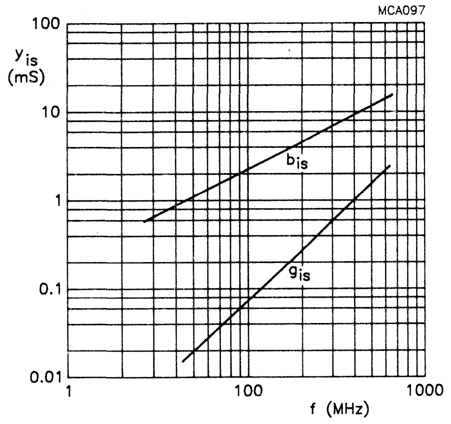


Fig.4 Input admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

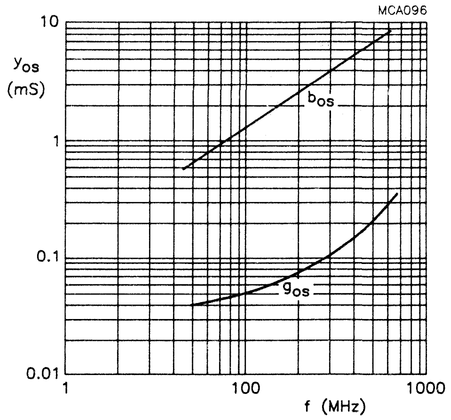


Fig.5 Output admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

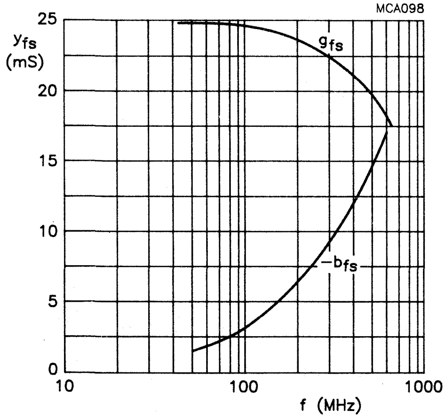


Fig.6 Transfer admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

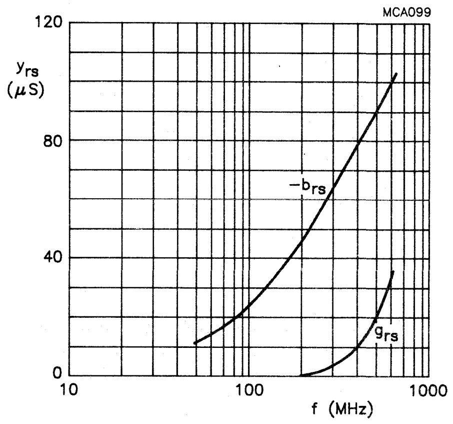


Fig.7 Feedback admittance as a function of frequency; V_{DS} = 10 V; $V_{G2\text{-}S}$ = 4 V; I_D = 15 mA; T_{amb} = 25 °C; typical values.

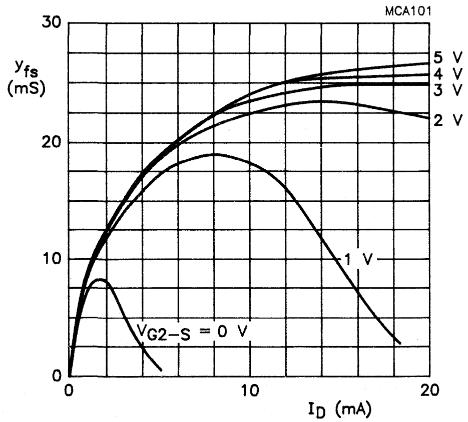


Fig.8 Transfer admittance as a function of drain current.

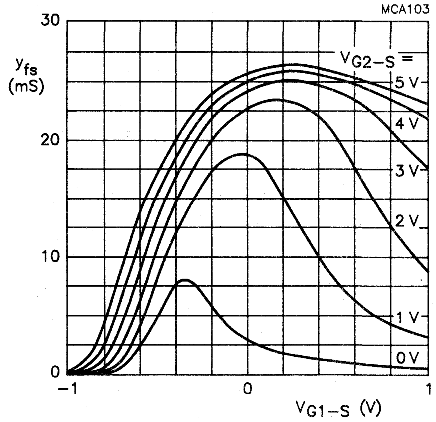


Fig.9 Transfer admittance as a function of gate 2 source voltage.

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected and intended for VHF applications in television tuners.
The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20 V
Drain current	I_D	max.	50 mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	150 °C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$\|y_{fs}\|$	typ.	18 mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.5 pF 3.0 pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25 fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.0 dB

MECHANICAL DATA

Dimensions in mm

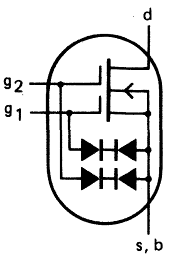
Fig.1 SOT143.

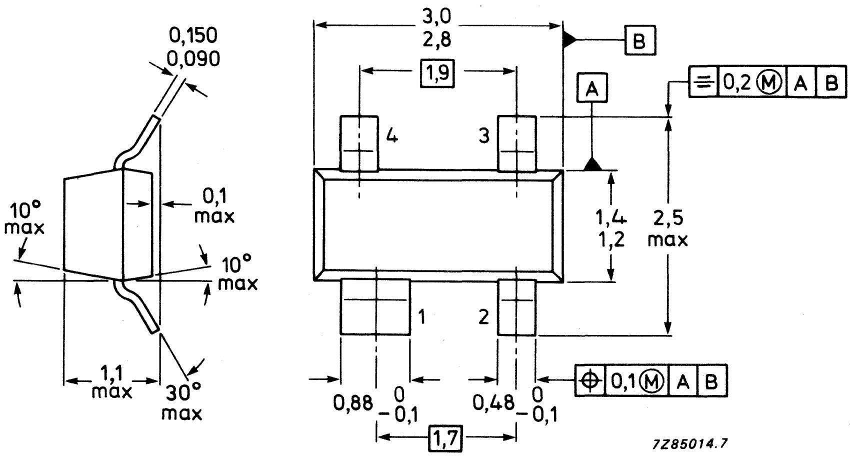
Marking code

BF994S = MGp

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





TOP VIEW

See also *Soldering recommendations.*

RATINGS

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

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	50	mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

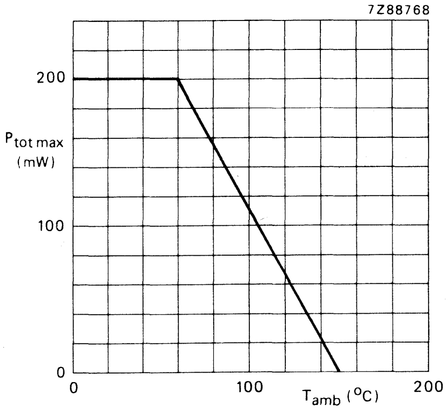


Fig. 2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1\text{-}S} = 5$ V; $V_{G2\text{-}S} = V_{DS} = 0$	$\pm I_{G1\text{-}SS}$	max.	50 nA
$\pm V_{G2\text{-}S} = 5$ V; $V_{G1\text{-}S} = V_{DS} = 0$	$\pm I_{G2\text{-}SS}$	max.	50 nA
Gate-source breakdown voltages			
$\pm I_{G1\text{-}S} = 10$ mA; $V_{G2\text{-}S} = V_{DS} = 0$	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
$\pm I_{G2\text{-}S} = 10$ mA; $V_{G1\text{-}S} = V_{DS} = 0$	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Drain current			
$V_{DS} = 15$ V; $V_{G1\text{-}S} = 0$; $V_{G2\text{-}S} = 4$ V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
$I_D = 20\ \mu$A; $V_{DS} = 15$ V; $+V_{G2\text{-}S} = 4$ V	$-V_{(P)G1\text{-}S}$	max.	2.5 V
$I_D = 20\ \mu$A; $V_{DS} = 15$ V; $V_{G1\text{-}S} = 0$	$-V_{(P)G2\text{-}S}$	max.	2.0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): $I_D = 10$ mA; $V_{DS} = 15$ V; $+V_{G2\text{-}S} = 4$ V; $T_{amb} = 25$ °C.

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.5 pF
		max.	3.0 pF
Input capacitance at gate 2: f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.0 pF
Noise figure at $G_S = 2$ mS; $B_S = B_S$ opt; f = 200 MHz	F	typ.	1.0 dB
Power gain at $G_S = 2$ mS; $B_S = B_S$ opt			
$G_L = 0.5$ mS; $B_L = B_L$ opt; f = 200 MHz	G_p	typ.	25 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected and intended for UHF applications in television tuners.
The device is also suitable for use in professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates ans source.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs} \rvert$	typ.	18	mS
Input capacitance at gate 1 : f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ. max.	2.3 2.6	pF pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.8	dB

MECHANICAL DATA

Dimensions in mm

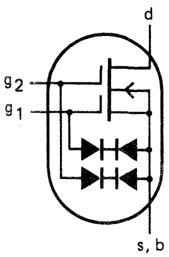
Fig.1 SOT143.

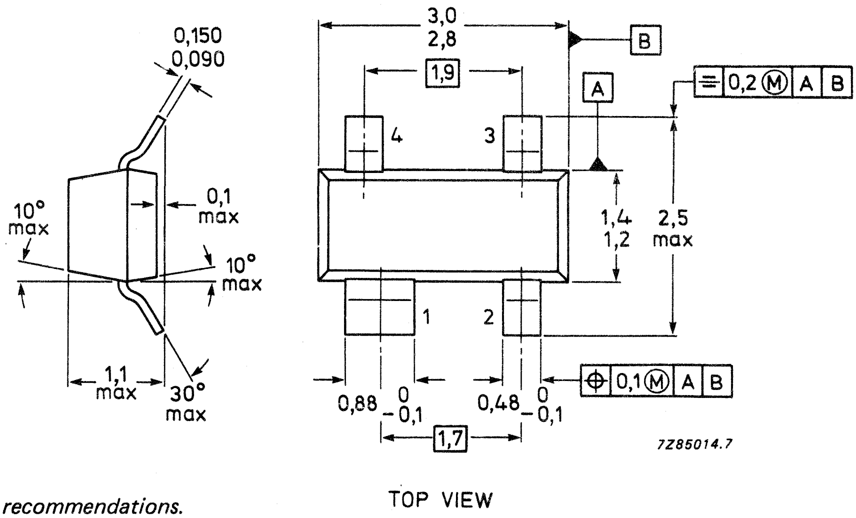
Marking code

BF996S = MHp

Pinning

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations*.

RATINGS

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

Drain-source voltage	V_{DS}	max.	20 V
Drain current (DC or average)	I_D	max.	30 mA
Gate 1-source current	$\pm I_{G1\text{-}S}$	max.	10 mA
Gate 2-source current	$\pm I_{G2\text{-}S}$	max.	10 mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200 mW
Storage temperature range	T_{stg}	−65 to + 150 °C	
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460 K/W

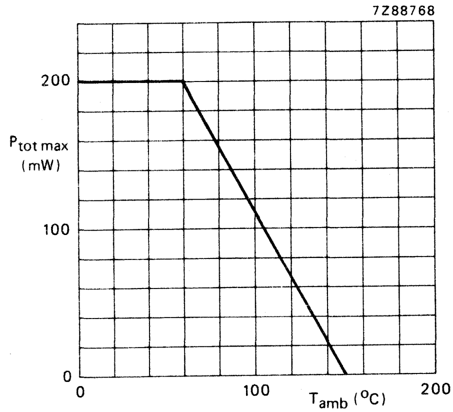


Fig. 2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
$\pm V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm I_{G1\text{-}SS}$	max.	50 nA
$\pm V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm I_{G2\text{-}SS}$	max.	50 nA
Gate-source breakdown voltages			
$\pm I_{G1\text{-}S}$ = 10 mA; $V_{G2\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
$\pm I_{G2\text{-}S}$ = 10 mA; $V_{G1\text{-}S} = V_{DS}$ = 0	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Drain current			
V_{DS} = 15 V; $V_{G1\text{-}S}$ = 0; $V_{G2\text{-}S}$ = 4 V	I_{DSS}		4 to 20 mA
Gate-source cut-off voltages			
I_D = 20 μA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	2.5 V
I_D = 20 μA; V_{DS} = 15 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	2.0 V

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; $+V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	15 mS
		typ.	18 mS
Input capacitance at gate 1: f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.3 pF
		max.	2.6 pF
Input capacitance at gate 2: f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	0.8 pF
Noise figure			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt	F	typ.	1.0 dB
f = 800 MHz; G_S = 3.3 mS; $B_S = B_S$ opt		typ.	1.8 dB
Power gain			
f = 200 MHz; G_S = 2 mS; $B_S = B_S$ opt; G_L = 0.5 mS; $B_L = B_L$ opt	G_p	typ.	25 dB
f = 800 MHz; G_S = 3.3 mS; $B_S = B_S$ opt; G_L = 1.0 mS; $B_L = B_L$ opt		typ.	18 dB

SILICON N-CHANNEL DUAL GATE MOS-FET

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for u.h.f. and v.h.f. applications, such as u.h.f./v.h.f. television tuners and professional communication equipment.

This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source and has an integrated drain resistance to suppress oscillation in the frequency range higher than 1 GHz.

This device is especially intended for use in pre-amplifiers in CATV tuners with a large tuning range up to 500 MHz.

QUICK REFERENCE DATA

Drain-source voltage	V_{DS}	max.	20	V
Drain current	I_D	max.	30	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	200	mW
Junction temperature	T_j	max.	150	°C
Transfer admittance at f = 1 kHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$\lvert y_{fs}\rvert$	typ.	18	mS
Input capacitance at gate 1; f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$C_{ig1\text{-}s}$	typ.	2.5	pF
Feedback capacitance at f = 1 MHz I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	C_{rs}	typ.	25	fF
Noise figure at G_S = 2 mS; B_S = B_S opt I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; f = 200 MHz	F	typ.	1.0	dB

MECHANICAL DATA

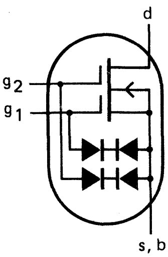
Dimensions in mm

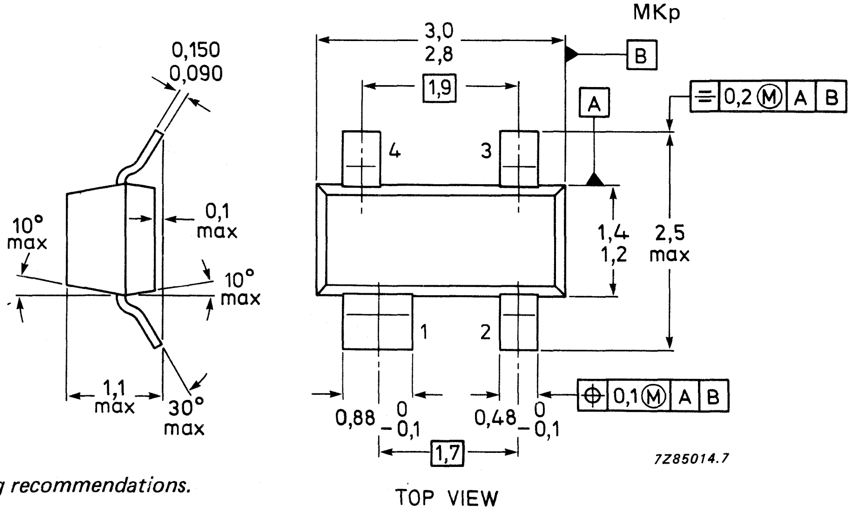
Marking code:
MKp

Fig.1 SOT143.

Pinning:

1 = source
2 = drain
3 = gate 2
4 = gate 1





See also *Soldering recommendations.*

RATINGS

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

Drain-source voltage	V_{DS}	max.	20	V
Drain current (DC or average)	I_D	max.	30	mA
Gate 1 - source current	$\pm I_{G1\text{-}S}$	max.	10	mA
Gate 2 - source current	$\pm I_{G2\text{-}S}$	max.	10	mA
Total power dissipation up to T_{amb} = 60 °C (note 1)	P_{tot}	max.	200	mW
Storage temperature range	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air (note 1)	$R_{th\ j\text{-}a}$	=	460	K/W

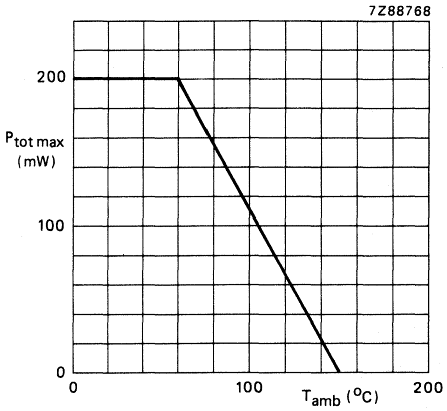


Fig.2 Power derating curve.

Note

1. Device mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Gate cut-off currents			
gate 1;			
$\pm V_{G1\text{-}S}$ = 5 V; $V_{G2\text{-}S}$ = V_{DS} = 0	$\pm I_{G1\text{-}SS}$	max.	50 nA
gate 2;			
$\pm V_{G2\text{-}S}$ = 5 V; $V_{G1\text{-}S}$ = V_{DS} = 0	$\pm I_{G2\text{-}SS}$	max.	50 nA
Gate-source breakdown voltages			
gate 1;			
$\pm I_{G1\text{-}SS}$ = 10 mA; $V_{G2\text{-}S}$ = V_{DS} = 0	$\pm V_{(BR)G1\text{-}SS}$		6 to 20 V
gate 2;			
$\pm I_{G2\text{-}SS}$ = 10 mA; $V_{G1\text{-}S}$ = V_{DS} = 0	$\pm V_{(BR)G2\text{-}SS}$		6 to 20 V
Gate-source cut-off voltages			
gate 1;			
I_D = 20 µA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V	$-V_{(P)G1\text{-}S}$	max.	2.5 V
gate 2;			
I_D = 20 µA; V_{DS} = 15 V; $V_{G1\text{-}S}$ = 0	$-V_{(P)G2\text{-}S}$	max.	2.0 V
Drain-source cut-off voltage			
V_{DS} = 15 V; $V_{G2\text{-}S}$ = 4 V; $V_{G1\text{-}S}$ = 0	I_{DSS}		2 to 20 mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source): I_D = 10 mA; V_{DS} = 15 V; + $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

Transfer admittance at f = 1 kHz	$\lvert y_{fs} \rvert$	min.	15 mS
		typ.	18 mS
Input capacitance at gate 1; f = 1 MHz	$C_{ig1\text{-}s}$	typ.	2.5 pF
Input capacitance at gate 2; f = 1 MHz	$C_{ig2\text{-}s}$	typ.	1.2 pF
Feedback capacitance at f = 1 MHz	C_{rs}	typ.	25 fF
Output capacitance at f = 1 MHz	C_{os}	typ.	1.0 pF
Noise figure at f = 200 MHz; G_S = 2 mS; B_S = B_S opt	F	typ.	1.0 dB
Power gain at G_S = 2 mS; B_S = B_S opt			
G_L = 0.5 mS; B_L = B_L opt; f = 200 MHz	G_p	typ.	25 dB

Philips Components

Data sheet	
status	Preliminary specification
date of issue	April 1991

BF998

Silicon n-channel dual gate MOS-FET

FEATURES

- Short channel transistor with high ratio $|Y_{fs}|/C_{is}$.
- Low noise gain controlled amplifier to 1 GHz.

DESCRIPTION

Depletion type field-effect transistor in a plastic SOT143 microminiature envelope with source and substrate interconnected, intended for VHF and UHF applications, such as television tuners, with 12 V supply voltage and professional communication equipment. This MOS-FET tetrode is protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
V_{DS}	drain-source voltage	-	12	V
I_D	drain current	-	30	mA
P_{tot}	total power dissipation	-	200	mW
T_j	junction temperature	-	150	°C
$\|Y_{fs}\|$	transfer admittance	24	-	mS
C_{ig1-s}	input capacitance at gate 1	2.1	-	pF
C_{rs}	feedback capacitance	25	-	fF
F	noise figure at 800 MHz	1	-	dB

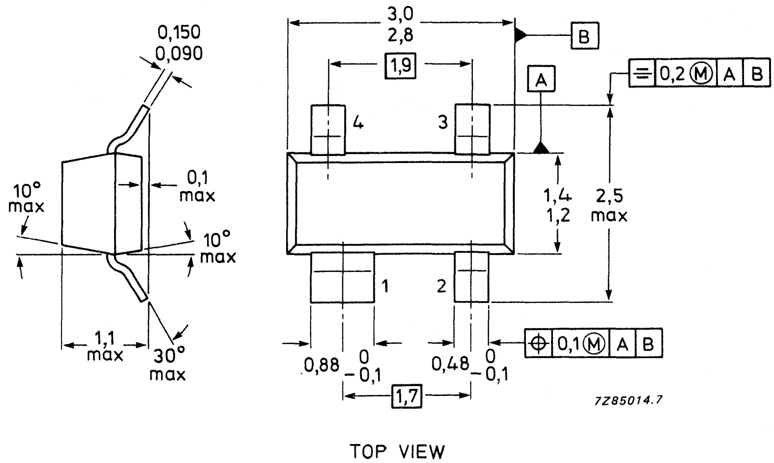
Silicon n-channel dual gate MOS-FET BF998

MECHANICAL DATA

Dimensions in mm

Marking code

BF998 = MOp



See also soldering recommendations.

Fig.1 SOT143.

PIN CONFIGURATION

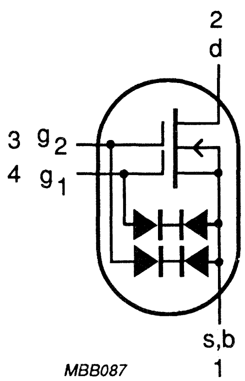


Fig.2 Pin configuration.

PINNING

PIN	DESCRIPTION
1	source
2	drain
3	gate 2
4	gate 1

Silicon n-channel dual gate MOS-FET BF998

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		-	12	V
I_D	drain current (DC or average)		-	30	mA
$\pm I_{G1-S}$	gate 1-source current		-	10	mA
$\pm I_{G2-S}$	gate 2-source current		-	10	mA
P_{tot}	total power dissipation	T_{amb} = 60 °C (note 1)	-	200	mW
P_{tot}	total power dissipation	T_{amb} = 50 °C (note 2)	-	200	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-a}$	from junction to ambient in free air (note 1)	460	K/W
$R_{th\ j-a}$	from junction to ambient in free air (note 2)	500	K/W

Notes

1. Device mounted on a ceramic substrate, 8 mm x 10 mm x 0.7 mm.
2. Device mounted on printed circuit board.

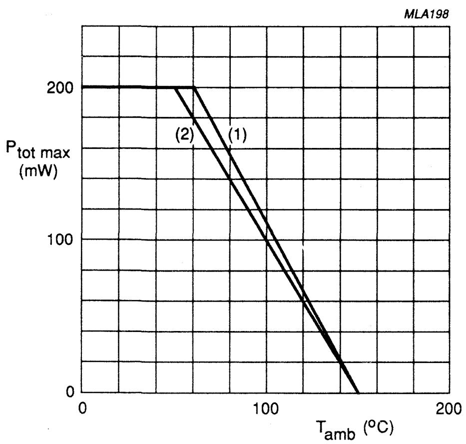


Fig.3 Power derating curve;
(1) ceramic substrate;
(2) printed-circuit board.

STATIC CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$\pm I_{G1\text{-}SS}$	gate 1 cut-off current	$\pm V_{G1\text{-}S}$ = 5 V $V_{G2S} = V_{DS}$ = 0	-	50	nA
$\pm I_{G2\text{-}SS}$	gate 2 cut-off current	$\pm V_{G2\text{-}S}$ = 5 V $V_{G1S} = V_{DS}$ = 0	-	50	nA
$\pm V_{(BR)G1\text{-}SS}$	gate 1-source breakdown voltage	$\pm I_{G1\text{-}SS}$ = 10 mA $V_{G2\text{-}S} = V_{DS}$ = 0	6	20	V
$\pm V_{(BR)G2\text{-}SS}$	gate 2-source breakdown voltage	$\pm I_{G2\text{-}SS}$ = 10 mA $V_{G1\text{-}S} = V_{DS}$ = 0	6	20	V
$-V_{(P)G1\text{-}S}$	gate 1-source cut-off voltage	I_D = 20 µA V_{DS} = 8 V $+V_{G2\text{-}S}$ = 4 V	-	2.5	V
$-V_{(P)G2\text{-}S}$	gate 2-source cut-off voltage	I_D = 20 µA V_{DS} = 8 V $V_{G1\text{-}S}$ = 0	-	2.0	V
I_{DSS}	drain current (measured under pulse condition)	V_{DS} = 8 V $V_{G1\text{-}S}$ = 0 $+V_{G2\text{-}S}$ = 4 V	2	18	mA

DYNAMIC CHARACTERISTICS

Measuring conditions (common source) I_D = 10 mA; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$\lvert Y_{fs} \rvert$	transfer admittance	f = 1 kHz	21	24	-	mS
$C_{ig1\text{-}s}$	input capacitance at gate 1	f = 1 MHz	-	2.1	2.5	pF
C_{os}	output capacitance	f = 1 MHz	-	1.05	-	pF
C_{rs}	feedback capacitance	f = 1 MHz	-	25	-	fF
$C_{ig2\text{-}s}$	input capacitance at gate 2	f = 1 MHz	-	1.2	-	pF
F	noise figure	f = 200 MHz G_s = 2 mS $B_s = B_{sopt}$	-	0.6	-	dB
F	noise figure	f = 800 MHz G_s = 3.3 mS $B_s = B_{sopt}$	-	1	-	dB

Silicon n-channel dual gate MOS-FET

BF998

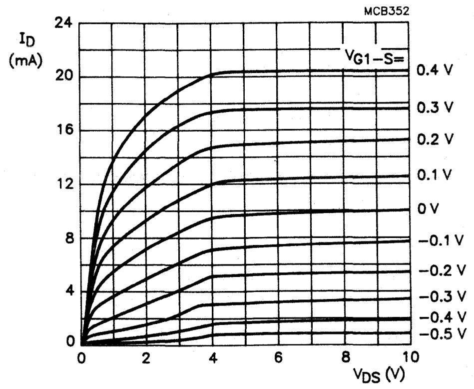


Fig.4 Output characteristics; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

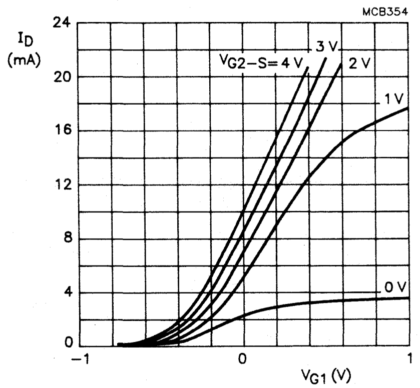


Fig.5 Transfer characteristics; V_{DS} = 8 V; T_{amb} = 25 °C.

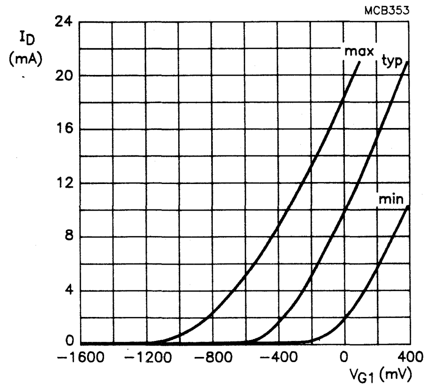


Fig.6 Drain current as a function of gate 1 voltage; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; T_{amb} = 25 °C.

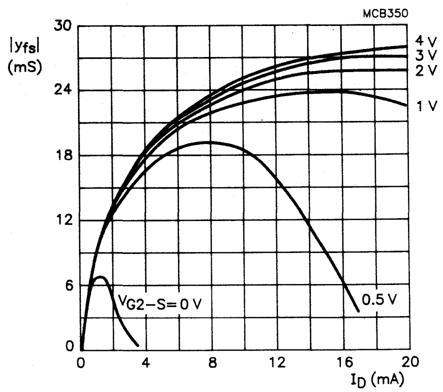


Fig.7 Transfer admittance as a function of drain current; V_{DS} = 8 V; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET

BF998

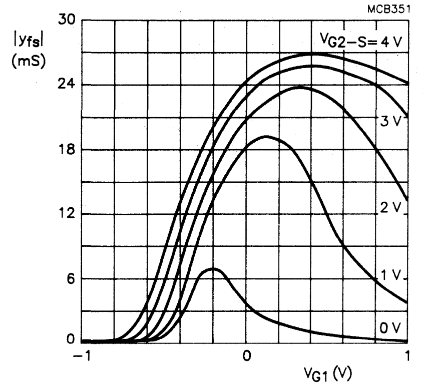


Fig.8 Transfer admittance as a function of gate 1 voltage; V_{DS} = 8 V; T_{amb} = 25 °C.

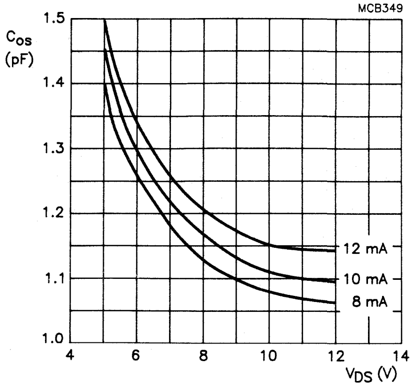


Fig.9 Output capacitance as a function of drain-source voltage; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

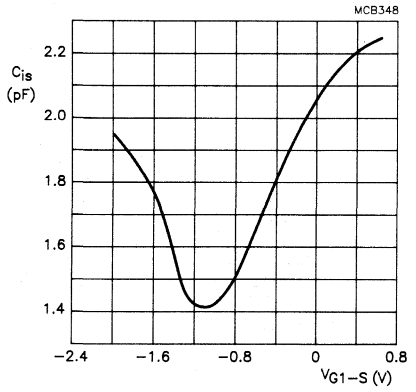


Fig.10 Gate 1 input capacitance as a function of gate 1-source voltage; V_{DS} = 8 V; $V_{G2\text{-}S}$ = 4 V; f = 1 MHz; T_{amb} = 25 °C.

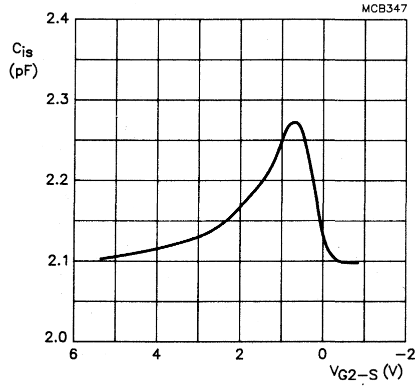


Fig.11 Gate 1 input capacitance as a function of gate 2-source voltage; V_{DS} = 8 V; $V_{G1\text{-}S}$ = 0; f = 1 MHz; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET

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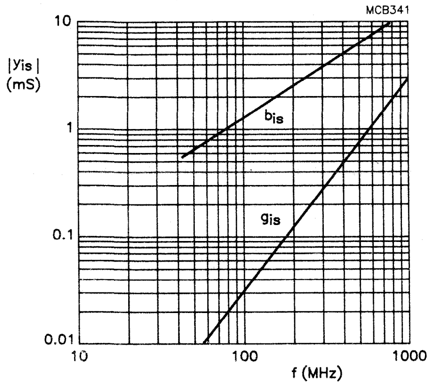


Fig.12 Input admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

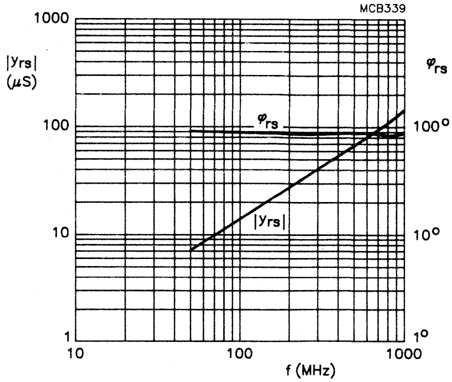


Fig.13 Feedback admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

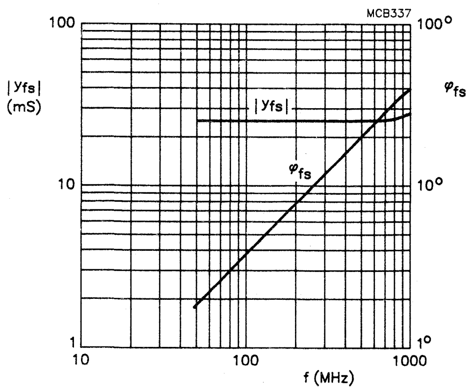


Fig.14 Transfer admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

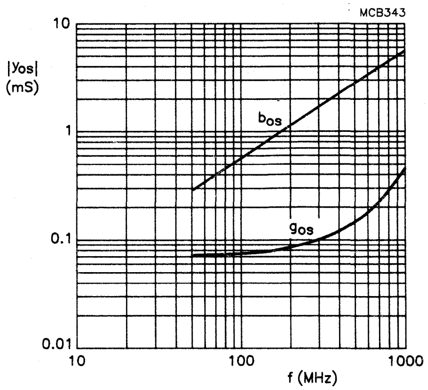
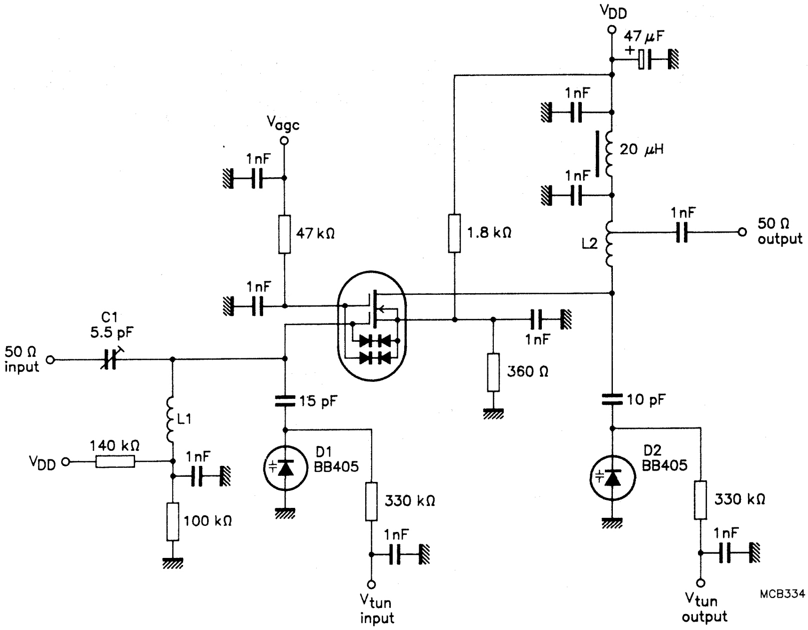


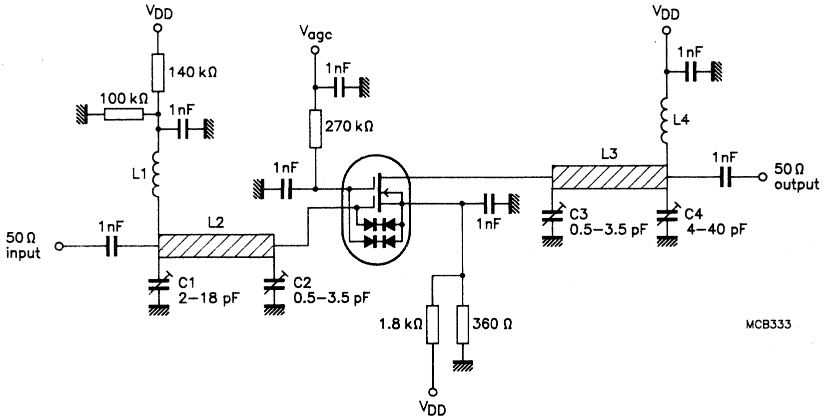
Fig.15 Output admittance as a function of frequency; V_{DS} = 8 V; V_{G2-S} = 4 V; I_D = 10 mA; T_{amb} = 25 °C.

Silicon n-channel dual gate MOS-FET — BF998



L1 = 45 nH, 4 turns, internal diameter 4 mm, 0.8 mm copper wire.
L2 = 160 nH, 3 turns, internal diameter 8 mm, 0.8 mm copper wire.
Tapped at approximately half a turn from the cold side, to adjust G_L = 0.5 mS.
C1 adjusted for G_S = 2 mS.

Fig.16 Gain control test circuit at f = 200 MHz; V_{DD} = 12 V; G_S = 2 mS; G_L = 0.5 mS.



L1 = L4 = 11 turns, internal diameter 3 mm, 0.5 mm copper wire, without spacing; ≈200 nH.
L2 = 2 cm, silvered 0.8 mm copper wire, 4 mm above ground plane.
L3 = 2 cm, silvered 0.5 mm copper wire, 4 mm above ground plane.

Fig.17 Gain control test circuit at f = 800 MHz; V_{DD} = 12 V; G_S = 3.3 mS; G_L = 1 mS.

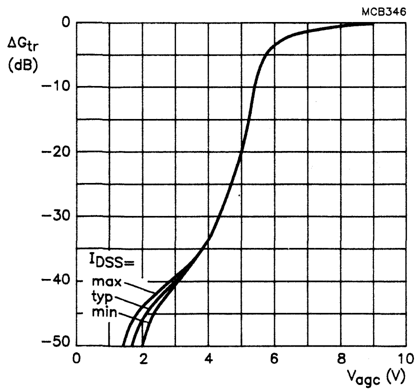


Fig.18 Automatic gain control characteristics measured in circuit of Fig.16; V_{DD} = 12 V; f = 200 MHz; T_{amb} = 25 °C.

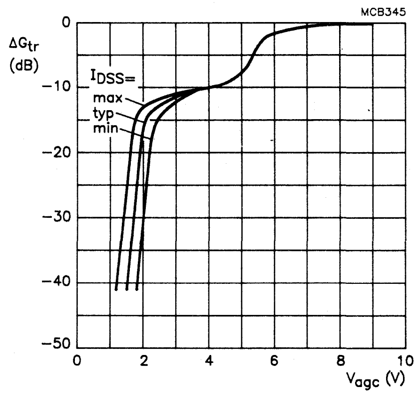


Fig.19 Automatic gain control characteristics measured in circuit of Fig.17; V_{DD} = 12 V; f = 800 MHz; T_{amb} = 25 °C.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG16A

NPN 1 GHz wideband transistor

DESCRIPTION

NPN transistor primarily intended for wideband amplifier, aerial amplifiers and vertical amplifiers in high speed oscilloscopes.
The BFG16A is mounted in a SOT223 plastic envelope.

FEATURES

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

MECHANICAL DATA

Plastic SOT223 envelope

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	40	V
V_{CEO}	collector-emitter voltage	open base	-	-	25	V
I_C	collector current (DC)		-	-	150	mA
P_{tot}	total power dissipation	T_{case} = 135 °C; (note 1)	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	I_C = 150 mA; V_{CE} = 5 V	25	-	-	
f_T	transition frequency	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	1.5	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V	-	10	-	dB

Note

1. T_{case} temperature measured on soldering point of collector tab.

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG16A	SOT223	bulk	500
BFG16A	SOT223	12 mm REEL	1000

NPN 1 GHz wideband transistor BFG16A

LIMITING VALUES

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

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}c}$	from junction to case.	40	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter I_C = 0.1 mA	25	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base I_C = 10 mA	18	-	-	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector I_E = 0.1 mA	3	-	-	V
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 28 V	-	-	20	μA
h_{FE}	DC current gain	I_C = 50 mA/ 150 mA; V_{CE} = 5 V	25	-	-	
C_c	collector capacitance	f = 1 MHz; $I_E = i_e$ = 0; V_{CB} = 10 V	-	2.5	-	pF
C_e	emitter capacitance	f = 1 MHz; $I_C = i_c$ = 0; V_{EB} = 0.5 V	-	10.0	-	pF
C_{re}	feedback capacitance	f = 1 MHz; I_C = 0 mA; V_{CB} = 10 V	-	1.8	-	pF
f_T	transition frequency	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	1.5	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	10	-	dB

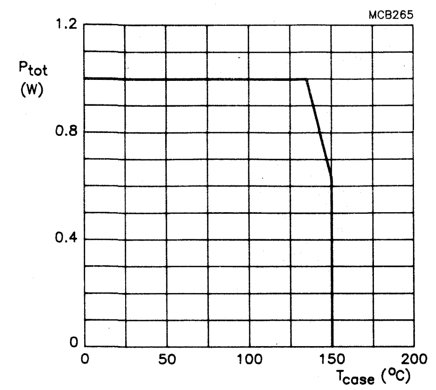


Fig.1 Power derating curve.

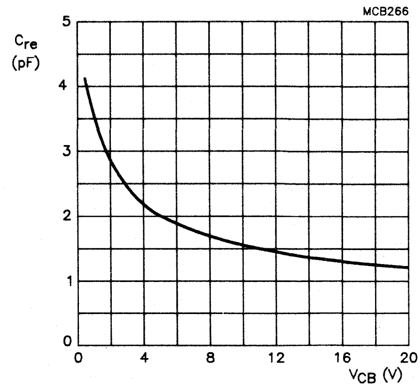


Fig.2 Feedback capacitance as function of collector-base voltage; $I_C = i_c = 0$; f = 1 MHz.

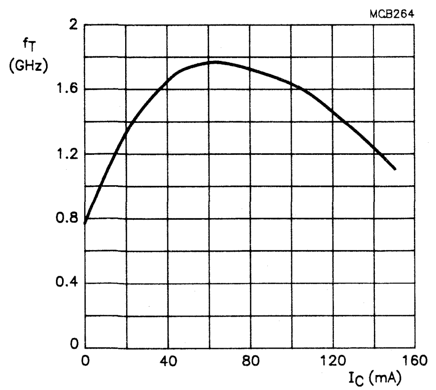


Fig.3 Transition frequency as function of collector current; V_{CE} = 10 V; f = 500 MHz.

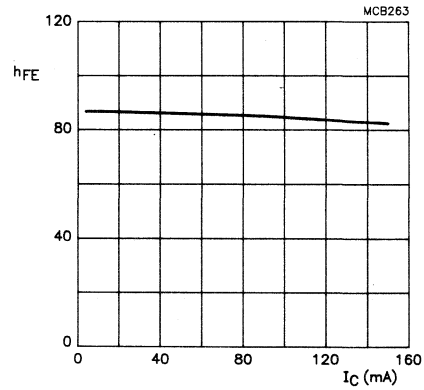


Fig.4 Current gain as function of collector current; V_{CE} = 10 V.

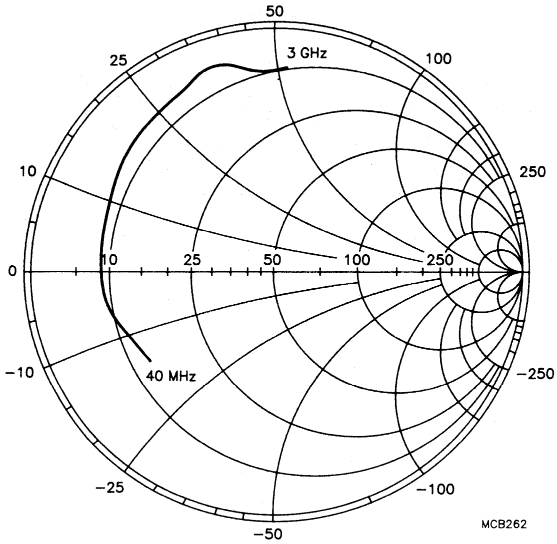


Fig.5 Common emitter input reflection coefficient, S_{11}; V_{CE} = 15 V; I_C = 70 mA.

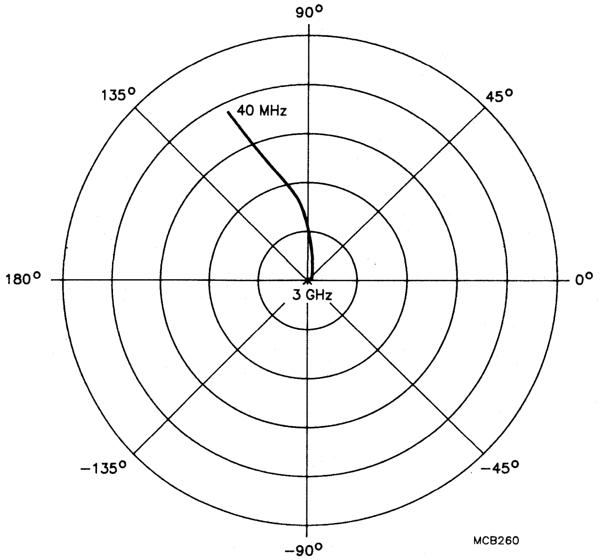


Fig.6 Common emitter forward transmission coefficient, S_{21}; V_{CE} = 15 V; I_C = 70 mA.

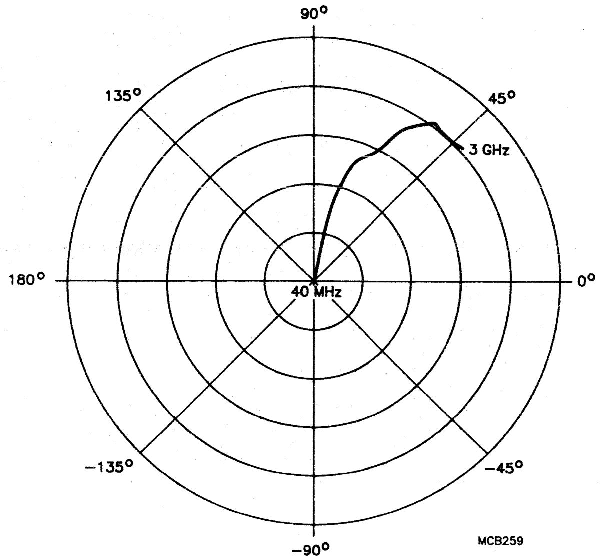


Fig.7 Common emitter reverse transmission coefficient, S_{12}; V_{CE} = 15 V; I_C = 70 mA.

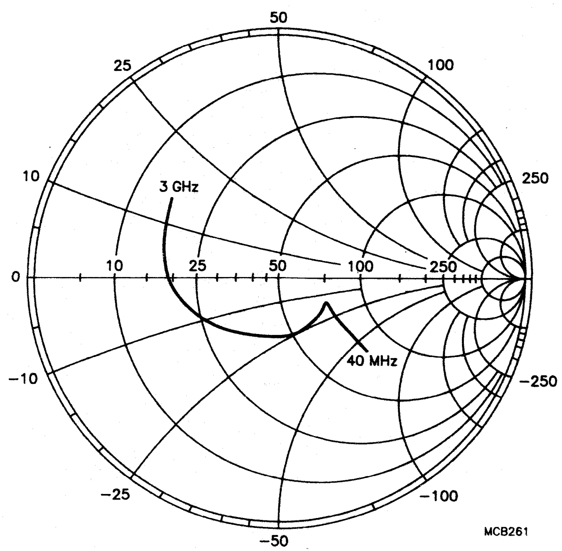


Fig.8 Common emitter output transmission coefficient, S_{22}; V_{CE} = 15 V; I_C = 70 mA.

S-Parameters (common-emitter) at V_{CE} = 15 V; I_C = 70 mA; typical values.

FREQUENCY (MHz)	S_{11} M (rat)	S_{11} Φ (deg)	S_{21} M (rat)	S_{21} Φ (deg)	S_{12} M (rat)	S_{12} Φ (deg)	S_{22} M (rat)	S_{22} Φ (deg)	G_{UM} (dB)
40	.622	−144.5	36.80	113.9	.011	50.6	.465	− 41.8	34.51
100	.679	−167.0	16.10	96.5	.016	57.8	.278	− 36.4	27.23
200	.694	−177.9	8.24	85.9	.026	67.8	.230	− 29.4	21.42
300	.699	176.7	5.54	79.1	.038	71.3	.220	− 29.1	18.01
400	.707	172.6	4.15	73.1	.049	73.4	.218	− 31.4	15.60
500	.710	168.6	3.32	67.9	.060	74.2	.218	− 35.0	13.69
600	.714	164.9	2.79	62.8	.071	75.8	.219	− 39.8	12.23
700	.721	161.5	2.39	58.0	.082	76.0	.221	− 45.2	10.98
800	.726	157.9	2.10	53.5	.093	76.1	.222	− 51.8	9.95
900	.733	154.2	1.88	49.1	.105	76.0	.226	− 58.6	9.08
1000	.740	150.6	1.70	44.9	.116	75.9	.229	− 66.0	8.34
1200	.760	144.2	1.42	36.6	.140	76.9	.240	− 81.7	7.06
1400	.778	137.8	1.20	29.2	.171	75.7	.258	− 98.1	5.97
1600	.786	132.2	1.04	21.7	.199	74.0	.281	−115.1	4.88
1800	.795	124.4	.92	15.1	.230	72.4	.309	−132.0	4.11
2000	.820	118.0	.82	9.5	.270	69.0	.346	−148.4	3.67

S-Parameters (common-emitter) at V_{CE} = 10 V; I_C = 100 mA; typical values.

FREQUENCY (MHz)	S_{11} M (rat)	S_{11} Φ (deg)	S_{21} M (rat)	S_{21} Φ (deg)	S_{12} M (rat)	S_{12} Φ (deg)	S_{22} M (rat)	S_{22} Φ (deg)	G_{UM} (dB)
40	.656	−157.2	34.60	109.7	.009	52.0	.376	− 51.1	33.90
100	.709	−172.5	14.80	94.4	.016	63.2	.201	− 46.9	26.64
200	.718	179.3	7.49	84.6	.028	71.6	.154	− 39.2	20.76
300	.729	174.6	5.03	77.9	.041	73.9	.145	− 38.3	17.43
400	.733	170.7	3.78	71.9	.053	75.2	.143	− 41.0	14.99
500	.736	167.4	3.01	66.6	.065	75.5	.144	− 45.3	13.08
600	.742	163.6	2.52	61.7	.077	76.1	.146	− 51.2	11.63
700	.745	160.1	2.18	56.5	.089	75.9	.150	− 58.3	10.40
800	.751	156.7	1.91	52.1	.101	75.7	.154	− 66.4	9.35
900	.757	152.8	1.71	47.7	.114	75.3	.161	− 74.8	8.51
1000	.764	149.5	1.55	43.3	.126	75.0	.169	− 83.9	7.77
1200	.781	142.8	1.28	35.3	.152	75.2	.190	−101.6	6.46
1400	.798	136.7	1.09	28.2	.184	73.4	.219	−118.9	5.43
1600	.804	130.6	.94	21.4	.213	71.1	.252	−135.6	4.34
1800	.809	123.4	.83	14.8	.244	69.1	.291	−151.4	3.48
2000	.832	116.7	.74	9.6	.284	65.4	.340	−166.2	3.05

S-Parameters (common-emitter) at V_{CE} = 10 V; I_C = 70 mA; typical values.

FREQUENCY (MHz)	S_{11} M (rat)	S_{11} Φ (deg)	S_{21} M (rat)	S_{21} Φ (deg)	S_{12} M (rat)	S_{12} Φ (deg)	S_{22} M (rat)	S_{22} Φ (deg)	G_{UM} (dB)
40	.644	−150.5	35.00	112.5	.011	50.8	.417	− 51.5	34.06
100	.700	−169.8	15.20	95.7	.017	58.0	.218	− 50.4	26.81
200	.715	−179.5	7.75	85.5	.028	68.1	.157	− 43.2	21.01
300	.721	175.4	5.21	78.6	.041	71.7	.145	− 41.7	17.62
400	.725	171.5	3.91	72.7	.053	73.7	.141	− 43.9	15.17
500	.731	167.8	3.12	67.4	.065	74.2	.141	− 47.9	13.31
600	.734	163.9	2.62	62.2	.077	75.0	.143	− 53.6	11.83
700	.740	160.6	2.25	57.3	.090	75.1	.146	− 60.4	10.61
800	.743	157.2	1.98	52.8	.101	74.7	.152	− 68.0	9.57
900	.748	153.4	1.78	48.5	.114	74.5	.158	− 76.2	8.69
1000	.758	149.9	1.61	44.2	.126	74.2	.166	− 85.0	7.96
1200	.776	143.2	1.34	35.9	.151	74.5	.188	−102.5	6.73
1400	.791	137.2	1.13	28.6	.183	72.8	.218	−119.2	5.61
1600	.794	131.0	.98	21.7	.213	70.7	.253	−135.7	4.51
1800	.804	123.8	.87	15.1	.243	68.9	.293	−151.2	3.72
2000	.827	117.0	.76	10.1	.282	65.2	.342	−166.0	3.26

S-Parameters (common-emitter) at V_{CE} = 5 V; I_C = 150 mA; typical values.

FREQUENCY (MHz)	S_{11} M (rat)	S_{11} Φ (deg)	S_{21} M (rat)	S_{21} Φ (deg)	S_{12} M (rat)	S_{12} Φ (deg)	S_{22} M (rat)	S_{22} Φ (deg)	G_{UM} (dB)
40	.791	−172.2	16.70	104.0	.009	53.8	.178	− 80.7	28.87
100	.810	−179.6	7.15	94.4	.017	67.4	.100	− 99.1	21.78
200	.815	175.1	3.77	86.1	.031	75.1	.088	−114.9	16.32
300	.818	171.1	2.62	78.8	.047	76.2	.094	−123.8	13.23
400	.824	167.7	2.00	72.3	.061	77.0	.105	−130.3	11.02
500	.821	164.1	1.62	66.4	.076	76.8	.117	−135.8	9.14
600	.826	160.1	1.37	61.0	.091	76.9	.132	−141.0	7.85
700	.826	156.5	1.20	55.5	.106	76.2	.149	−145.8	6.68
800	.828	153.0	1.06	50.9	.122	75.0	.167	−150.6	5.72
900	.833	149.2	.96	46.4	.138	74.0	.186	−155.2	5.02
1000	.840	145.6	.88	42.2	.151	72.7	.207	−159.9	4.41
1200	.845	138.7	.74	35.4	.183	71.1	.248	−169.2	3.17
1400	.853	132.5	.64	29.9	.219	67.6	.293	−178.4	2.25
1600	.845	126.1	.56	25.3	.249	63.8	.339	171.9	1.08
1800	.844	119.2	.51	20.8	.278	60.6	.382	162.6	.30
2000	.856	112.5	.47	18.7	.315	56.2	.429	153.4	.21

NPN 2 GHz WIDEBAND TRANSISTOR

BFG17A is a npn wideband transistor in a microminature SOT143 envelope with double emitter bonding. The device contains a BFW92A crystal. This transistor is intended for use in wideband (40 to 860 MHz) aerial amplifiers using SMD technology.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	25	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (DC)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
DC current gain	h_{FE}	min. max.	20 150	
Transition frequency at f = 500 MHz I_C = 25 mA; V_{CE} = 5 V	f_T	typ.	2.8	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0.06	pF
Noise figure I_C = 2 mA; V_{CE} = 5 V; f = 800 MHz; Z_s = 600 Ω; T_{amb} = 25 °C	F	typ.	2.5	dB
Maximum unilateral power gain at f = 800 MHz; I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C	G_{UM}	typ.	15	dB

MECHANICAL DATA

SOT143

Pinning

1 = collector
2 = base
3,4 = emitter

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	25 V
Collector-emitter voltage (open base)	V_{CEO}	max.	15 V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5 V
Collector current (DC)	I_C	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate 8 x 10 x 0.7 mm	P_{tot}	max.	300 mW
Storage temperature range	T_{stg}		−65 to 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient mounted on ceramic substrate 8 x 10 x 0.7 mm	$R_{th\ j\text{-}a}$	=	430 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$, $V_{CB} = 10$ V	I_{CBO}	max.	50 nA
DC current gain $I_C = 2$ mA; $V_{CE} = 1$ V	h_{FE}	min.	20
$I_C = 25$ mA; $V_{CE} = 1$ V	h_{FE}	max.	150
Transition frequency at f = 500 MHz $I_C = 25$ mA; $V_{CE} = 5$ V	f_T	typ.	2.8 GHz
Noise figure $I_C = 2$ mA; $V_{CE} = 5$ V; f = 800 MHz $Z_s = 60\ \Omega$; $T_{amb} = 25$ °C	F	typ.	2.5 dB
Collector capacitance at f = 1 MHz $I_E = 0$; $V_{CB} = 10$ V	C_c	typ.	0.7 pF
Emitter capacitance at f = 1 MHz $I_C = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.25 pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 5$ V	C_{re}	typ.	0.6 pF
Maximum unilateral power gain at f = 800 MHz $I_C = 14$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; $S_{12} = 0$ $G_{UM} = 10 \log \frac{\|S_{21}\|^2}{(1 - \|S_{11}\|^2)(1 - \|S_{22}\|^2)}$	G_{UM}	typ.	15 dB

Output voltage at d_{im} = −60 dB
(DIN 45004B, para. 6,3: 3-tone)
I_C = 14 mA; V_{CE} = 10 V; Z_L = 75 Ω
$V_p = V_O$; f_p = 795.25 MHz
$V_q = V_O$ −6 dB; f_q = 803.25 MHz
$V_r = V_O$ −6 dB; f_r = 805.25 MHz
Measured at $f_{(p+q-r)}$ = 793.25 MHz | V_O | typ. | 150 mV

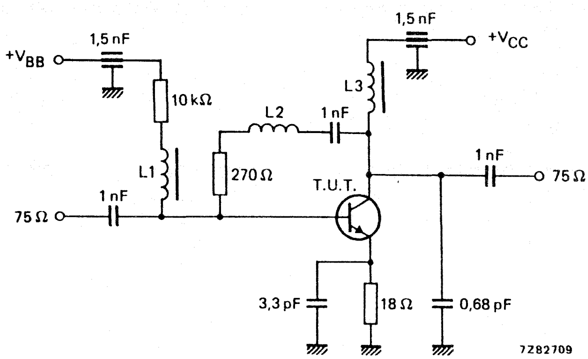


Fig.1 Intermodulation distortion and second harmonic distortion MATV test circuit.
L1 = L3 = 5 μH Ferroxcube choke.
L2 = 3 turns Copper wire (0.4 mm), internal diameter 3 mm, winding pitch 1 mm.

Table 1 S-parameters (common emitter)
Conditions: T_{amb} = 25 °C; V_{CE} = 10 V; typical values.

I_C (mA)	f (MHz)	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} (dB)
5	40	0.84/–19.4	14.3/168.2	0.02/67.7	0.98/–5.1	41.9
	100	0.77/–50.0	12.83/147.8	0.02/65.6	0.95/–13.0	35.7
	200	0.61/–84.3	9.31/128.7	0.03/54.4	0.80/–19.3	25.9
	500	0.51/–136;7	5.21/99.3	0.05/47.0	0.69/–26.2	18.5
	800	0.47/–157.4	3.51/84.6	0.06/50.3	0.63/–32.0	14.2
	1000	0.46/–168.7	2.86/75.4	0.07/51.4	0.64/–34.2	12.5
	1200	0.47/179.8	2.36/68.1	0.07/53.5	0.63/–38.9	10.7
	1500	0.46/173.4	1.96/60.2	0.09/56.8	0.57/–42.7	8.6
	2000	0.47/157.3	1.44/45.6	0.11/59.8	0.56/–55.6	5.9
10	40	0.75/–27.9	24.57/163.4	0.02/67.9	0.96/–8.1	42.8
	100	0.65/–68.5	19.95/138.6	0.02/58.9	0.86/–17.9	34.3
	200	0.52/–107.8	13.04/118.2	0.03/51.3	0.70/–22.3	26.6
	500	0.48/–152.8	6.31/91.7	0.04/54.2	0.59/–25.4	19.0
	800	0.45/–170.1	4.11/79.0	0.06/59.1	0.56/–30.5	14.9
	1000	0.46/–178.9	3.30/71.0	0.06/60.4	0.57/–32.2	13.1
	1200	0.47/171.4	2.72/64.6	0.07/62.0	0.56/–36.5	11.4
	1500	0.46/167.3	2.22/57.0	0.09/63.6	0.51/–40.8	9.3
	2000	0.47/152.7	1.63/43.4	0.11/64.3	0.51/–53.7	6.7
15	40	0.69/–34.4	31.29/159.8	0.02/62.6	0.94/–10.2	42.3
	100	0.59/–80.7	23.65/132.7	0.02/55.5	0.81/–20.2	34.0
	200	0.49/–120.7	14.46/112.6	0.02/52.5	0.64/–22.6	26.7
	500	0.47/–160.1	6.61/88.3	0.04/58.2	0.55/–23.7	19.1
	800	0.45/–174.7	4.25/76.3	0.05/63.3	0.53/–28.8	15.0
	1000	0.46/177.6	3.39/68.7	0.06/64.0	0.55/–30.6	13.2
	1200	0.47/168.6	2.79/62.6	0.07/65.0	0.54/–34.8	11.5
	1500	0.47/165.2	2.27/55.2	0.09/65.7	0.50/–39.6	9.4
	2000	0.48/151.1	1.65/42.0	0.11/66.0	0.51/–52.8	6.8
20	40	0.65/–39.4	35.51/157.2	0.02/54.5	0.93/–11.4	42.3
	100	0.56/–89.4	25.64/128.6	0.02/57.3	0.77/–20.9	33.7
	200	0.47/–128.5	14.99/109.0	0.02/53.5	0.61/–21.7	26.6
	500	0.47/–163.8	6.62/86.0	0.04/61.0	0.54/–22.0	19.0
	800	0.45/–176.8	4.21/74.5	0.05/66.0	0.52/–27.4	14.9
	1000	0.46/175.9	3.35/67.1	0.06/65.9	0.55/–29.4	13.1
	1200	0.47/167.4	2.75/61.2	0.07/66.7	0.55/–33.8	11.4
	1500	0.47/164.2	2.23/53.8	0.09/67.3	0.50/–38.8	9.3
	2000	0.48/150.4	1.62/40.9	0.11/67.1	0.51/–52.5	6.6
30	40	0.58/–51.2	39.39/150.7	0.01/57.5	0.89/–13.0	40.6
	100	0.50/–105.8	25.05/121.1	0.02/54.2	0.72/–19.3	32.3
	200	0.45/–141.0	13.65/103.2	0.02/55.2	0.60/–17.9	25.6
	500	0.46/–169.0	5.79/82.5	0.03/64.8	0.57/–19.0	18.0
	800	0.45/179.7	3.65/71.7	0.05/67.9	0.56/–25.7	13.8
	1000	0.46/173.1	2.89/64.5	0.06/67.9	0.58/–28.6	12.1
	1200	0.48/165.1	2.37/58.9	0.07/68.4	0.58/–33.9	10.4
	1500	0.48/161.8	1.91/51.9	0.09/69.2	0.53/–39.1	8.2
	2000	0.49/148.0	1.40/39.3	0.11/69.0	0.54/–53.8	5.6

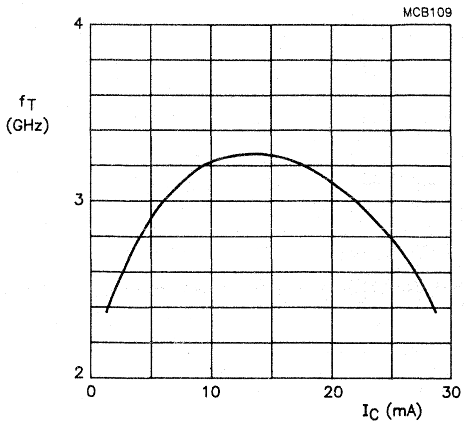


Fig.2 Transition frequency as a function of collector current; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

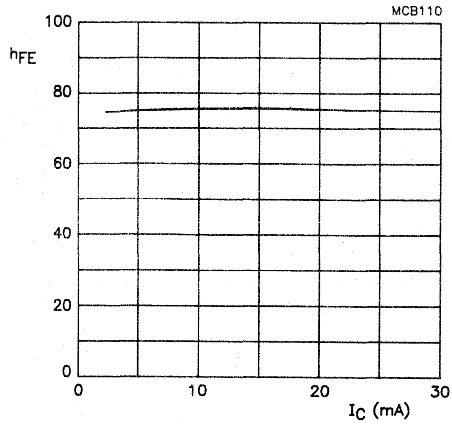


Fig.3 Current gain as a function of collector current; V_{CE} = 1 V; T_{amb} = 25 °C.

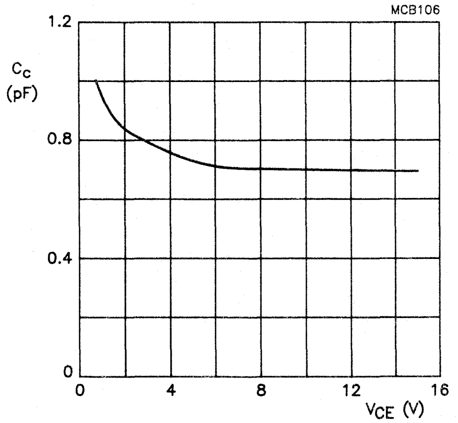


Fig.4 Collector capacitance as a function of collector-emitter voltage; f = 1 MHz; I_E = 0; T_{amb} = 25 °C.

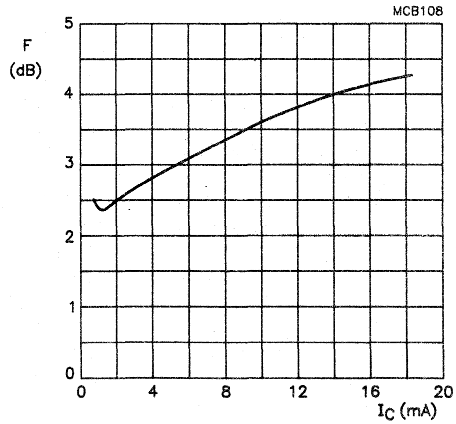


Fig.5 Noise figure as a function of collector current; V_{CE} = 5 V; f = 800 MHz; R_S = 60 Ω; b_s = opt.; T_{amb} = 25 °C.

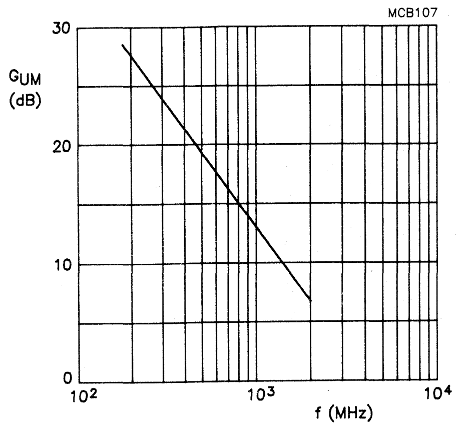


Fig.6 Maximum power gain as a function of frequency; V_{CE} = 10 V; I_C = 15 mA; T_{amb} = 25 °C.

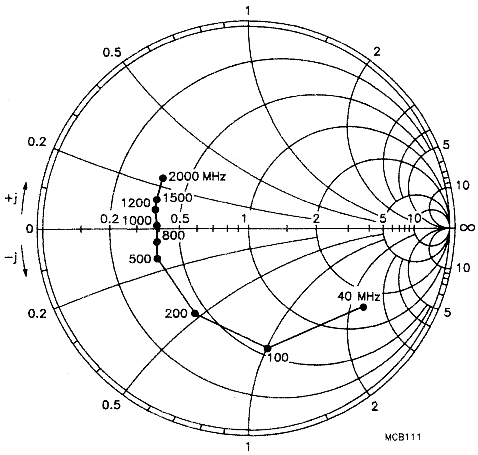


Fig.7 Input impedance derived from S_{11} (in Ohm x 50); V_{CE} = 10 V; I_C = 15 mA; T_{amb} = 25 °C.

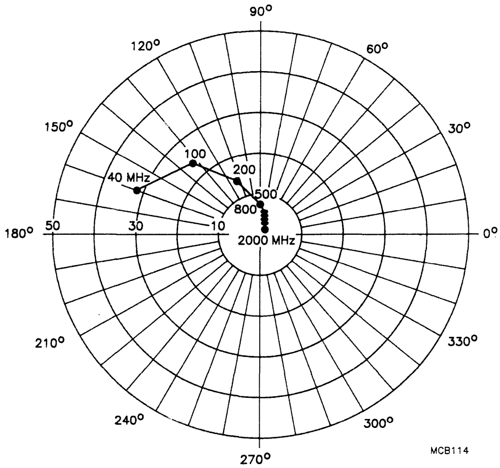


Fig.8 Forward transmission coefficient S_{21}; V_{CE} = 10 V; I_C = 15 mA; T_{amb} = 25 °C.

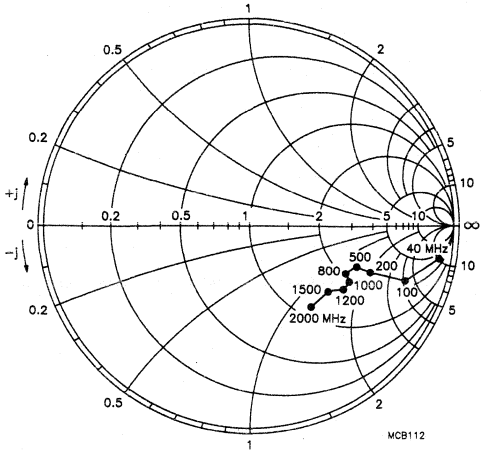


Fig.9 Output impedance derived from S_{22} (in Ohm x 50); V_{CE} = 10 V; I_C = 15 mA; T_{amb} = 25 °C.

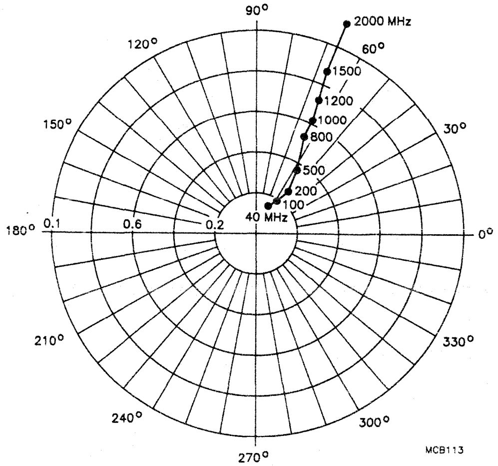


Fig.10 Reverse transmission coefficient S_{12}; V_{CE} = 10 V; I_C = 15 mA; T_{amb} = 25 °C.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	April 1991

BFG25AX
NPN HF wideband transistor

DESCRIPTION

NPN transistor in a plastic SOT143 envelope, primarily for use on low power amplifiers. Ideal for pagers and other battery operated systems where low power consumption is critical.

MECHANICAL DATA

Plastic SOT143 envelope.

Marking code: V11

PINNING

PIN	DESCRIPTION
1	collector
2,4	emitter
3	base

PIN CONFIGURATION

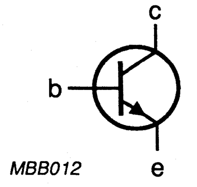


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	8	V
V_{CEO}	collector-emitter voltage	open base	-	-	5	V
I_C	collector current		-	-	6.5	mA
P_{tot}	total power dissipation (DC)	note 1	-	-	32	mW
T_j	junction temperature		-	-	150	°C
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
f_T	transition frequency	f = 500 MHz; I_C = 1 mA; V_{CE} = 1 V	3.5	5	-	GHz

Note

1. Up to T_s = 140 °C; T_s = temperature measured on soldering point of collector tab.

LIMITING VALUES

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

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

Note

1. Up to T_s = 140 °C; T_s = temperature measured on soldering point of collector tab.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}s}$	from junction to soldering point	320	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter I_C = 10 μA	8	-	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base I_C = 100 μA	5	-	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector I_E = 10 μA	2	-	–	V
h_{FE}	DC current gain	I_C = 0.5 mA; V_{CE} = 1 V	50	80	200	
C_{re}	feedback capacitance	f = 1 MHz; I_C = 0; V_{CE} = 1 V	-	0.22	0.3	pF
G_{UM}	unilateral gain	f = 500 MHz; I_C = 0.5 mA; V_{CE} = 1 V	-	30	–	dB
G_{UM}	unilateral gain	f = 1 GHz; I_C = 0.5 mA; V_{CE} = 1 V	–	18	–	dB
F	noise figure	f = 500 MHz; I_C = 0.5 mA; V_{CE} = 1 V	-	1.6	2.0	dB
F	noise figure	f = 1 GHz; I_C = 1.0 mA; V_{CE} = 1 V	–	1.8	2.5	dB
f_T	transition frequency	f = 500 MHz; I_C = 1 mA; V_{CE} = 1 V	3.5	5		GHz

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG31
PNP 5 GHz wideband transistor

FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary npn type BFG97.

DESCRIPTION

PNP planar epitaxial transistor intended for wideband amplifier applications.
The BFG31 is mounted in a SOT223 plastic envelope.

MECHANICAL DATA

Plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	-	-	20	V
$-V_{CEO}$	collector-emitter voltage	open base	-	-	15	V
$-I_C$	collector current (DC)		-	-	100	mA
P_{tot}	total power dissipation	T_{case} = 135 °C; note 1	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	$-I_C$ = 70 mA; $-V_{CE}$ = 10 V	25	-	-	
f_T	transition frequency	f = 500 MHz; $-I_C$ = 70 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	5.0	-	-	GHz
G_{UM}	maximum power gain	f = 800 MHz; $-I_C$ = 70 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	12	-	dB
V_o	output voltage	d_{im} = −60 dB; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 848.25 MHz	-	600	-	mV

Note

1. T_{case} temperature measured on soldering point of collector tab.

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ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG31	SOT223	bulk	500
BFG31	SOT223	12 mm tape	1000

LIMITING VALUES

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

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}c}$	from junction to case.	40	K/W

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CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter $-I_C$ = 10 mA	20	-	-	V
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	open base $-I_C$ = 10 mA	18	-	-	V
$-V_{(BR)EBO}$	emitter-base breakdown voltage	open collector $-I_E$ = 0.1 mA	3	-	-	V
$-I_{CBO}$	collector cut-off current	$-I_E$ = 0; $-V_{CB}$ = 10 V	-	-	1	μA
h_{FE}	DC current gain	$-I_C$ = 100 mA; $-V_{CE}$ = 10 V	25	-	-	
C_{cb}	collector-base capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{CB}$ = 10 V	-	1.8	-	pF
C_{eb}	emitter-base capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{EB}$ = 10 V	-	5	-	pF
C_{re}	feedback capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{CE}$ = 10 V	-	1.6	-	pF
f_T	transition frequency	f = 500 MHz; $-I_C$ = 70 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	5	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; $-I_C$ = 70 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	16	-	dB
G_{UM}	maximum power gain	f = 800 MHz; $-I_C$ = 70 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C;	-	12	-	dB
V_o	output voltage	note 1	-	600	-	mV
V_o	output voltage	note 2	-	650	-	mV

Note

1. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; $-I_C$ = 100 mA;
   $-V_{CE}$ = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB;
   f_p = 850.25 MHz; $V_q = V_o$ −6 dB;
   f_q = 858.25 MHz; $V_r = V_o$ −6 dB;
   f_r = 860.25 MHz; Measured at $f_{(p+q+r)}$ = 848.25 MHz.

2. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; $-I_C$ = 100 mA;
   $-V_{CE}$ = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB;
   f_p = 445.25 MHz; $V_q = V_o$ −6 dB;
   f_q = 453.25 MHz; $V_r = V_o$ −6 dB;
   f_r = 455.25 MHz; Measured at $f_{(p+q-r)}$ = 443.25 MHz.

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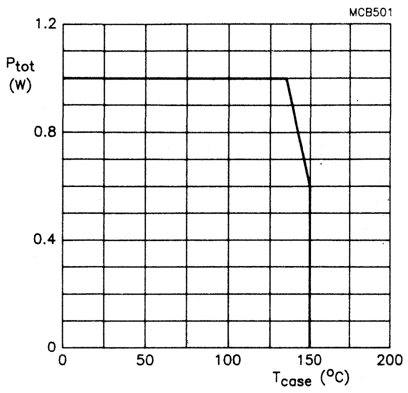

Fig.1 Power derating curve.

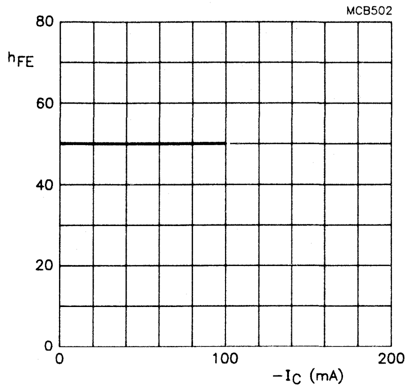

Fig.2 DC current gain as a function of collector current; $-V_{CE}$ = 10 V; T_{amb} = 25 °C.

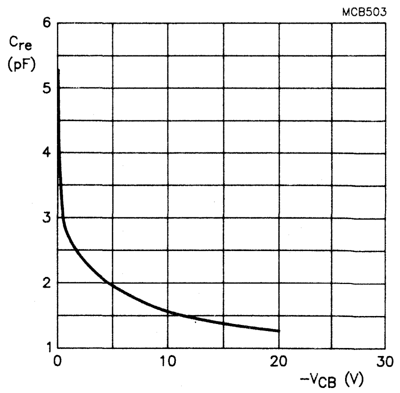

Fig.3 Feedback capacitance as a function of collector-base voltage; f = 1 MHz; T_{amb} = 25 °C; typical values.

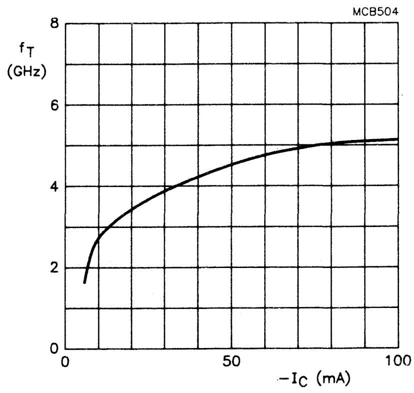

Fig.4 Transition frequency as a function of collector current; $-V_{CE}$ = 10 V; T_{amb} = 25 °C; typical values.

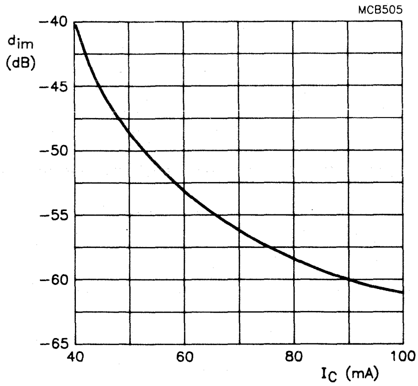

Fig.5 Intermodulation distortion as a function of collector current; $-V_{CE} = 10$ V; $V_o = 650$ mV; $T_{amb} = 25$ °C; $f_{(p+q-r)} = 443.25$ MHz.

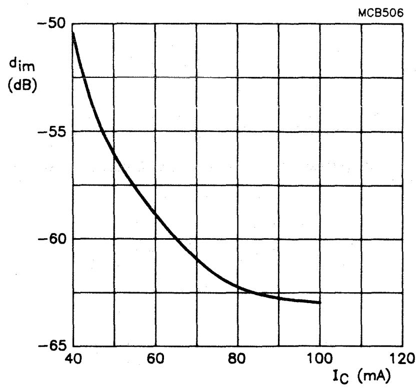

Fig.6 Intermodulation distortion as a function of collector current; $-V_{CE} = 10$ V; $V_o = 600$ mV; $T_{amb} = 25$ °C; $f_{(p+q-r)} = 848.25$ MHz.

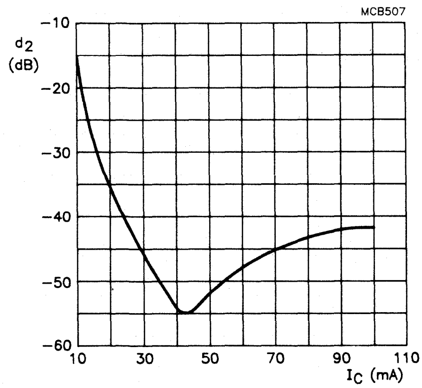

Fig.7 Second order beat as a function of collector current; $-V_{CE} = 10$ V; $V_o = 50$ dBmV; $T_{amb} = 25$ °C; $f_{(p+q)} = 450$ MHz.

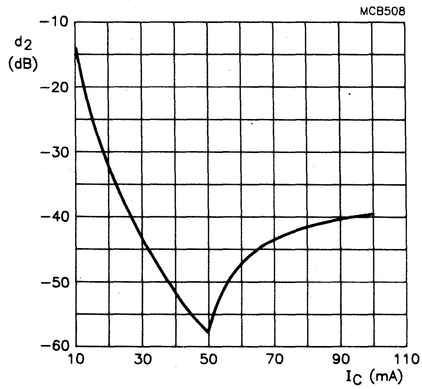

Fig.8 Second order beat as a function of collector current; $-V_{CE} = 10$ V; $V_o = 50$ dBmV; $T_{amb} = 25$ °C; $f_{(p+q)} = 810$ MHz.

NPN 12 GHz WIDEBAND TRANSISTOR

BFG33 is an npn transistor in a microminiature SOT143 envelope with double emitter bonding. The device contains a BFQ33 crystal and is for use in circuits using SMD technology.

Features

- Extremely high transition frequency
- Very low noise at high frequencies.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	9.0	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7.0	V
Collector current (DC)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate 8 x 10 x 0.7 mm	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 1.5 GHz I_C = 14 mA; V_{CE} = 5 V; T_{amb} = 25 °C	f_T	typ.	12	GHz
Noise figure at optimum source impedance I_C = 5 mA; V_{CE} = 5 V; f = 2 GHz; T_{amb} = 25 °C	F	typ.	2.5	dB

MECHANICAL DATA

SOT143.

BFG33 Marking code: V6
BFG33X Marking code: V16

Pinning

BFG33
1 = collector
2 = base
3, 4 = emitter

BFG33X
1 = collector
2, 4 = emitter
3 = base

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	9.0	V
Collector-emitter voltage (open base)	V_{CEO}	max.	7.0	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.0	V
Collector current (DC)	I_C	max.	20	mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate 8 x 10 x 0.7 mm	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−65 to 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient mounted on ceramic substrate 8 x 10 x 0.7 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50	nA
DC current gain $I_C = 14$ mA; $V_{CE} = 5$ V	h_{FE}	min.	50	
Transition frequency at f = 1.5 GHz $I_C = 14$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ °C	f_T	typ.	12	GHz
Noise figure at optimum source impedance $I_C = 5$ mA; $V_{CE} = 5$ V; f = 2 GHz; $T_{amb} = 25$ °C	F	typ.	2.5	dB
Maximum unilateral power gain $I_C = 14$ mA; $V_{CE} = 5$ V; f = 2 GHz; $T_{amb} = 25$ °C; $S_{12} = 0$				
$G_{UM} = 10 \log \frac{\lvert S_{21}\rvert^2}{(1 - \lvert S_{11}\rvert^2)(1 - \lvert S_{22}\rvert^2)}$	G_{UM}	typ.	10.5	dB

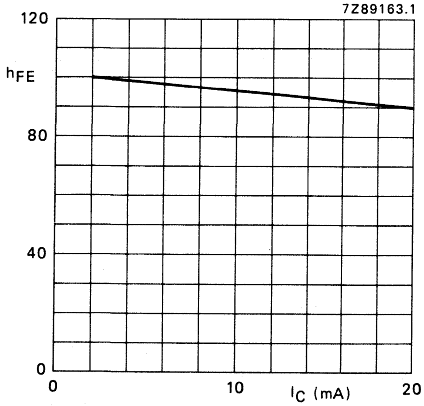

Fig.1 Gain as a function of collector current.

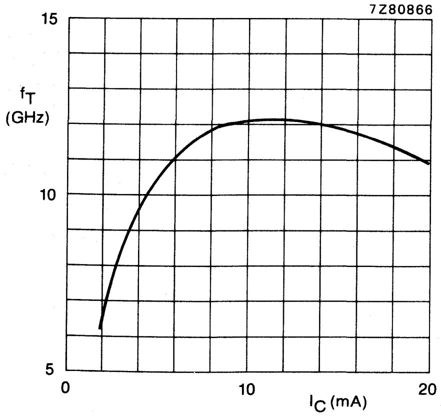

Fig.2 Transitional frequency as a function of collector current.

Philips Components

Data sheet	
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date of issue	April 1991

BFG35

NPN 4 GHz wideband transistor

DESCRIPTION

NPN planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The device features high output voltage capabilities.
Its pnp complement is the BFG55.

MECHANICAL DATA

Plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

PIN CONFIGURATION

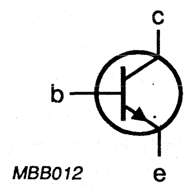


Fig.1 Pin configuration

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	25	V
V_{CEO}	collector-emitter voltage	open base	-	-	18	V
I_C	collector current (DC)		-	-	150	mA
P_{tot}	total power dissipation	T_{case} = 135 °C; note 1	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	-	-	
f_T	transition frequency	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	4.0	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V	-	15	-	dB
G_{UM}	maximum power gain	f = 800 MHz; I_C = 100 mA; V_{CE} = 10 V	-	11	-	dB
V_o	output voltage	d_{im} = −60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	-	750	-	mV

Note

1. T_{case} temperature measured on soldering point of collector tab.

NPN 4 GHz wideband transistor

BFG35

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG35	SOT223	bulk	500
BFG35	SOT223	12 mm reel	1000

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	25	V
V_{CEO}	collector-emitter voltage	open base	-	18	V
V_{EBO}	emitter-base voltage	open collector	-	2	V
I_C	collector current (DC)		-	150	mA
P_{tot}	total power dissipation	T_{case} = 135 °C	-	1	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}c}$	from junction to case	40	K/W

NPN 4 GHz wideband transistor BFG35

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10$ V	-	-	1	μA
h_{FE}	DC current gain	$I_C = 100$ mA; $V_{CE} = 10$ V	25	-	-	
C_c	collector capacitance	f = 1 MHz; $I_E = i_e = 0$; $V_{CB} = 10$ V	-	2.0	-	pF
C_e	emitter capacitance	f = 1 MHz; $I_C = i_c = 0$; $V_{EB} = 0.5$ V	-	10.0	-	pF
C_{re}	feedback capacitance	f = 1 MHz; $I_C = 0$; $V_{CE} = 10$ V	-	1.2	-	pF
f_T	transition frequency	f = 500 MHz; $I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	-	4.0	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; $I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C	-	15	-	dB
G_{UM}	maximum power gain	f = 800 MHz; $I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C;	-	11	-	dB
V_o	output voltage	see note 1	-	750	-	mV
V_o	output voltage	see note 2	-	800	-	mV

Note

1. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 100$ mA;
   $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_o$ at $d_{im} = -60$ dB;
   $f_p = 795.25$ MHz; $V_q = V_o - 6$ dB;
   $f_q = 803.25$ MHz; $V_r = V_o - 6$ dB;
   $f_r = 805.25$ MHz; Measured at $f_{(p+q-r)} = 793.25$ MHz.

2. $d_{im} = -60$ dB (DIN 45004B); $T_{amb} = 25$ °C; $I_C = 100$ mA;
   $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $V_p = V_o$ at $d_{im} = -60$ dB;
   $f_p = 445.25$ MHz; $V_q = V_o - 6$ dB;
   $f_q = 453.25$ MHz; $V_r = V_o - 6$ dB;
   $f_r = 455.25$ MHz; Measured at $f_{(p+q-r)} = 443.25$ MHz.

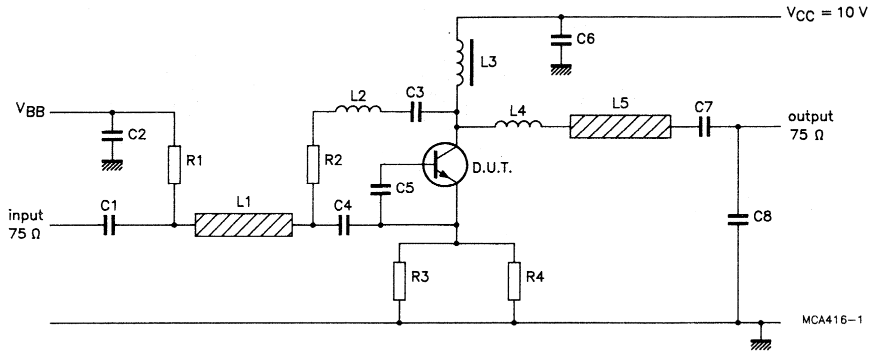


Fig.2 Intermodulation and second harmonic test circuit.

List of components:

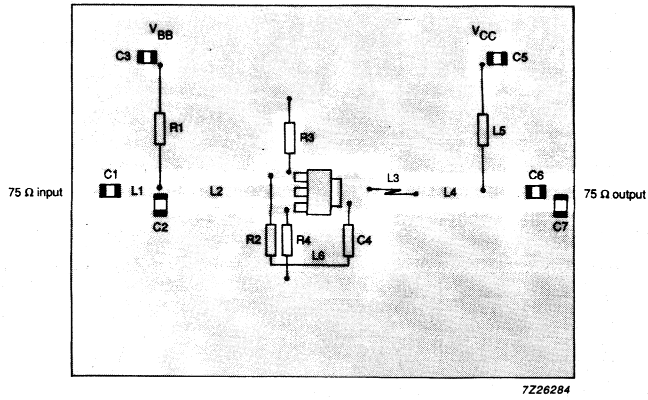
R1 = 10 kΩ metal film resistor (cat. no. 2322 180 73103)
R2 = 200 Ω metal film resistor (cat. no. 2322 180 73201)
R3 = R4 = 27 Ω metal film resistor (cat. no. 2322 180 73279)

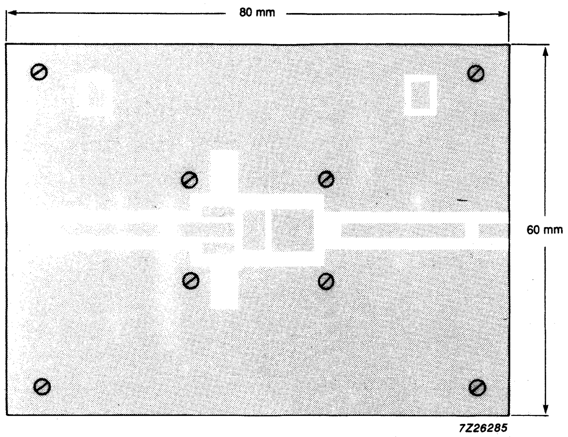
C1 = C3 = C5 = C6 = 10 nF ceramic multilayer capacitor (cat. no. 2222 590 08627)
C2 = C7 = 1 pF ceramic multilayer capacitor (cat. no. 2222 851 12108)
C4 = 10 nF miniature ceramic plate capacitor (cat. no. 2222 629 08103)

L1 = 75 Ω microstripline (L = 7 mm; W = 2.5 mm)
L2 = 75 Ω microstripline (L = 22 mm; W = 2.5 mm)
L3 = 1.5 turn Cu wire (0.4 mm), internal diameter 3 mm, winding pitch 1 mm
L4 = 75 Ω microstripline (L = 19 mm; W = 2.5 mm)
L5 = 5 μH Ferroxcube choke (cat. no. 3122 108 20153)
L6 = 30 mm Cu-wire (0.4 mm; L ≈ 24 nH)

The circuit has been built on a double Cu clad printed circuit board with PTFE. dielectric (ε_r = 2.2); thickness 1/16 inch; thickness of copper-sheet 2 x 35 μm; see Figs 3a, 3b and 3c.

The components R2, L6, C5 and L3 are mounted on the underside of the PCB.





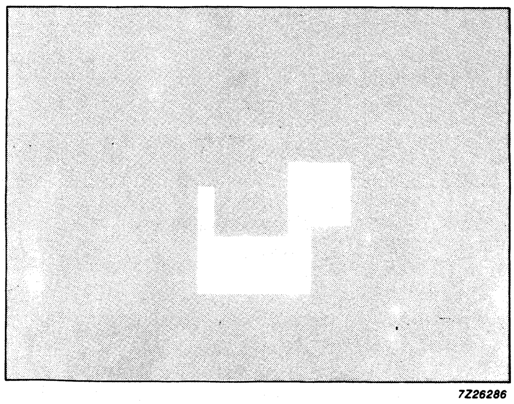


Fig.3 Intermodulation test circuit printed circuit board.

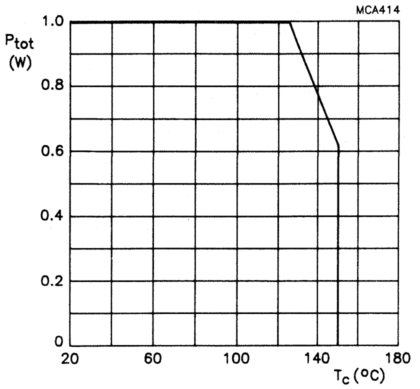


Fig.4 Power derating curve.

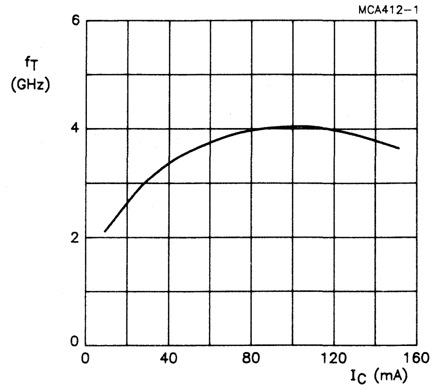


Fig.5 Transition frequency as a function of collector current; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

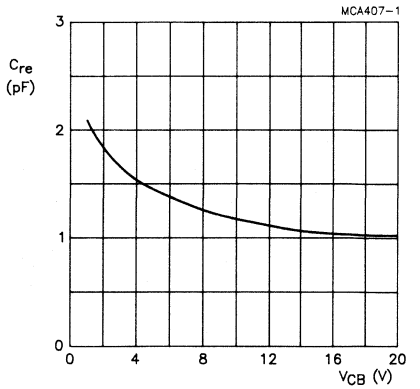


Fig.6 Feedback capacitance as a function of collector-base voltage; I_E = 0; f = 1 MHz; T_j = 25 °C.

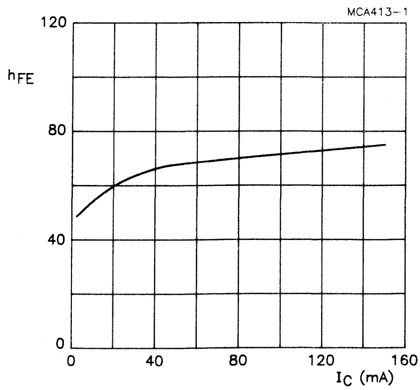


Fig.7 DC current gain as a function of collector current; V_{CE} = 10 V; T_j = 25 °C.

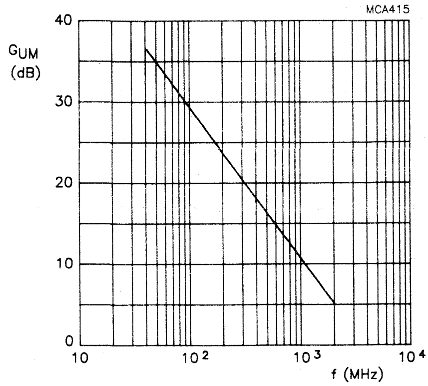


Fig.8 Maximum gain as a function of frequency; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

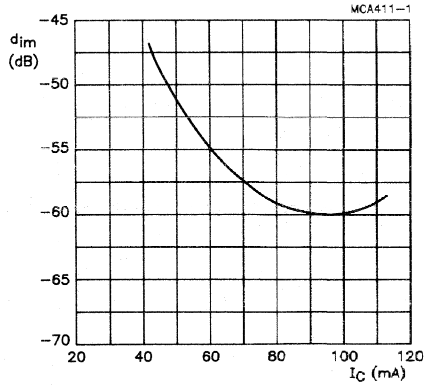


Fig.9 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 800 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C; typical values.

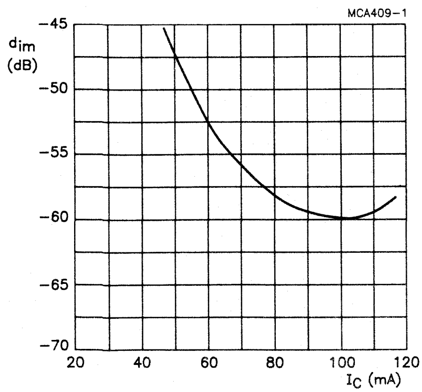


Fig.10 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 750 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C; typical values.

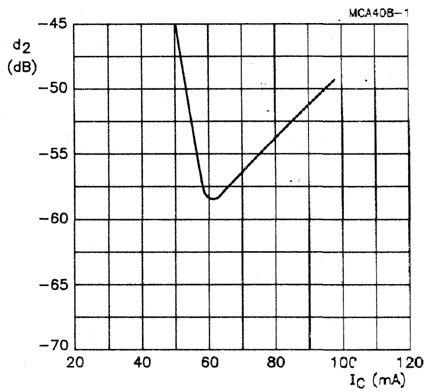


Fig.11 Second order beat as a function of collector current; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C; typical values.

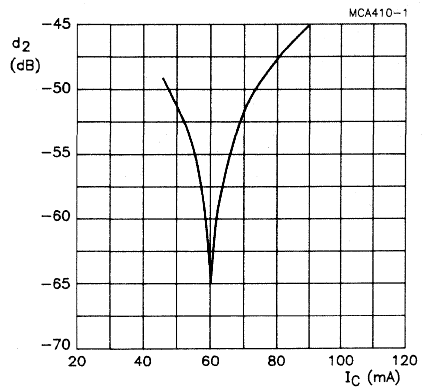


Fig.12 Second order beat as a function of collector current; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; typical values.

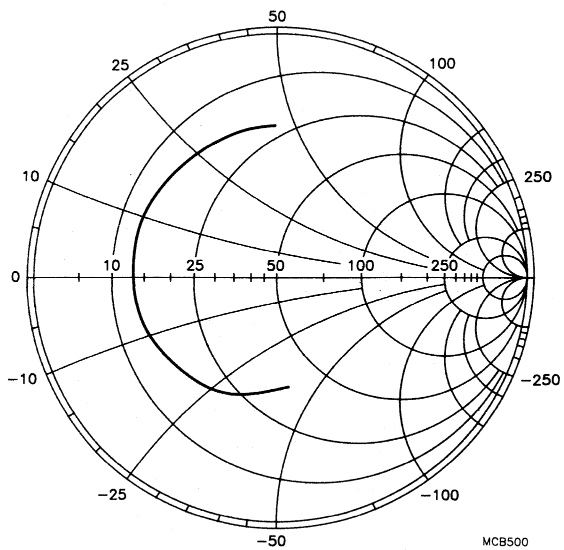


Fig.13 Input reflection coefficient, S_{11}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

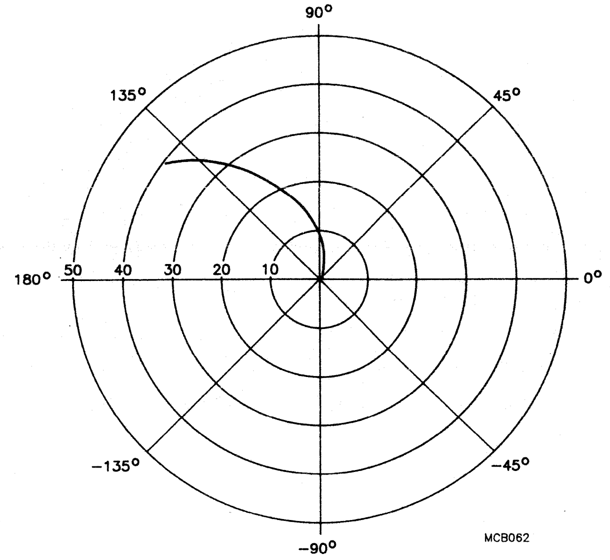


Fig.14 Forward transmission coefficient, S_{21}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

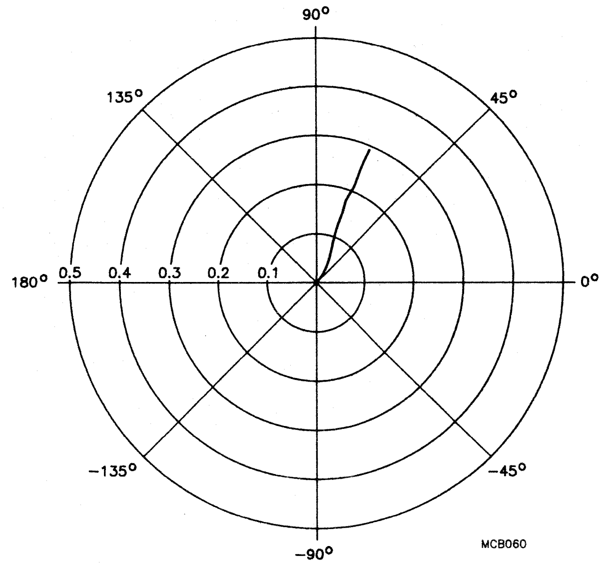


Fig.15 Reverse transmission coefficient, S_{12}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

NPN 4 GHz wideband transistor BFG35

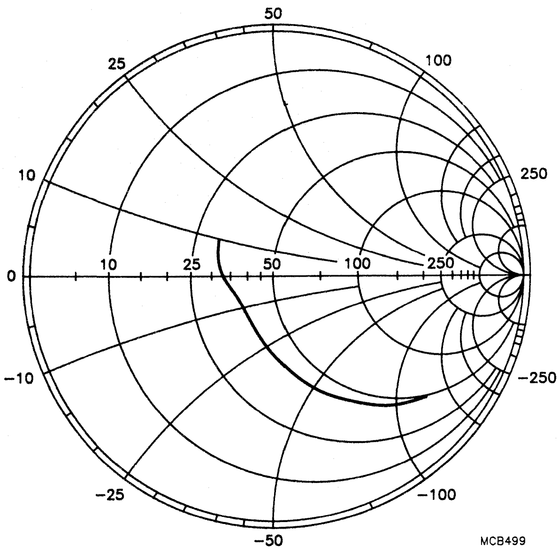


Fig.16 Output reflection coefficient, S_{22}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

NPN 4 GHz wideband transistor BFG35

S-Parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

I_C (mA)	f (MHz)	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} (dB)
10	40	0.60/- 53.6	17.3/153.9	0.02/71.2	0.91/- 20.3	34.4
	100	0.63/-104.6	12.6/127.3	0.04/49.2	0.70/- 38.4	27.0
	200	0.66/-144.8	7.7/105.2	0.05/39.5	0.48/- 50.4	21.4
	500	0.68/-174.0	3.4/ 77.4	0.06/48.9	0.34/- 65.4	13.8
	800	0.68/ 151.8	2.1/ 61.1	0.09/64.5	0.33/- 84.2	9.7
	1000	0.68/ 139.9	1.7/ 51.0	0.11/71.0	0.33/- 99.4	7.8
	1200	0.68/ 128.8	1.4/ 42.6	0.13/77.8	0.34/-115.2	5.9
	1500	0.67/ 112.8	1.1/ 33.5	0.18/78.3	0.36/-138.8	3.5
	2000	0.66/ 89.5	0.7/ 22.0	0.28/77.1	0.42/-175.3	0.5
20	40	0.49/- 66.9	24.3/150.1	0.02/68.7	0.87/- 27.3	35.0
	100	0.56/-119.1	16.5/123.2	0.04/52.2	0.60/- 50.5	28.0
	200	0.61/-153.9	9.7/102.7	0.05/46.3	0.38/- 65.8	22.5
	500	0.63/ 170.6	4.1/ 78.3	0.07/59.9	0.22/- 85.3	14.8
	800	0.63/ 150.4	2.6/ 63.7	0.10/68.2	0.21/-103.9	10.8
	1000	0.64/ 139.2	2.1/ 54.5	0.12/70.3	0.21/-118.3	8.9
	1200	0.64/ 128.5	1.7/ 47.0	0.15/72.7	0.22/-132.5	7.0
	1500	0.63/ 113.7	1.4/ 37.7	0.19/73.7	0.26/-153.5	5.2
	2000	0.63/ 91.0	0.9/ 25.1	0.28/72.6	0.33/ 173.4	2.1
50	40	0.43/- 80.9	31.7/145.8	0.02/62.5	0.82/- 35.3	35.7
	100	0.53/-130.9	20.0/118.8	0.03/51.7	0.52/- 64.5	28.8
	200	0.59/-160.8	11.3/100.3	0.04/53.5	0.31/- 86.6	23.3
	500	0.60/ 168.2	4.7/ 78.8	0.08/64.3	0.18/-119.6	15.6
	800	0.61/ 149.2	3.0/ 65.5	0.11/69.3	0.17/-139.1	11.6
	1000	0.61/ 138.6	2.4/ 57.4	0.14/69.8	0.17/-155.0	9.6
	1200	0.61/ 128.5	1.9/ 50.6	0.16/70.7	0.19/-165.9	7.9
	1500	0.61/ 114.1	1.6/ 41.6	0.21/68.9	0.22/ 179.2	6.2
	2000	0.61/ 91.9	1.1/ 29.7	0.28/67.3	0.29/ 154.6	3.2
70	40	0.44/- 83.3	33.6/144.3	0.02/65.8	0.80/- 37.8	35.9
	100	0.53/-132.9	20.7/117.5	0.03/53.1	0.50/- 68.4	29.0
	200	0.58/-162.0	11.6/ 99.5	0.04/55.3	0.30/- 92.3	23.5
	500	0.59/ 167.7	4.8/ 78.7	0.08/66.2	0.18/-127.6	15.7
	800	0.60/ 149.2	3.0/ 65.7	0.12/67.6	0.16/-148.8	11.7
	1000	0.60/ 138.6	2.4/ 57.1	0.14/68.7	0.17/-160.7	9.8
	1200	0.60/ 128.4	2.0/ 51.2	0.17/70.6	0.19/-172.3	8.0
	1500	0.60/ 114.2	1.6/ 42.0	0.21/68.2	0.23/ 172.8	6.3
	2000	0.61/ 92.1	1.1/ 30.7	0.29/67.0	0.29/ 149.1	3.4
100	40	0.45/- 85.7	35.2/142.8	0.02/65.1	0.78/- 40.4	36.0
	100	0.53/-134.7	21.2/116.1	0.03/51.6	0.48/- 71.7	29.1
	200	0.58/-163.0	11.8/ 98.6	0.04/54.1	0.29/- 97.7	23.5
	500	0.59/ 167.1	4.9/ 78.6	0.08/65.5	0.17/-134.9	15.8
	800	0.60/ 148.8	3.0/ 65.4	0.12/67.7	0.17/-154.8	11.8
	1000	0.60/ 138.2	2.4/ 57.7	0.14/68.3	0.18/-167.5	9.8
	1200	0.60/ 128.4	2.0/ 51.2	0.17/69.9	0.19/-178.9	8.1
	1500	0.60/ 113.8	1.6/ 42.3	0.21/67.7	0.22/ 168.5	6.3
	2000	0.61/ 92.0	1.1/ 31.1	0.29/65.7	0.29/ 146.1	3.4

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG55
PNP 4 GHz wideband transistor

FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability
- Complementary npn type BFG35.

DESCRIPTION

PNP planar epitaxial transistor intended for wideband amplifier applications.
The BFG55 is mounted in a SOT223 plastic envelope.

MECHANICAL DATA

Plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	-	-	25	V
$-V_{CEO}$	collector-emitter voltage	open base	-	-	18	V
$-I_C$	collector current (DC)		-	-	150	mA
P_{tot}	total power dissipation	T_{case} = 135 °C; note 1	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	$-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	25	-	-	
f_T	transition frequency	f = 500 MHz; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	4	-	GHz
G_{UM}	maximum power gain	f = 800 MHz; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	11	-	dB
V_o	output voltage	d_{im} = −60 dB; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 848.25 MHz	-	750	-	mV

Note

1. T_{case} temperature measured on soldering point of collector tab.

PNP 4 GHz wideband transistor BFG55

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG55	SOT223	bulk	500
BFG55	SOT223	12 mm reel	1000

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$-V_{CBO}$	collector-base voltage	open emitter	-	25	V
$-V_{CEO}$	collector-emitter voltage	open base	-	18	V
$-V_{EBO}$	emitter-base voltage	open collector	-	2	V
$-I_C$	collector current (DC)		-	150	mA
P_{tot}	total power dissipation	T_{case} = 135 °C	-	1	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}c}$	from junction to case	35	K/W

PNP 4 GHz wideband transistor BFG55

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$-V_{(BR)CBO}$	collector-base breakdown voltage	open emitter $-I_C$ = 0.1 mA	25	-	-	V
$-V_{(BR)CEO}$	collector-emitter breakdown voltage	open base $-I_C$ = 10 mA	18	-	-	V
$-V_{(BR)EBO}$	emitter-base breakdown voltage	open collector $-I_E$ = 0.1 mA	3	-	-	V
$-I_{CBO}$	collector cut-off current	$-I_E$ = 0; $-V_{CB}$ = 10 V	-	-	1	µA
h_{FE}	DC current gain	$-I_C$ = 100 mA; $-V_{CE}$ = 10 V	-	25	-	
C_c	collector-base capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{CB}$ = 10 V	-	2.3	-	pF
C_e	emitter-base capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{EB}$ = 10 V	-	8	-	pF
C_{re}	feedback capacitance	f = 1 MHz; $-I_C$ = 0; $-V_{CE}$ = 10 V	-	1.7	-	pF
f_T	transition frequency	f = 500 MHz; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	4	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C	-	15	-	dB
G_{UM}	maximum power gain	f = 800 MHz; $-I_C$ = 100 mA; $-V_{CE}$ = 10 V; T_{amb} = 25 °C;	-	11	-	dB
V_o	output voltage	see note 1	-	750	-	mV
V_o	output voltage	see note 2	-	800	-	mV

Note

1. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; $-I_C$ = 100 mA;
   $-V_{CE}$ = 10 V; R_L = 75 Ω;
   $V_p = V_o$ at d_{im} = −60 dB; f_p = 850.25 MHz;
   $V_q = V_o$ −6 dB; f_q = 858.25 MHz;
   $V_r = V_o$ −6 dB; f_r = 860.25 MHz;
   Measured at $f_{(p+q+r)}$ = 848.25 MHz.

2. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; $-I_C$ = 100 mA;
   $-V_{CE}$ = 10 V; R_L = 75 Ω;
   $V_p = V_o$ at d_{im} = −60 dB; f_p = 445.25 MHz;
   $V_q = V_o$ −6 dB; f_q = 453.25 MHz;
   $V_r = V_o$ −6 dB; f_r = 455.25 MHz;
   Measured at $f_{(p+q-r)}$ = 443.25 MHz.

PNP 4 GHz wideband transistor BFG55

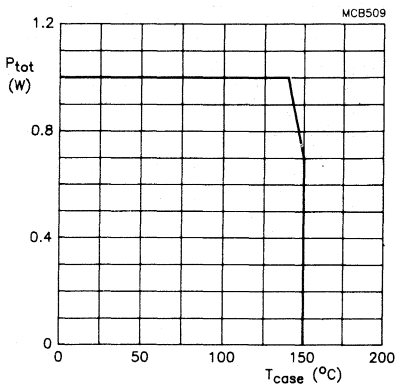


Fig.1 Power derating curve.

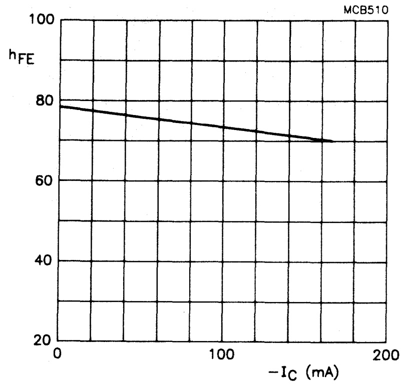


Fig.2 DC current gain as a function of collector current; $-V_{CE}$ = 10 V; T_{amb} = 25 °C.

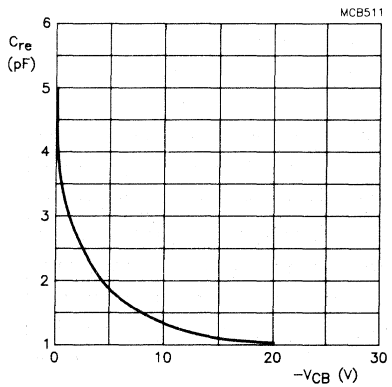


Fig.3 Feedback capacitance as a function of collector-base voltage; f = 1 MHz; T_{amb} = 25 °C; typical values.

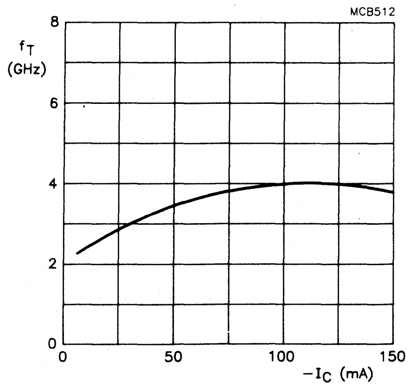


Fig.4 Transition frequency as a function of collector current; $-V_{CE}$ = 10 V; T_{amb} = 25 °C; typical values.

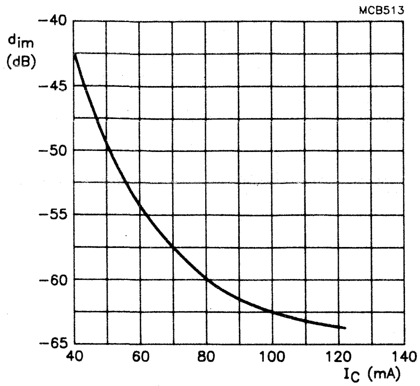


Fig.5 Intermodulation distortion as a function of collector current; $-V_{CE}$ = 10 V; V_o = 650 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 443.25 MHz.

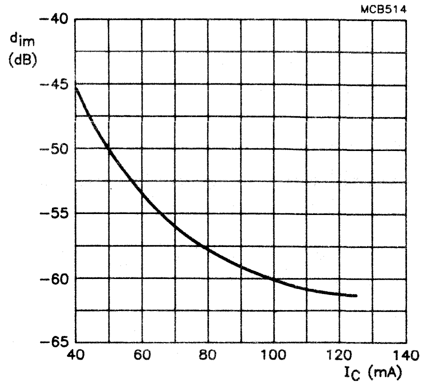


Fig.6 Intermodulation distortion as a function of collector current; $-V_{CE}$ = 10 V; V_o = 600 mV; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 848.25 MHz.

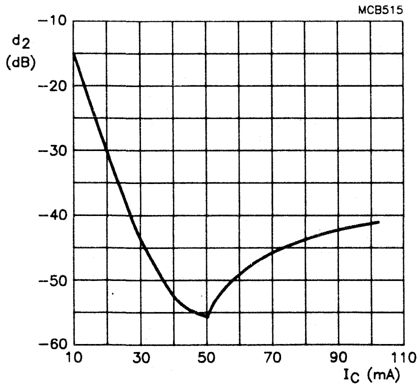


Fig.7 Second order beat as a function of collector current; $-V_{CE}$ = 10 V; V_o = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 450 MHz.

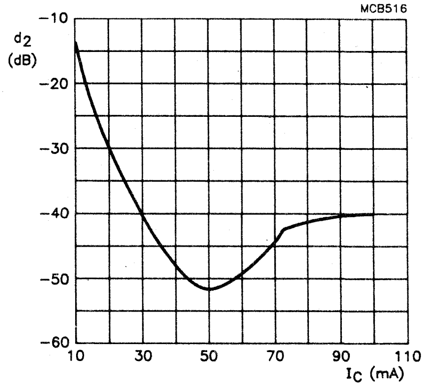


Fig.8 Second order beat as a function of collector current; $-V_{CE}$ = 10 V; V_o = 50 dBmV; T_{amb} = 25 °C; $f_{(p+q)}$ = 810 MHz.

NPN 7 GHz WIDEBAND TRANSISTOR

NPN transistor in a four-lead dual emitter plastic envelope (SOT143). A version with reverse pinning is available on request. It is designed for wideband application in the GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optical systems. The device features a very high transition frequency, high gain and a very low noise figure up to high frequencies.

QUICK REFERENCE DATA

Collector-base voltage	V_{CBO}	max.	20	V
Collector-emitter voltage	V_{CEO}	max.	10	V
Collector current (DC)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
DC current gain I_C = 15 mA; V_{CE} = 5 V	h_{FE}	min.	60	
		typ.	100	
Transition frequency at f = 500 MHz I_C = 15 mA; V_{CE} = 8 V	f_T	typ.	7.5	GHz
Maximum unilateral power gain at f = 2 GHz I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C	G_{UM}	typ.	10.0	dB
Noise figure at f = 2 GHz Z_S = 60 Ω; T_{amb} = 25 °C				
I_C = 5 mA; V_{CE} = 8 V	F	typ.	2.5	dB
I_C = 15 mA; V_{CE} = 8 V	F	typ.	3.0	dB

MECHANICAL DATA

SOT143

Marking code:

BFG67 : V3
BFG67X: V12

Pinning:

BFG67	BFG67X
1 = collector	1 = collector
2 = base	2,4 = emitter
3,4 = emitter	3 = base

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	10	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2.5	V
Collector current (DC)	I_C	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	50	nA
DC current gain $I_C = 15$ mA; $V_{CE} = 5$ V	h_{FE}	min.	60	
		typ.	100	
Transition frequency at f = 500 MHz $I_C = 15$ mA; $V_{CE} = 8$ V	f_T	typ.	7.5	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 8$ V	C_c	typ.	0.7	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	1.3	pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 8$ V	C_{re}	typ.	0.5	pF

Maximum unilateral power gain (S_{12} assumed to be zero)

$$G_{UM} = 10 \log \frac{|S_{21}|^2}{[1-|S_{11}|^2]\ [1-|S_{22}|^2]}$$

at $I_C = 15$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	G_{UM}	typ.	10.0	dB

Noise figures at f = 800 MHz; Z_S = opt.; $T_{amb} = 25$ °C; $V_{CE} = 8$ V

$I_C = 5$ mA	F	typ.	0.8	dB
$I_C = 15$ mA	F	typ.	1.5	dB

Noise figures at f = 2 GHz; $Z_S = 60\ \Omega$; $T_{amb} = 25$ °C; $V_{CE} = 8$ V

$I_C = 5$ mA	F	typ.	2.5	dB
$I_C = 15$ mA	F	typ.	3.0	dB

s-parameters (common emitter) at V_{CE} = 8 V; T_{amb} = 25 °C; typical values.

I_C mA	f MHz	S_{11} M / Φ	S_{21} M / Φ	S_{12} M / Φ	S_{22} M / Φ	G_{UM} dB
	40	0,96/ −6,8°	5,8/177,8°	0,01/ 84,5°	0,99/ −3,2°	44,1
	100	0,98/ −20,8°	5,6/165,8°	0,03/ 77,5°	1,01/ −10,0°	46,5
	200	0,89/ −40,1°	5,1/153,2°	0,05/ 66,8°	0,91/ −19,0°	28,7
	500	0,81/ −89,3°	4,3/121,5°	0,09/ 43,4°	0,79/ −38,5°	21,5
2	800	0,68/−123,0°	3,3/102,0°	0,11/ 33,8°	0,67/ −50,0°	15,7
	1000	0,64/−139,9°	2,8/ 89,8°	0,11/ 28,0°	0,65/ −54,5°	13,7
	1200	0,60/−157,3°	2,3/ 81,1°	0,11/ 25,8°	0,62/ −61,7°	11,5
	1500	0,59/−173,3°	2,0/ 71,8°	0,11/ 27,4°	0,55/ −69,3°	9,5
	2000	0,57/+161,7°	1,5/ 56,3°	0,10/ 32,2°	0,54/ −85,8°	6,7
	40	0,91/ −10,9°	13,5/174,8°	0,01/ 83,3°	0,98/ −5,9°	44,2
	100	0,91/ −30,3°	12,6/159,5°	0,03/ 72,2°	0,96/ −17,0°	40,9
	200	0,79/ −56,3°	10,6/143,5°	0,04/ 60,3°	0,81/ −29,5°	29,3
	500	0,64/−115,9°	7,4/109,8°	0,07/ 41,4°	0,58/ −50,8°	21,5
5	800	0,55/−145,5°	5,2/ 93,5°	0,08/ 39,9°	0,48/ −59,5°	17,1
	1000	0,53/−161,4°	4,2/ 84,0°	0,08/ 39,1°	0,44/ −62,2°	15,0
	1200	0,52/−176,5°	3,5/ 77,8°	0,08/ 41,2°	0,42/ −67,1°	13,1
	1500	0,51/+172,2°	2,9/ 69,1°	0,09/ 44,6°	0,38/ −75,7°	11,3
	2000	0,50/+149,8°	2,2/ 56,7°	0,11/ 49,8°	0,38/ −89,5°	8,7
	40	0,85/ −16,1°	23,5/170,6°	0,01/ 80,1°	0,96/ −9,7°	43,8
	100	0,81/ −42,6°	21,3/151,8°	0,02/ 67,2°	0,89/ −25,2°	38,0
	200	0,67/ −76,3°	16,6/133,0°	0,04/ 55,5°	0,68/ −40,0°	29,6
	500	0,54/−137,5°	9,5/101,5°	0,05/ 45,7°	0,42/ −60,2°	21,9
10	800	0,49/−161,8°	6,3/ 88,5°	0,07/ 49,2°	0,35/ −67,0°	17,7
	1000	0,49/−175,2°	5,1/ 80,5°	0,07/ 50,6°	0,32/ −68,9°	15,8
	1200	0,49/+171,5°	4,2/ 75,8°	0,08/ 53,4°	0,29/ −72,5°	13,9
	1500	0,47/+163,5°	3,5/ 67,5°	0,09/ 55,3°	0,28/ −82,1°	12,3
	2000	0,47/+142,5°	2,6/ 56,8°	0,12/ 57,7°	0,29/ −94,5°	9,6
	40	0,80/ −20,1°	31,0/167,8°	0,01/ 76,4°	0,94/ −12,2°	43,5
	100	0,74/ −51,8°	26,9/146,8°	0,02/ 64,1°	0,83/ −30,3°	37,2
	200	0,60/ −89,4°	19,9/126,7°	0,03/ 54,0°	0,60/ −45,5°	29,8
	500	0,51/−147,5°	10,3/ 98,0°	0,05/ 49,7°	0,35/ −64,9°	22,1
15	800	0,47/−168,5°	6,7/ 86,5°	0,06/ 54,6°	0,29/ −70,8°	18,1
	1000	0,47/+179,2°	5,4/ 79,3°	0,07/ 55,9°	0,27/ −72,8°	16,1
	1200	0,48/+166,5°	4,4/ 75,0°	0,08/ 58,4°	0,24/ −75,8°	14,3
	1500	0,46/+160,0°	3,7/ 67,0°	0,10/ 59,2°	0,24/ −86,0°	12,5
	2000	0,45/+139,5°	2,7/ 56,8°	0,12/ 60,2°	0,25/ −97,8°	10,0
	40	0,76/ −23,8°	37,2/165,4°	0,01/ 75,6°	0,92/ −14,3°	43,3
	100	0,69/ −60,0°	31,2/142,6°	0,02/ 61,7°	0,78/ −34,3°	36,8
	200	0,55/ −99,6°	21,8/122,5°	0,03/ 53,6°	0,54/ −49,5°	29,8
	500	0,49/−152,5°	10,6/ 96,0°	0,04/ 53,0°	0,31/ −68,0°	22,2
20	800	0,46/−172,9°	7,0/ 85,0°	0,06/ 58,1°	0,26/ −73,3°	18,2
	1000	0,46/+175,9°	5,5/ 78,3°	0,07/ 59,3°	0,24/ −75,3°	16,1
	1200	0,47/+163,5°	4,6/ 74,3°	0,08/ 61,5°	0,21/ −78,3°	14,5
	1500	0,45/+157,9°	3,8/ 66,4°	0,10/ 61,4°	0,22/ −88,9°	12,8
	2000	0,45/+137,8°	2,8/ 56,7°	0,12/ 61,7°	0,22/−100,2°	10,2

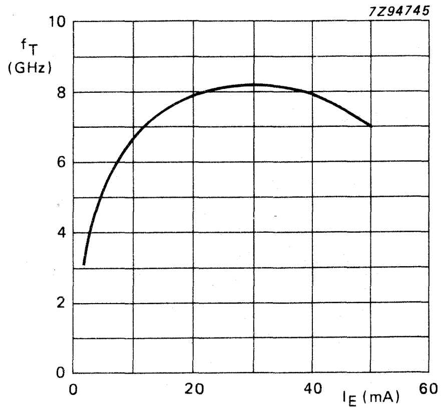


Fig.1 V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C; typical values.

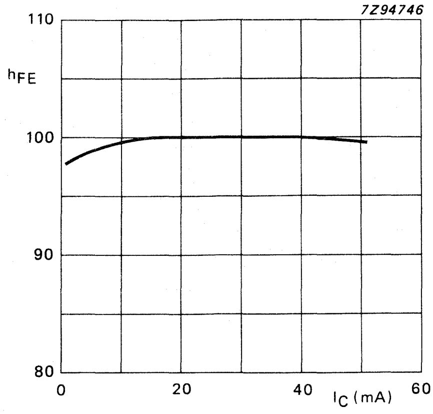


Fig.2 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

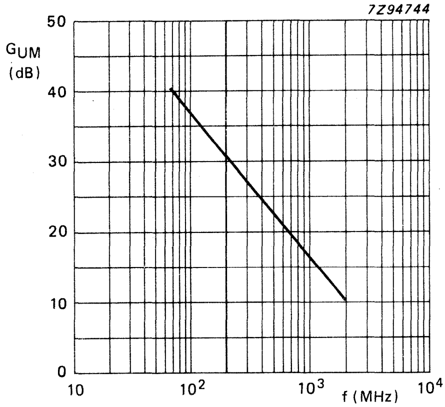


Fig.3 V_{CE} = 8 V; I_C = 15 mA; T_{amb} = 25 °C; typical values.

NPN 5 GHz WIDEBAND TRANSISTOR

NPN transistor in a four-lead dual-emitter SOT143 envelope. The device is primarily intended for use in vhf and uhf wideband amplifiers and features low noise and high power gain.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Collector current (DC)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
DC current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min.	40	
		typ.	90	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5.0	GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 10 V	C_{re}	typ.	0.35	pF
Noise figure at f = 800 MHz I_C = 4 mA; V_{CE} = 10 V; Z_S = opt.	F	typ.	1.8	dB
Maximum unilateral power gain I_C = 14 mA; V_{CE} = 10 V f = 800 MHz	G_{UM}	typ.	17.5	dB
f = 2 GHz		typ.	9.5	dB

MECHANICAL DATA

SOT143

Marking code:

BFG92A: P8
BFG92AX: V14

Pinning

BFG92A

1 = collector
2 = base
3, 4 = emitter

BFG92AX

1 = collector
2, 4 = emitter
3 = base

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20	V
Collector-emitter voltage (open base)	V_{CEO}	max.	15	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (DC)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C and mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; V_{CB} = 10 V	I_{CBO}	max.	50	nA
DC current gain I_C = 14 mA; V_{CE} = 10 V	h_{FE}	min.	40	
		typ.	90	
Transition frequency at f = 500 MHz I_C = 14 mA; V_{CE} = 10 V	f_T	typ.	5.0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	0.6	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0.5 V	C_e	typ.	1.2	pF
Feedback capacitance at f = 1 MHz $I_C = 0$; V_{CE} = 10 V	C_{re}	typ.	0.35	pF

Maximum unilateral power gain (S_{12} assumed to be zero)

$$G_{UM} = 10 \log \frac{|S_{21}|^2}{[1-|S_{11}|^2]\,[1-|S_{22}|^2]}$$

I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C: f = 800 MHz	G_{UM}	typ.	17.5	dB
f = 2 GHz	G_{UM}	typ.	9.5	dB
Noise figure at f = 800 MHz and T_{amb} = 25 °C I_C = 4 mA; V_{CE} = 10 V; Z_S = opt.	F	typ.	1.8	dB

s-parameters (common emitter) at V_{CE} = 5 V; T_{amb} = 25 °C; typical values

I_C mA	f MHz	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} dB
	40	0,87/ −9,1°	7,0/174,7°	0,01/ 82,1°	1,00/ −2,8°	50,0
	100	0,88/ −26,2°	6,9/162,5°	0,02/ 75,2°	1,01/ −9,0°	39,6
	200	0,79/ −49,8°	6,1/148,0°	0,04/ 65,0°	0,92/−16,6°	28,2
	500	0,68/−102,5°	4,6/115,2°	0,07/ 44,4°	0,81/−30,0°	20,6
2	800	0,59/−153,5°	3,2/ 97,7°	0,07/ 39,3°	0,73/−39,7°	15,3
	1000	0,56/−149,0°	2,7/ 86,8°	0,08/ 36,6°	0,73/−44,0°	13,6
	1200	0,54/−164,7°	2,2/ 78,4°	0,08/ 36,1°	0,72/−50,8°	11,5
	1500	0,53/−178,6°	1,9/ 70,8°	0,08/ 40,6°	0,63/−57,9°	9,0
	2000	0,51/ 158,1°	1,4/ 55,7°	0,08/ 46,3°	0,63/−76,2°	6,3
	40	0,74/ −14,0°	14,4/172,1°	0,01/ 80,4°	0,99/ −4,8°	45,2
	100	0,73/ −37,7°	13,8/156,7°	0,02/ 71,0°	0,98/−13,8°	39,6
	200	0,64/ −68,7°	11,4/138,8°	0,03/ 60,1°	0,84/−22,8°	28,7
	500	0,55/−126,5°	7,0/106,5°	0,05/ 46,3°	0,66/−35,0°	21,0
5	800	0,50/−152,7°	4,7/ 91,5°	0,06/ 47,4°	0,59/−42,8°	16,6
	1000	0,49/−166,7°	3,9/ 82,7°	0,06/ 47,8°	0,59/−45,9°	14,8
	1200	0,48/ 179,7°	3,2/ 76,1°	0,07/ 49,8°	0,58/−51,3°	12,9
	1500	0,48/ 169,9°	2,6/ 69,0°	0,08/ 54,2°	0,51/−58,7°	10,8
	2000	0,48/ 148,9°	1,9/ 56,0°	0,09/ 57,5°	0,51/−75,9°	8,2
	40	0,59/ −21,1°	23,6/168,8°	0,01/ 73,4°	0,98/ −7,3°	44,3
	100	0,57/ −53,7°	21,6/149,8°	0,02/ 67,1°	0,92/−19,0°	36,7
	200	0,50/ −92,0°	16,2/129,8°	0,02/ 56,9°	0,74/−28,5°	28,9
	500	0,48/−146,3°	8,7/100,2°	0,04/ 52,2°	0,54/−37,6°	21,4
10	800	0,46/−167,6°	5,7/ 87,5°	0,05/ 56,9°	0,49/−44,1°	17,3
	1000	0,46/−179,1°	4,6/ 80,0°	0,06/ 57,9°	0,50/−46,6°	15,5
	1200	0,47/ 169,1°	3,8/ 74,6°	0,06/ 60,0°	0,48/−51,1°	13,7
	1500	0,46/ 162,3°	3,1/ 67,9°	0,08/ 62,4°	0,44/−59,1°	11,7
	2000	0,46/ 142,8°	2,3/ 56,3°	0,09/ 63,8°	0,44/−75,9°	9,2
	40	0,50/ −26,3°	28,8/166,7°	0,01/ 74,4°	0,98/ −8,8°	43,9
	100	0,49/ −64,6°	25,4/145,8°	0,02/ 66,4°	0,89/−21,5°	36,2
	200	0,46/−105,3°	18,2/125,5°	0,02/ 57,5°	0,68/−30,6°	29,0
	500	0,47/−154,3°	9,2/ 97,9°	0,03/ 56,7°	0,50/−37,8°	21,6
14	800	0,45/−173,4°	6,0/ 86,0°	0,05/ 61,1°	0,46/−44,0°	17,5
	1000	0,46/ 176,3°	4,8/ 78,8°	0,05/ 52,2°	0,46/−46,4°	15,7
	1200	0,47/ 165,3°	3,9/ 73,9°	0,06/ 63,8°	0,45/−50,7°	13,9
	1500	0,46/ 159,5°	3,2/ 67,3°	0,08/ 65,4°	0,41/−59,1°	12,0
	2000	0,46/ 140,6°	2,4/ 56,1°	0,10/ 65,9°	0,41/−75,8°	9,5
	40	0,42/ −33,9°	34,3/164,1°	0,01/ 73,6°	0,97/−10,4°	43,3
	100	0,43/ −79,0°	28,8/141,3°	0,01/ 63,1°	0,84/−24,0°	35,4
	200	0,42/−120,1°	19,7/121,0°	0,02/ 58,1°	0,63/−31,3°	29,0
	500	0,46/−162,0°	9,4/ 95,5°	0,03/ 60,6°	0,46/−37,1°	21,6
20	800	0,45/−178,4°	6,1/ 84,5°	0,05/ 65,0°	0,43/−43,5°	17,6
	1000	0,46/ 172,4°	4,9/ 77,8°	0,05/ 65,6°	0,44/−45,9°	15,7
	1200	0,48/ 162,3°	4,0/ 73,1°	0,06/ 66,9°	0,43/−50,1°	14,0
	1500	0,46/ 157,2°	3,3/ 66,7°	0,08/ 67,3°	0,39/−58,9°	12,1
	2000	0,47/ 138,9°	2,5/ 55,8°	0,10/ 67,6°	0,39/−75,9°	9,5

s-parameters (common-emitter) at V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

I_C mA	f MHz	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} dB
	40	0,87/ −8,9°	6,8/174,8°	0,01/ 80,8°	1,00/ −2,5°	49,9
	100	0,88/ −25,8°	6,8/162,8°	0,02/ 76,3°	1,01/ −8,8°	39,5
	200	0,79/ −49,3°	6,0/148,3°	0,04/ 64,8°	0,92/−16,3°	28,2
	500	0,69/−101,8°	4,5/115,5°	0,07/ 44,9°	0,82/−29,8°	20,6
2	800	0,59/−131,9°	3,2/ 98,0°	0,08/ 39,1°	0,73/−39,6°	15,2
	1000	0,56/−148,5°	2,7/ 87,0°	0,08/ 36,3°	0,73/−43,8°	13,5
	1200	0,54/−164,1°	2,2/ 78,6°	0,08/ 36,3°	0,72/−50,7°	11,5
	1500	0,53/−178,2°	1,8/ 71,0°	0,08/ 40,5°	0,64/−57,8°	9,0
	2000	0,52/ 158,5°	1,4/ 55,8°	0,08/ 46,3°	0,63/−76,2°	6,3
	40	0,73/ −14,1°	14,6/172,2°	0,01/ 77,9°	0,99/ −4,8°	44,6
	100	0,72/ −37,9°	14,1/156,6°	0,02/ 71,0°	0,98/−13,8°	39,7
	200	0,63/ −69,2°	11,6/138,7°	0,03/ 60,3°	0,83/−22,9°	28,6
	500	0,55/−127,0°	7,1/106,4°	0,05/ 46,4°	0,66/−35,0°	21,1
5	800	0,50/−153,1°	4,8/ 91,5°	0,06/ 48,0°	0,58/−42,7°	16,6
	1000	0,49/−167,1°	3,9/ 82,8°	0,06/ 48,6°	0,59/−45,8°	14,8
	1200	0,48/ 179,5°	3,2/ 76,2°	0,07/ 50,2°	0,58/−51,1°	12,9
	1500	0,48/ 169,8°	2,6/ 69,2°	0,08/ 54,7°	0,51/−58,6°	10,8
	2000	0,47/ 148,7°	2,0/ 56,3°	0,09/ 58,0°	0,51/−75,8°	8,2
	40	0,59/ −20,9°	23,7/168,9°	0,01/ 76,7°	0,98/ −7,2°	43,5
	100	0,57/ −53,5°	21,6/149,9°	0,02/ 67,5°	0,92/−18,8°	36,7
	200	0,50/ −91,7°	16,2/130,0°	0,02/ 58,0°	0,74/−28,3°	28,9
	500	0,48/−146,0°	8,7/100,5°	0,04/ 52,4°	0,55/−37,3°	21,5
10	800	0,46/−167,3°	5,7/ 87,7°	0,05/ 57,2°	0,49/−43,7°	17,3
	1000	0,46/−178,8°	4,6/ 80,3°	0,06/ 58,3°	0,50/−46,3°	15,5
	1200	0,47/ 169,4°	3,8/ 74,8°	0,06/ 60,2°	0,48/−50,9°	13,7
	1500	0,46/ 162,5°	3,1/ 68,0°	0,08/ 62,7°	0,44/−58,9°	11,7
	2000	0,46/ 143,1°	2,3/ 56,5°	0,09/ 64,0°	0,44/−75,6°	9,2
	40	0,51/ −25,9°	28,5/166,9°	0,01/ 72,3°	0,98/ −8,5°	43,9
	100	0,50/ −63,8°	25,4/146,1°	0,02/ 65,3°	0,89/−21,3°	36,2
	200	0,46/−104,5°	18,2/125,8°	0,02/ 57,6°	0,69/−30,3°	29,0
	500	0,47/−153,6°	9,2/ 98,2°	0,03/ 55,7°	0,50/−37,5°	21,6
14	800	0,45/−172,9°	6,0/ 86,2°	0,05/ 61,3°	0,46/−43,7°	17,5
	1000	0,46/ 176,8°	4,8/ 79,0°	0,05/ 62,6°	0,46/−46,2°	15,7
	1200	0,47/ 165,8°	3,9/ 74,1°	0,06/ 63,7°	0,45/−50,4°	14,0
	1500	0,46/ 159,9°	3,2/ 67,5°	0,08/ 65,3°	0,41/−58,9°	12,0
	2000	0,46/ 140,9°	2,4/ 56,4°	0,09/ 65,9°	0,41/−75,6°	9,5
	40	0,42/ −32,2°	34,3/165,3°	0,01/ 72,8°	0,97/ −9,3°	43,3
	100	0,43/ −77,0°	28,8/142,5°	0,01/ 65,2°	0,85/−22,9°	35,7
	200	0,43/−118,2°	19,7/122,1°	0,02/ 58,3°	0,64/−30,8°	29,0
	500	0,46/−160,6°	9,5/ 96,5°	0,03/ 61,6°	0,47/−36,0°	21,7
20	800	0,45/−177,2°	6,1/ 85,5°	0,05/ 65,4°	0,43/−42,3°	17,6
	1000	0,46/ 173,6°	4,9/ 78,8°	0,05/ 66,7°	0,44/−44,8°	15,8
	1200	0,48/ 163,5°	4,0/ 74,1°	0,06/ 68,0°	0,43/−49,1°	14,1
	1500	0,46/ 158,3°	3,3/ 67,5°	0,08/ 68,9°	0,39/−57,7°	12,1
	2000	0,47/ 139,9°	2,5/ 56,7°	0,10/ 68,4°	0,40/−74,7°	9,6

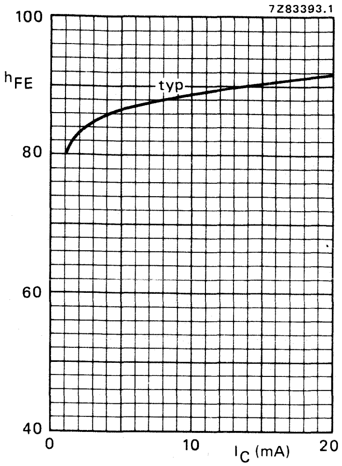


Fig.1 Gain as a function of collector current.
V_{CE} = 10 V; T_j = 25 °C; typical values.

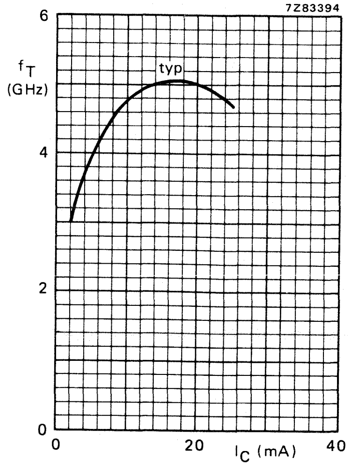


Fig.2 Transition frequency as a function of collector current.
V_{CE} = 10 V; f = 500 MHz;
T_j = 25 °C; typical values.

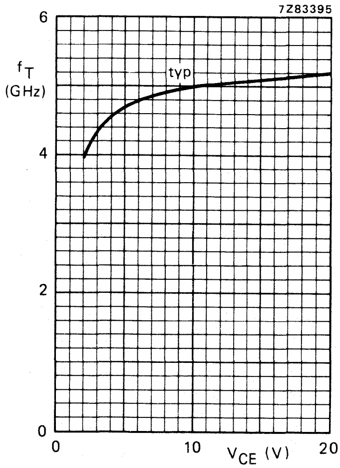


Fig.3 Transition frequency as a function of V_{CE}.
I_C = 14 mA; f = 500 MHz; T_j = 25 °C; typical values.

NPN 5 GHz WIDEBAND TRANSISTOR

NPN transistor in a four-lead dual-emitter SOT143 envelope. The device is primarily intended for use in UHF and microwave amplifiers and features low noise and high power gain.

QUICK REFERENCE DATA

Collector-base voltage (open emitter)	V_{CBO}	max.	15 V
Collector-emitter voltage (open base)	V_{CEO}	max.	12 V
Collector current (DC)	I_C	max.	35 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
DC current gain I_C = 30 mA; V_{CE} = 5 V	h_{FE}	min.	40
		typ.	90
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	6.0 GHz
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 5 V	C_{re}	typ.	0.6 pF
Noise figure at f = 800 MHz I_C = 4 mA; V_{CE} = 8 V; Z_S = opt.	F	typ.	1.6 dB
Maximum unilateral power gain I_C = 30 mA; V_{CE} = 8 V, f = 800 MHz	G_{UM}	typ.	17.0 dB
f = 2 GHz		typ.	9.0 dB

MECHANICAL DATA

Dimensions in mm

SOT143

Marking code:
BFG93A : R8
BFG93AX: V15

Pinning

BFG93A	BFG93AX
1 = collector	1 = collector
3,4 = emitter	2,4 = emitter
2 = base	3 = base

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Emitter-base voltage (open collector)	V_{EBO}	max.	2	V
Collector current (DC)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 25 °C and mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	P_{tot}	max.	300	mW
Storage temperature range	T_{stg}		−65 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient and mounted on a ceramic substrate of 8 mm x 10 mm x 0.7 mm	$R_{th\ j\text{-}a}$	=	430	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current $I_E = 0$; $V_{CB} = 5$ V	I_{CBO}	max.	50	nA
DC current gain $I_C = 30$ mA; $V_{CE} = 5$ V	h_{FE}	min. typ.	40 90	
Transition frequency at f = 500 MHz $I_C = 30$ mA; $V_{CE} = 5$ V	f_T	typ.	6.0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 5$ V	C_c	typ.	0.9	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; $V_{EB} = 0.5$ V	C_e	typ.	2.5	pF
Feedback capacitance at f = 1 MHz $I_C = 0$; $V_{CE} = 5$ V	C_{re}	typ.	0.6	pF

Maximum unilateral power gain (S_{12} assumed to be zero)

$$G_{UM} = 10 \log \frac{|S_{21}|^2}{[1 - |S_{11}|^2]\ [1 - |S_{22}|^2]}$$

$I_C = 30$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C: f = 800 MHz f = 2 GHz	G_{UM}	typ. typ.	17.0 9.0	dB dB
Noise figure at f = 800 MHz and T_{amb} = 25 °C $I_C = 4$ mA; $V_{CE} = 8$ V; Z_S = opt.	F	typ.	1.6	dB

s-parameters (common emitter) at V_{CE} = 5 V; T_{amb} = 25 °C; typical values

I_C mA	f MHz	s_{11} M/Φ	s_{21} M/Φ	s_{12} M/Φ	s_{22} M/Φ	G_{UM} dB
2	40	0,93/ −10,4°	7,1/174,6°	0,02/ 84,9°	1,00/ −3,3°	52,9
	100	0,93/ −30,9°	7,0/160,6°	0,03/ 73,5°	1,00/ −11,9°	52,8
	200	0,83/ −58,3°	6,0/144,6°	0,06/ 60,4°	0,88/ −22,1°	27,2
	500	0,74/−115,5°	4,2/110,2°	0,10/ 36,5°	0,71/ −40,3°	18,9
	800	0,67/−144,9°	2,9/ 92,5°	0,11/ 29,0°	0,61/ −51,6°	13,9
	1000	0,65/−161,0°	2,4/ 81,5°	0,11/ 25,2°	0,60/ −55,8°	12,0
	1200	0,64/−175,0°	2,0/ 73,9°	0,10/ 25,2°	0,58/ −62,7°	9,9
	1500	0,64/+171,3°	1,7/ 64,5°	0,11/ 28,1°	0,52/ −72,1°	8,1
	2000	0,63/+148,8°	1,2/ 49,6°	0,10/ 35,4°	0,52/ −90,7°	5,5
5	40	0,86/ −17,1°	16,2/171,0°	0,01/ 81,2°	0,99/ −7,5°	46,5
	100	0,83/ −46,6°	15,2/152,3°	0,03/ 66,6°	0,92/ −21,4°	36,9
	200	0,72/ −82,0°	11,6/133,0°	0,05/ 53,3°	0,73/ −34,7°	27,8
	500	0,63/−140,5°	6,5/101,0°	0,07/ 38,0°	0,48/ −52,8°	19,6
	800	0,60/−164,4°	4,3/ 87,0°	0,08/ 39,2°	0,41/ −61,7°	15,4
	1000	0,59/−177,4°	3,5/ 78,3°	0,08/ 39,9°	0,39/ −64,2°	13,4
	1200	0,59/+170,7°	2,9/ 72,9°	0,09/ 43,3°	0,37/ −69,0°	11,6
	1500	0,58/+160,8°	2,4/ 64,2°	0,10/ 46,6°	0,34/ −79,5°	9,9
	2000	0,58/+140,3°	1,8/ 51,8°	0,11/ 51,4°	0,35/ −95,8°	7,4
10	40	0,78/ −25,7°	27,2/166,2°	0,01/ 78,4°	0,97/ −12,5°	44,5
	100	0,72/ −64,9°	23,2/143,3°	0,03/ 61,1°	0,83/ −31,4°	35,5
	200	0,62/−105,0°	16,2/123,2°	0,04/ 50,0°	0,59/ −45,9°	28,1
	500	0,59/−155,7°	7,9/ 95,5°	0,05/ 44,9°	0,34/ −63,2°	20,3
	800	0,56/−175,9°	5,1/ 83,5°	0,07/ 50,4°	0,29/ −70,7°	16,2
	1000	0,57/+173,2°	4,1/ 76,3°	0,07/ 52,3°	0,27/ −72,7°	14,3
	1200	0,58/+162,5°	3,4/ 72,1°	0,08/ 55,6°	0,25/ −76,2°	12,5
	1500	0,56/+154,8°	2,8/ 63,8°	0,10/ 56,6°	0,25/ −88,2°	10,8
	2000	0,56/+135,3°	2,1/ 52,8°	0,13/ 58,5°	0,26/−102,7°	8,4
20	40	0,65/ −39,4°	42,2/159,3°	0,01/ 72,3°	0,91/ −19,7°	42,7
	100	0,60/ −89,5°	31,6/132,8°	0,02/ 55,5°	0,69/ −42,9°	34,8
	200	0,55/−129,0°	19,7/114,0°	0,02/ 50,4°	0,44/ −57,0°	28,4
	500	0,57/−168,3°	8,8/ 91,5°	0,04/ 54,8°	0,24/ −74,1°	20,8
	800	0,55/+175,7°	5,6/ 81,0°	0,06/ 60,5°	0,21/ −80,3°	16,8
	1000	0,55/+166,5°	4,5/ 74,8°	0,07/ 61,7°	0,19/ −82,5°	14,8
	1200	0,57/+156,9°	3,7/ 71,1°	0,08/ 64,0°	0,17/ −85,5°	13,2
	1500	0,54/+150,5°	3,1/ 63,0°	0,10/ 63,0°	0,18/−130,7°	11,4
	2000	0,55/+131,8°	2,3/ 53,3°	0,13/ 62,3°	0,20/−111,3°	9,0
30	40	0,58/ −50,3°	50,7/154,7°	0,01/ 69,7°	0,87/ −24,2°	42,2
	100	0,56/−104,9°	35,1/127,1°	0,02/ 53,8°	0,61/ −48,7°	34,5
	200	0,54/−141,0°	20,7/109,8°	0,02/ 52,4°	0,37/ −61,2°	28,4
	500	0,56/−173,6°	8,9/ 89,5°	0,04/ 60,0°	0,20/ −77,6°	20,8
	800	0,55/+172,3°	5,7/ 79,7°	0,06/ 64,8°	0,18/ −83,1°	16,9
	1000	0,56/+164,0°	4,5/ 73,8°	0,07/ 65,3°	0,17/ −85,3°	14,9
	1200	0,58/+154,8°	3,7/ 70,6°	0,08/ 67,1°	0,15/ −88,3°	13,3
	1500	0,55/+148,9°	3,1/ 62,5°	0,10/ 65,2°	0,16/−100,8°	11,5
	2000	0,55/+130,5°	2,3/ 53,0°	0,13/ 63,7°	0,18/−114,1°	9,1

s-parameters (common-emitter) at V_{CE} = 8 V; T_{amb} = 25 °C; typical values

I_C mA	f MHz	S_{11} M/Φ	S_{21} M/Φ	S_{12} M/Φ	S_{22} M/Φ	G_{UM} dB
	40	0,94/ −9,9°	7,1/174,8°	0,01/ 84,5°	1,00/ −2,8°	53,5
	100	0,94/ −30,0°	7,0/161,3°	0,03/ 73,7°	1,00/ −11,0°	53,4
	200	0,83/ −56,5°	6,1/145,5°	0,05/ 61,5°	0,89/ −20,5°	27,7
	500	0,74/−113,2°	4,3/111,4°	0,09/ 37,8°	0,73/ −37,8°	19,4
2	800	0,66/−142,9°	3,0/ 93,7°	0,10/ 30,8°	0,63/ −48,7°	14,3
	1000	0,64/−159,0°	2,5/ 82,5°	0,10/ 27,0°	0,62/ −52,8°	12,4
	1200	0,63/−173,3°	2,0/ 74,6°	0,10/ 26,9°	0,61/ −59,6°	10,3
	1500	0,62/+172,7°	1,7/ 65,5°	0,10/ 29,8°	0,54/ −68,5°	8,3
	2000	0,63/+149,9°	1,3/ 50,5°	0,10/ 37,8°	0,54/ −87,0°	5,7
	40	0,87/ −15,9°	15,9/171,6°	0,01/ 81,6°	0,99/ −6,5°	46,7
	100	0,84/ −43,8°	14,8/153,5°	0,03/ 68,2°	0,93/ −19,3°	37,7
	200	0,72/ −78,0°	11,6/134,5°	0,05/ 54,8°	0,76/ −31,6°	28,3
	500	0,63/−136,7°	6,7/102,2°	0,07/ 38,8°	0,52/ −48,3°	20,0
5	800	0,59/−161,4°	4,4/ 87,9°	0,08/ 40,0°	0,44/ −56,7°	15,7
	1000	0,58/−174,8°	3,6/ 79,0°	0,08/ 40,8°	0,43/ −59,3°	13,7
	1200	0,58/+172,8°	2,9/ 73,4°	0,08/ 44,0°	0,41/ −63,9°	11,9
	1500	0,57/+162,6°	2,5/ 64,9°	0,09/ 47,2°	0,37/ −73,9°	10,1
	2000	0,57/+141,9°	1,8/ 52,3°	0,11/ 52,4°	0,38/ −90,2°	7,6
	40	0,80/ −23,3°	26,3/167,2°	0,01/ 78,3°	0,97/ −11,0°	44,6
	100	0,74/ −60,0°	22,9/145,1°	0,03/ 62,7°	0,85/ −28,1°	36,3
	200	0,62/ −99,1°	16,2/125,0°	0,04/ 50,9°	0,62/ −41,6°	28,4
	500	0,58/−151,7°	8,1/ 96,7°	0,05/ 45,4°	0,38/ −56,3°	20,6
10	800	0,55/−172,9°	5,3/ 84,4°	0,06/ 50,5°	0,32/ −63,4°	16,5
	1000	0,55/+175,8°	4,2/ 77,0°	0,07/ 52,3°	0,31/ −64,9°	14,5
	1200	0,56/+164,5°	3,5/ 72,4°	0,08/ 55,1°	0,29/ −68,2°	12,8
	1500	0,54/+156,7°	2,9/ 64,3°	0,10/ 56,6°	0,28/ −79,7°	11,1
	2000	0,54/+136,8°	2,1/ 53,1°	0,12/ 58,5°	0,28/ −94,3°	8,6
	40	0,70/ −35,0°	41,2/160,7°	0,01/ 75,1°	0,92/ −17,3°	43,5
	100	0,63/ −82,0°	31,7/134,8°	0,02/ 57,6°	0,72/ −38,6°	35,4
	200	0,55/−122,2°	20,2/115,6°	0,03/ 50,9°	0,47/ −51,0°	28,7
	500	0,55/−164,6°	9,1/ 92,2°	0,04/ 54,4°	0,27/ −63,8°	21,0
20	800	0,53/+178,4°	5,8/ 81,6°	0,06/ 60,2°	0,24/ −69,5°	17,0
	1000	0,54/+168,8°	4,6/ 75,3°	0,07/ 61,3°	0,22/ −70,7°	15,0
	1200	0,55/+158,7°	3,8/ 71,4°	0,08/ 63,4°	0,20/ −72,9°	13,4
	1500	0,52/+152,5°	3,2/ 63,5°	0,10/ 63,0°	0,21/ −85,9°	11,6
	2000	0,53/+133,3°	2,4/ 53,4°	0,13/ 62,3°	0,22/ −99,5°	9,2
	40	0,65/ −42,9°	49,0/156,7°	0,01/ 72,7°	0,89/ −20,9°	43,0
	100	0,58/ −94,4°	35,1/129,5°	0,02/ 54,7°	0,65/ −43,2°	35,0
	200	0,53/−132,8°	21,1/111,5°	0,03/ 51,8°	0,40/ −53,7°	28,7
	500	0,54/−169,5°	9,2/ 90,5°	0,04/ 58,8°	0,23/ −64,8°	21,1
30	800	0,52/+175,3°	5,9/ 80,5°	0,06/ 63,6°	0,21/ −70,2°	17,0
	1000	0,53/+166,4°	4,7/ 74,3°	0,07/ 64,6°	0,20/ −71,4°	15,1
	1200	0,55/+156,8°	3,9/ 70,8°	0,08/ 66,1°	0,18/ −73,2°	13,4
	1500	0,52/+150,9°	3,2/ 63,0°	0,10/ 64,8°	0,19/ −87,3°	11,7
	2000	0,53/+132,2°	2,4/ 53,0°	0,13/ 63,5°	0,20/−100,8°	9,0

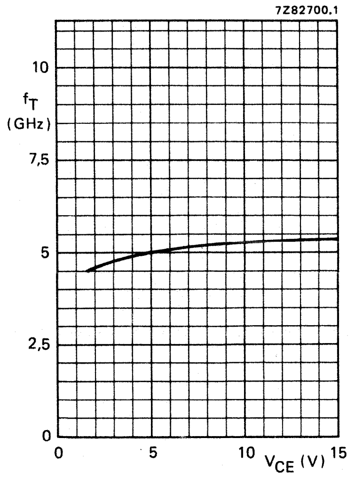


Fig.1 Transition frequency as a function of collector-emitter voltage.

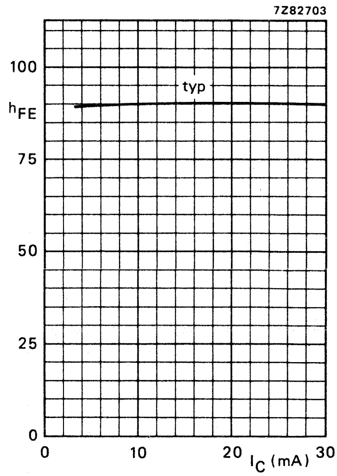


Fig.2 Current gain as a function of collector current.

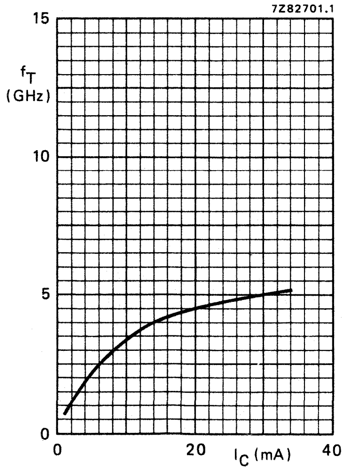


Fig.3 Transition frequency as a function of collector current.

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG94
NPN 6 GHz wideband transistor

FEATURES

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

DESCRIPTION

The BFG94 is a npn transistor primarily intended for use in communication and instrumentation systems.
The BFG94 is mounted in a SOT223 plastic envelope.

MECHANICAL DATA

Plastic SOT223 envelope.

PINNING

PIN	DESCRIPTION
1,3	emitter
2	base
4	collector

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	15	V
V_{CEO}	collector-emitter voltage	open base	-	-	12	V
I_C	collector current (DC)		-	-	60	mA
P_{tot}	total power dissipation	T_{case} = 140 °C; note 1	-	-	700	mW
T_j	junction temperature		-	-	175	°C
C_{re}	feedback capacitance	f = 1 MHz; I_C = 0; V_{CB} = 10 V	-	-	0.8	pF
f_T	transition frequency	f = 1 GHz; I_C = 45 mA; V_{CE} = 10 V; T_{amb} = 25 °C	4	-	-	GHz
G_{UM}	maximum power gain	f = 1 GHz; I_C = 45 mA; V_{CE} = 10 V; note 2	11.5	13.5	-	dB
V_o	output voltage	d_{im} = −60 dB; I_C = 45 mA; V_{CE} = 10 V; R_L = 75 Ω; f = 800 MHz	-	500	-	mV
P_{L1}	output power at 1 dB gain compression	I_C = 45 mA; V_{CE} = 10 V; f = 1 GHz	-	21.5	-	dBm

Notes to the Quick Reference Data

1. T_{case} temperature measured on soldering point of collector tab.
2. $G_{UM} = 10 \text{ LOG} \dfrac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ [dB]

   (S_{12} assumed to be zero)

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	15	V
V_{CEO}	collector-emitter voltage	open base	-	12	V
V_{EBO}	emitter-base voltage	open collector	-	2	V
I_C	collector current (DC)		-	60	mA
P_{tot}	total power dissipation	T_{case} = 140 °C note 1	-	700	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction temperature		-	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}s}$	from junction to soldering point	50	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	-	-	100	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	45	-	-	
		I_C = 45 mA; V_{CE} = 10 V	-	100	-	
C_c	collector capacitance	f = 1 MHz; $I_E = i_e$ = 0; V_{CB} = 10 V	-	0.9	2.0	pF
C_e	emitter capacitance	f = 1 MHz; $I_C = i_e$ = 0; V_{EB} = 0.5 V	-	2.9	4.5	pF
C_{re}	feedback capacitance	f = 1 MHz; $I_C = i_c$ = 0; V_{CB} = 10 V	-	0.5	0.8	pF
f_T	transition frequency	f = 1 GHz; I_C = 45 mA; V_{CE} = 10 V; T_{amb} = 25 °C	4	-	-	GHz
		f = 1 GHz; I_C = 30 mA; V_{CE} = 5 V; T_{amb} = 25 °C	-	6	-	GHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
G_{UM}	maximum power gain	f = 1 GHz; T_{amb} = 25 °C; I_C = 45 mA; V_{CE} = 10 V; note 2	11.5	13.5	-	dB
F_{min}	noise figure	$\Gamma s = \Gamma opt$; I_C = 45 mA; V_{CE} = 10 V; f = 500 MHz	-	2.7	-	dB
		$\Gamma s = \Gamma opt$; I_C = 45 mA; V_{CE} = 10 V; f = 1000 MHz	-	3	-	dB
V_o	output voltage	note 3	-	500	-	mV
V_o	output voltage	note 4	-	280	-	mV
P_{L1}	output power at 1 dB gain compression	I_C = 45 mA; V_{CE} = 10 V; R_L = 50 Ω; T_{amb} = 25 °C; measured at f = 1 GHz	-	21.5	-	dBm
ITO	third order intercept point	note 5	-	34	-	dBm

Notes

1. T_{case} temperature measured on soldering point of collector tab.
2. $$G_{UM} = 10 \text{ LOG} \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)} \text{ [dB]}$$
   (S_{12} assumed to be zero)
3. d_{im} = −60 dB (DIN 45004B, par.6.3 : 3-tone); T_{amb} = 25 °C; I_C = 45 mA; V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB; f_p = 795.25 MHz; $V_q = V_o$ −6 dB; $V_r = V_o$ −6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at $f_{(p+q-r)}$ = 793.25 MHz.
4. d_2 = −50 dB; T_{amb} = 25 °C; I_C = 45 mA;V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_2 = −50 dB; $V_q = V_o$ at d_2 = −50 dB; f_p = 250 MHz; f_q = 560 MHz; measured at $f_{(p+qr)}$ = 810 MHz.
5. I_C = 45 mA; V_{CE} = 10 V; R_L = 50 Ω; T_{amb} = 25 °C; P_p = ITO = −6 dB; f_p = 1000 MHz; P_q = ITO = −6 dB; f_q = 1001 MHz; measured at $f_{(2p-q)}$ and $f_{(2q-p)}$.

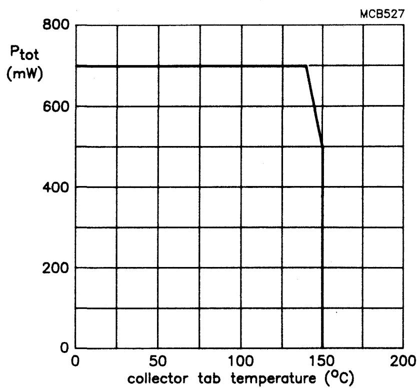


Fig.1 Power derating curve as a function of collector tab temperature.

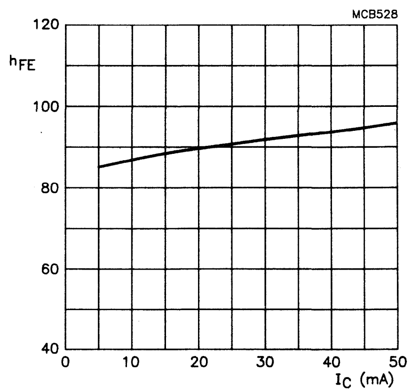


Fig.2 DC current gain as a function of collector current; $V_{CE} = 10$ V.

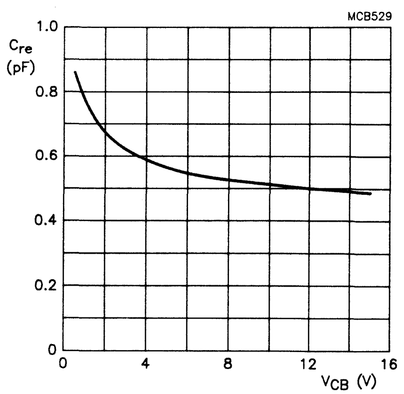


Fig.3 Feedback capacitance as a function of collector voltage; $I_C = i_c = 0$; f = 1 MHz.

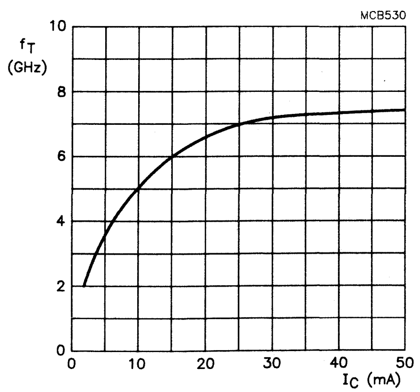


Fig.4 Transition frequency as a function of collector current; $V_{CE} = 10$ V; f = 1 GHz.

NPN 6 GHz wideband transistor BFG94

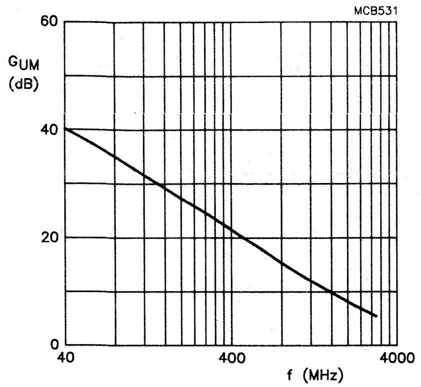


Fig.5 Maximum unilateral power gain as a function of frequency; V_{CE} = 10 V; I_C = 45 mA.

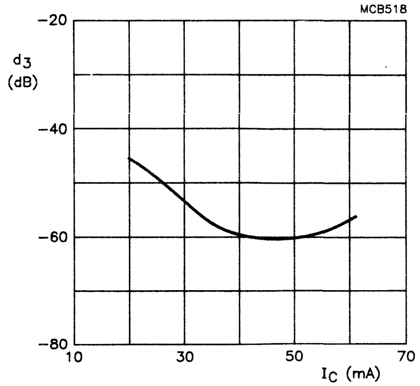


Fig.6 Third order intermodulation distortion. See test circuit (Fig.14); V_{CE} = 10 V; I_C = 45 mA; fm = 793.25 MHz.

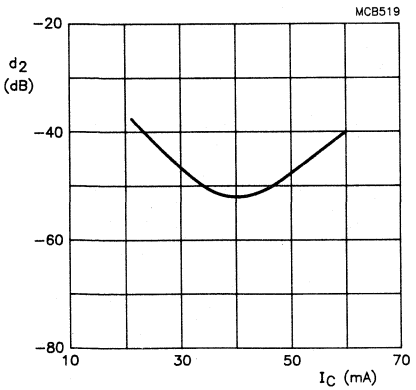


Fig.7 Second order distortion. See test circuit (Fig.14); V_{CE} = 10 V; I_C = 45 mA; fm = 810 MHz.

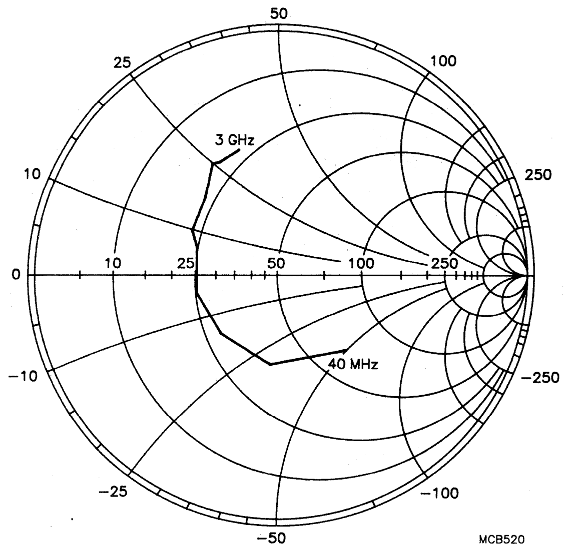


Fig.8 Common emitter input reflection coefficient S_{11}; V_{CE} = 10 V; I_C = 45 mA.

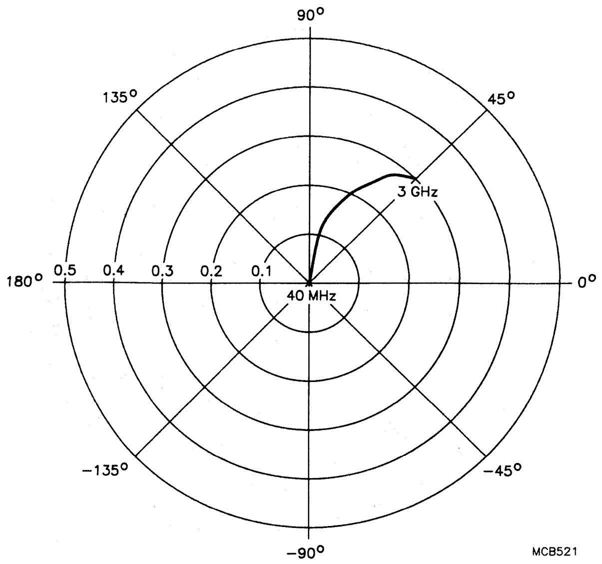


Fig.9 Common emitter forward transmission coefficient S_{21}; V_{CE} = 10 V; I_C = 45 mA.

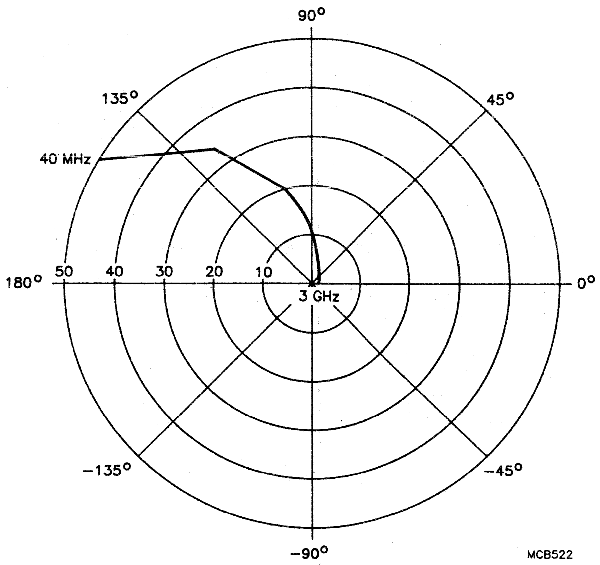


Fig.10 Common emitter reverse transmission coefficient S_{12}; V_{CE} = 10 V; I_C = 45 mA.

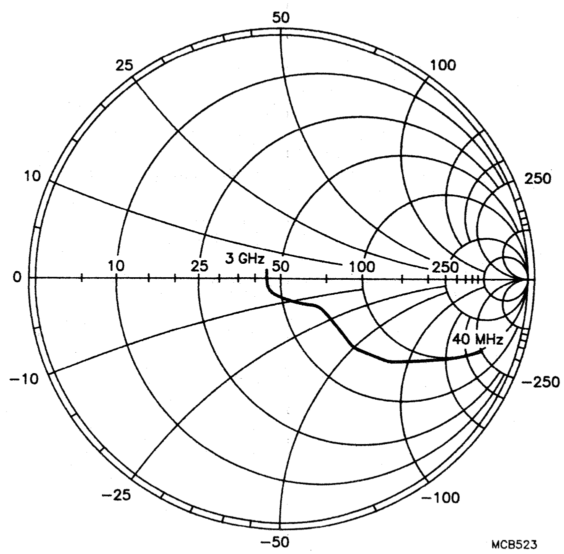


Fig.11 Common emitter output reflection coefficient S_{22}; V_{CE} = 10 V; I_C = 45 mA.

NPN 6 GHz wideband transistor

BFG94

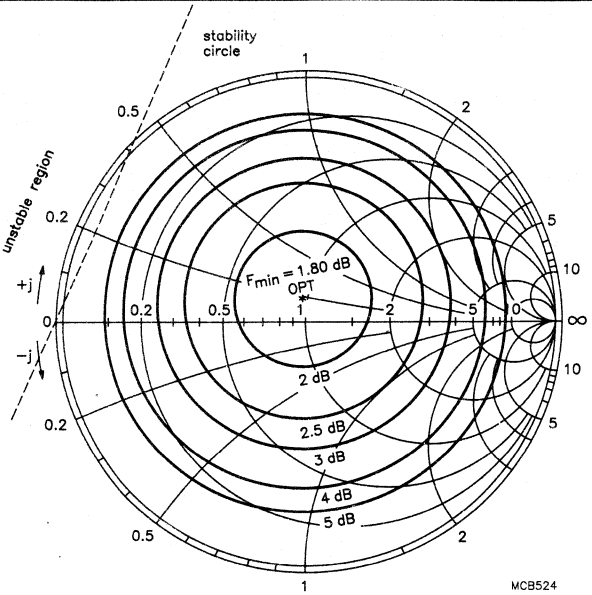


Fig.12 Location of optimum source reflection coefficient for minimum noise figure; V_{CE} = 10 V; I_C = 15 mA; f = 500 MHz.

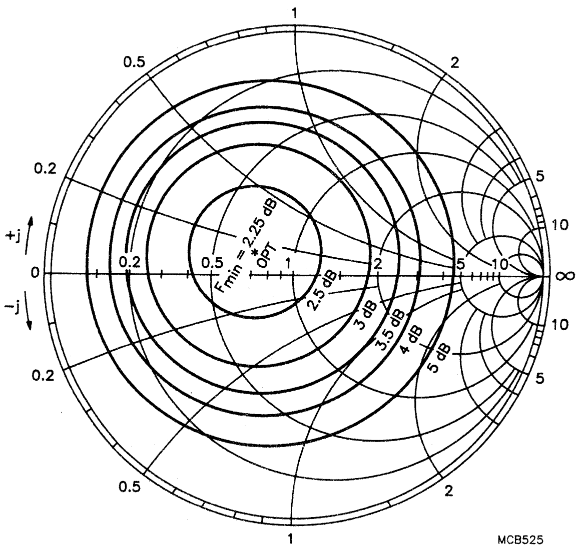


Fig.13 Location of optimum source reflection coefficient for minimum noise figure; V_{CE} = 10 V; I_C = 15 mA; f = 1 GHz.

NPN 6 GHz wideband transistor BFG94

Common emitter S and noise parameters at V_{CE} = 10 V; I_C = 15 mA.

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM}
	M	Φ	M	Φ	M	Φ	M	Φ	
(MHz)	(rat)	(deg)	(rat)	(deg)	(rat)	(deg)	(rat)	(deg)	(dB)
40	.404	− 48.4	50.03	150.0	.009	74.3	.836	− 22.0	40.0
100	.347	− 97.6	33.55	124.0	.017	66.9	.587	− 38.4	32.9
200	.319	−134.5	19.73	105.9	.027	67.6	.385	− 43.0	27.1
300	.316	−152.0	13.62	97.2	.037	70.5	.304	− 41.8	23.6
400	.320	−162.4	10.46	91.3	.048	71.4	.262	− 40.1	21.2
500	.325	−169.4	8.42	86.8	.058	72.1	.239	− 39.2	19.3
600	.328	−175.0	7.07	83.3	.068	72.3	.222	− 38.5	17.7
700	.321	179.8	6.10	80.1	.078	72.2	.210	− 38.6	16.4
800	.325	175.1	5.37	77.0	.089	71.4	.199	− 38.8	15.3
900	.329	170.0	4.81	74.2	.099	70.8	.189	− 39.4	14.3
1000	.336	164.9	4.37	71.2	.108	69.9	.178	− 40.1	13.5
1200	.364	157.5	3.65	65.7	.129	68.8	.158	− 43.1	12.0
1400	.392	152.6	3.15	60.9	.149	66.8	.139	− 48.2	10.8
1600	.391	147.8	2.79	55.6	.168	64.9	.120	− 54.1	9.7
1800	.407	140.5	2.51	50.4	.186	63.0	.099	− 60.5	8.8
2000	.426	133.4	2.31	45.9	.207	60.7	.078	− 70.5	8.2
2200	.465	127.8	2.11	41.8	.224	57.7	.057	− 92.9	7.6
2400	.491	124.8	1.95	37.8	.238	56.1	.050	−125.7	7.0
2600	.511	121.6	1.79	33.0	.255	54.6	.052	−155.3	6.4
2800	.506	115.7	1.68	27.9	.279	52.0	.054	179.9	5.8
3000	.527	108.7	1.61	23.7	.290	46.8	.066	154.9	5.6

FREQUENCY	F_{min}	Γopt		Rn	rn (= Rn/50)
		M	Φ		
(MHz)	(dB)	(rat)	(deg)	(Ω)	(Ω)
500	2.70	.168	159.1	12.1	.241
1000	3.00	.295	−177.3	10.2	.204

Common emitter S and noise parameters at V_{CE} = 10 V; I_C = 15 mA.

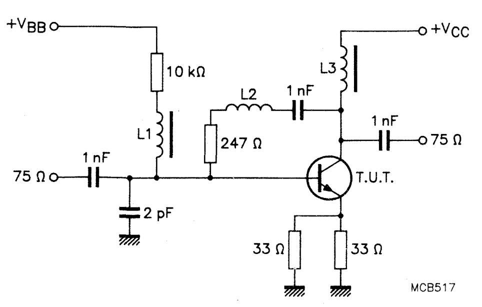
FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM}
	M	Φ	M	Φ	M	Φ	M	Φ	
(MHz)	(rat)	(deg)	(rat)	(deg)	(rat)	(deg)	(rat)	(deg)	(dB)
40	.438	− 41.5	44.41	153.0	.009	74.6	.865	− 19.7	39.9
100	.374	− 87.1	31.75	128.2	.018	66.3	.641	− 36.3	33.0
200	.320	−126.9	19.27	108.7	.028	66.9	.429	− 43.2	27.1
300	.314	−147.0	13.58	99.2	.038	68.6	.338	− 43.0	23.6
400	.315	−158.3	10.38	92.9	.048	69.9	.291	− 41.7	21.2
500	.314	−166.3	8.38	88.3	.058	70.6	.263	− 40.5	19.2
600	.315	−174.1	7.05	84.3	.068	71.6	.245	− 40.1	17.7
700	.316	−178.9	6.08	80.8	.078	71.3	.230	− 40.4	16.4
800	.316	175.3	5.35	77.7	.088	70.7	.217	− 40.8	15.2
900	.318	170.3	4.79	74.8	.099	70.1	.206	− 41.6	14.3
1000	.325	165.1	4.36	71.9	.108	69.3	.196	− 43.1	13.5
1200	.348	157.1	3.66	66.2	.128	68.4	.176	− 46.7	12.0
1400	.372	150.9	3.14	61.1	.149	66.6	.160	− 51.8	10.7
1600	.386	146.8	2.79	56.0	.168	64.5	.144	− 57.8	9.7
1800	.389	139.1	2.52	51.4	.186	62.8	.124	− 63.8	8.8
2000	.413	132.5	2.29	46.2	.206	60.7	.103	− 73.7	8.1
2200	.455	126.1	2.12	42.3	.223	57.6	.084	− 92.2	7.6
2400	.481	122.7	1.96	38.2	.238	55.7	.079	−113.2	7.0
2600	.489	118.3	1.81	33.0	.256	54.4	.075	−130.0	6.4
2800	.496	113.4	1.67	29.1	.279	51.8	.065	−149.4	5.8
3000	.514	106.1	1.60	24.3	.287	46.7	.064	−179.0	5.5

FREQUENCY	F_{min}	Γopt		Rn	rn (= Rn/50)
		M	Φ		
(MHz)	(dB)	(rat)	(deg)	(Ω)	(Ω)
500	2.30	.134	155.2	11.00	.222
1000	2.70	.253	175.6	10.80	.216

Common emitter S and noise parameters at V_{CE} = 10 V; I_C = 15 mA.

FREQUENCY (MHz)	S_{11} M (rat)	S_{11} Φ (deg)	S_{21} M (rat)	S_{21} Φ (deg)	S_{12} M (rat)	S_{12} Φ (deg)	S_{22} M (rat)	S_{22} Φ (deg)	G_{UM} (dB)
40	.609	− 29.1	32.10	159.5	.010	76.7	.925	− 14.6	40.6
100	.526	− 65.4	25.66	136.9	.022	65.5	.758	− 30.1	33.3
200	.427	−104.2	17.25	115.9	.033	59.5	.539	− 40.5	27.1
300	.385	−128.2	12.43	104.5	.042	60.7	.425	− 43.1	23.5
400	.367	−143.8	9.72	96.9	.051	62.2	.360	− 43.4	21.0
500	.361	−154.5	7.91	91.4	.059	63.6	.323	− 43.7	19.1
600	.359	−163.1	6.66	87.0	.068	64.7	.297	− 43.6	17.5
700	.346	−169.8	5.78	83.1	.077	65.6	.280	− 43.5	16.2
800	.350	−176.3	5.08	79.8	.087	65.6	.266	− 44.1	15.0
900	.348	177.6	4.55	76.4	.096	66.0	.253	− 44.7	14.0
1000	.355	171.6	4.13	73.3	.104	65.5	.240	− 45.8	13.2
1200	.374	162.4	3.48	67.2	.122	65.6	.219	− 49.3	11.7
1400	.394	155.5	2.99	61.7	.142	64.2	.199	− 54.9	10.4
1600	.395	150.1	2.65	56.6	.159	63.0	.183	− 61.1	9.4
1800	.414	143.3	2.40	51.3	.176	61.8	.166	− 66.8	8.6
2000	.430	135.8	2.21	46.5	.197	60.2	.146	− 73.9	7.9
2200	.466	130.3	2.03	42.4	.214	57.4	.127	− 86.9	7.3
2400	.486	125.5	1.87	37.8	.227	56.1	.117	−104.2	6.7
2600	.508	121.9	1.73	32.9	.245	55.0	.110	−119.0	6.1
2800	.505	117.2	1.61	28.3	.270	52.5	.100	−129.7	5.5
3000	.527	109.4	1.55	24.0	.281	47.7	.090	−144.9	5.3

FREQUENCY (MHz)	F_{min} (dB)	Γopt M (rat)	Γopt Φ (deg)	Rn (Ω)	rn (= Rn/50) (Ω)
500	1.80	.112	98.1	10.55	.211
1000	2.25	.203	152.1	10.50	.210



L1 = L3 5 μH micro choke

L2 = 1 turn Cu wire 0.4 mm dia., internal dia. 4 mm

Fig.14 Test circuit for third order intermodulation distortion (d_{im}) and second order distortion (d_2).

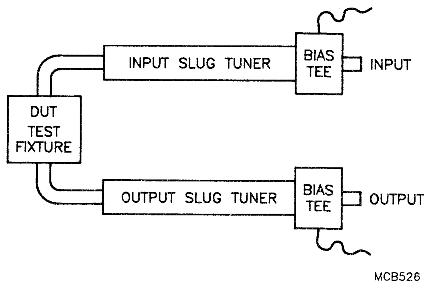


Fig.15 Measurement set-up for third order intercept point (ITO) and 1 dB gain compression (P_{L1}).

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG97
NPN 5 GHz wideband transistor

NPN planar epitaxial transistor in a plastic SOT223 envelope, primarily intended for MATV applications.

The device features excellent output voltage capabilities.
Its pnp complement is the BFG31.

MECHANICAL DATA

SOT223.

PINNING

PIN	DESCRIPTION
1,3	emitter
2	base
4	collector

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	20	V
V_{CEO}	collector-emitter voltage	open base	-	-	15	V
I_C	collector current (DC)		-	-	100	mA
P_{tot}	total power dissipation	T_{case} = 125 °C; note 1	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	-	-	
f_T	transition frequency	f = 500 MHz; I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	5.5	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; I_C = 70 mA; V_{CE} = 10 V	-	16	-	dB
G_{UM}	maximum power gain	f = 800 MHz; I_C = 70 mA; V_{CE} = 10 V	-	12	-	dB
V_o	output voltage	d_{im} = −60 dB; I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	-	700	-	mV

Note

1. T_{case} temperature measured on soldering point of collector tab.

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ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG97	SOT223	bulk	500
BFG97	SOT223	12 mm reel	1000

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	20	V
V_{CEO}	collector-emitter voltage	open base	-	15	V
V_{EBO}	emitter-base voltage	open collector	-	3	V
I_C	collector current (DC)		-	100	mA
P_{tot}	total power dissipation	T_{case} = 125 °C	-	1	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j-c}$	from junction to case	50	K/W

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CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	-	-	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 10 V	25	-	-	
f_T	transition frequency	f = 500 MHz; I_C = 70 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	5.5	-	GHz
C_c	collector capacitance	f = 1 MHz; $I_E = i_e$ = 0; V_{CB} = 10 V	-	1.5	-	pF
C_e	emitter capacitance	f = 1 MHz; $I_C = i_c$ = 0; V_{EB} = 0.5 V	-	6.5	-	pF
C_{re}	feedback capacitance	f = 1 MHz; I_C = 0; V_{CE} = 10 V	-	1.0	-	pF
G_{UM}	maximum power gain	f = 500 MHz; T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 10 V	-	16	-	dB
G_{UM}	maximum power gain	f = 800 MHz; T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 10 V	-	12	-	dB
V_o	output voltage	note 1	-	750	-	mV
V_o	output voltage	note 2	-	700	-	mV

Notes

1. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB; $V_q = V_o$ −6 dB; f_p = 445.25 MHz; $V_r = V_o$ −6 dB; f_q = 453.25 MHz; f_r = 445.25 MHz; measured at $f_{(p+q-r)}$ = 443.25 MHz.

2. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; I_C = 70 mA; V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB; $V_q = V_o$ −6 dB; f_p = 795.25 MHz; $V_r = V_o$ −6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz; measured at $f_{(p+q-r)}$ = 793.25 MHz

List of components:

R1 = 10 kΩ metal film resistor (cat. no. 2322 180 73103)
R2 = 220 Ω metal film resistor (cat. no. 2322 180 73221)
R3 = R4 = 30 Ω metal film resistor (cat. no. 2322 180 73309)

C2 = C3 = C7 = C8 = 10 nF ceramic multilayer capacitor (cat. no. 2222 590 08627)
C1 = C4 = C6 = 1.2 pF ceramic multilayer capacitor (cat. no. 2222 851 12128)
C5 = 10 nF miniature ceramic plate capacitor (cat. no. 2222 629 08103)

L1 = 0.5 turn Cu wire (0.4 mm), internal diameter 3 mm
L2 = 75 Ω microstripline (L = 14 mm; W = 2.5 mm)
L3 = 75 Ω microstripline (L = 8 mm; W = 2.5 mm)
L4 = L5 = 1.5 turns Cu wire (0.4 mm), internal diameter 3 mm, winding pitch 1 mm
L6 = 75 Ω microstripline (L = 19 mm; W = 2.5 mm)
L7 = 5 μH Ferroxcube choke (cat. no. 3122 108 20153)

The circuit has been built on a double Cu clad printed circuit board with PTFE dielectric (ε_r = 2.2); thickness 1/16 inch; thickness of copper-sheet 2 x 35 μm.

The components L1, R2, L4, C5 and L5 are mounted on the underside of the PCB.

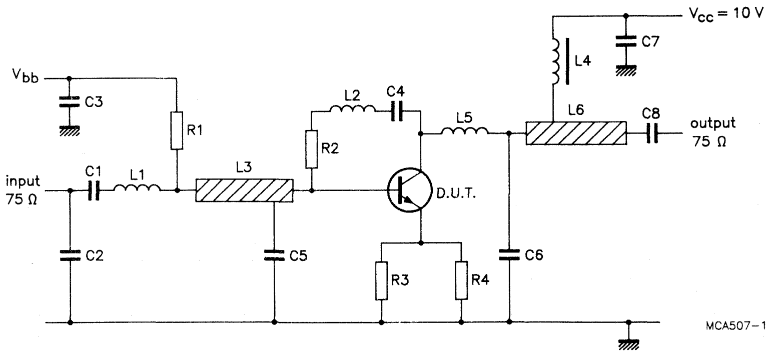

Fig.1 Intermodulation and second harmonic test circuit.

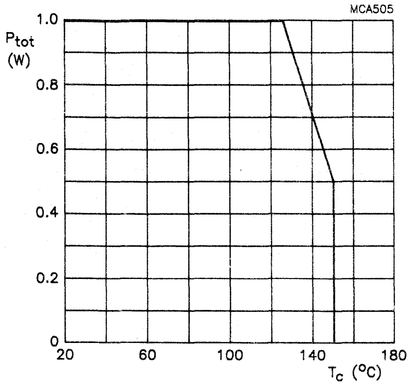

Fig.2 Power derating curve as a function of case temperature.

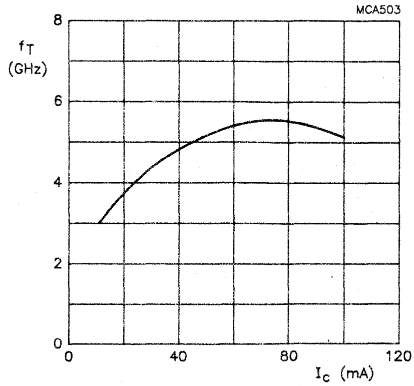

Fig.3 Transition frequency as a function of collector current; V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C; typical values.

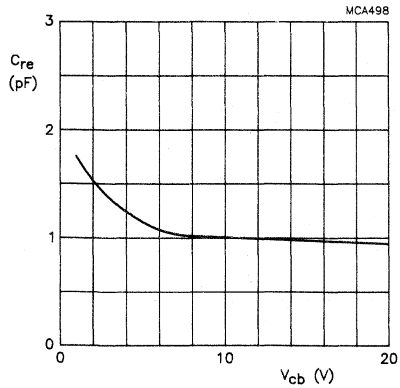

Fig.4 Feedback capacitance as a function of collector-base voltage; I_E = 0; f = 1 MHz; T_j = 25 °C; typical values.

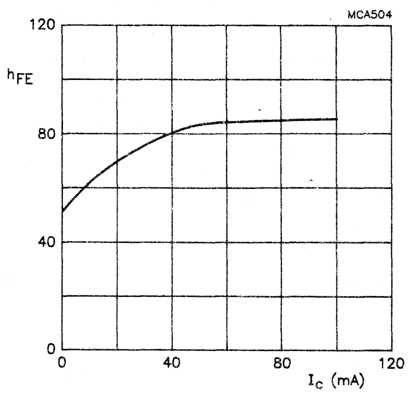

Fig.5 DC current gain as a function of collector current; V_{CE} = 10 V; T_j = 25 °C; typical values.

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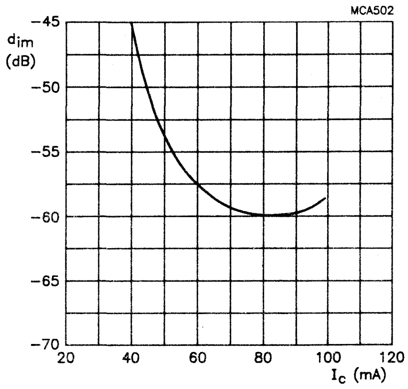

Fig.6 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 750 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C; typical values.

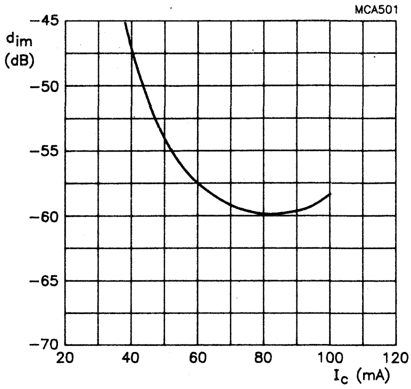

Fig.7 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C; typical values.

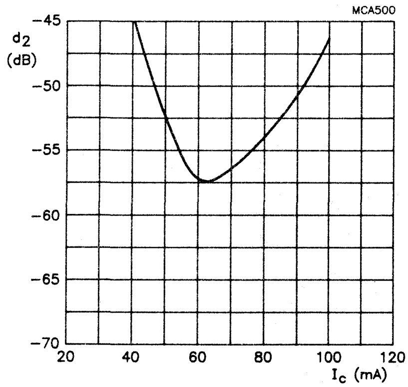

Fig.8 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C; typical values.

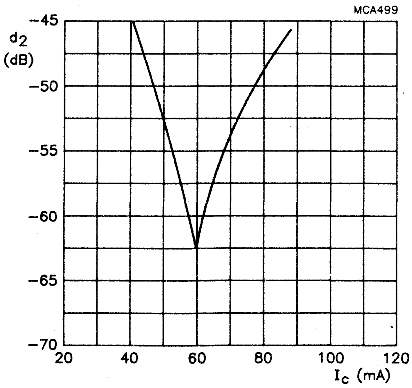

Fig.9 Intermodulation distortion as a function of collector current; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; typical values.

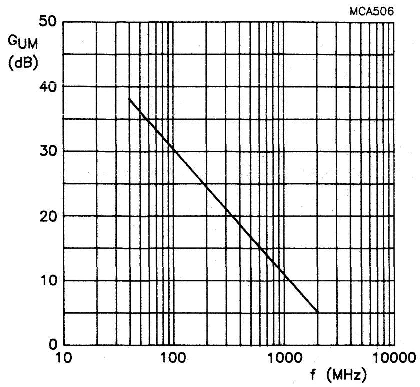

Fig.10 Gain as a function of frequency; V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C; typical values.

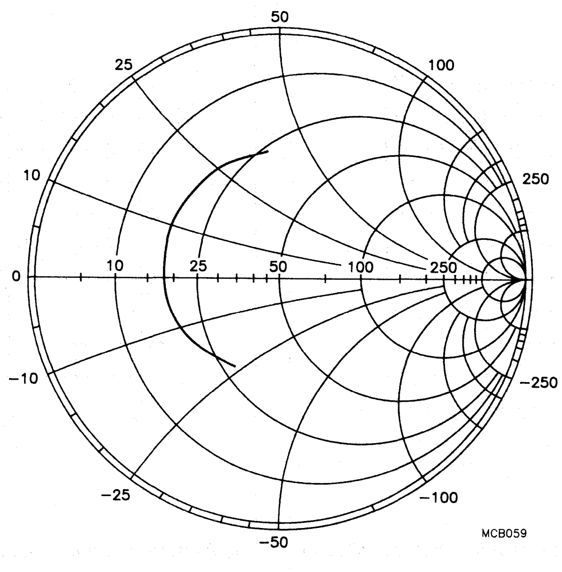

Fig.11 Input reflection coefficient $\mathbf{S_{11}}$; V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C; typical values.

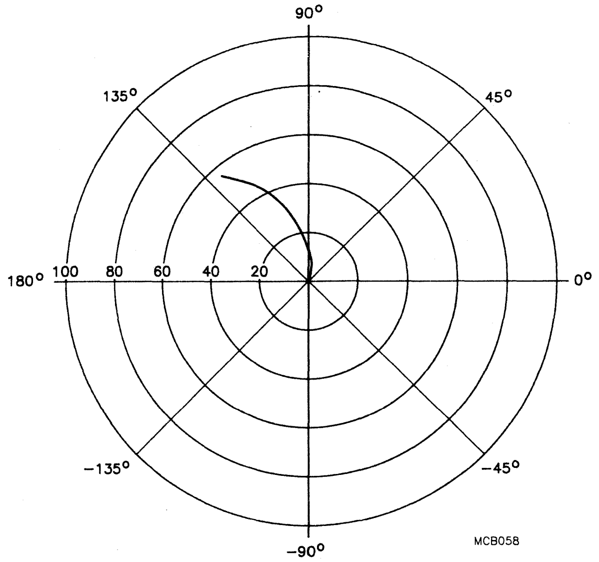

Fig.12 Forward transmission coefficient S_{21}; V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C; typical values.

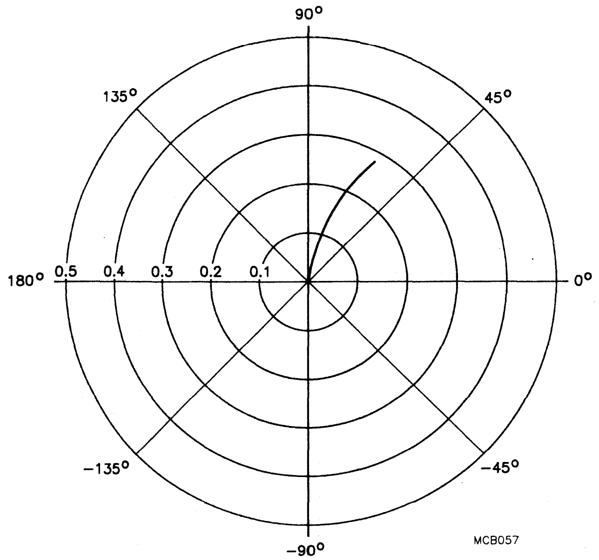

Fig.13 Reverse transmission coefficient S_{12}; V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C; typical values.

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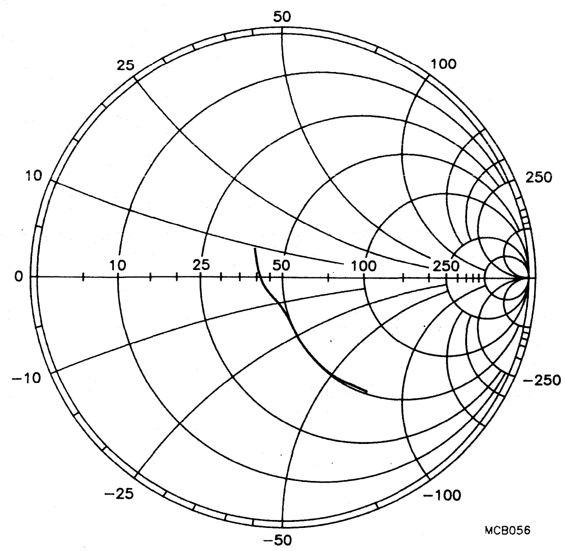

Fig.14 Output reflection coefficient S_{22}; V_{CE} = 10 V; I_C = 70 mA; T_{amb} = 25 °C; typical values.

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S-Parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

I_C (mA)	f (MHz)	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} (dB)
	40	0.84/- 32.9	13.1/160.1	0.02/74.0	0.95/- 12.8	37.8
	100	0.76/- 73.1	10.2/138.1	0.04/56.3	0.79/- 27.3	28.2
	200	0.69/-117.6	7.4/114.1	0.06/43.1	0.62/- 35.4	22.2
	500	0.63/-171.8	3.4/ 84.6	0.07/41.3	0.45/- 44.7	13.8
5	800	0.61/ 159.8	2.2/ 69.3	0.09/48.3	0.42/- 55.8	9.6
	1000	0.61/ 146.0	1.8/ 60.5	0.10/55.1	0.40/- 65.1	7.7
	1200	0.61/ 133.8	1.5/ 52.2	0.11/63.4	0.37/- 75.8	6.1
	1500	0.59/ 117.1	1.2/ 43.9	0.14/67.2	0.36/- 93.4	4.0
	2000	0.59/ 82.8	0.8/ 30.6	0.21/72.5	0.33/-126.2	0.6
	40	0.71/- 46.9	24.2/152.2	0.02/66.8	0.89/- 21.4	37.5
	100	0.63/- 95.9	17.0/126.6	0.04/52.3	0.65/- 38.7	29.2
	200	0.59/-137.8	10.3/106.0	0.05/47.2	0.44/- 46.9	23.0
	500	0.56/ 177.7	4.5/ 82.6	0.07/56.0	0.29/- 51.3	15.0
10	800	0.56/ 154.7	2.8/ 69.5	0.10/61.6	0.25/- 61.1	11.0
	1000	0.56/ 142.8	2.3/ 61.6	0.11/63.7	0.23/- 69.4	9.0
	1200	0.56/ 131.6	1.9/ 54.7	0.14/66.6	0.22/- 80.2	7.3
	1500	0.56/ 116.3	1.5/ 46.4	0.17/67.9	0.21/- 99.1	5.3
	2000	0.56/ 93.2	1.1/ 34.1	0.23/68.8	0.19/-136.7	2.4
	40	0.47/- 85.5	44.5/137.3	0.02/65.4	0.73/- 39.1	37.3
	100	0.48/-135.9	24.8/112.1	0.02/58.7	0.41/- 60.0	29.8
	200	0.50/-163.5	13.4/ 97.2	0.04/65.9	0.24/- 69.3	24.0
	500	0.50/ 167.5	5.5/ 80.5	0.07/70.5	0.12/- 80.5	16.2
30	800	0.51/ 149.5	3.5/ 69.4	0.11/70.7	0.09/- 91.9	12.2
	1000	0.52/ 139.2	2.8/ 62.8	0.13/70.7	0.08/-106.3	10.2
	1200	0.52/ 129.5	2.3/ 57.3	0.16/71.5	0.07/-126.8	8.5
	1500	0.52/ 115.2	1.8/ 49.2	0.19/67.0	0.08/-154.7	6.7
	2000	0.53/ 93.7	1.3/ 39.0	0.25/65.6	0.10/ 158.6	4.0
	40	0.42/-105.0	51.8/131.1	0.01/63.4	0.65/- 46.5	37.5
	100	0.46/-148.6	26.6/107.7	0.02/64.8	0.34/- 68.4	30.1
	200	0.48/-170.0	14.0/ 94.9	0.03/64.4	0.19/- 80.7	24.3
	500	0.49/ 165.2	5.7/ 79.7	0.07/73.8	0.09/-100.5	16.4
50	800	0.50/ 148.5	3.6/ 69.2	0.11/71.4	0.07/-119.4	12.4
	1000	0.51/ 138.5	2.9/ 63.1	0.14/71.9	0.07/-140.3	10.5
	1200	0.51/ 128.9	2.4/ 57.5	0.16/71.8	0.07/-157.3	8.8
	1500	0.52/ 114.9	1.9/ 49.9	0.20/67.6	0.09/ 174.1	7.0
	2000	0.53/ 93.6	1.4/ 40.2	0.26/65.7	0.13/ 141.3	4.2
	40	0.40/-117.5	55.2/127.4	0.01/64.0	0.60/- 51.0	37.5
	100	0.46/-154.5	27.2/105.3	0.02/62.6	0.30/- 72.6	30.1
	200	0.48/-173.1	14.2/ 93.6	0.03/70.8	0.16/- 86.1	24.3
	500	0.49/ 164.1	5.8/ 79.3	0.07/75.0	0.08/-109.8	16.4
70	800	0.51/ 148.0	3.6/ 69.1	0.11/73.1	0.06/-131.5	12.5
	1000	0.51/ 138.3	2.9/ 62.8	0.14/70.8	0.06/-155.7	10.5
	1200	0.51/ 128.7	2.4/ 57.8	0.16/70.9	0.07/-172.6	8.8
	1500	0.51/ 114.7	1.9/ 49.9	0.20/68.1	0.10/ 165.6	7.0
	2000	0.53/ 93.5	1.4/ 40.6	0.27/64.4	0.14/ 136.3	4.3

Philips Components

Data sheet	
status	Product specification
date of issue	April 1991

BFG135

NPN 7 GHz wideband transistor

NPN planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The small emitter structures ensure high output voltage capabilities at a low distortion level.
The distribution of the active areas across the surface of the device, gives an excellent temperature profile.

MECHANICAL DATA

SOT223.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

PIN CONFIGURATION

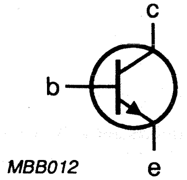


Fig.1 Pin configuration.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	-	25	V
V_{CEO}	collector-emitter voltage	open base	-	-	15	V
I_C	collector current (DC)		-	-	150	mA
P_{tot}	total power dissipation	T_{case} = 145 °C note 1	-	-	1	W
T_j	junction temperature		-	-	175	°C
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	-	-	
f_T	transition frequency	f = 1 GHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	7.0	-	GHz
G_{UM}	maximum power gain	f = 500 MHz; I_C = 100 mA; V_{CE} = 10 V	-	16	-	dB
G_{UM}	maximum power gain	f = 800 MHz; I_C = 100 mA; V_{CE} = 10 V	-	12	-	dB
V_o	output voltage	d_{im} = −60 dB; I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz	-	850	-	mV

Note

1. T_{case} temperature measured on soldering point of collector tab.

NPN 7 GHz wideband transistor BFG135

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG135	SOT223	bulk	500
BFG135	SOT223	12 mm reel	1000

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	25	V
V_{CEO}	collector-emitter voltage	open base	-	15	V
V_{EBO}	emitter-base voltage	open collector	-	2	V
I_C	collector current (DC)		-	150	mA
P_{tot}	total power dissipation	T_{case} = 145 °C	-	1	W
T_{stg}	storage temperature range		−65	+150	°C
T_j	junction temperature		-	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	NOM.	UNIT
$R_{th\ j\text{-}c}$	from junction to case	30	K/W

NPN 7 GHz wideband transistor BFG135

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	-	-	1	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	80	-	-	
f_T	transition frequency	f = 1 GHz; I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C	-	7.0	-	GHz
C_c	collector capacitance	f = 1 MHz; $I_e = i_e = 0$; V_{CB} = 10 V	-	2.0	-	pF
C_e	emitter capacitance	f = 1 MHz; $I_c = i_c = 0$; V_{EB} = 0.5 V	-	7.0	-	pF
C_{re}	feedback capacitance	f = 1 MHz; I_C = 0; V_{CE} = 10 V	-	1.2	-	pF
G_{UM}	maximum power gain	f = 500 MHz; T_{amb} = 25 °C; I_C = 100 mA; V_{CE} = 10 V	-	16	-	dB
G_{UM}	maximum power gain	f = 800 MHz; T_{amb} = 25 °C; I_C = 100 mA; V_{CE} = 10 V	-	12	-	dB
V_o	output voltage	note 1	-	900	-	mV
V_o	output voltage	note 2	-	850	-	mV

Notes

1. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; I_C = 100 mA;
   V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB;
   $V_q = V_o$ −6 dB; f_p = 445.25 MHz;
   $V_r = V_o$ −6 dB; f_q = 453.25 MHz; f_r = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz

2. d_{im} = −60 dB (DIN 45004B); T_{amb} = 25 °C; I_C = 100 mA;
   V_{CE} = 10 V; R_L = 75 Ω; $V_p = V_o$ at d_{im} = −60 dB;
   $V_q = V_o$ −6 dB; f_p = 795.25 MHz;
   $V_r = V_o$ −6 dB; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz

S-Parameters (common emitter) at V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

I_C (mA)	f (MHz)	S_{11}	S_{21}	S_{12}	S_{22}	G_{UM} (dB)
		M Φ	M Φ	M Φ	M Φ	
	40	0.79/- 25.3	12.7/165.9	0.02/75.7	0.97/- 11.1	38.3
	100	0.70/- 57.4	12.1/146.9	0.04/62.4	0.87/- 25.4	31.7
	200	0.64/-100.7	9.0/125.7	0.06/46.1	0.69/- 41.2	25.3
	500	0.60/-162.7	4.6/ 92.7	0.08/32.6	0.44/- 60.4	17.0
10	800	0.60/ 168.5	2.9/ 75.6	0.08/34.3	0.35/- 73.9	12.7
	1000	0.60/ 154.0	2.4/ 65.9	0.08/41.3	0.34/- 82.6	10.8
	1200	0.60/ 141.4	1.9/ 57.5	0.08/50.5	0.33/- 93.4	8.9
	1500	0.60/ 124.7	1.5/ 48.5	0.09/61.3	0.32/-111.5	6.7
	2000	0.61/ 100.0	1.1/ 34.3	0.41/76.3	0.32/-144.0	3.2
	40	0.69/- 38.7	24.8/159.3	0.02/72.6	0.93/- 17.4	38.7
	100	0.62/- 81.3	18.7/138.5	0.04/57.9	0.74/- 39.9	31.0
	200	0.58/-127.1	13.1/115.7	0.05/45.3	0.53/- 56.9	25.9
	500	0.56/ 174.8	6.0/ 88.8	0.06/44.4	0.32/- 72.4	18.3
20	800	0.56/ 159.5	3.7/ 74.8	0.07/54.9	0.22/- 91.6	13.9
	1000	0.56/ 148.2	3.0/ 66.5	0.08/58.2	0.20/-103.6	11.9
	1200	0.57/ 136.6	2.5/ 59.8	0.10/63.9	0.19/-114.9	10.2
	1500	0.57/ 121.5	1.9/ 51.4	0.12/67.9	0.20/-135.1	8.0
	2000	0.58/ 99.8	1.4/ 39.3	0.17/73.3	0.22/-167.3	5.1
	40	0.60/- 83.2	44.8/148.9	0.01/69.2	0.82/- 33.1	38.4
	100	0.55/-131.0	29.7/123.0	0.02/52.4	0.55/- 62.4	32.2
	200	0.54/-159.8	17.3/104.4	0.03/55.6	0.33/- 86.9	26.9
	500	0.54/ 169.9	7.3/ 84.9	0.05/68.7	0.18/-124.2	19.2
50	800	0.54/ 152.0	4.6/ 73.7	0.08/71.1	0.15/-147.1	15.2
	1000	0.54/ 142.0	3.6/ 67.0	0.09/71.1	0.15/-160.5	13.1
	1200	0.54/ 132.6	3.0/ 61.8	0.12/72.1	0.15/-174.7	11.4
	1500	0.54/ 119.1	2.4/ 54.2	0.15/72.3	0.18/-170.8	9.4
	2000	0.56/ 98.3	1.6/ 44.2	0.20/71.1	0.22/ 148.3	6.4
	40	0.33/-117.0	53.4/143.7	0.01/73.3	0.76/- 39.7	38.8
	100	0.49/-147.8	32.6/117.1	0.02/65.0	0.46/- 74.6	32.5
	200	0.56/-169.3	18.2/101.0	0.03/66.7	0.28/-102.7	27.2
	500	0.58/ 166.0	7.5/ 83.9	0.05/72.8	0.17/-141.6	19.4
70	800	0.59/ 149.8	4.7/ 73.2	0.08/73.2	0.16/-164.9	15.4
	1000	0.59/ 140.1	3.7/ 66.8	0.10/72.2	0.17/-177.0	13.4
	1200	0.58/ 131.1	3.0/ 61.9	0.12/73.9	0.17/-173.4	11.6
	1500	0.58/ 117.9	2.4/ 54.5	0.15/71.8	0.20/ 161.2	9.7
	2000	0.58/ 97.8	1.7/ 45.3	0.20/70.6	0.25/ 138.5	6.7
	40	0.35/-130.4	58.2/140.3	0.01/59.3	0.70/- 44.7	38.8
	100	0.50/-156.7	33.7/114.7	0.02/64.8	0.42/- 79.1	32.7
	200	0.56/-173.5	18.4/ 99.3	0.03/67.8	0.26/-108.5	27.2
	500	0.58/ 164.4	7.6/ 82.9	0.05/75.5	0.18/-150.7	19.5
100	800	0.59/ 148.8	4.7/ 72.7	0.08/74.8	0.17/-169.5	15.5
	1000	0.59/ 139.4	3.7/ 66.3	0.10/75.8	0.18/-177.7	13.4
	1200	0.58/ 130.5	3.0/ 61.7	0.12/74.6	0.18/-166.9	11.6
	1500	0.58/ 117.5	2.4/ 54.4	0.16/73.2	0.21/ 156.6	9.8
	2000	0.59/ 97.7	1.7/ 45.1	0.20/70.6	0.26/ 135.2	6.7

NPN 7 GHz wideband transistor
BFG135

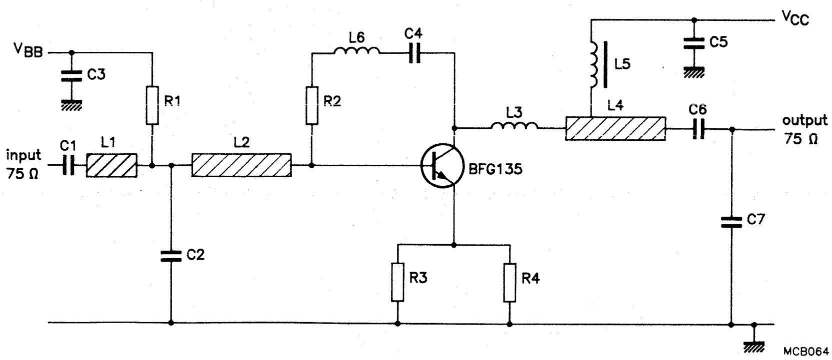


Fig.2 Intermodulation and second harmonic test circuit.

List of components:

R1 = 10 kΩ metalfilm resistor (cat. no. 2322 180 73103)
R2 = 200 Ω metalfilm resistor (cat. no. 2322 180 73201)
R3 = R4 = 27 Ω metalfilm resistor (cat. no. 2322 180 73279)

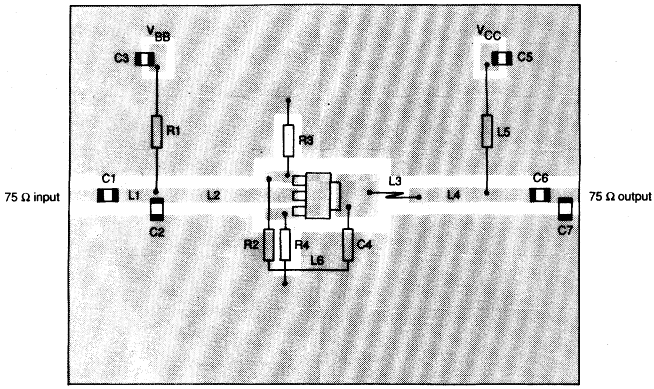
C1 = C3 = C5 = C6 = 10 nF ceramic multilayer capacitor (cat. no. 2222 590 08627)
C2 = C7 = 1 pF ceramic multilayer capacitor (cat. no. 2222 851 12108)
C4 = 10 nF miniature ceramic plate capacitor (cat. no. 2222 629 08103)

L1 = 75 Ω microstripline (L = 7 mm; W = 2.5 mm)
L2 = 75 Ω microstripline (L = 22 mm; W = 2.5 mm)
L3 = 1.5 turn Cu wire (0.4 mm), internal diameter 3 mm, winding pitch 1 mm
L4 = 75 Ω microstripline (L = 19 mm; W = 2.5 mm)
L5 = 5 µH Ferroxcube choke (cat. no. 3122 108 20153)
L6 = 30 mm Cu wire (0.4 mm; L ≈ 24 nH)

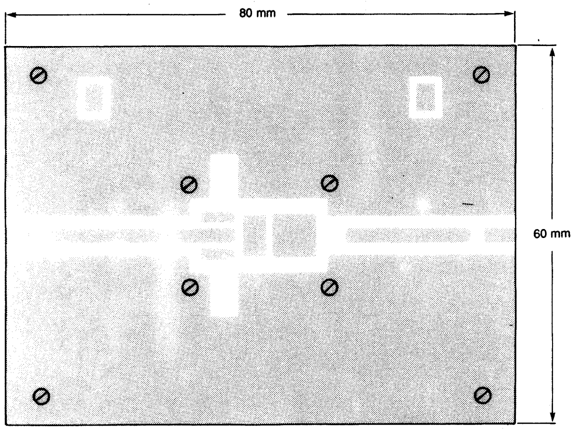
The circuit has been build on a double Cu clad printed circuit board with P.T.F.E. dielectric ($\varepsilon_r = 2.2$); thickness 1/16 inch; thickness of copper-sheet 2 x 35 µm; see Fig 3.

The components R2, L6, C4 and L3 are mounted on the underside of the PCB

NPN 7 GHz wideband transistor BFG135



7Z26284



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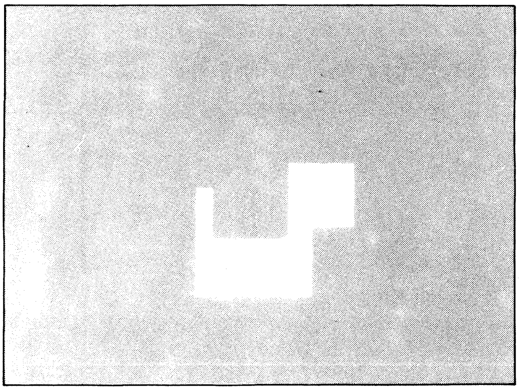

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Fig.3 Intermodulation test circuit printed circuit board.

NPN 7 GHz wideband transistor BFG135

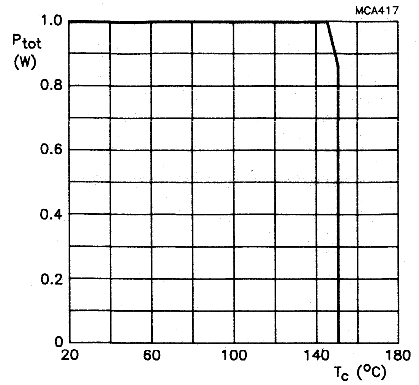


Fig.4 Power derating curve.

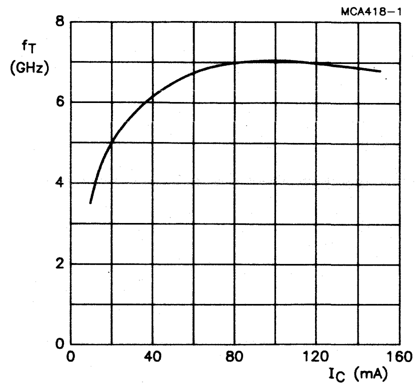


Fig.5 Transition frequency as a function of collector current; V_{CE} = 10 V; f = 1 GHz; T_j = 25 °C; typical values.

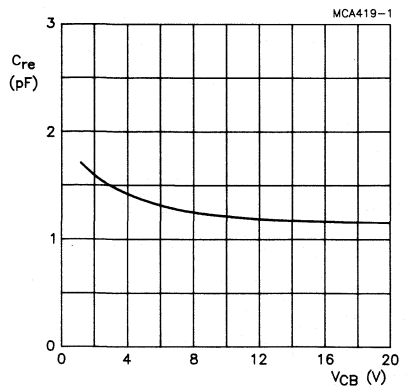


Fig.6 Feedback capacitance as a function of collector-base voltage; I_E = 0; f = 1 MHz; T_j = 25 °C; typical values.

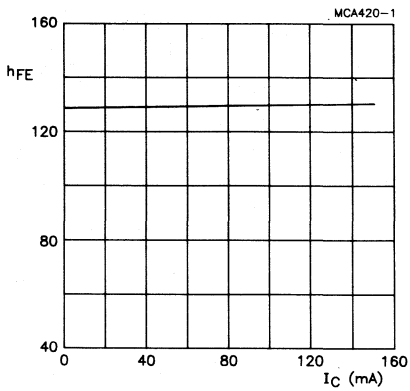


Fig.7 DC current gain as a function of collector current; V_{CE} = 10 V; T_j = 25 °C; typical values.

NPN 7 GHz wideband transistor BFG135

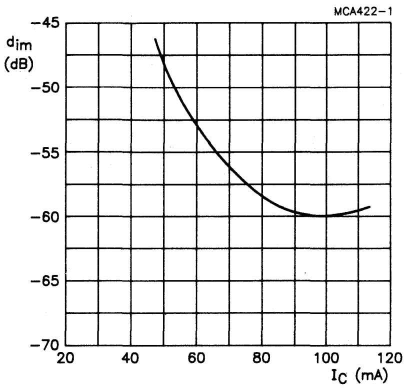


Fig.8 Intermodulation distortion; V_{CE} = 10 V; V_o = 900 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C; typical values.

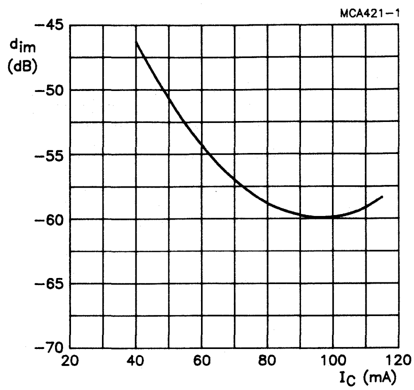


Fig.9 Intermodulation distortion; V_{CE} = 10 V; V_o = 850 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C; typical values.

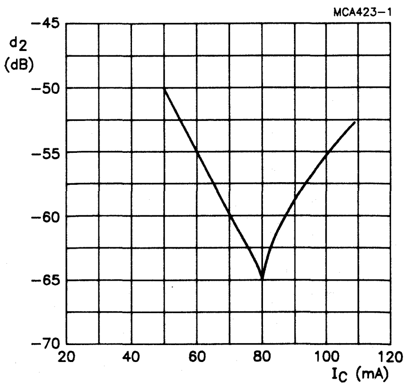


Fig.10 Second order beat; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C; typical values.

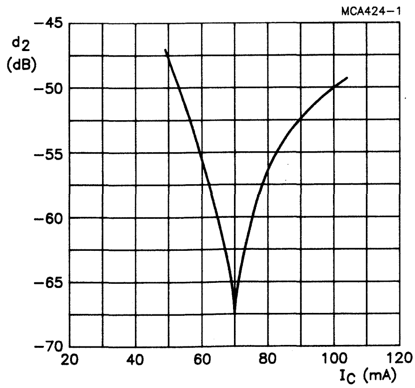


Fig.11 Second order beat; V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C; typical values.

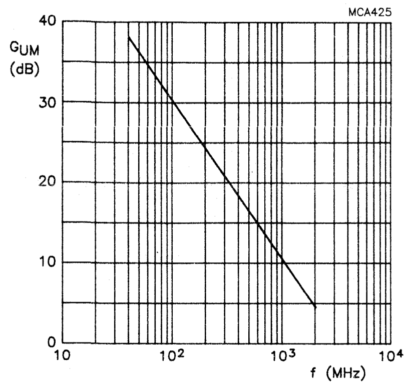


Fig.12 Maximum unilateral gain as a function of frequency; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

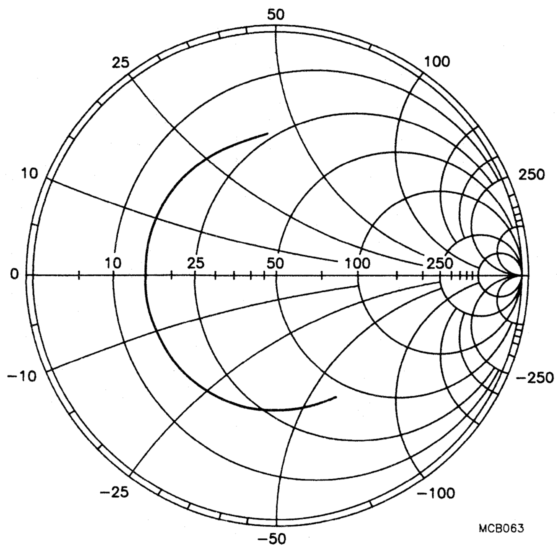


Fig.13 Input reflection coefficient S_{11}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

NPN 7 GHz wideband transistor BFG135

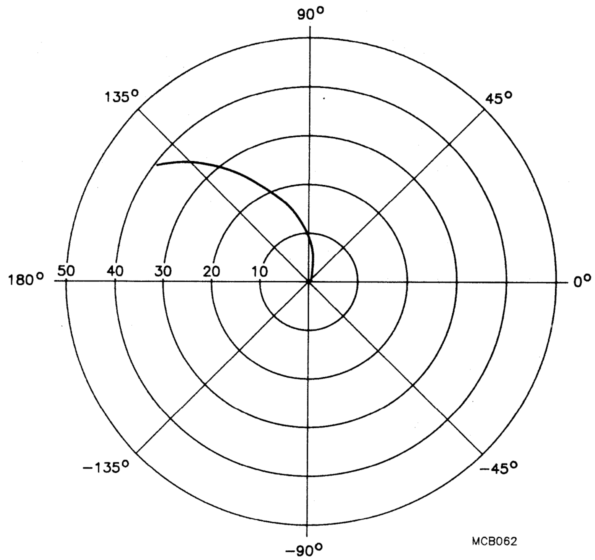


Fig.14 Forward transmission coefficient S_{21}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

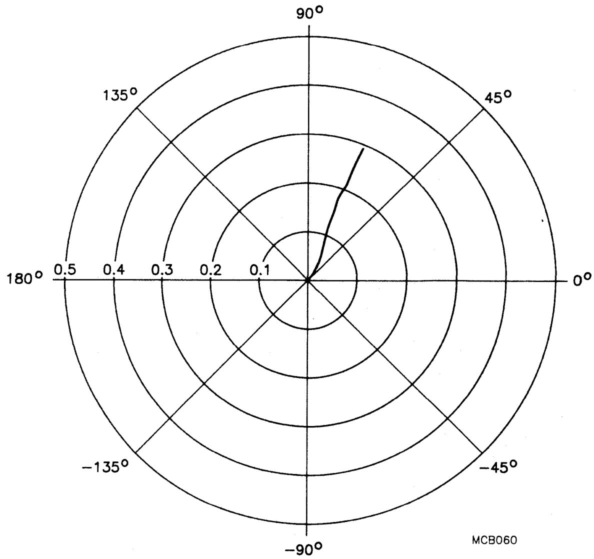


Fig.15 Reverse transmission coefficient S_{12}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

NPN 7 GHz wideband transistor | BFG135

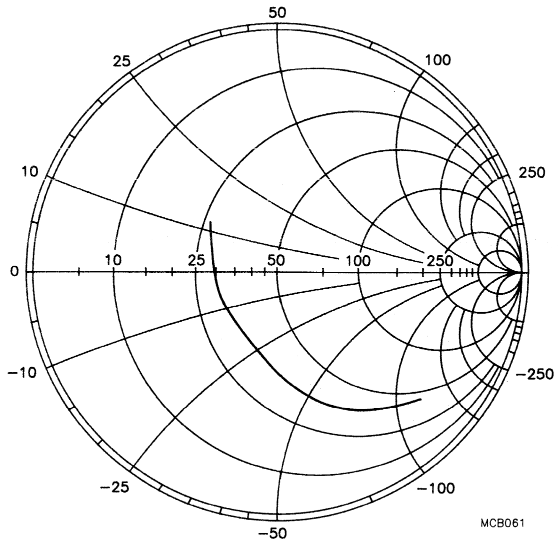


Fig.16 Output reflection coefficient S_{22}; V_{CE} = 10 V; I_C = 100 mA; T_{amb} = 25 °C; typical values.

Philips Components

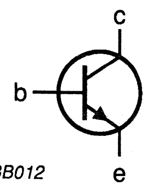
Data sheet	
status	Product specification
date of issue	April 1991

BFG197/197X
NPN 7 GHz wideband transistor

DESCRIPTION

NPN transistor in a microminiature SOT143 envelope. It is designed for wideband application in the 7 GHz range, such as satellite TV systems (SATV) and repeater amplifiers in fibre-optical systems. The device features a very high transition frequency, high gain and a very low noise figure up to high frequencies.

PIN CONFIGURATION



MBB012

Fig.1 Symbol

PINNING

BFG 197

PIN	DESCRIPTION
1	collector
2	base
3	emitter
4	emitter

BFG197X

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	20	V
V_{CEO}	collector-emitter voltage	open base	-	10	V
I_C	collector current (DC)		-	100	mA
P_{tot}	total power dissipation	$T_s = 80$ °C	-	300	W
T_j	junction temperature		-	150	°C
f_T	transition frequency	f = 2 GHz; $I_C = 50$ mA; $V_{CE} = 4$ V; $T_{amb} = 25$ °C	7.5	-	GHz
C_{re}	feedback capacitance	f = 1 MHz; $I_C = 0$; $V_{CE} = 8$ V	0.85	-	pF
G_{UM}	maximum power gain	f = 2 GHz; $I_C = 50$ mA; $T_{amb} = 25$ °C;			
		$V_{CE} = 4$ V;	-	11	dB
		$V_{CE} = 6$ V;	-	11	dB

ORDERING AND PACKAGE INFORMATION

EXTENDED TYPE NUMBER	PACKAGE		
	CODE	PACKING METHOD	PACKING QUANTITY
BFG197	SOT143	bulk	500
BFG197	SOT143	12 mm tape	3000
BFG197X	SOT143 note 1	bulk	500
BFG197X	SOT143 note 1	12 mm tape	3000

Note

1. Cross emitter pinning.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	-	20	V
V_{CEO}	collector-emitter voltage	open base	-	10	V
V_{EBO}	emitter-base voltage	open collector	-	2.5	V
I_C	collector current (DC)		-	100	mA
P_{tot}	total power dissipation	T_s = 80 °C note 1	-	300	mW
T_{stg}	storage temperature range		−65	150	°C
T_j	junction temperature		-	150	°C

THERMAL RESISTANCE

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

Note

1. Mounted on a ceramic substrate measuring 8 x 10 x 0.7 mm.
   T_s = temperature measured at soldering pont of collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 5$ V	-	-	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 5$ V	40	90	-	
f_T	transition frequency	f = 2 GHz; $I_C = 50$ mA; $V_{CE} = 4$ V; $T_{amb} = 25$ °C	-	7.5	-	GHz
F	noise figure at optimum source impedance	$I_C = 15$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	-	1.7	-	dB
F	noise figure at optimum source impedance	$I_C = 50$ mA; $V_{CE} = 6$ V; f = 1 GHz; $T_{amb} = 25$ °C	-	2.3	-	dB
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	-	1.5	-	pF
C_e	emitter capacitance	f = 1 MHz; $I_C = i_c = 0$; $V_{EB} = 0.5$ V	-	3.3	-	pF
C_{re}	feedback capacitance	f = 1 MHz; $I_C = 0$; $V_{CE} = 8$ V	-	0.85	-	pF
G_{UM}	maximum unilateral power gain	note 1 f = 2 GHz; $T_{amb} = 25$ °C; $I_E = 50$ mA; $V_{CE} = 4$ V	-	11	-	dB
G_{UM}	maximum unilateral power gain	note 1 f = 2 GHz; $T_{amb} = 25$ °C; $I_E = 50$ mA; $V_{CE} = 6$ V	-	11	-	dB

Note

1. $$G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)\ (1-|S_{22}|^2)}$$

S-parameters (common emitter) at V_{CE} = 4.00 V

I_C (mA)	f (MHz)	S_{11} M Φ	S_{21} M Φ	S_{12} M Φ	S_{22} M Φ	G_{UM} (dB)
	40	0.36/- 49.6	20.42/165.1	0.02/69.8	1.08/- 14.9	34.7
	100	0.54/-100.4	17.36/141.8	0.03/57.2	0.94/- 38.0	35.7
	200	0.69/-134.8	11.94/120.5	0.04/43.6	0.65/- 59.6	26.7
	500	0.82/-166.8	5.61/ 91.2	0.05/34.6	0.40/- 89.5	20.6
10	800	0.84/-178.7	3.68/ 78.0	0.06/40.2	0.37/- 99.9	17.1
	1000	0.85/ 175.2	2.89/ 70.1	0.06/44.3	0.35/-103.5	15.2
	1200	0.86/ 169.3	2.37/ 66.2	0.07/50.9	0.34/-109.2	13.8
	1500	0.84/ 164.4	2.02/ 56.5	0.08/54.9	0.37/-113.9	12.0
	2000	0.84/ 153.5	1.49/ 46.1	0.11/62.6	0.40/-123.6	9.7
	40	0.29/- 72.8	26.00/162.3	0.02/66.9	1.06/- 18.9	37.6
	100	0.55/-119.0	20.87/137.3	0.03/55.1	0.88/- 46.2	34.4
	200	0.70/-146.8	13.71/116.5	0.04/44.0	0.58/- 70.3	27.5
	500	0.83/-172.1	6.12/ 89.5	0.04/41.6	0.36/-104.2	21.5
15	800	0.84/ 177.8	4.00/ 77.5	0.06/49.0	0.34/-113.8	17.7
	1000	0.85/ 172.4	3.14/ 70.3	0.06/52.8	0.32/-117.5	15.9
	1200	0.86/ 166.8	2.58/ 66.9	0.07/58.0	0.31/-123.5	14.5
	1500	0.84/ 162.5	2.20/ 57.3	0.09/59.9	0.34/-125.7	12.6
	2000	0.83/ 151.9	1.64/ 47.8	0.12/64.6	0.37/-133.1	10.1
	40	0.28/- 93.5	30.55/160.2	0.02/65.4	1.05/- 22.1	40.3
	100	0.57/-130.7	23.42/133.8	0.02/54.4	0.83/- 52.5	34.2
	200	0.72/-153.7	14.69/113.8	0.03/45.8	0.54/- 78.4	28.0
	500	0.83/-175.1	6.43/ 88.5	0.04/47.4	0.35/-114.5	21.8
20	800	0.83/ 175.8	4.19/ 77.2	0.06/54.6	0.33/-137.8	18.1
	1000	0.85/ 170.8	3.28/ 70.3	0.06/57.8	0.32/-126.9	16.2
	1200	0.86/ 165.3	2.71/ 67.4	0.07/62.2	0.31/-133.5	14.9
	1500	0.83/ 161.4	2.31/ 57.8	0.09/62.6	0.33/-133.8	12.8
	2000	0.83/ 151.0	1.73/ 48.7	0.12/65.2	0.36/-139.9	10.3
	40	0.31/-119.7	36.73/157.0	0.02/62.3	1.01/- 26.9	47.3
	100	0.62/-143.8	26.39/129.3	0.02/52.4	0.76/- 61.3	34.3
	200	0.75/-161.8	15.92/110.3	0.03/47.9	0.48/- 89.9	28.7
	500	0.83/-178.4	6.74/ 87.3	0.04/54.9	0.34/-126.7	22.2
30	800	0.83/ 173.6	4.38/ 76.7	0.05/61.5	0.33/-133.6	18.5
	1000	0.85/ 169.0	3.43/ 70.3	0.06/63.0	0.32/-138.0	16.6
	1200	0.86/ 163.8	2.84/ 67.8	0.07/66.9	0.32/-144.6	15.3
	1500	0.83/ 160.2	2.42/ 58.3	0.10/65.1	0.34/-143.1	13.2
	2000	0.83/ 149.8	1.82/ 49.6	0.13/66.4	0.35/-148.1	10.8
	40	0.40/-140.6	44.62/152.6	0.02/54.8	0.96/- 33.5	45.4
	100	0.68/-155.5	29.14/124.0	0.02/51.8	0.68/- 72.5	34.6
	200	0.77/-167.8	16.87/106.6	0.02/53.7	0.44/-103.1	29.4
	500	0.84/ 178.7	6.92/ 86.0	0.04/62.3	0.35/-112.1	22.7
50	800	0.84/ 171.7	4.49/ 75.8	0.06/66.2	0.34/-143.8	18.8
	1000	0.85/ 167.5	3.51/ 70.0	0.07/67.5	0.33/-147.8	16.9
	1200	0.86/ 162.5	2.91/ 67.8	0.08/70.2	0.33/-154.4	15.6
	1500	0.83/ 159.0	2.48/ 58.3	0.10/67.2	0.34/-151.3	13.4
	2000	0.82/ 148.8	1.88/ 50.0	0.13/66.9	0.36/-155.2	11.0

S-parameters (common emitter) at V_{CE} = 8.00 V

I_C (mA)	f (MHz)	S_{11} M / Φ	S_{21} M / Φ	S_{12} M / Φ	S_{22} M / Φ	G_{UM} (dB)
5	40	0.57/- 25.7	12.45/169.2	0.02/74.6	1.10/- 9.0	30.5
	100	0.63/- 66.0	11.47/149.8	0.04/62.3	1.03/- 24.9	35.1
	200	0.70/-106.1	8.71/129.0	0.06/46.8	0.80/- 41.5	26.2
	500	0.83/-152.5	4.63/ 95.3	0.07/25.7	0.54/- 64.8	19.9
	800	0.84/-169.0	3.08/ 79.8	0.07/24.3	0.48/- 75.6	16.3
	1000	0.86/-177.1	2.43/ 70.3	0.07/25.2	0.47/- 79.4	14.5
	1200	0.86/ 175.9	1.98/ 65.2	0.07/31.4	0.46/- 86.3	12.8
	1500	0.86/ 169.5	1.68/ 55.3	0.07/40.1	0.47/- 93.2	11.3
	2000	0.86/ 157.5	1.22/ 43.6	0.09/57.2	0.50/-107.6	9.0
10	40	0.41/- 42.3	20.42/165.6	0.02/69.2	1.08/- 14.1	34.9
	100	0.56/- 92.9	17.56/142.8	0.03/58.8	0.95/- 36.5	36.6
	200	0.68/-129.6	12.22/121.8	0.04/44.1	0.66/- 57.3	27.0
	500	0.81/-164.6	5.83/ 92.0	0.05/33.9	0.41/- 86.5	20.8
	800	0.83/-177.1	3.82/ 78.8	0.06/39.0	0.37/- 96.7	17.2
	1000	0.84/ 176.5	3.01/ 70.8	0.06/43.0	0.35/-100.4	15.4
	1200	0.85/ 170.3	2.47/ 66.9	0.07/49.0	0.34/-105.8	13.9
	1500	0.83/ 165.3	2.10/ 57.3	0.08/53.8	0.36/-110.9	12.1
	2000	0.83/ 154.3	1.55/ 47.0	0.11/61.8	0.40/-121.0	9.7
15	40	0.34/- 59.1	26.30/163.0	0.02/66.9	1.06/- 18.1	37.9
	100	0.55/-110.2	21.36/138.3	0.03/55.3	0.89/- 44.6	34.9
	200	0.69/-141.8	14.19/117.5	0.04/44.4	0.59/- 68.1	27.7
	500	0.81/-170.0	6.40/ 90.3	0.05/40.1	0.36/-101.5	21.4
	800	0.82/ 179.3	4.18/ 78.3	0.06/47.2	0.33/-111.1	17.7
	1000	0.83/ 173.6	3.28/ 71.0	0.06/51.4	0.32/-114.4	15.9
	1200	0.84/ 167.7	2.70/ 67.7	0.07/56.7	0.31/-120.9	14.3
	1500	0.82/ 163.5	2.30/ 58.2	0.09/58.9	0.33/-123.3	12.6
	2000	0.82/ 152.6	1.71/ 48.5	0.12/63.6	0.36/-130.8	10.1
20	40	0.31/- 74.2	30.90/160.9	0.02/66.7	1.04/- 21.2	41.3
	100	0.57/-121.5	24.24/134.8	0.02/53.8	0.83/- 50.9	34.5
	200	0.70/-148.9	15.38/114.7	0.03/44.9	0.54/- 76.3	28.2
	500	0.81/-173.1	6.75/ 89.3	0.04/45.5	0.35/-112.2	21.8
	800	0.82/ 177.2	4.39/ 77.8	0.06/53.0	0.32/- 44.9	18.1
	1000	0.83/ 171.9	3.45/ 71.0	0.06/55.9	0.31/-124.9	16.2
	1200	0.84/ 166.3	2.84/ 68.1	0.07/61.1	0.30/-131.5	14.7
	1500	0.82/ 162.3	2.42/ 58.7	0.09/61.2	0.33/-131.9	13.0
	2000	0.81/ 151.7	1.81/ 49.5	0.12/64.5	0.35/-138.1	10.3
30	40	0.31/- 95.5	37.63/157.6	0.02/63.8	1.01/- 26.0	47.5
	100	0.60/-134.2	27.51/130.3	0.02/53.1	0.77/- 59.7	34.6
	200	0.72/-156.5	16.67/111.1	0.03/46.6	0.49/- 87.7	28.8
	500	0.82/-176.4	7.10/ 87.8	0.04/51.9	0.34/-125.0	22.3
	800	0.82/ 175.0	4.62/ 77.3	0.06/59.4	0.32/-132.0	18.5
	1000	0.83/ 170.2	3.62/ 71.0	0.06/61.4	0.31/-136.5	16.6
	1200	0.84/ 164.6	2.99/ 68.4	0.07/64.7	0.30/-143.4	15.2
	1500	0.81/ 161.1	2.54/ 59.0	0.10/63.6	0.32/-141.8	13.2
	2000	0.81/ 150.6	1.92/ 50.4	0.13/65.1	0.34/-146.6	10.7

NPN 7 GHz wideband transistor

BFG197/197X

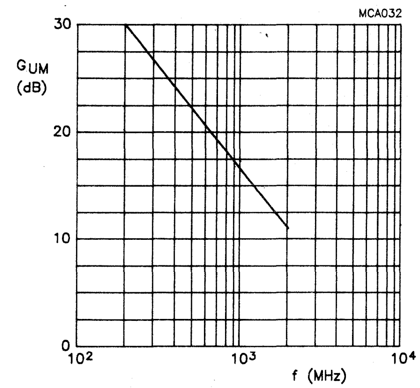


Fig.2 Gain as a function of frequency; $V_{CE} = 8$ V; $I_C = 50$ mA; $T_{amb} = 25$ °C; typical values.

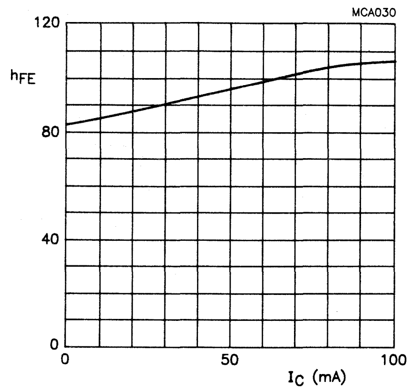


Fig.3 DC current gain; typical values.

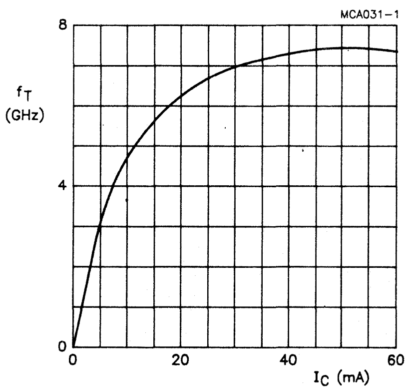


Fig.4 Transition frequency; $V_{CE} = 4$ V; f = 2 GHz; $T_{amb} = 25$ °C; typical values.

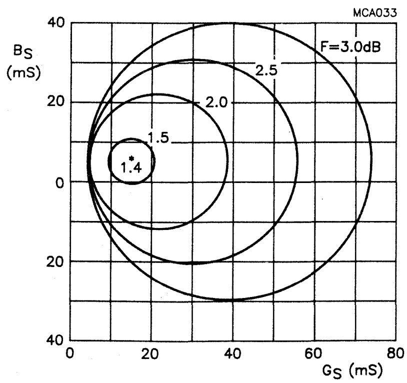


Fig.5 Circles of constant noise; $V_{CE} = 8$ V; $I_C = 15$ mA; f = 800 MHz; typical values.

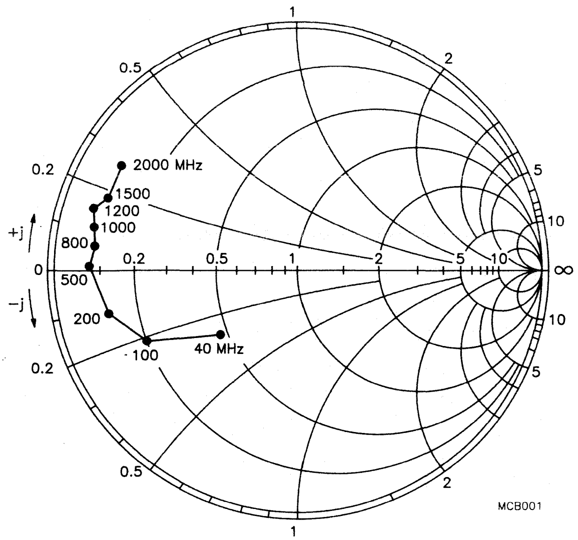


Fig.6 Input impedance derived from S_{11} (Ω x 50); V_{CE} = 4 V; I_C = 50 mA; T_{amb} = 25 °C.

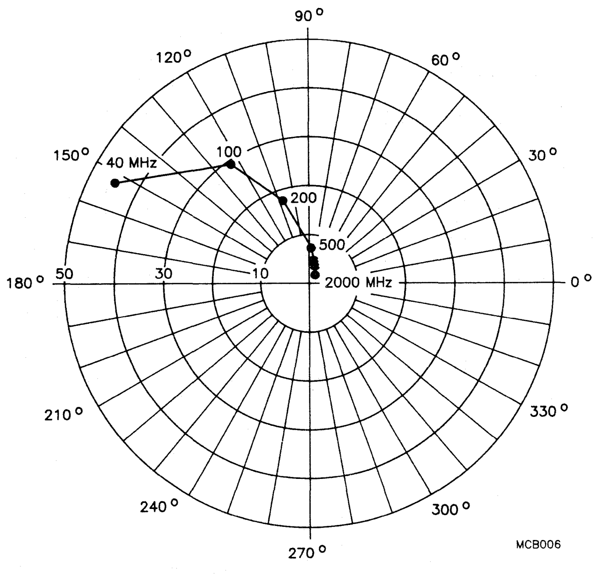


Fig.7 Forward transmission coefficient S_{21}; V_{CE} = 4 V; I_C = 50 mA; T_{amb} = 25 °C.

NPN 7 GHz wideband transistor BFG197/197X

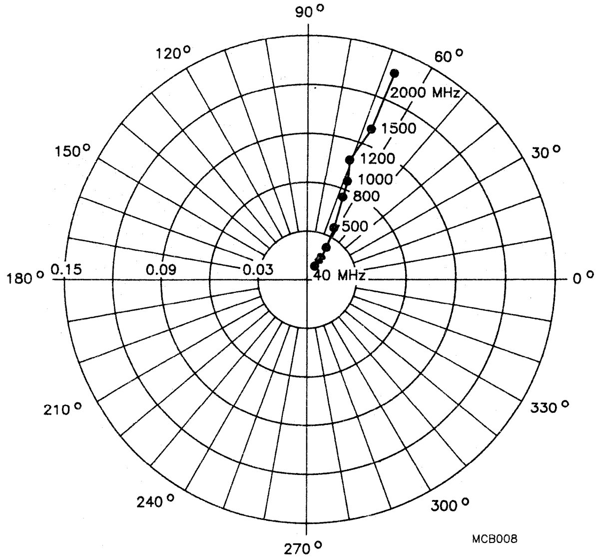


Fig.8 Reverse transmission coefficient S_{12}; V_{CE} = 4 V; I_C = 50 mA; T_{amb} = 25 °C.

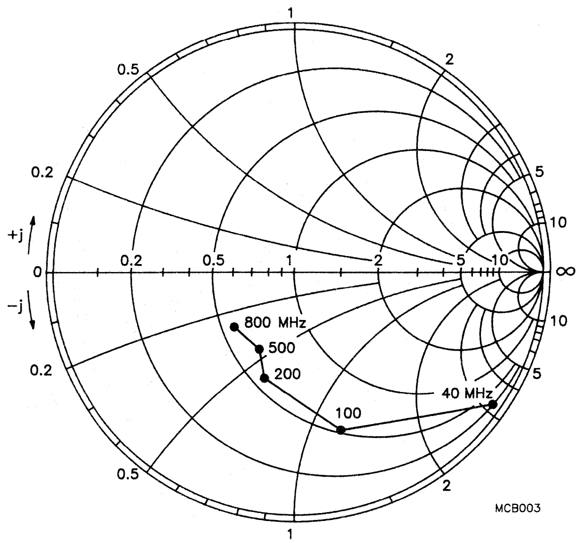


Fig.9 Output impedance derived from S_{22} (Ω x 50); V_{CE} = 4 V; I_C = 50 mA; T_{amb} = 25 °C.

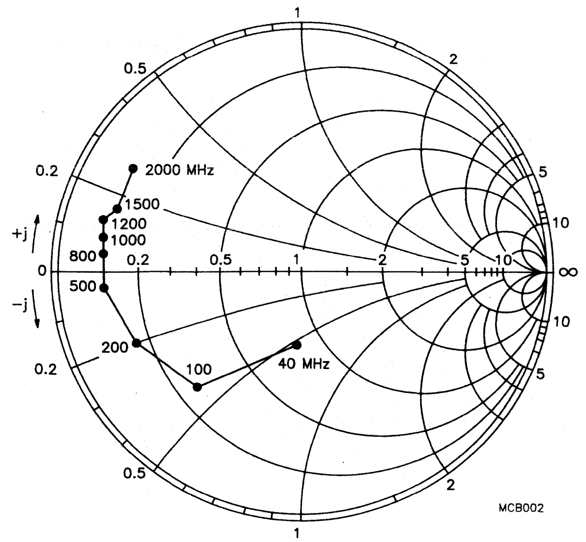


Fig.10 Input impedance derived from S_{11} (Ω x 50); V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

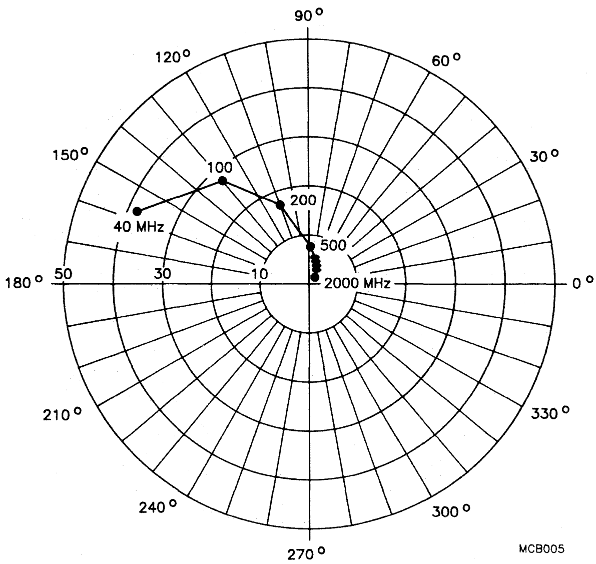


Fig.11 Forward transmission coefficient S_{21}; V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

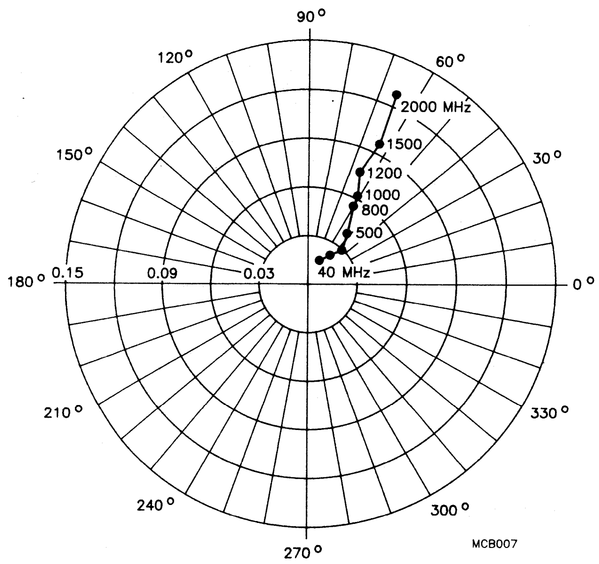


Fig.12 Reverse transmission coefficient S_{12}; V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

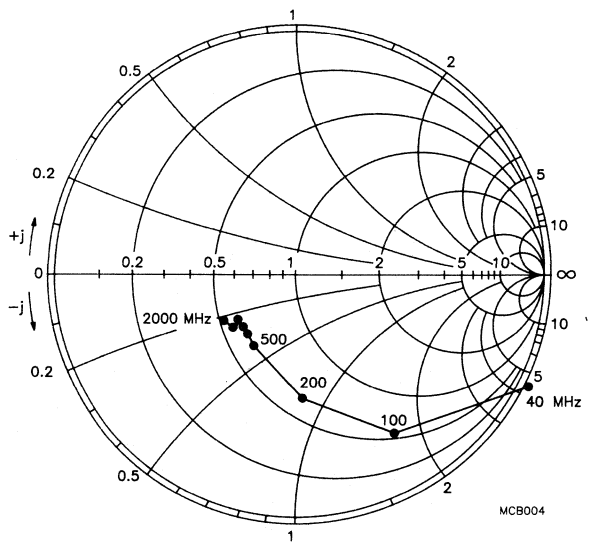


Fig.13 Output impedance derived from S_{22} (Ω x 50); V_{CE} = 8 V; I_C = 30 mA; T_{amb} = 25 °C.

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