DISCRETE SEMICONDUCTORS

RF Power Transistors

BOOK SC08 1989

Philips Components

PHILIPS

RF POWER TRANSISTORS

SELECTION GUIDE

The following tables present our complete range of transmitting transistors, grouped according to main RF power application area. The data in each table is further grouped according to voltage and (within each voltage group) arranged in order of increasing power.

	P_L (PEP) W	V_{CE} V	G_P dB	envelope	type number	page
SSB class-AB; f = 28 MHz; d_3; d_5 < −30 dB	10	13.5	18	SOT48/2	BLY88A	993
	10	13.5	18	SOT120	BLY88C	1001
	10	13.5	18	SOT123	BLV11	257
	15	13.5	18	SOT56	BLY89A	1009
	15	13.5	18	SOT120	BLY89C	1019
	15	13.5	18	SOT123	BLW87	705
	30	12.5	18	SOT56	BLW60	569
	30	12.5	18	SOT120	BLW60C	583
	30	12.5	18	SOT123	BLW85	679
	80	12.5	12.5	SOT121	BLW99	777
	10	28	20	SOT48/2	BLY92A	1051
	10	28	20	SOT120	BLY92C	1059
	10	28	20	SOT123	BLV21	273
	25	28	18	SOT56	BLX13	783
	25	28	18	SOT120	BLX13C	795
	25	28	18	SOT123	BLW83	661
	40	28	17	SOT120	BLX39	835
	45	28	17	SOT123	BLW86	691
	50	28	13	SOT55	BLX14	805
	80	28	13	SOT121	BLW76	595
	100	28	19	SOT121	BLW78	623
	130	28	12	SOT121	BLW77	609
	175	28	11.5	SOT121	BLW97	759
	50	50	18	SOT123	BLW50F	559
	150	50	14	SOT55	BLX15	819
	160	50	14	SOT121	BLW95	737
	200	50	13.5	SOT121	BLW96	747

SSB class-A; f = 28 MHz; d_3; $d_5 < -40$ dB

P_L (PEP) W	V_{CE} V	G_P dB	envelope	type number	page
1	12	18	SOT48/2	BLY87A	977
1	12	18	SOT120	BLY87C	985
1	12	18	SOT123	BLV10	249
2	12	18	SOT48/2	BLY88A	993
2	12	18	SOT120	BLY88C	1001
2	12	18	SOT123	BLV11	257
6	12	18	SOT56	BLY89A	1009
6	12	18	SOT120	BLY89C	1019
6	12	18	SOT123	BLW87	705
1.3	26	20	SOT48/2	BLY91A	1035
1.3	26	20	SOT120	BLY91C	1043
1.3	26	20	SOT123	BLV20	265
2.5	26	20	SOT48/2	BLY92A	1051
2.5	26	20	SOT120	BLY92C	1059
2.5	26	20	SOT123	BLV21	273
8	26	18	SOT56	BLX13	783
8	26	20	SOT120	BLX13C	795
10	26	20	SOT123	BLW83	661
15	26	18	SOT120	BLX39	835
17	26	20	SOT123	BLW86	691
30	26	18	SOT121	BLW78	623
16	45	19.5	SOT123	BLW50F	559
50	40	19	SOT121	BLW96	747

	P_L W	V_{CE} V	f MHz	G_P dB	envelope	type number	page
VHF base stations; class-B operation	1	28	175	15	TO-39/1	2N3866	1107
	4	28	175	10	TO-39/1	BFS23A	75
	8	28	175	12	SOT48/2	BLY91A	1035
	8	28	175	12	SOT120	BLY91C	1043
	8	28	175	12	SOT123	BLV20	265
	15	28	175	10	SOT48/2	BLY92A	1051
	15	28	175	10	SOT120	BLY92C	1059
	15	28	175	10	SOT123	BLV21	273
	25	28	175	9	SOT56	BLY93A	1067
	25	28	175	9	SOT120	BLY93C	1075
	25	28	175	9	SOT123	BLW84	671
	45	28	175	7.5	SOT120	BLX39	835
	45	28	175	7.5	SOT123	BLW86	691
	50	28	175	7	SOT55	BLY94	1083
	80	28	175	6.5	SOT121	BLV80/28	411
	80	28	108	8	SOT121	BLW76	595
	100	28	150	6	SOT121	BLW78	623
	130	28	87.5	7.5	SOT121	BLW77	609
	150	50	108	7.5	SOT55	BLX15	819
	160	50	108	7	SOT121	BLW95	737
	200	50	108	6.5	SOT121	BLW96	747
	250	28	108	10.5	SOT179	BLV37	357
VHF mobile transmitters; class-B operation	1	12	175	10	TO-39/1	2N4427	1107
	2	13.5	175	11	TO-39/1	BFQ42	49
	4	13.5	175	8	TO-39/1	BFS22A	67
	4	13.5	175	12	TO-39/3	BFQ43	59
	4	13.5	175	12	TO-39/3	BFQ43S	59
	8	13.5	175	9	SOT48/2	BLY87A	977
	8	13.5	175	12	SOT120	BLY87C	985
	8	13.5	175	9	SOT123	BLV10	249
	15	13.5	175	10	SOT120	BLW29	513
	15	13.5	175	7.5	SOT48/2	BLY88A	993
	15	13.5	175	7.5	SOT120	BLY88C	1001
	15	13.5	175	7.5	SOT123	BLV11	257
	25	13.5	175	6	SOT56	BLY89A	1009
	25	13.5	175	6	SOT120	BLY89C	1019
	25	13.5	175	6	SOT123	BLW87	705
	28	13.5	175	9	SOT120	BLW31	521
	45	12.5	175	6.5	SOT119	BLV45/12	369
	45	12.5	175	5	SOT56	BLW60	569
	45	12.5	175	5	SOT120	BLW60C	583
	45	12.5	175	4.5	SOT123	BLW85	679
	50	12.5	175	5	SOT55	BLY90	1027
	75	12.5	175	6.5	SOT119	BLV75/12	401

air communication class-B transmitters (225–400 MHz)

P_L W	V_{CE} V	f MHz	G_P dB	envelope	type number	page
30	28	400	10	SOT161	BLU50	203
45	28	400	9	SOT161	BLU51	205
60	28	400	8	SOT161	BLU52	207
100	28	400	6	SOT161	BLU53	209

470 MHz base stations; class-B operation

P_L W	V_{CE} V	f MHz	G_P dB	envelope	type number	page
1	28	470	7	TO-39/1	2N3866	1107
1	28	470	11	SOT48/3	BLX91A	897
2	28	470	12	SOT122	BLW89	713
2.5	28	470	11	SOT48/3	BLX92A	911
4	28	470	11	SOT122	BLW90	721
7	28	470	8.5	SOT48/3	BLX93A	921
10	28	470	9	SOT122	BLW91	729
25	28	470	6	SOT48	BLX94A	931
25	28	470	6.5	SOT122	BLX94C	931
25	24	470	8	SOT119	BLU30/28	15
30	28	470	8	SOT119	BLU30/28	15
40	28	470	4.5	SOT56	BLX95	941
50	24	470	7	SOT119	BLU60/28	15
60	28	470	7	SOT119	BLU60/28	15

UHF mobile transmitters; class-B operation

P_L W	V_{CE} V	f MHz	G_P dB	envelope	type number	page
2	12.5	470	6	TO-39/1	BLX65	849
2	12.5	470	9	TO-39/3	BLX65E	861
2	12.5	470	9	SOT122	BLW79	637
2.5	12.5	470	8.5	SOT48/3	BLX67	865
4	12.5	470	8	SOT122	BLW80	645
5	12.5	470	10.5	SOT122	BLU99	237
7	12.5	470	8.5	SOT122	BLU97	221
7	12.5	470	5	SOT48/3	BLX68	877
10	12.5	470	6	SOT122	BLW81	653
20	12.5	470	6.5	SOT119	BLU20/12	179
20	13.5	470	4	SOT48/2	BLX69A	889
30	12.5	470	6	SOT119	BLU30/12	187
45	12.5	470	4.8	SOT119	BLU45/12	195
60	12.5	470	4.4	SOT119	BLU60/12	213

	P_L W	V_{CE} V	f MHz	G_p dB	envelope	type number	page
900 MHz base stations; class-B operation	2	24	900	8	SOT172	BLV99	505
	14	24	900	8.5	SOT171	BLV98	497
	30	24	900	7	SOT171	BLV97	489
900 MHz mobile transmitters; class-B operation	0.5	12.5	900	8	SOT103	BLU98	229
	0.75	7.5	900	7	SOT172	BLT90/SL	147
	1	12.5	900	7.5	SOT172	BLV90	421
	1	12.5	900	7.5	SOT172	BLV90/SL	429
	1.5	7.5	900	6	SOT172	BLT91/SL	155
	2	12.5	900	6.5	SOT172	BLV91	437
	2	12.5	900	6.5	SOT172	BLV91/SL	445
	3	7.5	900	7	SOT122	BLT92/SL	163
	4	12.5	900	7	SOT122	BLU99	237
	4	12.5	900	7.5	SOT171	BLV92	453
	6	7.5	900	5.5	SOT122	BLT93/SL	171
	8	12.5	900	6.5	SOT171	BLV93	461
	15	12.5	900	6	SOT171	BLV94	471
	22	12.5	900	5.5	SOT171	BLV95	481

	P_L W	V_{CE} V	f MHz	G_p dB	envelope	type number	page
FM broadcast transmitters; class-B operation	1	28	87.5–108	18	TO-39/3	2N3866	1107
	4	28	87.5–108	20	SOT122	BLW90	721
	15	28	87.5–108	15	SOT123	BLV21	273
	45	28	87.5–108	11	SOT120	BLX39	835
	45	28	87.5–108	11	SOT123	BLW86	691
	100	28	87.5–108	8	SOT121	BLW78	623
	175	28	87.5–108	10.5	SOT119	BLV25	281
	250	28	87.5–108	10.5	SOT179	BLV37	357

	P_o sync W	V_{CE} V	f MHz	G_p dB	d_{im} dB	I_C mA	envelope	type number	page
TV transposer circuits; band III; class-A operation	0.25	24	225	17	–60	200	SOT115	BGY55	**)
	0.45	24	225	17	–55	200			
	1.5	25	225	18	–60	460	SOT122	BLV30	289
	5	25	225	15	–58	800	SOT122	BLV31	299
	10	25	225	16	–55	1500	SOT160	BLV32F	309
	16	25	225	13.5	–55	3200	SOT119	BLV33F	331
	19	25	225	9	–55	3200	SOT147	BLV33	319
TV transmitter circuits; band III; class-AB operation	85*	28	225	10.5	–	4250	SOT119	BLV33F	331
	90*	28	225	6.5	–	4460	SOT147	BLV33	319
	115*	28	225	10	–	2x3750	SOT161	BLV36	345
	225*	35	225	8	–	2x6000	SOT179	BLV38	363
TV transposer circuits; band IV-V; class-A operation	0.12	10	860	10	–60	70	SOT37	BFR96S	**)
	0.3	15	860	11	–60	120	SOT122	BFQ34	**)
	0.5	25	860	11	–60	150	SOT122	BLW32	529
	0.7	15	860	10	–60	240	SOT122	BFQ68	**)
	1.0	25	860	10	–60	300	SOT122	BLW33	539
	1.8	25	860	9	–60	600	SOT122	BLW34	549
	3.5	25	860	6.5	–60	850	SOT122	BLW98	767
	6	25	860	8	–60	2x850	SOT161	BLV57	377
TV transmitter circuits; band IV-V; class-AB operation	30*	25	860	7	–	2400	SOT171	BLV59	391

* At 1 dB power gain compression.

** See Handbook SC14 "Wideband transistors and wideband hybrid IC modules".

RF power MOSFETs

P_L (PEP) W	V_{DS} V	G_p dB	envelope	frequency MHz	type number	page
2	12.5	> 10	TO-39/3	175	BLF221	21
2	12.5	> 10	SOT5/11	175	BLF241	107
2	12.5	> 10	SOT172D	500	BLF521	21
5	28	> 13	SOT123	175	BLF242	117
5	12.5	> 10	SOT171	500	BLF522	21
8	28	> 24	SOT123	1.6-28	BLF145	83
8	50	> 24	SOT123	1.6-28	BLF175	99
10	28	> 12	SOT171	500	BLF543	21
15	28	> 13	SOT123	175	BLF244	123
20	28	> 12	NO-297	500	BLF544	21
30	28	> 13	SOT123	175	BLF245	133
40	28	> 11	NO-297	500	BLF545	21
80	28	> 16	SOT121	108	BLF246	143
100	28	> 10	NO-294	500	BLF547	21
150	28	> 17	SOT121	1.6-28	BLF147	95
150	50	> 20	SOT121	1.6-28	BLF177	103
150	28	> 10	NO-298	500	BLF548	21
250	50	> 13	NO-298	225	BLF378	21
300	50	> 20	NO-298	108	BLF278	21
300	32	> 12	NO-298	225	BLF368	21

TYPE NUMBER SURVEY

In this alphanumeric list we present all transmitting transistors mentioned in this handbook together with the most important data.

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB	page
BFQ42	TO-39/1	CW; class-B	13.5	175	2	> 11	49
			12.5	175	2	typ. 10.5	
BFQ43	TO-39/3	CW; class-B	13.5	175	4	> 12	59
			12.5	175	4	typ. 12	
BFQ43S	TO-39/3	CW; class-B	13.5	175	4	> 12	59
			12.5	175	4	typ. 12	
BFS22A	TO-39/1	CW; class-B	13.5	175	4	> 8	67
			12.5	175	4	typ. 8	
BFS23A	TO-39/1	CW; class-B	28	175	4	> 10	75
BLF . . .	see MOSFETs page						
BLT90/SL	SOT172	CW; class-B	7.5	900	0.75	> 7	147
BLT91/SL	SOT172	CW; class-B	7.5	900	1.5	> 6	155
BLT92/SL	SOT122	CW; class-B	7.5	900	3	> 7	163
BLT93/SL	SOT122	CW; class-B	7.5	900	6	> 5.5	171
BLU20/12	SOT119	CW; class-B	12.5	470	20	> 6.5	179
BLU30/28	SOT119	CW; class-B	28	470	30 (note 5)	> 8	
BLU30/28	SOT119	CW; class-B	24	470	25 (note 5)	typ. 8	
BLU60/28	SOT119	CW; class-B	28	470	60 (note 5)	> 7	
BLU60/28	SOT119	CW; class-B	24	470	50 (note 5)	typ. 7	
BLU30/12	SOT119	CW; class-B	12.5	470	30	> 6	187
						typ. 7.4	
BLU45/12	SOT119	CW; class-B	12.5	470	45	> 4.8	195
BLU50	SOT161	CW; class-B	28	400	30	> 10	203
BLU51	SOT161	CW; class-B	28	400	45	> 9	205
BLU52	SOT161	CW; class-B	28	400	60	> 8	207
BLU53	SOT161	CW; class-C	28	400	100	> 7	209
BLU60/12	SOT119	CW; class-B	12.5	470	60	> 4.4	213
BLU97	SOT122	CW; class-B	12.5	470	7	> 8.5	221
BLU98	SOT103	CW; class-B	12.5	900	0.5	> 8	229
BLU99	SOT122	CW; class-B	12.5	470	5	> 10.5	237
			12.5	900	4	typ. 7	249
BLV10	SOT123	CW; class-B	13.5	175	8	> 9	
			12.5	175	8	typ. 10.5	
		SSB; class-A	12	28	1 (note 3)	18	
BLV11	SOT123	CW; class-B	13.5	175	15	> 8	257
			12.5	175	15	typ. 7.5	
		SSB; class-A	12	28	2 (note 3)	18	
		SSB; class-AB	13.5	28	10 (note 4)	18	
BLV20	SOT123	CW; class-B	28	175	8	> 12	265
		SSB; class-A	26	28	1.3 (note 3)	20	

Notes: see next page.

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W		power gain dB	page
BLV21	SOT123	CW; class-B	28	175	15		> 10	273
		SSB; class-A	26	28	2.3	(note 3)	20	
BLV25	SOT119	CW; class-B narrow band	28	108	175		> 10	281
BLV30	SOT122	lin.ampl., class-A	25	225	1.5	(note 1)	> 18	289
			25	225	1.7	(note 1)	typ. 20	
BLV31	SOT122	lin.ampl., class-A	25	225	5	(note 1)	> 15	299
			25	225	7	(note 1)	typ. 16.5	
BLV32F	SOT160	lin.ampl., class-A	25	225	10	(note 2)	> 16	309
			25	225	12.5	(note 2)	typ. 17.2	
BLV33	SOT147	lin.ampl., class-A	25	225	19	(note 2)	> 9	319
			25	225	26	(note 2)	typ. 9.7	
		class-AB	28	225	90	(note 2)	typ. 6.5	
BLV33F	SOT119	lin.ampl., class-A	25	225	16	(note 2)	> 13.5	331
			25	225	22	(note 2)	typ. 14.8	
		class-AB	28	225	85	(note 2)	typ. 10.5	
BLV36	SOT161	lin.ampl., class-AB	28	225	115		> 11	345
			28	225	115		typ. 13	
			12.5	175	8		typ. 10.5	
BLV37	SOT179	CW; class-B	28	108	250		> 10.5	357
							typ. 11.3	
BLV38	SOT179	lin.ampl., class-AB	35	225	225		> 8	363
							typ. 8.8	
BLV45/12	SOT119	CW; class-B	12.5	175	45		> 6.5	369
BLV57	SOT161	lin.ampl., class-A	25	860	6	(note 2)	> 8	377
			25	860	12	(note 2)	typ. 9	
		lin.ampl., class-AB	25	860	38		typ. 6.5	
BLV59	SOT171	lin.ampl., class-AB	25	860	30		7	391
BLV75/12	SOT119	CW; class-B	12.5	175	75		> 6.5	401
							typ. 7.5	
BLV80/28	SOT121	CW; class-B	28	175	80		> 6.5	411
							typ. 7	
BLV90	SOT172	CW; class-B	12.5	900	1		> 7.5	421
			9.6	900	0.75		typ. 7.9	
BLV90/SL	SOT172	CW; class-B	12.5	900	1		> 7.5	429
			9.6	900	1		typ. 7	
BLV91	SOT172	CW; class-B	12.5	900	2		> 6.5	437
			9.6	900	1.5		typ. 6.6	

Notes

1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. $P_{o\ sync}$ at $d_{im} < -55$ dB.
3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.
5. Available on request as loose-leaf data

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB	page
BLV91/SL	SOT172	CW; class-B	12.5 9.6	900 900	2 1.5	> 6.5 typ. 6.6	445
BLV92	SOT171	CW; class-B	12.5 9.6	900 900	4 3	> 7.5 typ. 7.3	453
BLV93	SOT171	CW; class-B	12.5 9.6	900 900	8 6	> 6.5 typ. 6	461
BLV94	SOT171	CW; class-B	12.5	900	15	> 6 typ. 7	471
BLV95	SOT171	CW; class-B	12.5	900	22	> 5.5	481
BLV97	SOT171	CW; class-B	24	900	30	> 7 typ. 8	489
BLV98	SOT171	CW; class-B	24	900	14	> 8.5 typ. 10	497
BLV99	SOT172	CW; class-B	24	900	2	> 8 typ. 9.3	505
BLW29	SOT120	CW; class-B	13.5 12.5	175 175	15 15	> 10 typ. 10.5	513
BLW31	SOT120	CW; class-B	13.5 12.5	175 175	28 28	> 9 typ. 9.5	521
BLW32	SOT122	lin.ampl., class-A	25 25	860 860	0.5 (note 1) 0.63 (note 1)	> 11 typ. 12.2	529
BLW33	SOT122	lin.ampl., class-A	25 25	860 860	1 (note 1) 1.15 (note 1)	> 10 typ. 10.5	539
BLW34	SOT122	lin.ampl., class-A	25 25	860 860	1.8 (note 1) 2.15 (note 1)	> 9 typ. 10.2	549
BLW50F	SOT123	SSB; class-A SSB; class-AB	45 50	1.6-28 1.6-28	0-16 (note 3) 10-65 (note 4)	> 19.5 typ. 18	559
BLW60	SOT56	CW; class-B SSB; class-AB	12.5 12.5	175 1.6-28	45 3-30 (note 4)	> 5 typ. 19.5	569
BLW60C	SOT120	CW; class-B SSB; class-AB	12.5 12.5	175 1.6-28	45 3-30 (note 4)	> 5 typ. 19.5	583
BLW76	SOT121	SSB; class-AB CW; class-B	28 28	1.6-28 108	8-80 (note 4) 80	> 13 typ. 7.9	595
BLW77	SOT121	SSB; class-AB CW; class-B	28 28	1.6-28 87.5	15-130 (note 4) 130	> 12 typ. 7.5	609
BLW78	SOT121	CW; class-B SSB; class-A SSB; class-AB	28 26 28	150 28 28	100 35 (note 3) 100 (note 4)	> 6 typ. 19.5 typ. 19	623

Notes

1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. $P_{o\ sync}$ at $d_{im} < -55$ dB.
3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB	page
BLW79	SOT122	CW; class-B	12.5	470	2	> 9	637
			12.5	175	2	typ. 13.5	
BLW80	SOT122	CW; class-B	12.5	470	4	> 8	645
			12.5	175	4	typ. 15	
BLW81	SOT122	CW; class-B	12.5	470	10	> 6	653
			12.5	175	10	typ. 13.5	
BLW83	SOT123	SSB; class-A	26	1.6-28	0-10 (note 3)	> 20	661
		SSB; class-AB	28	1.6-28	3-30 (note 4)	typ. 21	
BLW84	SOT123	CW; class-B	28	175	25	> 9	671
BLW85	SOT123	CW; class-B	12.5	175	45	> 4.5	679
			13.5	175	45	typ. 6	
		SSB; class-AB	12.5	1.6-28	3-30 (note 4)	typ. 19.5	
BLW86	SOT123	CW; class-B	28	175	45	> 7.5	691
		SSB; class-AB	28	1.6-28	5-47.5 (note 4)	typ. 19	
		SSB; class-A	26	1.6-28	17 (note 3)	typ. 22	
BLW87	SOT123	CW; class-B	13.5	175	25	> 6	705
						typ. 6.6	
BLW89	SOT122	CW; class-B	28	470	2	> 12	713
						typ. 13.5	
BLW90	SOT122	CW; class-B	28	470	4	> 11	721
						typ. 12.5	
BLW91	SOT122	CW; class-B	28	470	10	> 9	729
						typ. 10.5	
BLW95	SOT121	SSB; class-AB	50	1.6-28	20-160 (note 4)	> 14	737
BLW96	SOT121	SSB; class-AB	50	1.6-28	25-200 (note 4)	> 13.5	747
		CW; class-B	50	108	200	typ. 6.5	
		SSB; class-A	40	28	50 (note 3)	typ. 19	
BLW97	SOT121	SSB; class-AB	28	1.6-28	175 (note 4)	> 11.5	759
BLW98	SOT122	lin.ampl., class-A	25	860	3.5 (note 1)	> 6.5	767
			25	860	4.4 (note 1)	typ. 7	
BLW99	SOT121	SSB; class-AB	12.5	1.6-28	80 (note 4)	> 12.5	777
BLX13	SOT56	SSB; class-A	26	28	0-8 (note 3)	> 18	783
		SSB; class-AB	28	28	25 (note 4)	> 18	
		CW; class-B	28	70	25	typ. 17	
BLX13C	SOT120	SSB; class-A	26	1.6-28	0-8 (note 3)	> 20	795
		SSB; class-AB	28	1.6-28	3-25 (note 4)	typ. 21	
BLX14	SOT55	SSB; class-A	28	1.6-28	25 (note 3)	> 13	805
		SSB; class-AB	28	1.6-28	7.5-50 (note 4)	> 13	
		CW; class-B	28	70	50	> 7.5	
		CW; class-B	28	30	50	typ. 16	

Notes

1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. $P_{o\ sync}$ at $d_{im} < -55$ dB.
3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB	page
BLX15	SOT55	SSB; class-AB	50	1.6-28	20-150 (note 4)	> 14	819
		SSB; class-A	40	1.6-28	30 (note 3)	> 14	
		CW; class-B	50	70	150	> 10	
		CW; class-B	50	108	150	typ. 7.4	
BLX39	SOT120	CW; class-B	28	175	45	> 7.5	835
		SSB; class-AB	28	1.6-28	5-42.5 (note 4)	typ. 19	
		SSB; class-A	26	1.6-28	15 (note 3)	typ. 20	
BLX65	TO-39/1	CW; class-B	13.8	470	2	typ. 7	849
		CW; class-B	12.5	470	2	> 6	
		CW; class-B	12.5	175	2	typ. 12	
BLX65E	TO-39/3	CW; class-B	12.5	175	2	typ. 16	861
		CW; class-B	12.5	470	2	> 9	
BLX65ES	TO-39/3	CW; class-B	12.5	175	2	typ. 16	861
		CW; class-B	12.5	470	2	> 9	
BLX67	SOT48/3	CW; class-B	13.8	470	1.5	typ. 10	865
		CW; class-B	13.8	470	3.0	typ. 9.3	
			12.5	470	2.5	> 8.5	
			12.5	175	3.0	typ. 20	
BLX68	SOT48/3	CW; class-B	13.8	470	7	> 5.4	877
			13.8	470	7.8	typ. 5.9	
			12.5	470	7	> 5	
			12.5	175	7.2	typ. 12.6	
BLX69A	SOT48/2	CW; class-B	13.5	470	20	> 4	889
			12.5	470	17	> 4	
			12.5	175	17	typ. 11	
BLX91A	SOT48/3	CW; class-B	24	470	0.85	typ. 12.3	897
			28	470	1	> 11	
			28	470	1.45	typ. 12.6	
			28	1000	1.4	typ. 5.4	
BLX91CB	SOT48/3	video CRT driver	28	"V_{CESM} max. 65 V; C_c typ. 3 pF"			907
BLX92A	SOT48/3	CW; class-B	24	470	2.4	typ. 10.8	911
			28	470	2.5	> 11	
			28	470	3	typ. 11.7	
			28	1000	2.5	typ. 5.5	
BLX93A	SOT48/3	CW; class-B	24	470	7	typ. 8.5	921
			28	470	7	> 8.5	
			28	470	8	typ. 9	
			28	1000	5	typ. 5.2	
BLX94A	SOT48/2	CW; class-B	28	470	25	> 6	931
						typ. 6.5	
BLX94C	SOT122	CW; class-B	28	470	25	> 6.5	931
						typ. 7.25	

Notes

1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. $P_{o\ sync}$ at $d_{im} < -55$ dB.
3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.

type	envelope	mode of operation	V_{CE} V	frequency MHz	output power W	power gain dB	page
BLX95	SOT56	CW; class-B	28 28	470 175	40 40	< 4.5 typ. 11	941
BLX96	SOT48/3	lin.ampl., class-A	25 25	860 860	0.5 (note 1) 0.6 (note 1)	> 6 typ. 7	951
BLX97	SOT48/3	lin.ampl., class-A	25 25	860 860	1 (note 1) 1.1 (note 1)	> 5.5 typ. 6.5	959
BLX98	SOT48/2	lin.ampl., class-A	25 25	860 860	3.5 (note 1) 4.0 (note 1)	> 5 typ. 5.5	967
BLY87A	SOT48/2	CW; class-B CW; class-B	13.5 12.5	175 175	8 8	> 9 typ. 9	977
BLY87C	SOT120	CW; class-B CW; class-B	13.5 12.5	175 175	8 8	> 12 typ. 11.5	985
BLY88A	SOT48/2	CW; class-B CW; class-B	13.5 12.5	175 175	15 15	> 7.5 typ. 7.5	993
BLY88C	SOT120	CW; class-B CW; class-B	13.5 12.5	175 175	15 15	> 8 typ. 7.5	1001
BLY89A	SOT56	CW; class-B	13.5	175	25	> 6	1009
BLY89C	SOT120	CW; class-B	13.5	175	25	> 6 typ. 6.6	1019
BLY90	SOT55	CW; class-B	12.5	175	50	> 5	1027
BLY91A	SOT48/2	CW; class-B	28	175	8	> 12	1035
BLY91C	SOT120	CW; class-B	28	175	8	> 12	1043
BLY92A	SOT48/2	CW; class-B	28	175	15	> 10	1051
BLY92C	SOT120	CW; class-B	28	175	15	> 10	1059
BLY93A	SOT56	CW; class-B	28	175	25	> 9	1067
BLY93C	SOT120	CW; class-B	28	175	25	> 9	1075
BLY94	SOT55	CW; class-B	28	175	50	> 7	1083
2N3375	TO-60	CW; class-B CW; class-B	28 28	100 400	7.5 > 3	> 8.8 > 4.8	1091
2N3553	TO-39/1	CW; class-B	28	175	2.5	> 10	1091
2N3632	TO-60	CW; class-B	28	175	> 13.5	> 5.9	1091
2N3866	TO-39/1	CW; class-B	28	400	1	> 10	1107
2N3924	TO-39/1	CW; class-B	13.5	175	4	> 6	1115
2N3926	TO-60	CW; class-B	13.5	175	7	> 5.4	1115
2N3927	TO-60	CW; class-B	13.5	175	12	> 4.8	1115
2N4427	TO-39/1	CW; class-B	12	175	1	> 10	1107

Notes

1. $P_{o\ sync}$ at $d_{im} < -60$ dB.
2. $P_{o\ sync}$ at $d_{im} < -55$ dB.
3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.

type (MOSFETs)	envelope	mode of operation	V_{DS} V	frequency MHz	output power W		power gain dB	page
BLF145	SOT123	SSB; class-A	28	1.6-28	8	(note 3)	> 24	83
		SSB; class-AB	28	1.6-28	30	(note 4)	typ. 20	
BLF147	SOT121	SSB; class-AB	28	1.6-28	150	(note 4)	> 17	95
BLF175	SOT123	SSB; class-A	50	1.6-28	8	(note 3)	> 24	99
		SSB; class-AB	50	1.6-28	30	(note 4)	typ. 23	
BLF177	SOT121	SSB; class-AB	50	1.6-28	150	(note 4)	> 20	103
		CW; class-B	50	108	150		typ. 19	
BLF221	TO-39/3	CW; class-B	12.5	175	2	(note 5)	> 10	
BLF241	SOT5/11	CW; class-AB	12.5	175	2		> 10	107
		CW; class-B	28	175	3		typ. 14	
BLF242	SOT123	CW; class-AB	28	175	5		> 13	117
		CW; class-B	28	400	5		13	
BLF244	SOT123	CW; class-B	28	175	15		> 13	123
		SSB; class-A	28	28	4	(note 3)	typ. 24	
		CW; class-B	28	400	15		typ. 11	
BLF245	SOT123	CW; class-B	28	175	30		> 13	133
		CW; class-B	28	400	30		typ. 10	
BLF246	SOT121	CW; class-B	28	108	80		> 16	143
		CW; class-B	28	28	80		typ. 20	
BLF278	NO-298	CW; class-B	50	108	300	(note 5)	> 20	
BLF368	NO-298	lin.ampl., class-AB	32	225	300	(note 5)	> 12	
BLF378	NO-298	lin.ampl., class-AB	50	225	250	(note 5)	> 13	
BLF521	SOT172D	CW; class-B	12.5	500	2	(note 5)	> 10	
BLF522	SOT171	CW; class-B	12.5	500	5	(note 5)	> 10	
BLF543	SOT171	CW; class-B	28	500	10	(note 5)	> 12	
BLF544	NO-297	CW; class-B	28	500	20	(note 5)	> 12	
BLF545	NO-297	CW; class-B	28	500	40	(note 5)	> 11	
BLF547	NO-294	CW; class-B	28	500	100	(note 5)	> 10	
BLF548	NO-298	CW; class-B	28	500	150	(note 5)	> 10	

Notes

3. PEP at $d_3 < -40$ dB.
4. PEP at d_3 typ. -30 dB.
5. Available on request as loose-leaf data.

LINE-UPS

In this section we present information on recommended circuit line-ups in the main RF power application areas. A comprehensive range of output power levels is indicated together with our recommended types in the particular line-up configuration. The necessary drive power level for each line-up is indicated in the first column.

More detailed application information as well as computer aided design parameters are available on request.

SSB TRANSMITTERS (1.5 MHz – 30 MHz)

input power mW	1st stage		2nd stage	3rd stage	P_L (PEP) W	V_{CE} V	stud S flange F
30	BLY87C	*	2 x BLY89C		30	13	S
30	BLV10	*	2 x BLW87		30	13	F
50	BLY88C	*	2 x BLW60C		50	13	S
50	BLV11	*	2 x BLW85		50	13	F
100	BLY89C	*	4 x BLW60C		100	13	S
100	BLW87	*	4 x BLW85		100	13	F
140	2 x BLW87	*	2 x BLW99		150	13	F
50	BLY91C	*	2 x BLX13C		50	28	S
50	BLV20	*	2 x BLW83		50	28	F
150	BLW83	*	2 x BLW76		150	28	F
250	2 x BLW83	*	2 x BLW77		250	28	F
220	2 x BLW86	*	2 x BLW97		300	28	F
500	2 x BLW86		4 x BLW77		450	28	F
680	2 x BLW78	*	4 x BLW97		600	28	F
300	2 x BLX13C	**	2 x BLX15		250	50	S
300	2 x BLW83	**	2 x BLW96		350	50	F
600	2 x BLX39	**	4 x BLX15		500	50	S
600	2 x BLW50F	*	4 x BLW95		500	50	F
40	BLY91C	**	2 x BLW78**	8 x BLX15	1000	50	S/F
40	BLV20	**	4 x BLW50F	8 x BLW96	1200	50	F

MILITARY COMMUNICATION TRANSMITTERS (25 MHz – 80 MHz)

input power mW	1st stage		2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
5	BFR96 ●	*	2 x BFQ42		2	7.5	–
15	2N4427	*	2 x BLW80		6	13	S
50	BLW79	*	2 x BLW29		25	13	S
50	BLW89	*	2 x BLY92C		25	28	S
20	2N3866	*	2 x BLY91C	2 x BLX39	90	28	S
20	2N3866	*	2 x BLV20	2 x BLW86	90	28	F

● See Handbook SC14, "Wideband transistors and wideband hybrid IC modules".
* Class-A operation.
** 28 V supply voltage; class-A operation.

MOBILE TRANSMITTERS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage		P_L W	V_{CE} V	stud S flange F
20	2N4427	BLY87C		8	13	S
20	2N4427	BLV10		8	13	F
35	2N4427	BLW29		14	13	S
10	BSX19 ●	BGY32		18	13	F
70	BFQ42	BLW31		28	13	S
160	BFQ43	BLW60C		45	13	S
160	BFQ43	BLW85		45	13	F
190	BLV10	BLV75/12		75	13	F

BASE STATIONS (68 MHz – 87,5 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
65	BFS23A	BLY93C		25	28	S
65	BFS23A	BLW84		25	28	F
125	BLX92A	BLX39		50	28	S
15	2N3866	BLV21	BLW78	100	28	F
50	2N3866 **	BLY93C **	BLX15	150	50	S
50	2N3866 **	BLW84 **	BLW95	150	50	F

FM BROADCAST TRANSMITTERS (87.5 MHz – 108 MHz)

input power mW	1st stage	2nd stage	3rd stage	P_L W	V_{CE} V	stud S flange F
100	BLW90	BLX39		50	28	S
40	2N3866	BLV21	BLW78	100	28	F
20	BLW90	BLW86	2 x BLV25	300	28	F
20	BLW89	BLW84	BLV37	250	28	F
20	BLW90	BLW86	2 x BLV37	500	28	F

AM AIRCRAFT TRANSMITTERS (118 MHz – 136 MHz)

input power mW	1st stage	2nd stage	3rd stage	$P_{L(carr)}$ W	V_{CE} V	stud S flange F
110	BLX92A	BLY93C		6	13/28	S
240	BLY91C	BLX39		12	13/28	S
240	BLV20	BLW86		12	13/28	F
100	BLX92A	BLY93C	BLW78	25	13/28	S/F
100	BLX92A	BLW84	BLW78	25	13/28	S/F

● See Handbook SC04, "Small signal transistors".
** 28 V supply voltage.

PORTABLE AND MOBILE TRANSMITTERS (132 MHz – 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
40	2N4427	BFQ43			2	7.5	–
100	2N4427	BLY87C			8	13	S
100	2N4427	BLV10			8	13	F
125	BFQ42	BLW29			14	13	S
150	BGY36				18	13	F
250	BFQ43	BLW31			28	13	S
100	2N4427	BLW29	BLV45/12		45	13	S/F
115	BGY43	BLV45/12			45	13	F
120	BFQ42	BLW29	BLV75/12		75	13	S/F

BASE STATIONS (132 MHz – 174 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE}	stud S flange F
200	BLY91C	BLY93C			25	28	S
200	BLV20	BLW84			25	28	F
25	2N3866	BLY91C	BLX39		50	28	S
25	2N3866	BLV20	BLW86		50	28	F
200	BFS23A	BLY93C	2 x BLX39		100	28	S
200	BFS23A	BLW84	2 x BLW86		100	28	F

TV TRANSPOSERS (Band III: 174 MHz – 230 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	$P_{o\,sync}$ W	$P_{o\,sat}$ W	V_{CE} V
6	BGY55 ●	2 x BLV31			10	10	25
7	BLV30	2 x BLV32F			20	20	25
3	BGY55 ●	2 x BLV31	2 x BLV33		30	40	25
6	BLV30	2 x BLV33F	4 x BLV33		60	75	25
2	BGY55 ●	2 x BLV31	4 x BLV33	8 x BLV33	100	140	25

TV TRANSMITTERS (Band III: 174 MHz – 230 MHz)

input power mW	1st stage	2nd stage	3rd stage		$P_{o\,sync}$* W		V_{CE} V
8	BGY55 ●	2 x BLV31	2 x BLV33F		130		28
10	BLV30	2 x BLV32F	BLV38		225		25/28/35
35	BLV30	2 x BLV33F	2 x BLV38		420		25/28/35
75	2 x BLV30	4 x BLV33F	4 x BLV38		800		25/28/35

* With linearity correction.

● See Handbook SC14, "Wideband transistors and wideband hybrid IC modules".

PORTABLE AND MOBILE TRANSMITTERS (400 MHz – 512 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
15	BFR96 ●	BLW79	BLW80		2	7.5	S
45	BLV90	BLU99			3	7.5	S
100	BGY40A ** BGY40B **				7.5	12.5	F
15	BFR96S	BLU99	BLW81		10	13	S
150	BGY41A ** BGY41B **				13	12.5	F
400	BLU99	BLU20/12			20	13	S/F
100	BGY40A/B ●**	BLU30/12			30	13	F
280	BLU99	BLU20/12	BLU45/12		45	13	S/F
400	BLU99	BLU20/12	BLU60/12		60	13	S/F

BASE STATIONS (400 MHz – 470 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_L W	V_{CE} V	stud S flange F
45	BLX91A	BLW91	BLX94C		25	28	S
400	BLW90	BLU30/28			30	28	F
250	BLW90	BLX94C	BLX95		40	28	S
45	BLX91A	BLW91	BLU60/28		60	28	F
45	BLX91A	BLW91	BLX94C	2 x BLX95	70	28	S

TV TRANSPOSERS (Band IV/V: 470 MHz – 860 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	$P_{o\ sync}$ W	$P_{o\ sat}$ W	V_{CE} V
5	BFQ34 ●	BFQ68 ●	2 x BFQ68 ●		1.4	1.4	15
6	BLW32	BLW33	2 x BLW34		4.4	5.7	25
2	BLW32	BLW33	2 x BLW34	2 x BLW98	8	8	25
3	BLW32	BLW33	2 x BLW34	2 x BLV57	13	15	25
10	BFQ68 ●	2 x BLW34	2 x BLW98	4 x BLV57	23	30	25
14	BFQ68 ●	2 x BLW34	2 x BLV57	8 x BLV57	38	60	25

TV TRANSMITTERS (Band IV/V: 470 MHz – 860 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	$P_{o\ sync}$* W		V_{CE} V
12	BFR96S ●	BFQ68 ●	2 x BLW34	2 x BLV59	60		28
30	BFQ34 ●	2 x BLW33	2 x BLV57	4 x BLV59	120		28
80	BFQ68 ●	2 x BLW34	4 x BLV57	8 x BLV59	240		28

* With linearity correction.
**See Handbook SC09, "RF power modules".
● See Handbook SC14, "Wideband transistors and wideband hybrid IC modules".

MOBILE TRANSMITTERS (800 MHz – 960 MHz)

input power mW	1st stage	2nd stage	3rd stage	4th stage	P_L W	V_{CE} V	stud S flange F
60	BLU98	BLV91	BLV93		**8**	13	S/F
100	BLV90	BLV92	BLV94		**15**	13	S/F
50	BLU98	BLV91	BLV93	BLV95	**22**	13	S/F
120	BLV90	BLV92	BLV94	2 x BLV95	**40**	13	S/F

BASE STATIONS (800 MHz – 960 MHz)

input power mW	1st stage	2nd stage	3rd stage		P_L W	V_{CE} V	stud S flange F
250	BLV99	BLV98	2 x BLV97		**60**	24	S/F

Notes

1. For TV transposers and transmitters, the input powers quoted relate to the peak sync levels.
2. $P_{o\ sync}$ for transposers is the peak sync output power for a three-tone intermodulation distortion of −54 dB (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB) without pre-correction.
3. $P_{o\ sync}$ is the peak sync output power of a transposer before the sound carrier has been added. After addition of the sound carrier the peak output power will be approximately twice $P_{o\ sync}$. In transposers with pre-correction the intermodulation distortion is reduced and therefore $P_{o\ sync}$ can be increased. However there is a limit formed by the saturated output power of the transistor. Taking this into account $P_{o\ sat}$ is the maximum value of $P_{o\ sync}$ in pre-corrected systems.
4. In the transmitter line-ups the output stage operates in class-AB, the driver stages in class-A.
5. $P_{o\ sync}$ for transmitters is the peak sync output power at 1 dB power gain compression.

GENERAL

Type designation
Rating systems
Letter symbols
s-parameters
Mounting recommendations

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.

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

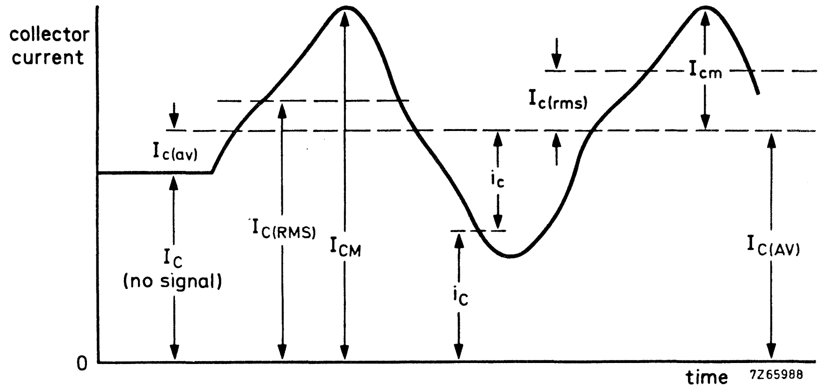
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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.

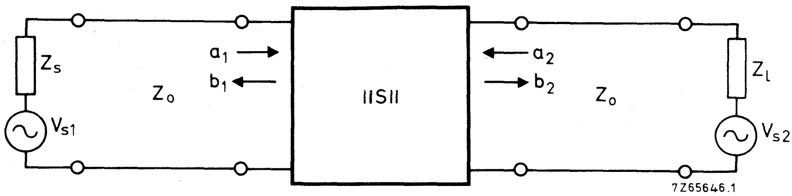
Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

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 $Z_1 = Z_o = 50\ \Omega$ 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 $Z_1 = Z_o = 50\ \Omega$ 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 $V_{s1} = 0$.

RECOMMENDATIONS FOR MOUNTING FLANGE R.F. POWER TRANSISTORS

Flange r.f. transistors are easy to mount but for optimum performance we offer the following recommendations:

- Holes or tapped holes in the heatsink should be free from burrs and spaced at 18,42 mm (+ 0,05; –0,05) between centres. They must have a depth of at least 6 mm.
  Recommended screw: for SOT-119, SOT-121 and SOT-161 cheese-head 4-40 UNC/2A, for SOT-123 and SOT-160 also M3. A washer to spread the joint pressure is also recommended.
- For transistors dissipating up to 80 W the heatsink thickness should be at least 3 mm copper (> 99,9%, ETP-Cu) or 5 mm aluminium (> 99,0% Al). For transistors dissipating more power, the thickness should be increased proportionally.
- The flatness of the heatsink mounting surface must be > 0,02 mm with a surface roughness $R_a < 0,5\ \mu m$ (preferably by grinding or lapping).
- The sparing use of evenly distributed heatsink compound on the transistor flange is recommended. Suitable heatsink compound brands are: Dow Corning 340, Eccotherm TC-5 (E&C), Wakefield 120.
- The screws through the flange holes should first both be tightened to 0,05 Nm (finger tight), and then tightened to 0,6 to 0,75 Nm, to achieve the published thermal resistance between the mounting base and heatsink.
- When a transistor is removed from the heatsink, the flange will almost certainly have been distorted by the joint pressure. Grinding or lapping of the flange according to the information above is necessary if the transistor is remounted.

RECOMMENDATIONS FOR MOUNTING ¼", ⅜" AND ½" CAPSTAN HEADERS AS USED FOR R.F. POWER TRANSISTORS

A nickel plated brass nut is supplied with each transistor for securing it to a heatsink.

Screw threads, diameter and nuts:

mounting base diameter	thread	maximum diameter of threaded stud	nut thickness
¼"	8-32UNC-2A(B)	4,14 mm	3,5 and 5 mm
⅜"	10-32UNF-2A(B)	4,80 mm	5 mm
½"	¼" x 28UNF-2A(B)	6,33 mm	5,5 mm

To ensure optimum heat transfer and to avoid damage to the threaded stud of the transistor the following recommendations should be observed.

– Diameter of the mounting hole in the heatsink:
  ¼" stud   diameter 4,15 +0,05; –0 mm
  ⅜" stud   diameter 4,85 +0,05; –0 mm
  ½" stud   diameter 6,35 +0,05; –0 mm

  Heatsink surfaces at the mounting hole to be flat, parallel, and free of burrs or oxidation.

– Mounting nut torque:
  ¼" nut   minimum 0,75 Nm (7,5 kg cm) maximum 0,85 Nm (8,5 kg cm)
  ⅜" nut   minimum 1,5 Nm (15 kg cm) maximum 1,7 Nm (17 kg cm)
  ½" nut   minimum 2,3 Nm (23 kg cm) maximum 2,7 Nm (27 kg cm)

– Recommended distance from the surface of the heatsink to the top surface of the printed-circuit board:
  ¼" capstan header   2,9 + 0; –0,2 mm
  ⅜" capstan header   3,8 + 0; –0,2 mm
  ½" capstan header   4,8 + 0; –0,2 mm

  It is important that the above maximum printed-circuit board mounting heights are not exceeded in order to prevent stress being applied to the encapsulation. Upward lead bending, in particular, can damage the encapsulation and impair the sealing of the header.

– Experience indicates that flux or flux solutions can penetrate even hermetically sealed ceramic-capped transistors. To prevent this, tin and wash the printed-circuit boards before mounting the power transistors, then solder the transistors in place without using flux.

– The leads may be tinned by dipping them, full length, into a solder bath at about 230 °C. Note, no flux should be used during tinning.

– The full mounting-nut torque (specified above) should be applied only once during the life of the transistor. For pre-assembly testing, apply no more than two thirds of the specified torque.

– Since locking washers are much harder than most heatsink materials, their locking action might deteriorate during the life of the transistor. The use of locking washers is therefore not recommended. Instead, tighten the nuts to their specified torque, allow about 30 minutes for them to bed down, then re-tighten. After this, apply locking paint.

DEVICE DATA

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ42 is especially suited as a driver transistor for the BLW29 in a two-stage wideband or semi-wide-band v.h.f. amplifier delivering 15 W output power.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

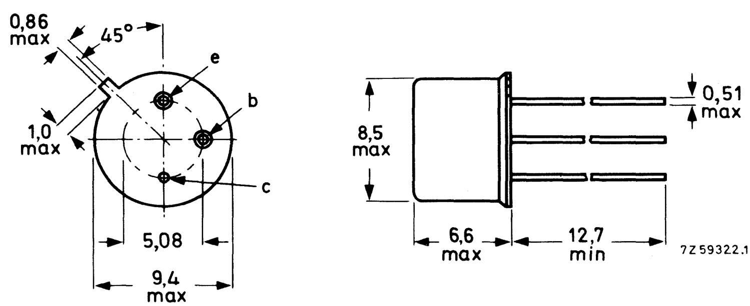
R.F. performance up to T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. class-B	**13,5**	**175**	**2**	**> 11**	**> 60**	**7,8 − j4,6**	**22 − j18**
c.w. class-B	12,5	175	2	typ. 10,5	typ. 65	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

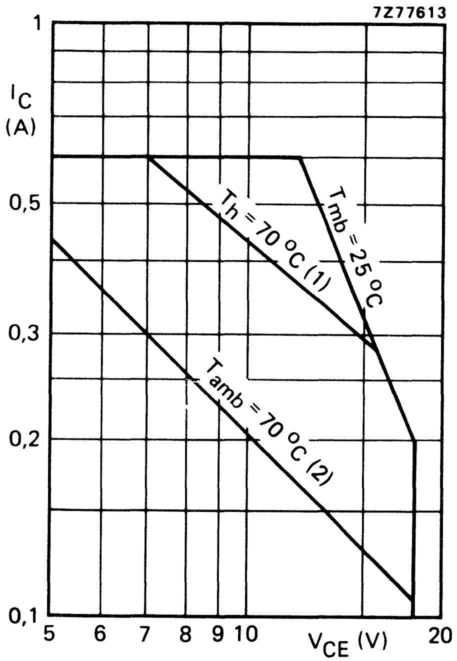


Maximum lead diameter is guaranteed only for 12,7 mm.

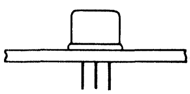
RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	0,6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	1,8 A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7,2 W
Storage temperature	T_{stg}		−65 to + 200 °C
Junction temperature	T_j	max.	200 °C



(1) Mounted on a heatsink.



(2) Free-air operation; using a spring cooling clip.

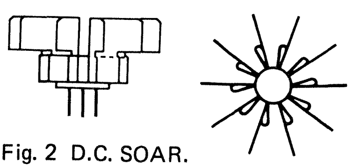
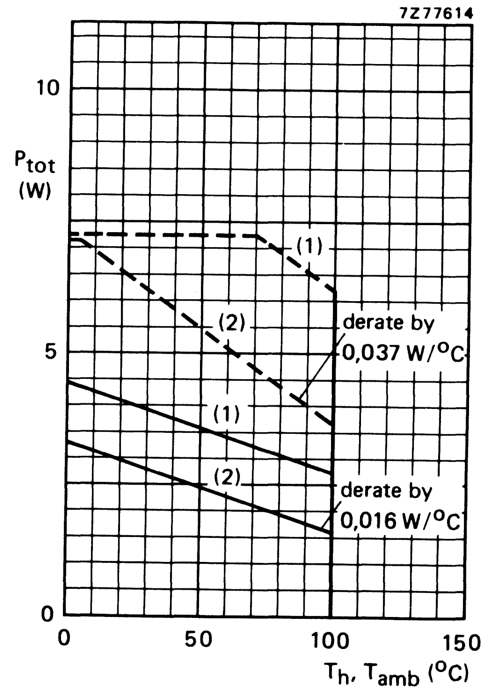


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; $R_{th\ mb\text{-}h}$ = 3 K/W; $R_{th\ c\text{-}a}$ = 32 K/W; f ⩾ 1 MHz.

(2) Continuous d.c. and r.f. operation; $R_{th\ mb\text{-}h}$ = 3 K/W; $R_{th\ c\text{-}a}$ = 32 K/W.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.
— — — Mounted on a heatsink.
——— Free-air operation; using a spring cooling clip having a thermal resistance of 32 K/W.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	24 K/W
From junction to case	$R_{th\ j\text{-}c}$	=	29 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	1 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5 mJ
D.C. current gain * $I_C = 0,25$ A; $V_{CE} = 5$ V	h_{FE}	typ. 10 to 60	30
Collector-emitter saturation voltage* $I_C = 0,75$ A; $I_B = 0,15$ A	V_{CEsat}	typ.	0,9 V
Transition frequency at f = 100 MHz * $-I_E = 0,25$ A; $V_{CB} = 13,5$ V	f_T	typ.	750 MHz
$-I_E = 0,75$ A; $V_{CB} = 13,5$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	8,6 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	3,8 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

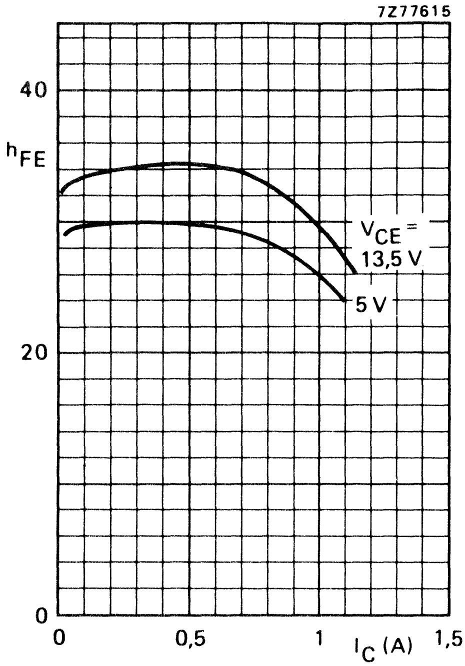


Fig. 4 Typical values; T_j = 25 °C.

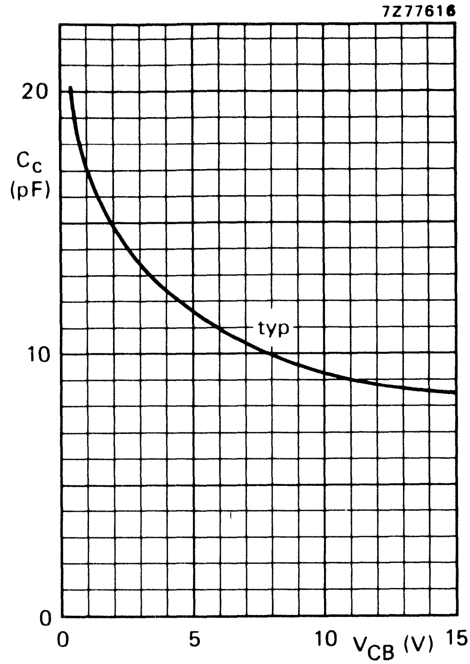


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

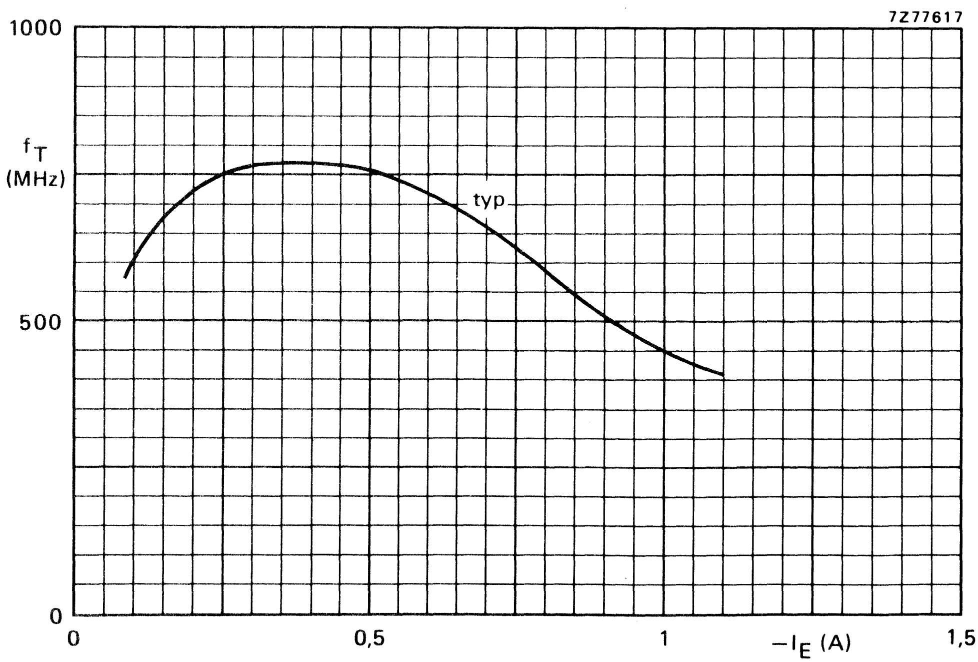


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 °C/W

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**2**	**< 0,16**	**> 11**	**< 0,25**	**> 60**	**7,8 − j4,6**	**22 − j18**
175	12,5	2	–	typ. 10,5		typ. 65	–	–

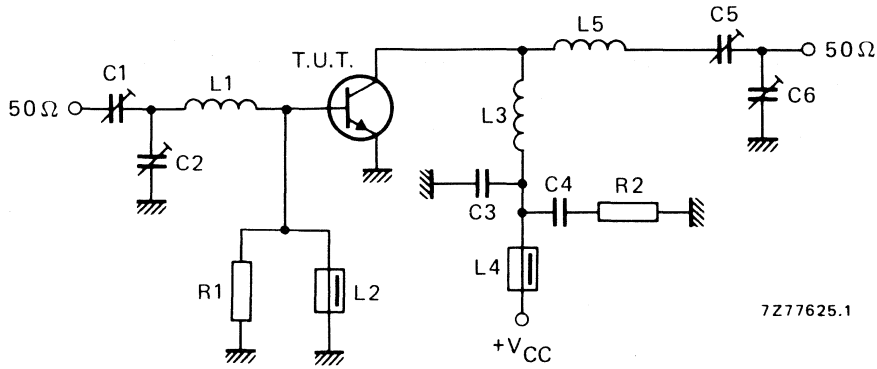


Fig. 7 Test circuit; c.w. class-B.

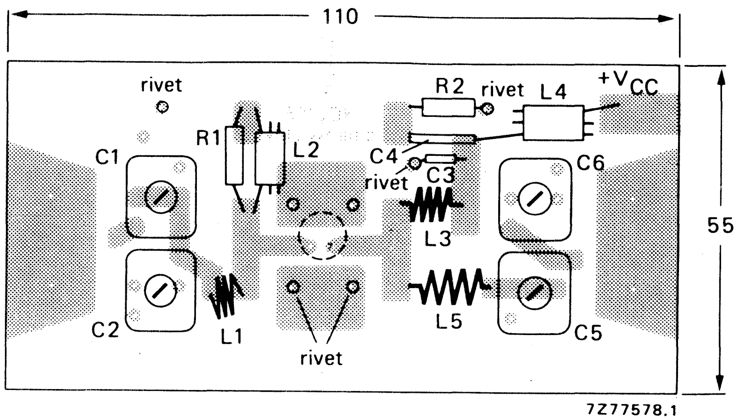
List of components:
C1 = C2 = C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor
C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

L1 = 3 turns enamelled Cu wire (1,0 mm); int. dia. 4,0 mm; length 4 mm; leads 2 x 5 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 4 turns Cu wire (1,0 mm); int. dia. 6,0 mm; length 6 mm; leads 2 x 5 mm

R1 = 220 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



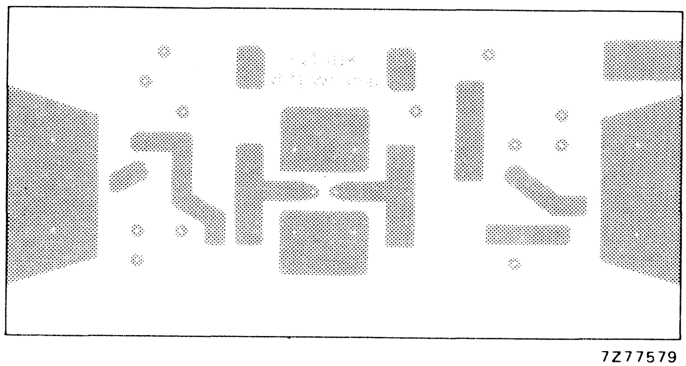


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The length of the external emitter lead is 1,2 mm.

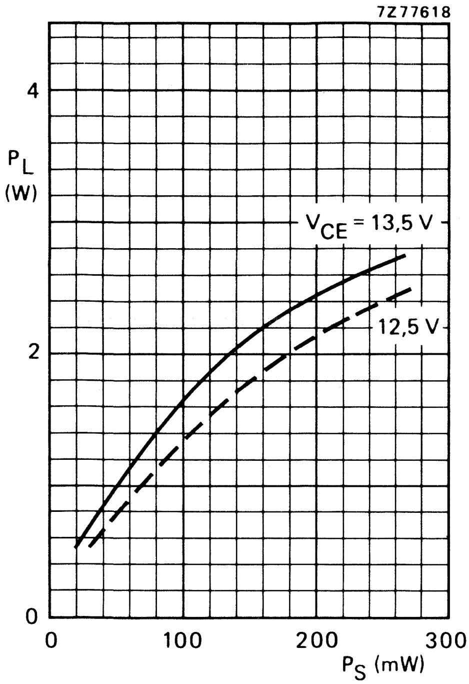


Fig. 9 Typical values; f = 175 MHz;
T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W.

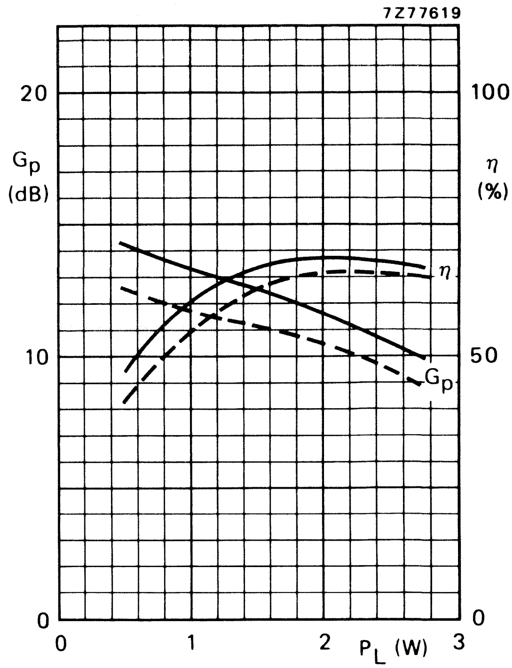


Fig. 10 Typical values; f = 175 MHz;
T_{amb} = 25 °C; —— V_{CE} = 13,5 V;
– – – V_{CE} = 12,5 V; $R_{th\ c\text{-}a}$ = 32 K/W.

APPLICATION INFORMATION (continued)

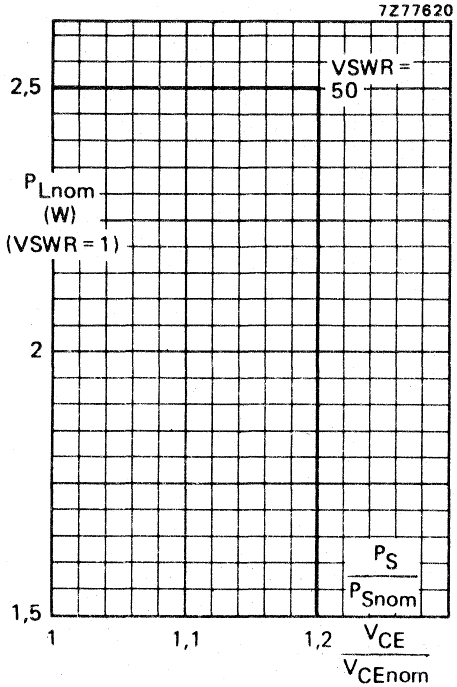


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

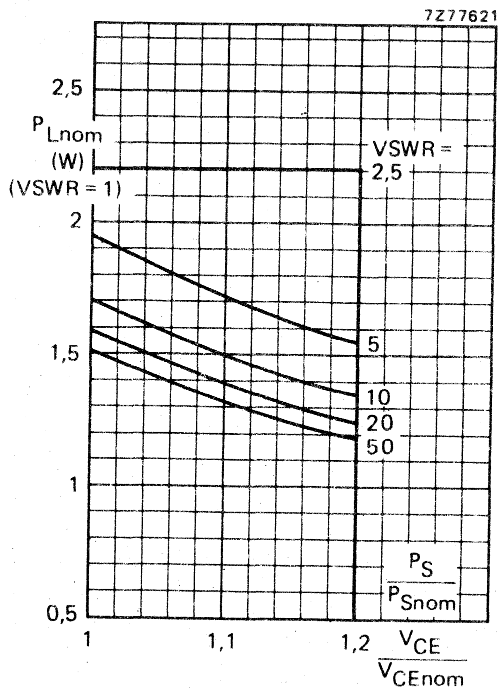


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 175 °C; T_{amb} = 70 °C; $R_{th\ c\text{-}a}$ = 32 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Figs 11 and 12:
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 22 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

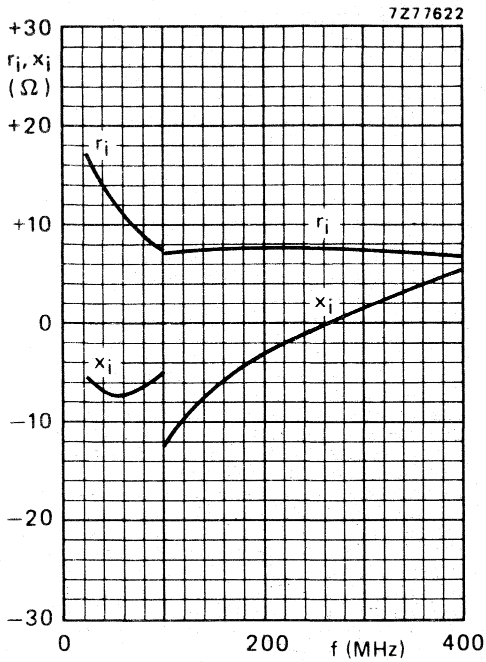


Fig. 13.

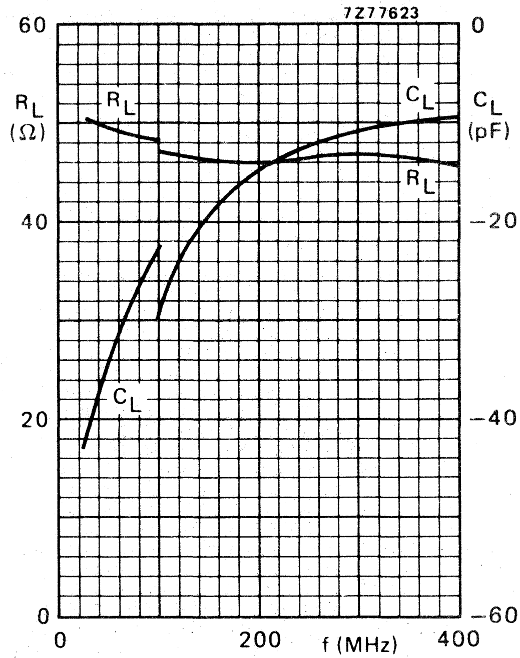
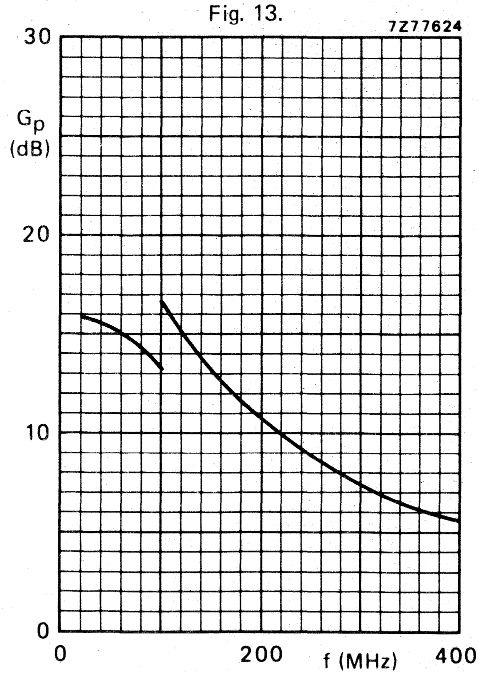


Fig. 14.



Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 13,5 V; P_L = 2 W; T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W.

Fig. 15.

V.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. The transistors are resistance stabilized and guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. The BFQ43 and BFQ43S are especially suited as driver transistors for the BLW31 in a two-stage wideband or semi-wideband v.h.f. amplifier delivering 28 W output power.

The BFQ43 and BFQ43S have a TO-39 metal envelope with the emitter connected to the case which enables excellent heatsinking and emitter grounding.

QUICK REFERENCE DATA

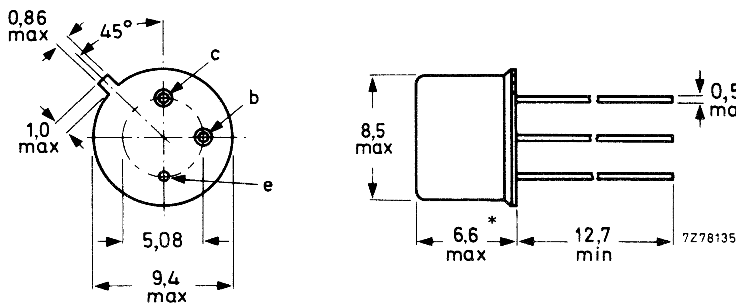
R.F. performance up to $T_h = 25\ ^oC$

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. class-B	**13,5**	**175**	**4**	**> 12**	**> 55**	**3,2 + j0,03**	**53 − j29**
c.w. class-B	12,5	175	4	typ. 12	typ. 60	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; emitter connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

* Max. 4,9 for BFQ43S.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,25	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	3,75	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	12	W
Storage temperature	T_{stg}	−65 to + 175		°C
Operating junction temperature	T_j	max.	200	°C

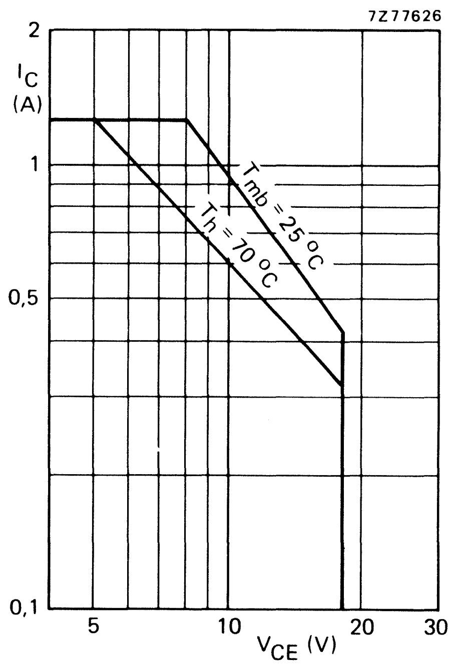
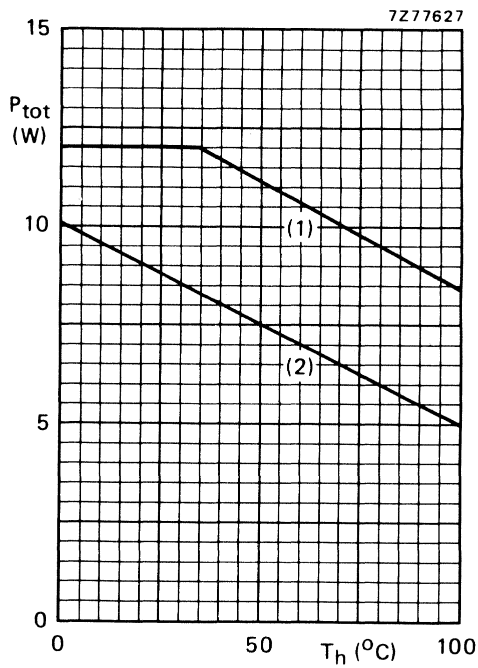


Fig. 2 D.C. SOAR.



(1) Short-time r.f. operation during mismatch; f ⩾ 1 MHz.
(2) Continuous d.c. and r.f. operation; derate by 0,05 W/°C.

Fig. 3 Total power dissipation; V_{CE} ⩽ 16,5 V.

THERMAL RESISTANCE (dissipation = 4 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	18	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	3	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 5 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 18 V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	0,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5	mJ
D.C. current gain * I_C = 0,5 A; V_{CE} = 5 V	h_{FE}	typ.	40	
			10 to 80	
Collector-emitter saturation voltage * I_C = 1,5 A; I_B = 0,3 A	V_{CEsat}	typ.	0,9	V
Transition frequency at f = 100 MHz *				
$-I_E$ = 0,5 A; V_{CB} = 13,5 V	f_T	typ.	750	MHz
$-I_E$ = 1,5 A; V_{CB} = 13,5 V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 13,5 V	C_c	typ.	15	pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 13,5 V	C_{re}	typ.	7,3	pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

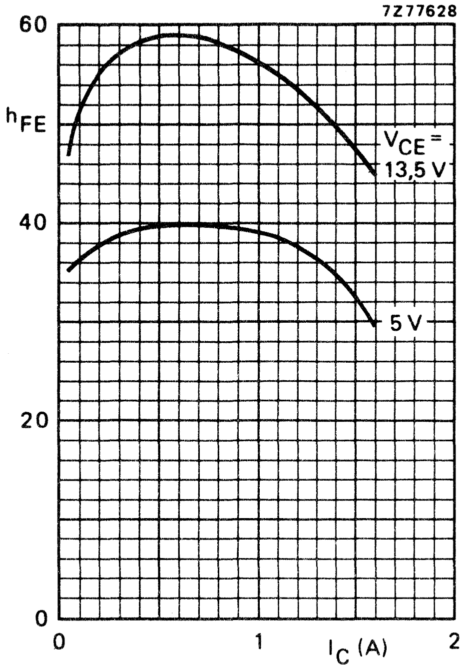


Fig. 4 Typical values; T_j = 25 °C.

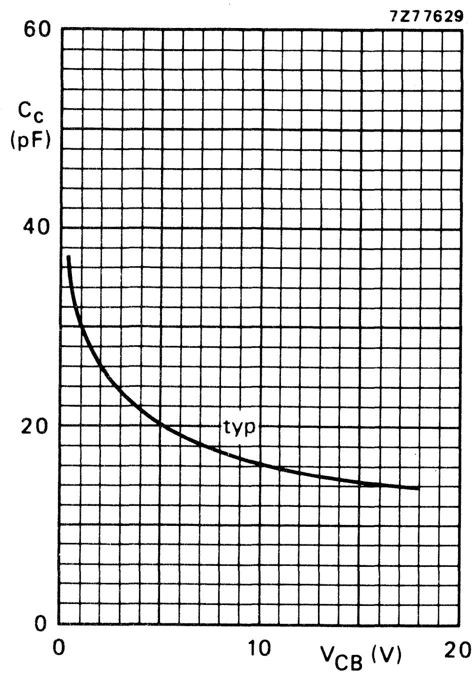


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

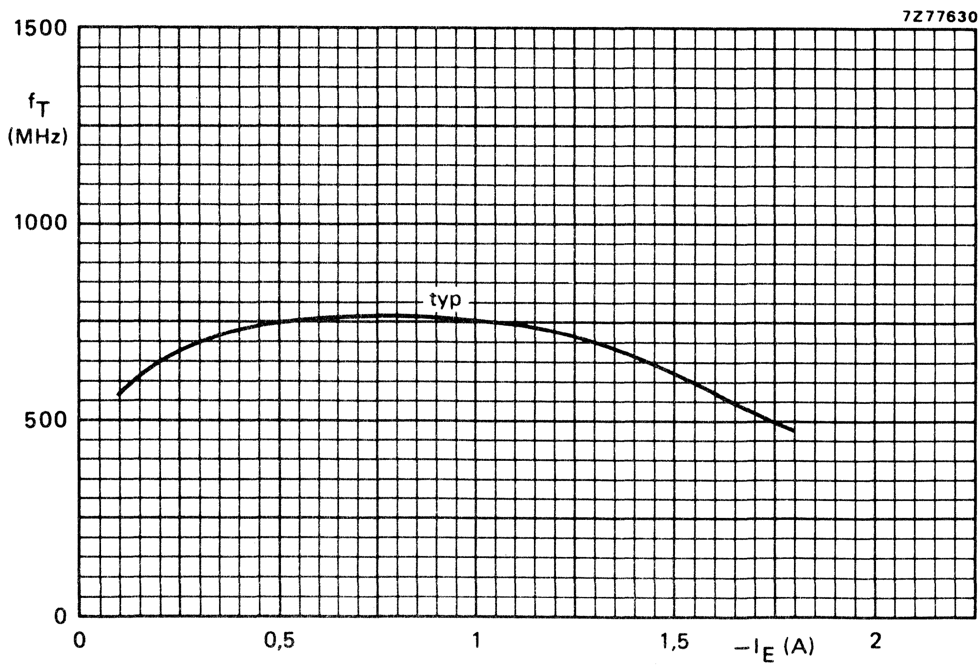


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**4**	**< 0,25**	**> 12**	**< 0,54**	**> 55**	**3,2 + j0,03**	**53 – j29**
175	12,5	4	–	typ. 12	–	typ. 60	–	–

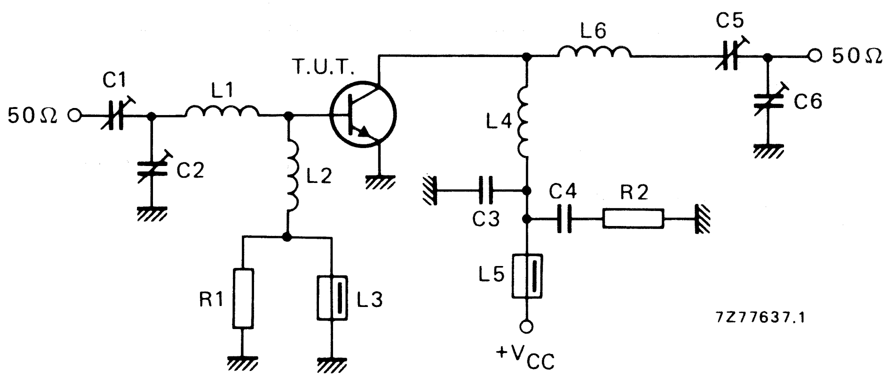


Fig. 7 Test circuit; c.w. class-B.

List of components:
C1 = C5 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor

L1 = 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3 mm; leads 2 x 5 mm
L2 = 7 turns enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; length 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 4 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 5 mm; leads 2 x 5 mm
L6 = 5 turns enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; length 7,5 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)

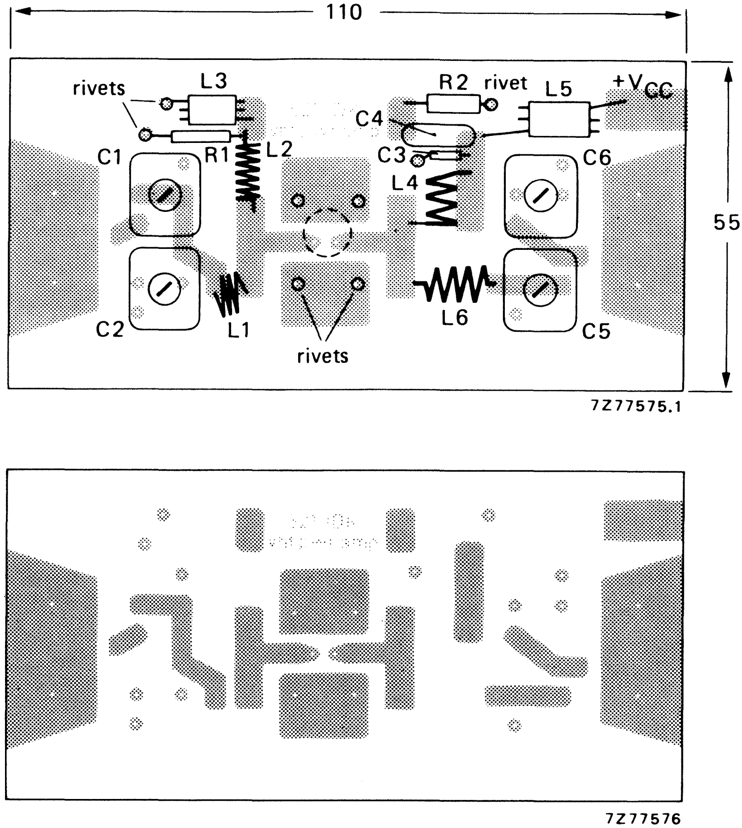


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Material of printed-circuit board: 1,6 mm epoxy fibre-glass.

The case is directly grounded on the printed-circuit board.

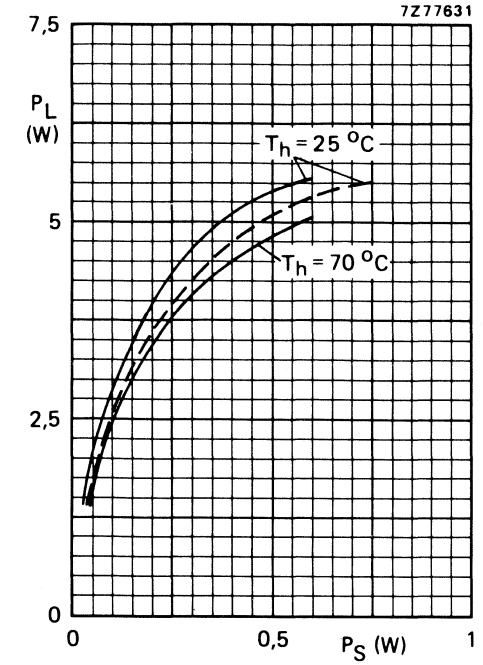


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

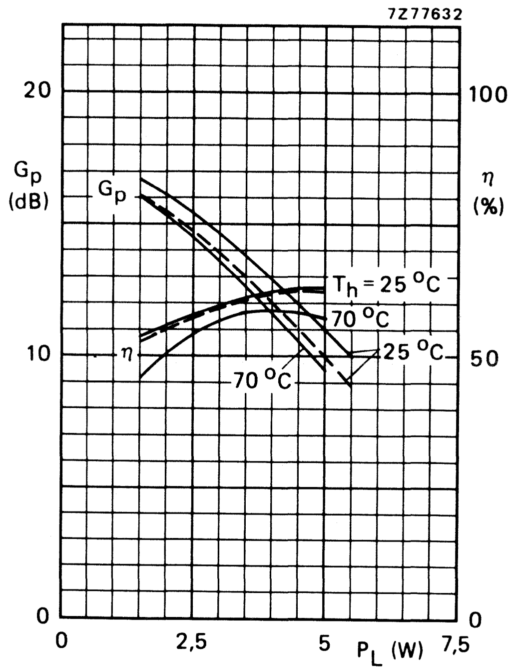


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

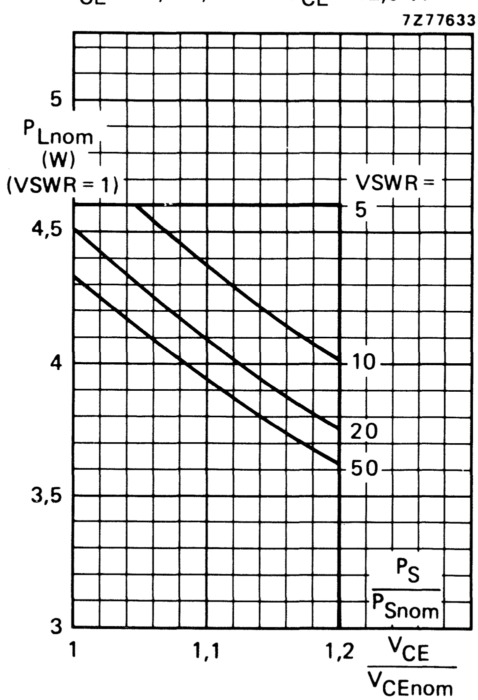


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C.
$R_{th\ mb\text{-}h}$ = 3 K/W; V_{CEnom} = 13,5 or 12,5 V;
$P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 140 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

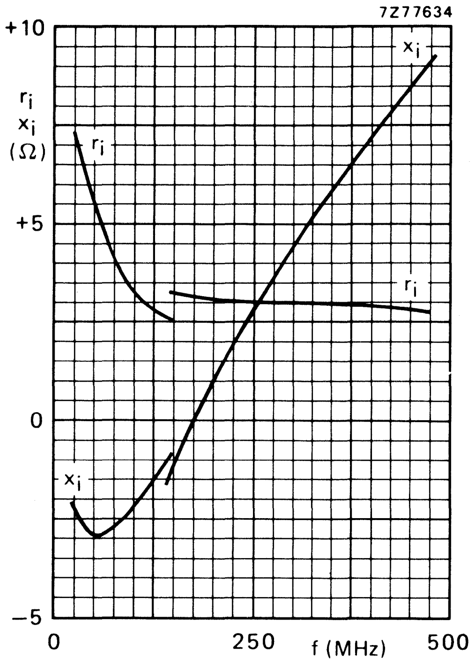


Fig. 12.

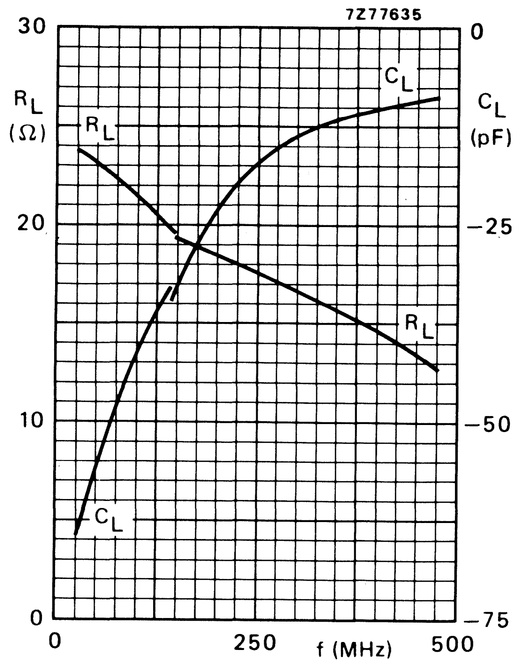
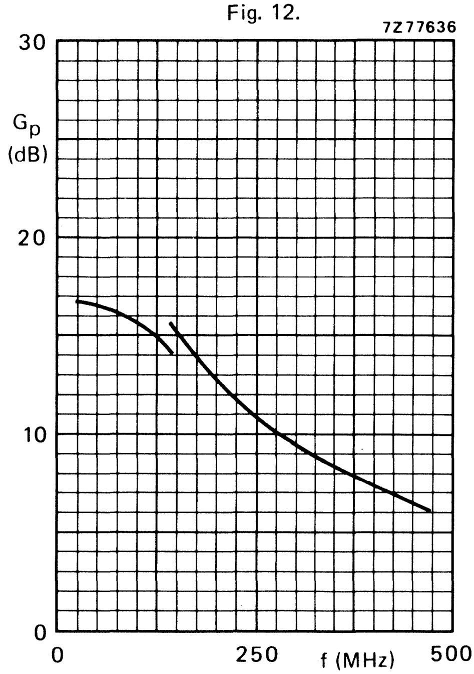


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 4 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

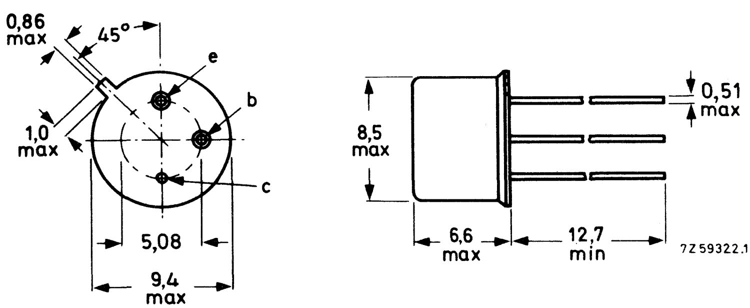
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,5	175	4	> 8	> 60	3,9 + j2,2	37 − j22
c.w.	12,5	175	4	typ. 8	typ. 60	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

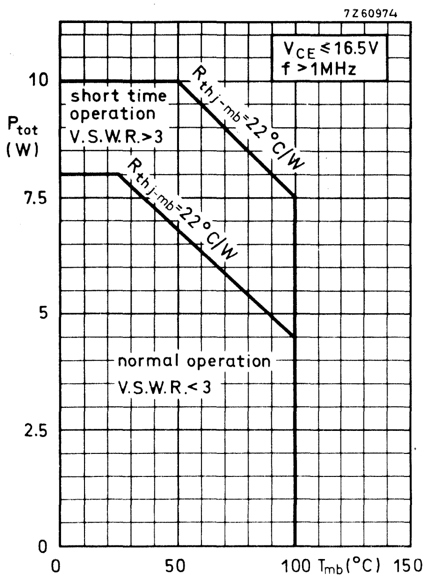


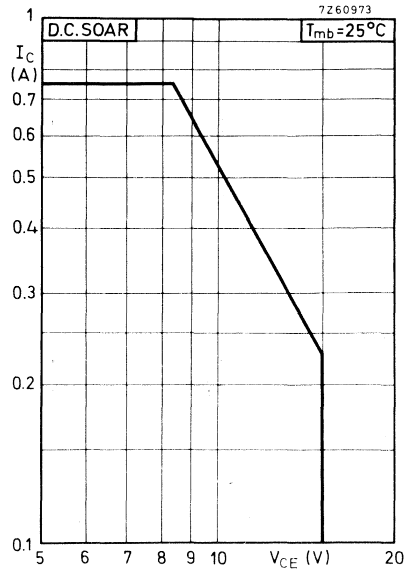
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

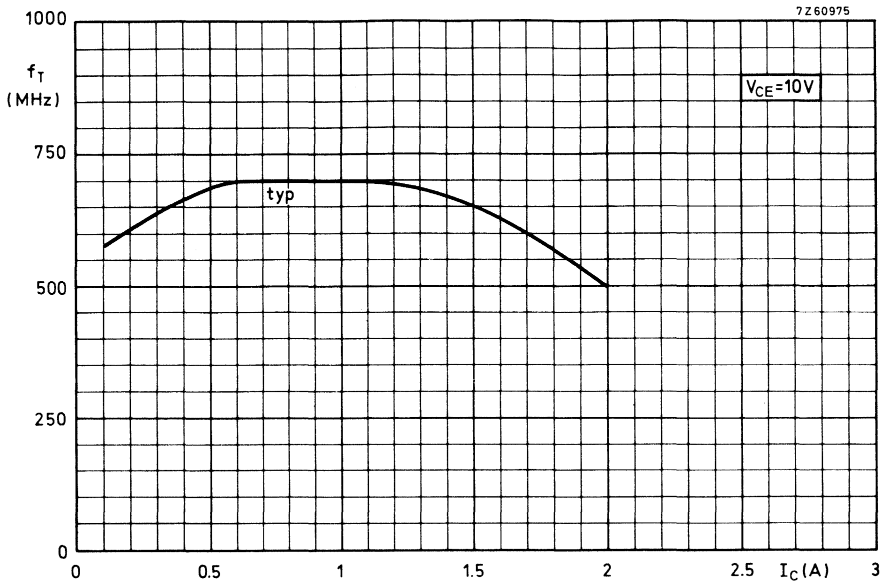
THERMAL RESISTANCE

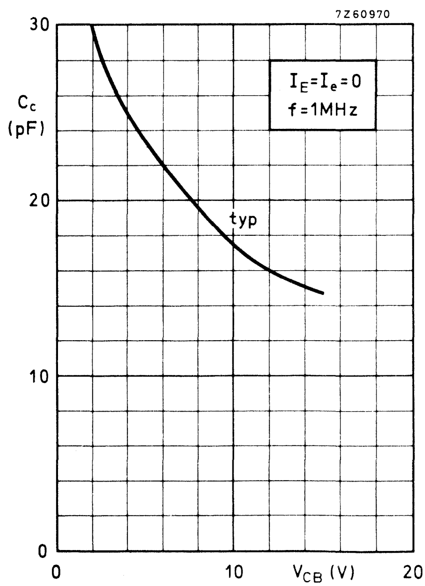
From junction to mounting base	$R_{th\,j-mb}$	=	22	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\,mb-h}$	=	2.5	K/W

CHARACTERISTICS

T_j = 25°C unless otherwise specified

Collector cut-off current				
I_B = 0; V_{CE} = 14 V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, I_C = 1 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, I_C = 10 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	mS
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	0.5	mS
D.C. current gain				
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	>	5	
Transition frequency				
I_C = 350 mA; V_{CE} = 10 V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 15 V	C_c	typ.	15	pF
		<	20	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 15 V	$-C_{re}$	typ.	11	pF


7Z60975
1000
f_T
(MHz)
750
500
250
0
0
0.5
1
1.5
2
2.5
I_C (A)
3
V_{CE}=10V
typ


7Z60970
30
C_c
(pF)
20
10
0
0
10
V_{CB} (V)
20
I_E=I_e=0
f=1MHz
typ

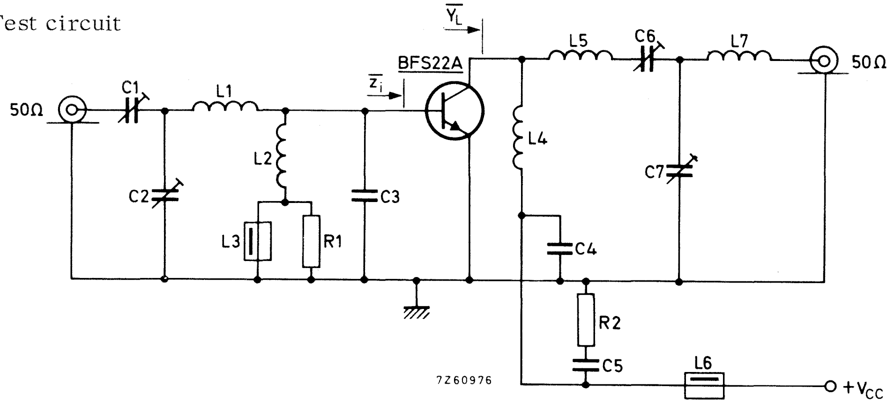
APPLICATION INFORMATION

R. F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mS)
13.5	< 0.63	4	< 0.49	> 8	> 60	3.9+j2.2	37−j22
12.5	typ. 0.63	4	typ. 0.53	typ. 8	typ. 60	−	−

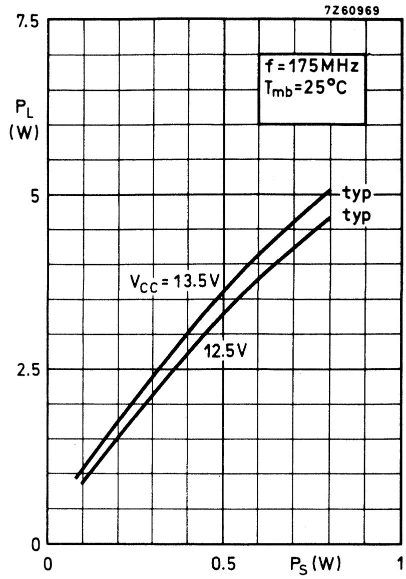
Test circuit

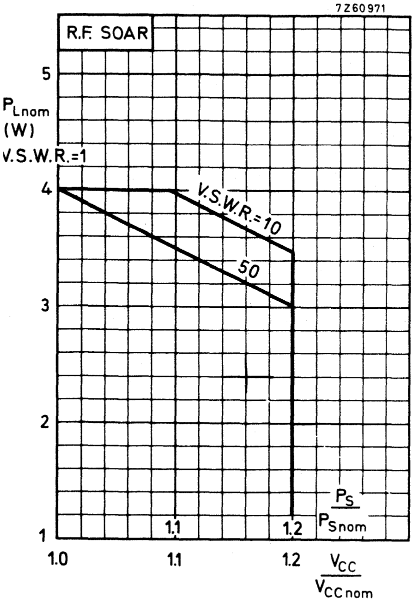


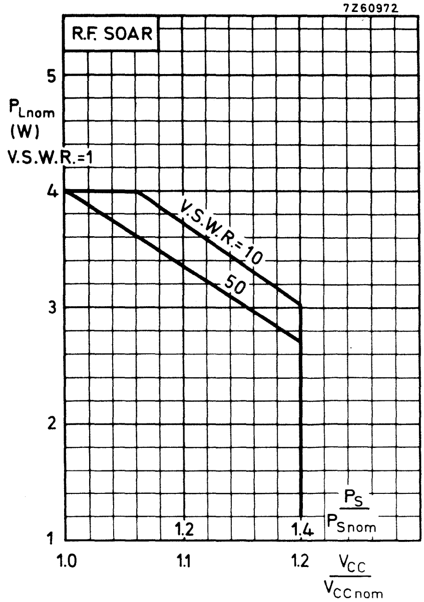
C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 7 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω carbon


7Z60969
7.5
P_L
(W)
5
2.5
0
0
0.5
P_S (W)
1
f = 175 MHz
T_{mb} = 25 °C
typ
typ
V_{CC} = 13.5 V
12.5 V





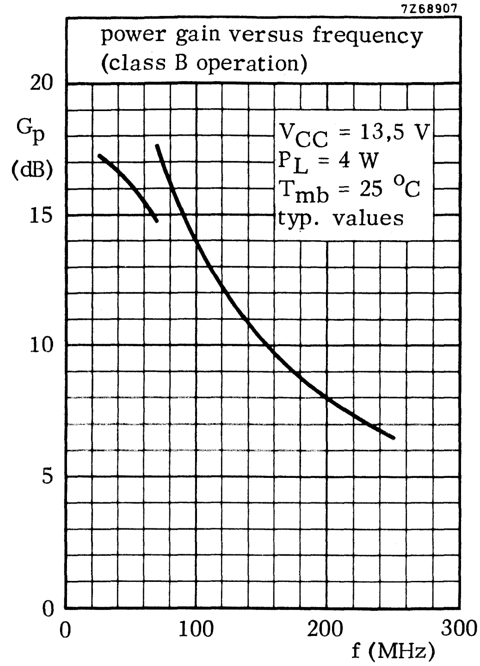
Conditions for R.F. SOAR:

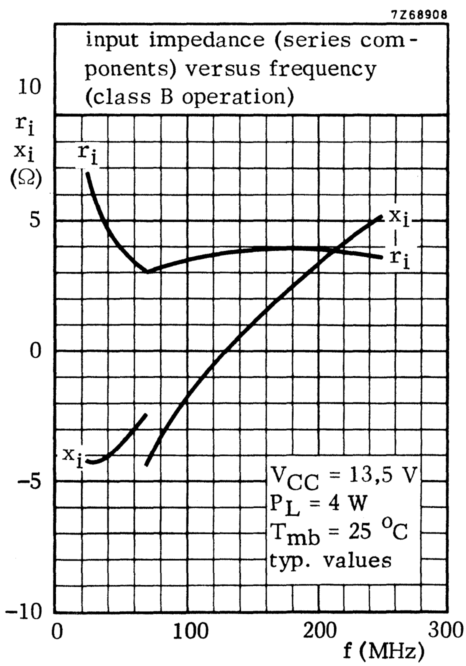
f = 175 MHz
T_{mb} = 70 °C
V_{CCnom} = 12.5 or 13.5 V

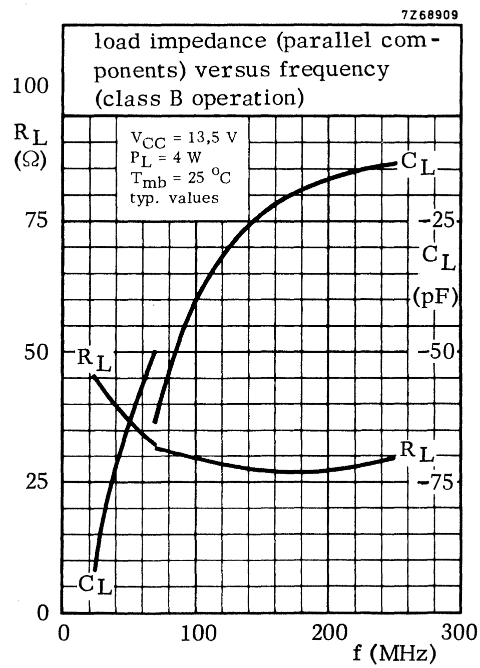
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.S. = 1

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V. S. W. R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions.

It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

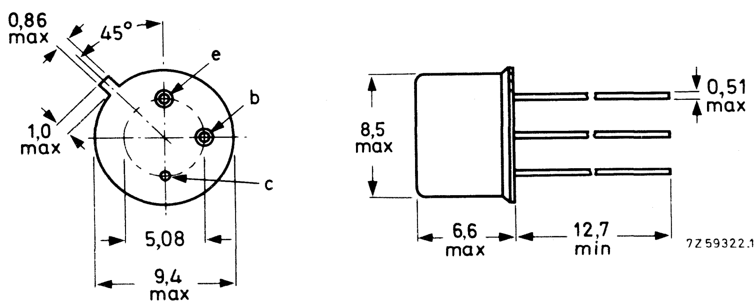
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	4	> 10	> 65	2,3 + j1,6	8,9 − j18,1

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.

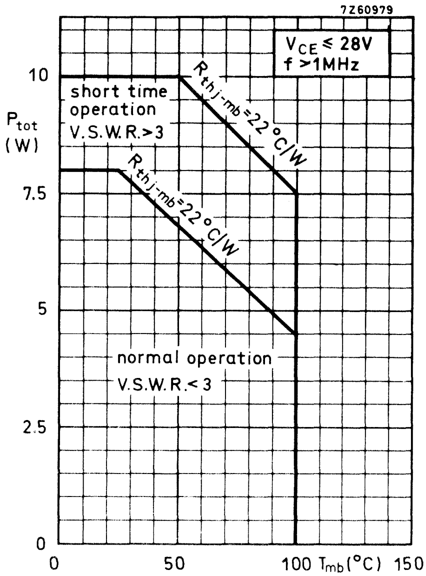


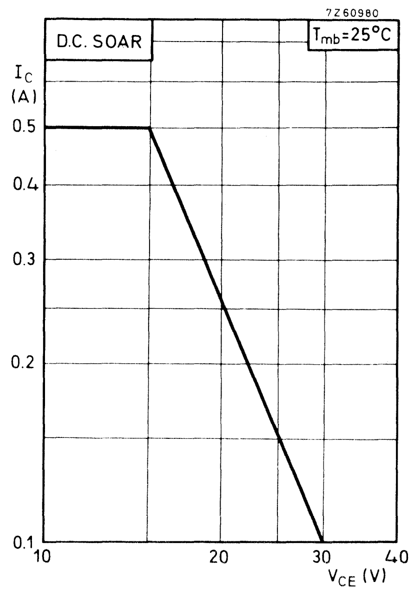
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1.5	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	8	W





Storage temperature	T_{stg}	−65 to	+200	°C
Operating junction temperature	T_j	max.	200	°C

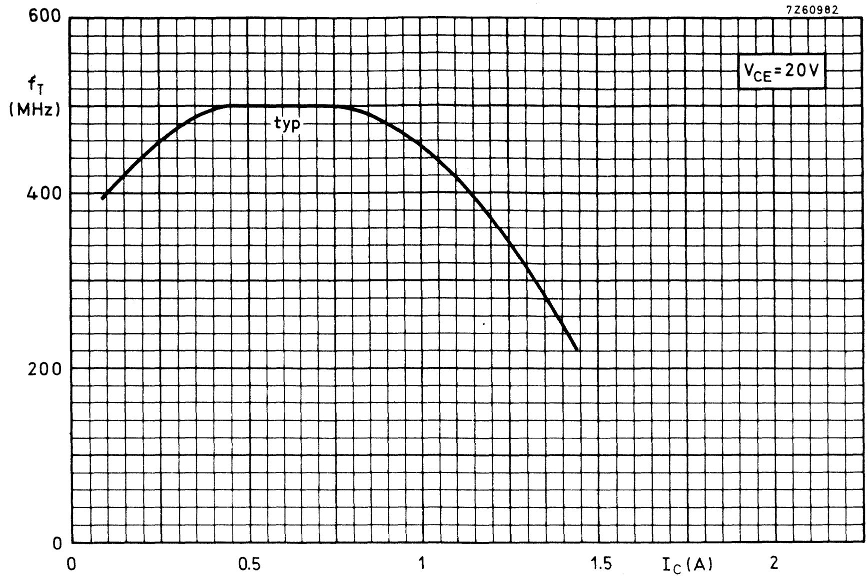
THERMAL RESISTANCE

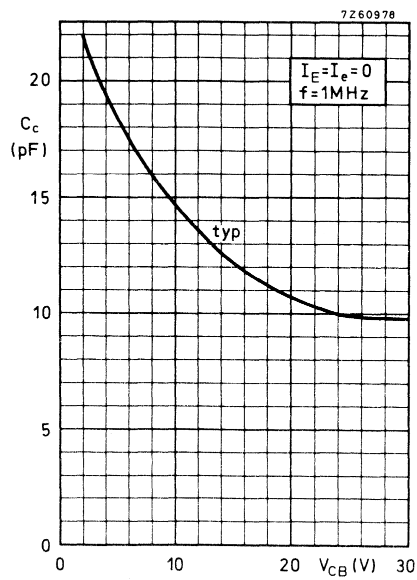
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	22	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	2.5	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	ms
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	ms
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 25$ mA; $V_{CE} = 30$ V	$-C_{re}$	typ.	7.5	pF


7Z60982
600
400
200
0
f_T
(MHz)
V_{CE}=20V
typ
0
0.5
1
1.5
I_C (A)
2


7Z60978
20
15
10
5
0
C_c
(pF)
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB} (V)
30

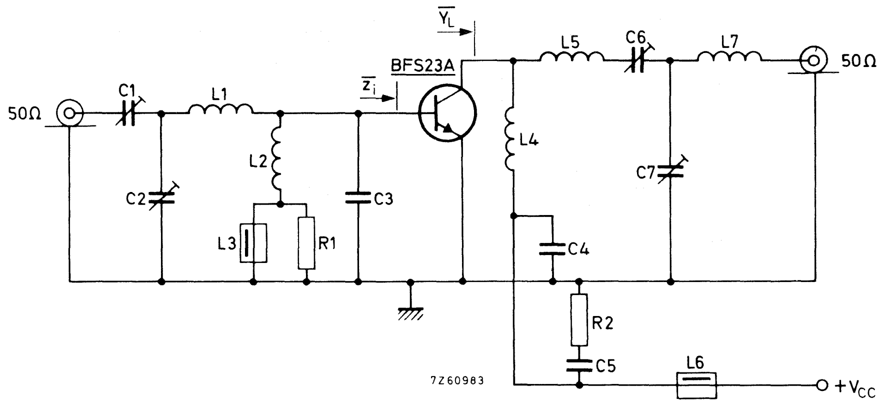
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	< 0.40	4	< 0.22	> 10	> 65	2.3+j1.6	8.9 − j18.1

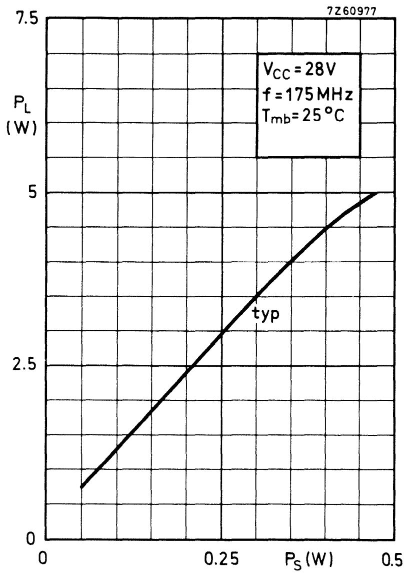
Test circuit

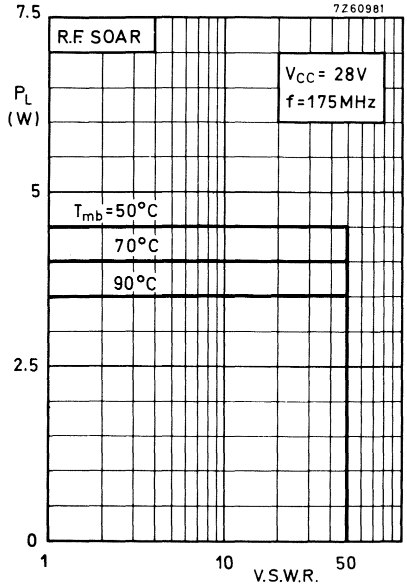


C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

L1 = 1 turn enamelled Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm
L2 = 6 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 8 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 10 mm
L5 = 5 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 8 mm; leads 2 x 10 mm
L7 = 4 turns enamelled Cu wire (1.0 mm); winding pitch 1.0 mm; int. diam. 6 mm; leads 2 x 5 mm

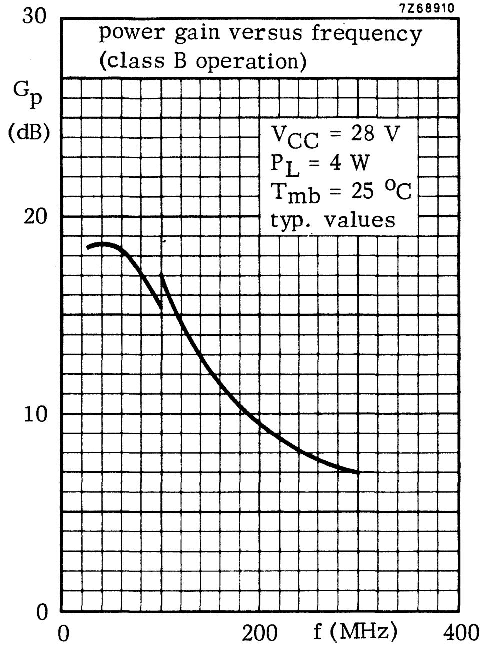
R1 = R2 = 10 Ω carbon

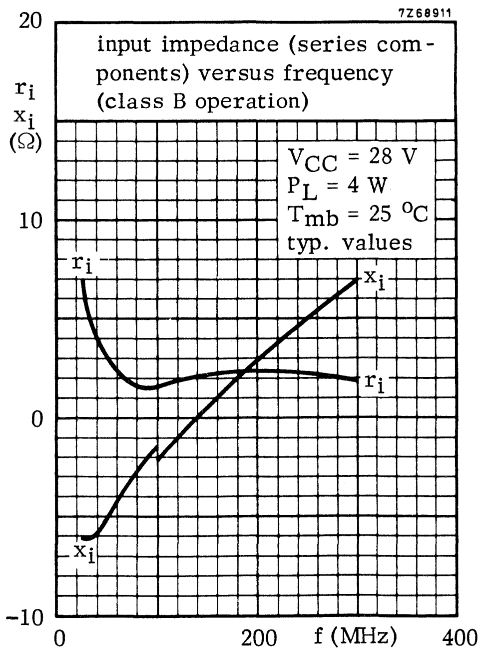


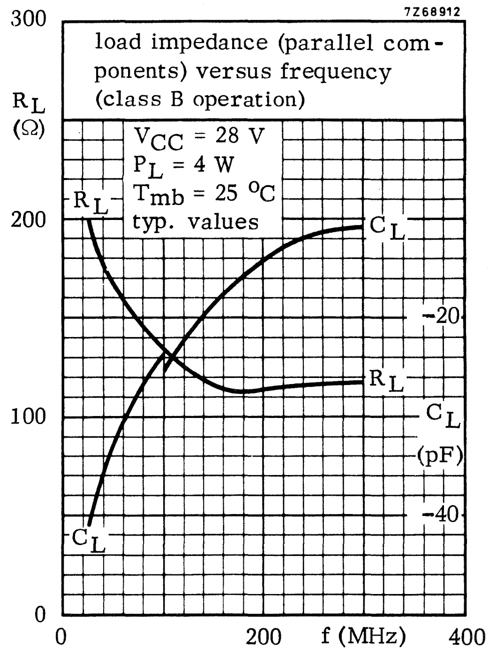


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







HF POWER MOS-TRANSISTOR

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in SSB transmitters in the HF range.

Features

- high power gain
- low noise figure
- good thermal stability
- withstands full load mismatch

The transistor has a 4-lead flange envelope with a ceramic cap (SOT123). All leads are isolated from the flange.

Matched V_{GS}-groups are available on request.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in common-source test circuit; f1 = 28.000 MHz; f2 = 28.001 MHz

mode of operation	V_{DS} V	I_D A	P_L (PEP) W	G_p dB	d3 dB	ηd (2-tone) %
class-A	28	1.3	8	< 24	< −40	–
class-AB	28	–	30	typ. 20	typ. −35	typ. 40

MECHANICAL DATA

SOT123 (see Fig. 1).

Note

The device is supplied in an anti-static package. Protect the gate-source input against static charge during transport or handling.

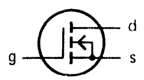
PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

1 = drain
2 = source
3 = gate
4 = source



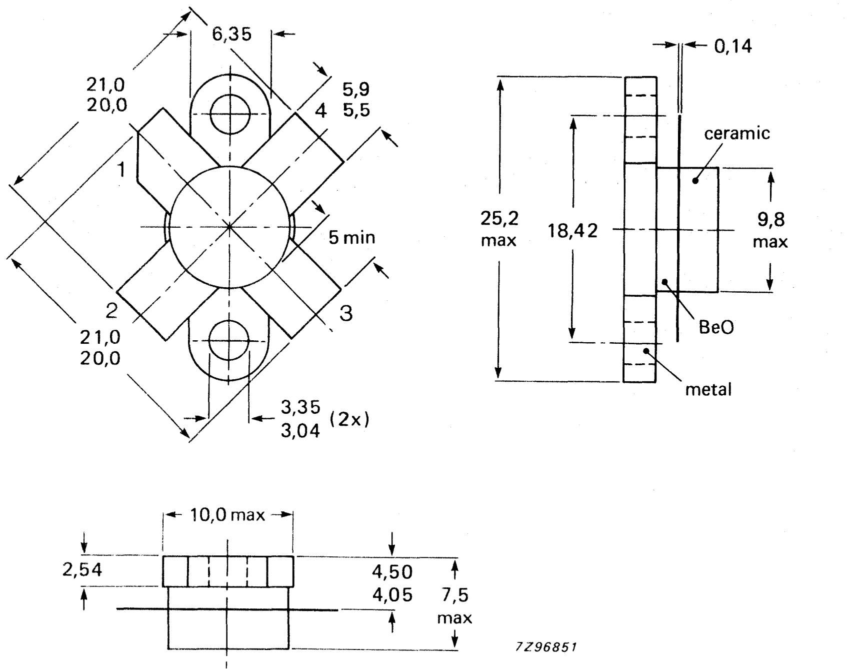


Fig. 1 SOT123

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage at $V_{GS} = 0$	V_{DSS}	max.	65 V
Gate-source voltage at $V_{DS} = 0$	$\pm V_{GSS}$	max.	20 V
Drain current DC or average	$I_D, I_{D(AV)}$	max.	3.0 A
(peak value); $f > 1$ MHz	I_{DM}	max.	10 A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	68 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

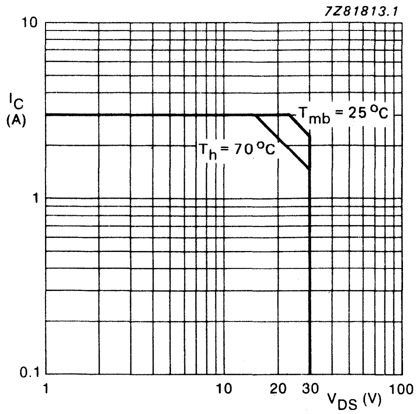


Fig. 2 Collector current as a function of drain-source voltage.

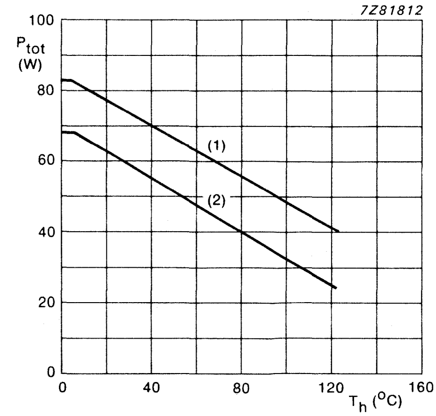


Fig. 3 Power/temperature derating curves.
(1) Short-time operation during mismatch.
(2) Continuous operation.

DEVELOPMENT DATA

THERMAL RESISTANCE

P = 68 W; T_{mb} = 25 °C

From junction to mounting base	$R_{th\,j\text{-}mb}$	max.	2.6 K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	max.	0.3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 10 mA; V_{GS} = 0	$V_{(BR)DSS}$	>	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	<	2.0 mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	1.0 μA
Gate threshold voltage I_D = 10 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate-source voltage difference of matched devices V_{DS} = 10 V; I_D = 10 mA	$\|V_{GS1}-V_{GS2}\|$	<	100 mV
Forward transconductance V_{DS} = 10 V; I_D = 1.5 A	G_{fs}	>	1.2 S
Drain-source on-state resistance I_D = 1.5 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.4 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	10 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{iss}	typ.	125 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{oss}	typ.	75 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rss}	typ.	11 pF

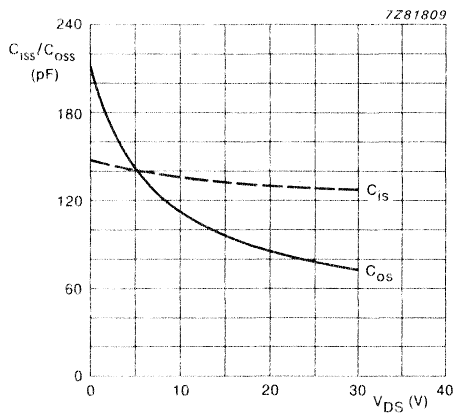


Fig. 4 Input and output capacitances as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

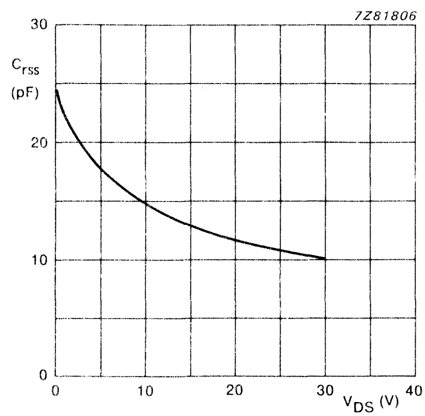


Fig. 5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

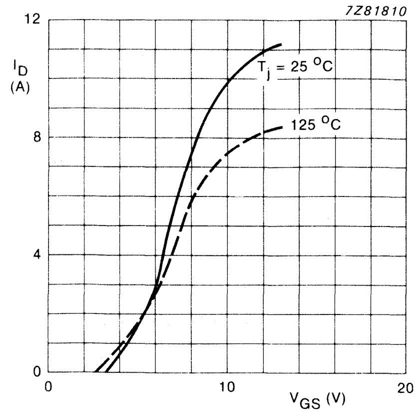


Fig. 6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

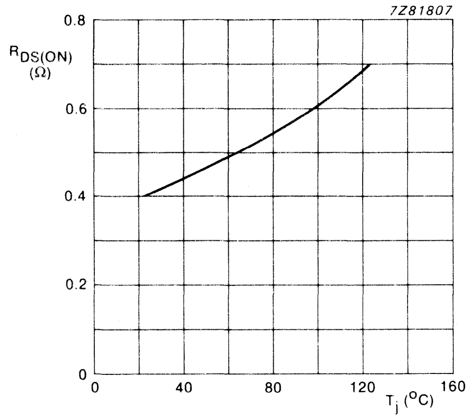


Fig. 7 Drain-source on-state resistance as a function of junction temperature; I_D = 1.5 A; V_{DS} = 10 V; typical values.

DEVELOPMENT DATA

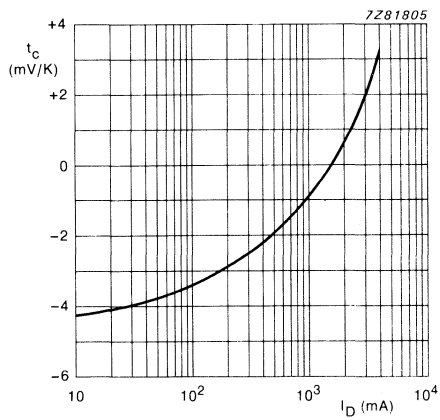


Fig. 8 Temperature coefficient of gate-source voltage as a function of drain current; V_{DS} = 10 V; valid for T_j = 25 to 125 °C; typical values.

APPLICATION INFORMATION

RF performance in SSB operation (common-source class-A circuit); f1 = 28.000 MHz; f2 = 28.001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R1 = 26 Ω.

V_{DS} V	I_D A	P_L (PEP) W	G_p dB	d3* dB	d5* dB	Z_I Ω
28	1.3	8	> 24 typ. 27	< −40 typ. −43	< −40 typ. −70	18.4 + j5.2

* **Note**

Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power (PEP) these figures should be increased by 6 dB.

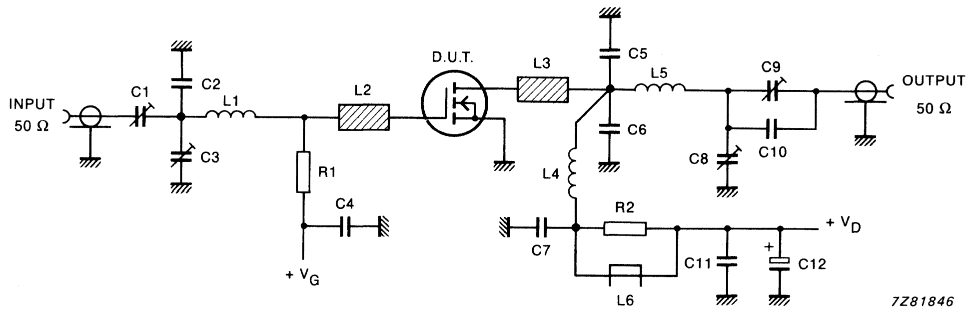


Fig. 9 Class-A test circuit at f = 28 MHz.

List of components: (class-A test circuit)

R1	= 26 Ω; metal film resistor (0.25 W)
R2	= 10 Ω; metal film resistor (0.25 W)
C1, C3, C8, C9	= 7 - 100 pF, film dielectric trimmer, cat. no. 2222 809 07015
C2, C10	= 39 pF, ceramic multilayer chip capacitor*
C4, C7	= 100 nF, ceramic multilayer chip capacitor
C5, C6	= 27 pF, ceramic multilayer chip capacitor*
C11	= 3 x 100 nF, ceramic multilayer chip capacitor
C12	= 2.2 μF (63 V), electrolytic capacitor
L1	= 307 nH; 12 turns of enamelled Cu-wire (0.5 mm), int. diam. 4 mm, length 8 mm
L2, L3	= 30 Ω stripline, (15 mm x 6 mm)
L4	= 1039 nH; 14 turns of enamelled Cu-wire (1 mm), int. diam. 9 mm, length 14 mm
L5	= 305 nH; 9 turns of enamelled Cu-wire (1 mm), int. diam. 6 mm, length 10 mm
L6	= ferroxcube wide-band HF choke, grade 3B, cat. no. 4312 020 36640

PC board material; double Cu-clad epoxy fibre-glass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

* American Technical Ceramics (type 100B) or equivalent.

DEVELOPMENT DATA

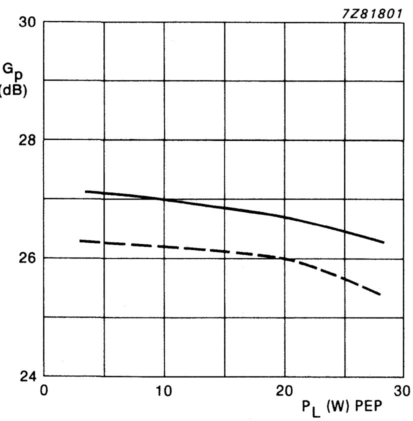


Fig. 10 Power gain as a function of load power.
——— T_h = 25 °C.
- - - - T_h = 70 °C.

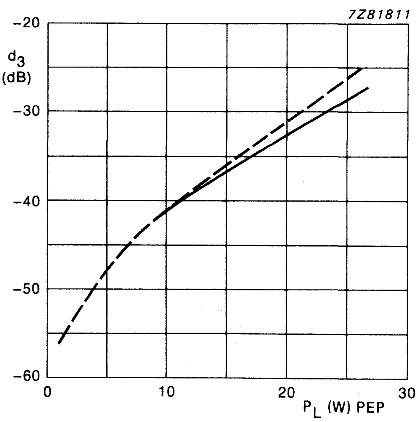


Fig. 11 Third order intermodulation distortion as a function of load power.

Conditions for Figs 10 and 11:
f = 28 MHz; V_{DS} = 28 V; I_D = 1.3 A; $R_{th\ mb\text{-}h}$ = 0.3 K/W; class-A operation; typical values.

APPLICATION INFORMATION

RF performance in SSB operation (common-source class-AB circuit); f1 = 28.000 MHz; f2 = 28.001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R1 = 34 Ω.

V_{DS} V	I_D A	P_L (PEP) W	G_p dB	η_d %	d3* dB	d5* dB	Z_I Ω
28	0.25	30	typ. 20	typ. 40	typ. −35	typ. −40	8.9 + j1.0

*** Note**

Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power these figures should be increased by 6 dB.

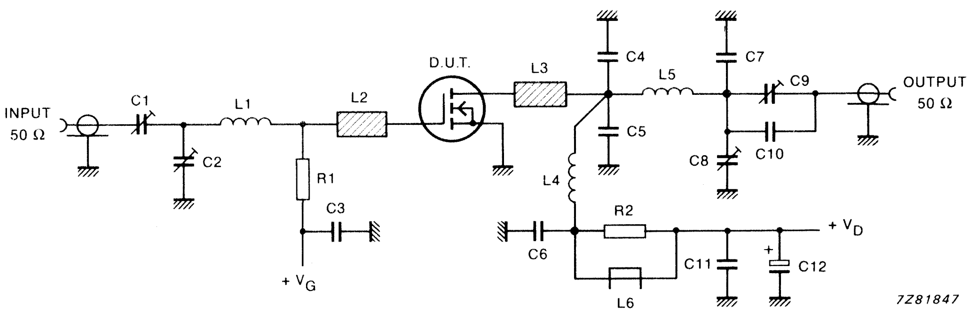


Fig. 12 Class-AB test circuit at f = 28 MHz.

List of components: (class-AB test circuit)

R1	= 35 Ω; metal film resistor (0.5 W)
R2	= 10 Ω; metal film resistor (0.25 W)
C1, C2	= 5 - 60 pF, film dielectric trimmer, cat. no. 2222 809 07011
C3, C6	= 100 nF, ceramic multilayer chip capacitor
C4, C5	= 27 pF, ceramic multilayer chip capacitor*
C7, C10	= 39 pF, ceramic multilayer chip capacitor*
C8, C9	= 7 - 10 pF, film dielectric trimmer, cat. no. 2222 809 07015
C11	= 3 x 100 nF, ceramic multilayer chip capacitor
C12	= 2.2 μF (63 V), electrolytic capacitor
L1	= 415 nH; 13 turns of enamelled Cu-wire (0.5 mm), int. diam. 5 mm, length 10 mm
L2, L3	= 30 Ω stripline, (15 mm x 6 mm)
L4	= 390 nH; 10 turns of enamelled Cu-wire (1 mm), int. diam. 7 mm, length 13 mm
L5	= 245 nH; 9 turns of enamelled Cu-wire (1 mm), int. diam. 5 mm, length 10 mm
L6	= ferroxcube wide-band HF choke, grade 3B, cat. no. 4312 020 36640

PC board material; double Cu-clad epoxy fibre-glass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

* American Technical Ceramics (type 100B) or equivalent.

DEVELOPMENT DATA

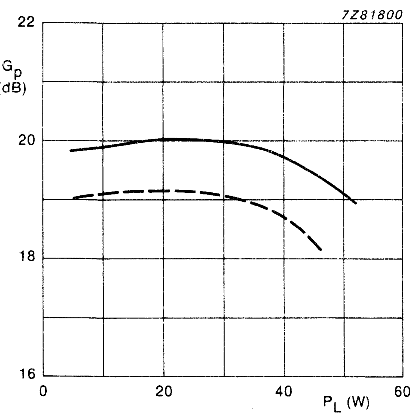


Fig. 13 Power gain as a function of load power.

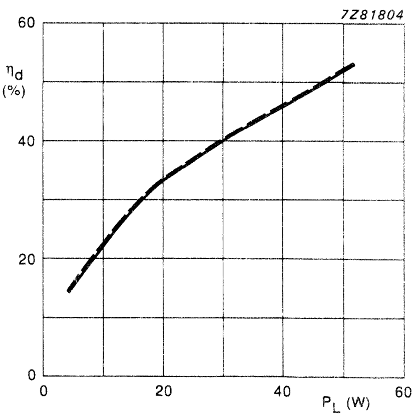


Fig. 14 Two tone efficiency as a function of load power.
——— T_h = 25 °C.
– – – T_h = 70 °C.

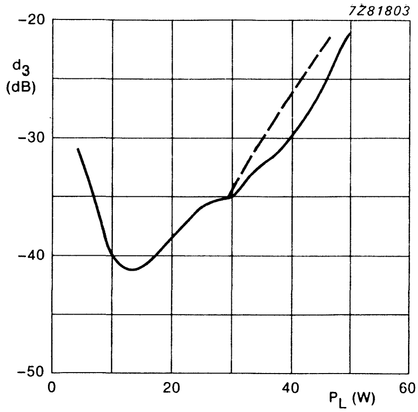


Fig. 15 Third order intermodulation distortion as a function of load power.

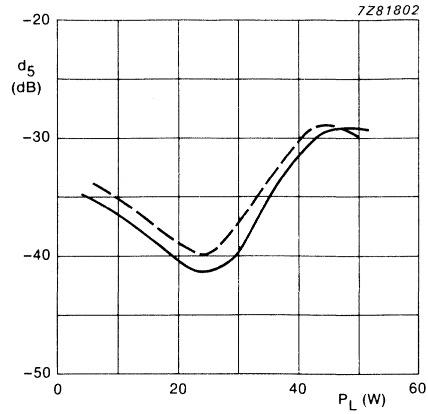


Fig. 16 Fifth order intermodulation distortion as a function of load power.

Conditions for Figs 13, 14, 15 and 16:
f = 28 MHz; V_{DS} = 28 V; I_{DQ} = 0.25 A; $R_{th\ mb\text{-}h}$ = 0.3 K/W; class-AB operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at P_L = 30 W single tone and V_{DS} = 28 V in class-AB operation (T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W).

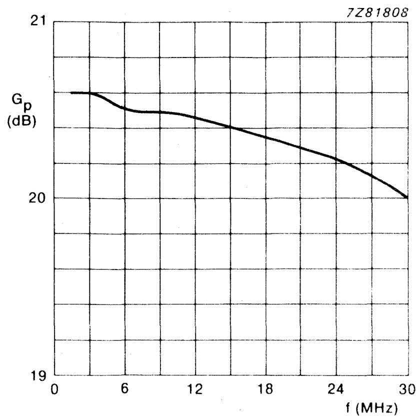


Fig. 17 Power gain as a function of frequency.

Conditions for Fig. 17:
V_{DS} = 28 V; I_{DQ} = 0.25 A; P_L = 30 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R_1 = 33 Ω; Z_L = 10 Ω; class-AB operation; typical values.

f (MHz)	Z_i (Ω)
1.5	32.9 – j2.2
3.0	32.4 – j4.3
6.0	30.7 – j8.1
10	27.4 – j11.9
15	22.8 – j14.6
20	18.5 – j15.4
25	15.1 – j15.3
30	12.5 – j14.6

Table 1 Input impedance as a function of frequency

DEVELOPMENT DATA

RF POWER MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the HF and VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-121). All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in common-source class-AB circuit.

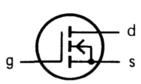
Mode of operation	f (MHz)	V_{DS} (V)	P_L (PEP) (W)	G_P (dB)	Dr. eff (2-tone) (%)	d_3 (dB)
SSB	28	28	150	> 17	> 35	< −30

MECHANICAL DATA

Dimensions in mm

Pinning

1 = Drain
2 = Source
3 = Gate
4 = Source



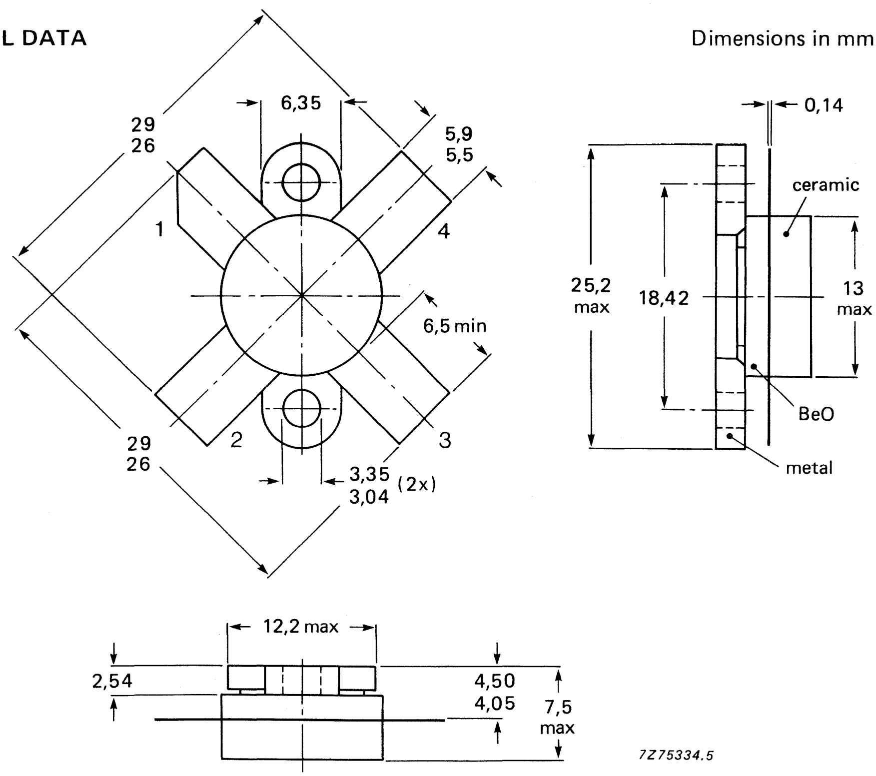


Fig. 1 SOT-121.

PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

RATINGS

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current (DC)	I_D	max.	13 A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	220 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	0.8 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 mA; V_{GS} = 0	BV_{DSS}	min.	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	max.	5.0 mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0 μA
Gate threshold voltage I_D = 100 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance I_D = 8 A; V_{DS} = 10 V	G_{fs}	min. typ.	5.0 S 7.5 S
Drain-source on-state resistance I_D = 8 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.1 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	37 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{iss}	typ.	530 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0 V	C_{oss}	typ.	370 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rss}	typ.	56 pF

APPLICATION INFORMATION

RF performance in SSB operation (common-source class-AB circuit)
f = 28 MHz; T_h = 25 °C; I_{DQ} = 1 A; R_{GS} = 10 Ω

Mode of operation	f (MHz)	V_{DS} (V)	P_L (PEP) (W)	G_P (dB)	Dr. eff (2-tone) (%)	d_3 (dB)
SSB	28	28	150	> 17	> 35	< −30

Optimum load impedance: 1.8 + j 0.2 Ω

The device is tested with a 2-tone signal.
The tones are of equal amplitude and separated by 1 kHz.
The intermodulation products are measured with respect to the level of one tone.

LOAD MISMATCH

The device is capable of withstanding a load VSWR of 50, varied through all phases, at rated load power and supply voltage (T_h = 25 °C).

DEVELOPMENT DATA

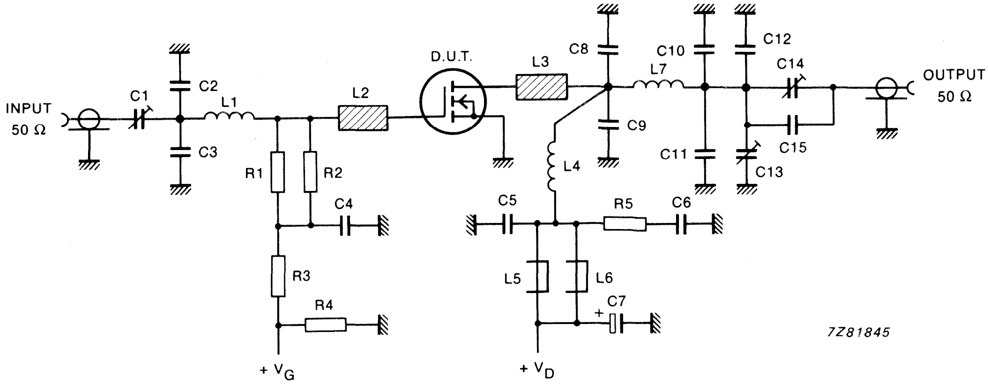


Fig. 2 Test circuit at 28 MHz.

C1 = C3 = C13 = C14 = 7-100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C2 = C8 = C9 = C15 = 75 pF multilayer ceramic chip capacitor *
C4 = C5 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C6 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = 2.2 μF electrolytic capacitor
C10 = 100 pF multilayer ceramic chip capacitor *
C11 = C12 = 150 pF multilayer ceramic chip capacitor *

L1 = 145 nH, 6 turns enamelled Cu-wire (0.7 mm), int. dia: 6 mm
L2 = L3 = 41.1 Ω stripline (10 mm x 6 mm)
L4 = 148 nH, 4 turns enamelled Cu-wire (1.5 mm), int. dia: 10 mm
L5 = L6 = Ferroxcube HF choke, grade 3B (cat. no. 4312 020 36642)
L7 = 79 nH, 3 turns enamelled Cu-wire (2.2 mm), int. dia: 8 mm

R1 = R2 = 19.6 Ω metal film resistor (cat. no. 2322 153 51969)
R3 = 1 kΩ metal film resistor (cat. no. 2322 151 71002)
R4 = 1 MΩ metal film resistor (cat. no. 2322 151 71005)
R5 = 10 Ω metal film resistor (cat. no. 2322 153 51009)

Printed circuit board (PCB): double Cu-clad, 1.6 mm PTFE fibre glass dielectric (ϵ_r = 2.2)

* American Technical Ceramics type 100B or capacitor of same quality.

RF POWER MOS TRANSISTOR

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in SSB transmitters in the HF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-123). All leads are isolated from the flange. Matched V_{GS}-groups are available on request.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in common-source class-A circuit.

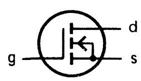
Mode of operation	f (MHz)	V_{DS} (V)	I_D (A)	P_L (PEP) (W)	G_P (dB)	d_3 (dB)	d_5 (dB)
SSB	28	50	0.8	8.0	> 24	< −40	< −40

MECHANICAL DATA

Dimensions in mm

Pinning

1 = Drain
2 = Source
3 = Gate
4 = Source



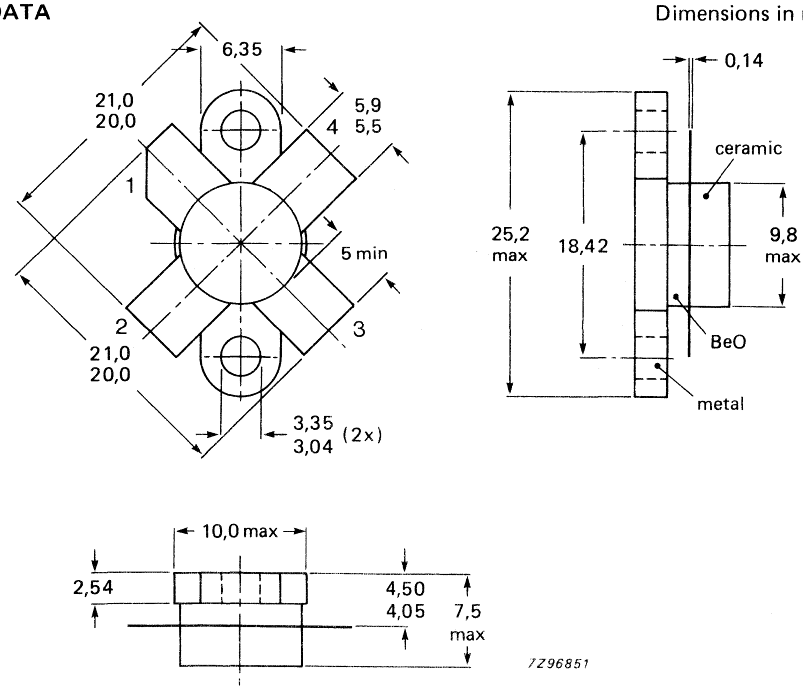


Fig. 1 SOT-123.

Note: Protect gate-source input against static charge during transport or handling.

PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

RATINGS

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

Drain-source voltage	V_{DS}	max.	110 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current (DC)	I_D	max.	1.5 A
Total power dissipation $T_{mb} = 25\ ^oC$	P_{tot}	max.	68 W
Storage temperature range	T_{stg}		−65 to + 150 ^oC
Operating junction temperature	T_j	max.	200 ^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	2.6 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Drain-source breakdown voltage $I_D = 10$ mA; $V_{GS} = 0$	BV_{DSS}	min.	110 V
Drain-source leakage current $V_{DS} = 50$ V; $V_{GS} = 0$	I_{DSS}	max.	60 μA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	max.	1.0 μA
Gate threshold voltage $I_D = 10$ mA; $V_{DS} = 10$ V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance $I_D = 1$ A; $V_{DS} = 10$ V	G_{fs}	min.	1.1 S
		typ.	1.5 S
Drain-source on-state resistance $I_D = 1$ A; $V_{GS} = 10$ V	$R_{DS(ON)}$	typ.	0.75 Ω
On-state drain current $V_{DS} = 10$ V; $V_{GS} = 10$ V	I_{DSX}	typ.	6.0 A
Input capacitance at f = 1 MHz $V_{DS} = 50$ V; $V_{GS} = 0$	C_{iss}	typ.	150 pF
Output capacitance at f = 1 MHz $V_{DS} = 50$ V; $V_{GS} = 0$ V	C_{oss}	typ.	38 pF
Feedback capacitance at f = 1 MHz $V_{DS} = 50$ V; $V_{GS} = 0$	C_{rss}	typ.	3.4 pF

APPLICATION INFORMATION

RF performance in SSB operation (common-source class-A circuit) at T_h = 25 °C

Mode of operation	f (MHz)	V_{DS} (V)	I_D (A)	P_L (PEP) (W)	G_P (dB)	d_3 (dB)	d_5 (dB)
SSB	28	50	0.8	8.0	> 24	< −40	< −40

Optimum load impedance: 51 + j 23 Ω

The device is tested with a 2-tone signal.
The tones are of equal amplitude and separated by 1 kHz.
The intermodulation products are measured with respect to the level of one tone.

LOAD MISMATCH

The device is capable of withstanding a load VSWR of 50, varied through all phases, at rated load power and supply voltage (T_h = 25 °C).

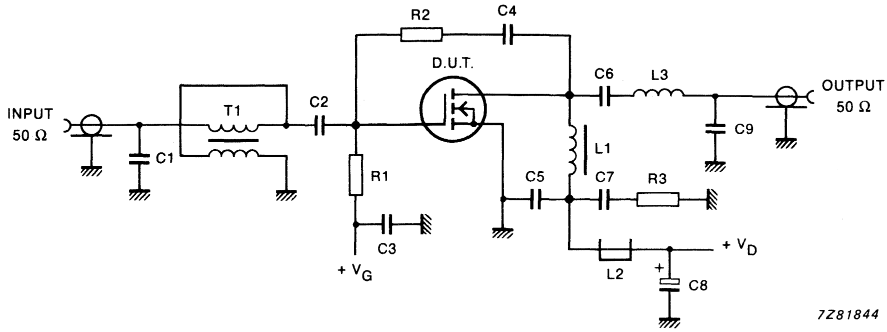


Fig. 2 Wideband test circuit (1.6 - 28 MHz).

R1 = 22 Ω, 0.25 W, metal film
R2 = 1500 Ω, 1 W, metal film
R3 = 10 Ω, 0.25 W, metal film

C1 = 47 pF, NPO chip
C2 = 33 nF, ceramic
C3 = 100 nF, chip
C4 = 100 nF, chip
C5 = 100 nF, chip
C6 = 8.2 nF, ceramic
C7 = 330 nF, chip
C8 = 2.2 μF, 63 V, electrolytic
C9 = 43 pF, ATC chip

L1 = 20 μH; core: FXC 4B1 rod, d = 5 mm, 1 = 30 mm (cat. no. 4330 030 30030), wound with 36 turns of 0.7 mm CuEm wire
L2 = FXC RF choke, material: 3B (cat. no. 4312 020 36640)
L3 = 190 nH; 8 turns of 1 mm CuEm wire, int. diam. 5 mm, length 9.5 mm, leads 2 x 3 mm

T1 = 4 : 1 impedance transformer; core: FXC 4C6 toroid, 9 x 6 x 3 mm^2 (cat. no. 4322 020 90760); windings: 18 turns of twisted pair of 2 x 0.25 mm CuEm wire

Printed circuit board (PCB) material: 1/16″ epoxy fibre-glass (ϵ_r = 4.5), copper clad on both sides

RF POWER MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the HF and VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-121). All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in common-source class-AB circuit.

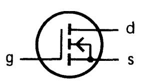
Mode of operation	f (MHz)	V_{DS} (V)	P_L (PEP) (W)	G_p (dB)	Dr. eff. (2-tone) (%)	d_3 (dB)
SSB	28	50	150	> 20	> 35	< −30

MECHANICAL DATA

Dimensions in mm

Pinning:

1 = drain
2 = source
3 = gate
4 = source



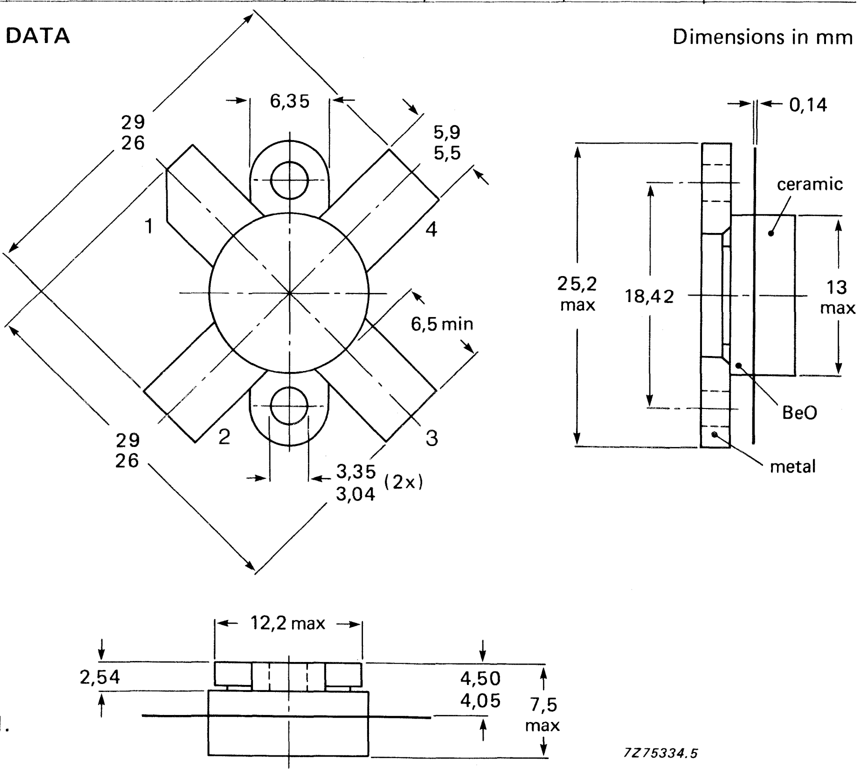


Fig. 1 SOT-121.

Note: Protect gate-source input against static charge during transport or handling.

PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

RATINGS

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

Drain-source voltage	V_{DS}	max.	110	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
Drain current (DC)	I_D	max.	7	A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	220	W
Storage temperature range	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	0.8	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 50 mA; V_{GS} = 0	BV_{DSS}	min.	110	V
Drain-source leakage current V_{DS} = 50 V; V_{GS} = 0	I_{DSS}	max.	2.5	mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0	μA
Gate-threshold voltage I_D = 50 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5	V
Forward transconductance I_D = 5 A; V_{DS} = 10 V	G_{fs}	min. typ.	4.5 6.2	S S
Drain-source on-state resistance I_D = 5 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.2	Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	25	A
Input capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{iss}	typ.	580	pF
Output capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0 V	C_{oss}	typ.	185	pF
Feedback capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{rss}	typ.	14	pF

APPLICATION INFORMATION

RF performance in SSB operation (common-source class-AB circuit) at T_h = 25 °C.

Mode of operation	f (MHz)	V_{DS} (V)	P_L (PEP) (W)	G_p (dB)	Dr. eff. (2-tone) (%)	d_3 (dB)
SSB	28	50	150	> 20	> 35	< −30

Optimum load impedance : 5.2 + j 2 Ω

The device is tested with a 2-tone signal.
The tones are of equal amplitude and separated by 1 kHz.
The intermodulation products are measured with respect to the level of one tone.

LOAD MISMATCH

The device is capable of withstanding a load VSWR of 50, varied through all phases, at rated load power and supply voltage (T_h = 25 °C).

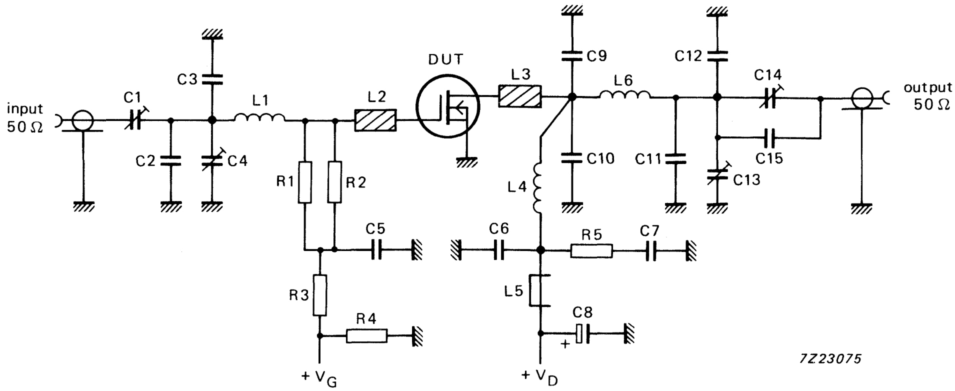


Fig. 2 Test circuit at 28 MHz.

C1 = C4 = C13 = C14 = 7 - 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C2 = 56 pF multilayer ceramic chip capacitor*
C3 = C11 = 62 pF multilayer ceramic chip capacitor*
C5 = C6 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C8 = 2.2 μF electrolytic capacitor, 100 V
C9 = C10 = 20 pF multilayer ceramic chip capacitor*
C12 = 100 pF multilayer ceramic chip capacitor*
C15 = 200 pF multilayer ceramic chip capacitor*

L 1 = 133 nH, 5 turns enamelled Cu-wire (0.7 mm), int. dia. = 6 mm, l = 5.6 mm
L2 = L3 = 41.1 Ω stripline (10 mm x 6 mm)
L4 = 236 nH, 7 turns enamelled Cu-wire (1.5 mm), int. dia. = 8 mm, l = 14.5 mm
L5 = Ferroxcube HF choke, grade 3B (cat. no. 4312 020 36642)
L6 = 149 nH, 4 turns enamelled Cu-wire (2.2.mm), int. dia. = 9 mm, l = 8.8 mm

R1 = 10 Ω metal film resistor (cat. no. 2322 153 51009)
R2 = 10 Ω metal film resistor (cat. no. 2322 153 51009)
R3 = 1 kΩ metal film resistor (cat. no. 2322 151 71002)
R4 = 1 MΩ metal film resistor (cat. no. 2322 151 71005)
R5 = 10 Ω metal film resistor (cat. no. 2322 153 51009)

Printed circuit board: double CU-clad, 1.6 mm PTFE fibre glass dielectric (ϵ_r = 2.2)

* American Technical Ceramics type 100B or capacitor of same quality.

VHF POWER MOSFET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the HF and VHF range with a nominal voltage supply of 12.5 V

Features

- high power gain
- low noise figure
- easy power control
- good thermal stability
- withstands full load mismatch
- gold metallization ensures excellent reliability

The BLF241 has a SOT5/11 envelope with the drain connected to the case.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in common-source class-B circuit.

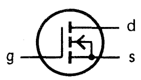
Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_p dB	η_D %
CW class-AB	175	12.5	100	2	> 10 typ. 12.5	> 50 typ. 55
CW class-B	175	28	10	3	typ. 14	typ. 50

MECHANICAL DATA

Dimensions in mm

Pinning

1 = source
2 = gate
3 = drain



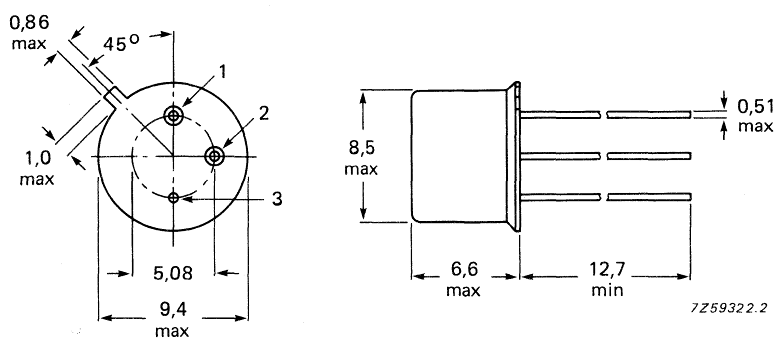


Fig.1 SOT5/11.

NOTE: The device is supplied in an anti-static package. Protect gate-source input against static charge during transport or handling.

RATINGS

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

Drain-source voltage at $V_{GS} = 0$	V_{DS}	max.	65	V
Gate-source voltage at $V_{DS} = 0$	$\pm V_{GS}$	max.	20	V
Drain current DC	I_D	max.	0.5	A
peak value; f > 1 MHz	I_{Dm}	max.	1.5	A
Total power dissipation $T_{mb} = 70\ ^oC$	P_{tot}	max.	6.5	W
Storage temperature range	T_{stg}	−65 to + 150		^oC
Operating junction temperature	T_j	max.	200	^oC

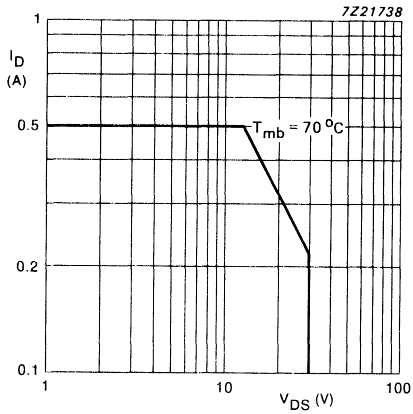


Fig.2 DC SOAR.

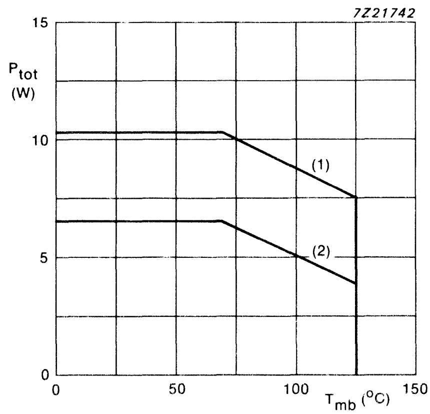


Fig.3 Total power dissipation as a function of mounting base temperature.

(1) short time operation during mismatch.

(2) continuous operation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	20 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 0.1 mA; V_{GS} = 0	$V_{(BR)DSS}$	>	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	<	10 μA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	1 μA
Gate threshold voltage I_D = 3 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance I_D = 0.3 A; V_{DS} = 10 V	G_{fs}	> typ.	0.16 S 0.24 S
Drain-source on-state resistance I_D = 0.3 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	3.3 Ω
On-state drain current V_{DS} = V_{GS} = 10 V	I_{DSX}	typ.	1.2 A
Input capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{is}	typ.	16 pF
Output capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{os}	typ.	13 pF
Feedback capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{rs}	typ.	2.4 pF

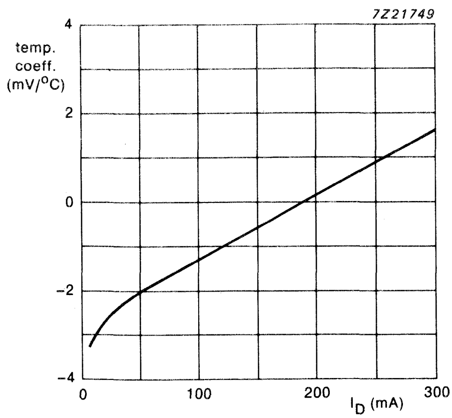


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 12.5 V; valid for T_h = 25 °C to 70 °C; typical values.

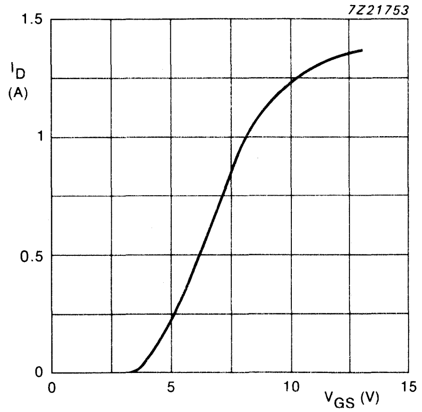


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

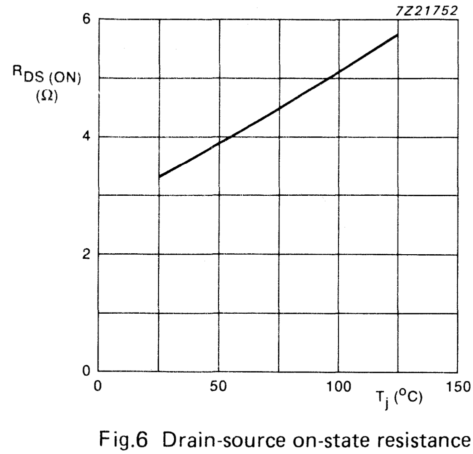


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{DS} = 10 V; I_D = 0.3 V; typical values.

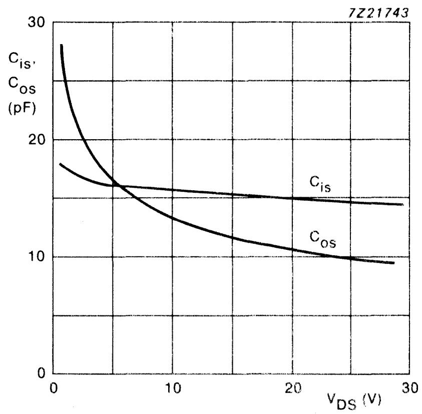


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

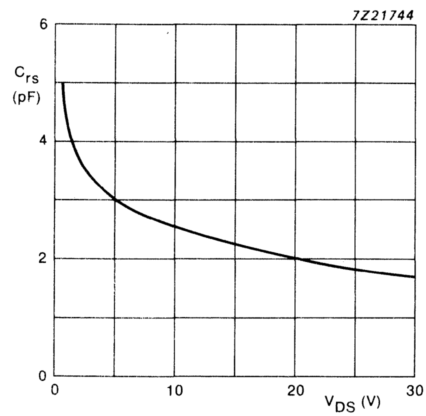


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

Application information

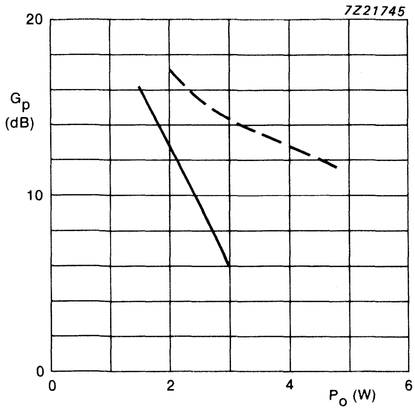


Fig.9 Gain as a function of output power.

——— = V_{DS} = 12.5 V
– – – = V_{DS} = 28 V

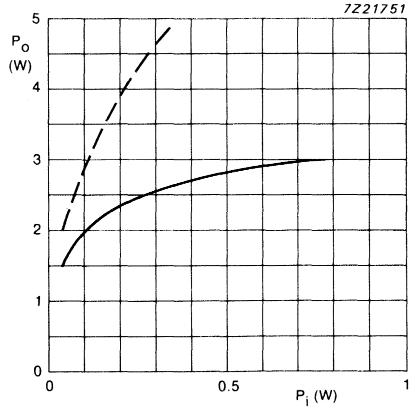


Fig.10 Output power as a function of input power.

——— = V_{DS} = 12.5 V
– – – = V_{DS} = 28 V

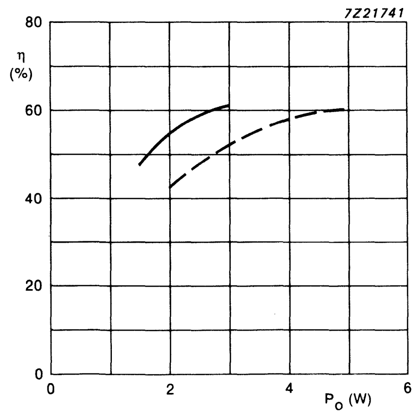


Fig.11 Efficiency as a function of output power.

——— = V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω
– – – = V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω

Ruggedness in class-B operation

The BLF241 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) under the following conditions: V_{DS} = 28 V; f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 8.8 K/W at rated output power.

RF performance at T_h = 25 °C in common-source class-B circuit.

Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_P dB	η_D %	R_{GS} Ω
CW class-AB	175	12.5	100	2	> 10 typ. 12.5	> 50 typ. 55	220
CW class-B	175	28	10	3	typ. 14	typ. 50	47

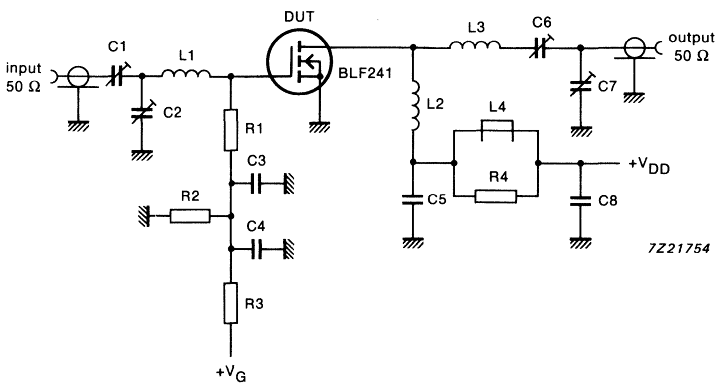


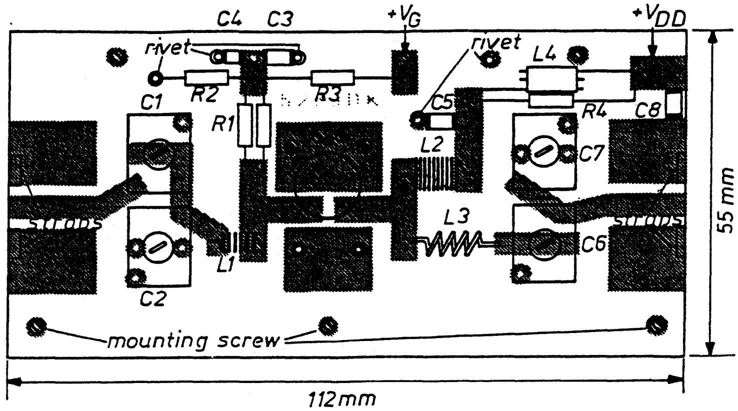
Fig.12 Test circuit for 175 MHz.

List of components:
C1 = C6 = 4-40 pF, film dielectric trimmer (cat. no. 2222 809 07008)
C2 = C7 = 2.5-20 pF, film dielectric trimmer (cat. no. 2222 809 07004)
C3 = C5 = 1 nF, multilayer ceramic chip capacitor (cat. no. 2222 851 3102)
C4 = C8 = 100 nF, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
L1 = 64.7 nH, 6 turns enamelled Cu-wire (0.5 mm); int. diam. = 3 mm; l = 5.8 mm; leads = 2 x 5 mm
L2 = 178 nH, 10 turns enamelled Cu-wire (0.5 mm); int. diam. = 3.5 mm; l = 7.4 mm; leads = 2 x 5 mm
L3 = 56.9 nH, 4 turns enamelled Cu-wire (1.0 mm); int. diam. = 4.5 mm; l = 6.5 mm; leads = 2 x 5 mm
L4 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)
R1 = 2 x 442 Ω in parallel; metal film resistor (0.4 W)
R2 = 100 kΩ; metal film resistor (0.4 W)
R3 = 1 kΩ; metal film resistor (0.4 W)
R4 = 10 Ω; metal film resistor (0.4 W)

Printed circuit board material: double Cu-clad epoxy fibre-glass (ϵ_r = 4.5); thickness 1/16 inch.

Note

At V_{DS} = 28 V operation, L3 = 102.2 nH and R1 = 2 x 95.3 Ω in parallel.



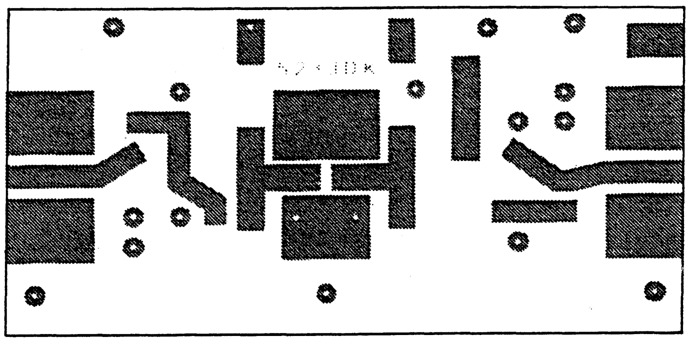


Fig.13 Printed circuit board and component lay-out for 175 MHz test circuit.

The other side of the board is fully metallized and used as ground plane. Ground returns are made by means of hollow rivets and copper foil straps. Heatsinking is achieved by pressing the transistor against an insulating thermal conductor (Al_2O_3 - disc), which is attached to a track on the printed circuit board. This track is connected to the heatsink by means of four screws.

Conditions:

f = 175 MHz; V_{DS} = 12.5 V; I_{DQ} = 100 mA;
R_{GS} = 220 Ω; Class-AB*

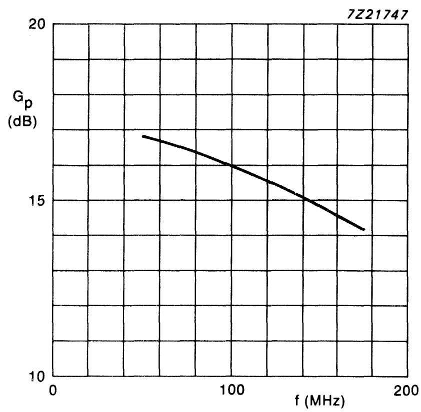


Fig.14 Gain as a function of frequency.

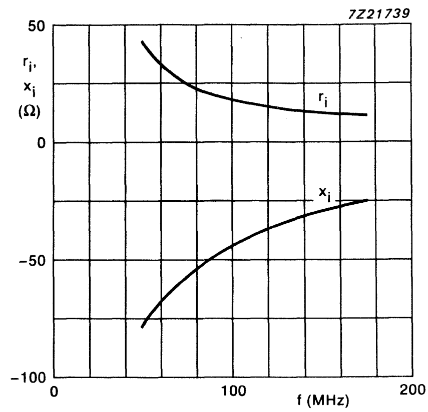


Fig.15 Input resistance and reactance as functions of frequency.

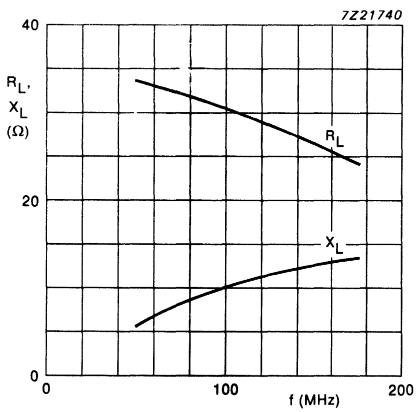


Fig.16 Load resistance and reactance as functions of frequency.

* Gain and input impedance including R_{GS}.

Conditions:

f = 175 MHz; V_{DS} = 28 V; I_{DQ} = 10 mA;
R_{GS} = 47 Ω; Class-B*

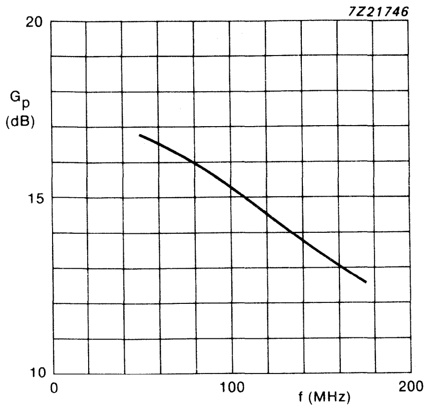


Fig.17 Gain as a function of frequency.

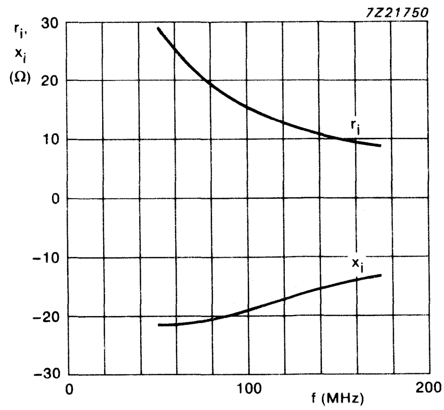


Fig.18 Input resistance and reactance as functions of frequency.

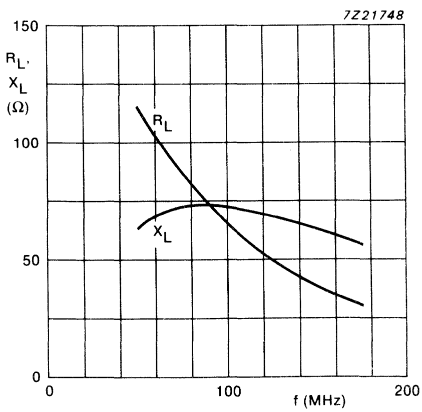


Fig.19 Load resistance and reactance as functions of frequency.

* Gain and input impedance including R_{GS}.

VHF POWER MOS TRANSISTOR

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters with frequencies up to 500 MHz.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT123). All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance at T_h = 25 ^oC in a common-source class-B circuit.

Mode of operation	V_{DS} V	f MHz	P_L W	G_p dB	η_d %
narrow band; CW	28	175	5	> 13	> 50

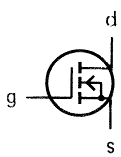
MECHANICAL DATA

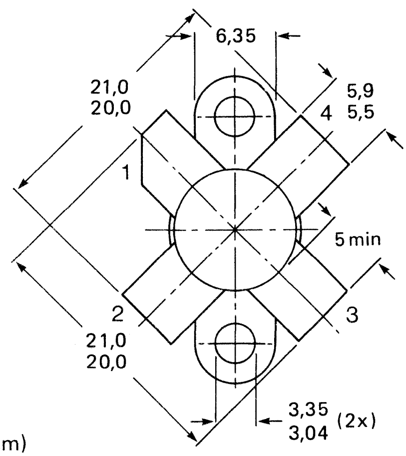
Dimensions in mm

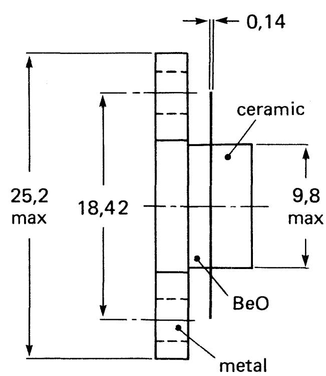
Fig. 1 SOT123.

Pinning

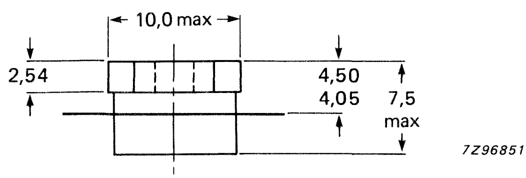
1 = drain
2 = source
3 = gate
4 = source







Torque on screw:
min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)
Recommended screw:
cheese-head
4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.



Note: The device is supplied in an anti-static package. Protect gate-source input against static charge during transport or handling.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

RATINGS

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

Drain-source voltage at $V_{GS} = 0$	V_{DS}	max.	65 V
Gate-source voltage at $V_{DS} = 0$	$\pm V_{GS}$	max.	20 V
Drain current (DC)	I_D	max.	0.5 A
Total power dissipation $T_{mb} = 25\ ^oC$	P_{tot}	max.	16 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	11 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Drain-source breakdown voltage $I_D = 0.1$ mA; $V_{GS} = 0$	$V_{(BR)DS}$	>	65 V
Drain-source leakage current $V_{DS} = 28$ V; $V_{GS} = 0$	I_{DSS}	<	10 µA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	<	1 µA
Gate threshold voltage $I_D = 3$ mA; $V_{DS} = 10$ V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance $I_D = 0.3$ A; $V_{DS} = 10$ V	G_{fs}	> typ.	0.16 S 0.24 S
Drain-source on-state resistance $I_D = 0.3$ A; $V_{GS} = 10$ V	$R_{DS(ON)}$	typ.	3.3 Ω
On-state drain current $V_{DS} = V_{GS} = 10$ V	I_{DSX}	typ.	1.4 A
Input capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{is}	typ.	14 pF
Output capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{os}	typ.	9.4 pF
Feedback capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{rs}	typ.	1.7 pF
Noise figure (test circuit, see Fig. 2; input and output power matched for $P_L = 5$ W): $V_{DS} = 28$ V; $I_D = 0.2$ A; f = 175 MHz; $R_1 = 47\ \Omega$; $T_h = 25\ ^oC$; $R_{th\ mb\text{-}h} = 0.3$ K/W	F	typ.	5.5 dB

APPLICATION INFORMATION

RF performance in CW operation (common-source class-B circuit)

f = 175 MHz; T_h = 25 °C; I_{DQ} = 10 mA; R_1 = 47 Ω; $R_{th\ j\text{-}mb}$ = 0.3 K/W

Mode of operation	V_{DS} V	P_L W	G_p dB	η_d %
narrow band; CW	28	5	> 13 typ. 16	> 50 typ. 60

Optimum load impedance: 19 + j 38 Ω

Input impedance* : 9.4 – j 22 Ω

* R_1 included

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W).

DEVELOPMENT DATA

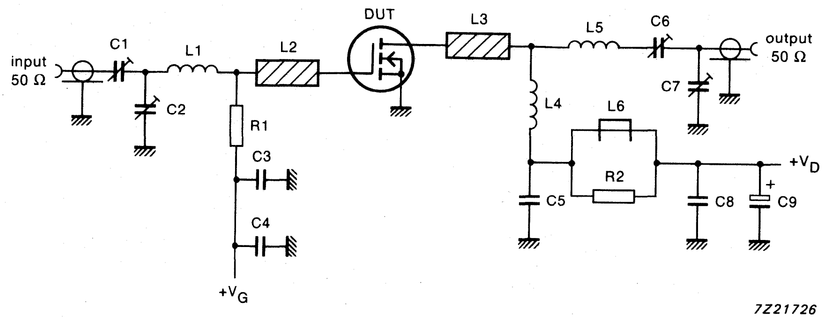


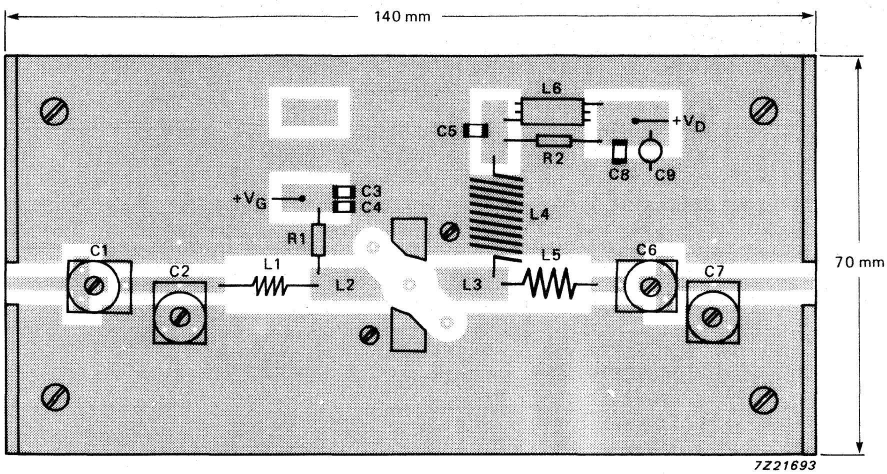
Fig. 2 Class-B test circuit for 175 MHz.

List of components:

R1 = 47 Ω; metal film resistor (0.5 W)
R2 = 10 Ω; metal film resistor (0.5 W)
C1 = C2 = C7 = 4 – 40 pF, film dielectric trimmer (cat. no. 2222 809 08002)
C3 = C5 = 100 pF ceramic multilayer chip capacitor *
C4 = C8 = 100 nF ceramic multilayer chip capacitor (cat. no. 2222 852 47104)
C6 = 5 – 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C9 = 2.2 μF (40 V) electrolytic capacitor
L1 = 53 nH, 5 turns of enamelled Cu-wire (0.7 mm); int. dia: 3 mm; length 5.4 mm; leads 2 x 5 mm
L2 = L3 = 30 Ω stripline (10 mm x 6 mm)
L4 = 500 nH, 11 turns of enamelled Cu-wire (1 mm); int. dia: 8 mm; length 15.5 mm; leads 2 x 5 mm
L5 = 79 nH, 5 turns of enamelled Cu-wire (1 mm); int. dia: 5 mm; length 9.1 mm; leads 2 x 5 mm
L6 = ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)

Printed circuit board material: double Cu-clad epoxy fibre-glass (ϵ_r = 4.5); thickness 1/16 inch.

* American Technical Ceramics (type 100B) or capacitor of same quality.



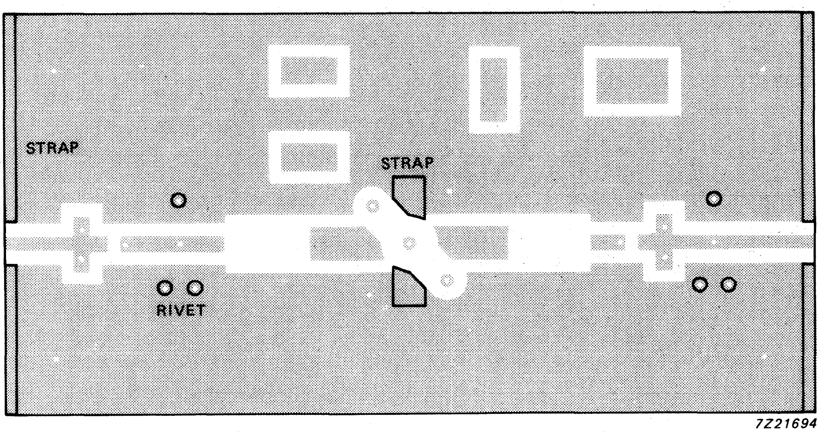


Fig. 3 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

Note: The circuit and components are on one side of the epoxy fibre-glass board; the other wide is unetched copper, serving as a ground plane. Earth connections are made by hollow rivets, fixing-screws and copper straps under the sources and around the edges to provide a direct contact between the copper on the component side and the ground plane.

VHF POWER MOS TRANSISTOR

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in large-signal amplifiers in the VHF range.

Features

- high power gain
- low noise figure
- easy power control
- good thermal stability
- withstand full load mismatch
- gold metallization ensures excellent reliability

The transistor has a 4-lead flange envelope with a ceramic cap (SOT123). All leads are isolated from the flange.

Matched V_{GS}-groups are available on request.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common-source class-B testcircuit

mode of operation	V_{DS} V	f MHz	P_L W	G_p dB	η_d %
CW	28	175	15	>13	>50

MECHANICAL DATA

SOT123 (see Fig.1).

NOTE: The device is supplied in an anti-static package. Protect the gate-source input against static charge during transport or handling.

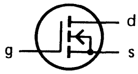
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

1 = drain
2 = source
3 = gate
4 = source



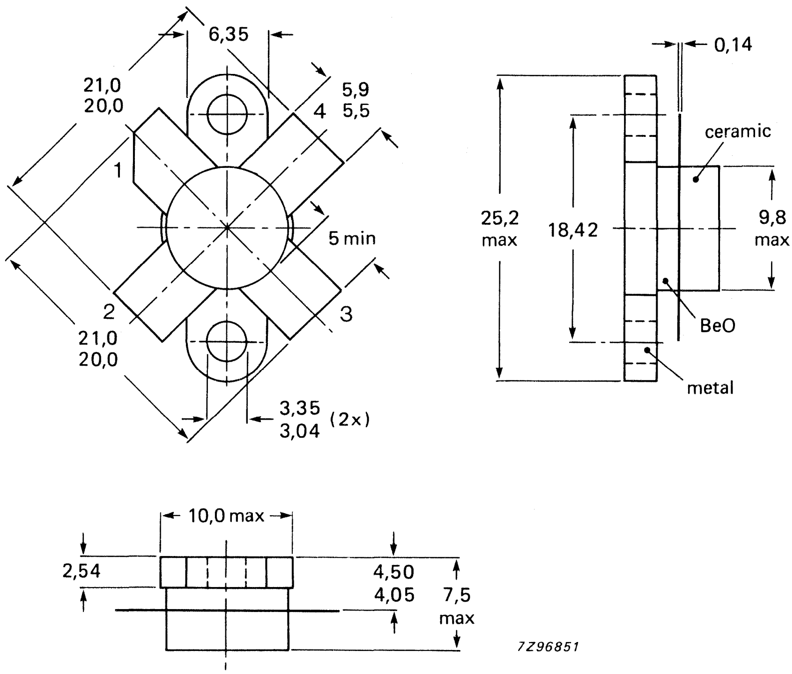


Fig.1 SOT123.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage				
$V_{GS} = 0$	V_{DSS}	max.	65	V
Gate-source voltage				
$V_{DS} = 0$	$\pm V_{GSS}$	max.	20	V
Drain current				
DC or average	I_D, $I_{D(AV)}$	max.	1.5	A
peak value; f > 1 MHz	I_{DM}	max.	5	A
Total power dissipation at $T_{mb} = 25\ ^{\circ}C$	P_{tot}	max.	38	W
Storage temperature range	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

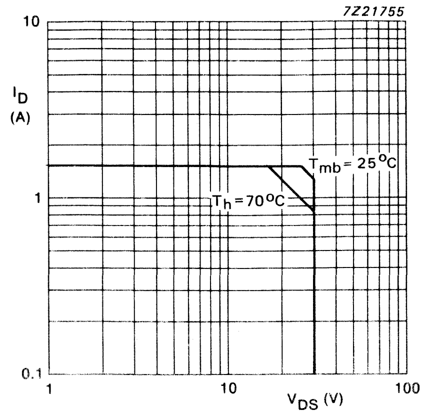


Fig.2 DC SOAR.
($R_{th\,mb\text{-}h} = 0.3$ K/W).

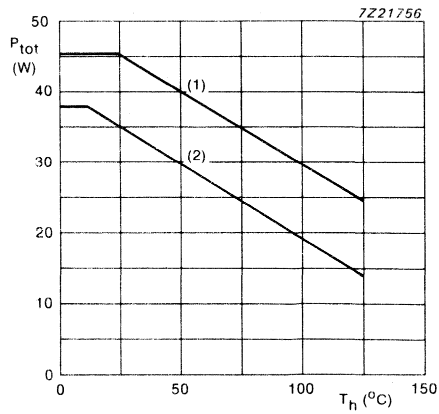


Fig.3 Power/temperature derating curves.

(1) Short-time operation during mismatch.

(2) Continuous operation.

THERMAL RESISTANCE
($P = 38$ W; $T_{mb} = 25\,^oC$)

From junction to mounting base	$R_{th\,j\text{-}mb}$	max.	4.6 K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	max.	0.3 K/W

CHARACTERISTICS

$T_j = 25\,^oC$ unless otherwise specified

Drain-source breakdown voltage $I_D = 5$ mA; $V_{GS} = 0$	$V_{(BR)DSS}$	>	65 V
Drain-source leakage current $V_{DS} = 28$ V; $V_{GS} = 0$	I_{DSS}	<	1 mA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	<	1 μA

CHARACTERISTICS (continued)

Gate threshold voltage I_D = 5 mA; V_{DS} = 10 V	$V_{GS(th)}$	2 to 4.5 V
Gate-source voltage difference of matched devices V_{DS} = 10 V; I_D = 5 mA	$\|V_{GS1} - V_{GS2}\|$	< 100 mV
Forward transconductance V_{DS} = 10 V; I_D = 0.75 A	G_{fs}	> 0.60 S
Drain-source on-state resistance I_D = 0.75 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ. 0.8 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ. 5 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{is}	typ. 60 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{os}	typ. 40 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rs}	typ. 4.5 pF
Noise figure (test circuit, see Fig.9 Input and output power matched for P_L = 15 W) V_{DS} = 28 V; I_D = 0.5 A; f = 175 MHz R_1 = 23 Ω; T_h = 25 °C $R_{th\ mb-h}$ = 0.3 K/W	F	typ. 4.3 dB

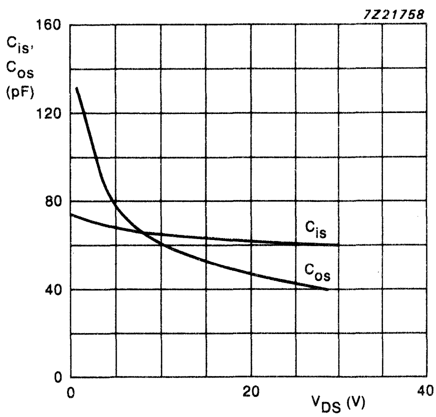


Fig.4 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

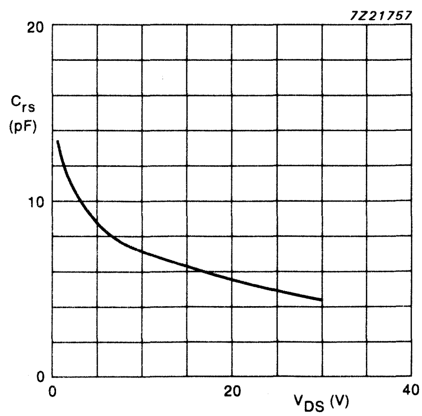


Fig.5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

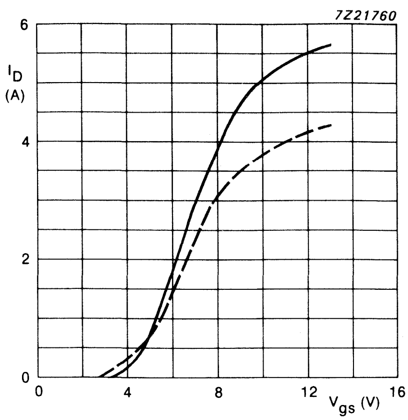


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

——— = T_j = 25 °C
– – – = T_j = 125 °C

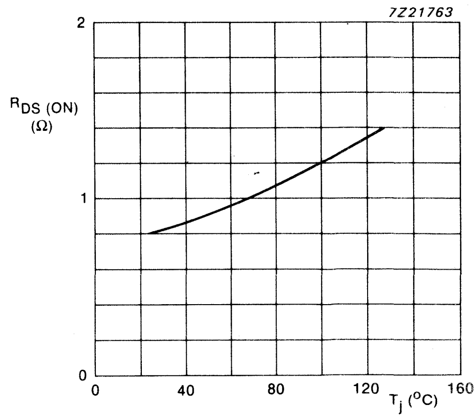


Fig.7 Drain-source on-state resistance as a function of junction temperature; I_D = 0.75 A; V_{GS} = 10 V; typical values.

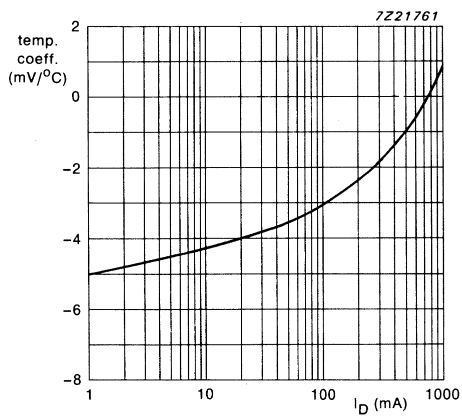


Fig.8 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; valid for T_j = 25 to 125 °C; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-source circuit; class-B operation; f = 175 MHz; I_{DQ} = 25 mA; T_h = 25 °C; $R_{th\,mb\text{-}h}$ = 0.3 K/W). See Fig. 9.

V_{DS} V	P_L W	G_p dB	η_d %	Z_i* Ω	Z_L Ω	R_1 Ω
28	15	> 13 typ. 17	> 50 typ. 65	3.0 − j4.0	6.3 + j9.8	46.4//46.4
12.5	6	typ. 15	typ. 60	3.0 − j4.0	4.5 + j3.3	100

* R_1 included.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (T_h = 25 °C; $R_{th\,mb\text{-}h}$ = 0.3 K/W).

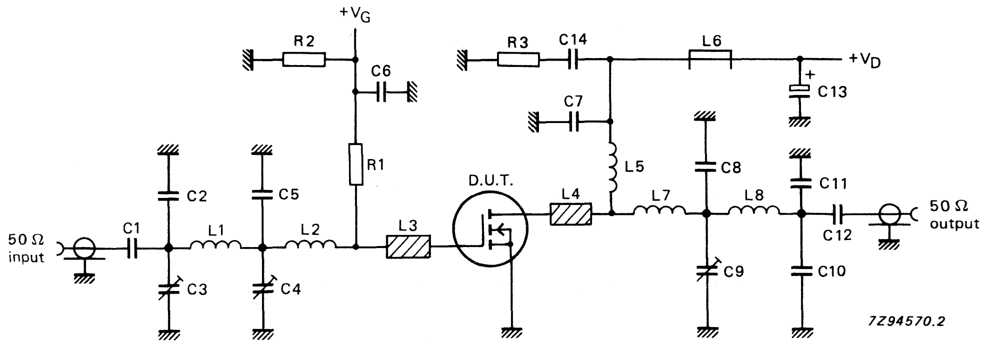


Fig.9 Class-B test circuit at f = 175 MHz.

List of components:

R1	= metal film resistor; refer to **APPLICATION INFORMATION** for value
R2	= 1 MΩ metal film resistor (0.4 W)
R3	= 10 Ω metal film resistor (0.4 W)
C1, C12	= 680 pF ceramic multilayer chip capacitor*
C2	= 20 pF ceramic multilayer chip capacitor*
C3, C4, C9	= 5 - 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C5	= 75 pF ceramic multilayer chip capacitor*
C6	= 10 nF ceramic multilayer chip capacitor (cat. no. 2222 852 47103)
C7	= 100 pF ceramic multilayer chip capacitor*
C8	= 47 pF ceramic multilayer chip capacitor*
C10, C11	= 11 pF ceramic multilayer chip capacitor*
C13	= 2.2 μF solid tantalum capacitor
C14	= 100 nF ceramic multilayer chip capacitor (cat. no. 2222 852 47104)
L1	= 32 nH, 4 turns of enamelled Cu-wire (1 mm); int. diam. 3 mm; length 6.3 mm; leads 2 x 5 mm
L2	= 12.2 nH, 1 turn of enamelled Cu-wire (1 mm); int. diam. 5.6 mm; leads 2 x 5 mm
L3, L4	= 30 Ω stripline, (15.0 mm x 6.0 mm)
L5	= 119 nH, 6 turns of enamelled Cu-wire (1 mm); int. diam. 6 mm; length 10.4 mm; leads 2 x 5 mm
L6	= ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)
L7	= 19 nH, 2 turns of enamelled Cu-wire (1 mm); int. diam. 3 mm; length 2.4 mm; leads 2 x 5 mm
L8	= 28.5 nH, 4 turns of enamelled Cu-wire (1 mm); int. diam. 3 mm; length 8.5 mm; leads 2 x 5 mm

Striplines are on a double Cu-clad printed circuit board with epoxy fibreglass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

* American Technical Ceramics (type 100B) or equivalent.

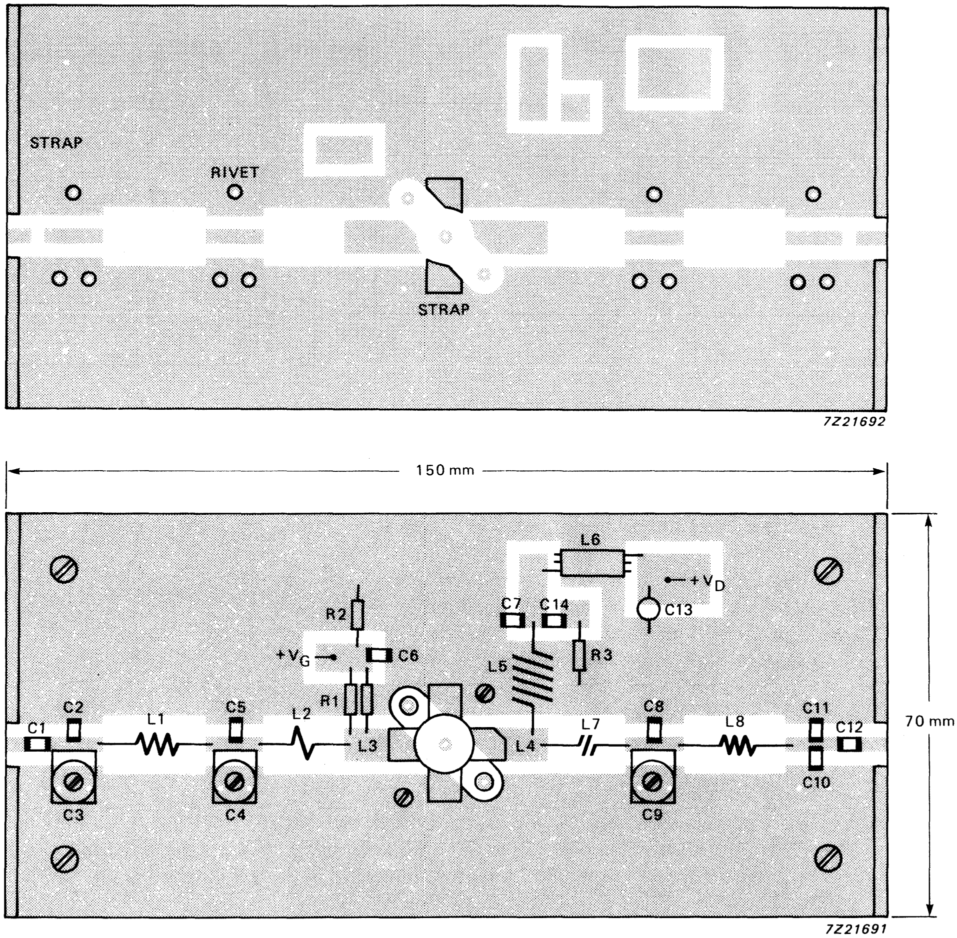


Fig.10 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

Note: The circuit and components are on one side of the epoxy fibreglass board; the other side is unetched copper, serving as a ground plane. Earth connections are made by hollow rivets, fixing-screws and copper straps under the sources and around the edges to provide a direct contact between the copper on the component side and the ground plane.

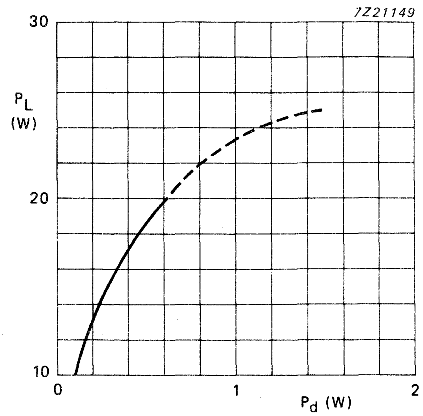


Fig.11 Load power as a function of drive power; V_{DS} = 28 V.

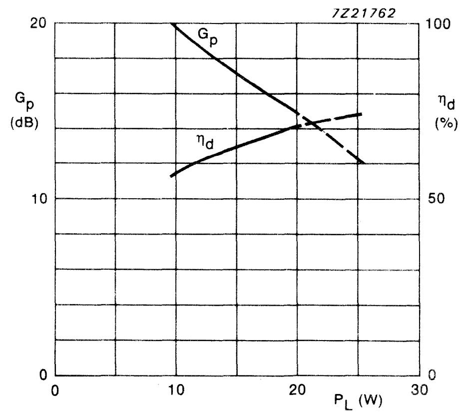


Fig.12 Power gain and efficiency as functions of load power; V_{DS} = 28 V.

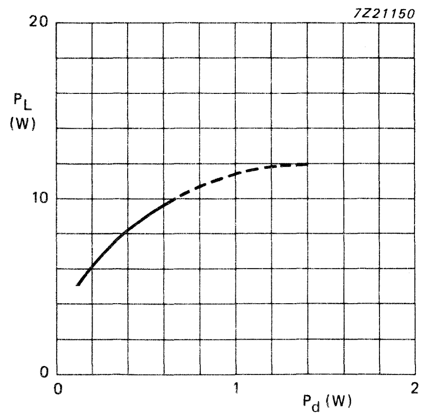


Fig.13 Load power as a function of drive power; V_{DS} = 12.5 V.

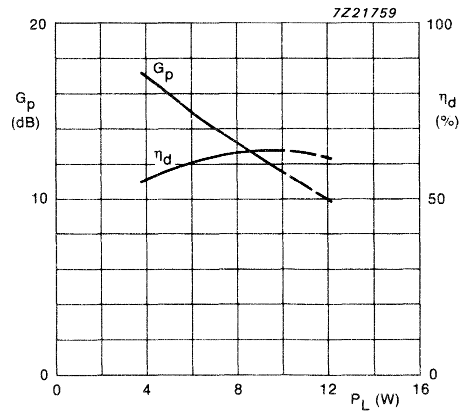


Fig.14 Power gain and efficiency as functions of load power; V_{DS} = 12.5 V.

Conditions for Figs 11 and 12:
I_{DQ} = 25 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; class-B operation; typical values.

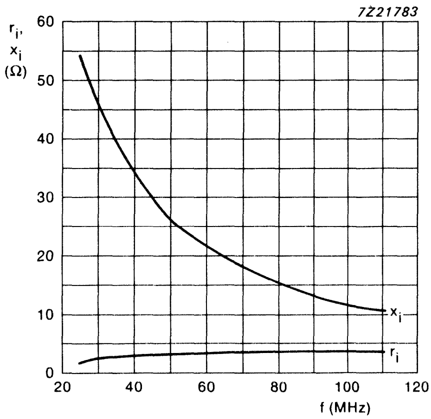


Fig.15 Input impedance as a function of frequency.

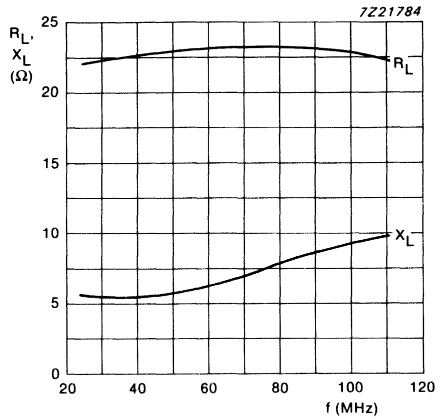


Fig.16 Load impedance as a function of frequency.

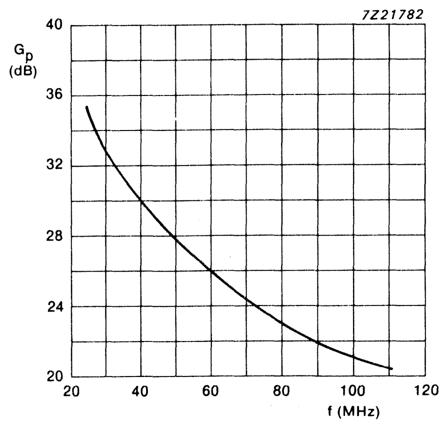


Fig.17 Power gain as a function of frequency.

Conditions for Figs 15 to 17:
V_{DS} = 28 V; I_{DQ} = 25 mA; P_L = 15 W; T_h = 25 °C; $R_{th\,mb\text{-}h}$ = 0.3 K/W; class-B operation; typical values.

VHF POWER MOSFET

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in large-signal amplifiers in the VHF range.

Features

- high power gain
- low noise figure
- easy power control
- good thermal stability
- withstands full load mismatch

The transistor has a 4-lead flange envelope with a ceramic cap (SOT-123). All leads are isolated from the flange.

Matched V_{GS}-groups are available on request.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in class-B circuit

mode of operation	V_{DS} V	f MHz	P_L W	G_p dB	η_d %
CW	28	175	30	> 13	> 50

MECHANICAL DATA

SOT-123 (see Fig.1)

Note

The device is supplied in an anti-static package. Protect the gate-source input against static charge during transport or handling.

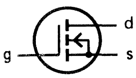
PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning:

1 = drain
2 = source
3 = gate
4 = source



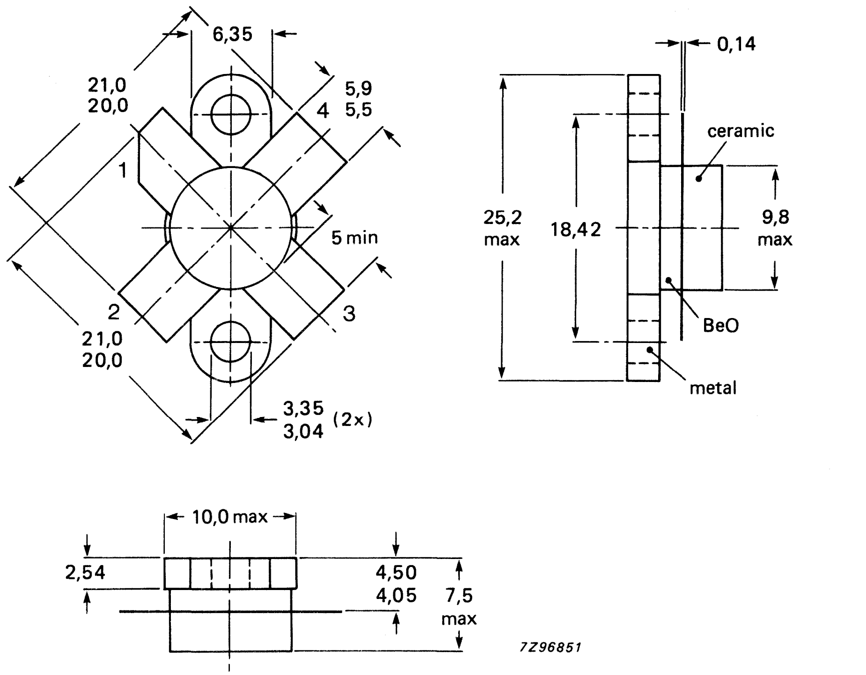


Fig.1 SOT-123.

Torque on screw: min. 0.6 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage			
$V_{GS} = 0$	V_{DS}	max.	65 V
Gate-source voltage			
$V_{DS} = 0$	$\pm V_{GS}$	max.	20 V
Drain current			
DC or average	I_D, $I_{D(AV)}$	max.	3 A
peak value; f > 1 MHz	I_{DM}	max.	10 A
Total power dissipation			
$T_{mb} = 25\ ^oC$	P_{tot}	max.	68 W
Storage temperature range	T_{stg}		−65 to + 150 ^oC
Operating junction temperature	T_j	max.	200 ^oC

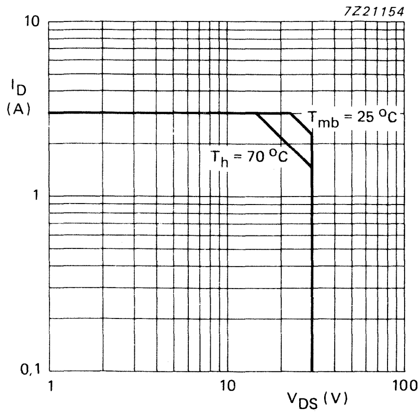


Fig.2 DC SOAR.
($R_{th\ mb\text{-}h}$ = 0.3 K/W).

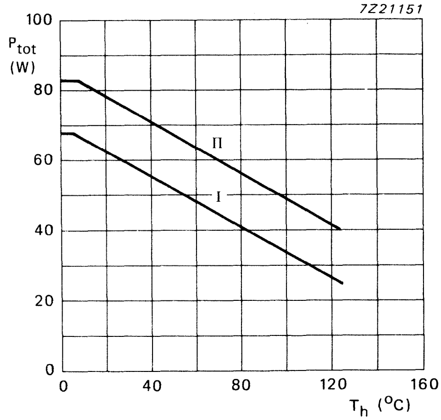


Fig.3 Power/temperature derating curves.
I Continuous operation.
II Short-time operation during mismatch.

THERMAL RESISTANCE

(P = 68 W; T_{mb} = 25 °C)

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	2.6 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 10 mA; V_{GS} = 0	$V_{(BR)DSS}$	>	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	<	2 mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	<	1 μA
Gate threshold voltage I_D = 10 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate-source voltage difference of matched devices V_{DS} = 10 V; I_D = 10 mA	$\|V_{GS1} - V_{GS2}\|$	<	100 mV
Forward transconductance V_{DS} = 10 V; I_D = 1.5 A	G_{fs}	>	1.2 S
Drain-source on-state resistance I_D = 1.5 A; V_{GS} = 10 V	$R_{DS(on)}$	typ.	0.4 Ω
On-state drain current V_{DS}=10 V;V_{GS}=10 V	I_{DSX}	typ.	10 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{is}	typ.	125 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{os}	typ.	75 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rs}	typ.	11 pF
$R_{th\ mb\text{-}h}$ = 0.3 K/W	F	typ.	2.0 dB

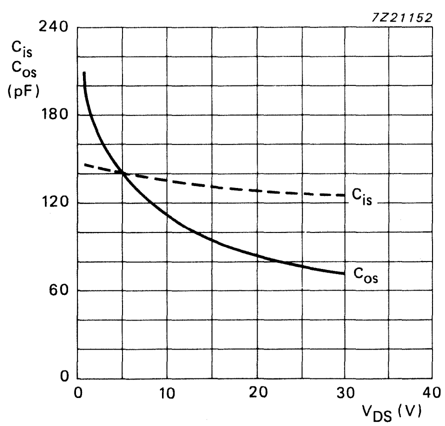


Fig.4 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

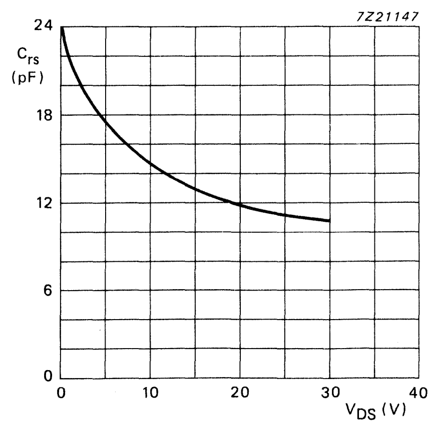


Fig.5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

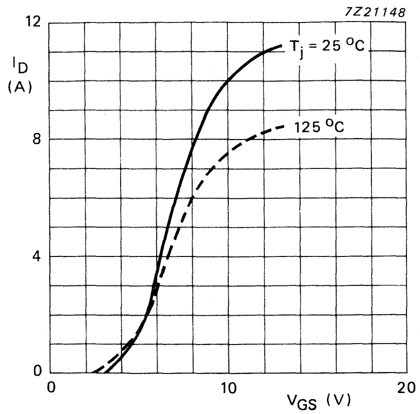


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

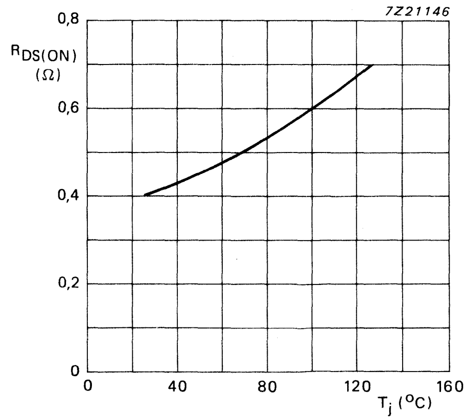


Fig.7 Drain-source on-state resistance as a function of junction temperature; I_D = 1.5 A; V_{DS} = 10 V; typical values.

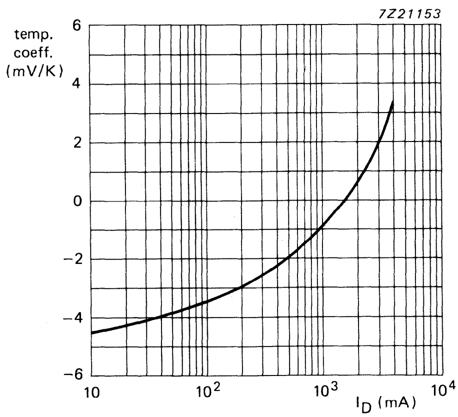


Fig.8 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; valid for T_j = 25 to 125 °C; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-source circuit; class-B operation) f = 175 MHz; I_{DQ} = 50 mA; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W); R_1 = 1 kΩ.

V_{DS} V	P_L W	G_p dB	η_d %	Z_i* Ω	Z_L Ω
28	30	> 13 typ. 15.5	< 50 typ. 67	2.0 − j2.7	3.9 + j4.4
12.5	12	typ. 12	typ. 66	2.4 − j2.5	3.8 + j1.3

* R_1 included.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power and supply voltage (T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W).

Noise figure (test circuit, see Fig.9)
Input and output power matched for
P_L = 30 W; V_{DS} = 28 V; I_D = 1 A;
f = 175 MHz; R_1 = 1 kΩ; T_h = 25 °C;

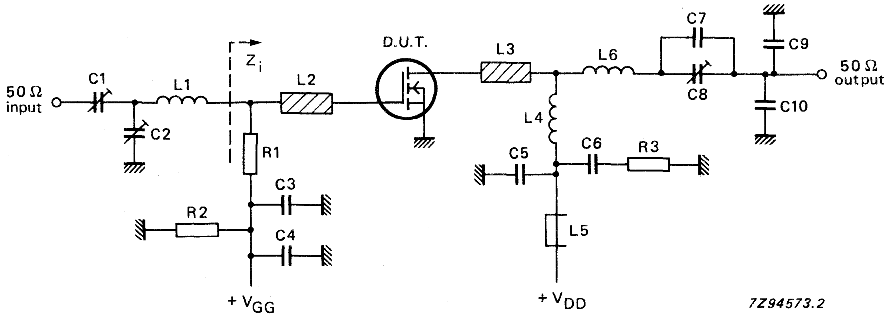


Fig.9 Class-B test circuit at f = 175 MHz.

List of components:

R1 = 1 kΩ; metal film resistor
R2 = 1 MΩ; metal film resistor
R3 = 10 Ω; metal film resistor
C1 = 4 - 40 pF, film dielectric trimmer (cat. no. 2222 809 07008)
C2, C8 = 5 - 60 pF, film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 100 pF, ceramic multilayer chip capacitor (cat. no. 2222 854 13101)
C4, C6 = 100 nF, ceramic multilayer chip capacitor (cat. no. 2222 852 47104)
C5 = 100 pF, ceramic capacitor (cat. no. 2222 680 10101)
C7 = 18 pF, ceramic multilayer chip capacitor*
C9 = 27 pF, ceramic multilayer chip capacitor*
C10 = 24 pF, ceramic multilayer chip capacitor*

L1 = 13.5 nH; 3 turns of enamelled Cu-wire (0.5 mm) int. dia. 2 mm; length 3.5 mm; leads 2 x 2 mm
L2, L3 = 30 Ω stripline (10.0 mm x 6.0 mm)
L4 = 98 nH; 6 turns of enamelled Cu-wire (1.5 mm) int. dia. 5 mm; length 12.5 mm; leads 2 x 2 mm
L5 = ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)
L6 = 24.5 nH; 2 turns of enamelled Cu-wire (1.5 mm) int. dia. 5 mm; length 4 mm; leads 2 x 2 mm

Striplines are on a double Cu-clad printed circuit board with epoxy fibreglass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

* American Technical Ceramics (type 100B) or equivalent.

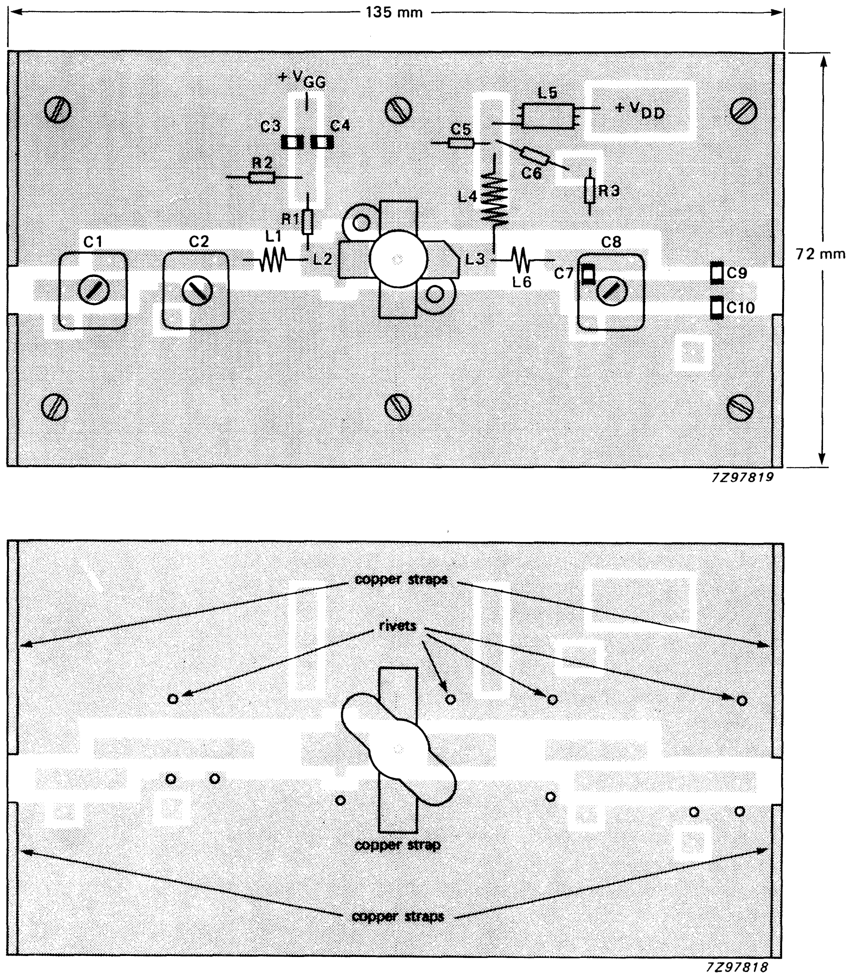


Fig.10 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

Note

The circuit and components are on one side of the epoxy fibreglass board; the other side is unetched copper, serving as a ground plane. Earth connections are made by hollow rivets, fixing-screws and copper straps under the sources and around the edges to provide a direct contact between the copper on the component side and the ground plane.

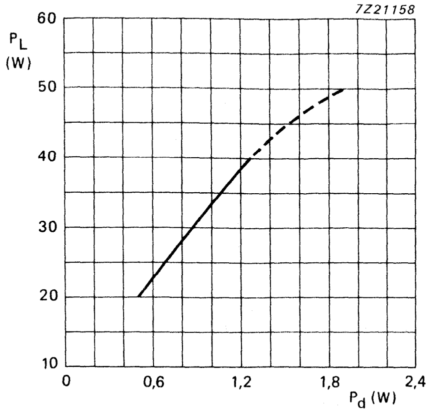


Fig.11 Load power as a function of drive power; V_{DS} = 28 V.

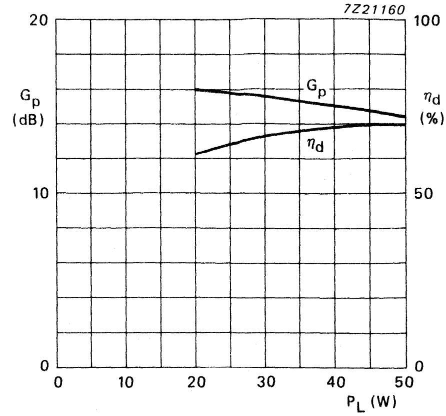


Fig.12 Power gain and efficiency as functions of load power; V_{DS} = 28 V.

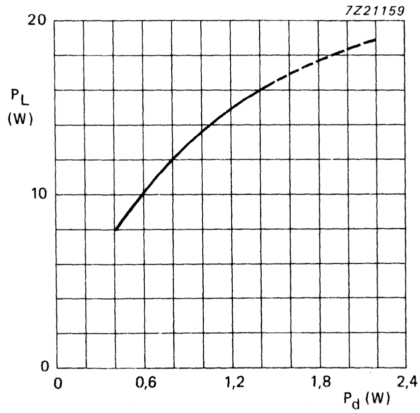


Fig.13 Load power as a function of drive power; V_{DS} = 12.5 V.

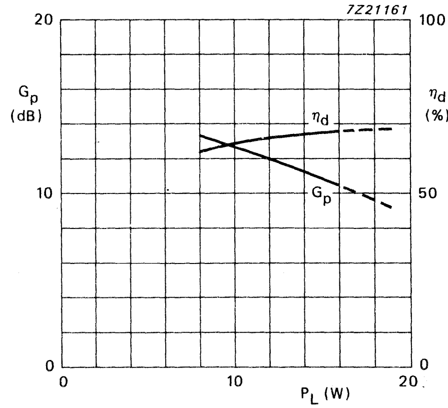


Fig.14 Power gain and efficiency as functions of load power; V_{DS} = 12.5 V.

Conditions for Figs 11 to 14:

I_{DQ} = 50 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; class-B operation; typical values.

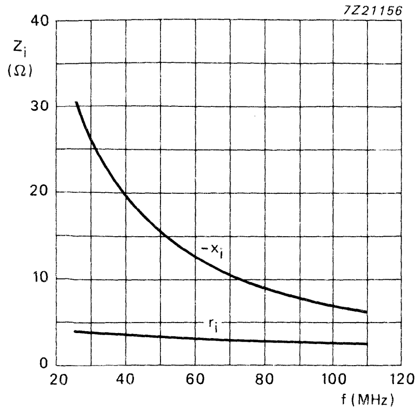


Fig.15 Input impedance as a function of frequency.

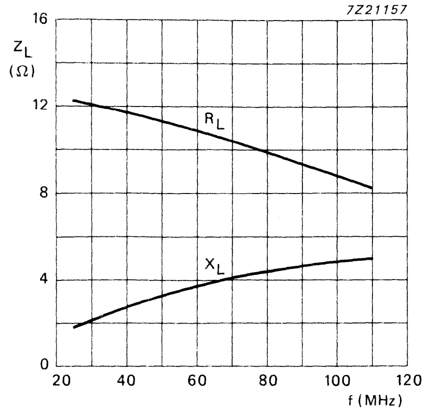


Fig.16 Load impedance as a function of frequency.

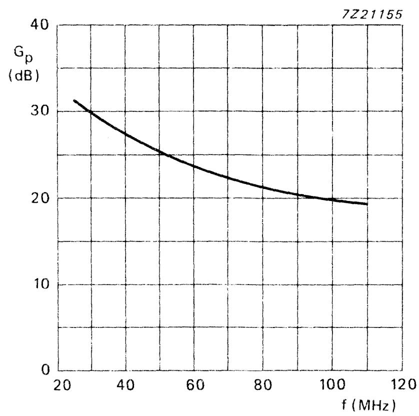


Fig.17 Power gain as a function of frequency.

Conditions for Figs 15 to 17:

V_{DS} = 28 V; I_{DQ} = 50 mA; P_L = 30 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; class-B operation; typical values.

RF POWER MOS FET

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the VHF range.

The transistor has a 4-lead flange envelope with a ceramic cap (SOT121). All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common-source class-B circuit.

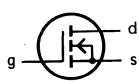
Mode of operation	V_{DS} V	f MHz	P_L W	G_p dB	η_d %
CW-FM	28	108	80	> 16	> 55

MECHANICAL DATA

Dimensions in mm

Pinning

1 = drain
2 = source
3 = gate
4 = source



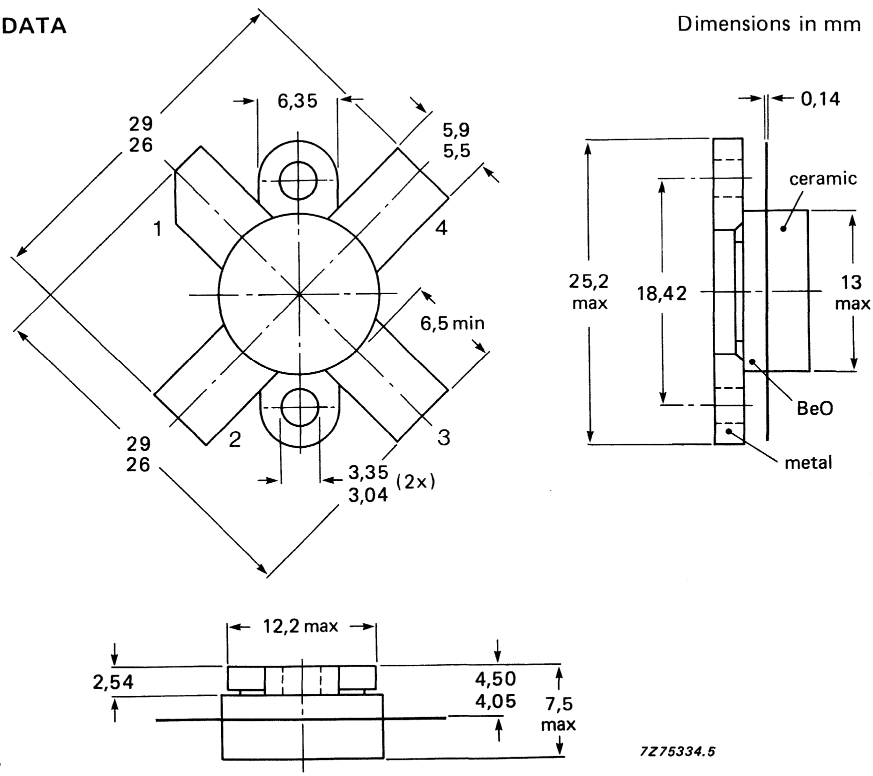


Fig. 1 SOT121.

Note: The device is supplied in an anti-static package. Protect gate-source input against static charge during transport or handling.

PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damagned.

RATINGS

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

Drain-source voltage at $V_{GS} = 0$	V_{DS}	max.	65 V
Gate-source voltage at $V_{DS} = 0$	$\pm V_{GS}$	max.	20 V
Drain current (DC)	I_D	max.	7 A
Total power dissipation $T_{mb} = 25\ ^oC$	P_{tot}	max.	130 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.35 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Drain-source breakdown voltage $I_D = 50$ mA; $V_{GS} = 0$	$V_{(BR)DS}$	>	65 V
Drain-source leakage current $V_{DS} = 28$ V; $V_{GS} = 0$	I_{DSS}	<	2.5 mA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	<	1 μA
Gate threshold voltage $I_D = 50$ mA; $V_{DS} = 10$ V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance $I_D = 5$ A; $V_{DS} = 10$ V	G_{fs}	> typ.	3.0 S 3.8 S
Drain-source on-state resistance $I_D = 5$ A; $V_{GS} = 10$ V	$R_{DS(ON)}$	typ.	0.2 Ω
On-state drain current $V_{DS} = V_{GS} = 10$ V	I_{DSX}	typ.	22 A
Input capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{is}	typ.	265 pF
Output capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{os}	typ.	185 pF
Feedback capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{rs}	typ.	28 pF

APPLICATION INFORMATION

RF performance in CW operation (common-source class-B circuit)

R_{GS} = 27 Ω; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W

Mode of operation	f MHz	V_{DS} V	I_{DQ} A	P_L W	G_p dB	η_d %
CW-FM	108	28	0.1	80	> 16	> 55
CW-FM	108	28	0.1	80	typ. 18	typ. 65
CW-FM	108	28	0 *	80	typ. 15	typ. 72

Input impedance: 1.8 − j 2.1 Ω (including R_{GS})

Load impedance: 3.0 + j 1.5 Ω

* V_{GS} = 0 (class-C)

Load mismatch

The device is capable of withstanding a load VSWR of 50, varied through all phases, at rated load power and supply voltage (T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W).

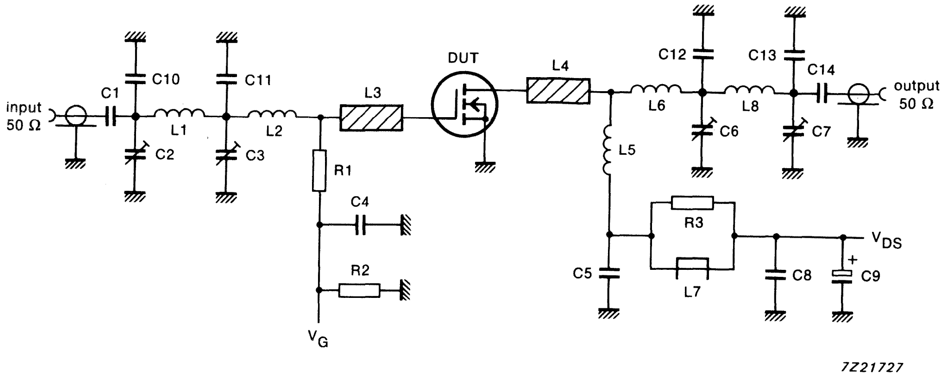


Fig. 2 Class-B test circuit at f = 108 MHz.

List of components:

C1 = C4 = C5 = C8 = C14 = 100 nF multilayer chip capacitor (cat. no. 2222 852 47104)
C2 = C3 = C6 = C7 = 5 — 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C9 = 2.2 μF (63 V) electrolytic capacitor (cat. no. 2222 030 38228)
C10 = para. connection of 68 pF + 39 pF multilayer chip capacitor *
C11 = para. connection of 68 pF + 100 pF multilayer chip capacitor *
C12 = para. connection of 100 pF + 100 pF multilayer chip capacitor *
C13 = 62 pF multilayer chip capacitor *

L1 = 52 nH, 5 turns enamelled Cu-wire (0.6 mm); int. dia: 3 mm; length 6.5 mm; leads: 2 x 10 mm
L2 = 19 nH, 2 turns enamelled Cu-wire (0.6 mm); int. dia: 3 mm; length 3.5 mm; leads: 2 x 7.5 mm
L3 = L4 = 31 Ω stripline; length 13 mm; width 6 mm
L5 = 36 nH, 3 turns enamelled Cu-wire (1.6 mm); int. dia: 6 mm; length 12 mm; leads: 2 x 5 mm
L6 = 14 nH hairpin; length 20 mm; enamelled Cu-wire (1.6 mm)
L7 = Ferroxcube HF choke grade 3B
L8 = 52 nH, 3 turns enamelled Cu-wire (1.6 mm); int. dia: 6 mm; length 8 mm; leads: 2 x 9 mm

R1 = 26.1 Ω, metal film resistor (cat. no. 2322 153 52619)
R2 = 100 kΩ, metal film resistor (cat. no. 2322 151 71004)
R3 = 10 Ω, metal film resistor (cat. no. 2322 151 71009)

Printed circuit board material: double Cu-clad, 1.6 mm epoxy fibre-glass (ϵ_r = 4.5)

* American Technical Ceramics (type 100B) or capacitor of same quality.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.

This device has been designed specifically for class-B operation.

Features:

- the device can be applied at rated load power without an external heatsink when it is mounted on a printed circuit board (see Fig. 4).
- gold metallization ensures excellent reliability.

The transistor has a 4-lead studless envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

R.F. performance at T_a = 25 °C in a common-emitter class-B circuit.*

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
c.w. (class-B)	7,5	900	0,75	> 7,0	> 50

* Device mounted on a printed circuit board (see Fig. 4).

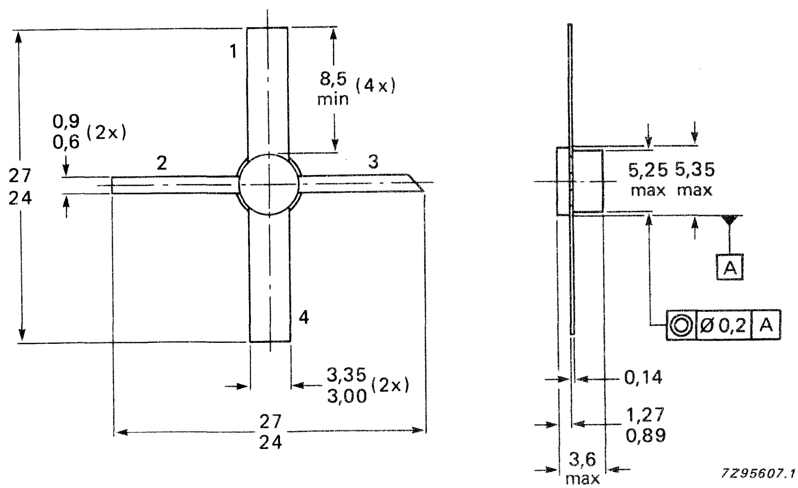
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.

Pinning:

1 Emitter
2 Base
3 Collector
4 Emitter



PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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.	3	V
Collector current				
average	I_C; $I_{C(AV)}$	max.	250	mA
(peak value); f > 1 MHz	I_{CM}	max.	750	mA
Total power dissipation				
at T_{amb} = 50 °C; f > 1 MHz*	$P_{tot(rf)}$	max.	2,3	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

Dissipation = 2,5 W; T_{mb} = 25 °C

From junction to ambient* (f > 1 MHz)	$R_{th\ j\text{-}a(rf)}$	max.	65	K/W
From junction to mounting base (f > 1 MHz)	$R_{th\ j\text{-}mb(rf)}$	max.	25	K/W

* Device mounted on a printed circuit board (see Fig. 4).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 2,5 mA	$V_{(BR)CBO}$	>	20 V
Collector-emitter breakdown voltage open base; I_C = 5 mA	$V_{(BR)CEO}$	>	10 V
Emitter-base breakdown voltage open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 10 V	I_{CES}	<	1 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0,3 mJ
D.C. current gain I_C = 0,15 A; V_{CE} = 5 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 7,5 V	C_c	typ.	2,8 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 7,5 V	C_{re}	typ.	1,6 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	0,5 pF

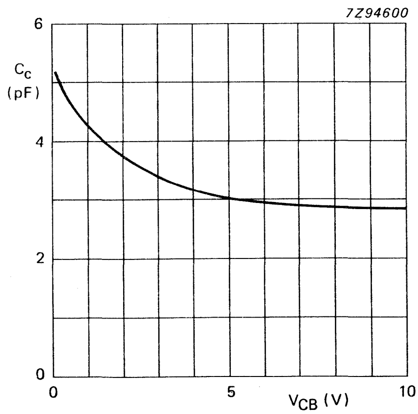


Fig. 2 I_E = i_e = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_a = 25 °C

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %
narrow band; c.w.	7,5	0,75	>7,0 typ. 8,5	>50 typ. 63

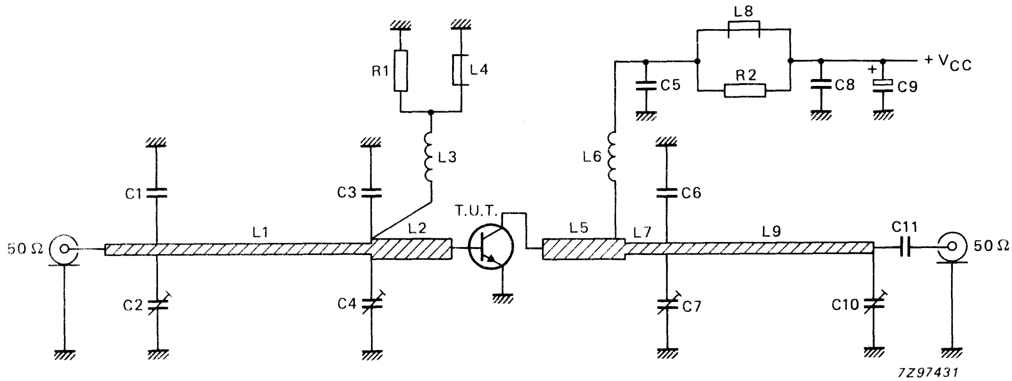


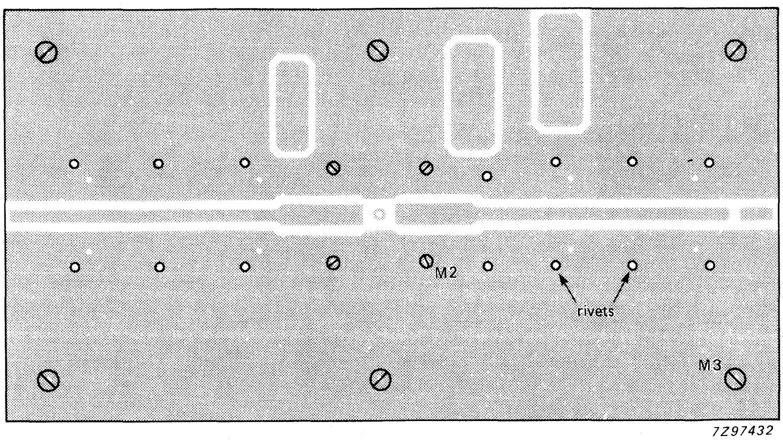
Fig. 3 Class-B test circuit at f = 900 MHz.

List of components:

C1 = 3 pF multilayer ceramic chip capacitor*
C2 = C4 = C7 = C10 = 1,4 to 5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = C6 = 3,9 pF multilayer ceramic chip capacitor*
C5 = C8 = C11 = 180 pF multilayer ceramic chip capacitor
C9 = 1 μF (35 V) tantalum capacitor
L1 = 50 Ω stripline (38 mm x 2,4 mm)
L2 = L5 = 35 Ω stripline (14 mm x 4 mm)
L3 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)
L6 = 50 nH; 5 turns closely wound enamelled Cu wire (0,6 mm); int. dia. 3 mm; leads 2 x 5 mm
L7 = 50 Ω stripline (12,2 mm x 2,4 mm)
L9 = 50 Ω stripline (30,5 mm x 2,4 mm)
R1 = R2 = 10 Ω ± 5%; 0,25 W metal film resistor

The striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



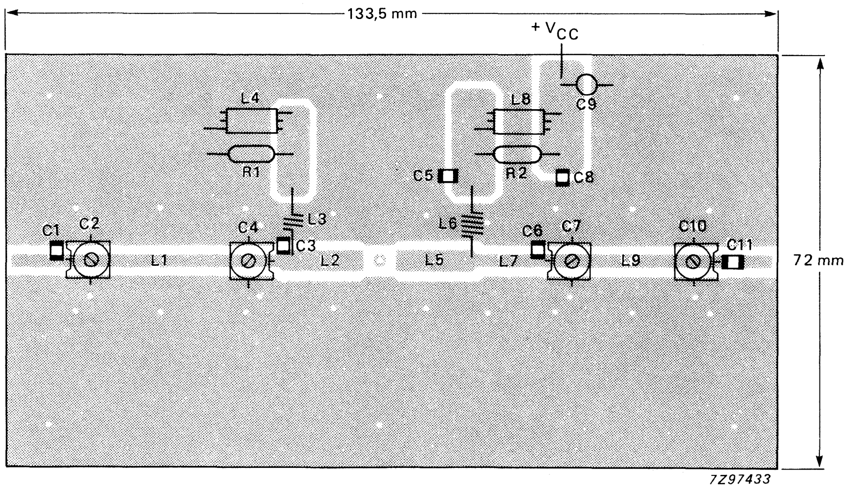


Fig. 4 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

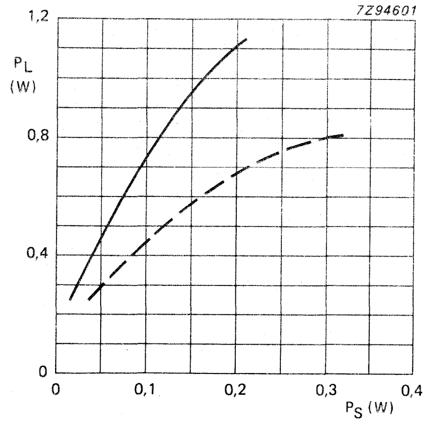


Fig. 5 Load power vs. source power.

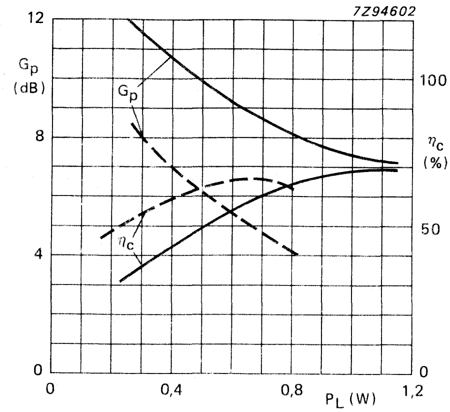


Fig. 6 Power gain and efficiency vs. load power.

Conditions for Figs 5 and 6:

f = 900 MHz; T_a = 25 °C; class-B operation; typical values.

V_{CE} = 7,5 V (———); V_{CE} = 5,0 V (---------)

(transistor mounted on printed circuit board, shown in Fig. 4, without applying an external heatsink).

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9,0 V at T_a = 25 °C. Device mounted on a printed circuit board (see Fig. 4).

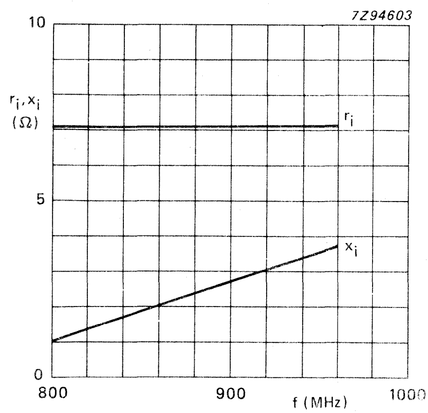


Fig. 7 Input impedance (series components).

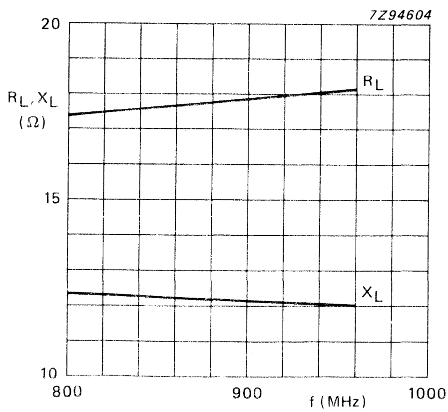


Fig. 8 Load impedance (series components).

Conditions for Figs 7, 8 and 9:

V_{CE} = 7,5 V; P_L = 0,75 W; f = 800 - 960 MHz; T_a = 25 °C; class-B operation; typical values.

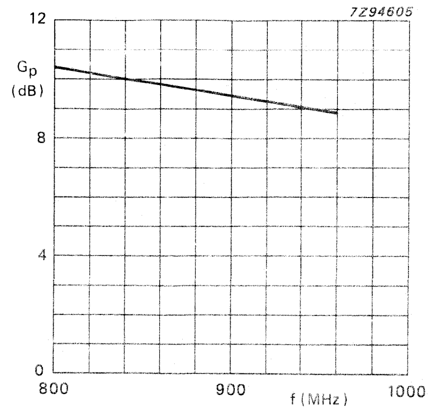


Fig. 9 Power gain vs. frequency.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.

This device has been designed specifically for class-B operation.

Features:

- the device can be applied at rated load power without an external heatsink when it is mounted on a printed wiring board.
- gold metallization ensures excellent reliability.

The transistor has a 4-lead studless envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

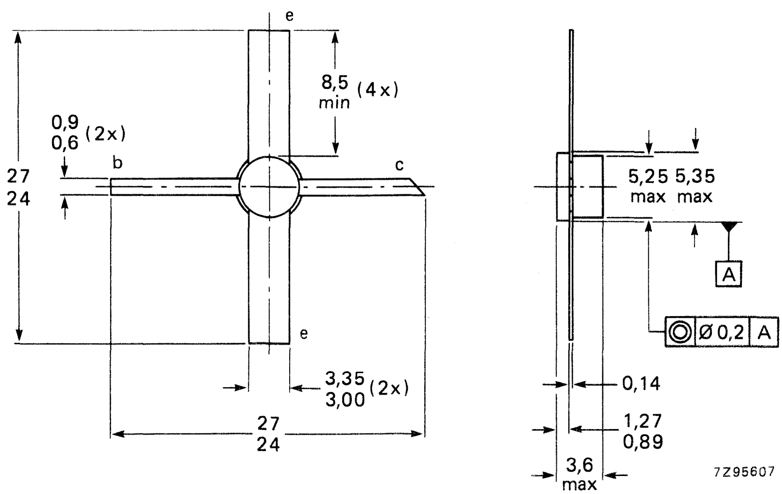
R.F. performance at T_a = 25 °C in a common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
c.w. (class-B)	7,5	900	1,5	> 6,0	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.



PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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.	3	V
Collector current				
→ average	I_C; $I_{C(AV)}$	max.	500	mA
(peak value); $f > 1$ MHz	I_{CM}	max.	1500	mA
Total power dissipation				
at $T_{amb} = 50\ ^oC$; $f > 1$ MHz*	$P_{tot(rf)}$	max.	3,0	W
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC

THERMAL RESISTANCE

Dissipation = 4,5 W; $T_{mb} = 25\ ^oC$

From junction to ambient* ($f > 1$ MHz)	$R_{th\ j\text{-}a(rf)}$	max.	50	K/W
From junction to mounting base ($f > 1$ MHz)	$R_{th\ j\text{-}mb(rf)}$	max.	20	K/W

* Device mounted on a printed wiring board (see Fig. 4).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 5 mA	$V_{(BR)CBO}$	>	20 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	10 V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 10 V	I_{CES}	<	2,5 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0,55 mJ
D.C. current gain I_C = 300 mA; V_{CE} = 5 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 7,5 V	C_c	typ.	4,5 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 7,5 V	C_{re}	typ.	3 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	0,5 pF

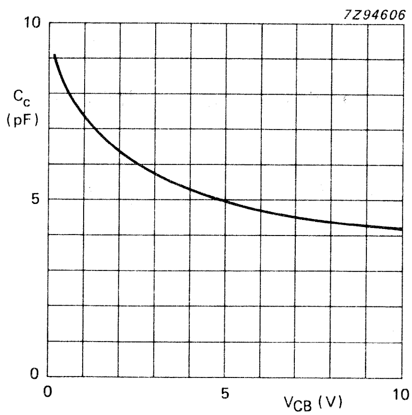


Fig. 2 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_a = 25 °C

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %
narrow band; c.w.	7,5	1,5	> 6,0 typ. 7,0	> 50 typ. 65

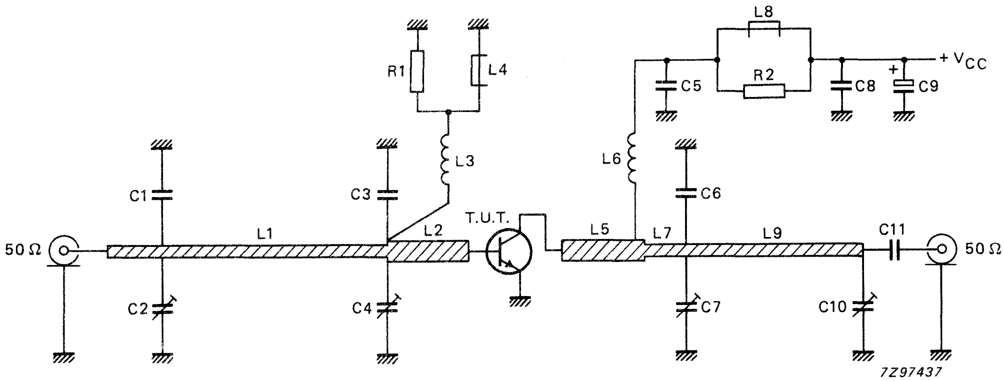


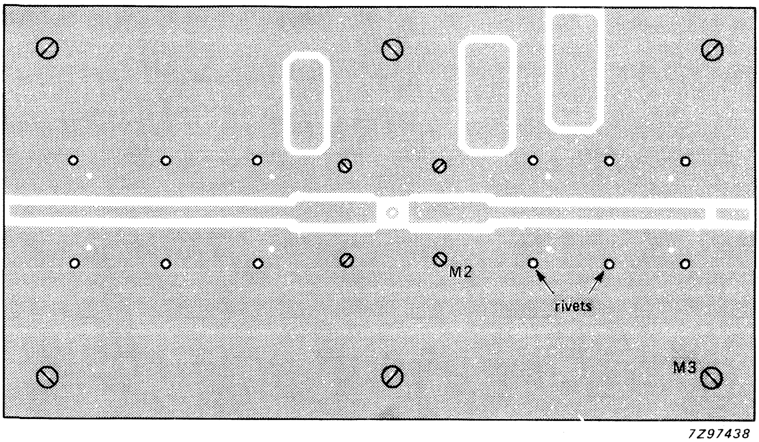
Fig. 3 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C6 = 2 pF multilayer ceramic chip capacitor*
C2 = C4 = C7 = C10 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 4,7 pF multilayer ceramic chip capacitor*
C5 = C8 = C11 = 180 pF multilayer ceramic chip capacitor
C9 = 1 μF (35 V) tantalum capacitor
L1 = 50 Ω stripline (40 mm x 2,4 mm)
L2 = L5 = 35 Ω stripline (14 mm x 4,0 mm)
L3 = 100 nH; 8 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)
L6 = 30 nH; 2 turns Cu wire (1,0 mm); int. dia. 5,5 mm; length 4,5 mm; leads 2 x 5 mm.
L7 = 50 Ω stripline (6,0 mm x 2,4 mm)
L9 = 50 Ω stripline (30,3 mm x 2,4 mm)
R1 = R2 = 10 Ω ± 5%; 0,25 W metal film resistor

The striplines on a double Cu-clad printed wiring board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



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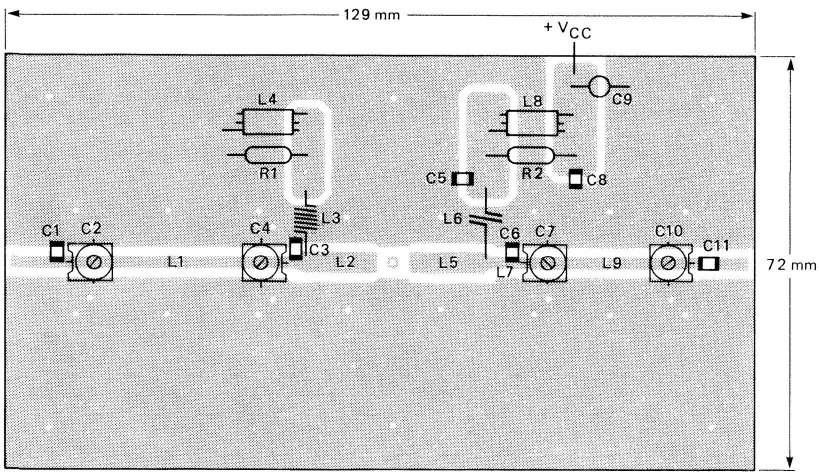


7Z97439

Fig. 4 Printed wiring board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as a groundplane. Earth connections are made by hollow rivets and also by fixing screws and copper straps under the emitters to provide a direct contact between the copper on the component side and the groundplane.

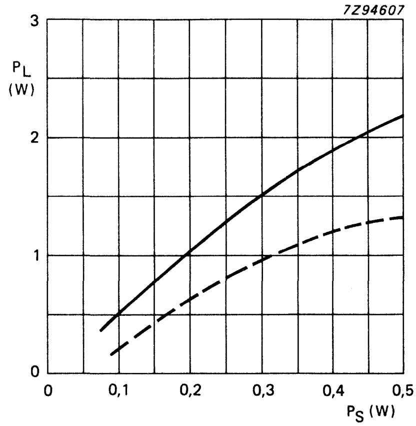


Fig. 5 Load power vs. source power.

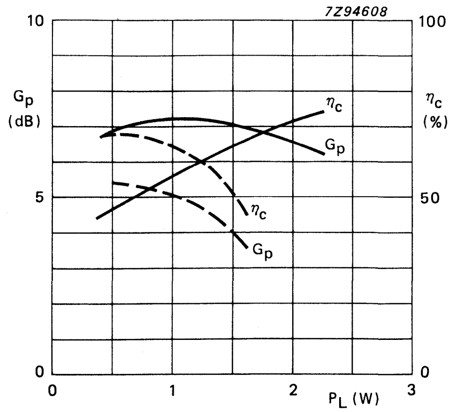


Fig. 6 Power gain and efficiency vs. load power.

Conditions for Figs 5 and 6:

f = 900 MHz; T_a = 25 °C; class-B operation; typical values.

V_{CE} = 7,5 V (———); V_{CE} = 5,0 V (----------)

(transistor mounted on printed wiring board, shown in Fig. 4, without applying an external heatsink).

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9,0 V at T_a = 25 °C.

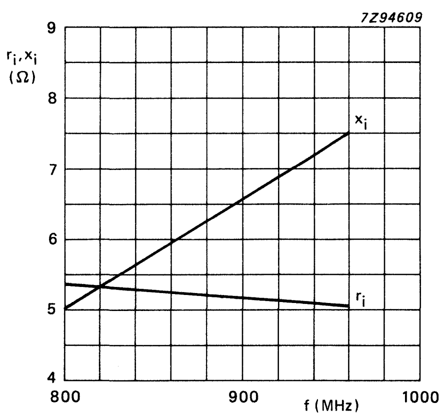


Fig. 7 Input impedance (series components).

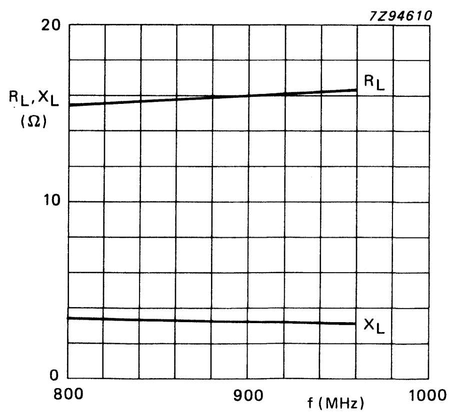


Fig. 8 Load impedance (series components).

Conditions for Figs 7, 8 and 9:

V_{CE} = 7,5 V; P_L = 1,5 W; f = 800 - 960 MHz; T_a = 25 °C; class-B operation; typical values.

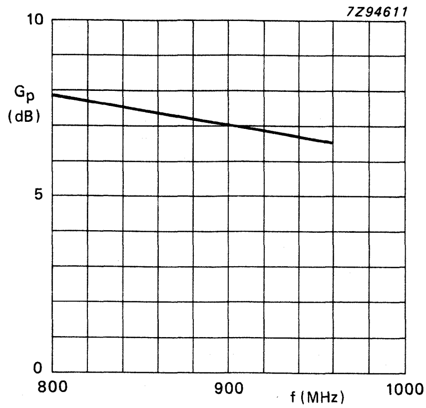


Fig. 9 Power gain vs. frequency.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.

This device has been designed specifically for class-B operation.

Features

- internal input matching capacitor for a high power gain
- gold metallization ensures excellent reliability

The transistor has a 4-lead studless envelope with a ceramic cap (SOT122D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
CW (class-B)	7.5	900	3.0	> 7.0	> 50

MECHANICAL DATA

Dimensions in mm

Pinning
1 = Collector
2 = Emitter
3 = Base
4 = Emitter

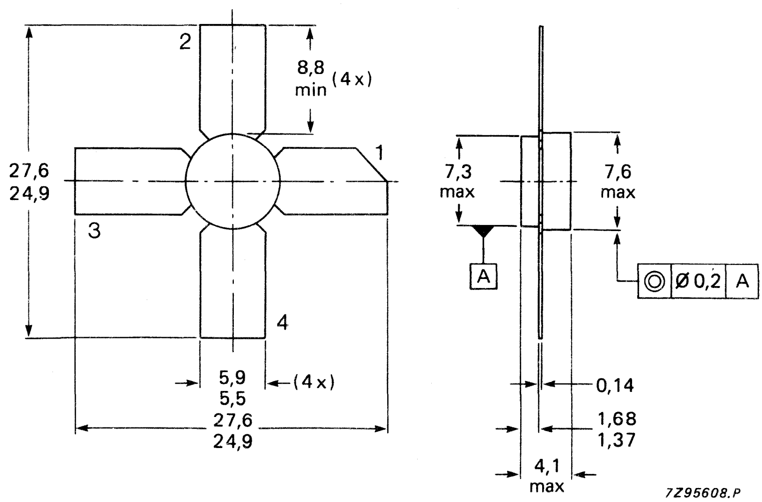


Fig.1 SOT122D.

PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

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.	3.0 V
Collector current			
DC or average	I_C; $I_{C(AV)}$	max.	1.2 A
(peak value); f > 800 MHz	I_{CM}	max.	3.6 A
Total power dissipation			
at T_{amb} < 120 °C; f > 800 MHz	P_{tot}	max.	10 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

Dissipation = 10 W; T_{mb} = 25 °C

From junction to mounting base (f > 800 MHz)	$R_{th\ j\text{-}mb(RF)}$	max.	6.0 K/W

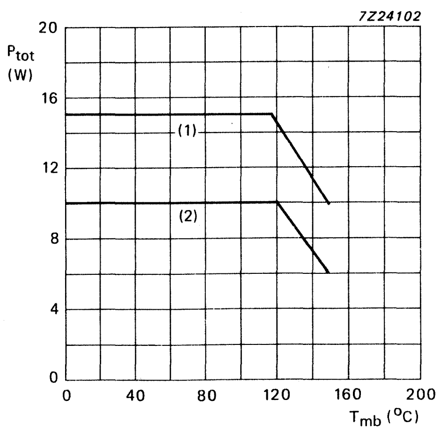


Fig. 2 Total power dissipation as a function of temperature.

(1) Short-time RF operation during mismatch (f > 800 MHz).
(2) Continuous RF operation (f > 800 MHz).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	20 V
Collector-emitter breakdown voltage open base; I_C = 20 mA	$V_{(BR)CEO}$	>	10 V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	3.0 V
Collector cut-off current V_{BE} = 0; V_{CE} = 10 V	I_{CES}	<	5.0 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	1.0 mJ
DC current gain I_C = 600 mA; V_{CE} = 5 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 7.5 V	C_c	typ.	11 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 7.5 V	C_{re}	typ.	6.0 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	1.2 pF

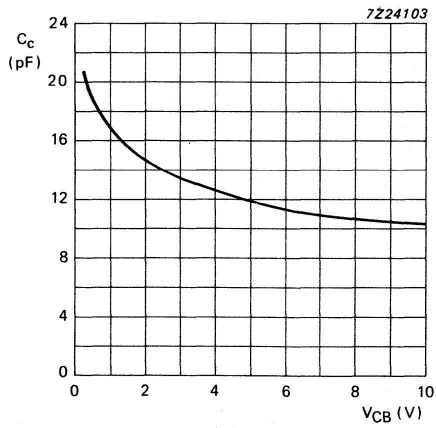


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $I_E = i_e$ = 0; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit; class-B); f = 900 MHz; T_{mb} = 25 °C

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %
Class-B; CW	7.5	3.0	> 7.0 typ. 8.5	> 50 typ. 57

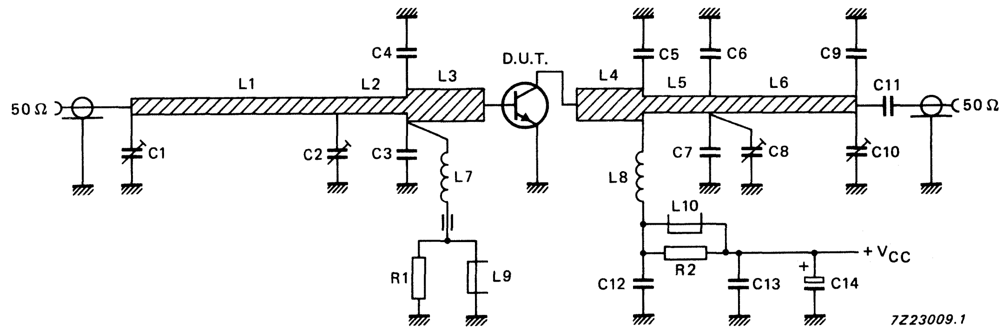


Fig.4 Class-B test circuit at f = 900 MHz.

List of components:

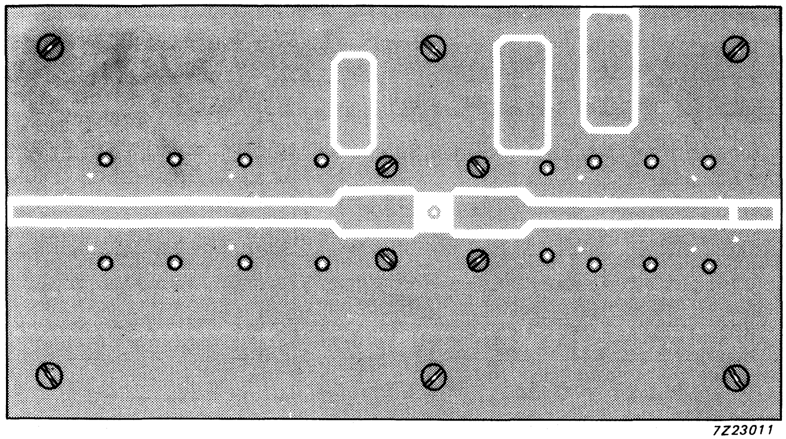
C1 = C2 = C8 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C6 = C7 = 3.3 pF multilayer ceramic chip capacitor*
C4 = C5 = C9 = 5.6 pF multilayer ceramic chip capacitor*
C11 = C12 = C13 = 180 pF multilayer ceramic chip capacitor
C14 = 1 μF (35 V) tantalum capacitor

L1 = 50 Ω stripline (25 mm x 2.4 mm)
L2 = 50 Ω stripline (11 mm x 2.4 mm)
L3 = L4 = 25 Ω stripline (11.5 mm x 6.0 mm)
L5 = 50 Ω stripline (7.0 mm x 2.4 mm)
L6 = 50 Ω stripline (27.0 mm x 2.4 mm)
L7 = 4 turns closely wound enamelled Cu wire (0.4 mm), int. dia; 3 mm, with ferrite beat (cat. no. 4330 830 32221) over the coldside lead
L8 = 1 turn Cu wire (1.0 mm); int. dia. 5.5 mm; length 2 mm; leads 2 x 5 mm
L9 = L10 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)

R1 = R2 = 10 Ω ± 5%; 0.25 W metal film resistor

The striplines on a double Cu-clad printed circuit board with PTFE fibreglass dielectric (E_r = 2.2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100 A or capacitor of same quality.



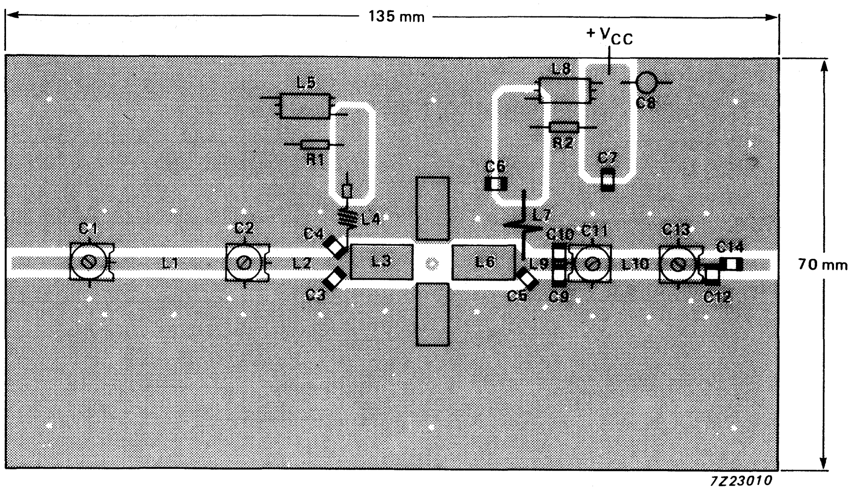


Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

Note:
The circuit and the components are on one side of the PTFE fibreglass board; the other side is un-etched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

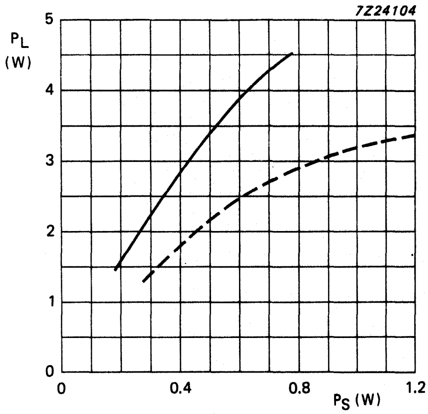


Fig. 6 Load power as a function of source power.

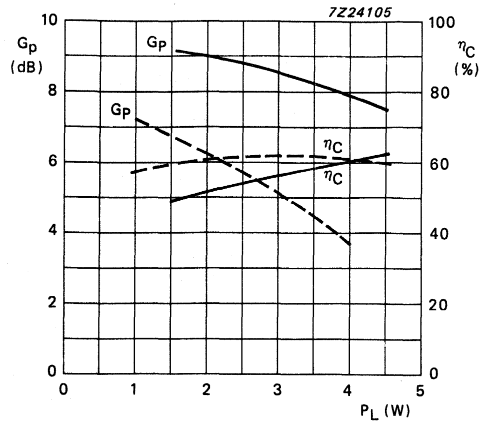


Fig. 7 Power gain and efficiency as a function of load power.

Conditions for Figs 6 and 7:

f = 900 MHz; T_{mb} = 25 °C; class-B operation; typical values.

——— V_{CE} = 7.5 V
– – – V_{CE} = 5.0 V

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9.0 V at T_{mb} = 25 °C.

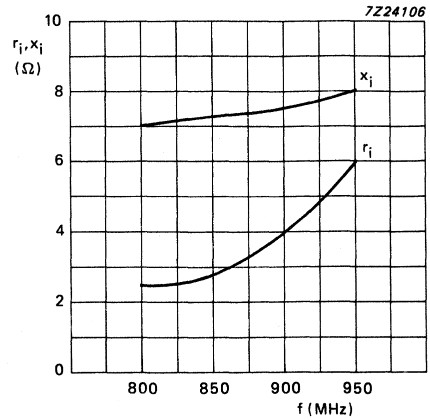


Fig. 8 Input impedance as a function of frequency (series components).

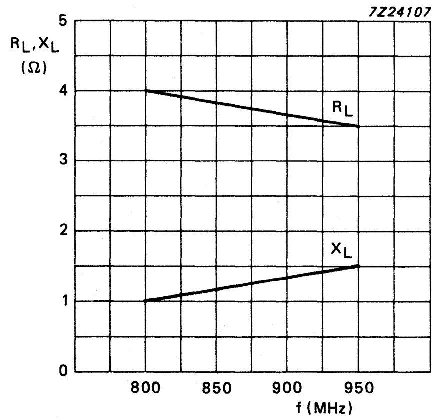


Fig. 9 Load impedance as a function of frequency (series components).

Conditions for Figs 8, 9 and 10:

V_{CE} = 7,5 V; P_L = 3 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

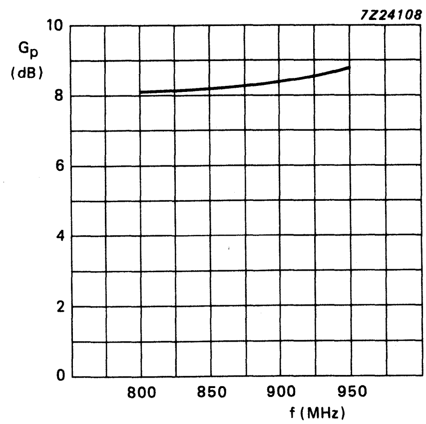


Fig. 10 Power gain as a function of frequency.

UHF POWER TRANSISTOR

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

This device has been designed specifically for class-B operation.

Features

- internal input matching capacitor for a high power gain
- gold metallization ensures excellent reliability

The transistor has a 4-lead studless envelope with a ceramic cap (SOT122D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in a common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
CW (class-B)	7.5	900	6.0	min. 5.5	min. 50

MECHANICAL DATA

Dimensions in mm

Pinning

1 = Collector
2 = Emitter
3 = Base
4 = Emitter

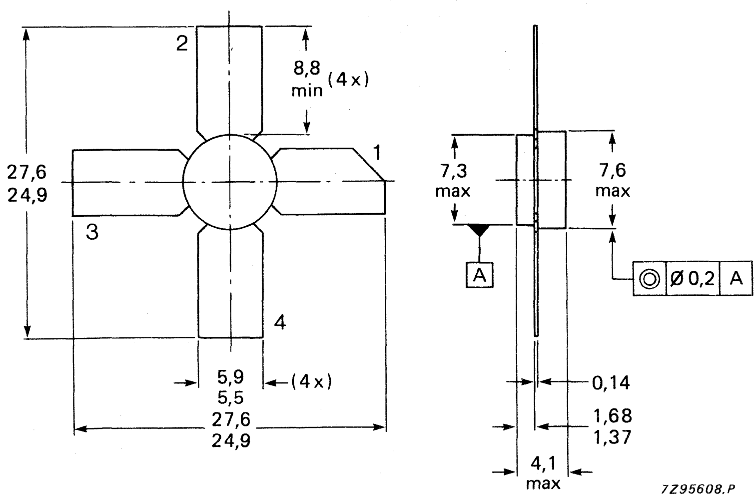


Fig.1 SOT122D.

PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

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.	3 V
Collector current			
DC or average	I_C; $I_{C(AV)}$	max.	1.2 A
(peak value); f > 200 MHz	I_{CM}	max.	3.6 A
Total power dissipation at T_{amb} < 105 °C; f > 200 MHz	P_{tot}	max.	12 W
Storage temperature range	T_{stg}	−65 to +150 °C	
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

Dissipation = 12 W; T_{mb} = 25 °C

From junction to mounting base (f > 200 MHz)	$R_{th\ j\text{-}mb(RF)}$	max.	6.5 K/W

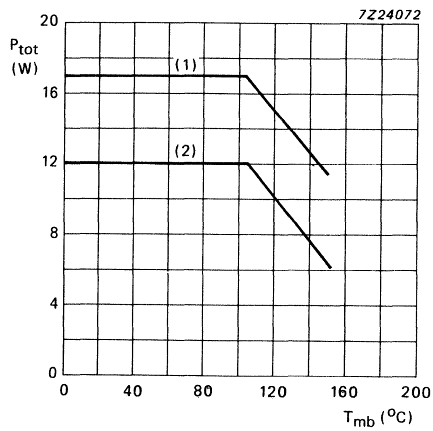


Fig. 2 Total power dissipation as a function of temperature.

(1) Short-time RF operation during mismatch (f > 800 MHz)
(2) Continuous RF operation (f > 800 MHz)

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 20 mA	$V_{(BR)CBO}$	>	20 V
Collector-emitter breakdown voltage open base; I_C = 40 mA	$V_{(BR)CEO}$	>	10 V
Emitter-base breakdown voltage open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	3.0 V
Collector cut-off current V_{BE} = 0, V_{CE} = 10 V	I_{CES}	<	1.0 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	2.0 mJ
DC current gain I_C = 1.2 A, V_{CE} = 5 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 7.5 V	C_c	typ.	19 pF
Feedback capacitance at f = 1 MHz I_C = 0, V_{CE} = 7.5 V	C_{re}	typ.	10 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	1.2 pF

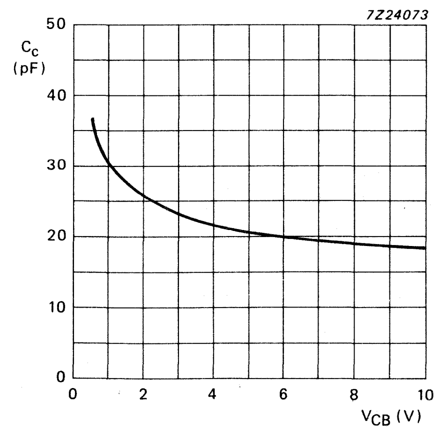


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $I_E = i_e$ = 0; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit; class-B); f = 900 MHz; T_{mb} = 25 °C

mode of operation	f MHz	V_{CE} V	P_L W	G_p dB	η_C %
class-B; CW	900	7.5	6.0	min. 5.5 typ. 7.0	min. 50 typ. 60

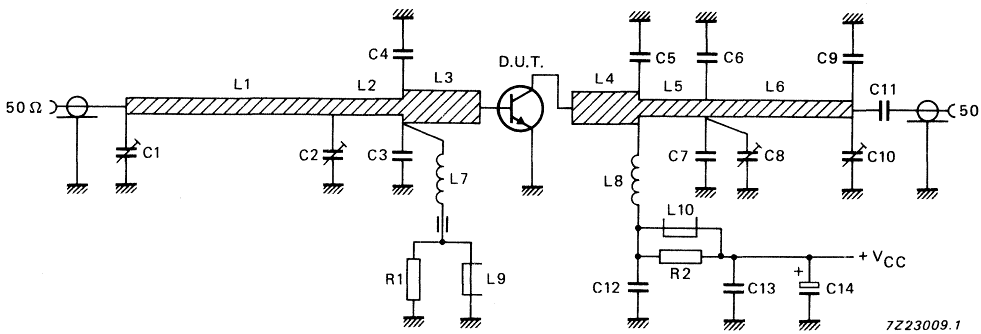


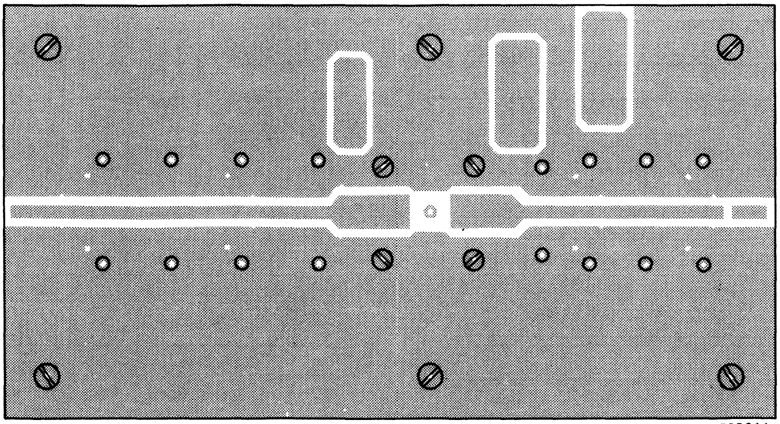
Fig. 4 Class-B test circuit at f = 900 MHz.

List of components:

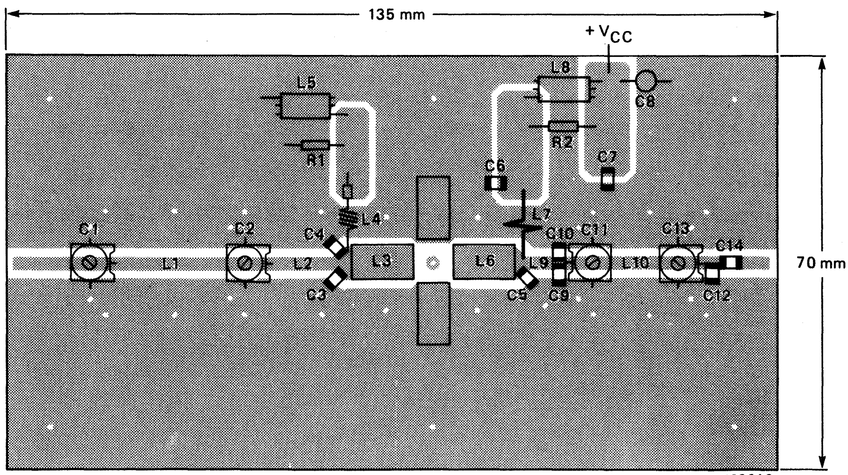
C1 = C2 = C8 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C6 = C7 = 3.3 pF multilayer ceramic chip capacitor*
C4 = C5 = C9 = 5.6 pF multilayer ceramic chip capacitor*
C11 = C12 = C13 = 180 pF multilayer ceramic chip capacitor
C14 = 1 μF (35 V) tantalum capacitor
L1 = 50 Ω stripline (25 mm x 2.4 mm)
L2 = 50 Ω stripline (11 mm x 2.4 mm)
L3 = L4 = 25 Ω stripline (11.5 mm x 6.0 mm)
L5 = 50 Ω stripline (7.0 mm x 2.4 mm)
L6 = 50 Ω stripline (27.0 mm x 2.4 mm)
L7 = 4 turns closely wound enamelled Cu wire (0.4 mm), int. diameter 3 mm, with ferrite beat (cat. no. 4330 030 32221) over the coldside lead
L8 = 1 turn Cu wire (1.0 mm); int. diameter 5.5 mm; length 2 mm, leads 2 x 5 mm
L9 = L10 = Ferroxdure wideband HF choke, grade 3B (cat. no. 4312 020 36642)
R1 = R2 = 10 Ω ± 5%; 0.25 W metal film resistor

The striplines on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



7Z23011



7Z23010

Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

Note:

The circuit and the components are on one side of the PTFE fibreglass board; the other side is un-etched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

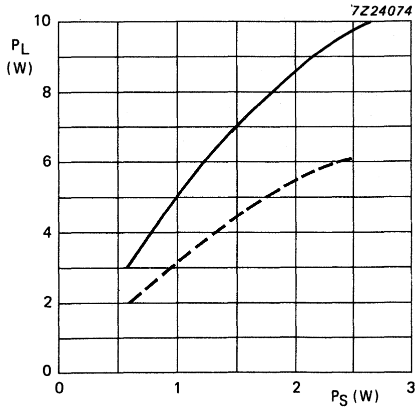


Fig. 6 Load power as a function of source power.

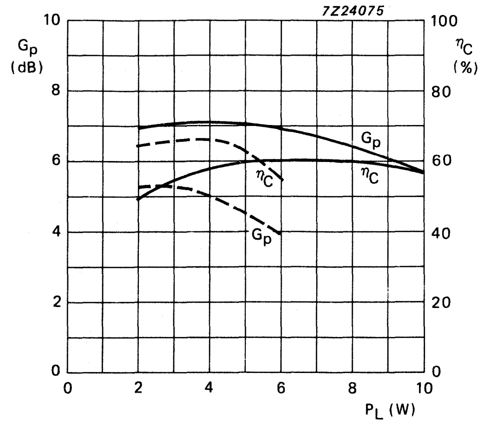


Fig. 7 Power gain and efficiency as a function of load power.

Conditions for Figs 6 and 7:

f = 900 MHz; T_{mb} = 25 °C; class-B operation; typical values.

——— V_{CE} = 7.5 V;
– – – – V_{CE} = 5.0 V

RUGGEDNESS:

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9.0 V at T_{mb} = 25 °C.

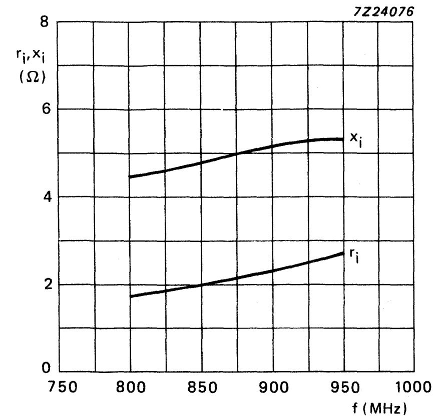


Fig. 8 Input impedance as a function of frequency (series components).

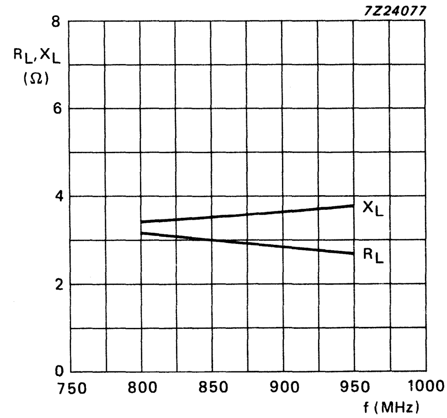


Fig. 9 Load impedance as a function of frequency (series components).

Conditions for Figs 8, 9 and 10:

V_{CE} = 7.5 V; P_L = 6 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

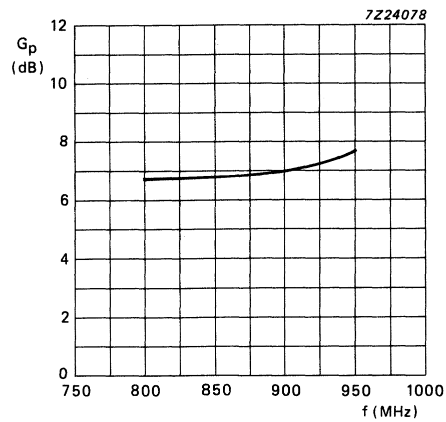


Fig. 10 Power gain as a function of frequency.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features:

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.
- internal matching to achieve an optimum wideband capability and high power gain.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

Envelope	SOT-119			
Mode of operation	class-B; c.w.			
Collector-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		20	W
Power gain	G_P	>	6,5	dB
Collector efficiency	η_C	>	55	%
Heatsink temperature	T_h		25	^oC

MECHANICAL DATA

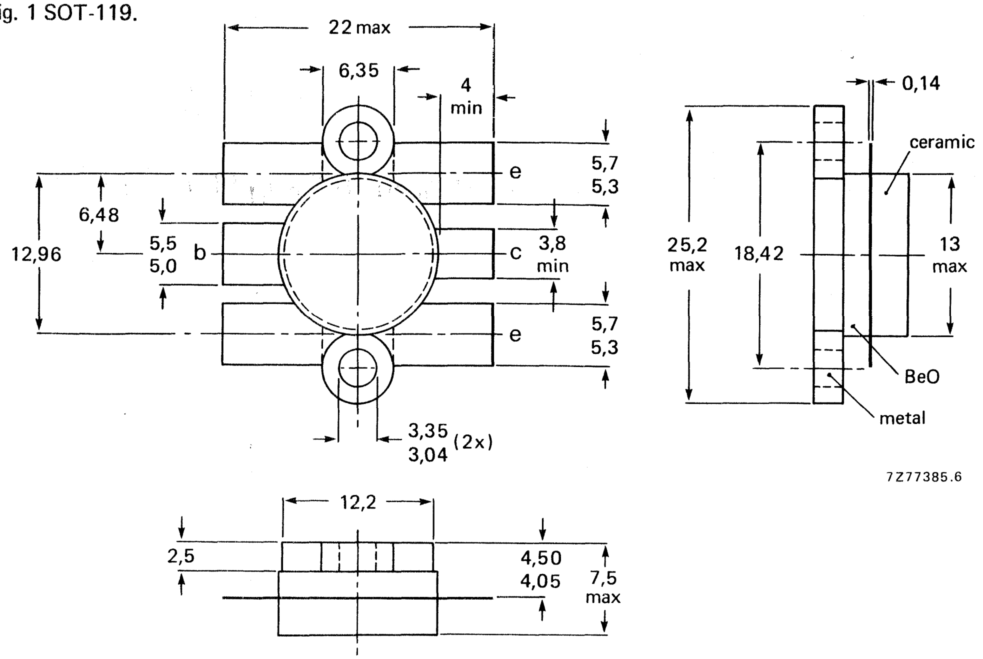
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter)			
peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C	max.	4 A
(peak value); f > 1 MHz	I_{CM}	max.	12 A
Total power dissipation			
at T_{mb} = 25 °C	P_{tot} (d.c.)	max.	38 W
f > 1 MHz; T_{mb} = 25 °C	P_{tot} (r.f.)	max.	44 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

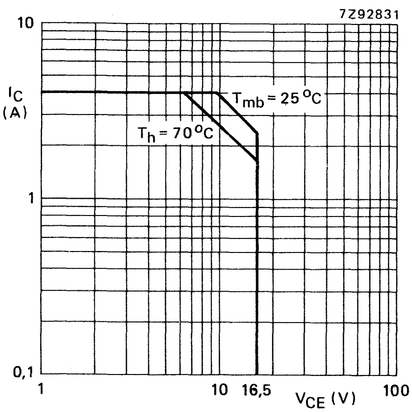


Fig. 2 D.C.SOAR.
$R_{th\ mb\text{-}h}$ = 0,2 K/W

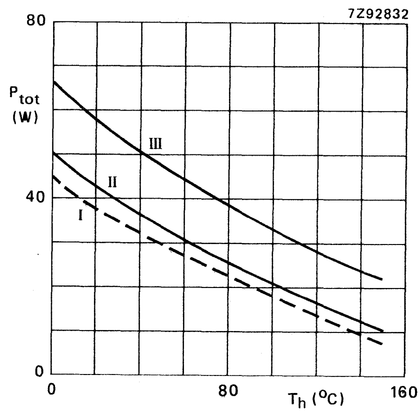


Fig. 3 Power/temperature derating curves
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE (dissipation = 37 W; T_{mb} = 25 °C, i.e. T_h = 18 °C

From junction to mounting base			
(d.c. dissipation)	$R_{th\ j\text{-}mb(d.c.)}$	max	4,6 K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(r.f.)}$	max	4,1 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max	0,2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage I_C = 25 mA; open emitter	$V_{(BR)CBO}$	>	36 V
Collector–emitter breakdown voltage I_C = 50 mA; open base	$V_{(BR)CEO}$	>	16,5 V
Emitter–base breakdown voltage I_E = 5 mA; open collector	$V_{(BR)EBO}$	>	4 V
Collector cut–off current V_{BE} = 0; V_{CE} = 20 V	I_{CES}	<	12,5 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	5,3 mJ
D.C. current gain I_C = 2,7 A; V_{CE} = 10 V	h_{FE}	> typ.	15 60
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	53 pF
Feed-back capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	33 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

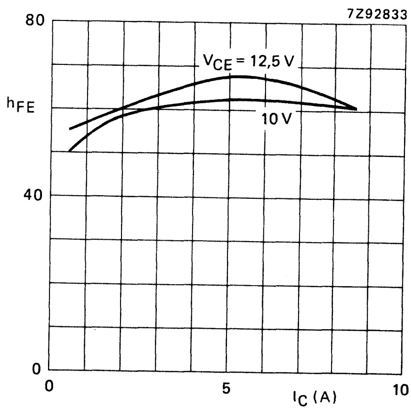


Fig. 4 T_j = 25 °C; typ. values.

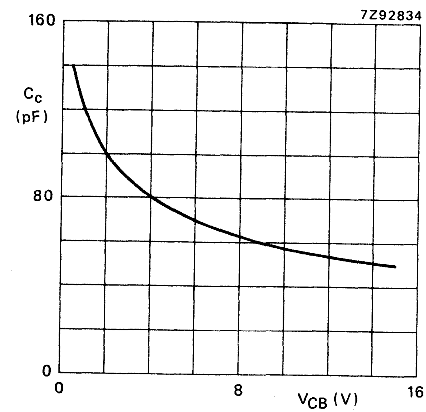


Fig. 5 $I_E = i_e$ = 0; f = 1 MHz; typ. values.

APPLICATION INFORMATION

Mode of operation	in narrow band test circuit; class-B; c.w.			
Colletor-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		20	W
Power gain	G_p	>	6,5	dB
		typ.	7,8	dB
Collector efficiency	η_c	>	55	%
		typ.	64	%
Heatsink temperature	T_h		25	°C

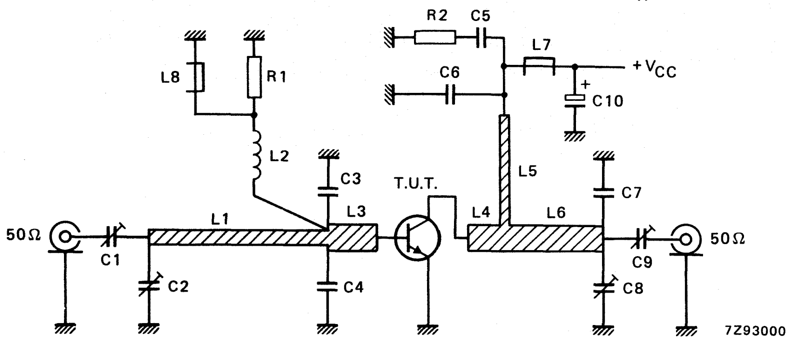


Fig. 6 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C9 = 1,8 to 10 pF film dielectric trimmer (cat.no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat.no. 2222 809 09002)
C3 = C4 = 8,2 pF multilayer ceramic chip capacitor (100A type) *
C5 = 100 nF polyester film capacitor
C6 = 120 pF multilayer ceramic chip capacitor
C7 = 8,2 pF multilayer ceramic chip capacitor (100B type) *
C8 = 2 to 18 pF film dielectric trimmer (cat.no. 2222 809 09003)
C10 = 2,2 μF electrolytic capacitor

L1 = 50 Ω stripline (43,5 mm x 4,0 mm)
L2 = 100 nH; 5 turns closely wound enamelled Cu-wire (0,5 mm); int. diam. 4 mm; leads 2 x 5 mm
L3 = 37,6 Ω stripline (8,0 mm x 6,0 mm)
L4 = 37,6 Ω stripline (9,0 mm x 6,0 mm)
L5 = 74,4 Ω stripline (22,5 mm x 2,0 mm)
L6 = 37,6 Ω stripline (18,0 mm x 6,0 mm)
L7 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36642)

R1 = 1 Ω ± 5%; 0,4 W metal film resistor (MR25 type)
R2 = 10 Ω ± 5%; 0,4 W metal film resistor (MR25 type)

L1, L3, L4, L5 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16 inch.

* American Technical Ceramics capacitor or capacitor of same quality.

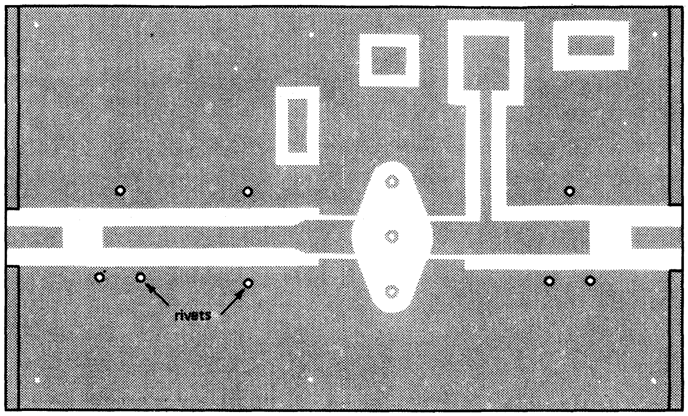


Fig. 7 P.C. board for 470 MHz, class-B test circuit.

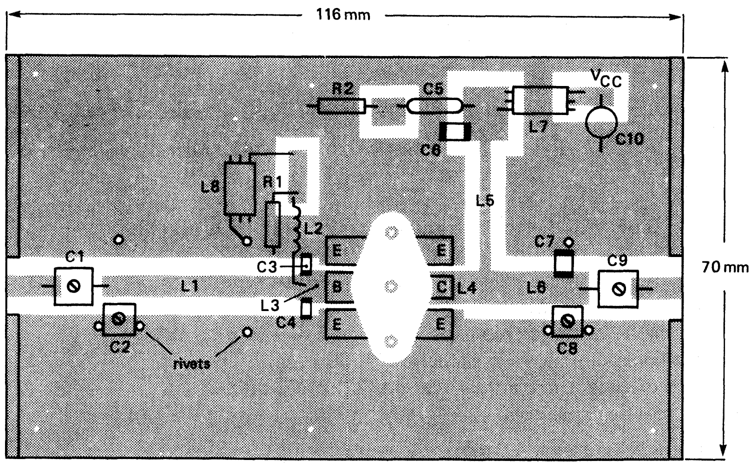


Fig. 8 Component lay-out of 470 MHz, class-B test circuit.

Note:

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by copper straps under the emitters and around the board to provide a direct contact between the copper on the component side and the ground plane.

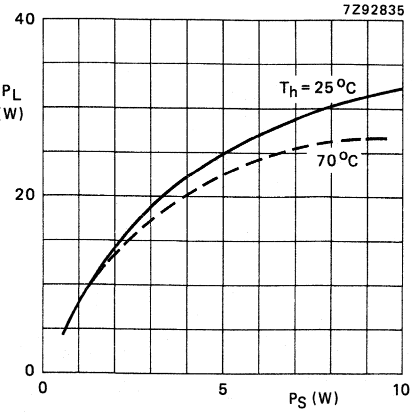


Fig. 9 Load power vs. source power.

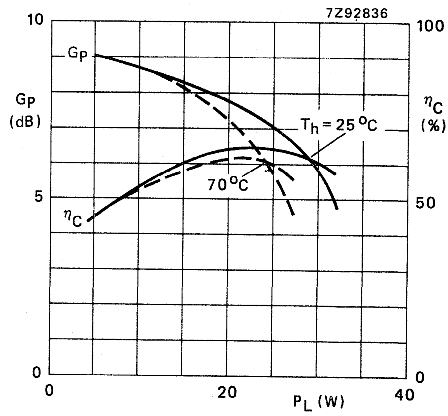


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs. 9 and 10:

V_{CE} = 12,5 V; f = 470 MHz; class-B operation; T_h = 25 ^oC and 70 ^oC; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) up to 25 W under the following conditions:
V_{CE} = 15,5 V; f = 470 MHz; T_h = 25 ^oC; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

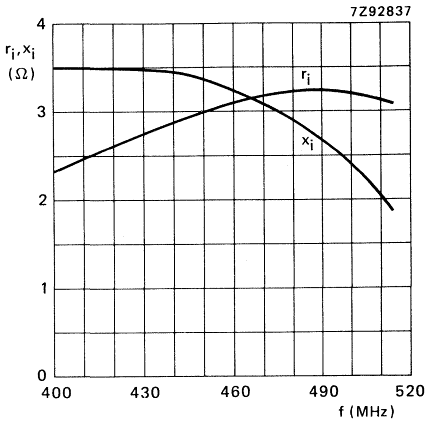


Fig. 11 Input impedance (series components).

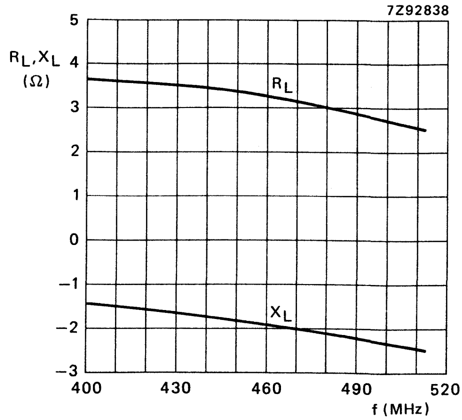


Fig. 12 Load impedance (series components).

Conditions for Figs. 11, 12 and 13:

V_{CE} = 12,5 V; P_L = 20 W; f = 400–512 MHz; T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

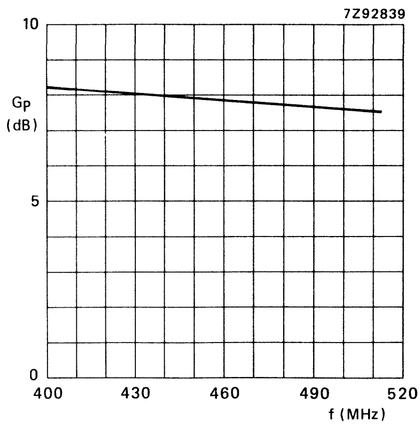


Fig. 13 Power gain versus frequency.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features:

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

Envelope	SOT-119			
Mode of operation	class-B; c.w.			
Collector-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		30	W
Power gain	G_p	>	6,0	dB
Collector efficiency	η_C	>	55	%
Heatsink temperature	T_h		25	°C

MECHANICAL DATA

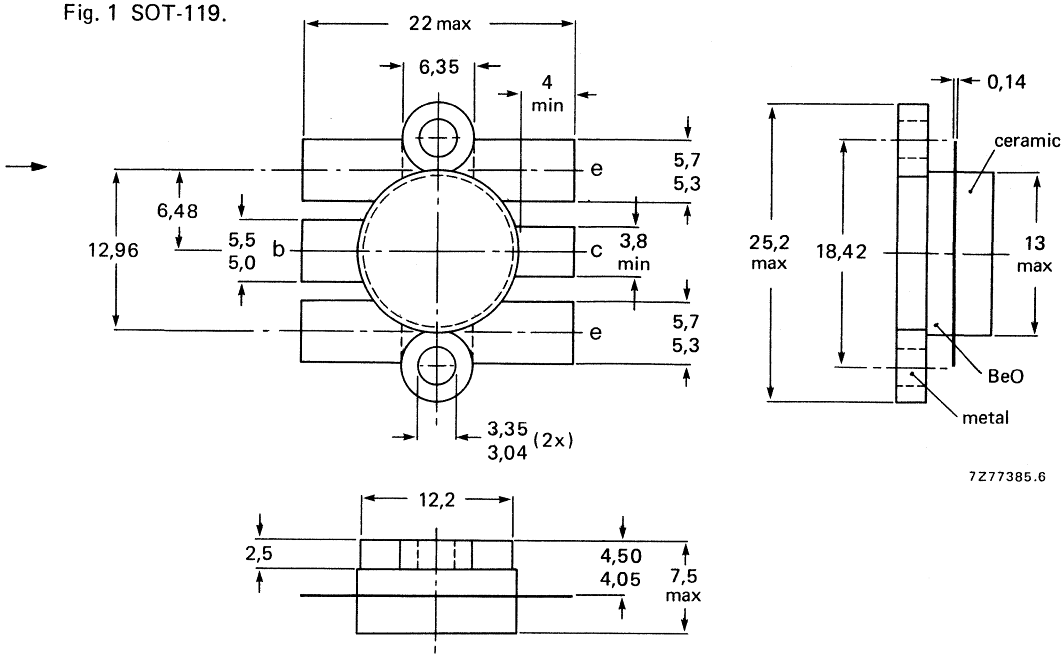
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw:	min. 0,6 Nm (6 kg.cm)
	max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C	max.	6 A
(peak value); f > 1 MHz	I_{CM}	max.	18 A
Total power dissipation f > 1 MHz; T_{mb} = 25 °C	P_{tot} (r.f.)	max.	65 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

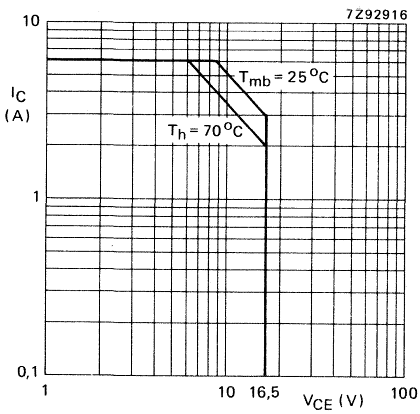


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,2 K/W

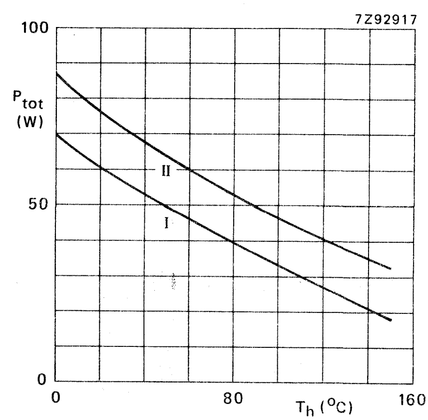


Fig. 3 Power/temperature derating curves
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE (dissipation = 45 W; T_{mb} = 25 °C).

From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(r.f.)}$	max.	2,45 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage I_C = 50 mA; open emitter	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage I_C = 100 mA; open base	$V_{(BR)CEO}$	>	16,5 V
Emitter-base breakdown voltage I_E = 10 mA; open collector	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	22 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain I_C = 4 A; V_{CE} = 10 V	h_{FE}	> typ.	15 60
Collector capacitance at f = 1 MHz* I_E = i_e = 0; V_{CB} = 12,5 V	C_c	typ.	85 pF
Feed-back capacitance at f = 1 MHz* I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	52 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

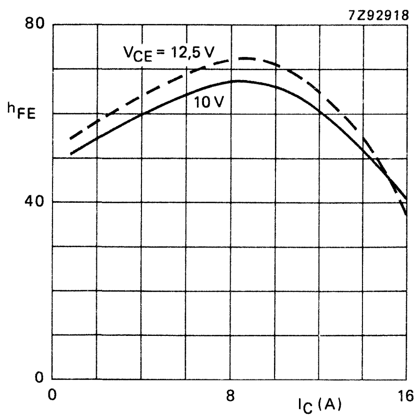


Fig. 4 T_j = 25 °C; typ. values.

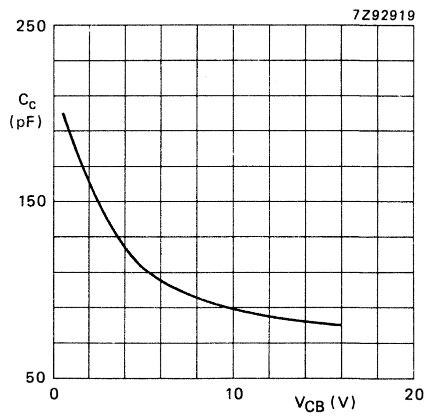


Fig. 5 I_E = i_e = 0; f = 1 MHz; typ. values.

* Device mounted in SOT-119 envelope without inputmatching.

APPLICATION INFORMATION

Mode of operation	In narrow-band test circuit; class-B; c.w.			
Collector-emitter voltage (d.c.)	V_{CE}		12,5	V
Frequency	f		470	MHz
Load power	P_L		30	W
Power gain	G_P	>	6,0	dB
		typ.	7,4	dB
Collector efficiency	η_C	>	55	%
		typ.	66	%
Heatsink temperature	T_h		25	°C

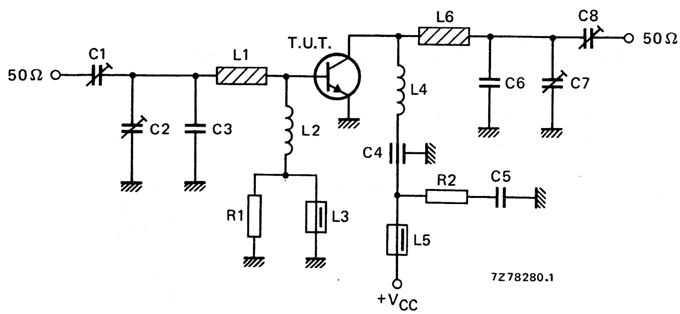


Fig. 6 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C2 = C7 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C6 = 3,9 pF ceramic capacitor (500 V)
C4 = 100 pF feed-through capacitor
C5 = 100 nF polyester film capacitor

L1 = stripline (24,0 mm x 6,7 mm)
L2 = 10 turns closely wound enamelled Cu-wire (0,4 mm); int. diam. 4 mm
L3 = 2 turns enamelled Cu-wire (0,6 mm); Ferroxcube tube core, grade 3B5 (cat. no. 4313 020 15170)
L4 = 12,6 nH; 2,5 turns enamelled Cu-wire (0,7 mm); int. diam. 4 mm; length 3 mm; leads 2 x 5 mm
L5 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L6 = stripline (28,4 mm x 6,7 mm)

R1 = R2 = 10 Ω carbon resistor

L1 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16 inch.

Component lay-out and printed-circuit board for 470 MHz test circuit are shown in Figs 7 and 8.

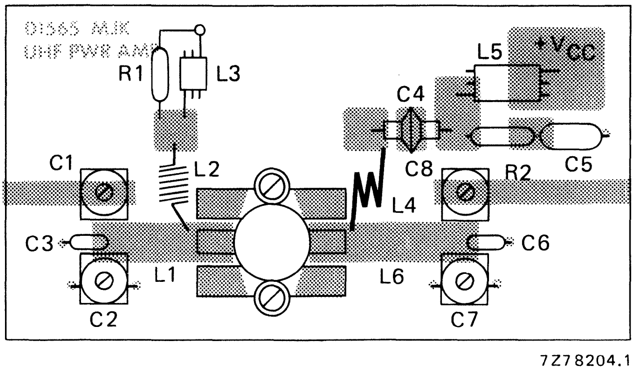


Fig. 7 Component lay-out of 470 MHz, class-B test circuit.

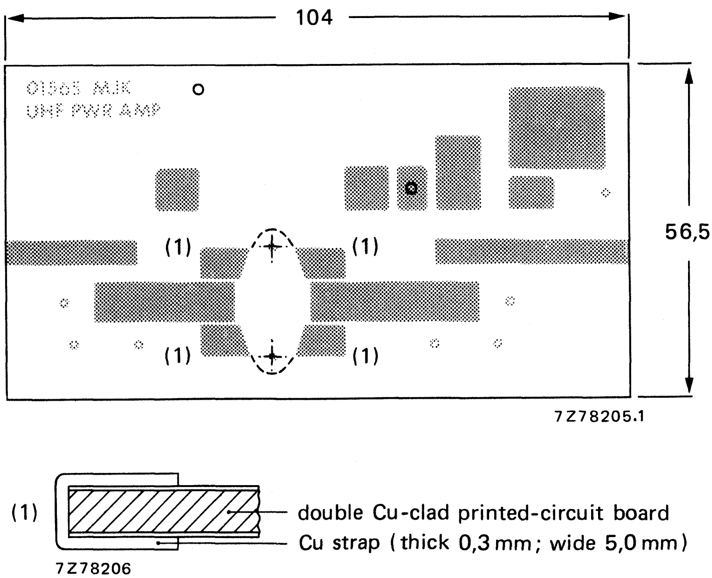


Fig. 8 P.c. board for 470 MHz, class-B test circuit.

Note:
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side fully metallized serving as groundplane. Earth connections are made by hollow rivets and also by copper straps under the emitter to provide a direct contact between the copper on the component side and the ground plane.

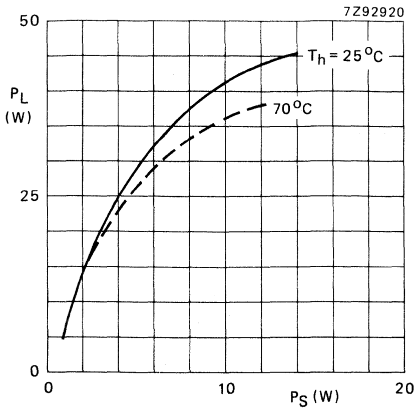


Fig. 9 Load power vs. source power.

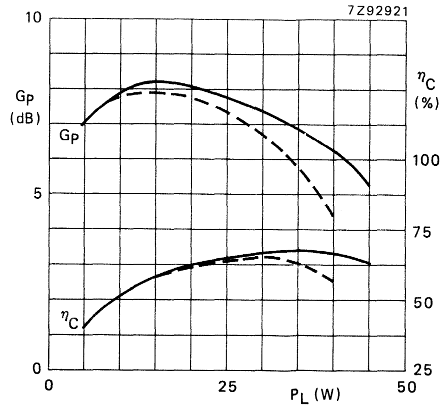


Fig. 10 Power gain and efficiency vs. load power.
——— $T_h = 25\,^oC$;
– – – $T_h = 70\,^oC$.

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; f = 470 MHz; class-B operation; T_h = 25 ^oC and 70 ^oC; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) up to 38 W under the following conditions:
V_{CE} = 15,5 V; f = 470 MHz; T_h = 25 ^oC; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

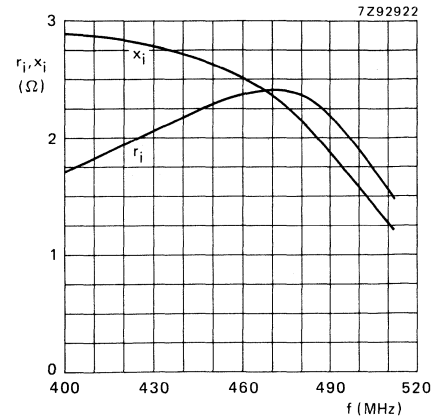


Fig. 11 Input impedance (series components).

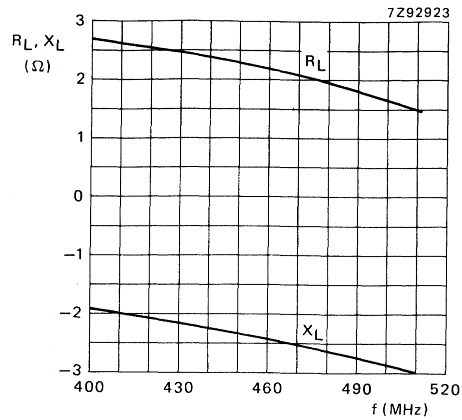


Fig. 12 Load impedance (series components).

Conditions for Figs 11, 12 and 13:

V_{CE} = 12,5 V; P_L = 30 W; f = 400–512 MHz; T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W; typical values.

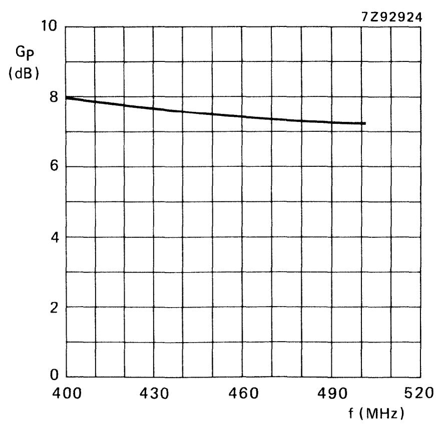


Fig. 13 Power gain versus frequency.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-119 envelope primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
- internal matching to achieve an optimum wideband capability and high power gain.
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	470	45	> 4,8	> 55

MECHANICAL DATA

Dimensions in mm

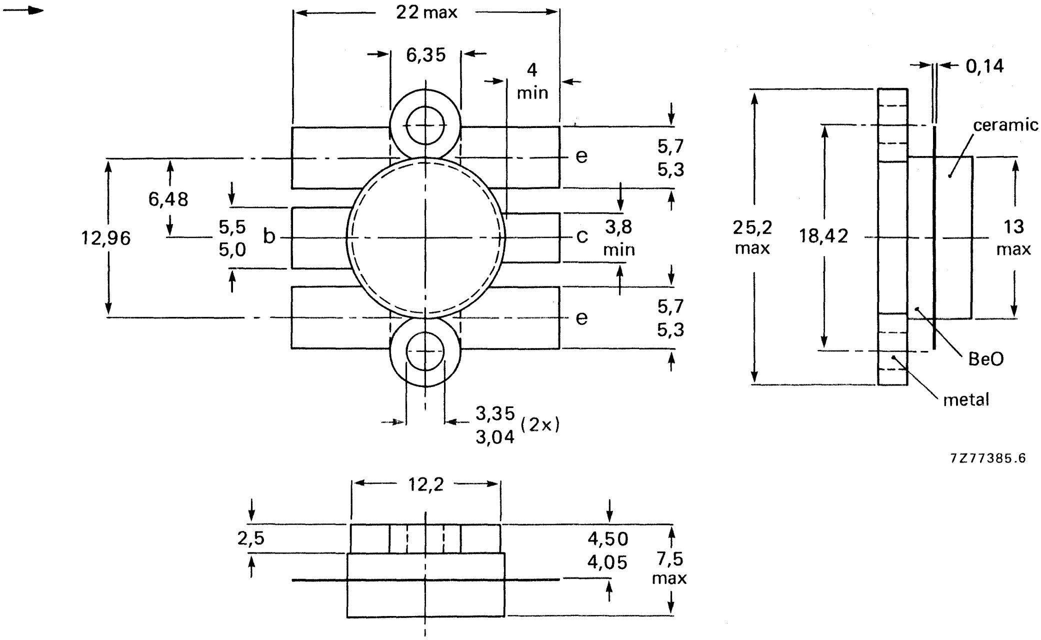
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119



Torque on screw:	min. 0,6 Nm (6 kg.cm) max. 0,75 Nm (7,5 kg.cm)
Recommended screw:	cheese-head 4-40 UNC/2A

Heatsink compound must be applied and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C	max.	9 A
(peak value); f > 1 MHz	I_{CM}	max.	27 A
Total power dissipation at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	87 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

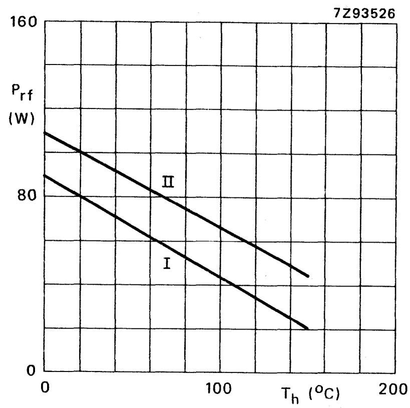


Fig. 2 Power/temperature derating curves.

I Continuous operation (f > 1 MHz).

II Short-time operation during mismatch (f > 1 MHz).

MAXIMUM THERMAL RESISTANCE

Dissipation = 54 W; T_{amb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb}$	max.	1,7 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	min.	36	V
Collector-emitter breakdown voltage open base; I_C = 200 mA	$V_{(BR)CEO}$	min.	16,5	V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	min.	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	44	mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	15	mJ
D.C. current gain V_{CE} = 10 V; I_C = 8 A	h_{FE}	min. typ.	15 60	
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	170	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5	C_{re}	typ.	100	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

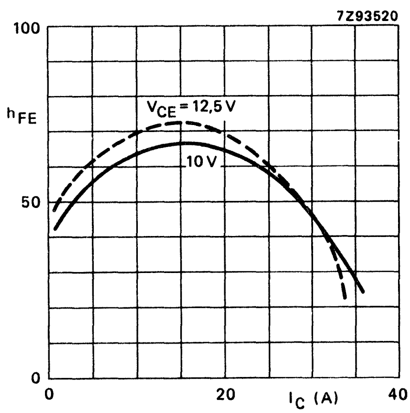


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

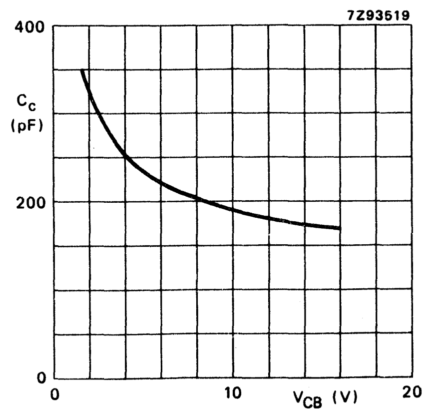


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

APPLICATION INFORMATION

R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	470	45	> 4,8 typ. 5,8	> 55 typ. 61

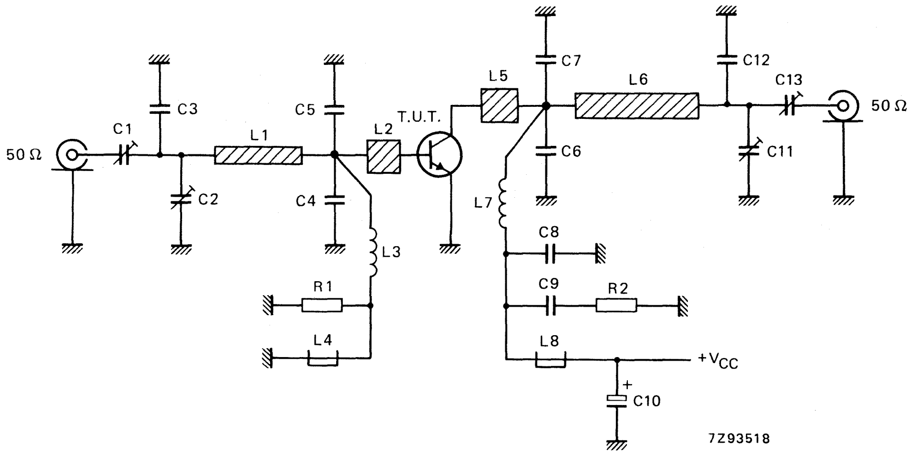


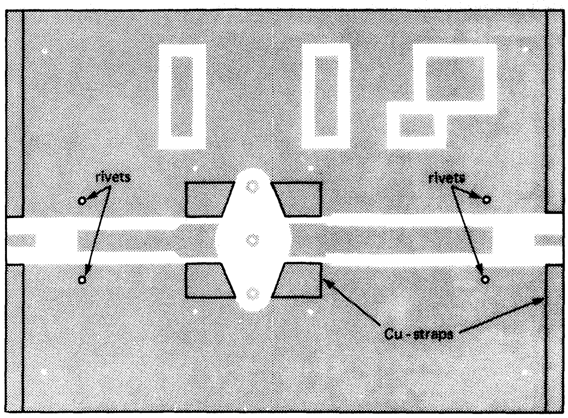
Fig. 5 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C13 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 12 pF multilayer ceramic chip capacitor*
C4 = C5 = 8,2 pF multilayer ceramic chip capacitor**
C6 = C7 = 15 pF multilayer ceramic chip capacitor*
C8 = 110 pF multilayer ceramic chip capacitor*
C9 = 3 x 100 nF multilayer ceramic chip capacitor in parallel
C10 = 2,2 μF (35 V) electrolytic capacitor
C12 = 5,6 pF multilayer ceramic chip capacitor*
L1 = 34,6 Ω stripline (17 mm x 4 mm)
L2 = L5 = 25,3 Ω stripline (6 mm x 6 mm)
L3 = 45 nH; 4 turns, closely wound enamelled Cu-wire (0,5 mm); int. dia. 2,5 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L6 = 29,2 Ω stripline (25,5 mm x 5 mm)
L7 = 10 nH; 1 turn Cu-wire (1,0 mm); int. dia. 5 mm; leads 2 x 5 mm
R1 = 1 Ω ± 5% (0,4 W) metal film resistor
R2 = 10 Ω ± 5% (1,0 W) metal film resistor

* American Technical Ceramics capacitor type B or capacitor of the same quality.
** Idem type A.

Striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (E_r = 2,2); thickness 1/32 inch.



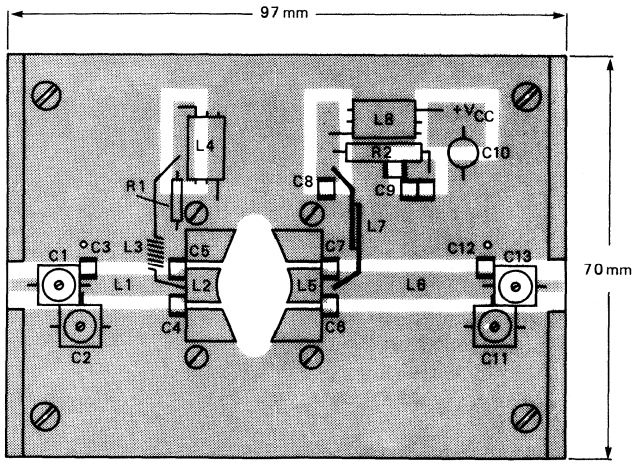


Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

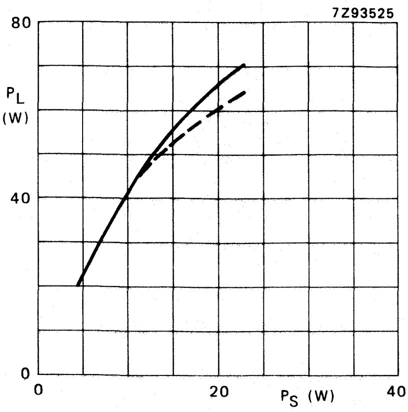


Fig. 7 Load power versus source power.

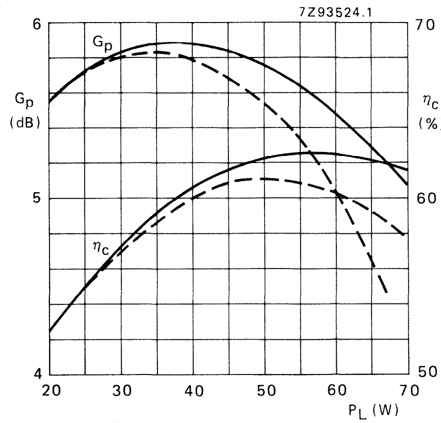


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

Typical values; V_{CE} = 12,5 V; f = 470 MHz; T_h = 25 °C (——) and 70 °C (– – –);
$R_{th\ mb\text{-}h}$ = 0,2 K/W; class-B operation.

RUGGEDNESS

The BLU45/12 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) up to 55 W under the following conditions: V_{CE} = 15,5 V; f = 470 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

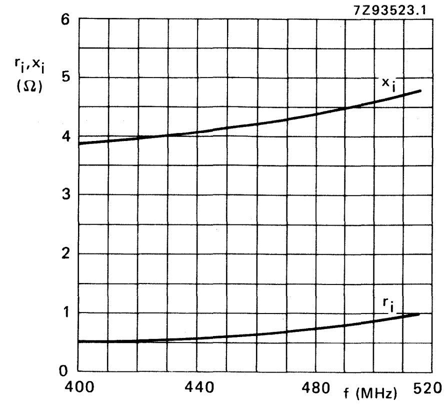


Fig. 9 Input impedance
(series components).

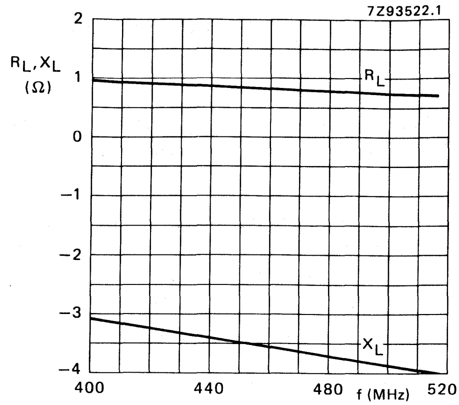


Fig. 10 Load impedance
(series components).

Conditions for Figs 9, 10 and 11 (class-B operation):

Typical values; V_{CE} = 12,5 V; P_L = 45 W; f = 400 to 512 MHz; T_h = 25 °C;
$R_{th\,mb\text{-}h}$ = 0,2 K/W.

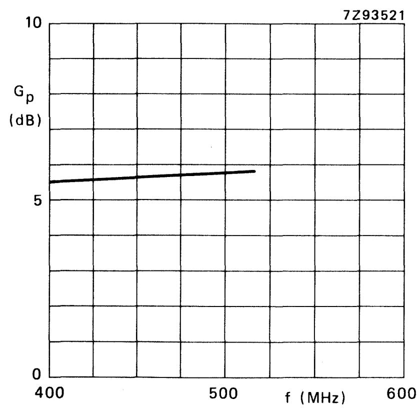


Fig. 11 Power gain versus frequency.

V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:

- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

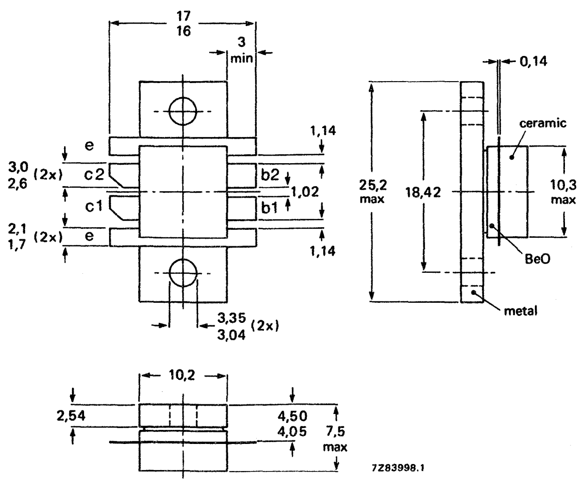
R.F. performance in a common-emitter class-B wideband (100—400 MHz) circuit at T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
c.w.	28	400	30	> 10	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.



Torque on screw: min. 0,60 Nm (6,0 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be sparingly applied and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	60 V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current d.c.	I_C	max.	2 x 1,8 A
Total power dissipation * at T_{mb} = 75 °C	P_{tot}	max.	45 W*
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (total device)

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	2,7 K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	60 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	3,5 V
Collector-base capacitance I_E = i_e = 0; V_{CB} = 28 V	C_{cb}	typ.	2 x 10 pF

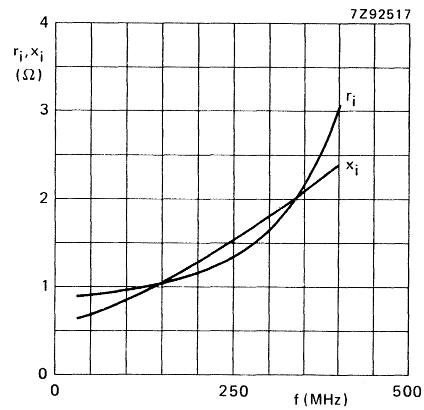


Fig. 2 Input impedance (series components; either section).

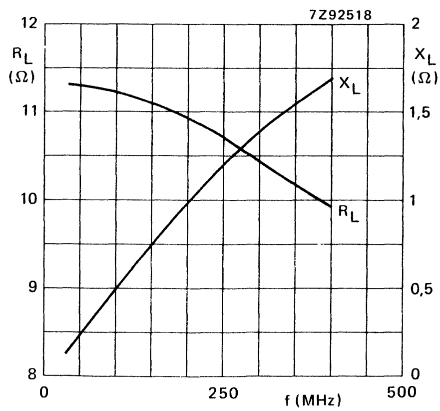


Fig. 3 Load impedance (series components; either section).

Conditions for Figs 2 and 3:
Typical values; V_{CE} = 28 V; P_L = 30 W; T_h = 25 °C; class-B operation.

* Dissipation of either transistor section should not exceed half rated dissipation.

V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:

- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

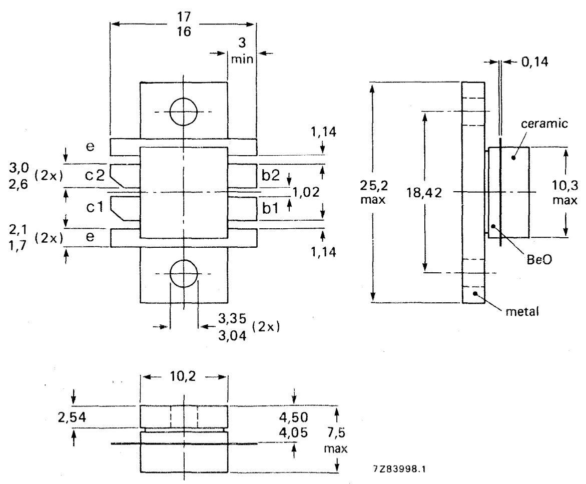
R.F. performance in a common-emitter class-B wideband (100–400 MHz) circuit at T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
c.w.	28	400	45	> 9	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.



Torque on screw: min. 0,60 Nm (6,0 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	60 V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	45 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current d.c.	I_C	max.	2 x 2,5 A
Total power dissipation* at T_{mb} = 75 °C	P_{tot}	max.	65 W*
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (total device)

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	2 K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 20 mA	$V_{(BR)CES}$	>	60 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	3,5 V
Collector-base capacitance I_E = i_e = 0; V_{CB} = 28 V	C_{cb}	typ.	2 x 15 pF

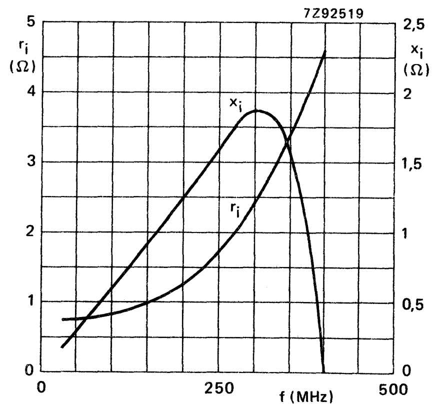


Fig. 2 Input impedance (series components; either section).

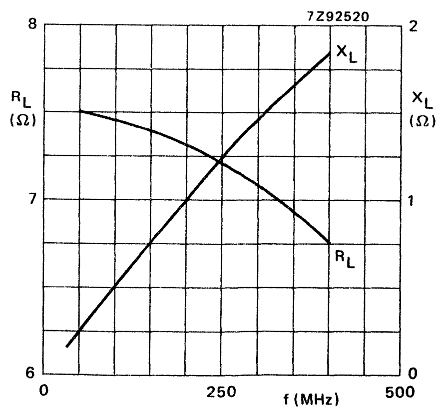


Fig. 3 Load impedance (series components; either section).

Conditions for Figs 2 and 3:
Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C; class-B operation.

* Dissipation of either transistor section should not exceed half rated dissipation.

V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:

- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

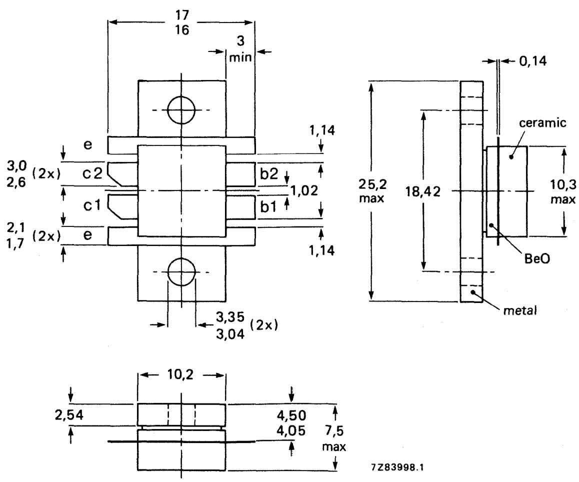
R.F. performance in a common-emitter class-B wideband (100—400 MHz) circuit at T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
c.w.	28	400	60	> 8	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.



Torque on screw: min. 0,60 Nm (6,0 kg.cm)
max. 0,75 Nm (7,5 kg.cm)
Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current d.c.	I_C	max.	2 x 4	A
Total power dissipation* at T_{mb} = 75 °C	P_{tot}	max.	95	W*
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (total device)

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	1,3	K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 20 mA	$V_{(BR)CES}$	>	60	V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	3,5	V
Collector-base capacitance $I_E = i_e = 0$; V_{CB} = 28 V	C_{cb}	typ.	2 x 22	pF

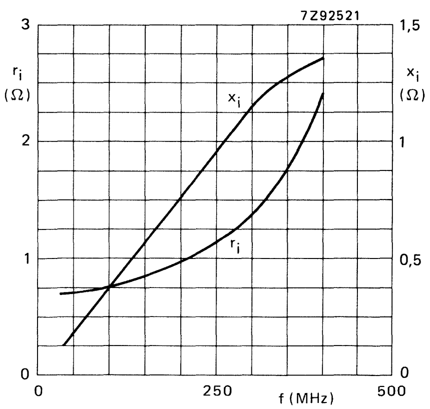


Fig. 2 Input impedance
(series components; either section).

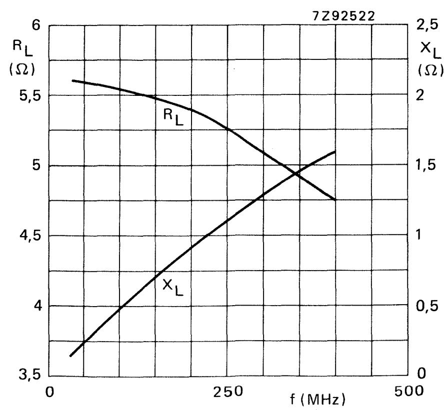


Fig. 3 Load impedance
(series components; either section).

Conditions for Figs 2 and 3:
Typical values; V_{CE} = 28 V; P_L = 60 W; T_h = 25 °C; class-B operation.

* Dissipation of either transistor section should not exceed half rated dissipation.

V.H.F./U.H.F. PUSH-PULL POWER TRANSISTOR

N-P-N silicon planar epitaxial push-pull transistor designed for use in military and professional wideband applications in the 30 to 400 MHz range.

Features:

- Diffused emitter ballasting resistors providing excellent current sharing and ruggedness;
- Gold metallization ensures excellent reliability;
- Multicell geometry giving good balance of dissipated power and low thermal resistance;
- Internal input matching to achieve an optimum wideband capability and high power gain.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

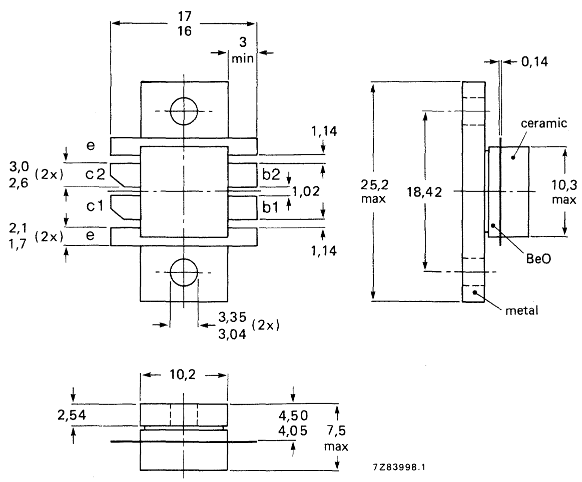
R.F. performance in a common-emitter class-C wideband circuit at T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
c.w.	28	225–400	100	> 7	> 55
c.w.	28	100–400	100	> 6	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.



Torque on screw: min. 0,60 Nm (6,0 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be sparingly applied and evenly distributed

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	60	V
Collector-emitter voltage (R_{BE} = 10 Ω)	V_{CER}	max.	45	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current d.c.	I_C	max.	2 x 5	A
Total power dissipation* at T_{mb} = 75 °C	P_{tot}	max.	125	W*
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (total device)

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	1,0	K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 100 mA	$V_{(BR)CES}$	>	60	V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	3,5	V
Collector-base capacitance $I_E = i_e = 0$; V_{CB} = 28 V	C_{cb}	typ.	2 x 30	pF

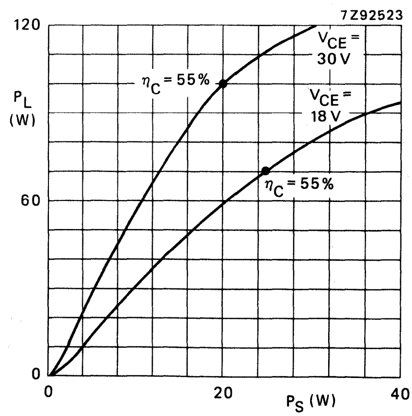


Fig. 2 Load power vs. source power.

* Dissipation of either transistor section should not exceed half rated dissipation.

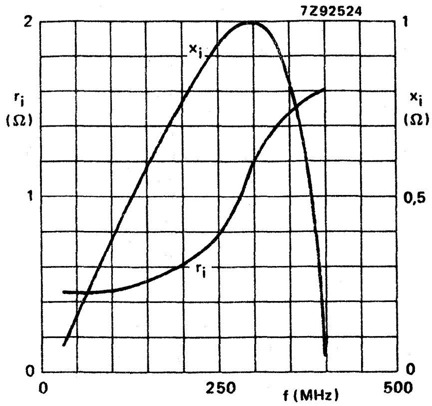


Fig. 3 Input impedance
(series components; either section).

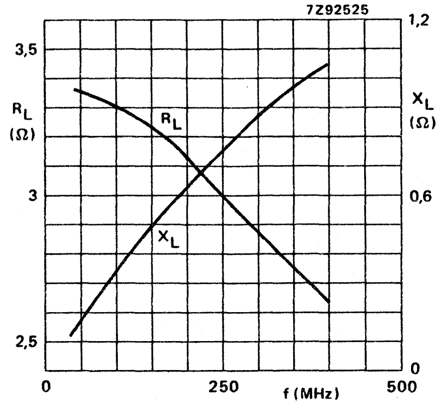


Fig. 4 Load impedance
(series components; either section).

Conditions for Figs 3 and 4:
Typical values: V_{CE} = 28 V; P_L = 100 W; T_h = 25 °C; class-C operation.

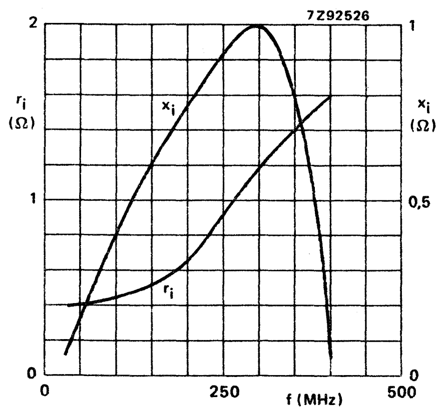


Fig. 5 Input impedance
(series components; either section).

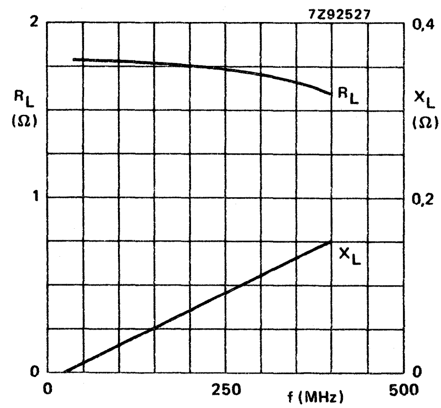


Fig. 6 Load impedance
(series components; either section).

Conditions for Figs 5 and 6:
Typical values: V_{CE} = 18 V; P_L = 70 W; T_h = 25 °C; class-C operation.

APPLICATION INFORMATION

R.F. performance in a common-emitter class-C wideband circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
c.w.	28	100–400	100	> 6	> 50
c.w.	28	225–400	100	> 7	> 55

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-119 envelope primarily intended for use in mobile radio transmitters in the 470 MHz communications band.

Features

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
- internal matching to achieve an optimum wideband capability and high power gain.
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	470	60	> 4,4	> 55

MECHANICAL DATA

Dimensions in mm

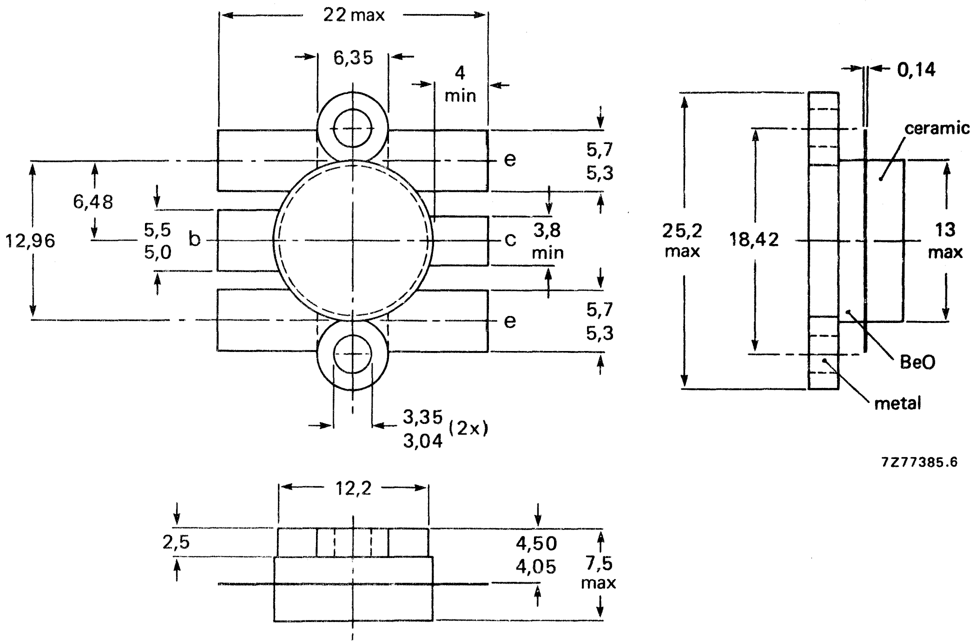
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current d.c. or average	I_C	max.	12	A
(peak value); f > 1 MHz	I_{CM}	max.	36	A
Total power dissipation at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	110	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

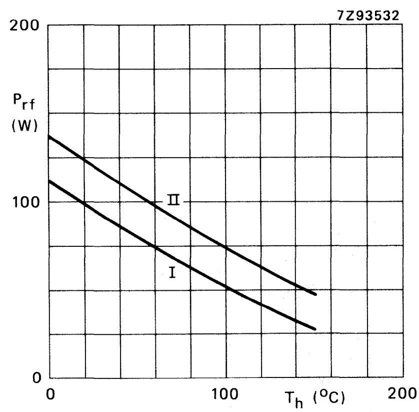


Fig. 2 Power/temperature derating curves.

I Continuous operation (f > 1 MHz).
II Short-time operation during mismatch (f > 1 MHz).

MAXIMUM THERMAL RESISTANCE

Dissipation = 72 W; T_{amb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb}$	max.	1,4	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	min.	36	V
Collector-emitter breakdown voltage open base; I_C = 200 mA	$V_{(BR)CEO}$	min.	16,5	V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	min.	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	44	mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	15	mJ
D.C. current gain V_{CE} = 10 V; I_C = 8 A	h_{FE}	min. typ.	15 60	
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 12,5 V	C_c	typ.	170	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5	C_{re}	typ.	100	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

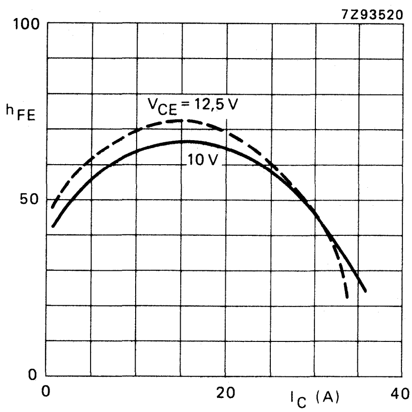


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

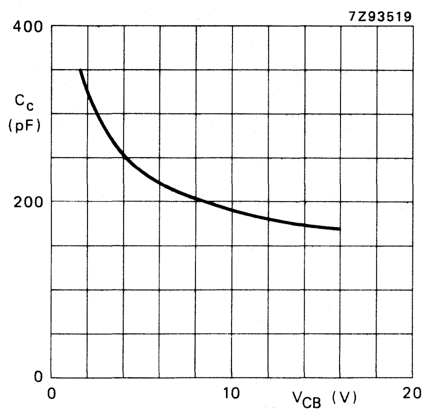


Fig. 4 Output capacitance versus V_{CB}; I_E = i_e = 0; f = 1 MHz.

APPLICATION INFORMATION

R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	470	60	> 4,4 typ. 5,5	> 55 typ. 62

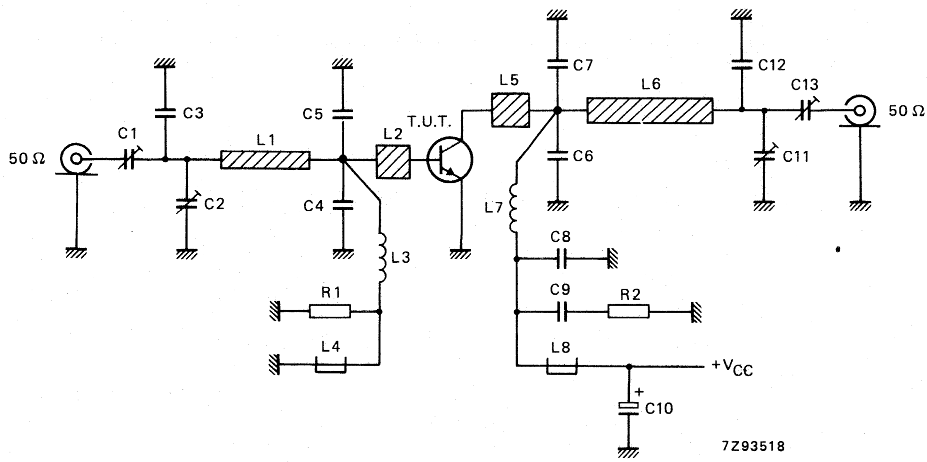


Fig. 5 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C13 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 12 pF multilayer ceramic chip capacitor*
C4 = C5 = 8,2 pF multilayer ceramic chip capacitor**
C6 = C7 = 15 pF multilayer ceramic chip capacitor*
C8 = 110 pF multilayer ceramic chip capacitor*
C9 = 3 x 100 nF multilayer ceramic chip capacitor in parallel
C10 = 2,2 μF (35 V) electrolytic capacitor
C12 = 5,6 pF multilayer ceramic chip capacitor*
L1 = 34,6 Ω stripline (17 mm x 4 mm)
L2 = L5 = 25,3 Ω stripline (6 mm x 6 mm)
L3 = 45 nH; 4 turns, closely wound enamelled Cu-wire (0,5 mm); int. dia. 2,5 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L6 = 29,2 Ω stripline (25,5 mm x 5 mm)
L7 = 10 nH; 1 turn Cu-wire (1,0 mm); int. dia. 5 mm; leads 2 x 5 mm
R1 = 1 Ω ± 5% (0,4 W) metal film resistor
R2 = 10 Ω ± 5% (1,0 W) metal film resistor

* American Technical Ceramics capacitor type B or capacitor of the same quality.
** Idem type A.

Striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (E_r = 2,2); thickness 1/32 inch.

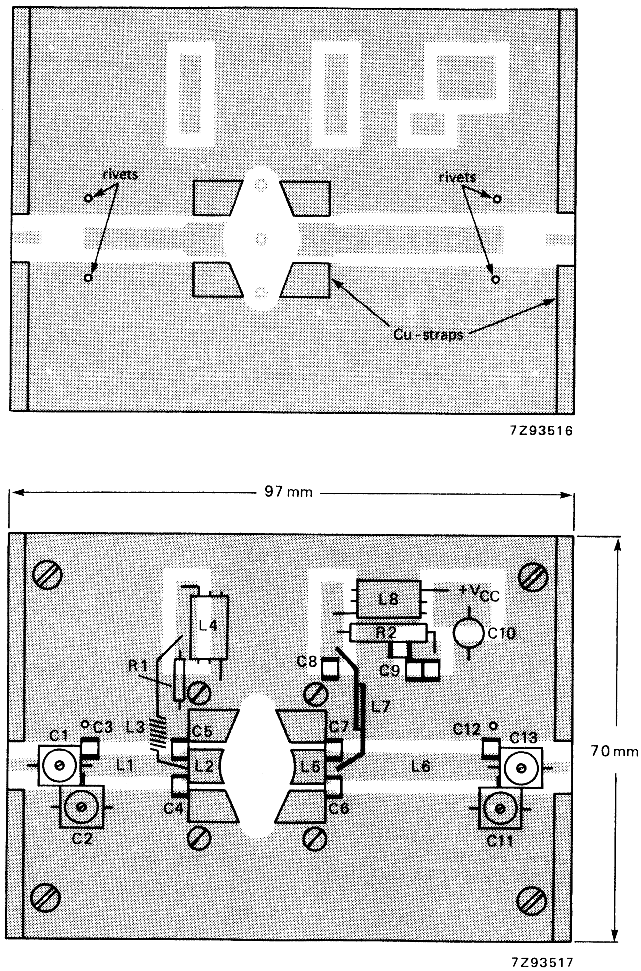


Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

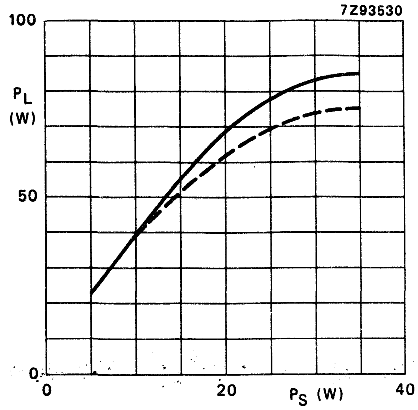


Fig. 7 Load power versus source power.

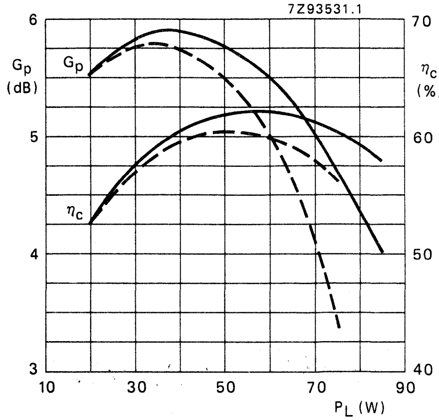


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

Typical values; V_{CE} = 12,5 V; f = 470 MHz; T_h = 25 °C (——) and 70 °C (– – –);
$R_{th\ mb\text{-}h}$ = 0,2 K/W; class-B operation.

RUGGEDNESS

The BLU60/12 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) up to 70 W under the following conditions; V_{CE} = 15,5 V; f = 470 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

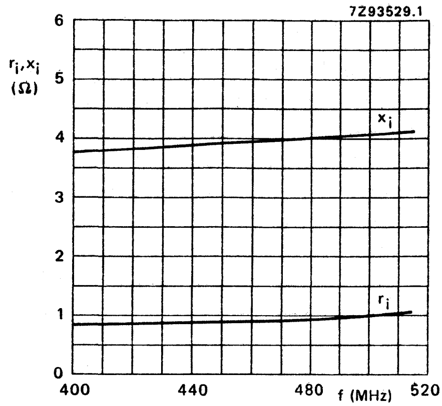


Fig. 9 Input impedance
(series components).

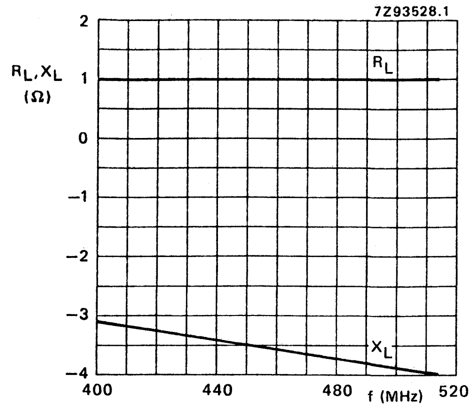


Fig. 10 Load impedance
(series components).

Conditions for Figs 9, 10 and 11 (class-B operation):

Typical values; V_{CE} = 12,5 V; P_L = 60 W; f = 400 to 512 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

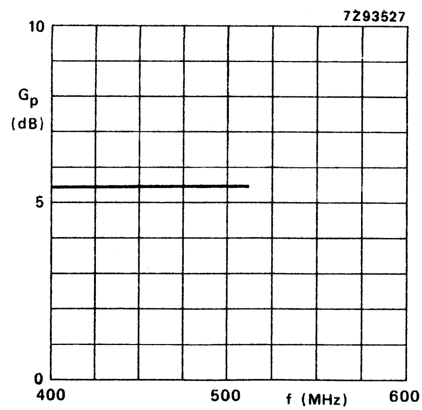


Fig. 11 Power gain versus frequency.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 470 MHz band.

Features:

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-122). All leads are isolated from the stud.

QUICK REFERENCE DATA

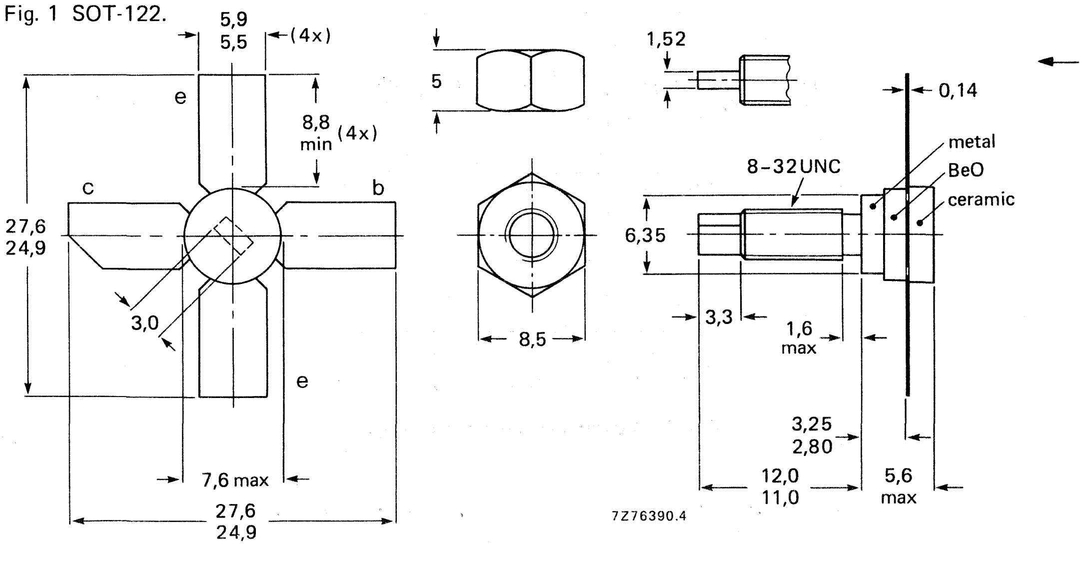
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	470	7	> 8,5	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg.cm)
max. 0,85 Nm (8,5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
Deburring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
d.c. or average	I_C	max.	1,2	A
(peak value); f > 1 MHz	I_{CM}	max.	3,6	A
Total power dissipation				
at T_{mb} = 52 °C	$P_{tot(d.c.)}$	max.	17	W
f > 1 MHz; T_{mb} = 52 °C	$P_{tot(r.f.)}$	max.	22,5	W
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

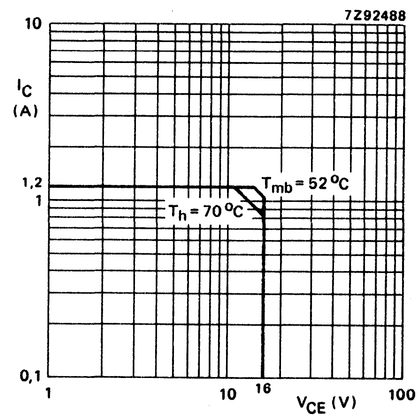


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,6 K/W.

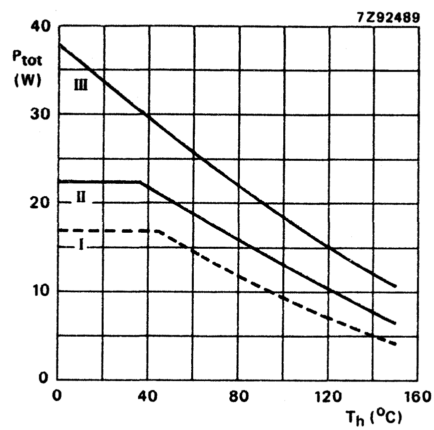


Fig. 3 Power/temperature derating curves.
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE

Dissipation = 15 W; T_{mb} = 25 °C

From junction to mounting base				
(d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	7,5	K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	5,6	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I_C = 15 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage, open base; I_C = 30 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage, open collector; I_E = 1,5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current, V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	7,5 mA
Second breakdown energy, L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	2,3 mJ
D.C. current gain, I_C = 0,9 A; V_{CE} = 10 V	h_{FE}	> typ.	25 100
Transition frequency at f = 500 MHz*, $-I_E$ = 0,9 A; V_{CB} = 12,5 V	f_T	typ.	4,0 GHz
Collector capacitance at f = 1 MHz, $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	10 pF
Feed-back capacitance at f = 1 MHz, I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	7 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF ←

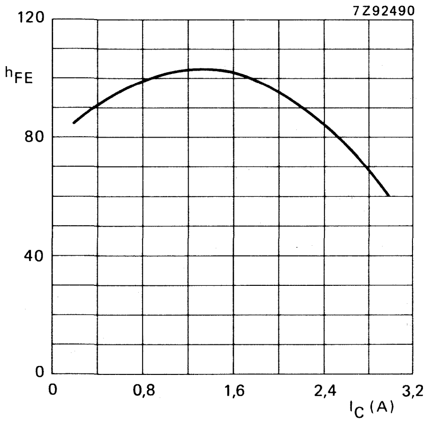


Fig. 4 T_j = 25 °C; V_{CE} = 10 V; typical values.

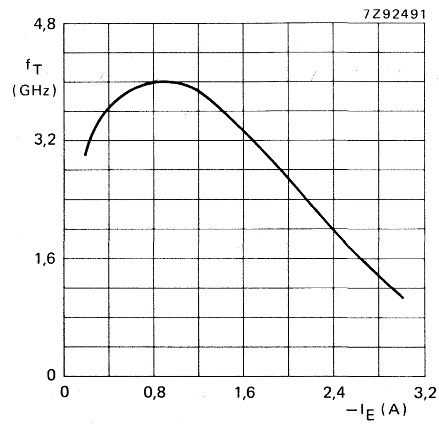


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; t_p = 50 μs; T_j = 25 °C; typical values.

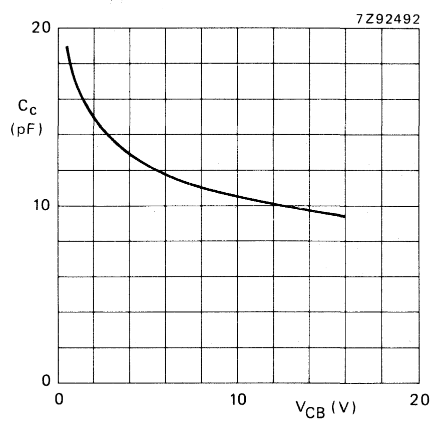


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* Measured under pulse conditions: t_p = 50 μs; δ < 1%.

APPLICATION INFORMATION

R.F. performance in common-emitter circuit; class-B: f = 470 MHz; T_h = 25 °C

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	7	< 0,99 typ. 0,55	> 8,5 typ. 11,0	< 1,0 typ. 0,8	> 55 typ. 70

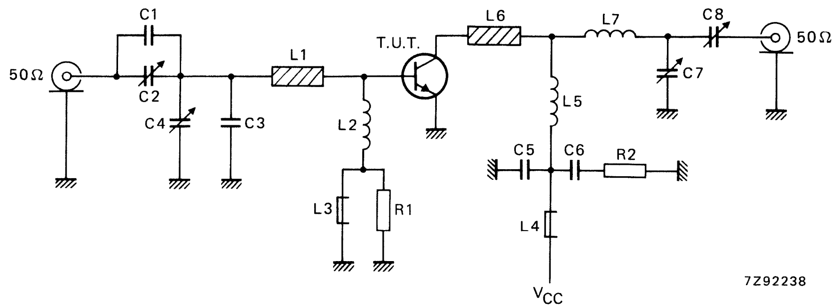


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor
C6 = 100 nF metallized film capacitor

L1 = 38 Ω stripline (22,5 mm x 6,0 mm)
L2 = 15 nH; 1 turn Cu wire (1,0 mm); int. dia. 5 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L5 = 29 nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 6 mm; length 3,5 mm; leads 2 x 5 mm
L6 = 38 Ω stripline (10,0 mm x 6,0 mm)
L7 = 7 nH; 1/2 turn Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω ± 10%; 0,25 W metal film resistor

L1 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.

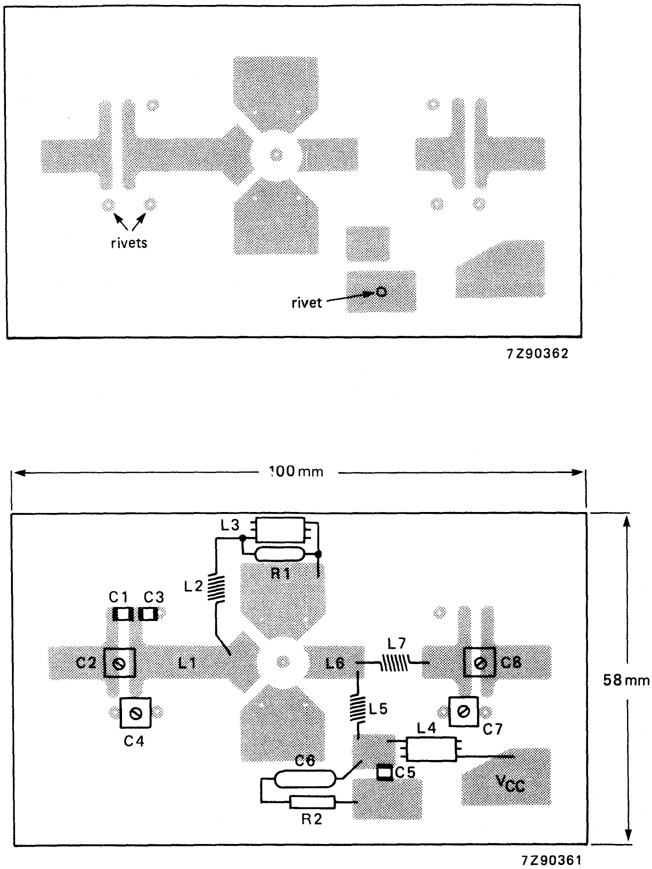


Fig. 8 Printed circuit board and component lay-out for 470 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by copper straps under the emitters.

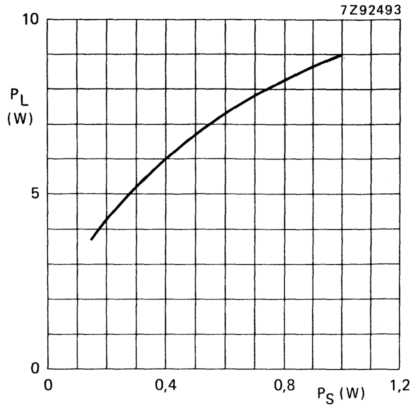


Fig. 9 Load power vs. source power.

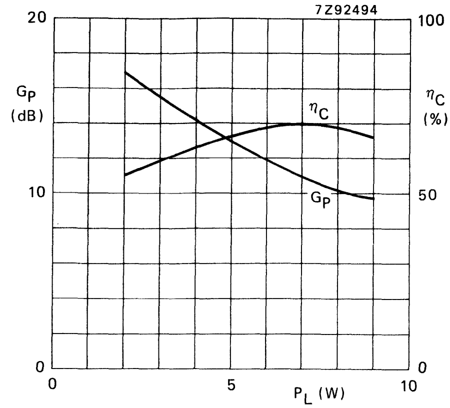


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; f = 470 MHz; T_h = 25 ^oC; class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V and T_h = 25 ^oC.

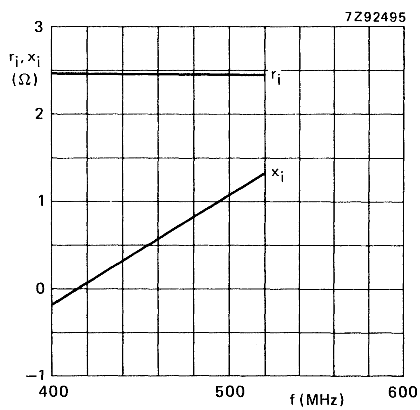


Fig. 11 Input impedance (series components).

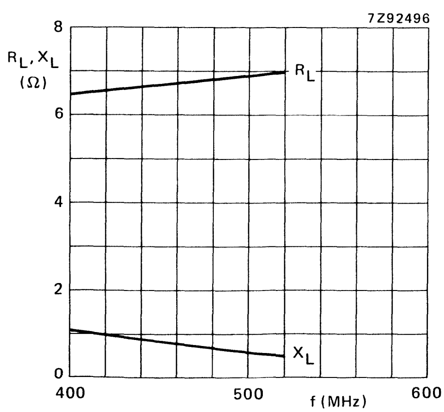


Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:

V_{CE} = 12,5 V; P_L = 7 W; f = 400-520 MHz; T_h = 25 ^oC; class-B operation; typical values.

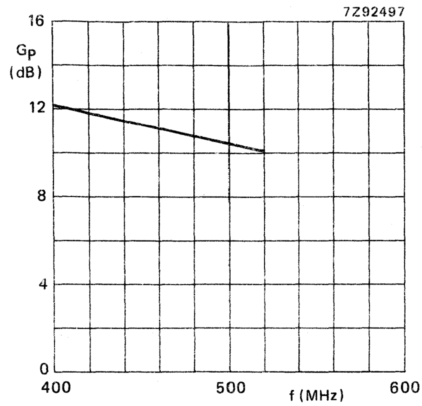


Fig. 13 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 7 W; f = 400-520 MHz; T_h = 25 °C;
class-B operation; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:

- emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor is encapsulated in a subminiature plastic transfer-moulded cross package (SOT-103).

QUICK REFERENCE DATA

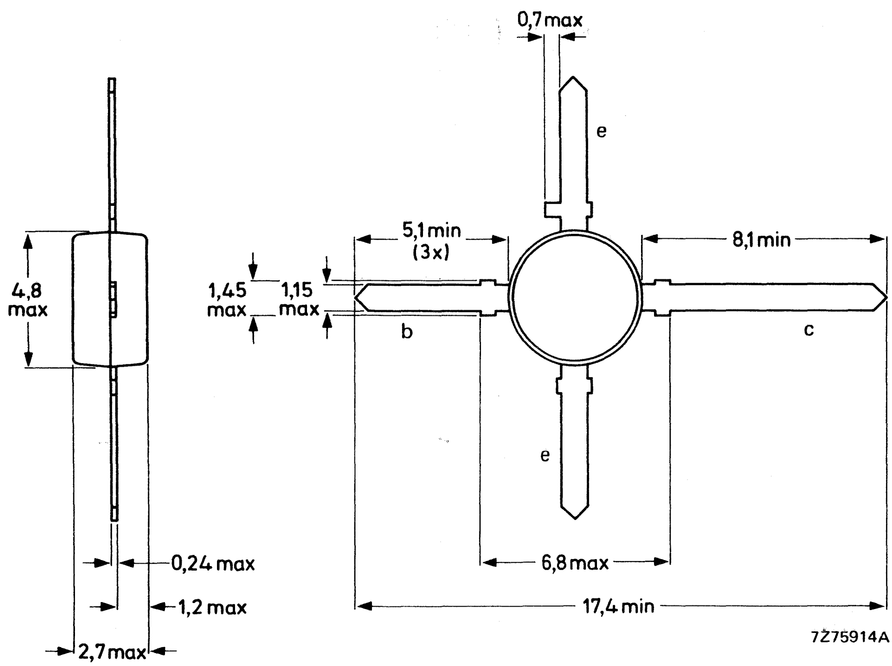
R.F. performance at T_{amb} = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	900	0,5	> 8,0	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-103.



RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
d.c. or average	I_C	max.	150	mA
(peak value); f > 1 MHz	I_{CM}	max.	500	mA
Total power dissipation at $T_{coll.\ tap}$ = 75 °C	P_{tot}	max.	1,65	W
Total power dissipation* at T_{amb} = 25 °C	P_{tot}	max.	1,0	W
Storage temperature	T_{stg}	−65 to	+150	°C
Operating junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE*

From junction to collector tap (d.c.)	$R_{th\ j\text{-}ct(dc)}$	=	60	K/W
From junction to ambient (d.c.)	$R_{th\ j\text{-}a(dc)}$	=	150	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 2,5 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16	V
Emitter-base breakdown voltage open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	>	3	V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	1	mA
D.C. current gain I_C = 100 mA; V_{CE} = 10 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz** $-I_E$ = 100 mA; V_{CB} = 12,5 V	f_T	typ.	4,0	GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 12,5 V	C_c	typ.	2,1	pF
Feed-back capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	1,3	pF

* Transistor mounted on a p.c. board with a collector area of 50 mm².
** Measured under pulse conditions: t_p = 50 μs; $\delta < 1\%$.

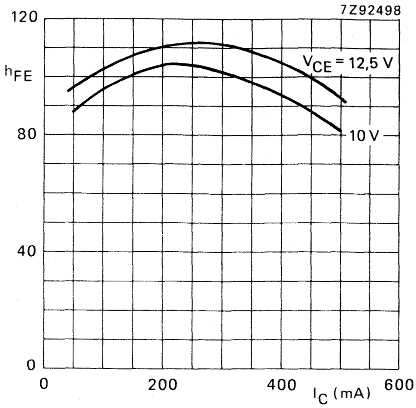


Fig. 2 T_j = 25 °C; typical values.

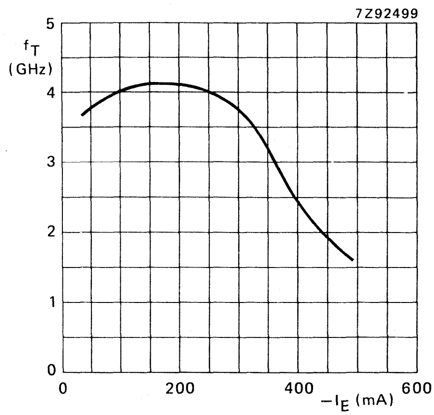


Fig. 3 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

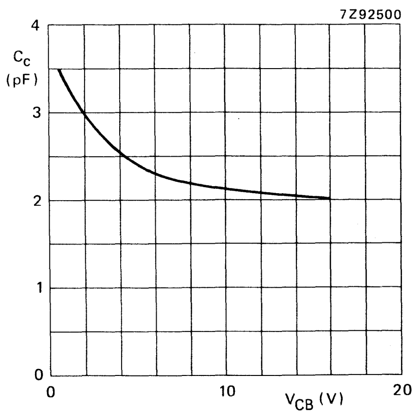


Fig. 4 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_{amb} = 25 °C

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C mA	η_C %
narrow band; c.w.	12,5	0,5	< 0,079 typ. 0,056	> 8,0 typ. 9,5	< 80 typ. 62	> 50 typ. 65

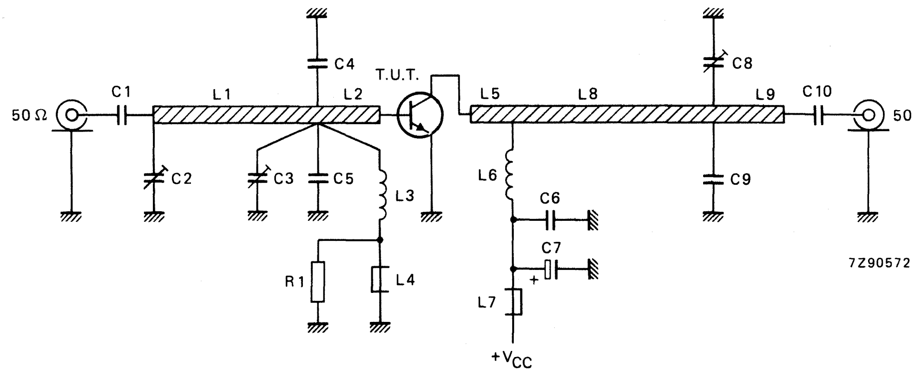


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

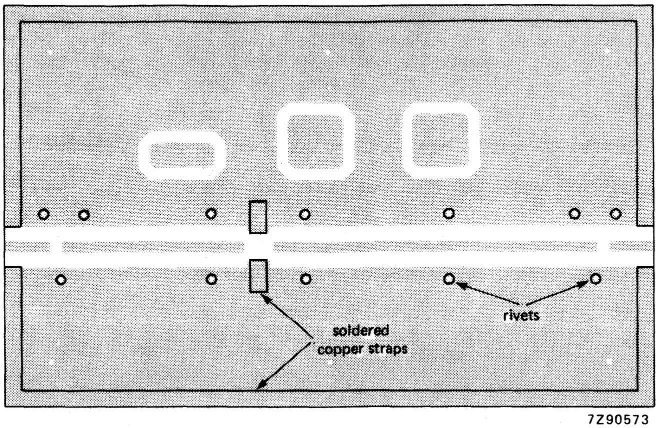
C1 = C6 = C10 = 330 pF multilayer ceramic chip capacitor
C2 = C3 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 6,8 pF multilayer ceramic chip capacitor*
C7 = 6,8 μF (63 V) electrolytic capacitor
C8 = 1,0 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C9 = 1,2 pF multilayer ceramic chip capacitor*

L1 = 50 Ω stripline (24,0 mm x 2,4 mm)
L2 = 50 Ω stripline (8,0 mm x 2,4 mm)
L3 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L4 = L7 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L5 = 50 Ω stripline (14,0 mm x 2,4 mm)
L6 = 245 nH; 9 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5 mm; leads 2 x 3 mm
L8 = 50 Ω stripline (32,5 mm x 2,4 mm)
L9 = 50 Ω stripline (10,0 mm x 2,4 mm)

R1 = 10 Ω ± 10%; 0,25 W metal film resistor

L1, L2, L5, L8 and L9 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



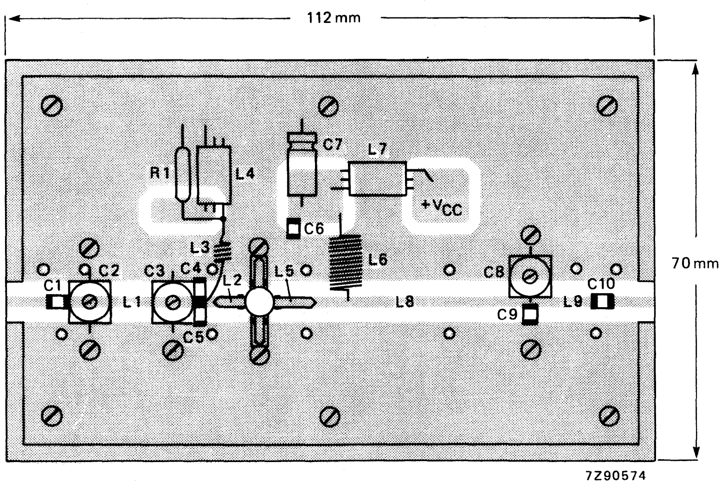


Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

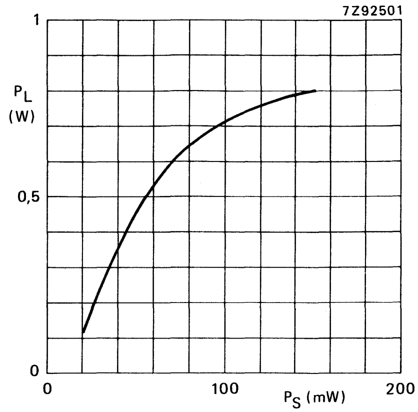


Fig. 7 Load power vs. source power.

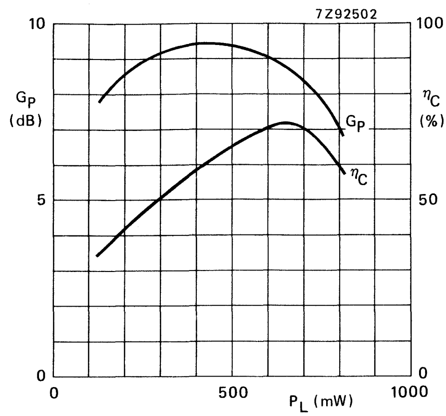


Fig. 8 Power gain and efficiency vs. load power.

Conditions for Figs 7 and 8:

V_{CE} = 12,5 V; f = 900 MHz; T_{amb} = 25 °C; class-B operation; test circuit tuned at P_L = 0,5 W; typical values.

RUGGEDNESS

The transistor is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V and T_{amb} = 25 °C.

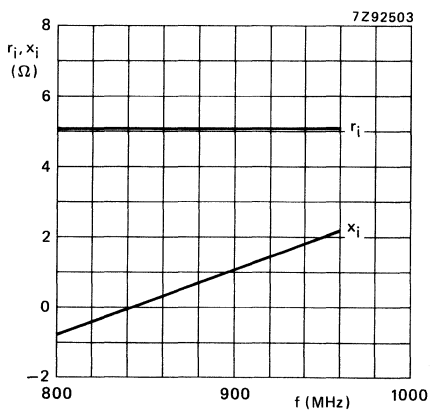


Fig. 9 Input impedance (series components).

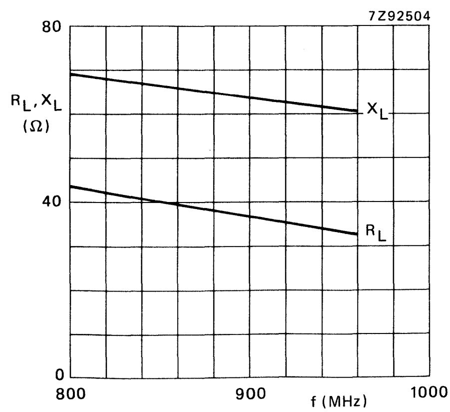


Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; P_L = 0,5 W; f = 800-960 MHz; T_{amb} = 25 °C; class-B operation; typical values.

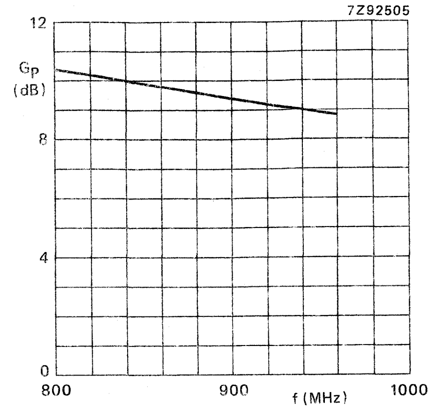


Fig. 11 Power gain vs. frequency.

V_{CE} = 12,5 V; P_L = 0,5 W; f = 800-960 MHz; T_{amb} = 25 °C; class-B operation; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the u.h.f. band. The transistor is also very suitable for application in the 900 MHz mobile radio band.

Features:

- multi-base structure and diffused emitter-ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-122). All leads are isolated from the stud.

QUICK REFERENCE DATA

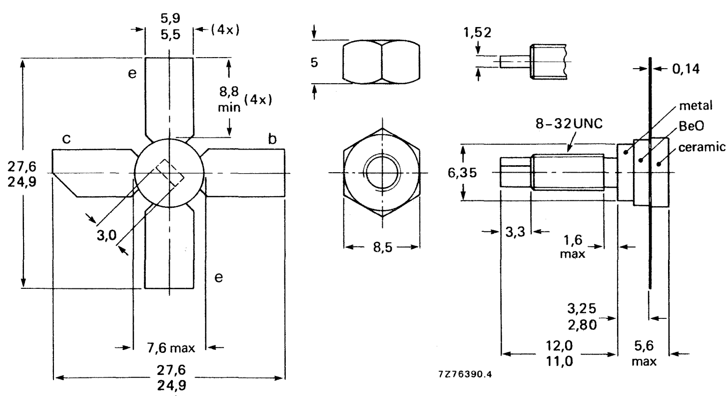
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_c %
narrow band; c.w.	12,5 12,5	470 900	5 4	> 10,5 typ. 7,0	> 60 typ. 60

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg.cm) max. 0,85 Nm (8,5 kg.cm)	Diameter of clearance hole in heatsink: max. 4,2 mm Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current			
d.c. or average	$I_C; I_{C(AV)}$	max.	0,8 A
peak value; f > 1 MHz	I_{CM}	max.	2,5 A
D.C. power dissipation up to T_{mb} = 50 °C	$P_{tot\ (d.c.)}$	max.	12,5 W
R.F. power dissipation			
f > 1 MHz; T_{mb} = 25 °C	$P_{tot\ (r.f.)}$	max.	19 W
Storage temperature	T_{stg}	−65 to +150 °C	
Operating junction temperature	T_j	max.	200 °C

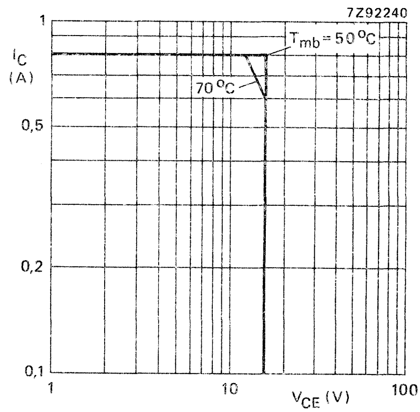


Fig. 2 D.C. SOAR.
$R_{th\ mb-h}$ = 0,6 K/W.

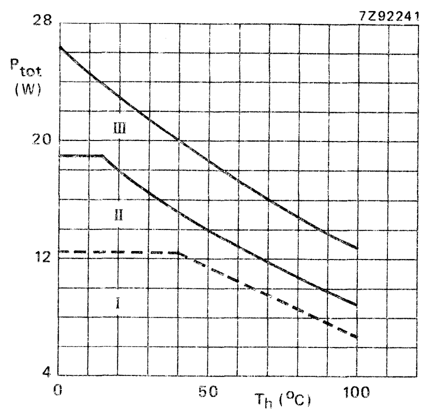


Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation.
II Continuous r.f. operation (f > 1 MHz).
III Short-time r.f. pperation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE (dissipation = 9 W; T_{mb} = 25 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j-mb(dc)}$	=	10 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j-mb(rf)}$	=	7,5 K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 20 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz R_{BE} = 10 Ω	E_{SBR}	>	1 mJ
D.C. current gain** I_C = 0,6 A; V_{CE} = 10 V	h_{FE}	> typ.	25 100
Transition frequency at f = 500 MHz* I_C = 0,6 A; V_{CE} = 12,5 V	f_T	typ.	4,0 GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 12,5 V	C_c	typ.	7,5 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	5 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: t_p = 50 μs; δ < 0,01.

** Measured under pulse conditions: t_p = 300 μs; δ < 0,01.

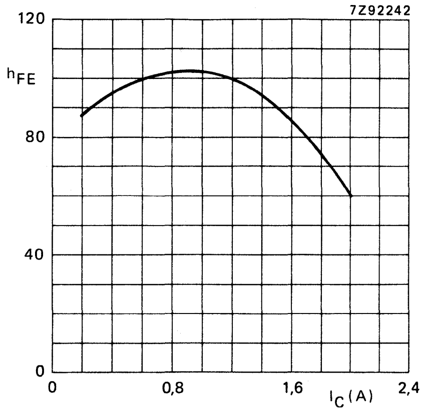


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; typ. values.

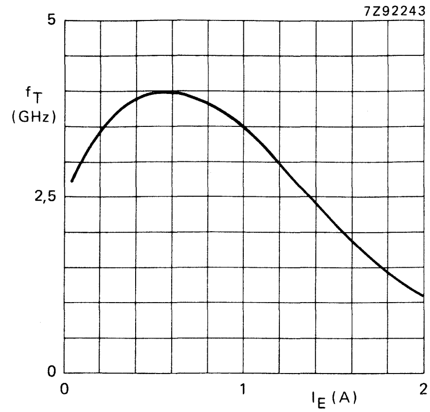


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typ. values.

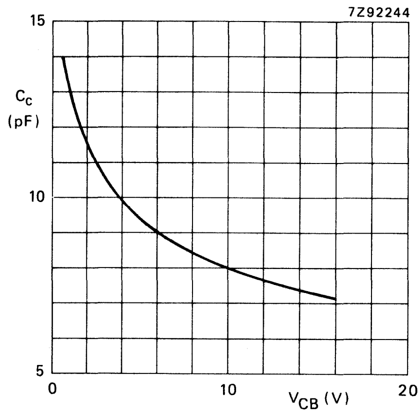


Fig. 6 I_E = i_e = 0; f = 1 MHz; typ. values.

APPLICATION INFORMATION (part I)

R.F. performance in c.w. operation (common-emitter class-B circuit) at f = 470 MHz; T_h = 25 °C.

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	5	< 0,45 typ. 0,32	> 10,5 typ. 12	< 0,665 typ. 0,60	> 60 typ. 66

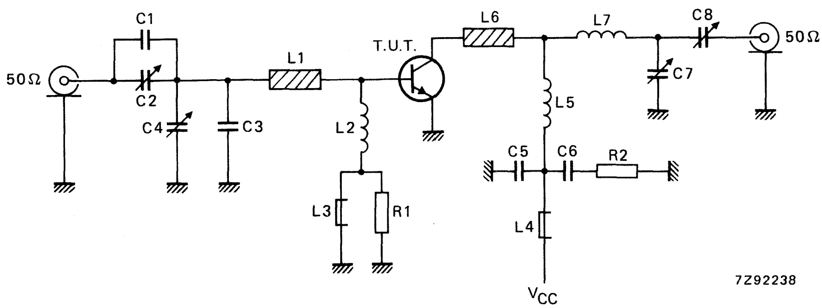


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

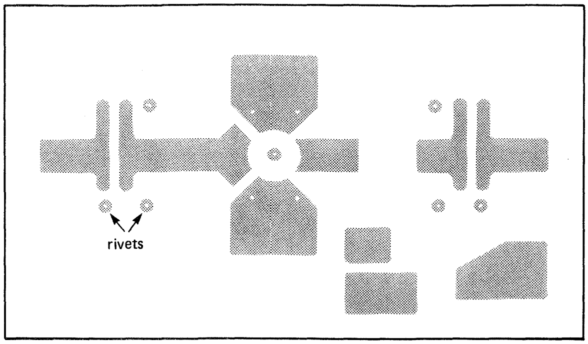
C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4-5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2-9 pF film dielectric trimmer (cat.no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13101)
C6 = 100 nF metallized fllm capacitor (cat. no. 2222 352 45104)

L1 = stripline, 22,5 mm x 6,0 mm
L2 = 1 turn Cu-wire (1,0 mm), int. dia. 5,5 mm, leads 2 x 5 mm
L3 = L4 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L5 = 4 turns enamelled Cu-wire (1,0 mm), int. dia. 6 mm, length 7,5 mm, leads 2 x 5 mm
L6 = stripline, 10,0 mm x 6,0 mm
L7 = 1 turn Cu-wire (1,0 mm), int. dia. 5 mm, leads 2 x 5 mm

R1 = R2 = 10 Ω metal film resistor, 0,25 W

L1 and L6 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74) and a thickness of 1/16 inch.

* American Technical Ceramics capacitor type 100 A or capacitor of same quality.



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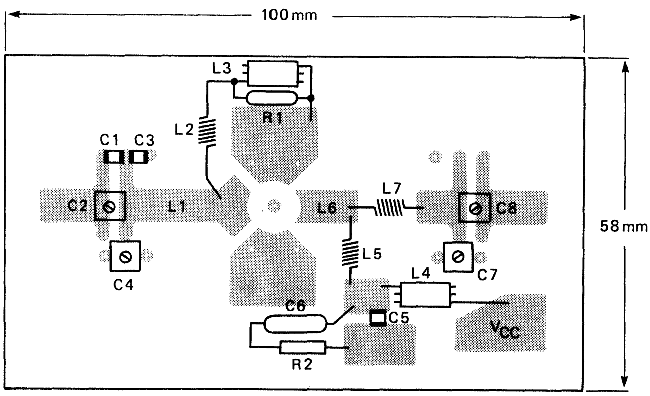

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Fig. 8 Printed circuit board and component layout for 470 MHz.

The circuits and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper to serve as ground plane. Earth connections are made by hollow rivets.

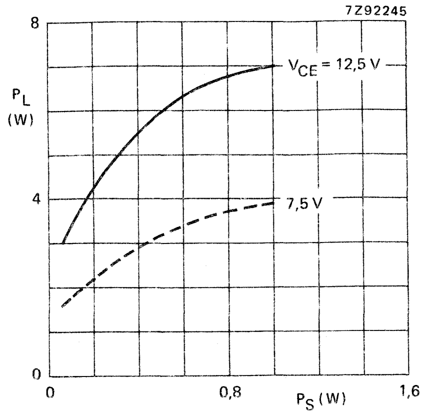


Fig. 9 Output power.

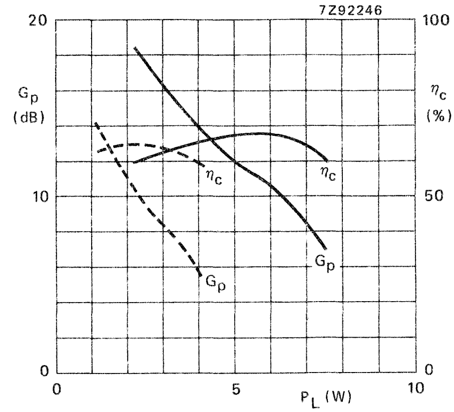


Fig. 10 Power gain and efficiency;
——— : V_{CE} = 12,5 V
– – – – : V_{CE} = 7,5 V.

Conditions for Figs 9 and 10:

f = 470 MHz; class-B operation; T_h = 25 °C; typ. values.

RUGGEDNESS:

The device is capable of withstanding a load mismatch with VSWR = 50 (all phases) up to a supply voltage of 15,5 V at rated load power.

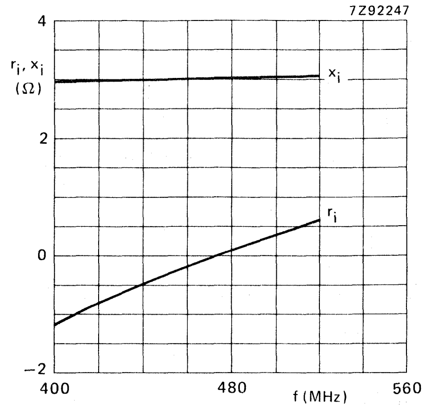


Fig. 11 Input impedance (series components).

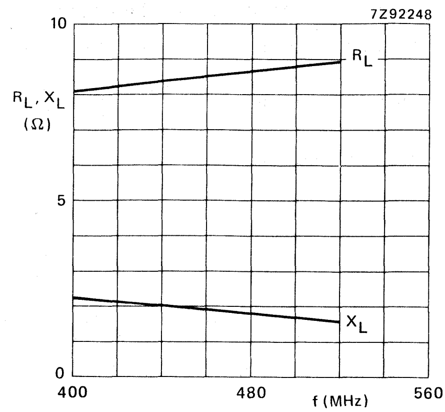


Fig. 12 Load impedance (series components).

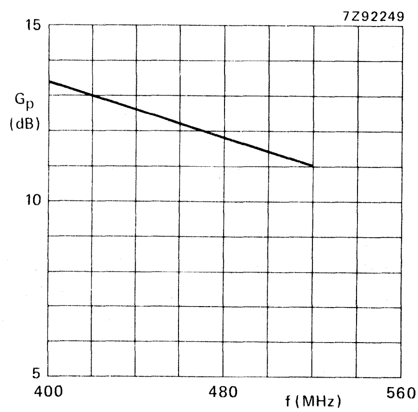


Fig. 13 Power gain.

Conditions for Figs 11, 12 and 13:

V_{CE} = 12,5 V; P_L = 5 W; T_h = 25 °C; f = 400-520 MHz; typical values.

APPLICATION INFORMATION (part II)

R.F. performance in c.w. operation (common-emitter class-B circuit) at f = 900 MHz; T_h = 25 °C

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	4	typ. 0,8	typ. 7,0	typ. 0,54	typ. 60

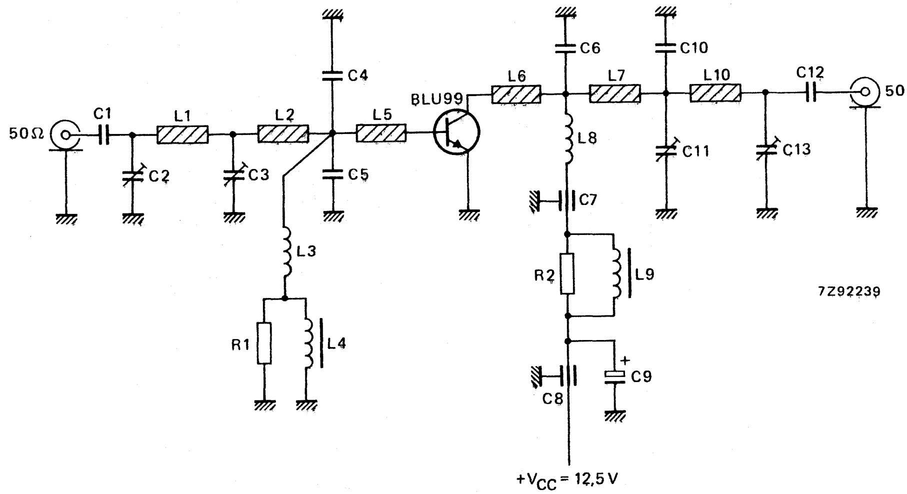


Fig. 14 Class-B test circuit at f = 900 MHz.

List of components:

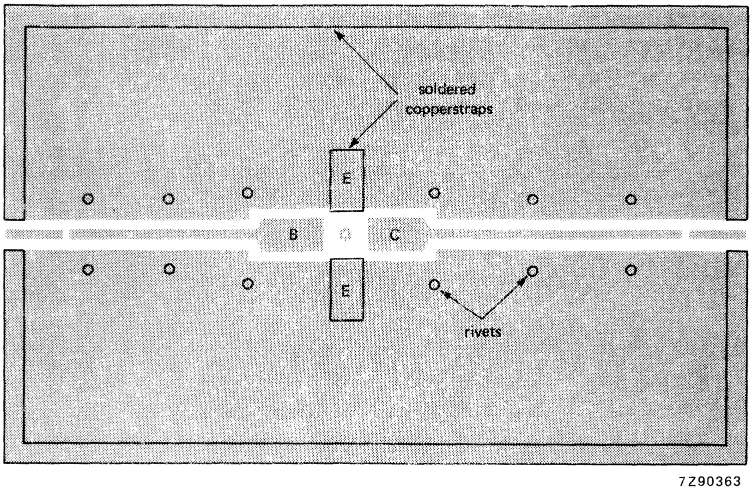
C1 = C12 = 33 pF multilayer ceramic chip capacitor*
C2 = C13 = 1,4-5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C11 = 1,2-3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = C5 = C10 = 6,2 pF multilayer ceramic chip capacitor*
C6 = 1 pF multilayer ceramic chip capacitor*
C7 = 10 pF ceramic feed-through capacitor
C8 = 330 pF ceramic feed-through capacitor
C9 = 2,2 μF tantalum electrolytic capacitor

L1 = stripline, 21,0 mm x 1,85 mm
L2 = stripline, 5,0 mm x 1,85 mm
L3 = 60 nH, 4 turns enamelled Cu-wire (0,4 mm), close wound, int. dia. 3 mm
L4 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat. no 4312 020 36642)
L5 = stripline, 11,3 mm x 6,0 mm
L6 = stripline, 10,0 mm x 6,0 mm
L7 = stripline, 15,9 mm x 1,85 mm
L8 = 280 nH, 15 turns enamelled Cu-wire (0,4 mm), close wound, int. dia. 3 mm
L10 = stripline, 28,0 mm x 1,85 mm

R1 = R2 = 10 Ω metal film resistor, 0,25 W

L1, L2, L5, L6, L7 and L10 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74) and thickness of 1/32 in.

* American Technical Ceramics capacitor type 100 A or capacitor of same quality.



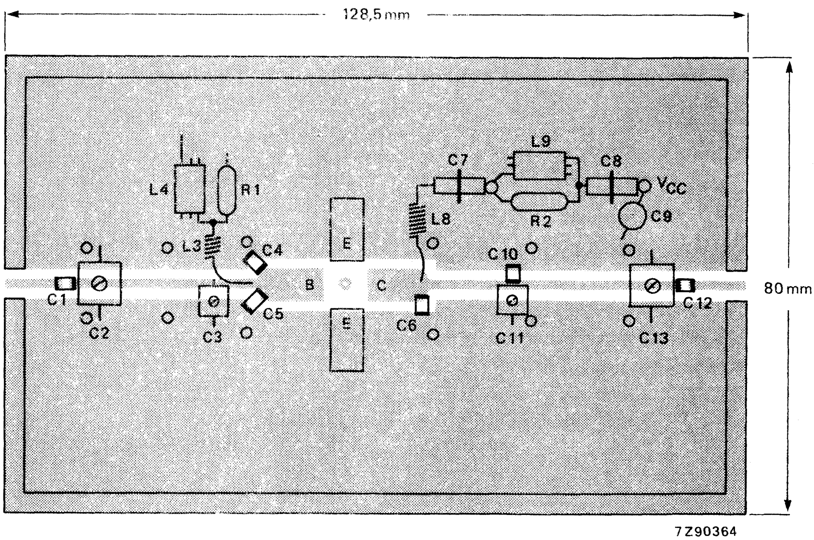


Fig. 15 Printed circuit board and component layout for a 900 MHz test circuit.

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper to serve as a ground plane. Earth connections are made by hollow rivets and also by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

RUGGEDNESS

The device is capable of withstanding a load mismatch with VSWR = 50 (all phases) up to a supply voltage of 15,5 V at rated load power.

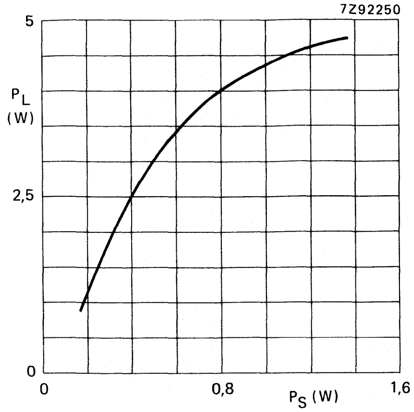


Fig. 16 Output power.

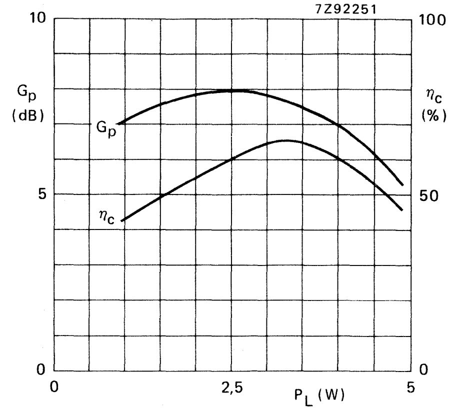


Fig. 17 Power gain and efficiency.

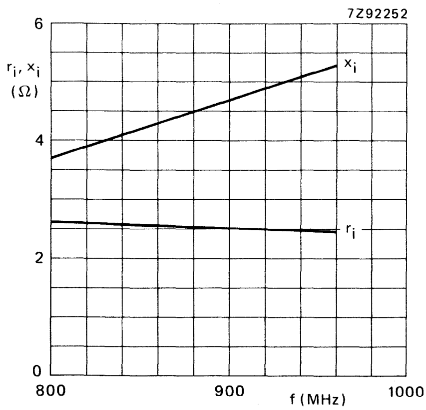


Fig. 18 Input impedance (series components).

Conditions for Figs 16 and 17:
f = 900 MHz; V_{CE} = 12,5 V; class-B operation;
T_h = 25 °C; typ. values.

Conditions for Figs 18 and 19:
f = 800-960 MHz; V_{CE} = 12,5 V; P_L = 4 W;
T_h = 25 °C; typ. values.

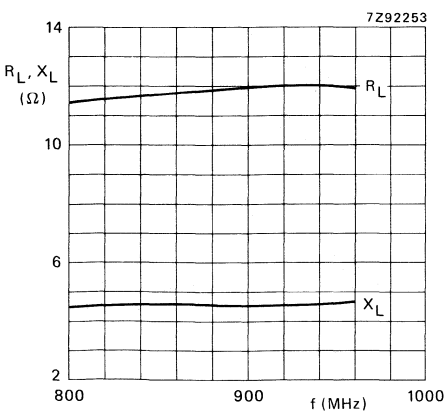


Fig. 19 Load impedance (series components).

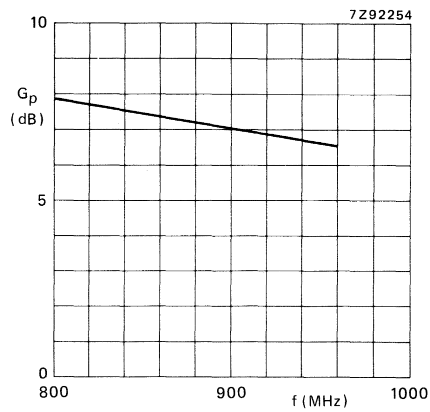


Fig. 20 Power gain.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

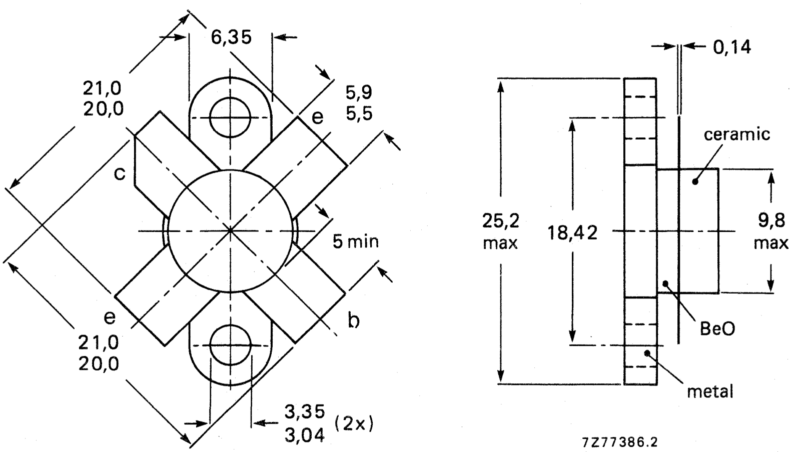
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

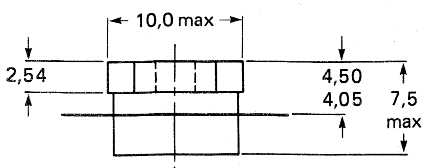
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**8**	**> 9,0**	**> 70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 10,5	typ. 75	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$)				
peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

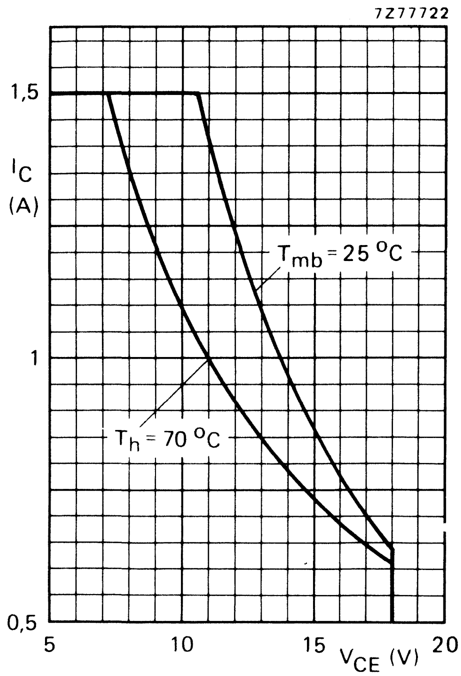


Fig. 2 D.C. SOAR.

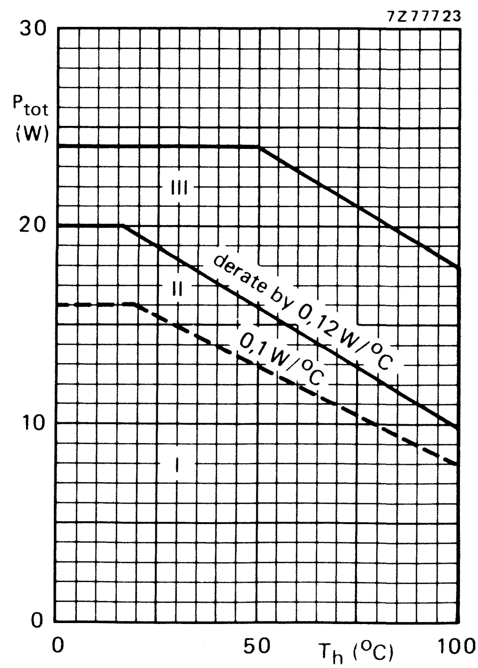


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5	mJ
D.C. current gain * $I_C = 0,75$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100	
Collector-emitter saturation voltage * $I_C = 2$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	0,85	V
Transition frequency at f = 100 MHz * $-I_E = 0,75$ A; $V_{CB} = 13,5$ V	f_T	typ.	950	MHz
$-I_E = 2$ A; $V_{CB} = 13,5$ V	f_T	typ.	850	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	16,5	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	12	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

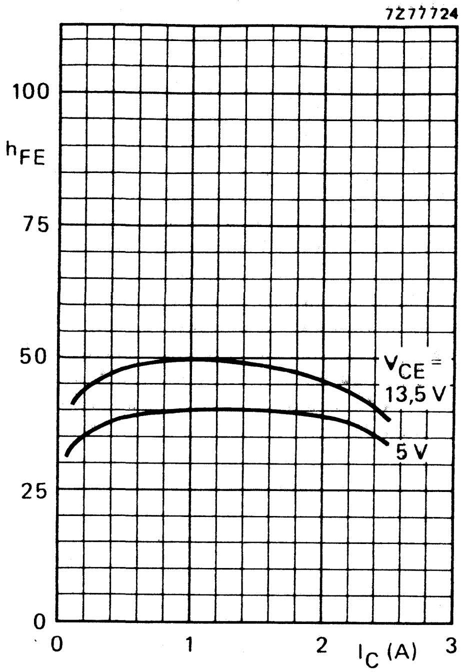


Fig. 4 Typical values; T_j = 25 °C.

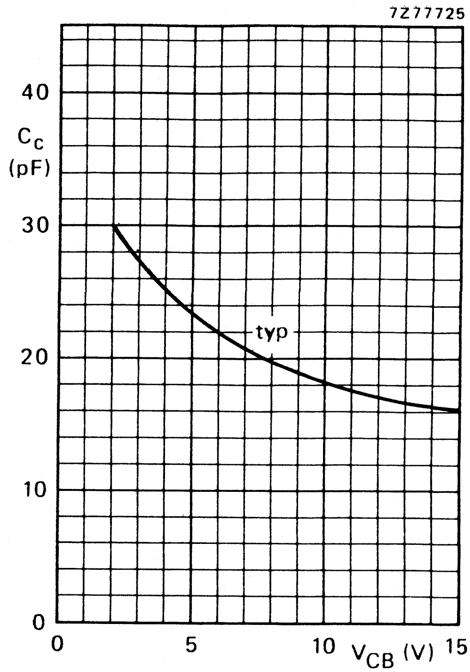


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

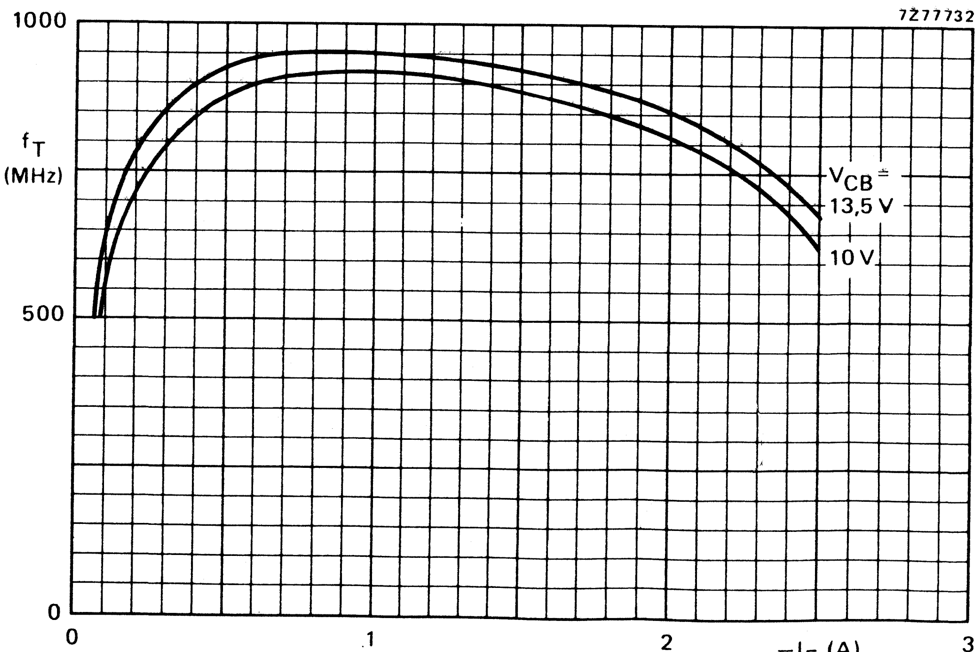


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**8**	**< 1,0**	**> 9,0**	**< 0,85**	**> 70**	**2,8 + j1,2**	**76 − j16**
175	12,5	8	–	typ. 10,5	–	typ. 75	–	–

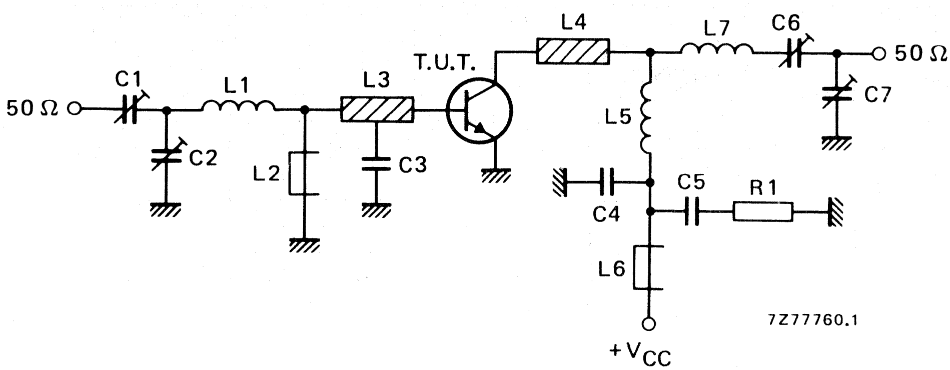


Fig. 7 Test circuit; c.w. class-B.

List of components:

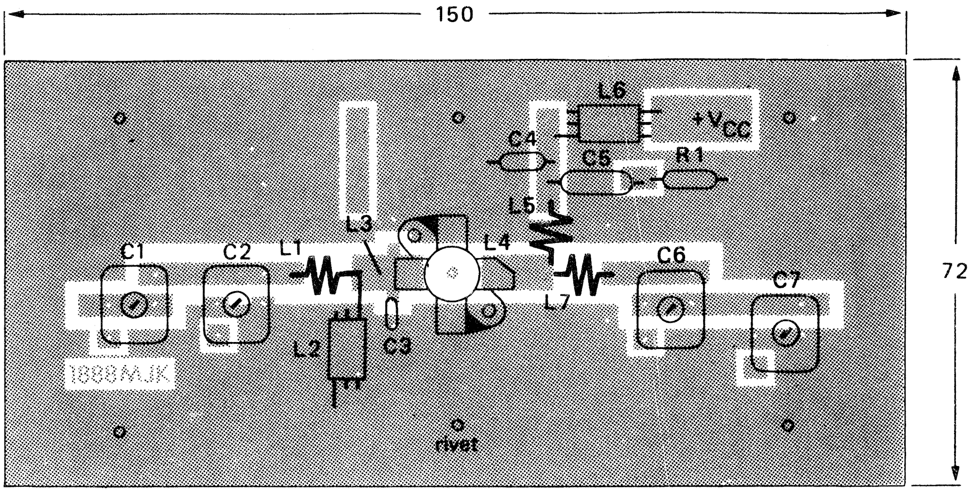
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



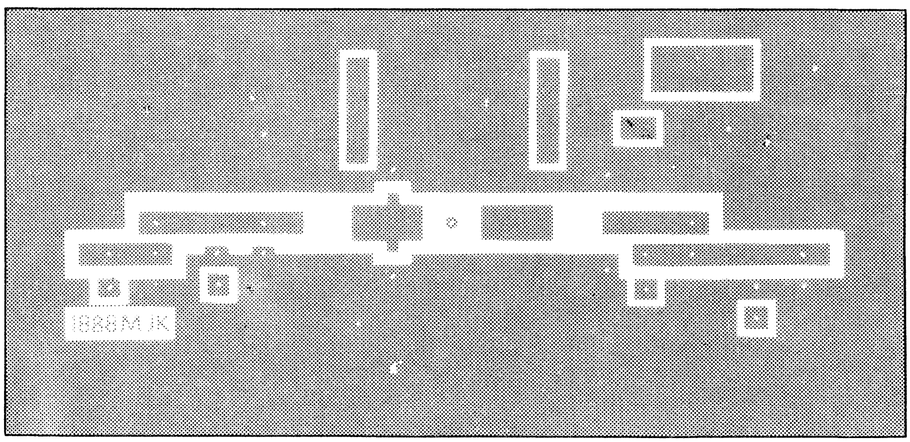


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

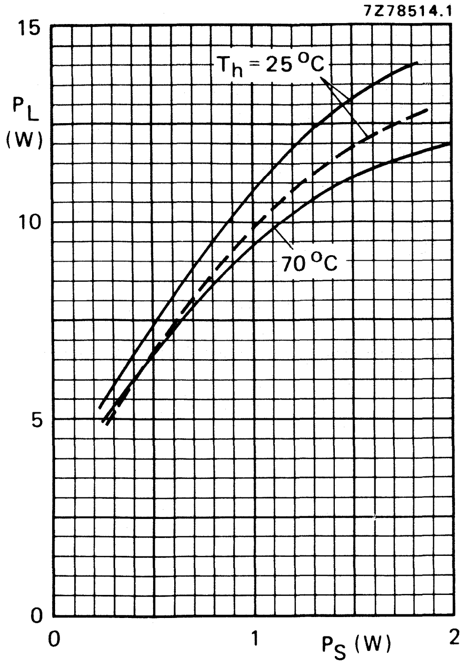


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

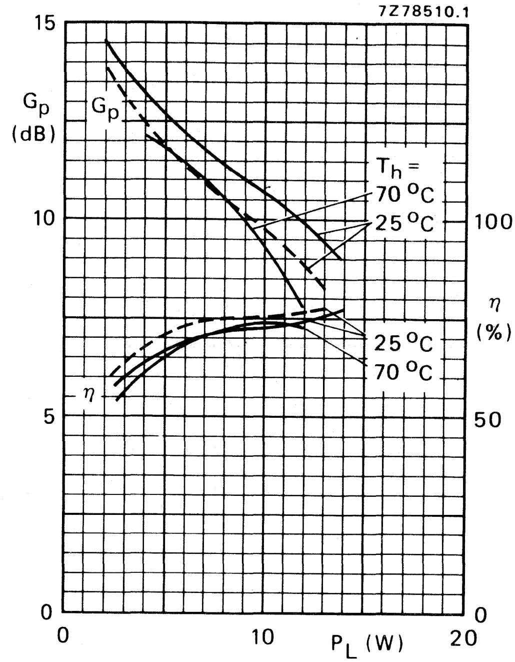


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

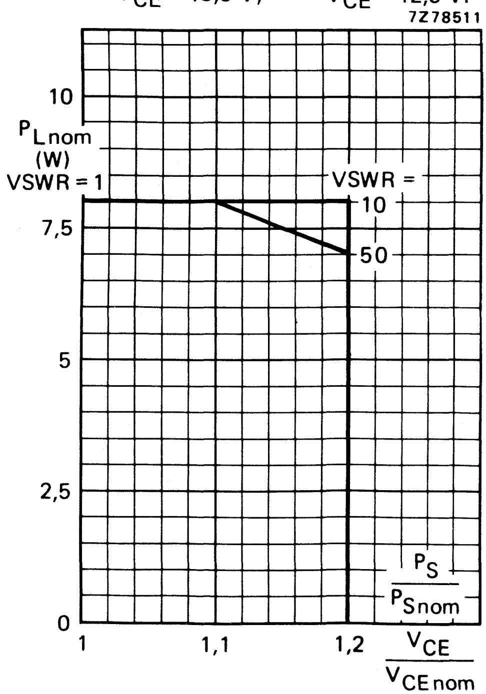


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\,mb\text{-}h}$ = 0,3 K/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

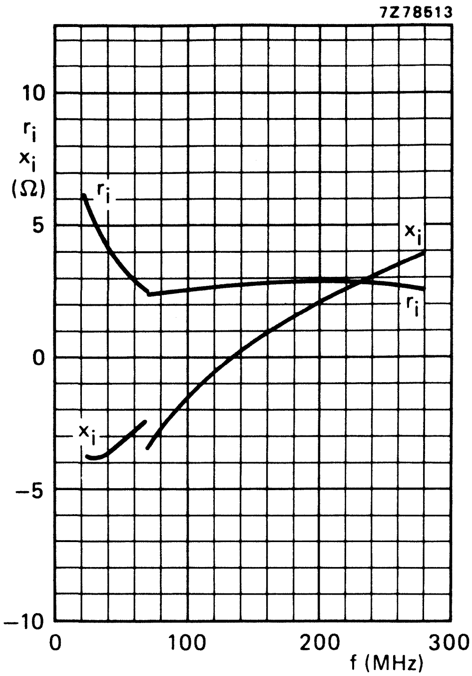


Fig. 12 Input impedance (series components).

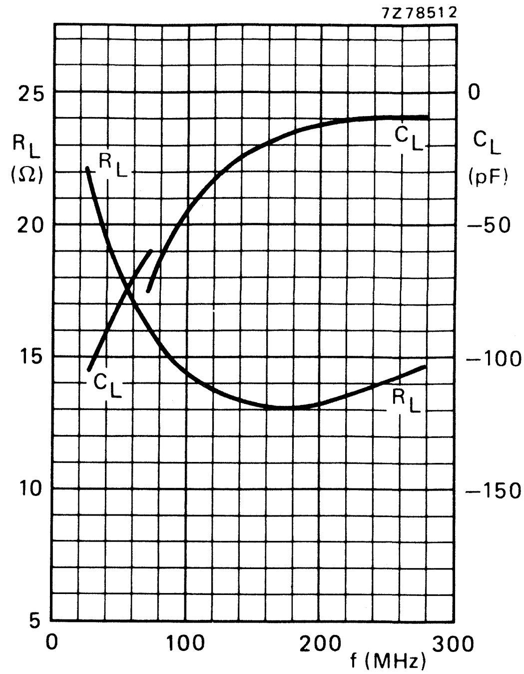


Fig. 13 Load impedance (parallel components).

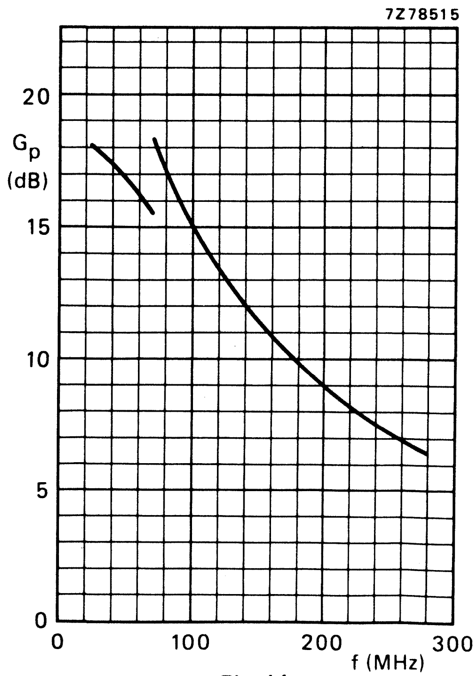


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W;
T_h = 25 °C.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

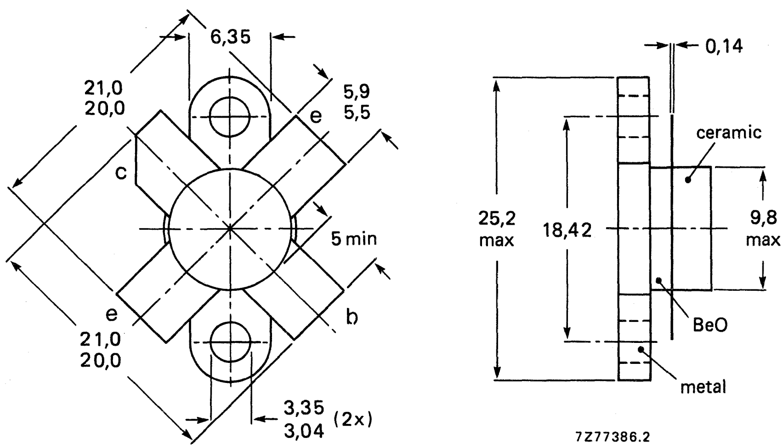
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

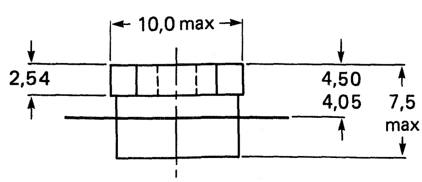
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**15**	**> 8,0**	**> 60**	**2,3 + j2,2**	**130 − j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 67	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	3 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

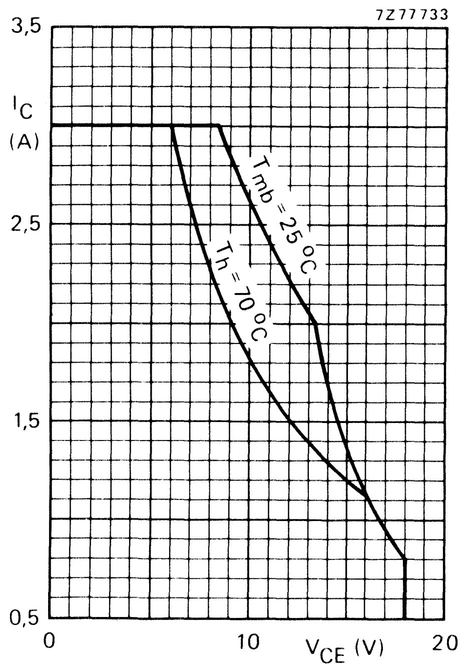


Fig. 2 D.C. SOAR.

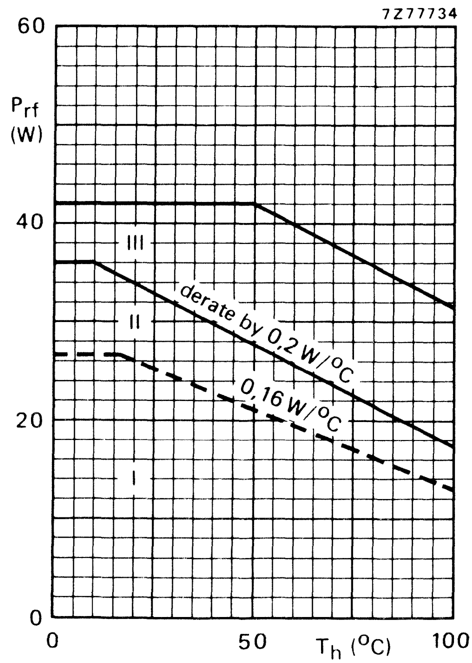


Fig. 3 R.F. power dissipation; $V_{CE} \leq 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5	mJ
D.C. current gain * $I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40 10 to 100	
Collector-emitter saturation voltage * $I_C = 4,5$ A; $I_B = 0,9$ A	V_{CEsat}	typ.	1,0	V
Transition frequency at f = 100 MHz * $-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850	MHz
$-I_E = 4,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	32	pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	23	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

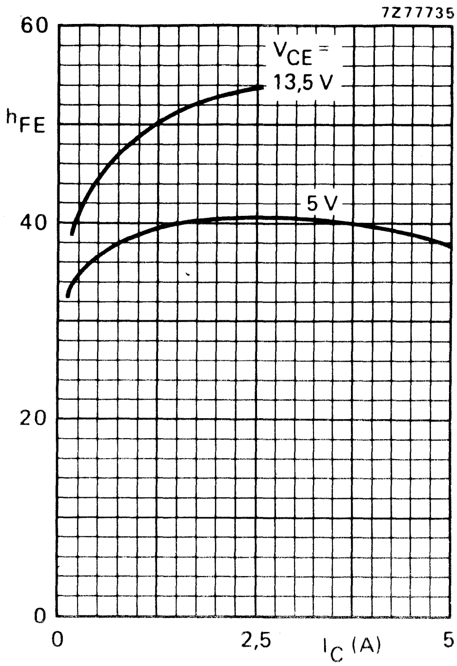


Fig. 4 Typical values; T_j = 25 °C.

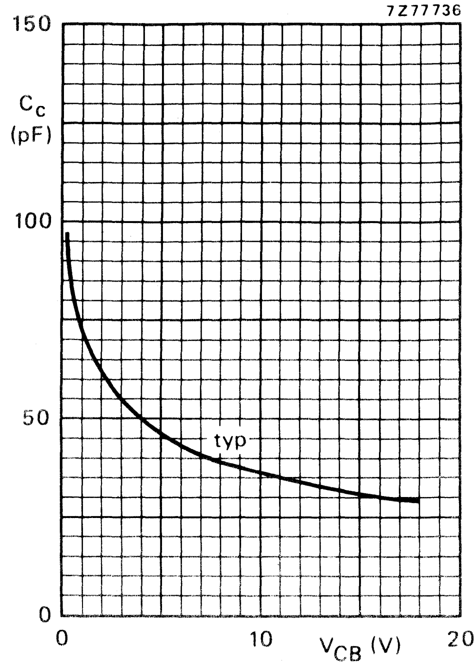


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

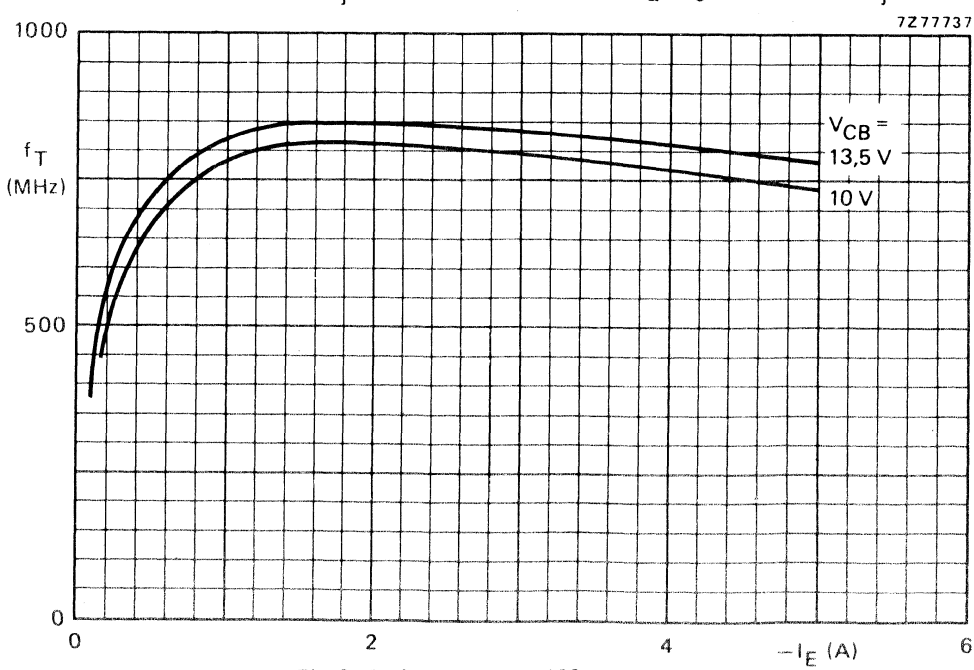


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C .

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**15**	**< 2,4**	**> 8,0**	**< 1,85**	**> 60**	**2,3 + j2,2**	**130 – j4,4**
175	12,5	15	–	typ. 7,5	–	typ. 67	–	–

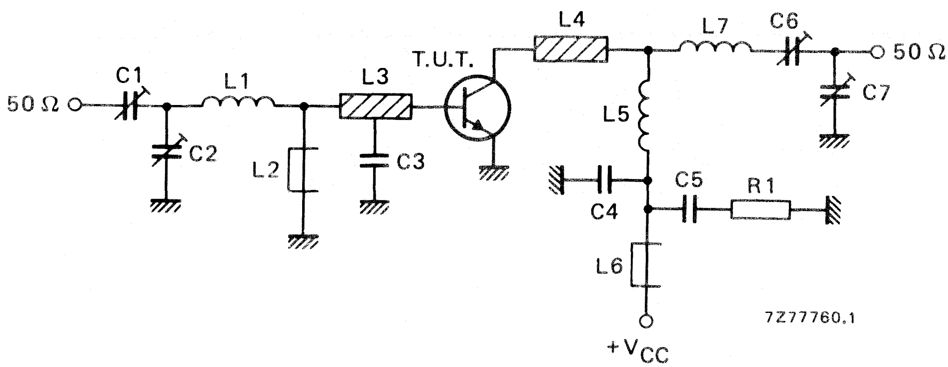


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

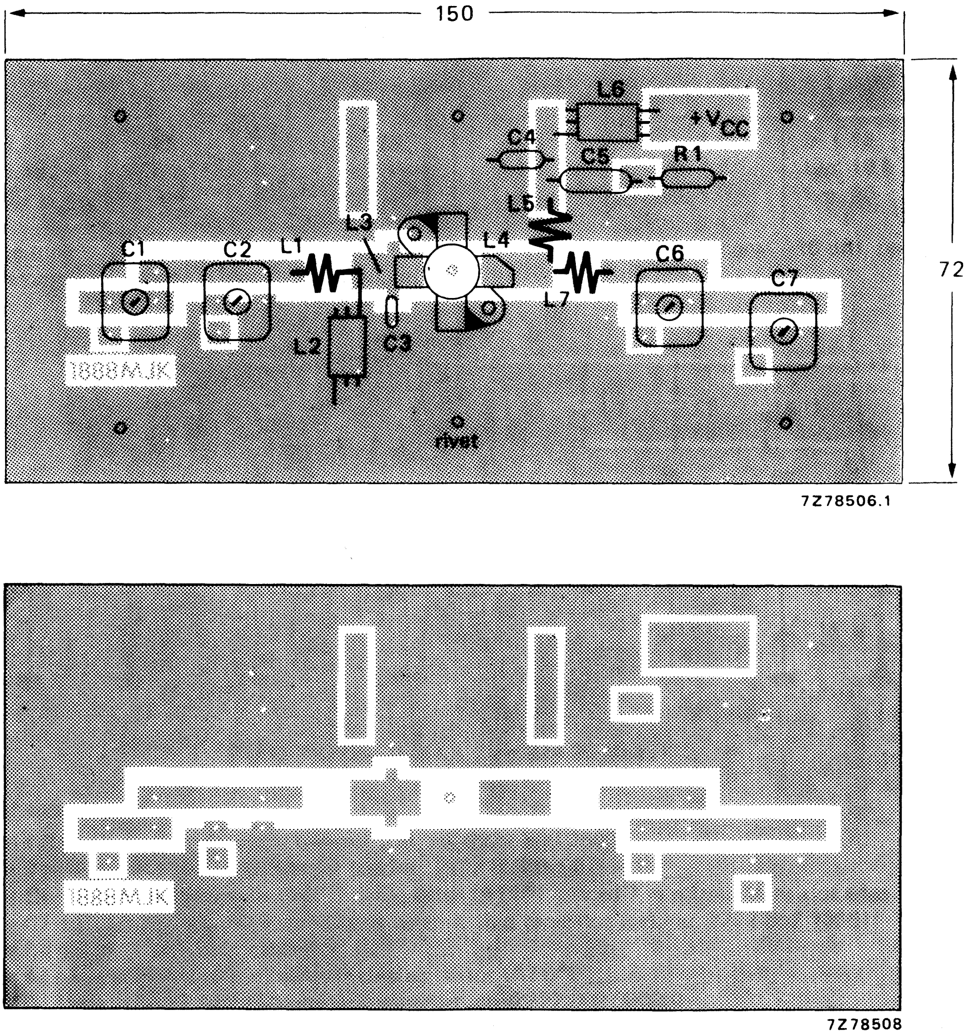


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

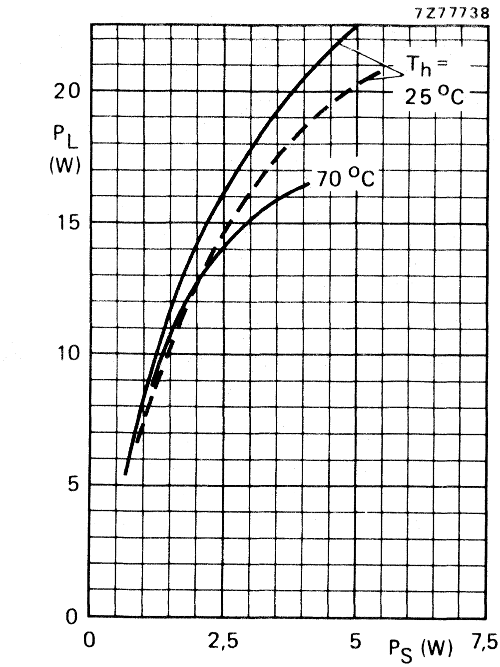


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

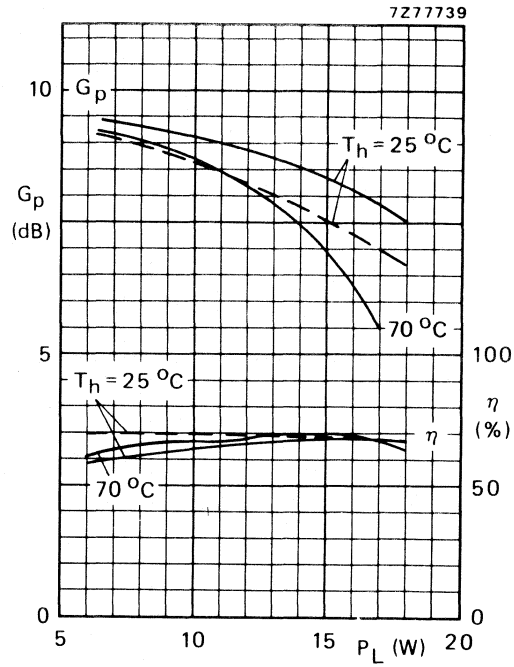


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

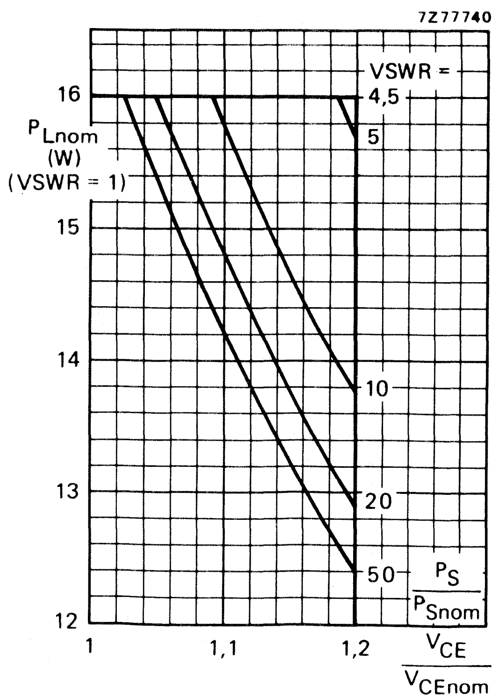


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

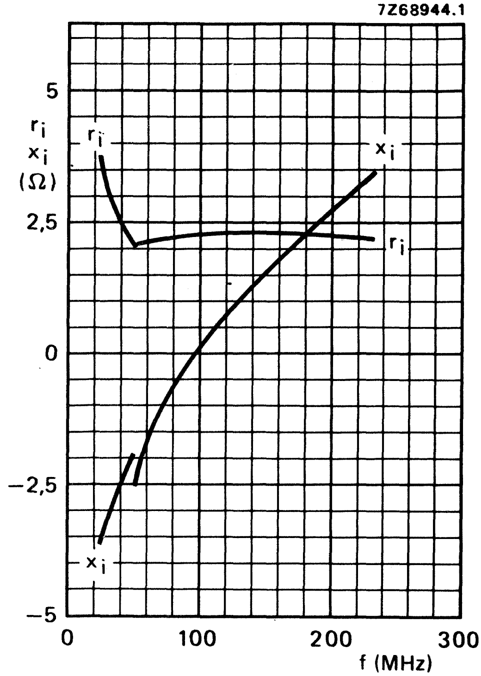


Fig. 12 Input impedance (series components).

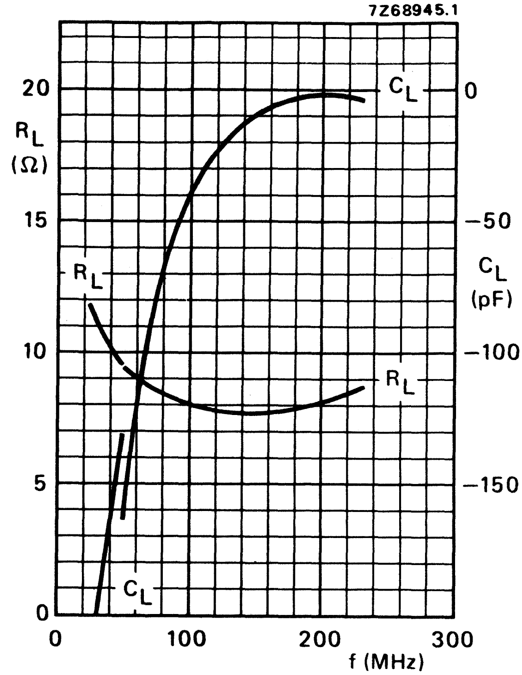


Fig. 13 Load impedance (parallel components).

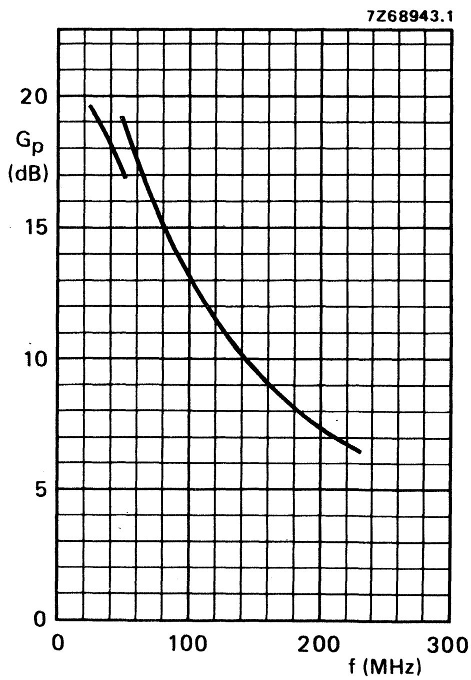


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

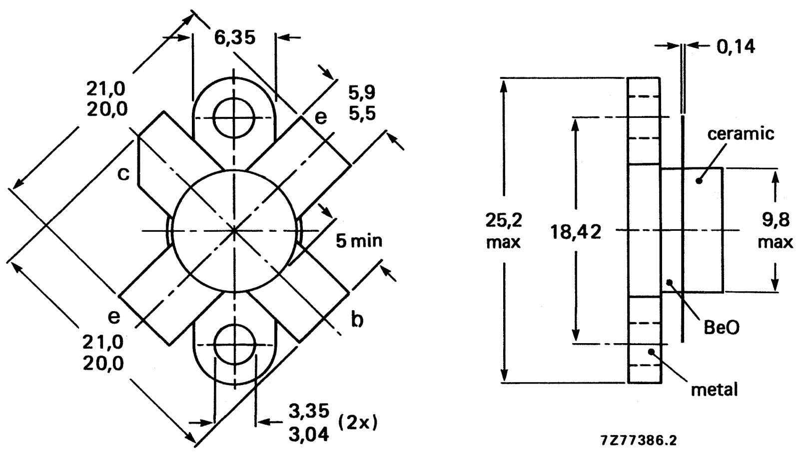
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

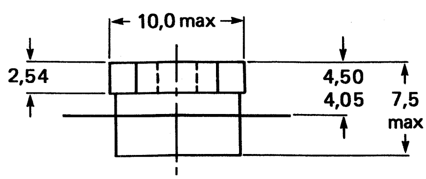
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

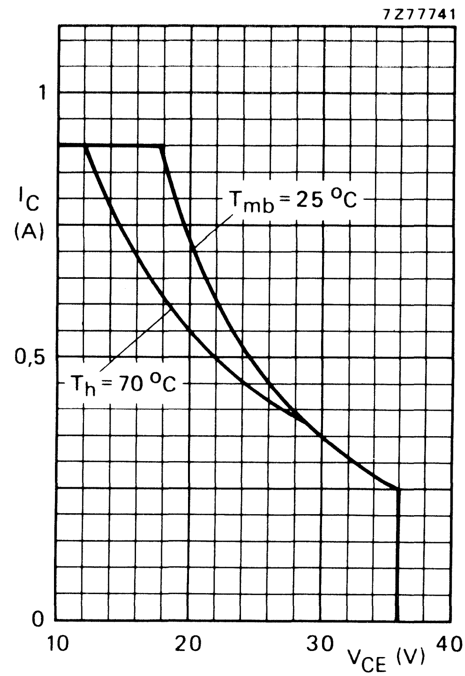


Fig. 2 D.C. SOAR.

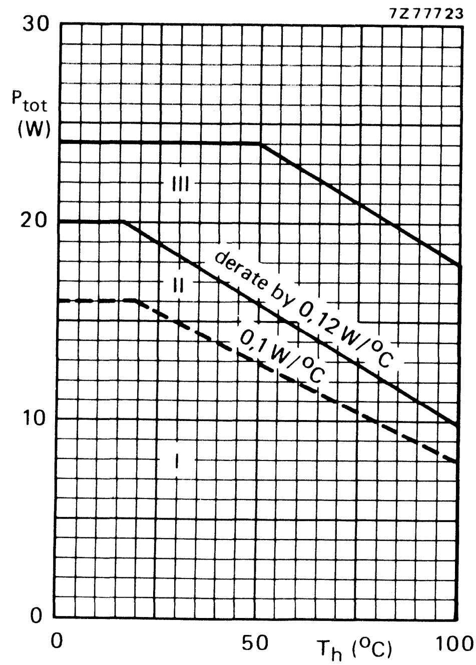


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 72,4 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	1	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	0,5	mJ
D.C. current gain * $I_C = 0,4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 100	
Collector-emitter saturation voltage * $I_C = 1,25$ A; $I_B = 0,25$ A	V_{CEsat}	typ.	0,8	V
Transition frequency at f = 100 MHz * $-I_E = 0,4$ A; $V_{CB} = 28$ V	f_T	typ.	600	MHz
$-I_E = 1,25$ A; $V_{CB} = 28$ V	f_T	typ.	520	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	10	pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 28$ V	C_{re}	typ.	7,1	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

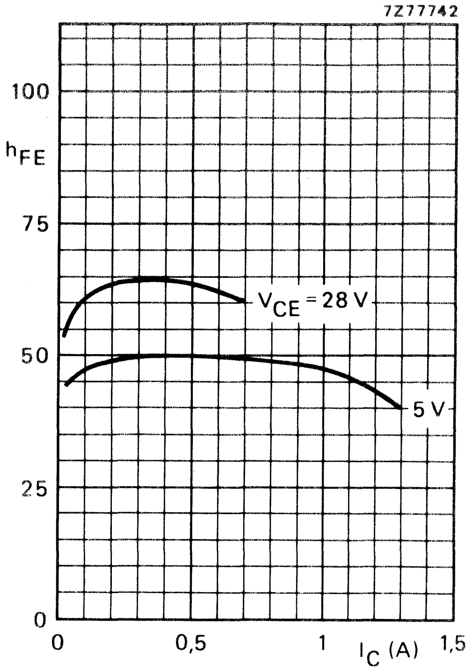


Fig. 4 Typical values; T_j = 25 °C.

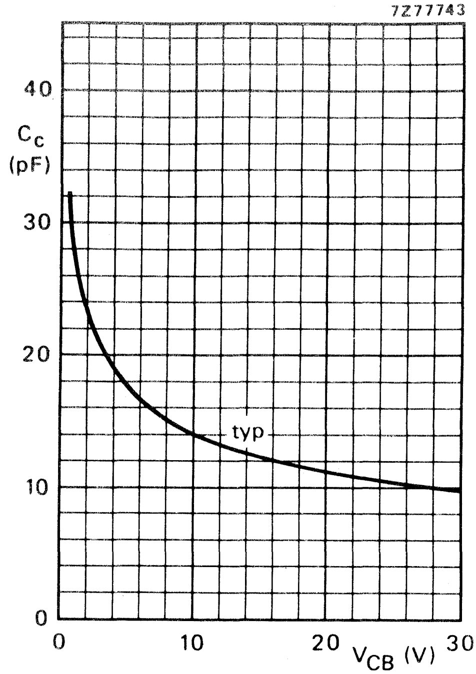


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

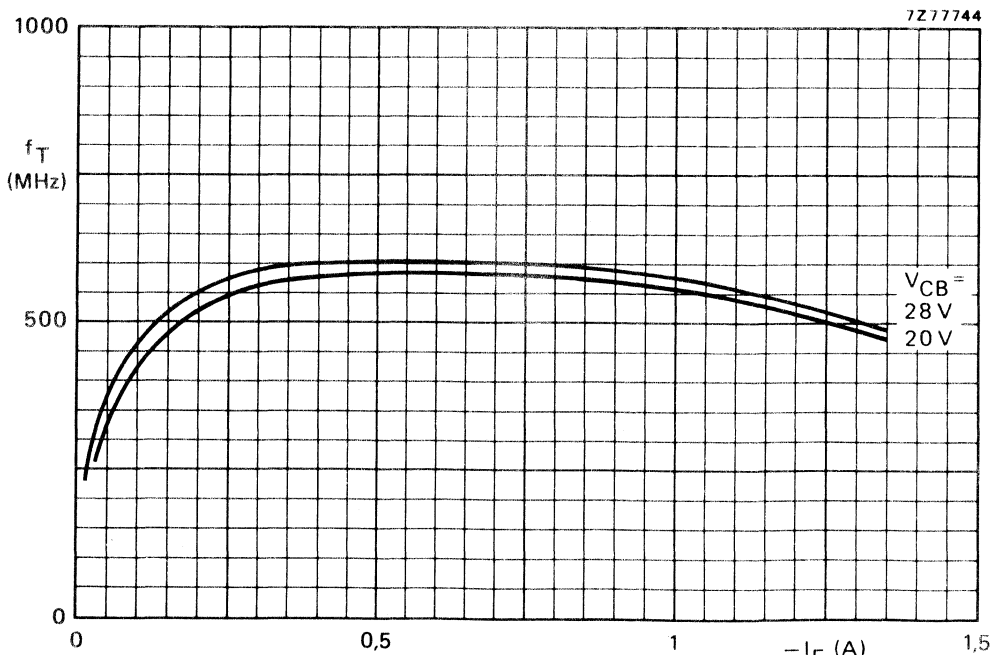


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 − j20

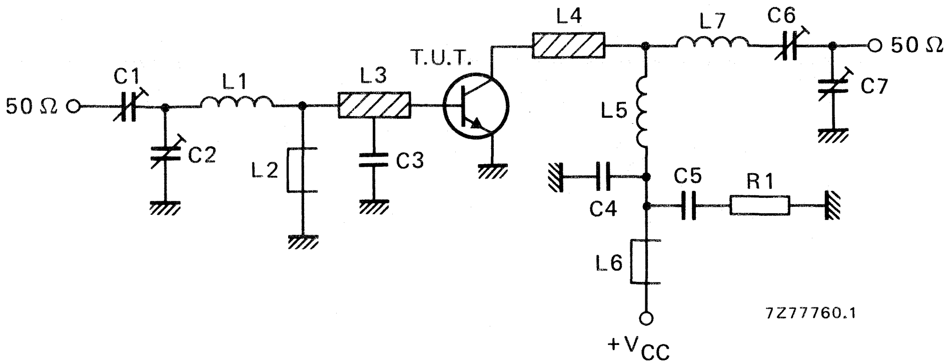


Fig. 7 Test circuit; c.w. class-B.

List of components:

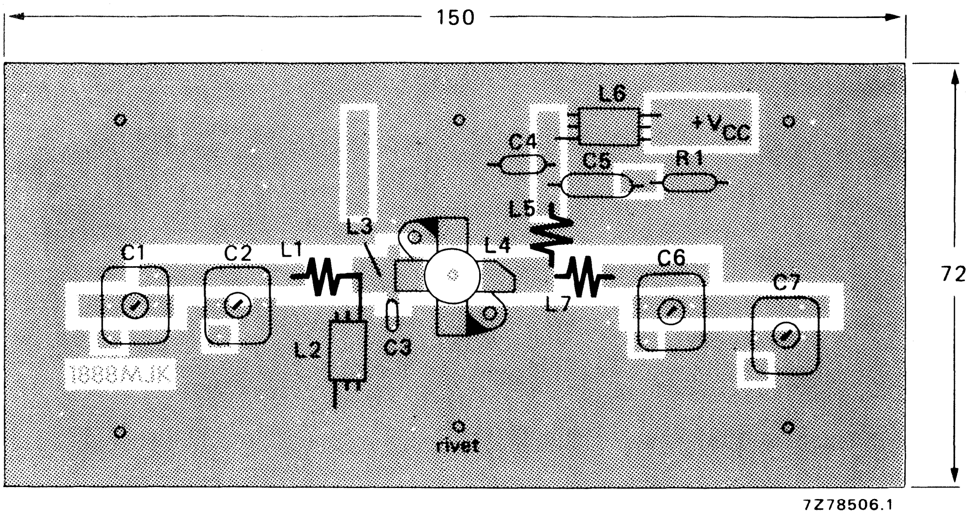
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



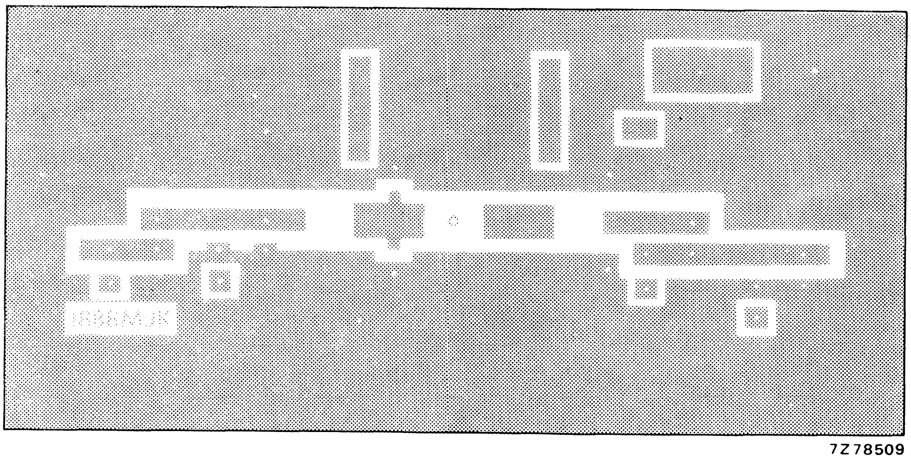


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

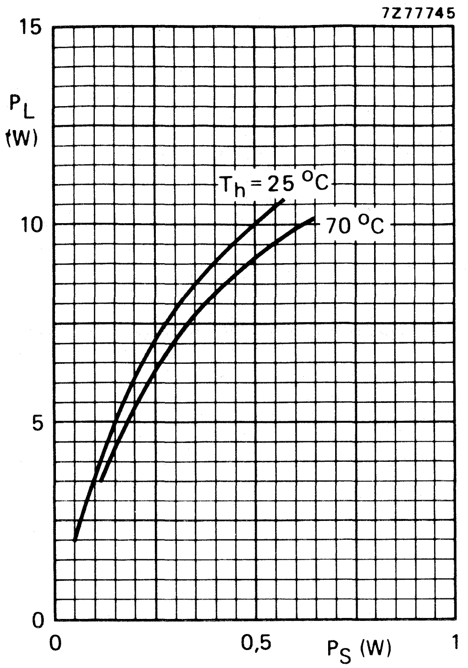


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

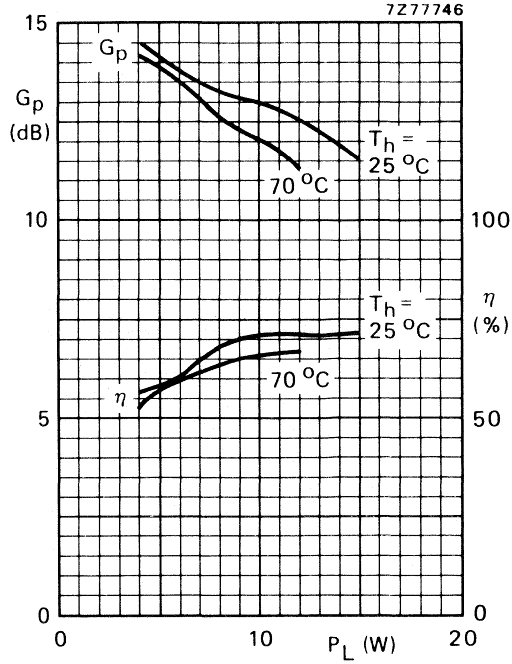


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

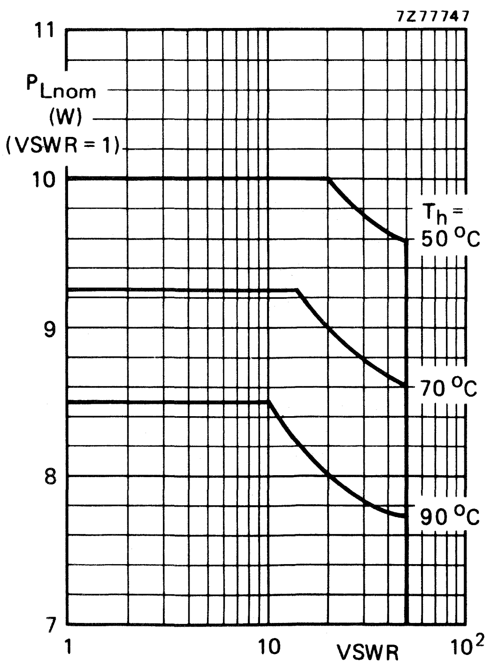


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,3 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

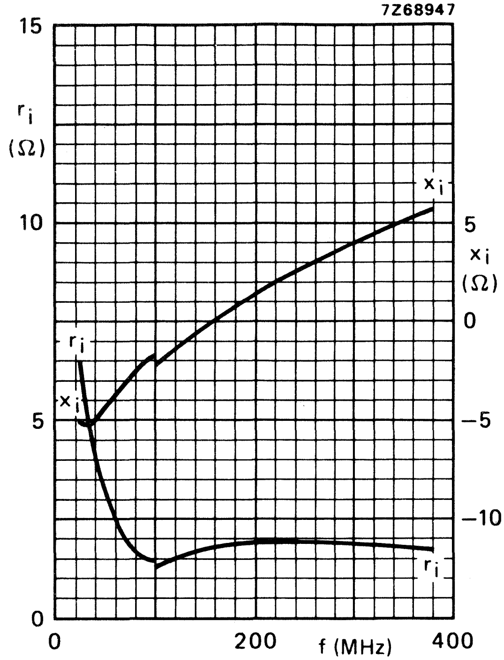


Fig. 12 Input impedance (series components).

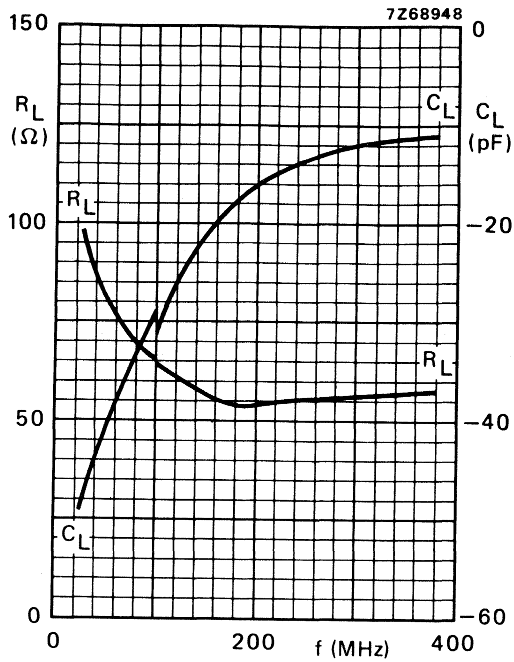


Fig. 13 Load impedance (parallel components).

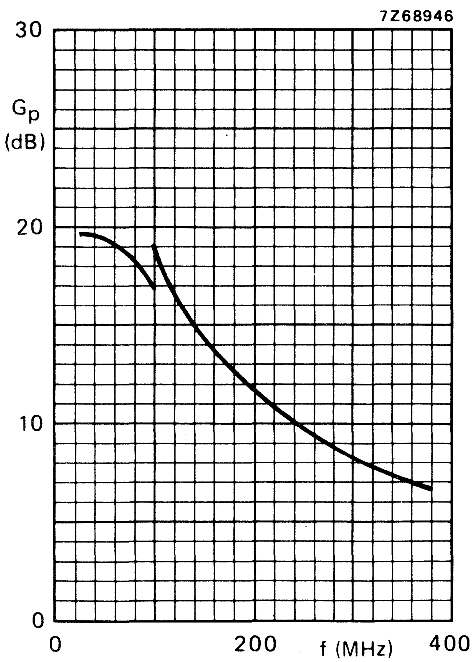


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

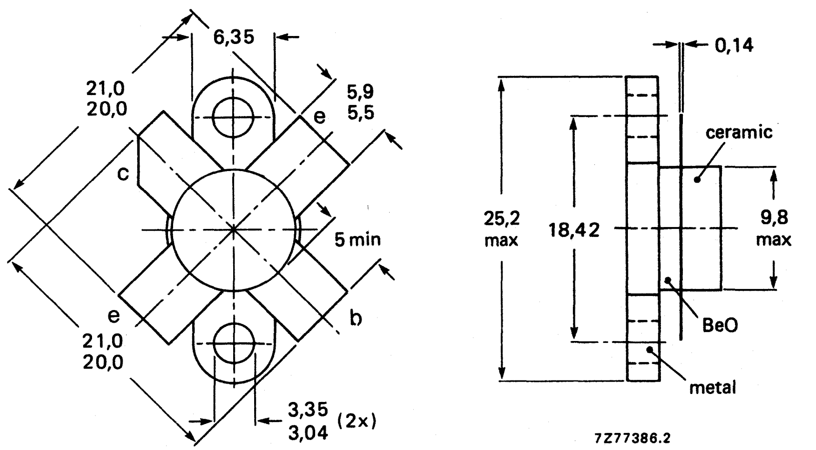
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

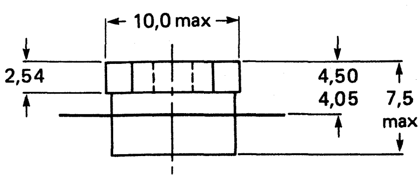
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,75	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

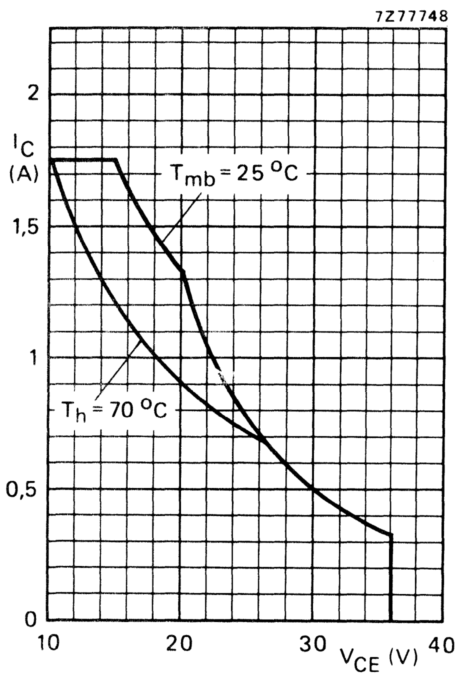


Fig. 2 D.C. SOAR.

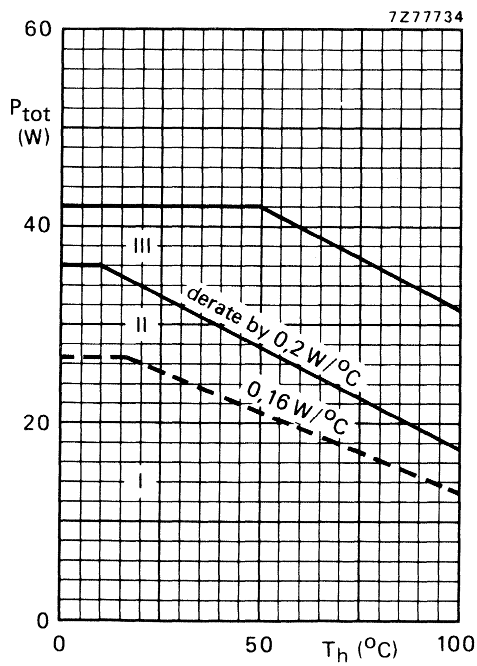


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 74,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 5 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; I_C = 25 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	2,5	mJ
D.C. current gain * I_C = 0,7 A; V_{CE} = 5 V	h_{FE}	typ.	50	
			10 to 100	
Collector-emitter saturation voltage * I_C = 2 A; I_B = 0,4 A	V_{CEsat}	typ.	0,65	V
Transition frequency at f = 100 MHz * $-I_E$ = 0,7 A; V_{CB} = 28 V	f_T	typ.	650	MHz
$-I_E$ = 2 A; V_{CB} = 28 V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	18	pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	12,8	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

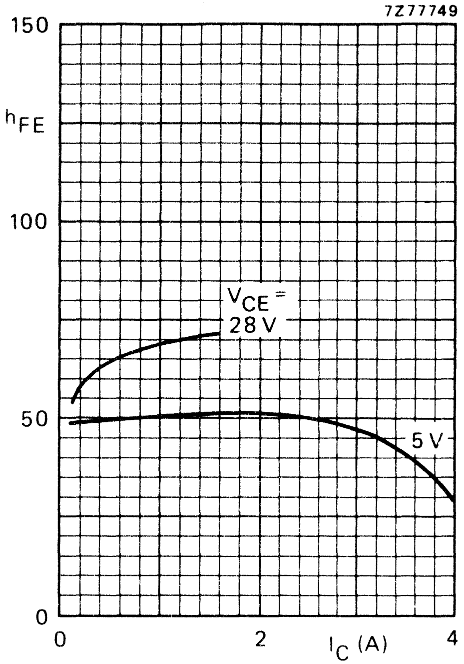


Fig. 4 Typical values; T_j = 25 °C.

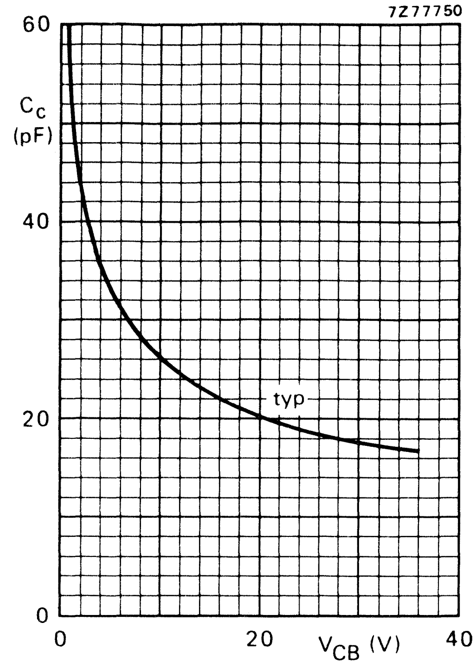


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

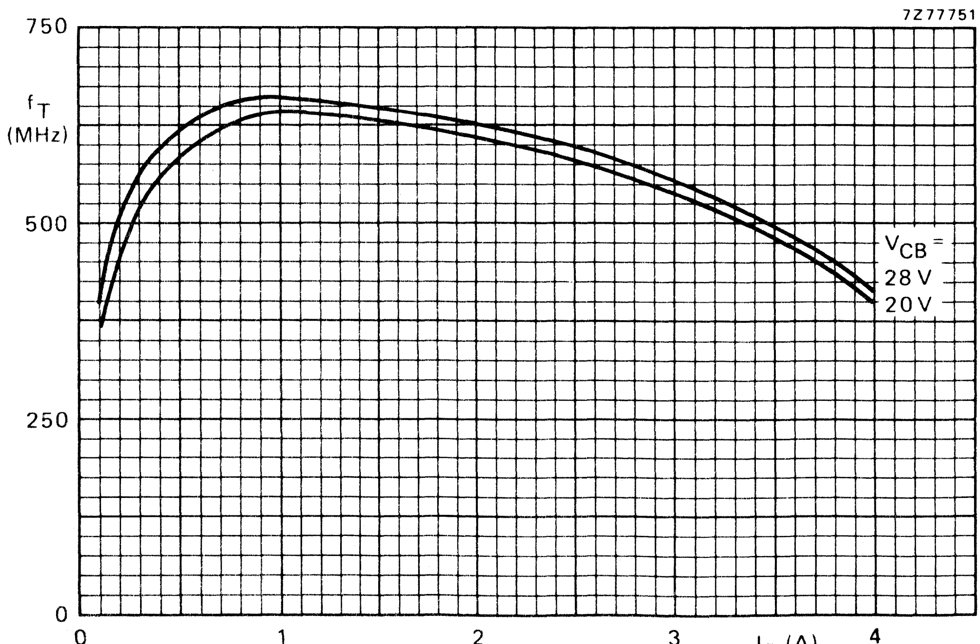


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 – j27,5

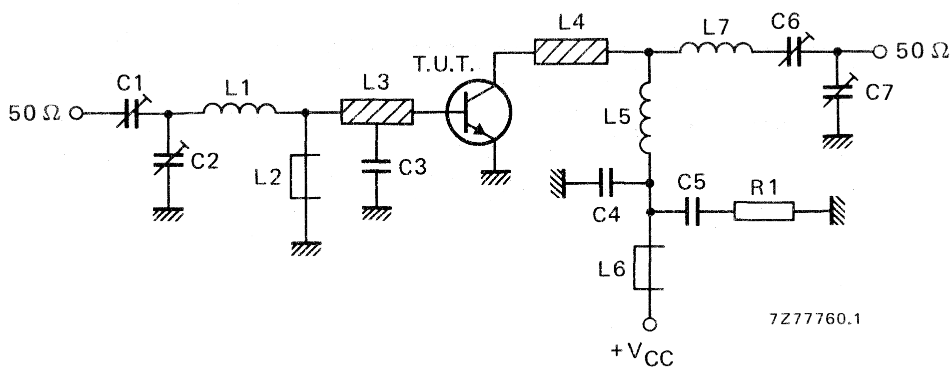


Fig. 7 Test circuit; c.w. class-B.

List of components:

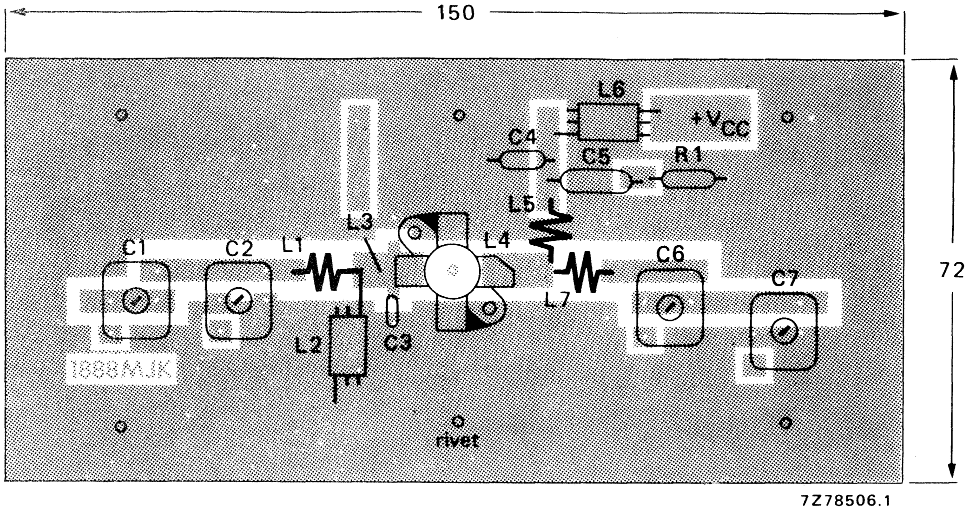
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



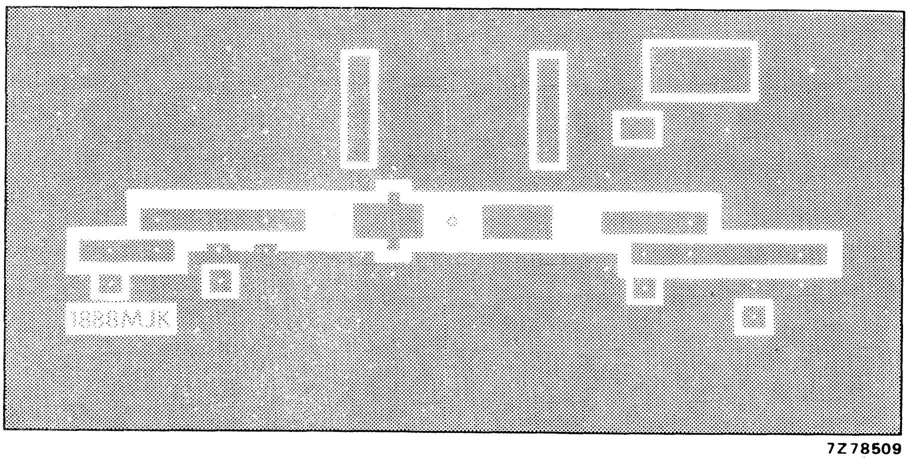


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

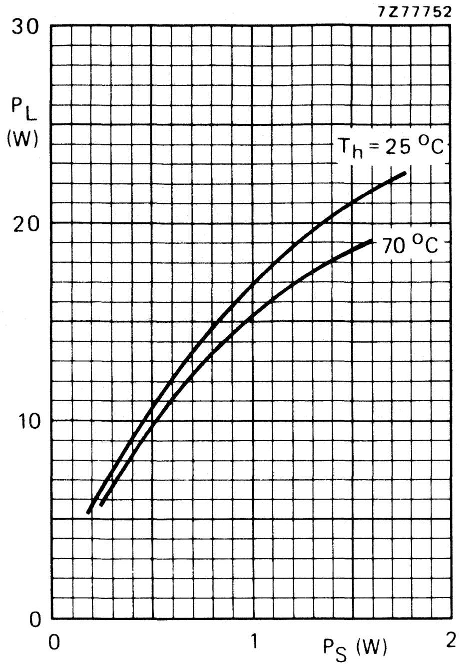


Fig. 9 Typical values; V_{CE} = 28 V;
f = 175 MHz.

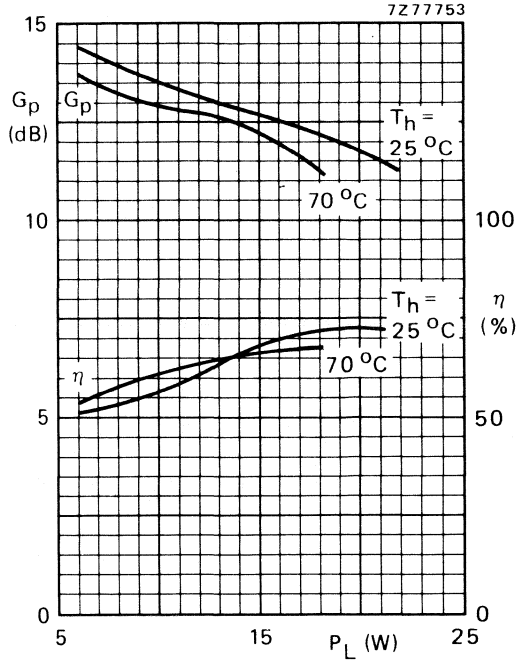


Fig. 10 Typical values; V_{CE} = 28 V;
f = 175 MHz.

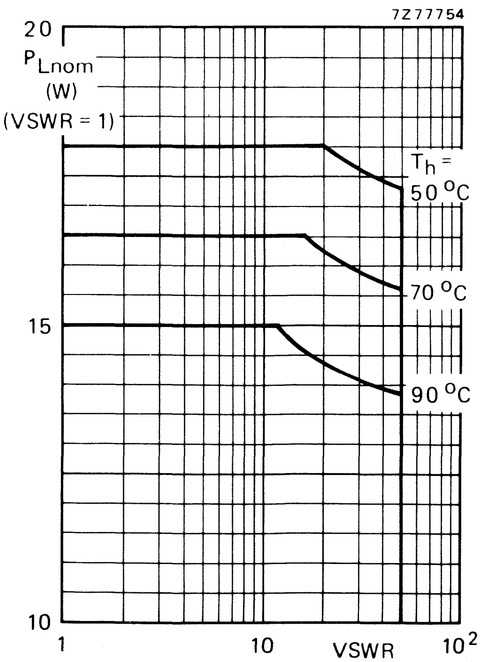


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

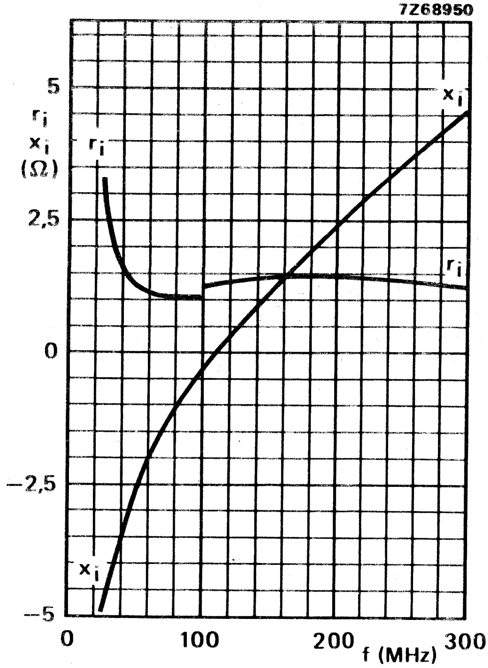


Fig. 12 Input impedance (series components).

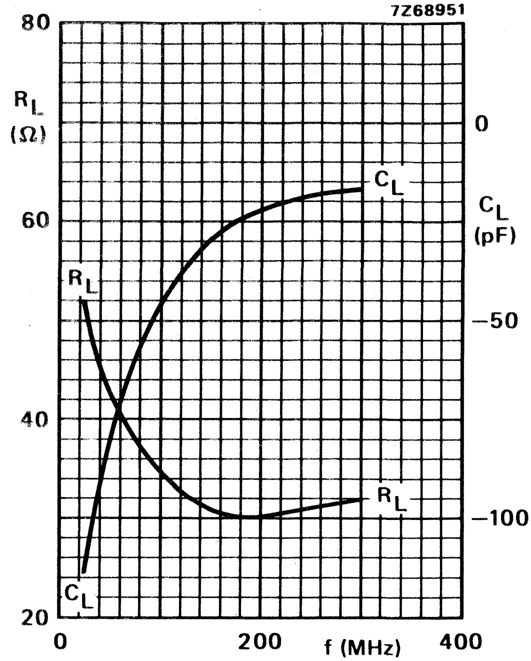


Fig. 13 Load impedance (parallel components).

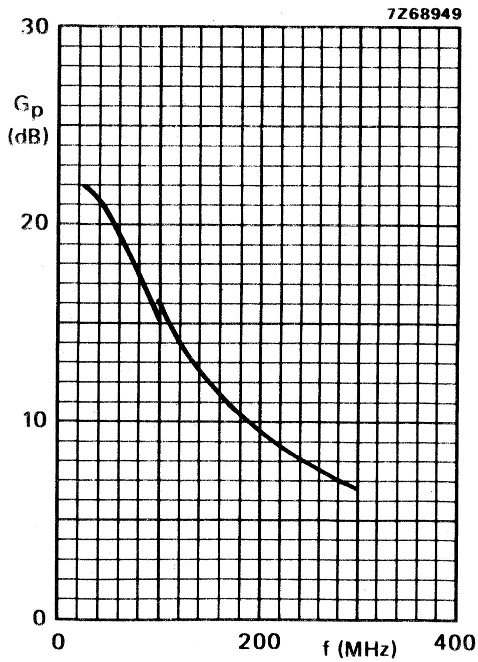


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W;
T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily for use in v.h.f.-f.m. broadcast transmitters.

Features:

- internally matched input for wideband operation and high power gain;
- multi-base structure and diffused emitter ballasting resistors for an optimum temperature profile;
- gold-metallization ensures excellent reliability.

The transistor has a ½in 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode operation	V_{CE} V	f MHz	P_L W	P_S W	G_p dB	η %
narrow band; c.w.	28	108	175	< 17,5	> 10,0	> 65

MECHANICAL DATA

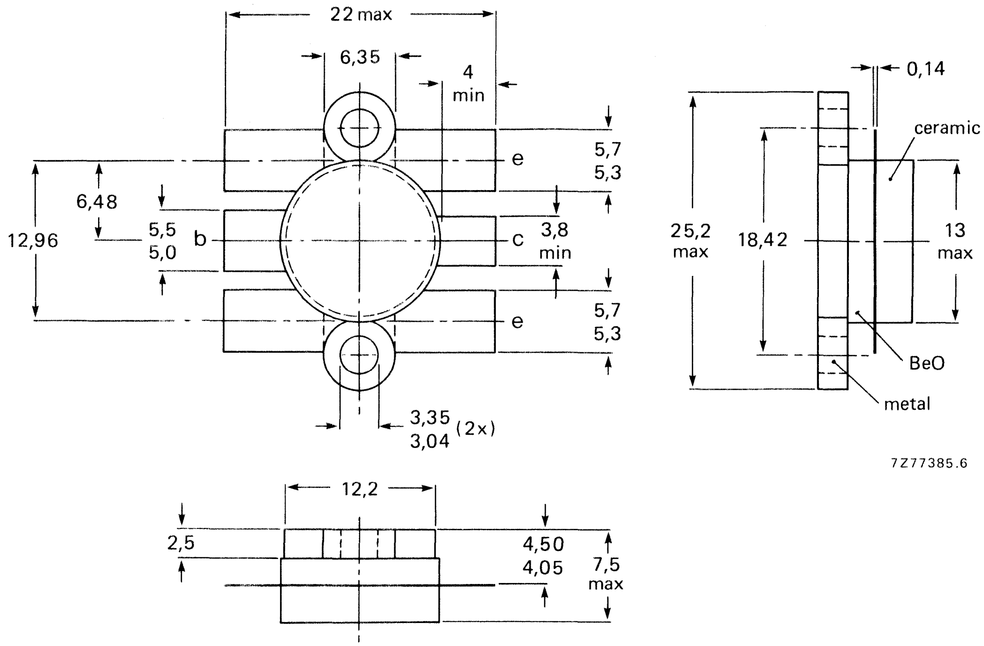
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

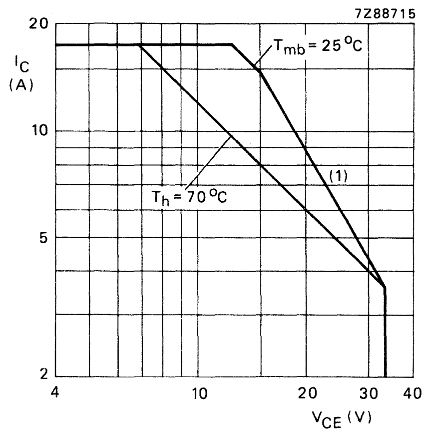
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	17,5	A
(peak value); f > 1 MHz	I_{CM}	max.	35	A
Total power dissipation at T_{mb} = 25 °C	$P_{tot\ (d.c.)}$	max.	220	W
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	$P_{tot\ (r.f.)}$	max.	270	W
R.F. power dissipation (f > 1 MHz); T_h = 70 °C	$P_{tot\ (r.f.)}$	max.	146	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit.

Fig. 2 D.C. SOAR.

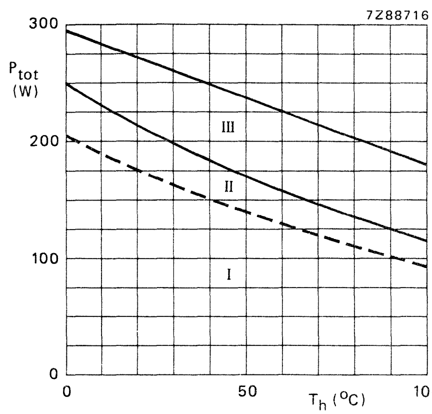


Fig. 3 Power derating curves vs. temperature.

I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE (dissipation = 150 W; T_{mb} = 72 °C, i.e. T_h = 42 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	max	0,85	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	max	0,60	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max	0,2	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	65 V
open base; $I_C = 200$ mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 33$ V	I_{CES}	<	25 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	20 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	20 mJ
D.C. current gain*			
$I_C = 8,5$ A; $V_{CE} = 25$ V	h_{FE}	typ.	50
			15 to 100
Collector-emitter saturation voltage*			
$I_C = 20$ A; $I_B = 4,0$ A	V_{CEsat}	typ.	1,6 V
Transition frequency at f = 100 MHz**			
$-I_E = 8,5$ A; $V_{CB} = 25$ V	f_T	typ.	600 MHz
$-I_E = 20$ A; $V_{CB} = 25$ V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	275 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 25$ V	C_{re}	typ.	155 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

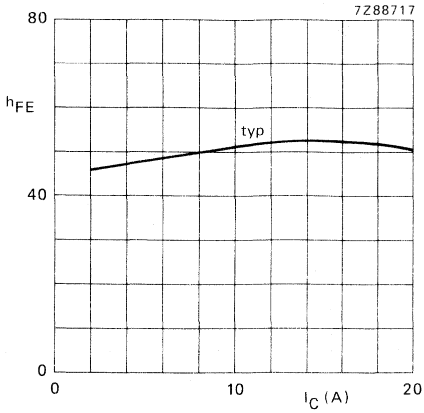


Fig. 4 V_{CE} = 25 V; T_j = 25 °C.

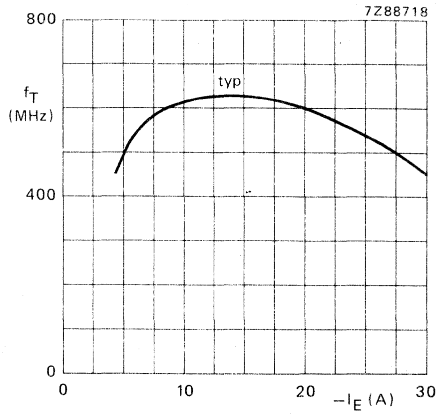


Fig. 5 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

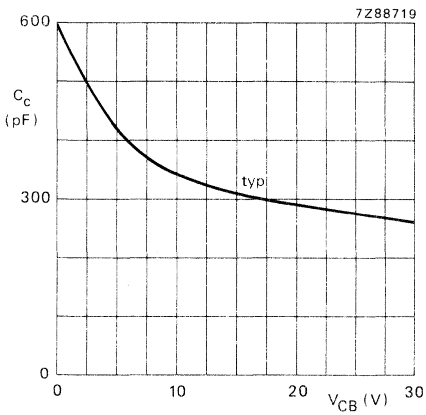


Fig. 6 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in narrow band c.w. operation (common-emitter class-B circuit) T_h = 25 °C

f MHz	V_{CE} V	P_L W	P_S W	G_p dB	I_C A	η %
108	28	175	< 17,5 typ. 13,9	> 10,0 typ. 11,0	< 9,6 typ. 8,9	> 65 typ. 70

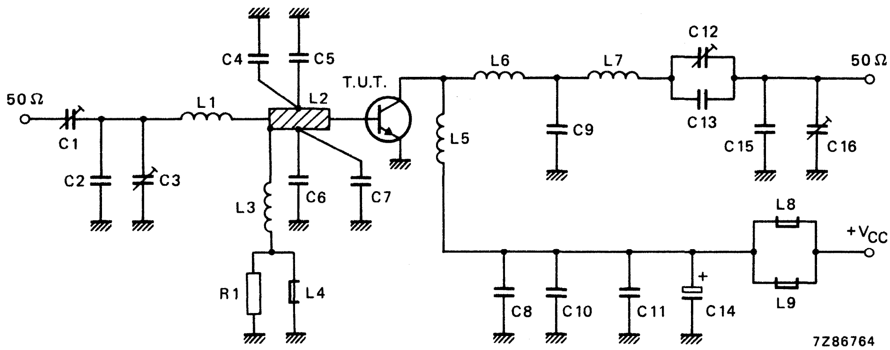


Fig. 7 Class-B test circuit at f = 108 MHz.

List of components

C1 = C3 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C2 = C4 = C5 = C6 = C7 = 100 pF (500 V) multilayer ceramic chip capacitor (ATC▲); except for C2 these capacitors are placed 7 mm from transistor edge
C8 = C10 = 470 pF multilayer ceramic chip capacitor (cat. no. 2222 856 13471)
C9 = C15 = 40 pF, parallel connection of 4 x 10 pF lead feed-through capacitors (cat.no. 2222 702 05109)
C11 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
C12 = C16 = 7 to 47 pF precesion tuning capacitor (cat. no. 2222 805 00174)
C13 = 19 pF, parallel connection of 4 x 4,7 pF lead feed-through capacitors (cat. no. 2222 702 04478)
C14 = 6,8 μF/63 V electrolytic capacitor

L1 = Cu strip (10 mm x 4 mm x 0,5 mm)
L2 = strip on printed-circuit board
L3 = 7 turns closely wound enamelled Cu wire (0,3 mm); int. dia. 3,0 mm; leads 2 x 6 mm
L4 = L8 = L9 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 9 mm; leads 2 x 5 mm
L6 = Cu strip (27 mm x 9 mm x 0,5 mm)
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 9 mm; leads 2 x 10 mm

L2 is strip on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 in.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

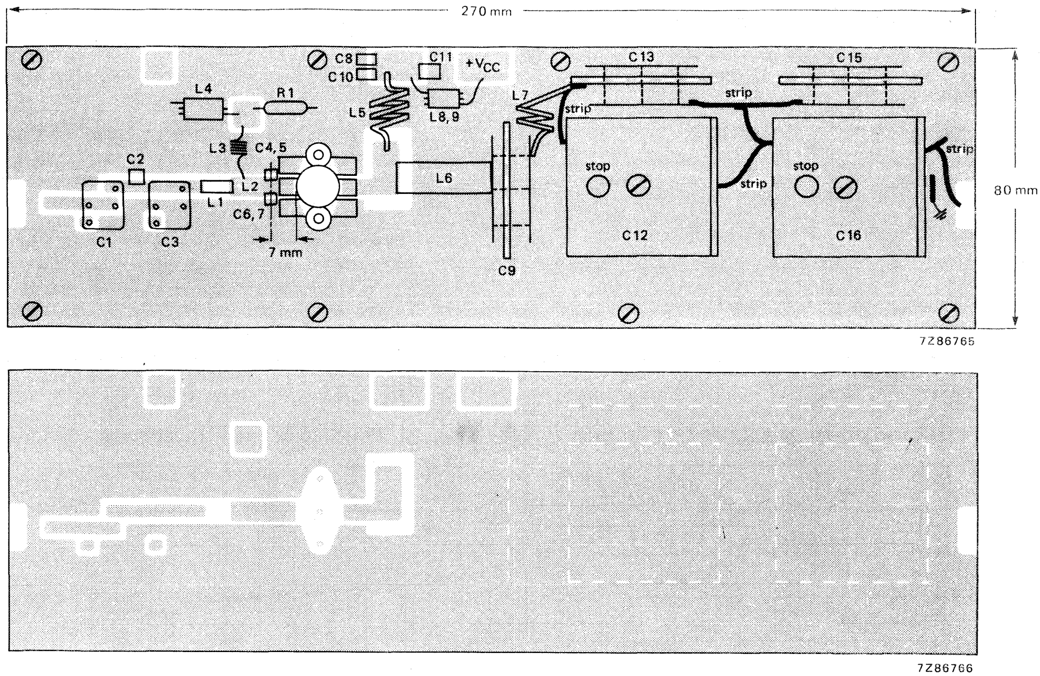


Fig. 8 Component layout and printed-circuit board for 108 MHz class-B test circuit. (Dimensions in mm.)

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of fixing screws. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

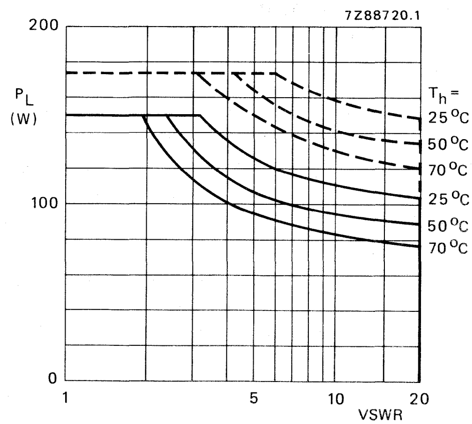


Fig. 9 R.F. SOAR. ——— f > 1 MHz (continuous);
– – – – short time operation during mismatch (f > 1 MHz).

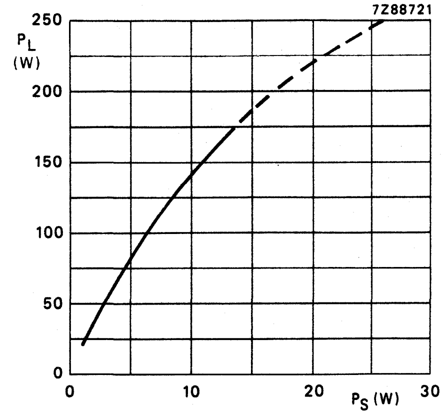


Fig. 10 Load power as a function of source power.

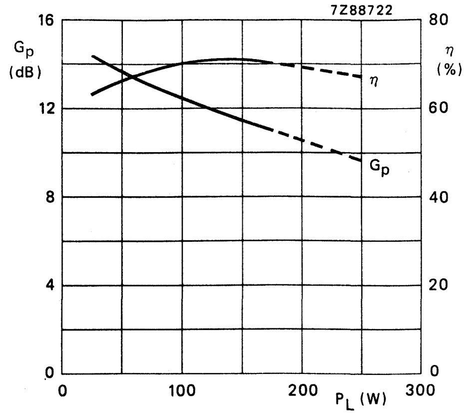


Fig. 11 Power gain and efficiency as a function of source power.

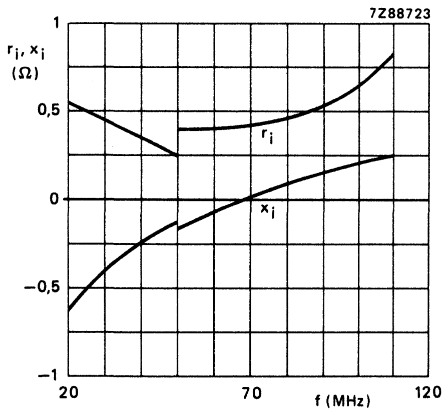


Fig. 12 Input impedance (series components).

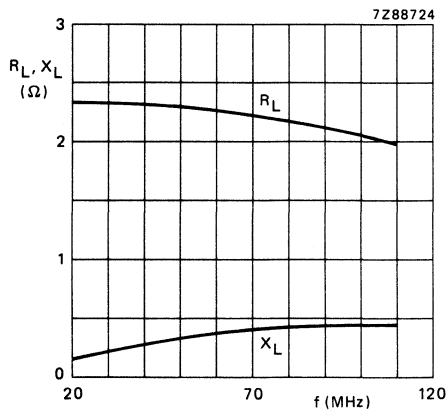


Fig. 13 Load impedance (series components).

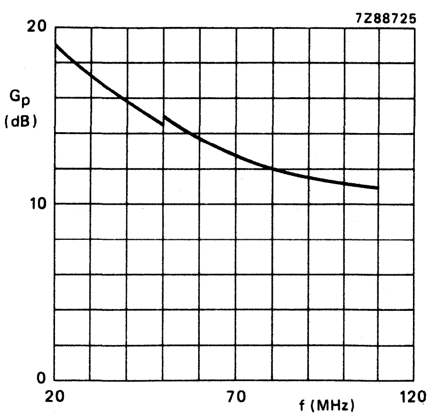


Fig. 14 Power gain as a function of frequency.

Conditions for Figs 10 and 11:

Test circuit tuned for each power level; typical values; V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; class-B operation.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C; class-B operation.

OPERATING NOTE for Figs 12, 13 and 14:

Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation.
This resistor must be effective for r.f. only.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

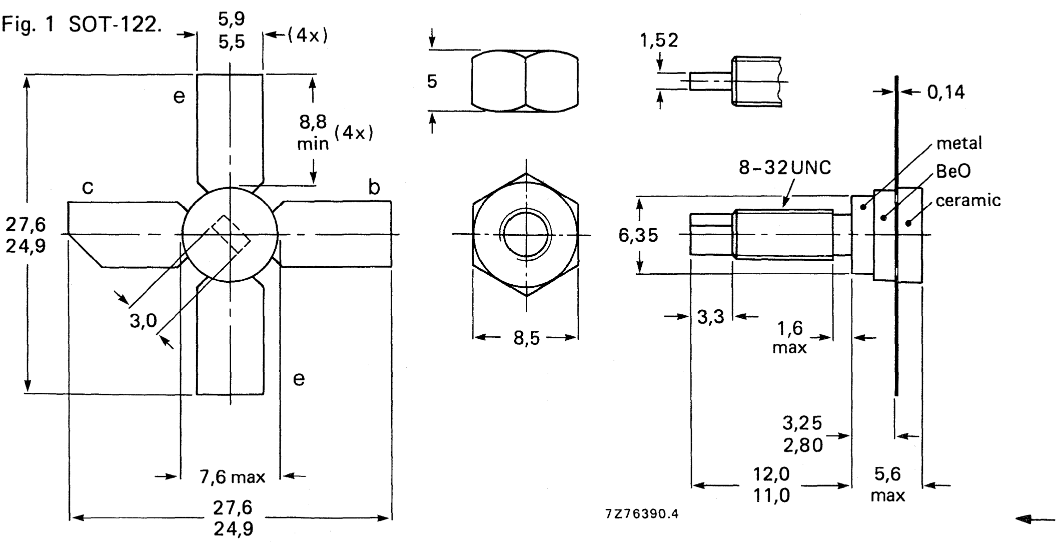
R.F. performance mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A; linear amplifier	224,25 224,25	25 25	0,46 0,46	70 25	−60 −60	> 1,5 typ. 1,7	> 18 typ. 20

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

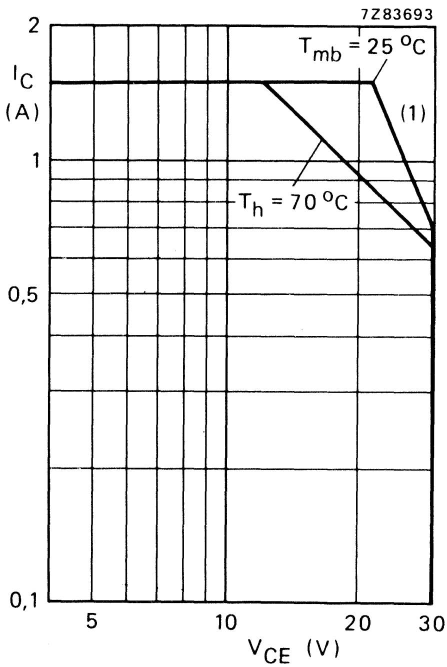
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	1,5 A
(peak value); f > 1 MHz	I_{CM}	max.	3,5 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	32,5 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

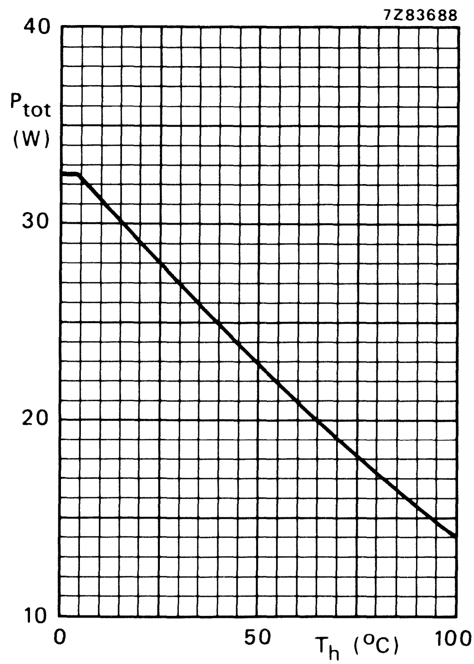


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 12 W; T_{mb} = 77 °C; i.e. T_h = 70 °C)	$R_{th\,j\text{-}mb}$	=	5,6 K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0,6 K/W

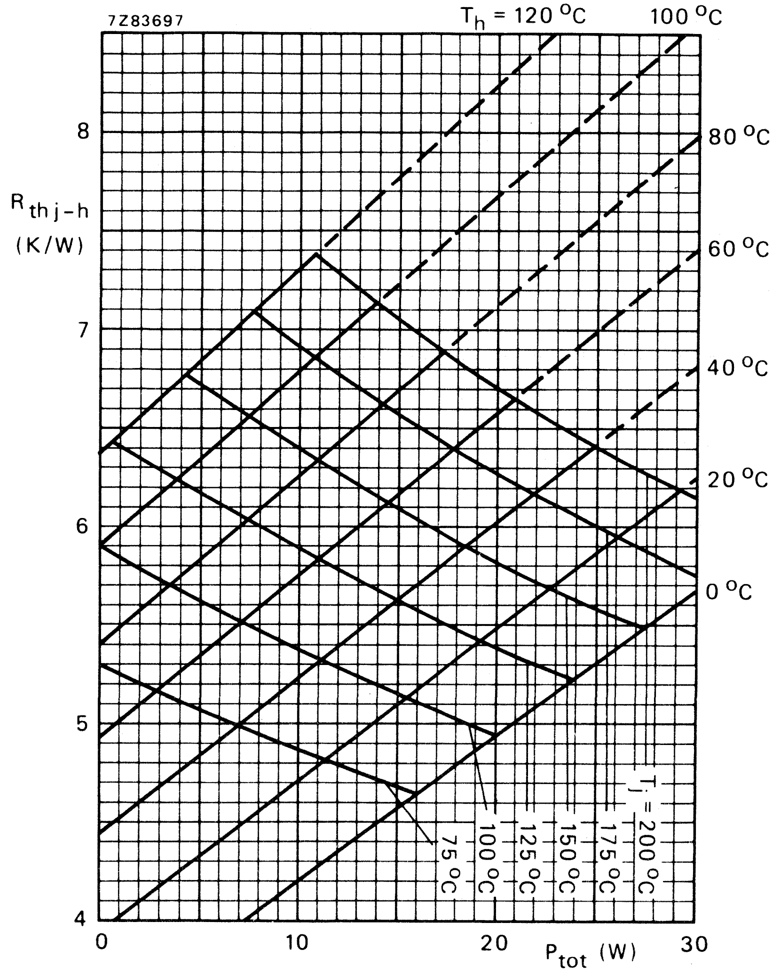


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W).

Example

Nominal class-A operation; V_{CE} = 25 V; I_C = 0,46 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	6,13 K/W
	T_j	max.	140,5 °C
Typical device:	$R_{th\,j\text{-}h}$	typ.	5,45 K/W
	T_j	typ.	133 °C

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	60	V
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base breakdown voltage				
open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	2	mJ
R_{BE} = 10 Ω	E_{SBR}	>	2	mJ
D.C. current gain *				
I_C = 0,5 A; V_{CE} = 25 V	h_{FE}	typ.	65	
			15 to 120	
Collector-emitter saturation voltage *				
I_C = 1,0 A; I_B = 0,1 A	V_{CEsat}	typ.	0,8	V
Transition frequency at f = 500 MHz **				
$-I_E$ = 0,5 A; V_{CB} = 25 V	f_T	typ.	1,20	GHz
$-I_E$ = 1,0 A; V_{CB} = 25 V	f_T	typ.	1,15	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 25 V	C_c	typ.	18	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 25 V	C_{re}	typ.	9,2	pF
→ Collector-stud capacitance	C_{cs}	typ.	1,2	pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

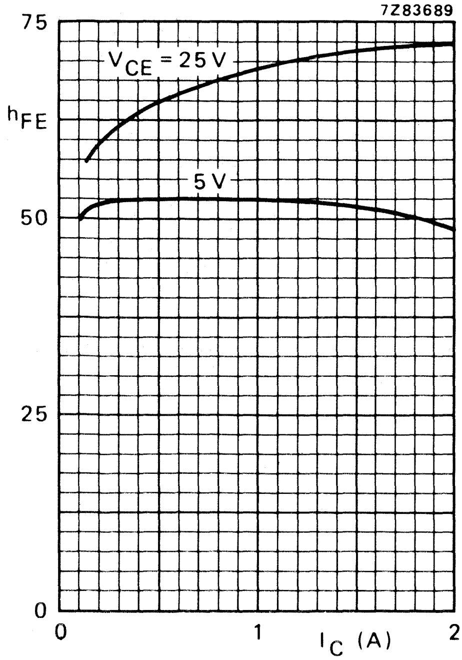


Fig. 5 Typical values; T_j = 25 °C.

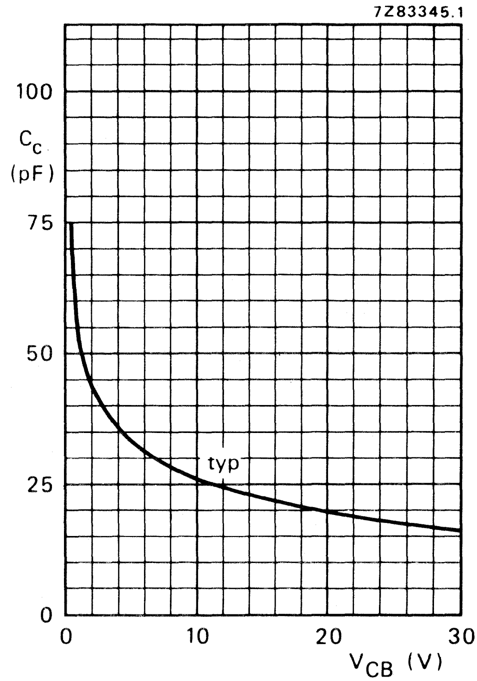


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

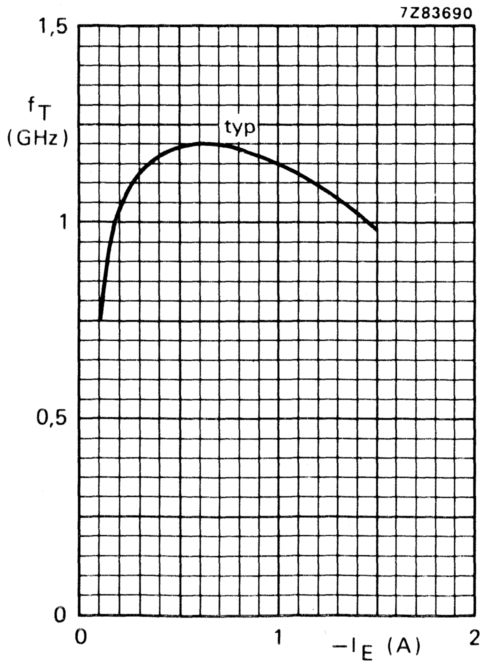


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
224,25	25	0,46	70	−60	> 1,5	> 18
224,25	25	0,46	70	−60	typ. 1,7	typ. 19,5
224,25	25	0,46	25	−60	typ. 1,8	typ. 20

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

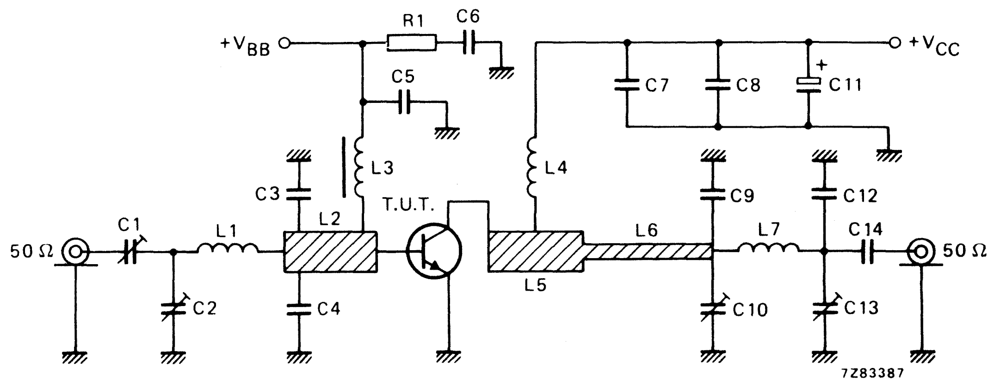


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C6 = C8 = 330 nF polyester capacitor
C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C11 = 10 μF/40 V solid aluminium electrolytic capacitor
C12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 49 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,6 mm; length 6,3 mm; leads 2 x 5 mm
L2 = L5 = 30 Ω stripline (10,0 mm x 6,0 mm)
L3 = 0,1 μH; microchoke (cat. no. 4322 057 01070)
L4 = 130 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,0 mm; length 10,7 mm; leads 2 x 5 mm
L6 = 60 Ω stripline (50,5 mm x 2,0 mm)
L7 = 30 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,0 mm; length 7,9 mm; leads 2 x 5 mm

L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

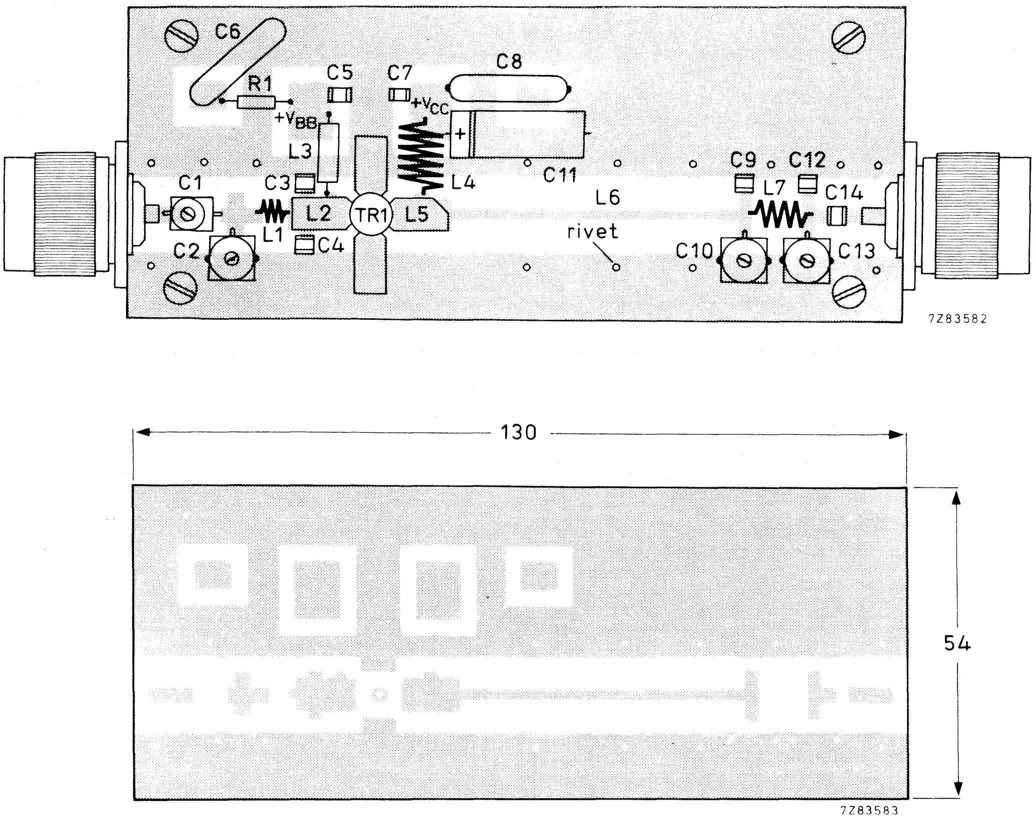


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

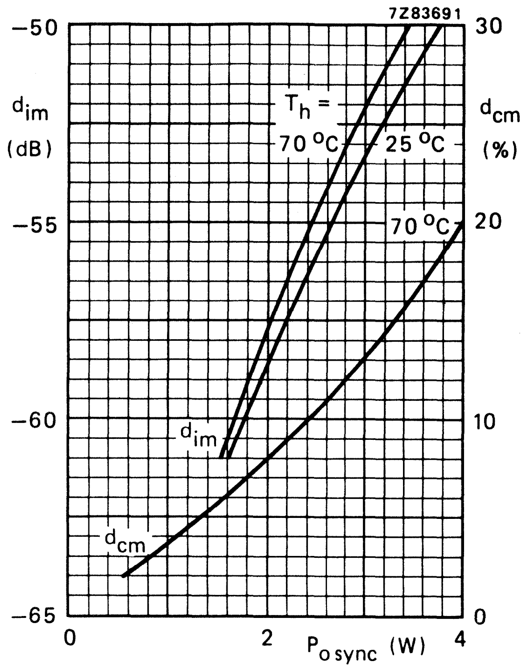


Fig. 10 Intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

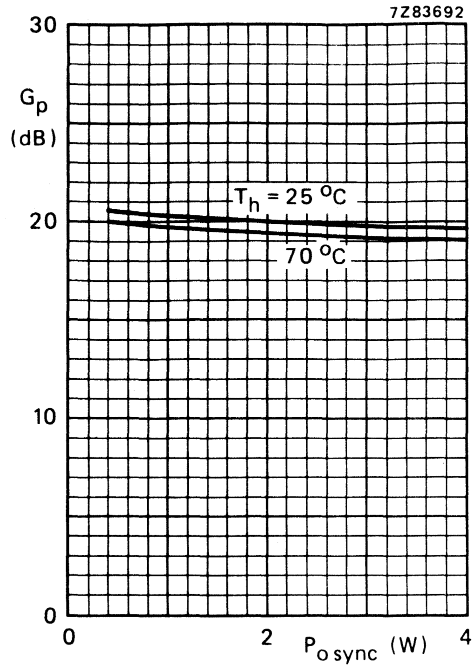


Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:

Typical values; V_{CE} = 25 V; I_C = 0,46 A; f_{vision} = 224,25 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

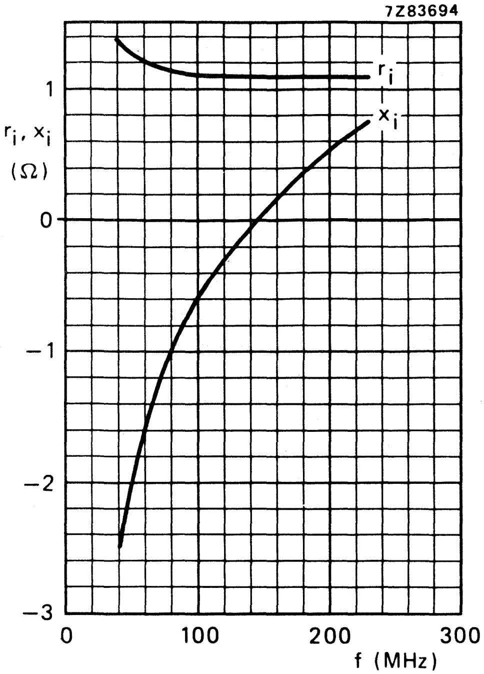


Fig. 12 Input impedance (series components).

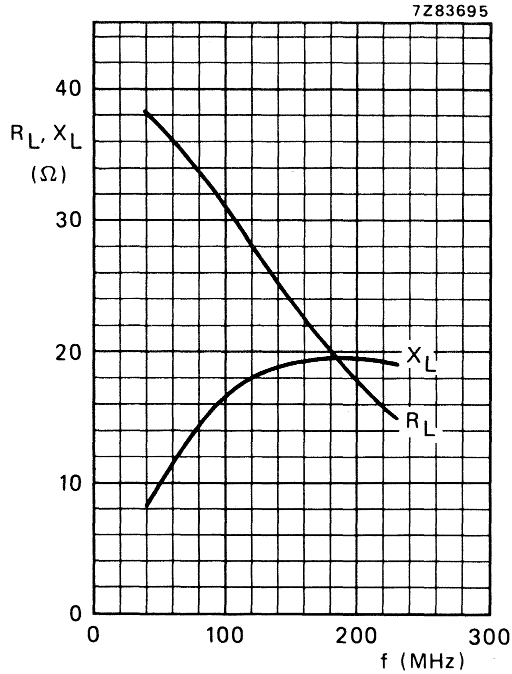


Fig. 13 Load impedance (series components).

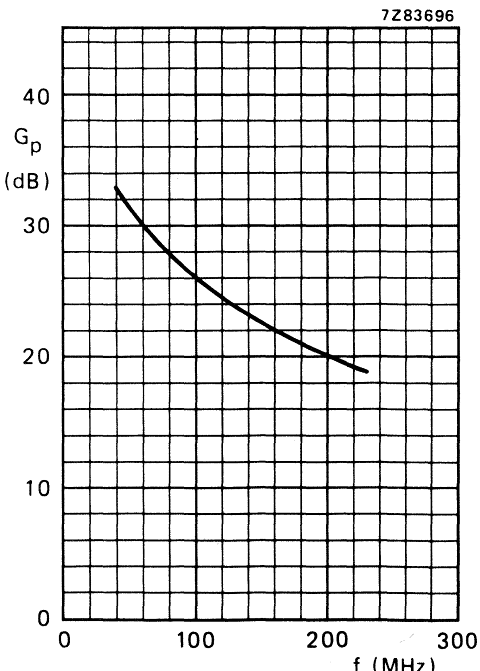


Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 25 V; I_C = 0,46 A;
T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance

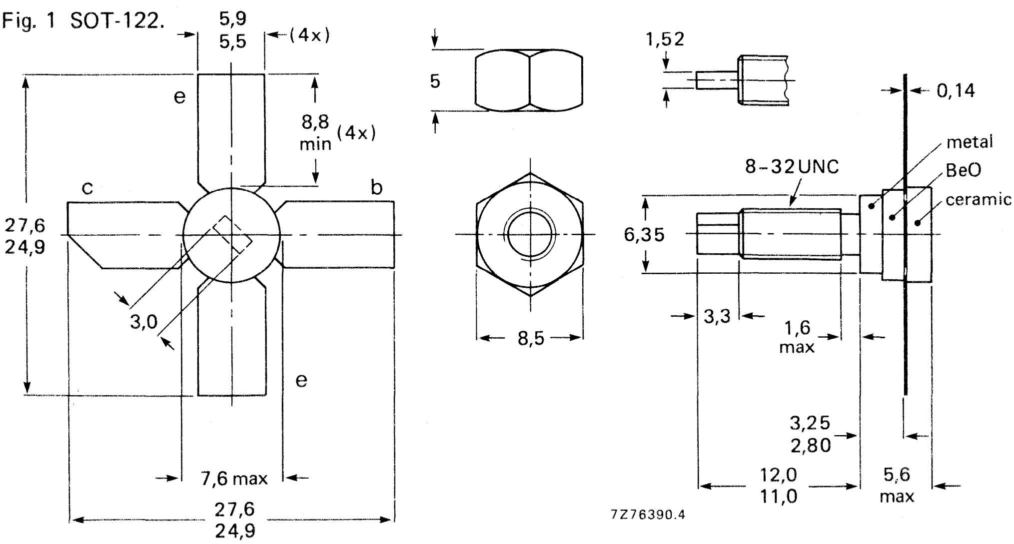
mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A; linear amplifier	224,25	25	0,8	70	−58	> 5	> 15
	224,25	25	0,8	25	−58	typ. 7	typ. 16,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

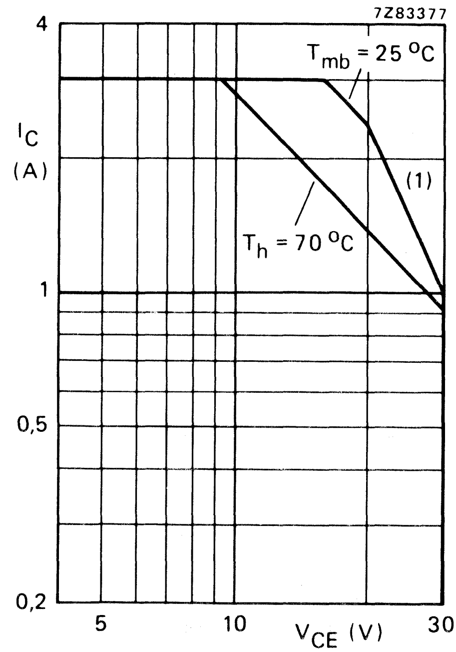
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	3	A
(peak value); f > 1 MHz	I_{CM}	max.	6	A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	48	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

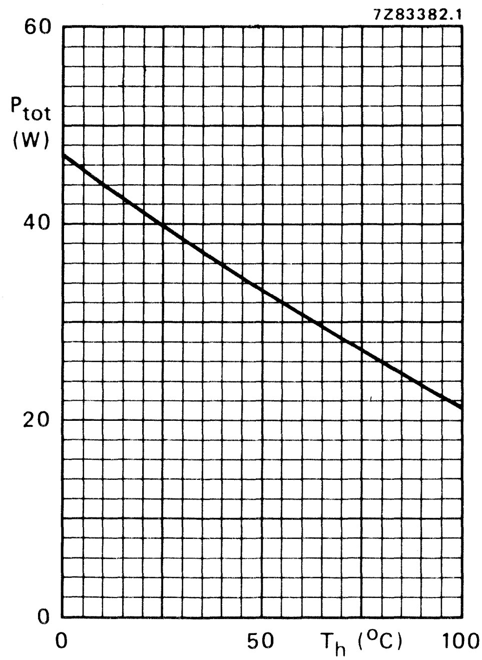


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 20 W; T_{mb} = 82 °C; i.e. T_h = 70 °)	$R_{th\ j\text{-}mb}$	=	3,45	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

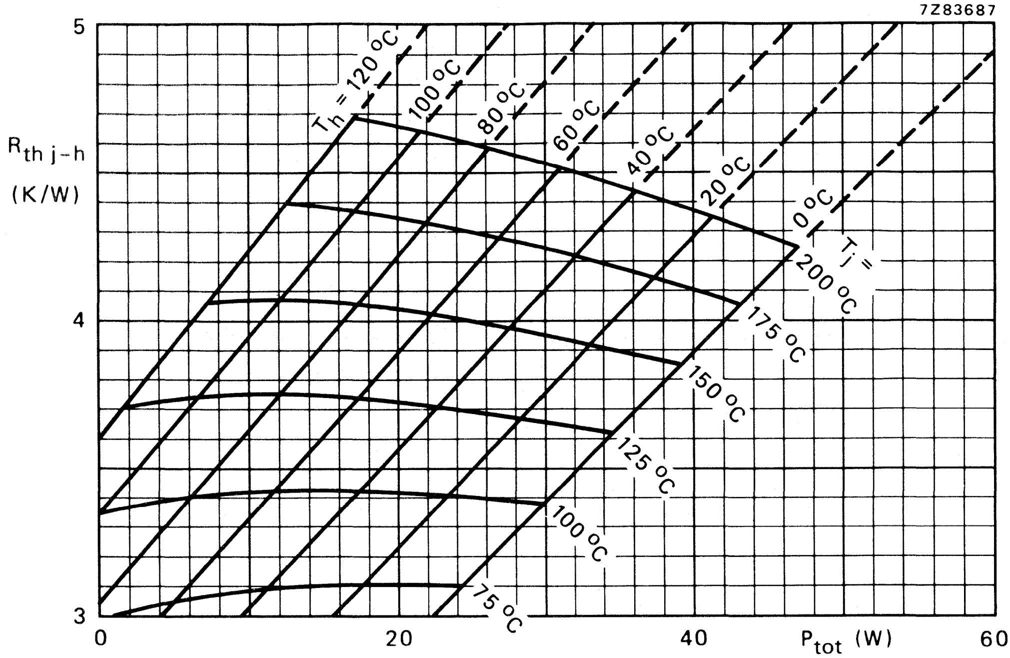


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb-h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 0,8 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j-h}$	max.	4,05 K/W
	T_j	max.	151 °C
Typical device:	$R_{th\ j-h}$	typ.	3,80 K/W
	T_j	typ.	146 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; I_C = 25 mA	$V_{(BR)CES}$	>	60 V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; V_{CE} = 30 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	3 mJ
R_{BE} = 10 Ω	E_{SBR}	>	3 mJ
D.C. current gain *			
I_C = 0,8 A; V_{CE} = 25 V	h_{FE}	typ.	75
			15 to 120
Collector-emitter saturation voltage *			
I_C = 2,0 A; I_B = 0,2 A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 500 MHz **			
$-I_E$ = 0,8 A; V_{CB} = 25 V	f_T	typ.	1,0 GHz
$-I_E$ = 2,0 A; V_{CB} = 25 V	f_T	typ.	1,1 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; V_{CB} = 25 V	C_c	typ.	35 pF
Feedback capacitance at f = 1 MHz			
I_C = 100 mA; V_{CE} = 25 V	C_{re}	typ.	20 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.

** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

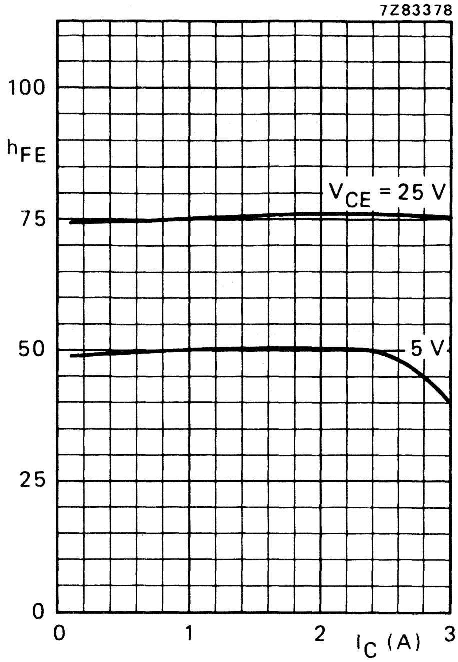


Fig. 5 Typical values; T_j = 25 °C.

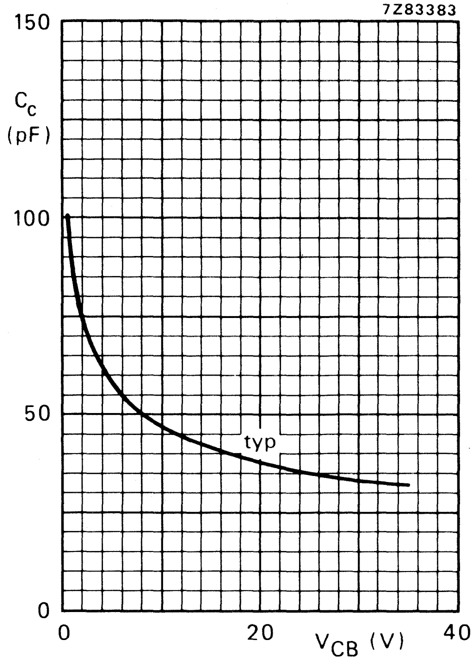


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

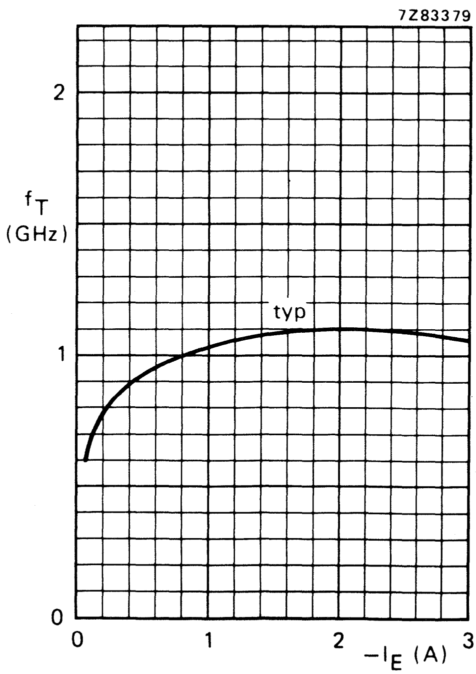


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
224,25	25	0,8	70	−58	> 5	> 15
224,25	25	0,8	70	−58	typ. 5,8	typ. 16,2
224,25	25	0,8	25	−58	typ. 7	typ. 16,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

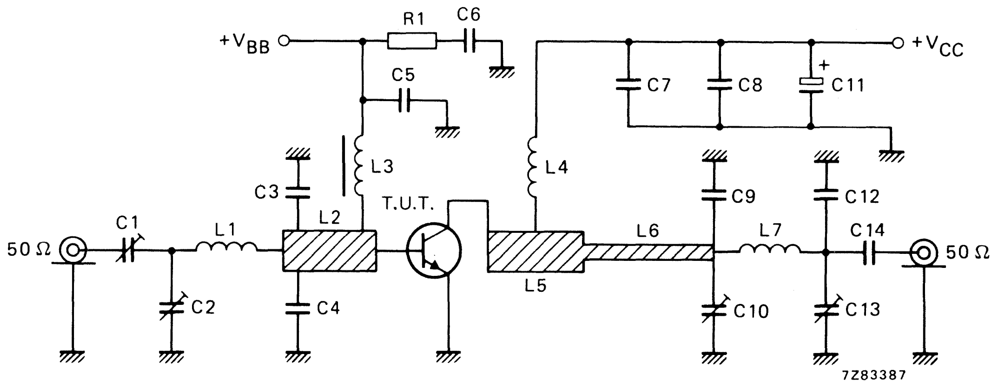


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C6 = C8 = 330 nF polyester capacitor
C9 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C10 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C11 = 10 μF/40 V solid aluminium electrolytic capacitor
C12 = 18 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 49 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,6 mm; length 6,3 mm; leads 2 x 5 mm
L2 = L5 = 30 Ω stripline (10,0 mm x 6,0 mm)
L3 = 0,1 μH; microchoke (cat. no. 4322 057 01070)
L4 = 130 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,0 mm; length 10,7 mm; leads 2 x 5 mm
L6 = 60 Ω stripline (50,5 mm x 2,0 mm)
L7 = 30 nH; 4 turns enamelled Cu wire (1,0 mm); int. dia. 3,0 mm; length 7,9 mm; leads 2 x 5 mm

L2, L5 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

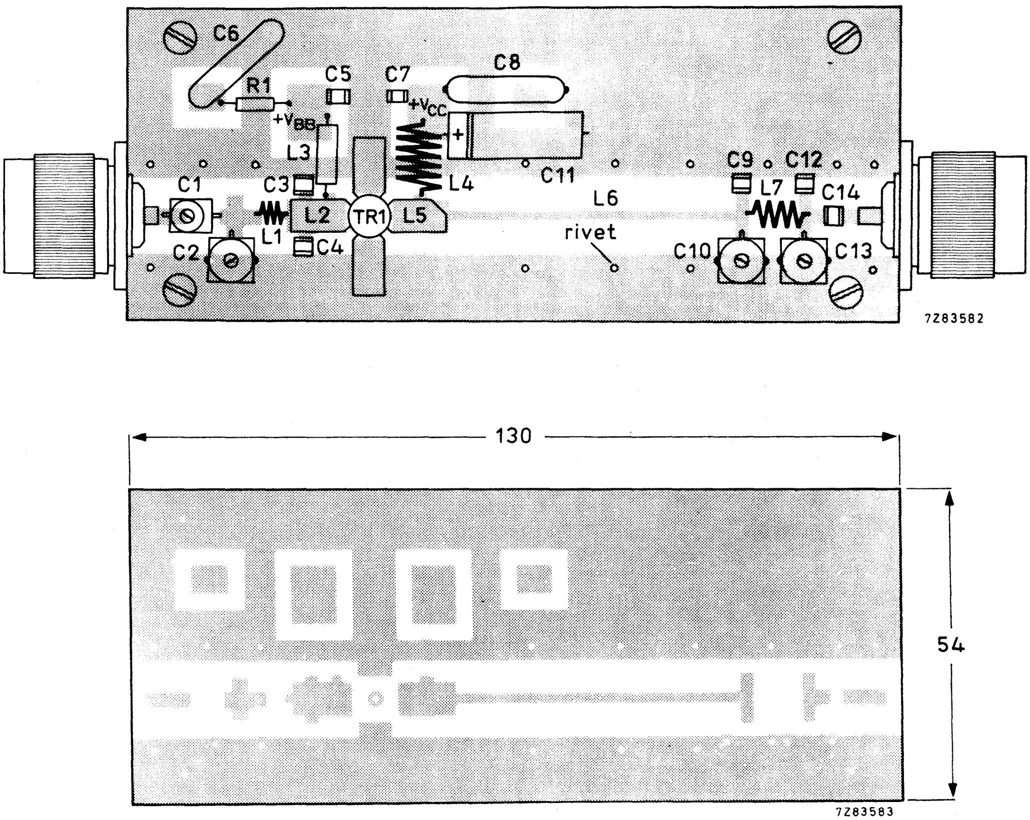


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

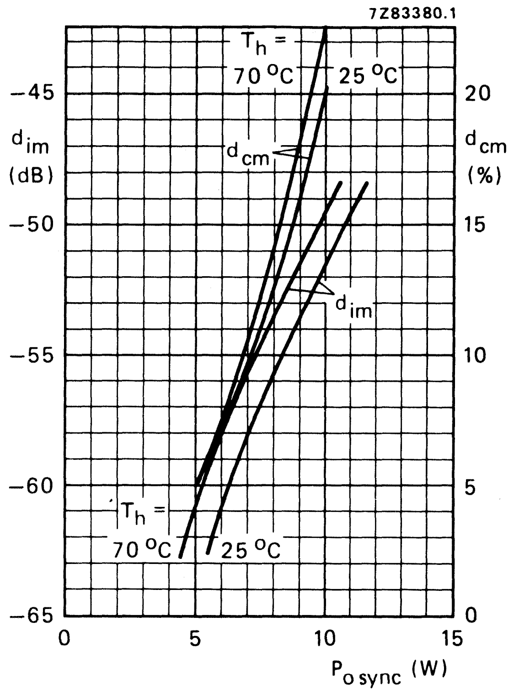


Fig. 10 Intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

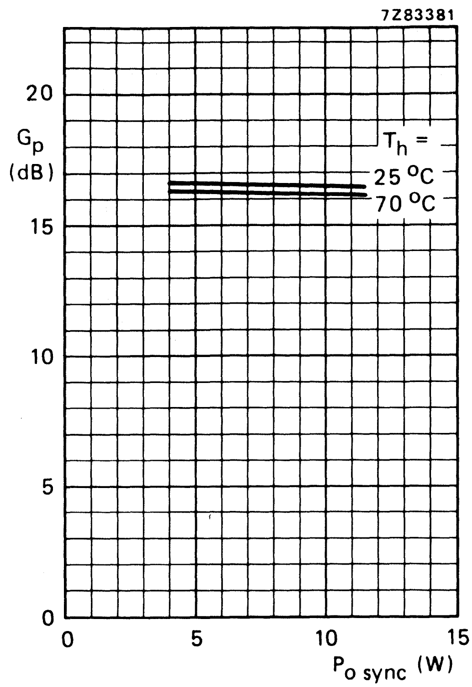


Fig. 11 Power gain as a function of output power.

Conditions for Figs 10 and 11:

Typical values; V_{CE} = 25 V; I_C = 0,8 A; f_{vision} = 224,25 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

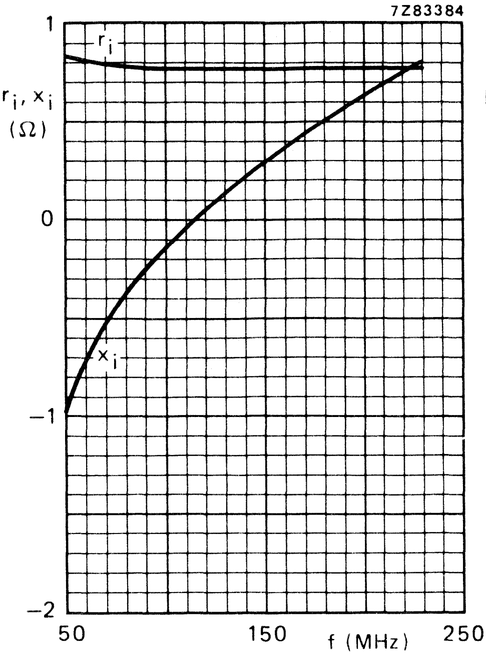


Fig. 12 Input impedance (series components).

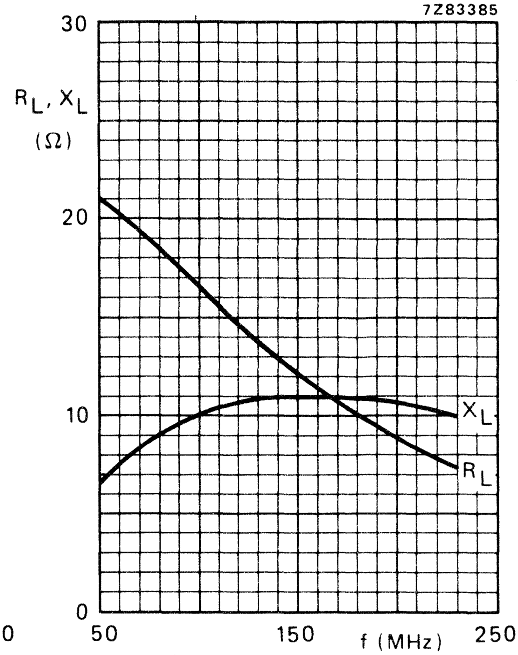


Fig. 13 Load impedance (series components).

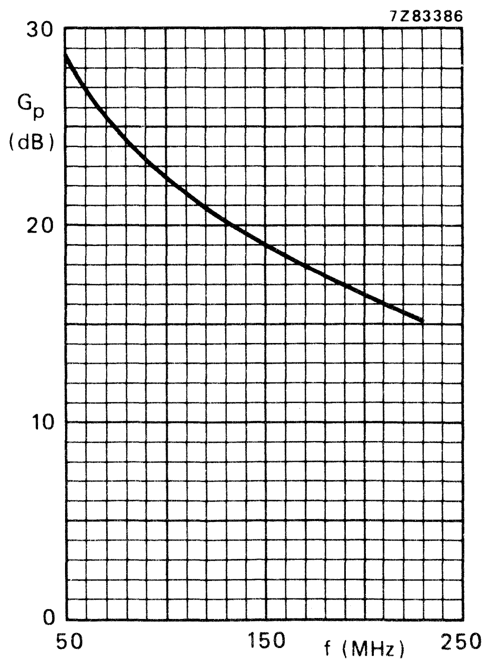


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 0,8 A; T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers of television transmitters and transposers.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 3/8" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	224,25	25	1,5	70	−55	> 10	> 16
class-A	224,25	25	1,5	25	−55	typ. 12,5	typ. 17,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

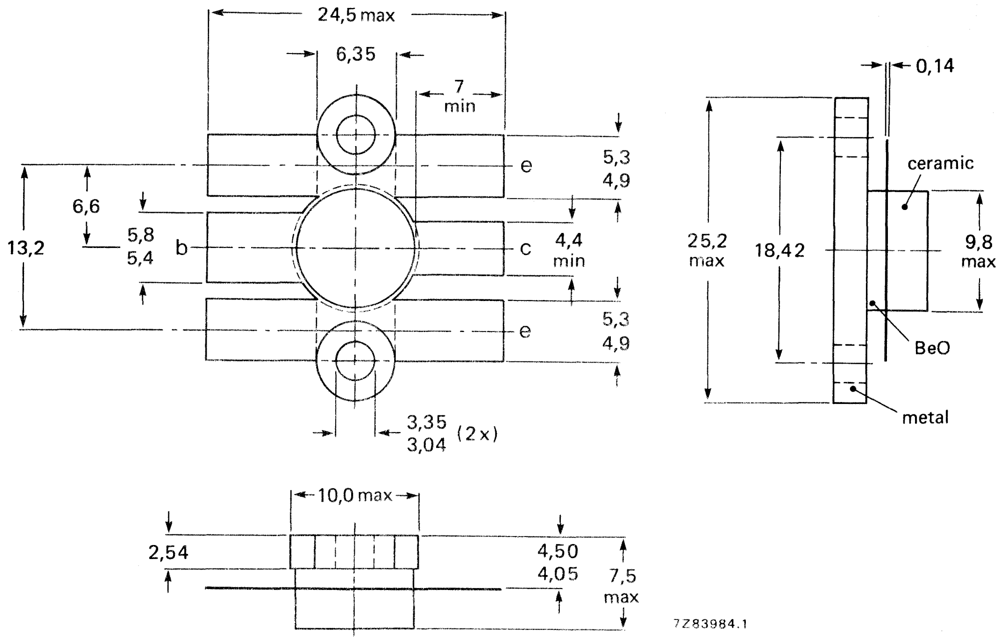
SOT-160 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-160.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

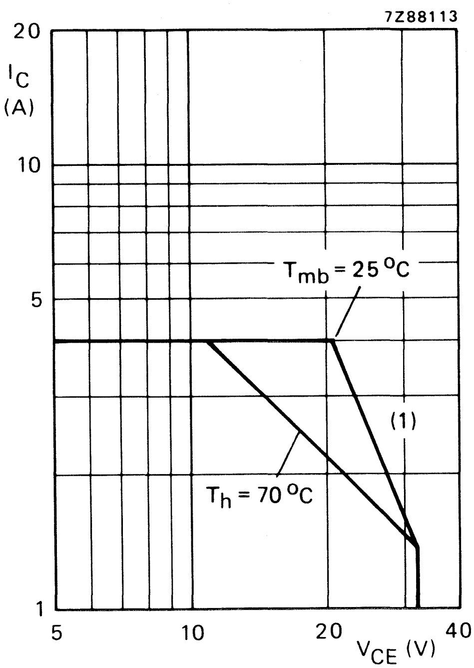
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60 V
open base	V_{CEO}	max.	32 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	4 A
(peak value); f > 1 MHz	I_{CM}	max.	12 A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	82 W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	100 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

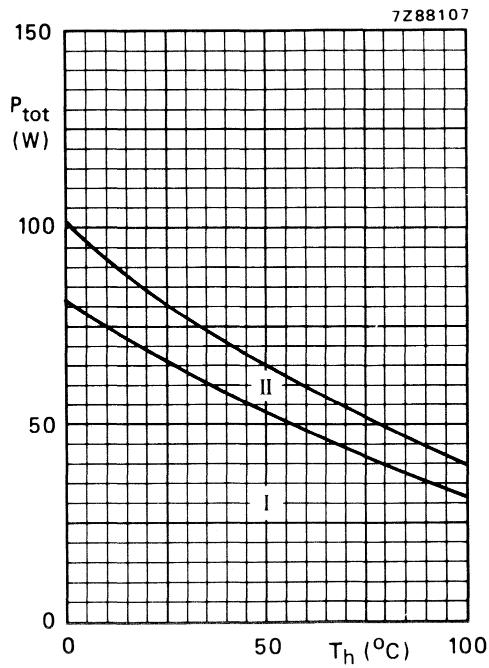


Fig. 3 Power derating curves vs. temperature.

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 37,5 W; $T_{mb} = 82\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,55 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,10 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

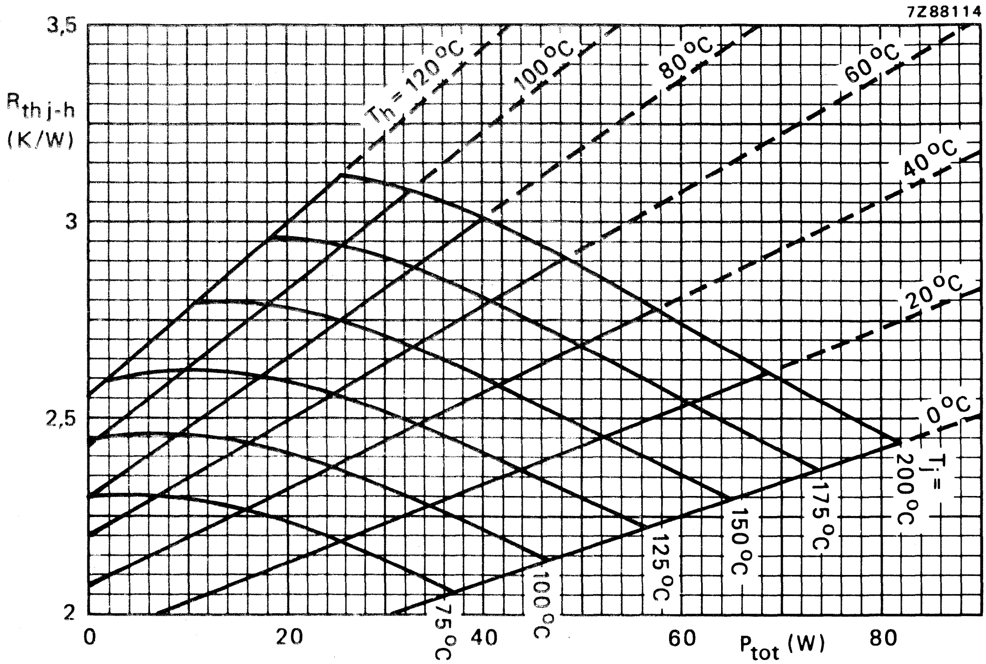


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,3 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 1,5 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	2,85 K/W
	T_j	max.	177 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	2,30 K/W
	T_j	typ.	156 °C

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 15 mA	$V_{(BR)CES}$	>	60 V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	32 V
Emitter-base breakdown voltage			
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 32 V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	4,5 mJ
R_{BE} = 10 Ω	E_{SBR}	>	4,5 mJ
D.C. current gain*			
I_C = 1,6 A; V_{CE} = 25 V	h_{FE}	typ.	50
			20 to 120
Collector-emitter saturation voltage*			
I_C = 3,5 A; I_B = 0,35 A	V_{CEsat}	typ.	1,4 V
Transition frequency at f = 500 MHz**			
$-I_E$ = 1,6 A; V_{CB} = 25 V	f_T	typ.	2 GHz
$-I_E$ = 3,5 A; V_{CB} = 25 V	f_T	typ.	2 GHz
Collector capacitance at f = 1 MHz			
I_E = I_e = 0; V_{CB} = 25 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz			
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	31 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

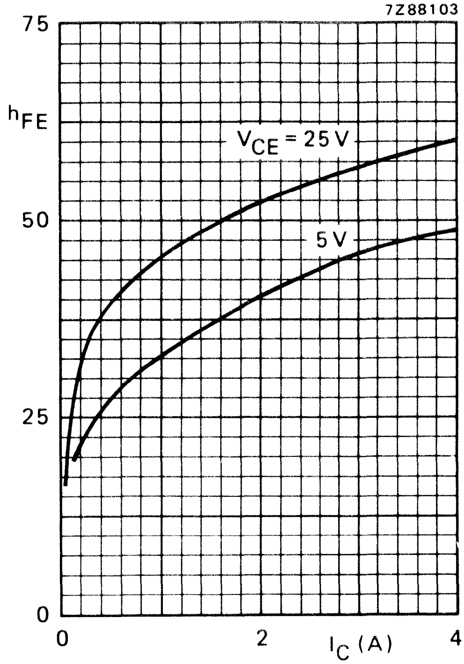


Fig. 5 Typical values; T_j = 25 °C.

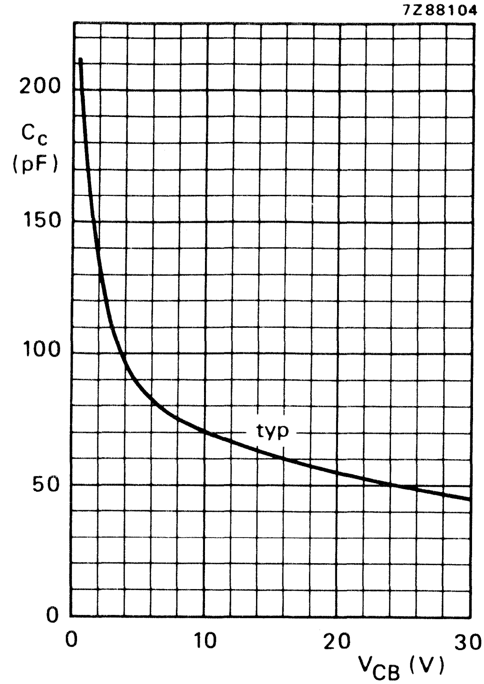


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

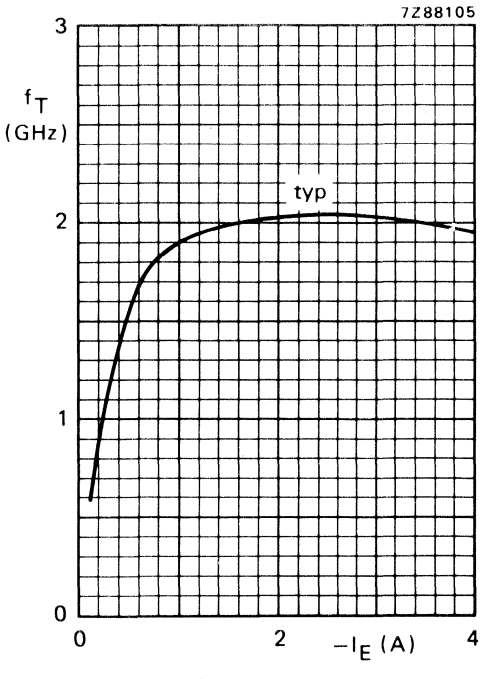


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

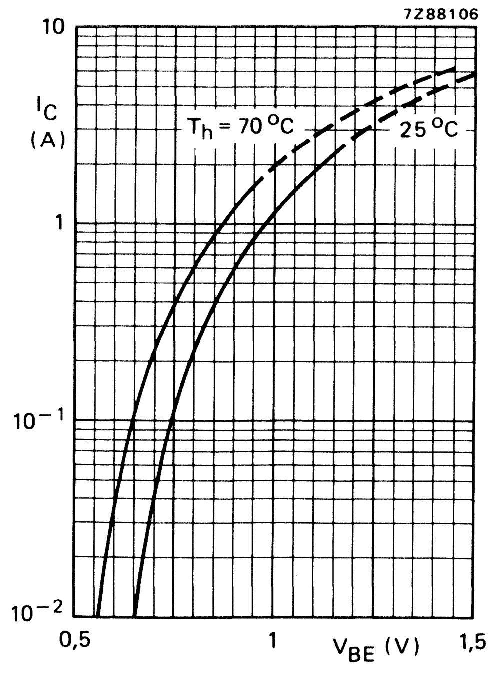


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)*	I_C (A)	T_h (°C)	d_{im} (dB)**	$P_{o\ sync}$ (W)**	G_p (dB)
224,25	25	1,5	70	−55	> 10	> 16
			70	−55	typ. 11	typ. 16,8
			70	−52	typ. 13	typ. 16,8
			25	−55	typ. 12,5	typ. 17,2

* The transistor is capable of operating up to 28 V.

** Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

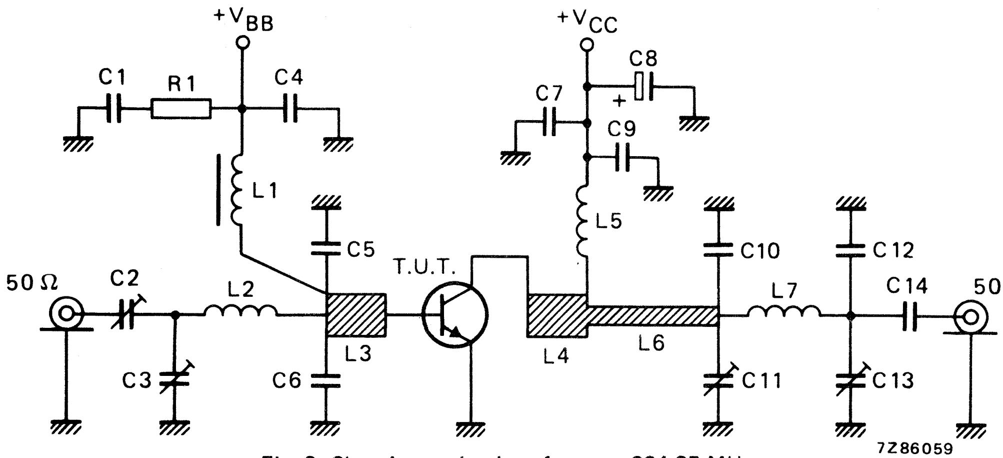


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = C9 = 330 nF polyester capacitor
C2 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C3 = C11 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = C6 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C8 = 10 μF/63 V solid tantalum capacitor
C10 = 82 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C12 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

L1 = 1 μH microchoke (cat. no. 4322 057 01080)
L2 = 3 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 14,0 mm; leads 2 x 3 mm
L3 = L4 = 32 Ω stripline (6,0 mm x 10,0 mm)
L5 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 5,5 mm; length 10,0 mm; leads 2 x 2 mm
L6 = 62 Ω stripline (2,0 mm x 22,5 mm)
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 4,0 mm; leads 2 x 3 mm

L3, L4 and L6 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 27 Ω carbon resistor

▲ ATC means American Technical Ceramics.

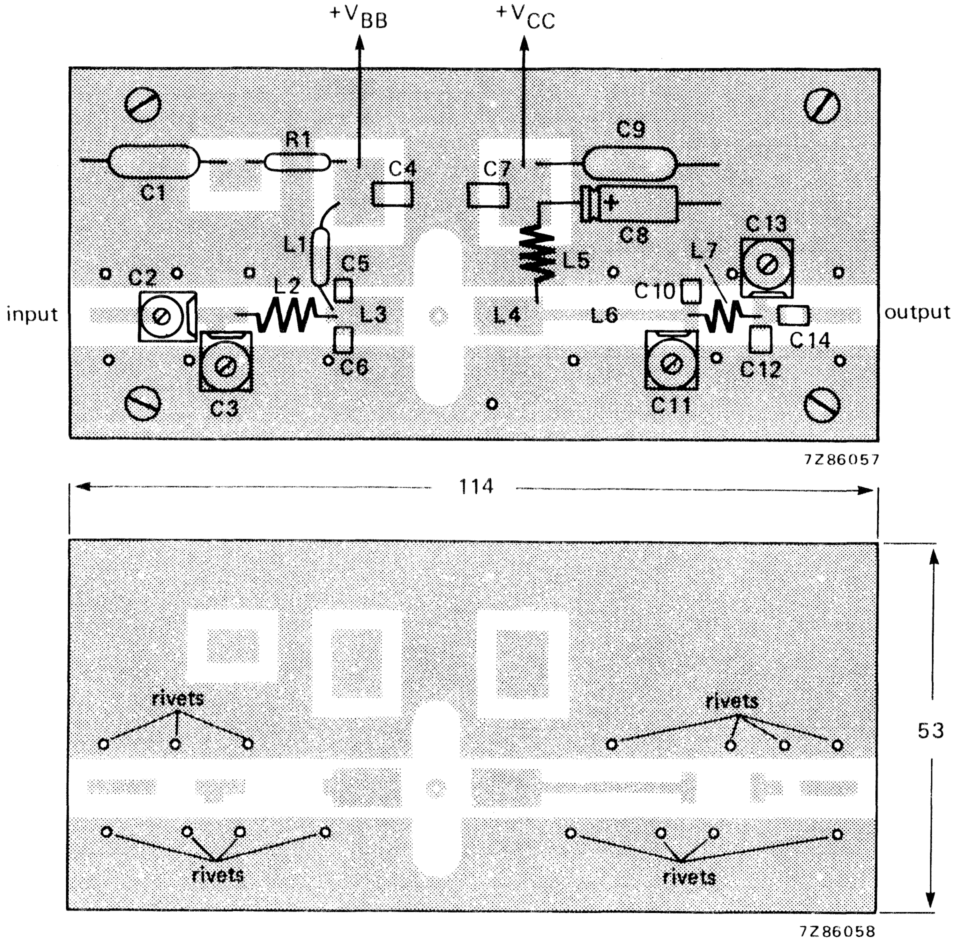


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

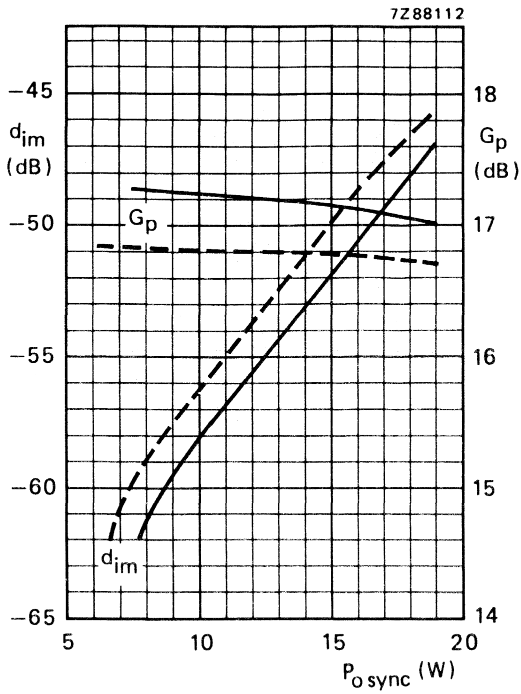


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

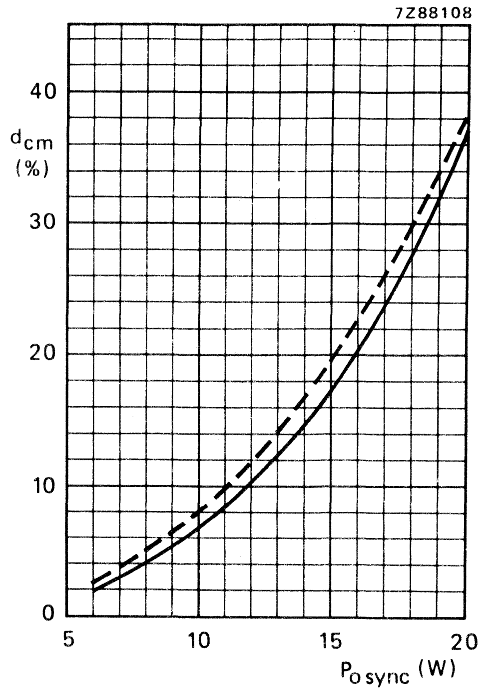


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 1,5 A; —— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV32F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 15 W (r.m.s. value) or 20 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 1,5 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\,mb\text{-}h}$ = 0,3 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

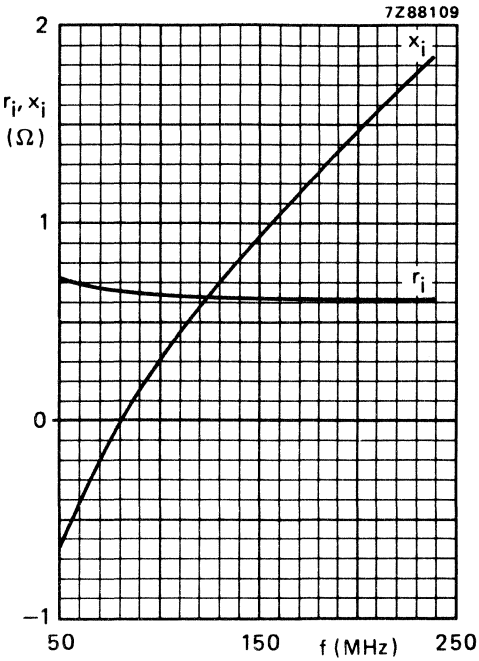


Fig. 13 Input impedance (series components).

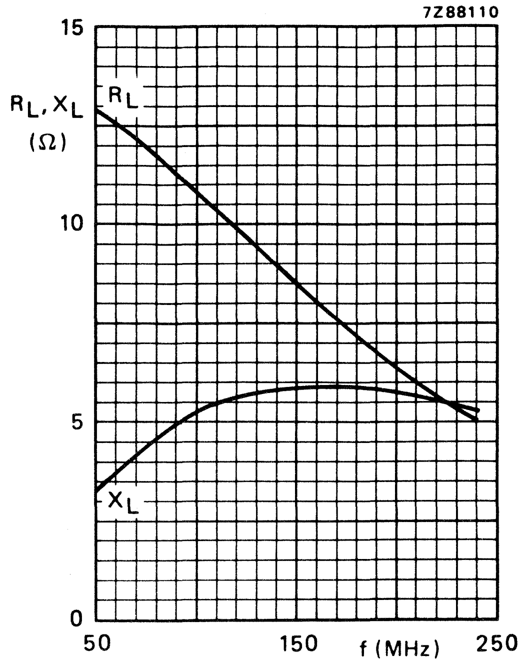


Fig. 14 Load impedance (series components).

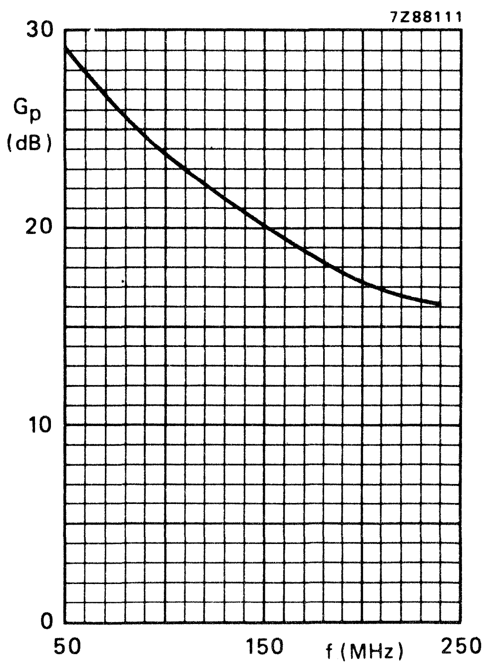


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 1,5 A; class-A operation; T_h = 70 °C.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers. Diffused emitter ballasting resistors and the application of **gold sandwich metallization** ensure an optimum temperature profile and excellent reliability properties.

The transistor has a ½" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C $I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB	sync compr.** sync in (%)/sync out (%)
class-A	224,25	25	3,20	70	−55	> 19	> 9	
				25	−55	typ. 26	typ. 9,7	
class-AB	224,25	28	0,10	70		typ. 90	typ. 6,5	30/25

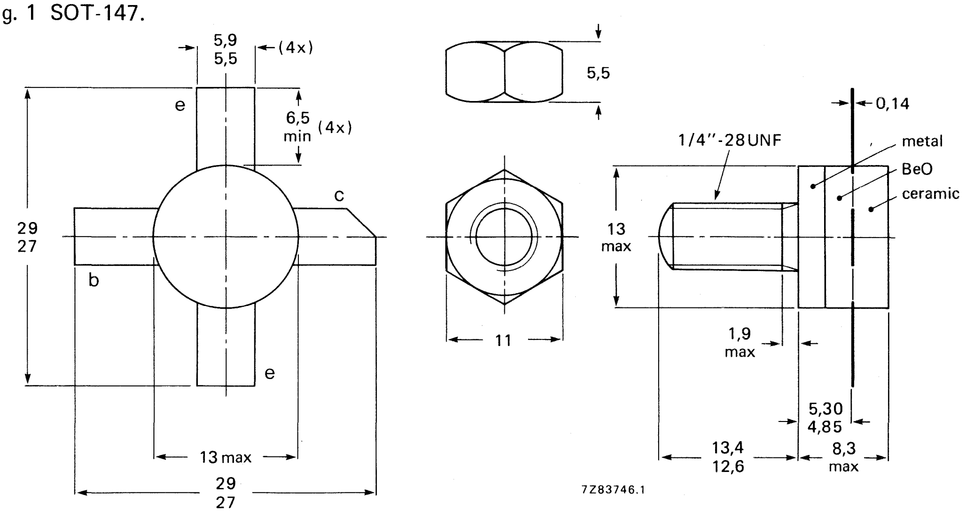
* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-147.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

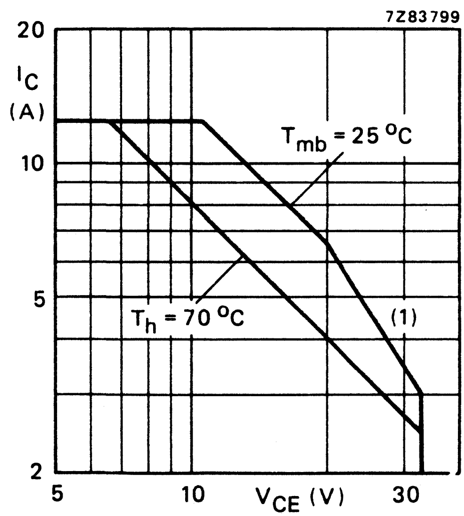
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	12,5	A
(peak value); f > 1 MHz	I_{CM}	max.	20	A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	132	W
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	165	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

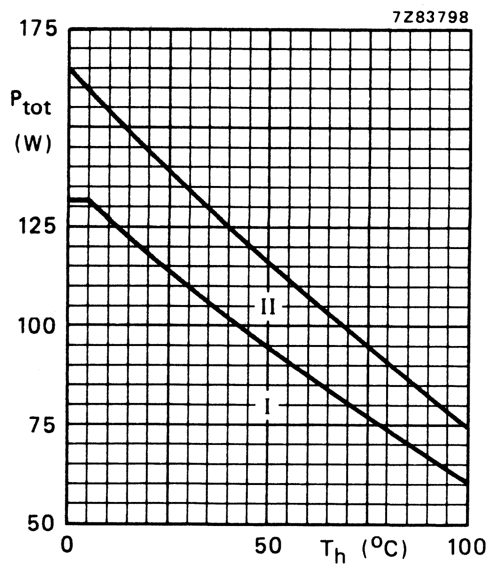


Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,46	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,17	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,15	K/W

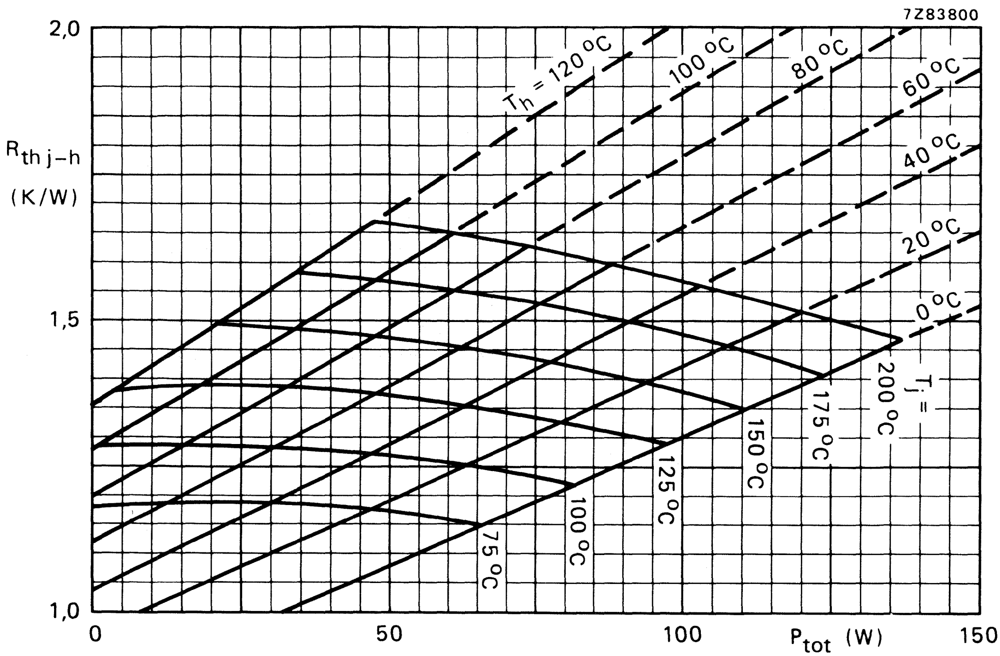


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,15 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	1,60 K/W
	T_j	max.	198 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	1,50 K/W
	T_j	typ.	190 °C

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65	V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	12,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	12,5	mJ
D.C. current gain*				
I_C = 3,0 A; V_{CE} = 25 V	h_{FE}	typ.	50	
			15 to 100	
Collector-emitter saturation voltage*				
I_C = 6,0 A; I_B = 0,6 A	V_{CEsat}	typ.	0,75	V
Transition frequency at f = 100 MHz**				
$-I_E$ = 3,0 A; V_{CB} = 25 V	f_T	typ.	680	MHz
$-I_E$ = 6,0 A; V_{CB} = 25 V	f_T	typ.	750	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	155	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 25 V	C_{re}	typ.	88	pF
Collector-stud capacitance	C_{cs}	typ.	3	pF

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

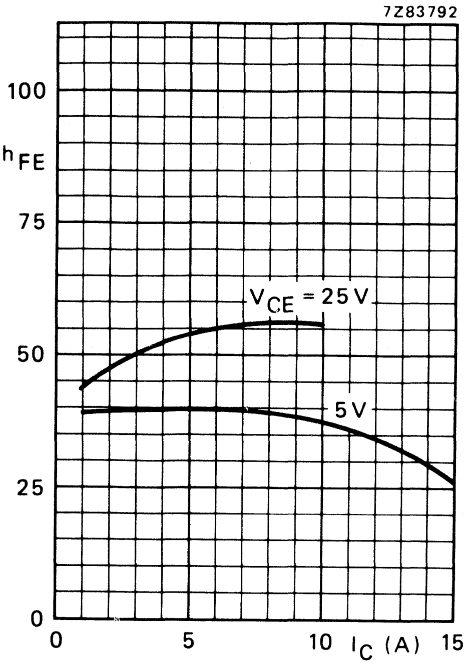


Fig. 5 Typical values; T_j = 25 °C.

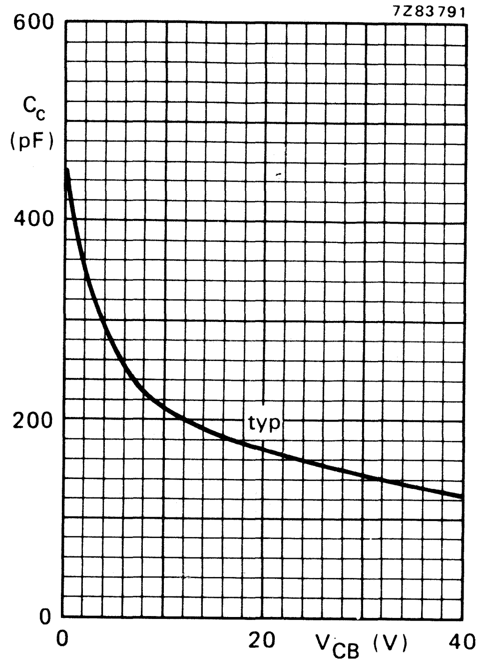


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

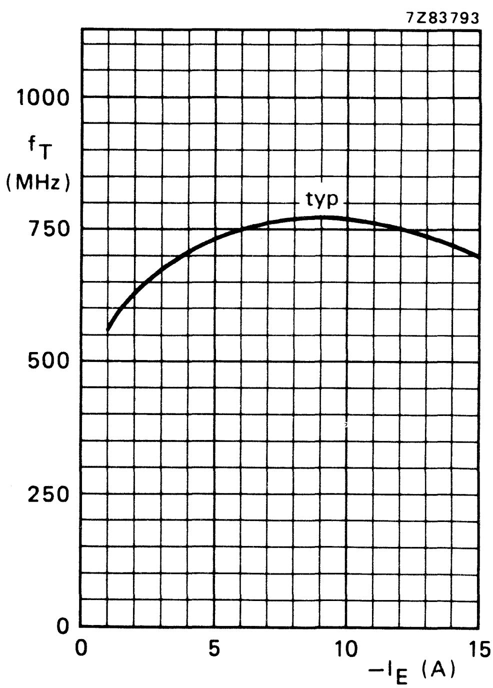


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

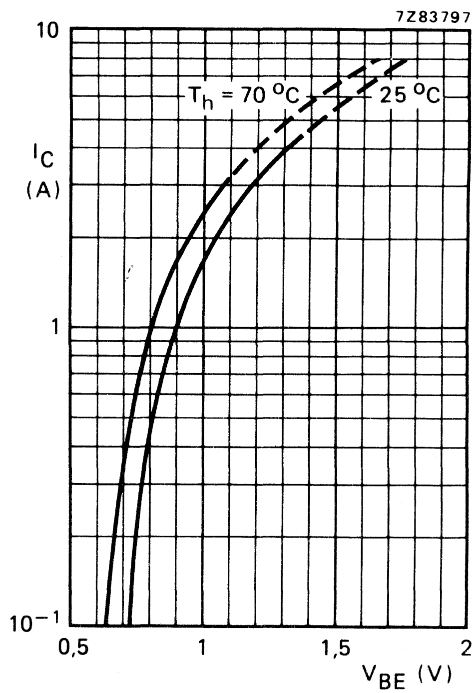


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB)*	P_o sync (W)*	G_p (dB)
224,25	25	3,2	70	−55	> 19	> 9
			70	−55	typ. 22	typ. 9,3
			70	−52	typ. 26,5	typ. 9,3
			25	−55	typ. 26	typ. 9,7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

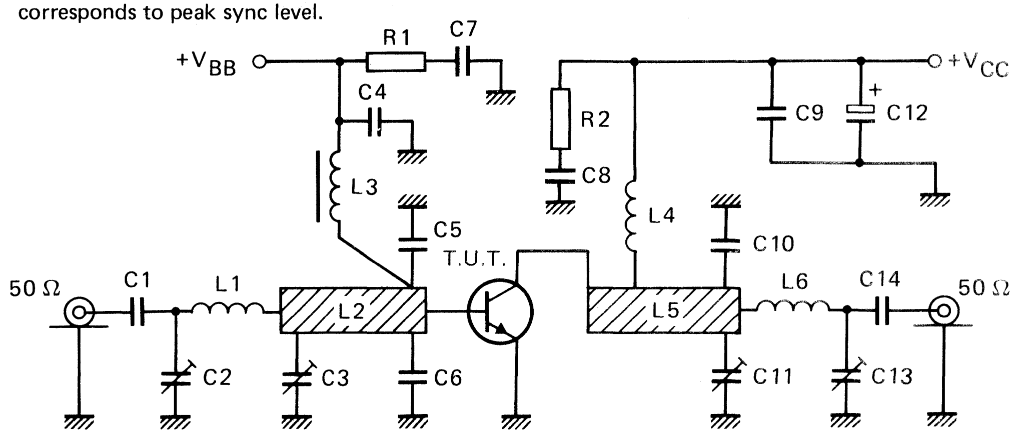


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

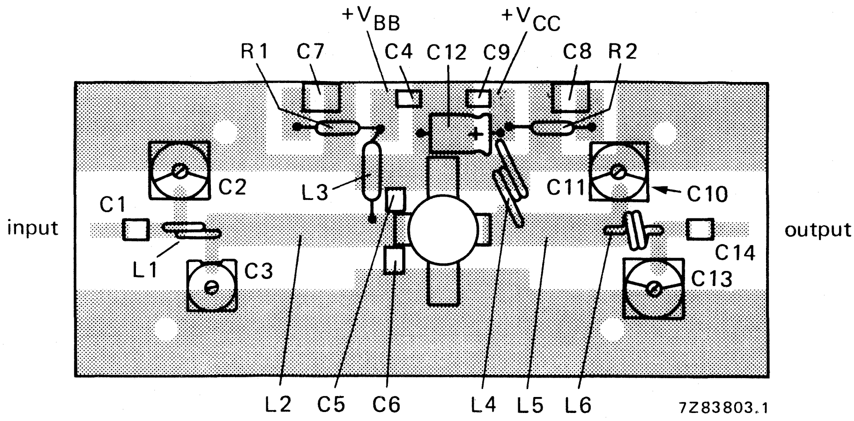
C1 = C14 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C11 = C13 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C9 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = C6 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲), placed 2 mm from transistor edge
C7 = C8 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C10 = 24 pF (500 V) multilayer ceramic chip capacitor (ATC▲), positioned under C11
C12 = 10 μF/40 V solid aluminium electrolytic capacitor

L1 = 1½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; leads 2 x 3 mm
L2 = 30 Ω stripline (6,0 mm x 32,7 mm)
L3 = 1 μH microchoke (cat. no. 4322 057 01080)
L4 = 27 nH; 2 turns enamelled Cu wire (1,1 mm); int. dia; 4,5 mm; length 2,9 mm; leads 2 x 5 mm
L5 = 30 Ω stripline (6,0 mm x 24,0 mm)
L6 = 19 nH; 2 turns enamelled Cu wire (1,1 mm); int. dia. 3,5 mm; length 3,5 mm; leads 2 x 5 mm

L2 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.



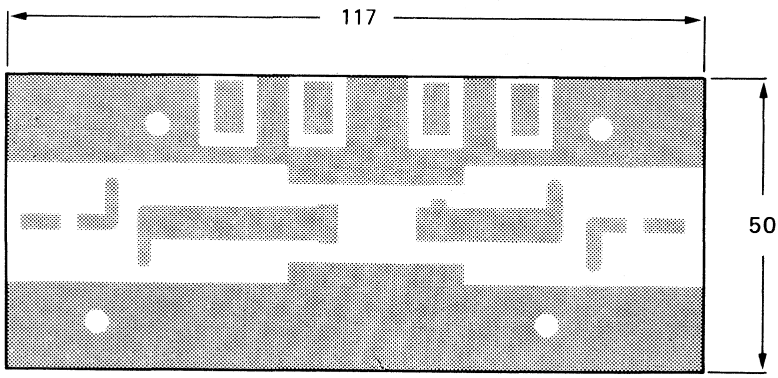


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

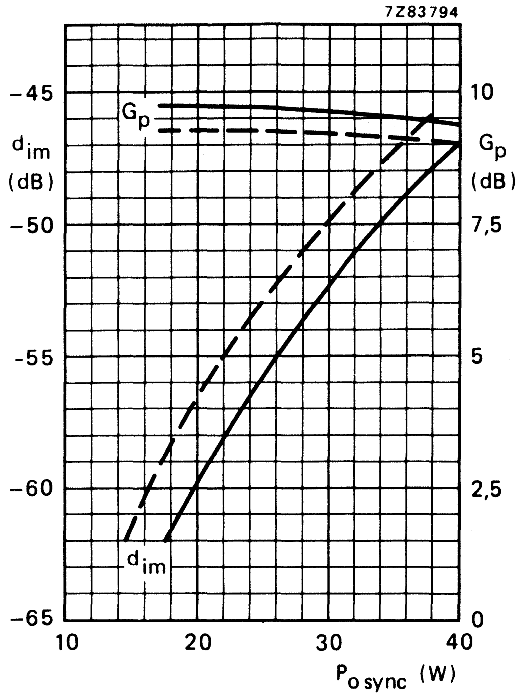


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

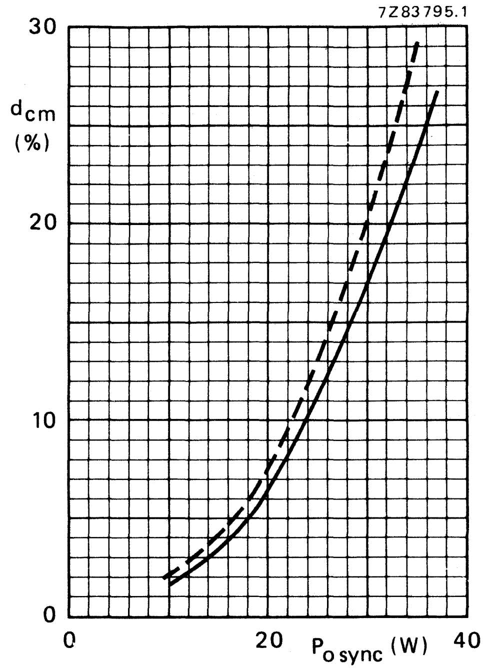


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; —— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV33 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\,mb\text{-}h}$ = 0,15 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

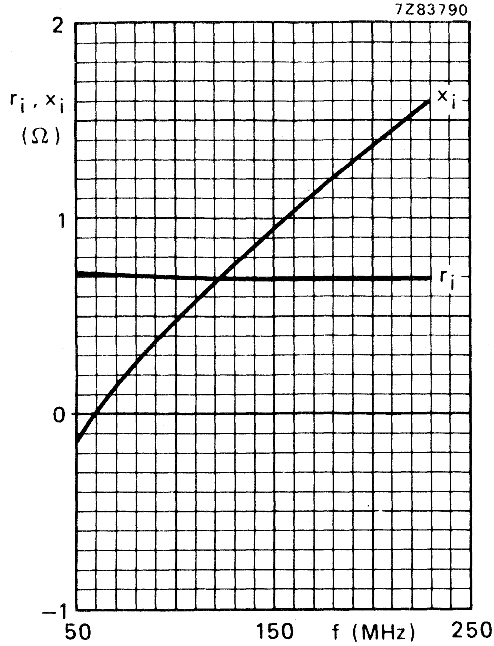


Fig. 13 Input impedance (series components).

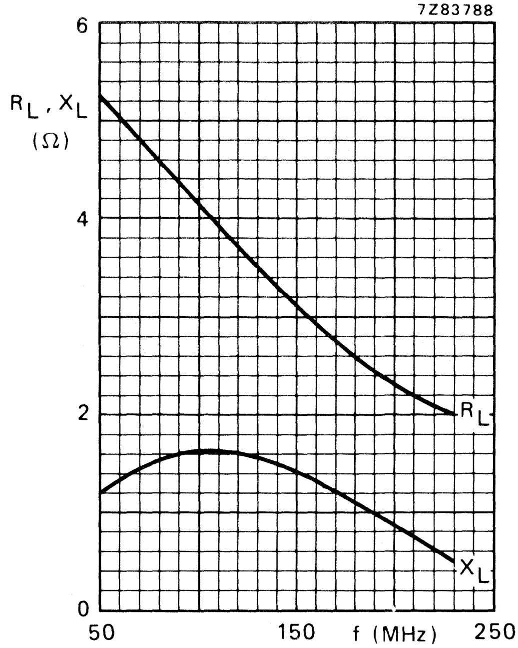


Fig. 14 Load impedance (series components).

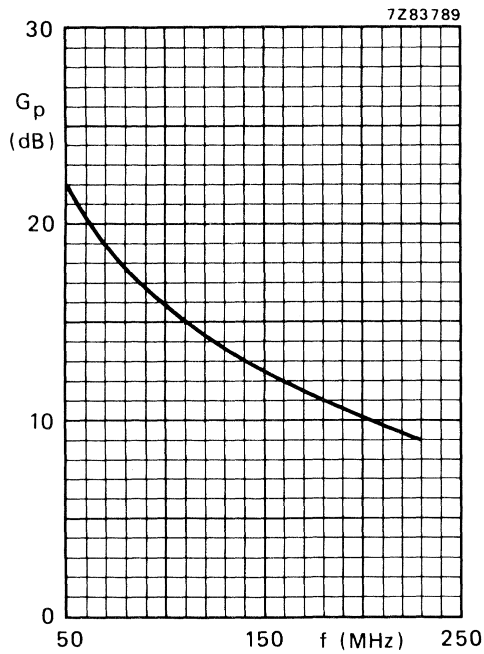


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; class-A operation; T_h = 70 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	I_C (A)	η (%)	G_p (dB)*
224,25	28	0,1	70	40	typ. 2,60	typ. 55	typ. 7,5
				90	typ. 4,46	typ. 72	typ. 6,5

* Gain compression point of 1 dB is at typical 90 W (minimum 80 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

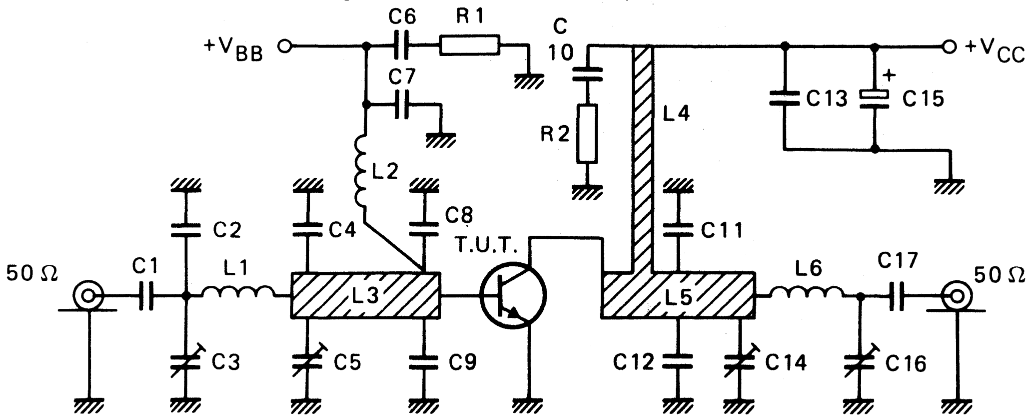


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz. 7Z83802

List of components:

C1 = C17 = 680 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = C16 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C6 = C10 = 330 nF polyester capacitor
C7 = C13 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C8 = C9 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 2,5 mm from transistor edge
C11 = C12 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 7 mm from transistor edge
C14 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C15 = 10 μF/40 V solid aluminium electrolytic capacitor

L1 = 25 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,3 mm; length 3,4 mm; leads 2 x 5 mm
L2 = 120 nH; 4 turns closely wound enamelled Cu wire (1,1 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L3 = 30 Ω stripline (6,0 mm x 48,8 mm)
L4 = 48 Ω stripline (3,0 mm x 27,0 mm) at 3 mm from transistor edge
L5 = 30 Ω stripline (6,0 mm x 42,9 mm)
L6 = 24 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 3,4 mm; leads 2 x 5 mm

L3, L4 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.

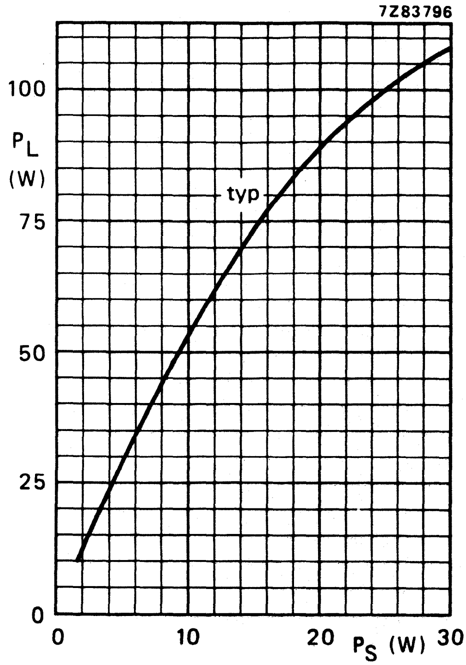


Fig. 17 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 °C; f_{vision} = 224,25 MHz.

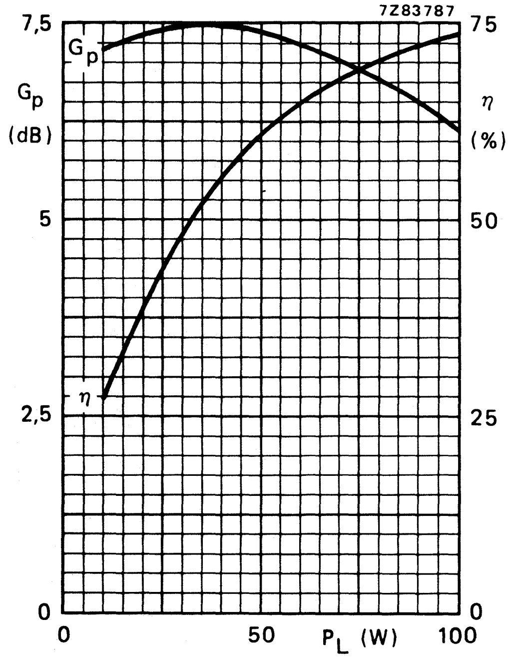


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 °C; f_{vision} = 224,25 MHz; typical values.

Ruggedness in class-AB operation

The BLV33 is capable of withstanding a load mismatch (VSWR ⩽ 2 through all phases) up to 60 W (r.m.s. value) and 90 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; T_h = 70 °C; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,15 K/W.

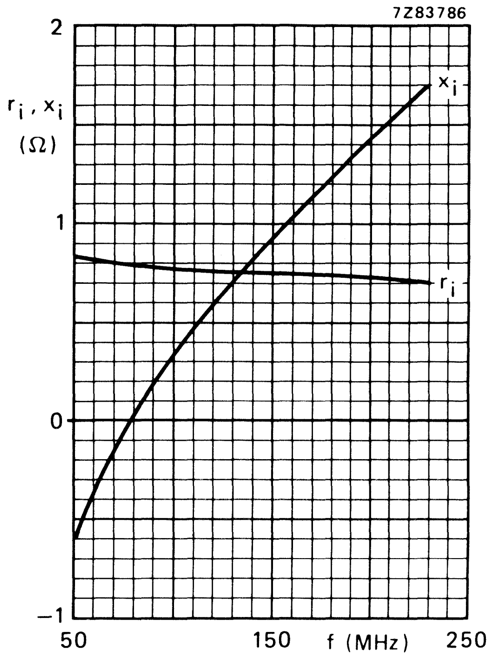


Fig. 19 Input impedance (series components).

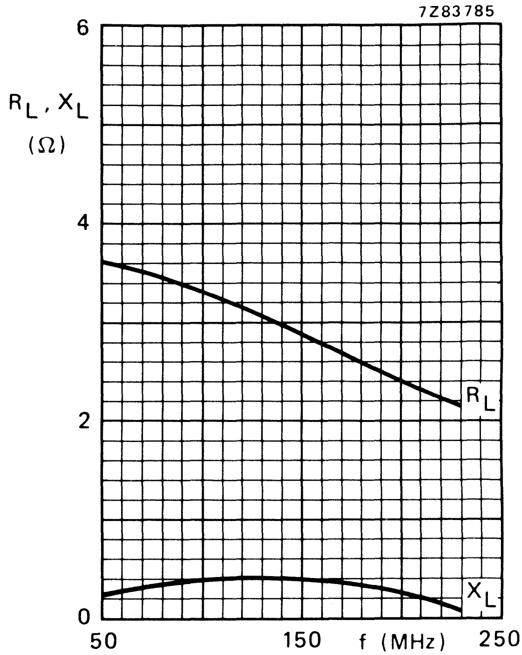


Fig. 20 Load impedance (series components).

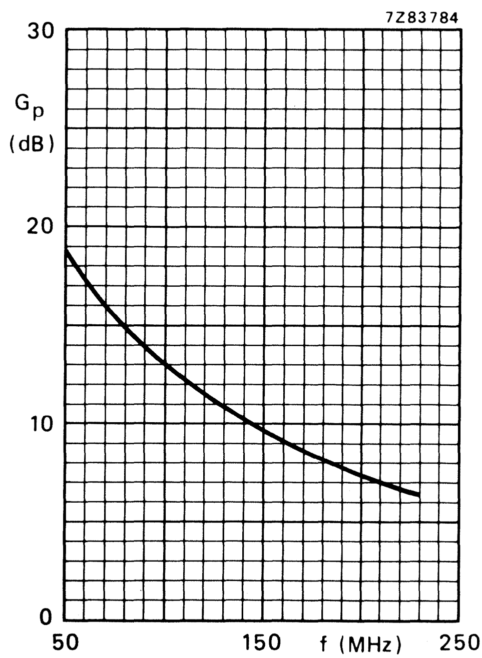


Fig. 21.

Conditions for Figs 19, 20 and 21:

Typical values; V_{CE} = 28 V; P_L = 80 W (P.E.P.); class-AB operation; T_h = 70 ^oC.

V.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear v.h.f. amplifiers for television transmitters and transposers.

Features of this product:
- internally matched input for wideband operation and high power gain;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ½" 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	I_C $I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB	sync compr.** sync in (%)/sync out (%)
class-A	224,25	25	3,20	70	−55	> 16	> 13,5	
				25	−55	typ. 22	typ. 14,8	
class-AB	224,25	28	0,20	70		typ. 85	typ. 10,5	30/25

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** Television service (negative modulation, C.C.I.R. system).

MECHANICAL DATA

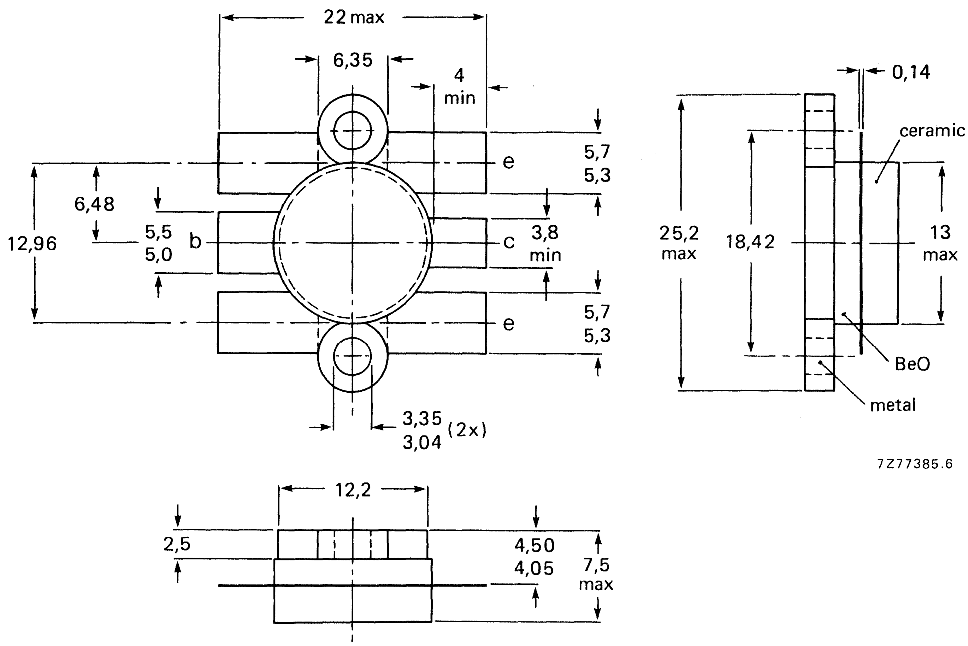
SOT-119 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

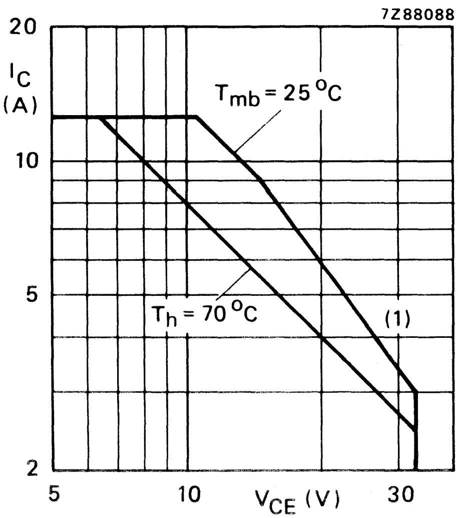
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	12,5	A
(peak value); f > 1 MHz	I_{CM}	max.	20	A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	133	W
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	162	W
Storage temperature	T_{stg}	−65 to + 150		^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

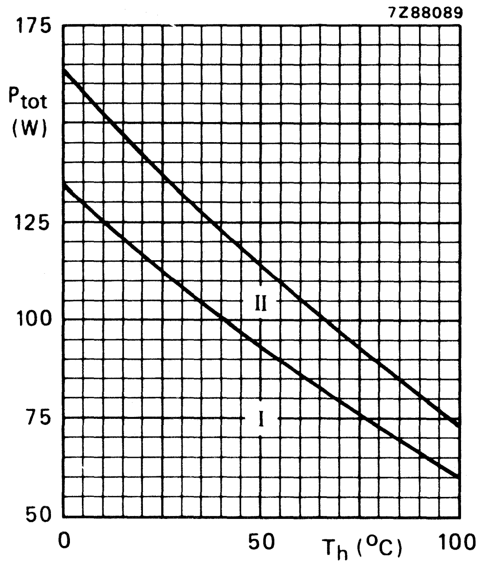


Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 80 W; $T_{mb} = 86\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,43	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,17	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W

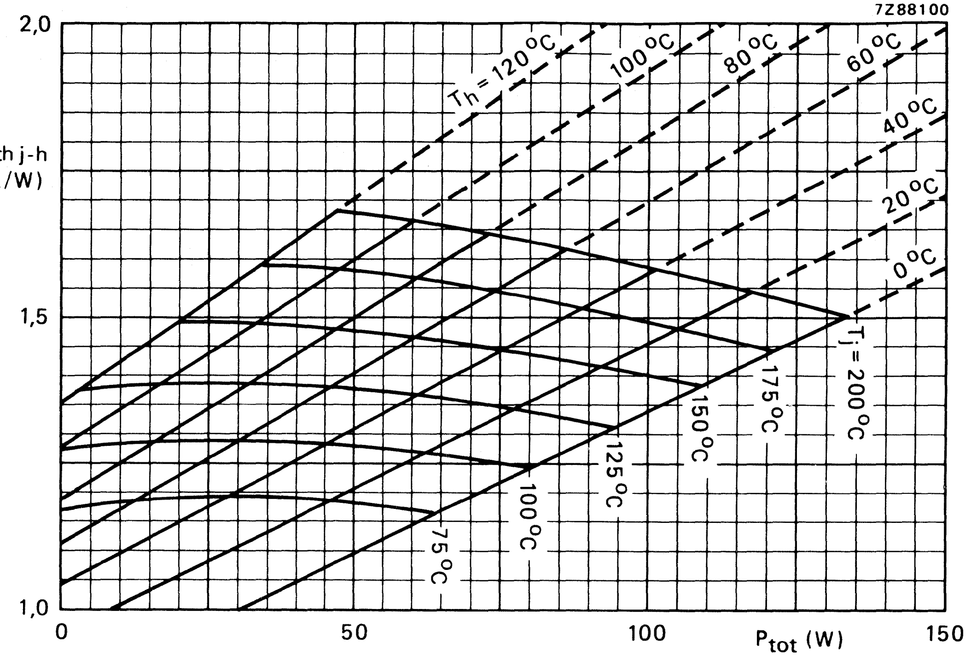


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,2 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	1,63 K/W
	T_j	max.	200 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	1,53 K/W
	T_j	typ.	192 °C

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65	V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	12,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	12,5	mJ
D.C. current gain*				
I_C = 3,0 A; V_{CE} = 25 V	h_{FE}	typ.	50	
			15 to 100	
Collector-emitter saturation voltage*				
I_C = 6,0 A; I_B = 0,6 A	V_{CEsat}	typ.	0,75	V
Transition frequency at f = 100 MHz**				
$-I_E$ = 3,0 A; V_{CB} = 25 V	f_T	typ.	680	MHz
$-I_E$ = 6,0 A; V_{CB} = 25 V	f_T	typ.	750	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	155	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	88	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0{,}02$.

** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0{,}01$.

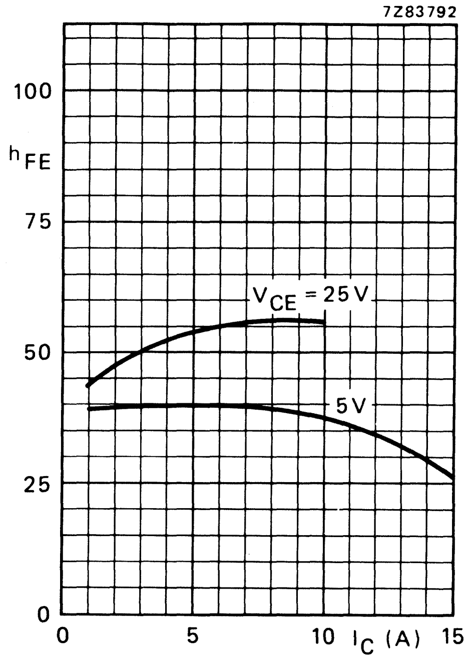


Fig. 5 Typical values; T_j = 25 °C.

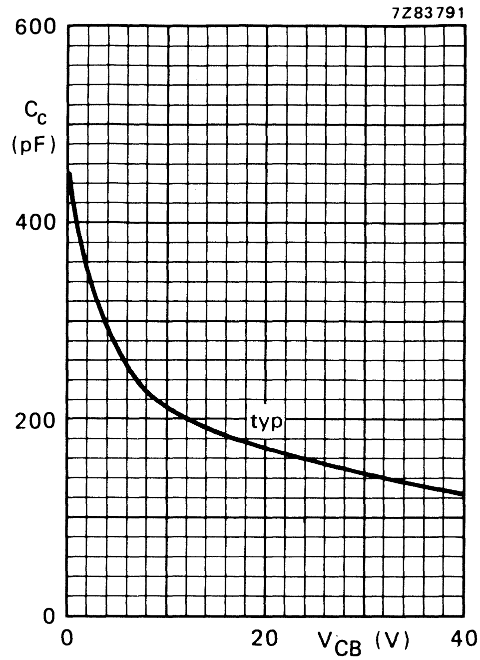


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

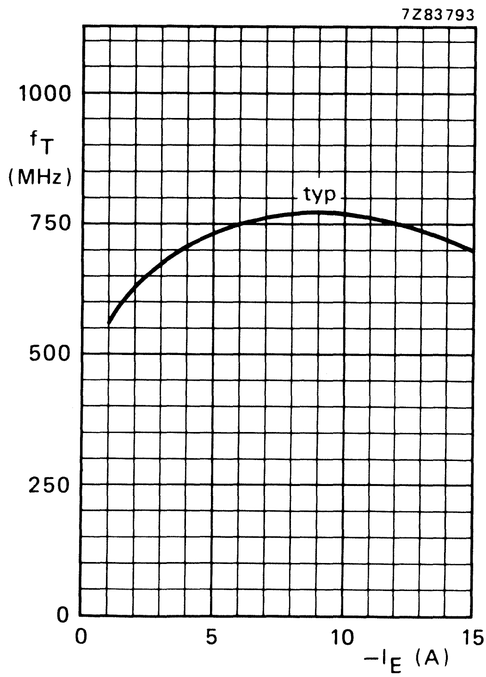


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

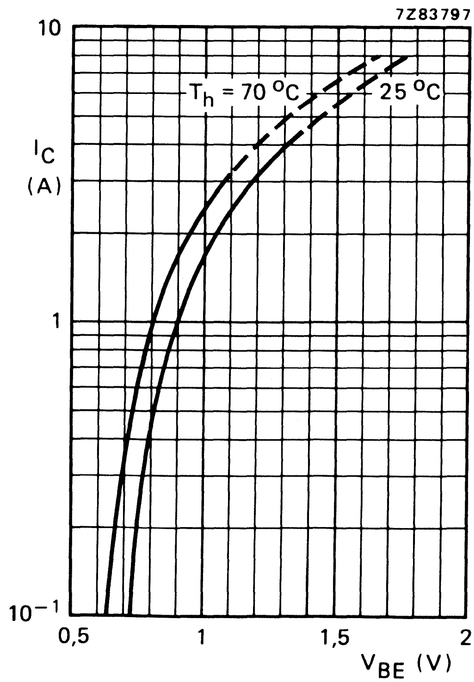


Fig. 8 Typical values; V_{CE} = 25 V.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (A)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
224,25	25	3,2	70	−55	> 16	> 13,5
			70	−55	typ. 17,5	typ. 14,5
			70	−52	typ. 22	typ. 14,5
			25	−55	typ. 22	typ. 14,8

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

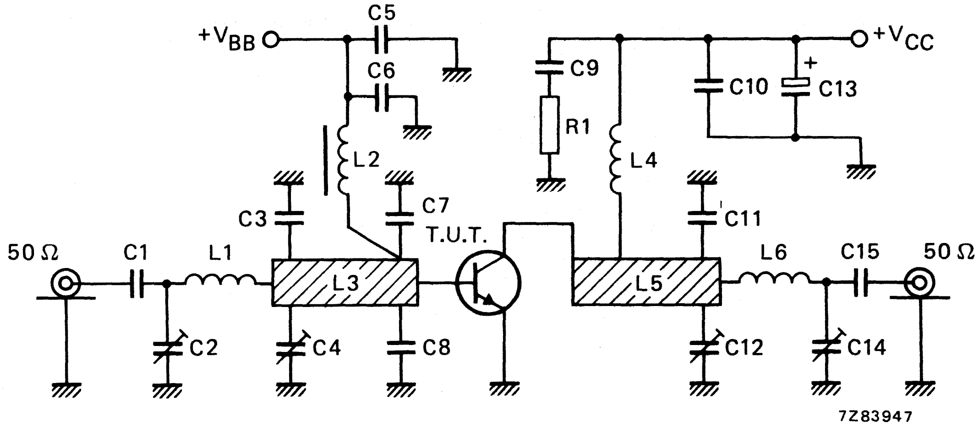


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

C1 = C15 = 560 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C4 = C12 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C3 = 10 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C6 = C10 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C7 = C8 = 47 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 8 mm from transistor edge
C9 = 330 nF polyester capacitor
C11 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C13 = 6,8 μF/35 V solid tantalum capacitor

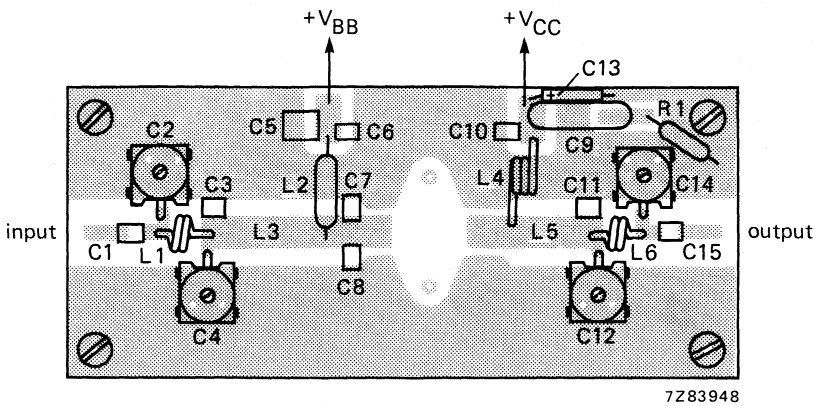
L1 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 5,0 mm; leads 2 x 3 mm
L2 = 1 μH microchoke (cat. no. 4322 057 01080)
L3 = 30 Ω stripline (6,0 mm x 32,7 mm)
L4 = 2 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 10 mm
L5 = 30 Ω stripline (6,0 mm x 24,0 mm)
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 4,5 mm; leads 2 x 3 mm

L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 224,25 MHz class-A test circuit are shown in Fig. 10.

▲ ATC means American Technical Ceramics.



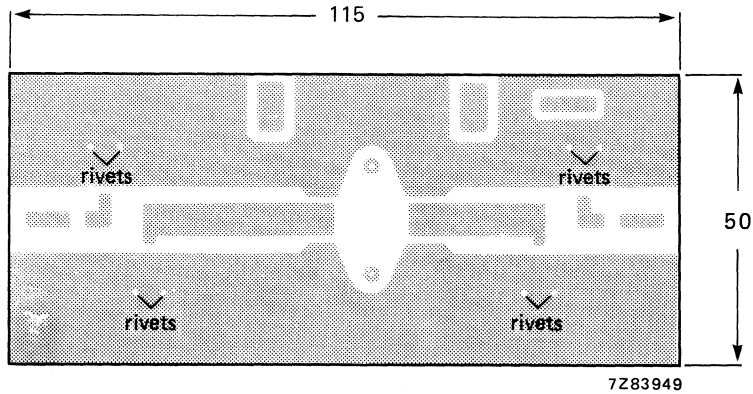


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

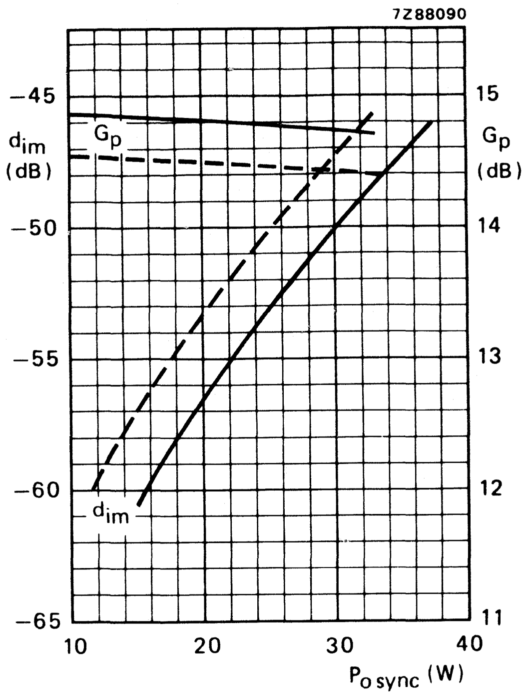


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

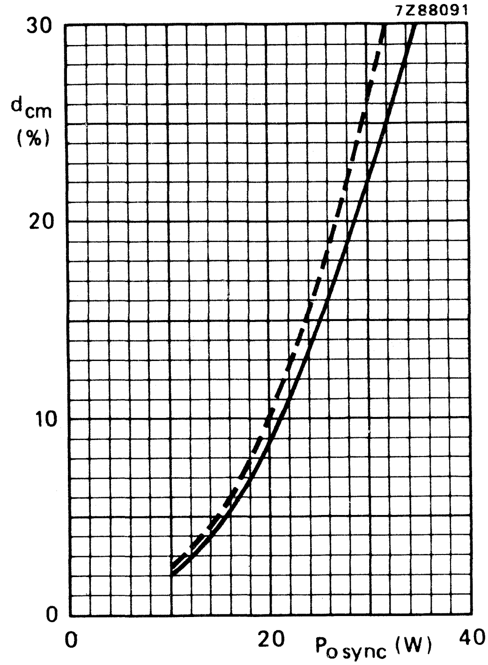


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; ——— T_h = 25 °C; – – – T_h = 70 °C; f_{vision} = 224,25 MHz.

Ruggedness in class-A operation

The BLV33F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 30 W (r.m.s. value) or 40 W (P.E.P.) under the following conditions:
V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C; f = 224,25 MHz; $R_{th\,mb\text{-}h}$ = 0,2 K/W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

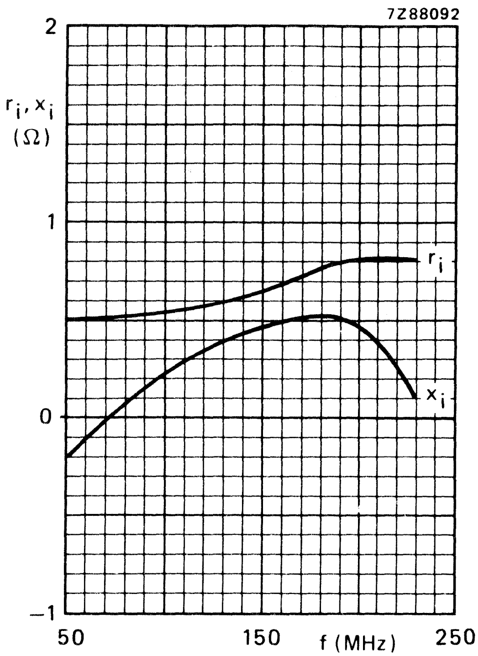


Fig. 13 Input impedance (series components).

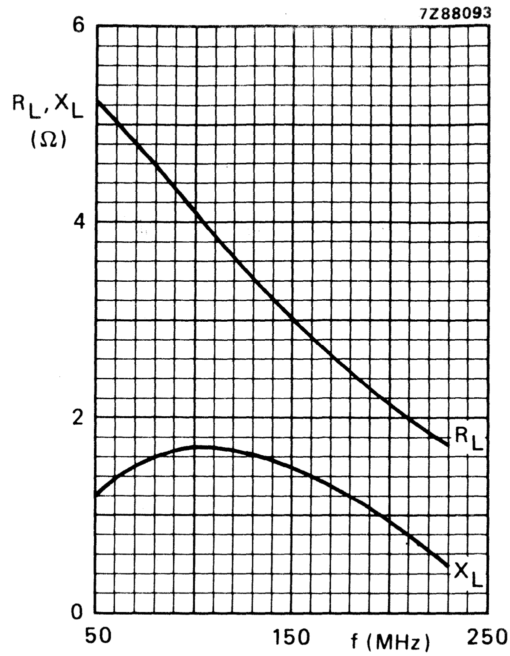


Fig. 14 Load impedance (series components).

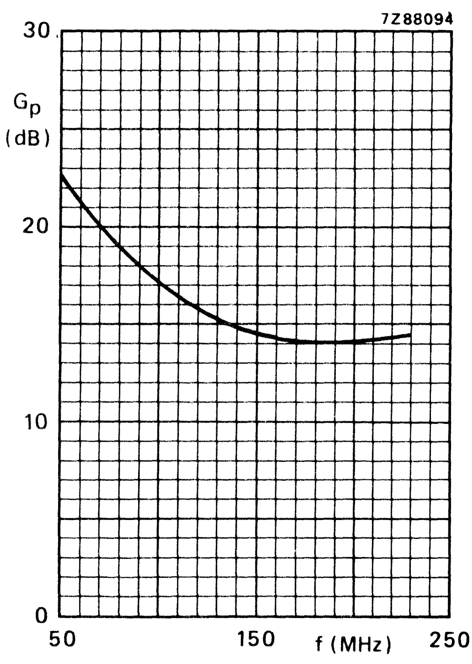


Fig. 15.

Conditions for Figs 13, 14 and 15:

Typical values; V_{CE} = 25 V; I_C = 3,2 A; class-A operation; T_h = 70 °C.

APPLICATION INFORMATION

R.F. performance in v.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	I_C (A)	η (%)	G_p (dB)*
224,25	28	0,2	70	40 85	typ. 2,75 typ. 4,25	typ. 52 typ. 71	typ. 11,5 typ. 10,5

* Gain compression point of 1 dB is at typical 85 W (minimum 75 W). Using a 3rd-order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

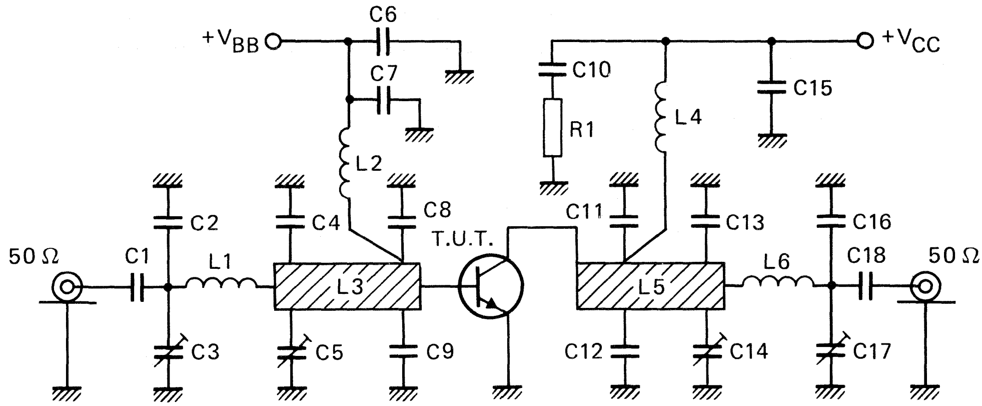


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz. 7Z83946

List of components (component layout and p.c.b. class-AB test circuit see Fig. 17):

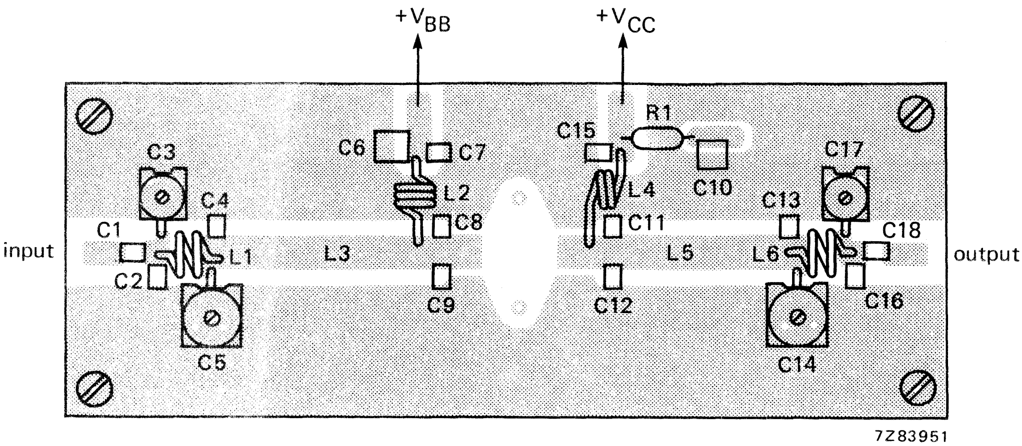
C1 = C18 = 620 pF (100 V) multilayer ceramic chip capacitor (ATC▲)
C2 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C6 = C10 = 470 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 856 48474)
C7 = C15 = 680 pF (50 V) multilayer ceramic chip capacitor (2222 852 13681)
C8 = C9 = 68 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 6,4 mm from transistor edge
C11 = C12 = 43 pF (500 V) multilayer ceramic chip capacitor (ATC▲); placed 10 mm from transistor edge
C13 = 39 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C16 = 3,3 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C17 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)

L1 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 4,0 mm; leads 2 x 4 mm
L2 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 7 mm
L3 = 30 Ω stripline (6,0 mm x 47,8 mm)
L4 = 2 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 8 mm
L5 = 30 Ω stripline (6,0 mm x 42,9 mm)
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,0 mm; length 4,0 mm; leads 2 x 3 mm

L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.



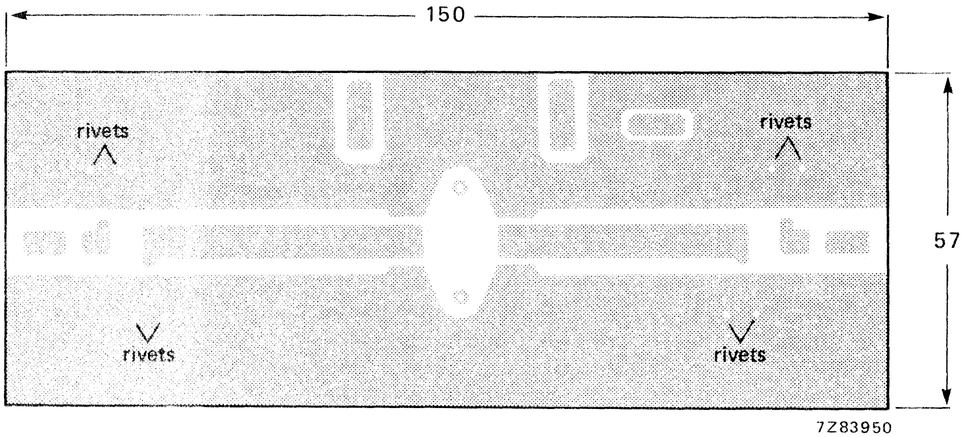
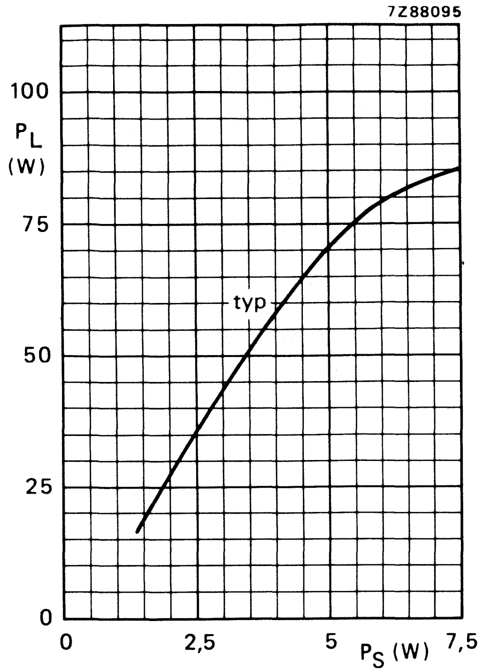


Fig. 17 Component layout and printed-circuit board for 224,25 MHz class-AB test circuit.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as earth. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.



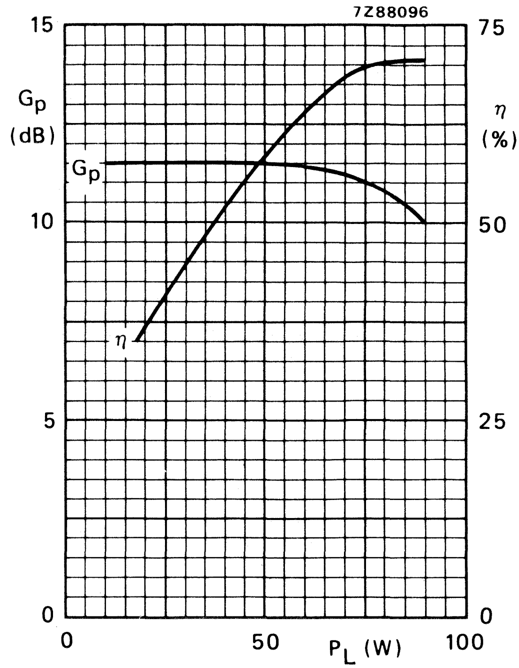


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz.

Fig. 19 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz; typical values.

Ruggedness in class-AB operation

The BLV33F is capable of withstanding a load mismatch (VSWR ⩽ 2 through all phases) up to 60 W (r.m.s. value) and 85 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; T_h = 70 °C; f = 224,25 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

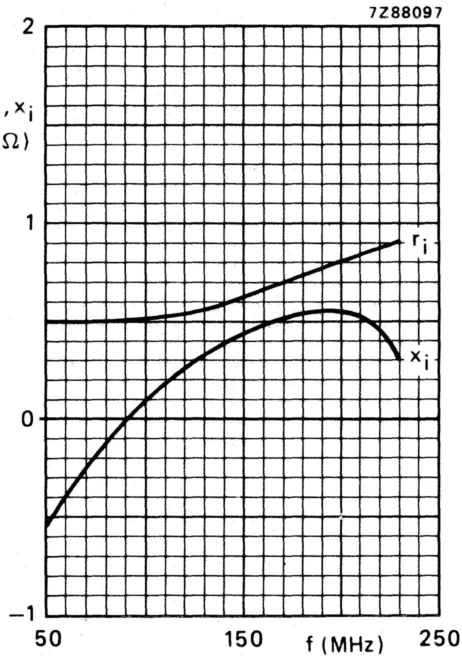


Fig. 20 Input impedance (series components).

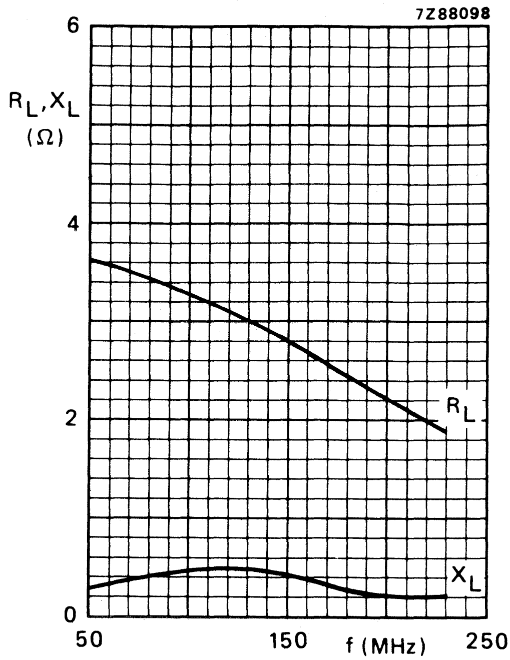


Fig. 21 Load impedance (series components).

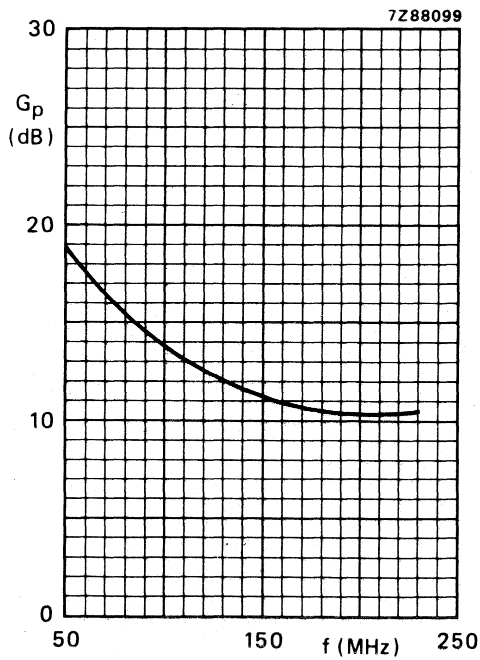


Fig. 22.

Conditions for Figs 20, 21 and 22:

Typical values; V_{CE} = 28 V; P_L = 80 W (P.E.P.); class-AB operation; T_h = 70 °C.

VHF LINEAR PUSH-PULL POWER TRANSISTOR

Two NPN silicon planar epitaxial transistor sections in one envelope to be used as a push-pull amplifier. This device is primarily intended for use in linear VHF television transmitters and transposers (vision or sound amplifier).

Features

- Internally matched input for wideband operation and high power gain
- Internal midpoint (RF ground) reduces negative feedback and improves power gain
- Increased input and output impedance (compared with single-ended transistors) simplify wideband matching
- Length of external emitter leads is not critical
- Diffused emitter balancing resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance in push-pull amplifier

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	T_h °C	G_p dB	η_c %	gain compression dB
CW; class-AB	28	2 x 0.25	224.25	115	25	⩾ 11.0 typ. 13.0	⩾ 48 typ. 55	⩽ 1.0*

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, CCIR system).

MECHANICAL DATA

SOT161 (see Fig.1).

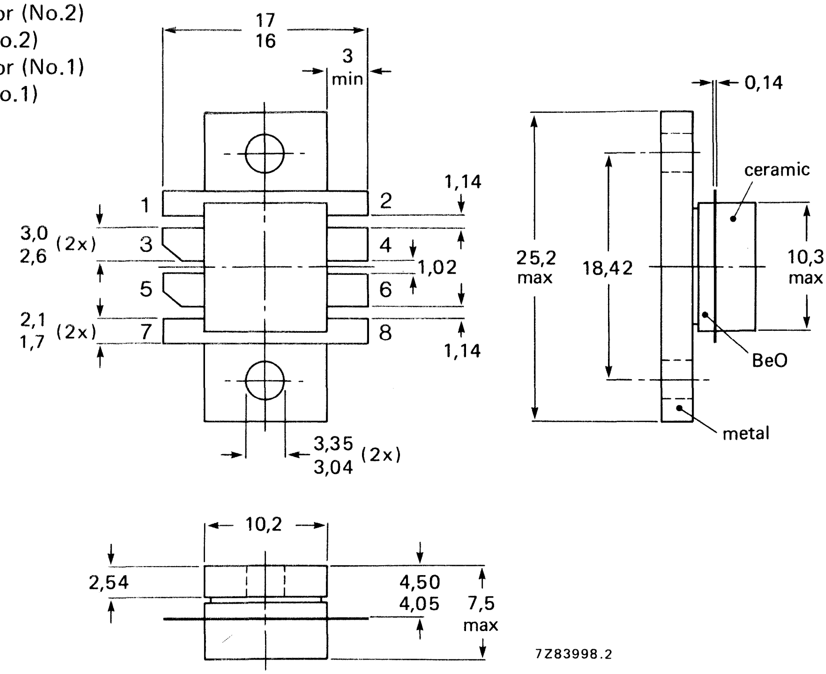
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA — Dimensions in mm

Fig.1 SOT161.

Pinning

1 Emitter
2 Emitter
3 Collector (No.2)
4 Base (No.2)
5 Collector (No.1)
6 Base (No.1)
7 Emitter
8 Emitter



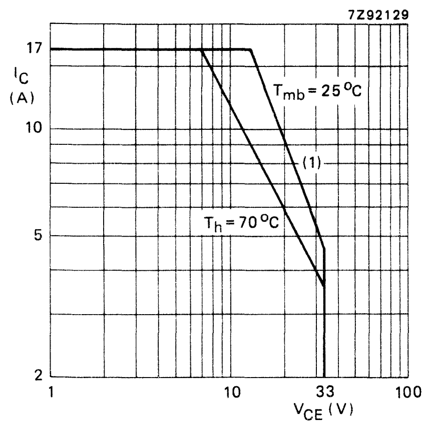
Torque on screw: min. 0.60 Nm
max. 0.75 Nm

Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be sparingly applied and evenly distributed.

RATINGS

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

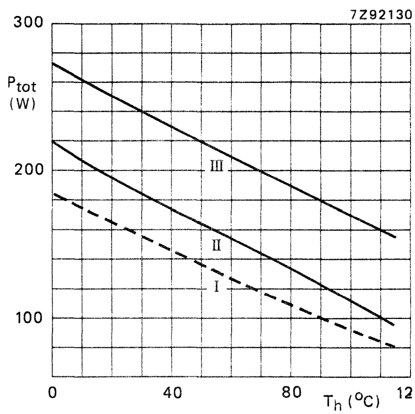
Collector-emitter voltage (peak value);			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current per transistor section			
DC or average	I_C, $I_{C(AV)}$	max.	8.5 A
(peak value); f > 1 MHz	I_{CM}	max.	17.5 A
Total DC power dissipation; $T_{mb} = 25\ ^oC$	$P_{tot(DC)}$	max.	218 W*
RF power dissipation			
f > 1 MHz; $T_{mb} = 25\ ^oC$	$P_{tot(RF)}$	max.	270 W*
Storage temperature range	T_{stg}	–65 to +150	^oC
Operating junction temperature	T_j	max.	200 ^oC



(1) Second breakdown limit.

Fig.2 DC SOAR.

Conditions for Figs 2 and 3:
$R_{th\ mb\text{-}h} = 0.25$ K/W; Total device*.



I Continuous DC operation
II Continuous RF operation; (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

(dissipation = 180 W; $T_{mb} = 25\ ^oC$)**

From junction to mounting base (DC dissipation)	$R_{th\ j\text{-}mb(DC)}$	=	0.85 K/W
From junction to mounting base (RF dissipation)	$R_{th\ j\text{-}mb(RF)}$	=	0.64 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.25 K/W

* Dissipation of either transistor section shall not exceed half rated power.
** Both transistor sections equally loaded.

CHARACTERISTICS

Apply to either transistor section unless otherwise specified. T_j = 25 °C.

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65	V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 33 V	I_{CES}	<	10	mA
Second-breakdown energy; L = 25 mH; f = 50 Hz				
R_{BE} = 10 Ω	E_{SBR}	>	10	mJ
DC current gain*				
I_C = 3.5 A; V_{CE} = 25 V	h_{FE}	typ.	45	
		15 to	100	
Transition frequency at f = 100 MHz*				
$-I_E$ = 3.3 A; V_{CB} = 25 V	f_T	typ.	575	MHz
$-I_E$ = 10 A; V_{CB} = 25 V	f_T	typ.	600	MHz
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; V_{CB} = 25 V	C_c	typ.	155	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	88	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0.02$.

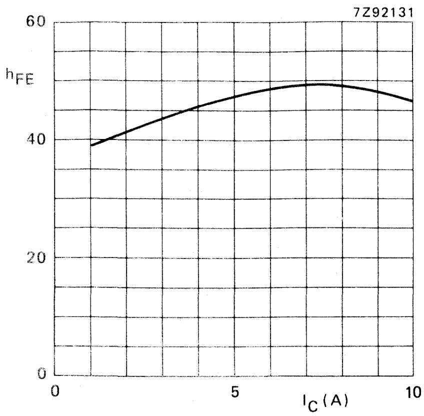


Fig.4 DC current gain as a function of collector current; V_{CE} = 25 V; T_j = 25 °C; typical values.

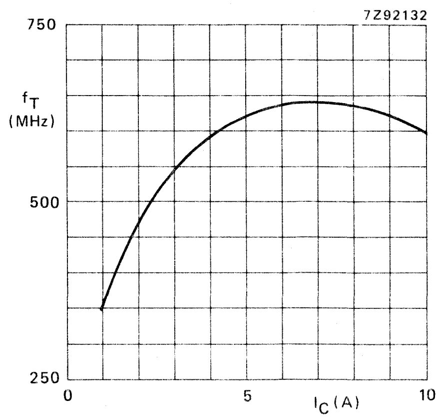


Fig.5 Transition frequency as a function of collector current; V_{CE} = 25 V; f = 100 MHz; T_j = 25 °C; typical values.

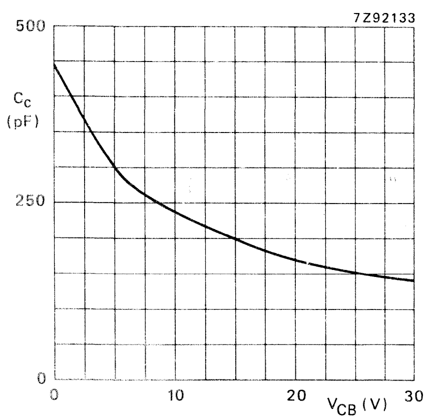


Fig.6 Collector capacitance as a function of collector-base voltage; I_E = i_e = 0; f = 1 MHz; typical values.

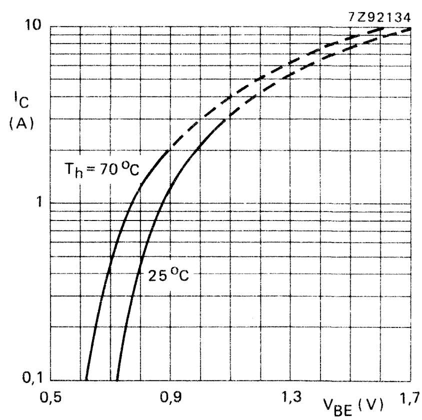


Fig.7 Collector current as a function of base-emitter voltage; V_{CE} = 25 V; typical values.

The above graphs apply to either transistor section.

APPLICATION INFORMATION

RF performance in VHF class-AB operation (linear push-pull power amplifier) V_{CE} = 28 V; T_h = 25 °C; f = 224.25 MHz.

mode of operation	P_L W	$I_{C(ZS)}$ A	G_P dB	η_C %	gain compression dB
class-AB; CW	115	2 x 0.15	≥ 11.0 typ. 13.0	≥ 48 typ. 55	≤ 1.0* typ. 0.5*

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

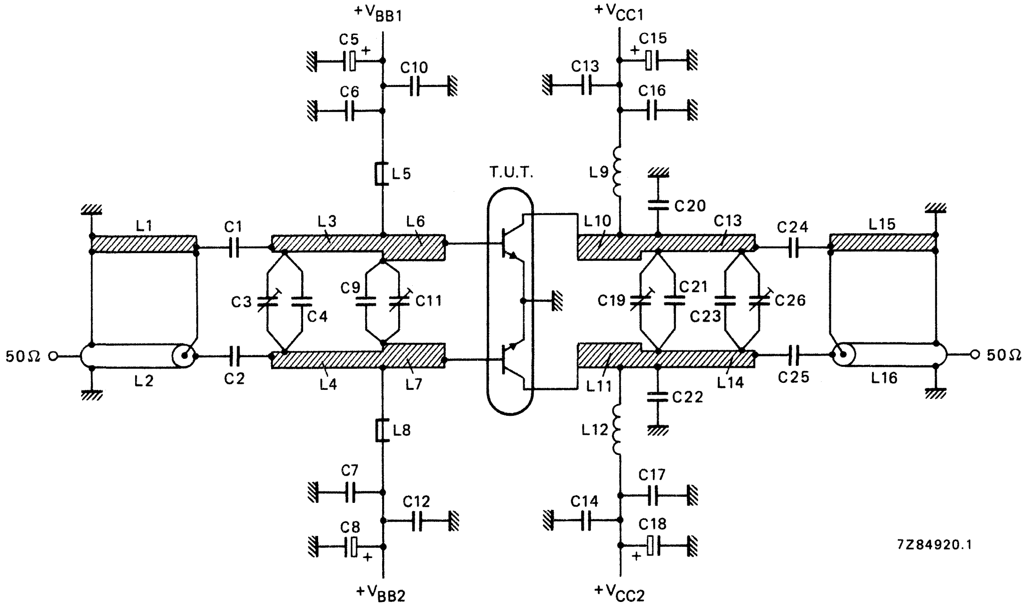


Fig.8 Class-AB test circuit at 224.25 MHz.

List of components:

C1 = C2 = C24 = C25 = 68 pF (500 V) multilayer ceramic chip capacitor.**
C3 = C11 = C26 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002).
C4 = 33 pF (500 V) multilayer ceramic chip capacitor.**
C5 = C8 = 4.7 µF (63 V) electrolytic capacitor.
C6 = C7 = C16 = C17 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 855 48104).
C9 = 2 x 47 pF (500 V) multilayer ceramic chip capacitors in parallel.**
C10 = C12 = C13 = C14 = 470 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13471).
C15 = C18 = 10 µF (63 V) electrolytic capacitor.
C19 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003).
C20 = C22 = 3.3 pF (500 V) multilayer ceramic chip capacitor.**
C21 = parallel connection of 2 x 27 pF (500 V) ceramic chip capacitors.**
C23 = 5.6 pF (500 V) multilayer ceramic chip capacitor.**

(C9 and C11 are connected 11 mm from transistor edge and C19 and C21 18 mm from transistor edge.)

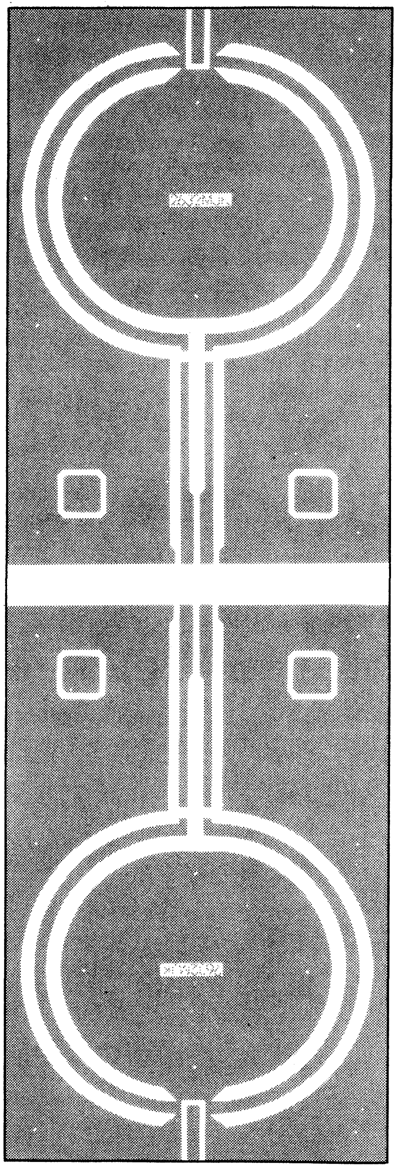
** American Technical Ceramics capacitor type 100A or capacitor of same quality.

L1 = L15 = 50 Ω stripline (2.8 mm x 91.3 mm).
L2 = L16 = 50 Ω semi-rigid cable; outer diameter 2.2 mm; outer conductor length 91.3 mm.
L3 = L4 = L13 = L14 = 60 Ω stripline (2.0 mm x 27.9 mm).
L5 = L8 = 100 nH microchoke.
L6 = L7 = L10 = L11 = 48 Ω stripline (3.0 mm x 14.6 mm).
L9 = L12 = 20.5 nH; 2 turns enamelled Cu wire (1.0 mm); int. dia. 4.5 mm; length 3 mm; leads 2 x 10 mm; connected 15 mm from transistor edge.

L1, L3, L4, L6, L7, L10, L11, L13, L14 and L15 are striplines on a double Cu-clad printed circuit board with epoxy fibre-glass dielectric (ϵ_r = 4.5); thickness 1/16 inch.

The printed circuit board and component layout for a 224.25 MHz, class-AB test are given in Fig. 9 and Fig. 10 respectively.

The circuit and the components are on one side of the epoxy fibre-glass board; the other side is unetched copper to serve as ground plane. Earth connections are made by hollow rivets and in addition by fixing screws and also by copper straps under the emitters and at the input and output.



7Z90217

Fig. 9 Printed circuit board for 224.25 MHz class-AB test circuit.

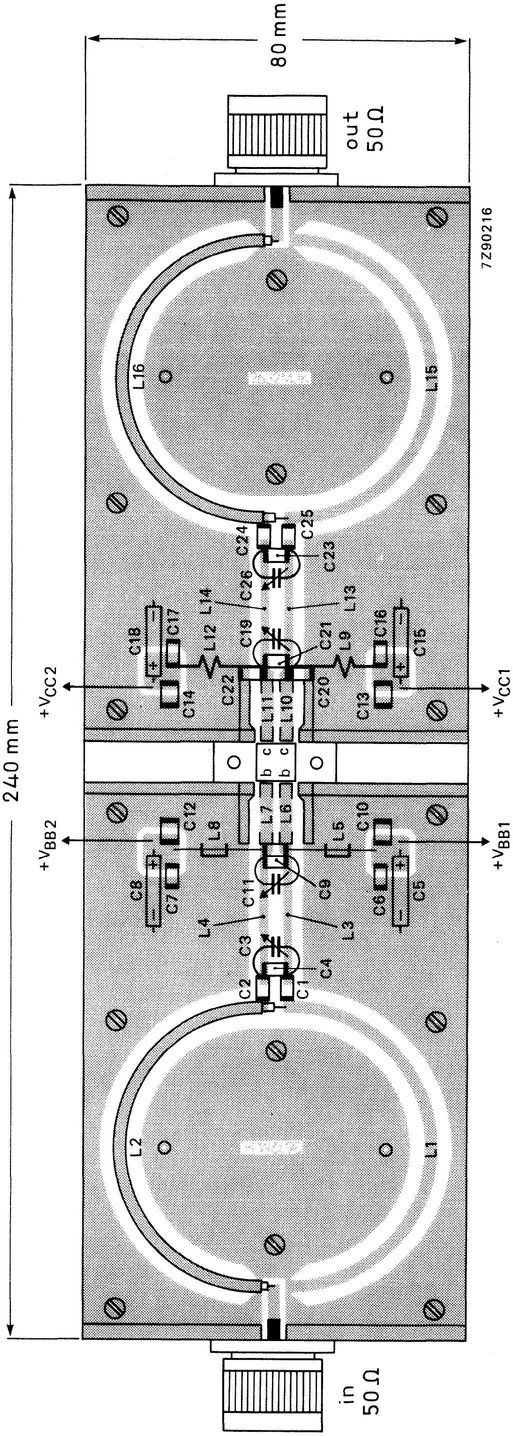


Fig. 10 Component layout of a 224.25 MHz class-AB test circuit.

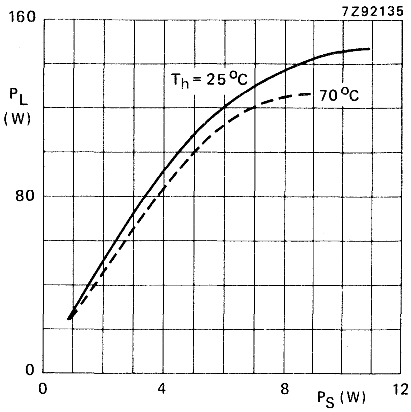


Fig.11 Load power as a function of source power; typical values.

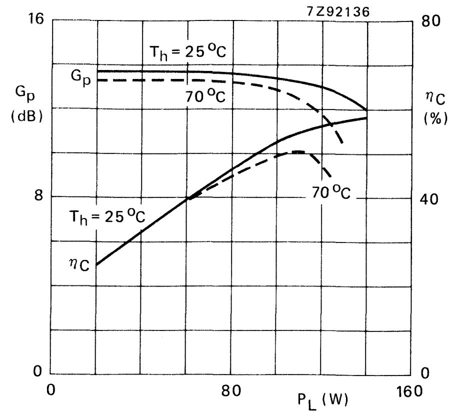


Fig.12 Power gain and efficiency as functions of load power; typical values.

Conditions for Figs 11 and 12:
V_{CE} = 28 V; $I_{C(ZS)}$ = 2 x 0.15 A; f = 224.25 MHz; class-AB.

RUGGEDNESS

The BLV36 is capable of continuously withstanding a load mismatch (VSWR = 5, through all phases) up to 80 W under the following conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 2 x 0.15 A; T_h = 25 °C; f = 224.25 MHz; $R_{th\ mb\text{-}h}$ = 0.25 K/W.

The instantaneous collector current should not exceed 10 A.

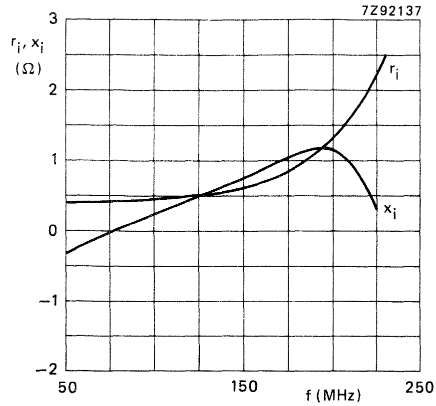


Fig.13 Input impedance (series components) as a function of frequency; typical values.

Conditions for Figs 13, 14 and 15:

The graphs apply to either transistor section assuming class-AB push-pull operation
V_{CE} = 28 V; $I_{C(ZS)}$ = 0.15 A; P_L = 70 W;
T_h = 25 °C.

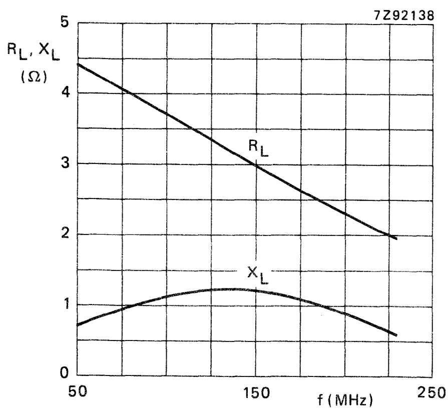


Fig.14 Load impedance (series components) as a function of frequency; typical values.

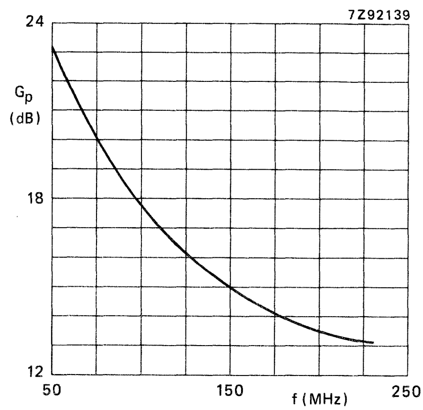


Fig.15 Power gain as a function of frequency; typical values.

VHF PUSH-PULL POWER TRANSISTOR

Push-pull npn silicon planar epitaxial transistor primarily intended for use in VHF broadcast transmitters.

Features:

- internally matched input for wideband operation and high power gain;
- implanted emitter ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.

The transistor has a 5-lead rectangular flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance up to T_h = 25 °C in a common-emitter class-B push-pull test circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; cw	28	108	250	> 10.5	> 60

MECHANICAL DATA

(See next page).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning:

1 = Collector (No. 2)
2 = Base (No. 2)
3 = Emitter
4 = Base (No. 1)
5 = Collector (No. 1)

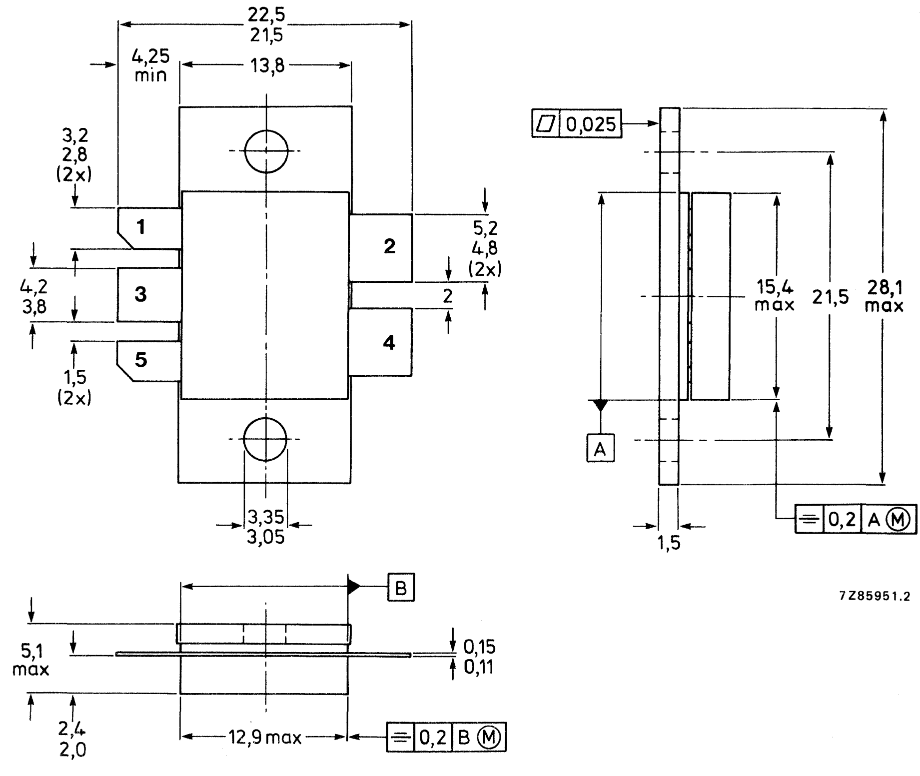


Fig. 1 SOT-179.

RATINGS (per transistor section)

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

Collector-emitter voltage $V_{BE} = 0$; peak value	V_{CESM}	max.	70 V
Collector-emitter voltage open base	V_{CEO}	max.	40 V
Emitter-base voltage open collector	V_{EBO}	max.	4.0 V
Collector current DC or average	I_C	max.	10 A
peak (f > 1 MHz)	I_{CM}	max.	30 A
Total power dissipation (both sections)* $T_{mb} = 25$ °C	P_{tot}	max.	290 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (Total device; $T_{mb} = 25$ °C)

From junction to mounting base (DC dissipation = 2 x 120 W; $T_{mb} = 25$ °C)	$R_{th\ j\text{-}mb(DC)}$	max.	0.6 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2 K/W

CHARACTERISTICS (per transistor section)

$T_j = 25$ °C unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 60$ mA	$V_{(BR)CES}$	min.	70 V
Collector-emitter breakdown voltage open base; $I_C = 120$ mA	$V_{(BR)CEO}$	min.	40 V
Emitter-base breakdown voltage open collector; $I_E = 12$ mA	$V_{(BR)EBO}$	min.	4.0 V
Collector cut-off current $V_{CE} = 40$ V; $V_{BE} = 0$	I_{CES}	max.	30 mA
DC current gain $I_C = 6$ A; $V_{CE} = 30$ V	h_{FE}	min. max.	15 80
DC current gain ratio of transistor sections; $I_C = 6$ A; $V_{CE} = 30$ V			0.67 to 1.5
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 30$ V	C_c	typ.	195 pF

* Both sections equally loaded

APPLICATION INFORMATION

RF performance in cw operation (common-emitter class-B circuit); T_h = 25 °C.

f MHz	V_{CE} V	P_L W	G_p dB	ηC %
108	28	250	> 10.5 typ. 11.3	> 60 typ. 70

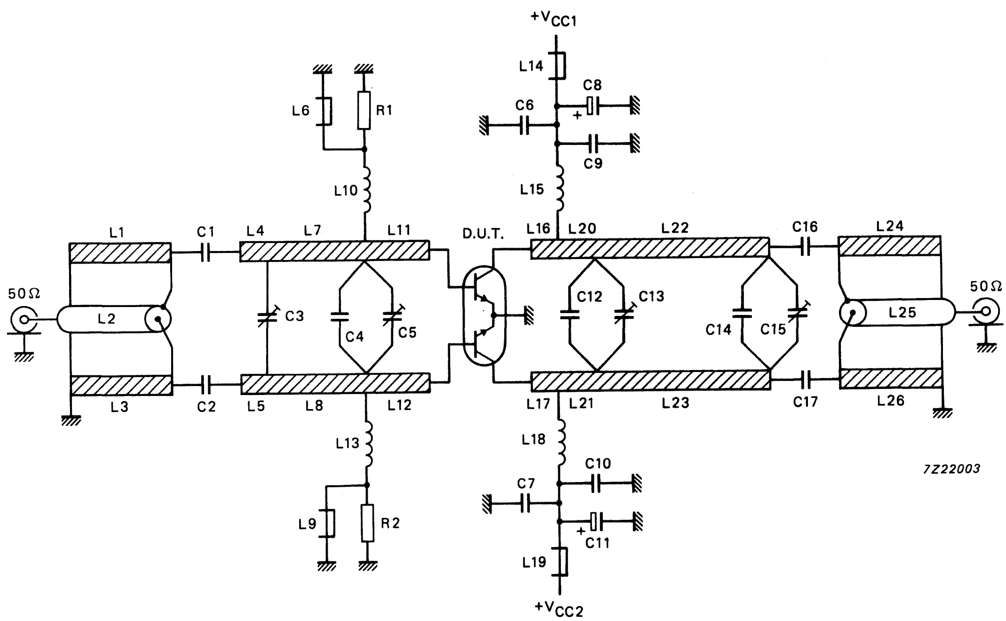


Fig. 2 Class-B test circuit at f = 108 MHz.

List of components

C1 = C2 = 1 x 100 pF (500 V) and 1 x 120 pF (500 V) multilayer ceramic chip capacitors in parallel.*
C3 = C5 = C13 = C15 = 5 to 60 film dielectric trimmer (cat. no. 2222 809 08003).
C4 = 2 x 100 pF (500 V) multilayer chip capacitors in parallel.*
C6 = C7 = 10 nF (50 V) multilayer ceramic chip capacitor.
C8 = C11 = 6,8 μF (63 V) electrolytic capacitor.
C9 = C10 = 2 x 470 pF (500 V) multilayer ceramic chip capacitors in parallel. *
C12 = 1 x 22 pF (500 V) and 4 x 27 pF (500 V) multilayer ceramic chip capacitors in parallel. *
C14 = 14 pF (500 V) multilayer ceramic chip capacitor .*
C16 = C17 = 2 x 62 pF (500 V) multilayer ceramic chip capacitors in parallel. *

L1 = L3 = L24 = L26 = 50 Ω stripline (4.8 mm x 163.8 mm).
L2 = L21 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 163.8 mm; soldered on striplines L1 and L24.
L4 = L5 = 43 Ω stripline (6.0 mm x 11.5 mm).
L6 = L9 = Ferroxcube wide-band HF choke; grade 3B (cat. no. 4312 020 36642).
L7 = L8 = 43 Ω stripline (6.0 mm x 64.8 mm).
L10 = L13 = 7 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm.
L11 = L12 = 43 Ω stripline (6.0 mm x 24.3 mm).
L16 = L17 = 43 Ω stripline (6.0 mm x 11.0 mm).
L14 = L19 = 2 x Ferroxcube wide-band HF choke; grade 3B (cat. no. 4312 020 36642) in parallel or modified single choke with 3 straight wires (0.8 mm) through FXC-bead in parallel.
L15 = L18 = 40 nH; 1 3/4 turns enamelled Cu wire (2.0 mm); int. dia. 10 mm; leads 2 x 7 mm; space 1 mm.
L20 = L21 = 43 Ω stripline (6.0 mm x 31.9 mm).
L22 = L23 = 43 Ω stripline (6.0 mm x 87.4 mm).

R1 = R2 = 10 Ω ± 5%; 1/2 W metal film resistor.

L1, L3, L4, L5, L7, L8, L11, L12, L16, L17, L20, L21, L22, L23, L24 and L26 are striplines on a double Cu-clad printed circuit board with glass microfibre reinforced PTFE dielectric (ϵ_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.

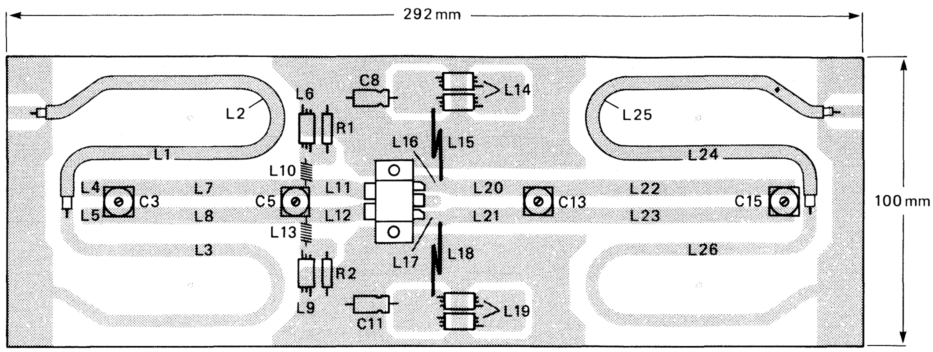
The circuit and the components are on one side of the pc board, the other side is unetched copper to serve as ground plane. Earth connections are made by copper straps under the emitter and at the input and output. The emitter-lead is also connected to earth by a hollow rivet.

Ruggedness in class-B operation

The BLV37 is capable of withstanding a load mismatch (VSWR = 3 through all phases) under the following conditions:
V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; P_L = 250 W.

DEVELOPMENT DATA

* American Technical Ceramics (ATC) capacitor, type 100B or capacitor of same quality.



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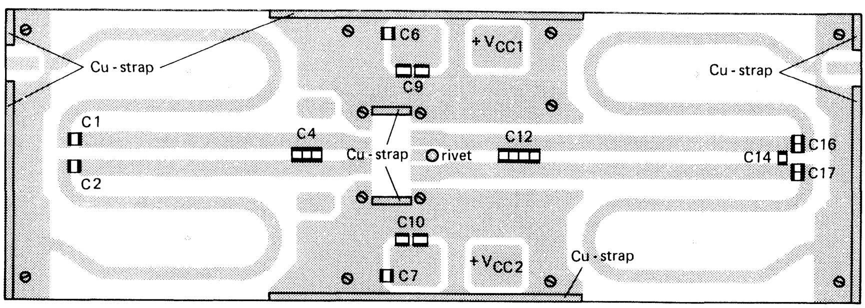

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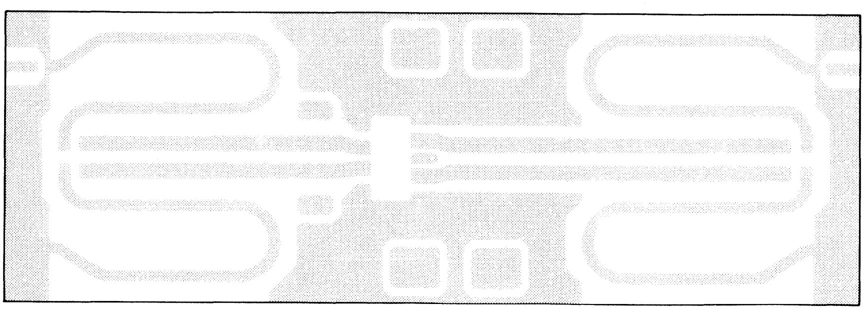

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Fig. 3 Component layout and printed-circuit board for 108 MHz test circuit.

V H F LINEAR PUSH-PULL POWER TRANSISTOR

Push-pull npn silicon planar epitaxial transistor primarily intended for use in VHF television transmitters.

Features:

- internally matched input for wideband operation and high power gain;
- implanted emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 5-lead rectangular flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common-emitter class-AB push-pull test circuit.

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_C %	gain compression dB
narrow band; cw; class-AB	35	2 x .200	224.25	225	> 8.0	> 50	≤ 1.0 *

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/ 25% sync output compression in television service (negative modulation, CCIR system).

MECHANICAL DATA

(See next page).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning:

1 = Collector (No. 2)
2 = Base (No. 2)
3 = Emitter
4 = Base (No. 1)
5 = Collector (No. 1)

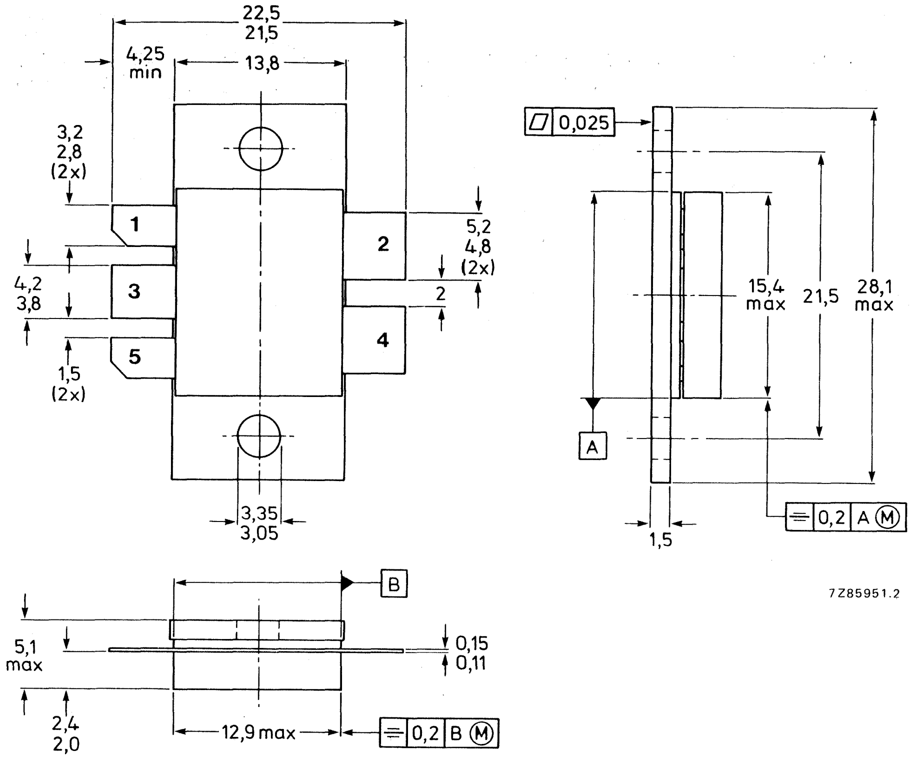


Fig. 1 SOT-179.

DEVELOPMENT DATA

RATINGS (per transistor section)

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

Collector-emitter voltage $V_{BE} = 0$; peak value	V_{CESM}	max.	70 V
Collector-emitter voltage open base	V_{CEO}	max.	40 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0 V
Collector current DC or average	I_C	max.	10 A
peak (f > 1 MHz)	I_{CM}	max.	25 A
Total power dissipation (both sections)* $T_{mb} = 25\ ^oC$; f > 1 MHz	P_{tot}	max.	290 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE (Total device; $T_{mb} = 25\ ^oC$)

From junction to mounting base (DC dissipation = 2 x 120 W; $T_{mb} = 25\ ^oC$)	$R_{th\ j\text{-}mb(DC)}$	max.	0.6 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2 K/W

CHARACTERISTICS (per transistor section)

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 60$ mA	$V_{(BR)CES}$	min.	70 V
Collector-emitter breakdown voltage open base; $I_C = 120$ mA	$V_{(BR)CEO}$	min.	40 V
Emitter-base breakdown voltage open collector; $I_E = 12$ mA	$V_{(BR)EBO}$	min.	4.0 V
Collector cut-off current $V_{CE} = 40$ V; $V_{BE} = 0$	I_{CES}	max.	30 mA
DC current gain $I_C = 6$ A; $V_{CE} = 30$ V	h_{FE}	min.	15
		max.	80
DC current gain ratio of transistor sections: $I_C = 6$ A; $V_{CE} = 30$ V			0.67 to 1.5
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; $V_{CB} = 30$ V	C_c	typ.	195 pF

*Both sections equally loaded

APPLICATION INFORMATION

RF performance in cw operation (common-emitter class-AB circuit); T_h = 25 °C.

f MHz	V_{CE} V	P_L W	$I_{C(ZS)}$ A	G_p dB	η_C %
224.25	35	225	2 x .200	> 8.0 typ. 8.8	> 50 typ. 58
		112.5		> 9.0 typ. 9.8	

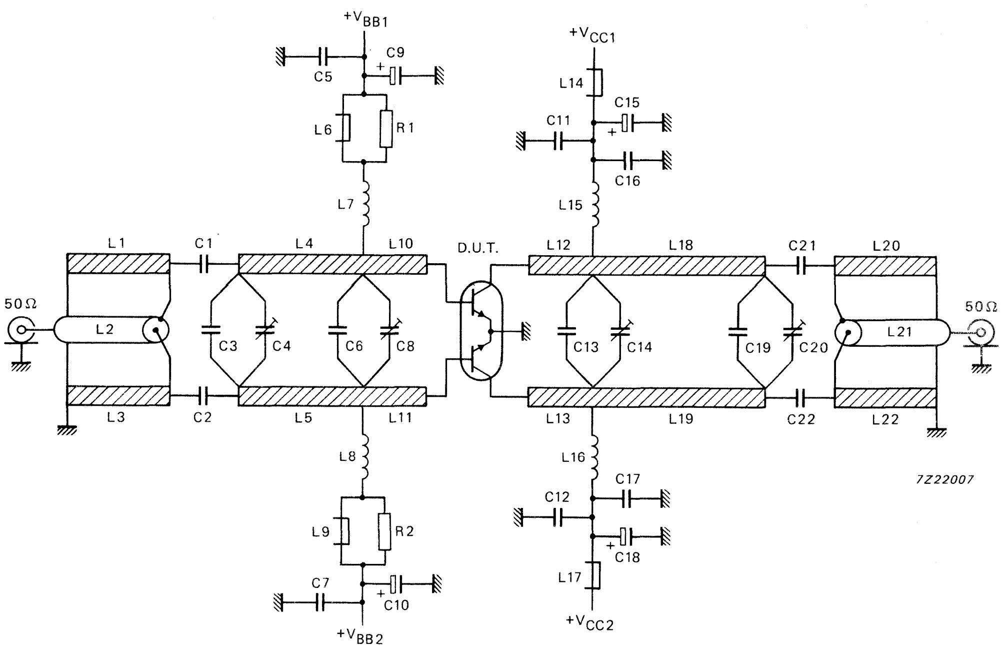


Fig. 2 Class-AB test circuit at f = 225 MHz.

List of components

C1 = C2 = C6 =	2 x 27 pF (500 V) multilayer ceramic chip capacitors in parallel.*
C3 =	68 pF (500 V) multilayer ceramic chip capacitor. *
C4 = C20 =	2 to 18 pF film dielectric trimmer. (cat. no. 2222 809 05003).
C5 = C7 =	470 pF (500 V)* and 10 nF (50 V) multilayer ceramic chip capacitors in parallel.
C8 = C14 =	4 to 40 pF film dielectric trimmer. (cat. no. 2222 809 08002).
C9 = C10 =	4.7 μF (63 V) electrolytic capacitor.
C11 = C12 =	10 nF (50 V) multilayer ceramic chip capacitor.
C13 =	3 x 27 pF (500 V) multilayer ceramic chip capacitors in parallel. *
C15 = C18 =	10 μF (63 V) electrolytic capacitor.
C16 = C17 =	2 x 470 pF multilayer ceramic chip capacitors in parallel. *
C19 =	3 x 8.2 pF (500 V) multilayer ceramic chip capacitors in parallel. *
C21 = C22 =	3 x 18 pF (500 V) multilayer ceramic chip capacitors in parallel. *
L1 = L3 = L20 =	L22 = 50 Ω stripline (4.8 x 80 mm).
L2 = L21 =	50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 80 mm; soldered on striplines L1 and L20.
L4 = L5 =	43 Ω stripline (6.0 mm x 37 mm).
L6 = L9 =	Ferroxcube wide-band HF choke; grade 3B (cat. no. 4312 020 36642).
L7 = L8 =	7 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm.
L10 = L11 =	43 Ω stripline (6.0 mm x 15.8 mm).
L12 = L13 =	43 Ω stripline (6.0 mm x 11.4 mm).
L14 = L17 =	Ferroxcube wide-band HF choke; grade 3B (cat. no. 4312 020 36642), 3 straight wires (0.8 mm) through FXC-bead in parallel.
L15 = L16 =	30 nH; 2 turns enamelled Cu wire (1.6 mm); int. dia. 6 mm; leads 2 x 6 mm; coil length 5 mm; connected 10 mm from transistor edge.
L18 = L19 =	43 Ω stripline (6.0 mm x 34.6 mm).
R1 = R2 =	10 Ω ± 5%; 1/2 W metal film resistor.

DEVELOPMENT DATA

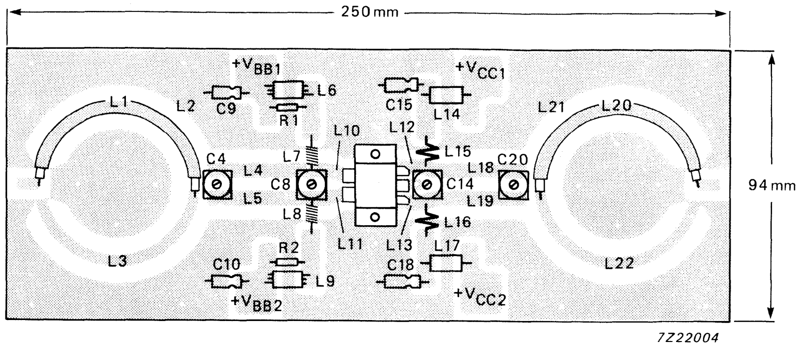
L1, L3, L4, L5, L10, L11, L12, L13, L18, L19, L20 and L22 are striplines on a double Cu-clad printed circuit board with glass microfibre reinforced PTFE, dielectric (ϵ_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.

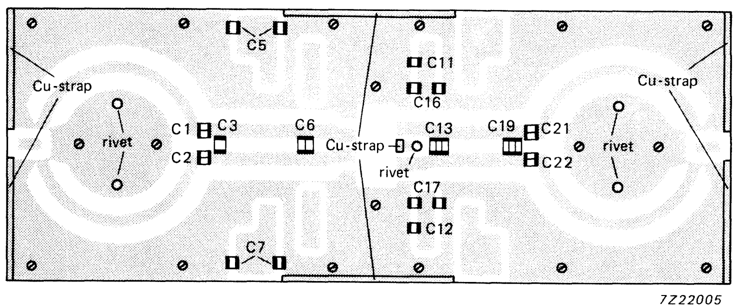
The circuit and the components are on one side of the pc board, the other side is unetched copper to serve as ground plane. Earth connections are made by copper straps under the emitter and at the input and output. The emitter-lead is also connected to earth by a hollow rivet.

Ruggedness in class-AB operation

The BLV38 is capable of withstanding a load mismatch (VSWR = 3 through all phases) under the following conditions:
V_{CE} = 35 V; f = 224.25 MHz; T_h = 25 °C; P_L = 225 W.

* American Technical Ceramics (ATC) capacitor, type 100B or capacitor of same quality.





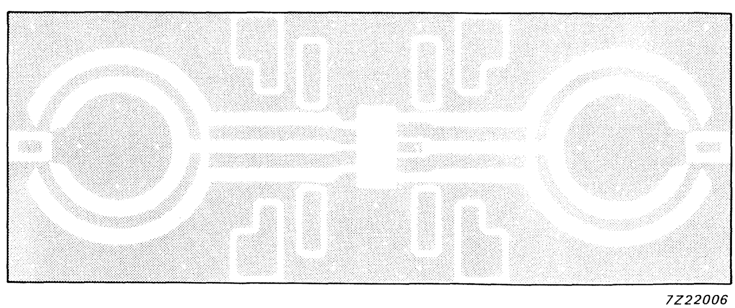


Fig. 3 Component layout and printed-circuit board for 224,25 MHz test circuit.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 175 MHz communications band.

Features

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	175	45	>6,5	>55

MECHANICAL DATA

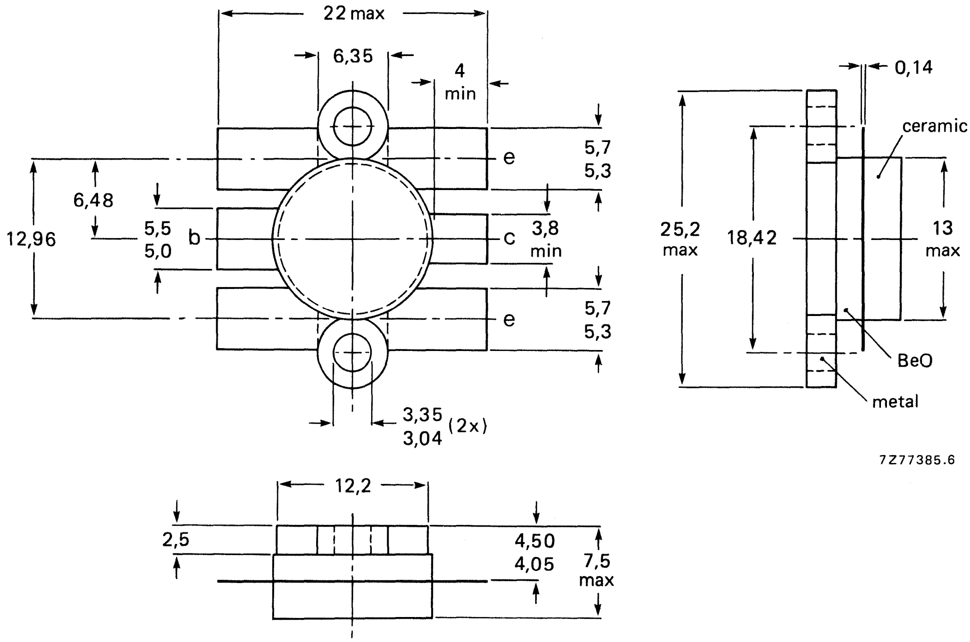
SOT-119 (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm
max. 0,75 Nm

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter)				
peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	9	A
peak value; f > 1 MHz	I_{CM}	max.	27	A
Total power dissipation				
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	90	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

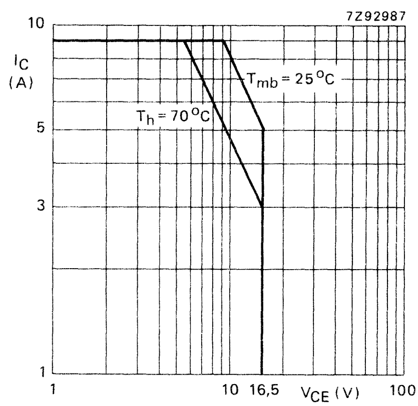


Fig. 2 D.C. soar.
$R_{th\ mb\text{-}h}$ = 0,2 K/W.

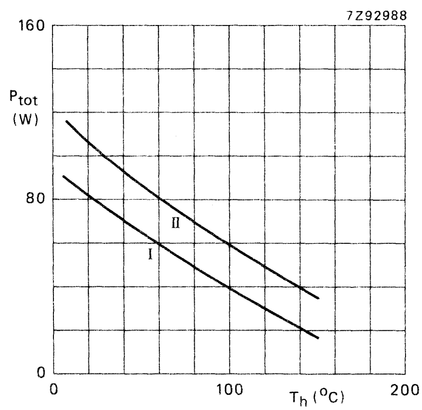


Fig. 3 Power/temperature derating curves; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 68 W; T_{mb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb}$	=	1,58 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	16,5	V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	22	mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	12,5	mJ
D.C. current gain V_{CE} = 10 V; I_C = 6 A	h_{FE}	> typ.	15 55	
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 12,5 V	C_c	typ.	130	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	80	pF

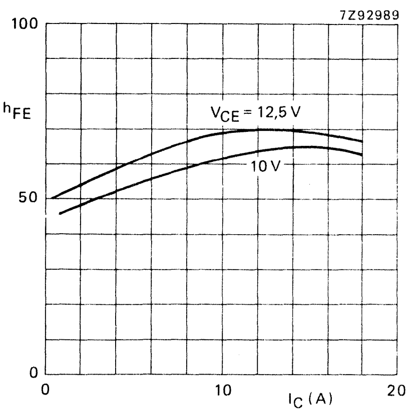


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

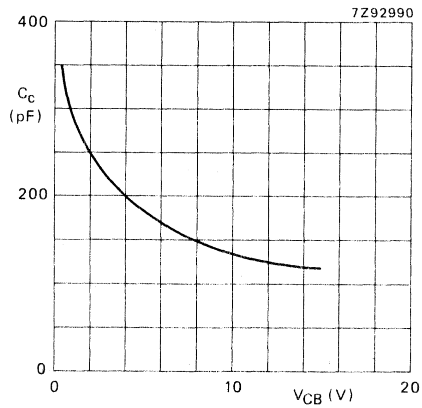


Fig. 5 Output capacitance versus V_{CB}; I_E = i_e = 0; f = 1MHz; T_j = 25 °C

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 175 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0,2 K/W

mode of operation	V_{CE} V	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	45	> 6,5 typ. 8,0	> 55 typ. 67

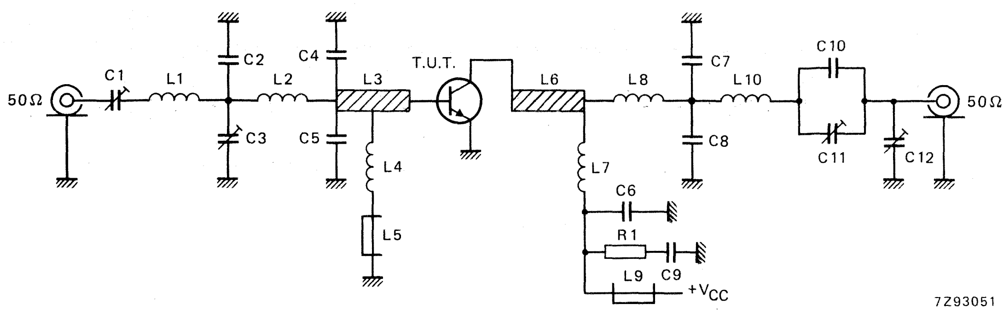


Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

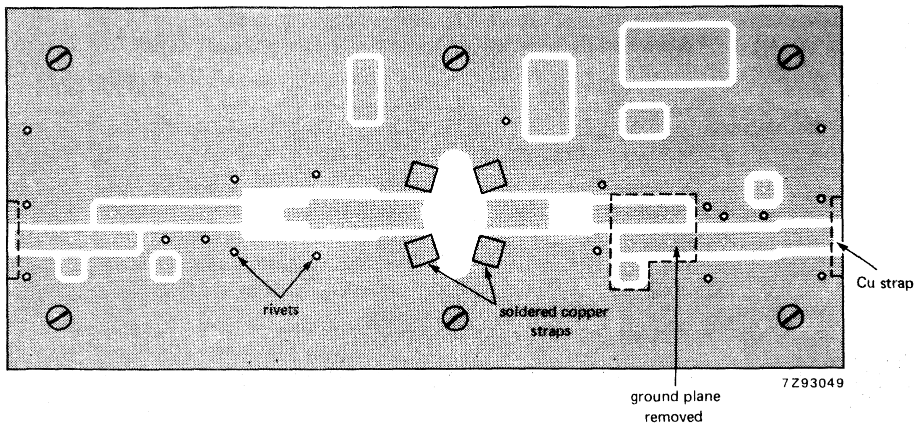
C1 = C11 = C12 = 4 to 40 film dielectric trimmer (cat.no. 2222 809 07008)
C2 = C10 = 10 pF multilayer ceramic chip capacitor *
C3 = 2,5 to 20 pF film dielectric trimmer (cat.no. 2222 809 07004)
C4 = C5 = 91 pF multilayer ceramic chip capacitor *
C6 = 820 pF multilayer ceramic chip capacitor *
C7 = C8 = 2 x 4,7 pF multilayer ceramic chip capacitors* in parallel
C9 = 100 nF polyester capacitor

L1 = strip, 28 mm x 4 mm
L2 = 4 turns Cu wire (1,0 mm); int.dia. 4,0 mm; length 7,5 mm; leads 2 x 3,5 mm
L3 = strip, 22 mm x 6 mm
L4 = 1 turn Cu wire (0,8 mm); int.dia. 3,0 mm; leads 2 x 9 mm
L5 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat.no. 4312 020 36640)
L6 = strip, 12 mm x 6 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int.dia. 5,0 mm; length 7,0 mm; leads 2 x 5 mm
L8 = 2 turns enamelled Cu wire (1,6 mm); int.dia. 5,0 mm; length 7,0 mm; leads 2 x 3 mm
L10 = strip, 18 mm x 4 mm

L1, L3, L6 and L10 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 inch.

R1 = 4,7 Ω ± 10%, carbon resistor

* American Technical Ceramics capacitor type 100B or capacitor of same quality.



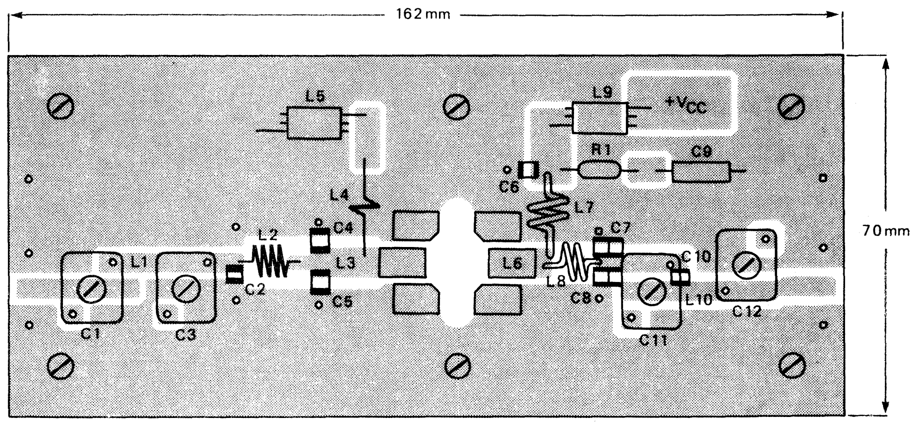


Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

The circuit and components are on one side of the epoxy fibre-glass board. The other side, except for the area indicated by the dotted line, is unetched copper serving as a ground plane.
If the p.c.b. is in direct contact with the heatsink, the heatsink area within the dotted line has to be raised al least 0,5 mm to minimize the dielectric losses.
Earth connections are made by hollow rivets and additionally by fixing screws and copper straps under the emitters to provide a direct contact between the copper of the component side and the ground plane.

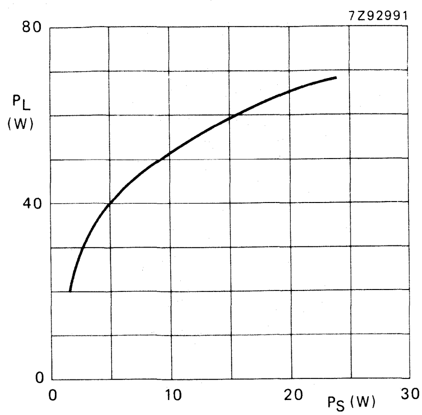


Fig. 8 Load power versus source power.

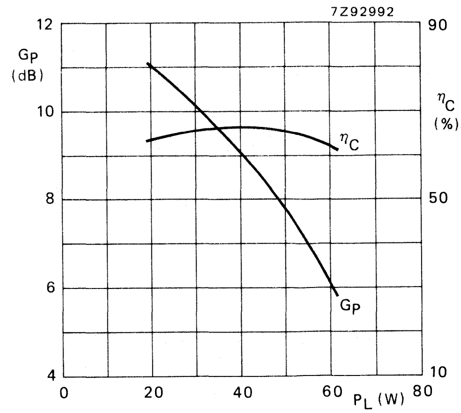


Fig. 9 Power gain and efficiency versus load power.

Condition for Figs 8 and 9:

Typical values; V_{CE} = 12,5 V; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Ruggedness in class-B operation

The BLV45/12 is capable of withstanding a load mismatch (VSWR = 20 through all phases) at rated load power up to a supply voltage of 15,5 V; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Power slump

If T_h is increased from 25 °C to 70 °C the output power slump for constant P_S amounts to typ. 7 % (V_{CE} = 12,5; f = 175 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W).

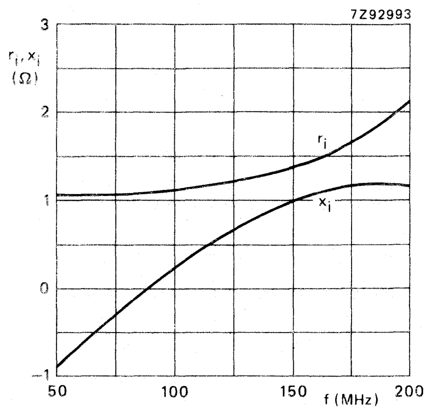


Fig. 10 Input impedance
(series components).

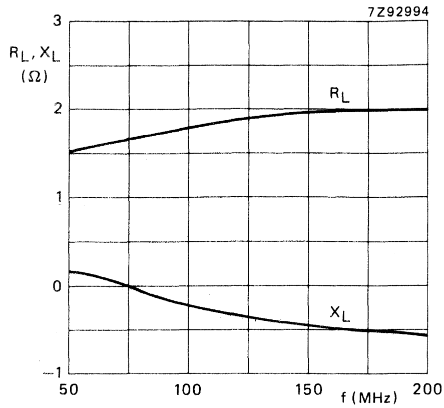


Fig. 11 Load impedance
(series components).

Conditions for Figs 10, 11 and 12:
Typical values; V_{CE} = 12,5 V; P_L = 45 W; f = 50 to 200 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

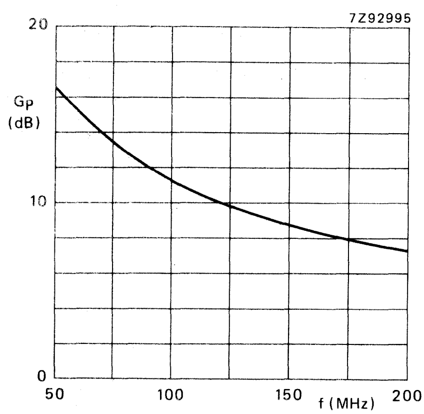


Fig. 12 Power gain versus frequency.

U.H.F. LINEAR PUSH-PULL POWER TRANSISTOR

Two n-p-n silicon planar epitaxial transistor sections in one envelope to be used as push-pull amplifier, primarily intended for use in linear u.h.f. television transmitters and transposers.

Features:

- internally matched input for wideband operation and high power gain;
- internal midpoint (r.f. ground) reduces negative feedback and improves power gain;
- increased input and output impedances (compared with single-ended transistors) simplify wideband matching;
- length of the external emitter leads is not critical;
- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The envelope is an 8-lead flange type with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

mode of operation	f_{vision} MHz	V_{CE} V	$I_{C1} = I_{C2}$ A	$I_{C(ZS)}$ A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	P_L W	G_p dB
class-A	860	25	0,85	–	70 25	–60 –55	> 6 typ. 12	–	> 8,0 typ. 9,0
class-AB	860	25	1,25	2 x 0,1	25	–	–	typ. 38**	typ. 6,5**

* Three-tone test method (vision carrier –8 dB, sound carrier –7 dB, sideband signal –16 dB), zero dB corresponds to peak sync level.

** Power gain compression is 1 dB.

MECHANICAL DATA

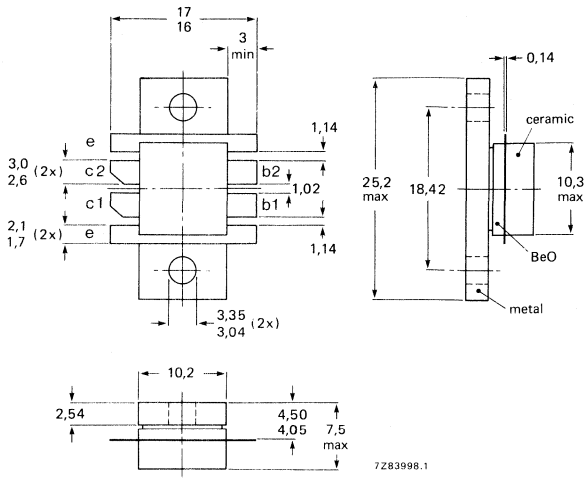
SOT-161 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-161.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

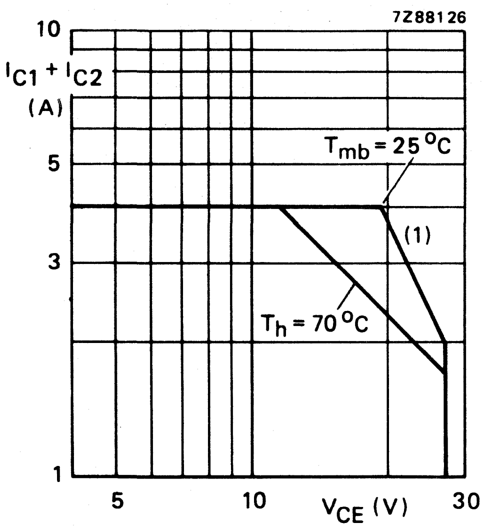
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50 V
open base	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current per transistor section			
d.c. or average	I_C; $I_{C(AV)}$	max.	2 A
(peak value); f > 1 MHz	I_{CM}	max.	4 A
Total power dissipation at T_{mb} = 25 °C*	P_{tot}	max.	77 W*
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C*	P_{rf}	max.	93 W*
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.*

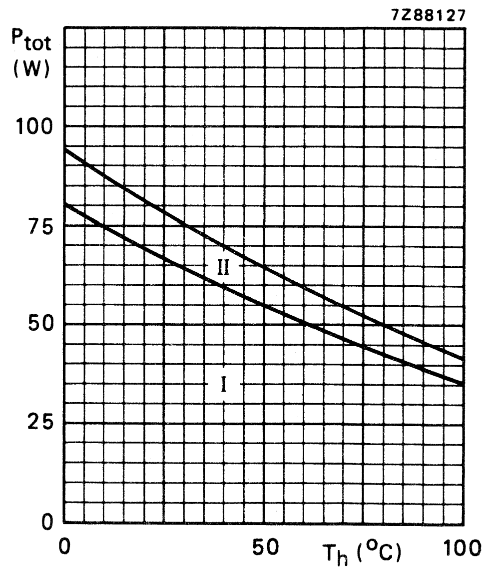


Fig. 3 Power derating curves vs. temperature.*

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 42 W; T_{mb} = 80,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,43 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,91 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,25 K/W

* Dissipation of either transistor section should not exceed half rated dissipation.

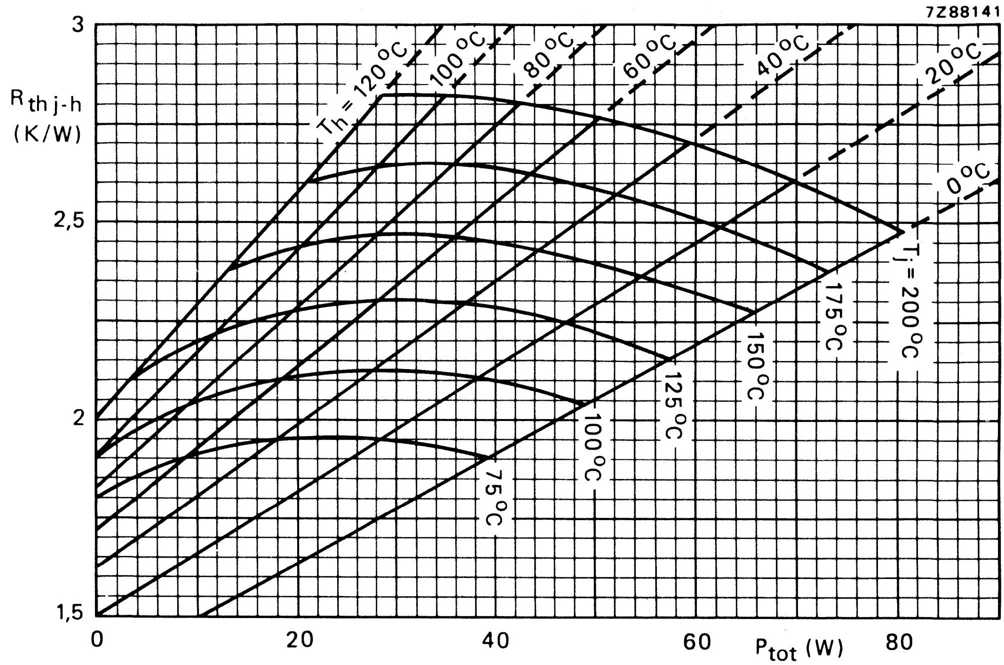


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,25 K/W.)

Example

Nominal class-A push-pull operation (without r.f. signal): V_{CE} = 25 V; $I_{C1} = I_{C2}$ = 0,85 A; T_h = 70 °C.

Fig. 4 shows: $R_{th\,j\text{-}h}$ max. 2,68 K/W
T_j max. 184 °C

Typical device: $R_{th\,j\text{-}h}$ typ. 2,28 K/W
T_j typ. 167 °C

CHARACTERISTICS apply to either transistor section unless otherwise specified

$T_j = 25\ ^{o}C$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	27 V
Emitter-base breakdown voltage			
open collector; $I_E = 5$ mA	$V_{(BR)EBO}$	>	3,5 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 27$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	2 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2 mJ
D.C. current gain*			
$I_C = 0{,}85$ A; $V_{CE} = 25$ V	h_{FE}	>	15
		typ.	40
D.C. current gain ratio of transistor sections			
$I_C = 0{,}85$ A; $V_{CE} = 25$ V		0,67 to 1,5	
Collector-emitter saturation voltage*			
$I_C = 1{,}7$ A; $I_B = 0{,}17$ A	V_{CEsat}	typ.	0,75 V
Transition frequency at f = 100 MHz**			
$-I_E = 0{,}85$ A; $V_{CB} = 25$ V	f_T	typ.	2,5 GHz
$-I_E = 1{,}7$ A; $V_{CB} = 25$ V	f_T	typ.	2,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	24 pF
		<	30 pF
Feedback capacitance at f = 1 MHz			
$I_C = 50$ mA; $V_{CE} = 25$ V	C_{re}	typ.	15 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

The graphs apply to either transistor section.

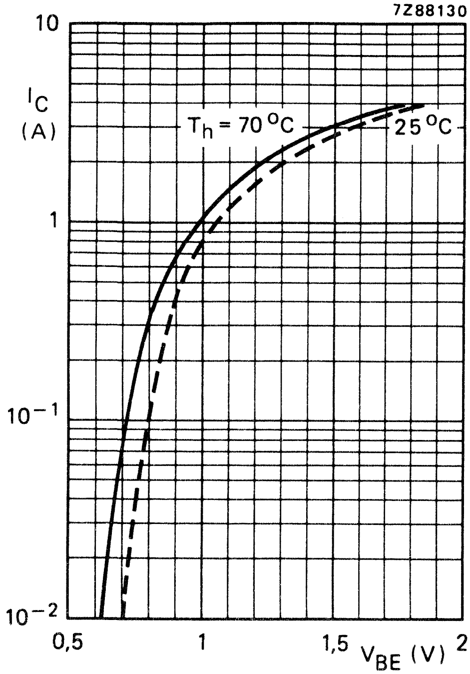


Fig. 5 Typical values; $V_{CE} = 25$ V.

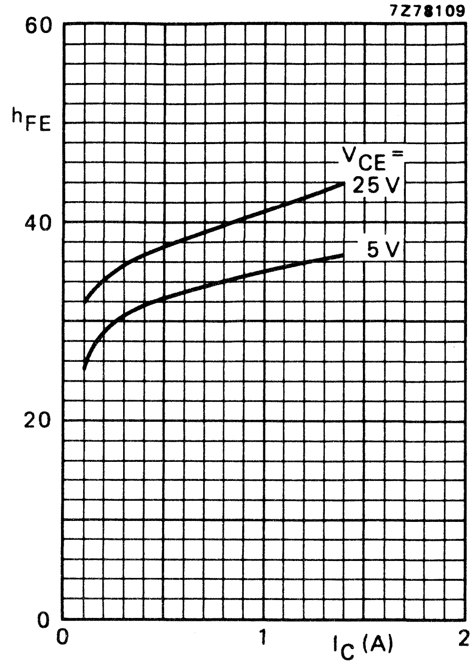


Fig. 6 Typical values; $T_j = 25\ ^oC$.

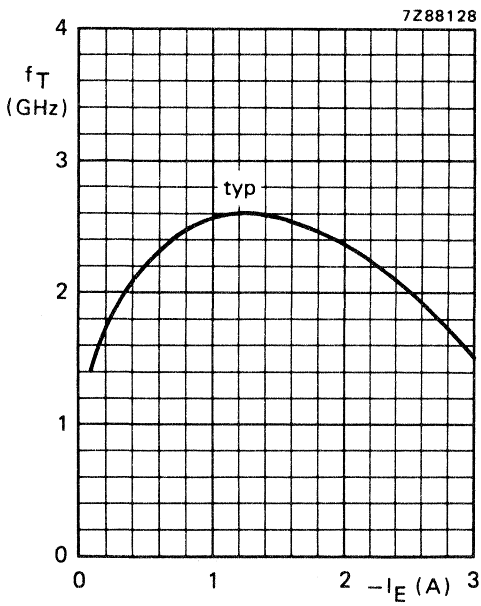


Fig. 7 $V_{CB} = 25$ V; f = 500 MHz; $T_j = 25\ ^oC$.

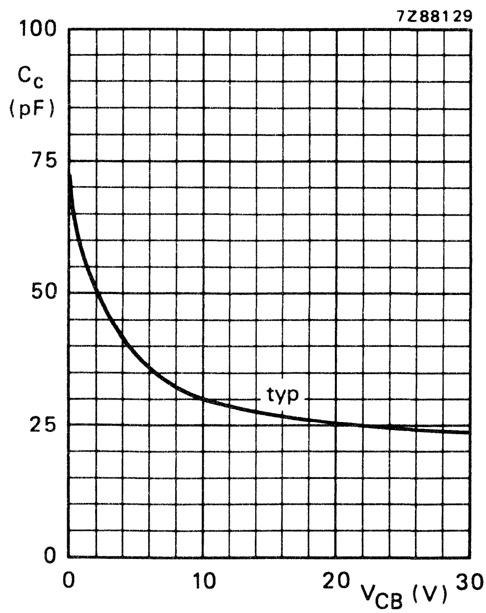


Fig. 8 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear push-pull power amplifier)

f_{vision} (MHz)	V_{CE} (V)	$I_{C1} = I_{C2}$ (A)	T_h (°C)	d_{im}* (dB)	$P_{o\ sync}$* (W)	G_p (dB)
860	25	0,85	70	−60	> 6	> 8,0
			70	−60	typ. 7,5	typ. 8,5
			70	−55	typ. 10	typ. 8,5
			25	−55	typ. 12	typ. 9,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

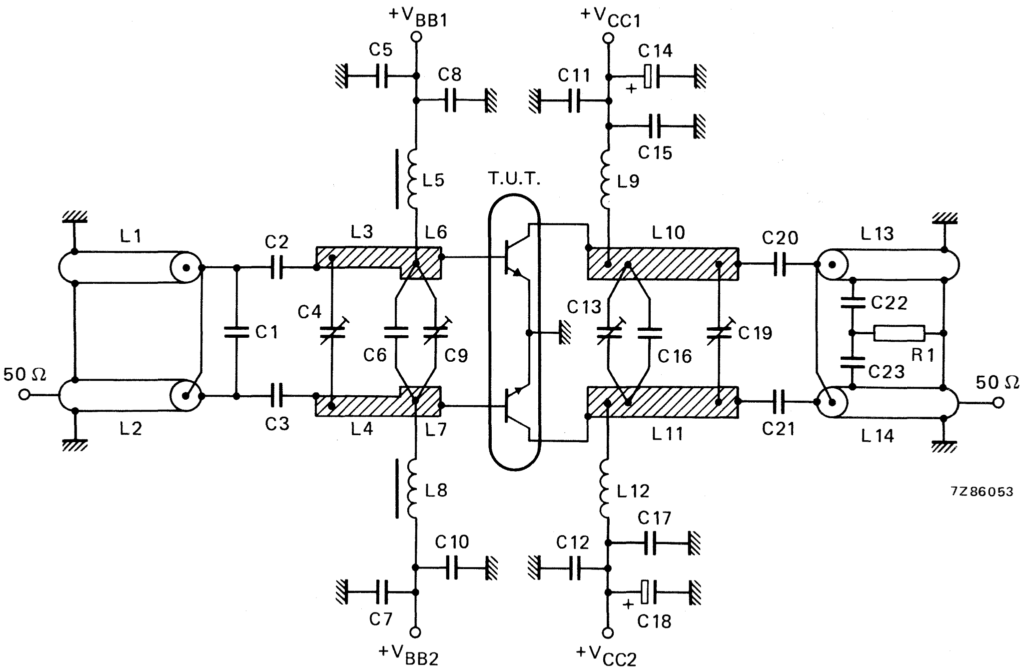


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C6 = C16 = 4,7 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C3 = C20 = C21 = 33 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
C4 = C9 = C13 = C19 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C5 = C7 = C15 = C17 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
C8 = C10 = C11 = C12 = 220 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13221)
C14 = C18 = 6,8 μF/40 V solid aluminium electrolytic capacitor
C22 = C23 = 1 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

C9 and C13 are placed 8,0 and 14,0 mm from transistor edge, respectively.

▲ ATC means American Technical Ceramics.

L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; length 29,0 mm. These cables are soldered on 75 Ω striplines (1,1 mm x 28,0 mm). The centre conductors of the cables L1 and L13 are not connected.
L3 = L4 = 52 Ω stripline (2,0 mm x 16,5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3,1 mm x 8,0 mm)
L9 = L12 = 1 turn Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 3,5 mm
L10 = L11 = 39 Ω stripline (3,1 mm x 34,0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/32".

R1 = 10 Ω carbon resistor

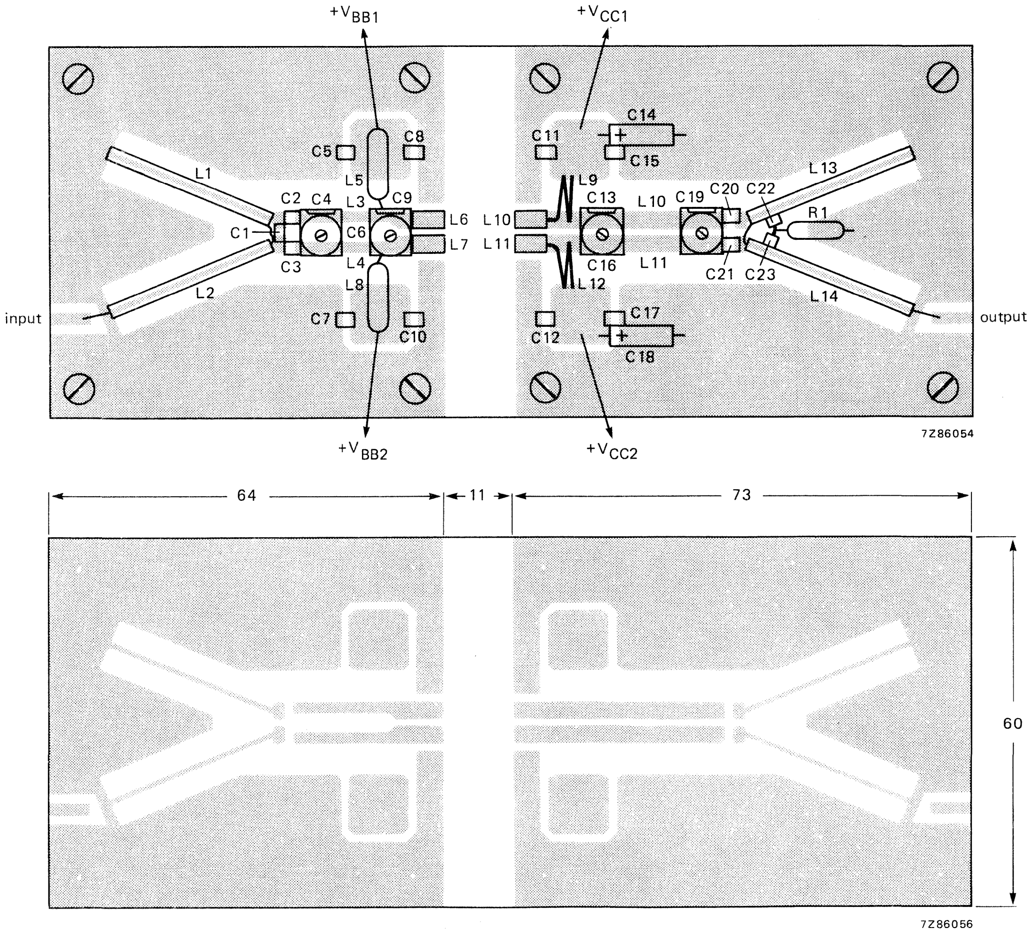


Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

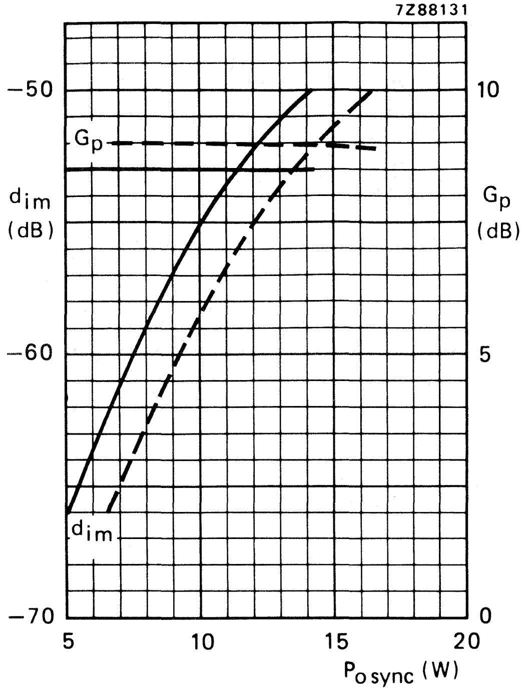


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

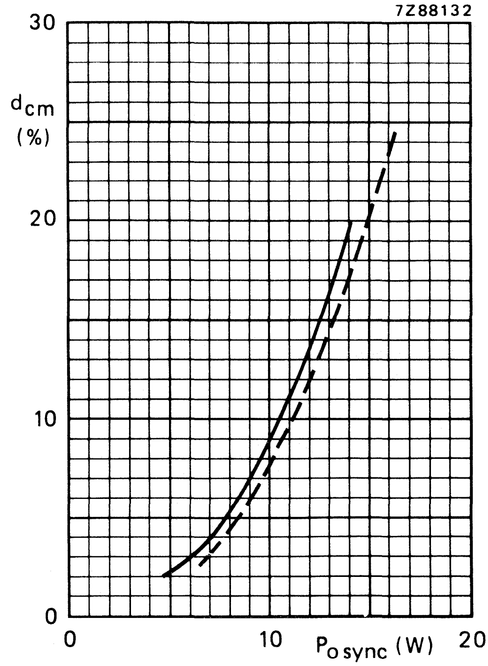


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

Conditions for Figs 11 and 12:

Typical values; V_{CE} = 25 V; I_C = 2 x 0,85 A; – – – T_h = 25 °C; —— T_h = 70 °C; f_{vision} = 860 MHz.

Ruggedness in push-pull class-A operation

The BLV57 is capable of withstanding full load mismatch (VSWR = 50 through all phases) under the following conditions:
V_{CE} = 25 V; I_C = 2 x 0,85 A; T_h = 70 °C; $P_{o\ sync}$* ⩽ 12,5 W; f = 860 MHz; $R_{th\ mb\text{-}h}$ = 0,25 K/W.
At any other composition of the output signal: P_L (r.m.s. value) ⩽ 5 W.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −70 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

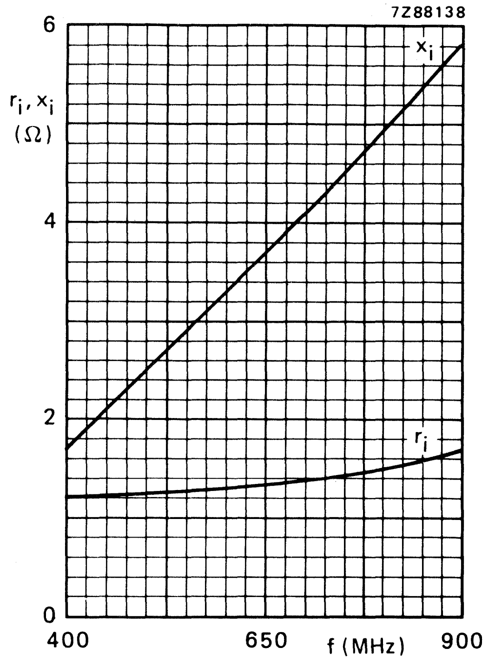


Fig. 20 Input impedance (series components).

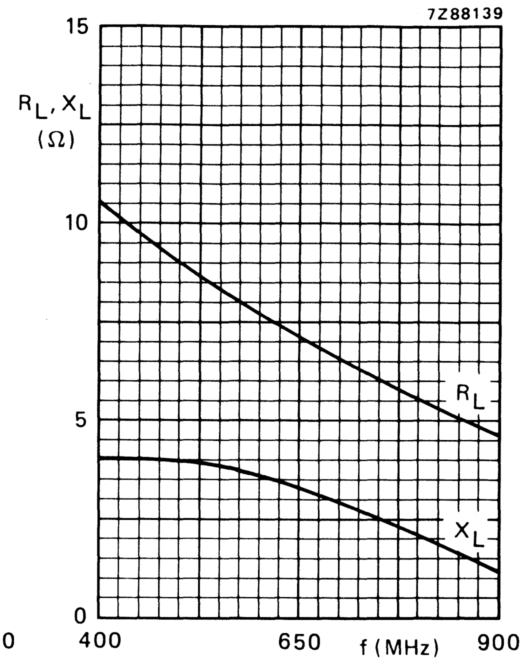


Fig. 21 Load impedance (series components).

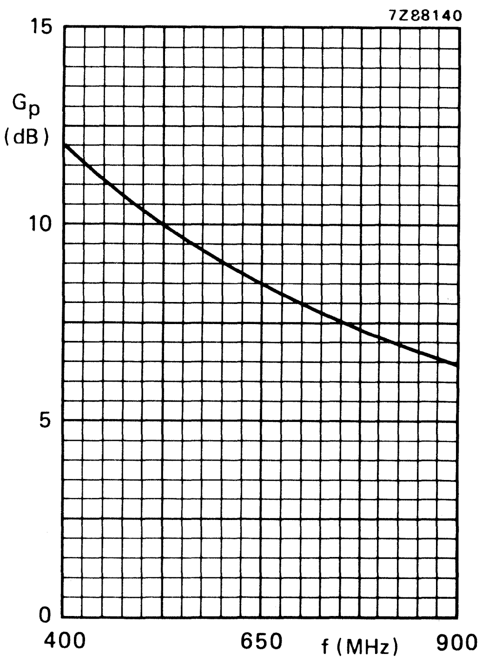


Fig. 22.

Conditions for Figs 20; 21 and 22:

The graphs apply to either transistor section assuming class-AB push-pull operation.
Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 0,1 A; P_L = 17,5 W (P.E.P.); T_h = 70 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-AB operation (c.w.)

f_{vision} (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (A)	T_h (°C)	P_L (W)	$I_{C1} = I_{C2}$ (A)	η (%)	G_p* (dB)
860	25	2 x 0,1	25	12,5			typ. 7,5
				38	typ. 1,25	typ. 60	typ. 6,5
860	25	2 x 0,1	70	12,5			typ. 7,0
				30	typ. 1,10	typ. 55	typ. 6,0

* Typical values are based on 1 dB gain compression. Using a 3rd order amplitude transfer characteristic, 1 dB compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

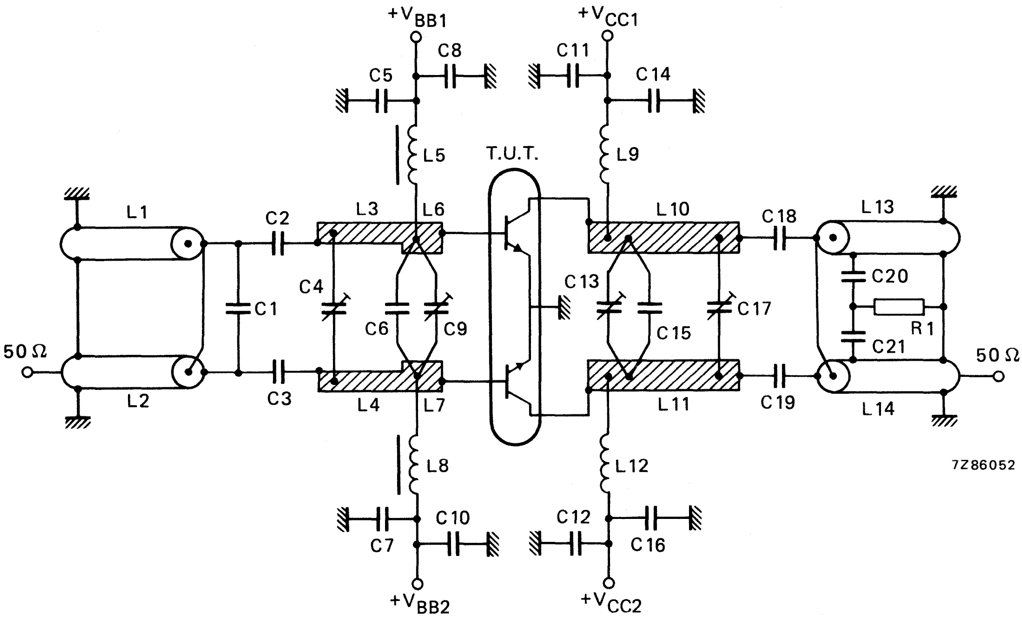


Fig. 16 Class-AB test circuit at f_{vision} = 860 MHz.

List of components:

C1 = C6 = C15 = 4,7 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C2 = C3 = C18 = C19 = 33 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13339)
C4 = C9 = C13 = C17 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C5 = C7 = C14 = C16 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 59104)
C8 = C10 = C11 = C12 = 220 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13221)
C20 = C21 = 1 pF (500 V) multilayer ceramic chip capacitor (ATC▲)

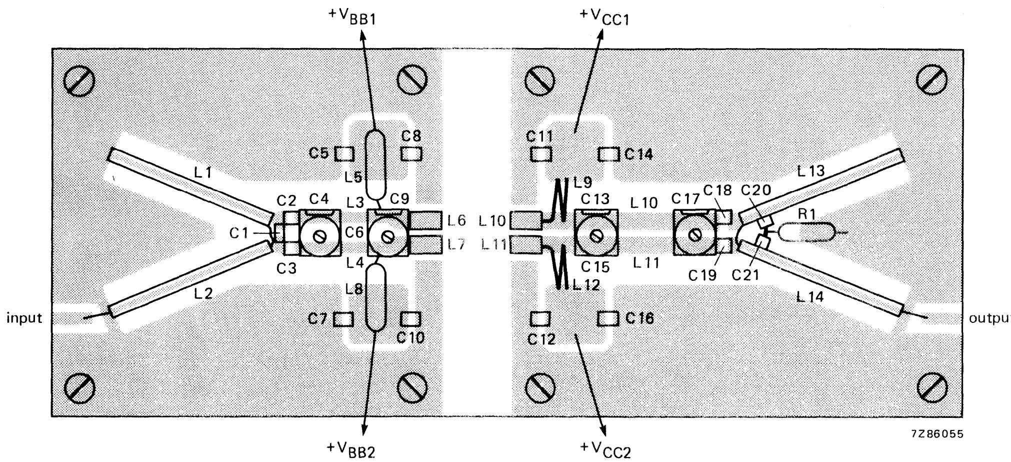
C9 and C13 are placed 8,0 and 14,0 mm from transistor edge, respectively.

▲ ATC means American Technical Ceramics.

L1 = L2 = L13 = L14 = 50 Ω semi-rigid cable; outer diameter 2,2 mm; length 29,0 mm. These cables are soldered on 75 Ω striplines (1,1 mm x 28,0 mm). The centre conductors of the cables L1 and L13 are not connected.
L3 = L4 = 52 Ω stripline (2,0 mm x 16,5 mm)
L5 = L8 = 470 nH microchoke
L6 = L7 = 39 Ω stripline (3,1 mm x 8,0 mm)
L9 = L12 = 1 turn Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 3,5 mm
L10 = L11 = 39 Ω stripline (3,1 mm x 34,0 mm)

L3, L4, L6, L7, L10 and L11 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/32″.

R1 = 10 Ω carbon resistor



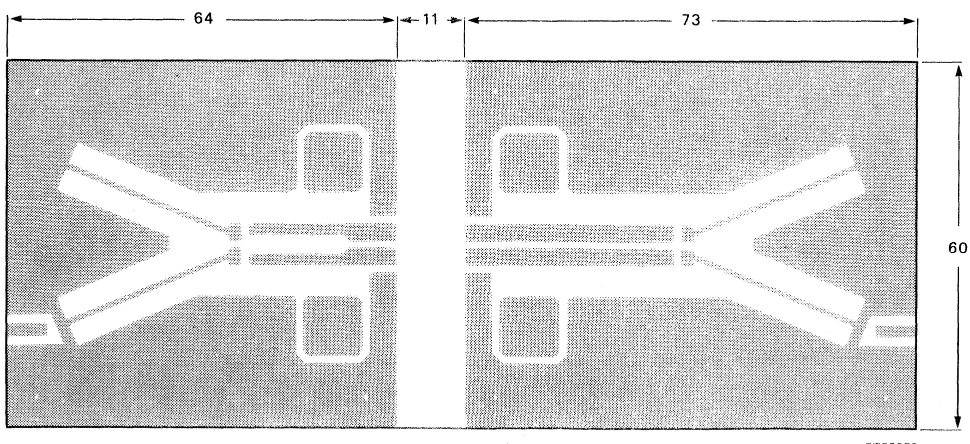


Fig. 17 Component layout and printed-circuit board for 860 MHz class-AB test circuit.

The circuit and the componenets are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by means of bolts. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

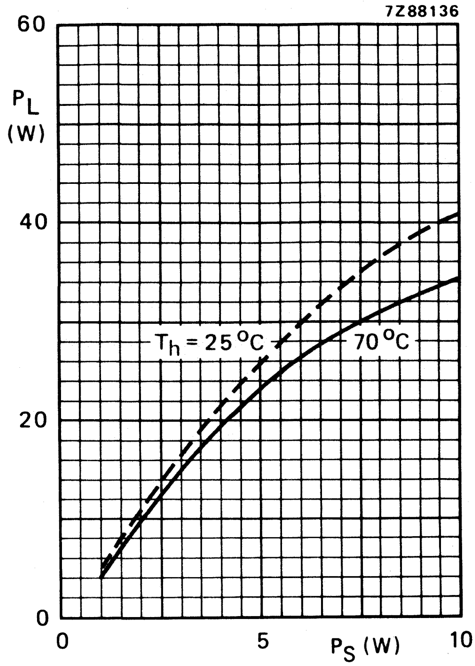


Fig. 18 Typical values; V_{CE} = 25 V;
$I_{C(ZS)}$ = 2 x 0,1 A; f_{vision} = 860 MHz.

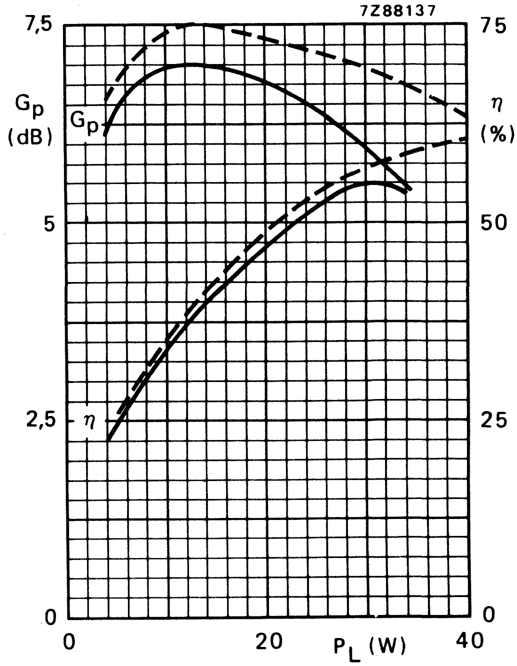


Fig. 19 Typical values; V_{CE} = 25 V;
$I_{C(ZS)}$ = 2 x 0,1 A; – – – T_h = 25 °C;
——— T_h = 70 °C; f_{vision} = 860 MHz.

Ruggedness in class-AB operation

The BLV57 is capable of withstanding a load mismatch (VSWR ⩽ 2 through all phases) up to 30 W (r.m.s. value) or (VSWR ⩽ 50 through all phases) up to 19 W under the following conditions: V_{CE} = 25 V; T_h = 70 °C; f = 860 MHz; $R_{th\ mb-h}$ = 0,25 K/W.

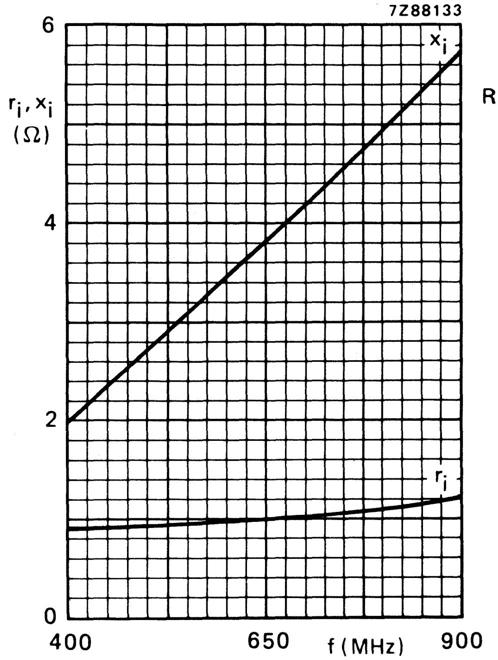


Fig. 13 Input impedance (series components).

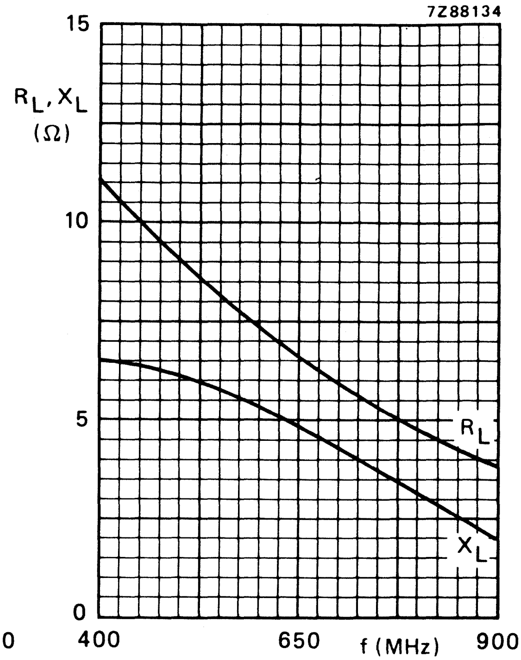


Fig. 14 Load impedance (series components).

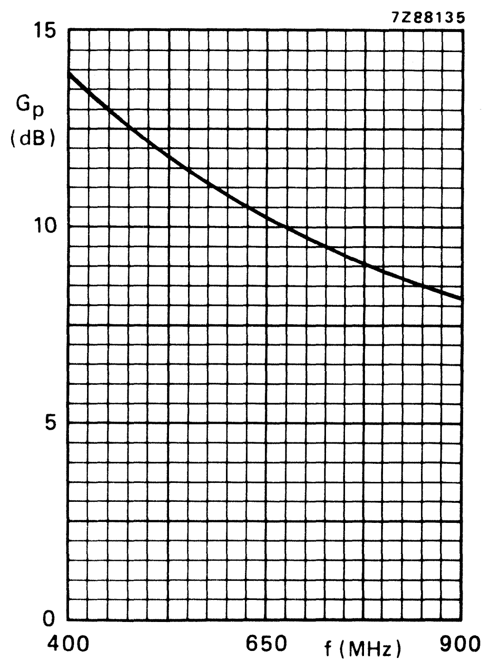


Fig. 15.

Conditions for Figs 13, 14 and 15:

The graphs apply to either transistor section assuming class-A push-pull operation.
Typical values; V_{CE} = 25 V; I_C = 0,85 A; T_h = 70 °C.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope primarily intended for use as linear amplifier in u.h.f. television transmitters.

Features:

- internal input matching to achieve an optimum wideband capability and high power gain
- emitter-ballasting resistors for lower junction temperatures.
- titanium-platinum-gold ensures long life and excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in common emitter class-AB circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
class AB; c.w.	25	860	30	min. 7,0	min. 50

MECHANICAL DATA

Dimensions in mm

SOT-171 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

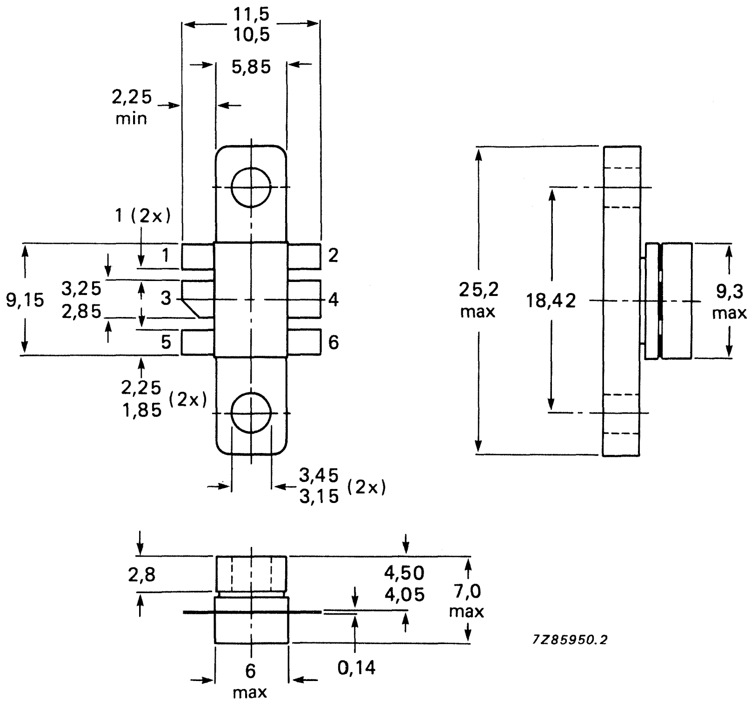
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:

1 Emitter
2 Emitter
3 Collector
4 Base
5 Emitter
6 Emitter



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw : cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

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)	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current			
d.c. or average	I_C	max.	3 A
(peak value); f > 1 MHz	I_{CM}	max.	9 A
Total power dissipation			
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	70 W
Storage temperature	T_{stg}	−65 to +150	°C
Operating junction temperature	T_j	max.	200 °C

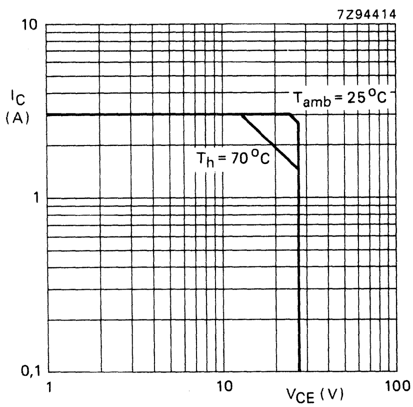


Fig. 2 D.C. SOAR; $R_{th\ mb\text{-}h}$ = 0,4 K/W.

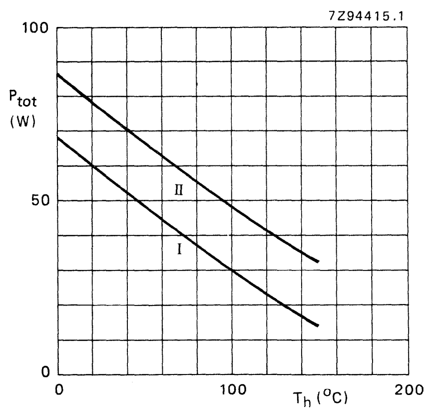


Fig. 3 Power/temperature derating curves versus heatsink temperature.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch (f > 1 MHz)

MAXIMUM THERMAL RESISTANCE

Dissipation = 50 W; T_{amb} = 25 °C

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	2,3 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,4 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	min.	50 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	min.	27 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	min.	3,5 V
Collector leakage current V_{BE} = 0; V_{CE} = 27 V	I_{CES}	max.	10 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	4 mJ
D.C. current gain V_{CE} = 20 V; I_C = 2 A	h_{FE}	min.	15
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 25 V	C_c	typ.	44 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 25 V	C_{re}	typ.	30 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

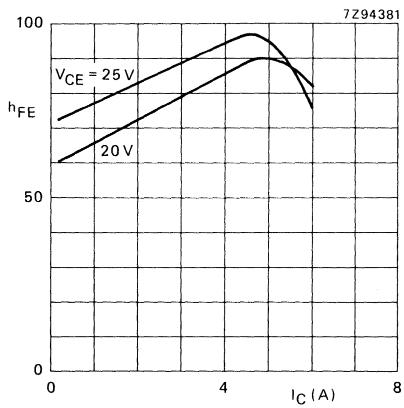


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

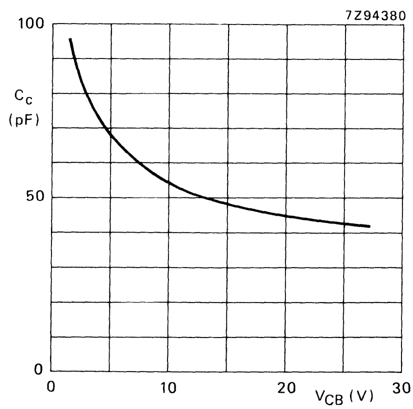


Fig. 5 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

APPLICATION INFORMATION

R.F. performance up to T_h = 25 °C in common emitter class-AB circuit (c.w.); $R_{th\ mb\text{-}h}$ = 0,4 K/W

f (MHz)	V_{CE} (V)	$I_{C(ZS)}$(mA)	G_P (dB)	P_L (W)	η (%)	ΔG_P (dB)▲
860	25	60	min. 7,0 typ. 8,5	30	min. 50 typ. 55	max. 1,0 typ. 0,2

▲ Assuming a 3rd-order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (negative modulation, C.C.I.R. system).

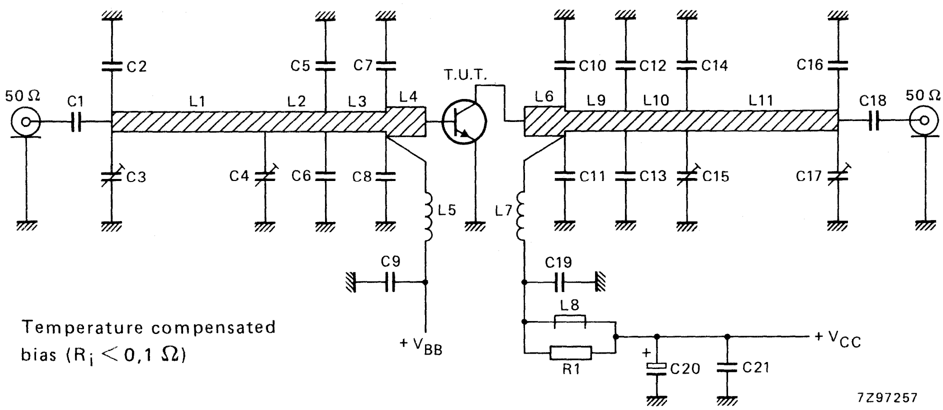


Fig. 6 Class-AB test circuit at f = 860 MHz.

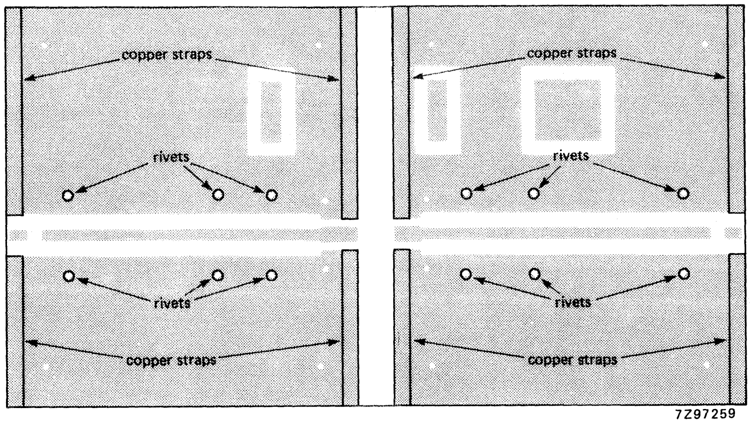
List of components:

C1 = C18 = 33 pF multilayer ceramic chip capacitor*
C2 = C14 = C16 = 3,6 pF multilayer ceramic chip capacitor*
C3 = C4 = C15 = C17 = 1,4 – 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C5 = C6 = 1,8 pF multilayer ceramic chip capacitor*
C7 = C8 = 6,2 pF multilayer ceramic chip capacitor*
C9 = C21 = 330 pF multilayer ceramic chip capacitor*
C10 = C11 = 5,6 pF multilayer ceramic chip capacitor**
C12 = 5,6 pF multilayer ceramic chip capacitor*
C13 = 6,2 pF multilayer ceramic chip capacitor*
C19 = 10 pF multilayer ceramic chip capacitor*
C20 = 6,8 µF (63 V) electrolytic capacitor
L1 = L11 = 50 Ω stripline (26 mm x 2,4 mm)
L2 = L3 = 50 Ω stripline (9,5 mm x 2,4 mm)
L4 = 42,6 Ω stripline (6,0 mm x 3,0 mm)
L5 = 60 nH; 4 turns closely wound enamelled Cu-wire (0,4 mm) int. dia. 3 mm; leads 2 x 5 mm.
L6 = 42,6 Ω stripline (4,0 mm x 3,0 mm)
L7 = 45 nH; 4 closely wound enamelled Cu-wire (1 mm); int. dia. 4 mm; leads 2 x 5 mm
L8 = Ferroxcube h.f. choke, grade 3B (cat.no. 4312 020 36642)
L9 = 50 Ω stripline (9,0 mm x 2,4 mm)
L10 = 50 Ω stripline (13,5 mm x 2,4 mm)
R1 = 10 Ω ± 5%, 1 W metal film resistor

The striplines are on a double Cu-clad printed circuit board with a P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics type 100B or capacitor of the same quality.

** American Technical Ceramics type 100A or capacitor of the same quality.



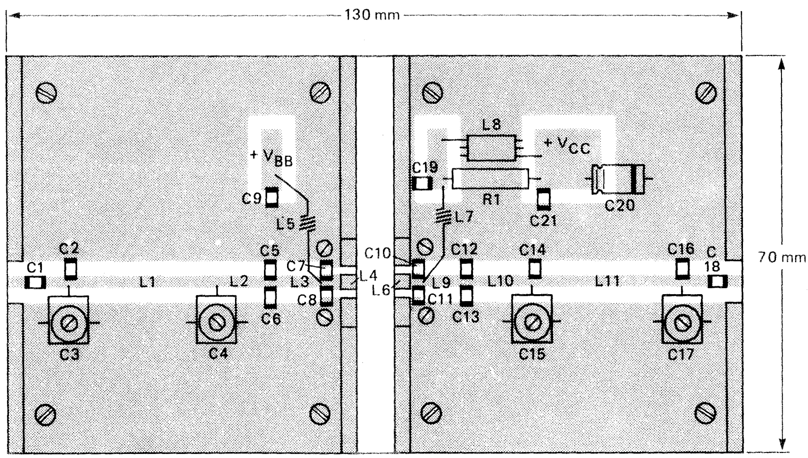


Fig. 7 Printed circuit board and component layout for 860 MHz class-AB test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

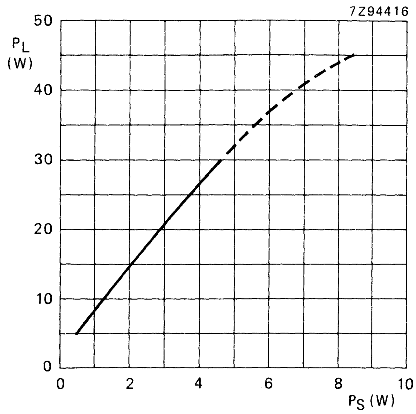


Fig. 8 Load power versus source power.

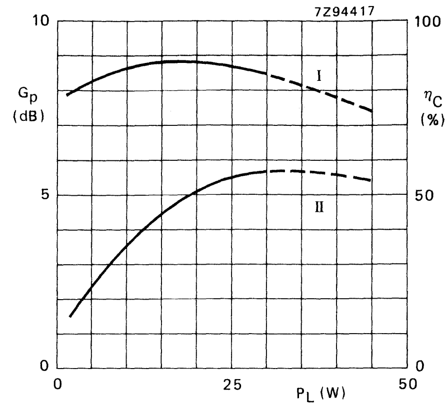


Fig. 9 Power gain (I) and efficiency versus load power (II).

Conditions for Figs 8 and 9:

Typical values; V_{CE} = 25 V; f = 860 MHz; $I_{C(ZS)}$ = 60 mA; T_h = 25 °C
$R_{th\ mb\text{-}h}$ = 0,4 K/W; class-AB operation.

RUGGEDNESS

The BLV59 is capable of withstanding load mismatch (VSWR = 10 through all phases) at rated load power under the following conditions; V_{CE} = 25 V; f = 860 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,4 K/W; $I_{C(ZS)}$ = 60 mA (class-AB operation).

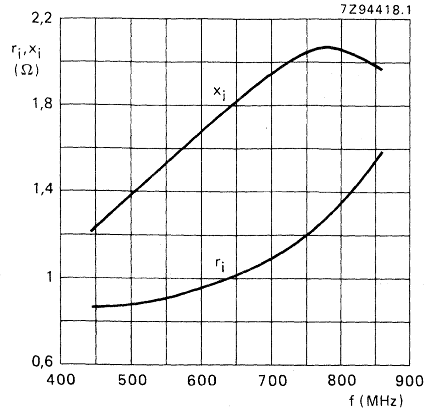


Fig. 10 Input impedance (series components).

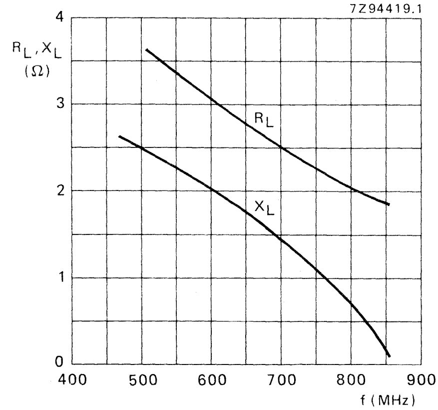


Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12

Typical values; V_{CE} = 25 V; P_L = 30 W; f = 470 to 860 MHz; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0,4 K/W; $I_{C(ZS)}$ = 60 mA; class-AB operation.

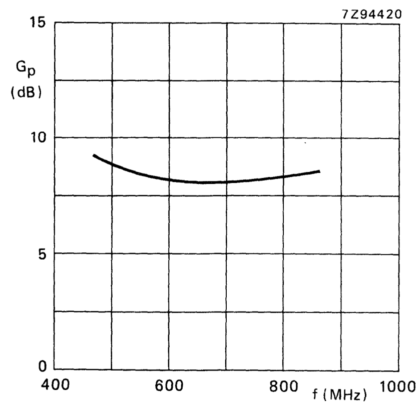


Fig. 12 Power gain versus frequency.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 175 MHz communications band.

Features

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-119). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	175	75	> 6,5	> 55

MECHANICAL DATA

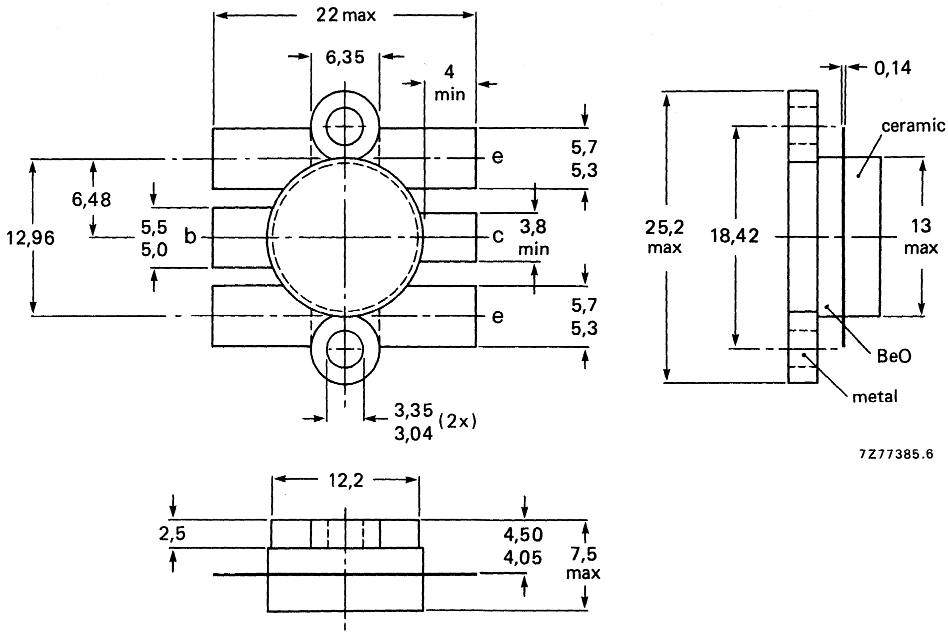
Fig. 1 SOT-119 (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16,5 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C	max.	15 A
peak value; f > 1 MHz	I_{CM}	max.	45 A
Total power dissipation at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	150 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

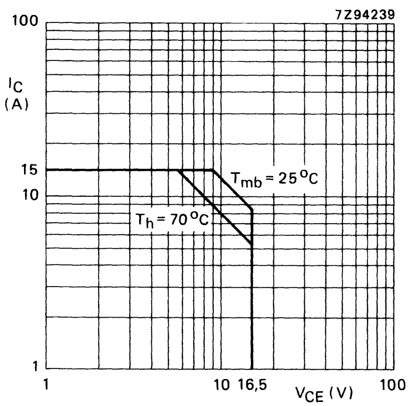


Fig. 2 D.C. soar.
$R_{th\ mb\text{-}h}$ = 0,2 K/W.

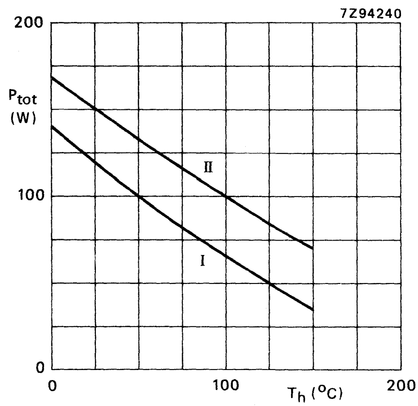


Fig. 3 Power/temperature derating curves; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE

Dissipation = 96 W; T_{mb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb}$	=	1,05 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	min.	36 V
Collector-emitter breakdown voltage open base; I_C = 200 mA	$V_{(BR)CEO}$	min.	16,5 V
Emitter-base breakdown voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	min.	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	44 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	20 mJ
D.C. current gain V_{CE} = 10 V; I_C = 10 A	h_{FE}	min. typ.	15 55
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	240 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	150 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

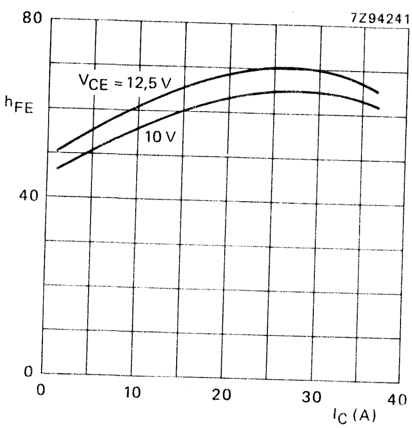


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

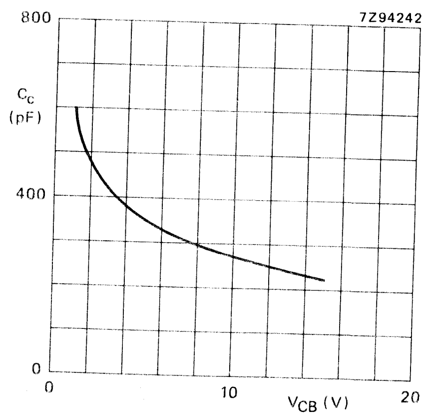


Fig. 5 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	75	> 6,5 typ. 7,5	> 55 typ. 63

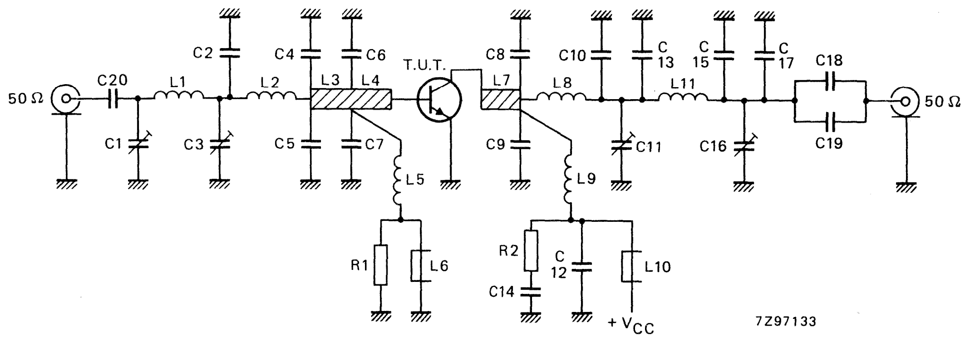


Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

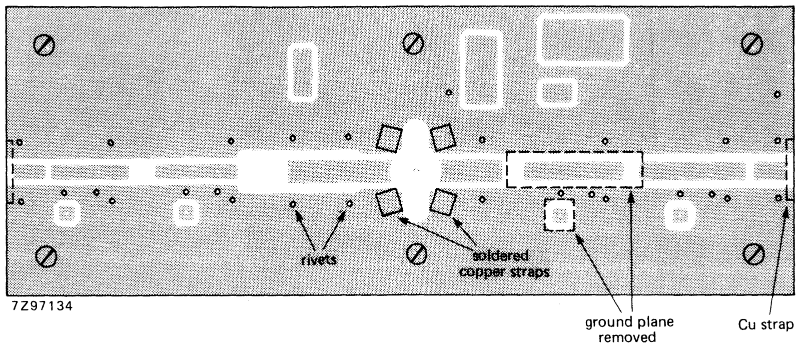
C1 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C2 = 10 pF multilayer ceramic chip capacitor*
C3 = C16 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C4 = C5 = 75 pF multilayer ceramic chip capacitor
C6 = C7 = 100 pF multilayer ceramic chip capacitor*
C8 = C9 = 2 x 75 pF multilayer ceramic chip capacitors* in parallel
C10 = C13 = 39 pF multilayer ceramic chip capacitor*
C11 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C12 = 2 x 820 pF multilayer ceramic chip capacitors in parallel*
C14 = 100 nF polyester capacitor
C15 = C17 = 12 pF multilayer ceramic chip capacitor*
C18 = C19 = 470 pF multilayer ceramic chip capacitor*
C20 = 820 pF multilayer ceramic chip capacitor*

* American Technical Ceramics capacitor type 100B or capacitor of the same quality.

L1 = 1 turn silver-plated Cu-wire (2,0 mm); int. dia. 10 mm; leads 2 x 4 mm
L2 = 1 turn silver-plated Cu-wire (2,0 mm); int. dia. 1 mm; leads 2 x 6 mm
L3 = strip (14 mm x 6 mm)
L4 = strip (8 mm x 6 mm)
L5 = 100 nH, 7 turns closely wound enamelled Cu-wire (0,5 mm); int. dia. 3 mm; leads 2 x 7 mm
L6 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36640)
L7 = strip (12 mm x 6 mm)
L8 = silver-plated copper U-shaped inductance (7 + 15 + 7) mm x 4 mm x 0,5 mm
L9 = silver-plated copper U-shaped inductance (8 + 8,5 + 6) mm x 4 mm x 0,5 mm
L10 = modified Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36640) with 3 parallel connected Cu wires (0,8 mm)
L11 = 2 turns silver-plated Cu-wire (2,0 mm); int. dia. 9 mm; length 7,5 mm; leads 2 x 3,5 mm

L3, L4 and L7 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, (ϵ_r = 4,5) thickness 1/16 inch).

R1 = 10 Ω ± 10%, carbon resistor
R2 = 4,7 Ω ± 10%, carbon resistor



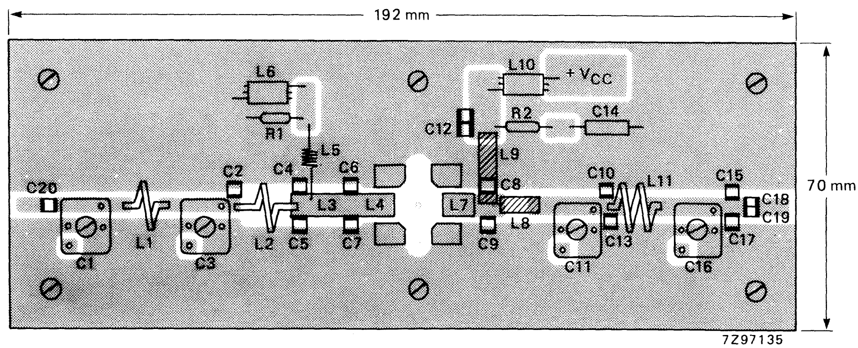


Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

The circuit and components are on one side of the epoxy fibre-glass board. The other side, except for the area indicated by the dotted line, is unetched copper serving as a ground plane.
If the p.c.b. is in direct contact with the heatsink, the heatsink area within the dotted line has to be raised at least 0,5 mm to minimize the dielectric losses.
Earth connections are made by hollow rivets and additionally by fixing screws and copper straps under the emitters to provide a direct contact between the copper of the component side and the ground plane.

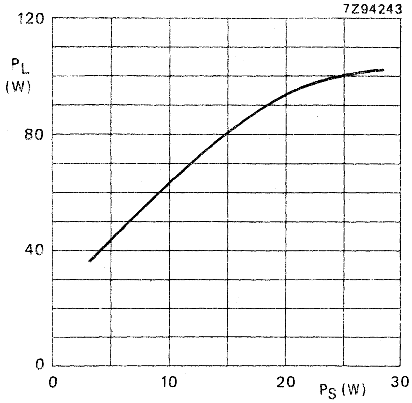


Fig. 8 Load power versus source power.

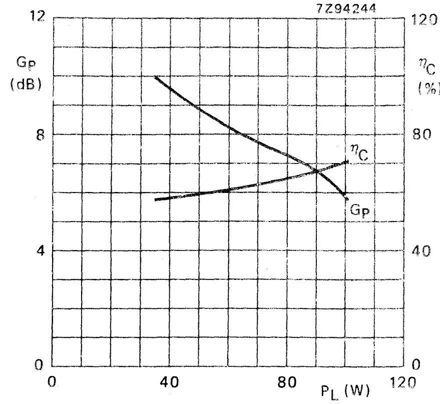


Fig. 9 Power gain and efficiency versus load power.

Condition for Figs 8 and 9:

Typical values; V_{CE} = 12,5 V; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Ruggedness in class-B operation

The BLV75/12 is capable of withstanding a load mismatch (VSWR = 20 through all phases) at rated load power up to a supply voltage of 12,5 V; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Power slump

If T_h is increased from 25 °C to 70 °C the output power slump for constant P_S amounts to typ. 7% (V_{CE} = 12,5; f = 175 MHz; $R_{th\ mb\text{-}h}$ = 0,2 K/W).

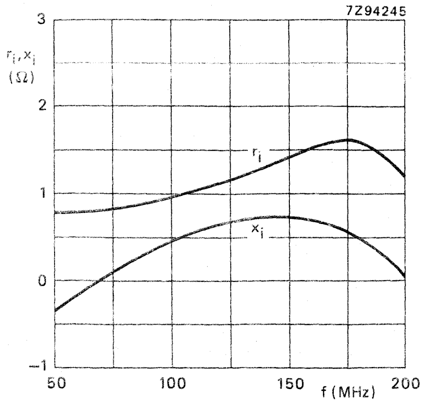


Fig. 10 Input impedance (series components).

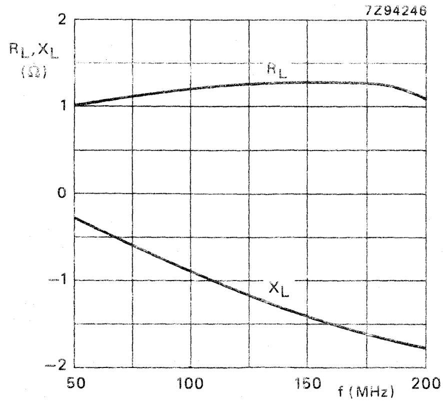


Fig. 11 Load impedance (series components).

Conditions for Figs 10, 11 and 12:

Typical values; V_{CE} = 12,5 V; P_L = 75 W; f = 50 to 200 MHz; class-B operation; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

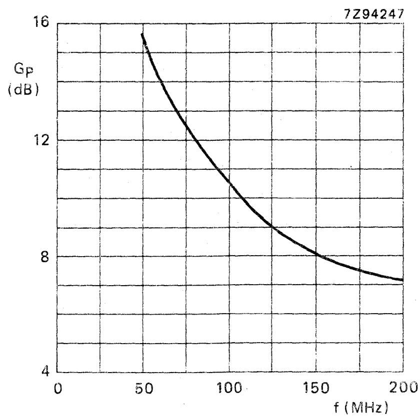


Fig. 12 Power gain versus frequency.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in base stations in the v.h.f. mobile radio band.

Features:

- multi-base structure and diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a 1/2 in. 4-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	P_S W	G_p dB	η %
narrow band; c.w.	28	175	80	< 17,9	> 6,5	> 70

MECHANICAL DATA

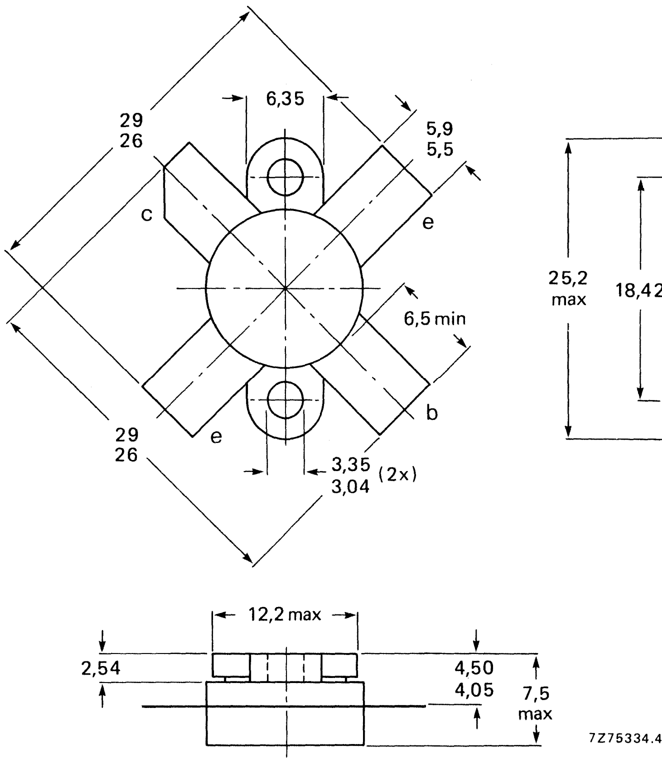
SOT-121 (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,60 Nm (6,0 kg cm)
max. 0,75 Nm (7,5 kg cm)

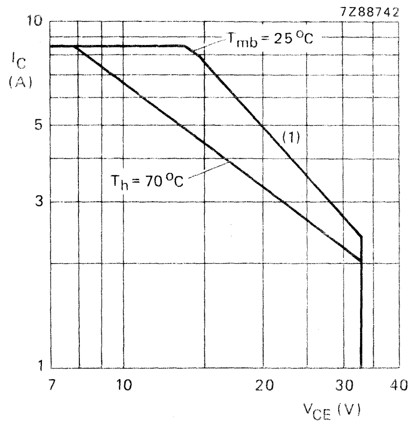
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be appiied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (peak-value);				
$V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	8,5	A
(peak value); f > 1 MHz	I_{CM}	max.	17,5	A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	116	W
R.F. power dissipation				
f > 1 MHz; $T_{mb} = 25\ ^oC$	P_{rf}	max.	144	W
f > 1 MHz; $T_h = 70\ ^oC$	P_{rf}	max.	80	W
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit.

Fig. 2 D.C. SOAR.

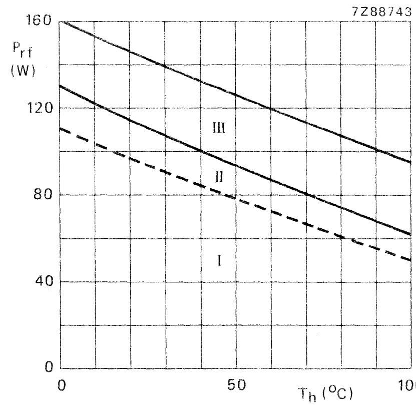


Fig. 3 Power derating curve vs. temperature.

I Continuous d.c. operation
II Continuous r.f. operation; (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE (dissipation = 90 W; $T_{mb} = 60\ ^oC$, i.e. $T_h = 33\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,50	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,30	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 33 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	10 mJ
R_{BE} = 10 Ω	E_{SBR}	>	10 mJ
D.C. current gain*			
I_C = 3,5 A; V_{CE} = 25 V	h_{FE}	typ.	45 15 to 100
Collector-emitter saturation voltage*			
I_C = 10 A; I_B = 2 A	V_{CEsat}	typ.	1,6 V
Transition frequency at f = 100 MHz*			
$-I_E$ = 3,5 A; V_{CB} = 25 V	f_T	typ.	575 MHz
$-I_E$ = 10 A; V_{CB} = 25 V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz			
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	88 pF
Collector-flange capacitance	C_{cf}	typ.	4,5 pF

* Measured under pulse conditions: $t_p > 300\ \mu s$; $\delta < 0{,}02$.

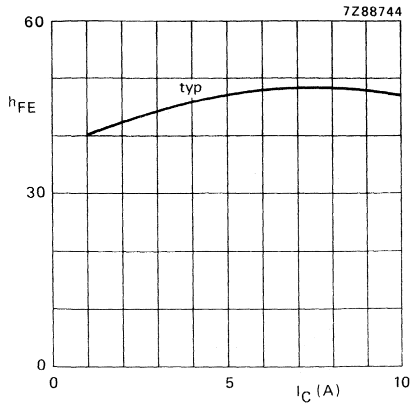


Fig. 4 V_{CE} = 25 V; T_j = 25 ^oC.

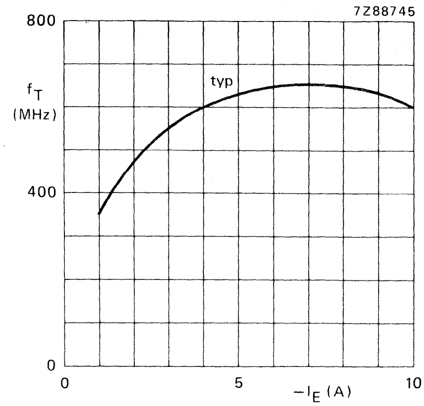


Fig. 5 V_{CB} = 25 V; f = 100 MHz; T_j = 25^oC.

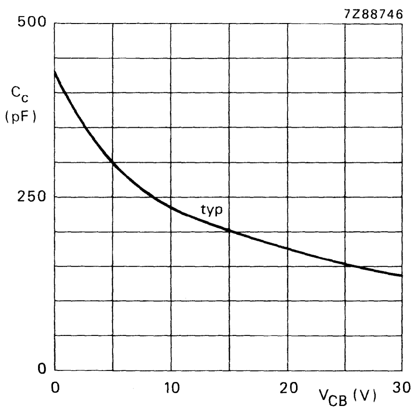


Fig. 6 I_E = I_e = 0; f = 1 MHz; T_j = 25 ^oC.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter class-B circuit)
f = 175 MHz; T_h = 25 °C

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η %
narrow band; c.w.	28	80	< 17,9 typ. 16,0	> 6,5 typ. 7,0	< 4,1 typ. 3,8	> 70 typ. 75

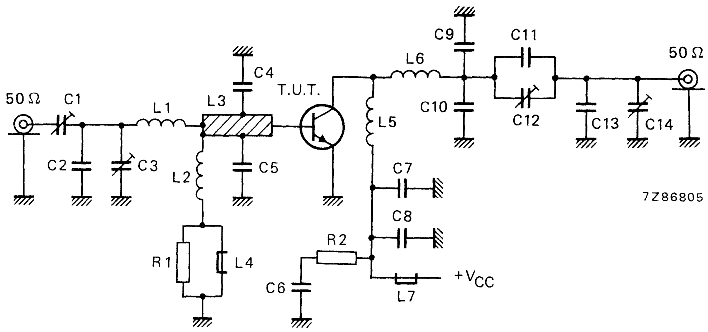


Fig. 7 Class-B test circuit at f = 175 MHz.

List of components:

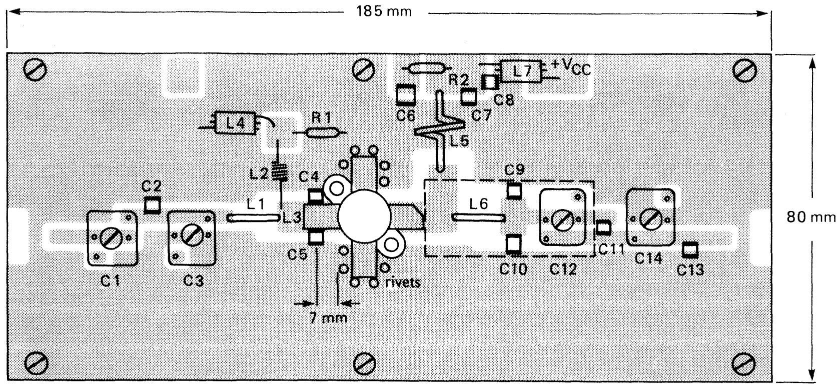
C1 = C12 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = 30 pF (500 V) multilayer ceramic chip capacitor*
C3 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C4 = C5 = 56 pF (500 V) multilayer ceramic chip capacitor*
C6 = 100 nF (50 V) multilayer ceramic chip capacitor
C7 = C8 = 220 pF (50 V) multilayer ceramic chip capacitor
C9 = C10 = 10 pF (500 V) multilayer ceramic chip capacitor*
C11 = 24 pF (500 V) multilayer ceramic chip capacitor*
C13 = 13 pF (500 V) multilayer ceramic chip capacitor*

L1 = Cu wire (1,8 mm); length 15 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 7 mm
L3 = strip (15 mm x 8 mm); taps for C4 and C5 at 7 mm from transistor edge
L4 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 1 turn Cu wire (1,8 mm); int. dia. 9 mm; leads 2 x 10 mm
L6 = 1/2 turn Cu wire (1,8 mm); int. dia. 13 mm; leads 2 x 5 mm

L3 is a strip on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16 in.

R1 = R2 = 10 Ω (± 10%) carbon resistor (0,25 W)

* American Technical Ceramics capacitors or capacitors of same quality.



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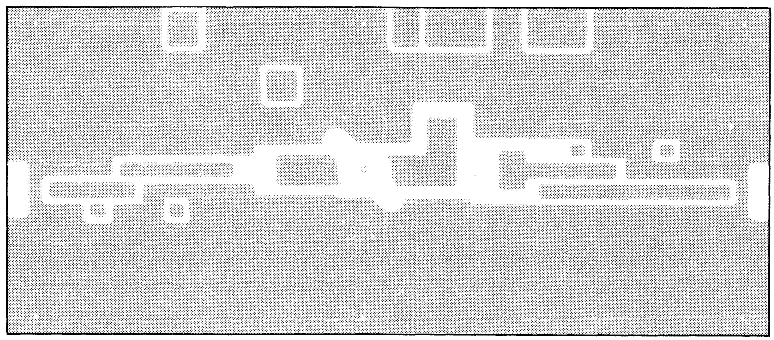

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Fig. 8 Component layout and printed-circuit board for 175 MHz.

The circuit and the components are on one side of the epoxy fibre-glass board, the other side is unetched copper to serve as ground-plane. Earth connections are made by hollow rivets and additionally by fixing screws and copper straps at the input and output to provide direct contact between the copper on the component side and the ground-plane.

To minimize the dielectric losses, the ground-plane under the interconnections of L6, C9, C10, C11 and C12 has been removed.

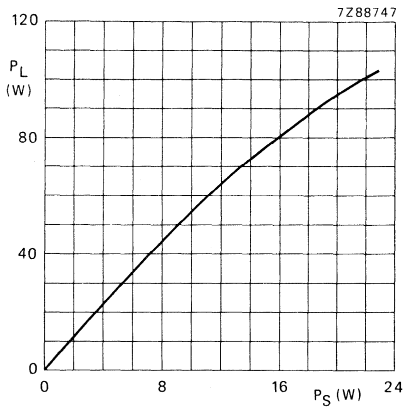


Fig. 9 Load power as a function of source power.

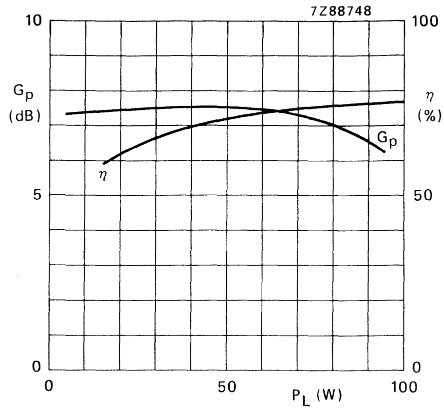


Fig. 10 Power gain and efficiency as a function of load power.

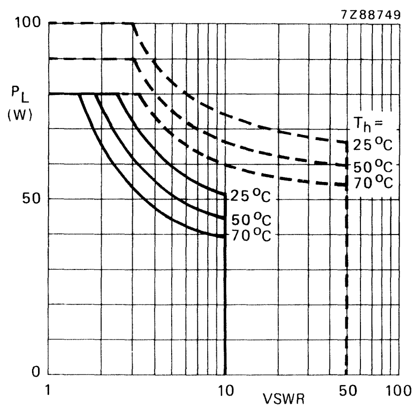


Fig. 11 R.F. SOAR at V_{CE} = 28 V.
——— f > 1 MHz (continuous);
- - - - short time operation during mismatch (f > 1 MHz).

Conditions for Figs 9 and 10:

Test circuit tuned for each power level; typical values; V_{CE} = 28 V; f = 175 MHz; T_h = 25 °C; class-B operation.

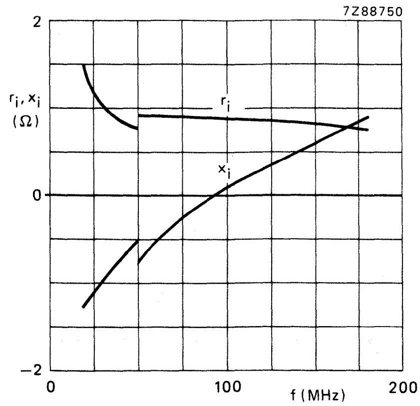


Fig. 12 Input impedance (series components).

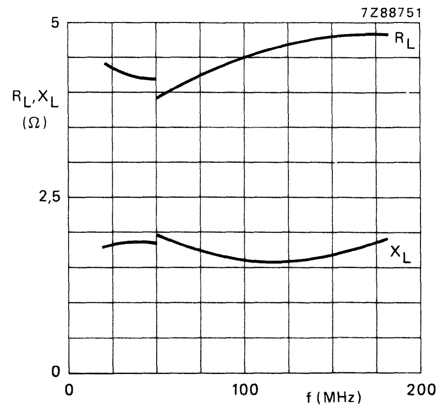


Fig. 13 Load impedance (series components).

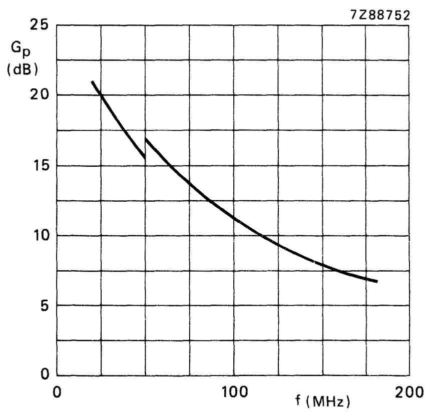


Fig. 14 Power gain as a function of frequency.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; class-B operation.

OPERATING NOTE for Figs 12, 13 and 14:

Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:

- diffused emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

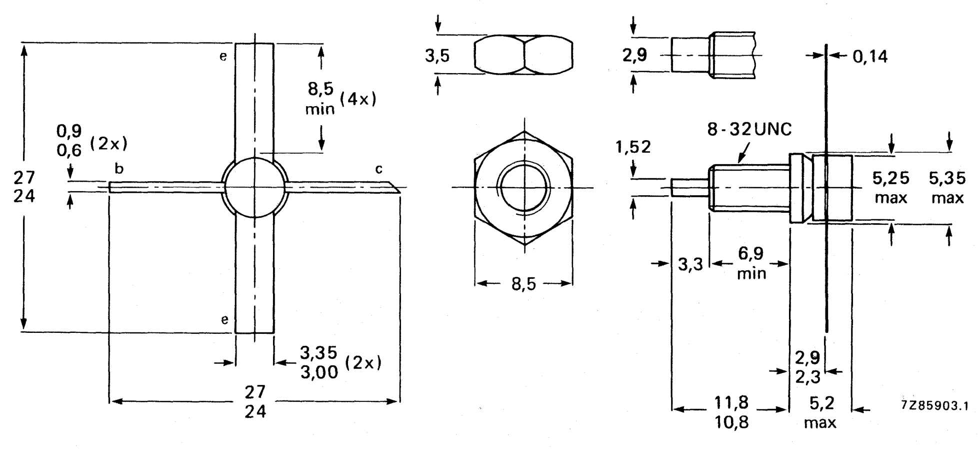
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	900	1	> 7,5	> 50
	9,6	900	0,75	typ. 7,9	typ. 61

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172A1.



Torque on nut: min. 0,75 Nm
(7,5 kg.cm)
max. 0,85 Nm
(8,5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
Deburring must leave surface flat; donot chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	0,2 A
(peak value); f > 1 MHz	I_{CM}	max.	0,6 A
D.C. power dissipation at T_{mb} = 115 °C	$P_{tot(dc)}$	max.	2,25 W
R.F. power dissipation f > 1 MHz; T_{mb} = 105 °C	$P_{tot(rf)}$	max.	3,5 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

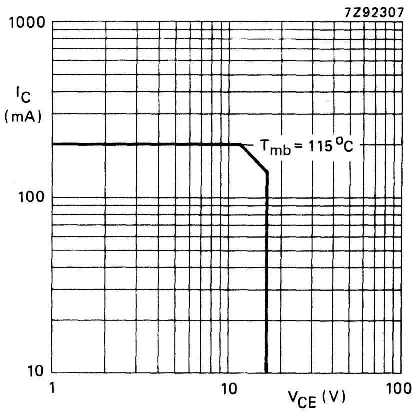


Fig. 2 D.C. SOAR.

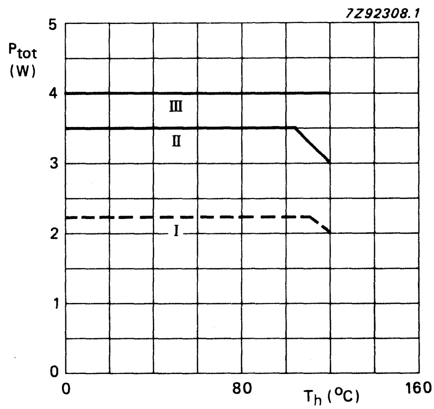


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 2,25 W; T_{mb} = 25 °C.

From junction to mounting base			
(d.c. dissipation)	$R_{th\ j\text{-}mb(d.c.)}$	max.	25 K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(r.f.)}$	max.	19 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,8 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I_C = 2,5 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage, open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage, open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current, V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	1 mA
Second breakdown energy, L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0,3 mJ
D.C. current gain, I_C = 0,15 A; V_{CE} = 10 V	h_{FE}	>	25
Transition frequency at f = 500 MHz*, $-I_E$ = 0,15 A; V_{CB} = 12,5 V	f_T	typ.	4,8 GHz
$-I_E$ = 0,5 A; V_{CB} = 12,5 V	f_T	typ.	1,4 GHz
Collector capacitance at f = 1 MHz, I_E = i_e = 0; V_{CB} = 12,5 V	C_c	typ.	1,8 pF
Feedback capacitance at f = 1 MHz, I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	1,0 pF
Collector-stud capacitance	C_{cs}	typ.	0,5 pF

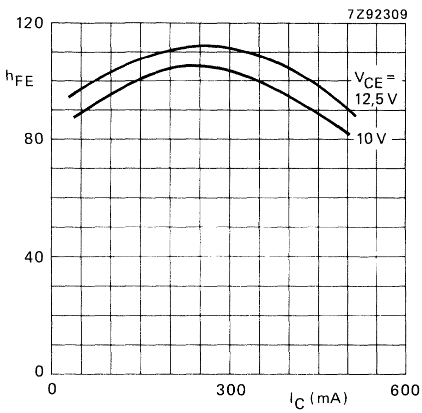


Fig. 4 T_j = 25 °C; typical values.

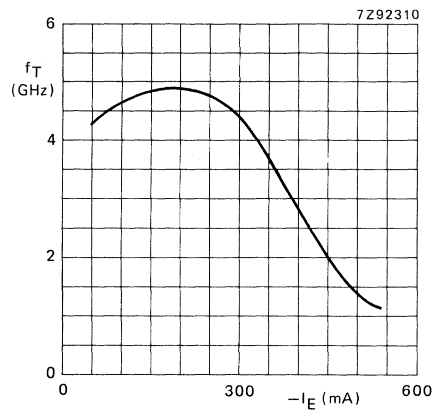


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

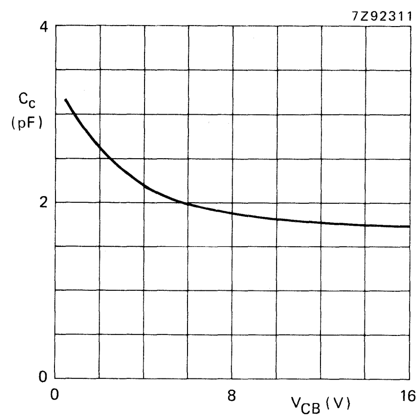


Fig. 6 I_E = i_e = 0; f = 1 MHz; typical values.

* Measured under pulse conditions: t_p = 50 μs; δ < 1%.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.			< 0,178	> 7,5	< 0,160	> 50
	12,5	1	typ. 0,126	typ. 9,0	typ. 0,133	typ. 60
	9,6	0,75	typ. 0,122	typ. 7,9	typ. 0,128	typ. 61

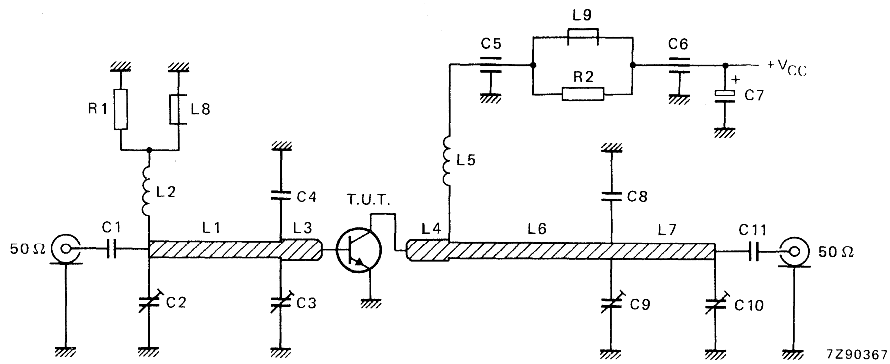


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

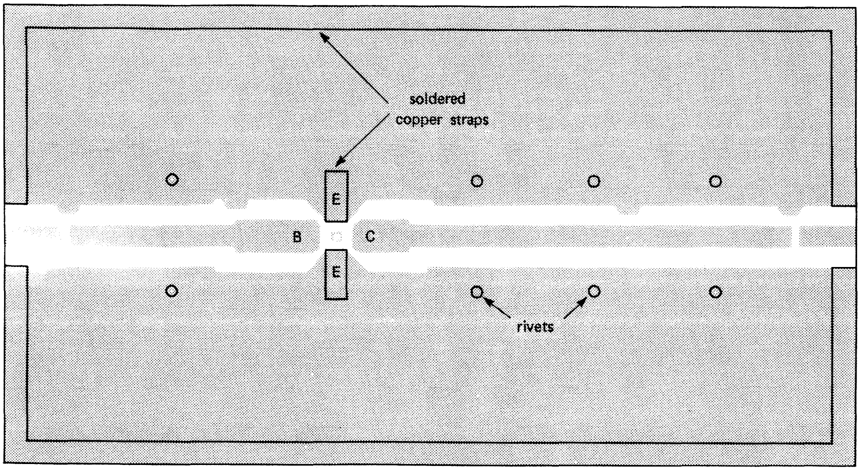
C1 = C11 = 33 pF multilayer ceramic chip capacitor
C2 = C10 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C9 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = 5,6 pF multilayer ceramic chip capacitor*
C5 = 10 pF ceramic feed-through capacitor
C6 = 330 pF ceramic feed-through capacitor
C7 = 2,2 μF (35 V) tantalum electrolytic capacitor
C8 = 3,9 pF multilayer ceramic chip capacitor*

L1 = L7 = 50 Ω stripline (28,2 mm x 4,0 mm)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 38 Ω stripline (14,6 mm x 6,0 mm)
L4 = 38 Ω stripline (10,0 mm x 6,0 mm)
L5 = 280 nH; 15 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 50 Ω stripline (37,7 mm x 4,0 mm)
L8 = L9 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)

R1 = R2 = 10 Ω ± 10%; 0,25 W metal film resistor

L1, L3, L4, L6 and L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



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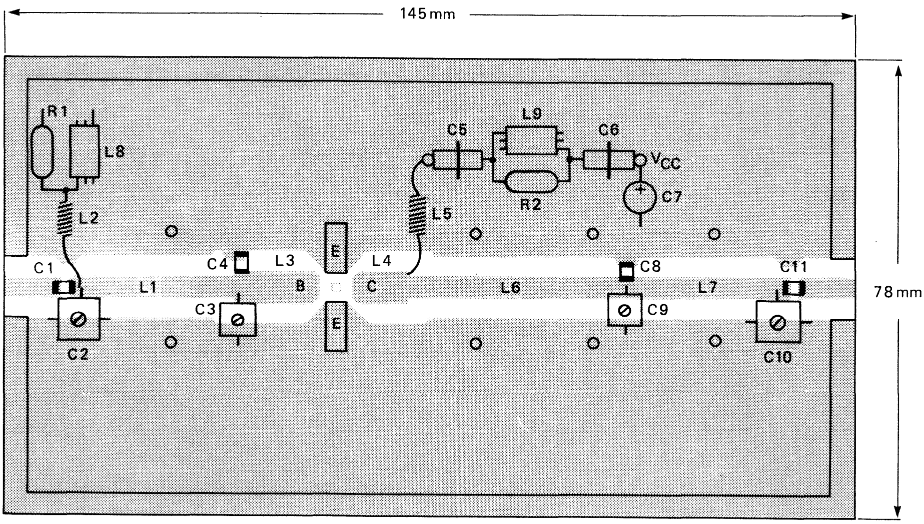


7Z90369

Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

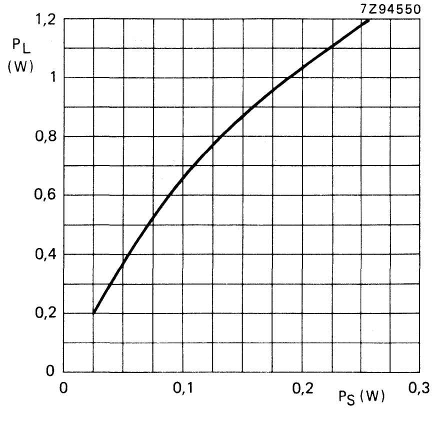


Fig. 9 Load power vs. source power.

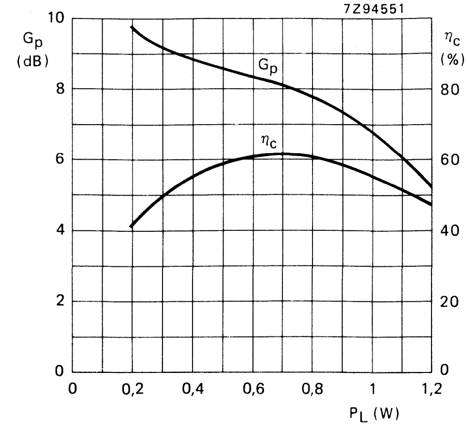


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

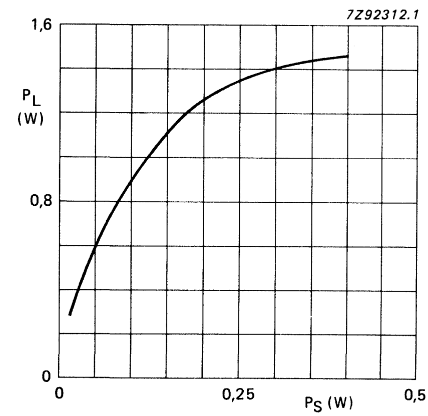


Fig. 11 Input impedance (series components).

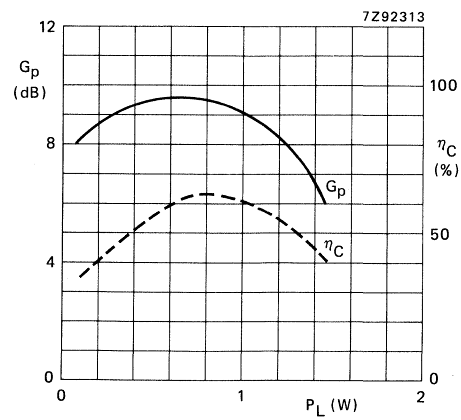


Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:
V_{CE} = 12,5 V; P_L = 1 W; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V at T_h = 25 °C.

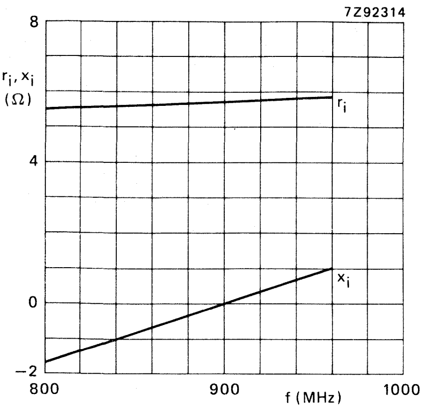


Fig. 13 Input impedance (series components).

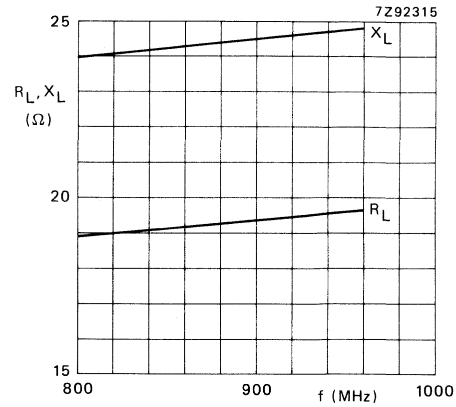


Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:
V_{CE} = 12,5 V; P_L = 1 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

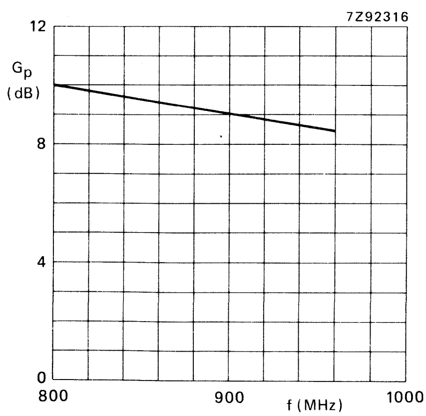


Fig. 15 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 1 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:

- diffused emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.
- the device can be applied at rated output power without an external heatsink when it is mounted on a printed-circuit board (see Fig. 6).

The transistor has a 4-lead envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

RF performance at T_a = 25 °C in a common-emitter class-B circuit.*

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
Narrow band; CW	12.5	900	1	> 7.5	> 50
	9.6	900	1	typ. 7.0	typ. 57

* Device mounted on a printed-circuit board (see Fig. 6).

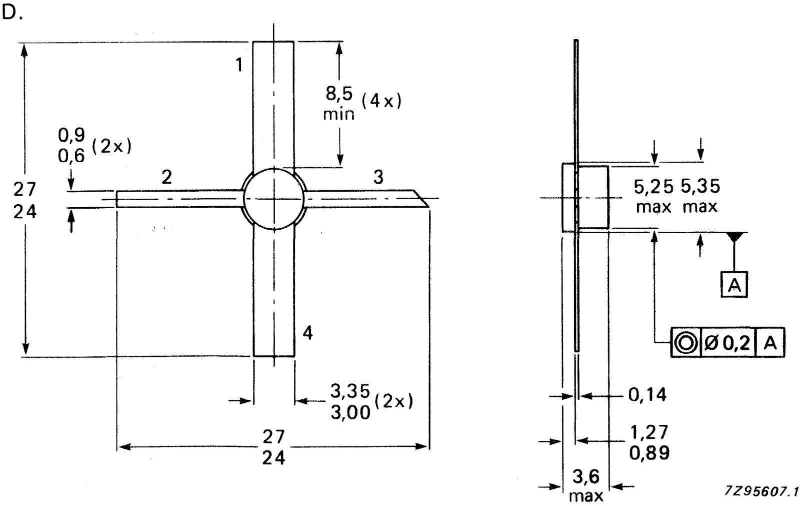
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.

Pinning:

1 Emitter
2 Base
3 Collector
4 Emitter



PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
DC or average	I_C; $I_{C(AV)}$	max.	0.2	A
(peak value); f > 1 MHz	I_{CM}	max.	0.6	A
Total power dissipation				
f > 1 MHz; T_{mb} < 105 °C	$P_{tot(rf)}$	max.	3.5	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

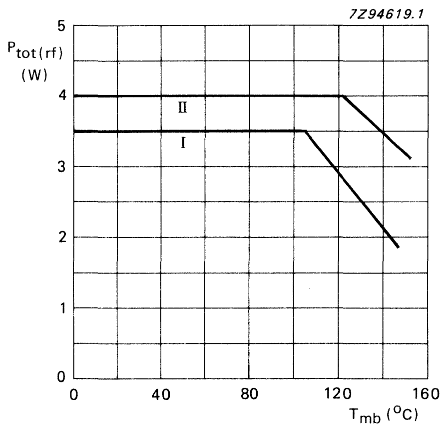


Fig. 2 Power/temperature curve

I Continuous RF operation (f > 1 MHz)
II Short-time RF operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 2.25 W

From junction to ambient* (f > 1 MHz)				
T_a = 25 °C	$R_{th\ j\text{-}a\ (RF)}$	max.	60	K/W
From junction to mounting base				
T_{mb} = 25 °C (f > 1 MHz)	$R_{th\ j\text{-}mb\ (RF)}$	max.	19	K/W

* Device mounted on a printed-circuit board (see Fig. 6).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 2.5 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 0.5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	1 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0.3 mJ
D.C. current gain I_C = 0.15 A; V_{CE} = 10 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12.5 V	C_c	typ.	1.8 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12.5 V	C_{re}	typ.	1.0 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	0.5 pF

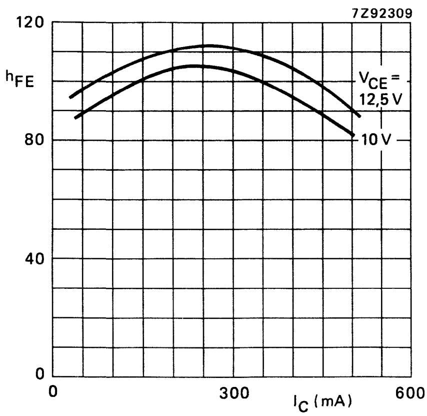


Fig. 3 T_j = 25 °C; typical values.

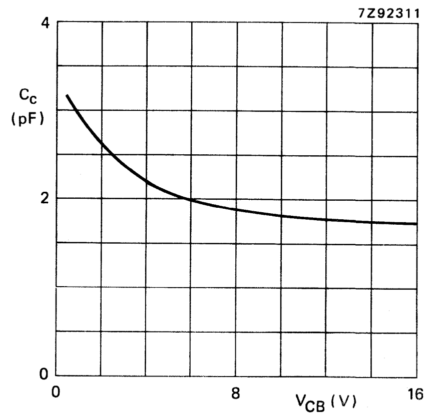


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit, class-B): f = 900 MHz; T_a = 25 °C

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %
narrow band; CW	12.5	1	> 7.5	> 50
			typ. 9.0	typ. 60
	9.6	1	typ. 7.0	typ. 57

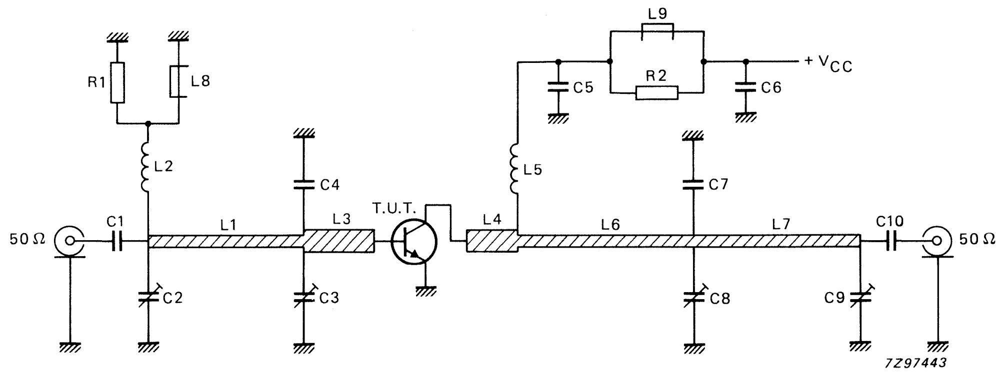


Fig. 5 Class-B test circuit at f = 900 MHz.

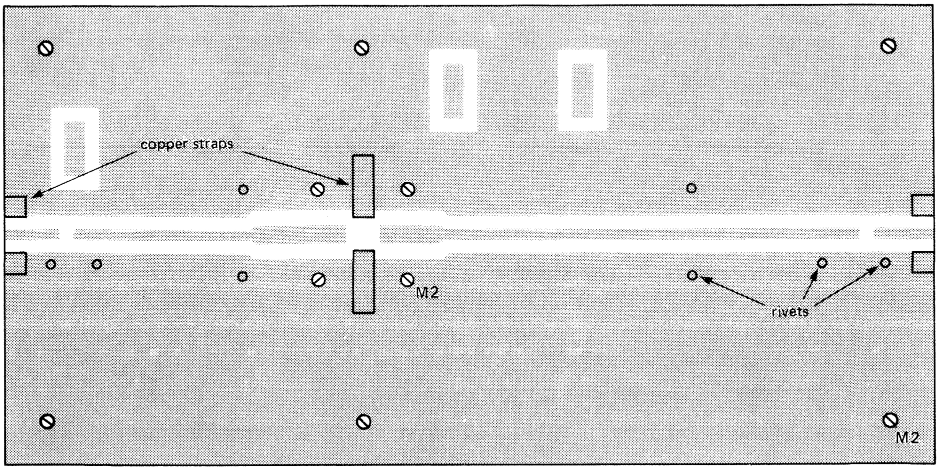
List of components:

C1 = C10 = 33 pF multilayer ceramic chip capacitor
C2 = C9 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C4 = 5.6 pF multilayer ceramic chip capacitor*
C5 = 10 pF multilayer ceramic chip capacitor
C6 = 330 pF multilayer ceramic chip capacitor
C7 = 3.9 pF multilayer ceramic chip capacitor*
C8 = 1.2 to 3.5 pF film dielectric trimmer (cat. no. 2222 809 05001)
L1 = L7 = 50 Ω stripline (30.8 mm x 2.4 mm)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 38 Ω stripline (16.0 mm x 3.5 mm)
L4 = 38 Ω stripline (11.0 mm x 3.5 mm)
L5 = 280 nH; 15 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 50 Ω stripline (41.2 mm x 2.4 mm)
L8 = L9 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)
R1 = R2 = 10 Ω ± 5%; 0.25 W metal film resistor

L1, L3, L4, L6 and L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.

** Device mounted on a printed-circuit board (see Fig. 6).



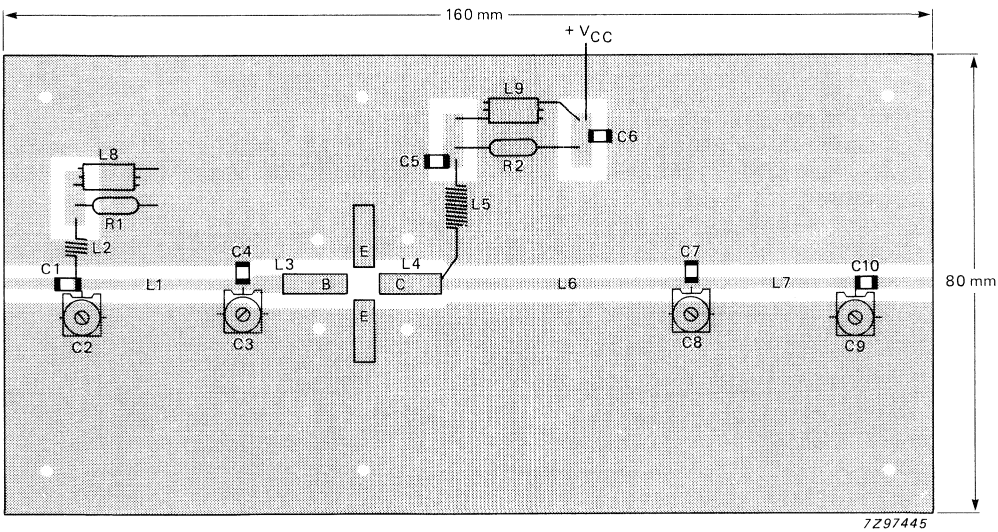


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

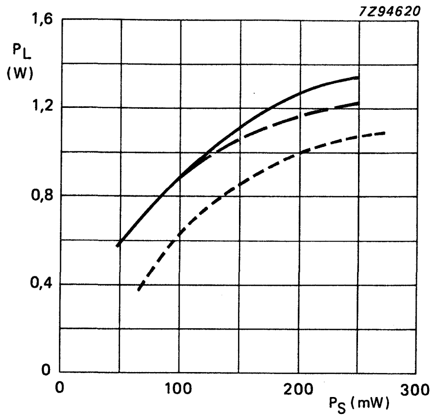


Fig. 7 Load power as a function of source power.

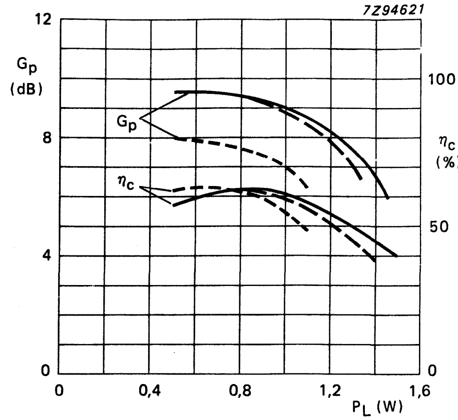


Fig. 8 Power gain and efficiency as a function of load power.

Conditions for Figs 7 and 8:

f = 900 MHz; class-B operation; typical values.

(——— T_{mb} = 25 °C; V_{CE} = 12.5 V; – – – – T_a = 25 °C; V_{CE} = 12.5 V; -------- T_a = 25 °C; V_{CE} = 9.6 V)

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15.5 V at T_a = 25 °C. Device mounted on a printed circuit board (see Fig. 6).

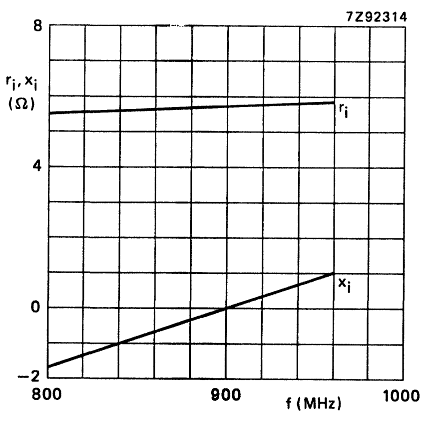


Fig. 9 Input impedance (series components).

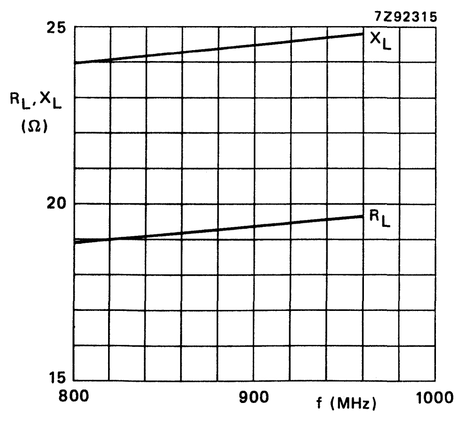


Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:

V_{CE} = 12.5 V; P_L = 1 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

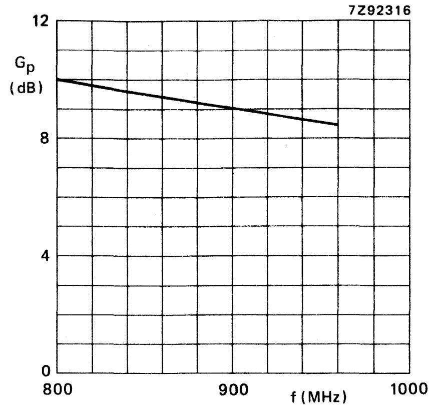


Fig. 11 Power gain as a function of frequency.

V_{CE} = 12.5 V; P_L = 1 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:

- multi-base structure and diffused emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability.

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

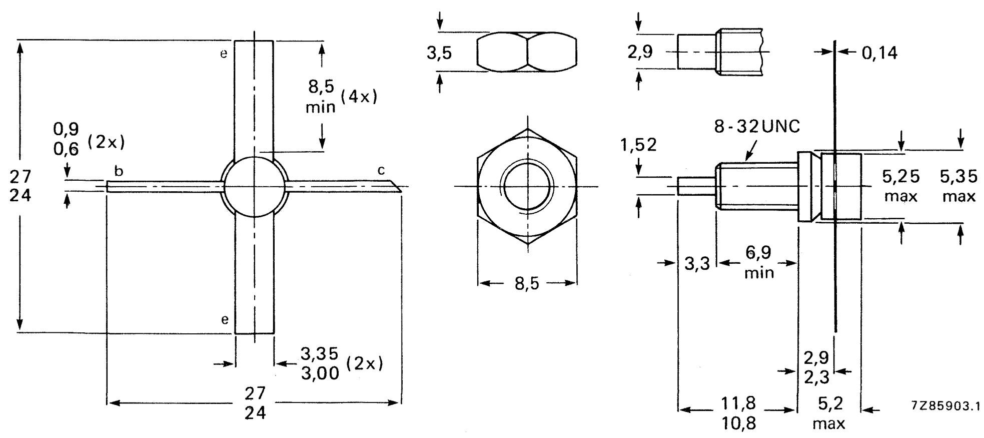
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	900	2	> 6,5	> 50
	9,6	900	1,5	typ. 6,6	typ. 60

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172A1.



Torque on nut: min. 0,75 Nm (7,5 kg.cm)
max. 0,85 Nm (8,5 kg.cm)

When locking is required an adhesive is preferred instead of a lock washer.

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
Deburring must leave surface flat; donot chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged. **See also page 8.**

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current			
d.c. or average	I_C; $I_{C(AV)}$	max.	0,4 A
(peak value); f > 1 MHz	I_{CM}	max.	1,2 A
D.C. power dissipation at T_{mb} = 90 °C	$P_{tot(dc)}$	max.	4,5 W
R.F. power dissipation f > 1 MHz; T_{mb} = 90 °C	$P_{tot(rf)}$	max.	6 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

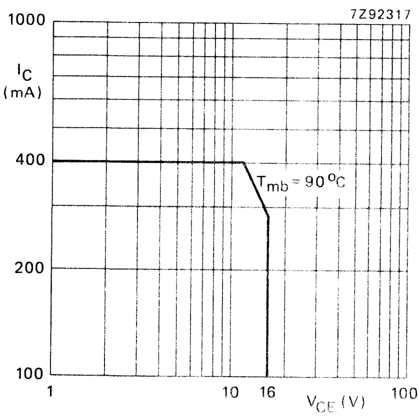


Fig. 2 D.C. SOAR.

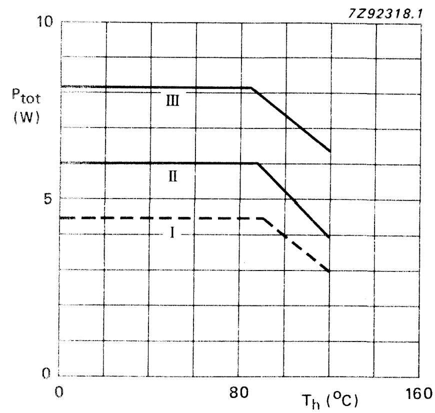


Fig. 3 Power/temperature derating curves
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 4,5 W; T_{mb} = 25 °C

From junction to mounting base			
(d.c. dissipation)	$R_{th\ j\text{-}mb(d.c.)}$	max.	20 K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(d.c.)}$	max.	15 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,8 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I_C = 5 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter breakdown voltage, open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16	V
Emitter-base breakdown voltage, open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	>	3	V
Collector cut-off current, V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	2,5	mA
Second breakdown energy, L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0,55	mJ
D.C. current gain, I_C = 0,3 A; V_{CE} = 10 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz*, $-I_E$ = 0,3 A; V_{CB} = 12,5 V	f_T	typ.	4	GHz
$-I_E$ = 1,0 A; V_{CB} = 12,5 V	f_T	typ.	1	GHz
Collector capacitance at f = 1 MHz, $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	3,5	pF
Feed-back capacitance at f = 1 MHz, I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	2,0	pF
Collector-stud capacitance	C_{cs}	typ.	0,5	pF

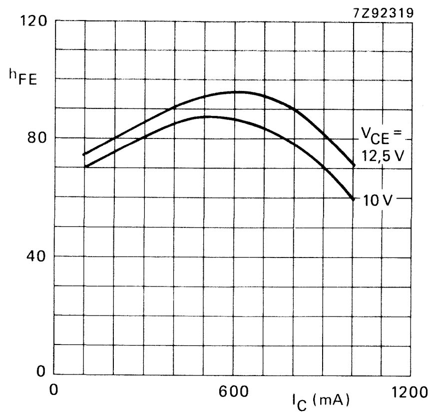


Fig. 4 T_j = 25 °C; typical values.

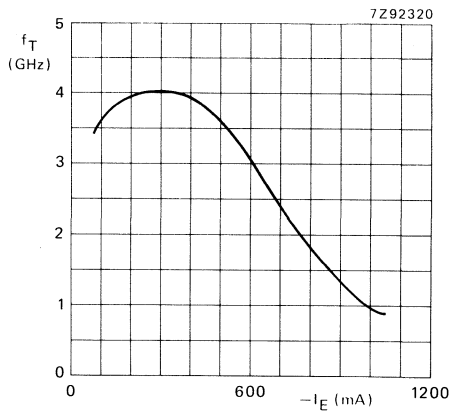


Fig. 5 V_{CB} = 12,5 V; t_p = 50 μs; T_j = 25 °C; typical values.

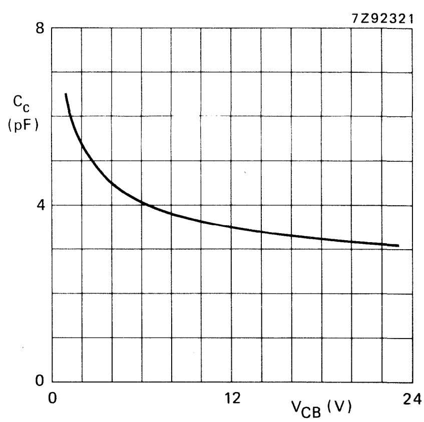


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* Measured under pulse conditions: t_p = 50 μs; δ < 1%.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

mode of operation	V_{CE}	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	2	< 0,450 typ. 0,332	> 6,5 typ. 7,8	< 0,320 typ. 0,267	> 50 typ. 60
	9,6	1,5	typ. 0,328	typ. 6,6	typ. 0,260	typ. 60

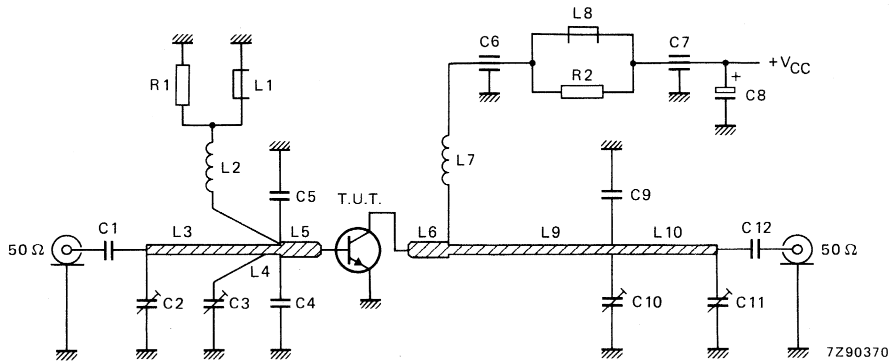


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

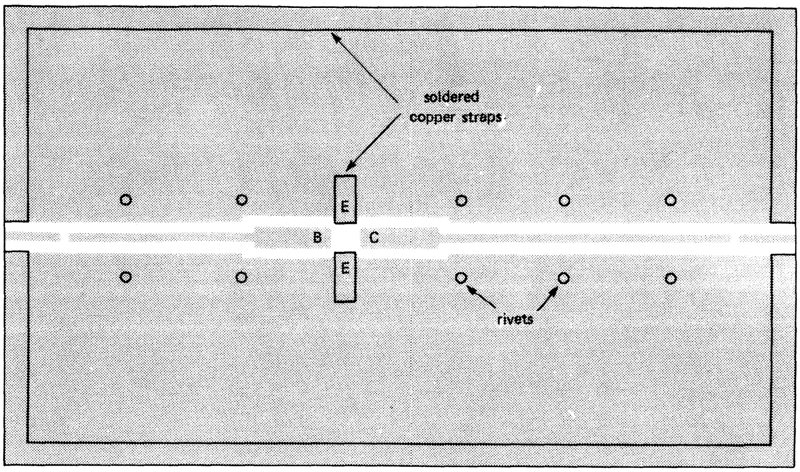
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 5,6 pF multilayer ceramic chip capacitor*
C6 = 10 pF ceramic feed-through capacitor
C7 = 330 pF ceramic feed-through capacitor
C8 = 2,2 μF (35 V) tantalum electrolytic capacitor
C9 = 3,9 pF multilayer ceramic chip capacitor*
C10 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)

L1 = L8 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 50 Ω stripline (23,3 mm x 1,85 mm)
L4 = 50 Ω stripline (4,0 mm x 1,85 mm)
L5 = L6 = 29 Ω stripline (14,0 mm x 4,0 mm)
L7 = 280 nH; 15 turns closely wound enamelled Cu wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L9 = 50 Ω stripline (22,7 mm x 1,85 mm)
L10 = 50 Ω stripline (28,0 mm x 1,85 mm)

R1 = R2 = 10 Ω ± 10%; 0,25 W metal film resistor

L3, L4, L5, L6, L9 and L10 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,74); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



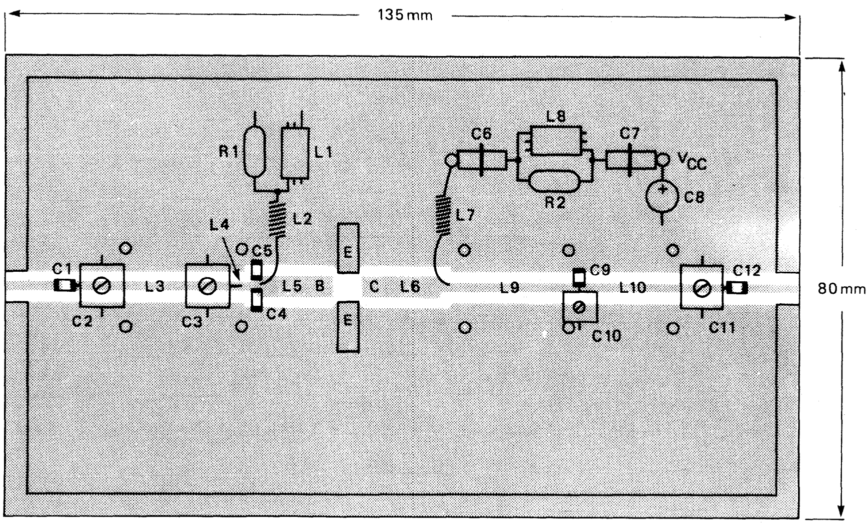


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

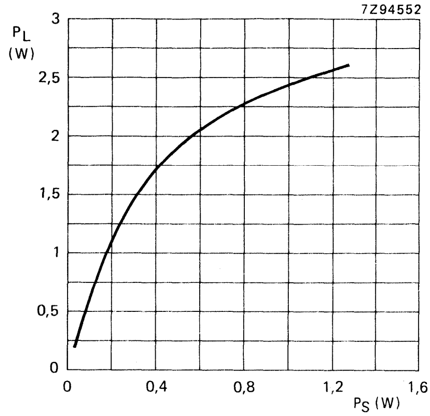


Fig. 9 Load power vs. source power.

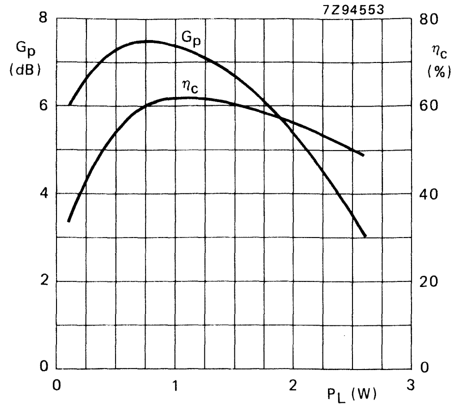


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

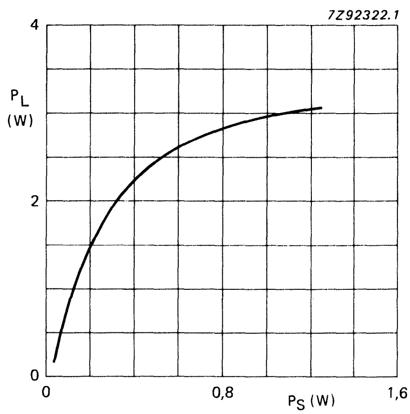


Fig. 11 Input impedance (series components).

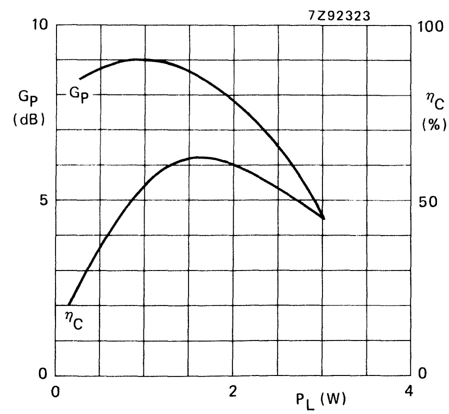


Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:
V_{CE} = 12,5 V; P_L = 2 W; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V at T_h = 25 °C.

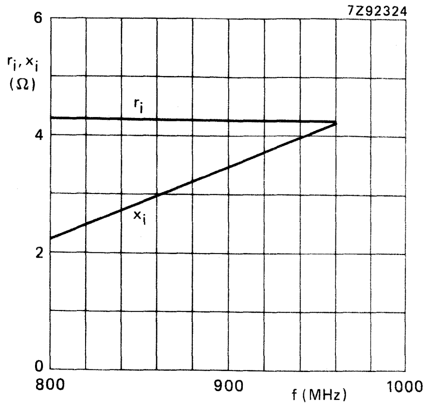


Fig. 13 Input impedance (series components).

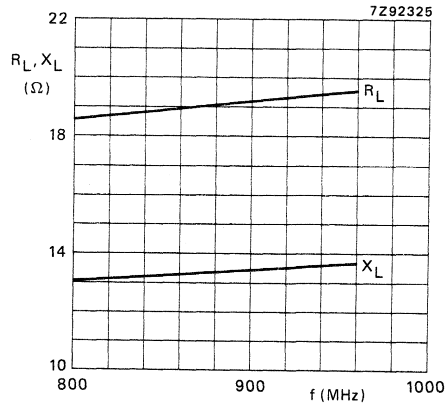


Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:
V_{CE} = 12,5 V; P_L = 2 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

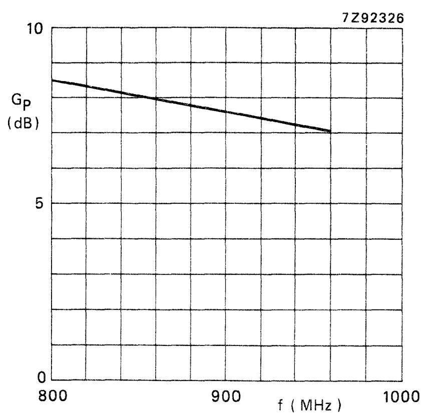


Fig. 15 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 2 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor designed for use in mobile radio transmitters in the 900 MHz band.

Features:

- diffused emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.
- the device can be applied at rated load power, without an external heatsink, when it is mounted on a printed-circuit board (see Fig. 6).

The transistor has a 4-lead envelope with a ceramic cap (SOT-172D). All leads are isolated from the mounting base.

QUICK REFERENCE DATA

RF performance in a common-emitter class-B circuit.

mode of operation	T °C	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; CW	T_{mb} = 25	12.5	900	2	> 6.5	> 50
	T_a = 25*	12.5	900	1.5	> 6.5	> 50
	T_a = 25*	9.6	900	1.5	typ. 6.6	typ. 60

* Device mounted on a printed-circuit board (see Fig. 6).

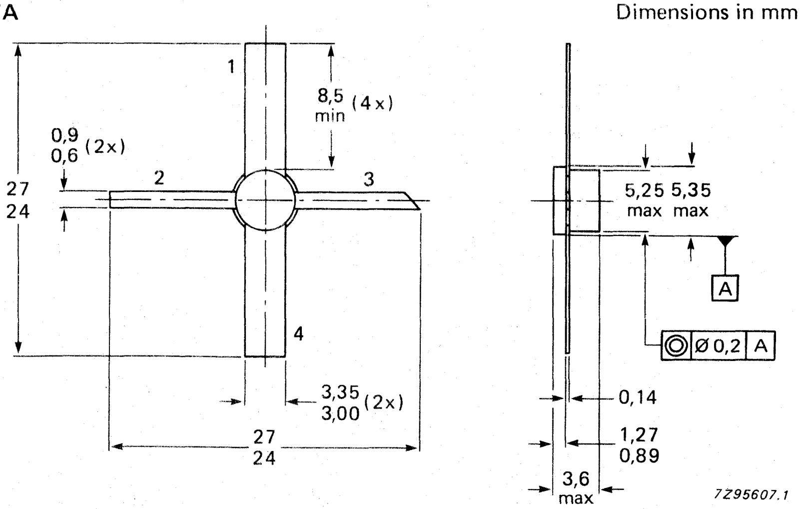
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.

Pinning:

1 Emitter
2 Base
3 Collector
4 Emitter



PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
DC or average	I_C; $I_{C(AV)}$	max.	0.4	A
(peak value); f > 1 MHz	I_{CM}	max.	1.2	A
Total power dissipation				
f > 1 MHz; $T_{mb} \leqslant 90$ °C	$P_{tot(RF)}$	max.	6	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

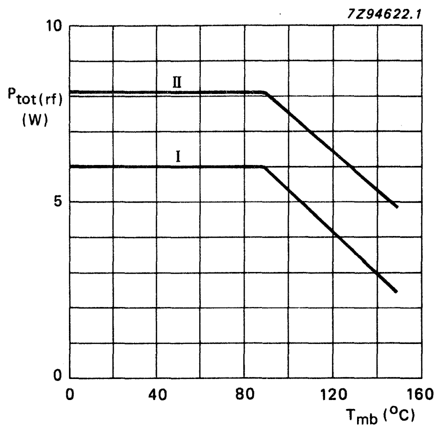


Fig. 2 Power/temperature curve.

I Continuous RF operation (f > 1 MHz)
II Short-time RF operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 4.5 W

From junction to ambient* (f > 1 MHz)				
$T_a = 25$ °C	$R_{th\ j\text{-}a\ (RF)}$	max.	55	K/W
From junction to mounting base				
$T_{mb} = 25$ °C (f > 1 MHz)	$R_{th\ j\text{-}mb\ (RF)}$	max.	15	K/W

* Device mounted on a printed-circuit board (see Fig. 6).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 5 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 0.5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	2.5 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0.55 mJ
D.C. current gain I_C = 0.3 A; V_{CE} = 10 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12.5 V	C_c	typ.	3.5 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12.5 V	C_{re}	typ.	2.0 pF
Collector-mounting base capacitance	C_{c-mb}	typ.	0.5 pF

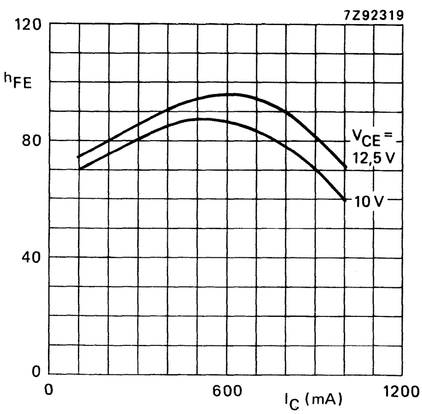


Fig. 3 T_j = 25 °C; typical values.

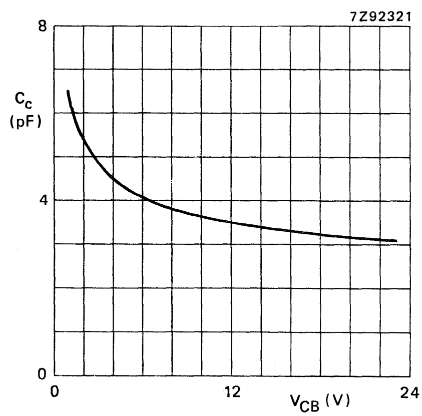


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit; class-B): f = 900 MHz

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %	T °C
narrow band; CW	12.5	2	> 6.5	> 50	T_{mb} = 25
	12.5	2	typ. 7.8	typ. 60	T_{mb} = 25
	12.5	1.5	> 6.5	> 50	T_a = 25**
	9.6	1.5	typ. 6.6	typ. 60	T_a = 25**

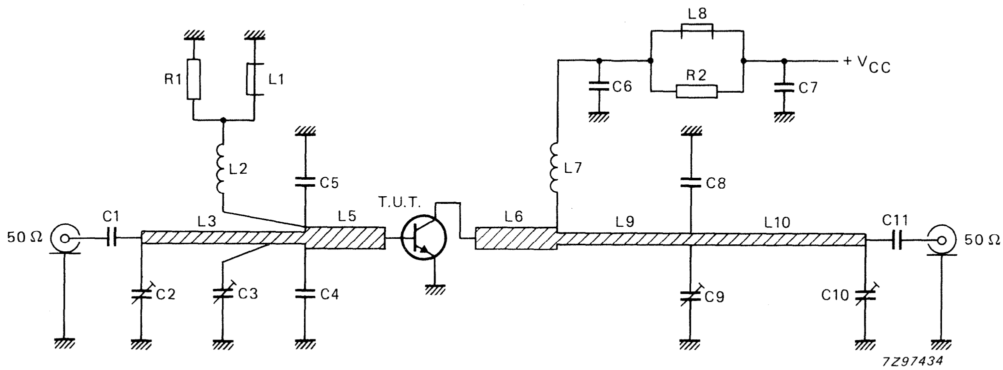


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C11 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 5.6 pF multilayer ceramic chip capacitor*
C6 = 10 pF multilayer ceramic chip capacitor
C7 = 330 pF multilayer ceramic chip capacitor
C8 = 3.9 pF multilayer ceramic chip capacitor*
C9 = 1.2 to 3.5 pF film dielectric trimmer (cat. no. 2222 809 05001)
L1 = L8 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 50 Ω stripline (25.4 mm x 2.4 mm)
L4 = 50 Ω stripline (4.4 mm x 2.4 mm)
L5 = L6 = 34 Ω stripline (14.0 mm x 4.0 mm)
L7 = 280 nH; 15 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L9 = 50 Ω stripline (24.8 mm x 2.4 mm)
L10 = 50 Ω stripline (30.5 mm x 2.4 mm)
R1 = R2 = 10 Ω ± 5%; 0.25 W metal film resistor

L3, L4, L5, L6, L9 and L10 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
** Device mounted on a printed-circuit board (see Fig. 6).

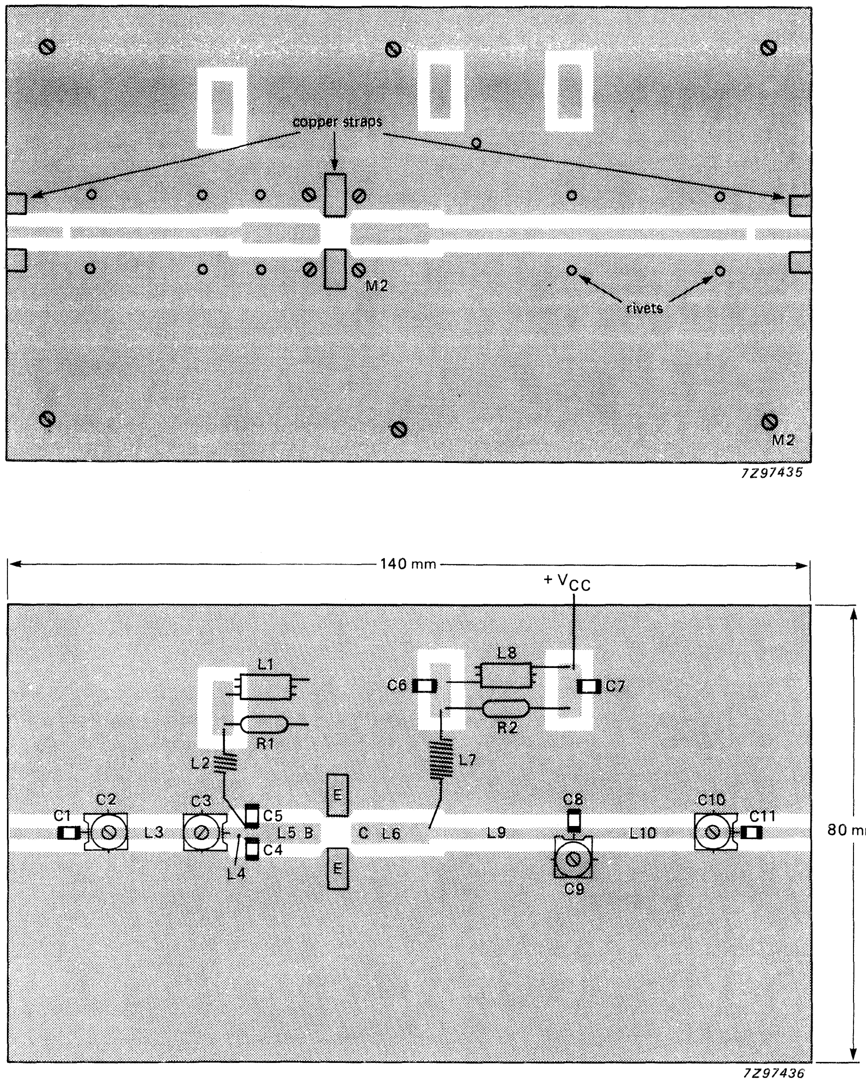


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

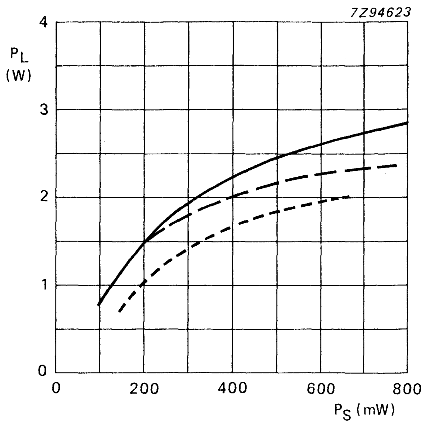


Fig. 7 Load power as a function of source power.

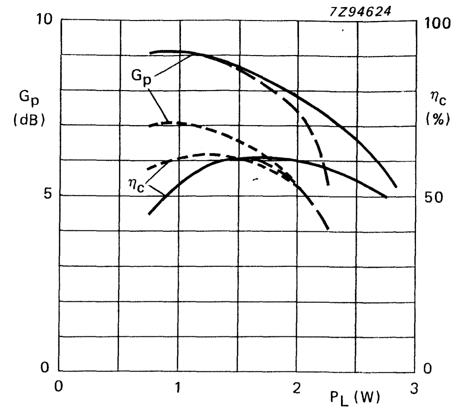


Fig. 8 Power gain and efficiency as a function of load power.

Conditions for Figs 7 and 8:

f = 900 MHz; class-B operation; typical values.

(——— T_{mb} = 25 °C; V_{CE} = 12.5 V; – – – – T_a = 25 °C; V_{CE} = 12.5 V; -------- T_a = 25 °C; V_{CE} = 9.6 V)

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at P_L = 1.5 W up to a supply voltage of 15.5 V at T_a = 25 °C. Device mounted on a printed-circuit board (see Fig. 6).

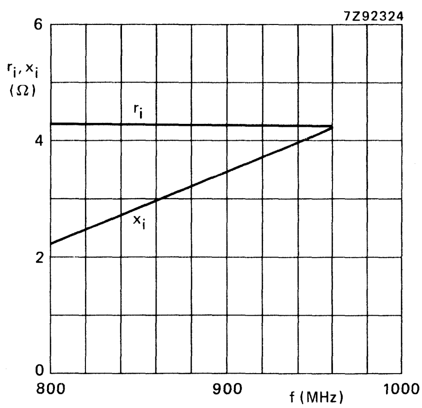


Fig. 9 Input impedance (series components).

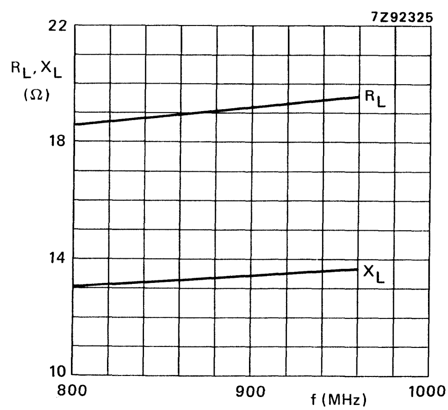


Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:

V_{CE} = 12.5 V; P_L = 2 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

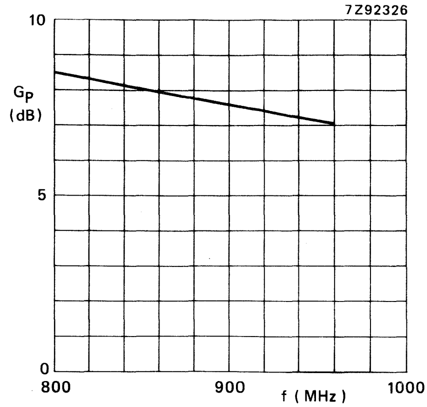


Fig. 11 Power gain as a function of frequency.

V_{CE} = 12.5 V; P_L = 2 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 900 MHz communications band.

Features:

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- internal input matching to achieve an optimum wideband capability and high power gain
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in a common-emitter class-B test circuit

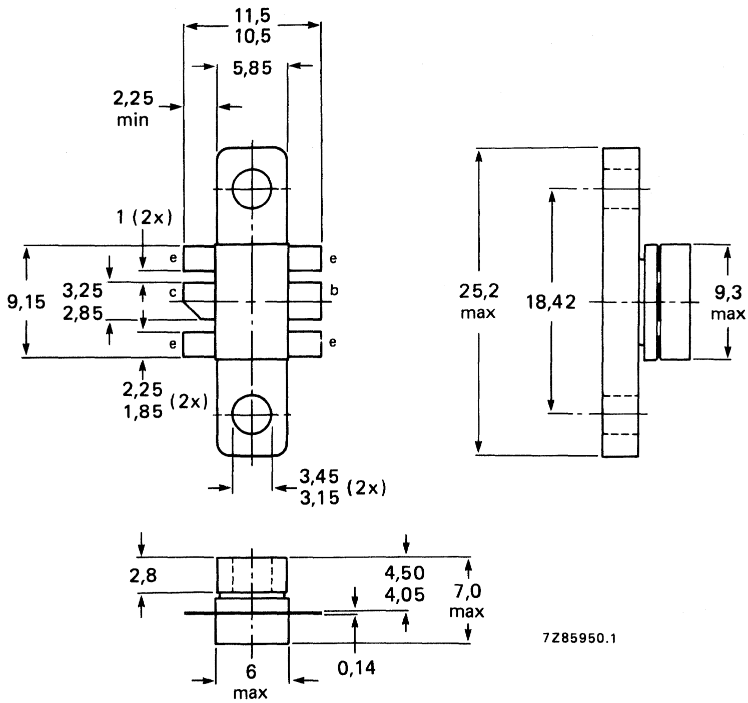
mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	900	4	> 7,5	> 50
	9,6	900	3	typ. 7,3	typ. 56

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A.

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current d.c. or average	I_C	max.	0,8	A
(peak value); f > 1 MHz	I_{CM}	max.	2,4	A
Total power dissipation at T_{mb} = 94 °C	$P_{tot(dc)}$	max.	9	W
at T_{mb} = 94 °C; f > 1 MHz	$P_{tot(rf)}$	max.	12	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

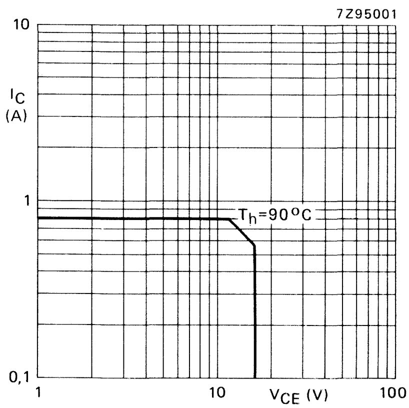


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,4 K/W.

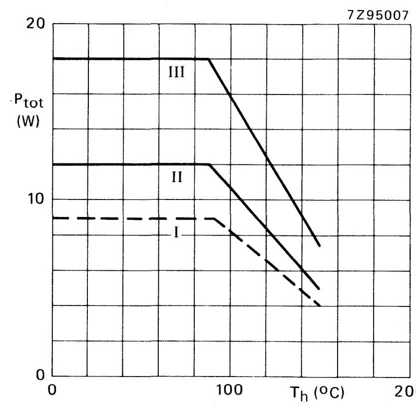


Fig. 3 Power/temperature derating curves.
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 6 W; T_{mb} = 128 °C

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	max.	12	K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	max.	9	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage, open base; I_C = 20 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage, open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current, V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	5 mA
Second breakdown energy, L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	1 mJ
D.C. current gain, I_C = 0,6 A; V_{CE} = 10 V	h_{FE}	>	25
Transition frequency at f = 500 MHz*, $-I_E$ = 0,6 A; V_{CE} = 12,5 V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz, $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	8 pF
Feed-back capacitance at f = 1 MHz, I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	5 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

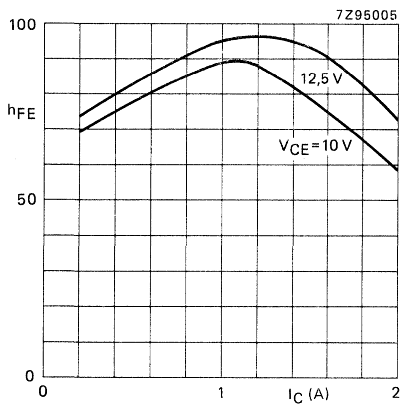


Fig. 4 T_j = 25 °C; typical values.

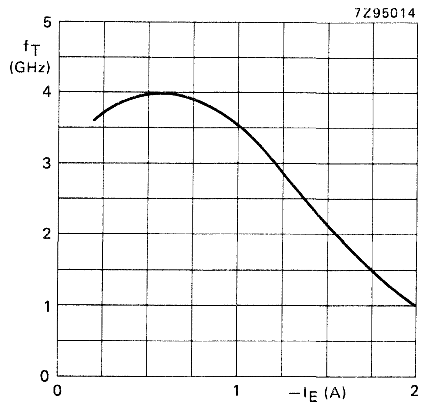


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

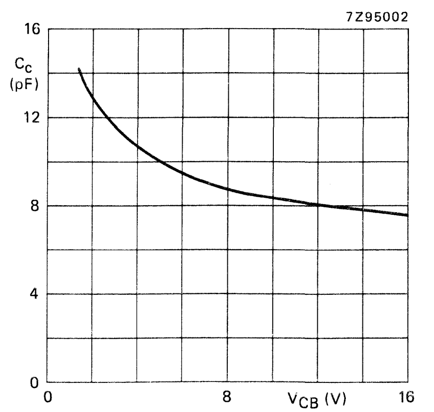


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* Measured under pulse conditions: t_p = 50 μs; δ < 1%.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	4	< 0,71 typ. 0,57	> 7,5 typ. 8,5	< 0,64 typ. 0,56	> 50 typ. 57
	9,6	3	typ. 0,56	typ. 7,3	typ. 0,56	typ. 56

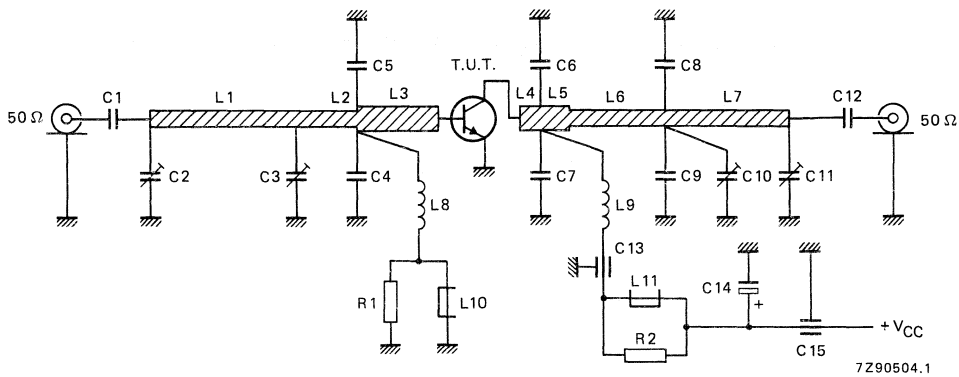


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 3,9 pF multilayer ceramic chip capacitor*
C6 = C7 = C8 = C9 = 6,2 pF multilayer ceramic chip capacitor*
C13 = 10 pF ceramic feed-through capacitor
C14 = 6,8 μF (63 V) electrolytic capacitor
C15 = 330 pF ceramic feed-through capacitor

L1 = 50 Ω stripline (29,5 mm x 2,4 mm)
L2 = 50 Ω stripline (5,5 mm x 2,4 mm)
L3 = 42,7 Ω stripline (16,8 mm x 3,0 mm)
L4 = 42,7 Ω stripline (7,5 mm x 3,0 mm)
L5 = 42,7 Ω stripline (2,0 mm x 3,0 mm)
L6 = 50 Ω stripline (8,5 mm x 2,4 mm)
L7 = 50 Ω stripline (28,0 mm x 2,4 mm)
L8 = 60 nH; 4 turns closely wound enamelled Cu-wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L9 = 45 nH; 4 turns enamelled Cu-wire (1,0 mm); length 6 mm; int. dia. 4 mm; leads 2 x 5 mm
L10 = L11 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)

R1 = R2 = 10 Ω ± 10%; 0,25 W, metal film resistor

L1 to L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitors type 100A or capacitor of same quality.

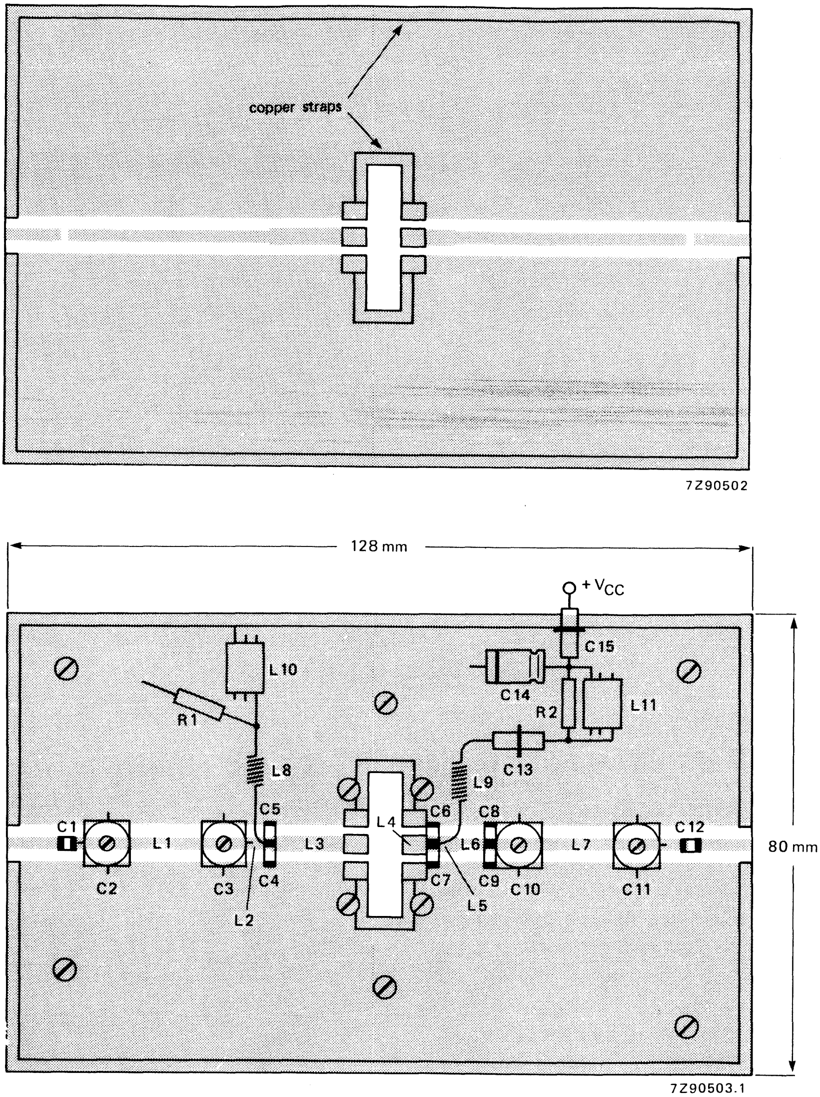


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

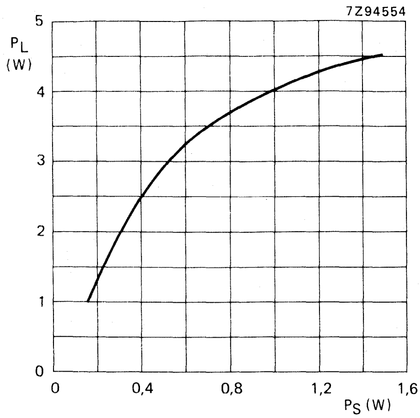


Fig. 9 Load power vs. source power.

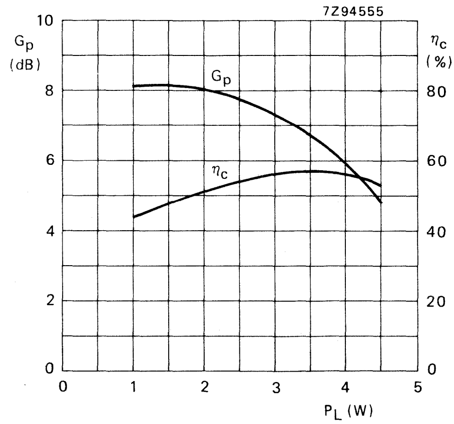


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

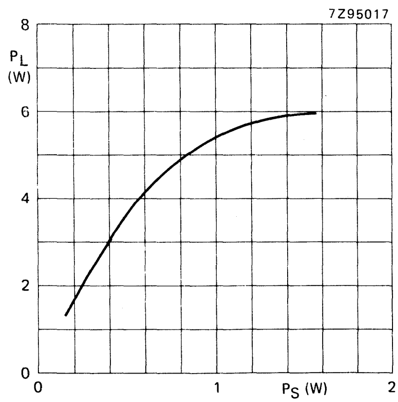


Fig. 11 Load power vs. source power.

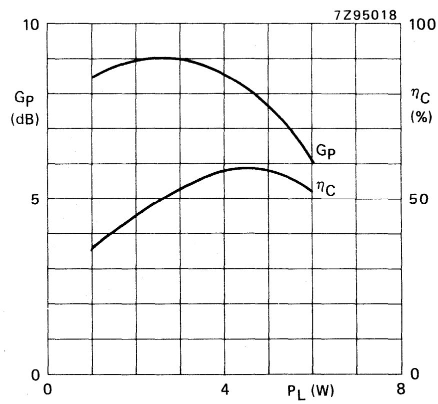


Fig. 12 Power gain and efficiency vs. load power.

Conditions for Figs 11 and 12:
V_{CE} = 12,5 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V and at T_h = 25 °C.

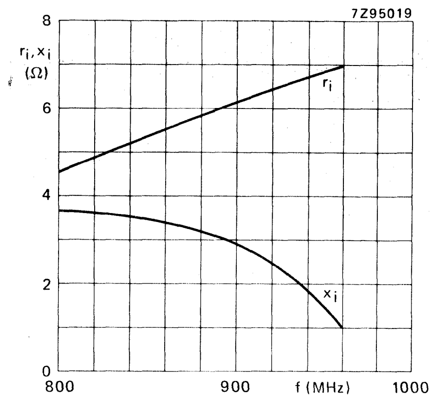


Fig. 13 Input impedance (series components).

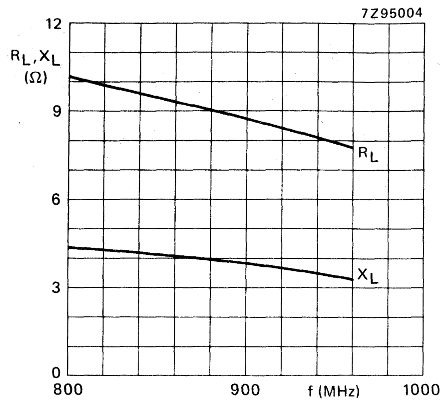


Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:
V_{CE} = 12,5 V; P_L = 4 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

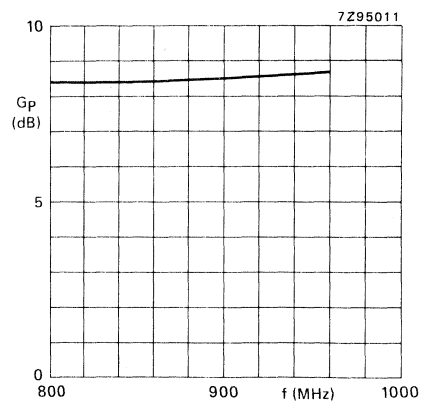


Fig. 15 Power gain vs. frequency.

V_{CE} = 12,5 V; P_L = 4 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 900 MHz communications band.

Features:

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- internal input matching to achieve an optimum wideband capability and high power gain
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

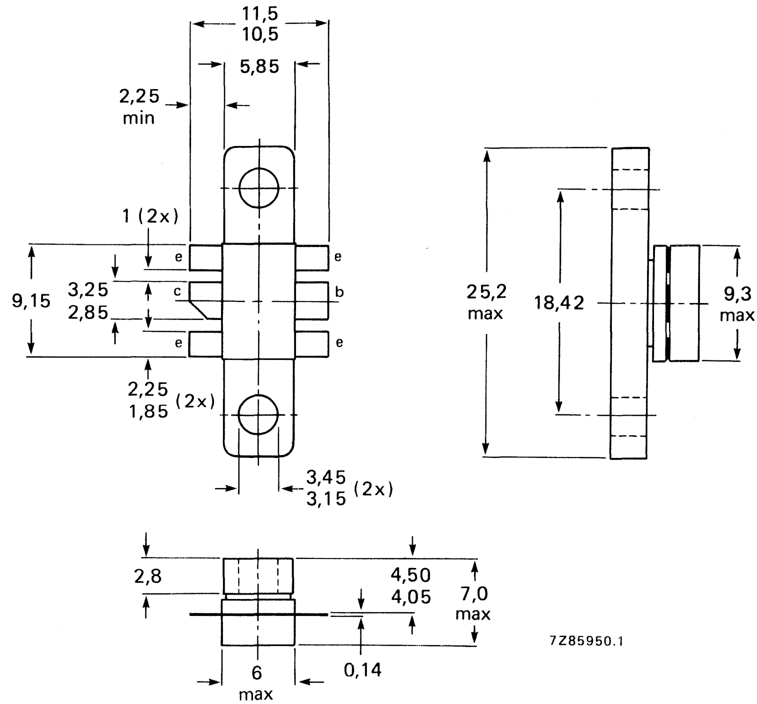
R.F. performance at T_h = 25 °C in a common-emitter class-B test circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	900	8	> 6,5	> 50
	9,6	900	6	typ. 6,0	typ. 59

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-171.



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter)			
peak value	V_{CBOM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	16 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3 V
Collector current			
d.c. or average	I_C; $I_{C AV}$	max.	1,6 A
(peak value); f > 1 MHz	I_{CM}	max.	4,8 A
Total power dissipation			
at T_{mb} = 67 °C	$P_{tot(dc)}$	max.	18 W
at T_{mb} = 67 °C; f > 1 MHz	$P_{tot(rf)}$	max.	24 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

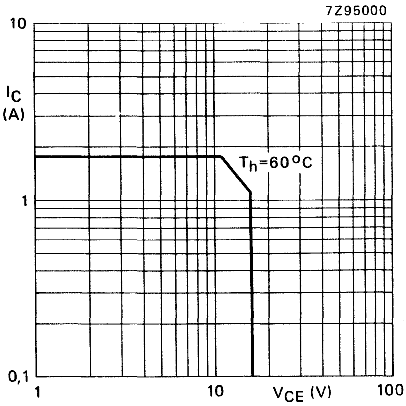


Fig. 2 D.C.-SOAR.

$R_{th\ mb-h}$ = 0,4 K/W

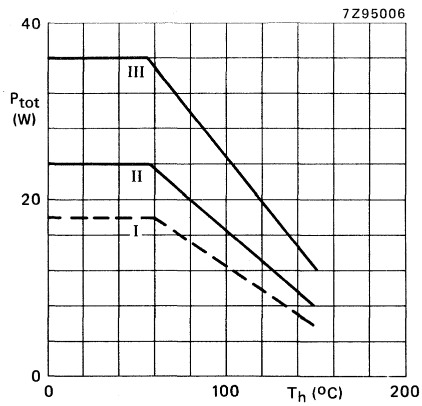


Fig. 3 Power/temperature derating curves.

I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 12 W; T_{mb} = 112 °C

From junction to mounting base			
(d.c. dissipation)	$R_{th\ j-mb(dc)}$	max.	7,0 K/W
(r.f. dissipation)	$R_{th\ j-mb\ (rf)}$	max.	5,2 K/W
From mounting base to heatsink	$R_{th\ mb-h}$	max.	0,4 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 20 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 40 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	10 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	2 mJ
D.C. current gain I_C = 1,2 A; V_{CE} = 10 V	h_{FE}	>	25
Transition frequency at f = 500 MHz* $-I_E$ = 1,2 A; V_{CE} = 12,5 V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	15 pF
Feed-back capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	9 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

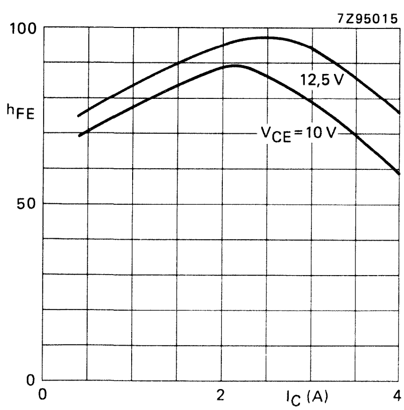


Fig. 4 T_j = 25 °C; typical values.

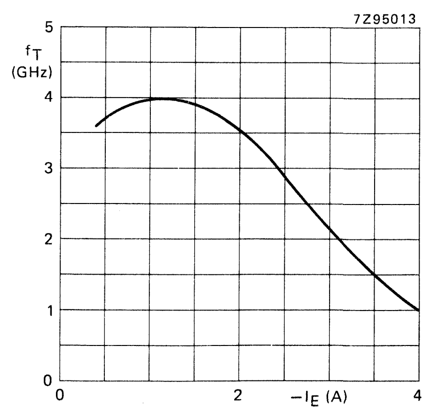


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz;
T_j = 25 °C; typical values.

* Measured under pulse conditions: t_p = 50 µs; δ < 1%.

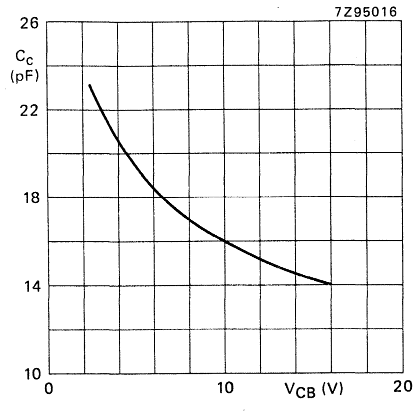


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 ^oC.

mode of operation	V_{CE} V	P_L W	P_S W	G_P dB	I_C A	η_C %
narrow band; c.w.	12,5	8	< 1,8 typ. 1,5	> 6,5 typ. 7,3	< 1,28 typ. 1,1	> 50 typ. 58
	9,6	6	typ. 1,5	typ. 6,0	typ. 1,05	typ. 59

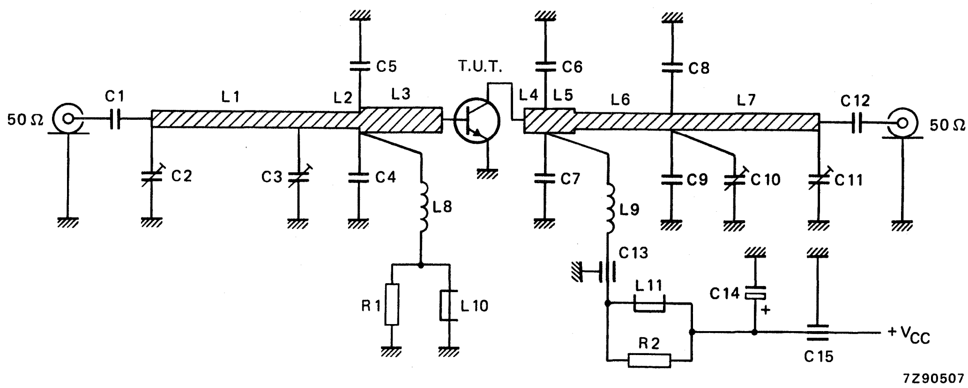


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

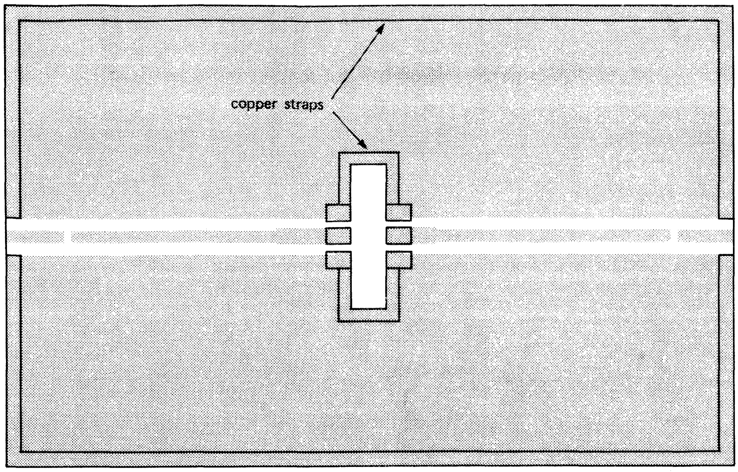
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer
(cat. no. 2222 809 09001)
C4 = C5 = 4,7 pF multilayer ceramic chip capacitor*
C6 = C7 = 5,6 pF multilayer ceramic chip capacitor*
C8 = C9 = 3,3 pF multilayer ceramic chip capacitor*
C13 = 10 pF ceramic feed-through capacitor
C14 = 6,8 μF (63 V) electrolytic capacitor
C15 = 330 pF ceramic feed-through capacitor

L1 = L7 = 50 Ω stripline (29,0 x 2,4 mm)
L2 = 50 Ω stripline (6,0 mm x 2,4 mm)
L3 = 42,7 Ω stripline (13,1 mm x 3,0 mm)
L4 = 42,7 Ω stripline (4,4 mm x 3,0 mm)
L5 = 42,7 Ω stripline (4,6 mm x 3,0 mm)
L6 = 50 Ω stripline (11,0 x 2,4 mm)
L8 = 60 nH; 4 turns closely wound enamelled Cu-wire (0,4 mm); int. dia. 3 mm; leads 2 x 5 mm
L9 = 45 nH; 4 turns enamelled Cu-wire (1,0 mm); length 6 mm; int. dia 4 mm; leads 2 x 5 mm
L10 = L11 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)

R1 = R2 = 10 Ω ± 10%; 0,25 W, metal film resistor

L1 to L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.



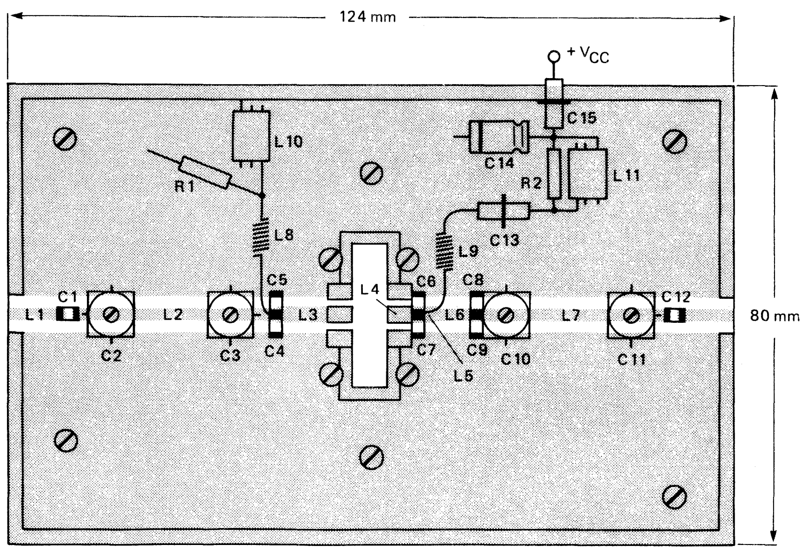


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

Note

The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

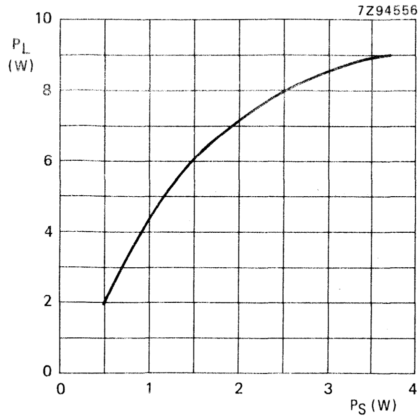


Fig. 9 Load power vs. source power.

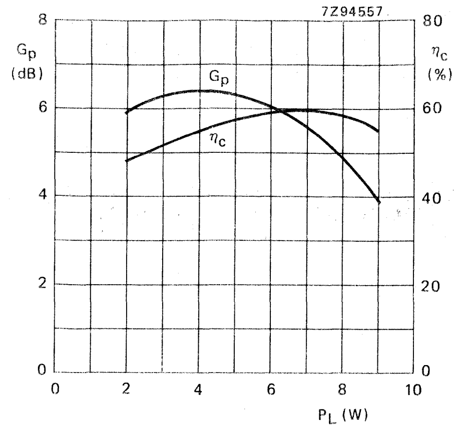


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:

V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

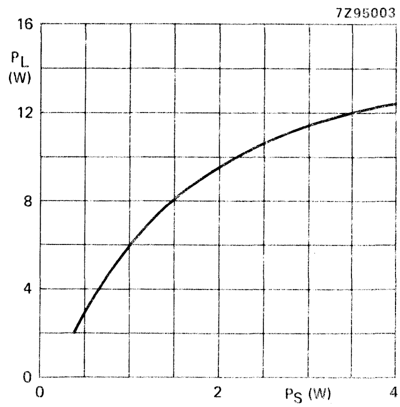


Fig. 11 Load power vs. source power.

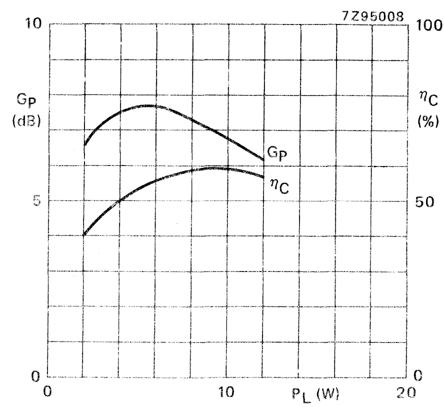


Fig. 12 Power gain and efficiency vs. load power.

Conditions for Figs 11 and 12:

V_{CE} = 12,5 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V and at T_h = 25 °C.

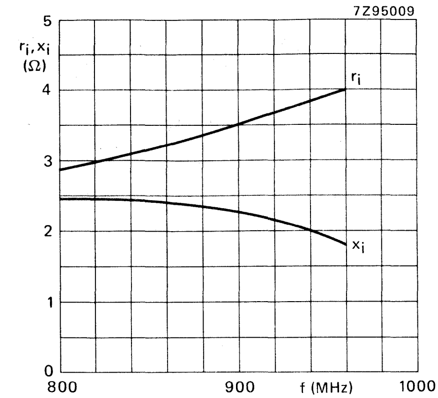


Fig. 13 Input impedance (series components).

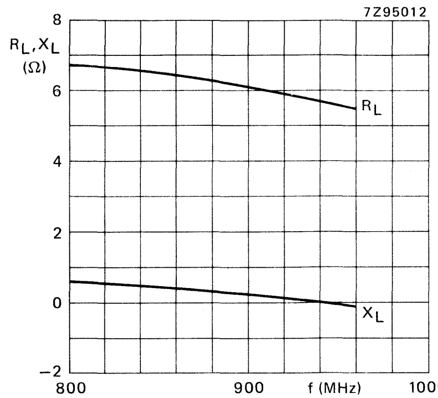


Fig. 14 Load impedance (series components).

Conditions for Figs 13 and 14:

V_{CE} = 12,5 V; P_L = 8 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

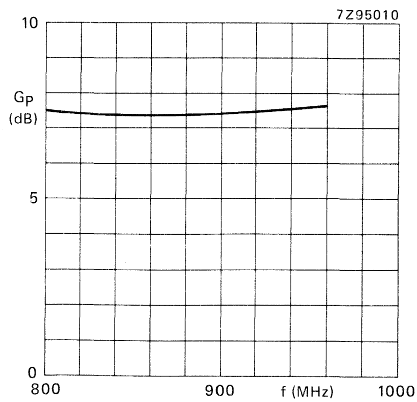


Fig. 15 Power gain vs. frequency.

V_{CE} = 12,5 V; P_L = 8 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor primarily intended for common base, class-B operation in mobile radio transmitters for the 900 MHz communication band.

Features

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve an optimum wideband capability and stable operation

The transistor has a 6-lead flange envelope with a ceramic cap (SOT171). All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance up to T_h = 25 °C in a common-base class-B circuit

mode of operation	V_{CB} V	f MHz	P_L W	G_p dB	η_C %
narrow band; CW	12.5	900	15	> 6	> 50

MECHANICAL DATA

SOT171 (see Fig.1).

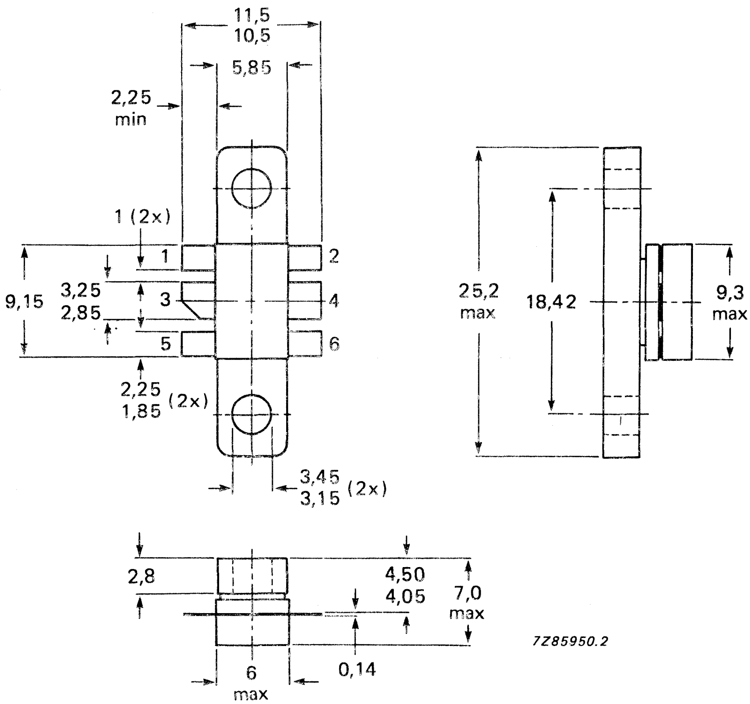
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig.1 SOT171.

Pinning:

1 Base
2 Base
3 Collector
4 Emitter
5 Base
6 Base



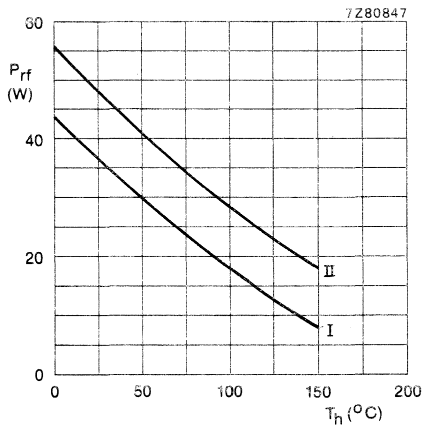
Torque on screw:	min. 0.6 Nm (6 kg.cm) max. 0.75 Nm (7.5 kg.cm)
Recommended screw:	cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.5	V
Collector current				
DC or average	I_C	max.	3	A
peak value; f > 1 MHz	I_{CM}	max.	9	A
Total power dissipation				
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	45	W
Storage temperature range	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C



I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

Fig.2 Power/temperature derating curves.

THERMAL RESISTANCE

From junction to mounting base (RF operation)	$R_{th\ j\text{-}mb}$	max.	4	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 25 mA	$V_{(BR)CBO}$	min.	36 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	min.	16 V
Emitter-base breakdown voltage open collector; I_E = 5 mA	$V_{(BR)EBO}$	min.	3.5 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	10 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	4.5 mJ
DC current gain V_{CE} = 10 V; I_C = 2 A	h_{FE}	min. typ.	15 65
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12.5 V	C_c	typ.	33 pF
Feedback capacitance at f = 1 MHz I_E = 0; V_{CB} = 12.5 V	C_{rb}	typ.	9 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

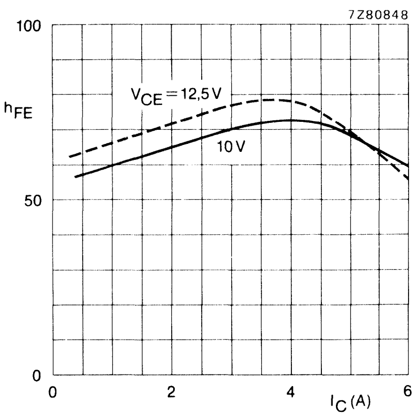


Fig.3 DC current gain as a function of collector current; T_j = 25 °C. Typical values.

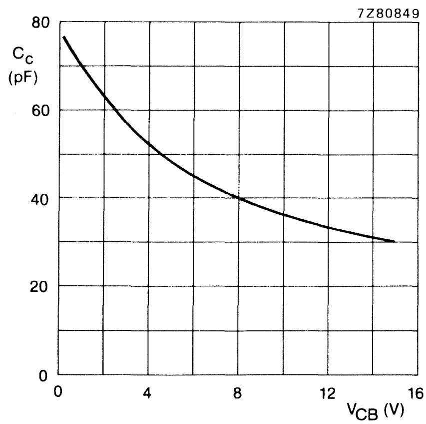


Fig.4 Output capacitance as a function of V_{CB}; $I_E = i_e$ = 0; f = 1 MHz. Typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-base circuit; class-B)
f = 900 MHz; T_h = 25 °C

mode of operation	V_{CB} V	P_L W	G_p dB	η_C %
narrow band; CW	12.5	15	> 6.0 typ. 7.0	> 50 typ. 61

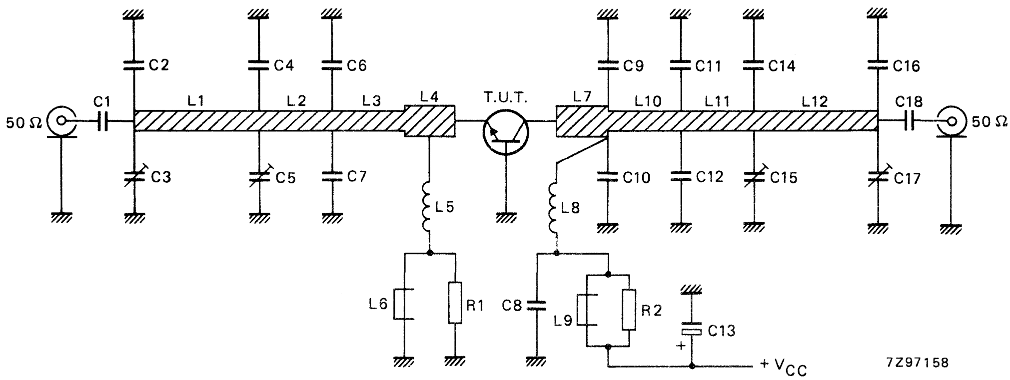


Fig.5 Class-B test circuit at f = 900 MHz.

List of components:

$C_1 = C_{18}$ = 330 pF multilayer ceramic chip capacitor *
$C_2 = C_4 = C_{16}$ = 5.6 pF multilayer ceramic chip capacitor *
$C_3 = C_5 = C_{15} = C_{17}$ = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
$C_6 = C_7$ = 4.3 pF multilayer ceramic chip capacitor *
C_8 = 330 pF multilayer ceramic chip capacitor
$C_9 = C_{10}$ = 5.6 pF multilayer ceramic chip capacitors **
$C_{11} = C_{12}$ = 6.2 pF multilayer ceramic chip capacitor *

C_{13} = 6.8 μF (63 V) electrolytic capacitor
C_{14} = 2.2 pF multilayer ceramic chip capacitor *
L_1 = L_{12} = 50 Ω stripline (24 mm x 2.4 mm)
L_2 = L_{11} = 50 Ω stripline (10 mm x 2.4 mm)
L_3 = 50 Ω stripline (8 mm x 2.4 mm)
L_4 = L_7 = 41 Ω (3 mm x 3.2 mm)
L_5 = L_8 = 4 turns Cu-wire (1.0 mm); int. dia. 4 mm; length 5 mm;
leads 2 x 7 mm
L_6 = L_9 = Ferroxcube wideband HF choke; grade 3B (cat. no 4312 020 36642)
L_{10} = 50 Ω stripline (7 mm x 2.4 mm)

R_1 = R_2 = 10 Ω ± 10 %; 0.25 W, metal film resistor
The striplines are on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.

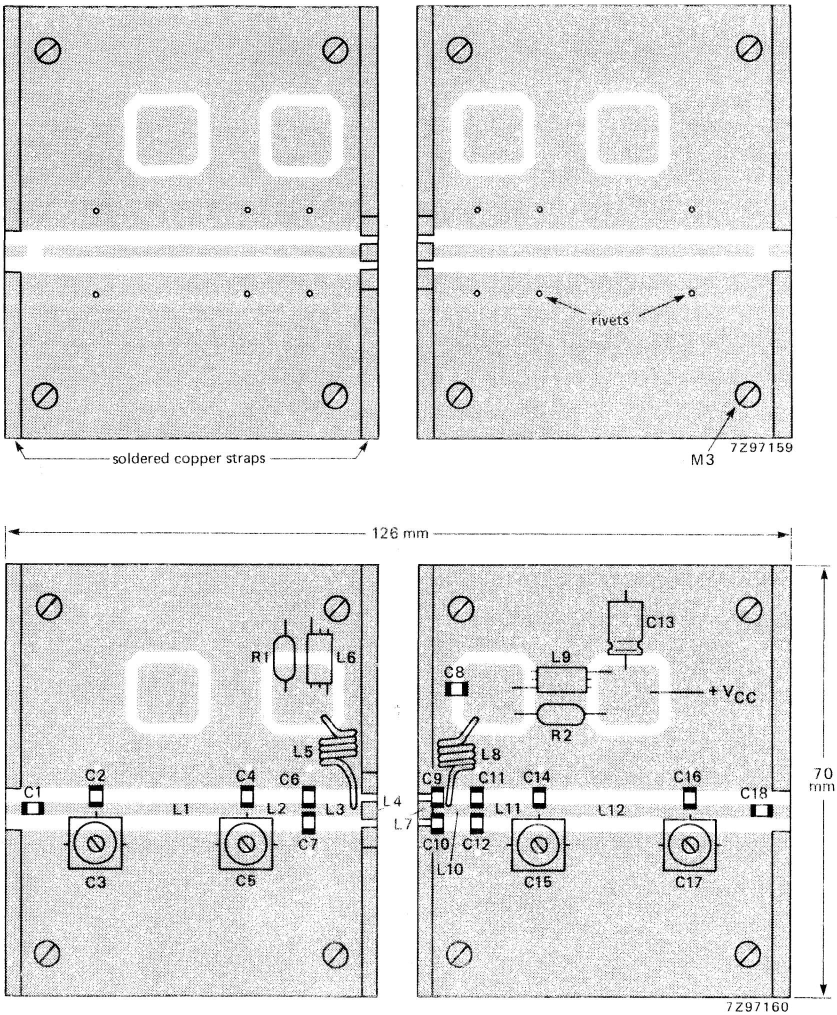


Fig.6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

The circuit and components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane.

Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper of the component side and the ground plane.

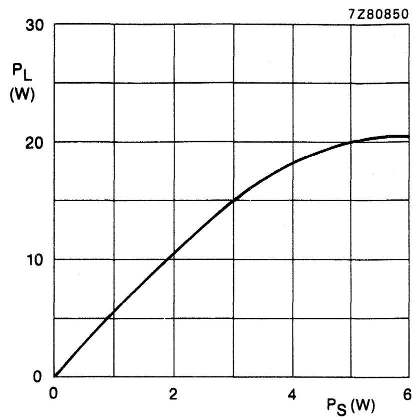


Fig.7 Load power as a function of source power.

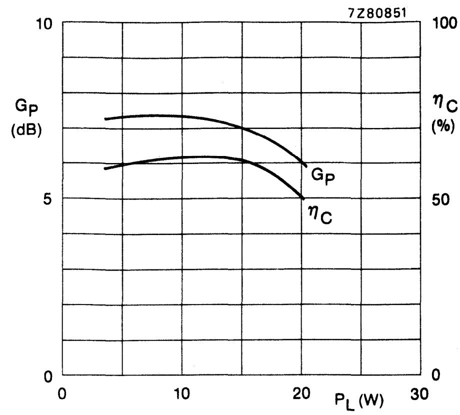


Fig.8 Power gain and efficiency as functions of load power.

Conditions for Figs 7 and 8:

V_{CB} = 12.5 V; f = 900 MHz; T_h = 25 °C; class-B operation;
$R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

RUGGEDNESS

The BLV94 is capable of withstanding a load mismatch (VSWR = 50 through all phases) at rated load power up to a supply voltage of 15.5 V at T_h = 25 °C and $R_{th\ mb\text{-}h}$ = 0.4 K/W.

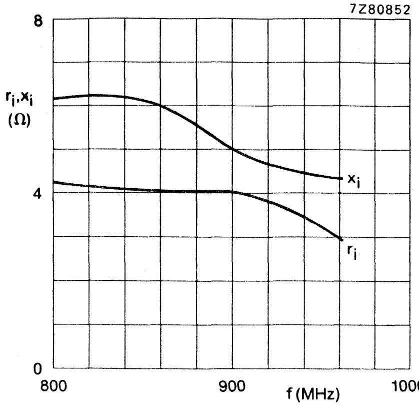


Fig.9 Input impedance (series components) as a function of frequency.

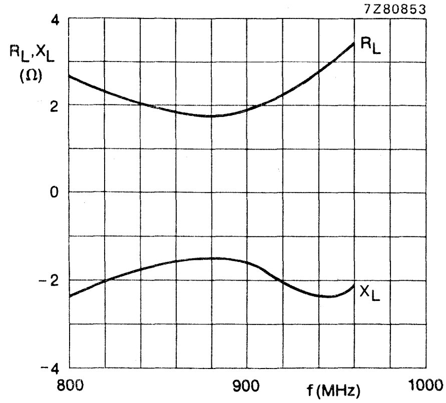


Fig.10 Load impedance (series components) as a function of frequency.

Conditions for Figs 9, 10 and 11:

Typical values; V_{CE} = 12.5 V; P_L = 15 W; f = 800 to 960 MHz;
$R_{th\ mb\text{-}h}$ = 0.4 K/W; T_h = 25 °C.

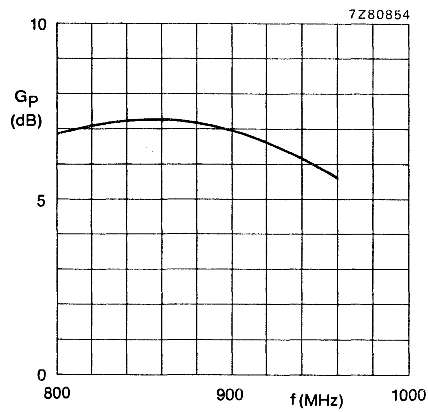


Fig.11 Power gain as a function of frequency.

U.H.F. POWER TRANSISTOR

N.P.N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters for the 900 MHz communication band.

Features

- multi base structure and emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability
- internal input matching to achieve an optimum wideband capability and high power gain

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). The device has a common-base pinning and all leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in a common-base class-B circuit

mode of operation	V_{CB} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	900	22	> 5,5	> 50

MECHANICAL DATA

Dimensions in mm

SOT-171. (see Fig. 1)

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

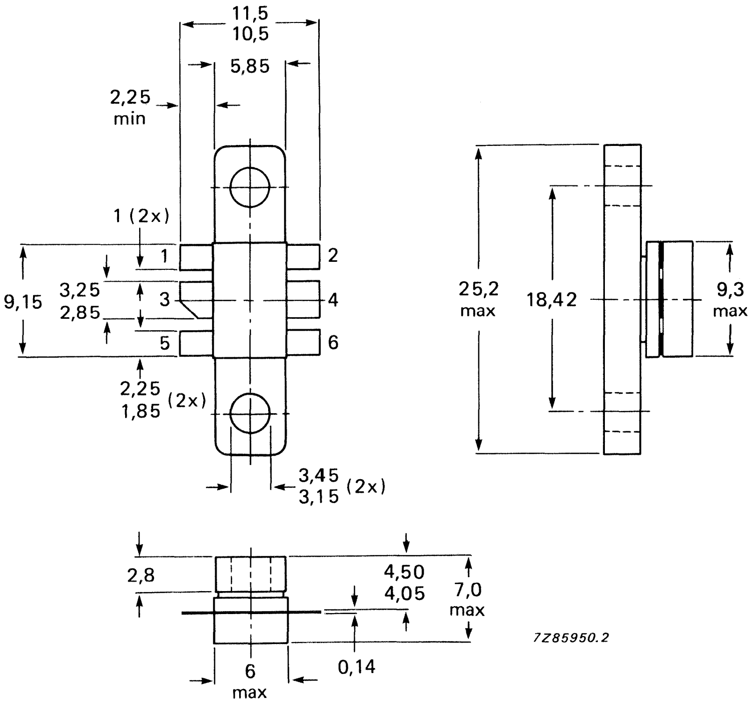
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:

1 Base
2 Base
3 Collector
4 Emitter
5 Base
6 Base



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)
Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
d.c. or average	I_C	max.	5	A
(peak value); f > 1 MHz	I_{CM}	max.	15	A
Total power dissipation				
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	70	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

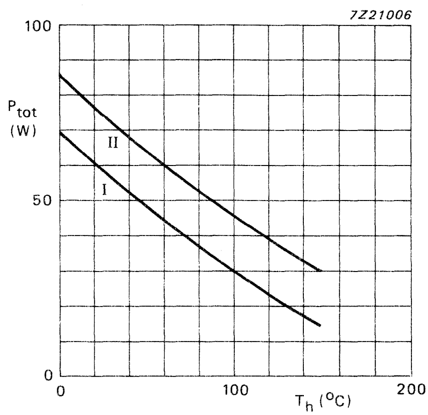


Fig. 2 Power/temperature derating curves.

I Continuous operation (f > 1 MHz).
II Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE

Dissipation = 60 W; T_{mb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb\ (r.f.)}$	max.	2,5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	min.	36 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	min.	16 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	min.	3,5 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	15 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	6,5 mJ
D.C. current gain I_C = 3,5 A; V_{CE} = 10 V	h_{FE}	min. typ.	15 60
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	62 pF
Feedback capacitance at f = 1 MHz I_E = 0; V_{CB} = 12,5 V	C_{rb}	typ.	20 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

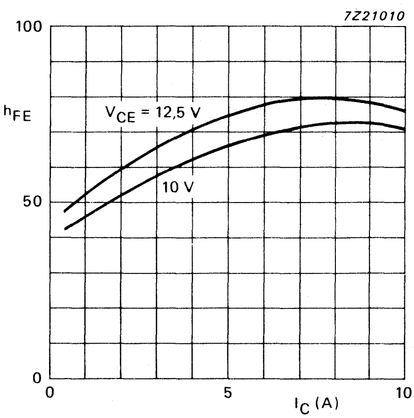


Fig. 3 D.C. current gain versus collector current; T_h = 25 °C. Typical values.

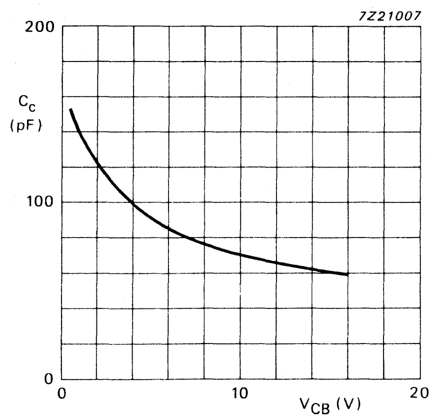


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-base circuit; class-B); f = 900 MHz; T_h = 25 °C

mode of operation	V_{CB} V	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	22	> 5,5 typ. 7,0	> 50 typ. 60

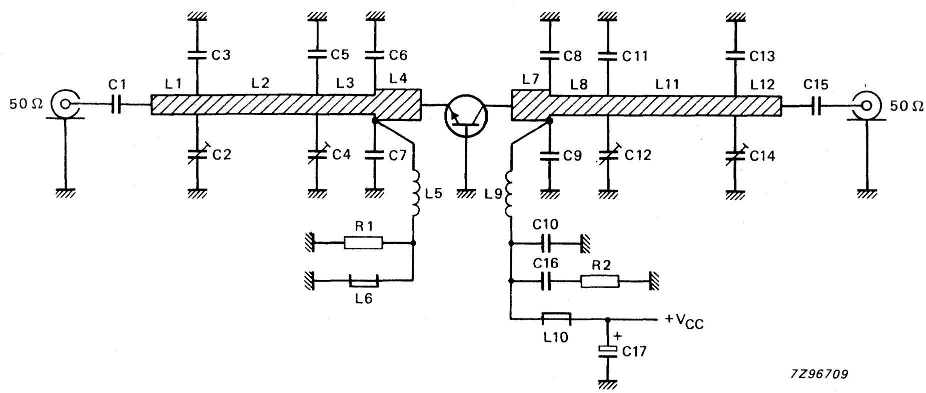


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

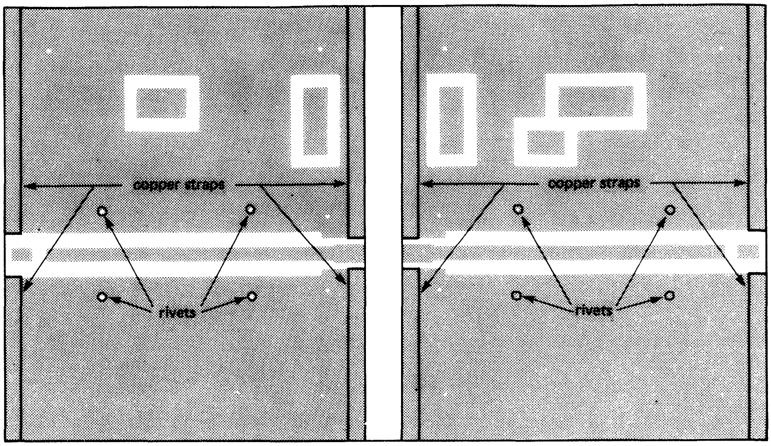
C1 = C15 = 47 pF multilayer ceramic chip capacitor*
C2 = C4 = C12 = C14 = 1,4 - 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 3,3 pF multilayer ceramic chip capacitor*
C5 = C11 = C13 = 6,2 pF multilayer ceramic chip capacitor*
C6 = C7 = 6,2 pF multilayer ceramic chip capacitor**
C8 = 7,5 pF multilayer ceramic chip capacitor**
C9 = 8,2 pF multilayer ceramic chip capacitor**
C10 = 24 pF multilayer ceramic chip capacitor
C16 = 3 x 100 nF multilayer ceramic chip capacitor
C17 = 2,2 μF (35 V) electrolytic capacitor

L1 = L12 = 50 Ω stripline (9 mm x 2,4 mm)
L2 = L11 = 50 Ω stripline (24 mm x 2,4 mm)
L3 = L8 = 50 Ω stripline (14 mm x 2,4 mm)
L4 = L7 = 43 Ω stripline (5 mm x 3 mm)
L5 = 88 nH; 9 turns Cu-wire (0,8 mm); int. dia. 3 mm; length 10 mm; leads 2 x 5 mm
L6 = L10 = Ferroxdure wideband h.f. choke; grade 3B (cat. no. 4312 020 36642)
L9 = 53 nH; 4 turns Cu-wire (1 mm); int. dia. 4 mm; length 5,5 mm; leads 2 x 5 mm

R1 = 1 Ω ± 10%; 0,25 W, metal film resistor
R2 = 10 Ω ± 10%; 0,25 W, metal film resistor

The striplines are on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100 A.



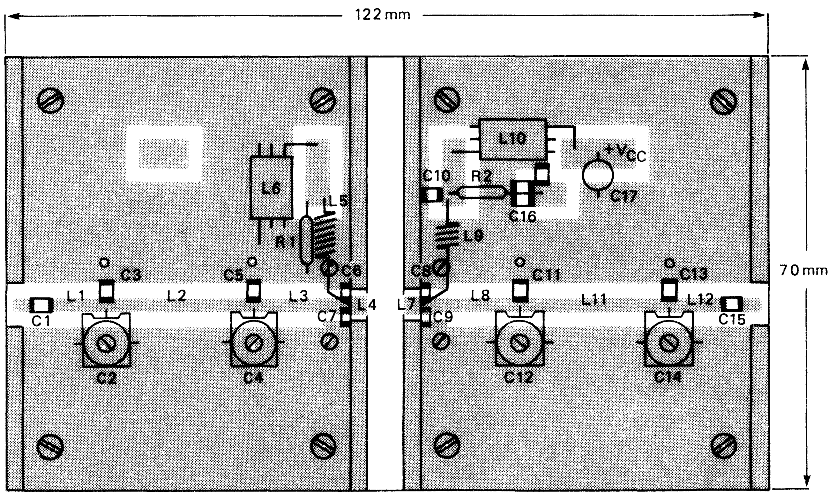


Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

The circuit and components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as a ground plane.
Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

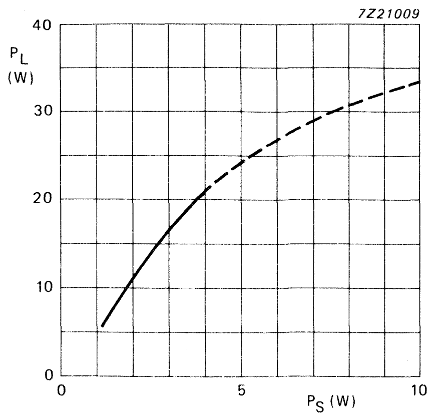


Fig. 7 Load power versus source power.

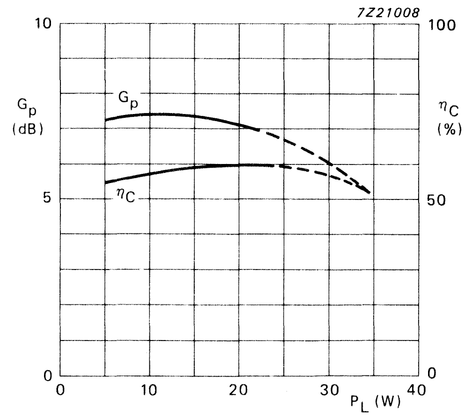


Fig. 8 Power gain and efficiency versus load power.

Condition for Figs 7 and 8:

V_{CB} = 12,5 V; f = 900 MHz; T_h = 25 °C; class-B operation;
$R_{th\ mb-h}$ = 0,4 K/W; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at rated load power under the following conditions:
V_{CB} = 15,5 V; f = 900 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0,4 K/W.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor in SOT171 envelope intended for use in class-B operated base station transmitters in the 900 MHz communications band.

Features

- Internal matching to achieve an optimum wideband capability and stable operation
- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

RF performance up to T_h = 25 °C in common-base class-B circuit.

mode of operation	V_{CB} V	f MHz	P_L W	G_p dB	η_C %
narrow band; CW	24	900	30	> 7.0	> 55

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT171.

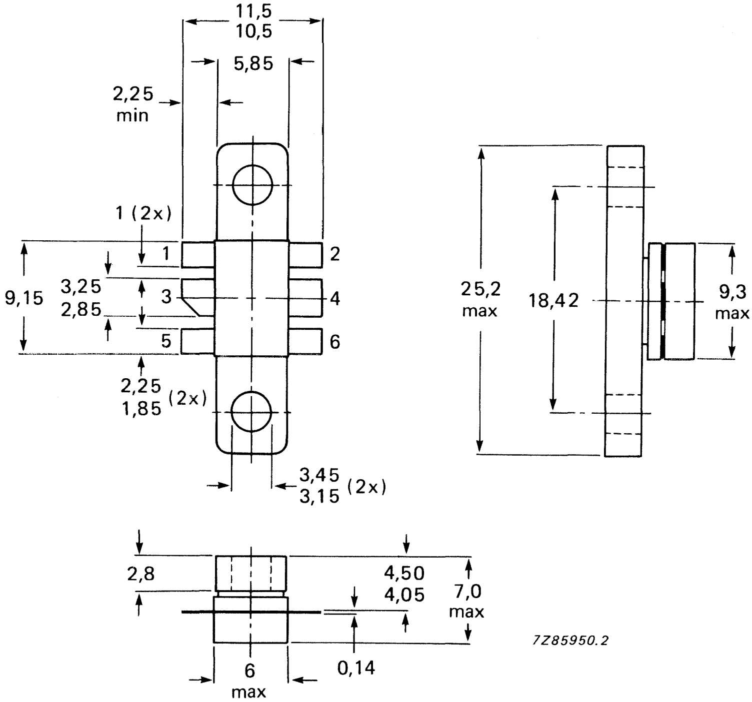
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig.1 SOT171.

Pinning

1 Base
2 Base
3 Collector
4 Emitter
5 Base
6 Base



Torque on screw: min. 0.6 Nm (6 kg.cm)
max. 0.75 Nm (7.5 kg.cm)

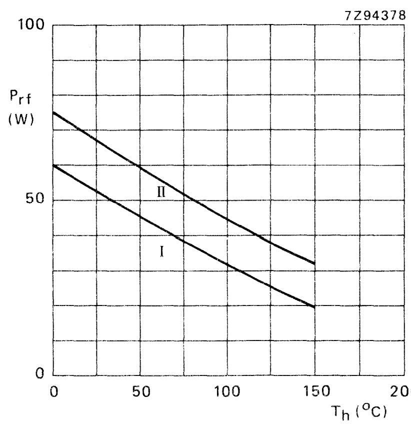
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

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)	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.5 V
Collector current			
DC or average	I_C	max.	3 A
peak value; f > 1 MHz	I_{CM}	max.	9 A
Total power dissipation			
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	60 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C



I Continuous operation (f > 1 MHz)
II Short-time operating during mismatch (f > 1 MHz)

Fig.2 Power/temperature derating curves.

THERMAL RESISTANCE

Dissipation = 60 W; T_{amb} = 25 °C.

From junction to mounting base (RF operation)	$R_{th\ j\text{-}mb}$	max.	2.9 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.4 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

Collector-base breakdown voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	min.	50	V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	min.	27	V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	min.	3.5	V
Collector-emitter leakage current V_{BE} = 0; V_{CE} = 27 V	I_{CES}	max.	10	mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	4	mJ
DC current gain V_{CE} = 20 V; I_C = 2 A	h_{FE}	min.	15	
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 24 V	C_c	typ.	44	pF
Feedback capacitance at f = 1 MHz I_E = 0; V_{CB} = 24 V	C_{rb}	typ.	14	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

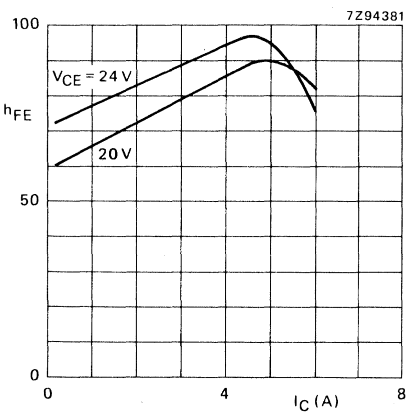


Fig.3 DC current gain as a function of collector current; T_j = 25 °C.

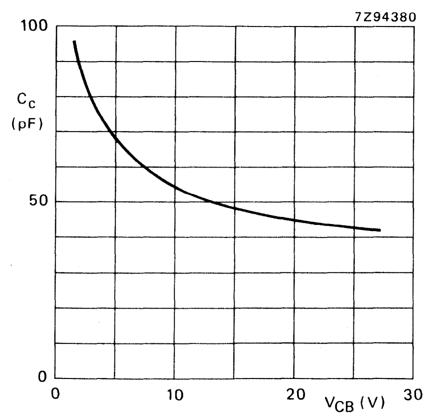


Fig.4 Collector capacitance as a function of V_{CB}; I_E = i_e = 0; f = 1 MHz.

APPLICATION INFORMATION

RF performance at T_h = 25 °C in common-base class-B circuit.

mode of operation	V_{CB} V	f MHz	P_L W	G_p dB	η_C %
narrow band; CW	24	900	30	> 7.0 typ. 8.0	> 55 typ. 63

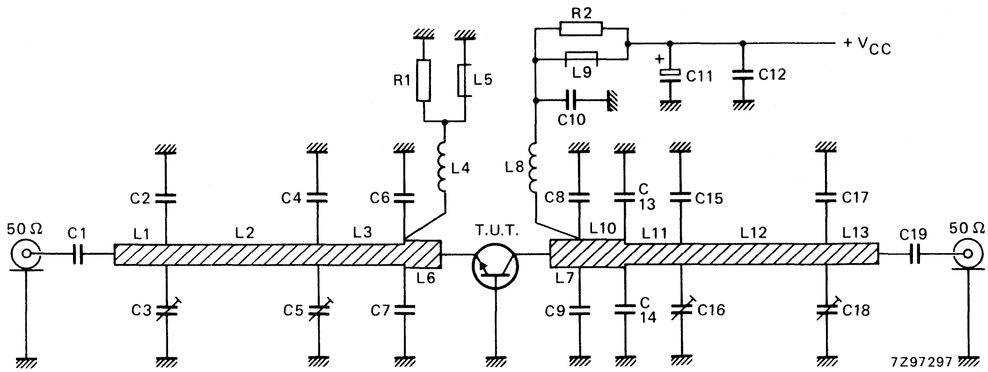


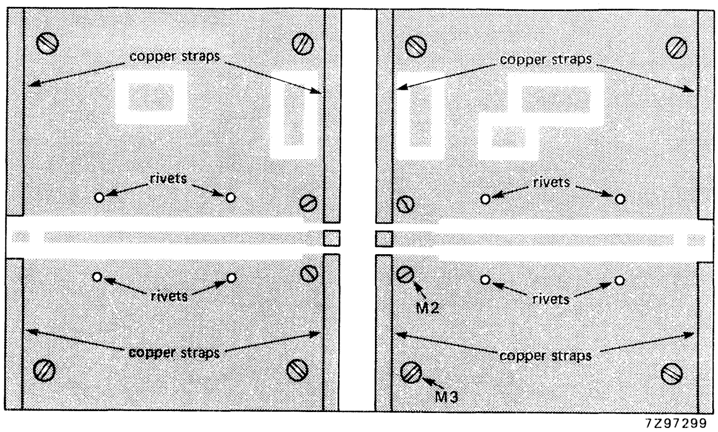
Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C10 = C19 = 330 pF multilayer ceramic chip capacitor
C2 = C4 = C13 = C14 = C15 = C17 = 6.2 pF multilayer ceramic chip capacitor*
C3 = C5 = C16 = C18 = 1.4 to 5.5 pF dielectric trimmer (cat. no. 2222 809 09001)
C6 = 6.2 pF multilayer ceramic chip capacitor**
C7 = C8 = C9 = 6.8 pF multilayer ceramic chip capacitor*
C11 = 2.2 μF (63 V) electrolytic capacitor
C12 = 3 x 100 nF multilayer ceramic chip capacitor in parallel
L1 = L13 = 50 Ω stripline (9.0 mm x 2.4 mm)
L2 = 50 Ω stripline (24.0 mm x 2.4 mm)
L3 = 50 Ω stripline (13.0 mm x 2.4 mm)
L4 = 250 nH; 9 turns closely wound enamelled Cu-wire (1.0 mm) int. dia. 4 mm; leads 2 x 7 mm
L5 = L9 = Ferroxcube wide-band HF choke, grade 3B (cat. no. 4312 020 26642)
L6 = 43 Ω stripline (5.5 mm x 3.0 mm)
L7 = 43 Ω stripline (3.0 mm x 3.0 mm)
L8 = 65 nH; 5 turns closely wound enamelled Cu-wire (1.0 mm) int. dia. 4 mm; leads 2 x 7 mm
L10 = 43 Ω stripline (7.5 mm x 3.0 mm)
L11 = 50 Ω stripline (8.0 mm x 2.4 mm)
L12 = 50 Ω stripline (24.0 mm x 2.4 mm)
R1 = 1 Ω ± 5% (0.25 W) metal film resistor
R2 = 10 Ω ± 5% (0.25 W) metal film resistor

The striplines are on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch.

* Americal Technical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.



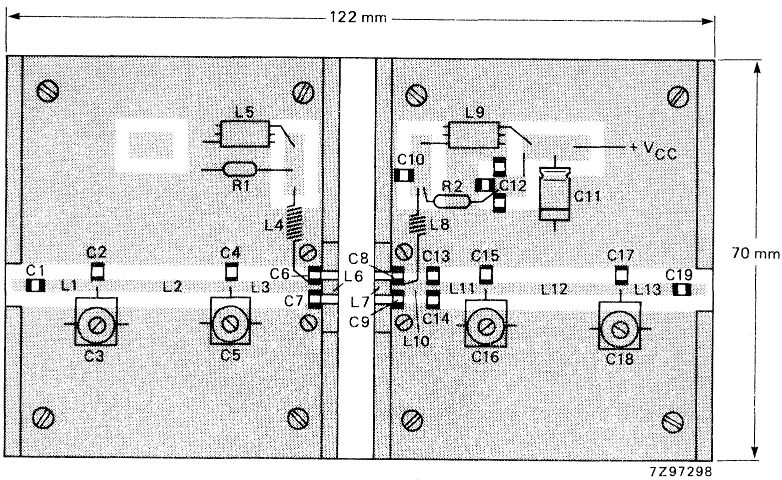


Fig.6 Printed circuit board and component layout for 900 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

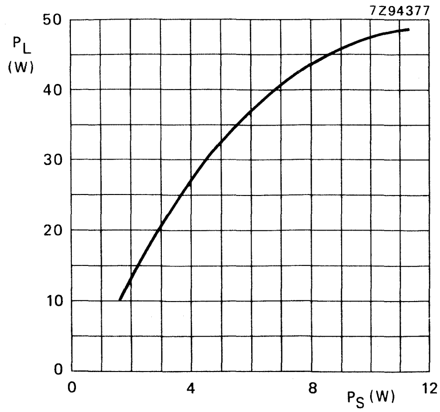


Fig.7 Load power as a function of source power.

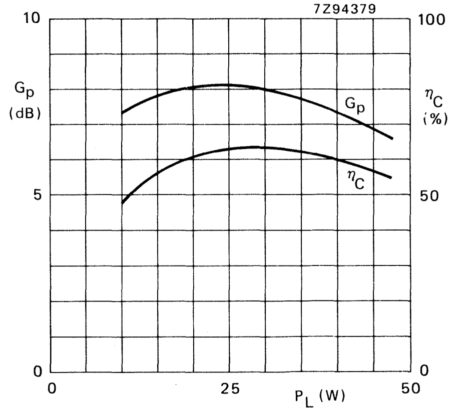


Fig.8 Power gain and efficiency as functions of load power.

Conditions for Figs 7 and 8:

Typical values; V_{CB} = 24 V; f = 900 MHz; T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

RUGGEDNESS

The BLV97 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at rated load power and supply voltage; when T_h = 25 °C and $R_{th\ mb\text{-}h}$ = 0.4 K/W.

INPUT AND LOAD IMPEDANCES

$\overline{Z}_i$ = 1.6 + j 4.4 Ω and $\overline{Z}_L$ = 1.20 + j 3.0 Ω (series components).
Conditions: V_{CB} = 24 V; P_L = 30 W; f = 900 MHz, T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor in SOT-171 envelope intended for use in class-B operated base station transmitters in the 900 MHz communications band.

Features

- internal matching to achieve an optimum wideband capability and stable operation.
- emitter ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C in common-base class-B circuit.

mode of operation	V_{CB} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	24	900	14	> 8,5	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

PRODUCT SAFETY **This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.**

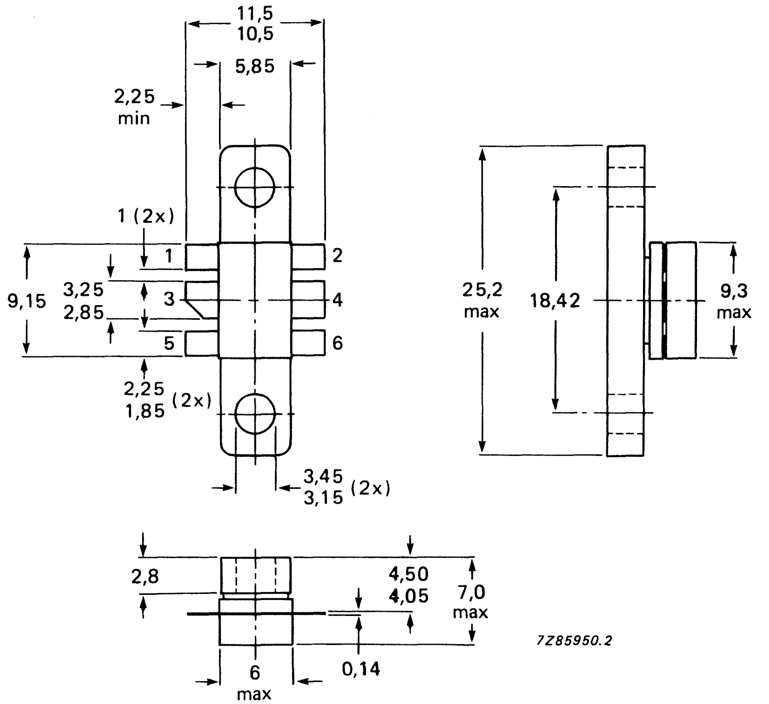
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:

1 Base
2 Base
3 Collector
4 Emitter
5 Base
6 Base



Torque on screw: min. 0,6 Nm (6 kg.cm)
max. 0,75 Nm (7,5 kg.cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

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)	V_{CEO}	max.	27 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5 V
Collector current			
d.c. or average	I_C	max.	1,5 A
peak value; f > 1 MHz	I_{CM}	max.	4,5 A
Total power dissipation			
at T_{mb} = 25 °C; f > 1 MHz	P_{tot}	max.	40 W
Storage temperature	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

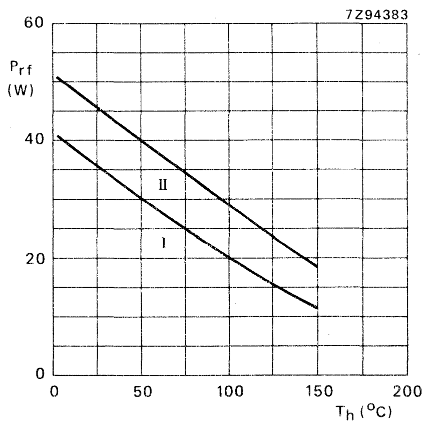


Fig. 2 Power/temperature derating curves.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 40 W; T_{amb} = 25 °C

From junction to mounting base (r.f. operation)	$R_{th\ j\text{-}mb}$	max.	4,4 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,4 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 25 mA	$V_{(BR)CBO}$	min.	50	V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	min.	27	V
Emitter-base breakdown voltage open collector; I_E = 5 mA	$V_{(BR)EBO}$	min.	3,5	V
Collector-emitter leakage current V_{BE} = 0; V_{CE} = 27 V	I_{CES}	max.	5	mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	2	mJ
D.C. current gain V_{CE} = 20 V; I_C = 1 A	h_{FE}	min.	15	
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 24 V	C_c	typ.	23	pF
Feedback capacitance at f = 1 MHz I_E = 0; V_{CB} = 24 V	C_{rb}	typ.	7	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

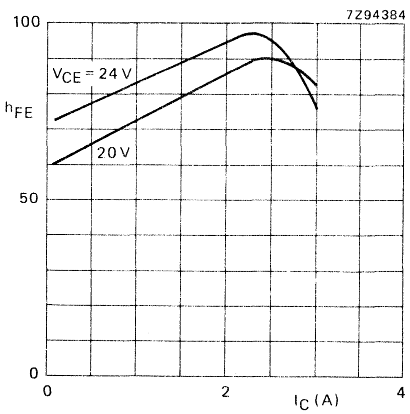


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

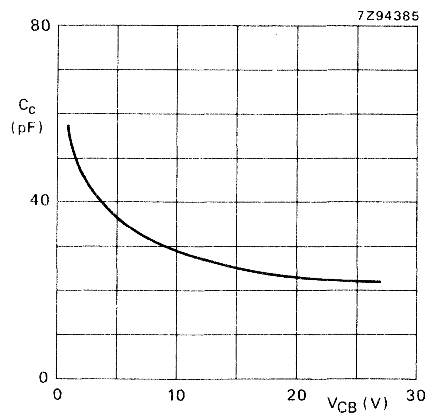


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

APPLICATION INFORMATION

R.F. performance at T_h = 25 °C in common-base class-B circuit.

mode of operation	V_{CB} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	24	900	14	> 8,5 typ. 10,0	> 55 typ. 65

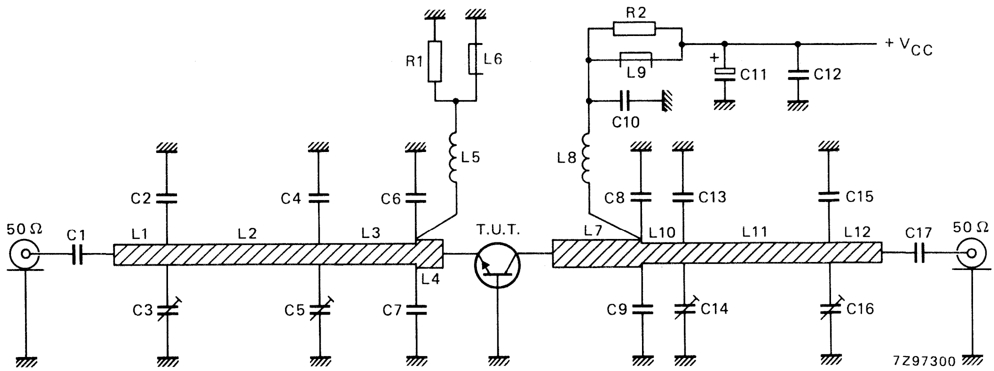


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C10 = C17 = 330 pF multilayer ceramic chip capacitor
C2 = C13 = 3,3 pF multilayer ceramic chip capacitor*
C3 = C5 = C14 = C16 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C8 = C9 = C15 = 6,2 pF multilayer ceramic chip capacitor*
C6 = C7 = 6,2 pF multilayer ceramic chip capacitor**
C11 = 2,2 μF (63 V) electrolytic capacitor
C12 = 3 x 100 nF multilayer ceramic chip capacitors in parallel
L1 = L12 = 50 Ω stripline (9,0 mm x 2,4 mm)
L2 = L11 = 50 Ω stripline (24,0 mm x 2,4 mm)
L3 = 50 Ω stripline (16,0 mm x 2,4 mm)
L4 = 43 Ω stripline (3,0 mm x 3,0 mm)
L5 = 88 nH; 9 turns closely wound enamelled Cu-wire (0,8 mm); int. dia. 3 mm length 12 mm; leads 2 x 5 mm
L6 = L9 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36642)
L7 = 43 Ω stripline (14,5 mm x 3,0 mm)
L8 = 53 nH; 4 turns enamelled Cu-wire (1,0 mm); int. dia. 4 mm; length 5 mm; leads 2 x 5 mm
L10 = 50 Ω stripline (4,5 mm x 2,4 mm)

R1 = 1 Ω ± 5% (0,25 W) metal film resistor
R2 = 10 Ω ± 5% (0,25 W) metal film resistor

The striplines are on a double Cu-clad printed circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* AmericanTechnical Ceramics capacitor type 100B or capacitor of the same quality.
** Idem type 100A.

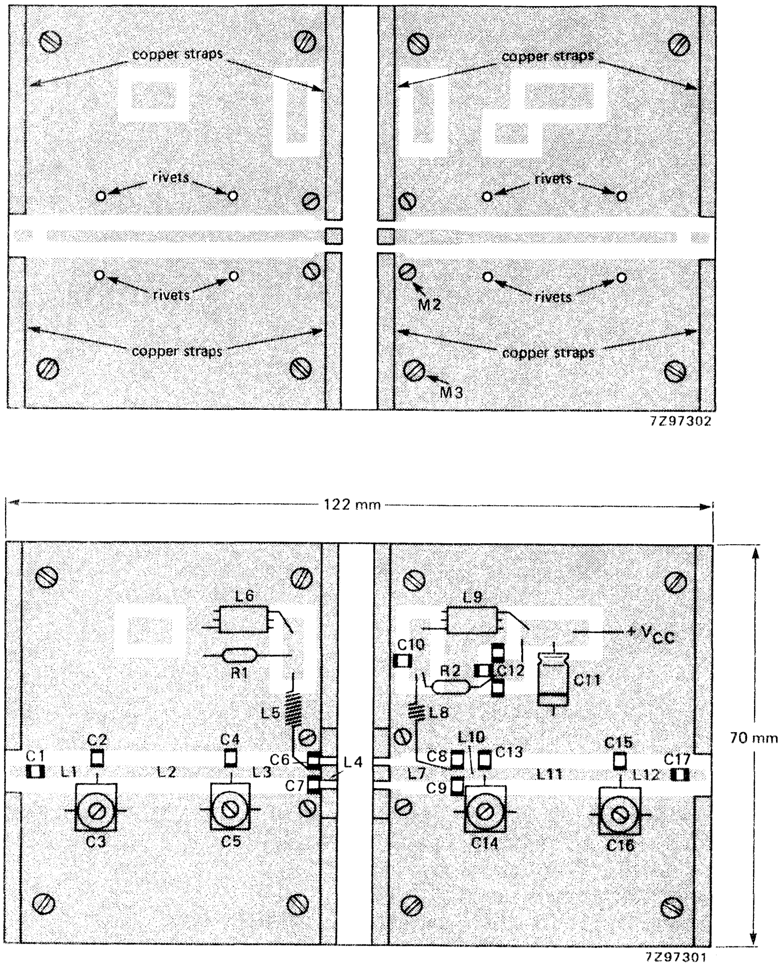


Fig. 6 Printed circuit board and component layout for 900 MHz class-B test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the bases to provide a direct contact between the copper on the component side and the ground plane.

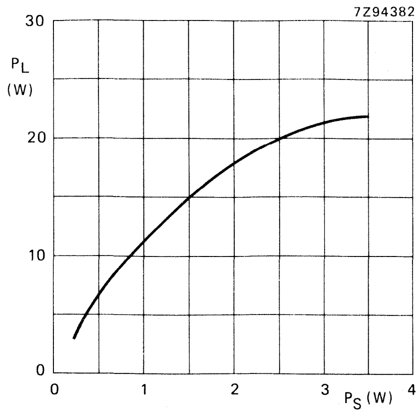


Fig. 7 Load power versus source power.

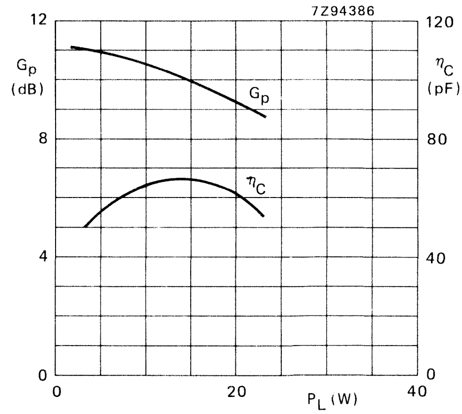


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

Typical values; V_{CB} = 24 V; f = 900 MHz; T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,4 K/W.

RUGGEDNESS

The BLV98 is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at rated load power and supply voltage; when T_h = 25 °C and $R_{th\ mb\text{-}h}$ = 0,4 K/W.

INPUT AND LOAD IMPEDANCES

$\overline{Z}_i$ = 5,1 + j 4,5 Ω and $\overline{Z}_L$ = 2,2 + j 3,0 Ω (series components).
Conditions: V_{CB} = 24 V; P_L = 14 W; f = 900 MHz, T_h = 25 °C; class-B operation; $R_{th\ mb\text{-}h}$ = 0,4 K/W; typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use as a driver-stage in base stations in the 900 MHz communications band.

Features:

- emitter-ballasting resistors for an optimum temperature profile
- gold metallization ensures excellent reliability

The transistor has a 4-lead stud envelope with a ceramic cap (SOT-172). All leads are isolated from the stud.

QUICK REFERENCE DATA

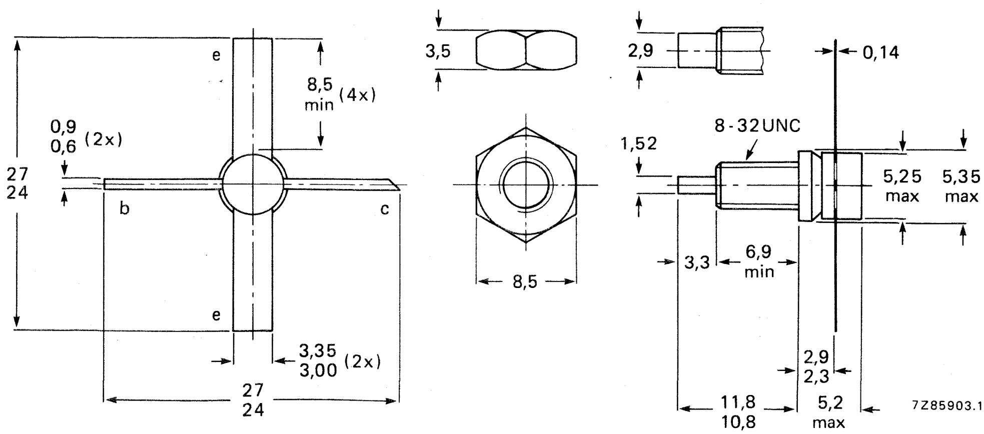
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	24	900	2	> 8,0	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172.



Torque on nut: min. 0,75 Nm (7,5 kg.cm)
max. 0,85 Nm (8,5 kg.cm)
When locking is required an adhesive is preferred instead of a lock washer.

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
Deburring must leave surface flat; donot chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current; d.c.	I_C	max.	0,2	A
Collector current (peak value) $f > 1$ MHz	I_{CM}	max.	0,6	A
Total power dissipation at $T_{mb} = 50$ °C; $f > 1$ MHz	P_{tot}	max.	6	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

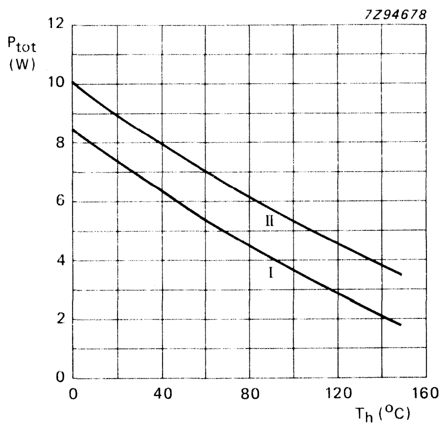


Fig. 2 Power/temperature derating curves.

I continuous r.f. operation ($f > 1$ MHz)

II short-time r.f. operation during mismatch ($f > 1$ MHz)

THERMAL RESISTANCE

$P = 4,5$ W; $T_{mb} = 25$ °C

From junction to mounting base ($f > 1$ MHz)	$R_{th\ j\text{-}mb}$	max.	20	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,8	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 5 mA	$V_{(BR)CBO}$	min.	50 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	min.	27 V
Emitter-base breakdown voltage open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	min.	3,5 V
Collector-emitter leakage current V_{BE} = 0; V_{CE} = 27 V	I_{CES}	max.	2 mA
Second breakdown energy at f = 50 Hz L = 25 mH; R_{BE} = 10 Ω	E_{SBR}	min.	0,5 mJ
D.C. current gain I_C = 150 mA; V_{CE} = 20 V	h_{FE}	min.	25
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 24 V	C_c	typ.	3 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 24 V	C_{re}	typ.	1,3 pF
Collector-stud capacitance	C_{cs}	typ.	0,5 pF

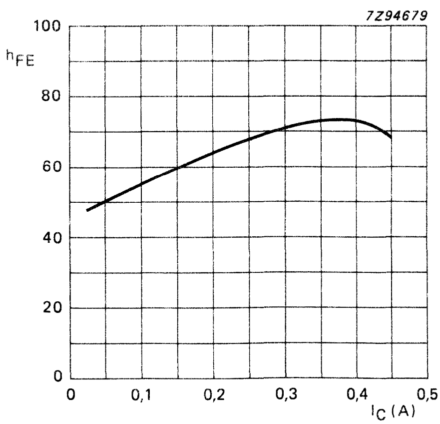


Fig. 3 V_{CE} = 20 V; T_j = 25 °C; typical values.

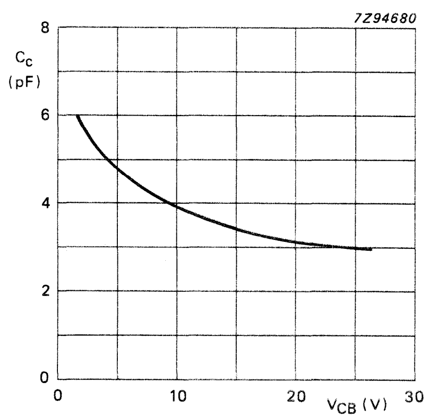


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 900 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0,8 K/W

mode of operation	V_{CE} V	f MHz	P_L W	G_P dB	η_C %
narrow band; c.w.	24	900	2	min. 8,0 typ. 9,3	min. 55 typ. 63

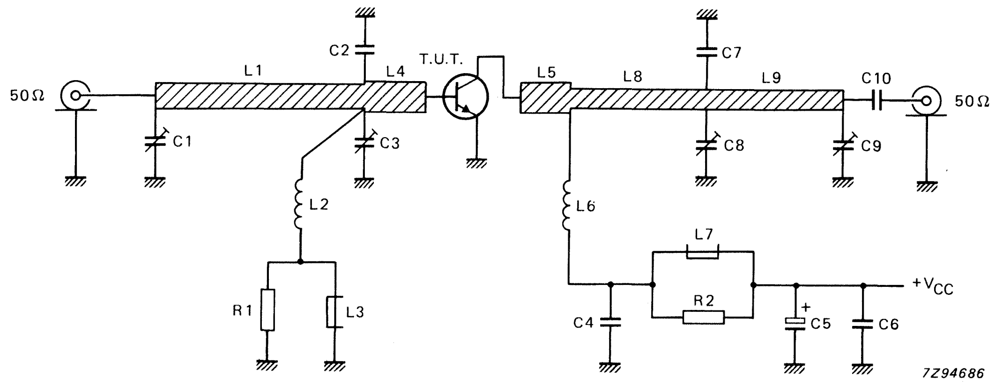


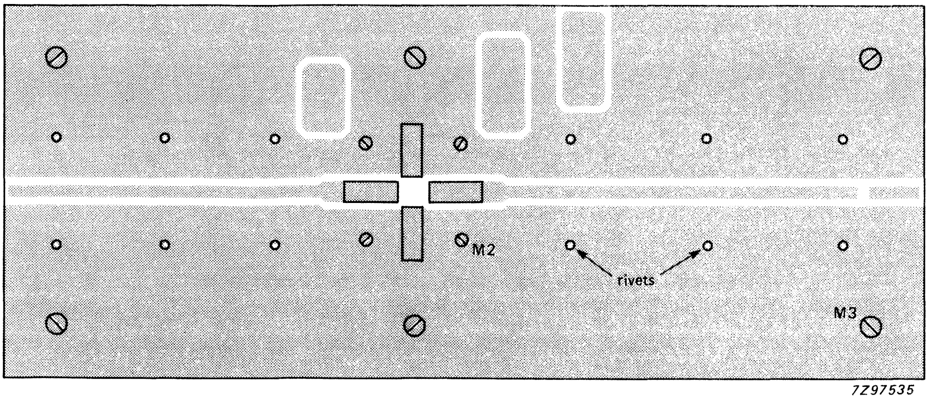
Fig. 5 class-B test circuit at f = 900 MHz.

List of components

C1 = C3 = C8 = C9	1,4 – 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2	4,7 pF multilayer ceramic chip capacitor*
C4 = C6 = C10	220 pF multilayer ceramic chip capacitor
C5	1 μF (63 V) electrolytic capacitor
C7	2,2 pF multilayer ceramic chip capacitor*
L1	50 Ω stripline (48 mm x 2,4 mm)
L2	60 nH; 7 turns closely wound enamelled Cu-wire (0,4 mm); int. dia. 2 mm; leads 2 x 5 mm
L3 = L7	Ferroxcube wide-band h.f. choke; grade 3B; (cat. no. 4312 020 36642)
L4 = L5	35 Ω stripline (14 mm x 4,0 mm)
L6	120 nH; 6 turns Cu-wire (1,0 mm); int. dia. 6 mm; length 10 mm leads 2 x 5 mm
L8	50 Ω stripline (31 mm x 2,4 mm)
L9	50 Ω stripline (29 mm x 2,4 mm)
R1 = R2	10 Ω ± 5% (0,4 W) metal film resistor

The striplines are on a Cu-clad printed-circuit board with a PTFE fibre-glass dielectric (ϵ_r = 2,2); thickness 1/32 inch.

* American Technical Ceramics capacitor type 100A or capacitor of the same quality.



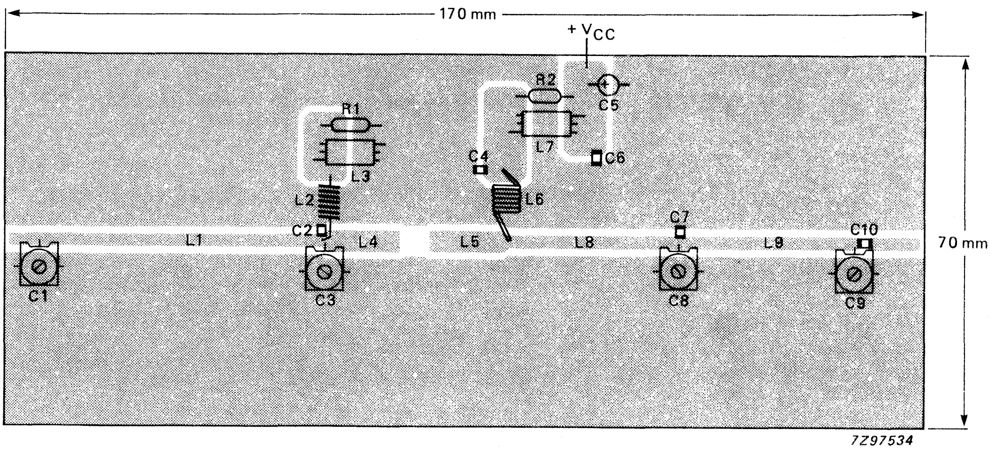


Fig. 6 Printed-circuit board and component layout for 900 MHz class-B test circuit.

Note:

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is unetched copper serving as a ground plane. Earth connections are made by hollow rivets and also by fixing screws and copper straps under the emitters to provide a direct contact between the copper on the component side and the ground plane.

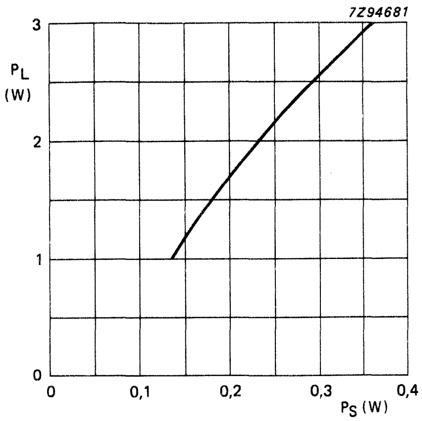


Fig. 7 Load power versus source power.

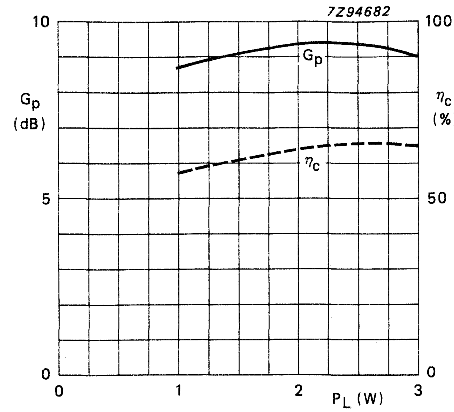


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

V_{CE} = 24 V; f = 900 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,8 K/W; class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50) through all phases, at rated load power and supply voltage (T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,8 K/W).

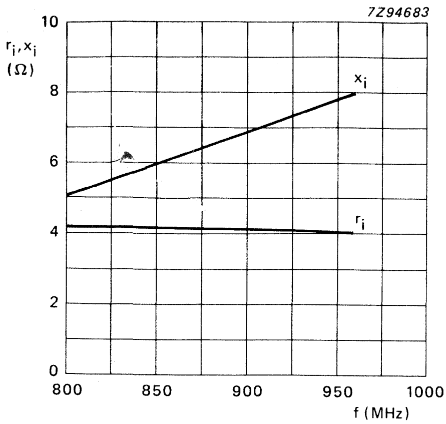


Fig. 9 Input impedance (series components).

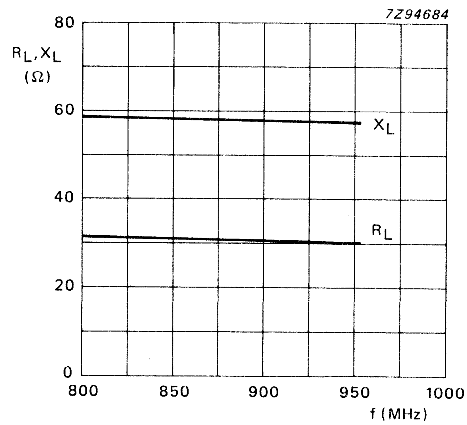


Fig. 10 Load impedance (series components).

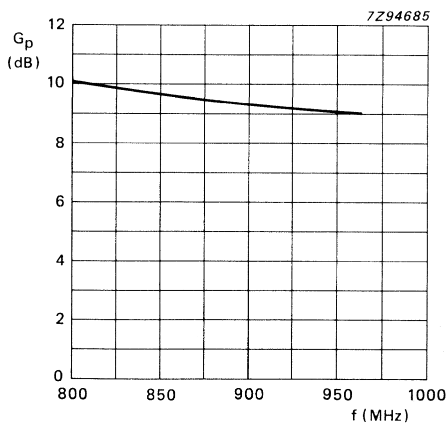


Fig. 11 Power gain versus frequency.

Conditions for Figs 9, 10 and 11:

V_{CE} = 24 V; P_L = 2 W; f = 800 – 960 MHz; $R_{th\ mb\text{-}h}$ = 0,8 K/W; T_h = 25 °C; class-B operation; typical values.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ42 driver stage, the chain can deliver 15 W with a maximum drive power of 120 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

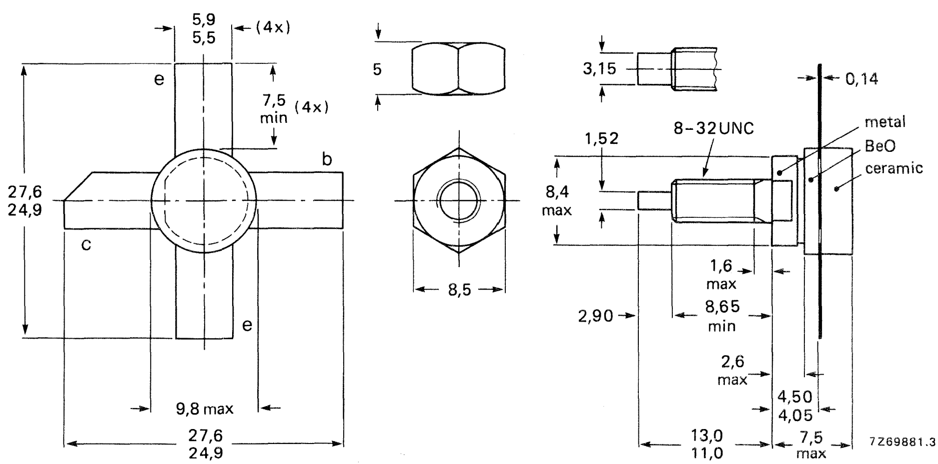
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. class-B	**13,5**	**175**	**15**	**> 10**	**> 60**	**1,3 + j0,68**	**180 − j54**
c.w. class-B	12,5	175	15	typ. 10,5	typ. 67	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	2,75 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	53 W
Storage temperature	T_{stg}		–65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

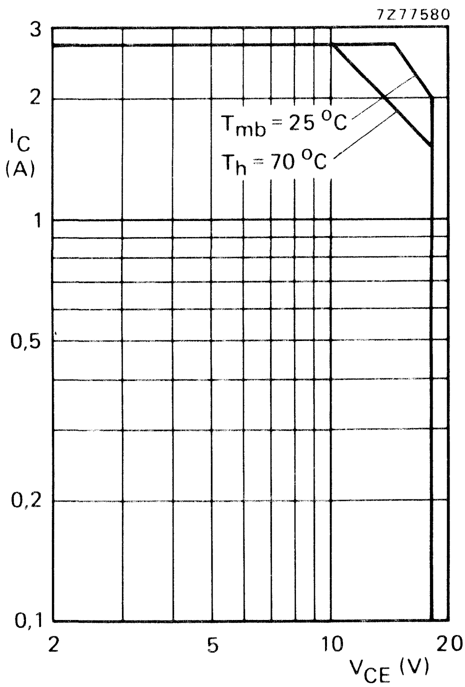


Fig. 2 D.C. SOAR.

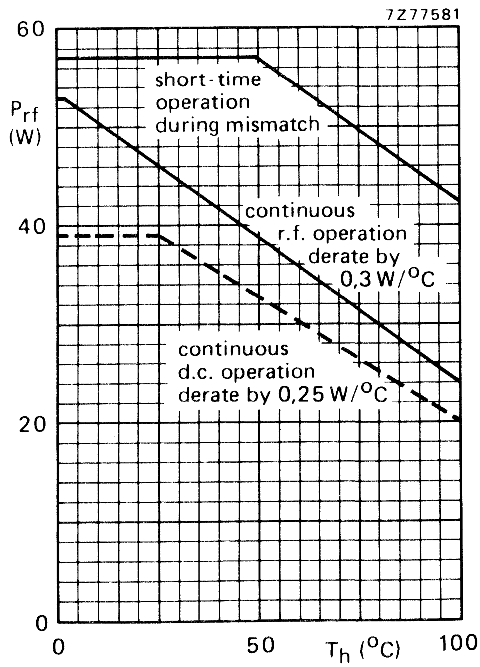


Fig. 3 R.F. power dissipation; $V_{CE} \leq 16,5$ V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,7 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	3,05 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 15 mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; I_E = 5 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 18 V	I_{CES}	<	5 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	4 mJ
R_{BE} = 10 Ω	E_{SBR}	>	4 mJ
D.C. current gain* I_C = 1,75 A; V_{CE} = 5 V	h_{FE}	typ.	40
			10 to 80
Collector-emitter saturation voltage* I_C = 5 A; I_B = 1 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E$ = 1,75 A; V_{CB} = 13,5 V	f_T	typ.	900 MHz
$-I_E$ = 5 A; V_{CB} = 13,5 V	f_T	typ.	825 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 13,5 V	C_c	typ.	43 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 13,5 V	C_{re}	typ.	27 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

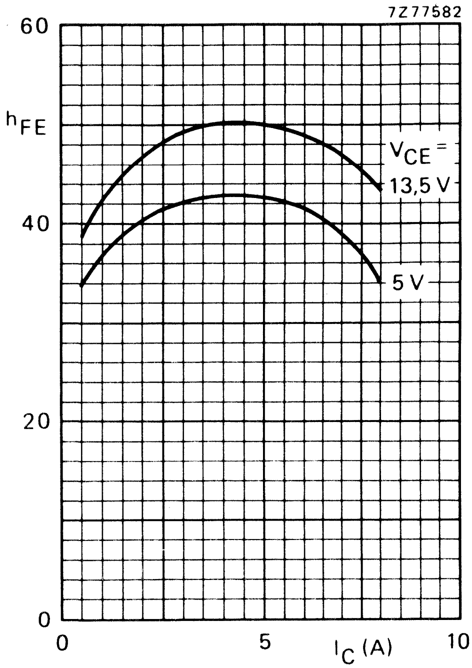


Fig. 4 Typical values; T_j = 25 °C.

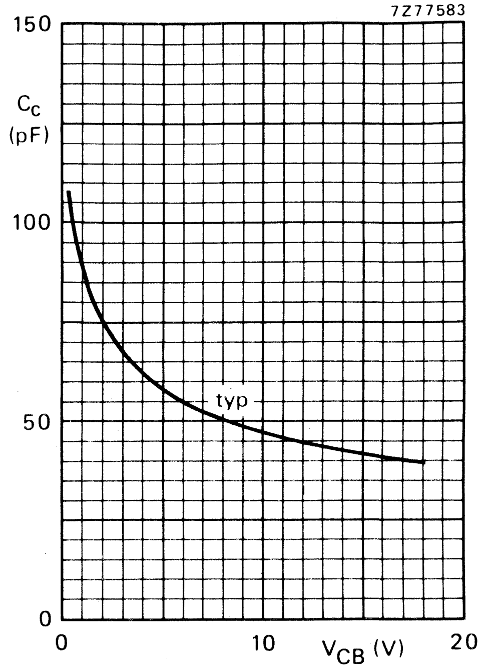


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

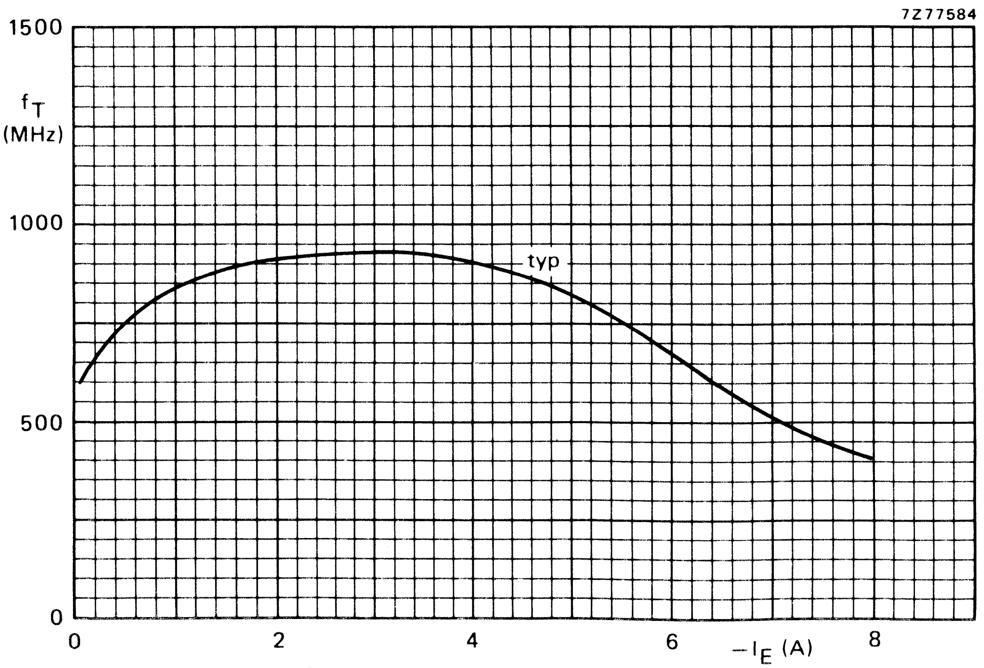


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**15**	**< 1,5**	**> 10**	**< 1,85**	**> 60**	**1,3 + j0,68**	**180 − j54**
175	12,5	15	typ. 1,34	typ. 10,5	typ. 1,8	typ. 67	–	–

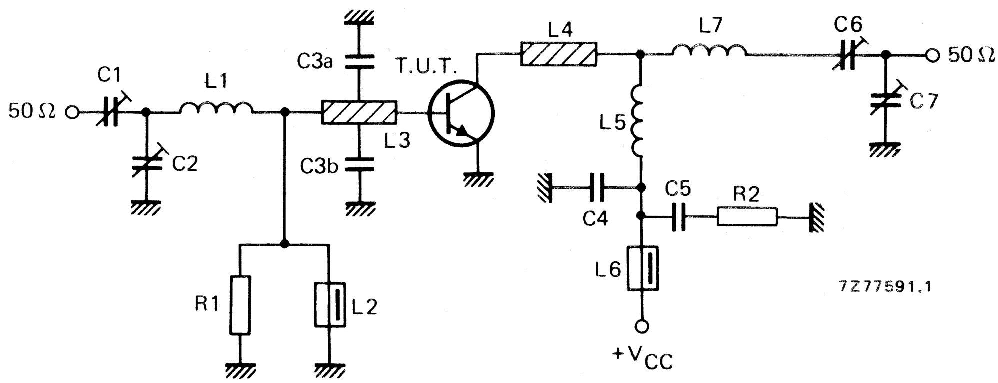


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 1 nF ceramic capacitor
C5 = 100 nF polyester capacitor

L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L5 = 4½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L7 = 2 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)

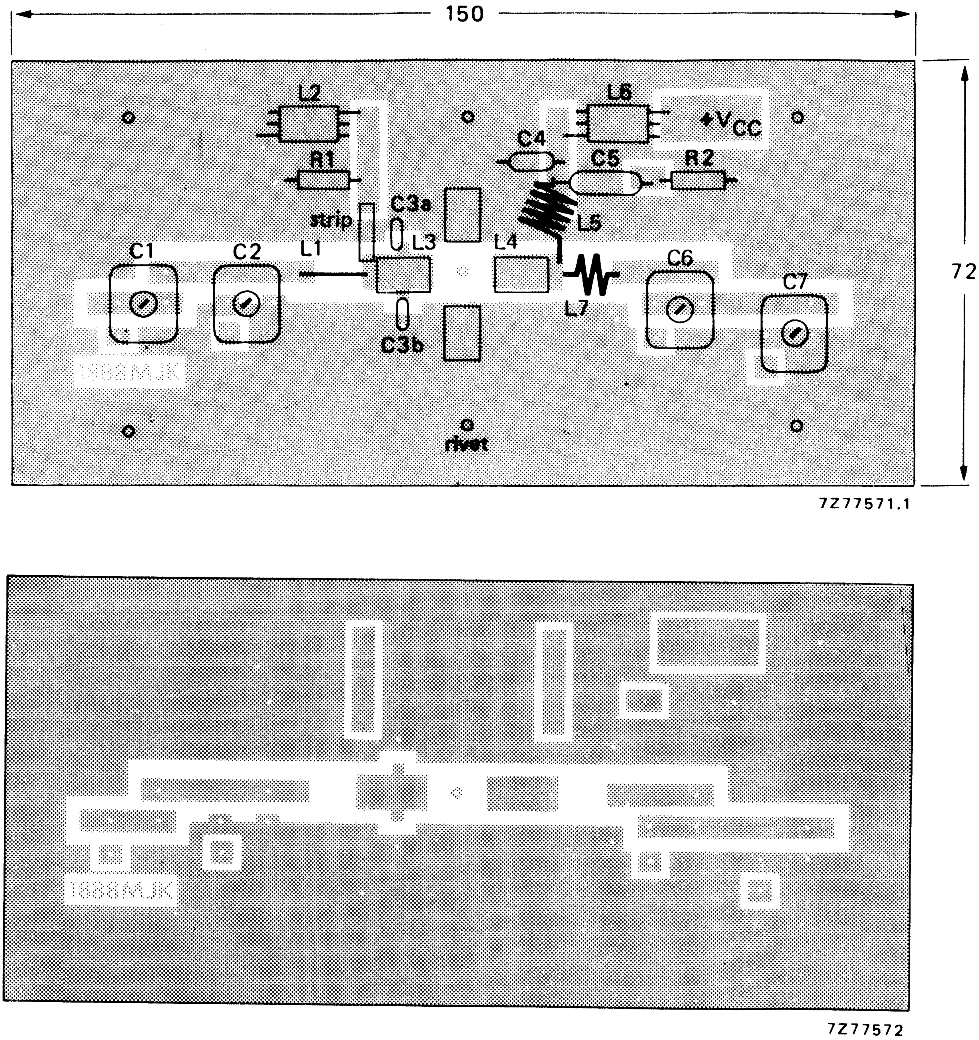


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

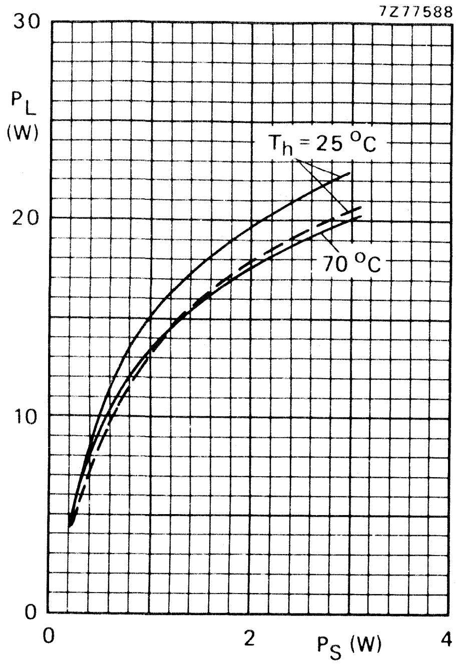


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

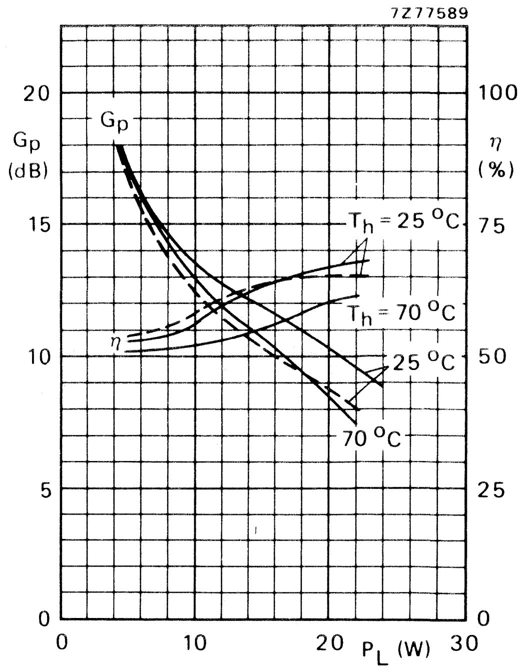


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

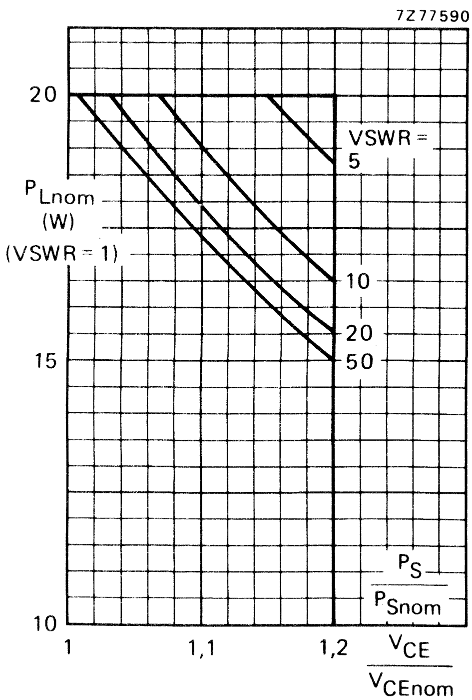


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 K/W ; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

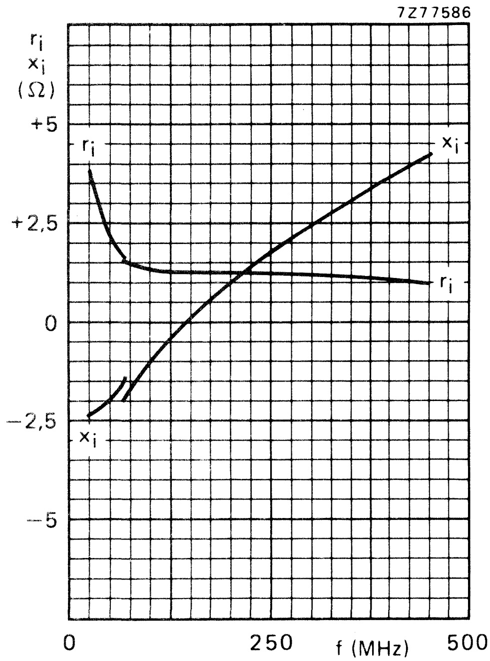


Fig. 12.

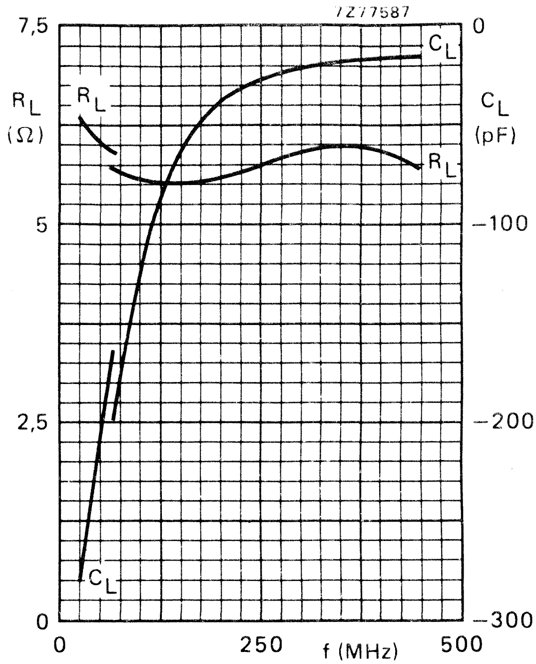
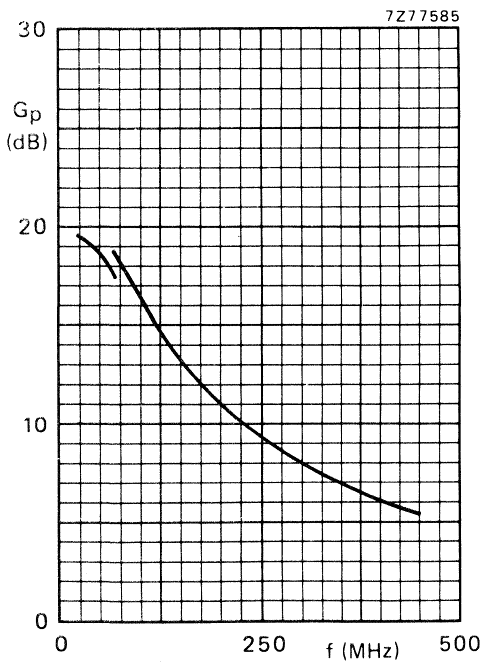


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

Fig. 14.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B or C operated mobile transmitters with a nominal supply voltage of 13,5 V. Because of the high gain and excellent power handling capability, the transistor is especially suited for design of wide-band and semi-wide-band v.h.f. amplifiers. Together with a BFQ43 driver stage, the chain can deliver 28 W with a maximum drive power of 250 mW at 175 MHz. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

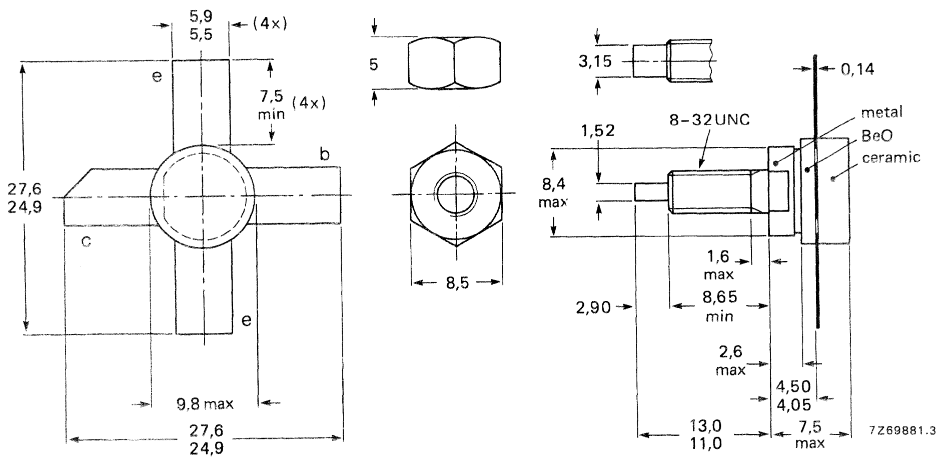
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. class-B	**13,5**	**175**	**28**	**> 9**	**> 60**	**0,9 + j0,9**	**380 + j40**
c.w. class-B	12,5	175	28	typ. 9,5	typ. 70	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	15 A
R.F. power dissipation (f > 1 MHz); $T_{mb} = 25\ ^oC$	P_{rf}	max.	96 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

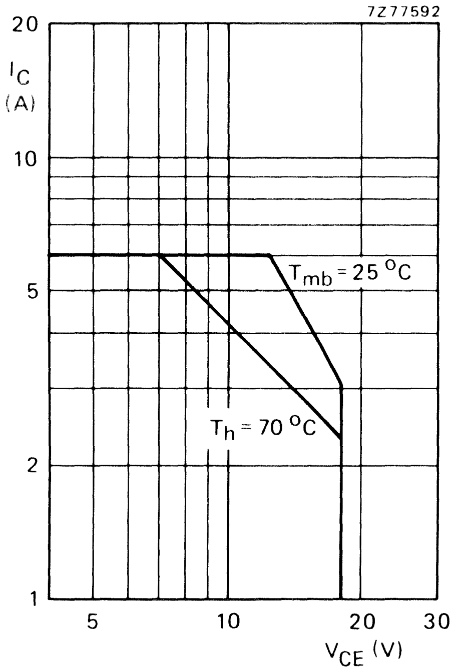


Fig. 2 D.C. SOAR.

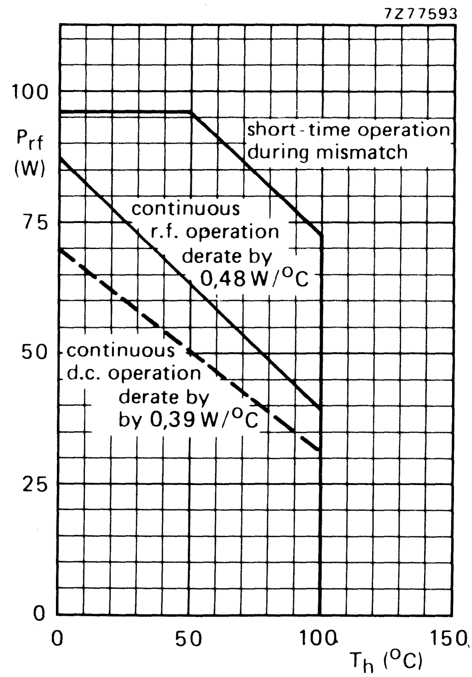


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 25 W; $T_{mb} = 81\ ^oC$, i.e. $T_h = 70\ ^oC$)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,4 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,85 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage				
$V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage				
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage				
open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain*				
$I_C = 3,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40	
			10 to 80	
Collector-emitter saturation voltage*				
$I_C = 10$ A; $I_B = 2$ A	V_{CEsat}	typ.	1,8	V
Transition frequency at f = 100 MHz*				
$-I_E = 3,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850	MHz
$-I_E = 10$ A; $V_{CB} = 13,5$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	92	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	58	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

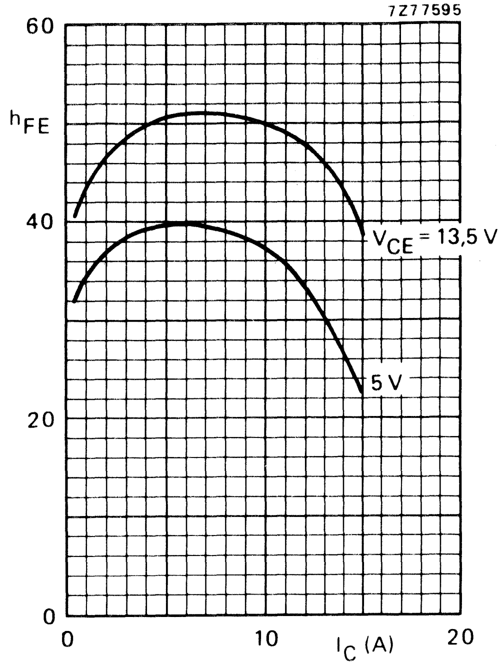


Fig. 4 Typical values; T_j = 25 °C.

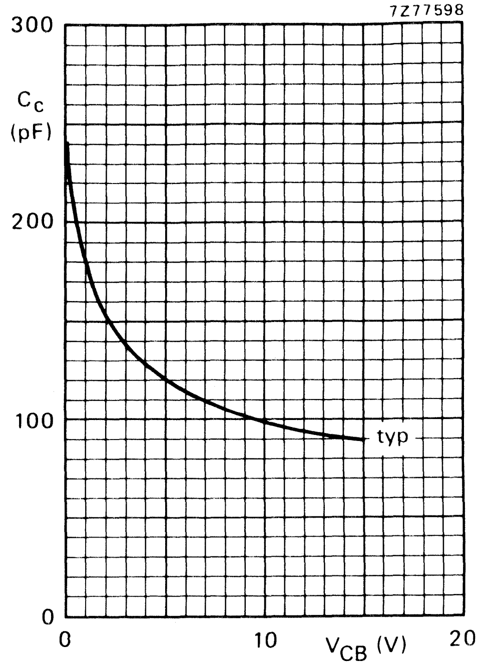


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

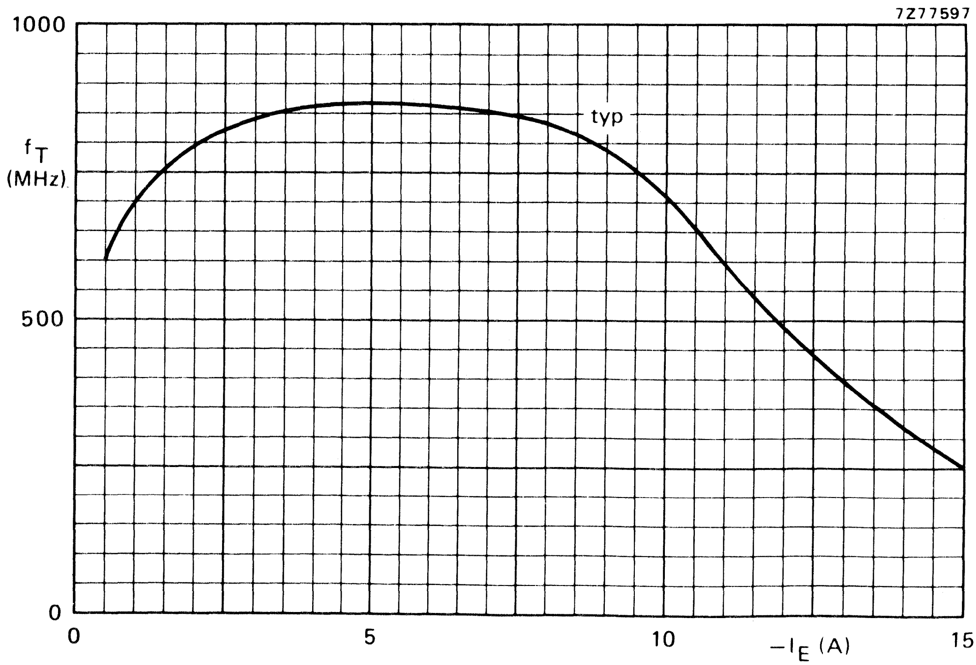


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**28**	**< 3,5**	**> 9**	**< 3,45**	**> 60**	**0,9 + j0,9**	**380 + j40**
175	12,5	28	typ. 3,15	typ. 9,5	typ. 3,2	typ. 70	–	–

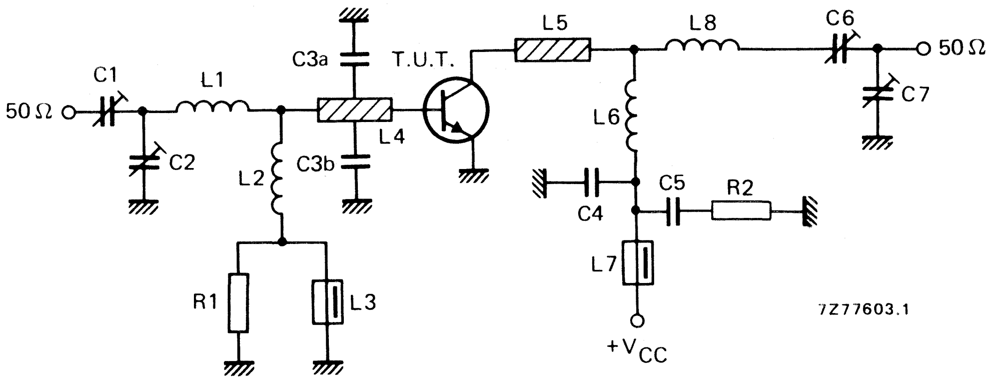


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)

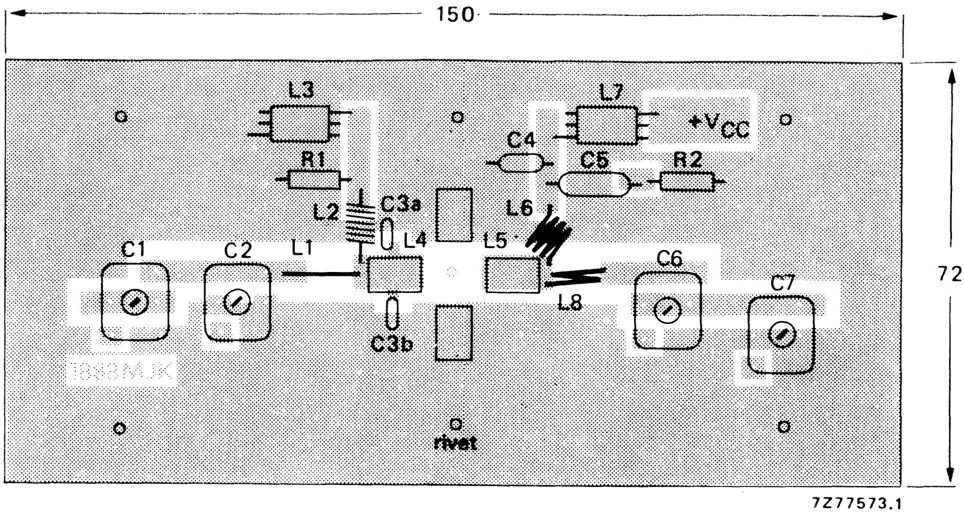
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 3½ turns closely wound enamelled Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm
L8 = 1 turn Cu wire (1,6 mm) int. dia. 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



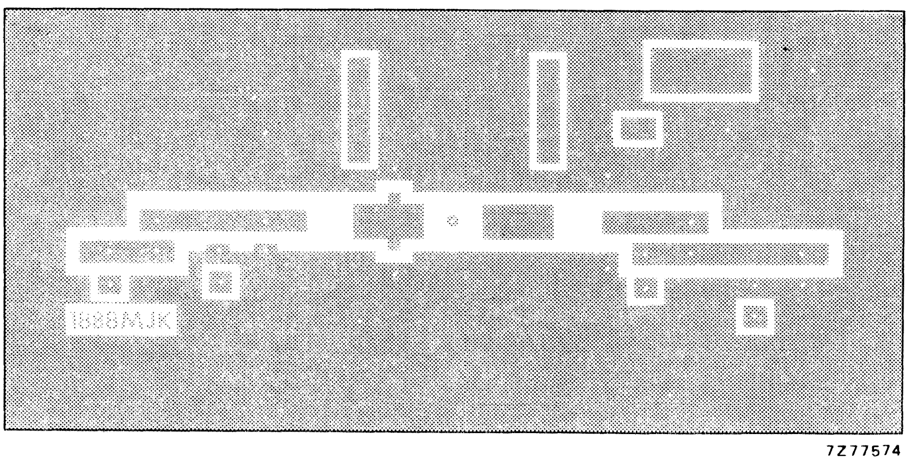


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

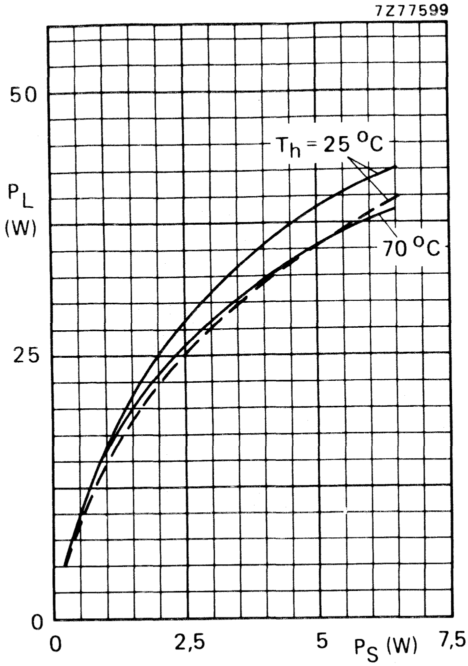


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

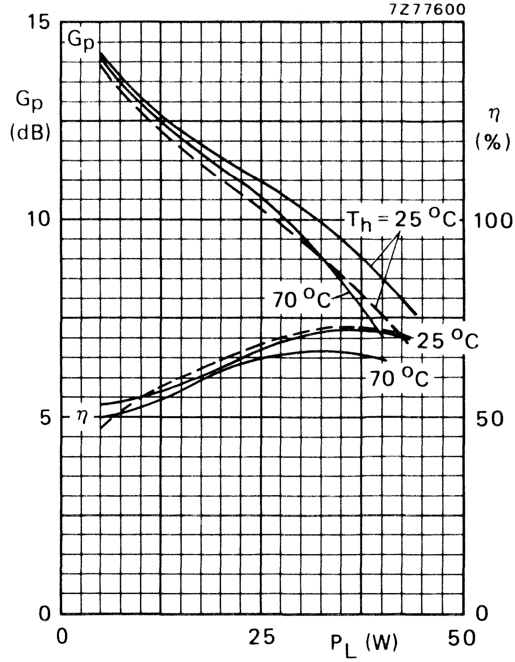


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

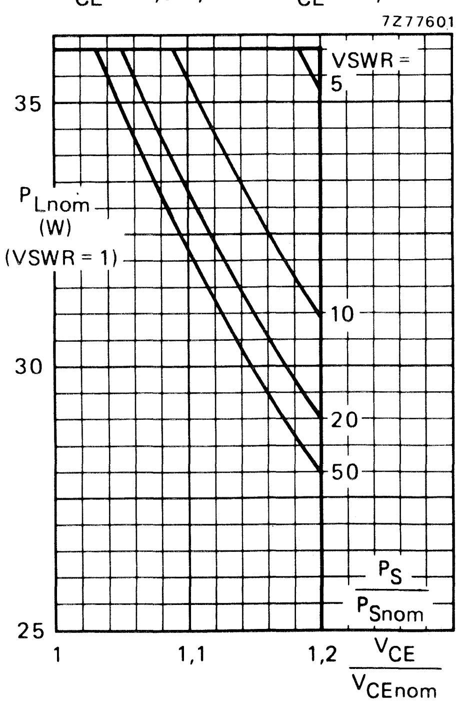


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

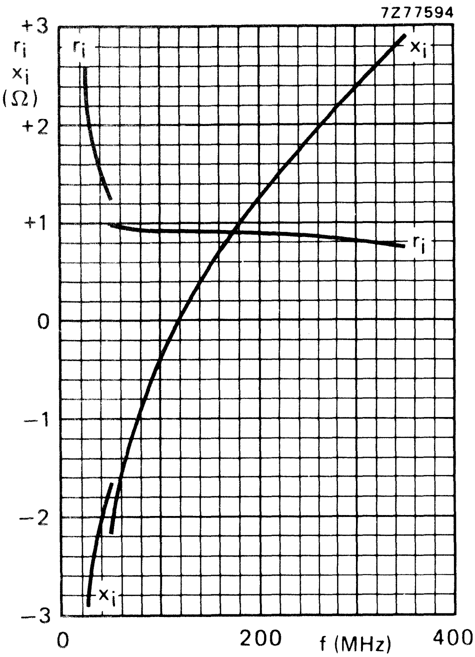


Fig. 12.

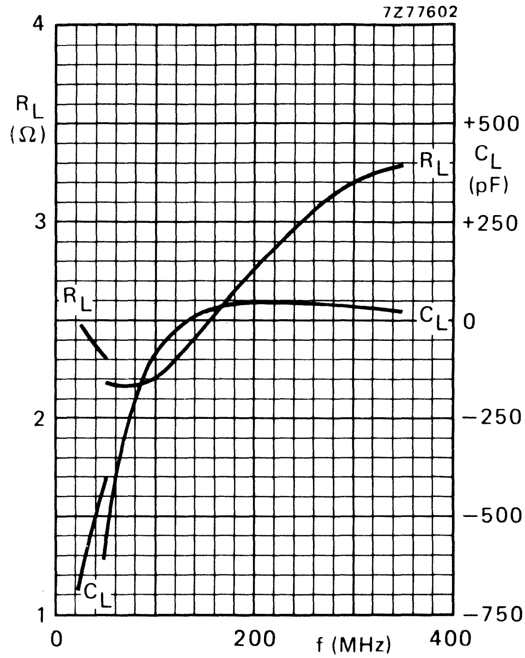
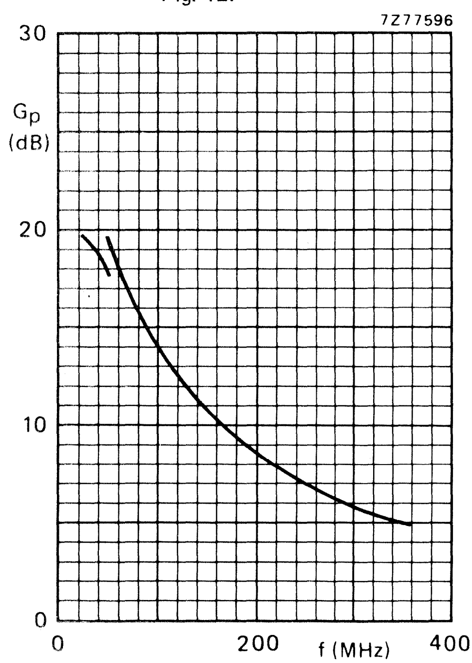


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 13,5 V; P_L = 28 W; T_h = 25 °C.

Fig. 14.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

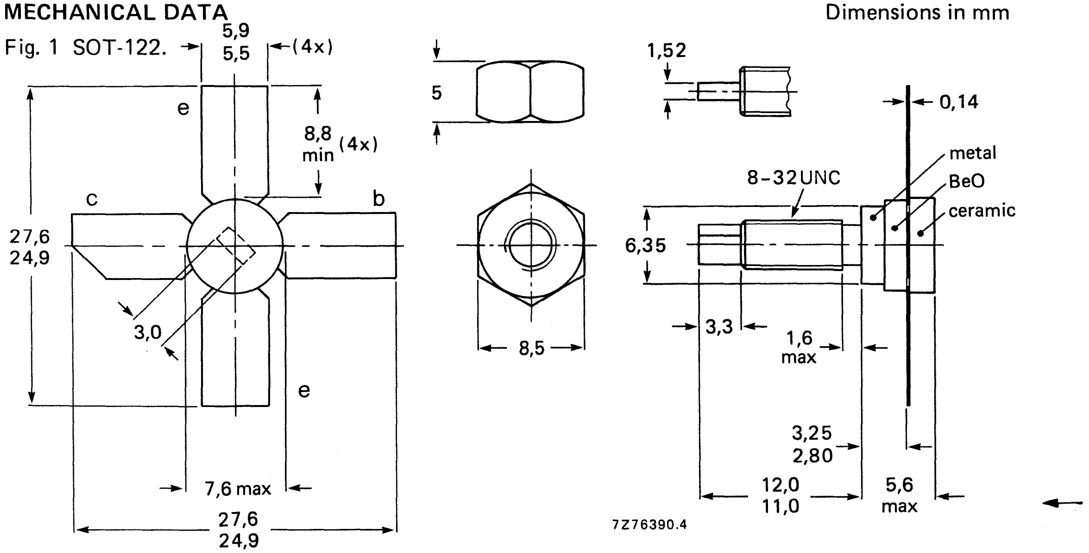
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	150	70	−60	> 0,5	> 11
	860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

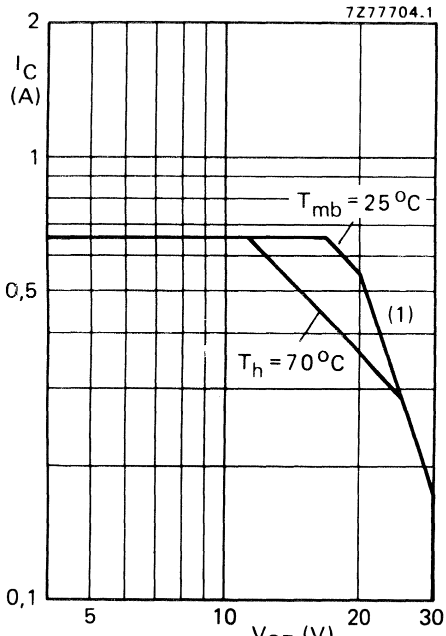
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	650	mA
(peak value); f > 1 MHz	I_{CM}	max.	1000	mA
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	10,8	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

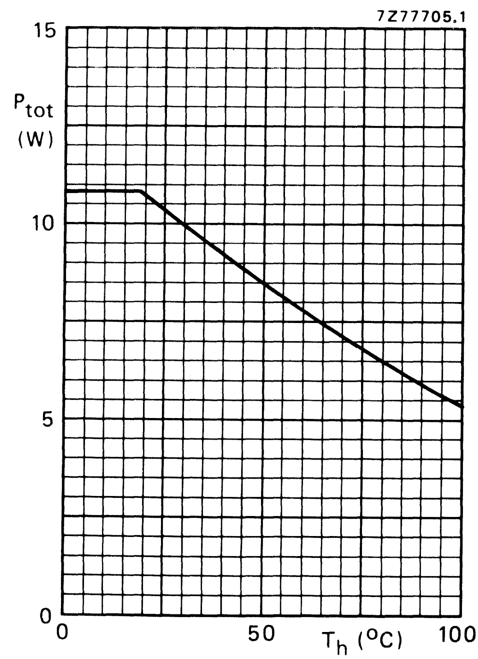


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 3,75 W; T_{mb} = 72,3 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	15,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

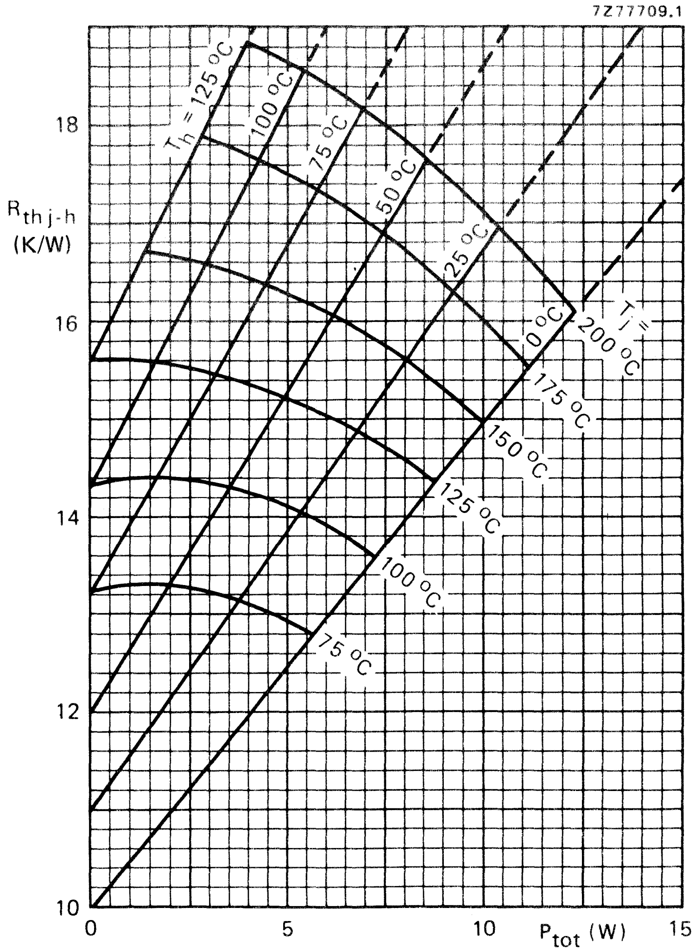


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 150 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	15,6	K/W
	T_j	max.	130	°C
Typical device:	$R_{th\,j\text{-}h}$	typ.	13,5	K/W
	T_j	typ.	120	°C

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 2$ mA	$V_{(BR)CES}$	>	50 V
open base; $I_C = 15$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	0,5 mA
$V_{BE} = 0$; $V_{CE} = 30$ V; $T_j = 175\ ^oC$	I_{CES}	<	1,2 mA
D.C. current gain *			
$I_C = 150$ mA; $V_{CE} = 25$ V	h_{FE}	>	20
		typ.	40
$I_C = 150$ mA; $V_{CE} = 25$ V; $T_j = 175\ ^oC$	h_{FE}	<	120
Collector-emitter saturation voltage *			
$I_C = 300$ mA; $I_B = 30$ mA	V_{CEsat}	typ.	500 mV
Transition frequency at f = 500 MHz **			
$-I_E = 150$ mA; $V_{CB} = 25$ V	f_T	typ.	3,5 GHz
$-I_E = 300$ mA; $V_{CB} = 25$ V	f_T	typ.	3,4 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 25$ V	C_c	typ.	3,7 pF
Feedback capacitance at f = 1 MHz			
$I_C = 10$ mA; $V_{CE} = 25$ V	C_{re}	typ.	1,9 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

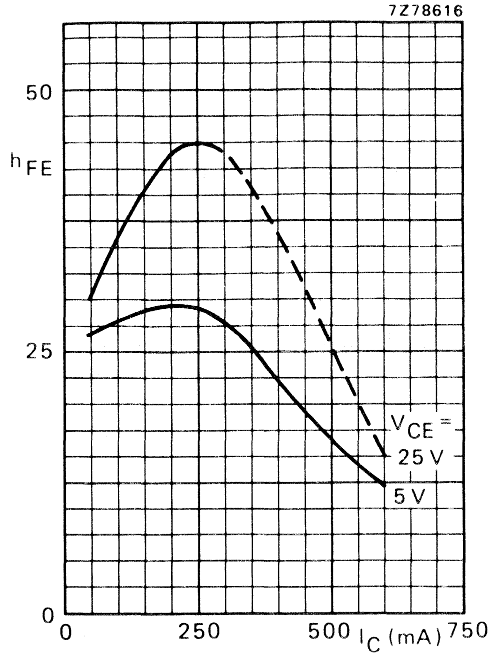


Fig. 5 Typical values; T_j = 25 °C.

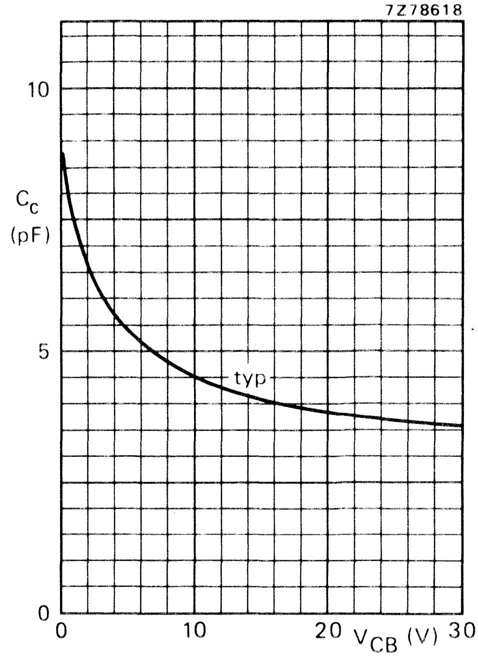


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

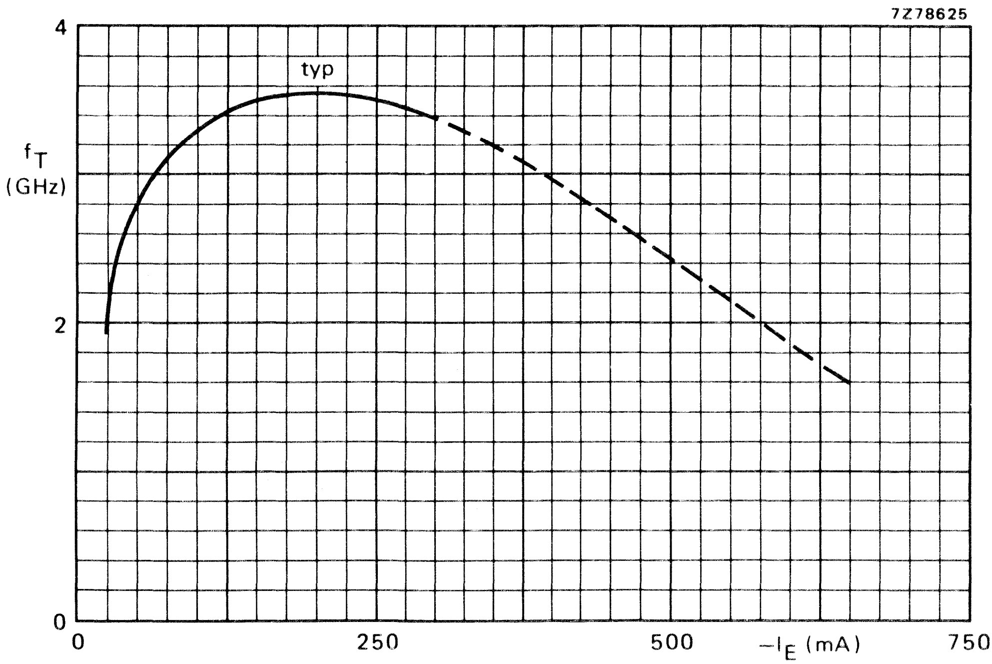


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	150	70	−60	> 0,5	> 11
860	25	150	70	−60	typ. 0,58	typ. 12,2
860	25	150	25	−60	typ. 0,63	typ. 12,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

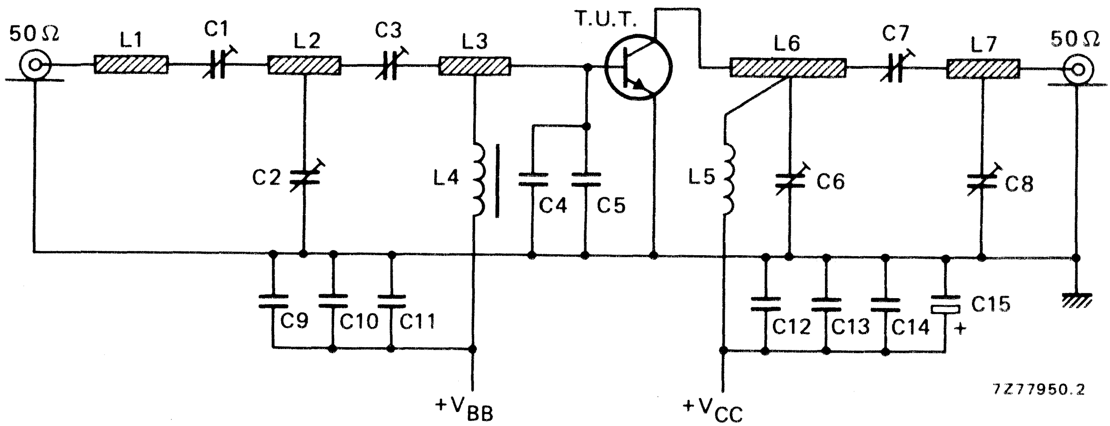


Fig. 8 Test circuit at f_{vision} = 860 MHz.

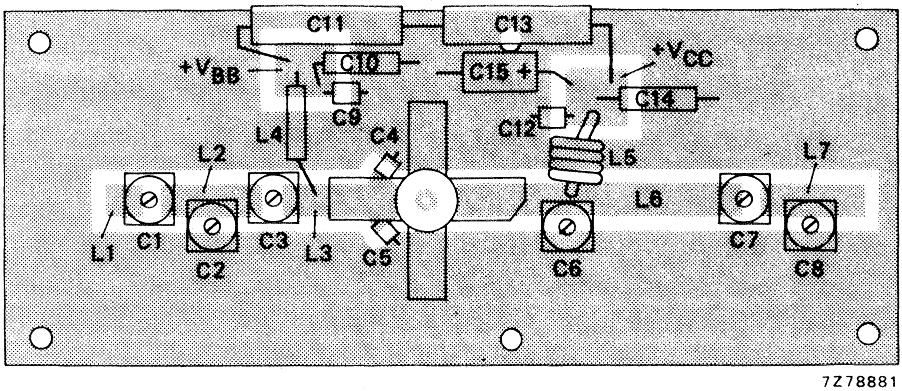
List of components:

C1 = C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 17 mm and 45 mm respectively from transistor edge
C3 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C4 = C5 = 3 pF multilayer chip capacitor (ATC 100A-3RO-C-PX-50)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 µF/40 V solid aluminium electrolytic capacitor

L1 = stripline (5,0 mm x 4,5 mm)
L2 = stripline (13,2 mm x 4,5 mm)
L3 = stripline (15,0 mm x 4,5 mm)
L4 = micro choke 0,47 µH (cat. no. 4322 057 04770)
L5 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm
L6 = stripline (37,0 mm x 4,5 mm)
L7 = stripline (13,5 mm x 4,5 mm)

L1; L2; L3; L6 and L7 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

Component layout and printed-circuit board for 860 MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.



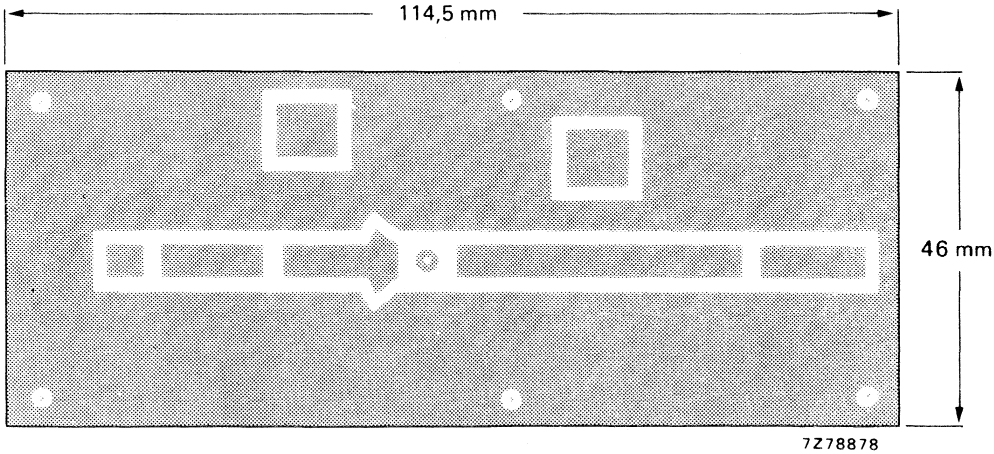
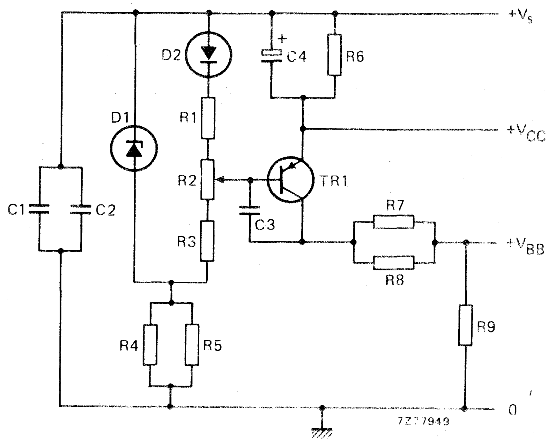


Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.



List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 12 Ω carbon resistor (0,5 W)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)
D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A amplifier at f_{vision} = 860 MHz.

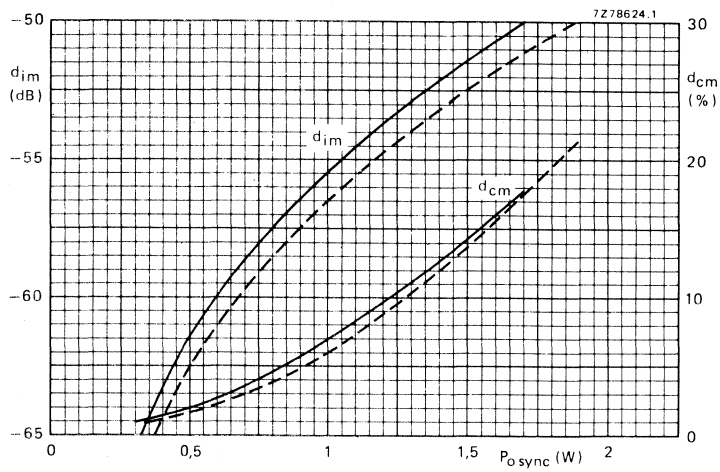


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 150 mA; f_{vision} = 860 MHz; — — — T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

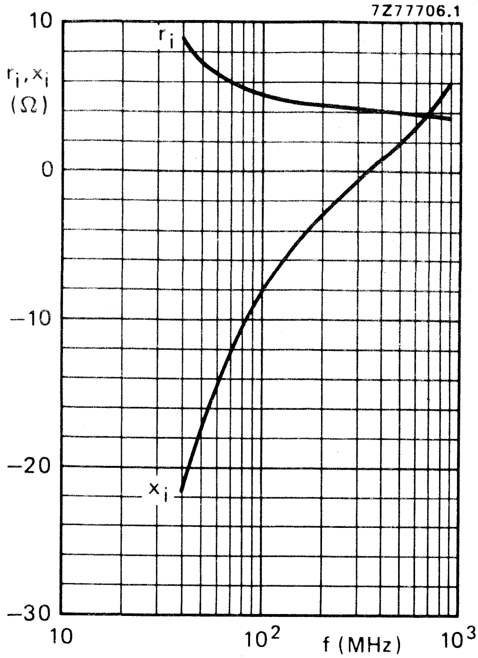


Fig. 12 Input impedance (series components).

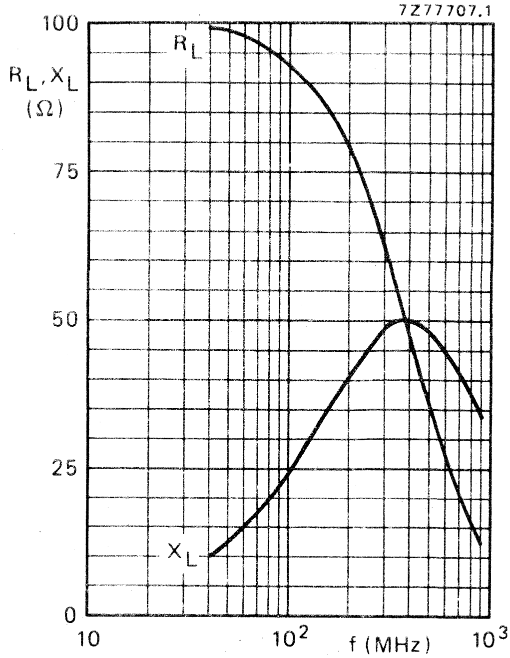


Fig. 13 Load impedance (series components).

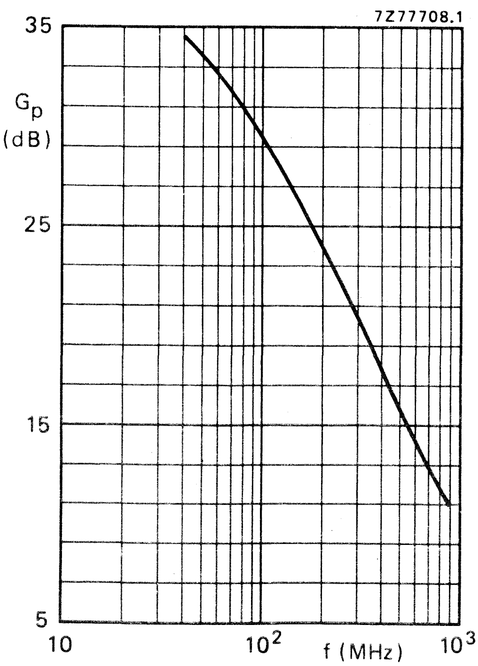


Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 25 V; I_C = 150 mA;
T_h = 70 °C.

Ruggedness

The BLW32 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 150 mA;
T_h = 70 °C and P_L = 1 W.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

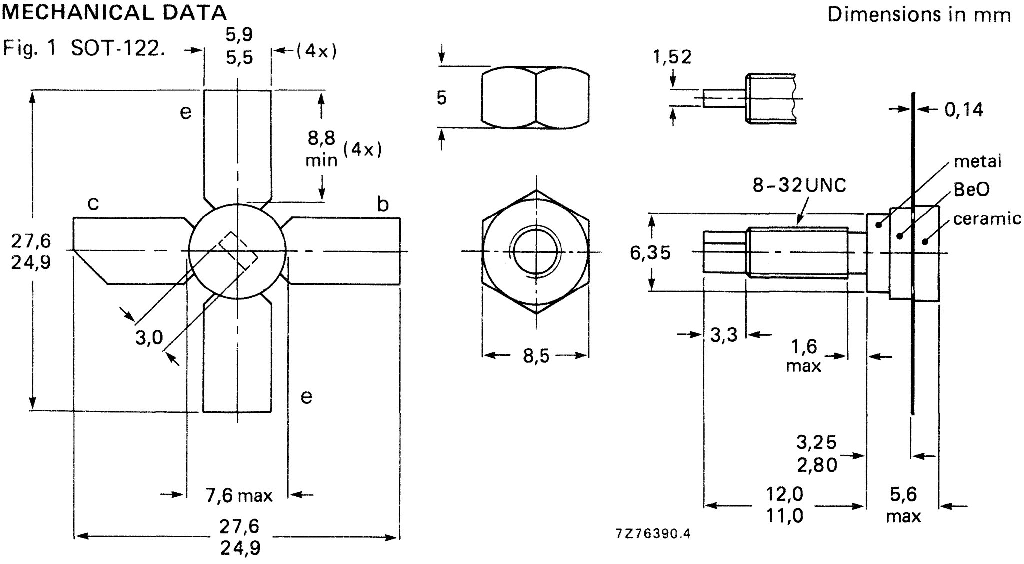
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	300	70	−60	> 1,0	> 10,0
	860	25	300	25	−60	typ. 1,15	typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

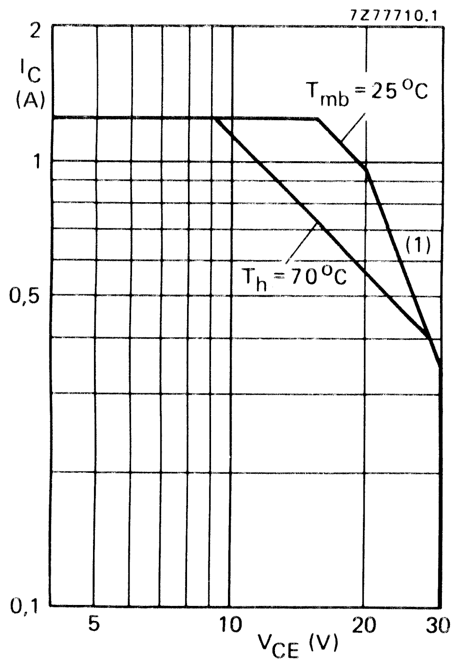
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	1,25	A
(peak value); f > 1 MHz	I_{CM}	max.	1,9	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	19,3	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

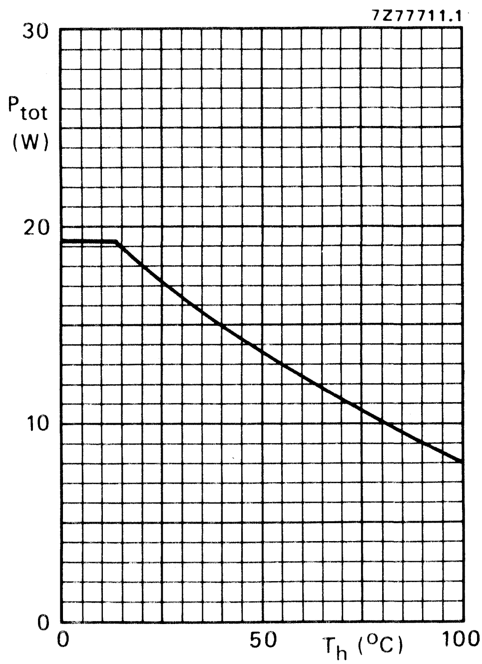


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 7,5 W; T_{mb} = 74,5 °C; i.e. T_h = 70 °C)	$R_{th\ j\text{-}mb}$	=	10,1	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

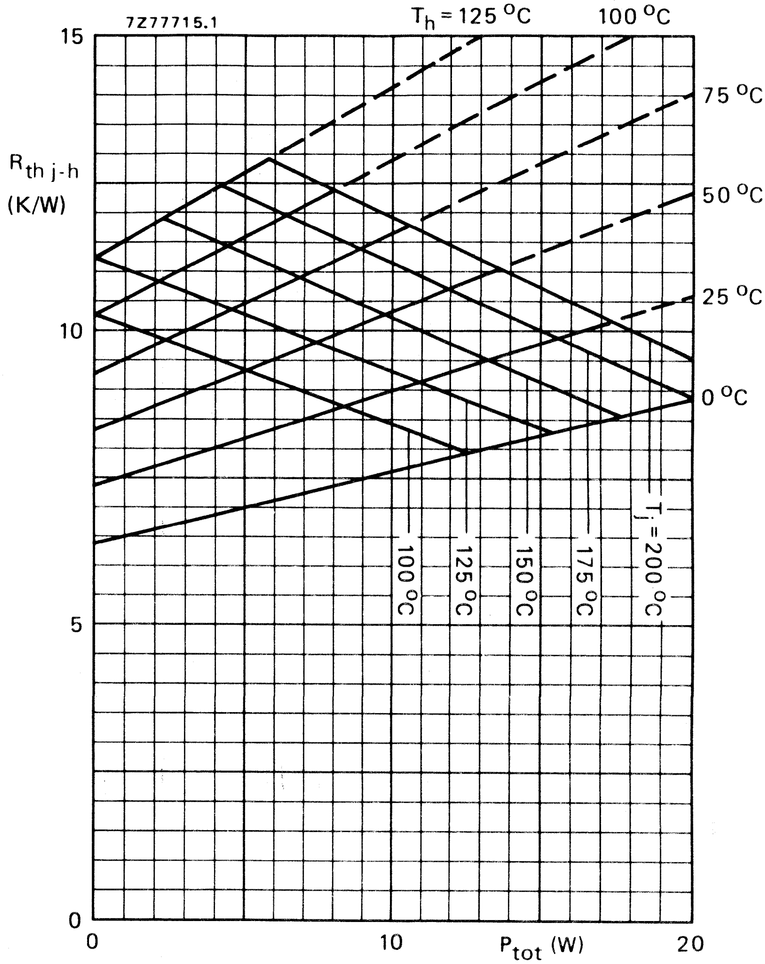


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	10,7	K/W
	T_j	max.	150	°C
Typical device:	$R_{th\ j\text{-}h}$	typ.	8,25	K/W
	T_j	typ.	132	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 4 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 30 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	1,0 mA
V_{BE} = 0; V_{CE} = 30 V; T_j = 175 °C	I_{CES}	<	2,5 mA
D.C. current gain			
I_C = 300 mA; V_{CE} = 25 V	h_{FE}	>	20
		typ.	40
I_C = 300 mA; V_{CE} = 25 V; T_j = 175 °C	h_{FE}	<	120
Collector-emitter saturation voltage *			
I_C = 600 mA; I_B = 60 mA	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E$ = 300 mA; V_{CB} = 25 V	f_T	typ.	3,4 GHz
$-I_E$ = 600 mA; V_{CB} = 25 V	f_T	typ.	3,1 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	6,6 pF
Feedback capacitance at f = 1 MHz			
I_C = 20 mA; V_{CE} = 25 V	C_{re}	typ.	3,5 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

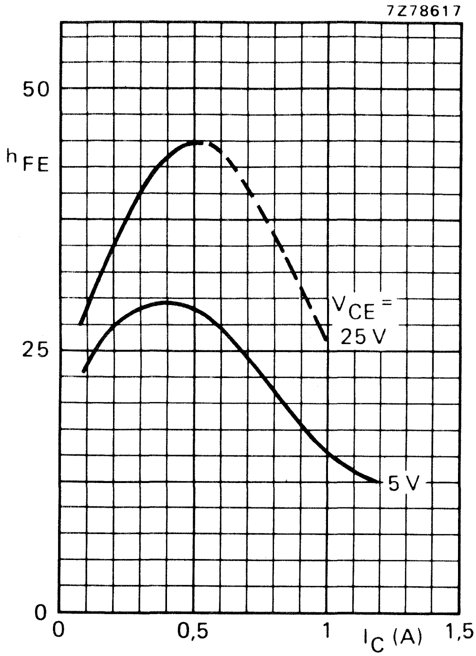


Fig. 5 Typical values; T_j = 25 °C.

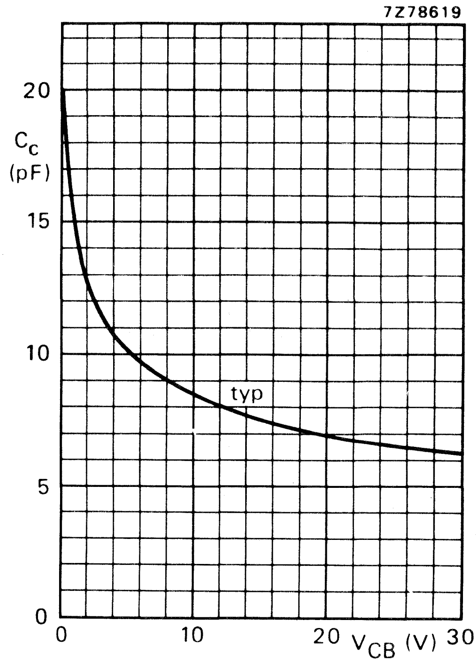


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

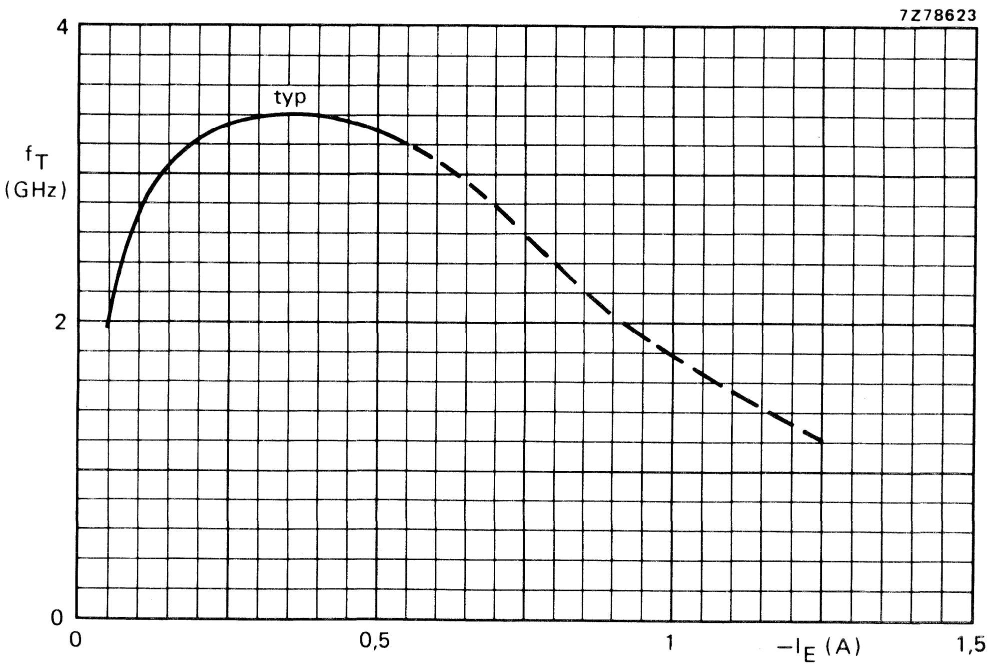


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	300	70	−60	> 1,0	> 10
860	25	300	70	−60	typ. 1,07	typ. 10,5
860	25	300	25	−60	typ. 1,15	typ. 10,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

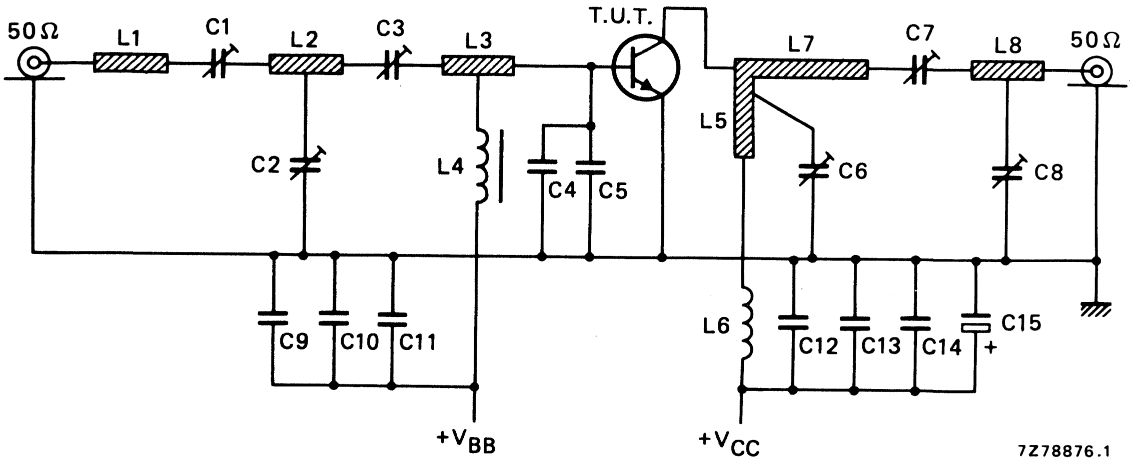


Fig. 8 Test circuit at f_{vision} = 860 MHz.

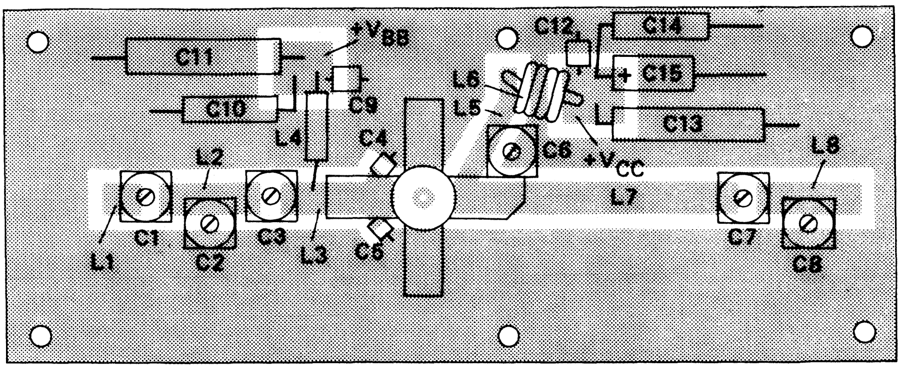
List of components:

C1 = C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C2 = C6 = C8 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 24 mm, 8 mm and 46 mm respectively from transistor edge
C4 = C5 = 4,3 pF multilayer chip capacitor (ATC 100A-4R3-C-PX-50)
C7 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C9 = C12 = 1 nF chip capacitor
C10 = 100 nF polyester capacitor
C11 = C13 = 470 nF polyester capacitor
C14 = 10 nF polyester capacitor
C15 = 3,3 μF/40 F solid aluminium electrolytic capacitor

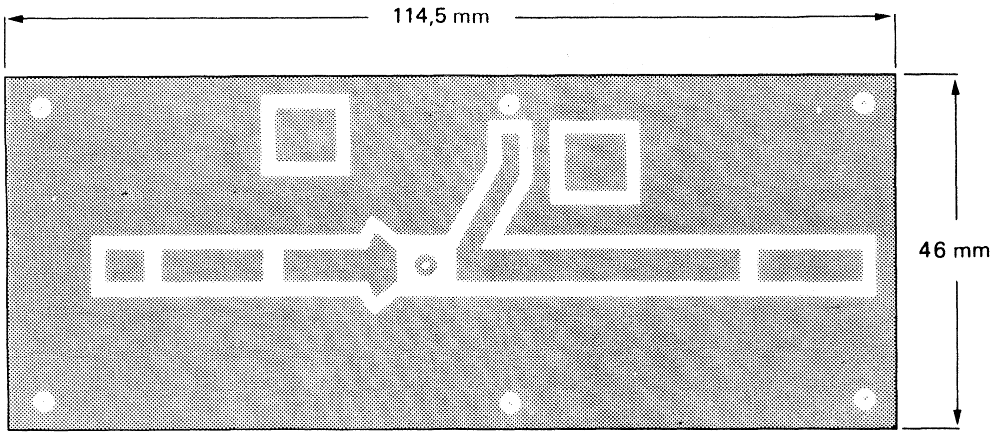
L1 = stripline (5,2 mm x 4,5 mm)
L2 = stripline (13,2 mm x 4,5 mm)
L3 = stripline (15,0 mm x 4,5 mm)
L4 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L5 = stripline (see Fig. 9 printed-circuit board layout)
L6 = 4 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,5 mm; leads 2 x 4 mm
L7 = stripline (37,0 mm x 4,5 mm)
L8 = stripline (13,5 mm x 4,5 mm)

L1; L2; L3; L5; L7 and L8 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

For bias circuit see Fig. 10.



7Z78880



7Z78879

Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

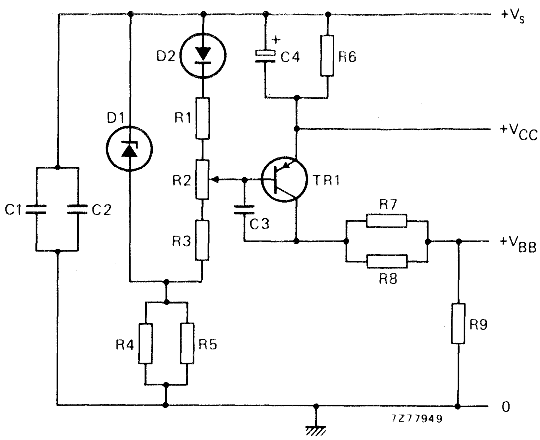


Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 6 Ω; parallel connection of 2 x 12 Ω carbon resistors (0,5 W each)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

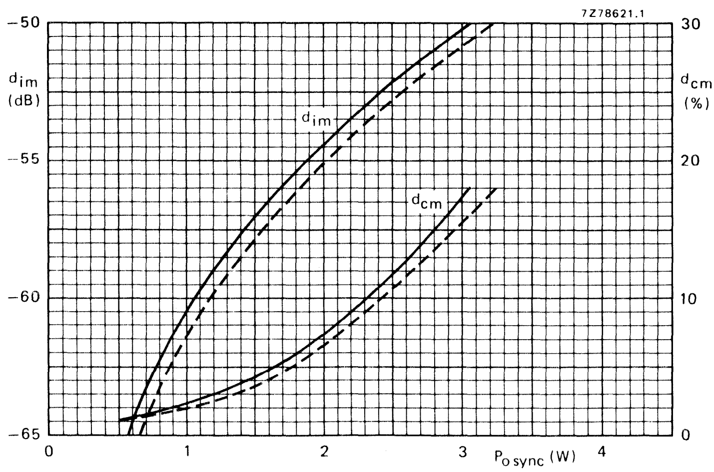


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 300 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

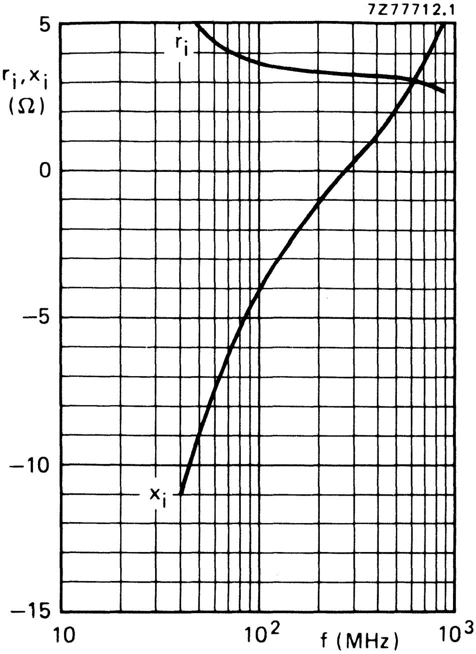


Fig. 12 Input impedance (series components).

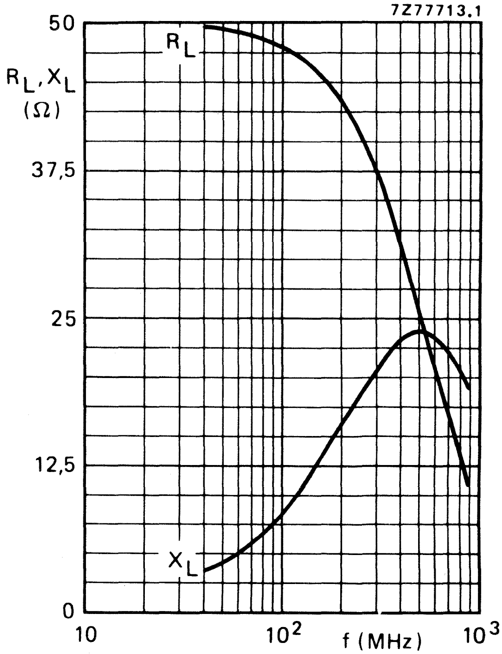


Fig. 13 Load impedance (series components).

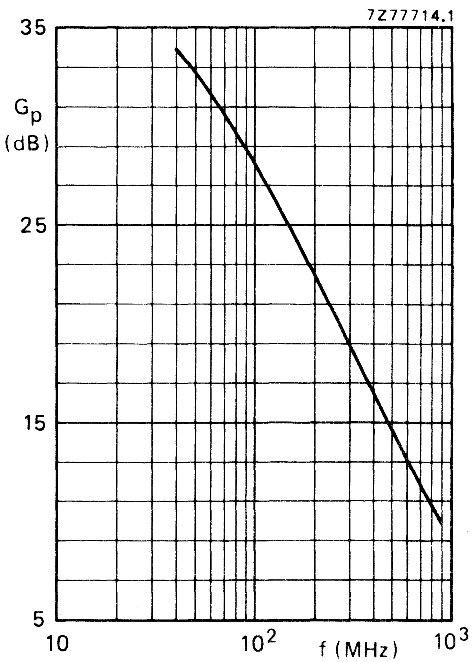


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Ruggedness

The BLW33 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C and P_L = 2 W.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in **linear u.h.f. amplifiers** for television transmitters and transposers. The **excellent d.c. dissipation properties** for class-A operation are obtained by means of diffused emitter ballasting resistors and a multi-base structure, providing an optimum temperature profile on the crystal area. The combination of optimum thermal design and the application of **gold sandwich metallization** realizes excellent reliability properties.

The transistor has a ¼" capstan envelope with ceramic cap.

QUICK REFERENCE DATA

R.F. performance

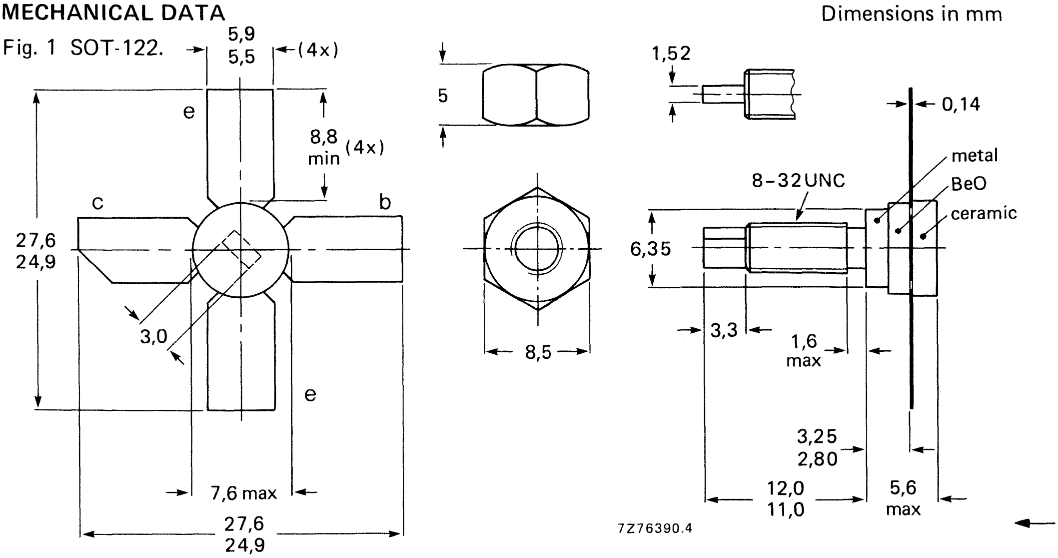
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	600	70	−60	> 1,8	> 9
	860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

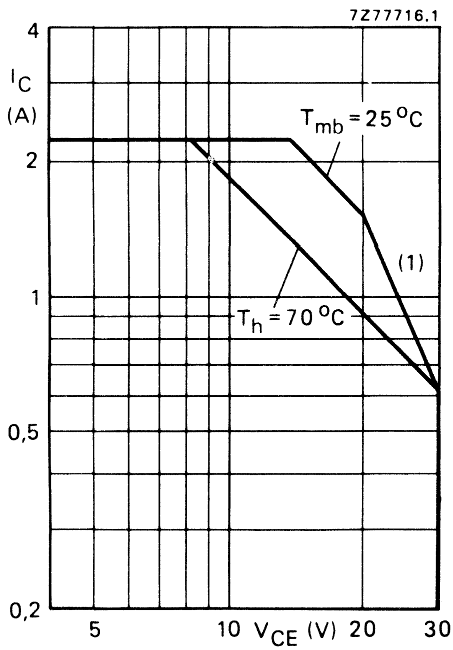
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C	max.	2,25	A
(peak value); f > 1 MHz	I_{CM}	max.	3,5	A
Total power dissipation at $T_{mb} = 25\ ^oC$	P_{tot}	max.	31	W
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

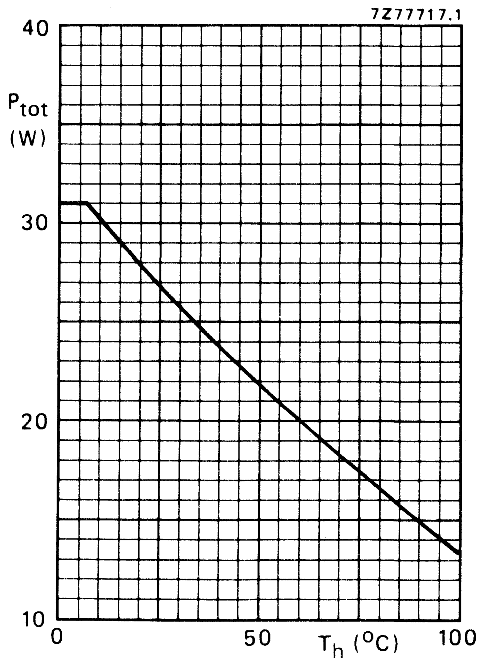


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base (dissipation = 15 W; $T_{mb} = 79\ ^oC$; i.e. $T_h = 70\ ^oC$)	$R_{th\ j\text{-}mb}$	=	6,2	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

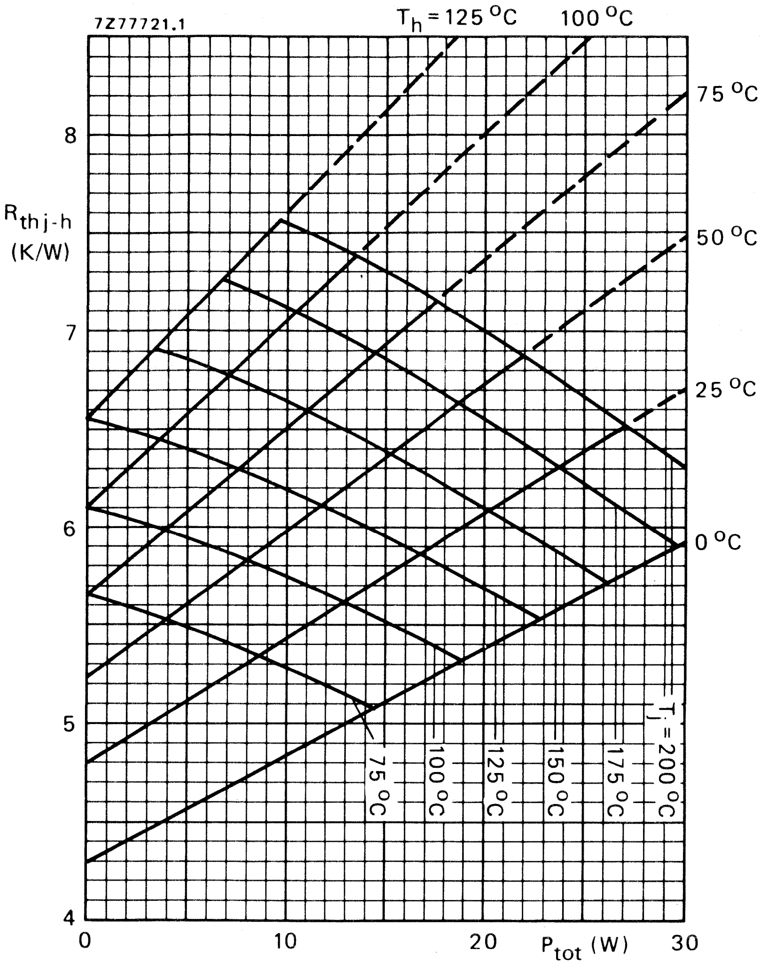


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max. 6,75	K/W
	T_j	max. 170	°C
Typical device:	$R_{th\,j\text{-}h}$	typ. 5,45	K/W
	T_j	typ. 152	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 8 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 60 mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage			
open collector; I_E = 4 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	2,0 mA
V_{BE} = 0; V_{CE} = 30 V; T_j = 175 °C	I_{CES}	<	5,0 mA
D.C. current gain			
I_C = 600 mA; V_{CE} = 25 V	h_{FE}	>	20
		typ.	40
I_C = 600 mA; V_{CE} = 25 V; T_j = 175 °C	h_{FE}	<	120
Collector-emitter saturation voltage *			
I_C = 1,2 A; I_B = 0,12 A	V_{CEsat}	typ.	450 mV
Transition frequency at f = 500 MHz **			
$-I_E$ = 0,6 A; V_{CB} = 25 V	f_T	typ.	3,3 GHz
$-I_E$ = 1,2 A; V_{CB} = 25 V	f_T	typ.	3,0 GHz
Collector capacitance at f = 1 MHz			
I_E = I_e = 0; V_{CB} = 25 V	C_c	typ.	13,5 pF
Feedback capacitance at f = 1 MHz			
I_C = 40 mA; V_{CE} = 25 V	C_{re}	typ.	8,4 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

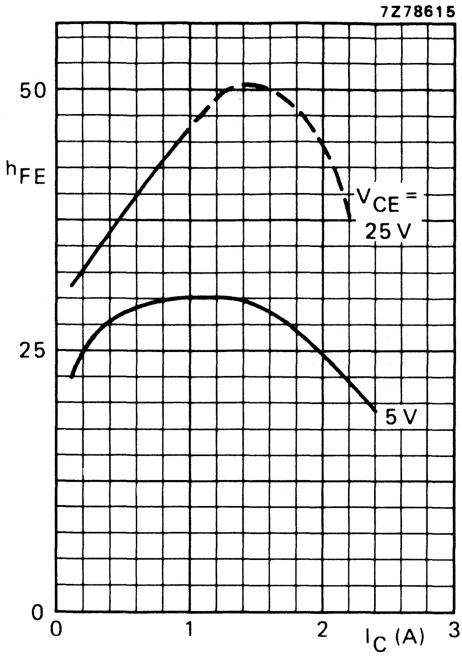


Fig. 5 Typical values; T_j = 25 °C.

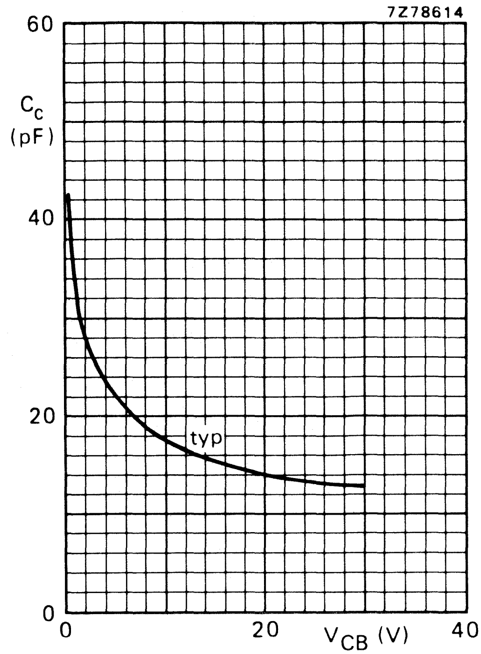


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

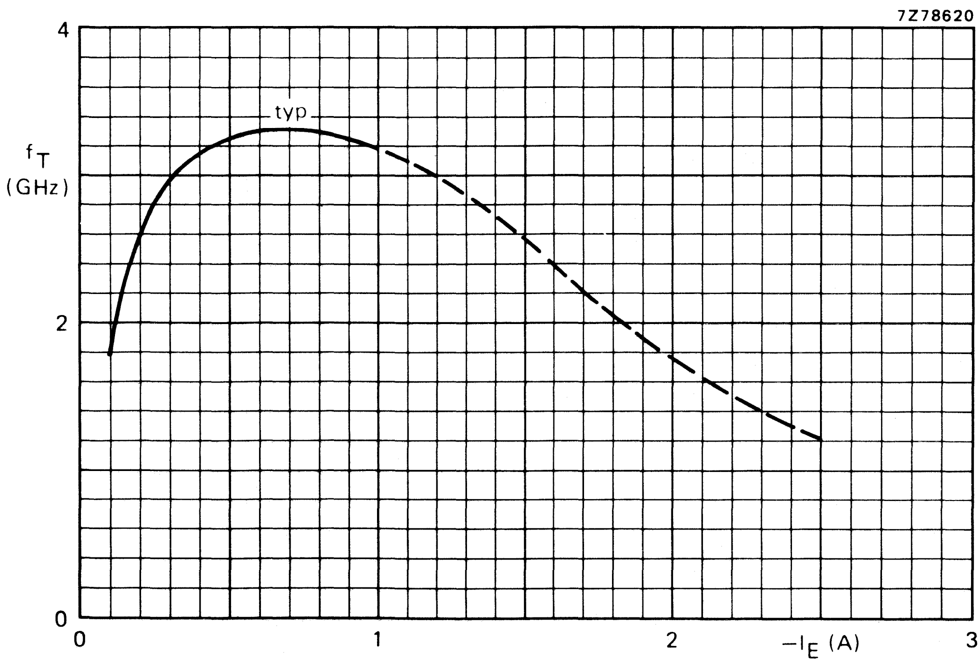


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C

APPLICATION INFORMATION

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB) *	$P_{o\,sync}$ (W) *	G_p (dB)
860	25	600	70	−60	> 1,8	> 9
860	25	600	70	−60	typ. 1,9	typ. 10,2
860	25	600	25	−60	typ. 2,15	typ. 10,2

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

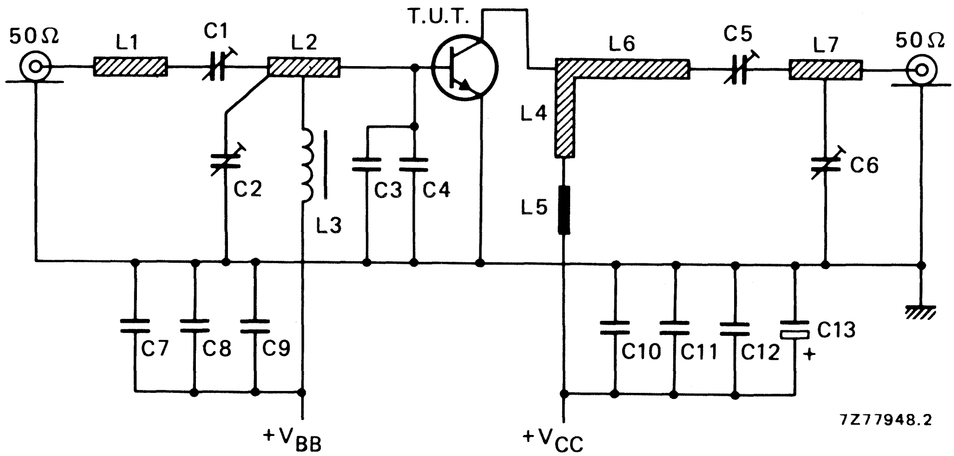


Fig. 8 Test circuit at f_{vision} = 860 MHz.

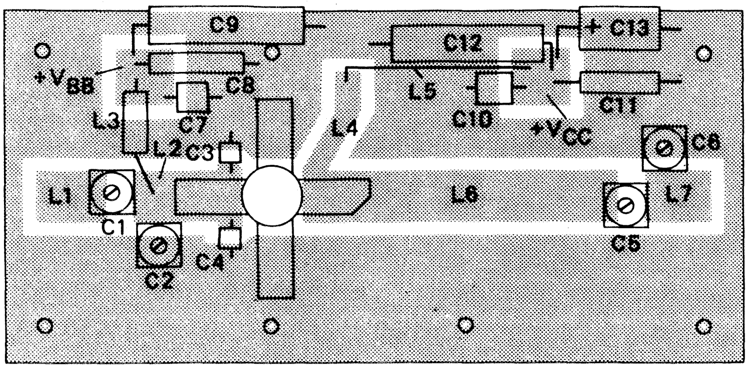
List of components:

C1 = C5 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C6 = 1 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001) placed 13,5 mm and 46 mm respectively from transistor edge
C3 = C4 = 2 pF multilayer chip capacitor (ATC 100A-2RO-C-PX-50)
C7 = C10 = 1 nF chip capacitor
C8 = 100 nF polyester capacitor
C9 = C12 = 470 nF polyester capacitor
C11 = 10 nF polyester capacitor
C13 = 3,3 μF/40 V solid aluminium electrolytic capacitor

L1 = stripline (9,2 mm x 7,0 mm)
L2 = stripline (14,2 mm x 7,0 mm)
L3 = micro choke 0,47 μH (cat. no. 4322 057 04770)
L4 = stripline (see Fig. 9 printed-circuit board layout)
L5 = 34 mm straight Cu wire (1,0 mm); height above print 3,3 mm
L6 = stripline (41,0 mm x 7,0 mm)
L7 = stripline (8,7 mm x 7,0 mm)

L1; L2; L4; L6 and L7 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

Component layout and printed-circuit board for 860 MHz test circuit are shown in Fig. 9. For bias circuit see Fig. 10.



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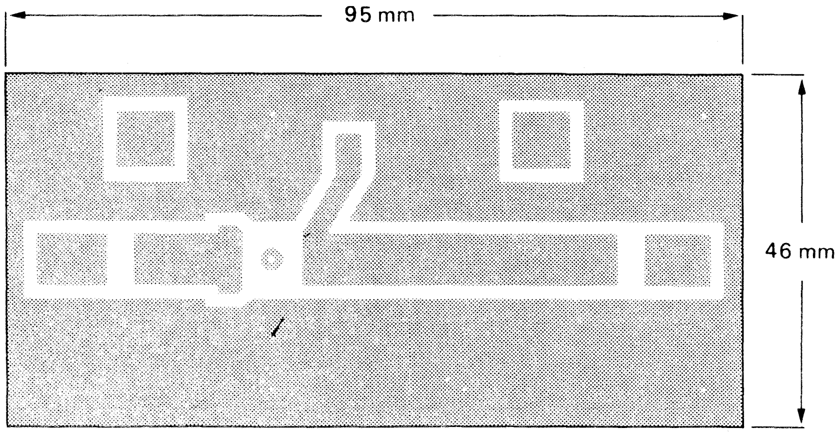

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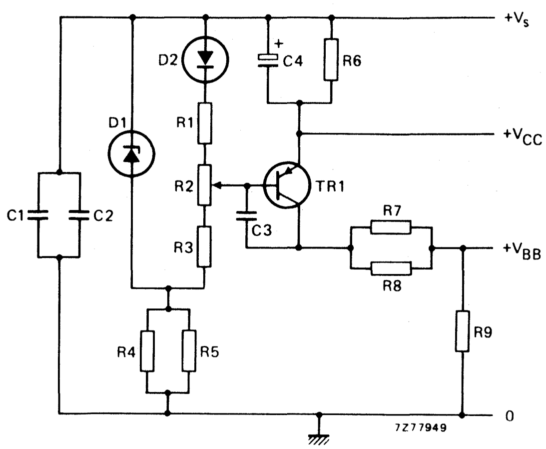
Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

The circuit and the components are situated on one sode of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.



List of components:

C1 = 100 pF ceramic capacitor
C2 = C3 = 100 nF polyester capacitor
C4 = 10 μF/25 V solid aluminium electrolytic capacitor
R1 = 150 Ω carbon resistor (0,25 W)
R2 = 100 Ω preset potentiometer (0,1 W)
R3 = 82 Ω carbon resistor (0,25 W)
R4 = R5 = 2,2 kΩ carbon resistor (0,25 W)
R6 = 2,8 Ω; parallel connection of 2 x 5,6 Ω carbon resistors (0,5 W each)
R7 = R8 = 820 Ω carbon resistor (0,25 W)
R9 = 33 Ω carbon resistor (0,25 W)

D1 = BZY88-C3V3
D2 = BY206
TR1 = BD136

Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

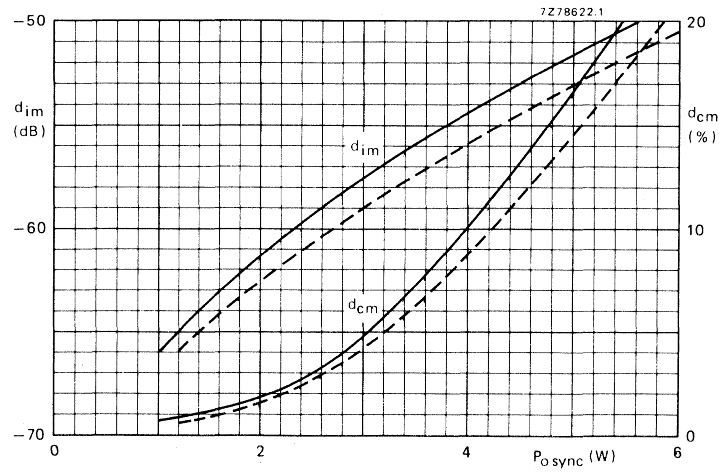


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 600 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

Information for wideband application from 470 to 860 MHz available on request.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ⩽ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

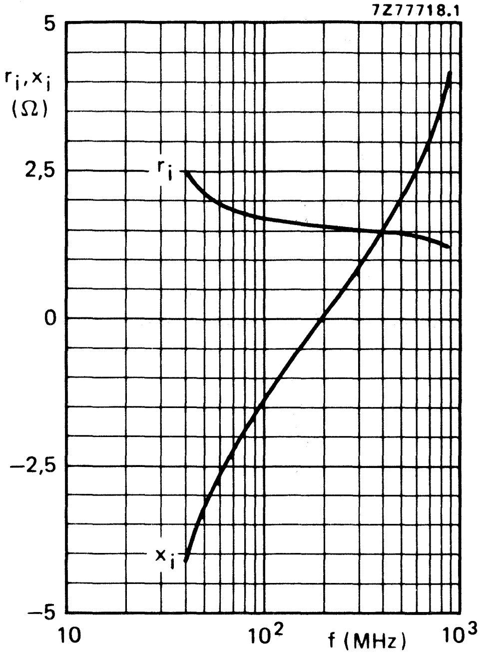


Fig. 12 Input impedance (series components).

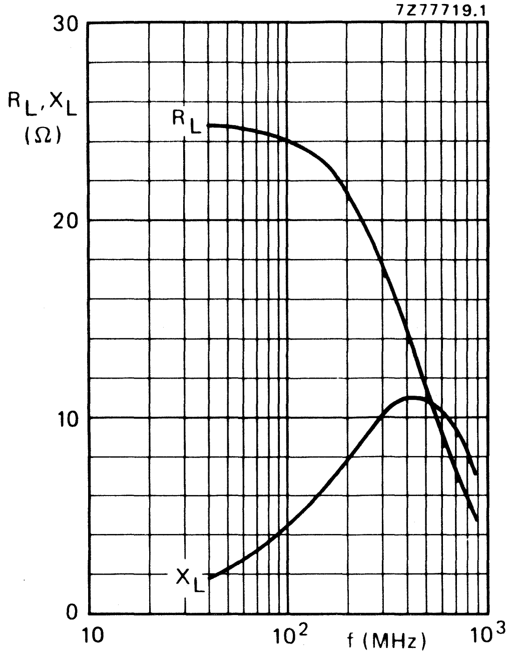


Fig. 13 Load impedance (series components).

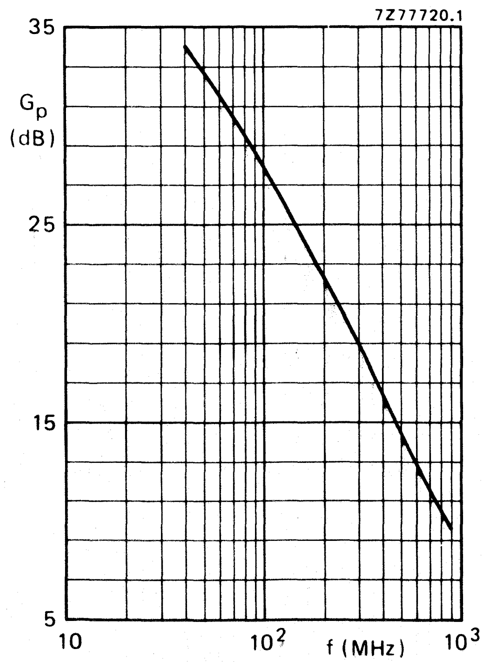


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C.

Ruggedness

The BLW34 is capable of withstanding a load mismatch (VSWR = 50 through all phases) under the following conditions:

f = 860 MHz; V_{CE} = 25 V; I_C = 600 mA; T_h = 70 °C and P_L = 4 W.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in class-A, AB and B operated, industrial and military transmitters in the h.f. and v.h.f. band. Resistance stabilization provides protection against device damage at severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance

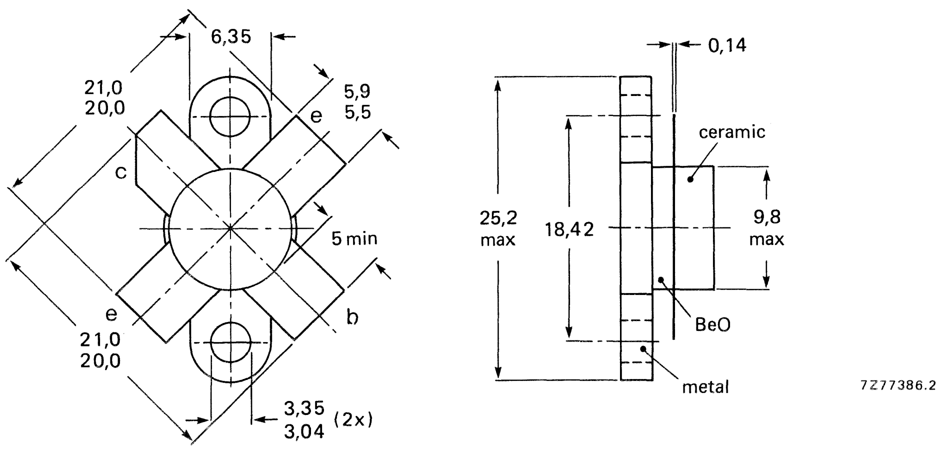
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< −40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45*	1,45	50	typ. −30	25

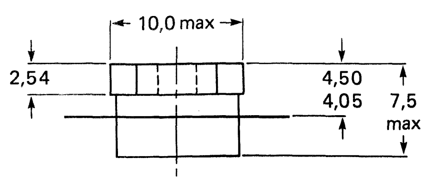
* At 65W P.E.P.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	2,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	7,5	A
D.C. and r.f. (f > 1 MHz) power dissipation; T_{mb} = 25 °C	P_{tot}; P_{rf}	max.	94	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

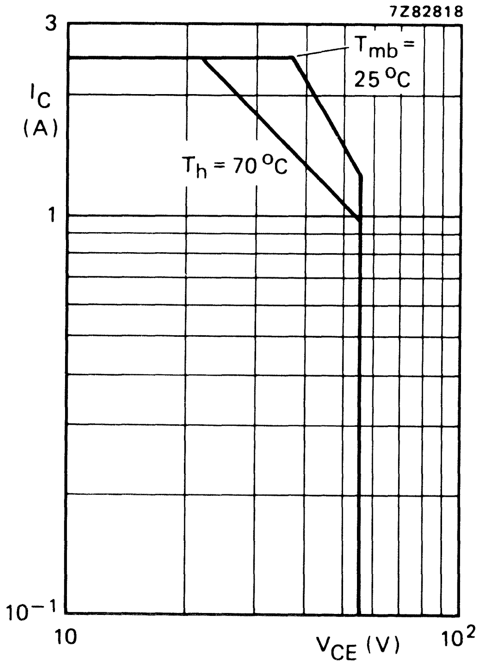


Fig. 2 D.C. SOAR.

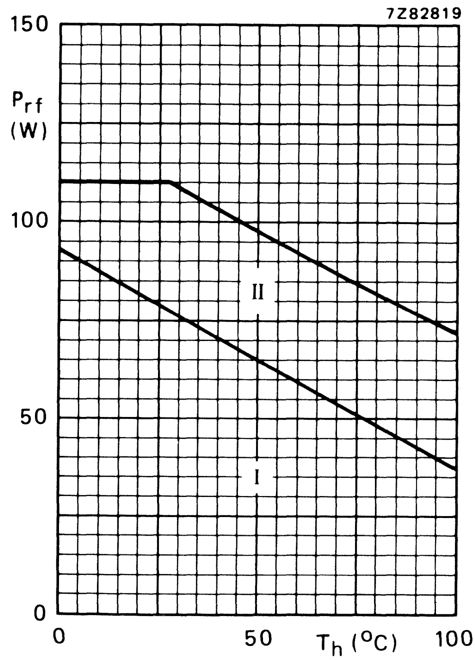


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 54 W; T_{mb} = 86 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	2,1 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	110	V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	55	V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 55$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8	mJ
D.C. current gain* $I_C = 1,2$ A; $V_{CE} = 5$ V	h_{FE}	typ.	25	
			15 to 100	
D.C. current gain ratio of matched devices* $I_C = 1,2$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage* $I_C = 3,0$ A; $I_B = 0,6$ A	V_{CEsat}	typ.	1,2	V
Transition frequency at f = 100 MHz* $-I_E = 1,2$ A; $V_{CB} = 45$ V	f_T	typ.	490	MHz
$-I_E = 4,0$ A; $V_{CB} = 45$ V	f_T	typ.	540	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 45$ V	C_c	typ.	53	pF
Feedback capacitance at f = 1 MHz $I_C = 50$ mA; $V_{CE} = 45$ V	C_{re}	typ.	35	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

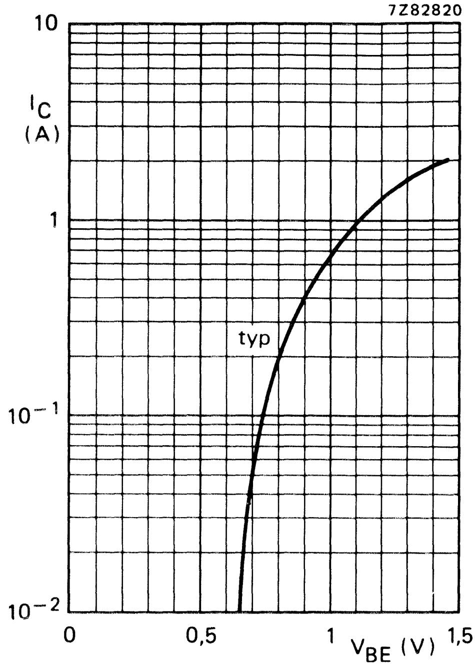


Fig. 4 V_{CE} = 40 V; T_{mb} = 25 °C.

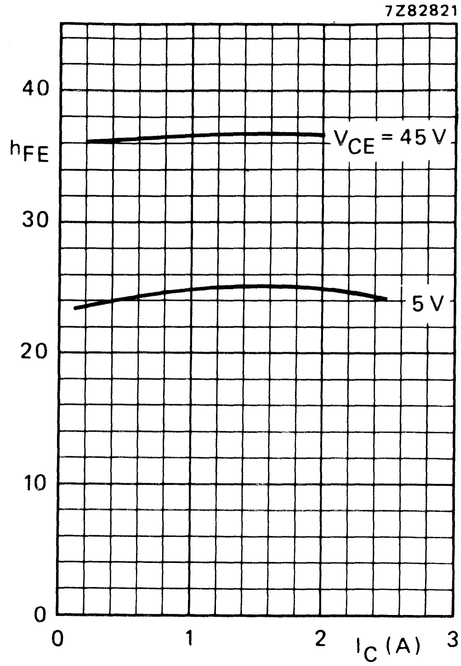


Fig. 5 Typical values; T_j = 25 °C.

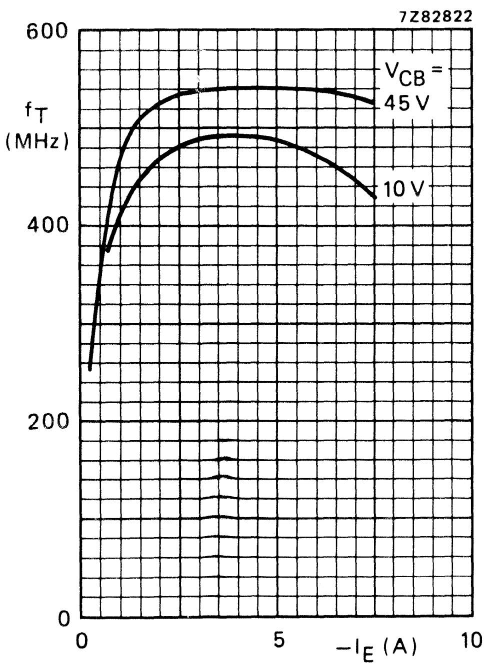


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

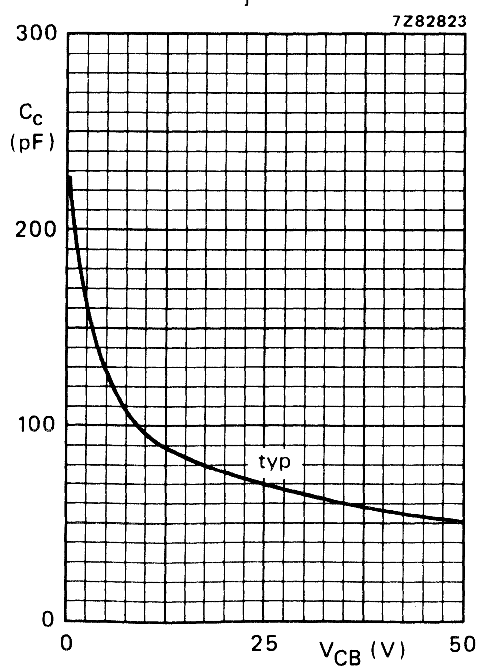


Fig. 7 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3* dB	d_5* dB	T_h °C
> 16 (P.E.P.)	> 19,5	1,2	−40	< −40	70
typ. 17 (P.E.P.)	typ. 20,5	1,2	−40	< −40	70

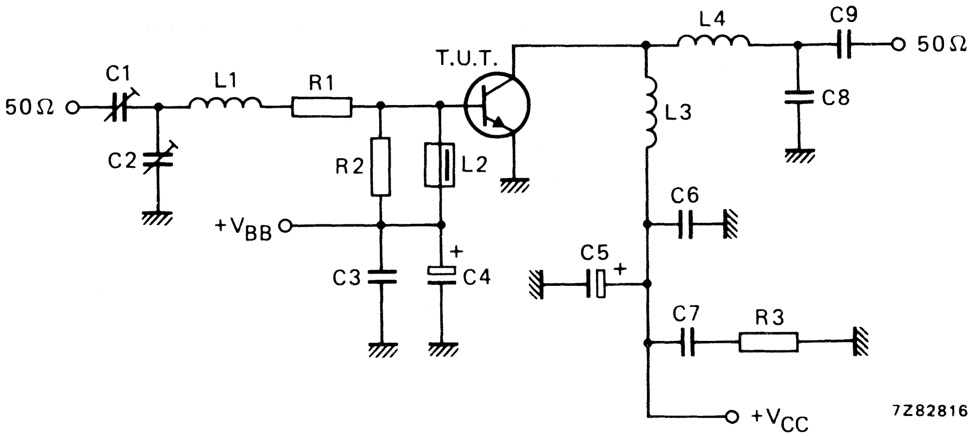


Fig. 8 Test circuit; s.s.b. class-A.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 4,7 μF/16 V electrolytic capacitor
C5 = 1 μF/75 V solid tantalum capacitor
C6 = C7 = 47 nF polyester capacitor (100 V)
C8 = 68 pF ceramic capacitor (500 V)
C9 = 3,9 nF ceramic capacitor

L1 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 1,05 μH; 15 turns enamelled Cu wire (1,0 mm); int. dia. 10,0 mm; length 17,4 mm; leads 2 x 5 mm
L4 = 162 nH; 6 turns enamelled Cu wire (1,0 mm); int. dia. 7,0 mm; length 11,6 mm; leads 2 x 5 mm

R1 = 1,6 Ω; parallel connection of 3 x 4,7 Ω carbon resistors (± 5%; 0,125 W)
R2 = 47 Ω carbon resistor (± 5%; 0,25 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,25 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

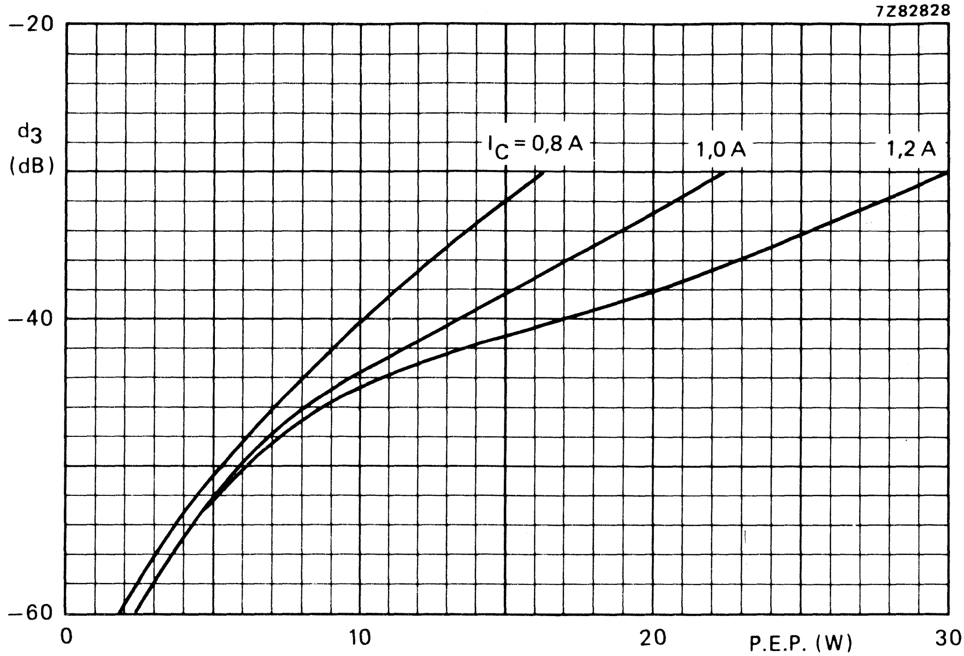


Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 65 W P.E.P.	I_C (A) at 65 W P.E.P.	d_3* dB	d_5* dB	$I_{C(ZS)}$ mA	T_h °C
10 to 65 (P.E.P.)	typ. 18	typ. 45	typ. 1,45	typ. −30	< −30	50	25

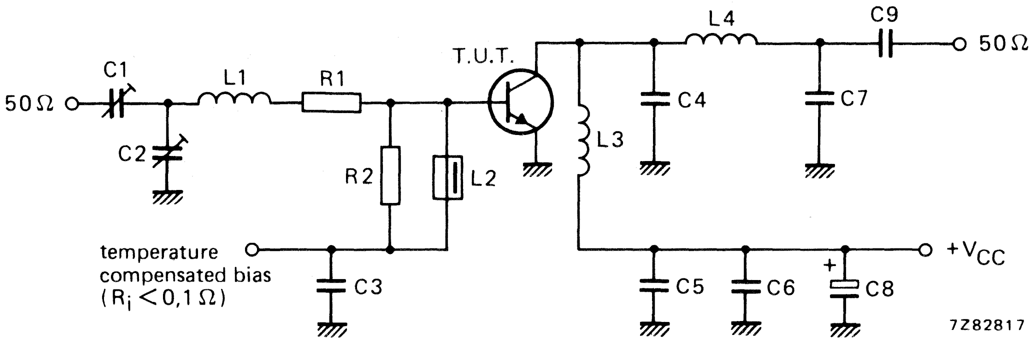


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 120 pF ceramic capacitor (500 V)
C7 = 150 pF ceramic capacitor (500 V)
C8 = 47 μF/63 V electrolytic capacitor
C9 = 3,9 nF ceramic capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 9 turns enamelled Cu wire (1,0 mm); int. dia. 10 mm; length 14,5 mm; leads 2 x 5 mm
L4 = 6 turns enamelled Cu wire (1,0 mm); int. dia. 6,5 mm; length 11,0 mm; leads 2 x 5 mm

R1 = 2,4 Ω; parallel connection of 2 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

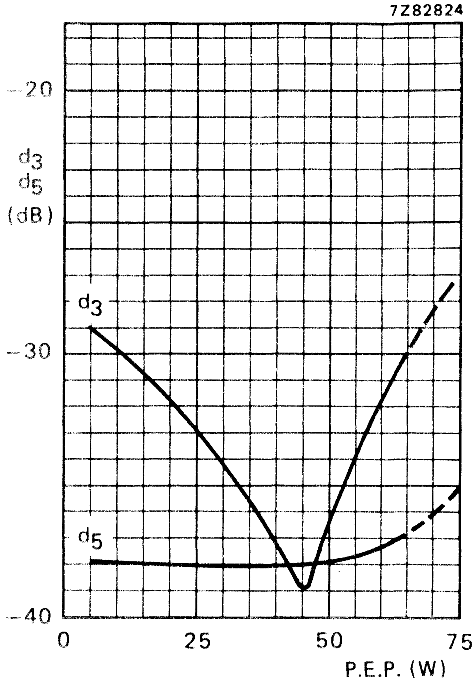


Fig. 11 Intermodulation distortion as a function of output power*.

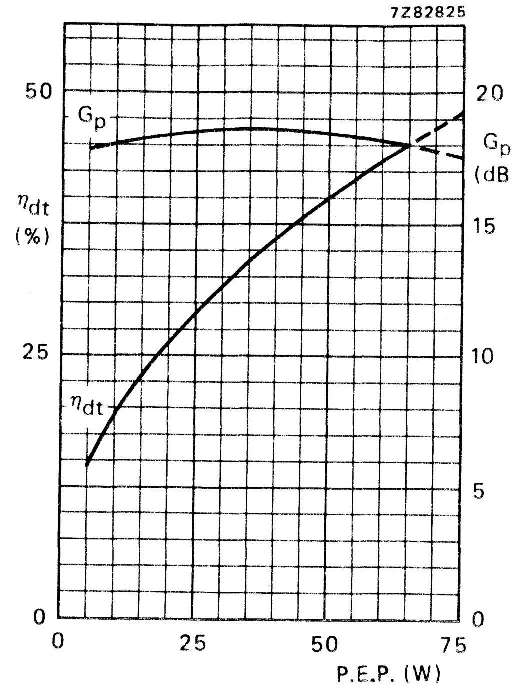


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 11 and 12:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness in s.s.b. operation

The BLW50F is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 45 W (P.E.P.) under the following conditions:
V_{CE} = 50 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 K/W.

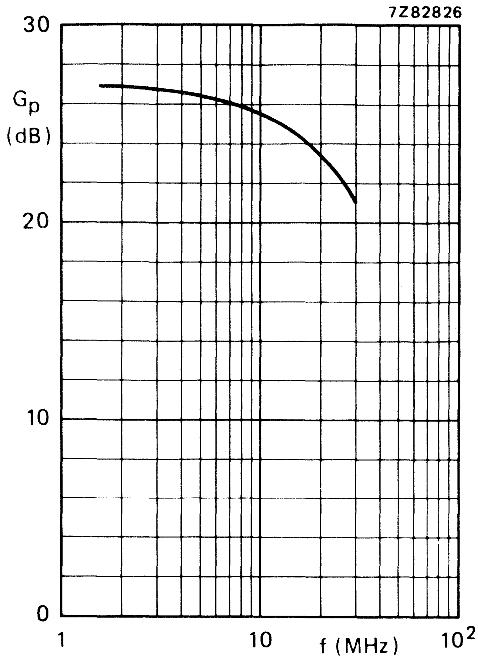


Fig. 13 Power gain as a function of frequency.

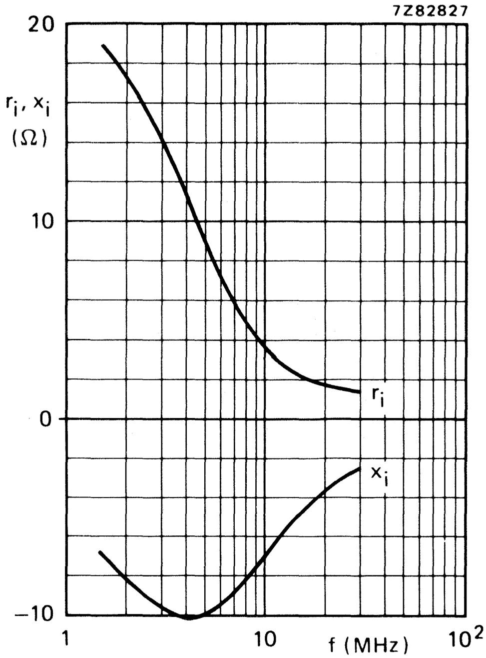


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions for Figs 13 and 14:

V_{CE} = 50 V; $I_{C(ZS)}$ = 50 mA; P_L = 60 W; T_h = 25 °C; Z_L = 16 Ω.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. Matched h_{FE} groups are available on request.

It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

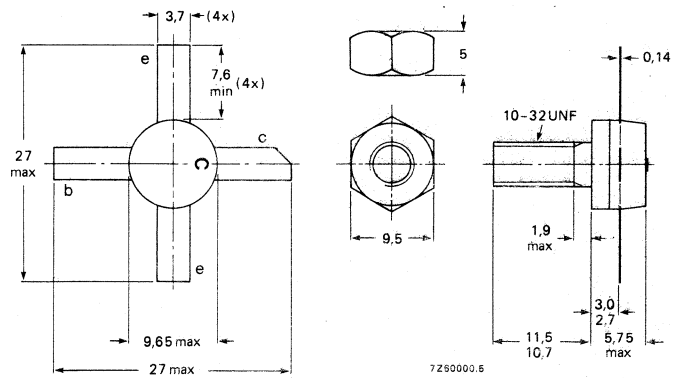
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 5,0**	**> 75**	**1,2 + j1,4**	**2,6 − j1,2**	**—**
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	—	—	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



When locking is required an adhesive is preferred instead of a lock washer.

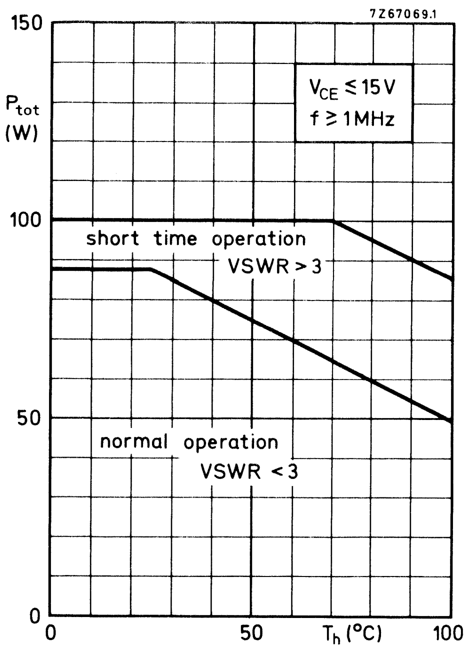
Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

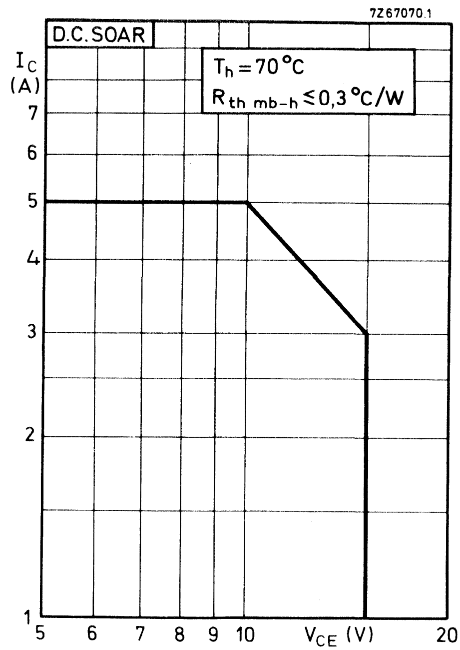
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value); f ≥ 1MHz	I_{CM}	max.	20	A
Total power dissipation at T_h = 70 °C f ≥ 1 MHz; V_{CE} ≤ 15 V; $R_{th\ mb-h}$ ≤ 0,3 K/W Derate by 0,5 W/K for 50 °C ≤ T_h ≤ 100 °C	P_{tot}	max.	65	W



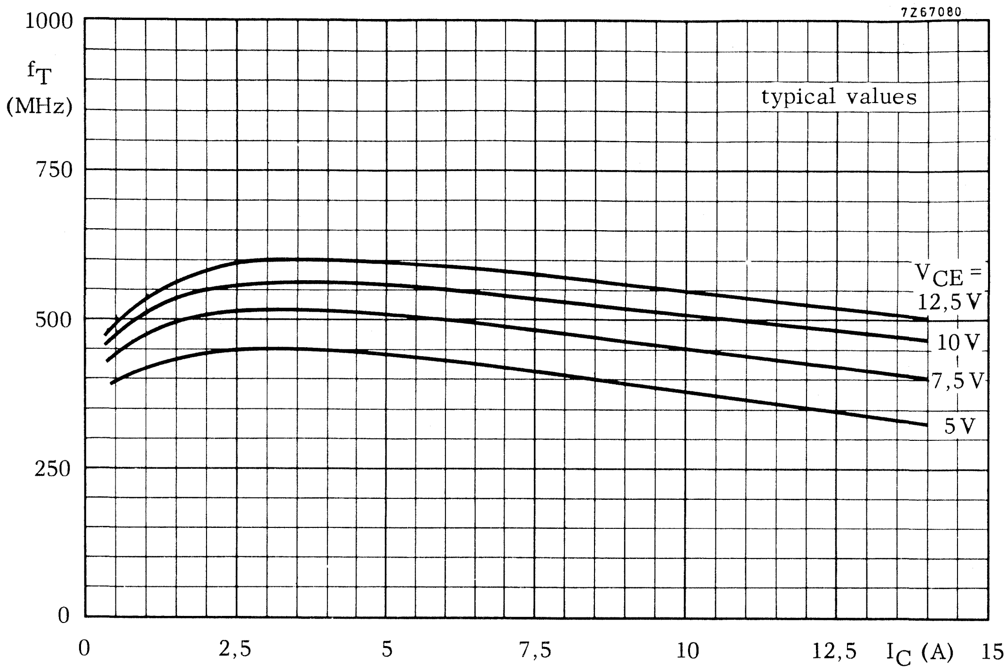


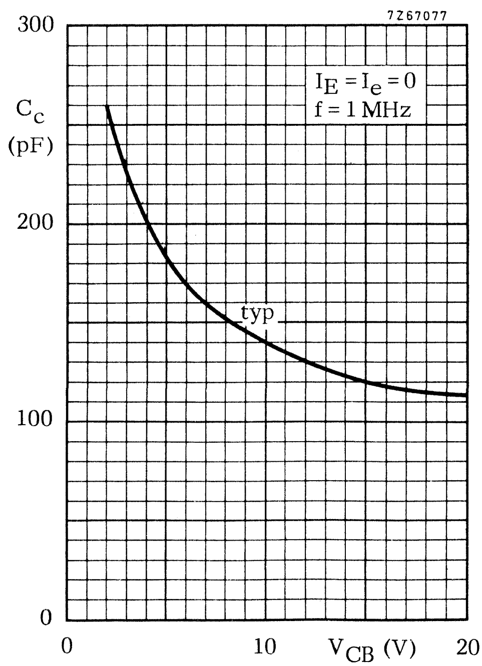
Storage temperature	T_{stg}	−65 to +200	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter; I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}		20 to 100	
D.C. current gain ratio of matched devices				
I_C = 1 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ. <	120 160	pF pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	C_{re}	typ.	80	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67080
1000
f_T
(MHz)
750
500
250
0
typical values
V_{CE} =
12,5 V
10 V
7,5 V
5 V
0
2,5
5
7,5
10
12,5
I_C (A)
15


7Z67077
300
C_c
(pF)
200
100
0
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB} (V)
20

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f MHz	V_{CE} V	P_L W	P_S W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω
175	12,5	45	< 14,2	> 5,0	< 4,8	> 75	1,2 + j1,4	2,6 − j1,2

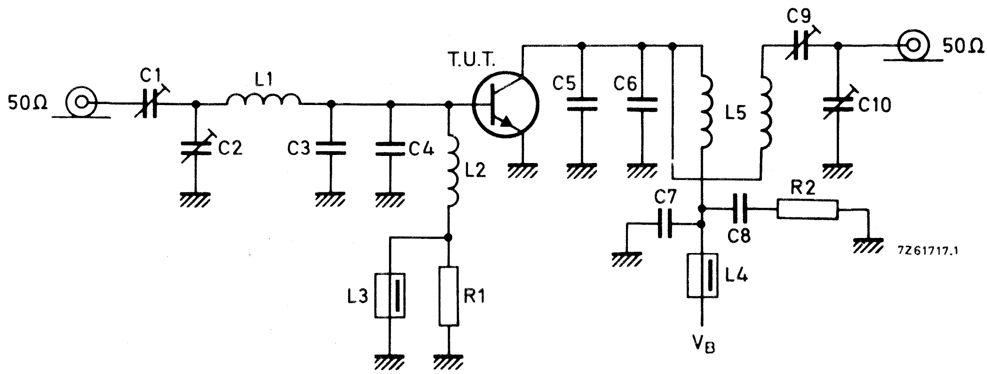


Fig. 6 Test circuit; c.w. class-B.

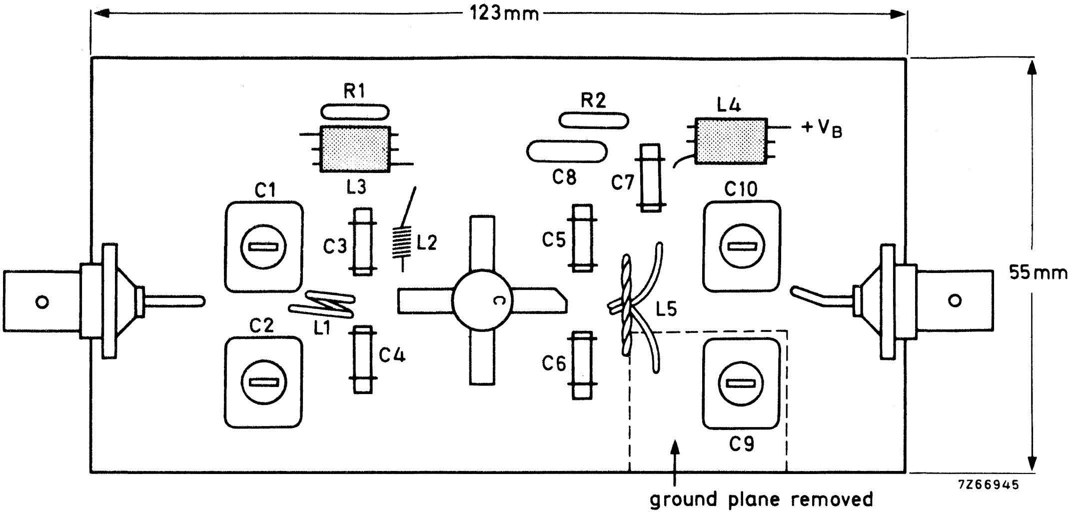
List of components:

C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

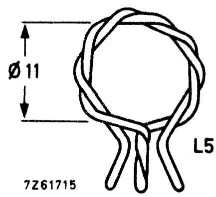
L1 =1½ turns enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3,0 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on

R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

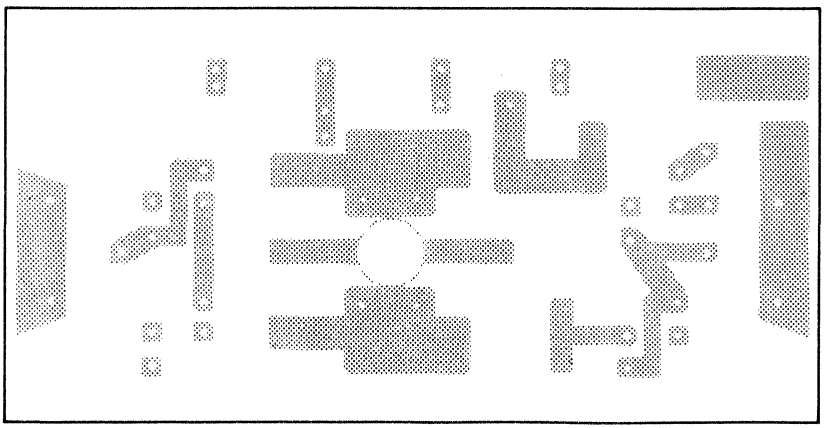
APPLICATION INFORMATION (continued)



7Z66945

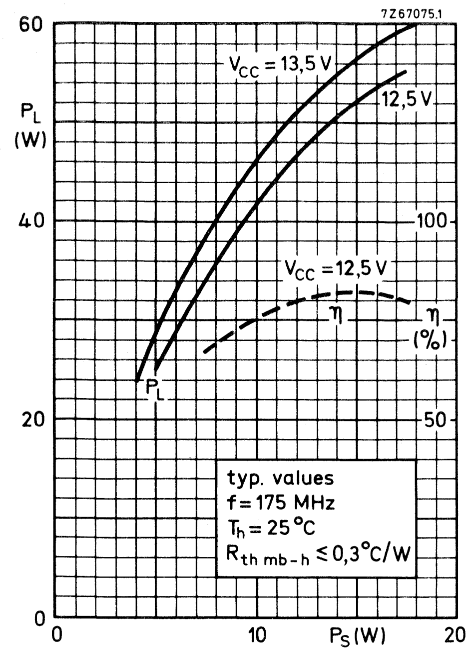


7Z61715

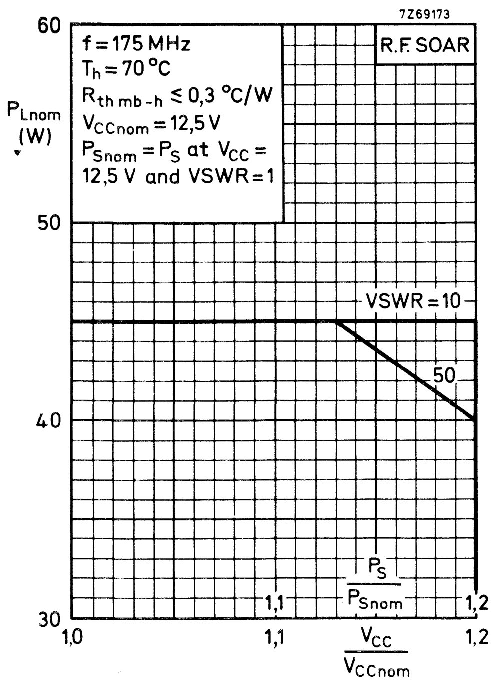


7Z66943

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



At P_L = 45 W and V_{CC} = 12,5 V, the output power at heatsink temperatures between 25 ^oC and 70 ^oC relative to that at 25 ^oC is diminished by 60 mW/K



The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltages other than nominal.
The graph shows the allowable output power under nominal conditions as a function of the supply overvoltage ratio with VSWR as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC}/V_{CCnom}).

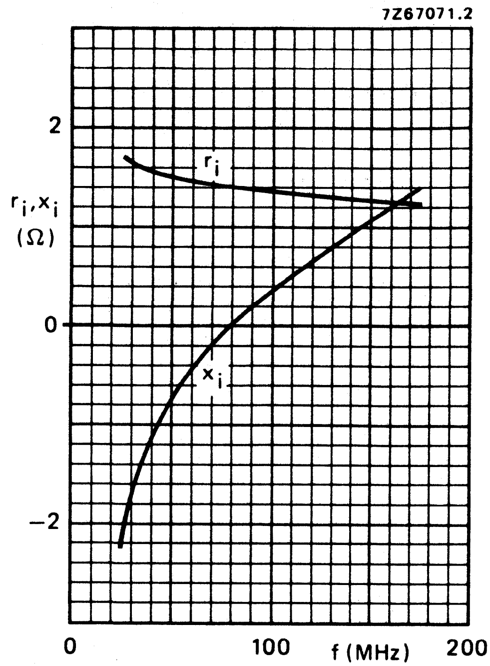


Fig. 10 Input impedance (series components).

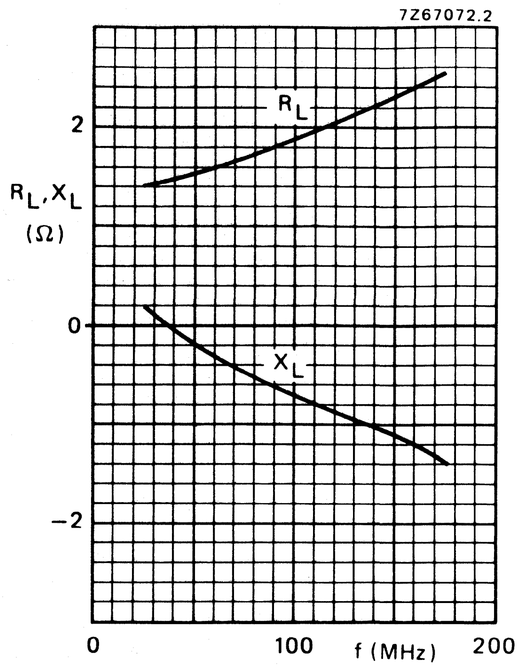


Fig. 11 Load impedance (series components).

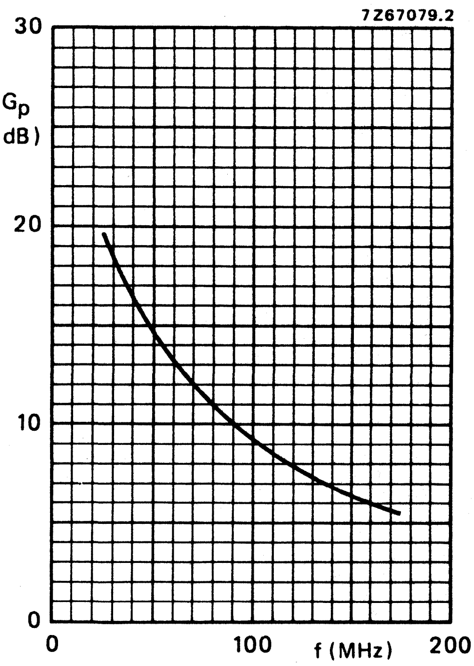


Fig. 12.

Conditions for Figs 10, 11 and 12:
Typical values; V_{CE} = 12,5 V; P_L = 45 W; T_h = 25 °C.

APPLICATION INFORMATION (continued)

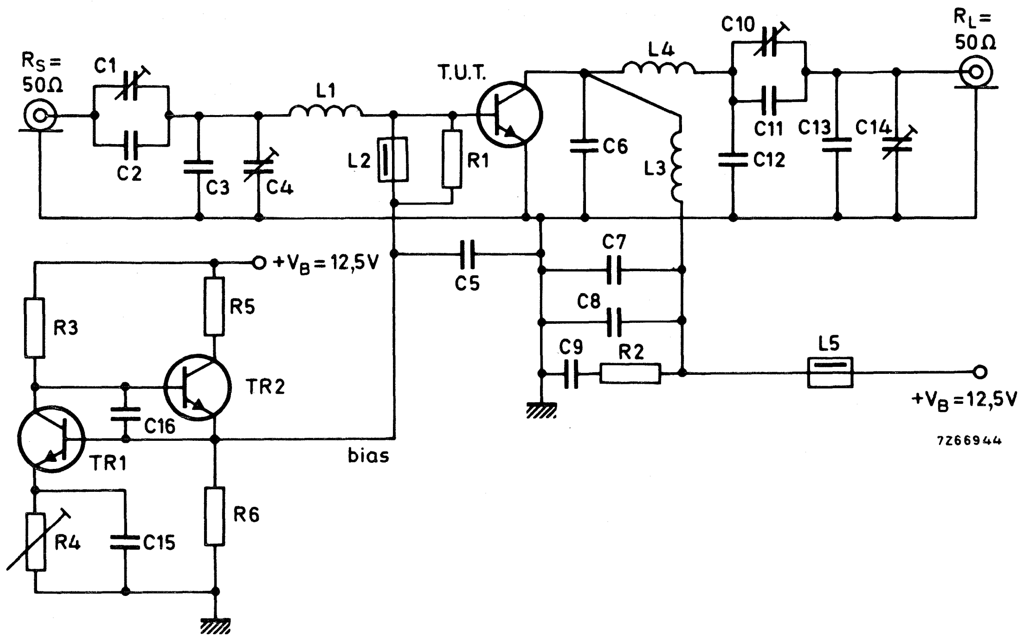
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leq 0,3$ K/W

f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

Test circuit; s.s.b. class-AB.



List of components on

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components:

Tr1 = Tr2 = BD137

C1 =	100 pF	air dielectric capacitor (single insulated rotor)
C2 =	27 pF	ceramic capacitor
C3 =	180 pF	ceramic capacitor
C4 =	100 pF	air dielectric capacitor (single non-insulated rotor)
C5 = C7 =	3,9 nF	polyester capacitor (±10%)
C6 =	2 x 270 pF	polystyrene capacitors in parallel
C8 = C15 = C16 =	100 nF	polyester capacitor (±10%)
C9 =	2,2 μF	moulded metallized polyester capacitor
C10 =	2 x 385 pF	film dielectric trimmers in parallel
C11 =	68 pF	ceramic capacitor
C12 =	2 x 82 pF	ceramic capacitors in parallel
C13 =	47 pF	ceramic capacitor
C14 =	385 pF	film dielectric trimmer

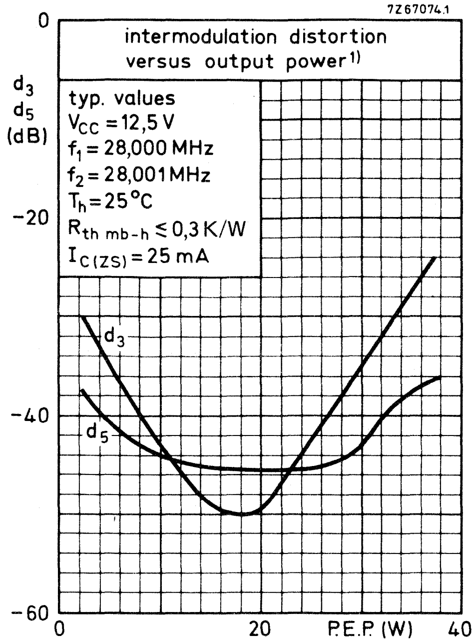
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm

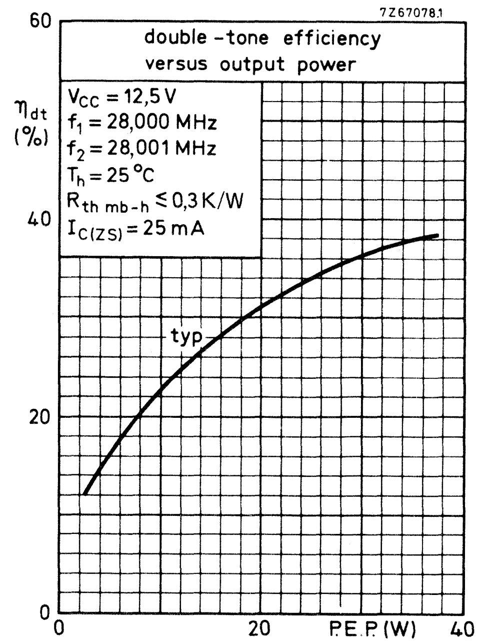
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)

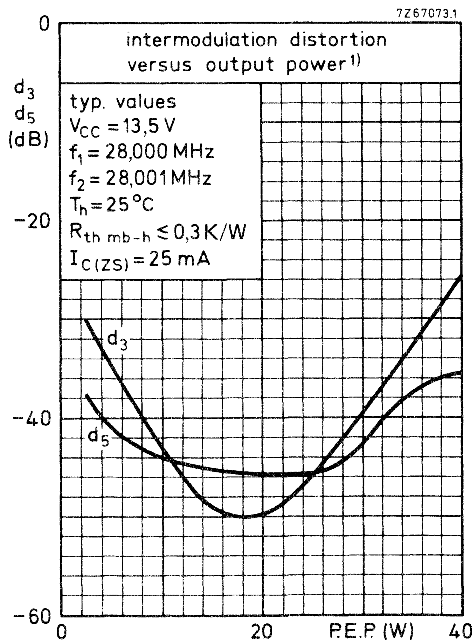
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm

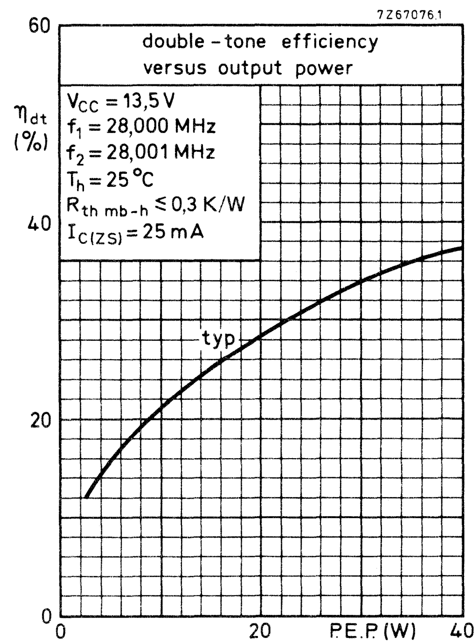
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; coil length 7,6 mm; leads 2 x 5 mm

R1 =	27 Ω	carbon resistor (±5%)
R2 =	4,7 Ω	carbon resistor (±5%)
R3 =	1,5 kΩ	carbon resistor (±5%)
R4 =	10 Ω	wire-wound potentiometer (3 W)
R5 =	47 Ω	wire-wound resistor (5,5 W)
R6 =	150 Ω	carbon resistor (±5%)

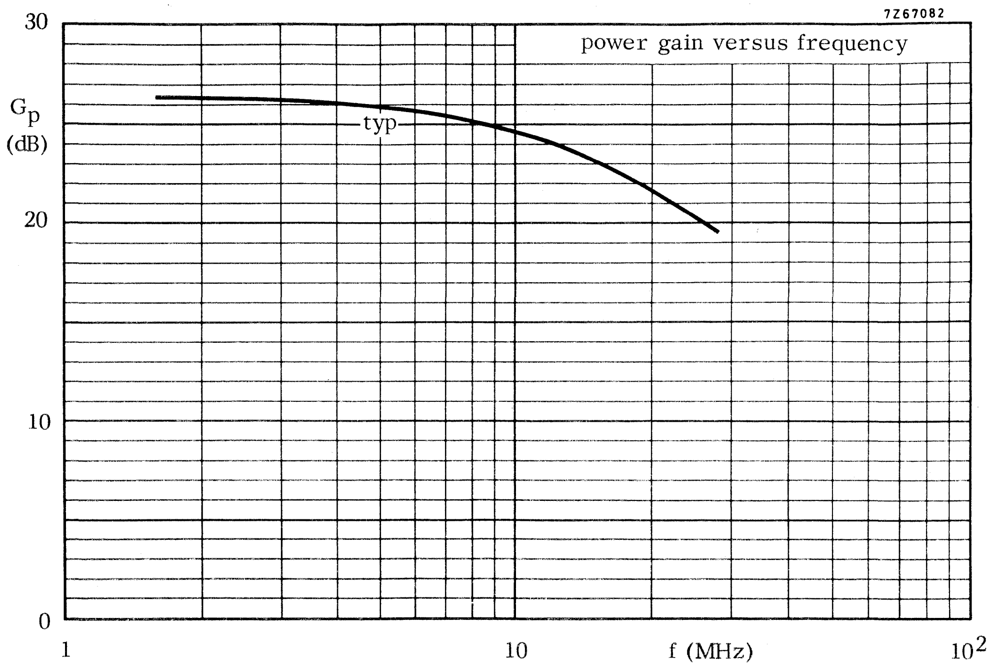








1) Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

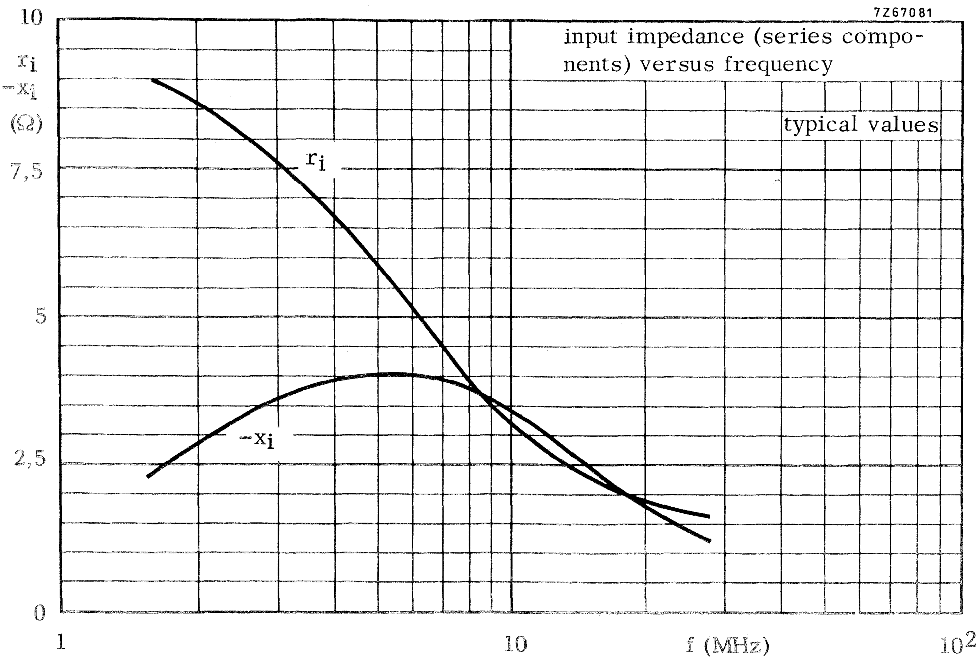


S.S.B. class AB operation

Conditions:

P_L	= 30 W (PEP)	P_L	= 35 W (PEP)
V_{CC}	= 12,5 V	V_{CC}	= 13,5 V
$I_{C(ZS)}$	= 25 mA	$I_{C(ZS)}$	= 25 mA
T_h	= 25 °C	T_h	= 25 °C
$R_{th\ mb-h}$	≤ 0,3 K/W	$R_{th\ mb-h}$	≤ 0,3 K/W
Z_L	= 1,9 Ω	Z_L	= 1,9 Ω

The curve (both conditions) holds for an unneutralized amplifier.



S.S.B. class AB operation

Conditions:

P_L	= 30 W (PEP)	P_L	= 35 W (PEP)
V_{CC}	= 12,5 V	V_{CC}	= 13,5 V
$I_{C(ZS)}$	= 25 mA	$I_{C(ZS)}$	= 25 mA
T_h	= 25 °C	T_h	= 25 °C
$R_{th\ mb-h}$	≤ 0,3 K/W	$R_{th\ mb-h}$	≤ 0,3 K/W
Z_L	= 1,9 Ω	Z_L	= 1,9 Ω

The curve (both conditions) holds for an unneutralized amplifier.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

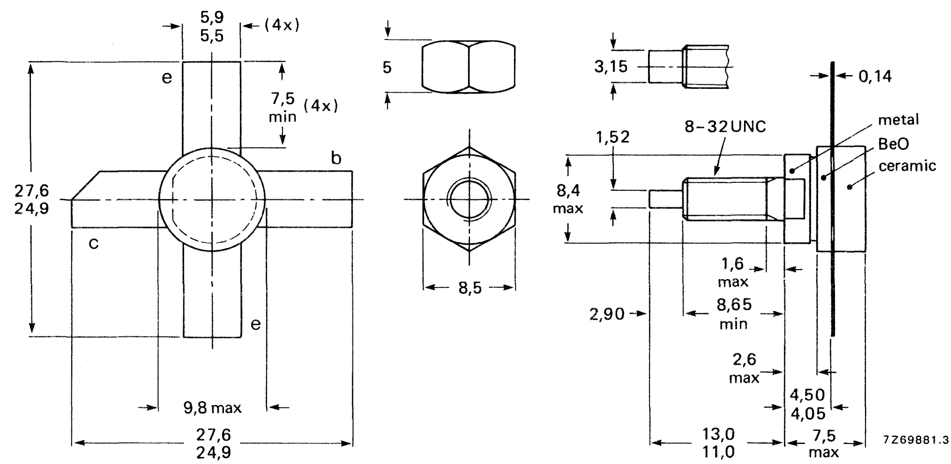
R.F. performance up to T_h = 25 °C

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\bar{z_i}$ Ω	$\bar{Z_L}$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	> **5,0**	> **75**	**1,2 + j1,4**	**2,6 − j1,2**	—
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	—	—	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

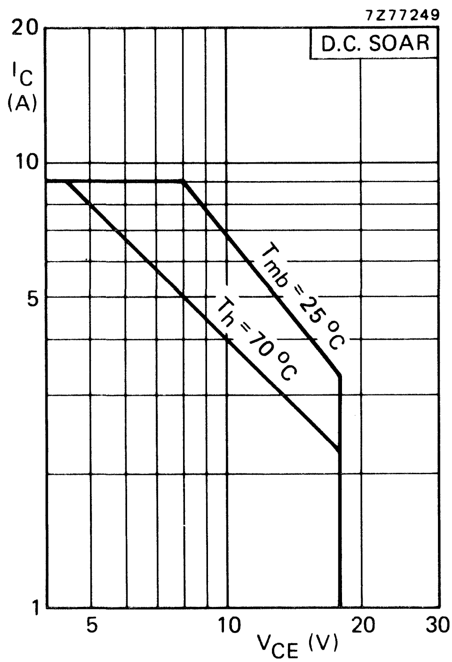


Fig. 2 D.C. SOAR.

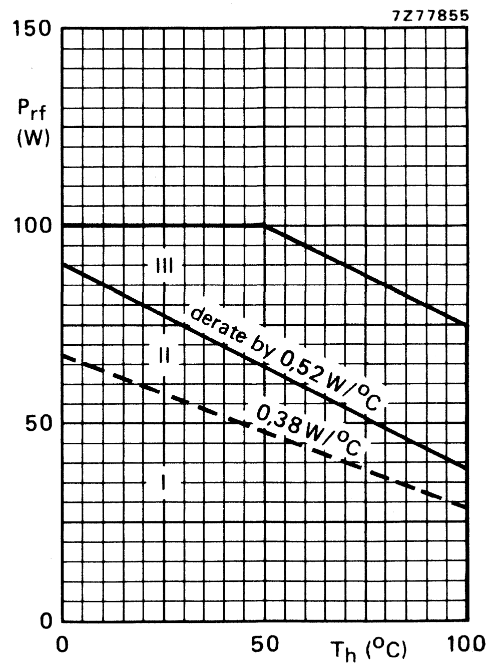


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

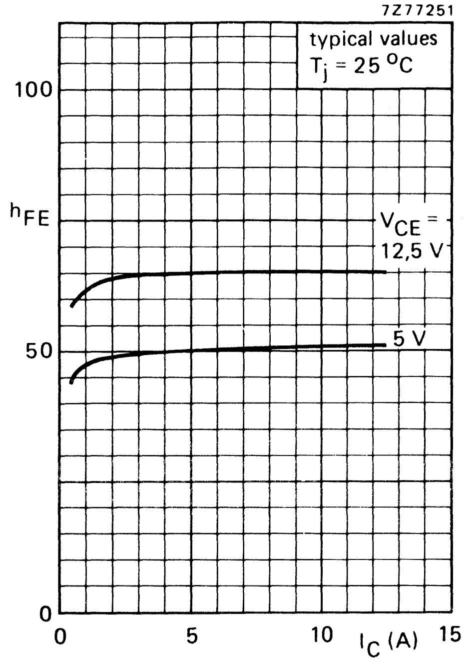
From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

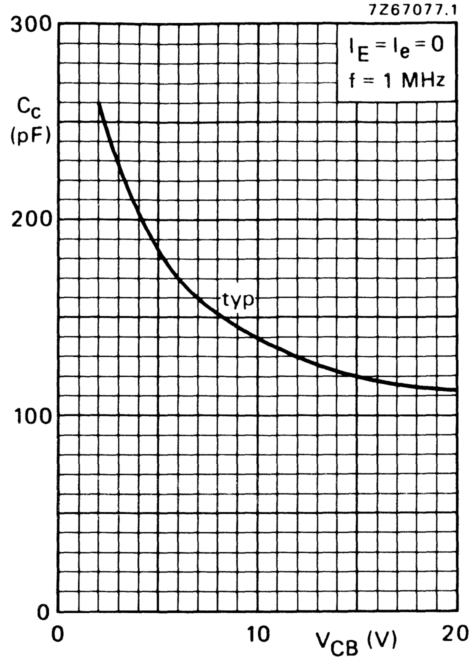
CHARACTERISTICS

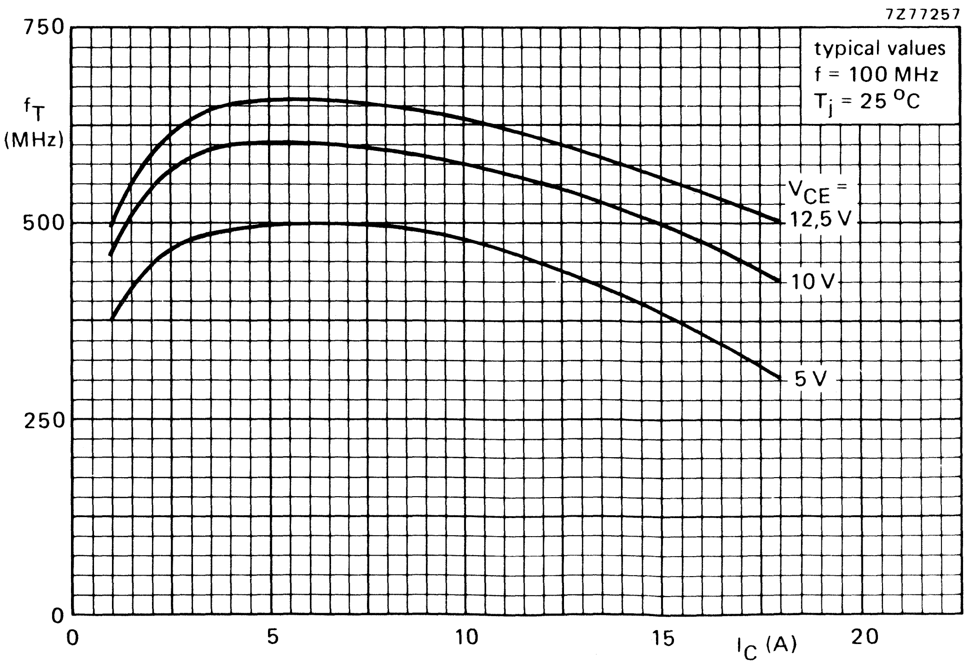
$T_j = 25\ ^oC$

Breakdown voltage			
Collector-emitter voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 15$ V	I_{CES}	<	25 mA
Transient energy			
L = 25 mH; f = 50 Hz			
open base	E	>	8 ms
$-V_{BE} = 1,5$ V; $R_{BE} = 33\ \Omega$	E	>	8 ms
D.C. current gain *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ	50
			10 to 80
D.C. current gain ratio of matched devices *			
$I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage *			
$I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ	1,5 V
Transition frequency at f = 100 MHz *			
$I_C = 4$ A; $V_{CE} = 12,5$ V	f_T	typ	650 MHz
$I_C = 12,5$ A; $V_{CE} = 12,5$ V	f_T	typ	600 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ	120 pF
		<	160 pF
Feedback capacitance at f = 1 MHz			
$I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ	80 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77251
typical values
T_j = 25 °C
100
h_{FE}
V_{CE} =
12,5 V
50
5 V
0
0
5
10
I_C (A)
15


7Z67077.1
300
$I_E = I_e = 0$
f = 1 MHz
C_c
(pF)
200
typ
100
0
0
10
V_{CB} (V)
20


7Z77257
750
typical values
f = 100 MHz
T_j = 25 °C
f_T
(MHz)
500
V_{CE} =
12,5 V
10 V
5 V
250
0
0
5
10
15
I_C (A)
20

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CC} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
175	**12,5**	**45**	**< 14,2**	**> 5,0**	**< 4,8**	**> 75**	**1,2 + j1,4**	**2,6 − j1,2**
175	13,5	45	−	typ. 6,0	−	typ. 75	−	−

Test circuit for 175 MHz

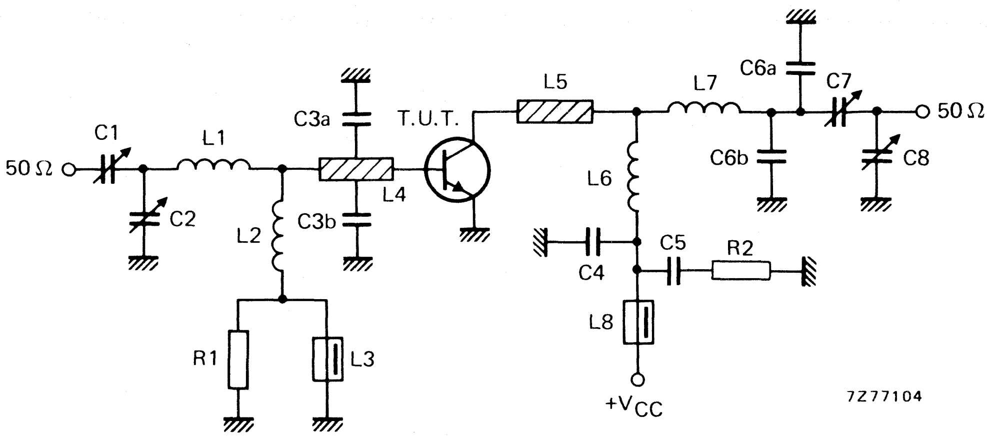


Fig. 7 Class-B test circuit at f = 175 MHz.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

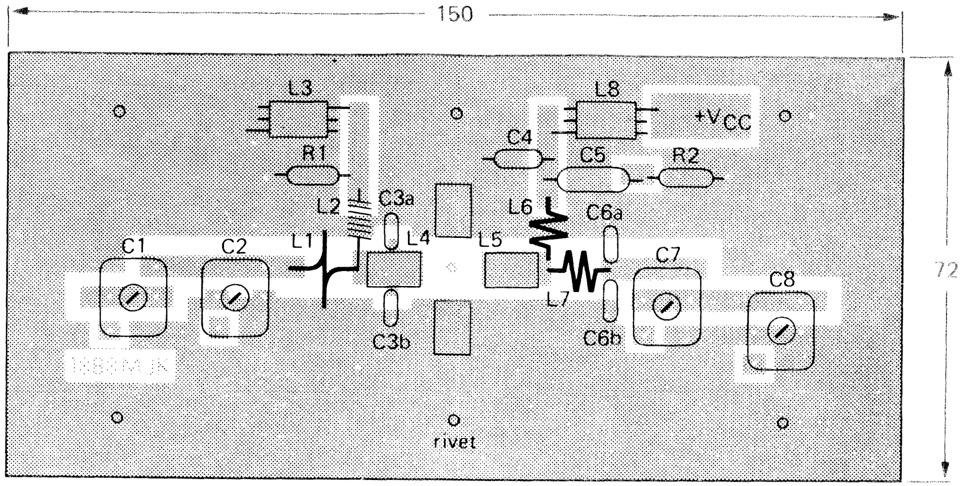
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

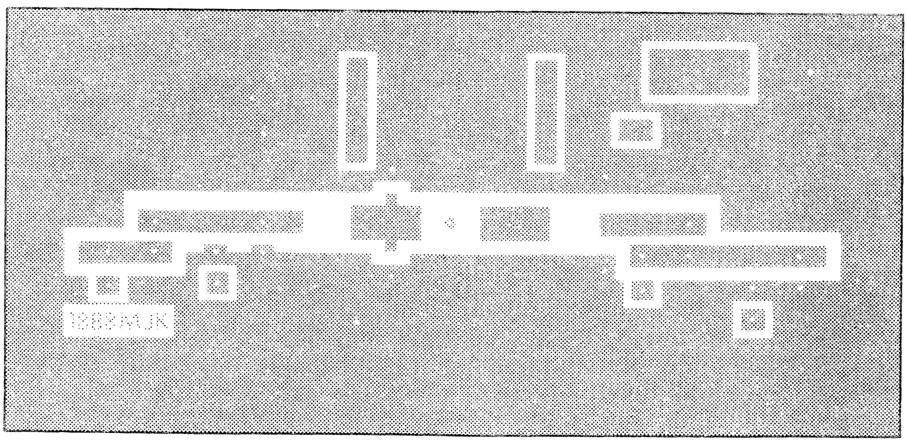
Component layout and printed-circuit board for 175 MHz test circuit on

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

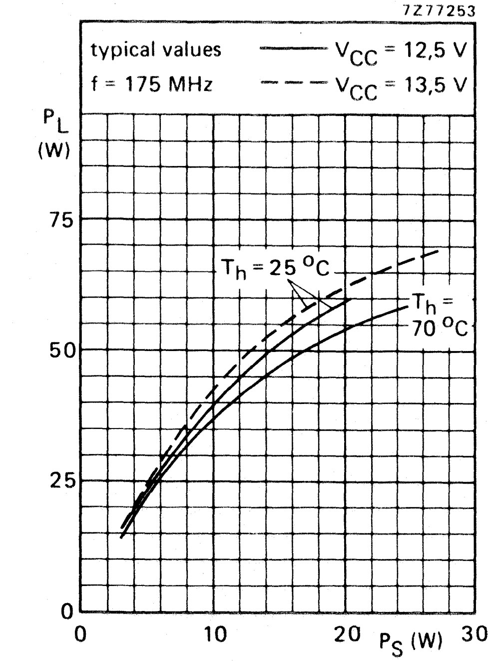


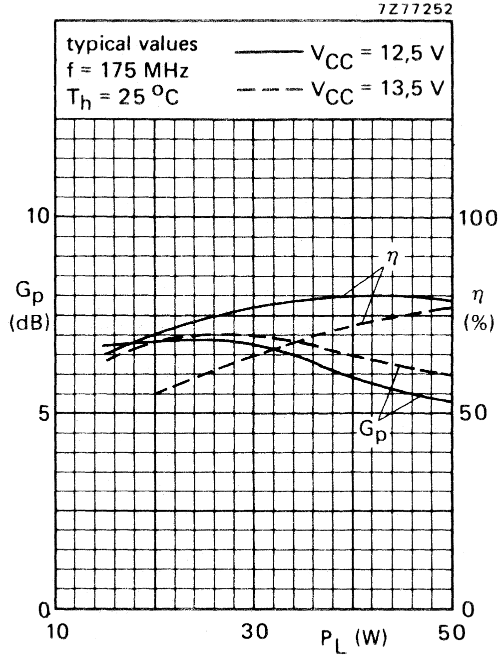
7Z77102

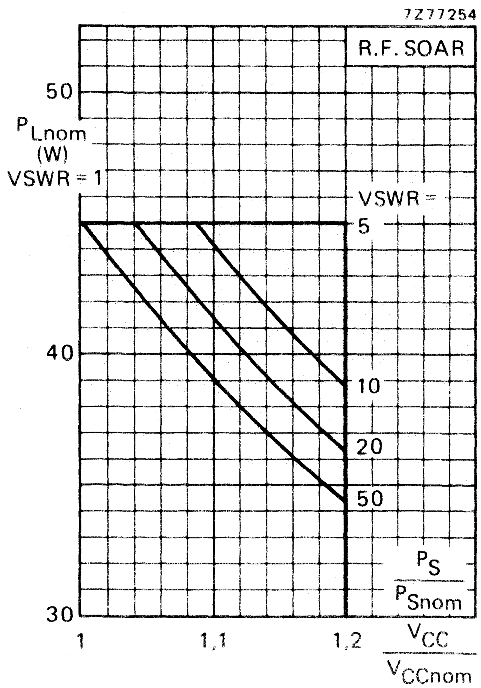


7Z77103

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.







Conditions for R.F. SOAR

f = 175 MHz

T_h = 70 °C

$R_{th\ mb\text{-}h}$ = 0,45 K/W

V_{CCnom} = 12,5 V or 13,5 V

P_S = P_{Snom} at V_{CCnom} and VSWR = 1

see

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

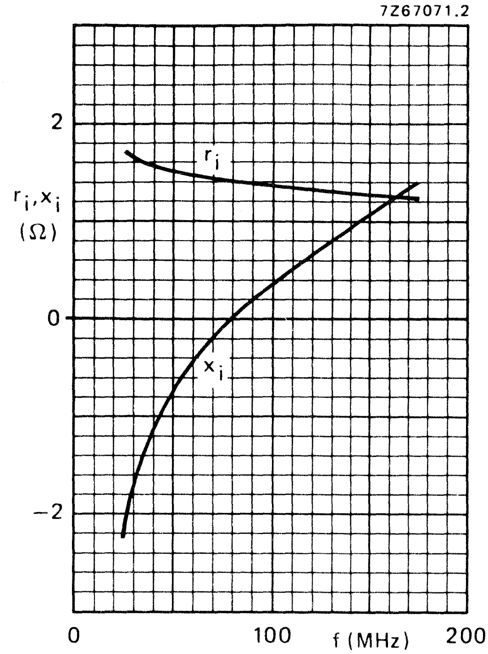


Fig. 12 Input impedance (series components).

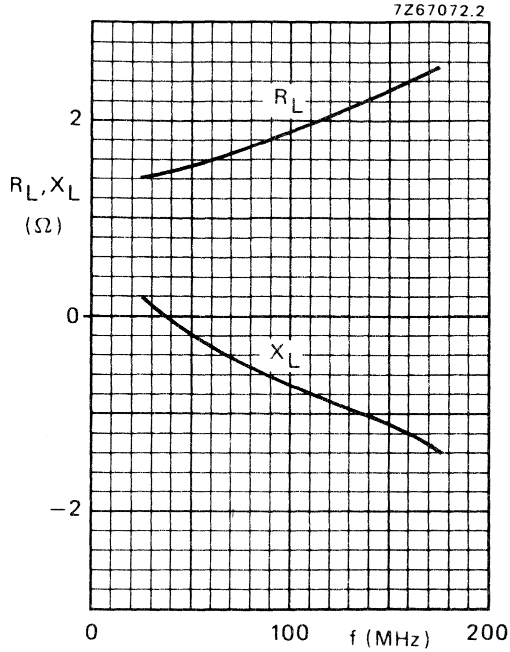


Fig. 13 Load impedance (series components).

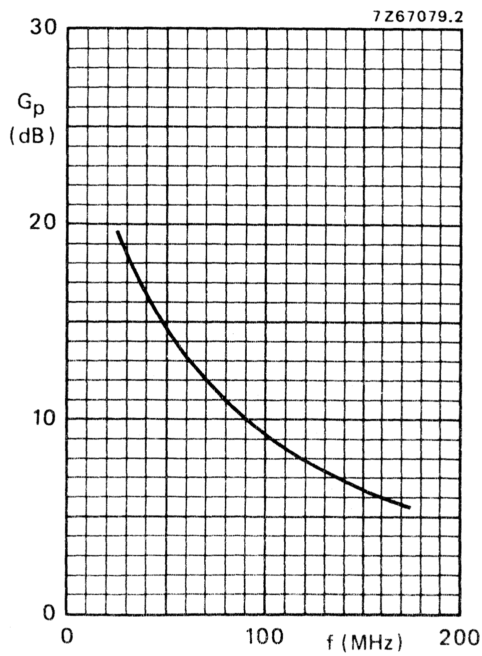


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; class-B operation; T_h = 25 °C.

APPLICATION INFORMATION (continued)

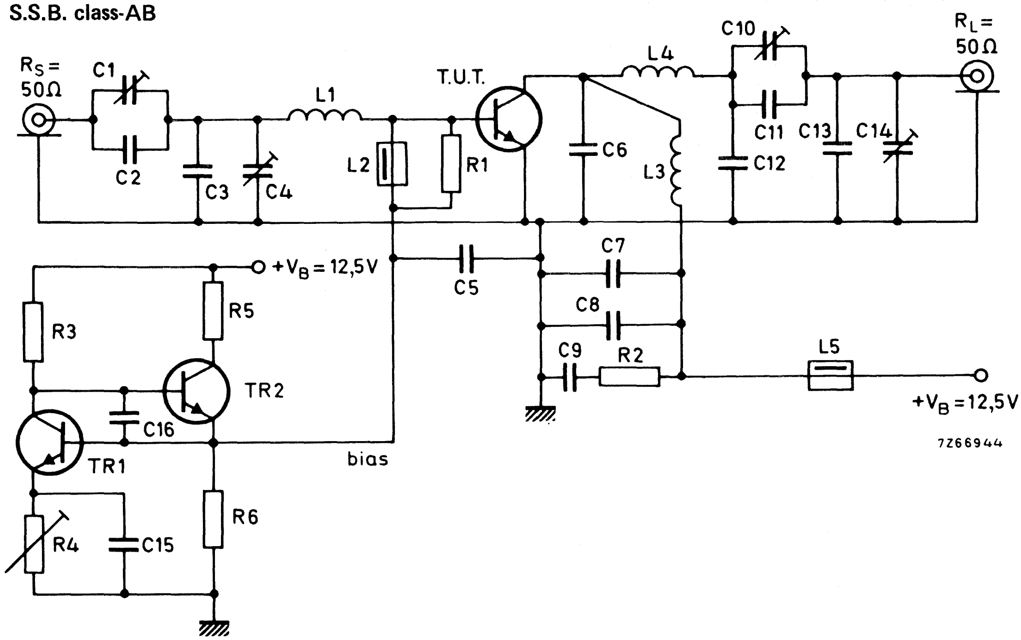
R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb\text{-}h} \leq 0{,}45$ K/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ 19,5	typ 35	typ −33	typ −36	25

Test circuit

S.S.B. class-AB



List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF film dielectric trimmer
C11 = 68 pF ceramic capacitor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel
C13 = 47 pF ceramic capacitor
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

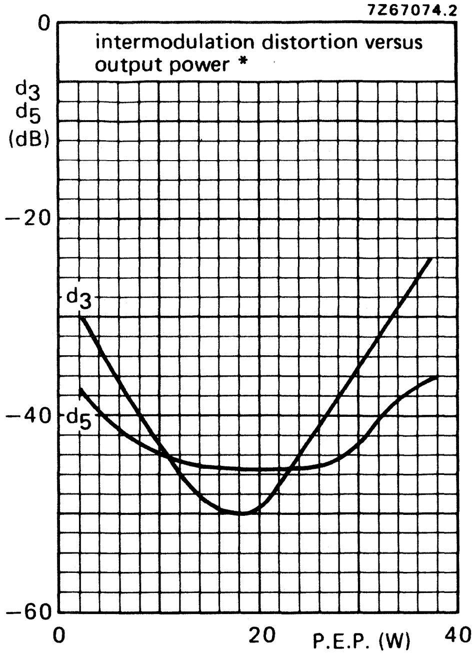
R1 = 27 Ω (±5%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor
R3 = 1,5 kΩ (±5%) carbon resistor
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor

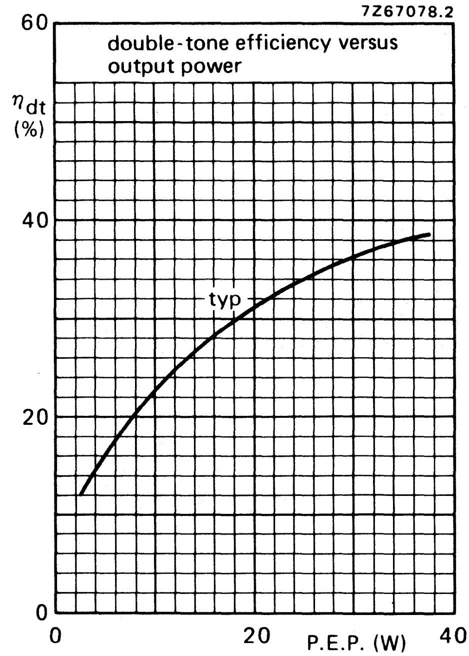
Measuring conditions for the upper graphs on page 11

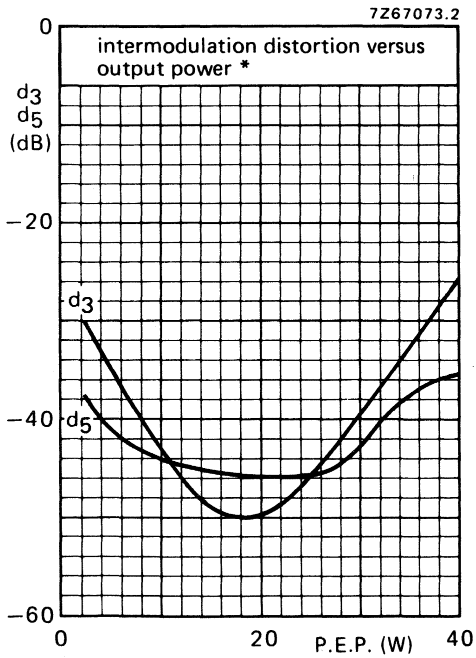
V_{CC} = 12,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb-h} \leqslant$ 0,45 °K/W
$I_{C(ZS)}$ = 25 mA
typical values

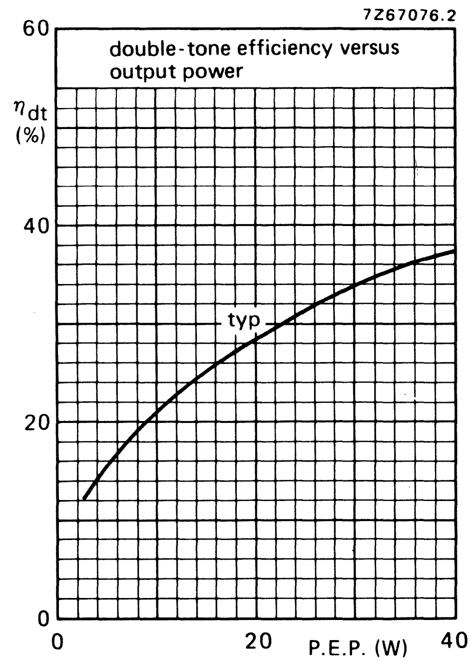
Measuring conditions for the lower graphs on page 11

V_{CC} = 13,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb-h} \leqslant$ 0,45 °K/W
$I_{C(ZS)}$ = 25 mA
typical values

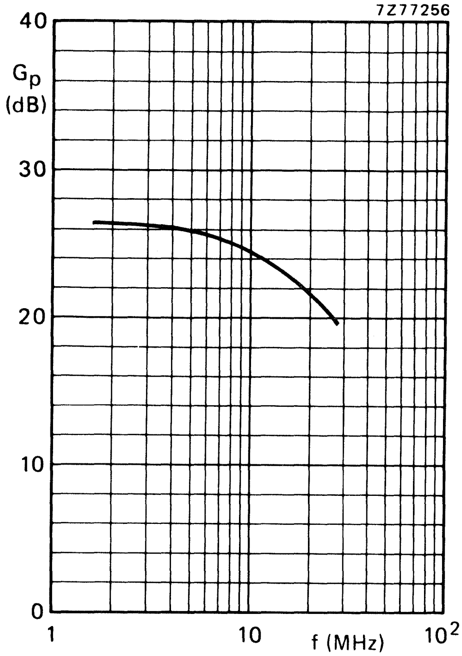


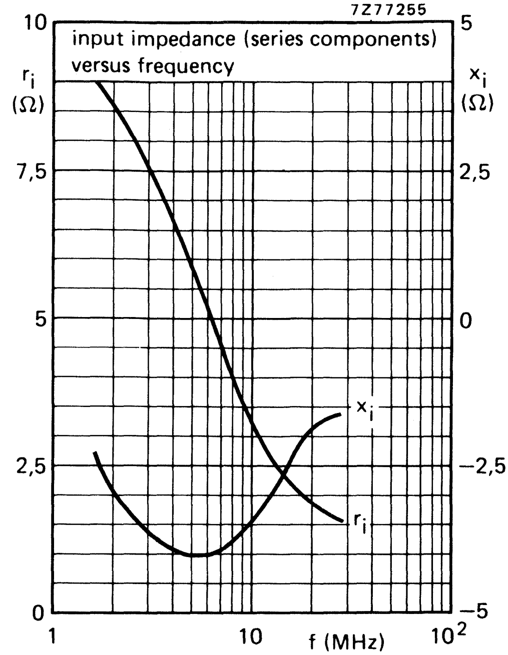






* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





S.S.B. class-AB operation

Conditions for the graphs above:

V_{CC} = 12,5 V
P_L = 30 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 K/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,9 Ω

V_{CC} = 13,5 V
P_L = 35 W (P.E.P.)
T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,45 K/W
$I_{C(ZS)}$ = 25 mA
Z_L = 1,9 Ω

The typical curves (both conditions) hold for an unneutralized amplifier.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,05**	**1,6–28**	**8–80 (P.E.P.)**	**> 13**	**> 35***	**< –30**
c.w. (class-B)	28	–	108	80	typ. 7,9	typ. 70	–

* At 80 W P.E.P.

MECHANICAL DATA

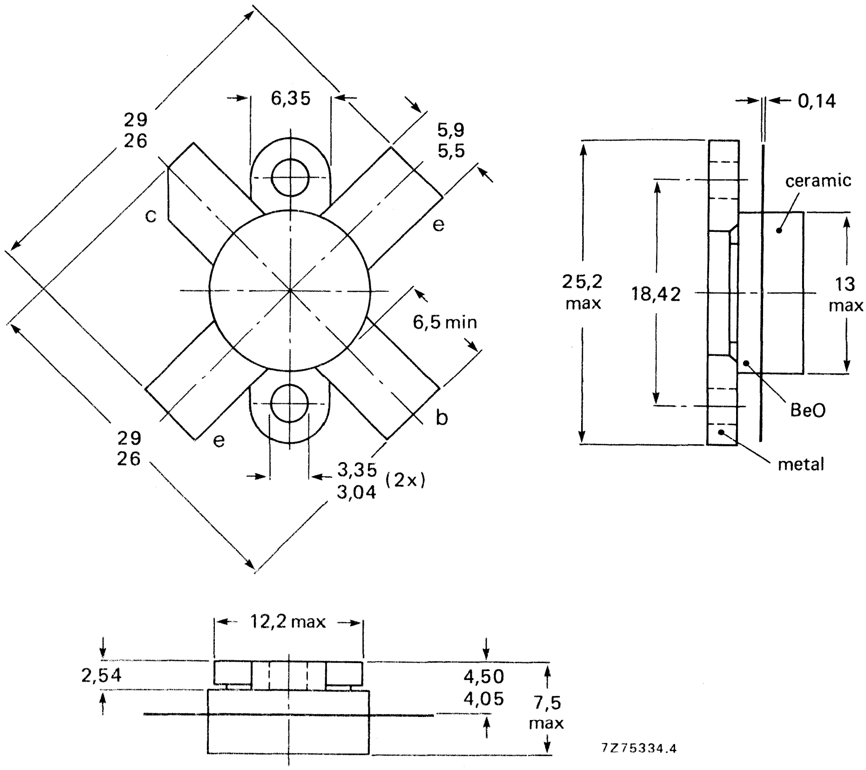
SOT-121 (see Fig.1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	70	V
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	140	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

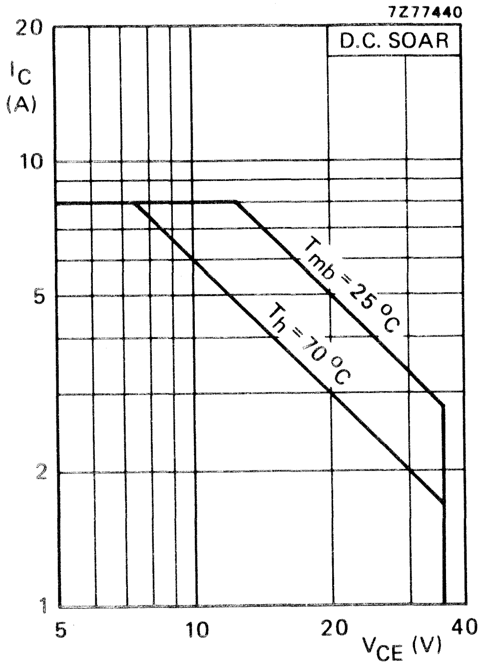


Fig. 2 D.C. SOAR.

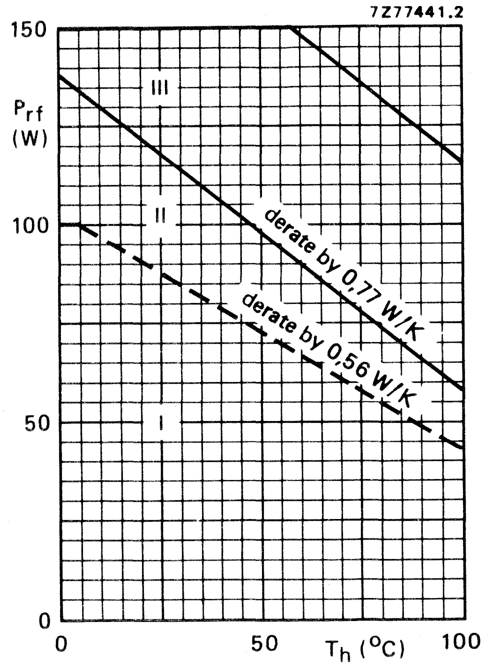


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 60 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,92	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,33	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 35 V	I_{CES}	<	10 mA
D.C. current gain* I_C = 4 A; V_{CE} = 5 V	h_{FE}		15 to 80
D.C. current gain ratio of matched devices* I_C = 4 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* I_C = 12,5 A; I_B = 2,5 A	V_{CEsat}	typ.	2,5 V
Transition frequency at f = 100 MHz** $-I_E$ = 4 A; V_{CB} = 28 V	f_T	typ.	315 MHz
$-I_E$ = 12,5 A; V_{CB} = 28 V	f_T	typ.	305 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	125 pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 28 V	C_{re}	typ.	85 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

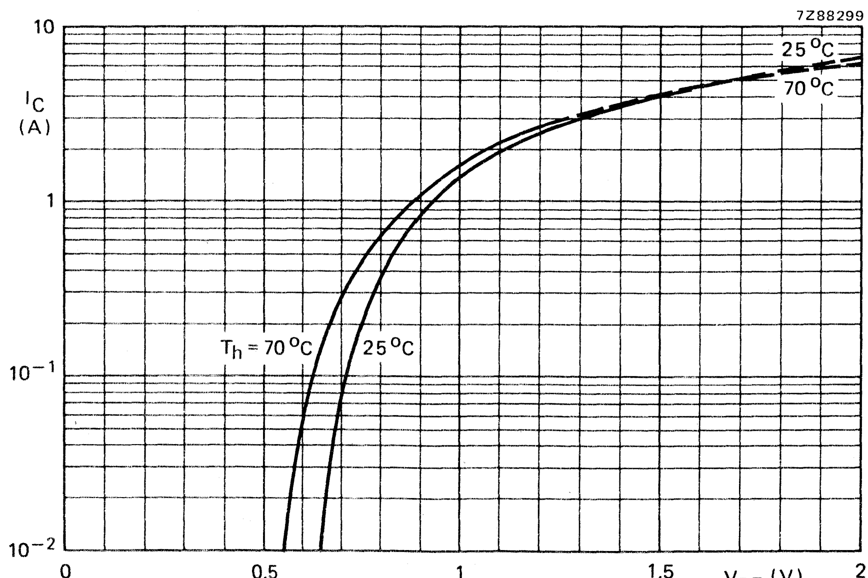


Fig. 4 Typical values; V_{CE} = 20 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

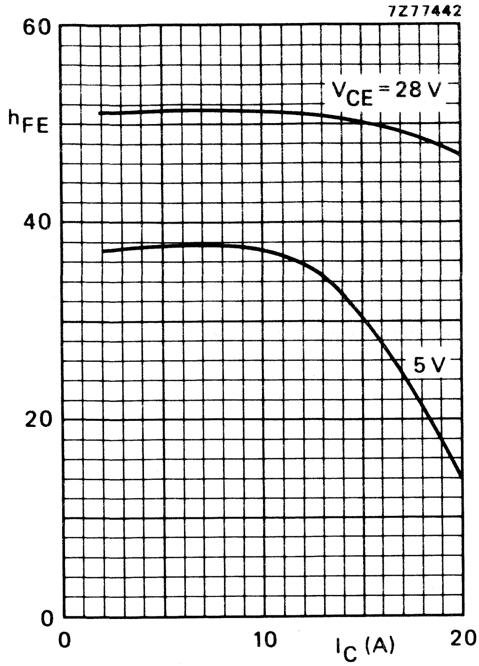


Fig. 5 Typical values; T_j = 25 °C.

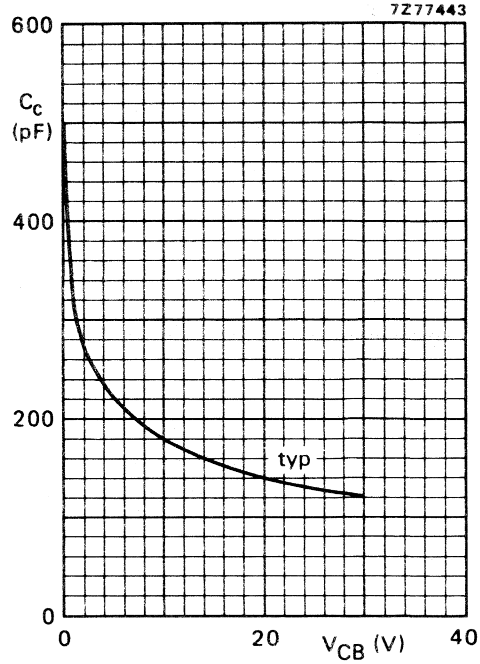


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

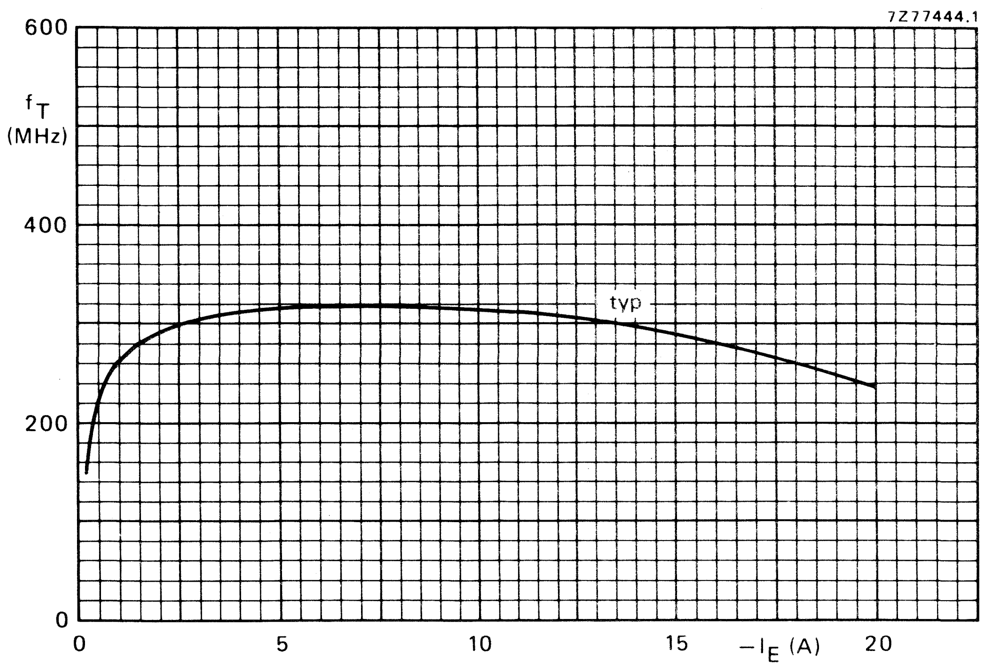


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 80 W P.E.P.	I_C(A) at 80 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
8 to 80 (P.E.P.)	**> 13**	**> 35**	**< 4,1**	**< –30**	**< –30**	**0,05**

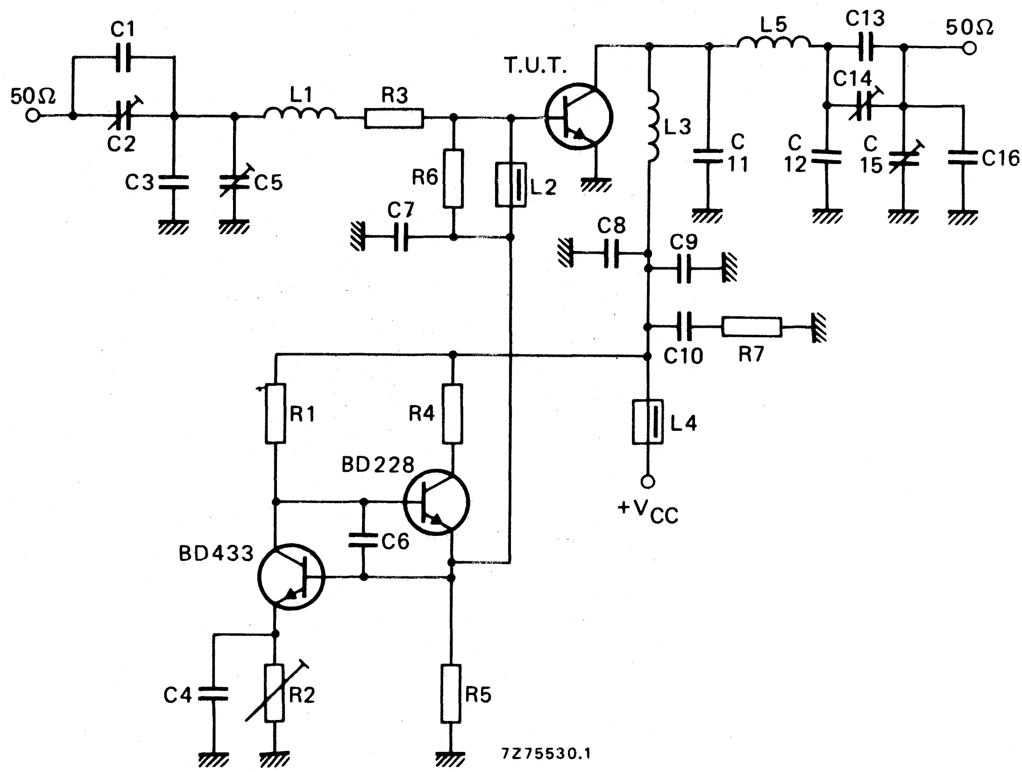


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 100 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 μF moulded metallized polyester capacitor
C11 = 180 pF polystyrene capacitor
C12 = 2 x 68 pF ceramic capacitors in parallel (500 V)
C13 = 120 pF polystyrene capacitor

C14 = C15 = 280 pF air dielectric trimmer (single insulated rotor type)
C16 = 56 pF ceramic capacitor (500 V)

L1 = 108 nH; 4 turns Cu wire (1,6 mm); int. dia. 8,7 mm; length 11,2 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 88 nH; 3 turns Cu wire (1,6 mm); int. dia. 8,0 mm; length 8,0 mm; leads 2 x 7 mm
L5 = 120 nH; 4 turns Cu wire (1,6 mm); int. dia. 9,3 mm; length 11,2 mm; leads 2 x 7 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 10 Ω wirewound potentiometer (3 W)
R3 = 0,9 Ω; parallel connection of 2 x 1,8 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 60 Ω; parallel connection of 2 x 120 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 33 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

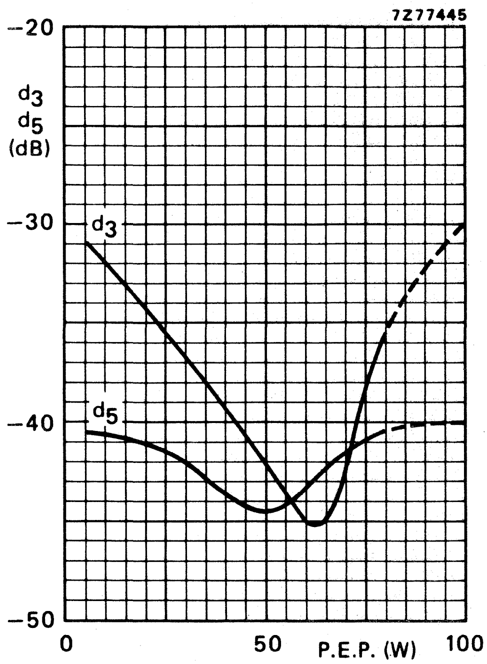


Fig. 9 Intermodulation distortion as a function of output power.*

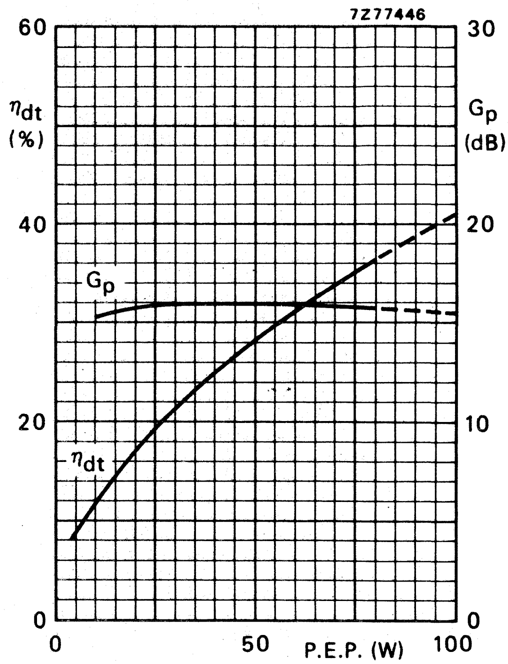


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

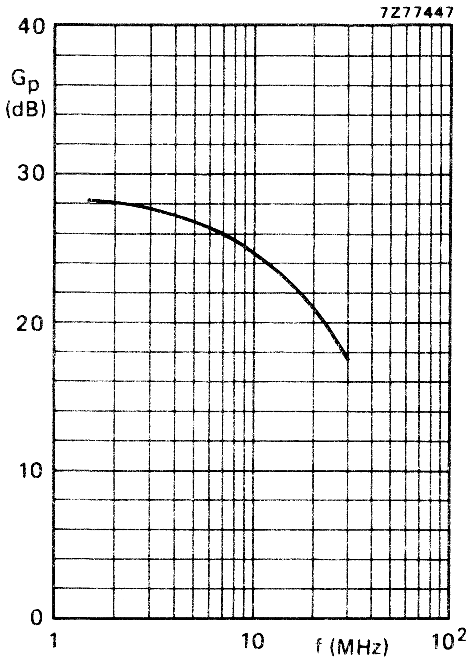


Fig. 11 Power gain as a function of frequency.

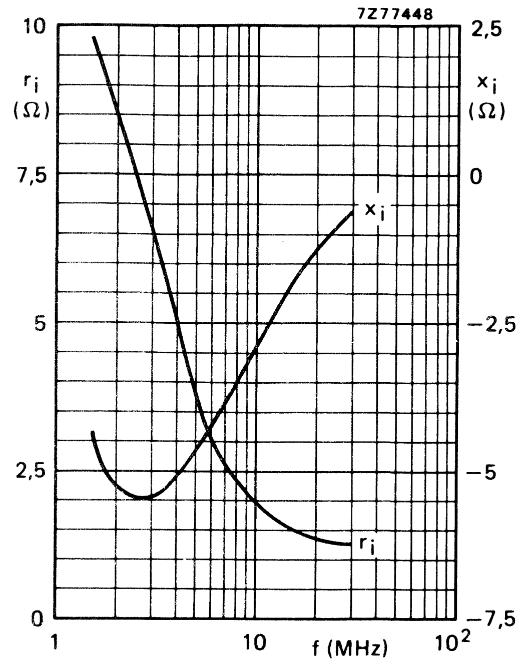


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω.

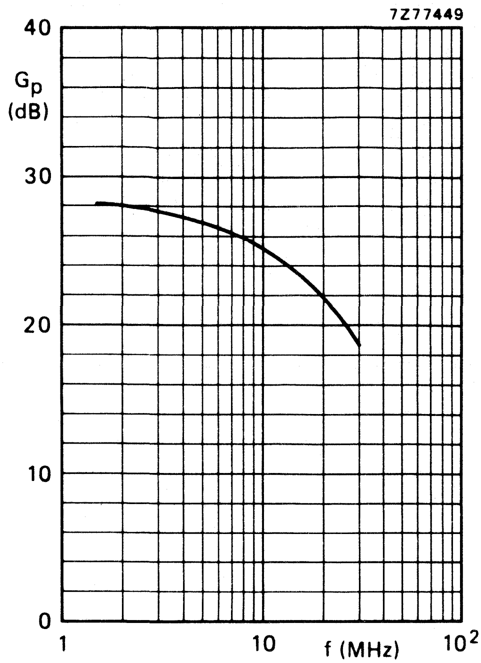


Fig. 13 Power gain as a function of frequency.

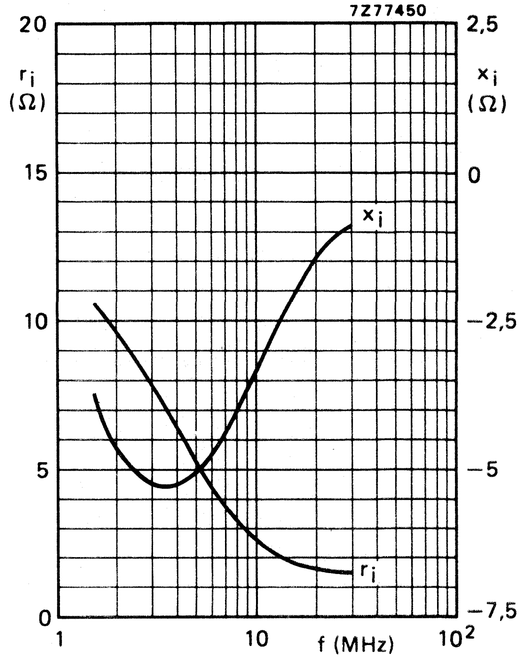


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 80 W; T_h = 25 °C; Z_L = 3,9 Ω; neutralizing capacitor: 68 pF.

APPLICATION INFORMATION (continued)

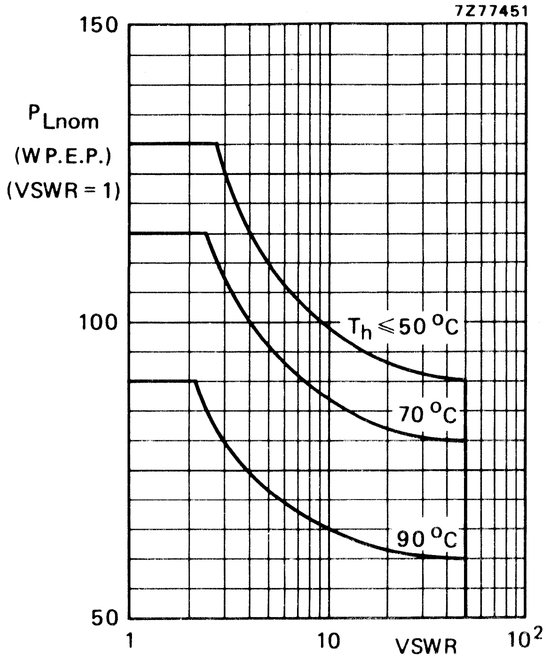


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
108	**28**	**80**	typ. **13**	typ. **7,9**	typ. **4,1**	typ. **70**	**0,85 + j1,0**	**174 – j40**

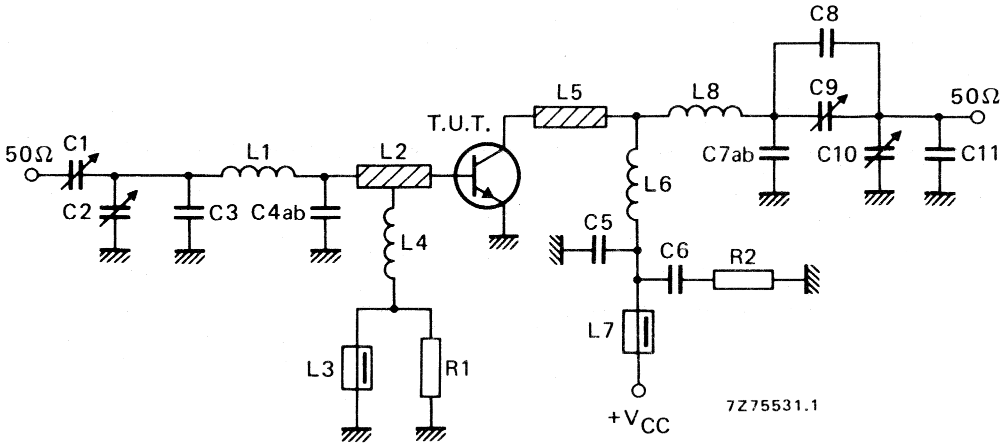


Fig. 16 Test circuit; c.w. class-B.

List of components:

C1 = C9 = C10 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 22 pF ceramic capacitor (500 V)
C4ab = 2 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 270 pF polystyrene capacitor
C6 = 100 nF polyester capacitor
C7a = 8,2 pF ceramic capacitor (500 V)
C7b = 10 pF ceramic capacitor (500 V)
C 8 = 5,6 pF ceramic capacitor (500 V)
C11 = 10 pF ceramic capacitor (500 V)

L1 = 21 nH; 2 turns Cu wire (1,0 mm); int. dia. 4,0 mm; length 3,5 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 at 6 mm from transistor
L3 = L 7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 49 nH; 2 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 4,7 mm; leads 2 x 5 mm
L8 = 56 nH; 2 turns Cu wire (1,6 mm); int. dia. 10,0 mm; length 4,5 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = R2 = 10 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 108 MHz test circuit are shown in Fig. 17.

APPLICATION INFORMATION (continued)

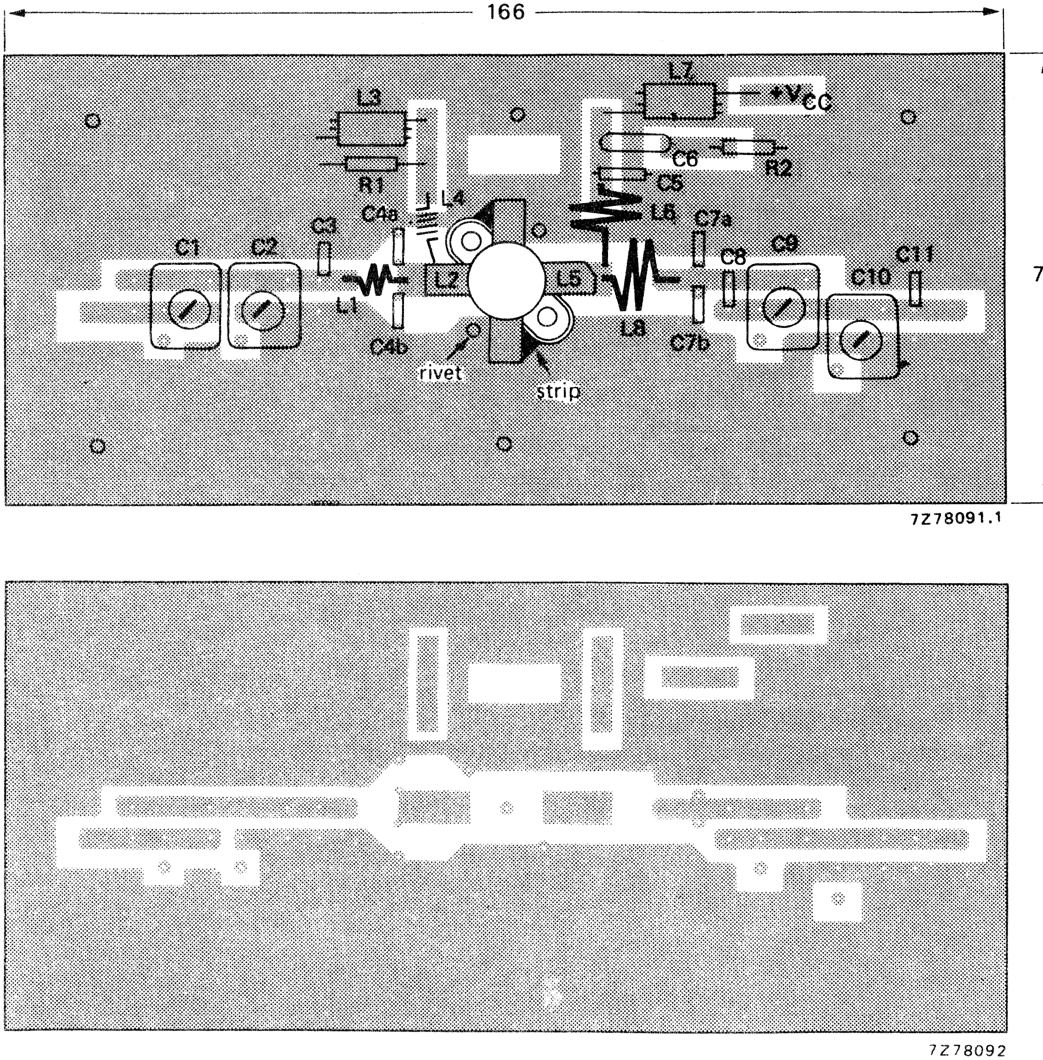


Fig. 17 Component layout and printed-circuit board for 108 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

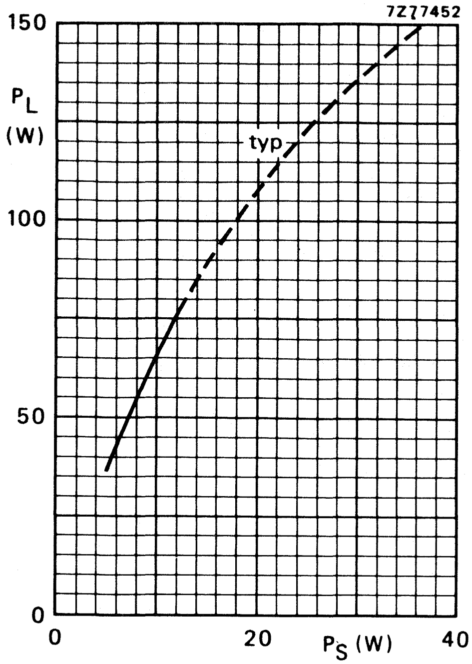


Fig. 18 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C.

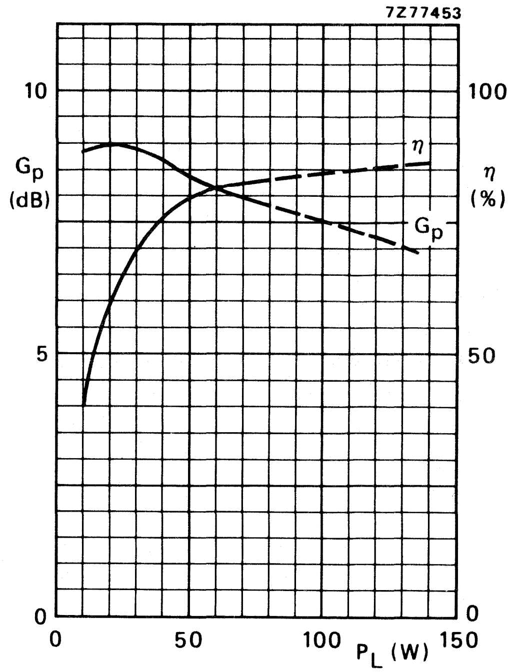


Fig. 19 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; typical values.

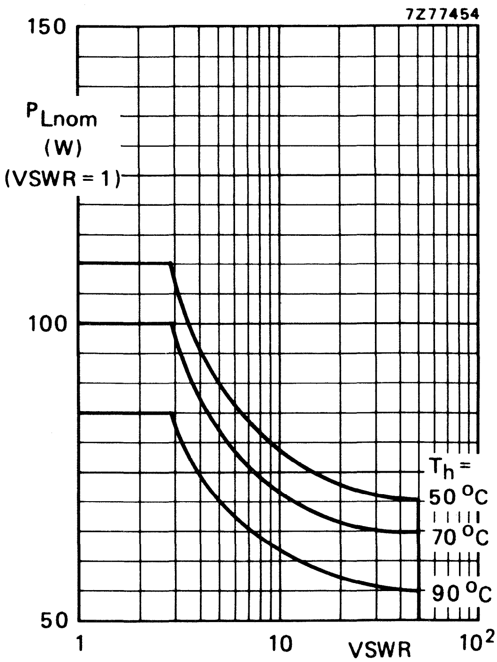


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 108 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

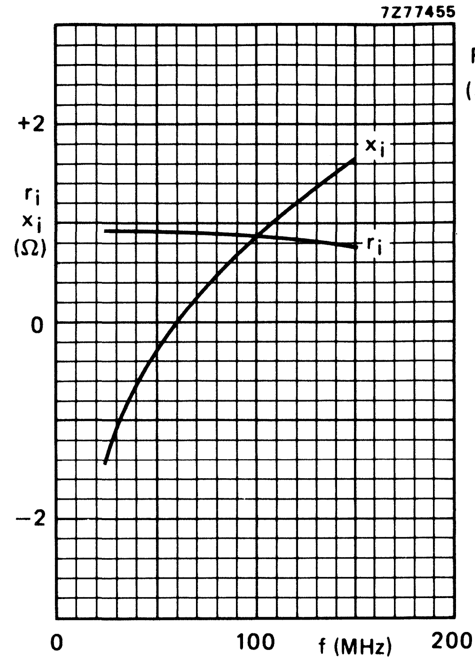


Fig. 21 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C typical values.

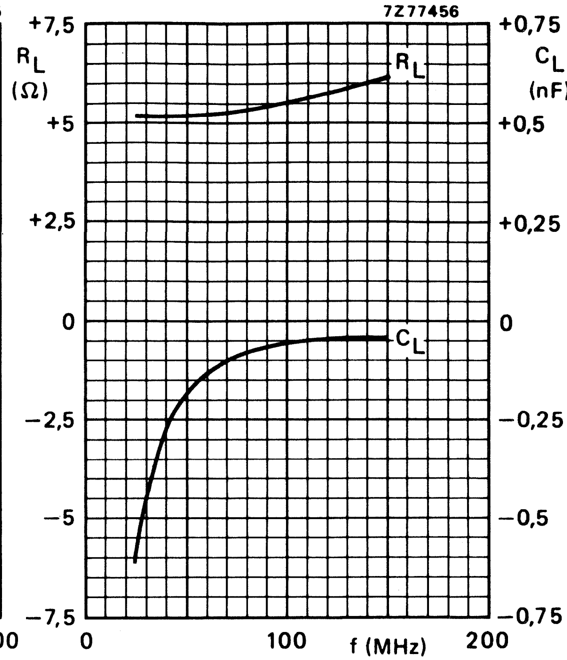


Fig. 22 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; typical values.

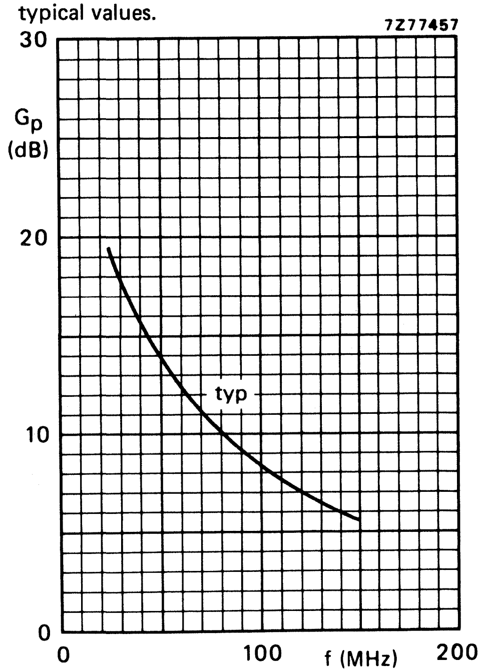


Fig. 23 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB or class-B operated high power transmitters in the h.f. and v.h.f. bands. The transistor presents excellent performance as a linear amplifier in the h.f. band. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are delivered in matched h_{FE} groups.

The transistor has a ½″ flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3 dB
s.s.b. (class-AB)	**28**	**0,1**	**1,6–28**	**15–130** (P.E.P.)	> **12**	> **37,5***	< **–30**
c.w. (class-B)	28	–	87,5	130	typ. 7,5	typ. 75	–

* At 130 W P.E.P.

MECHANICAL DATA

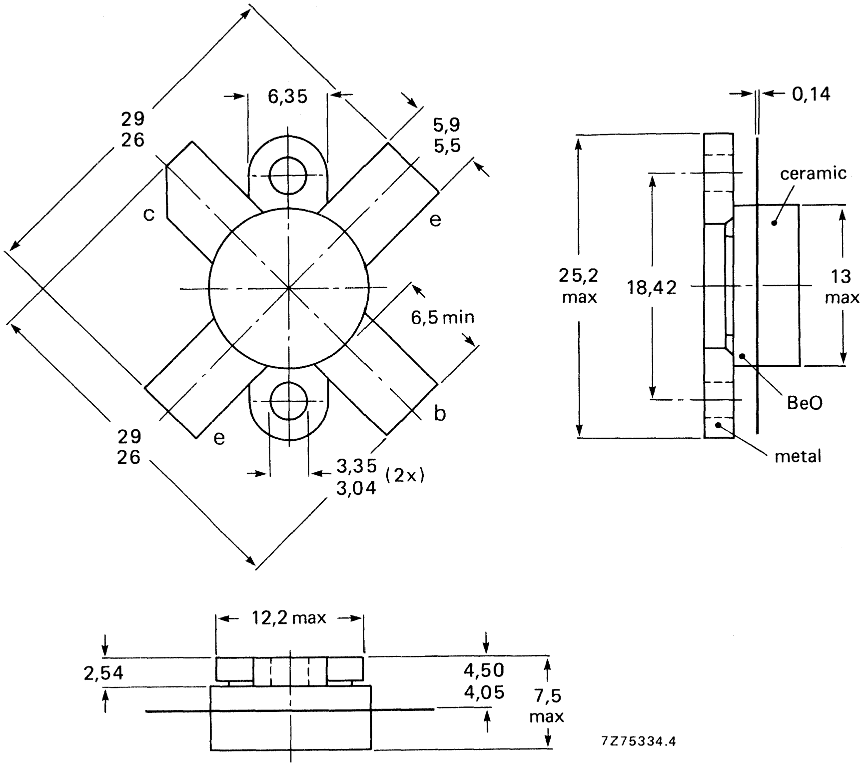
SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	12 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	30 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

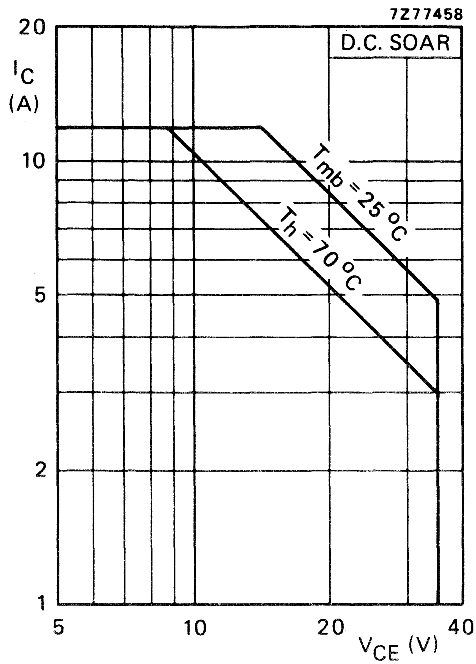


Fig. 2 D.C. SOAR.

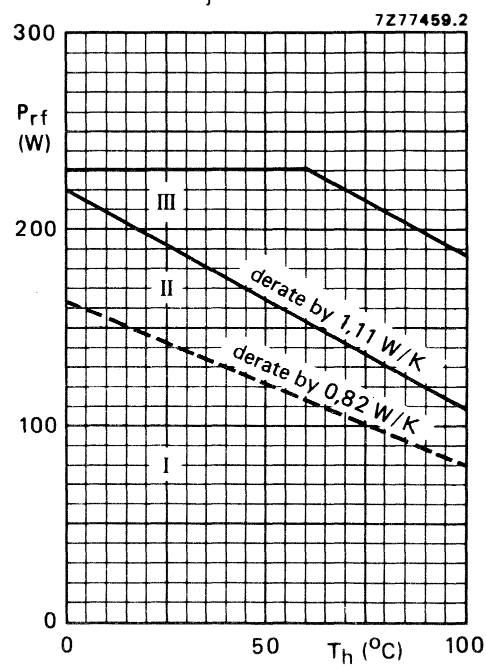


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,03 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,71 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	70	V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	35	V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 35$ V	I_{CES}	<	20	mA
D.C. current gain* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE}		15 to 80	
D.C. current gain ratio of matched devices* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage* $I_C = 20$ A; $I_B = 4$ A	V_{CEsat}	typ.	2	V
Transition frequency at f = 100 MHz** $-I_E = 7$ A; $V_{CB} = 28$ V	f_T	typ.	320	MHz
$-I_E = 20$ A; $V_{CB} = 28$ V	f_T	typ.	300	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	255	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	175	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

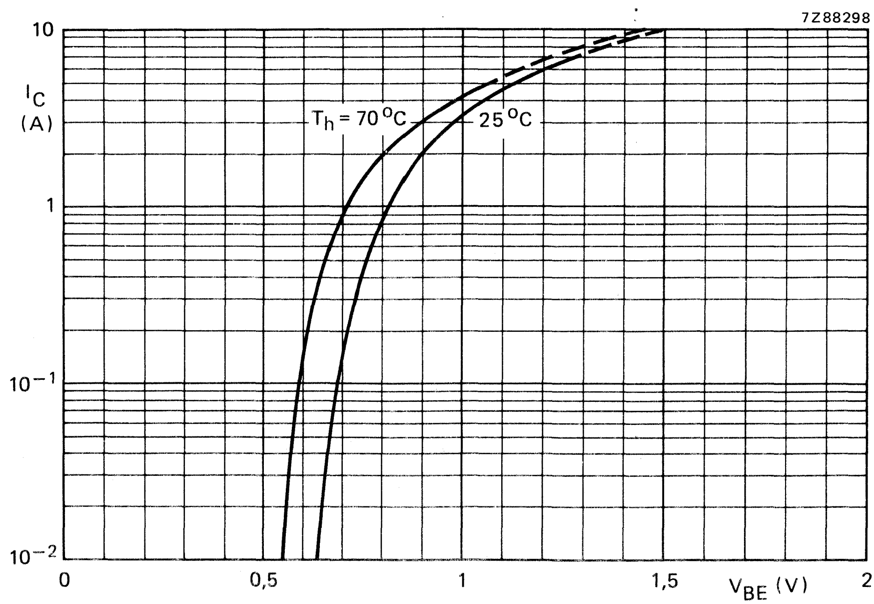


Fig. 4 Typical values; $V_{CE} = 20$ V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

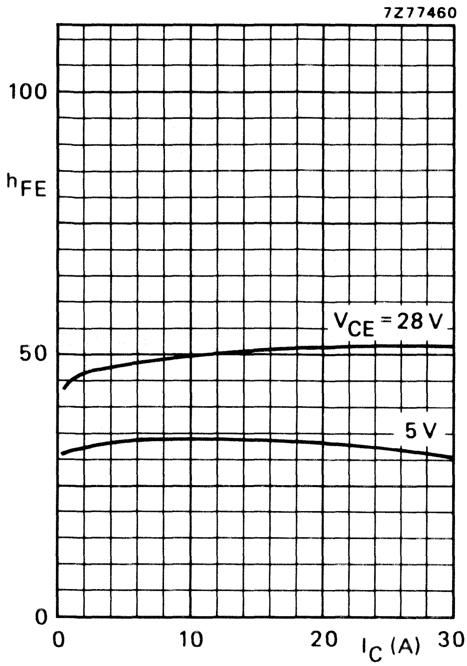


Fig. 5 Typical values; T_j = 25 °C.

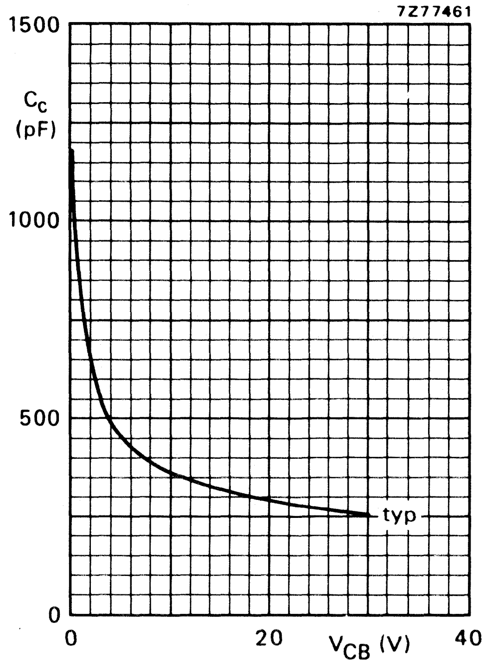


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

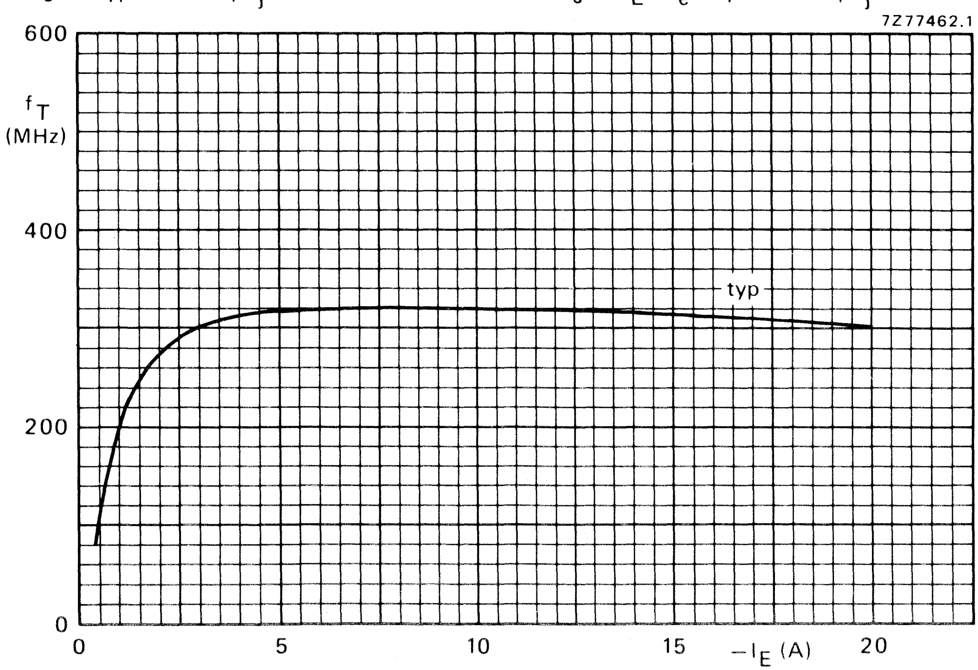


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 130 W P.E.P.	I_C (A) at 130 W P.E.P.	d_3 dB	d_5 dB	$I_{C(ZS)}$ A
15 to 130 (P.E.P.)	**> 12**	**> 37,5**	**< 6,2**	**< −30**	**< −30**	**0,1**

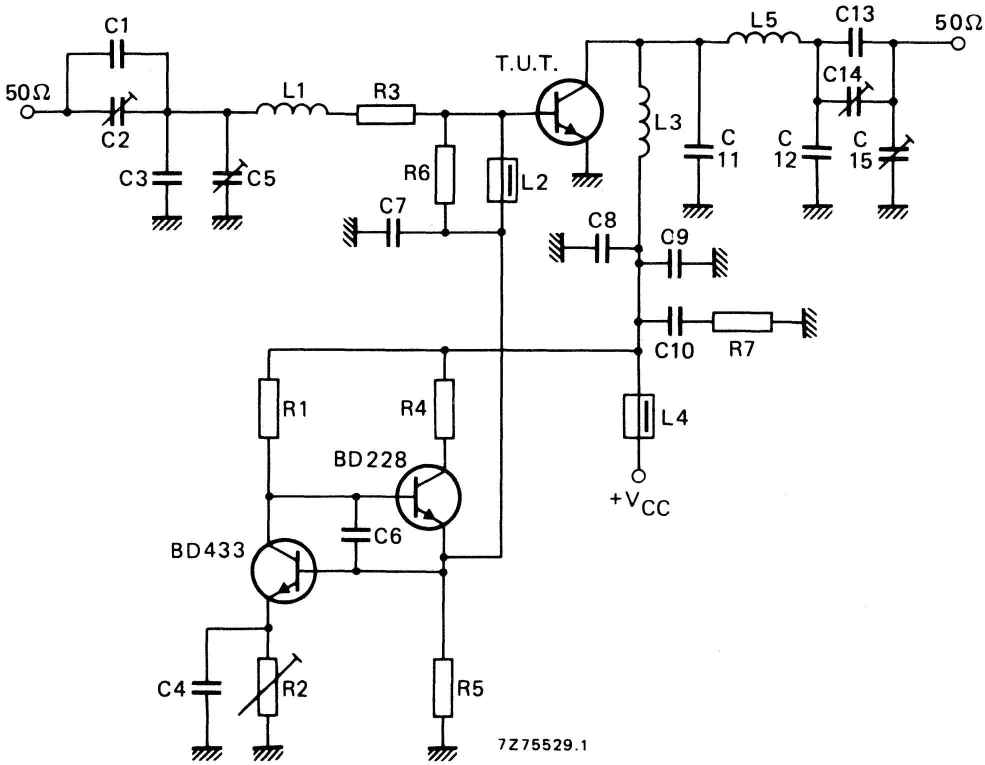


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = 27 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 180 pF polystyrene capacitor
C4 = C6 = C9 = 100 nF polyester capacitor
C5 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C7 = C8 = 3,9 nF ceramic capacitor
C10 = 2,2 μF moulded metallized polyester capacitor
C11 = 2 x 180 pF polysterene capacitors in parallel
C12 = 3 x 56 pF and 33 pF ceramic capacitors in parallel (500 V)
C13 = 4 x 56 pF and 68 pF ceramic capacitors in parallel (500 V)

C14 = 360 pF air dielectric trimmer (single insulated rotor type)
C15 = 360 pF air dielectric trimmer (single non-insulated rotor type)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 7 mm
L2 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L5 = 80 nH; 2,5 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 10,0 mm; leads 2 x 7 mm

R1 = 470 Ω wirewound resistor (5,5 W)
R2 = 4,7 Ω wirewound potentiometer (3 W)
R3 = 0,55 Ω; parallel connection of 4 x 2,2 Ω carbon resistors (± 5%; 0,5 W each)
R4 = 45 Ω; parallel connection of 4 x 180 Ω wirewound resistors (5,5 W each)
R5 = 56 Ω (± 5%) carbon resistor (0,5 W)
R6 = 27 Ω (± 5%) carbon resistor (0,5 W)
R7 = 4,7 Ω (± 5%) carbon resistor (0,5 W)

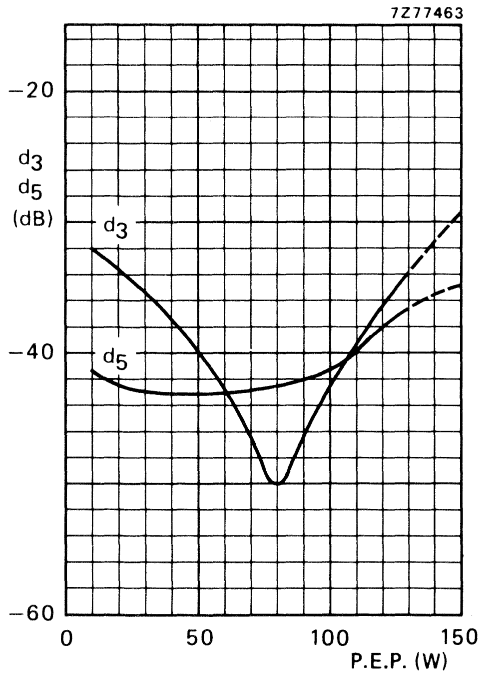


Fig. 9 Intermodulation distortion as a function of output power.*

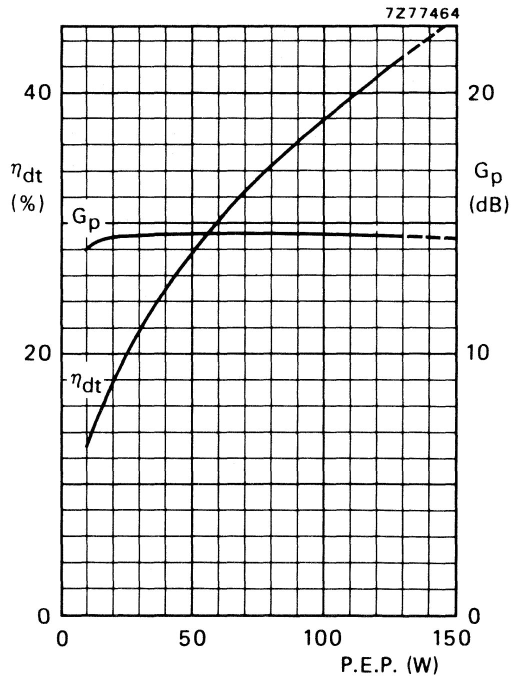


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

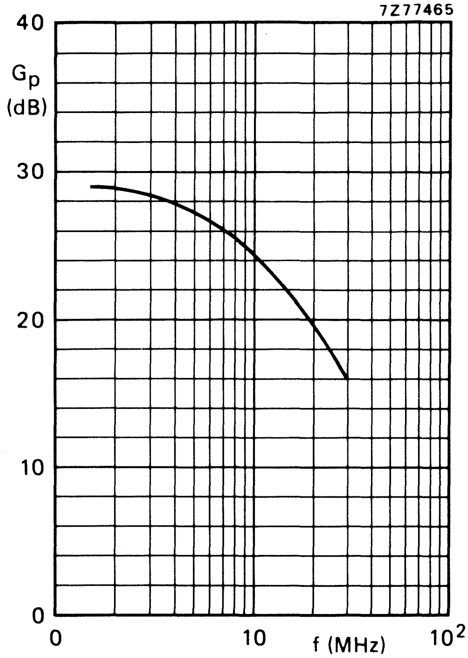


Fig. 11 Power gain as a function of frequency.

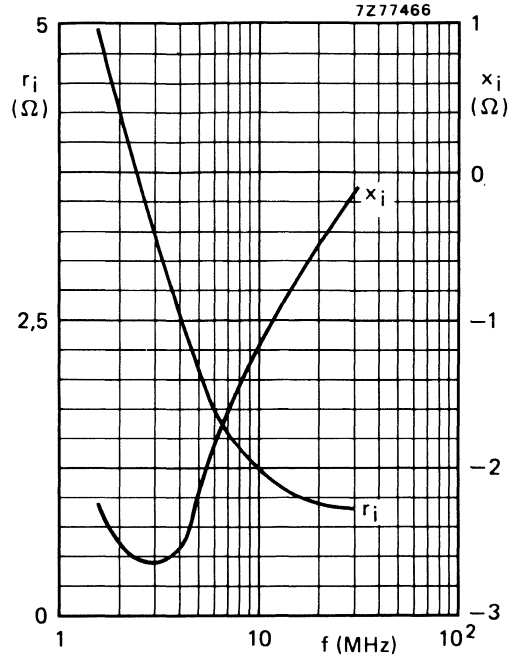


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω.

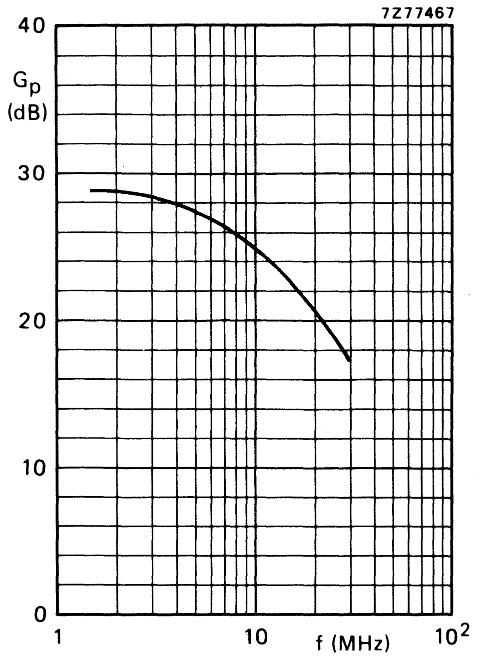


Fig. 13 Power gain as a function of frequency.

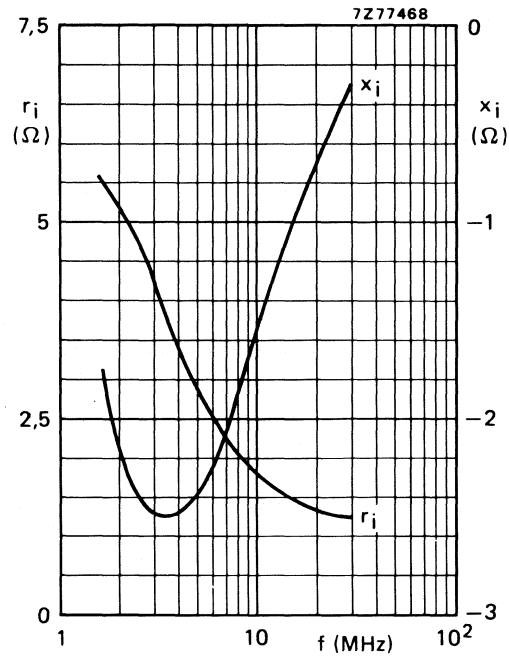


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for a push-pull amplifier with cross-neutralization in s.s.b class-AB operation.

Conditions:
V_{CE} = 28 V; $I_{C(ZS)}$ = 100 mA; P_L = 130 W; T_h = 25 °C; Z_L = 2,5 Ω; neutralizing capacitor: 150 pF.

APPLICATION INFORMATION (continued)

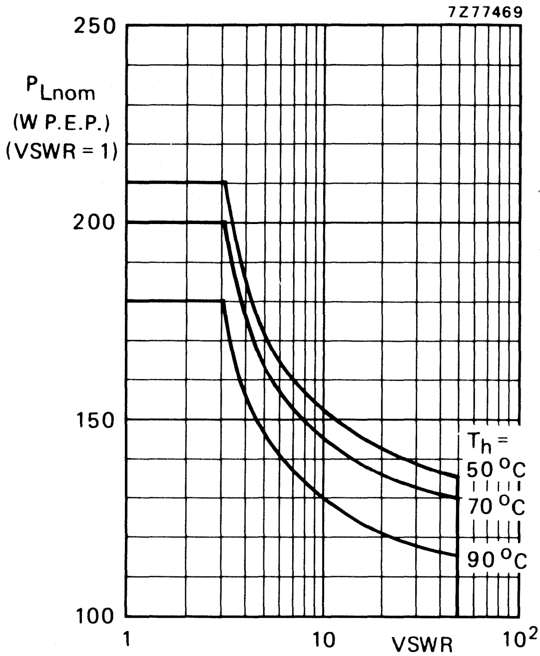


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
87,5	**28**	**130**	typ. **23,2**	typ. **7,5**	typ. **6,2**	typ. **75**	**0,62 + j0,73**	**273 − j42**

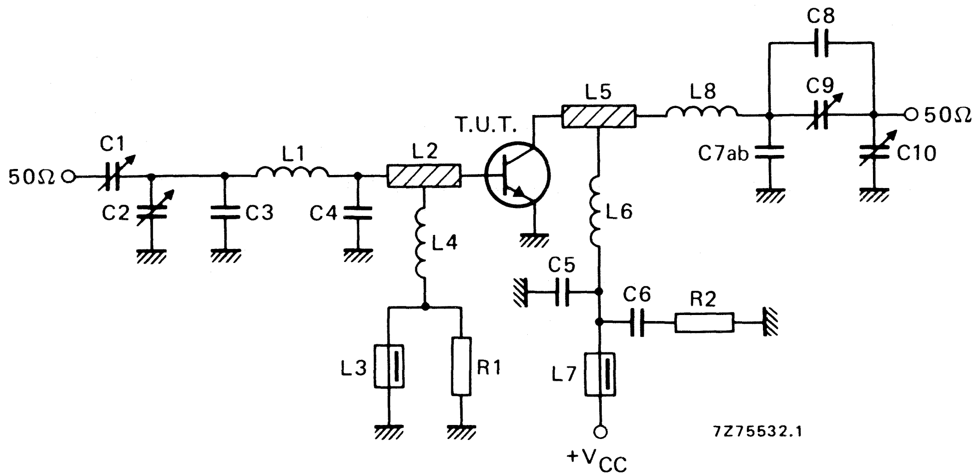


Fig. 16 Test circuit; c.w. class-B.

List of components:

C1 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = C9 = C10 = 7 to 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C3 = C8 = 22 pF ceramic capacitor (500 V)
C4 = 4 x 82 pF ceramic capacitors in parallel (500 V)
C5 = 390 pF polystyrene capacitor
C6 = 220 nF polyester capacitor
C7a = 2 x 10 pF ceramic capacitors in parallel (500 V)
C7b = 2 x 8,2 pF ceramic capacitors in parallel (500 V)

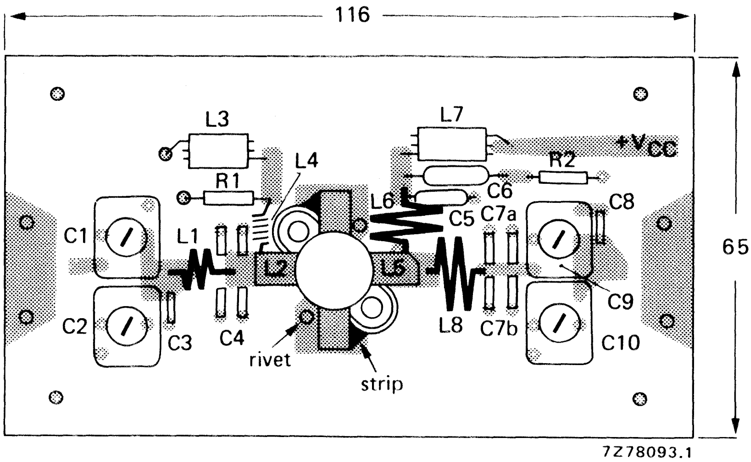
L1 = 25 nH; 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 4,6 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 and L6 at 5 mm from transistor
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L6 = 46 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,0 mm; leads 2 x 5 mm
L8 = 44 nH; 2 turns Cu wire (2,0 mm); int. dia. 9,0 mm; length 6,7 mm; leads 2 x 5 mm

L2 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric.

R1 = 10 Ω (± 10%) carbon resistor
R2 = 4,7 Ω (± 10%) carbon resistor

Component layout and printed-circuit board for 87,5 MHz test circuit are shown in Fig. 17.

APPLICATION INFORMATION (continued)



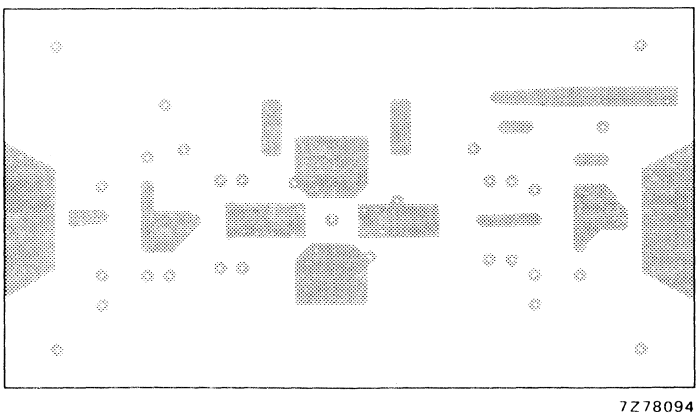


Fig. 17 Component layout and printed-circuit board for 87,5 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

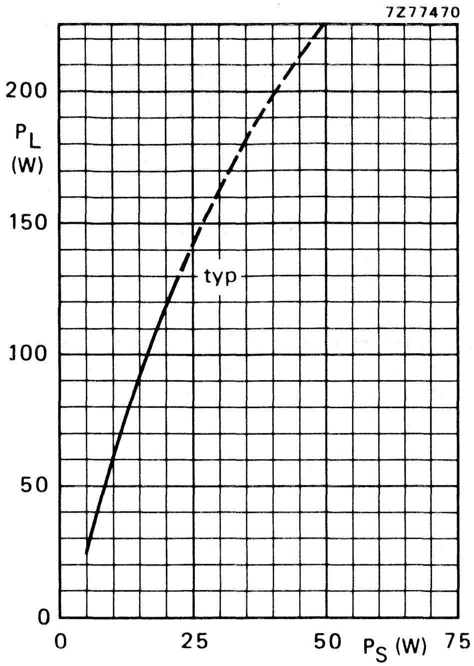


Fig. 18 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C.

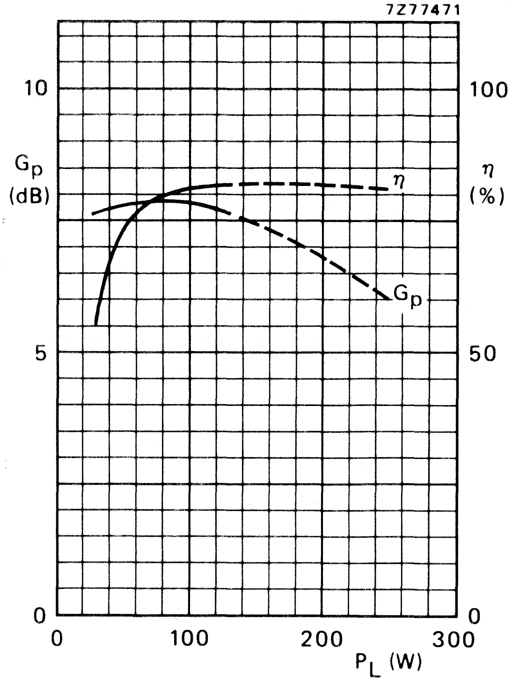


Fig. 19 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C; typical values.

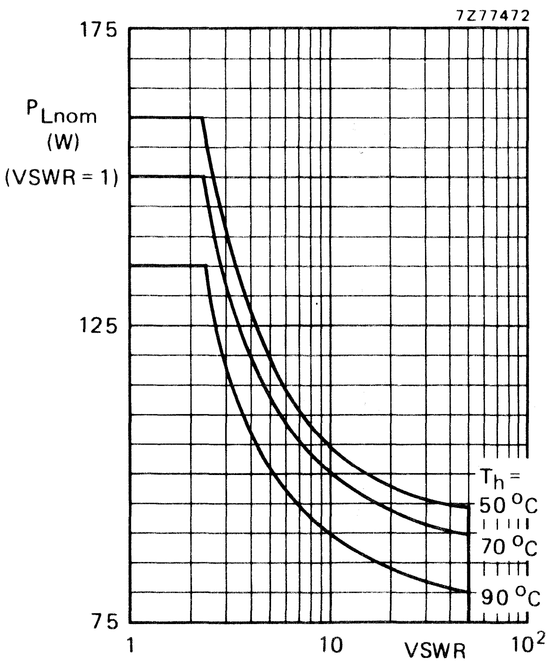


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 87,5 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

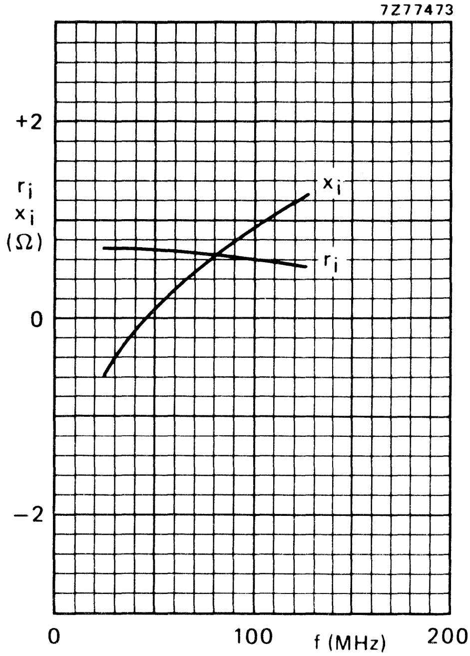


Fig. 21 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

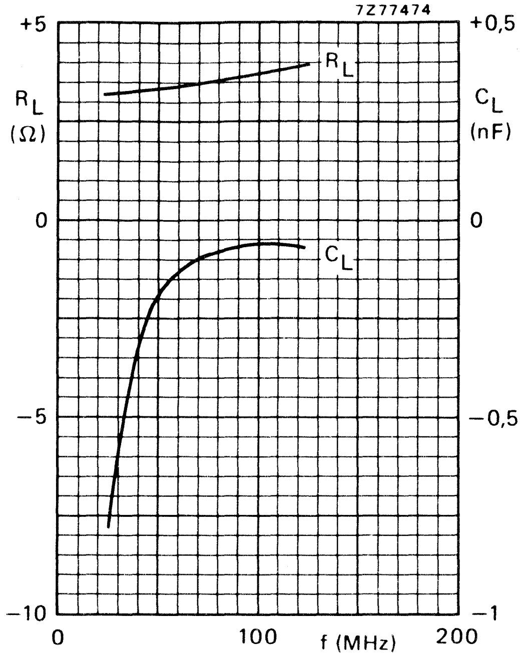


Fig. 22 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

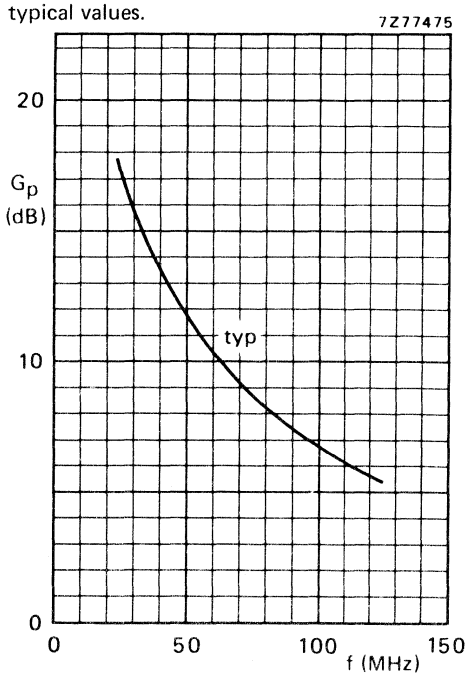


Fig. 23 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB or B operated mobile, industrial and military transmitters in the h.f. and v.h.f. bands. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	I_C $I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η %	d_3* dB
c.w. (class-B)	**28**	–	**150**	**100**	> **6**	> **70**	–
s.s.b. (class-A)	26	3	28	35 (P.E.P.)	typ. 19,5	–	typ. −40
s.s.b. (class-AB)	28	0,05	28	100 (P.E.P.)	typ. 19,0	typ. 42	typ. −30

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

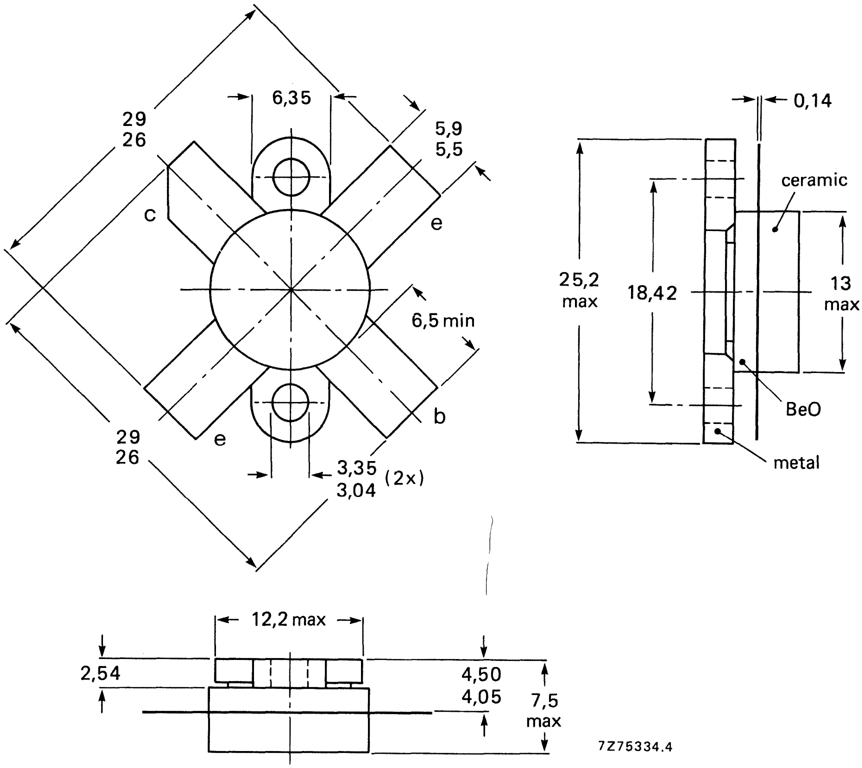
MECHANICAL DATA

SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	35 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	10 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	25 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	160 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

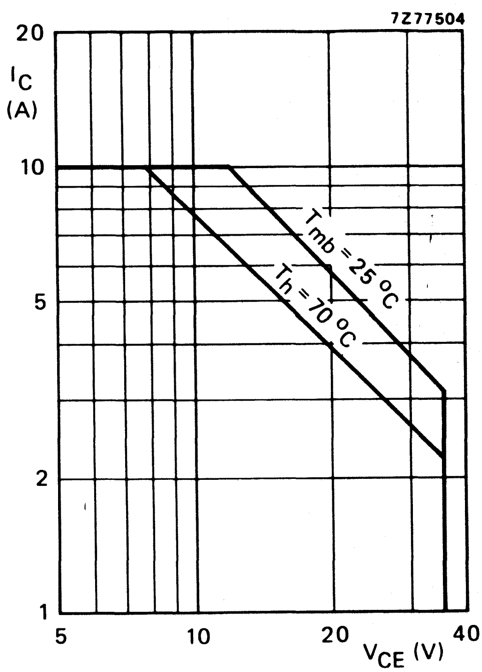


Fig. 2 D.C. SOAR.

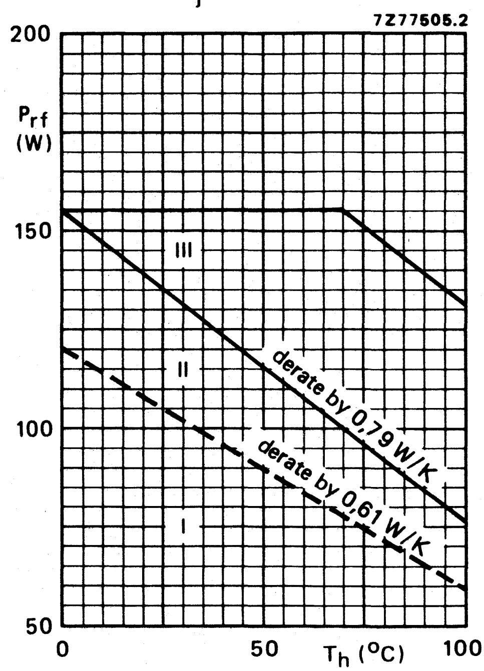


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 80 W; T_{mb} = 86 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,45 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,06 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	70 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	35 V
Emitter-base breakdown voltage open collector; I_E = 5 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 35 V	I_{CES}	<	5 mA
D.C. current gain* I_C = 5 A; V_{CE} = 5 V	h_{FE}	20 to 85	
Collector-emitter saturation voltage I_C = 15 A; I_B = 3 A	V_{CEsat}	typ.	2 V
Transition frequency at f = 100 MHz** $-I_E$ = 5 A; V_{CB} = 28 V	f_T	typ.	370 MHz
$-I_E$ = 15 A; V_{CB} = 28 V	f_T	typ.	350 MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	155 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	102 pF
Collector-flange capacitance	C_{cf}	typ.	3 pF

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0{,}02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0{,}01$.

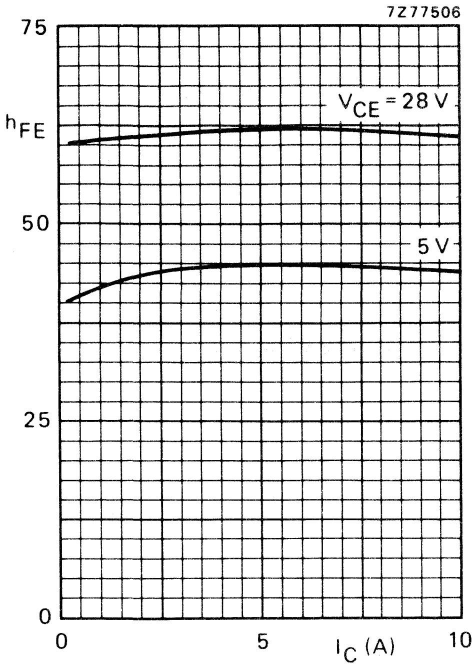


Fig. 4 Typical values; T_j = 25 °C.

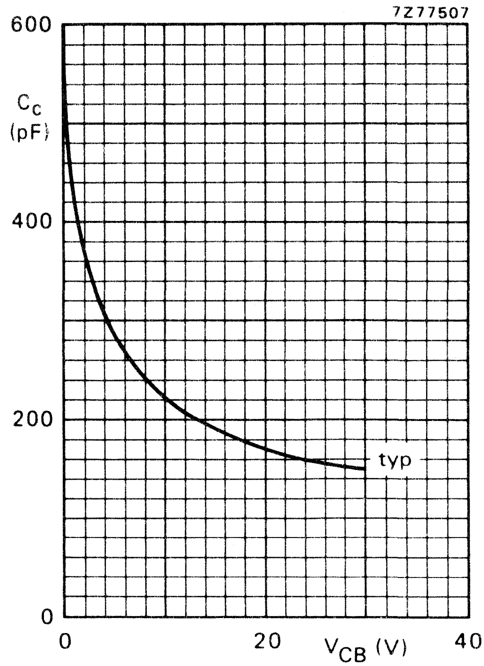


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

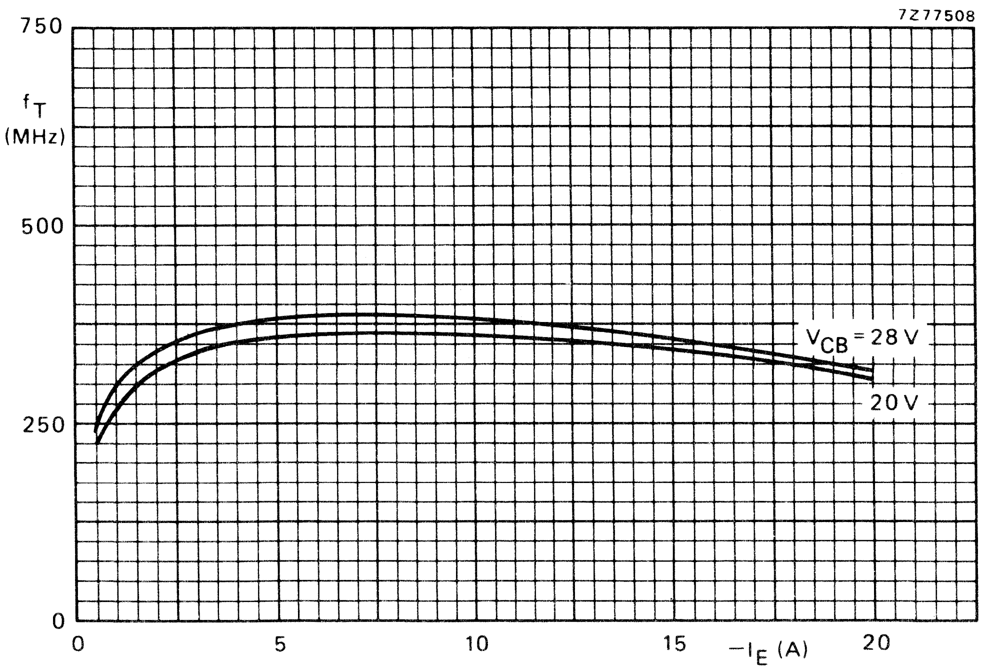


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit); T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_D (W)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
150	**28**	**100**	**≤ 25**	**≥ 70**	**0,74 + j1,35**	**4,30 + j0,60**

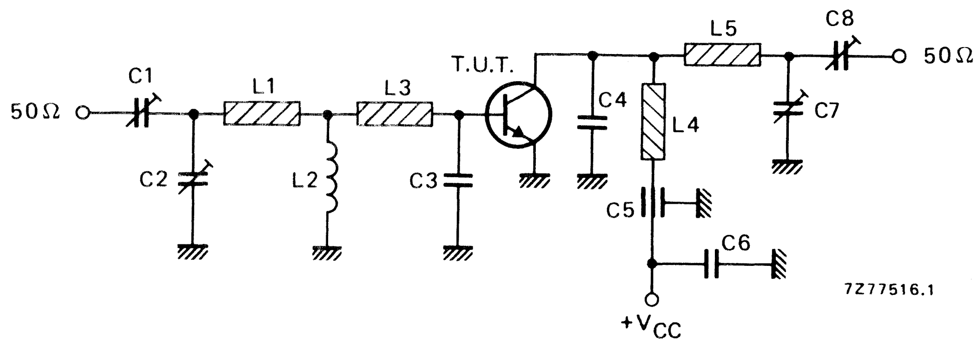


Fig. 7 Test circuit; c.w. class-B; f = 150 MHz.

List of components:

C1 = C2 = C7 = C8 = 5 to 100 pF film dielectric trimmer
C3 = 203 pF; 2 x 82 pF and 39 pF multilayer ceramic chip capacitors (500 V, ATC▲) in parallel
C4 = 39 pF multilayer ceramic chip capacitor (500 V, ATC▲)
C5 = 1 nF feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = strip (30 mm x 8 mm); bent to form inverted 'U' shape with top 15 mm above heatsink, and bottom 5 mm above heatsink
L2 = 1 μH r.f. choke
L3 = strip; shape as shown in Fig. 8; 5 mm above heatsink
L4 = strip (40 mm x 8 mm); bent in form __⌐‾‾‾, 25 mm at 15 mm above heatsink, 5 mm at 5 mm above heatsink
L5 = strip (75 mm long; width 8 mm); 5 mm above base

L1, L3, L4, and L5 are copper strips with a thickness of 0,6 mm.

Heatsink: aluminium; 0,9 K/W

At P_L = 100 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 0,12 W/K.

Component layout on an aluminium heatsink for 150 MHz test circuit is shown in Fig. 8.

▲ ATC means American Technical Ceramics.

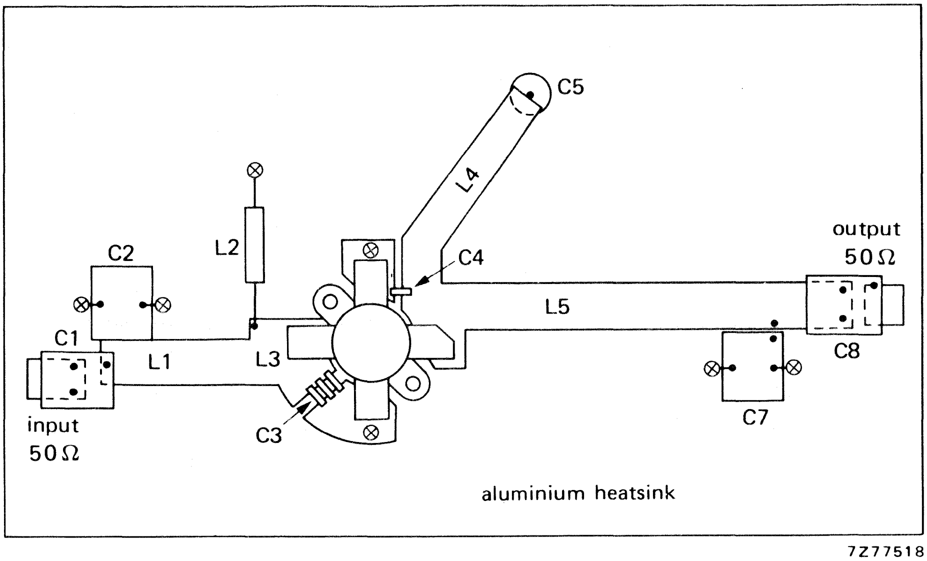


Fig. 8 Component layout on an aluminium heatsink for 150 MHz test circuit. ⊗ Earthing bolts.

APPLICATION INFORMATION (continued)

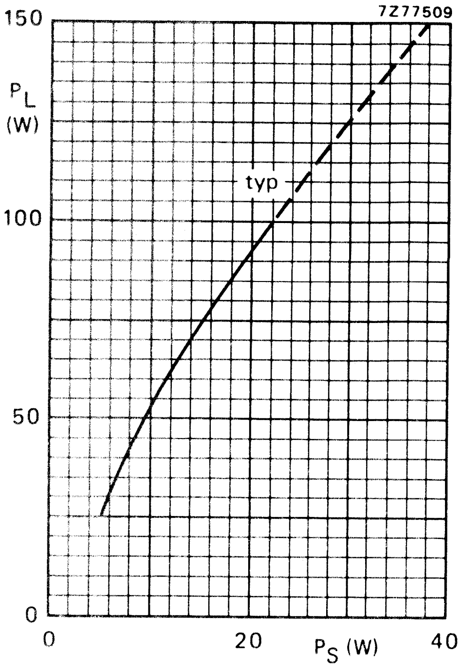


Fig. 9 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C.

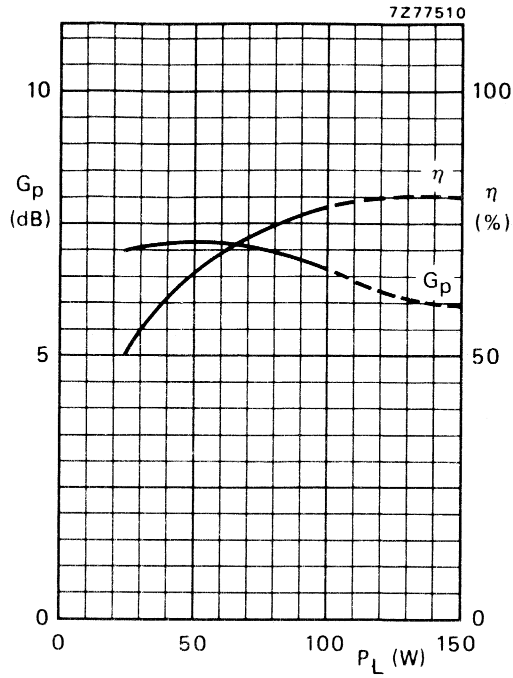


Fig. 10 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C; typical values.

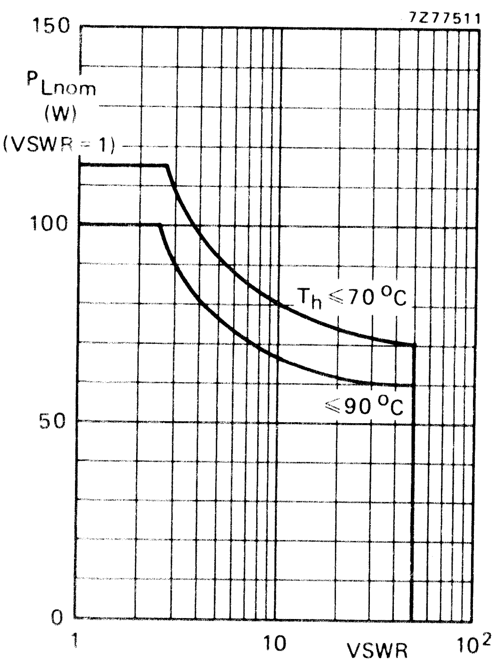


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 150 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 4,7 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

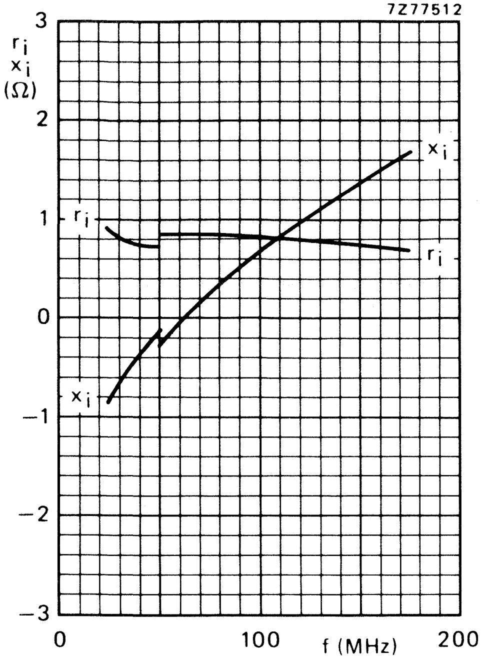


Fig. 12 Input impedance (series components).

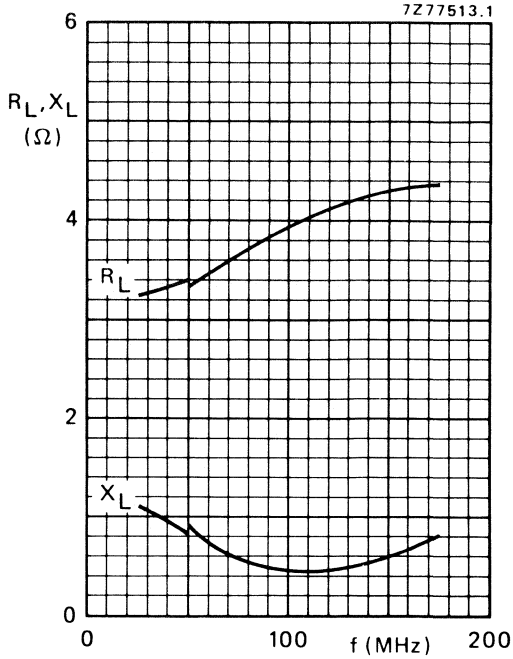
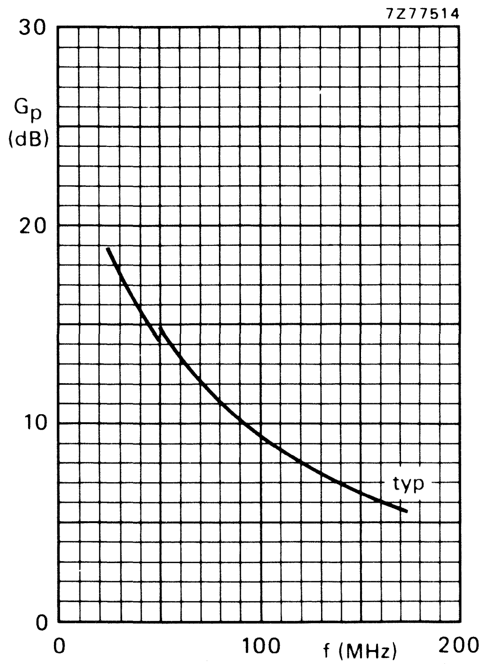


Fig. 13 Load impedance (series components).



Conditions for Figs 12, 13 and 14:
V_{CE} = 28 V; P_L = 100 W; T_h = 25 °C;
typical values; class-B operation.

Fig. 14.

APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-A operation

V_{CE} = 26 V; T_h = 40 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB
35 (P.E.P.)	typ. 19,5	3	typ. −40

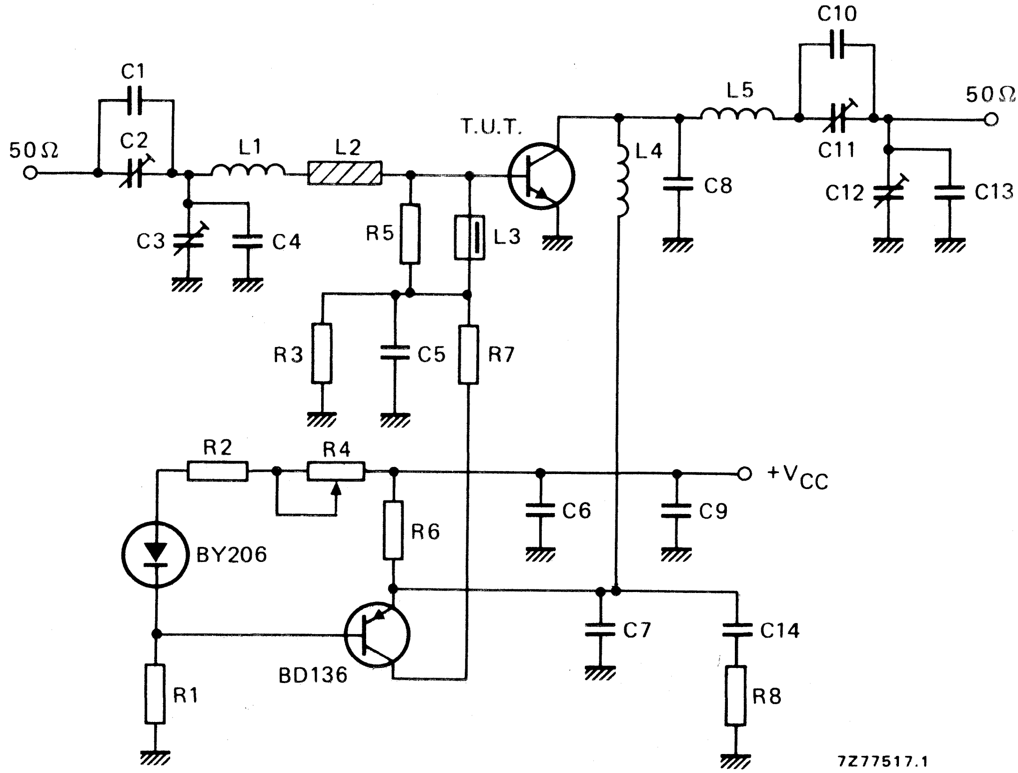


Fig. 15 Test circuit; s.s.b. class-A; f = 28 MHz.

List of components:

C1 = 33 pF ceramic capacitor (500 V)
C2 = 100 pF air dielectric trimmer (single insulated rotor type)
C3 = 280 pF air dielectric trimmer (single non-insulated rotor type)
C4 = 180 pF polystyrene capacitor
C5 = C6 = C7 = 3,9 nF ceramic capacitor
C8 = 2 x 33 pF ceramic capacitors in parallel (500 V)
C9 = 330 nF polyester capacitor
C10 = 82 pF ceramic capacitor (500 V)
C11 = 100 pF air dielectric trimmer (single insulated rotor type)
C12 = 180 pF air dielectric trimmer (single non-insulated rotor type)
C13 = 150 pF polystyrene capacitor
C14 = 390 nF polyester capacitor

List of components in Fig. 15 (continued):

L1 = 72 nH; 3 turns Cu wire (1,0 mm); int. dia. 7 mm; length 4,8 mm; leads 2 x 5 mm
L2 = Cu strip (28 mm x 5 mm x 0,2 mm); 18 mm at 3 mm above printed-circuit board
L3 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = 300 nH; 6 turns Cu wire (1,5 mm); int. dia. 12 mm; length 16 mm; leads 2 x 5 mm
L5 = 330 nH; 7 turns Cu wire (1,5 mm); int. dia. 12 mm; length 20,8 mm; leads 2 x 5 mm

R1 = 1,5 kΩ (± 5%) carbon resistor (0,5 W)
R2 = 100 Ω (± 5%) carbon resistor (0,5 W)
R3 = 68 Ω (± 5%) carbon resistor (0,5 W)
R4 = 100 Ω wirewound potentiometer
R5 = 33 Ω (± 5%) carbon resistor (0,5 W)
R6 = 0,68 Ω (± 10%) wirewound resistor (7 W)
R7 = 120 Ω wirewound resistor (8 W)
R8 = 10 Ω (± 10%) carbon resistor (0,5 W)

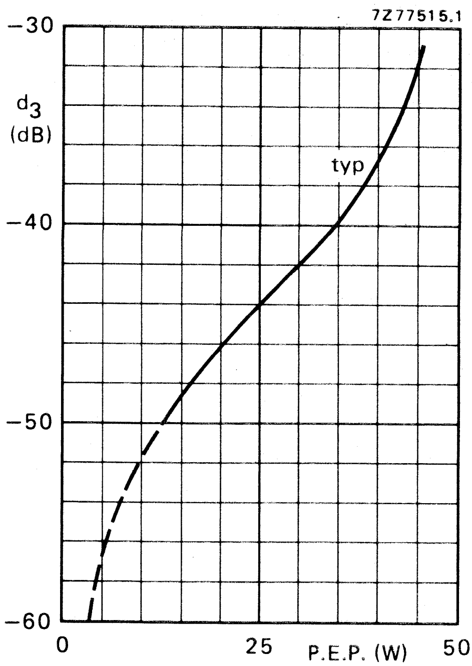


Fig. 16 Intermodulation distortion as a function of output power; V_{CE} = 26 V; I_C = 3 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 40 °C.

APPLICATION INFORMATION (continued)

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ mA
100 (P.E.P.)	typ. 19	typ. 42	typ. 4,3	typ. −30	typ. −37	50

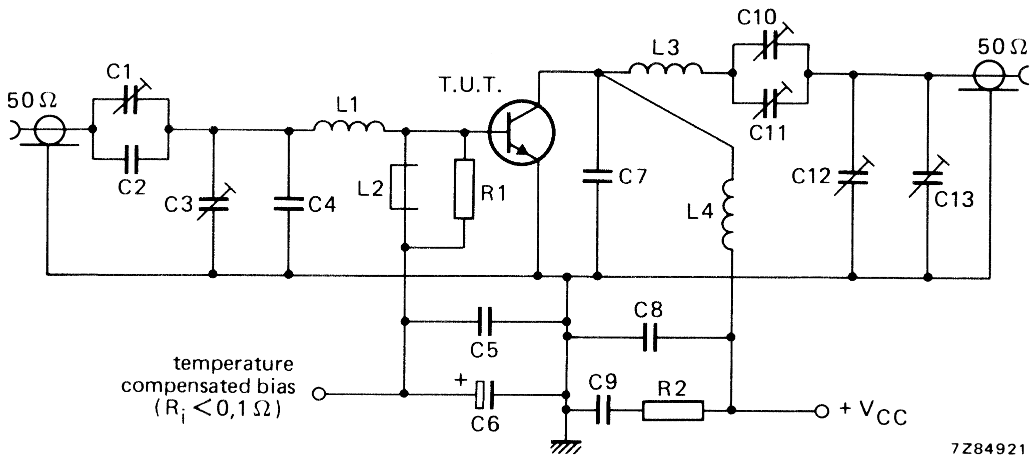


Fig. 17 Test circuit; s.s.b. class-AB; f = 28 MHz.

List of components:

C1 = C11 = 150 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor (500 V)
C3 = C12 = 150 pF air dielectric trimmer (single non-insulated rotor type)
C4 = 180 pF ceramic capacitor (500 V)
C5 = C8 = 3,9 nF ceramic capacitor
C6 = 150 μF/6 V solid tantalum capacitor
C7 = 150 pF ceramic capacitor (500 V)
C9 = 100 nF polyester capacitor
C10 = 750 pF mica dielectric trimmer (single insultated rotor type)
C13 = 750 pF mica dielectric trimmer (single non-insulated rotor type)

L1 = 3 turns enamelled Cu wire (1,0 mm); int. dia. 12 mm; length 12 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 3 turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 12 mm
L4 = 2 turns enamelled Cu wire (2,0 mm); int. dia. 12 mm; length 8 mm

R1 = 27 Ω (± 10%) carbon resistor (0,5 W)
R2 = 4,7 Ω (± 10%) carbon resistor (0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

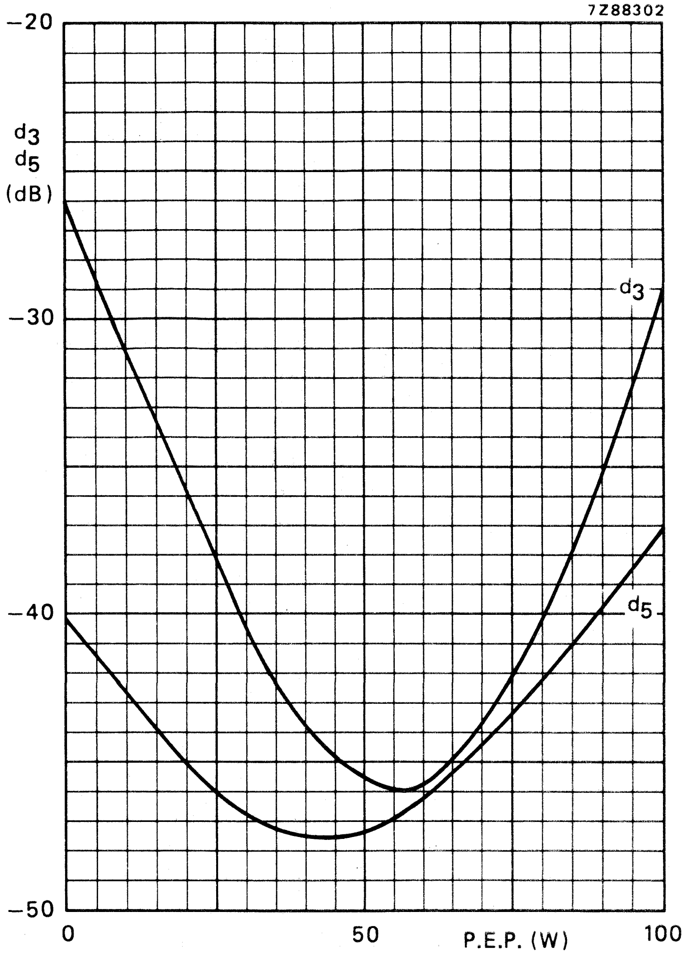


Fig. 18 Intermodulation distortion* as a function of output power.
Typical values; V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

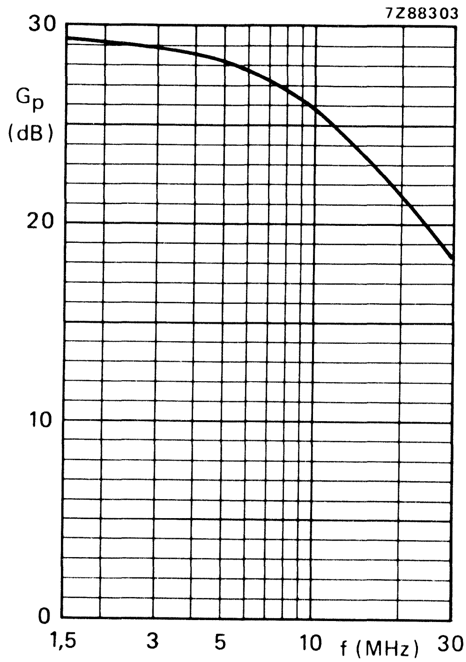


Fig. 19 Power gain as a function of frequency.

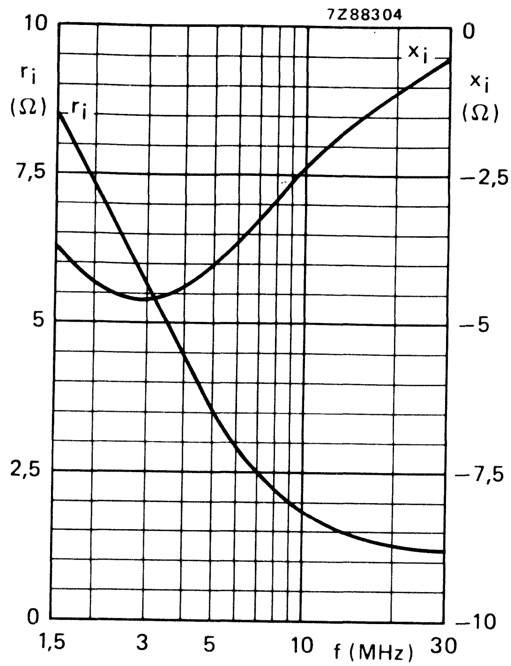


Fig. 20 Input impedance (series components).

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.
Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 100 W (P.E.P.); T_h = 25 °C; Z_L = 2,7 Ω.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V. The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

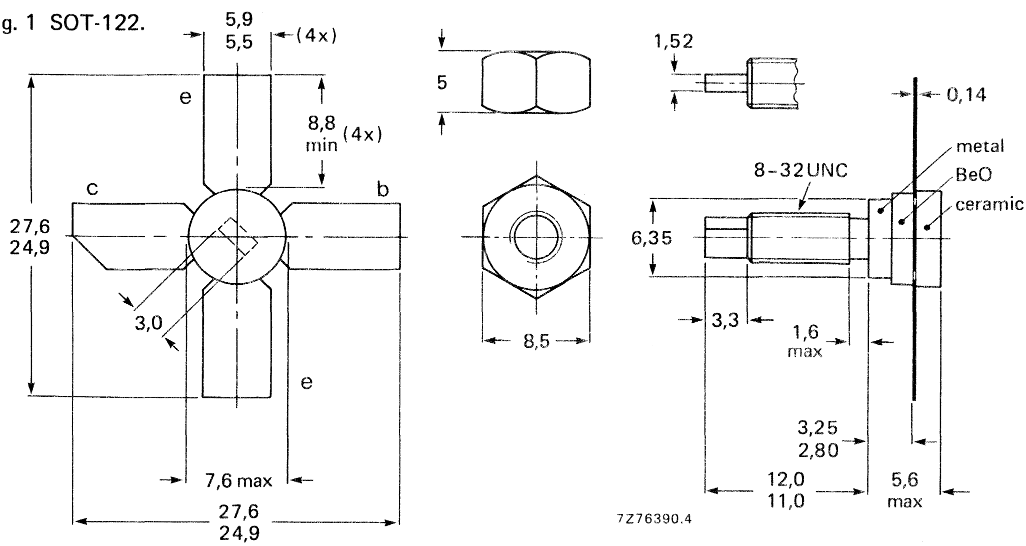
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**12,5**	**470**	**2**	**> 9,0**	**> 60**	**3,5 + j0,4**	**28 − j38**
c.w.	12,5	175	2	typ. 13,5	typ. 60	4,2 − j3,4	25 − j24

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

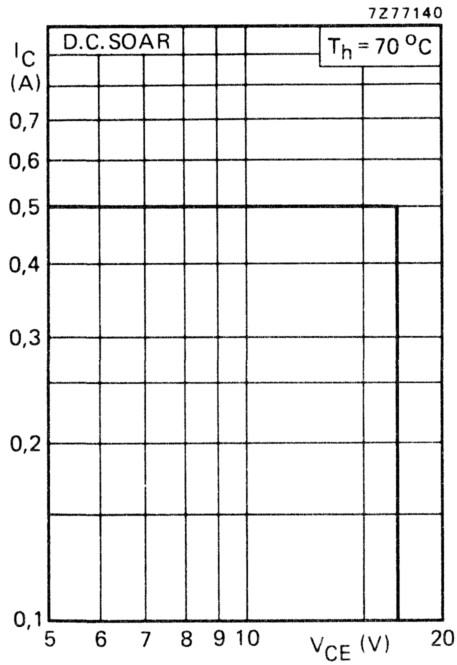
When locking is required an adhesive is preferred instead of a lock washer.

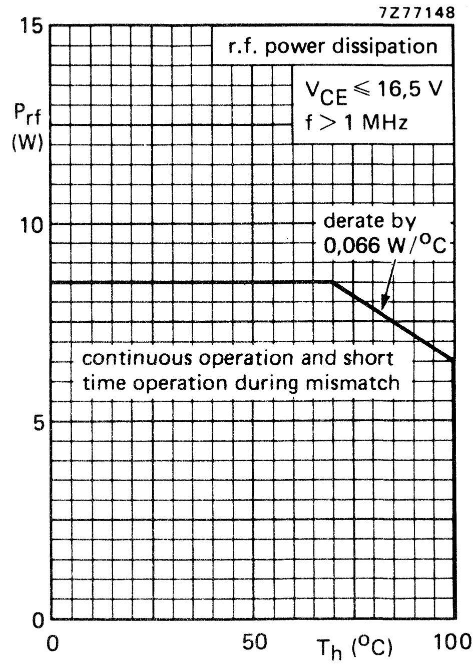
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36	V
Collector-emitter voltage (open base)	V_{CEO}	max	17	V
Emitter-base voltage (open collector)	V_{EBO}	max	4	V
Collector current (d.c.)	I_C	max	0,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max	1,5	A
Total power dissipation (d.c. and r.f.) up to T_h = 70 °C	P_{tot}	max	8,5	W





Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	14,5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

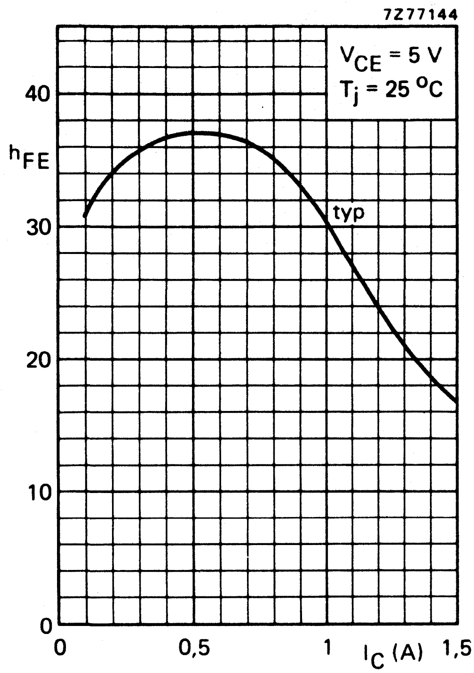
CHARACTERISTICS

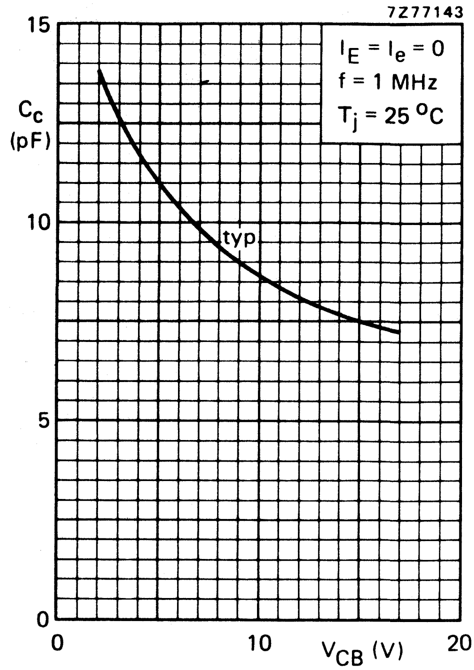
$T_j = 25\ ^oC$

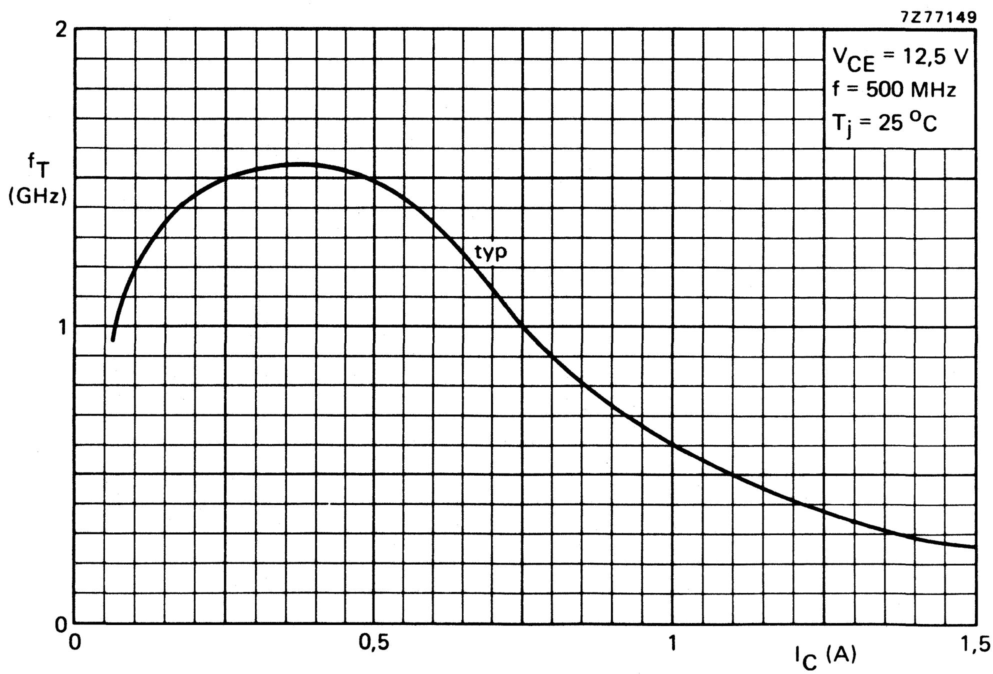
Breakdown voltages

Collector-emitter voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	2 mA
D.C. current gain *			
$I_C = 250$ mA; $V_{CE} = 5$ V	h_{FE}	>	10
		typ	35
Collector-emitter saturation voltage *			
$I_C = 750$ mA; $I_B = 150$ mA	V_{CEsat}	typ	0,6 V
Transition frequency at f = 500 MHz *			
$I_C = 250$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,5 GHz
$I_C = 750$ mA; $V_{CE} = 12,5$ V	f_T	typ	1,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	8 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	3,6 pF
Collector-stud capacitance	C_{cs}	typ	1,2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77144
V_CE = 5 V
T_j = 25 °C
h_FE
40
30
20
10
0
typ
0
0,5
1
I_C (A)
1,5


7Z77143
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c
(pF)
15
10
5
0
typ
0
10
V_CB (V)
20


7Z77149
V_CE = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
2
1
0
typ
0
0,5
1
I_C (A)
1,5

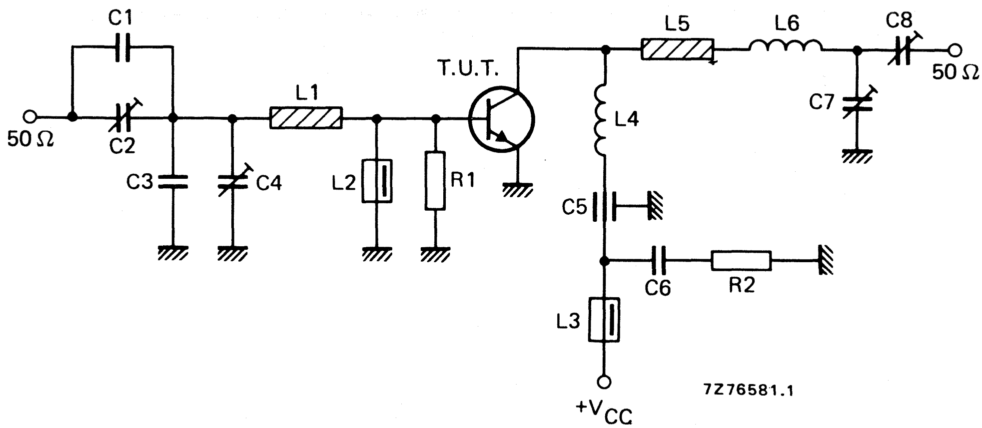
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
470	**12,5**	**2**	**< 0,25**	**> 9,0**	**< 0,27**	**> 60**	**3,5 + j0,4**	**28 – j38**
470	13,5	2	–	typ 10,5	–	typ 70	–	–
175	12,5	2	–	typ 13,5	–	typ 60	4,2 – j3,4	25 – j24

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C4 = C7 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 3,3 pF (± 0,25 pF) ceramic capacitor
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

L1 = stripline (35,6 mm x 6,0 mm)
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 178 nH; 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
L5 = stripline (10,0 mm x 6,0 mm)
L6 = 28 nH; ½ turn Cu wire (1 mm); int. dia. 10 mm

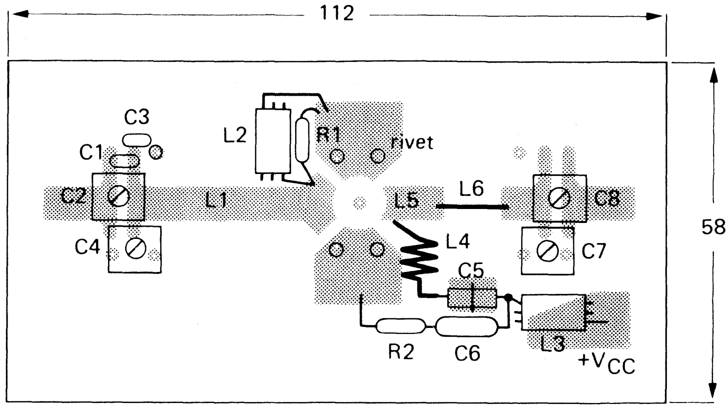
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 100 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

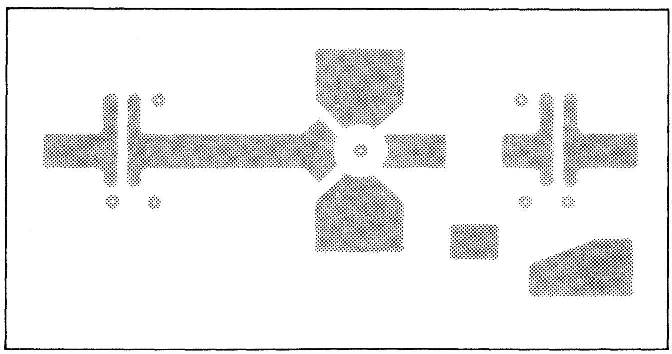
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

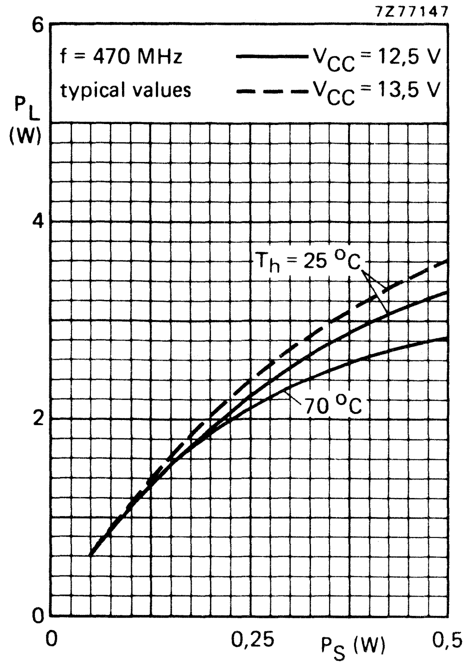


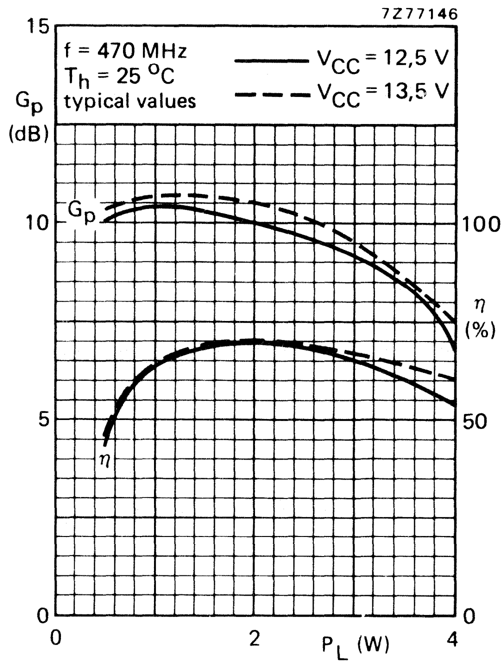
7Z76579

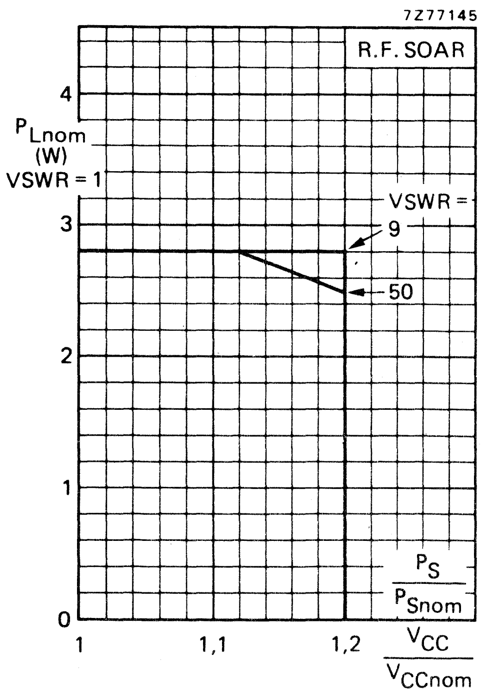


7Z76580

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







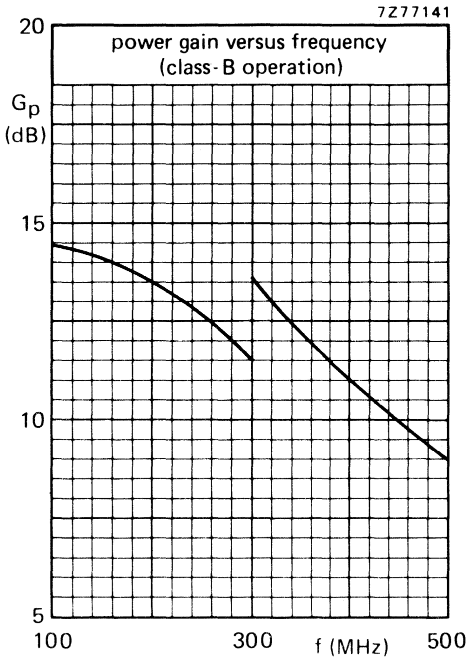
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 K/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

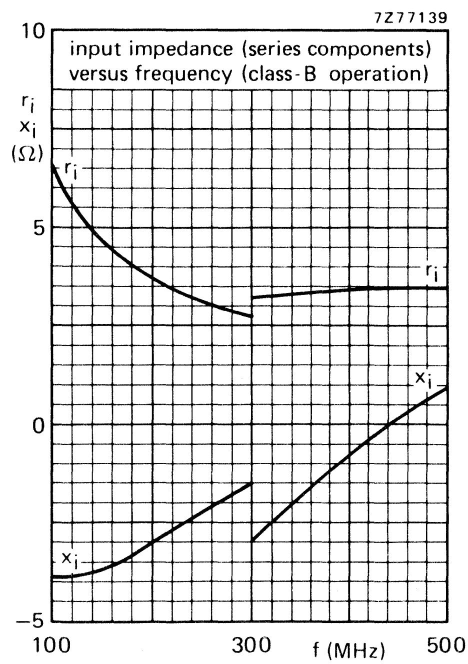
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

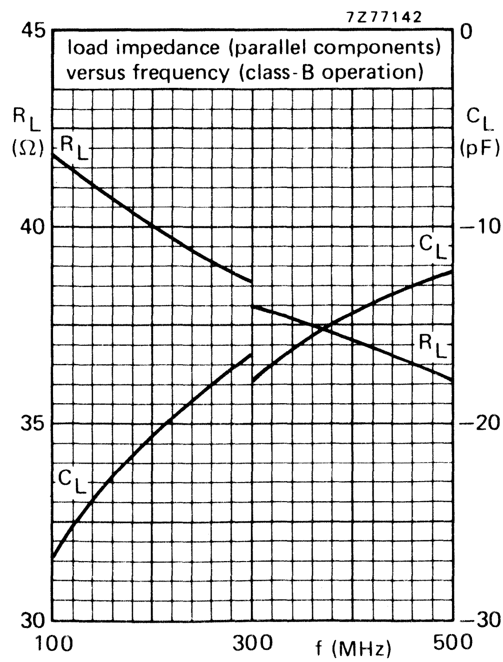
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 2 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

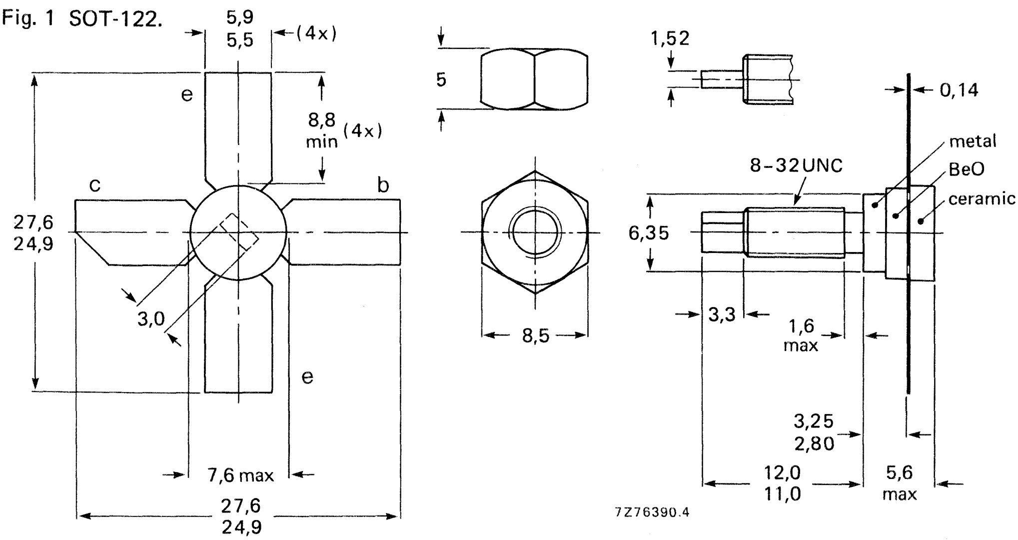
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**12,5**	**470**	**4**	**> 8,0**	**> 60**	**2,1 + j2,3**	**57 – j56**
c.w.	12,5	175	4	typ. 15,0	typ. 60	2,0 – j2,2	51 – j48

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

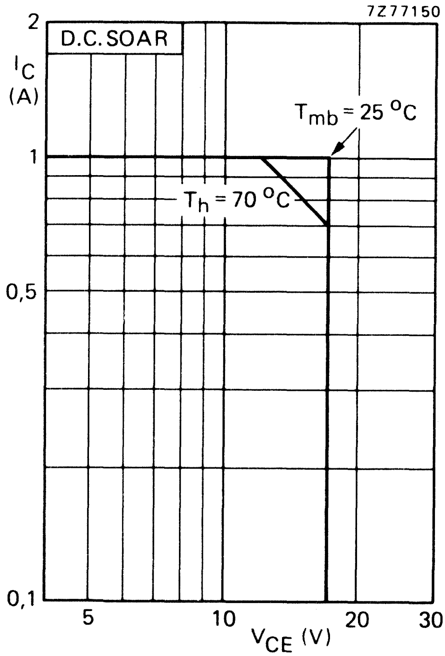
When locking is required an adhesive is preferred instead of a lock washer.

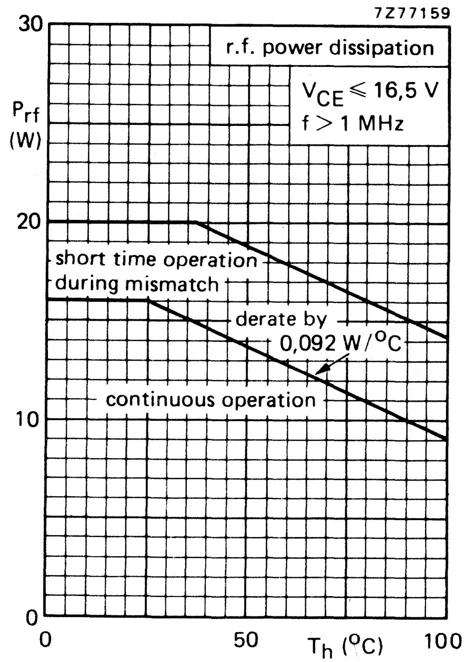
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	17 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V
Collector current (d.c.)	I_C	max	1 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	3 A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 25 °C	P_{tot}	max	17 W





Storage temperature	T_{stg}	–65 to +150	°C
Operating junction temperature	T_j	max 200	°C

THERMAL RESISTANCE

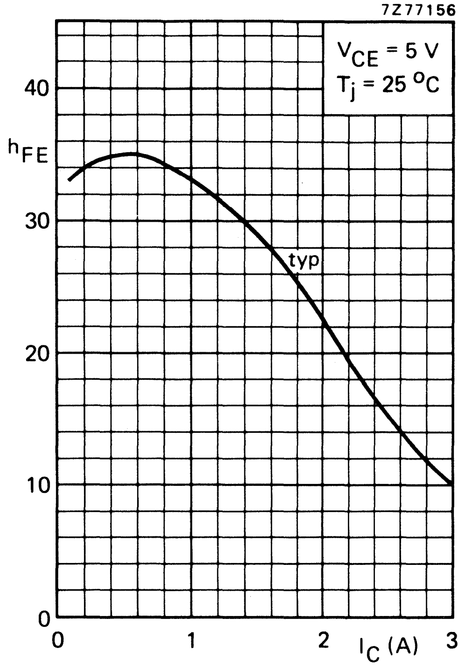
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10,3 °C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 °C/W

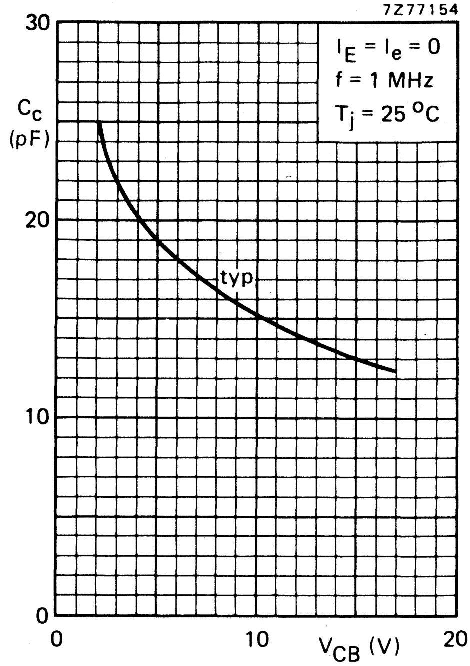
CHARACTERISTICS

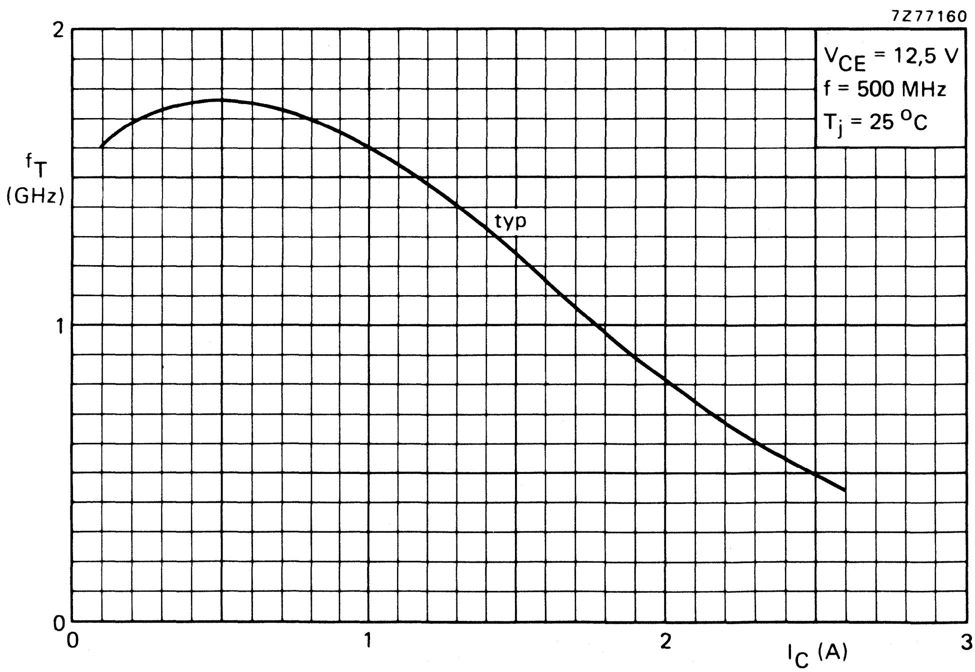
$T_j = 25\ ^oC$

Breakdown voltages				
Collector-emitter voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	17	V
Emitter-base voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	4	mA
D.C. current gain *				
$I_C = 0,5$ A; $V_{CE} = 5$ V	h_{FE}	> typ	10 35	
Collector-emitter saturation voltage *				
$I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ	0,75	V
Transition frequency at f = 500 MHz *				
$I_C = 0,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,75	GHz
$I_C = 1,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,25	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	14	pF
Feedback capacitance at f = 1 MHz				
$I_C = 40$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	7,1	pF
Collector-stud capacitance	C_{cs}	typ	1,2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77156
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
40
30
20
10
0
typ
0
1
2
3
I_C (A)


7Z77154
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
C_c
(pF)
30
20
10
0
typ
0
10
20
V_{CB} (V)


7Z77160
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
2
1
0
typ
0
1
2
3
I_C (A)

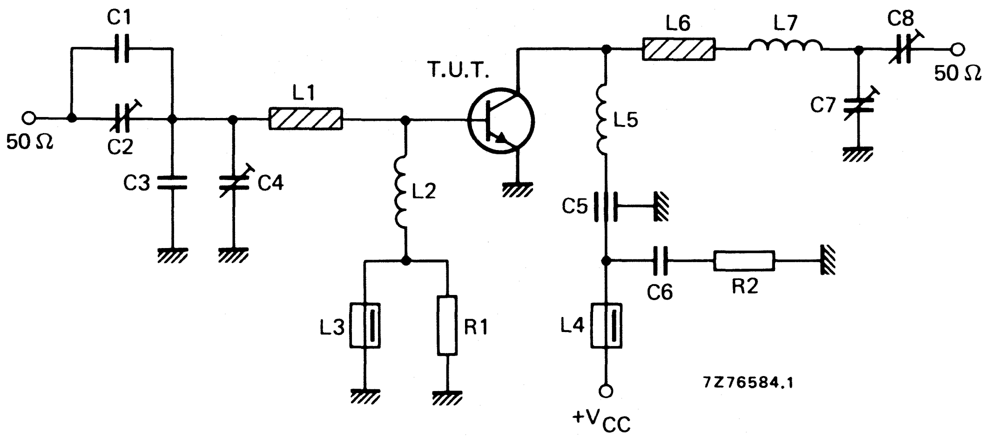
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
470	**12,5**	**4**	**< 0,63**	**> 8,0**	**< 0,53**	**> 60**	**2,1 + j2,3**	**57 – j56**
470	13,5	4	–	typ 9,5	–	typ 65	–	–
175	12,5	4	–	typ 15,0	–	typ 60	2,0 – j2,2	51 – j48

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 5,6 pF (± 0,25 pF) ceramic capacitor
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF ceramic feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (10,0 mm x 6,0 mm)
L7 = 15 nH; 1 turn Cu wire (1 mm); int. dia. 5 mm; leads 2 x 5 mm

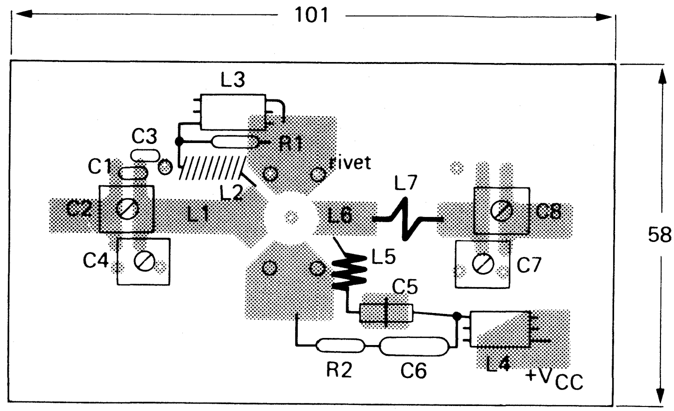
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω (± 5%) carbon resistor

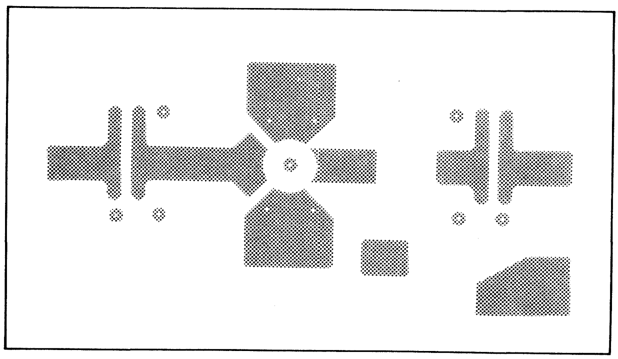
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

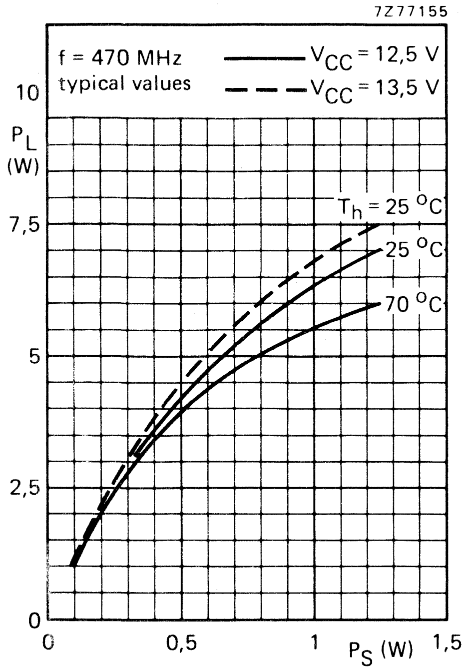


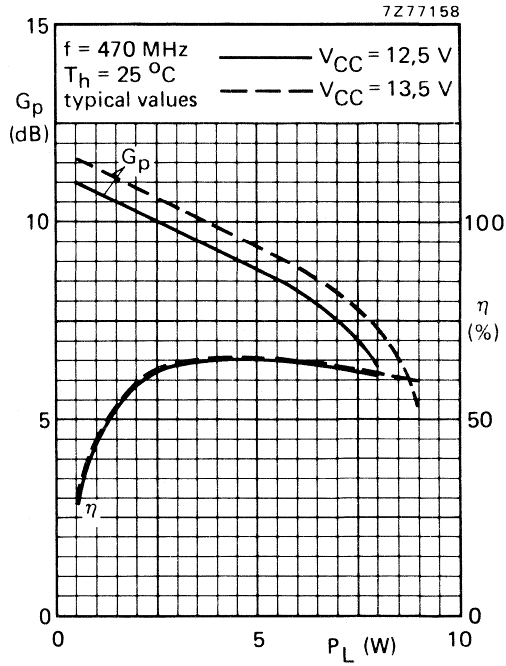
7Z76582

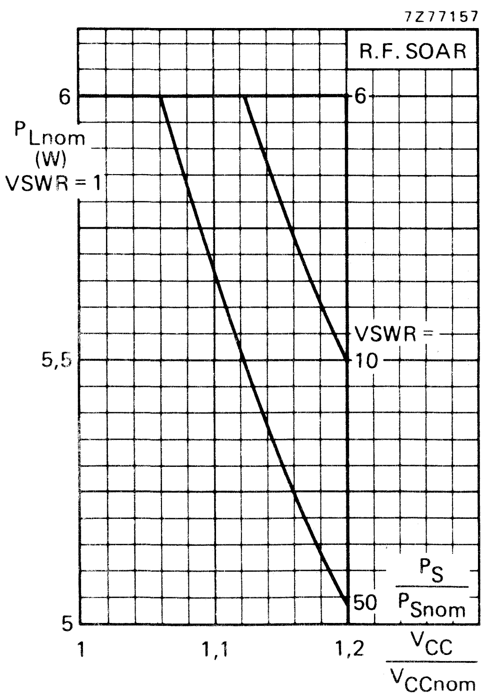


7Z76583

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







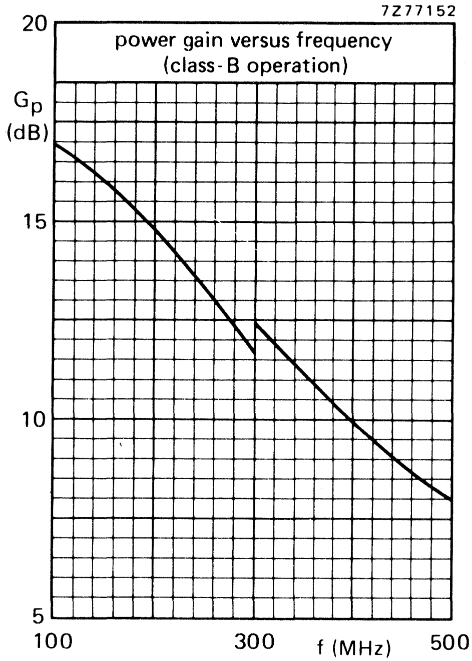
Conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 K/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other that the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

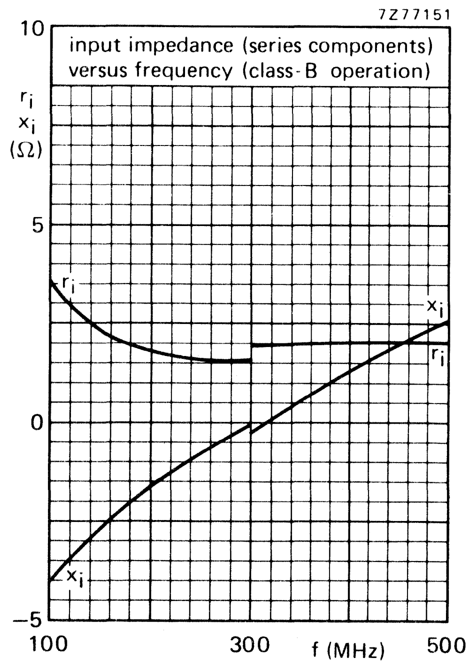
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

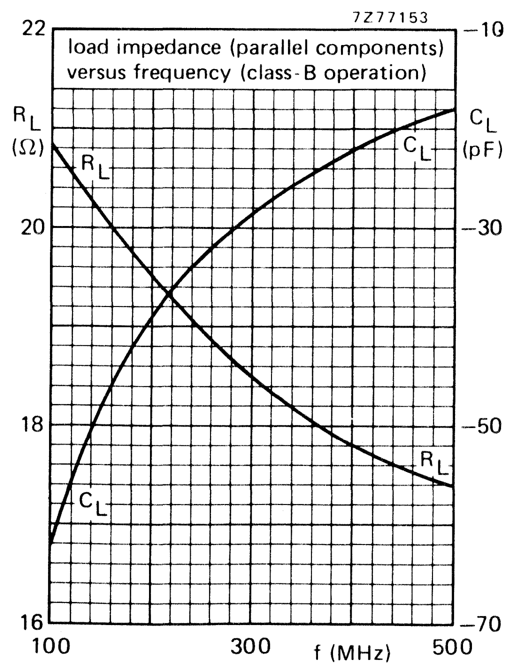
OPERATING NOTE Below 300 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 4 W
T_h = 25 °C
typical values





U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for nominal supply voltages up to 13,5 V.
The resistance stabilization of the transistor provides protection against device damage at severe load mismatch conditions.
The transistor is housed in a ¼" capstan envelope with a ceramic cap.

QUICK REFERENCE DATA

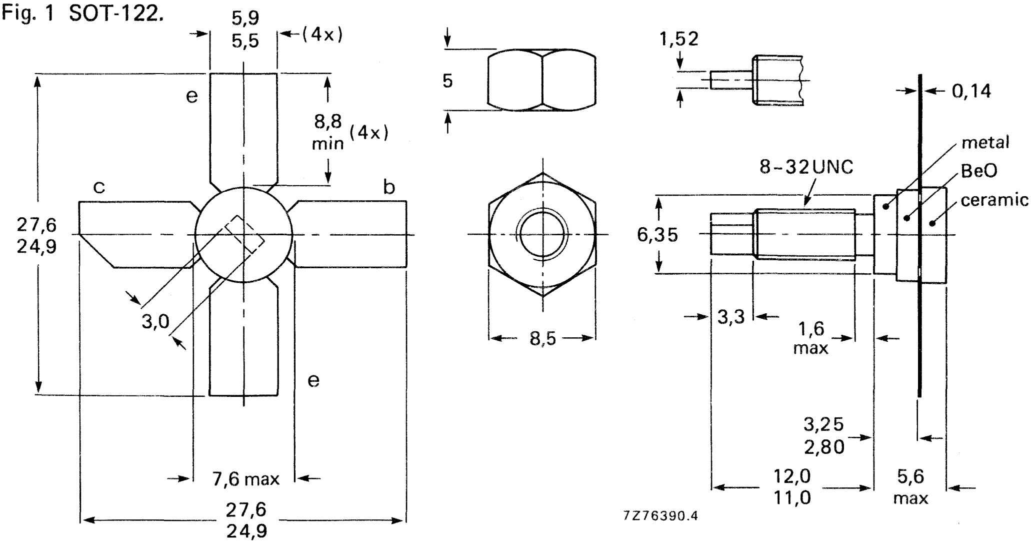
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**12,5**	**470**	**10**	**> 6,0**	**> 60**	**1,3 + j2,5**	**150 − j66**
c.w.	12,5	175	10	typ. 13,5	typ. 60	1,2 − j0,6	140 − j80

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

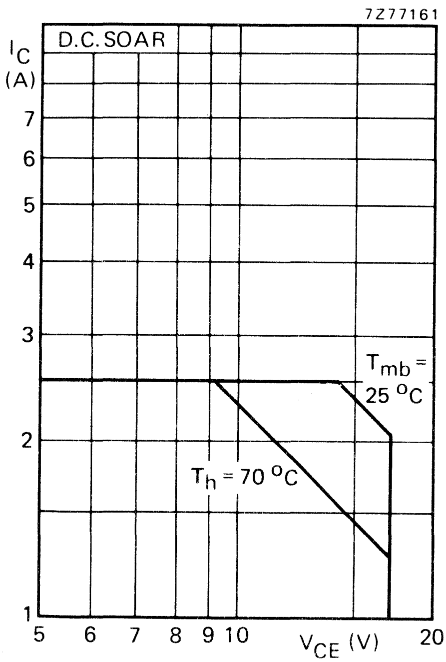
When locking is required an adhesive is preferred instead of a lock washer.

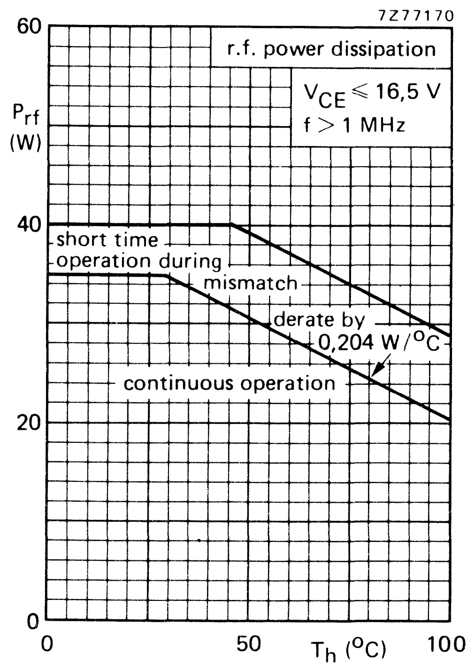
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36	V
Collector-emitter voltage (open base)	V_{CEO}	max	17	V
Emitter-base voltage (open collector)	V_{EBO}	max	4	V
Collector current (d.c. or average)	I_C	max	2,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max	7,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{tot}	max	40	W





Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,3	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

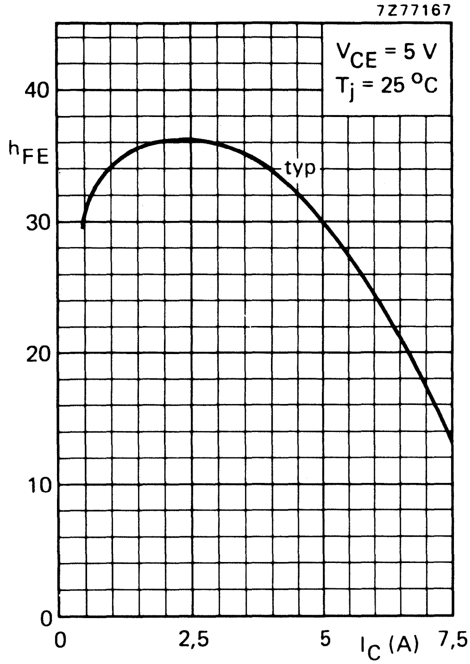
CHARACTERISTICS

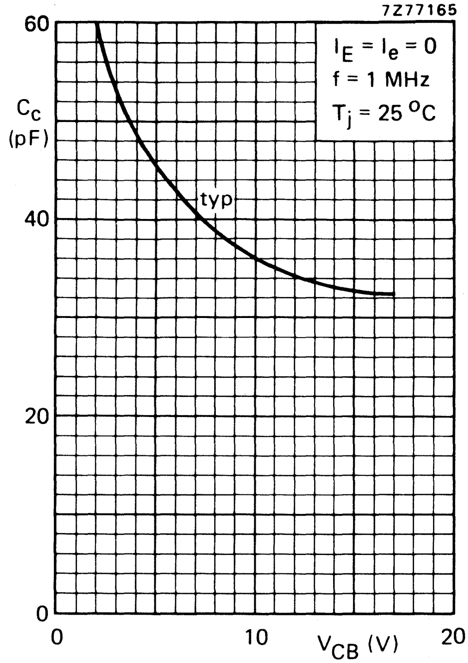
T_j = 25 °C

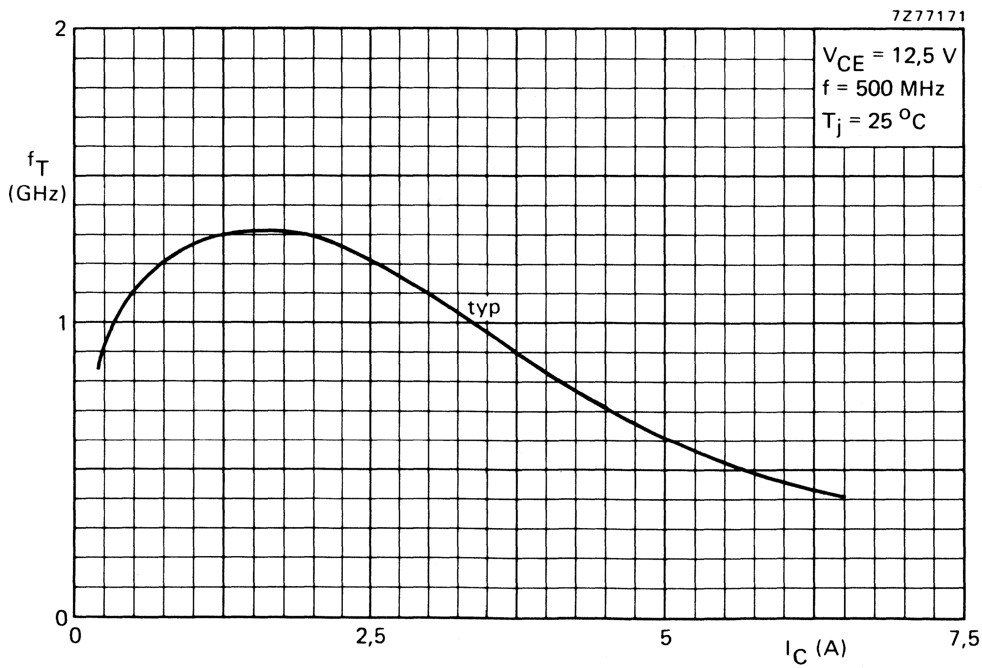
Breakdown voltages

Collector-emitter voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	17	V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 17 V	I_{CES}	<	10	mA
D.C. current gain *				
I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	>	10	
		typ	35	
Collector-emitter saturation voltage *				
I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ	0,75	V
Transition frequency at f = 500 MHz *				
I_C = 1,25 A; V_{CE} = 12,5 V	f_T	typ	1,3	GHz
I_C = 3,75 A; V_{CE} = 12,5 V	f_T	typ	0,9	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 12,5 V	C_c	typ	34	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 12,5 V	C_{re}	typ	18	pF
Collector-stud capacitance	C_{cs}	typ	1,2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.


7Z77167
V_{CE} = 5 V
T_j = 25 °C
h_{FE}
typ
40
30
20
10
0
0
2,5
5
7,5
I_C (A)


7Z77165
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
C_c
(pF)
typ
60
40
20
0
0
10
20
V_{CB} (V)


7Z77171
V_{CE} = 12,5 V
f = 500 MHz
T_j = 25 °C
f_T
(GHz)
typ
2
1
0
0
2,5
5
7,5
I_C (A)

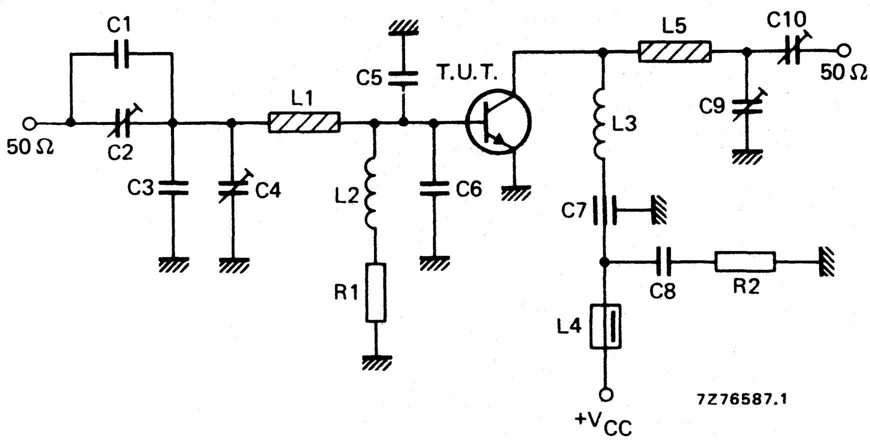
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
470	**12,5**	**10**	**< 2,5**	**> 6,0**	**< 1,33**	**> 60**	**1,3 + j2,5**	**150 – j66**
470	13,5	10	typ 1,9	typ 7,2	–	typ 75	–	–
175	12,5	10	typ 0,45	typ 13,5	–	typ 60	1,2 – j0,6	140 – j80

Test circuit for 470 MHz



List of components:

C1 = 2,2 pF (± 0,25 pF) ceramic capacitor
C2 = C9 = C10 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C3 = 3,9 pF (± 0,25 pF) ceramic capacitor
C4 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C5 = C6 = 15 pF ceramic chip capacitor (cat. no. 2222 851 13159)
C7 = 100 pF ceramic feed-through capacitor
C8 = 100 nF polyester capacitor

L1 = stripline (27,9 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm
L3 = 17 nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm
L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = stripline (45,8 mm x 6,0 mm)

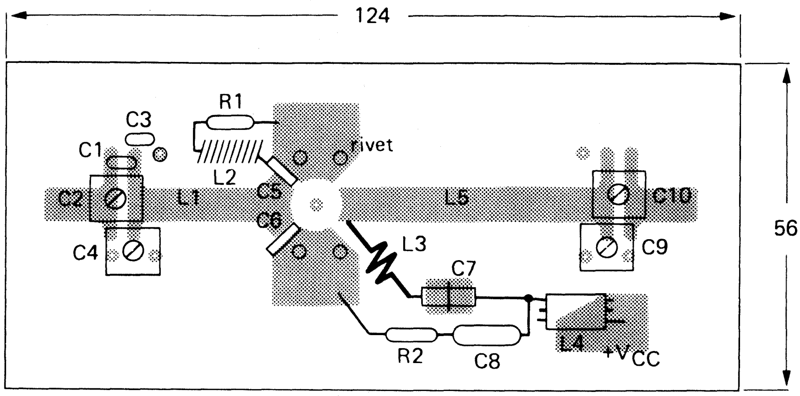
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 1 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

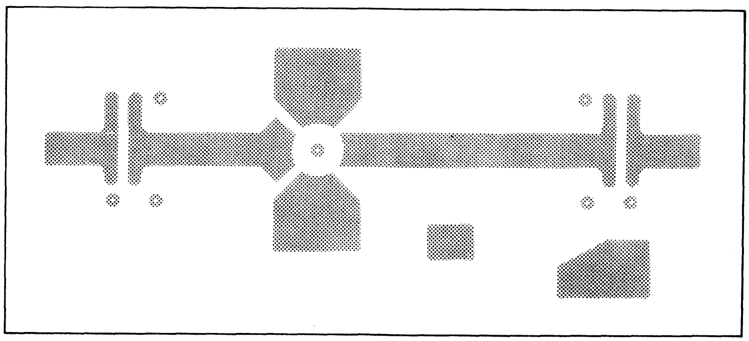
Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

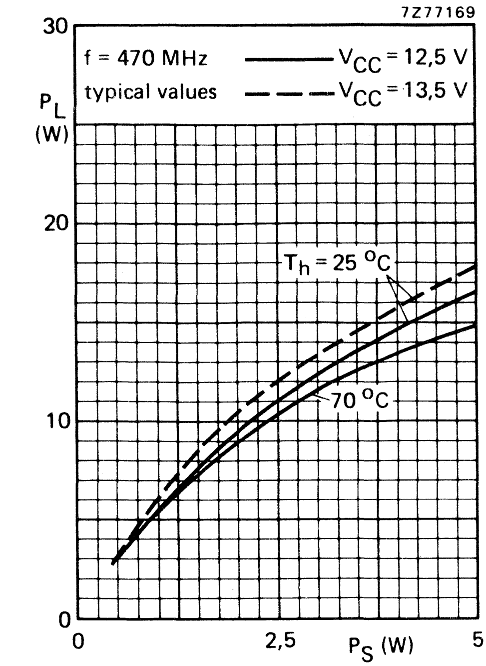


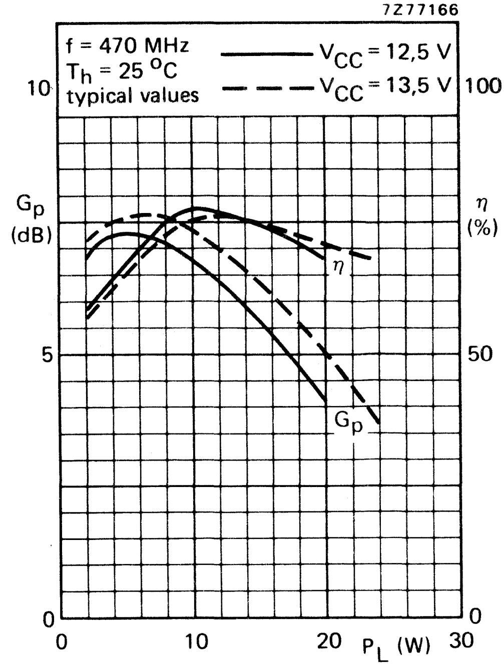
7Z76585

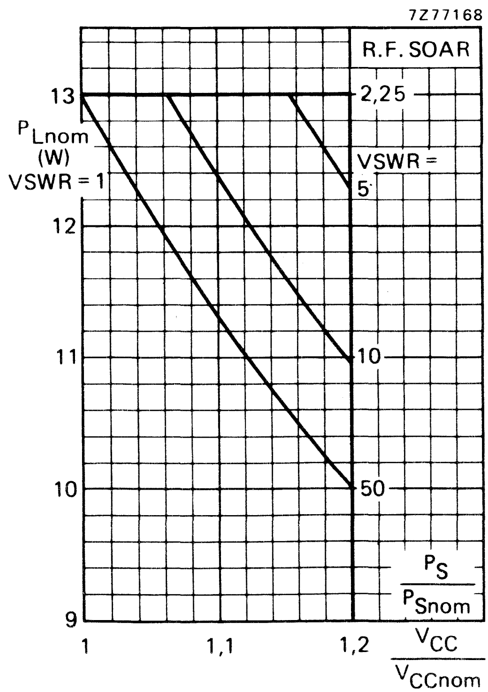


7Z76586

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.







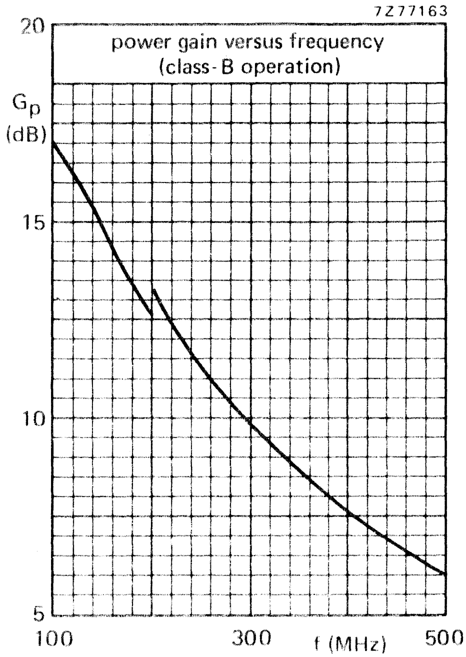
Measuring conditions for R.F. SOAR

f = 470 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,6 K/W
V_{CCnom} = 12,5 V or 13,5 V
$P_S = P_{Snom}$ at V_{CCnom} and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio, with VSWR as parameter.

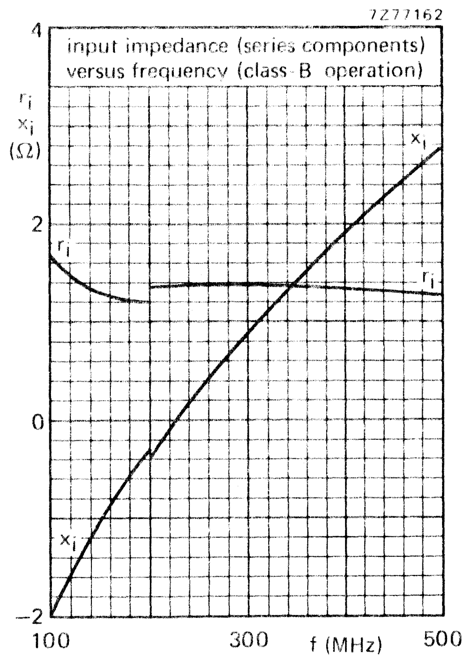
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

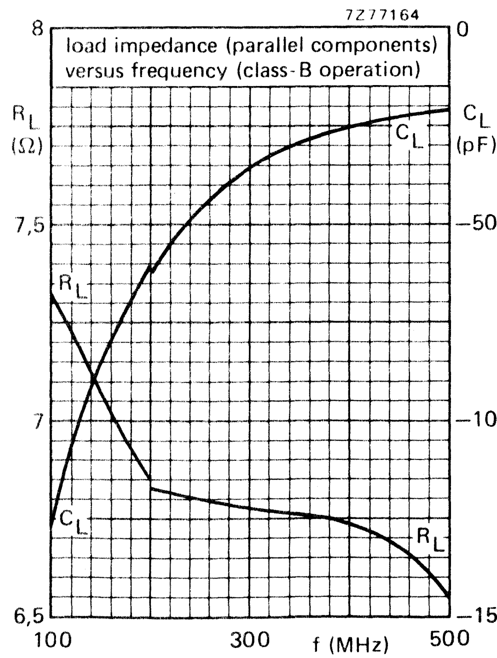
OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 10 W
T_h = 25 °C
typical values





H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

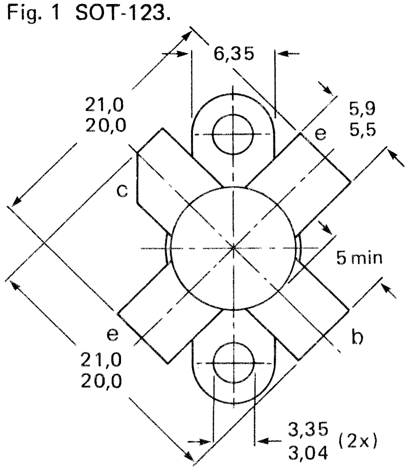
R.F. performance

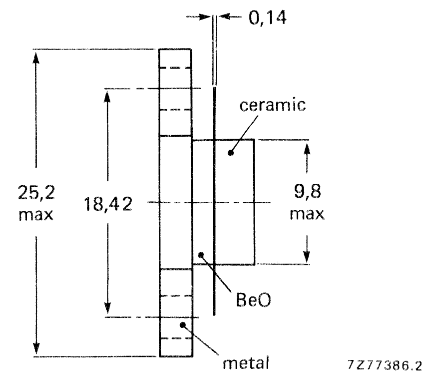
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 10** (P.E.P.)	> **20**	–	**1,35**	< **–40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	25

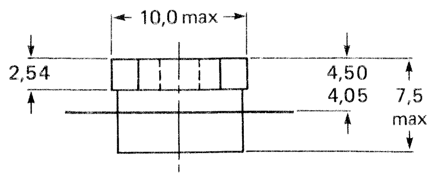
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.







Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

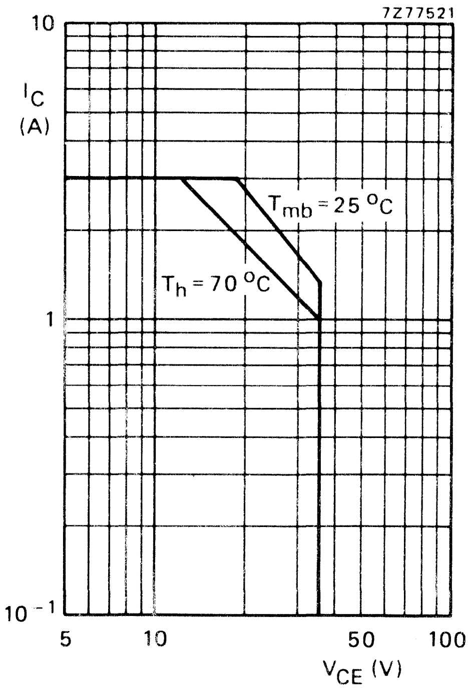


Fig. 2 D.C. SOAR.

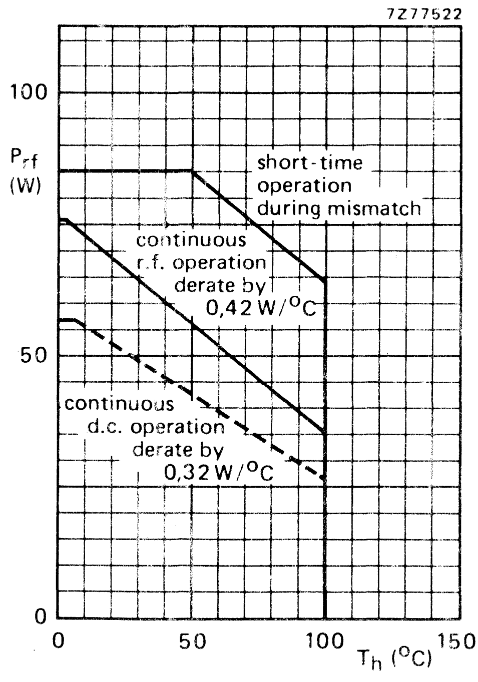


Fig. 3 R.F. power dissipation; V_{CE} ≤ 28 V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 35 W; T_{mb} = 80 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,15	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,35	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage				
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 10 Ω	E_{SBR}	>	8	mJ
D.C. current gain*				
I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	50	
			10 to 100	
D.C. current gain ratio of matched devices*				
I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage*				
I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5	V
Transition frequency at f = 100 MHz*				
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530	MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	50	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

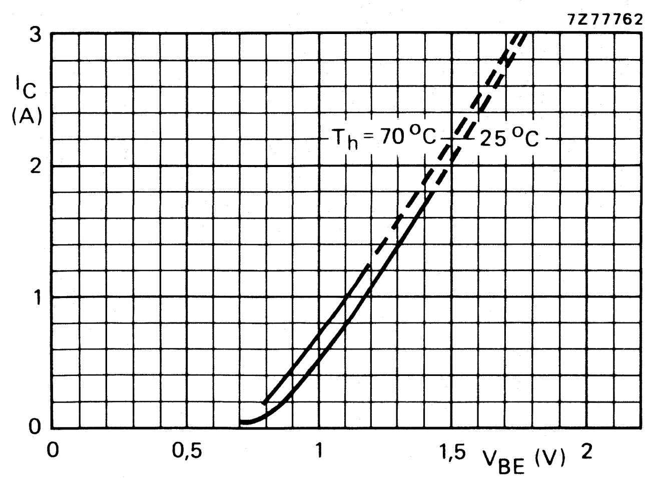


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

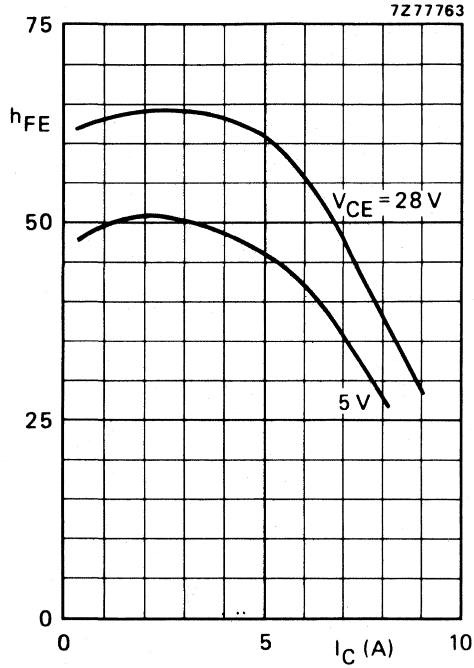


Fig. 5 Typical values; T_j = 25 °C.

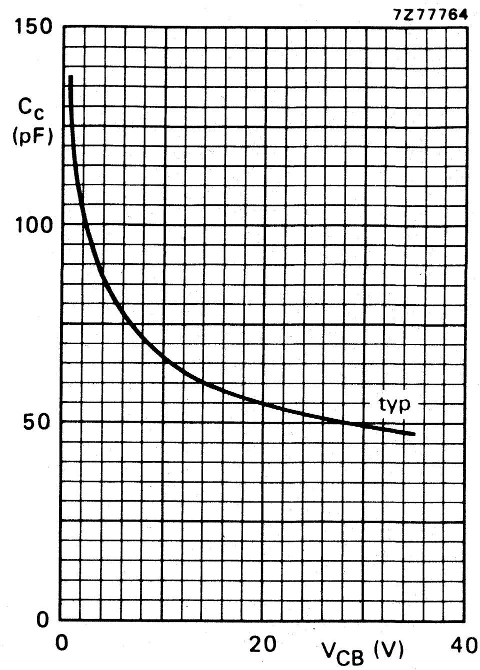


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

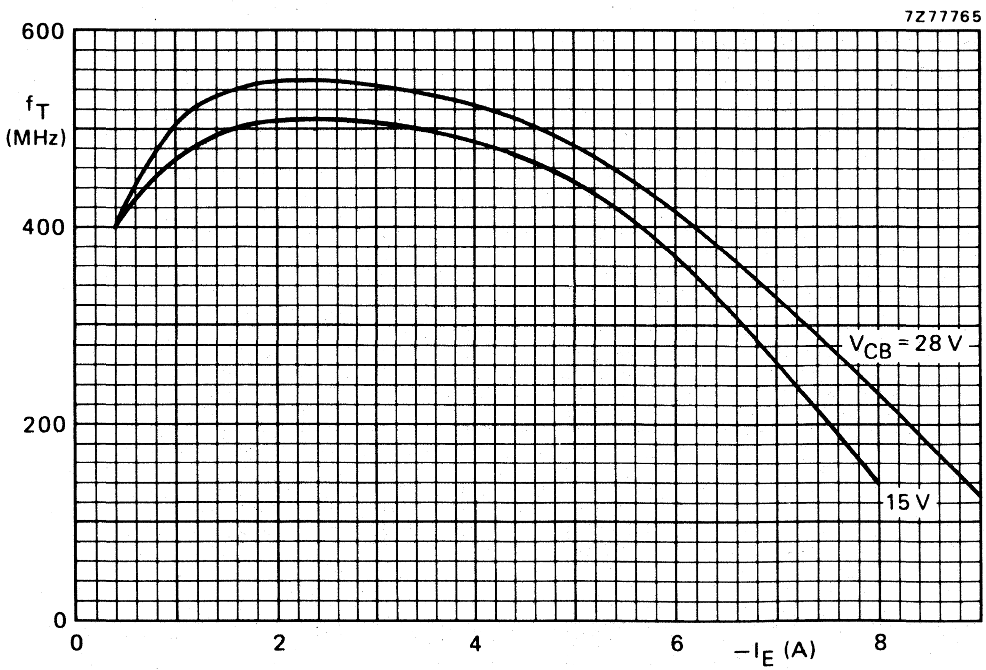


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
> 10 (P.E.P.) typ. 11 (P.E.P.)	> 20	1,35	−40	< −40	70
typ. 12 (P.E.P.)	typ. 24	1,35	−40	< −40	25

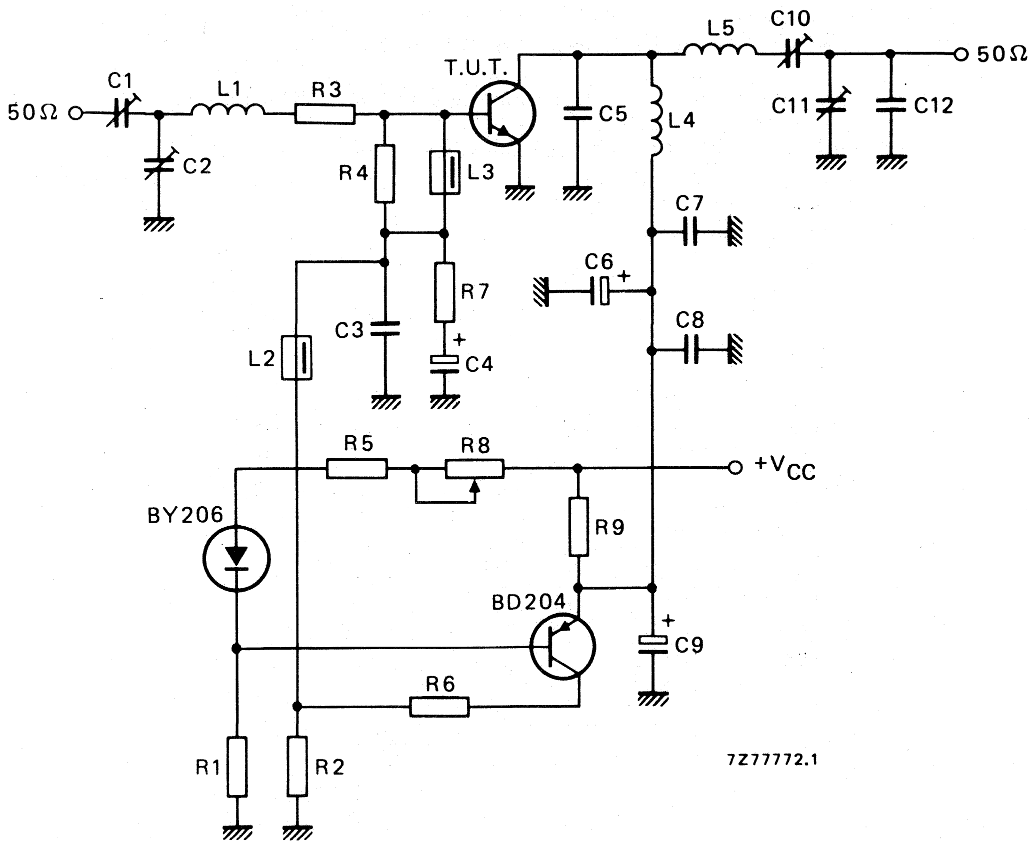


Fig. 8 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = C11 = 7 to 100 pF film dielectric trimmer
C12 = 82 pF ceramic capacitor (500 V)

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads to 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

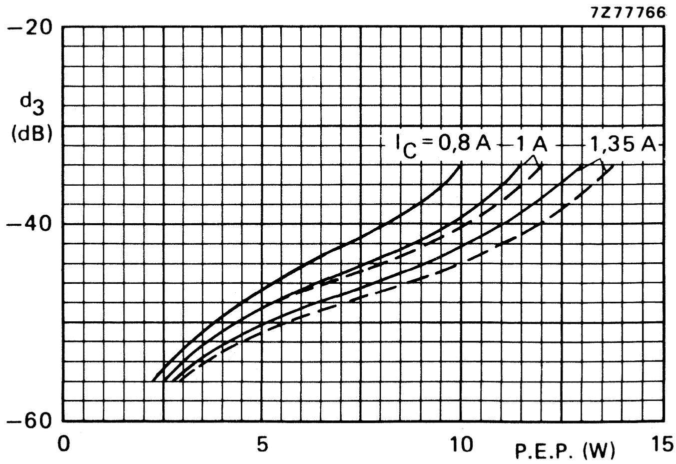


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; —— T_h = 70 °C; – – – T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 30 W P.E.P.	I_C (A) at 30 W P.E.P.	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
3 to 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	< –30	25	25
3 to 25 (P.E.P.)	typ. 21	–	–	typ. –30	< –30	25	70

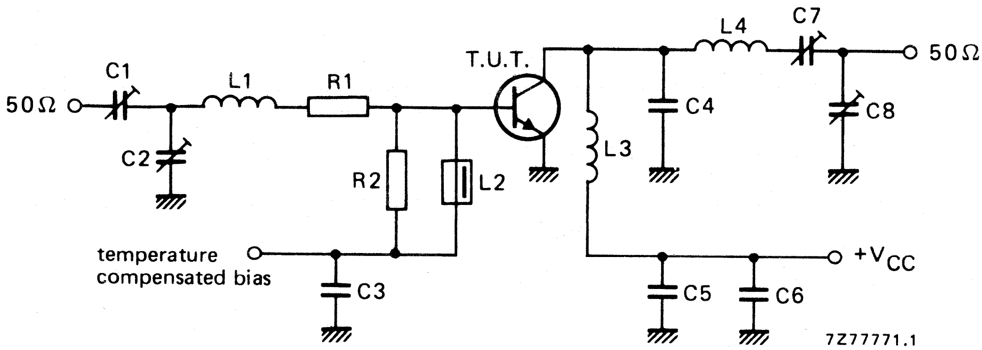


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

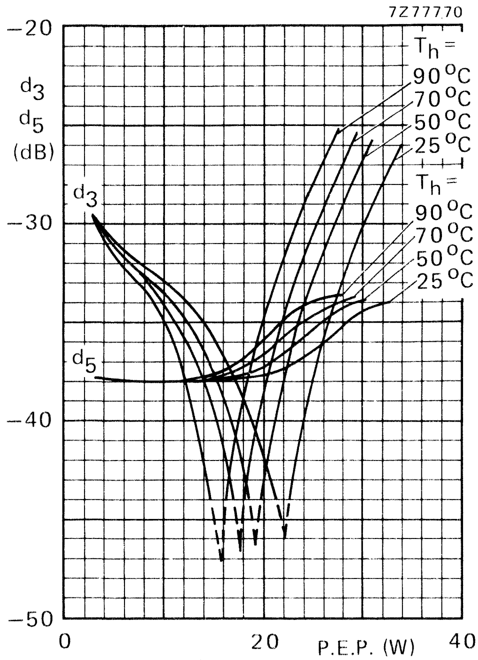


Fig. 11 Intermodulation distortion as a function of output power.*

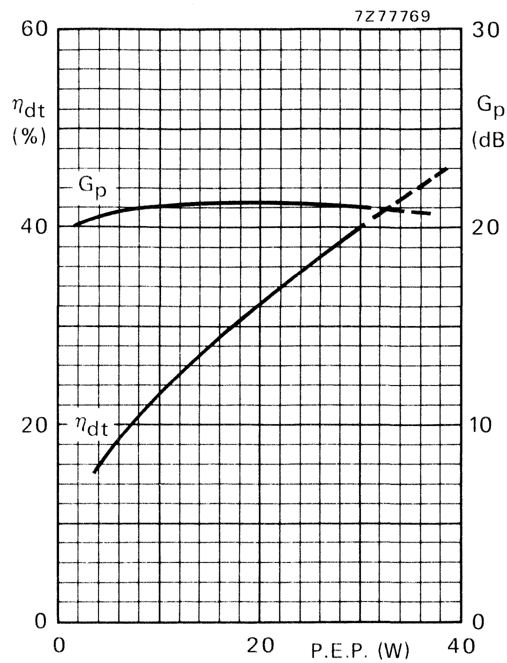


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on previous page.

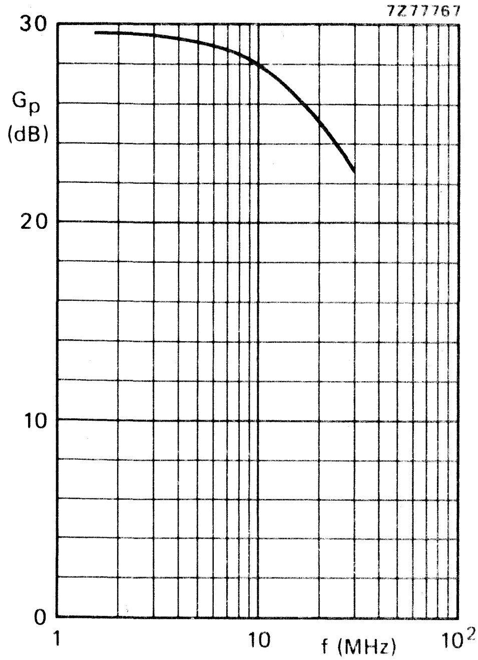


Fig. 13 Power gain as a function of frequency.

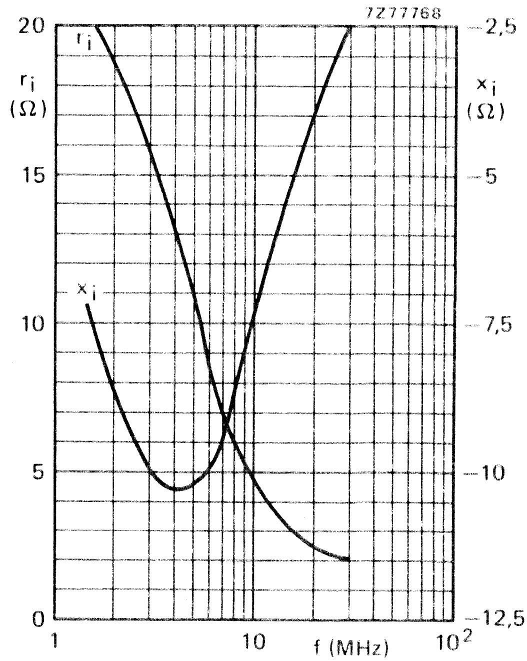


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 30 W; T_h = 25 °C; Z_L = 9,5 Ω.

Ruggedness in s.s.b. operation

The BLW83 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 35 W (P.E.P.).

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

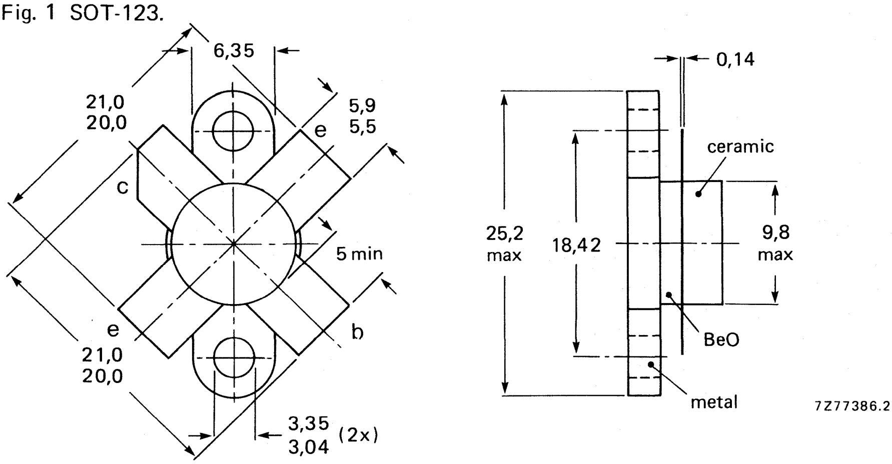
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

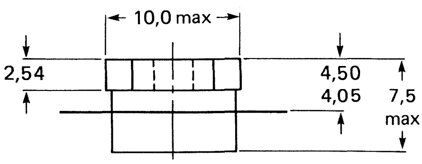
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**28**	**175**	**25**	**> 9**	**> 60**	**1,0 + j1,2**	**59 − j54**

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4–40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

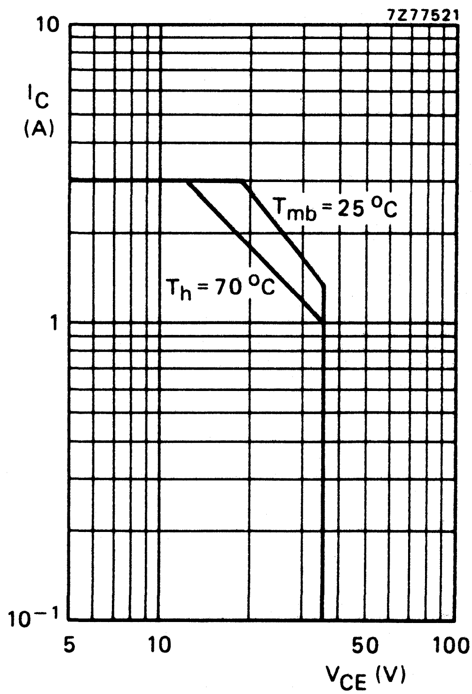


Fig. 2 D.C. SOAR.

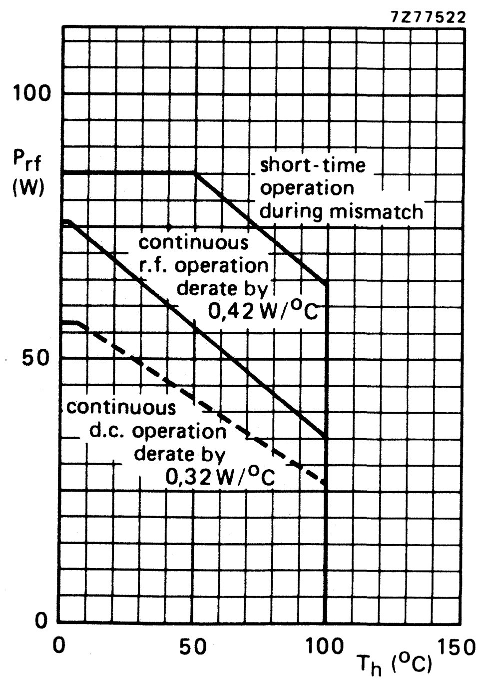


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,0	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,25	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 10 Ω	E_{SBR}	>	8	mJ
D.C. current gain * I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	45	
			10 to 100	
Collector-emitter saturation voltage * I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5	V
Transition frequency at f = 100 MHz *				
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	650	MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	650	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	45	pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	28	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

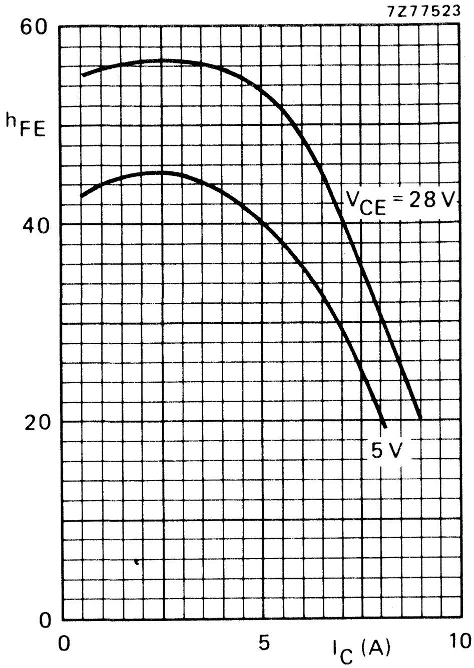


Fig. 4 Typical values; T_j = 25 °C.

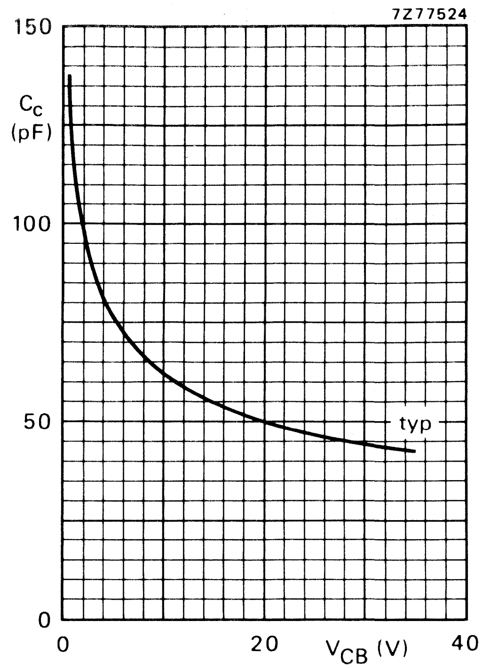


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

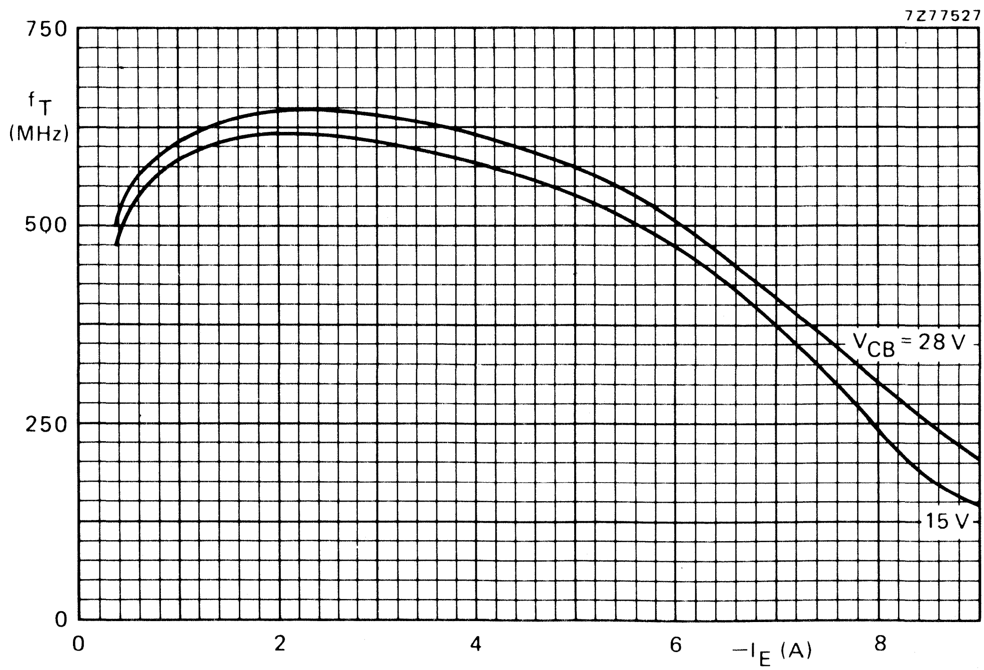


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**28**	**25**	**< 3,15**	**> 9**	**< 1,49**	**> 60**	**1,0 + j1,2**	**59 – j54**

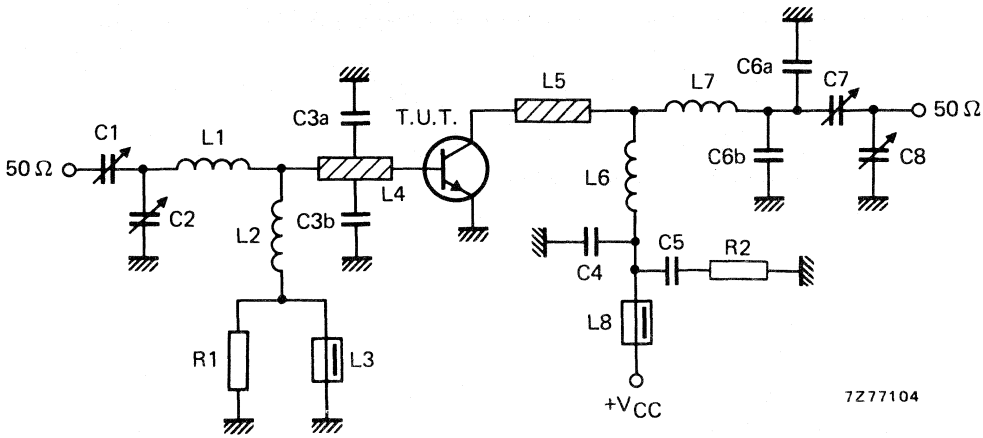


Fig. 7 Test circuit; c.w. class-B.

List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF (± 10%) polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

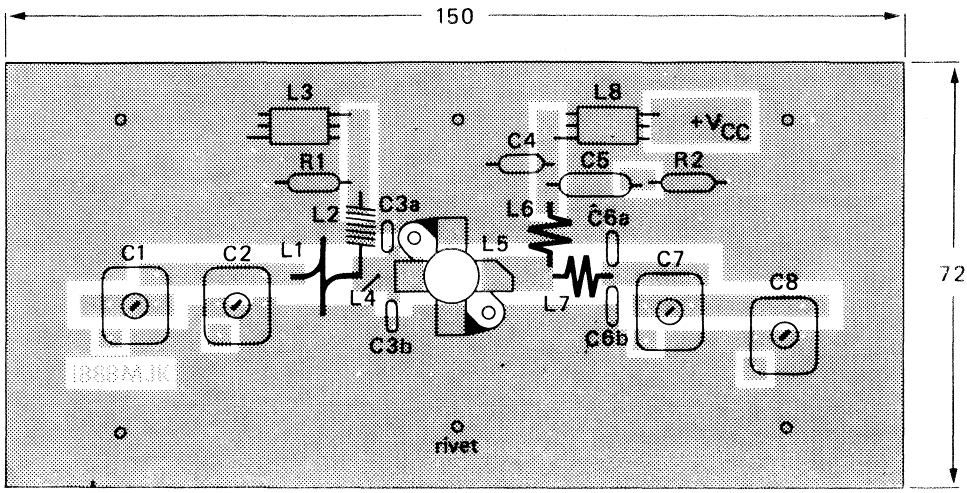
L1 = 14 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω (± 10%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



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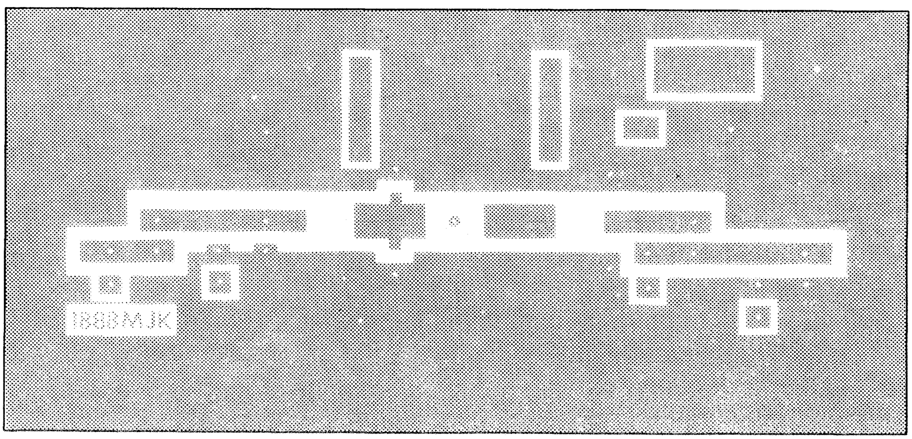

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Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

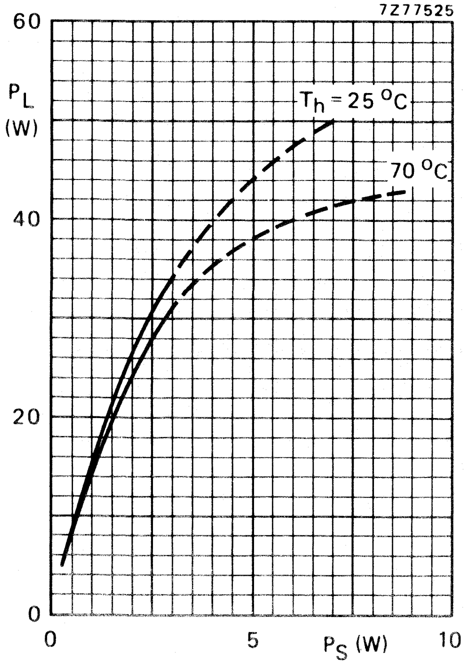


Fig. 9 $V_{CE} = 28$ V; f = 175 MHz; typical values.

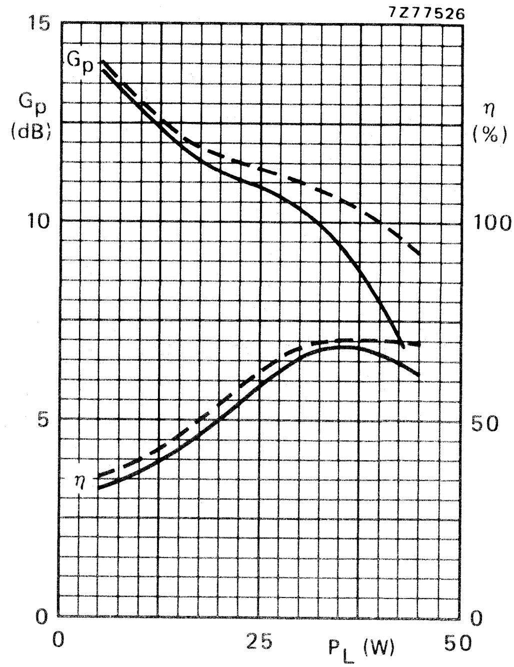


Fig. 10 $V_{CE} = 28$ V; f = 175 MHz; typical values;
– – – $T_h = 25\ ^oC$; ——— $T_h = 70\ ^oC$.

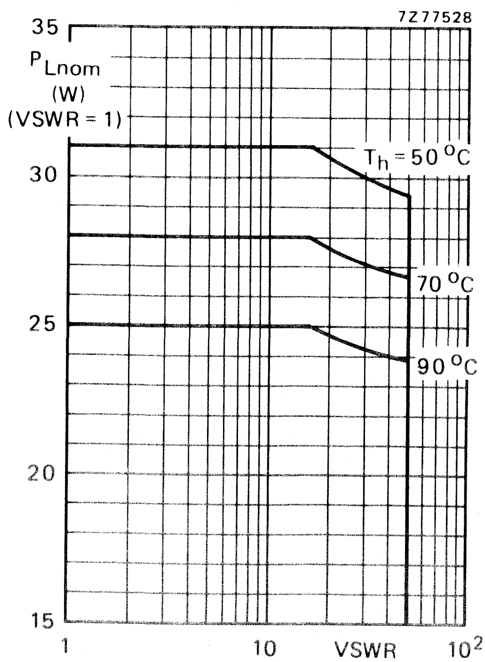


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; $V_{CE} = 28$ V; $R_{th\ mb\text{-}h} = 0,3$ K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

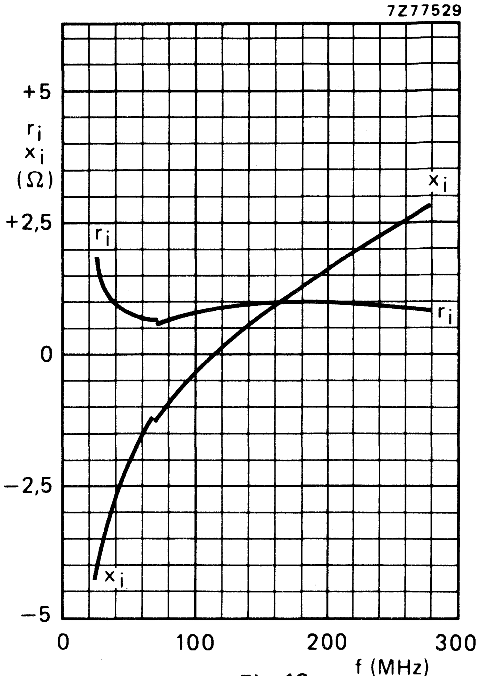


Fig. 12.

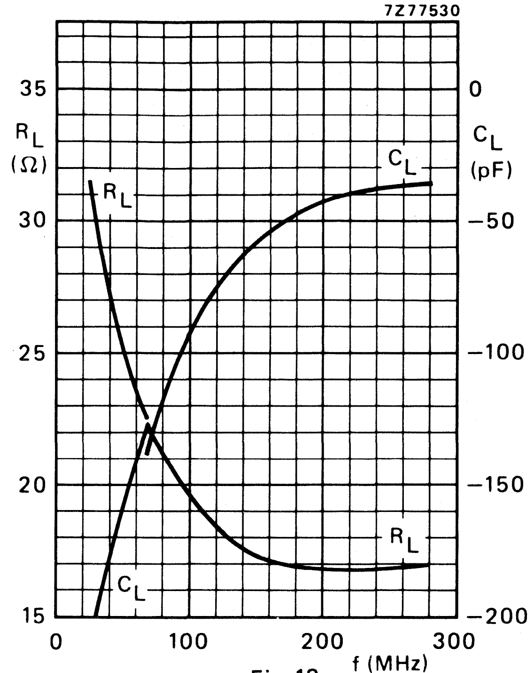
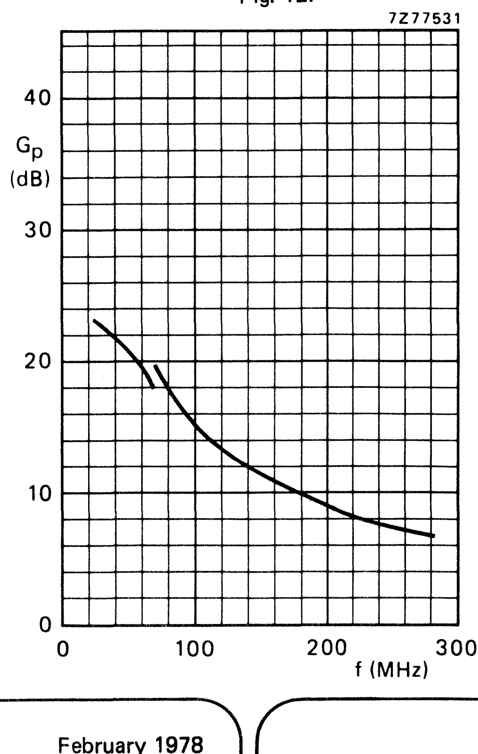


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

Fig. 14.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 12,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

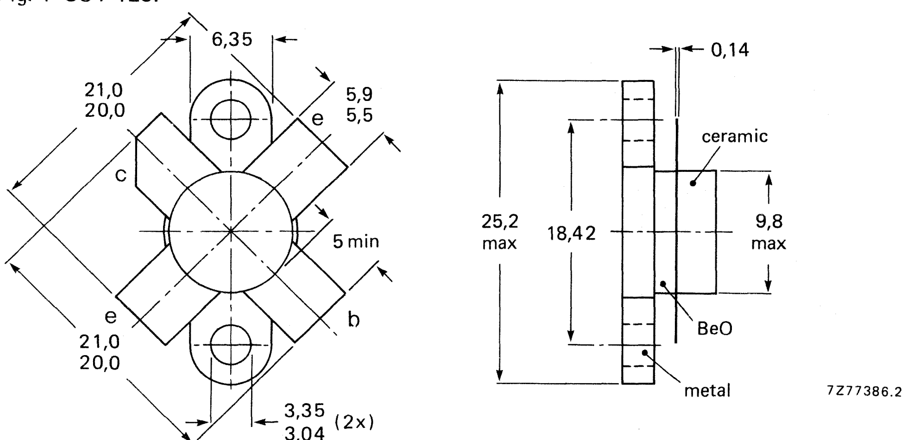
R.F. performance up to T_h = 25 °C

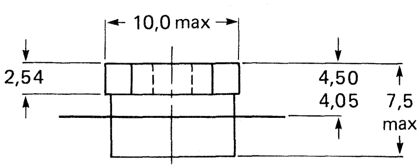
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 4,5**	**> 75**	**1,4 + j1,5**	**2,7 − j1,3**	–
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	–	–	typ. −33

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	9 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	22 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	105 W
Storage temperature	T_{stg}		− 65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

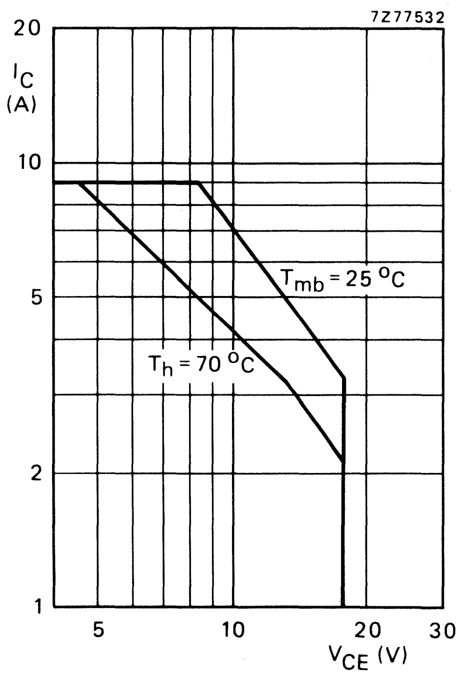


Fig. 2 D.C. SOAR.

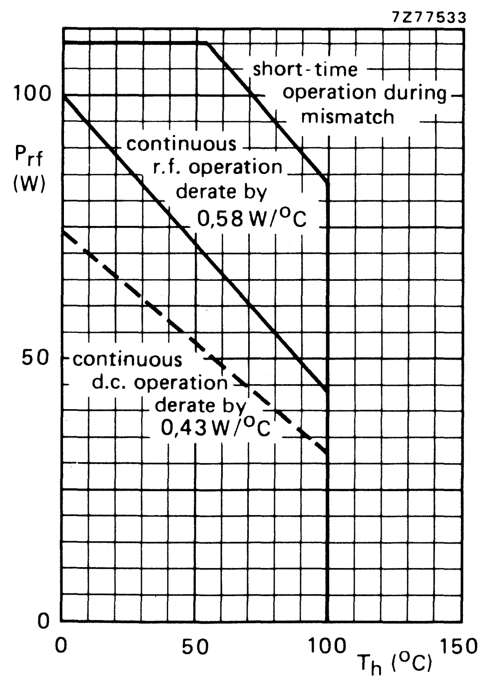


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f ≥ 1 MHz.

THERMAL RESISTANCE (dissipation = 30 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,5 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,8 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 25$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	25 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ. 10 to 80	50
D.C. current gain ratio of matched devices* $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage* $I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz* $-I_E = 4$ A; $V_{CB} = 12,5$ V	f_T	typ.	650 MHz
$-I_E = 12,5$ A; $V_{CB} = 12,5$ V	f_T	typ.	600 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	120 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 15$ V	C_{re}	typ.	82 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

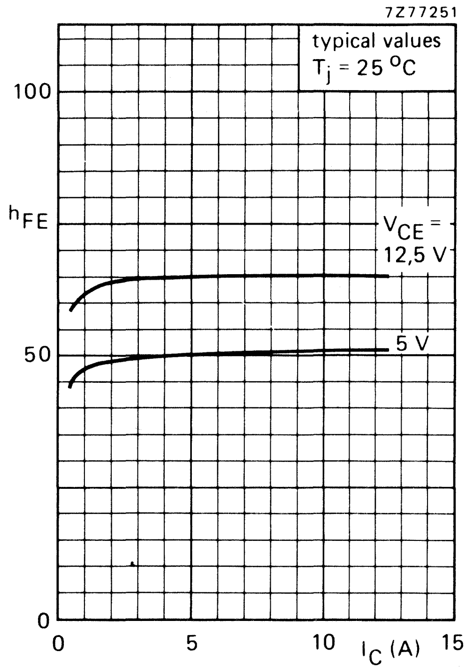


Fig. 4.

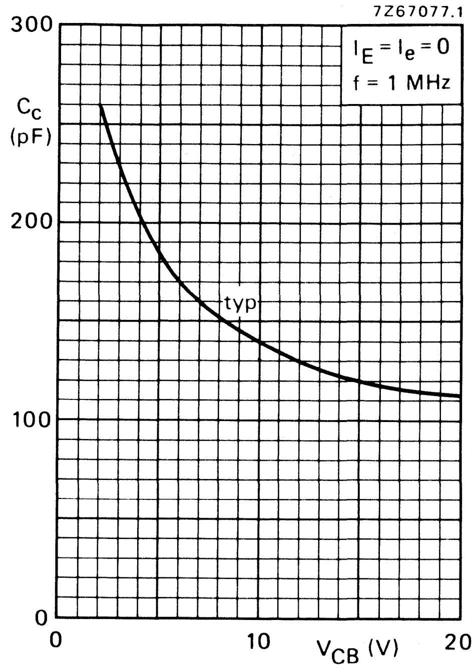


Fig. 5 T_j = 25 °C.

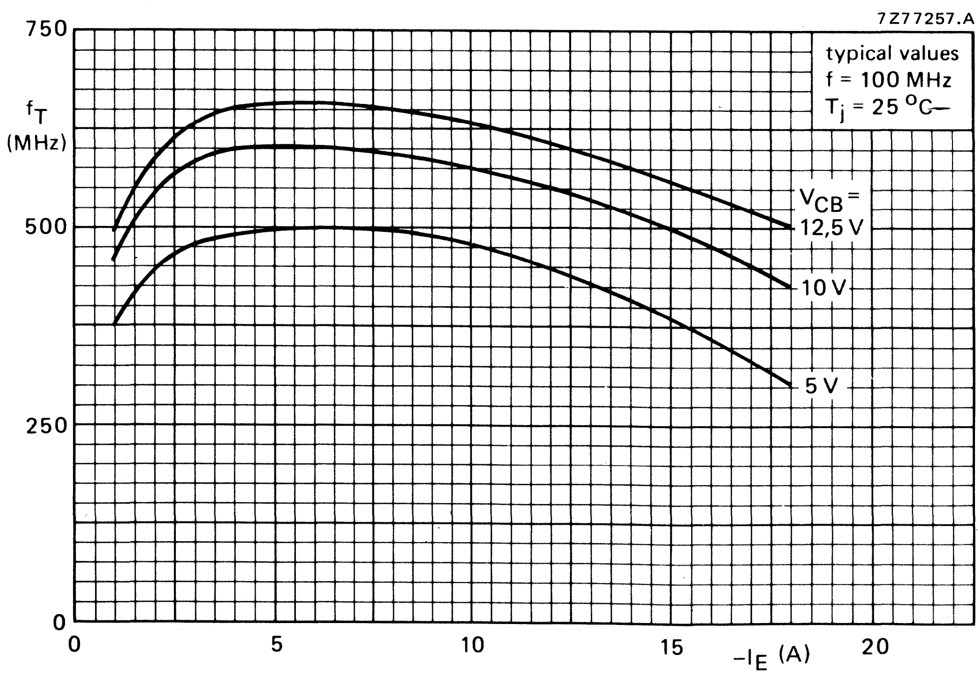


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
175	**12,5**	**45**	**< 16**	**> 4,5**	**< 4,8**	**> 75**	**1,4 + j1,5**	**2,7 − j1,3**
175	13,5	45	–	typ. 6,0	–	typ. 75	–	–

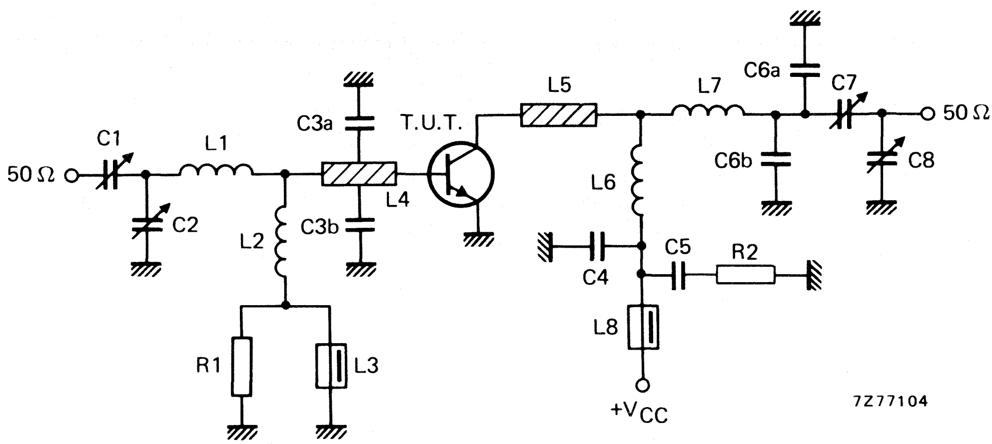


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

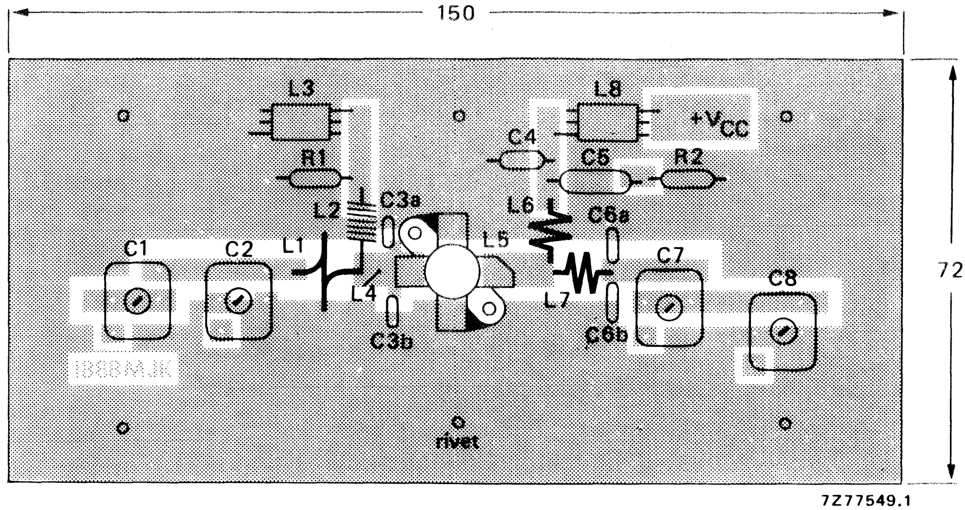
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (±10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



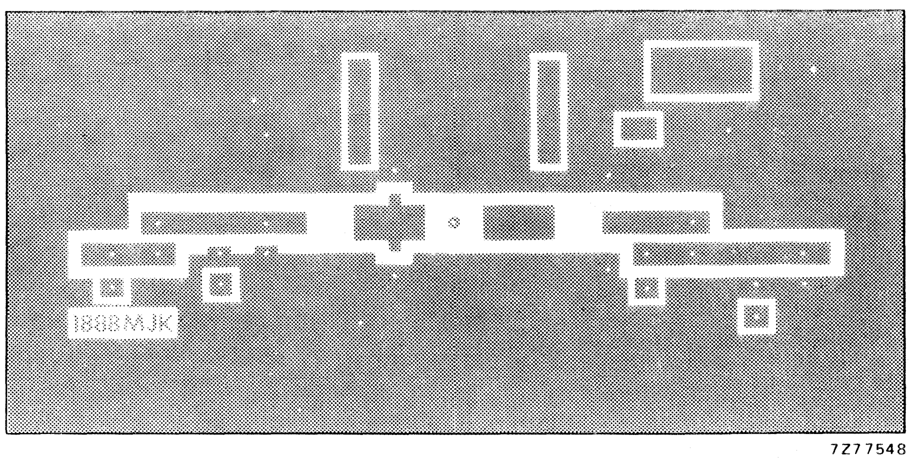


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

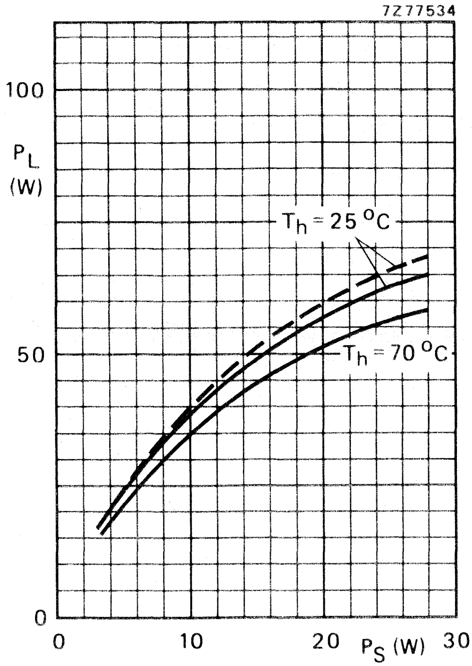


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

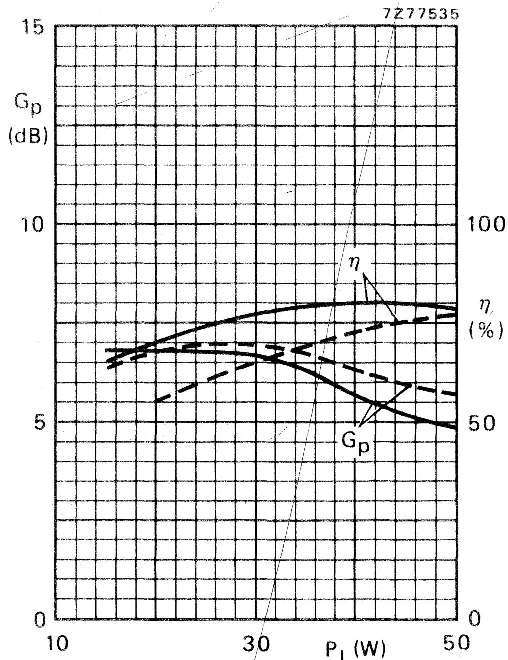


Fig. 10 Typical values; f = 175 MHz; T_h = 25 °C;
—— V_{CE} = 12,5 V; – – – V_{CE} = 13,5 V.

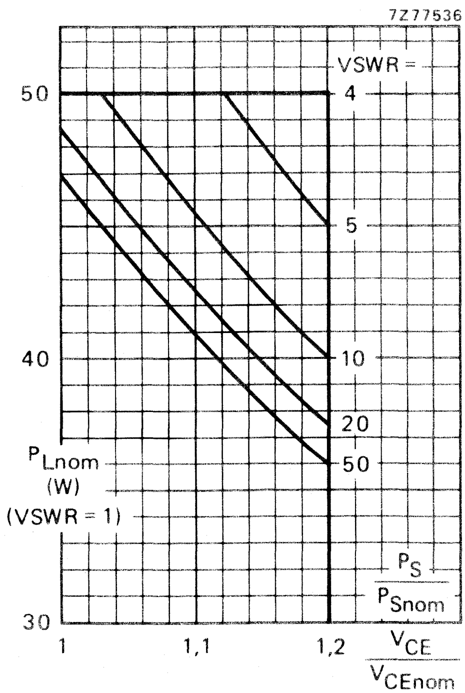


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C;
$R_{th\,mb\text{-}h}$ = 0,3 K/W ; V_{CEnom} = 12,5 V or 13,5 V;
$P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

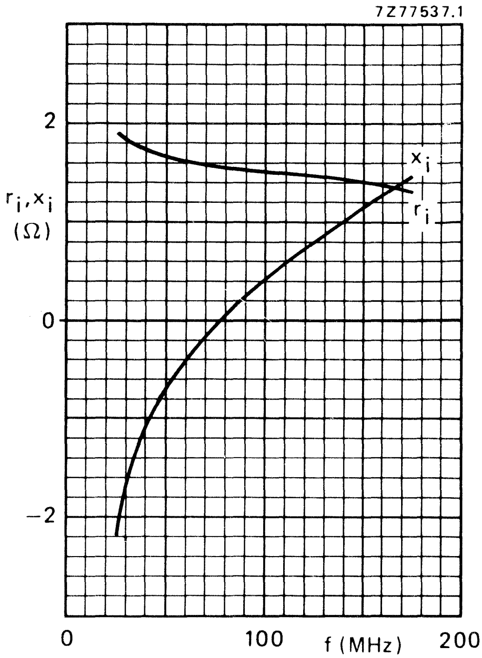


Fig. 12 Input impedance (series components).

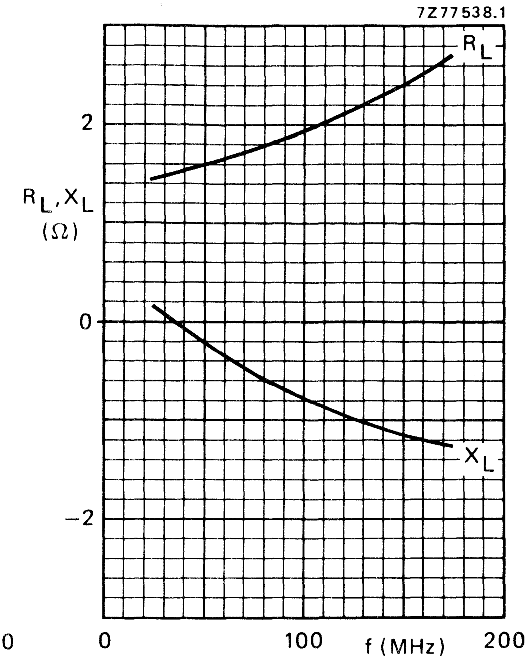


Fig. 13 Load impedance (series components).

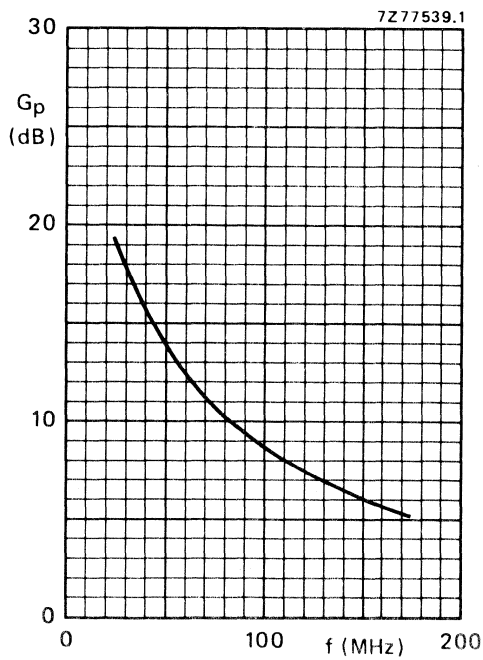


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 12,5 V; P_L = 45 W; class-B operation; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation

V_{CE} = 12,5 V; T_h up to 25 °C; $R_{th\ mb-h} \leqslant$ 0,3 K/W
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA
3 to 30 (P.E.P.)	typ. 19,5	typ. 35	typ. −33	typ. −36	25

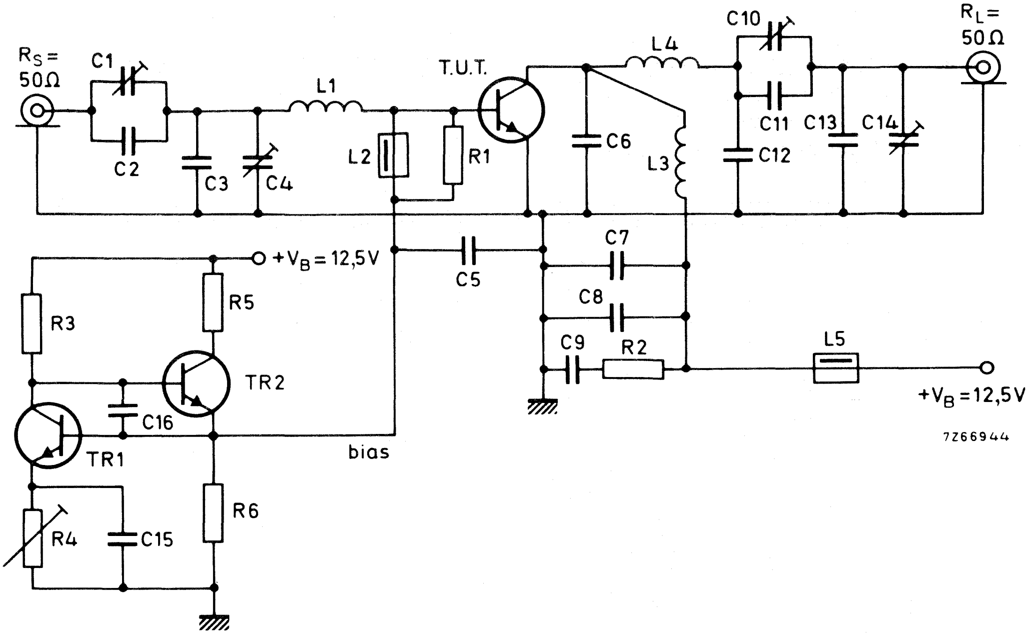


Fig. 15 Test circuit; s.s.b. class-AB.

List of components:

TR1 = TR2 = BD137

C1 = 100 pF air dielectric trimmer (single insulated rotor type)
C2 = 27 pF ceramic capacitor (500 V)
C3 = 180 pF polystyrene capacitor
C4 = 100 pF air dielectric trimmer (single non-insulated rotor type)
C5 = C7 = 3,9 nF polyester capacitor
C6 = 2 x 270 pF polystyrene capacitors in parallel
C8 = C15 = C16 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C10 = 2 x 385 pF (sections in parallel) film dielectric trimmer
C11 = 68 pF ceramic capacitor (500 V)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

List of components (continued)

C12 = 2 x 82 pF ceramic capacitors in parallel (500 V)
C13 = 47 pF ceramic capacitor (500 V)
C14 = 385 pF film dielectric trimmer

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L3 = 68 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 8 mm; length 8,3 mm; leads 2 x 5 mm
L4 = 96 nH; 3 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 7,6 mm; leads 2 x 5 mm

R1 = 27 Ω (±5%) carbon resistor (0,5 W)
R2 = 4,7 Ω (±5%) carbon resistor (0,25 W)
R3 = 1,5 kΩ (±5%) carbon resistor (0,5 W)
R4 = 10 Ω wirewound potentiometer (3 W)
R5 = 47 Ω wirewound resistor (5,5 W)
R6 = 150 Ω (±5%) carbon resistor (0,25 W)

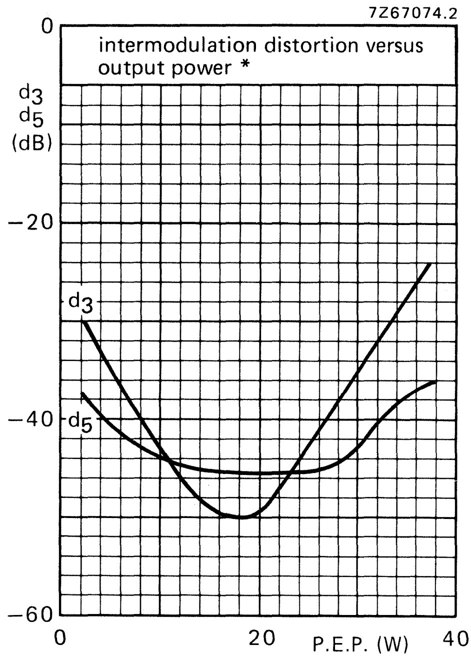


Fig. 16.

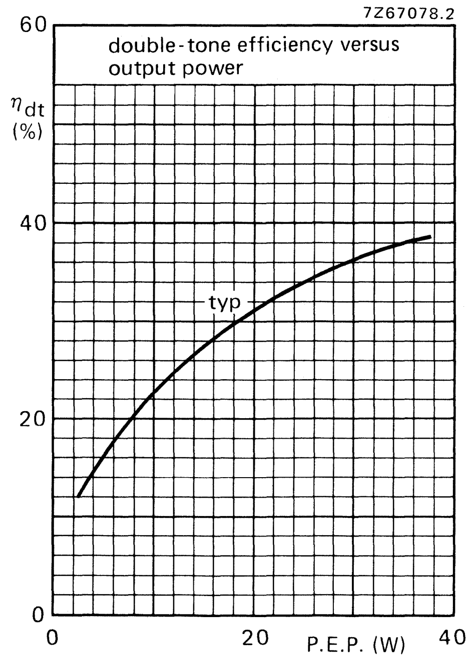


Fig. 17.

Conditions for Figs 16 and 17:

V_{CE} = 12,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h} \leqslant 0,3$ °K/W; $I_{C(ZS)}$ = 25 mA; typical values.

* See next page.

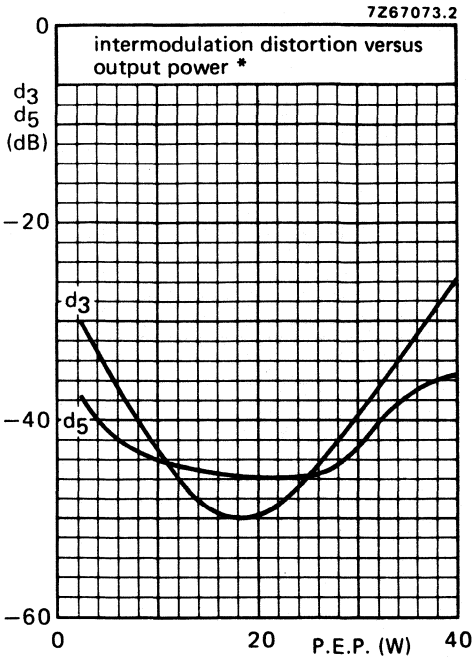


Fig. 18.

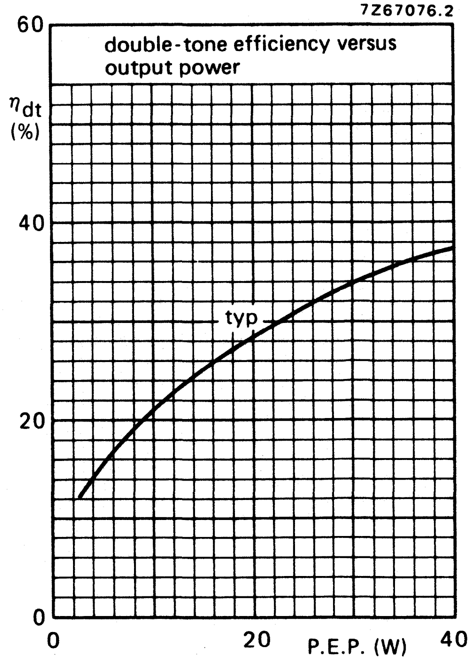


Fig. 19.

Conditions for Figs 18 and 19:

V_{CE} = 13,5 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h} \leqslant$ 0,3 K/W ; $I_{C(ZS)}$ = 25 mA; typical values.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

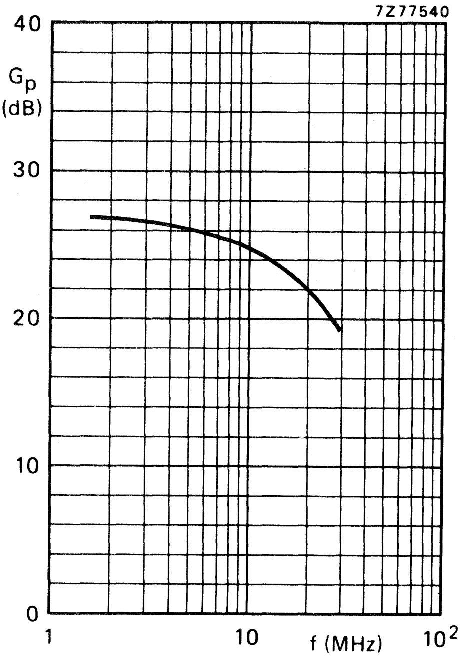


Fig. 20 Power gain as a function of frequency.

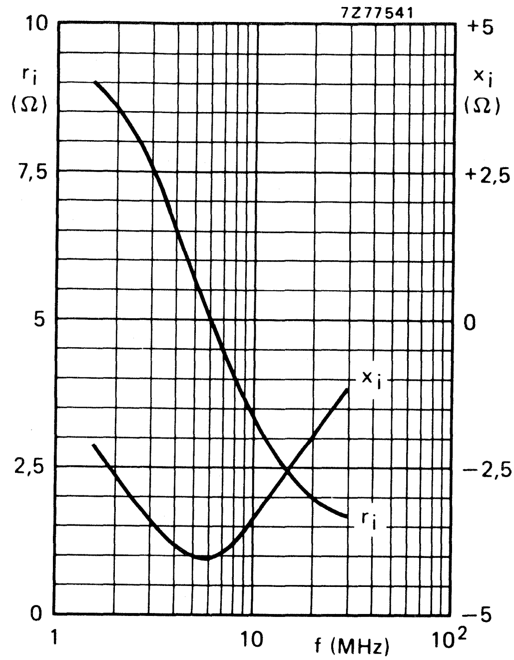


Fig. 21 Input impedance (series components) as a function of frequency.

Fig. 20 and 21 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 12,5 V	V_{CE} = 13,5 V
P_L = 30 W (P.E.P.)	P_L = 35 W (P.E.P.)
T_h = 25 °C	T_h = 25 °C
$R_{th\ mb\text{-}h} \leqslant$ 0,3 K/W	$R_{th\ mb\text{-}h} \leqslant$ 0,3 K/W
$I_{C(ZS)}$ = 25 mA	$I_{C(ZS)}$ = 25 mA
Z_L = 1,8 Ω	Z_L = 1,8 Ω

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

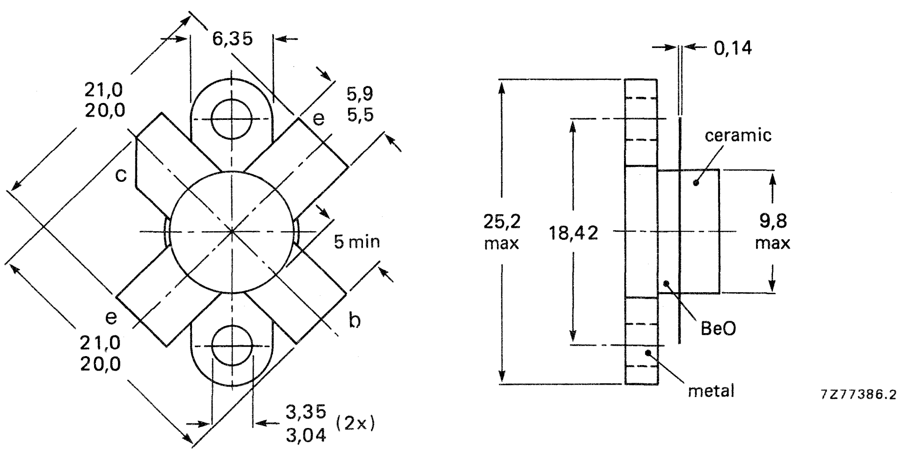
R.F. performance up to T_h = 25 °C

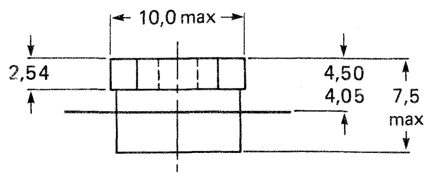
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS	d_3 dB
c.w. (class-B)	**28**	**175**	**45**	**> 7,5**	**> 70**	**0,7 + j1,3**	**110 – j62**	–
s.s.b. (class-AB)	28	1,6 – 28	5–47,5(P.E.P.)	typ. 19	typ. 45	–	–	typ. –30
s.s.b. (class-A)	26	1,6 – 28	17(P.E.P.)	typ. 22	–	–	–	typ. –42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	4	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	105	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

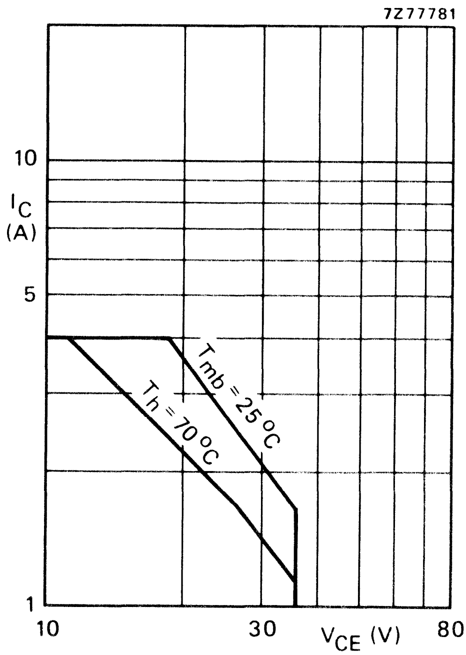


Fig. 2 D.C. SOAR.

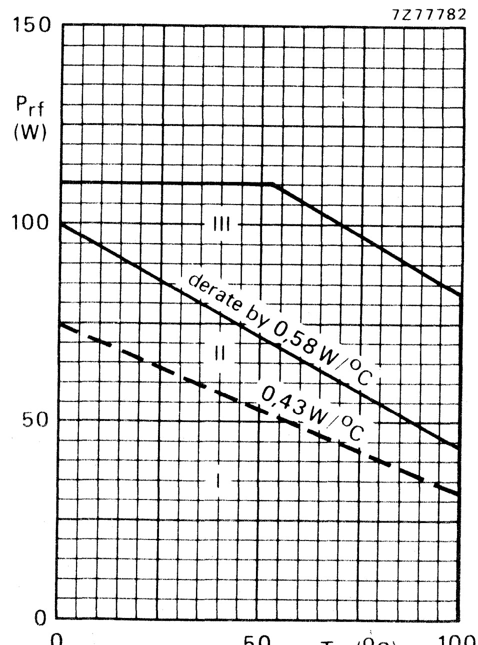


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 45 W; T_{mb} = 83,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,65	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	1,95	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage				
open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 10 Ω	E_{SBR}	>	8	mJ
D.C. current gain*				
I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45	
			10 to 80	
D.C. current gain ratio of matched devices*				
I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2	
Collector-emitter saturation voltage*				
I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5	V
Transition frequency at f = 100 MHz*				
$-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570	MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	82	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

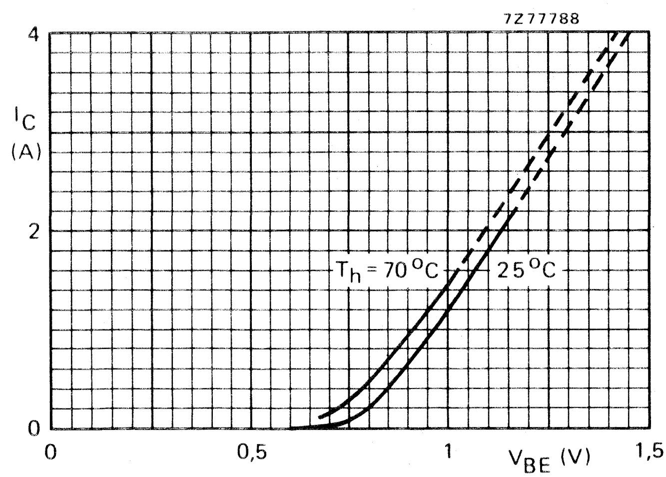


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200$ μs; $\delta \leq 0{,}02$.

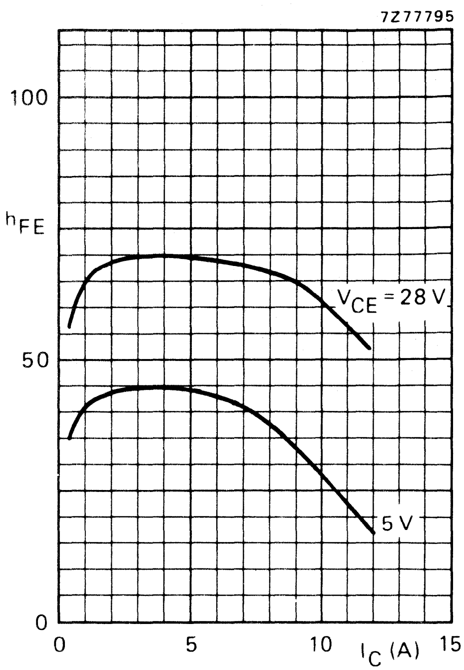


Fig. 5 Typical values; T_j = 25 °C.

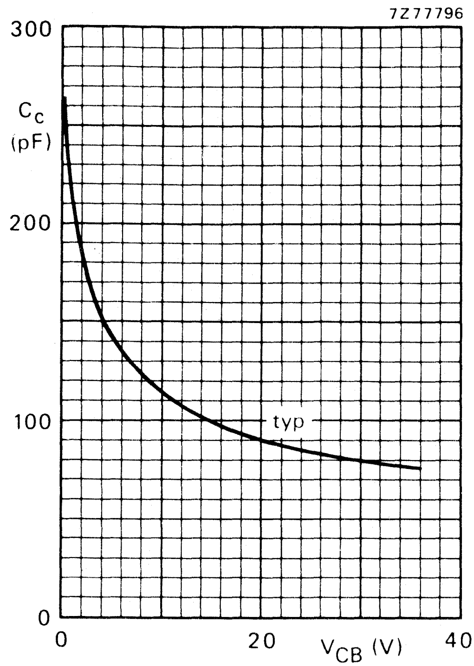


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

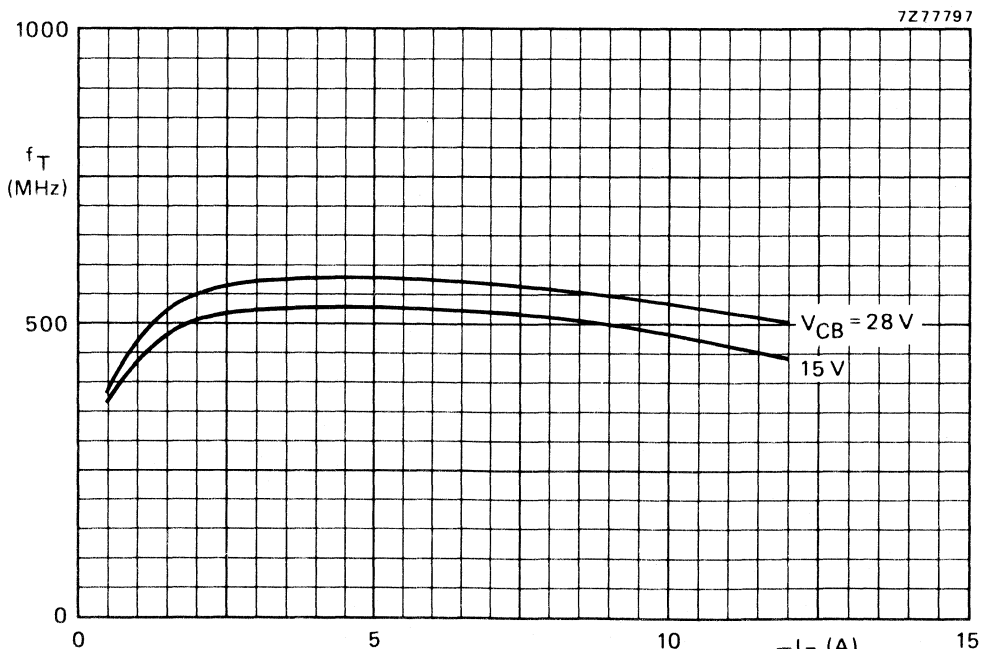


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 – j62

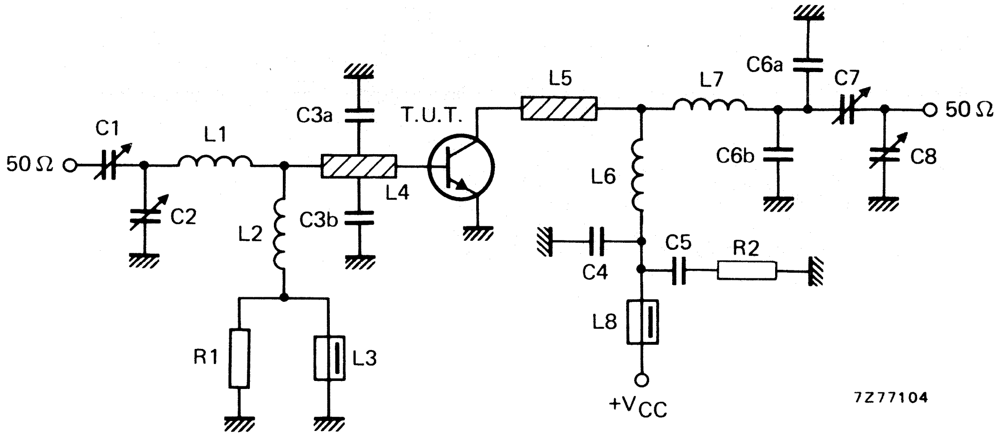


Fig. 8 Test circuit; c.w. class-B.

List of components:

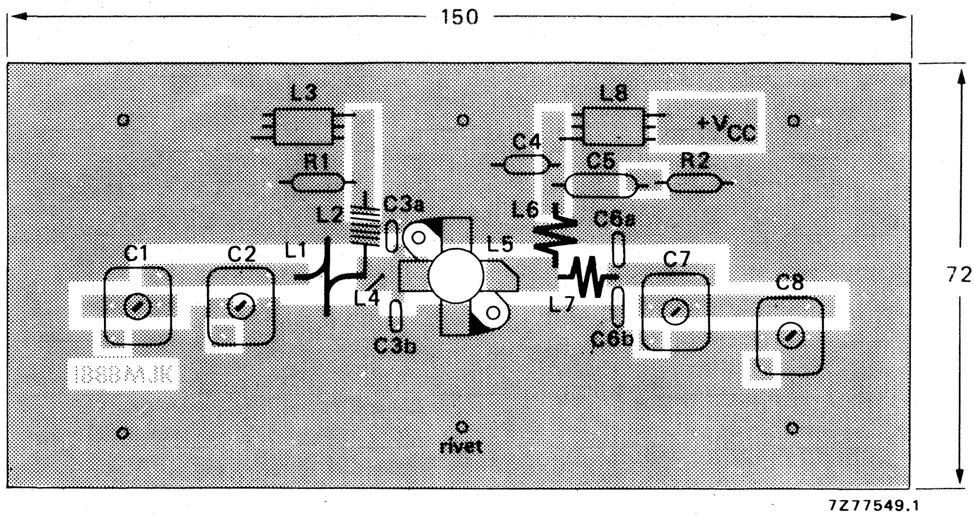
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.



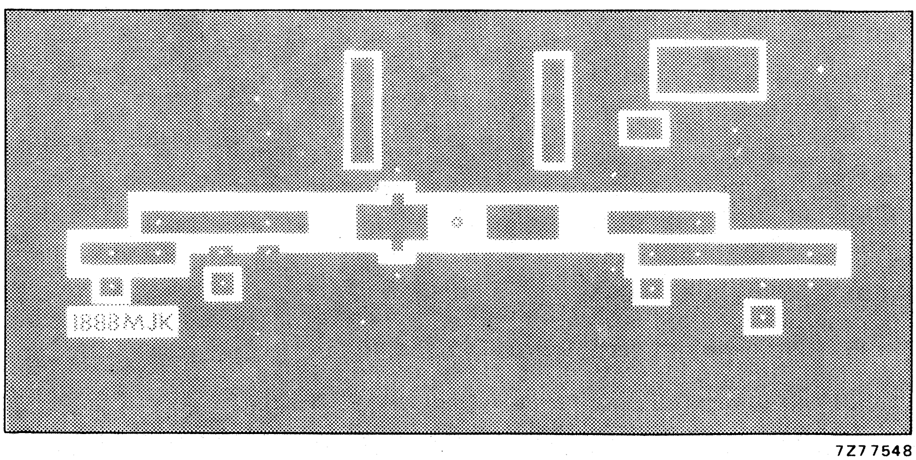


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

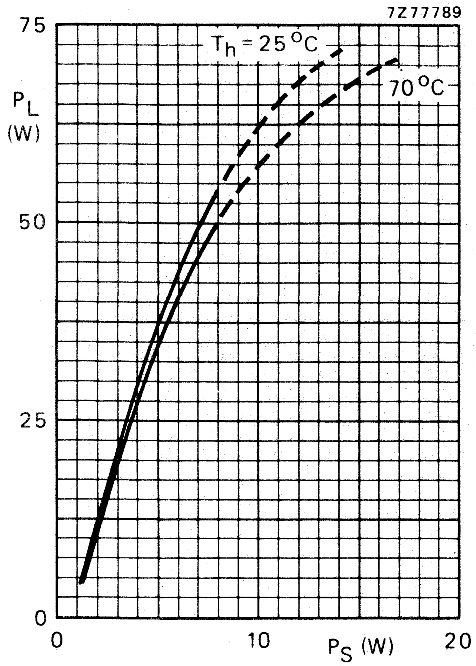


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

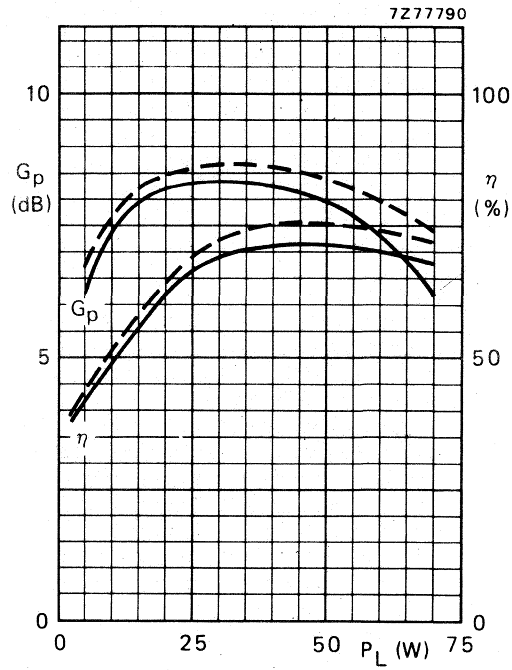


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz;
--- T_h = 25 °C; —— T_h = 70 °C.

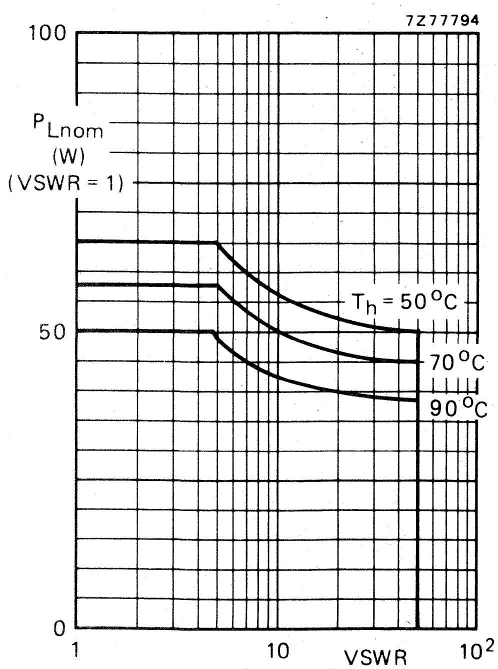


Fig. 12 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,3 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

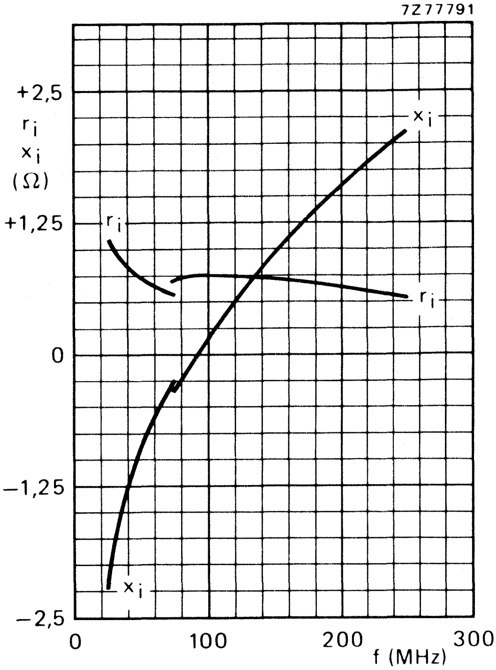


Fig. 13 Input impedance (series components).

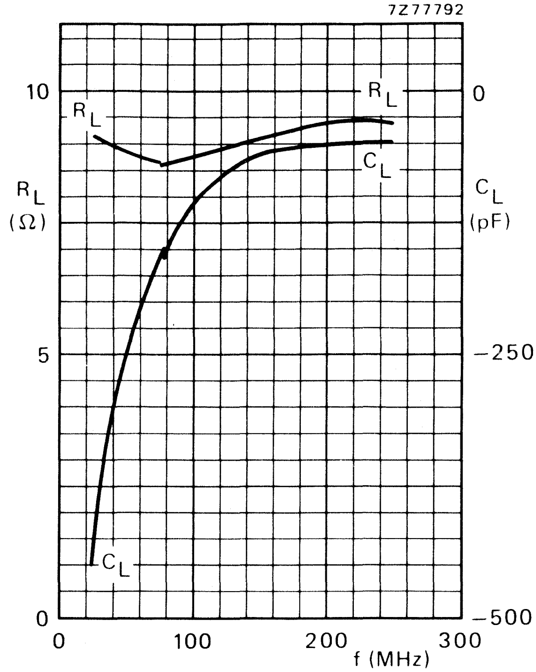


Fig. 14 Load impedance (parallel components).

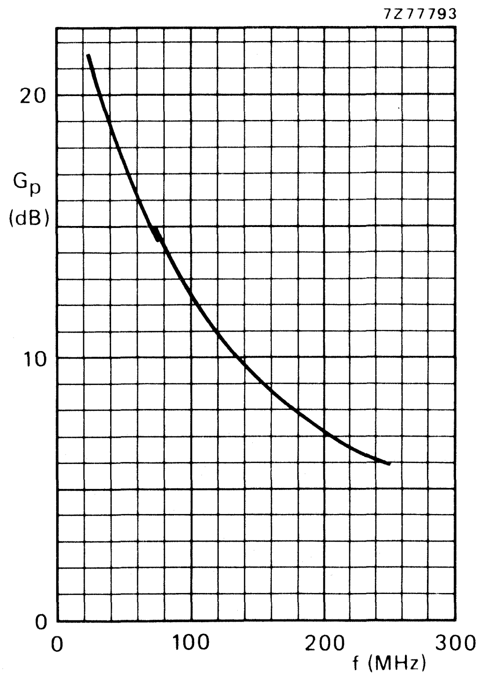


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 47,5 W	I_C (A) (P.E.P.)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 47,5 (P.E.P.)	typ. 19	typ. 45	typ. 1,9	typ. −30	< −30	50	25
5 to 42,5 (P.E.P.)	typ. 19	—	—	typ. −30	< −30	50	70

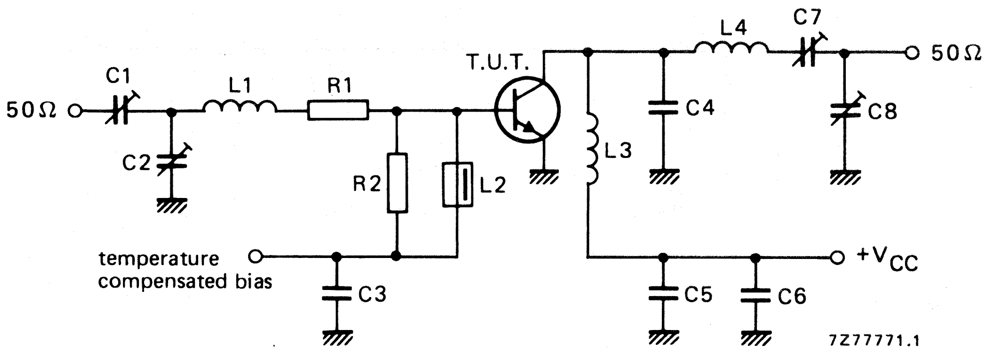


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

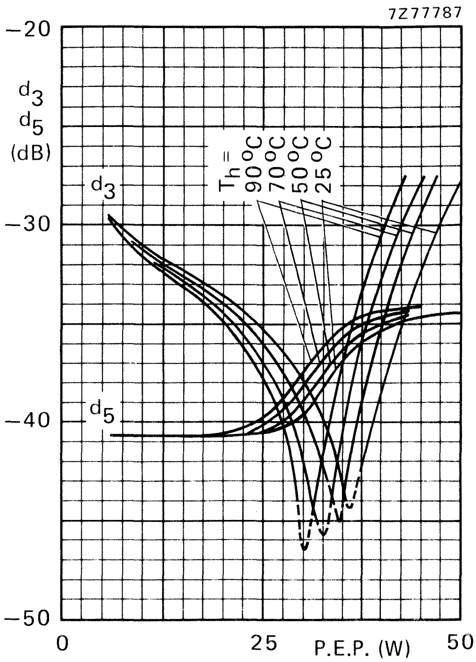


Fig. 17 Intermodulation distortion as a function of output power.*

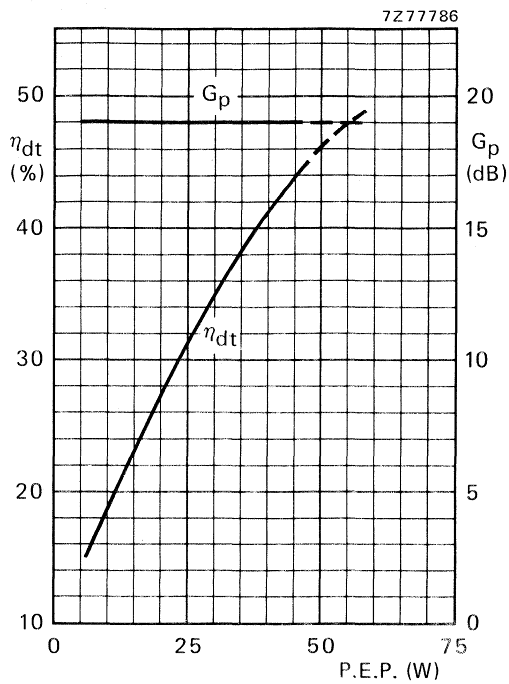


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on previous page.

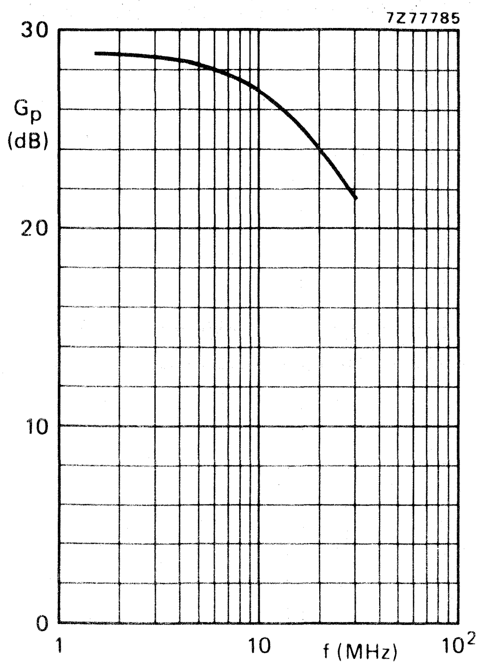


Fig. 19 Power gain as a function of frequency.

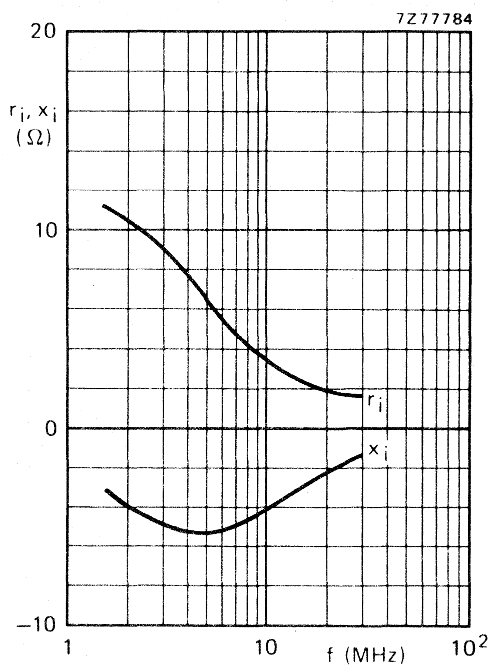


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 47,5 W; T_h = 25 °C; Z_L = 6,4 Ω.

Ruggedness in s.s.b. operation

The BLW86 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 50 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB*	d_5 dB*	T_h °C
17 (P.E.P.)	typ. 22	1,7	typ. −40	< −40	70
17 (P.E.P.)	typ. 22	1,7	typ. −42	< −40	25

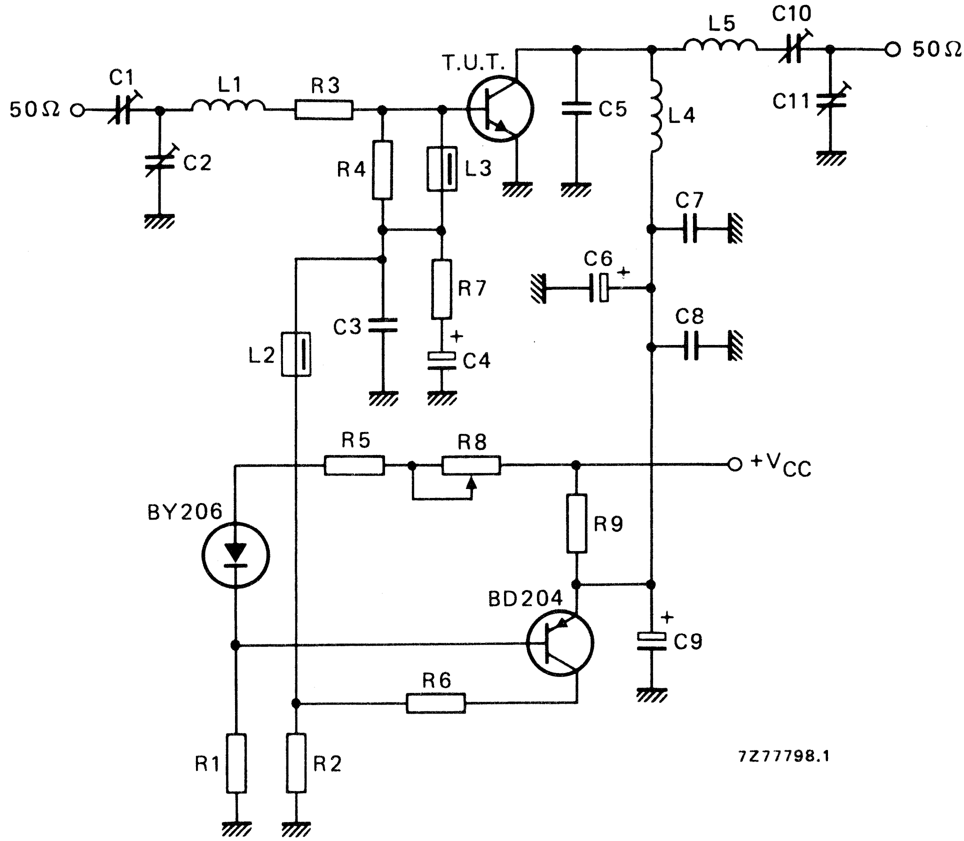


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (±5%; 0,5 W each)
R2 = 15 Ω carbon resistor (±5%; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (±5%; 0,125 W each)
R4 = 33 Ω carbon resistor (±5%; 0,25 W)
R5 = 18 Ω carbon resistor (±5%; 0,25 W)
R6 = 120 Ω wirewound resistor (±5%; 5,5 W)
R7 = 1 Ω carbon resistor (±5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (±5%; 5,5 W each)

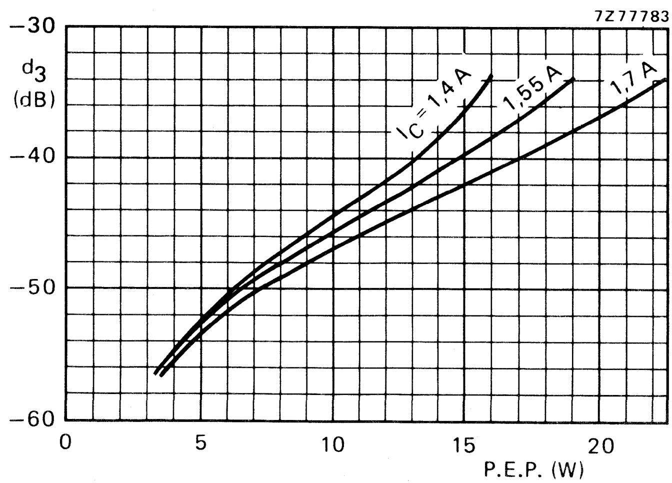


Fig. 22 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

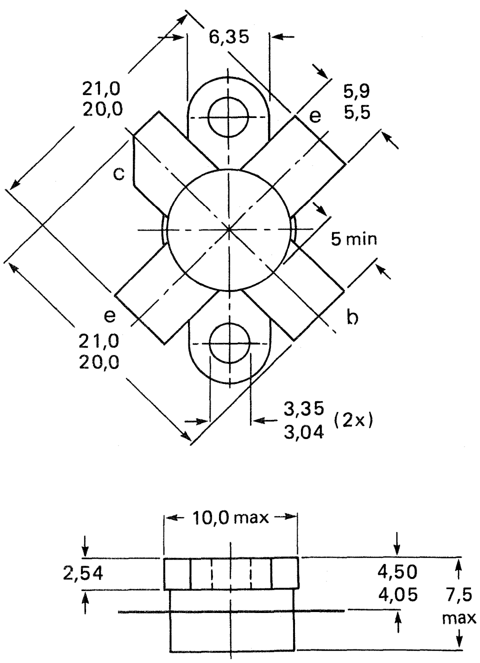
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

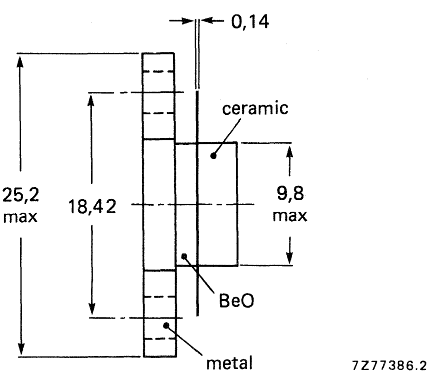
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**25**	**> 6**	**> 70**	**1,6 + j1,4**	**210 + j5,5**

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head
4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36 V
Collector-emitter voltage (open base)	V_{CEO}	max.	18 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	76 W
Storage temperature	T_{stg}	– 65 to + 150	°C
Operating junction temperature	T_j	max.	200 °C

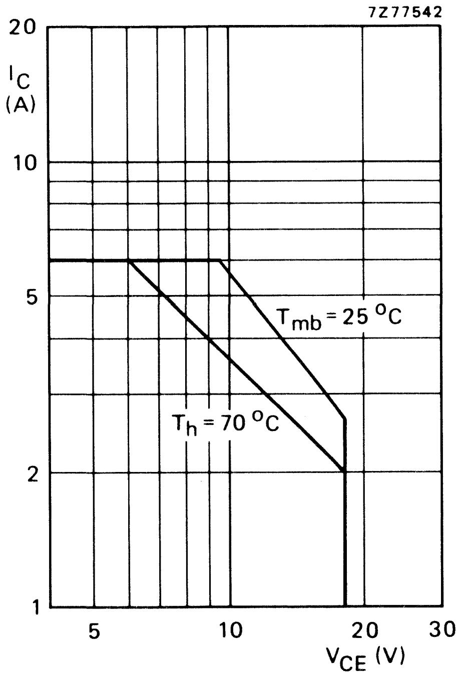


Fig. 2 D.C. SOAR.

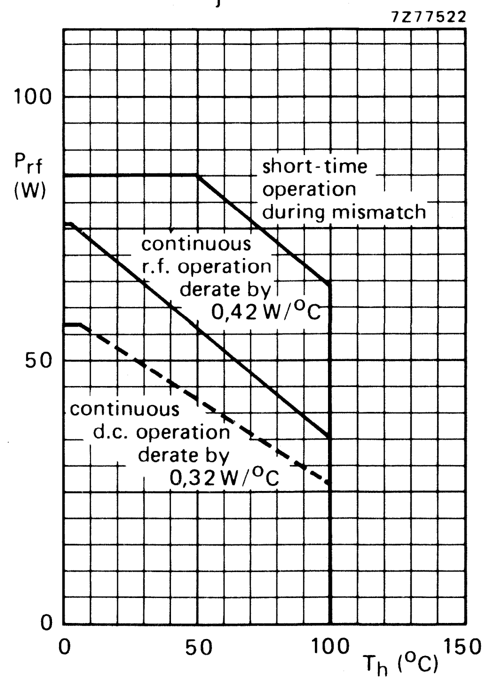


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f $\geqslant$ 1 MHz.

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 76 °C; i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,0 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,25 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain* $I_C = 2,5$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50 10 to 80
Collector-emitter saturation voltage* $I_C = 7,5$ A; $I_B = 1,5$ A	V_{CEsat}	typ.	1,7 V
Transition frequency at f = 100 MHz* $-I_E = 2,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800 MHz
$-I_E = 7,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	750 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	65 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ.	41 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

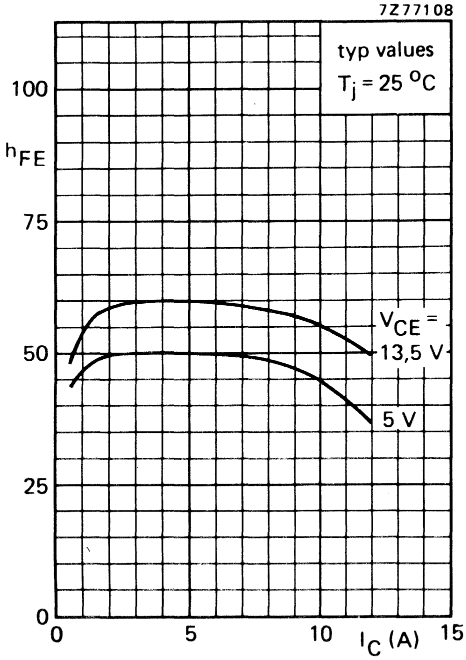


Fig. 4.

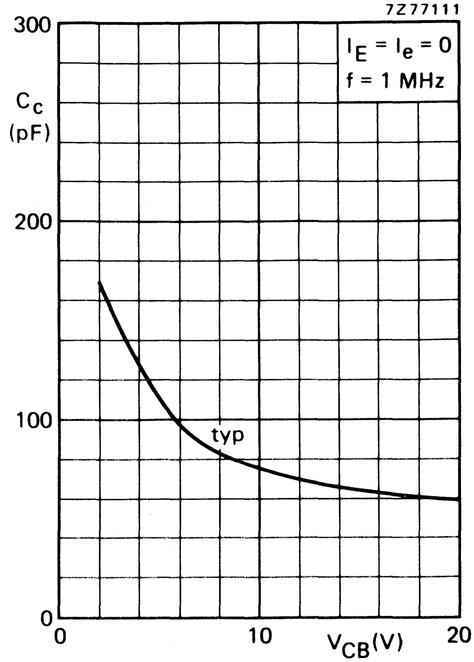


Fig. 5 T_j = 25 °C.

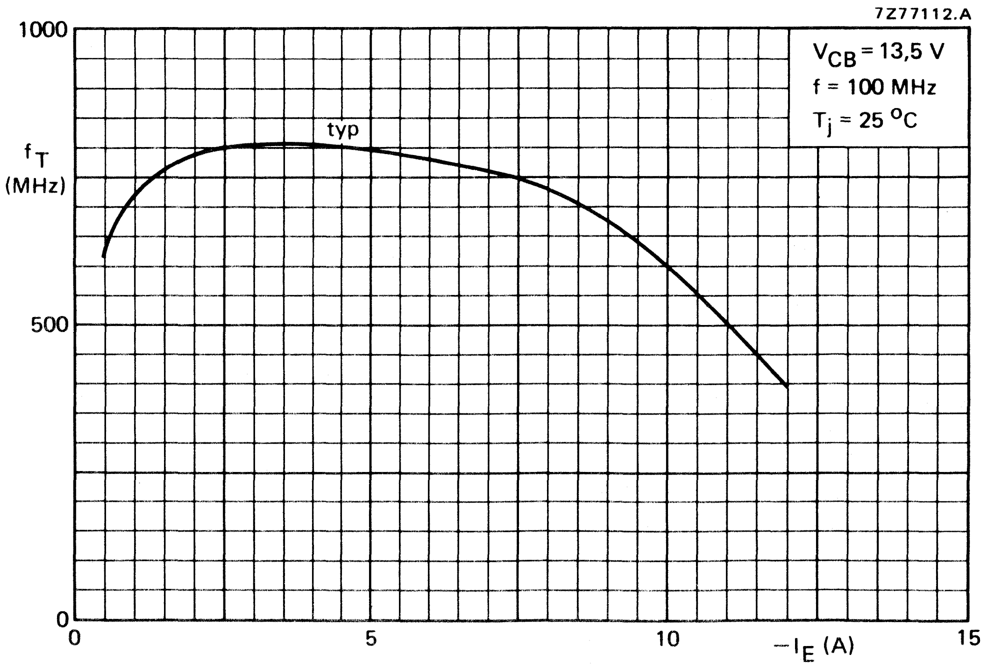


Fig. 6.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**25**	**< 6,25**	**> 6**	**< 2,64**	**> 70**	**1,6 + j1,4**	**210 + j5,5**
175	12,5	25	–	typ. 6,6	–	typ. 75	–	–

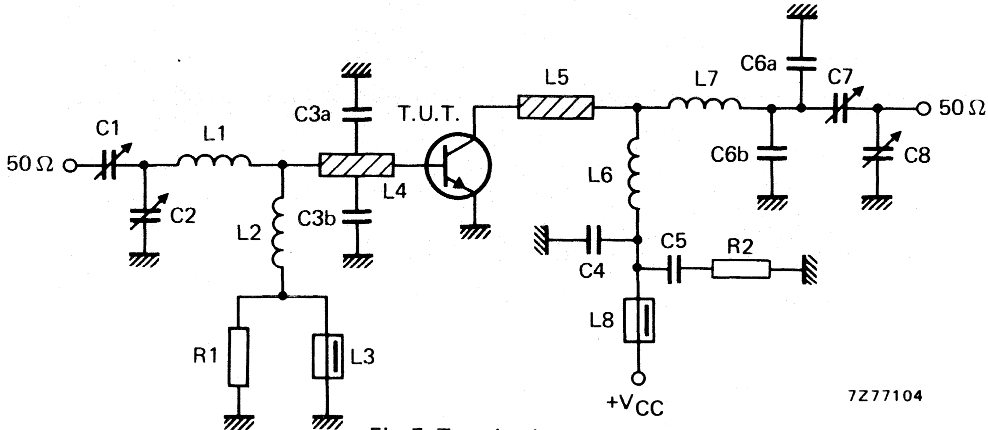


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

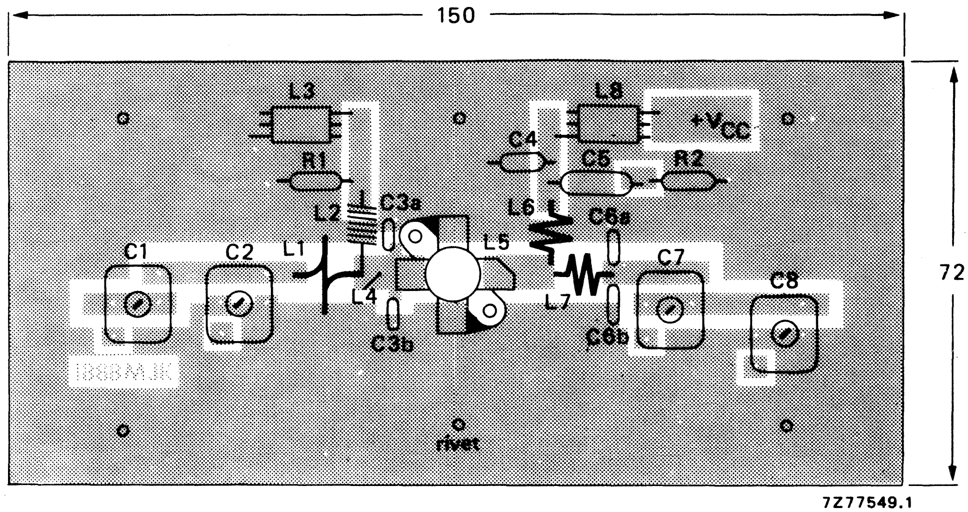
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω (± 10%) carbon resistor (0,25 W)
R2 = 4,7 Ω (± 5%) carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit are shown in Fig. 8.

APPLICATION INFORMATION (continued)



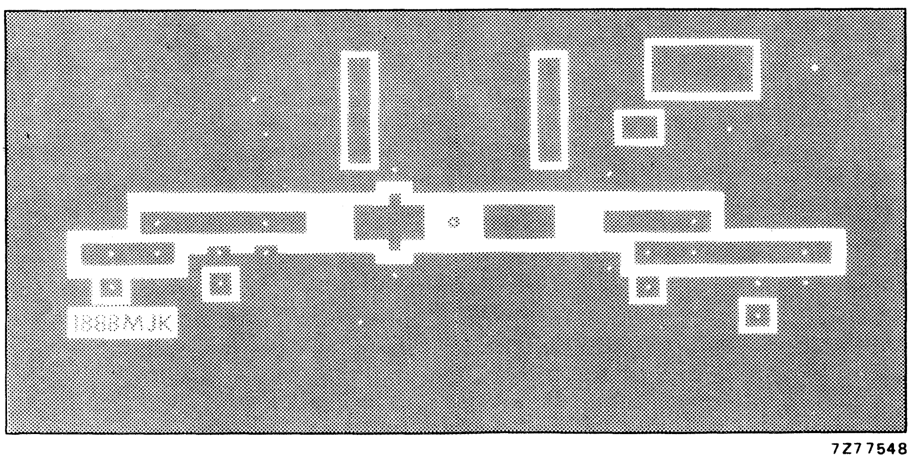


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

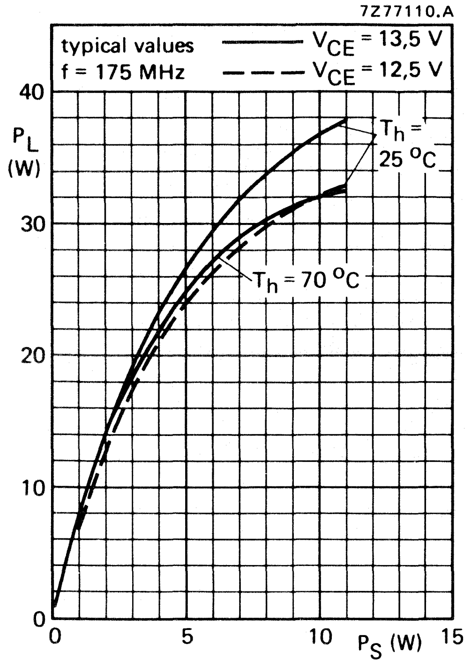


Fig. 9.

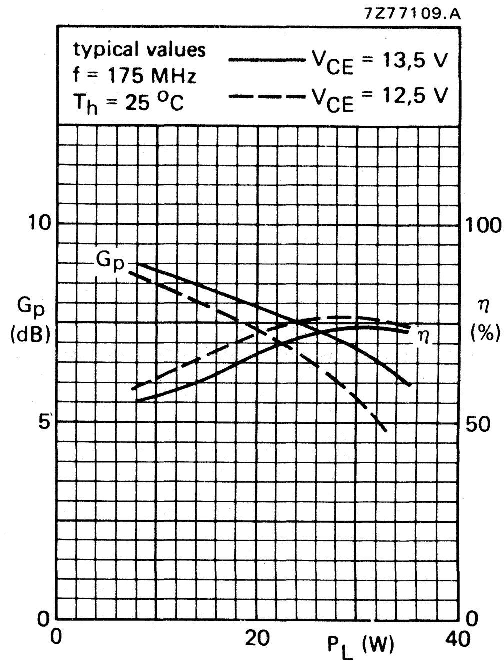


Fig. 10.

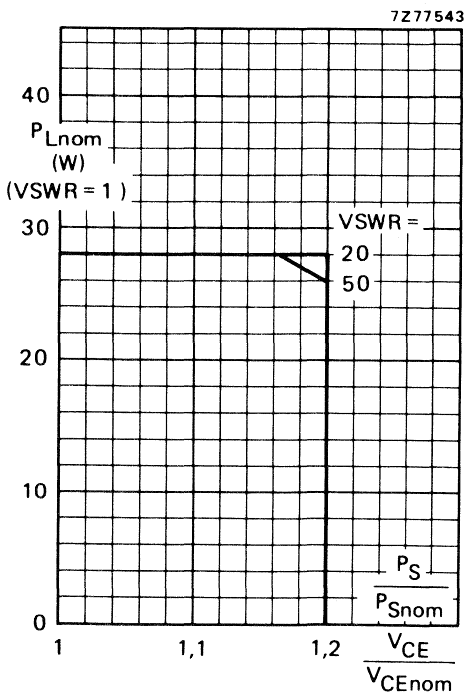


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W ; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 (see page 5).

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

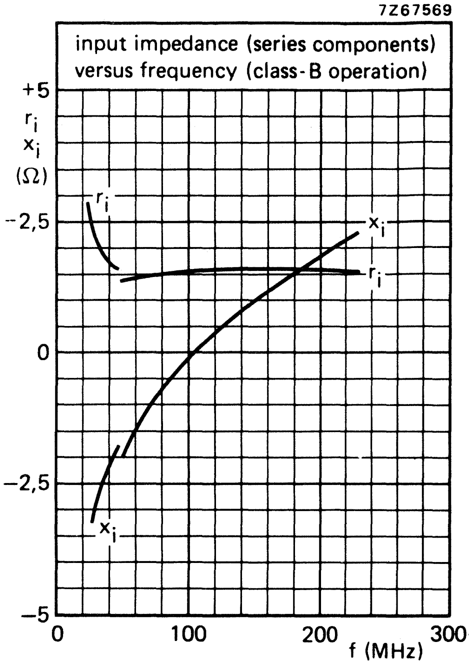


Fig. 12.

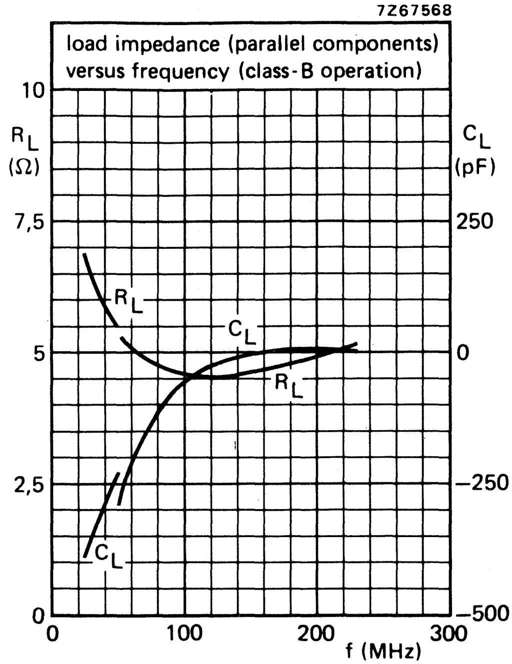


Fig. 13.

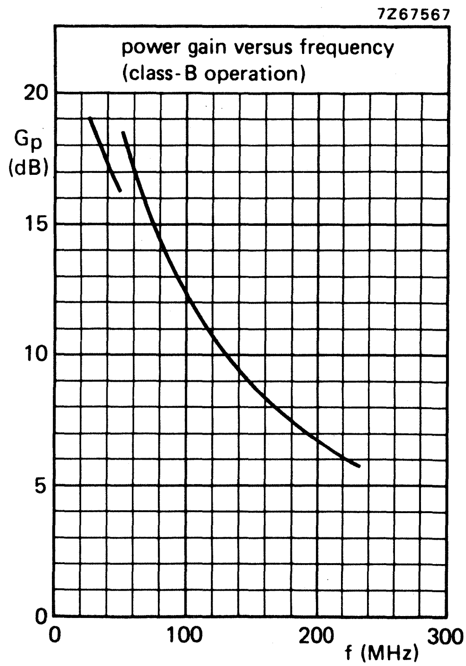


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 25 W; T_h = 25 °C.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

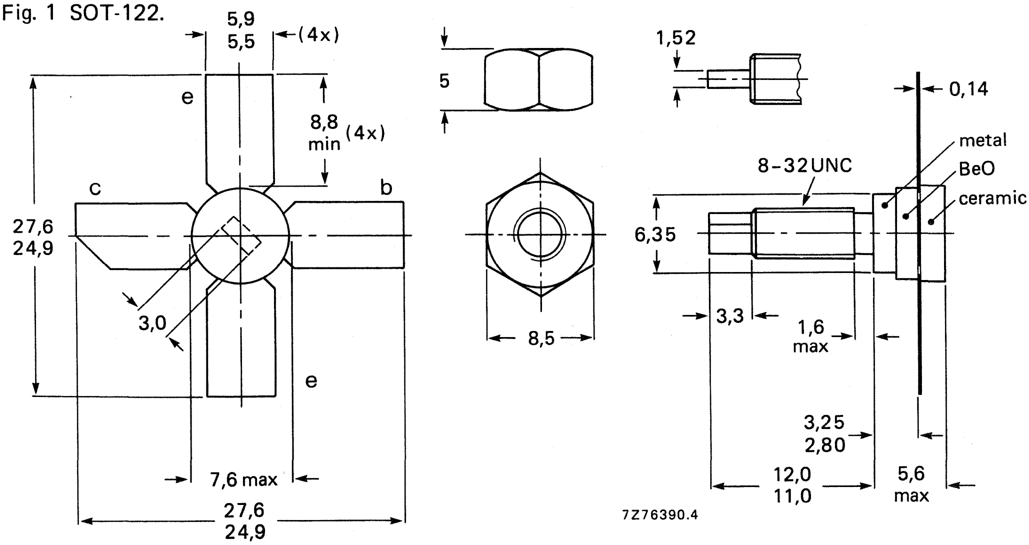
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	2	> 12	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); V_{BE} = 0	V_{CESM}	max.	60	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	0,32	A
(peak value); f > 1 MHz	I_{CM}	max.	1,0	A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 50 °C	P_{tot}	max.	9,6	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

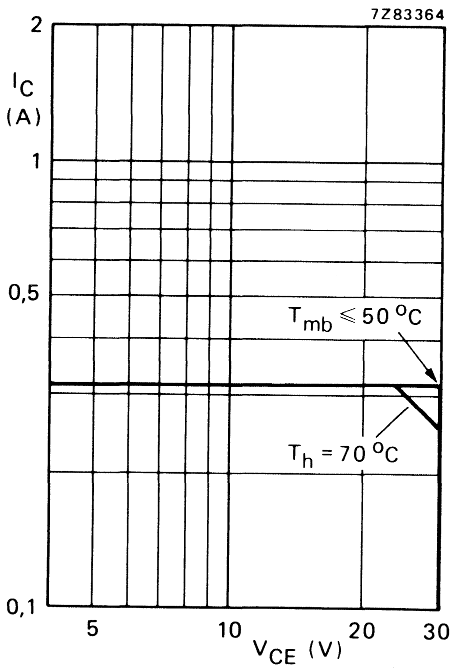


Fig. 2 D.C. SOAR.

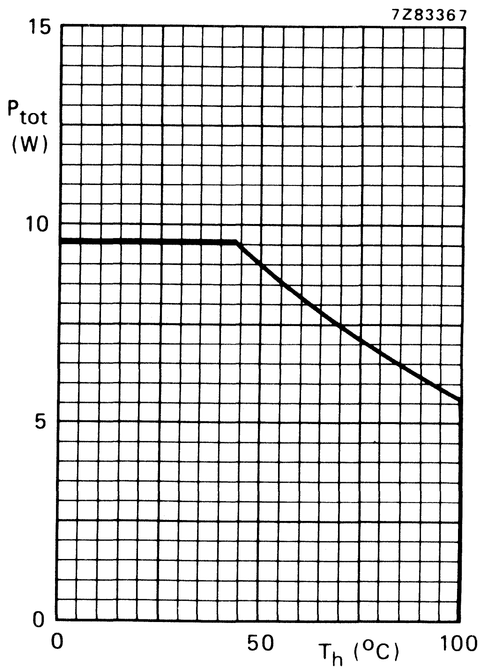


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 3,5 W; T_{mb} = 72 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	13,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	60	V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	1	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5	mJ
D.C. current gain * I_C = 0,15 A; V_{CE} = 5 V	h_{FE}	typ.	40 10 to 100	
Collector-emitter saturation voltage * I_C = 0,5 A; I_B = 0,1 A	V_{CEsat}	typ.	0,9	V
Transition frequency at f = 500 MHz * $-I_E$ = 0,15 A; V_{CB} = 28 V	f_T	typ.	1,20	GHz
$-I_E$ = 0,50 A; V_{CB} = 28 V	f_T	typ.	0,85	GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	5,5	pF
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 28 V	C_{re}	typ.	2	pF
Collector-stud capacitance	C_{cs}	typ.	1,2	pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

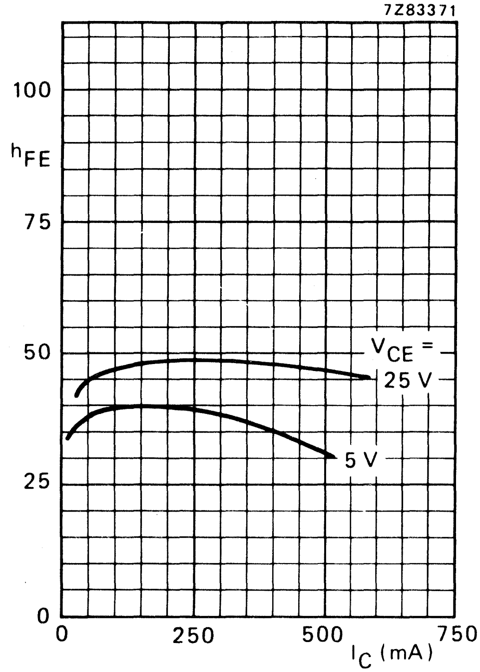


Fig. 4 Typical values; T_j = 25 °C.

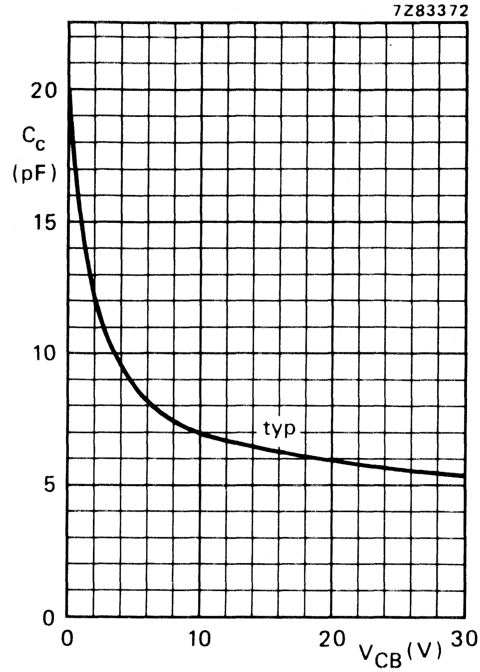


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

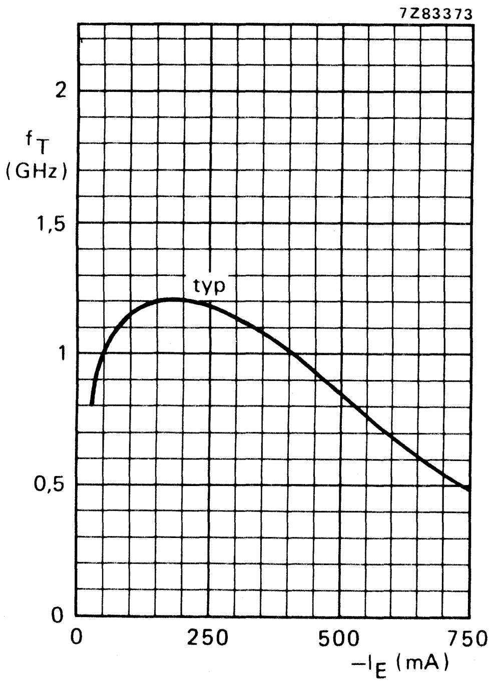


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**2**	< **0,13**	> **12**	< **0,145**	> **50**	**3,0 − j0,4**	**12 + j45**
470	28	2	typ. 0,09	typ. 13,5	typ. 0,135	typ. 53	−	−

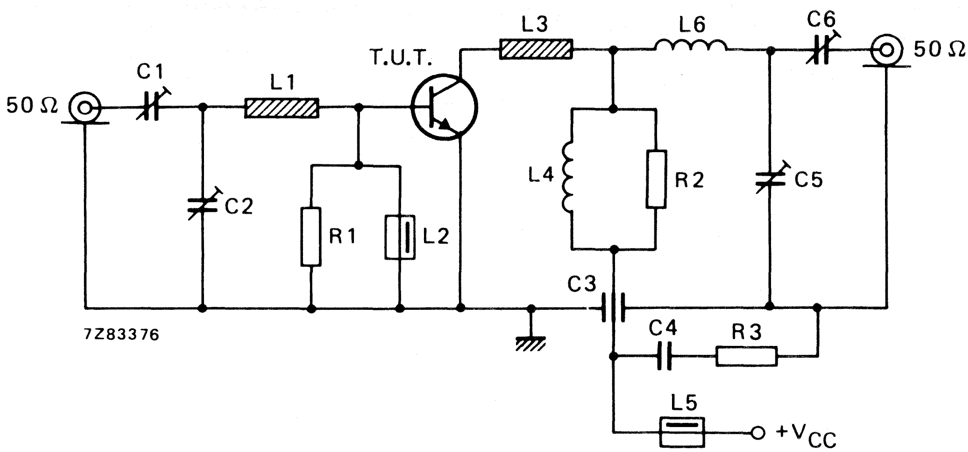


Fig. 7 Test circuit; c.w. class-B.

List of components:

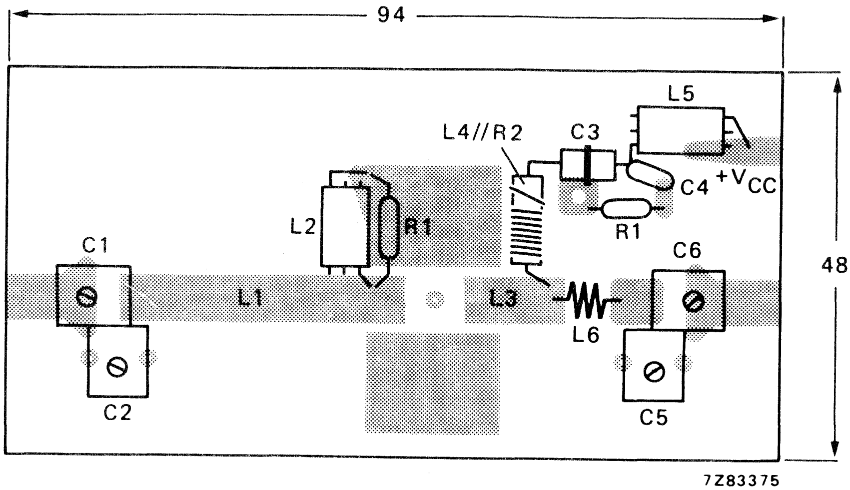
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF ceramic feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = stripline (12,0 mm x 6,0 mm)
L4 = 220 nH; 10 turns enamelled Cu wire (0,35 mm) closely wound around R2
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L3 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 100 Ω carbon resistor
R2 = 10 kΩ carbon resistor (style CR37)
R3 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.



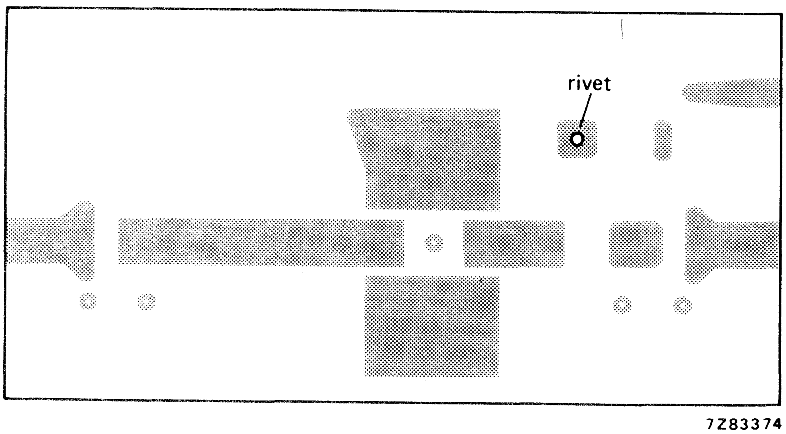


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

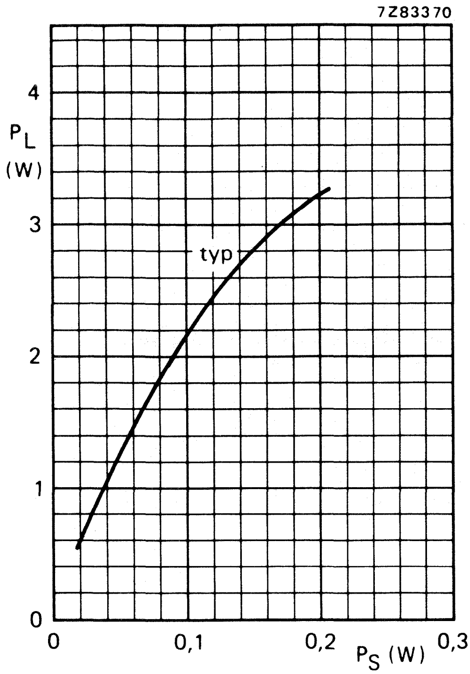


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

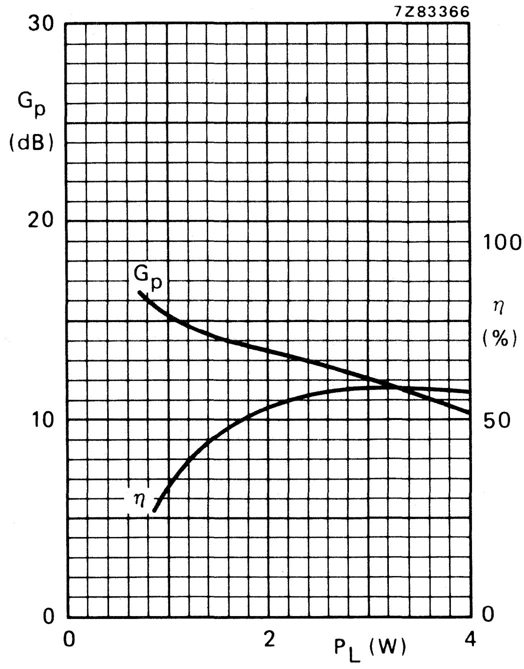


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

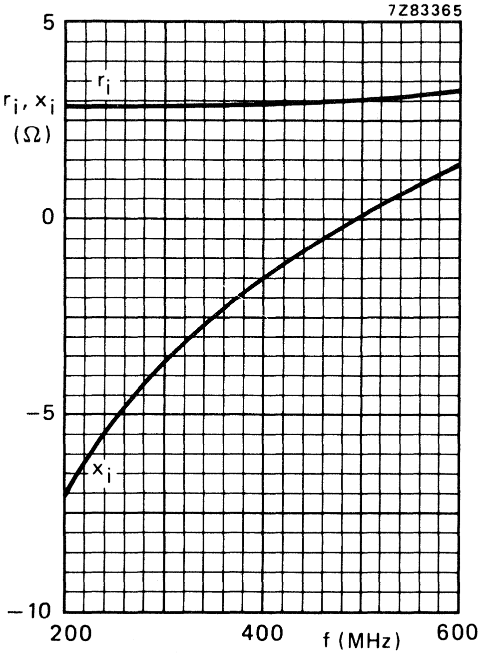


Fig. 11 Input impedance (series components).

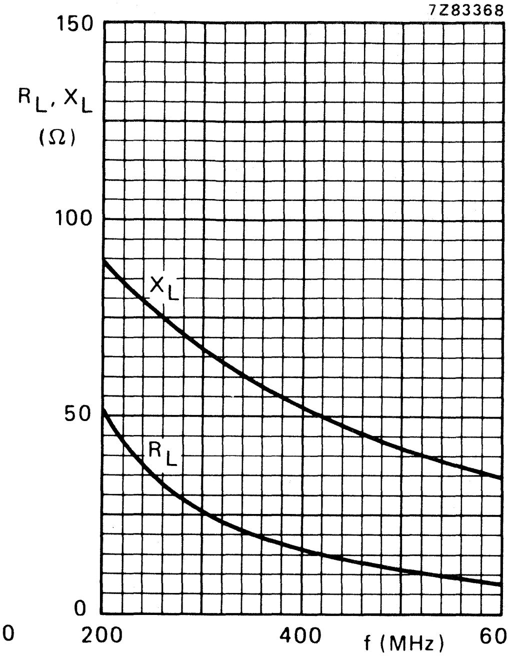


Fig. 12 Load impedance (series components).

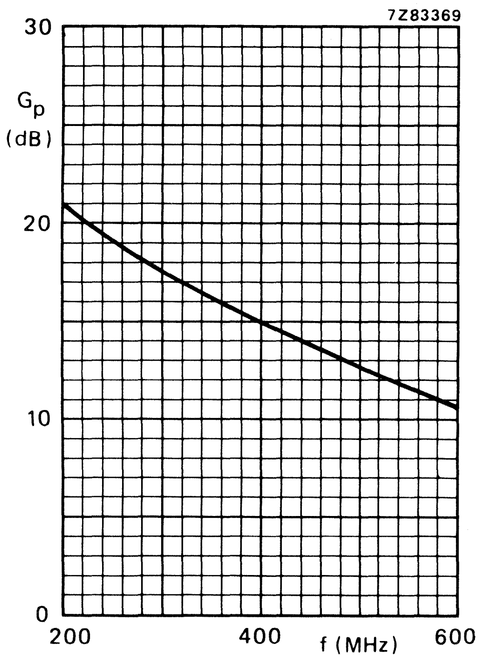


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 2 W; T_h = 25 °C.

Ruggedness

The BLW89 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 2 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

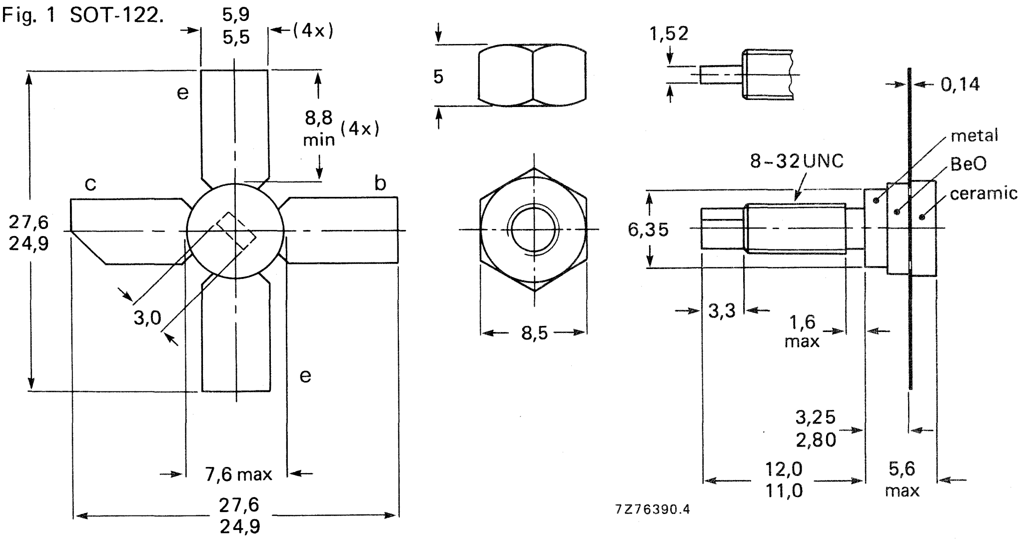
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	4	> 11	> 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	0,62	A
(peak value); f > 1 MHz	I_{CM}	max.	2,0	A
Total power dissipation (d.c. and r.f.) up to T_{mb} = 25 °C	P_{tot}	max.	18,6	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

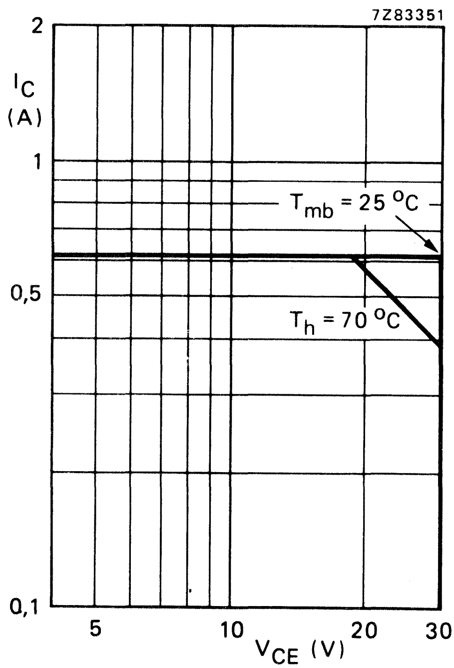


Fig. 2 D.C. SOAR.

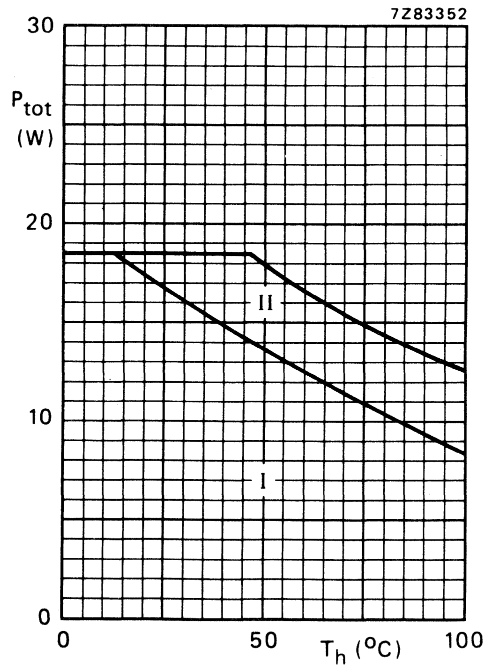


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 6 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	9,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 4 mA	$V_{(BR)CES}$	>	60	V
Collector-emitter breakdown voltage open base; I_C = 20 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 30 V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	1	mJ
R_{BE} = 10 Ω	E_{SBR}	>	1	mJ
D.C. current gain * I_C = 0,3 A; V_{CE} = 5 V	h_{FE}	typ.	40	
			10 to 100	
Collector-emitter saturation voltage * I_C = 1,0 A; I_B = 0,2 A	V_{CEsat}	typ.	0,9	V
Transition frequency at f = 500 MHz *				
$-I_E$ = 0,3 A; V_{CB} = 28 V	f_T	typ.	1,2	GHz
$-I_E$ = 1,0 A; V_{CB} = 28 V	f_T	typ.	0,9	GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	8,4	pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 28 V	C_{re}	typ.	3,6	pF
Collector-stud capacitance	C_{cs}	typ.	1,2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

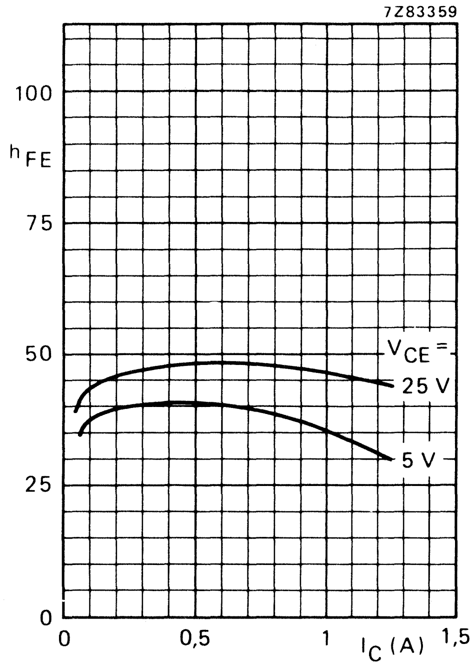


Fig. 4 Typical values; T_j = 25 °C.

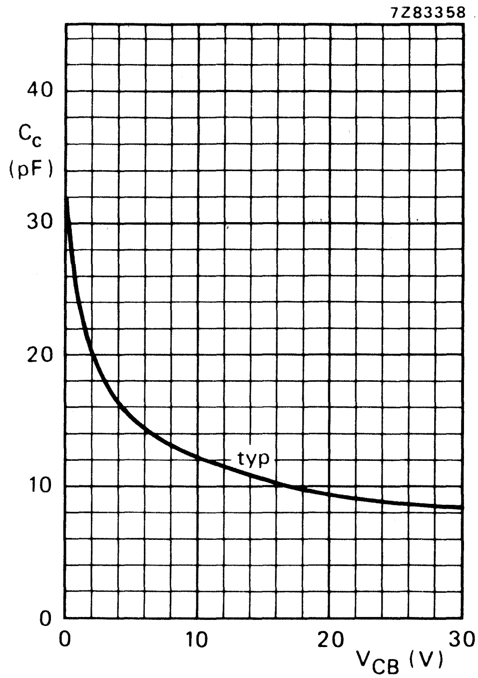


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

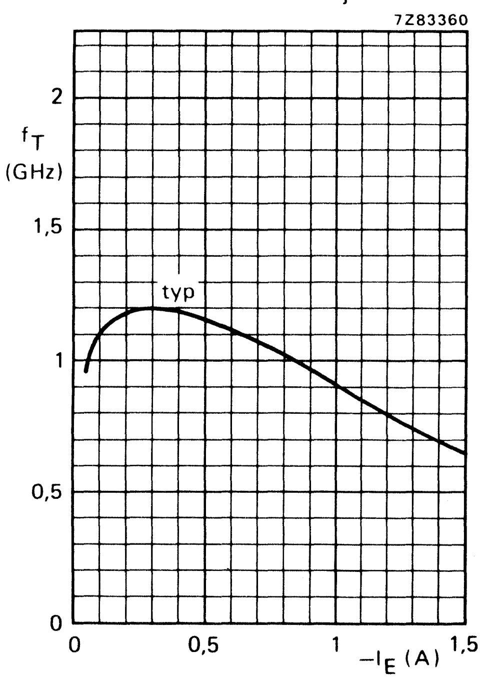


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**4**	< **0,32**	> **11**	< **0,26**	> **55**	**1,7 + j1,8**	**8 + j26**
470	28	4	typ. 0,23	typ. 12,5	typ. 0,25	typ. 58	–	–

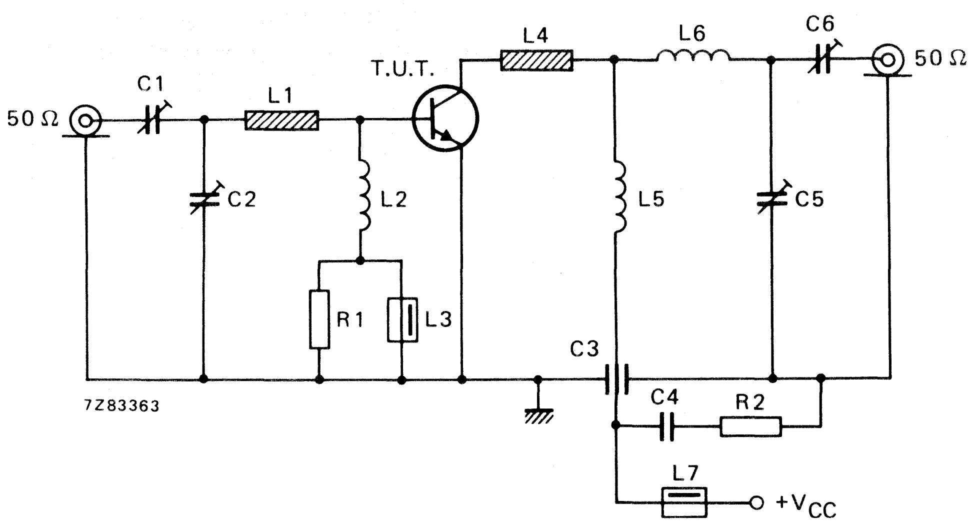


Fig. 7 Test circuit; c.w. class-B.

List of components:

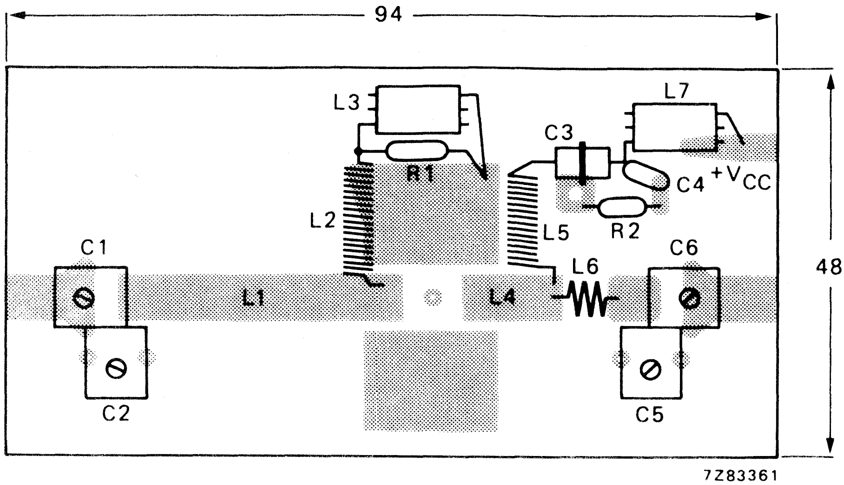
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF feed-through capacitor
C4 = 100 nF polyester capacitor

L1 = stripline (34,8 mm x 6,0 mm)
L2 = 320 nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = stripline (12,0 mm x 6,0 mm)
L5 = 265 nH; 13 turns closely wound enamelled Cu wire (0,35 mm); int. dia. 3,5 mm; leads 2 x 4 mm
L6 = 29 nH; 3 turns closely wound enamelled Cu wire (1 mm); int. dia. 3,5 mm; leads 2 x 4 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16″.

R1 = 100 Ω carbon resistor
R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit are shown in Fig. 8.



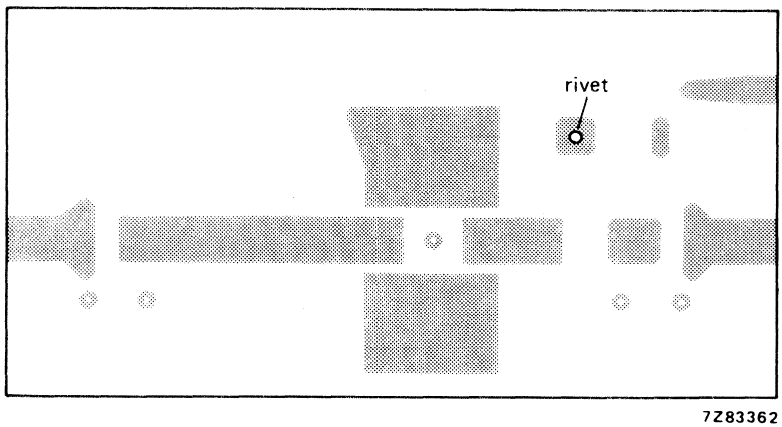


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

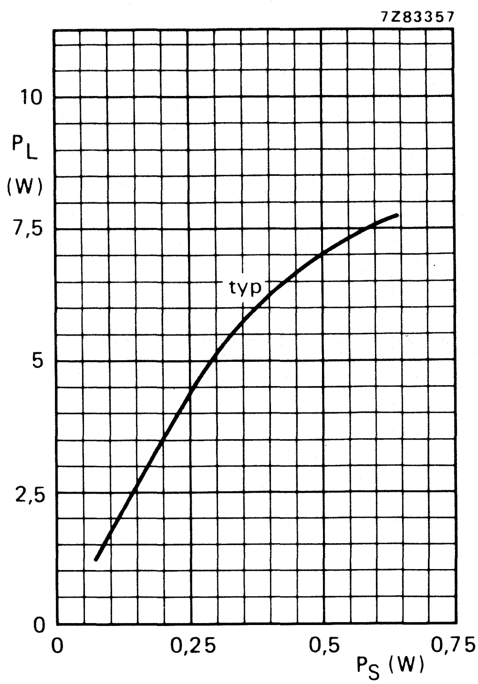


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

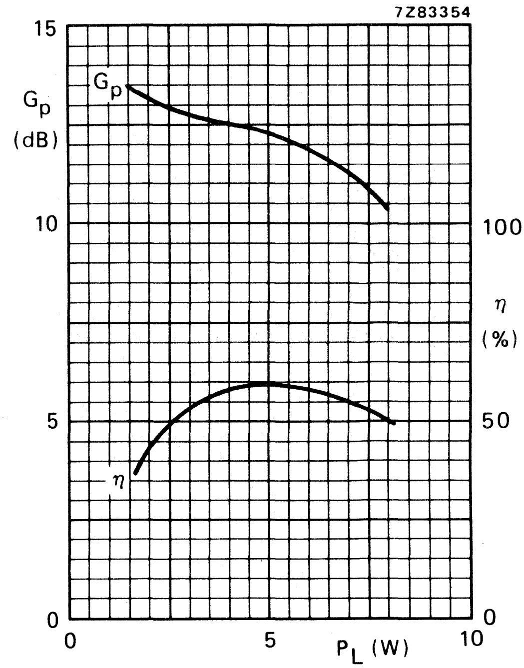


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

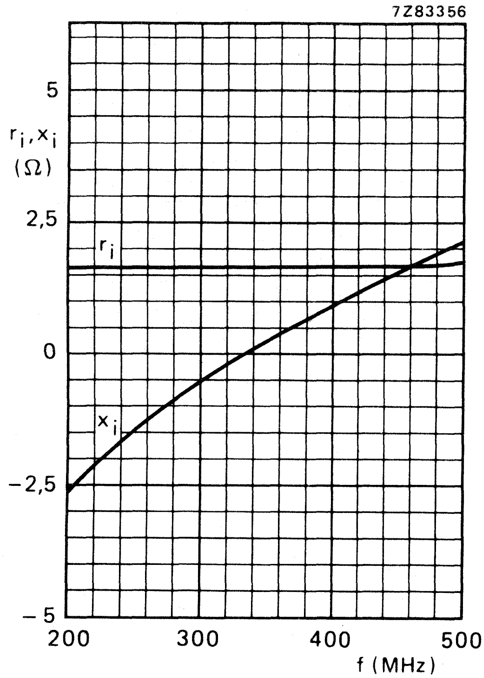


Fig. 11 Input impedance (series components).

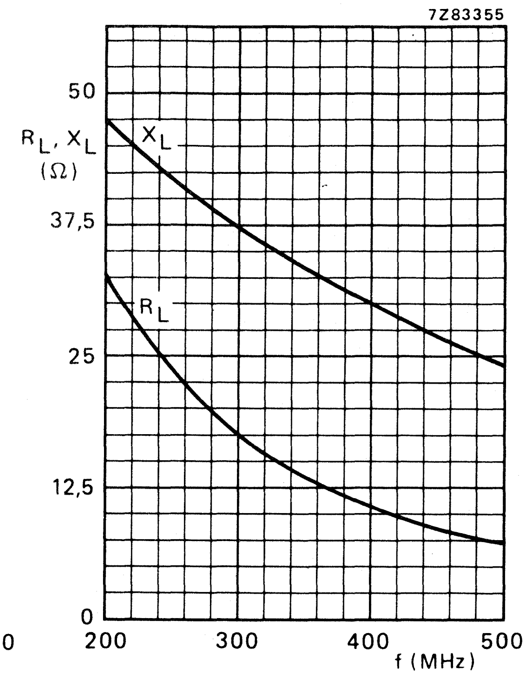


Fig. 12 Load impedance (series components).

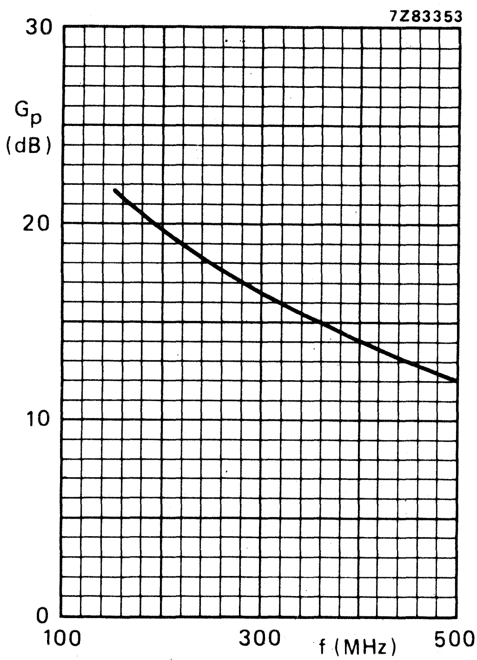


Fig. 13.

Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 4 W; T_h = 25 °C.

Ruggedness

The BLW90 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 4 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,6 K/W.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor suitable for transmitting applications in class-A, B or C in the u.h.f. and v.h.f. range for a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand infinite VSWR at rated output power. High reliability is ensured by a **gold sandwich metallization.**

The transistor is housed in a ¼″ capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

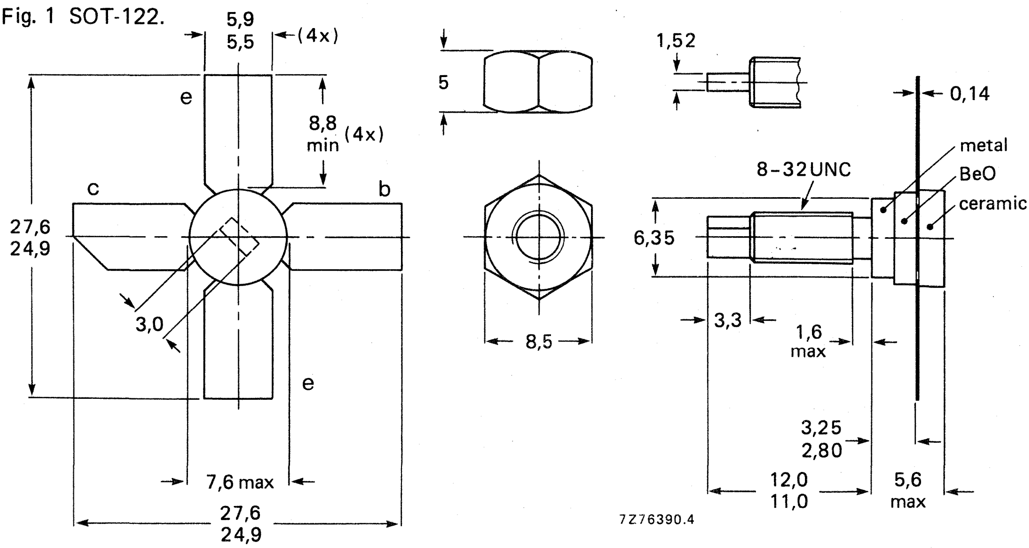
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
c.w.	28	470	10	> 9	> 60

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	60	V
open base	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c. or average	I_C; $I_{C(AV)}$	max.	1,5	A
(peak value); f > 1 MHz	I_{CM}	max.	3,5	A
Total power dissipation up to T_{mb} = 35 °C	P_{tot}	max.	30	W
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	32,5	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

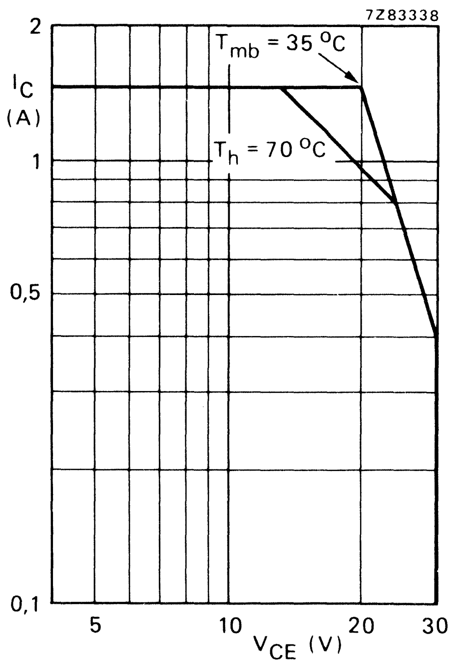


Fig. 2 D.C. SOAR.

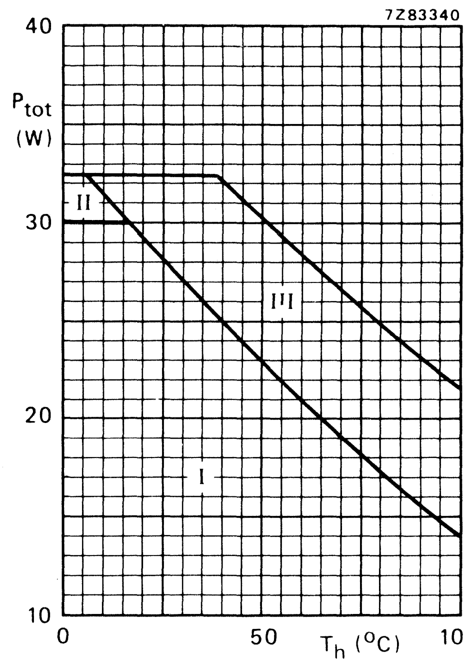


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 10 W; T_{mb} = 76 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. and r.f. dissipation)	$R_{th\ j\text{-}mb}$	=	6,2	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	60	V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	30	V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	4	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2	mJ
D.C. current gain * $I_C = 0,6$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40	
			10 to 100	
Collector-emitter saturation voltage * $I_C = 2,0$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	1,0	V
Transition frequency at f = 500 MHz * $-I_E = 0,6$ A; $V_{CB} = 28$ V	f_T	typ.	1,2	GHz
$-I_E = 2,0$ A; $V_{CB} = 28$ V	f_T	typ.	1,0	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	17	pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	8,5	pF
Collector-stud capacitance	C_{cs}	typ.	1,2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

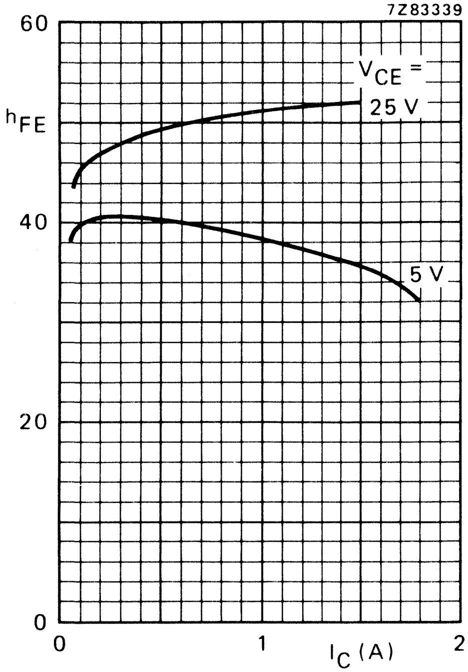


Fig. 4 Typical values; T_j = 25 °C.

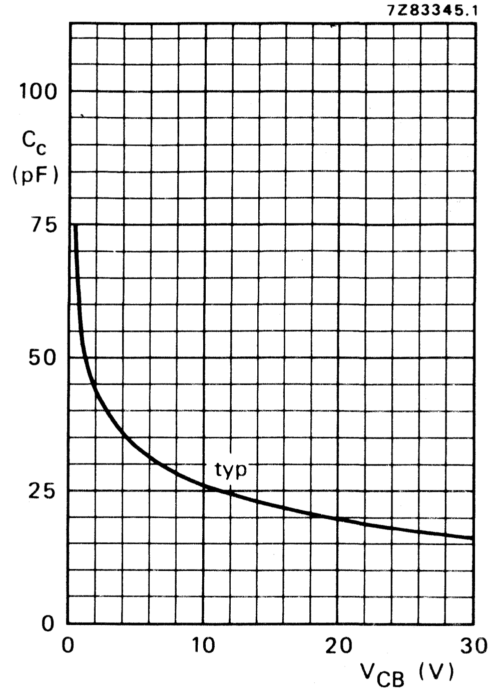


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

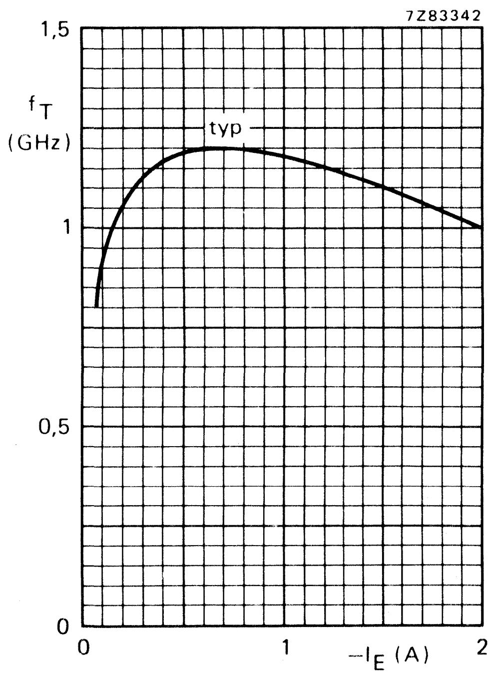


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Z_L}$ (Ω)
470	**28**	**10**	< **1,26**	> **9**	< **0,6**	> **60**	**1,0 + j2,1**	**4,9 + j11**
470	28	10	typ. 0,9	typ. 10,5	typ. 0,56	typ. 63	–	–

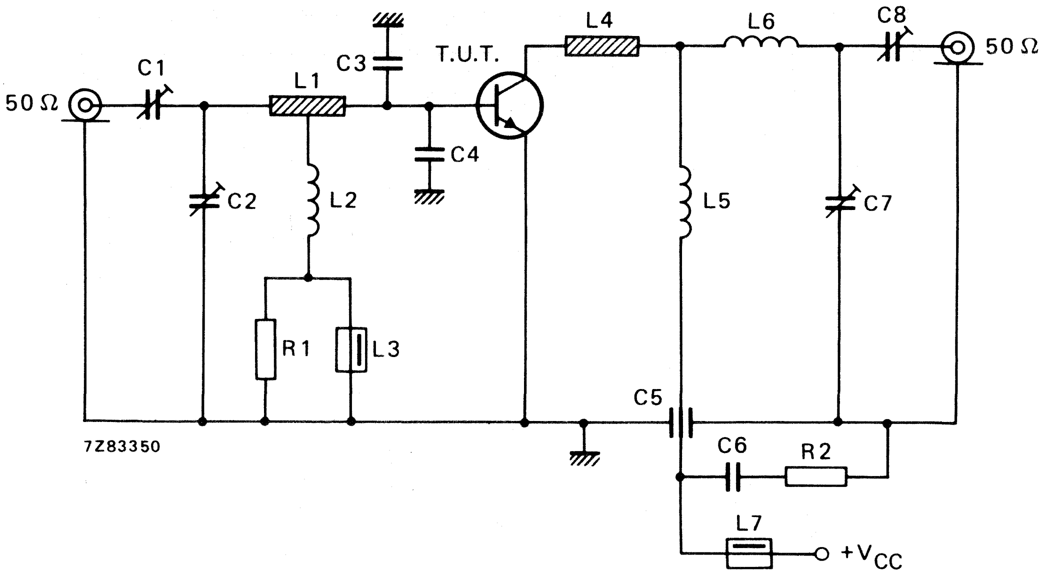


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

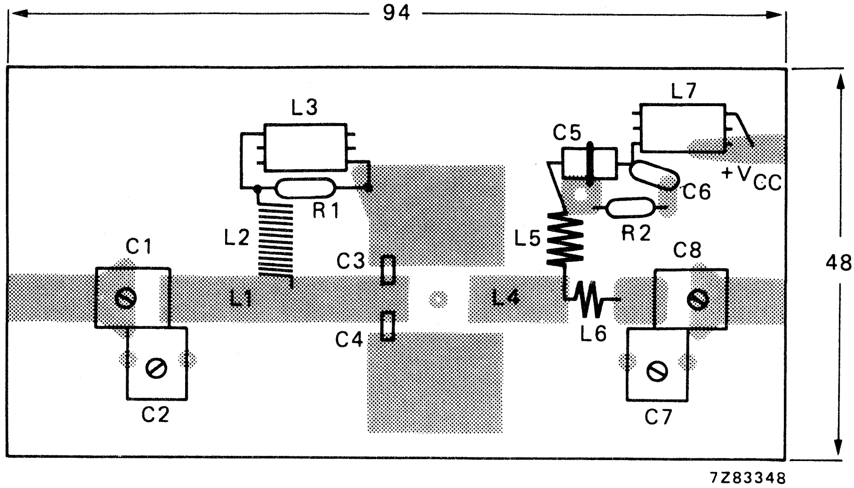
List of components:

C1 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF multilayer ceramic chip capacitor (cat. no. 2222 851 13159), middle of capacitor 3 mm from transistor edge
C5 = 100 pF feed-through capacitor
C6 = 100 nF polyester capacitor

L1 = stripline (30,4 mm x 6,0 mm); tap for L2 placed 11 mm from transistor edge
L2 = 320 nH; 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 4 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = stripline (12,0 mm x 6,0 mm)
L5 = 78 nH; 5 turns enamelled Cu wire (1,0 mm); int. dia. 5 mm; length 9,3 mm; leads 2 x 5 mm
L6 = 22 nH; 2 turns enamelled Cu wire (1,0 mm); int. dia. 4 mm; length 3,2 mm; leads 2 x 5 mm

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω carbon resistor



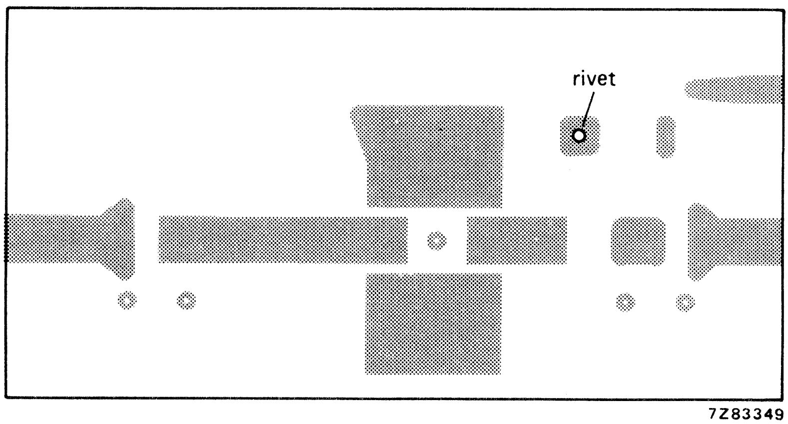


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

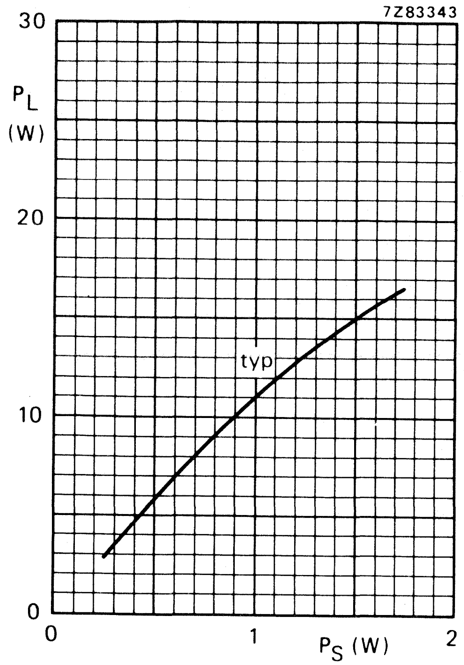


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

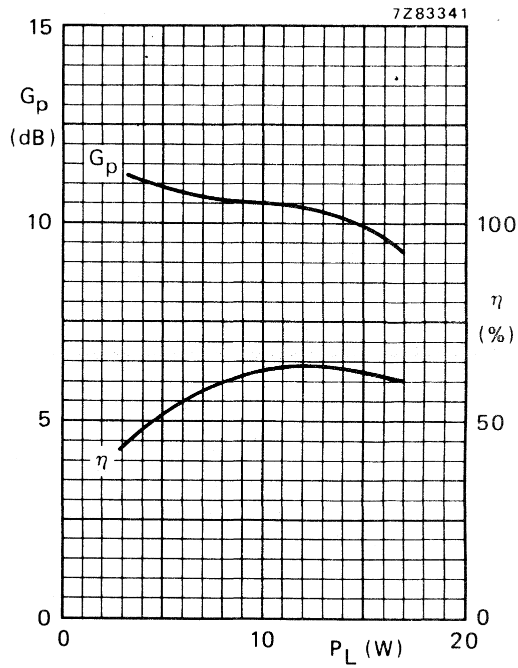


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

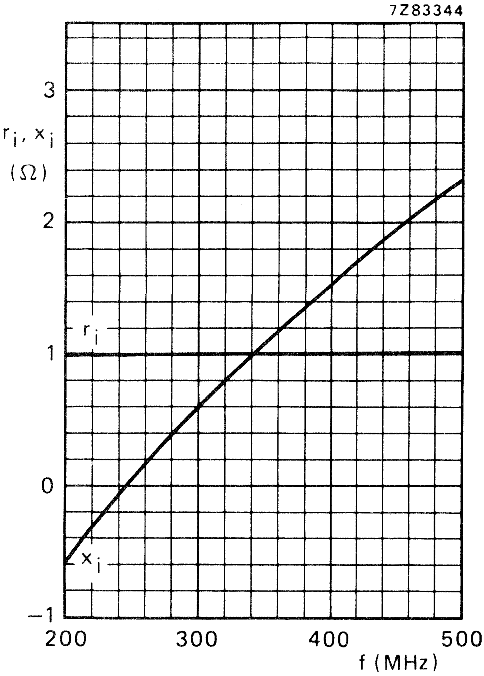


Fig. 11 Input impedance (series components).

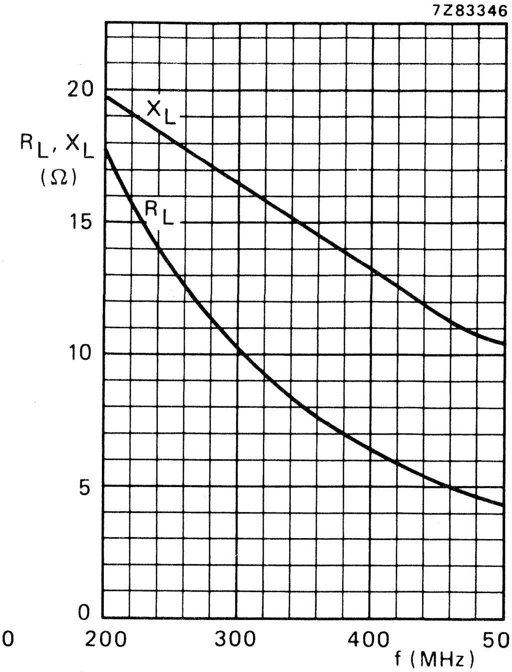
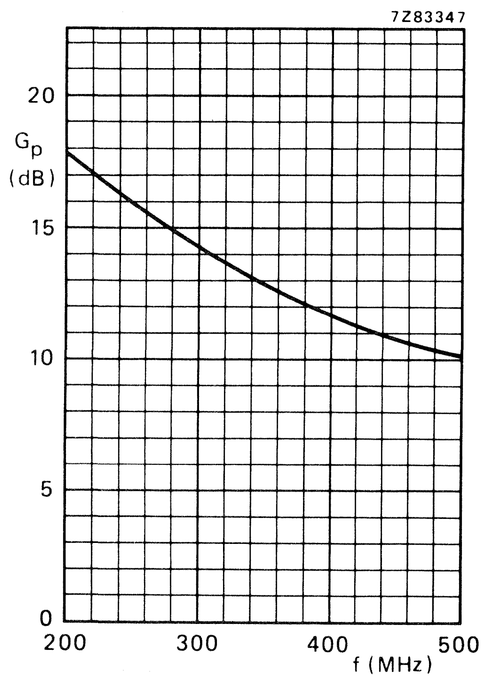


Fig. 12 Load impedance (series components).



Conditions for Figs 11, 12 and 13:

Typical values; V_{CE} = 28 V; P_L = 10 W;
T_h = 25 °C.

Ruggedness

The BLW91 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 10 W under the following conditions:

V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C;
$R_{th\ mb\text{-}h}$ = 0,6 K/W.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB operated high power industrial and military transmitting equipment in the h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

The transistor has a ½″ flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_p dB	η_{dt} %	d_3 dB
s.s.b. (class-AB)	50	0,1	1,6 – 28	20 – 160 (P.E.P.)	> 14	> 40*	< −30

* At 160 W P.E.P.

MECHANICAL DATA

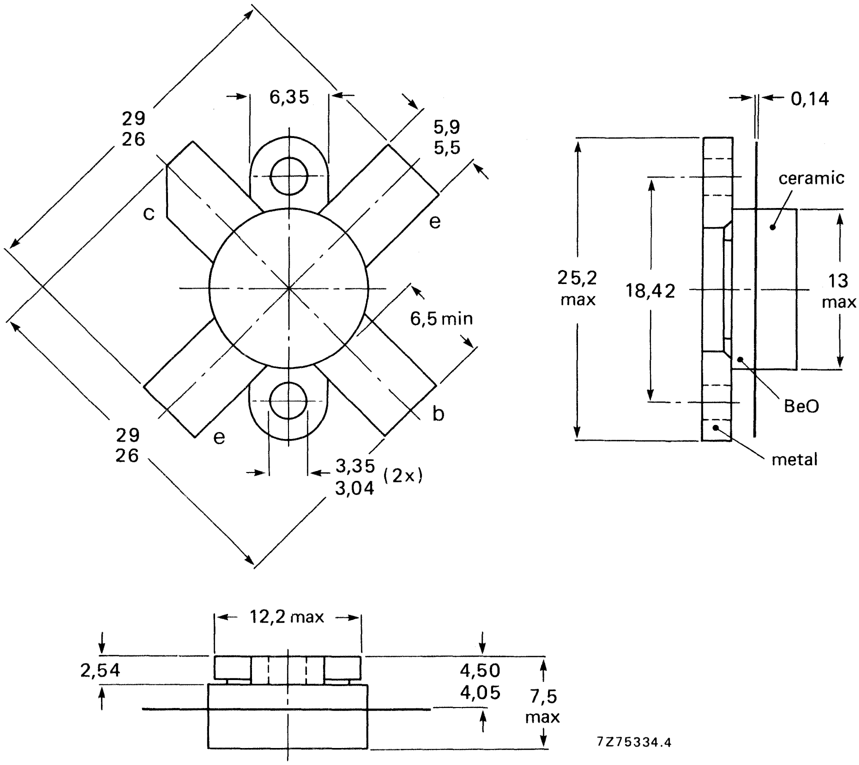
SOT-121A (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110 V
Collector-emitter voltage (open base)	V_{CEO}	max.	53 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	8 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	20 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	245 W
Storage temperature	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

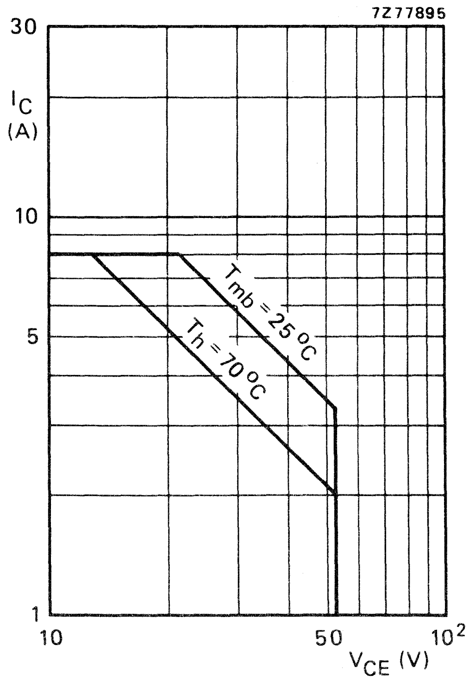


Fig. 2 D.C. SOAR.

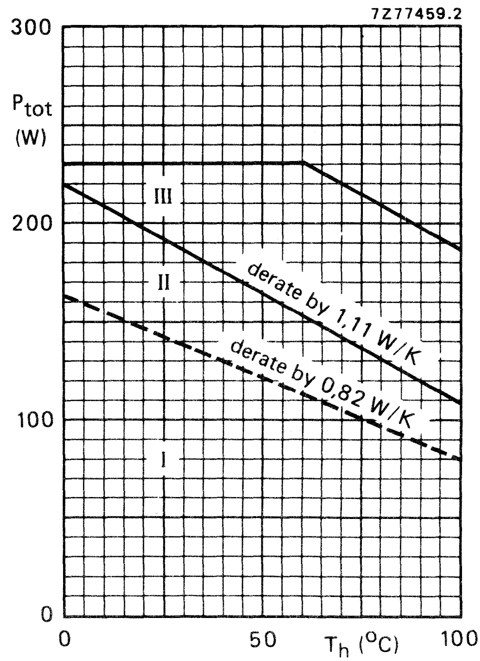


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 50$ V; $f \geqslant 1$ MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,0 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,7 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	110	V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	53	V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 53$ V	I_{CES}	<	10	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	12,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5	mJ
D.C. current gain * $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30 15 to 50	
D.C. current gain ratio of matched devices * $I_C = 4$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	⩽	1,2	
Collector-emitter saturation voltage * $I_C = 12,5$ A; $I_B = 2,5$ A	V_{CEsat}	typ.	2,2	V
Transition frequency at f = 100 MHz * $-I_E = 4$ A; $V_{CB} = 40$ V	f_T	typ.	270	MHz
$-I_E = 12,5$ A; $V_{CB} = 40$ V	f_T	typ.	285	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 50$ V	C_c	typ.	185	pF
Feedback capacitance at f = 1 MHz $I_C = 150$ mA; $V_{CE} = 50$ V	C_{re}	typ.	115	pF
Collector-flange capacitance	C_{cf}	typ.	3	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

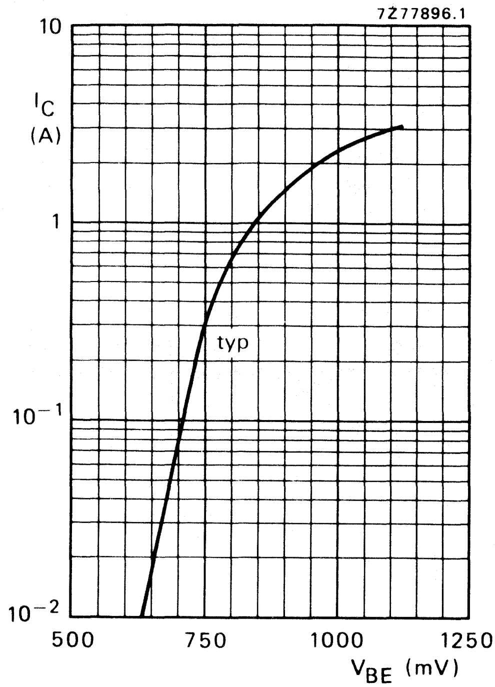


Fig. 4 V_{CE} = 40 V; T_h = 25 °C.

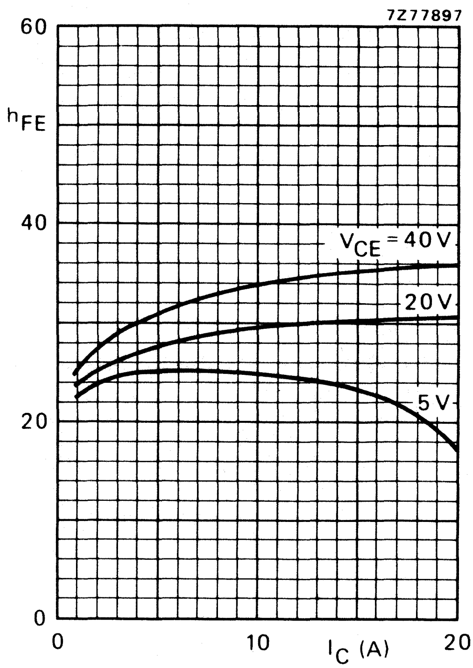


Fig. 5 Typical values; T_j = 25 °C.

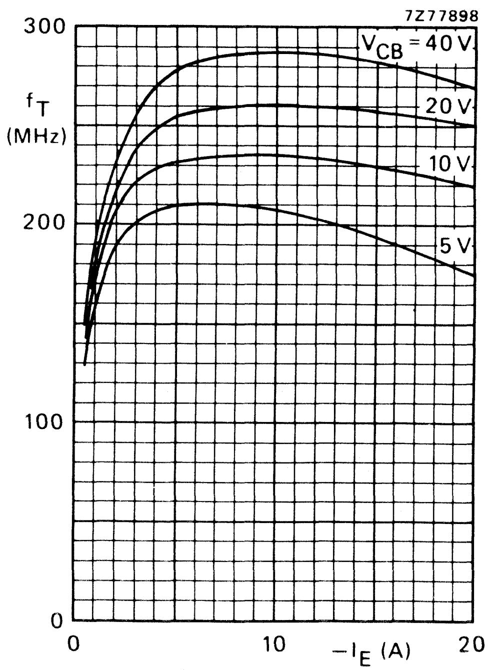


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

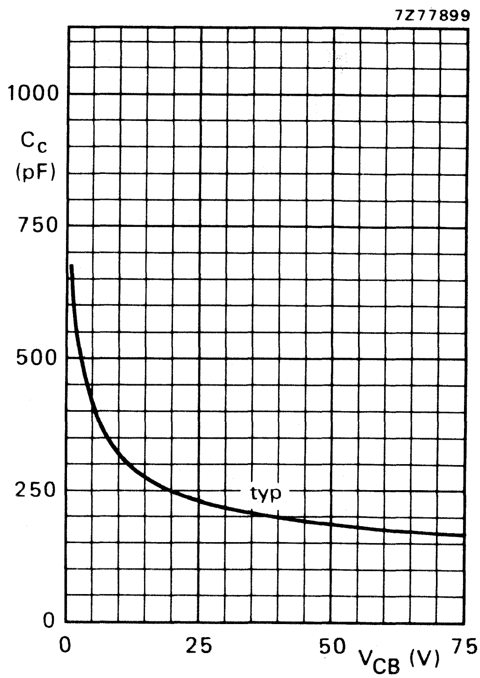


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 160 W (P.E.P.)	I_C (A) at 160 W (P.E.P.)	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ A
20 to 160 (P.E.P.)	> 14	> 40	< 4,0	< −30	< −30	0,1

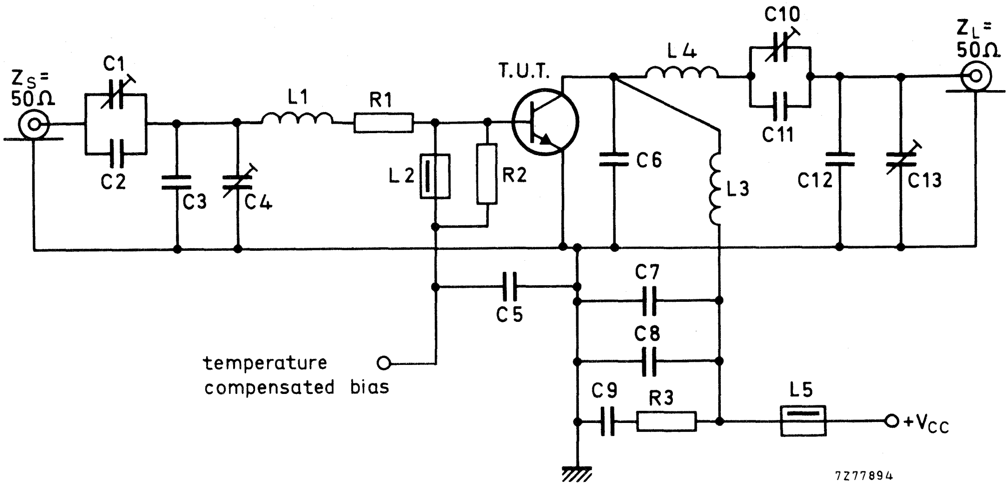


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C10 = 100 pF film dielectric trimmer
C2 = C6 = 27 pF ceramic capacitor (500 V)
C3 = 220 pF polystyrene capacitor
C4 = C13 = 100 pF film dielectric trimmer
C5 = C7 = 3,9 nF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor (500 V)
C12 = 220 pF polystyrene capacitor

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,6 mm); int. dia. 12,0 mm; length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω carbon resistors (± 5%; 0,5 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

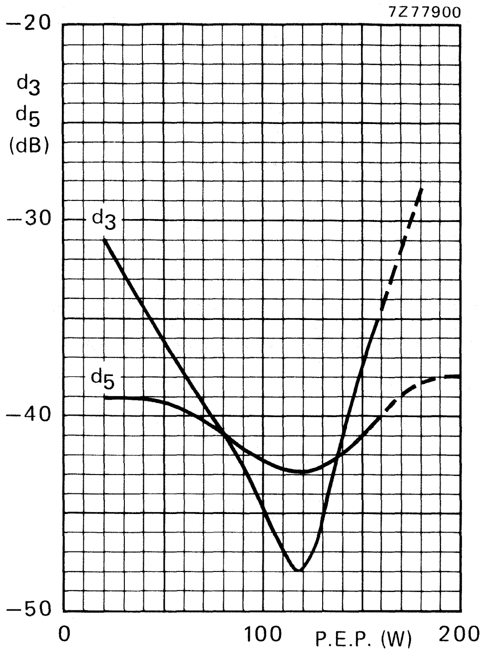


Fig. 9 Intermodulation distortion as a function of output power.*

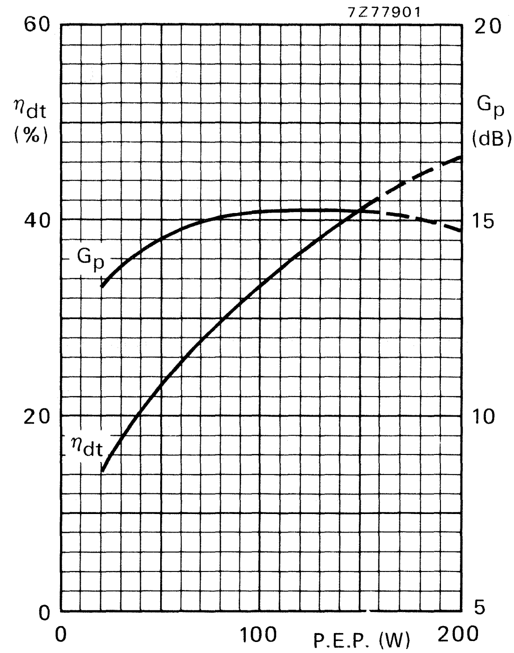


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW95 is capable of withstanding full load mismatch (VSWR = 50) up to 150 W (P.E.P.) under the following conditions:

V_{CE} = 45V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* See note on previous page.

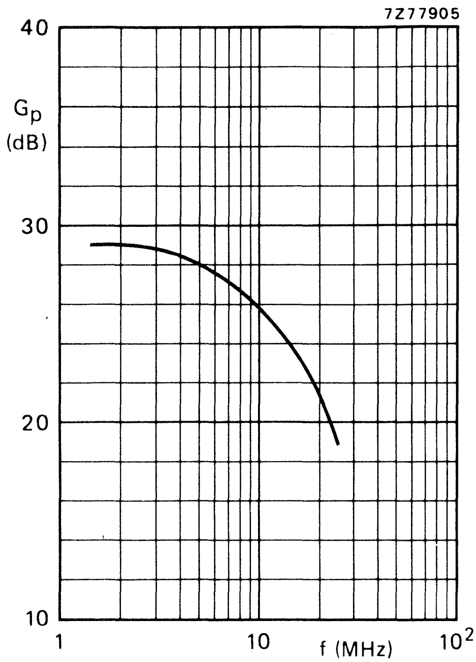


Fig. 11 Power gain as a function of frequency.

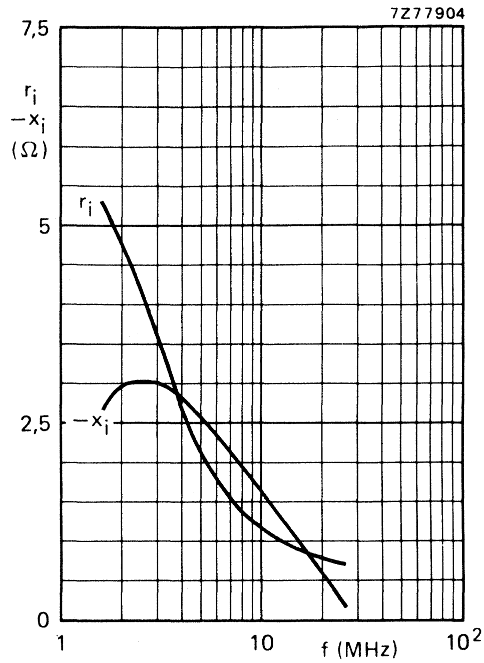


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF).

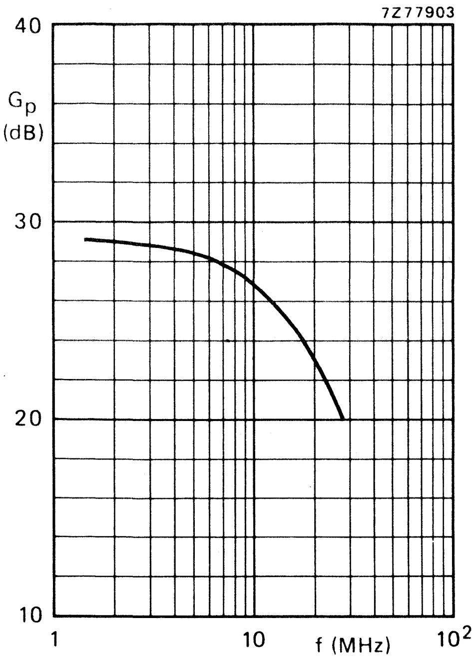


Fig. 13 Power gain as a function of frequency.

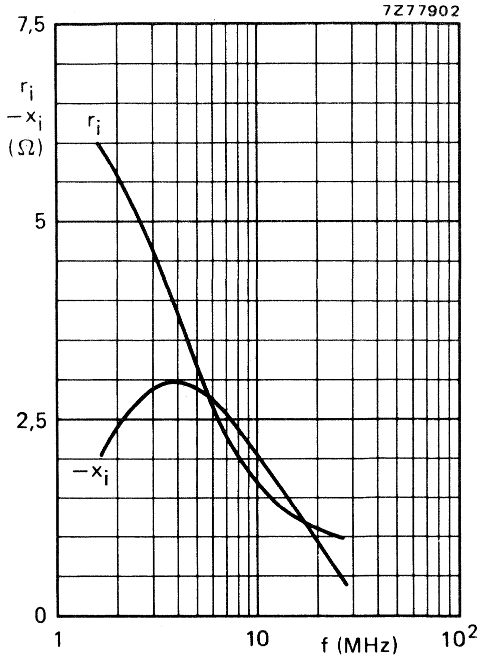


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:
V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 160 W (P.E.P.); T_h = 25 °C; Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF); neutralizing capacitor: 82 pF.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, AB and B operated high power industrial and military transmitting equipment in the h.f. and v.h.f. band. The transistor presents excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Transistors are supplied in matched h_{FE} groups.

The transistor has a ½" flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	d_3 dB	d_5 dB	$I_{C(ZS)}$ (I_C) A
s.s.b. (class-AB)	**50**	**1,6 – 28**	**25 – 200 (P.E.P.)**	**> 13,5**	**> 40***	**< –30**	**< –30**	**0,1**
c.w. (class-B)	50	108	200	typ. 6,5	typ. 67	–	–	(6)
s.s.b. (class-A)	40	28	50 (P.E.P.)	typ. 19	–	typ. –40	< –40	(4)

* η_{dt} at 200 W P.E.P.

MECHANICAL DATA

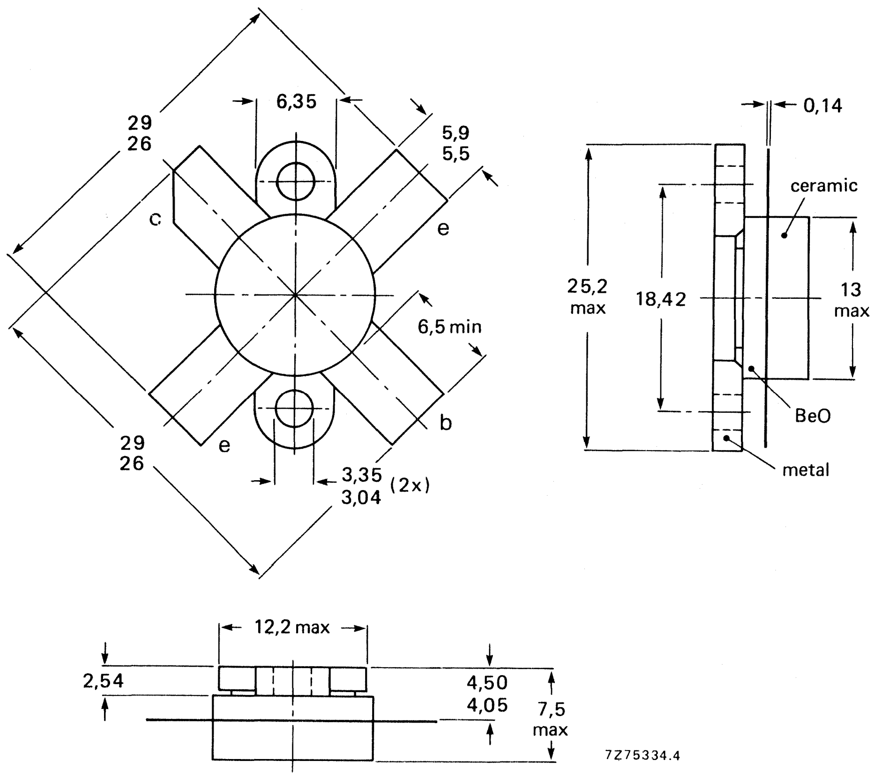
SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	12	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	40	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 45 °C	P_{rf}	max.	340	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

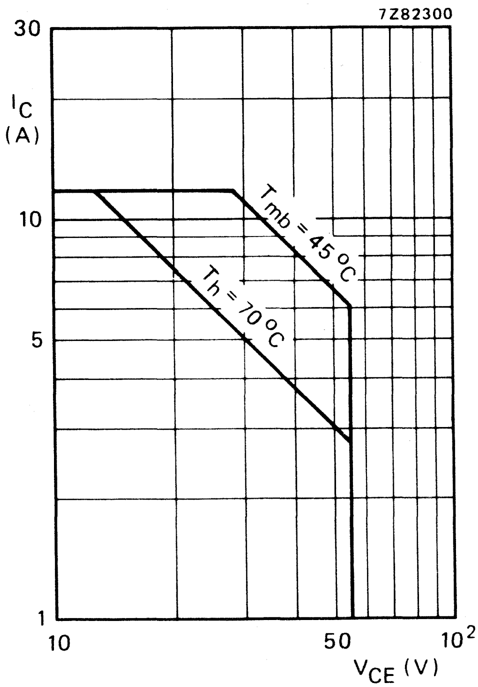


Fig. 2 D.C. SOAR.

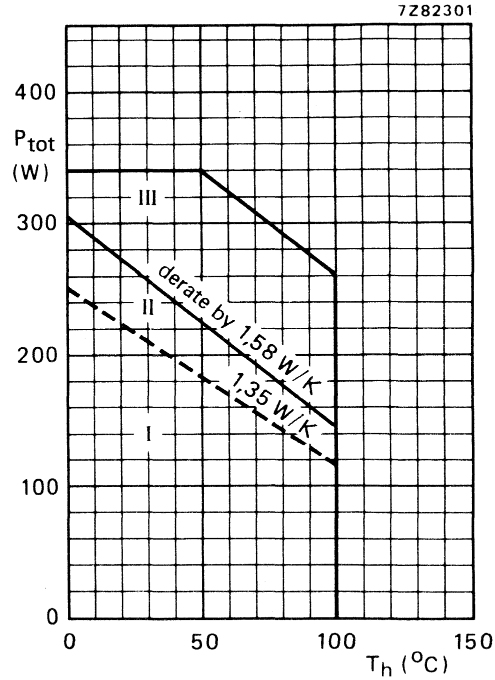


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation; f > 1 MHz
III Short-time operation during mismatch; f > 1 MHz

THERMAL RESISTANCE (dissipation = 150 W; T_{mb} = 100 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,63	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,45	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	110 V
Collector-emitter breakdown voltage open base; $I_C = 200$ mA	$V_{(BR)CEO}$	>	55 V
Emitter-base breakdown voltage open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 55$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	20 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	20 mJ
D.C. current gain* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	30 15 to 50
D.C. current gain ratio of matched devices* $I_C = 7$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	⩽	1,2
Collector-emitter saturation voltage* $I_C = 20$ A; $I_B = 4$ A	V_{CEsat}	typ.	1,9 V
Transition frequency at f = 100 MHz** $-I_E = 7$ A; $V_{CB} = 45$ V	f_T	typ.	235 MHz
$-I_E = 20$ A; $V_{CB} = 45$ V	f_T	typ.	245 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 50$ V	C_c	typ.	280 pF
Feedback capacitance at f = 1 MHz $I_C = 150$ mA; $V_{CE} = 50$ V	C_{re}	typ.	170 pF
Collector-flange capacitance	C_{cf}	typ.	4,4 pF

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

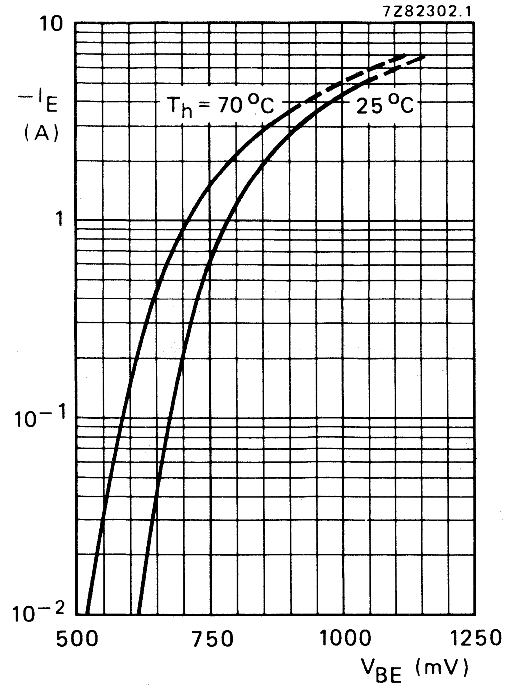


Fig. 4 Typical values; $V_{CE} = 40$ V.

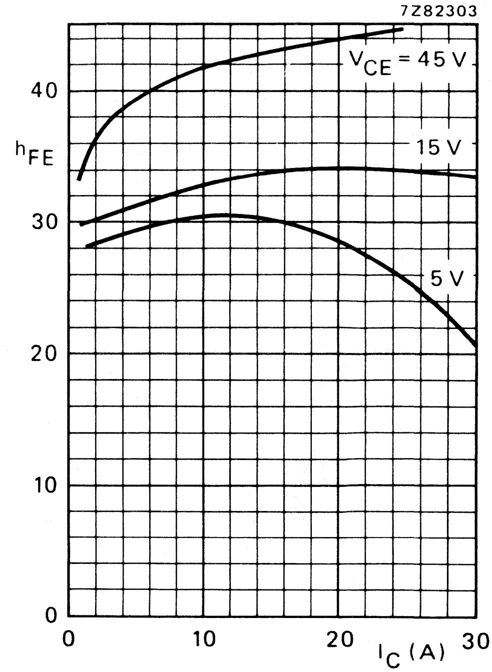


Fig. 5 Typical values; $T_j = 25\ ^oC$.

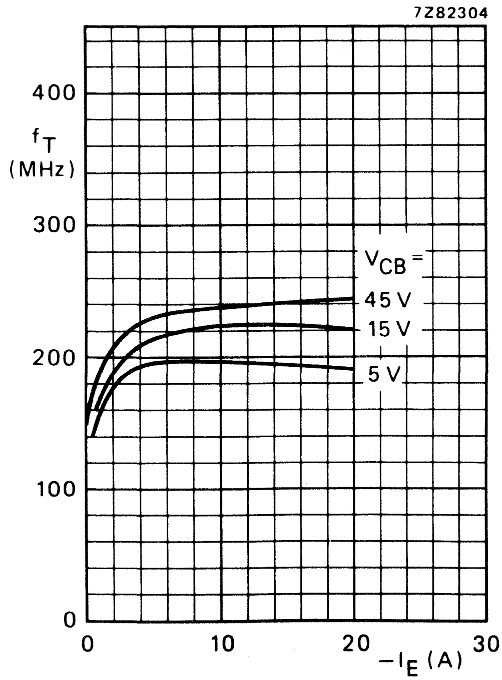


Fig. 6 Typical values; f = 100 MHz; $T_j = 25\ ^oC$.

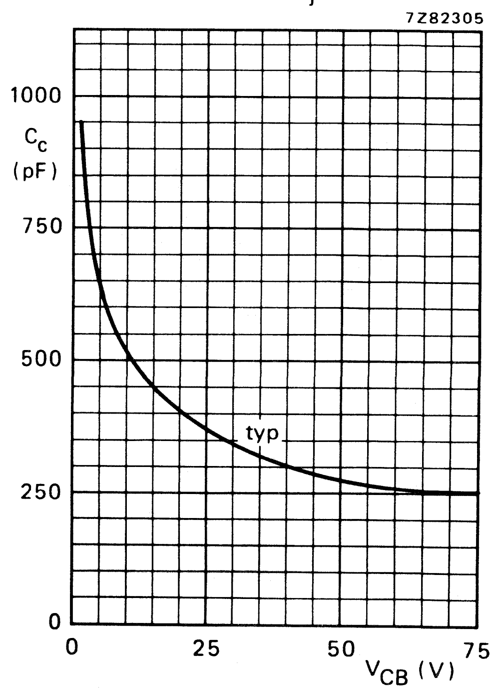


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 50 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 200 W (P.E.P.)	I_C (A) at 200 W (P.E.P.)	d_3 * dB	d_5 * dB	$I_{C(ZS)}$ A
25 to 200 (P.E.P.)	> 13,5	> 40	< 5,0	< −30	< −30	0,1

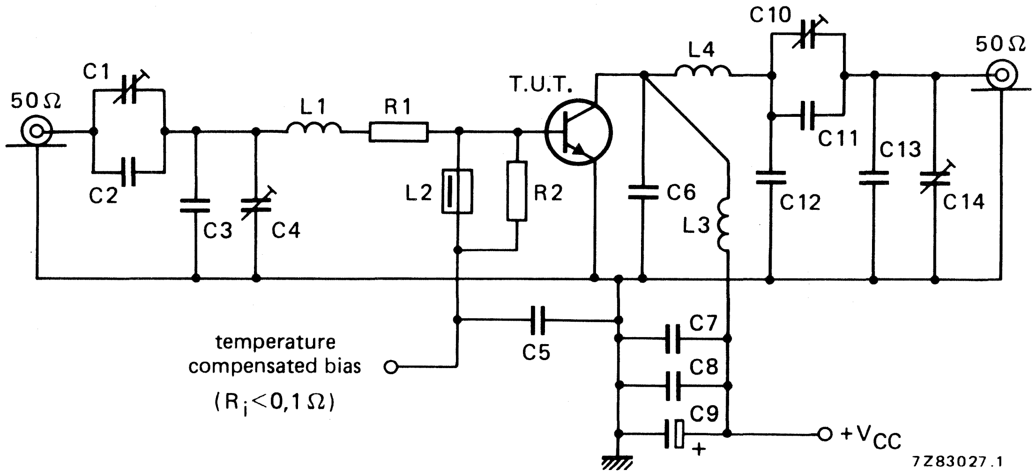


Fig. 8 Test circuit; s.s.b. class-AB.

List of components:

C1 = C4 = C10 = C14 = 100 pF film dielectric trimmer
C2 = 27 pF ceramic capacitor (500 V)
C3 = 270 pF polysterene capacitor (630 V)
C5 = C7 = C8 =220 nF multilayer ceramic chip capacitor
C6 = 27 pF multilayer ceramic chip capacitor (500 V; ATC▲)
C9 = 47 μF/63 V electrolytic capacitor
C11 = 2 x 36 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C12 = 2 x 43 pF multilayer ceramic chip capacitors (500 V; ATC▲) in parallel
C13 = 43 pF multilayer ceramic chip capacitor (500 V; ATC▲)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); int. dia. 9,0 mm; length 6,1 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 150 nH; 5 turns Cu wire (2,0 mm); int. dia. 10,0 mm; length 18,7 mm; leads 2 x 5 mm
L4 = 197 nH; 5 turns Cu wire (2,0 mm); int. dia. 12,0 mm; length 18,6 mm; leads 2 x 5 mm

R1 = 0,66 Ω; parallel connection of 5 x 3,3 Ω metal film resistors (PR37; ± 5%; 1,6 W each)
R2 = 27 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

▲ ATC means American Technical Ceramics.

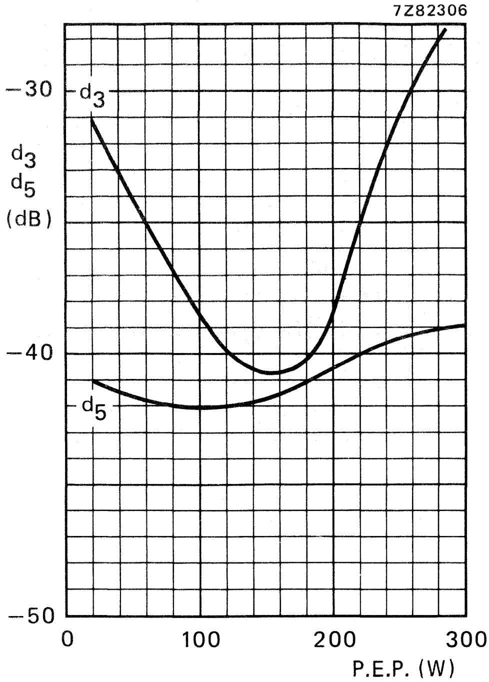


Fig. 9 Intermodulation distortion as a function of output power.*

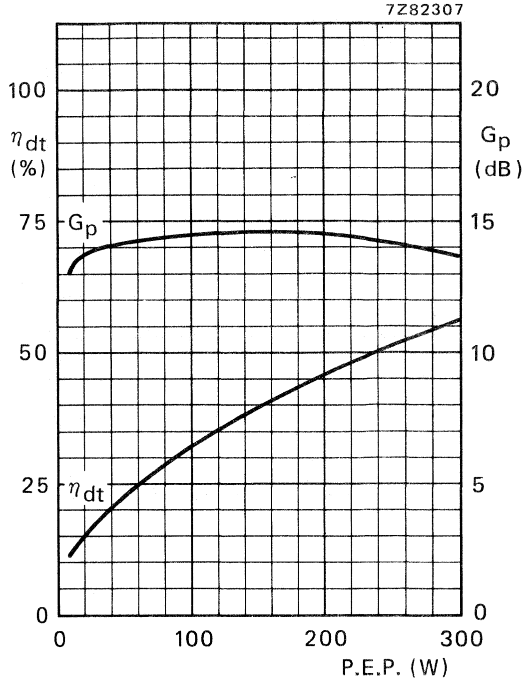


Fig. 10 Double-tone efficiency and power gain as a function of output power.

Conditions for Figs 9 and 10:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

Ruggedness

The BLW96 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 200 W (P.E.P.) under the following conditions:

V_{CE} = 45 V; f = 28 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

* See note on previous page.

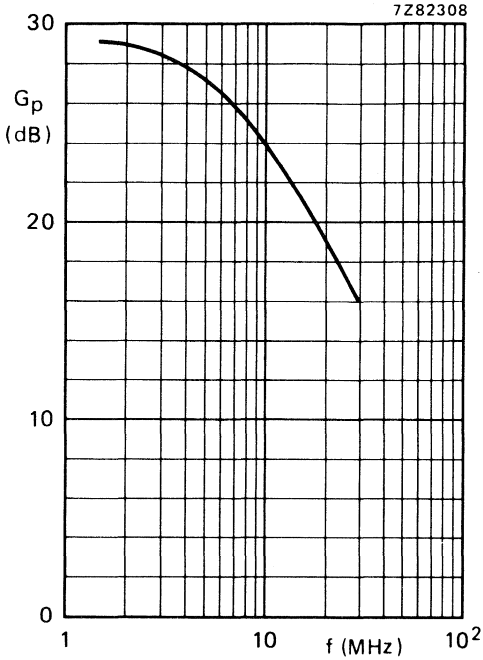


Fig. 11 Power gain as a function of frequency.

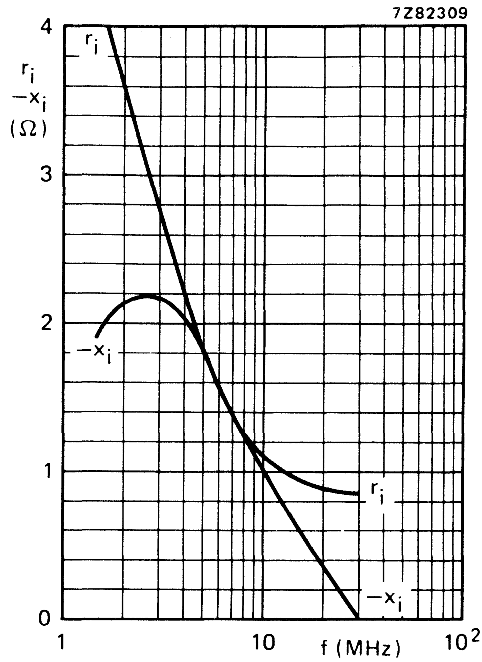


Fig. 12 Input impedance (series components) as a function of frequency.

Figs 11 and 12 are typical curves and hold for one transistor of a push-pull amplifier with cross-neutralization in s.s.b. class-AB operation.

Conditions:

V_{CE} = 50 V; $I_{C(ZS)}$ = 0,1 A; P_L = 200 W (P.E.P.); T_h = 25 °C; Z_L = 5 Ω; neutralizing capacitor: 47 pF.

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)
T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)
108	50	200	typ. 45	typ. 6,5	typ. 6	typ. 67

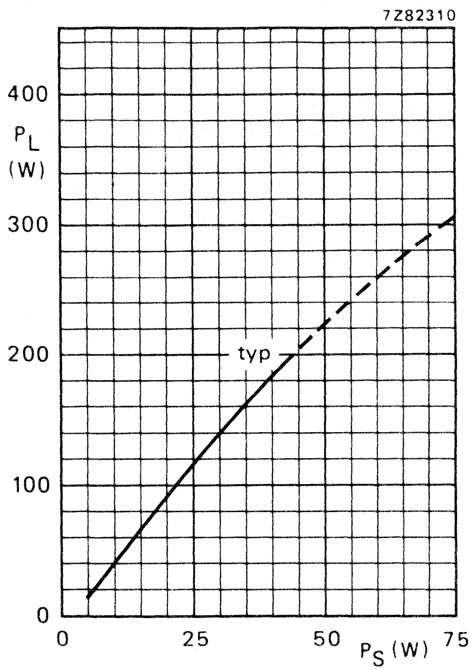


Fig. 13 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C.

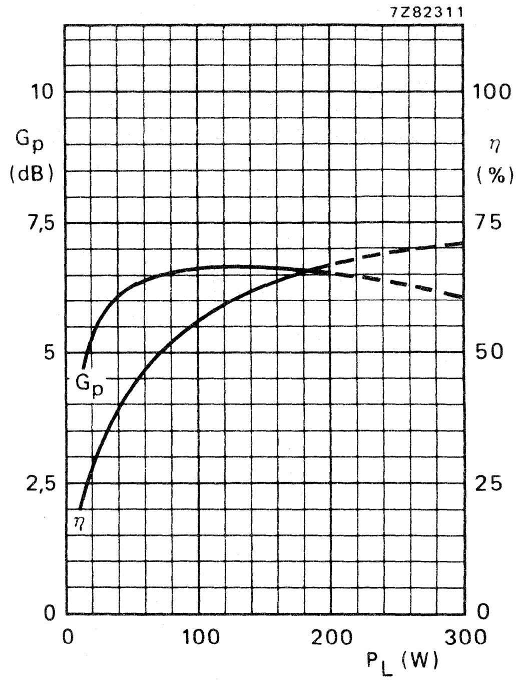


Fig. 14 V_{CE} = 50 V; f = 108 MHz; T_h = 25 °C; typical values.

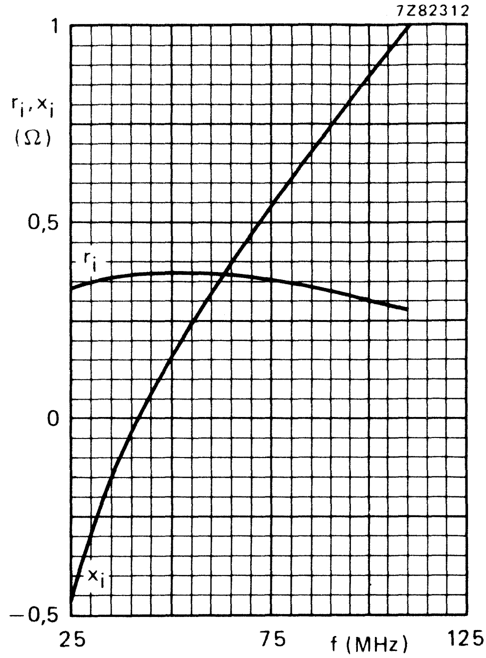


Fig. 15 Input impedance (series components).

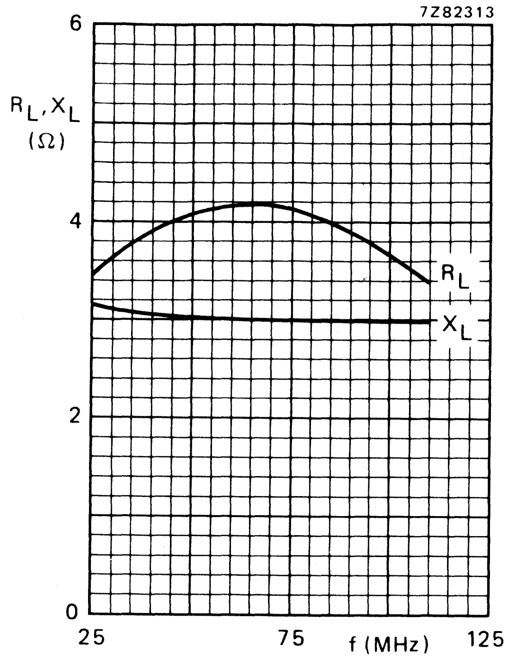


Fig. 16 Load impedance (series components).

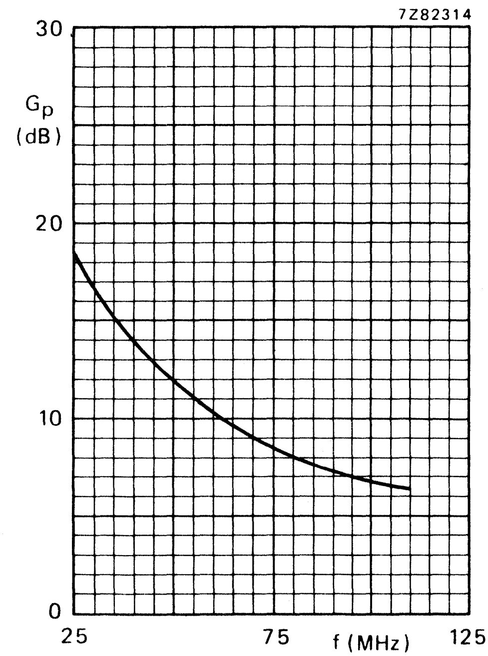


Fig. 17.

Conditions for Figs 15, 16 and 17:

Typical values; V_{CE} = 50 V; P_L = 200 W; T_h = 25 °C; class-B operation.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 40 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3* dB	d_5* dB
typ. 50 (P.E.P.)	typ. 19	4	typ. −40	< −40

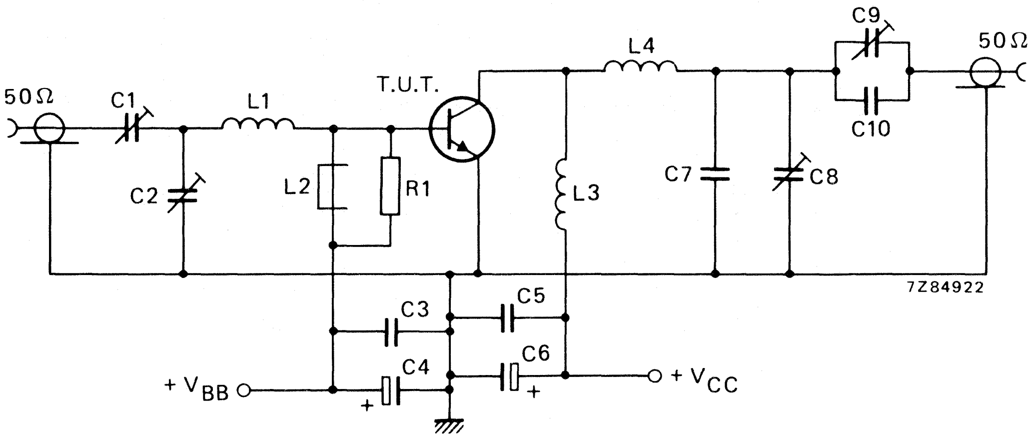


Fig. 18 Test circuit; s.s.b. class-A.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 220 nF polyester capacitor (100 V)
C4 = 100 μF/4 V electrolytic capacitor
C5 = 2 x 330 nF polyester capacitors (100 V) in parallel
C6 = 47 μF/63 V electrolytic capacitor
C7 = C10 = 2 x 82 pF ceramic capacitors (500 V) in parallel
C8 = C9 = 10 to 150 pF air dielectric trimmer

L1 = 45 nH; 2 turns enamelled Cu wire (1,6 mm); int. dia. 8,0 mm; length 4,0 mm; leads 2 x 3 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 110 nH; 4 turns enamelled Cu wire (2,0 mm); int. dia. 10,0 mm; length 8,0 mm; leads 2 x 2 mm
L4 = 210 nH; 5 turns enamelled Cu wire (2,0 mm); int. dia. 12,0 mm; length 10,0 mm; leads 2 x 2 mm

R1 = 27 Ω carbon resistor (± 5%; 0,5 W)

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

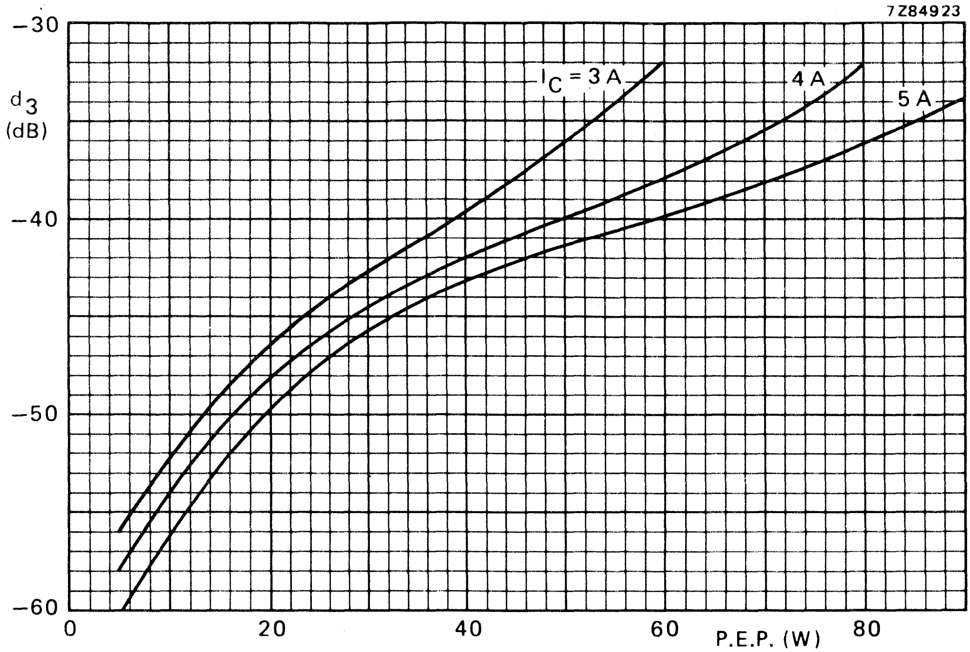


Fig. 19 Third order intermodulation distortion as a function of output power.*
Typical values; V_{CE} = 40 V; T_h = 25 ^oC; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor designed for use in class-A, AB and B operated high-power industrial and military transmitting equipment in the h.f. band.

The transistor offers excellent performance as a linear amplifier in s.s.b. applications. It is resistance stabilized and is made to withstand severe load-mismatch conditions. All leads are isolated from the flange.

The transistors are supplied in matched h_{FE} groups.

QUICK REFERENCE DATA

R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_P dB	η_{dt} %	d_3 dB	d_5 dB
s.s.b. (class-AB)	28	0,1	1,6 – 28	175 (PEP)	> 11,5	> 40	< –30	< –30

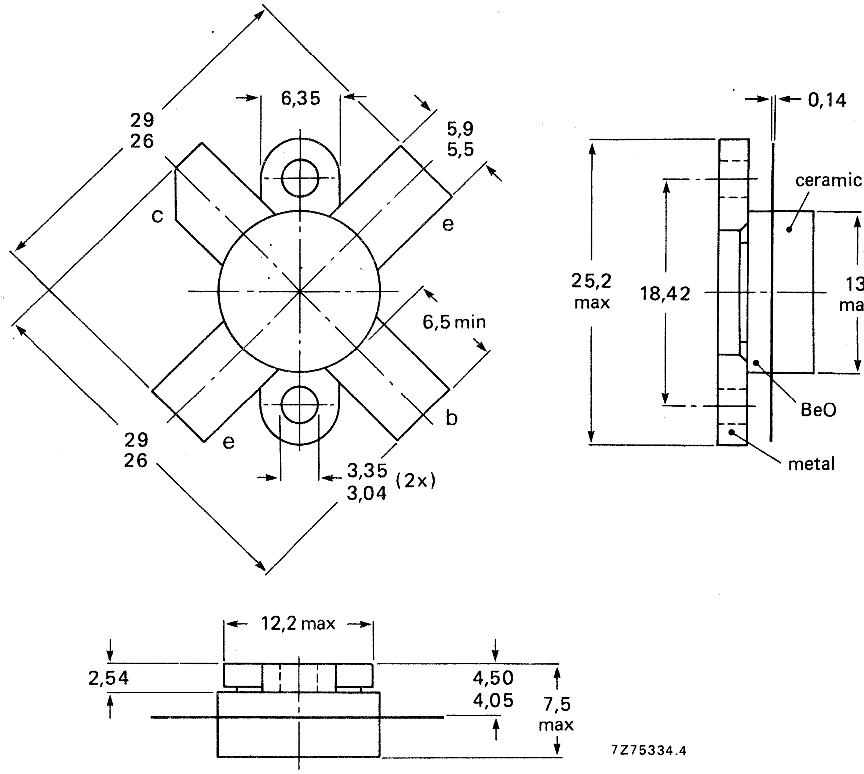
MECHANICAL DATA

SOT-121 (see Fig. 1).

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-121.



Torque on screw: min. 0,60 Nm (6,0 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Collector-emitter voltage (peak value)			
$V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
average	$I_{C(AV)}$	max.	15 A
peak value; f > 1 MHz	I_{CM}	max.	50 A
Total d.c. power dissipation at $T_h = 25°C$	$P_{tot(d.c.)}$	max.	190 W
R.F. power dissipation			
f > 1 MHz; $T_h = 25°C$	$P_{tot(rf)}$	max.	230 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

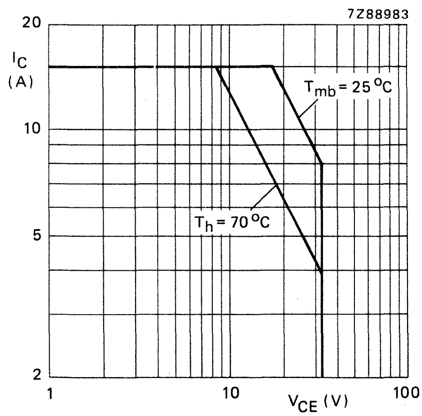


Fig. 2 D.C. SOAR.

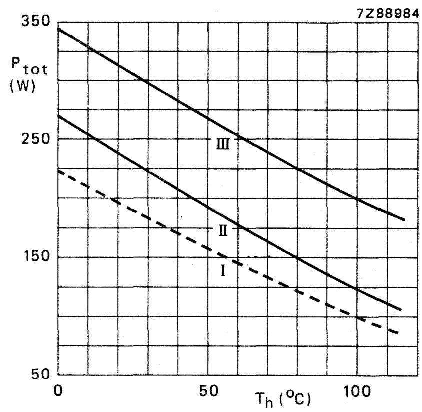


Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz).
III Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE (dissipation = 120 W; T_h = 25 °C i.e. T_{mb} = 49 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,63 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	0,48 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,20 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 50 mA	$V_{(BR)CES}$	>	65 V
I_C = 100 mA; open base	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
I_E = 20 mA; open collector	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
V_{CE} = 33 V; V_{BE} = 0	I_{CES}	<	20 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	20 mJ
R_{BE} = 10 Ω	E_{SBR}	>	20 mJ
D.C. current gain*			
I_C = 10 A; V_{CE} = 5 V	h_{FE}	typ. 15 to	30 50
D.C. current gain ratio of matched devices*			
I_C = 10 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage*			
I_C = 25 A; I_B = 5 A	V_{CEsat}	typ.	2,4 V
Transition frequency at f = 100 MHz**			
$-I_E$ = 10 A; V_{CB} = 28 V	f_T	typ.	230 MHz
$-I_E$ = 20 A; V_{CB} = 28 V	f_T	typ.	235 MHz
Collector capacitance at f = 1 MHz			
$I_E = i_e$ = 0; V_{CB} = 28 V	C_c	typ.	380 pF
Feedback capacitance at f = 1 MHz			
I_C = 0; V_{CE} = 28 V	C_{re}	typ.	235 pF
Collector-flange capacitance	C_{cf}	typ.	4,5 pF

* Measured under pulse conditions: t_p = 500 µs.
** Measured under pulse conditions: t_p = 300 µs; δ = 0,02.

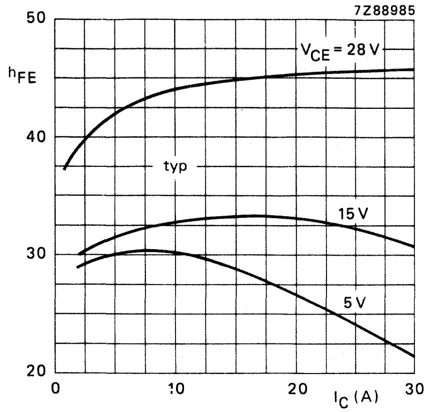


Fig. 4 T_j = 25 °C.

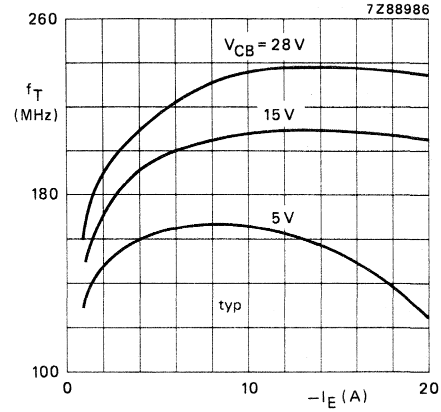


Fig. 5 T_j = 25 °C; f = 100 MHz; t_p = 300 μs.

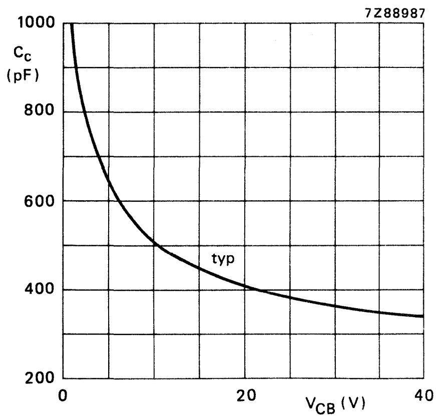


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

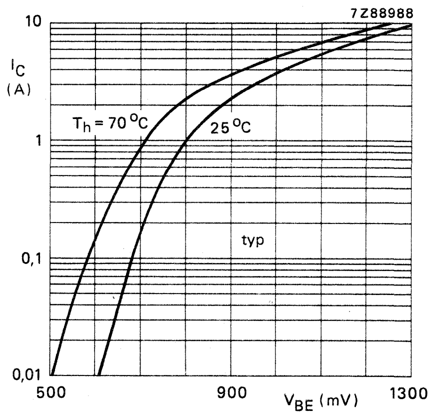


Fig. 7 V_{CE} = 28 V.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier).
V_{CE} = 28 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

output power W	G_P dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A
175 (PEP)	> 11,5 typ. 13,0	> 40 typ. 50	< 7,8 typ. 6,3	< −30 typ. −34	< −30 typ. −38	0,1

* The stated intermodulation distortion levels are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

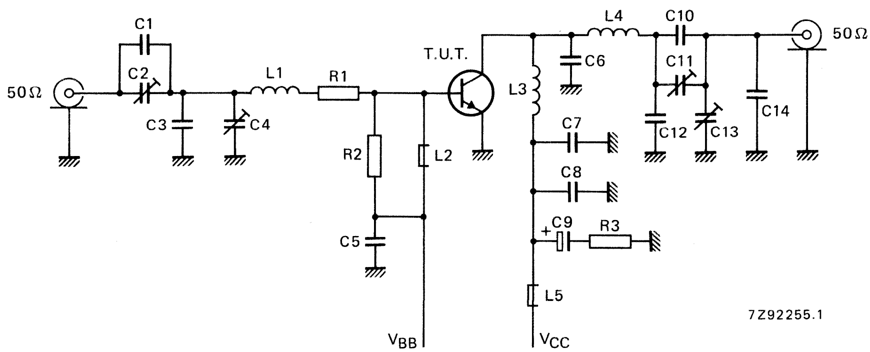


Fig. 8 Class-AB (s.s.b.) test circuit.

List of components:

C1 = 47 pF (500 V) multilayer ceramic chip capacitor*
C2 = 100 pF film dielectric trimmer
C3 = 2 x 130 pF (300 V) multilayer ceramic chip capacitors in parallel*
C4 = 280 pF film dielectric trimmer
C5 = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C6 = 2 x 180 pF (300 V) multilayer ceramic chip capacitors in parallel*
C7 = 100 nF (50 V) multilayer ceramic chip capacitor 2222 856 48104
C8 = 10 nF (50 V) multilayer ceramic chip capacitor 2222 856 13103
C9 = 2,2 μF - 63 V solid aluminium electrolytic capacitor
C10 = 5 x 82 pF (500 V) multilayer ceramic chip capacitors in parallel*
C11 = 250 pF air dielectric trimmer
C12 = 5 x 33 pF ceramic feed-through capacitors mounted in parallel on a brass plate
C13 = 100 pF air dielectric trimmer
C14 = 3 x 91 pF (500 V) multilayer ceramic chip capacitors in parallel*

R1 = 0,7 Ω - 7 W (7 x 4,7 Ω - 1 W carbon resistors in parallel)
R2 = 27 Ω - 0,25 W carbon resistor
R3 = 4,7 Ω - 0,25 W carbon resistor

* American Technical Ceramics capacitor or capacitor of same quality.

L1 = 73 nH; 4 turns Cu wire (1,5 mm); int. dia. 7 mm; length 9,4 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke grade 3B (cat. no. 4312 020 36640); 6 leads in parallel
L3 = 70,4 nH; 4 turns Cu wire (2 mm); int. dia. 7 mm; length 14,8 mm; leads 2 x 5 mm
L4 = 83,5 nH; 4 turns Cu wire (2 mm); int. dia. 8 mm; length 15 mm; leads 2 x 5 mm
L5 = Ferroxcube wide-band h.f. choke grade 3 B (cat. no. 4312 020 36640) with 6 leads in parallel

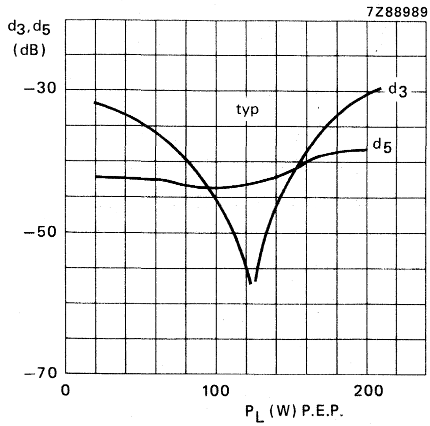


Fig. 9 Intermodulation distortion (see note on preceding page).

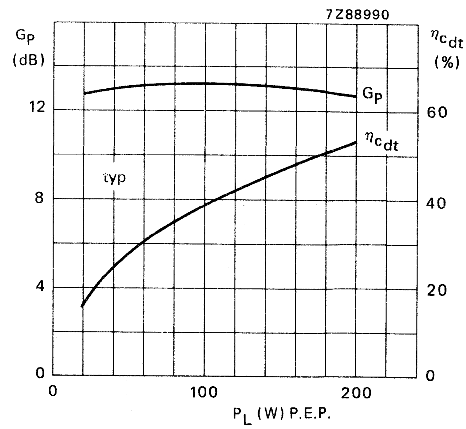


Fig. 10 Power gain and double-tone efficiency.

Conditions for Figs 9 and 10:
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

RUGGEDNESS

The BLW97 is capable of withstanding full load mismatch (VSWR = 50 through all phases) up to 150 W (P.E.P.) or a load mismatch (VSWR = 5 through all phases) up to 175 W (P.E.P.) under the following conditions:
V_{CE} = 28 V; f = 28 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W.

Figures 11 and 12 on the next page present typical curves which are valid for one transistor of a push-pull amplifier in s.s.b. class-AB operation.

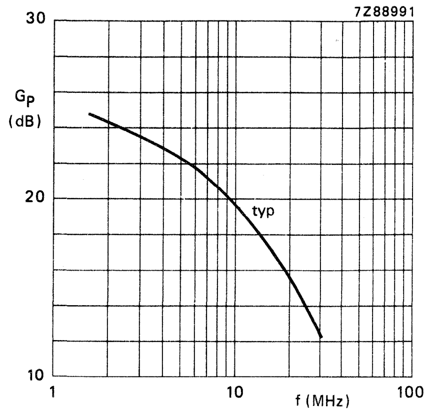


Fig. 11 Power gain.

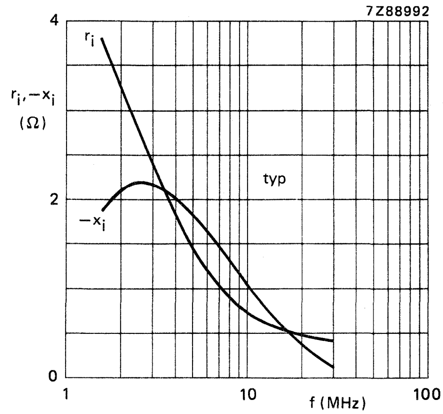


Fig. 12 Input impedance (series components).

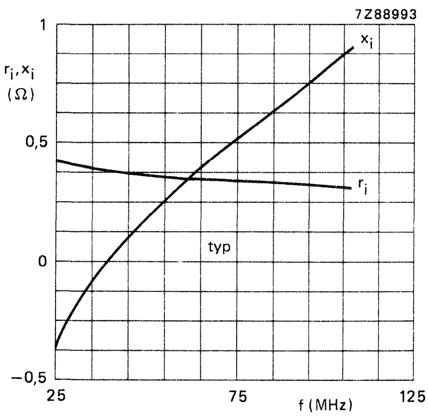


Fig. 13 Input impedance (series components).

Conditions for Figs 11 and 12:
V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A;
P_L = 175 W(PEP); T_h = 25 °C;
Z_L = 1,55 Ω

Conditions for Figs 13, 14 and 15:
V_{CE} = 28 V; P_L = 175 W; T_h = 25 °C;
class-B operation.

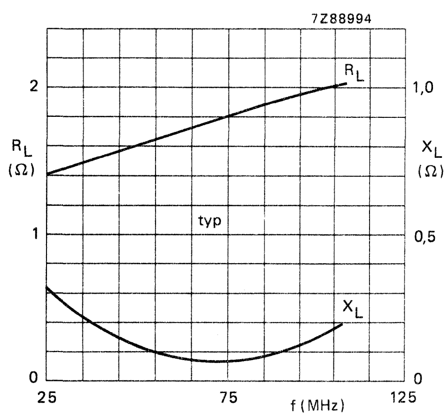


Fig. 14 Load impedance (series components).

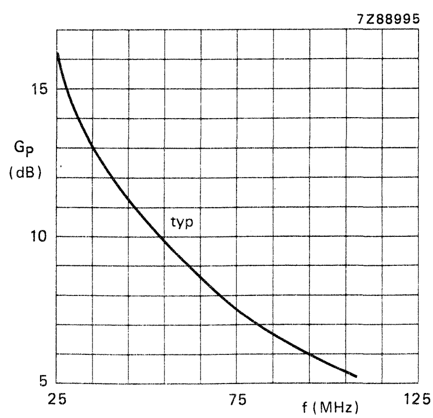


Fig. 15 Power gain.

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of TV transposers and transmitters in band IV-V, as well as for driver stages in tube systems.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold sandwich metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

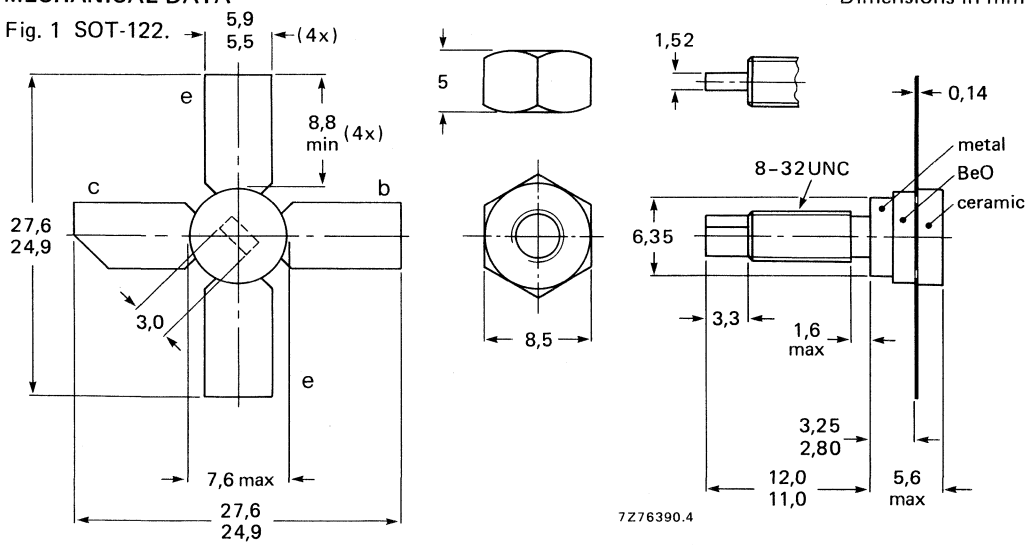
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 6,5
class-A	860	25	850	25	−60	typ. 4,4	typ. 7,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

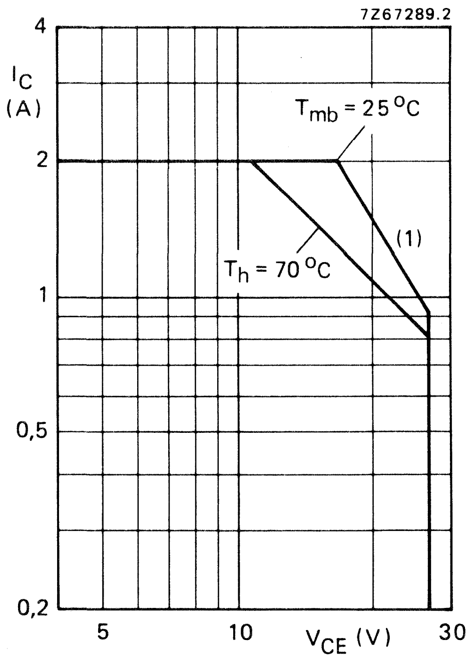
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
d.c.	I_C	max.	2	A
(peak value); f > 1 MHz	I_{CM}	max.	4	A
Total power dissipation at T_h = 70 °C	P_{tot}	max.	21,5	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

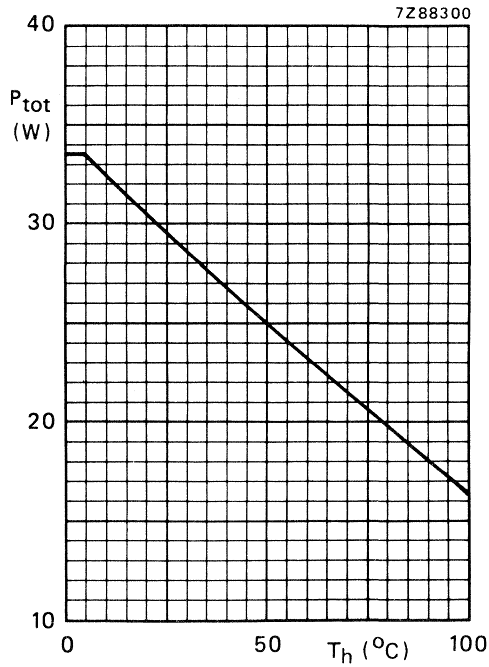


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 21,25 W; T_{mb} = 82,75 °C, T_h = 70 °C)

From junction to mounting base	$R_{th\ j-mb}$	=	5,45	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

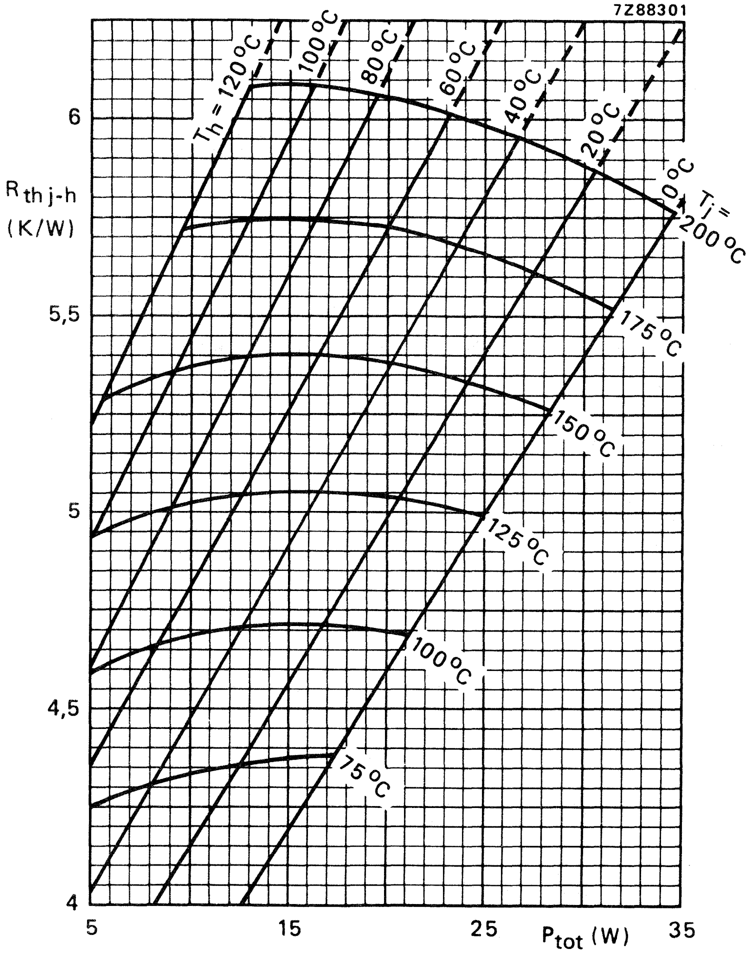


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 850 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	6,05 K/W
	T_j	max.	200 °C
Typical device:	$R_{th\ j\text{-}h}$	typ.	5,35 K/W
	T_j	typ.	183 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage				
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	50	V
open base, I_C = 25 mA	$V_{(BR)CEO}$	>	27	V
Emitter-base breakdown voltage				
open collector, I_E = 5 mA	$V_{(BR)EBO}$	>	3,5	V
D.C. current gain*		>	15	
I_C = 850 mA; V_{CE} = 25 V	h_{FE}	typ.	40	
Collector-emitter saturation voltage*				
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0,25	V
Transition frequency at f = 500 MHz**				
$-I_E$ = 850 mA; V_{CB} = 25 V	f_T	typ.	2,5	GHz
Collector capacitance at f = 1 MHz		typ.	24	pF
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	<	30	pF
Feedback capacitance at f = 1 MHz				
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	1,2	pF

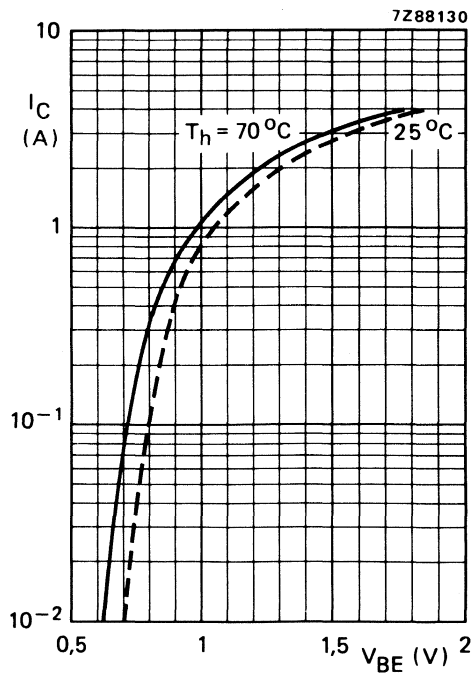


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

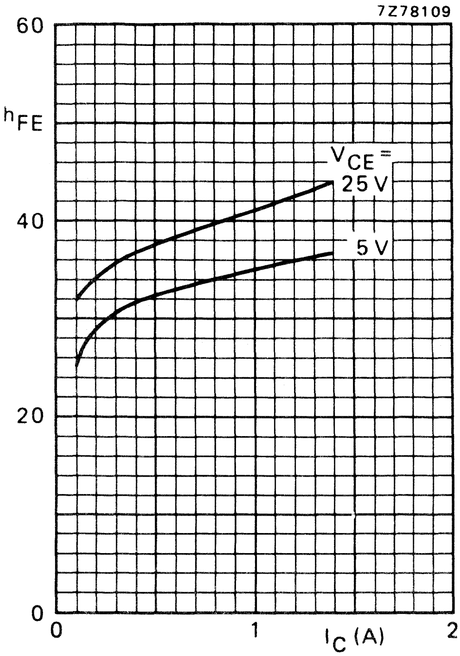


Fig. 6 Typical values; T_j = 25 °C.

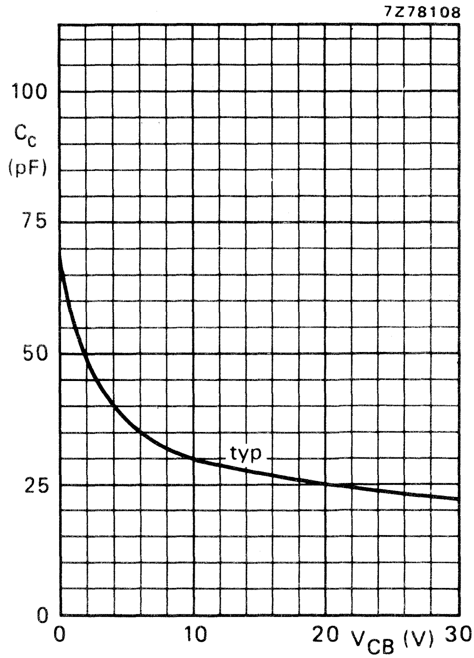


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

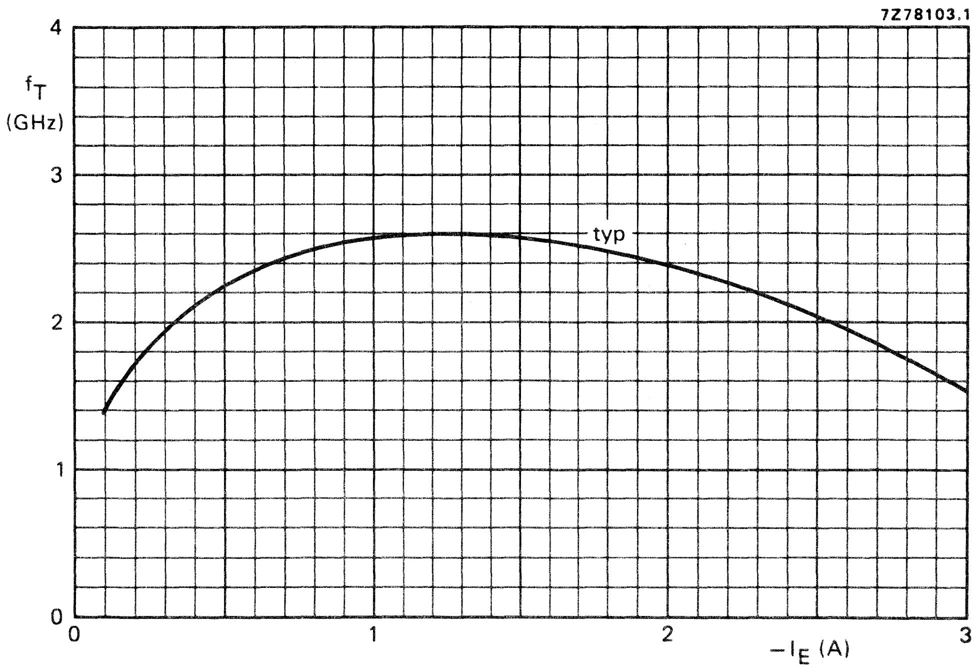


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB)*	$P_{o\ sync}$ (W)*	G_p (dB)
860	25	850	70	−60	> 3,5	> 6,5
860	25	850	70	−60	typ. 3,8	typ. 7,0
860	25	850	25	−60	typ. 4,4	typ. 7,0

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

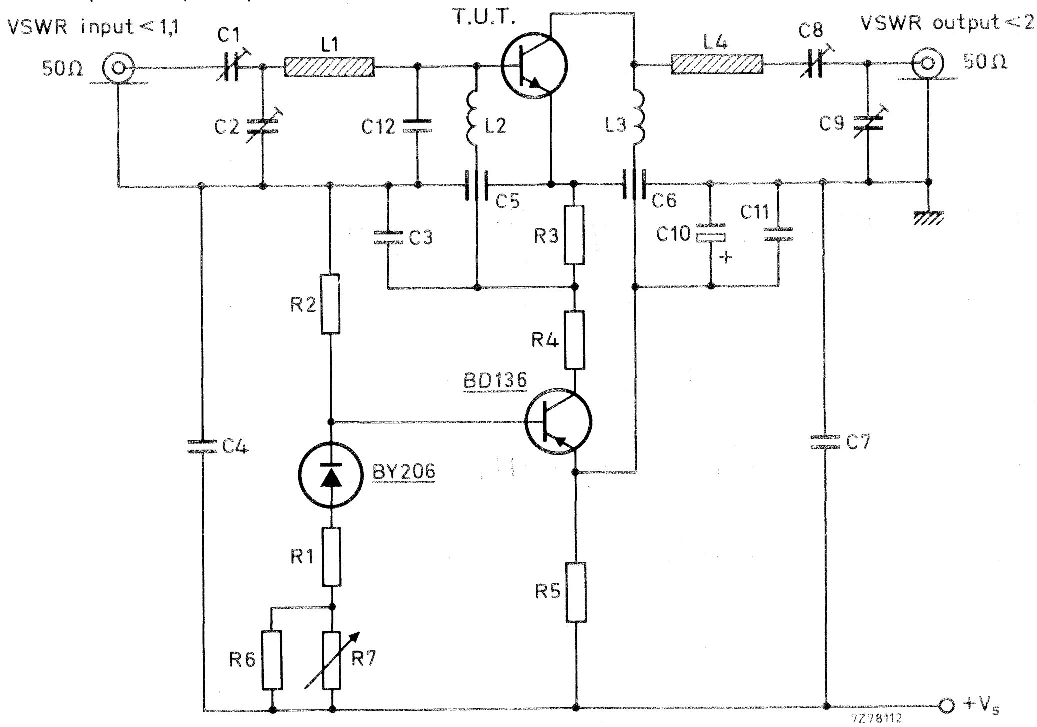


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

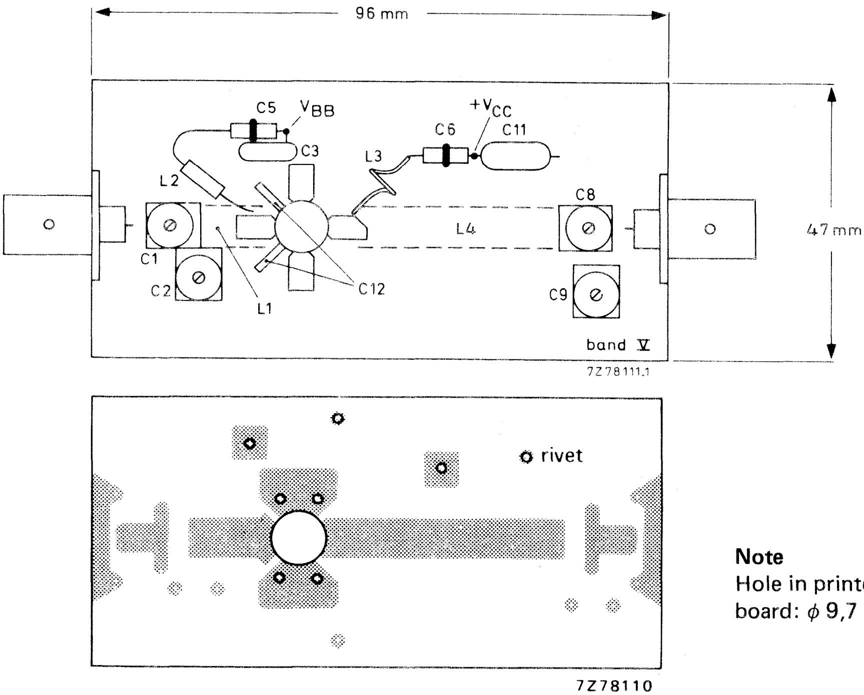
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

List of components: (continued)

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 1,8 kΩ carbon resistor (0,5 W)
R3 = 33 Ω carbon resistor (0,5 W)
R4 = 220 Ω carbon resistor (1 W)
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)
R6 = 1 kΩ carbon resistor (0,25 W)
R7 = 220 Ω carbon potentiometer (0,25 W)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.



Note
Hole in printed-circuit board: ϕ 9,7 mm.

Fig. 10 Component layout and printed circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

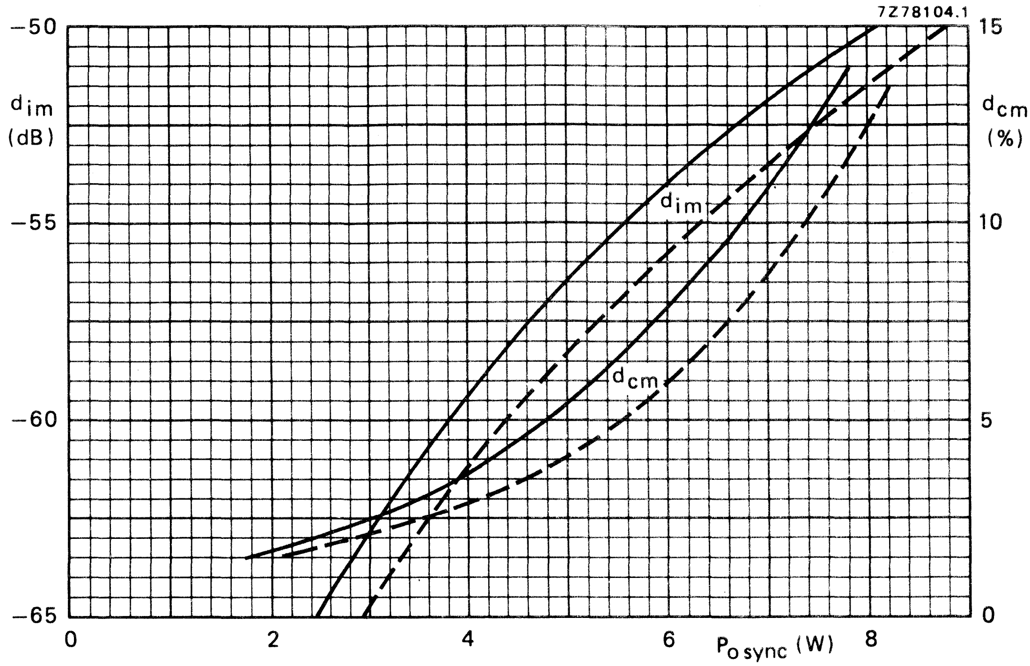


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\ sync}$. Typical values; V_{CE} = 25 V; I_C = 850 mA;- - - T_h = 25 °C;—— T_h = 70 °C; f_{vision} = 860 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

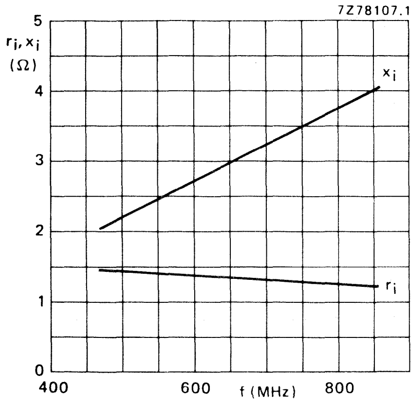


Fig. 12 Input impedance (series components).

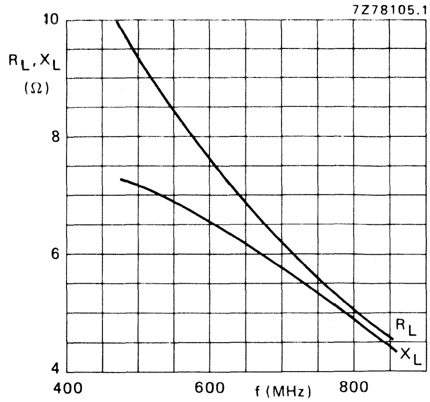


Fig. 13 Load impedance (series components).

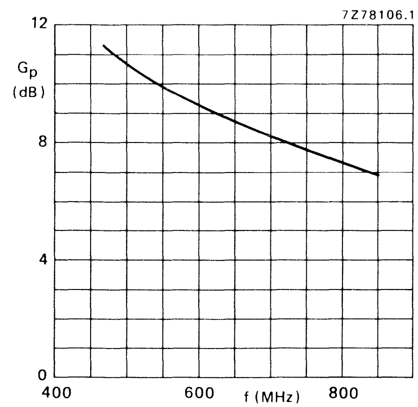


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 25 V; I_C = 850 mA; class-A operation; T_h = 70 °C.

H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-AB and B operated high-power mobile transmitting equipment in the h.f. band.

The transistors are resistance-stabilized and are guaranteed to withstand severe load mismatch conditions. They are supplied in matched h_{FE} groups.

The transistor has a 1/2 in 4-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

QUICK REFERENCE DATA

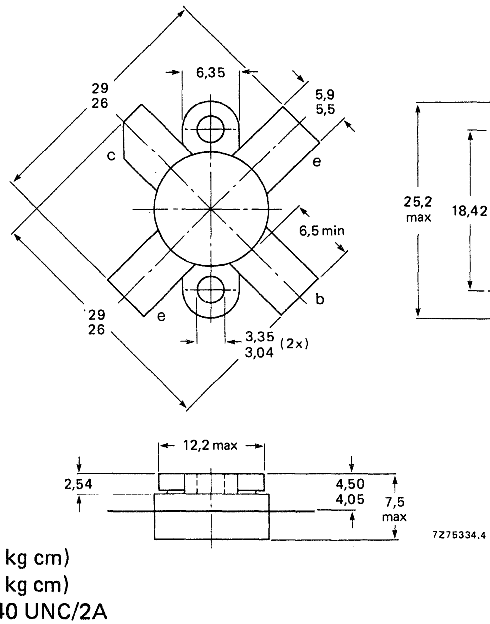
R.F. performance at T_h = 25 °C

mode of operation	V_{CE} V	$I_{C(ZS)}$ A	f MHz	P_L W	G_P dB	η_{dt} %	d_3* dB	d_5* dB
s.s.b. class-AB	12,5	0,15	1,6-28	80 (P.E.P.)	> 12,5	> 35	< −24	< −24

* See note on page 4.

MECHANICAL DATA

Fig. 1 SOT-121.



Torque on screw: min. 0,60 Nm (6,0 kg cm)
max. 0,75 Nm (7,5 kg cm)

Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be applied sparingly and evenly distributed.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	36 V
open base	V_{CEO}	max.	17 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current			
average	$I_{C(AV)}$	max.	18 A
(peak value); f > 1 MHz	I_{CM}	max.	55 A
D.C. power dissipation at $T_{mb} = 25\ ^oC$	$P_{tot(d.c.)}$	max.	154 W
R.F. power dissipation			
f > 1 MHz; $T_{mb} = 25\ ^oC$	$P_{tot(rf)}$	max.	192 W
Storage temperature	T_{stg}	−65 to +150	^oC
Operating junction temperature	T_j	max.	200 ^oC

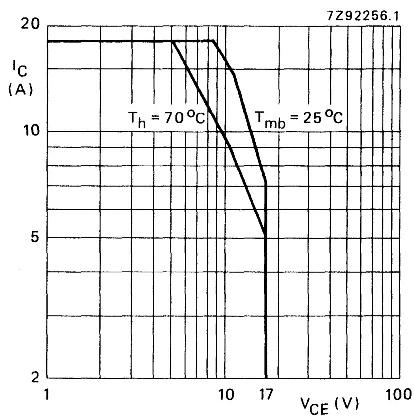


Fig. 2 D.C. SOAR.

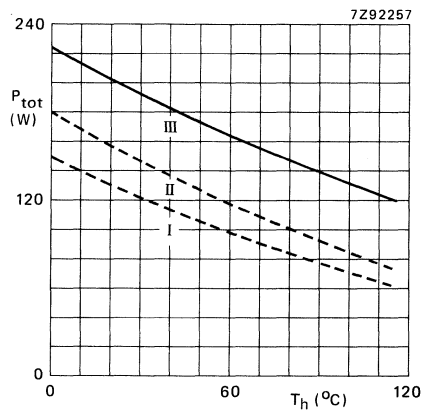


Fig. 3 Power/temperature derating curves.

I Continuous d.c. operation
II Continuous r.f. operation; (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

THERMAL RESISTANCE

Dissipation = 100 W; $T_{mb} = 25\ ^oC$

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,00 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	0,75 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage			
$V_{BE} = 0$; $I_C = 50$ mA	$V_{(BR)CES}$	>	36 V
open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	17 V
Emitter-base breakdown voltage			
open collector; $I_E = 20$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	20 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	12,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	12,5 mJ
D.C. current gain*			
$I_C = 10$ A; $V_{CE} = 5$ V	h_{FE}	typ. 15 to	35 80
D.C. current gain ratio of matched devices*			
$I_C = 10$ A; $V_{CE} = 5$ V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage*			
$I_C = 25$ A; $I_B = 5$ A	V_{CEsat}	typ.	1,7 V
Transition frequency at f = 100 MHz**			
$-I_E = 10$ A; $V_{CB} = 12,5$ V	f_T	typ.	290 MHz
$-I_E = 20$ A; $V_{CB} = 12,5$ V	f_T	typ.	275 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ.	400 pF
Feedback capacitance at f = 1 MHz			
$I_C = 0$; $V_{CE} = 12,5$ V	C_{re}	typ.	265 pF
Collector-flange capacitance	C_{cf}	typ.	4,5 pF

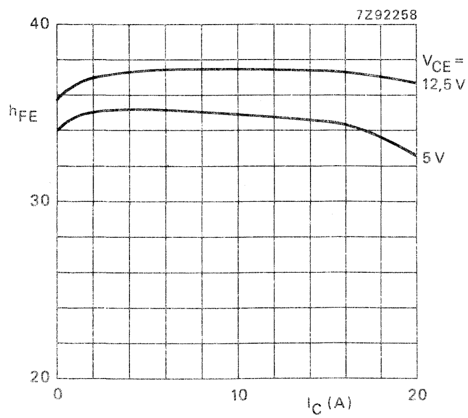


Fig. 4 $T_j = 25\ ^oC$.

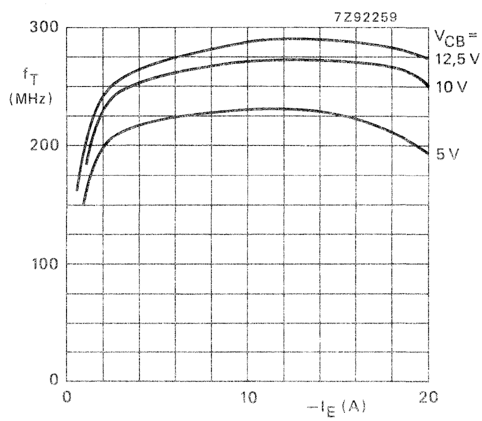


Fig. 5 f = 100 MHz; $T_j = 25\ ^oC$.

* Measured under pulse conditions: $t_p = 500\ \mu s$.
** Measured under pulse conditions: $t_p = 300\ \mu s$; $\delta = 0,02$.

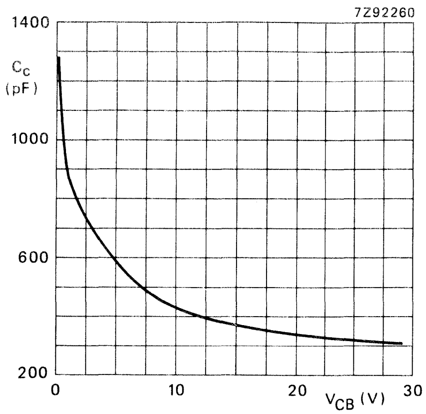


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

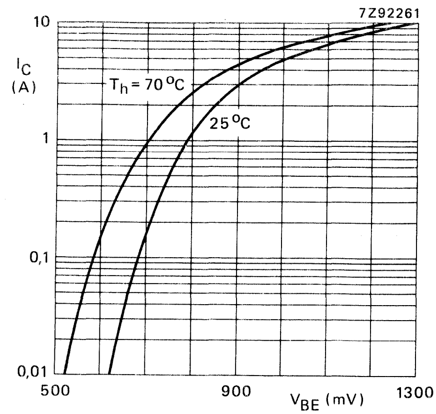


Fig. 7 V_{CE} = 12,5 V; typ. values.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier) V_{CE} = 12,5 V; $T_h = 25\ ^oC$; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A
80 (P.E.P.)	> 12,5 typ. 14	> 35 typ. 40	< 9,1 typ. 7,6	< −24 typ. −27	< −24 typ. −36	0,15

* The stated intermodulation distortion levels are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

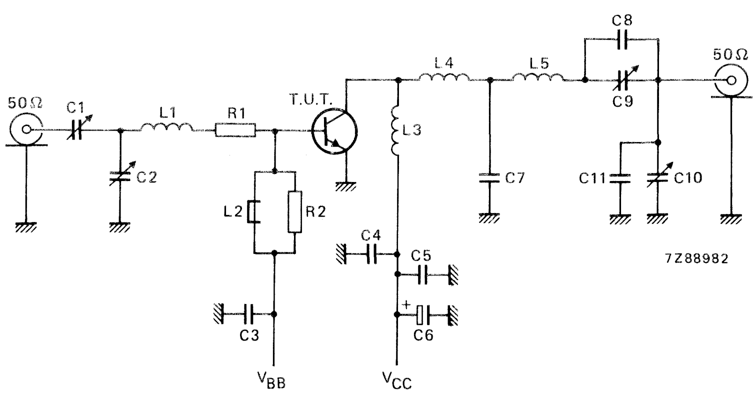


Fig. 8 Class-AB test circuit, s.s.b.

List of components:

C1 = C2 = 270 pF film dielectric trimmer capacitor
C3 = 220 nF chip capacitor
C4 = 1 nF chip capacitor
C5 = 100 nF chip capacitor
C6 = 47 μF – 63 V electrolytic capacitor
C7 = 3 x 180 pF multilayer ceramic chip capacitors in parallel*
C8 = 2 x 150 pF (500 V) multilayer ceramic chip capacitors*
C9 = C10 = 100 pF film dielectric trimmer capacitor
C11 = 150 pF multilayer ceramic chip capacitor*

R1 = 4 x 1,2 Ω carbon resistors in parallel (4 x 0,125 W)
R2 = 27 Ω carbon resistor (0,5 W)

L1 = 3 turns Cu wire (2 mm); int. dia. 8 mm; length 9 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke (cat. no. 4312 020 36640)
L3 = L4 = 2 turns Cu wire (2 mm); int. dia. 8 mm; length 5 mm; leads 2 x 5 mm
L5 = 3 turns Cu wire (2 mm); int. dia. 8,5 mm; length 8,5 mm; length 8,5 mm; leads 2 x 5 mm

* American Technical Ceramics capacitor type 100 B or capacitor of same quality.

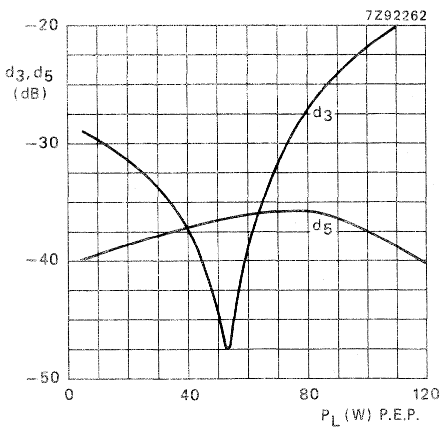


Fig. 9 Intermodulation distortion (see note on preceding page); typ. values.

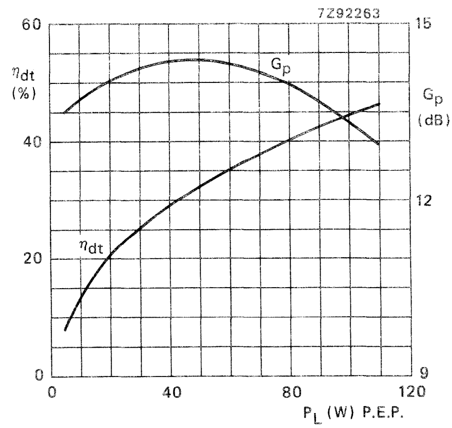


Fig. 10 Double-tone efficiency and power gain; typ. values.

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; $I_{C(ZS)}$ = 0,15 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

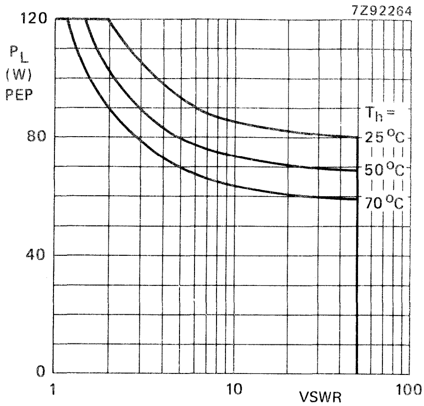


Fig. 11 R.F. SOAR: s.s.b. class-AB operation; V_{CE} = 15 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

This graph shows the permissible output power as a function of VSWR during mismatch conditions with the heatsink temperature as parameter.

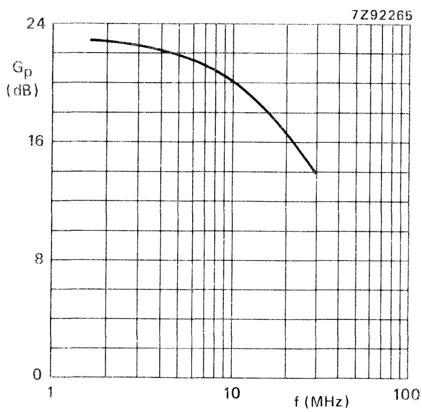


Fig. 12 Power gain.

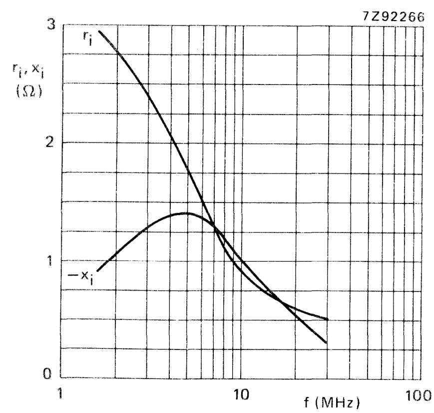


Fig. 13 Input impedance (series components).

Conditions for Figs 12 and 13:

V_{CE} = 12,5 V; $I_{C(ZS)}$ = 0,15 A; Z_L = 0,65 Ω; P_L = 80 W (PEP); T_h = 25 °C.

The curves in Figs 12 and 13 are typical and hold for one transistor of a push-pull amplifier in s.s.b. class-AB operation.

H.F./V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for s.s.b. in class-A and AB and in f.m. transmitting applications in class-C with a supply voltage up to 28 V. The transistor is resistance stabilized and tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

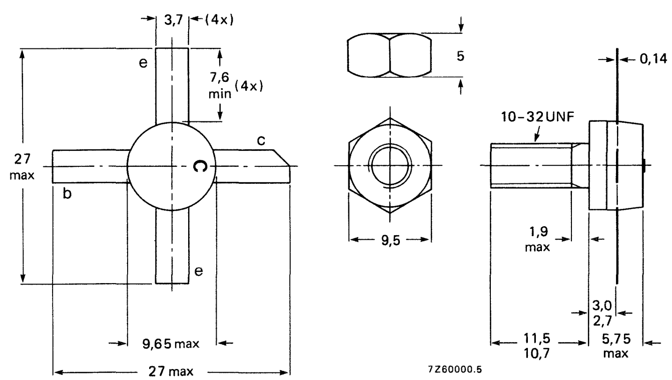
mode of operation	V_{CE} V	f_1 MHz	f_2 MHz	P_L W	G_p dB	d_3 dB	I_C A	η_{dt} %
s.s.b. (class-A)	26	28,000	28,001	0-8(P.E.P.)	> 18	< −40	< 1,2	–
s.s.b. (class-AB)	28	28,000	28,001	25(P.E.P.)	> 18	typ. −35	typ. 1,28	typ. 35

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	G_p dB	I_C A	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w. (class-B)	28	70	typ. 0,5	25	typ. 17	typ. 1,49	typ. 60	0,53 − j1,4	42,5 − j54

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

CHARACTERISTICS

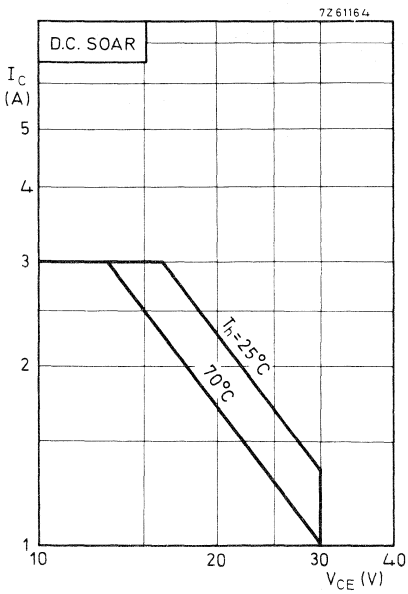
T_j = 25 °C unless otherwise specified

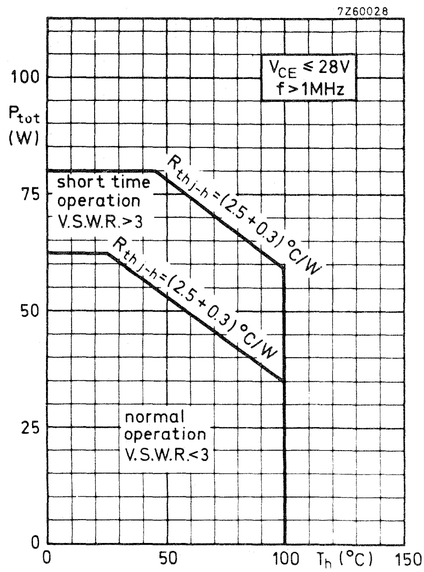
Breakdown voltages

Collector-base voltage open emitter; I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4.0	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1.0 A; V_{CE} = 5 V	h_{FE}	typ. 10 to	50 100	
Transition frequency				
I_C = 3.0 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ. <	50 65	pF pF
Feedback capacitance				
I_C = 100 mA; V_{CE} = 30 V	$-C_{re}$	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V
Collector current (average)	$I_{C(AV)}$	max.	3.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	6	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	62.5	W

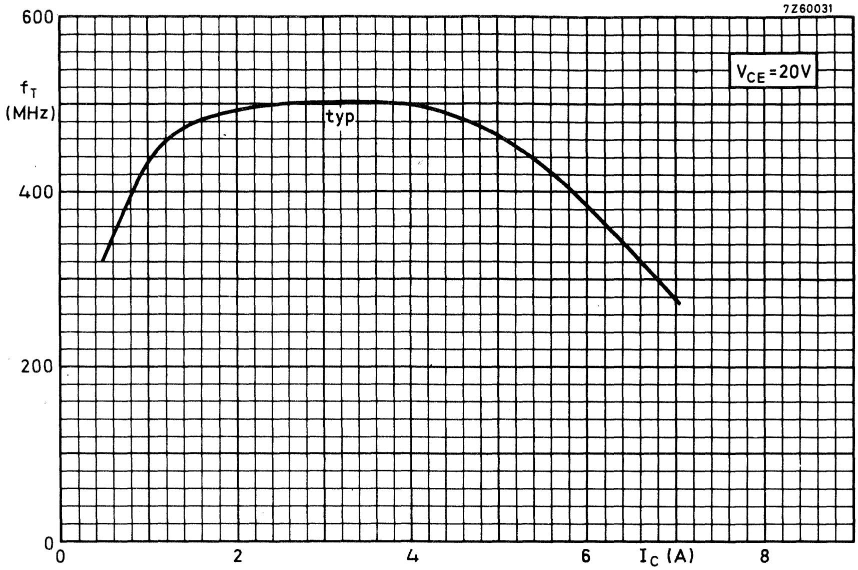


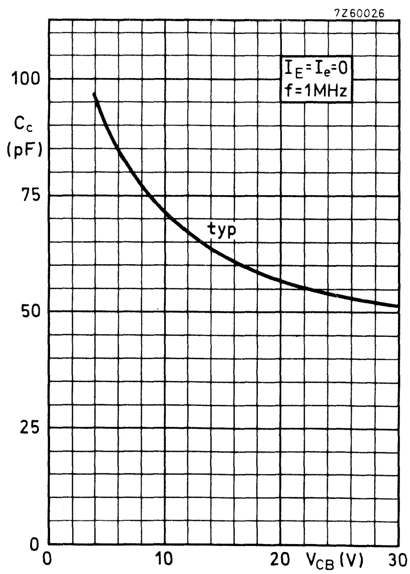


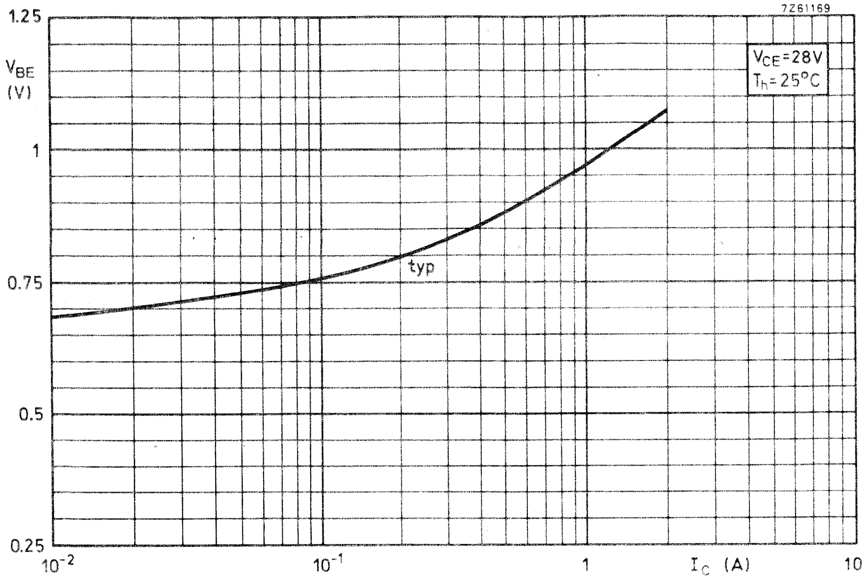
Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.3	K/W


7Z60031
600
f_T
(MHz)
400
200
0
0
2
4
6
I_C (A)
8
V_{CE} = 20V
typ


7Z60026
100
C_c
(pF)
75
50
25
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1MHz
typ


7Z61169
1.25
V_{BE}
(V)
1
0.75
0.5
0.25
V_{CE}=28V
T_h=25°C
typ
10^{-2}
10^{-1}
1
I_C (A)
10

APPLICATION INFORMATION

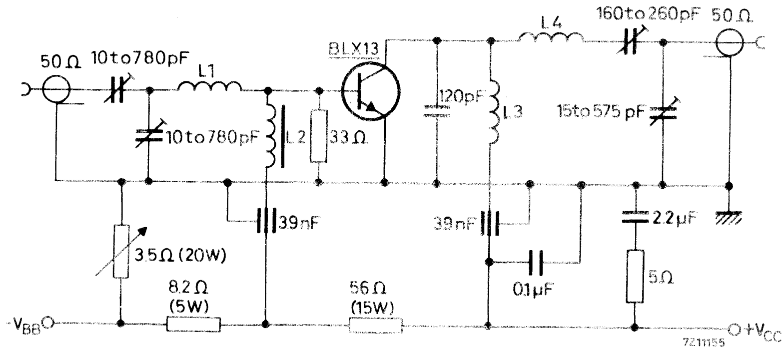
R.F. performance in S.S.B. operation (linear power amplifier)

V_{CE} = 26 V; T_h up to 25 °C
f_1 = 28.000 MHz; f_2 = 28.001 MHz

output power (W)	G_p (dB)	d_3 (dB) [1]	I_C (A)	Class
0-8 (PEP)	> 18	< −40	< 1.2	A

Test circuit:

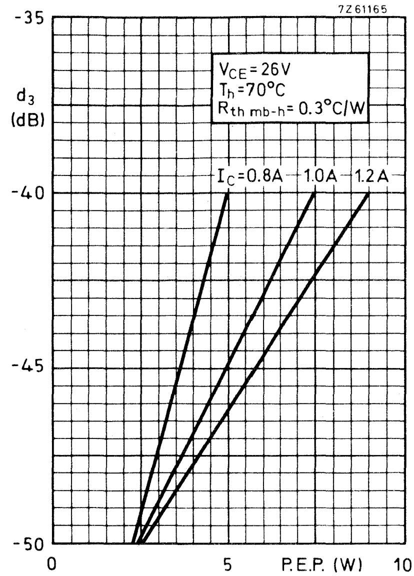
S.S.B.
class A



L1 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0.7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 10 mm
L4 = 7 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; int. diam. 12 mm

Detailed information for a wide band application
1.6 to 28 MHz available on request

[1]) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal ampl. tones. Relative to the according peak envelope power these figures should be increased by 6 dB.


7Z61165
-35
-40
-45
-50
d3
(dB)
V_{CE} = 26 V
T_h = 70 °C
$R_{th\ mb-h}$ = 0.3 °C/W
I_C = 0.8 A
1.0 A
1.2 A
0
5
10
P.E.P. (W)

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} %	I_C A	d_3* dB	$I_{C(ZS)}$ mA	T_h °C
25 (P.E.P.)	> 18	typ. 35	typ. 1,28	typ. −35	25	25

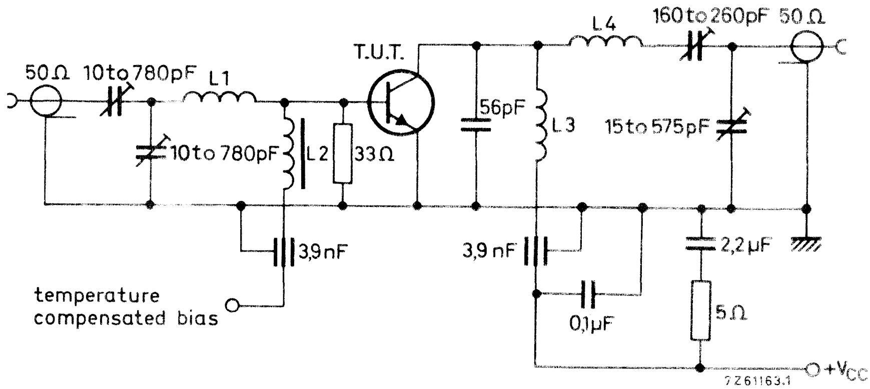
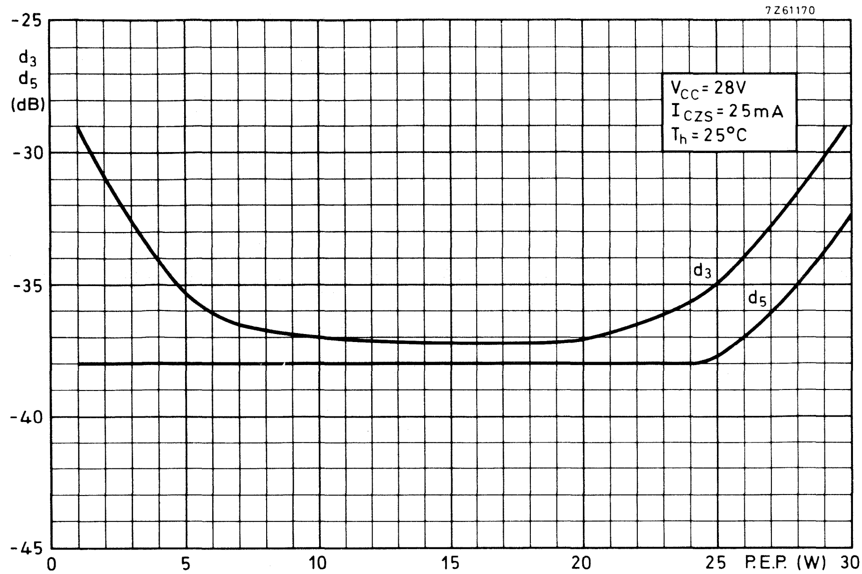


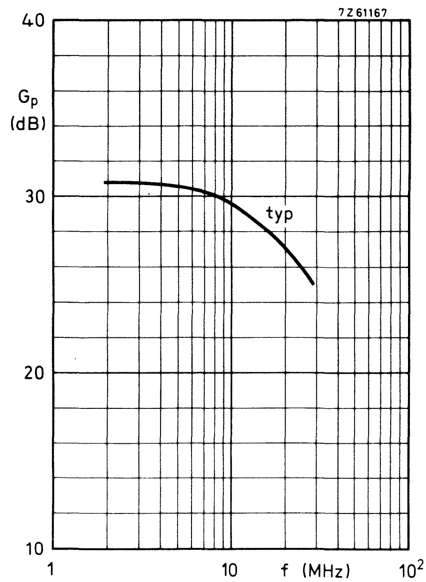
Fig. 9 Test circuit; s.s.b. class-AB.

List of components:

L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7,0 mm; leads 50 mm (total)
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 μH (cat. no. of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.





Conditions:

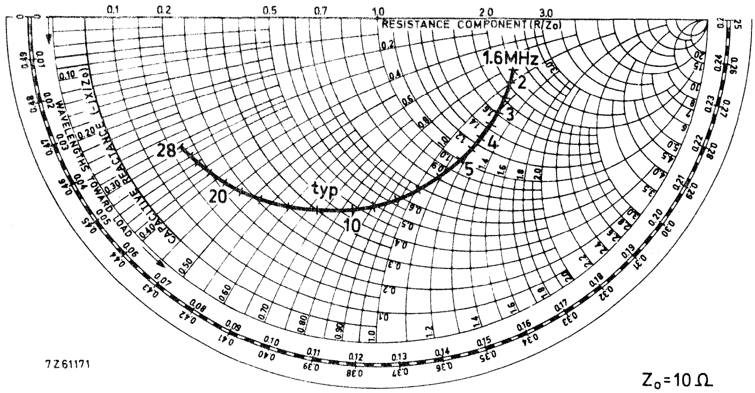
P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 °C



Conditions:

P_L = 25 W PEP

V_{CC} = 28 V

I_{CZS} = 25 mA

Z_L = 12.5 Ω

T_h = 25 °C

APPLICATION INFORMATION

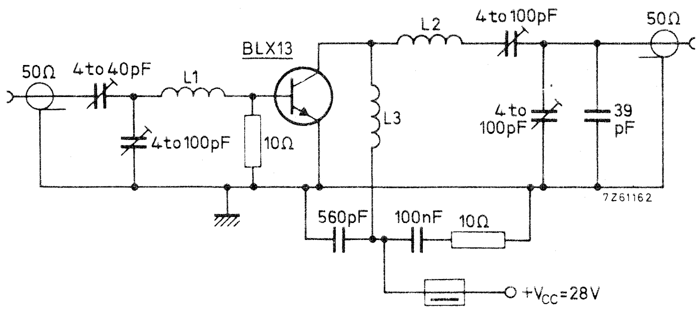
R.F. performance in c.w. operation (class B)

V_{CC} = 28 V; T_h up to 25 °C

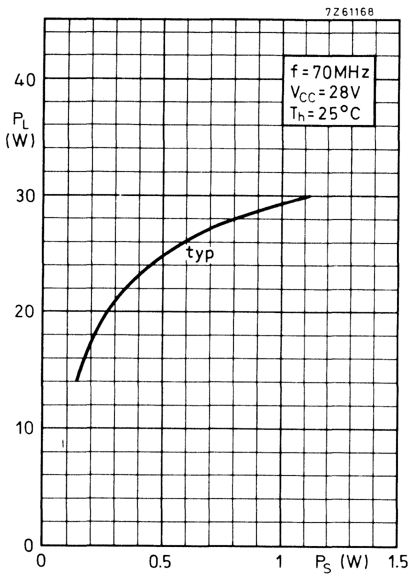
f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mS)
70	typ. 0.5	25	typ. 1.49	typ. 17	typ. 60	0.53-j1.4	42.5-j54

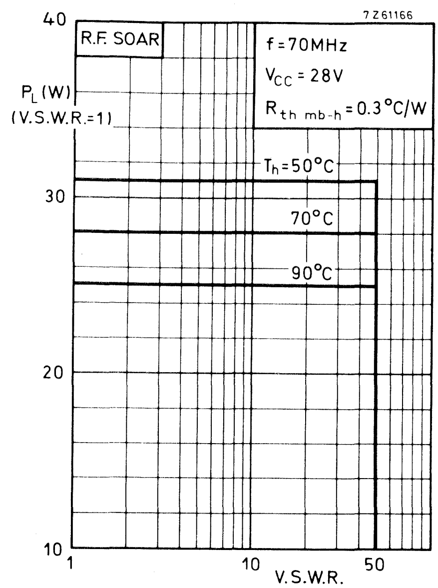
Test circuit:

C.W.
class B



L1 = 93 nH; 3 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 8 mm; leads 2 x 5 mm
L2 = 147 nH; 5 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 14 mm; leads 2 x 5 mm
L3 = 118 nH; 4 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 10.5 mm; leads 2 x 5 mm
L4 = FXC choke (code number 4312 020 36640)





For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in transmitting amplifiers operating in the h.f. and v.h.f. bands, with a nominal supply voltage of 28 V. The transistor is specified for s.s.b. applications as linear amplifier in class-A and AB. The device is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

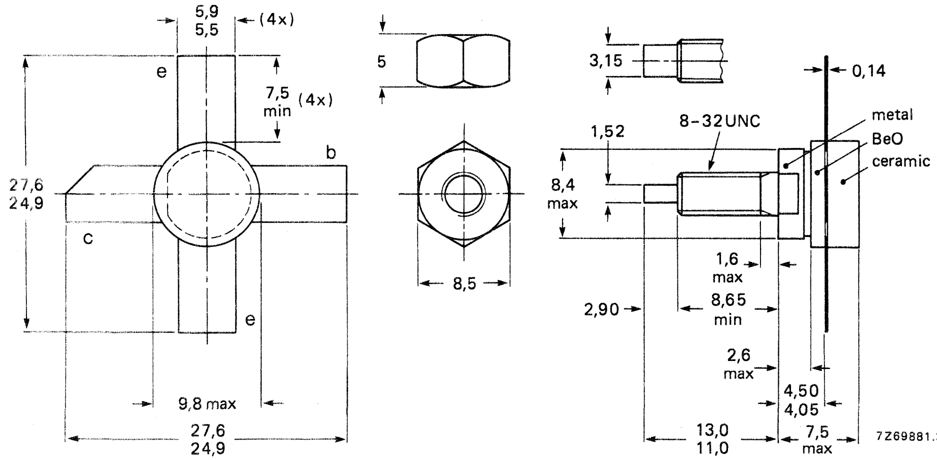
R.F. performance

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 8 (P.E.P.)**	**> 20**	**–**	**1,25**	**< –40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. –30	25

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	73	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

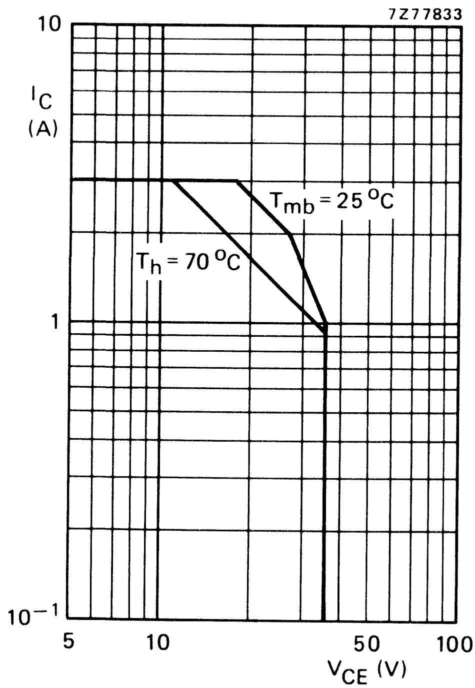


Fig. 2 D.C. SOAR.

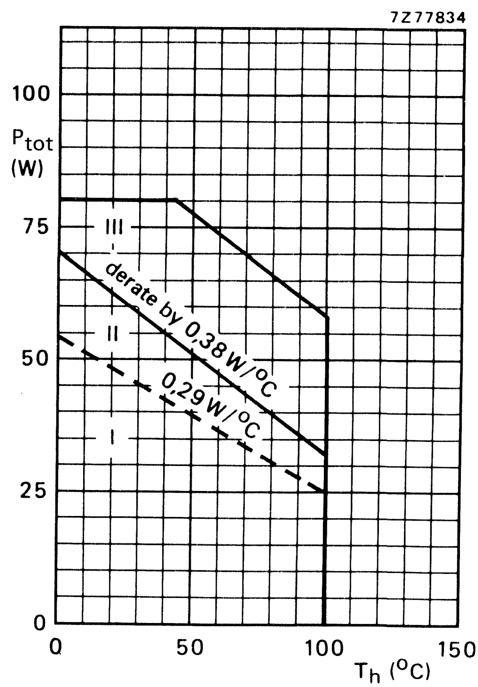


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operating during mismatch

THERMAL RESISTANCE (dissipation = 32,5 W; T_{mb} = 85 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,55	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,65	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 1,25 A; V_{CE} = 5 V	h_{FE}	typ.	50 10 to 100
D.C. current gain ratio of matched devices * I_C = 1,25 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 3,75 A; I_B = 0,75 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	530 MHz
$-I_E$ = 3,75 A; V_{CB} = 28 V	f_T	typ.	530 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	50 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	31 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

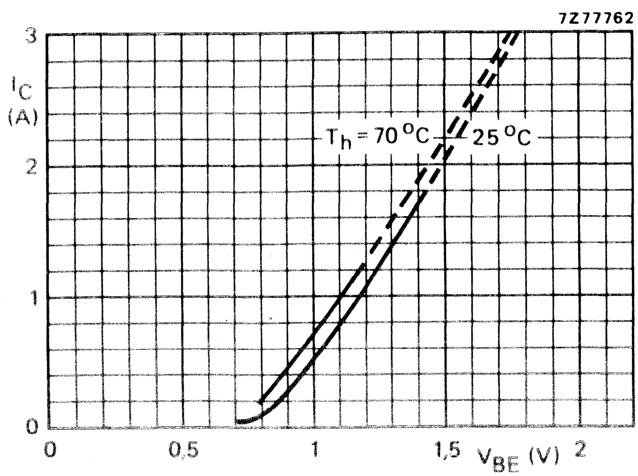


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

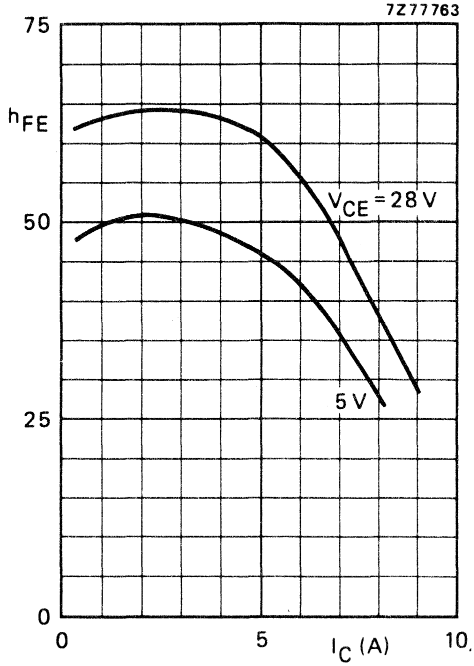


Fig. 5 Typical values; T_j = 25 °C.

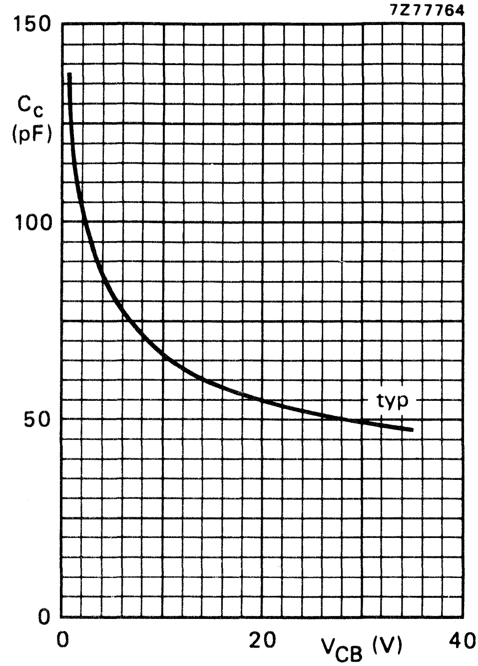


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

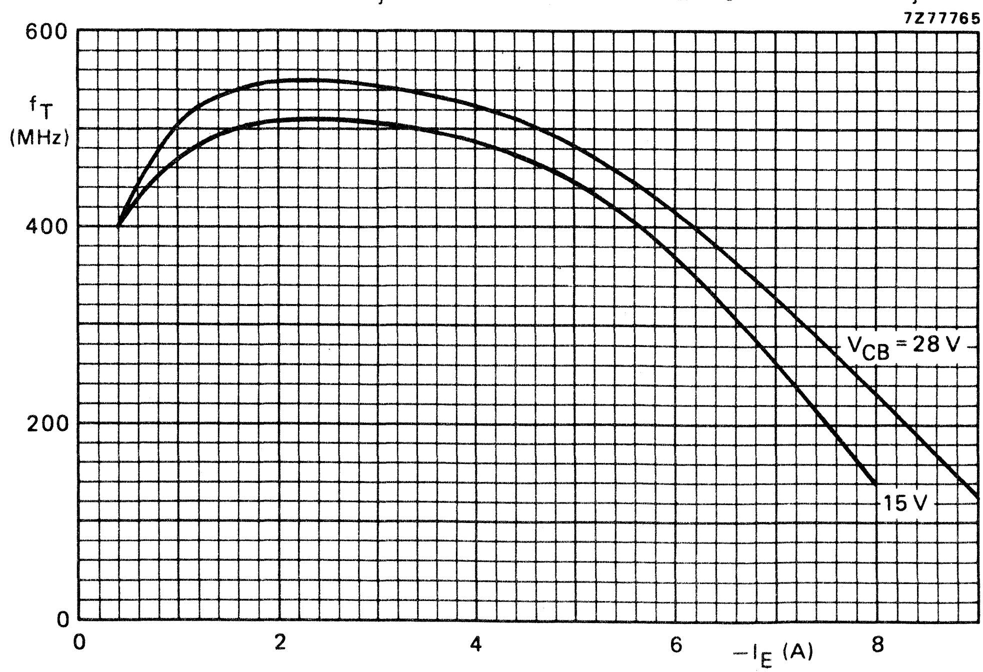


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *	T_h °C
> 8 (P.E.P.)	> 20	1,25	−40	< −40	70
typ. 10 (P.E.P.)	typ. 24	1,25	−40	< −40	25

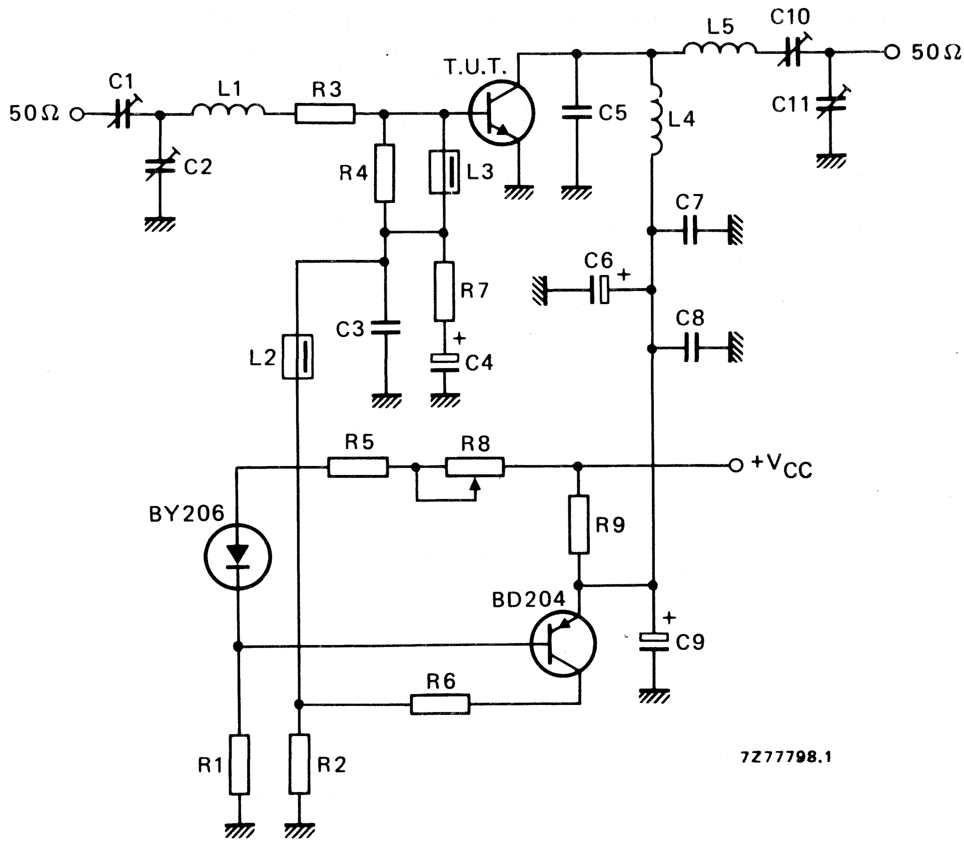


Fig. 8 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 8:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5%; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5%; 0,25 W)
R3 = 1,2 Ω parallel connection of 4 x 4,7 Ω carbon resistors (± 5%; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5%; 0,25 W)
R5 = 18 Ω carbon resistor (± 5%; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5%; 5,5 W)
R7 = 1 Ω carbon resistor (± 5%; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5%; 5,5 W each)

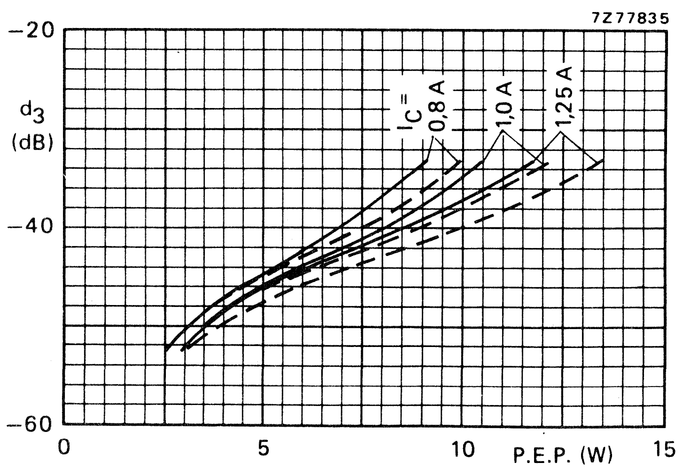


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz;
——— T_h = 70 °C; — — — T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt} (%) at 25 W P.E.P.	I_C (A) at 25 W P.E.P.	d_3 dB *	d_5 dB *	$I_{C(ZS)}$ mA	T_h °C
3 to 25 (P.E.P.)	typ. 21	typ. 45	typ. 1,0	typ. −30	< −30	25	25
3 to 22 (P.E.P.)	typ. 21	–	–	typ. −30	< −30	25	70

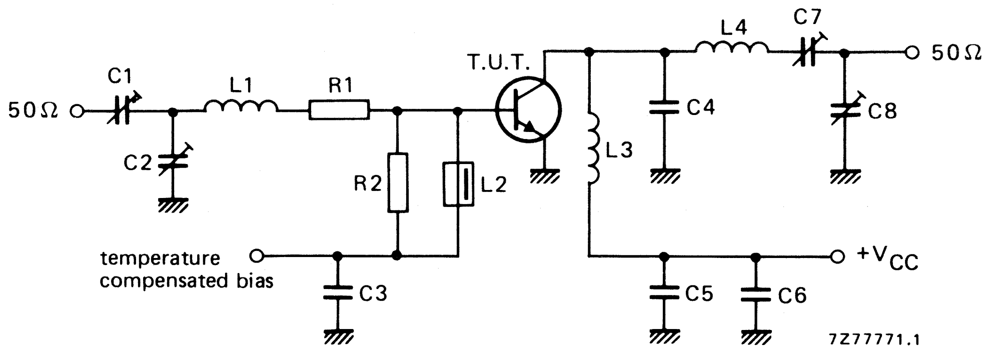


Fig. 10 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric trimmer

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

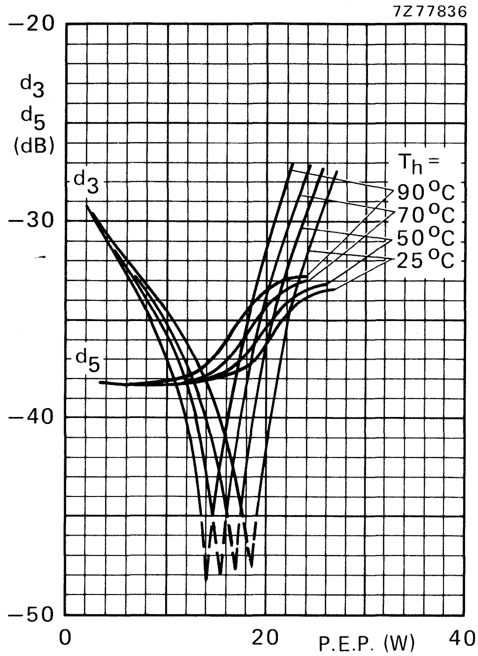


Fig. 11 Intermodulation distortion as a function of output power. *

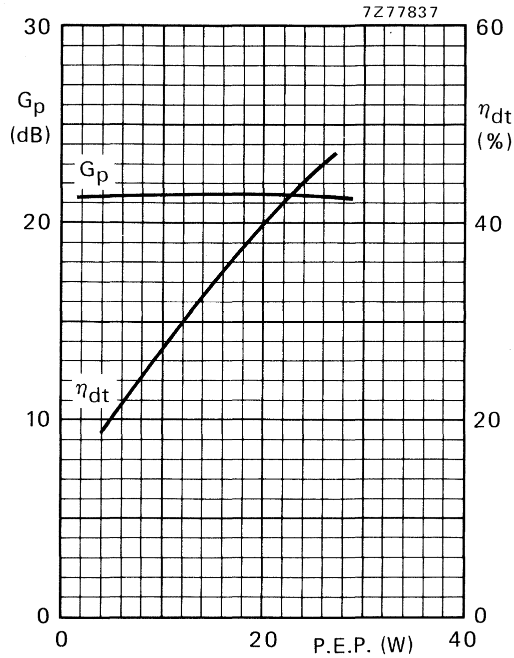


Fig. 12 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 11:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 12:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C; typical values.

* See note on previous page.

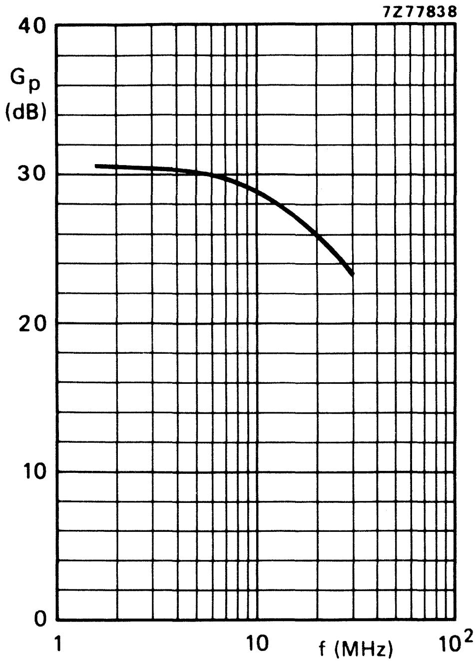


Fig. 13 Power gain as a function of frequency.

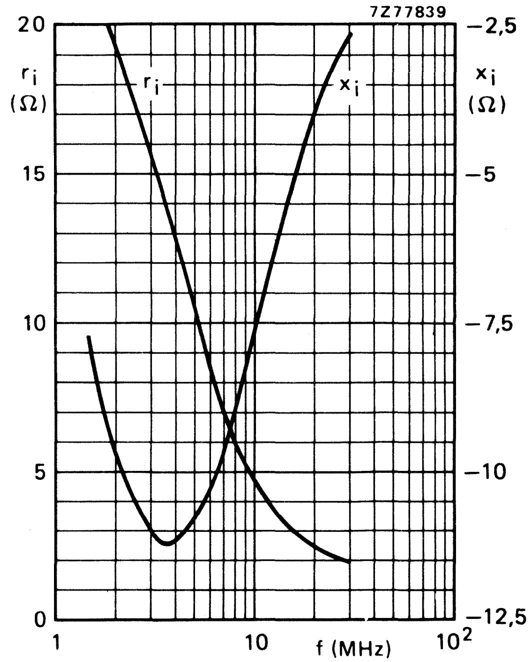


Fig. 14 Input impedance (series components) as a function of frequency.

Figs 13 and 14 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 25 mA; P_L = 25 W; T_h = 25 °C; Z_L = 12 Ω.

Ruggedness in s.s.b. operation

The BLX13C is capable of withstanding a load mismatch (VSWR = 50) under the following conditions: f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_L = 30 W (P.E.P.).

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, AB and B operated transmitting equipment in the h.f. and v.h.f. band.

- rated for 50 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than −30 dB); full load mismatch permissible at stud temperatures up to 70 °C
- rated at 50 W for frequencies up to 70 MHz in c.w. operation
- supply voltage 28 V
- plastic stripline package

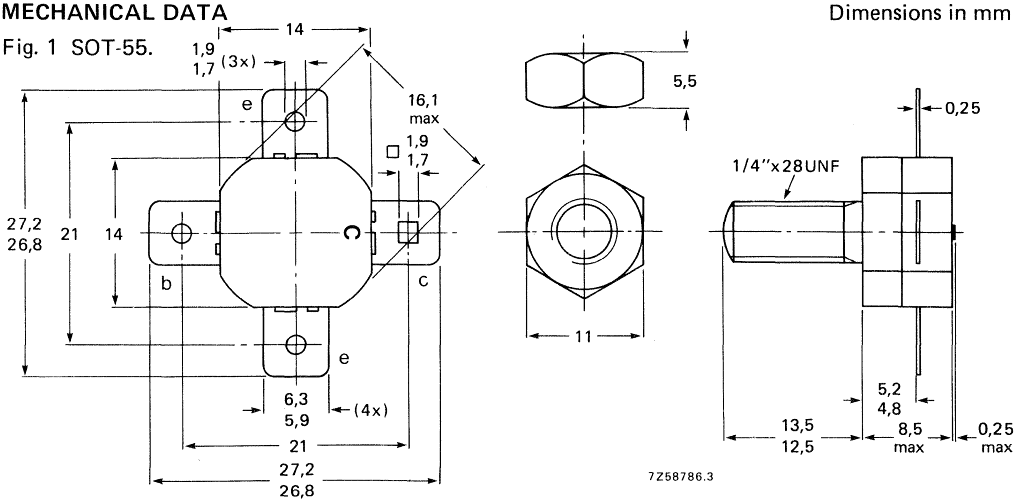
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-A)	28	1,6 to 28	15 (P.E.P.)	> 13	typ. −40	2,0
s.s.b. (class-AB)	28	1,6 to 28	7,5-50 (P.E.P.)	> 13	< −30	0,1
c.w. (class-B)	28	70	50	> 7,5		
c.w. (class-B)	28	30	50	typ. 16		

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

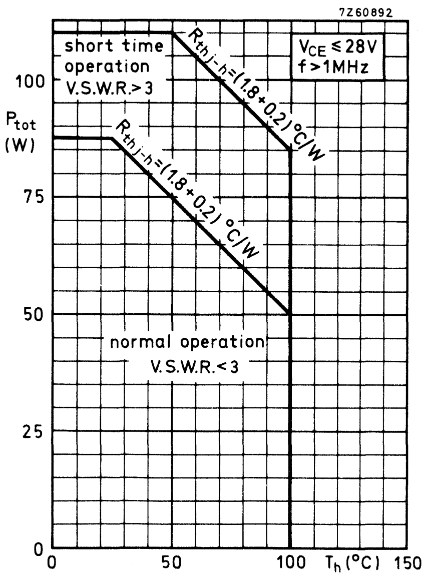
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

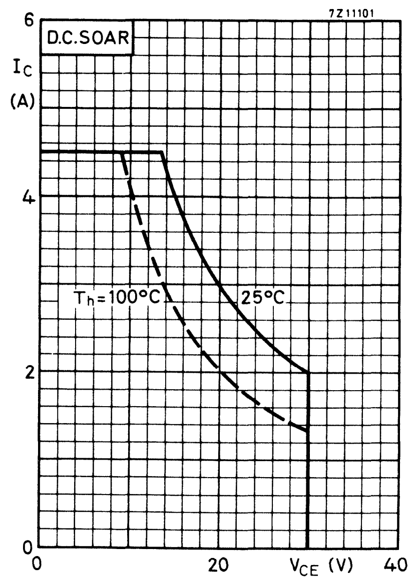
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	85	V
Collector-emitter voltage (R_{BE} = 10 Ω) peak value	V_{CERM}	max.	85	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4.0	V
Collector current (average)	I_{CAV}	max.	4.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	88	W





Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	+200	°C

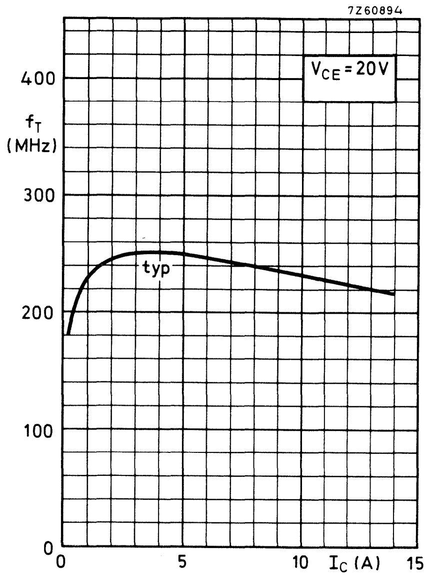
THERMAL RESISTANCE

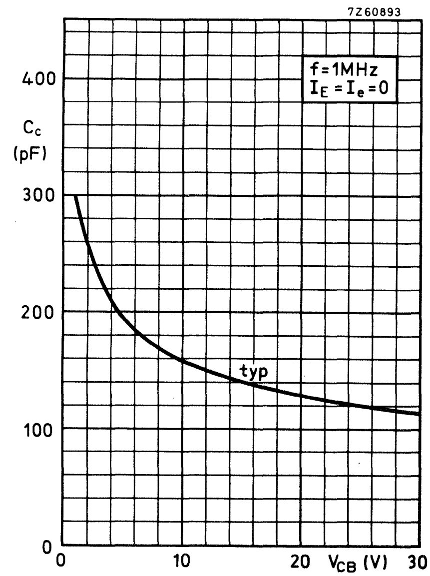
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.8	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	K/W

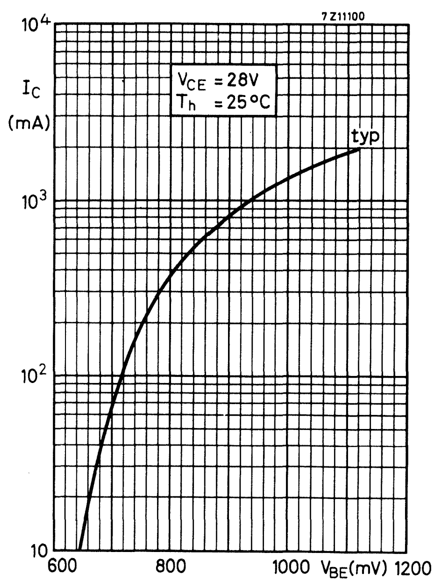
CHARACTERISTICS

T_j = 25 °C

Collector-base breakdown voltage				
open emitter; I_C = 25 mA	$V_{(BR)CBO}$	>	85	V
Collector-emitter breakdown voltage				
R_{BE} = 10 Ω; I_C = 25 mA	$V_{(BR)CER}$	>	85	V
open base; I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage				
open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4,0	V
Collector-emitter saturation voltage				
I_C = 0,7 A; I_B = 0,14 A	V_{CEsat}	<	1,0	V
Second breakdown energy; L = 25 mH; f = 50 Hz				
open base	E_{SBO}	>	8	mJ
R_{BE} = 33 Ω	E_{SBR}	>	8	mJ
D.C. current gain				
I_C = 1,4 A; V_{CE} = 6 V	h_{FE}		15 to 100	
Transition frequency				
I_C = 3,0 A; V_{CE} = 20 V	f_T	typ.	250	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	115	pF
		<	125	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 30 V	C_{re}	typ.	90	pF
Collector-stud capacitance	C_{cs}	typ.	3,5	pF


7Z60894
V_{CE} = 20V
400
f_T
(MHz)
300
200
100
0
typ
0
5
10
I_C (A)
15


7Z60893
f = 1MHz
$I_E = I_e = 0$
400
C_c
(pF)
300
200
100
0
typ
0
10
20
V_{CB} (V)
30


7Z11100
10^4
I_C
(mA)
V_{CE} = 28V
T_h = 25 °C
typ
10^3
10^2
10
600
800
1000
V_{BE}(mV)
1200

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	Gp dB	η_{dt} %	I_C A	d_3* dB	d_5* dB	$I_{C(ZS)}$ A	T_h °C
7,5 to 50 (P.E.P.)	> 13	> 35	< 2,55	< −30	< −30	0,1	25

At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by −40 mW/K.

The transistor is designed to withstand a full load mismatch operating under 50 W P.E.P. at V_{CE} = 28 V and T_h = 70 °C.

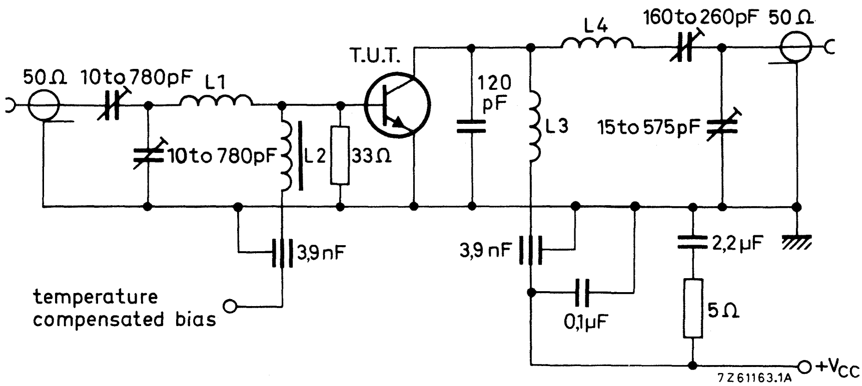
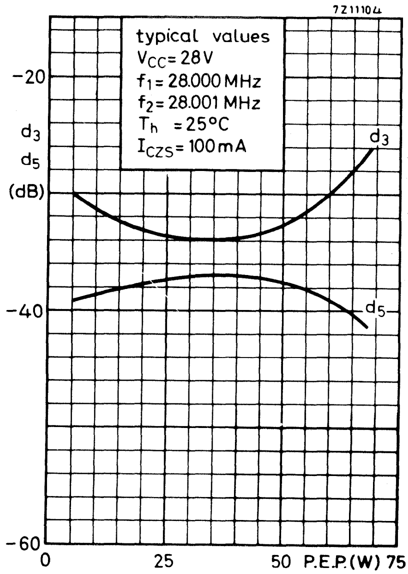


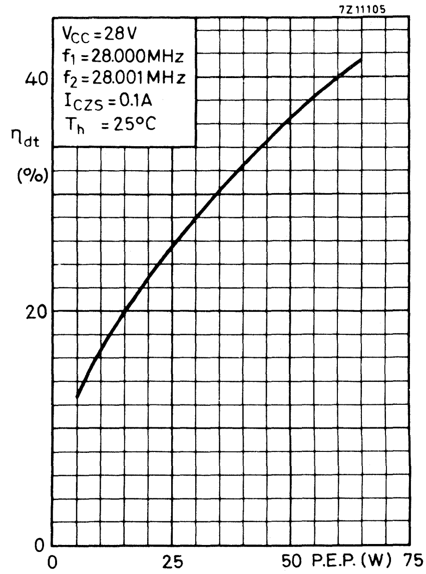
Fig. 7 Test circuit; s.s.b. class-AB.

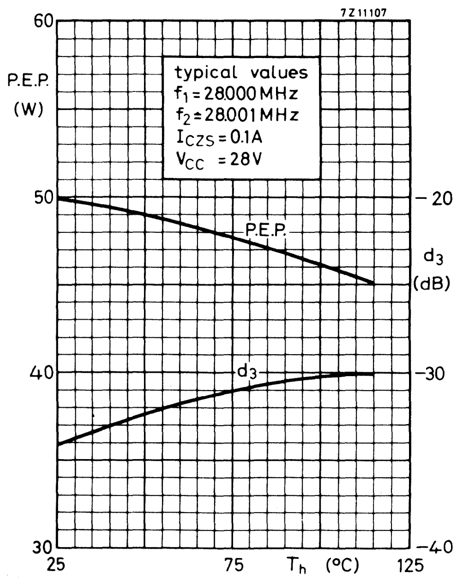
List of components:

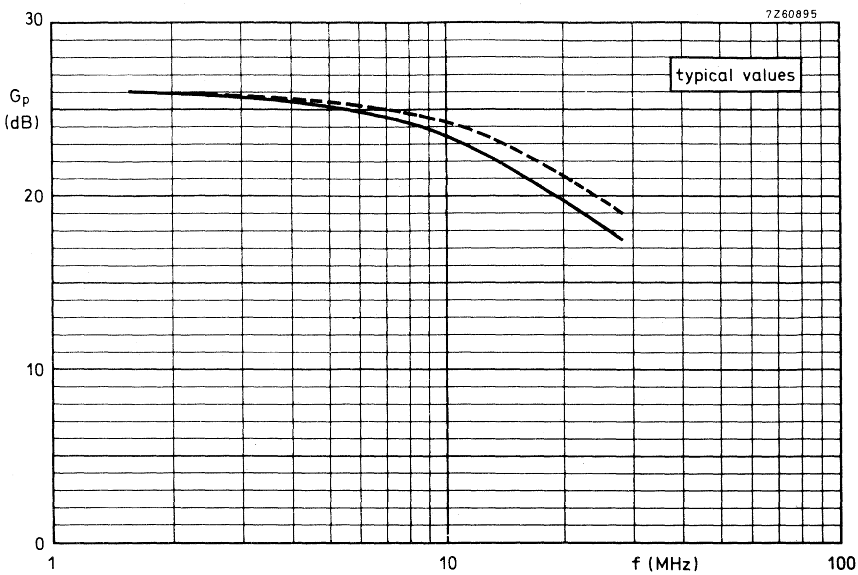
L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7,0 mm; leads 50 mm (total)
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 μH (cat. no. of 3H1 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.


7Z11104
typical values
V_{CC} = 28 V
f_1 = 28.000 MHz
f_2 = 28.001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
(dB)
−20
−40
−60
0
25
50
P.E.P. (W)
75


7Z11105
V_{CC} = 28 V
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
T_h = 25 °C
η_{dt}
(%)
40
20
0
25
50
P.E.P. (W)
75


7Z11107
typical values
f_1 = 28.000 MHz
f_2 = 28.001 MHz
I_{CZS} = 0.1 A
V_{CC} = 28 V
P.E.P.
(W)
60
50
40
30
P.E.P.
d_3
d_3
(dB)
−20
−30
−40
25
75
T_h (°C)
125

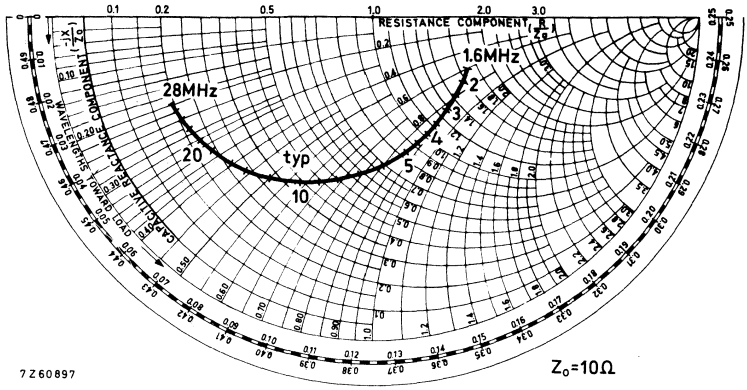


S.S.B. class AB operation

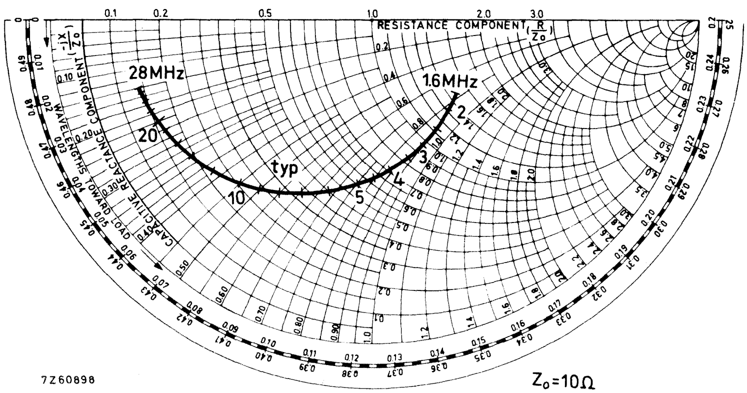
P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

The drawn curve holds for an unneutralized amplifier.

The dashed curve holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF



7Z60897



7Z60898

S.S.B. class AB operation

P_L = 50 W PEP
V_{CC} = 28 V
I_C = 100 mA
Z_L = 6.25 Ω
T_h = 25 °C

The upper graph holds for a push-pull amplifier with cross neutralization.
Collector-base neutralizing capacitor: 82 pF

The lower graph holds for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

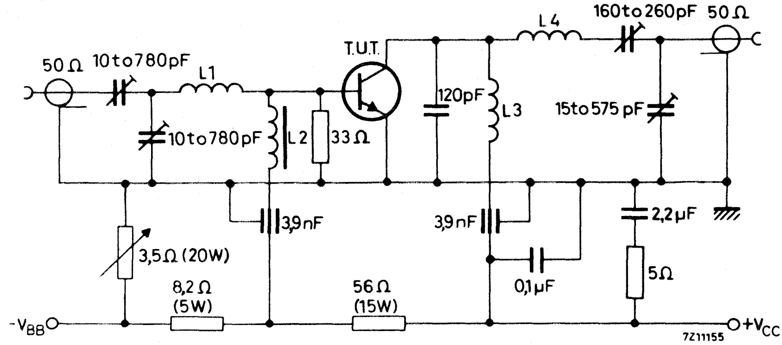
R.F. performance in s.s.b. operation (linear power amplifier)

V_{CC} = 28 V; T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

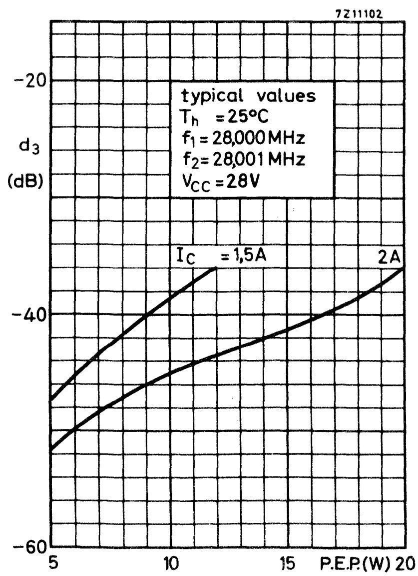
output power (W)	G_p (dB)	d_3 (dB) [1]	d_5 (dB) [1]	I_C (A)	Class
15 PEP	> 13	typ. −40	typ. −45	2,0	A

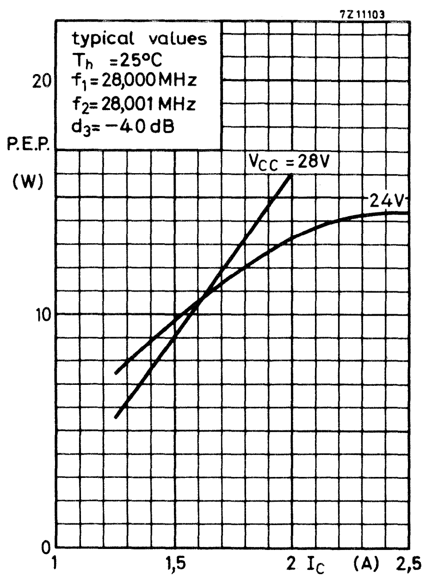
Test circuit:

S.S.B. class-A



L1 = 3 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 7 mm leads 50 mm totally
L2 = 7 turns enamelled Cu wire (0,7 mm) on 3H1 toroid; 60 μH (code number of 3H1: 4322 020 36620)
L3 = 4 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 10 mm
L4 = 7 turns enamelled Cu wire (1,5 mm); winding pitch 2,5 mm; int. dia. 12 mm





APPLICATION INFORMATION

R.F. performance in c.w. operation (class B)

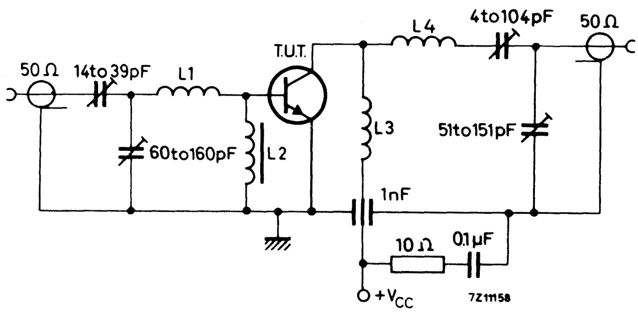
V_{CC} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
70	< 8.9	50	< 3.25	> 7.5	> 55	1.0+j0.2	120 − j75
50	typ. 4	50	typ. 3.25	typ. 11	typ. 55	–	–
30	typ. 1.2	50	typ. 3.25	typ. 16	typ. 55	–	–

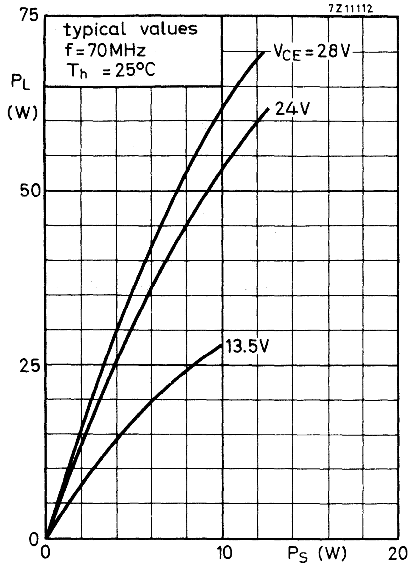
At temperatures up to 90 °C the output power relative to that at 25 °C is diminished by a factor −40 mW/K

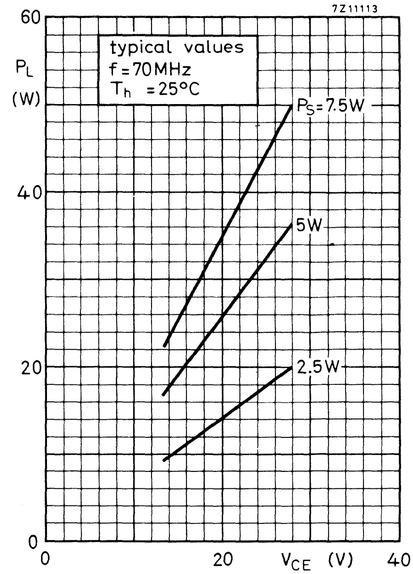
Test circuit:

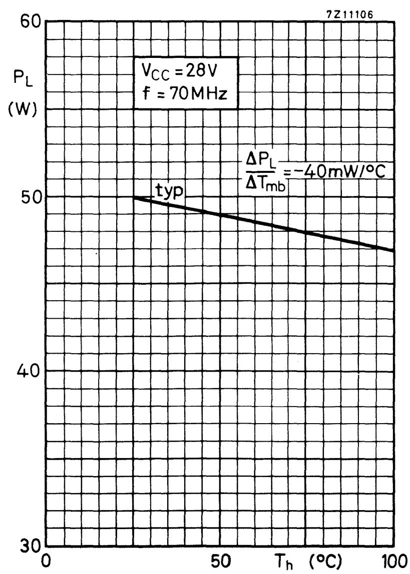
C.W.
70 MHz

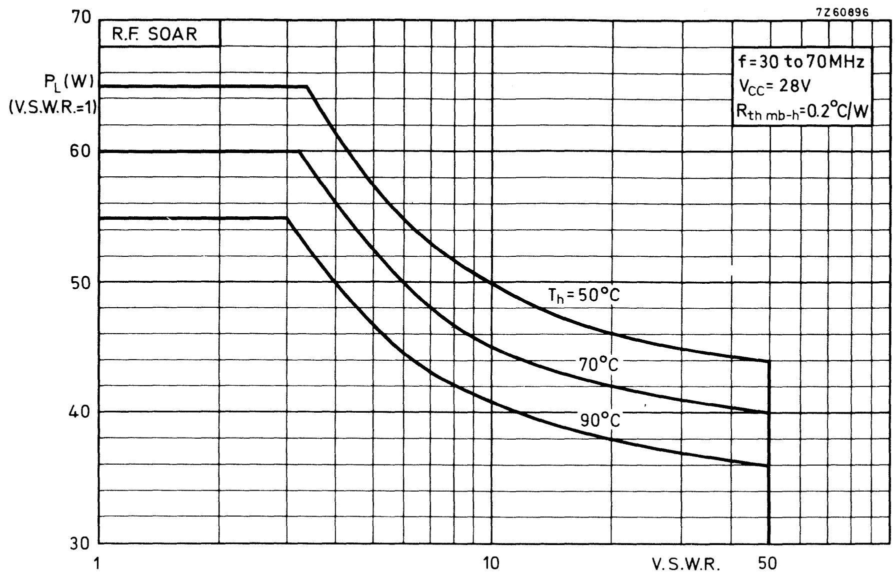


L1 = 60 mm straight enamelled Cu wire (1.5 mm); 9 mm above chassis
L2 = FXC choke coil (code number 4322 020 36640)
L3 = 2 turns enamelled Cu wire (1.5 mm); winding pitch 2 mm; internal diam. 10 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1.5 mm); winding pitch 2.5 mm; internal diam. 10 mm; leads 50 mm totally


7Z11112
typical values
f = 70 MHz
T_h = 25°C
P_L
(W)
75
50
25
0
V_{CE} = 28 V
24 V
13.5 V
0
10
P_S (W)
20

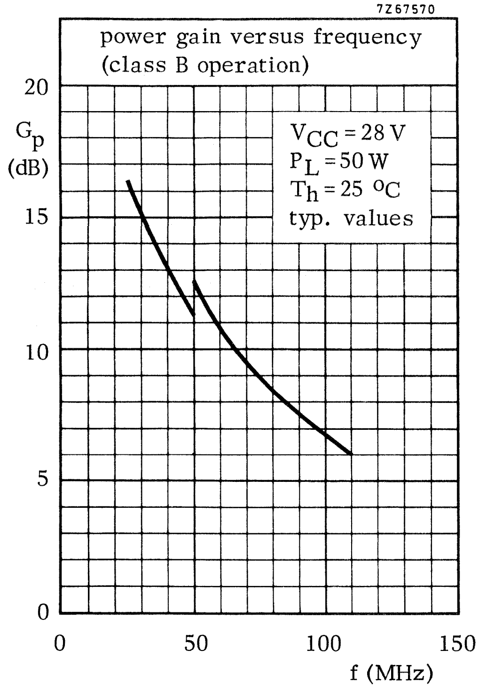

7Z11113
typical values
f = 70 MHz
T_h = 25°C
P_L
(W)
60
40
20
0
P_S = 7.5 W
5 W
2.5 W
0
20
V_{CE} (V)
40

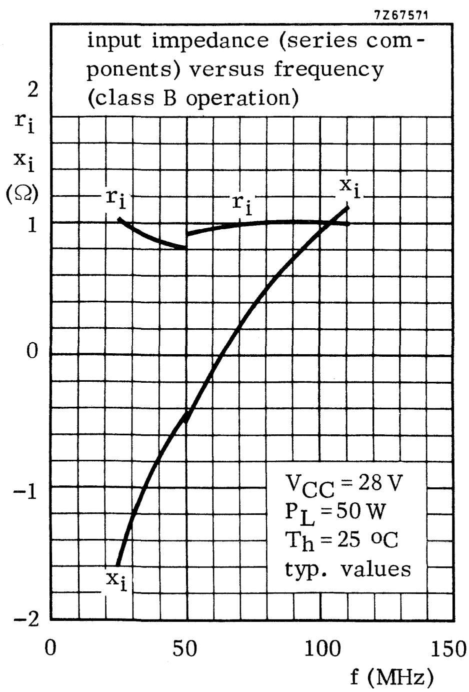

7Z11106
V_{CC} = 28 V
f = 70 MHz
P_L
(W)
60
50
40
30
typ
$\frac{\Delta P_L}{\Delta T_{mb}}$ = −40 mW/°C
0
50
T_h (°C)
100

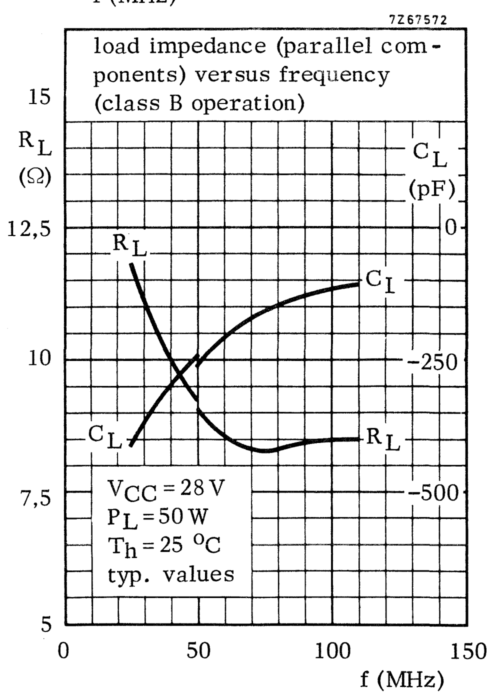


For high voltage operation, a stabilized power supply generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heatsink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 6,8 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







H.F./V.H.F. POWER TRANSISTOR

Silicon n-p-n power transistor for use in industrial and military s.s.b. and c.w. equipment operating in the h.f. and v.h.f. band:

- rated for 150 W P.E.P. at 1,6 MHz to 28 MHz (intermodulation distortion better than 30 dB down)
- rated at 150 W output power for frequencies up to 108 MHz in c.w. operation
- supply voltage up to 50 V
- plastic encapsulated stripline package
- delivered in matched h_{FE} groups

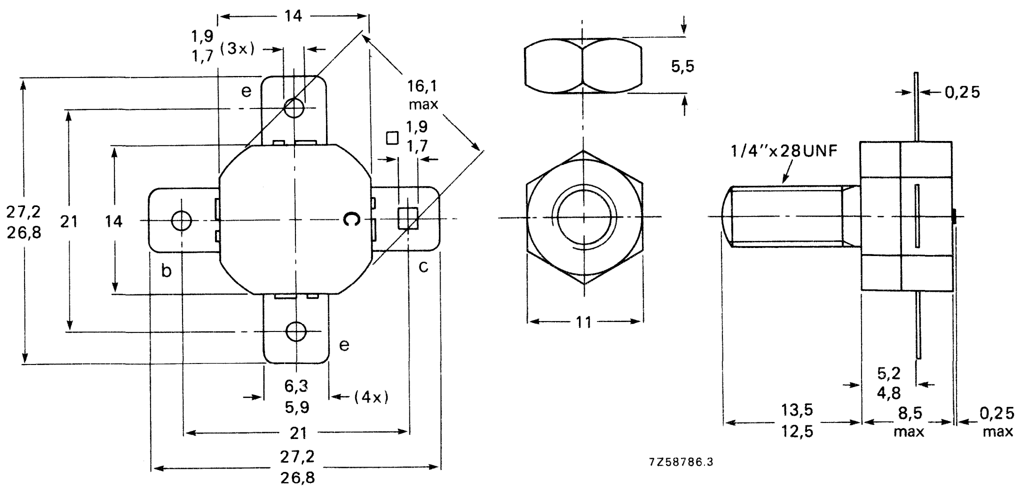
QUICK REFERENCE DATA

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	d_3 dB	$I_{C(ZS)}$ A
s.s.b. (class-AB)	50	1,6 to 28	20 to 150 (P.E.P.)	> 14	< −30	0,10
s.s.b. (class-A)	40	1,6 to 28	typ. 30 (P.E.P.)	> 14	< −40	2,5
c.w. (class-B)	50	70	150	> 10	–	–
c.w. (class-B)	50	108	150	typ. 7,4	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



When locking is required an adhesive is preferred instead of a lock washer.

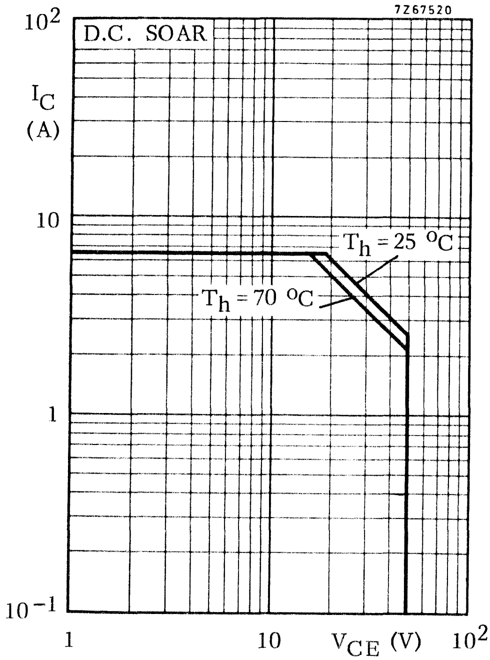
Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

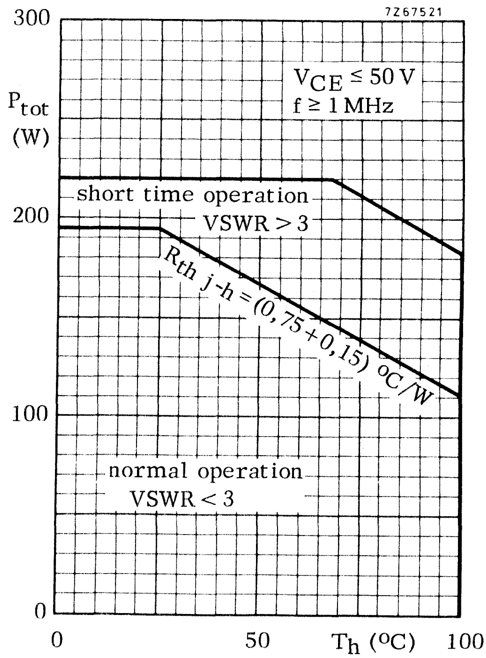
Diameter of clearance hole in heatsink: max.6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	110	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	110	V
Collector-emitter voltage (open base)	V_{CEO}	max.	53	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V
Collector current (average)	$I_{C(AV)}$	max.	6,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A





Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

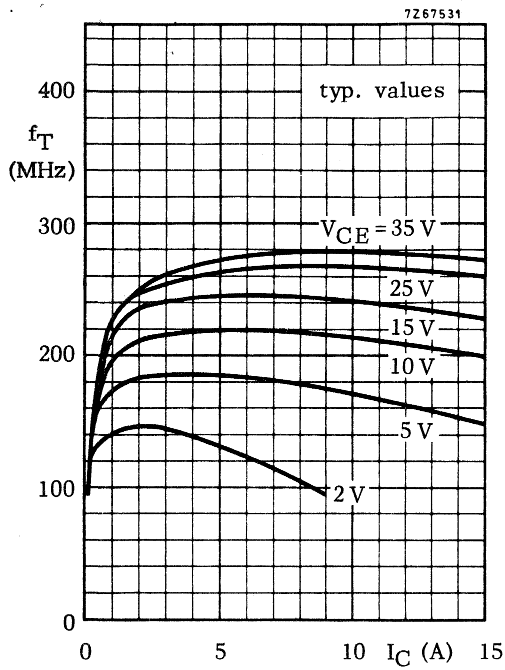
THERMAL RESISTANCE

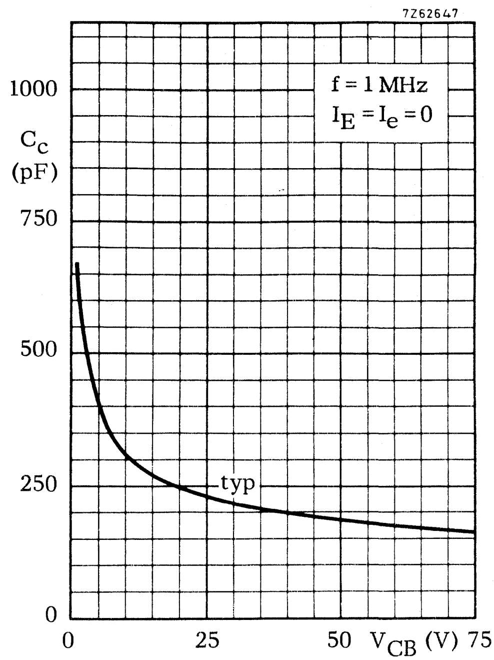
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,75	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,15	K/W

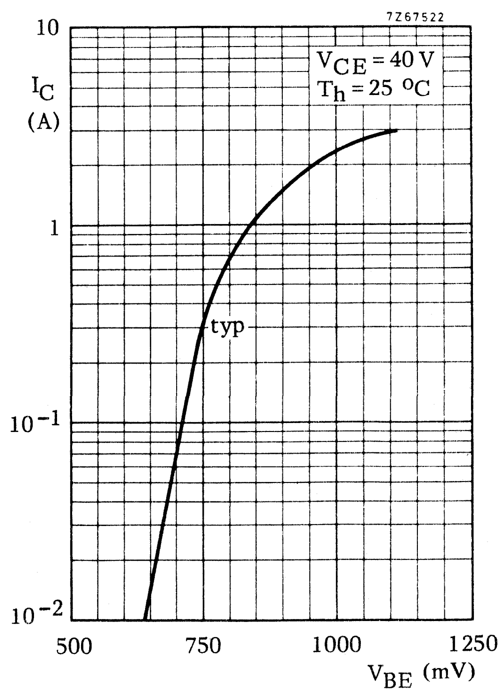
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter ; I_C = 100 mA	$V_{(BR)CBO}$	>	110	V
Collector-emitter voltage R_{BE} = 5 Ω ; I_C = 100 mA	$V_{(BR)CER}$	>	110	V
Collector-emitter voltage open base ; I_C = 100 mA	$V_{(BR)CEO}$	>	53	V
Emitter-base voltage open collector; I_E = 20 mA	$V_{(BR)EBO}$	>	4,0	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	12,5	ms
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	12,5	ms
D.C. current gain				
I_C = 1,4 A ; V_{CE} = 6 V	h_{FE}		15 to 50	
D.C. current gain ratio of matched devices				
I_C = 1,4 A ; V_{CE} = 6 V	h_{FE1}/h_{FE2}	<	1,2	
Transition frequency				
I_C = 6,0 A ; V_{CE} = 35 V	f_T	typ.	275	MHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0 ; V_{CB} = 50 V	C_c	typ. <	185 220	pF pF
Feedback capacitance at f = 1 MHz				
I_C = 150 mA; V_{CE} = 50 V	C_{re}	typ.	115	pF
Collector-stud capacitance	C_{cs}	typ.	3,5	pF


7Z67531
typ. values
f_T (MHz)
400
300
200
100
0
V_{CE} = 35 V
25 V
15 V
10 V
5 V
2 V
0
5
10
I_C (A)
15


7Z62647
f = 1 MHz
$I_E = I_e = 0$
C_c (pF)
1000
750
500
250
0
typ
0
25
50
V_{CB} (V)
75


7Z67522
V_{CE} = 40 V
T_h = 25 °C
I_C (A)
10
1
10^{-1}
10^{-2}
typ
500
750
1000
1250
V_{BE} (mV)

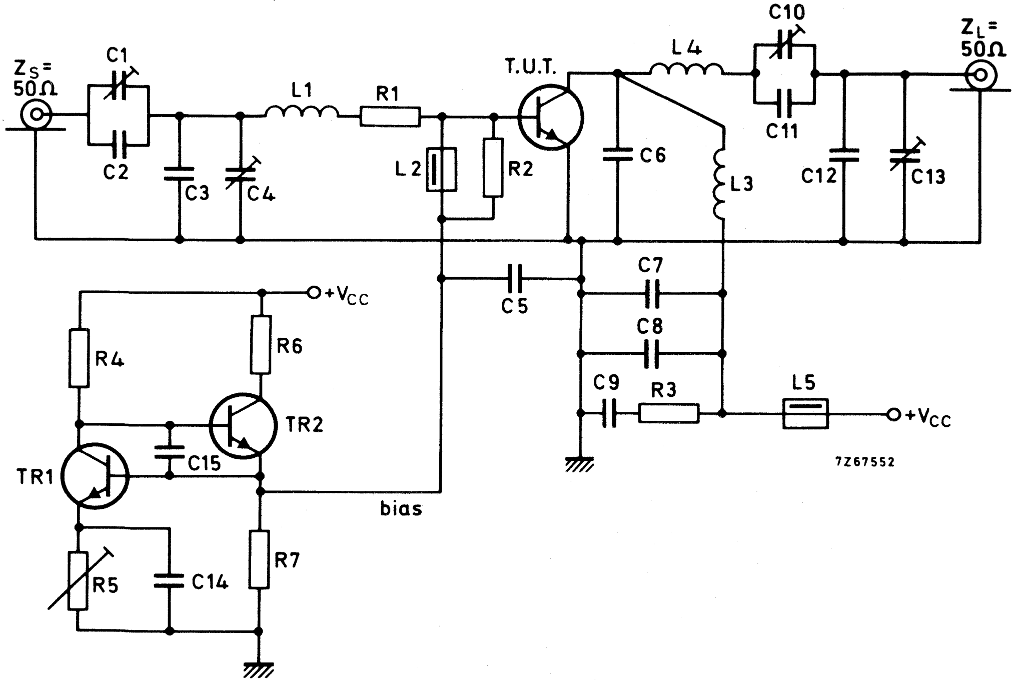
APPLICATION INFORMATION

R.F. performance in s.s.b. operation (linear power amplifier)

T_h up to 25 °C
f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power (W)	G_p (dB)	η_{dt} (%)	d_3 (dB) 1)	d_5 (dB) 1)	I_{CZS} (A)	I_C (A)	V_{CE} (V)	Class
20 to 150 (PEP)	> 14	> 37,5	< −30	< −30	0,10	< 4	50	AB
typ. 30 (PEP)	> 14	typ. 15	< −40	< −40	2,5	–	40	A

S.S.B. test circuit class AB; f = 28 MHz



List of components: see page 6.

1) Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope power these figures should be increased by 6 dB.

APPLICATION INFORMATION (continued)

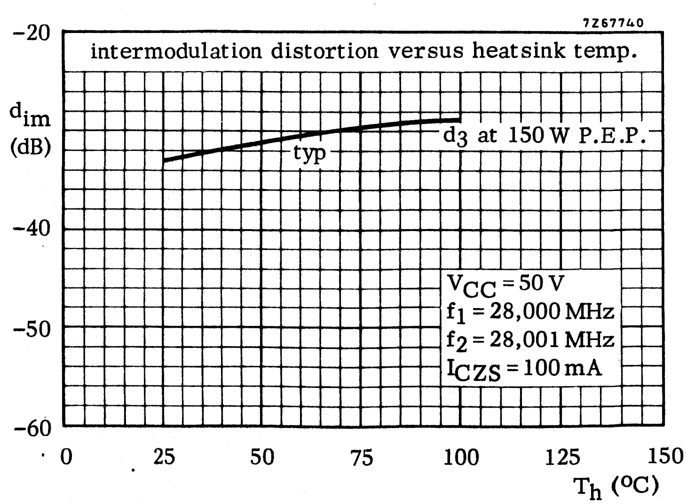
List of components:

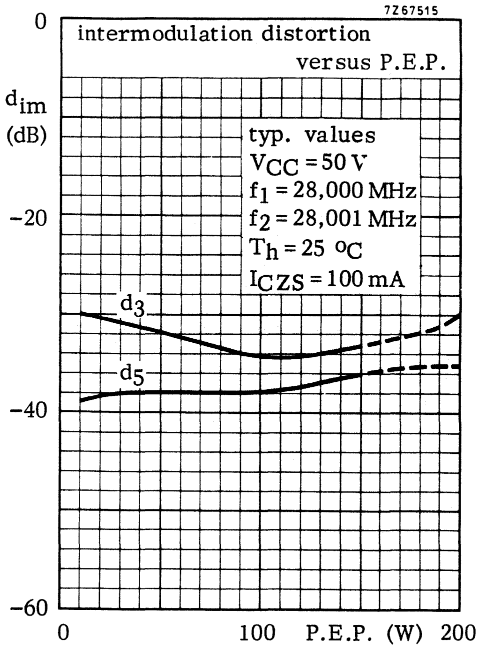
Tr1 = BD135
Tr2 = BD228

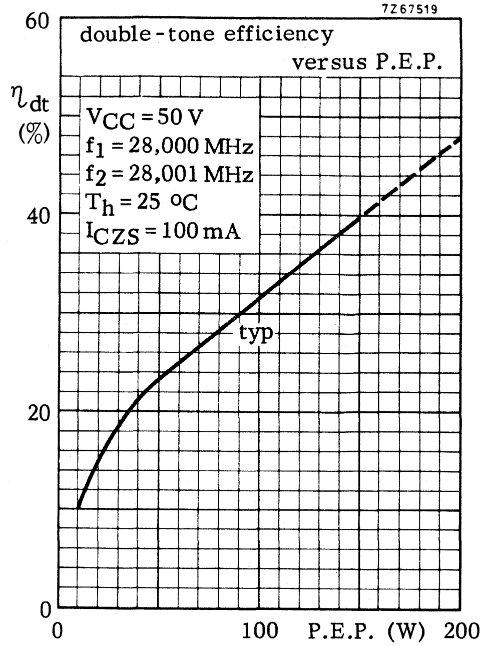
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = C14 = C15 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

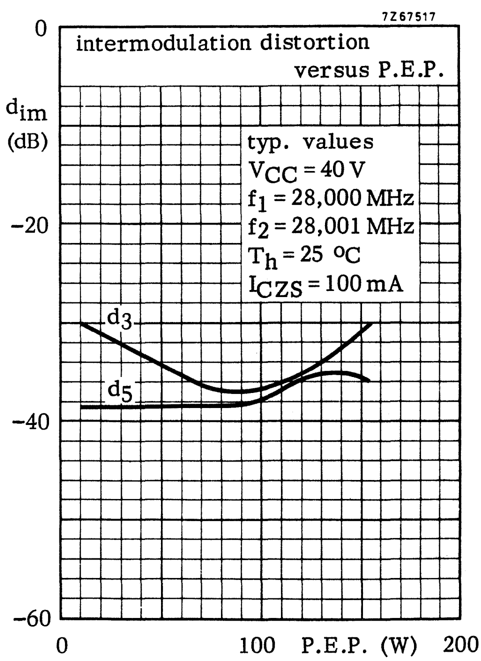
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

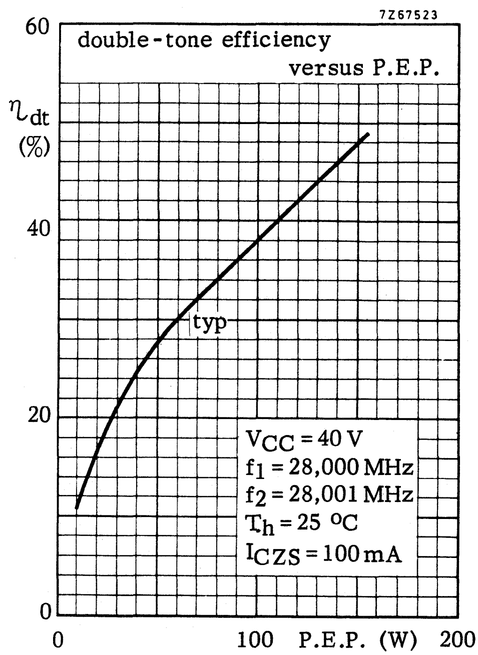
R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 5,6 kΩ carbon resistor (±5%; 1 W)
R5 = 15 Ω wire-wound potentiometer (3W)
R6 = 157 Ω parallel connection of 3 x 470 Ω wire-wound resistors (5,5W each)
R7 = 68 Ω carbon resistor (±5%; 0,5 W)

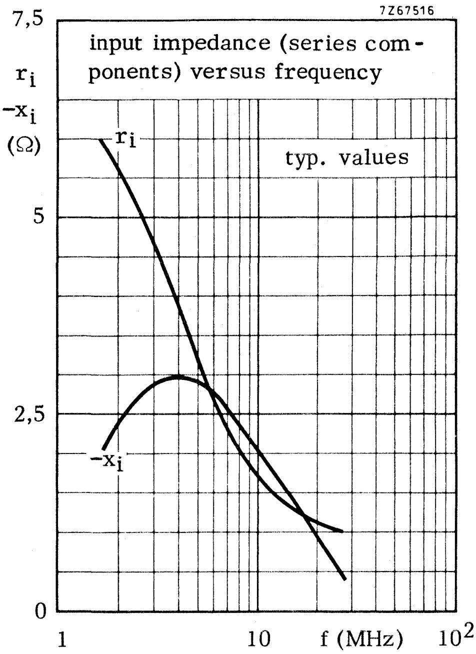


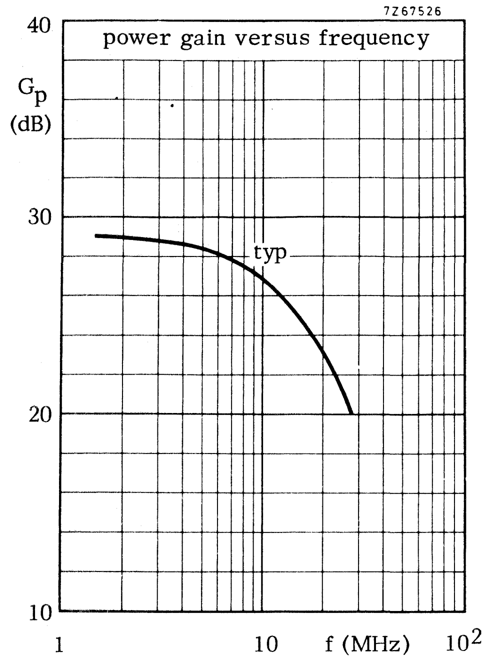

7Z67515
intermodulation distortion
versus P.E.P.
d_{im}
(dB)
0
-20
-40
-60
typ. values
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
0
100
P.E.P. (W)
200


7Z67519
double-tone efficiency
versus P.E.P.
η_{dt}
(%)
60
40
20
0
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
typ
0
100
P.E.P. (W)
200


7Z67517
intermodulation distortion
versus P.E.P.
d_{im}
(dB)
0
-20
-40
-60
typ. values
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
0
100
P.E.P. (W)
200


7Z67523
double-tone efficiency
versus P.E.P.
η_{dt}
(%)
60
40
20
0
typ
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
0
100
P.E.P. (W)
200

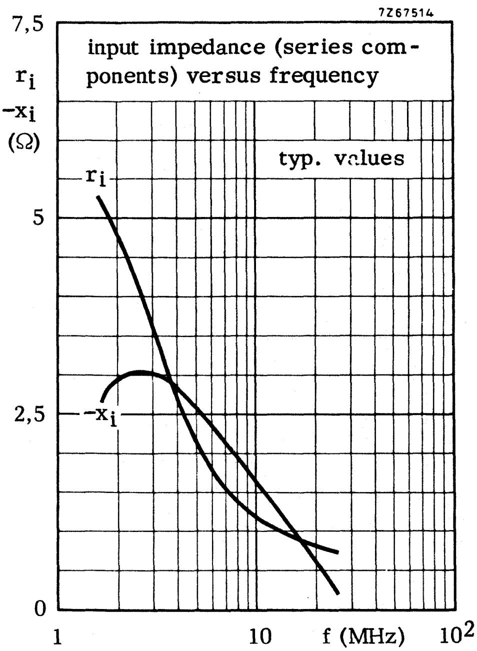


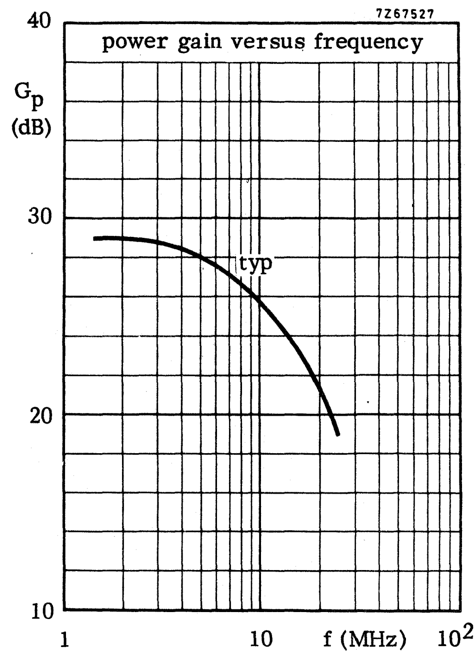


<u>S.S.B. class AB operation</u>

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 10,4 nH (in parallel with −267 pF)

The graphs hold for one transistor of a push-pull amplifier with cross neutralization; collector (Tr1) − base (Tr2), neutralizing capacitor: 82 pF.





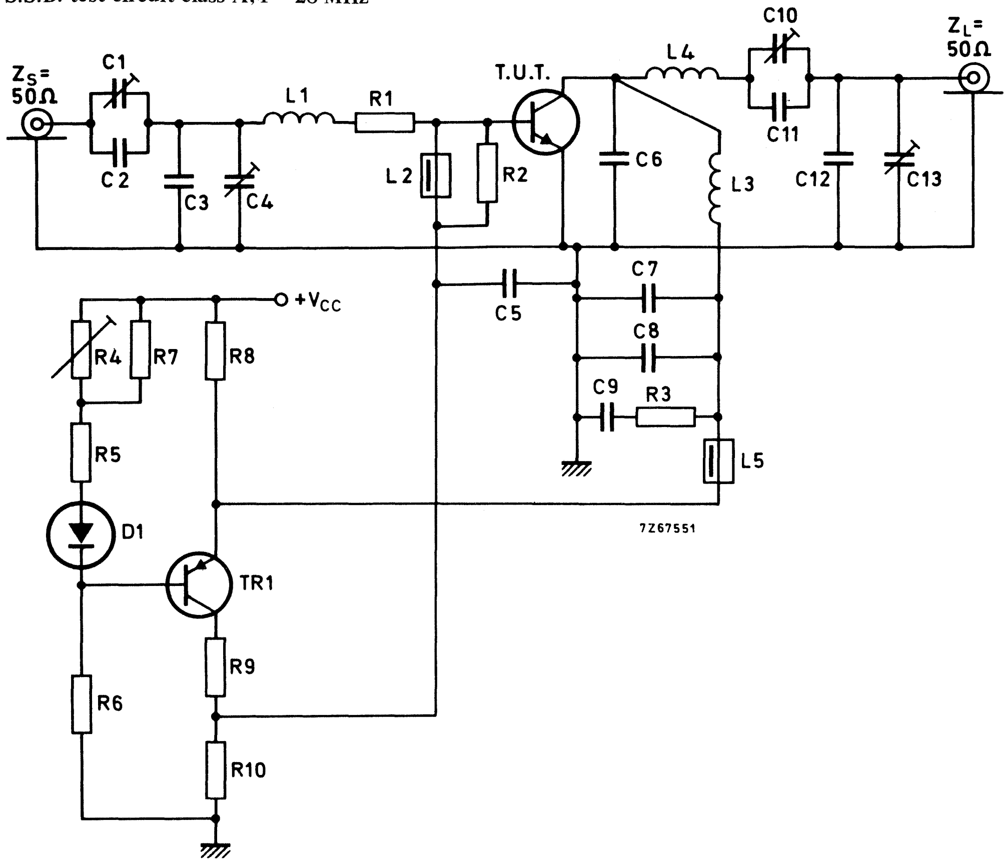
S.S.B. class AB operation

P_L = 150 W (PEP)
V_{CC} = 50 V
I_{CZS} = 100 mA
T_h = 25 °C
Z_L = 6,25 Ω in series with 7,3 nH (in parallel with −188 pF)

The graphs hold for an unneutralized amplifier.

APPLICATION INFORMATION (continued)

S.S.B. test circuit class-A; f = 28 MHz



List of components: (see also page 11)

D1 = BY206
TR1 = BD204

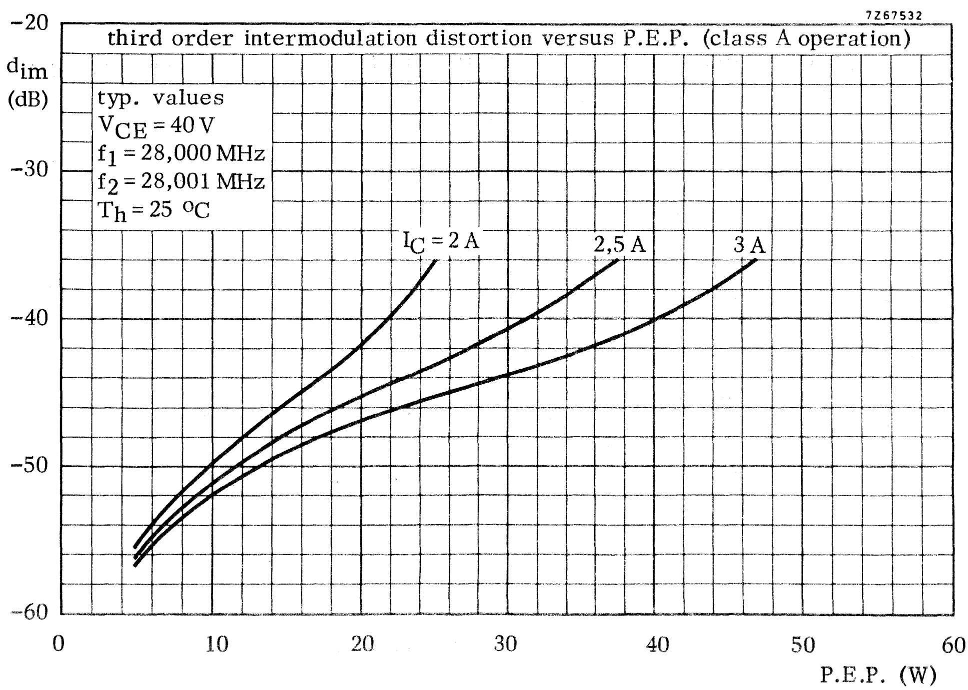
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36440)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 50 Ω wire-wound potentiometer (1 W)
R5 = 10 Ω carbon resistor (±5%; 1 W)
R6 = 560 Ω enamelled wire-wound resistor (5,5 W)
R7 = 270 Ω carbon resistor (±5%; 1 W)
R8 = 0,6 Ω parallel connection of 3 x 1,8 Ω wire-wound resistors (8 W each)
R9 = 90 Ω parallel connection of 3 x 270 Ω enamelled wire-wound resistor (5,5 W each)
R10 = 12 Ω carbon resistor (±5%; 1 W)



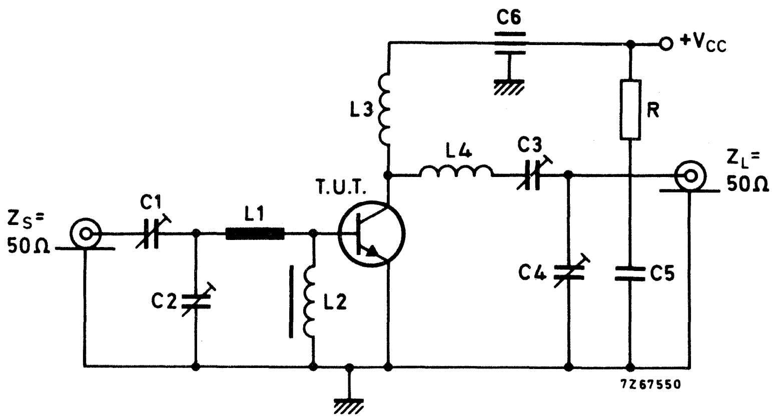
APPLICATION INFORMATION (continued)

R.F. performance in c.w. operation (class-B circuit)

V_{CE} = 50 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
70	< 15	150	< 4,6	> 10	> 65
108	typ. 27	150	typ. 4,0	typ. 7,4	typ. 75

Test circuit: 70 MHz; c.w. class-B.



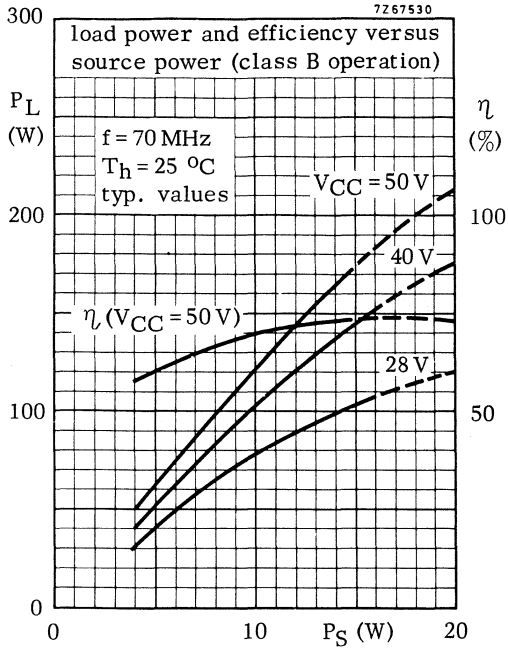
List of components:

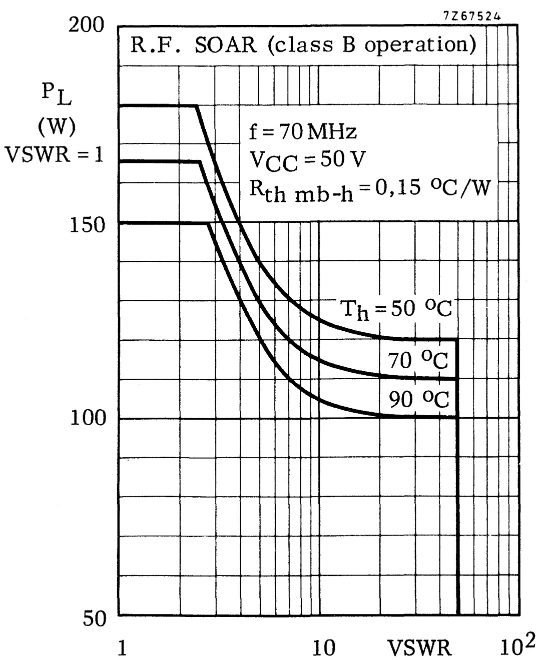
L1 = 60 mm straight enamelled Cu wire (1,6 mm); 9 mm above chassis
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 18 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2,5 mm; leads 50 mm totally

C1 = 4 to 29 pF concentric air trimmer in parallel with 10 pF ceramic capacitor
C2 = 4 to 104 pF film dielectric trimmer in parallel with 56 pF ceramic capacitor
C3 = 4 to 104 pF film dielectric trimmer
C4 = 4 to 104 pF film dielectric trimmer in parallel with 47 pF ceramic capacitor
C5 = 100 nF polyester capacitor (± 10%)
C6 = 1 nF ceramic feed-through capacitor

R = 10 Ω carbon resistor (0,5 W)

At P_L = 150 W and V_{CE} = 50 V, the output power at heatsink temperatures between 25 °C and 75 °C relative to that at 25 °C is diminished by 100 mW/K.



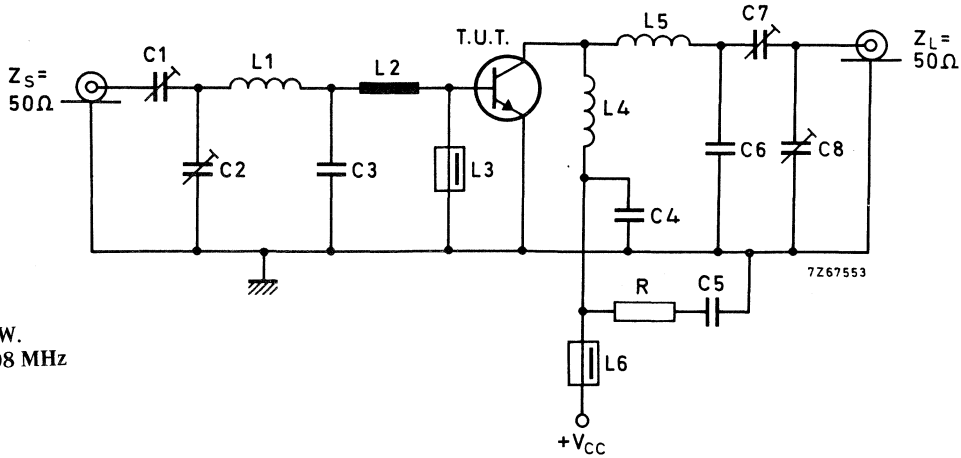


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 180 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 50 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit:



C.W.
108 MHz

List of components:

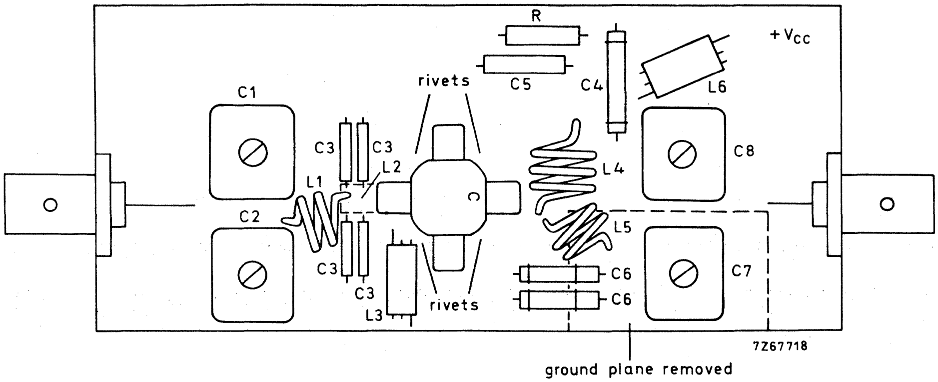
C1 = C2 = 40 pF film dielectric trimmer
C3 = 400 pF parallel connection of 4 x 100 pF ceramic capacitors
C4 = 270 pF ceramic capacitor
C5 = 100 nF polyester capacitor (±10%)
C6 = 20 pF parallel connection of 2 x 10 pF ceramic capacitors
C7 = C8 = 60 pF film dielectric trimmer

L1 = 49 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 9 mm; coil length 4,8 mm; leads 2 x 5 mm
L2 = strip-line (7,7 mm x 6 mm); tap for C3 is 7,5 mm from transistor edge
L3 = L6 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L4 = 67 nH; 3 turns enamelled Cu wire (1,5 mm); internal diameter 8 mm; coil length 8,3 mm; leads 2 x 5 mm
L5 = 57 nH; 2 turns enamelled Cu wire (1,5 mm); internal diameter 10 mm; coil length 4,5 mm; leads 2 x 5 mm

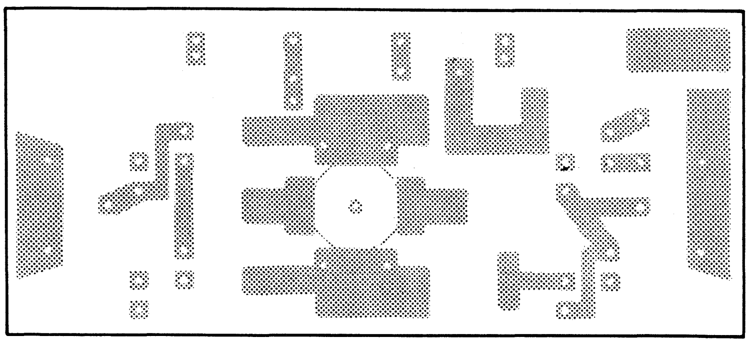
R = 10 Ω carbon resistor (0,5 W)

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 108 MHz test circuit.

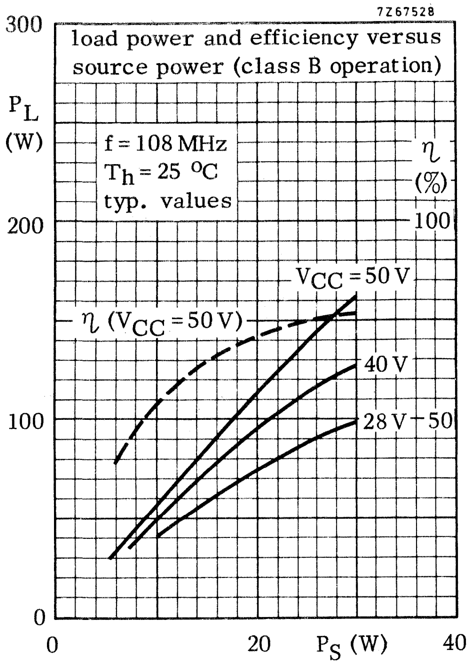


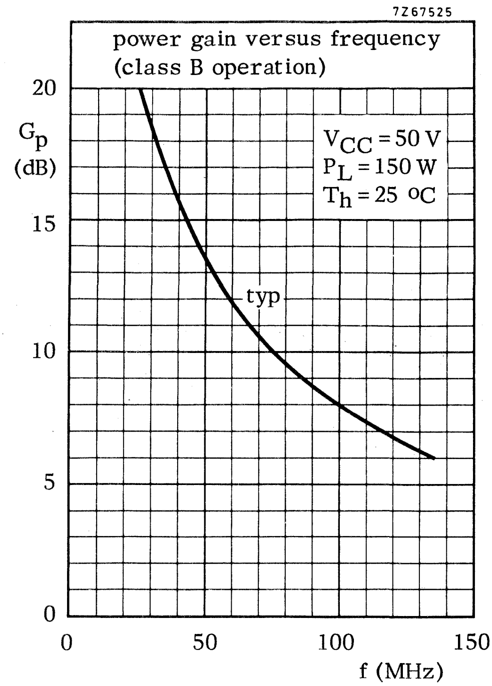
Dimensions of printed circuit board 123 mm x 55 mm.

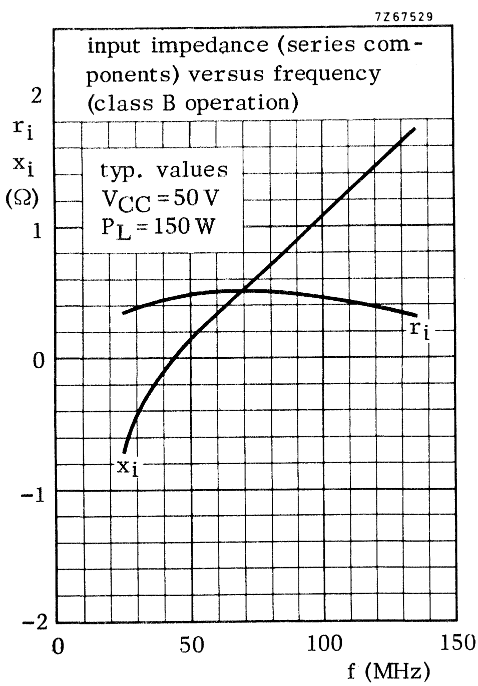


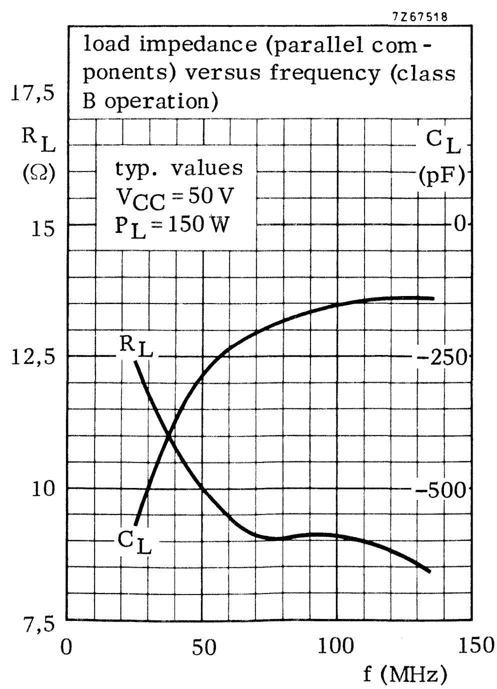
7Z67664

The circuit has been built on epoxy fibre-glass double copper clad printed circuit board (thickness 1/16"). To minimize the dielectric losses, the ground plane under the interconnection of L5, C6 and C7 has been removed.


7Z67528
load power and efficiency versus source power (class B operation)
P_L (W)
f = 108 MHz
T_h = 25 °C
typ. values
η (%)
V_{CC} = 50 V
η (V_{CC} = 50 V)
40 V
28 V
100
50
300
200
100
0
0
20
40
P_S (W)


7Z67525
power gain versus frequency (class B operation)
G_p (dB)
V_{CC} = 50 V
P_L = 150 W
T_h = 25 °C
typ
20
15
10
5
0
0
50
100
150
f (MHz)


7Z67529
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
typ. values
V_{CC} = 50 V
P_L = 150 W
r_i
x_i
2
1
0
−1
−2
0
50
100
150
f (MHz)


7Z67518
load impedance (parallel components) versus frequency (class B operation)
R_L (Ω)
C_L (pF)
typ. values
V_{CC} = 50 V
P_L = 150 W
R_L
C_L
17,5
15
12,5
10
7,5
0
−250
−500
0
50
100
150
f (MHz)

H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Matched h_{FE} groups are available on request.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

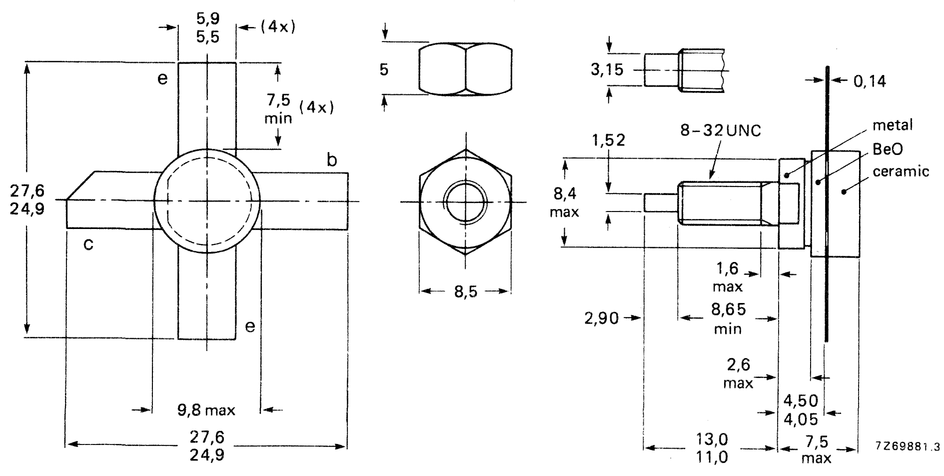
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\bar{z_i}$ Ω	$\overline{Y_L}$ mS	d_3 dB
c.w. (class-B)	**28**	**175**	**45**	> **7,5**	> **70**	**0,7 + j1,3**	**110 – j62**	–
s.s.b. (class-AB)	28	1,6–28	5–42,5(P.E.P)	typ. 19	typ. 50	–	–	typ. –30
s.s.b. (class-A)	26	1,6–28	15 (P.E.P)	typ. 20	–	–	–	typ. –42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65 V
Collector-emitter voltage (open base)	V_{CEO}	max.	36 V
Emitter-base voltage (open-collector)	V_{EBO}	max.	4 V
Collector current (average)	$I_{C(AV)}$	max.	4 A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	100 W
Storage temperature	T_{stg}	– 65 to + 150	°C
Operating junction temperature	T_j	max.	200 °C

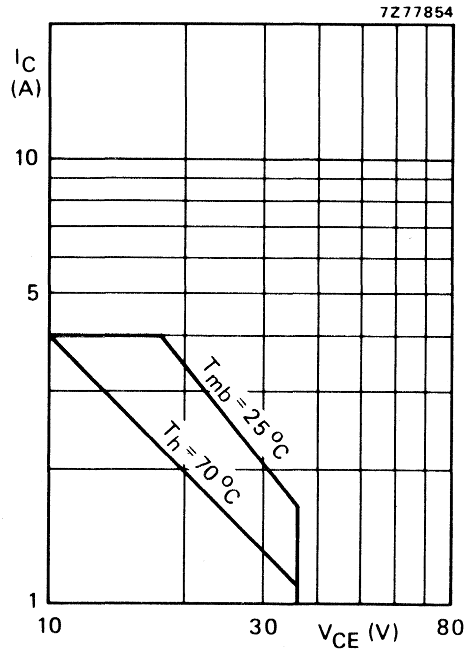


Fig. 2 D.C. SOAR.

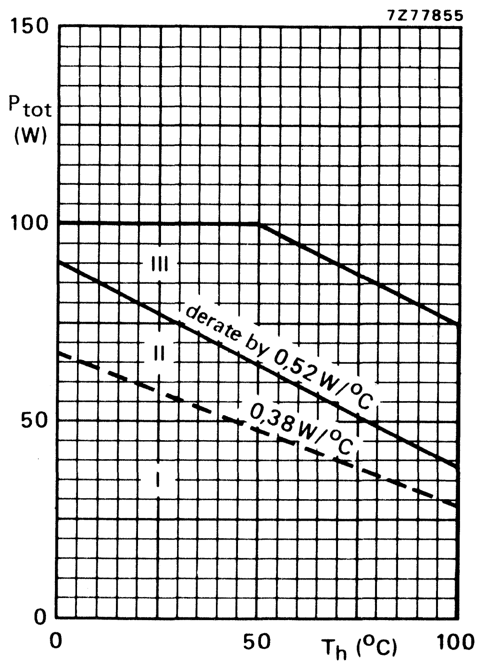


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 40 W; T_{mb} = 88 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	2,8 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,05 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 25 mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; I_C = 100 mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
R_{BE} = 10 Ω	E_{SBR}	>	8 mJ
D.C. current gain * I_C = 2,5 A; V_{CE} = 5 V	h_{FE}	typ.	45 10 to 80
D.C. current gain ratio of matched devices * I_C = 2,5 A; V_{CE} = 5 V	h_{FE1}/h_{FE2}	<	1,2
Collector-emitter saturation voltage * I_C = 7,5 A; I_B = 1,5 A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E$ = 2,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
$-I_E$ = 7,5 A; V_{CB} = 28 V	f_T	typ.	570 MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	82 pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 28 V	C_{re}	typ.	54 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

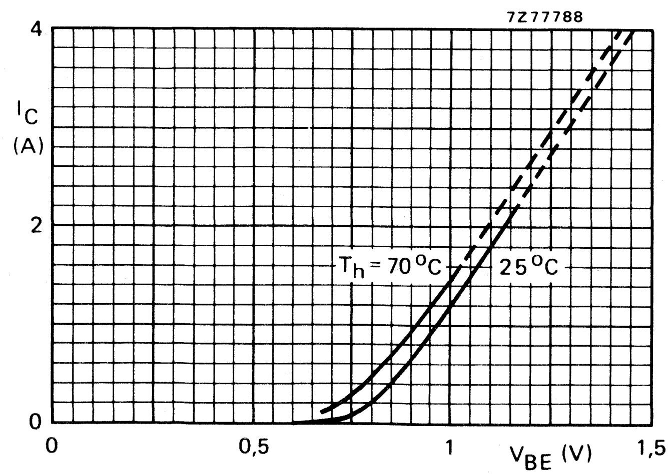


Fig. 4 Typical values; V_{CE} = 28 V.

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

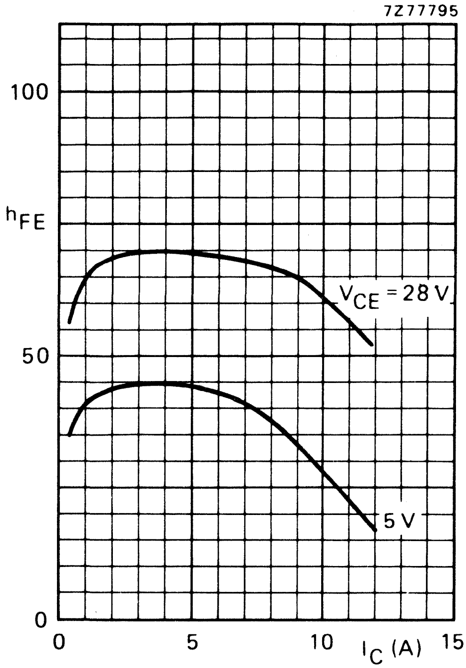


Fig. 5 Typical values; T_j = 25 °C.

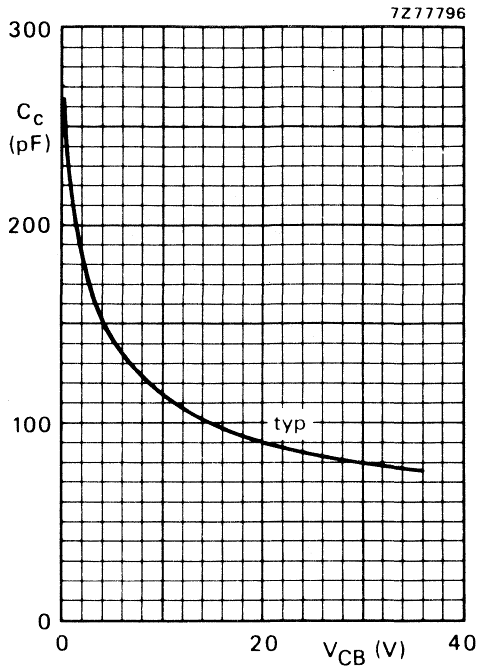


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

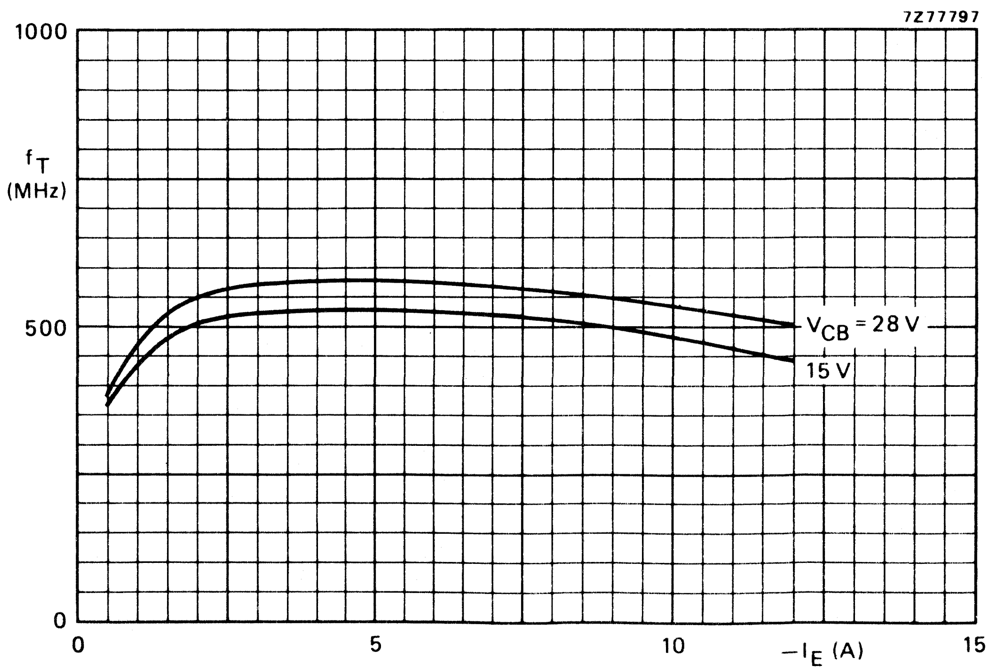


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	45	< 8	> 7,5	< 2,47	> 70	0,7 + j1,3	110 – j62

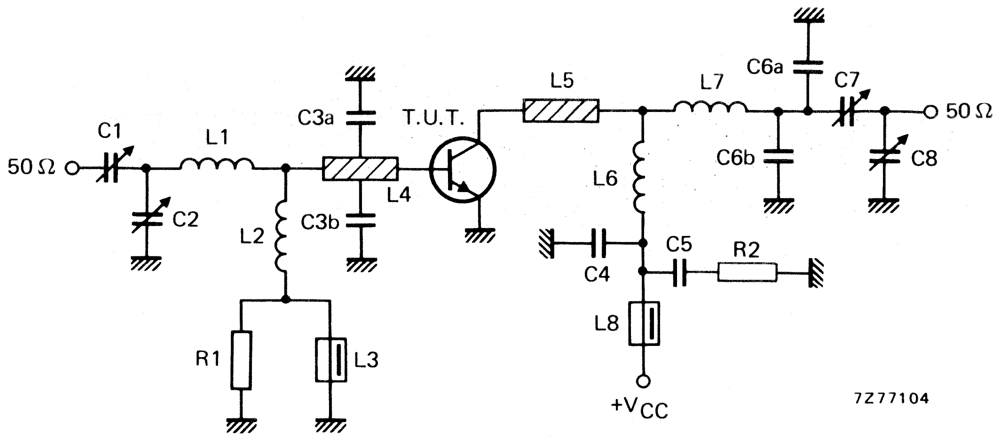


Fig. 8 Test circuit; c.w. class-B.

List of components:

C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor.

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 9.

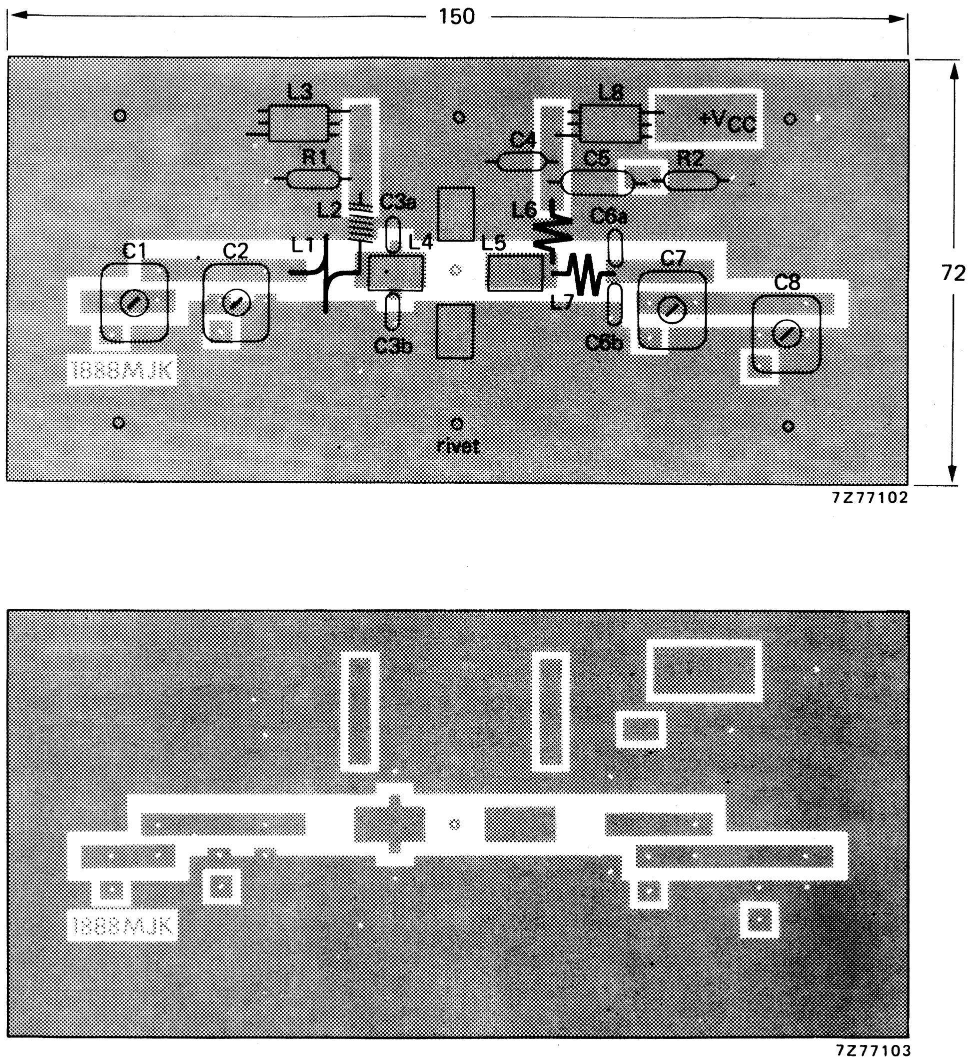


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

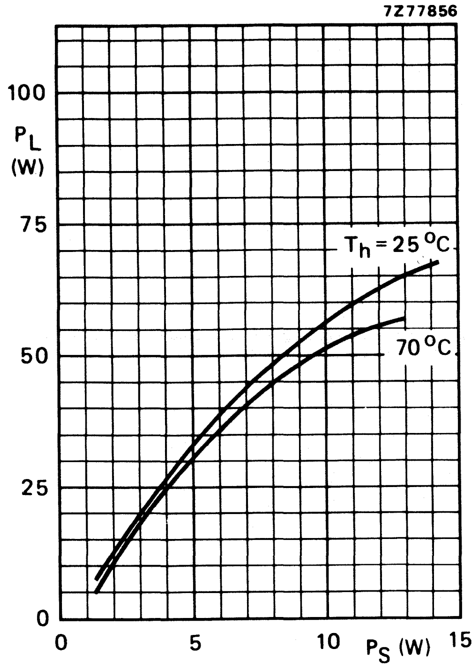


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

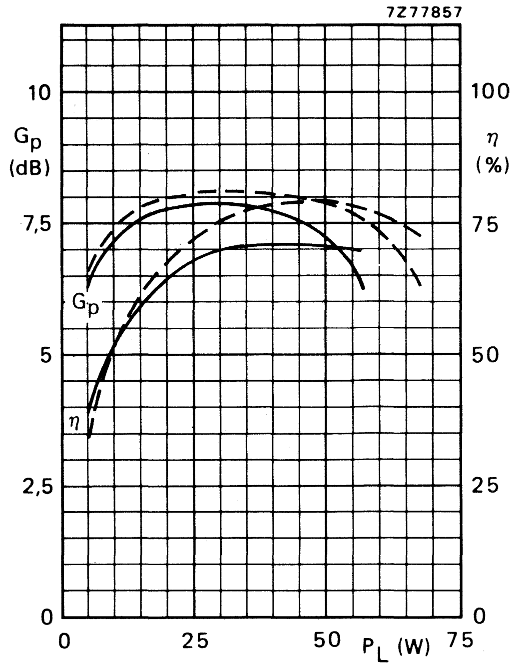


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz; — — — T_h = 25 °C; —— T_h = 70 °C.

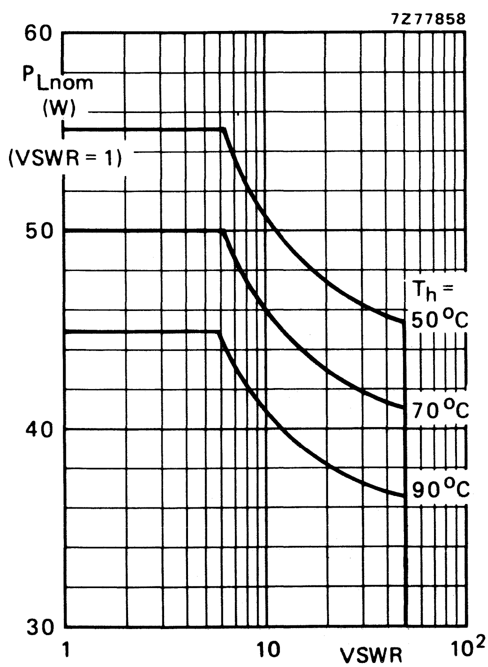


Fig. 12 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W .
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

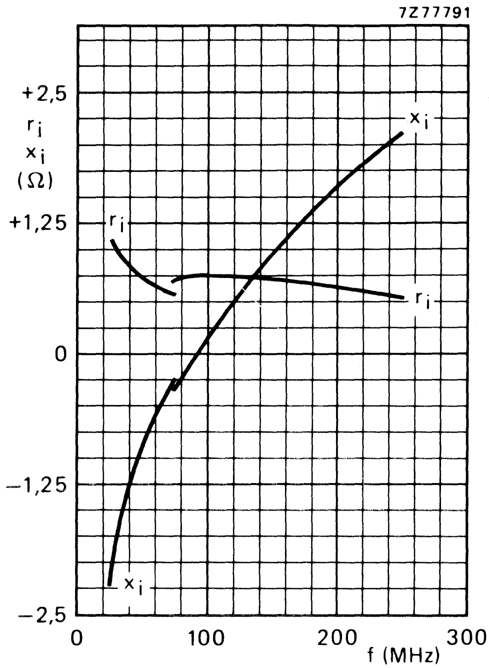


Fig. 13 Input impedance (series components).

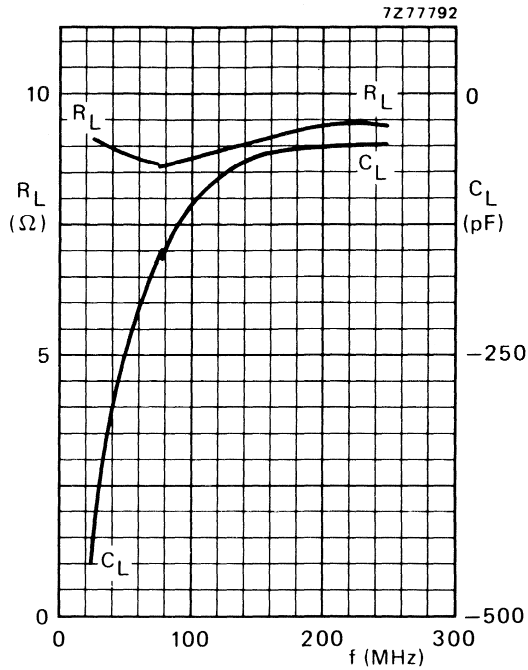


Fig. 14 Load impedance (parallel components).

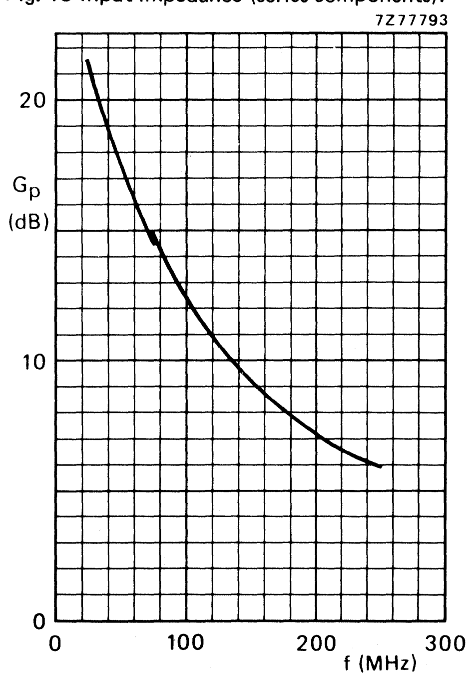


Fig. 15 Power gain versus frequency.

OPERATING NOTE

Below 75 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 13; 14 and 15.

Typical values; V_{CE} = 28 V; P_L = 45 W; T_h = 25 °C.

R.F. performance in s.s.b. class-AB operation (linear power amplifier)

V_{CE} = 28 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	η_{dt}(%) at 42,5 W (P.E.P)	I_C (A) at 42,5 W (P.E.P)	d_3 dB*	d_5 dB*	$I_{C(ZS)}$ mA	T_h °C
5 to 42,5(P.E.P)	typ. 19	typ. 50	typ. 1,52	typ. −30	< −30	50	25
5 to 37,5(P.E.P)	typ. 19	–	–	typ. −30	< −30	50	70

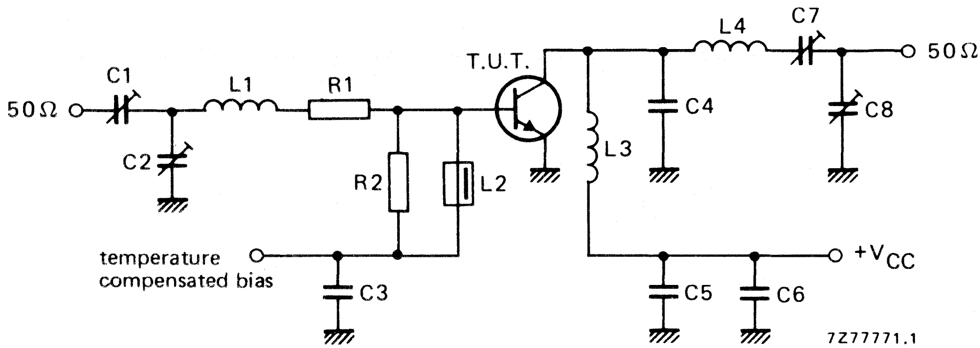


Fig. 16 Test circuit; s.s.b. class-AB.

List of components:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = C5 = C6 = 220 nF polyester capacitor
C4 = 56 pF ceramic capacitor (500 V)
C7 = C8 = 15 to 575 pF film dielectric capacitor

L1 = 4 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 7,0 mm; leads 2 x 5 mm
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 4 turns enamelled Cu wire (1,6 mm); int. dia. 10 mm; length 9,4 mm; leads 2 x 5 mm
L4 = 7 turns enamelled Cu wire (1,6 mm); int. dia. 12 mm; length 17,2 mm; leads 2 x 5 mm

R1 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors
R2 = 39 Ω carbon resistor

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

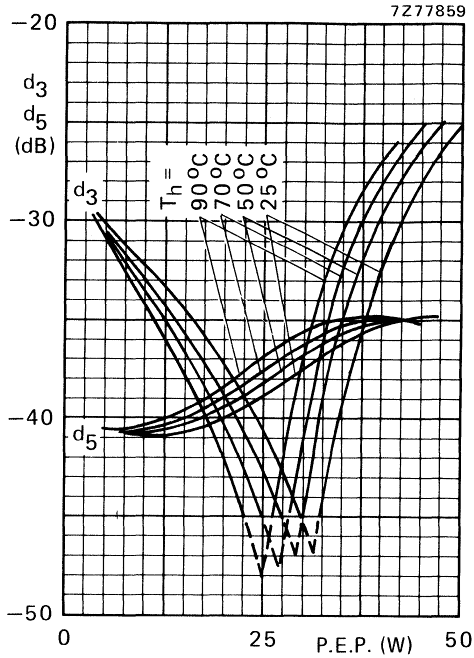


Fig. 17 Intermodulation distortion as a function of output power.*

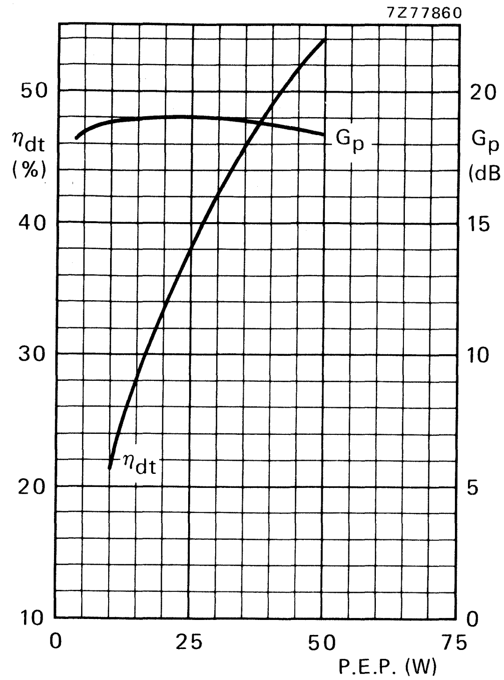


Fig. 18 Double-tone efficiency and power gain as a function of output power.

Conditions for Fig. 17:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; typical values.

Conditions for Fig. 18:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C; typical values.

* See note on previous page.

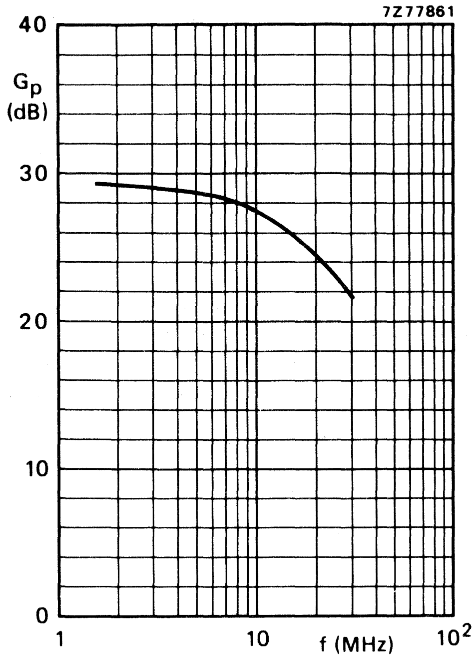


Fig. 19 Power gain as a function of frequency.

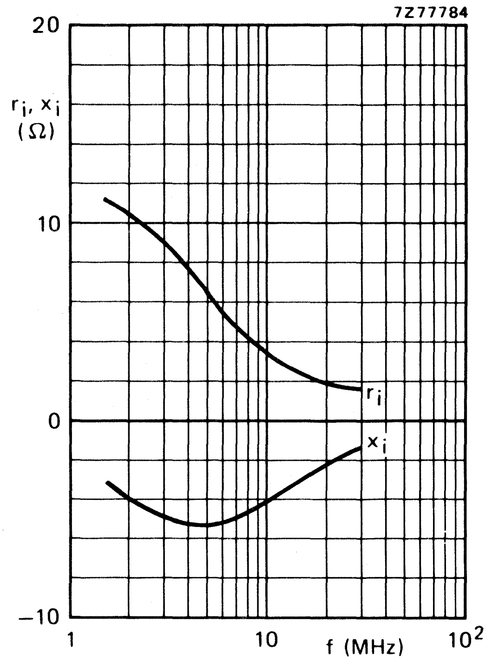


Fig. 20 Input impedance (series components) as a function of frequency.

Figs 19 and 20 are typical curves and hold for an unneutralized amplifier in s.s.b. class-AB operation.

Conditions:

V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; P_L = 42,5 W; T_h = 25 °C; Z_L = 7,4 Ω.

Ruggedness in s.s.b. operation

The BLX39 is capable of withstanding a load mismatch (VSWR = 50) under the following conditions:
Class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; T_h = 70 °C and P_{Lnom} = 45 W P.E.P.

R.F. performance in s.s.b. class-A operation (linear power amplifier)

V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz

output power W	G_p dB	I_C A	d_3 dB *	d_5 dB *
15 (P.E.P)	typ. 20	1,55	typ. −42	< −40

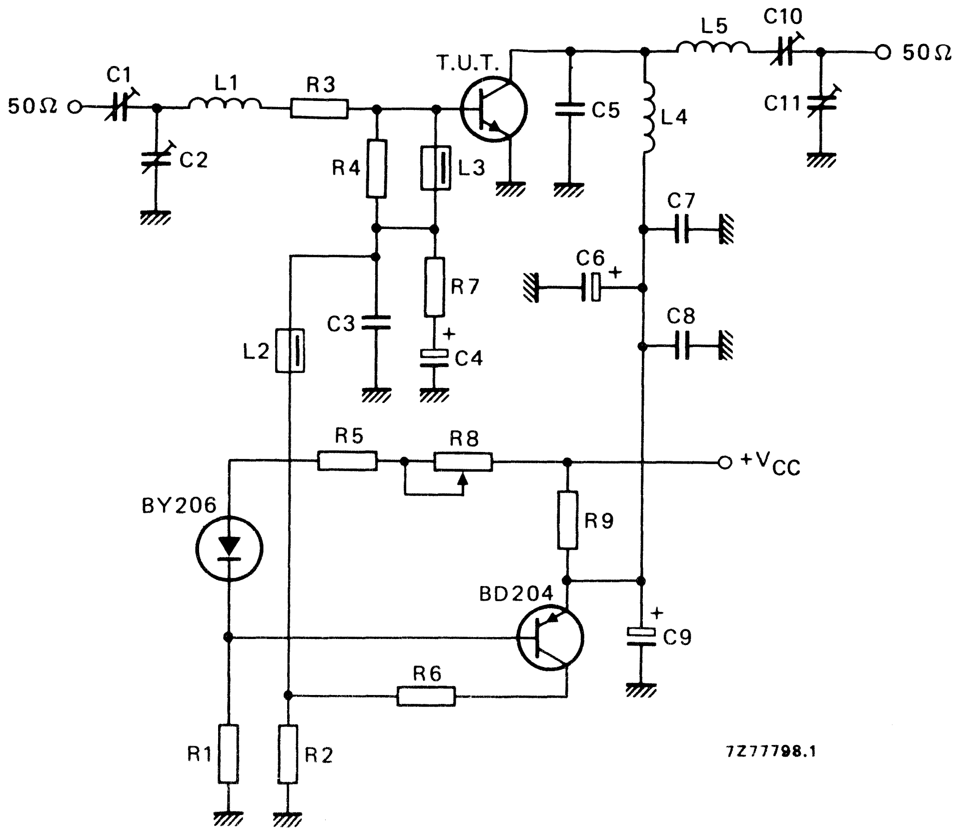


Fig. 21 Test circuit; s.s.b. class-A.

* Stated intermodulation distortion figures are referred to the according level of either of the equal amplified tones. Relative to the according peak envelope powers these figures should be increased by 6 dB.

List of components in Fig. 21:

C1 = C2 = 10 to 780 pF film dielectric trimmer
C3 = 22 nF ceramic capacitor (63 V)
C4 = 47 μF/10 V electrolytic capacitor
C5 = 56 pF ceramic capacitor (500 V)
C6 = 47 μF/35 V electrolytic capacitor
C7 = C8 = 220 nF polyester capacitor
C9 = 10 μF/35 V electrolytic capacitor
C10 = 10 to 210 pF film dielectric trimmer
C11 = 15 to 575 pF film dielectric trimmer

L1 = 3 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 11 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm
L5 = 14 turns closely wound enamelled Cu wire (1,6 mm); int. dia. 11,0 mm

R1 = 600 Ω; parallel connection of 2 x 1,2 kΩ carbon resistors (± 5% ; 0,5 W each)
R2 = 15 Ω carbon resistor (± 5% ; 0,25 W)
R3 = 1,2 Ω; parallel connection of 4 x 4,7 Ω carbon resistors (± 5% ; 0,125 W each)
R4 = 33 Ω carbon resistor (± 5% ; 0,25 W)
R5 = 18 Ω carbon resistor (± 5% ; 0,25 W)
R6 = 120 Ω wirewound resistor (± 5% ; 5,5 W)
R7 = 1 Ω carbon resistor (± 5% ; 0,125 W)
R8 = 47 Ω wirewound potentiometer (3 W)
R9 = 1,57 Ω; parallel connection of 3 x 4,7 Ω wirewound resistors (± 5% ; 5,5 W each)

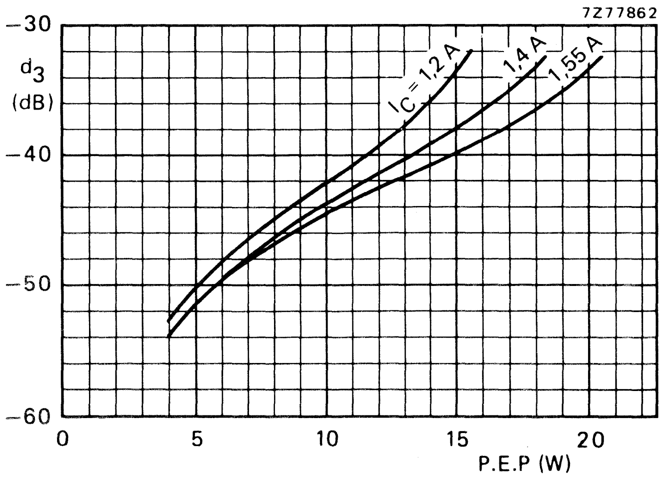


Fig. 22 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

U.H.F./V.H.F. TRANSMITTING TRANSISTOR

N-P-N transistor intended for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V. It has a TO-39 metal envelope with the collector connected to the case.

QUICK REFERENCE DATA

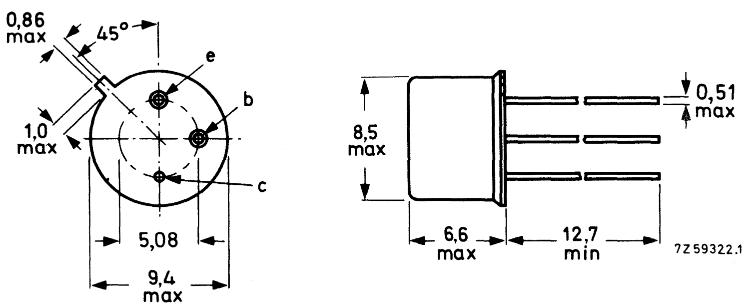
R.F. performance up to T_{case} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,8	470	typ. 0,4	2,0	typ. 0,22	typ. 7	typ. 66	5 + j11	17 − j19
c.w.	12,5	470	< 0,5	2,0	< 0,25	> 6	> 65	–	–
c.w.	12,5	175	typ. 0,12	2,0	typ. 0,21	typ. 12	typ. 75	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A
Total power dissipation up to T_{case} = 90 °C f > 10 MHz	P_{tot}	max.	3.0	W
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max	165	°C

THERMAL RESISTANCE

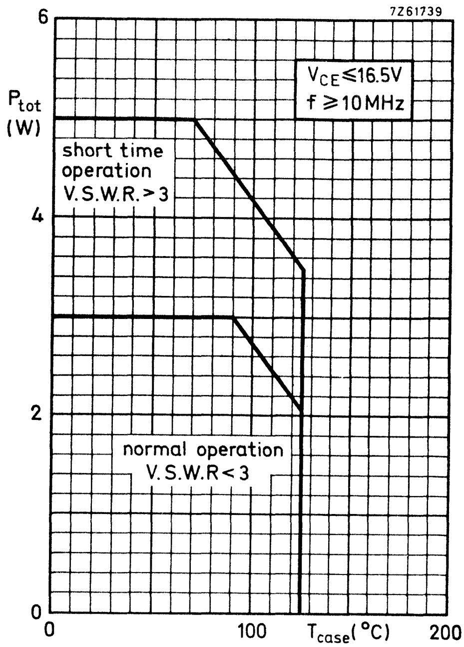
From junction to case	$R_{th\ j-c}$	=	25	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	2.5	K/W

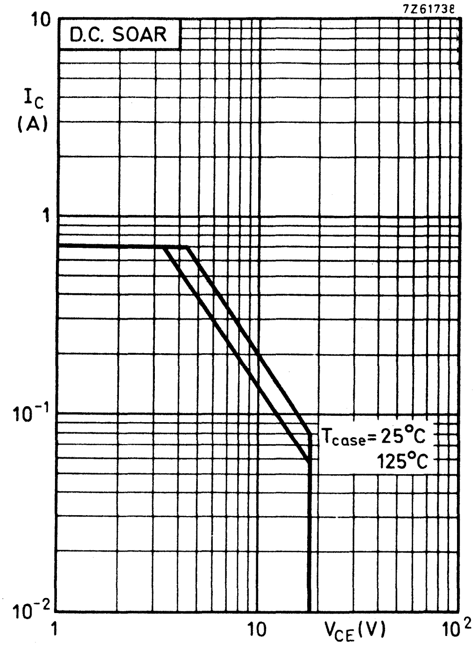
CHARACTERISTICS

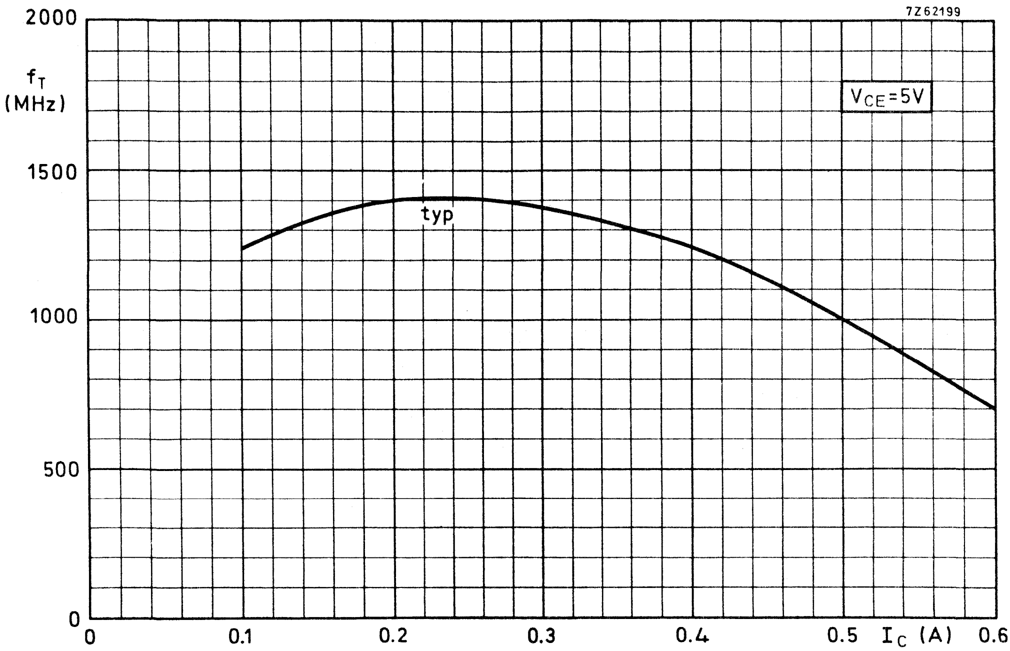
T_j = 25 °C unless otherwise specified

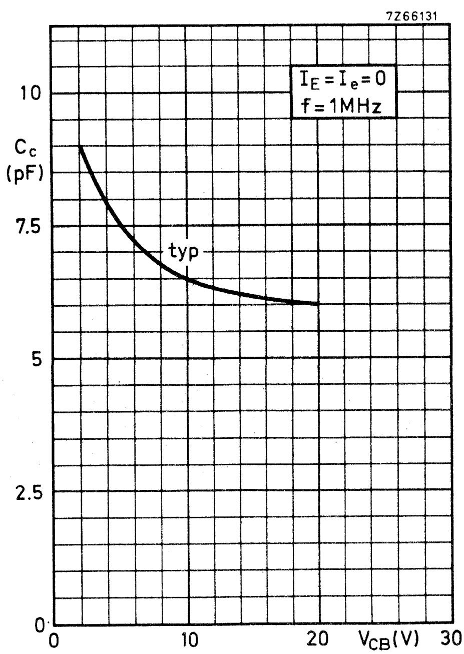
Breakdown voltages

Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1.0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0.1	V
D.C. current gain I_C = 100 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency I_C = 200 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ. <	6.5 9.0	pF pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 10 V	$-C_{re}$	typ.	4.8	pF


7Z61739
P_{tot} (W)
$V_{CE} \leq 16.5V$
$f \geq 10MHz$
short time operation V.S.W.R. > 3
normal operation V.S.W.R < 3
T_{case} (°C)
0
2
4
6
0
100
200


7Z61738
D.C. SOAR
I_C (A)
T_{case} = 25°C
125°C
V_{CE} (V)
10
1
10^{-1}
10^{-2}
1
10
10^2


7Z62199
2000
f_T
(MHz)
1500
1000
500
0
V_{CE}=5V
typ
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6


7Z66131
10
C_c
(pF)
7.5
5
2.5
0
$I_E = I_e = 0$
f = 1MHz
typ
0
10
20
V_{CB}(V)
30

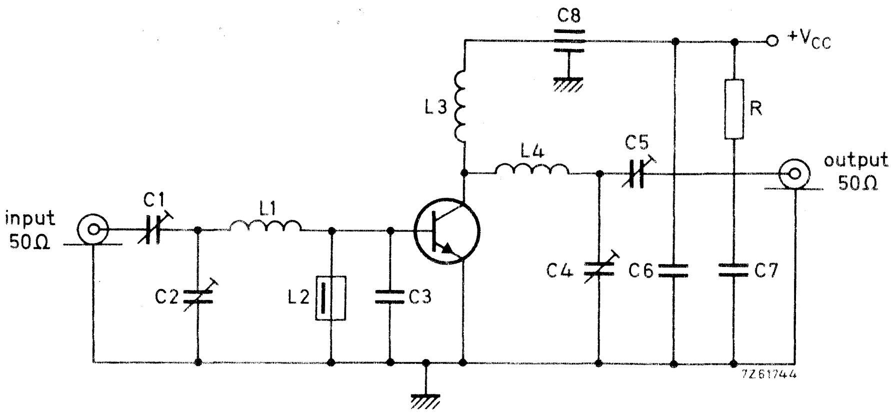
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_{case} up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ mS
470	13.8	typ. 0.4	2.0	typ. 0.22	typ. 7	typ. 66	5 + j11	17 − j19
470	12.5	< 0.5	2.0	< 0.25	> 6	> 65	–	–
175	12.5	typ. 0.12	2.0	typ. 0.21	typ. 12	typ. 75	–	–

Test circuit I (470 Mhz)



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 22 pF disc ceramic capacitor
C6 = 10 nF ceramic capacitor
C7 = 0.1 μF polyester capacitor
C8 = 4 nF feed-through capacitor

L1 = 1 turn Cu wire (1 mm); int. diam. 5 mm, max. lead length 1 mm
L2 = 0.22 μH choke
L3 = 1 turn Cu wire (1 mm); int. diam. 7 mm; lead length 2 mm
L4 = 1 turn Cu wire (1 mm); int. diam. 5 mm; lead length 2 mm

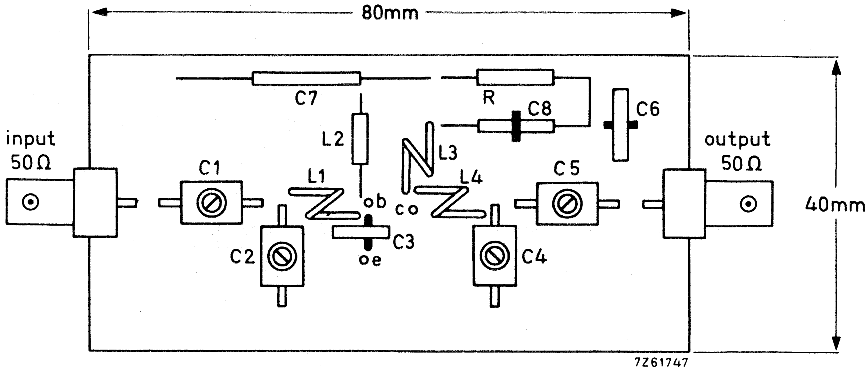
R = 10 Ω carbon

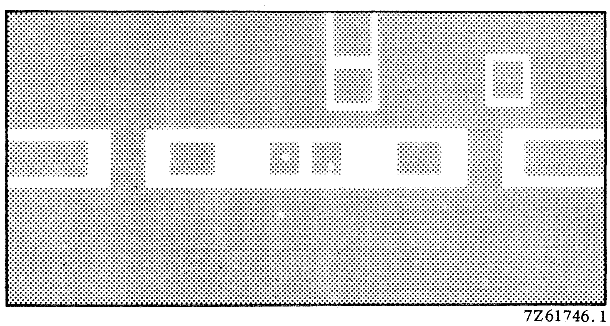
At P_L = 2.0 W and V_{CC} = 12.5 V the output power at case temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_{case} = 70 °C
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 1.4 W transistor output into 50 Ω load at V_{CC} = 13.8 V.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

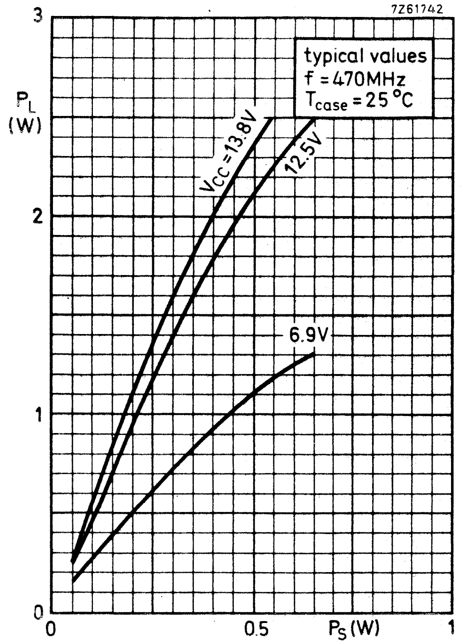


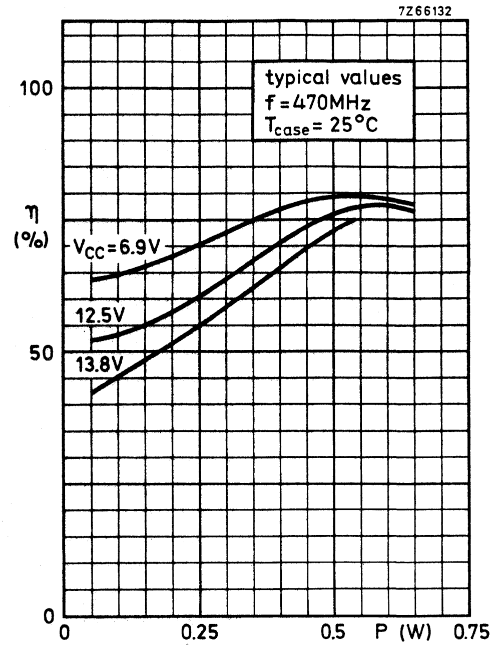


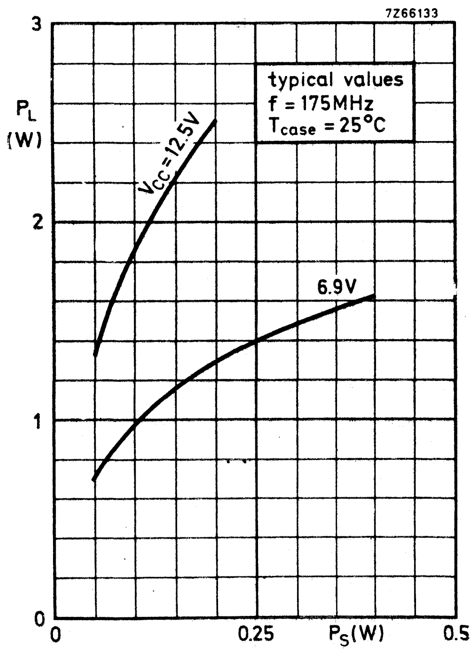
Shaded area copper

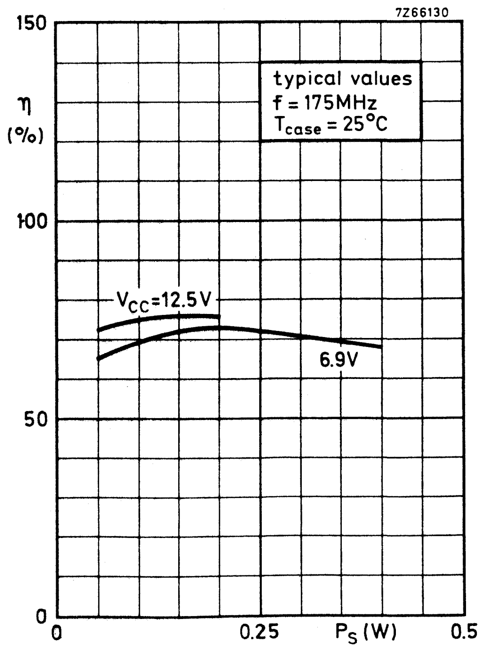
Back area not metalized

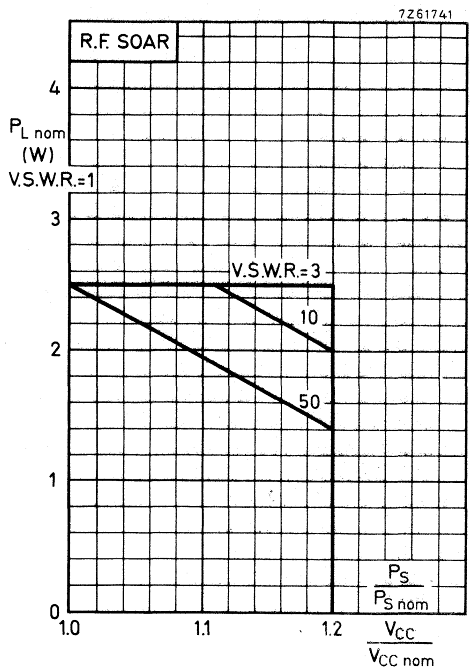
Material of printed circuit board: 1.5 mm epoxy fibre-glass


7Z61742
typical values
f = 470MHz
T_{case} = 25 °C
P_L (W)
V_{CC} = 13.8V
12.5V
6.9V
P_S (W)
0
0.5
1
2
3


7Z66132
typical values
f = 470MHz
T_{case} = 25 °C
η (%)
V_{CC} = 6.9V
12.5V
13.8V
P (W)
0
0.25
0.5
0.75
50
100


7Z66133
typical values
f = 175MHz
T_{case} = 25 °C
P_L (W)
V_{CC} = 12.5V
6.9V
P_S (W)
0
0.25
0.5
1
2
3


7Z66130
typical values
f = 175MHz
T_{case} = 25 °C
η (%)
V_{CC} = 12.5V
6.9V
P_S (W)
0
0.25
0.5
50
100
150



Conditions for R.F. SOAR

f = 470 MHz

T_{case} = 70 °C

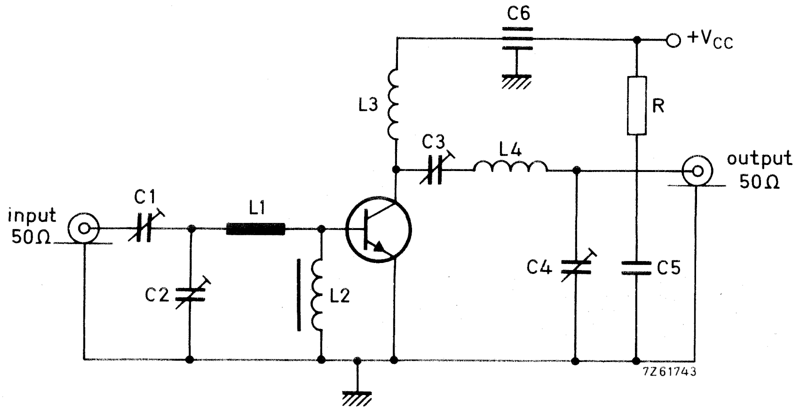
V_{CCnom} = 13.8 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in test circuit I.
Supply voltage was varied from V_{CCnom} to 1.2 V_{CCnom}, and V.S.W.R. from 1 to 50.
It shows the maximum allowable output power under nominal conditions in order not to exceed the maximum allowable power dissipation under conditions of supply overvoltage ($V_{CC} > V_{CCnom}$) and load mismatch (V.S.W.R. > 1).
It assumed that the drive power increases linearly with the supply voltage; i.e.
$P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

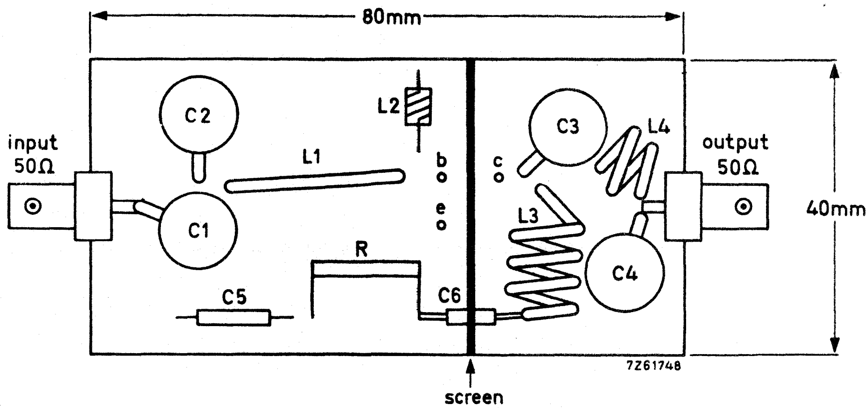
C1 = C4 = 60 pF concentric air trimmer
C2 = C3 = 30 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

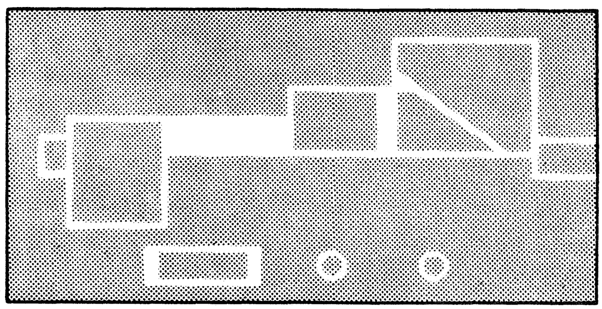
L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm, material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

R = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed cicuit board for 175 MHz test circuit:





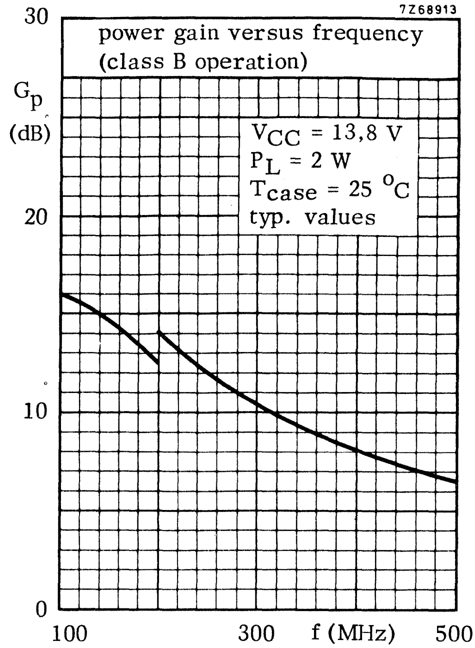
7Z61745.1

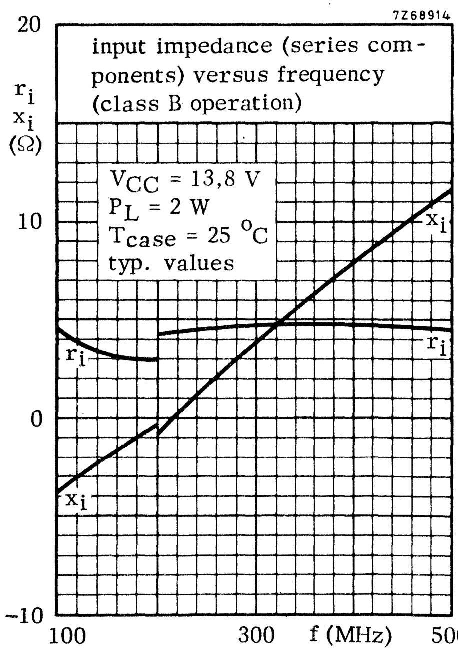
Shaded area copper

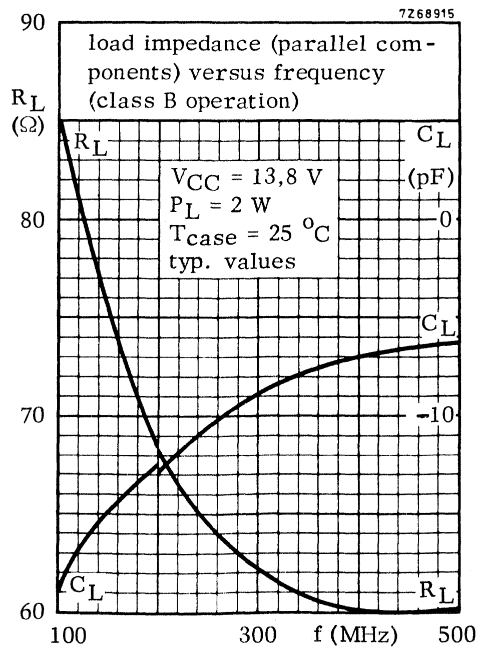
Back area not metallized

Material of printed circuit board: 1.5 mm epoxy fibre-glass

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F./U.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors in TO-39 envelope designed for use in portable and mobile radio transmitters in the v.h.f. and u.h.f. bands.

QUICK REFERENCE DATA

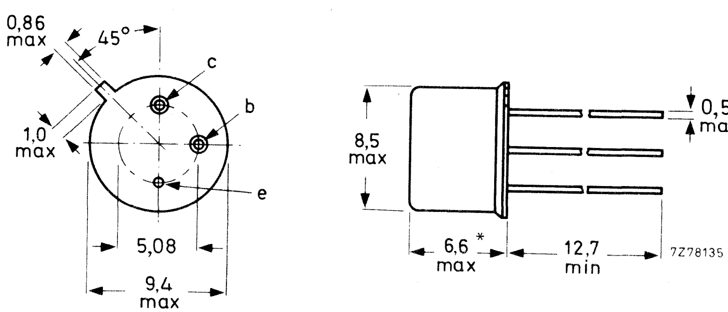
R.F. performance at T_c = 25 °C in a common-emitter class-B circuit.

mode of oepration	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
C.W.; narrow band	12,5	175	2	typ. 16	typ. 68
	12,5	470	2	≥ 9	≥ 55

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39/3.
Emitter connected
to case.



* Max. 4,9 for BLX65ES.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36 V
Collector emitter voltage (open base)	V_{CEO}	max.	16 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current d.c. or average	I_C	max.	0,7 A
(peak value); f ≥ 1 MHz	I_{CM}	max.	2,0 A
Total power dissipation at T_{mb} ≤ 90 °C; f ≥ 1 MHz	P_{tot}	max.	3,0 W
Storage temperature	T_{stg}	−65 to + 175 °C	

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 10 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 25 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; + I_E = 1,0 mA	$V_{(BR)EBO}$	>	4 V
Collector-emitter saturation voltage I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1 V
D.C. current gain I_C = 100 mA; V_{CE} = 5 V	h_{FE}	>	10
		typ.	40
Transition frequency at f = 500 MHz $-I_E$ = 200 mA; V_{CB} = 5 V	f_T	typ.	1,4 GHz
Collector capacitance at f = 1 MHz $I_E = i_e = 0$; V_{CB} = 10 V	C_c	typ.	6,5 pF

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class B); T_c = 25 °C

V_{CE} V	f MHz	P_L W	G_p dB	η_C %	Z_i Ω	Z_L Ω
9,6	175	2,0	typ. 13	typ. 68	—	—
12,5	175	2,0	typ. 16	typ. 68	—	—
12,5	470	2,0	⩾ 9	> 55	3 + j8	12 − j17
12,5	470	2,0	typ. 10,6	typ. 68	—	—

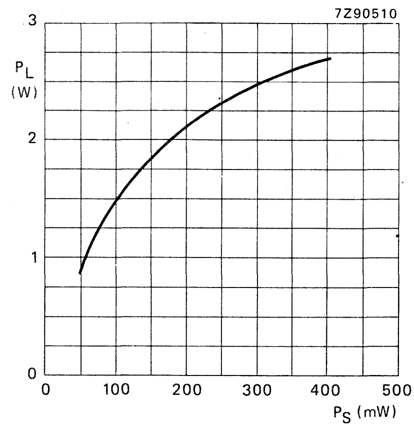


Fig. 2 Load power vs. source power; V_{CE} = 12,5 V; f = 470 MHz; T_{mb} = 25 °C; class-B operation; typical values.

RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases)at rated load power up to a supply voltage of 15,0 V, P_S + 20%, f = 470 MHz and T_{mb} = 25 °C.

U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

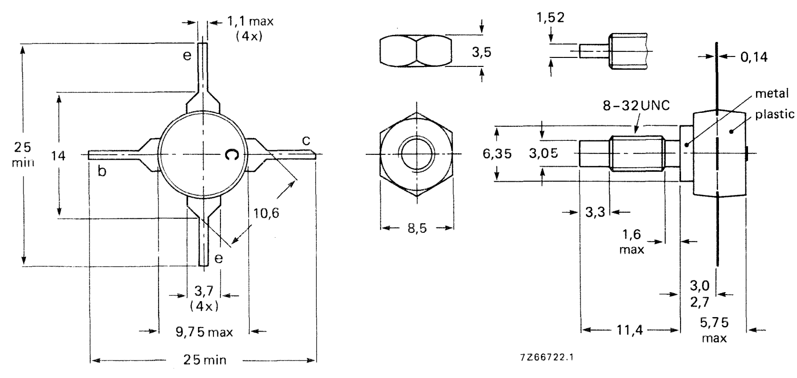
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,8	470	typ. 0,15	1,5	typ. 0,17	typ. 10	typ. 65	–	–
c.w.	13,8	470	typ. 0,35	3,0	typ. 0,28	typ. 9,3	typ. 79	2,9 + j5,1	27 – j21
c.w.	12,5	470	< 0,35	2,5	< 0,31	> 8,5	> 65	–	–
c.w.	12,5	175	typ. 0,03	3,0	typ. 0,29	typ. 20	typ. 84	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0.7	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.0	A
Total power dissipation up to T_h = 90 °C f > 10 MHz	P_{tot}	max.	4.5	W
Storage temperature	T_{stg}	−65 to	+150	°C
Junction temperature	T_j	max.	150	°C

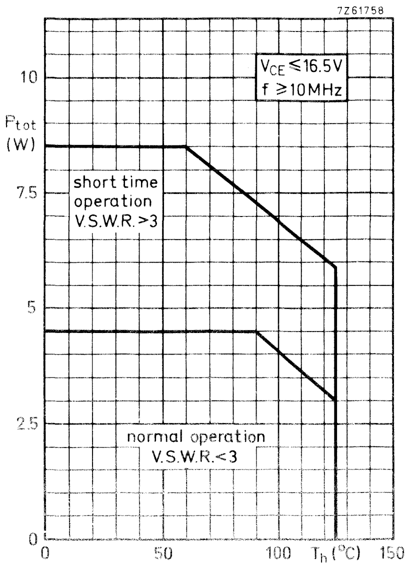
THERMAL RESISTANCE

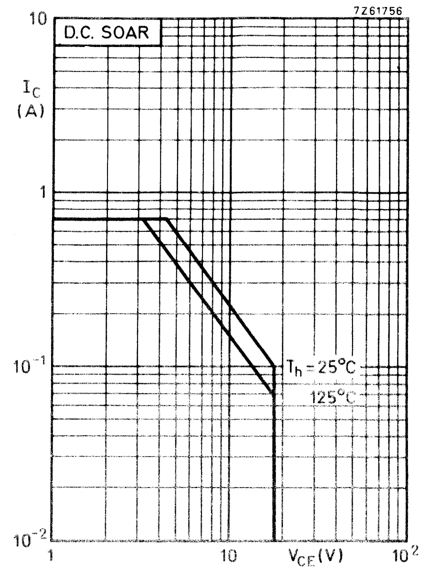
From junction to mounting base	$R_{th\ j-mb}$ =	12	K/W
From mounting base to heatsink	$R_{th\ mb-h}$ =	0.6	K/W

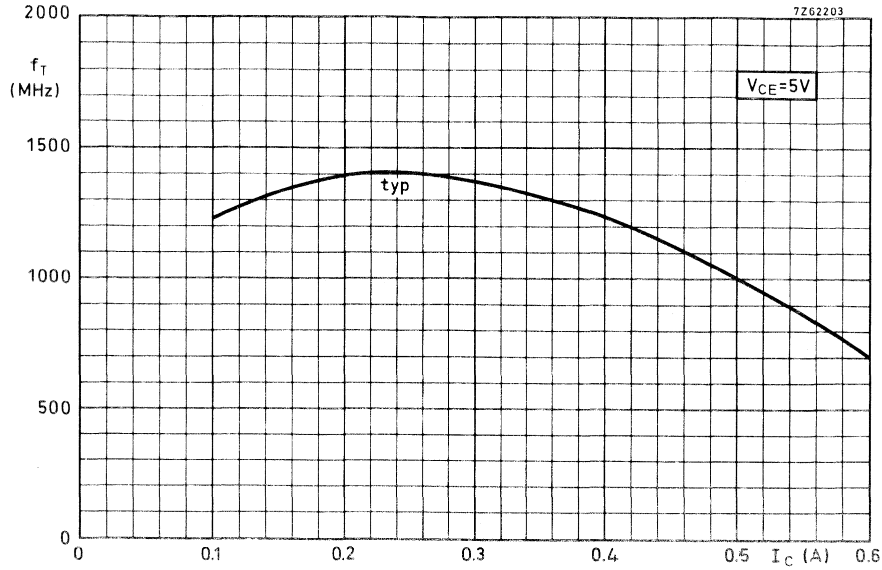
CHARACTERISTICS

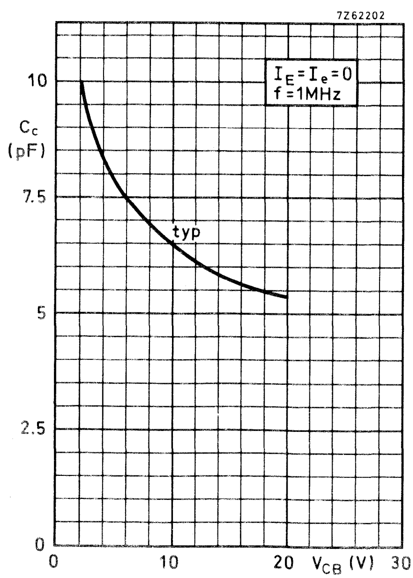
T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,1	V
D.C. current gain I_C = 100 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency I_C = 0,2 A; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1400	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ. <	6,5 9,0	pF pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z61758
Ptot (W)
10
7.5
5
2.5
0
VCE ≤16.5V
f ≥10MHz
short time operation V.S.W.R.>3
normal operation V.S.W.R.<3
0
50
100
Th (°C)
150


7Z61756
D.C. SOAR
IC (A)
10
1
10⁻¹
10⁻²
Th = 25°C
125°C
1
10
VCE (V)
10²


7Z62203
2000
f_T
(MHz)
1500
1000
500
0
0
0.1
0.2
0.3
0.4
0.5
I_C (A)
0.6
V_{CE}=5V
typ


7Z62202
10
C_c
(pF)
7.5
5
2.5
0
0
10
20
V_{CB} (V)
30
$I_E=I_e=0$
f =1MHz
typ

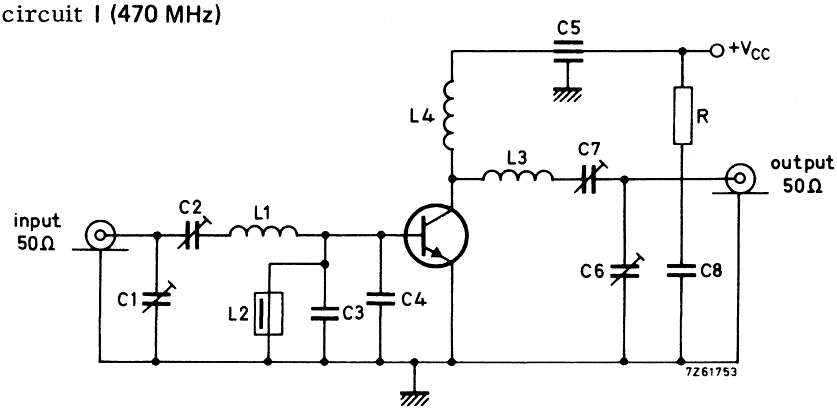
APPLICATION INFORMATION T_j = 25 °C unless otherwise specified

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mS)
470	13.8	typ. 0.15	1.5	typ. 0.17	typ. 10	typ. 65	-	-
470	13.8	typ. 0.35	3.0	typ. 0.28	typ. 9.3	typ. 79	2.9 + j5.1	27 − j21
470	12.5	< 0.35	2.5	< 0.31	> 8.5	> 65	-	-
175	12.5	typ. 0.03	3.0	typ. 0.29	typ. 20	typ. 84	-	-

Test circuit I (470 MHz)



C1 = C2 = C6 = C7 = 1.8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 4 nF feed-through capacitor
C8 = 0.1 μF polyester capacitor

L1 = 1 turn Cu wire (1.2 mm); int. diam. 6 mm; max. lead length 1 mm
L2 = 1 μH choke
L3 = 30 mm straight Cu wire (2 mm); height above print 2 mm
L4 = 2 turns closely wound Cu wire (0.5 mm); int. diam. 3 mm; max. lead length 8 mm

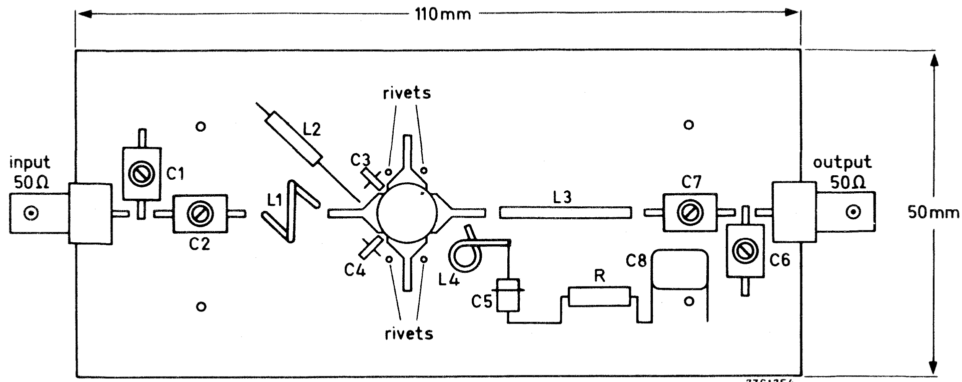
R = 10 Ω carbon

At P_L = 2.5 W and V_{CC} = 12.5 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mW/K

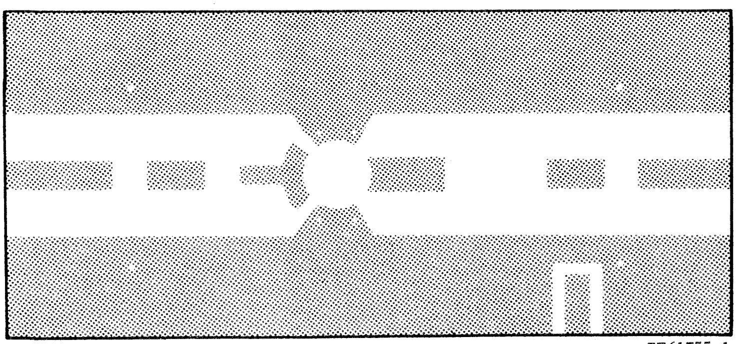
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 2.5 W transistor output into 50 Ω load and V_{CC} = 13.8 V

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.

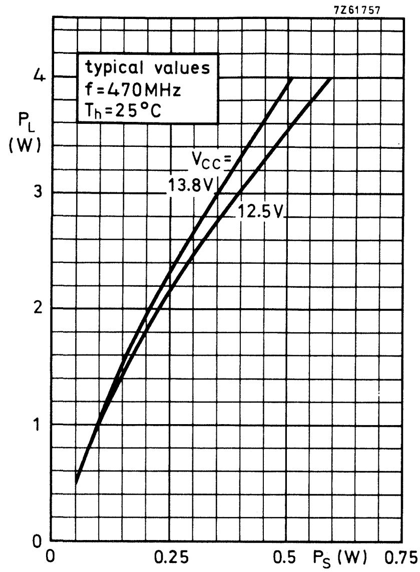


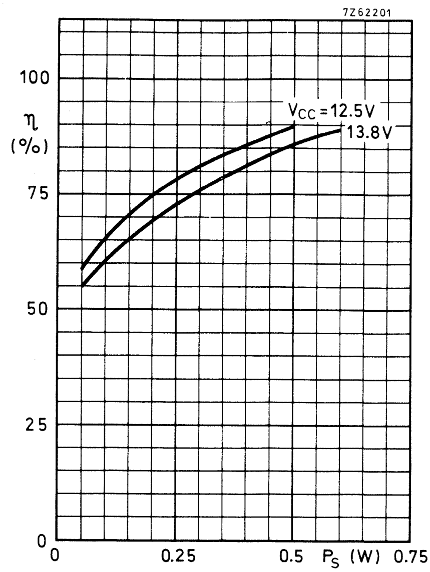
7Z61754

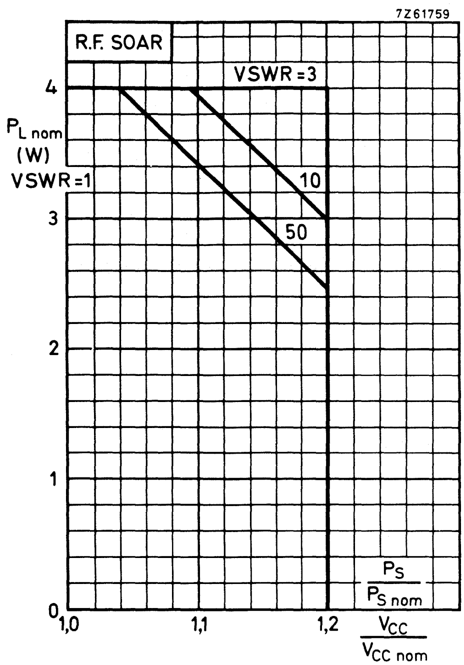


7Z61755.1

Shaded area copper
Back area completely copper clad.
Material of printed circuit board: 1,5 mm epoxy fibre glass.


7Z61757
typical values
f = 470 MHz
Th = 25 °C
PL
(W)
VCC =
13.8 V
12.5 V
4
3
2
1
0
0
0.25
0.5
PS (W)
0.75


7Z62201
η
(%)
VCC = 12.5 V
13.8 V
100
75
50
25
0
0
0.25
0.5
PS (W)
0.75



Conditions for R.F. SOAR

f = 470 MHz

T_h = 70 °C

V_{CCnom} = 13,8 V

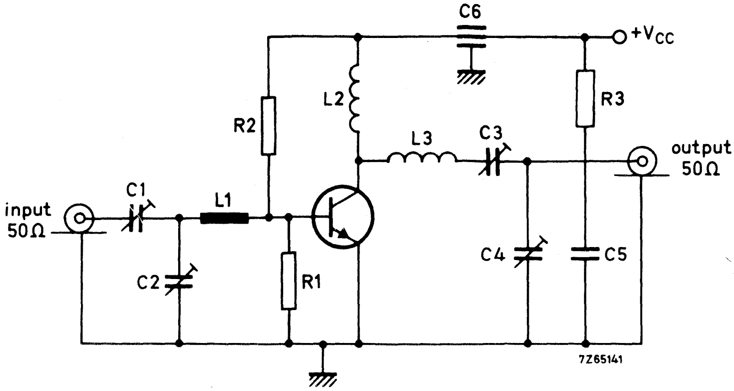
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

$R_{th\ mb-h}$ = 0,6 K/W

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in test circuit I.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases **linearly** with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)



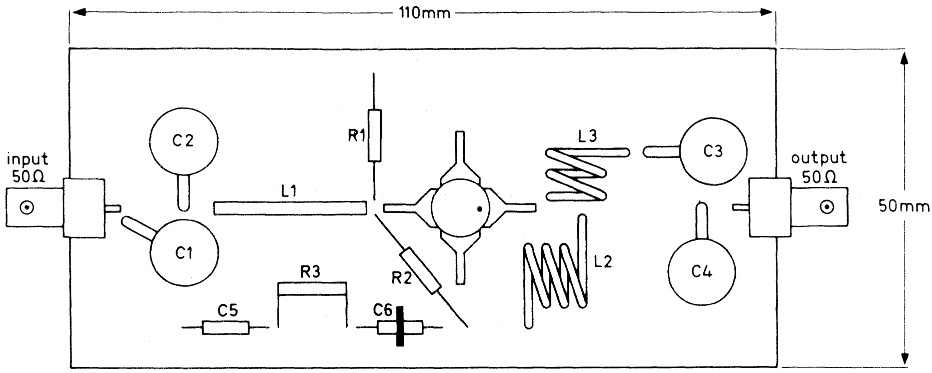
C1 = C3 = C4= 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF ceramic capacitor
C6 = 4 nF polyester capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print max. 3 mm
L2 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L3 = 2 turns closely wound Cu wire (1.7 mm); int. diam. 12 mm; lead length 5 mm

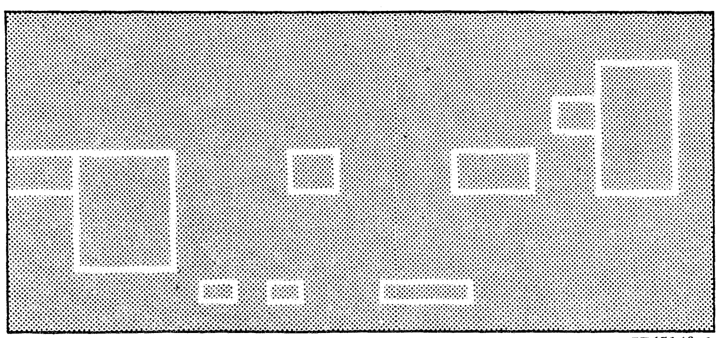
R1 = 50 Ω carbon
R2 = 1.2 kΩ carbon
R3 = 5 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175MHz test circuit.

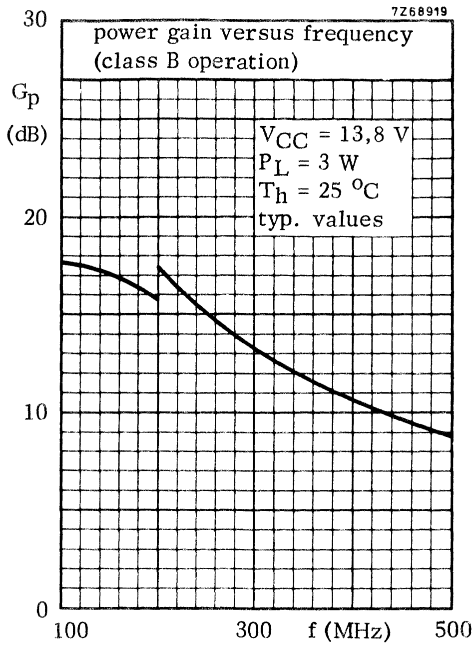


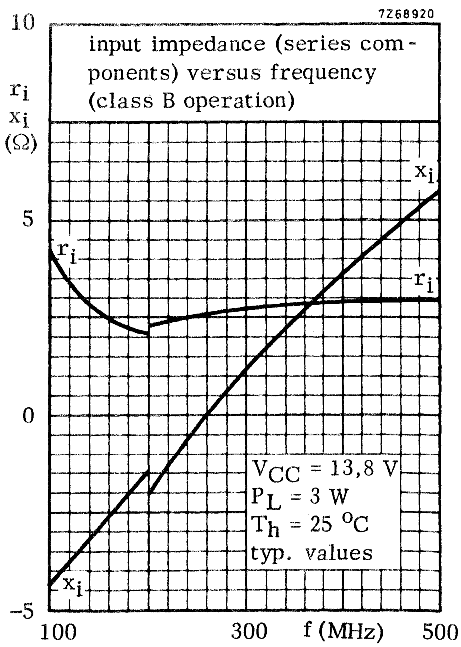
Shaded area copper
Back area not metalized
Material of pcb : 1.5 mm epoxy fibre glass

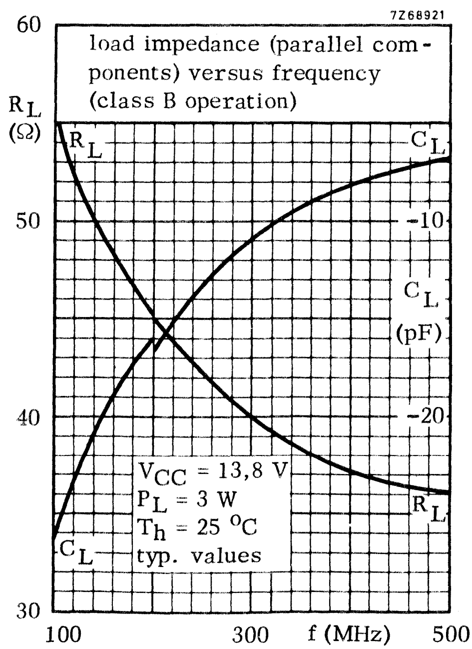


7Z65143.1

OPERATING NOTE Below 200 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F./V.H.F. POWER TRANSISTOR

N-P-N silicon transistor for use in class-B and C operated mobile, industrial and military transmitters with a supply voltage of 13,8 V.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

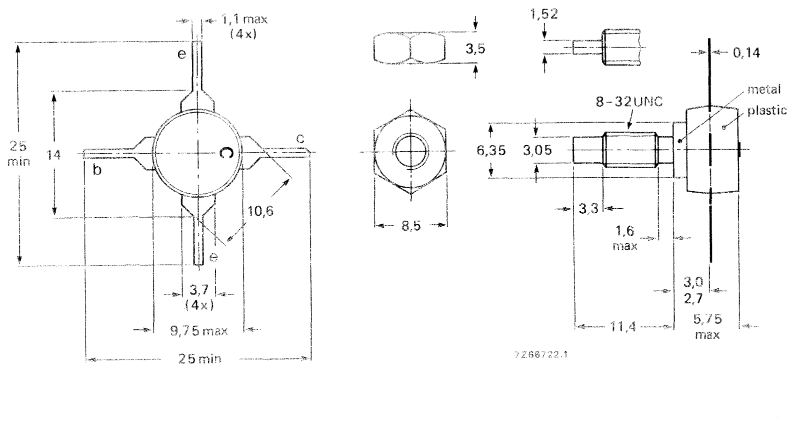
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,8	470	< 2,0	7,0	< 0,78	> 5,4	> 65	–	–
c.w.	13,8	470	typ. 2,0	7,8	typ. 0,81	typ. 5,9	typ. 70	2,4 + j6,7	60 – j20
c.w.	12,5	470	< 2,2	7,0	< 0,86	> 5,0	> 65	–	–
c.w.	12,5	175	typ. 0,4	7,2	typ. 0,87	typ.12,6	typ. 66	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (R_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1.0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.0	A
Total power dissipation up to T_h = 70 °C f > 10 MHz	P_{tot}	max.	10	W
Storage temperature	T_{stg}	−65 to +150		°C
Junction temperature	T_j	max.	150	°C

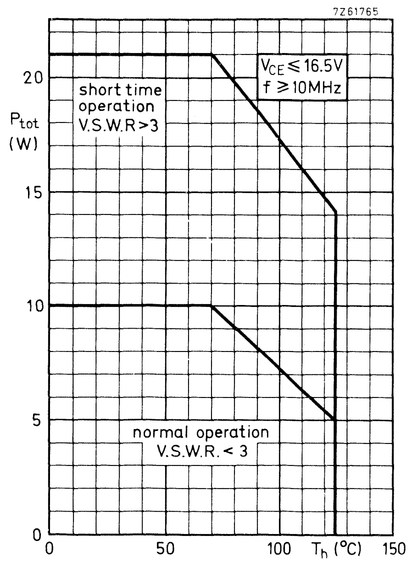
THERMAL RESISTANCE

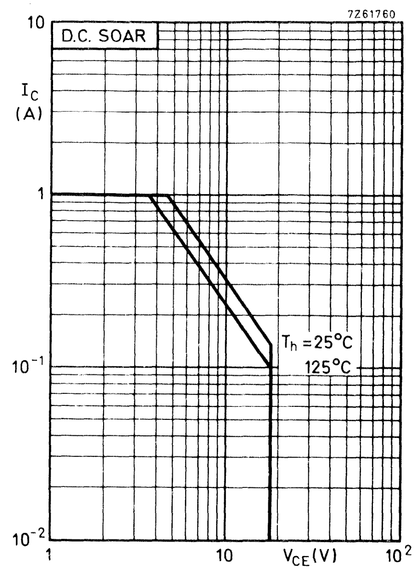
From junction to mounting base	$R_{th\ j-mb}$	=	7.0	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	K/W

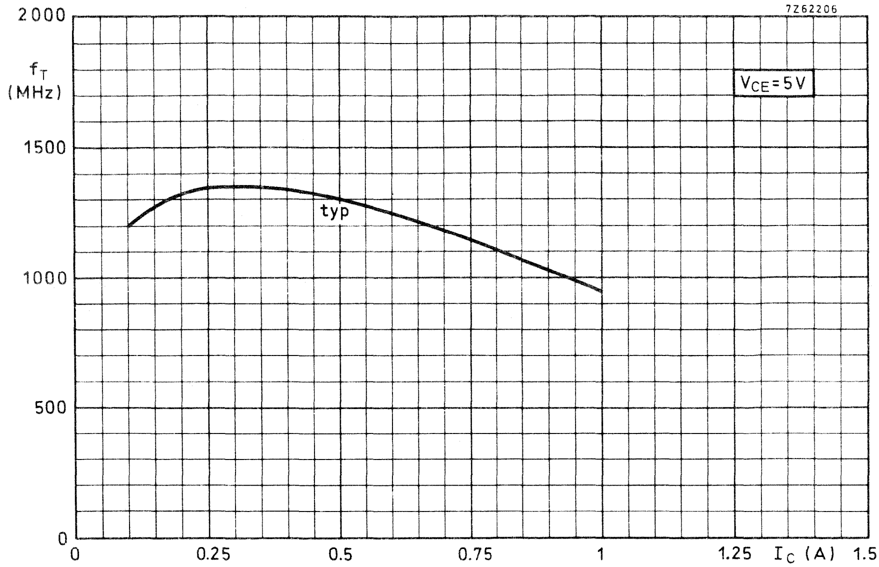
CHARACTERISTICS

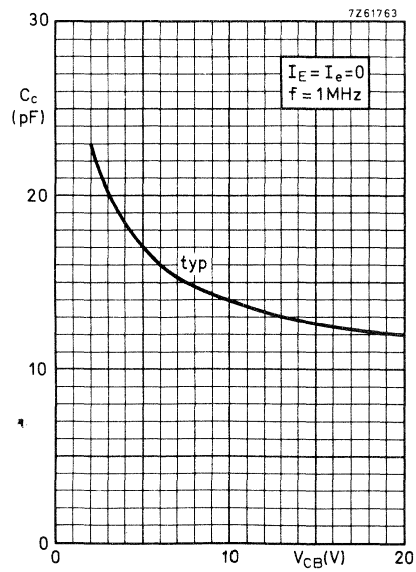
T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 1.0 mA	$V_{(BR)EBO}$	>	4	V
Collector-emitter saturation voltage I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0.2	V
D.C. current gain I_C = 500 mA; V_{CE} = 5 V	h_{FE}	> typ.	10 40	
Transition frequency I_C = 500 mA; V_{CE} = 5 V; f = 500 MHz	f_T	typ.	1300	MHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ. <	14 20	pF pF
Emitter capacitance at f = 1 MHz I_C = I_c = 0; V_{EB} = 0	C_e	typ.	65	pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 10 V	C_{re}	typ.	10.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z61765
$V_{CE} \leqslant 16.5V$
$f \geqslant 10MHz$
short time
operation
V.S.W.R>3
P_{tot}
(W)
normal operation
V.S.W.R. < 3
T_h (°C)
0
5
10
15
20
0
50
100
150


7Z61760
D.C. SOAR
I_C
(A)
T_h = 25°C
125°C
V_{CE} (V)
10
1
10^{-1}
10^{-2}
1
10
10^2


7Z62206
2000
1500
1000
500
0
f_T (MHz)
$V_{CE} = 5 V$
typ
0
0.25
0.5
0.75
1
1.25
I_C (A)
1.5


7Z61763
30
20
10
0
C_c (pF)
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB}(V)
20

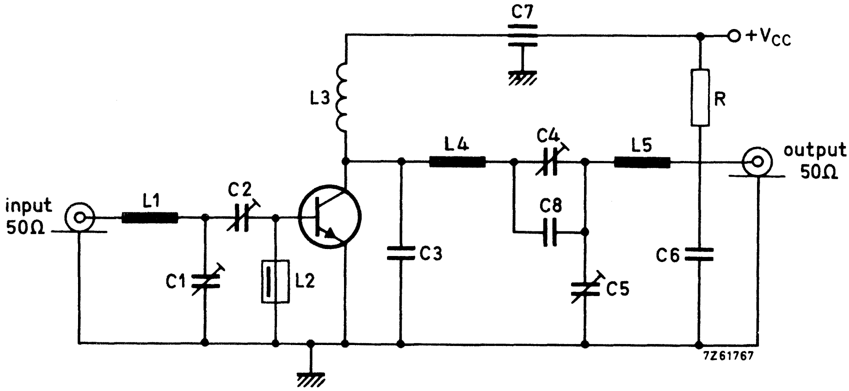
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class B circuit)

T_h up to 25 °C

f (MHz)	V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
470	13.8	< 2.0	7.0	< 0.78	> 5.4	> 65	–	–
470	13.8	typ. 2.0	7.8	typ. 0.81	typ. 5.9	typ. 70	2.4+j6.7	60 – j20
470	12.5	< 2.2	7.0	< 0.86	> 5.0	> 65	–	–
175	12.5	typ. 0.4	7.2	typ. 0.87	typ. 12.6	typ. 66	–	–

Test circuit I (470 MHz)



C1 = C2 = C4 = C5 = 1.8 to 18 pF film dielectric trimmer
C3 = 6.8 pF ceramic capacitor
C6 = 0.1 µF polyester capacitor
C7 = 4 nF feed-through capacitor
C8 = 10 pF ceramic capacitor

L1 = L4 = L5 = 20 mm straight Cu wire (1.2 mm); height above print 12 mm
L2 = 0.47 µH choke
L3 = 1 turn Cu wire (1.7 mm); int. diam. 10 mm; max. lead length 5 mm

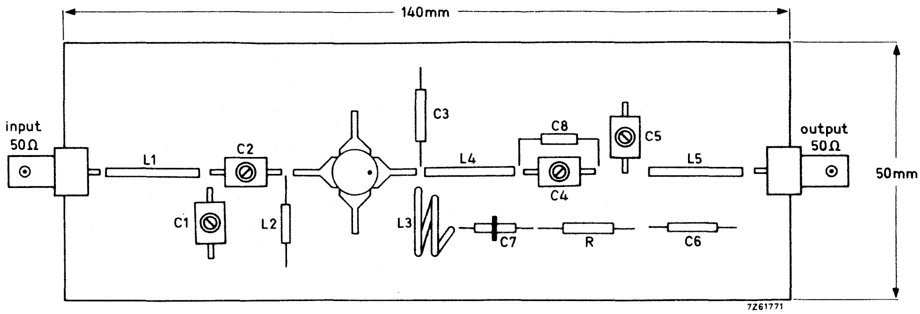
R = 10 Ω carbon

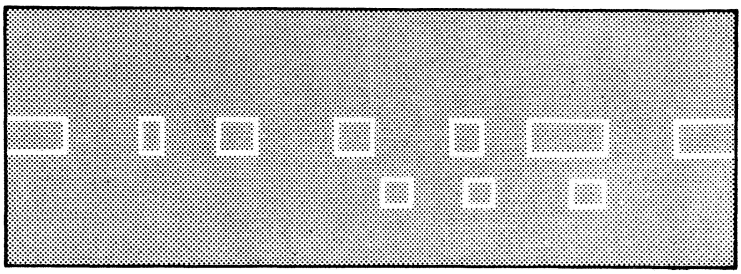
At P_L = 7.0 W and V_{CC} = 12.5 V the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 16.5 V; f = 470 MHz; T_h = 70 °C;
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom} + 20\,\%$
where $P_{Snom} = P_S$ for 7.0 W transistor output into 50 Ω load at V_{CC} = 13.8 V

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



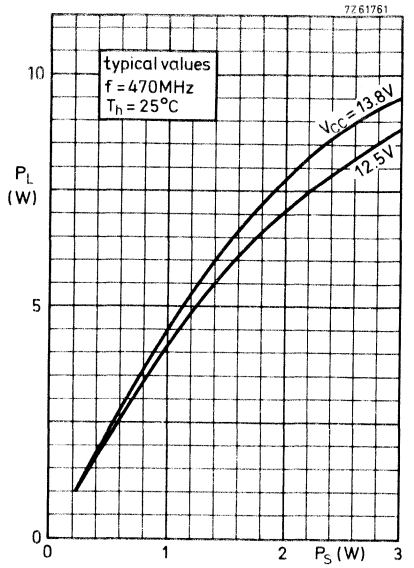


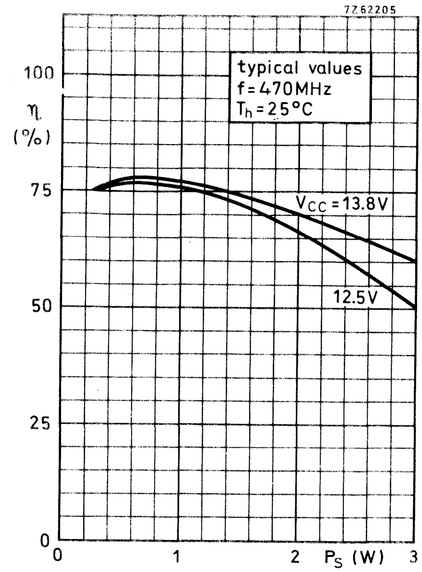
7Z61770.1

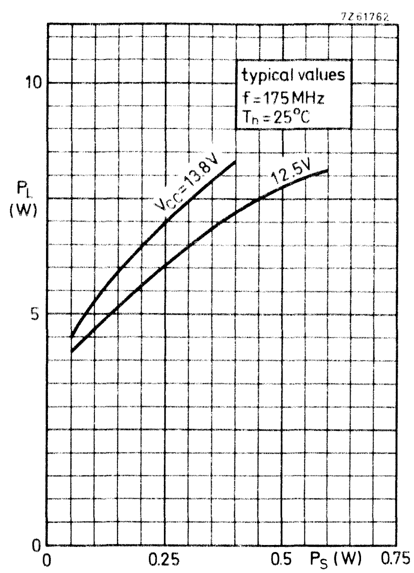
Shaded area copper

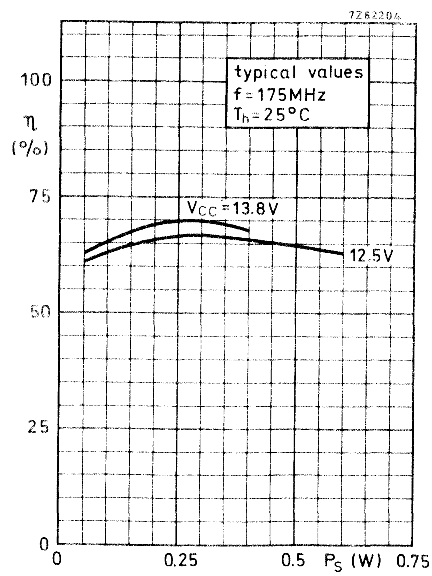
Back area completely copper clad

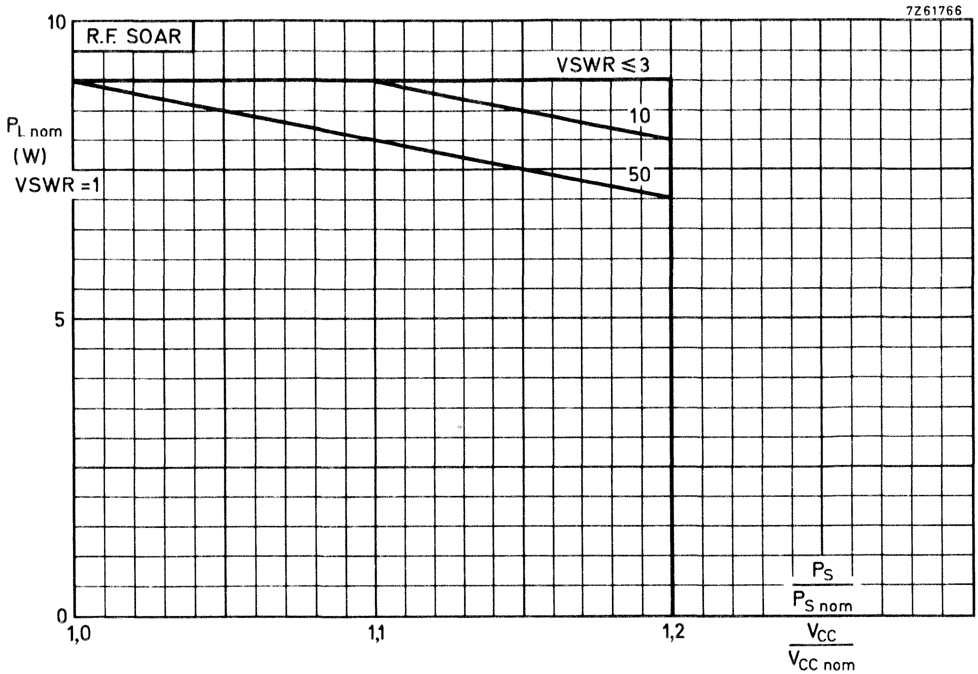
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z61761
typical values
f = 470MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
P_L
(W)
10
5
0
0
1
2
P_S (W)
3


7Z62205
typical values
f = 470MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
η
(%)
100
75
50
25
0
0
1
2
P_S (W)
3


7Z61762
typical values
f = 175MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
P_L
(W)
10
5
0
0
0.25
0.5
P_S (W)
0.75


7Z62204
typical values
f = 175MHz
T_h = 25°C
V_{CC} = 13.8V
12.5V
η
(%)
100
75
50
25
0
0
0.25
0.5
P_S (W)
0.75



Conditions for R.F. SOAR :

f = 470 MHz

T_h = 70 °C

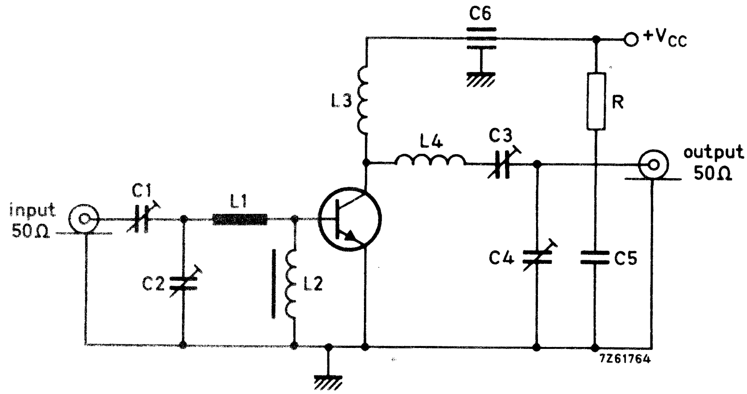
V_{CCnom} = 13,8 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and VSWR = 1

The transistor was developed for use with unstabilized supply voltage V_{CC}.
The above graph is based on its measured performance in test circuit I.
Supply voltage was varied from V_{CCnom} to 1,2 V_{CCnom}, and VSWR from 1 to 50.
It shows the max. permissible output power under nominal conditions in order not to exceed the max. permissible power dissipation under conditions of supply over-voltage ($V_{CC} > V_{CCnom}$) and load mismatch (VSWR > 1).
It is assumed that the drive power increases linearly with the supply voltage; i.e. $P_S/P_{Snom} = V_{CC}/V_{CCnom}$.

APPLICATION INFORMATION (continued)

Test circuit II (175 MHz)



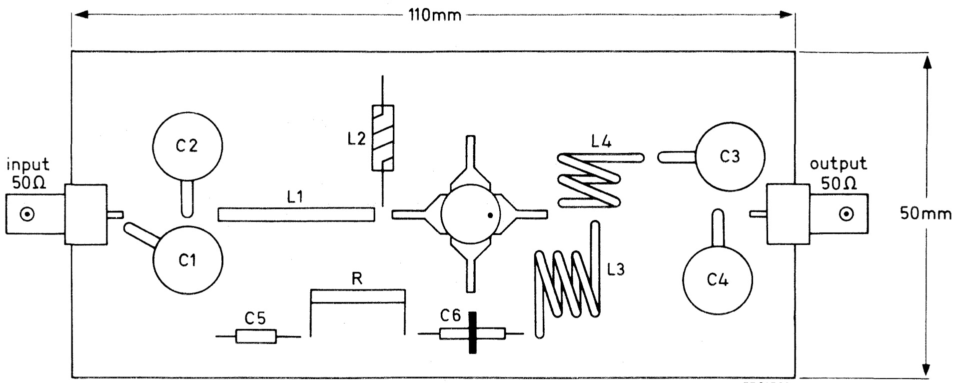
C1 = C3 = C4 = 30 pF concentric air trimmer
C2 = 60 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4.0 nF feed-through capacitor

L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on Ferrite FX1115, d = 2 mm, D = 4 mm, 1 = 5 mm material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm

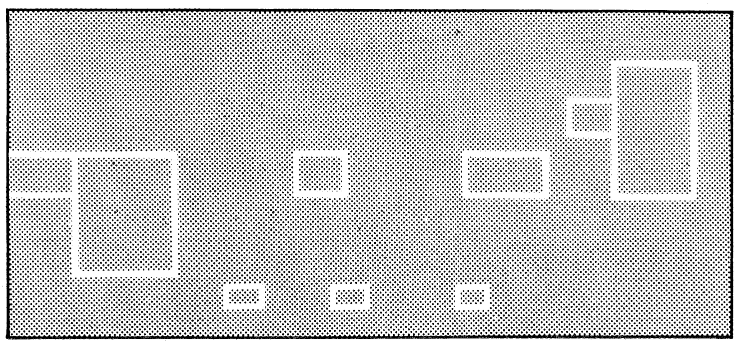
R = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit

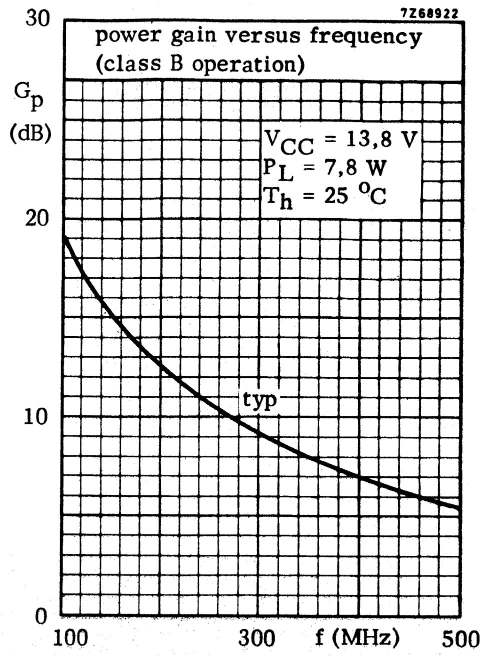


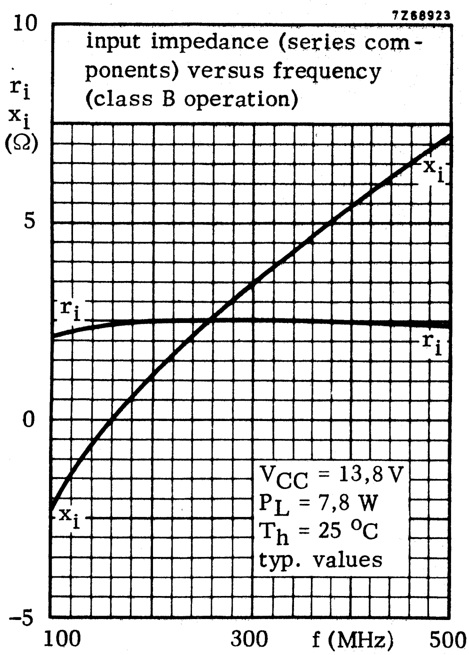
7Z61768

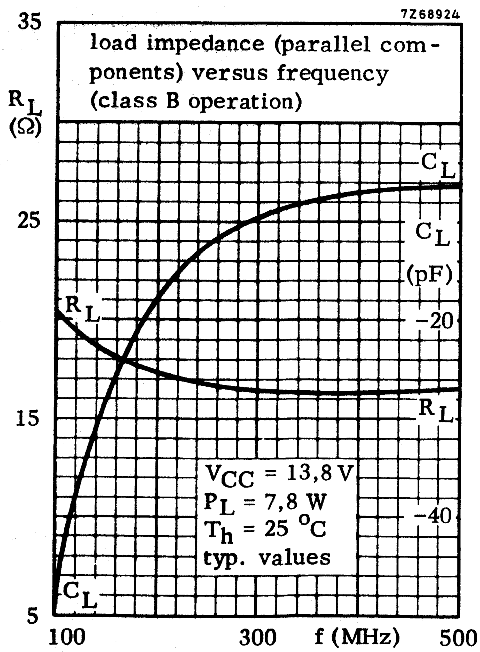


7Z61769.1

Shaded area copper
Back area not metalized
Material of printed circuit board: 1.5 mm epoxy fibre glass


7Z68922
power gain versus frequency
(class B operation)
30
G_p
(dB)
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
20
typ
10
0
100
300
f (MHz)
500


7Z68923
input impedance (series components) versus frequency
(class B operation)
10
r_i
x_i
(Ω)
x_i
5
r_i
r_i
0
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
typ. values
x_i
−5
100
300
f (MHz)
500


7Z68924
load impedance (parallel components) versus frequency
(class B operation)
35
R_L
(Ω)
C_L
25
C_L
(pF)
R_L
−20
15
R_L
V_{CC} = 13,8 V
P_L = 7,8 W
T_h = 25 °C
typ. values
−40
C_L
5
100
300
f (MHz)
500

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

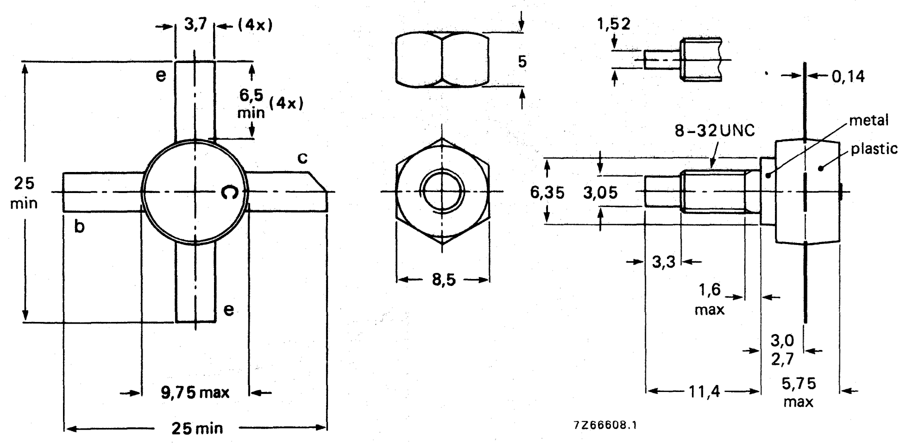
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_P dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,5	470	< 8,0	20	< 2,28	> 4	> 65	1,2 + j4,5	163 − j35
c.w.	12,5	470	< 6,8	17	< 2,09	> 4	> 65	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Voltages

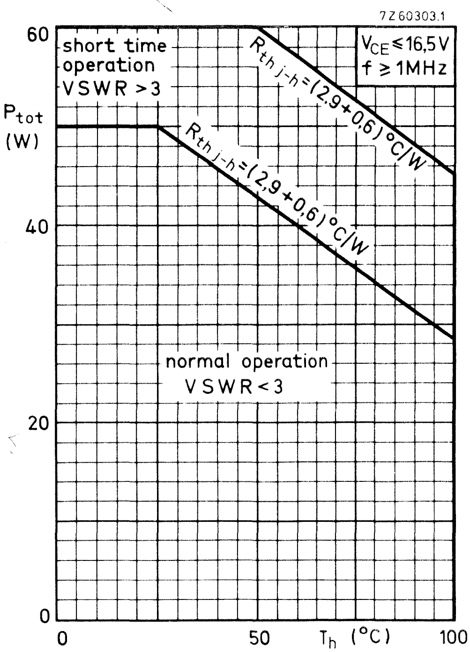
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

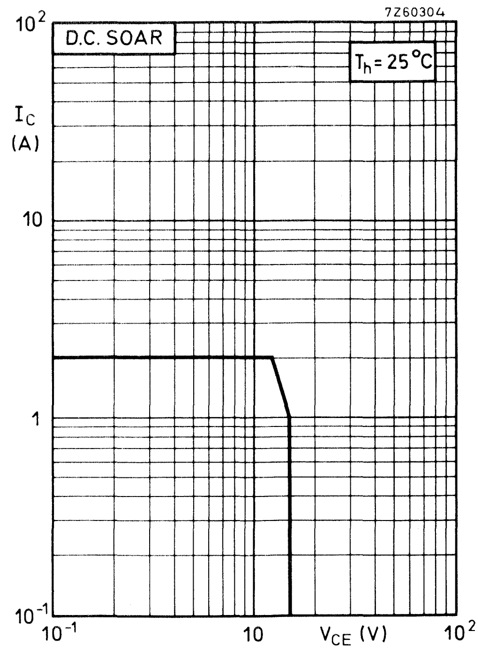
Currents

Collector current (average)	$I_{C(AV)}$	max.	3,5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A

Power dissipation

Total power dissipation up to $T_h = 25\ ^oC$ f ≥ 1 MHz	P_{tot}	max.	50	W





Temperatures

Storage temperature	T_{stg}	−65 to +200		^oC
Junction temperature	T_j	max.	200	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2,9	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter ; I_C = 25 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base ; I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector ; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V

Transient energy

L = 25 mH; f = 50 Hz				
open base	E	>	3,1	mWs
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	3,1	mWs

D.C. current gain

I_C = 1 A; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	30	

Transition frequency

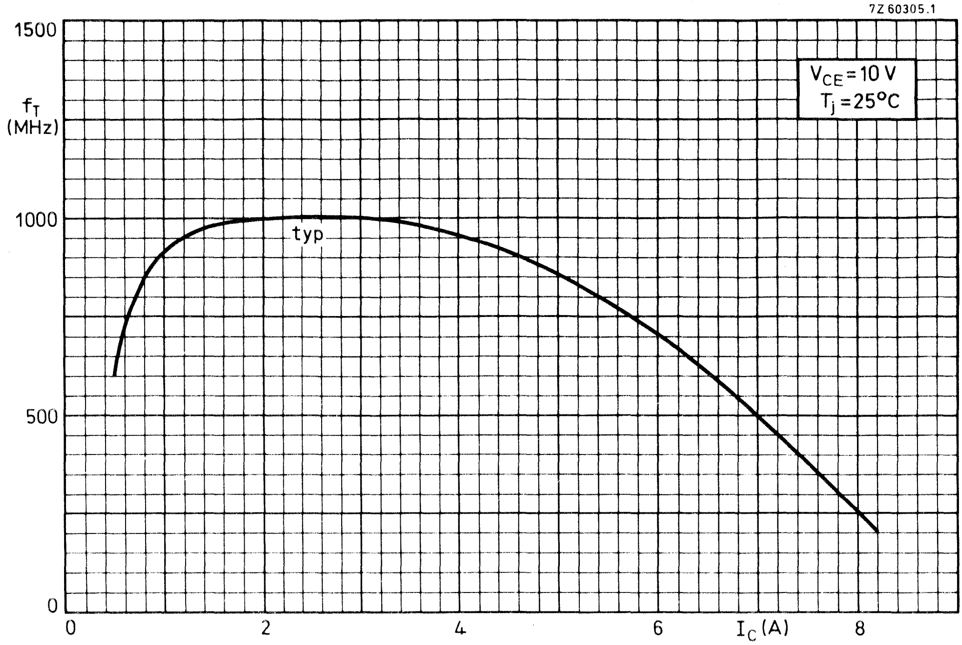
I_C = 2 A; V_{CE} = 10 V	f_T	typ.	1,0	GHz

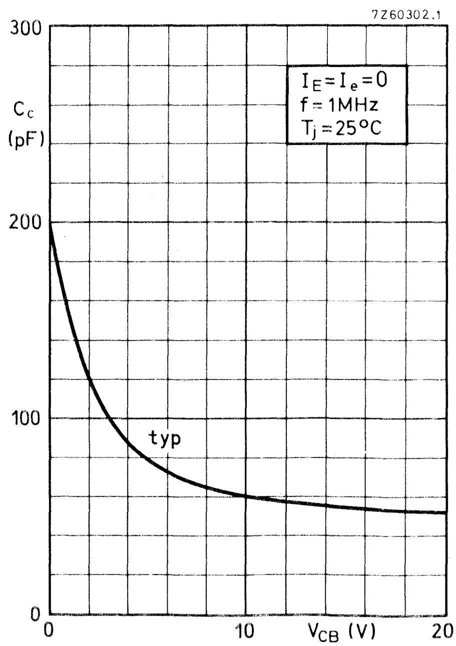
Collector capacitance at f = 1 MHz

$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	55	pF
		<	70	pF

Feedback capacitance

I_C = 100 mA; V_{CE} = 15 V	C_{re}	typ.	32	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z 60305.1
1500
f_T
(MHz)
1000
500
0
typ
V_{CE} = 10 V
T_j = 25 °C
0
2
4
6
I_C (A)
8


7Z60302.1
300
C_c
(pF)
200
100
0
typ
$I_E = I_e = 0$
f = 1 MHz
T_j = 25 °C
0
10
V_{CB} (V)
20

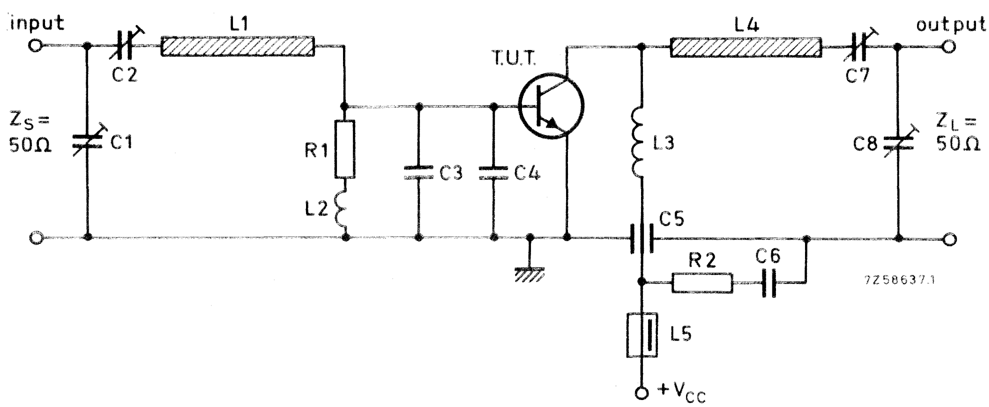
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_{mb} up to 25 °C

f (MHz)	V_{CE} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
470	13,5	< 8,00	20	< 2,28	> 4	> 65	1,2 + j4,5	163 – j35
470	12,5	< 6,80	17	< 2,09	> 4	> 65	–	–
175	12,5	typ. 1,35	17	typ. 2,30	typ. 11	typ. 60	–	–

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C2 = C7 = C8 = 2,0 to 9,0 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

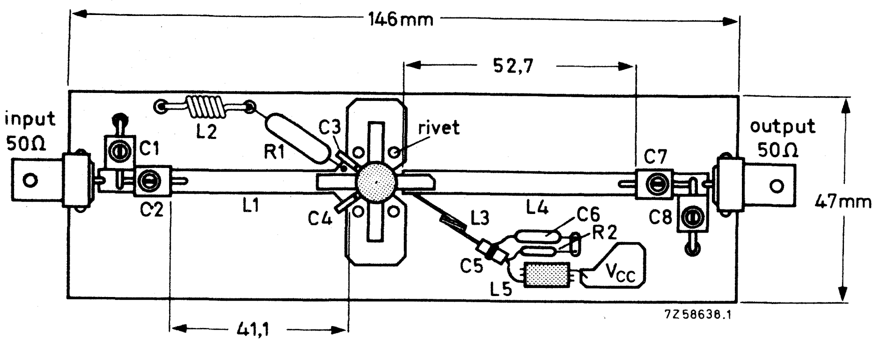
L1 = stripline (41,1 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm (0,32 μH)
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,7 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

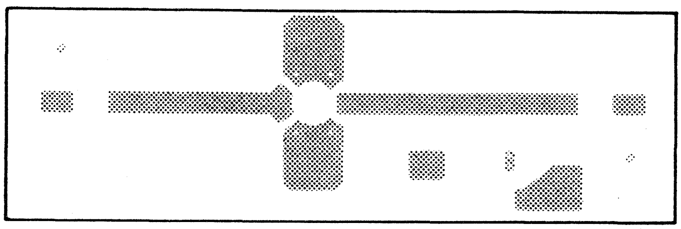
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.

Component layout and printed-circuit board for 470 MHz test circuit see page 6.

APPLICATION INFORMATION (continued)

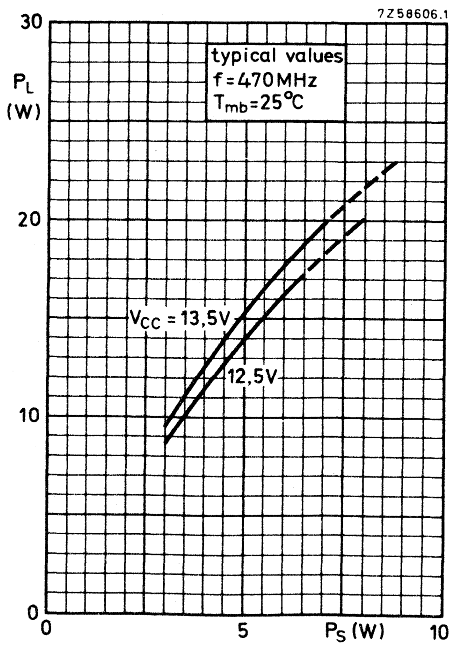
Component layout and printed-circuit board for 470 MHz test circuit.

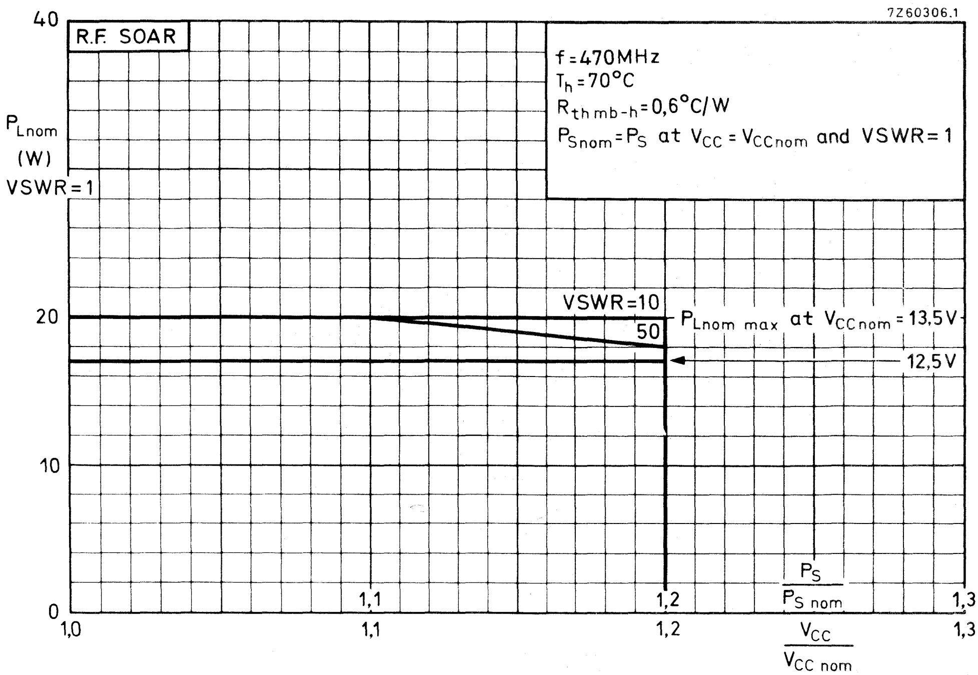




7Z66443.1

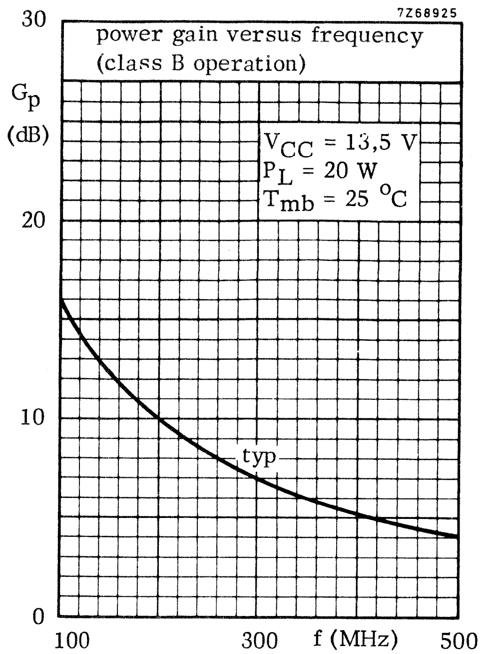
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

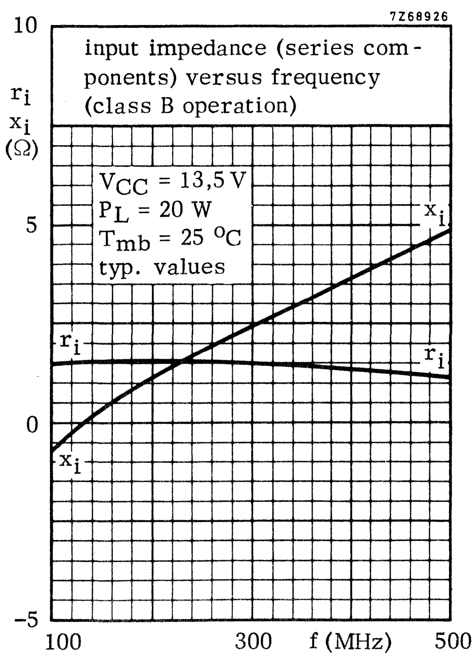


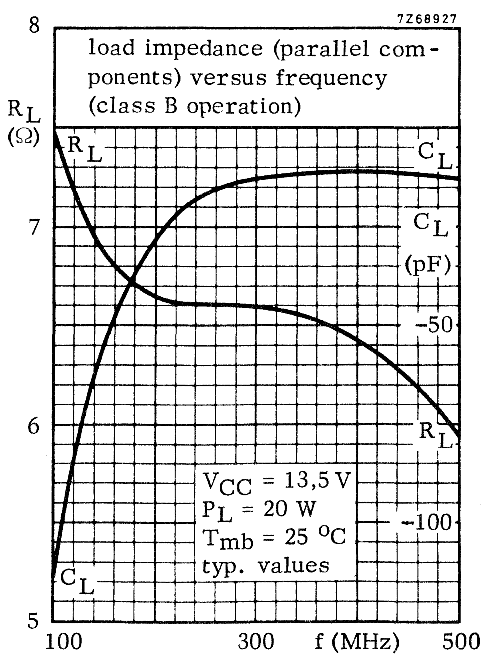


The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph above for safe operation at supply voltages other than the nominal. The graph shows the allowable output power, under nominal conditions, as a function of the supply overvoltage ratio, with VSWR as parameter.
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with the supply overvoltage ratio.

The horizontal line at 20 W applies at V_{CCnom} = 13, 5 V.
For V_{CCnom} = 12, 5 V, P_L should be derated to 17 W.


7Z68925
power gain versus frequency
(class B operation)
Gp
(dB)
30
20
10
0
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ
100
300
f (MHz)
500


7Z68926
input impedance (series components) versus frequency
(class B operation)
ri
xi
(Ω)
10
5
0
−5
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
xi
ri
ri
xi
100
300
f (MHz)
500


7Z68927
load impedance (parallel components) versus frequency
(class B operation)
RL
(Ω)
8
7
6
5
RL
CL
CL
(pF)
−50
RL
−100
CL
VCC = 13,5 V
PL = 20 W
Tmb = 25 °C
typ. values
100
300
f (MHz)
500

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

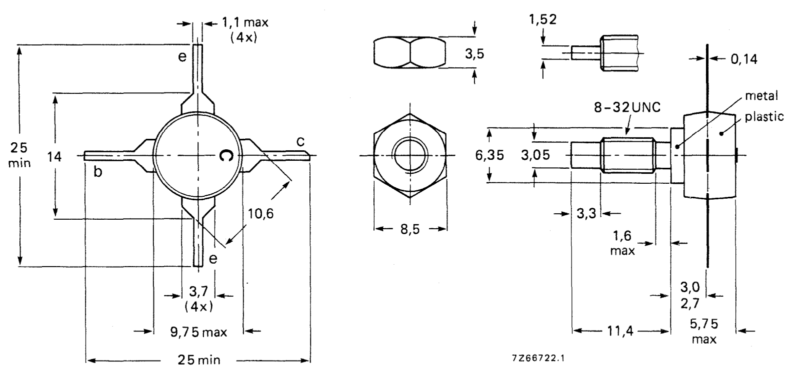
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S mW	P_L W	I_C mA	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
c.w.	28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
c.w.	28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
c.w.	28	1000	typ. 400	1,4	typ.100	typ. 5,4	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Voltages

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V

Currents

Collector current (d.c.)	I_C	max.	400	mA
Collector current (peak value); f ≥ 10 MHz	I_{CM}	max.	800	mA

Power dissipation

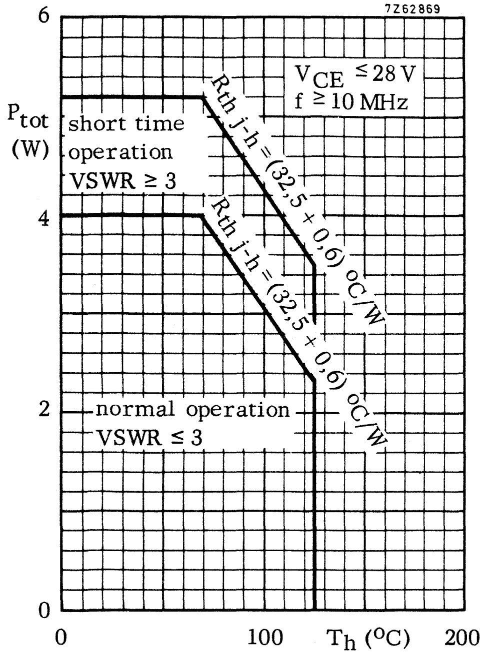
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	4,0	W

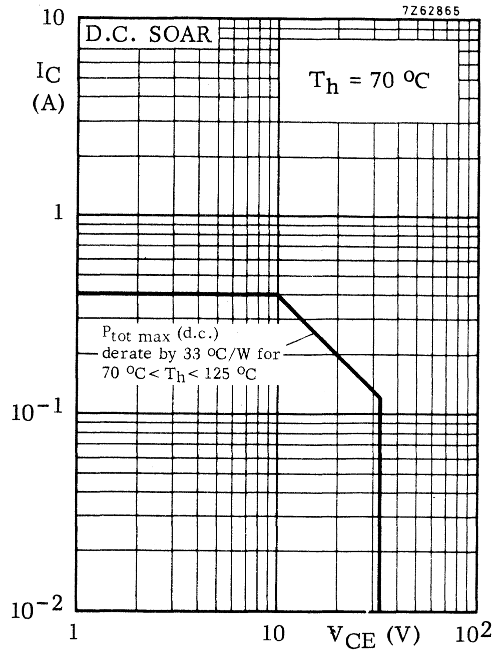
Temperatures

Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	32,5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W


7Z62869
Ptot (W)
short time operation VSWR ≥ 3
VCE ≤ 28 V
f ≥ 10 MHz
Rth j-h = (32,5 + 0,6) °C/W
Rth j-h = (32,5 + 0,6) °C/W
normal operation VSWR ≤ 3
Th (°C)
0
100
200
2
4
6

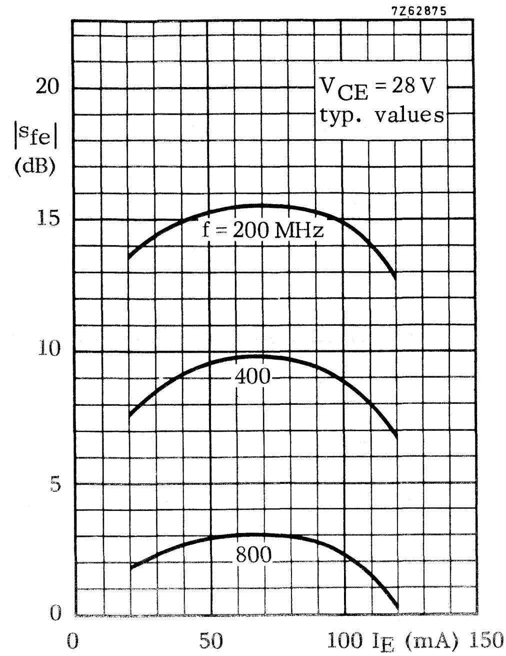

7Z62865
D.C. SOAR
IC (A)
Th = 70 °C
Ptot max (d.c.)
derate by 33 °C/W for
70 °C < Th < 125 °C
VCE (V)
1
10
10^2
10^-2
10^-1
1
10

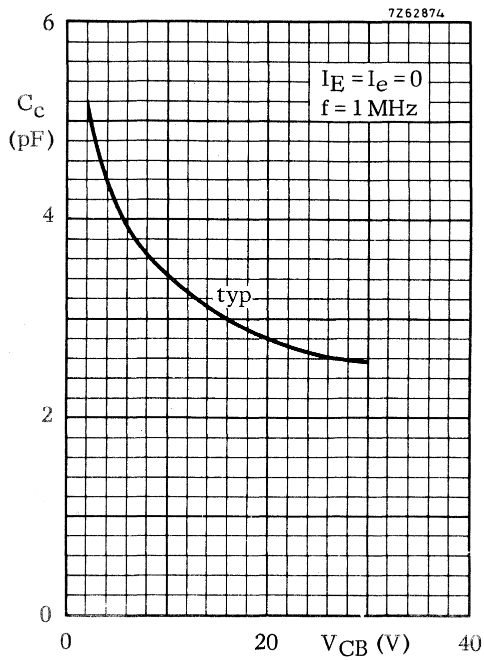
CHARACTERISTICS

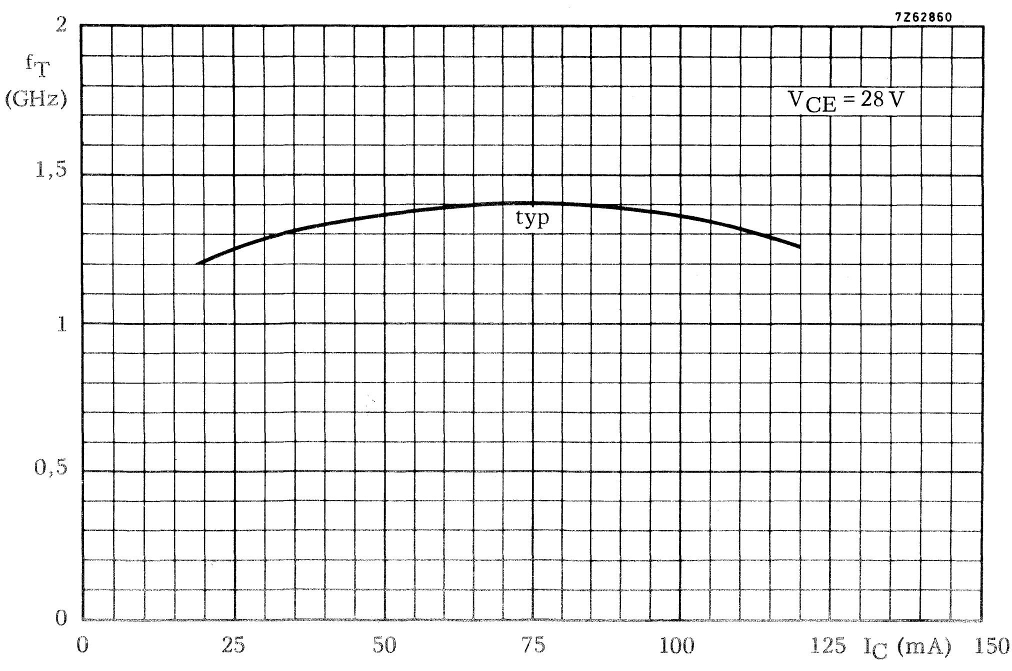
T_j = 25 °C unless otherwise specified

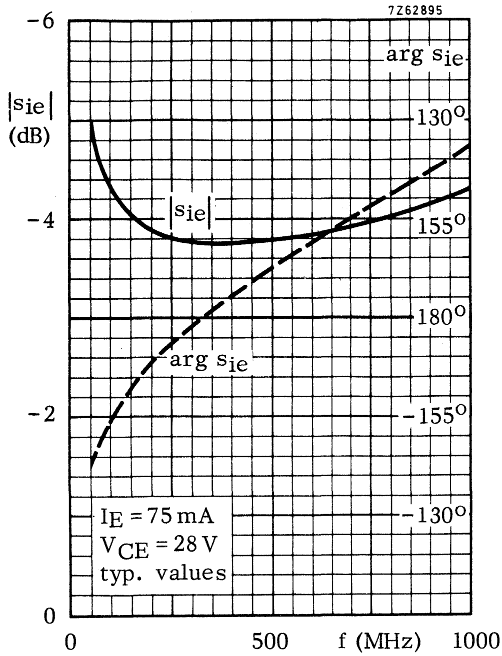
Breakdown voltages

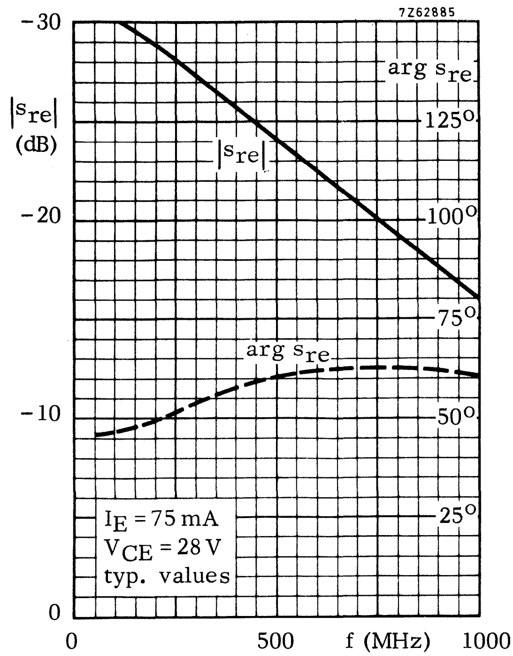
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency I_C = 50 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	3,5	pF
Emitter capacitance at f = 1 MHz I_C = I_c = 0; V_{EB} = 0	C_e	typ.	11	pF
Feedback capacitance at f = 1 MHz I_C = 5 mA; V_{CE} = 10 V	C_{re}	typ.	2,5	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

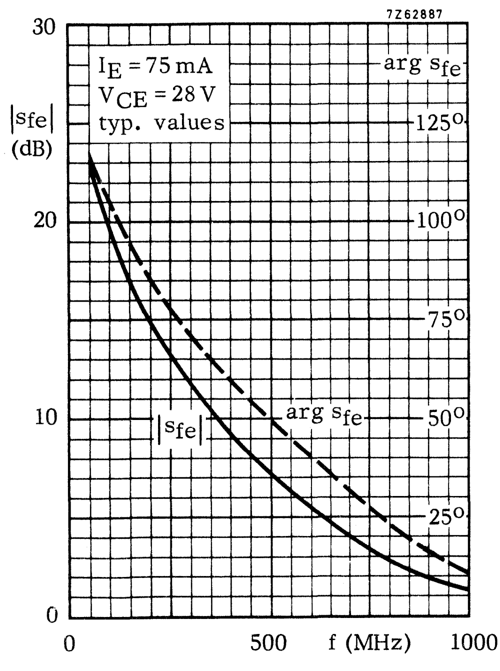

7Z62875
V_{CE} = 28 V
typ. values
$|s_{fe}|$
(dB)
f = 200 MHz
400
800
I_E (mA)
0
5
10
15
20
0
50
100
150

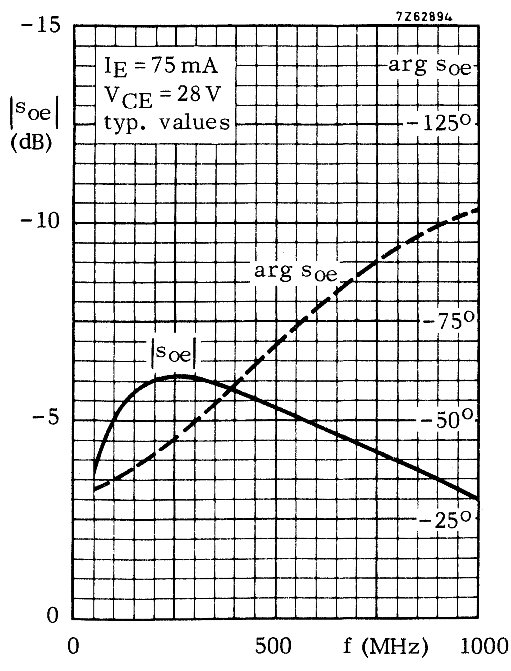

7Z62874
$I_E = I_e = 0$
f = 1 MHz
C_c
(pF)
typ
V_{CB} (V)
0
2
4
6
0
20
40


7Z62860
f_T
(GHz)
V_{CE} = 28 V
typ
I_C (mA)
0
0,5
1
1,5
2
0
25
50
75
100
125
150


7Z62895
-6
-4
-2
0
|sie|
(dB)
arg sie
130°
155°
180°
-155°
-130°
|sie|
arg sie
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62885
-30
-20
-10
0
|sre|
(dB)
arg sre
125°
100°
75°
50°
25°
|sre|
arg sre
IE = 75 mA
VCE = 28 V
typ. values
0
500
f (MHz)
1000


7Z62887
30
20
10
0
|sfe|
(dB)
IE = 75 mA
VCE = 28 V
typ. values
arg sfe
125°
100°
75°
50°
25°
|sfe|
arg sfe
0
500
f (MHz)
1000


7Z62894
-15
-10
-5
0
|soe|
(dB)
IE = 75 mA
VCE = 28 V
typ. values
arg soe
-125°
-75°
-50°
-25°
arg soe
|soe|
0
500
f (MHz)
1000

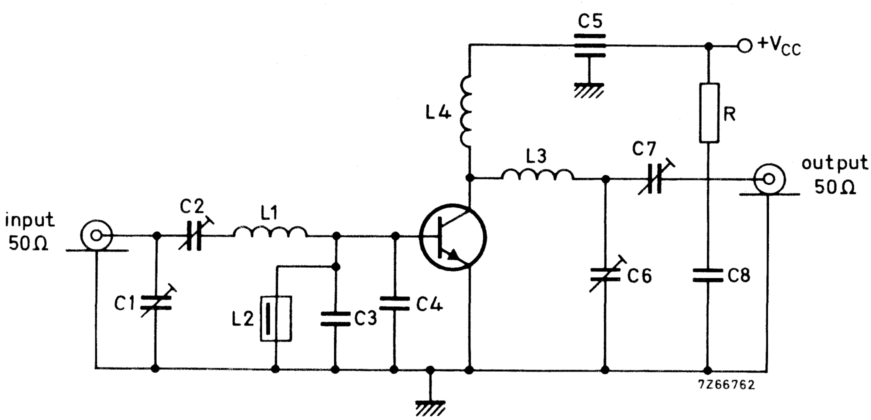
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (mW)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
24	470	typ. 50	0,85	typ. 67	typ. 12,3	typ. 53	–	–
28	470	< 80	1,0	< 71	> 11,0	> 50	–	–
28	470	typ. 80	1,45	typ. 86	typ. 12,6	typ. 60	2,5 + j0,2	3,4 – j16
28	1000	typ. 400	1,4	typ. 100	typ. 5,4	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = C7 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 4 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 5 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; lead length = 5 mm

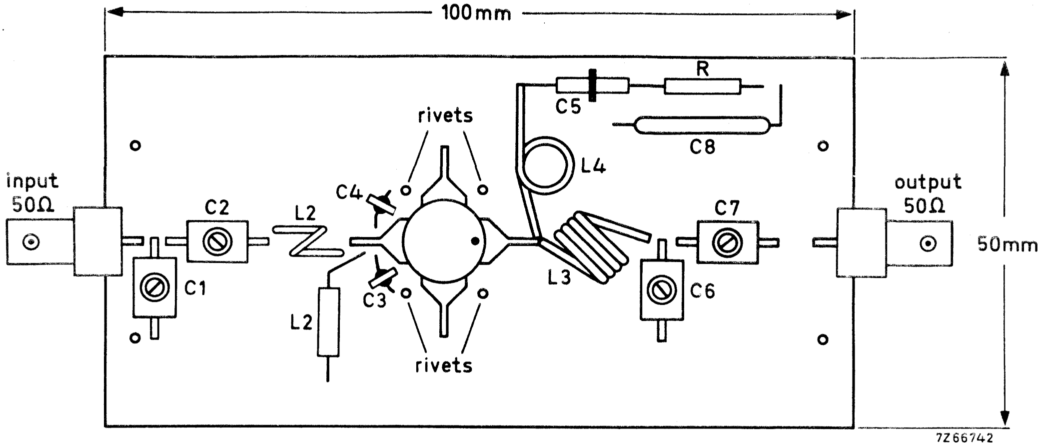
R = 10 Ω carbon

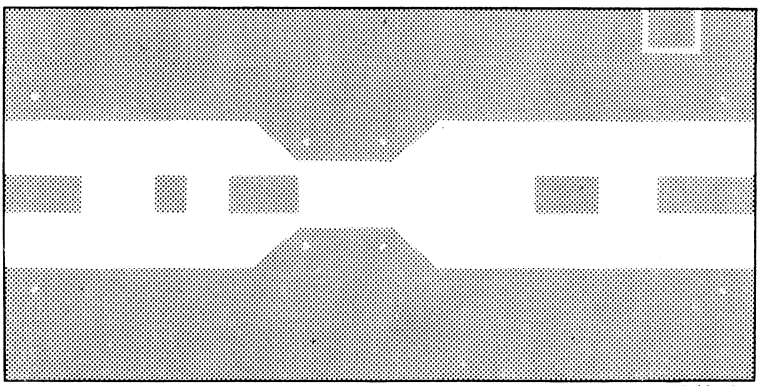
At P_L = 1,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 2 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 1,2 W.

APPLICATION INFORMATION (continued)

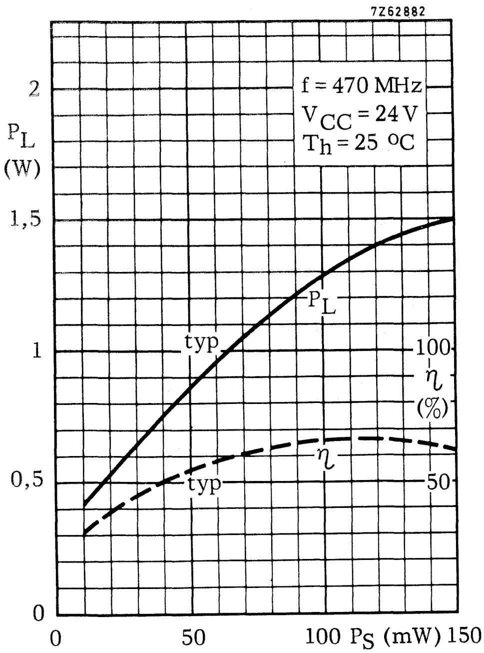
Component layout and printed-circuit board for 470 MHz test circuit.

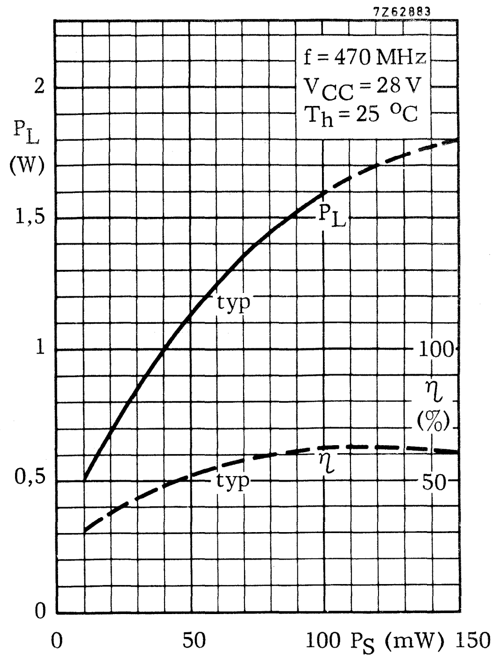


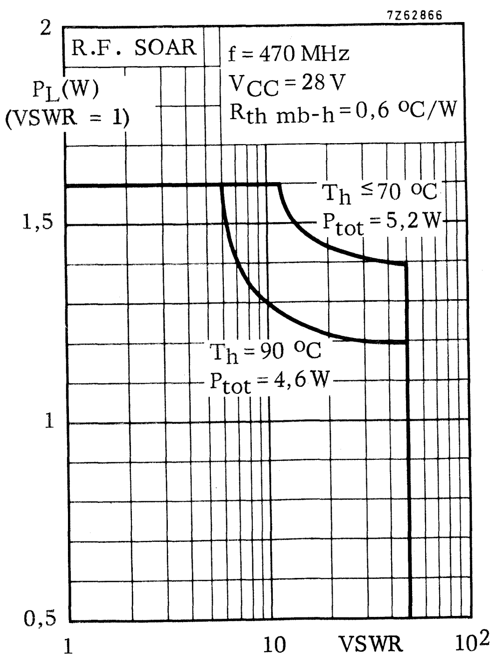


7Z66743.1

Shaded area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



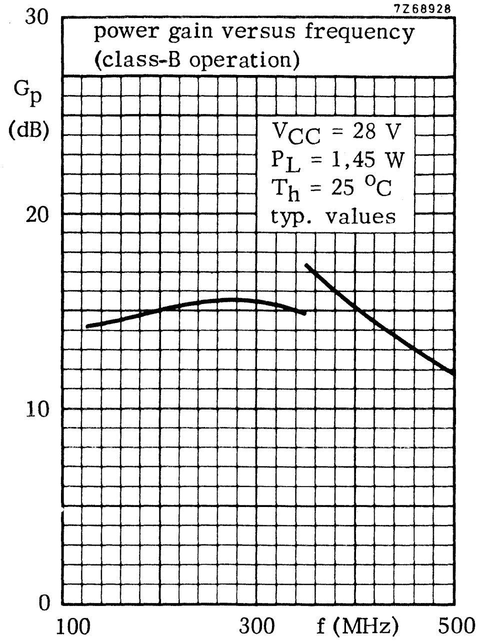


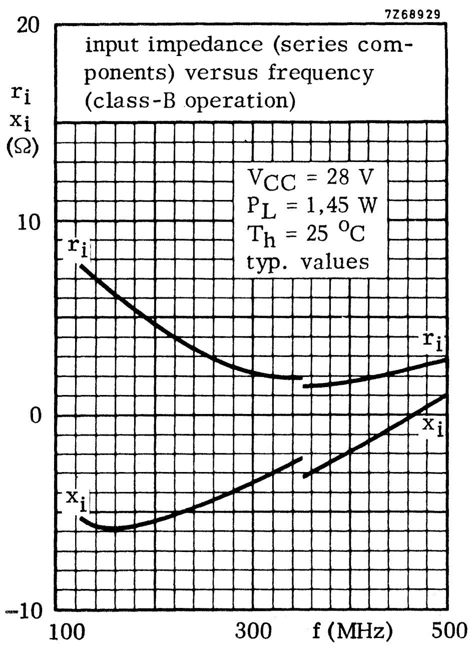


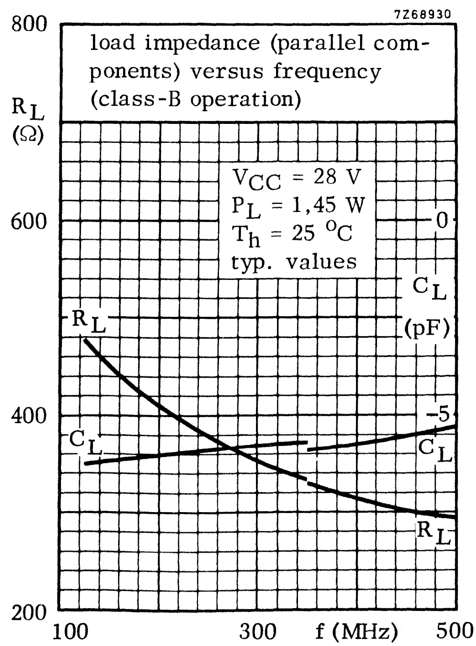
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 1,6 W load power in the test amplifier on page 7 and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily designed for use in fast-switching wide-band video amplifiers for driving the cathode of a picture tube.

The transistor has a common-base pin configuration and is sealed in a capstan envelope with a moulded cap. All the leads are isolated from the stud.

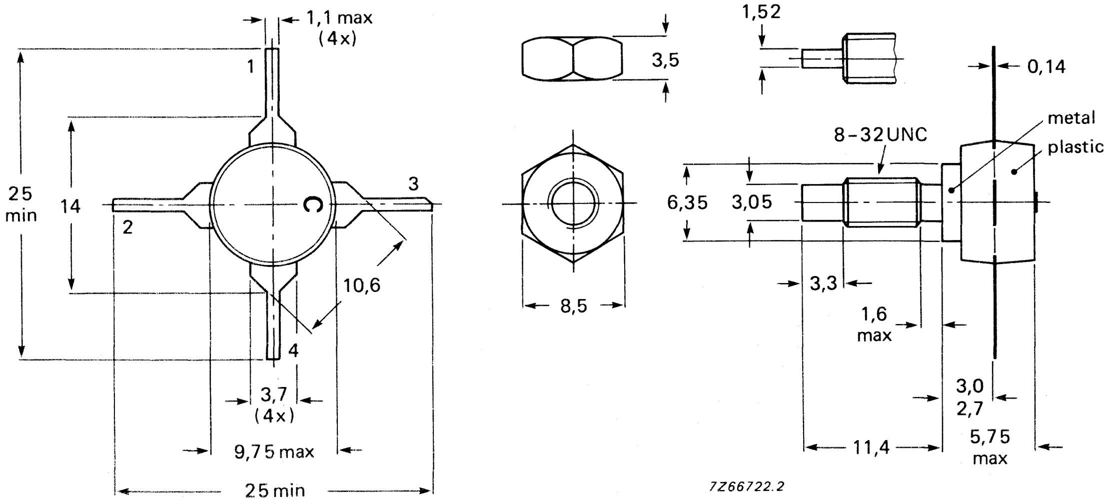
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.

Pinning:

1 Base
2 Emitter
3 Collector
4 Base



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm
Mounting holes to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65	V
open base	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current				
d.c.	I_C	max.	400	mA
(peak value); f > 1 MHz	I_{CM}	max.	800	mA
D.C. power dissipation up to $T_h = 70\ ^oC$				
(see D.C. SOAR in Fig. 2)	$P_{d.c.}$	max.	4	W
Storage temperature	T_{stg}		−65 to + 150	^oC
Operating junction temperature	T_j	max.	200	^oC

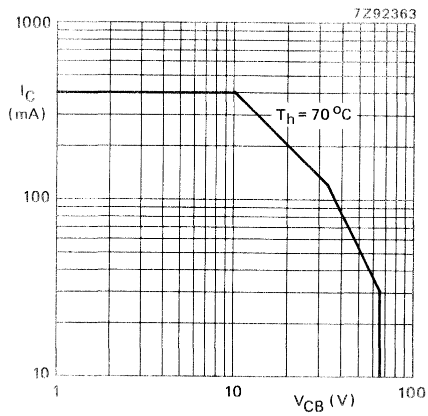


Fig. 2 D.C. SOAR.

THERMAL RESISTANCE

From junction to mounting base (d.c.)	$R_{th\ j\text{-}mb}$	=	32,5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	65 V
I_C = 25 mA; I_B = 0	$V_{(BR)CEO}$	>	33 V
Emitter-base breakdown voltage			
I_E = 1 mA; I_C = 0	$V_{(BR)EBO}$	>	4 V
Collector-base leakage current			
V_{CB} = 20 V; I_E = 0	I_{CBO}	<	1 mA
D.C. current gain			
I_C = 100 mA; V_{CE} = 5 V	h_{FE}		10 to 160 typ. 50
Transition frequency			
I_C = 50 mA; V_{CE} = 5 V	f_T	typ.	1,0 GHz
Collector capacitance at f = 1 MHz			
I_E = i_e = 0; V_{CB} = 10 V	C_c	typ.	3,5 pF
Emitter capacitance at f = 1 MHz			
I_C = i_c = 0; V_{EB} = 0,5 V	C_e	typ.	11 pF
Feedback capacitance at f = 1 MHz			
I_C = 5 mA; V_{CE} = 10 V	C_{re}	typ.	2,5 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

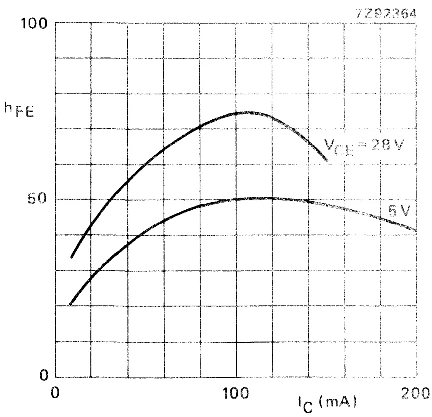


Fig. 3 Current gain (d.c.) versus collector current.

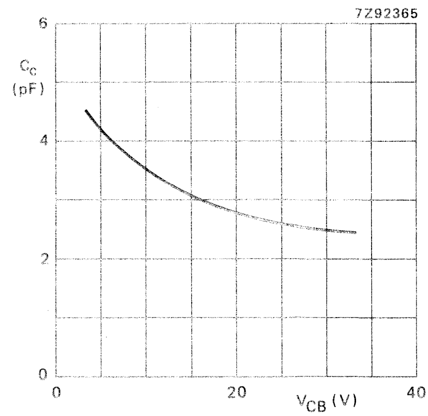


Fig. 4 Collector capacitance versus V_{CB}; I_E = i_e = 0; f = 1 MHz.

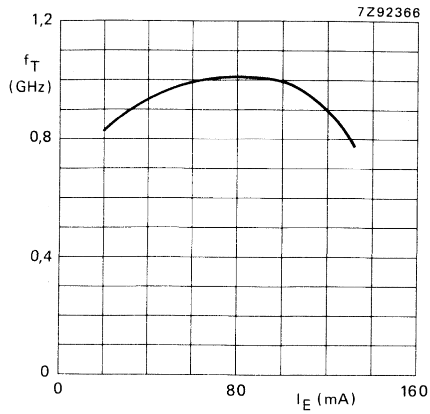


Fig. 5 Transition frequency versus emitter current; V_{CB} = 28 V.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

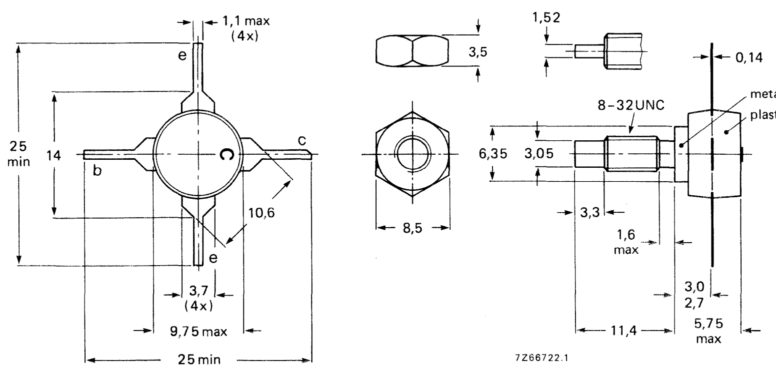
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C mA	G_P dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
c.w.	28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
c.w.	28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
c.w.	28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V
Collector current (d.c.)	I_C	max.	0,7	A
Collector current (peak value) f ≥ 10 MHz	I_{CM}	max.	2,0	A
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz (see also page 3)	P_{tot}	max.	6,0	W
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

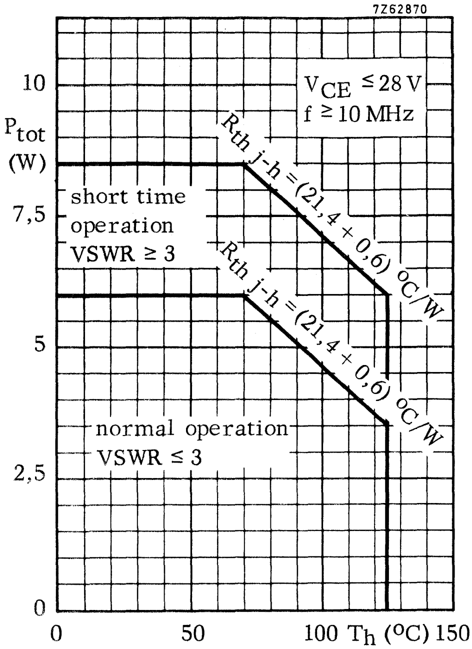
THERMAL RESISTANCE

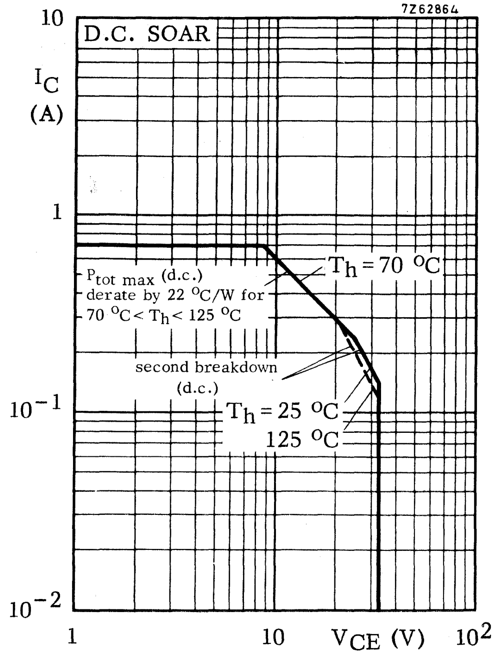
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	21,4	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

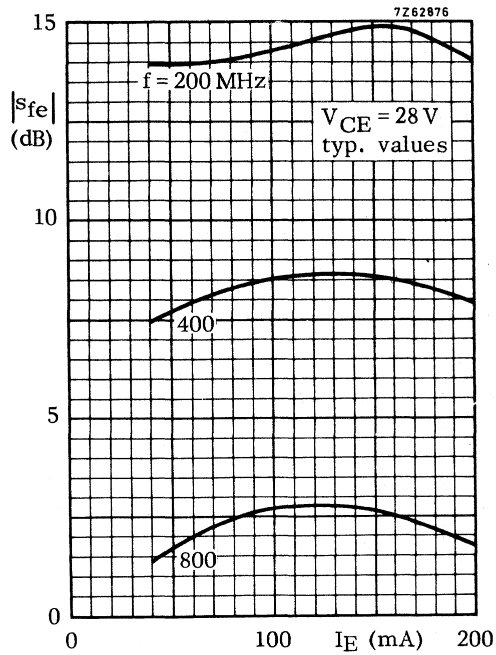
CHARACTERISTICS

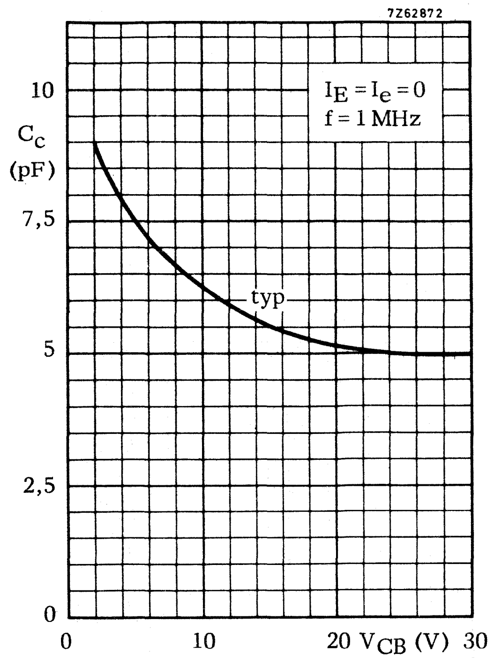
T_j = 25 °C unless otherwise specified

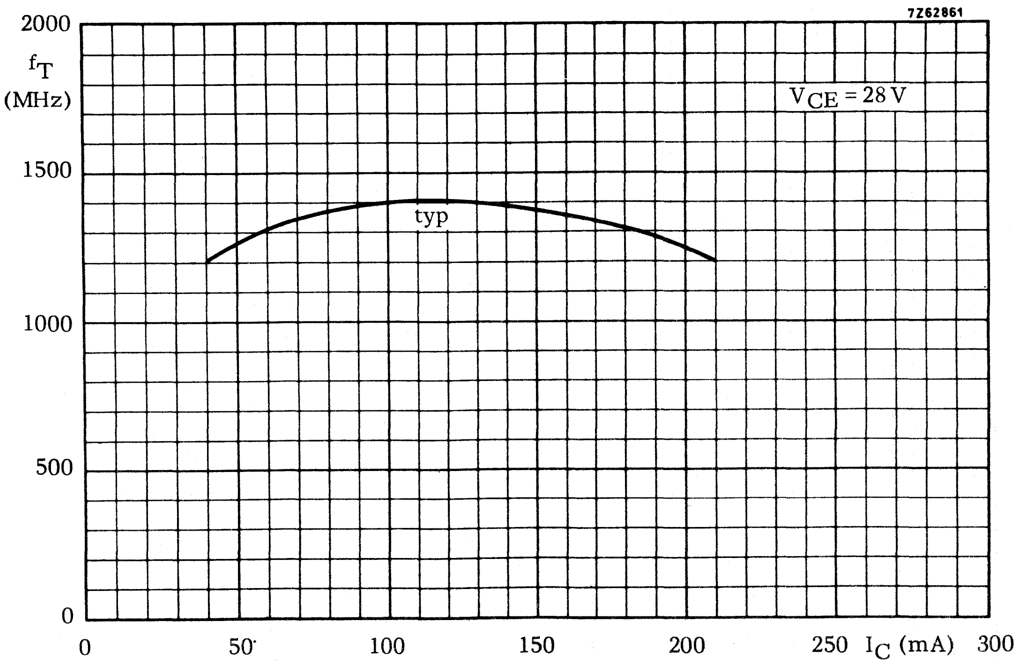
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage V_{BE} = 0, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
Collector-emitter saturation voltage I_C = 100 mA; I_B = 20 mA	V_{CEsat}	typ.	0,17	V
D.C. current gain I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 40	
Transition frequency I_C = 100 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	6,5	pF
Emitter capacitance at f = 1 MHz I_C = I_c = 0; V_{EB} = 0	C_e	typ.	25	pF
Feedback capacitance at f = 1 MHz I_C = 10 mA; V_{CE} = 10 V	C_{re}	typ.	4,8	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

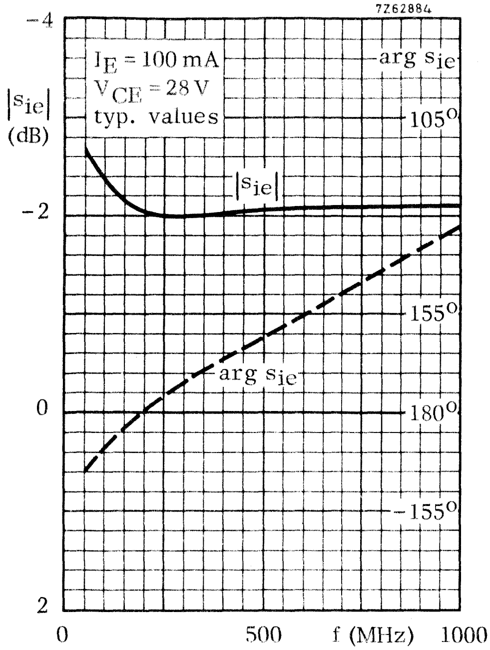

7Z62870
10
7,5
5
2,5
0
0
50
100
150
P_{tot}
(W)
T_h (°C)
$V_{CE} \leq 28$ V
f ≥ 10 MHz
short time
operation
VSWR ≥ 3
normal operation
VSWR ≤ 3
$R_{th\ j\text{-}h}$ = (21,4 + 0,6) °C/W
$R_{th\ j\text{-}h}$ = (21,4 + 0,6) °C/W

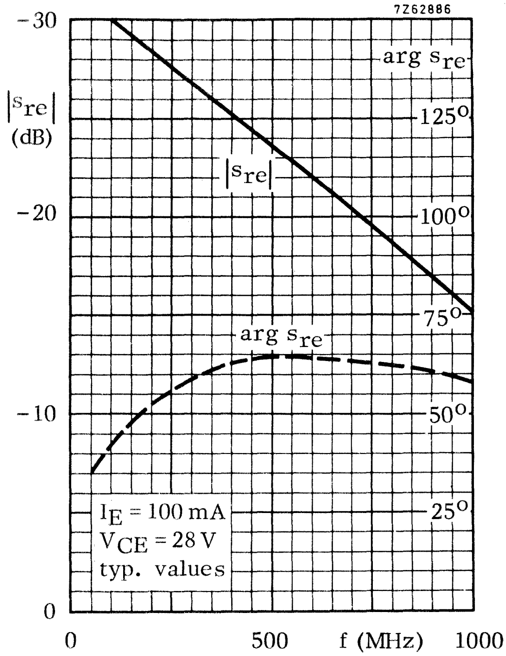

7Z62864
D.C. SOAR
10
1
10^{-1}
10^{-2}
I_C
(A)
1
10
10^2
V_{CE} (V)
$P_{tot\ max}$ (d.c.)
derate by 22 °C/W for
70 °C < T_h < 125 °C
T_h = 70 °C
second breakdown
(d.c.)
T_h = 25 °C
125 °C

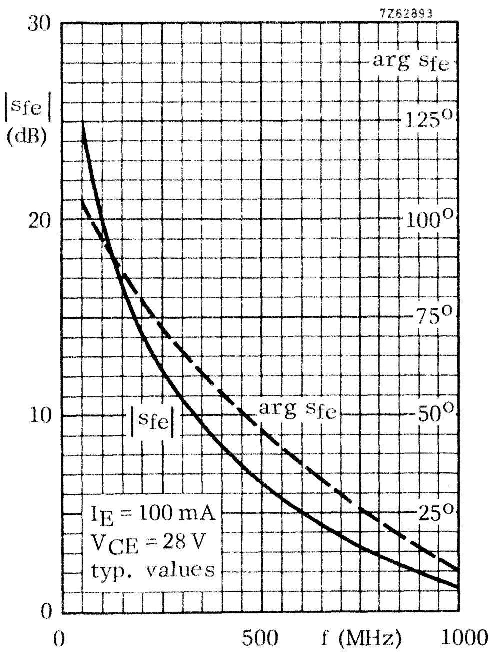

7Z62876
15
10
5
0
|s_fe|
(dB)
f = 200 MHz
400
800
V_CE = 28 V
typ. values
0
100
I_E (mA)
200

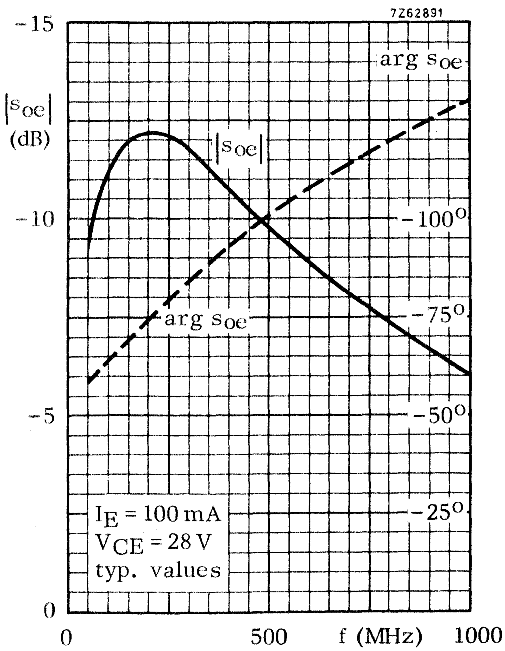

7Z62872
10
7,5
5
2,5
0
C_c
(pF)
I_E = I_e = 0
f = 1 MHz
typ
0
10
20 V_CB (V) 30


7Z62861
2000
f_T
(MHz)
1500
1000
500
0
V_CE = 28 V
typ
0
50
100
150
200
250
I_C (mA)
300


7Z62884
−4
−2
0
2
$|s_{ie}|$ (dB)
I_E = 100 mA
V_{CE} = 28 V
typ. values
arg s_{ie}
105°
155°
180°
−155°
$|s_{ie}|$
arg s_{ie}
0
500
f (MHz)
1000


7Z62886
−30
−20
−10
0
$|s_{re}|$ (dB)
arg s_{re}
125°
100°
75°
50°
25°
$|s_{re}|$
arg s_{re}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62893
30
20
10
0
$|s_{fe}|$ (dB)
arg s_{fe}
125°
100°
75°
50°
25°
$|s_{fe}|$
arg s_{fe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000


7Z62891
−15
−10
−5
0
$|s_{oe}|$ (dB)
arg s_{oe}
−100°
−75°
−50°
−25°
$|s_{oe}|$
arg s_{oe}
I_E = 100 mA
V_{CE} = 28 V
typ. values
0
500
f (MHz)
1000

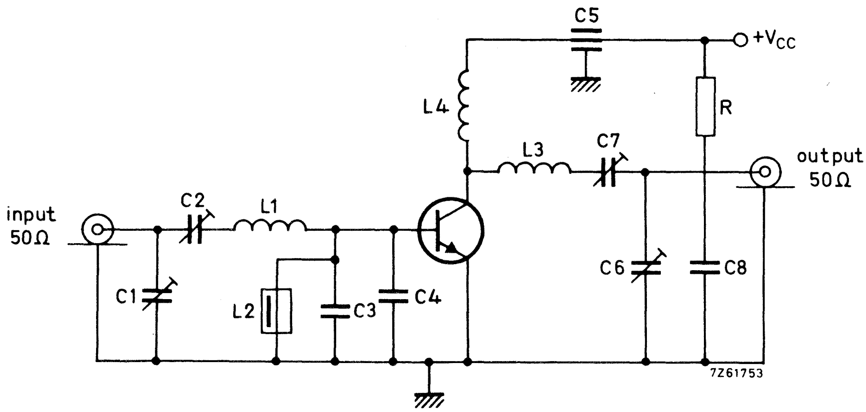
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (mA)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
24	470	typ. 0,2	2,4	typ. 143	typ. 10,8	typ. 70	–	–
28	470	< 0,2	2,5	< 149	> 11,0	> 60	–	–
28	470	typ. 0,2	3,0	typ. 162	typ. 11,7	typ. 66	1,8 + j2,8	7,2 – j24
28	1000	typ. 0,7	2,5	typ. 179	typ. 5,5	typ. 50	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

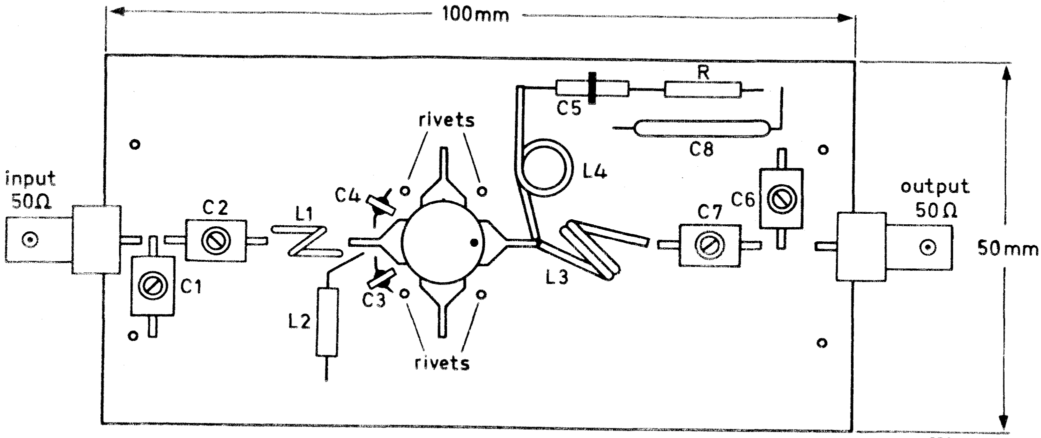
R = 10 Ω carbon

At P_L = 2,5 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 5 mw/K

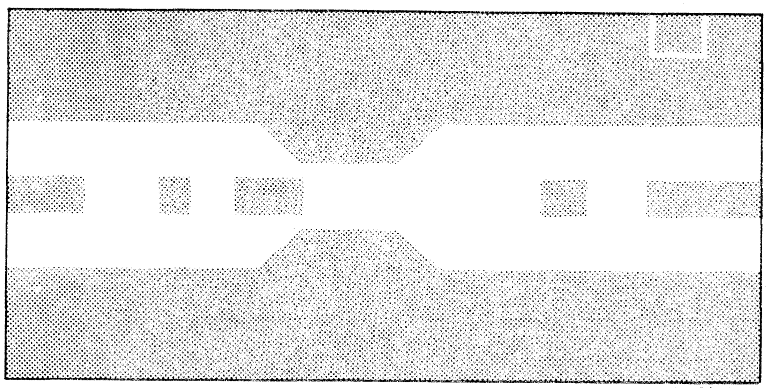
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 2,5 W.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

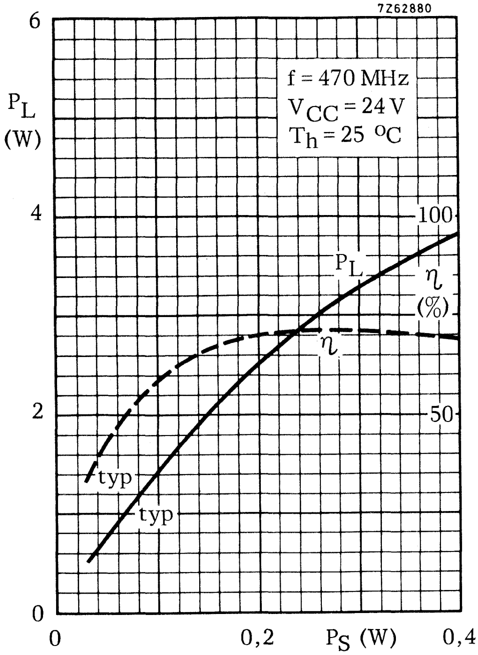


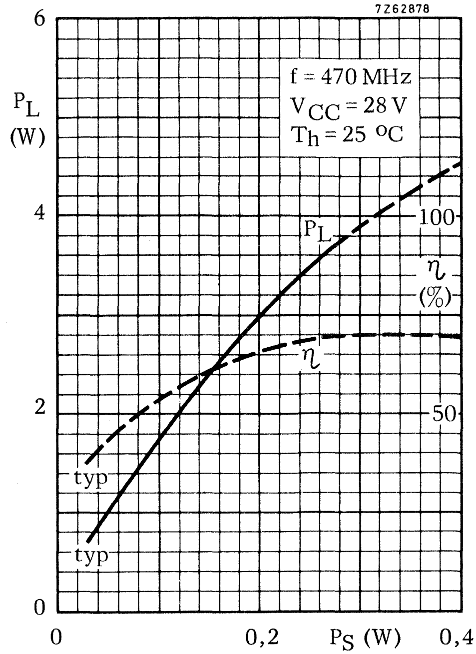
7Z66740

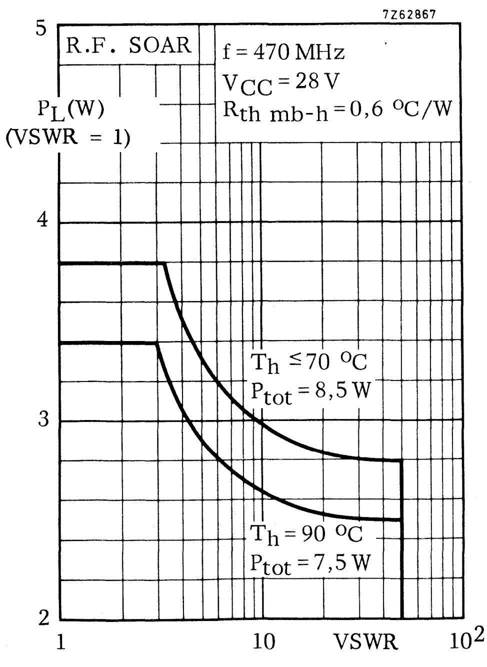


7Z66741.1

Shade area copper
Back area completely copper clad
Material of printed-circuit board: 1,5 mm epoxy fibre-glass



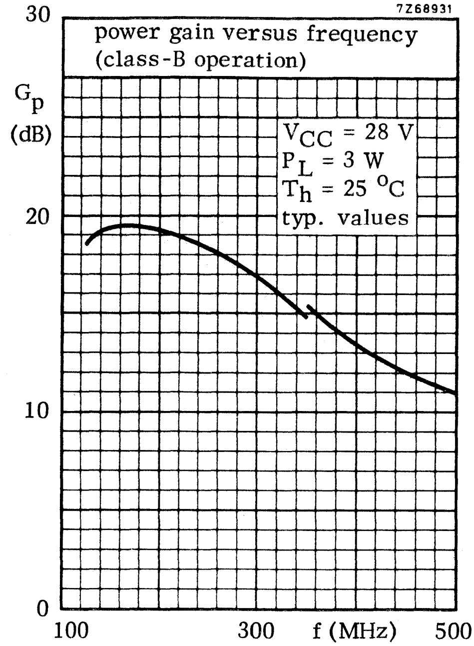


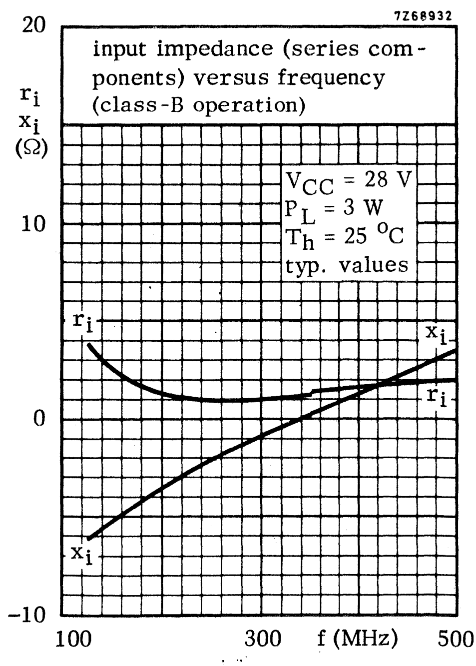


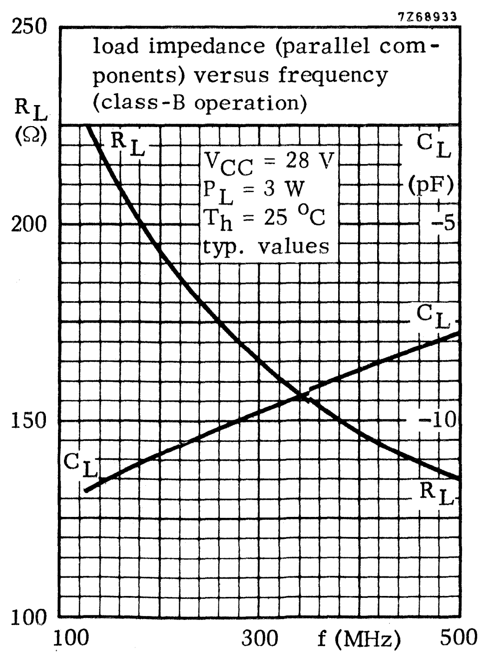
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 3,8 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 350 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

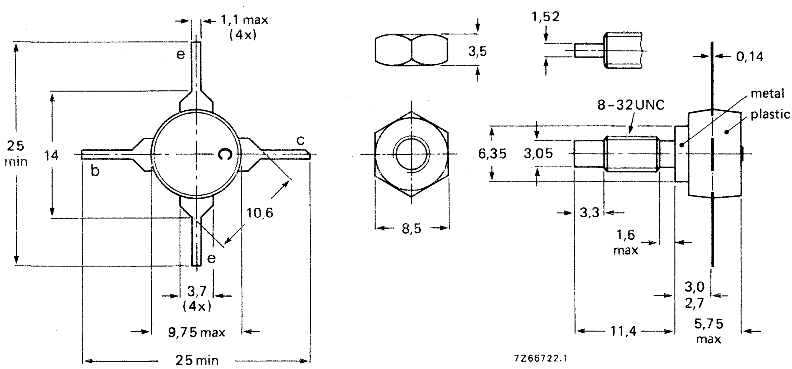
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
c.w.	28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
c.w.	28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
c.w.	28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V
Collector current (d.c.)	I_C	max.	1,0	A
Collector current (peak value) $f \geq 10$ MHz	I_{CM}	max.	3,0	A
Total power dissipation up to $T_h = 70$ °C $f \geq 10$ MHz (see also page 3)	P_{tot}	max.	12,5	W
Storage temperature	T_{stg}	-65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

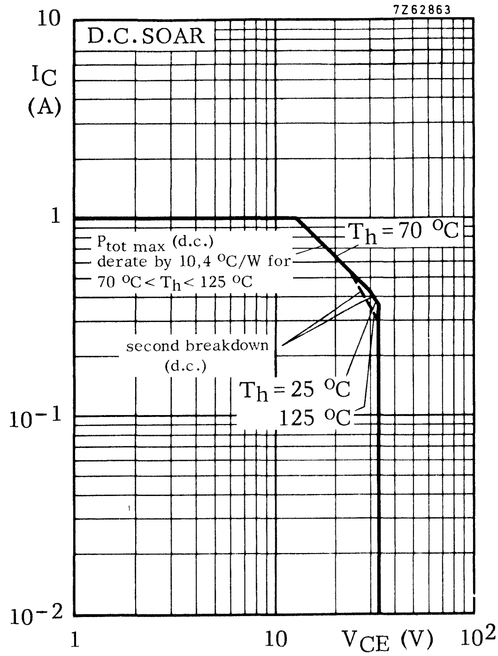
THERMAL RESISTANCE

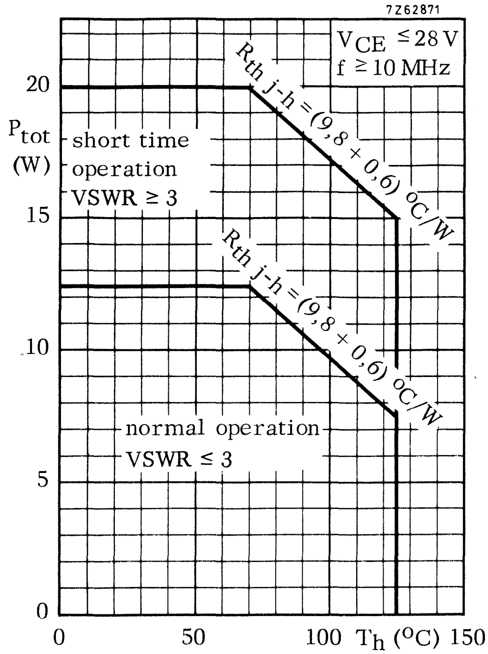
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9,8	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

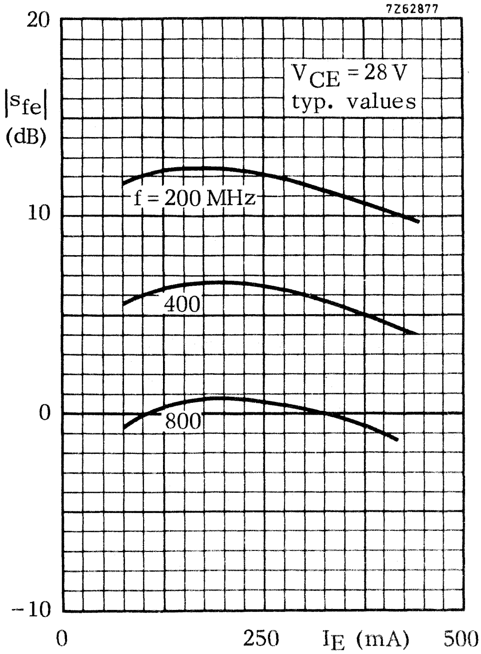
CHARACTERISTICS

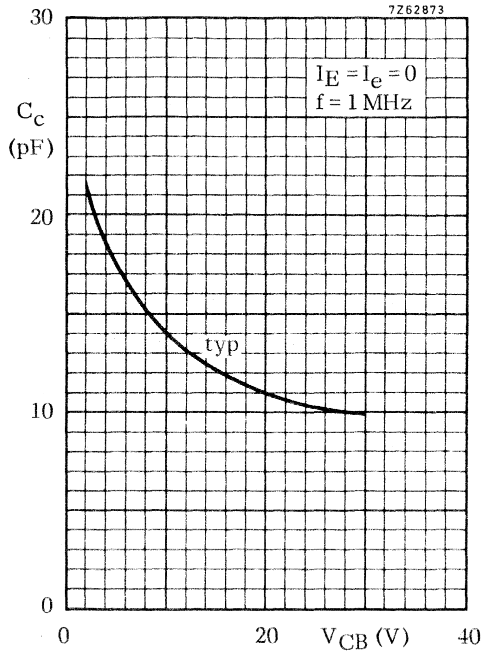
T_j = 25 °C unless otherwise specified

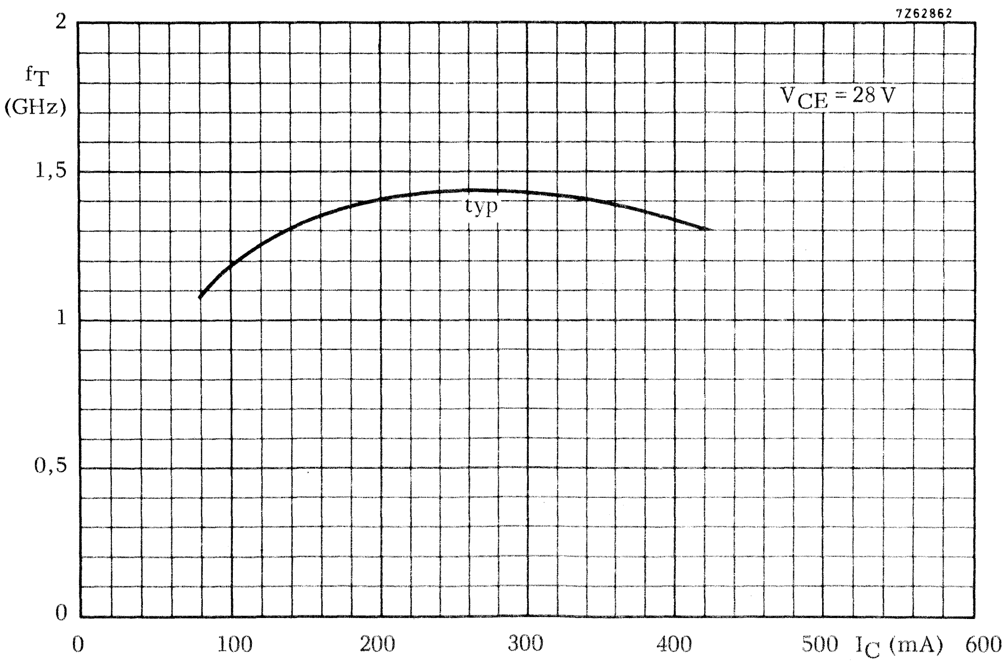
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency I_C = 200 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	14	pF
Emitter capacitance at f = 1 MHz $I_C = I_c = 0$; V_{EB} = 0	C_e	typ.	60	pF
Feedback capacitance at f = 1 MHz I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	10	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

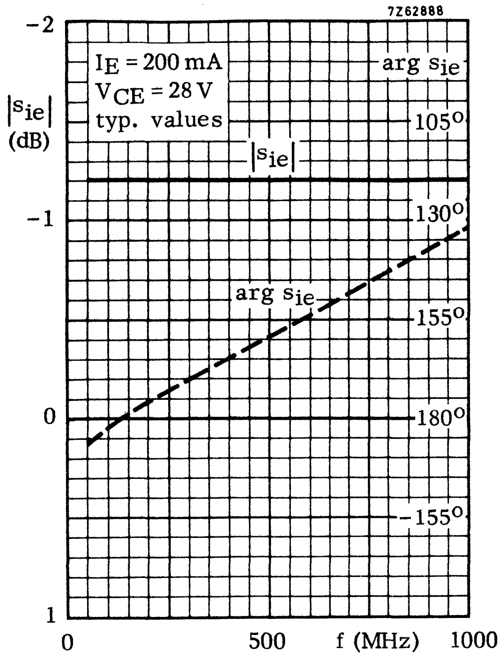

7Z62863
D.C.SOAR
I_C (A)
10
1
10^{-1}
10^{-2}
$P_{tot\ max}$ (d.c.)
derate by 10,4 °C/W for
70 °C < T_h < 125 °C
T_h = 70 °C
second breakdown (d.c.)
T_h = 25 °C
125 °C
1
10
V_{CE} (V)
10^2

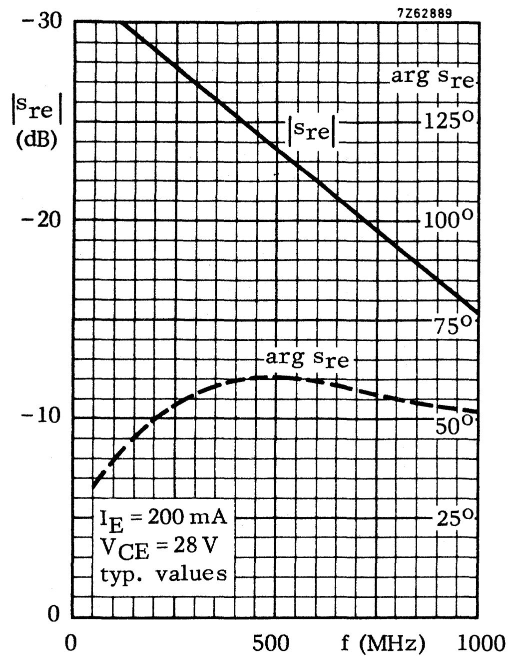

7Z62871
V_{CE} ≤ 28 V
f ≥ 10 MHz
$R_{th\ j-h}$ = (9,8 + 0,6) °C/W
P_{tot} (W)
short time operation
VSWR ≥ 3
normal operation
VSWR ≤ 3
20
15
10
5
0
50
100
T_h (°C)
150

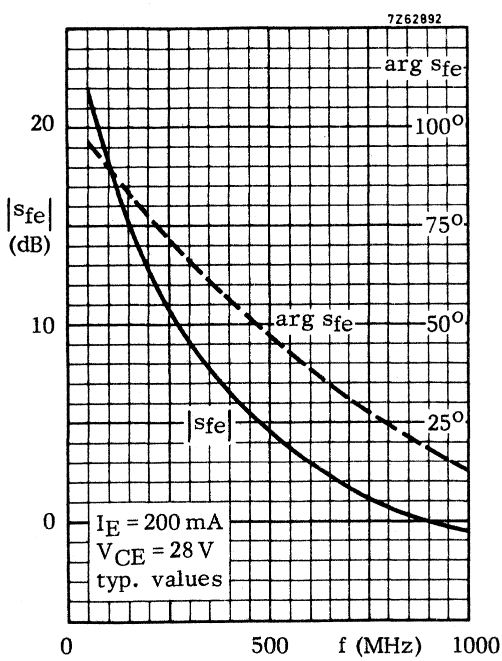

7Z62877
20
|sfe|
(dB)
10
0
−10
VCE = 28 V
typ. values
f = 200 MHz
400
800
0
250
IE (mA)
500

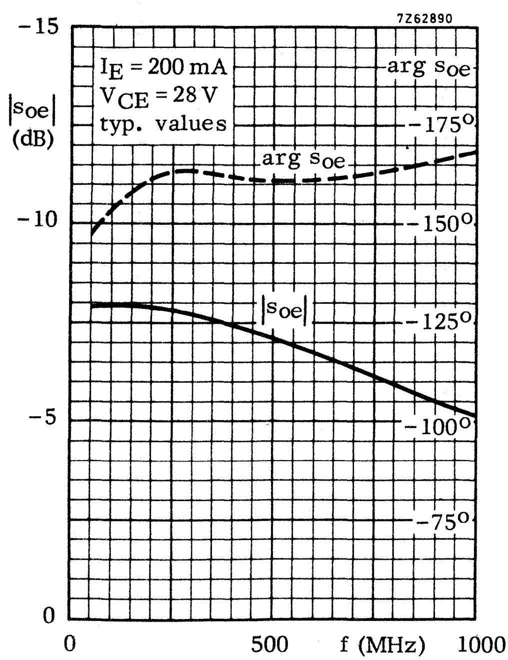

7Z62873
30
Cc
(pF)
20
10
0
IE = Ie = 0
f = 1 MHz
typ
0
20
VCB (V)
40


7Z62862
2
fT
(GHz)
1,5
1
0,5
0
VCE = 28 V
typ
0
100
200
300
400
500
IC (mA)
600


7Z62888
I_E = 200 mA
V_{CE} = 28 V
typ. values
$|s_{ie}|$
(dB)
arg s_{ie}
$|s_{ie}|$
arg s_{ie}
−2
−1
0
1
105°
130°
155°
180°
−155°
0
500
f (MHz)
1000


7Z62889
$|s_{re}|$
(dB)
arg s_{re}
$|s_{re}|$
arg s_{re}
I_E = 200 mA
V_{CE} = 28 V
typ. values
−30
−20
−10
0
125°
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62892
arg s_{fe}
$|s_{fe}|$
(dB)
arg s_{fe}
$|s_{fe}|$
I_E = 200 mA
V_{CE} = 28 V
typ. values
20
10
0
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62890
I_E = 200 mA
V_{CE} = 28 V
typ. values
arg s_{oe}
$|s_{oe}|$
(dB)
arg s_{oe}
$|s_{oe}|$
−15
−10
−5
0
−175°
−150°
−125°
−100°
−75°
0
500
f (MHz)
1000

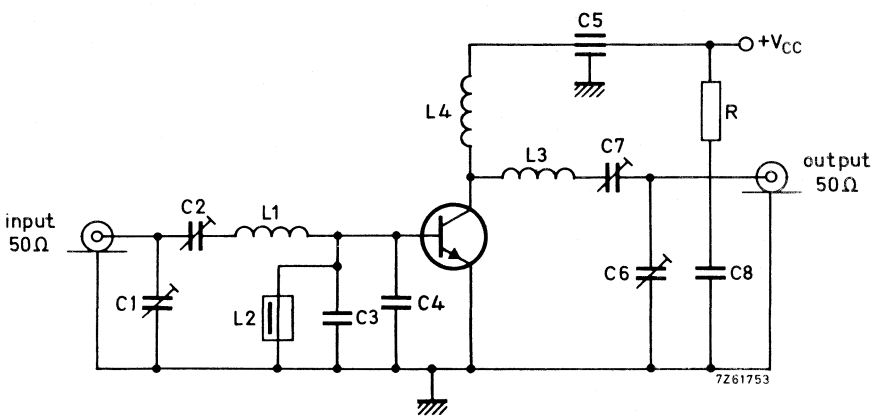
APPLICATION INFORMATION

R.F. performance in c.w. operation (Unneutralized common-emitter class-B circuit)

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

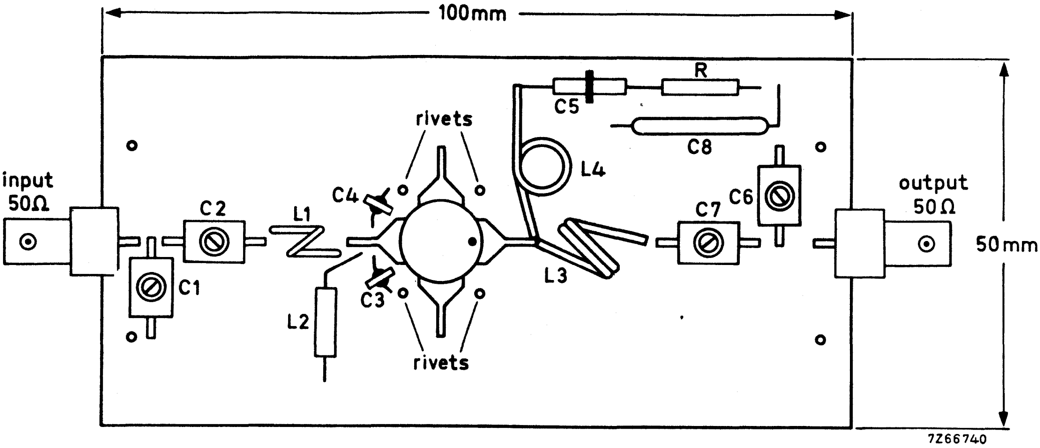
R = 10 Ω carbon

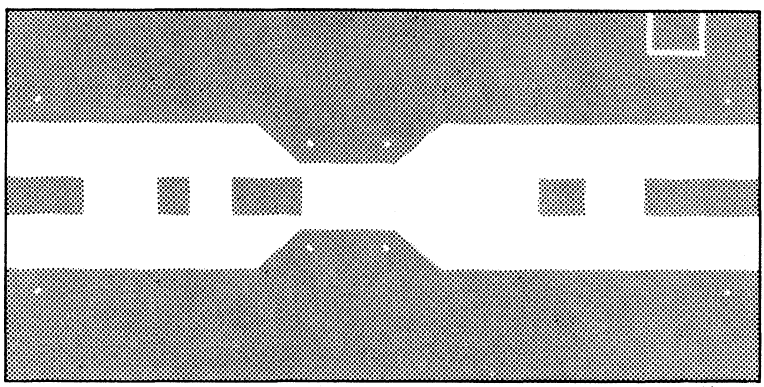
At P_L = 7,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 7,0 W.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.

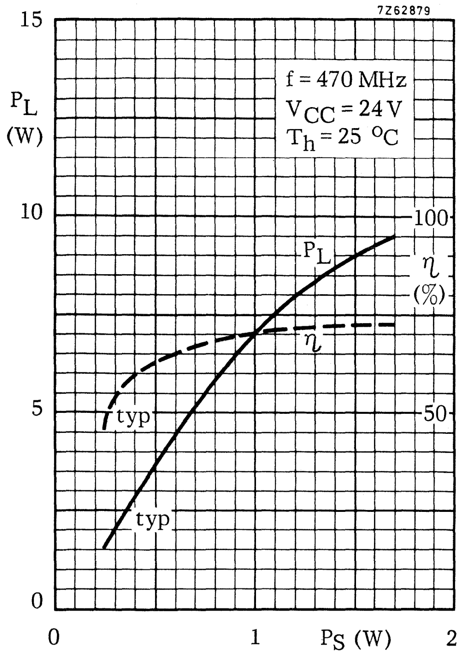


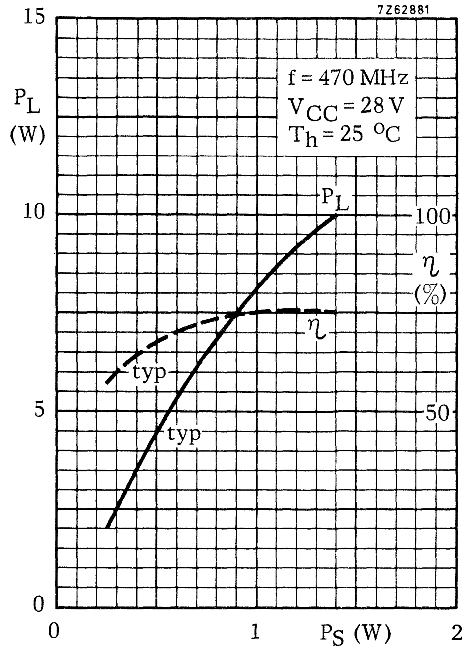


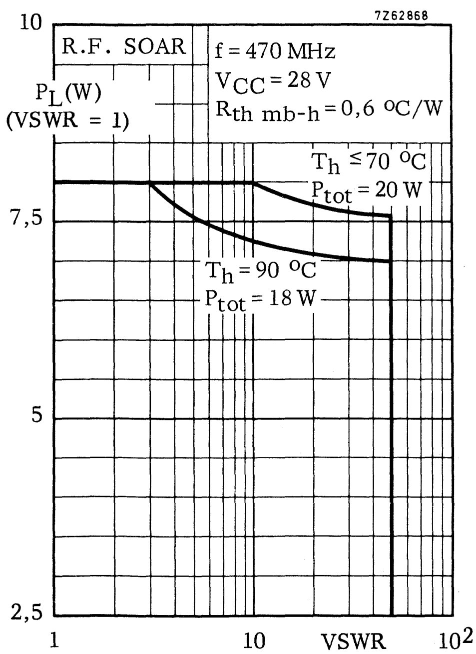
Shaded area copper

Back area completely copper clad

Material of printed-circuit board: 1,5 mm epoxy fibre-glass



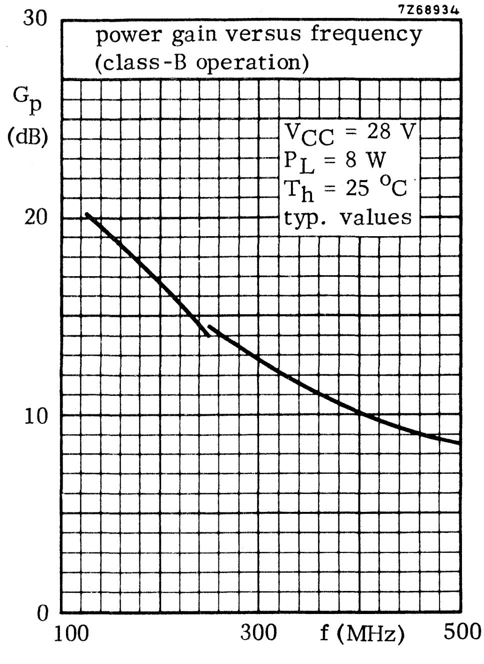


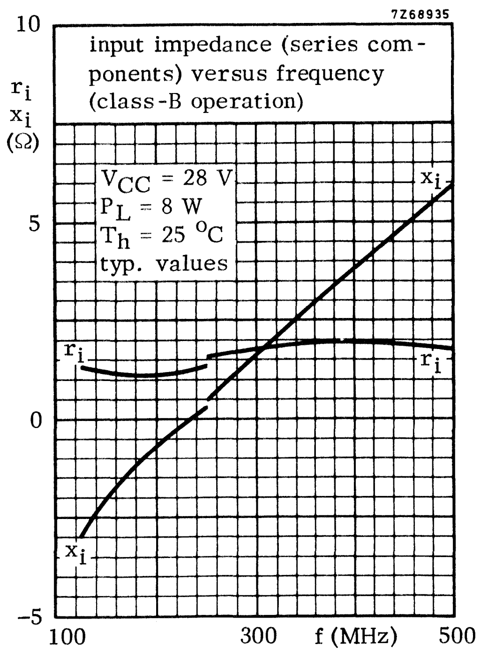


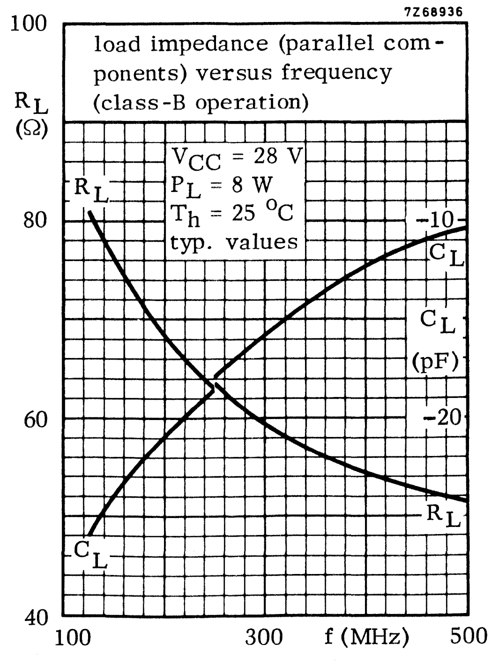
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 8 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 250 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







U.H.F. POWER TRANSISTORS

N-P-N silicon planar epitaxial transistors suitable for transmitting applications in class-A, B or C in the u.h.f. range for a nominal supply voltage up to 28 V. The transistors are resistance stabilized and tested under severe load mismatch conditions. Diffused emitter-ballasting resistors and gold sandwich metallization ensure excellent reliability properties.

These transistors are housed in capstan envelopes with ¼" studs, the **BLX94A** has a transfer-moulded cap and the **BLX94C** a ceramic cap.

All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in an unneutralized common-emitter class-B circuit

type number	mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %
BLX94A	c.w.	28	470	25	> 6	> 55
BLX94C	c.w.	28	470	25	> 6,5	> 55

MECHANICAL DATA

SOT-48/2 (see Fig. 1a)
SOT-122 (see Fig. 1b)

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOT-48/2 **(BLX94A)**

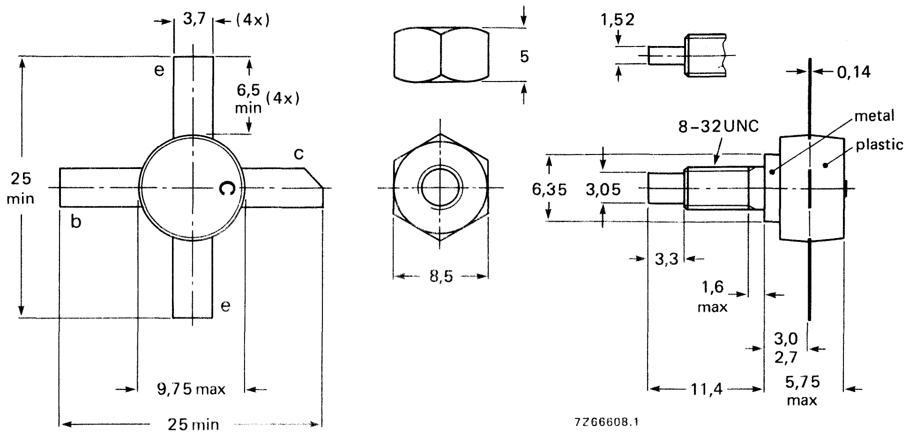
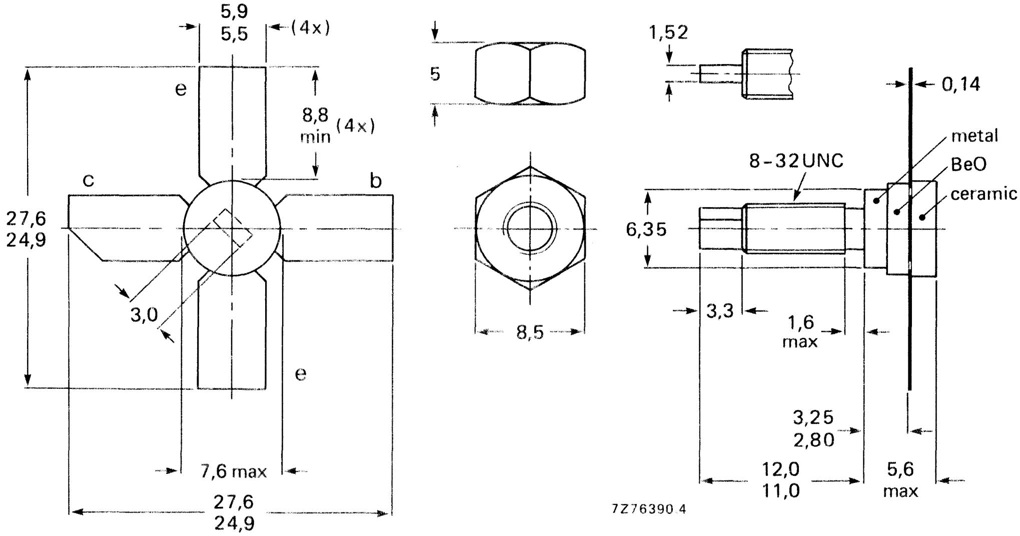


Fig. 1b SOT-122 **(BLX94C)**



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

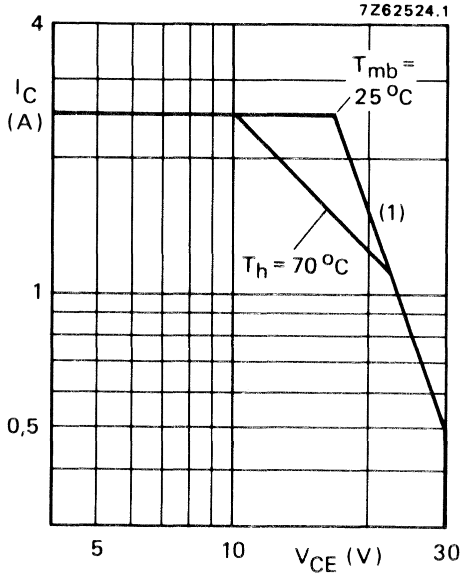
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$		V_{CESM}	max.	65 V
open base		V_{CEO}	max.	30 V
Emitter-base voltage (open collector)		V_{EBO}	max.	4 V
Collector current				
d.c. or average		I_C; $I_{C(AV)}$	max.	2,5 A
(peak value); f > 1 MHz		I_{CM}	max.	6,0 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C		P_{rf}	max.	60 W
Storage temperature	**BLX94A**	T_{stg}		−65 to +200 °C
	BLX94C	T_{stg}		−65 to +150 °C
Operating junction temperature		T_j	max.	200 °C



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

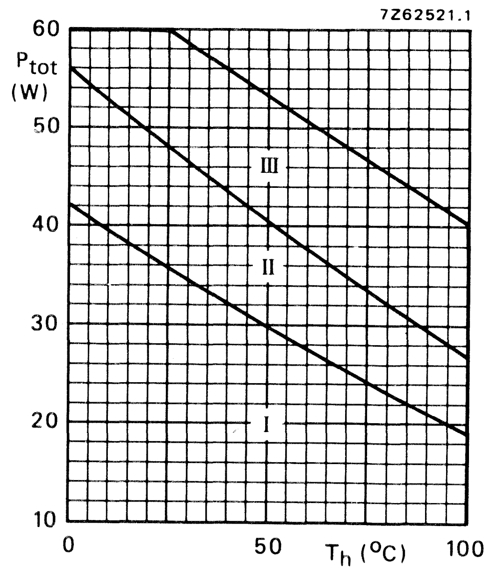


Fig. 3 Power derating curve vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	4,0 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,7 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6 K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	30 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 30$ V	I_{CES}	<	10 mA
Second breakdown energy; L = 25 mH; f = 50 Hz			
open base	E_{SBO}	>	3 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	3 mJ
D.C. current gain * $I_C = 1{,}5$ A; $V_{CE} = 5$ V	h_{FE}	> typ.	15 50
Collector-emitter saturation voltage * $I_C = 4{,}0$ A; $I_B = 0{,}8$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 500 MHz *			
$-I_E = 1{,}5$ A; $V_{CB} = 28$ V	f_T	typ.	1,1 GHz
$-I_E = 4{,}0$ A; $V_{CB} = 28$ V	f_T	typ.	0,75 GHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	33 pF
Feedback capacitance at f = 1 MHz $I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	18 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

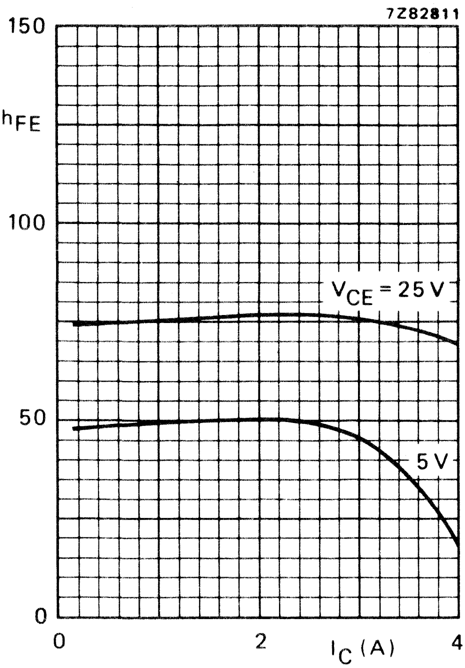


Fig. 4 Typical values; T_j = 25 °C.

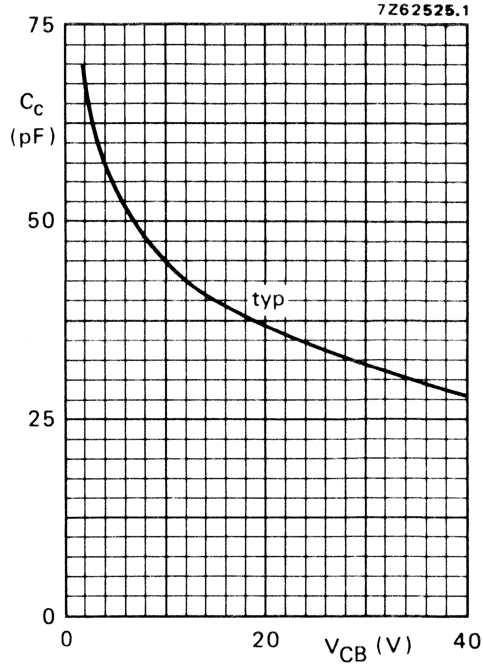


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

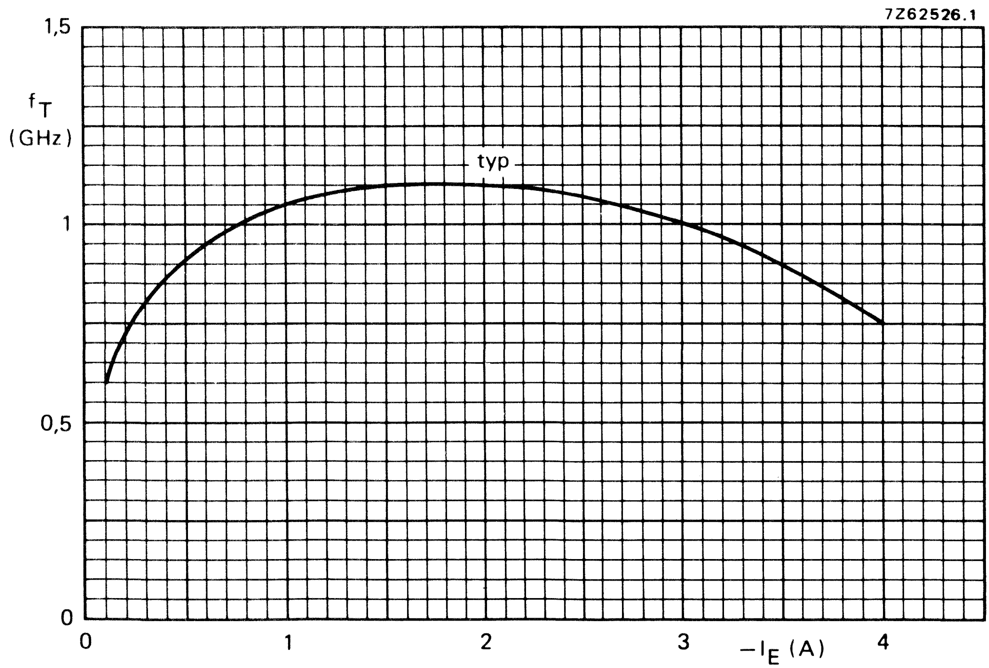


Fig. 6 V_{CB} = 28 V; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

f = 470 MHz; T_h = 25 °C

type number	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Z}_L$ (Ω)
BLX94A	28	25	< 6,25	> 6	< 1,62	> 55	–	–
	28	25	typ. 5,6	typ. 6,5	typ. 1,49	typ. 60	0,9 + j4,1	6,6 + j6,4
BLX94C	28	25	< 5,6	> 6,5	< 1,62	> 55	–	–
	28	25	typ. 4,7	typ. 7,25	typ. 1,54	typ. 58	0,7 + j2,6	5,8 + j6,3

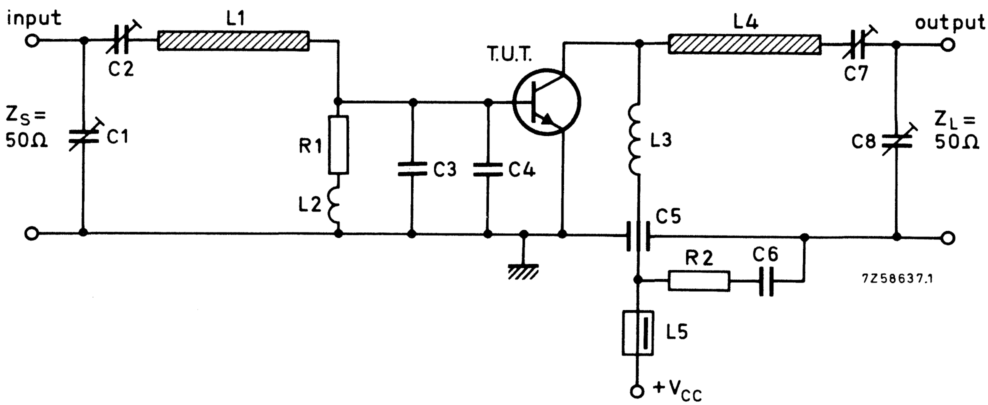


Fig. 7 470 MHz test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

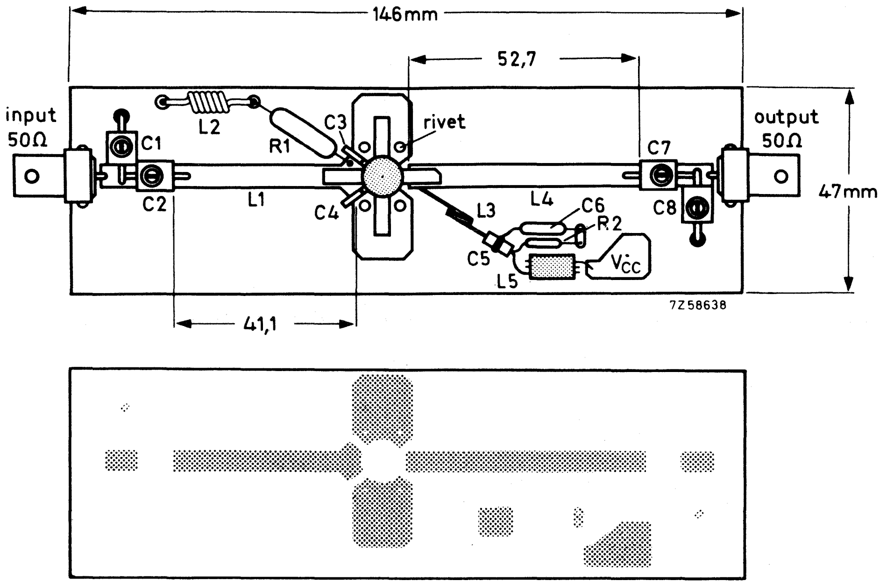
List of components:

C1 =C2 = C8 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 15 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C7 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)

R1 = 1 Ω carbon resistor
R2 = 10 Ω carbon resistor

L1 = stripline (41,1 mm x 5,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4 mm; leads 2 x 5 mm
L4 = stripline (52,7 mm x 5,0 mm)
L5 = Ferroxcube choke coil. Z (at f = 50 MHz) = 750 Ω ± 20% (cat. no. 4312 020 36640)

L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1,45 mm.



7Z66443.1

Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

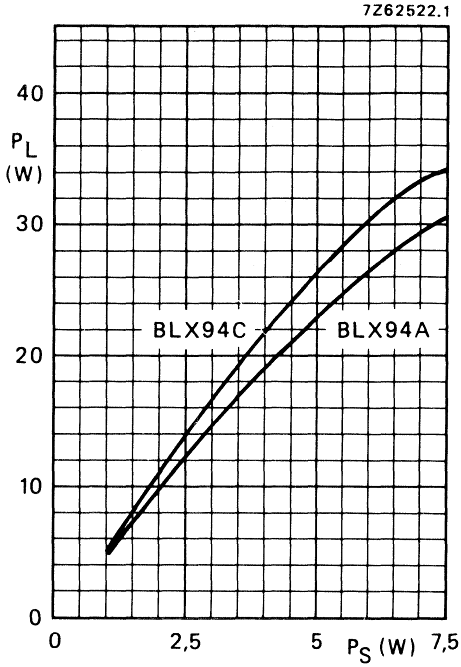


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typical values.

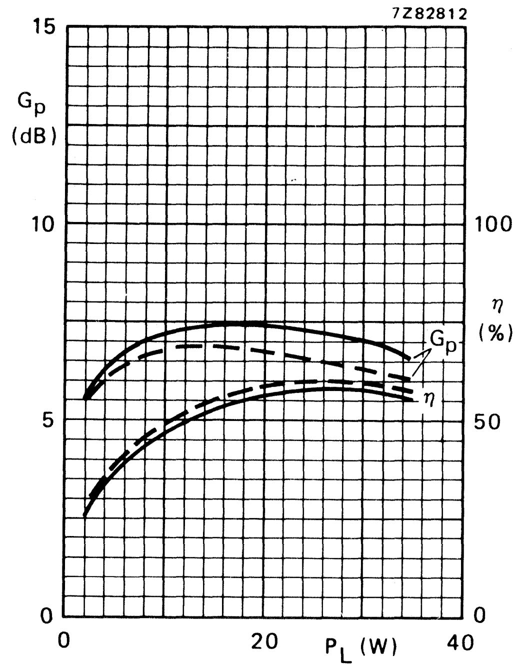


Fig. 10 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typ. values; ––– **BLX94A**; —— **BLX94C.**

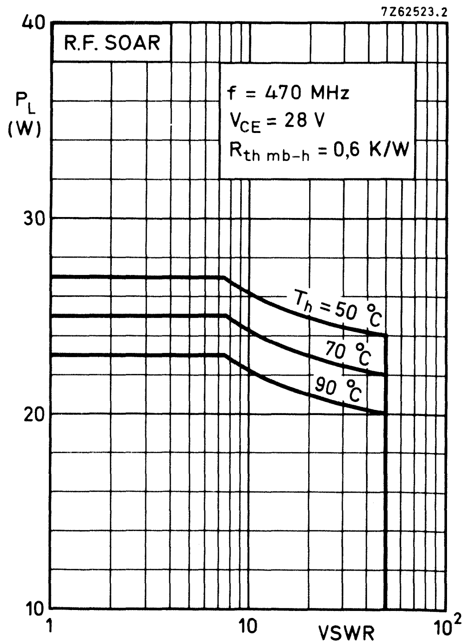


Fig. 11 For high voltage operation, a stabilized power supply is generally used. The graph shows the permissible output power under nominal conditions as a function of the VSWR, with heatsink temperature as parameter.

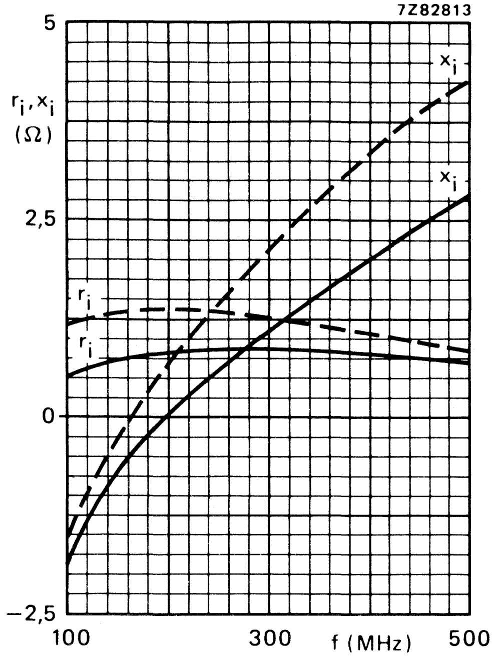


Fig. 12 Input impedance (series components).

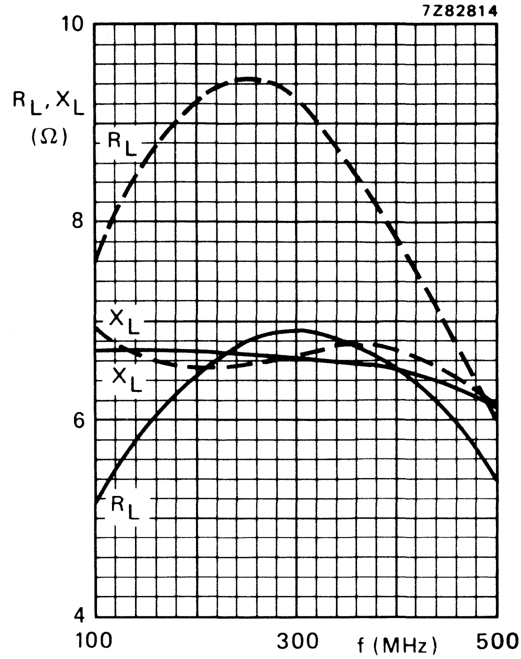


Fig. 13 Load impedance (series components).

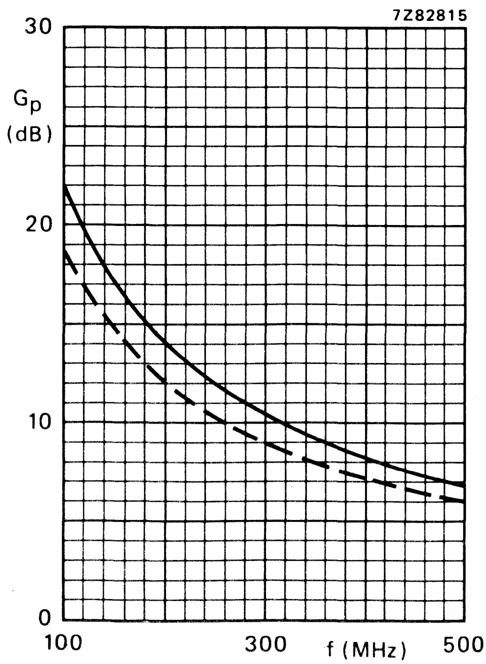


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C; class-B operation;
––– **BLX94A**; —— **BLX94C**.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C in the u.h.f. frequency range for supply voltages up to 28 V. The transistor is resistance stabilized and is tested under severe load mismatch conditions. Due to a gold metallization excellent reliability properties have been obtained. The transistor is housed in a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

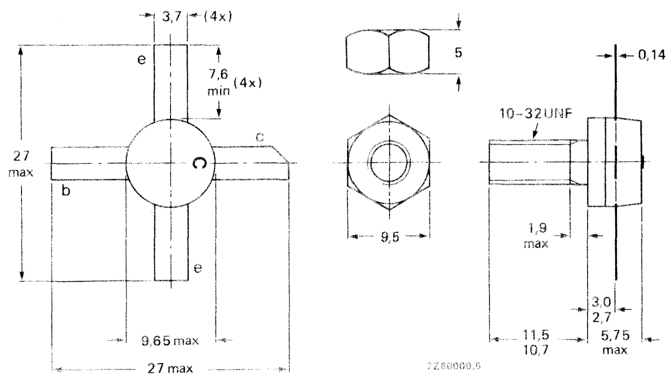
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %
c.w.	28	470	< 14,2	40	< 2,4	< 4,5	> 60
c.w.	28	175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

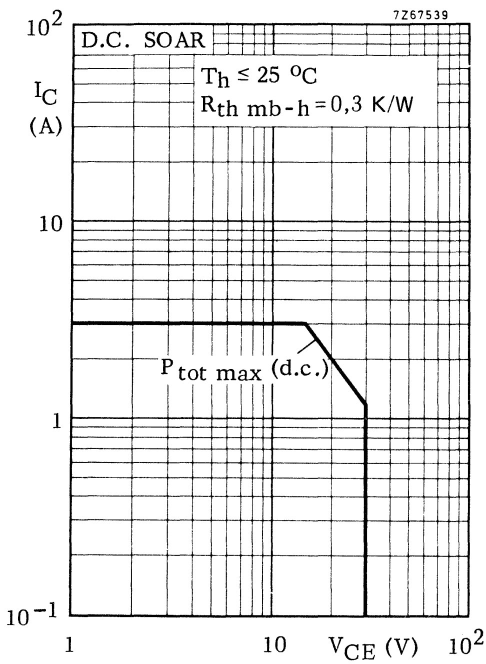
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

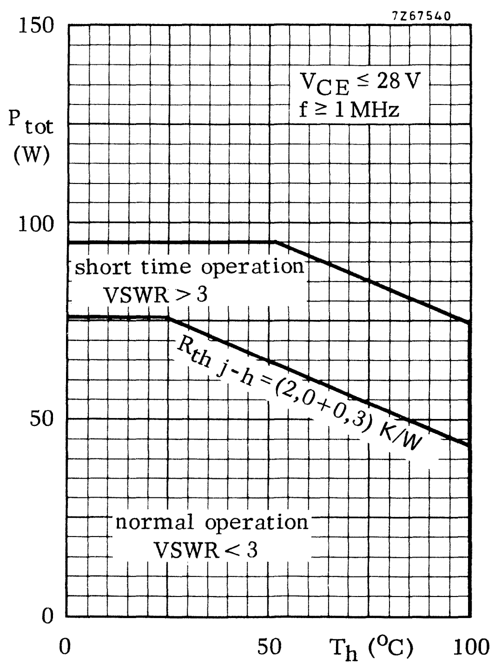
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage ($R_{BE} = 10\,\Omega$) peak value	V_{CERM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3,0	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10,0	A





Storage temperature	T_{stg}	−65 to +200		°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

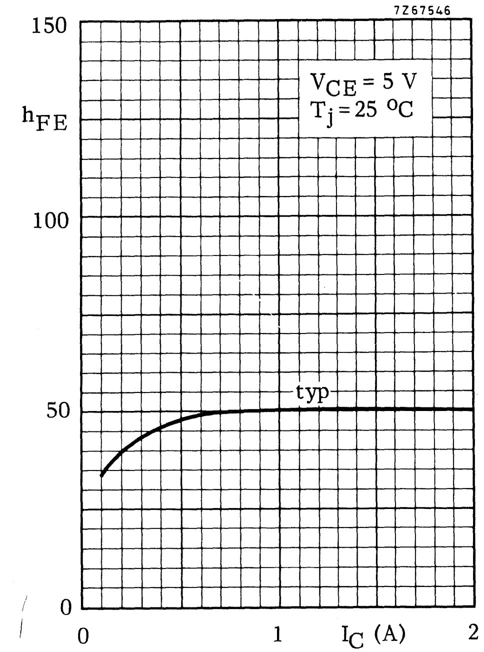
From junction to mounting base	$R_{th\ j-mb}$	=	2,0	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,3	K/W

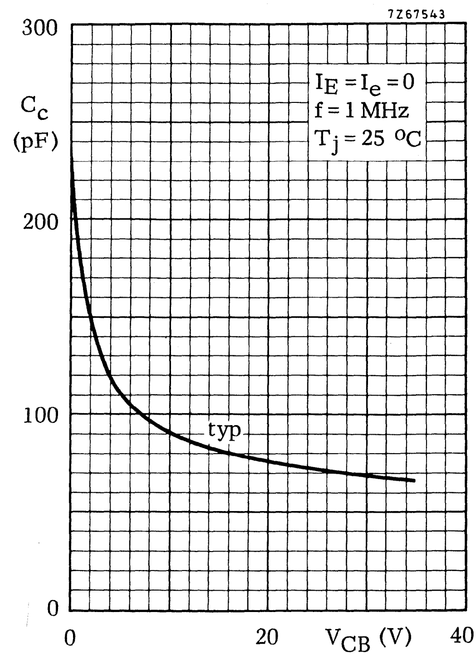
CHARACTERISTICS

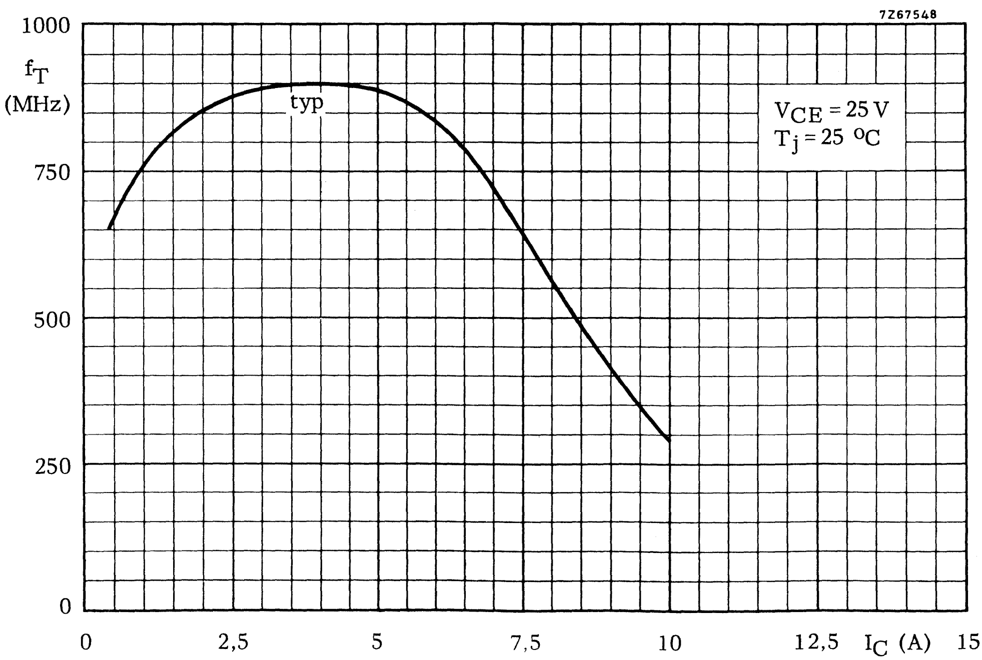
T_j = 25 °C unless otherwise specified

Breakdown voltages

Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage R_{BE} = 10 Ω, I_C = 50 mA	$V_{(BR)CER}$	>	65	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	30	V
Emitter-base voltage open collector, I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	4,5	mS
$-V_{BE}$ = 1,5 V; R_{BE} = 33 Ω	E	>	4,5	mS
D.C. current gain				
I_C = 1,0 A; V_{CE} = 5 V	h_{FE}	25 to 100		
Transition frequency				
I_C = 4 A; V_{CE} = 25 V	f_T	typ.	900	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	68	pF
		<	80	pF
Feedback capacitance at f = 1 MHz				
I_C = 200 mA; V_{CE} = 30 V	C_{re}	typ.	39	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z67546
150
100
50
0
h_{FE}
V_{CE} = 5 V
T_j = 25 °C
typ
0
1
2
I_C (A)


7Z67543
300
200
100
0
C_c
(pF)
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
typ
0
20
40
V_{CB} (V)


7Z67548
1000
750
500
250
0
f_T
(MHz)
typ
V_{CE} = 25 V
T_j = 25 °C
0
2,5
5
7,5
10
12,5
15
I_C (A)

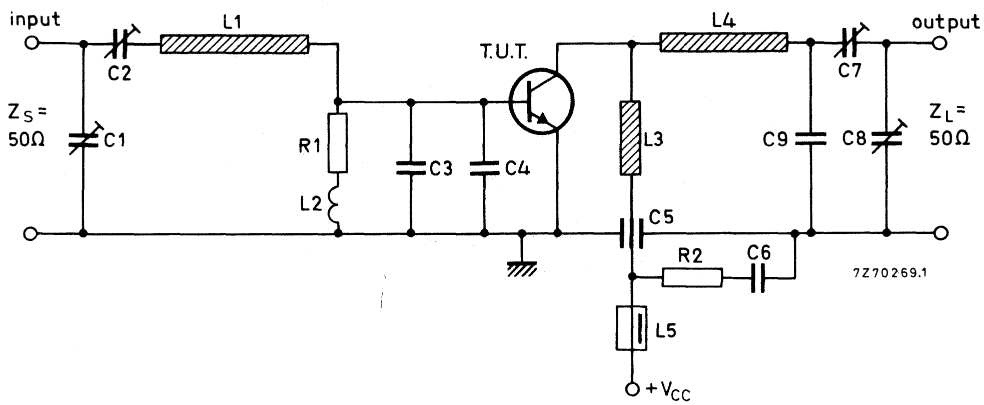
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_h up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)
470	< 14,2	40	< 2,4	> 4,5	> 60
175	typ. 3,2	40	typ. 1,9	typ. 11	typ. 75

Test circuit: 470 MHz; c.w. class-B.



List of components:

C1 = C7 = C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C2 = 1,8 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 18 pF chip capacitor
C5 = 100 pF feed-through capacitor
C6 = 33 nF polyester capacitor
C9 = 2 x 3,3 pF miniature ceramic plate capacitors (in parallel)

R1 = 1 Ω carbon resistor (0,25 W)
R2 = 10 Ω carbon resistor (0,25 W)

L1 = stripline (21,4 mm x 5,3 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); internal diameter 4,0 mm
L3 = stripline (43,8 mm x 3,0 mm)
L4 = stripline (45,5 mm x 5,3 mm)
L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)

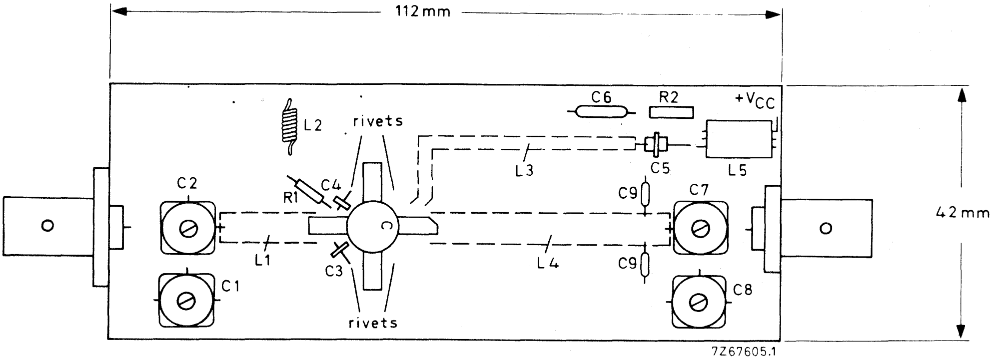
L1; L3; L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1/32".

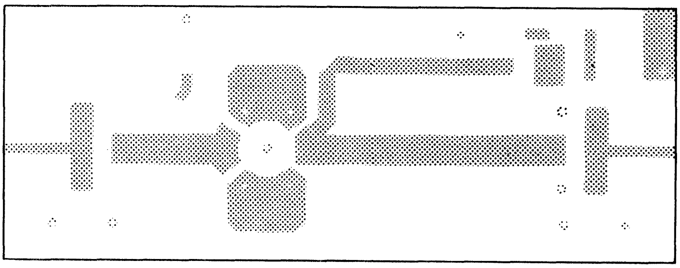
At P_L = 40 W and V_{CE} = 28 V, the output power at heatsink temperatures between 25 °C and 70 °C relative to that at 25 °C is diminished by typ. 50 mW/K.

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C.
VSWR = 50 through all phases; P_L = 36 W.

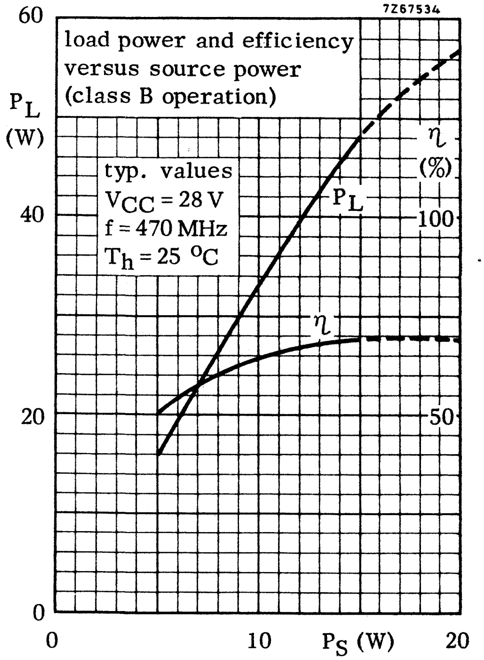
APPLICATION INFORMATION (continued)

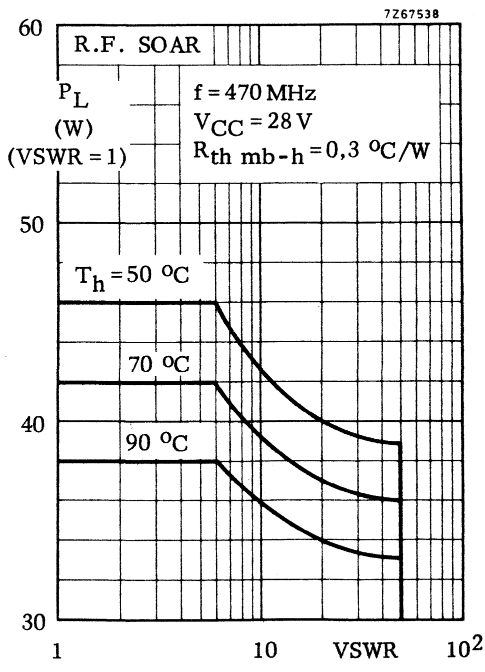
Component layout and printed-circuit board for 470 MHz test circuit.





The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.



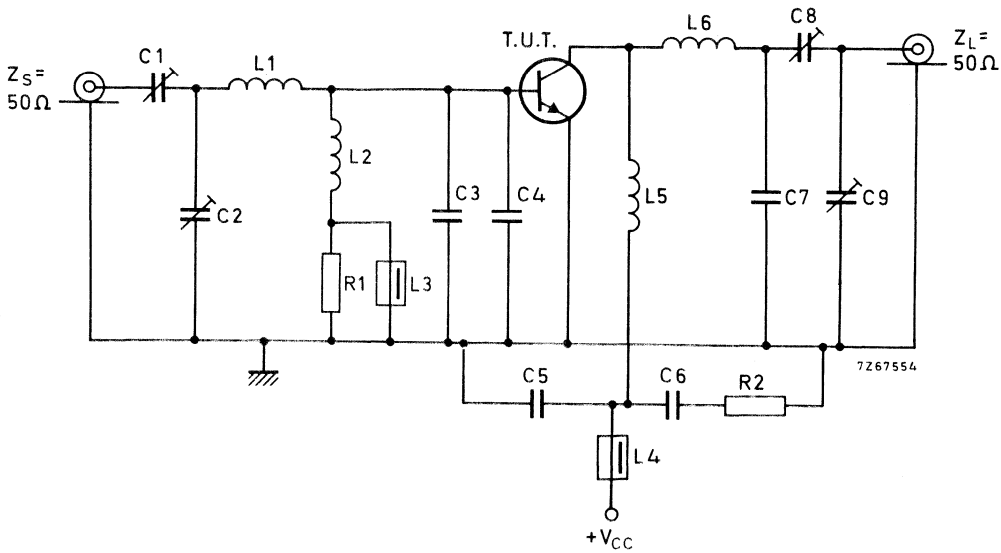


Indicated load power as a function of overload.

The graph has been derived from an evaluation of the performance of transistors matched up to 46 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures.
This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

APPLICATION INFORMATION (continued)

Test circuit for 175 MHz:



List of components:

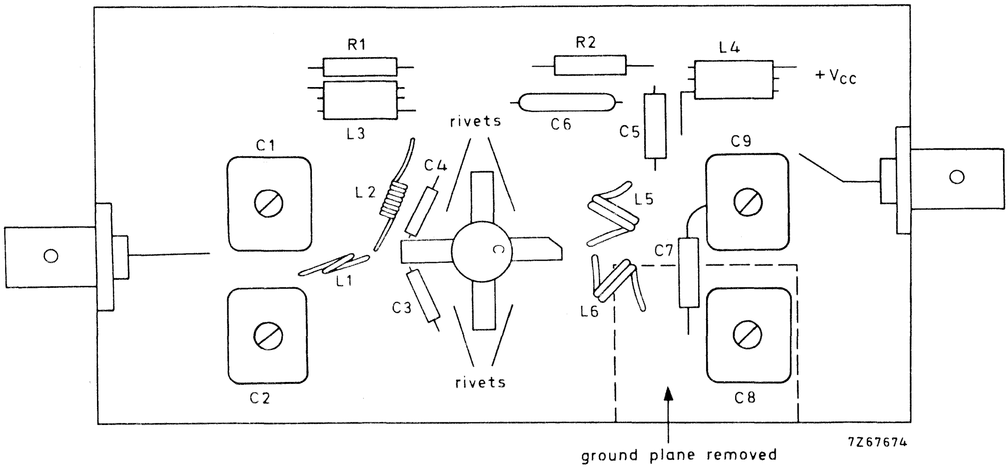
C1 = 2,5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 47 pF ceramic capacitor
C5 = 100 pF ceramic capacitor
C6 = 100 nF polyester capacitor
C7 = 6,8 pF ceramic capacitor
C8 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C9 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)

L1 = 0,5 turn enamelled Cu wire (1,5 mm); int. diam. 6 mm; lead length 2 x 6 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. diam. 3 mm; lead length 2 x 5 mm
L3 = L4 = ferroxcube choke coil (code number 4312 020 36640)
L5 = 53 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 10 mm; coil length 5,2 mm; lead length 2 x 5 mm
L6 = 46 nH; 2 turns enamelled Cu wire (1,5 mm); int. diam. 9 mm; coil length 5,4 mm; lead length 2 x 5 mm

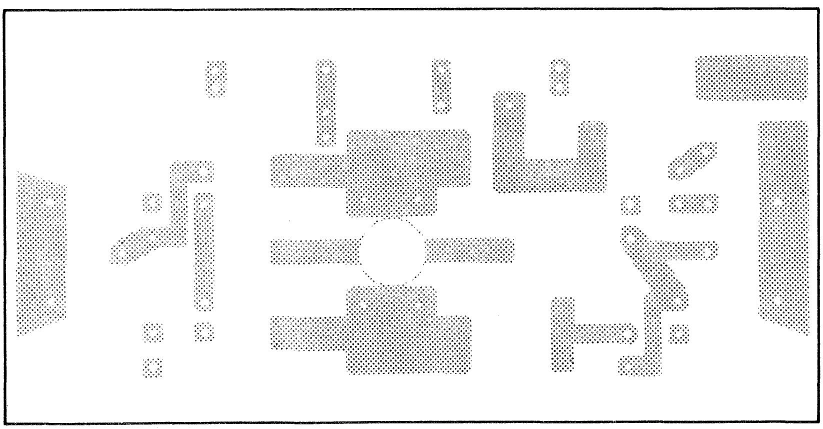
R1 = R2 = 10 Ω carbon resistor (0,25 W)

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

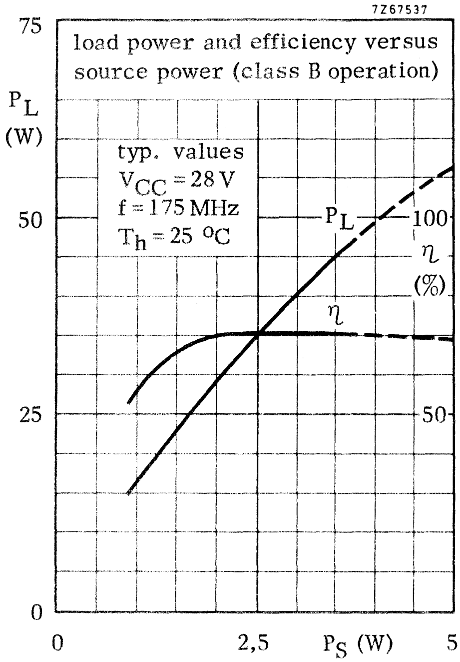


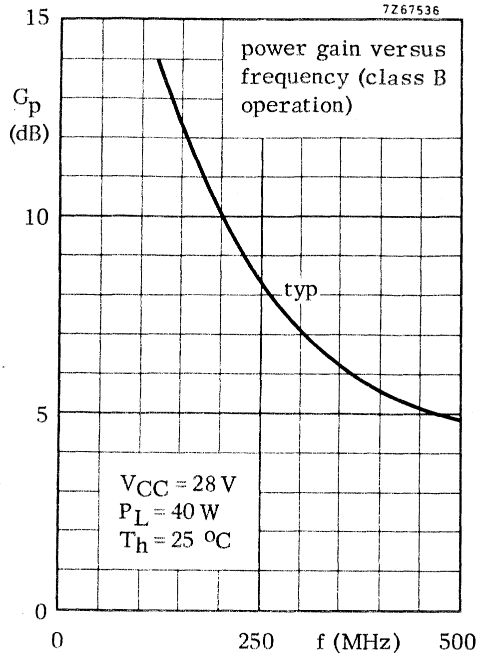
Dimensions of printed circuit board 123 mm x 55 mm.

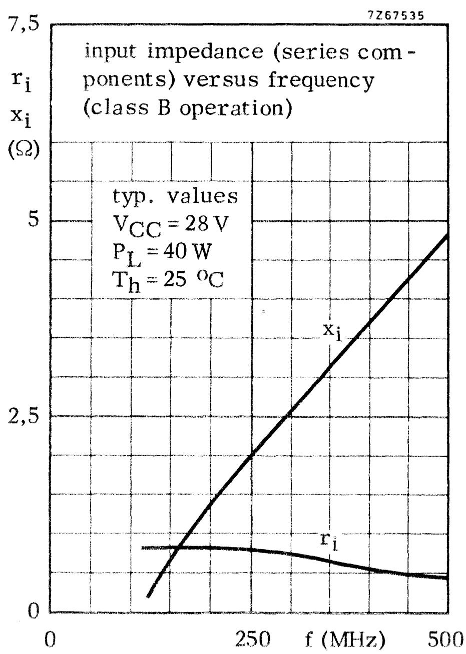


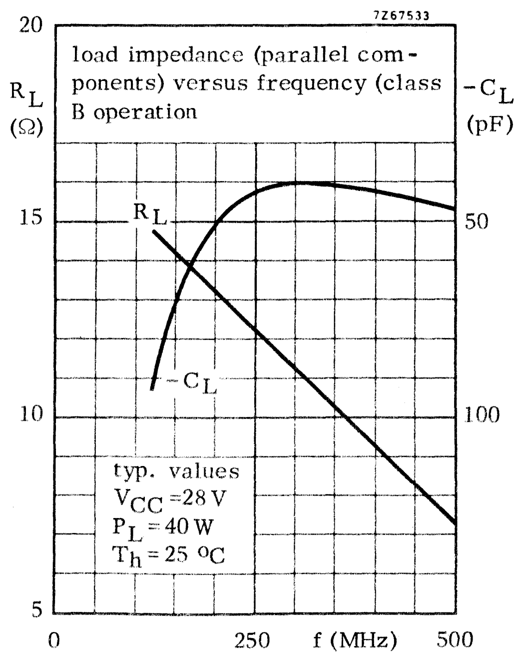
7Z66943

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.


7Z67537
load power and efficiency versus source power (class B operation)
typ. values
V_{CC} = 28 V
f = 175 MHz
T_h = 25 °C
P_L (W)
75
50
25
0
P_L
η
100
η (%)
50
0
2,5
P_S (W)
5


7Z67536
power gain versus frequency (class B operation)
G_p (dB)
15
10
5
0
typ
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
0
250
f (MHz)
500


7Z67535
input impedance (series components) versus frequency (class B operation)
r_i
x_i
(Ω)
7,5
5
2,5
0
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
x_i
r_i
0
250
f (MHz)
500


7Z67533
load impedance (parallel components) versus frequency (class B operation
R_L (Ω)
20
15
10
5
$-C_L$ (pF)
50
100
R_L
$-C_L$
typ. values
V_{CC} = 28 V
P_L = 40 W
T_h = 25 °C
0
250
f (MHz)
500

U.H.F. LINEAR POWER TRANSISTOR

N-P-N multi-emitter silicon planar epitaxial transistor primarily for use in linear u.h.f. amplifiers for television transposers and transmitters.

Features:

- guaranteed low intermodulation figures;
- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

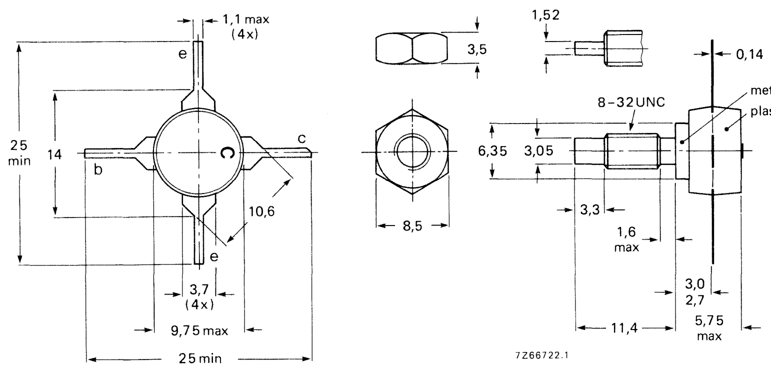
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	250	25	−60	> 0,5	> 6
class-A	860	25	250	25	−60	typ. 0,6	typ. 7

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

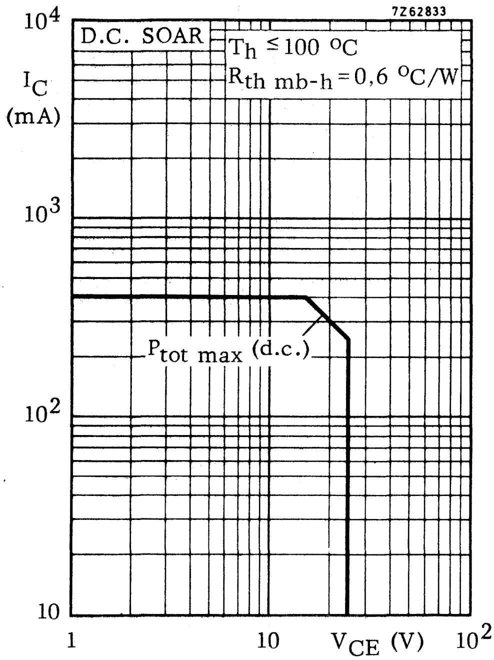
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current (d.c.)	I_C	max.	0,4	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	1	A
Total power dissipation up to T_h = 100 °C	P_{tot}	max.	6,25	W



Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

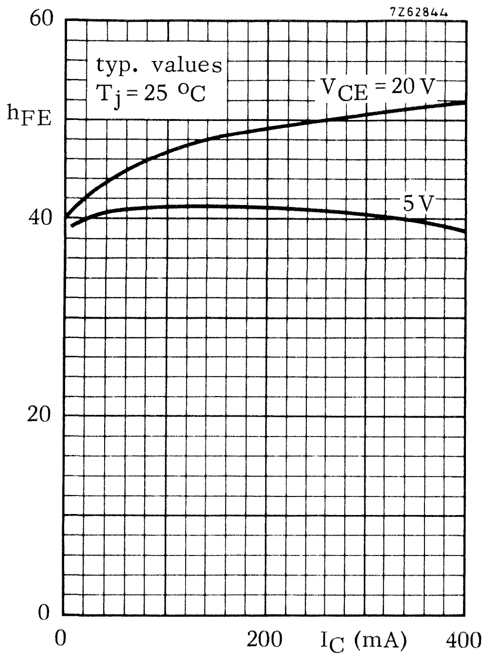
THERMAL RESISTANCE

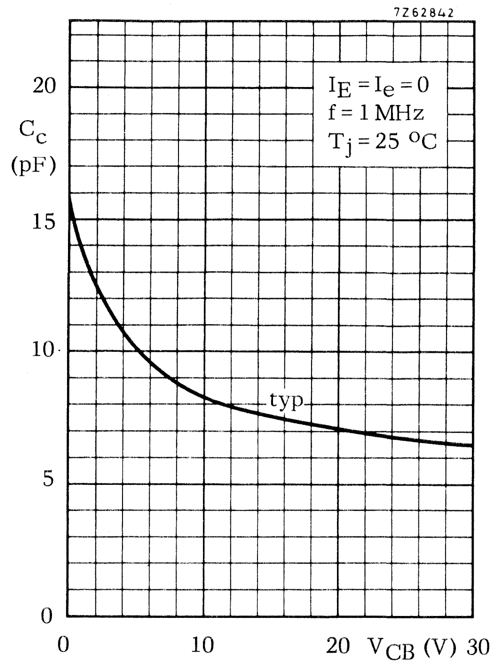
From junction to mounting base	$R_{th\ j-mb}$	=	15	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

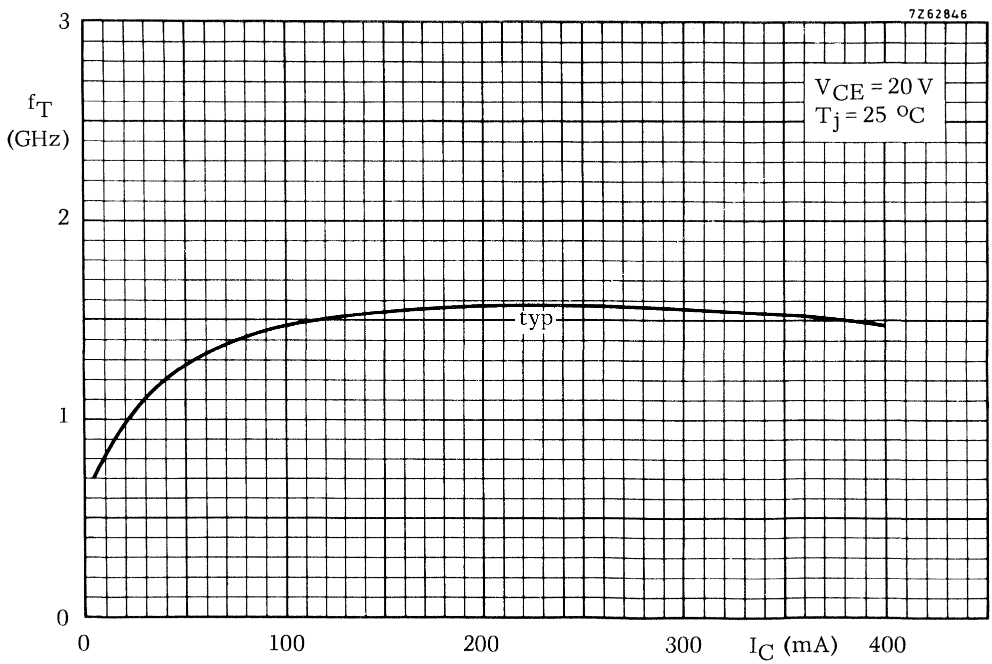
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	100	μA
Breakdown voltages				
Collector-base voltage				
open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage				
$R_{BE} = 10\ \Omega$; $I_C = 5$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 5$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage				
open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	3, 5	V
Saturation voltage				
$I_C = 200$ mA; $I_B = 20$ mA	V_{CEsat}	<	0, 75	V
D.C. current gain				
$I_C = 200$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 200$ mA; $V_{CE} = 20$ V	f_T	>	1, 2	GHz
$I_C = 350$ mA; $V_{CE} = 20$ V	f_T	>	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	10	pF
Feedback capacitance at f = 1 MHz				
$I_C = 10$ mA; $V_{CE} = 20$ V; $T_{mb} = 25$ °C	C_{re}	typ.	3, 5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62844
typ. values
Tj = 25 °C
hFE
VCE = 20 V
5 V
60
40
20
0
0
200
IC (mA)
400


7Z62842
IE = Ie = 0
f = 1 MHz
Tj = 25 °C
Cc
(pF)
typ
20
15
10
5
0
0
10
20
VCB (V)
30

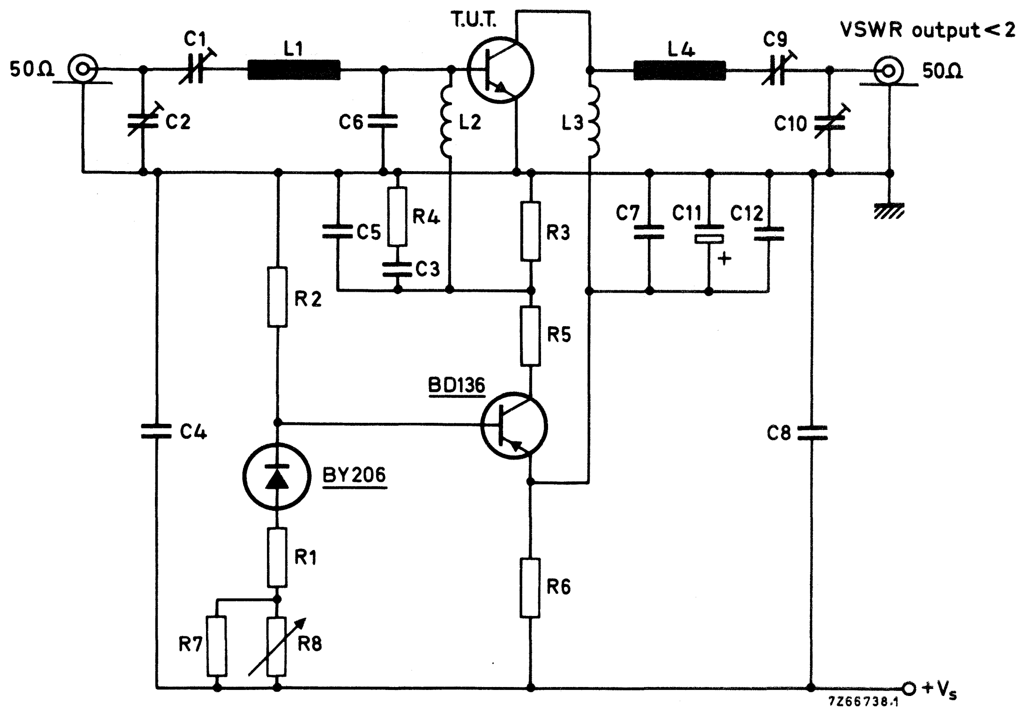

7Z62846
VCE = 20 V
Tj = 25 °C
fT
(GHz)
typ
3
2
1
0
0
100
200
300
IC (mA)
400

APPLICATION INFORMATION

d_{im}(dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	250	> 6	> 0,5	25
−60	860	25	250	typ. 7	typ. 0,6	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components:

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω

R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

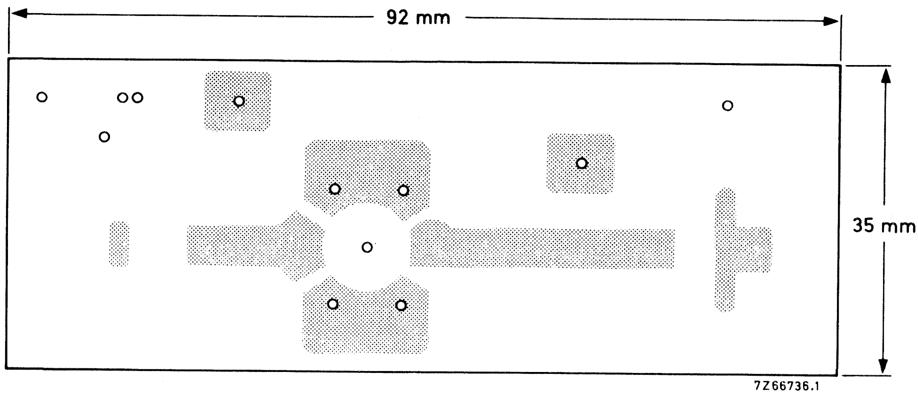
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

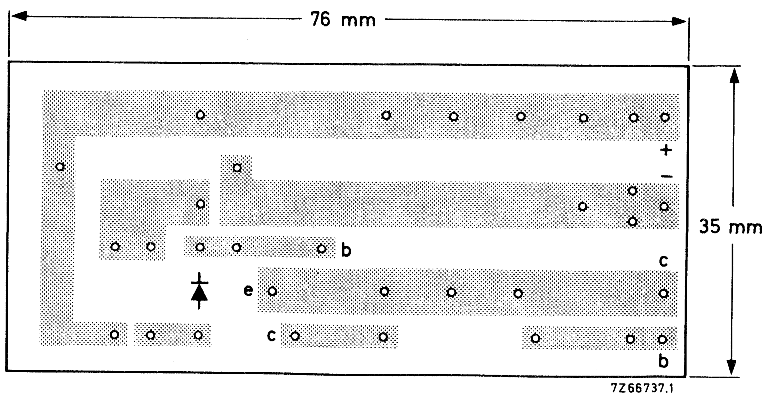
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

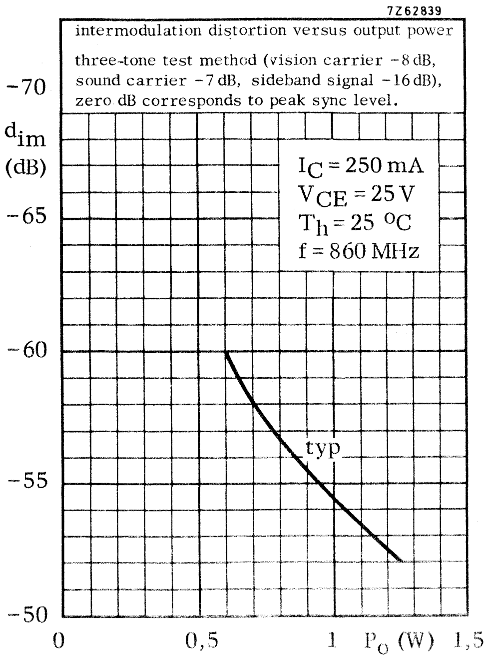
Layout of printed-circuit board for 860 MHz test circuit.

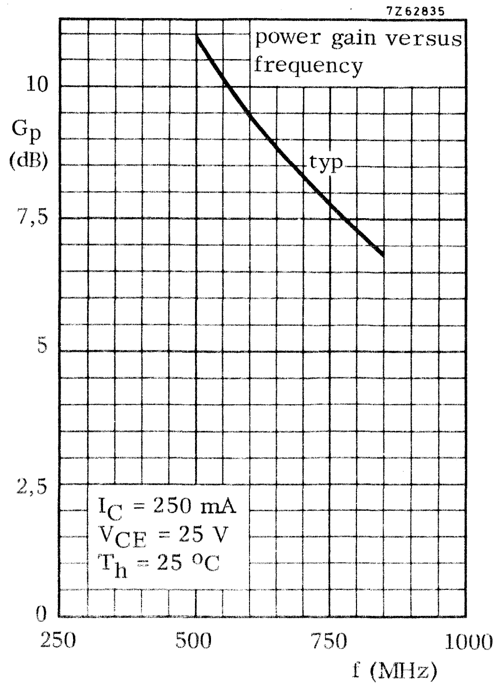


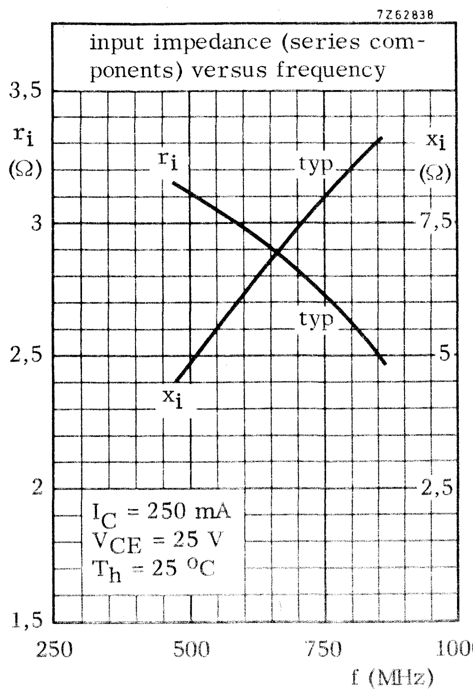
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

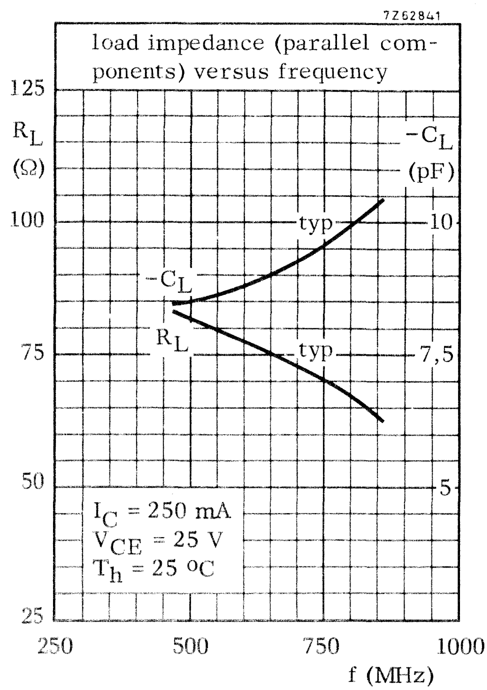
Layout of printed board bias circuit.




7Z62839
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
d_{im} (dB)
−70
−65
−60
−55
−50
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
typ
0
0,5
1
P_o (W)
1,5


7Z62835
power gain versus frequency
G_p (dB)
10
7,5
5
2,5
0
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)


7Z62838
input impedance (series components) versus frequency
r_i (Ω)
3,5
3
2,5
2
1,5
x_i (Ω)
7,5
5
2,5
r_i
x_i
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)


7Z62841
load impedance (parallel components) versus frequency
R_L (Ω)
125
100
75
50
25
$-C_L$ (pF)
10
7,5
5
$-C_L$
R_L
typ
typ
I_C = 250 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)

U.H.F. LINEAR POWER TRANSISTOR

N-P-N multi-emitter silicon planar epitaxial transistor primarily for use in linear u.h.f. amplifiers for television transposers and transmitters.

Features:

- guaranteed low intermodulation figures;
- gold metallization ensures excellent reliability.

The transistor has a ¼″ capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

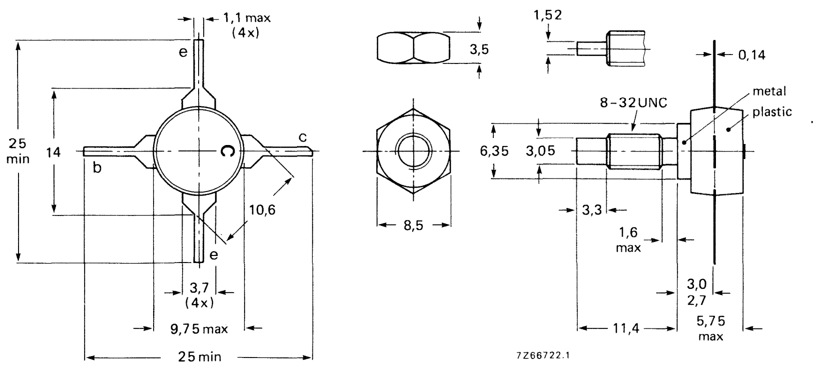
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A	860	25	500	25	−60	> 1,0	> 5,5
class-A	860	25	500	25	−60	typ. 1,1	typ. 6,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

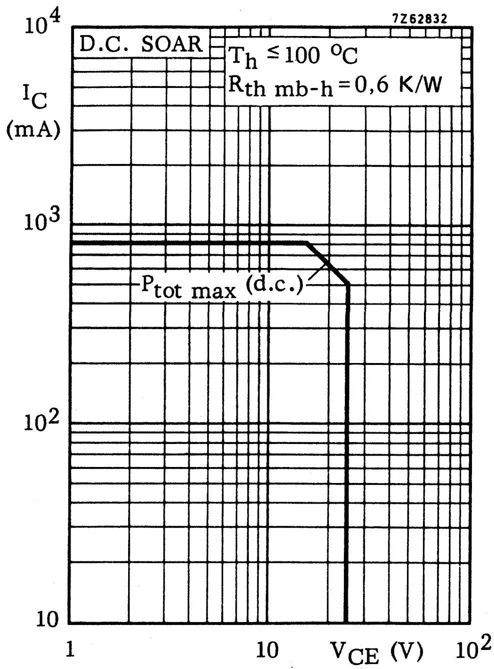
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter; peak value)	V_{CBOM}	max.	40	V
Collector-emitter voltage (R_{BE} = 10 Ω; peak value)	V_{CERM}	max.	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current (d.c.)	I_C	max.	0,8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2	A
Total power dissipation up to T_h = 100 °C	P_{tot}	max.	12,5	W



Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

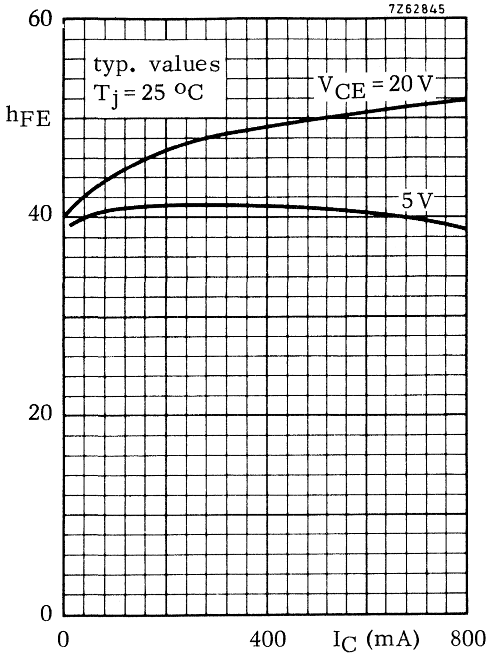
THERMAL RESISTANCE

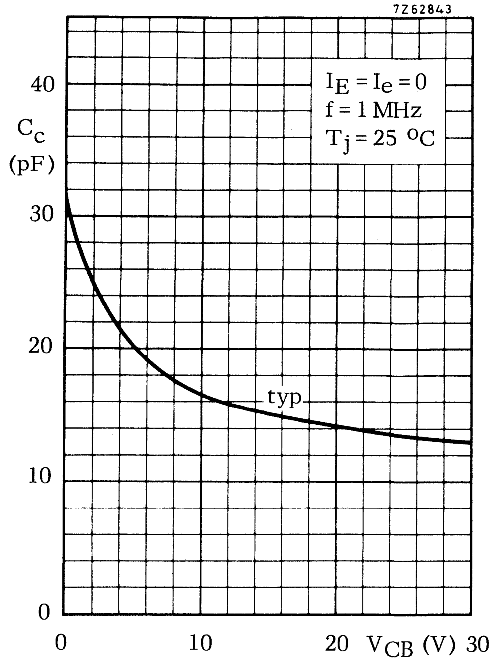
From junction to mounting base	$R_{th\ j-mb}$	=	7,5	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

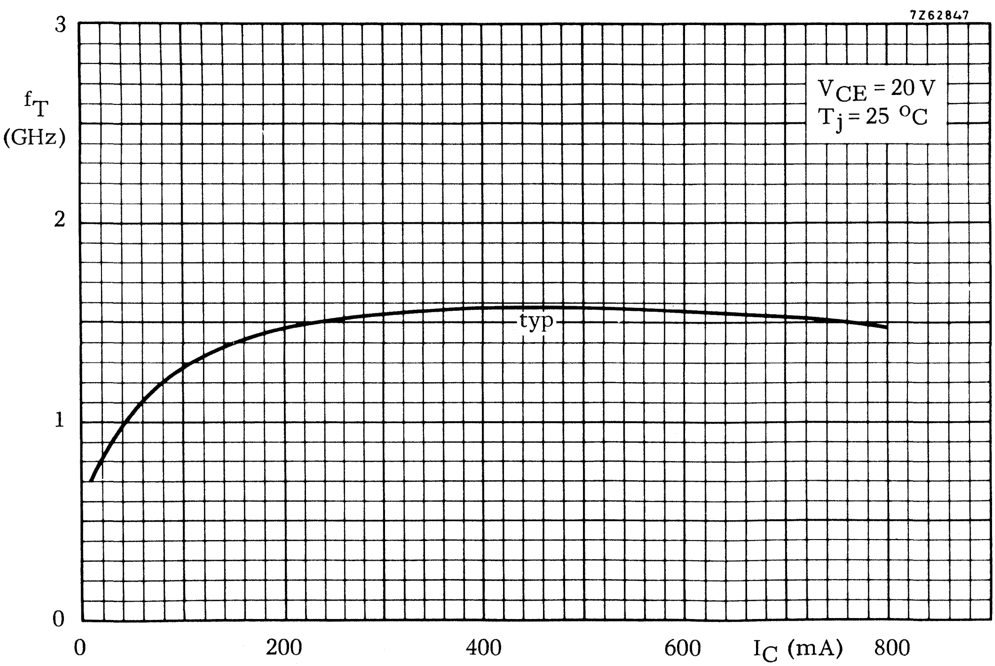
CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_E = 0$; $V_{CB} = 20$ V	I_{CBO}	<	200	μA
Breakdown voltages				
Collector-base voltage				
open emitter; $I_C = 2$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage				
$R_{BE} = 10\ \Omega$; $I_C = 10$ mA	$V_{(BR)CER}$	>	40	V
open base; $I_C = 10$ mA	$V_{(BR)CEO}$	>	27	V
Emitter-base voltage				
open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	3, 5	V
Saturation voltage				
$I_C = 400$ mA; $I_B = 40$ mA	V_{CEsat}	<	0, 75	V
D.C. current gain				
$I_C = 400$ mA; $V_{CE} = 20$ V	h_{FE}	>	30	
$I_C = 800$ mA; $V_{CE} = 20$ V	h_{FE}	>	20	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	>	1, 2	GHz
$I_C = 700$ mA; $V_{CE} = 20$ V	f_T	>	1, 0	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 20$ mA; $V_{CE} = 20$ V; $T_{mb} = 25$ °C	C_{re}	typ.	7	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z62845
typ. values
$T_j = 25\ ^oC$
h_{FE}
$V_{CE} = 20\ V$
5 V
60
40
20
0
0
400
I_C (mA)
800


7Z62843
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25\ ^oC$
C_c
(pF)
typ
40
30
20
10
0
0
10
20
V_{CB} (V)
30

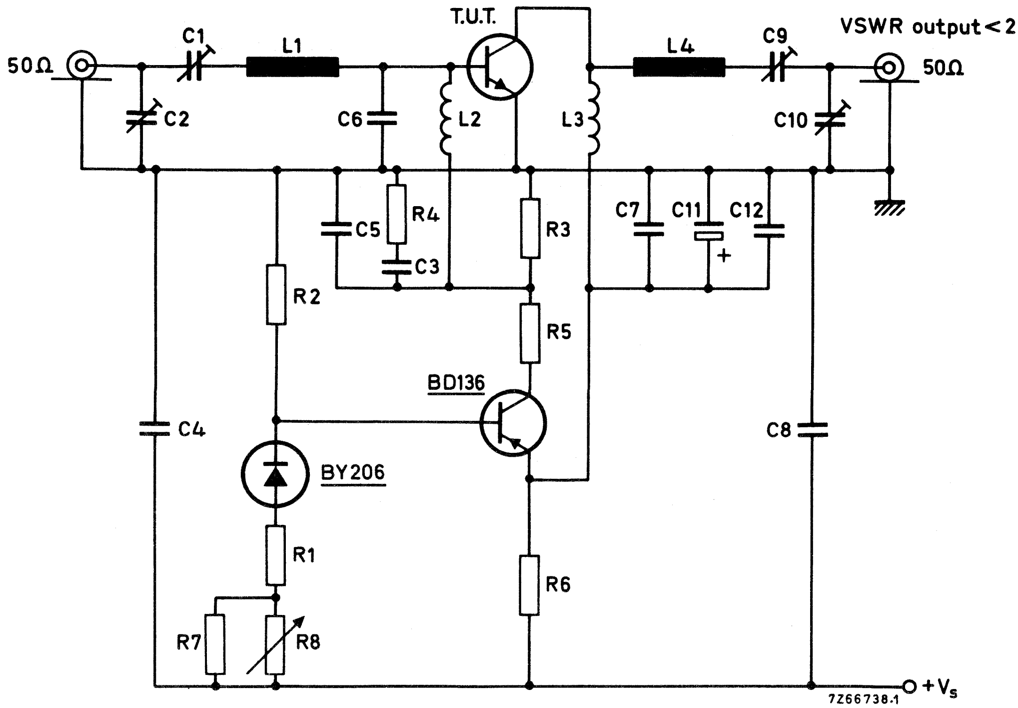

7Z62847
f_T
(GHz)
$V_{CE} = 20\ V$
$T_j = 25\ ^oC$
typ
3
2
1
0
0
200
400
600
I_C (mA)
800

APPLICATION INFORMATION

d_{im} (dB) *)	f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	G_p (dB)	$P_{o\ sync}$ (W) *)	T_h (°C)
−60	860	25	500	> 5,5	> 1,0	25
−60	860	25	500	typ. 6,5	typ. 1,1	25

*) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

Test circuit at f_{vision} = 860 MHz



List of components: (see also next page).

C1 = C2 = C10 = 2 to 9 pF film dielectric trimmers
C3 = C4 = C12 = 100 nF polyester capacitors
C5 = C7 = C8 = 100 pF feed-through capacitors
C6 = 2 x 2,7 pF in parallel, chip capacitors
C9 = 2 to 18 pF film dielectric trimmer
C11 = 10 μF/40 V solid aluminium electrolytic capacitor

R1 = 220 Ω
R2 = 4,7 kΩ
R3 = 100 Ω
R4 = 10 Ω
R5 = 470 Ω (1 W)
R6 = 3 x 22 Ω in parallel; (1 W)
R7 = 12 kΩ
R8 = 1 kΩ

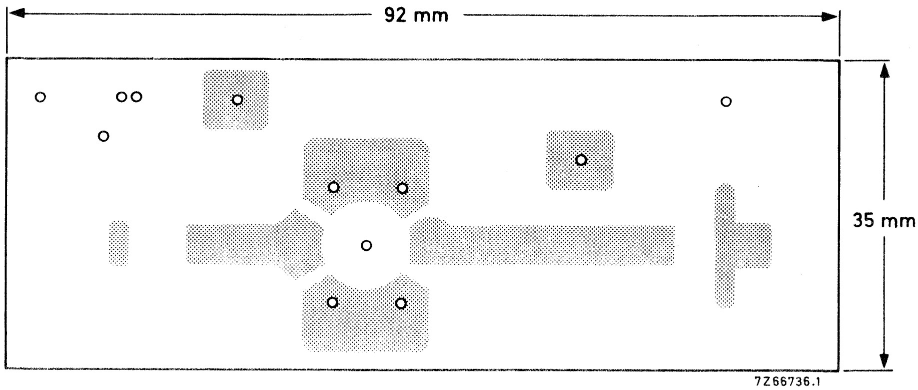
APPLICATION INFORMATION (continued)

List of components: (continued)

L1 = stripline (14,8 mm x 4,3 mm)
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm
L3 = 2 turns Cu wire (1 mm); winding pitch 1,5 mm; int. dia. 4,5 mm; leads 2 x 5 mm
L4 = stripline (29,5 mm x 4,3 mm)

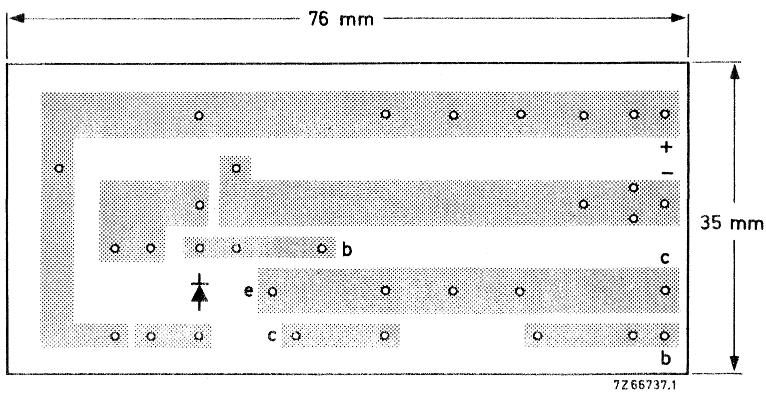
L1 and L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,45 mm.

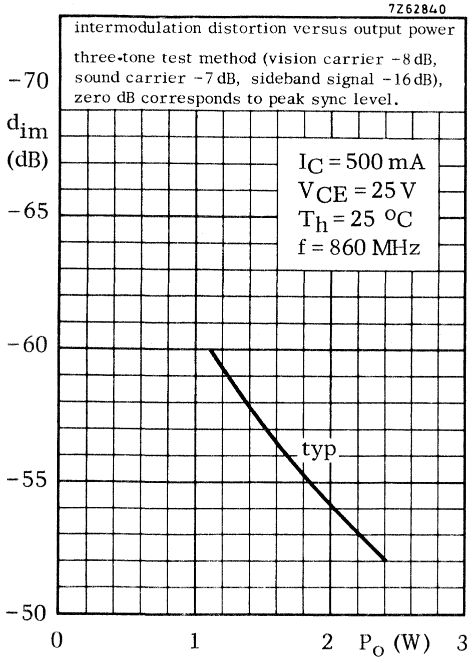
Layout of printed-circuit board for 860 MHz test circuit.

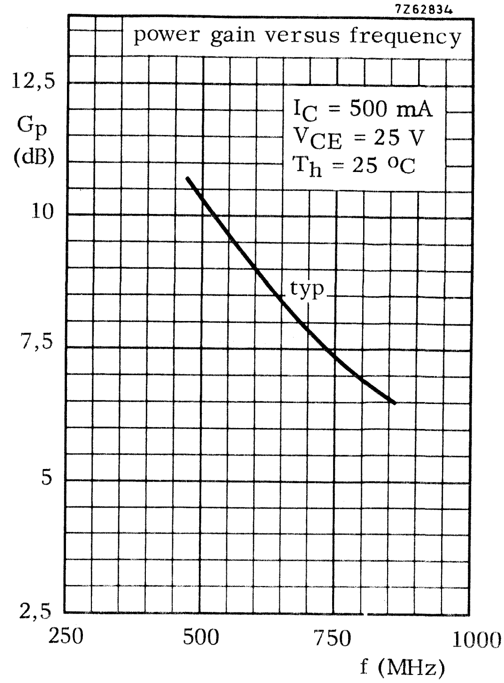


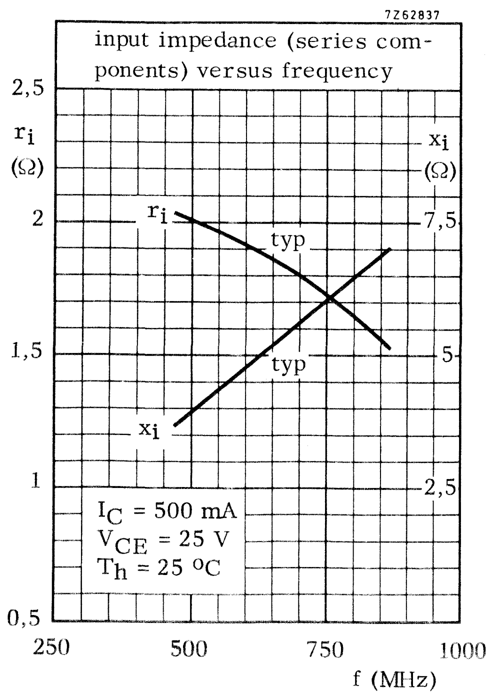
The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

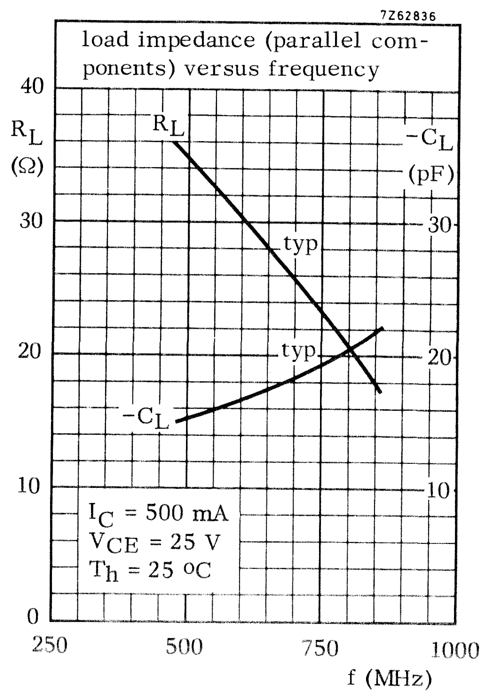
Layout of printed board bias circuit.




7Z62840
intermodulation distortion versus output power
three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
f = 860 MHz
d_{im} (dB)
−70
−65
−60
−55
−50
typ
0
1
2
P_o (W)
3


7Z62834
power gain versus frequency
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
G_p (dB)
12,5
10
7,5
5
2,5
typ
250
500
750
1000
f (MHz)


7Z62837
input impedance (series components) versus frequency
r_i (Ω)
x_i (Ω)
2,5
2
1,5
1
0,5
7,5
5
2,5
r_i
x_i
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)


7Z62836
load impedance (parallel components) versus frequency
R_L (Ω)
$-C_L$ (pF)
40
30
20
10
0
R_L
$-C_L$
typ
typ
I_C = 500 mA
V_{CE} = 25 V
T_h = 25 °C
250
500
750
1000
f (MHz)

U.H.F. LINEAR POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in linear u.h.f. amplifiers of television transposers and transmitters in band IV-V.

Features:

- diffused emitter ballasting resistors for an optimum temperature profile;
- gold metallization ensures excellent reliability.

The transistor has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

R.F. performance in linear amplifier

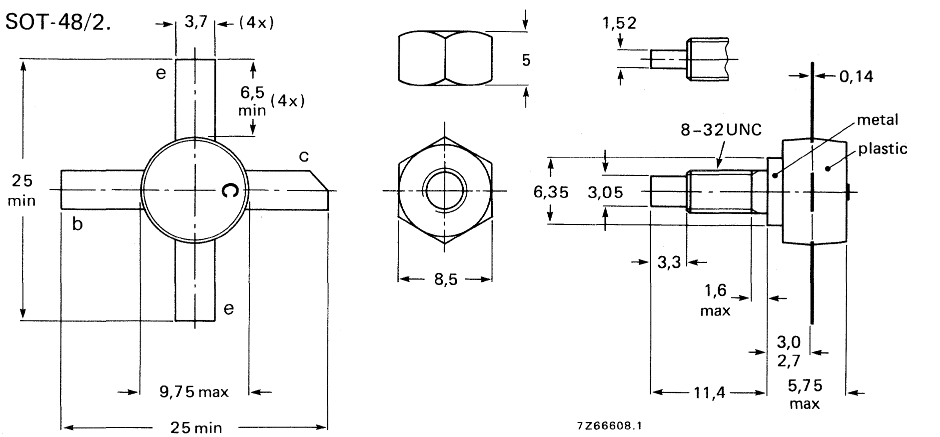
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 5,0
class-A	860	25	850	70	−60	typ. 4,0	typ. 5,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

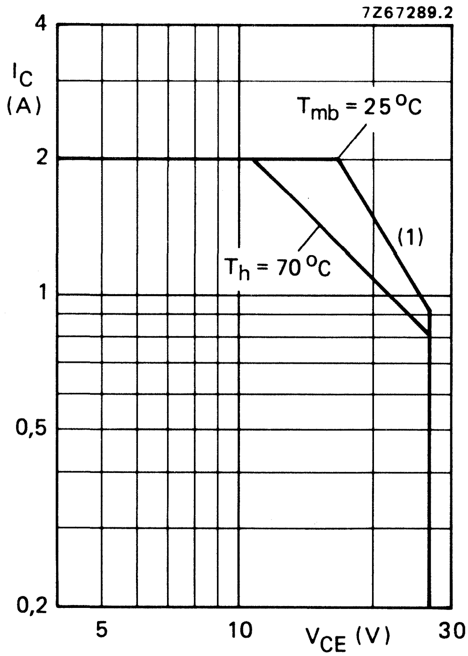
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage				
(peak value); $V_{BE} = 0$	V_{CESM}	max.	50	V
open base	V_{CEO}	max.	27	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	V
Collector current				
d.c.	I_C	max.	2	A
(peak value); f > 1 MHz	I_{CM}	max.	4	A
Total power dissipation at $T_h = 70\ ^oC$	P_{tot}	max.	21,5	W
Storage temperature	T_{stg}	−65 to + 200		^oC
Junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature.

Fig. 2 D.C. SOAR.

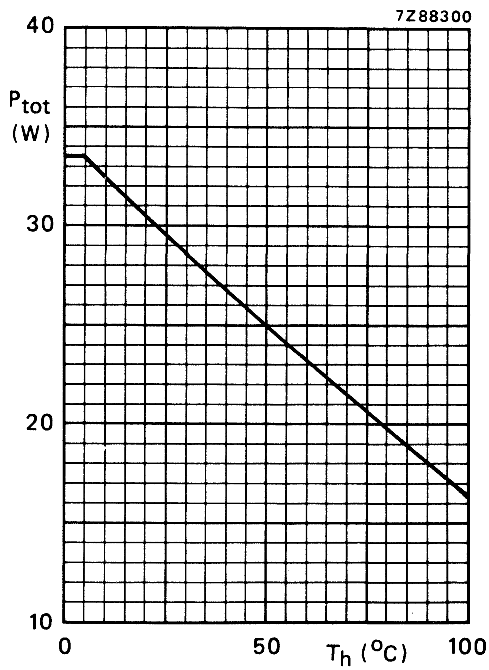


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 21,25 W; $T_{mb} = 82,75\ ^oC$, i.e. $T_h = 70\ ^oC$.

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5,45	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

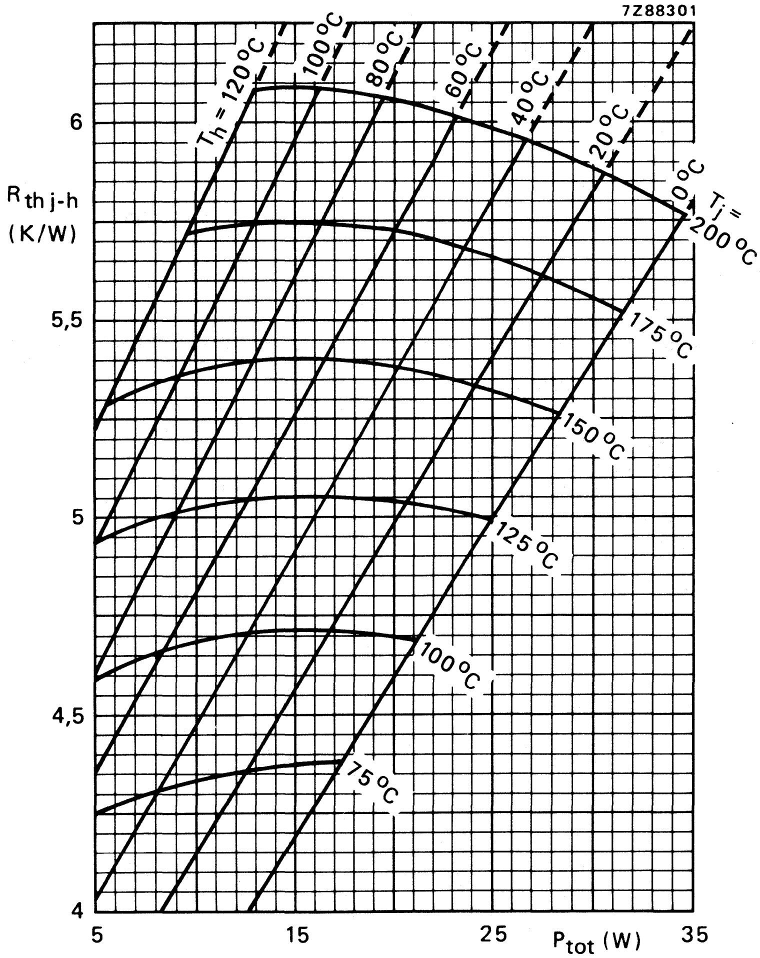


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation (without r.f. signal): V_{CE} = 25 V; I_C = 850 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j\text{-}h}$	max.	6,05 K/W
	T_j	max.	200 °C
Typical device:	$R_{th\,j\text{-}h}$	typ.	5,35 K/W
	T_j	typ.	183 °C

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-emitter breakdown voltage			
V_{BE} = 0; I_C = 10 mA	$V_{(BR)CES}$	>	50 V
open base; I_C = 25 mA	$V_{(BR)CEO}$	>	27 V
Emitter-base breakdown voltage			
open collector; I_E = 5 mA	$V_{(BR)EBO}$	>	3,5 V
D.C. current gain*			
I_C = 850 mA; V_{CE} = 25 V	h_{FE}	>	15
		typ.	40
Collector-emitter saturation voltage*			
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	typ.	0,25 V
Transition frequency at f = 500 MHz**			
$-I_E$ = 850 mA; V_{CB} = 25 V	f_T	typ.	2,5 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 25 V	C_c	typ.	24 pF
		<	30 pF
Feedback capacitance at f = 1 MHz			
I_C = 50 mA; V_{CE} = 25 V	C_{re}	typ.	15 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

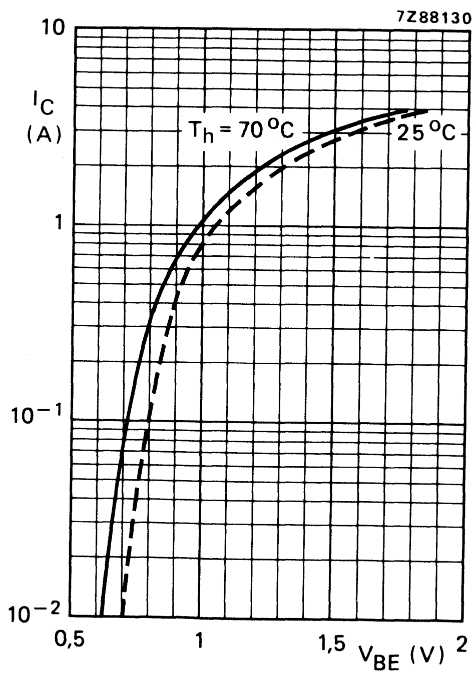


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

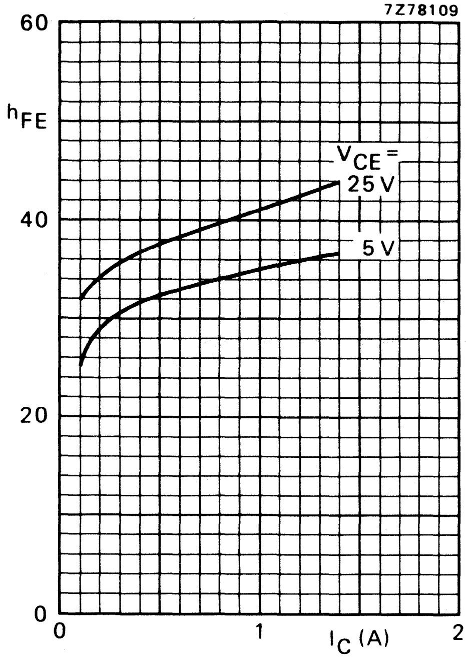


Fig. 6 Typical values; T_j = 25 °C.

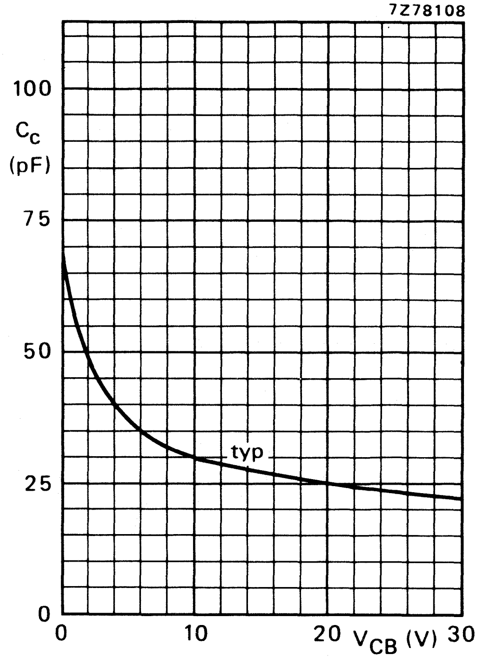


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

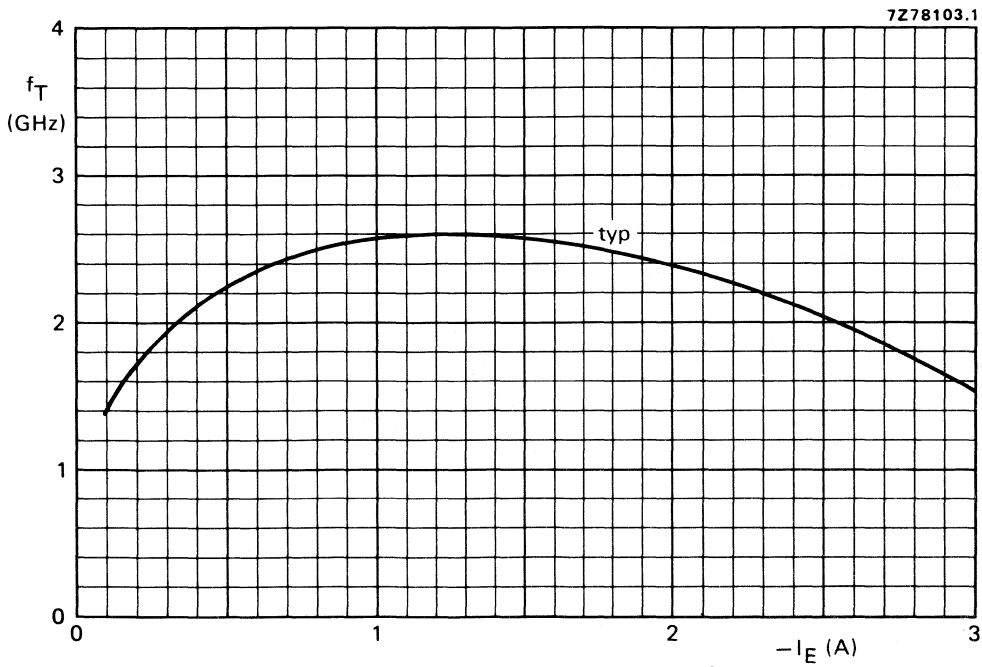


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in u.h.f. class-A operation (linear power amplifier)

f_{vision} (MHz)	V_{CE} (V)	I_C (mA)	T_h (°C)	d_{im} (dB)*	$P_{o\,sync}$ (W)*	G_p (dB)
860	25	850	70	−60	> 3,5	> 5,0
860	25	850	70	−60	typ. 4,0	typ. 5,5

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

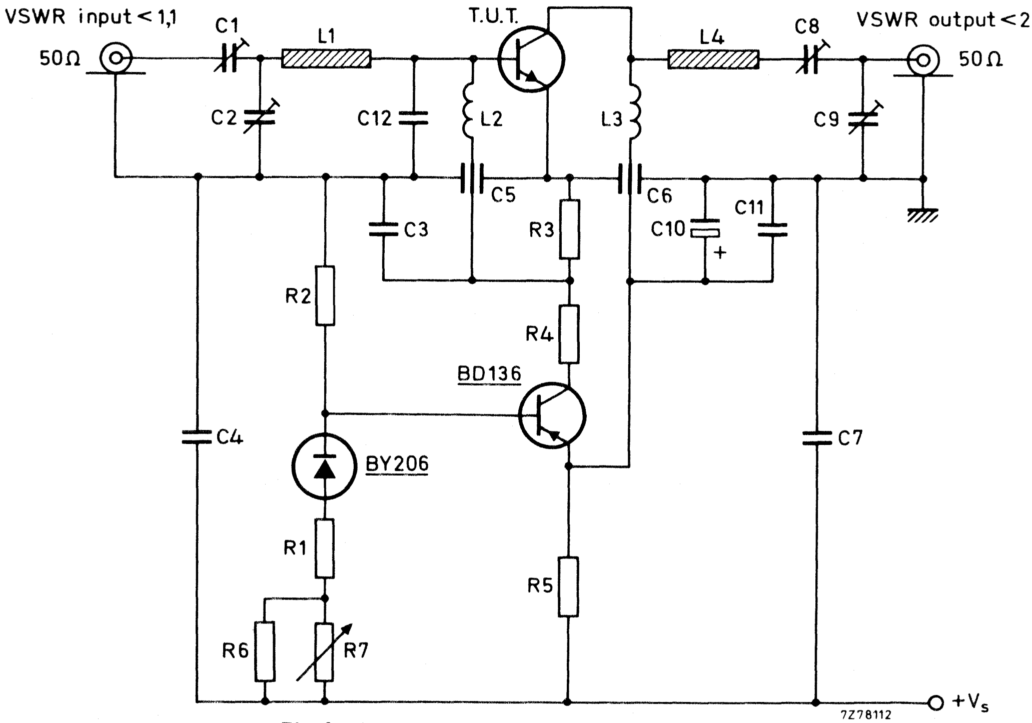


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

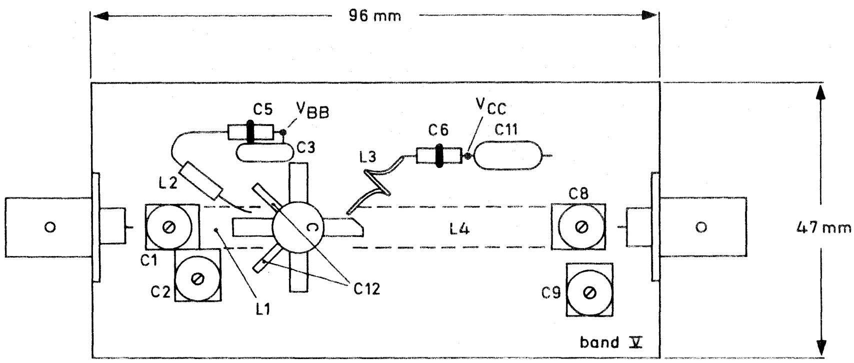
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C10 = 10 μF/40 V solid aluminium electrolytic capacitor
C11 = 470 nF polyester capacitor
C12 = 2 x 3,3 pF chip capacitors (in parallel)

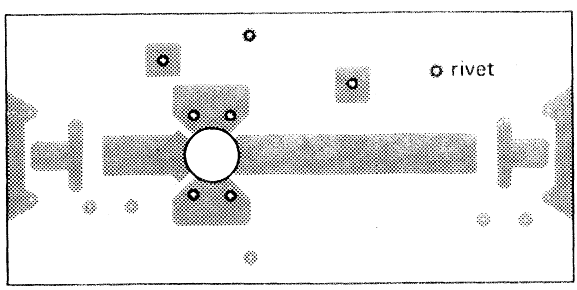
List of components: (continued)

R1 = 150 Ω carbon resistor (0,25 W)
R2 = 1,8 kΩ carbon resistor (0,5 W)
R3 = 33 Ω carbon resistor (0,5 W)
R4 = 220 Ω carbon resistor (1 W)
R5 = 4 x 12 Ω carbon resistors in parallel (1 W each)
R6 = 1 kΩ carbon resistor (0,25 W)
R7 = 220 Ω carbon potentiometer (0,25 W)

L1 = stripline (13,6 mm x 6,9 mm)
L2 = microchoke 0,47 μH (cat. no. 4322 057 04770)
L3 = 1 turn Cu wire (1 mm); internal diameter 5,5 mm; leads 2 x 5 mm
L4 = stripline (40,8 mm x 6,9 mm)

L1 and L4 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1,5 mm.





Note
Hole in printed-circuit board: ϕ 9,7 mm.

Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

The circuit and the components are on one side of the PTFE fibre-glass board, the other side is unetched copper to serve as a ground-plane. Earth connections are made by hollow rivets. Additionally copper straps are used under the emitters and at the input and output to provide direct contact between the copper on the component side and the ground-plane.

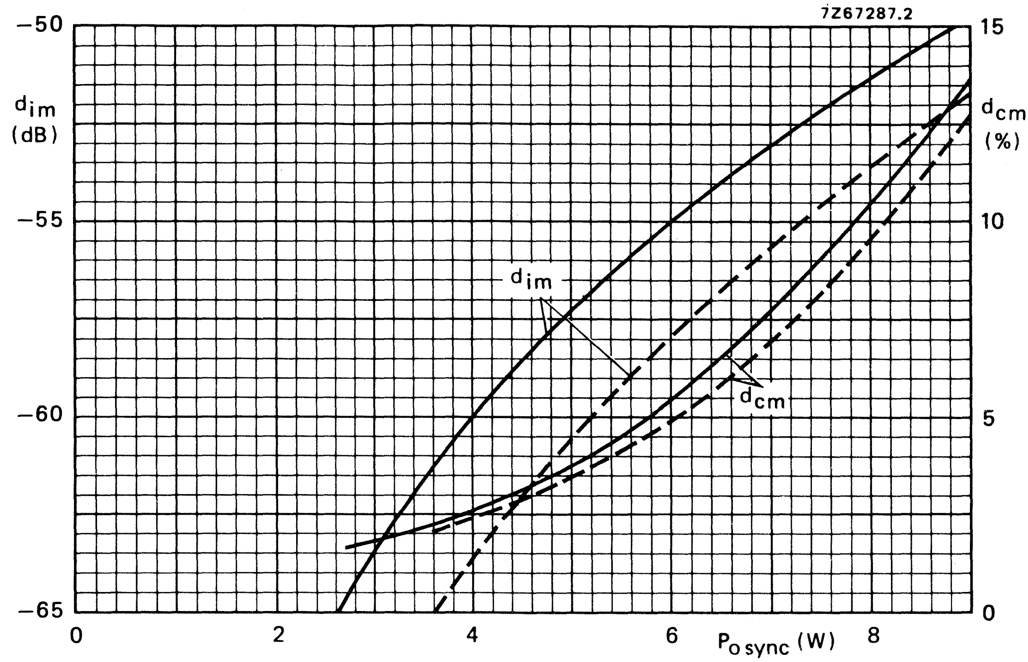


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\,sync}$. Typical values; V_{CE} = 25 C; I_C = 850 mA; — — — T_h = 25 °C; —— T_h = 70 °C; f_{vision} = 860 MHz.

* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.
Intermodulation distortion of input signal ≤ −75 dB.

** Two-tone test method (vision carrier 0 dB, sound carrier −7 dB), zero dB corresponds to peak sync level.
Cross-modulation distortion (d_{cm}) is the voltage variation (%) of sound carrier when vision carrier is switched from 0 dB to −20 dB.

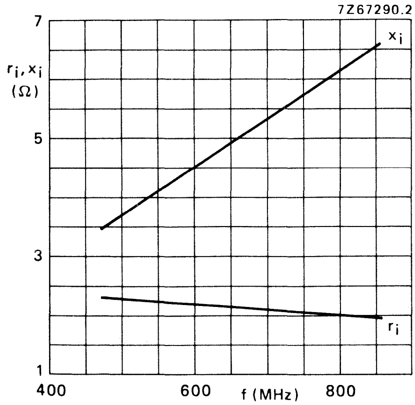


Fig. 12 Input impedance (series components).

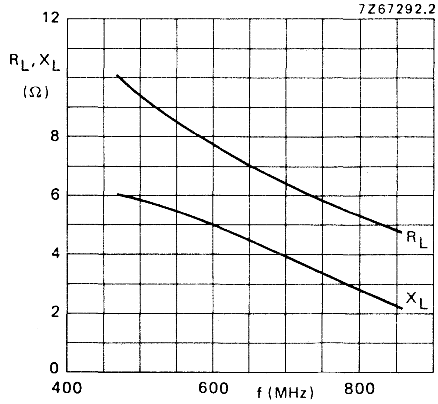


Fig. 13 Load impedance (series components).

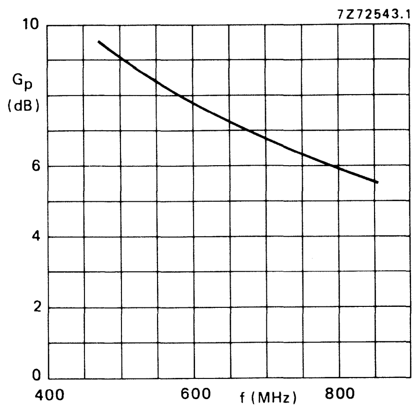


Fig. 14.

Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 25 V; I_C = 850 mA; class-A operation; T_h = 70 °C.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

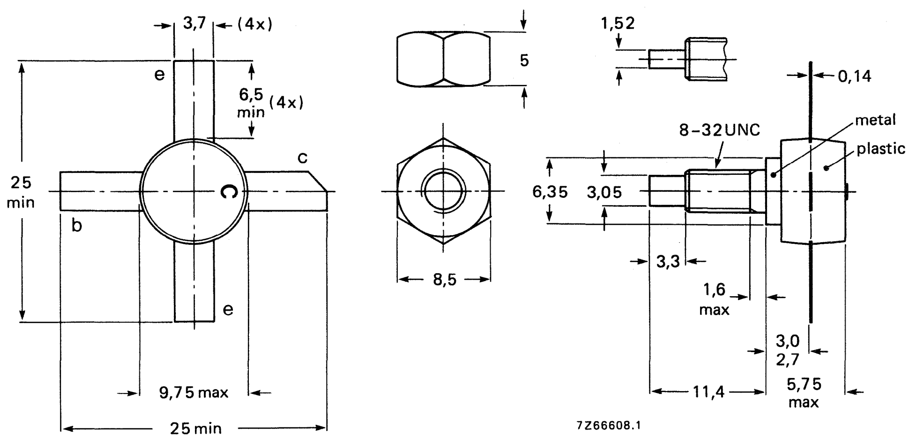
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**8**	**> 9**	**> 70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 9	typ. 70	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

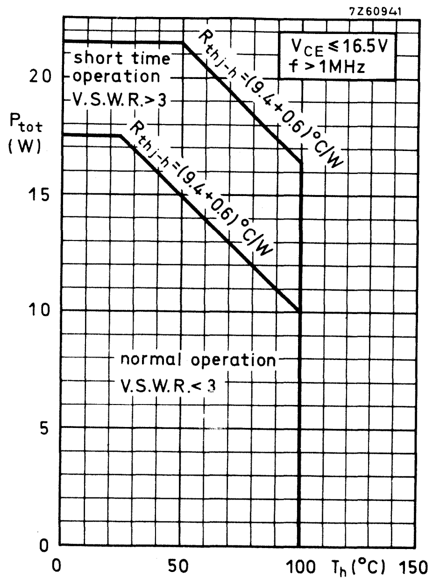
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

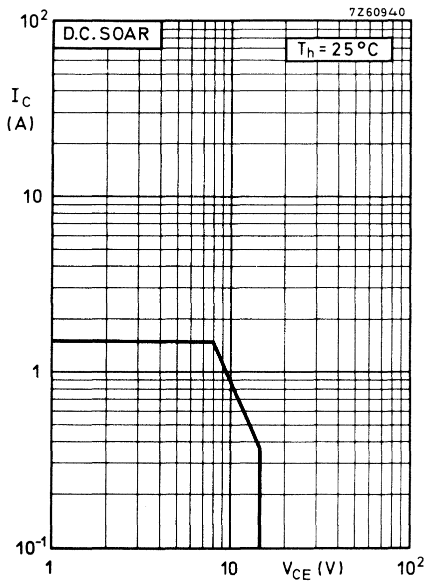
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1.25	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	3.75	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

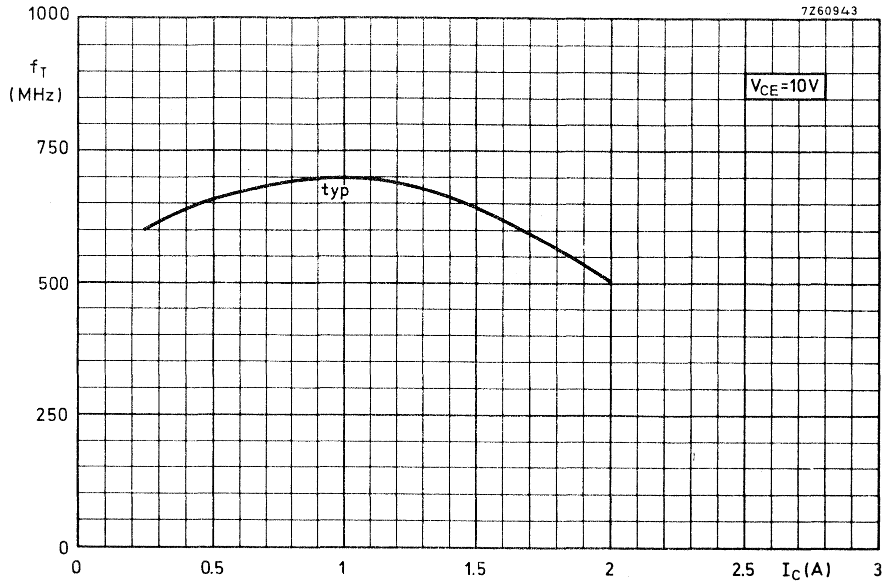
THERMAL RESISTANCE

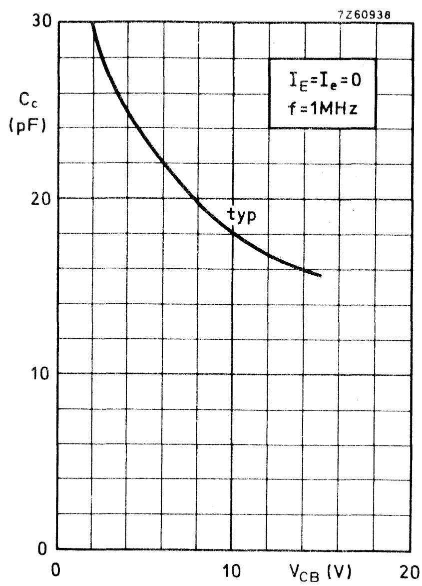
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9.4	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25°C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 1$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	mS
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	0.5	mS
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 500$ mA; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	15	pF
		<	20	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	$-C_{re}$	typ.	11	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60943
1000
f_T
(MHz)
750
500
250
0
V_{CE}=10V
typ
0
0.5
1
1.5
2
2.5
I_C(A)
3


7Z60938
30
C_c
(pF)
20
10
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

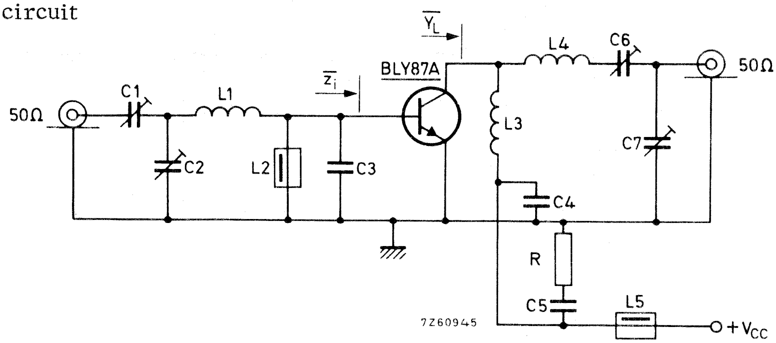
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C (A)	G_p(dB)	η(%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$(mS)
13.5	< 1.0	8	< 0.85	> 9	> 70	2.8 + j1.2	76 − j16
12.5	typ. 1.0	8	typ. 0.91	typ. 9	typ. 70	–	–

Test circuit



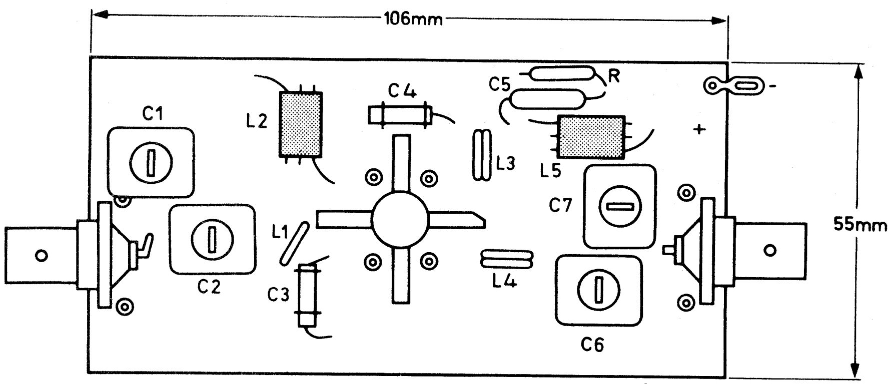
C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = L5 = ferroxcube choke (code number 4312 020 36640)
L3 = 2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4 = 4.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

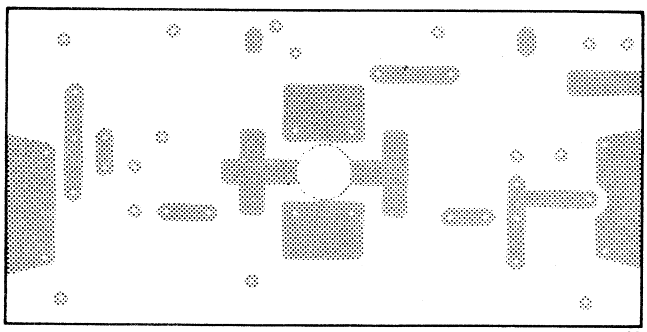
R = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.



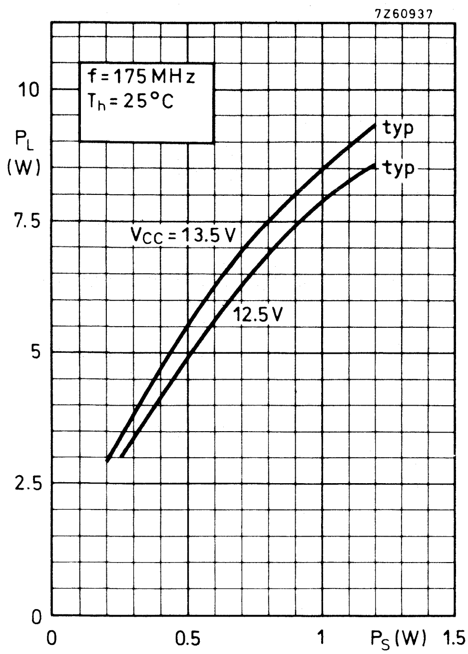
7Z60944

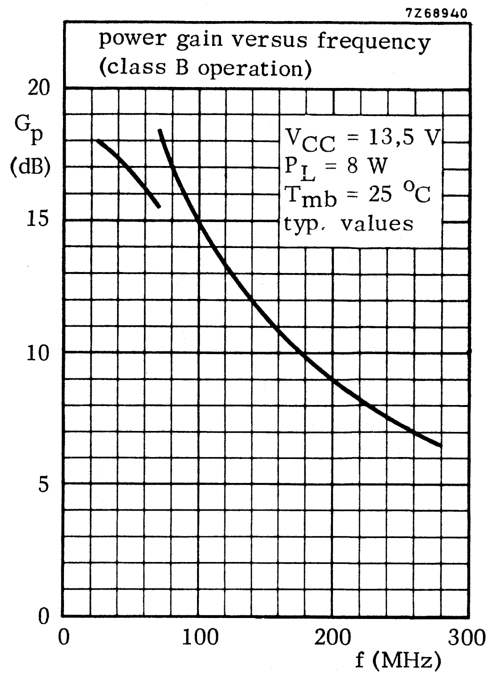


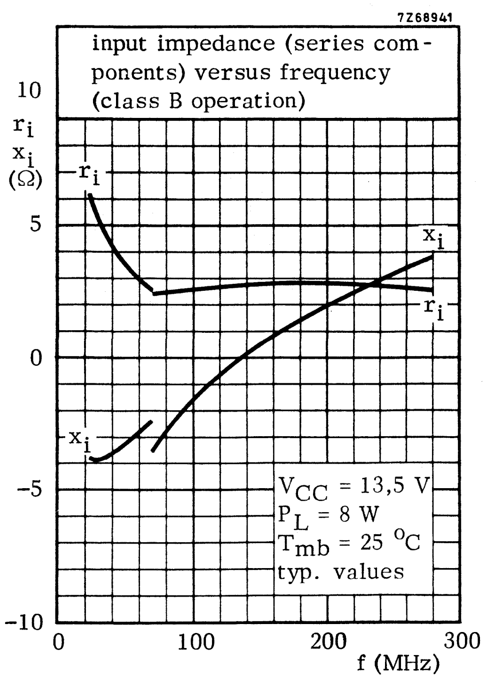
7Z67868

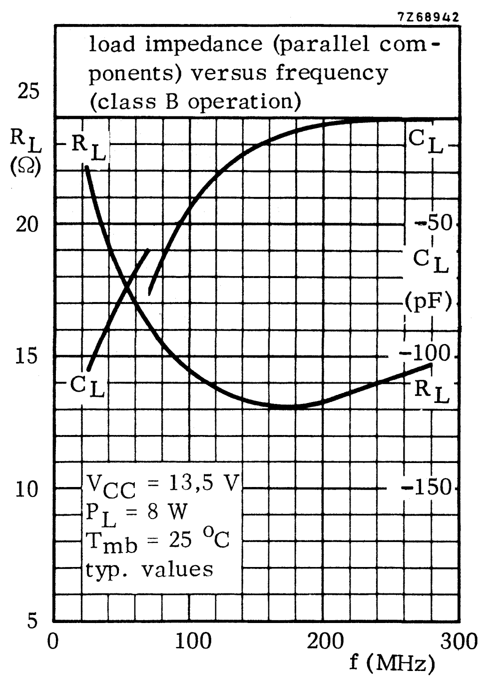
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

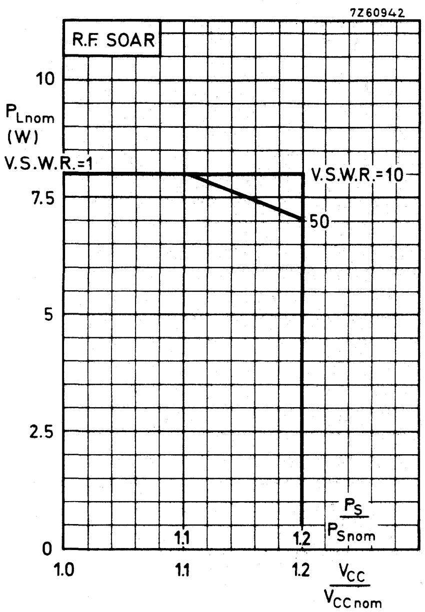
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

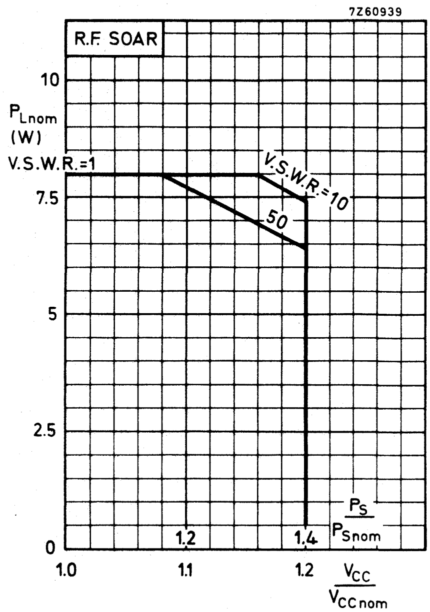












Conditions for R.F. SOAR:

f = 175 MHz $P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
T_h = 70 °C $R_{th\ mb\text{-}h}$ = 0.6 K/W
V_{CCnom} = 12.5 or 13.5 V see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8″ capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

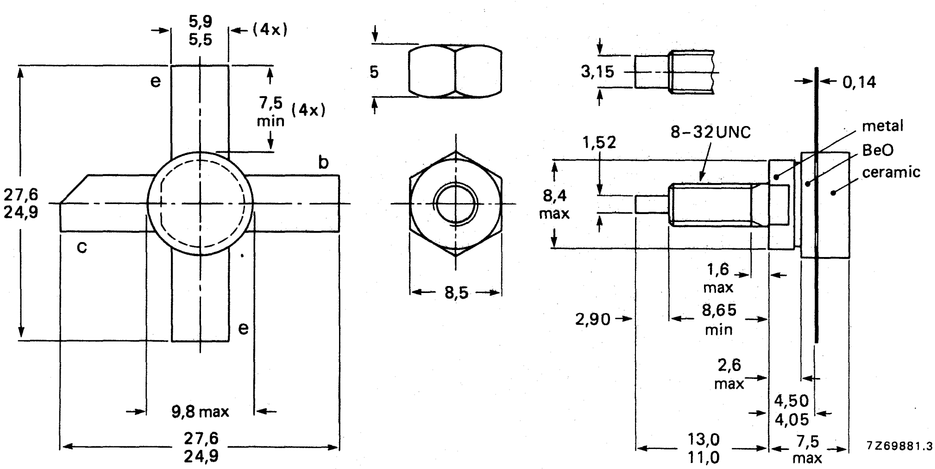
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**8**	> **12,0**	> **60**	**2,2 + j0,4**	**96 − j28**
c.w.	12,5	175	8	typ. 11,5	typ. 65	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,5	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	4,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W

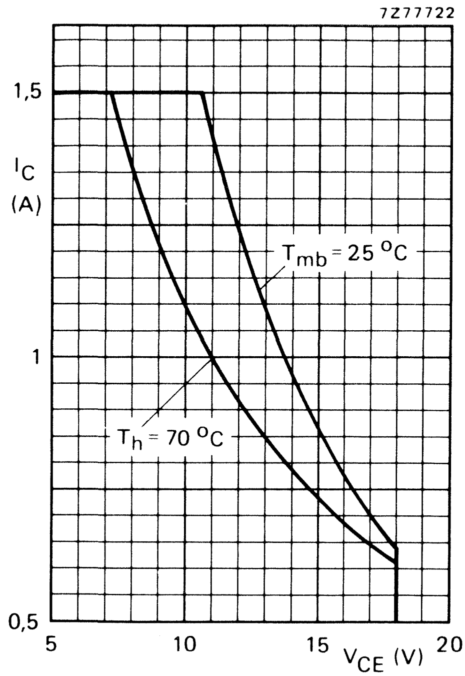


Fig. 2 D.C. SOAR.

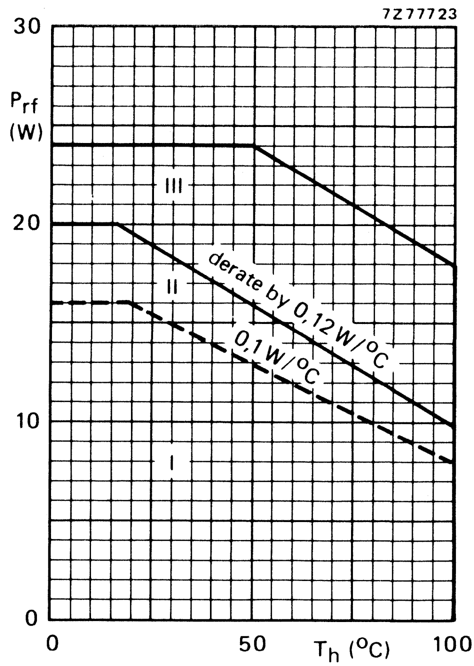


Fig. 3 R.F. power dissipation; $V_{CE} \leq$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,5 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 5 mA	$V_{(BR)CES}$	>	36	V
Collector-emitter breakdown voltage open base; I_C = 25 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 18 V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5	mJ
D.C. current gain * I_C = 0,75 A; V_{CE} = 5 V	h_{FE}	typ.	40 10 to 100	
Collector-emitter saturation voltage * I_C = 2 A; I_B = 0,4 A	V_{CEsat}	typ.	0,85	V
Transition frequency at f = 100 MHz * $-I_E$ = 0,75 A; V_{CB} = 13,5 V	f_T	typ.	950	MHz
$-I_E$ = 2 A; V_{CB} = 13,5 V	f_T	typ.	850	MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 13,5 V	C_c	typ.	16,5	pF
Feedback capacitance at f = 1 MHz I_C = 100 mA; V_{CE} = 13,5 V	C_{re}	typ.	12	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

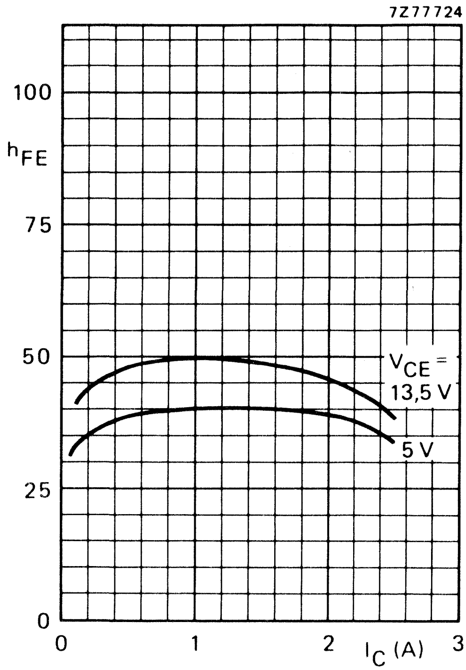


Fig. 4 Typical values; T_j = 25 °C.

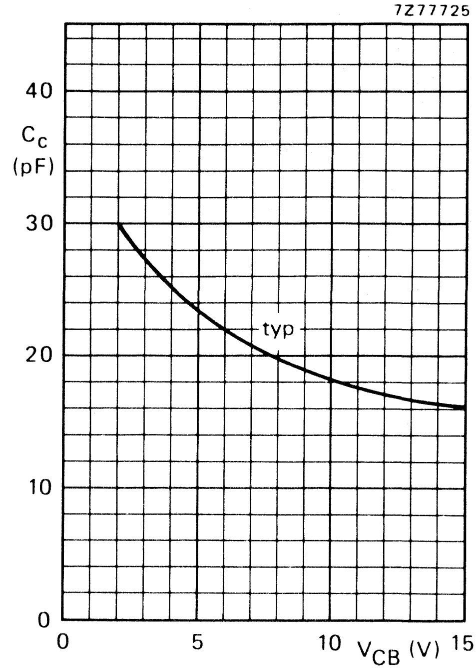


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

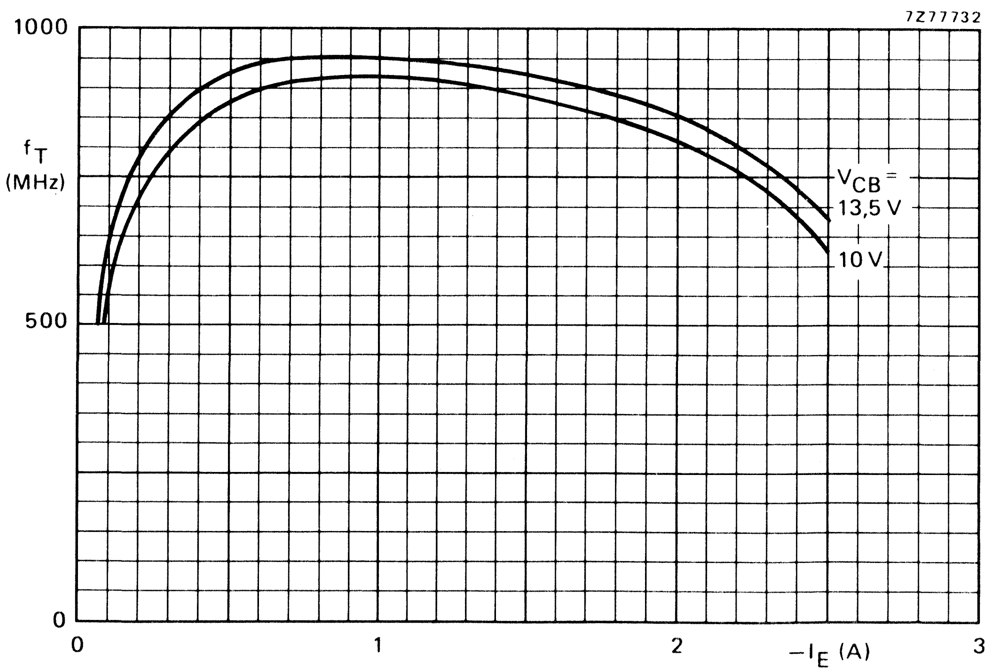


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**13,5**	**8**	**< 0,5**	**> 12,0**	**< 0,99**	**> 60**	**2,2 + j0,4**	**96 – j28**
175	12,5	8	–	typ. 11,5	–	typ. 65	–	–

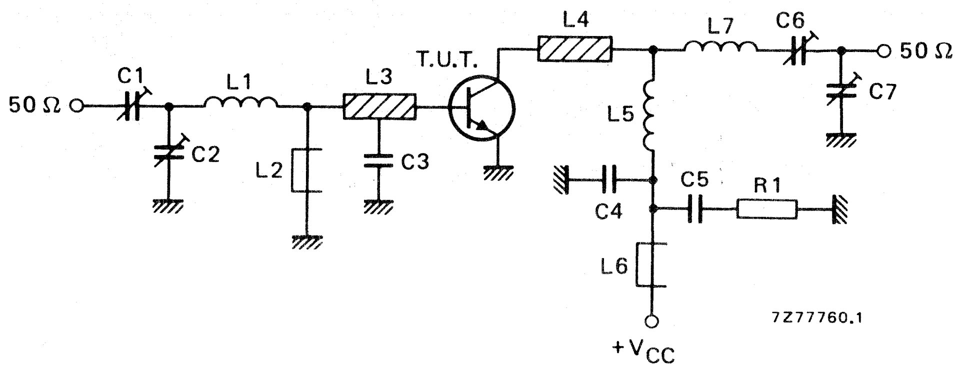


Fig. 7 Test circuit; c.w. class-B.

List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.

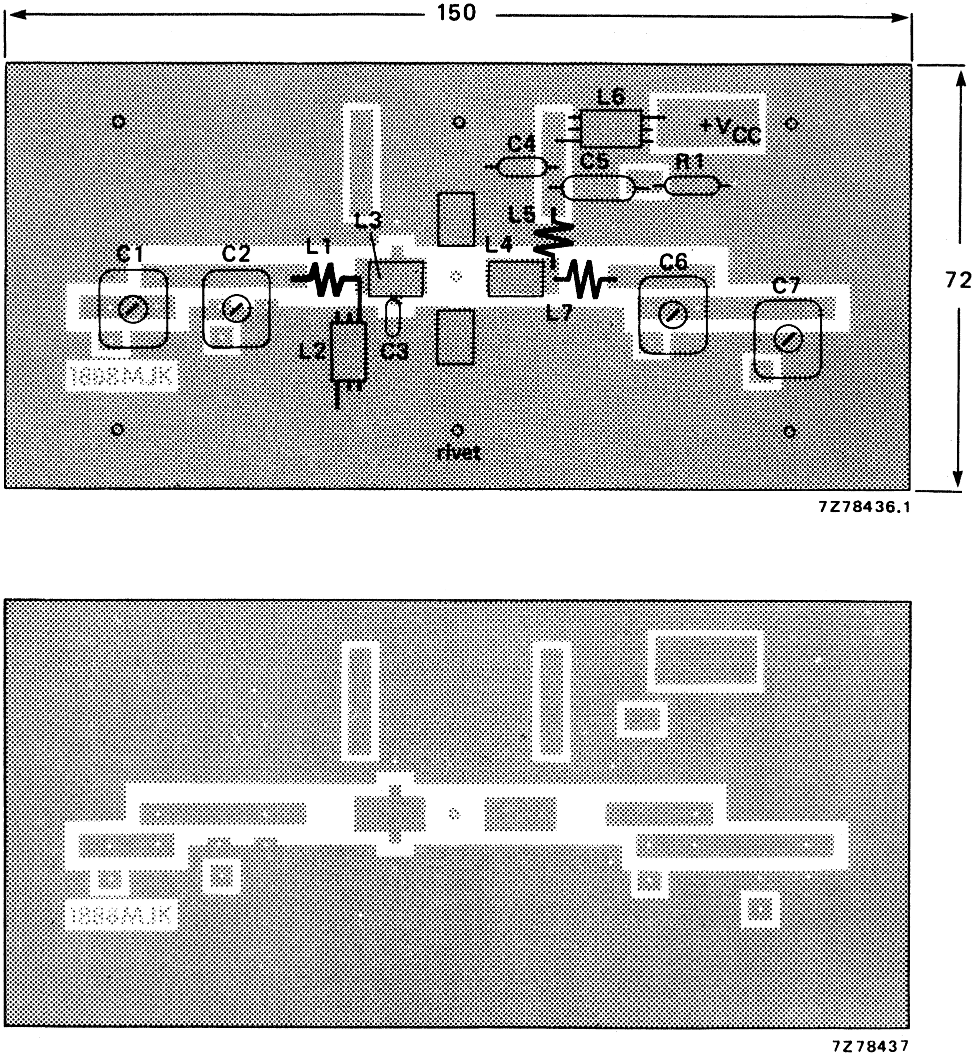


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

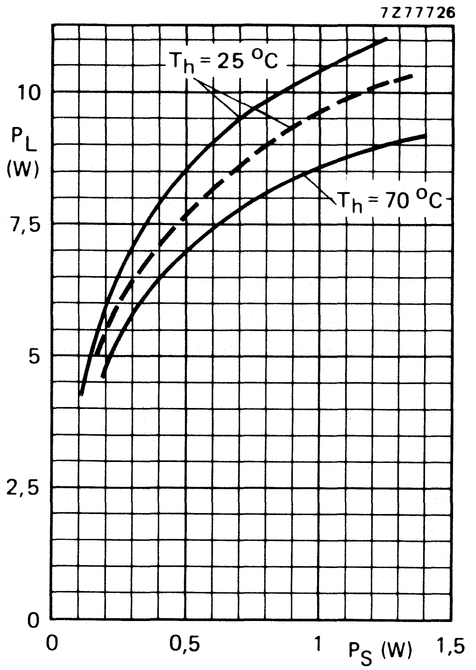


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

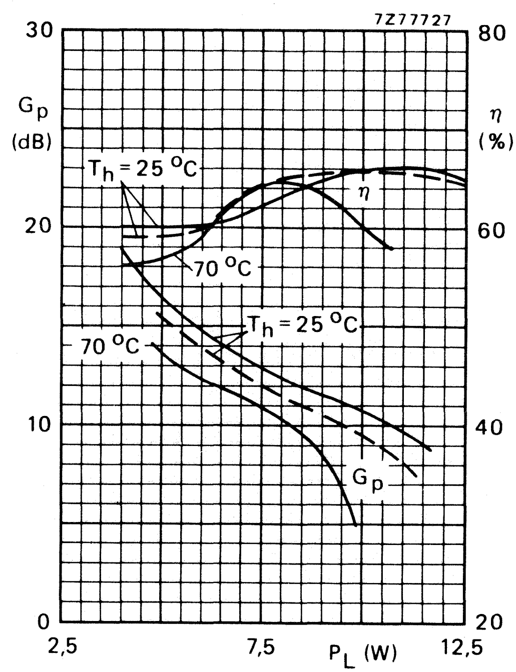


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

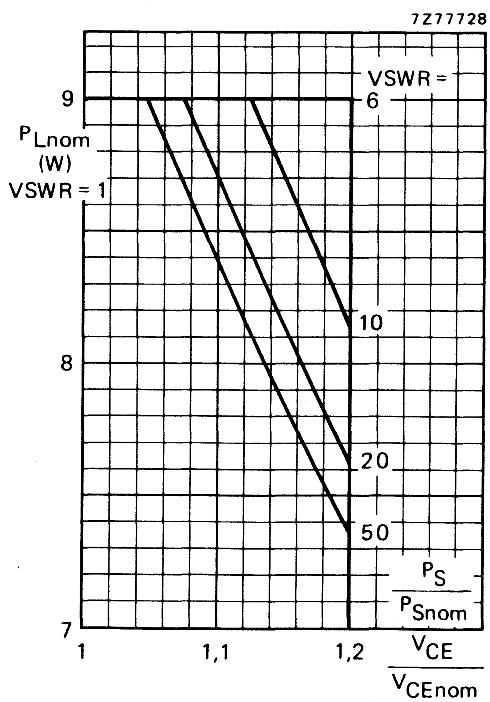


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 K/W ; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

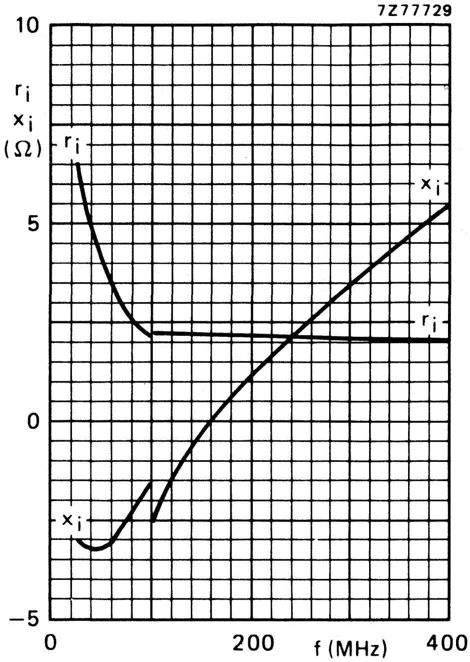


Fig. 12 Input impedance (series components).

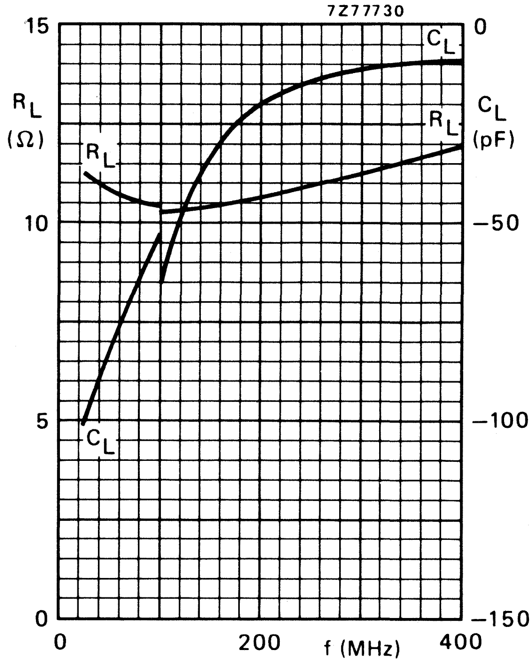


Fig. 13 Load impedance (parallel components).

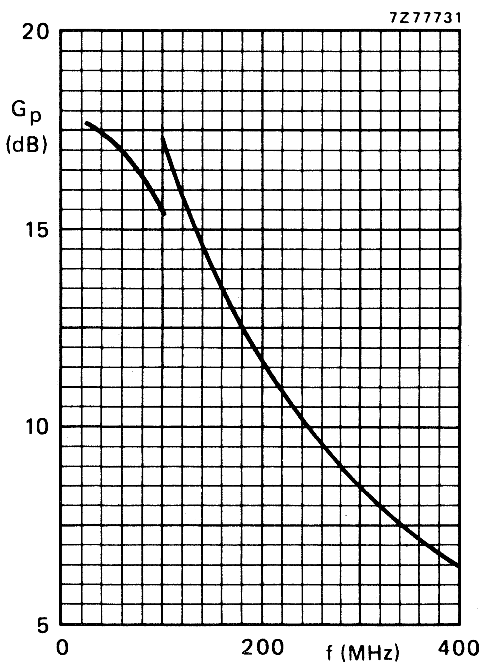


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

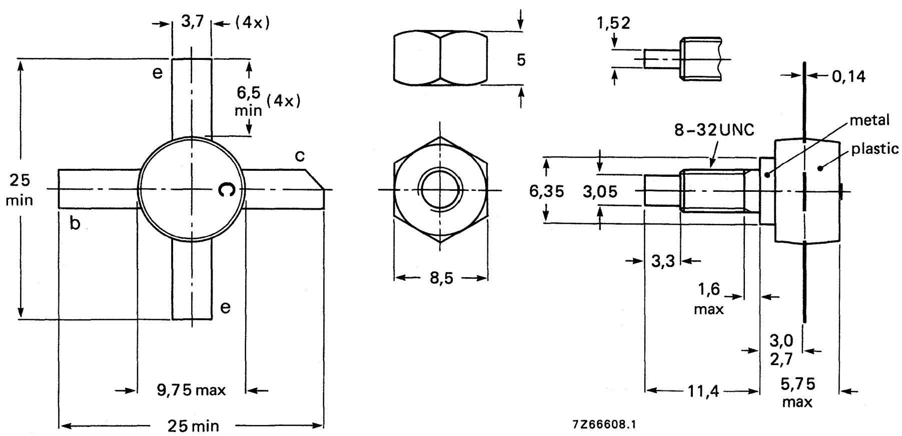
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**15**	**> 7,5**	**> 65**	**2,3 + j2,2**	**128 − j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 65	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

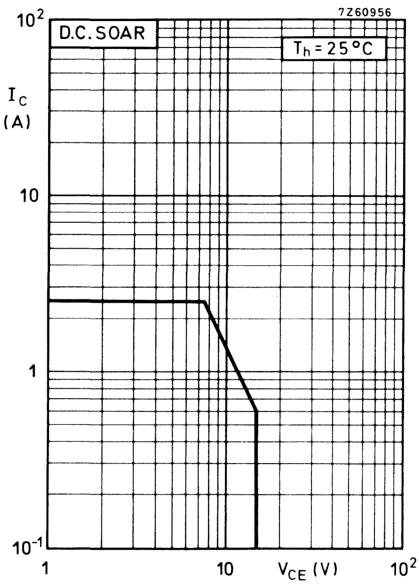
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

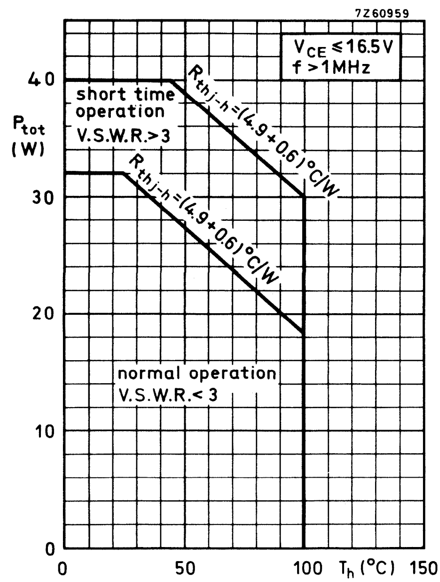
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	2.5	A
Collector (peak value) f > 1 MHz	I_{CM}	max.	7.5	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

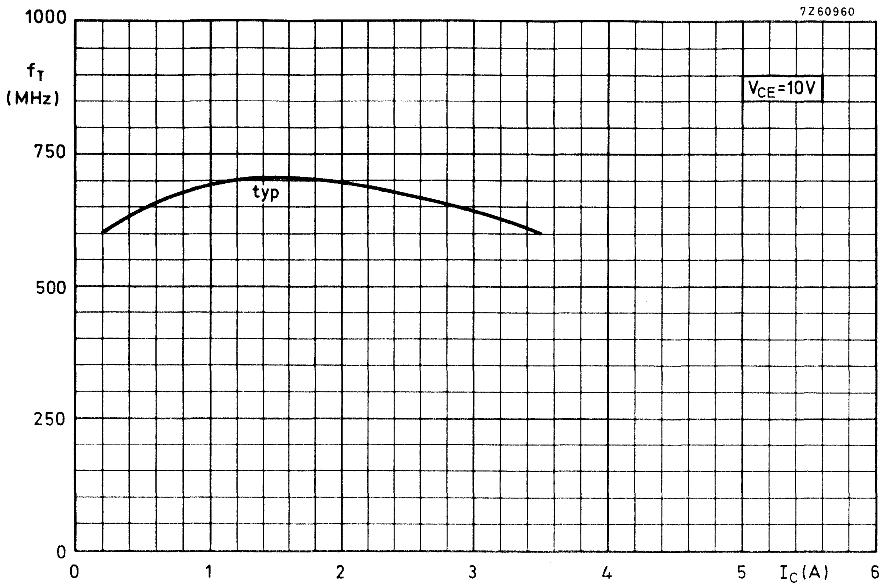
THERMAL RESISTANCE

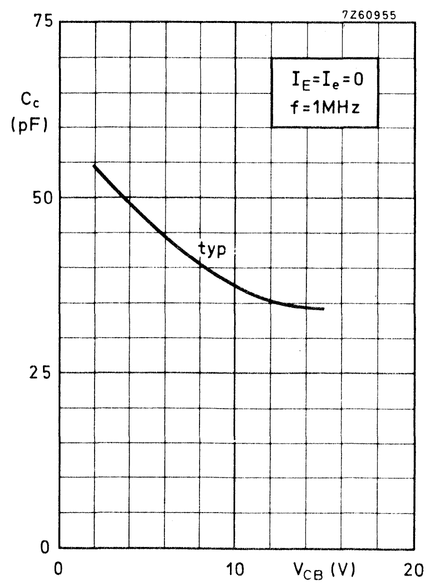
From junction to mounting base	$R_{th\,j-mb}$	=	4.9	K/W
From mounting base to heatsink	R_{mb-h}	=	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	2.0	ms
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	4.5	ms
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 1$ A; $V_{CE} = 10$ V	f_T	typ.	700	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ.	34	pF
		<	40	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 15$ V	$-C_{re}$	typ.	25	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60960
1000
f_T
(MHz)
750
500
250
0
V_{CE}=10V
typ
0
1
2
3
4
5
I_C (A)
6


7Z60955
75
C_c
(pF)
50
25
0
I_E=I_e=0
f=1MHz
typ
0
10
V_{CB} (V)
20

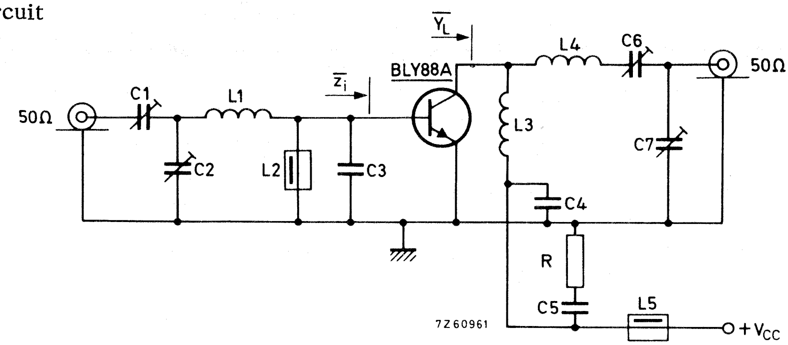
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC}(V)	P_S(W)	P_L(W)	I_C(A)	G_p(dB)	η (%)	$\overline{z_i}$(Ω)	$\overline{Y}_L$(mS)
13.5	< 2.65	15	< 1.71	> 7.5	> 65	2.3+j2.2	128−j4.4
12.5	typ. 2.65	15	typ. 1.85	typ. 7.5	typ. 65	–	–

Test circuit



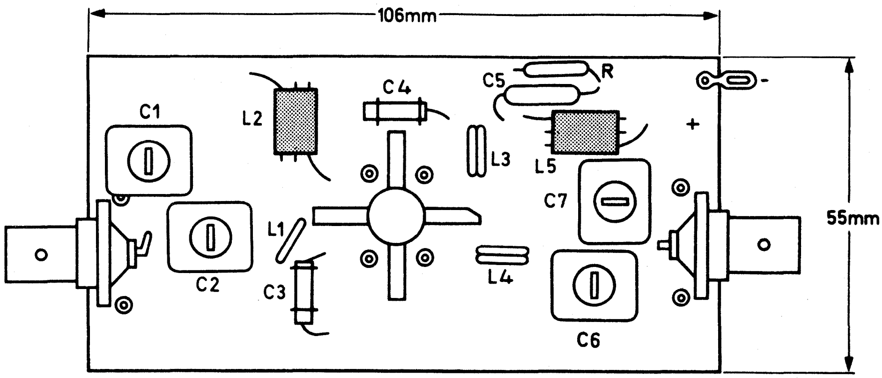
C1=	2.5 to 20 pF	film dielectric trimmer (code number 2222 809 07004)
C2=C6=C7=	4 to 40 pF	film dielectric trimmer (code number 2222 809 07008)
C3=	47 pF	ceramic
C4=	100 pF	ceramic
C5=	150 nF	polyester

L1=	0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2=L5=	ferroxcube choke (code number 4312 020 36640)
L3=	2.5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L4=	2.5 turns enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm

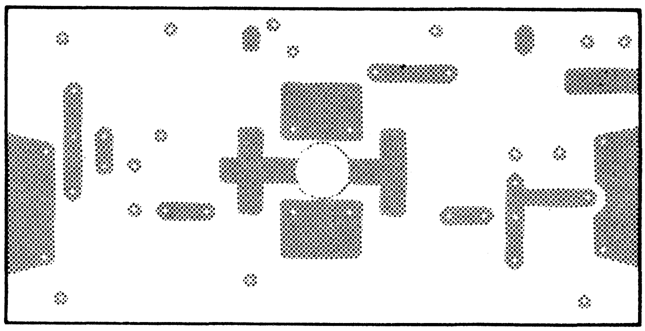
R = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.



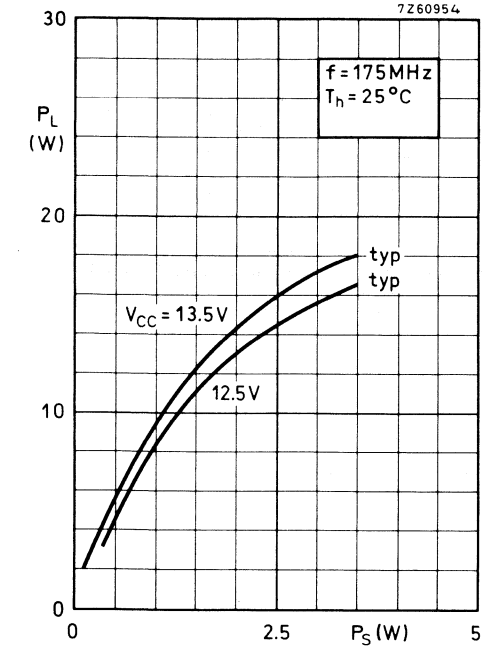
7Z60944

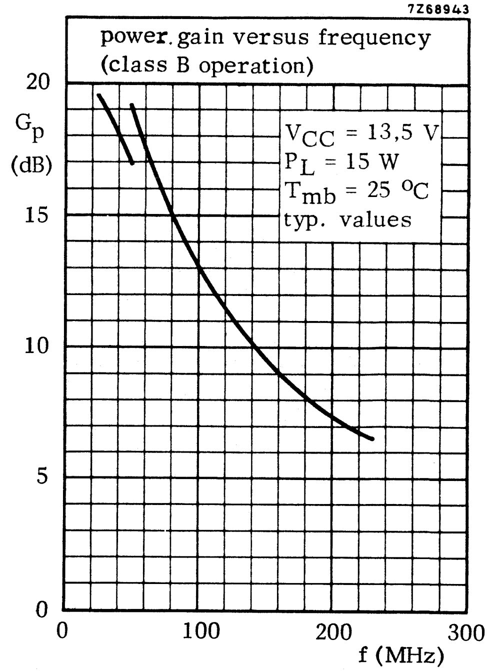


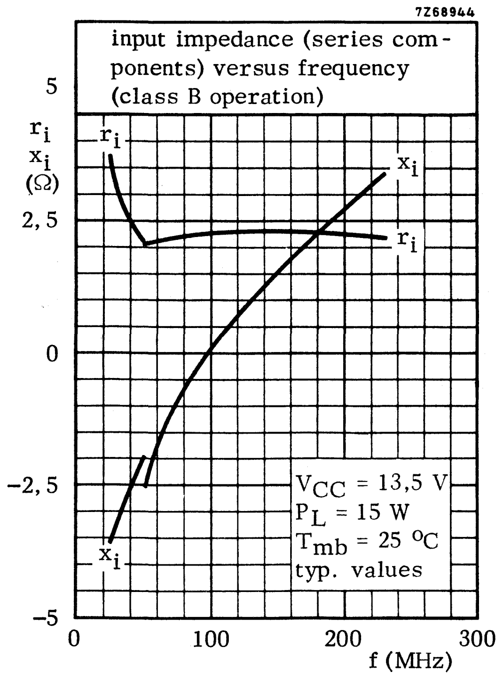
7Z67868

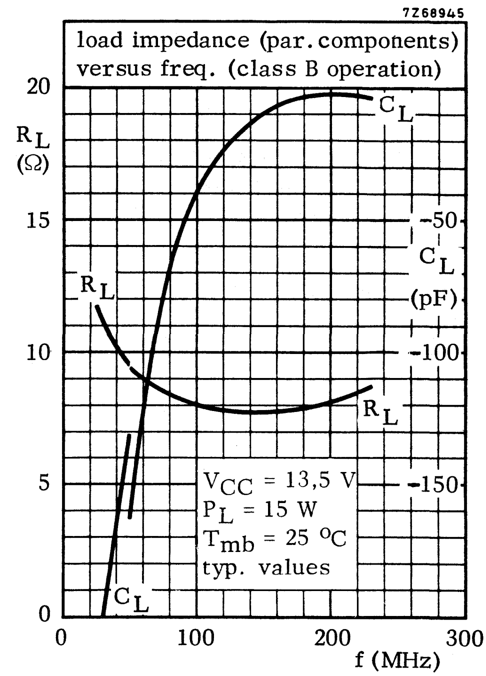
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

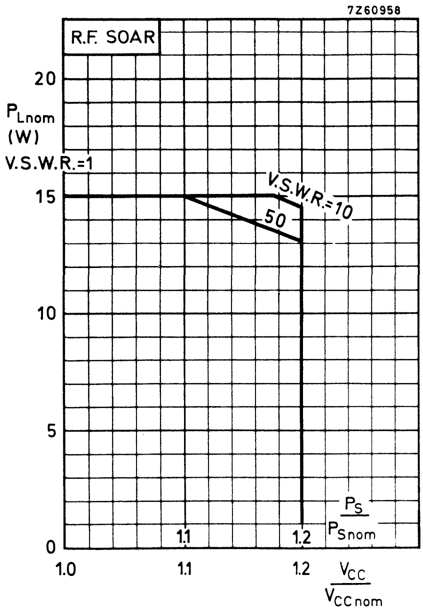
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

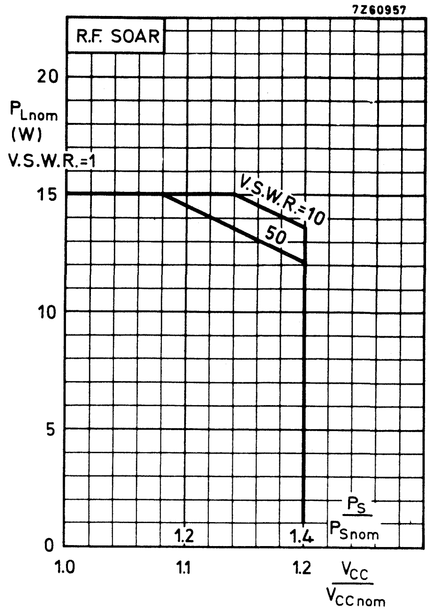












Conditions for R.F. SOAR:

f = 175 MHz
T_h = 70 °C
V_{CCnom} = 12.5 or 13.5 V

$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1
$R_{th\ mb-h}$ = 0.6 K/W
see also page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs above for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V. S. W. R. as parameter.
The left hand graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.
The right hand graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, h.f. and v.h.f. transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

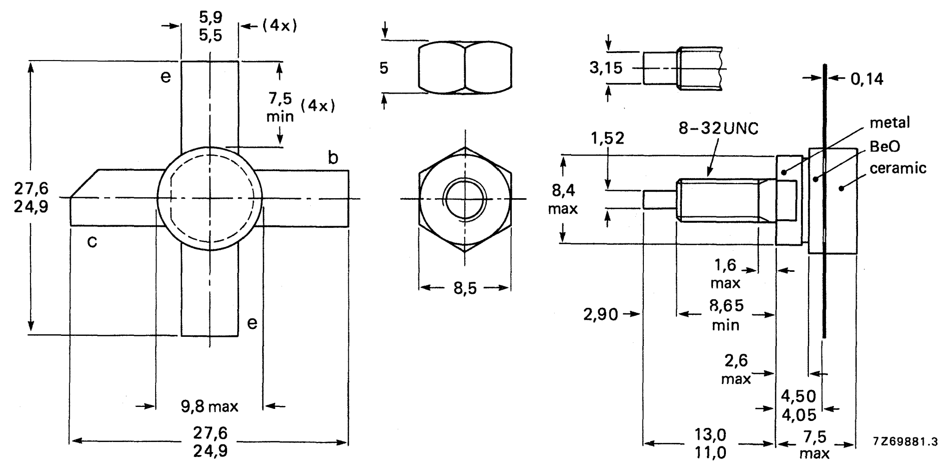
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,5	175	15	> 8,0	> 60	2,3 + j2,2	130 − j4,4
c.w.	12,5	175	15	typ. 7,5	typ. 67	−	−

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	8	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

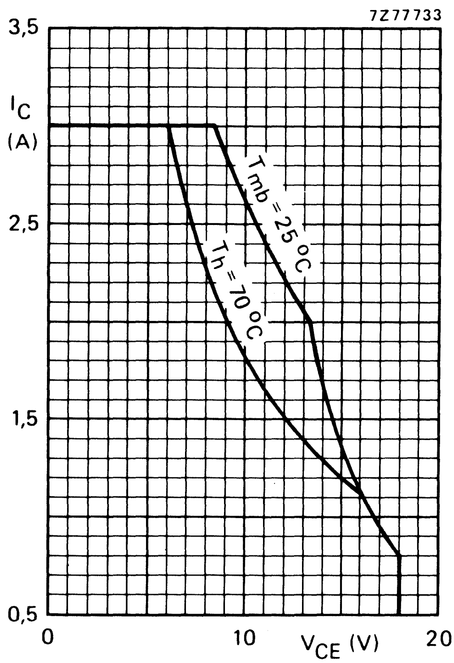


Fig. 2 D.C. SOAR.

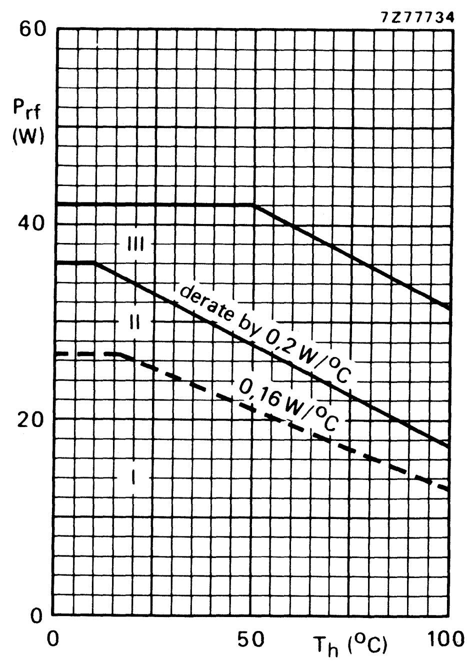


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	= 6,55	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	= 4,95	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	= 0,45	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base breakdown voltage open collector; $I_E = 4$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5 mJ
D.C. current gain* $I_C = 1,5$ A; $V_{CE} = 5$ V	h_{FE}	typ. 10 to	40 100
Collector-emitter saturation voltage* $I_C = 4,5$ A; $I_B = 0,9$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 100 MHz* $-I_E = 1,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	850 MHz
$-I_E = 4,5$ A; $V_{CB} = 13,5$ V	f_T	typ.	800 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 13,5$ V	C_c	typ.	32 pF
Feedback capacitance at f = 1 MHz $I_C = 200$ mA; $V_{CE} = 13,5$ V	C_{re}	typ.	23 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

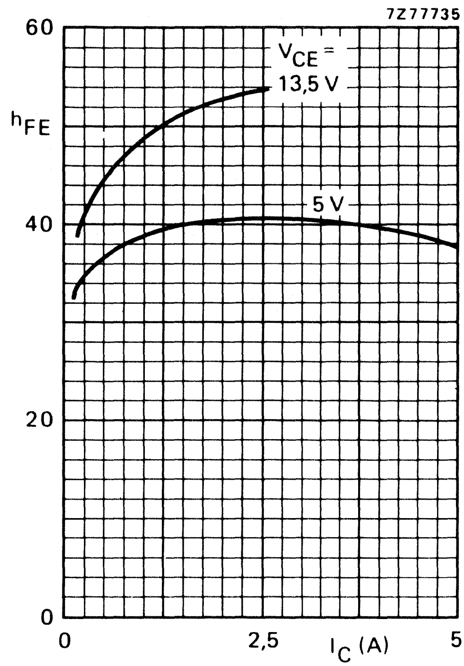


Fig. 4 Typical values; T_j = 25 °C.

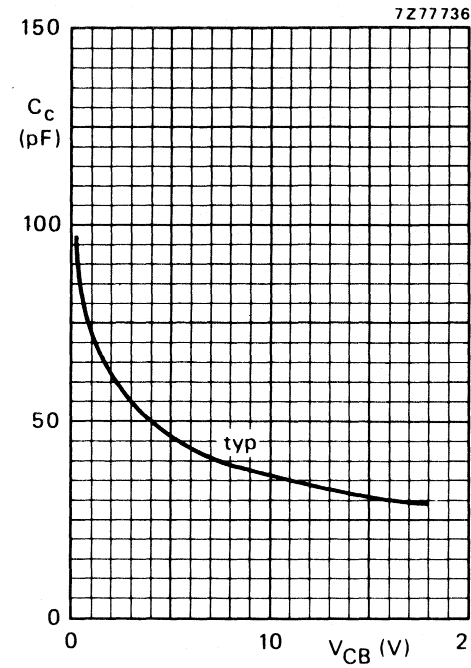


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

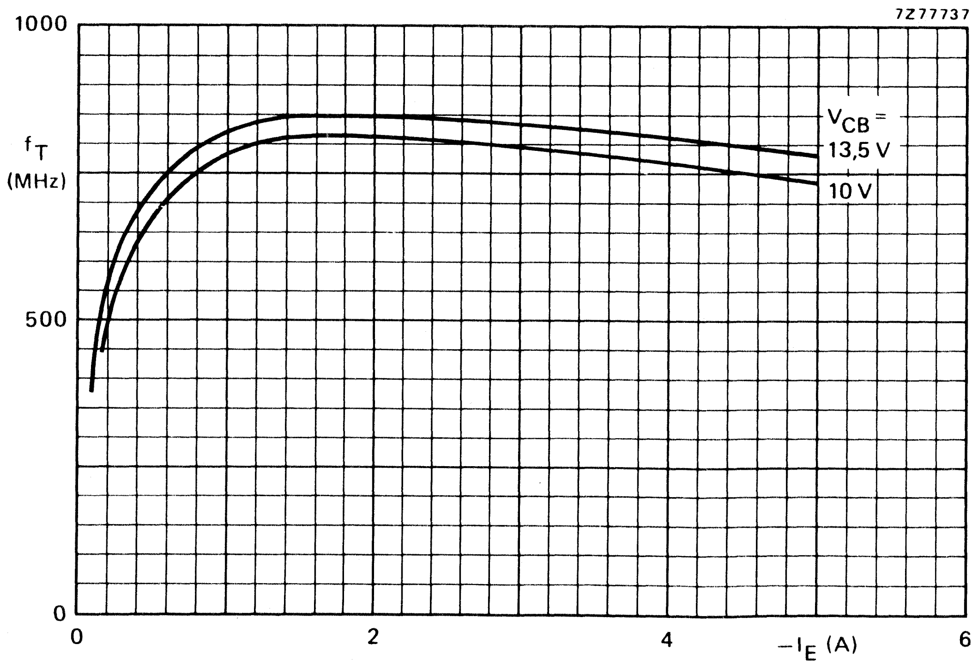


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	13,5	15	< 2,4	> 8,0	< 1,85	> 60	2,3 + j2,2	130 – j4,4
175	12,5	15	–	typ. 7,5	–	typ. 67	–	–

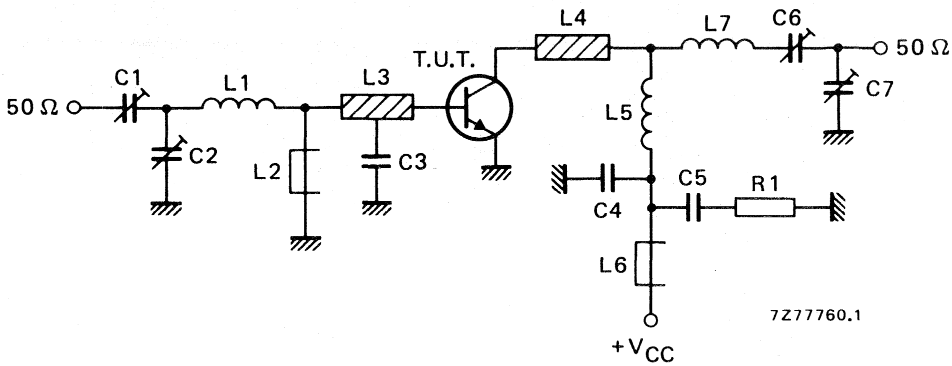


Fig. 7 Test circuit; c.w. class-B.

List of components:

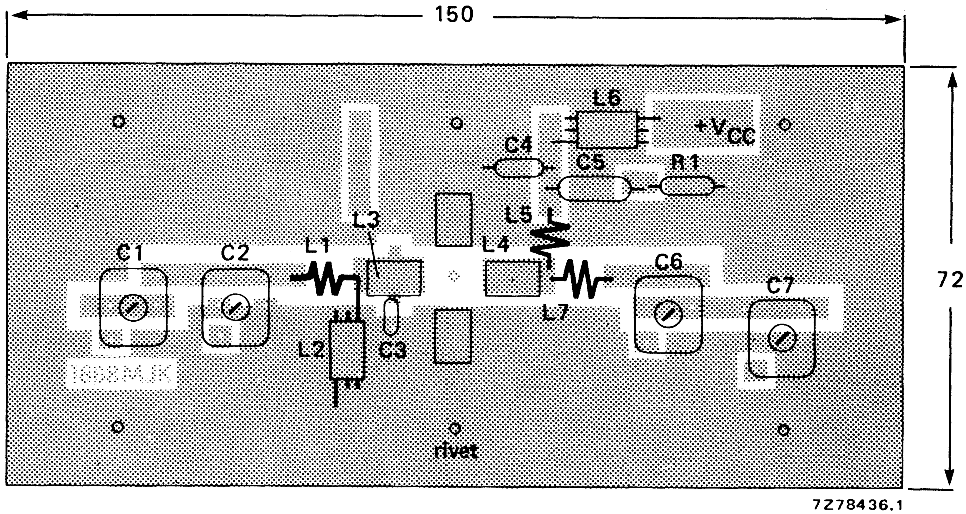
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

L1 = 2 turns Cu wire (1,6 mm); int. dia. 4,5 mm; length 5,7 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L5 = 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 7,5 mm; leads 2 x 5 mm
L7 = 3 turns Cu wire (1,6 mm); int. dia. 6,5 mm; length 7,4 mm; leads 2 x 5 mm

L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



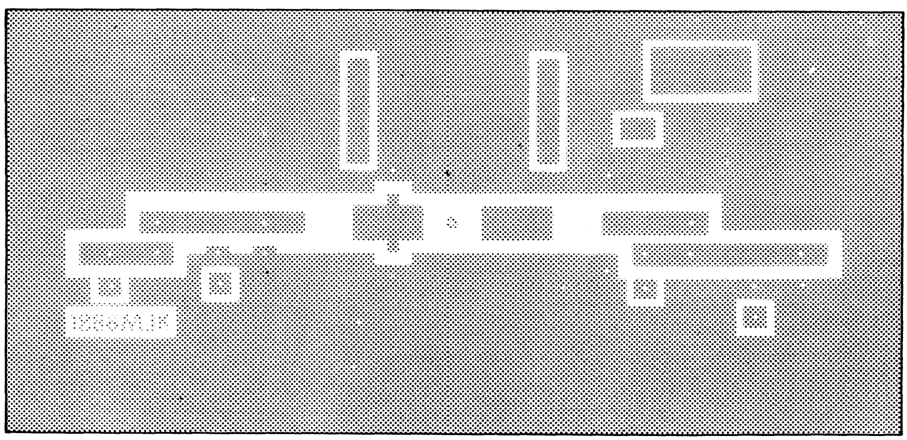


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

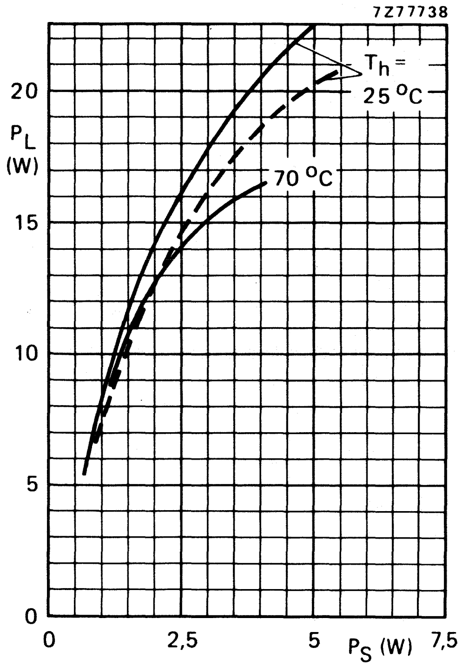


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

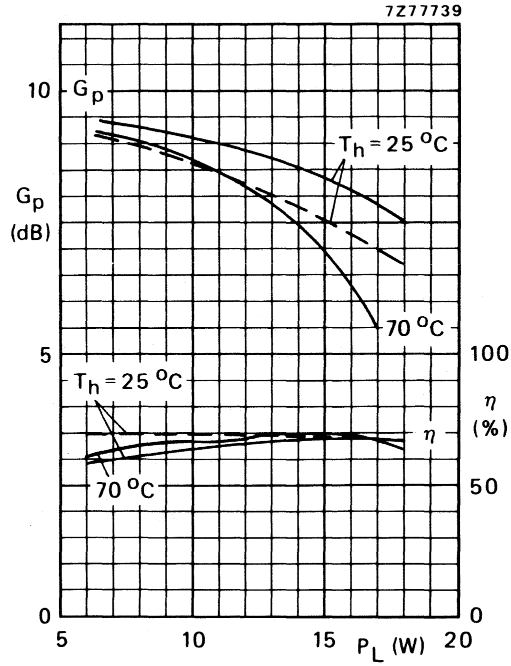


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

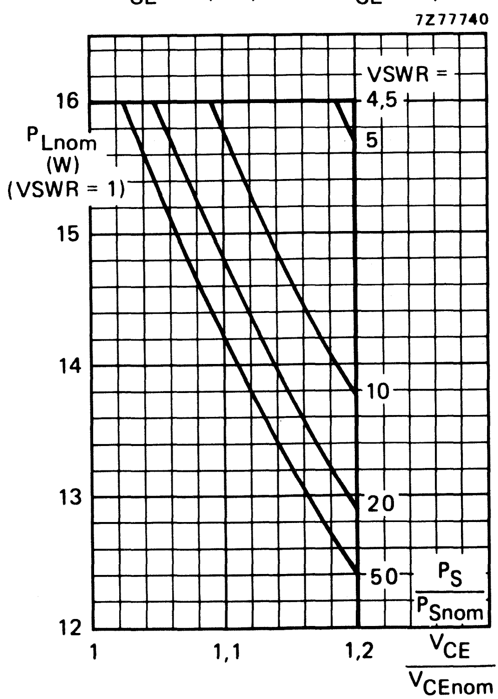


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

Note to Fig. 11:

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

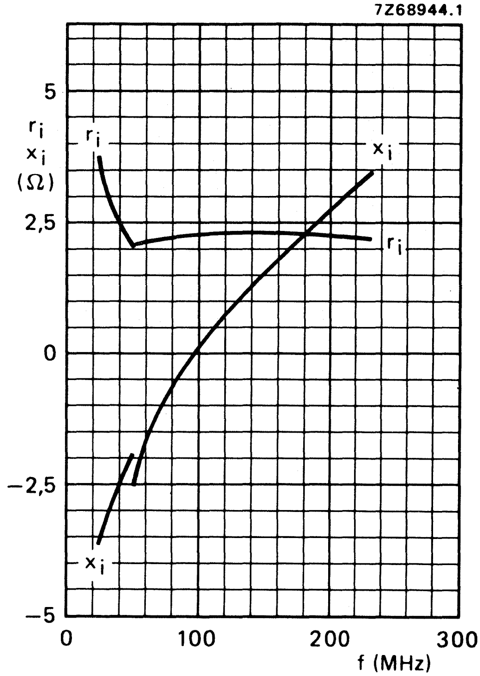


Fig. 12 Input impedance (series components).

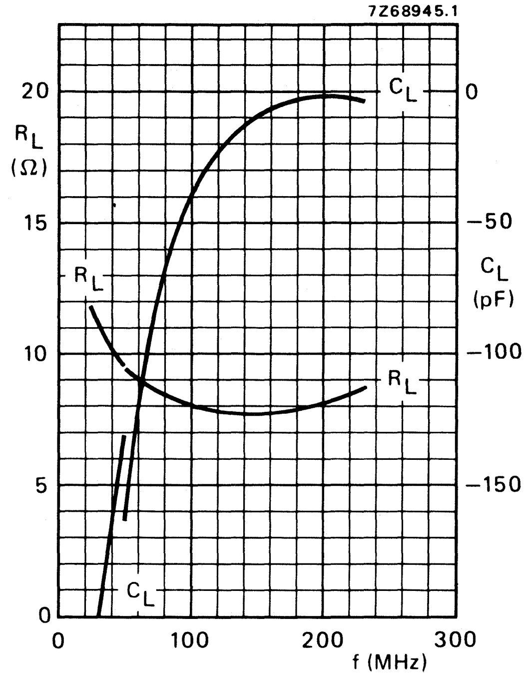


Fig. 13 Load impedance (parallel components).

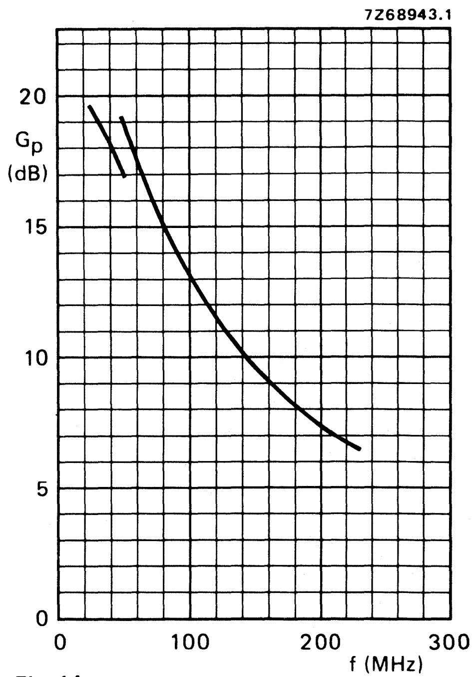


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values: V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 13,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a ¼″ capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

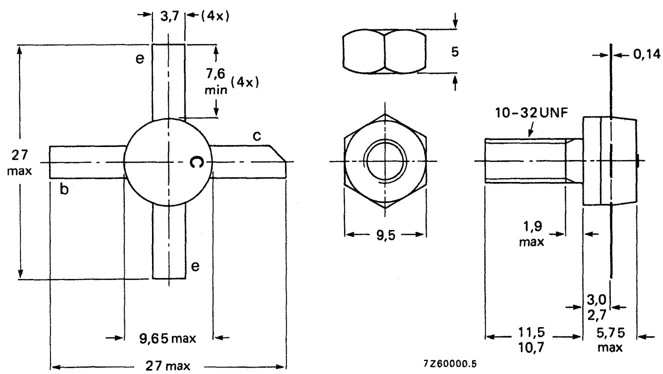
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,5	175	< 6,25	25	< 2,64	> 6	> 70	1,6 + j1,4	213 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

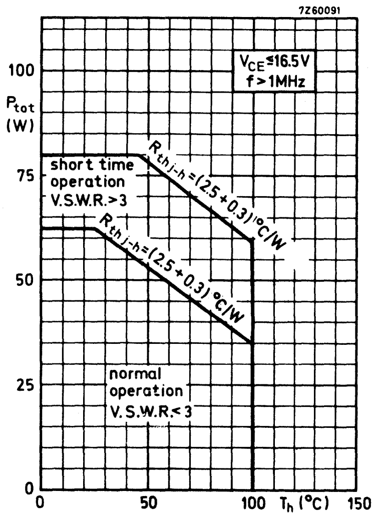
Diameter of clearance hole in heatsink: max. 4,9 mm. Mounting hole to have no burrs at either end. De-burring must leave surface flat; do not chamfer or countersink either end of hole.

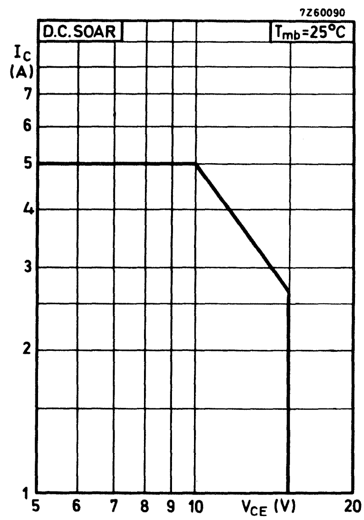
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	10	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

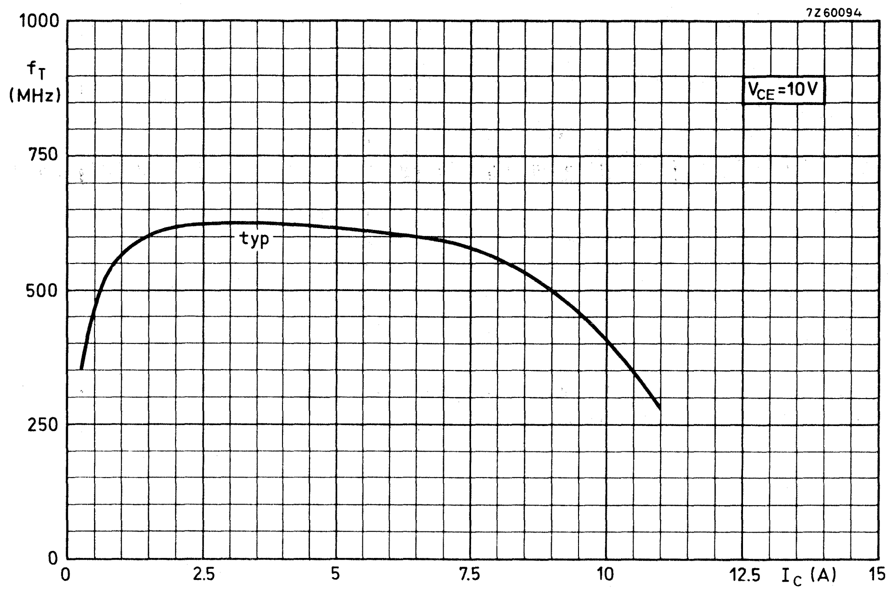
THERMAL RESISTANCE

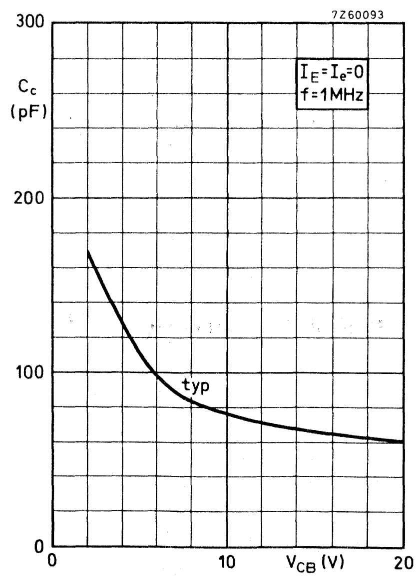
From junction to mounting base	$R_{th\,j\text{-}mb}$	=	2.5	K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	=	0.3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	typ.	50	
		10 to	120	
Transition frequency				
I_C = 4 A; V_{CE} = 10 V	f_T	typ.	650	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	65	pF
		<	90	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 15 V	C_{re}	typ.	41	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60094
1000
f_T
(MHz)
750
500
250
0
V_{CE} = 10 V
typ
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z60093
300
C_c
(pF)
200
100
0
$I_E = I_e = 0$
f = 1 MHz
typ
0
10
V_{CB} (V)
20

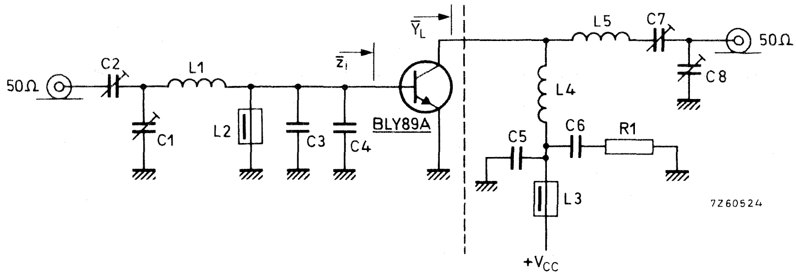
APPLICATION INFORMATION

R. F. performance in c. w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 13.5 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$ (mS)
175	< 6.25	25	< 2.64	> 6	> 70	1.6+j1.4	213 + j5.5

Test circuit



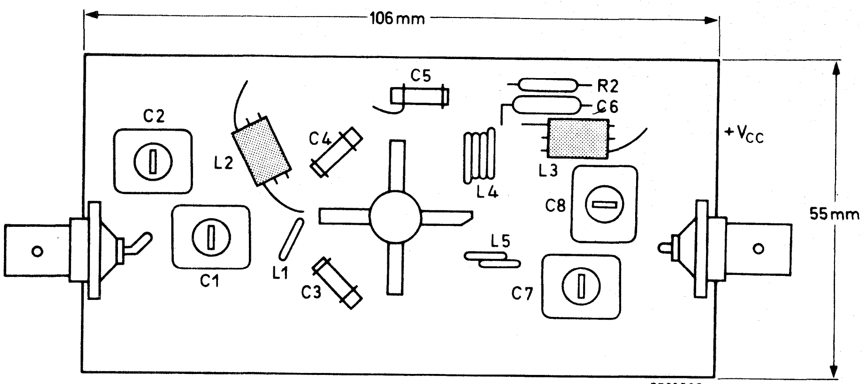
C1 = 4 to 44 pF film dielectric trimmer (code number 2222 809 07008)
C2 = 2 to 22 pF film dielectric trimmer (code number 2222 809 07004)
C3 = C4 = 47 pF ceramic
C5 = 100 pF ceramic
C6 = 150 nF polyester
C7 = 4 to 104 pF film dielectric trimmer (code number 2222 809 07015)
C8 = 4 to 64 pF film dielectric trimmer (code number 2222 809 07011)

L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2 x 6 mm
L2 = L3 = ferroxcube choke (code number 4312 020 36640)
L4 = 3.5 turns closely wound enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2 x 6 mm
L5 = 1 turn enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2 x 6 mm

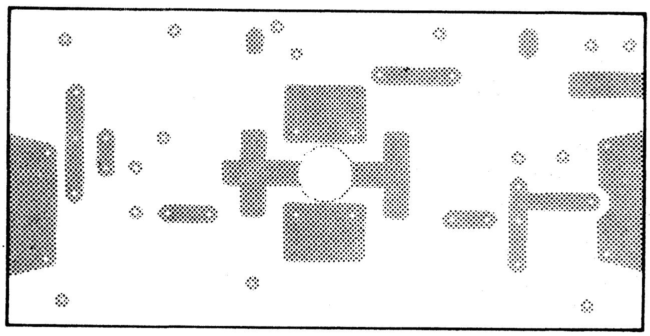
R1 = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

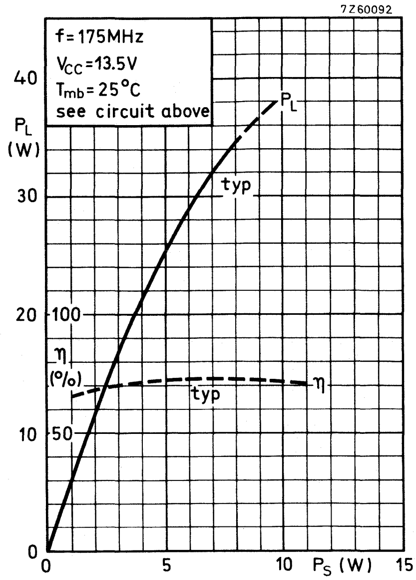


7Z60525



7Z67868

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

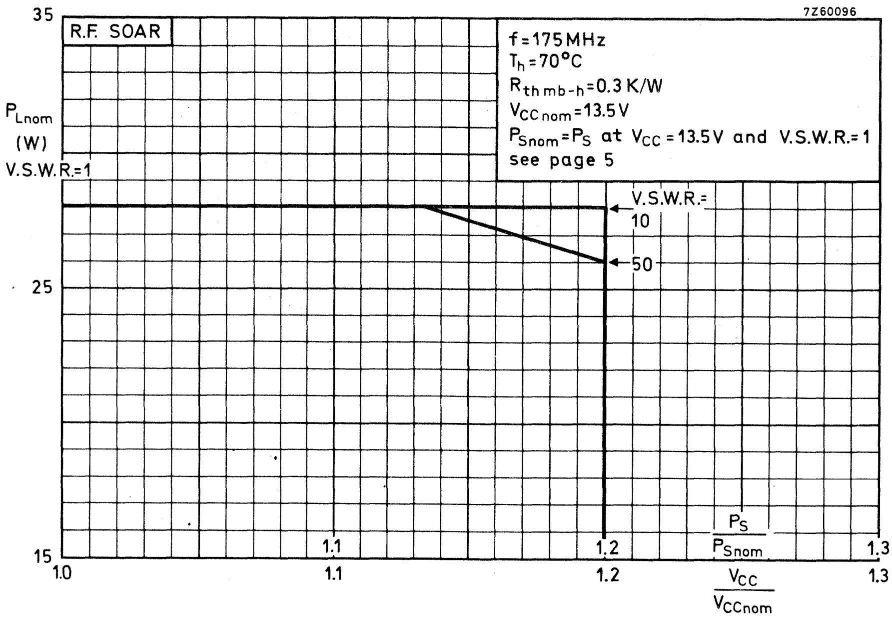


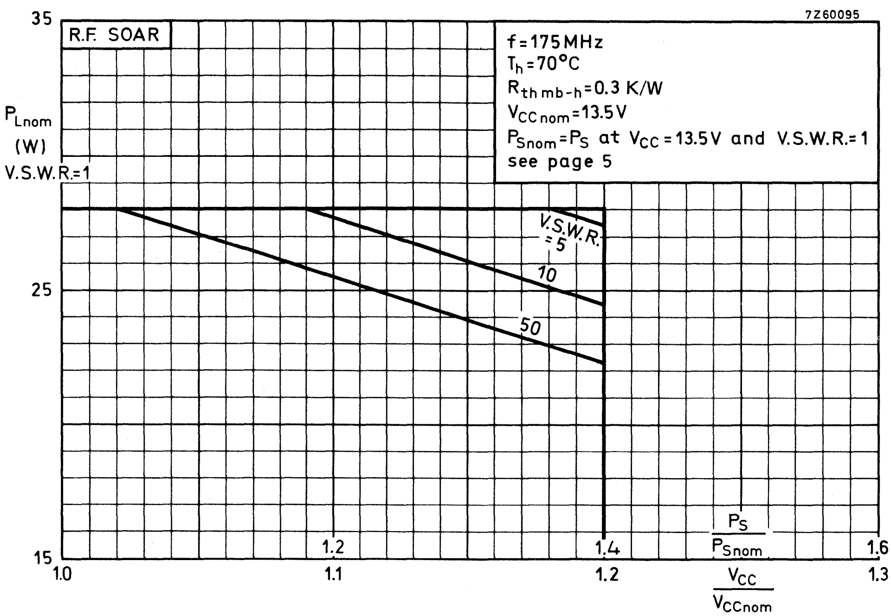
The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graphs next page for safe operation at supply voltages other than the nominal. The graphs show the allowable output power under nominal conditions, as a function of the supply overvoltage ratio, with V.S.W.R. as parameter.

The upper graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio.

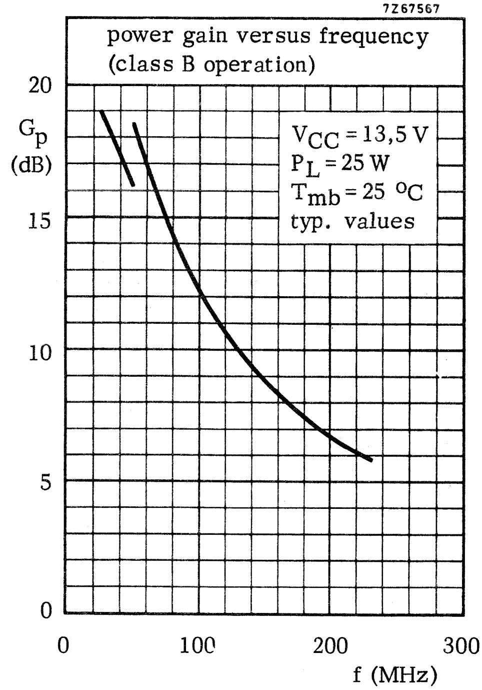
The lower graph shows the derating factor to be applied when the drive (P_S/P_{Snom}) increases as the square of the supply overvoltage ratio (V_{CC}/V_{CCnom}).

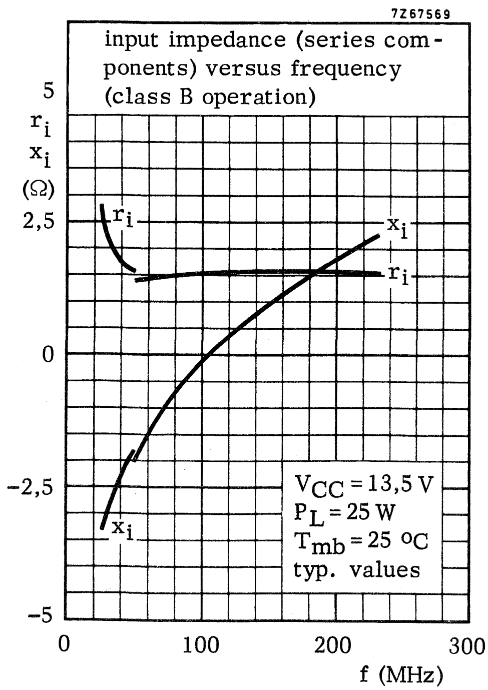
Depending on the operating conditions, the appropriate derating factor may lie in the region between the linear and the square-law functions.

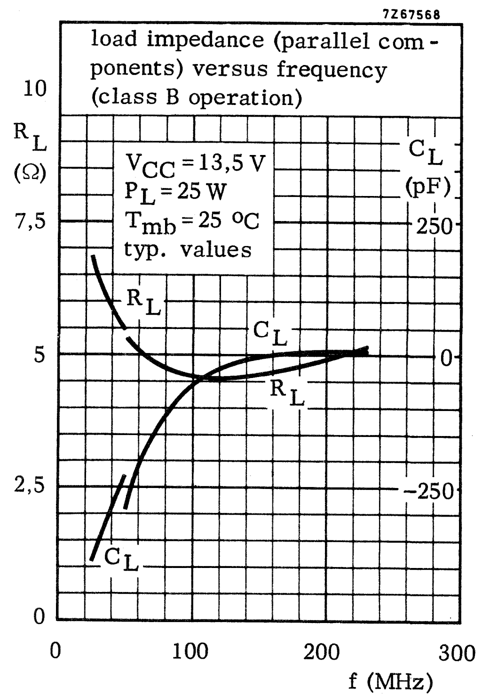

7Z60096
R.F. SOAR
P_{Lnom} (W) V.S.W.R.=1
f = 175 MHz
T_h = 70 °C
$R_{th\ mb-h}$ = 0.3 K/W
$V_{CC\ nom}$ = 13.5 V
$P_{Snom} = P_S$ at V_{CC} = 13.5 V and V.S.W.R. = 1
see page 5
V.S.W.R.= 10
50
35
25
15
1.0
1.1
1.2
1.3
$\frac{P_S}{P_{Snom}}$
$\frac{V_{CC}}{V_{CCnom}}$


7Z60095
R.F. SOAR
P_{Lnom} (W) V.S.W.R.=1
f = 175 MHz
T_h = 70 °C
$R_{th\ mb-h}$ = 0.3 K/W
$V_{CC\ nom}$ = 13.5 V
$P_{Snom} = P_S$ at V_{CC} = 13.5 V and V.S.W.R. = 1
see page 5
V.S.W.R. = 5
10
50
35
25
15
1.2
1.4
1.6
1.0
1.1
1.2
1.3
$\frac{P_S}{P_{Snom}}$
$\frac{V_{CC}}{V_{CCnom}}$

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 13,5 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions with a supply over-voltage to 16,5 V. It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

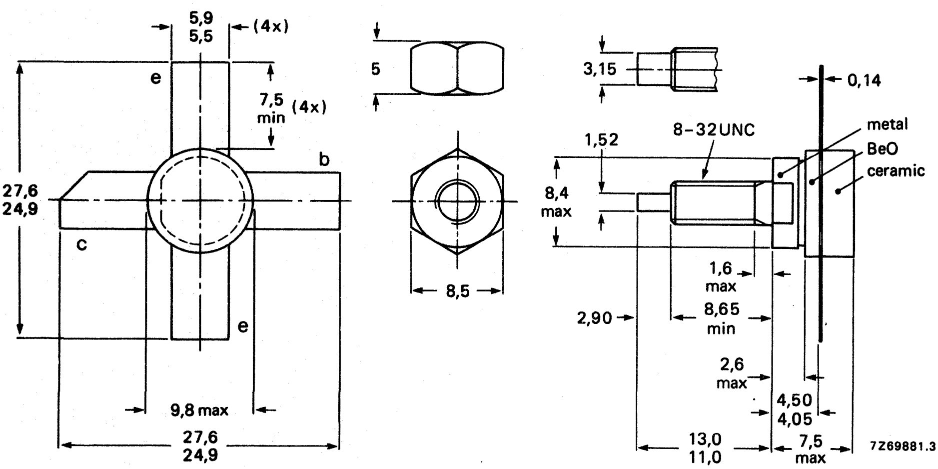
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	13,5	175	25	> 6	> 70	1,6 + j1,4	210 + j5,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min 0,75 Nm
(7,5 kg cm)
max 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

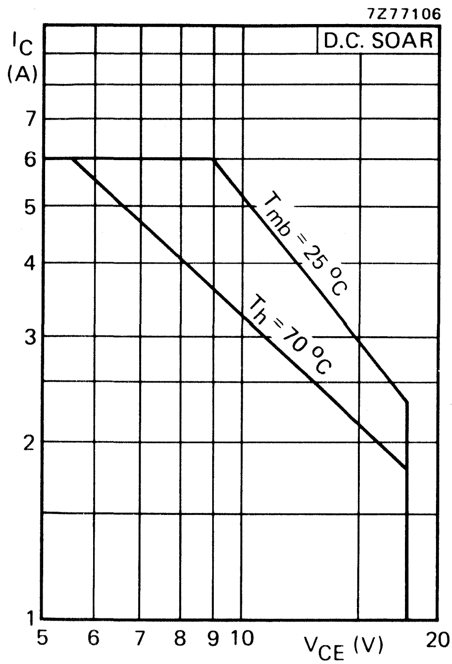
When locking is required an adhesive is preferred instead of a lock washer.

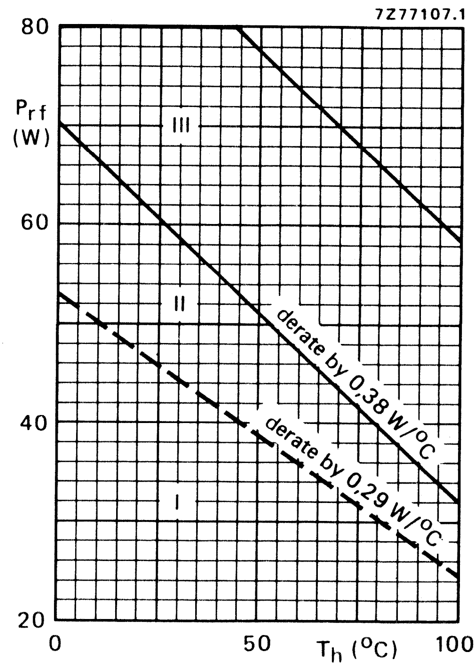
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max	36 V
Collector-emitter voltage (open base)	V_{CEO}	max	18 V
Emitter-base voltage (open collector)	V_{EBO}	max	4 V
Collector current (average)	$I_{C(AV)}$	max	6 A
Collector current (peak value); f > 1 MHz	I_{CM}	max	12 A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max	73 W





R.F. power dissipation; V_{CE} ⩽ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation 20 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	3,1 K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	2,3 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45 K/W

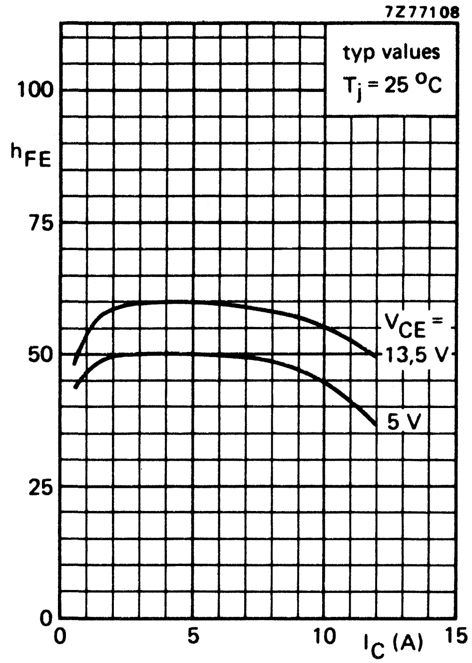
CHARACTERISTICS

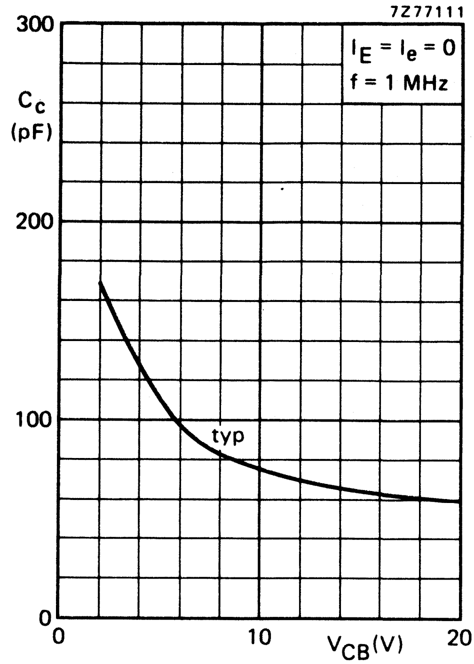
$T_j = 25\ ^oC$

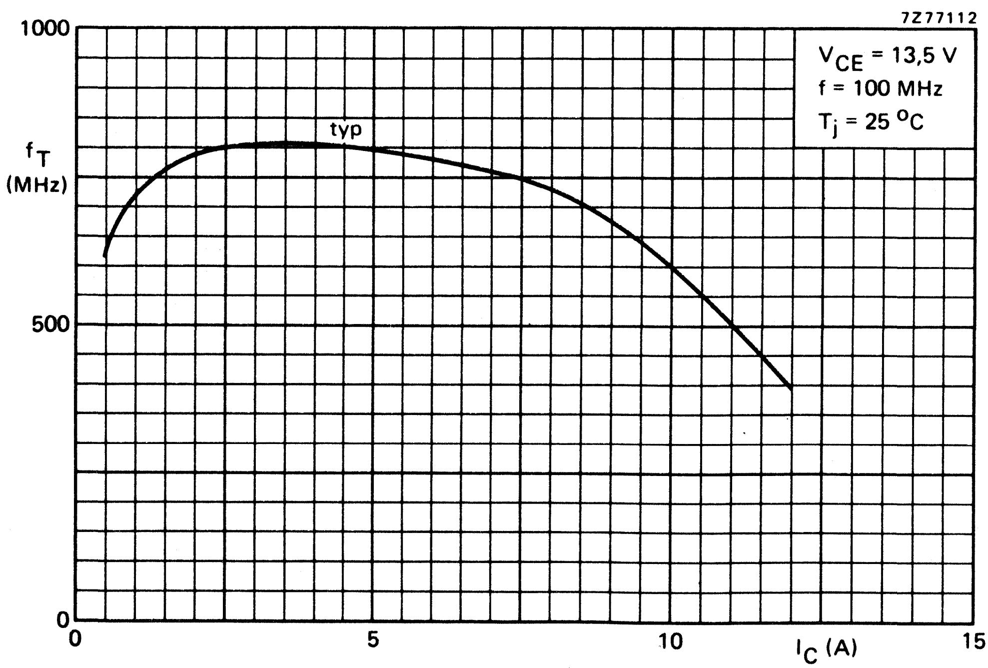
Breakdown voltage

Collector-emitter voltage $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36 V
Collector-emitter voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	18 V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current			
$V_{BE} = 0$; $V_{CE} = 18$ V	I_{CES}	<	10 mA
Transient energy			
L = 25 mH; f = 50 Hz			
open base	E	>	8 ms
$-V_{BE} = 1{,}5$ V; $R_{BE} = 33\ \Omega$	E	>	8 ms
D.C. current gain*			
$I_C = 2{,}5$ A; $V_{CE} = 5$ V	h_{FE}	typ	50
			10 to 80
Collector-emitter saturation voltage*			
$I_C = 7{,}5$ A; $I_B = 1{,}5$ A	V_{CEsat}	typ	1,7 V
Transition frequency at f = 100 MHz*			
$I_C = 2{,}5$ A; $V_{CE} = 13{,}5$ V	f_T	typ	800 MHz
$I_C = 7{,}5$ A; $V_{CE} = 13{,}5$ V	f_T	typ	750 MHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 15$ V	C_c	typ	65 pF
		<	90 pF
Feedback capacitance at f = 1 MHz			
$I_C = 100$ mA; $V_{CE} = 15$ V	C_{re}	typ	41 pF
Collector-stud capacitance	C_{cs}	typ	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.


7Z77108
typ values
T_j = 25 °C
h_{FE}
100
75
50
25
0
V_{CE} =
13,5 V
5 V
0
5
10
I_C (A)
15


7Z77111
$I_E = I_e = 0$
f = 1 MHz
C_c
(pF)
300
200
100
0
typ
0
10
V_{CB}(V)
20


7Z77112
V_{CE} = 13,5 V
f = 100 MHz
T_j = 25 °C
f_T
(MHz)
1000
500
0
typ
0
5
10
I_C (A)
15

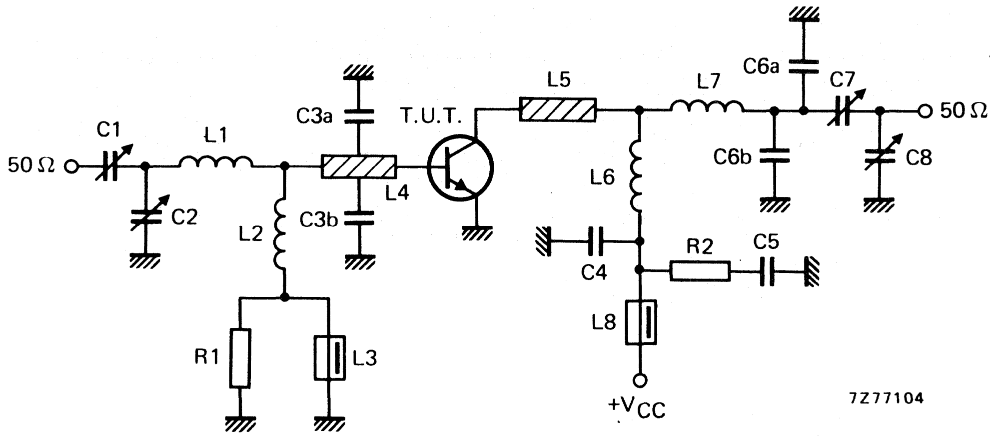
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CC}(V)	P_L(W)	P_S(W)	G_p(dB)	I_C(A)	η (%)	$\overline{z_i}$(Ω)	$\overline{Y_L}$ (mS)
175	13,5	25	<6,25	> 6	<2,64	> 70	1,6 + j1,4	210 + j5,5
175	12,5	25	—	typ 6,6	—	typ 75	—	—

Test circuit for 175 MHz



List of components:

C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = C6b = 8,2 pF ceramic capacitor (500 V)
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)

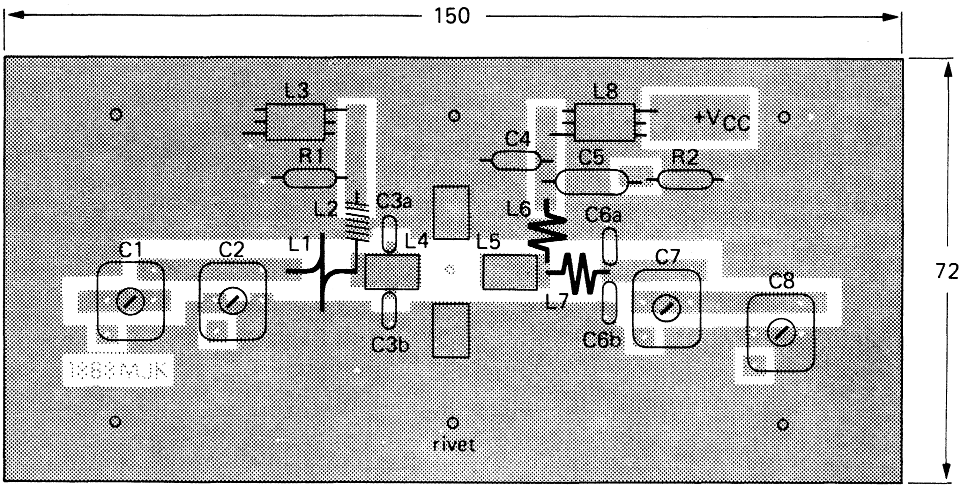
L1 = 1 turn enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 6,0 mm; leads 2 x 5 mm
L7 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 4,5 mm; length 6,0 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

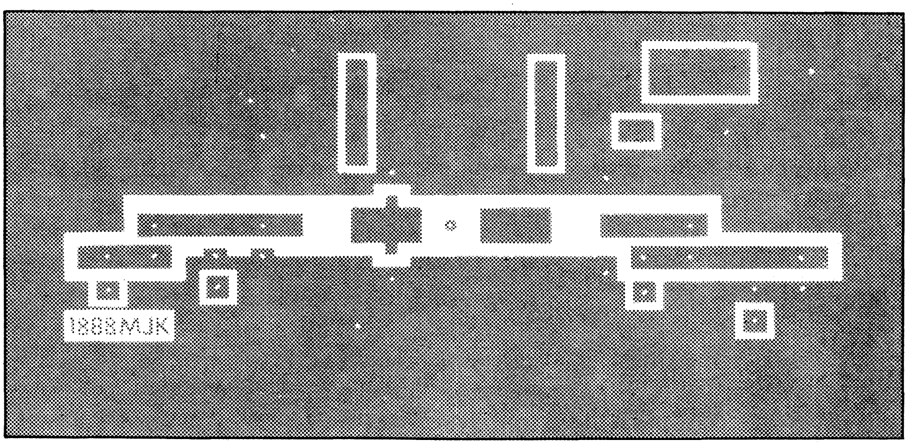
R1 = 10 Ω (±10%) carbon resistor
R2 = 4,7 Ω (±5%) carbon resistor

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 175 MHz test circuit.

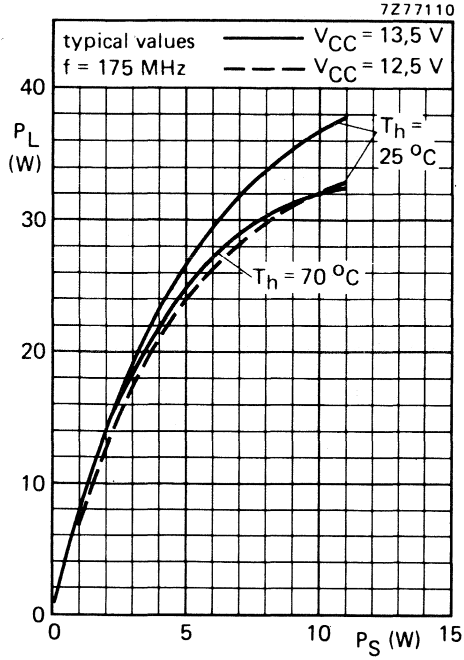


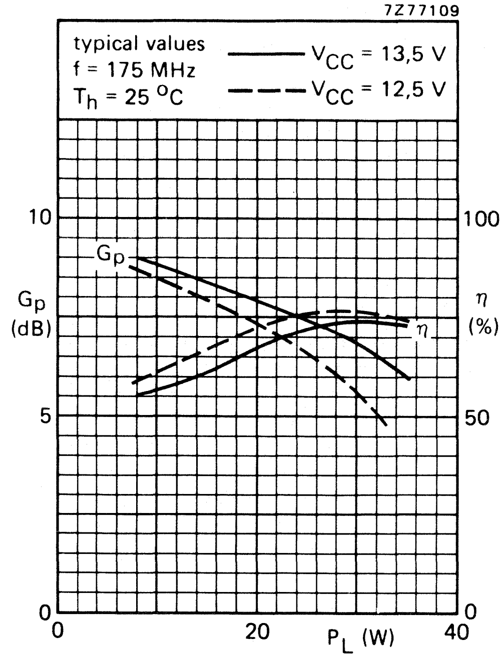
7Z77102

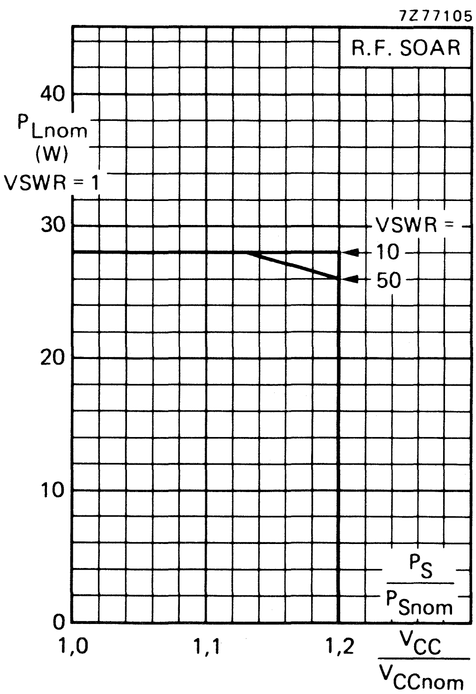


7Z77103

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.







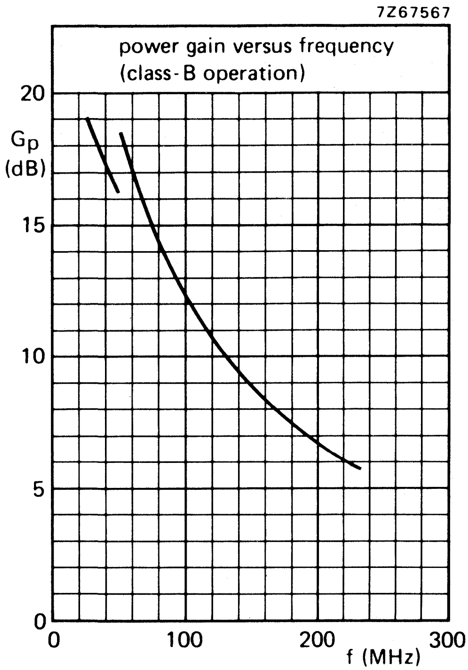
Conditions for R.F. SOAR

f = 175 MHz
T_h = 70 °C
$R_{th\ mb\text{-}h}$ = 0,45 K/W
V_{CCnom} = 13,5 V
P_S = P_{Snom} at V_{CCnom} = 13,5 V and VSWR = 1
see page 5

The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power must be derated in accordance with the graph for safe operation at supply voltages other than the nominal. The graph shows the permissible output power under nominal conditions (VSWR = 1), as a function of the expected supply over-voltage ratio with VSWR as parameter.

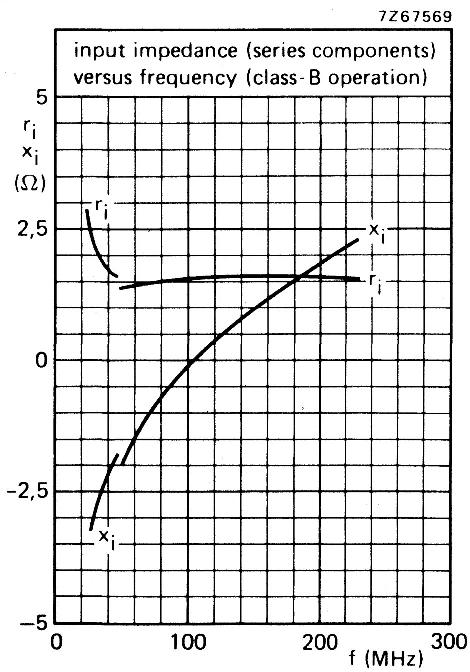
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

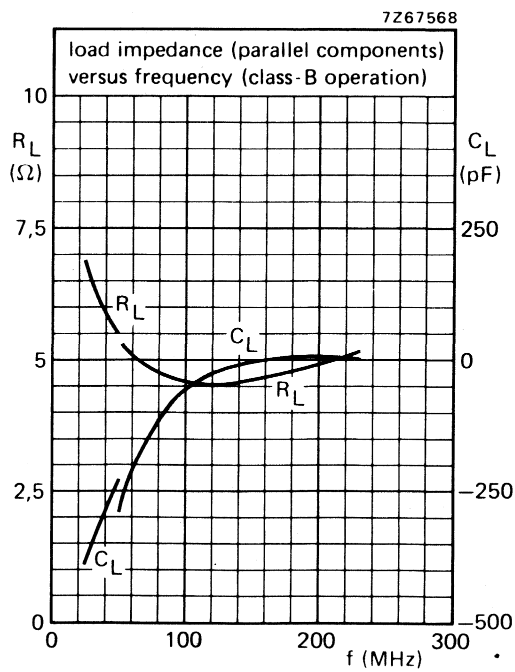
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



Measuring conditions for the graphs on this page

V_{CC} = 13,5 V
P_L = 25 W
T_h = 25 °C
typical values





V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 12,5 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions with a supply over-voltage to 15 V. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

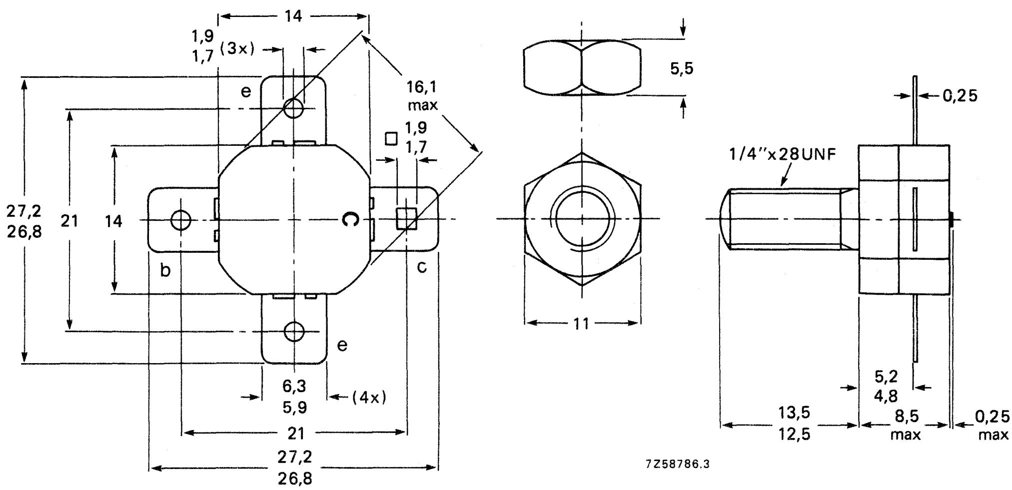
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	12,5	175	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j1,6	270 + j170

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

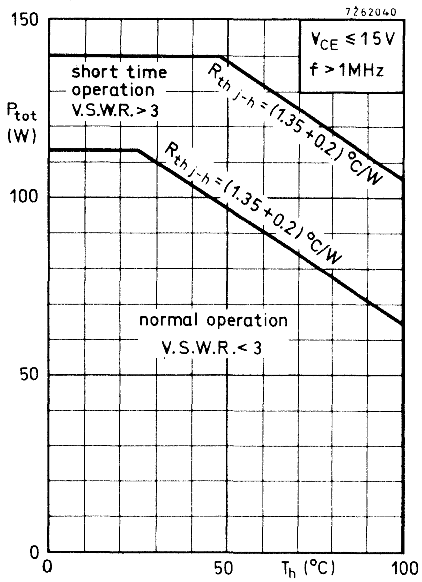
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

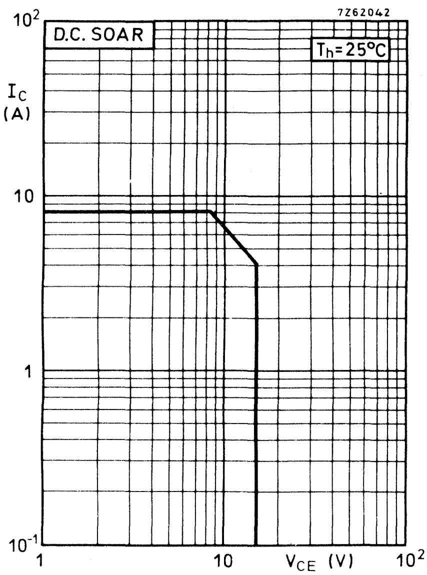
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	8	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	20	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

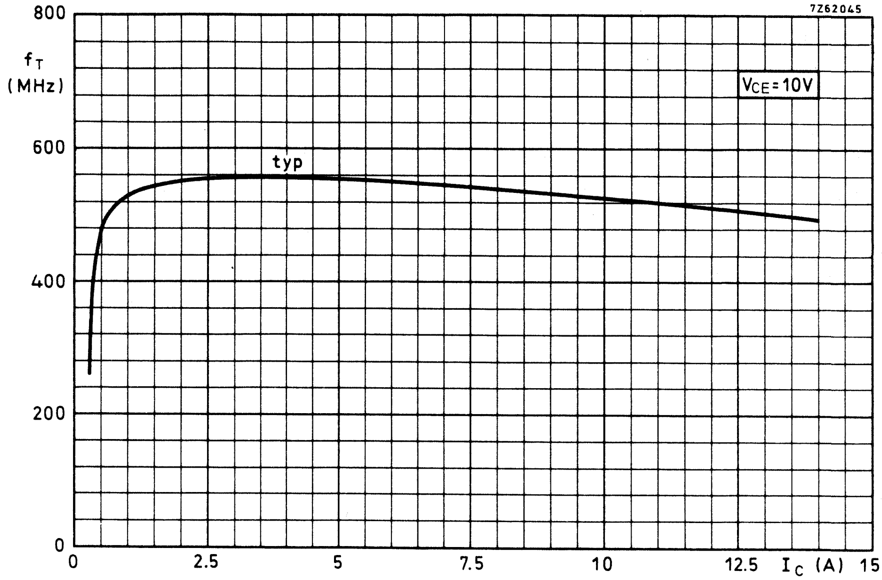
THERMAL RESISTANCE

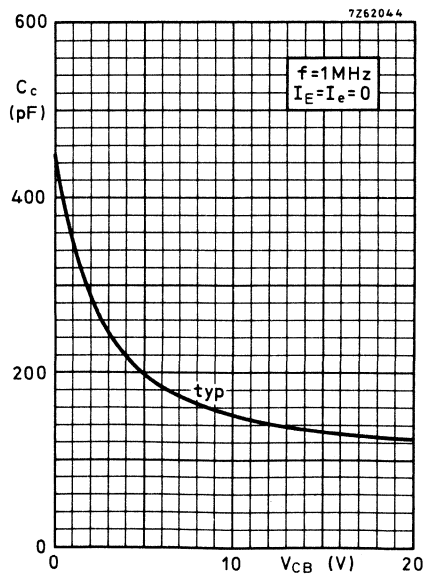
From junction to mounting base	$R_{th\,j-mb}$	=	1.35	K/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 100 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter voltage open base, I_C = 100 mA	$V_{(BR)CEO}$	>	18	V
Emitter-base voltage open collector, I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	>	10	
		typ.	50	
Transition frequency				
I_C = 6 A; V_{CE} = 10 V	f_T	typ.	550	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 15 V	C_c	typ.	130	pF
		<	160	pF
Feedback capacitance				
I_C = 200 mA; V_{CE} = 15 V	$-C_{re}$	typ.	82	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z62045
800
f_T
(MHz)
600
400
200
0
typ
V_{CE} = 10V
0
2.5
5
7.5
10
12.5
I_C (A)
15


7Z62044
600
C_c
(pF)
400
200
0
f = 1MHz
$I_E = I_e = 0$
typ
0
10
V_{CB} (V)
20

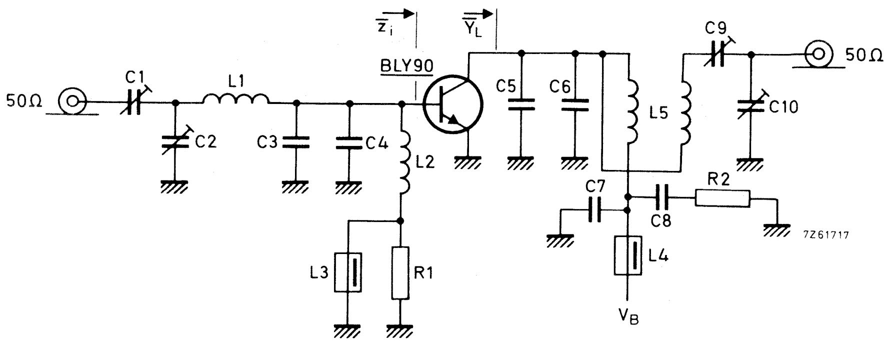
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

f = 175 MHz; T_h up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
12,5	< 15,8	50	< 5,33	> 5,0	> 75	1,3 + j 1,6	270 + j 170

Test circuit for 175 MHz:



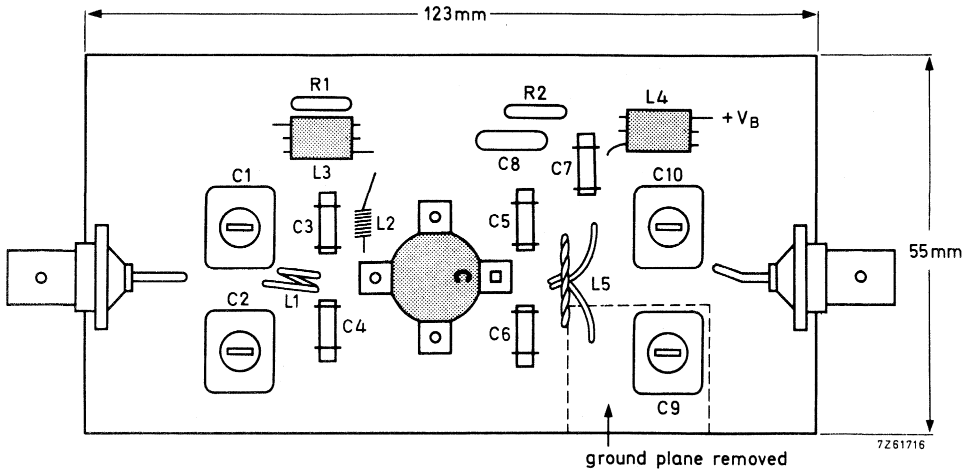
C1 = 2 to 20 pF film dielectric trimmer
C2 = 4 to 40 pF film dielectric trimmer
C3 = C4 = 27 pF ceramic capacitor
C5 = C6 = 56 pF ceramic capacitor
C7 = 100 pF ceramic capacitor
C8 = 100 nF polyester capacitor
C9 = 4 to 80 pF film dielectric trimmer
C10 = 4 to 60 pF film dielectric trimmer

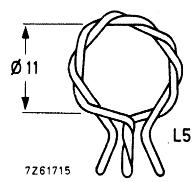
L1 = 1,5 turns enamelled Cu wire (1,5 mm); int. dia. 6 mm; length 4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube choke (code number 4312 020 36640)
L5 = bifilar wound enamelled Cu wire (1,0 mm); see figure on next page

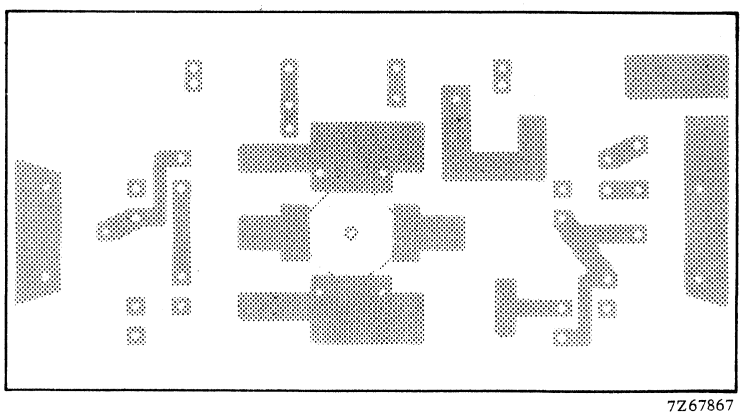
R1 = 10 Ω carbon resistor
R2 = 4,7 Ω carbon resistor

APPLICATION INFORMATION (continued)

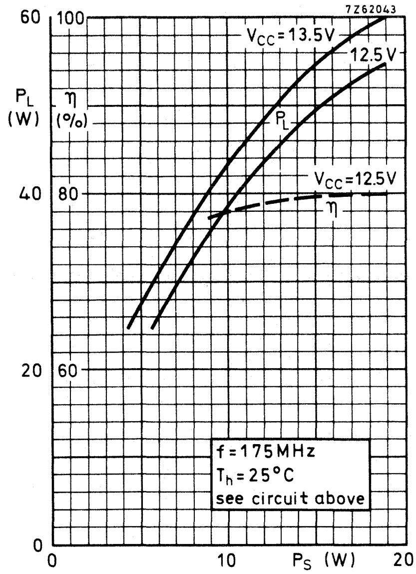
Component lay-out and printed circuit board for 175 MHz test circuit.

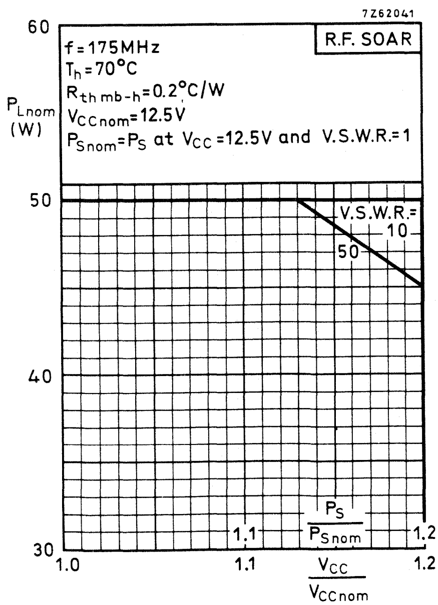




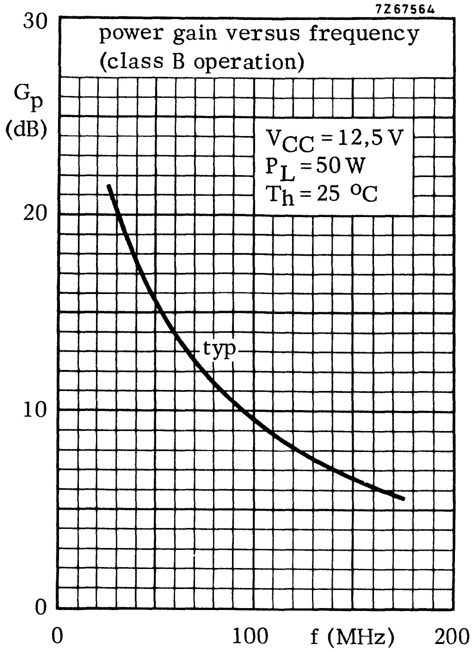


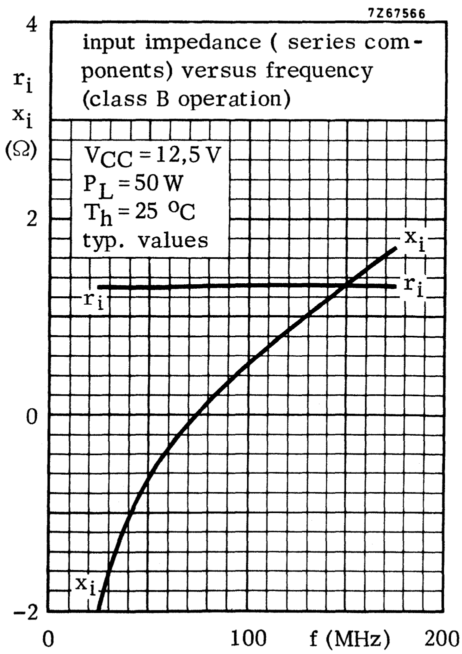
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

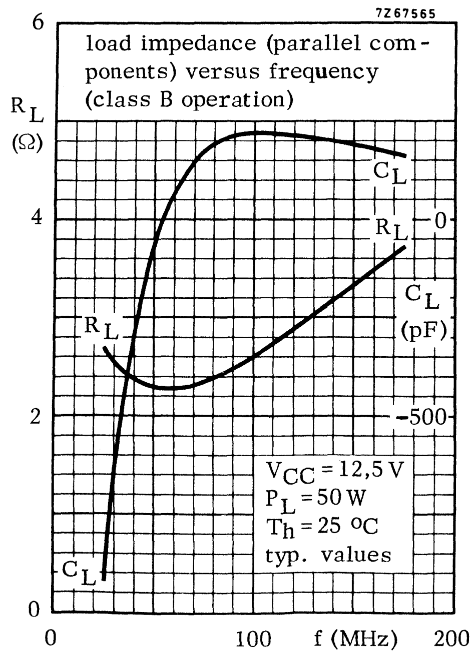




The transistor has been developed for use with unstabilized supply voltages. As the output power and drive power increase with the supply voltage, the nominal output power (P_{Lnom}) must be derated in accordance with the adjacent graph for safe operation at supply voltage other than the nominal. The graph shows the allowable output power under nominal conditions, as a function of the supply overvoltage ratio with V.S.W.R. as parameter. The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply overvoltage ratio (V_{CC}/V_{CCnom}).


7Z67564
power gain versus frequency
(class B operation)
G_p
(dB)
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ
30
20
10
0
0
100
f (MHz)
200


7Z67566
input impedance (series components) versus frequency
(class B operation)
r_i
x_i
(Ω)
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ. values
x_i
r_i
r_i
x_i
4
2
0
−2
0
100
f (MHz)
200


7Z67565
load impedance (parallel components) versus frequency
(class B operation)
R_L
(Ω)
C_L
R_L
0
C_L
(pF)
R_L
−500
V_{CC} = 12,5 V
P_L = 50 W
T_h = 25 °C
typ. values
C_L
6
4
2
0
0
100
f (MHz)
200

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ¼″ capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

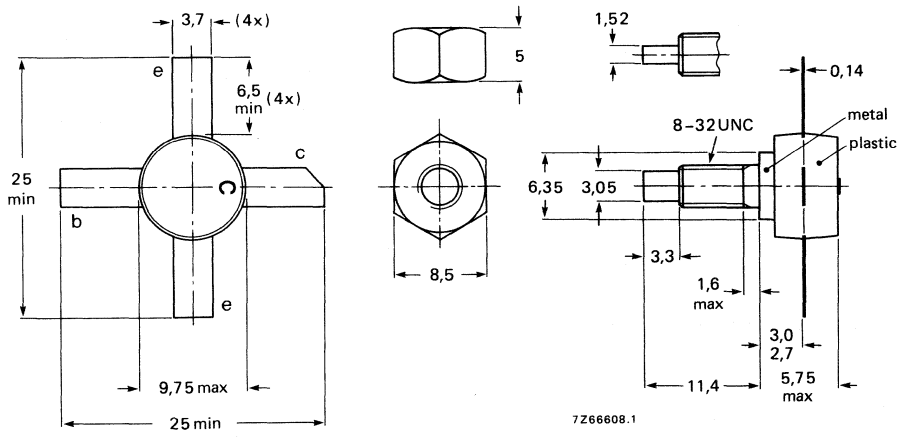
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

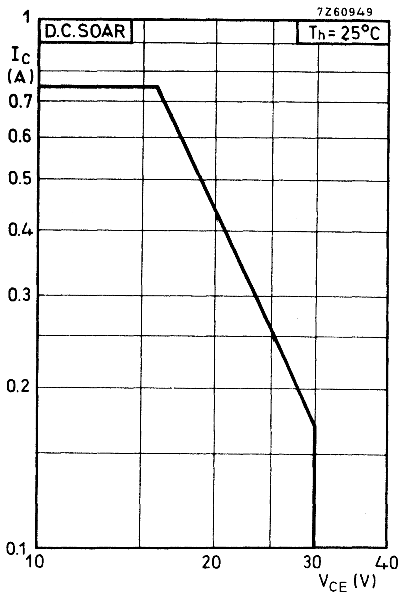
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

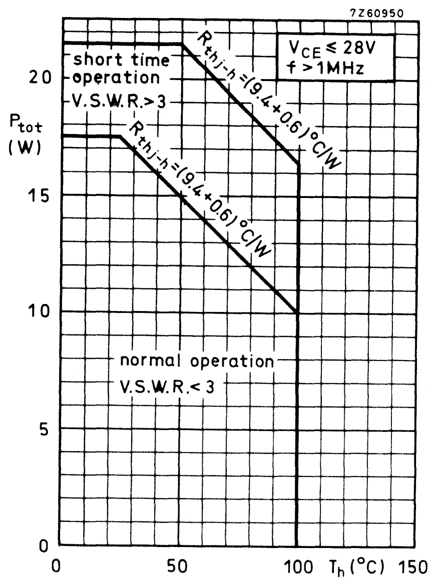
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0.75	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	2.25	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	17.5	W





Storage temperature	T_{stg}	−30 to +200		°C
Operating junction temperature	T_j	max.	200	°C

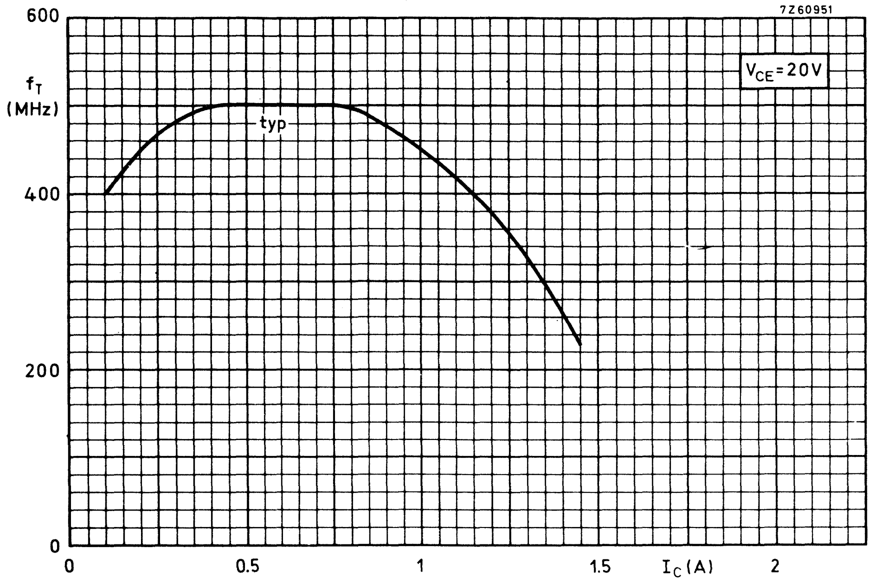
THERMAL RESISTANCE

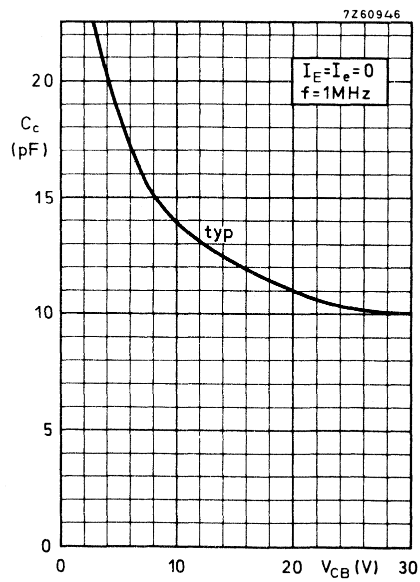
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9.4	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	5	mA
Breakdown voltages				
Collector-base voltage open emitter; $I_C = 1$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 10$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 1$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	0.5	ms
$-V_{BE} = 1.5$ V; $R_{BE} = 33\ \Omega$	E	>	0.5	ms
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 400$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ.	10	pF
		<	15	pF
Feedback capacitance at f = 1 MHz				
$I_C = 50$ mA; $V_{CE} = 30$ V	C_{re}	typ.	7.5	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60951
600
f_T
(MHz)
400
200
0
0
0.5
1
1.5
I_C (A)
2
V_{CE} = 20 V
typ


7Z60946
20
C_c
(pF)
15
10
5
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1 MHz
typ

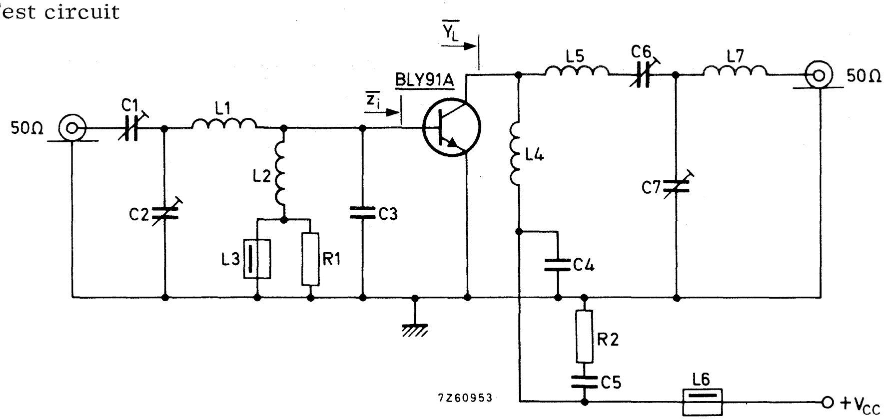
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} up to 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	< 0.50	8	< 0.44	> 12	> 65	1.8+j0.7	18−j20

Test circuit



C1 = 2.5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = 47 pF ceramic
C4 = 100 pF ceramic
C5 = 150 nF polyester

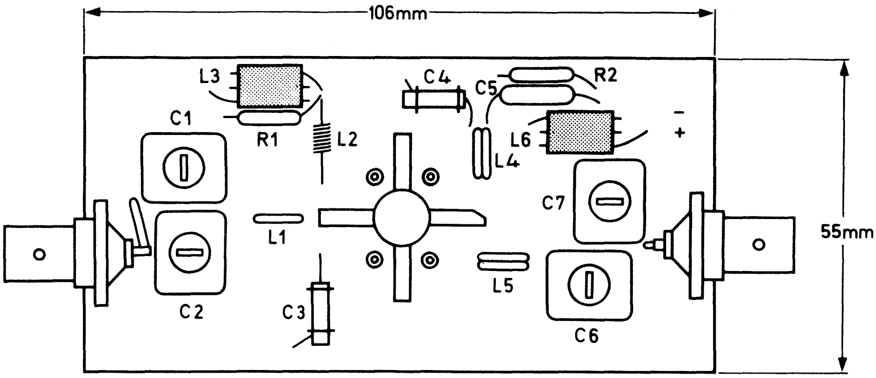
L1 = 0.5 turn enamelled Cu wire (1.5 mm); int. diam. 6 mm; leads 2 x 10 mm
L2 = 6.5 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L3 = L6 = ferroxcube choke (code number 4312 020 36640)
L4 = 7.5 turns enamelled Cu wire (0.7 mm); int. diam. 4 mm; leads 2 x 5 mm
L5 = 4.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm
L7 = 3.5 turns enamelled Cu wire (0.7 mm); int. diam. 6 mm; leads 2 x 7 mm

R1 = R2 = 10 Ω carbon

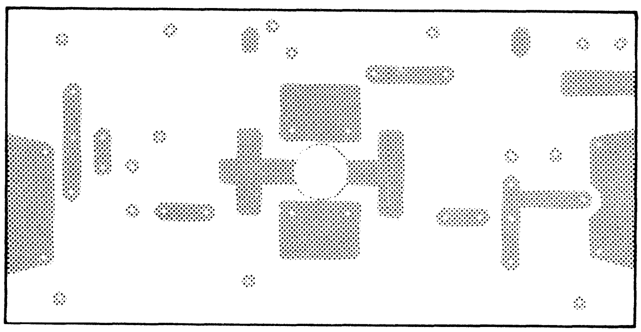
Component lay-out for 175 MHz test circuit see **next page.**

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

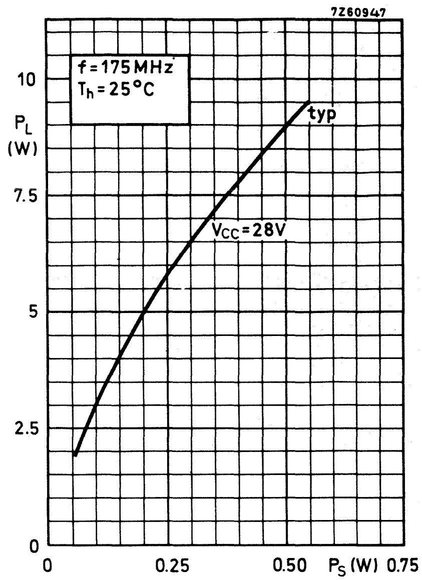


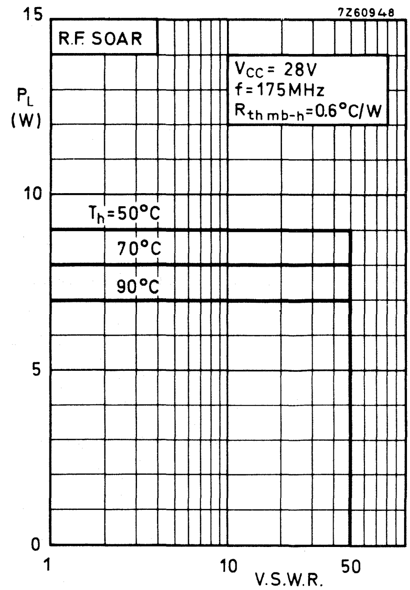
7Z60952



7Z67868

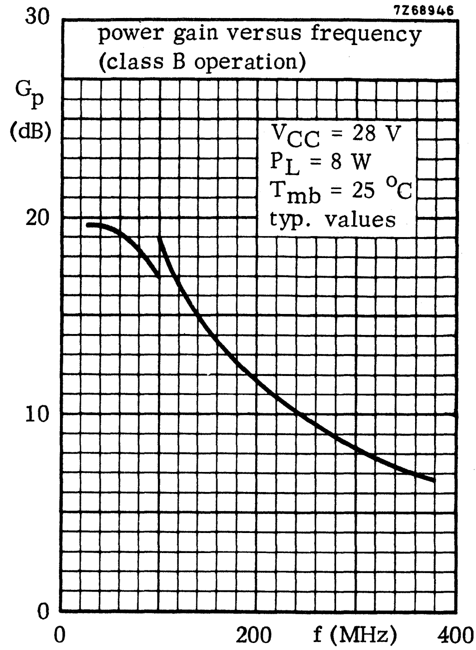
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

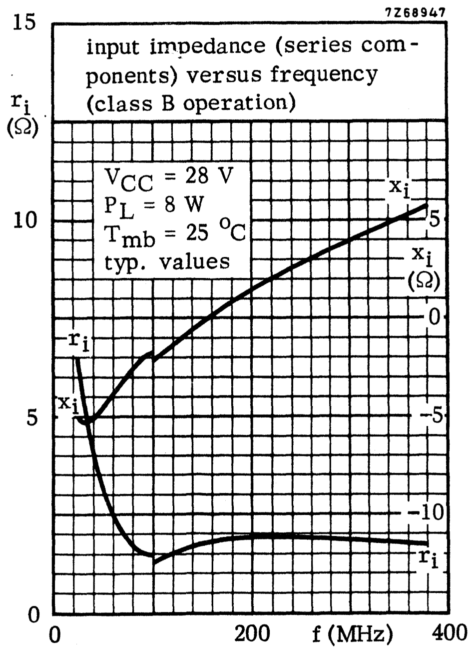


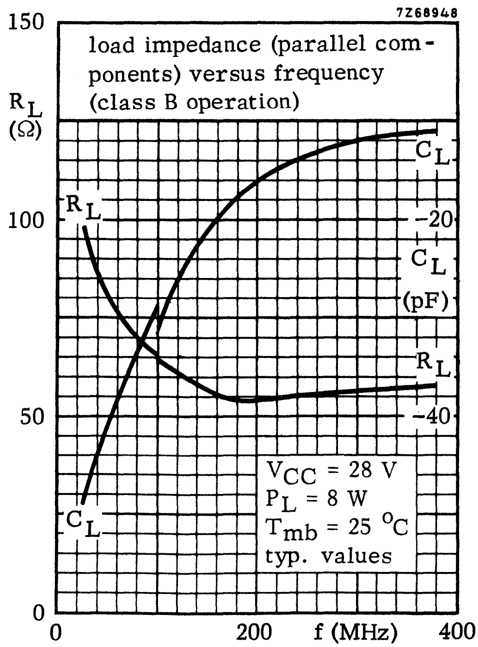


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

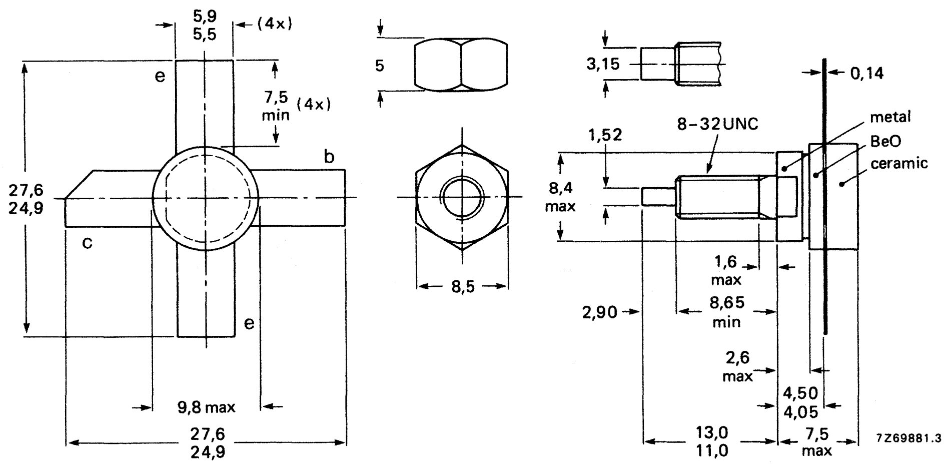
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	0,9	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	2,5	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

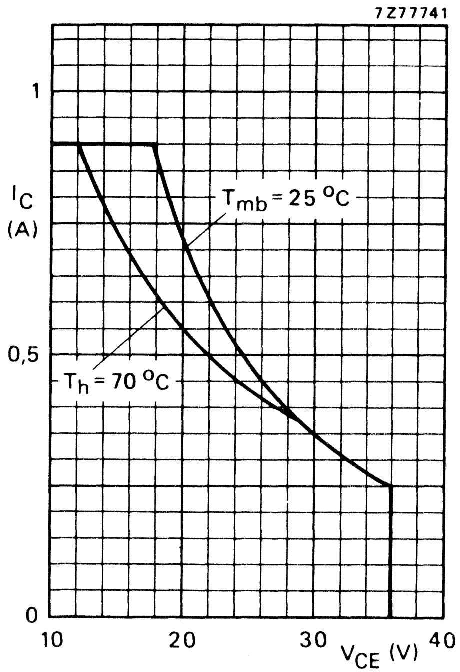


Fig. 2 D.C. SOAR.

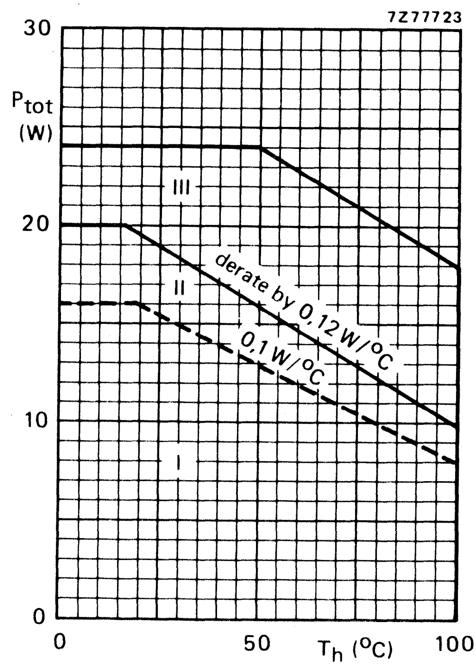


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 73,6 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10,7	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	8,6	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

CHARACTERISTICS

T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 2 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; I_E = 1 mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current V_{BE} = 0; V_{CE} = 36 V	I_{CES}	<	1	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	0,5	mJ
R_{BE} = 10 Ω	E_{SBR}	>	0,5	mJ
D.C. current gain* I_C = 0,4 A; V_{CE} = 5 V	h_{FE}	typ.	50 10 to 100	
Collector-emitter saturation voltage* I_C = 1,25 A; I_B = 0,25 A	V_{CEsat}	typ.	0,8	V
Transition frequency at f = 100 MHz* $-I_E$ = 0,4 A; V_{CB} = 28 V	f_T	typ.	600	MHz
$-I_E$ = 1,25 A; V_{CB} = 28 V	f_T	typ.	525	MHz
Collector capacitance at f = 1 MHz $I_E = I_e$ = 0; V_{CB} = 28 V	C_c	typ.	10	pF
Feedback capacitance at f = 1 MHz I_C = 50 mA; V_{CE} = 28 V	C_{re}	typ.	7,1	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

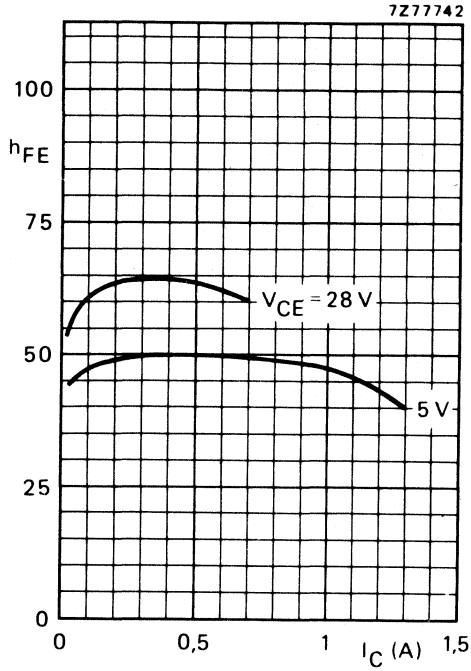


Fig.4 Typical values; T_j = 25 °C.

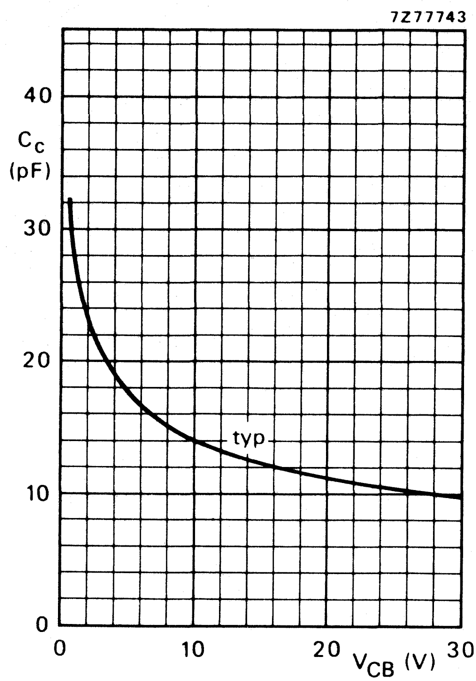


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

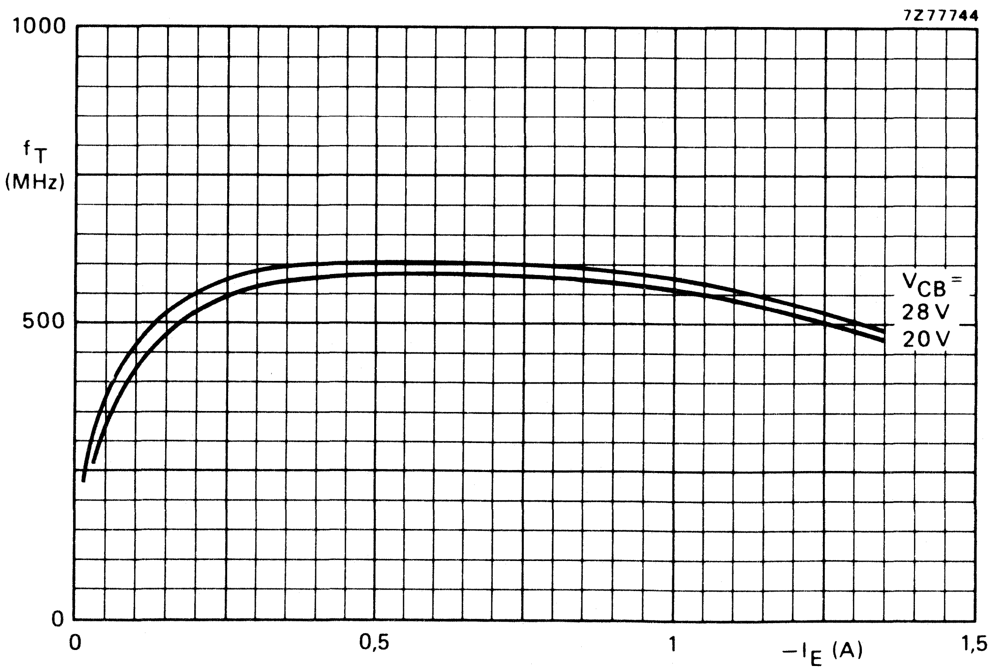


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 − j20

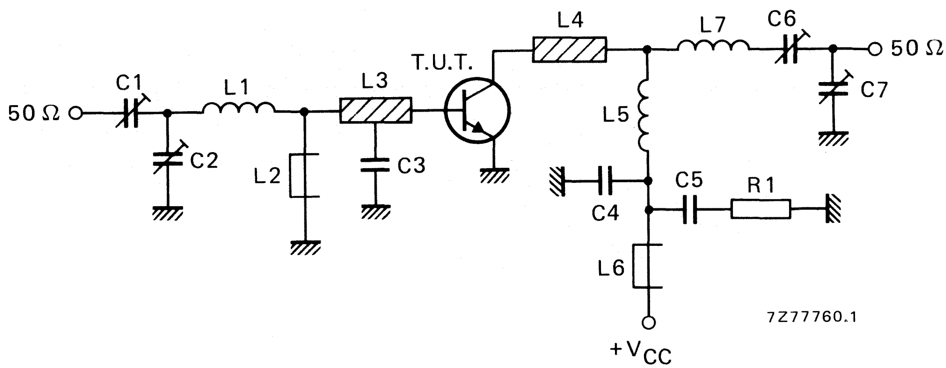


Fig. 7 Test circuit; c.w. class-B.

List of components:

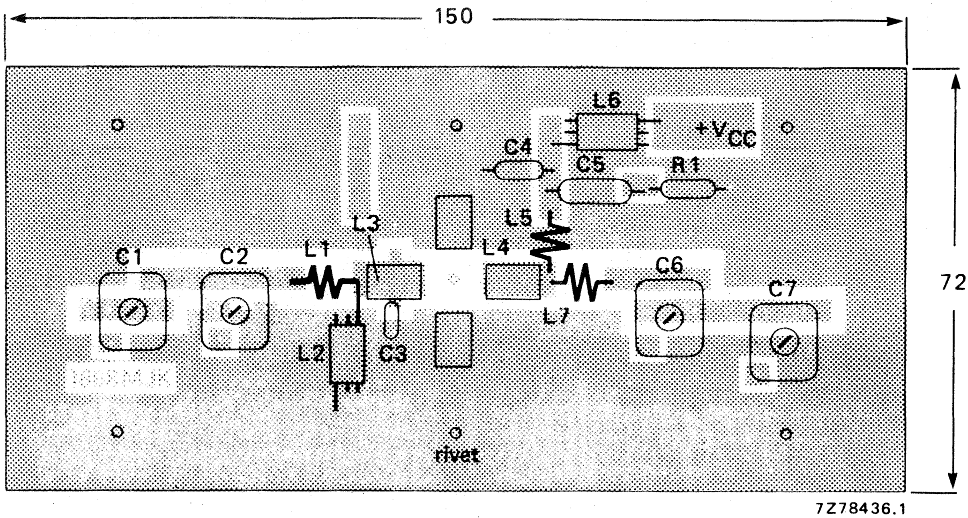
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



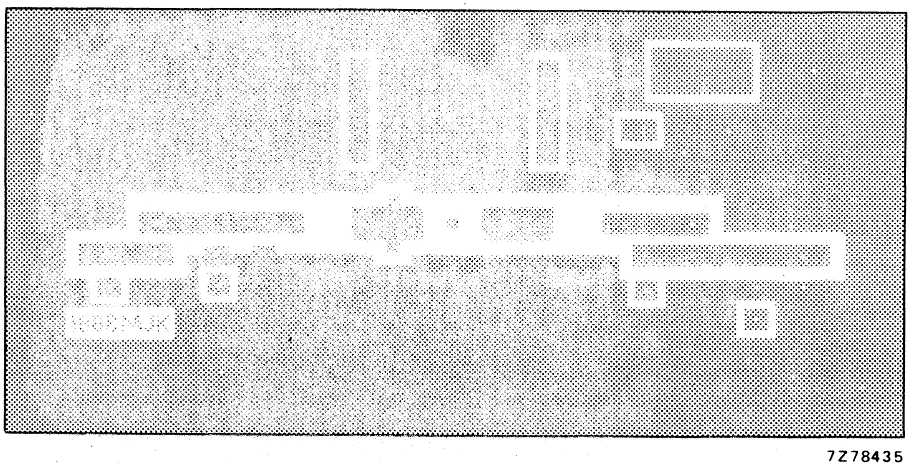


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

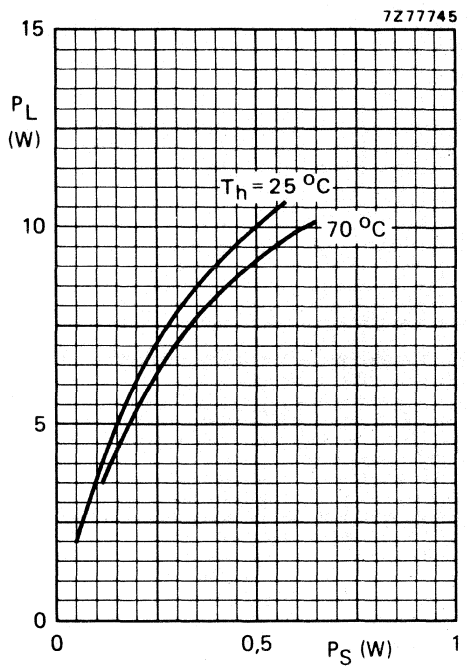


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

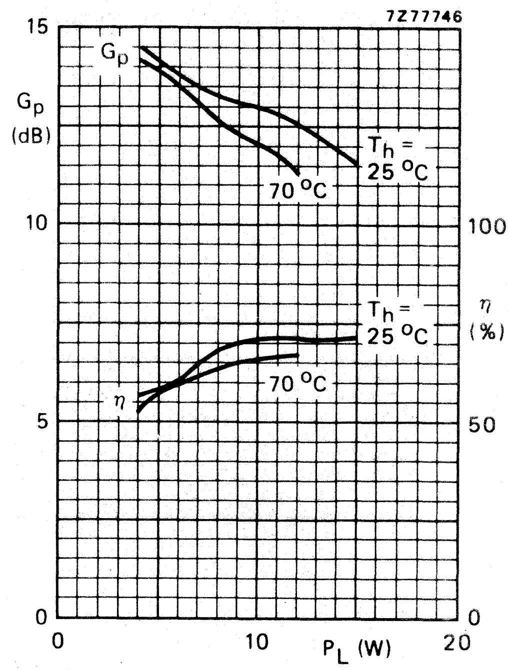


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

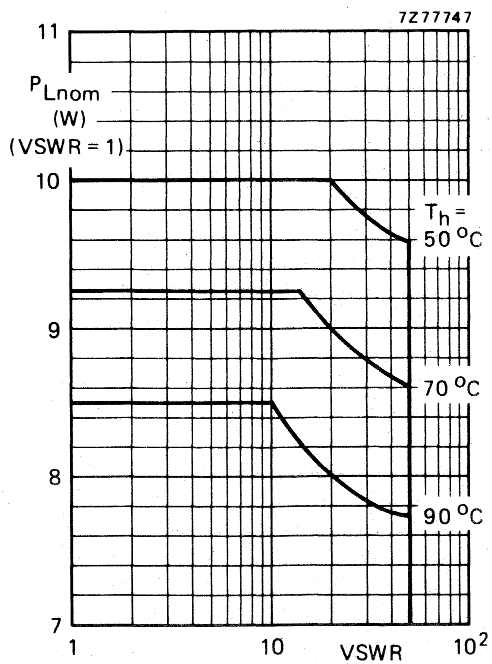


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\,mb\text{-}h}$ = 0,45 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

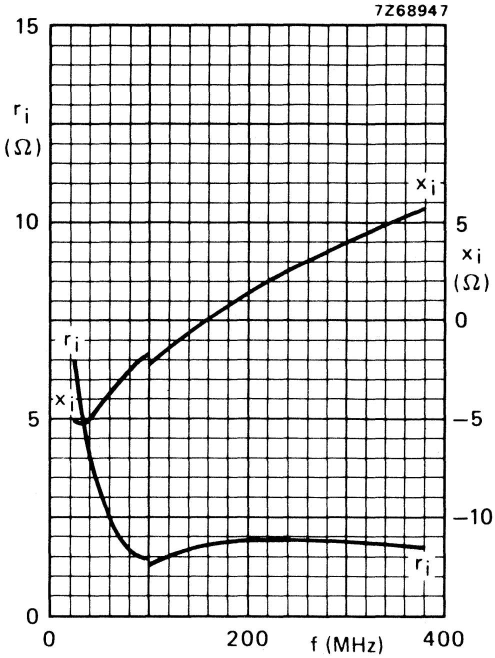


Fig. 12 Input impedance (series components).

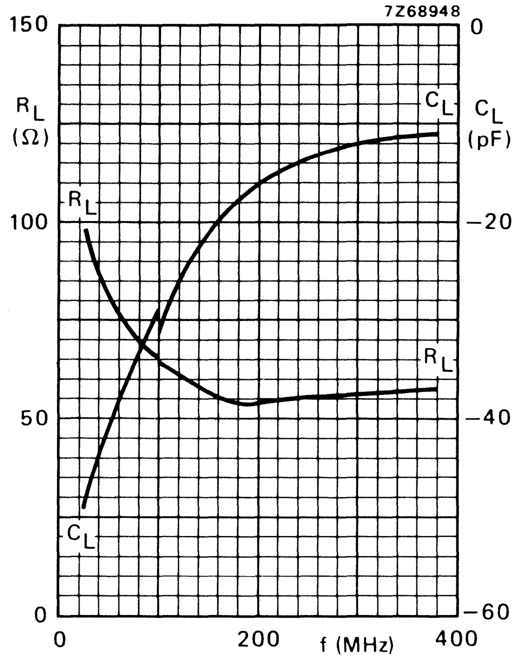


Fig. 13 Load impedance (parallel components).

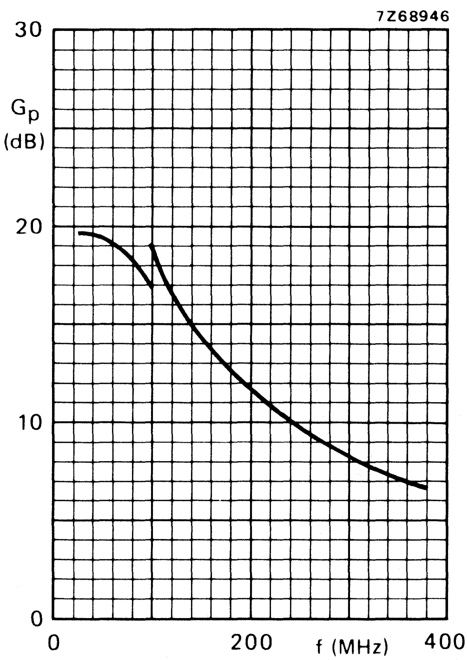


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 8 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor for use in class-A, B and C operated mobile, industrial and military transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

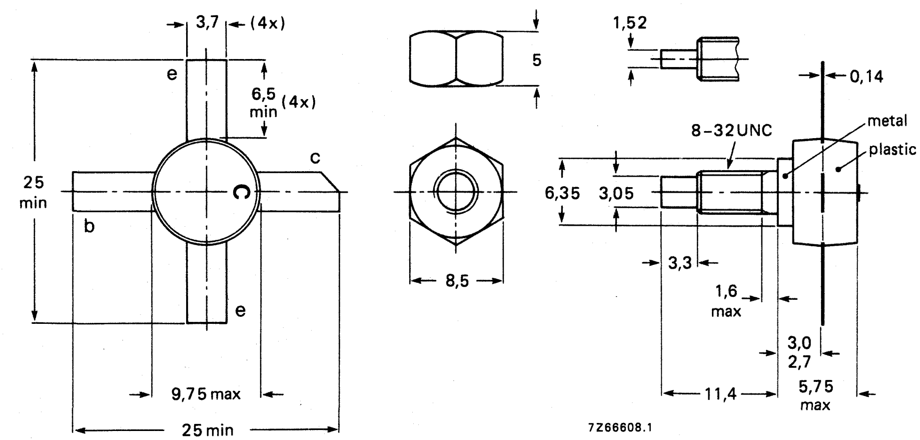
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

Mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 − j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/2.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

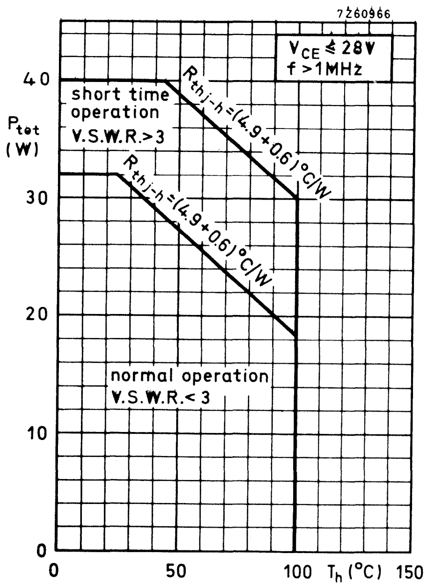
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

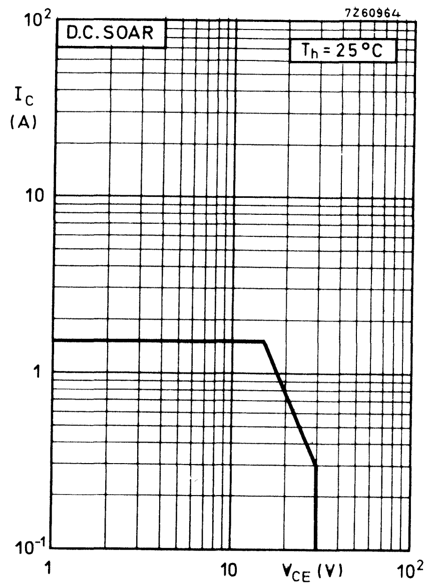
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1.5	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	4.5	A
Total power dissipation up to T_h = 25 °C f > 1 MHz	P_{tot}	max.	32	W





Storage temperature	T_{stg}	−30 to	+200	°C
Operating junction temperature	T_j	max.	200	°C

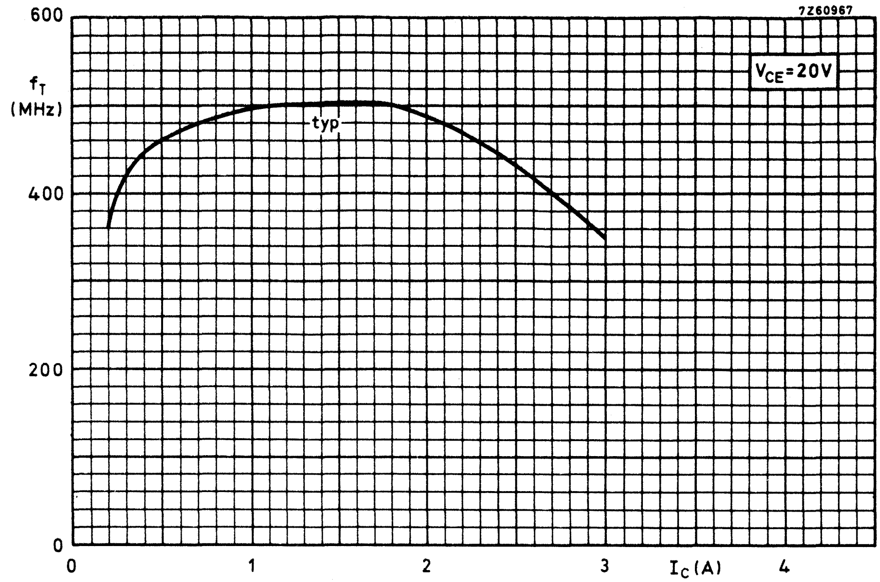
THERMAL RESISTANCE

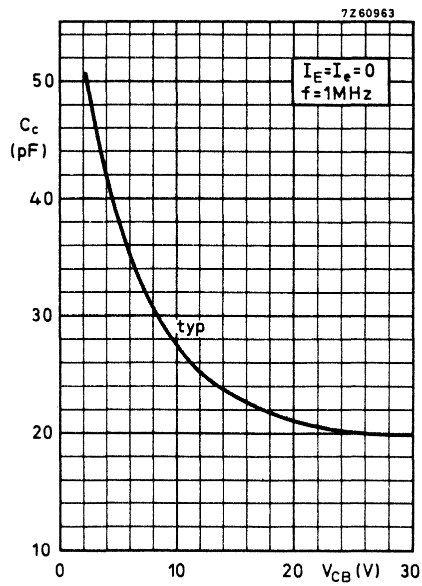
From junction to mounting base	$R_{th\ j-mb}$	=	4.9	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 28$ V	I_{CEO}	<	10	mA
Breakdown voltages				
Collector-base voltage open emitter, $I_C = 3$ mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, $I_C = 25$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; $I_E = 3$ mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	2.0	ms
$-V_{BE} = 1.5$ V; $R_{BE} = 33\,\Omega$	E	>	4.5	ms
D.C. current gain				
$I_C = 500$ mA; $V_{CE} = 5$ V	h_{FE}	>	5	
Transition frequency				
$I_C = 600$ mA; $V_{CE} = 20$ V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 30$ V	C_c	typ. <	20 30	pF pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 30$ V	C_{re}	typ.	15	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60967
f_T
(MHz)
600
400
200
0
V_{CE}=20V
typ
0
1
2
3
4
I_C(A)


7Z60963
C_c
(pF)
50
40
30
20
10
I_E=I_e=0
f=1MHz
typ
0
10
20
V_{CB}(V)
30

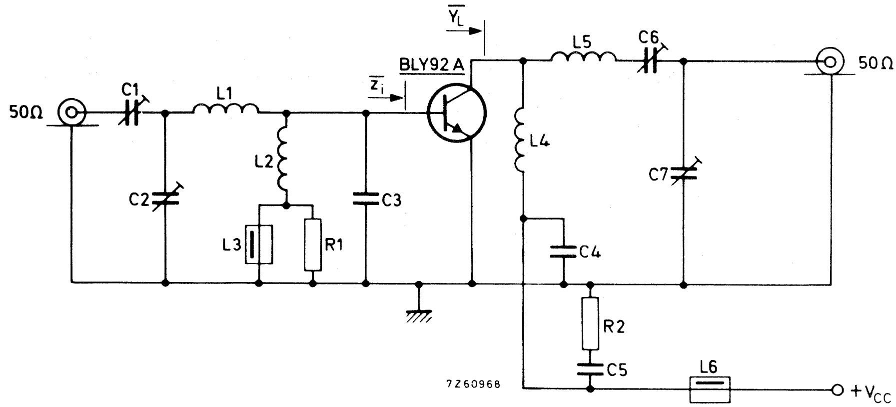
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

V_{CE} = 28 V; T_{mb} up to 25 °C

f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	< 1,5	15	< 0,83	> 10	> 65	1,4 + j1,85	33 – j27,5

Test circuit: 175 MHz; c.w. class-B.



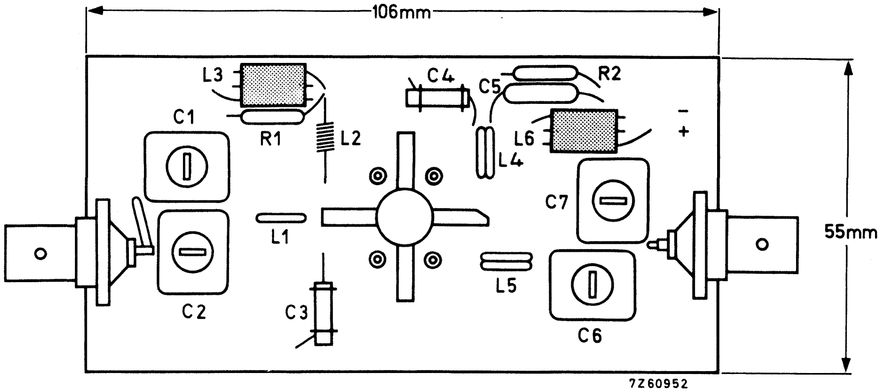
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = C7 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor
C4 = 100 pF ceramic capacitor
C5 = 150 nF polyester capacitor

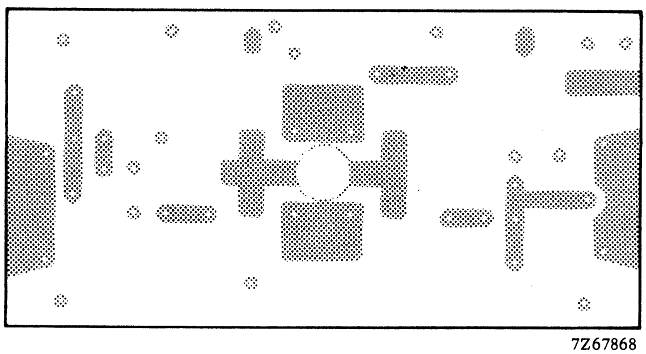
L1 = 0,5 turn enamelled Cu wire (1,6 mm); int. dia. 6 mm; leads 2 x 10 mm
L2 = 6,5 turns closely wound enamelled Cu wire (0,7 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L5 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 2,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm
L6 = 4,5 turns enamelled Cu wire (0,7 mm); int. dia. 6 mm; leads 2 x 7 mm

R1 = R2 = 10 Ω carbon resistor

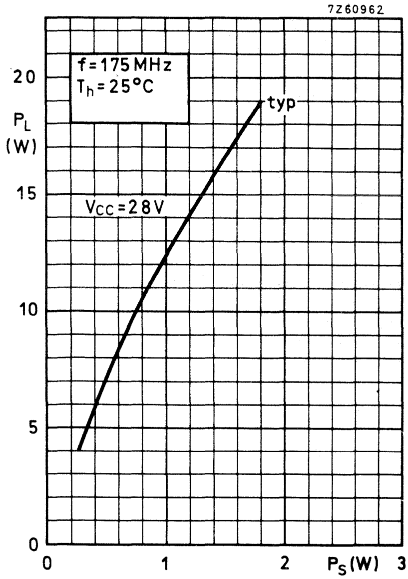
APPLICATION INFORMATION (continued)

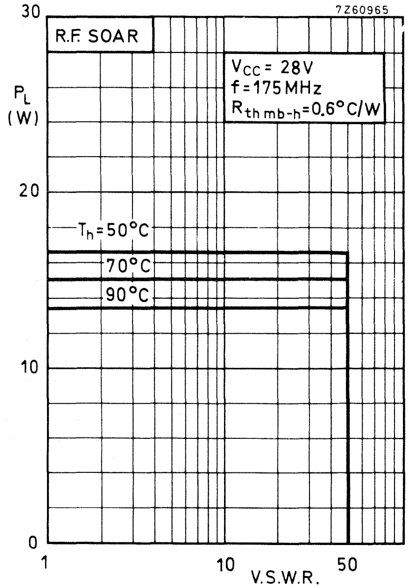
Component lay-out and printed circuit board for 175 MHz test circuit.





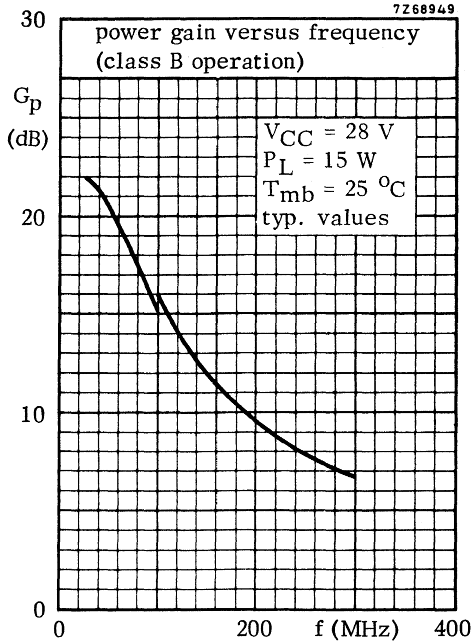
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

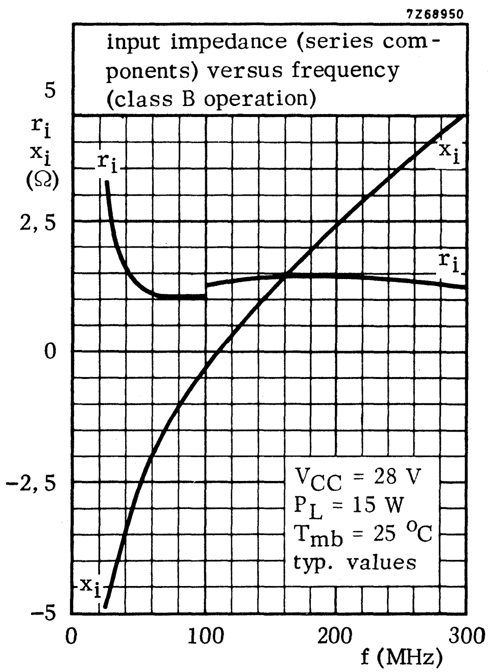


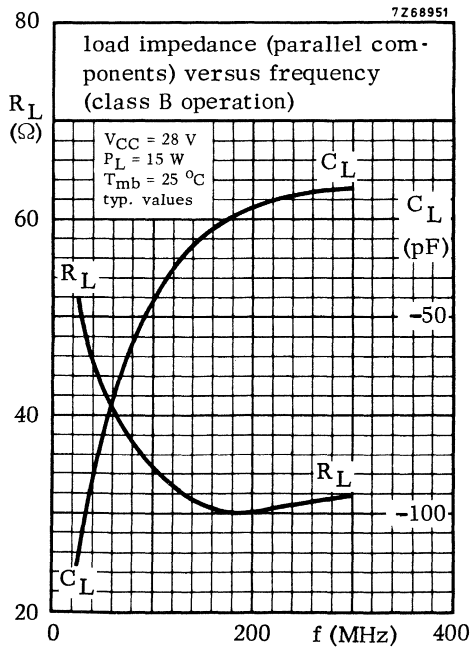


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

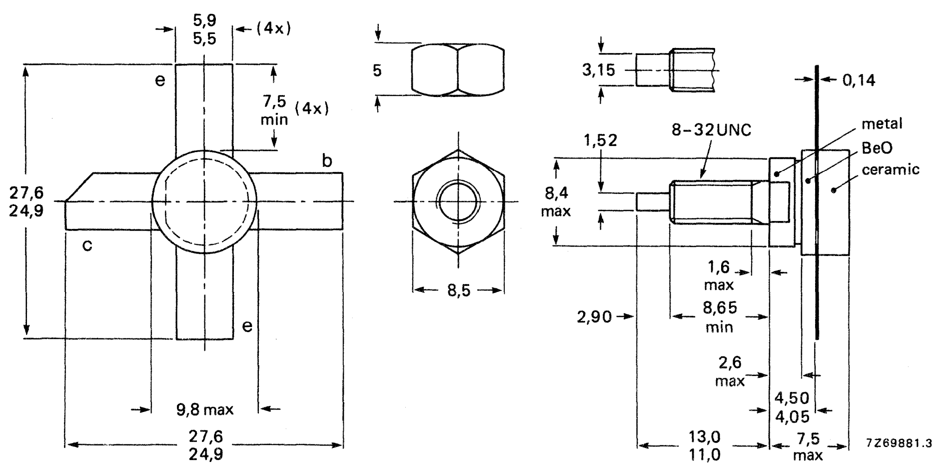
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 – j27,5

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm (7,5 kg cm)
max. 0,85 Nm (8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	1,75	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	5,0	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	36	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

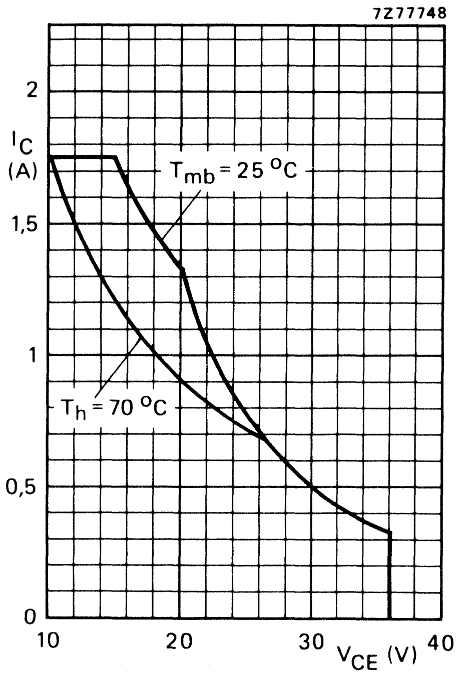


Fig. 2 D.C. SOAR.

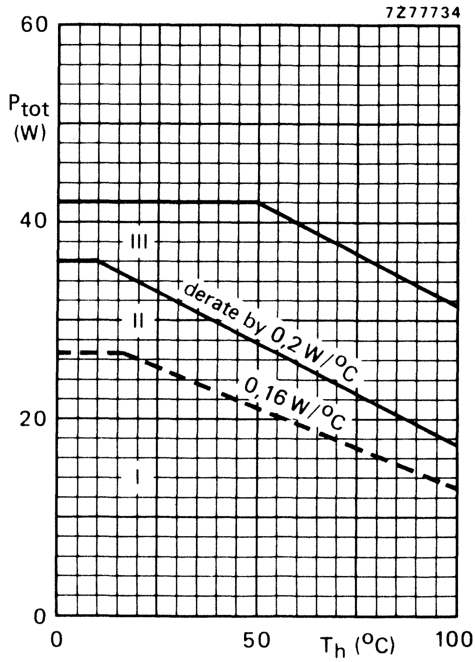


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 77 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	6,55	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	4,95	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 5$ mA	$V_{(BR)CES}$	>	65	V
Collector-emitter breakdown voltage open base; $I_C = 25$ mA	$V_{(BR)CEO}$	>	36	V
Emitter-base breakdown voltage open collector; $I_E = 2$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	2	mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	2,5	mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2,5	mJ
D.C. current gain* $I_C = 0,7$ A; $V_{CE} = 5$ V	h_{FE}	typ.	50	
			10 to 100	
Collector-emitter saturation voltage* $I_C = 2$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	0,65	V
Transition frequency at f = 100 MHz* $-I_E = 0,7$ A; $V_{CB} = 28$ V	f_T	typ.	650	MHz
$-I_E = 2$ A; $V_{CB} = 28$ V	f_T	typ.	625	MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	18	pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	12,8	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

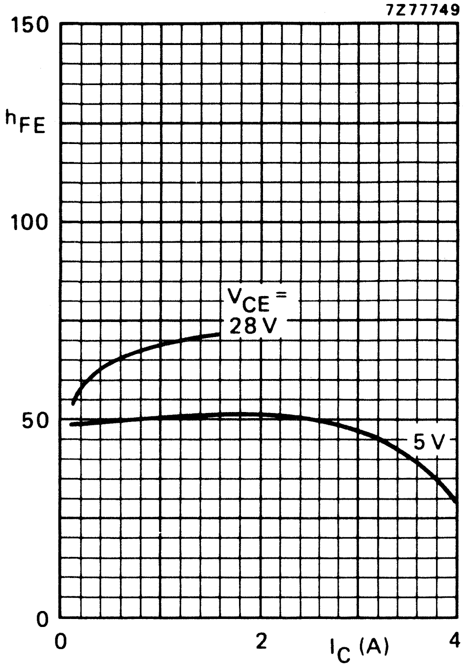


Fig. 4 Typical values; T_j = 25 °C.

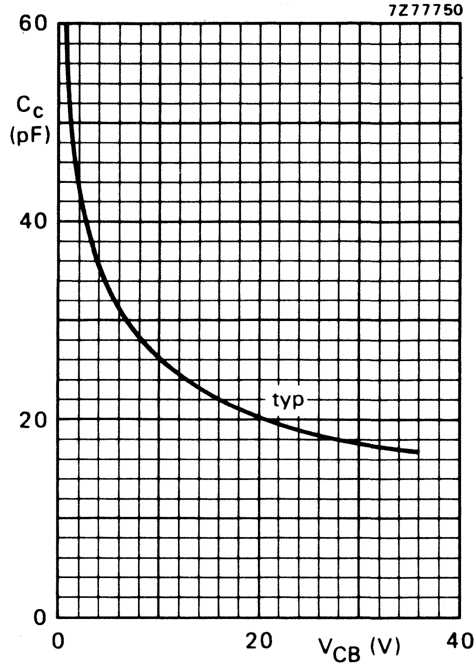


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

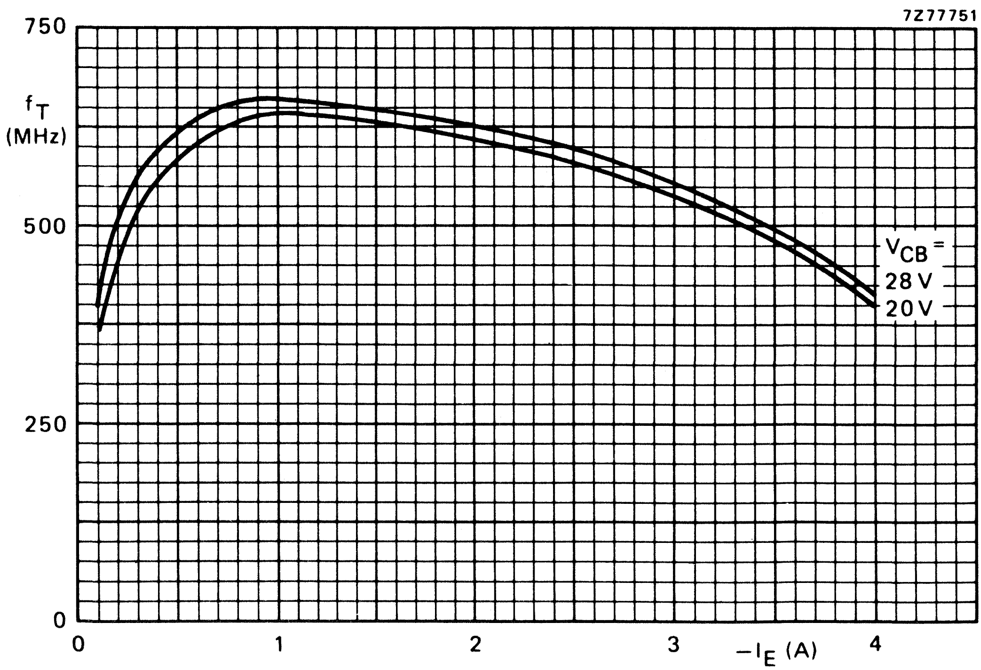


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

$T_h = 25\ ^oC$

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	28	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 − j27,5

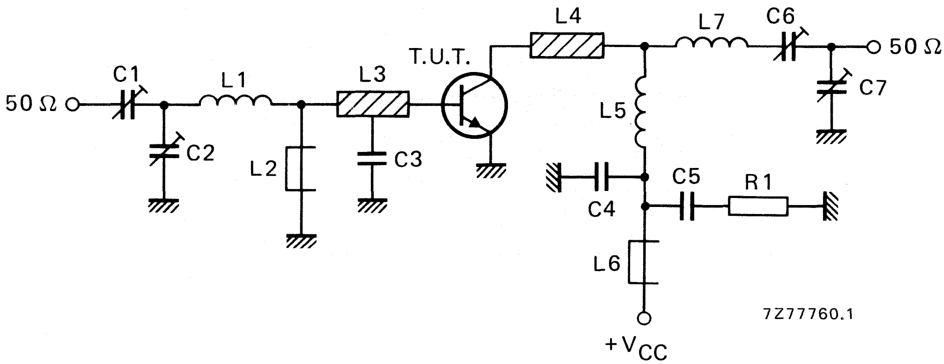


Fig. 7 Test circuit; c.w. class-B.

List of components:

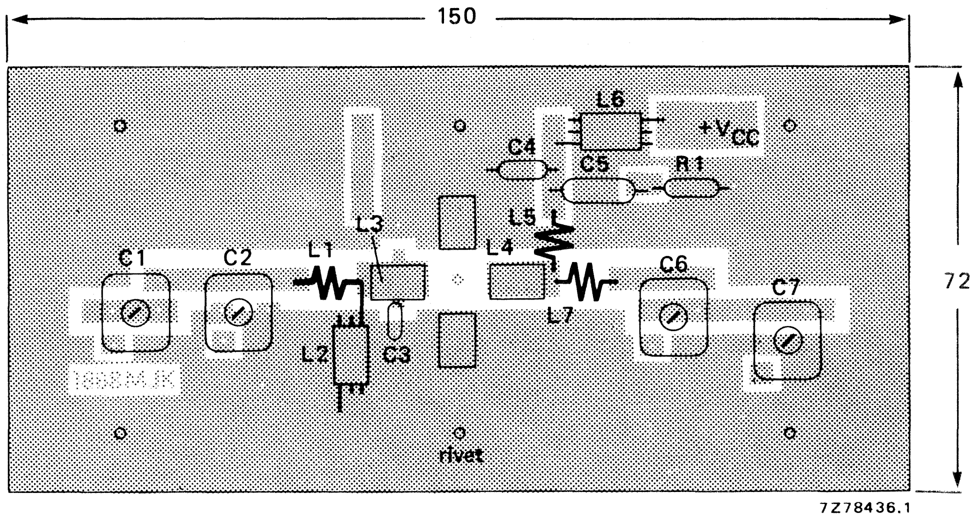
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

L1 = 1 turn Cu wire (1,6 mm); int. dia. 8,4 mm; leads 2 x 5 mm
L2 = 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); tap for C3 at 5 mm from transistor
L6 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L7 = 3 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 8,2 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16″.

R1 = R2 = 10 Ω carbon resistor

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



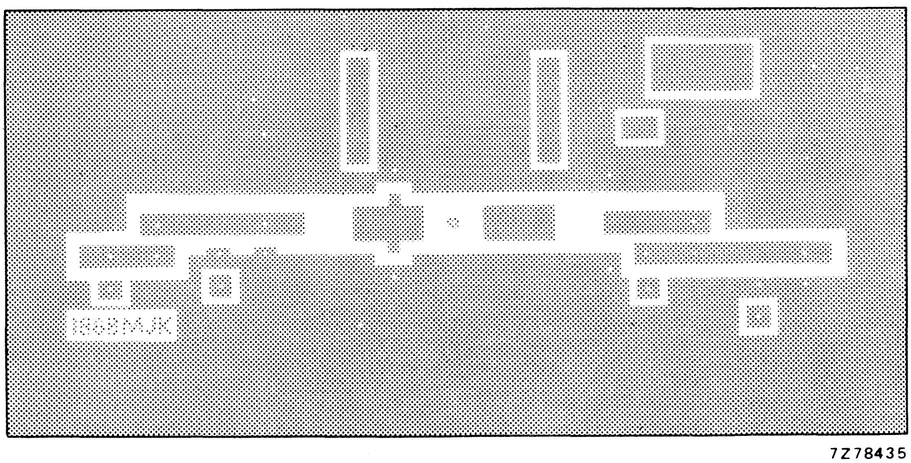


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

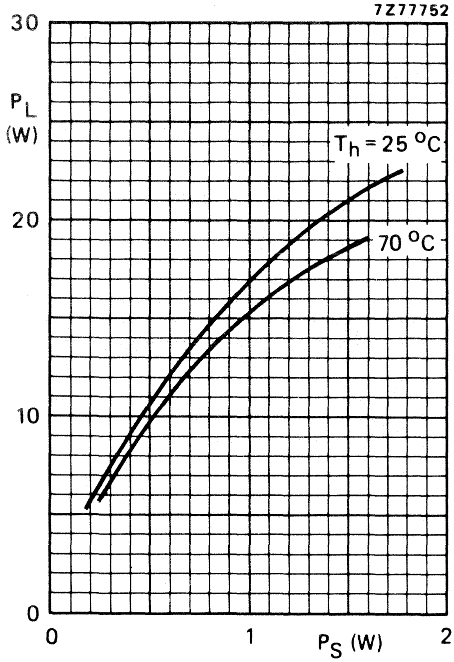


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

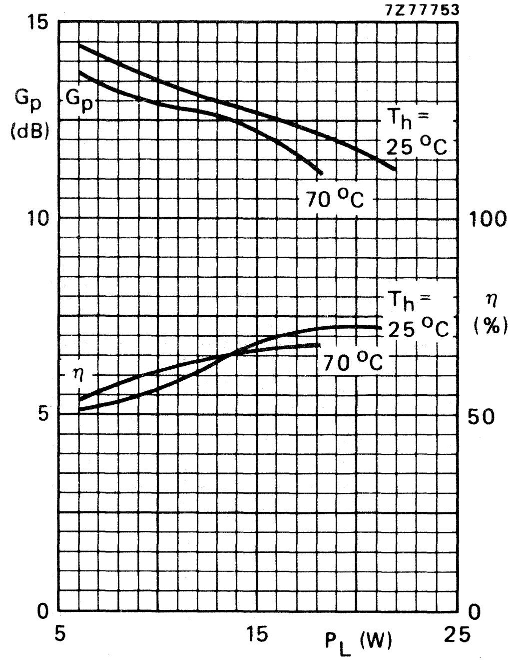


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

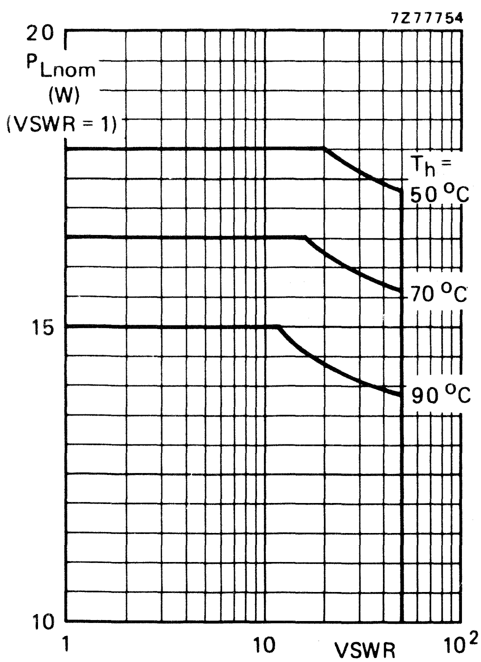


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

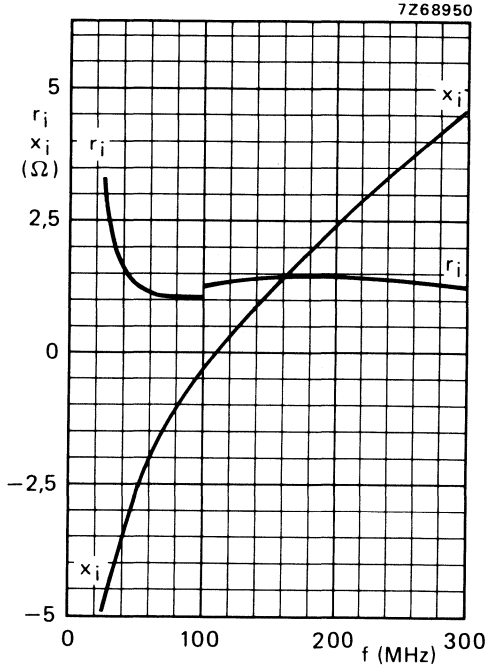


Fig. 12 Input impedance (series components).

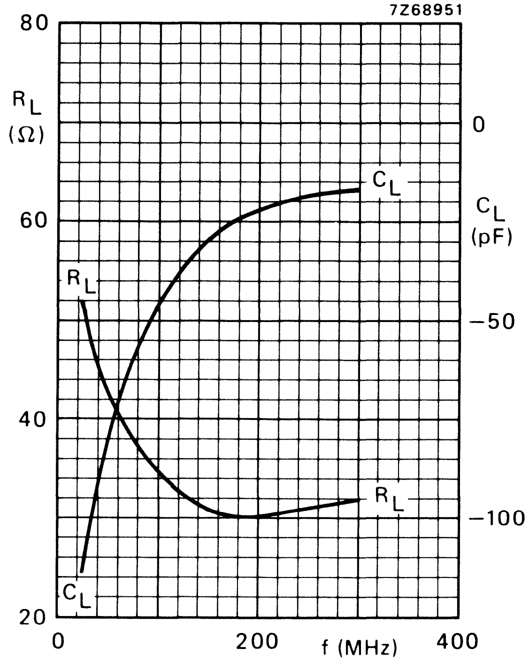


Fig. 13 Load impedance (parallel components).

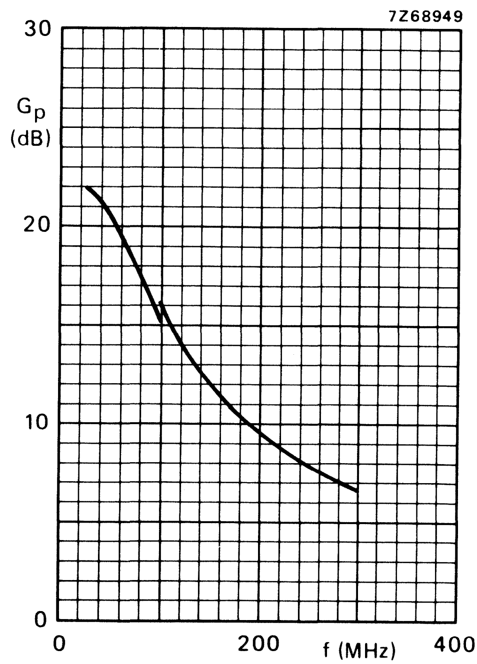


Fig. 14.

Conditions for Figs 12, 13 and 14.

Typical values; V_{CE} = 28 V; P_L = 15 W; T_h = 25 °C.

OPERATING NOTE

Below 100 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

V.H.F. POWER TRANSISTOR

N-P-N epitaxial planar transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a ¼" capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

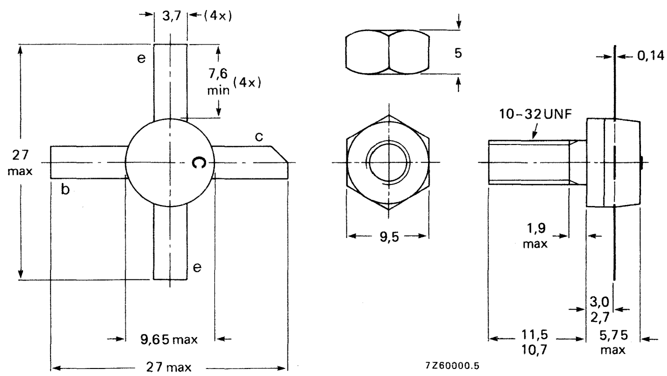
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	< 3,1	25	< 1,5	> 9	> 60	1,0 + j1,2	58,8 − j53,8

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-56.



Torque on nut: min. 1,5 Nm
(15 kg cm)
max. 1,7 Nm
(17 kg cm)

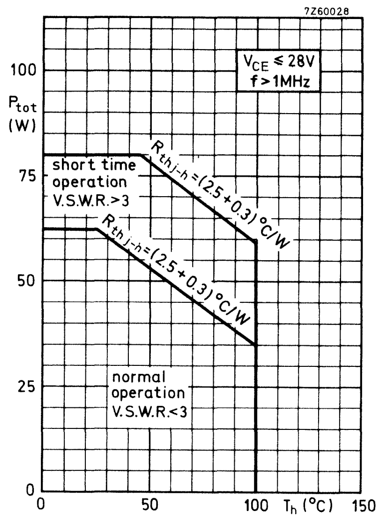
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

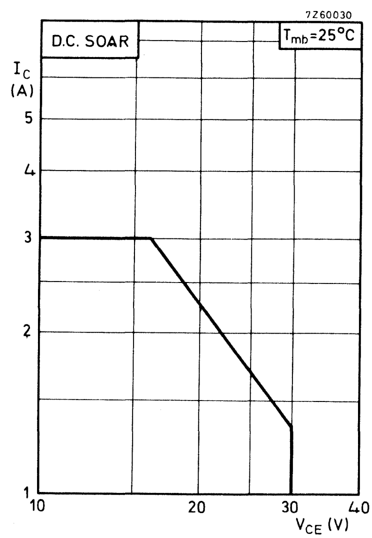
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	9	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	70	W





Storage temperature	T_{stg}		−30 to +200	°C
Operating junction temperature	T_j	max.	200	°C

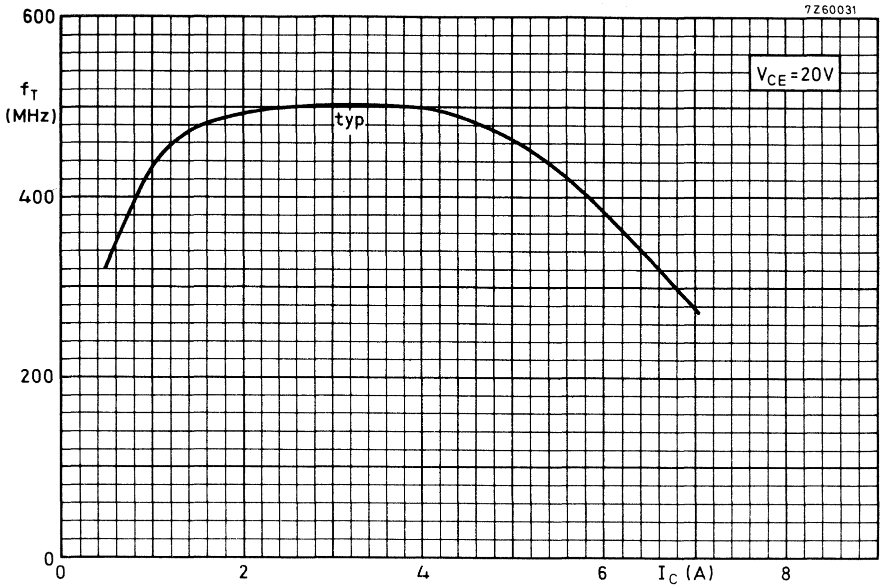
THERMAL RESISTANCE

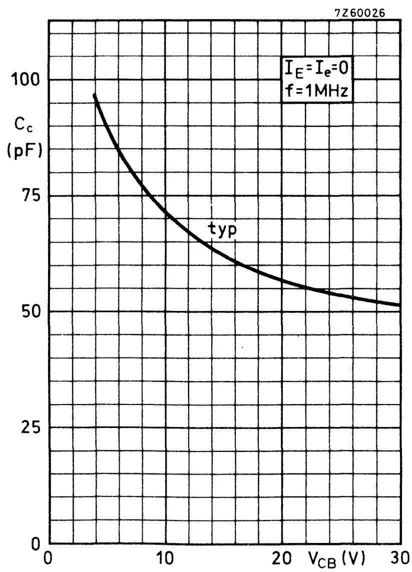
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.3	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 50 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 50 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; I_E = 10 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	typ.	50	
		10 to	120	
Transition frequency				
I_C = 3 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	50	pF
		<	65	pF
Feedback capacitance at f = 1 MHz				
I_C = 100 mA; V_{CE} = 30 V	C_{re}	typ.	31	pF
Collector-stud capacitance	C_{cs}	typ.	2	pF


7Z60031
600
f_T
(MHz)
400
200
0
0
2
4
6
I_C (A)
8
$V_{CE} = 20V$
typ


7Z60026
100
C_c
(pF)
75
50
25
0
0
10
20
V_{CB} (V)
30
$I_E = I_e = 0$
f = 1MHz
typ

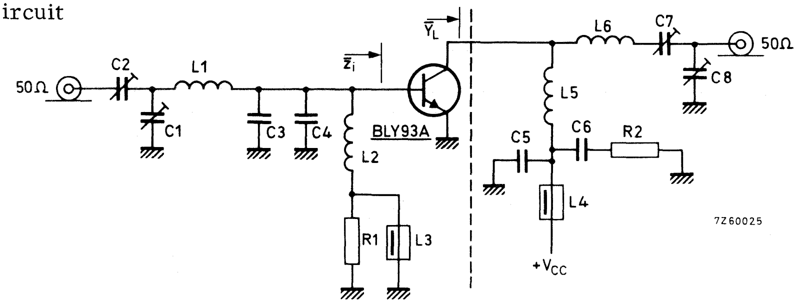
APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralised common-emitter class B circuit)

V_{CC} = 28 V; T_{mb} = 25 °C

f(MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z}_i$ (Ω)	$\overline{Y}_L$ (mS)
175	< 3.1	25	< 1.5	> 9	> 60	1.0+j1.2	58.8−j53.8

Test circuit



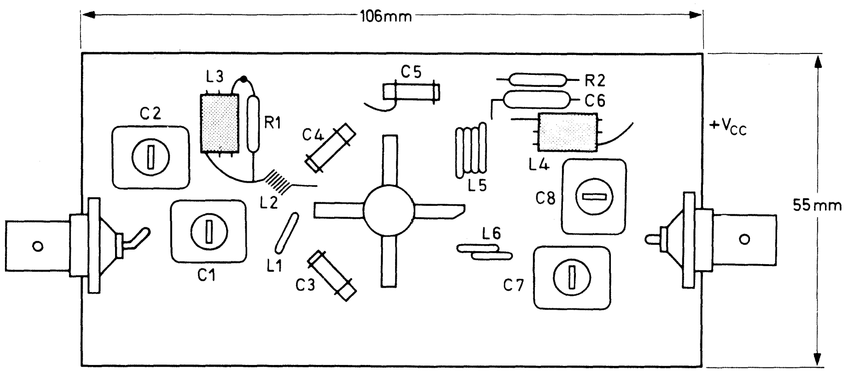
C1 = 4 to 44 pF film dielectric trimmer (code number 2222 809 07008)
C2 = 2 to 22 pF film dielectric trimmer (code number 2222 809 07004)
C3 = C4 = 47 pF ceramic
C5 = 100 pF ceramic
C6 = 150 nF polyester
C7 = 4 to 104 pF film dielectric trimmer (code number 2222 809 07015)
C8 = 4 to 64 pF film dielectric trimmer (code number 2222 809 07011)

L1 = 0.5 turn enamelled Cu wire (1.5 mm); int.diam.6 mm; leads 2x6 mm
L2 = 6 turns closely wound enamelled Cu wire (0.7 mm); int.diam.4 mm; leads 2x4 mm
L3 = L4 = ferroxcube choke (code number 4312 020 36640)
L5 = 3.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm
L6 = 1.5 turns enamelled Cu wire (1.5 mm); int.diam. 6 mm; leads 2x6 mm

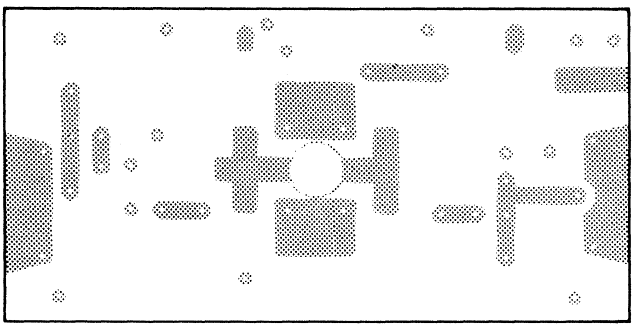
R1 = R2 = 10 Ω carbon

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

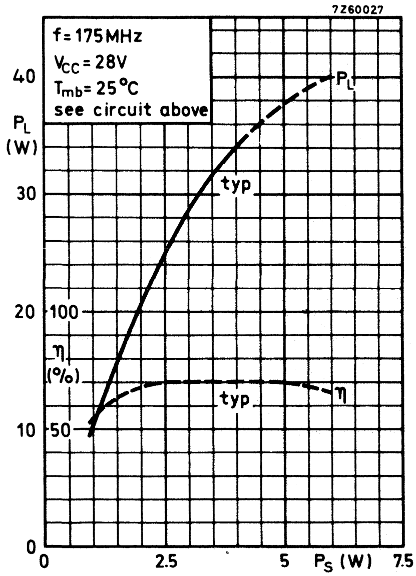


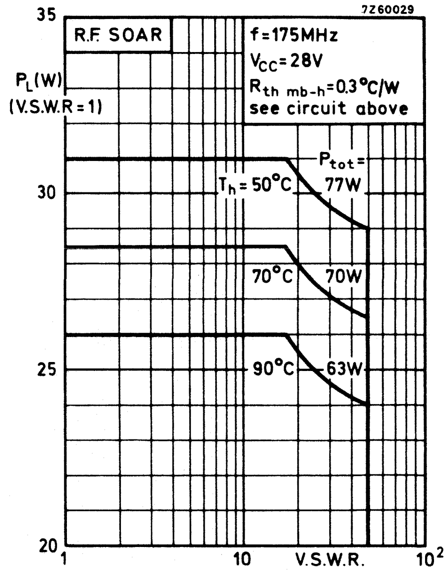
7Z60526



7Z67868

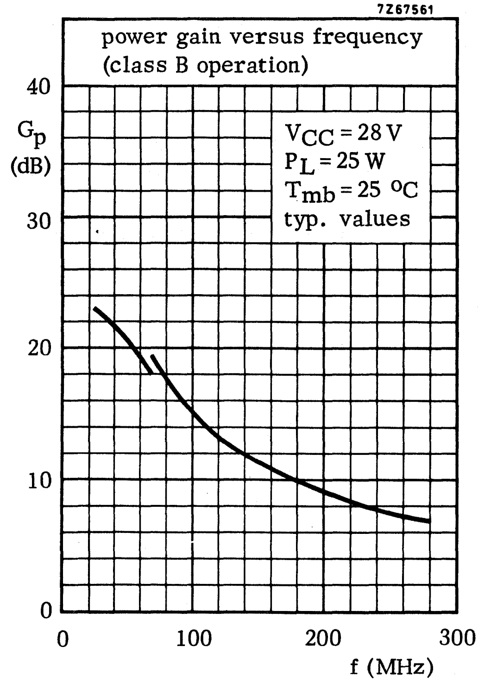
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

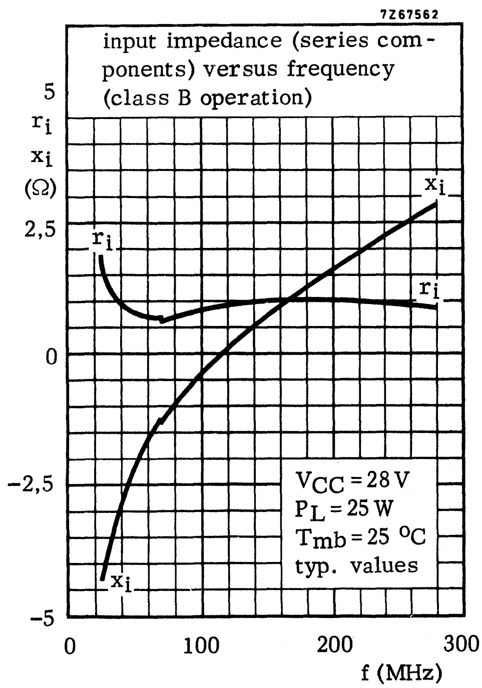


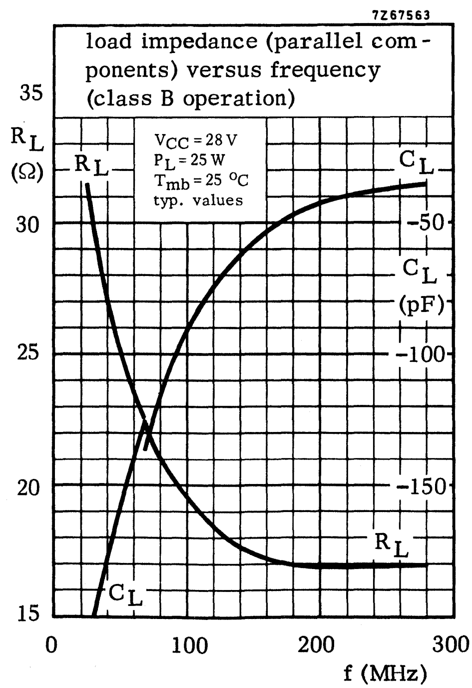


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







V.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for use in class-A, B and C operated h.f. and v.h.f. transmitters with a nominal supply voltage of 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions.

It has a 3/8" capstan envelope with a ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

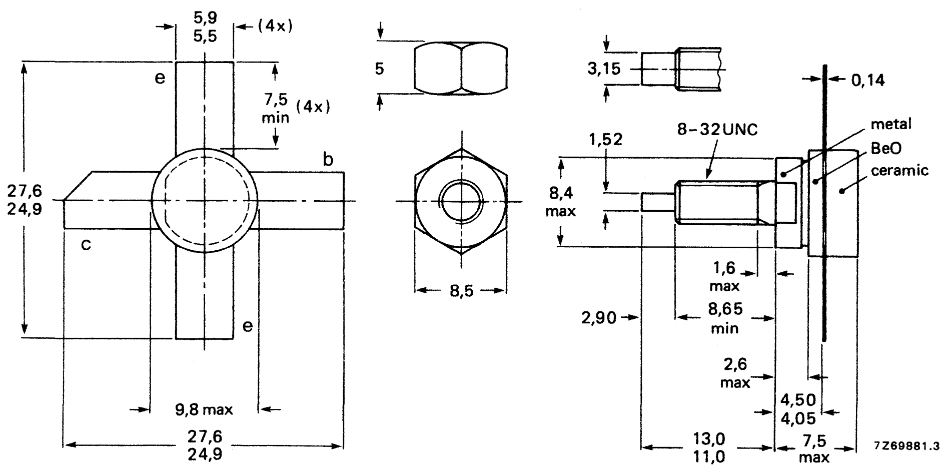
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**28**	**175**	**25**	**> 9**	**> 60**	**1,0 + j1,2**	**59–j54**

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-120.



Torque on nut: min. 0,75 Nm
(7,5 kg cm)
max. 0,85 Nm
(8,5 kg cm)

Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-emitter voltage (V_{BE} = 0) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	3	A
Collector current (peak value); f > 1 MHz	I_{CM}	max.	9	A
R.F. power dissipation (f > 1 MHz); T_{mb} = 25 °C	P_{rf}	max.	70	W
Storage temperature	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

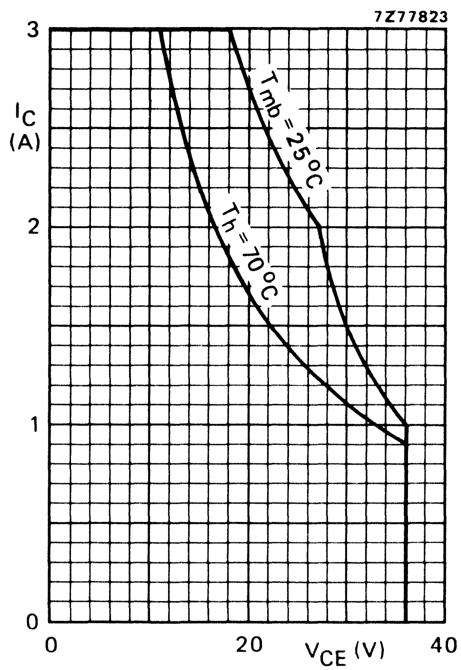


Fig. 2 D.C. SOAR.

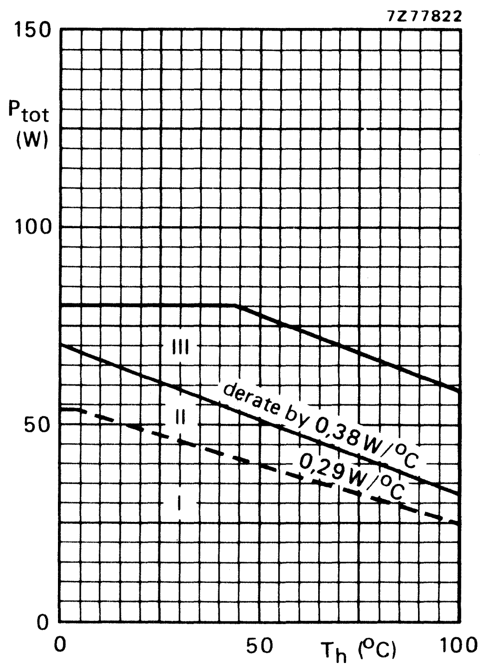


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 20 W; T_{mb} = 79 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb\ (dc)}$	=	3,1	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb\ (rf)}$	=	2,3	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,45	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-emitter breakdown voltage $V_{BE} = 0$; $I_C = 10$ mA	$V_{(BR)CES}$	>	65 V
Collector-emitter breakdown voltage open base; $I_C = 50$ mA	$V_{(BR)CEO}$	>	36 V
Emitter-base breakdown voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4 V
Collector cut-off current $V_{BE} = 0$; $V_{CE} = 36$ V	I_{CES}	<	4 mA
Second breakdown energy; L = 25 mH; f = 50 Hz open base	E_{SBO}	>	8 mJ
$R_{BE} = 10\ \Omega$	E_{SBR}	>	8 mJ
D.C. current gain * $I_C = 1{,}25$ A; $V_{CE} = 5$ V	h_{FE}	typ.	45
			10 to 100
Collector-emitter saturation voltage * $I_C = 3{,}75$ A; $I_B = 0{,}75$ A	V_{CEsat}	typ.	1,5 V
Transition frequency at f = 100 MHz * $-I_E = 1{,}25$ A; $V_{CB} = 28$ V	f_T	typ.	625 MHz
$-I_E = 3{,}75$ A; $V_{CB} = 28$ V	f_T	typ.	625 MHz
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	45 pF
Feedback capacitance at f = 1 MHz $I_C = 100$ mA; $V_{CE} = 28$ V	C_{re}	typ.	28 pF
Collector-stud capacitance	C_{cs}	typ.	2 pF

* Measured under pulse conditions: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

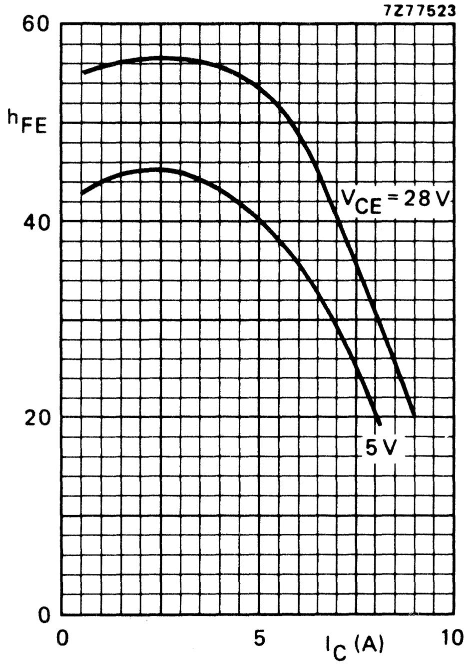


Fig. 4 Typical values; T_j = 25 °C.

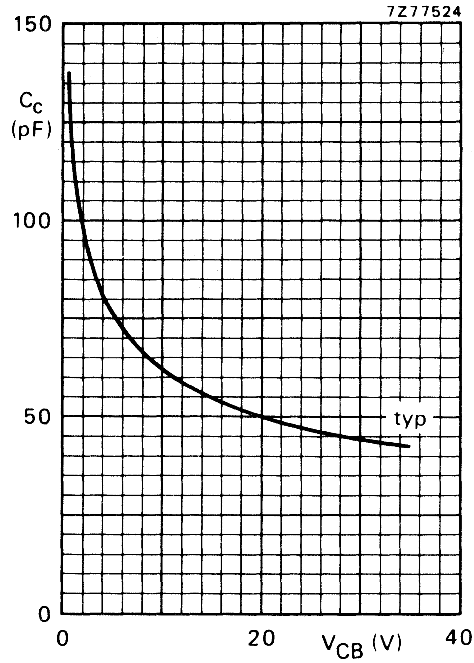


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

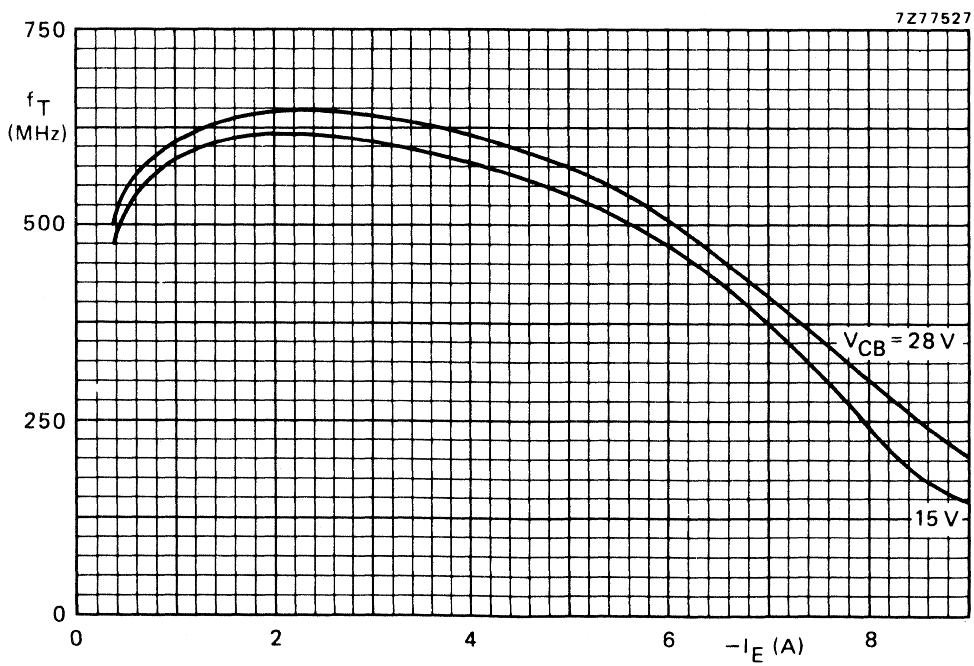


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in c.w. operation (unneutralized common-emitter class-B circuit)

T_h = 25 °C

f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
175	**28**	**25**	**< 3,15**	**> 9**	**< 1,5**	**> 60**	**1,0 + j1,2**	**59–j54**

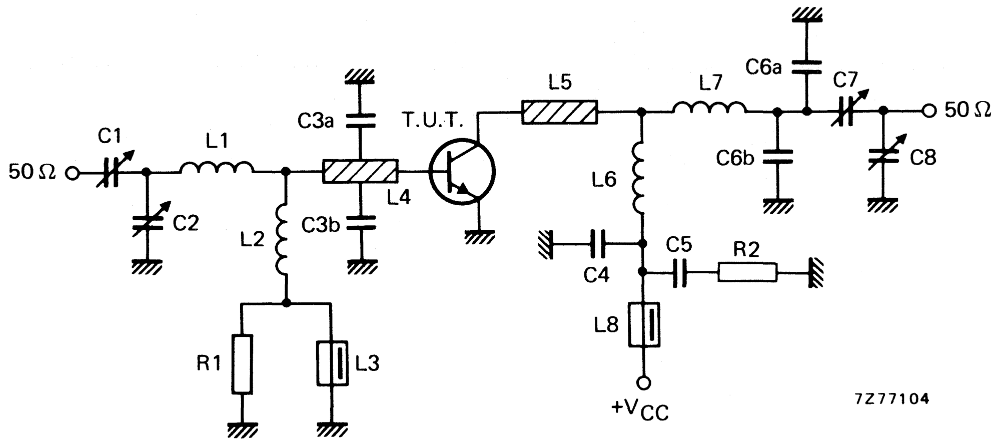


Fig. 7 Test circuit; c.w. class-B.

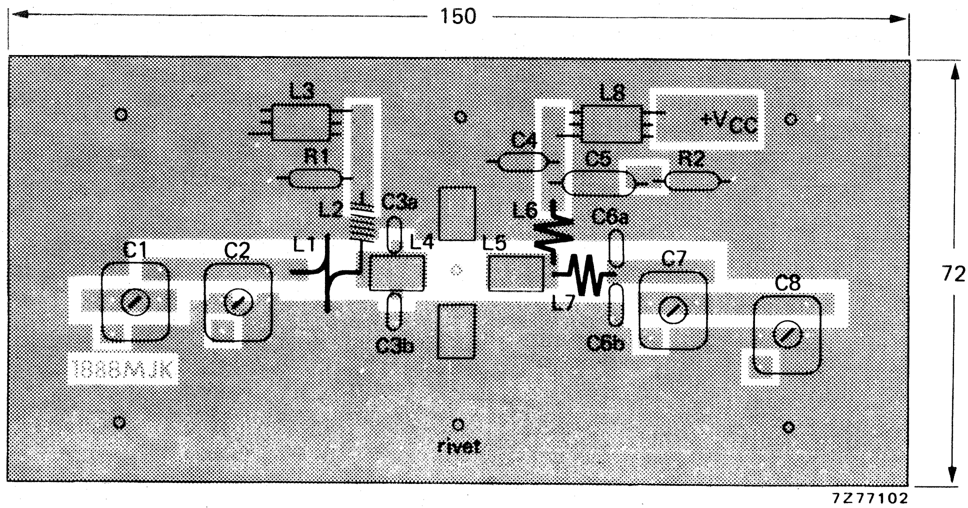
List of components
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic capacitor (500 V)
C8 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)

L1 = 14 nH; 1 turn Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L6 = 80 nH; 3 turns Cu wire (1,6 mm); int. dia. 9,0 mm; length 8,0 mm; leads 2 x 5 mm
L7 = 62 nH; 3 turns Cu wire (1,6 mm); int. dia. 7,5 mm; length 8,1 mm; leads 2 x 5 mm

L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = R2 = 10 Ω carbon resistor (0,25 W)

Component layout and printed-circuit board for 175 MHz test circuit see Fig. 8.



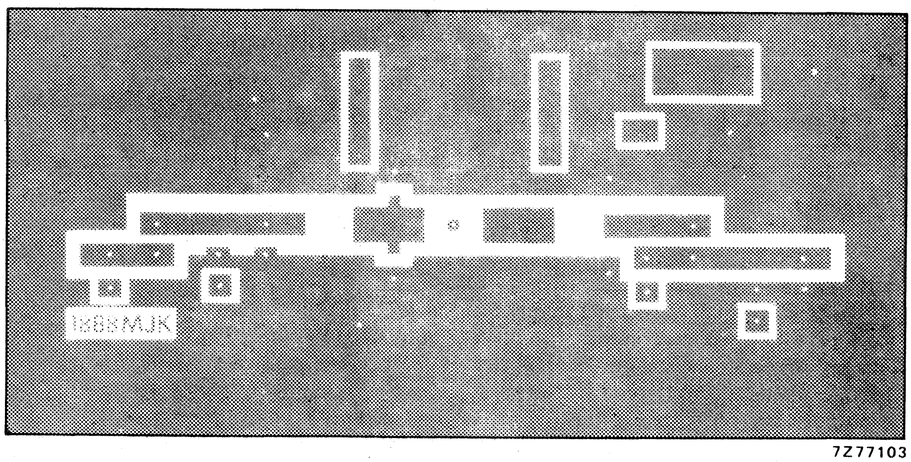


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

To minimize the dielectric losses, the ground plane under the interconnection of L7 and C7 has been removed.

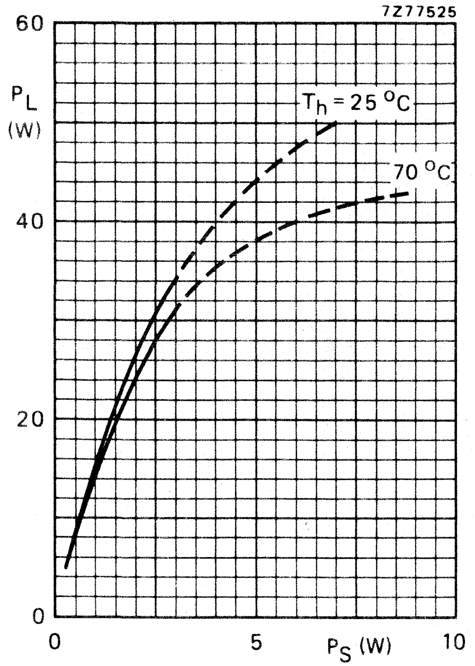


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

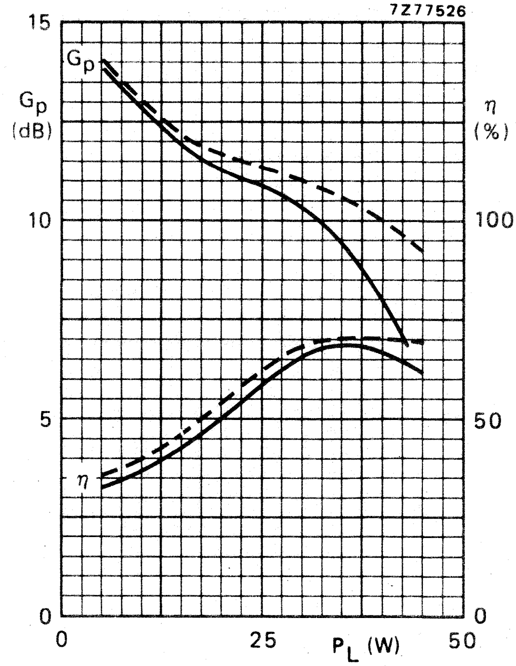


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values; — — — T_h = 25 °C; ——— T_h = 70 °C.

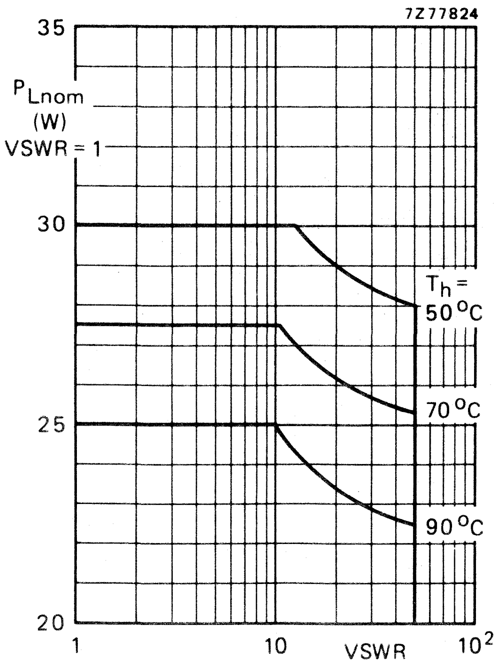


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W

The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

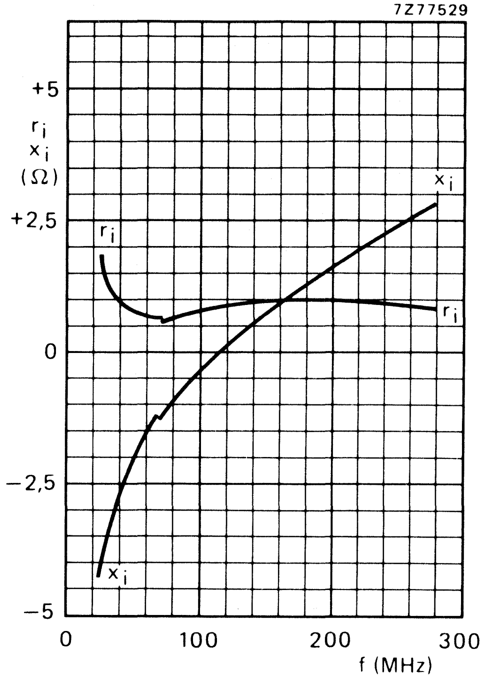


Fig. 12 Input impedance (series components).

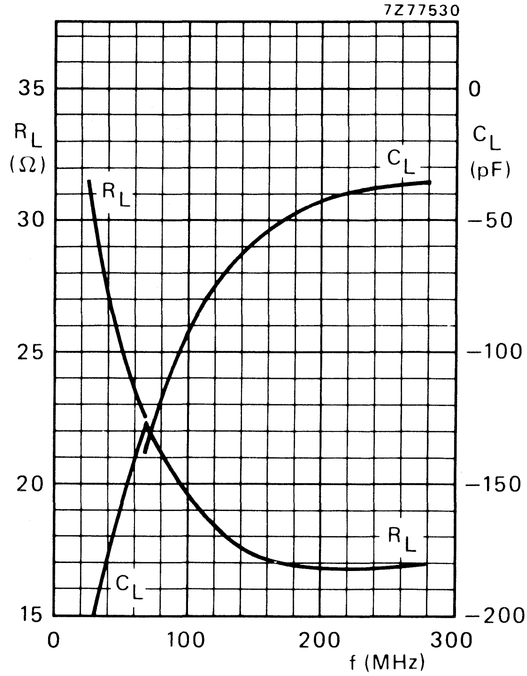


Fig. 13 Load impedance (parallel components).

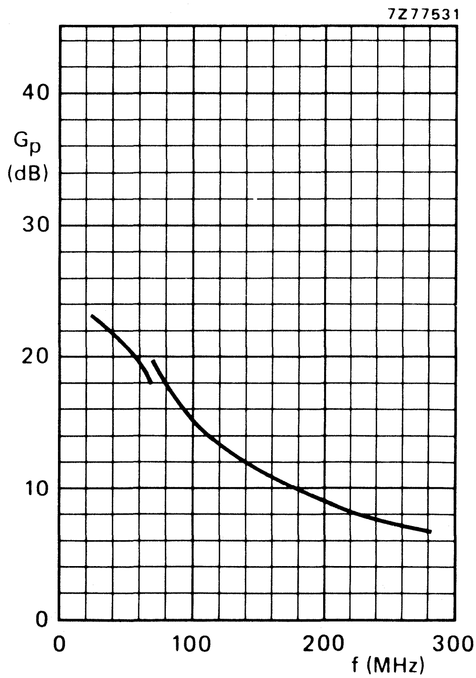


Fig. 14 Power gain versus frequency.

OPERATING NOTE

Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W; T_h = 25 °C.

V.H.F. POWER TRANSISTOR

N-P-N planar epitaxial transistor intended for use in class-A, B and C operated mobile, industrial and military transmitters with a supply voltage of 28 V. The transistor is resistance stabilized. Every transistor is tested under severe load mismatch conditions. It has a plastic encapsulated stripline package. All leads are isolated from the stud.

QUICK REFERENCE DATA

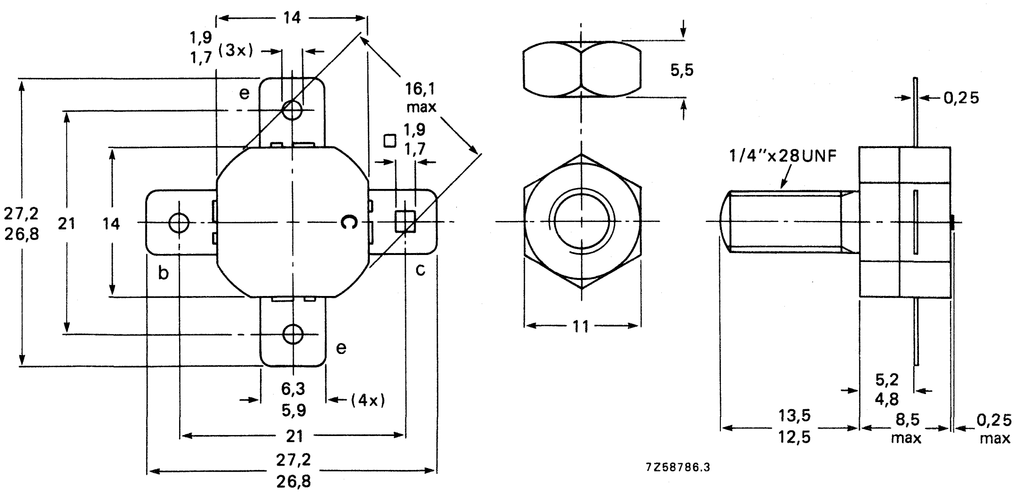
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	< 10	50	< 2,75	> 7	> 65	0,8 + j1,45	125 − j66

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-55.



Torque on nut: min. 2,3 Nm
(23 kg cm)
max. 2,7 Nm
(27 kg cm)

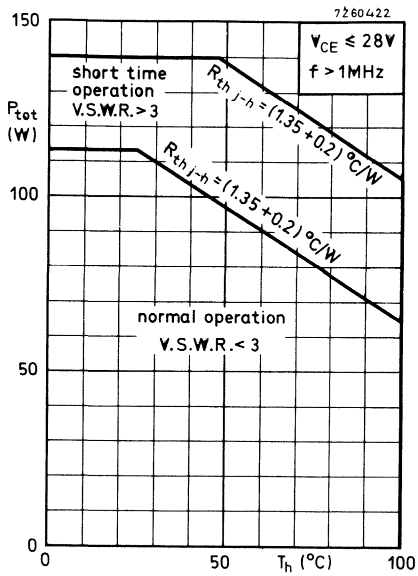
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

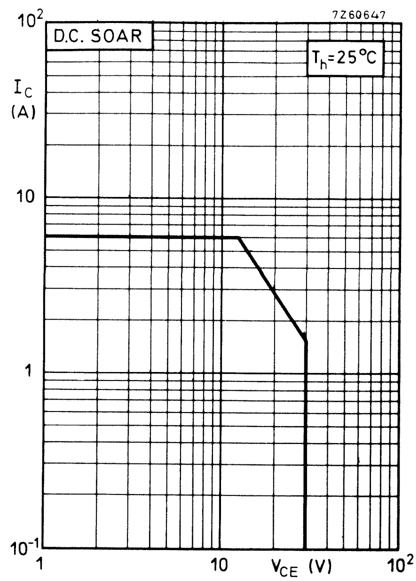
When locking is required an adhesive is preferred instead of a lock washer.

PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	36	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V
Collector current (average)	$I_{C(AV)}$	max.	6	A
Collector current (peak value) f > 1 MHz	I_{CM}	max.	12	A
Total power dissipation up to T_{mb} = 25 °C f > 1 MHz	P_{tot}	max.	130	W





Storage temperature	T_{stg}		−65 to +200	°C
Operating junction temperature	T_j	max.	200	°C

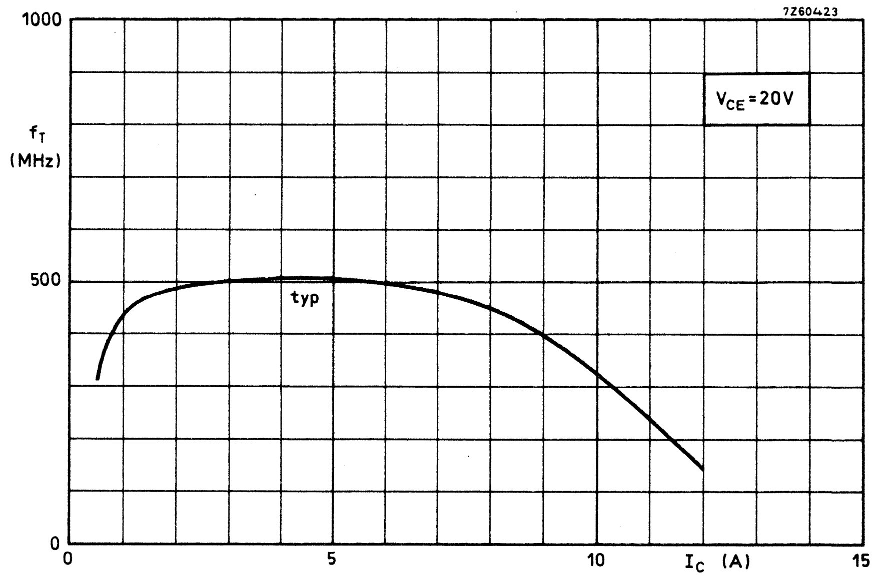
THERMAL RESISTANCE

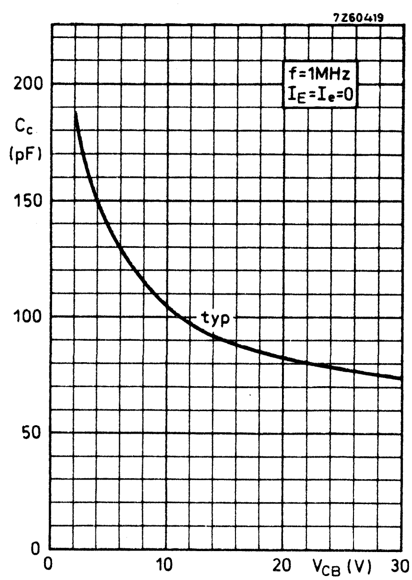
From junction to mounting base	$R_{th\ j-mb}$	=	1.35	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Breakdown voltages				
Collector-base voltage open emitter, I_C = 100 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 100 mA	$V_{(BR)CEO}$	>	36	V
Emitter-base voltage open collector; I_E = 25 mA	$V_{(BR)EBO}$	>	4	V
Transient energy				
L = 25 mH; f = 50 Hz				
open base	E	>	8	ms
$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω	E	>	8	ms
D.C. current gain				
I_C = 1 A; V_{CE} = 5 V	h_{FE}	10 to 120		
Transition frequency				
I_C = 6 A; V_{CE} = 20 V	f_T	typ.	500	MHz
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 30 V	C_c	typ.	75	pF
		<	130	pF
Feedback capacitance				
I_C = 100 mA; V_{CE} = 30 V	$-C_{re}$	typ.	47	pF
Collector-stud capacitance	C_{cs}	typ.	3.5	pF


7Z60423
1000
500
0
f_T
(MHz)
$V_{CE} = 20V$
typ
0
5
10
I_C (A)
15


7Z60419
200
150
100
50
0
C_c
(pF)
f = 1MHz
$I_E = I_e = 0$
typ
0
10
20
V_{CB} (V)
30

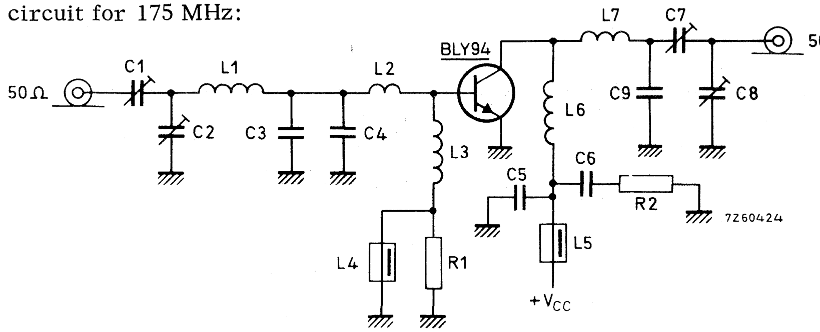
APPLICATION INFORMATION

R. F. performance in c. w. operation (unneutralised common-emitter class B circuit)

f = 175 MHz; T_{mb} up to 25 °C

V_{CC} (V)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
28	< 10	50	< 2.75	> 7	> 65	0.8+j1.45	125 − j66

Test circuit for 175 MHz:



List of components:

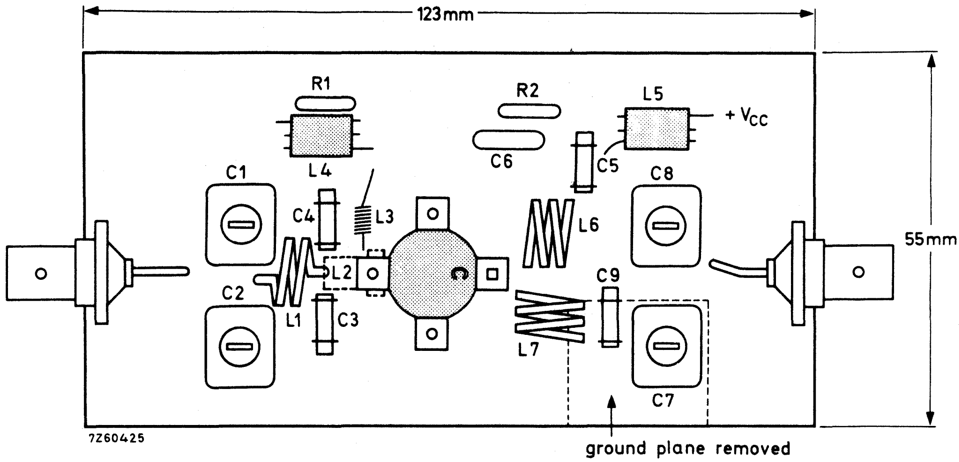
C1 = 2 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 56 pF ceramic
C5 = 100 pF ceramic
C6 = 100 nF polyester
C7 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C8 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
C9 = 6.8 pF ceramic

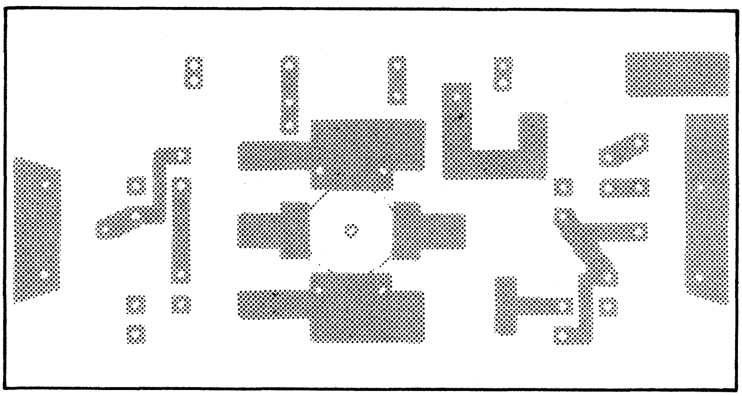
L1 = 36 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 7 mm; length 5 mm; lead length 2 x 5 mm
L2 = formed by the metallization on the p.c. board; see component lay-out
L3 = 100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam 3 mm; lead length 2 x 5 mm
L4 = L5 = ferroxcube choke (code number 4312 020 36640)
L6 53 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 10 mm; length 5.2 mm; lead length 2 x 5 mm
L7 = 46 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 9 mm; length 5.4 mm; lead length 2 x 5 mm

R1 = R2 = 10 Ω carbon

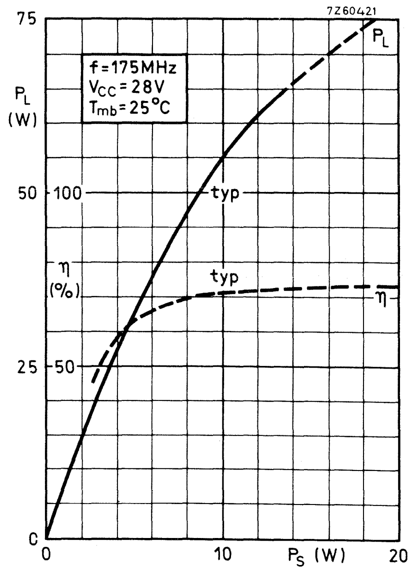
APPLICATION INFORMATION (continued)

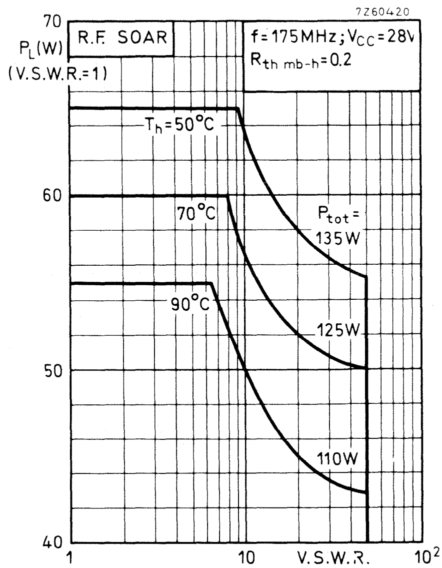
Component lay-out and printed circuit board for 175 MHz test circuit.





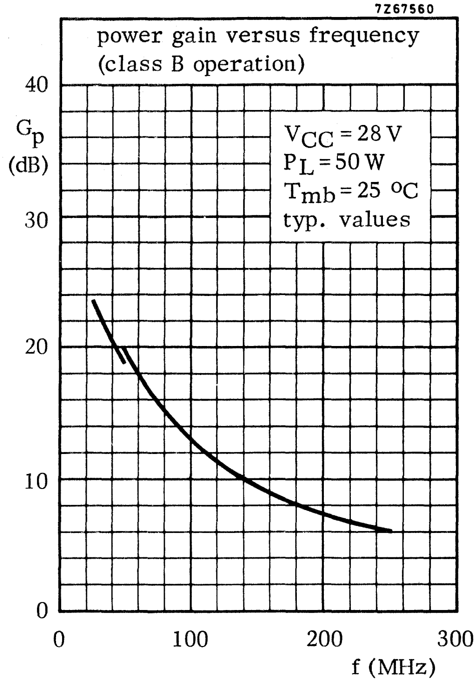
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

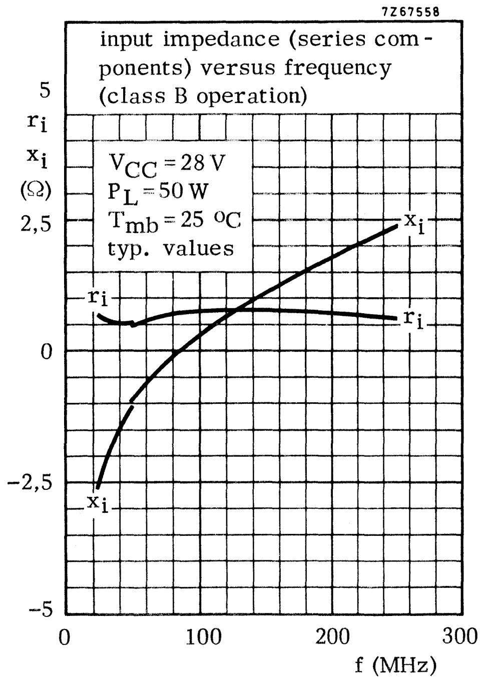


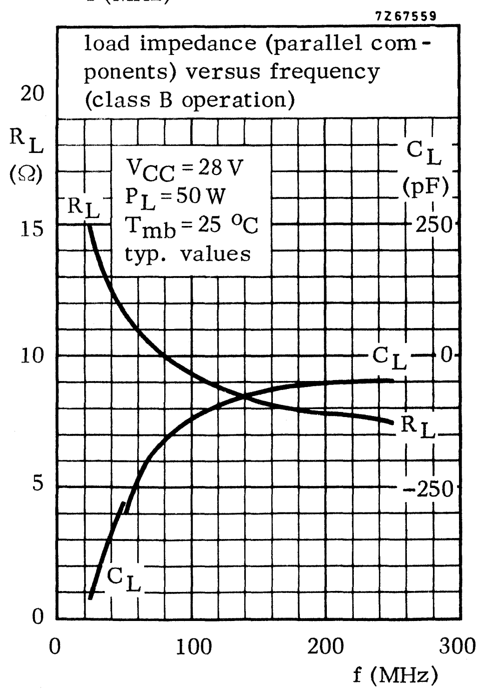


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







SILICON EPITAXIAL PLANAR OVERLAY TRANSISTORS

The **2N3553** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case.
The **2N3375** and the **2N3632** are n-p-n overlay transistors in TO-60 metal envelopes with the electrodes insulated from the studs.
The **2N3553** and the **2N3375** are intended for v.h.f./u.h.f. and the **2N3632** for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3553	2N3375	2N3632	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	65	65	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	40	40	40	V
Collector current (peak value)	I_{CM}	max.	1,0	1,5	3,0	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500	–	MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.	–	–	400	MHz

R.F. performance at V_{CE} = 28 V

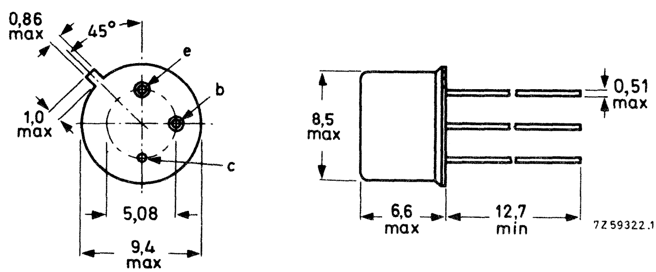
type number	f (MHz)	P_o (W)	P_i (W)	η (%)
2N3553	175	2,5	< 0,25	> 50
2N3375	100	7,5	< 1	> 65
2N3375	400	> 3	1	> 40
2N3632	175	> 13,5	3,5	> 70

MECHANICAL DATA

Dimensions in mm

Fig. 1a TO-39; collector connected to case.

2N3553



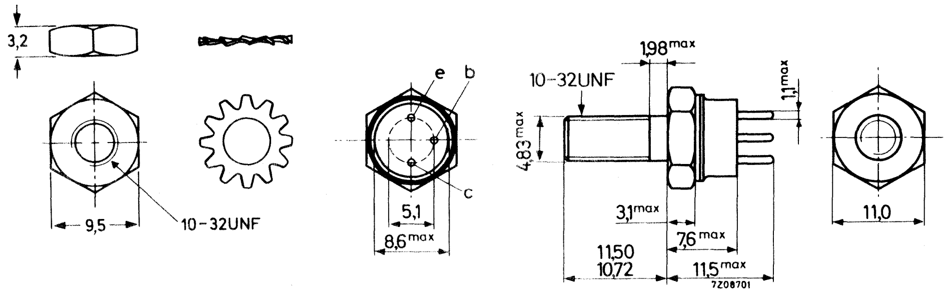
Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

MECHANICAL DATA (continued) Dimensions in mm

Fig. 1b TO-60 (**2N3375** and **2N3632**).

The top pins should not be bent.



Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

P.S. This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.		65		V
Collector-emitter voltage						
$I_C \leq 200$ mA; $-V_{BE} = 1,5$ V	V_{CEX}	max.		65		V
(open base); $I_C \leq 200$ mA	V_{CEO}	max.		40		V
Emitter-base voltage (open collector)	V_{EBO}	max.		4		V
			2N3553	**2N3375**	**2N3632**	
Collector current						
d.c.	I_C	max.	0,35	0,5	1	A
peak value	I_{CM}	max.	1,0	1,5	3	A
Total power dissipation						
up to $T_{mb} = 25$ °C	P_{tot}	max.	7	11,6	23	W
Storage temperature	T_{stg}			−65 to +200		°C
Junction temperature	T_j	max.		200		°C

THERMAL RESISTANCE

			2N3553	2N3375	2N3632	
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	25	15	7.5	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=		0.6	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
Collector cut-off current						
I_B = 0; V_{CE} = 30 V	I_{CEO}	<	100	100	250	μA
Breakdown voltages						
I_E = 0; I_C = 250 μA	$V_{(BR)CBO}$	>	65	65	65	V
I_C up to 200 mA						
$-V_{BE}$ = 1.5 V; R_B = 33 Ω [1]	$V_{(BR)CEX}$	>	65	65	65	V
I_B = 0 [1]	$V_{(BR)CEO}$	>	40	40	40	V
I_C = 0; I_E = 250 μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
I_C = 250 mA; V_{CE} = 5 V	V_{BE}	<	1.5			V
I_C = 500 mA; V_{CE} = 5 V	V_{BE}	<		1.5		V
I_C = 1000 mA; V_{CE} = 5 V	V_{BE}	<			1.5	V
Saturation voltage						
I_C = 250 mA; I_B = 50 mA	V_{CEsat}	<	1.0			V
I_C = 500 mA; I_B = 100 mA	V_{CEsat}	<		1.0		V
I_C = 1000 mA; I_B = 200 mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; δ = 0.5; f = 50 Hz

CHARACTERISTICS (continued)

T_j = 25 °C unless otherwise specified

			2N3553	2N3375	2N3632	
D.C. current gain						
I_C = 125 mA; V_{CE} = 5 V	h_{FE}	>	15	15		
		<	200	200		
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	>	10	10	10	
		<	100	100	150	
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	>			5	
		<			110	
Collector capacitance at f = 1 MHz						
$I_E = I_e = 0$; V_{CB} = 28 V	C_c	<	10	10	20	pF
Collector-case capacitance		<		6	6	pF
Transition frequency						
I_C = 125 mA; V_{CE} = 28 V	f_T	typ.	500	500		MHz
I_C = 250 mA; V_{CE} = 28 V	f_T	typ.			400	MHz
Real part of input impedance at f = 200 MHz						
I_C = 125 mA; V_{CE} = 28 V	$Re(h_{ie})$	<	20	20		Ω
I_C = 250 mA; V_{CE} = 28 V	$Re(h_{ie})$	<			20	Ω

R.F. performance at V_{CE} = 28 V

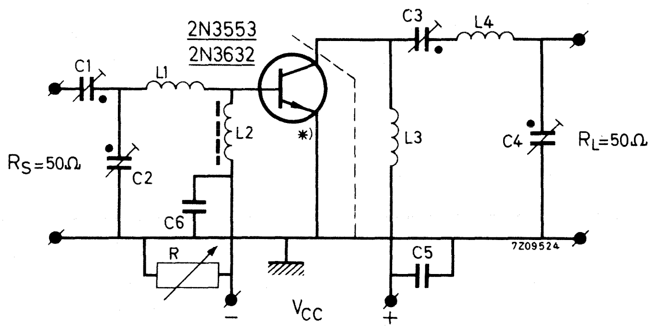
	f (MHz)	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit at page
2N3553	175	2.5	< 0.25	< 180	> 50	I
2N3375	100	7.5	< 1	< 410	> 65	II
2N3375	400	> 3	1	270	> 40	III
2N3632	175	> 13.5	3.5	690	> 70	I

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit I **(with the 2N3553 or the 2N3632 at f = 175 MHz)**



*) The length of the external emitter wire of the 2N3553 is 1.6 mm.
The emitter of the 2N3632 should be connected to the case as short as possible.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester
C6 =	100 pF	ceramic

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 36640)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

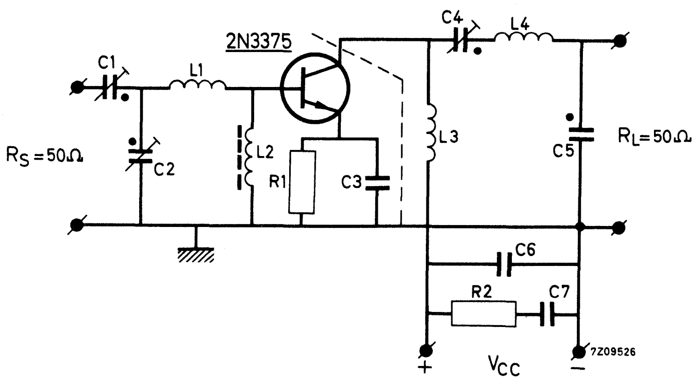
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

R = 0 for the 2N3553

R = 0 to 2 Ω for the 2N3632

CHARACTERISTICS (continued)

Test circuit II (with the 2N3375 at f = 100 MHz)



Components

C1 = C2 = 3.5 to 61.5 pF		air trimmer
C3 =	10 nF	polyester
C4 = C5 = 4 to	29 pF	air trimmer
C6 =	330 pF	ceramic
C7 =	10 nF	polyester

L1 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 10 mm

L2 = Ferroxcube choke coil. Z (at f = 100 MHz) = 700 Ω ± 20% (code number 4312 020 36640)

L3 = 23 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 6 mm

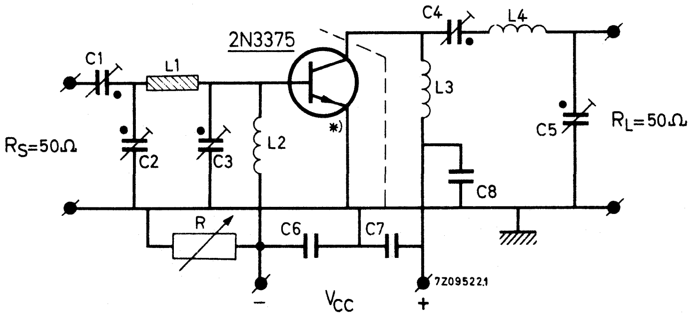
L4 = 5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm

R1 = 1.35 Ω carbon

R2 = 10 Ω carbon

CHARACTERISTICS (continued)

Test circuit III **(with the 2N3375 at f = 400 MHz)**



*) The emitter should be connected to the case as short as possible.

Components

C1 = C2 =	0.7 to 6.7 pF	ceramic trimmer
C3 =	0.5 to 3.5 pF	ceramic trimmer
C4 = C5 =	3 to 19 pF	air trimmer
C6 = C7 =	15 pF	ceramic
C8 =	4700 pF	ceramic

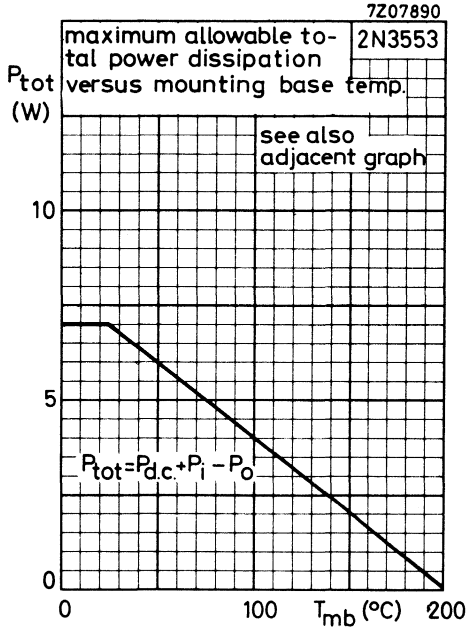
L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis

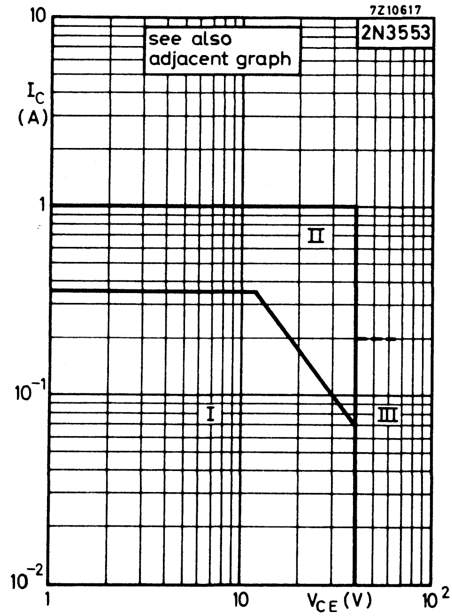
L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

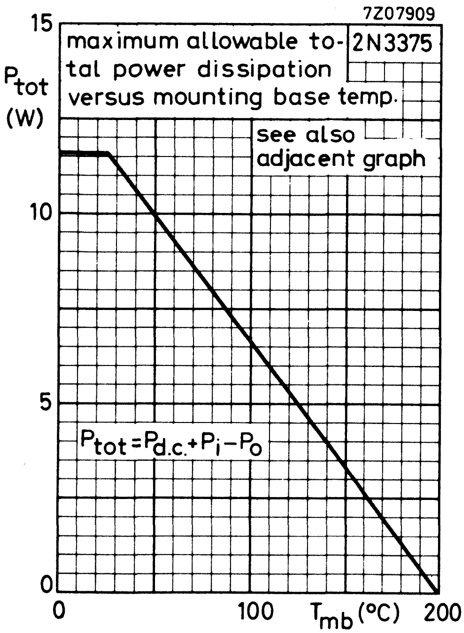
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

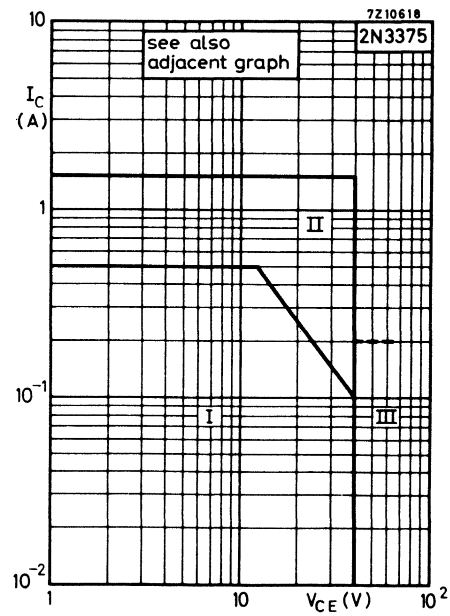
L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm

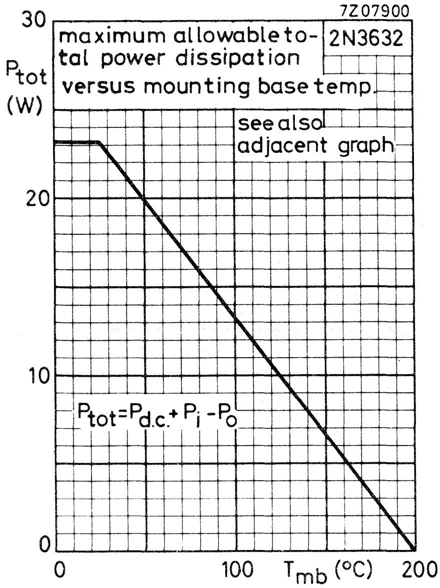
R = 0 to 5 Ω

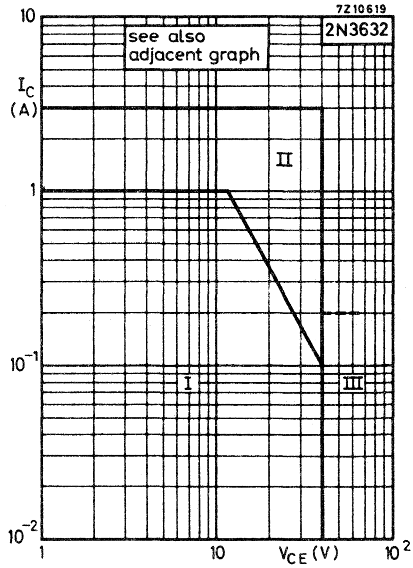

7Z07890
maximum allowable total power dissipation versus mounting base temp.
2N3553
P_{tot} (W)
see also adjacent graph
$P_{tot} = P_{d.c.} + P_i - P_o$
0
5
10
0
100
T_{mb} (°C)
200


7Z10617
see also adjacent graph
2N3553
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2


7Z07909
maximum allowable total power dissipation versus mounting base temp.
2N3375
P_{tot} (W)
see also adjacent graph
$P_{tot} = P_{d.c.} + P_i - P_o$
15
10
5
0
0
100
T_{mb} (°C)
200


7Z10618
see also adjacent graph
2N3375
I_C (A)
10
1
10^{-1}
10^{-2}
I
II
III
1
10
V_{CE} (V)
10^2

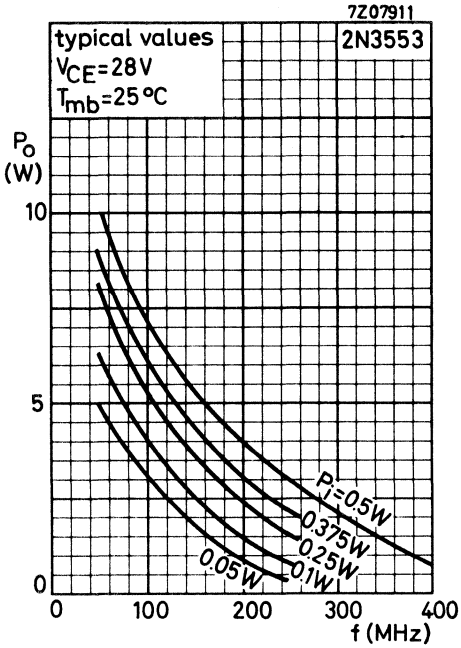


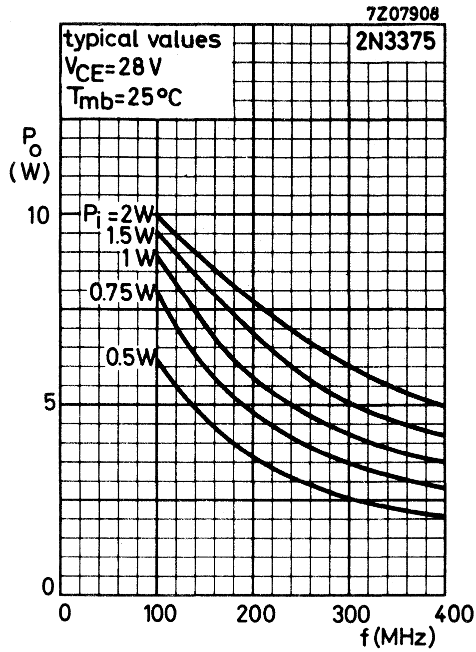


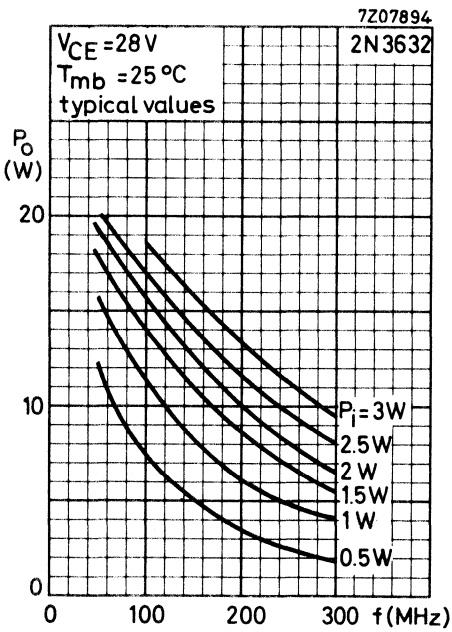
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

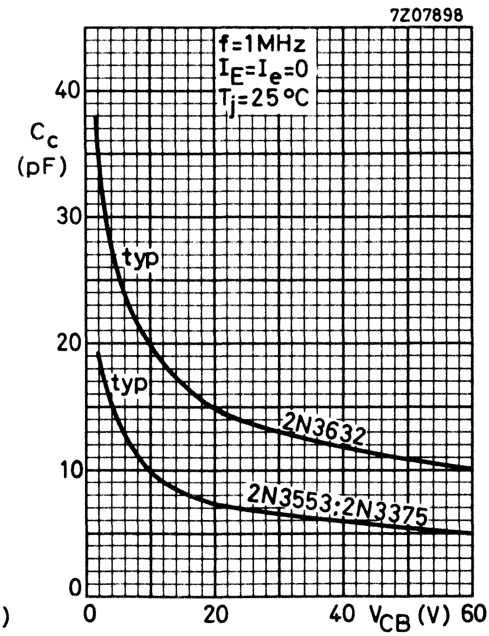
II Additional region of operation at f ≥ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

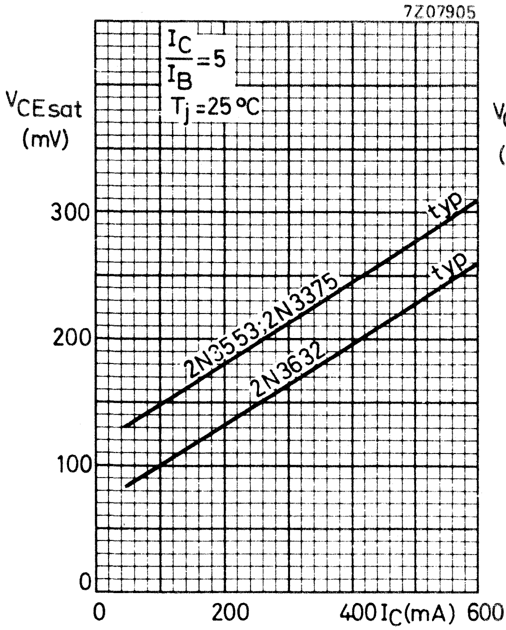
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.

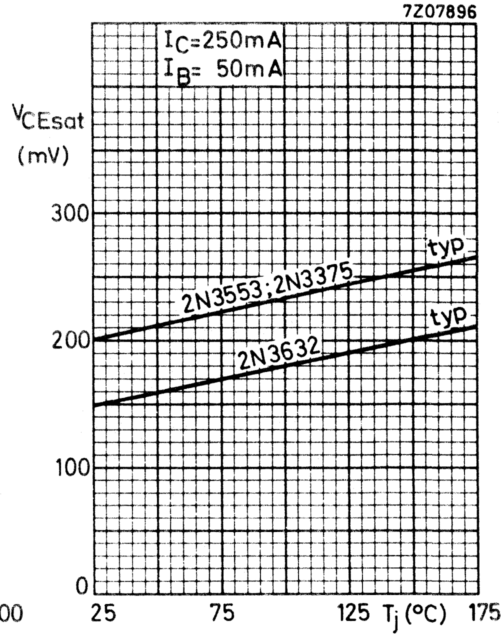

7Z07911
typical values
V_{CE}=28V
T_{mb}=25 °C
2N3553
P_o (W)
P_i=0.5W
0.375W
0.25W
0.1W
0.05W
f (MHz)

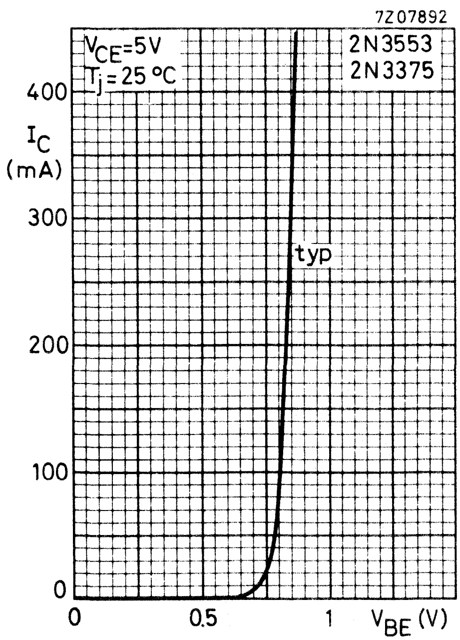

7Z07908
typical values
V_{CE}=28 V
T_{mb}=25 °C
2N3375
P_o (W)
P_i=2W
1.5W
1 W
0.75W
0.5W
f (MHz)

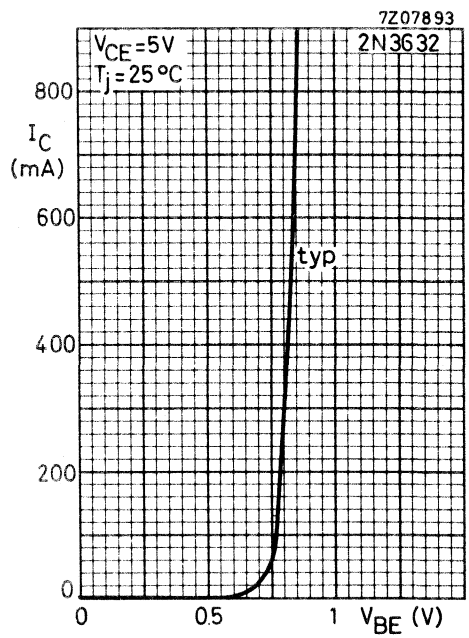

7Z07894
V_{CE} =28 V
T_{mb} =25 °C
typical values
2N3632
P_o (W)
P_i= 3W
2.5W
2 W
1.5W
1 W
0.5W
f (MHz)

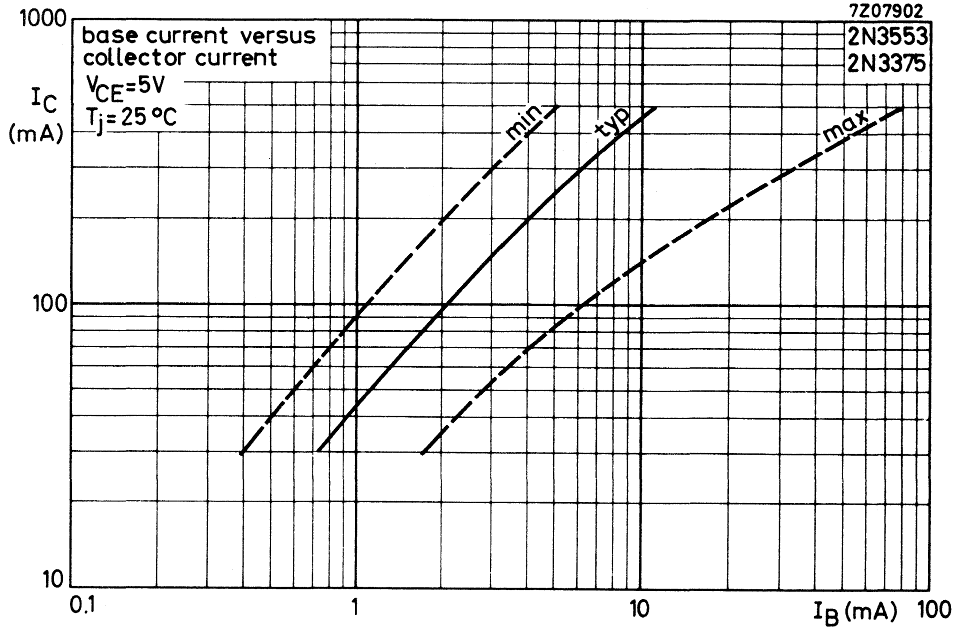

7Z07898
f=1MHz
I_E=I_e=0
T_j=25 °C
C_c (pF)
typ
typ
2N3632
2N3553;2N3375
V_{CB} (V)

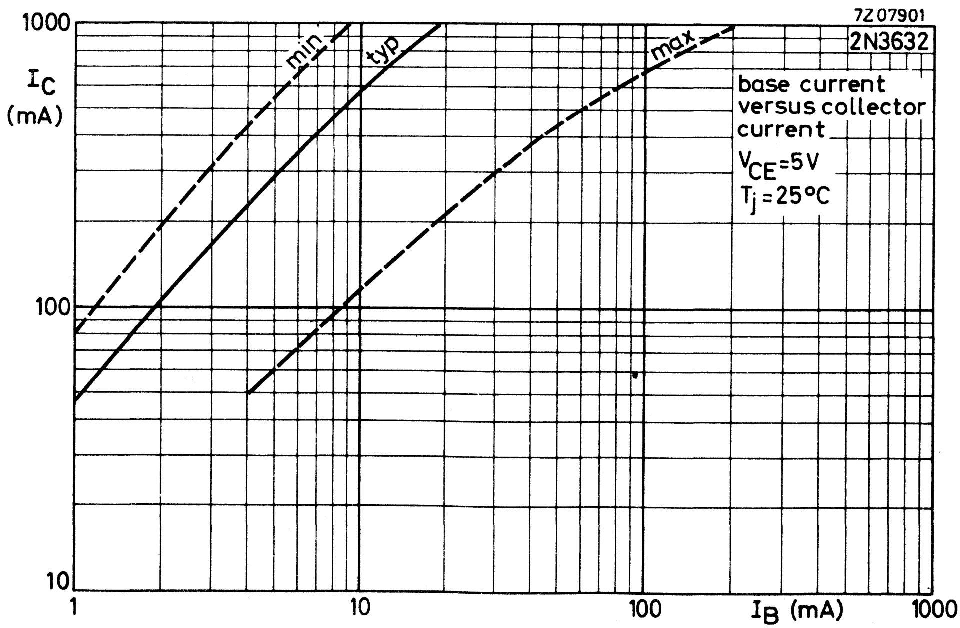

7Z07905
$I_C/I_B = 5$
$T_j = 25\,^{\circ}C$
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
0
200
400
I_C (mA)
600

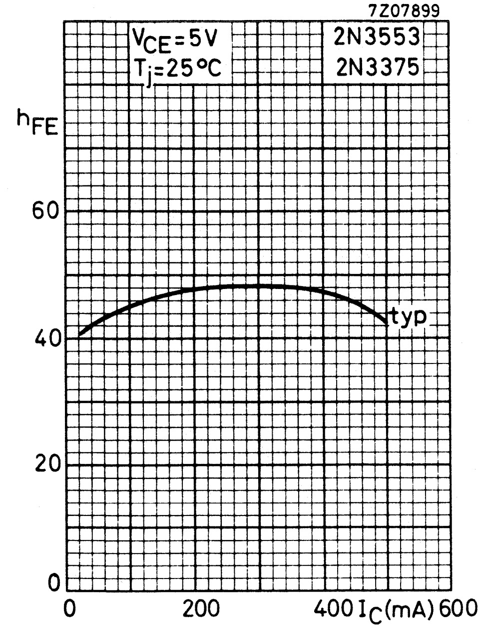

7Z07896
$I_C = 250\,mA$
$I_B = 50\,mA$
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
25
75
125
T_j (°C)
175

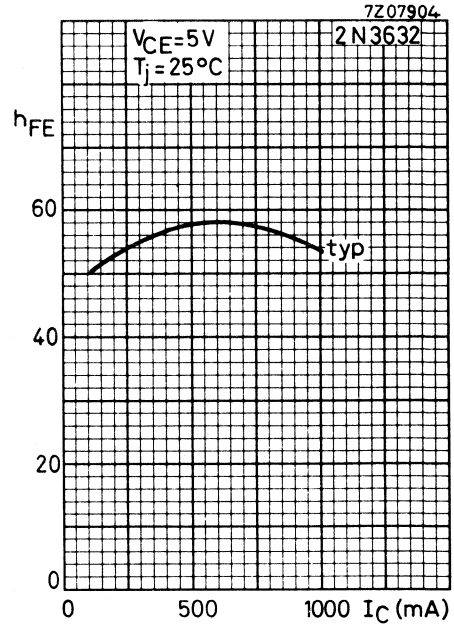

7Z07892
$V_{CE} = 5\,V$
$T_j = 25\,^{\circ}C$
2N3553
2N3375
400
I_C (mA)
300
200
100
0
typ
0
0.5
1
V_{BE} (V)

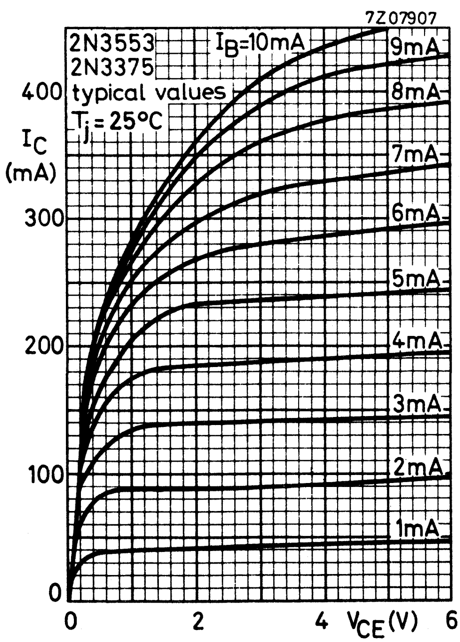

7Z07893
$V_{CE} = 5\,V$
$T_j = 25\,^{\circ}C$
2N3632
800
I_C (mA)
600
400
200
0
typ
0
0.5
1
V_{BE} (V)

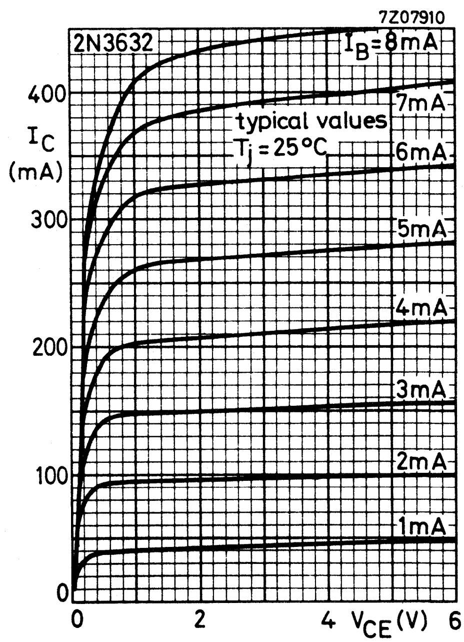

7Z07902
2N3553
2N3375
base current versus
collector current
V_{CE}=5V
T_j=25 °C
I_C
(mA)
1000
100
10
min
typ
max
0.1
1
10
I_B (mA)
100

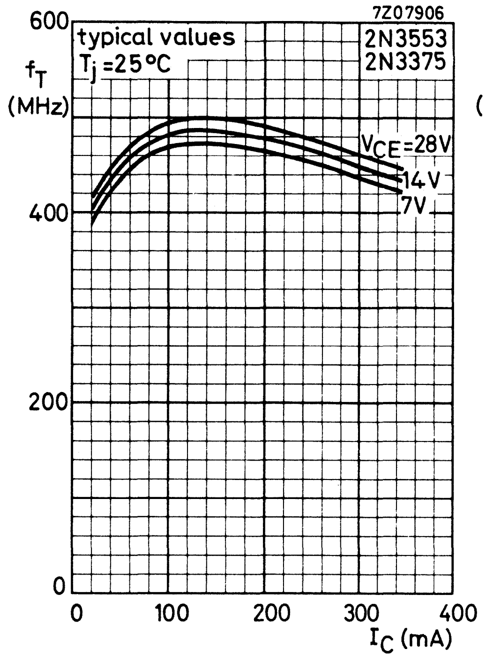

7Z07901
2N3632
base current
versus collector
current
V_{CE}=5V
T_j=25°C
I_C
(mA)
1000
100
10
min
typ
max
1
10
100
I_B (mA)
1000

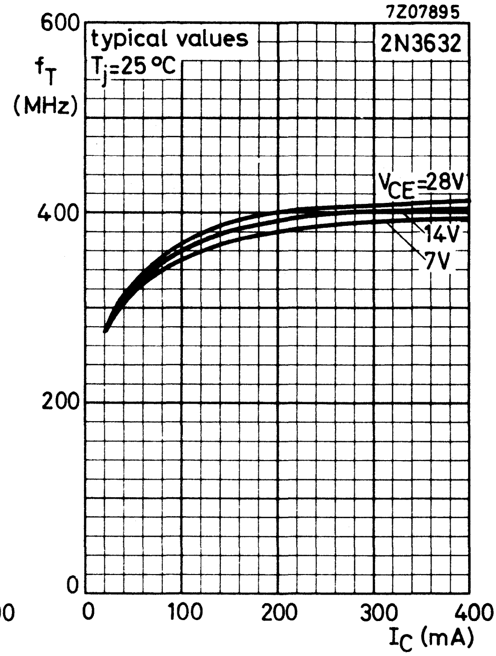

7Z07899
V_{CE} = 5 V
T_j = 25 °C
2N3553
2N3375
h_{FE}
typ
0
20
40
60
0
200
400
600
I_C (mA)

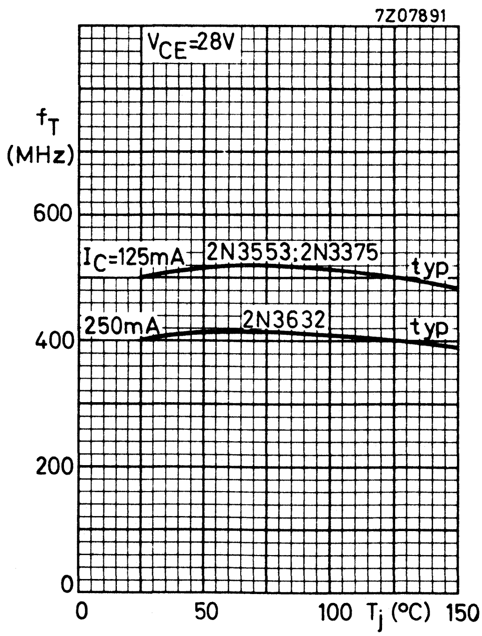

7Z07904
V_{CE} = 5 V
T_j = 25 °C
2N3632
h_{FE}
typ
0
20
40
60
0
500
1000
I_C (mA)

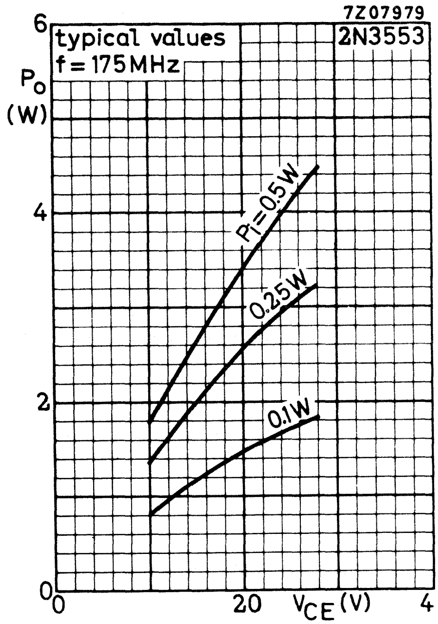

7Z07907
2N3553
2N3375
typical values
T_j = 25 °C
I_B = 10 mA
9mA
8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C (mA)
0
100
200
300
400
0
2
4
6
V_{CE} (V)

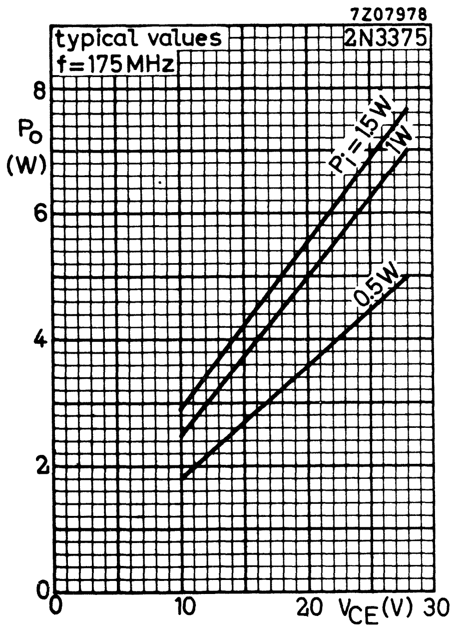

7Z07910
2N3632
I_B = 8 mA
typical values
T_j = 25 °C
7mA
6mA
5mA
4mA
3mA
2mA
1mA
I_C (mA)
0
100
200
300
400
0
2
4
6
V_{CE} (V)

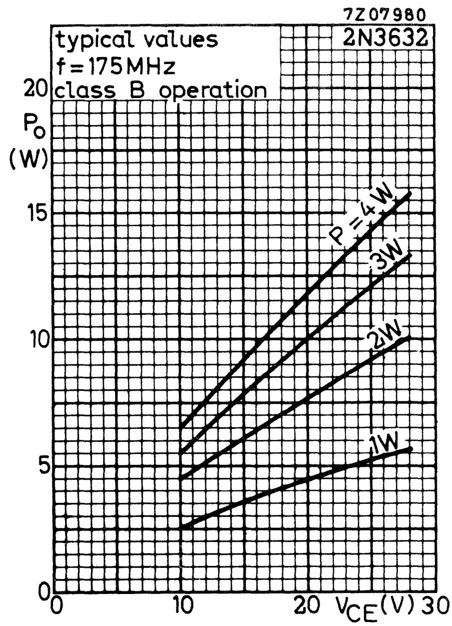

7Z07906
typical values
$T_j = 25\,^{\circ}C$
2N3553
2N3375
f_T (MHz)
$V_{CE} = 28V$
14V
7V
600
400
200
0
0
100
200
300
400
I_C (mA)


7Z07895
typical values
$T_j = 25\,^{\circ}C$
2N3632
f_T (MHz)
$V_{CE} = 28V$
14V
7V
600
400
200
0
0
100
200
300
400
I_C (mA)


7Z07891
$V_{CE} = 28V$
f_T (MHz)
$I_C = 125mA$
2N3553; 2N3375
typ
250mA
2N3632
typ
600
400
200
0
0
50
100
150
T_j (°C)


7Z07979
typical values
f = 175 MHz
2N3553
Po
(W)
6
4
2
0
Pi = 0.5 W
0.25 W
0.1 W
0
20
VCE (V)
4


7Z07978
typical values
f = 175 MHz
2N3375
Po
(W)
8
6
4
2
0
Pi = 1.5 W
1 W
0.5 W
0
10
20
VCE (V)
30


7Z07980
typical values
f = 175 MHz
class B operation
2N3632
Po
(W)
20
15
10
5
0
Pi = 4 W
3 W
2 W
1 W
0
10
20
VCE (V)
30

SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

N-P-N overlay transistors in TO-39 metal envelopes with the collector connected to the case. The devices are primarily intended for class-A, B or C amplifiers, frequency multiplier and oscillator circuits. The transistors are suitable in output, driver or pre-driver stages in v.h.f. and u.h.f. equipment.

QUICK REFERENCE DATA

			2N3866	2N4427	
Collector-emitter voltage R_{BE} = 10 Ω	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base)	V_{CEO}	max.	30	20	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3,5	2,0	V
Collector current (d.c. or averaged over any 20 ms period)	I_C	max.	0,4	0,4	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	5	3,5	W
Junction temperature	T_j	max.	200	200	°C
Transition frequency I_C = 50 mA; V_{CE} = 15 V; f = 200 MHz	f_T	min.	500	500	MHz

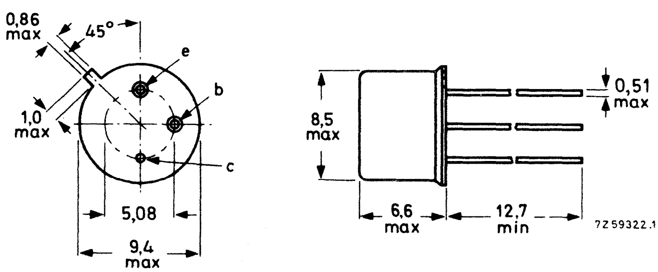
R.F. performance

type number	f (MHz)	V_{CE} (V)	P_o (W)	G_p (dB)	η (%)
2N3866	400	28	1	> 10	> 45
2N4427	175	12	1	> 10	> 50

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-39; collector connected to case.



Maximum lead diameter is guaranteed only for 12,7 mm.

Accessories: 56245 (distance disc).

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

			2N3866	2N4427	
Collector-base voltage (open emitter) 1)	V_{CBO}	max.	55	40	V
Collector-emitter voltage 1) R_{BE} = 10 Ω	V_{CER}	max.	55	40	V
Collector-emitter voltage (open base) 1)	V_{CEO}	max.	30	20	V
Emitter-base voltage (open collector) 1)	V_{EBO}	max.	3.5	2.0	V
Collector current (d.c. or averaged over any 20 ms period) 1)	I_C	max.	0.4	0.4	A
Collector current (peak value) 1)	I_{CM}	max.	0.4	0.4	A
Total power dissipation up to T_{mb} = 25 °C 1)	P_{tot}	max.	5	3.5	W

Temperatures

Storage temperature	T_{stg}		−65 to +200	°C
Junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	200	K/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	35	K/W
From mounting base to heatsink mounted with top clamping washer of 56218	$R_{th\ mb\text{-}h}$	=	1.0	K/W
top clamping washer of 56218 and a boron nitride washer for electrical insulation	$R_{th\ mb\text{-}h}$	=	2.5	K/W

1) See also graphs indicating areas of permissible operation.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3866	2N4427
Collector cut-off current				
I_B = 0; V_{CE} = 28 V	I_{CEO}	<	20	µA
I_B = 0; V_{CE} = 12 V	I_{CEO}	<		20 µA
Breakdown voltages				
I_E = 0; I_C = 100 µA	$V_{(BR)CBO}$	>	55	40 V
I_C = 5 mA; R_{BE} = 10 Ω	$V_{(BR)CER}$	>	55	40 V
I_B = 0; I_C = 5 mA	$V_{(BR)CEO}$	>	30	20 V
I_C = 0; I_E = 100 µA	$V_{(BR)EBO}$	>	3,5	2 V
Collector-emitter saturation voltage				
I_C = 100 mA; I_B = 20 mA	V_{CEsat}	<	1,0	0,5 V
D.C. current gain				
I_C = 50 mA; V_{CE} = 5 V	h_{FE}		10 to 200	
I_C = 100 mA; V_{CE} = 5 V	h_{FE}			10 to 200
I_C = 360 mA; V_{CE} = 5 V	h_{FE}	>	5	5
Transition frequency				
I_C = 50 mA; V_{CE} = 15 V; f = 200 MHz	f_T	⩾	500	500 MHz
Collector capacitance				
V_{CB} = 28 V; I_E = I_e = 0; f = 1 MHz	C_c	<	3	pF
V_{CB} = 12 V; I_E = I_e = 0; f = 1 MHz	C_c	<		4 pF

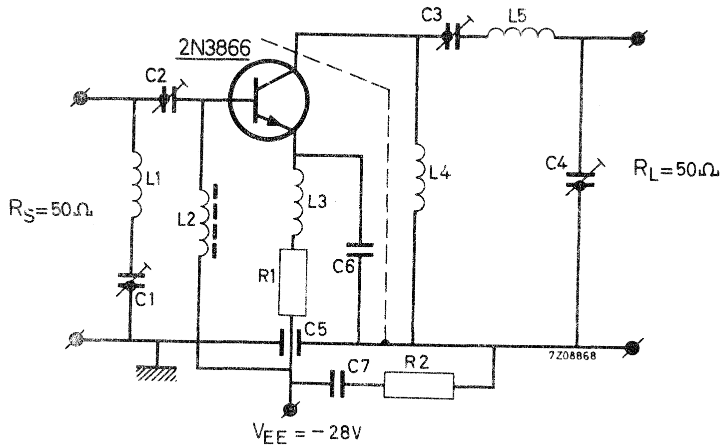
R.F. performance at T_{mb} = 25 °C

	f (MHz)	V_{CE} (V)	P_o (W)	G_P (dB)	I_C (mA)	η (%)	test circuit
2N3866	100	28	1,8	> 10	<107	> 60	
2N3866	250	28	1,5	> 10	<107	> 50	
2N3866	400	28	1,0	> 10	< 79	> 45	I*
2N4427	175	12	1,0	> 10	<167	> 50	II*
2N4427	470	12	0,4	> 10	67	50	

* The transistor can withstand an output V.S.W.R. of 3 : 1 varied through all phases for conditions, mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit I (with the 2N3866 at f = 400 MHz)

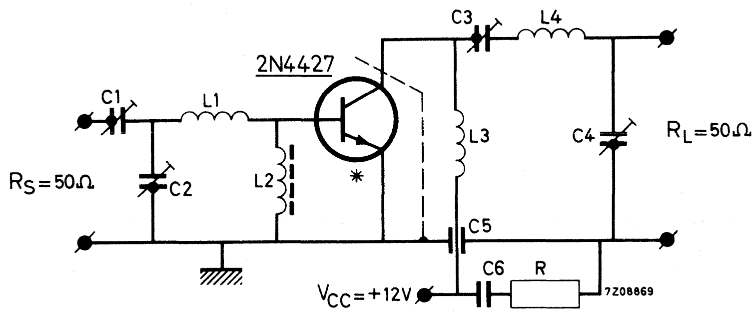


C1 = C2 = C3 =	4 to 29 pF	air trimmer
C4 =	4 to 14 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 pF	
C7 =	12 nF	
R1 =	5.6 Ω	
R2 =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 3 mm
L2 = Ferroxcube choke coil; Z (at f = 250 MHz) = 450 Ω (code number 4312 020 36690)
L3 = L4 = 6 turns enamelled Cu wire (0.5 mm); int. diam. 3.5 mm (100 nH)
L5 = 2 turns Cu wire (1 mm); int. diam. 7 mm; winding pitch 2.5 mm; leads 2x15 mm.

APPLICATION INFORMATION (continued)

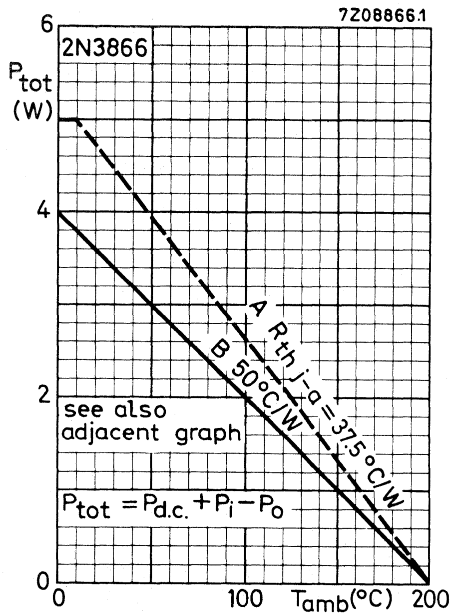
Test circuit **II (with the 2N4427 at f = 175 MHz)**

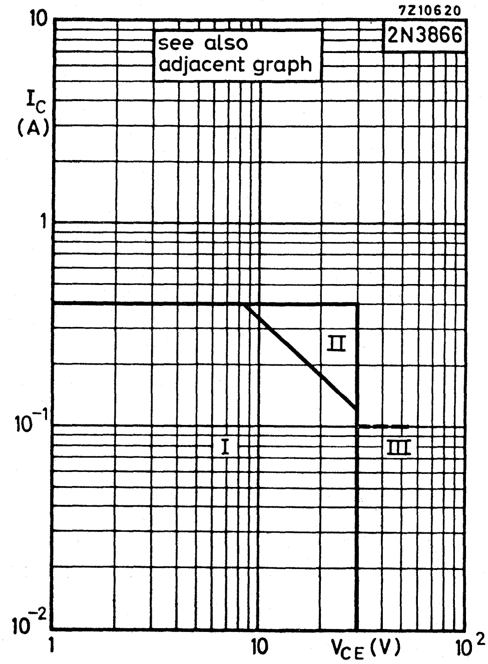


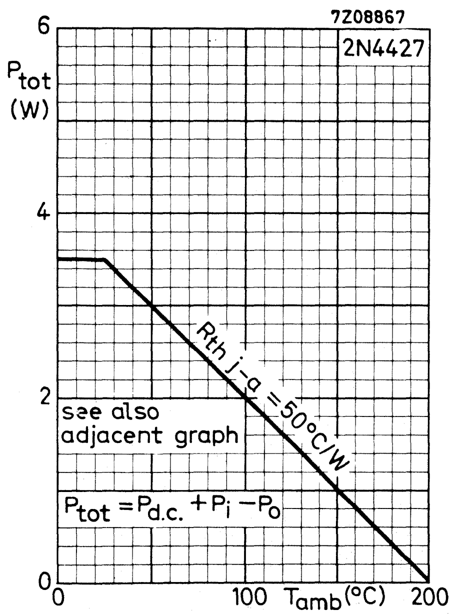
*) The length of the external emitter wire is 1.6 mm

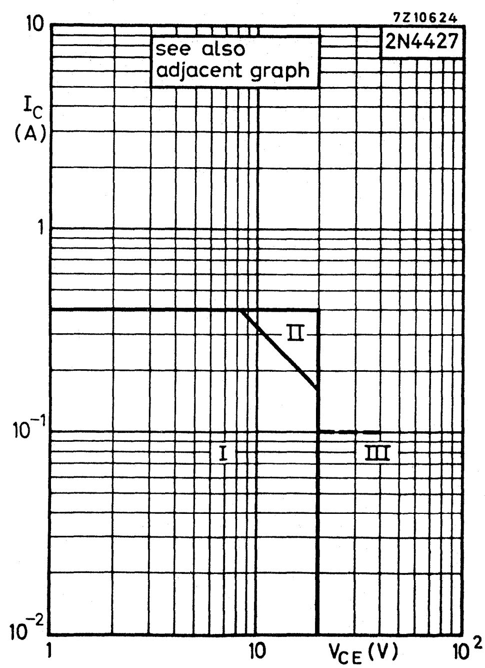
C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 nF	
R =	10 Ω	

L1 = 2 turns Cu wire (1 mm); int. diam. 6 mm; winding pitch 2 mm; leads 2x10 mm
L2 = Ferroxcube choke coil; Z (at f = 175 MHz) = 550 Ω (code number 4312 020 36640)
L3 = 2 turns Cu wire (1 mm); int. diam. 5 mm; winding pitch 2 mm; leads 2x10 mm
L4 = 3 turns Cu wire (1.5 mm); int. diam. 10 mm; winding pitch 2 mm; leads 2x15 mm


7Z08866.1
2N3866
Ptot (W)
A Rth j-a = 37.5 °C/W
B 50 °C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po
Tamb (°C)


7Z10620
2N3866
see also adjacent graph
IC (A)
I
II
III
VCE (V)


7Z08867
2N4427
Ptot (W)
Rth j-a = 50 °C/W
see also adjacent graph
Ptot = Pd.c. + Pi − Po
Tamb (°C)


7Z10624
2N4427
see also adjacent graph
IC (A)
I
II
III
VCE (V)

I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 100$ mA and the transient energy does not exceed 0.125 mWs.

SILICON PLANAR EPITAXIAL OVERLAY TRANSISTORS

The **2N3924** is an n-p-n overlay transistor in a TO-39 metal envelope with the collector connected to the case.
The **2N3926** and the **2N3927** are n-p-n overlay transistors in TO-60 metal envelopes with the emitter connected to the case.
The transistors are intended for v.h.f. transmitting applications.

QUICK REFERENCE DATA

			2N3924	2N3926	2N3927	
Collector-emitter voltage $-V_{BE}$ = 1,5 V	V_{CEX}	max.	36	36	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	18	18	V
Collector current (peak value)	I_{CM}	max.	1,5	3,0	4,5	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	7	11,6	23	W
Junction temperature	T_j	max.	200	200	200	°C
Transition frequency I_C = 100 mA; V_{CE} = 13,5 V	f_T	>	250	250	–	MHz
I_C = 200 mA; V_{CE} = 13,5 V	f_T	>	–	–	200	MHz

R.F. performance at V_{CE} = 13,5 V; f = 175 MHz

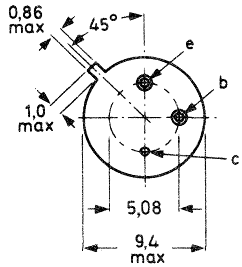
type number	P_o (W)	P_i (W)	η (%)
2N3924	4	< 1	> 70
2N3926	7	< 2	> 70
2N3927	12	< 4	> 80

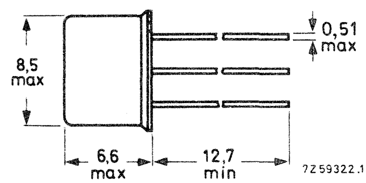
MECHANICAL DATA

Dimensions in mm

Fig. 1a TO-39; collector connected to case.

2N3924



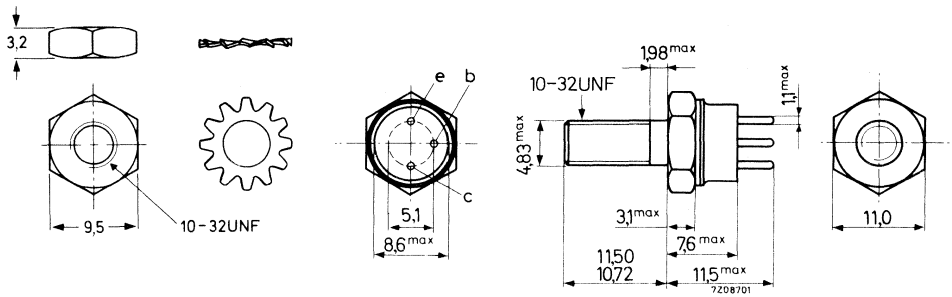


Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

MECHANICAL DATA (continued) Dimensions in mm

Fig. 1b TO-60 (**2N3926** and **2N3927**).

Emitter connected to case.
The top pins should not be bent.



Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

Diameter of clearance hole in heatsink: 4,8 mm to 5,2 mm.

P.S. This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.		36		V
Collector-emitter voltage						
$I_C \leq 400$ mA; $-V_{BE} = 1,5$ V	V_{CEX}	max.		36		V
(open base); $I_C \leq 400$ mA	V_{CEO}	max.		18		V
Emitter-base voltage (open collector)	V_{EBO}	max.		4		V
			2N3924	**2N3926**	**2N3927**	
Collector current						
d.c.	I_C	max.	0,5	1,0	1,5	A
peak value	I_{CM}	max.	1,5	3,0	4,5	A
Total power dissipation						
up to $T_{mb} = 25\ ^{o}C$	P_{tot}	max.	7	11,6	23	W
Storage temperature	T_{stg}			−65 to +200		°C
Junction temperature	T_j	max.		200		°C

THERMAL RESISTANCE

			2N3924	2N3926	2N3927	
From junction to mounting base	$R_{th\ j-mb}$	=	25	15	7.5	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=		0.6	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

			2N3924	2N3926	2N3927	
Collector cut-off current						
$I_E = 0$; $V_{CB} = 15$ V	I_{CBO}	<	100	100	250	μA
$I_E = 0$; $V_{CB} = 15$ V; $T_j = 150$ °C	I_{CBO}	<	5	5	10	mA
Breakdown voltages						
$I_E = 0$; $I_C = 250$ μA	$V_{(BR)CBO}$	>	36	36	36	V
I_C up to 400 mA						
$-V_{BE} = 1.5$ V; $R_B = 33\ \Omega$ [1]	$V_{(BR)CEX}$	>	36	36	36	V
$I_B = 0$ [1]	$V_{(BR)CEO}$	>	18	18	18	V
$I_C = 0$; $I_E = 250$ μA	$V_{(BR)EBO}$	>	4	4	4	V
Base-emitter voltage						
$I_C = 250$ mA; $V_{CE} = 5$ V	V_{BE}	<	1.5			V
$I_C = 500$ mA; $V_{CE} = 5$ V	V_{BE}	<		1.5		V
$I_C = 1000$ mA; $V_{CE} = 5$ V	V_{BE}	<			1.5	V
Saturation voltage						
$I_C = 250$ mA; $I_B = 50$ mA	V_{CEsat}	<	0.75			V
$I_C = 500$ mA; $I_B = 100$ mA	V_{CEsat}	<		0.75		V
$I_C = 1000$ mA; $I_B = 200$ mA	V_{CEsat}	<			1.0	V

[1]) Pulsed through an inductor of 25 mH; $\delta = 0.5$; f = 50 Hz

CHARACTERISTICS (continued)

T_j = 25°C unless otherwise specified

			2N3924	2N3926	2N3927	
D.C. current gain						
I_C = 250 mA; V_{CE} = 5 V	h_{FE}	> <	10 150			
I_C = 500 mA; V_{CE} = 5 V	h_{FE}	> <		5 150		
I_C = 1000 mA; V_{CE} = 5 V	h_{FE}	> <			5 150	
Collector capacitance at f = 1 MHz						
$I_E = I_e$ = 0; V_{CB} = 13.5 V	C_c	<	20	20	45	pF
Transition frequency						
I_C = 100 mA; V_{CE} = 13.5 V	f_T	>	250	250		MHz
I_C = 200 mA; V_{CE} = 13.5 V	f_T	>			200	MHz
Real part of input impedance at f = 200 MHz						
I_C = 100 mA; V_{CE} = 13.5 V	Re (h_{ie})	<	20	20		Ω
I_C = 200 mA; V_{CE} = 13.5 V	Re (h_{ie})	<			20	Ω

R.F. performance at V_{CE} = 13.5 V; f = 175 MHz

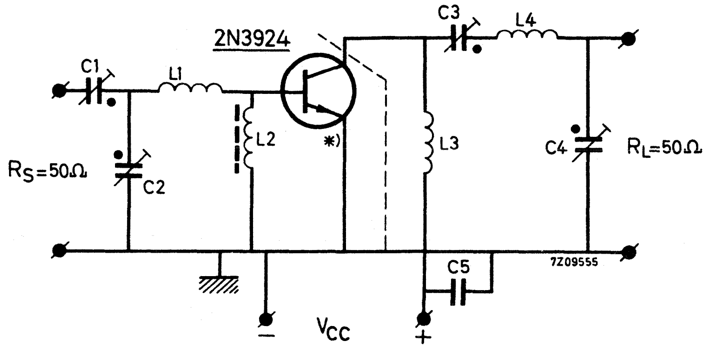
	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit
2N3924	4	< 1	< 420	> 70	I
2N3926	7	< 2	< 740	> 70	II
2N3927	12	< 4	< 1100	> 80	II

NOTE

The transistors can withstand an output V.S.W.R. of 3:1 varied through all phases under conditions mentioned in the table above.

CHARACTERISTICS (continued)

Test circuit I (with the 2N3924 at f = 175 MHz)



*) The length of the external emitter wire of the 2N3924 is 1.6 mm.

Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	10 nF	polyester

L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

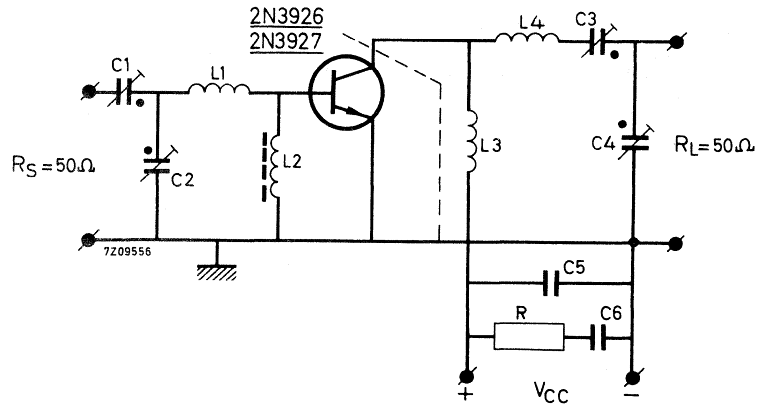
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 36640)

L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

CHARACTERISTICS (continued)

Test circuit II (with the 2N3926 or 2N3927 at f = 175 MHz)



Components

C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	100 pF	ceramic
C6 =	10 nF	polyester

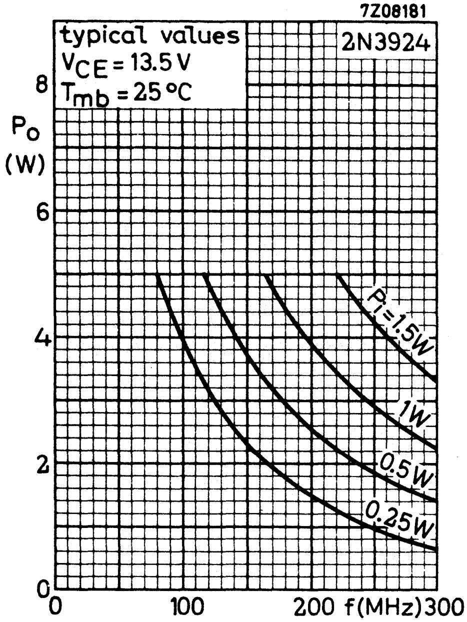
L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

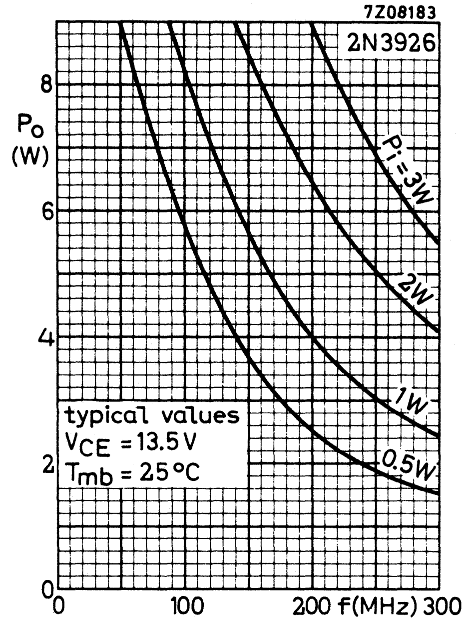
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20%
(code number 4312 020 36640)

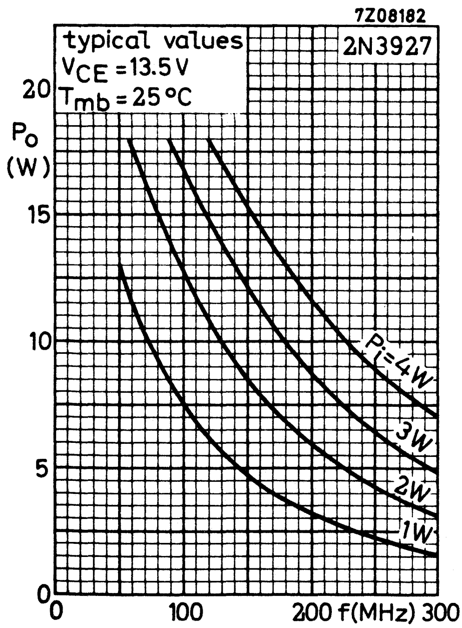
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

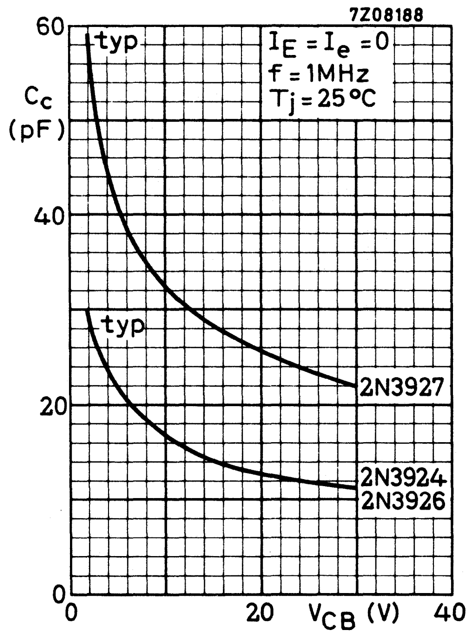
L4 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 8.5 mm; leads 2 x 20 mm

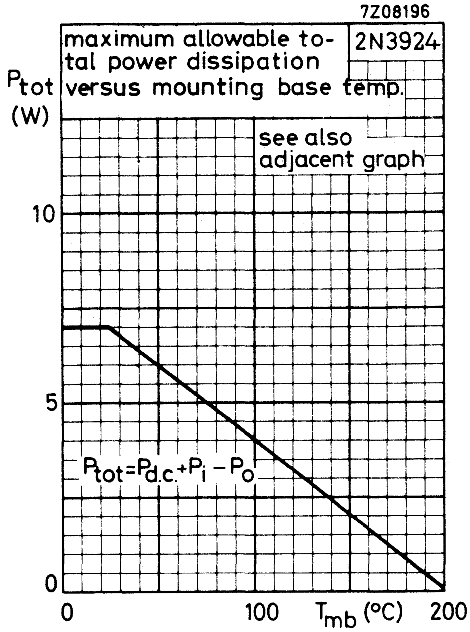
R = 10 Ω carbon

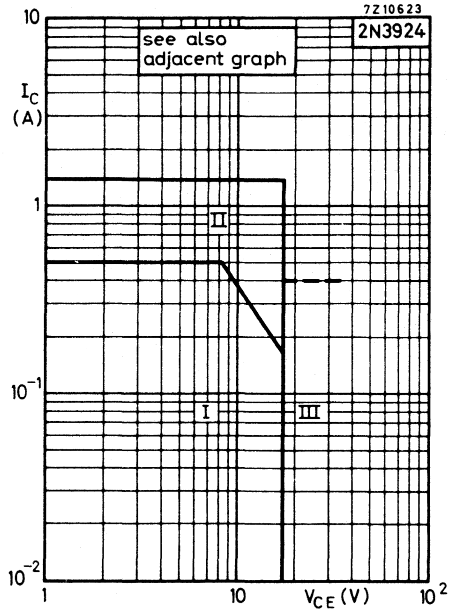

7Z08181
typical values
VCE = 13.5 V
Tmb = 25 °C
2N3924
Po
(W)
Pi = 1.5W
1W
0.5W
0.25W
f (MHz)

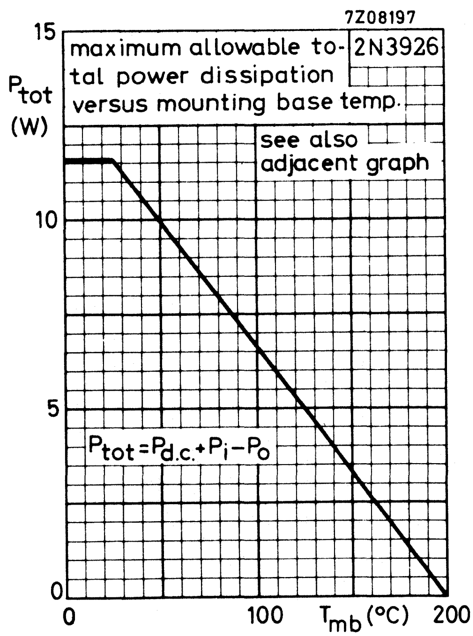

7Z08183
2N3926
Po
(W)
Pi = 3W
2W
1W
0.5W
typical values
VCE = 13.5 V
Tmb = 25 °C
f (MHz)

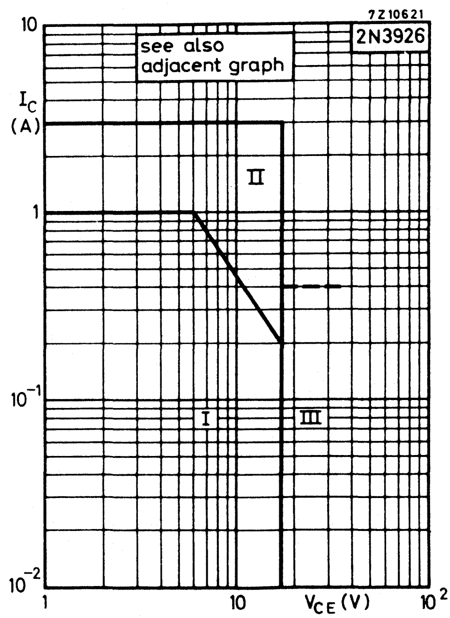

7Z08182
typical values
VCE = 13.5 V
Tmb = 25 °C
2N3927
Po
(W)
Pi = 4W
3W
2W
1W
f (MHz)

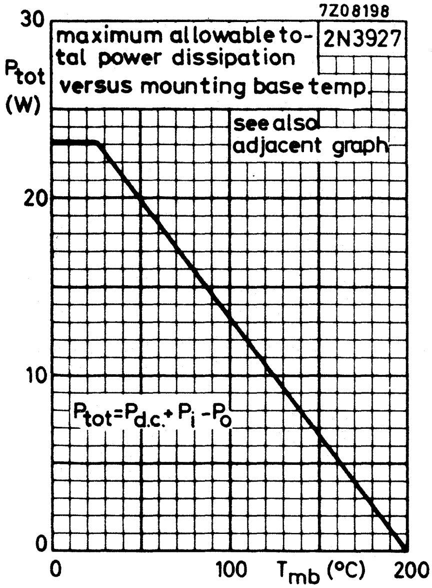

7Z08188
typ
IE = Ie = 0
f = 1MHz
Tj = 25 °C
Cc
(pF)
typ
2N3927
2N3924
2N3926
VCB (V)

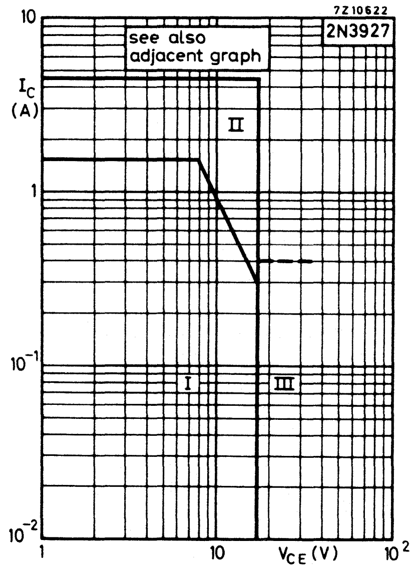

7Z08196
maximum allowable total power dissipation versus mounting base temp.
2N3924
P_{tot} (W)
see also adjacent graph
$P_{tot} = P_{d.c.} + P_i - P_o$
10
5
0
0
100
T_{mb} (°C)
200


7Z10623
2N3924
see also adjacent graph
I_C (A)
10
1
10^{-1}
10^{-2}
II
I
III
1
10
V_{CE} (V)
10^2


7Z08197
maximum allowable total power dissipation versus mounting base temp.
2N3926
P_{tot} (W)
see also adjacent graph
$P_{tot} = P_{d.c.} + P_i - P_o$
15
10
5
0
0
100
T_{mb} (°C)
200


7Z10621
2N3926
see also adjacent graph
I_C (A)
10
1
10^{-1}
10^{-2}
II
I
III
1
10
V_{CE} (V)
10^2

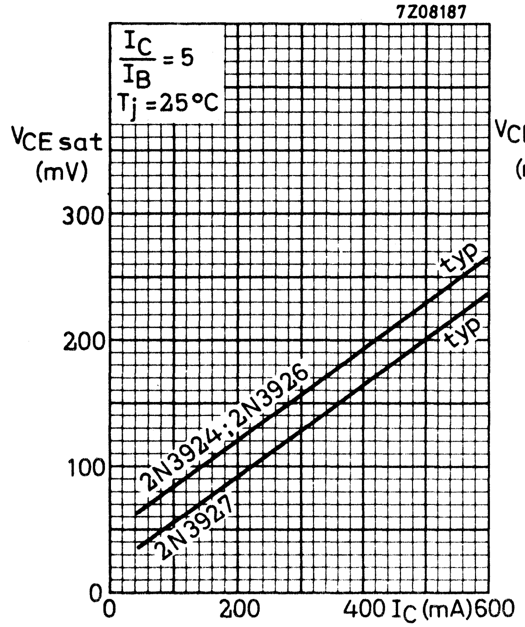


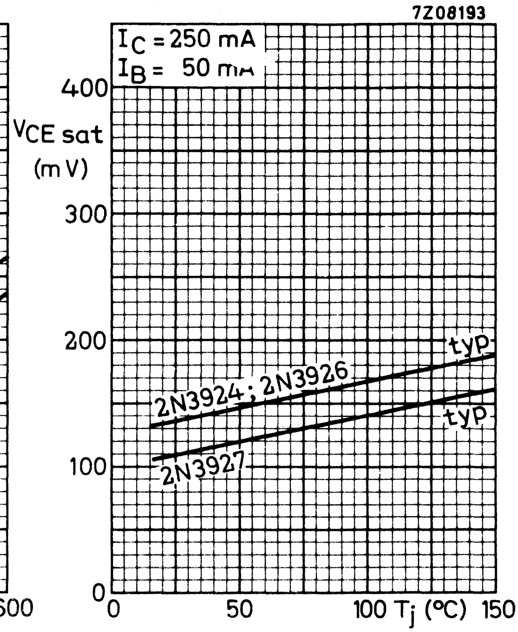


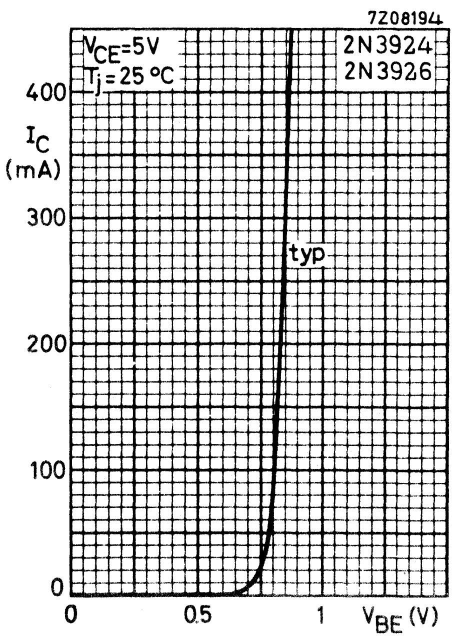
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

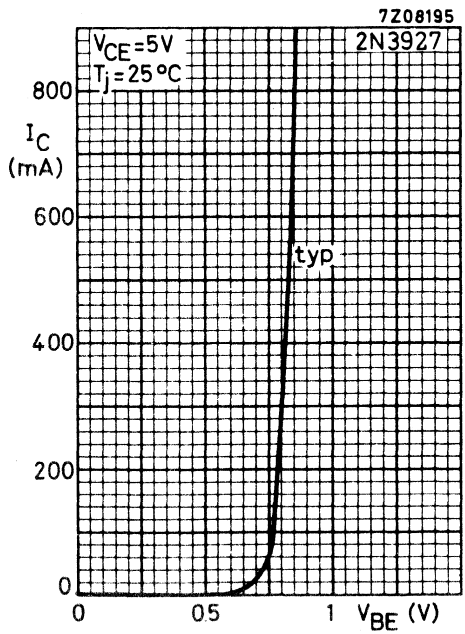
II Additional region of operation at f ≥ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

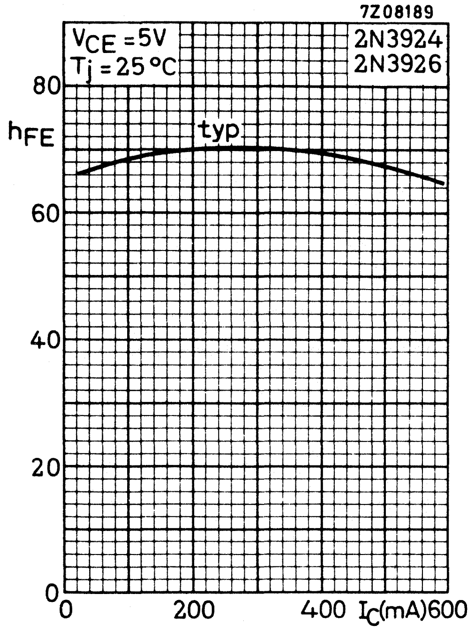
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 400$ mA and the transient energy does not exceed 2 mWs.

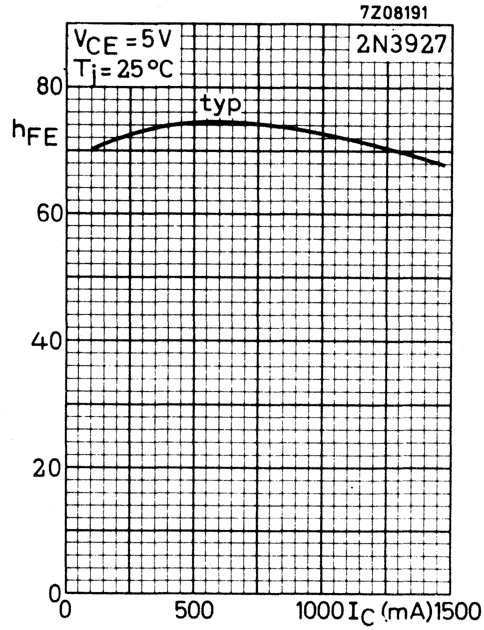

7Z08187
IC/IB = 5
Tj = 25 °C
VCE sat (mV)
300
200
100
0
0
200
400
IC (mA)
600
typ
typ
2N3924; 2N3926
2N3927

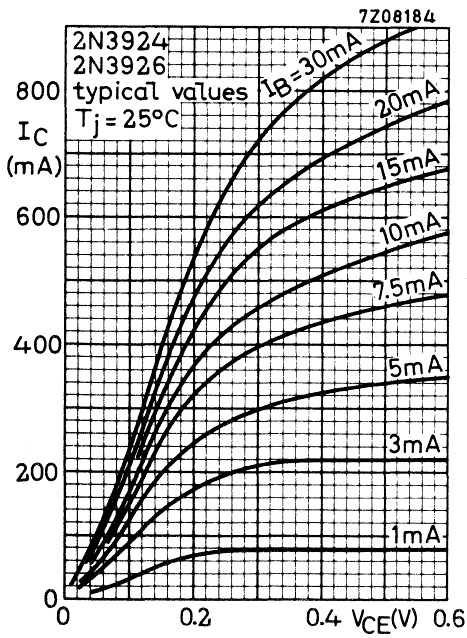

7Z08193
IC = 250 mA
IB = 50 mA
400
VCE sat (mV)
300
200
100
0
0
50
100
Tj (°C)
150
typ
typ
2N3924; 2N3926
2N3927

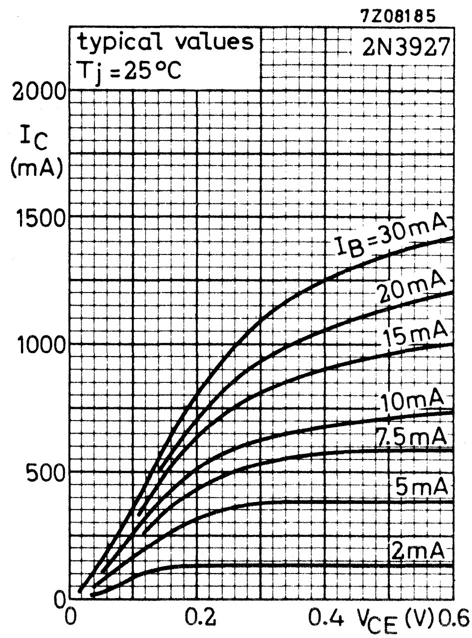

7Z08194
VCE=5V
Tj=25 °C
2N3924
2N3926
400
IC (mA)
300
200
100
0
0
0.5
1
VBE (V)
typ

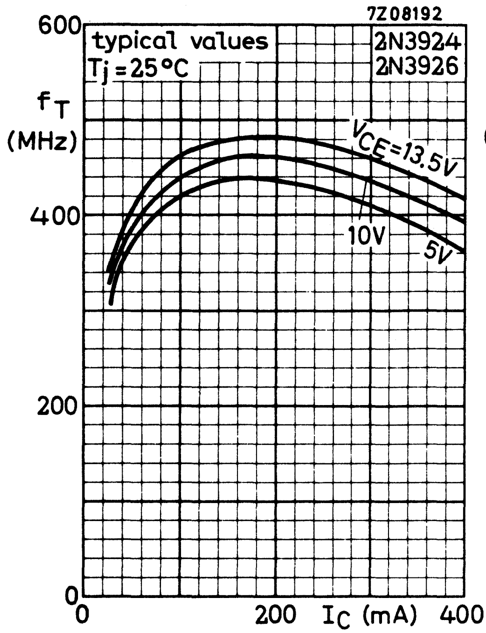

7Z08195
VCE=5V
Tj=25 °C
2N3927
800
IC (mA)
600
400
200
0
0
0.5
1
VBE (V)
typ

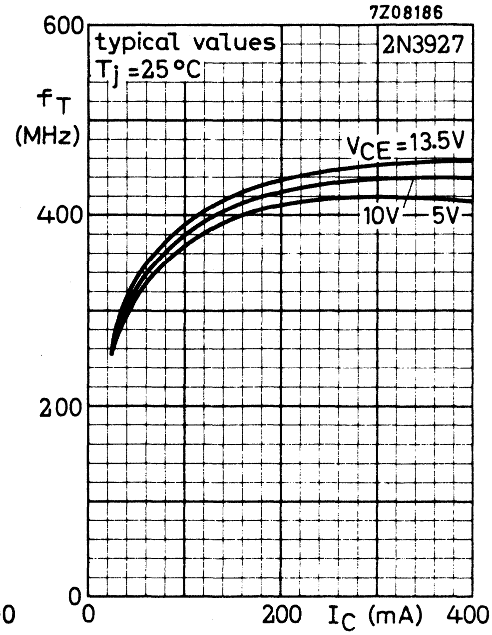

7Z08189
VCE = 5V
Tj = 25 °C
2N3924
2N3926
hFE
typ
0
20
40
60
80
0
200
400
IC(mA)600

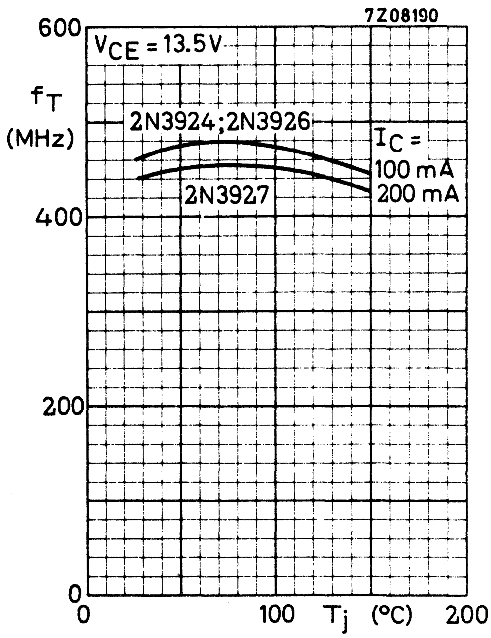

7Z08191
VCE = 5V
Tj = 25 °C
2N3927
hFE
typ
0
20
40
60
80
0
500
1000 IC (mA)1500


7Z08184
2N3924
2N3926
typical values
Tj = 25°C
IC
(mA)
IB=30mA
20mA
15mA
10mA
7.5mA
5mA
3mA
1mA
0
200
400
600
800
0
0.2
0.4 VCE(V) 0.6


7Z08185
typical values
Tj = 25°C
2N3927
IC
(mA)
IB=30mA
20mA
15mA
10mA
7.5mA
5mA
2mA
0
500
1000
1500
2000
0
0.2
0.4 VCE (V) 0.6


7Z08192
typical values
Tj = 25 °C
2N3924
2N3926
fT
(MHz)
VCE = 13.5V
10V
5V
600
400
200
0
0
200
IC (mA)
400

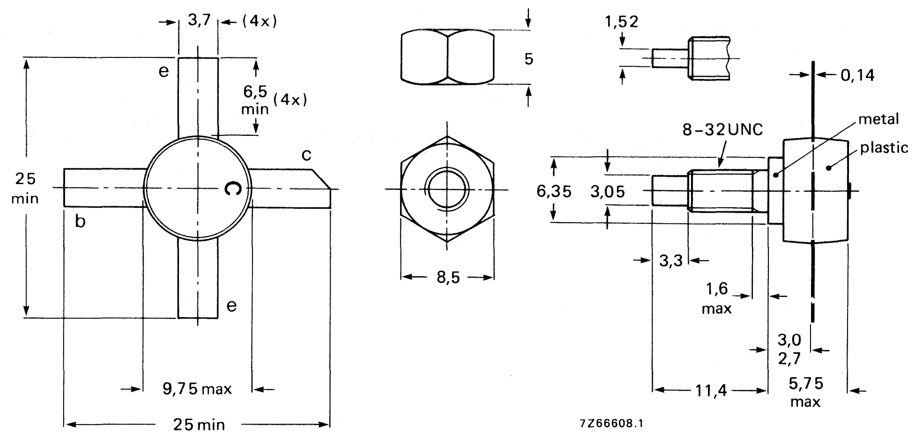

7Z08186
typical values
Tj = 25 °C
2N3927
fT
(MHz)
VCE = 13.5V
10V
5V
600
400
200
0
0
200
IC (mA)
400


7Z08190
VCE = 13.5V
fT
(MHz)
2N3924;2N3926
IC =
100 mA
200 mA
2N3927
600
400
200
0
0
100
Tj (°C)
200

SOT48/2

MECHANICAL DATA

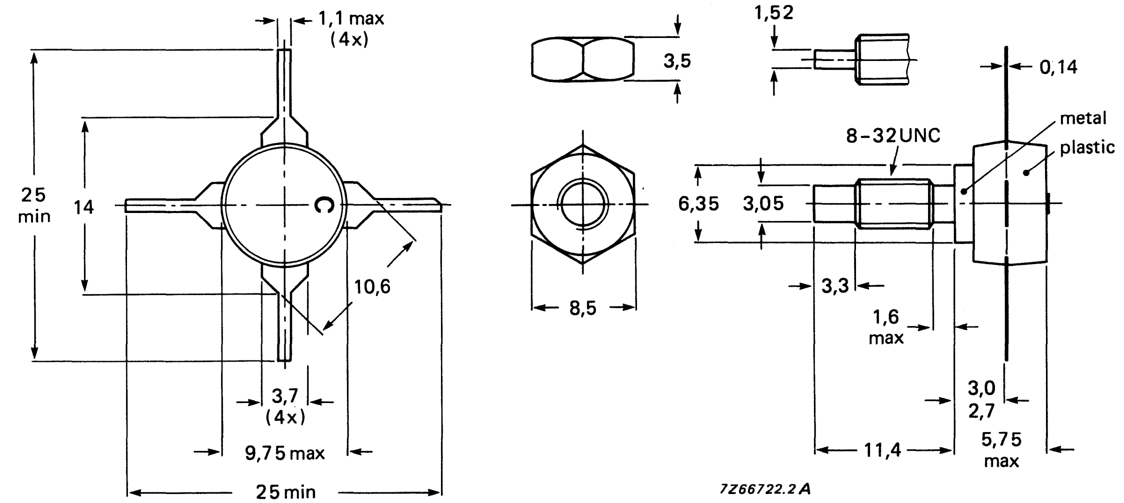
Dimensions in mm



SOT48/3

MECHANICAL DATA

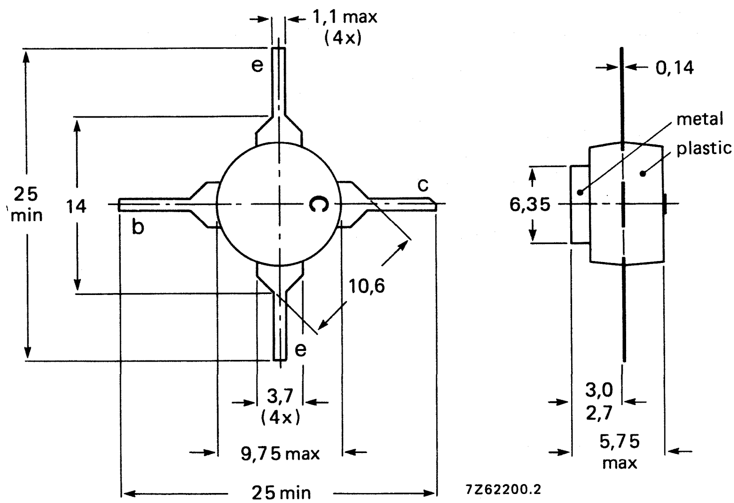
Dimensions in mm



SOT48/4

MECHANICAL DATA

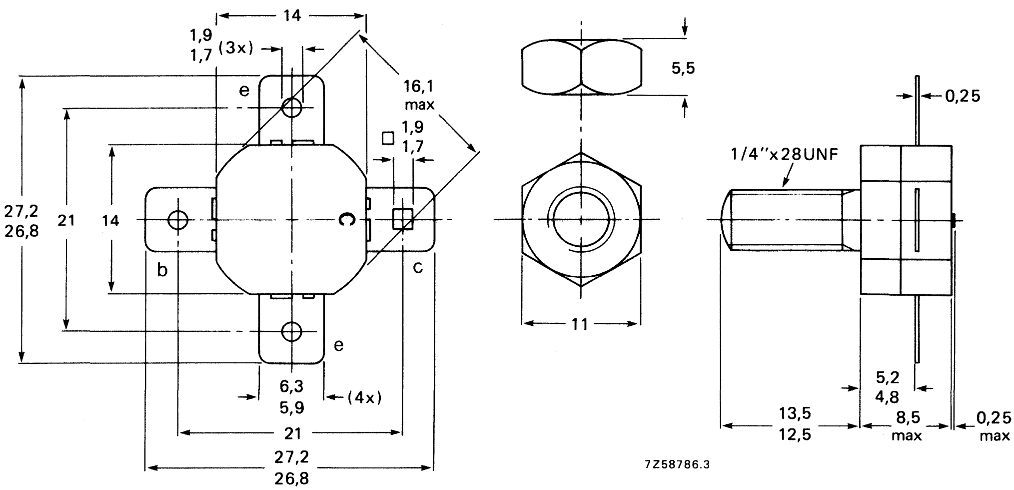
Dimensions in mm



SOT55

MECHANICAL DATA

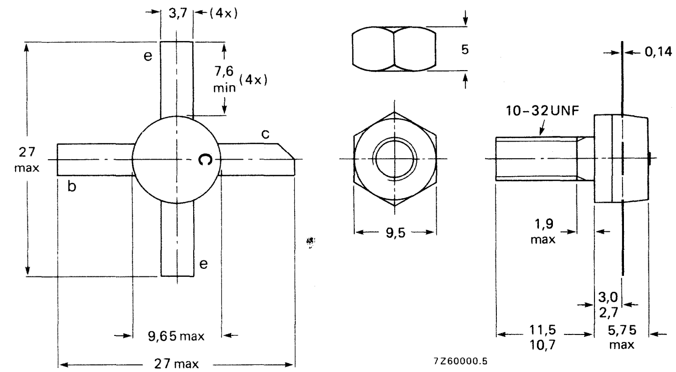
Dimensions in mm



SOT56

MECHANICAL DATA

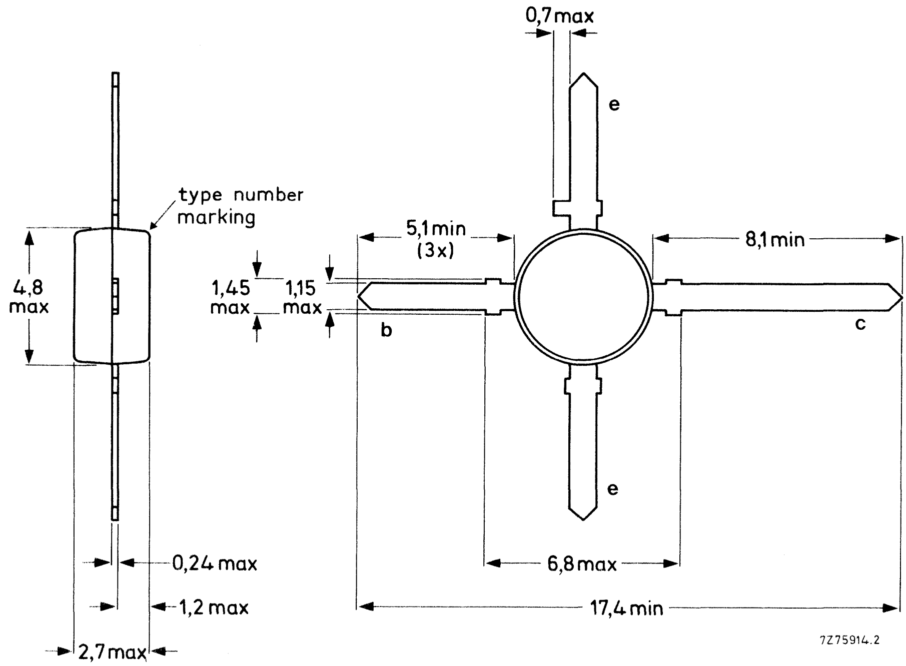
Dimensions in mm



SOT103

MECHANICAL DATA

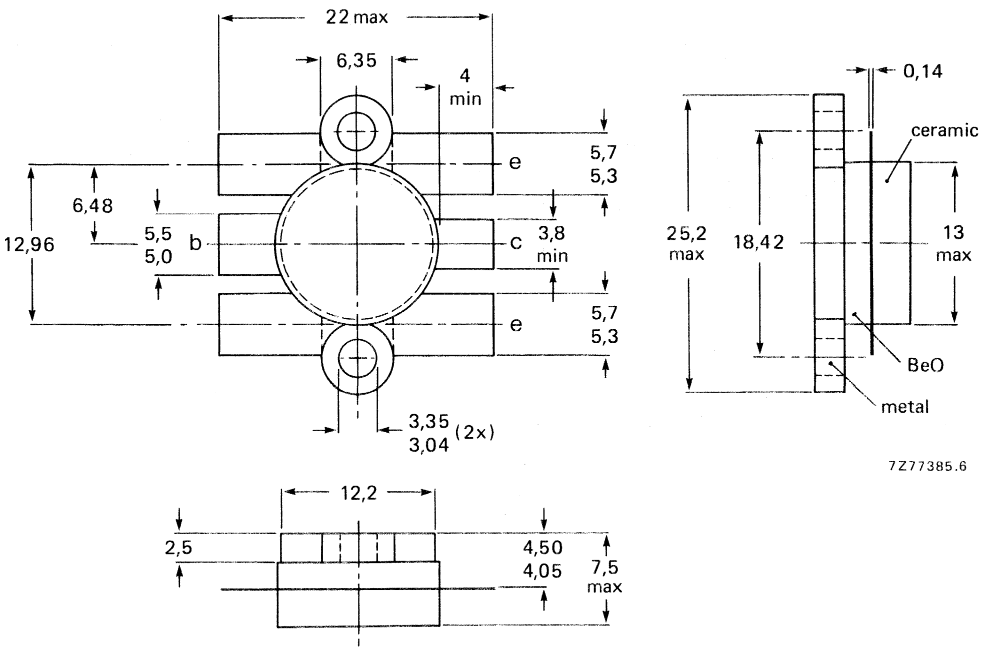
Dimensions in mm



SOT119

MECHANICAL DATA

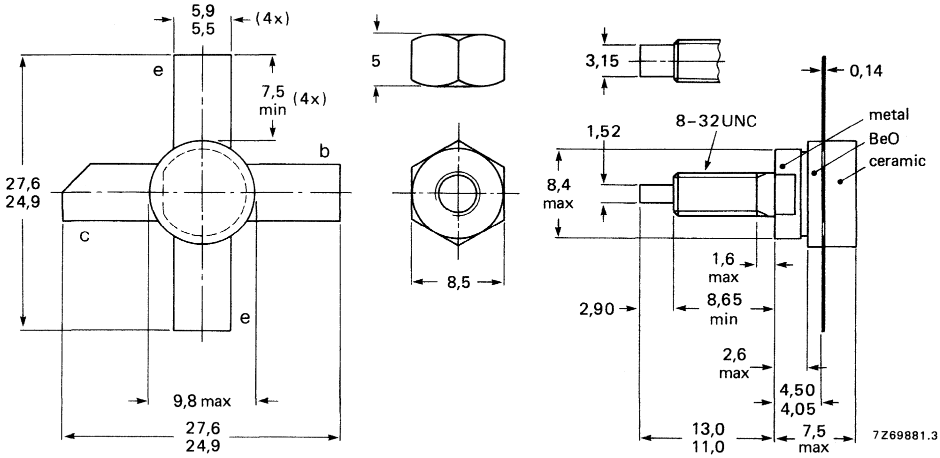
Dimensions in mm



SOT120

MECHANICAL DATA

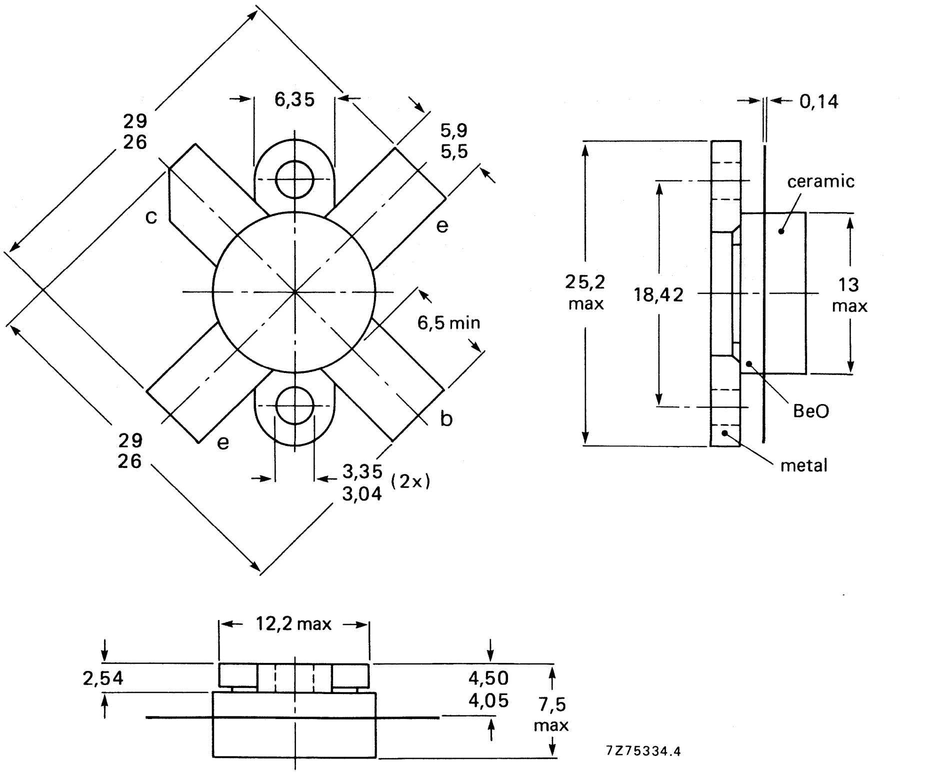
Dimensions in mm



SOT121

MECHANICAL DATA

Dimensions in mm

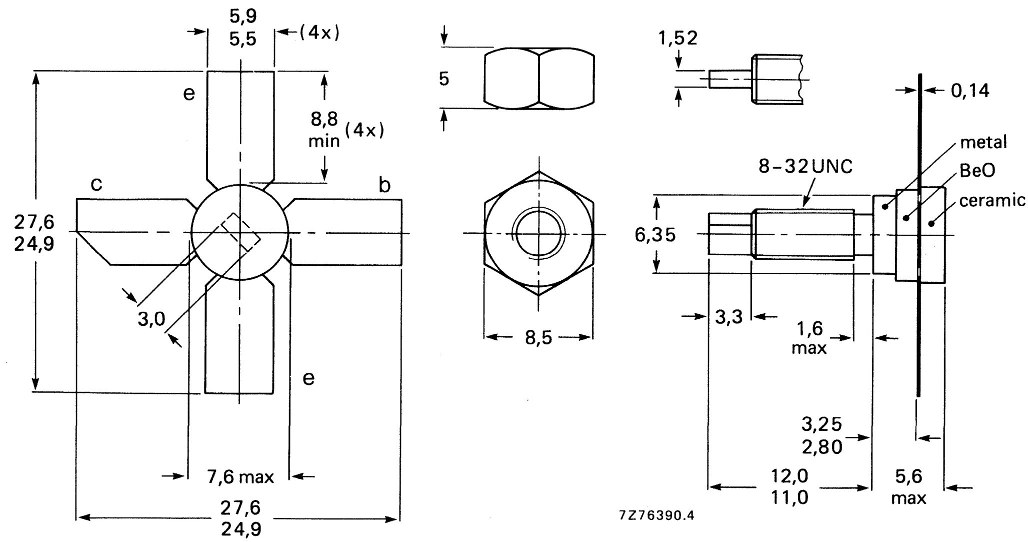


7Z75334.4

SOT122

MECHANICAL DATA

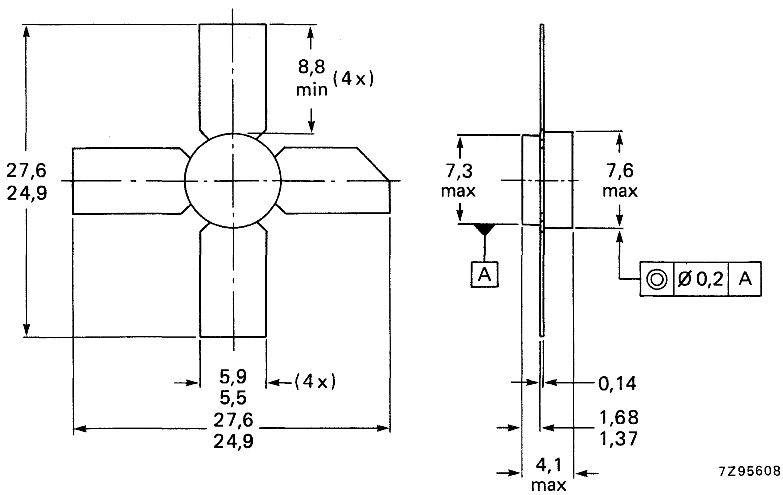
Dimensions in mm



SOT122D

MECHANICAL DATA

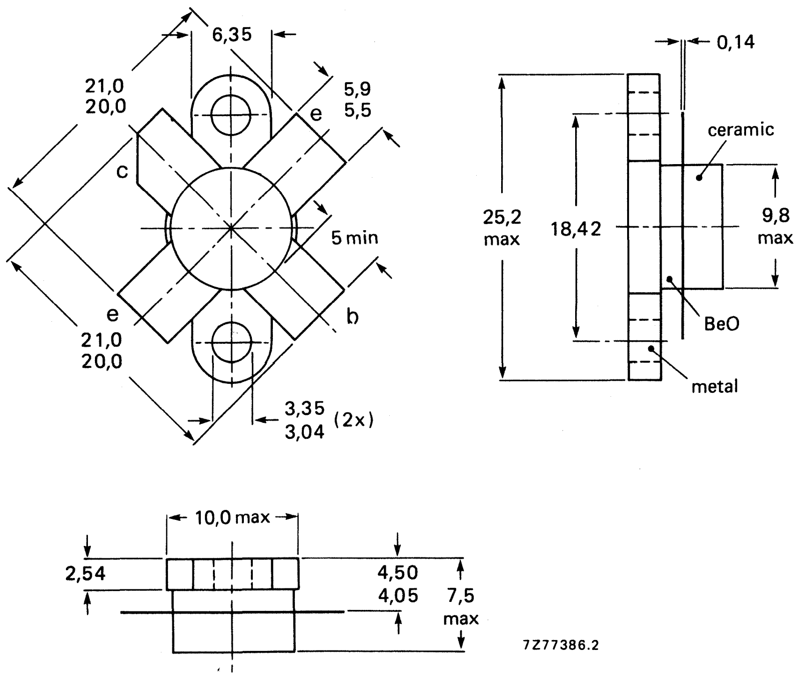
Dimensions in mm



SOT123

MECHANICAL DATA

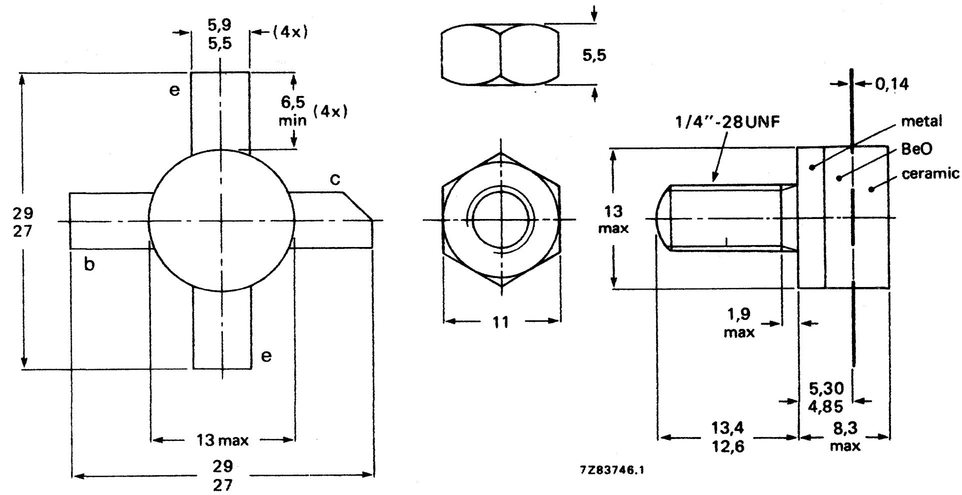
Dimensions in mm



SOT147

MECHANICAL DATA

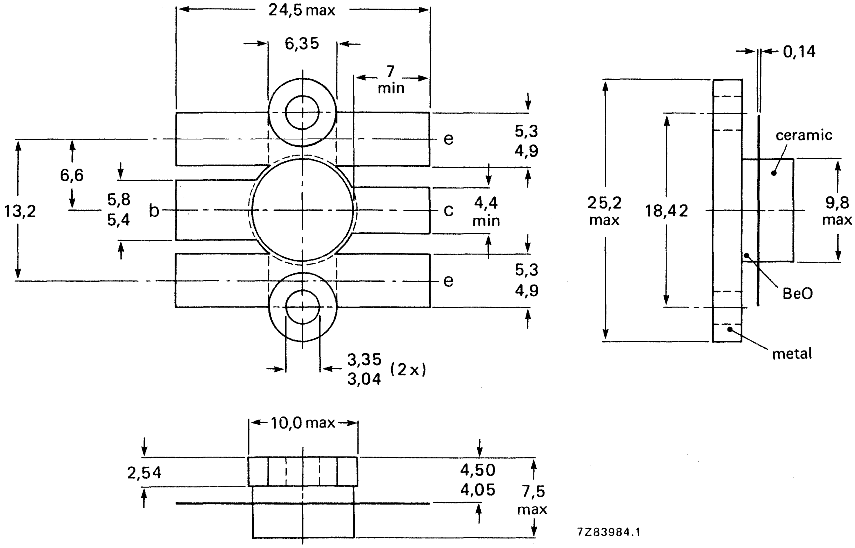
Dimensions in mm



SOT160

MECHANICAL DATA

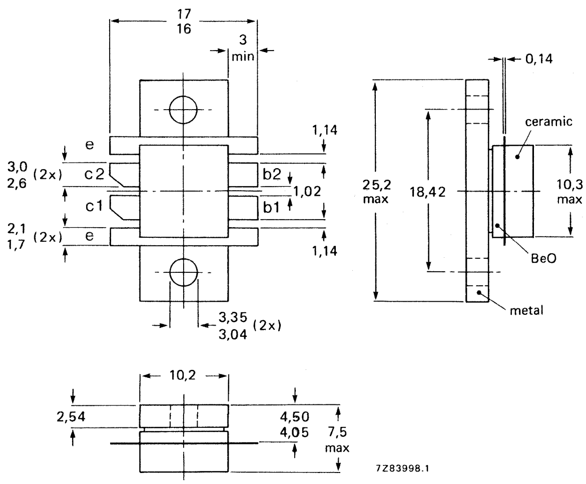
Dimensions in mm



SOT161

MECHANICAL DATA

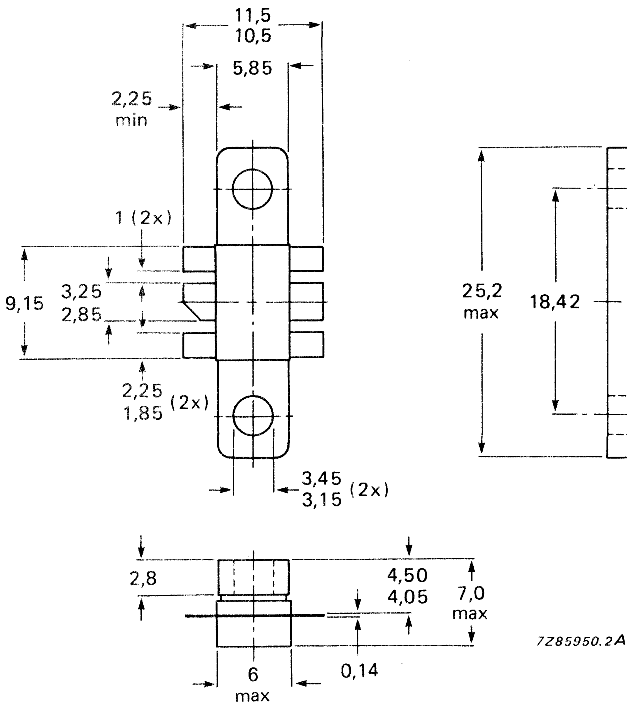
Dimensions in mm



SOT171

MECHANICAL DATA

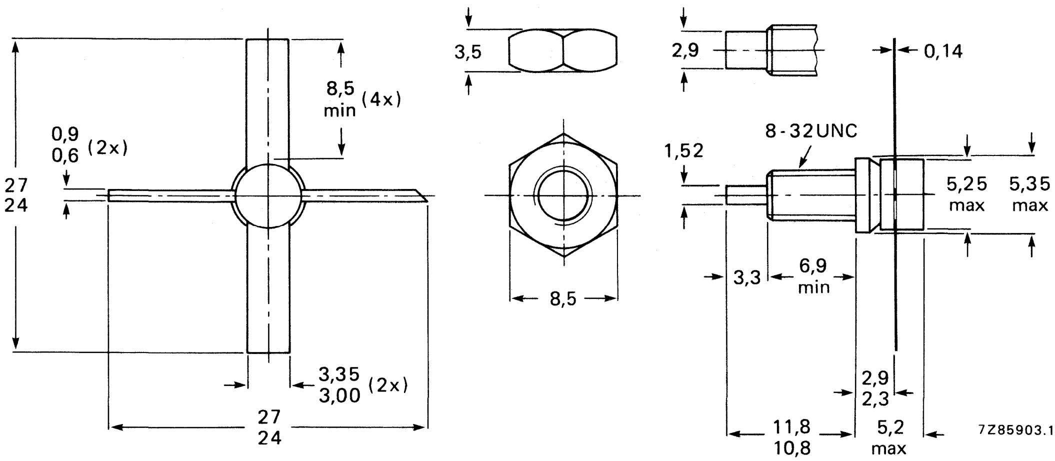
Dimensions in mm



SOT172A1

MECHANICAL DATA

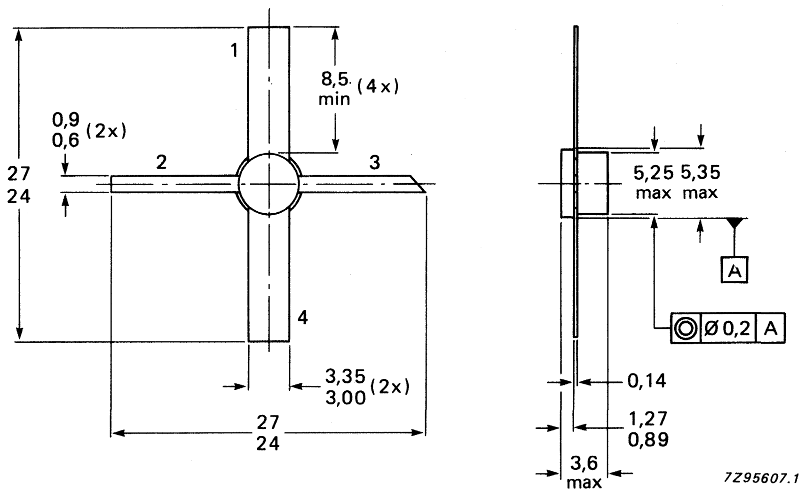
Dimensions in mm



SOT172D

MECHANICAL DATA

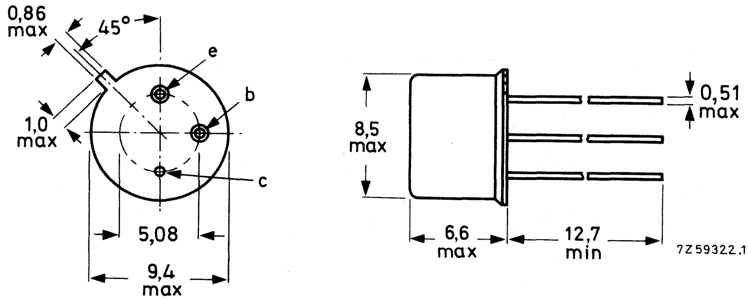
Dimensions in mm



TO39/1

MECHANICAL DATA

Dimensions in mm

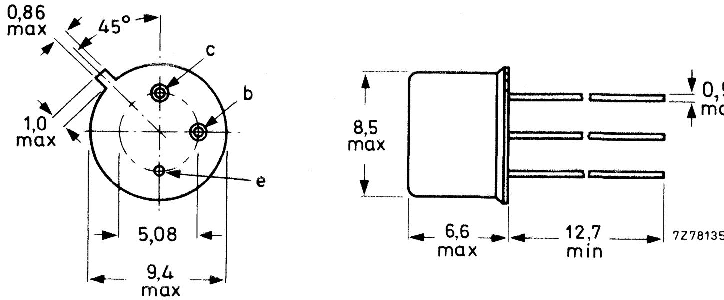


Collector connected to case.
(TO-39/1)

TO39/3

MECHANICAL DATA

Dimensions in mm

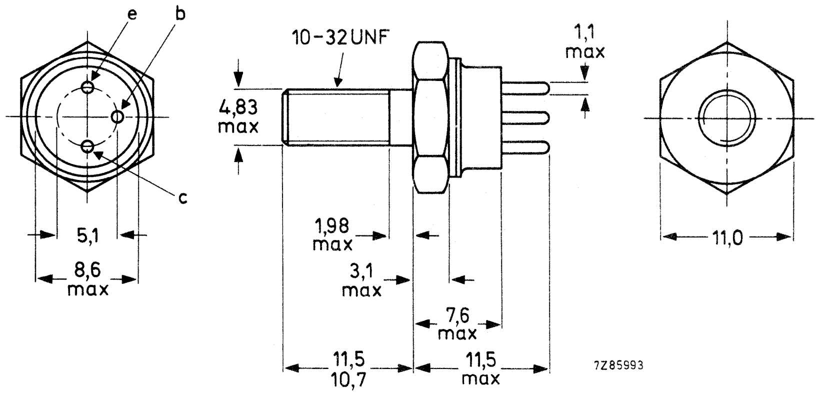


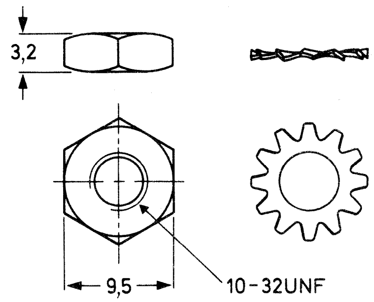
Emitter connected to case.
(TO-39/3)

TO60

MECHANICAL DATA

Dimensions in mm

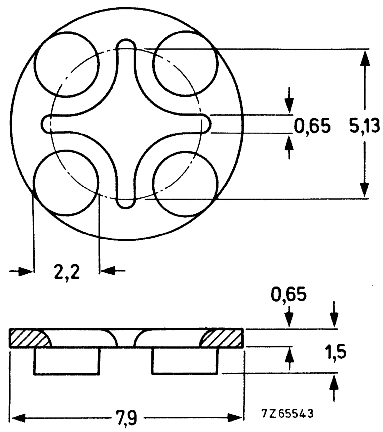




56245

MECHANICAL DATA

Dimensions in mm



(Distance disc) for TO-39.

Insulating material.

Maximum permissible temperature 100 °C.

INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

Key to handbook sections

A = Accessories
FET = Field-effect transistors
I = Infrared devices
LED = Light-emitting diodes
LCD = Liquid crystal displays
Mm = Surface-mounted devices
M = Microwave transistors
P = Low-frequency power transistors and modules
PDT = Photodiodes or transistors
Ph = Photoconductive devices
PhC = Photocouplers
PM = PowerMOS transistors
R = Rectifier diodes
RFP = RF power transistors and modules
RT = Triplers
SEN = Semiconductor sensors
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
SP = Low-frequency switching power diodes
St = Rectifier stacks
T = Tuner diodes
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

* series.

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DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of six series of handbooks:

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MATERIALS*

The contents of each series are listed on pages iii to viii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application is given it is advisory and does not form part of the product specification.

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Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

INTEGRATED CIRCUITS

This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
IC03	**ICs for Telecom** Bipolar, MOS Subscriber sets, Cordless Telephones
IC04	**HE4000B logic family** CMOS
IC05	**Advanced Low-power Schottky (ALS) Logic Series**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**Advanced CMOS logic (ACL)**
IC08	**ECL 10K and 100K logic families**
IC09N	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
Supplement to IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** NMOS, CMOS
IC15	**FAST TTL logic series**
Supplement to IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**

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This series of data handbooks comprises:

current code	new code	handbook title
S1	SC01	**Diodes** High-voltage tripler units
S2a	SC02*	**Power diodes**
S2b	SC03*	**Thyristors and triacs**
S3	SC04	**Small-signal transistors**
S4a	SC05	**Low-frequency power transistors and hybrid IC power modules**
S4b	SC06	**High-voltage and switching power transistors**
S5	SC07	**Small-signal field-effect transistors**
S6	SC08 SC09	**RF power transistors** **RF power modules**
S7	SC10	**Surface mounted semiconductors**
S8a	SC11*	**Light emitting diodes**
S8b	SC12	**Optocouplers**
S9	SC13*	**PowerMOS transistors**
S10	SC14	**Wideband transistors and wideband hybrid IC modules**
S11	SC15	**Microwave transistors**
S15**	SC16	**Laser diodes**
S13	SC17	**Semiconductor sensors**
S14	SC18*	**Liquid crystal displays and driver ICs for LCDs**

* Not yet issued with the new code in this series of handbooks.
** New handbook in this series; will be issued shortly.

DISPLAY COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T8	**DC01**	**Colour display components**
T16	**DC02**	**Monochrome monitor tubes and deflection units**
C2	**DC03***	**Television tuners, coaxial aerial input assemblies**
C3	**DC04***	**Loudspeakers**
C20	**DC05***	**Wire-wound components for TVs and monitors**

* These handbooks are currently issued in another series; they are not yet issued in the Display Components series of handbooks.

PASSIVE COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
C14	**PA01**	**Electrolytic capacitors; solid and non-solid**
C11	**PA02***	**Varistors, thermistors and sensors**
C12	**PA03**	**Potentiometers, encoders and switches**
C7	**PA04***	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08***	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

PROFESSIONAL COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T1	*****	**Power tubes for RF heating and communications**
T2a	*****	**Transmitting tubes for communications, glass types**
T2b	*****	**Transmitting tubes for communications, ceramic types**
T3	**PC01****	**High-power klystrons**
T4	*****	**Magnetrons for microwave heating**
T5	**PC02****	**Cathode-ray tubes**
T6	**PC03****	**Geiger-Müller tubes**
T9	**PC04****	**Photo and electron multipliers**
T10	**PC05**	**Plumbicon camera tubes and accessories**
T11	**PC06**	**Circulators and Isolators**
T12	**PC07**	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08**	**Image intensifiers**
T15	**PC09****	**Dry reed switches**
C8	**PC10**	**Variable mains transformers; annular fixed transformers**
	PC11	**Solid state image sensors and peripheral integrated circuits**

* These handbooks will not be reissued.
** Not yet issued with the new code in this series of handbooks.

MATERIALS

This series of data handbooks comprises:

current code	new code	handbook title
C4 **C5**	**MA01***	**Soft Ferrites**
C16	**MA02****	**Permanent magnet materials**
C19	**MA03****	**Piezoelectric ceramics**

* Handbooks C4 and C5 will be reissued as one handbook having the new code MA01.

** Not yet issued with the new code in this series of handbooks.

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