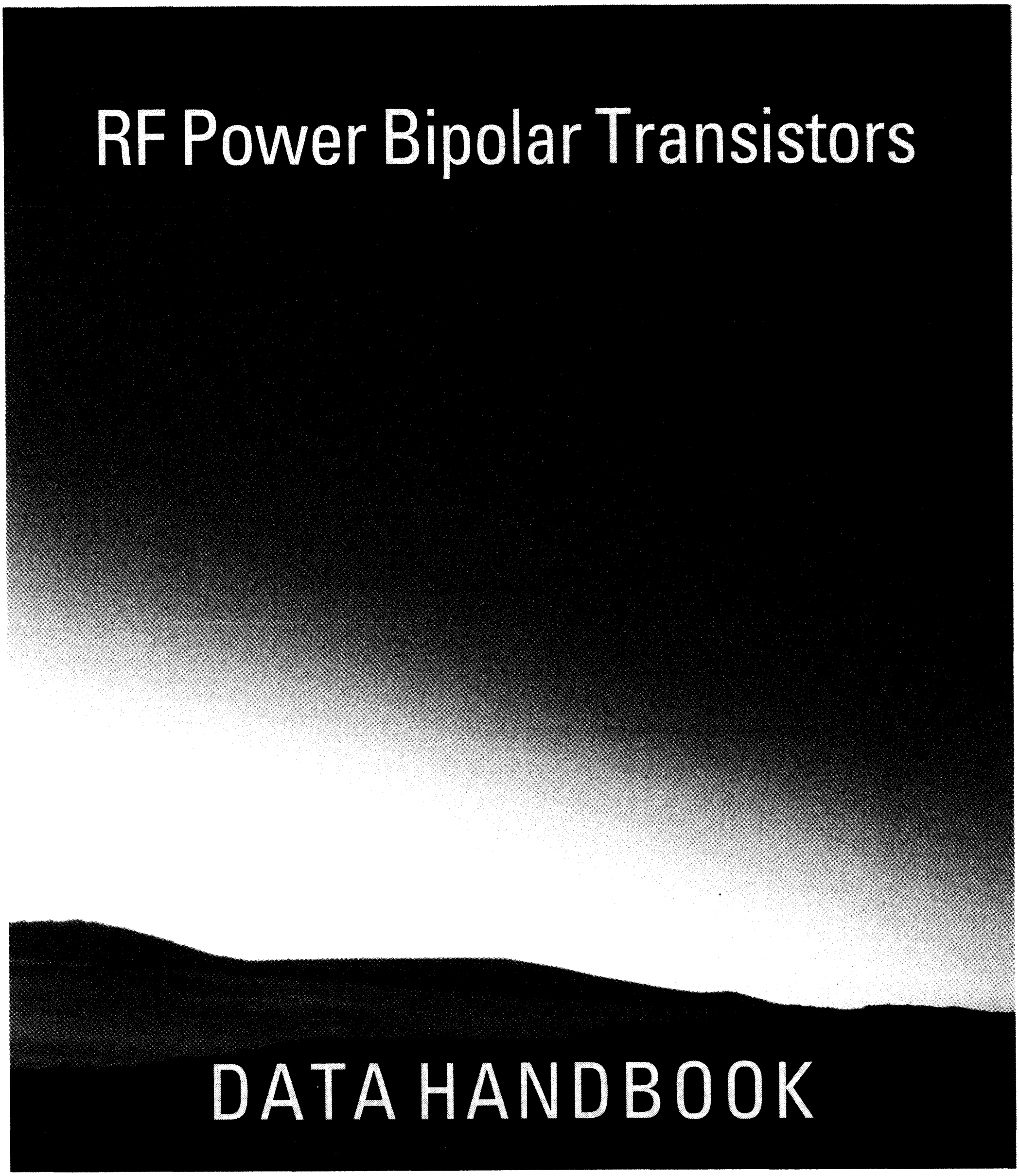
RF Power Bipolar Transistors



DATA HANDBOOK

BOOK SC08a 1993

Philips Semiconductors

PHILIPS

QUALITY ASSURED

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

PRODUCT SAFETY

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

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

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

RF Power Bipolar Transistors

Contents

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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

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ALPHANUMERIC INDEX

Types added to the range since the last issue of handbook SC08a (1991 issue) are shown in bold print.

MAINTENANCE TYPES

Maintenance types are types no longer recommended for equipment production but available for maintenance of existing equipment. Brief data of maintenance types is included in this handbook; full data, if required, can be obtained on request.

MAINTENANCE TYPE	SUCCESSOR
BLW60	BLW60C
BLX13	BLX13C
BLX67	BLW79
BLX68	BLW81
BLX69A	BLU15/12
BLX91A	BLW89
BLX91CB	–
BLX92A	BLW89
BLX93A	BLW91
BLX94A	BLX94C

MAINTENANCE TYPE	SUCCESSOR
BLX96	–
BLX97	–
BLY87A	BLY87C/01
BLY88A	BLY88C/01
BLY89A	BLY89C
BLY90	–
BLY91A	BLY91C/01
BLY92A	BLY92C/01
BLY93A	BLY93C

SELECTION GUIDE

INTRODUCTION

The following tables represent our complete range of bipolar 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.

HF SINGLE SIDEBAND (1.6 to 30 MHz)

P_L (PEP) (W)	V_{CE} (V)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-A; intermodulation distortion d_3, d_5 < −40 dB					
1	12	18	SOT123	BLV10	259
1	12	18	SOT122	BLY87C/01	1067
1	12	18	SOT120	BLY87C	1059
2	12	18	SOT123	BLV11	267
2	12	18	SOT120	BLY88C	1077
6	12	18	SOT123	BLW87	859
6	12	18	SOT120	BLY89C	1095
1.3	26	20	SOT120	BLY91C	1107
1.3	26	20	SOT123	BLV20	291
2.5	26	20	SOT120	BLY92C	1125
2.5	26	20	SOT123	BLV21	299
8	26	20	SOT120	BLX13C	939
10	26	20	SOT123	BLW83	815
15	26	20	SOT120	BLX39	979
17	26	22	SOT123	BLW86	845
35	26	19.5	SOT121	BLW78	777
16	45	19.5	SOT123	BLW50F	725
50	40	19	SOT121	BLW96	901

HF SINGLE SIDEBAND (1.6 to 30 MHz) *(Continued)*

P_L (PEP) (W)	V_{CE} (V)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-AB; intermodulation distortion d_3, d_5 < −30 dB					
10	13.5	18	SOT123	BLV11	267
10	13.5	18	SOT120	BLY88C	1077
15	13.5	18	SOT120	BLY89C	1095
15	13.5	18	SOT123	BLW87	859
30	12.5	19.5	SOT120	BLW60C	737
30	12.5	19.5	SOT123	BLW85	833
80	12.5	12.5	SOT121	BLW99	931
10	28	20	SOT120	BLY92C	1125
10	28	20	SOT123	BLV21	299
25	28	18	SOT120	BLX13C	939
25	28	20	SOT123	BLW83	815
40	28	19	SOT120	BLX39	979
45	28	19	SOT123	BLW86	845
50	28	13	SOT55	BLX14	949
80	28	13	SOT121	BLW76	749
100	28	19	SOT121	BLW78	777
130	28	12	SOT121	BLW77	763
175	28	11.5	SOT121	BLW97	913
65	50	18	SOT123	BLW50F	725
150	50	14	SOT55	BLX15	963
160	50	14	SOT121	BLW95	891
200	50	13.5	SOT121	BLW96	901

VHF (25 to 175 MHz)

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-B; 7.5 to 9.6 V; portable						
0.7	7.5	175	8	TO-39/1	2N4427	1175
1.5	7.5	175	8.4	TO-39/1	BFQ42	47
3	7.5	175	9.4	TO-39/3	BFQ43	57
9	7.5	175	7.4	SOT120	BLW29	663
Class-B; 12.5 to 13.5 V; car mobile						
1	12	175	10	TO-39/1	2N4427	1175
2	13.5	175	11	TO-39/1	BFQ42	47
4	13.5	175	8	TO-39/1	BFS22A	65
4	13.5	175	12	TO-39/3	BFQ43	57
4	13.5	175	12	TO39/3	BFQ43S	57
8	13.5	175	9	SOT123	BLV10	259
8	13.5	175	9	SOT122	BLY87C/01	1067
8	13.5	175	12	SOT120	BLY87C	1059
15	13.5	175	8	SOT123	BLV11	267
15	13.5	175	7.5	SOT122	BLY88C/01	1085
15	13.5	175	10	SOT120	BLW29	663
25	13.5	175	6	SOT123	BLW87	859
25	13.5	175	6	SOT120	BLY89C	1095
28	13.5	175	9	SOT120	BLW31	679
30	12.5	175	9	SOT123	BLV12	275
30	12.5	175	10	SOT120	BLW30	671
40	12.5	175	8.5	SOT123	BLV13	283
40	12.5	175	10	SOT120	BLW40	717
45	12.5	175	6.5	SOT119	BLV45/12	403
45	12.5	175	5	SOT120	BLW60C	737
45	12.5	175	4.5	SOT123	BLW85	833
75	12.5	175	6.5	SOT119	BLV75/12	455

RF power bipolar transistors

VHF (25 to 175 MHz) *(Continued)*

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-B; 28 V base stations						
1	28	175	10	TO-39/1	2N3866	1175
2.5	28	175	10	TO-39/1	2N3553	1159
4	28	175	10	TO-39/1	BFS23A	73
8	28	175	12	SOT123	BLV20	291
8	28	175	12	SOT120	BLY91C	1107
8	28	175	12	SOT122F	BLY91C/01	1115
15	28	175	10	SOT120	BLY92C	1125
15	28	175	10	SOT122F	BLY92C/01	1133
15	28	175	10	SOT123	BLV21	299
25	28	175	9	SOT123	BLW84	825
25	28	175	9	SOT120	BLY93C	1143
45	28	175	7.5	SOT123	BLW86	845
45	28	175	7.5	SOT120	BLX39	979
50	28	175	7	SOT55	BLY94	1151
80	28	175	6.5	SOT121	BLV80/28	465
100	28	150	6	SOT121	BLW78	777
130	28	87.5	7.5	SOT121	BLW77	763

UHF (400 to 512 MHz)

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-B; 7.5 V; portable						
1.2	7.5	470	10	SOT223	BLT50	81
8	7.5	470	6	SOT122D	BLT53	89
Class-B; 12.5 V; car mobile						
1	12.5	470	12	SOT223	BLU56	199
2	12.5	470	6	TO-39/1	BLX65	993
2	12.5	470	9	TO-39/3	BLX65E	1005
2	12.5	470	9	TO-39/3	BLX65ES	1005
2	12.5	470	9	SOT122	BLW79	791
2.5	12.5	470	10	SOT122D	BLU11/SL	153
4	12.5	470	8	SOT122	BLW80	799
5	12.5	470	10.5	SOT122	BLU99	247
7	12.5	470	8.5	SOT122	BLU97	231
10	12.5	470	6	SOT122	BLW81	807
10	12.5	470	8	SOT122A	BLU10/12	145
15	12.5	470	7.8	SOT122	BLU15/12	159
20	12.5	470	6.5	SOT119	BLU20/12	167
30	12.5	470	6	SOT119	BLU30/12	175
45	12.5	470	4.8	SOT119	BLU45/12	191
60	12.5	470	4.4	SOT119	BLU60/12	207
Class-B; 28 V base stations						
1	28	470	10	TO-39/1	2N3866	1175
2	28	470	12	SOT122	BLW89	867
4	28	470	11	SOT122	BLW90	875
10	28	470	9	SOT122	BLW91	883
25	28	470	6.5	SOT122	BLX94C	1023
25	24	470	8	SOT119	BLU30/28	183
30	28	470	8	SOT119	BLU30/28	183
40	28	470	4.5	SOT56	BLX95	1033
50	24	470	7	SOT119	BLU60/28	215
60	28	470	7	SOT119	BLU60/28	215

SHF (900 MHz)

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-B; 7.5 V; portable						
0.5	7.5	900	6.8	SOT103	BLU98	239
0.75	7.5	900	7	SOT172D	BLT90/SL	113
0.8	7.5	900	6	SOT223	BLT80	97
1.2	7.5	900	6	SOT223	BLT81	105
1.5	7.5	900	6	SOT172D	BLT91/SL	121
3	7.5	900	7	SOT122D	BLT92/SL	129
6	7.5	900	5.5	SOT122D	BLT93/SL	137
Class-B; 12.5 V; car mobile						
0.5	12.5	900	8	SOT103	BLU98	239
1	12.5	900	7	SOT223	BLU86	223
1	12.5	900	7.5	SOT172	BLV90	475
1	12.5	900	7.5	SOT172D	BLV90/SL	483
2	12.5	900	6.5	SOT172	BLV91	491
2	12.5	900	6.5	SOT172D	BLV91/SL	499
4	12.5	900	7	SOT122	BLU99	247
4	12.5	900	7	SOT122D	BLU99/SL	247
4	12.5	900	7.5	SOT171	BLV92	507
8	12.5	900	6.5	SOT171	BLV93	515
12	12.5	900	6.5	SOT171	BLV193	607
15	12.5	900	6	SOT171	BLV94	525
16	12.5	900	7	SOT171	BLV194	619
22	12.5	900	5.5	SOT171	BLV95	535

SHF (900 to 960 MHz)

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-AB and class-B; 24 to 26 V base stations						
2	24	900	8	SOT172	BLV99	563
2	24	900	8	SOT172D	BLV99/SL	571
4	24	900	11.5	SOT171	BLV103	599
8	24	960	8	SOT171	BLV100	579
15	24	960	7.5	SOT171	BLV98CE	553
25	25	900	9	SOT324	BLV945A	627
25	25	960	8.5	SOT324	BLV945B	639
30	26	960	10	SOT273	BLV946	641
35	24	960	7	SOT171	BLV97CE	543
50	26	900	8.5	SOT273	BLV101A	587
50	26	960	7.5	SOT273	BLV101B	587
100	26	960	9	SOT262A2	BLV947	643
150	26	960	6.5	SOT262A2	BLV948	645

FM BROADCAST (87 to 108 MHz)

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	ENVELOPE	TYPE NUMBER	PAGE
Class-B						
1	28	87.5 to 108	18	TO-39/3	2N3866	1175
4	28	87.5 to 108	20	SOT122	BLW90	875
15	28	87.5 to 108	10	SOT123	BLV21	299
45	28	87.5 to 108	7.5	SOT123	BLW86	845
45	28	87.5 to 108	7.5	SOT120	BLX39	979
80	28	87.5 to 108	7	SOT121	BLV80/28	465
80	28	87.5 to 108	7.9	SOT121	BLW76	749
100	28	87.5 to 108	6	SOT121	BLW78	777
175	28	87.5 to 108	10	SOT119	BLV25	307
250	28	87.5 to 108	10.5	SOT179	BLV37	383

TV TRANSPOSERS/TRANSMITTERS

P_L (W)	V_{CE} (V)	f (MHz)	G_p (dB)	d_{im} (dB)	I_C (mA)	ENVELOPE	TYPE NUMBER	PAGE
Class-A; bands I (41 to 68 MHz) and III (174 to 230 MHz)								
1.5	25	225	18	–60	460	SOT122	BLV30	315
5	25	225	15	–58	800	SOT122	BLV31	325
10	25	225	16	–55	1500	SOT160	BLV32F	335
16	25	225	13.5	–55	3200	SOT119	BLV33F	357
19	25	225	9	–55	3200	SOT147	BLV33	345
Class-AB; bands I (41 to 68 MHz) and III (174 to 230 MHz)								
10	25	225	15	–	460	SOT122	BLV30	315
20	25	225	12	–	800	SOT122	BLV31	325
30	25	225	13	–	1500	SOT160	BLV32F	335
85	28	225	10.5	–	4250	SOT119	BLV33F	357
90	28	225	6.5	–	4460	SOT147	BLV33	345
115	28	225	10	–	2 x 3750	SOT161	BLV36	371
225	35	225	8	–	2 x 6000	SOT179	BLV38	393
Class-A; bands IV and V (470 to 860 MHz)								
0.12	10	860	10	–60	70	SOT37	BFR96S	note 2
0.3	15	860	11	–60	120	SOT122	BFQ34	note 2
0.5	25	860	11	–60	150	SOT122	BLW32	687
0.7	15	860	10	–60	240	SOT122	BFQ68	note 2
1	25	860	10	–60	300	SOT122	BLW33	697
1.8	25	860	9	–60	600	SOT122	BLW34	707
3.5	25	860	5	–60	860	SOT48/2	BLX98	1047
3.5	25	860	6.5	–60	850	SOT122	BLW98	921
6	25	860	8	–60	2 x 850	SOT161	BLV57	411
25	25	860	10	–45	2 x 1600	SOT289	BLV58	425
Class-AB; bands IV and V (470 to 860 MHz)								
30 (note 1)	25	860	7	–	2400	SOT171	BLV59	435
38 (note 1)	25	860	6.5	–	2 x 1250	SOT161	BLV57	411
150 (note 1)	28	860	8.5	–	2 x 400	SOT262A2	BLV62	445

Notes

1. At 1 dB power gain compression.
2. See Handbook SC14, 'Wideband Transistors and Wideband Hybrid IC Modules'.

LINE-UPS

INTRODUCTION

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 can be found in the application reports book 'Bipolar and MOS Transmitting Transistors' (9398 074 40011).

SSB TRANSMITTERS (1.5 to 30 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (PEP) (W)	V_{CE} (V)	S = STUD F = FLANGE
30	BLY87C (note 1)	2 x BLY89C		30	13	S
30	BLV10 (note 1)	2 x BLW87		30	13	F
50	BLY88C (note 1)	2 x BLW60C		50	13	S
50	BLV11 (note 1)	2 x BLW85		50	13	F
100	BLY89C (note 1)	4 x BLW60C		100	13	S
100	BLY87 (note 1)	4 x BLW85		100	13	F
140	2 x BLW87 (note 1)	2 x BLW99		150	13	F
50	BLY91C (note 1)	2 x BLX13C		50	28	S
50	BLV20 (note 1)	2 x BLW83		50	28	F
150	BLW83 (note 1)	2 x BLW76		150	28	F
250	2 x BLW83 (note 1)	2 x BLW77		250	28	F
220	2 x BLW86 (note 1)	2 x BLW97		300	28	F
500	2 x BLW86	4 x BLW77		450	28	F
680	2 x BLW78 (note 1)	4 x BLW97		600	28	F
300	2 x BLX13C (note 2)	2 x BLX15		250	50	S
300	2 x BLW83 (note 2)	2 x BLW96		350	50	F
600	2 x BLX39 (note 2)	4 x BLX15		500	50	S
600	2 x BLW50F (note 1)	4 x BLW95		500	50	F
40	BLY91C (note 2)	2 x BLW78 (note 2)	8 x BLX15	1000	50	S/F
40	BLV20 (note 2)	4 x BLW50F	8 x BLW96	1200	50	F

Notes

1. Class-A operation.
2. 28 V supply voltage in class-A operation.

MOBILE TRANSMITTERS (68 to 87.5 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
20	2N4427	BLY87C	8	13	S
20	2N4427	BLV10	8	13	F
35	2N4427	BLW29	14	13	S
10	BSX190	BLY32	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 to 87.5 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
65	BFS23A	BLY93C		25	28	S
65	BFS23A	BLW84		25	28	F
125	BLW89	BLX39		50	28	S
15	2N3866	BLV21	BLW78	100	28	F
50	2N3866 (note 1)	BLY93C (note 1)	BLX15	150	50	S
50	2N3866 (note 1)	BLW84 (note 1)	BLW95	150	50	F

Note

1. 28 V supply voltage in class-A operation.

FM BROADCAST TRANSMITTERS (87.5 to 108 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
100	BLW90	BLX39		50	28	S
40	2N3866	BLV21	BLW78	100	28	F
100	BLW90	BLW86	2 x BLV25	300	28	F
500	BLV21	BLW78	2 x BLV37	500	28	F
600	BLV21	BLV25	4 x BLV37	1000	28	F

AM AIRCRAFT TRANSMITTERS (118 to 136 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	$P_{L(carr)}$ (W)	V_{CE} (V)	S = STUD F = FLANGE
110	BLX92C	BLY93C		6	13/28	S
240	BLY91C	BLX39		12	13/28	S
240	BLV20	BLW86		12	13/28	F
100	BLW89	BLY93C	BLW78	25	13/28	S/F
100	BLW89	BLW84	BLW78	25	13/28	S/F

AM AIRCRAFT TRANSMITTERS (100 to 400 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	$P_{L(carr)}$ (W)	V_{CE} (V)	S = STUD F = FLANGE
40	BLX91C	2 x BLW90	2 x BLX94C	40	28	S
120	BLX91C	2 x BLW91	2 x BLU30/28	60	28	S/F
500	BLW90	2 x BLX94C	2 x BLU60/28	120	28	S/F

PORTABLE AND MOBILE TRANSMITTERS (132 to 174 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
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	12.5	F
200	BFQ43	BLW30		30	12.5	S
200	BFQ43	BLV12		30	12.5	F
100	2N4427	BLW29	BLV45/12	45	12.5	S/F
115	BGY43	BLV45/12		45	12.5	F
120	BFQ42	BLW29	BLV75/12	75	12.5	S/F

BASE STATIONS (132 to 174 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
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 to 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 to 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	2 x BLV38	225	25/28/35
35	BLV30	2 x BLV33F	4 x BLV38	420	25/28/35
75	2 x BLV30	4 x BLV33F	8 x BLV38	800	25/28/35

PORTABLE AND MOBILE TRANSMITTERS (400 to 512 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
15	BFR96 (note 1)	BLT50	BLW80	2	7.5	S
45	BLT50	BLU99		3	7.5	S
15	BFR96S (note 1)	BLU99	BLW81	10	12.5	S
250	BLU99	BLU15/12		15	12.5	S
400	BLU99	BLU20/12		20	–	S/F
280	BLU99	BLU20/12	BLU45/12	45	12.5	S/F
400	BLU99	BLU20/12	BLU60/12	60	12.5	S/F

BASE STATIONS (400 to 470 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
40	BLW89	BLW91	BLX94C	30	28	S
220	BLW90	BLX94C	BLU60/28	60	28	S/F
60	BLW89	BLW91	BLU30/28	30	28	S/F

TV TRANSPOSERS (Band IV/V: 470 to 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 (note 1)	BFQ68 (note 1)	2 x BFQ68 (note 1)		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
3	BFQ68	BLW34	BLW98	2 x BLV58	25 (note 2)	30	25

Notes

1. See Handbook SC14 'RF Wideband Transistors, Video Transistors and Modules'.
2. 25 W sync, –dB (–8/–16/–7 dB).

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

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	$P_{o\ sync}$ (W) (note 1)	V_{CE} (V)
12	BFR96S (note 2)	BFQ68 (note 2)	2 x BLW34	2 x BLV59	60	28
15	BFQ34	BLW34	BLV58	BLV62	150	28
30	BFQ34	2 x BLW33	2 x BLV58	4 x BLV62	500	28

Notes

1. With linearity correction.
2. See Handbook SC14 ‘RF Wideband Transistors, Video Transistors and Modules’.

PORTABLE TRANSMITTERS (860 to 960 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
1	BFG540	BLT80	BLT81	1.2	6.0	–
15	BFG91A	BLT80	BLT92/SL	3	7.5	–

MOBILE TRANSMITTERS (860 to 960 MHz)

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)	S = STUD F = FLANGE
60	BLU98	BLV91	BLV93		8	12.5	S/F
100	BLU86	BLV193	BLV194		15	12.5	S/F
50	BLV98	BLV91	BLV93	BLV95	22	12.5	S/F

BASE STATIONS (860 to 960 MHz), CLASS-AB OPERATION

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)	f (MHz)
64	BLV99SL	BLV100	BLV101A		45	25	900
100	BLV99SL	BLV100	BLV101B		45	25	960
7	BLV99SL	BLV103	BLV98CE	2 x BLV101A	85	25	960
8	BLV99SL	BLV103	BLV97CE	2 x BLV101	85	25	960
9	BLV99SL	BLV103	BLV945A	BLV948	120	25	900
7	BLV99SL	BLV103	BLV945A	BLV948	150 (PEP)	25	900 (note 1)

Note

1. IMD –30 dB.

GENERAL

QUALITY

Total Quality Management

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

quality assurance

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

partnerships with customers

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

partnerships with suppliers

ship-to-stock, statistical process control and ISO 9000 audits

quality improvement programme

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

Advanced quality planning

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

Product conformance

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

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

Product reliability

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

Customer responses

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

PRO ELECTRON TYPE NUMBERING SYSTEM

Basic type number

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

FIRST LETTER

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

- A germanium or other material with a band gap of 0.6 to 1 eV
- B silicon or other material with a band gap of 1 to 1.3 eV
- C gallium arsenide (GaAs) or other material with a band gap of 1.3 eV or more
- R compound materials, e.g. cadmium sulphide.

SECOND LETTER

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

A	diode; signal, low power
B	diode; variable capacitance
C	transistor; low power, audio frequency
D	transistor; power, audio frequency
E	diode; tunnel
F	transistor; low power, high frequency
G	multiple of dissimilar devices/miscellaneous devices; e.g. oscillators. Also with special third letter, see under '*Serial number*'
H	diode; magnetic sensitive
L	transistor; power, high frequency
N	photocoupler
P	radiation detector; e.g. high sensitivity photo-transistor; with special third letter
Q	radiation generator; e.g. LED, laser; with special third letter
R	control or switching device; e.g. thyristor, low power; with special third letter
S	transistor; low power, switching
T	control and switching device; e.g. thyristor, power; with special third letter
U	transistor; power, switching
W	surface acoustic wave device
X	diode; multiplier, e.g. varactor, step recovery
Y	diode; rectifying, booster
Z	diode; voltage reference or regulator, transient suppressor diode; with special third letter.

SERIAL NUMBER

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

Version letter

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

RATING SYSTEMS

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

Definitions of terms used

ELECTRONIC DEVICE

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

CHARACTERISTIC

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

BOGEY ELECTRONIC DEVICE

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

RATING

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

RATING SYSTEM

The set of principles upon which ratings are established and which determine their interpretation. The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the

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

object of ensuring that the working conditions do not exceed the ratings.

Absolute maximum rating system

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

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

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

Design maximum rating system

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

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

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

Design centre rating system

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

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

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

LETTER SYMBOLS

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

Basic letters

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

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

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

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

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

Subscripts

Upper-case subscripts are used for the indication of:

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

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

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

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

A, a	anode
amb	ambient
(AV), (av)	average value
B, b	base
(BO)	breakover
(BR)	breakdown
case	case
C, c	collector
C	controllable
D, d	drain
E, e	emitter
F, f	fall, forward (or forward transfer)
G, g	gate
H	holding
h	heatsink
I, i	input
j-a	junction to ambient
j-mb	junction to mounting base
K, k	cathode
L	load
M, m	peak value
(min)	minimum
(max)	maximum
mb	mounting base
O, o	as third subscript: the terminal not mentioned is open-circuit
(OV)	overload
P, p	pulse
Q, q	turn-off
R, r	as first subscript: reverse (or reverse transfer), rise. As second subscript: repetitive, recovery. As third subscript: with a specified resistance between the terminal not mentioned and the reference terminal
(RMS), (rms)	root-mean-square value
S, s	as first subscript: series, source, storage, stray, switching. As second subscript: surge (non-repetitive). As third subscript: short circuit between the terminal not mentioned and the reference terminal
stg	storage
th	thermal
TO	threshold
tot	total
W	working
X, x	specified circuit
Z, z	reference or regulator (zener)
1	input (four-pole matrix)
2	output (four-pole matrix).

Applications and examples

TRANSISTOR CURRENTS

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

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

TRANSISTOR VOLTAGES

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

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

SUPPLY VOLTAGES OR CURRENTS

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

Examples: V_D=C_C, I_{EE}.

A reference terminal is indicated by a third subscript.

Example: V_{CCE}.

DEVICES WITH MORE THAN ONE TERMINAL OF THE SAME KIND

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

Examples:

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

MULTIPLE DEVICES

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

Examples:

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

ELECTRICAL PARAMETERS

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

Examples:

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

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

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

Examples:

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

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

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

FOUR-POLE MATRIX PARAMETERS

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

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

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

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

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

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

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

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

Examples:

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

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

FLANGE-MOUNTED POWER TRANSISTORS

Mounting recommendations

- Ensure holes in heatsinks are free from burrs.
- The minimum depth of tapped holes in heatsinks is 6 mm.
- Use 4-40 UNC-2A cheese-head screws with a flat washer to spread the joint pressure.
- 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% Al). The thickness of the heatsink should be increased proportionally for transistors dissipating more power.
- The minimum flatness of the mounting area is 0.02 mm.
- The roughness of the mounting area should be less than 0.5 µm.
- Avoid, as much as possible, use of flux or flux solutions because flux can penetrate even hermetically sealed ceramic-capped transistors. Tin and wash the printed-circuit boards **before** mounting the power transistors, then solder the transistors into place without using flux.
- Transistor leads may be tinned by dipping them full-length into a solder bath at a temperature of about 230 °C. No flux should be used during tinning.
- Recommended heatsink compounds:
  WPS II (silicone-free) from Austerlitz-Electronics;
  Comp. Trans. from KF; 340 from Dow Corning;
  Trans-Heat from E. Friis-Mikkelsen.
- When a transistor is removed from a heatsink, the flange will, almost certainly, have been distorted by the joint pressure. Grinding or lapping of the flange to the required flatness and smoothness is necessary before the transistor is remounted.

Mounting sequence

- Apply a thin layer of evenly-distributed heatsink compound to the flange.
- Position the device with flat washers in place.
- Tighten the screws until finger-tight (0.05 Nm).
- Further tighten the screws until the specified torque is reached (do not lubricate); for torques, refer to the Envelopes section of this data handbook.
- To lock mounting screws, allow about 30 minutes for them to bed-down after the specified torque has been applied, re-tighten to the specified torque and apply locking paint.

Thermal behaviour

The coefficients of linear thermal expansion (α) shown in Table 1 can be used to calculate the thermal expansion of the different header parts.

Table 1 Coefficients of linear thermal expansion

SYMBOL	ENVELOPE	FLANGE	LEAD FRAME	UNIT
α	SOT119 SOT121 SOT123 SOT160 SOT161 SOT171 SOT273 SOT279	18.3×10^{-6}	7.5×10^{-6} to 8.5×10^{-6}	K^{-1}
	SOT179 SOT262 SOT268 SOT324	6.5×10^{-6}	7.5×10^{-6} to 8.5×10^{-6}	K^{-1}
	SOT289	6.5×10^{-6}	5.7×10^{-6} to 6.2×10^{-6}	K^{-1}

MOUNTING CAPSTAN HEADERS

Mounting recommendations

- Avoid, as much as possible, use of flux or flux solutions because flux can penetrate even hermetically sealed ceramic-capped transistors. Tin and wash the printed-circuit boards **before** mounting the power transistors, then solder the transistors into place without using flux.
- Transistor leads may be tinned by dipping them full-length into a solder bath at a temperature of about 230 °C. No flux should be used during tinning.
- Heatsink surfaces at the mounting hole are to be flat, parallel and free of burrs or oxidation.
- Do not use locking washers, their locking action can deteriorate in time due to the comparative softness of most heatsink materials. A flat washer can be used to spread the joint pressure.
- Ensure a positive clearance exists between leads and printed circuit board, this prevents upward lead-bending and consequent damage to the encapsulation
- Recommended heatsink compounds: WPS II (silicone-free) from Austerlitz-Electronics; Comp. Trans. from KF; 340 from Dow Corning; Trans-Heat from E. Friis-Mikkelsen.
- The full mounting nut torque should be applied only once in the life of a transistor. For pre-assembly testing, apply no more than two-thirds of the specified torque.

Mounting sequence

- Apply a thin layer of evenly-distributed heatsink compound to the heatsink.
- Position the device with a flat washer in place.
- Tighten the screws until finger-tight (0.05 Nm).
- Further tighten the screws until the specified torque is reached (do not lubricate); for torques, refer to the Envelopes section of this data handbook.
- To lock mounting screws, allow about 30 minutes for them to bed-down after the specified torque has been applied, re-tighten to the specified torque and apply locking paint.

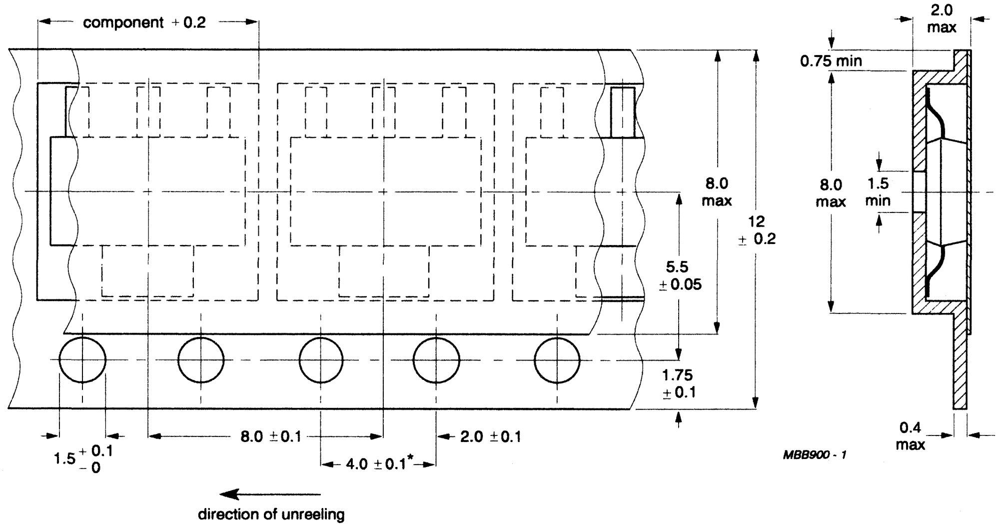
Table 2 Mounting data for capstan headers

ITEM	MOUNTING STUD DIAMETER			TOLERANCE	UNIT
	$^{1}/_{4}$″	$^{3}/_{8}$″	$^{1}/_{2}$″		
Thread	8-32 UNC-2A(B)	10-32 UNF-2A(B)	$^{1}/_{4}$″ × 28 UNF-2A(B)	–	–
Maximum diameter of threaded stud	4.14	4.80	6.33	–	mm
Diameter of heatsink mounting hole	4.15	4.85	6.35	+0.05/–0	mm
Mounting nut thickness	3.5 and 5	5	5.5	–	mm
Mounting nut torque:					
minimum	0.75	1.5	2.3		Nm
maximum	0.85	1.7	2.7		Nm
Distance from heatsink to printed-circuit board	2.9	3.8	4.8	+0/–0.2	mm

TAPE and REEL PACKING (SOT223)

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

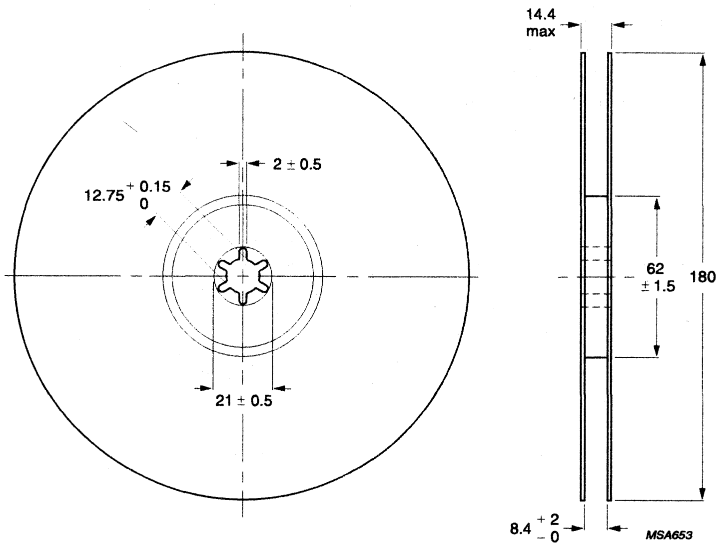
Packing quantities for SOT223 are 1000 pieces per 7-inch (180 mm) reel.



Dimensions in mm.

Tolerance over any 10 pitches: ±0.2 mm.

Fig.1 Specification for 12 mm tape, 7-inch reel (SOT223).



Dimensions in mm.

Fig.2 Reel for blister tape.

MOUNTING AND SOLDERING (SOT223)

Mounting methods

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

No all electronic components are available as surface mounting types and this often leads to the mixing of through-hole with surface mounting components on one substrate (a mixed print). The mix of components affects the soldering methods that can be applied. A substrate having SMDs mounted on one or both sides but no through-hole components is likely to be suitable for reflow or wave soldering. A double-sided mixed print that has through-hole components and some SMDs on one side and densely packed SMDs on the other normally undergoes a sequential combination of reflow and wave soldering. When the mixed print has only through-hole components on one side and all SMDs on the other, wave soldering is usually applied.

Reflow soldering

This is the preferred soldering technique for SOT223 components.

SOLDER PASTE

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

Screen printing

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

Stencilling

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

Dispensing

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

Pin transfer

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

REFLOW TECHNIQUES

Thermal conduction

The prepared substrates are carried on a conveyor belt, first through a preheating stage and then through a soldering stage. Heat is transferred to the substrate by conduction through the belt. Figure 3 shows a theoretical time/temperature relationship for thermal conduction reflow soldering. This method is particularly suited to thick film substrates and is often combined with infrared heating.

Infrared

An infrared oven has several heating elements giving a broad spectrum of infrared radiation, normally above and below a closed loop belt system. There are separate zones for preheating, soldering and cooling. Dwell time in the soldering zone is kept as short as possible to prevent damage to components and substrate. A typical heating profile is shown in Fig.4. This reflow method is often applied in double-sided prints.

Vapour phase

A substrate is immersed in the vapours of a suitable boiling liquid. The vapours transfer latent heat of condensation to the substrate and solder reflow takes place. Temperature is controlled precisely by the boiling point of the liquid at a given pressure. Some systems employ two vapour zones, one above the other. An elevator tray, suspended from a hoist mechanism passes the substrate vertically through the first vapour zone into the secondary soldering zone and then hoists it out of the vapour to be cooled. A theoretical time/temperature relationship for this method is shown in Fig.5.

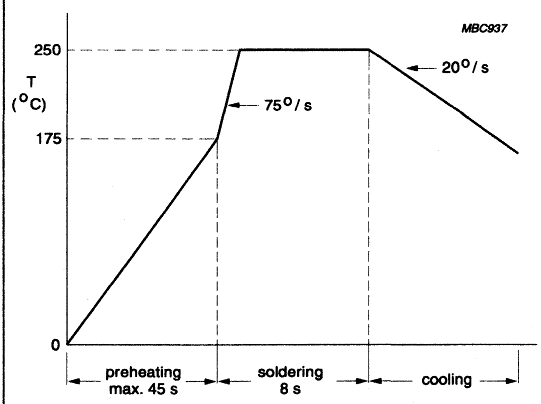


Fig.3 Theoretical time/temperature curve for a typical thermal conduction reflow cycle.

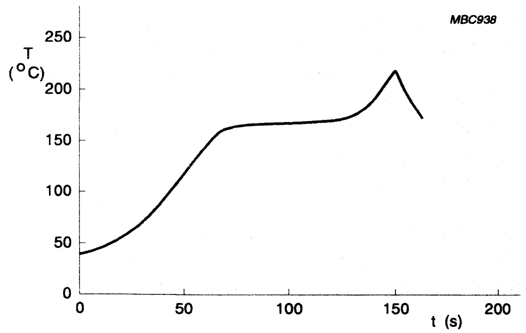


Fig.4 Typical temperature profile of an infrared oven operating at a belt speed of 0.41 m/min.

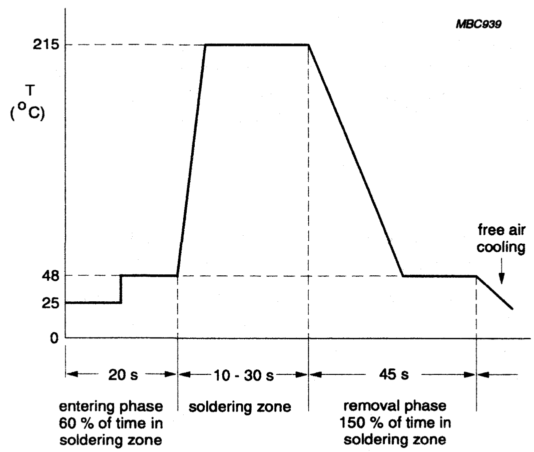


Fig.5 Theoretical time/temperature curve relationship for dual vapour reflow soldering.

Wave soldering

This soldering technique can be applied to SOT223 components.

ADHESIVE APPLICATION

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

Pin transfer method

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

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

Screen printing method

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

Pressure syringe method

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

FLUXING

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

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

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

Foam

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

Spray

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

Wave

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

PRE-HEATING

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

SOLDERING

Wave soldering is usually the best method to use when high throughput rates are required. The single-wave soldering principle (Fig.6) is the most straight forward method and can be used on simple substrates with two-terminal SMD components. More complex substrates with increased circuit density and closer spacing of conductors can pose the problems of nonwetting (dry joints) and solder bridging. Bridging can occur across the closely spaced leads of multi-leaded devices as well as across adjacent leads on neighbouring components. Nonwetting is usually caused by components with plastic bodies. The plastic is not wetted by solder and creates a depression in the solder wave, which is augmented by surface tension. This can cause a shadow behind the component and prevent solder from reaching the joint surfaces. A smooth laminar solder wave is required to avoid bridging and a high pressure wave is needed to completely cover the areas that are difficult to wet. These conflicting demands are difficult to attain in a single wave but dual wave techniques go a long way in overcoming the problem.

In a dual wave machine (Fig.7), the substrate first comes into contact with a turbulent wave which has a high vertical velocity. This ensures good solder contact with both edges of the components and prevents joints from being missed. The second smooth laminar wave completes the formation of the solder fillet, removes excess solder and prevents bridging. Figure 8 indicates the time/temperature relationship measured at the soldering site in dual wave soldering.

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

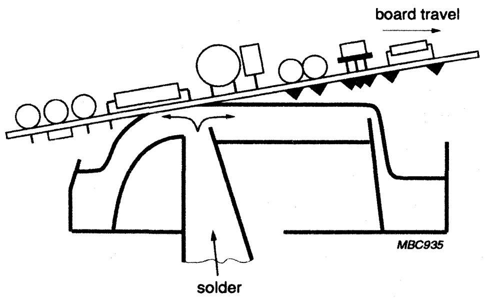


Fig.6 Single wave soldering principle.

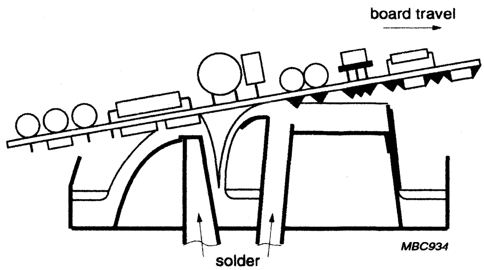


Fig.7 Dual wave soldering principle.

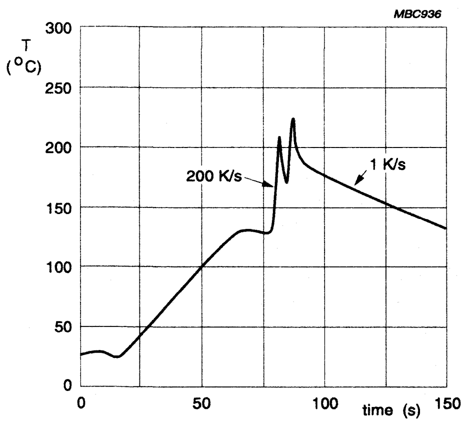


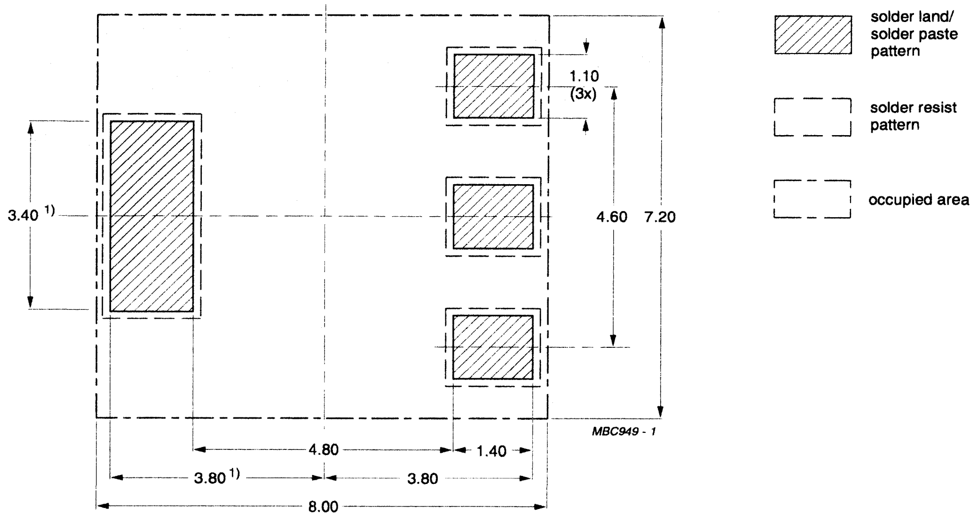
Fig.8 Typical time-temperature curve measured at the soldering site.

Footprint design

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

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

SOT223 FOOTPRINTS

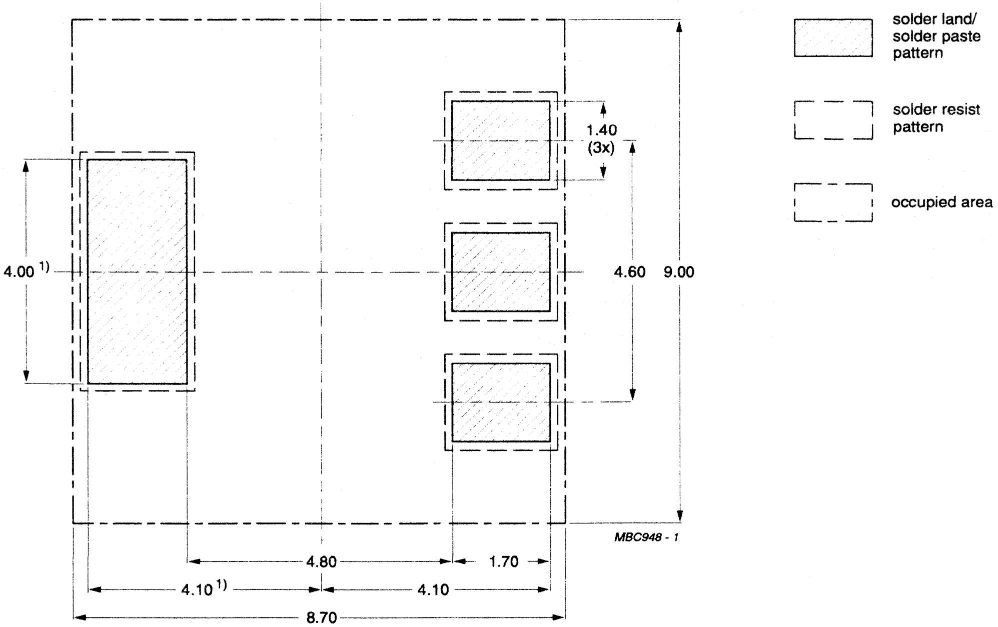


Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.9 Reflow soldering footprint for SOT223; typical dimensions.



Dimensions in mm.

Placement accuracy: ±0.25 mm.

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

Fig.10 Wave soldering footprint for SOT223; typical dimensions.

Hand soldering microminiature components

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

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

THERMAL CONSIDERATIONS

Thermal resistance

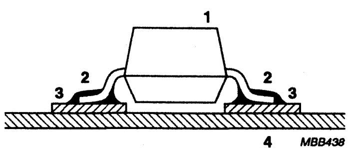
Circuit performance and long-term reliability are affected by the temperature of the transistor die. Normally, both are improved by keeping the die temperature (junction temperature) low.

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

Devices lose most of their heat by conduction when mounted on a substrate. Referring to Fig.11, heat conducts from its source (the junction) via the envelope leads and soldered connections to the substrate. Some heat radiates from the envelope into the surrounding air where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The elements of thermal resistance shown in Fig.12 are defined as follows:

$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base
$R_{th\ j\text{-}c}$	thermal resistance from junction to case
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point
$R_{th\ s\text{-}a}$	thermal resistance from soldering point to ambient
$R_{th\ c\text{-}a}$	thermal resistance from case to ambient ($R_{th\ s\text{-}a}$ and $R_{th\ c\text{-}a}$ are the same for most envelopes)
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient.



Heat radiates from the envelope (1) to ambient.

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

Fig.11 Heat losses.

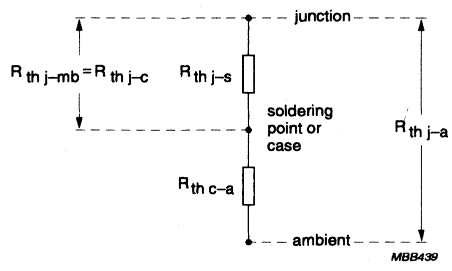


Fig.12 Representation of thermal resistance paths of a device mounted on a substrate or printed board.

The temperature at the junction depends on the ability of the envelope and its mounting to transfer heat from the junction region to the ambient environment. The basic relationship between junction temperature and power dissipation is:

$T_{j\ max} = T_{amb} + P_{tot\ max} (R_{th\ j\text{-}s} + R_{th\ s\text{-}a})$
$= T_{amb} + P_{tot\ max} (R_{th\ j\text{-}a})$

where

$T_{j\ max}$ is the maximum junction temperature

T_{amb} is the ambient temperature

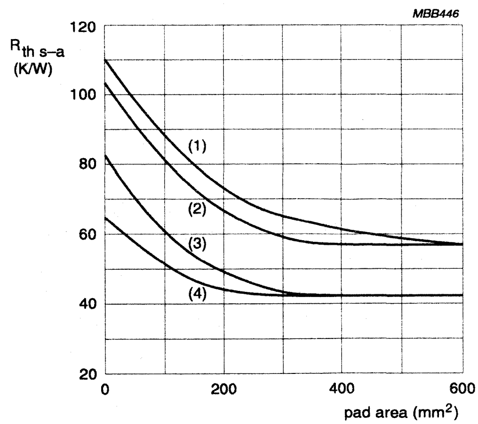
$P_{tot\ max}$ is the maximum power handling capability of the device, including the effects of external loads when applicable.

In the expression for $T_{j\ max}$, only T_{amb} and $R_{th\ s\text{-}a}$ can be varied by the user. The package mounting technique and the flow of cooling air are factors that affect $R_{th\ s\text{-}a}$. The device power dissipation can be controlled to a limited extent but under recommended usage, the supply voltage and circuit loading dictate a fixed power maximum. The $R_{th\ j\text{-}s}$ value is essentially independent of external mounting method and cooling air; but is sensitive to the materials used in the envelope construction, the die bonding method and the die area, all of which are fixed.

Values of $T_{j\ max}$ and $R_{th\ j\text{-}s}$ or $R_{th\ j\text{-}c}$ are given in the device data sheets. For applications where the temperature of the case is stabilized by a large or temperature-controlled heatsink, the junction temperature can be calculated from $T_j = T_{case} + P_{tot} \times R_{th\ j\text{-}c}$ or, using the soldering point definition, from $T_j = T_{solder} + P_{tot} \times R_{th\ j\text{-}s}$.

Thermal resistance ($R_{th\ s\text{-}a}$ and $R_{th\ c\text{-}a}$)

The thermal resistance from soldering point to ambient and that from case to ambient depends on the shape and material of the tracks and substrate as illustrated in Figs 13 and 14. Standard mounting conditions to set the maximum power ratings of the SOT223 envelope are shown in Fig.15. This shows single-sided 35 µm copper-clad epoxy fibre-glass print, 1.5 mm thick. the tracks are fully solder-tinned and the shaded areas shown are copper.



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

Fig.13 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of pad area on different configurations of FR4 epoxy fibre-glass circuit board.

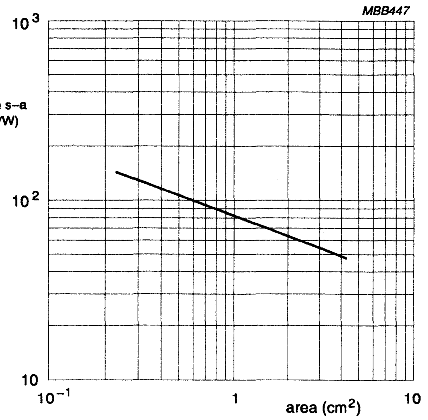


Fig.14 Thermal resistance ($R_{th\ s\text{-}a}$) as a function of area of ceramic substrate.

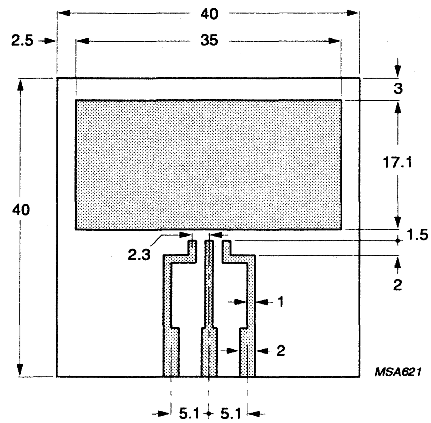


Fig.15 Test circuit for SOT223.

DEVICE DATA

in alphanumeric sequence

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-wideband 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

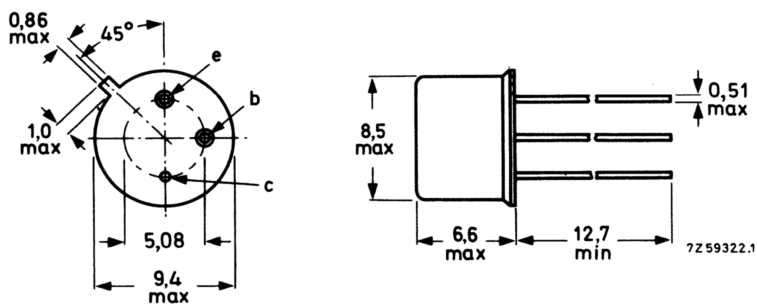
R.F. performance up to T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W

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-39/1; collector connected to case.

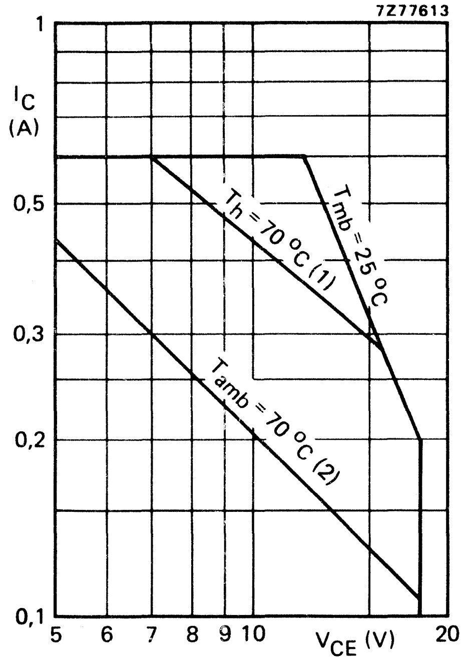


Maximum lead diameter is guaranteed only for 12,7 mm.

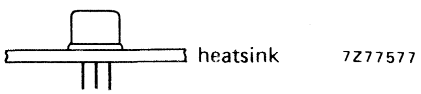
RATINGS

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.

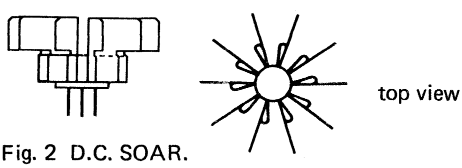
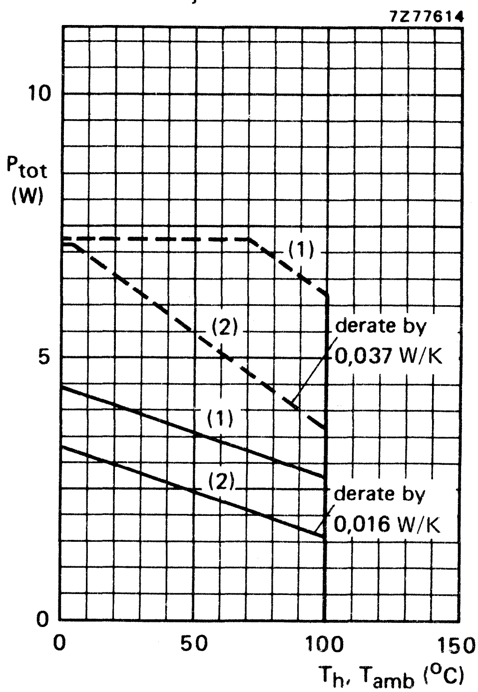


Fig. 2 D.C. SOAR.



(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 °C

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 Ω	E_{SBR}	> 0,5 mJ
D.C. current gain * I_C = 0,25 A; V_{CE} = 5 V	h_{FE}	typ. 30 10 to 60
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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

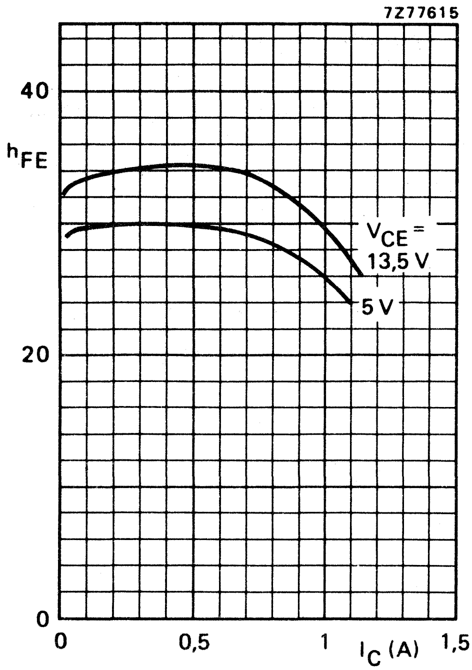


Fig. 4 Typical values; T_j = 25 °C.

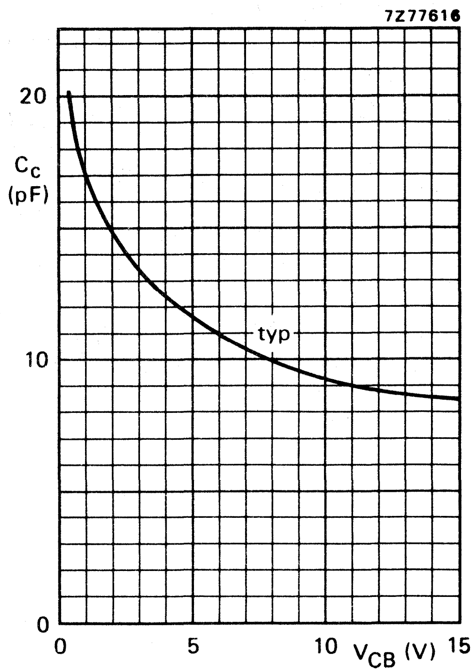


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

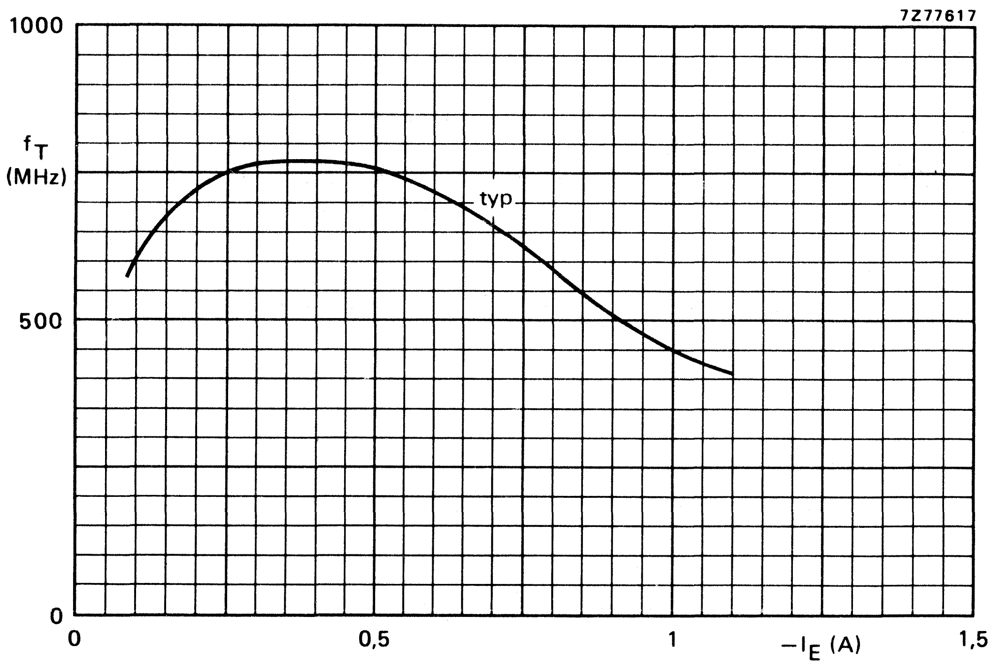


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

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 K/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	—	—

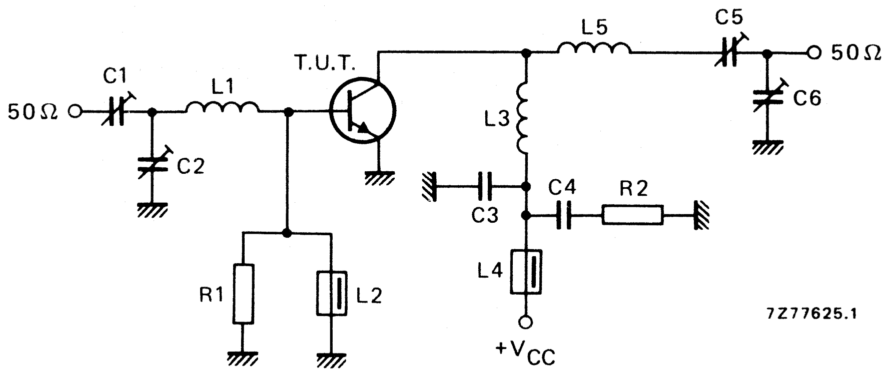


Fig. 7 Test circuit; c.w. class-B.

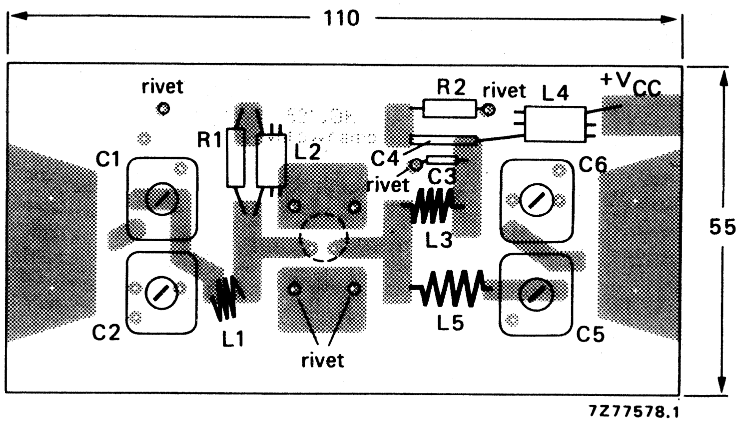
List of components:
C1 = C2 = C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor
C6 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)

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)



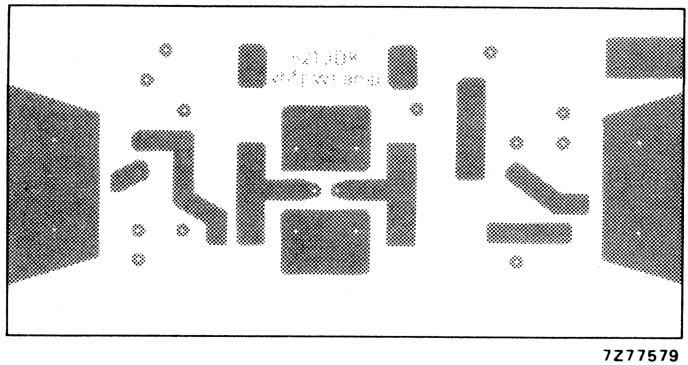


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

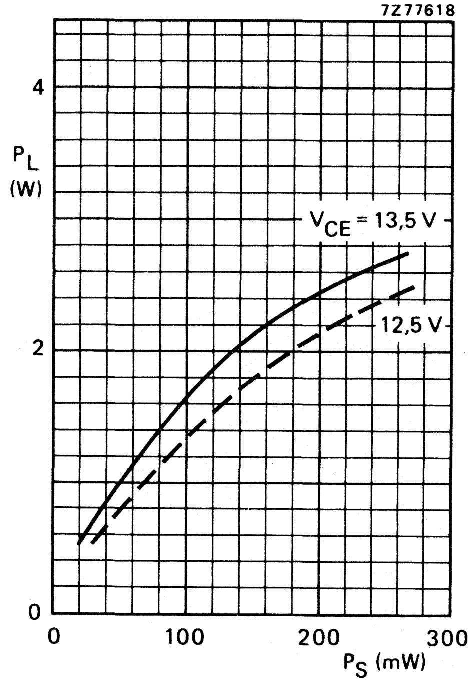


Fig. 9 Typical values; f = 175 MHz;
T_{amb} = 25 °C; $R_{th\ c\text{-}a}$ = 32 K/W.

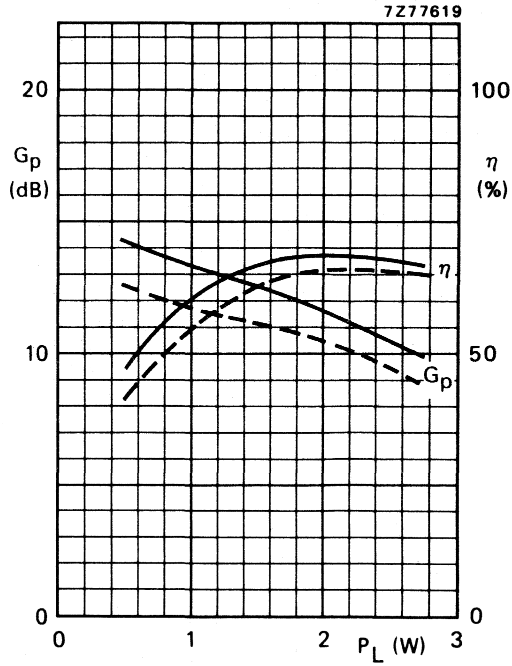


Fig. 10 Typical values; f = 175 MHz;
T_{amb} = 25 °C; —— V_{CE} = 13,5 V;
– – – V_{CE} = 12,5 V; $R_{th\ c\text{-}a}$ = 32 K/W.

APPLICATION INFORMATION (continued)

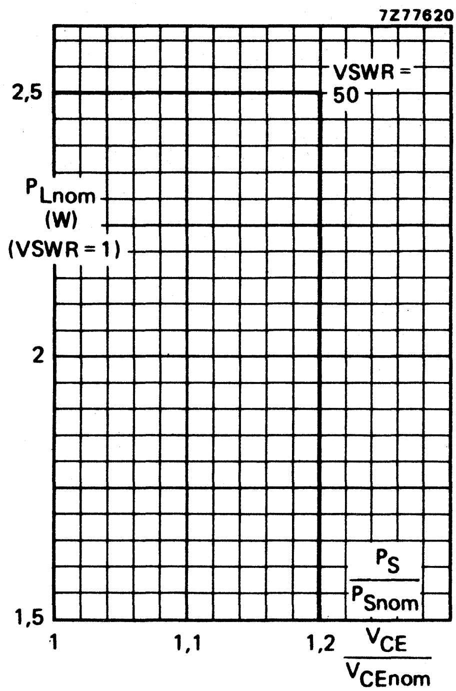


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

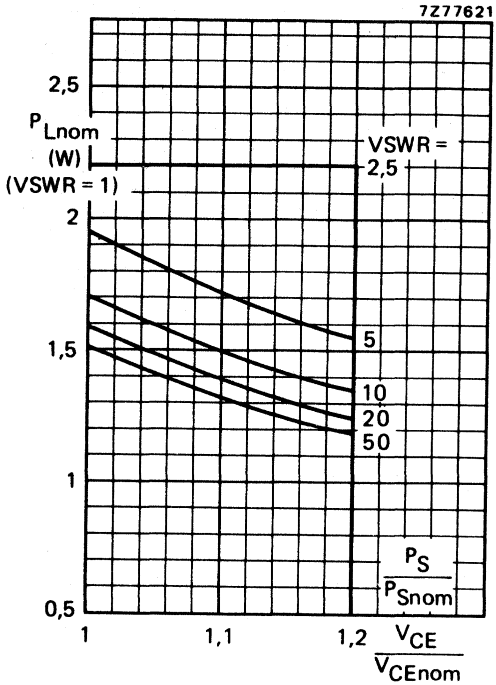


Fig. 12 R.F. SOAR (short-time operation during mismatch); f = 175 °C; T_{amb} = 70 °C; $R_{th\ c\text{-}a}$ = 32 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

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.

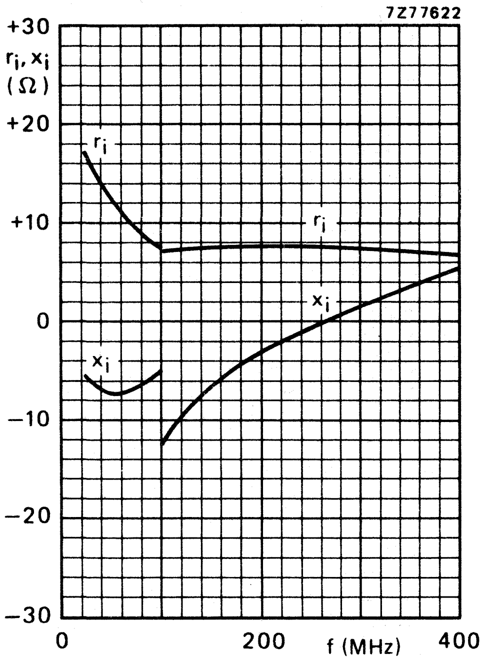


Fig. 13.

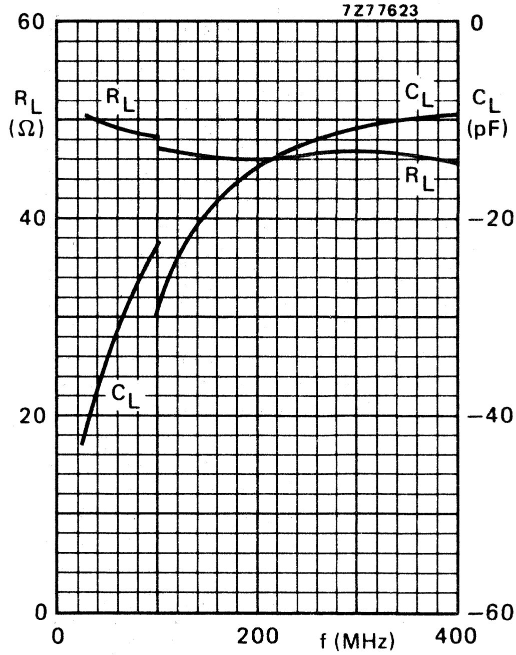
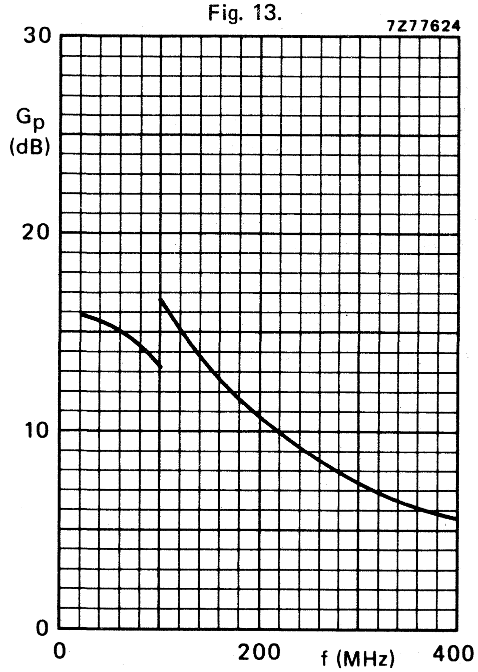


Fig. 14.



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

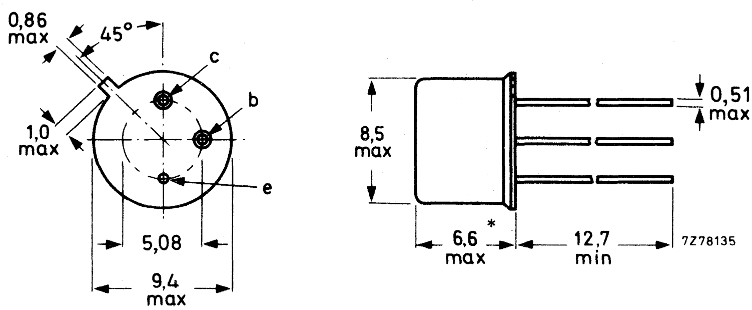
R.F. performance up to T_h = 25 °C

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**	**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-39/3; emitter connected to case.



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

* Max. 4,9 for BFQ43S.

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.	1,25	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

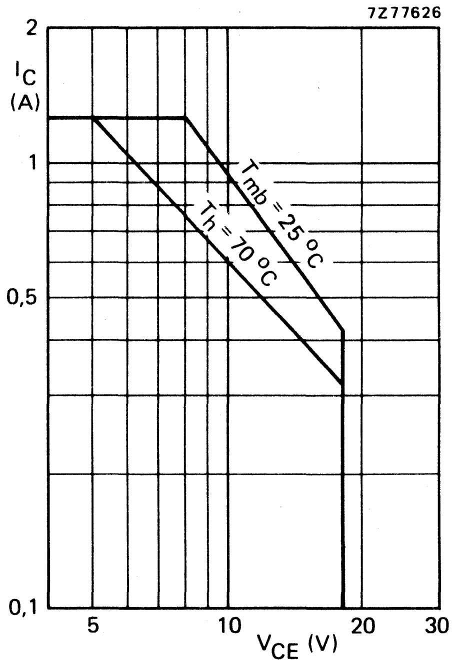
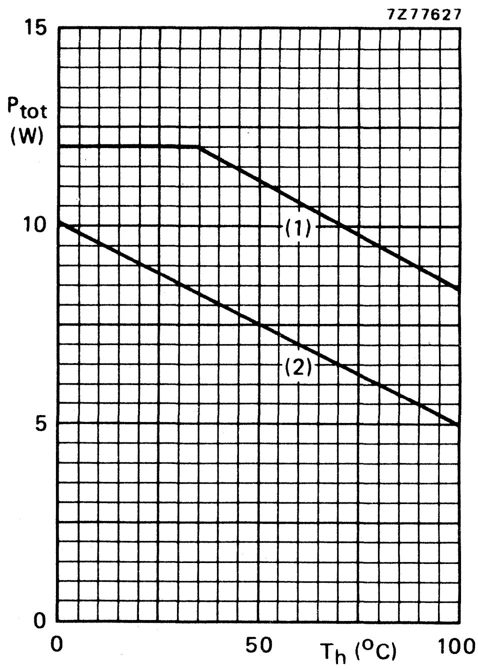


Fig. 2 D.C. SOAR.



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

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: $t_p \leq 200\ \mu s$; $\delta \leq 0{,}02$.

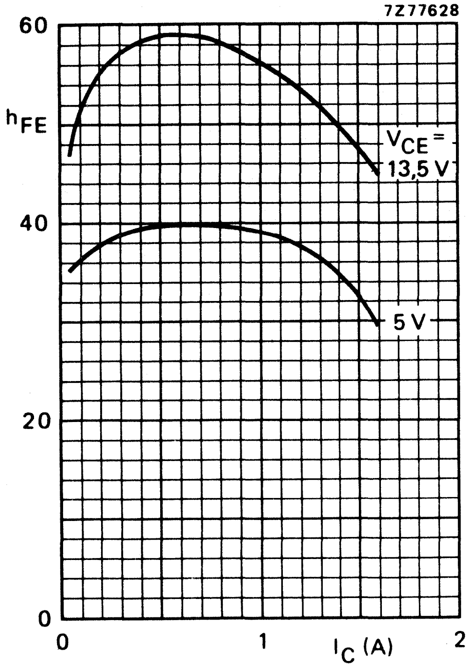


Fig. 4 Typical values; T_j = 25 °C.

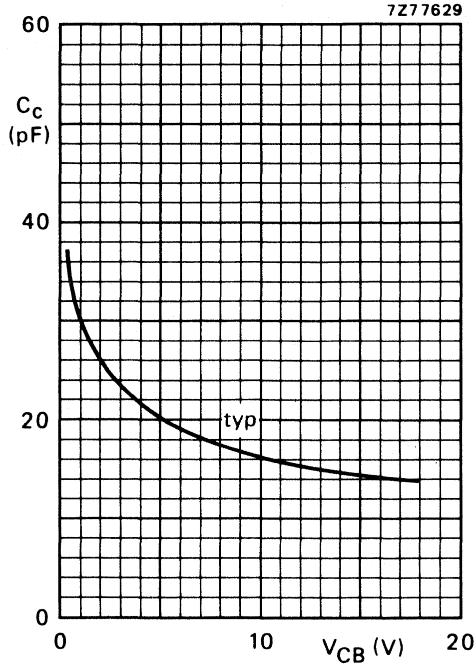


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

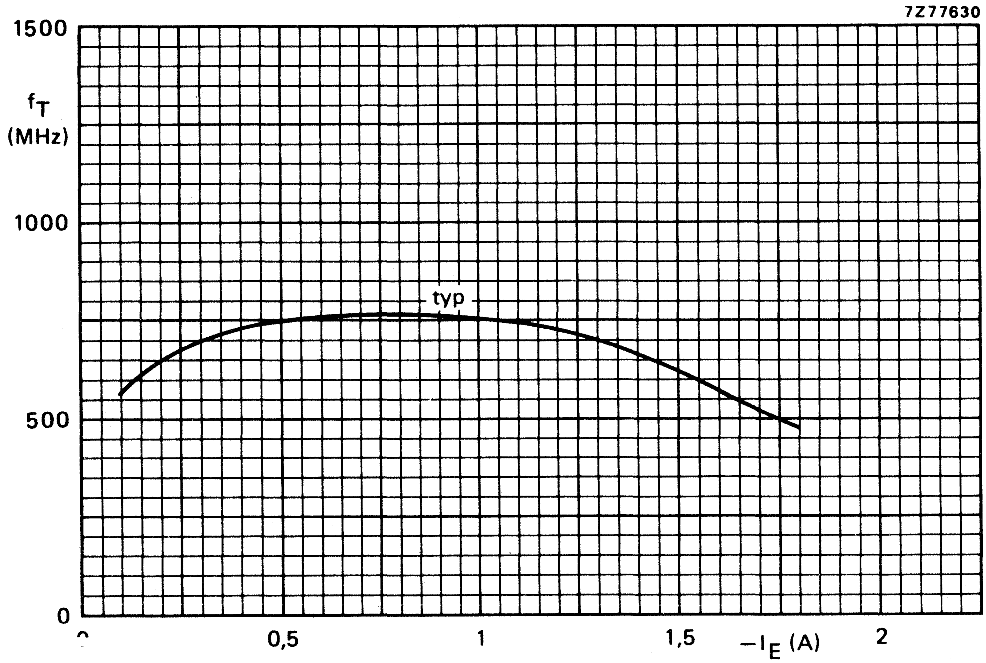


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

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	–	–

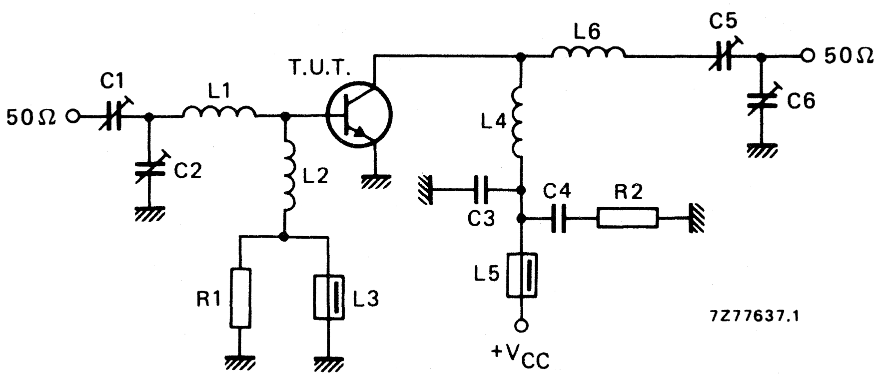


Fig. 7 Test circuit; c.w. class-B.

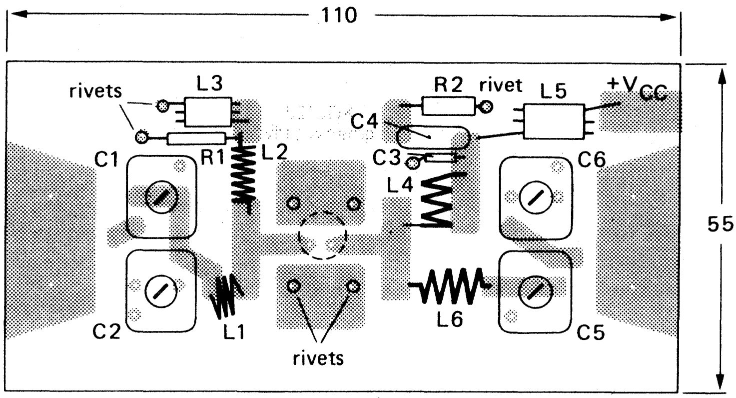
List of components:
C1 = C5 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 100 pF ceramic capacitor
C4 = 100 nF polyester capacitor

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

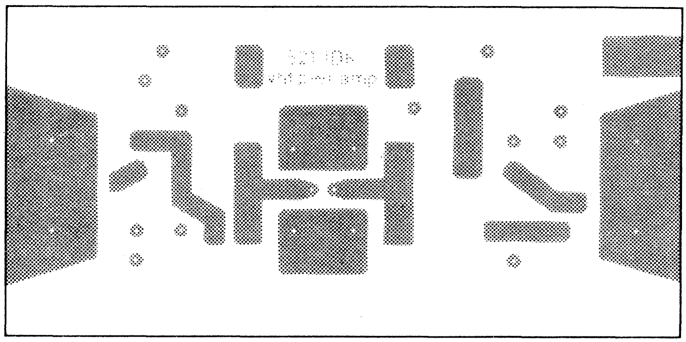
R1 = R2 = 10 Ω carbon resistor

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

APPLICATION INFORMATION (continued)



7Z77575.1



7Z77576

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.

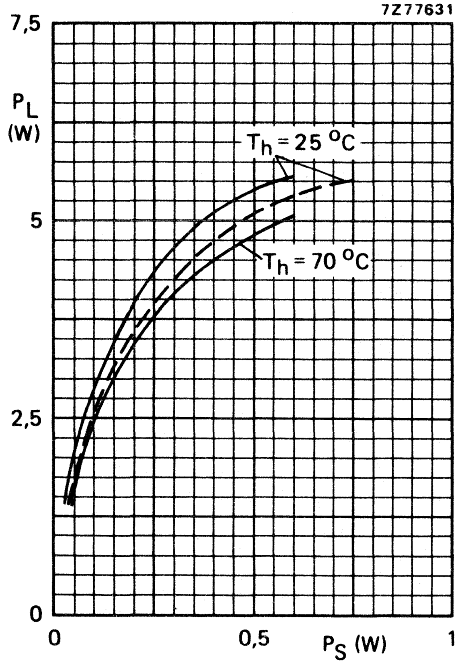


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

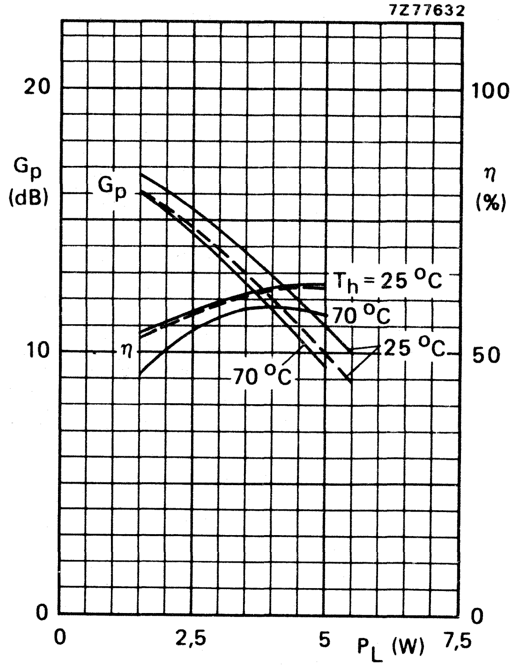


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

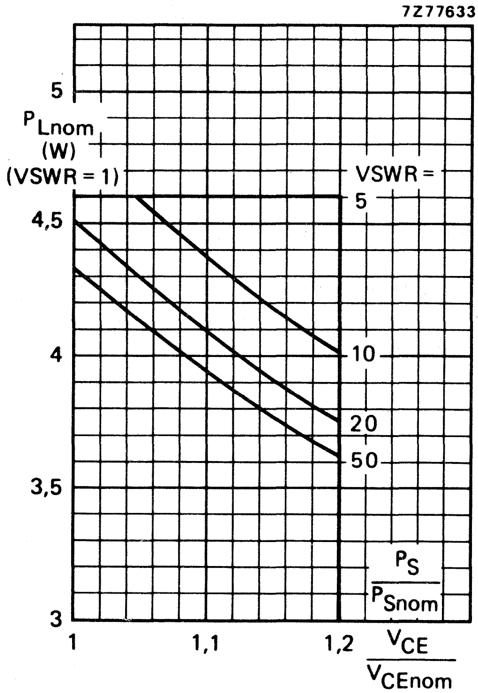


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C.
$R_{th\ mb\text{-}h}$ = 3 K/W; V_{CEnom} = 13,5 or 12,5 V;
$P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

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.

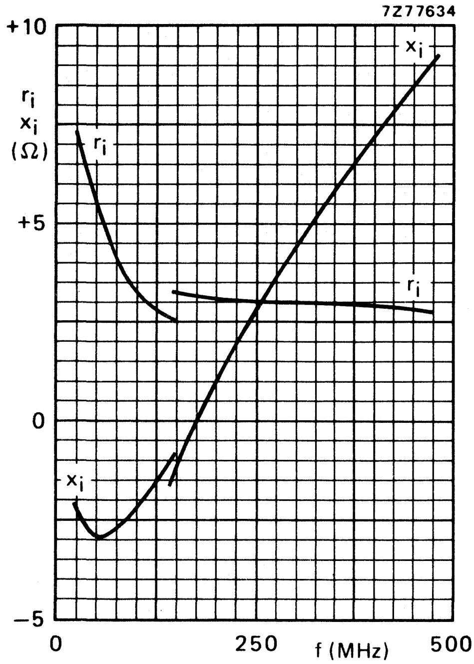


Fig. 12.

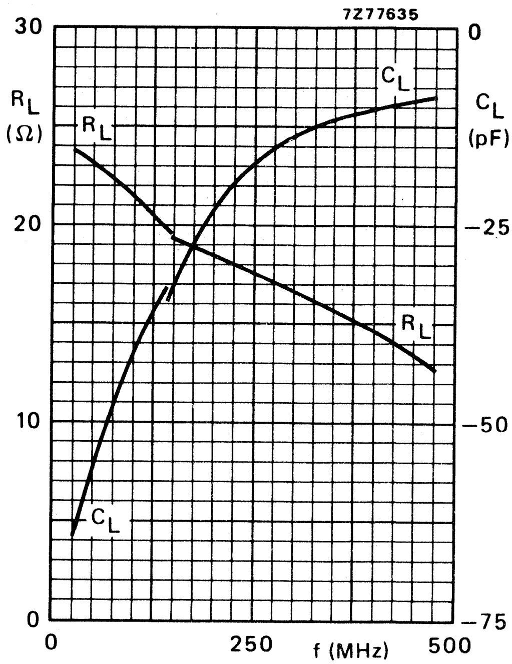
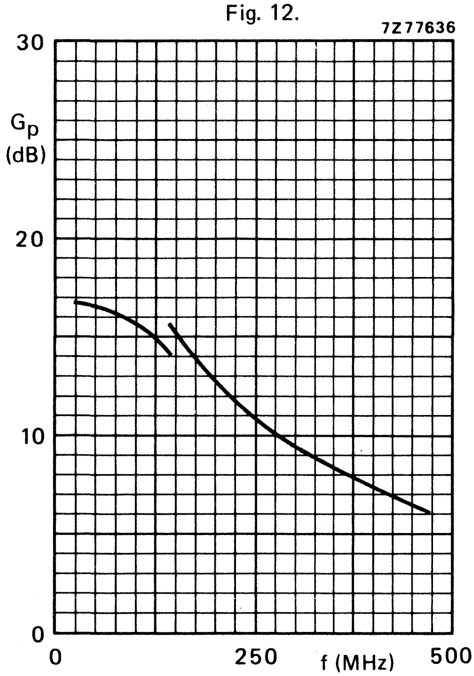


Fig. 13.



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

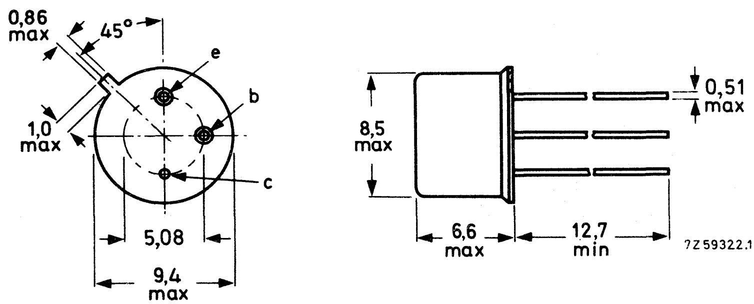
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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-39/1; collector connected to case.

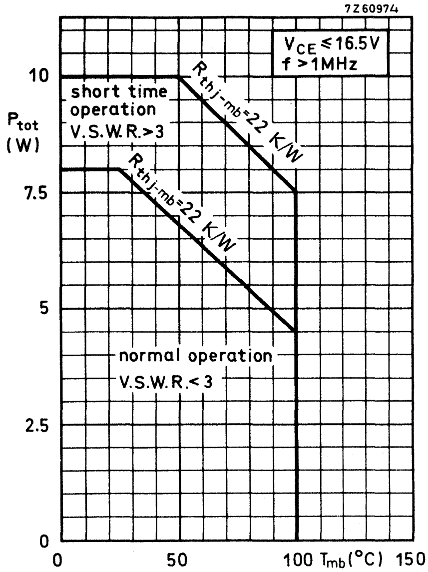


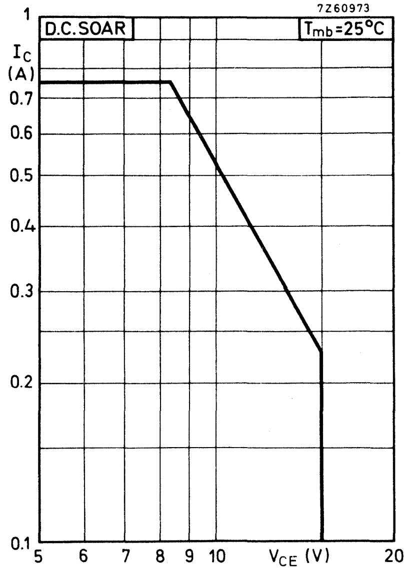
Maximum lead diameter is guaranteed only for 12,7 mm.

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

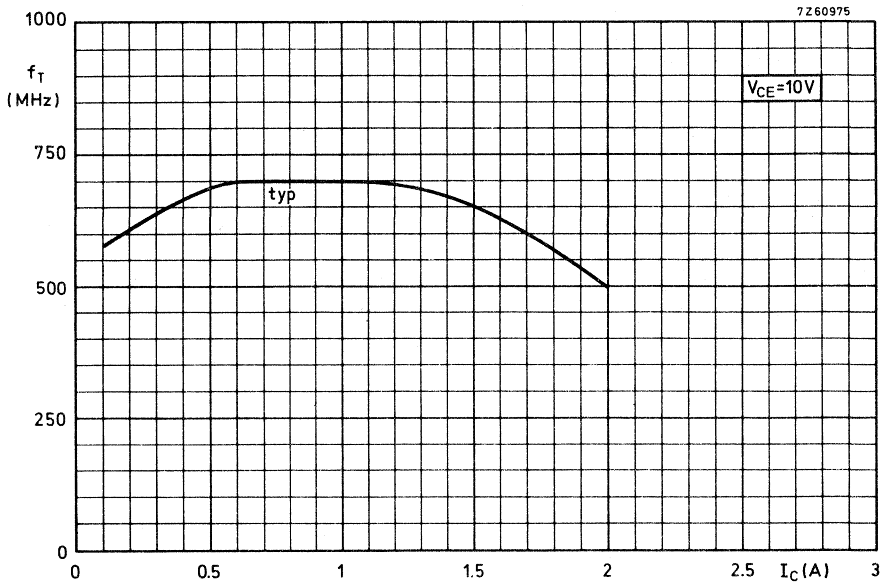
THERMAL RESISTANCE

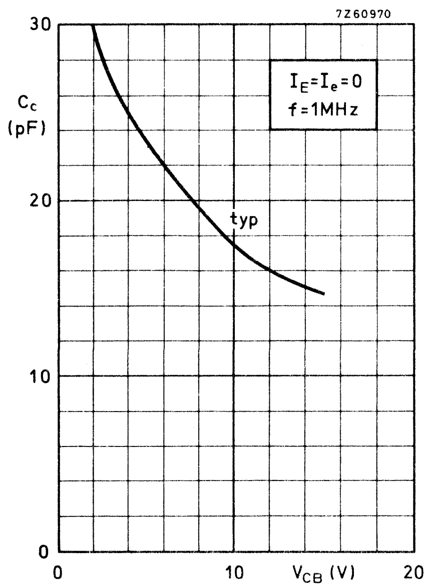
From junction to mounting base	$R_{th\,j\text{-}mb}$	=	22	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\,mb\text{-}h}$	=	2.5	K/W

CHARACTERISTICS

T_j = 25°C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ 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				
$I_C = 350$ 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 20	pF 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

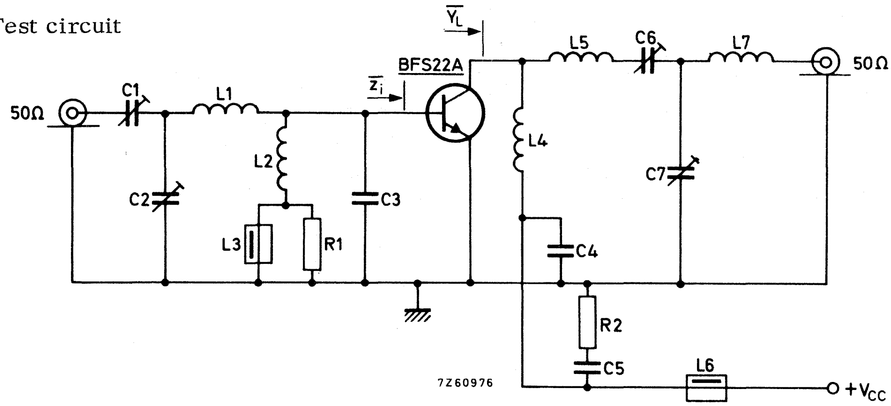
APPLICATION INFORMATION

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	−	−

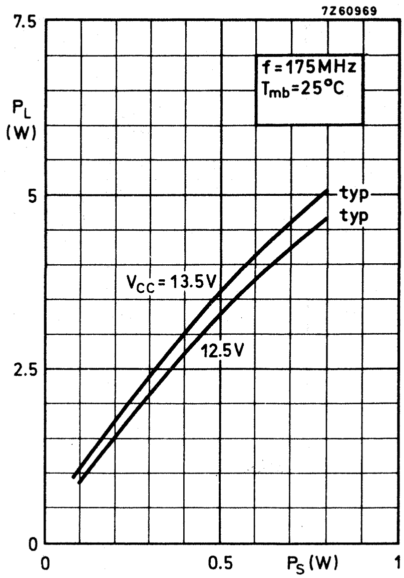
Test circuit

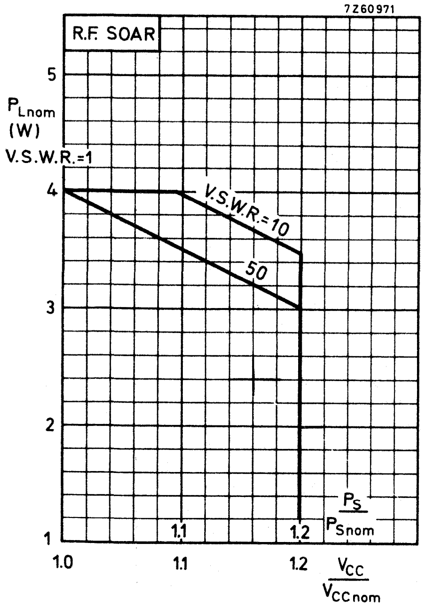


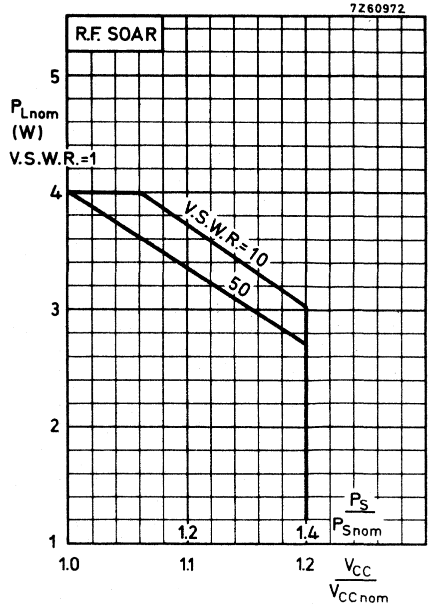
C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

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





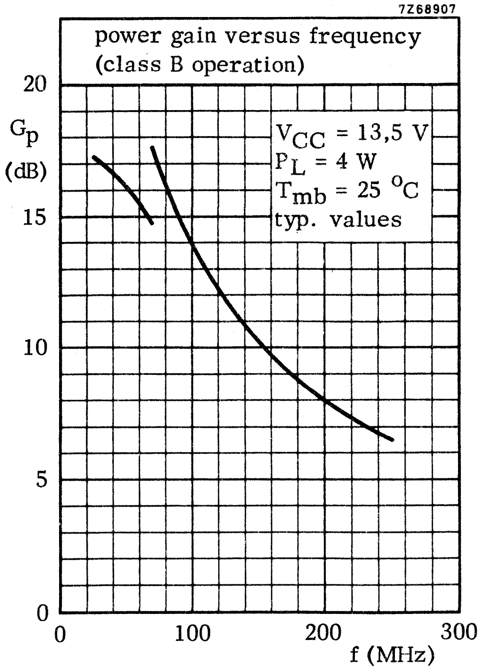
Conditions for R.F. SOAR:

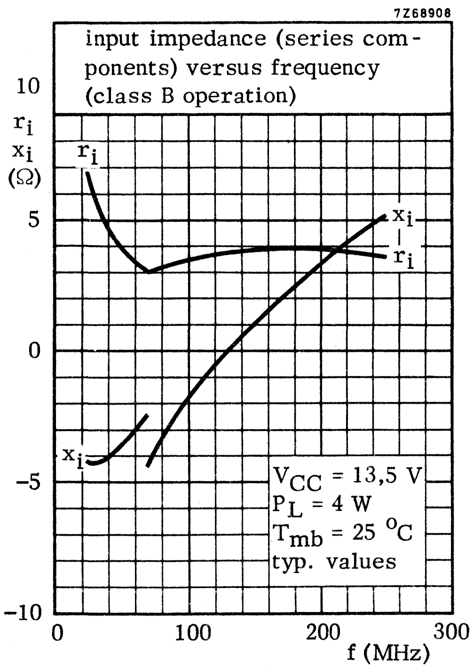
f = 175 MHz
T_{mb} = 70 °C
V_{CCnom} = 12.5 or 13.5 V

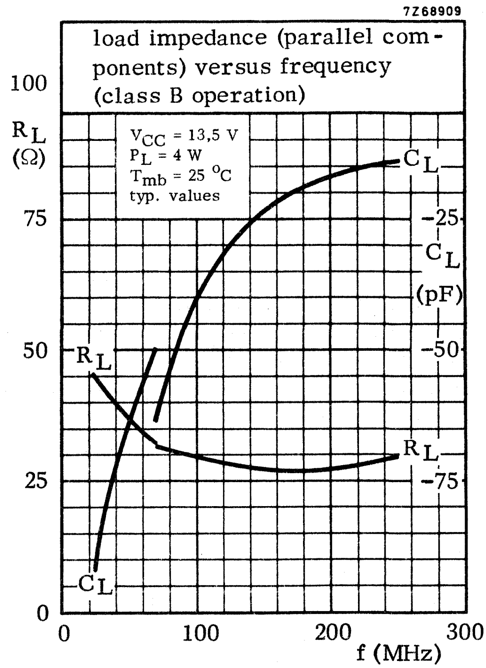
$P_{Snom} = P_S$ at $V_{CC} = V_{CCnom}$ and V.S.W.R. = 1

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

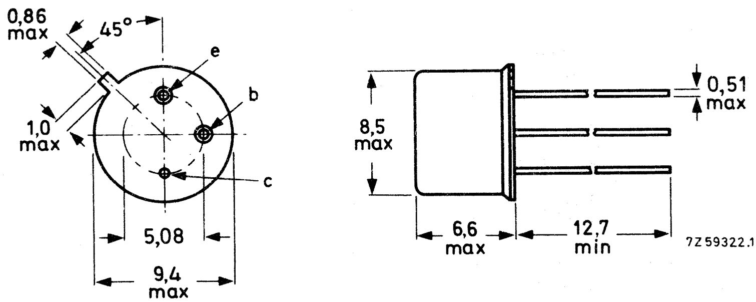
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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-39/1; collector connected to case.

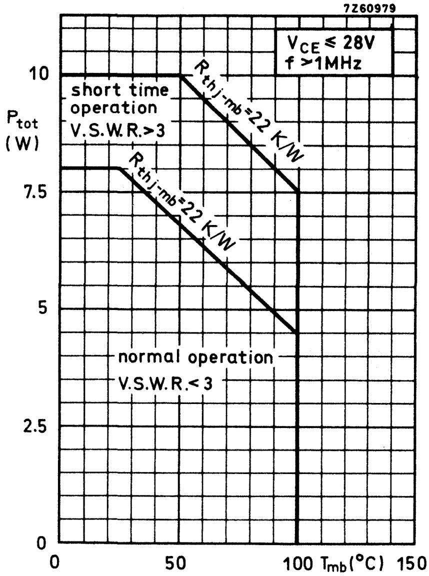


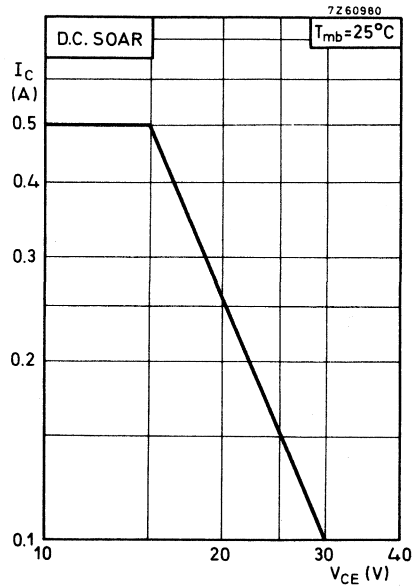
Maximum lead diameter is guaranteed only for 12,7 mm.

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 ^{o}C f > 1 MHz	P_{tot}	max.	8	W





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

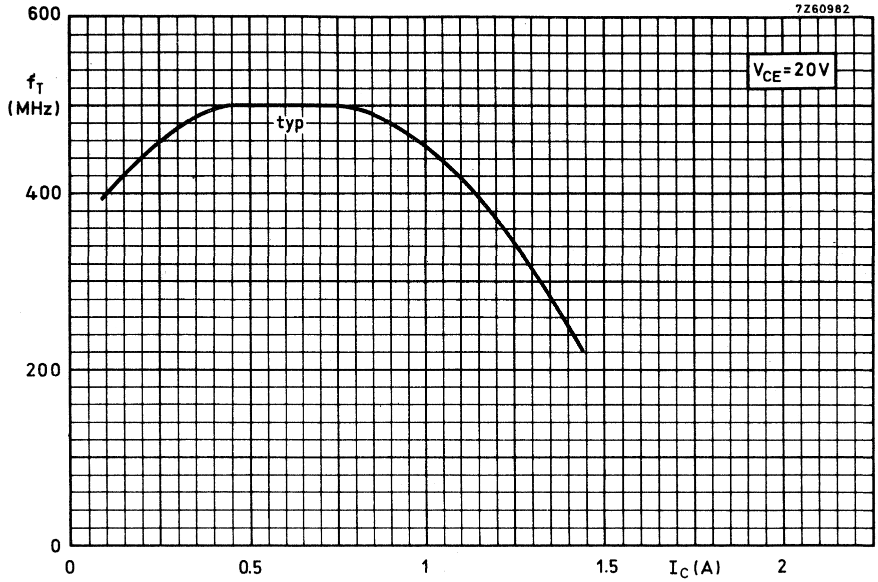
THERMAL RESISTANCE

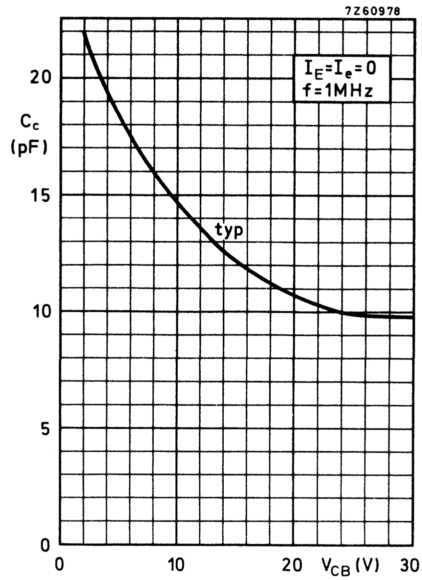
From junction to mounting base	$R_{th\ j-mb}$	=	22	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	2.5	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; V_{CE} = 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 Ω	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
f_T
(MHz)
400
200
0
typ
V_{CE} = 20 V
0
0.5
1
1.5
I_C (A)
2


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

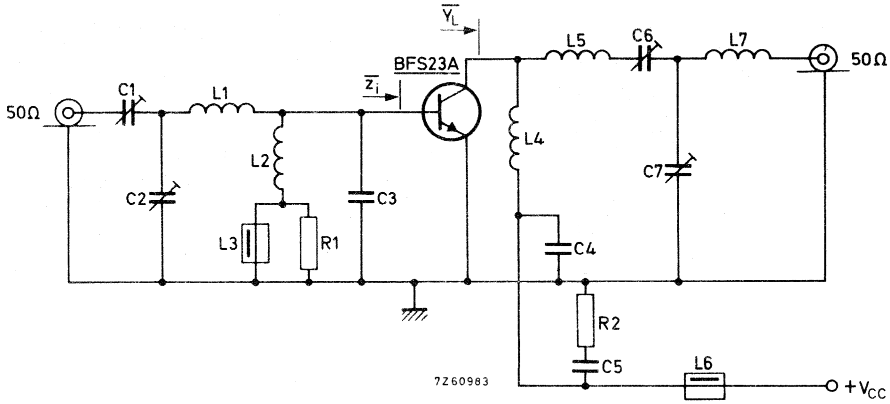
APPLICATION INFORMATION

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

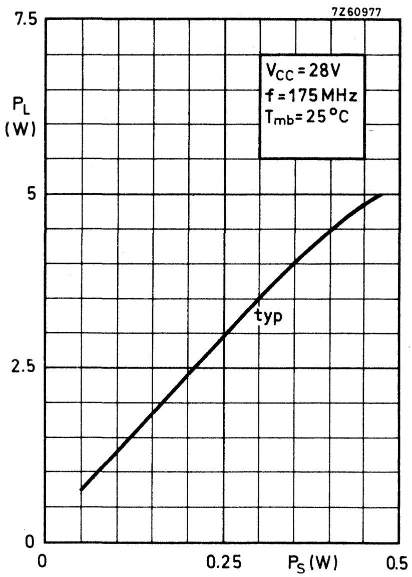
Test circuit

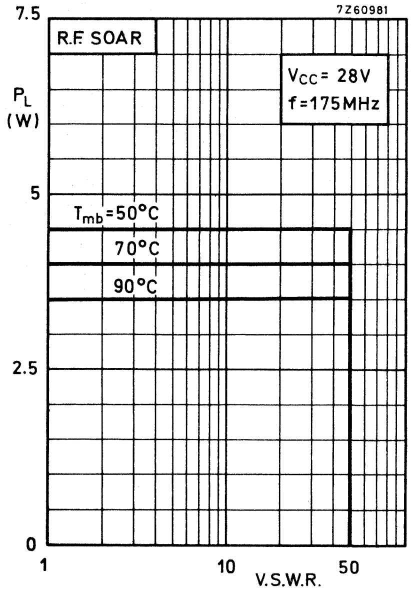


C1 = C6 = 4 to 29 pF air trimmer with insulated rotor
C2 = C7 = 4 to 29 pF air trimmer with non-insulated rotor
C3 = 39 pF ceramic
C4 = 100 pF ceramic
C5 = 15 nF polyester

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

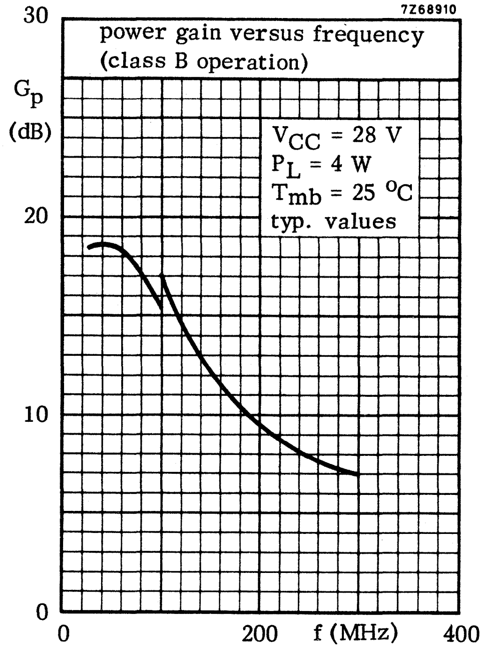
R1 = R2 = 10 Ω carbon

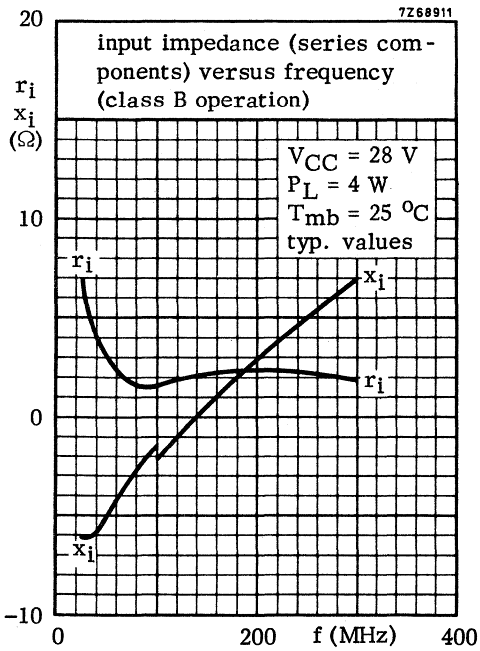


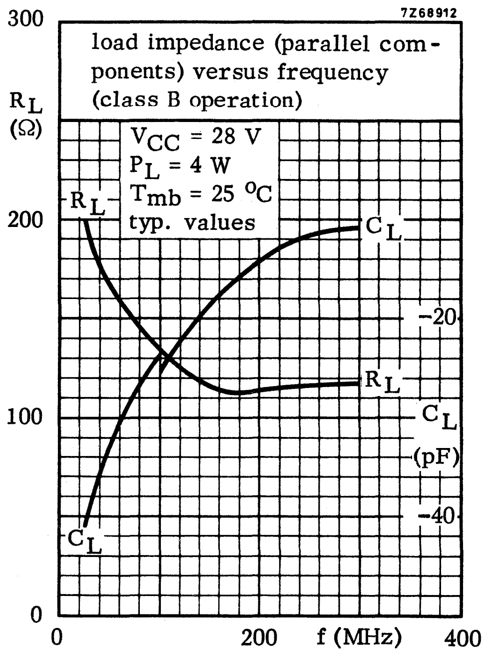


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

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.







UHF power transistor BLT50

FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

DESCRIPTION

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

PINNING - SOT223

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

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

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

Note

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

PIN CONFIGURATION

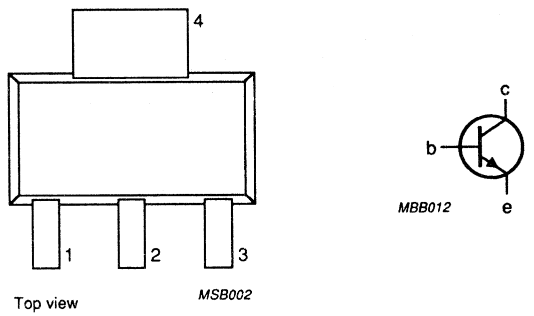


Fig.1 Simplified outline and symbol.

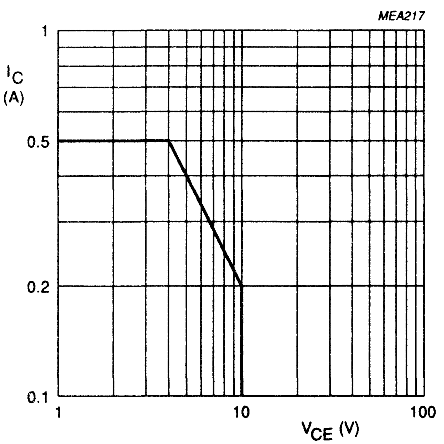
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	500	mA
I_{CM}	collector current	peak value f > 1 MHz	–	1.5	A
P_{tot}	total power dissipation	f > 1 MHz; T_S = 103 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		–	175	°C

Note

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



T_S = 103 °C.

Fig.2 DC SOAR.

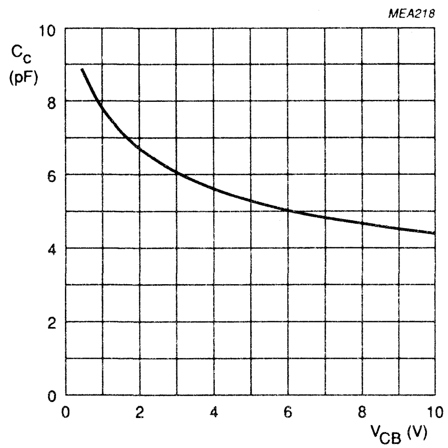
THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 10 V	–	–	250	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 300 mA	25	–	–	
E_{SBR}	second breakdown energy	L = 25 mH; R_{BE} = 10 Ω; f = 50 Hz	0.55	–	–	mJ
C_c	collector capacitance	V_{CB} = 7.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	4.7	6	pF
C_{re}	feedback capacitance	V_{CE} = 7.5 V; I_C = 0; f = 1 MHz	–	2.9	4.5	pF



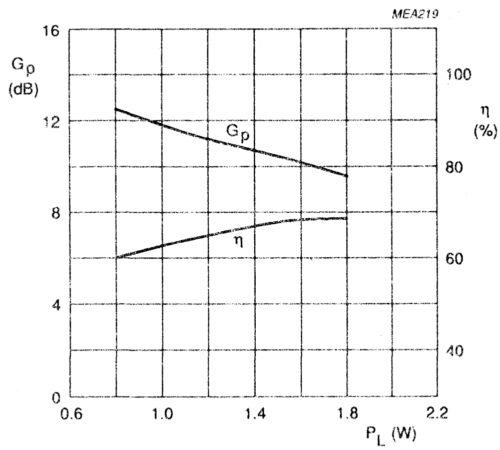
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

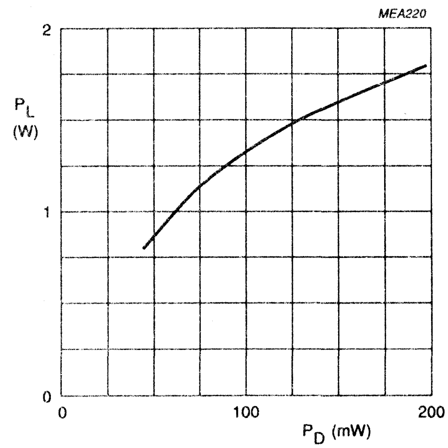
RF performance at $T_s \leq 60$ °C in a common emitter class-B test circuit.

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



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

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



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

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

Ruggedness in class-B operation

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

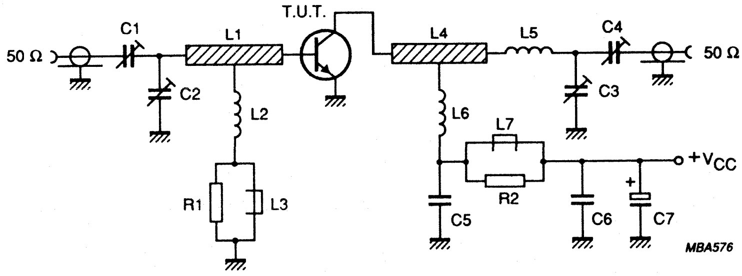


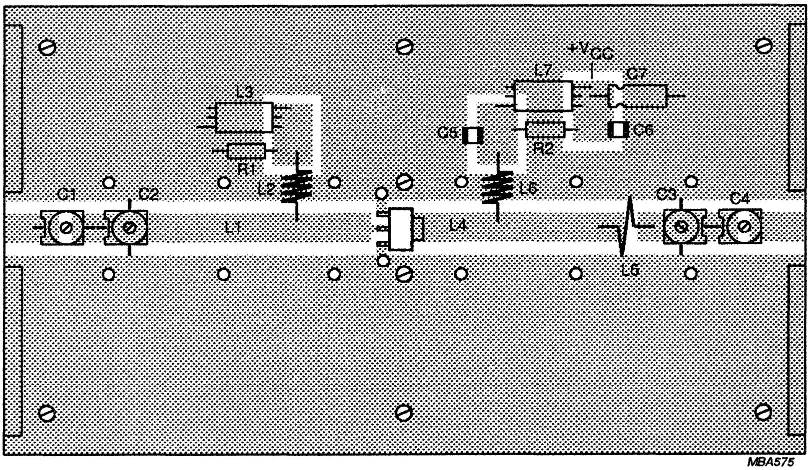
Fig.6 Class-B test circuit at f = 470 MHz.

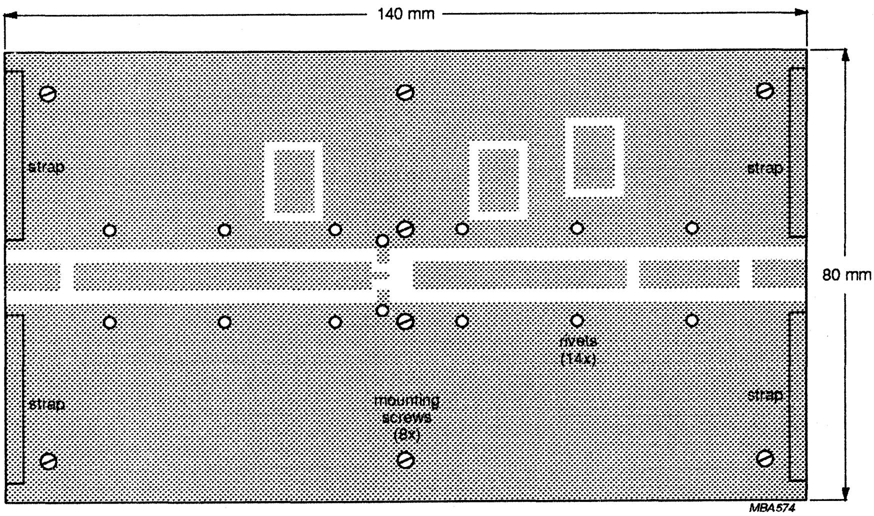
List of components (see test circuit)

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

Notes

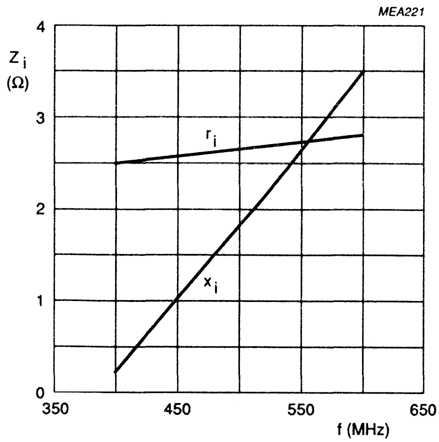
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.





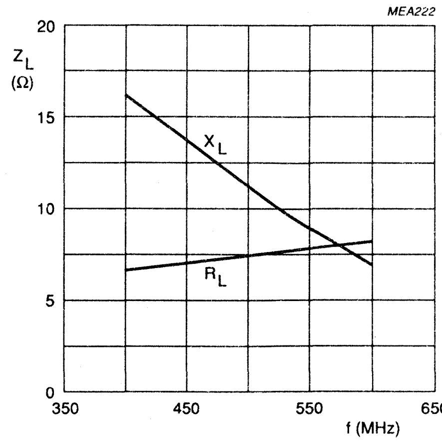
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

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



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

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



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

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

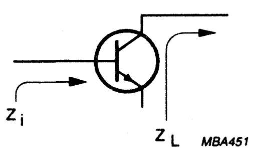
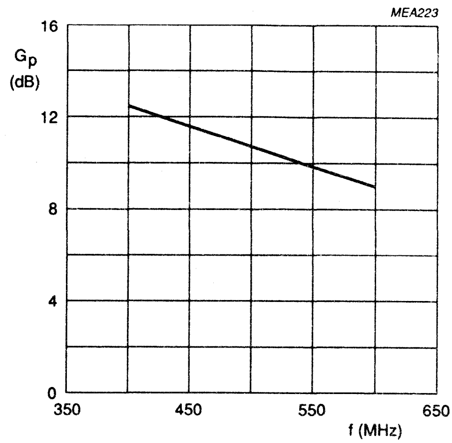


Fig.10 Definition of transistor impedance.



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

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

UHF power transistor BLT53

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability
- Withstands full load mismatch.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT122D studless envelope with a ceramic cap. It is designed for common emitter, class-B operation in portable radio transmitters in the 470 MHz communications band. All leads are isolated from the mounting flange.

PINNING - SOT122D

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	7.5	8	> 6	> 60

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

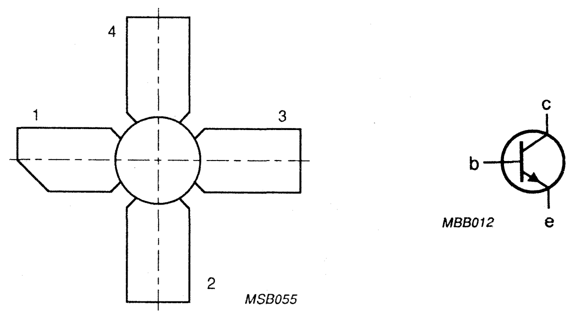


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	2.5	A
I_{CM}	collector current	peak value f > 1 MHz	–	7.5	A
P_{tot}	total power dissipation	RF operation; T_{mb} = 25 °C	–	35.5	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

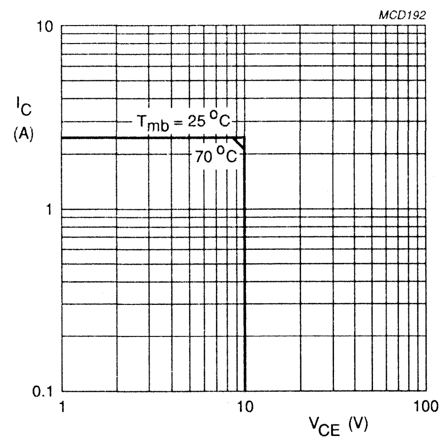
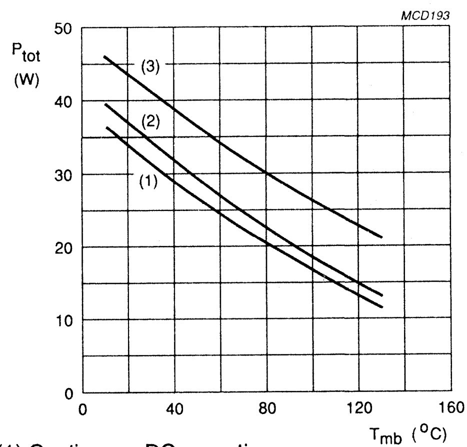


Fig.2 DC SOAR.



(1) Continuous DC operation.

(2) Continuous RF operation (f > 1 MHz).

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

Fig.3 Power derating curve.

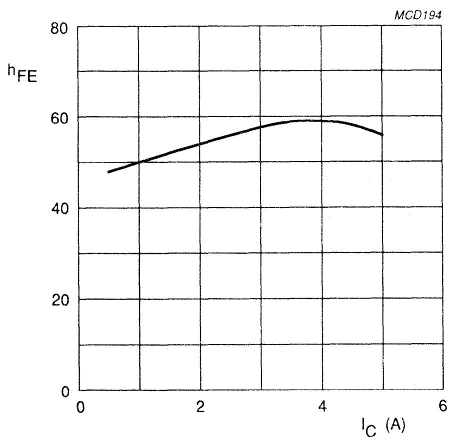
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 35.5 W; T_{mb} = 25 °C	4.9	K/W

CHARACTERISTICS

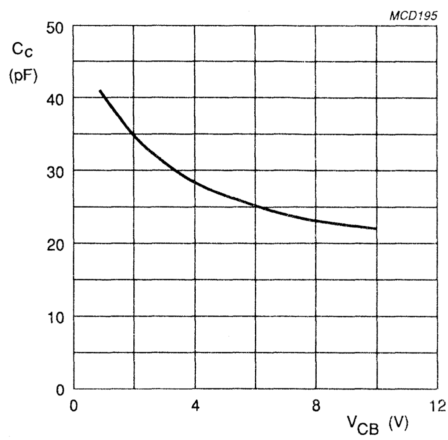
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 40 mA	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 4 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 10 V	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 1.2 A	25	–	–	
f_T	transition frequency	V_{CE} = 7.5 V; I_E = 1.6 A	–	3.9	–	GHz
C_c	collector capacitance	V_{CB} = 7.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	24	–	pF
C_{re}	feedback capacitance	V_{CE} = 7.5 V; I_C = 0; f = 1 MHz	–	17	–	pF
$C_{c\text{-}mb}$	collector-mounting base capacitance	f = 1 MHz	–	1.2	–	pF



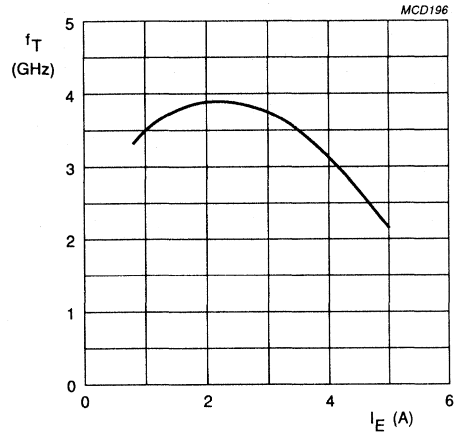
V_{CE} = 5 V.

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



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

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



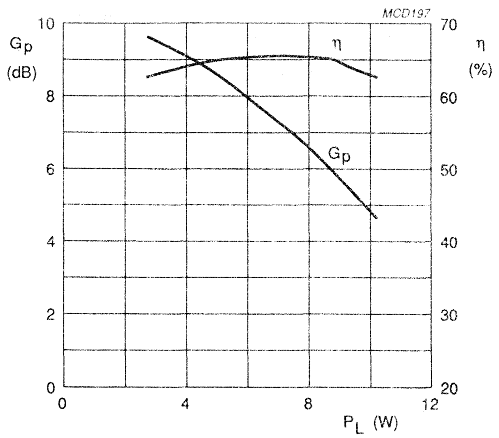
$V_{CB} = 7.5$ V.

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

APPLICATION INFORMATION

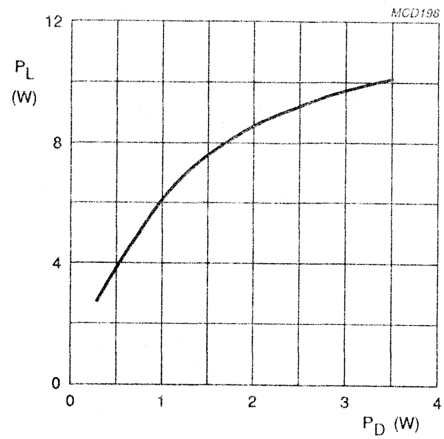
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	7.5	8	> 6 typ. 6.8	> 60 typ. 65



Class-B operation; V_{CE} = 7.5 V; f = 470 MHz.

Fig.7 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 7.5 V; f = 470 MHz.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLT53 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 9 V, and f = 470 MHz.

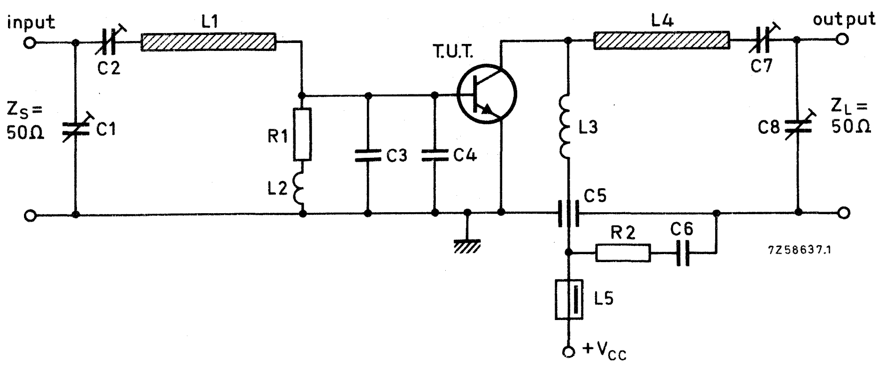


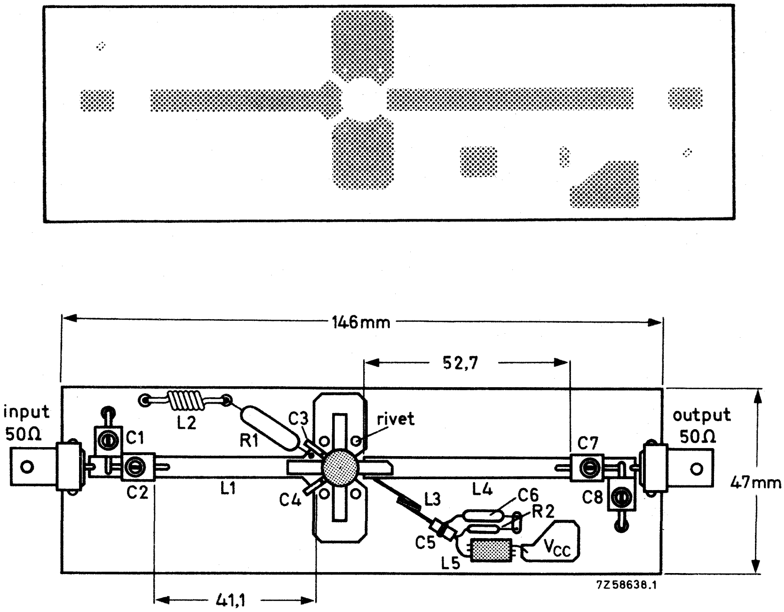
Fig.9 Class-B test circuit at f = 470 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C7, C8	film dielectric trimmer	2 to 9 pF		2222 809 09002
C3, C4	multilayer ceramic chip capacitor	15 pF		
C5	feed-through capacitor	100 pF		
C6	polyester capacitor	33 nF		
L1	stripline (note 1)	44 Ω	41.1 mm x 5 mm	
L2	13 turns closely wound enamelled 0.5 mm copper wire	320 nH	int. dia. 4 mm	
L3	2 turns enamelled 1 mm copper wire		int. dia. 4 mm; pitch 1.5 mm; leads 2 x 5 mm	
L4	stripline (note 1)	44 Ω	52.7 mm x 5 mm	
L5	grade 3B1 Ferroxcube wideband HF choke			4312 020 36640
R1	0.25 W carbon resistor	1 Ω, 5%		
R2	0.25 W carbon resistor	10 Ω, 5%		

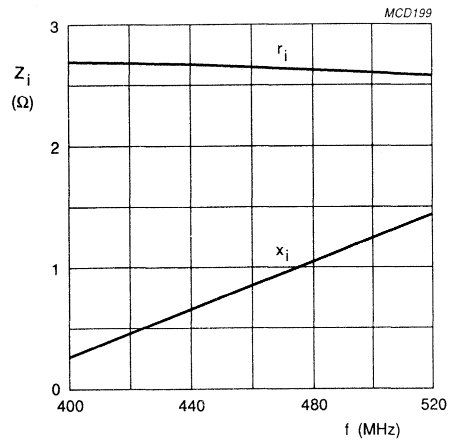
Note

1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.74); thickness 1⁄16 inch.



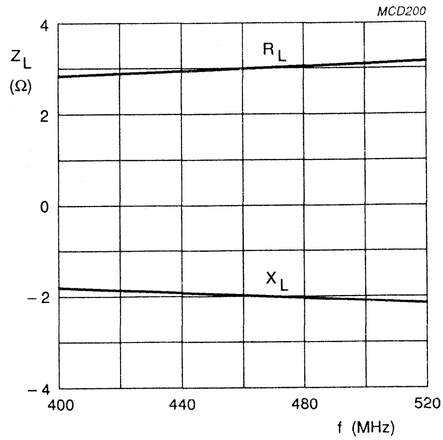
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of hollow rivets.

Fig.10 Component layout for 470 MHz class-B test circuit.



Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.11 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.12 Load impedance (series components) as a function of frequency, typical values.

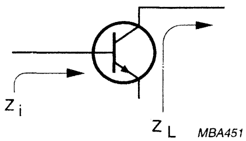
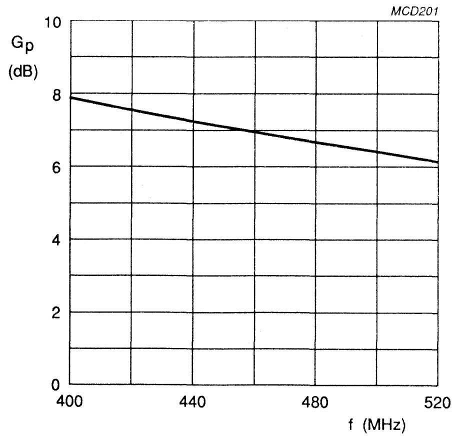


Fig.13 Definition of transistor impedance.



Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.14 Power gain as a function of frequency, typical values.

UHF power transistor BLT80

FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

DESCRIPTION

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

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

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

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

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

Note

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

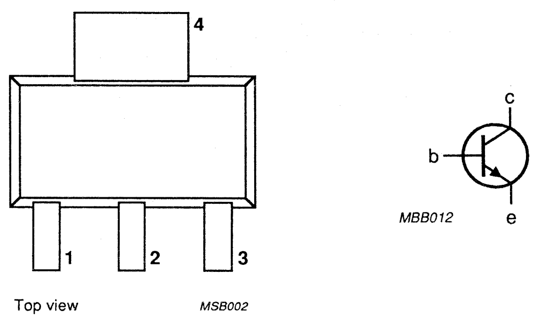


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

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

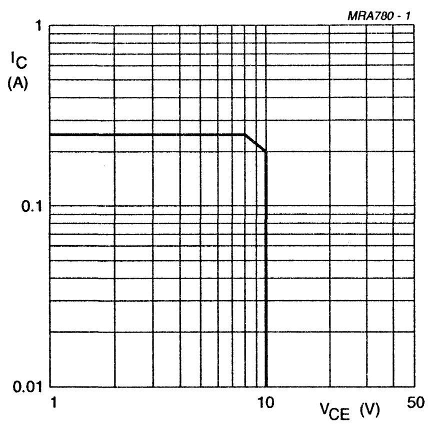
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC or average collector current		–	250	mA
I_{CM}	peak collector current	f > 1 MHz	–	750	mA
P_{tot}	total power dissipation	T_s = 131 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	P_{dis} = 2 W; T_s = 131 °C (note 1)	22 K/W
$R_{th\ j\text{-}amb}$	from junction to ambient	P_{dis} = 2 W; T_{amb} = 25 °C (note 2)	85 K/W

Notes

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



T_s = 131 °C.

Fig.2 DC SOAR.

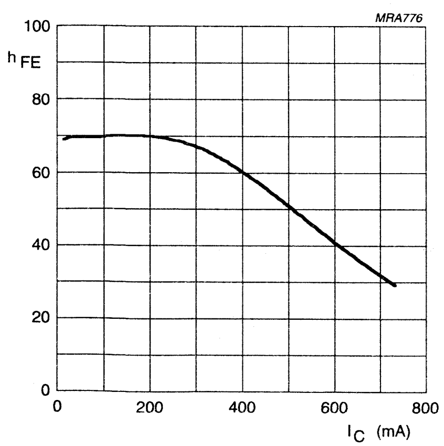
CHARACTERISTICS

$T_j = 25$ °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 2.5$ mA	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 5$ mA	10	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 0.5$ mA	3	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 10$ V	–	0.1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 150$ mA (note 1)	25	–	
C_c	collector capacitance	$V_{CB} = 7.5$ V; $I_E = I_e = 0$; f = 1 MHz	–	3.5	pF
C_{re}	feedback capacitance	$V_{CE} = 7.5$ V; $I_C = 0$; f = 1 MHz	–	2.5	pF

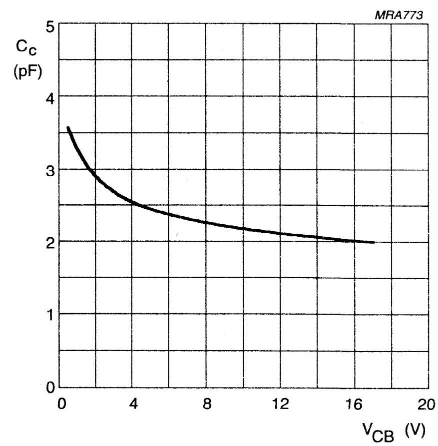
Note

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



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

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



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

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

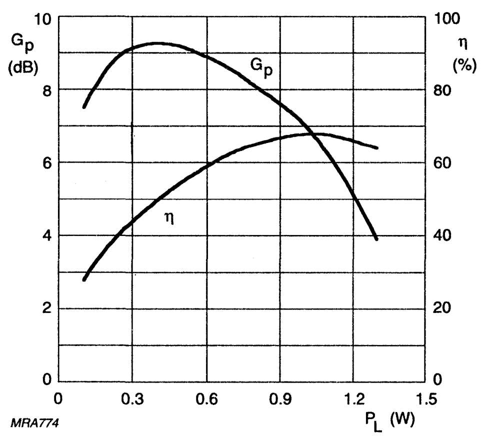
APPLICATION INFORMATION

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

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

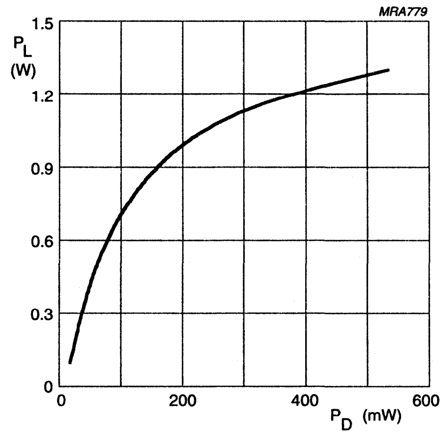
Note

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



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

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



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

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

Ruggedness in class-B operation

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

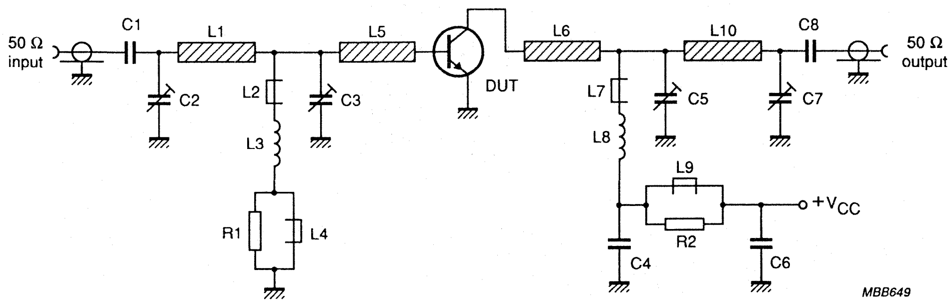


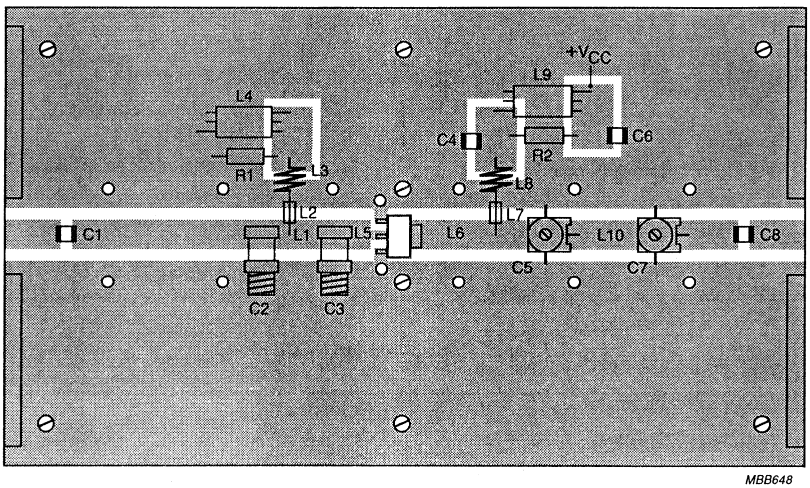
Fig.7 Class-B test circuit at f = 900 MHz.

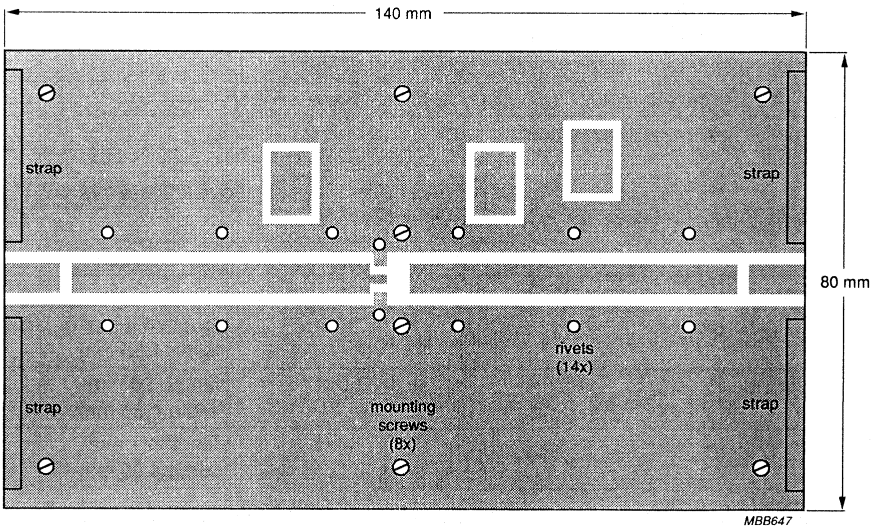
List of components (see test circuit)

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

Notes

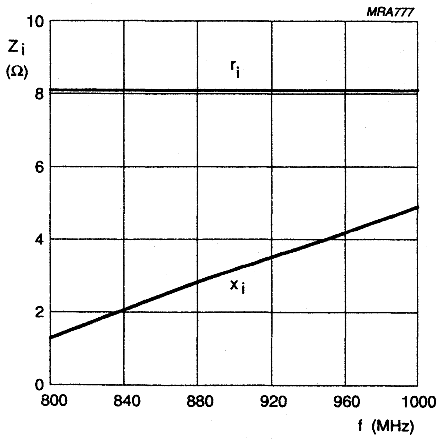
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.





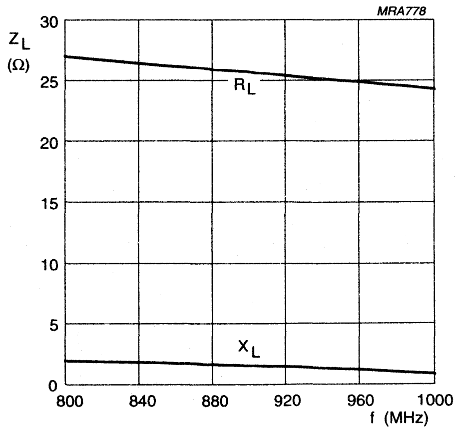
The components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws and copper straps under the emitter leads.

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



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

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



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

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

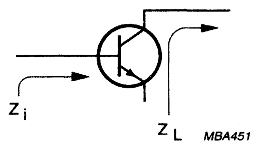
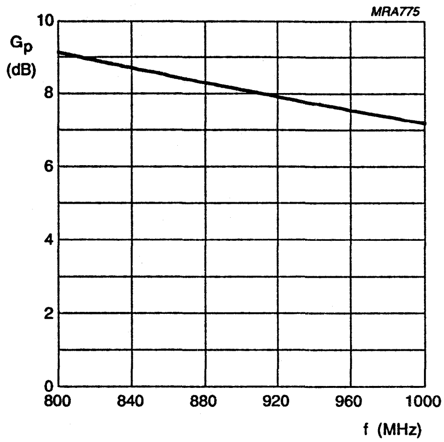


Fig.11 Definition of transistor impedance.



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

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

UHF power transistor | BLT81

FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor in a 4-lead SOT223 surface mounting package.

It is primarily designed for use in hand-held radio equipment in the 900 MHz communications band.

PINNING - SOT223

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW class-B, narrow band	900	7.5	1.2	≥ 6	≥ 60
	900	6	1.2	typ. 6.5	typ. 70

Note

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

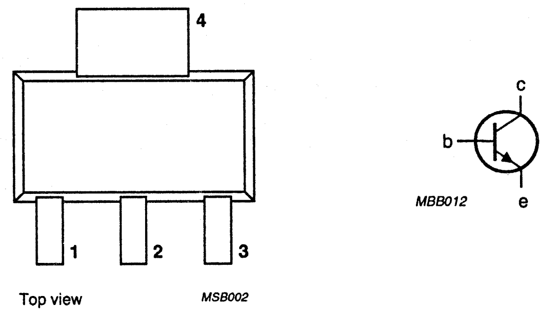


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

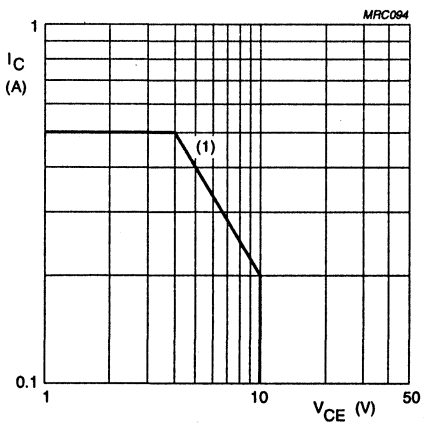
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	9.5	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	T_s = 110 °C (note 1)	–	2	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2 W; T_s = 110 °C (note 1)	max. 32 K/W

Note

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



(1) T_s = 110 °C.

Fig.2 DC SOAR.

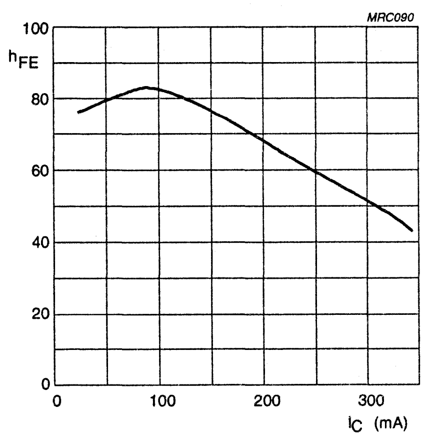
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 1 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	9.5	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	–	V
I_{CES}	collector-emitter cut-off current	V_{BE} = 0; V_{CE} = 10 V	–	–	0.1	mA
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V (note 1)	25	–	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 7.5 V; f = 1 MHz	–	2.7	4	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 7.5 V; f = 1 MHz	–	1.7	3	pF

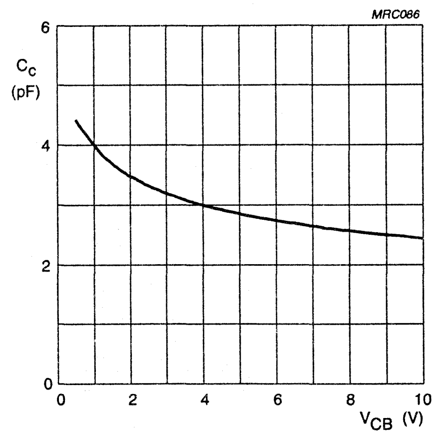
Note

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



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

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



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

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

APPLICATION INFORMATION

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

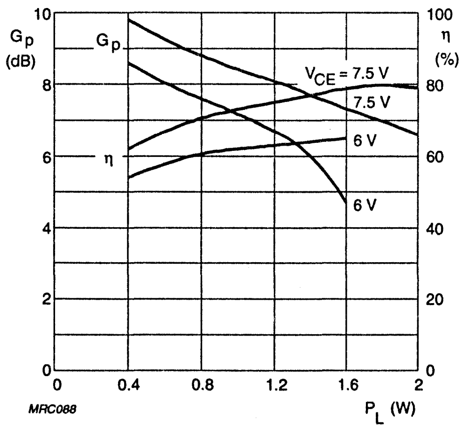
MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW class-B, narrow band	900	7.5	1.2	≥ 6 typ. 8	≥ 60 typ. 70
	900	6	1.2	typ. 6.5	typ. 70

Note

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

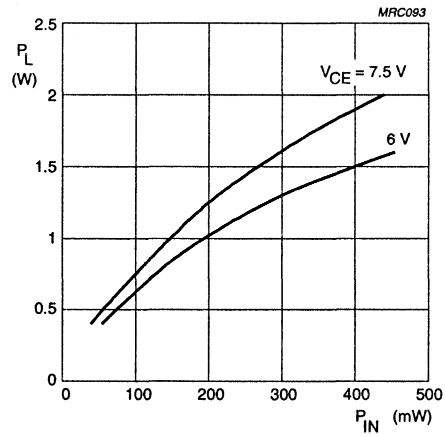
Ruggedness in class-B operation

The BLT81 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 9 V, f = 900 MHz and $T_s \leq 60$ °C, where T_s is the temperature at the soldering point of the collector tab.



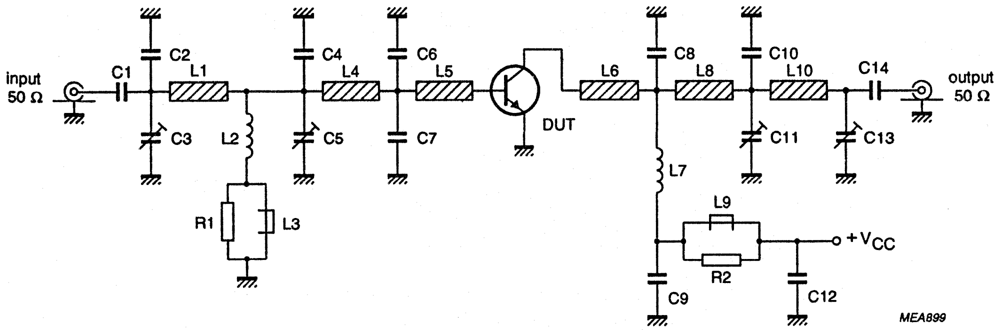
Class-B operation;
f = 900 MHz.

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



Class-B operation;
f = 900 MHz.

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



f = 900 MHz.

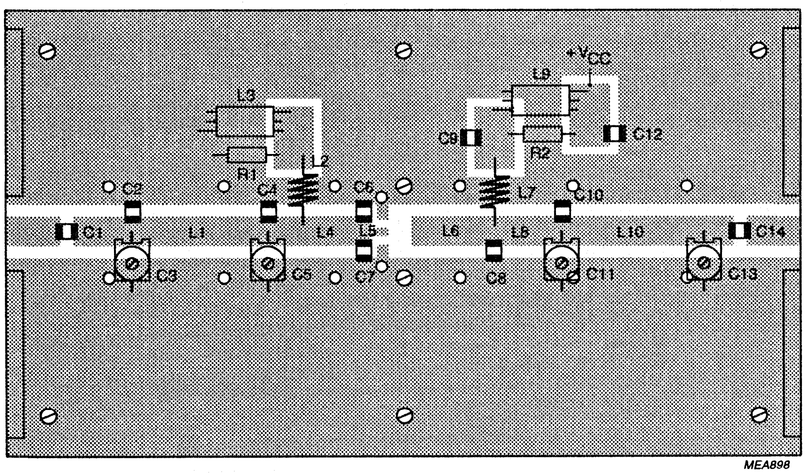
Fig.7 Class-B test circuit.

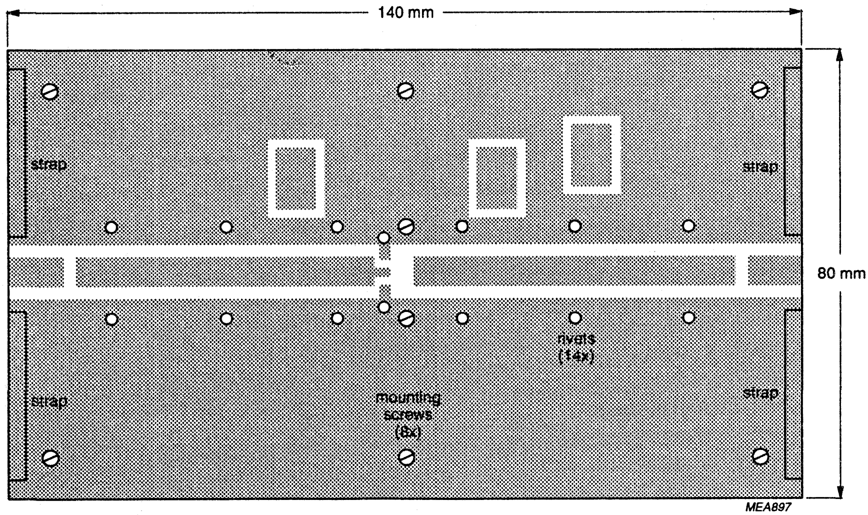
List of components (see Figs 7 and 8)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C14	multilayer ceramic chip capacitor (note 1)	110 pF		
C2	multilayer ceramic chip capacitor (note 1)	3 pF		
C3, C5, C11, C13	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09004
C4	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C6, C7, C10	multilayer ceramic chip capacitor (note 1)	5.1 pF		
C8	multilayer ceramic chip capacitor (note 1)	3.6 pF		
C9	multilayer ceramic chip capacitor (note 1)	220 pF		
C12	multilayer ceramic chip capacitor	1 nF		
L1	stripline (note 2)	50 Ω	length 26.6 mm width 4.85 mm	
L2	10 turns 0.6 mm enamelled copper wire	250 nH	int. dia. 4.5 mm leads 2 x 5 mm	
L3, L9	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4	stripline (note 2)	50 Ω	length 18 mm width 4.85 mm	
L5	stripline (note 2)	75 Ω	length 3.5 mm width 2.5 mm	
L6	stripline (note 2)	50 Ω	length 10 mm width 4.85 mm	
L7	4 turns 0.6 mm enamelled copper wire	65 nH	int. dia. 4.5 mm leads 2 x 5 mm	
L8	stripline (note 2)	50 Ω	length 15 mm width 4.85 mm	
L10	stripline (note 2)	50 Ω	length 24.6 mm width 4.85 mm	
R1, R2	metal film resistor	10 Ω, 0.25 W		

Notes

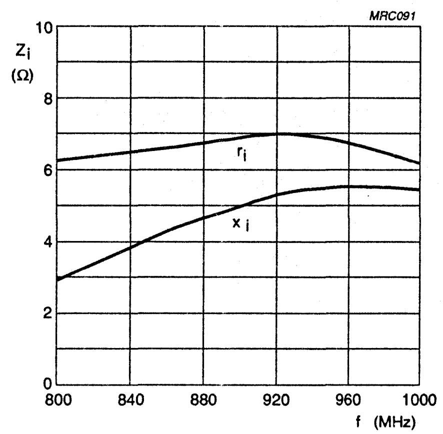
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1⁄16 inch.





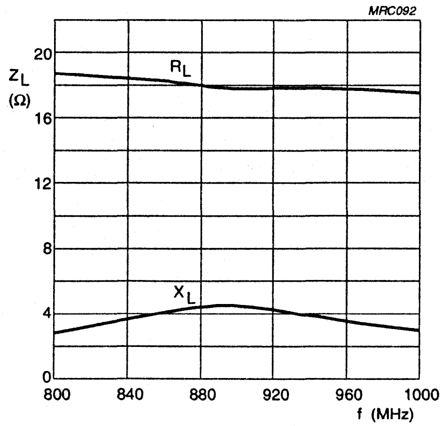
The components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws and copper foil straps under the emitter leads.

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



Class-B operation;
V_{CE} = 7.5 V; P_L = 1.2 W; $T_s \leq$ 60 °C.

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



Class-B operation;
V_{CE} = 7.5 V; P_L = 1.2 W; $T_s \leq$ 60 °C.

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

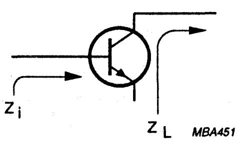
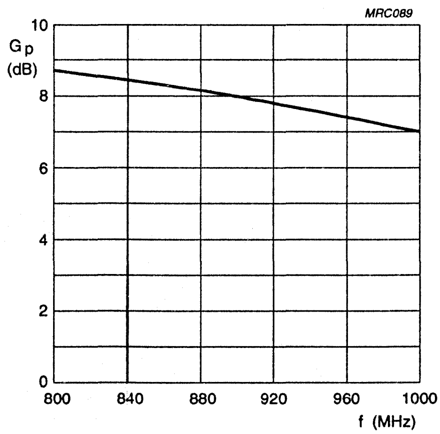


Fig.11 Definition of transistor impedance.



Class-B operation;
V_{CE} = 7.5 V; P_L = 1.2 W; $T_s \leq$ 60 °C.

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

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).

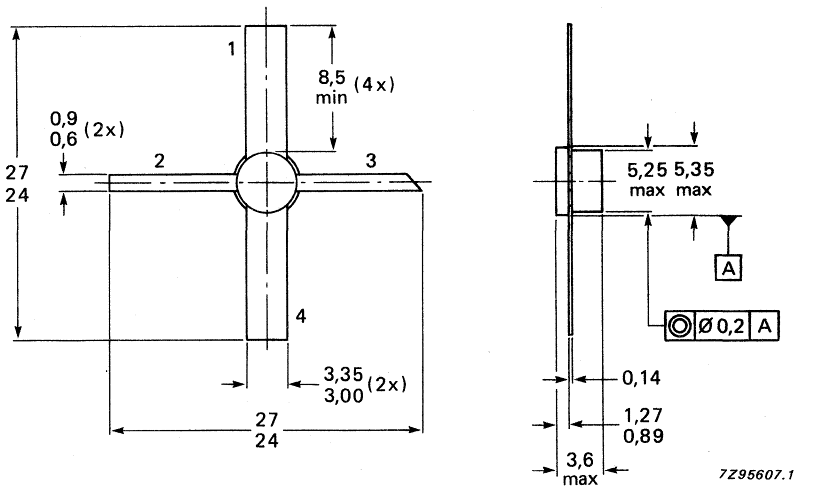
MECHANICAL DATA

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

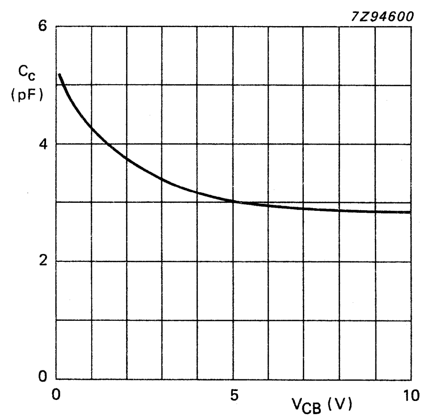


Fig. 2 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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

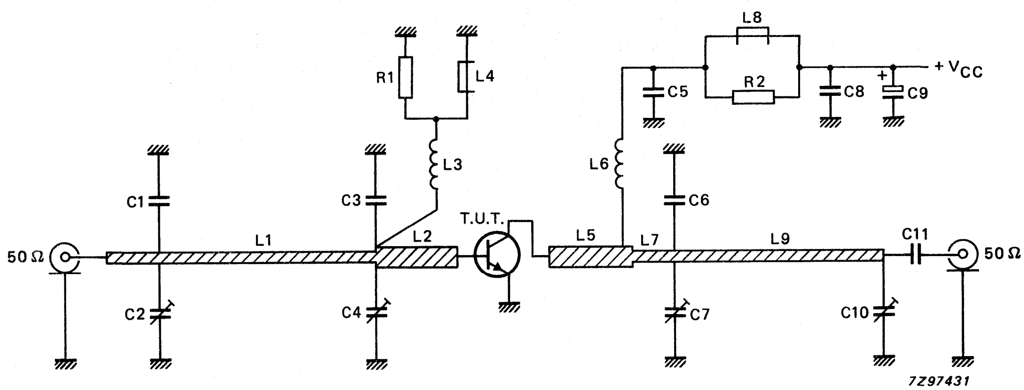


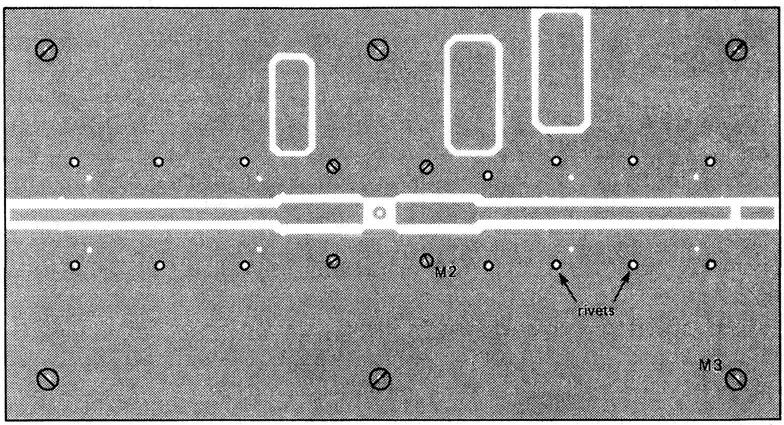
Fig. 3 Class-B test circuit at f = 900 MHz.

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.



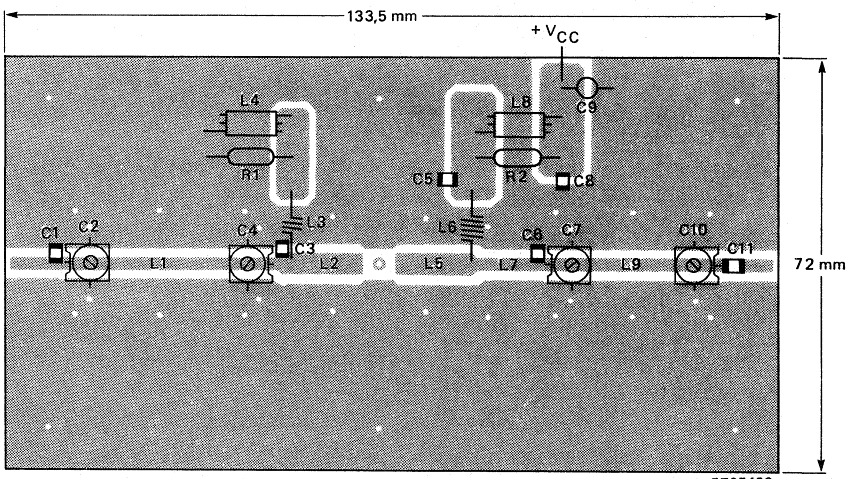


Fig. 4 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

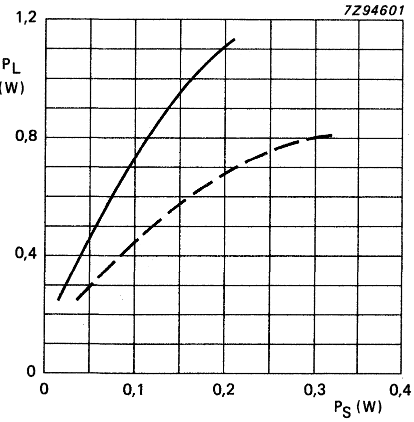


Fig. 5 Load power vs. source power.

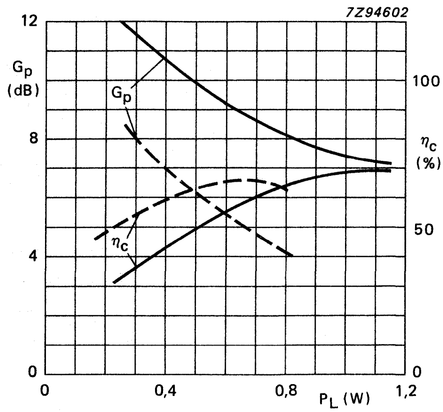


Fig. 6 Power gain and efficiency vs. load power.

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).

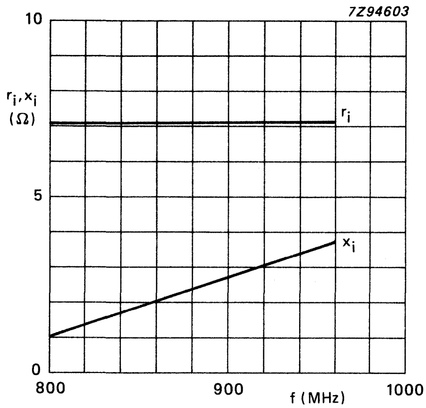


Fig. 7 Input impedance (series components).

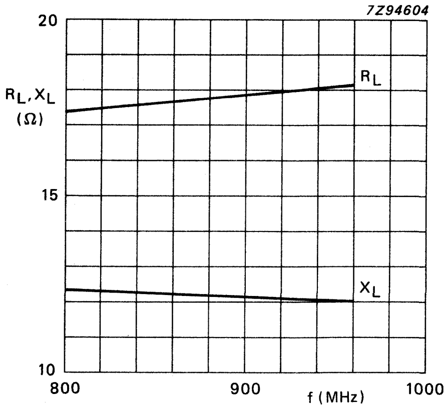


Fig. 8 Load impedance (series components).

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.

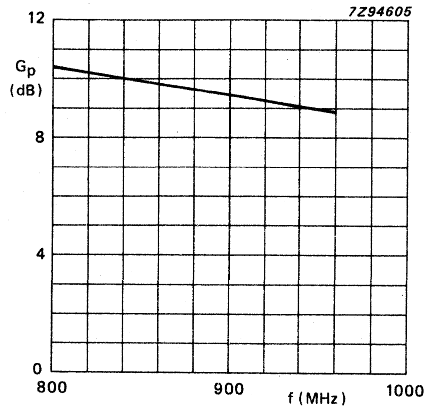


Fig. 9 Power gain vs. frequency.

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

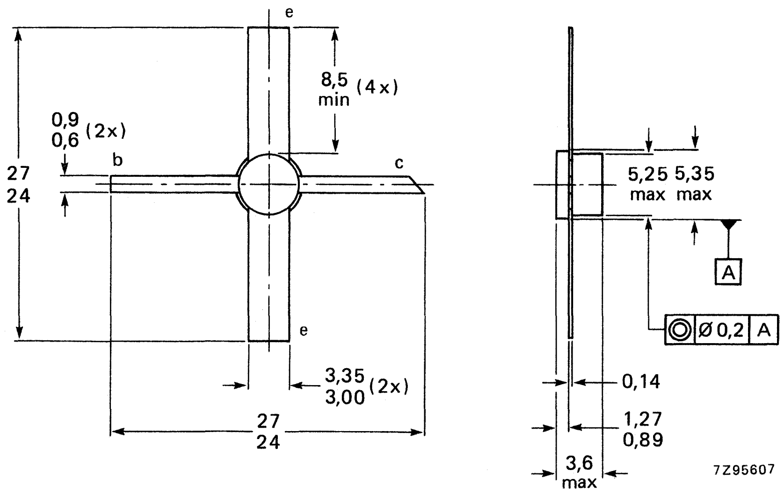
R.F. performance at T_a = 25 °C in a common-emitter class-B circuit.

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 °C; f > 1 MHz*	$P_{tot(rf)}$	max.	3,0	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

Dissipation = 4,5 W; T_{mb} = 25 °C

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-mb}	typ.	0,5 pF

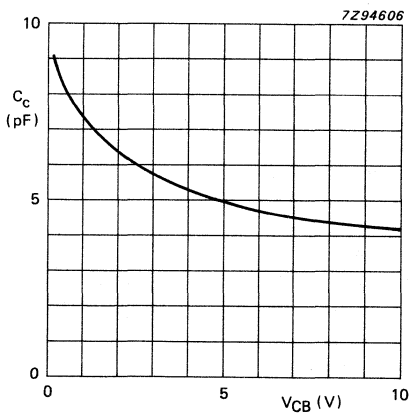


Fig. 2 I_E = i_e = 0; f = 1 MHz; typical values.

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

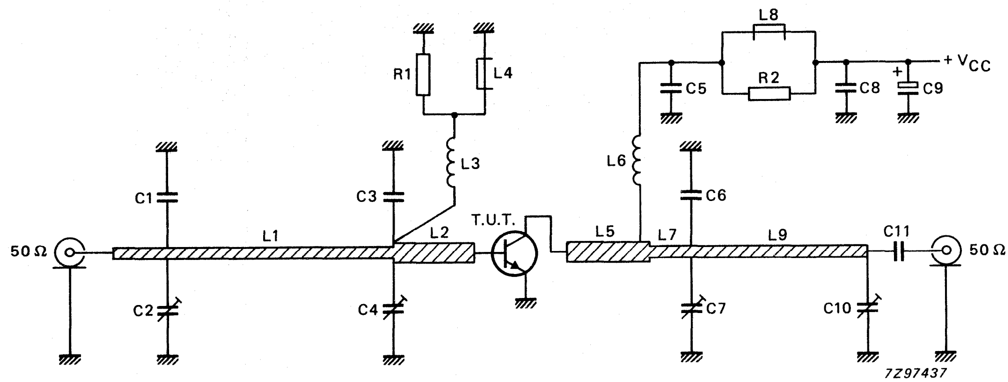


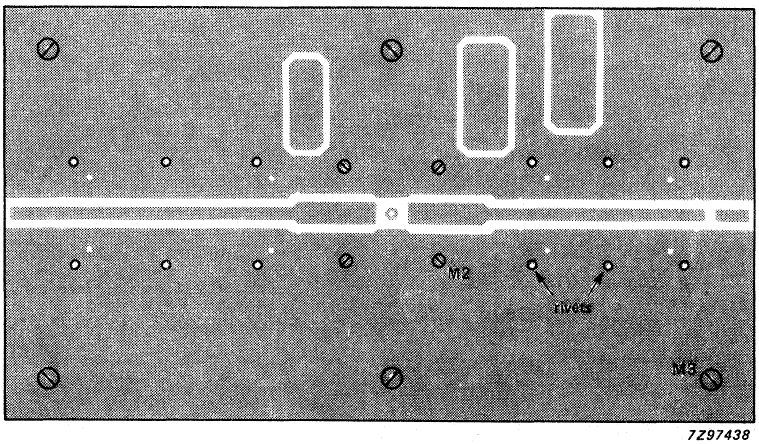
Fig. 3 Class-B test circuit at f = 900 MHz.

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.



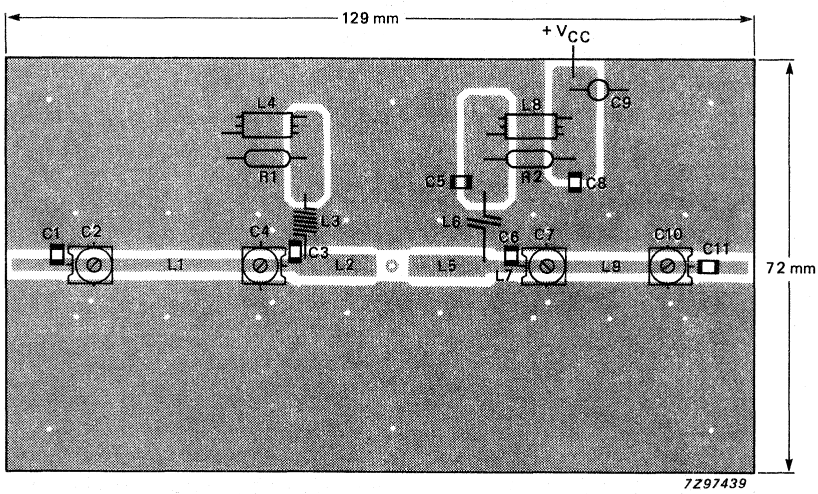


Fig. 4 Printed wiring board and component lay-out for 900 MHz class-B test circuit.

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.

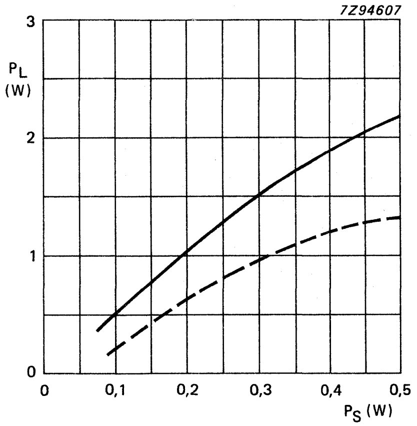


Fig. 5 Load power vs. source power.

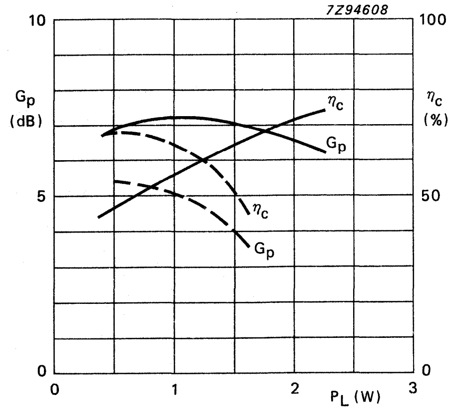


Fig. 6 Power gain and efficiency vs. load power.

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.

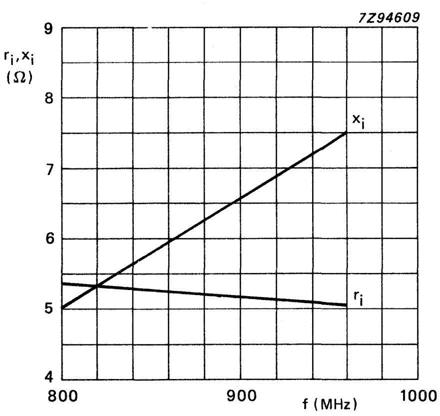


Fig. 7 Input impedance (series components).

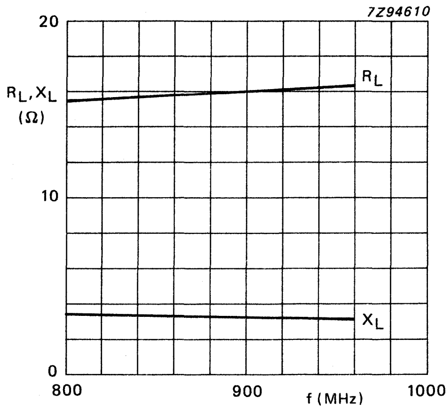


Fig. 8 Load impedance (series components).

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.

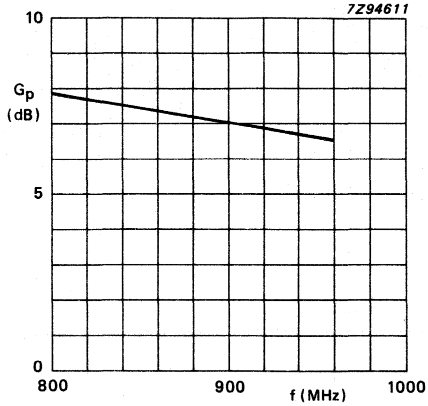


Fig. 9 Power gain vs. frequency.

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

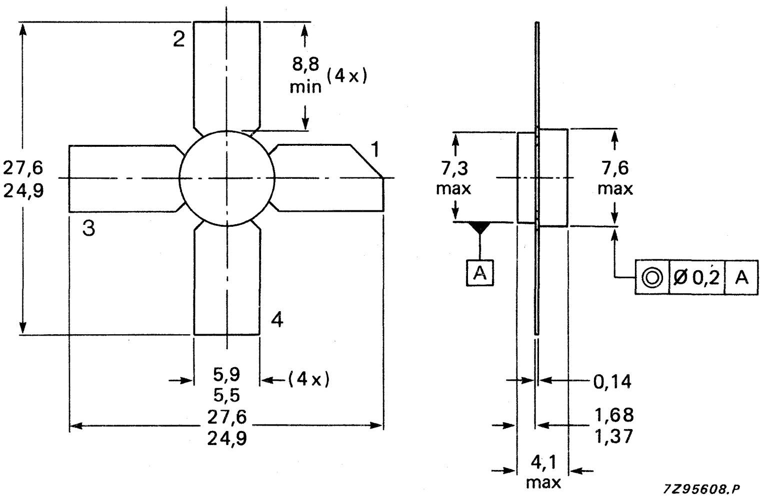


Fig.1 SOT122D.

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

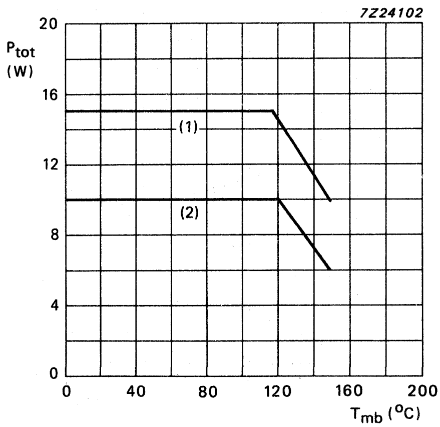


Fig. 2 Total power dissipation as a function of temperature.

(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-mb}	typ.	1.2 pF

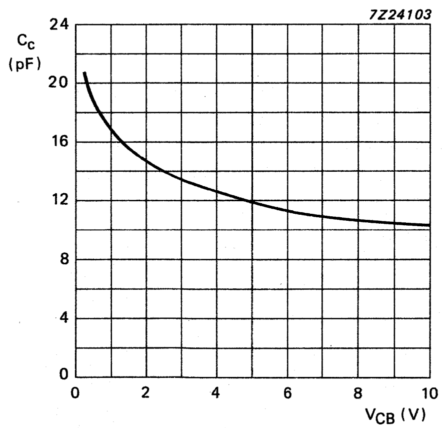


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $I_E = i_e$ = 0; typical values.

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

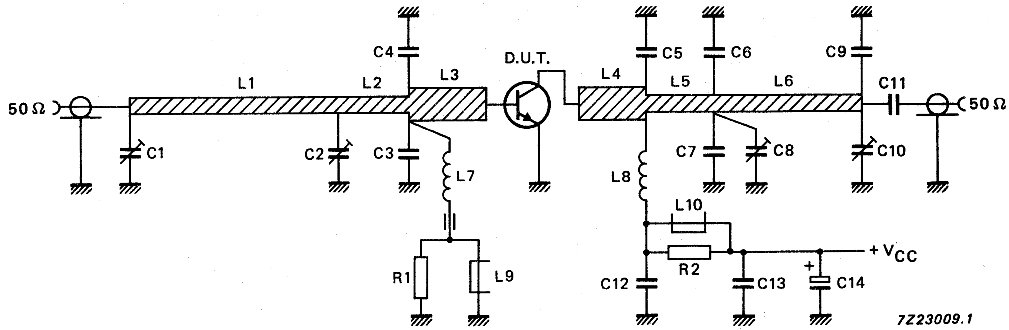


Fig.4 Class-B test circuit at f = 900 MHz.

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 (ϵ_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.

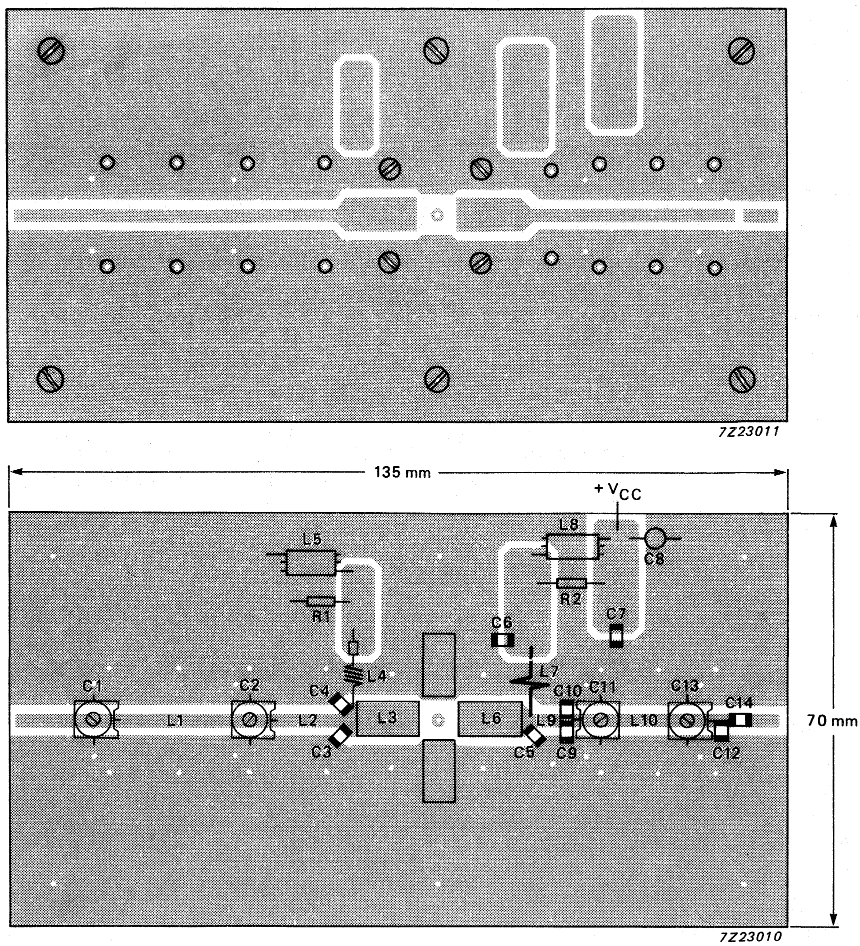


Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

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.

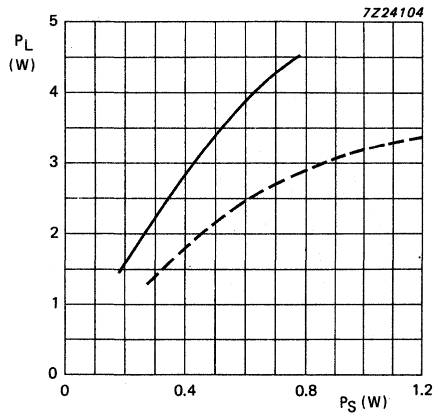


Fig. 6 Load power as a function of source power.

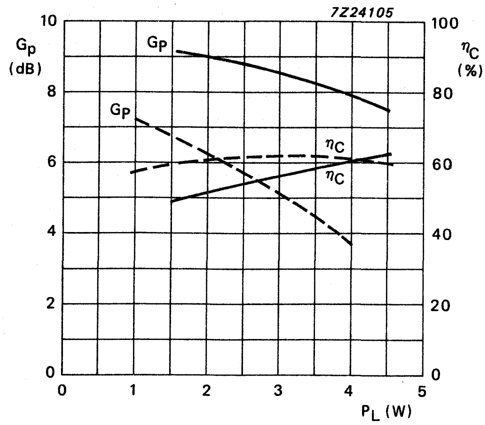


Fig. 7 Power gain and efficiency as a function of load power.

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.

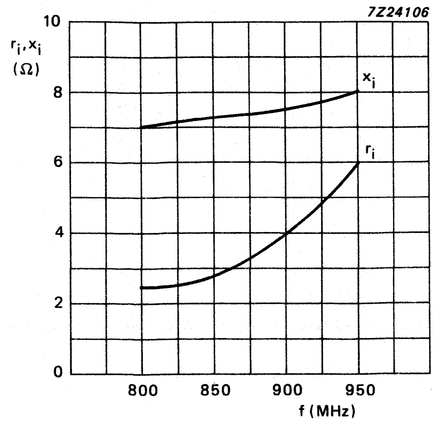


Fig. 8 Input impedance as a function of frequency (series components).

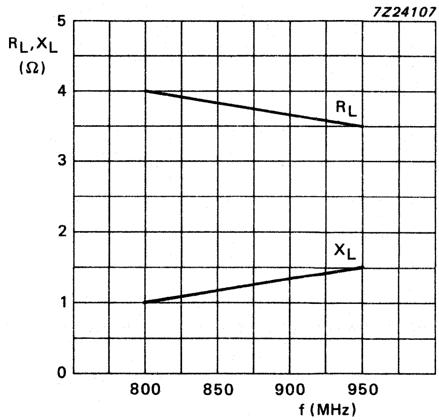


Fig. 9 Load impedance as a function of frequency (series components).

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.

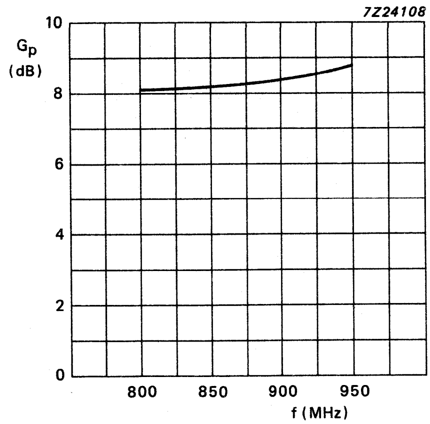


Fig. 10 Power gain as a function of frequency.

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

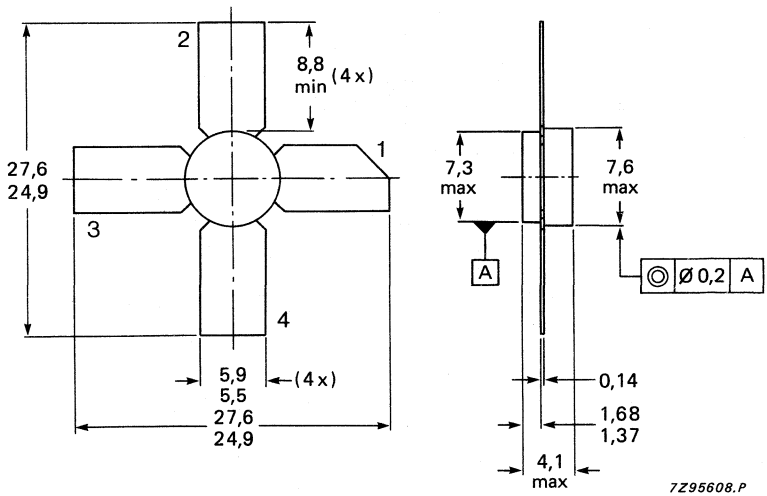


Fig.1 SOT122D.

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

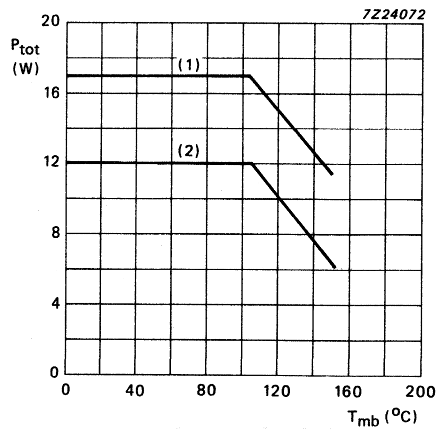


Fig. 2 Total power dissipation as a function of temperature.

(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

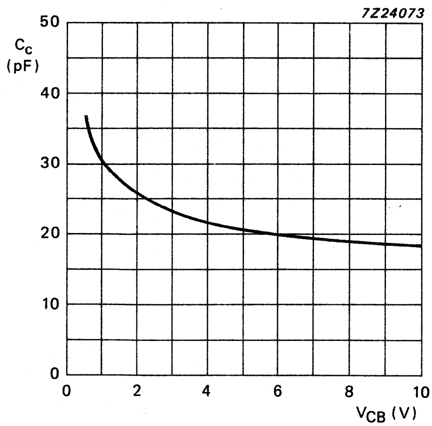


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $I_E = i_e$ = 0; typical values.

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

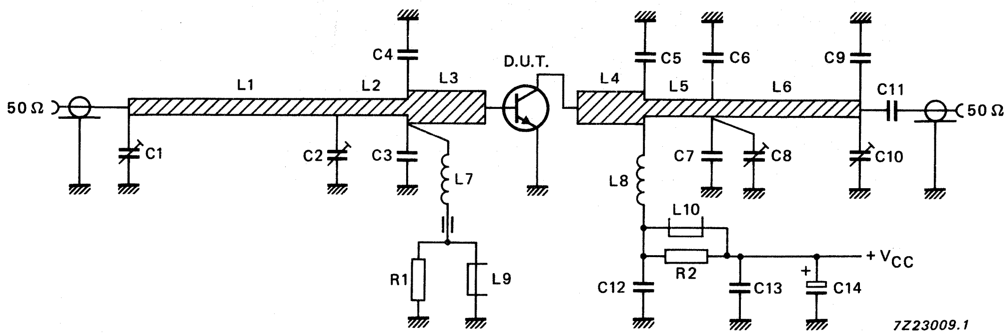


Fig. 4 Class-B test circuit at f = 900 MHz.

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.

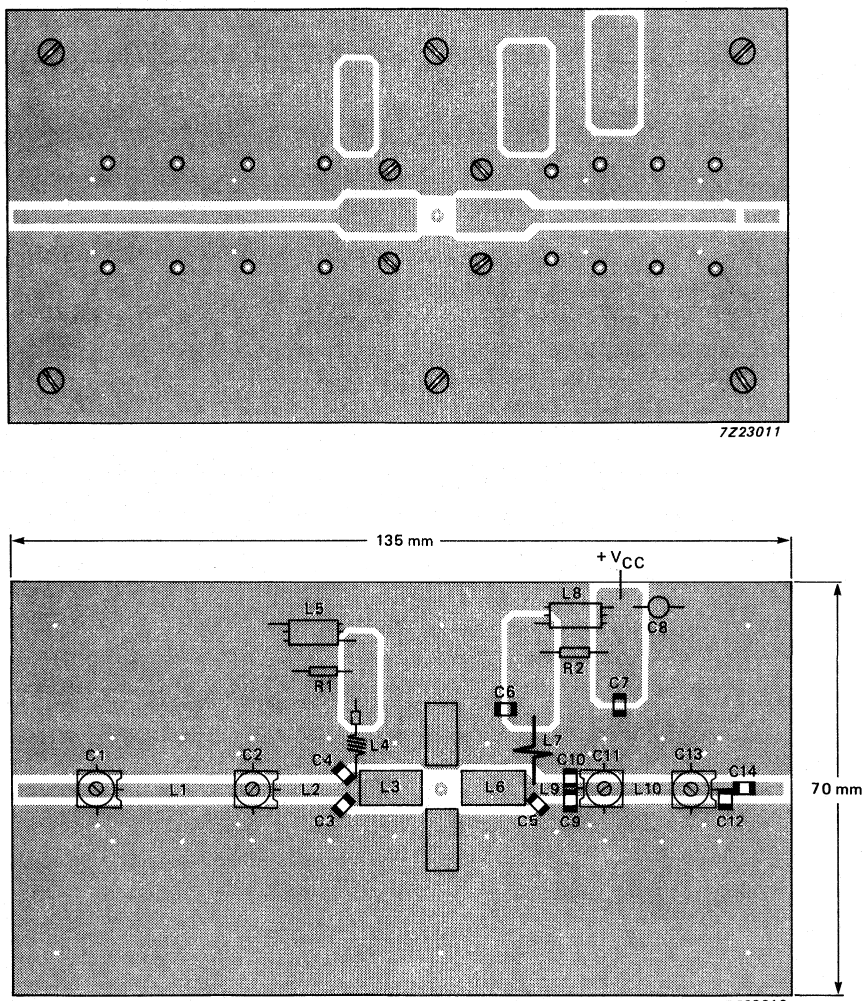


Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

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.

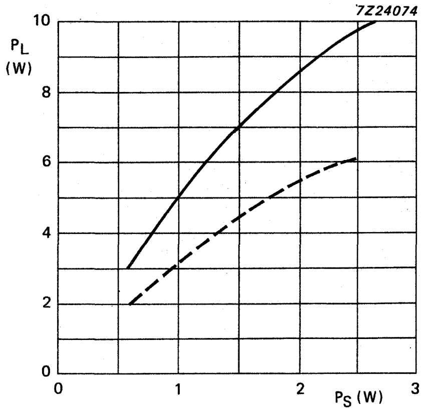


Fig. 6 Load power as a function of source power.

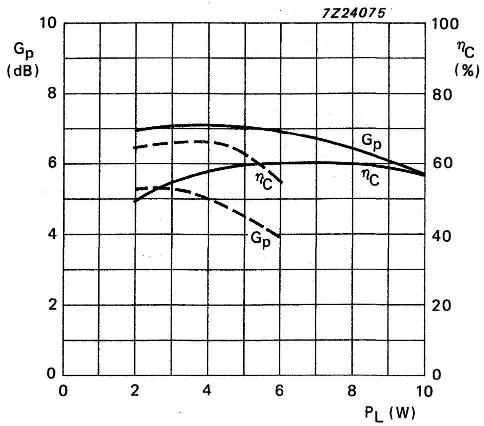


Fig. 7 Power gain and efficiency as a function of load power.

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.

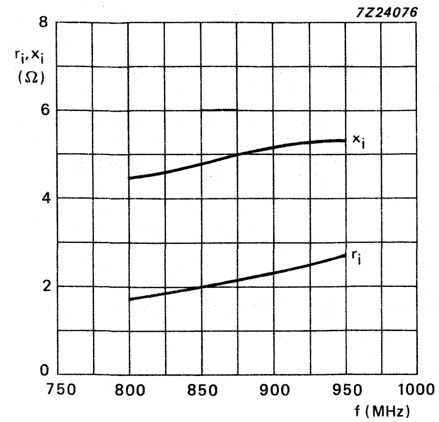


Fig. 8 Input impedance as a function of frequency (series components).

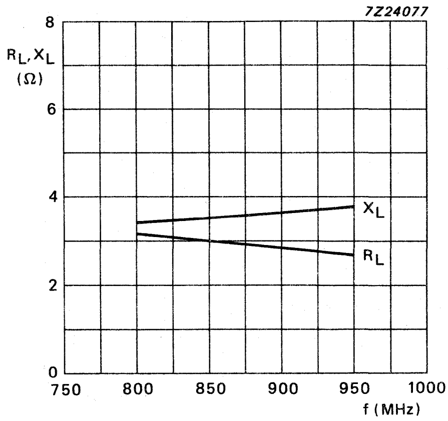


Fig. 9 Load impedance as a function of frequency (series components).

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.

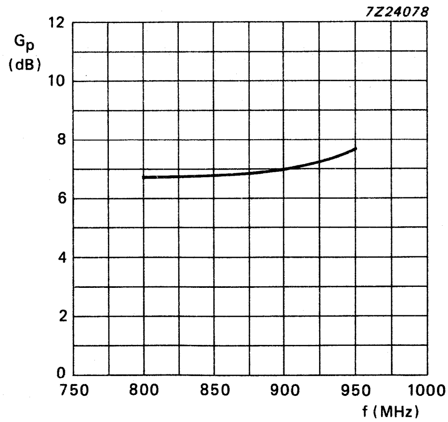


Fig. 10 Power gain as a function of frequency.

UHF power transistor

BLU10/12

FEATURES

- Emitter-ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Withstands full load mismatch.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-pin SOT122 envelope. It is designed for common emitter, class-B operation in mobile radio transmitters in the 470 MHz communications band.

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

PINNING - SOT122A

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	12.5	10	> 8	> 65

PIN CONFIGURATION

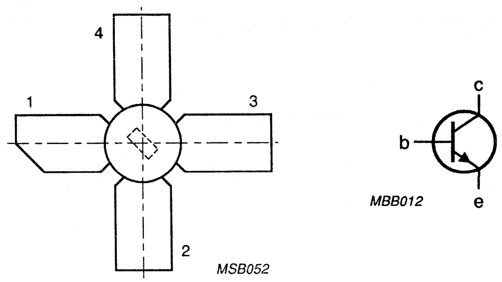


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	1.6	A
I_{CM}	collector current	peak value f > 1 MHz	–	4.8	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	41	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		–	200	°C

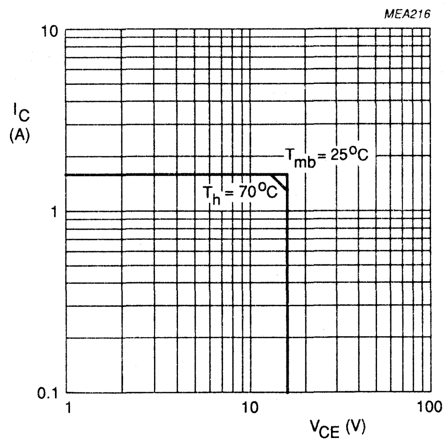
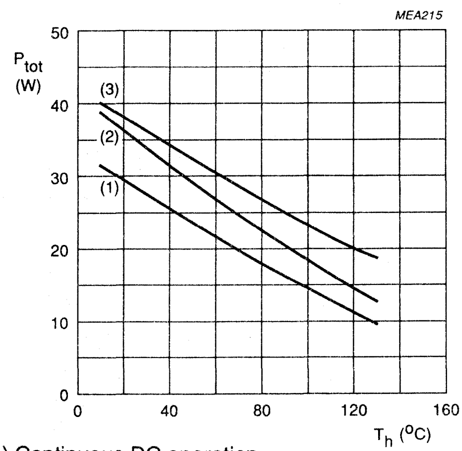


Fig.2 DC SOAR.



(1) Continuous DC operation.

(2) Continuous RF operation (f > 1 MHz).

(3) Short time RF operation during mismatch (f > 1 MHz).

Fig.3 Power/temperature derating.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	P_{tot} = 41 W; T_{mb} = 25 °C	4.3	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.6	K/W

CHARACTERISTICS

$T_j = 25\ °C$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 20$ mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 40$ mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 2$ mA	3	–	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 16$ V	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 10$ V; $I_C = 1.2$ A	25	–	–	
C_c	collector capacitance	$V_{CB} = 12.5$ V; $I_E = I_e = 0$; f = 1 MHz	–	15	–	pF
C_{re}	feedback capacitance	$V_{CE} = 12.5$ V; $I_C = 0$; f = 1 MHz	–	9	–	pF
C_{cs}	collector-stud capacitance	f = 1 MHz	–	1.2	–	pF

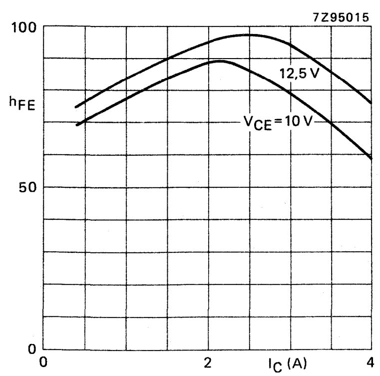
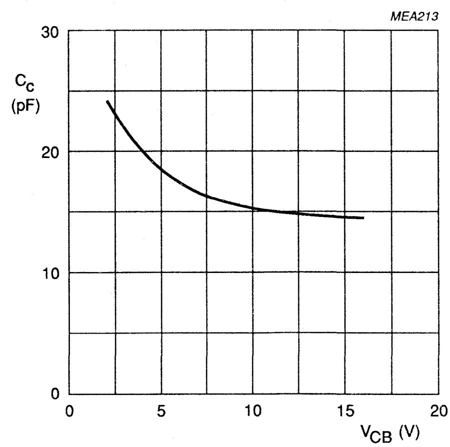
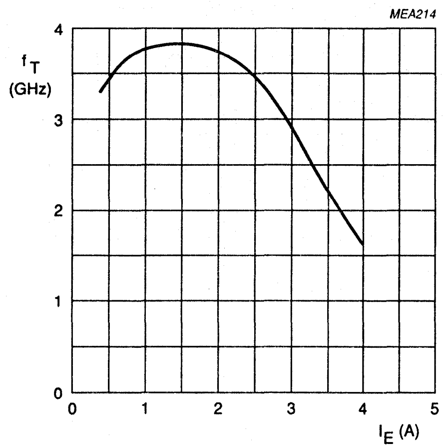


Fig.4 DC current gain as a function of collector current, typical values.



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

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



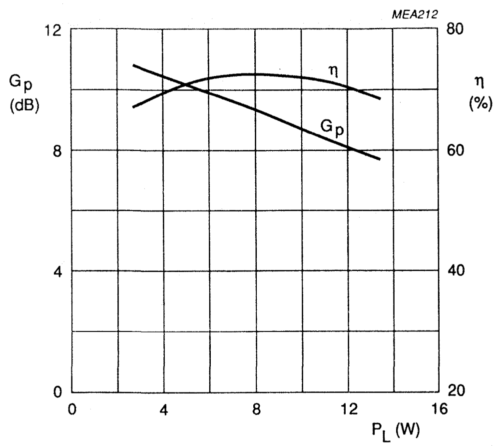
V_{CB} = 12.5 V.

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

APPLICATION INFORMATION

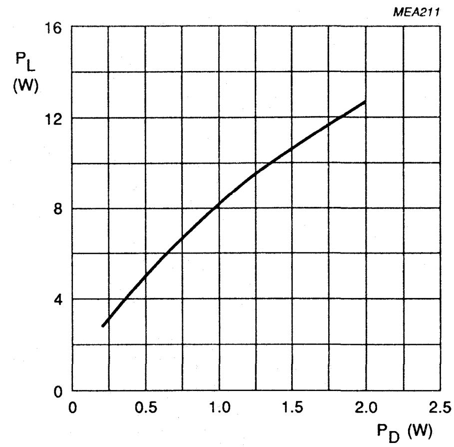
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	12.5	10	> 8 typ. 8.7	> 65 typ. 73



Class-B operation; V_{CE} = 12.5 V; f = 470 MHz.

Fig.7 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 12.5 V; f = 470 MHz.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLU10/12 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{CE} = 15.5 V, f = 470 MHz, at rated output power.

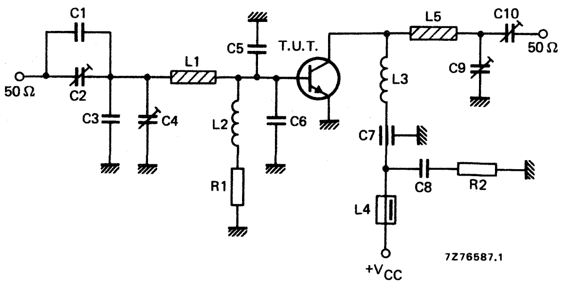


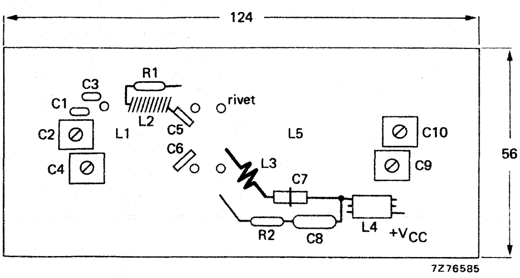
Fig.9 Class-B test circuit at f = 470 MHz.

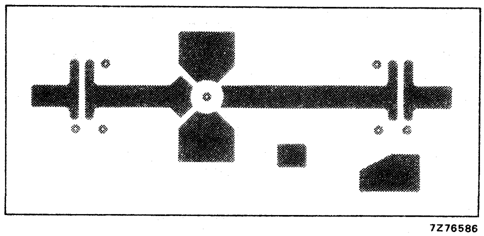
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	ceramic capacitor	2.2 pF		
C2, C9, C10	film dielectric trimmer	2 to 18 pF		2222 809 09003
C3	ceramic capacitor	3.9 pF		
C4	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C5, C6	multilayer ceramic chip capacitor	15 pF		2222 851 13159
C7	ceramic feed-through capacitor	100 pF		
C8	polyester capacitor	100 nF		
L1	stripline (note 1)	39 Ω	27.9 x 6 mm	
L2	13 turns closely wound enamelled 0.5 mm copper wire	320 nH	int. dia. 4 mm leads 2 x 5 mm	
L3	1½ turns enamelled 1 mm copper wire	17 nH	int. dia. 6 mm leads 2 x 5 mm spacing 1 mm	
L4	grade 3B Ferroxcube wideband RF choke			4312 020 36640
L5	stripline (note 1)	39 Ω	45.8 x 6 mm	
R1	0.25 W carbon resistor	1 Ω, 5%		
R2	0.25 W carbon resistor	10 Ω, 5%		

Note

1. The striplines L1 and L5 are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.74$); thickness 1⁄16 inch.

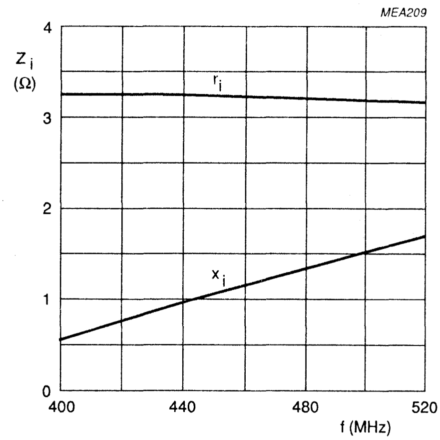




Dimensions in mm.

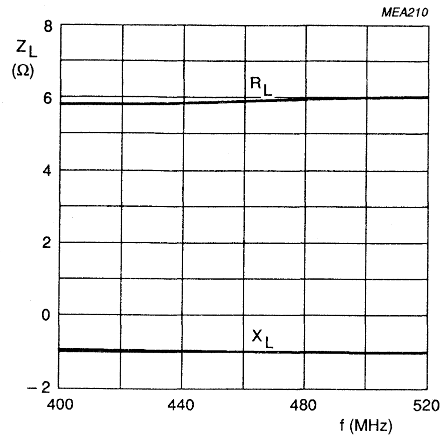
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board. The other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of hollow rivets.

Fig.10 Component layout and printed circuit board for 470 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 10 W.

Fig.11 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 12.5 V; P_L = 10 W.

Fig.12 Load impedance (series components) as a function of frequency, typical values.

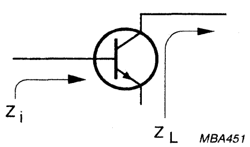
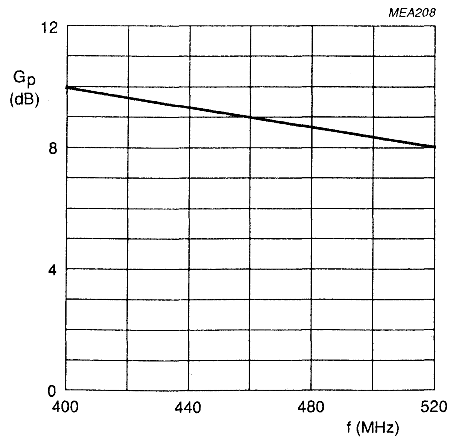


Fig.13 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 10 W.

Fig.14 Power gain as a function of frequency, typical values.

U.H.F. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile 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 device can be applied at a P_L of max. 1,5 W when it is mounted on a printed wiring board (see Fig. 6) without an external heatsink.

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

QUICK REFERENCE DATA

R.F. performance in a common-emitter class-B circuit.

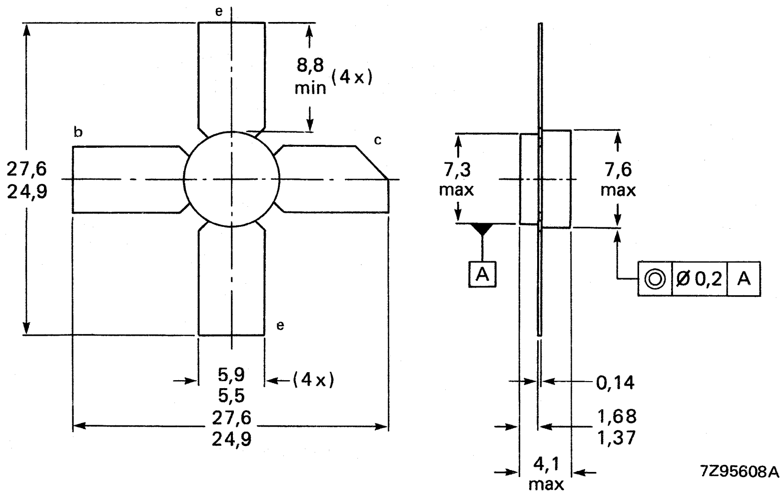
mode of operation	T °C	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	T_{mb} = 25	12,5	470	2,5	> 10	> 55
	T_a = 25*	12,5	470	1,5	> 12	> 55

* Device mounted on a printed wiring board (see Fig. 6).

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-122D.



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.	0,4 A
(peak value), f > 1 MHz	I_{CM}	max.	1,2 A
Total power dissipation			
at $T_{mb} \leqslant 90$ °C; f > 1 MHz	$P_{tot(rf)}$	max.	6 W
Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max.	200 °C

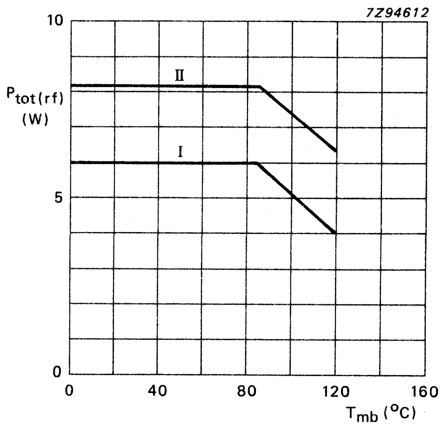


Fig. 2 Power/temperature derating curves.

I Continuous r.f. operation (f > 1 MHz)

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

THERMAL RESISTANCE

Dissipation = 4,5 W

From junction to ambient* at T_a = 25 °C; f > 1 MHz (r.f. operation)	$R_{th\ j\text{-}a\ (rf)}$	max.	50 K/W
From junction to mounting base at T_{mb} = 25 °C; f > 1 MHz (r.f. operation)	$R_{th\ j\text{-}mb\ (rf)}$	max.	15 K/W

* Device mounted on a printed wiring board (see Fig. 6).

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 5 mA	$V_{(BR)CBO}$	min.	36 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	min.	16 V
Emitter-base breakdown voltage open collector; I_E = 0,5 mA	$V_{(BR)EBO}$	min.	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	max.	2,5 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	min.	0,55 mJ
D.C. current gain I_C = 0,3 A; V_{CE} = 10 V	h_{FE}	min.	25
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 12,5 V	C_c	typ.	4 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	2,5 pF
Collector-mounting base capacitance	$C_{c\text{-}mb}$	typ.	1,2 pF

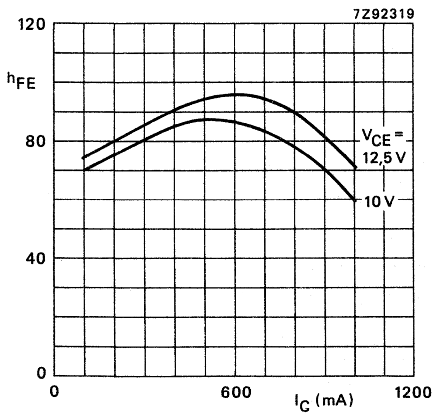


Fig. 3 T_j = 25 °C; typical values.

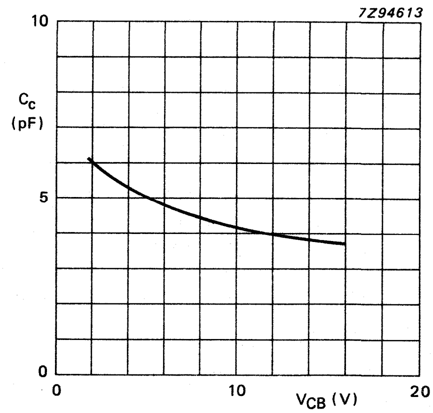


Fig. 4 I_E = i_e = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in common-emitter circuit; class-B; f = 470 MHz; circuit tuned at P_L = 2,5 W.

mode of operation	T ^oC	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	T_{mb} = 25	12,5	470	2,5	> 10	> 55
	T_{mb} = 25				typ. 12	typ. 60
	T_a = 25**	12,5	470	1,5	> 12	> 55

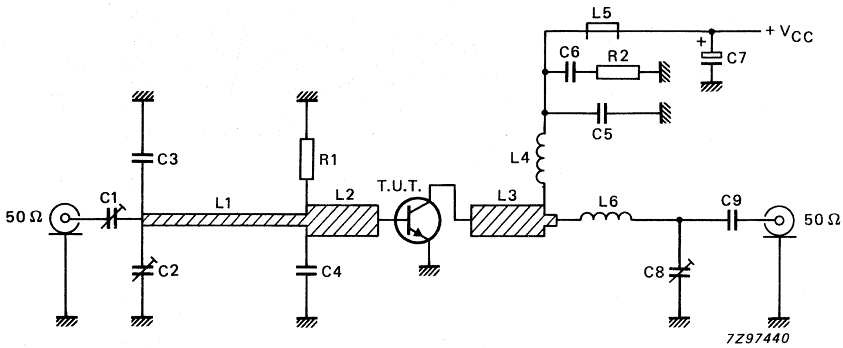


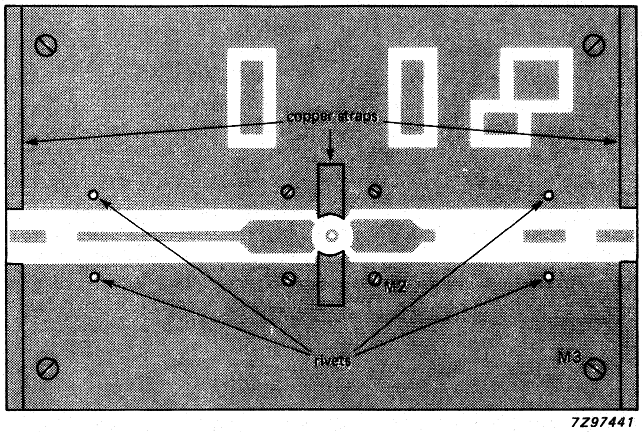
Fig. 5 Class-B test circuit at f = 470 MHz.

List of components:

C1 = C2 = 2-9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 1,6 pF multilayer ceramic chip capacitor*
C4 = 10 pF multilayer ceramic chip capacitor*
C5 = 100 pF multilayer ceramic chip capacitor
C6 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 809 47104)
C7 = 2,2 μF (35 V) tantalum electrolytic capacitor
C8 = 1,4 - 55 pF film dielectric trimmer (cat. no. 2222 809 09001)
C9 = 5,6 pF multilayer ceramic chip capacitor*
L1 = 56 Ω stripline (25,5 mm x 2 mm)
L2 = L3 = 25 Ω stripline (11 mm x 6 mm)
L4 = 132 nH; 6 turns closely wound enamelled Cu-wire (1 mm), int. dia. 6 mm, leads 2 x 5 mm
L5 = Ferroxcube h.f. choke, grade 3B (cat. no. 4312 020 36642)
L6 = 16 nH; 1 turn enamelled Cu-wire (1 mm), int. dia. 6 mm, leads 2 x 5 mm
R1 = 10 Ω; ± 5% 0,4 W metal film resistor
R2 = 10 Ω; ± 5% 0,4 W metal film resistor

L1, L4 and L5 are striplines on a double Cu-clad printed wiring board with PTFE fibre-glass dielectric (ϵ_r = 2,2) and a thickness of 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type B or capacitor of the same quality.
** Device mounted on a printed wiring board (see Fig. 6).



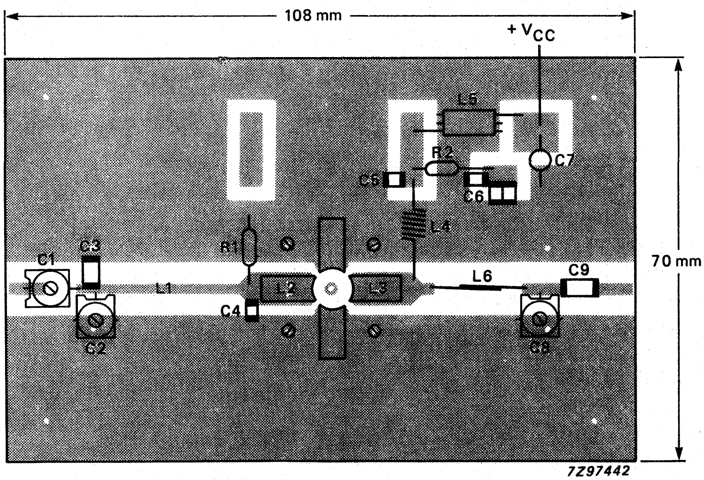


Fig. 6 Printed wiring board and component lay-out for 470 MHz class-B test circuit.

Note

The circuit and the components are situated 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 using hollow rivets, fixing-screws and copper straps at the input and output and under the two emitters to provide a direct contact between the copper on the component side and the groundplane.

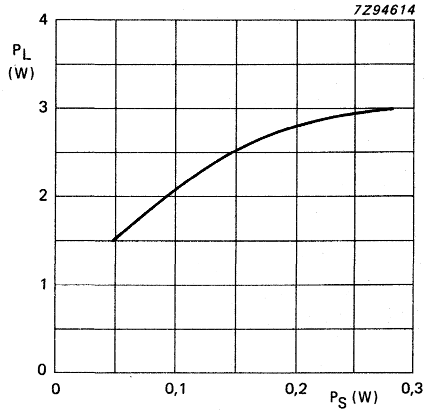


Fig. 7 Load power versus source power.

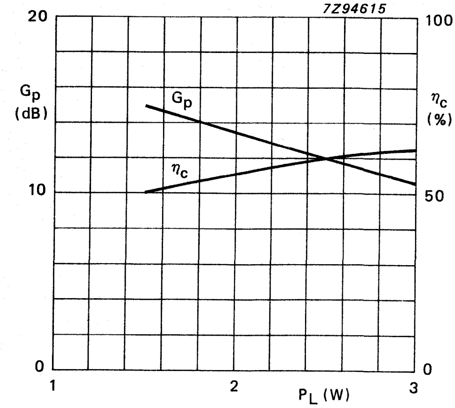


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

V_{CE} = 12,5 V; f = 470 MHz; T_{mb} = 25 °C; class-B operation; test circuit tuned at P_L = 2,5 W; typical values.

RUGGEDNESS

The BLU11/SL is capable of withstanding a full load mismatch (VSWR = 50 through all phases) at P_L = 2,5 W up to a supply voltage of 15,5 V and T_{mb} = 25 °C.

Input and output impedances (series components) versus frequency:

V_{CE} = 12,5 V; P_L = 2,5 W; f = 400 to 512 MHz; T_{mb} = 25 °C; class-B operation; typical values.

frequency (MHz)	Z_i (Ω)	Z_o (Ω)
400	4,0 – j 4,1	13,1 + j 7,2
430	4,0 – j 3,3	13,3 + j 7,0
460	4,0 – j 2,6	13,6 + j 6,9
490	4,1 – j 1,9	13,8 + j 6,8
512	4,1 – j 1,5	13,8 + j 6,7

UHF power transistor BLU15/12

FEATURES

- Internal input matching, to achieve wide bandwidth
- Ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT122 envelope and intended for common emitter, class-B operation in mobile radio transmitters in the 450 MHz communications band.

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

PINNING - SOT122A

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	12.5	15	> 7.8	> 55

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

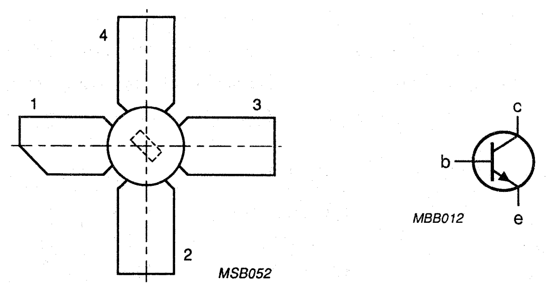


Fig.1 Simplified outline and symbol.

UHF power transistor BLU15/12

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	3	A
I_{CM}	collector current	peak value f > 1 MHz	–	9	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	35	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		–	200	°C

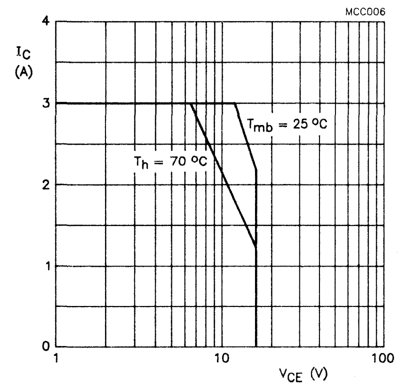
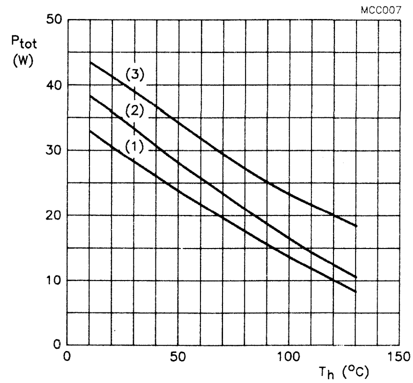


Fig.2 DC SOAR.



(1) Continuous operation.

(2) Continuous operation (f > 1 MHz).

(3) Short time operation during mismatch.

Fig.3 Power/temperature derating.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	5	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.6	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 25 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 5 mA	3.5	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 16 V	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 2 A	15	65	–	
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	33	–	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	24	–	pF
C_{cs}	collector-stud capacitance		–	1.2	–	pF

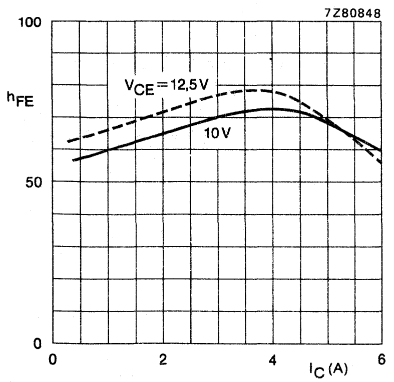


Fig.4 DC current gain as a function of collector current, typical values.

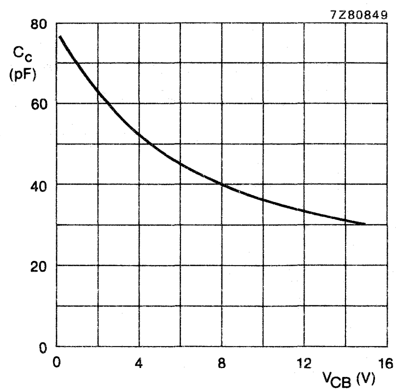


Fig.5 Collector capacitance as a function of collector-base voltage, typical values.

APPLICATION INFORMATION

RF performance in a common emitter test circuit; T_h = 25 °C; $R_{th\ mb-h}$ = 0.6 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	12.5	15	> 7.8 typ. 8.8	> 55 typ. 63

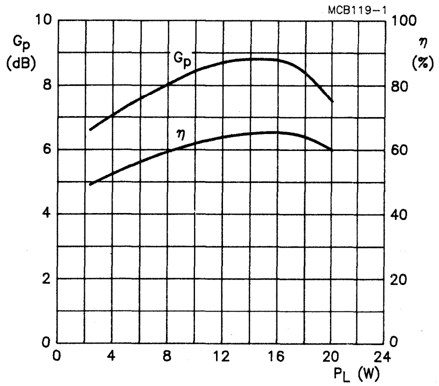


Fig.6 Power gain and efficiency as functions of load power, typical values.

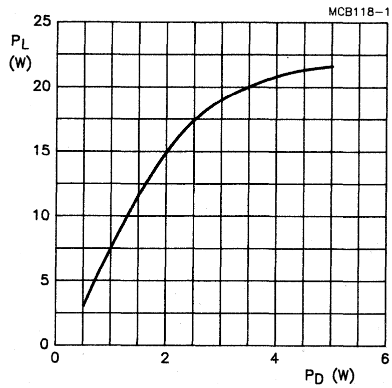


Fig.7 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLU15/12 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{CE} = 15.5 V, f = 470 MHz, T_h = 25 °C and $R_{th\ mb-h}$ = 0.6 K/W, at rated output power.

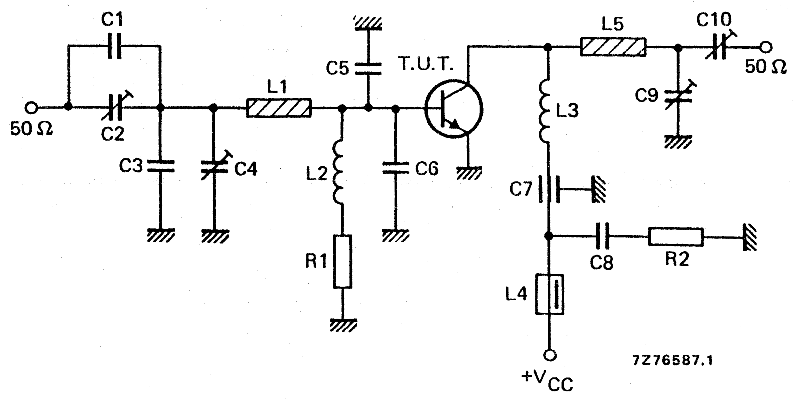


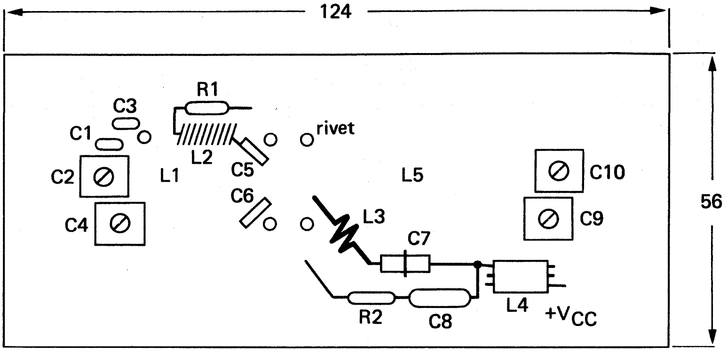
Fig.8 Class-B test circuit at f = 470 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	ceramic capacitor	2.2 ±0.25 pF		
C2, C9, C10	film dielectric trimmer	2 to 18 pF		2222 809 09003
C3	ceramic capacitor	3.9 ±0.25 pF		
C4	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C5, C6	multilayer ceramic chip capacitor	15 pF		2222 851 13159
C7	ceramic feed-through capacitor	100 pF		
C8	polyester capacitor	100 nF		
L1	stripline (note 1)		27.9 x 6 mm	
L2	13 turns closely wound enamelled 0.5 mm copper wire		int. dia. 4 mm leads 2 x 5 mm	
L3	1½ turns enamelled 1 mm copper wire	17 nH	int. dia. 6 mm leads 2 x 5 mm spacing 1 mm	
L4	grade 3B Ferroxcube wideband RF choke			4312 020 36640
L5	stripline (note 1)		45.8 x 6 mm	
R1	carbon resistor	1 Ω, 5%		
R2	carbon resistor	10 Ω, 5%		

Note

1. The striplines L1 and L5 are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.74); thickness 1⁄16 inch.



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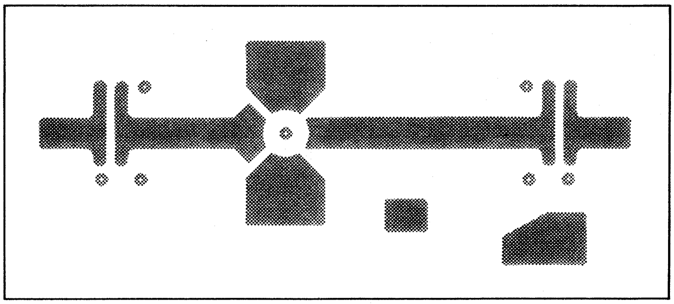

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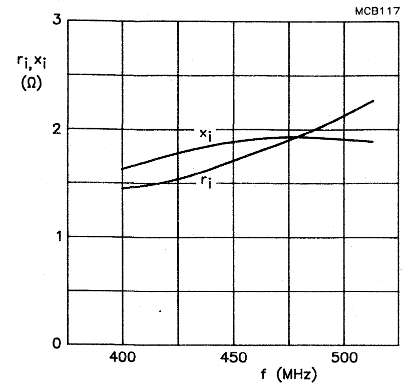
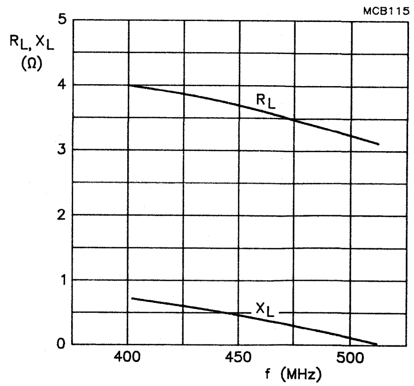
The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections from the component side to the ground plane are made by means of hollow rivets.

Fig.9 Component layout and printed circuit board for 470 MHz class-B test circuit.



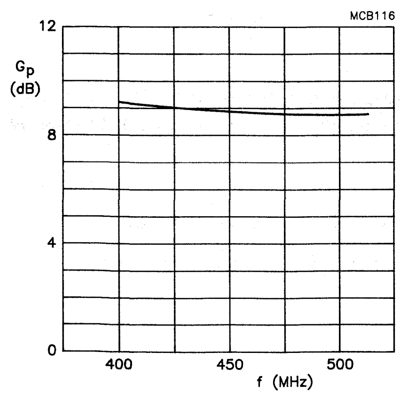
Class-B operation; V_{CE} = 12.5 V; P_L = 15 W.

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



Class-B operation; V_{DS} = 12.5 V; P_L = 15 W.

Fig.11 Load impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{DS} = 12.5 V; P_L = 15 W.

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

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

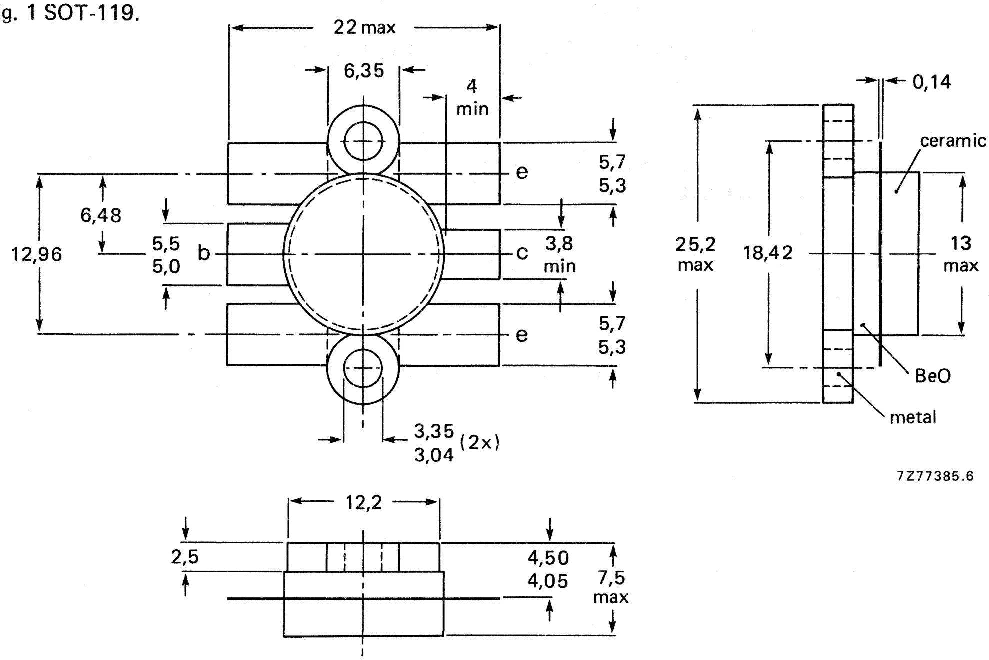
SOT-119 (see Fig. 1).

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

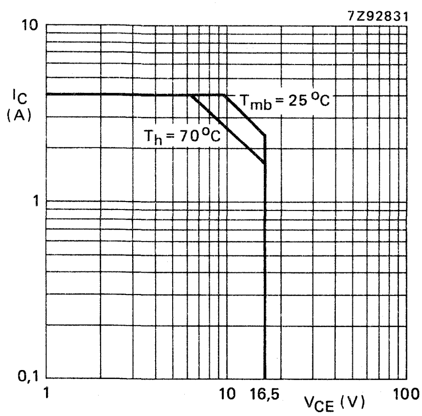


Fig. 2 D.C.SOAR.
$R_{th\ mb\text{-}h}$ = 0,2 K/W

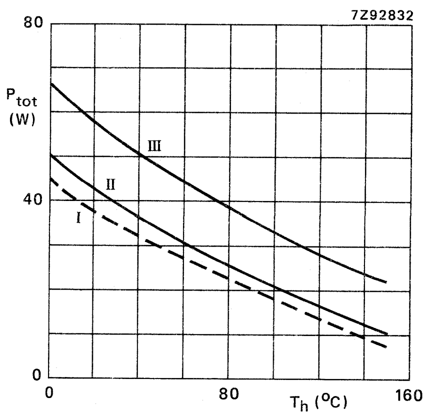


Fig. 3 Power/temperature derating curves
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

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

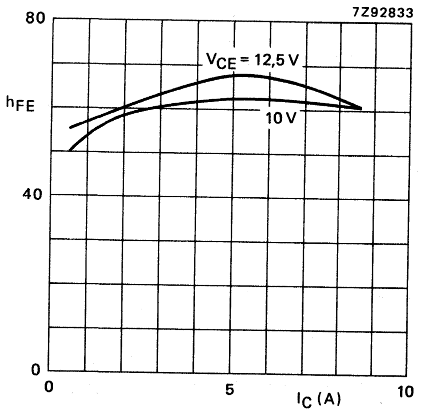


Fig. 4 T_j = 25 °C; typ. values.

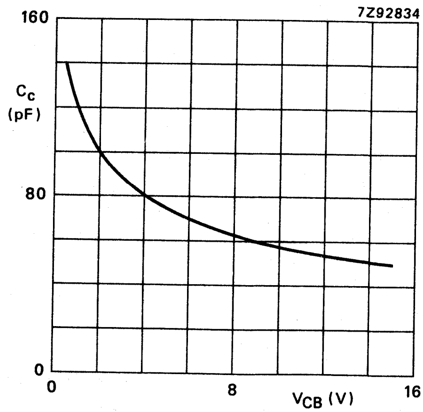


Fig. 5 $I_E = i_e$ = 0; f = 1 MHz; typ. values.

APPLICATION INFORMATION

Mode of operation	in narrow band test circuit; class-B; c.w.			
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
		typ.	7,8	dB
Collector efficiency	η_c	>	55	%
		typ.	64	%
Heatsink temperature	T_h		25	°C

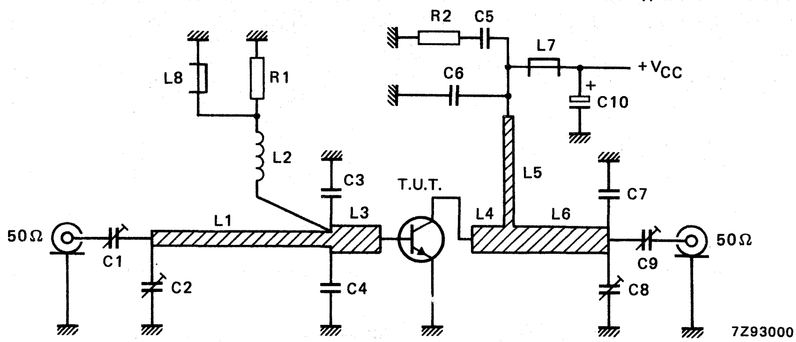


Fig. 6 Class-B test circuit at f = 470 MHz.

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.

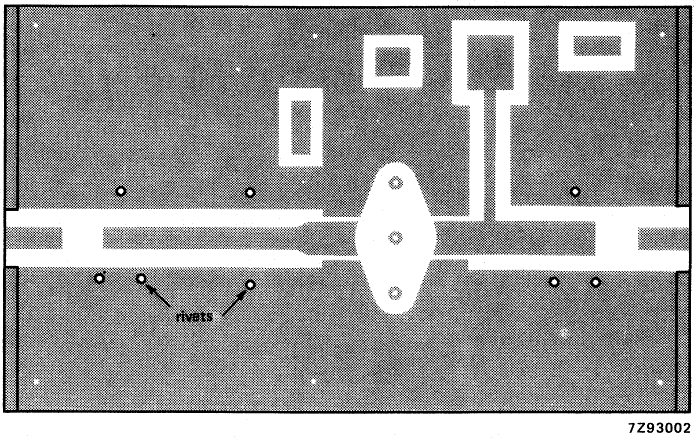


Fig. 7 P.C. board for 470 MHz, class-B test circuit.

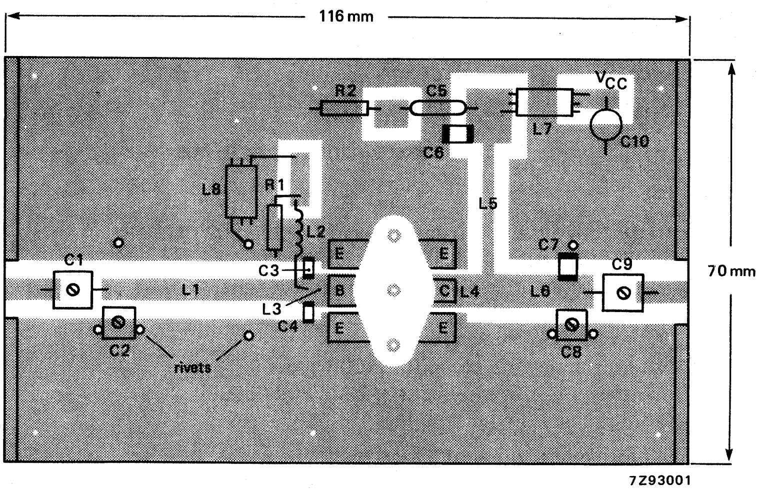


Fig. 8 Component lay-out of 470 MHz, class-B test circuit.

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.

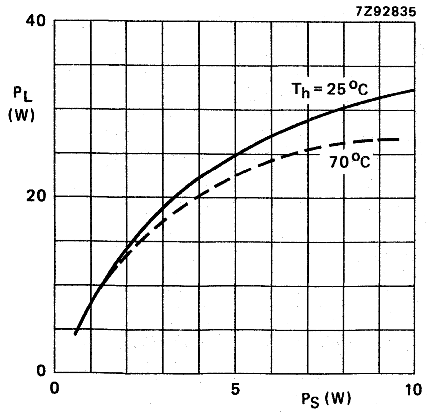


Fig. 9 Load power vs. source power.

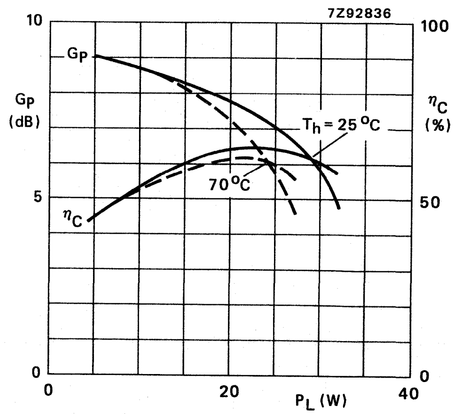


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs. 9 and 10:

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

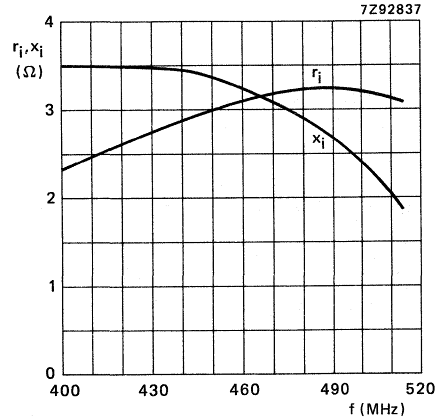


Fig. 11 Input impedance (series components).

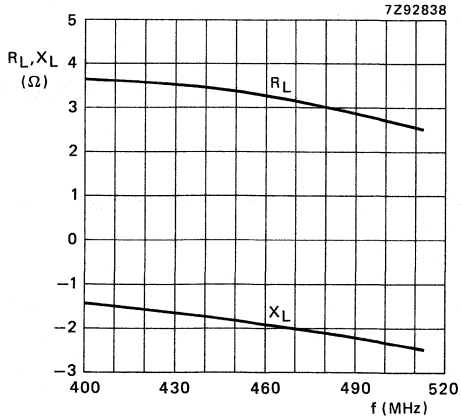


Fig. 12 Load impedance (series components).

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.

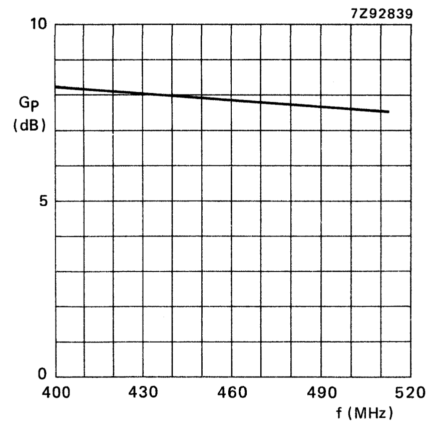


Fig. 13 Power gain versus frequency.

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	^oC

MECHANICAL DATA

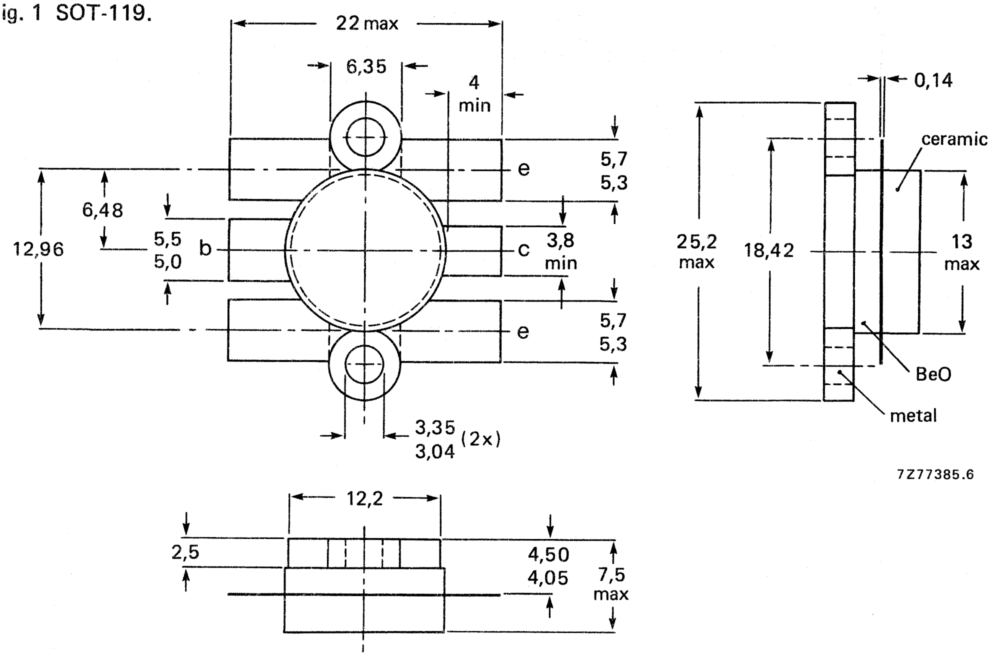
SOT-119 (see Fig. 1).

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)

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

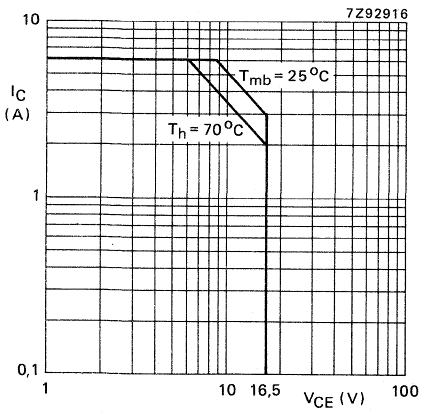


Fig. 2 D.C. SOAR.
$R_{th\ mb-h}$ = 0,2 K/W

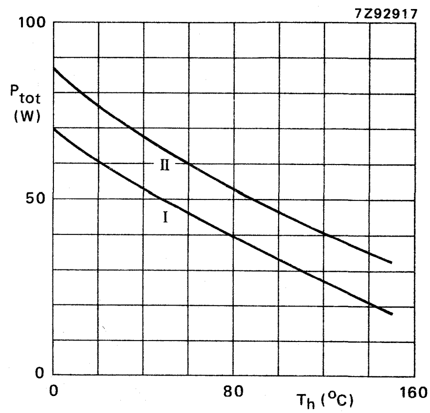


Fig. 3 Power/temperature derating curves
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

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

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

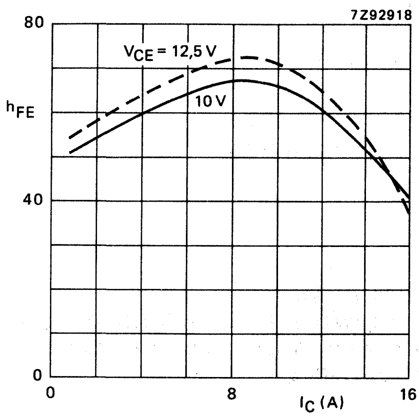


Fig. 4 T_j = 25 °C; typ. values.

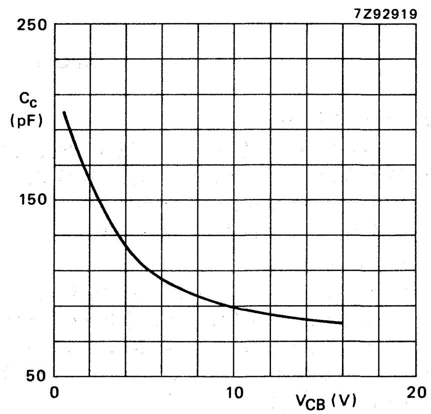


Fig. 5 I_E = i_e = 0; f = 1 MHz; typ. values.

* 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

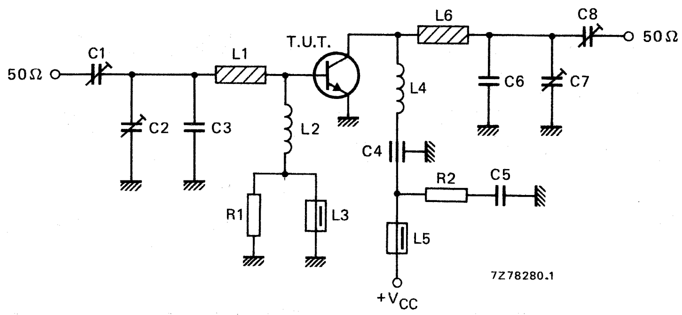


Fig. 6 Class-B test circuit at f = 470 MHz.

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.

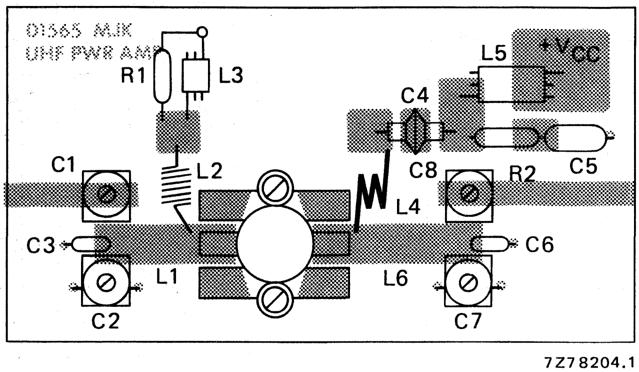


Fig. 7 Component lay-out of 470 MHz, class-B test circuit.

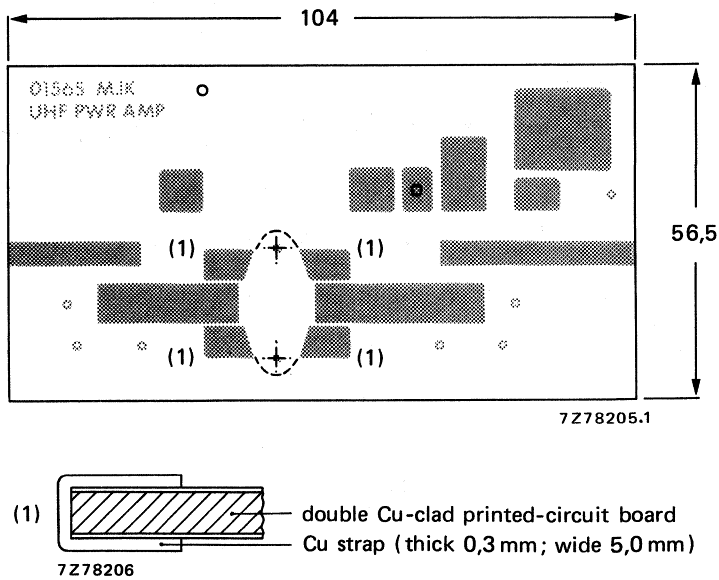


Fig. 8 P.c. board for 470 MHz, class-B test circuit.

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.

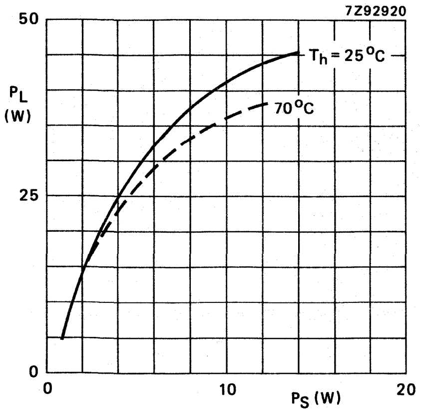


Fig. 9 Load power vs. source power.

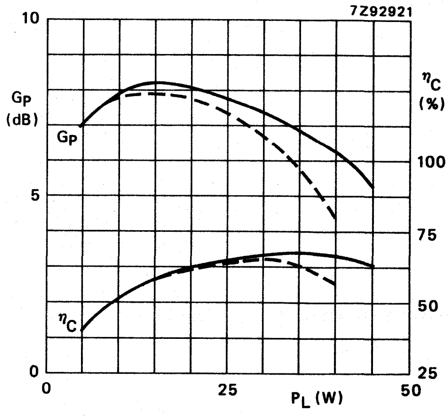


Fig. 10 Power gain and efficiency vs. load power.
——— T_h = 25 °C;
– – – T_h = 70 °C.

Conditions for Figs 9 and 10:

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

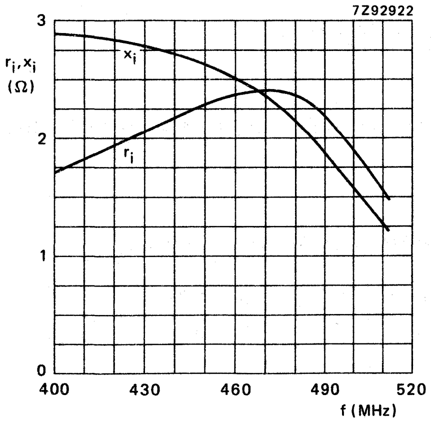


Fig. 11 Input impedance (series components).

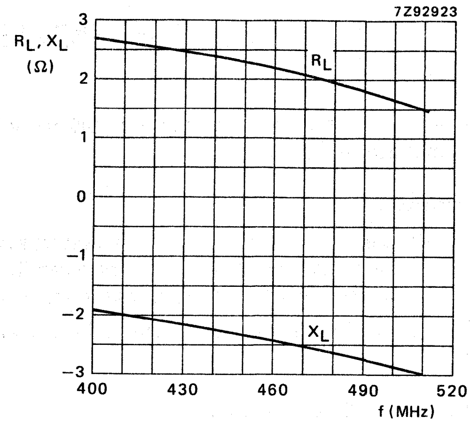


Fig. 12 Load impedance (series components).

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; $R_{th\ mb-h}$ = 0,2 K/W; typical values.

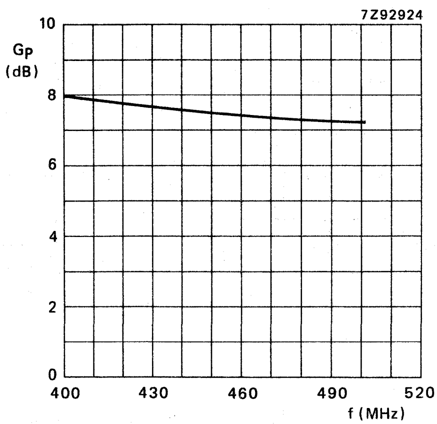


Fig. 13 Power gain versus frequency.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor primarily intended for use in 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 BLU30/28 has a 6-lead flange envelope with a ceramic cap (SOT119). All leads are isolated from the flange.

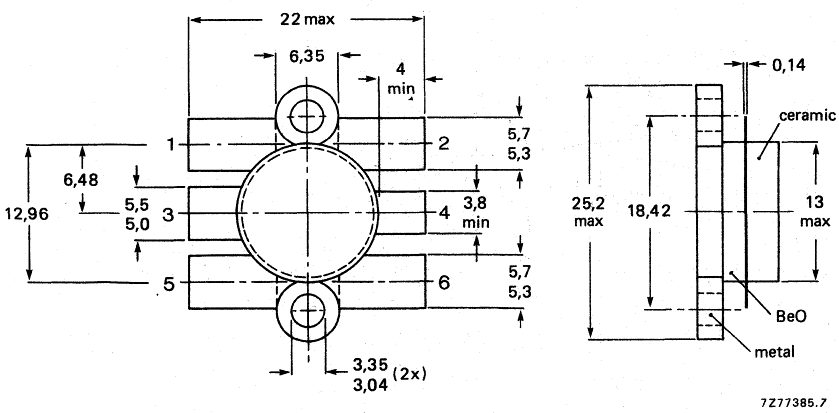
QUICK REFERENCE DATA

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

Mode of operation	f MHz	V_{CE} V	P_L W	G_p dB	η_C %
CW class-B	470	28	30	> 8	> 55
CW class-B	470	24	25	typ. 8	typ. 60

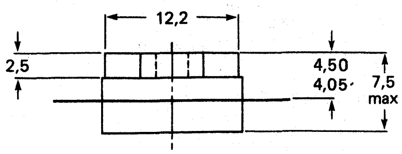
MECHANICAL DATA

Dimensions in mm



Lead reference

1 = emitter
2 = emitter
3 = base
4 = collector
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.

Fig.1 SOT119.

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)

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.	3.5 V
Collector current			
DC or average	$I_C, I_{C(AV)}$	max.	4.0 A
peak value; f > 1 MHz	I_{CM}	max.	12 A
RF power dissipation			
f > 1 MHz; T_{mb} = 25 °C	P_{rf}	max.	65 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

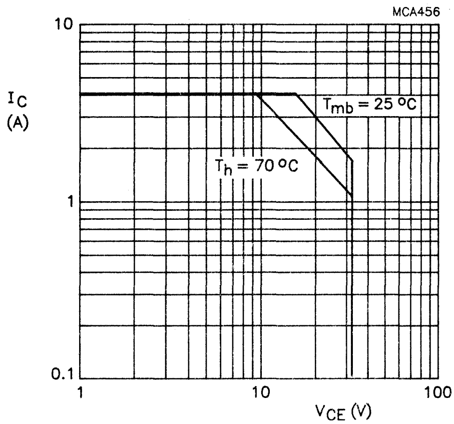
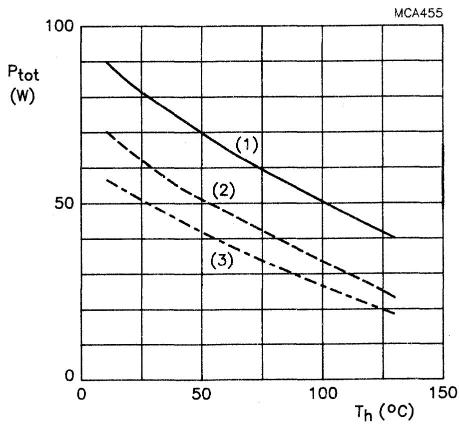


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

RF dissipation = 65 W; T_{mb} = 25 °C

From junction to mounting base (rf)	$R_{th\ j\text{-}mb}$	max.	2.55 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-emitter breakdown voltage			
V_{BE} = 0; I_C = 15 mA	$V_{(BR)CES}$	min.	60 V
open base; I_C = 100 mA	$V_{(BR)CEO}$	min.	32 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} = 32 V	I_{CES}	max.	5.0 mA
DC current gain			
I_C = 1.6 A; V_{CE} = 25 V	h_{FE}		20 to 120
		typ.	75
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 = 0; V_{CE} = 28 V	C_{re}	typ.	28 pF
Collector-flange capacitance	C_{cf}	typ.	3.0 pF

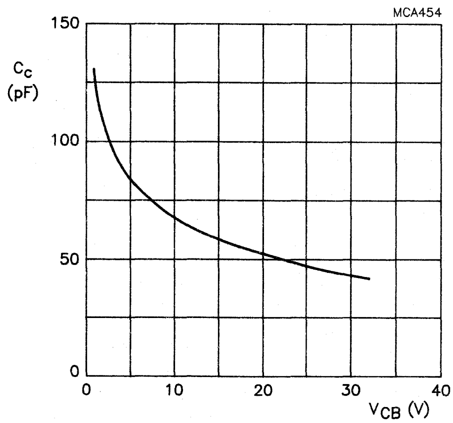
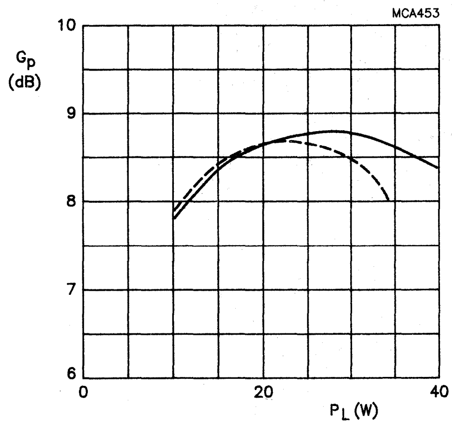


Fig.4 Collector capacitance as a function of base-collector voltage; $I_E = I_e = 0$; f = 1 MHz; typical values.

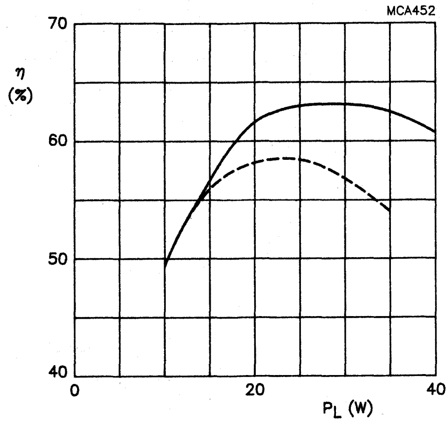
APPLICATION INFORMATION

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

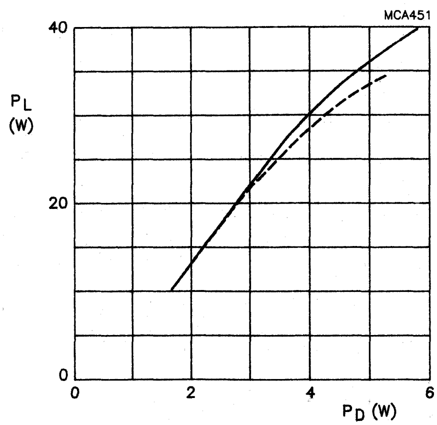
Mode of operation	f MHz	V_{CE} V	P_L W	G_P dB	η_C %
CW class-B	470	28	30	> 8	> 55
CW class-B	470	24	25	typ. 8	typ. 60



—— T_h = 25 °C
– – – T_h = 70 °C
Fig.5 Power gain as a function of load power; typical values.



—— T_h = 25 °C
– – – T_h = 70 °C
Fig.6 Efficiency as a function of load power; typical values.



—— T_h = 25 °C
– – – T_h = 70 °C
Fig.7 Load power as a function of drive power; typical values.

Conditions for Figs 5 to 7

Class-B operation; V_{CE} = 28 V; f = 470 MHz; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

Ruggedness in class-B operation

The BLU30/28 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W, at rated output power.

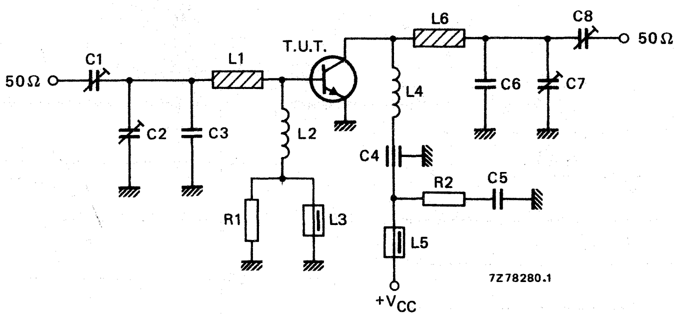


Fig.8 Class-B test circuit at f = 470 MHz.

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 HF 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 PTFE fibre-glass dielectric; thickness 1/16 inch; (ϵ_r = 2.74).

APPLICATION INFORMATION (continued)

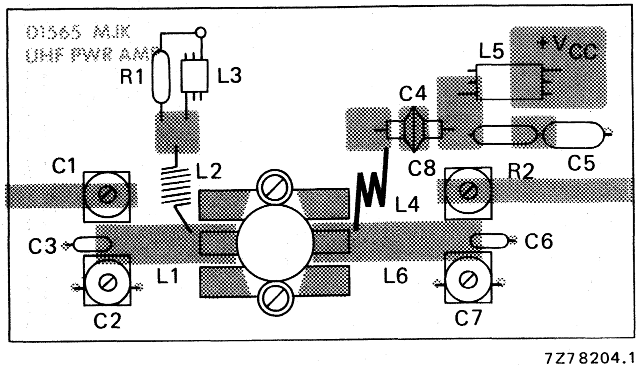
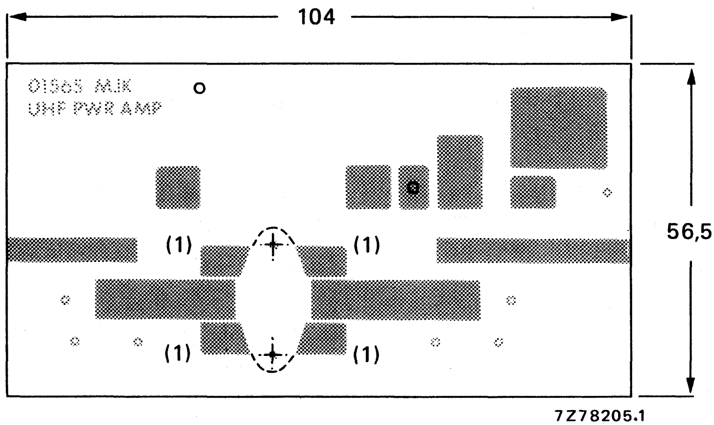


Fig.9 Component layout of 470 MHz, class-B test circuit.



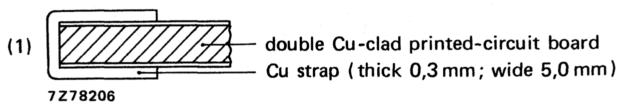


Fig.10 Printed-circuit board for 470 MHz, class-B test circuit.

NOTE

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is 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.

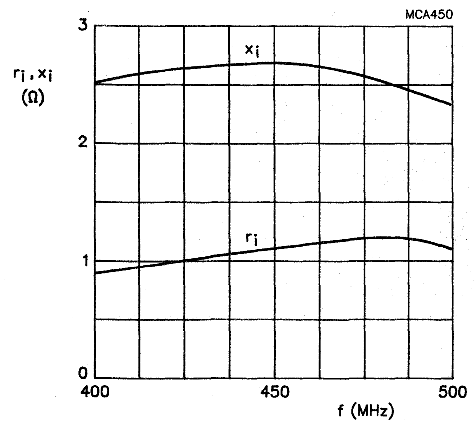


Fig.11 Input impedance as a function of frequency (series components); typical values.

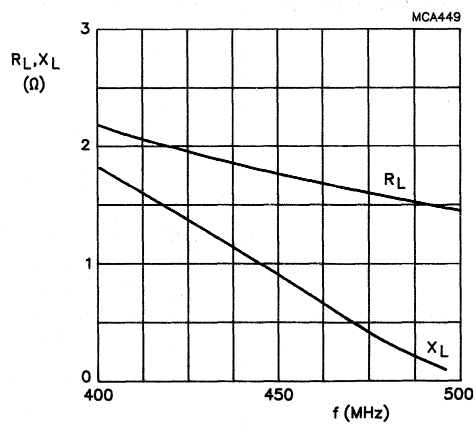


Fig.12 Load impedance as a function of frequency (series components); typical values.

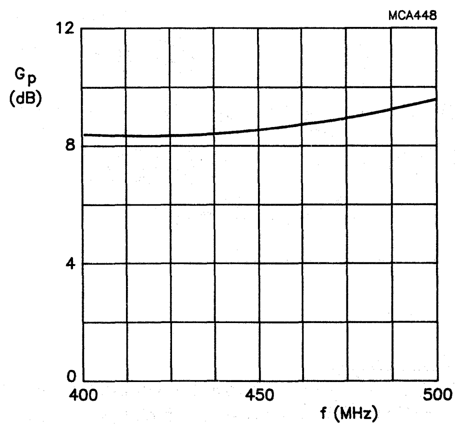


Fig.13 Power gain as a function of frequency; typical values.

Conditions for Figs 11 to 13

Class-B operation; V_{CE} = 28 V; P_L = 30 W; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

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

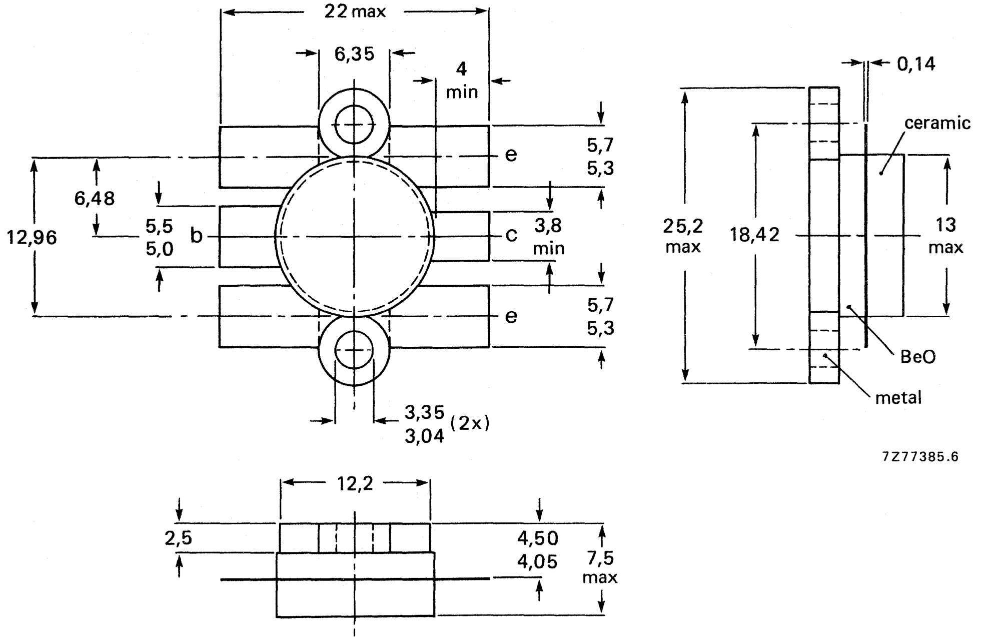
SOT-119 (see Fig. 1).

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

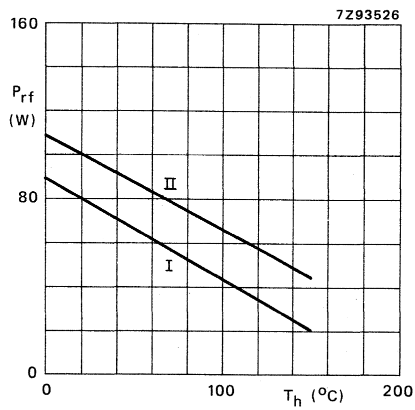


Fig. 2 Power/temperature derating curves.

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

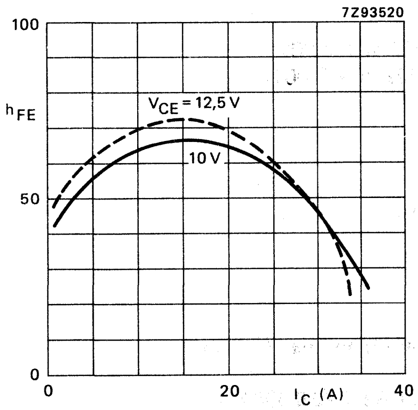


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

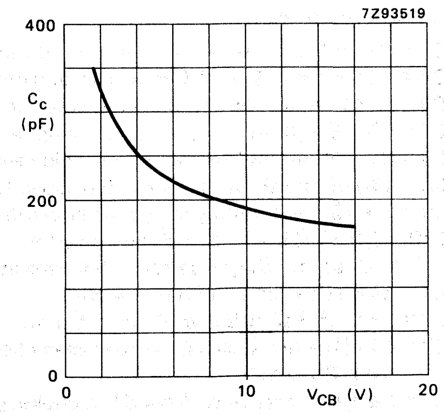


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

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

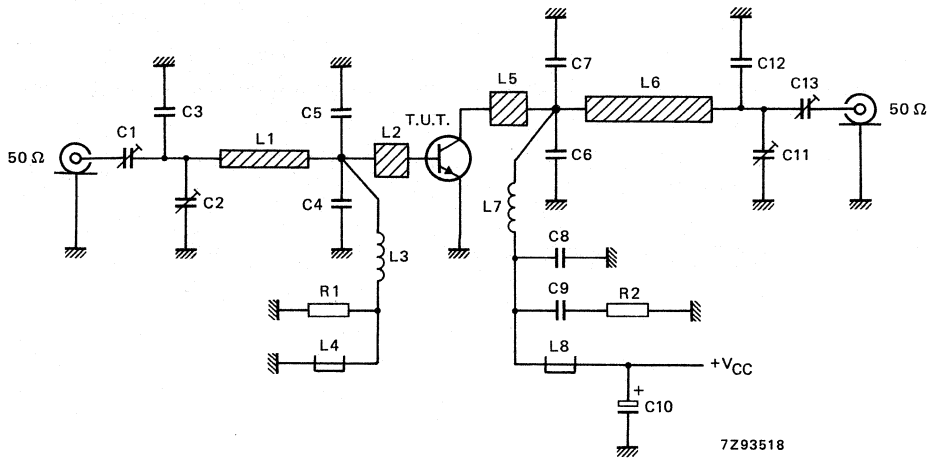


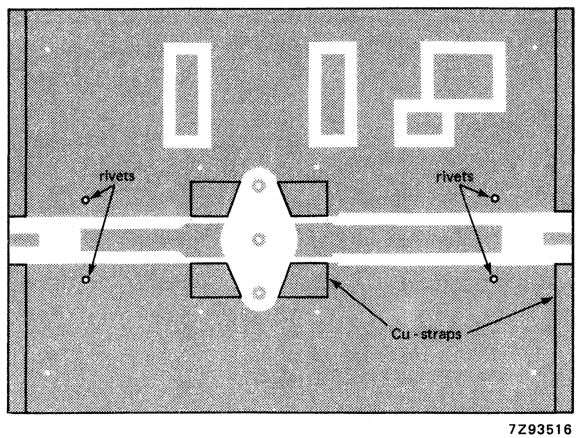
Fig. 5 Class-B test circuit at f = 470 MHz.

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 (ϵ_r = 2,2); thickness 1/32 inch.



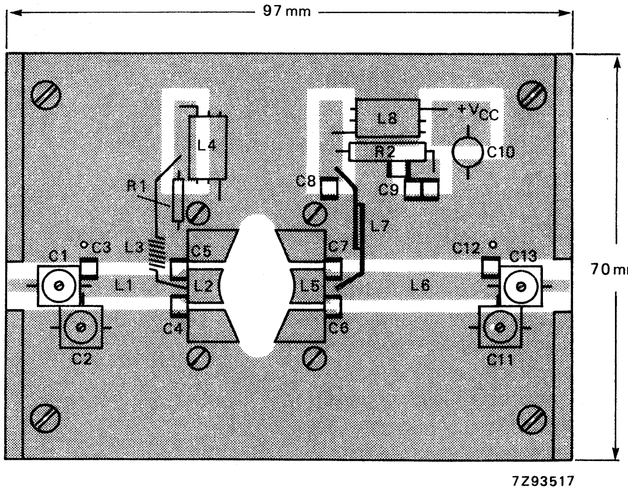


Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

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.

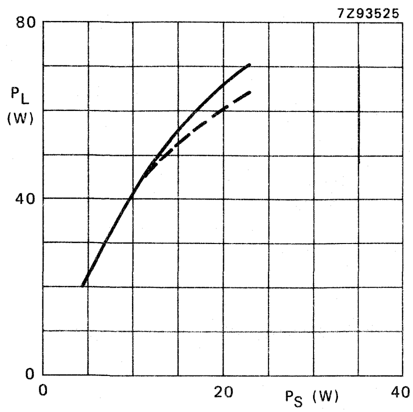


Fig. 7 Load power versus source power.

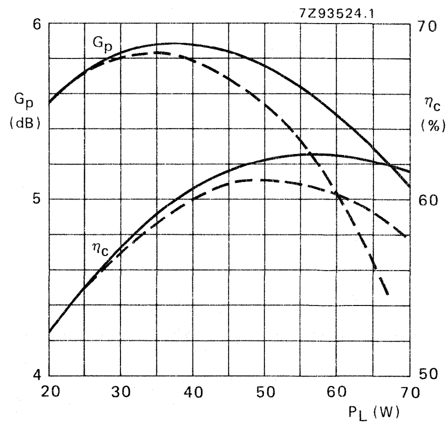


Fig. 8 Power gain and efficiency versus load power.

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.

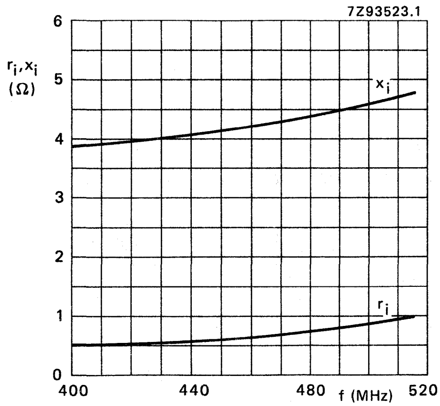


Fig. 9 Input impedance (series components).

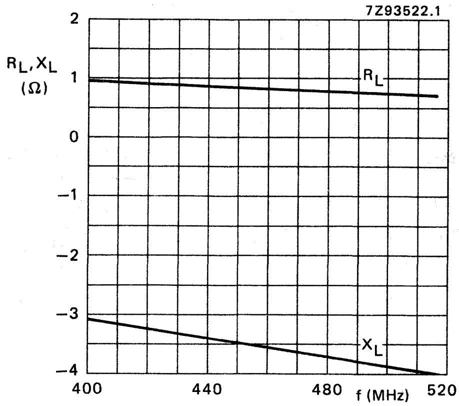


Fig. 10 Load impedance (series components).

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.

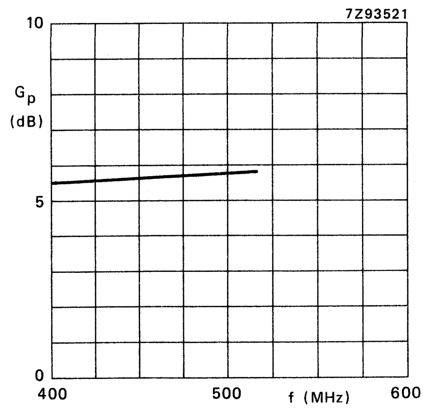


Fig. 11 Power gain versus frequency.

Data sheet	
status	Product specification
date of issue	January 1991

BLU56
UHF power transistor

FEATURES

- SMD encapsulation
- Emitter-ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

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

PINNING - SOT223

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	470	12.5	1	> 12	> 50

Note

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

PIN CONFIGURATION

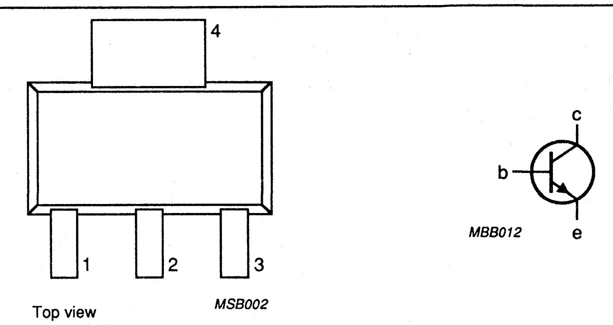


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	200	mA
I_{CM}	collector current	peak value f > 1 MHz	–	600	mA
P_{tot}	total power dissipation	f > 1 MHz T_S = 105 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		–	175	°C

Note

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

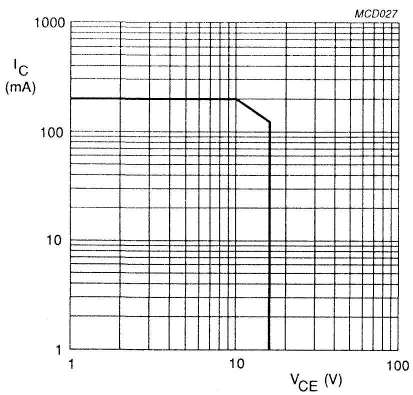


Fig.2 DC SOAR; T_S = 105 °C.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	35	K/W

UHF power transistor BLU56

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter I_C = 2.5 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base I_C = 10 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector I_E = 0.5 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0 V_{CE} = 16 V	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 10 V I_C = 150 mA	25	–	–	
E_{SBR}	second breakdown energy	L = 25 mH R_{BE} = 10 Ω f = 50 Hz	0.3	–	–	mJ
C_c	collector capacitance	V_{CB} = 12.5 V $I_E = I_e = 0$ f = 1 MHz	–	2.2	3	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V I_C = 0 f = 1 MHz	–	1.2	2	pF

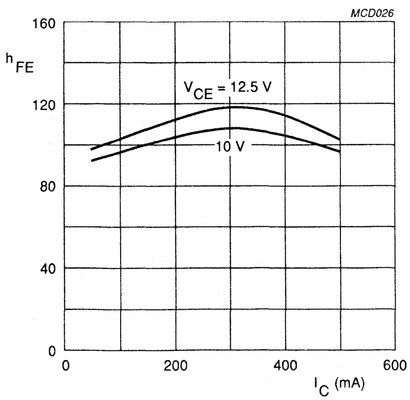


Fig.3 DC current gain as a function of drain current; typical values.

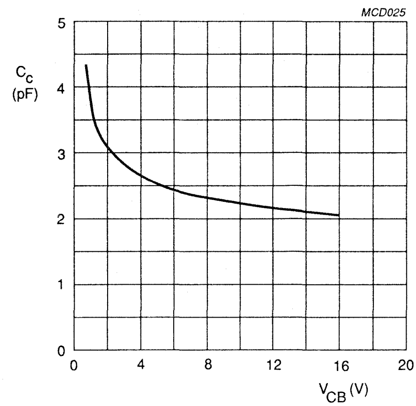


Fig.4 Collector capacitance as a function of collector-base voltage; $I_E = I_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	470	12.5	1	> 12 typ. 14	> 50 typ. 58

Ruggedness in class-B operation

The BLU56 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 15.5 V, f = 470 MHz and $T_S \leq 60$ °C.

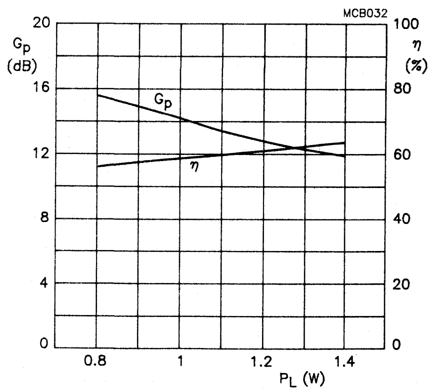


Fig.5 Gain and efficiency as functions of load power; typical values.

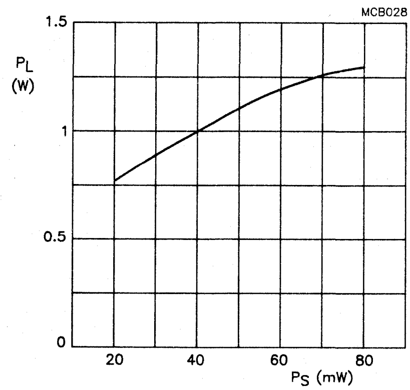


Fig.6 Load power as a function of drive power; typical values.

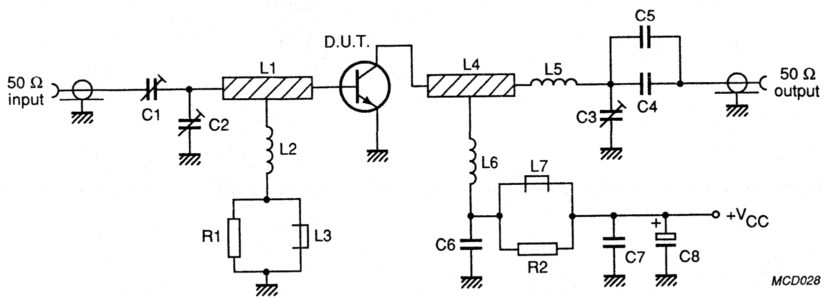


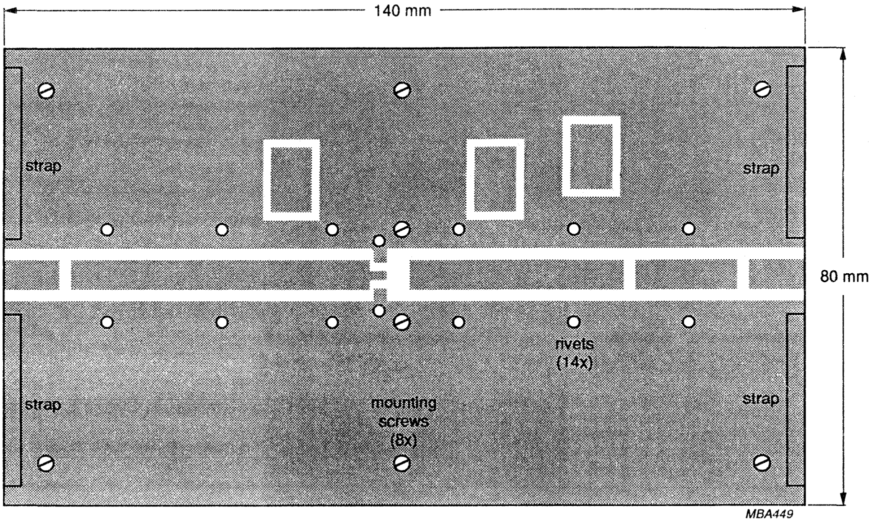
Fig.7 Class-B test circuit at f = 470 MHz.

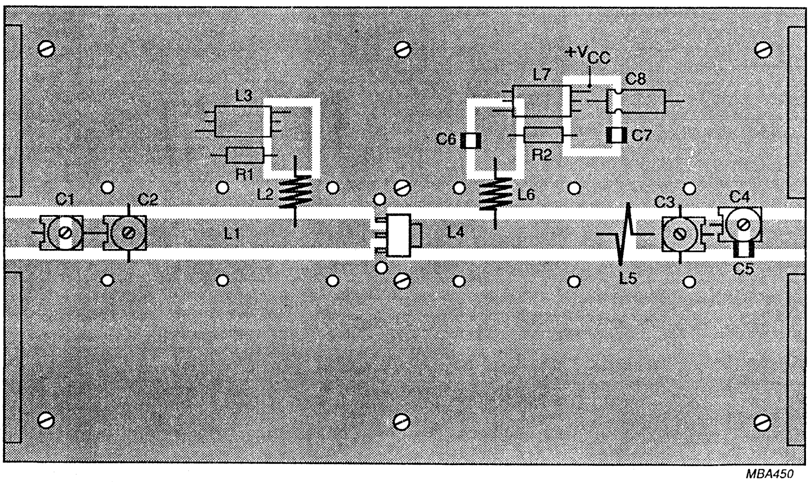
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4	film dielectric trimmer	2 to 18 pF		2222 809 05217
C2, C3	film dielectric trimmer	2 to 9 pF		2222 809 09002
C5	multilayer ceramic chip capacitor (note 1)	10 pF		
C6	multilayer ceramic chip capacitor (note 1)	100 pF		
C7	multilayer ceramic chip capacitor (note 1)	1 nF		
C8	63 V electrolytic capacitor	2.2 μF		
L1	stripline (note 2)	50 Ω	54 mm x 4.7 mm	
L2, L6	4 turns enamelled 0.4 mm copper wire	50 nH	int. dia. 3 mm	
L3, L7	grade 3B1 Ferroxcube wideband RF choke			4312 020 36640
L4	stripline (note 2)	50 Ω	36 mm x 4.7 mm	
L5	1 turn enamelled 2.2 mm copper wire	20 nH	int. dia. 8 mm	
R1, R2	0.25 W metal film resistor	10 Ω, 5%		

Notes

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





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

Fig.8 Component layout for 470 MHz class-B test circuit.

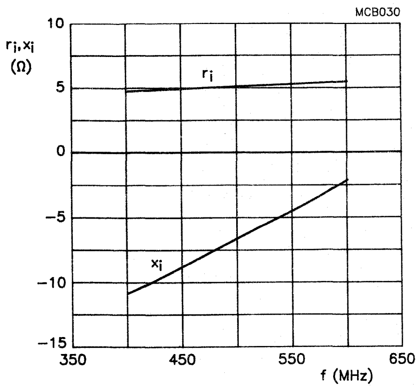


Fig.9 Input impedance (series components) as a function of frequency; class-B operation; V_{CE} = 12.5 V; P_L = 1 W; typical values.

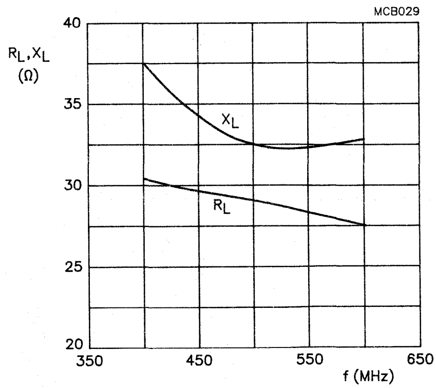


Fig.10 Load impedance (series components) as a function of frequency; class-B operation; V_{DS} = 12.5 V; P_L = 1 W; typical values.

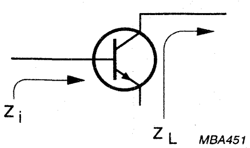


Fig.11 Definition of transistor impedance.

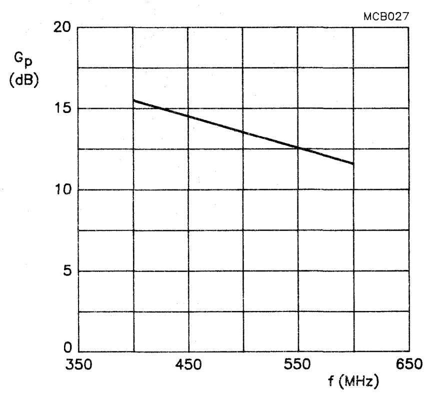


Fig.12 Power gain as a function of frequency; class-B operation; V_{DS} = 12.5 V; P_L = 1 W; typical values.

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

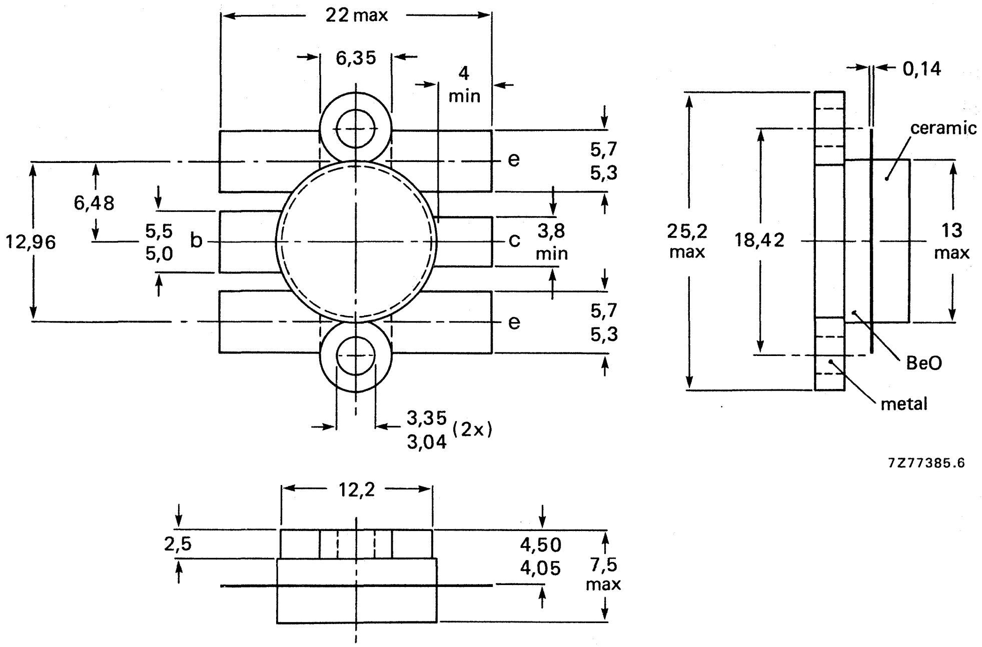
SOT-119 (see Fig. 1).

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

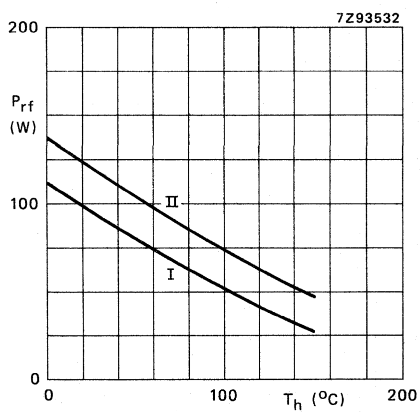


Fig. 2 Power/temperature derating curves.

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

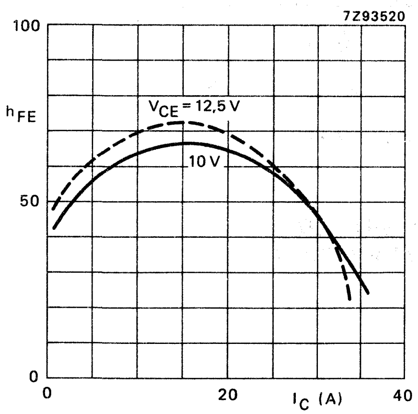


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

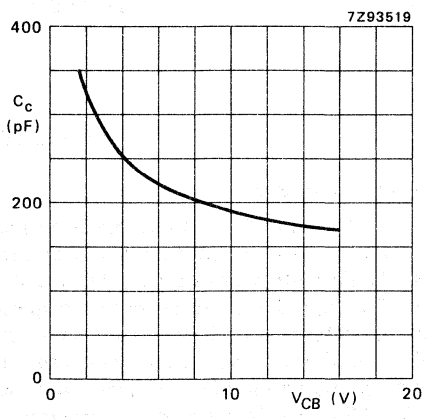


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

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

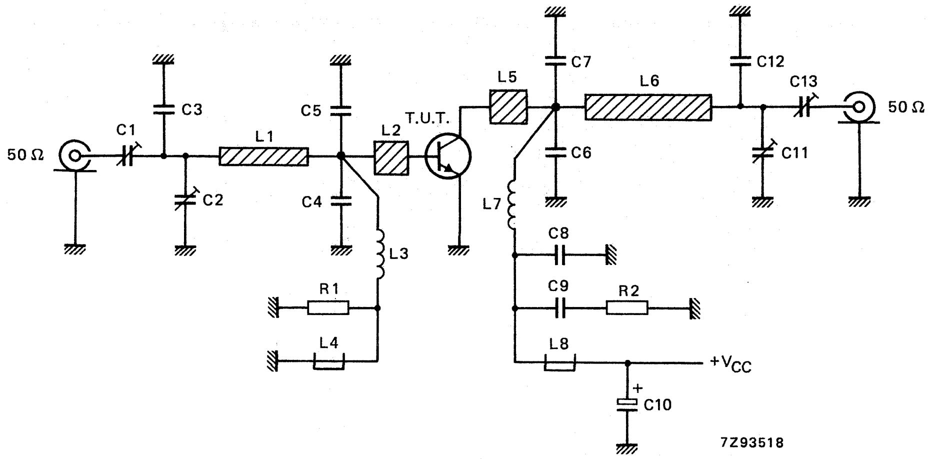


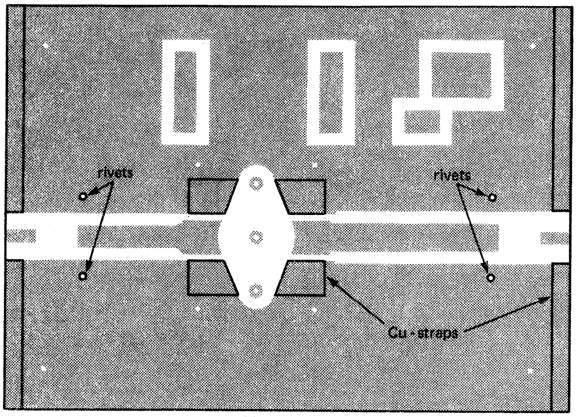
Fig. 5 Class-B test circuit at f = 470 MHz.

List of components:

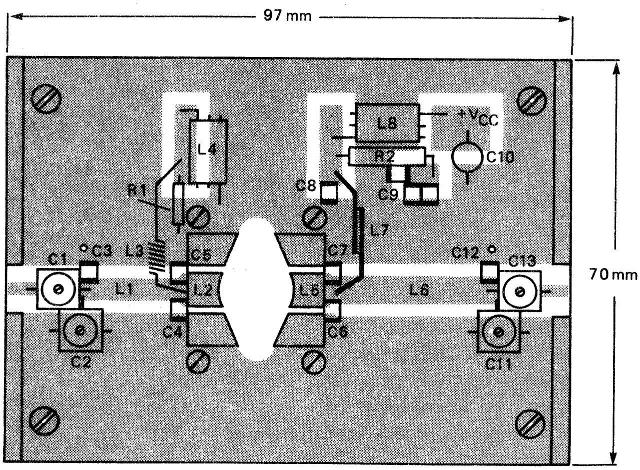
C1 = C13 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 12 pF multilayer ceramic chip capacitor*
C4 = C5 = 8,2 pF multilayer ceramic chip capacitor**
C6 = C7 = 15 pF multilayer ceramic chip capacitor*
C8 = 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 (ϵ_r = 2,2); thickness 1/32 inch.



7Z93516



7Z93517

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.

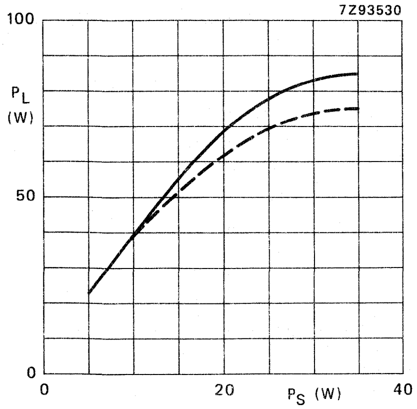


Fig. 7 Load power versus source power.

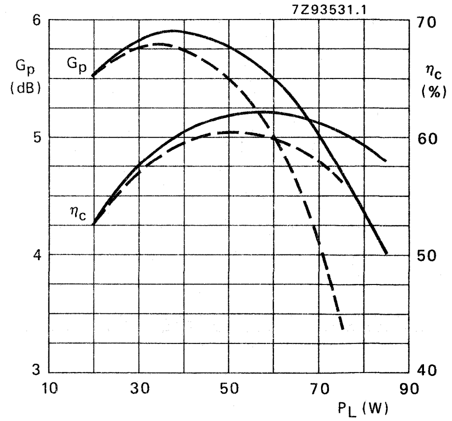


Fig. 8 Power gain and efficiency versus load power.

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.

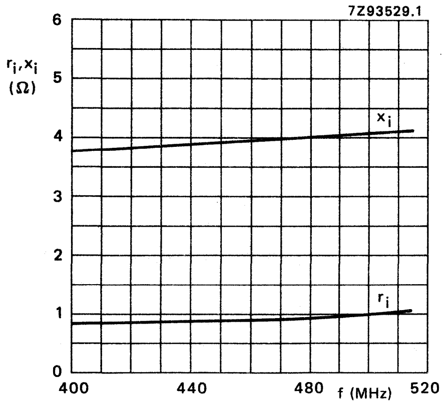


Fig. 9 Input impedance
(series components).

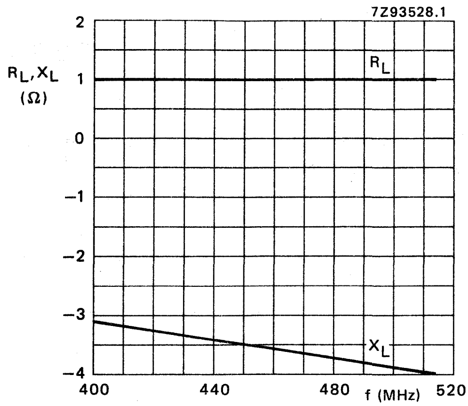


Fig. 10 Load impedance
(series components).

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.

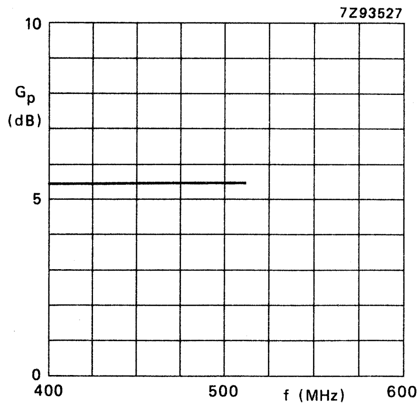


Fig. 11 Power gain versus frequency.

UHF POWER TRANSISTOR

NPN silicon planar epitaxial transistor primarily intended for use in 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 BLU60/28 has a 6-lead flange envelope with a ceramic cap (SOT119). All leads are isolated from the flange.

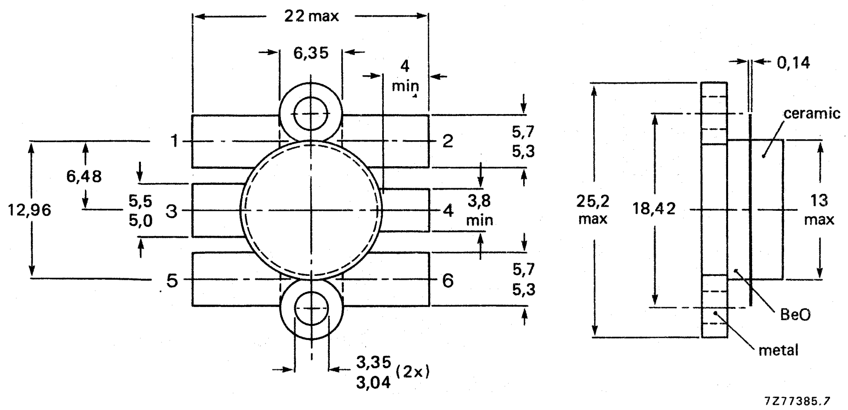
QUICK REFERENCE DATA

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

Mode of operation	f MHz	V_{CE} V	P_L W	G_p dB	η_C %
CW class-B	470	28	60	> 7	> 55
CW class-B	470	24	50	typ. 7	typ. 60

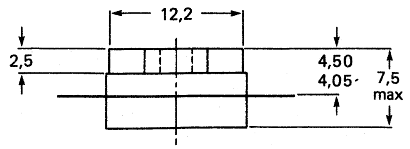
MECHANICAL DATA

Dimensions in mm



Lead reference

1 = emitter
2 = emitter
3 = base
4 = collector
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.

Fig.1 SOT119.

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)

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.	3.5	V
Collector current				
DC or average	I_C, $I_{C(AV)}$	max.	8.0	A
peak value; f > 1 MHz	I_{CM}	max.	24	A
RF power dissipation				
f > 1 MHz; T_{mb} = 25 °C	P_{rf}	max.	110	W
Storage temperature range	T_{stg}	−65 to + 150		°C
Operating junction temperature	T_j	max.	200	°C

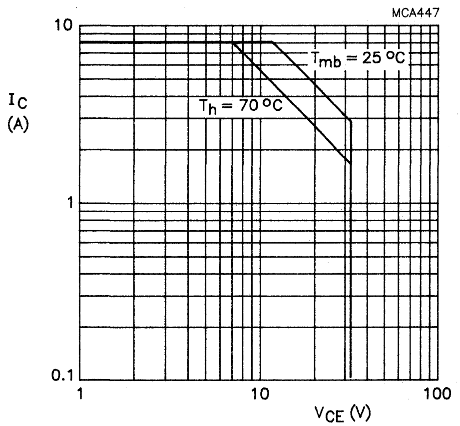
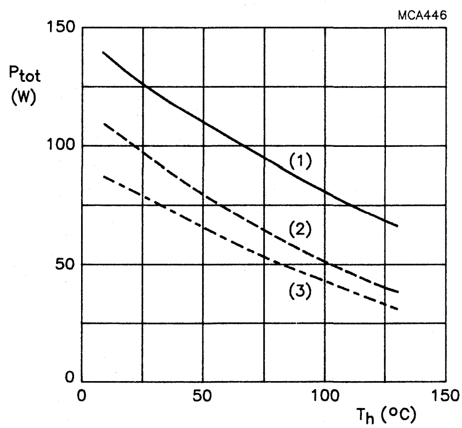


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

RF dissipation = 110 W; T_{mb} = 25 °C

From junction to mounting base	$R_{th\,j\text{-}mb}$	max.	1.55	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-emitter breakdown voltage				
V_{BE} = 0; I_C = 30 mA	$V_{(BR)CES}$	min.	60	V
open base; I_C = 200 mA	$V_{(BR)CEO}$	min.	32	V
Emitter-base breakdown voltage				
open collector; I_E = 20 mA	$V_{(BR)EBO}$	min.	3.5	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 32 V	I_{CES}	max.	10	mA
DC current gain				
I_C = 3.2 A; V_{CE} = 25 V	h_{FE}		20 to 120	
		typ.	75	
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 28 V	C_c	typ.	90	pF
Feedback capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 28 V	C_{re}	typ.	55	pF
Collector-flange capacitance	C_{cf}	typ.	3.0	pF

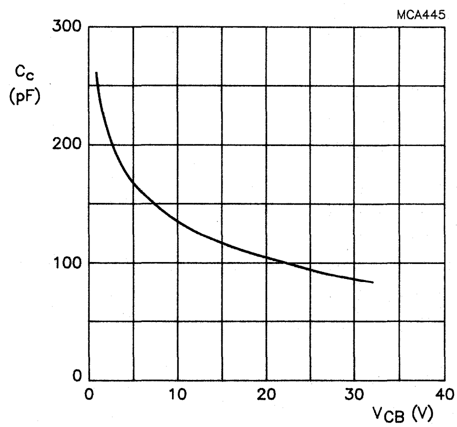
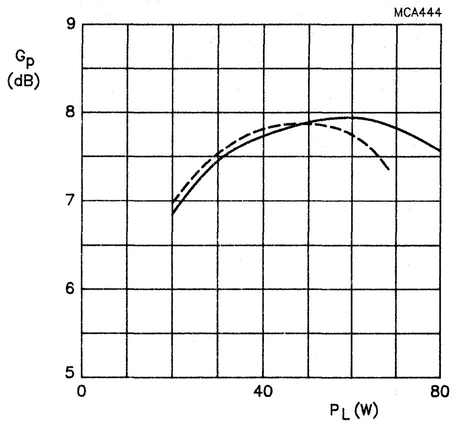


Fig.4 Collector capacitance as a function of base-collector voltage; I_E = I_e = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

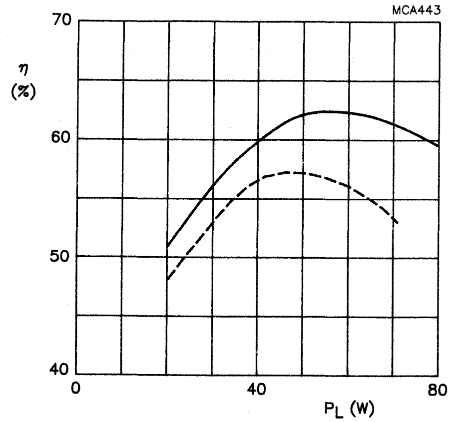
RF performance at T_h = 25 °C in a class-B test circuit

Mode of operation	f MHz	V_{CE} V	P_L W	G_P dB	η_C %
CW class-B	470	28	60	> 7	> 55
CW class-B	470	24	50	typ. 7	typ. 60



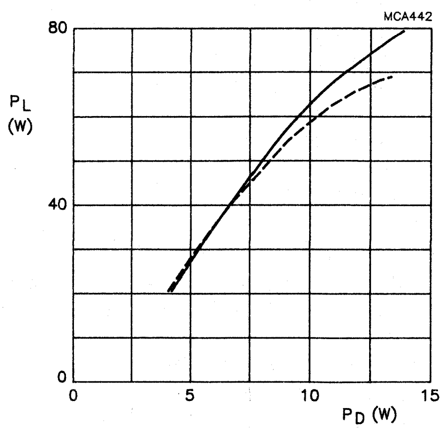
—— T_h = 25 °C
– – – T_h = 70 °C

Fig.5 Power gain as a function of load power; typical values.



—— T_h = 25 °C
– – – T_h = 70 °C

Fig.6 Efficiency as a function of load power; typical values.



—— T_h = 25 °C
– – – T_h = 70 °C

Fig.7 Load power as a function of drive power; typical values.

Conditions for Figs 5 to 7

Class-B operation; V_{CE} = 28 V; f = 470 MHz; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

Ruggedness in class-B operation

The BLU60/28 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W, at rated output power.

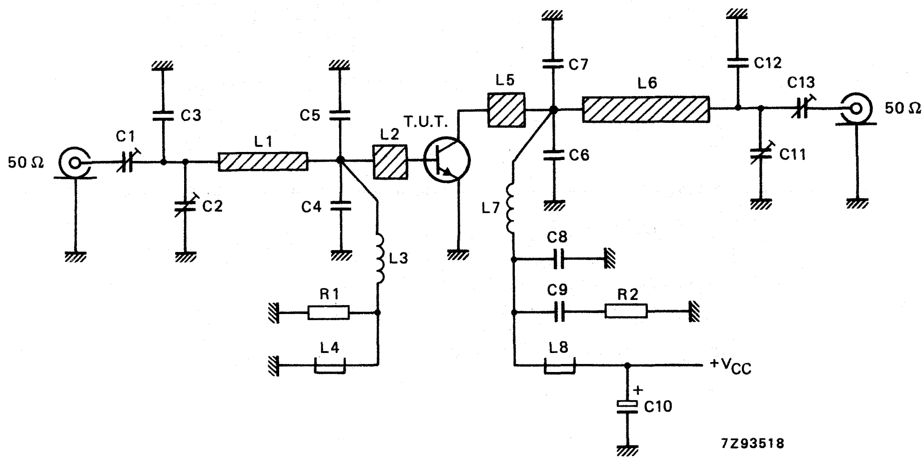


Fig.8 Class-B test circuit at f = 470 MHz.

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 capacitors 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. diam. 2.5 mm; leads 2 x 5 mm
L4 = L8 = Ferroxcube wideband HF 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. diam. 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

Striplines are on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric; thickness 1/32 inch; (ϵ_r = 2.2).

* American Technical Ceramics capacitor type B or equivalent.
** Idem type A.

APPLICATION INFORMATION (continued)

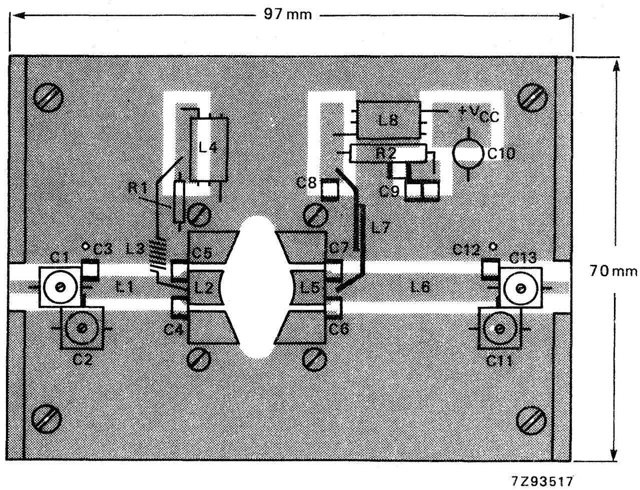


Fig.9 Component layout of 470 MHz, class-B test circuit.

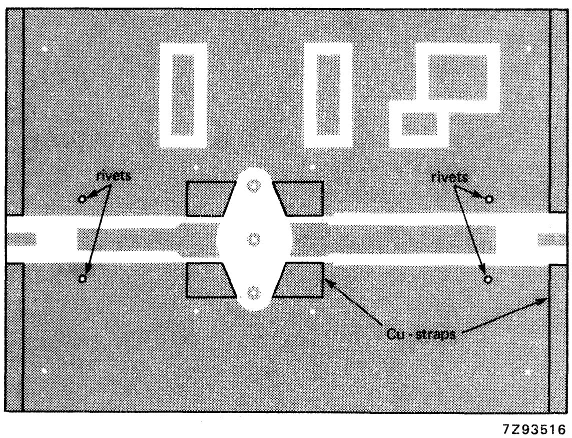


Fig.10 Printed-circuit board for 470 MHz, class-B test circuit.

NOTE

The circuit and the components are on one side of the PTFE fibre-glass board; the other side is fully metallized serving as groundplane. Earth connections are made by fixing screws, 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.

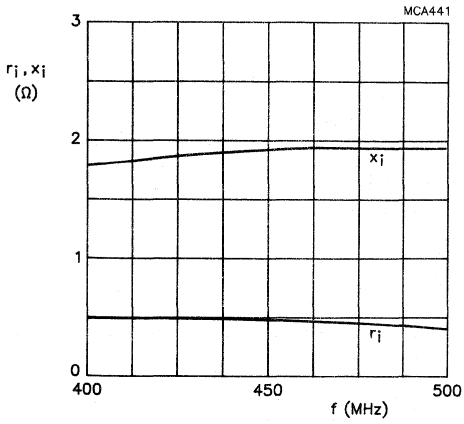


Fig.11 Input impedance as a function of frequency (series components); typical values.

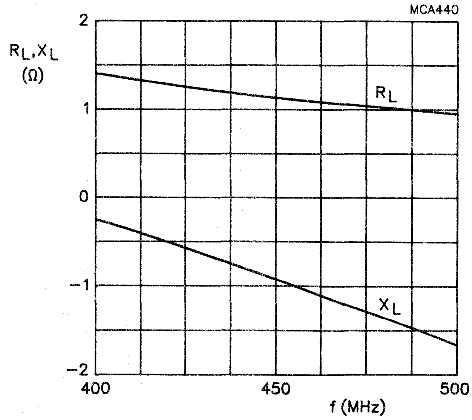


Fig.12 Load impedance as a function of frequency (series components); typical values.

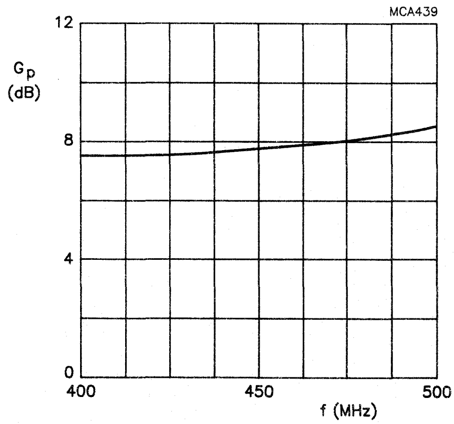


Fig.13 Gain as a function of frequency; typical values.

Conditions for Figs 11 to 13

Class-B operation; V_{CE} = 28 V; P_L = 60 W; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

UHF power transistor BLU86

FEATURES

- SMD encapsulation
- Emitter-ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT223 surface mounted envelope and designed primarily for use in mobile radio equipment in the 900 MHz communications band.

PINNING - SOT223

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	900	12.5	1	> 7	> 55

Note

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

PIN CONFIGURATION

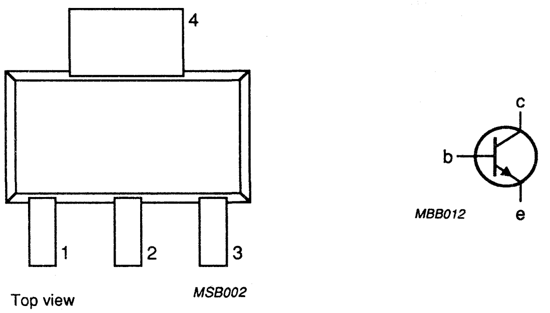


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	32	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	200	mA
I_{CM}	collector current	peak value; f > 1 MHz	–	600	mA
P_{tot}	total power dissipation	f > 1 MHz; T_S = 129 °C (note 1)	–	2	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		–	175	°C

Note

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

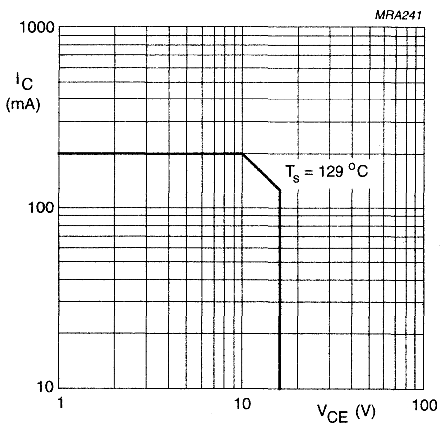


Fig.2 DC SOAR.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}s(DC)}$	from junction to soldering point	P_{tot} = 2 W; T_S = 129 °C	23	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 2.5 mA	32	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 16 V	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 150 mA	25	–	–	
E_{SBR}	second breakdown energy	L = 25 mH; R_{BE} = 10 Ω; f = 50 Hz	0.3	–	–	mJ
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	2.2	2.6	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	1.2	1.8	pF

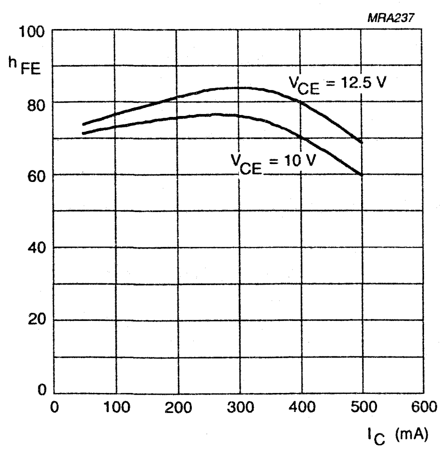


Fig.3 DC current gain as a function of collector current; typical values.

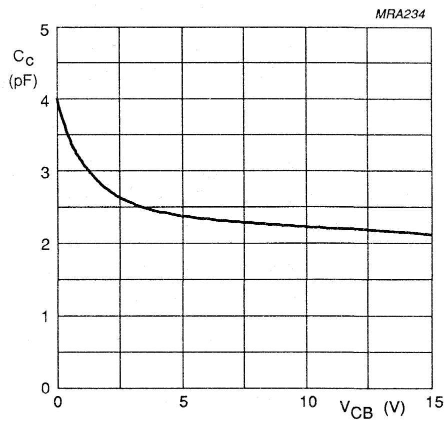


Fig.4 Collector capacitance as a function of collector-base voltage, typical values.

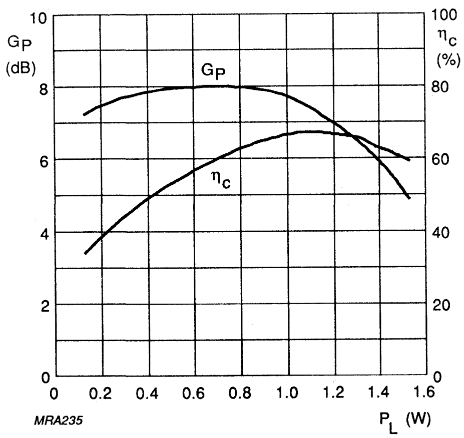
APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	900	12.5	1	> 7 typ. 7.7	> 55 typ. 66

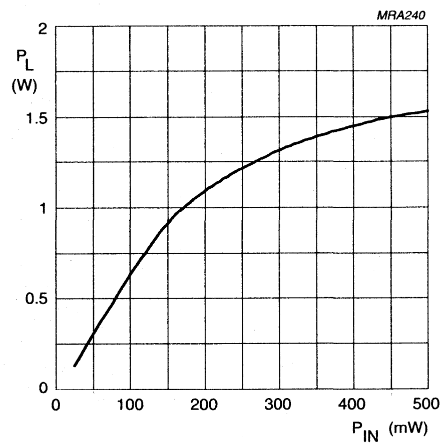
Note

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



Class-B operation; V_{CE} = 12.5 V; f = 900 MHz.

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



Class-B operation; V_{CE} = 12.5 V; f = 900 MHz.

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

Ruggedness in class-B operation

The BLU86 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 15.5 V, f = 900 MHz and $T_S \leq 60$ °C, where T_S is the temperature at the soldering point of the collector tab.

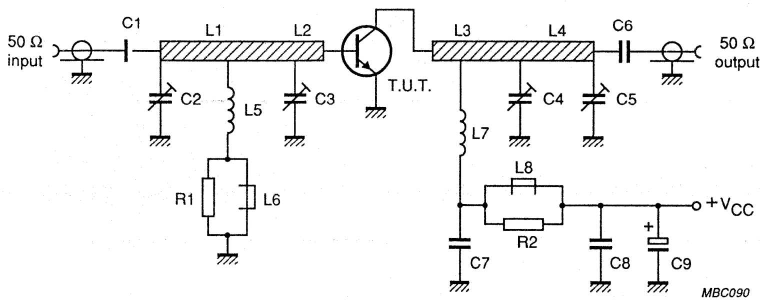


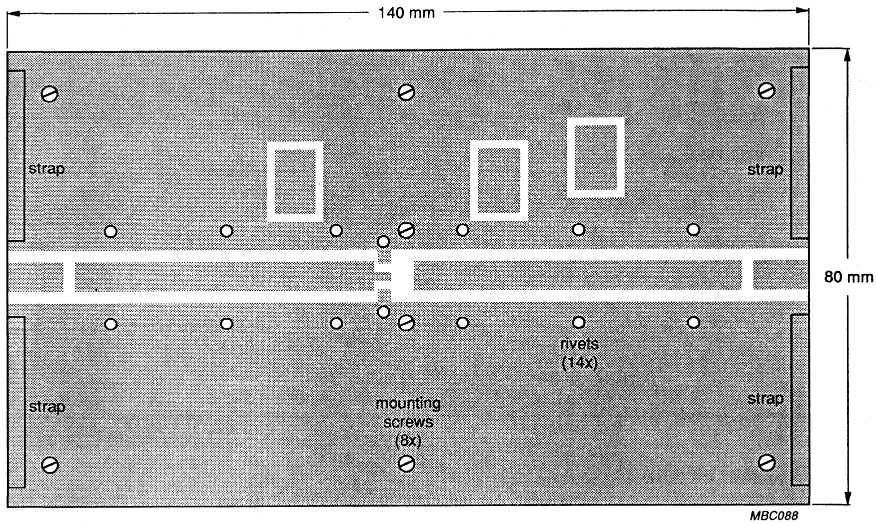
Fig.7 Class-B test circuit at f = 900 MHz.

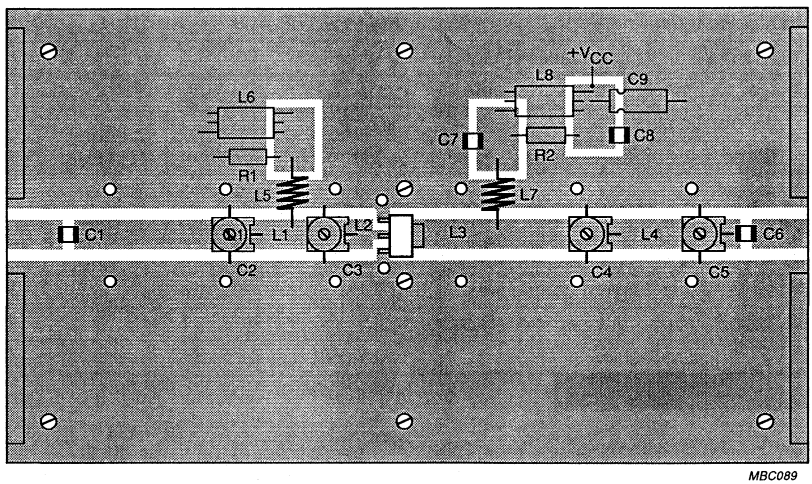
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6	multilayer ceramic chip capacitor (note 1)	100 pF		
C2, C3, C4, C5	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C7	multilayer ceramic chip capacitor (note 1)	220 pF		
C8	multilayer ceramic chip capacitor (note 1)	1 nF		
C9	63 V electrolytic capacitor	2.2 μF		
L1	stripline (note 2)	50 Ω	17 mm x 4.7 mm	
L2	stripline (note 2)	50 Ω	5 mm x 4.7 mm	
L3	stripline (note 2)	50 Ω	32 mm x 4.7 mm	
L4	stripline (note 2)	50 Ω	20 mm x 4.7 mm	
L5, L7	6 turns enamelled 0.8 mm copper wire		int. dia. 3 mm	
L6, L8	grade 3B1 Ferroxcube wideband HF choke			4312 020 36640
R1, R2	0.25 W metal film resistor	10 Ω, 5%		

Notes

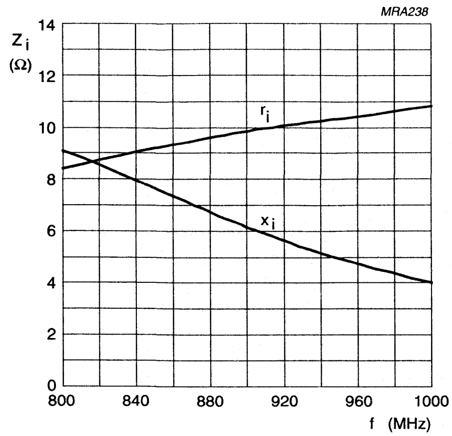
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.





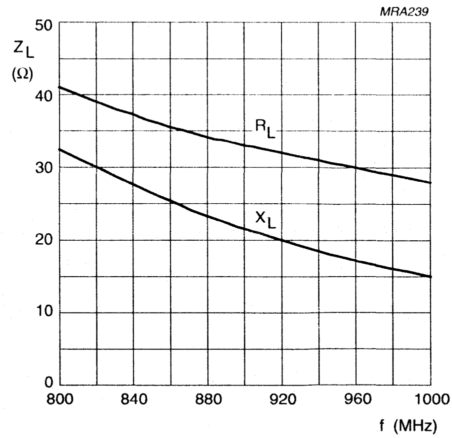
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.8 Component layout for 900 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 1 W.

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



Class-B operation; V_{CE} = 12.5 V; P_L = 1 W.

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

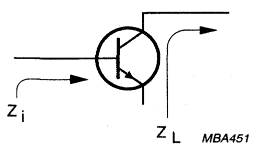
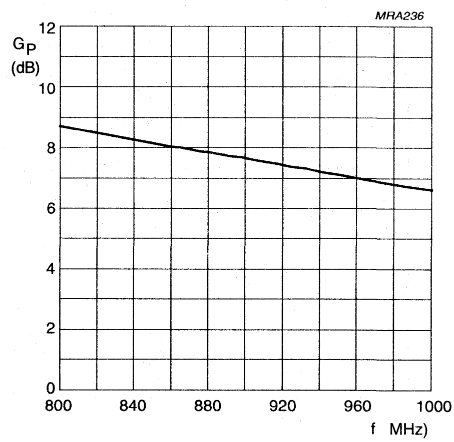


Fig.11 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 1 W.

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

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 (SOT122A). All leads are isolated from the stud.

QUICK REFERENCE DATA

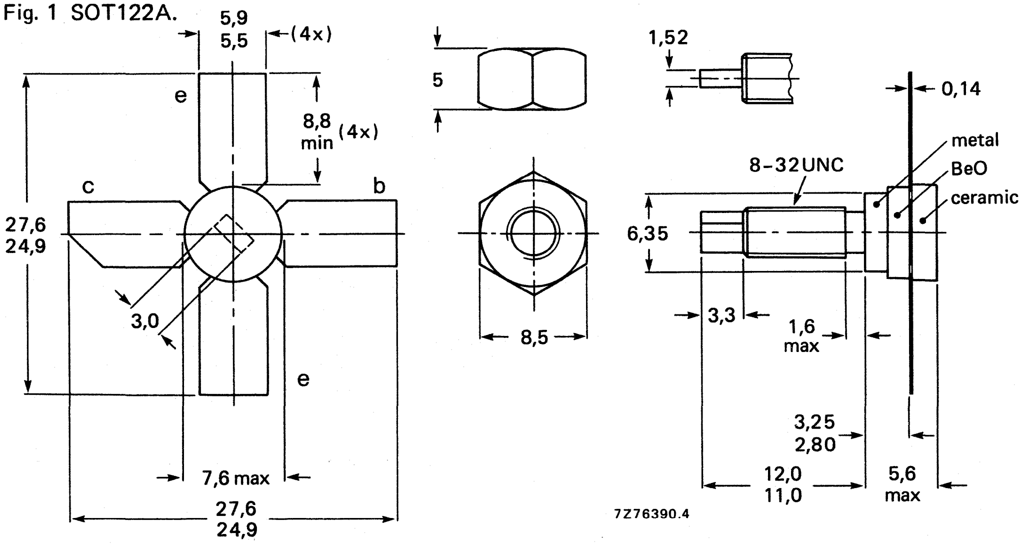
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

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 SOT122A.



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

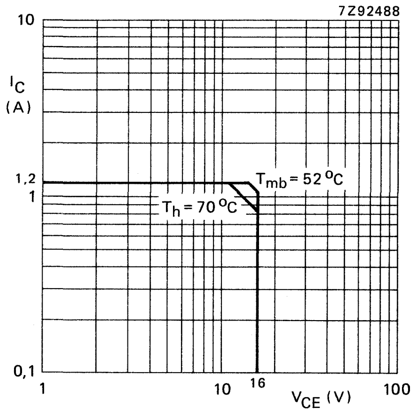


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,6 K/W.

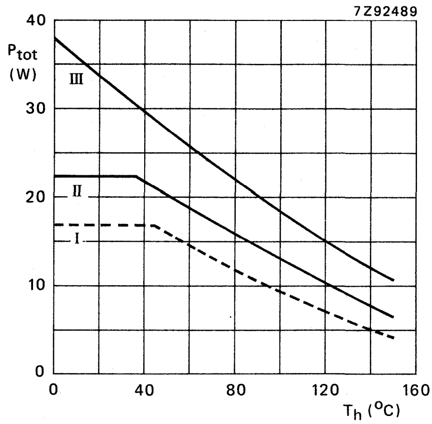


Fig. 3 Power/temperature derating curves.
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz).

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

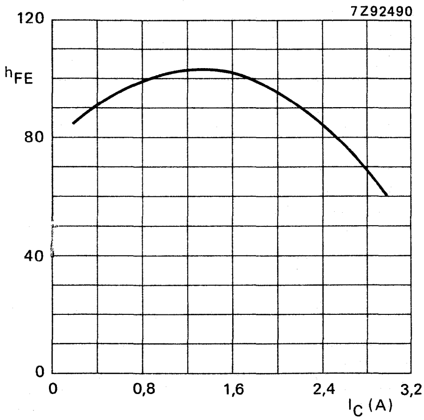


Fig. 4 T_j = 25 °C; V_{CE} = 10 V; typical values.

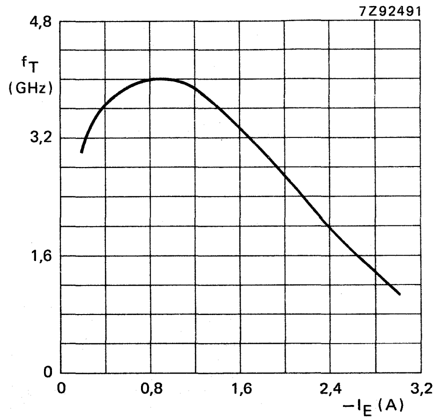


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; t_p = 50 μs; T_j = 25 °C; typical values.

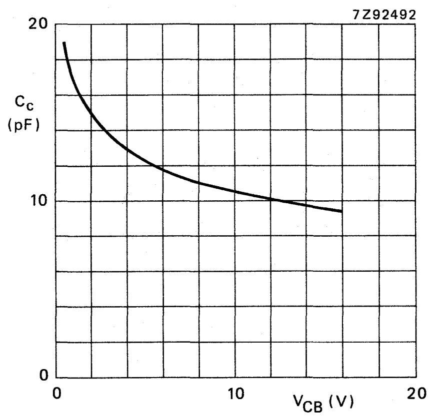


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* 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

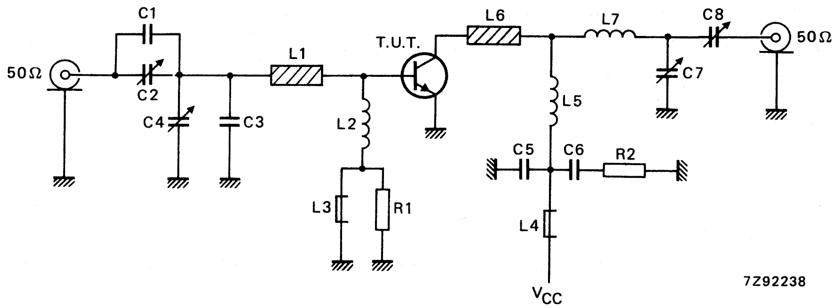


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

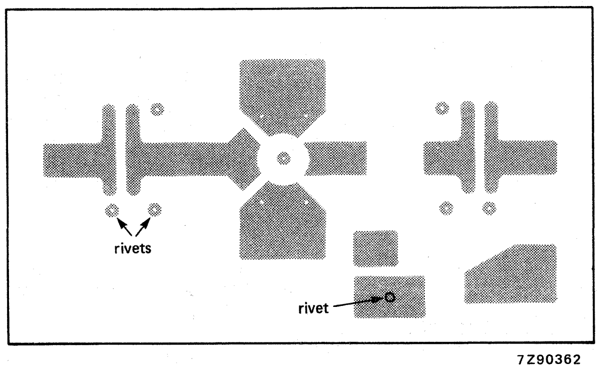
C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor
C6 = 100 nF metallized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



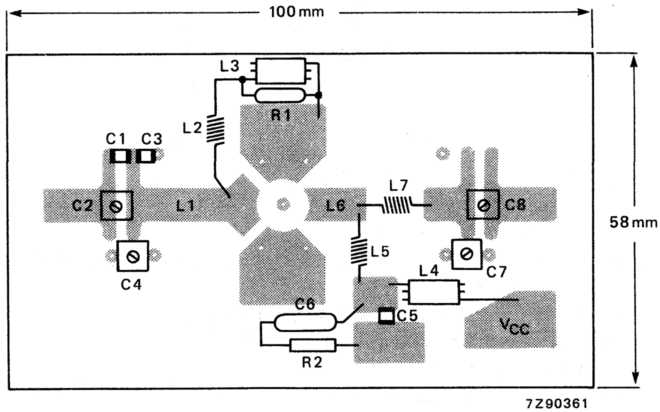


Fig. 8 Printed circuit board and component lay-out for 470 MHz class-B test circuit.

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.

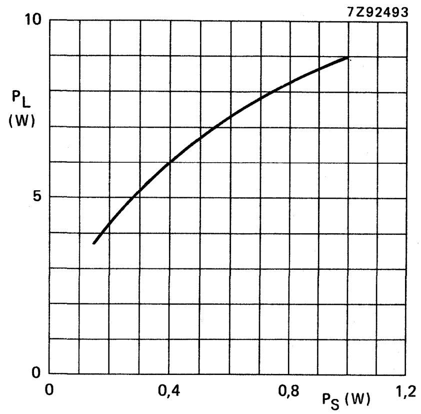


Fig. 9 Load power vs. source power.

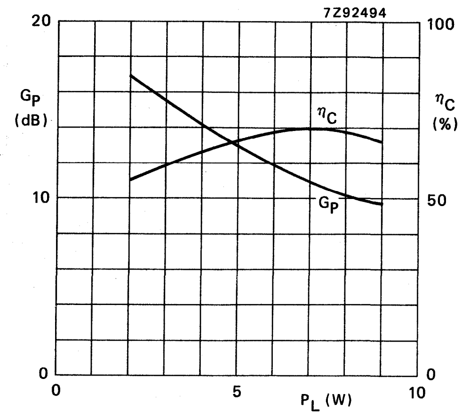


Fig. 10 Power gain and efficiency vs. load power.

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.

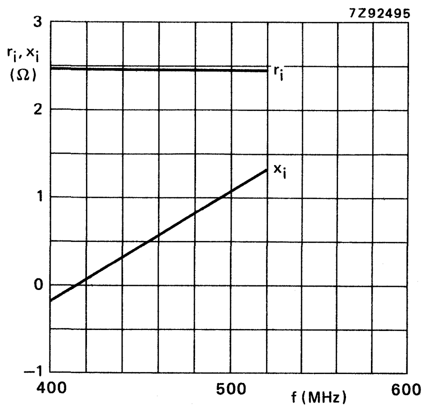


Fig. 11 Input impedance (series components).

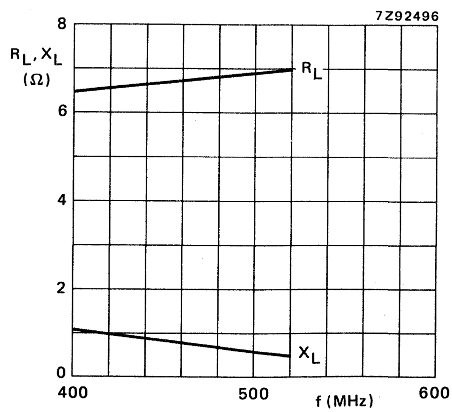


Fig. 12 Load impedance (series components).

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.

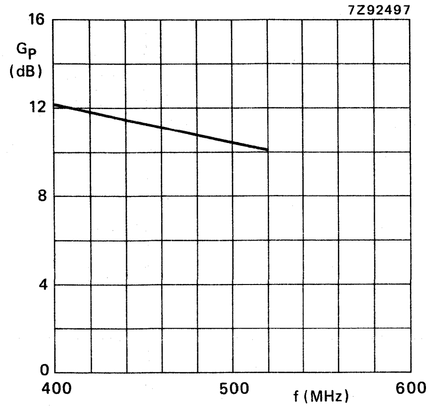


Fig. 13 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 7 W; f = 400-520 MHz; T_h = 25 °C; class-B operation; typical values.

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

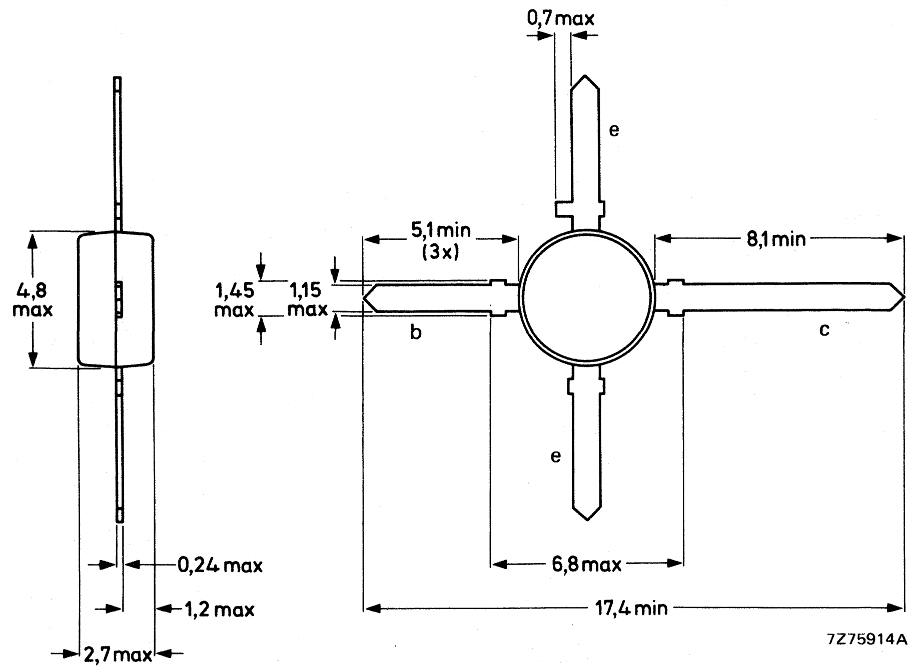
R.F. performance at T_{amb} = 25 °C in a common-emitter class-B circuit

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 mm^2.

** Measured under pulse conditions: t_p = 50 μs; $\delta < 1\%$.

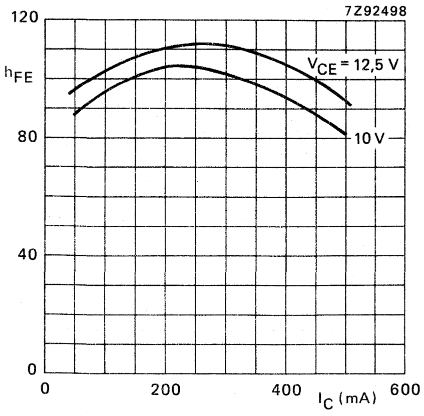


Fig. 2 T_j = 25 °C; typical values.

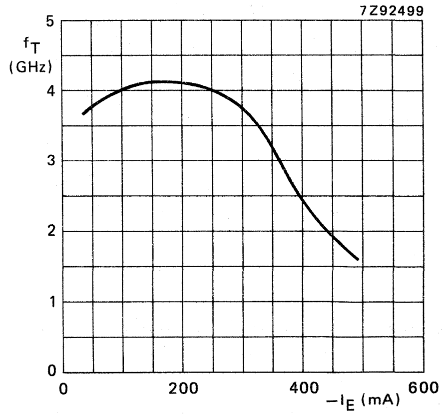


Fig. 3 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

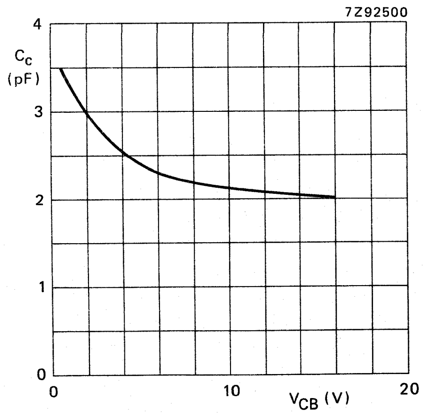


Fig. 4 I_E = i_e = 0; f = 1 MHz; typical values.

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

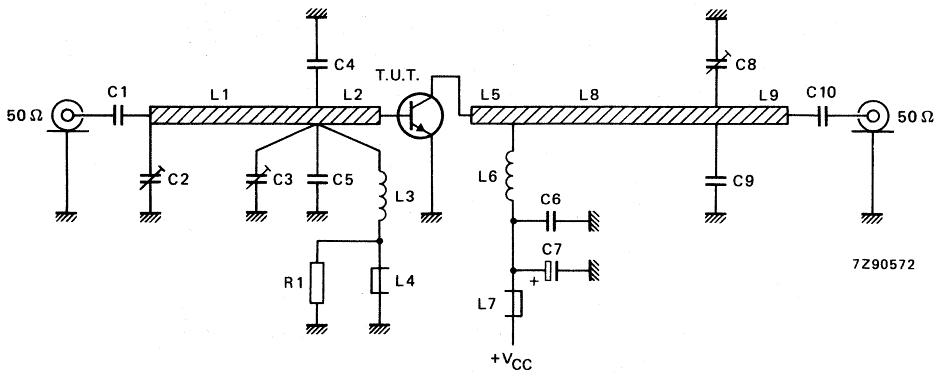


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

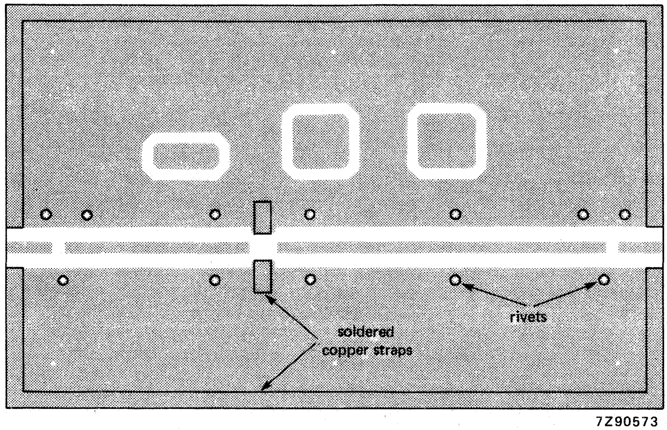
C1 = C6 = C10 = 330 pF multilayer ceramic chip capacitor
C2 = C3 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 6,8 pF multilayer ceramic chip capacitor*
C7 = 6,8 μF (63 V) electrolytic capacitor
C8 = 1,0 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C9 = 1,2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



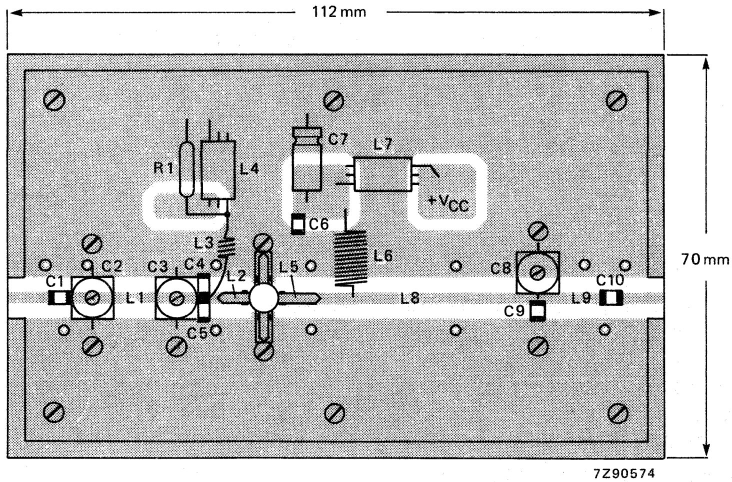


Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

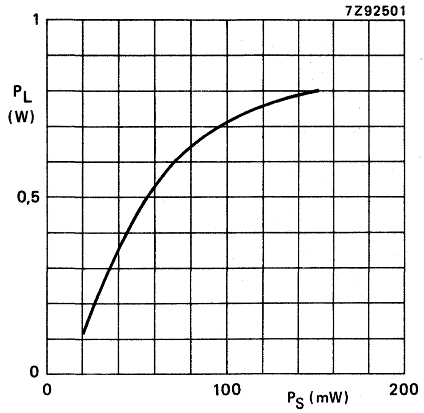


Fig. 7 Load power vs. source power.

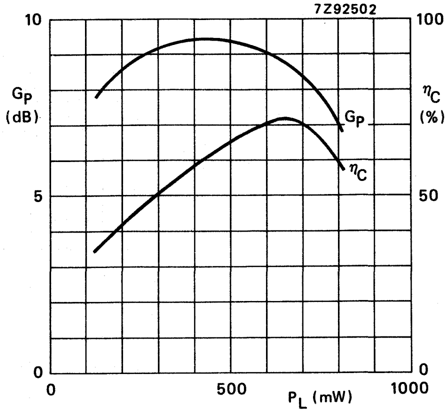


Fig. 8 Power gain and efficiency vs. load power.

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.

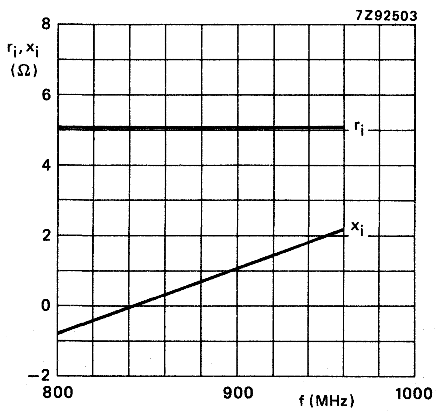


Fig. 9 Input impedance (series components).

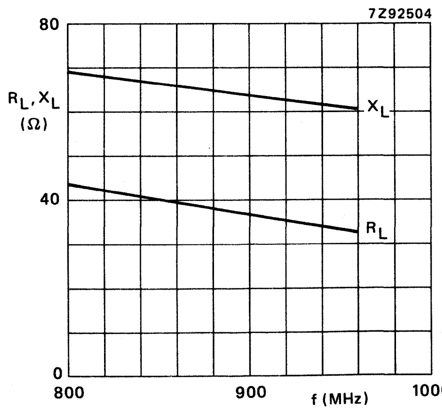


Fig. 10 Load impedance (series components).

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.

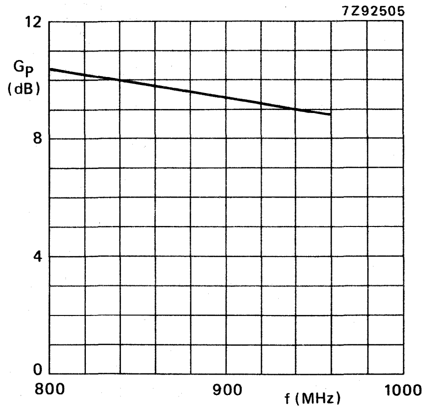


Fig. 11 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 0,5 W; f = 800-960 MHz; T_{amb} = 25 °C; class-B operation; typical values.

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 BLU99 has a 4-lead stud envelope with a ceramic cap (SOT122A). All leads are isolated from the stud. The BLU99/SL is a studless version (SOT122D).

QUICK REFERENCE DATA

R.F. performance at $T_h = 25\,^{\circ}C$ 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	5	> 10,5	> 60
	12,5	900	4	typ. 7,0	typ. 60

PIN CONFIGURATION

Pinning:

1 = collector
2 = emitter
3 = base
4 = emitter

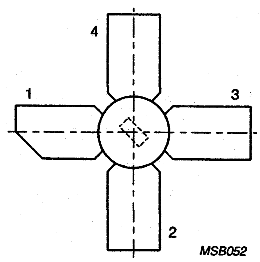


Fig.1a SOT122A (BLU99).

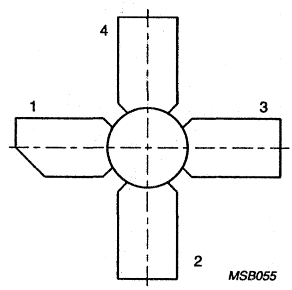


Fig.1b SOT122D (BLU99/SL).

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

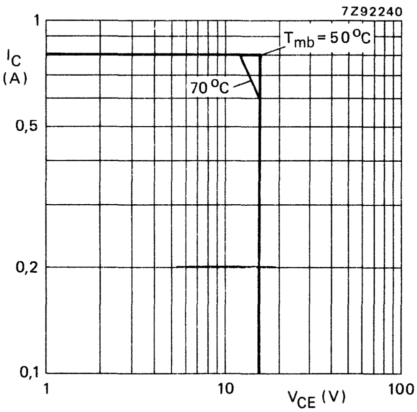


Fig. 2 D.C. SOAR.

$R_{th\ mb\text{-}h}$ = 0,6 K/W.

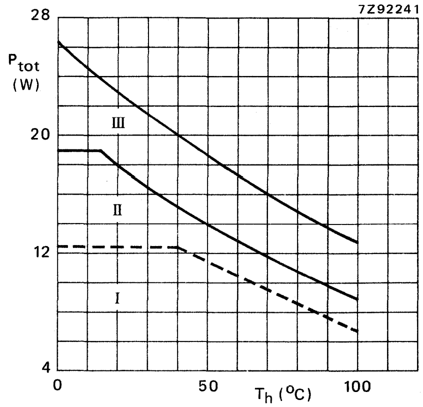


Fig. 3 Power/temperature derating curves.

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

THERMAL RESISTANCE (dissipation = 9 W; T_{mb} = 25 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	10	K/W
From junction to mounting base (r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	=	7,5	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-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; $\delta < 0{,}01$.
** Measured under pulse conditions: t_p = 300 μs; $\delta < 0{,}01$.

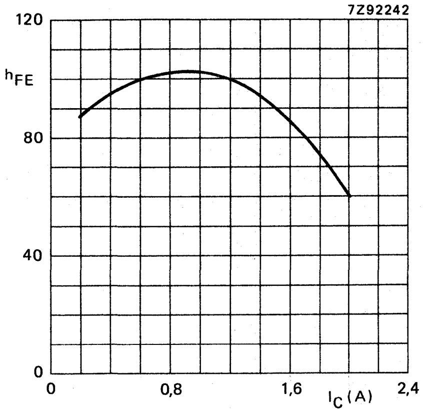


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; typ. values.

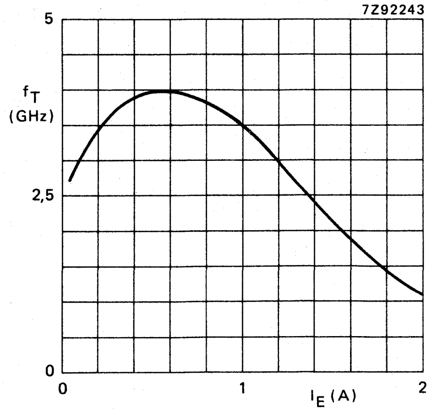


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typ. values.

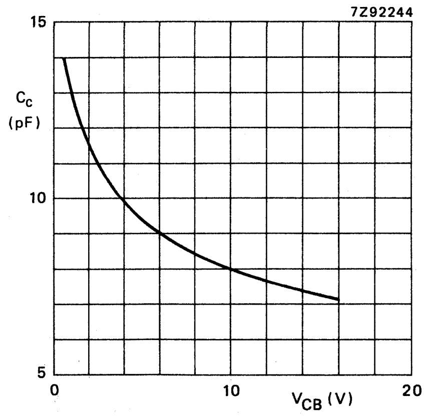


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; typ. values.

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

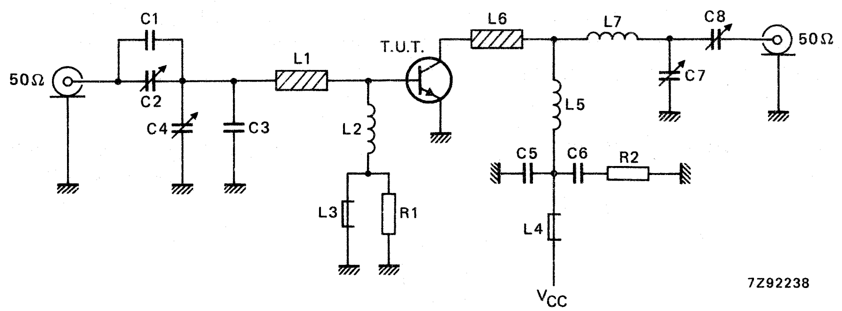


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

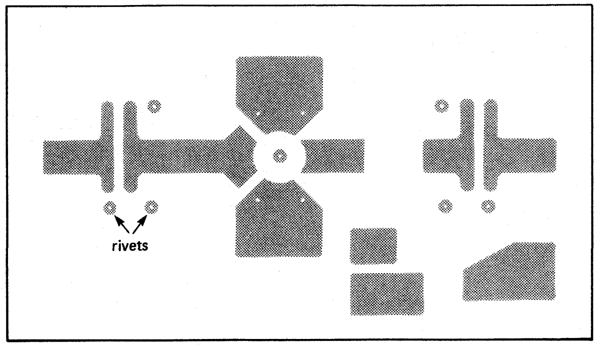
C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4-5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2-9 pF film dielectric trimmer (cat.no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13101)
C6 = 100 nF metallized film 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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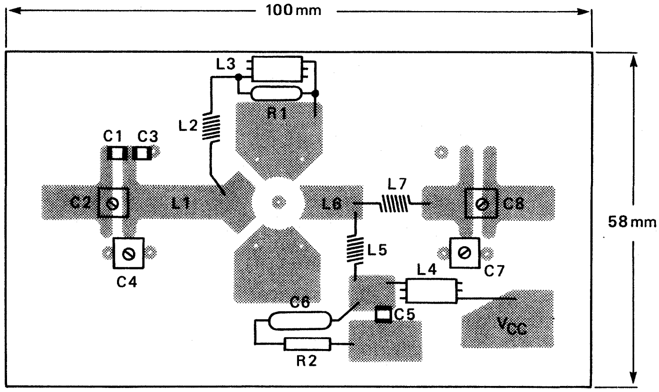


7Z90361

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.

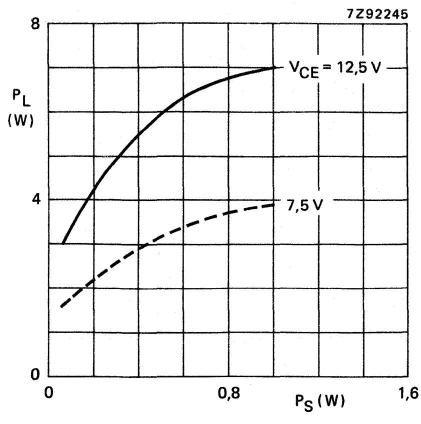


Fig. 9 Output power.

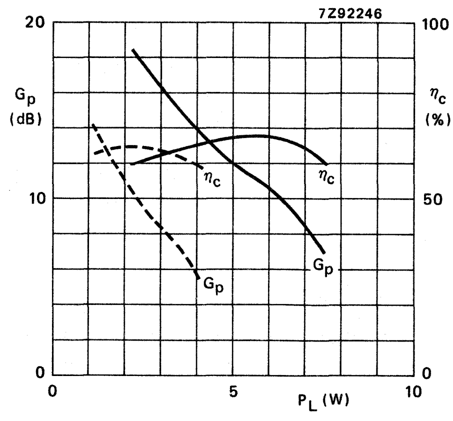


Fig. 10 Power gain and efficiency;
——— : V_{CE} = 12,5 V
– – – – : V_{CE} = 7,5 V.

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.

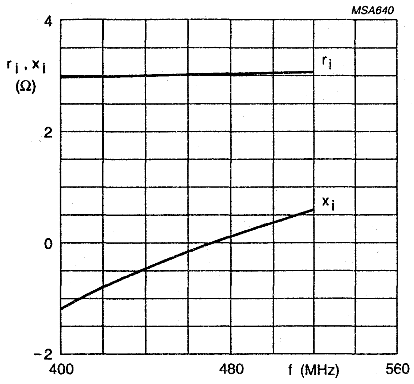


Fig. 11 Input impedance (series components).

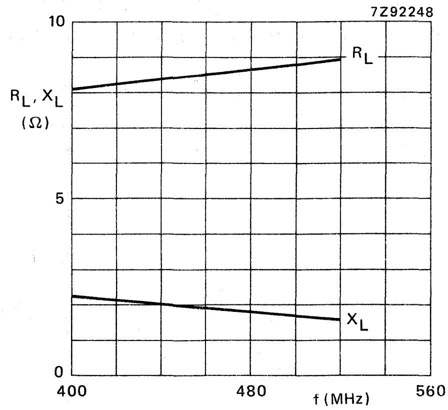


Fig. 12 Load impedance (series components).

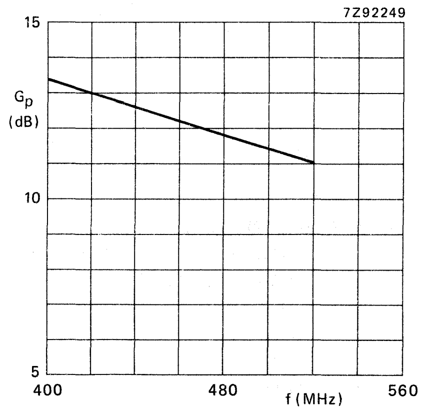


Fig. 13 Power gain.

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

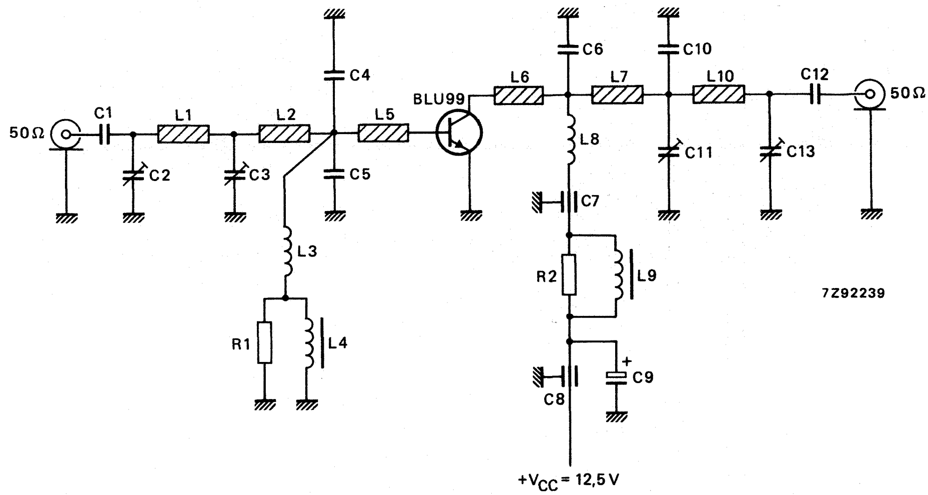


Fig. 14 Class-B test circuit at f = 900 MHz.

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.

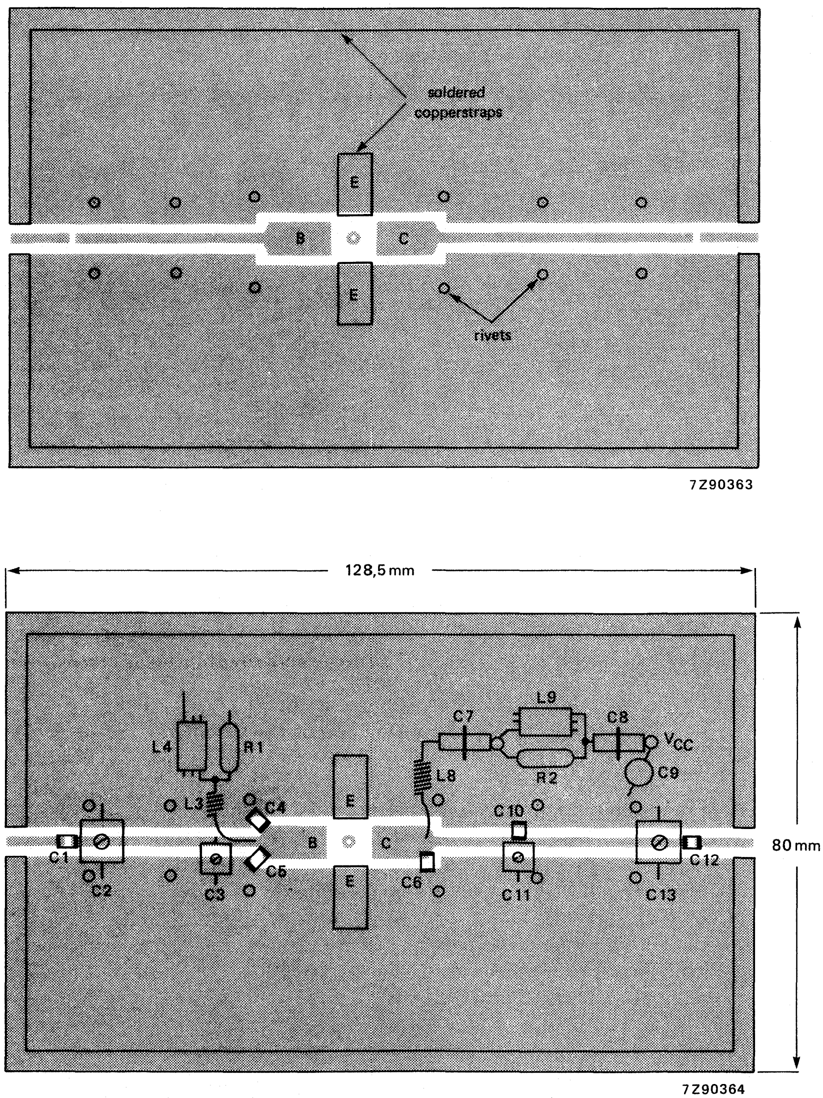


Fig. 15 Printed circuit board and component layout for a 900 MHz test circuit.

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.

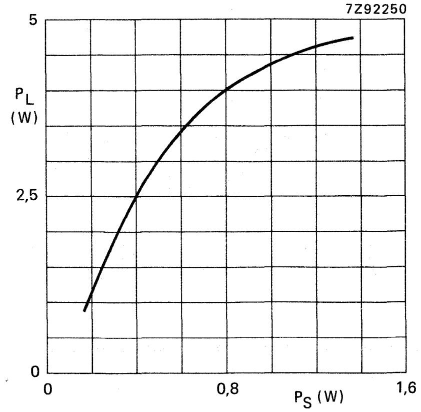


Fig. 16 Output power.

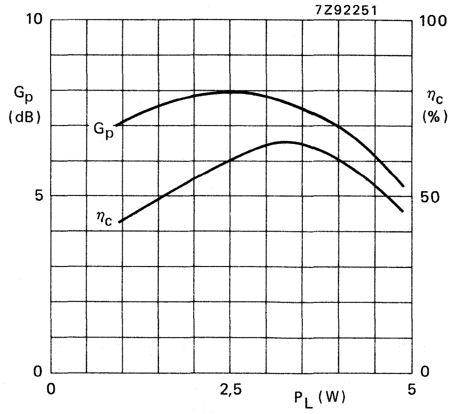


Fig. 17 Power gain and efficiency.

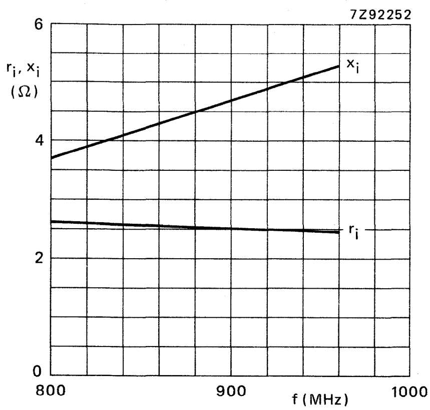


Fig. 18 Input impedance (series components).

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.

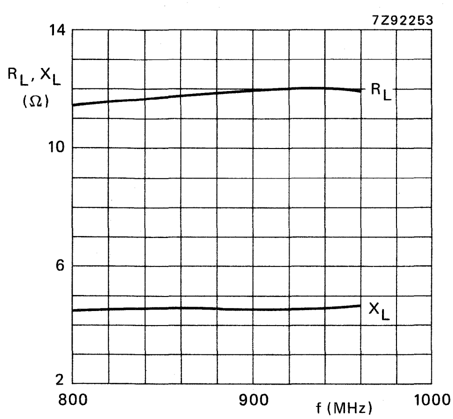


Fig. 19 Load impedance (series components).

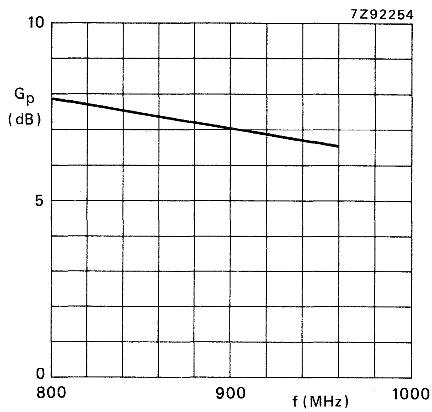


Fig. 20 Power gain.

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

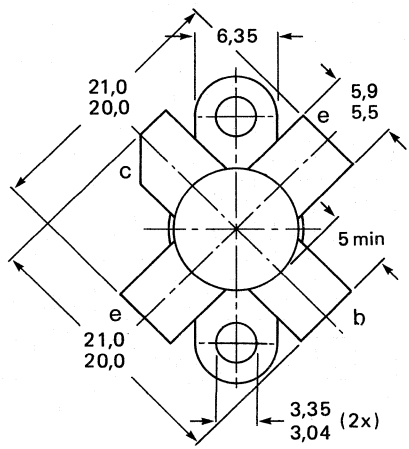
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

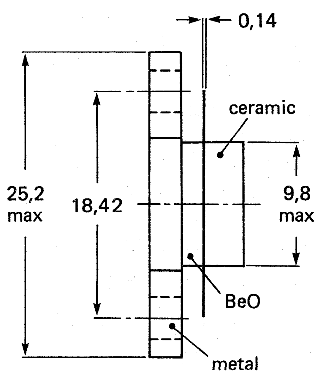
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**8**	**> 9,0**	**> 70**	**2,8 + j1,2**	**76 − j16**
c.w.	12,5	175	8	typ. 10,5	typ. 75	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





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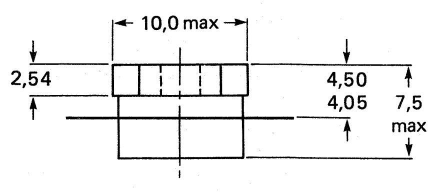


Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

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

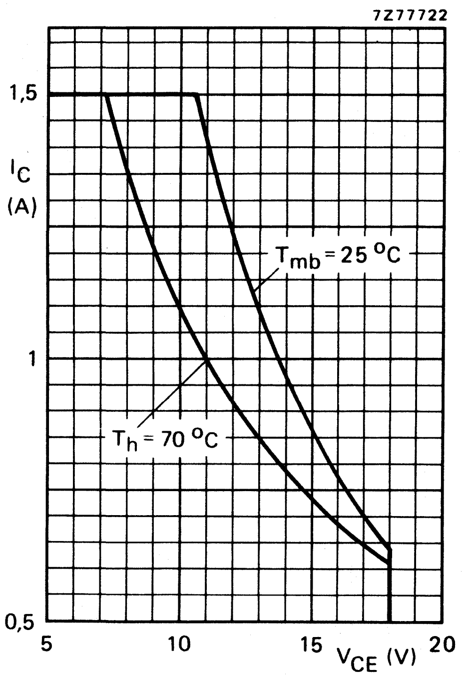


Fig. 2 D.C. SOAR.

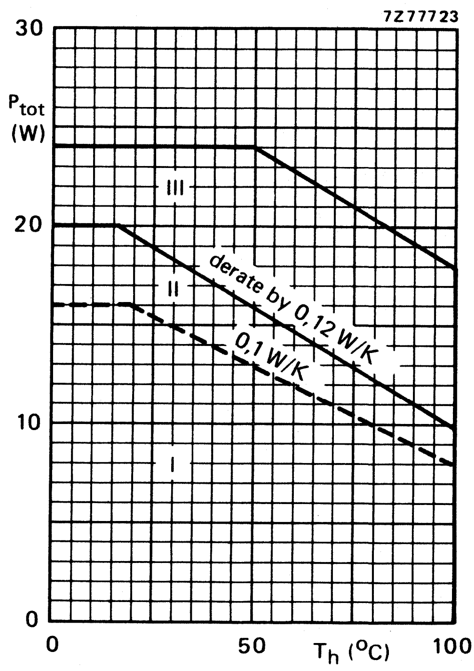


Fig. 3 R.F. power dissipation; $V_{CE} \leq 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

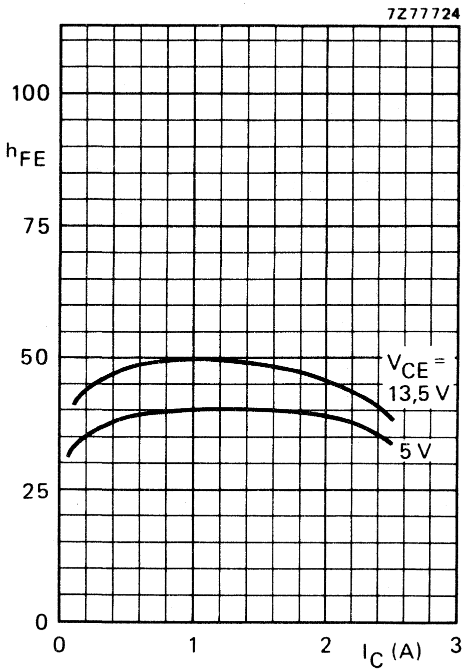


Fig. 4 Typical values; T_j = 25 °C.

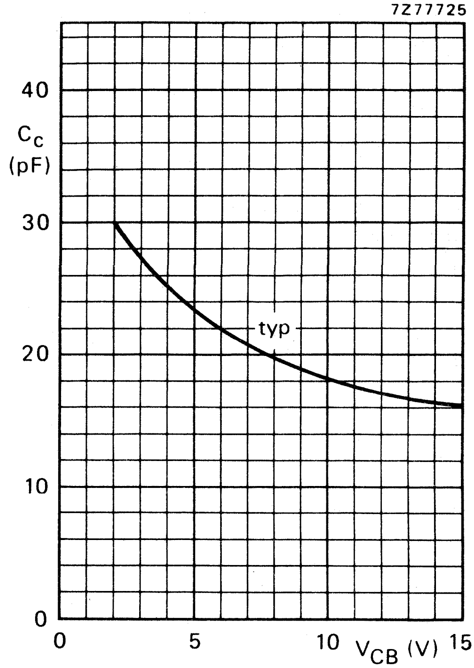


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

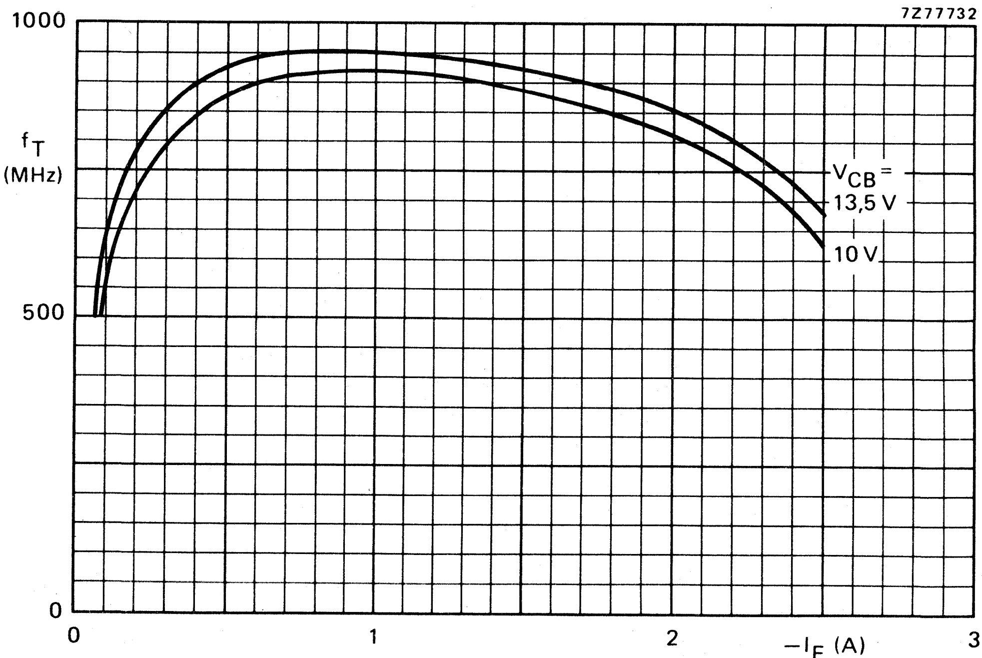


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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	–	–

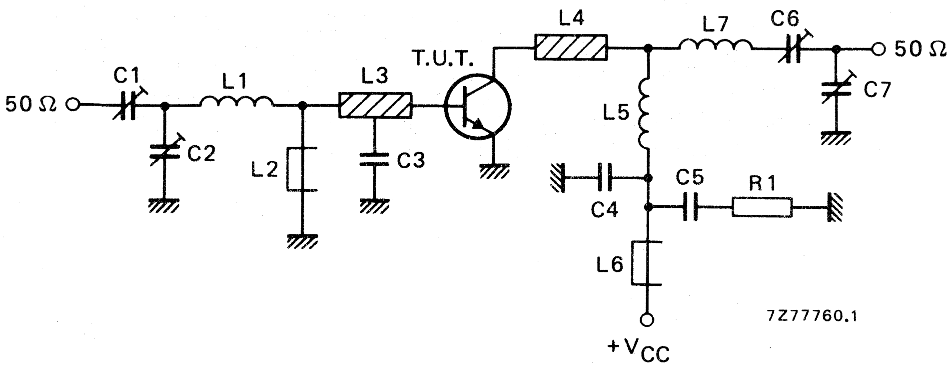


Fig. 7 Test circuit; c.w. class-B.

List of components:

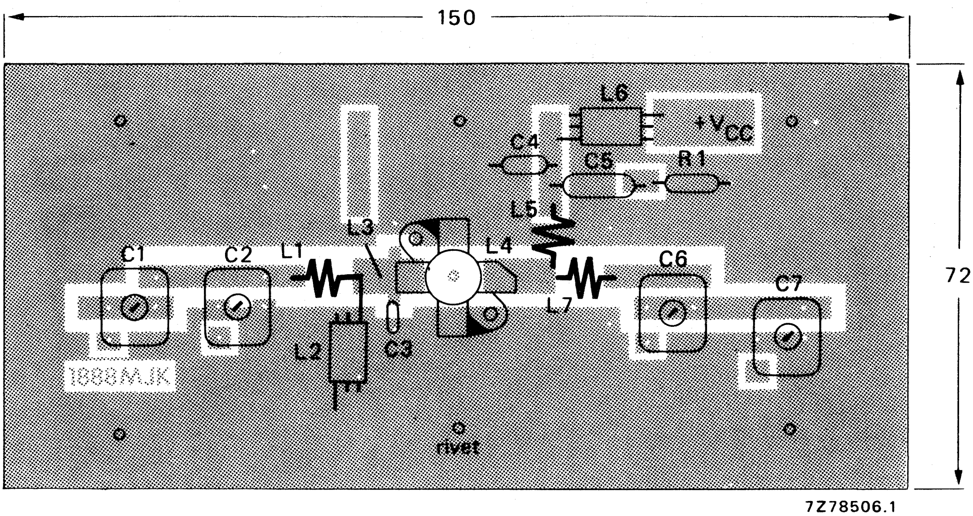
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 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.



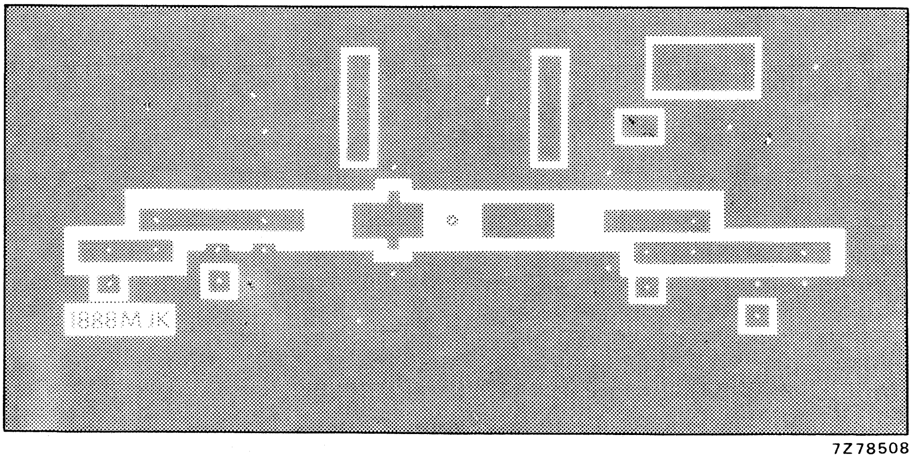


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

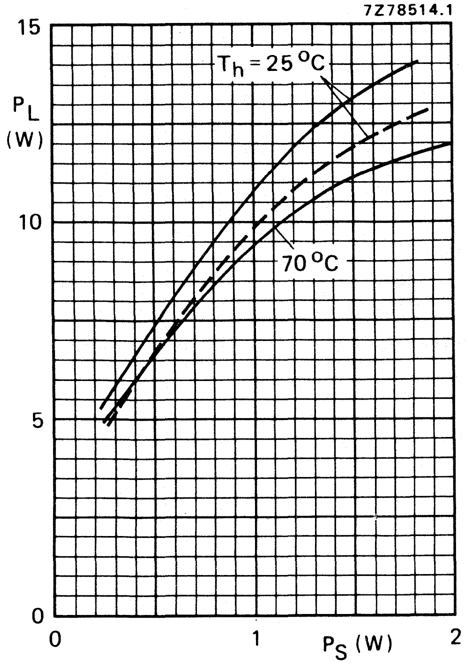


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

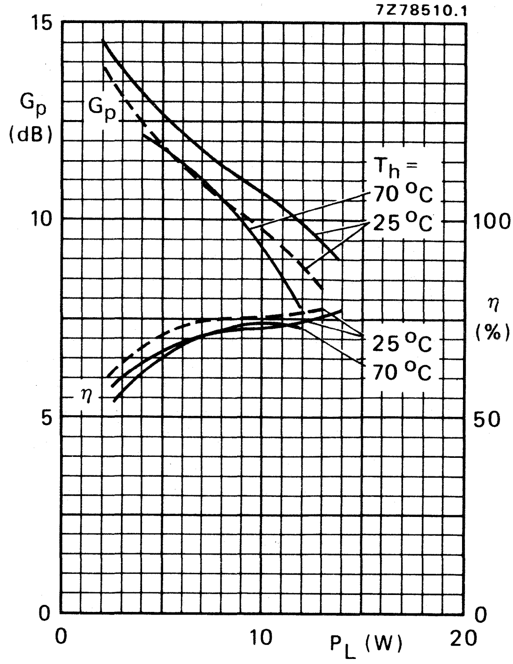


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

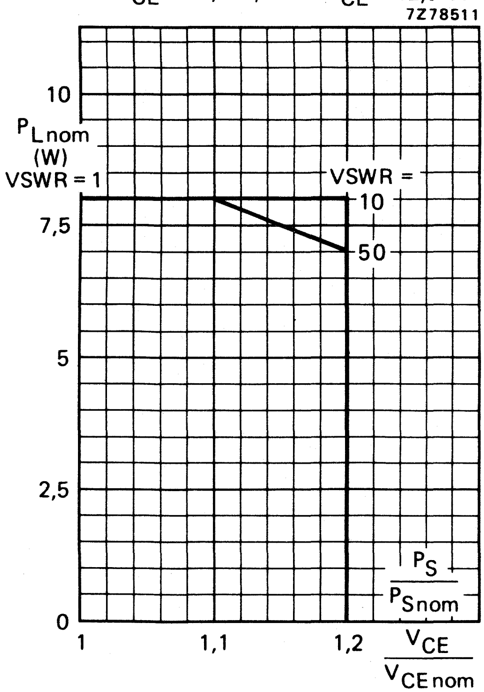


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

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.

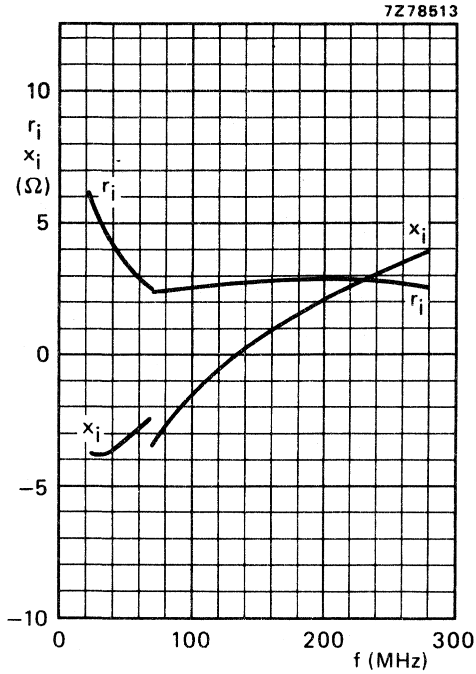


Fig. 12 Input impedance (series components).

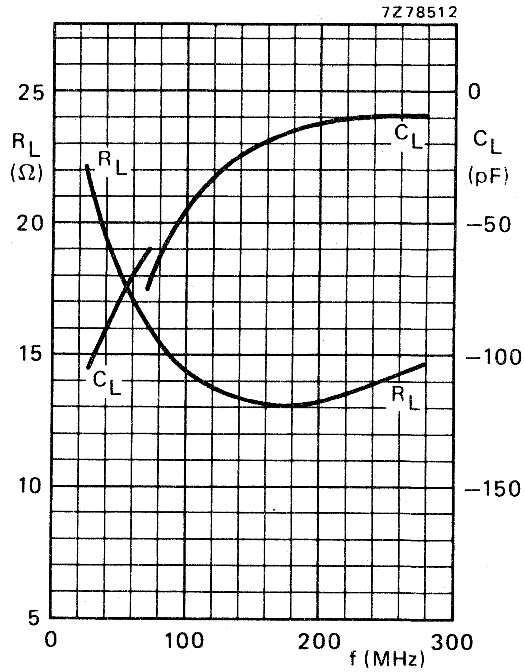


Fig. 13 Load impedance (parallel components).

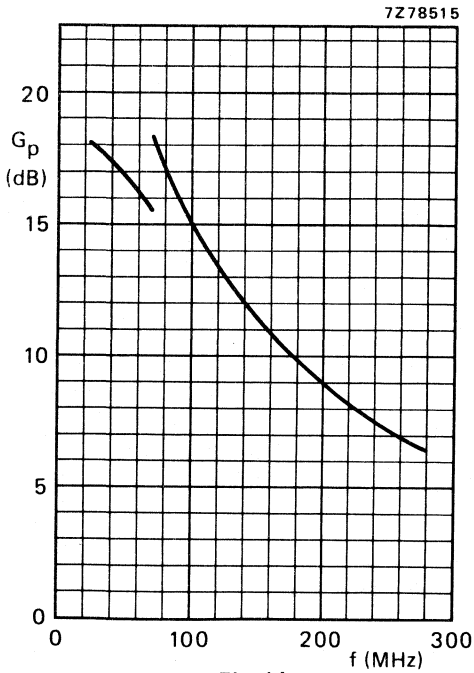


Fig. 14.

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

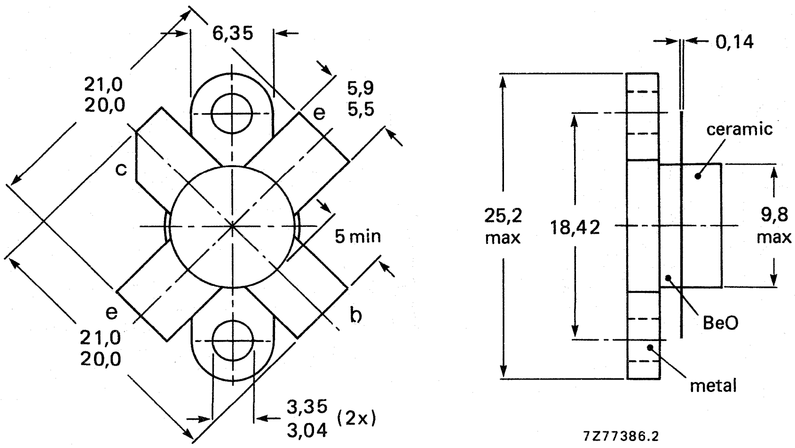
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

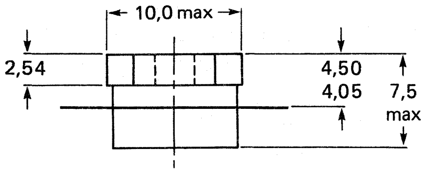
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**15**	**> 8,0**	**> 60**	**2,3 + j2,2**	**130 – j4,4**
c.w.	12,5	175	15	typ. 7,5	typ. 67	–	–

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

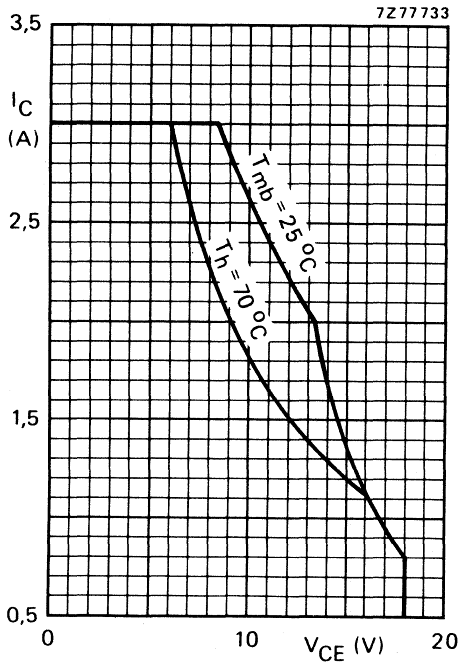


Fig. 2 D.C. SOAR.

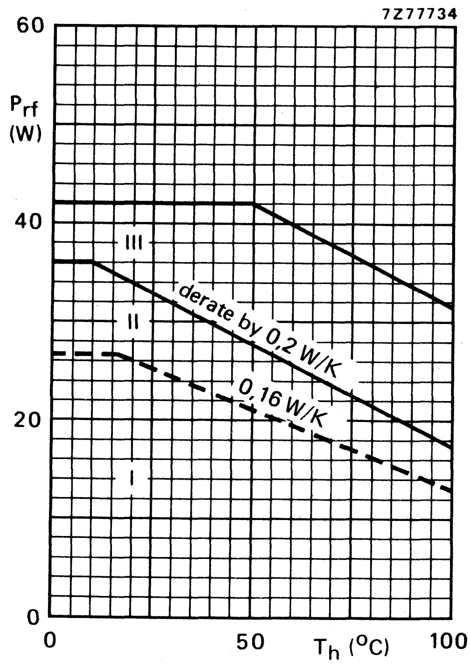


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

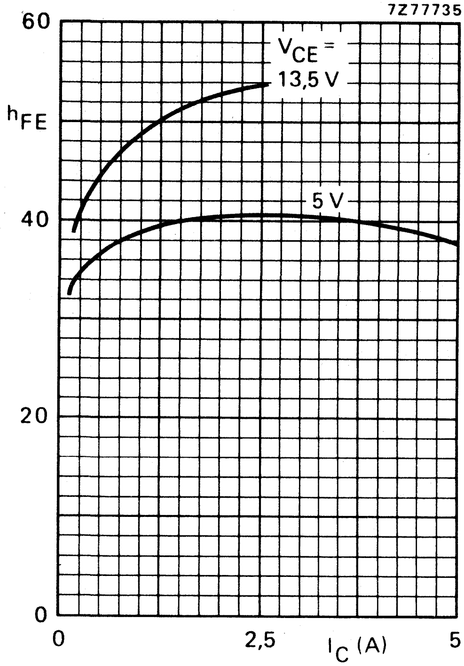


Fig. 4 Typical values; T_j = 25 °C.

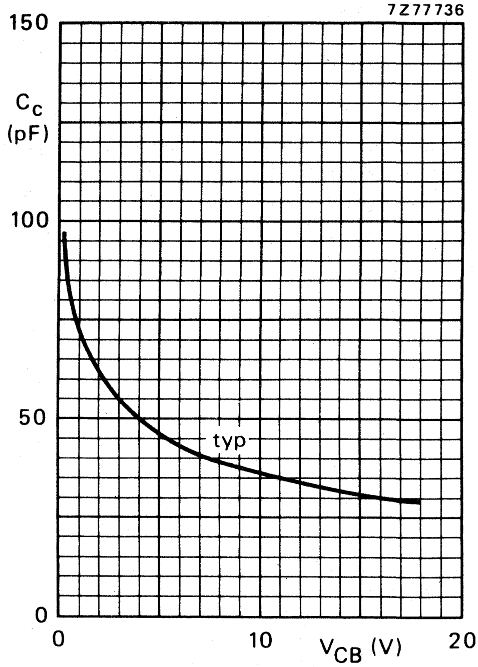


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

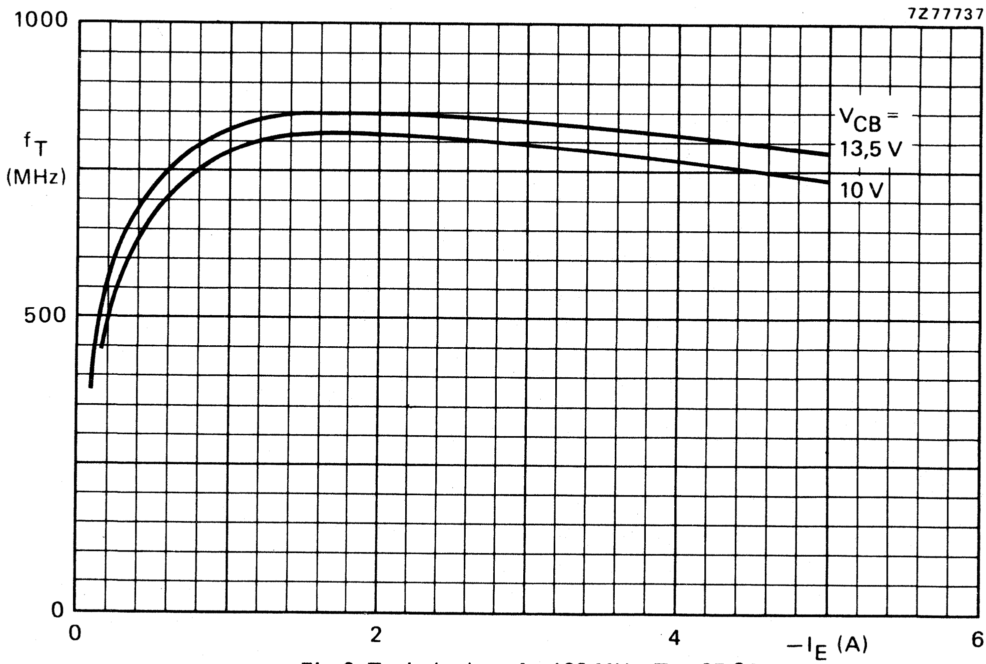


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C .

APPLICATION INFORMATION

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

T_h = 25 °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	–	–

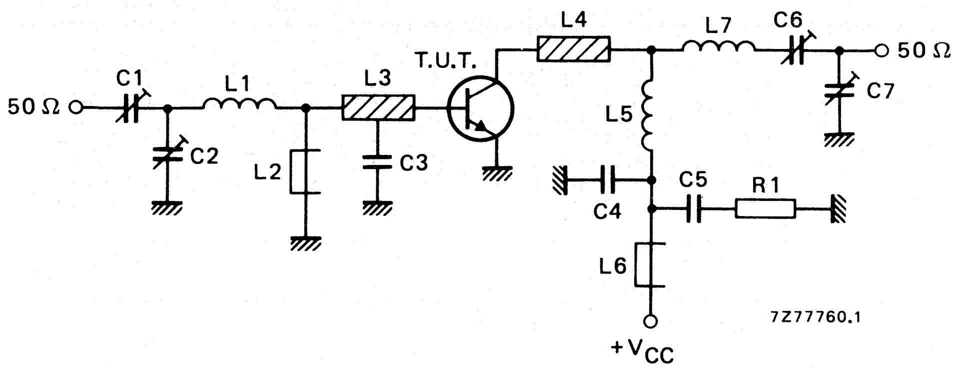


Fig. 7 Test circuit; c.w. class-B.

List of components:

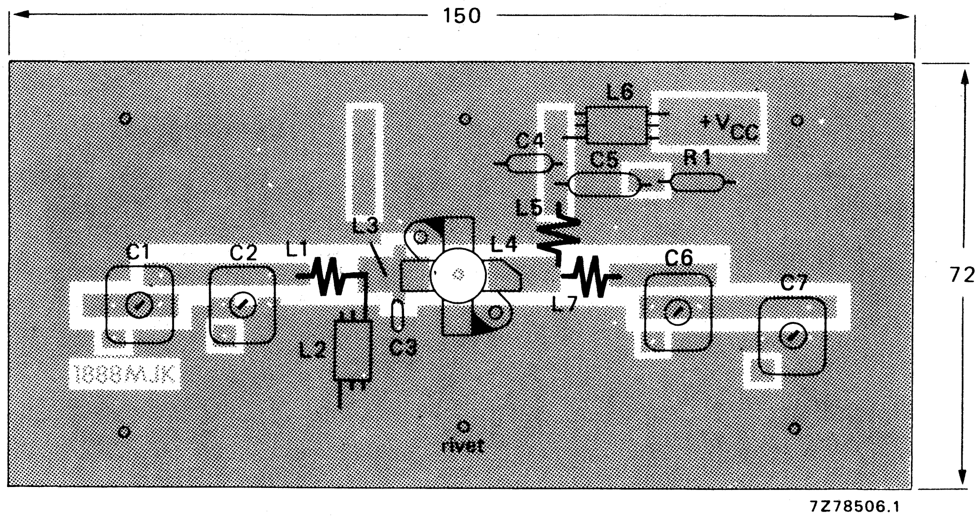
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 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.



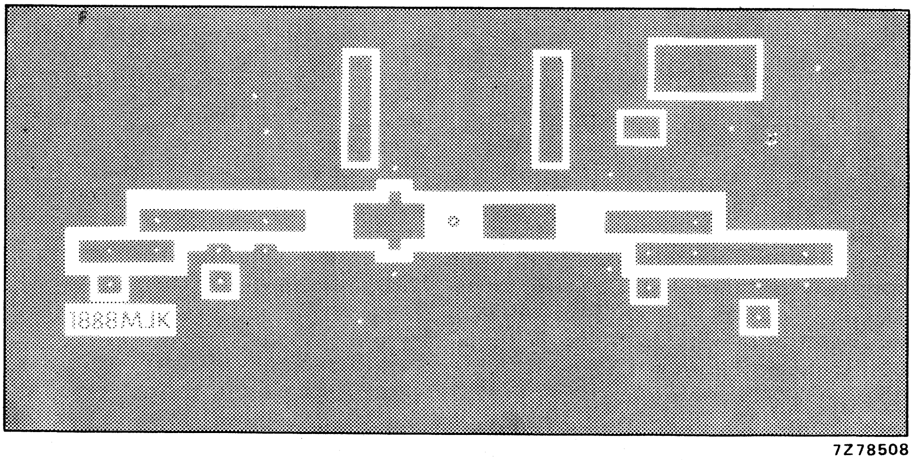


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

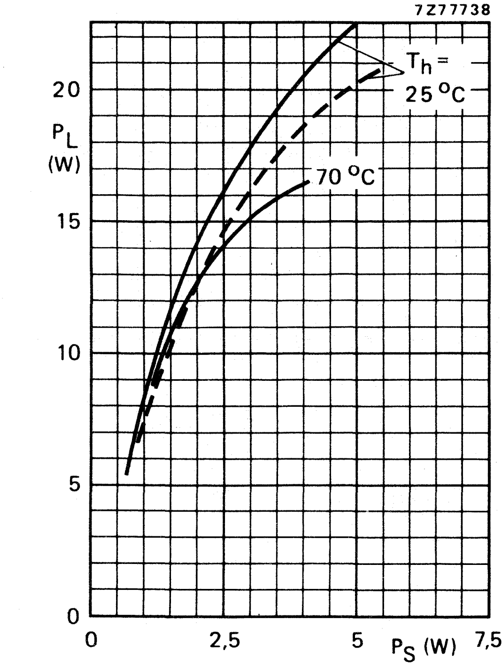


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

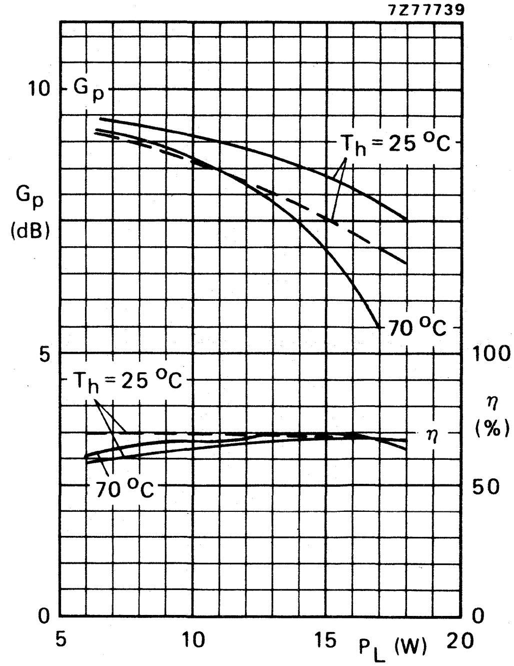


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

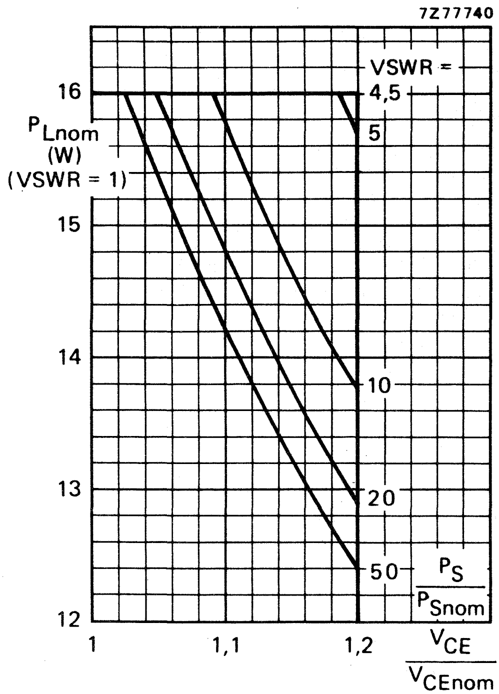


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

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.

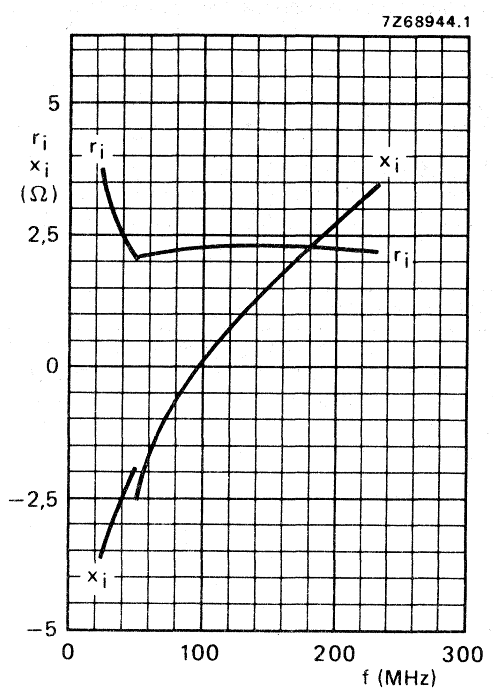


Fig. 12 Input impedance (series components).

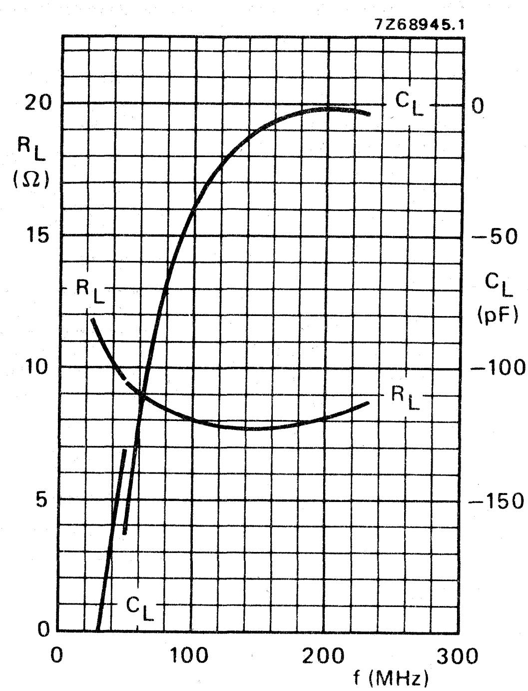


Fig. 13 Load impedance (parallel components).

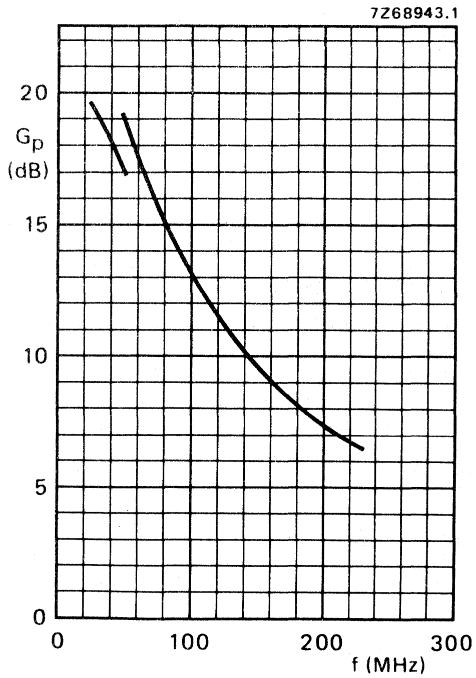


Fig. 14.

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.

VHF power transistor — BLV12

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Excellent reliability
- Withstands full load mismatch.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT123 flange envelope with a ceramic cap. It is designed for common emitter, class-B operation in mobile VHF transmitters with a supply voltage of 12.5 V. All leads are isolated from the mounting flange.

PINNING - SOT123

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	30	> 9	> 60

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

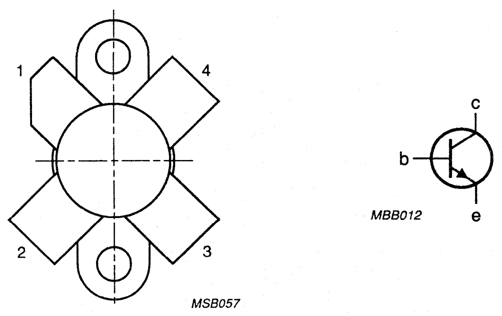
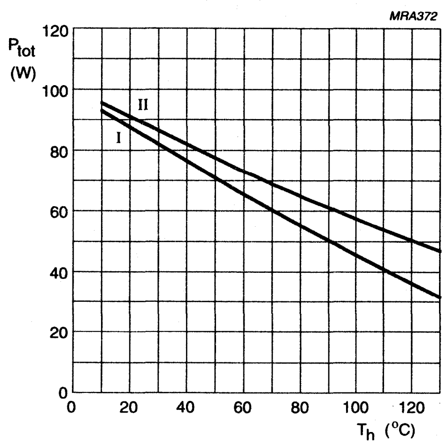


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	6	A
I_{CM}	collector current	peak value f > 1 MHz	–	18	A
P_{tot}	total power dissipation	RF operation; f > 1 MHz; T_{mb} = 25 °C	–	100	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C



(I) Continuous DC operation.

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

Fig.2 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 100 W; T_{mb} = 25 °C	1.75	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.3	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 25 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 2 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 16 V	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 4 A	25	35	–	
f_T	transition frequency	V_{CE} = 12.5 V; I_E = 4 A; f = 500 MHz	–	1.6	–	GHz
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	90	100	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	60	70	pF
$C_{c\text{-}f}$	collector-flange capacitance	f = 1 MHz	–	2	–	pF

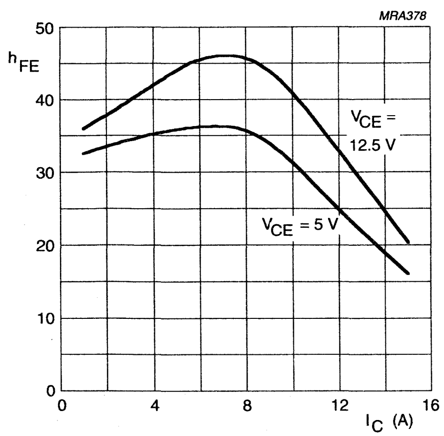
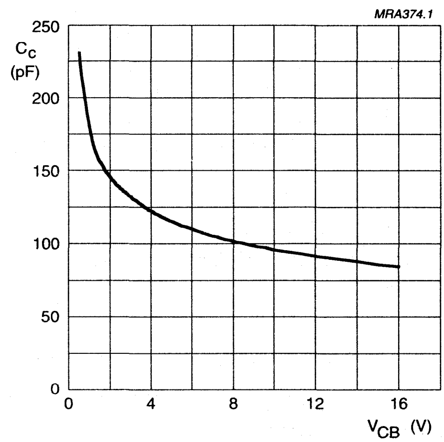
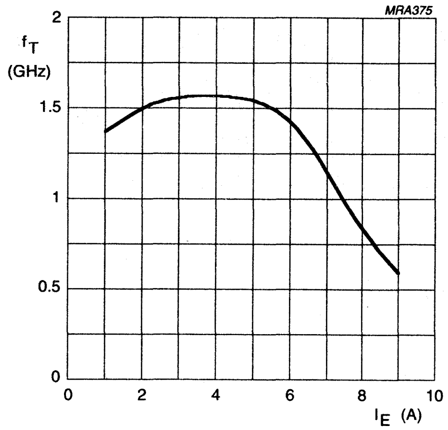


Fig.3 DC current gain as a function of collector current, typical values.



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

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



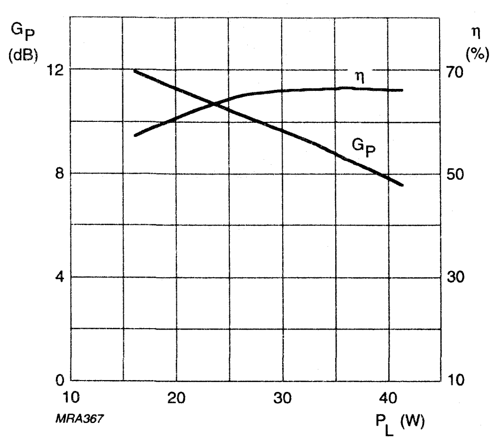
V_{CB} = 12.5 V.

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

APPLICATION INFORMATION

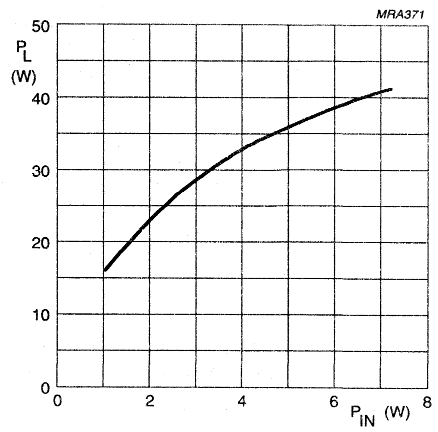
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	30	> 9 typ. 9.8	> 60 typ. 66



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.6 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.7 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLV12 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 15.5 V, and f = 175 MHz.

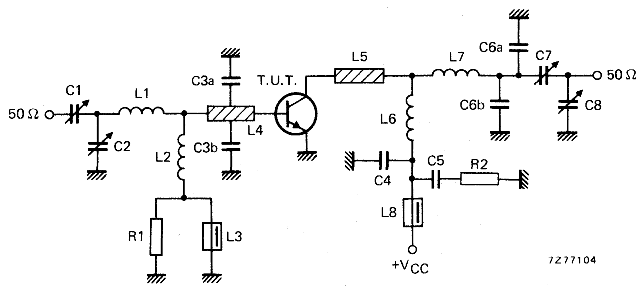


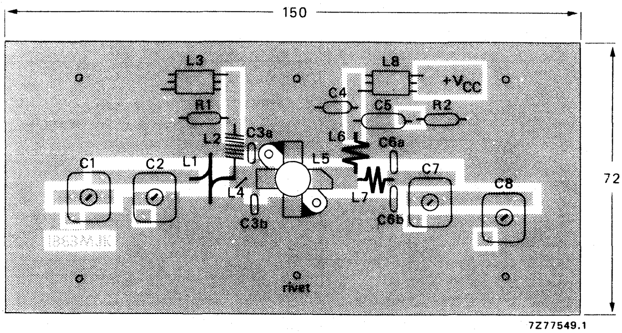
Fig.8 Class-B test circuit at f = 175 MHz.

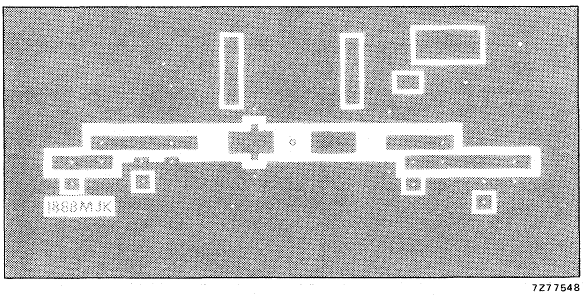
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C2, C8	film dielectric trimmer	4 to 40 pF		2222 809 07008
C3a, C3b	500 V ceramic capacitor	47 pF		
C4	500 V ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
C6a, C6b	500 V ceramic capacitor	8.2 pF		
C7	film dielectric trimmer	5 to 60 pF		2222 809 07011
L1	1 turn enamelled 1.6 mm copper wire		int. dia. 9 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire	100 nH	int. dia. 3 mm; leads 2 x 5 mm	
L3, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 1)		12 mm x 6 mm; note 2	
L6	2 turns enamelled 1.6 mm copper wire		int. dia. 5 mm; length 6 mm; leads 2 x 5 mm	
L7	2 turns enamelled 1.6 mm copper wire		int. dia. 4.5 mm; length 6 mm; leads 2 x 5 mm	
R1	0.25 W carbon resistor	10 Ω, 5%		
R2	0.25 W carbon resistor	4.7 Ω, 5%		

Notes

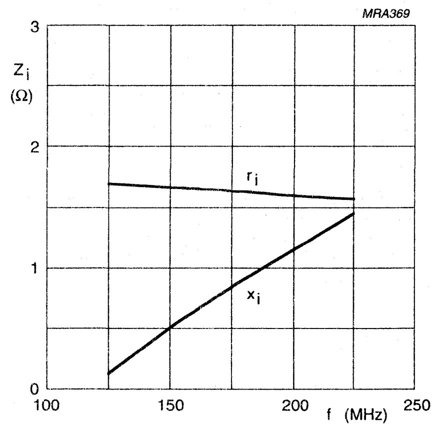
1. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric, thickness 1⁄16 inch.
2. Taps for capacitors C3a and C3b are situated 5 mm from the transistor.





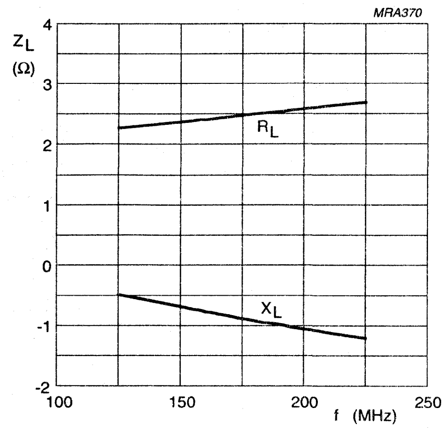
The circuit and components are situated on one side of an epoxy fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections are made by means of hollow rivets and copper straps under the emitters, to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 175 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

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



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

Fig.11 Load impedance (series components) as a function of frequency, typical values.

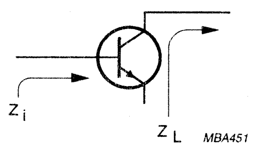
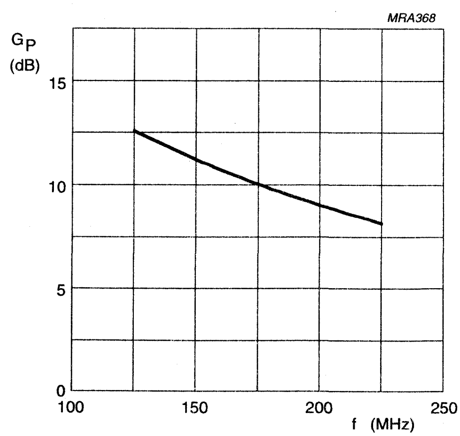


Fig.12 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

Fig.13 Power gain as a function of frequency, typical values.

VHF power transistor BLV13

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT123 flange envelope with a ceramic cap. It is designed for common emitter, class-B operation in mobile VHF transmitters with a supply voltage of 12.5 V. All leads are isolated from the mounting flange.

PINNING - SOT123

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	40	> 8.5	> 60

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

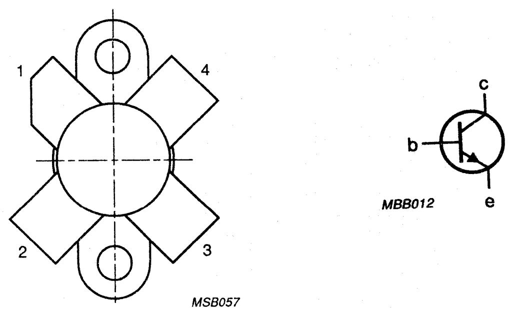


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16.5	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	8	A
I_{CM}	collector current	peak value f > 1 MHz	–	25	A
P_{tot}	total power dissipation	RF operation; f > 1 MHz; T_{mb} = 25 °C	–	106	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

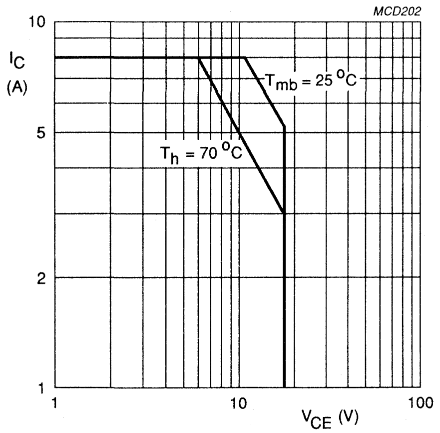
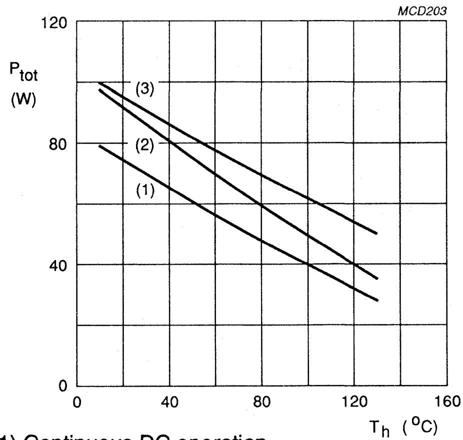


Fig.2 DC SOAR.



(1) Continuous DC operation.

(2) Continuous RF operation (f > 1 MHz).

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

Fig.3 Power derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 106 W; T_{mb} = 25 °C	1.65	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.3	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 50 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 100 mA	16.5	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 mA	4	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 20 V	–	–	25	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 5.4 A	15	60	–	
f_T	transition frequency	V_{CE} = 12.5 V; I_E = 5 A	–	1.65	–	GHz
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	105	–	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	65	–	pF
$C_{c\text{-}f}$	collector-flange capacitance	f = 1 MHz	–	2	–	pF

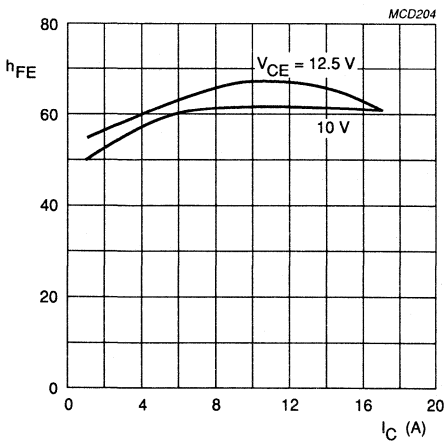
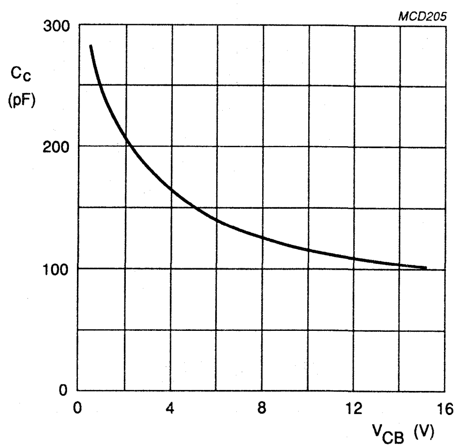


Fig.4 DC current gain as a function of collector current, typical values.

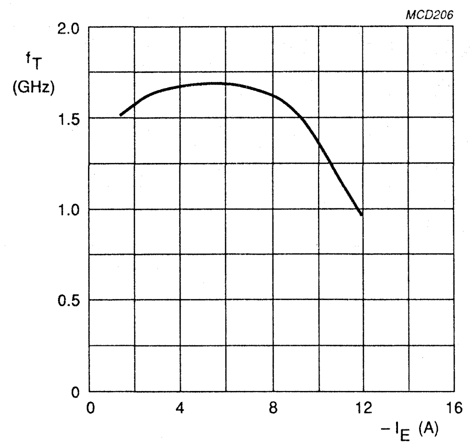


$I_E = i_e$ = 0; f = 1 MHz.

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

VHF power transistor

BLV13



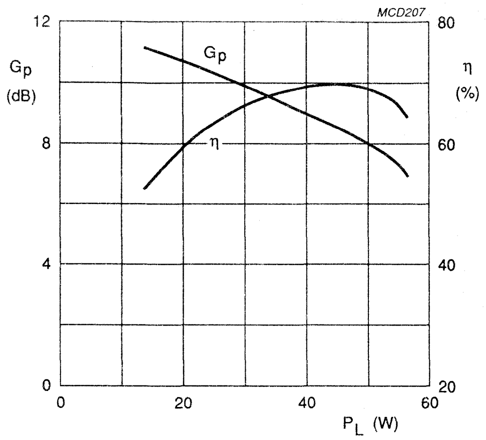
V_{CB} = 12.5 V.

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

APPLICATION INFORMATION

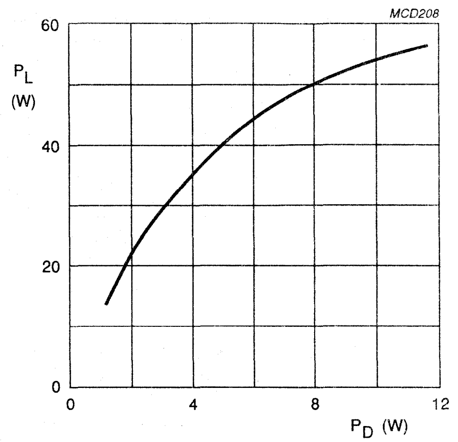
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	40	> 8.5 typ. 9	> 60 typ. 68



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.7 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLV13 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases at rated output power, up to a supply voltage of 15.5 V, and f = 175 MHz.

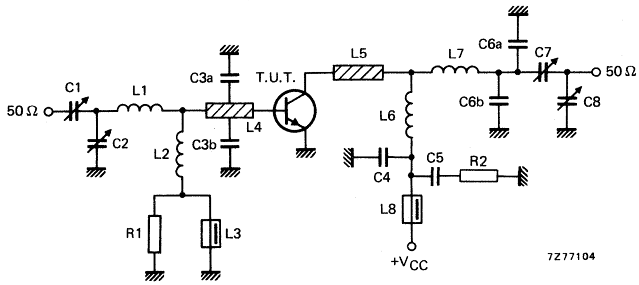


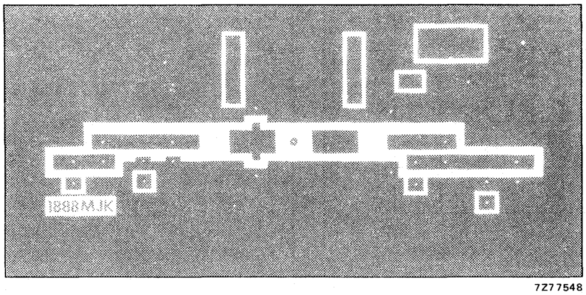
Fig.9 Class-B test circuit at f = 175 MHz.

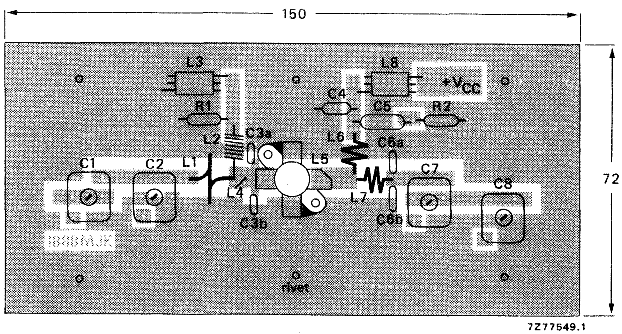
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C2, C8	film dielectric trimmer	4 to 40 pF		2222 809 07008
C3a, C3b	500 V ceramic capacitor	47 pF		
C4	500 V ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
C6a, C6b	500 V ceramic capacitor	8.2 pF		
C7	film dielectric trimmer	5 to 60 pF		2222 809 07011
L1	1 turn enamelled 1.6 mm copper wire		int. dia. 9 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire	100 nH	int. dia. 3 mm; leads 2 x 5 mm	
L3, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 1)		12 mm x 6 mm; note 2	
L6	2 turns enamelled 1.6 mm copper wire		int. dia. 5 mm; length 6 mm; leads 2 x 5 mm	
L7	2 turns enamelled 1.6 mm copper wire		int. dia. 4.5 mm; length 6 mm; leads 2 x 5 mm	
R1	0.25 W carbon resistor	10 Ω, 5%		
R2	0.25 W carbon resistor	4.7 Ω, 5%		

Notes

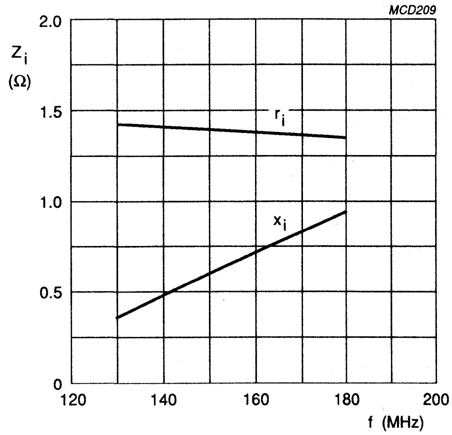
1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric, thickness 1⁄16 inch.
2. Taps for capacitors C3a and C3b are situated 5 mm from the transistor.





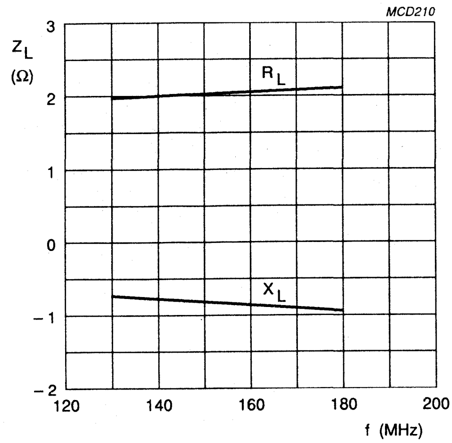
The circuit and components are situated on one side of an epoxy fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of hollow rivets and copper straps under the emitters.

Fig.10 Component layout for 175 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.11 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.12 Load impedance (series components) as a function of frequency, typical values.

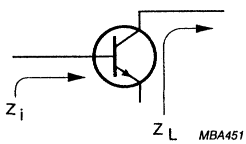
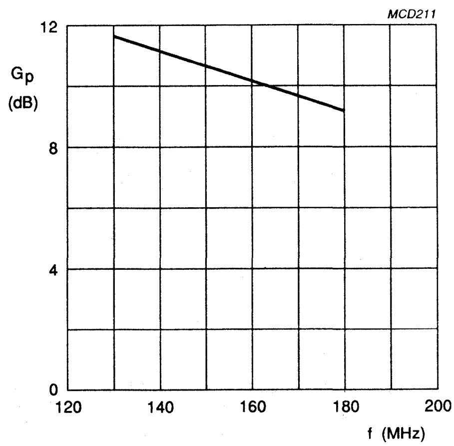


Fig.13 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.14 Power gain as a function of frequency, typical values.

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

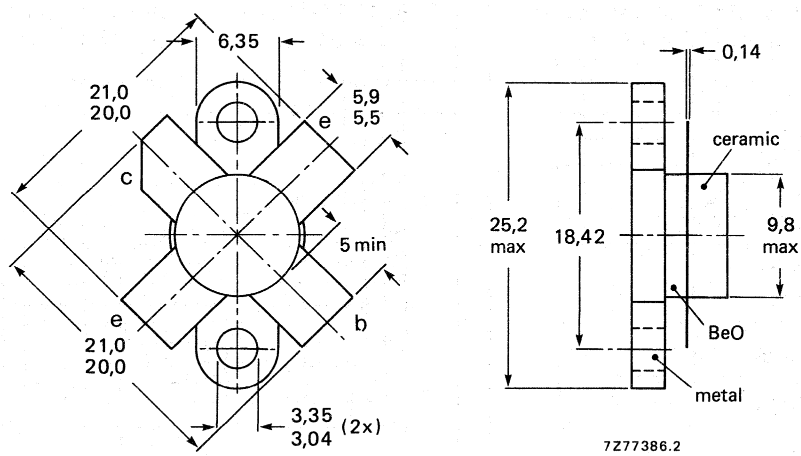
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

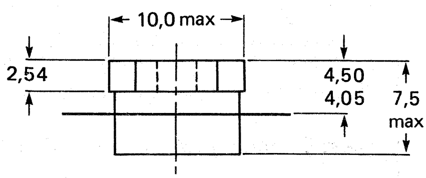
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	8	> 12	> 65	1,8 + j0,7	18 − j20

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); $T_{mb} = 25\ ^oC$	P_{rf}	max.	20	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

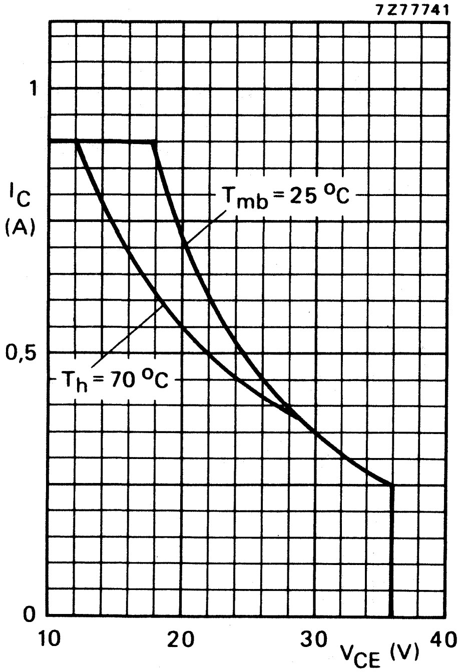


Fig. 2 D.C. SOAR.

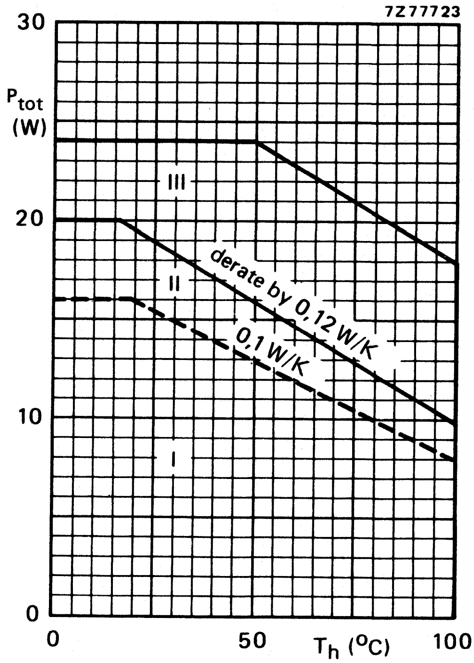


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; $T_{mb} = 72,4\ ^oC$, i.e. $T_h = 70\ ^oC$)

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

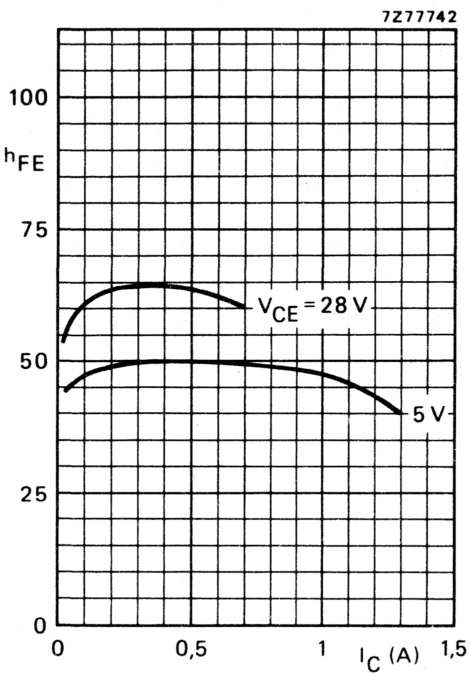


Fig. 4 Typical values; T_j = 25 °C.

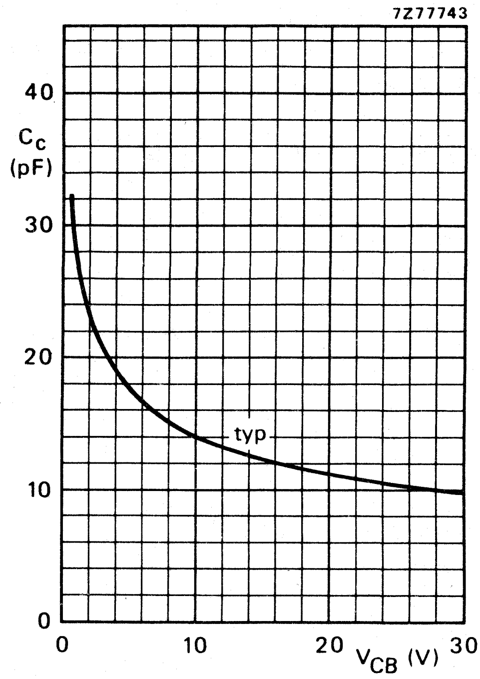


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

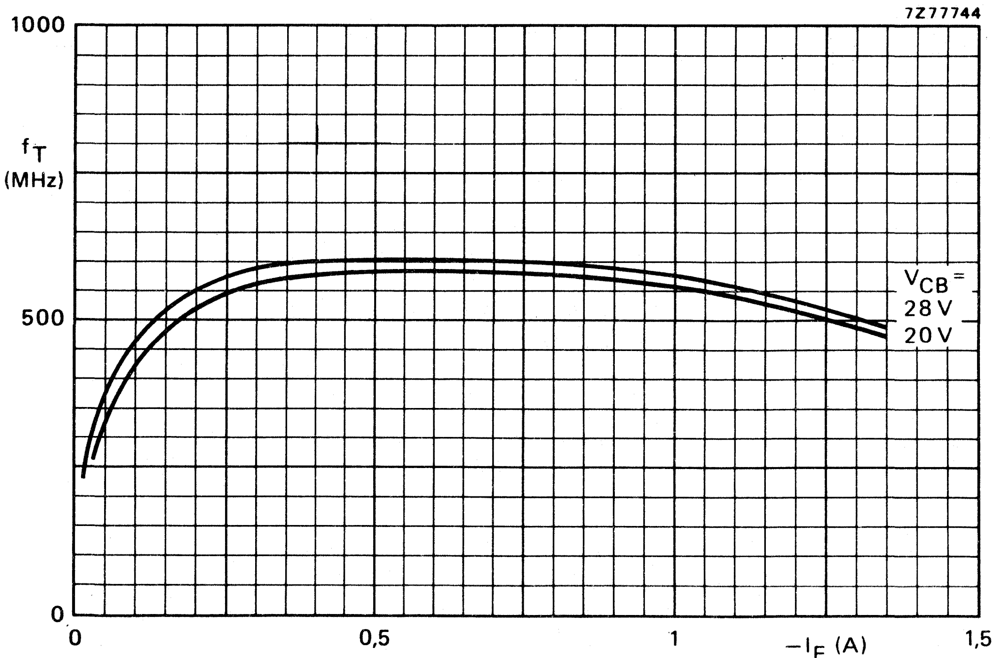


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

$T_h = 25\ ^oC$

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	8	< 0,5	> 12	< 0,44	> 65	1,8 + j0,7	18 − j20

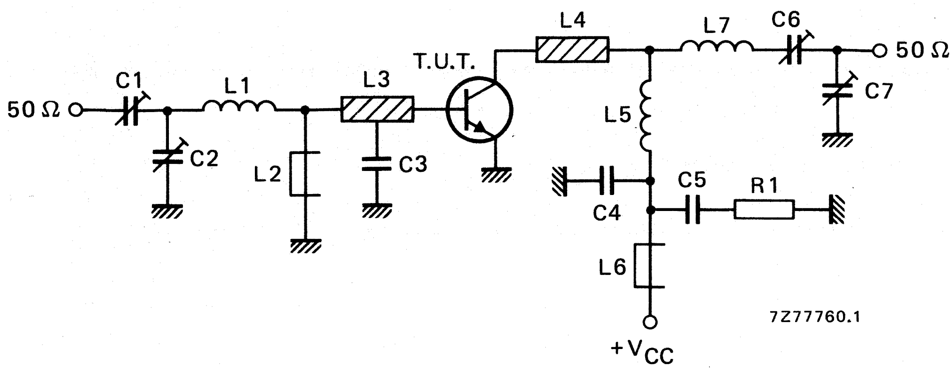


Fig. 7 Test circuit; c.w. class-B.

List of components:

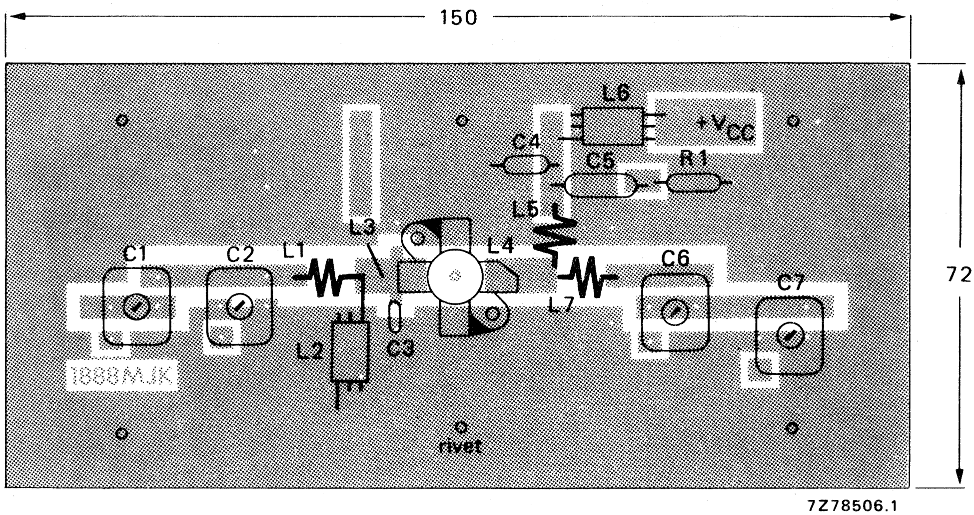
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

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.



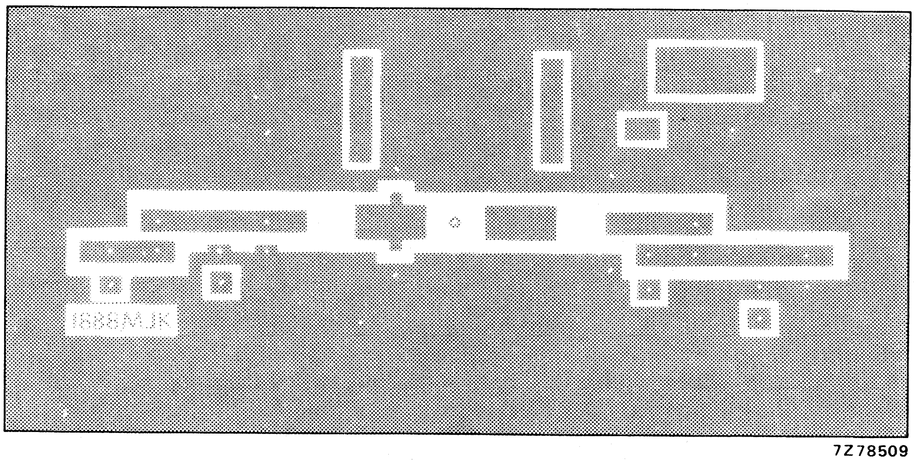


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

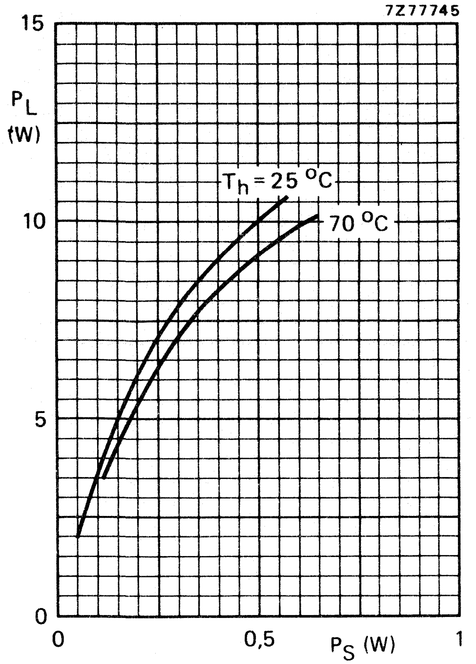


Fig. 9 Typical values; V_{CE} = 28 V;
f = 175 MHz.

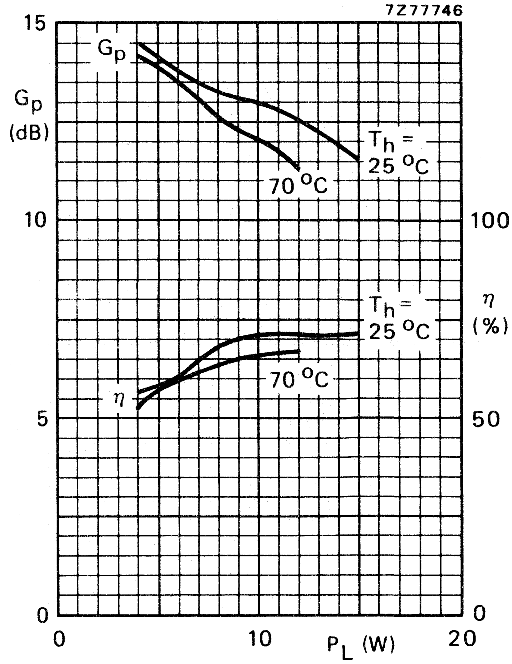


Fig. 10 Typical values; V_{CE} = 28 V;
f = 175 MHz.

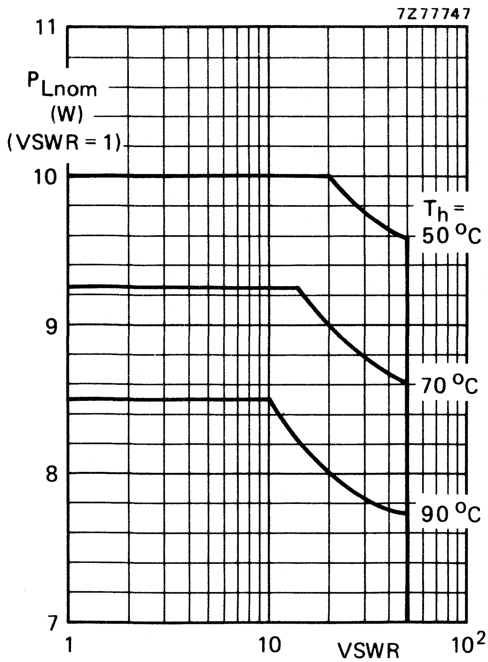


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb-h}$ = 0,3 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

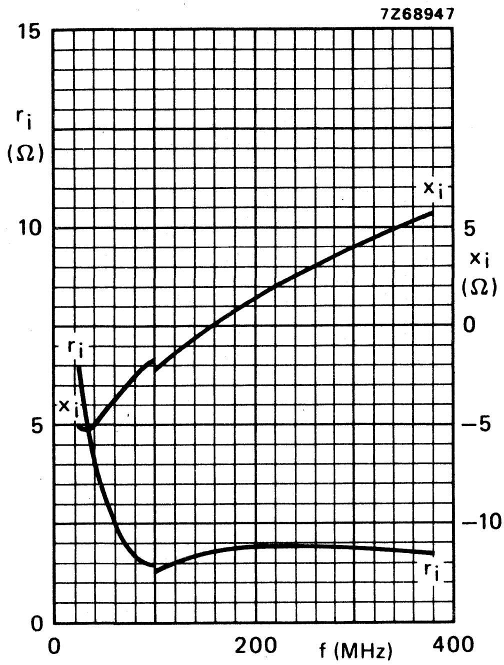


Fig. 12 Input impedance (series components).

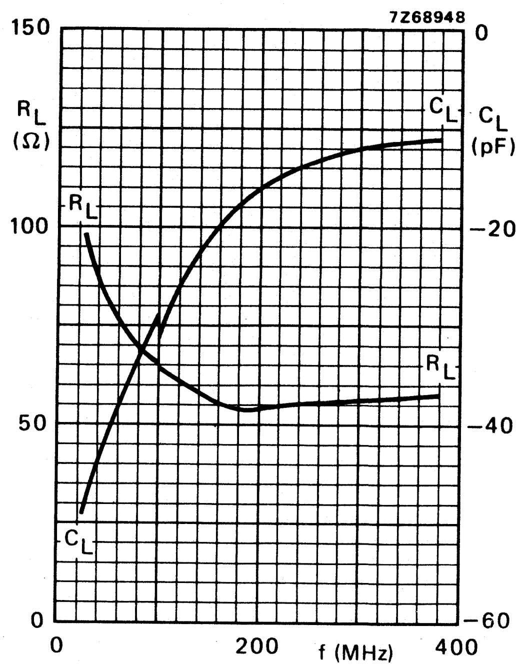


Fig. 13 Load impedance (parallel components).

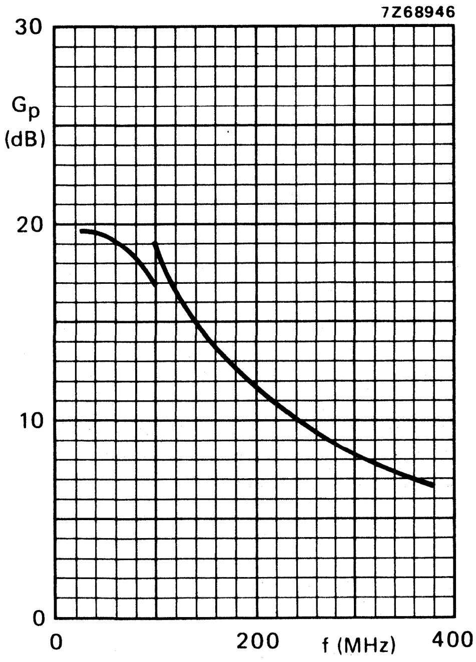


Fig. 14.

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

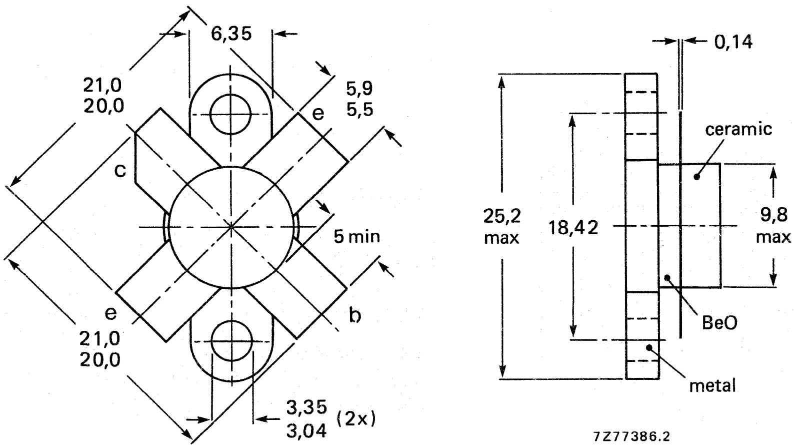
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

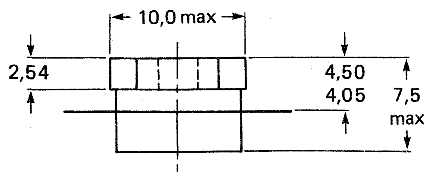
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	28	175	15	> 10	> 65	1,4 + j1,85	33 − j27,5

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

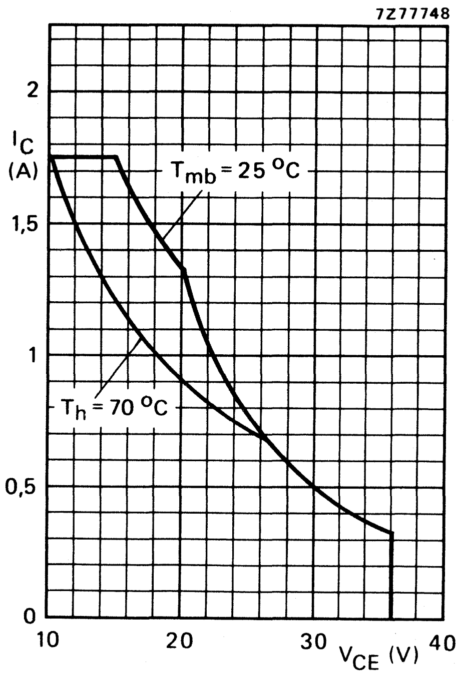


Fig. 2 D.C. SOAR.

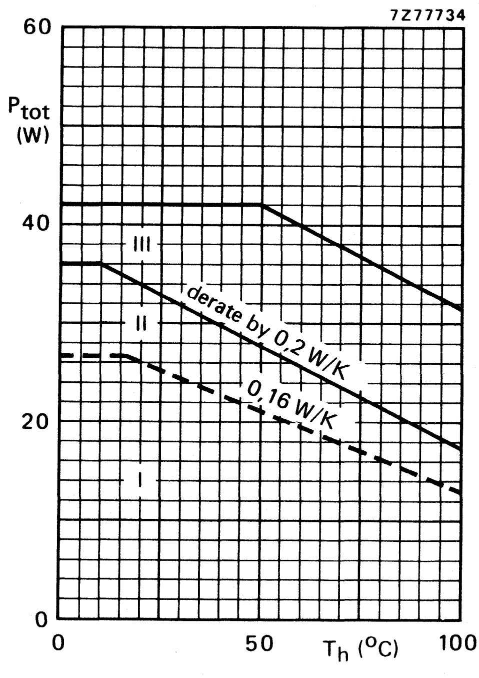


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 15 W; T_{mb} = 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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

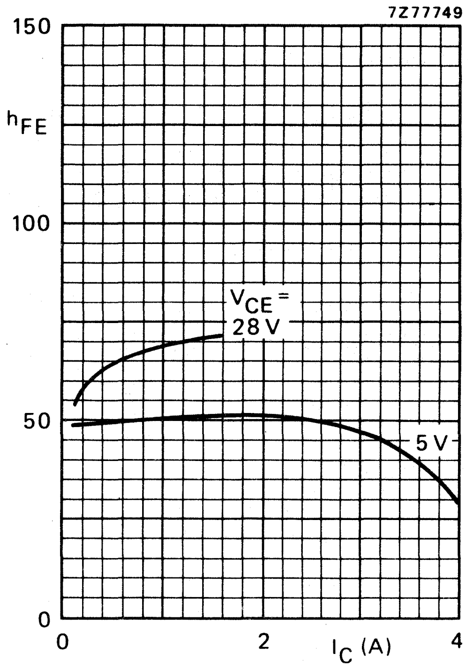


Fig. 4 Typical values; T_j = 25 °C.

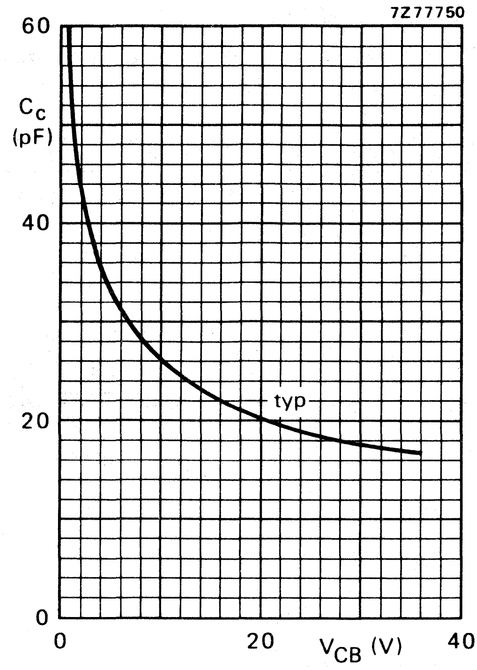


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

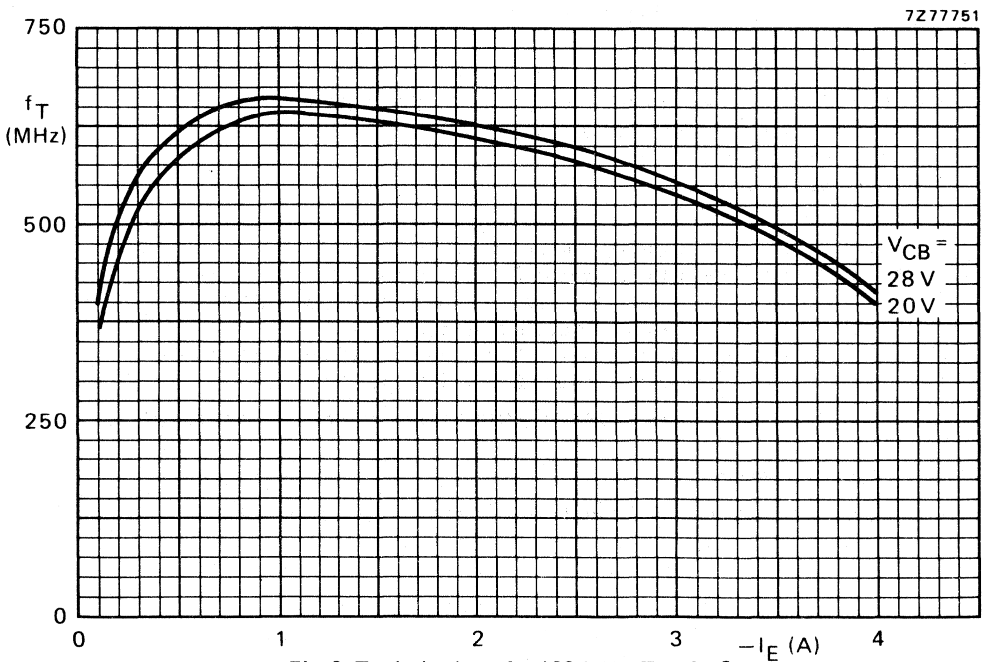


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 – j27,5

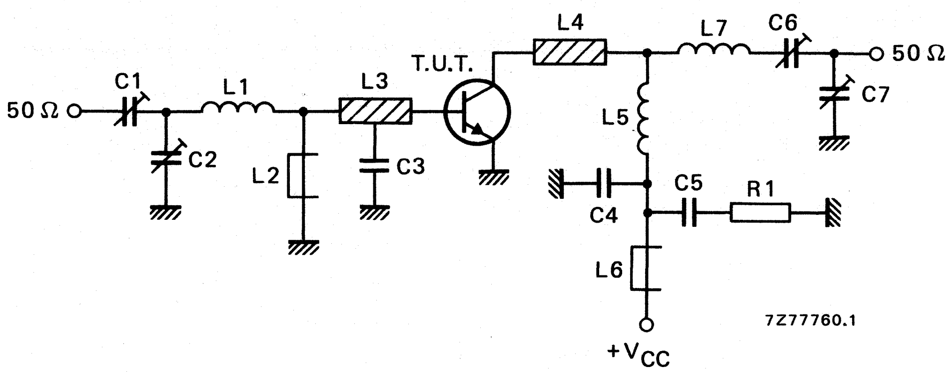


Fig. 7 Test circuit; c.w. class-B.

List of components:

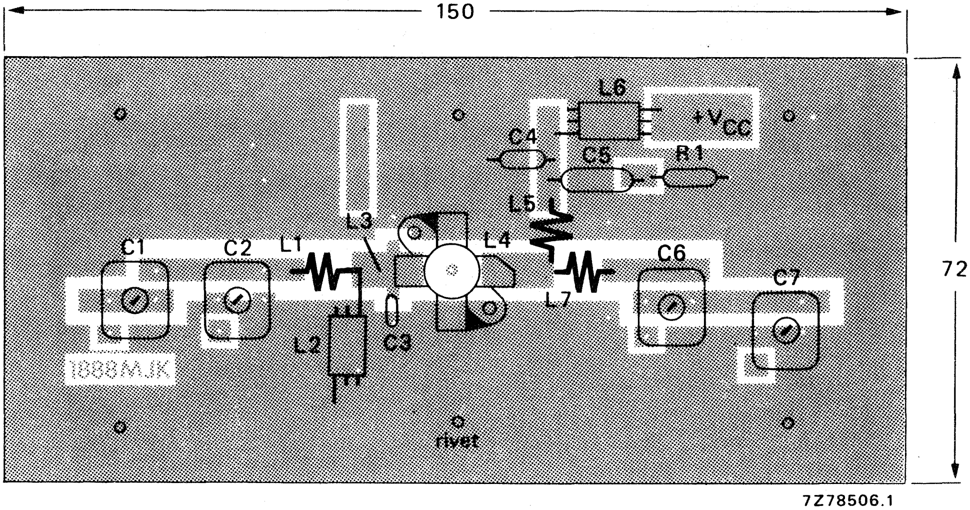
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

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.



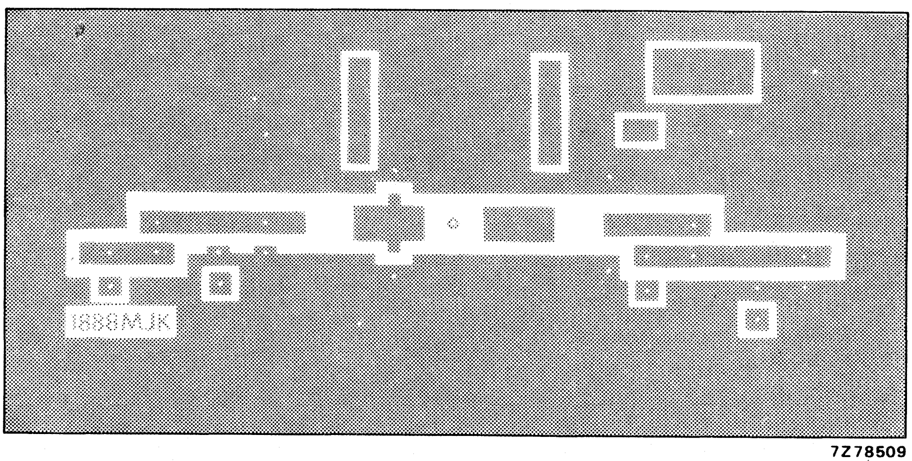


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

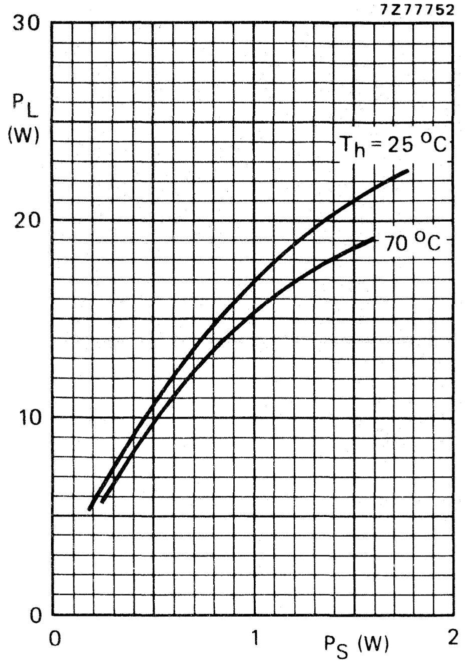


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

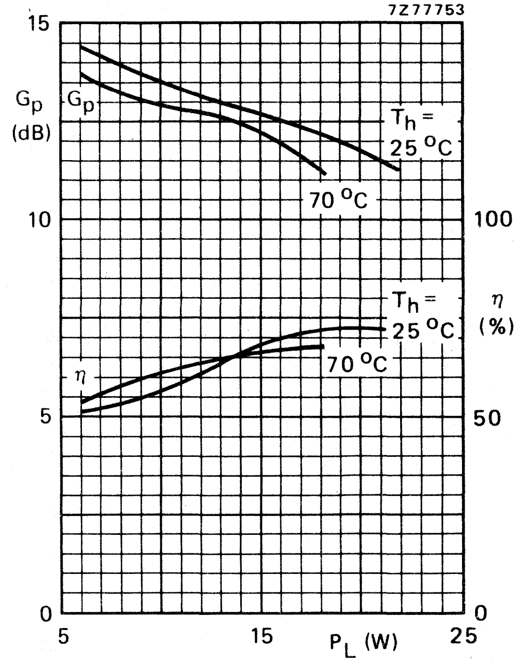


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

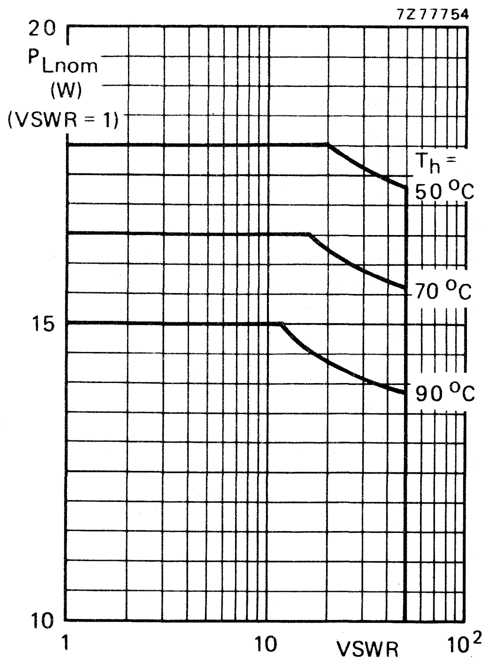


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

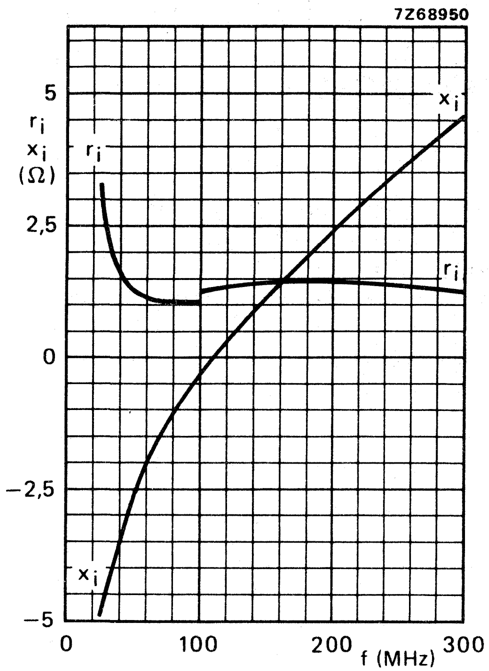


Fig. 12 Input impedance (series components).

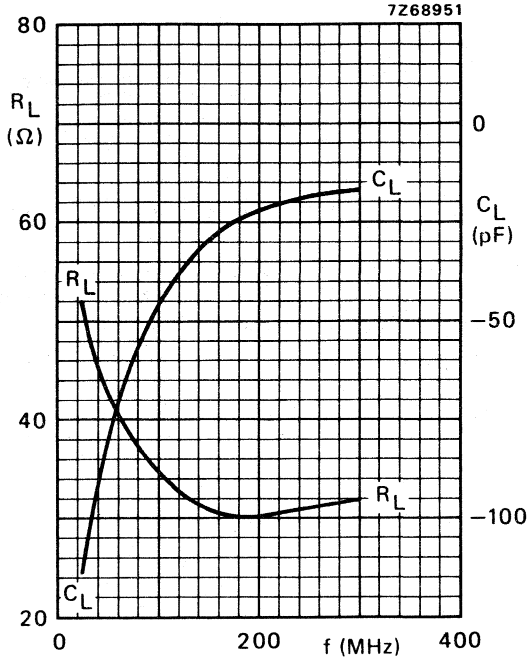


Fig. 13 Load impedance (parallel components).

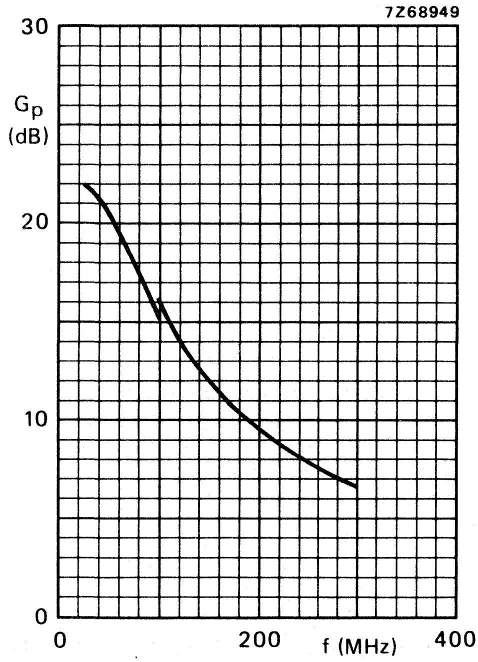


Fig. 14.

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

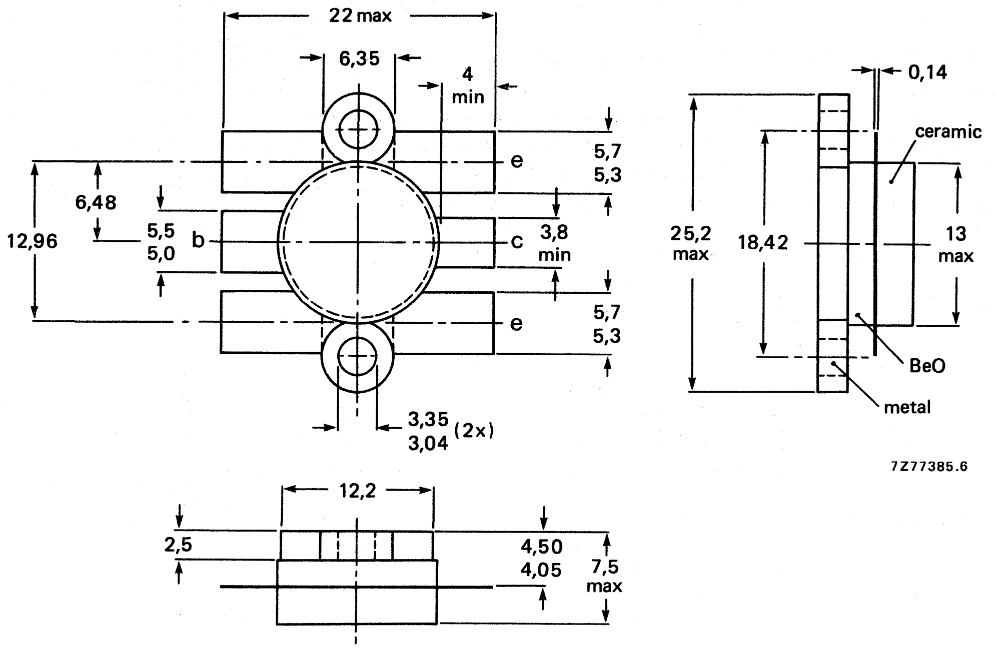
MECHANICAL DATA

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)

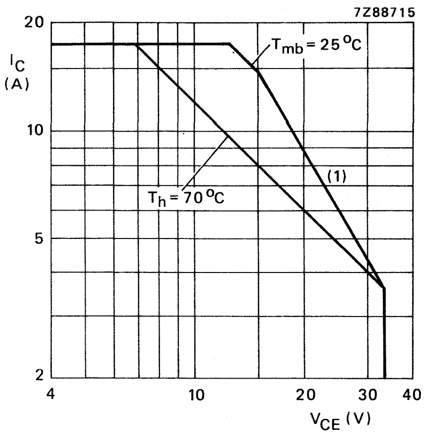
Recommended screw: cheese-head 4-40 UNC/2A

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.

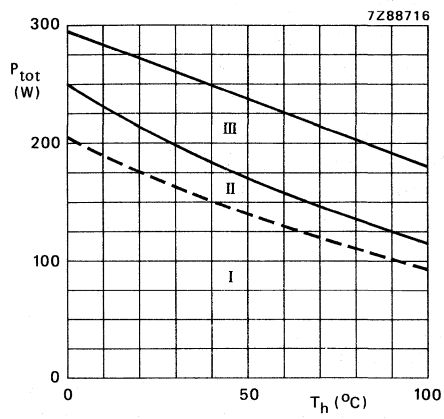


Fig. 3 Power derating curves vs. temperature.

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 °C

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 Ω	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: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

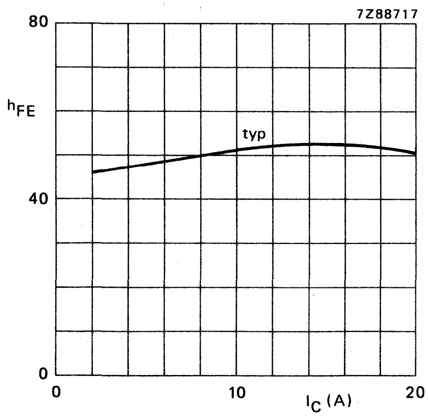


Fig. 4 V_{CE} = 25 V; T_j = 25 °C.

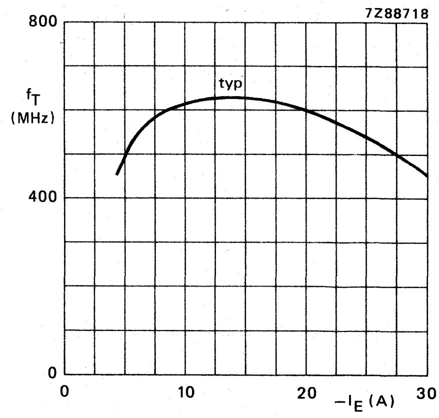


Fig. 5 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

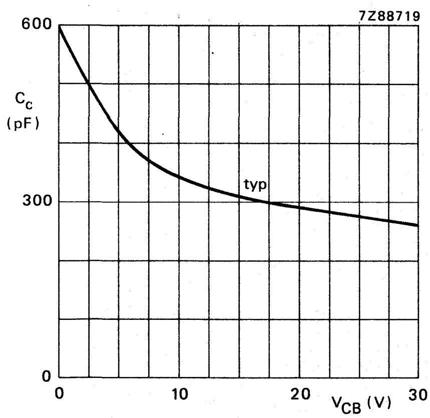


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

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

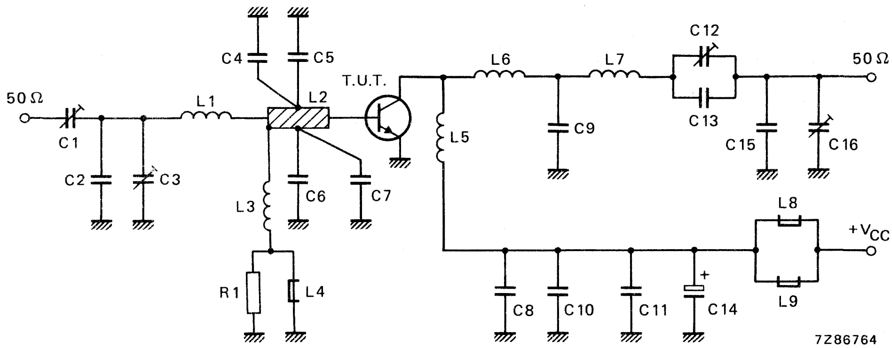


Fig. 7 Class-B test circuit at f = 108 MHz.

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 precision 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.

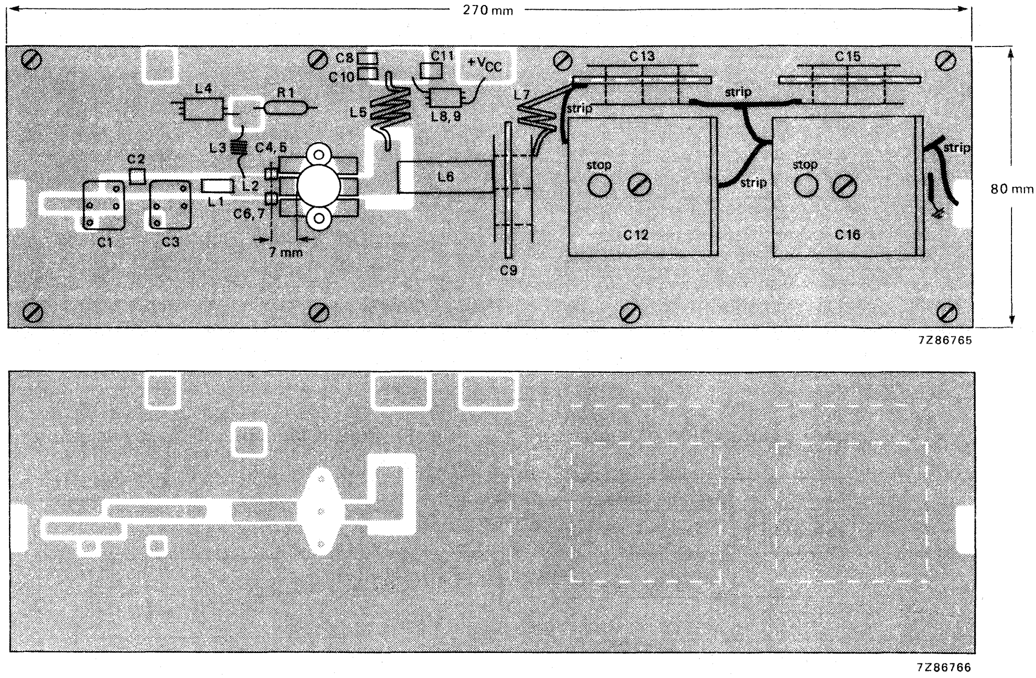


Fig. 8 Component layout and printed-circuit board for 108 MHz class-B test circuit. (Dimensions in mm.)

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.

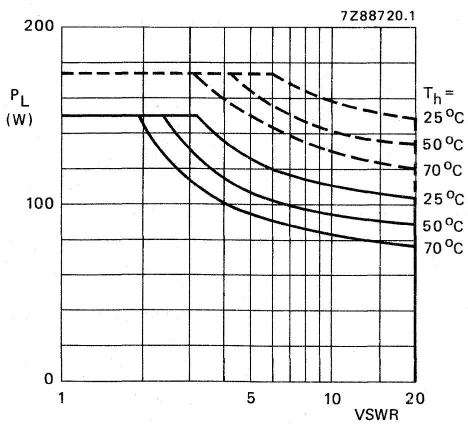


Fig. 9 R.F. SOAR. ——— f > 1 MHz (continuous);
– – – – short time operation during mismatch (f > 1 MHz).

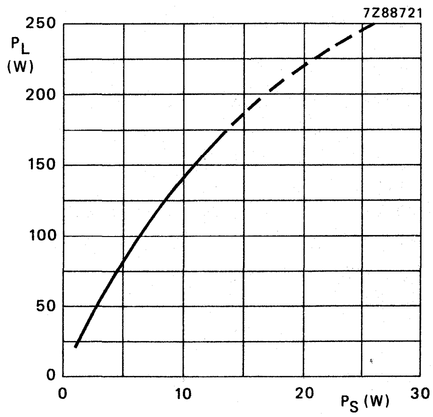


Fig. 10 Load power as a function of source power.

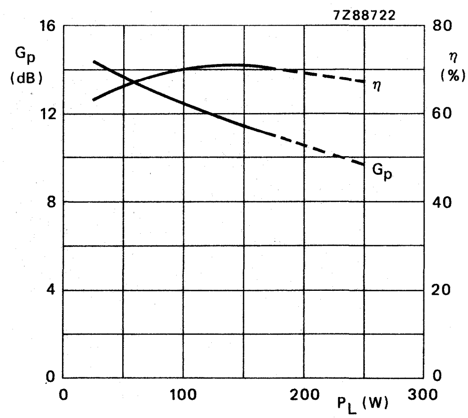


Fig. 11 Power gain and efficiency as a function of source power.

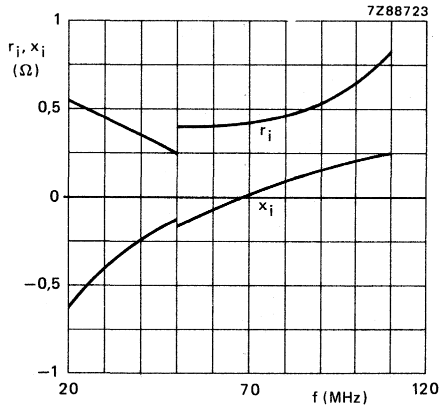


Fig. 12 Input impedance (series components).

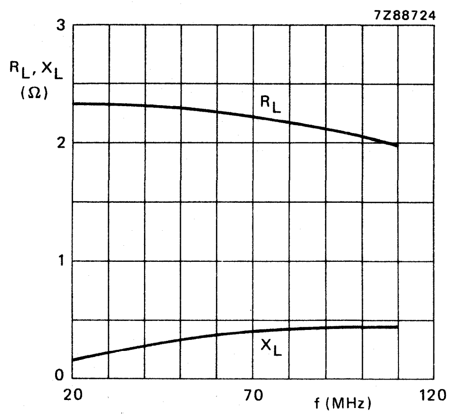


Fig. 13 Load impedance (series components).

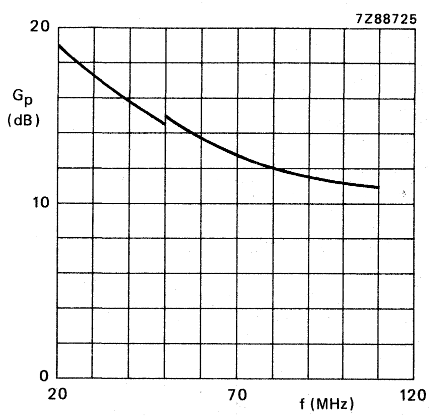


Fig. 14 Power gain as a function of frequency.

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 ^oC; class-B operation.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 175 W; T_h = 25 ^oC; 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

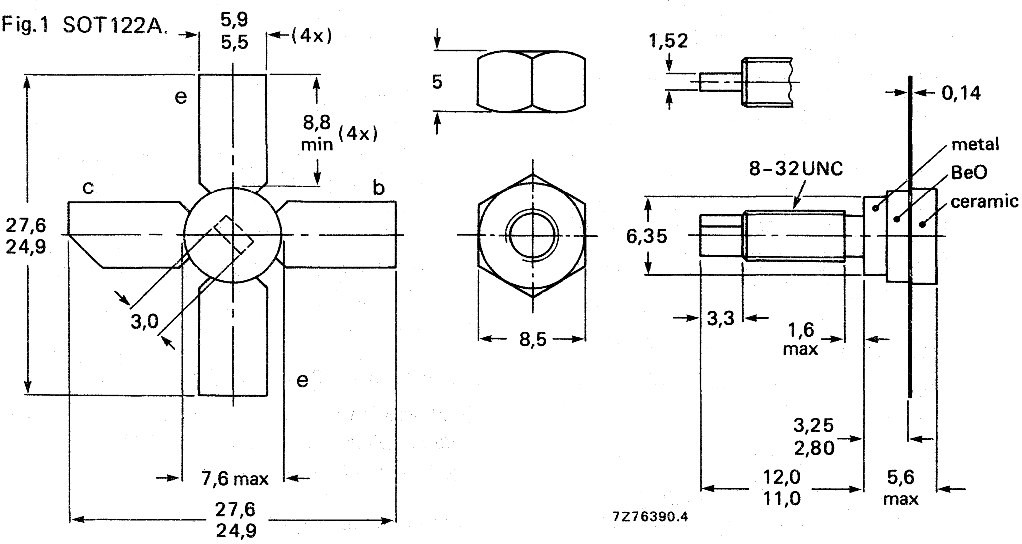
R.F. performance mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A; linear amplifier	224,25	25	0,46	70	−60	> 1,5	> 18
	224,25	25	0,46	25	−60	typ. 1,7	typ. 20

* 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 SOT122A.



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.

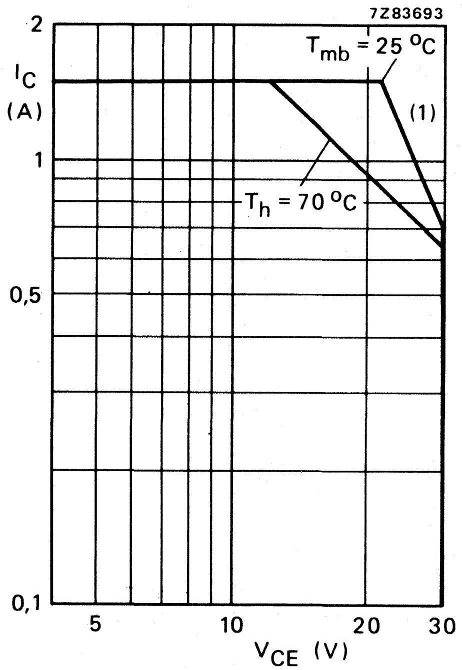
When locking is required an adhesive is preferred instead of a lock washer.

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.

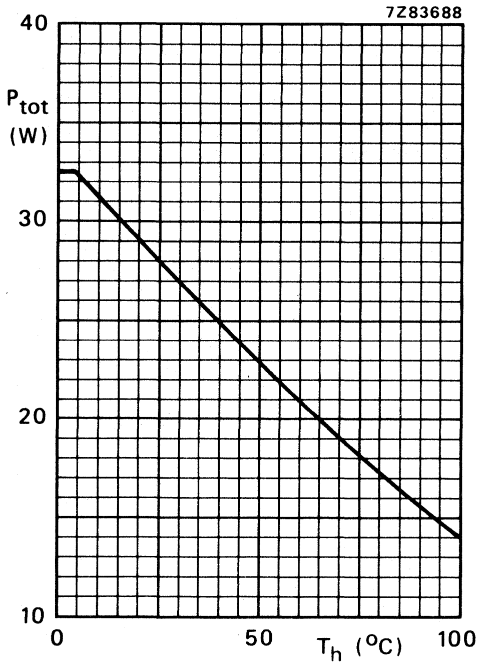


Fig. 3 Power derating curve vs. temperature.

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

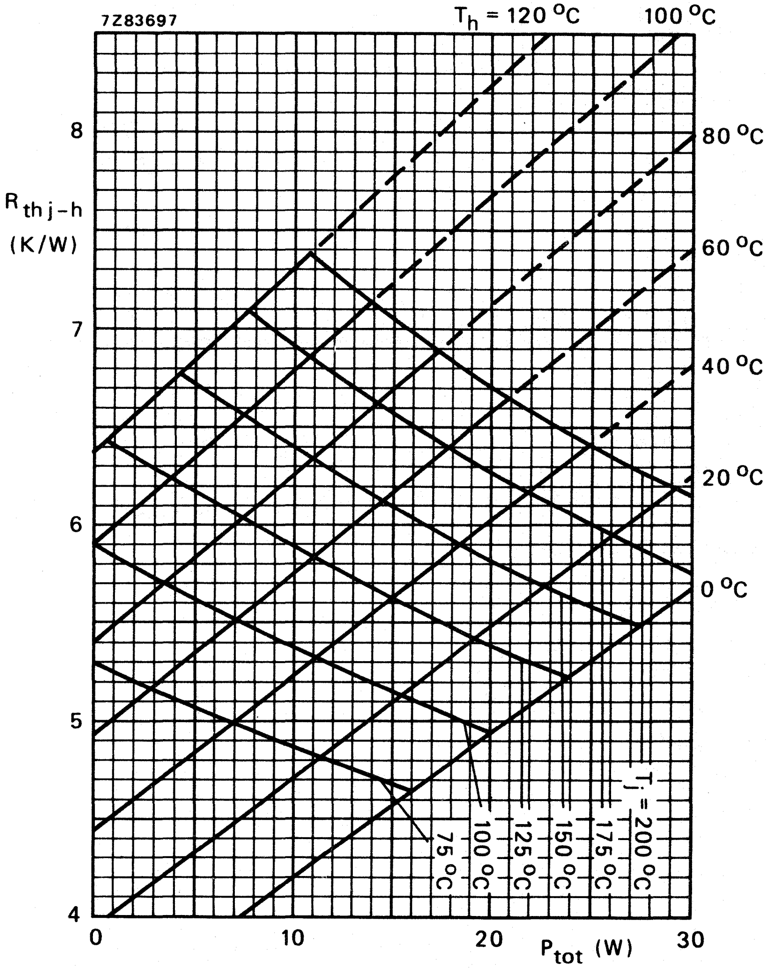


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb-h}$ = 0,6 K/W).

Example

Nominal class-A operation; V_{CE} = 25 V; I_C = 0,46 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j-h}$	max.	6,13 K/W
	T_j	max.	140,5 °C
Typical device:	$R_{th\,j-h}$	typ.	5,45 K/W
	T_j	typ.	133 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

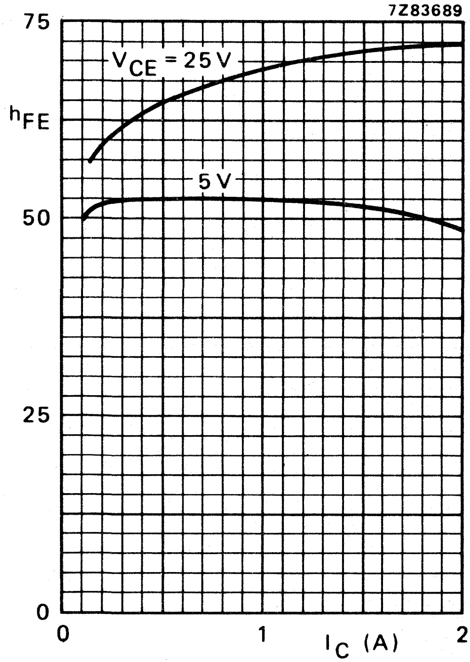


Fig. 5 Typical values; T_j = 25 °C.

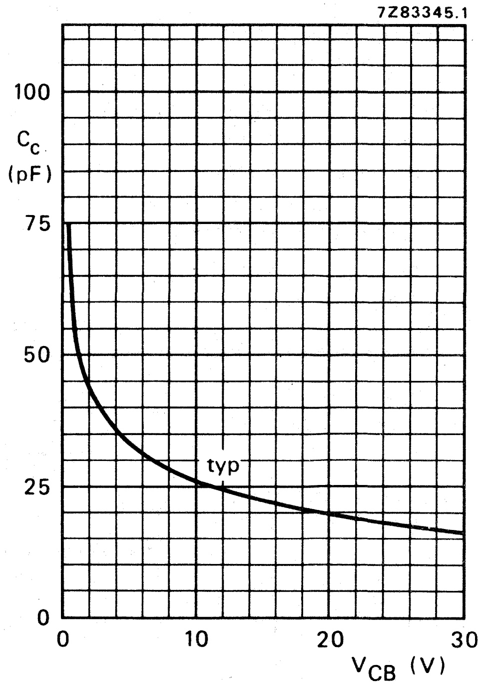


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

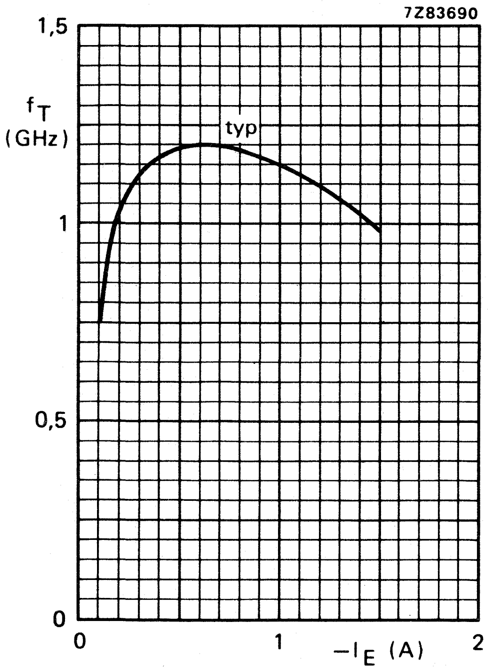


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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.

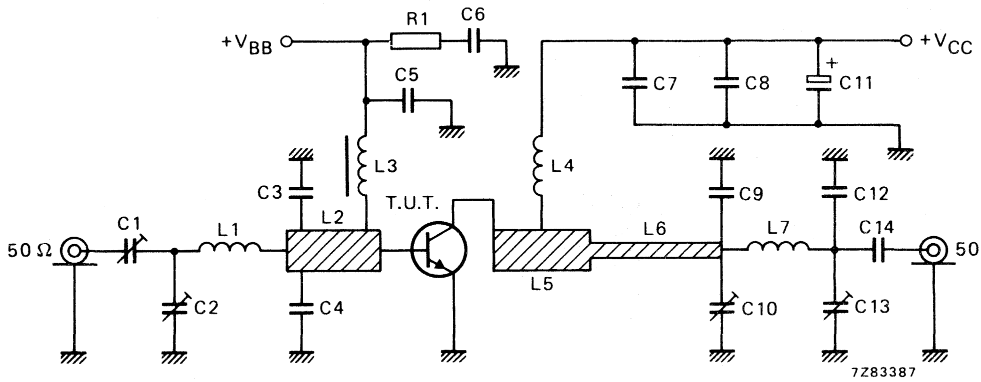


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

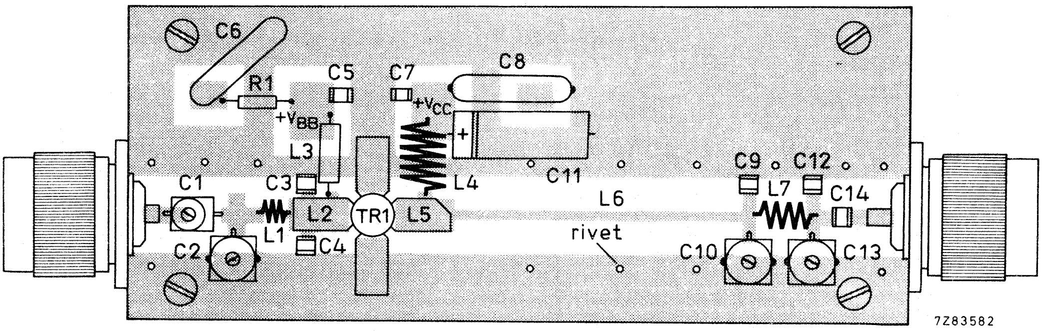
C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 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.



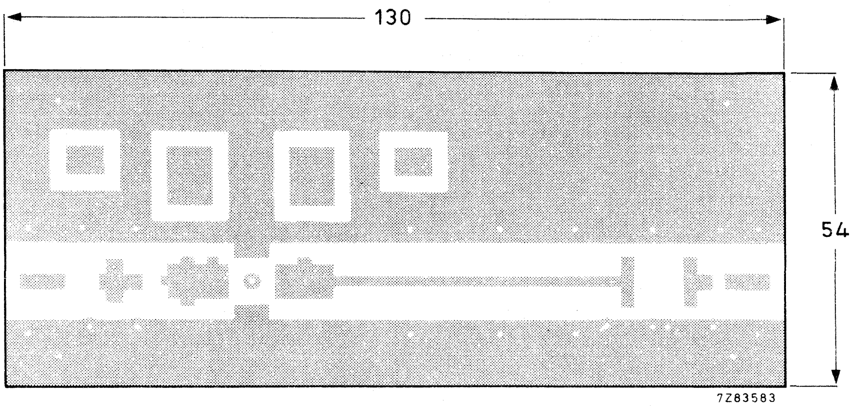


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

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.

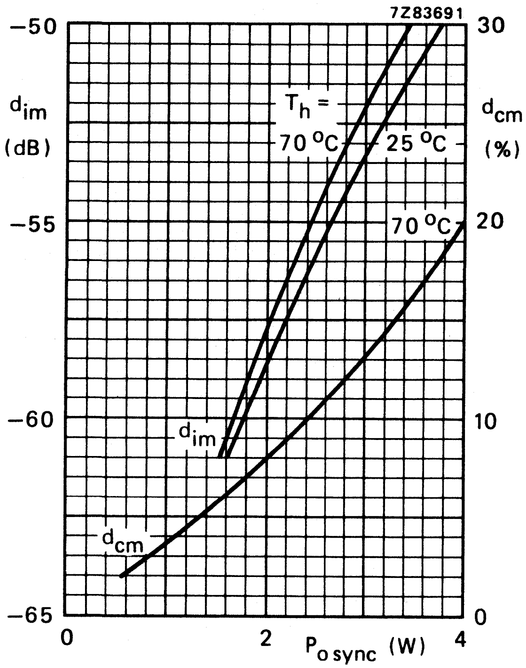


Fig. 10 Intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

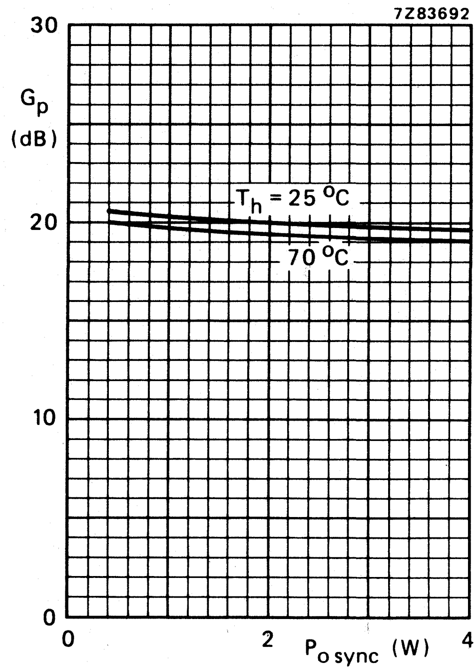


Fig. 11 Power gain as a function of output power.

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.

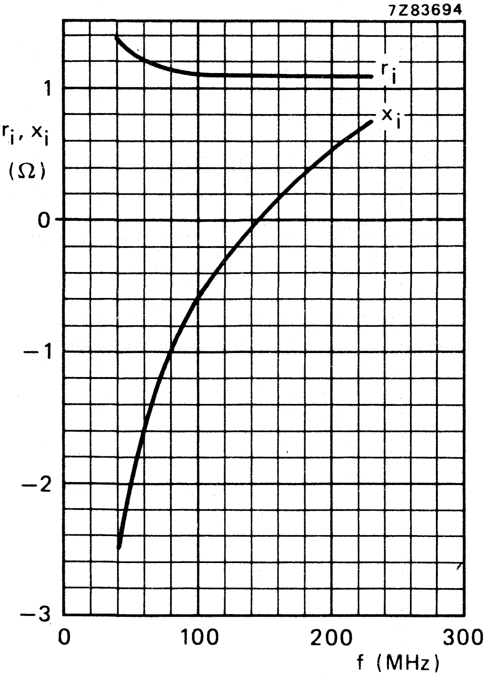


Fig. 12 Input impedance (series components).

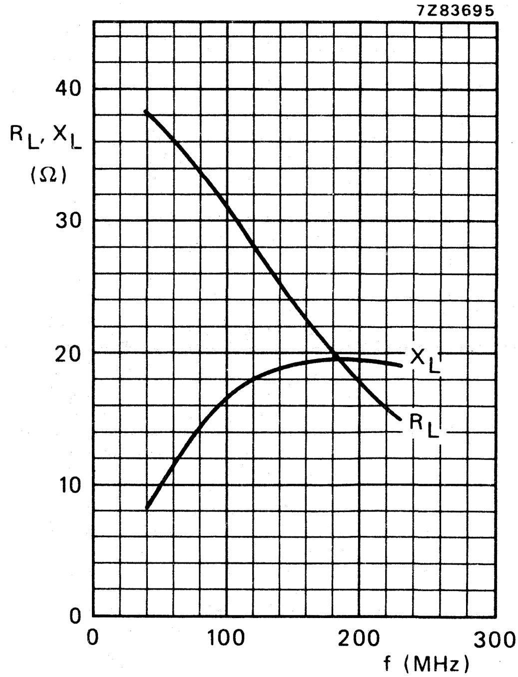


Fig. 13 Load impedance (series components).

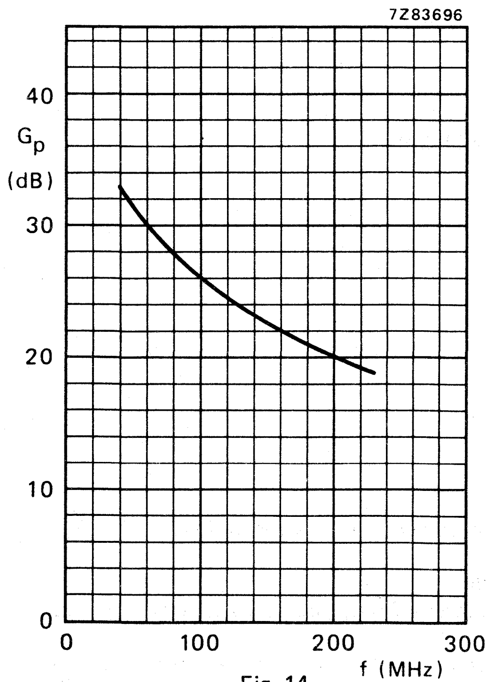


Fig. 14.

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

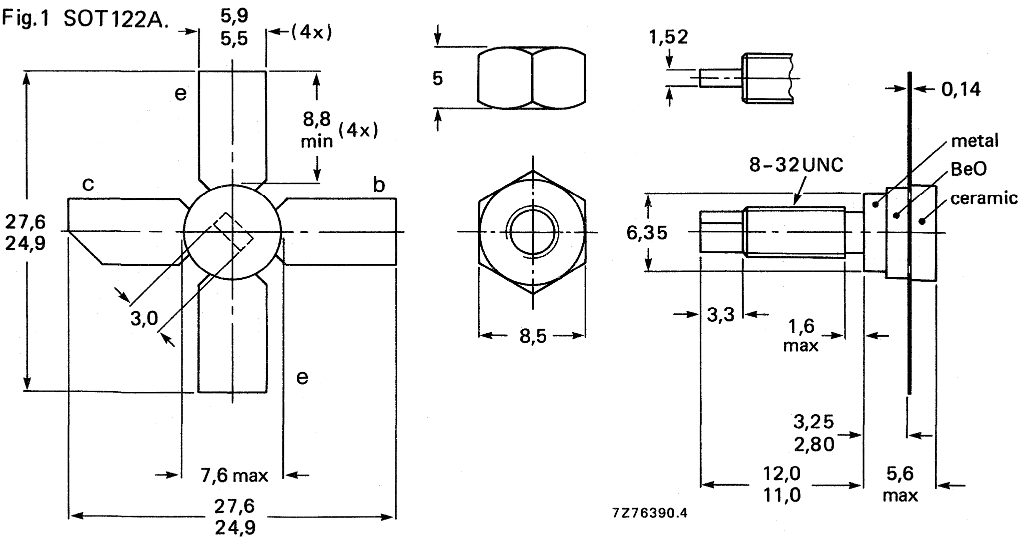
mode of operation	f_{vision} MHz	V_{CE} V	I_C A	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A; linear amplifier	224,25	25	0,8	70	−58	> 5	> 15
	224,25	25	0,8	25	−58	typ. 7	typ. 16,5

* 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 SOT122A.



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.

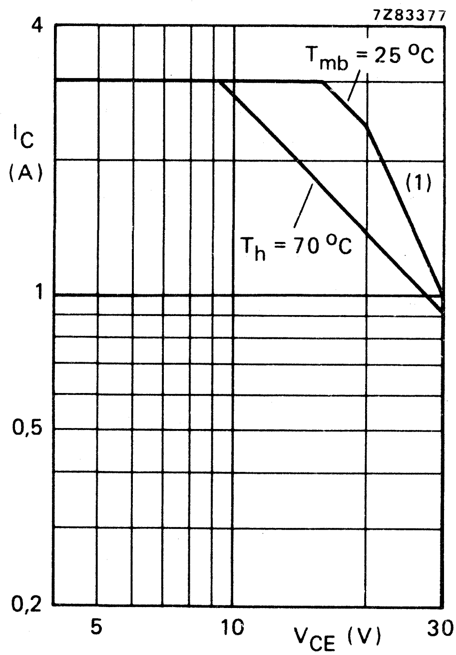
When locking is required an adhesive is preferred instead of a lock washer.

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.

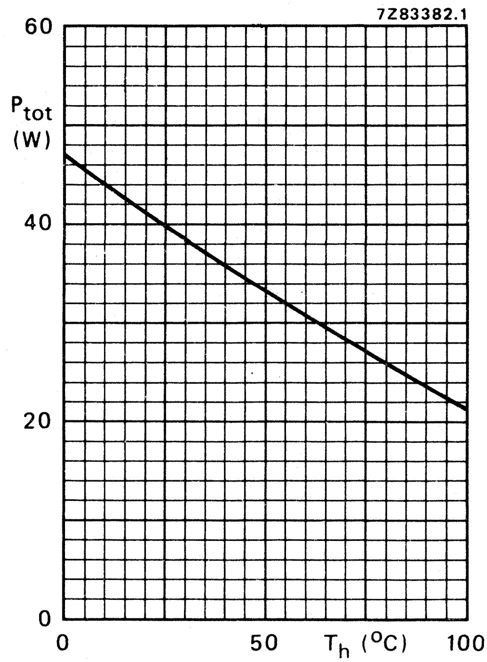


Fig. 3 Power derating curve vs. temperature.

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

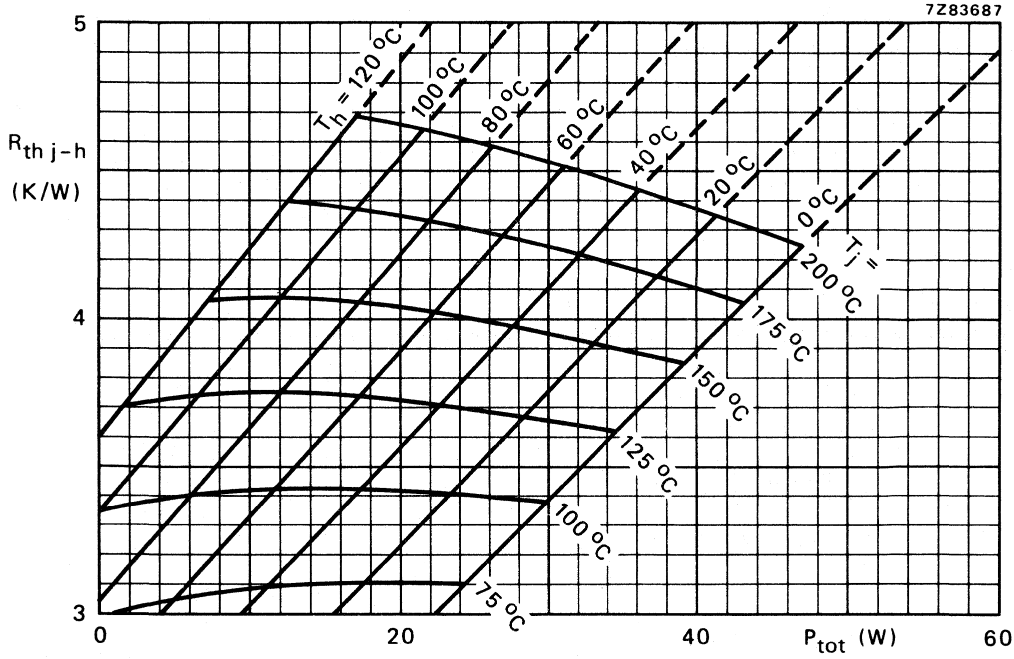


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 0,8 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j\text{-}h}$	max.	4,05 K/W
	T_j	max.	151 °C
Typical device:	$R_{th\ j\text{-}h}$	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: $t_p \leqslant 300$ μs; $\delta \leqslant 0{,}02$.
** Measured under pulse conditions: $t_p \leqslant 50$ μs; $\delta \leqslant 0{,}01$.

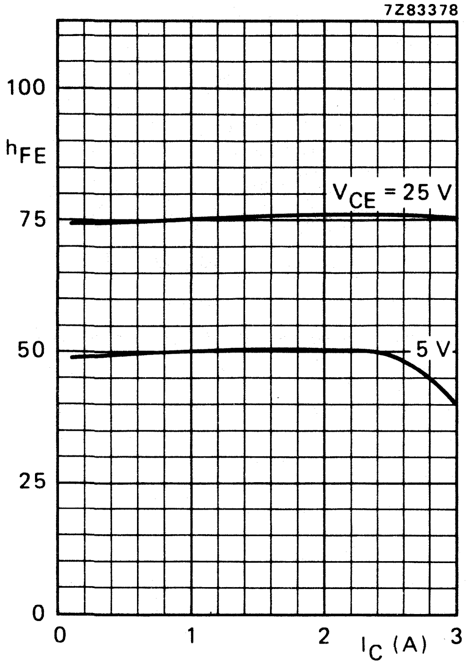


Fig. 5 Typical values; T_j = 25 °C.

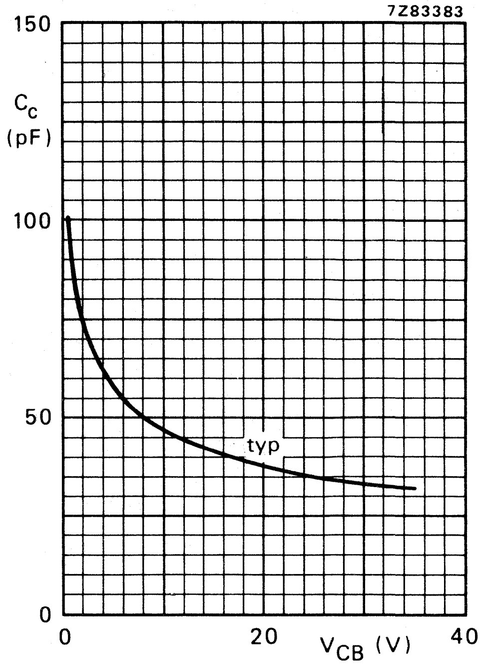


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

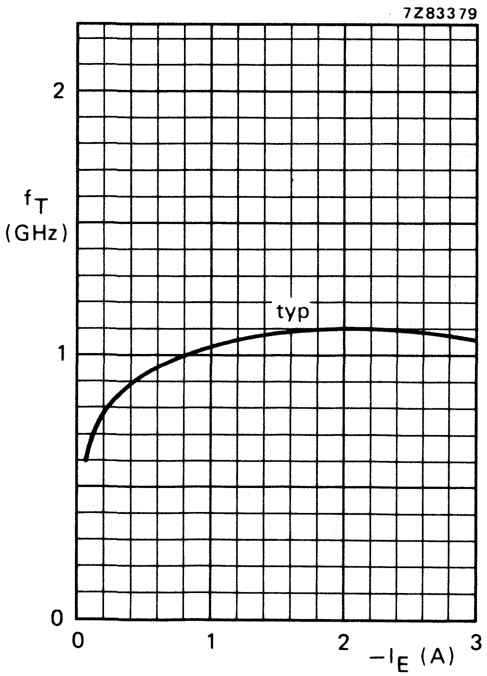


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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	0,8	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.

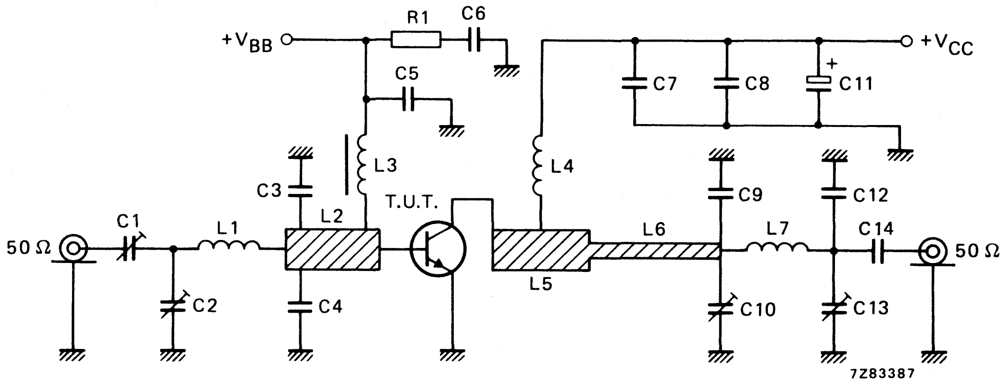


Fig. 8 Test circuit at f_{vision} = 224,25 MHz.

List of components:

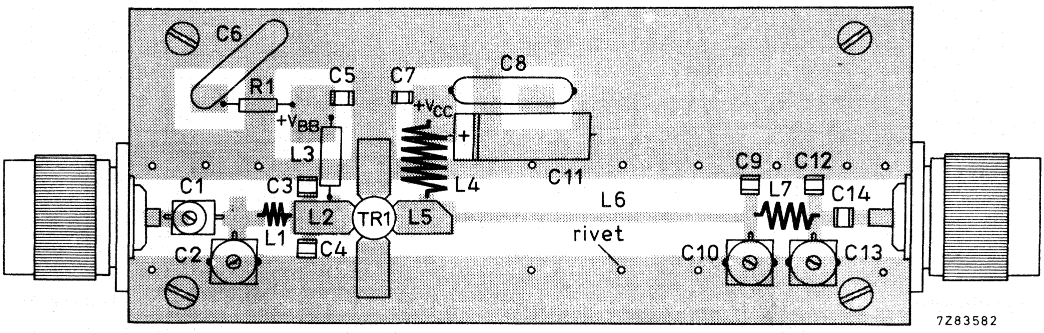
C1 = 1,8 to 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C4 = 82 pF multilayer ceramic chip capacitor (ATC▲), placed 7 mm from transistor edge
C5 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 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.



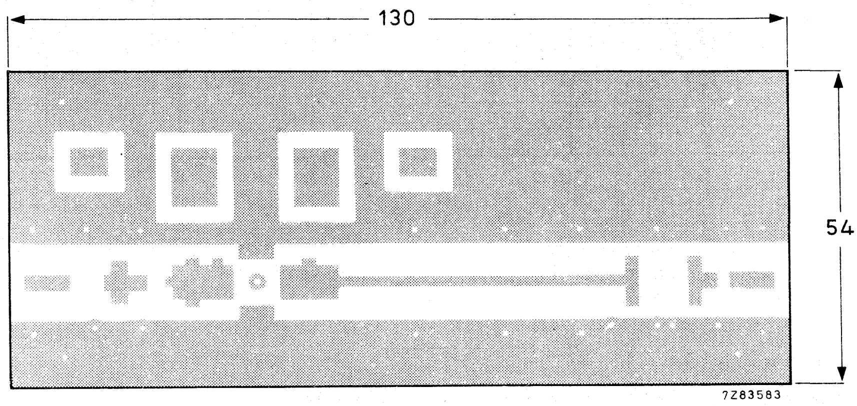


Fig. 9 Component layout and printed-circuit board for 224,25 MHz test circuit.

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.

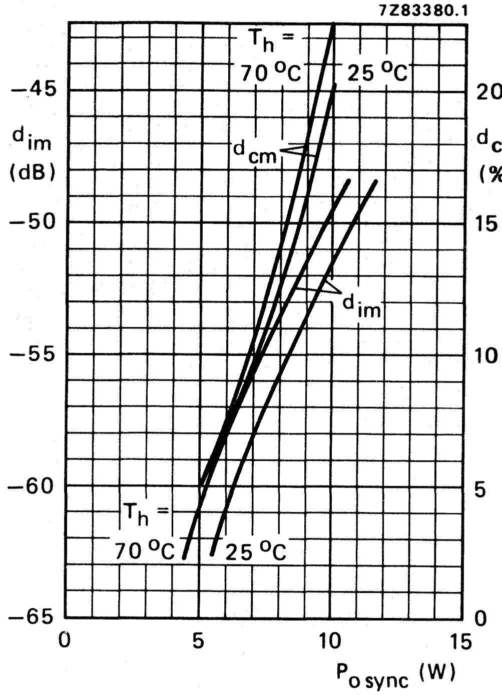


Fig. 10 Intermodulation distortion (d_{im}*) and cross-modulation distortion (d_{cm}**) as a function of output power.

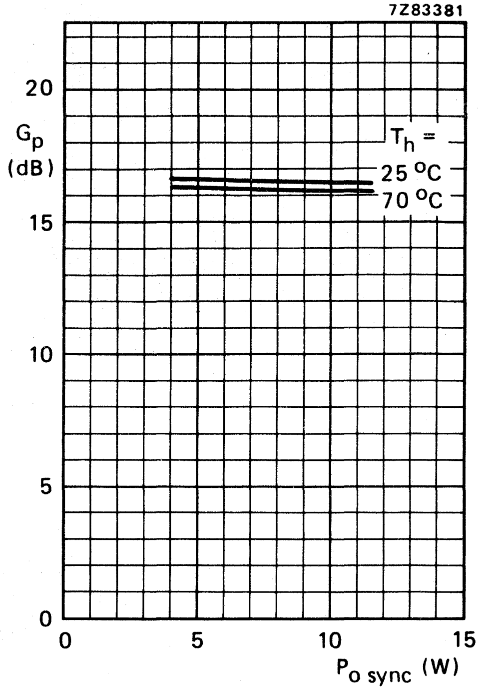


Fig. 11 Power gain as a function of output power.

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.

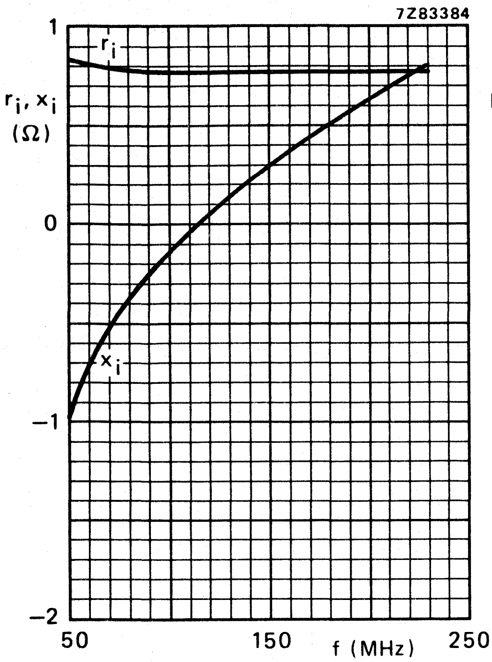


Fig. 12 Input impedance (series components).

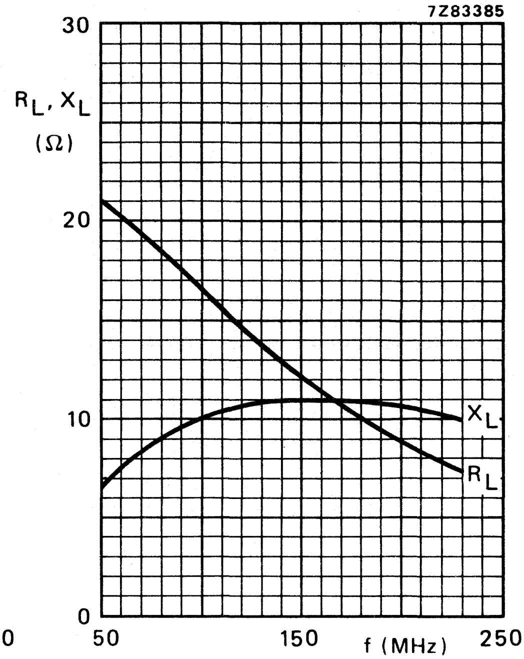


Fig. 13 Load impedance (series components).

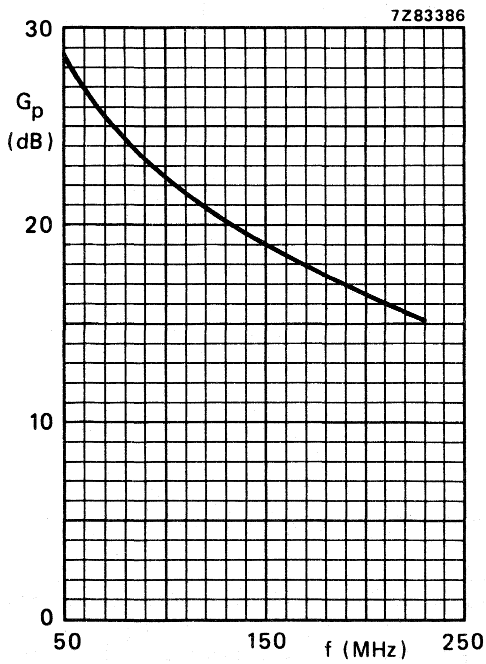


Fig. 14.

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

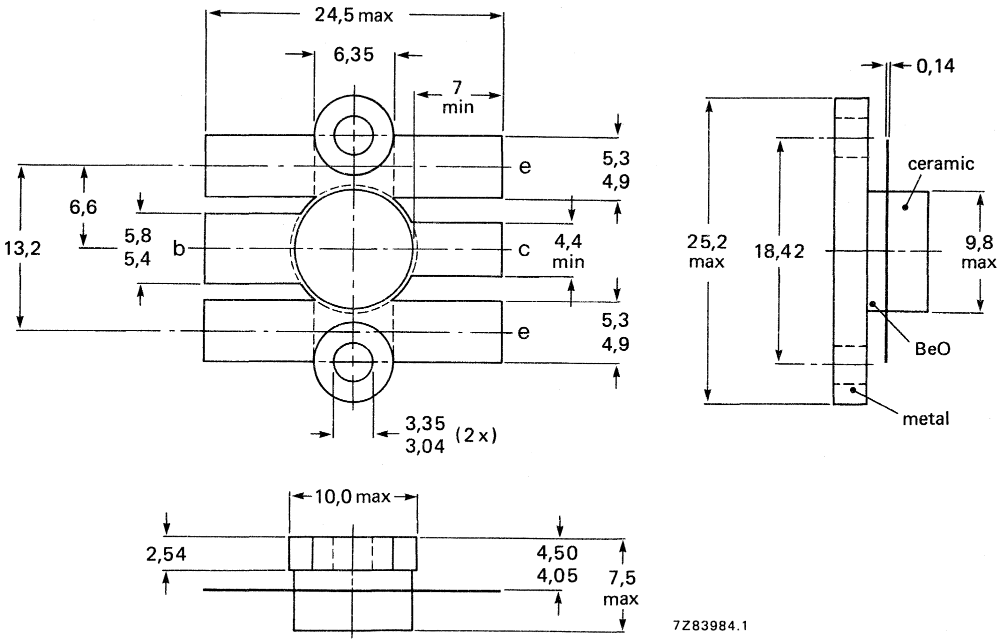
SOT-160 (see Fig. 1).

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)

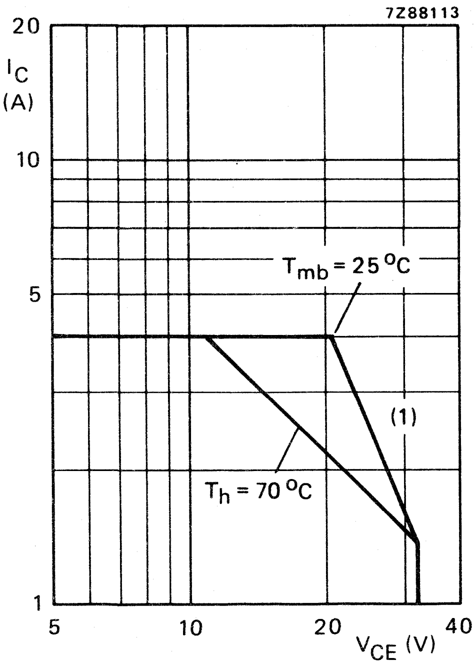
Recommended screw: cheese-head 4-40 UNC/2A

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 °C	P_{tot}	max.	82	W
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



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

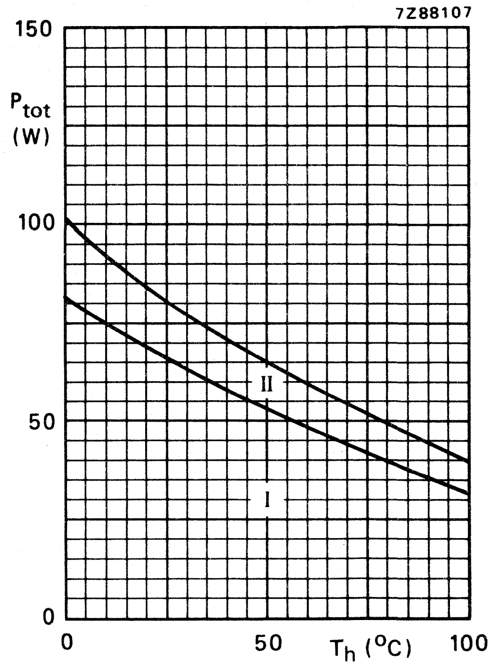


Fig. 3 Power derating curves vs. temperature.

I Continuous d.c. (including r.f. class-A) operation

II Continuous r.f. operation

THERMAL RESISTANCE (dissipation = 37,5 W; T_{mb} = 82 °C, i.e. T_h = 70 °C)

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

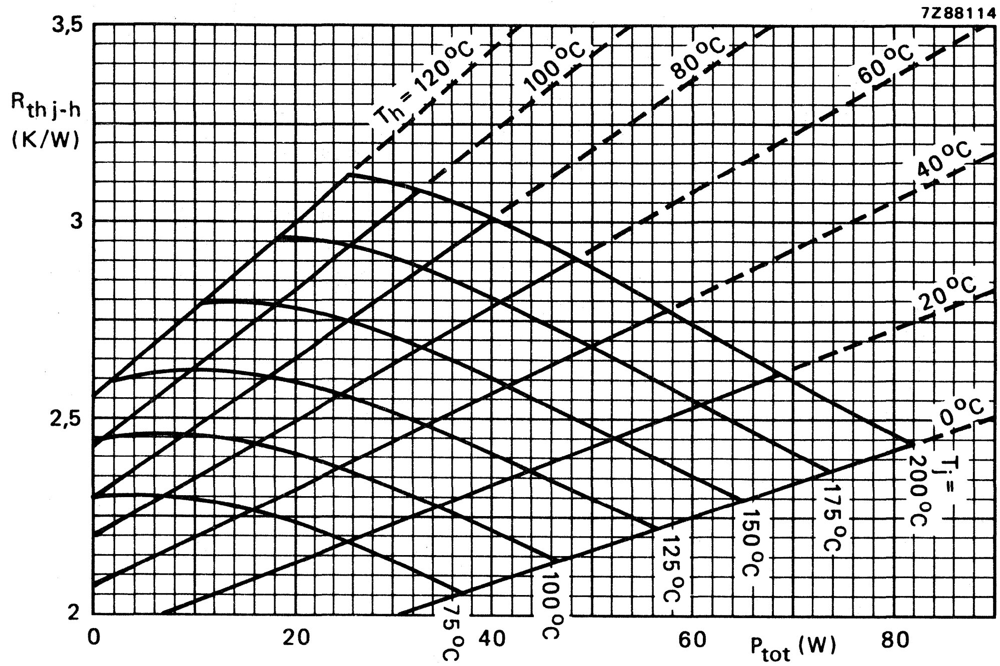


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,3 K/W.)

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

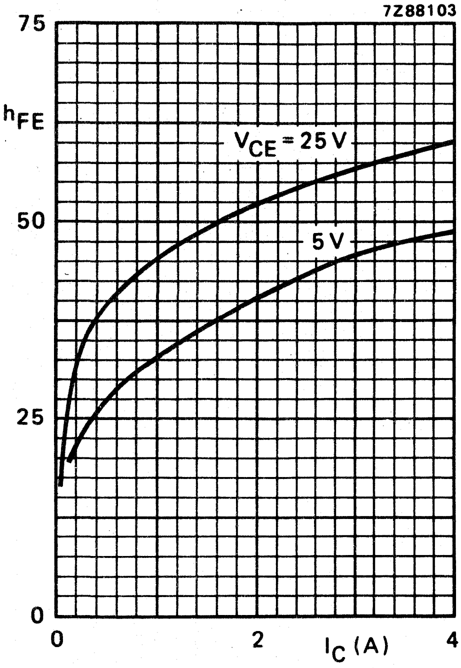


Fig. 5 Typical values; T_j = 25 °C.

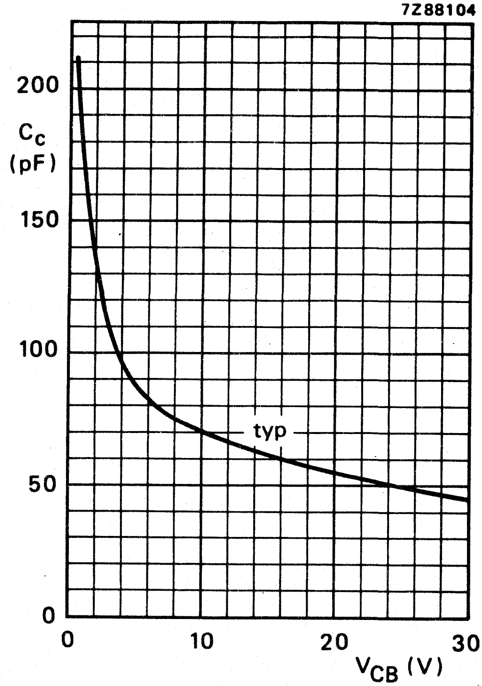


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

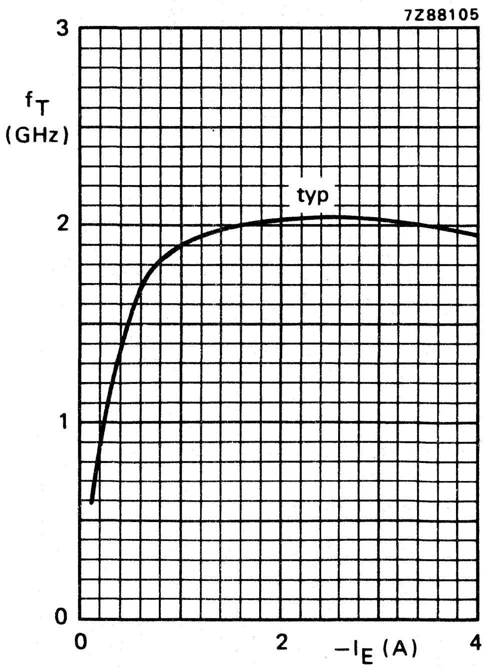


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

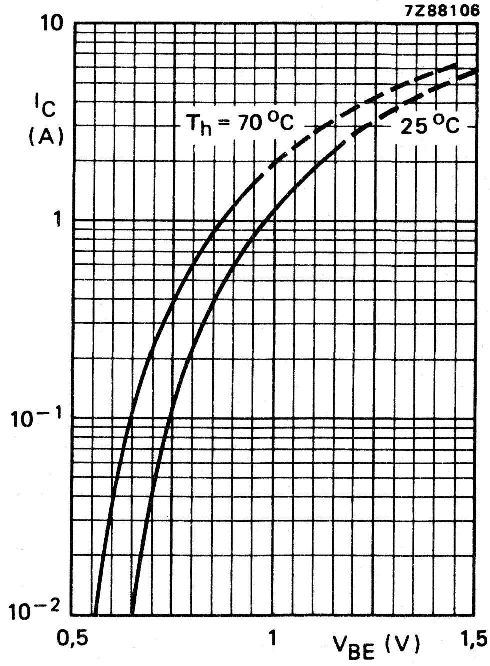


Fig. 8 Typical values; V_{CE} = 25 V.

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.

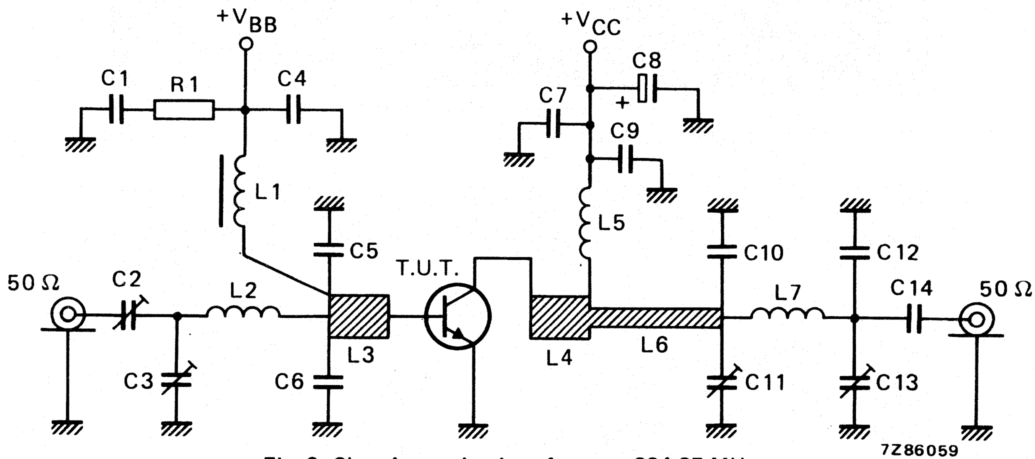


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

List of components:

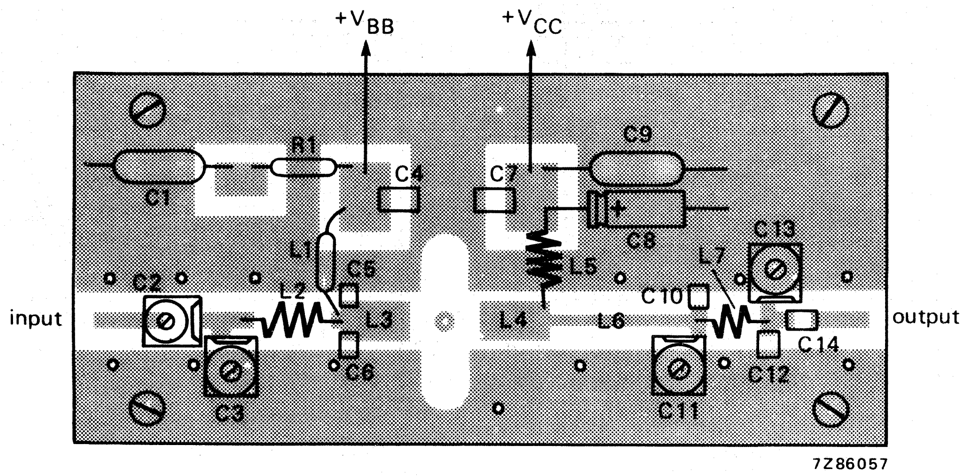
C1 = C9 = 330 nF polyester capacitor
C2 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 05003)
C3 = C11 = C13 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = C7 = C14 = 680 pF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 13681)
C5 = C6 = 68 pF (500 V) multilayer 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.



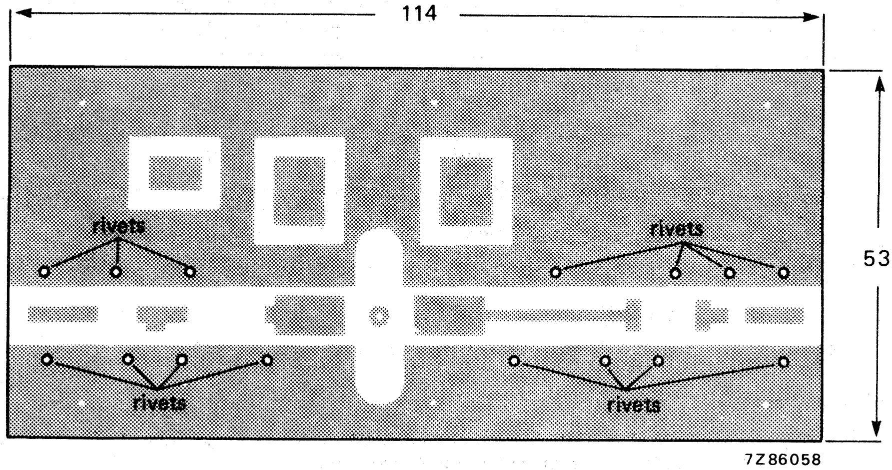


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

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.

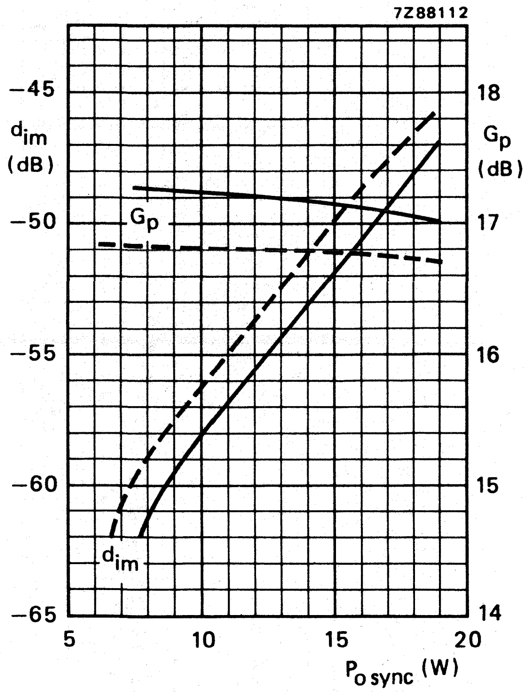


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

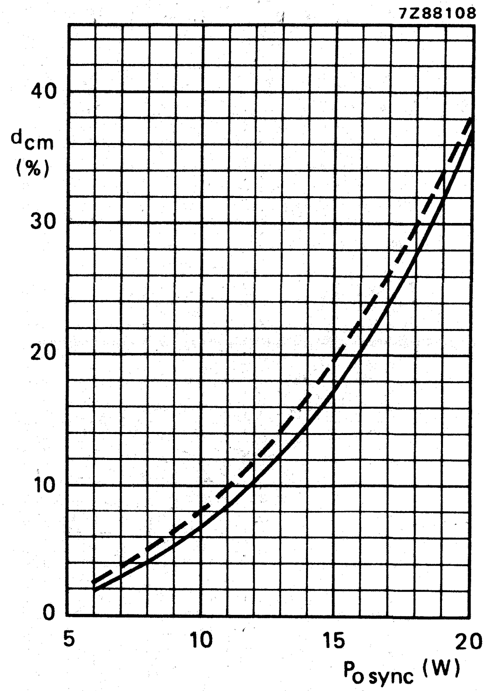


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

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.

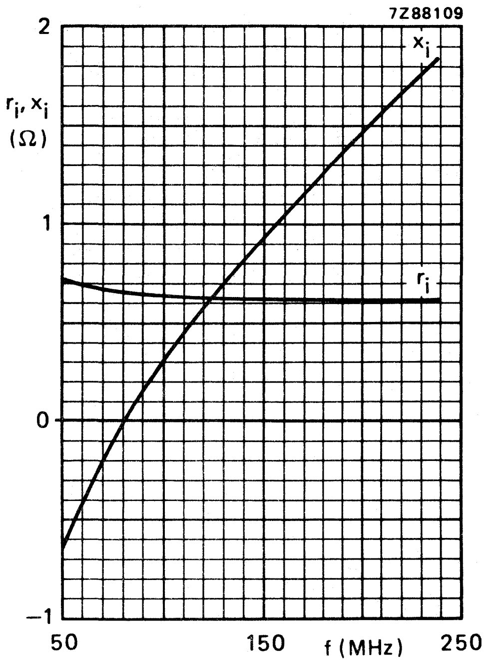


Fig. 13 Input impedance (series components).

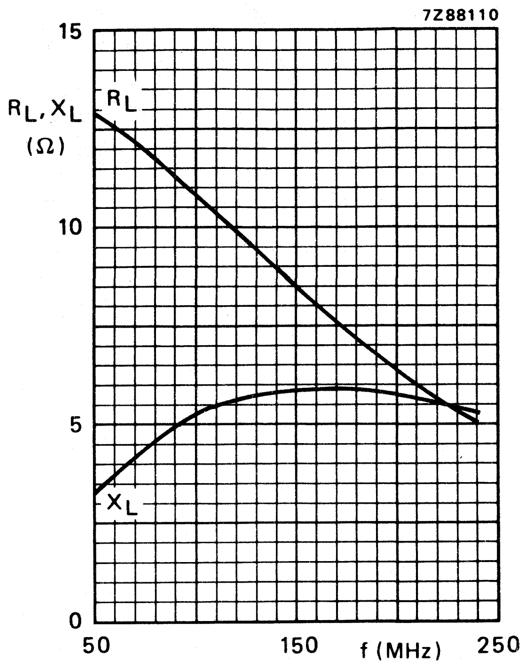


Fig. 14 Load impedance (series components).

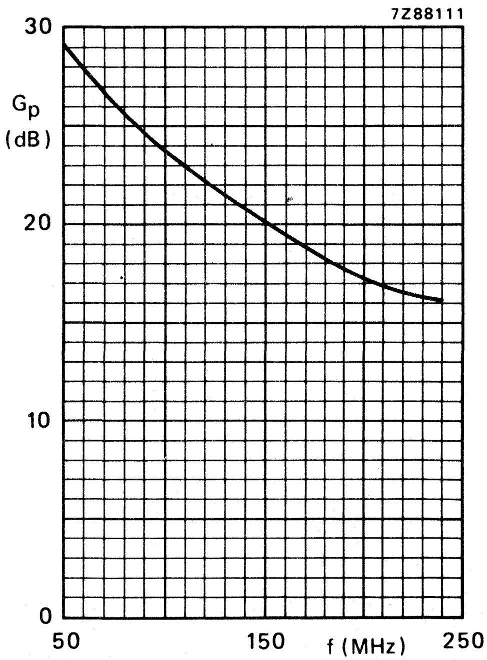


Fig. 15.

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 25	−55 −55	> 19 typ. 26	> 9 typ. 9,7	
class-AB	224,25	28	0,10	70		typ. 90	typ. 6,5	30/25

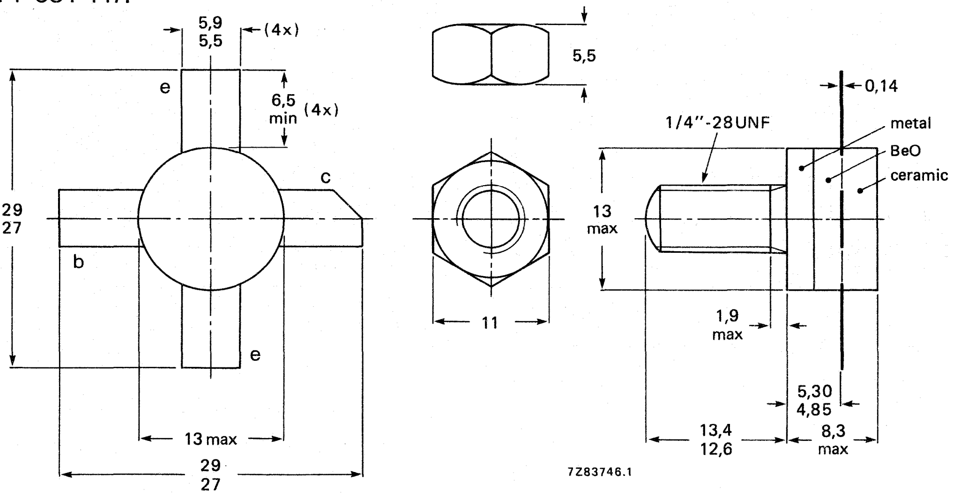
* Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak sync level.

** 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.

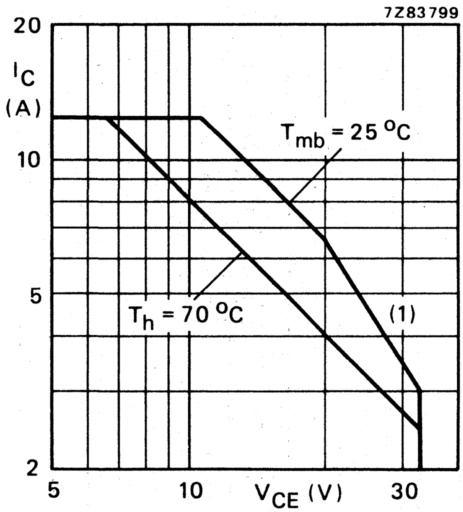
When locking is required an adhesive is preferred instead of a lock washer.

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.

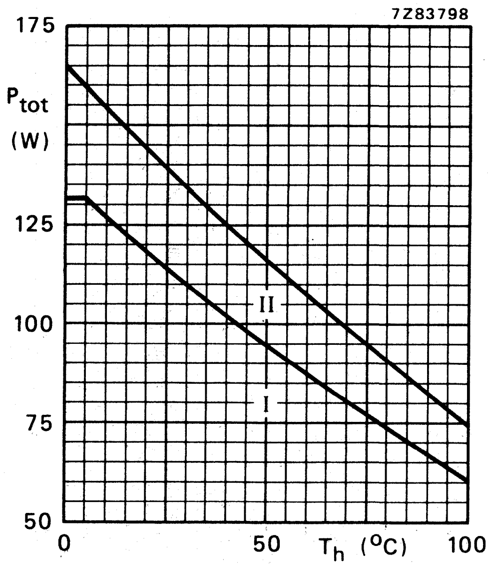


Fig. 3 Power derating curve vs. temperature.

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

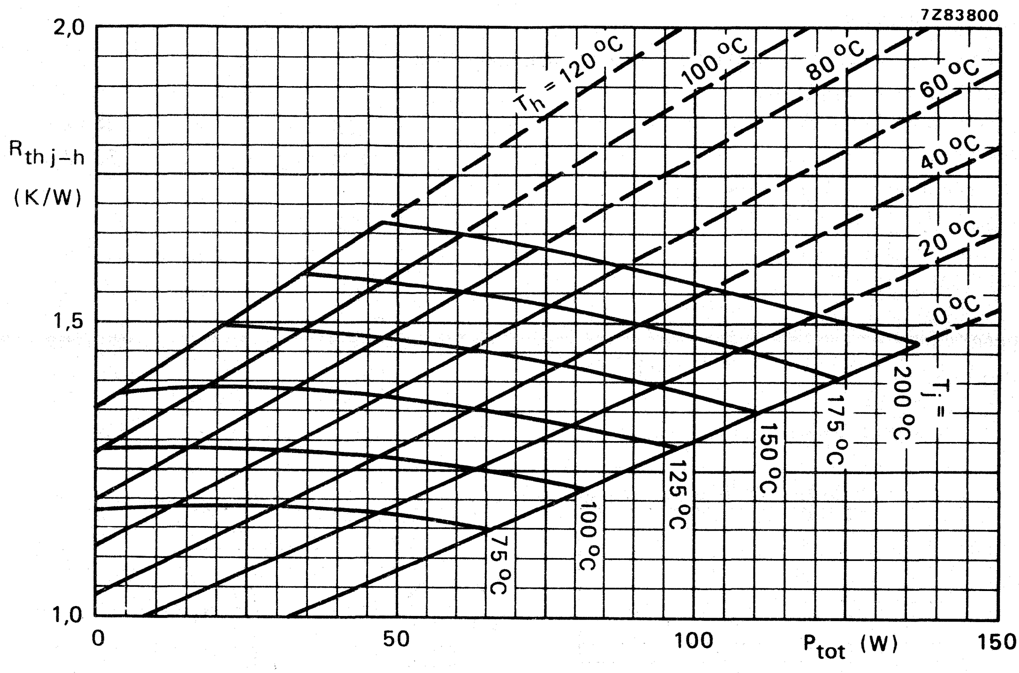


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb-h}$ = 0,15 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 3,2 A; T_h = 70 °C.

Fig. 4 shows:	$R_{th\,j-h}$	max.	1,60 K/W
	T_j	max.	198 °C
Typical device:	$R_{th\,j-h}$	typ.	1,50 K/W
	T_j	typ.	190 °C

CHARACTERISTICS

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

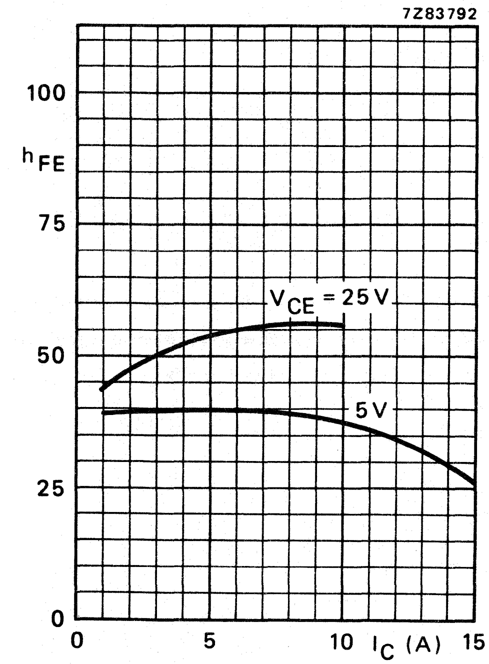


Fig. 5 Typical values; T_j = 25 °C.

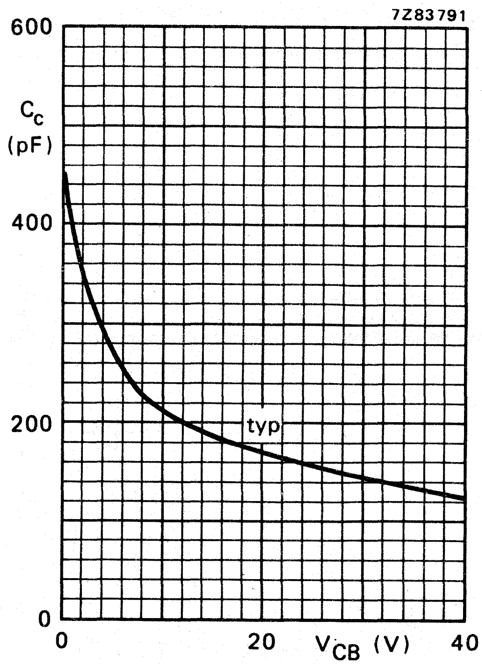


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

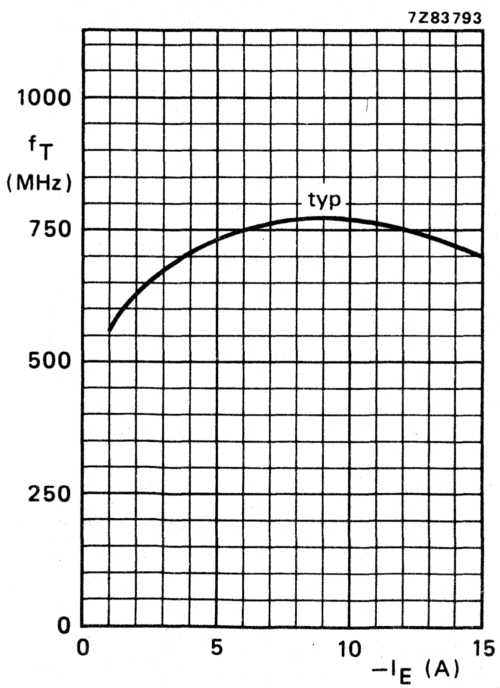


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

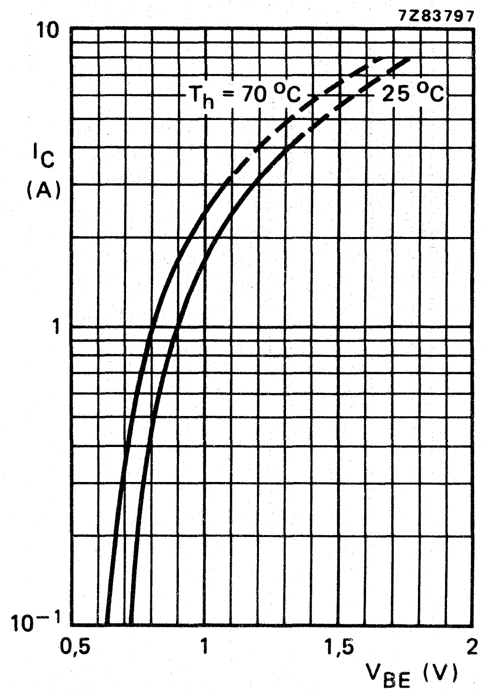


Fig. 8 Typical values; V_{CE} = 25 V.

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.

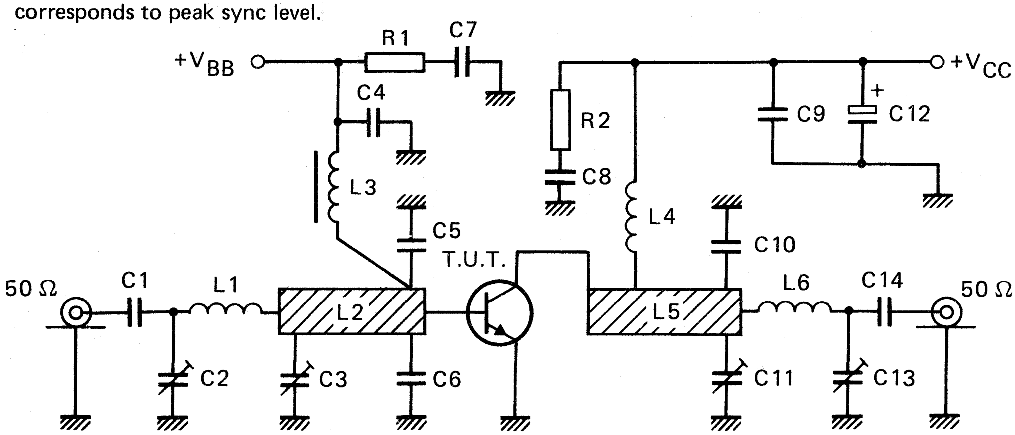


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

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.

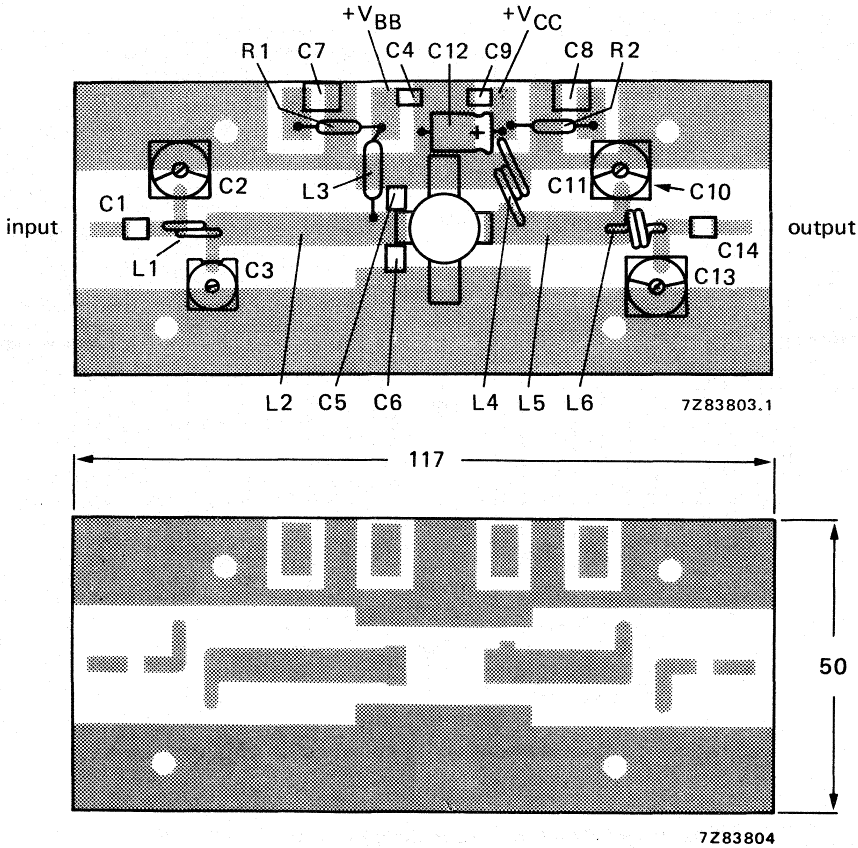


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

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.

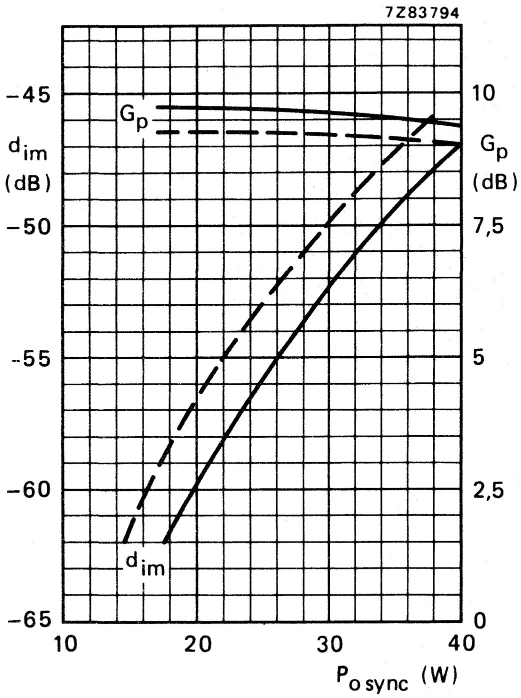


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

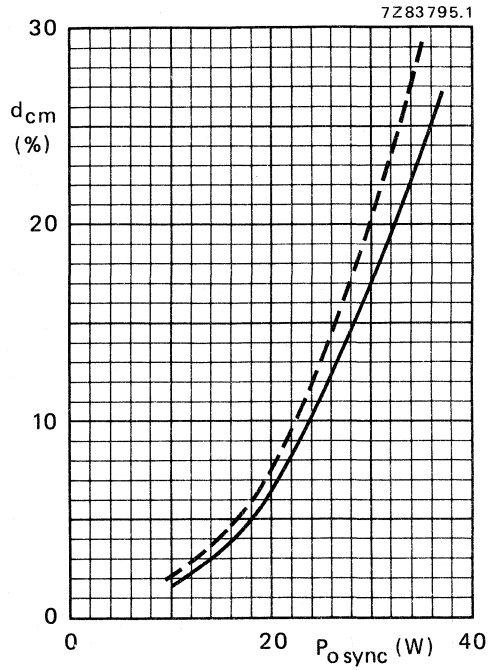


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

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.

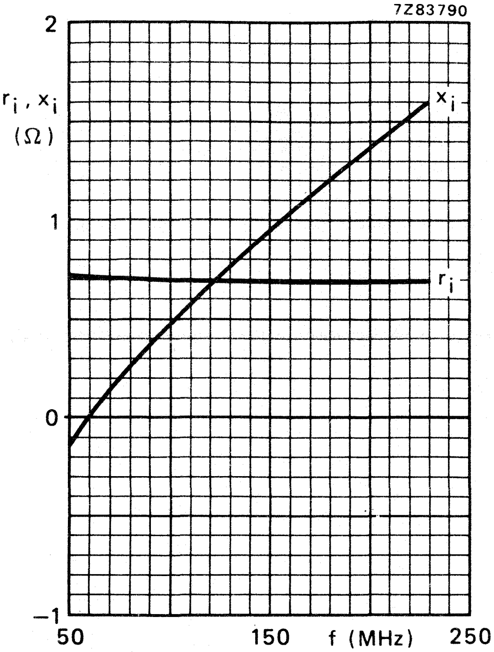


Fig. 13 Input impedance (series components).

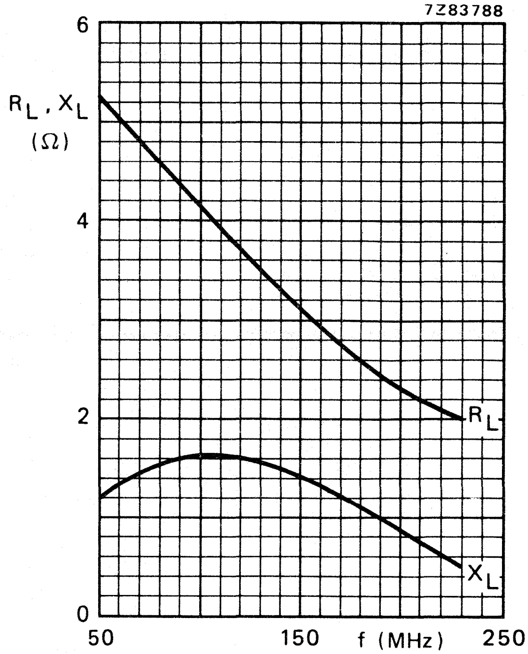


Fig. 14 Load impedance (series components).

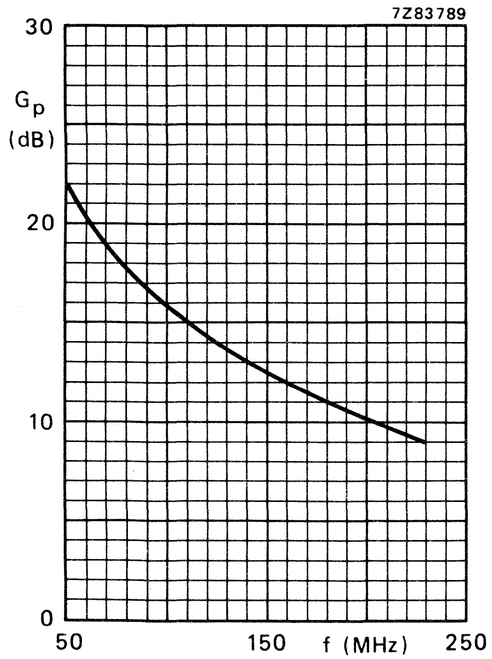


Fig. 15.

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).

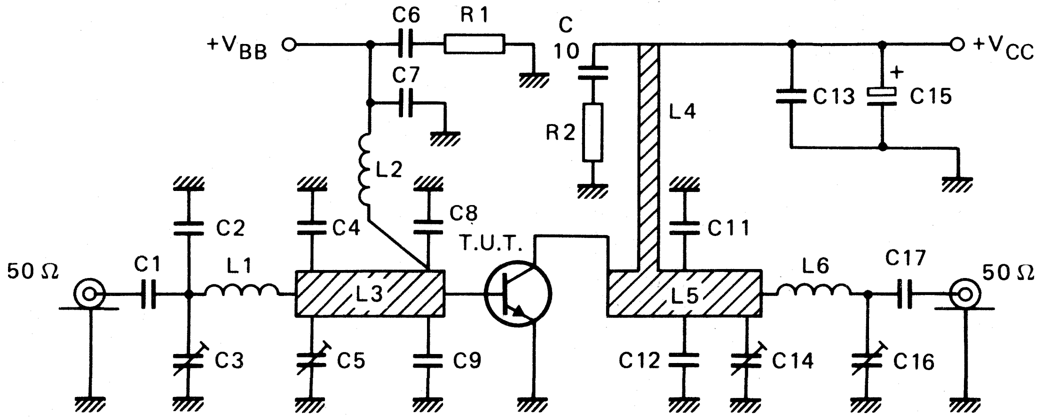


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz.

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.

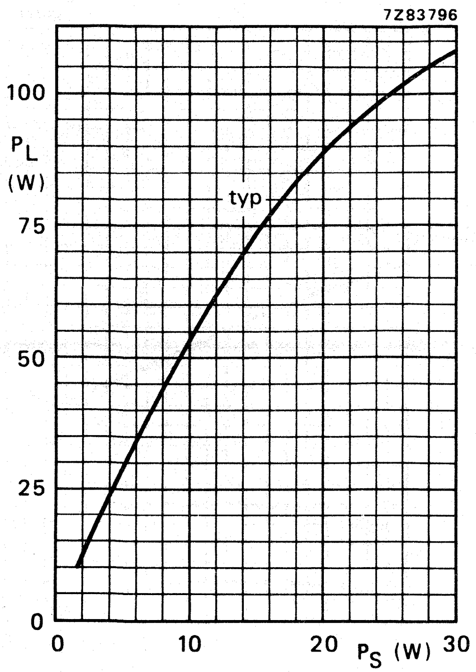


Fig. 17 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 °C; f_{vision} = 224,25 MHz.

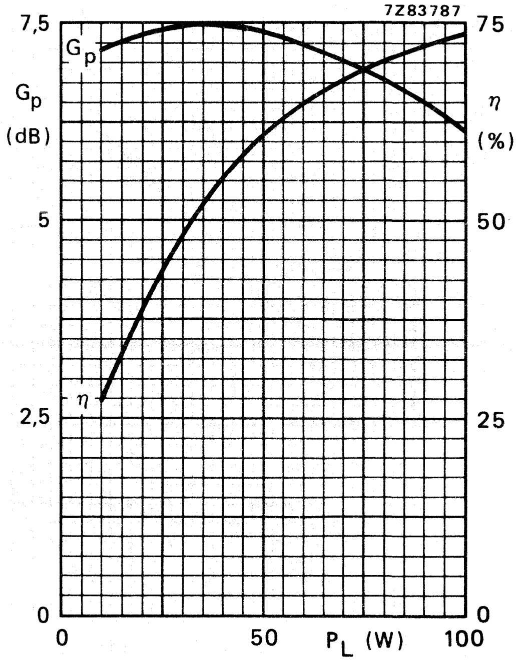


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,1 A; T_h = 70 °C; f_{vision} = 224,25 MHz; typical values.

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; $R_{th\ mb-h}$ = 0,15 K/W.

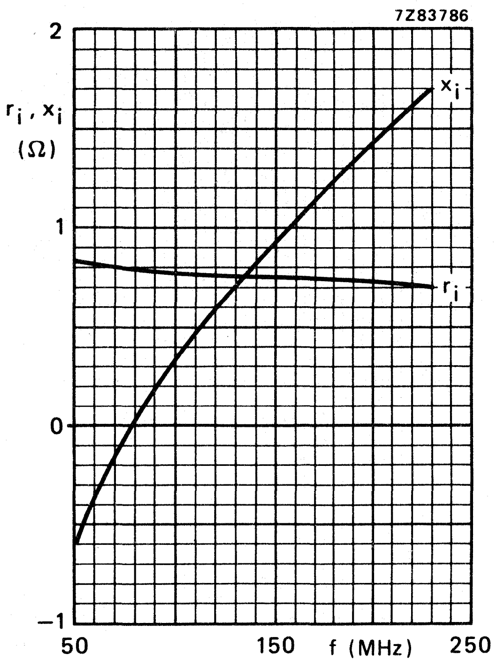


Fig. 19 Input impedance (series components).

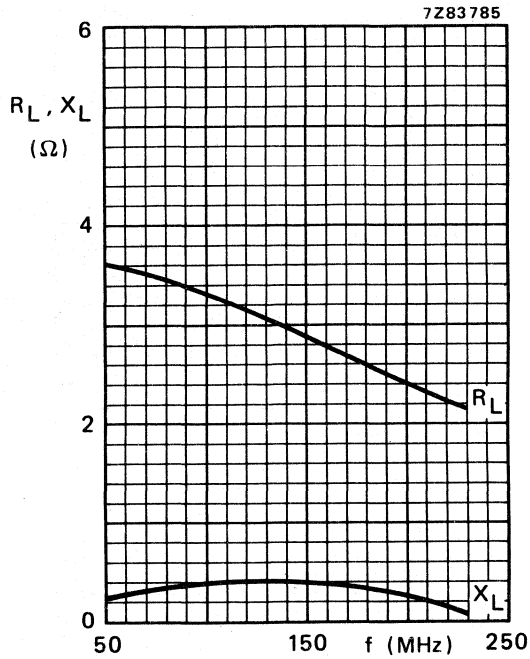


Fig. 20 Load impedance (series components).

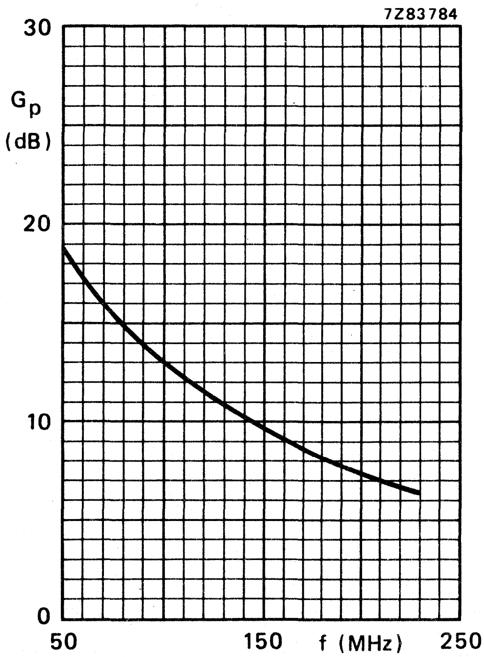


Fig. 21.

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 °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.

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

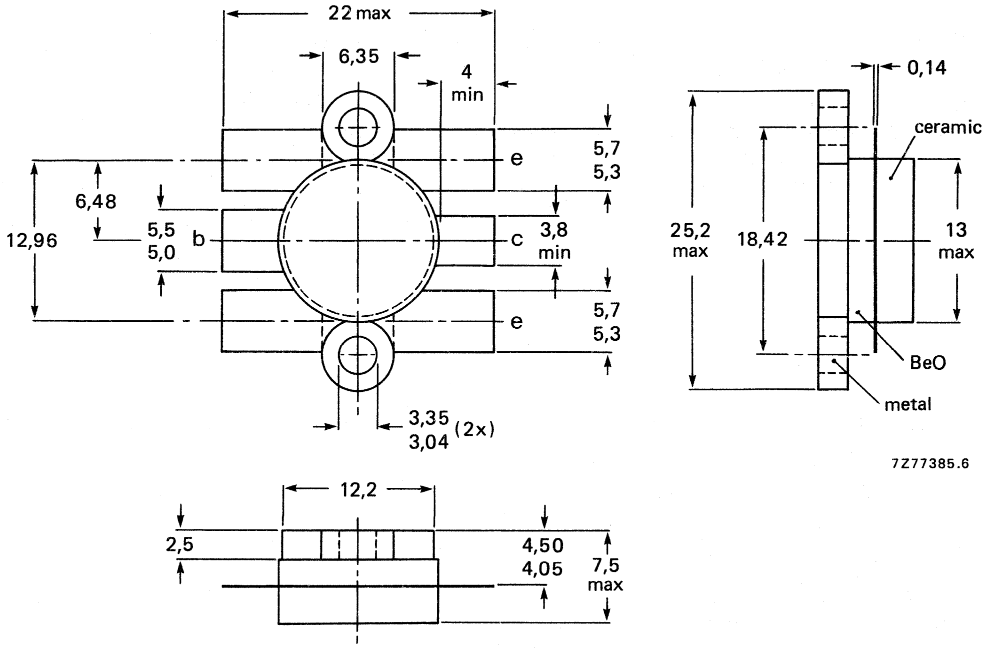
SOT-119 (see Fig. 1).

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)

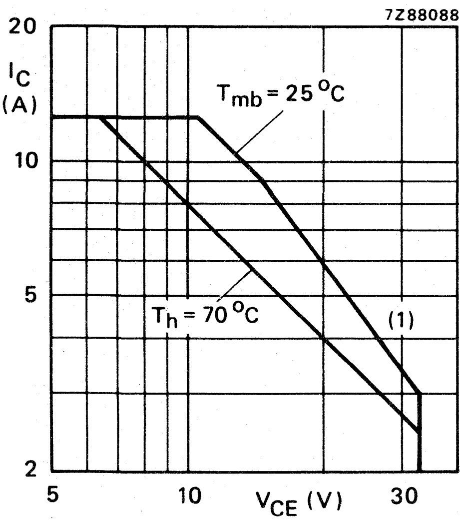
Recommended screw: cheese-head 4-40 UNC/2A

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.

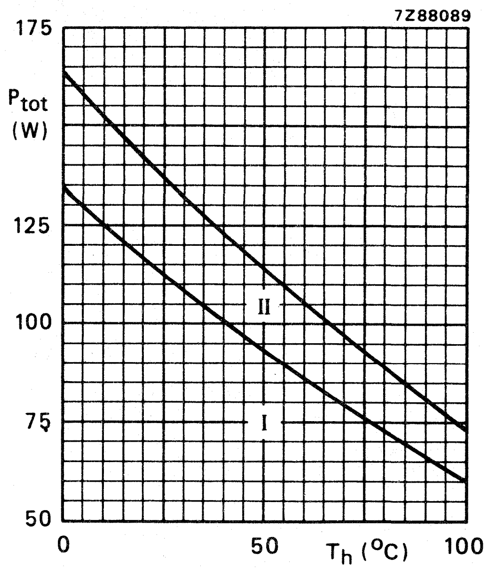


Fig. 3 Power derating curve vs. temperature.

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

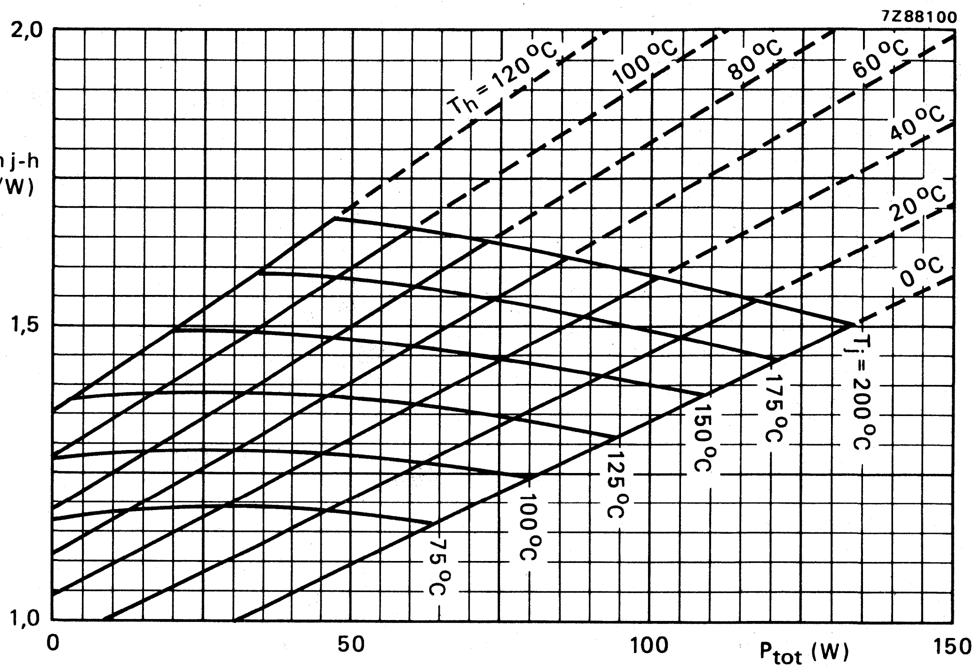


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,2 K/W.)

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

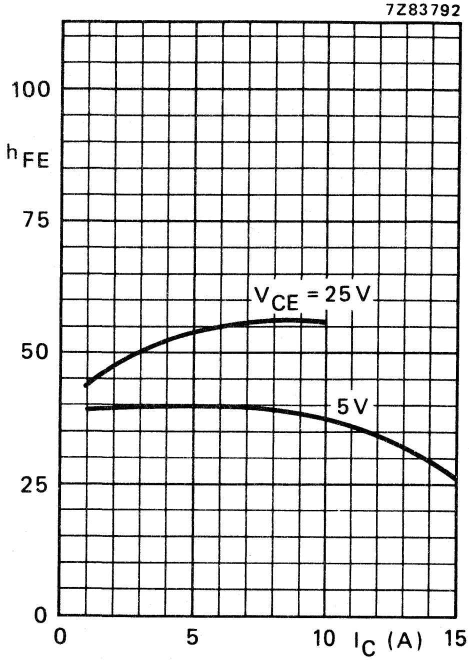


Fig. 5 Typical values; T_j = 25 °C.

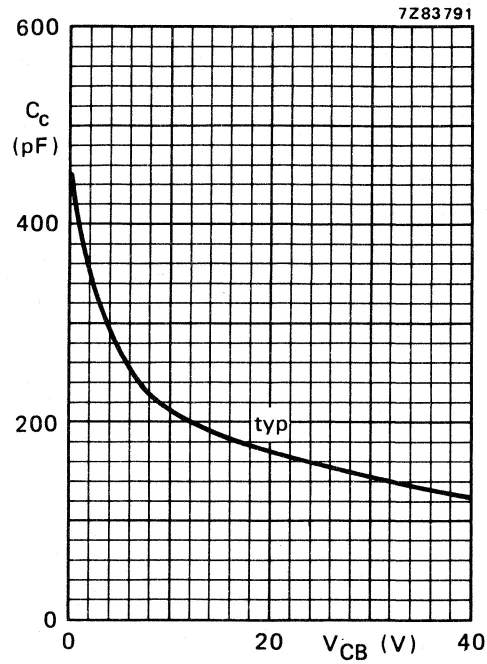


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

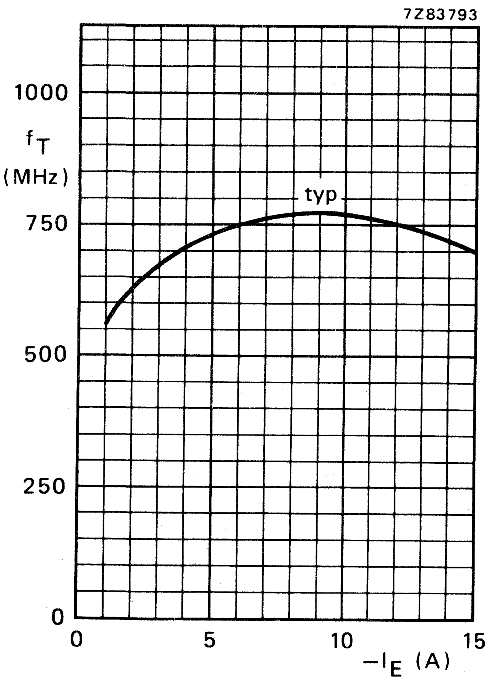


Fig. 7 V_{CB} = 25 V; f = 100 MHz; T_j = 25 °C.

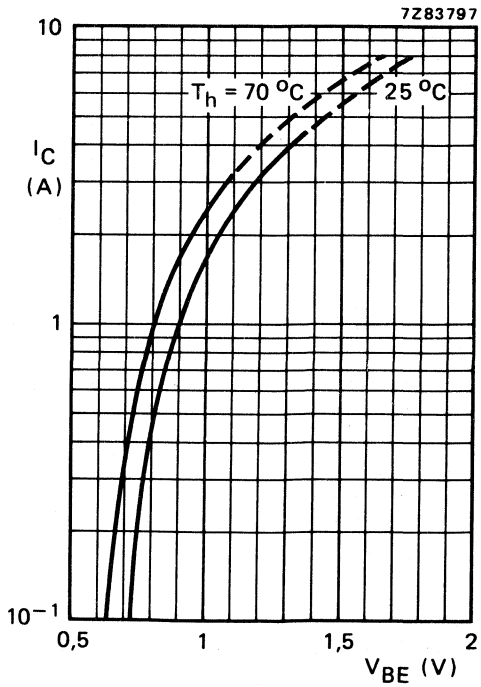


Fig. 8 Typical values; V_{CE} = 25 V.

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.

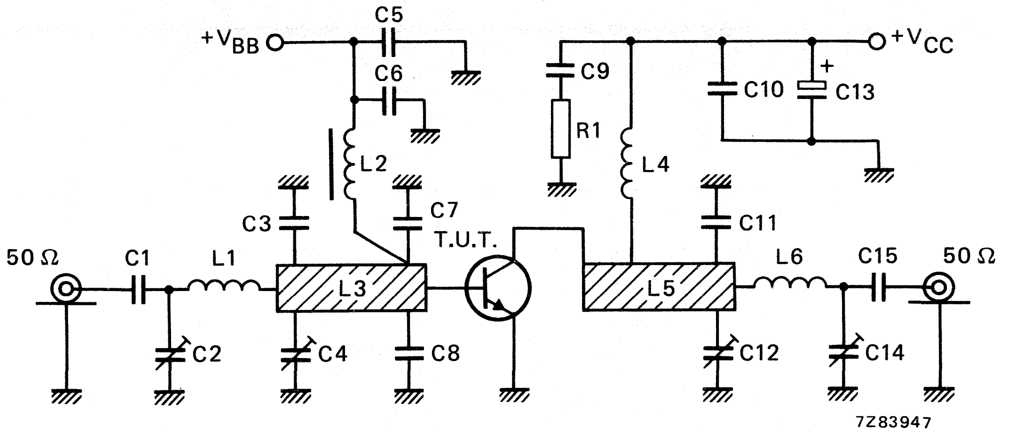


Fig. 9 Class-A test circuit at f_{vision} = 224,25 MHz.

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

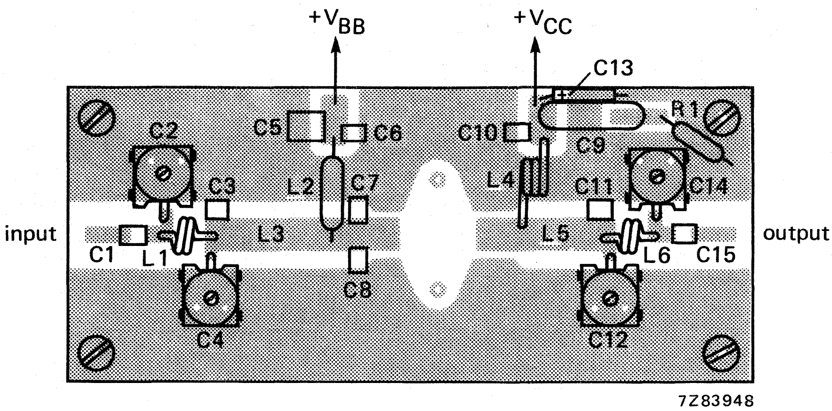
L1 = 2 turns enamelled Cu wire (1,6 mm); int. dia. 5,0 mm; length 5,0 mm; leads 2 x 3 mm
L2 = 1 μH microchoke (cat. no. 4322 057 01080)
L3 = 30 Ω stripline (6,0 mm x 32,7 mm)
L4 = 2 turns closely wound enamelled Cu wire (1,0 mm); int. dia. 5,0 mm; leads 2 x 10 mm
L5 = 30 Ω stripline (6,0 mm x 24,0 mm)
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.



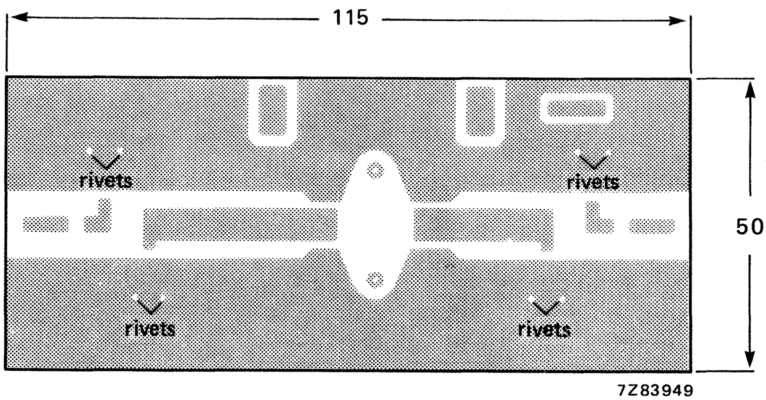


Fig. 10 Component layout and printed-circuit board for 224,25 MHz class-A test circuit.

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.

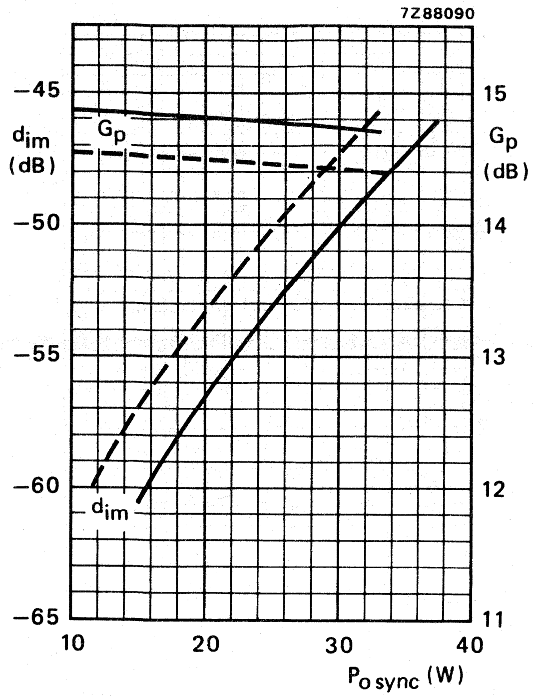


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

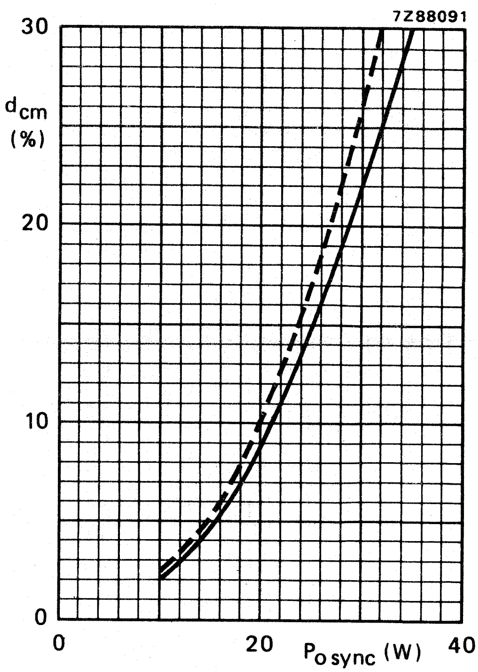


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

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.

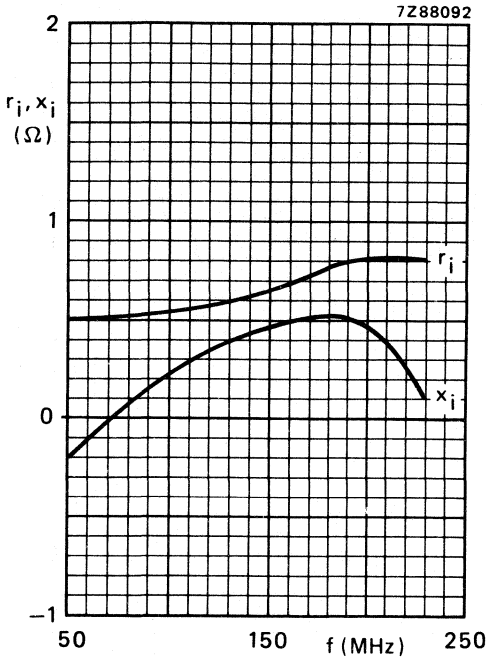


Fig. 13 Input impedance (series components).

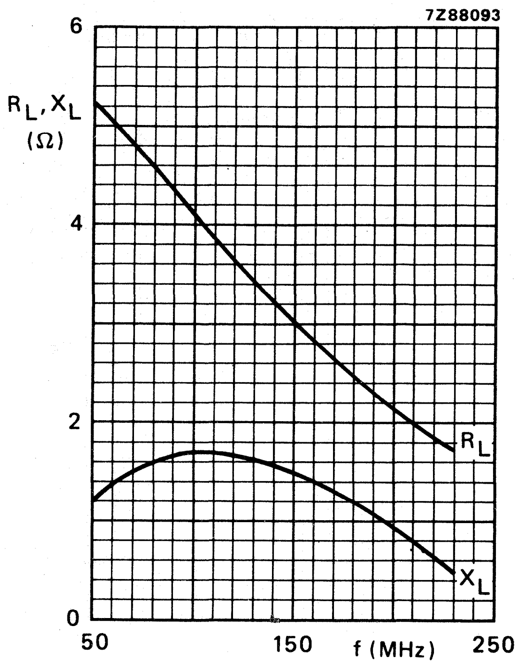


Fig. 14 Load impedance (series components).

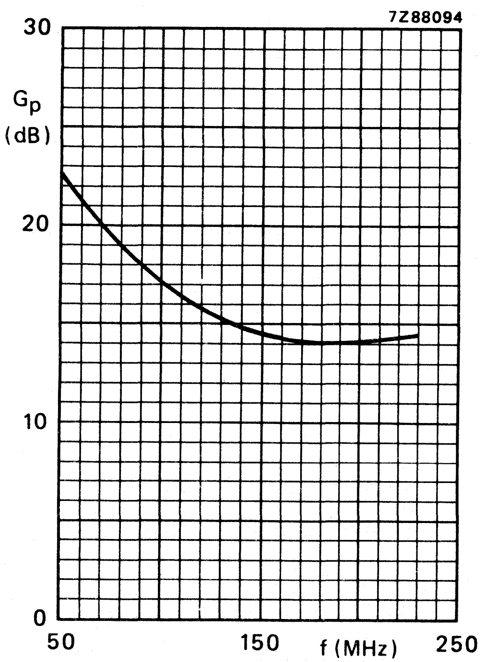


Fig. 15.

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).

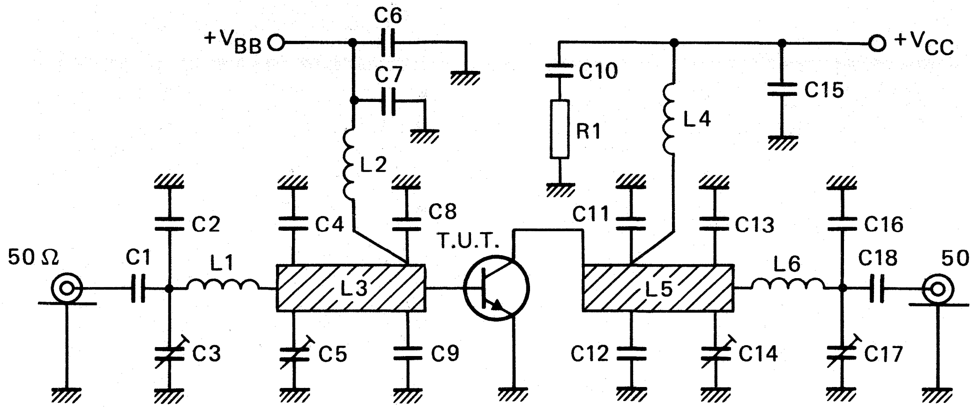


Fig. 16 Class-AB test circuit at f_{vision} = 224,25 MHz. 7Z83946

List of components (component layout and p.c.b. class-AB test circuit see Fig. 17):

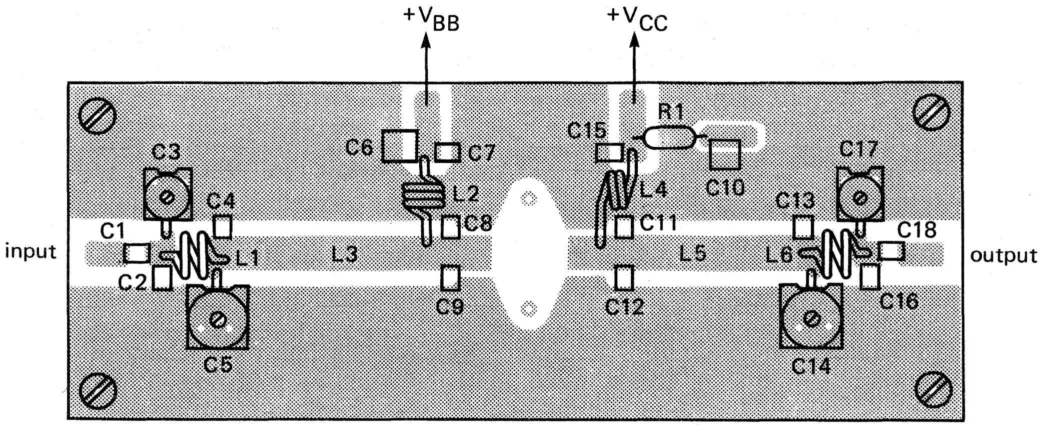
C1 = C18 = 620 pF (100 V) multilayer ceramic chip capacitor (ATC▲)
C2 = 27 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C3 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C4 = 30 pF (500 V) multilayer ceramic chip capacitor (ATC▲)
C5 = C14 = 4 to 40 pF film dielectric trimmer (cat. 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

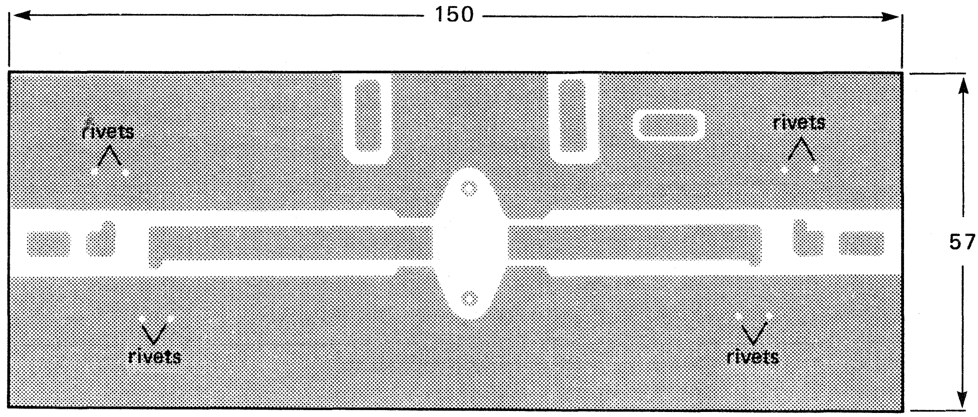
L3 and L5 are striplines on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric ($\epsilon_r \approx 4,5$); thickness 1/16″.

R1 = 10 Ω carbon resistor

▲ ATC means American Technical Ceramics.



7Z83951



7Z83950

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.

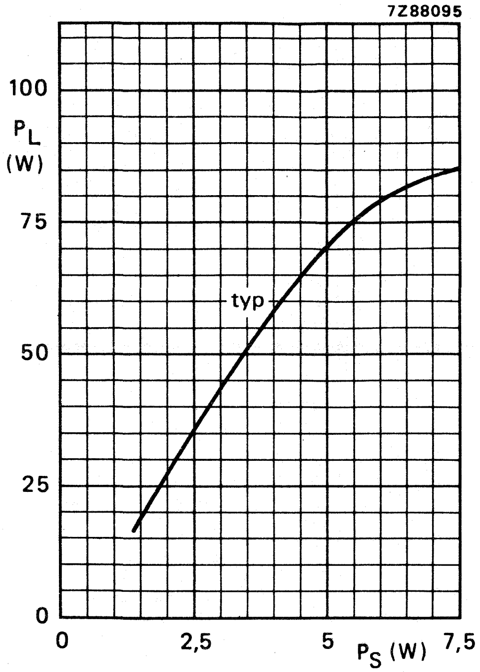


Fig. 18 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz.

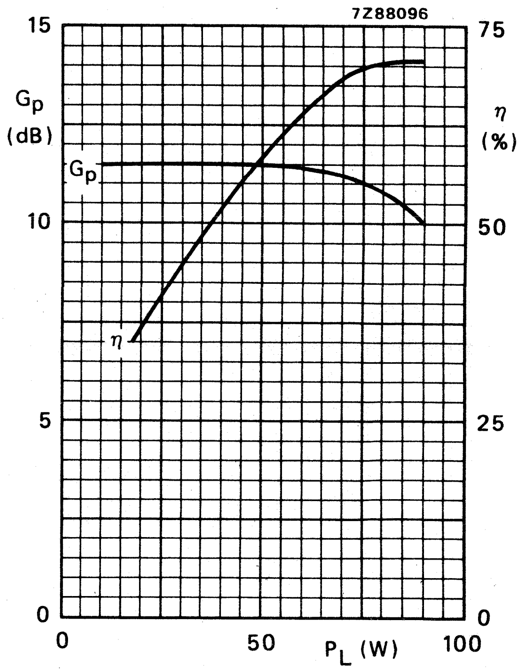


Fig. 19 V_{CE} = 28 V; $I_{C(ZS)}$ = 0,2 A; T_h = 70 °C; f_{vision} = 224,25 MHz; typical values.

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.

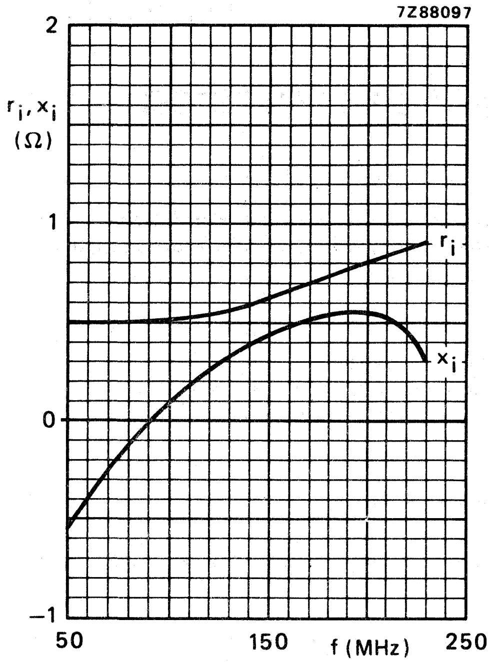


Fig. 20 Input impedance (series components).

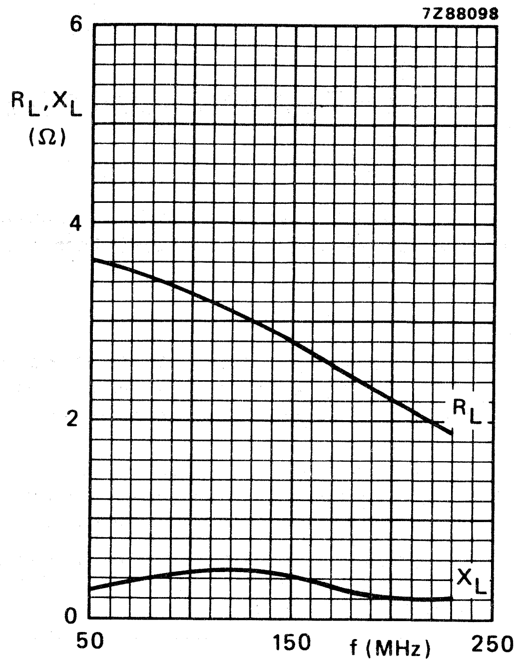


Fig. 21 Load impedance (series components).

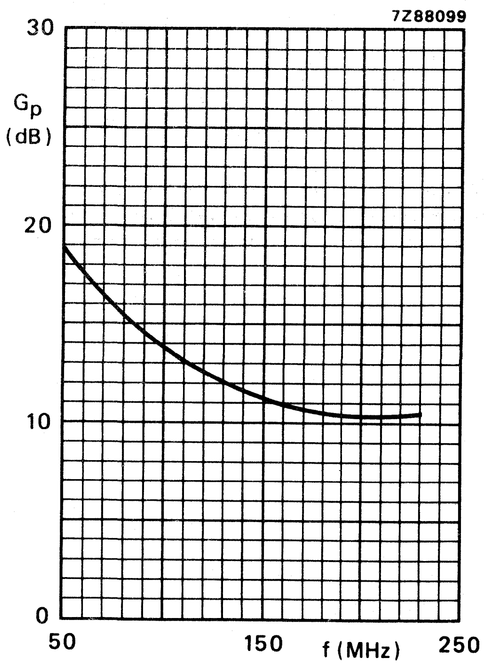


Fig. 22.

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.

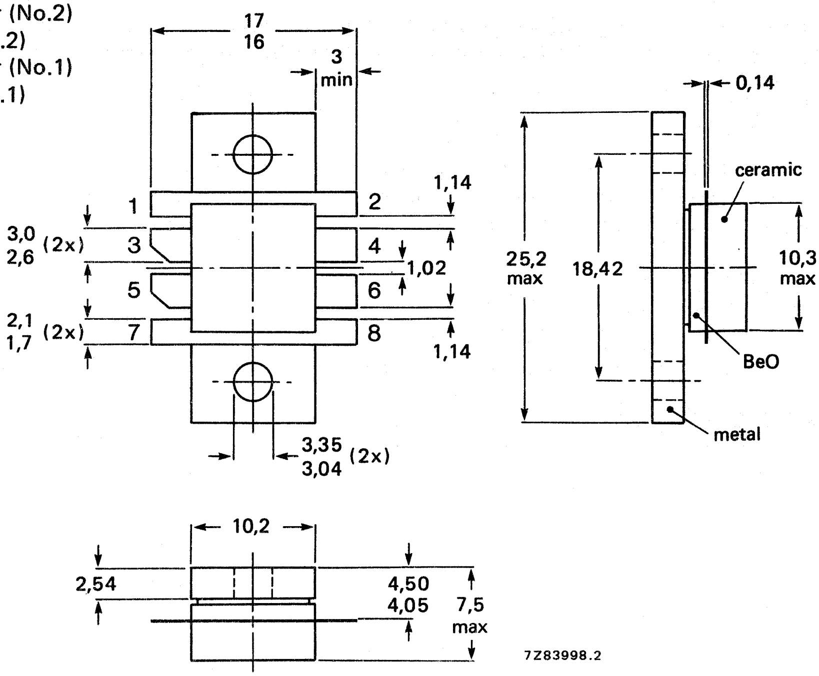
MECHANICAL DATA

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



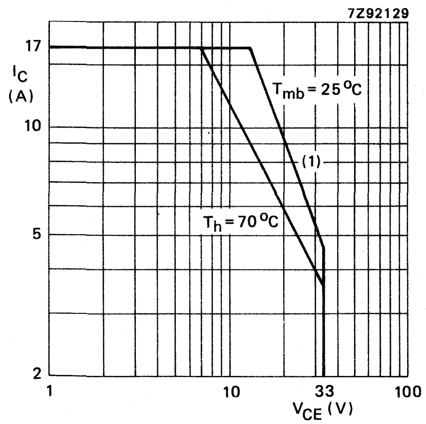
Torque on screw: min. 0.60 Nm
max. 0.75 Nm

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)

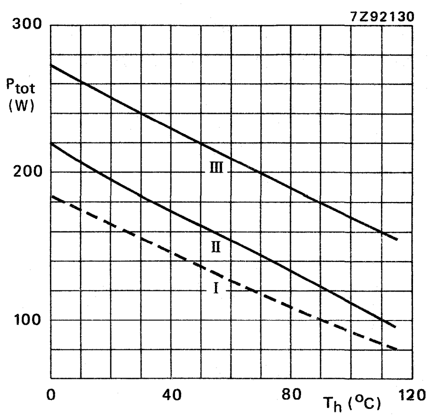
Collector-emitter voltage (peak value);			
(peak value); $V_{BE} = 0$	V_{CESM}	max.	65 V
open base	V_{CEO}	max.	33 V
Emitter-base voltage (open collector)	V_{EBO}	max.	4 V
Collector current per transistor section			
DC or average	I_C, $I_{C(AV)}$	max.	8.5 A
(peak value); f > 1 MHz	I_{CM}	max.	17.5 A
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. $T_j = 25\ ^oC$.

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			
$R_{BE} = 10\ \Omega$	E_{SBR}	>	10 mJ
DC current gain*			
$I_C = 3.5$ A; $V_{CE} = 25$ V	h_{FE}	typ. 15 to	45 100
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: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0.02$.

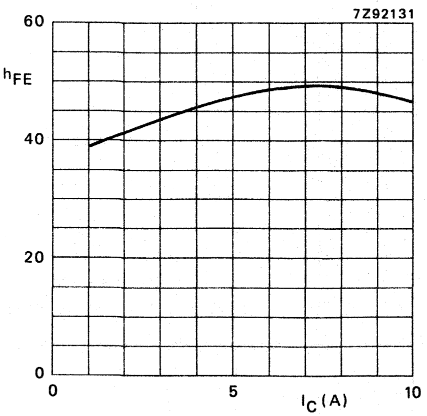


Fig.4 DC current gain as a function of collector current; V_{CE} = 25 V; T_j = 25 °C; typical values.

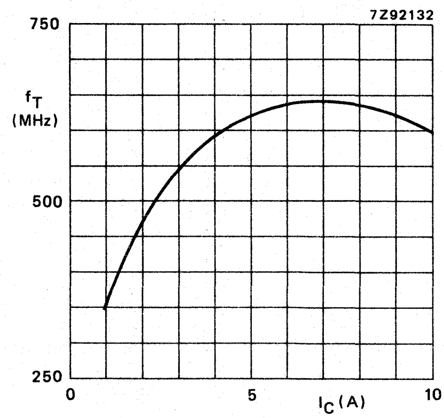


Fig.5 Transition frequency as a function of collector current; V_{CE} = 25 V; f = 100 MHz; T_j = 25 °C; typical values.

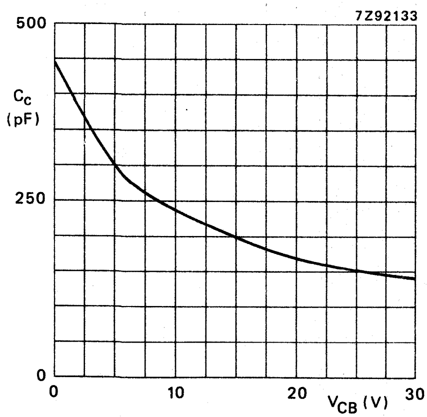


Fig.6 Collector capacitance as a function of collector-base voltage; $I_E = i_e = 0$; f = 1 MHz; typical values.

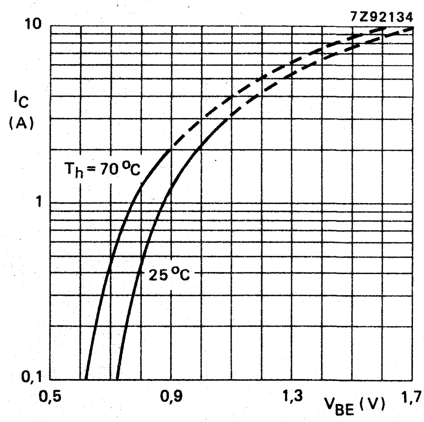


Fig.7 Collector current as a function of base-emitter voltage; V_{CE} = 25 V; typical values.

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).

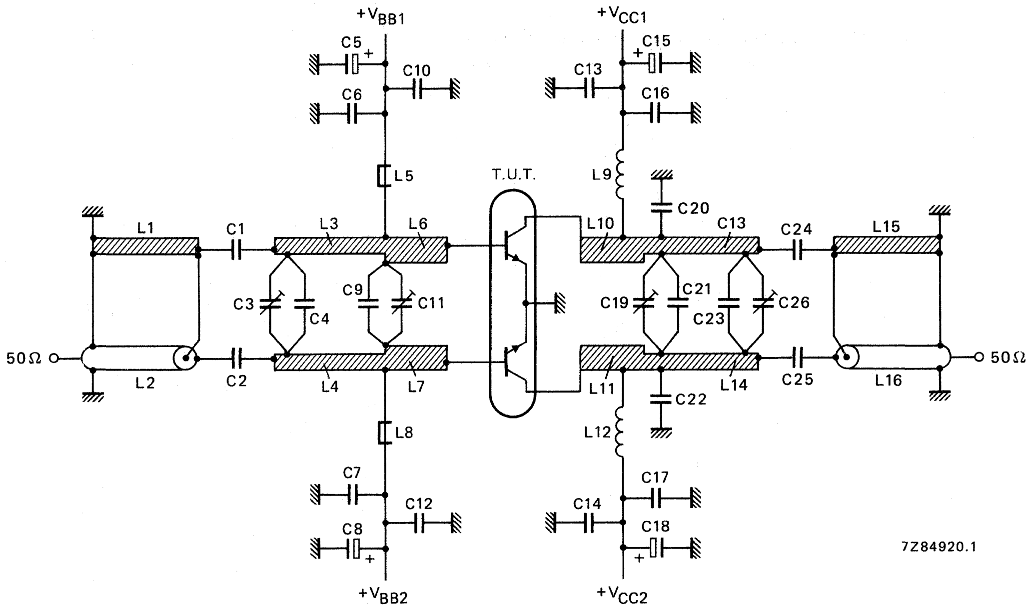


Fig.8 Class-AB test circuit at 224.25 MHz.

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.)

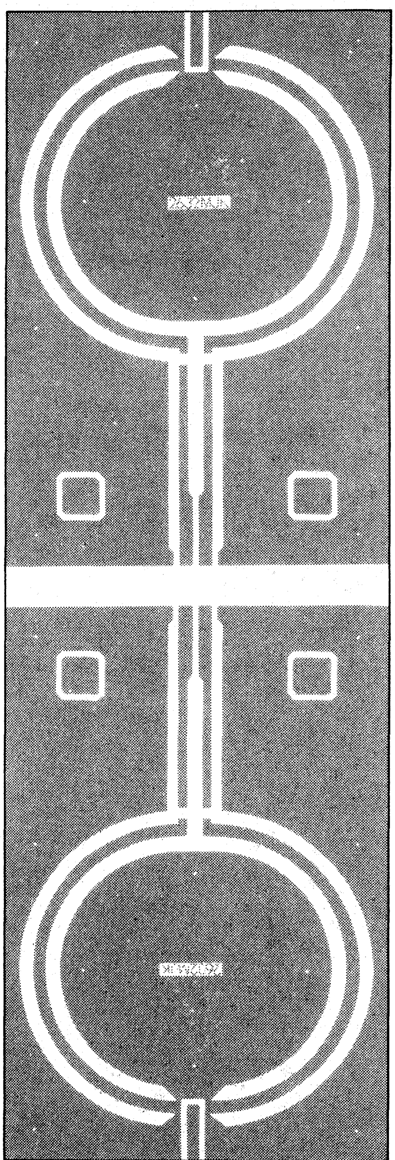
** American Technical Ceramics capacitor type 100A or capacitor of same quality.

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.

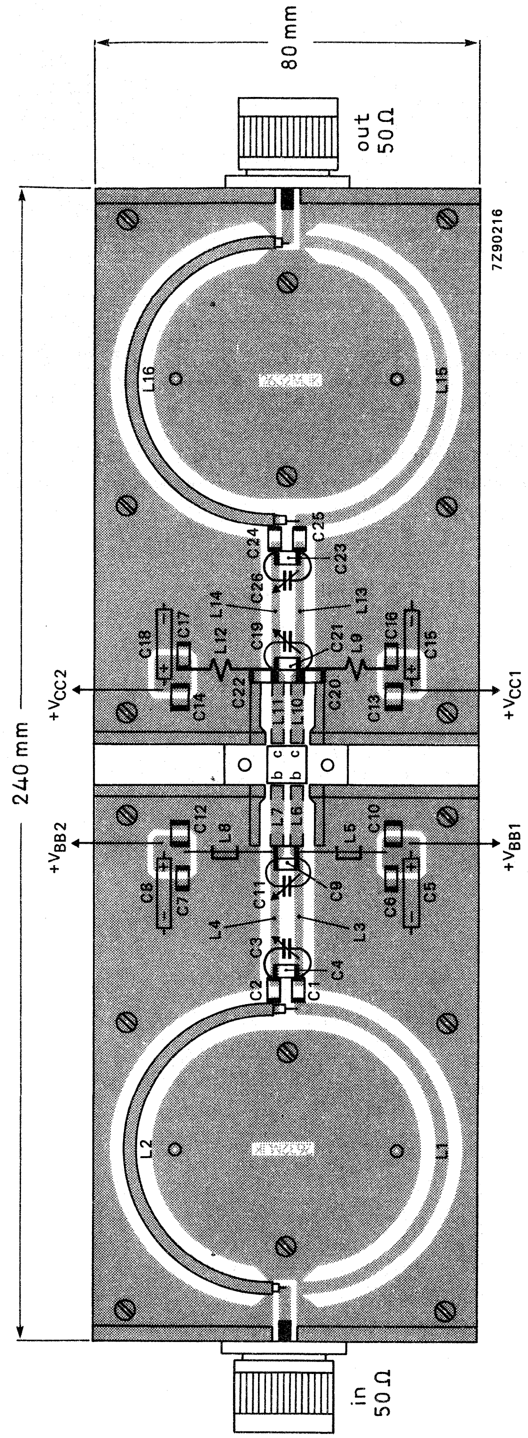


Fig. 10 Component layout of a 224.25 MHz class-AB test circuit.

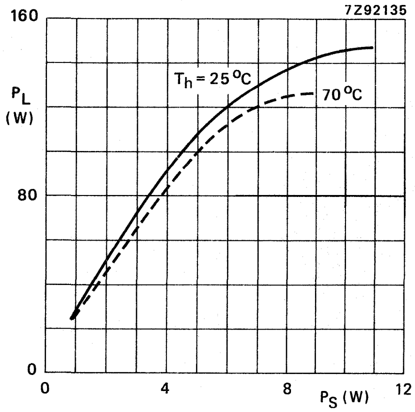


Fig.11 Load power as a function of source power; typical values.

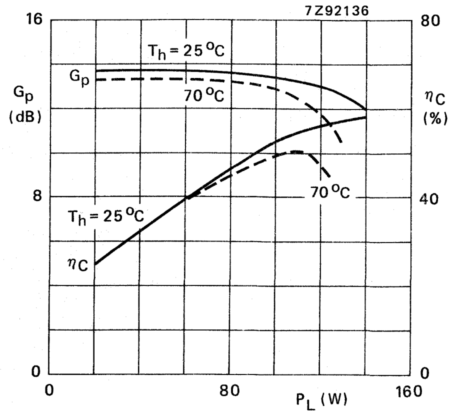


Fig.12 Power gain and efficiency as functions of load power; typical values.

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.

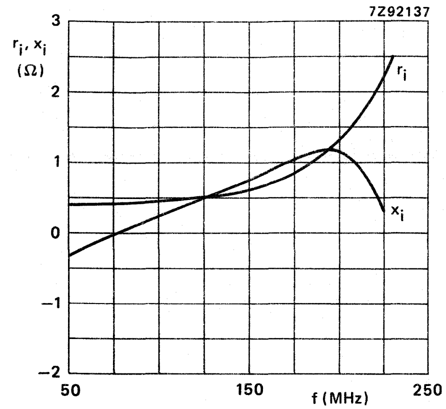


Fig.13 Input impedance (series components) as a function of frequency; typical values.

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.

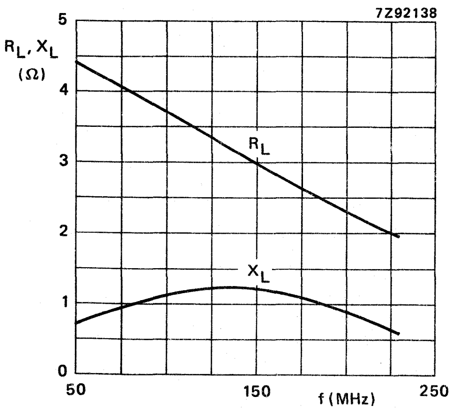


Fig.14 Load impedance (series components) as a function of frequency; typical values.

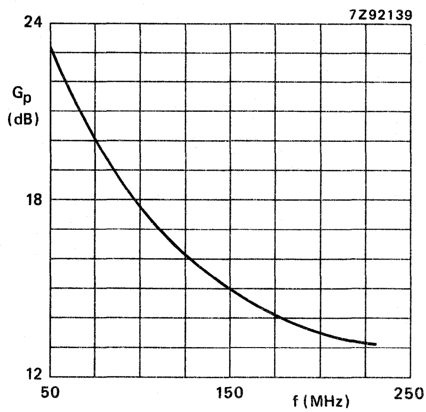


Fig.15 Power gain as a function of frequency; typical values.

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 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-B push-pull test circuit.

mode of operation	f MHz	V_{CE} V	P_L W	G_P dB	η_c %
CW class-B	108	28	250	> 10.5	> 60

MECHANICAL DATA

SOT179 (see Fig.1).

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 = Collector (No. 2)
2 = Base (No. 2)
3 = Emitter
4 = Base (No. 1)
5 = Collector (No. 1)

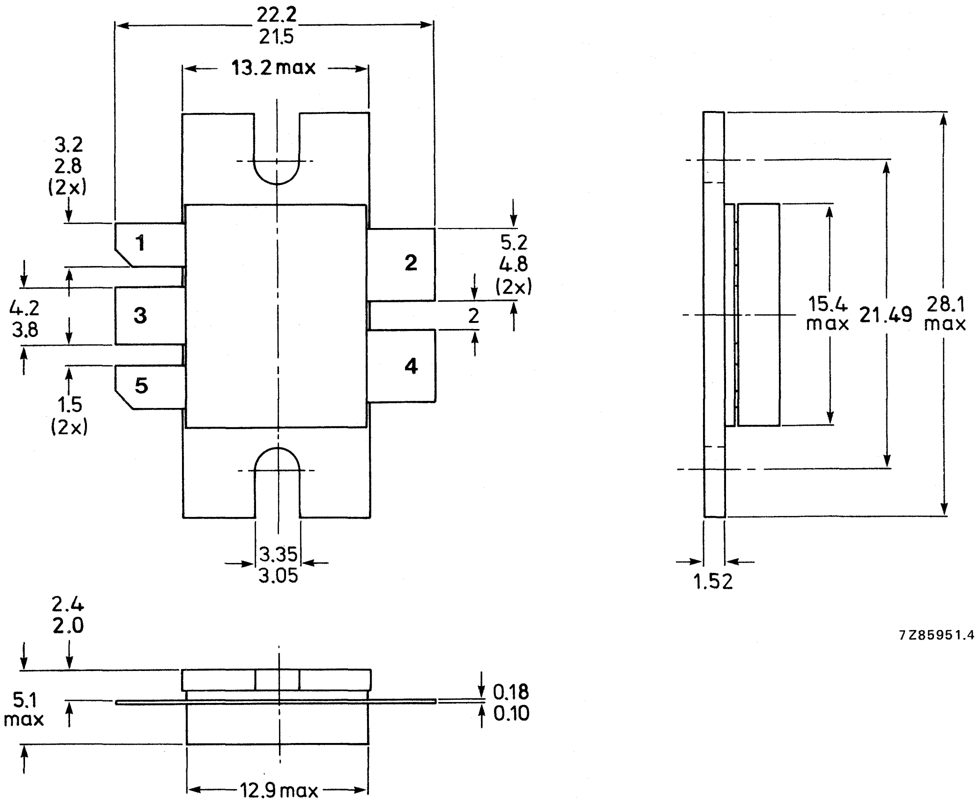


Fig.1 SOT179.

Torque on screw: min. 0.60 Nm
max. 0.75 Nm
Recommended screw: cheese head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.

RATINGS (per transistor section unless otherwise specified)

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.	4.0	V
Collector current DC or average	I_C; $I_{C(AV)}$	max.	10	A
peak (f > 1 MHz)	I_{CM}	max.	30	A
DC power dissipation (both sections)* $T_{mb} = 25\ ^oC$; f > 1 MHz	P_{tot}	max.	290	W
RF power dissipation (both sections)* $T_{mb} = 25\ ^oC$; f > 1 MHz	P_{tot}	max.	450	W
Storage temperature range	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC

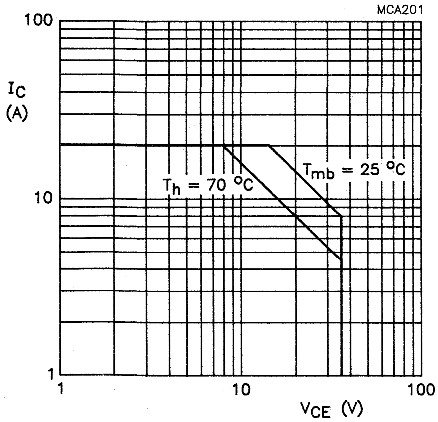
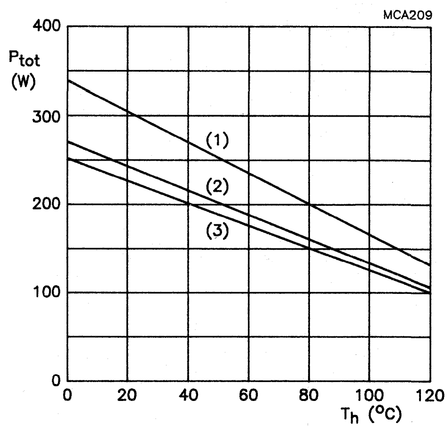


Fig.2 DC SOAR.



(1) short-time operation
(2) continuous RF operation (f > 1 MHz)
(3) continuous DC operation

Fig.3 Power/temperature derating curves.

* Dissipation of either section shall not exceed half-rated power.

THERMAL RESISTANCE (total device, both sections equally loaded)

DC dissipation = 2 x 112 W, T_{mb} = 25 °C

From junction to mounting base (DC)	$R_{th\ j\text{-}mb(DC)}$	max.	0.6	K/W
From junction to mounting base (RF)	$R_{th\ j\text{-}mb(RF)}$	max.	0.54	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2	K/W

CHARACTERISTICS

Applicable to either transistor section unless otherwise specified; T_j = 25 °C

Collector-emitter breakdown voltage V_{BE} = 0; I_C = 60 mA	$V_{(BR)CES}$	min.	65	V
Collector-emitter breakdown voltage open base; I_C = 120 mA	$V_{(BR)CEO}$	min.	36	V
Emitter-base breakdown voltage open collector; I_E = 12 mA	$V_{(BR)EBO}$	min.	4.0	V
Collector cut-off current V_{CE} = 36 V; V_{BE} = 0	I_{CES}	max.	25	mA
DC current gain I_C = 6 A; V_{CE} = 30 V	h_{FE}		15 to 80	
DC current gain ratio of both sections: I_C = 6 A; V_{CE} = 30 V	Δh_{FE}		0.67 to 1.5	
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 30 V	C_c	typ.	170	pF
Collector-flange capacitance	C_{cf}	typ.	4.0	pF

Figs 4 to 6 apply to either transistor section; $R_{th\ mb\text{-}h} = 0.2$ K/W.

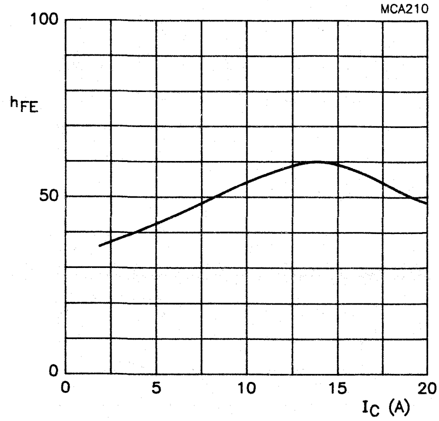


Fig.4 DC current gain as a function of collector current; $V_{CE} = 30$ V; $T_j = 25$ °C; typical values.

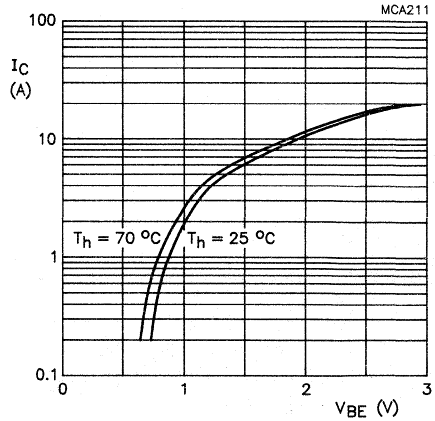


Fig.5 Collector current as a function of base-emitter voltage; $V_{CE} = 30$ V; typical values.

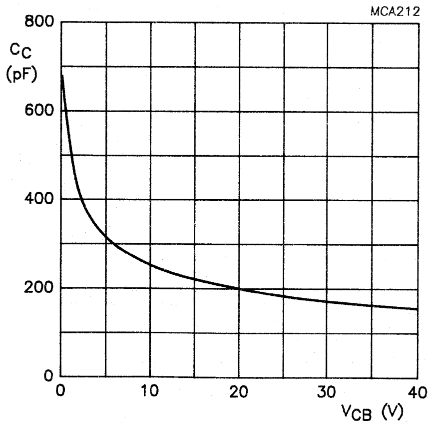
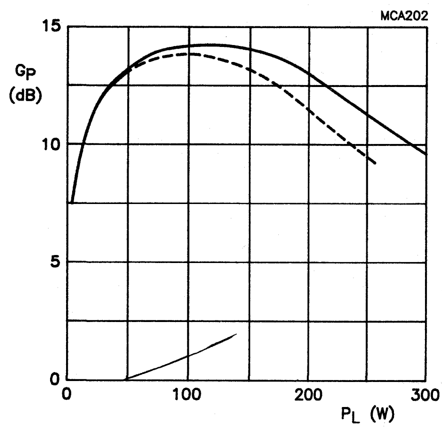


Fig.6 Collector capacitance as a function of collector-base voltage; $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

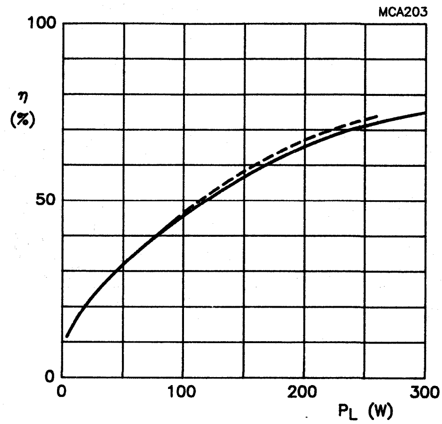
RF performance at T_h = 25 °C in a common-emitter class-B push-pull test circuit.

mode of operation	f MHz	V_{CE} V	P_L W	G_P dB	η_C %
CW class-B	108	28	250	> 10.5 typ. 11.3	> 60 typ. 70



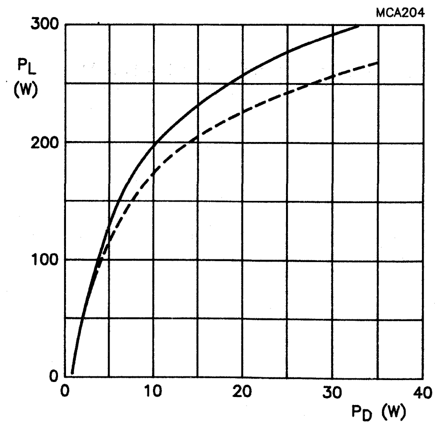
- - - - = 70 °C; —— = 25 °C

Fig.7 Power gain as a function of load power; typical values.



- - - - = 70 °C; —— = 25 °C

Fig.8 Efficiency as a function of load power; typical values.



- - - - = 70 °C; —— = 25 °C

Fig.9 Load power as a function of drive power; typical values.

Conditions: Class-B operation; V_{CE} = 28 V; f = 108 MHz; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

Ruggedness in class-B operation

The BLV37 is capable of withstanding a load mismatch corresponding with VSWR = 3 through all phases under the following conditions: V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W at rated output power.

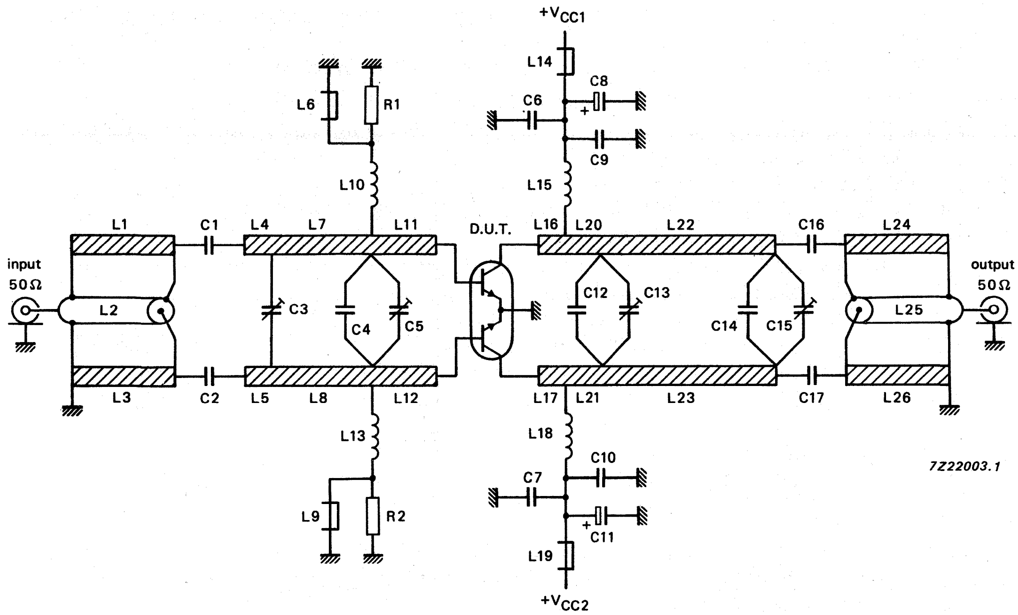


Fig.10 Class-B test circuit at f = 108 MHz.

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 pF 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 = L25 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 163.8 mm; soldered on striplines L1 and L24 respectively.
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, L10, 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 PRFE 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 printed-circuit 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.

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

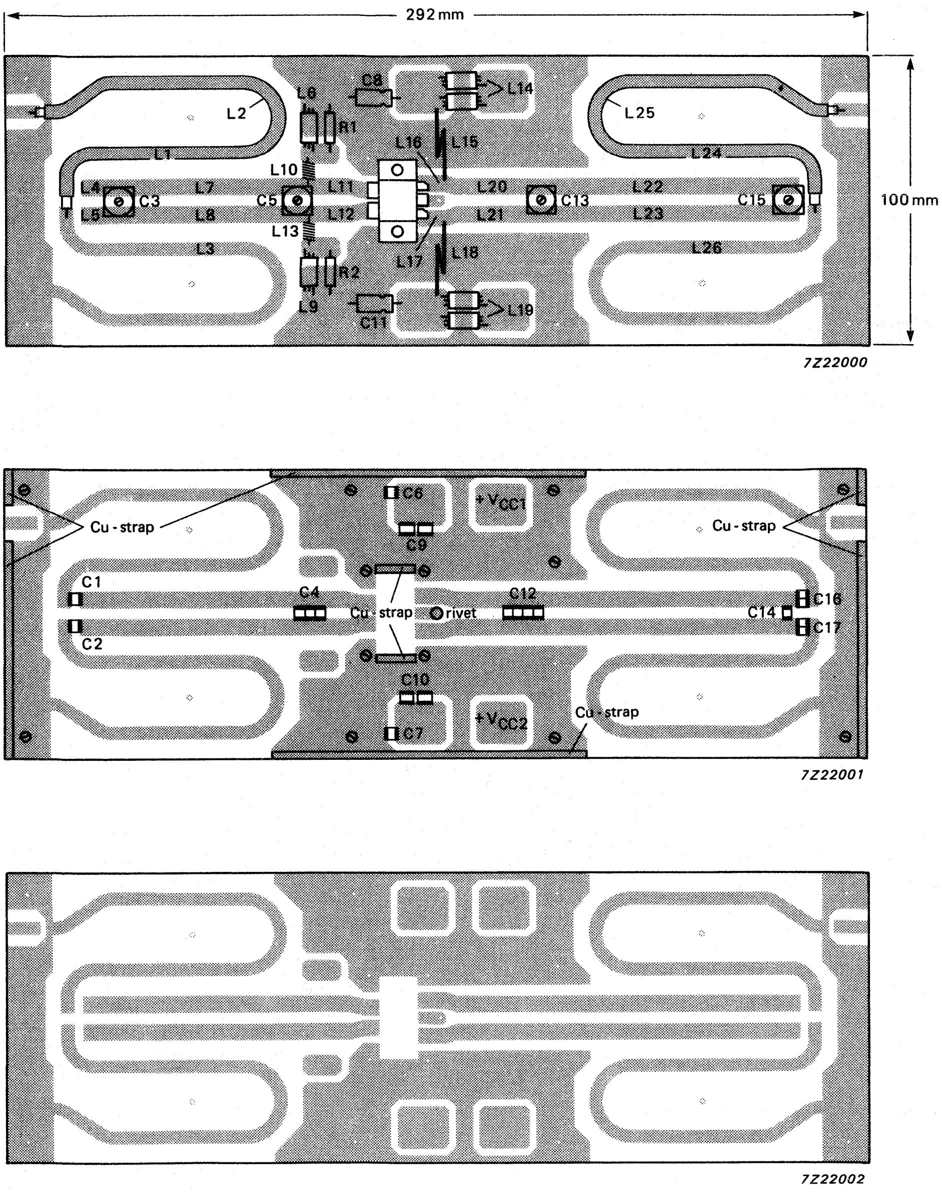


Fig.11 Component layout and printed-circuit board for 108 MHz test circuit.

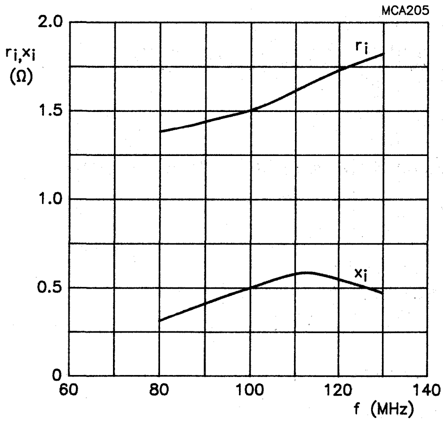


Fig.12 Input impedance as a function of frequency; typical per section (series components).

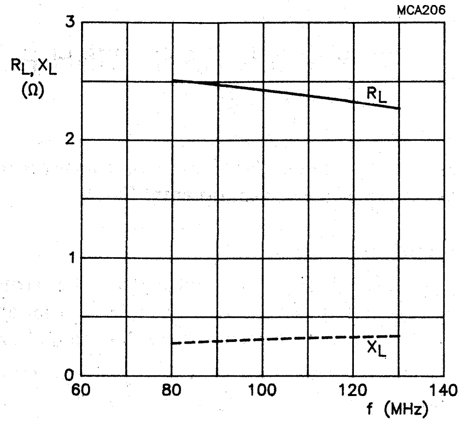


Fig.13 Load impedance as a function of frequency; typical per section (series components).

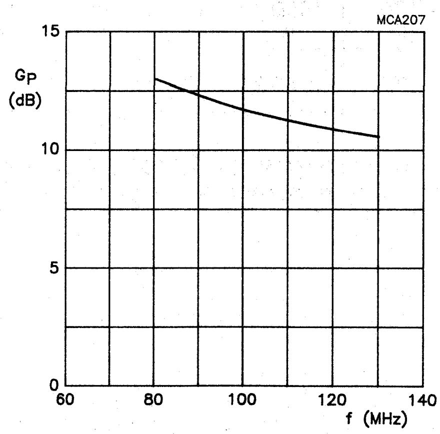


Fig.14 Power gain as a function of frequency; typical per section.

Conditions: Class-B operation; V_{CE} = 28 V; P_L = 250 W (total device); T_h = 25 °C.

VHF LINEAR PUSH-PULL POWER TRANSISTOR

Push-pull npn silicon planar epitaxial transistor primarily intended for use in linear VHF television transmitters (vision or sound amplifiers).

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	f MHz	V_{CE} V	$I_{C(ZS)}$ A	P_L W	G_P dB	η_C %	gain compression dB
CW class-AB	224.25	35	2 x 0.2	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

SOT179 (see Fig.1).

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 = Collector (No. 2)
2 = Base (No. 2)
3 = Emitter
4 = Base (No. 1)
5 = Collector (No. 1)

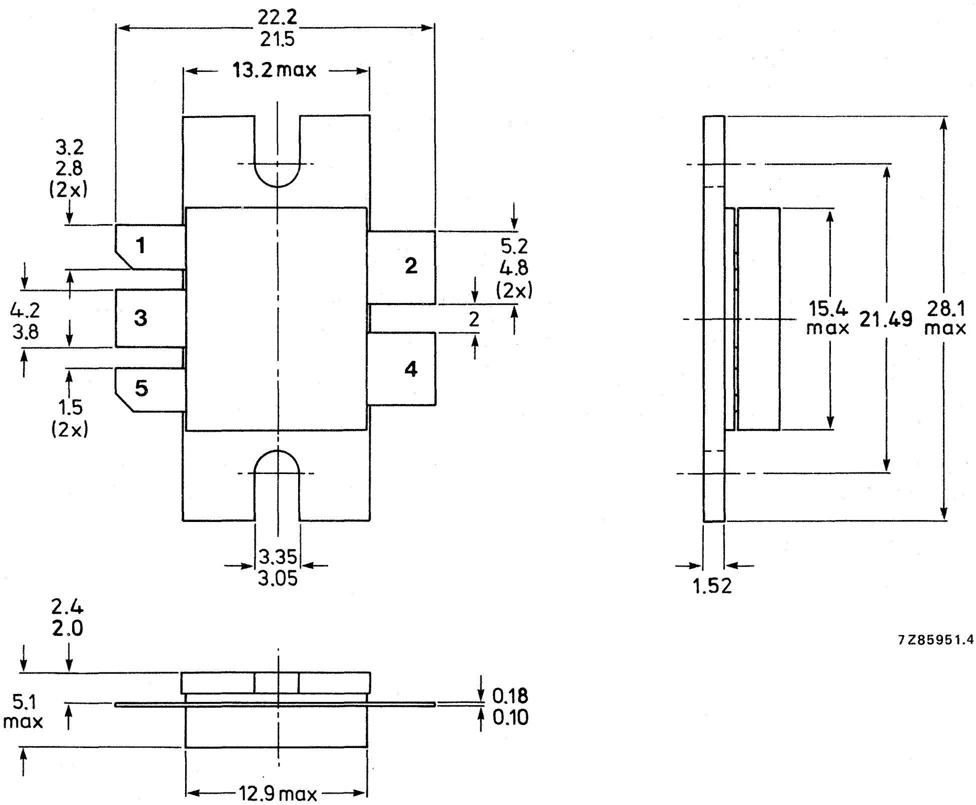


Fig.1 SOT179.

Torque on screw: min. 0.60 Nm
max. 0.75 Nm
Recommended screw: cheese head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.

RATINGS (per transistor section unless otherwise specified)

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; $I_{C(AV)}$	max.	10 A
peak (f > 1 MHz)	I_{CM}	max.	30 A
DC power dissipation (both sections)* $T_{mb} = 25\ ^oC$; f > 1 MHz	P_{tot}	max.	290 W
RF power dissipation (both sections)* $T_{mb} = 25\ ^oC$; f > 1 MHz	P_{tot}	max.	450 W
Storage temperature range	T_{stg}		−65 to +150 ^oC
Operating junction temperature	T_j	max.	200 ^oC

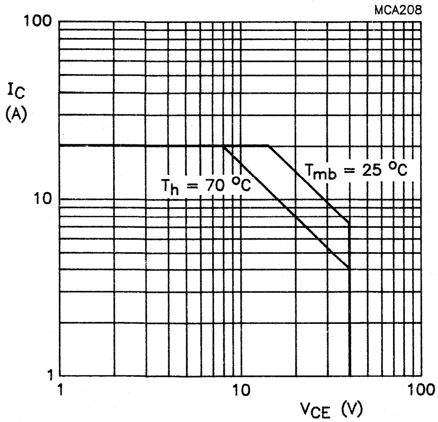
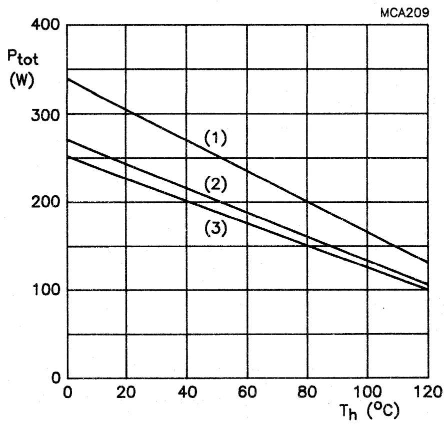


Fig.2 DC SOAR.



(1) short-time operation
(2) continuous RF operation (f > 1 MHz)
(3) continuous DC operation

Fig.3 Power/temperature derating curves.

* Dissipation of either section shall not exceed half-rated power.

THERMAL RESISTANCE (total device, both sections equally loaded)

DC dissipation = 2 x 112 W, T_{mb} = 25 °C

From junction to mounting base (DC)	$R_{th\ j\text{-}mb(DC)}$	max.	0.6 K/W
From junction to mounting base (RF)	$R_{th\ j\text{-}mb(RF)}$	max.	0.54 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.2 K/W

CHARACTERISTICS

Applicable to either transistor section unless otherwise specified; T_j = 25 °C.

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.	25 mA
DC current gain I_C = 6 A; V_{CE} = 30 V	h_{FE}		15 to 80
DC current gain ratio of both sections: I_C = 6 A; V_{CE} = 30 V	Δh_{FE}		0.67 to 1.5
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 30 V	C_c	typ.	170 pF
Collector-flange capacitance	C_{cf}	typ.	4.0 pF

Figs 4 to 6 apply to either transistor section; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

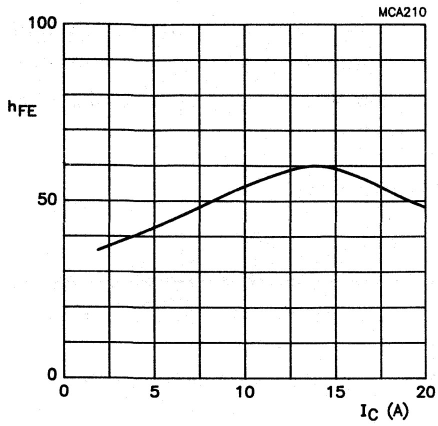


Fig.4 DC current gain as a function of collector current; V_{CE} = 30 V; T_j = 25 °C; typical values.

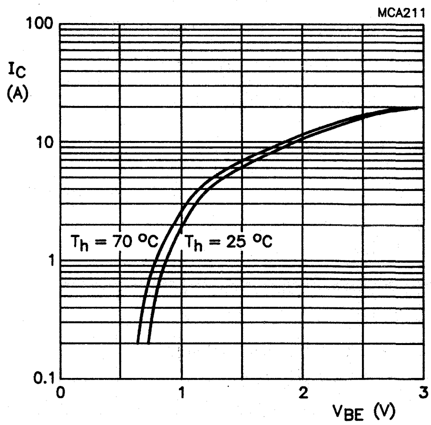


Fig.5 Collector current as a function of base-emitter voltage; V_{CE} = 30 V; typical values.

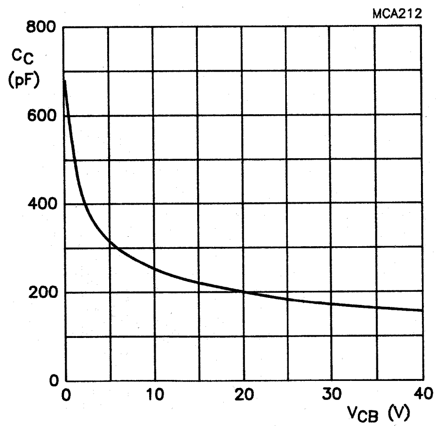
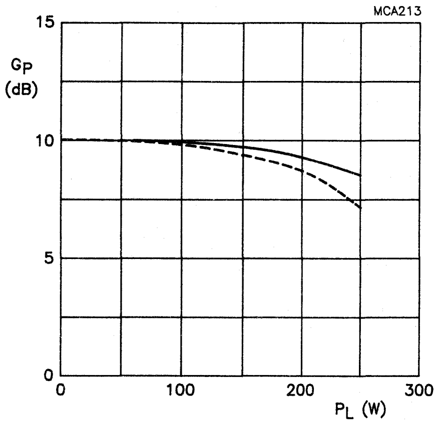


Fig.6 Collector capacitance as a function of collector-base voltage; $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

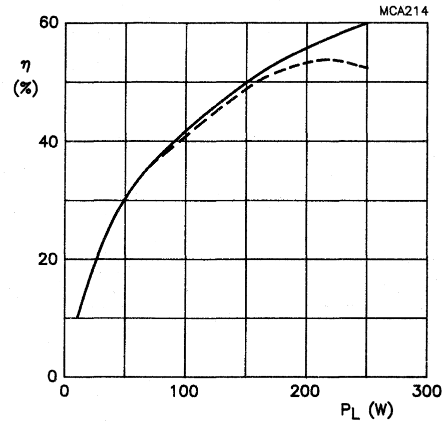
RF performance in a class-AB test circuit at T_h = 25 °C

mode of operation	f MHz	V_{CE} V	$I_{C(ZS)}$ A	P_L W	G_P dB	η_C %	gain compression dB
CW class-AB	224.25	35	2 x 0.2	225	> 8.0 typ. 8.8	> 50 typ. 58	⩽ 1.0* typ. 0.65
CW class-AB	224.25	35	2 x 0.2	112.5	> 9.0 typ. 9.8		



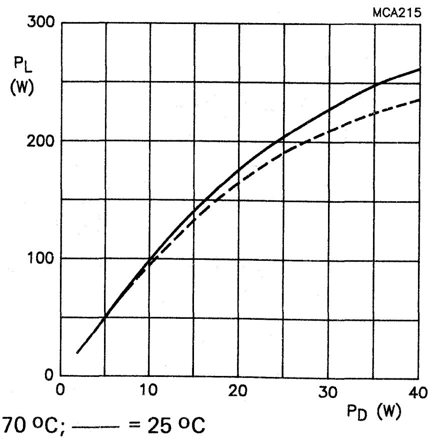
- - - - = 70 °C; —— = 25 °C

Fig.7 Power gain as a function of load power; typical values.



- - - - = 70 °C; —— = 25 °C

Fig.8 Efficiency as a function of load power; typical values.



- - - - = 70 °C; —— = 25 °C

Fig.9 Load power as a function of drive power; typical values.

Conditions: Class-AB operation; V_{CE} = 35 V; $I_{C(ZS)}$ = 2 x 0.2 A; f = 224.25 MHz; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

* 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).

Ruggedness in class-AB operation

The BLV38 is capable of withstanding a load mismatch corresponding with VSWR = 3 through all phases under the following conditions: V_{CE} = 35 V; f = 224.25 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W at rated power.

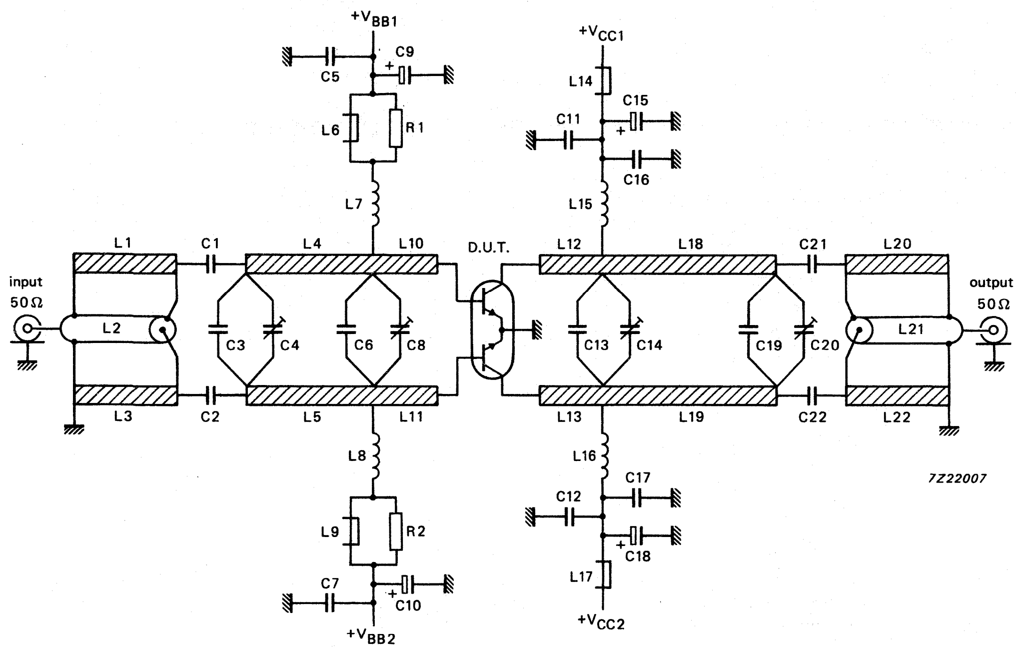


Fig.10 Class-AB test circuit at f = 224.25 MHz.

Temperature compensated bias (R_{input} < 0.1 Ω)

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 05503).
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 capacitors.
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.*

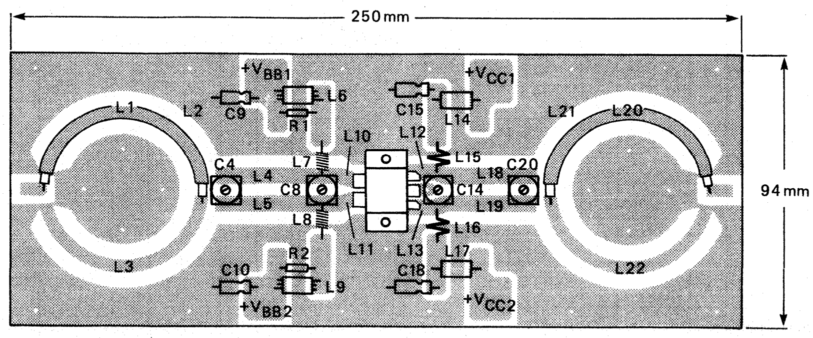
L1 = L3 = L20 = L22 = 50 Ω stripline (4.8 mm x 80 mm).
L2 = L21 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 80 mm; soldered on striplines L1 and L20 respectively.
L4 = L5 = 43 Ω stripline (6.0 mm x 37 mm).
L6 = L9 = Ferroxcube wide-band HF choke; grade 3B (cat. no. 4312 020 36642).
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).

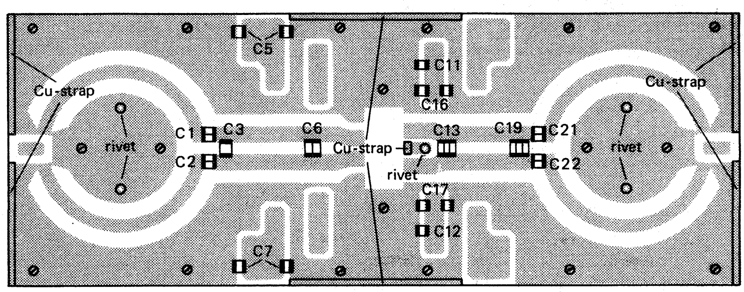
R1 = R2 = 10 Ω ± 5%; 1/2 W metal film resistor.

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 printed-circuit 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.

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





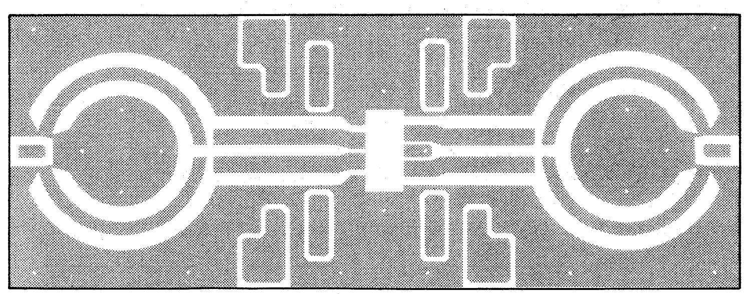


Fig.11 Component layout and printed-circuit board for 224.25 MHz test circuit.

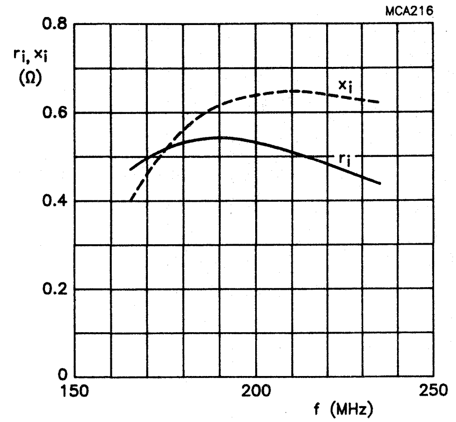


Fig.12 Input impedance as a function of frequency;(series components) typical per section.

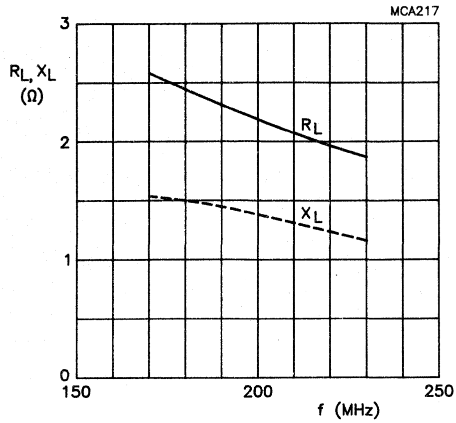


Fig.13 Load impedance as a function of frequency;(series components) typical per section.

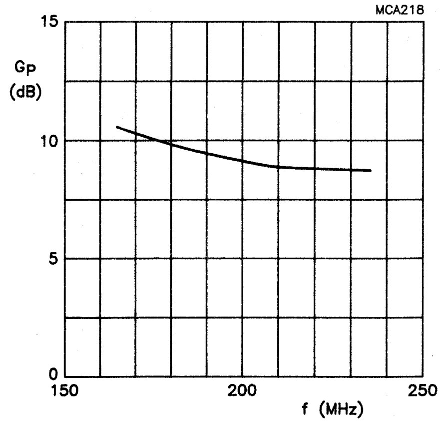


Fig.14 Power gain as a function of frequency; typical per section.

Conditions: Class-AB operation; V_{CE} = 35 V; $I_{C(ZS)}$ = 2 x 0.2 A; P_L = 225 W (total device); T_h = 25 °C.

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

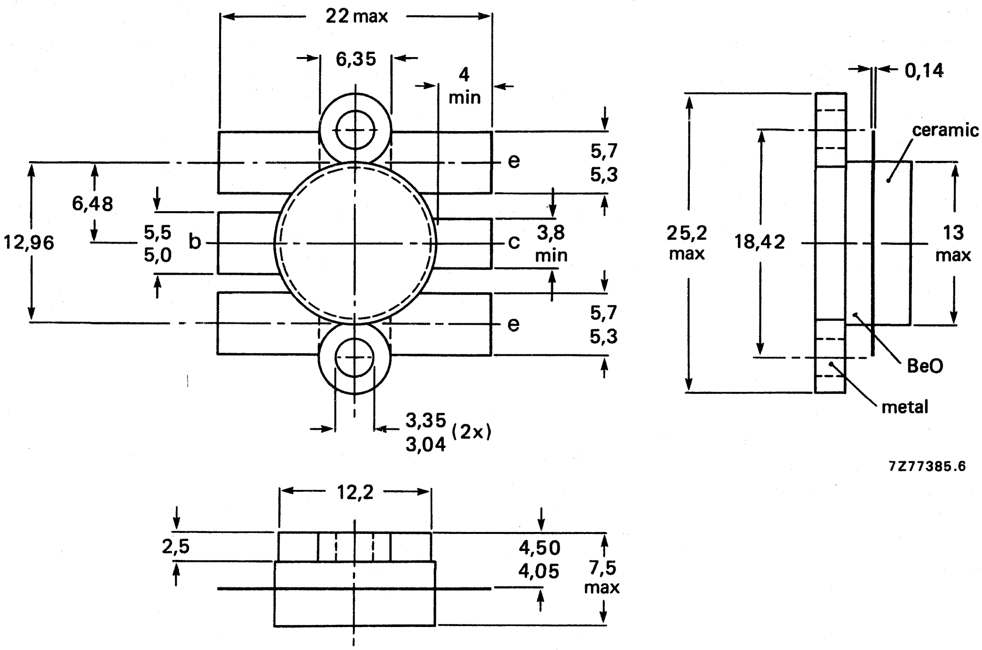
SOT-119 (see Fig. 1)

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

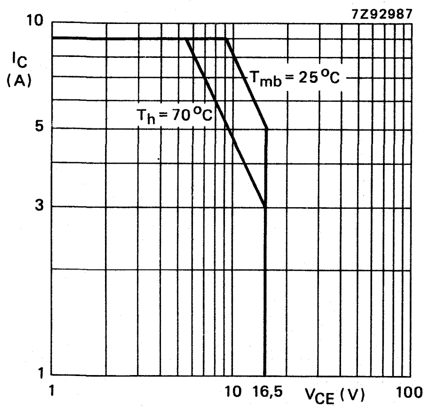


Fig. 2 D.C. soar.
$R_{th\ mb\text{-}h}$ = 0,2 K/W.

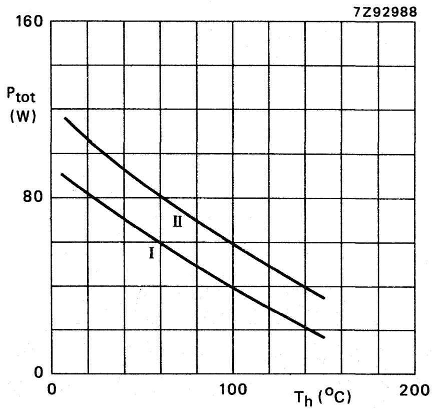


Fig. 3 Power/temperature derating curves; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

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

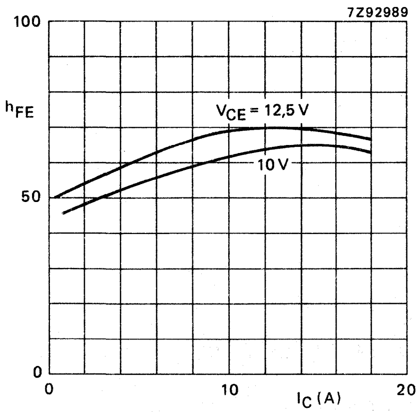


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

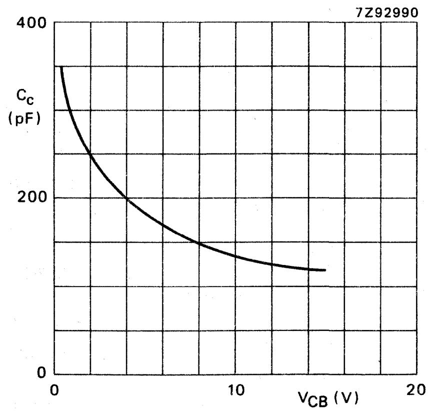


Fig. 5 Output capacitance versus V_{CB}; $I_E = i_e = 0$; f = 1MHz; T_j = 25 °C

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0,2 K/W

mode of operation	V_{CE} V	P_L W	G_P dB	η_C %
narrow band; c.w.	12,5	45	> 6,5 typ. 8,0	> 55 typ. 67

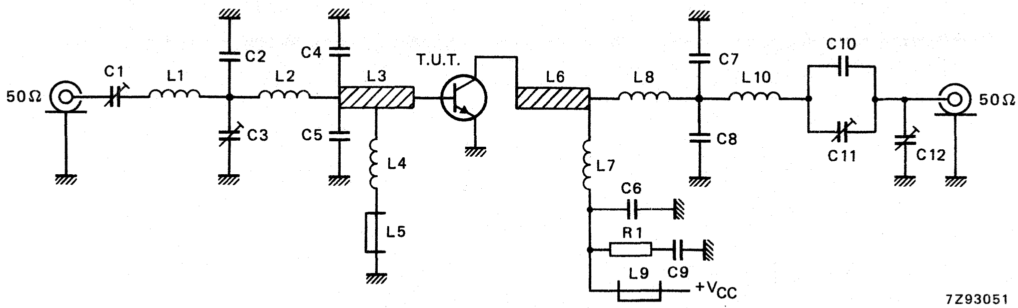


Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

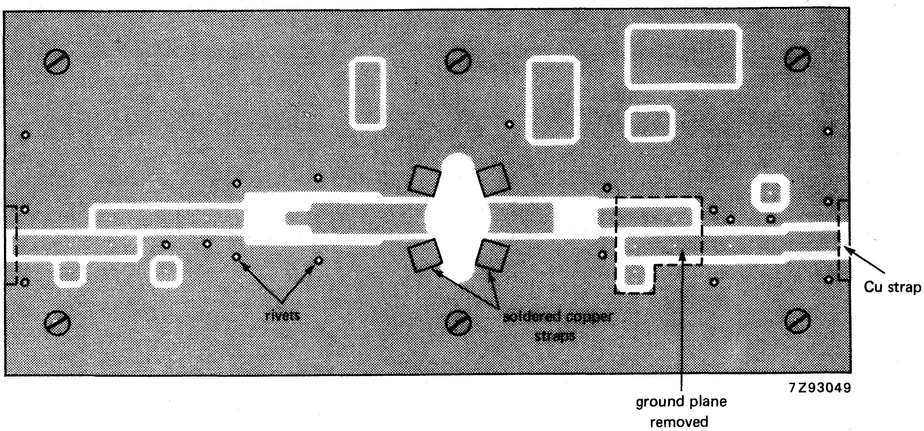
C1 = C11 = C12 = 4 to 40 film dielectric trimmer (cat.no. 2222 809 07008)
C2 = C10 = 10 pF multilayer ceramic chip capacitor *
C3 = 2,5 to 20 pF film dielectric trimmer (cat.no. 2222 809 07004)
C4 = C5 = 91 pF multilayer ceramic chip capacitor *
C6 = 820 pF multilayer ceramic chip capacitor *
C7 = C8 = 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.



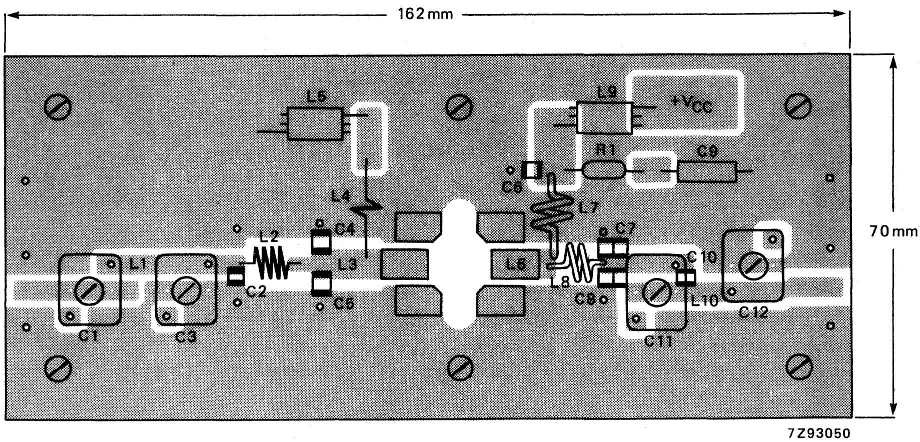


Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

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.

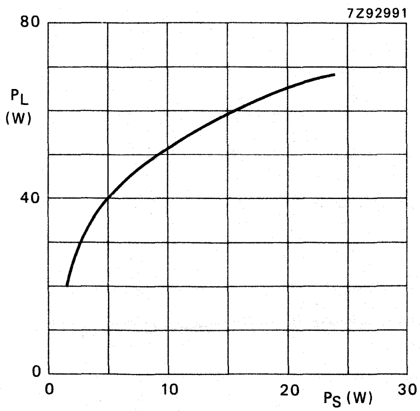


Fig. 8 Load power versus source power.

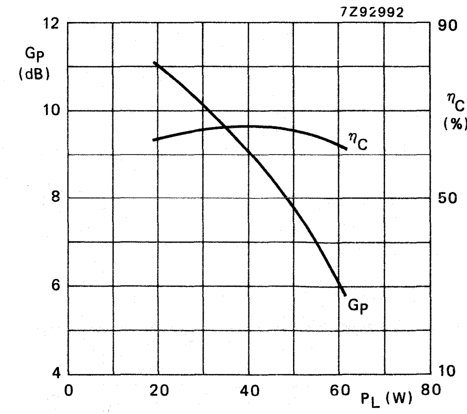


Fig. 9 Power gain and efficiency versus load power.

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).

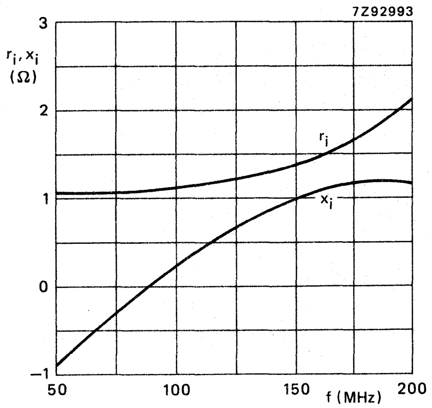


Fig. 10 Input impedance (series components).

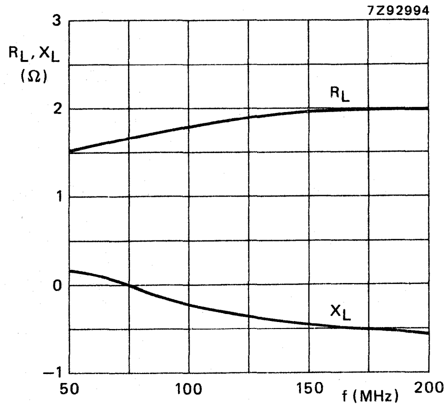


Fig. 11 Load impedance (series components).

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.

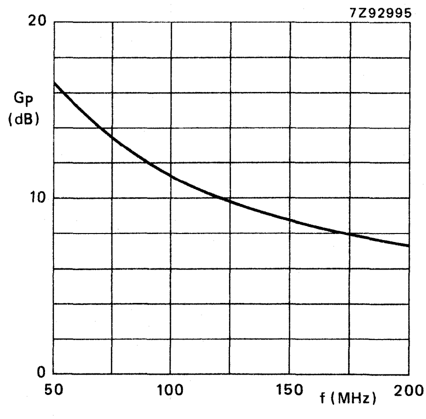


Fig. 12 Power gain versus frequency.

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

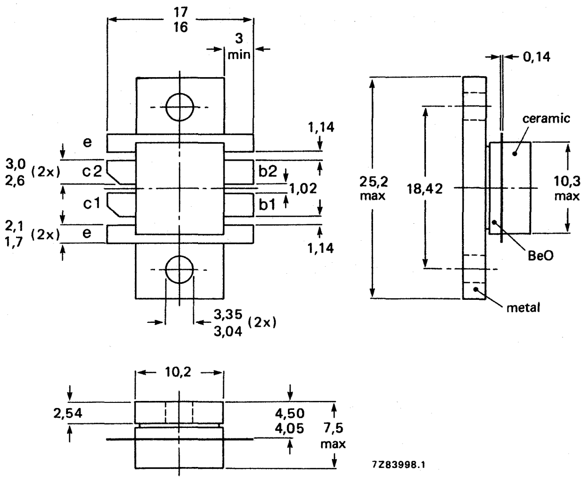
SOT-161 (see Fig. 1).

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)

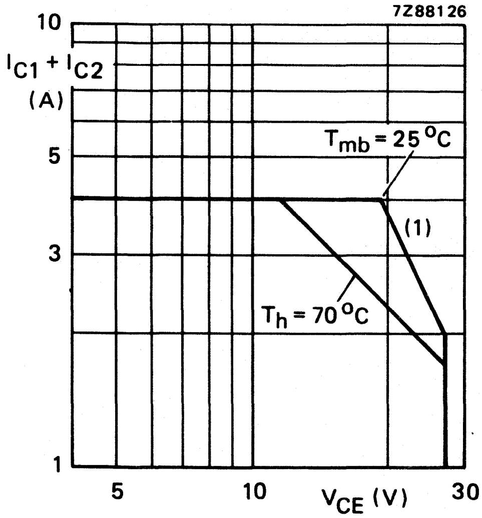
Recommended screw: cheese-head 4-40 UNC/2A

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.*

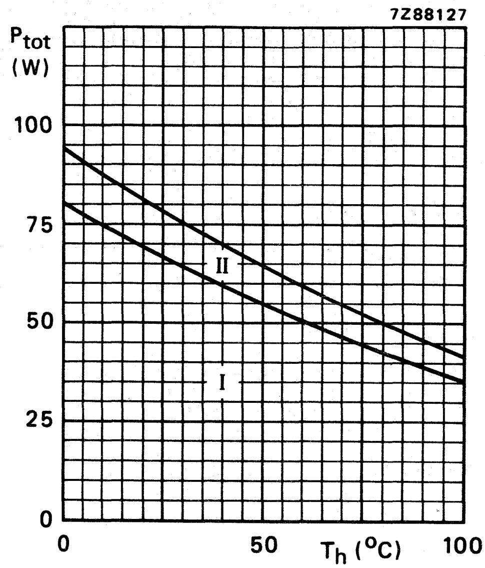


Fig. 3 Power derating curves vs. temperature.*

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.

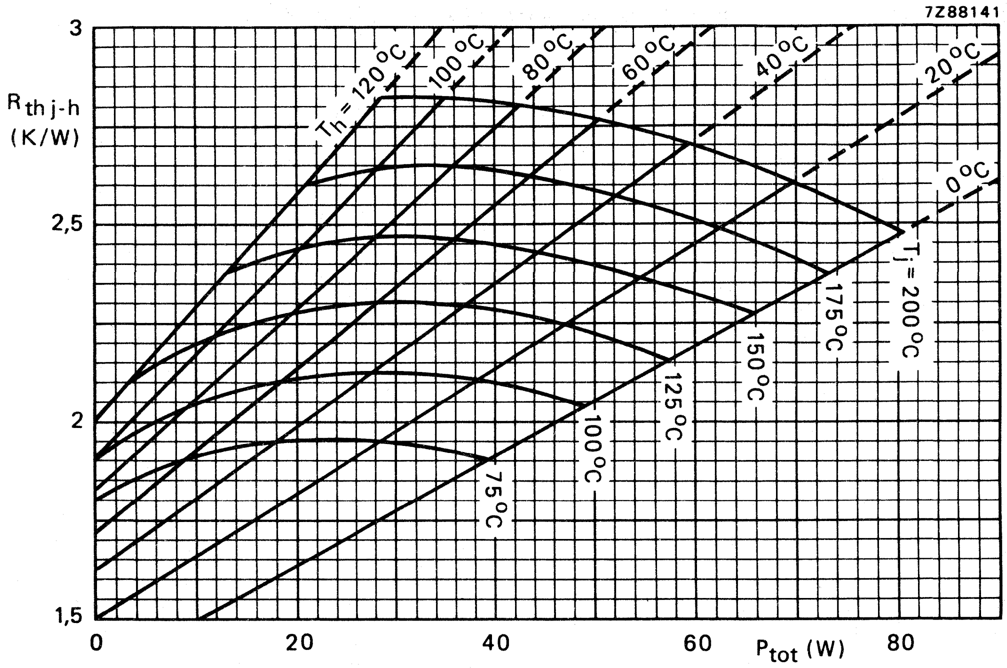


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,25 K/W.)

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

$T_j = 25\ ^oC$

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.

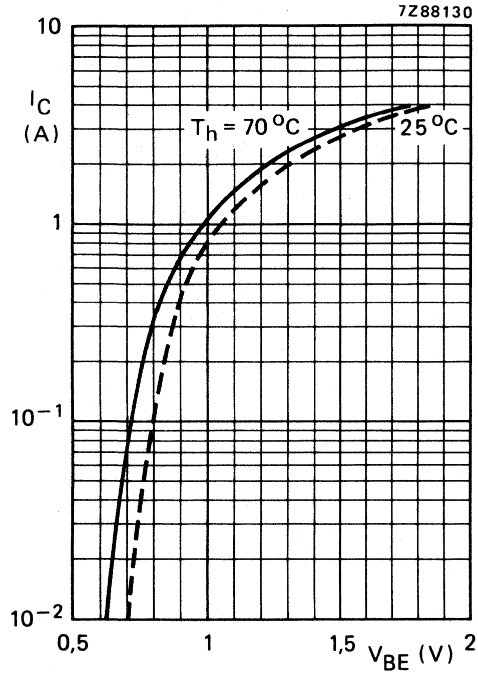


Fig. 5 Typical values; V_{CE} = 25 V.

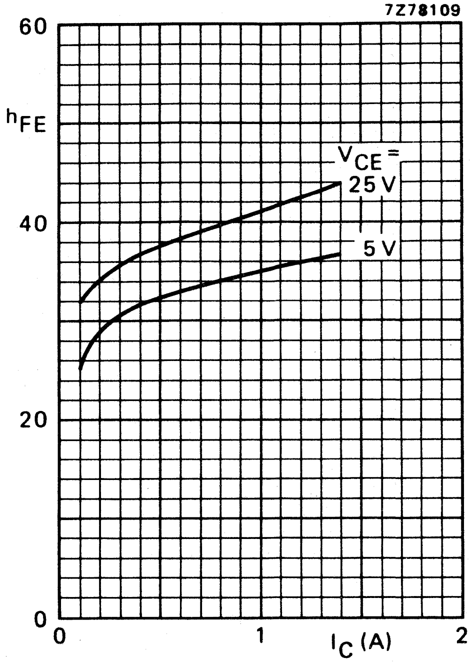


Fig. 6 Typical values; T_j = 25 °C.

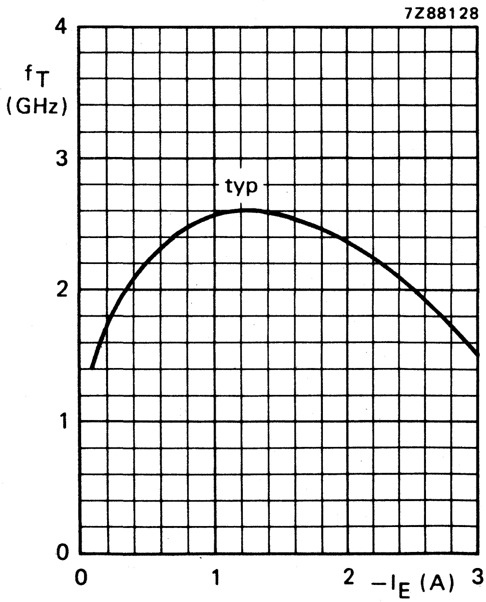


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

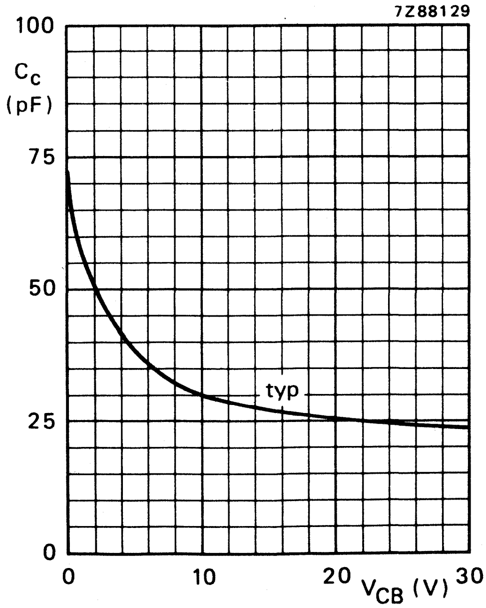


Fig. 8 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

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.

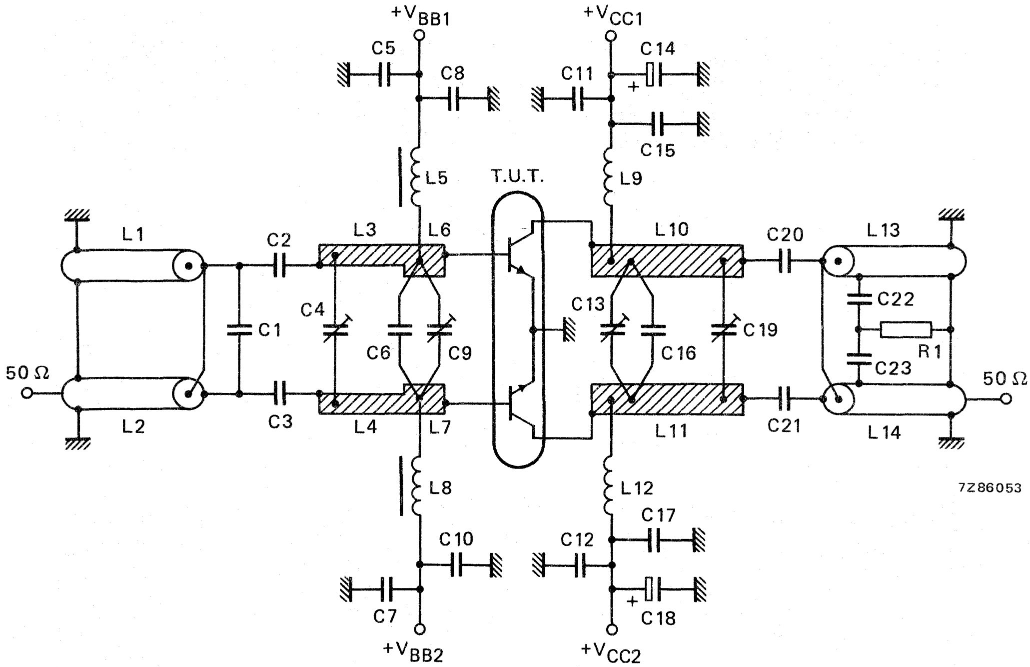


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

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

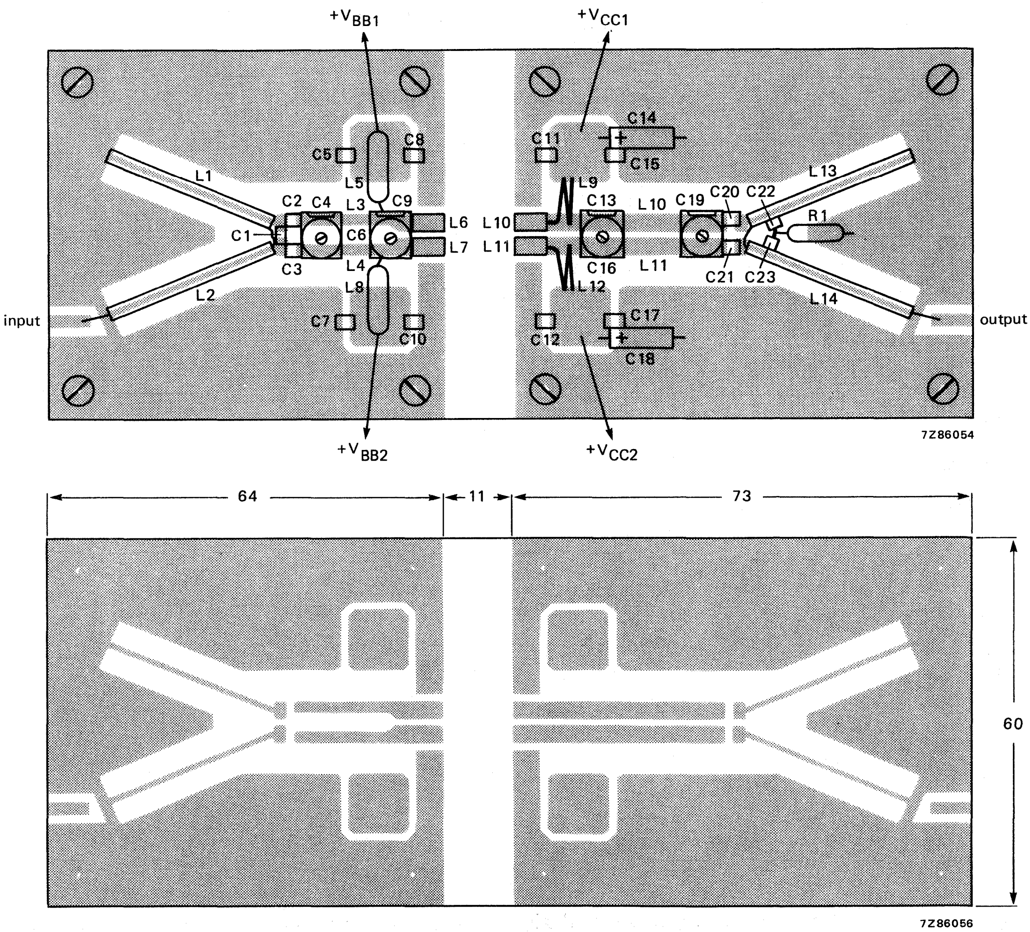


Fig. 10 Component layout and printed-circuit board for 860 MHz class-A test circuit.

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.

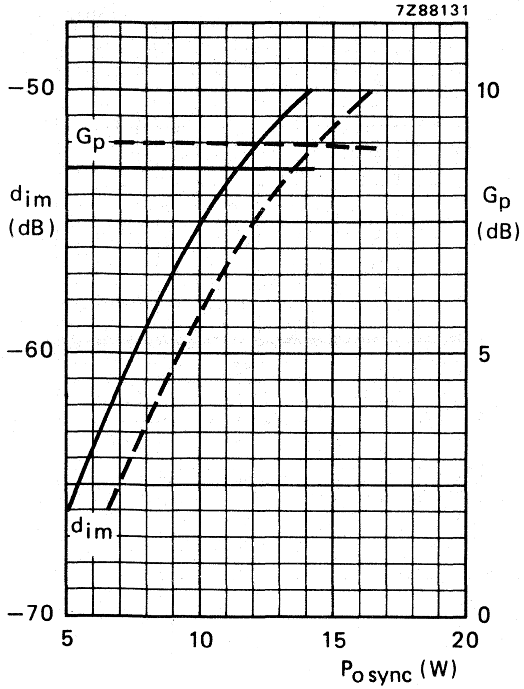


Fig. 11 Intermodulation distortion (d_{im})* and power gain as a function of output power.

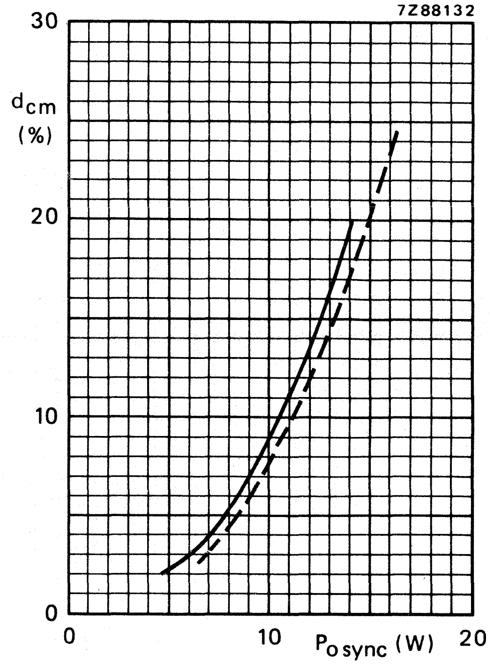


Fig. 12 Cross-modulation distortion (d_{cm})** as a function of output power.

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.

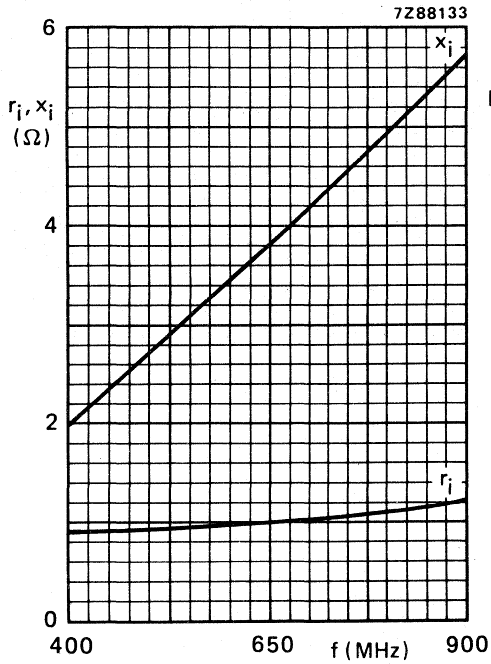


Fig. 13 Input impedance (series components).

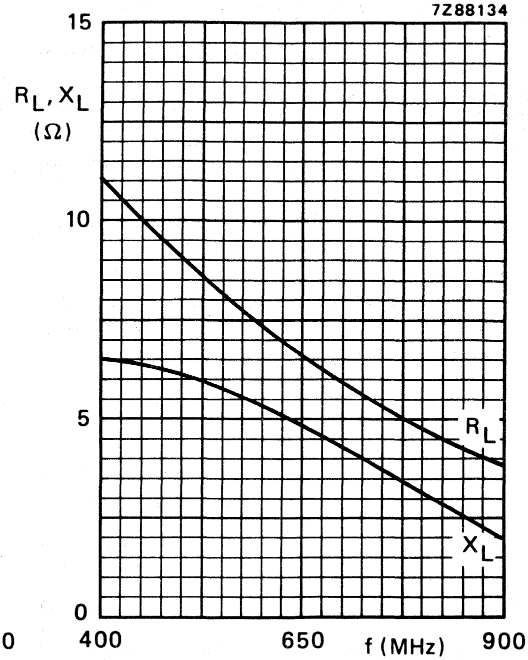


Fig. 14 Load impedance (series components).

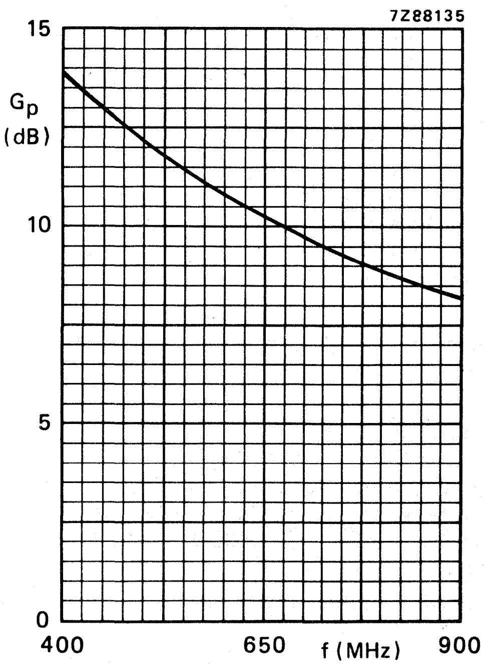


Fig. 15.

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.

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).

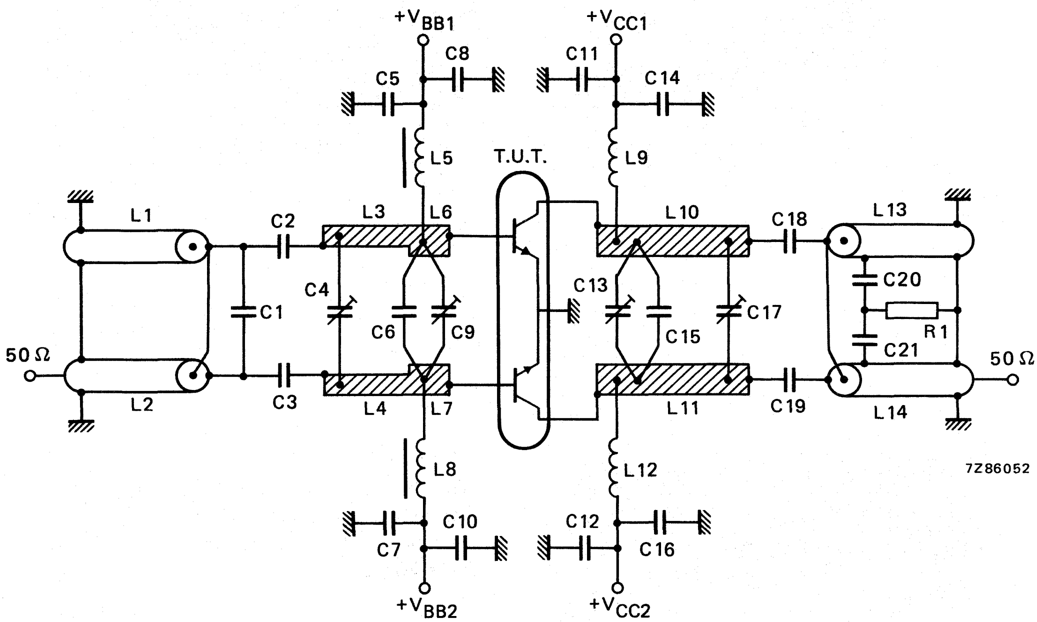


Fig. 16 Class-AB test circuit at f_{vision} = 860 MHz.

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.

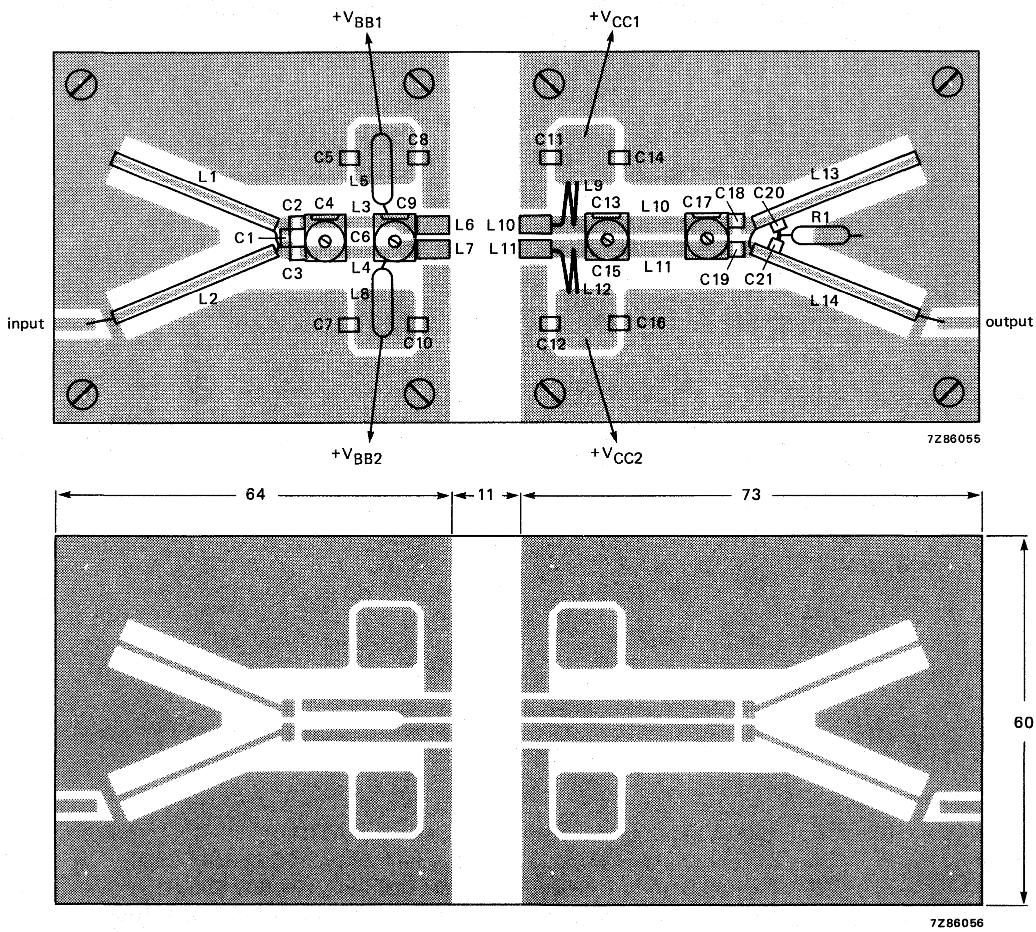


Fig. 17 Component layout and printed-circuit board for 860 MHz class-AB test circuit.

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.

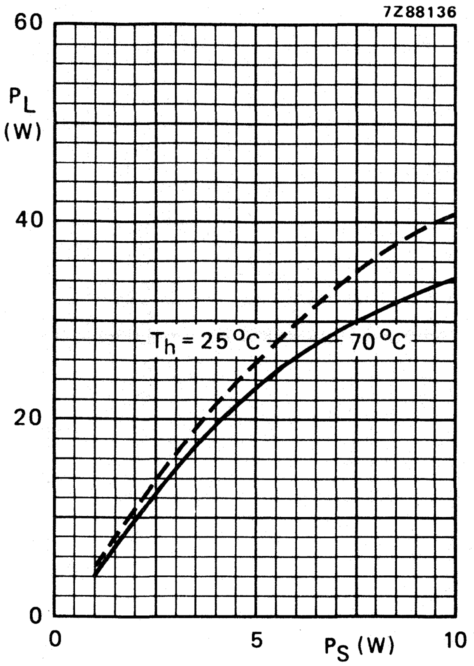


Fig. 18 Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 2 x 0,1 A; f_{vision} = 860 MHz.

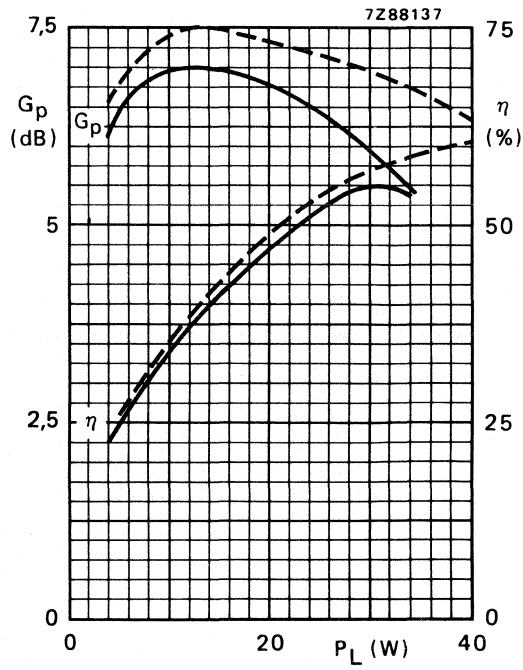


Fig. 19 Typical values; V_{CE} = 25 V; $I_{C(ZS)}$ = 2 x 0,1 A; – – – T_h = 25 °C; ——— T_h = 70 °C; f_{vision} = 860 MHz.

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; $R_{th\ mb\text{-}h}$ = 0,25 K/W.

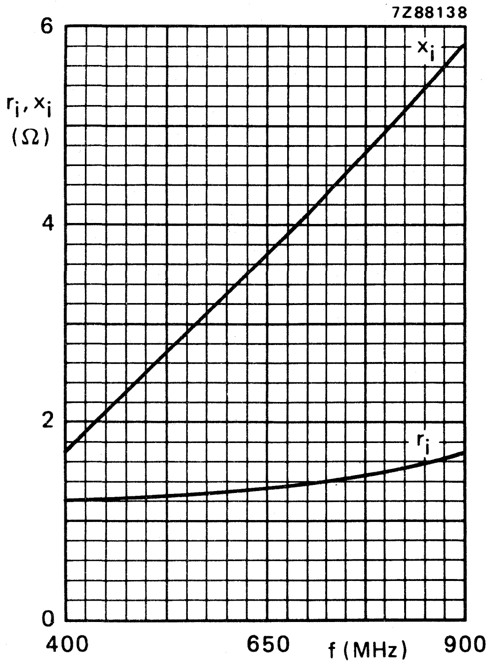


Fig. 20 Input impedance (series components).

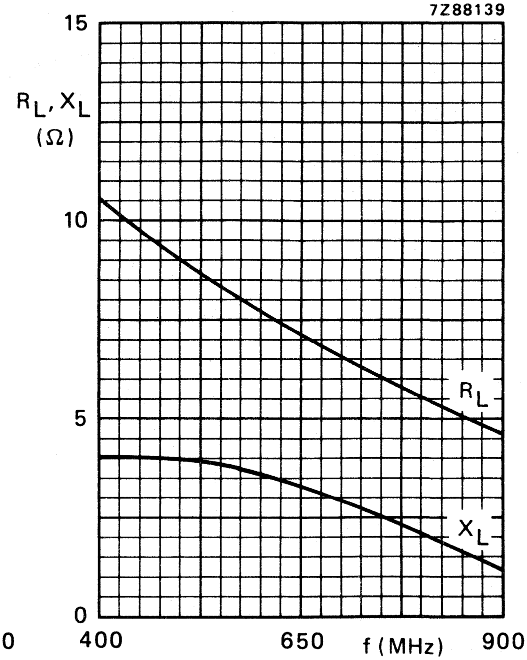


Fig. 21 Load impedance (series components).

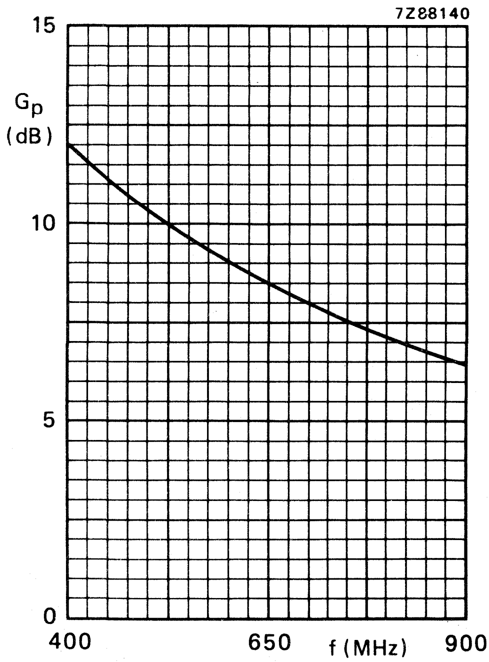


Fig. 22.

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.

UHF linear push-pull power transistor

BLV58

FEATURES

- High power gain
- Double stage internal input matching for high input impedance
- Diffused emitter-ballasting resistors enhances ruggedness
- Gold metallization for high reliability.

DESCRIPTION

The BLV58 is a common emitter epitaxial npn silicon planar transistor designed for high linearity class-A operation in UHF (bands 4 and 5) TV transmitters and transposers.

The device is incorporated in a push-pull SOT289 flange envelope with a ceramic cap, which is utilized with the emitters connected to the flange.

PINNING - SOT289

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f_{vision} (MHz)	V_{CE} (V)	I_{CQ} (A)	$P_{o\ sync}$ (W)	G_p (dB)	d_{im} (dB) (note 1)
c.w. class-A	860	25	2 x 1.6	25	> 10	< −45

Note

1. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB); zero dB corresponds to peak sync level.

PIN CONFIGURATION

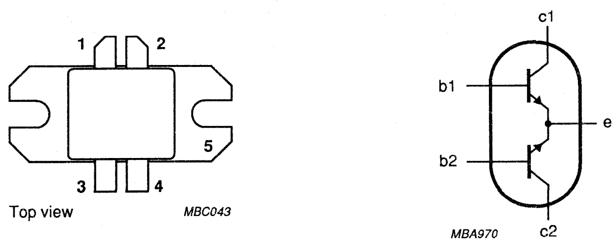


Fig.1 Simplified outline and symbol.

WARNING

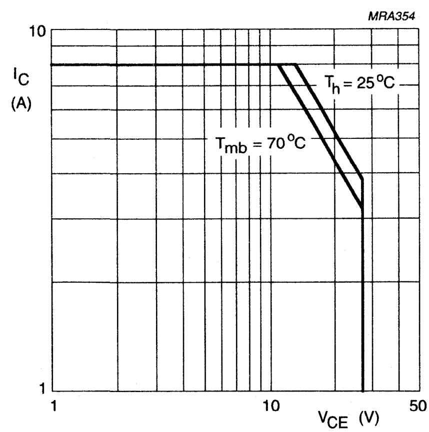
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO discs are not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES (per transistor section unless otherwise specified)
In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	4	A
I_{CM}	collector current	peak value; f > 1 MHz	–	8	A
P_{tot}	total power dissipation	DC operation; T_{mb} = 70 °C (note 1)	–	87	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

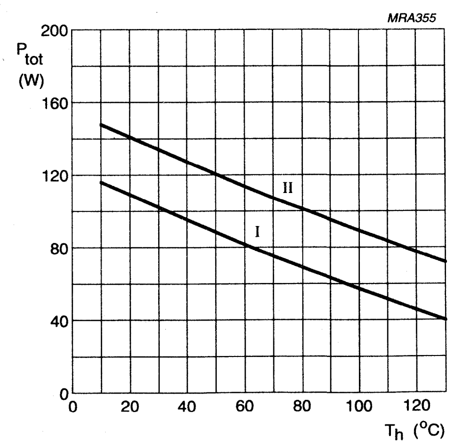
Note

1. Total device, both sections equally loaded.



Total device, both sections equally loaded.

Fig.2 DC SOAR.



(I) Continuous DC operation.
(II) Short time operation during mismatch.
Total device, both sections equally loaded.

Fig.3 Power derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(DC)}$	from junction to mounting base	P_{dis} = 87 W; T_{mb} = 70 °C (note 1)	1.5	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	note 1	0.2	K/W

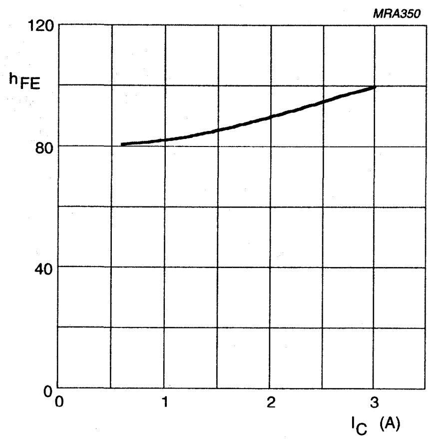
Note

1. Total device, both sections equally loaded.

CHARACTERISTICS

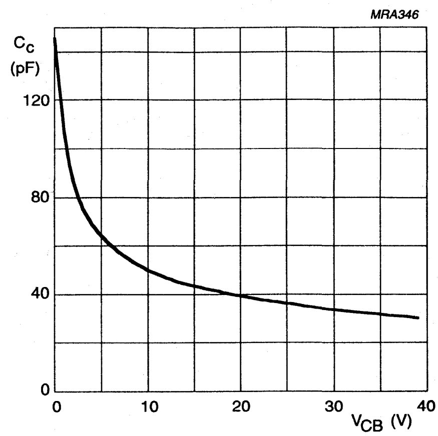
Values apply to either transistor section; T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 mA	3.5	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 27 V	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 1.6 A	30	–	–	
C_c	collector capacitance	V_{CB} = 25 V; $I_E = I_e$ = 0; f = 1 MHz	–	36	45	pF



V_{CE} = 25 V.

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



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

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

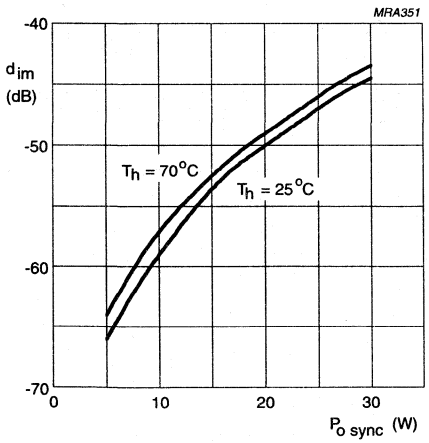
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter push-pull test circuit; $R_{th\ mb\text{-}h}$ = 0.2 K/W.

MODE OF OPERATION	f_{vision} (MHz)	V_{CE} (V)	I_{CQ} (A)	$P_{o\ sync}$ (W)	G_p (dB)	d_{im} (dB) (note 1)	d_{cm} (%) (note 2)
c.w. class-A	860	25	2 x 1.6	25	> 10 typ. 11.5	< –45 typ. –47	< 20

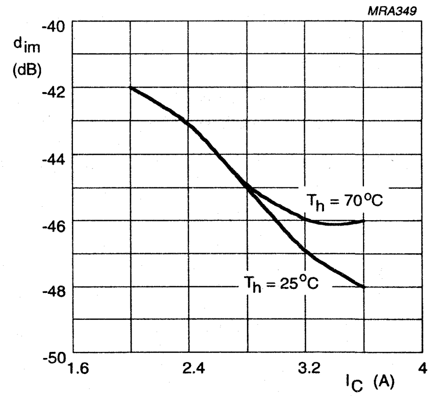
Notes

1. Three-tone test method: vision carrier –8 dB (860 MHz), sound carrier –7 dB (865.5 MHz), sideband signal –16 dB (861 MHz); zero dB corresponds to peak sync level.
2. Two-tone test method: vision carrier 0 dB (860 MHz), sound carrier –7 dB (865.5 MHz); zero dB corresponds to peak sync level. Cross-modulation distortion (d_{cm}) is the voltage variation (%) of the sound carrier when the vision carrier is switched from 0 dB to –20 dB.



Class-A operation; V_{CE} = 25 V; f = 860 MHz; 3-tone test (–8 dB, –16 dB, –7 dB); I_{CQ} = 2 x 1.6 A.

Fig.6 Intermodulation distortion as a function of output power.



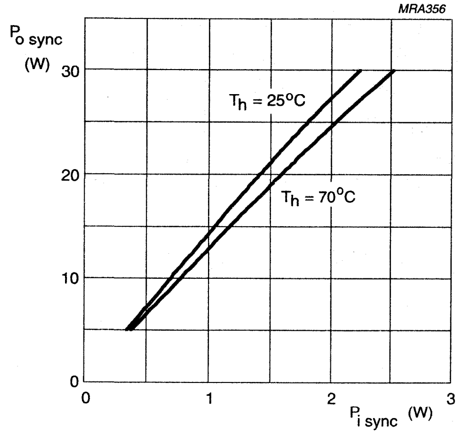
Class-A operation; V_{CE} = 25 V; f = 860 MHz; 3-tone test (–8 dB, –16 dB, –7 dB); $P_{o\ sync}$ = 25 W.

Fig.7 Intermodulation distortion as a function of collector current.

Ruggedness in class-A operation

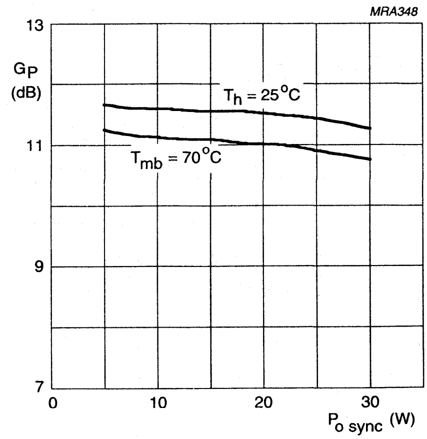
The BLV58 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{CE} = 25 V, f = 860 MHz, T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 0.2 K/W, I_{CQ} = 2 x 1.6 A, and rated output power.



Class-A operation; V_{CE} = 25 V; f = 860 MHz; 3-tone test (−8 dB, −16 dB, −7 dB); I_{CQ} = 2 x 1.6 A.

Fig.8 Output power as a function of input power.



Class-A operation; V_{CE} = 25 V; f = 860 MHz; 3-tone test (−8 dB, −16 dB, −7 dB); I_{CQ} = 2 x 1.6 A.

Fig.9 Gain as a function of output power, typical values.

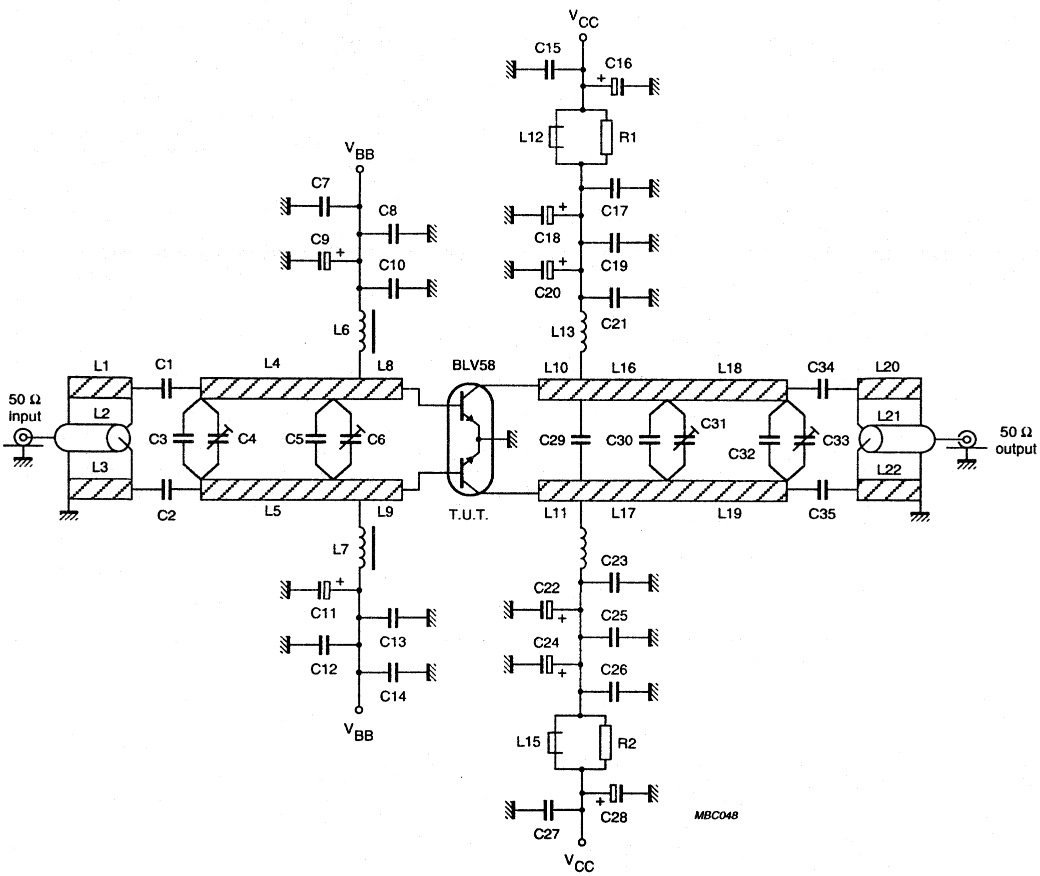


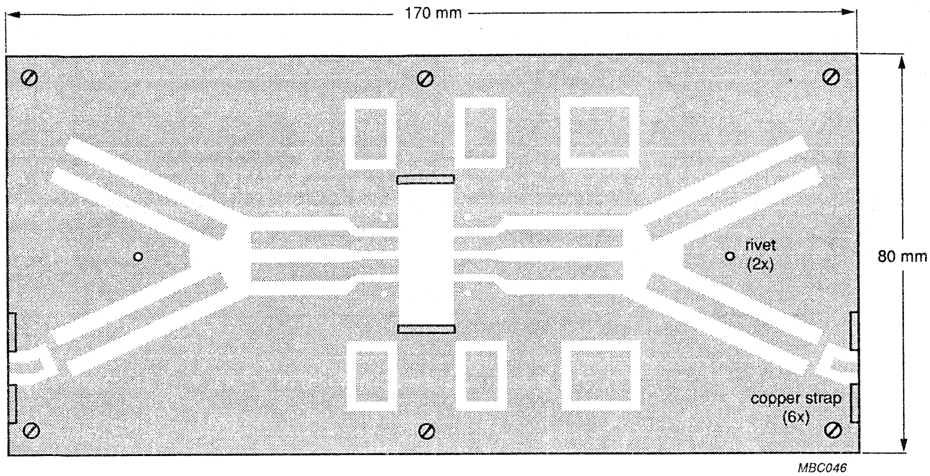
Fig.10 Class-A test circuit at f = 860 MHz.

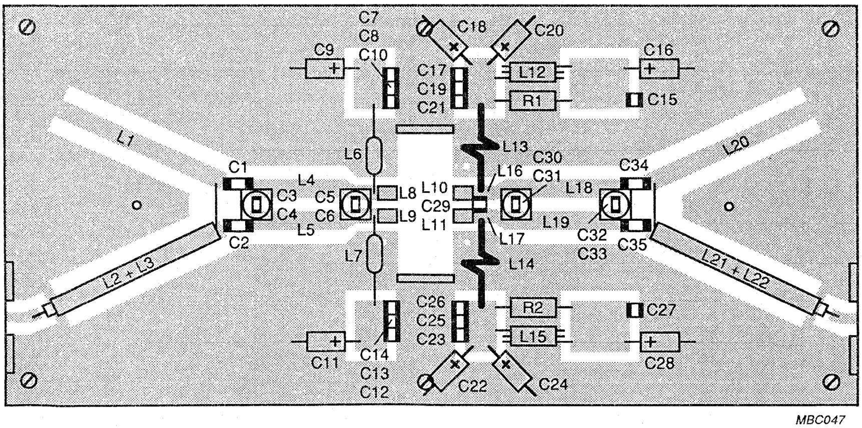
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C34, C35	multilayer ceramic chip capacitor (note 1)	15 pF		
C3	multilayer ceramic chip capacitor (note 1)	3.9 pF		
C4, C6	film dielectric trimmer	5.5 pF		2222 809 09005
C5	multilayer ceramic chip capacitor (note 1)	7.5 pF		
C7, C12, C17, C26	multilayer ceramic chip capacitor	10 nF		2222 852 47103
C8, C14, C19, C25	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C9, C11, C16, C20, C22, C28	63 V electrolytic capacitor	10 μF		
C10, C13, C15, C21, C23, C27	multilayer ceramic chip capacitor (note 1)	330 pF		
C18, C24	63 V electrolytic capacitor	1 μF		
C29	multilayer ceramic chip capacitor (note 1)	12 pF		
C30	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C31, C33	film dielectric trimmer	3.5 pF		2222 809 05001
C32	multilayer ceramic chip capacitor (note 1)	2.7 pF		
L1, L3, L20, L22	stripline (note 2)	35 Ω	39 mm x 4 mm	
L2, L21	semi-rigid cable (note 3)	50 Ω	ext. dia. 3.6 mm; length 39 mm	
L4, L5	stripline (note 2)	38 Ω	19 mm x 3.5 mm	
L6, L7	RF choke	470 nH		
L8, L9	stripline (note 2)	38 Ω	7.5 mm x 3.5 mm	
L10, L11	stripline (note 2)	38 Ω	4.5 mm x 3.5 mm	
L12, L15	grade 3B RF choke			4312 020 36642
L13, L14	1 turn 1.5 mm copper wire	14 nH	int. dia 7 mm; leads 2 x 6 mm	
L16, L17	stripline (note 2)	38 Ω	7 mm x 3.5 mm	
L18, L19	stripline (note 2)	38 Ω	18 mm x 3.5 mm	
R1, R2	1 W metal film resistor	10 Ω		

Notes

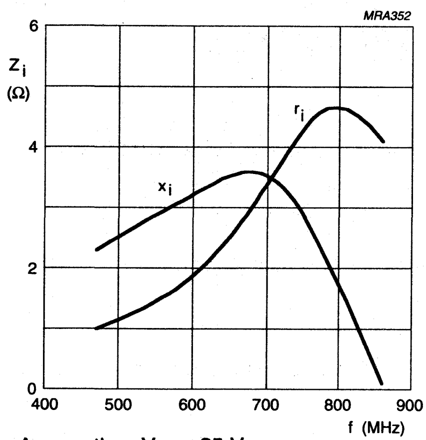
1. American Technical Ceramics type 100B or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric ($\varepsilon_r = 2.2$), thickness 1⁄32 inch, thickness of copper sheet 2 x 35 μm.
3. Cables L2 and L21 are soldered to striplines L1 and L20, respectively.





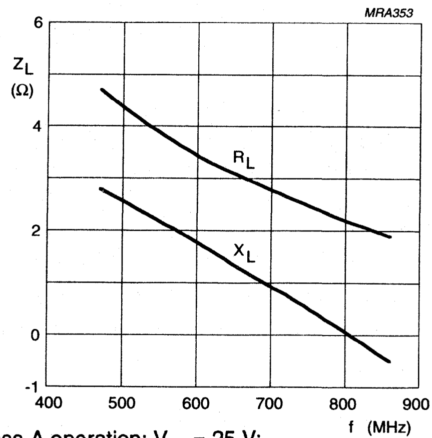
The components are mounted on one side of a copper clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by hollow rivets and copper straps.

Fig.11 Component layout for 860 MHz class-A test circuit.



Class-A operation; V_{CE} = 25 V;
I_{CQ} = 1.6 A (per section); P_L = 25 W (total device);
T_h = 25 °C.

Fig.12 Input impedance per section (series components) as a function of frequency, typical values.



Class-A operation; V_{CE} = 25 V;
I_{CQ} = 1.6 A (per section); P_L = 25 W (total device);
T_h = 25 °C.

Fig.13 Load impedance per section (series components) as a function of frequency, typical values.

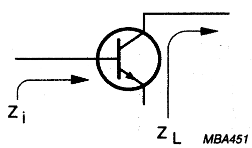
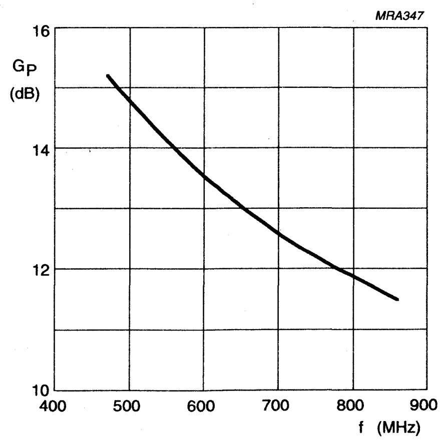


Fig.14 Definition of transistor impedance.



Class-A operation; V_{CE} = 25 V;
I_{CQ} = 1.6 A (per section); P_L = 25 W (total device);
T_h = 25 °C.

Fig.15 Power gain as a function of frequency, typical values.

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

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.

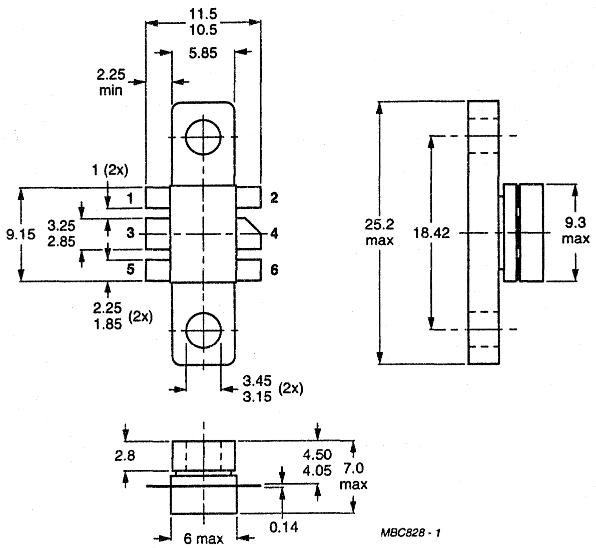
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:

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

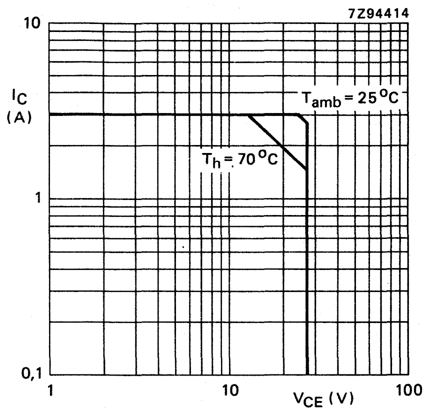


Fig. 2 D.C. SOAR; $R_{th\ mb\text{-}h}$ = 0,4 K/W.

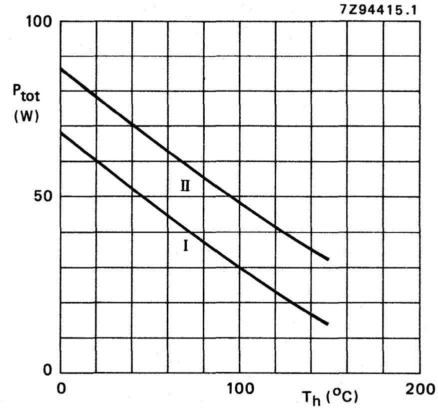


Fig. 3 Power/temperature derating curves versus heatsink temperature.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch (f > 1 MHz)

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

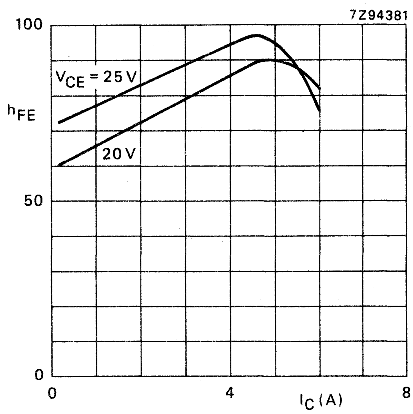


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

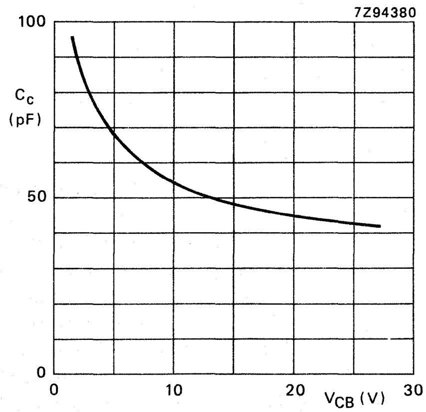


Fig. 5 Output capacitance versus V_{CB}; I_E = i_e = 0; f = 1 MHz.

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).

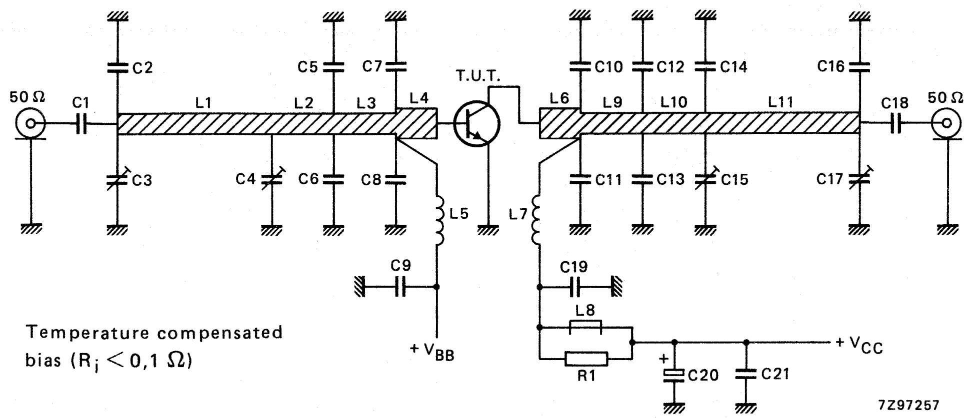


Fig. 6 Class-AB test circuit at f = 860 MHz.

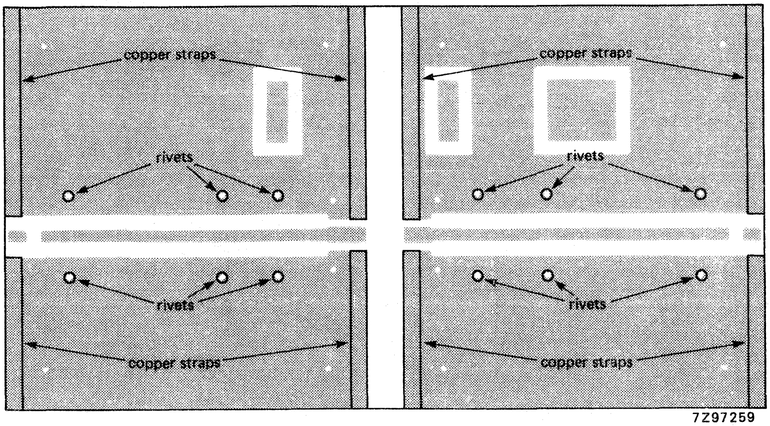
List of components:

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.



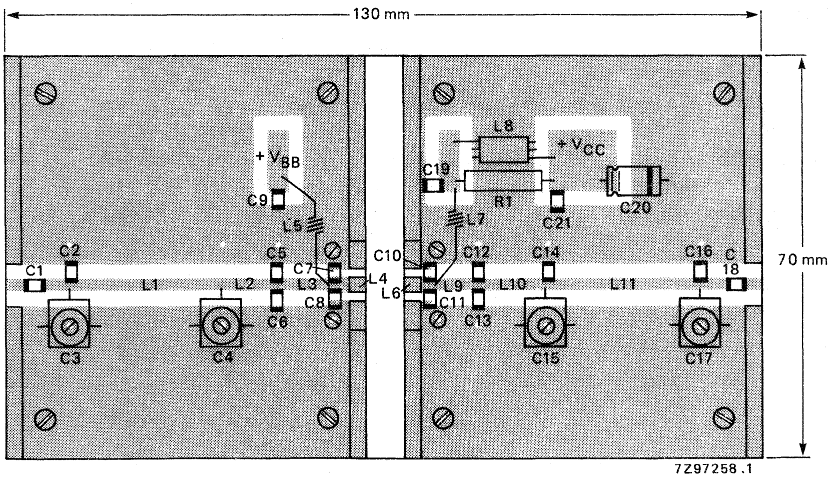


Fig. 7 Printed circuit board and component layout for 860 MHz class-AB test circuit.

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.

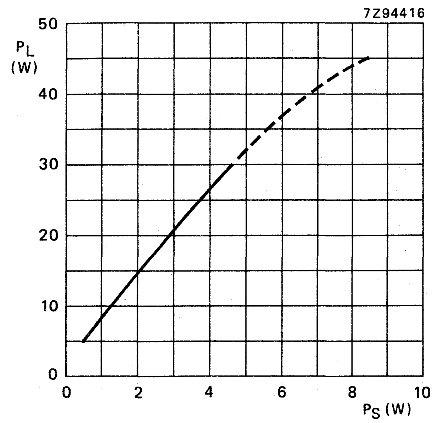


Fig. 8 Load power versus source power.

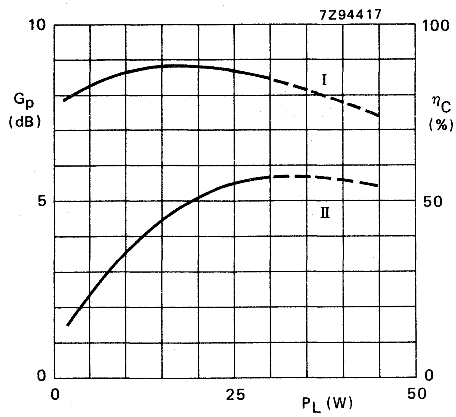


Fig. 9 Power gain (I) and efficiency versus load power (II).

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).

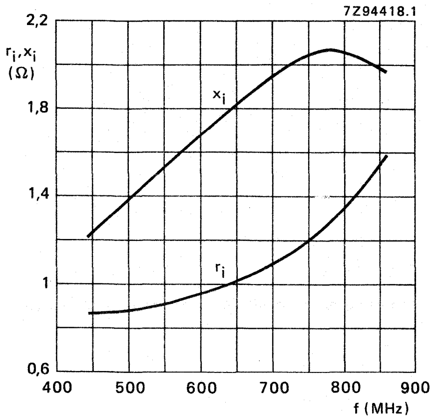


Fig. 10 Input impedance (series components).

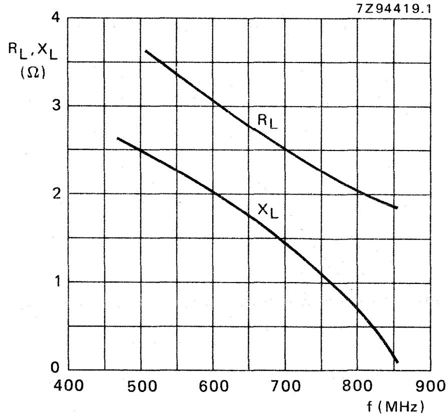


Fig. 11 Load impedance (series components).

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 ^oC;
$R_{th\ mb\text{-}h}$ = 0,4 K/W; $I_{C(ZS)}$ = 60 mA; class-AB operation.

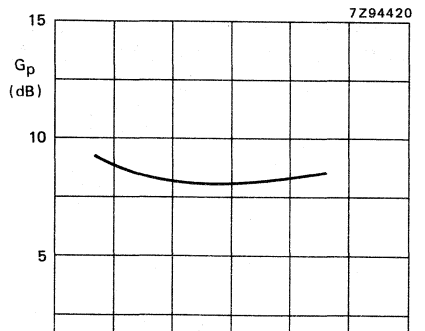


Fig. 12 Power gain versus frequency.

UHF linear push-pull power transistor

BLV62

FEATURES

- Internal matching for an optimum wideband capability and high gain
- Poly-silicon emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

Two npn silicon planar epitaxial sections in push-pull structure, intended for use in linear television transmitters (vision or sound).

The device is encapsulated in a 4-lead SOT262A2 flange envelope with 2 ceramic caps. The common emitter is connected to the flange.

PINNING - SOT262A2

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	ΔG_p (dB) (note 1)
c.w. class-AB	860	28	150	> 8.5 typ. 9.5	> 45 typ. 50	< 1 typ. 0.5

Note

1. 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).

PIN CONFIGURATION

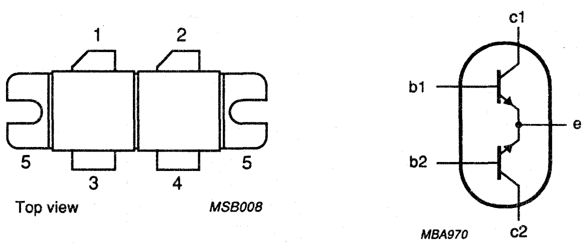


Fig.1 Simplified outline and symbol.

WARNING

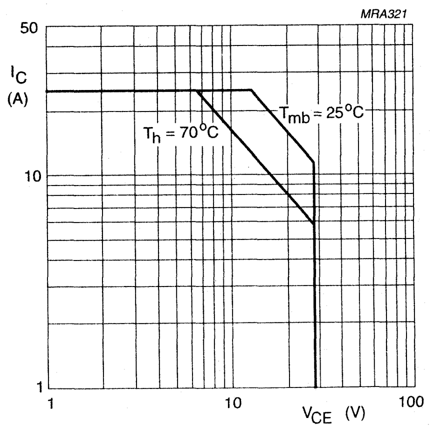
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO discs are not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES (per transistor section unless otherwise specified)
In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	28	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	12.5	A
P_{tot}	total power dissipation	DC operation; T_{mb} = 25 °C (note 1)	–	320	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

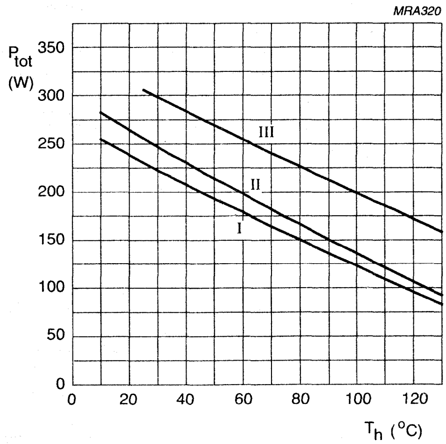
Note

1. Total device, both sections equally loaded.



Total device, both sections equally loaded.

Fig.2 DC SOAR.



Total device, both sections equally loaded.
(I) Continuous DC operation.
(II) Continuous RF operation.
(III) Short time operation during mismatch.

Fig.3 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(DC)}$	from junction to mounting base	P_{tot} = 320 W; T_{mb} = 25 °C (note 1)	0.55	K/W
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 350 W; T_{mb} = 25 °C (note 1)	0.5	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	(note 1)	0.15	K/W

Note

1. Total device, both sections equally loaded.

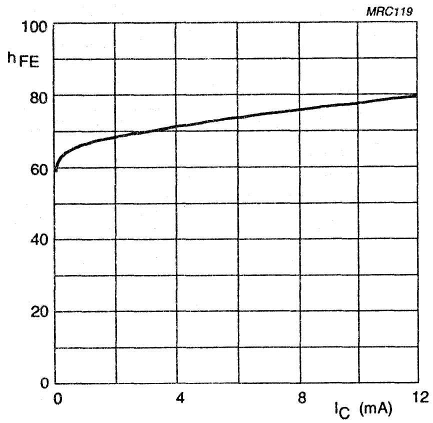
CHARACTERISTICS

Values apply to either transistor section; T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 60 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 150 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	30	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 4.5 A	30	–	–	
Δh_{FE}	DC current gain ratio of both sections	V_{CE} = 25 V; I_C = 4.5 A	0.67	–	1.5	
C_c	collector capacitance	V_{CB} = 28 V; $I_E = I_e$ = 0; f = 1 MHz	–	81	–	pF
$C_{c\text{-}f}$	collector-flange capacitance	f = 1 MHz	–	5.7	–	pF

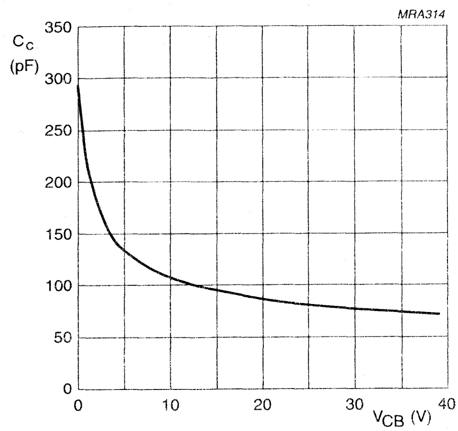
UHF linear push-pull power transistor

BLV62



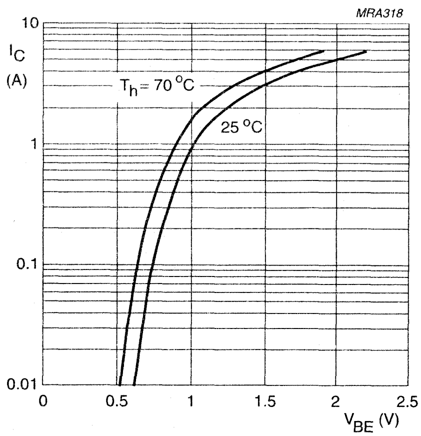
V_{CE} = 25 V.

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



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

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



V_{CE} = 25 V.

Fig.6 Collector current as a function of base-emitter voltage, typical values.

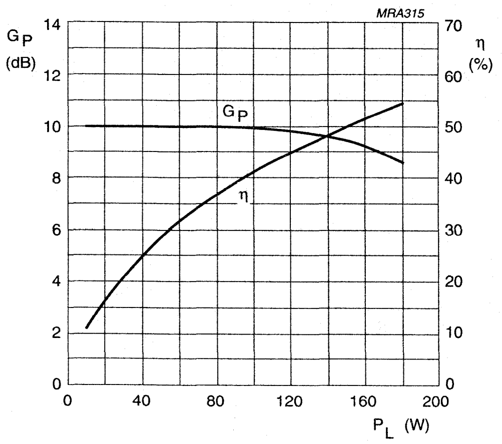
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_c (%)	ΔG_p (dB) (note 1)
c.w. class-AB	860	28	2 x 400	150	> 8.5 typ. 9.5	> 45 typ. 50	< 1 typ. 0.5

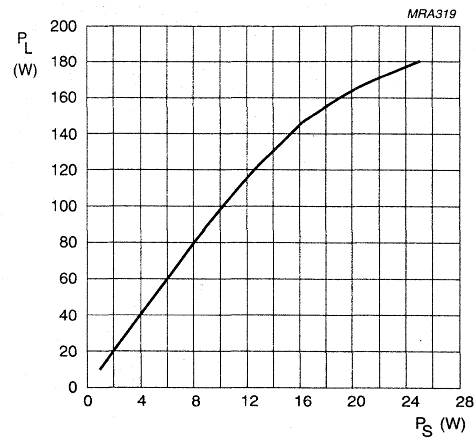
Note

1. 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).



Class-AB operation; V_{CE} = 28 V; f = 860 MHz; I_{CQ} = 2 x 0.4 A; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

Fig.7 Gain and efficiency as functions of load power, typical values.



Class-AB operation; V_{CE} = 28 V; f = 860 MHz; I_{CQ} = 2 x 0.4 A; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-AB operation

The BLV62 is capable of withstanding a load mismatch corresponding to VSWR = 2:1 through all phases under the following conditions:

V_{CE} = 28 V, f = 860 MHz, T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 0.15 K/W, and rated output power.

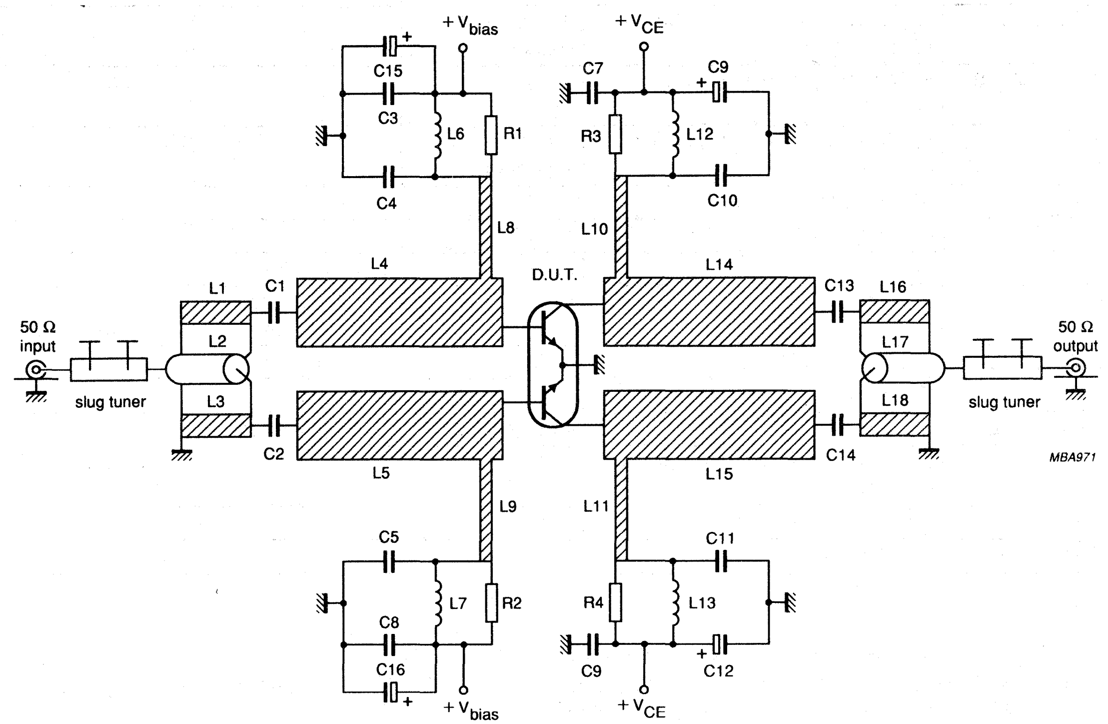


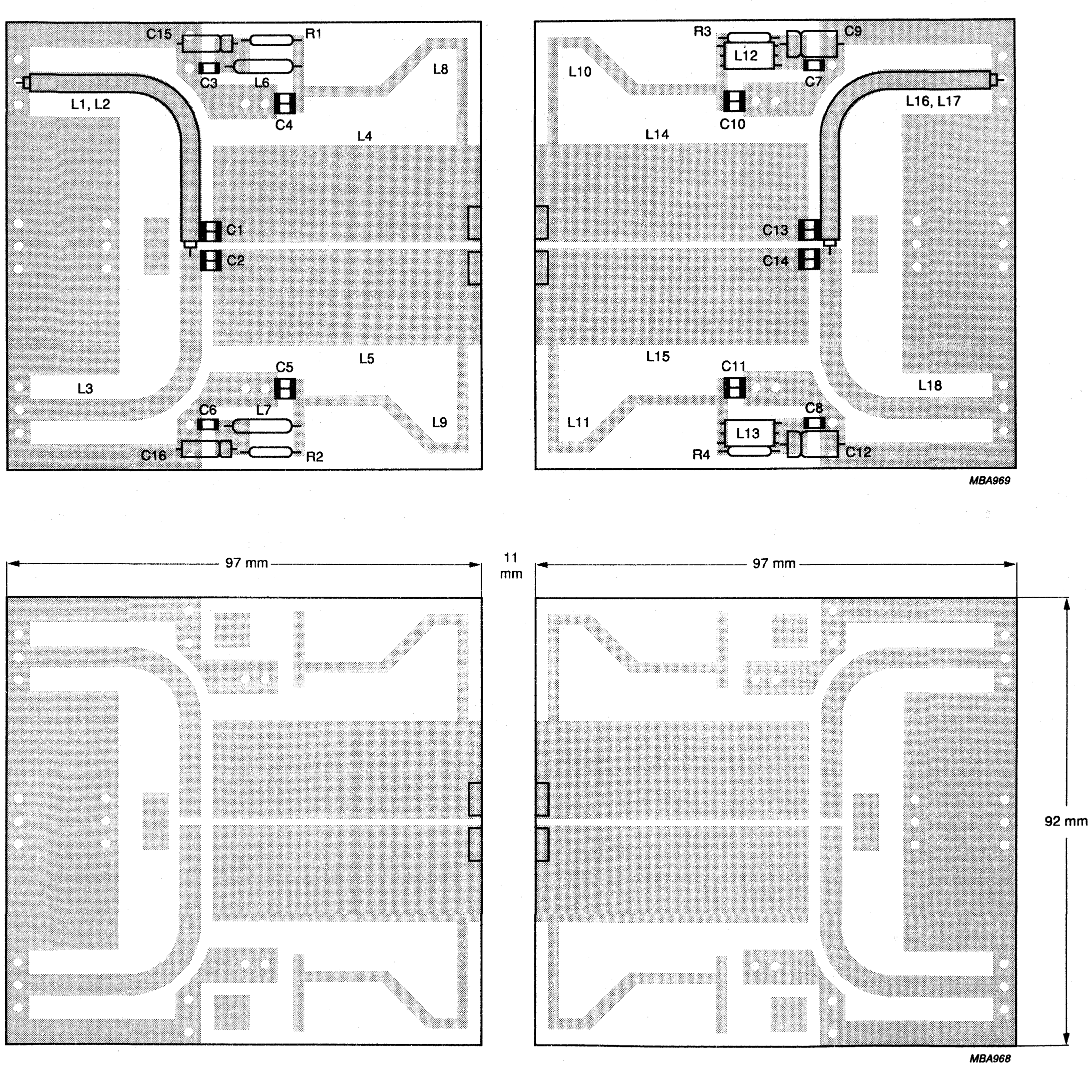
Fig.9 Class-AB test circuit at f = 860 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C13, C14	500 V multilayer ceramic chip capacitor (note 1)	2 x 100 pF in parallel		
C3, C6, C7, C8	50 V multilayer ceramic chip capacitor	100 nF		
C4, C5, C10, C11	500 V multilayer ceramic chip capacitor (note 1)	2 x 20 pF in parallel		
C9, C12	63 V electrolytic capacitor	10 µF		
C15, C16	63 V electrolytic capacitor	4.7 µF		
L1, L3, L16, L18	stripline (note 2)	29 Ω	59.6 mm x 5 mm	
L2, L17	semi-rigid cable (note 3)	50 Ω	ext. dia. 3.6 mm; length 59.6 mm	
L4, L5, L14, L15	stripline (note 2)	9.1 Ω	56 mm x 20 mm	
L6, L7	RF choke	2.2 µH		
L8, L9, L10, L11	stripline (note 2)	48.5 Ω	66 mm x 2.5 mm	
L12, L13	2 x 1 mm copper wires in parallel through bead			modified 4312 020 36640
R1, R2	0.4 W metal film resistor	10 Ω		
R3, R4	0.4 W metal film resistor	5.11 Ω		

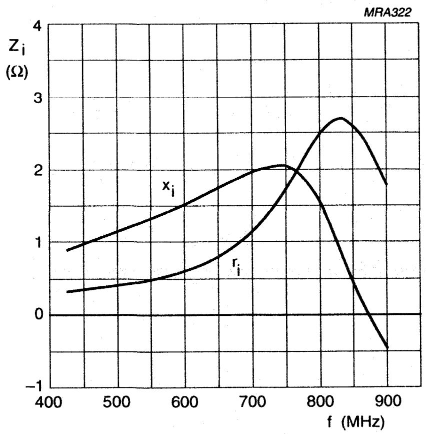
Notes

1. American Technical Ceramics type 100B or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric ($\varepsilon_r = 2.2$), thickness 1⁄32 inch, thickness of copper sheet 2 x 35 µm.
3. Cables L2 and L17 are soldered to striplines L1 and L16, respectively.



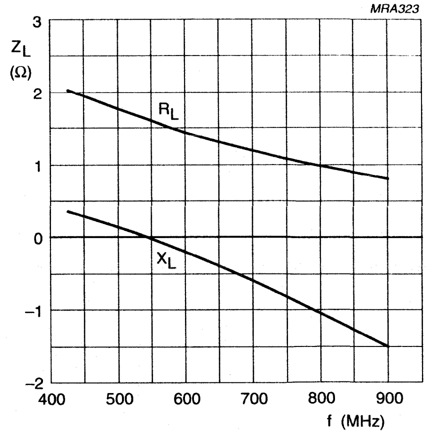
The components are mounted on one side of a copper clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization, which is indicated above by holes.

Fig.10 Component layout for 860 MHz class-AB test circuit.



Class-AB operation; V_{CE} = 28 V;
I_{CQ} = 400 mA (per section);
P_L = 150 W (total device).

Fig.11 Input impedance per section (series components) as a function of frequency, typical values.



Class-AB operation; V_{CE} = 28 V;
I_{CQ} = 400 mA (per section);
P_L = 150 W (total device).

Fig.12 Load impedance per section (series components) as a function of frequency, typical values.

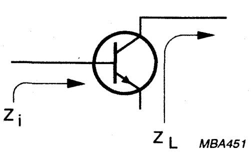
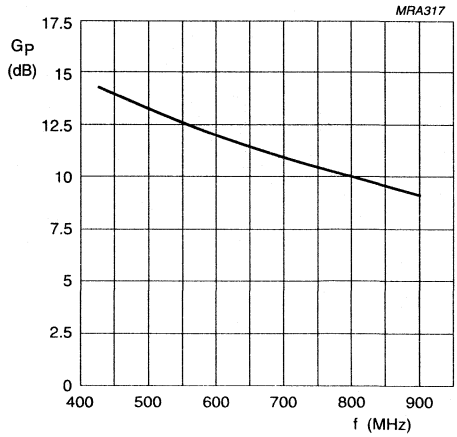


Fig.13 Definition of transistor impedance.



Class-AB operation; V_{CE} = 28 V;
I_{CQ} = 400 mA (per section);
P_L = 150 W (total device).

Fig.14 Power gain as a function of frequency, typical values.

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

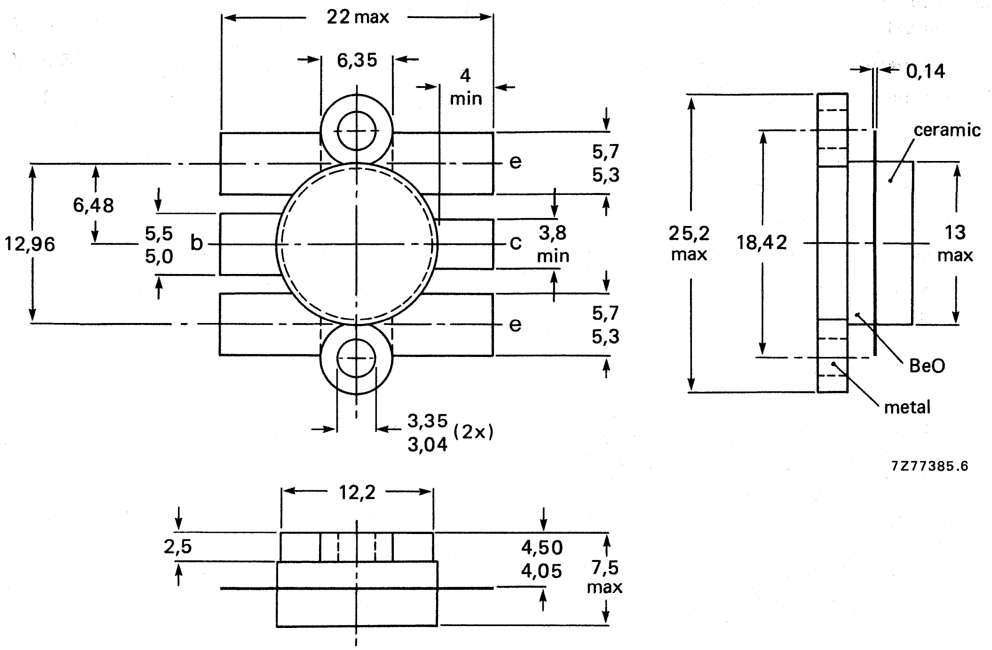
Fig. 1 SOT-119 (see Fig. 1)

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

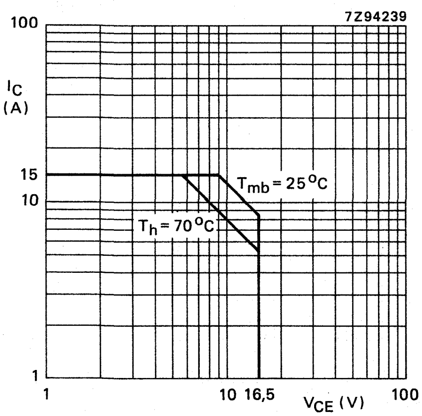


Fig. 2 D.C. soar.
$R_{th\ mb\text{-}h}$ = 0,2 K/W.

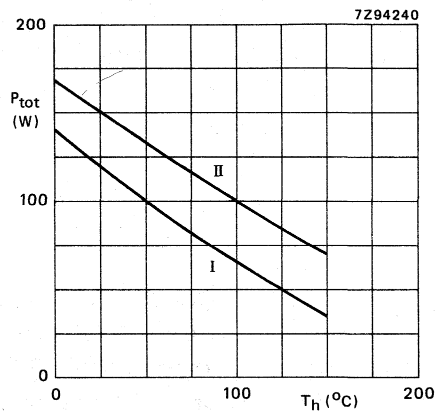


Fig. 3 Power/temperature derating curves; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz).

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

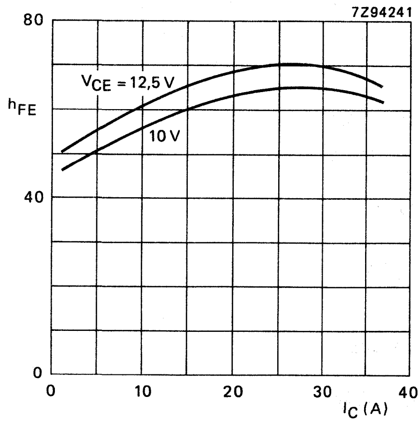


Fig. 4 D.C. current gain versus collector current; T_j = 25 °C.

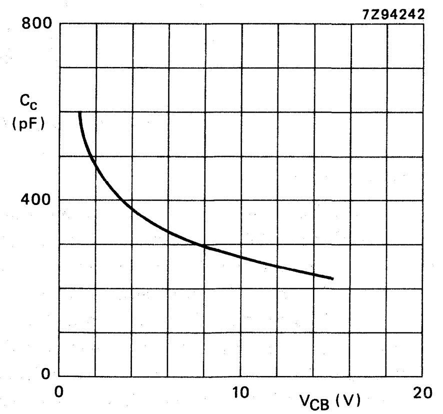


Fig. 5 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz; T_j = 25 °C.

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

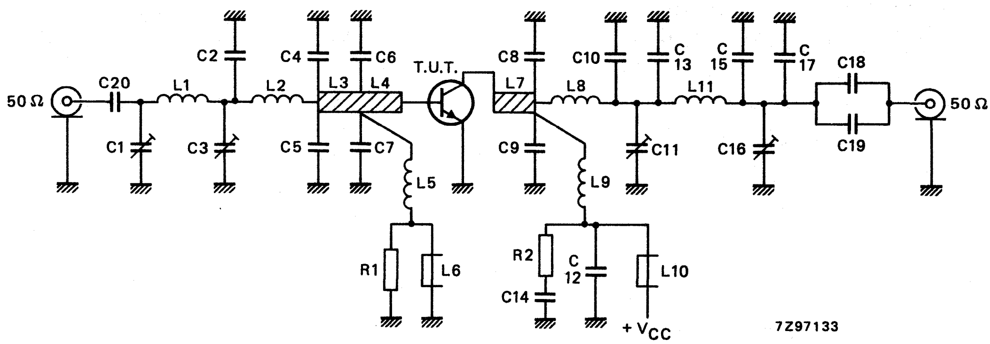


Fig. 6 Class-B test circuit at f = 175 MHz.

List of components:

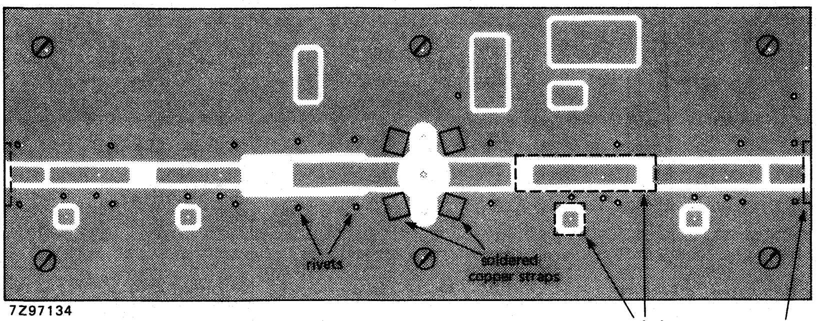
C1 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C2 = 10 pF multilayer ceramic chip capacitor*
C3 = C16 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C4 = C5 = 75 pF multilayer ceramic chip capacitor
C6 = C7 = 100 pF multilayer ceramic chip capacitor*
C8 = C9 = 2 x 75 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



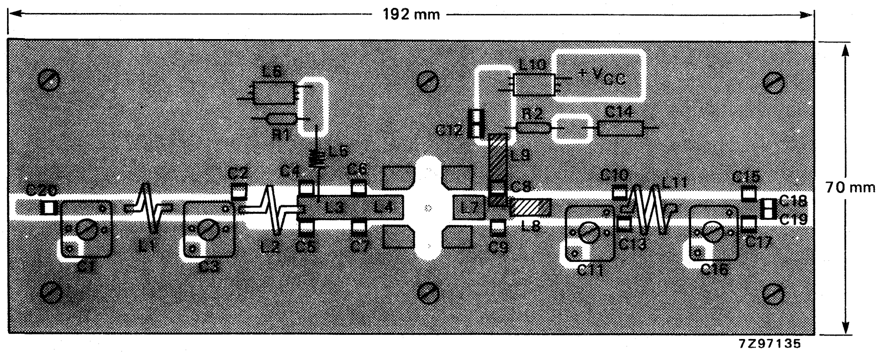


Fig. 7 Printed circuit board and component lay-out for 175 MHz class-B test circuit.

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.

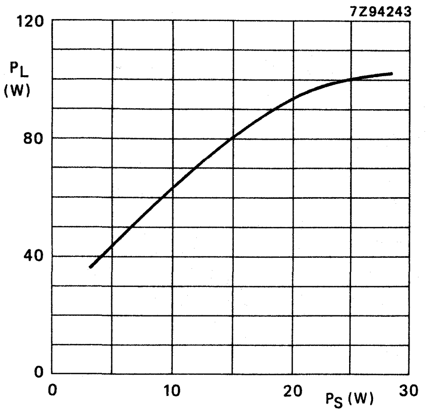


Fig. 8 Load power versus source power.

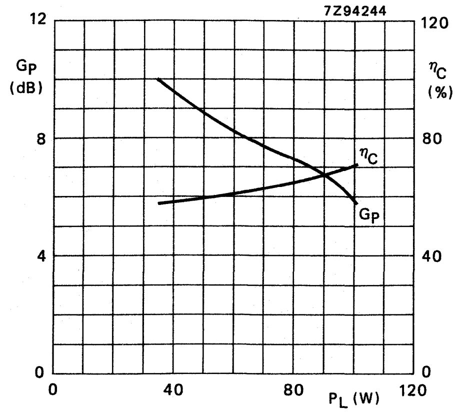


Fig. 9 Power gain and efficiency versus load power.

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).

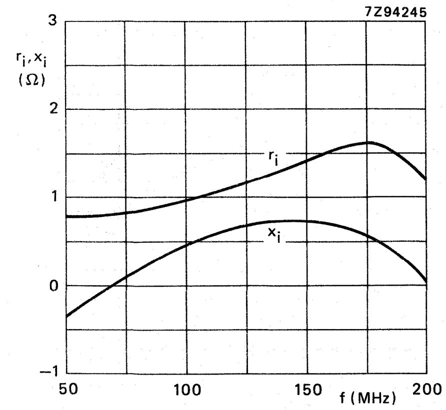


Fig. 10 Input impedance (series components).

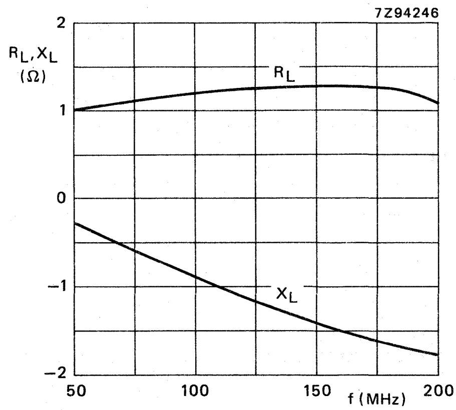


Fig. 11 Load impedance (series components).

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.

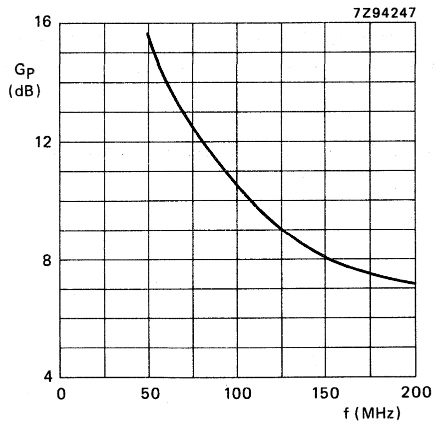


Fig. 12 Power gain versus frequency.

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

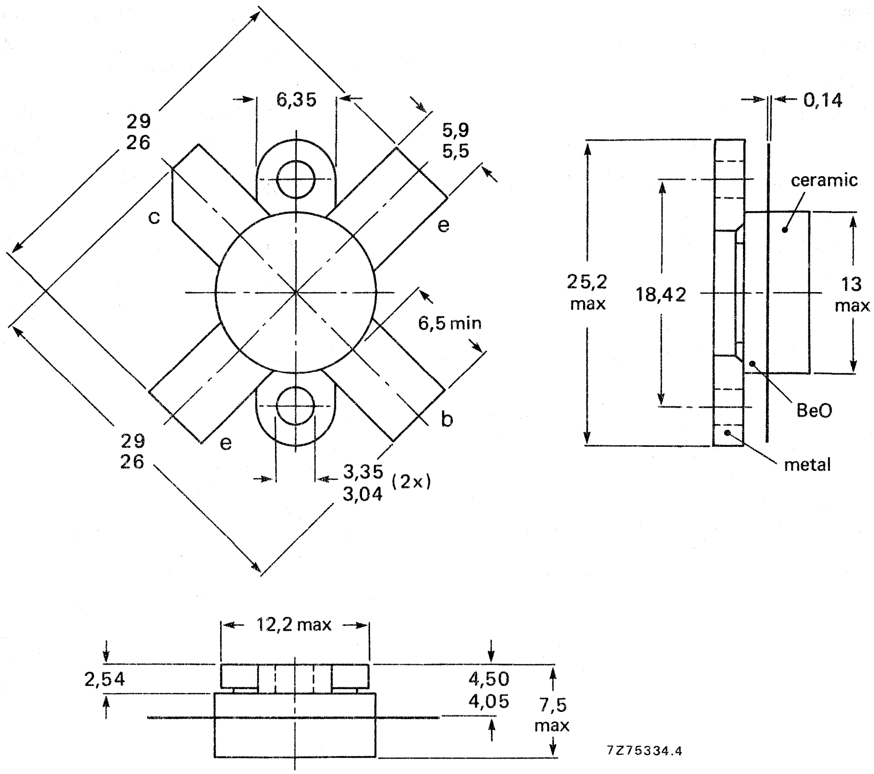
MECHANICAL DATA

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)

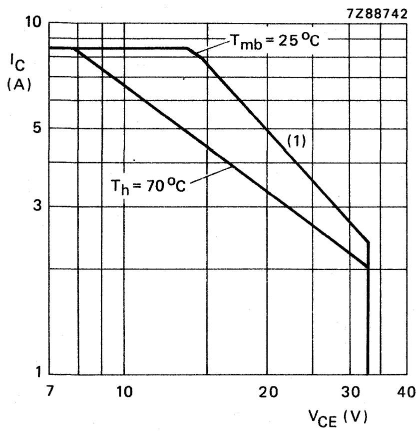
Recommended screw: cheese-head 4-40 UNC/2A

Heatsink compound must be 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.	8,5 A
(peak value); f > 1 MHz	I_{CM}	max.	17,5 A
Total power dissipation at T_{mb} = 25 °C	P_{tot}	max.	116 W
R.F. power dissipation			
f > 1 MHz; T_{mb} = 25 °C	P_{rf}	max.	144 W
f > 1 MHz; T_h = 70 °C	P_{rf}	max.	80 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.

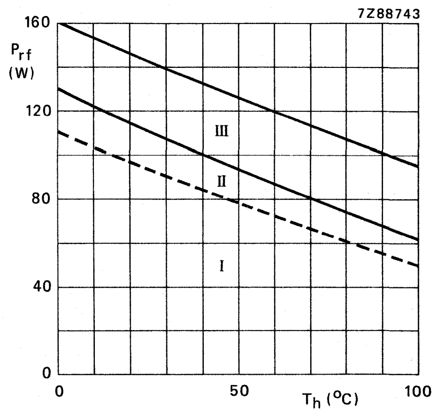


Fig. 3 Power derating curve vs. temperature.

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 °C, i.e. T_h = 33 °C)

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: $t_p > 300$ μs; $\delta < 0,02$.

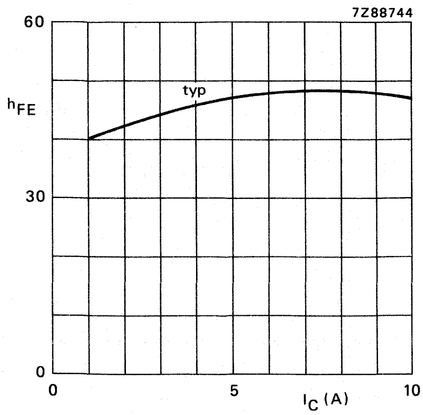


Fig. 4 V_{CE} = 25 V; T_j = 25 °C.

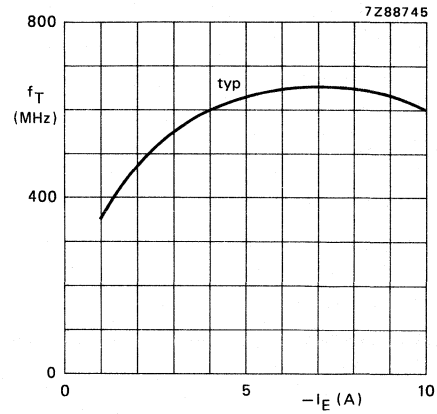


Fig. 5 V_{CB} = 25 V; f = 100 MHz; T_j = 25°C.

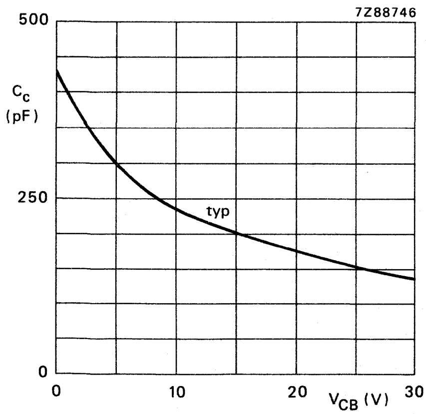


Fig. 6 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

APPLICATION INFORMATION

R.F. performance in 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

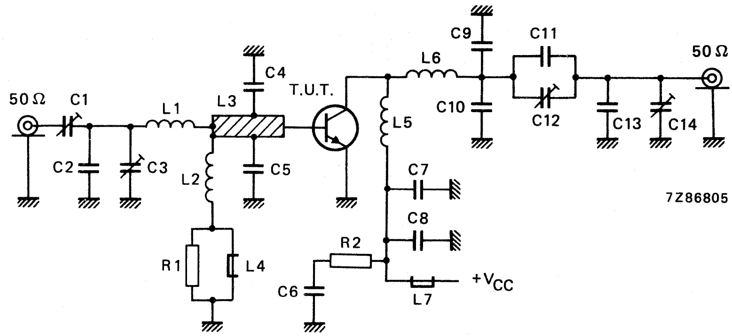


Fig. 7 Class-B test circuit at f = 175 MHz.

List of components:

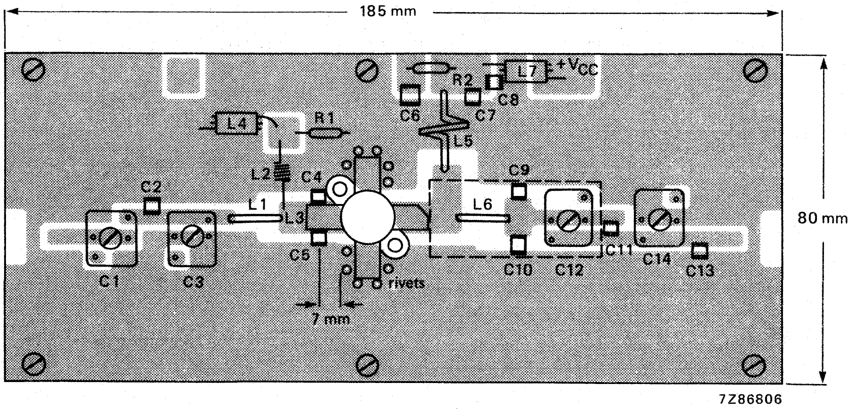
C1 = C12 = C14 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C2 = 30 pF (500 V) multilayer ceramic chip capacitor*
C3 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C4 = C5 = 56 pF (500 V) multilayer ceramic chip capacitor*
C6 = 100 nF (50 V) multilayer ceramic chip capacitor
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.



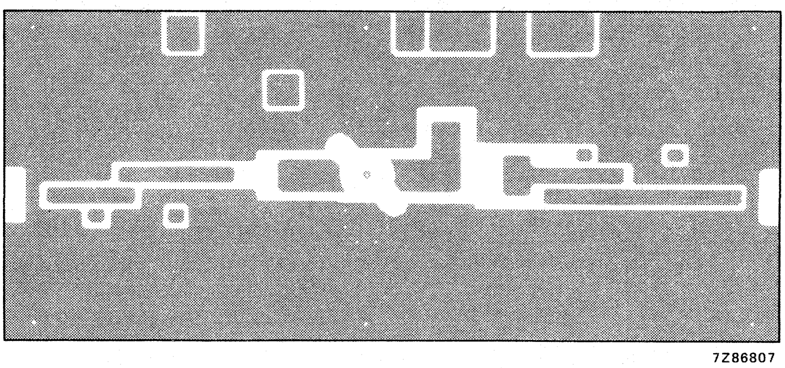


Fig. 8 Component layout and printed-circuit board for 175 MHz.

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.

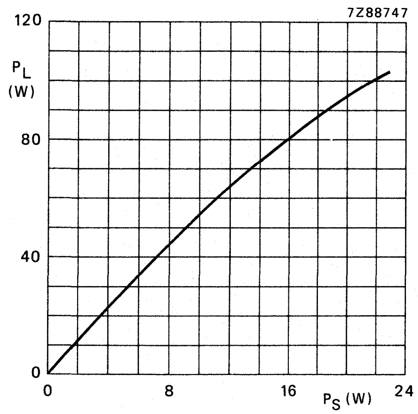


Fig. 9 Load power as a function of source power.

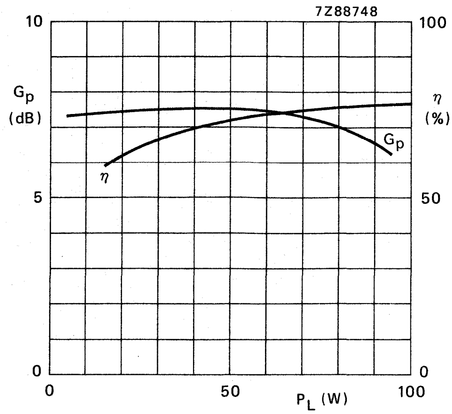


Fig. 10 Power gain and efficiency as a function of load power.

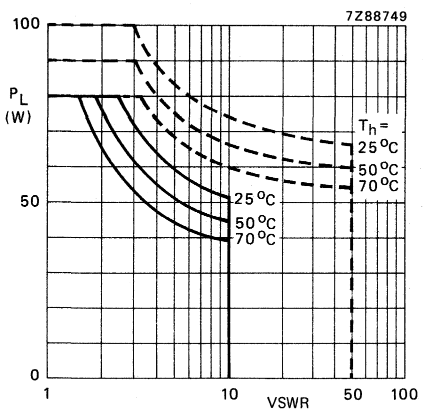


Fig. 11 R.F. SOAR at V_{CE} = 28 V.
——— f > 1 MHz (continuous);
- - - - short time operation during mismatch (f > 1 MHz).

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.

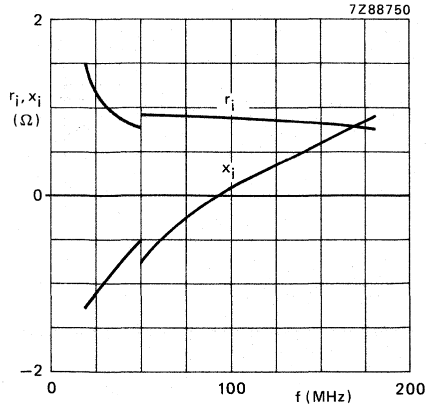


Fig. 12 Input impedance (series components).

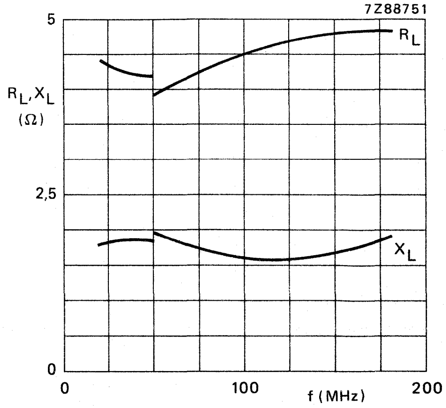


Fig. 13 Load impedance (series components).

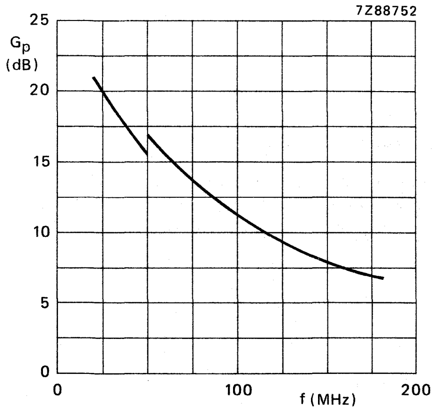


Fig. 14 Power gain as a function of frequency.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 80 W; T_h = 25 ^{o}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

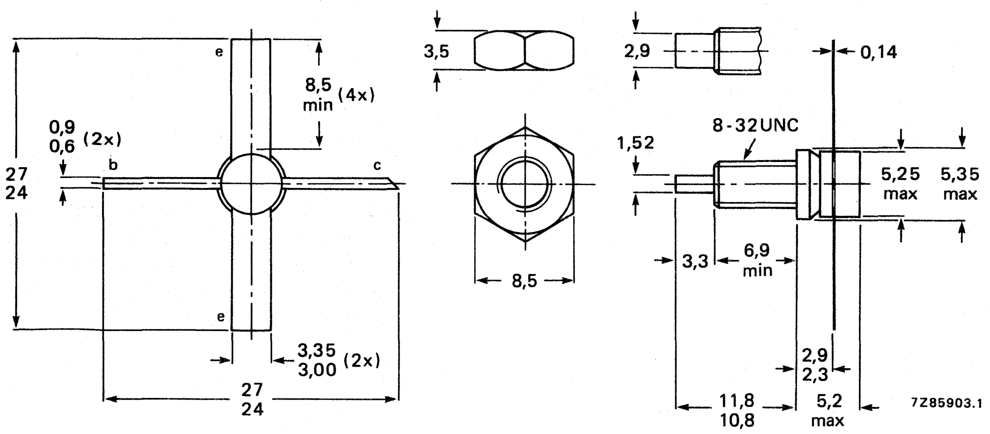
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

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; 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; $I_{C(AV)}$	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

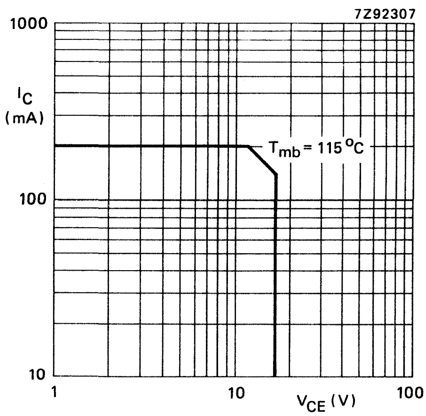


Fig. 2 D.C. SOAR.

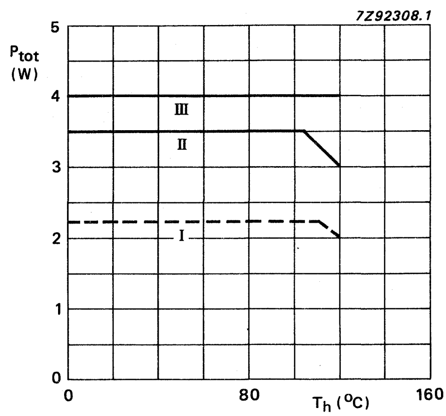


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

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

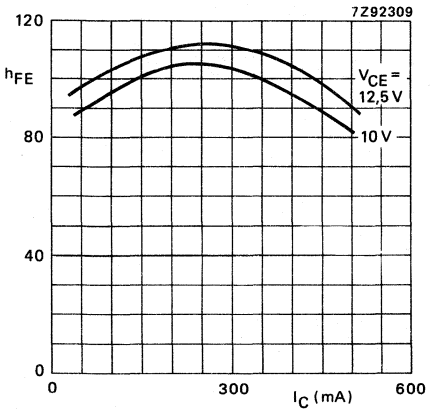


Fig. 4 T_j = 25 °C; typical values.

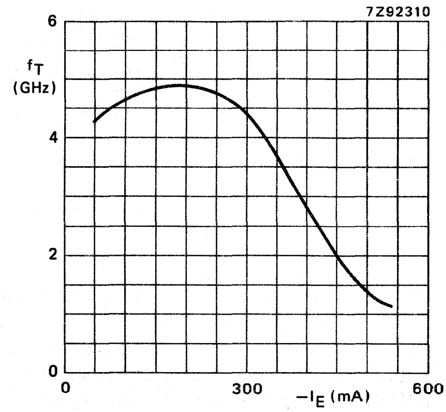


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

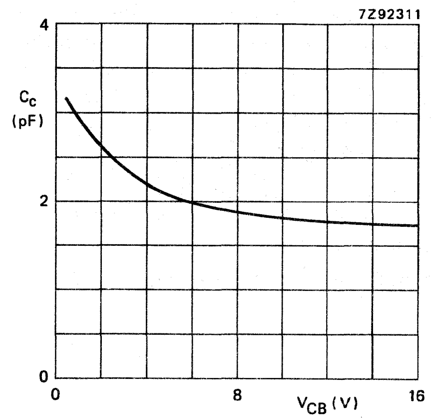


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* 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.	12,5	1	< 0,178 typ. 0,126	> 7,5 typ. 9,0	< 0,160 typ. 0,133	> 50 typ. 60
	9,6	0,75	typ. 0,122	typ. 7,9	typ. 0,128	typ. 61

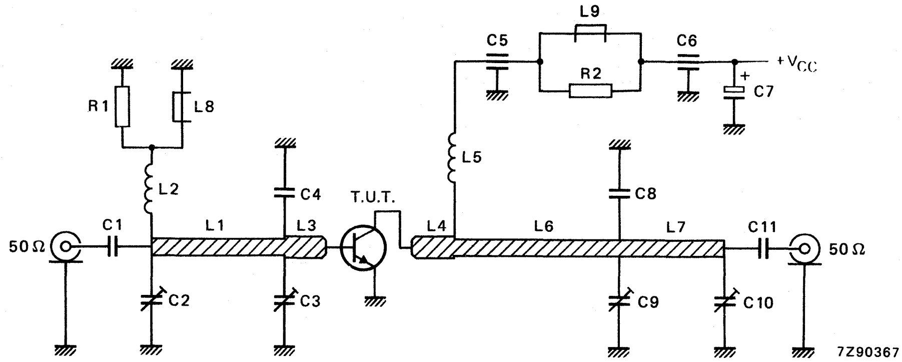


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

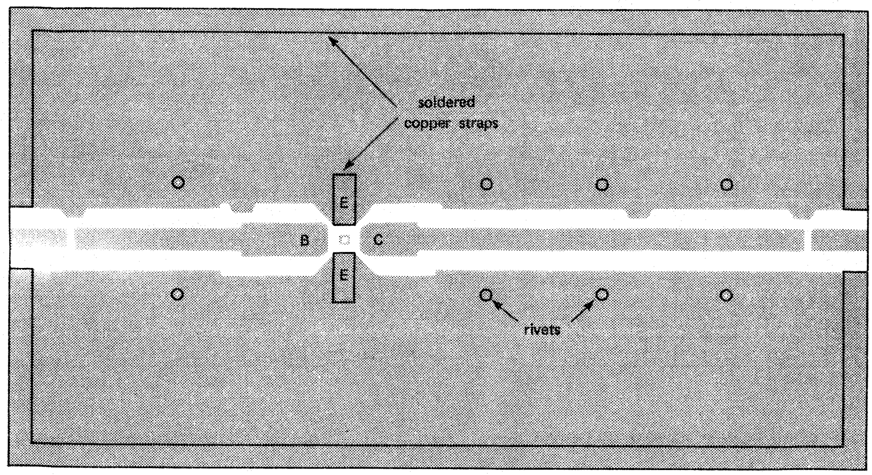
C1 = C11 = 33 pF multilayer ceramic chip capacitor
C2 = C10 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C9 = 1,2 to 3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = 5,6 pF multilayer ceramic chip capacitor*
C5 = 10 pF ceramic feed-through capacitor
C6 = 330 pF 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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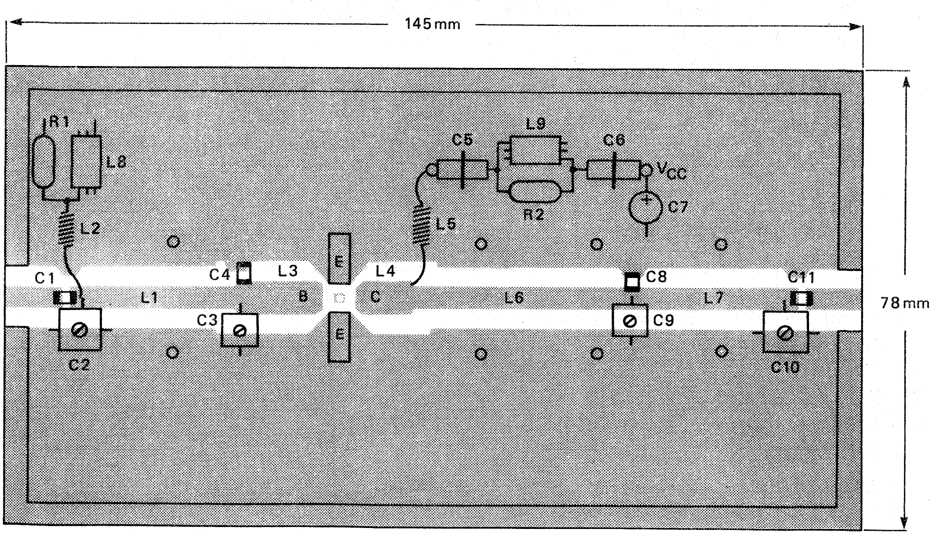

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Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

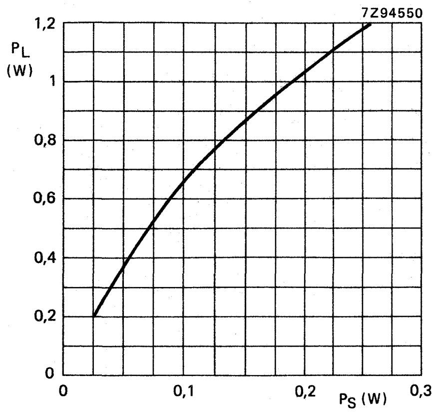


Fig. 9 Load power vs. source power.

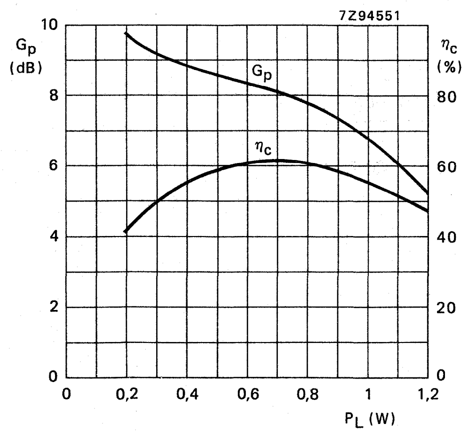


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

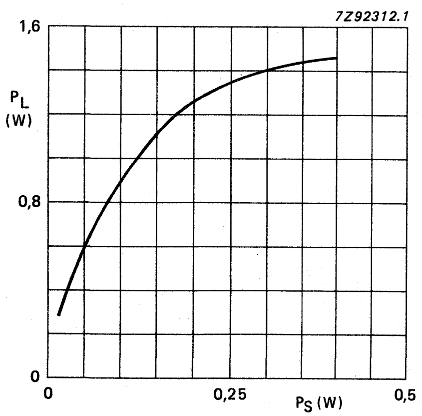


Fig. 11 Input impedance (series components).

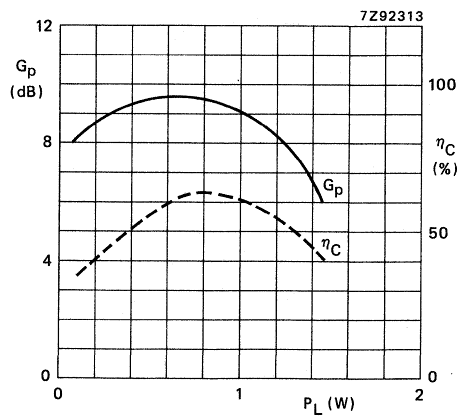


Fig. 12 Load impedance (series components).

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.

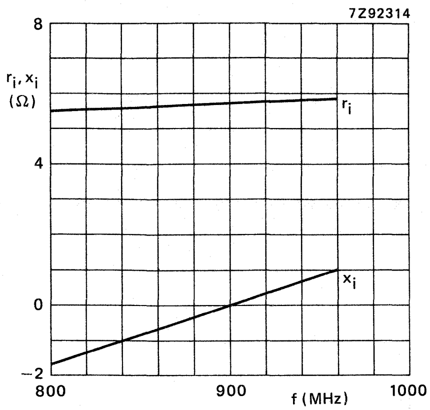


Fig. 13 Input impedance (series components).

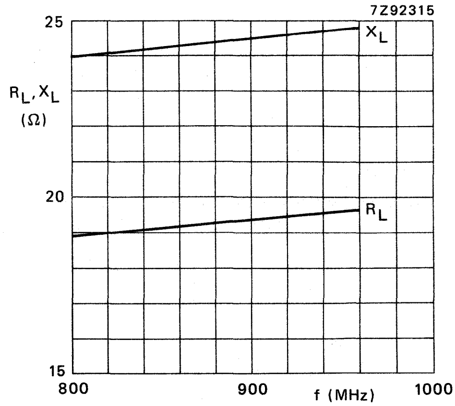


Fig. 14 Load impedance (series components).

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.

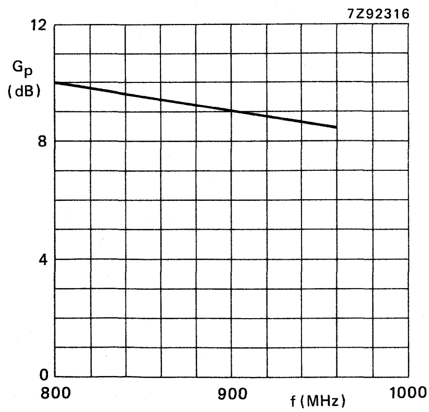


Fig. 15 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 1 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

U H F 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).

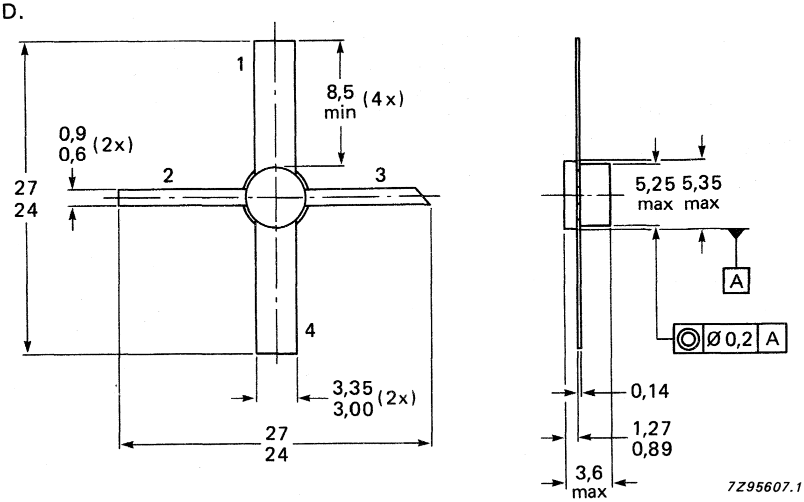
MECHANICAL DATA

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

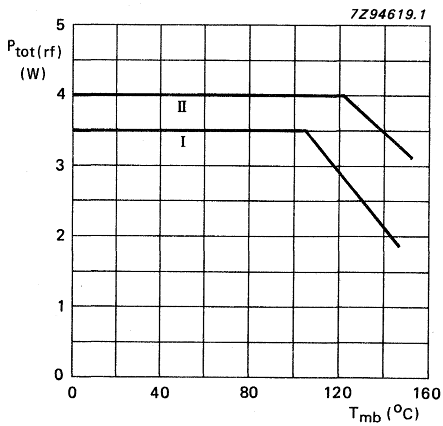


Fig. 2 Power/temperature curve

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

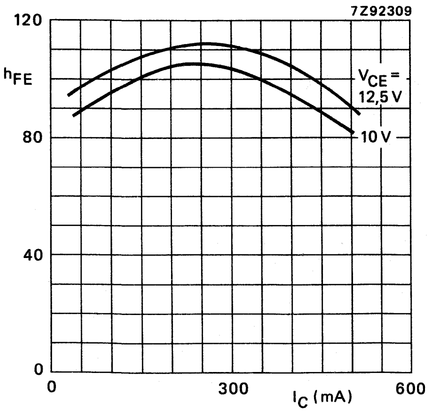


Fig. 3 T_j = 25 °C; typical values.

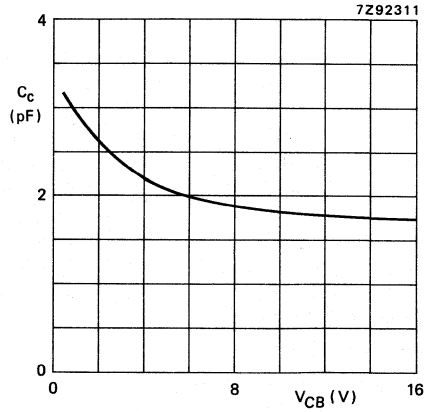


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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 typ. 9.0	> 50 typ. 60
	9.6	1	typ. 7.0	typ. 57

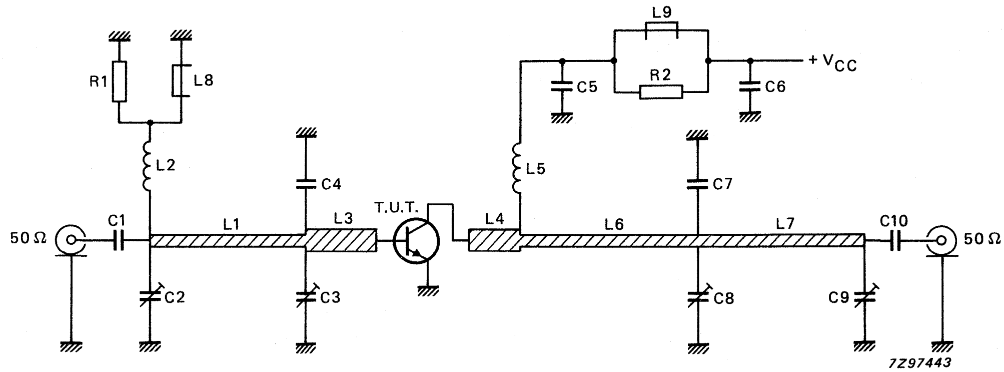


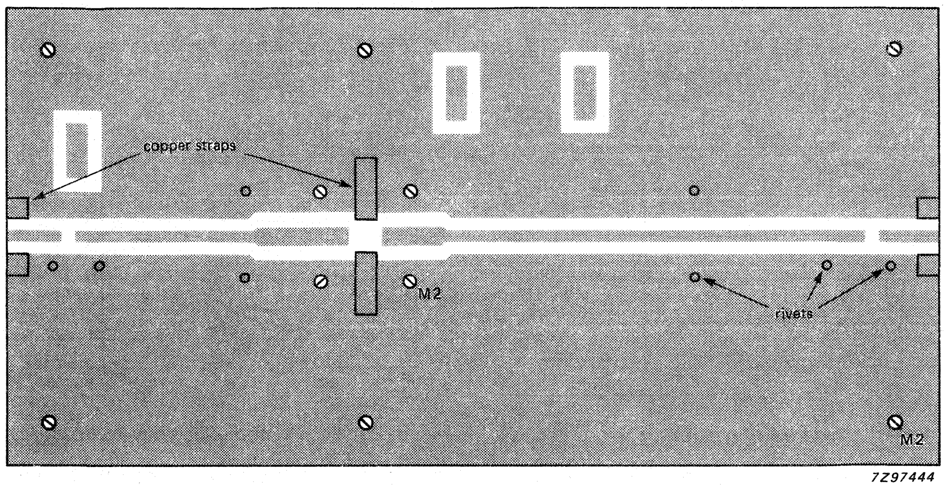
Fig. 5 Class-B test circuit at f = 900 MHz.

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).



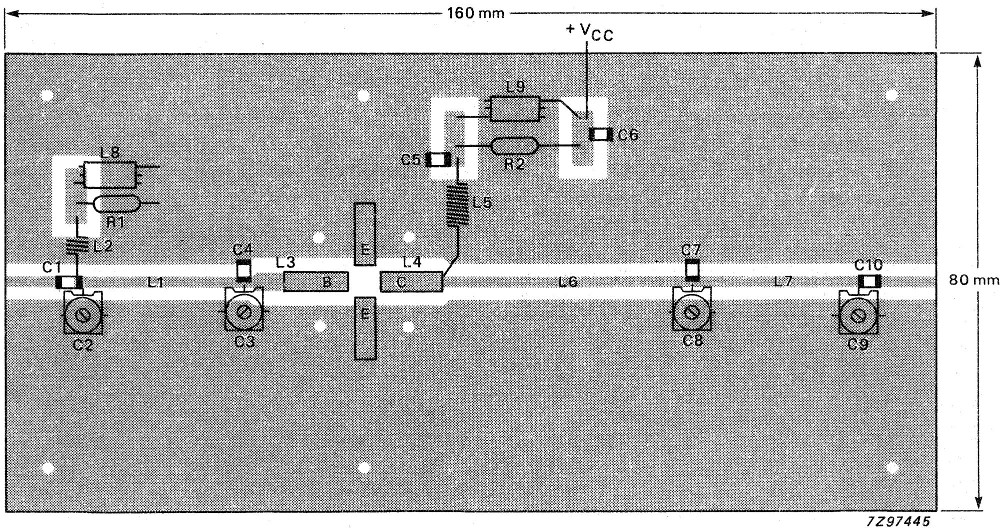


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

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.

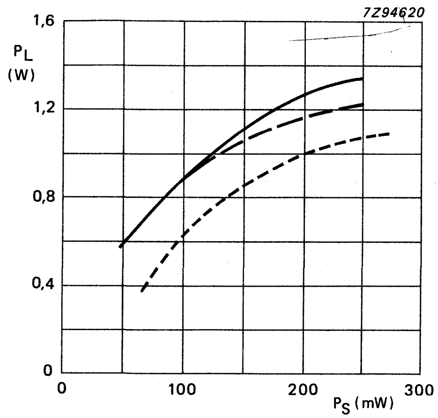


Fig. 7 Load power as a function of source power.

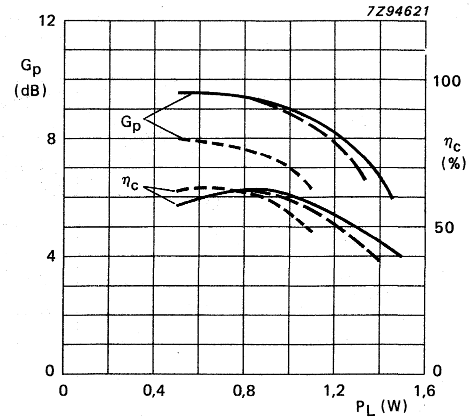


Fig. 8 Power gain and efficiency as a function of load power.

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).

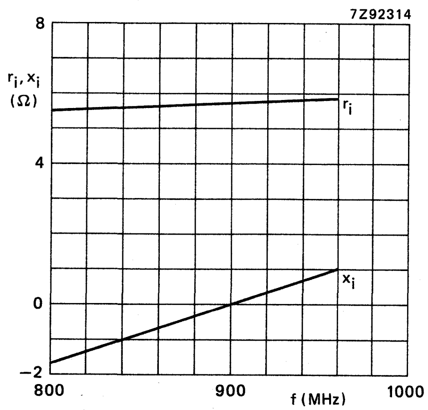


Fig. 9 Input impedance (series components).

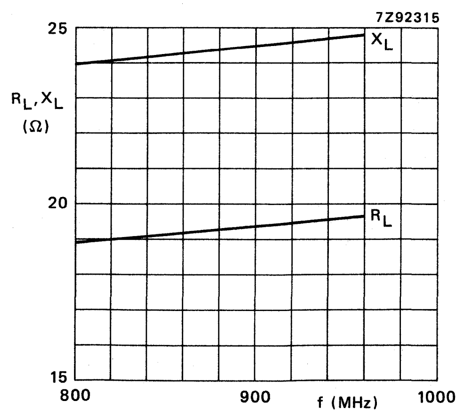


Fig. 10 Load impedance (series components).

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.

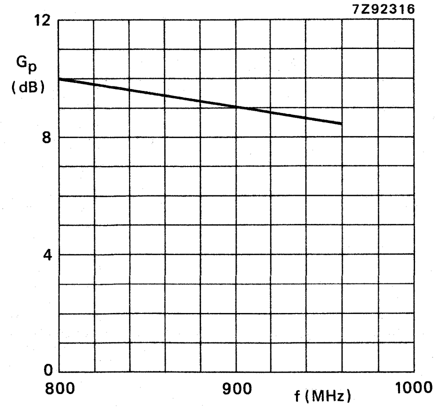


Fig. 11 Power gain as a function of frequency.

V_{CE} = 12.5 V; P_L = 1 W; f = 800 - 960 MHz; T_{mb} = 25 ^oC; 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

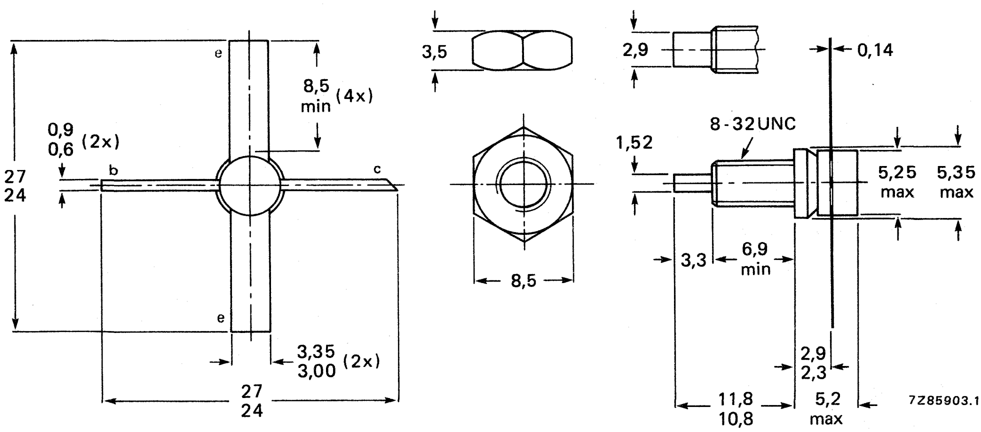
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

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; 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; $I_{C(AV)}$	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

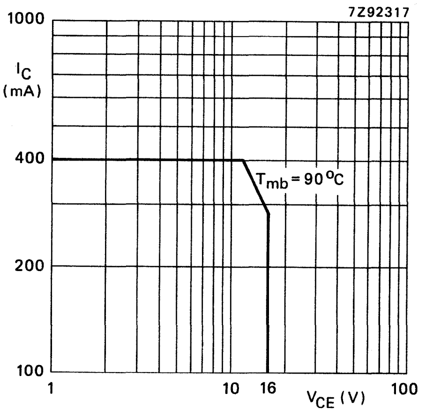


Fig. 2 D.C. SOAR.

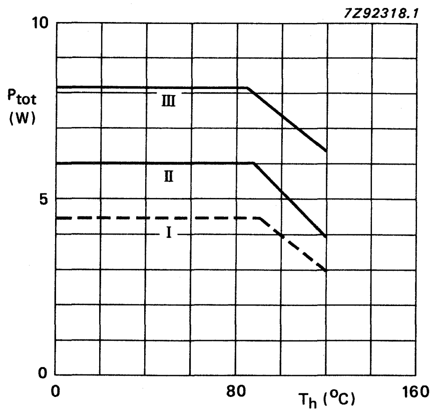


Fig. 3 Power/temperature derating curves
I Continuous d.c. operation
II Continuous r.f. operation (f > 1 MHz)
III Short-time r.f. operation during mismatch (f > 1 MHz)

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

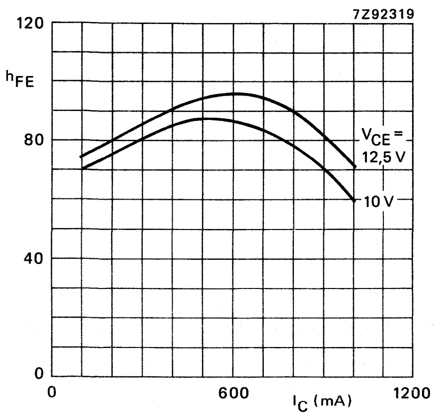


Fig. 4 T_j = 25 °C; typical values.

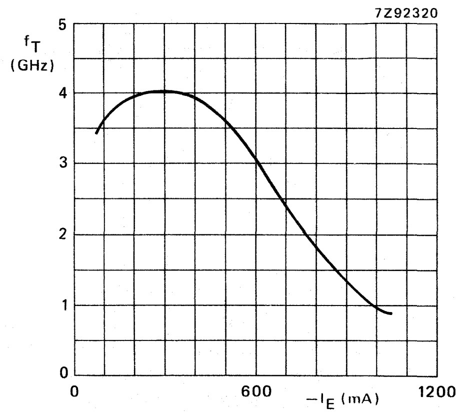


Fig. 5 V_{CB} = 12,5 V; t_p = 50 μs; T_j = 25 °C; typical values.

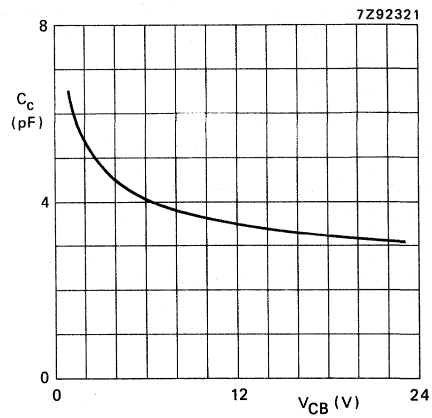


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* 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

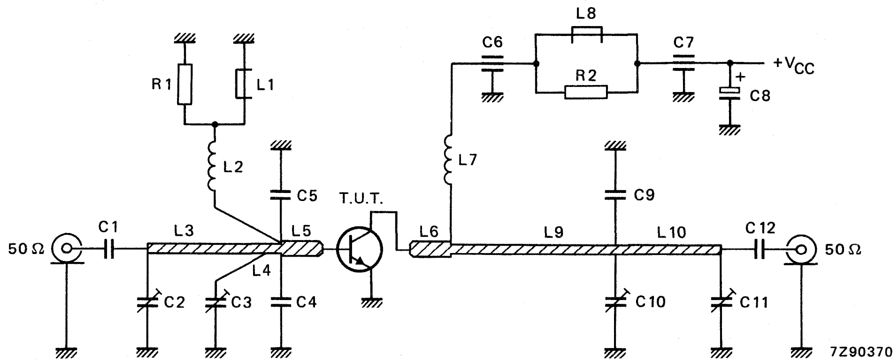


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

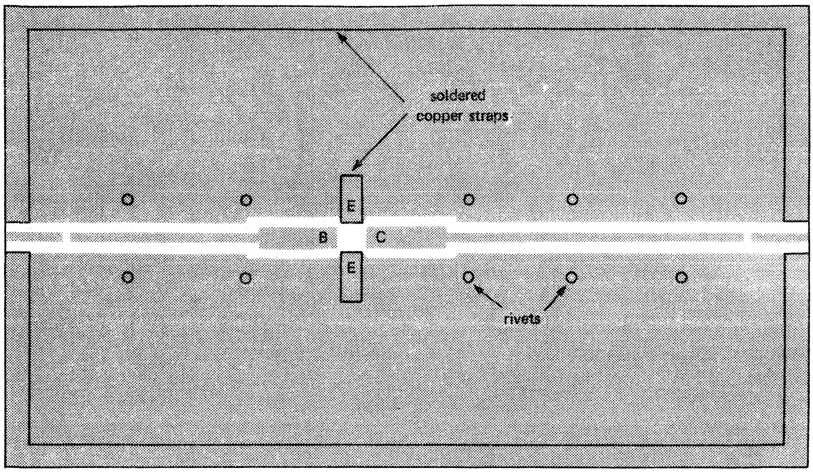
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 5,6 pF multilayer ceramic chip capacitor*
C6 = 10 pF ceramic feed-through capacitor
C7 = 330 pF ceramic feed-through capacitor
C8 = 2,2 μF (35 V) tantalum electrolytic 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.



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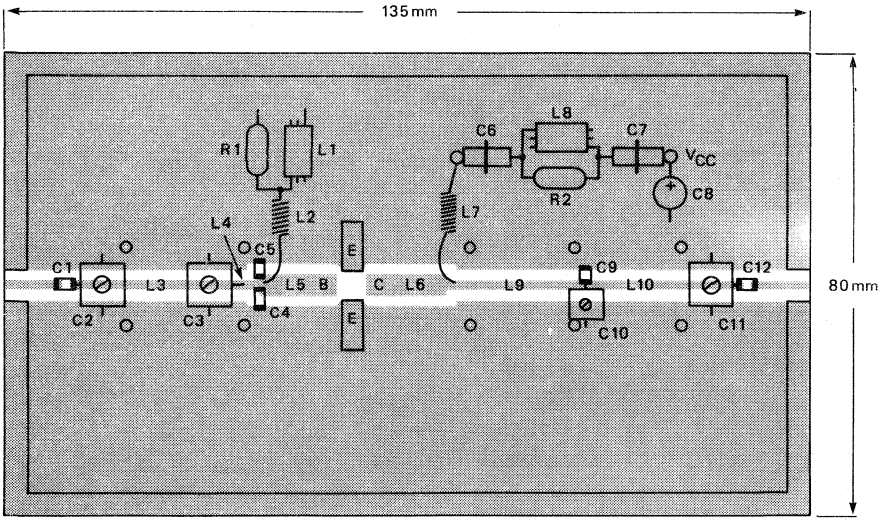


7Z90372

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.

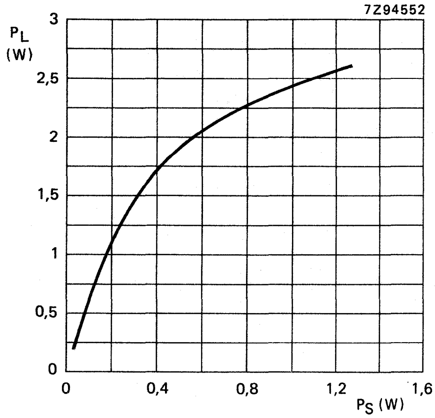


Fig. 9 Load power vs. source power.

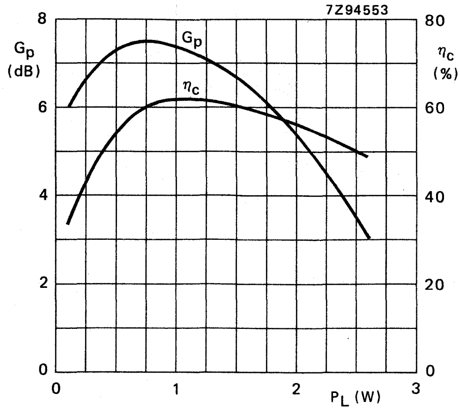


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

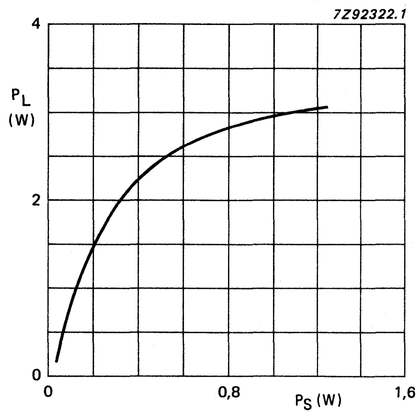


Fig. 11 Input impedance (series components).

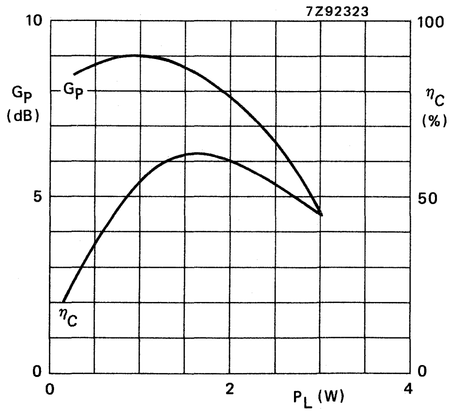


Fig. 12 Load impedance (series components).

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.

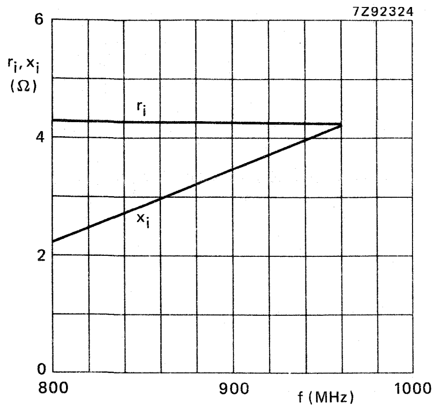


Fig. 13 Input impedance (series components).

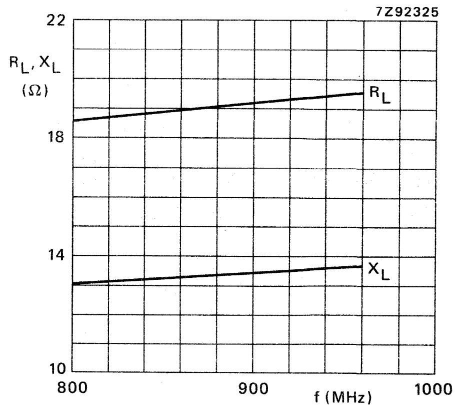


Fig. 14 Load impedance (series components).

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.

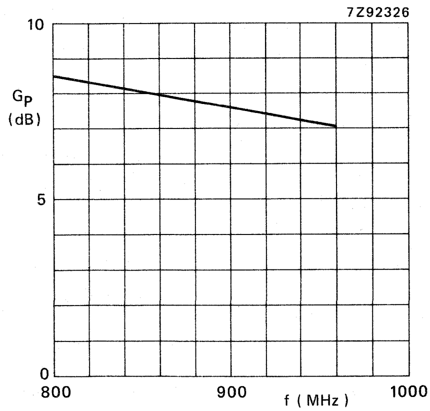


Fig. 15 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 2 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

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 ^{o}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).

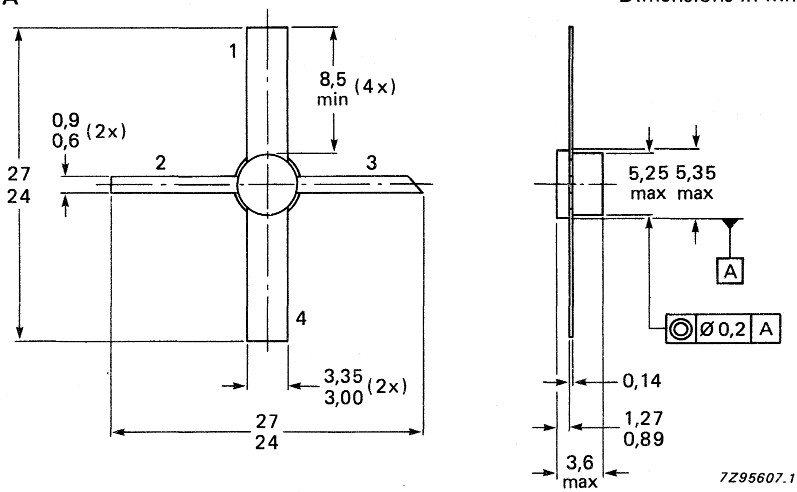
MECHANICAL DATA

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; $T_{mb} \leq 90$ °C	$P_{tot(RF)}$	max.	6	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

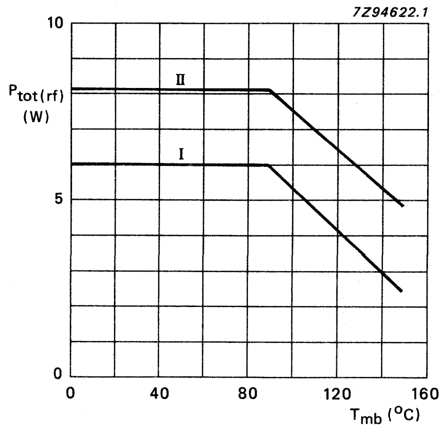


Fig. 2 Power/temperature curve.

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

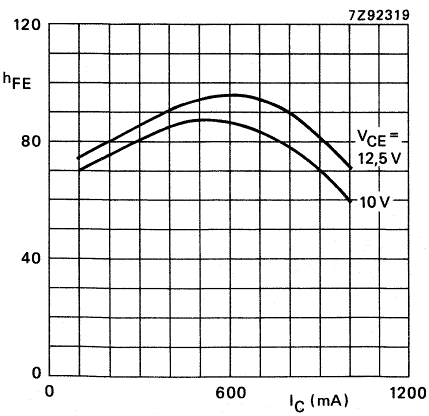


Fig. 3 T_j = 25 °C; typical values.

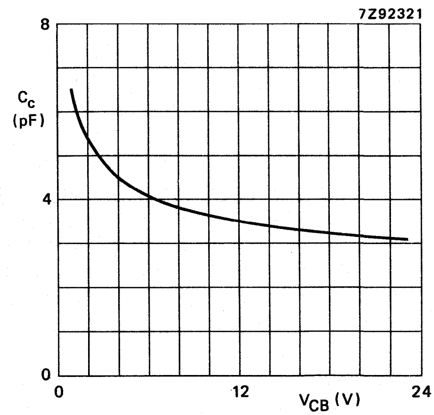


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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**

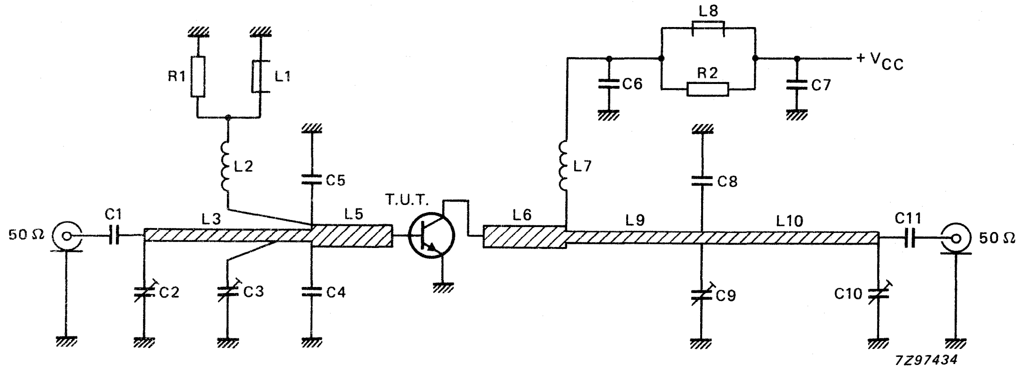


Fig. 5 Class-B test circuit at f = 900 MHz.

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).

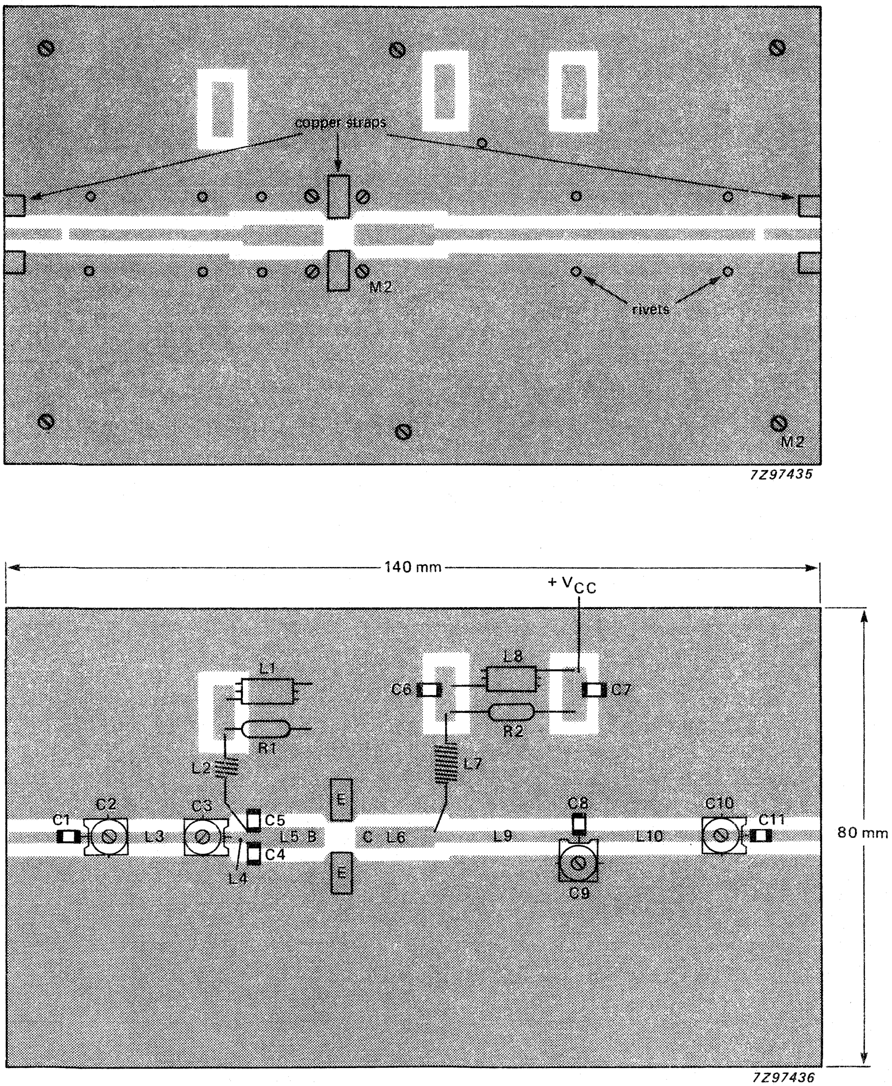


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

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.

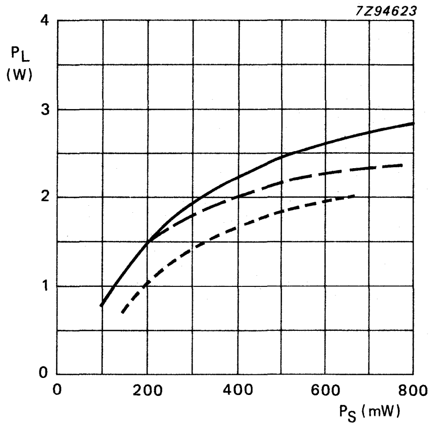


Fig. 7 Load power as a function of source power.

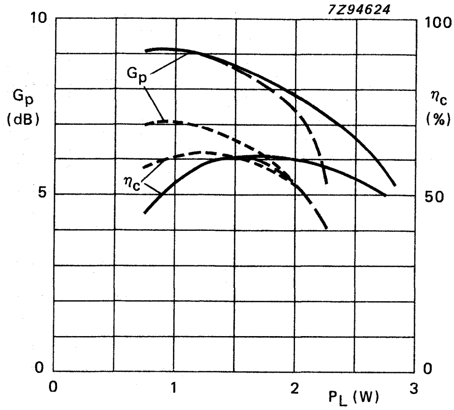


Fig. 8 Power gain and efficiency as a function of load power.

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).

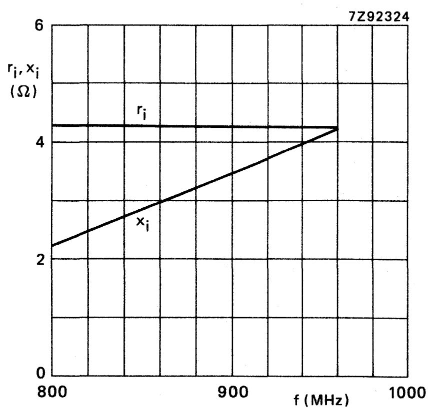


Fig. 9 Input impedance (series components).

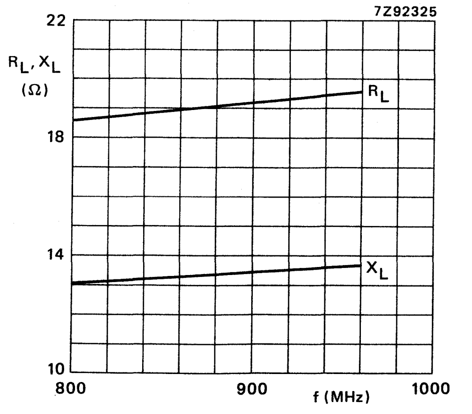


Fig. 10 Load impedance (series components).

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.

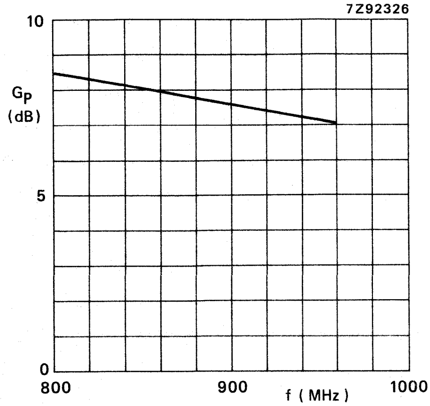


Fig. 11 Power gain as a function of frequency.

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

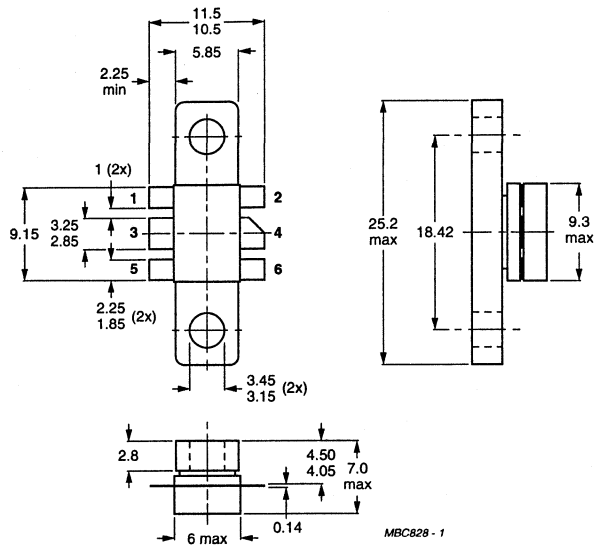
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-171.

Pinning:

1 = emitter
2 = emitter
3 = base
4 = collector
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)			
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

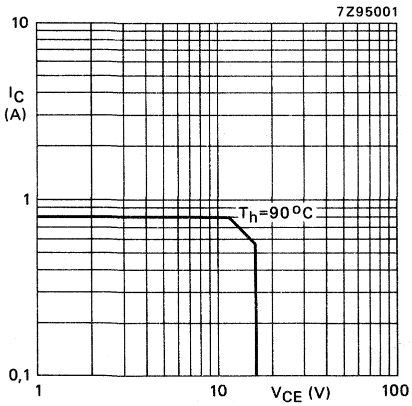


Fig. 2 D.C. SOAR.

$R_{th\ mb\text{-}h}$ = 0,4 K/W.

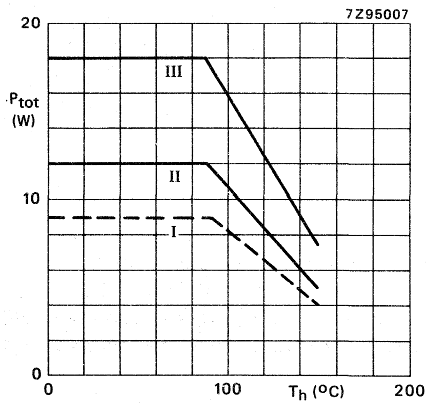


Fig. 3 Power/temperature derating curves.

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

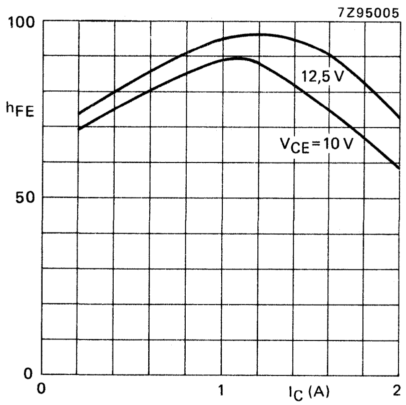


Fig. 4 T_j = 25 °C; typical values.

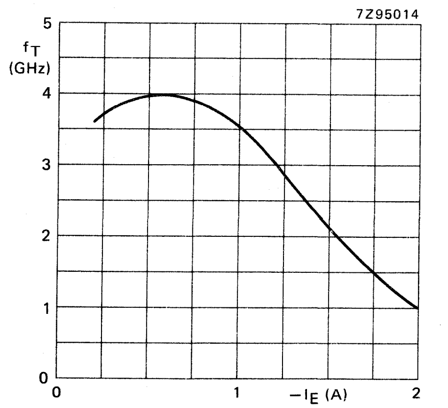


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

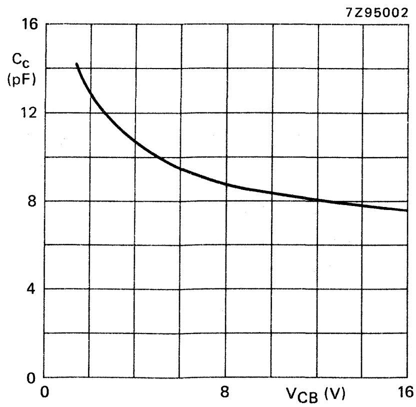


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* 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

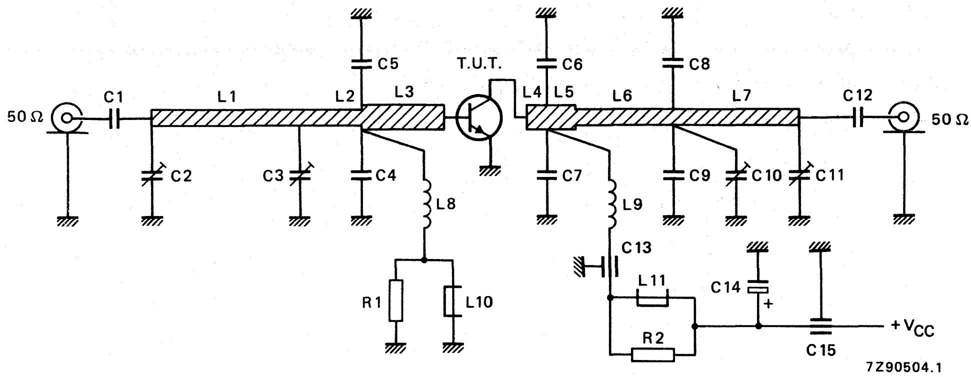


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

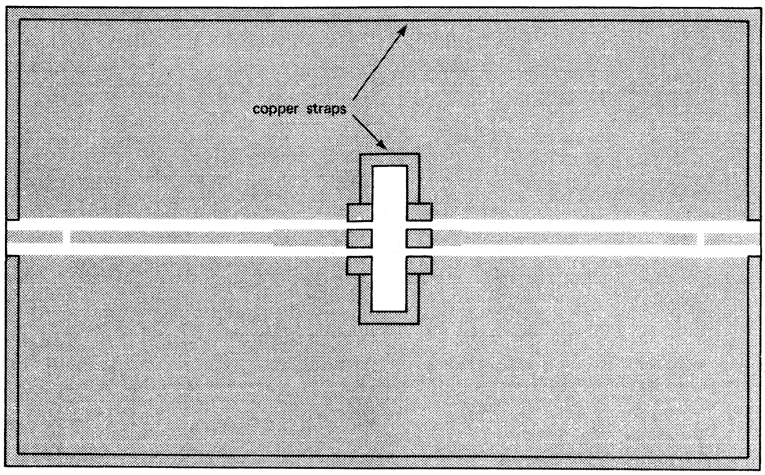
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 3,9 pF multilayer ceramic chip capacitor*
C6 = C7 = C8 = C9 = 6,2 pF multilayer ceramic chip capacitor*
C13 = 10 pF ceramic feed-through capacitor
C14 = 6,8 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.



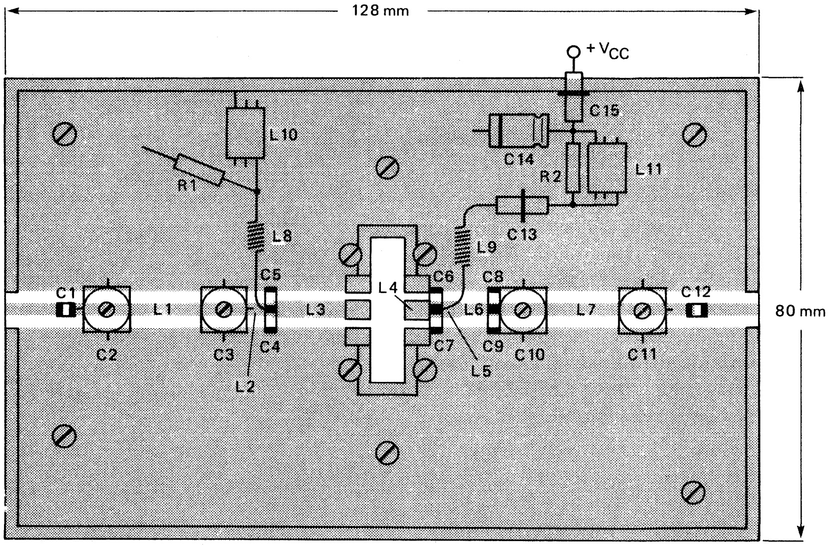


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

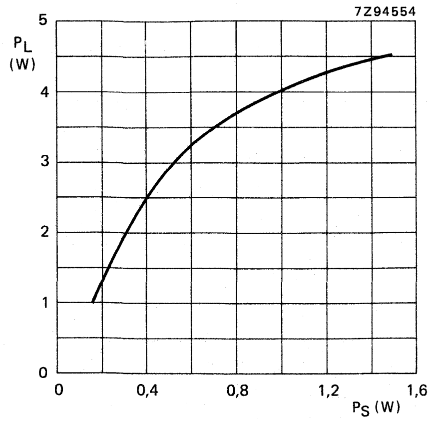


Fig. 9 Load power vs. source power.

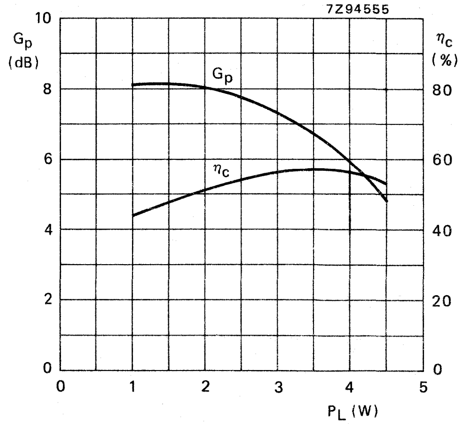


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

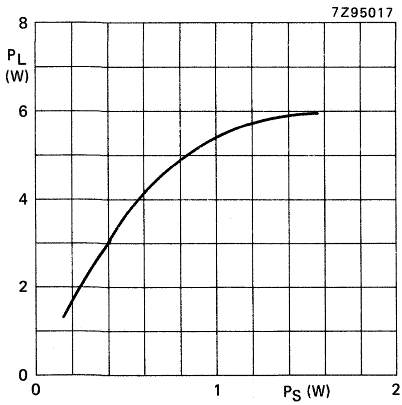


Fig. 11 Load power vs. source power.

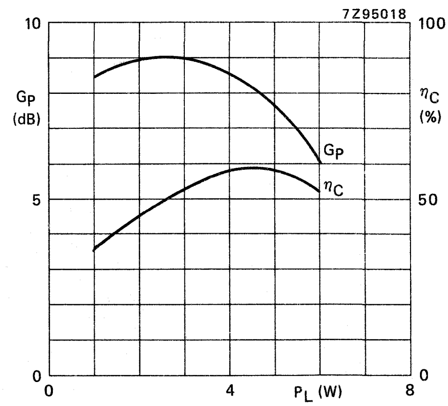


Fig. 12 Power gain and efficiency vs. load power.

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.

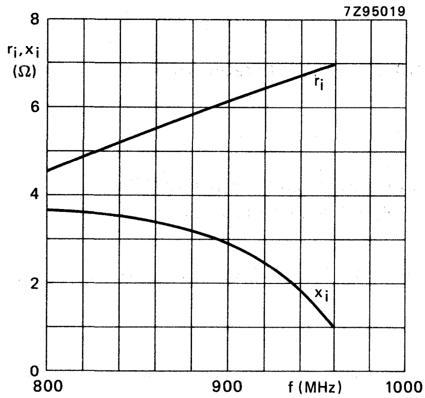


Fig. 13 Input impedance (series components).

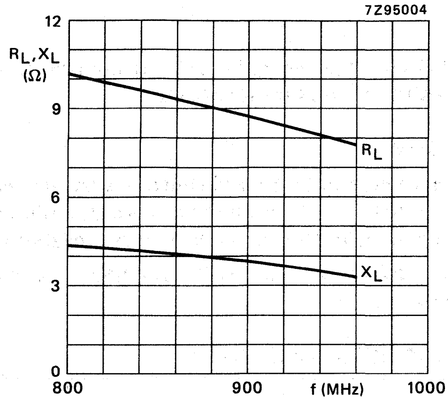


Fig. 14 Load impedance (series components).

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.

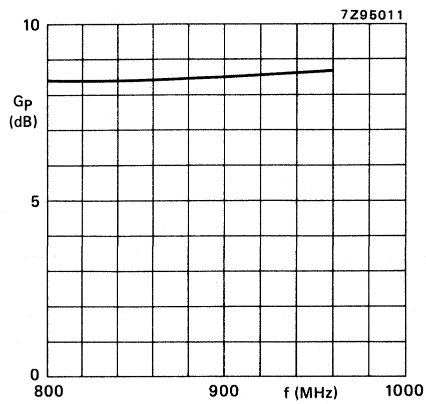


Fig. 15 Power gain vs. frequency.

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

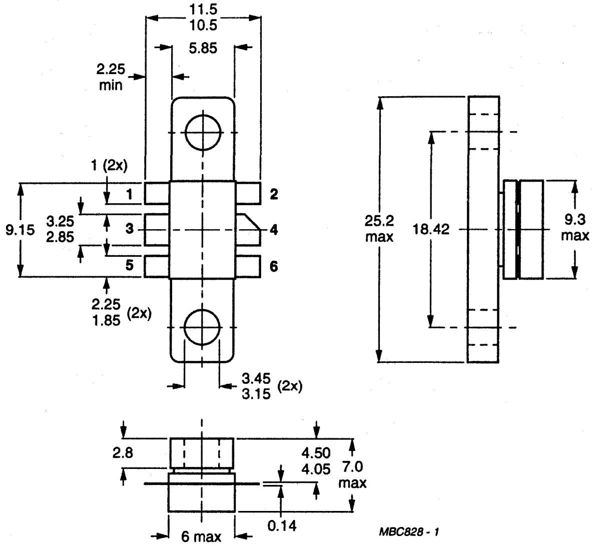
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:
1 = emitter
2 = emitter
3 = base
4 = collector
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) 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

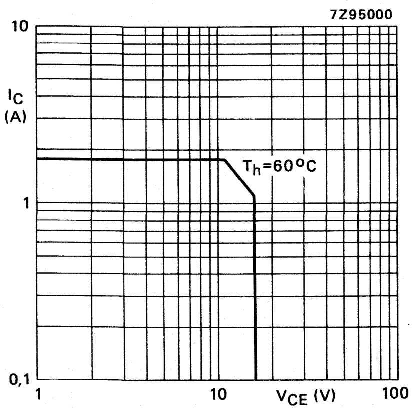


Fig. 2 D.C.-SOAR.

$R_{th\,mb\text{-}h}$ = 0,4 K/W

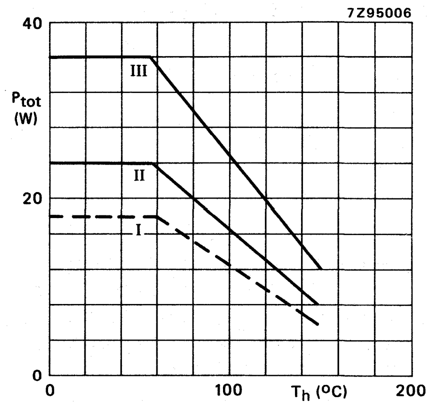


Fig. 3 Power/temperature derating curves.

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

THERMAL RESISTANCE

Dissipation = 12 W; T_{mb} = 112 °C

From junction to mounting base (d.c. dissipation)	$R_{th\,j\text{-}mb(dc)}$	max.	7,0 K/W
(r.f. dissipation)	$R_{th\,j\text{-}mb\,(rf)}$	max.	5,2 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 = 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

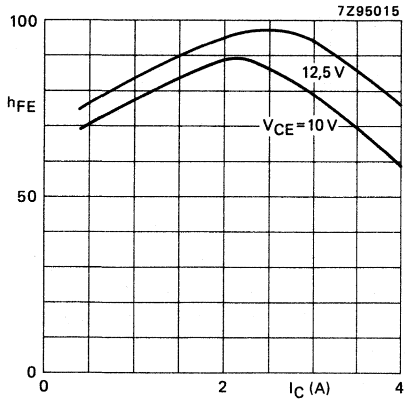


Fig. 4 T_j = 25 °C; typical values.

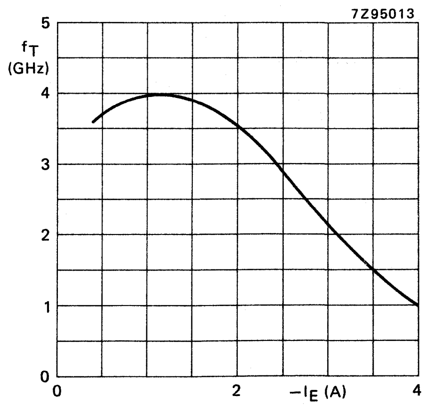


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

* Measured under pulse conditions: t_p = 50 μs; $\delta < 1\%$.

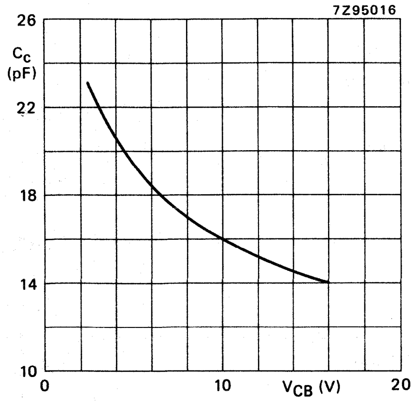


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

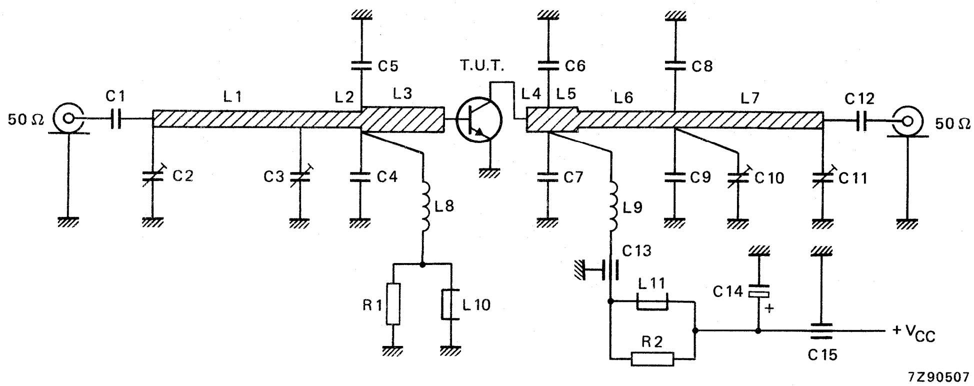


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

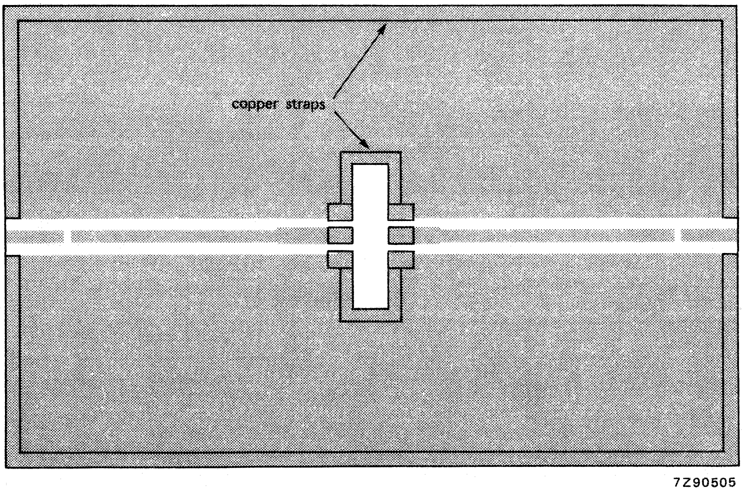
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 4,7 pF multilayer ceramic chip capacitor*
C6 = C7 = 5,6 pF multilayer ceramic chip capacitor*
C8 = C9 = 3,3 pF multilayer ceramic chip capacitor*
C13 = 10 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.



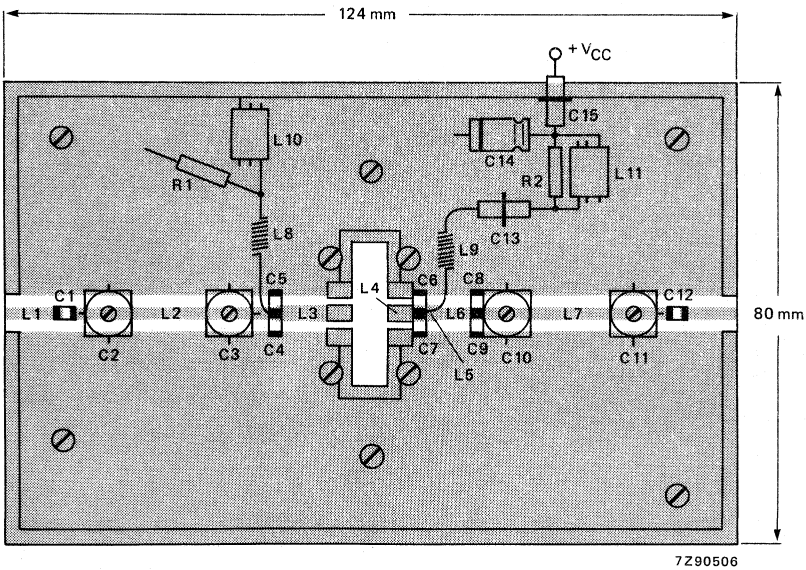


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

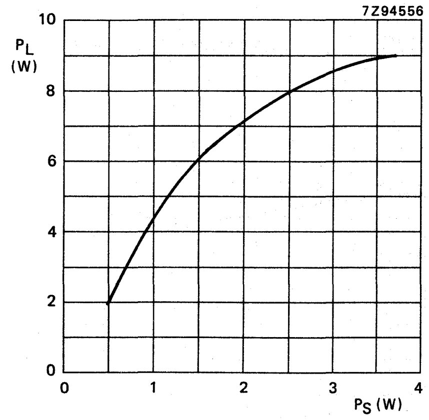


Fig. 9 Load power vs. source power.

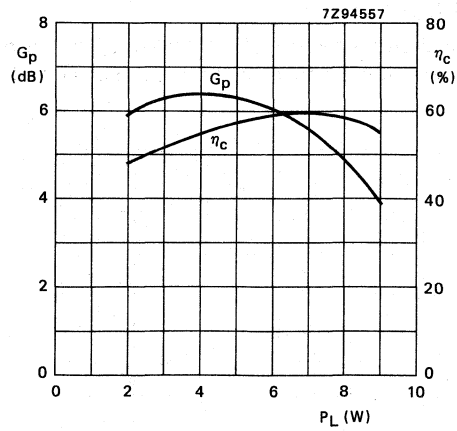


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

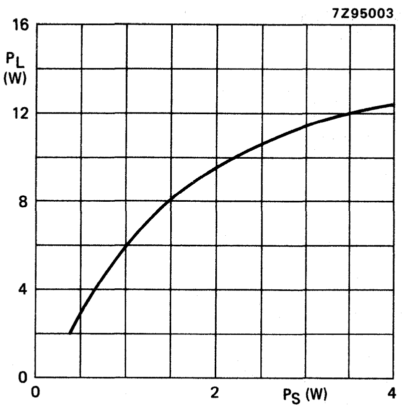


Fig. 11 Load power vs. source power.

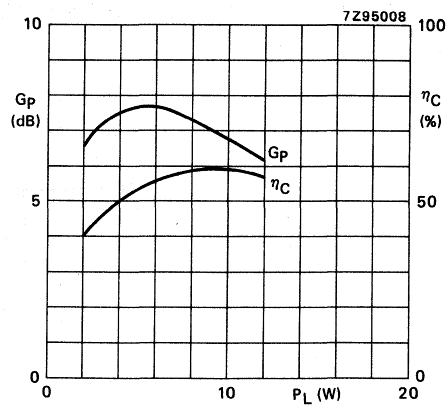


Fig. 12 Power gain and efficiency vs. load power.

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.

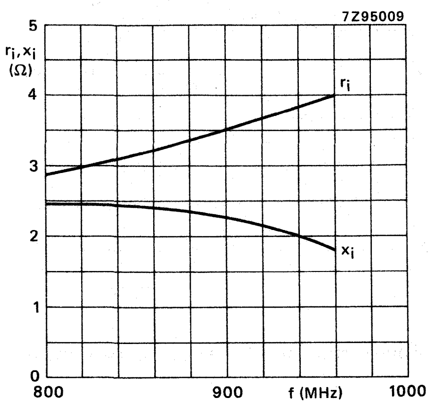


Fig. 13 Input impedance (series components).

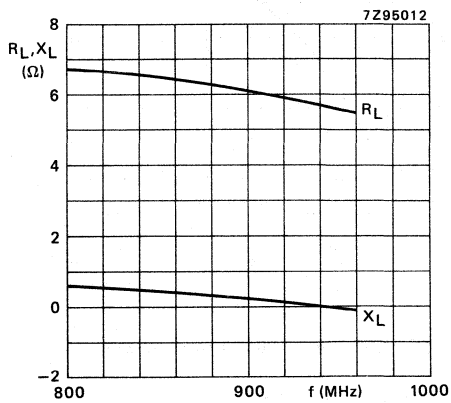


Fig. 14 Load impedance (series components).

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.

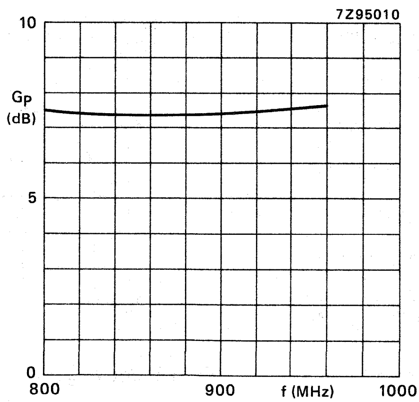


Fig. 15 Power gain vs. frequency.

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.

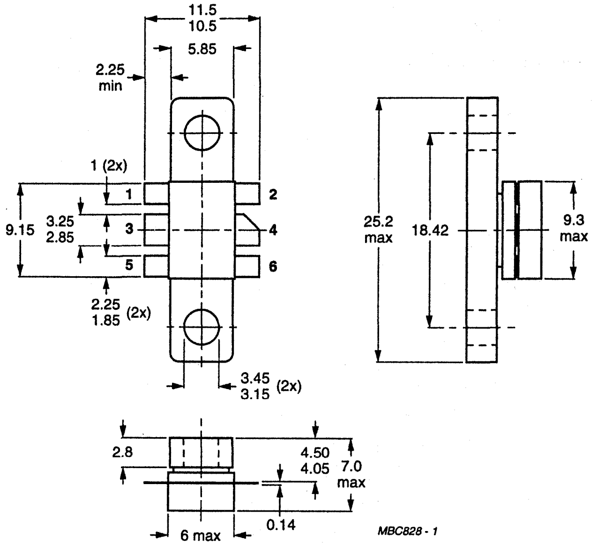
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT171.

Pinning:

1 = base
2 = base
3 = emitter
4 = collector
5 = base
6 = base



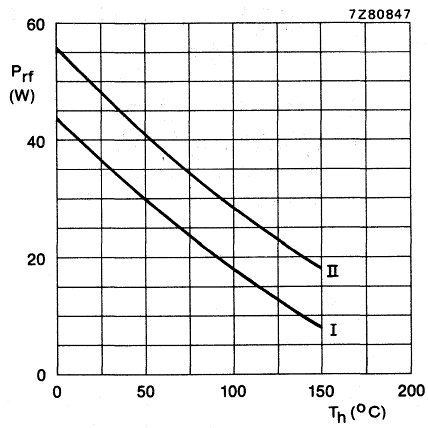
Torque on screw:	min. 0.6 Nm (6 kg.cm) max. 0.75 Nm (7.5 kg.cm)
Recommended screw:	cheese-head 4-40 UNC/2A

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

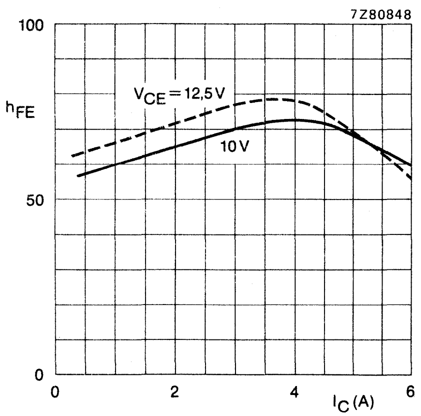


Fig.3 DC current gain as a function of collector current; T_j = 25 °C. Typical values.

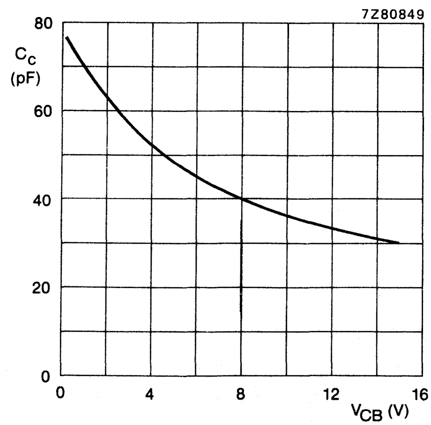


Fig.4 Output capacitance as a function of V_{CB}; $I_E = i_e$ = 0; f = 1 MHz. Typical values.

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

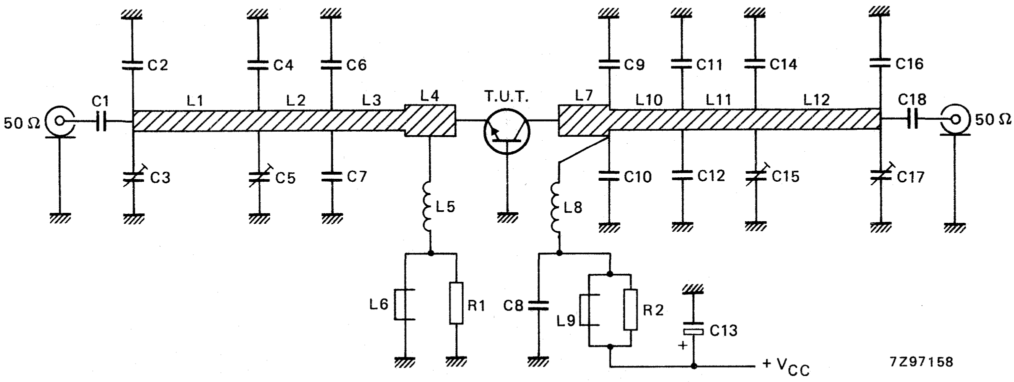


Fig.5 Class-B test circuit at f = 900 MHz.

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.

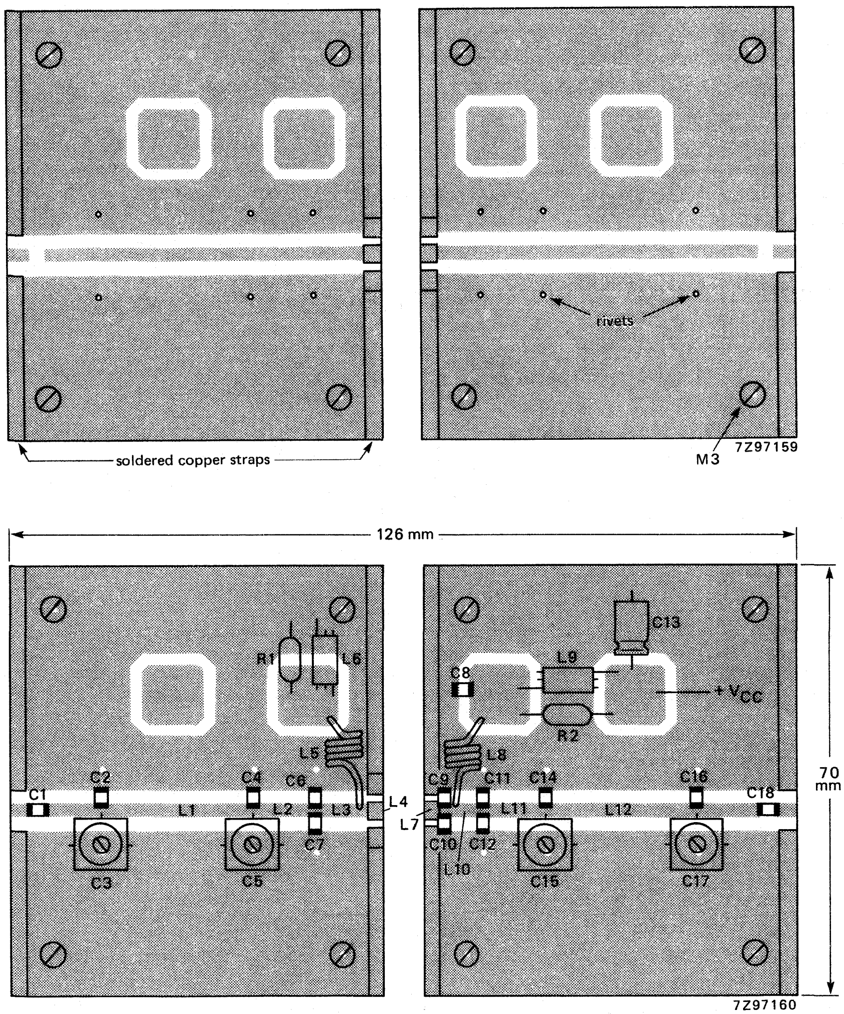


Fig.6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

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.

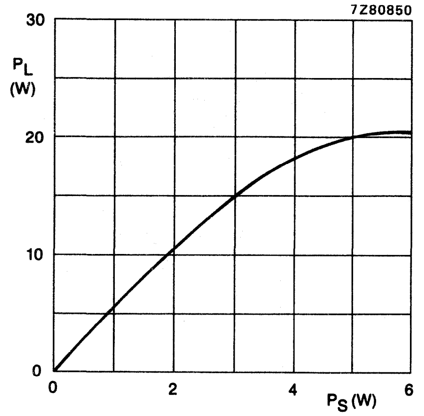


Fig.7 Load power as a function of source power.

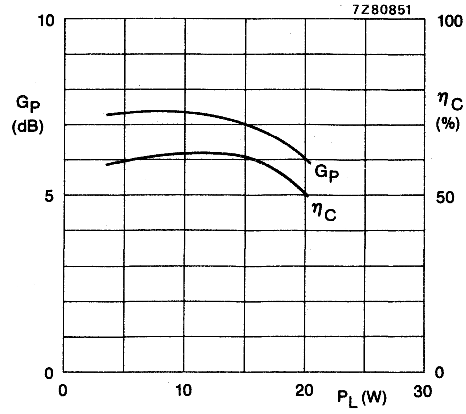


Fig.8 Power gain and efficiency as functions of load power.

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.

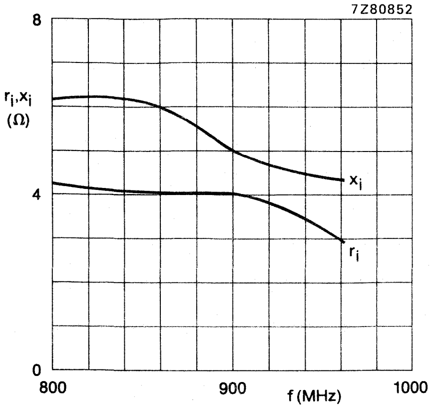


Fig.9 Input impedance (series components) as a function of frequency.

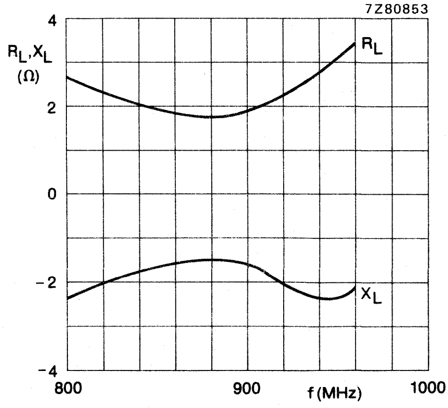


Fig.10 Load impedance (series components) as a function of frequency.

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.

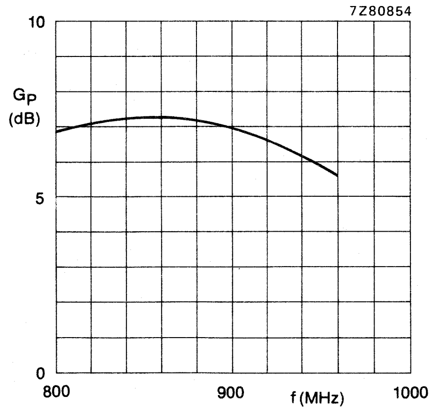


Fig.11 Power gain as a function of frequency.

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

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.

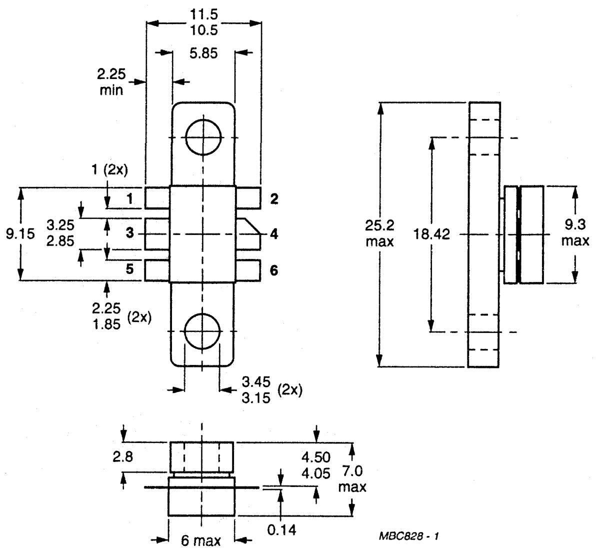
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-171.

Pinning:

1 = base
2 = base
3 = emitter
4 = collector
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

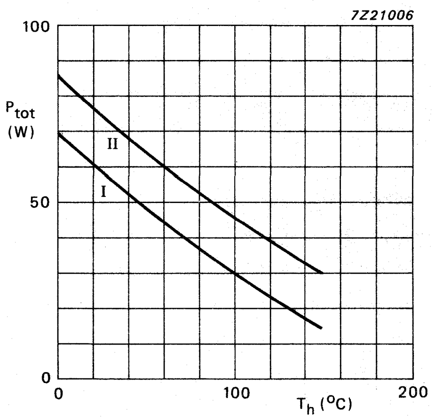


Fig. 2 Power/temperature derating curves.

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

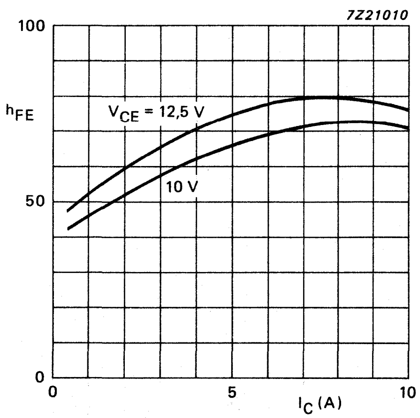


Fig. 3 D.C. current gain versus collector current; T_h = 25 °C. Typical values.

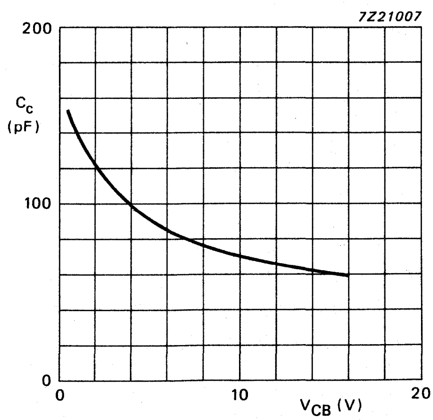


Fig. 4 Output capacitance versus V_{CB}; I_E = i_e = 0; typical values.

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

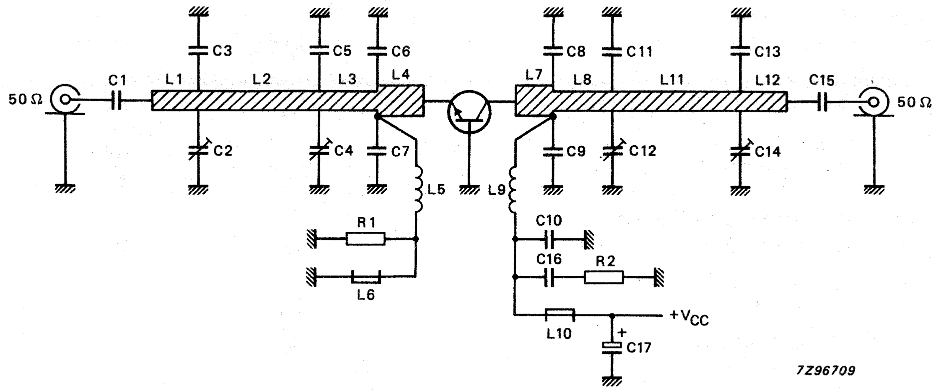


Fig. 5 Class-B test circuit at f = 900 MHz.

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.

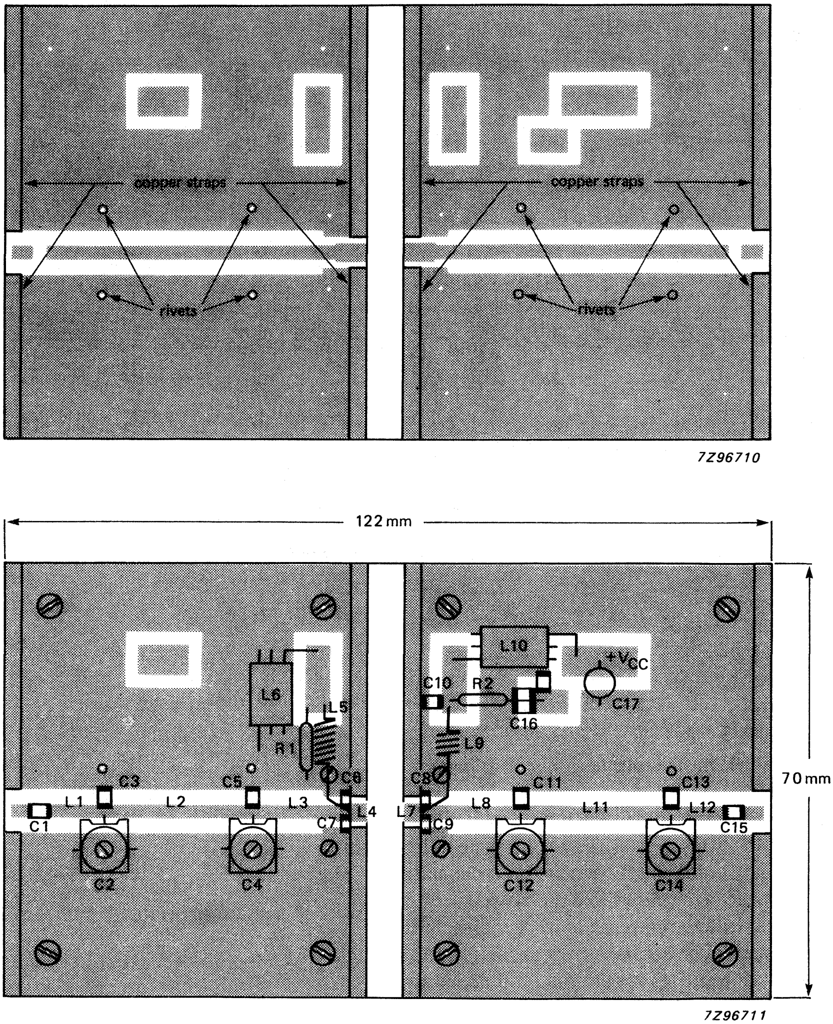


Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

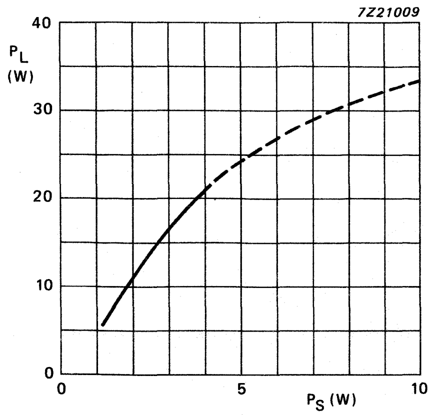


Fig. 7 Load power versus source power.

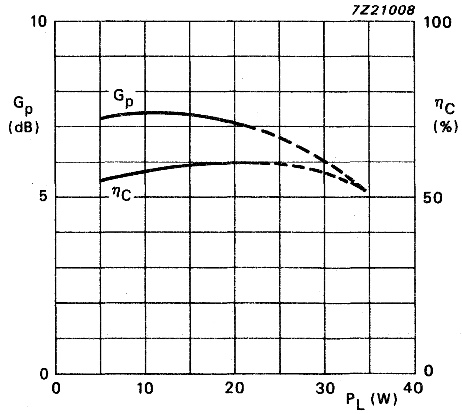


Fig. 8 Power gain and efficiency versus load power.

Condition for Figs 7 and 8:

V_{CB} = 12,5 V; f = 900 MHz; T_h = 25 °C; class-B operation;
$R_{th\ mb\text{-}h}$ = 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; $R_{th\ mb\text{-}h}$ = 0,4 K/W.

Data sheet	
status	Product specification
date of issue	March 1993

BLV97CE
UHF power transistor

FEATURES

- Internal input matching to achieve high power gain
- Ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability

DESCRIPTION

NPN silicon planar epitaxial transistor in a SOT171 envelope, intended for common emitter, class-AB operation in radio transmitters for the 960 MHz communications band. 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 a common emitter class-AB circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_P (dB)	η_c (%)
c.w. class-AB	960	24	35	> 7	> 50

MECHANICAL DATA

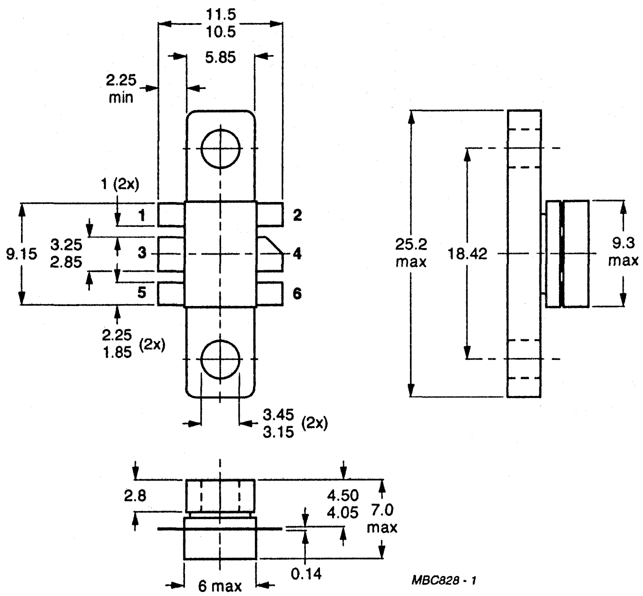
SOT171 - see Fig.1.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. **After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.**

MECHANICAL DATA

Dimensions in mm



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.

Fig.1 SOT171.

PINNING

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

PIN CONFIGURATION

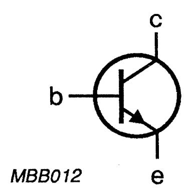


Fig.2 Pin configuration.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector base voltage	open emitter	–	50	V
V_{CEO}	collector emitter voltage	open base	–	27	V
V_{EBO}	emitter base voltage	open collector	–	3.5	V
I_C	collector current	DC or average	–	3	A
I_{CM}	collector current	peak value f > 1 MHz	–	9	A
P_{tot}	total power dissipation	f > 1 MHz T_{mb} = 25 °C	–	70	W
T_{stg}	storage temperature		–65	150	°C
T_j	operating junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\,j\text{-}mb}$	from junction to mounting base (RF)		–	2.3	K/W
$R_{th\,mb\text{-}h}$	from mounting base to heatsink		–	0.4	K/W

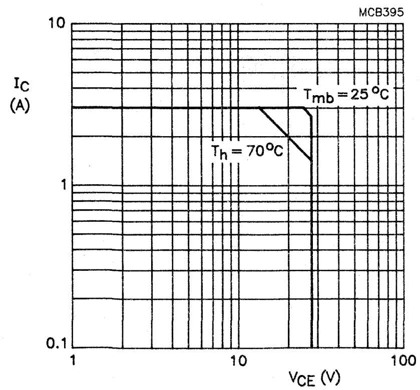


Fig.3 DC SOAR.

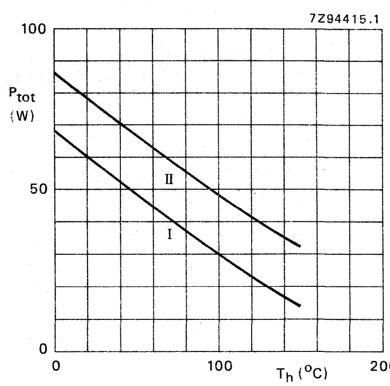


Fig.4 Power/temperature derating;
(I): DC or RF operation;
(II): short-term operation during mismatch.

UHF power transistor BLV97CE

CHARACTERISTICS

at T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter I_C = 50 mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base I_C = 100 mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector I_E = 10 mA	3.5	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0 V_{CE} = 27 V	–	–	10	mA
h_{FE}	DC current gain	I_C = 2 A V_{CE} = 20 V	15	–	–	
C_c	collector capacitance at f = 1 MHz	$I_E = I_e = 0$ V_{CB} = 25 V	–	44	–	pF
C_{re}	feedback capacitance at f = 1 MHz	I_C = 0 V_{CE} = 25 V	–	30	–	pF
C_{cf}	collector-flange capacitance		–	2	–	pF

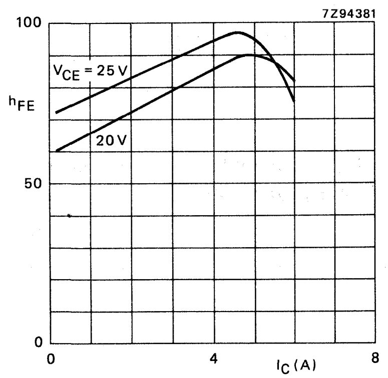


Fig.5 DC current gain as a function of collector current; typical values.

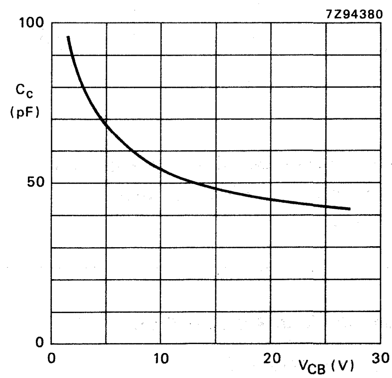


Fig.6 Output capacitance as a function of collector-base voltage; typical values.

APPLICATION INFORMATION

RF performance in a common emitter test circuit.
$T_h = 25\ °C$, $R_{th\ mb-h} = 0.4\ K/W$ unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (mA)	P_L (W)	G_P (dB)	η_c (%)
c.w. class-AB	960	24	60	35	> 7 typ. 8.5	> 50 typ. 55

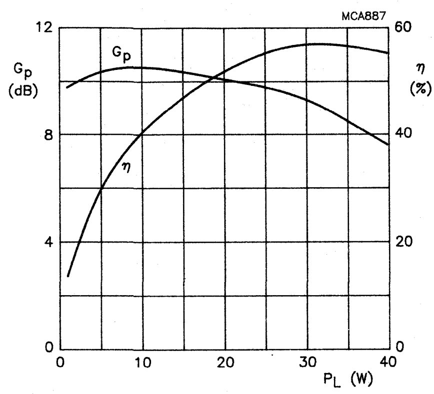


Fig.7 Power gain and efficiency as a function of load power; typical values.

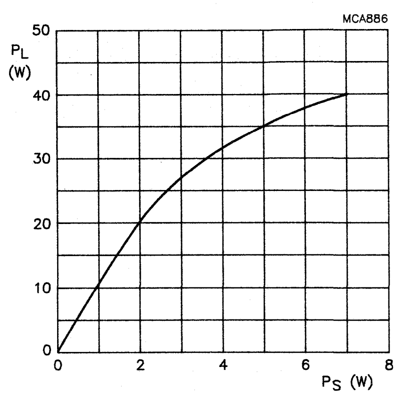


Fig.8 Load power as a function of input power; typical values.

Ruggedness in class-AB operation

The BLV97CE is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: $V_{CE} = 24\ V$; $I_{C(ZS)} = 120\ mA$; f = 960 MHz at rated output power.

APPLICATION INFORMATION (continued)

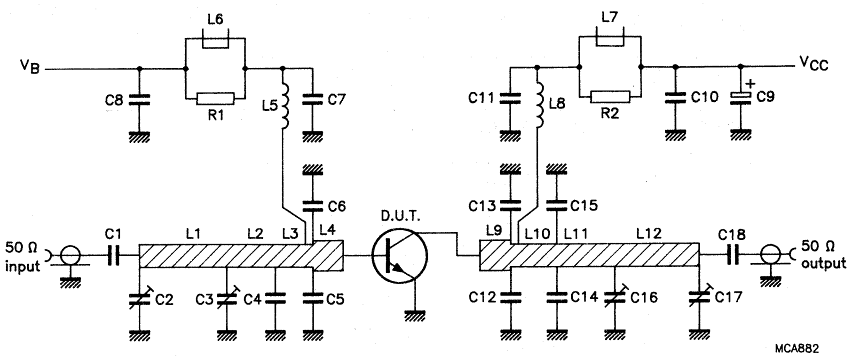


Fig.9 Test circuit BLV97CE class-AB.

APPLICATION INFORMATION (continued)

List of components (Fig. 9)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C18	multilayer ceramic chip capacitor note 1	33 pF		
C2, C3, C16, C17	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C5, C6	multilayer ceramic chip capacitor note 2	3.3 pF		
C7, C11	multilayer ceramic chip capacitor note 1	10 pF		
C8	multilayer ceramic chip capacitor	100 nF		
C9	35 V solid aluminium capacitor	2.2 μF		2222 128 50228
C10	multilayer ceramic chip capacitor	3 x 100 nF in parallel		
C12, C13	multilayer ceramic chip capacitor note 2	12 pF		
C14, C15	multilayer ceramic chip capacitor note 1	3.3 pF		
L1, L12	microstrip note 3	50 Ω	26 x 2.4 mm	
L2, L3	microstrip note 3	50 Ω	9.5 x 2.4 mm	
L4	microstrip note 3	42.6 Ω	6.0 x 3.0 mm	
L5	3 turns enamelled 1 mm copper wire	30 nH	int. dia. 4 mm length 3 mm leads 2 x 5mm	
L6, L7	grade 3B ferroxcube wide-band RF choke			4312 020 36642
L8	4 turns enamelled 1 mm copper wire	45 nH	int. dia. 4 mm length 4 mm leads 2 x 5 mm	
L9	microstrip note 3	42.6 Ω	4.0 x 3.0 mm	
L10	microstrip note 3	50 Ω	9.0 x 2.4 mm	
L11	microstrip note 3	50 Ω	13.5 x 2.4 mm	
R1, R2	1 W metal film resistor	10 Ω		2322 153 51009

Notes

1. ATC capacitor type 100B or capacitor of the same quality.
2. ATC capacitor type 100A or capacitor of the same quality.
3. The microstrips are on a double copper-clad PCB with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1/32 inch.

APPLICATION INFORMATION (continued)

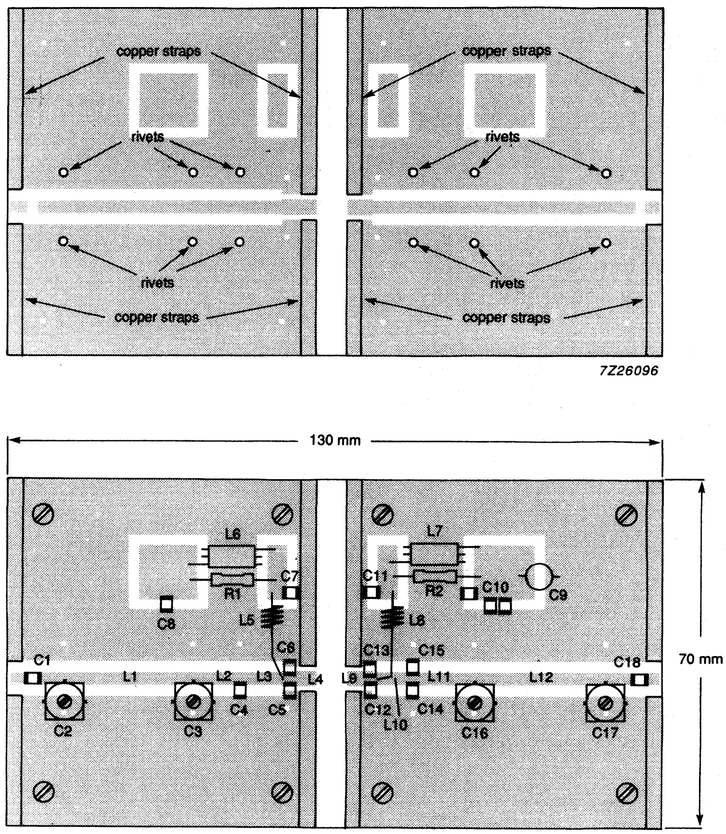


Fig.10 Printed circuit board and component layout for 960 MHz test circuit.

The circuit and components are located on one side of the PTFE fibre-glass board, the other side being fully metallized, to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact between the component side and the ground plane.

APPLICATION INFORMATION (continued)

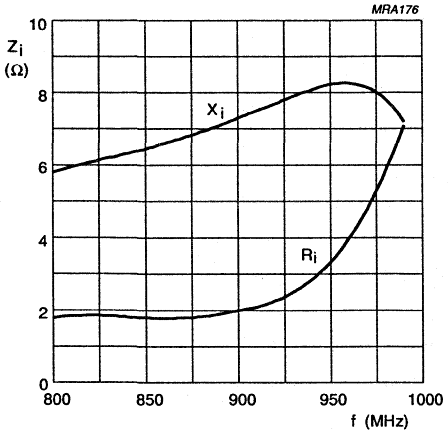


Fig.11 Input impedance; series components; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

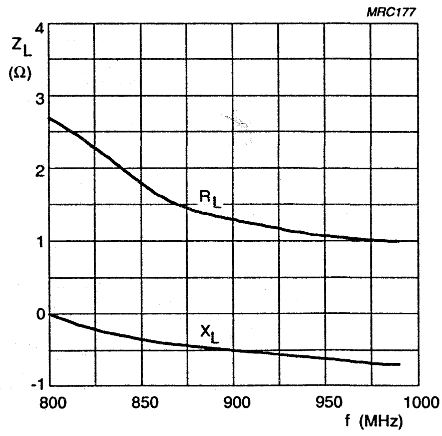


Fig.12 Load impedance; series components; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

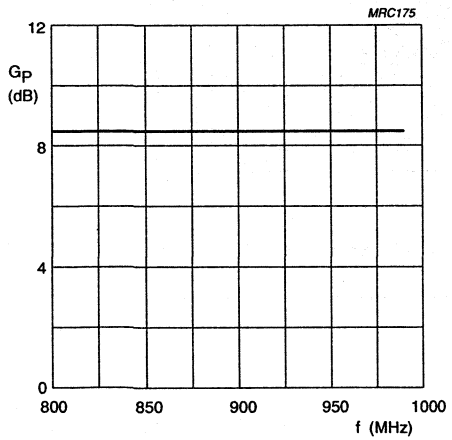


Fig.13 Power gain; class-AB operation; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

Philips Semiconductors

Data sheet	
status	Product specification
date of issue	March 1993

BLV98CE
UHF power transistor

FEATURES

- Internal input matching to achieve high power gain
- Implanted ballasting resistors an for optimum temperature profile
- Gold metallization ensures excellent reliability

DESCRIPTION

NPN silicon planar epitaxial transistor in an SOT-171 envelope, intended for common emitter, class-AB operation in radio transmitters for the 960 MHz communications band. 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 a common emitter class-AB circuit.

mode of operation	f (MHz)	V_{CE} (V)	P_L (W)	G_P (dB)	η_c (%)
c.w. class-AB	960	24	15	> 7.5	> 50

MECHANICAL DATA

SOT171 - see Fig.1.

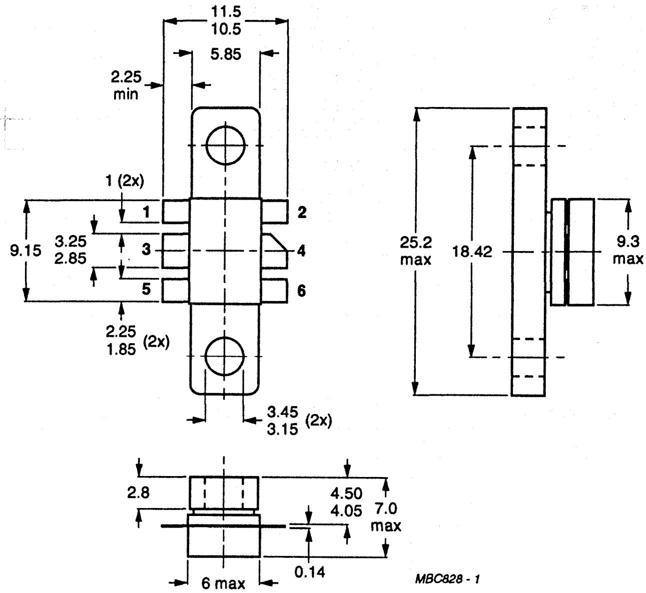
WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. **After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.**

UHF power transistor BLV98CE

MECHANICAL DATA

Dimensions in mm



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.

Fig.1 SOT-171.

PIN CONFIGURATION

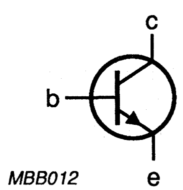


Fig.2 Pin configuration.

PINNING

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector base voltage	open emitter	–	50	V
V_{CEO}	collector emitter voltage	open base	–	27	V
V_{EBO}	emitter base voltage	open collector	–	3.5	V
I_C	collector current	DC or average	–	1.5	A
I_{CM}	collector current	peak value f > 1 MHz	–	4.5	A
P_{tot}	total power dissipation	f > 1 MHz T_{mb} = 25 °C	–	40	W
T_{stg}	storage temperature		–65	150	°C
T_j	operating junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
R_{thj-mb}	from junction to mounting base (RF)		–	4.4	K/W
$R_{th\ mb-h}$	from mounting base to heatsink		–	0.4	K/W

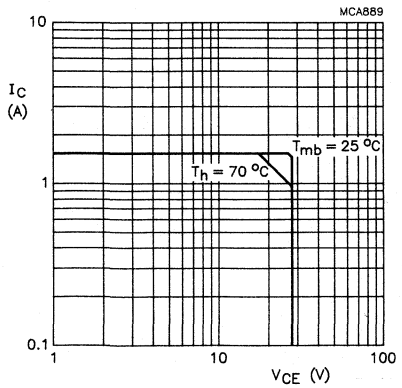


Fig.3 DC SOAR.

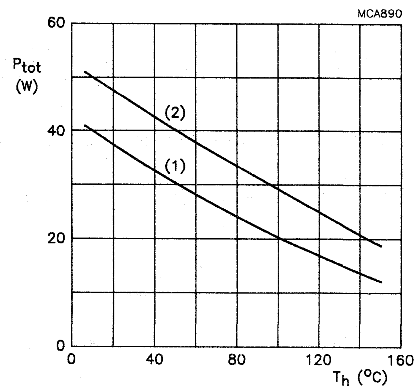


Fig.4 Power/temperature derating;
I: DC or RF operation;
II: short-term operation during mismatch.

CHARACTERISTICS

at $T_j = 25$ °C unless otherwise stated.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter $I_C = 25$ mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base $I_C = 50$ mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector $I_E = 5$ mA	3.5	–	–	V
I_{CES}	collector leakage current	$V_{BE} = 0$ $V_{CE} = 27$ V	–	–	5	mA
h_{FE}	DC current gain	$I_C = 1$ A $V_{CE} = 20$ V	15	–	–	
C_c	collector capacitance at f = 1 MHz	$I_E = I_e = 0$ $V_{CB} = 24$ V	–	23	–	pF
C_{re}	feedback capacitance at f = 1 MHz	$I_C = 0$ $V_{CE} = 24$ V	–	14	–	pF
C_{cf}	collector-flange capacitance		–	2	–	pF

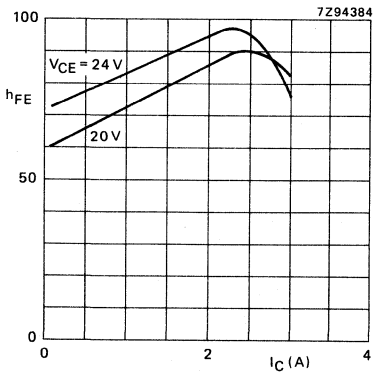


Fig.5 DC current gain as a function of collector current; typical values.

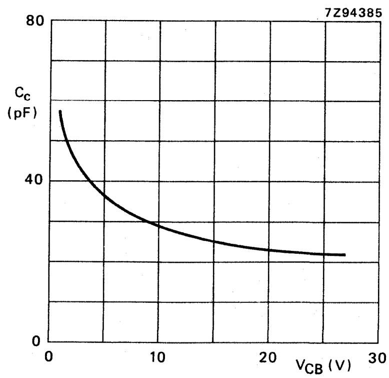


Fig.6 Output capacitance as a function of V_{CB}; typical values.

APPLICATION INFORMATION

RF performance in a common emitter test circuit.
T_h = 25 °C, $R_{th\ mb-h}$ = 0.4 K/W unless otherwise specified.

mode of operation	f (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (mA)	P_L (W)	G_P (dB)	η_c (%)
c.w. class-AB	960	24	30	15	> 7.5 typ. 8.5	> 50 typ. 55

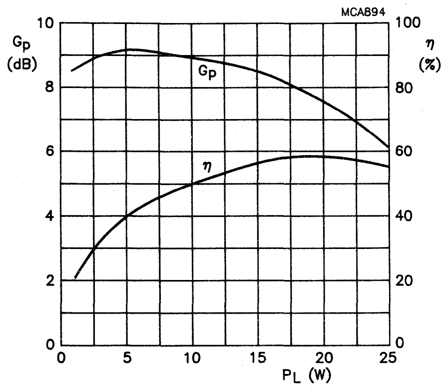


Fig.7 Power gain and efficiency as a function of load power; typical values.

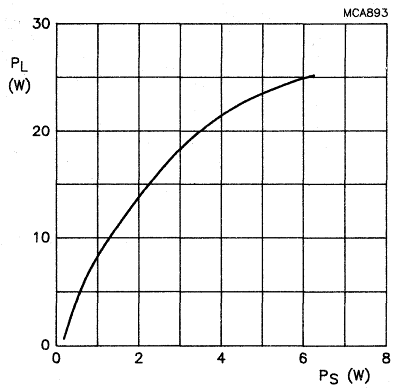


Fig.8 Load power as a function of input power; typical values.

Ruggedness in class-AB operation

The BLV98CE is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: V_{CE} = 24 V, $I_{C(ZS)}$ = 30 mA, f = 960 MHz at rated output power.

APPLICATION INFORMATION (continued)

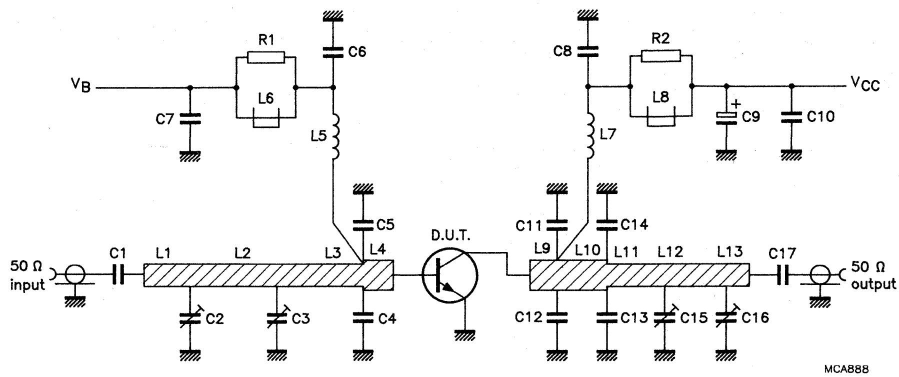


Fig.9 Test circuit BLV98CE class-AB.

APPLICATION INFORMATION (continued)

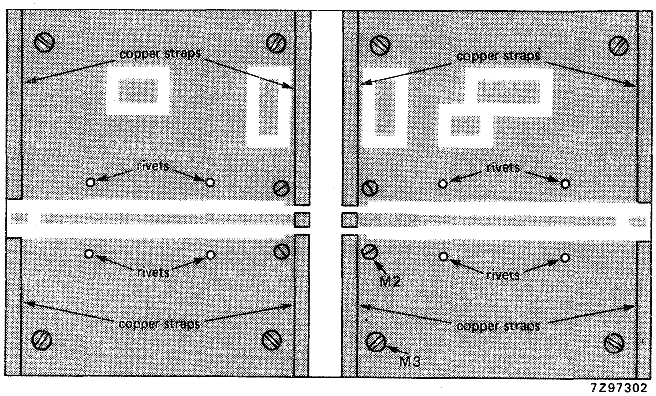
List of components (Fig. 9)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C7, C8,C17	multilayer ceramic chip capacitor	330 pF		
C2, C3, C15, C16	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor note 1	4.3 pF		
C9	35 V solid aluminium capacitor	2.2 μF		2222 128 50228
C10	multilayer ceramic chip capacitor	3 x 100 nF in parallel		
C11, C12	multilayer ceramic chip capacitor note 1	5.6 pF		
C13, C14	multilayer ceramic chip capacitor note 2	5.1 pF		
L1, L13	microstrip note 3	50 Ω	9.0 x 2.4 mm	
L2, L12	microstrip note 3	50 Ω	23.0 x 2.4 mm	
L3	microstrip note 3	50 Ω	16.0 x 2.4 mm	
L4	microstrip note 3	43 Ω	3.0 x 3.0 mm	
L5	3 turns enamelled 0.8 mm copper wire		int. dia. 3 mm length 5 mm leads 2 x 5 mm	
L6, L8	grade 3B ferroxcube wide-band RF choke			4312 020 36642
L7	4 turns enamelled 0.8 mm copper wire		int. dia. 4 mm length 5 mm leads 2 x 5 mm	
L9	microstrip note 3	43 Ω	3.5 x 3.0 mm	
L10	microstrip note 3	43 Ω	11.0 x 3.0 mm	
L11	microstrip note 3	50 Ω	4.5 x 2.4 mm	
R1, R2	0.4 W metal film resistor	10 Ω		2322 151 71009

Notes

1. ATC capacitor type 100A or capacitor of the same quality.
2. ATC capacitor type 100B or capacitor of the same quality.
3. The microstrips are on a double copper-clad PCB with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1/32 inch.

APPLICATION INFORMATION (continued)



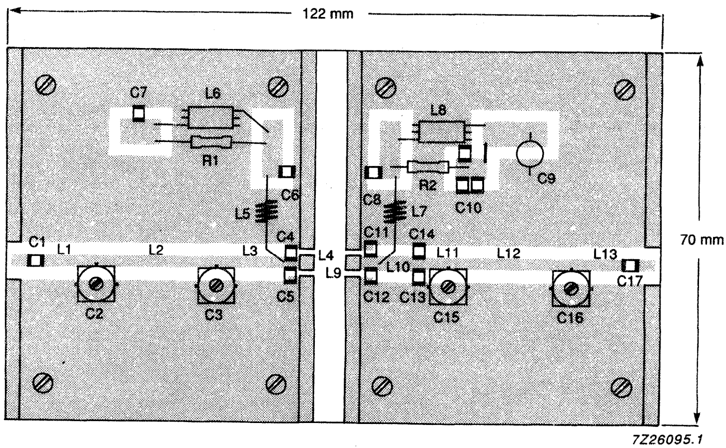


Fig.10 Printed circuit board and component layout for 960 MHz test circuit.

The circuit and components are located on one side of the PTFE fibre-glass board, the other side being fully metallized, to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact between the component side and the ground plane.

APPLICATION INFORMATION (continued)

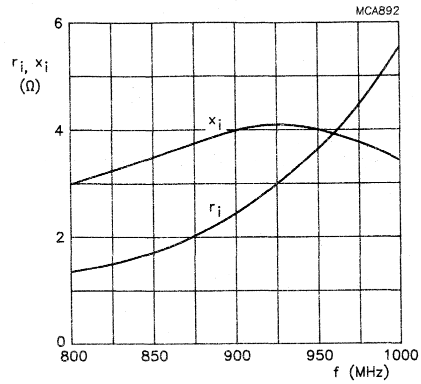


Fig.11 Input impedance; series components; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

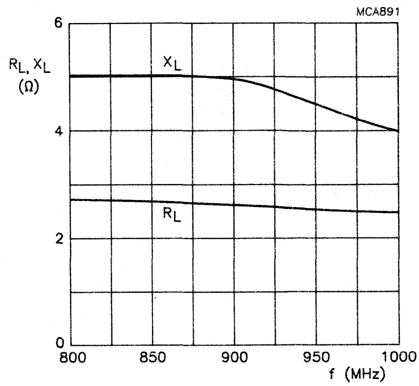


Fig.12 Load impedance; series components; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

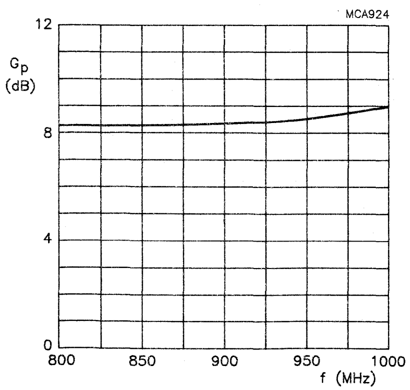


Fig.13 Power gain; class-AB operation; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

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 (SOT172A1). All leads are isolated from the stud.

QUICK REFERENCE DATA

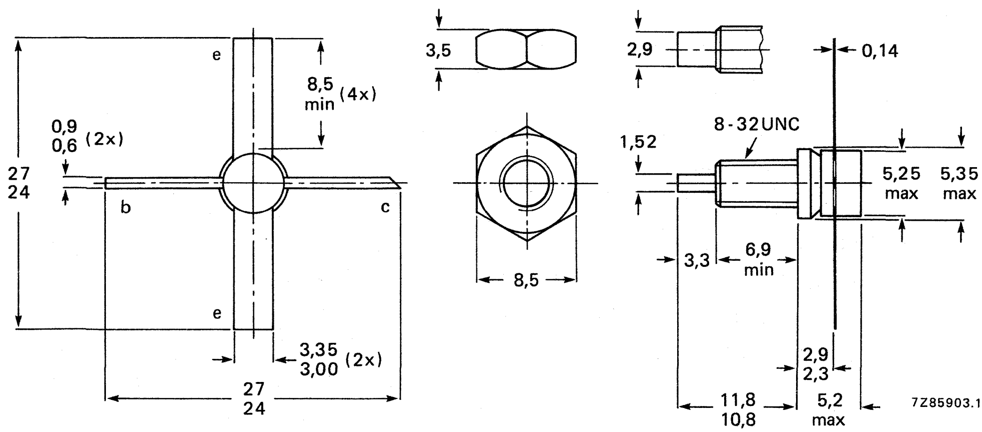
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

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 SOT172A1.



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.	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

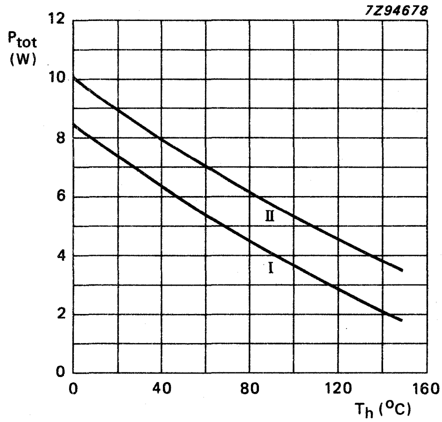


Fig. 2 Power/temperature derating curves.

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

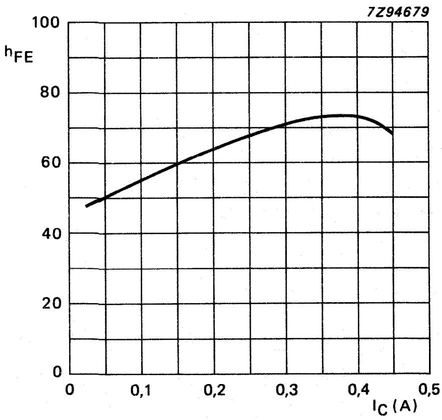


Fig. 3 V_{CE} = 20 V; T_j = 25 °C; typical values.

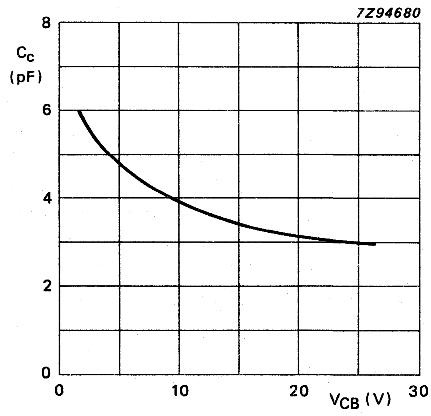


Fig. 4 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B)
f = 900 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 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

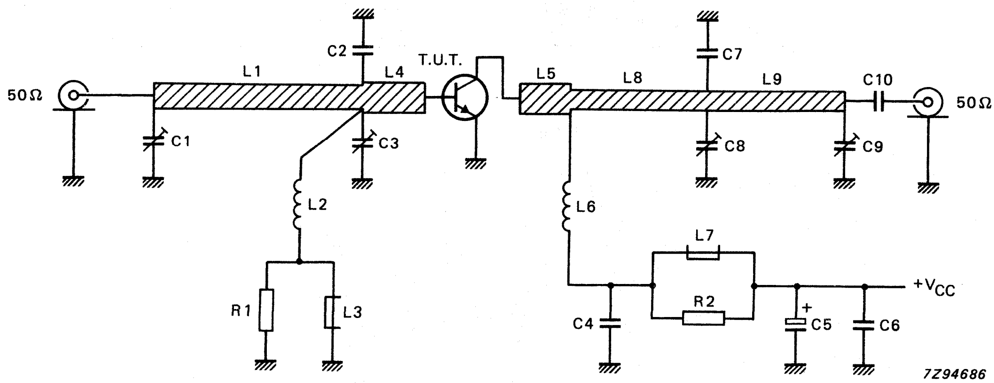


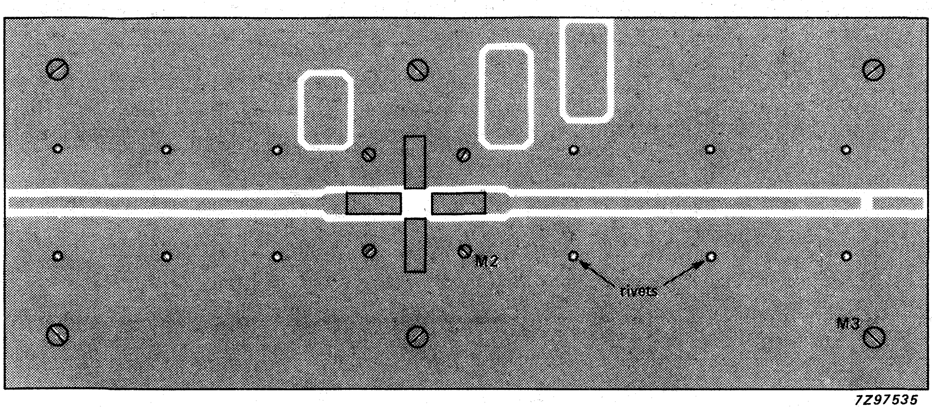
Fig. 5 class-B test circuit at f = 900 MHz.

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.



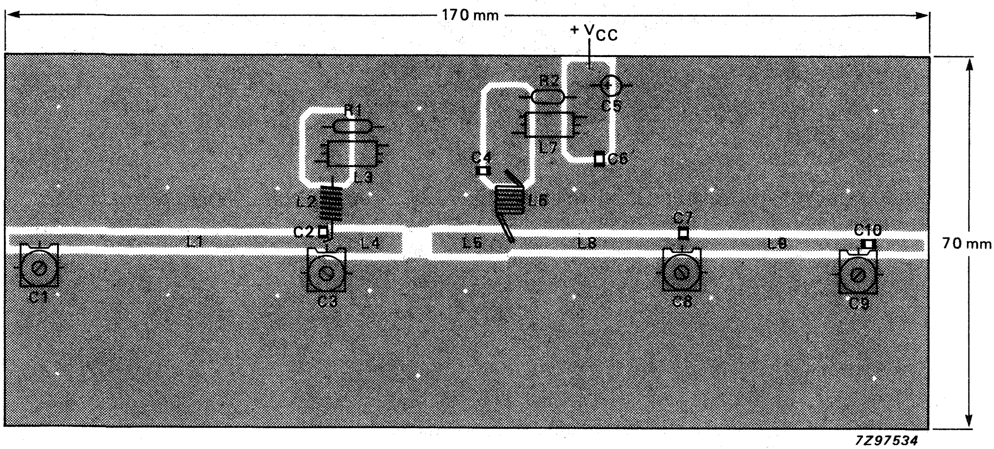


Fig. 6 Printed-circuit board and component layout for 900 MHz class-B test circuit.

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.

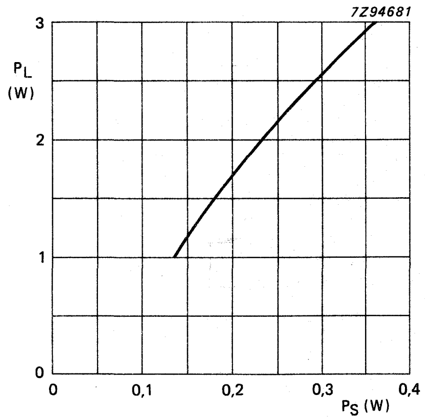


Fig. 7 Load power versus source power.

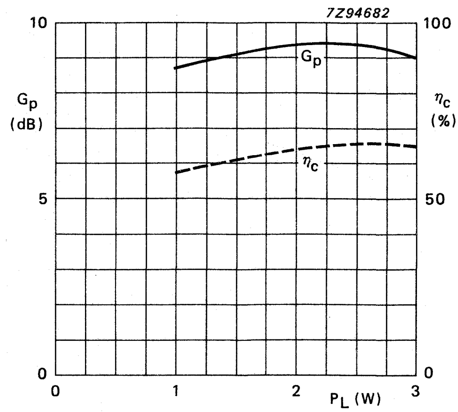


Fig. 8 Power gain and efficiency versus load power.

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).

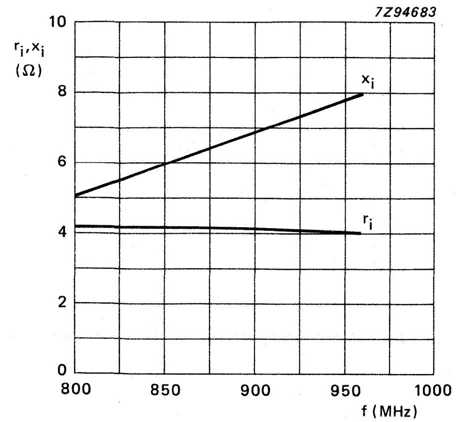


Fig. 9 Input impedance (series components).

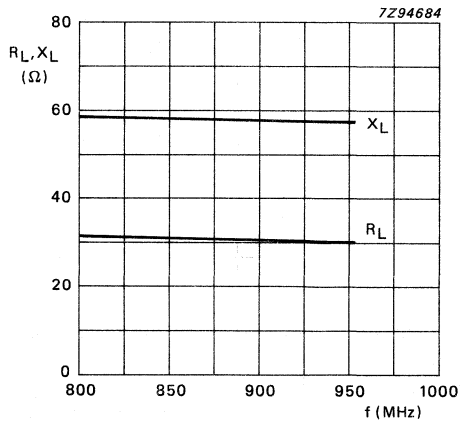


Fig. 10 Load impedance (series components).

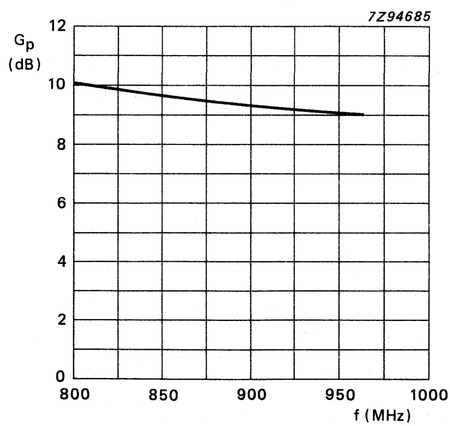


Fig. 11 Power gain versus frequency.

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.

UHF power transistor — BLV99/SL

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT172D envelope with a ceramic cap. It is designed primarily for use as a driver stage in base stations in the 900 MHz communications band. All leads are isolated from the mounting base.

PINNING - SOT172D

PIN	DESCRIPTION
1	emitter
2	base
3	collector
4	emitter

PIN CONFIGURATION

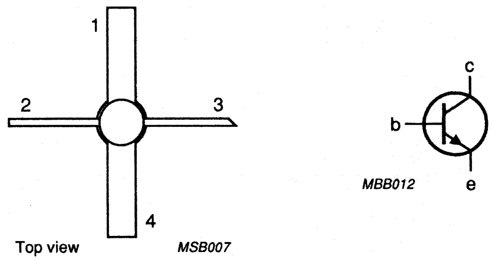


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

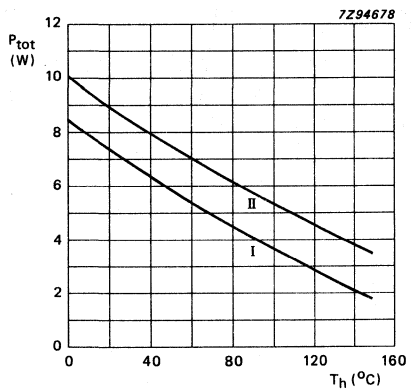
RF performance at T_{mb} = 25 °C in a common emitter class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	900	24	2	> 8	> 55

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current	DC value	–	200	mA
I_{CM}	collector current	peak value f > 1 MHz	–	600	mA
P_{tot}	total power dissipation	f > 1 MHz; T_{mb} = 50 °C	–	6	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C



(I) Continuous RF operation.

(II) Short time operation during mismatch.

Fig.2 Power/temperature derating curves.

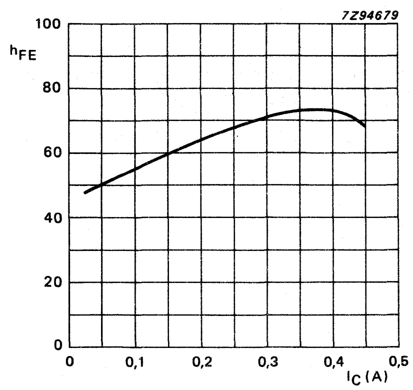
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_L = 4.5 W; T_{mb} = 25 °C	20	K/W

CHARACTERISTICS

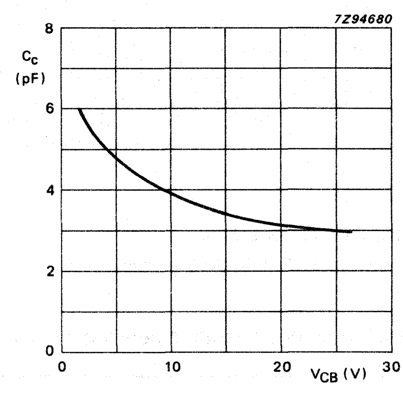
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	V_{BE} = 0; I_C = 10 mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	3.5	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 27 V	–	–	2	mA
h_{FE}	DC current gain	V_{CE} = 20 V; I_C = 150 mA	25	–	–	
E_{SBR}	second breakdown energy	L = 25 mH; R_{BE} = 10 Ω; f = 50 Hz	0.5	–	–	mJ
C_c	collector capacitance	V_{CB} = 24 V; $I_E = I_e$ = 0; f = 1 MHz	–	3	–	pF
C_{re}	feedback capacitance	V_{CE} = 24 V; I_C = 0; f = 1 MHz	–	1.3	–	pF



V_{CE} = 20 V; T_j = 25 °C.

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



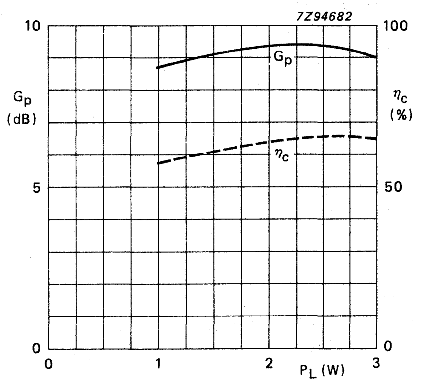
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

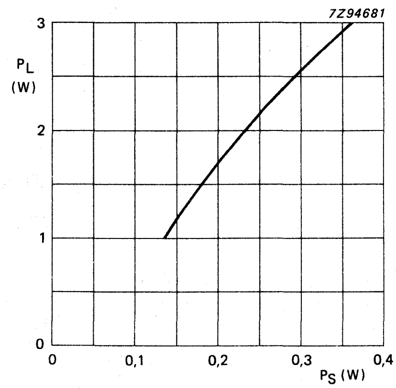
RF performance at T_{mb} = 25 °C in a common emitter class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. narrow band	900	24	2	> 8 typ. 9.3	> 55 typ. 63



Class-B operation; V_{CE} = 24 V; f = 900 MHz; T_{mb} = 25 °C.

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



Class-B operation; V_{CE} = 24 V; f = 900 MHz; T_{mb} = 25 °C.

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

Ruggedness in class-B operation

The BLV99/SL is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{CE} = 24 V, f = 900 MHz,
T_{mb} = 25 °C, and rated output power.

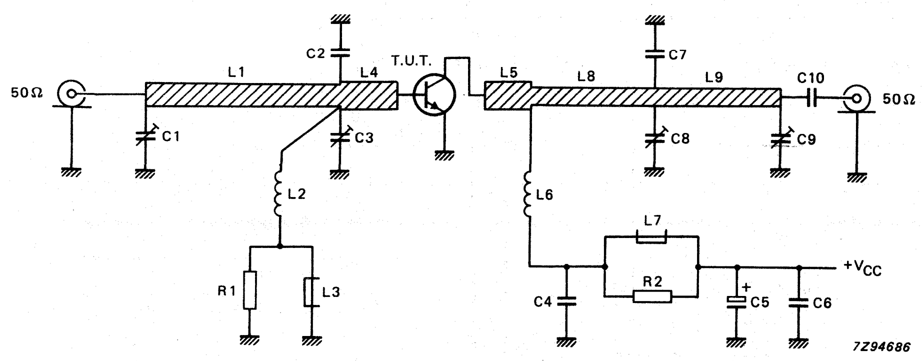


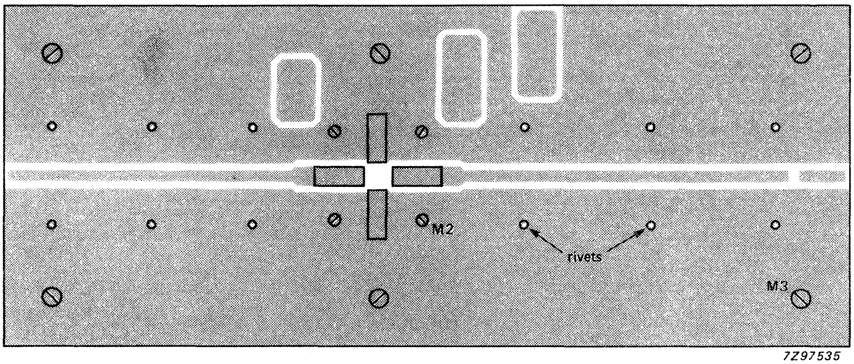
Fig.7 Class-B test circuit at f = 900 MHz.

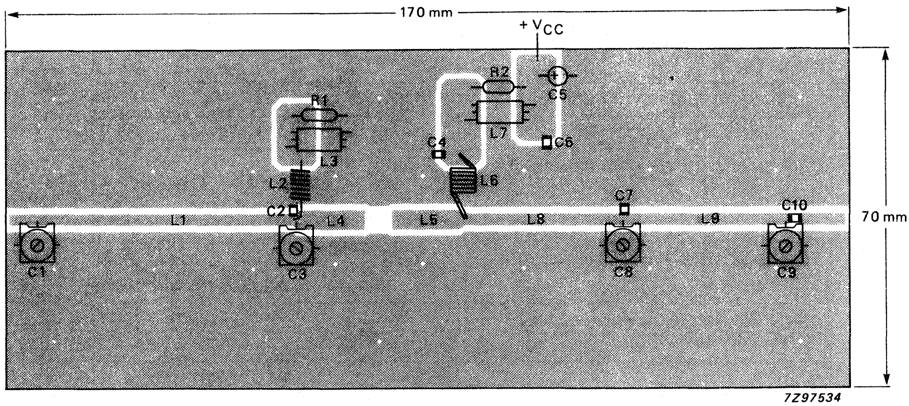
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C8, C9	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C2	multilayer ceramic chip capacitor (note 1)	4.7 pF		
C4, C6, C10	multilayer ceramic chip capacitor	220 pF		
C5	63 V electrolytic capacitor	1 µF		
C7	multilayer ceramic chip capacitor (note 1)	2.2 pF		
L1	stripline (note 2)	50 Ω	48 mm x 2.4 mm	
L2	7 turns enamelled 0.4 mm copper wire	50 nH	int. dia. 2 mm; leads 2 x 5 mm	
L3, L7	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L4, L5	stripline (note 2)	35 Ω	14 mm x 4 mm;	
L6	6 turns enamelled 1 mm copper wire	120 nH	int. dia. 6 mm; length 10 mm; leads 2 x 5 mm	
L8	stripline (note 2)	50 Ω	31 mm x 2.4 mm	
L9	stripline (note 2)	50 Ω	29 mm x 2.4 mm	
R1, R2	0.4 W metal film resistor	10 Ω, 5%		

Notes

1. American Technical Ceramics type 100A or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 1⁄32 inch.

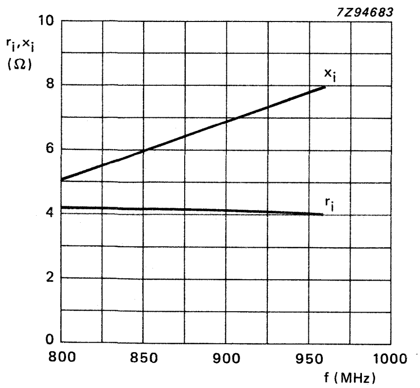




The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws, hollow rivets and copper straps under the emitters.

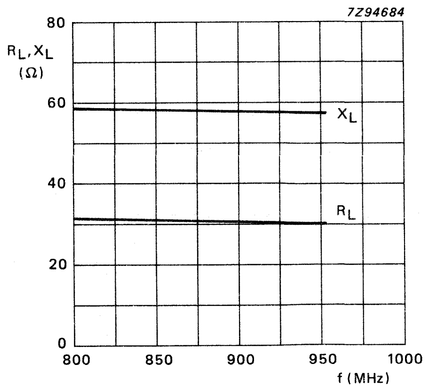
Fig.8 Component layout for 900 MHz class-B test circuit.

UHF power transistor BLV99/SL



Class-B operation; V_{CE} = 24 V; P_L = 2 W; T_{mb} = 25 °C.

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



Class-B operation; V_{CE} = 24 V; P_L = 2 W; T_{mb} = 25 °C.

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

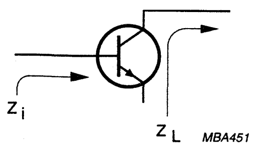
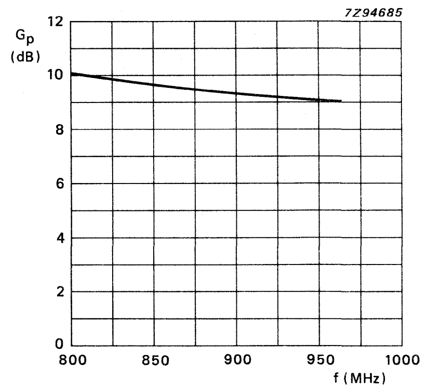


Fig.11 Definition of transistor impedance.



Class-B operation; V_{CE} = 24 V; P_L = 2 W; T_{mb} = 25 °C.

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

UHF power transistor — BLV100

FEATURES

- Internal input matching to achieve high power gain
- Ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor in a SOT171 envelope, intended for common emitter, class-AB operation in radio transmitters for the 960 MHz communications band. The transistor has a 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

PIN CONFIGURATION

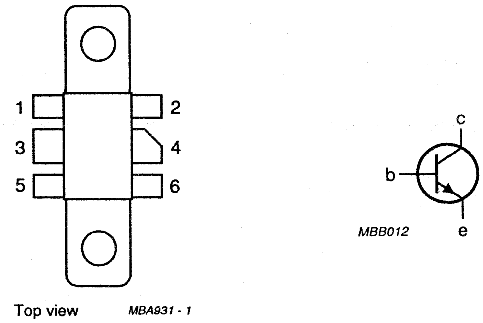


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

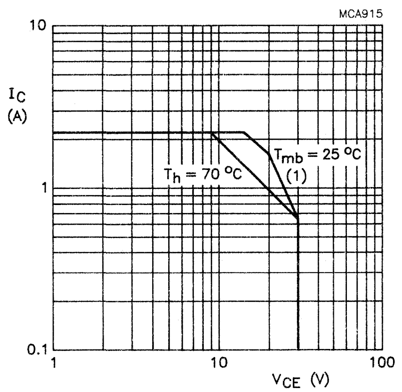
RF performance up to T_h = 25 °C in a common emitter class-AB test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-AB	960	24	8	> 8	> 50

LIMITING VALUES

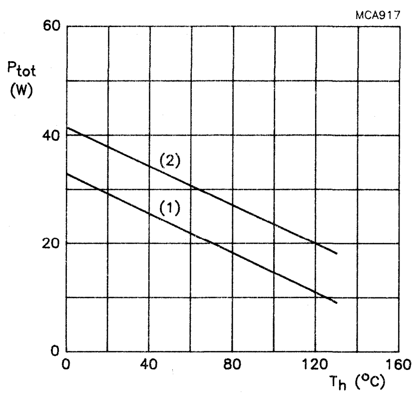
In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter voltage	peak value; $V_{BE} = 0$	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current	DC or average value	–	2.25	A
I_{CM}	collector current	peak value f > 1 MHz	–	3.5	A
P_{tot}	total power dissipation	f > 1 MHz; T_{mb} = 25 °C	–	31	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C



(1) Second breakdown limit (temperature independent).

Fig.2 DC SOAR.



(1) RF operation.

(2) Short time operation during mismatch.

Fig.3 Power/temperature derating curve.

THERMAL RESISTANCE

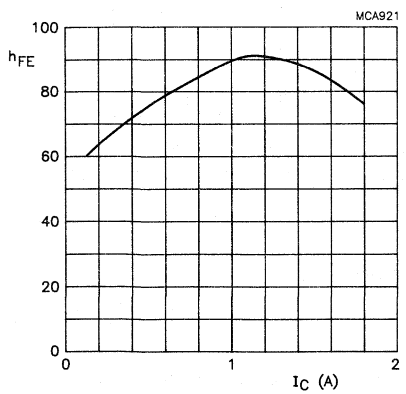
Dissipation = 31 W; T_{mb} = 25 °C.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	5.6	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.4	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CES}$	collector-emitter breakdown voltage	V_{BE} = 0; I_C = 8 mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 60 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 4 mA	4	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 30 V	–	–	2	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 0.6 A	20	75	–	
C_c	collector capacitance	V_{CB} = 25 V; $I_E = I_e$ = 0; f = 1 MHz	–	13.5	–	pF
C_{re}	feedback capacitance	V_{CE} = 25 V; I_C = 40 mA; f = 1 MHz	–	8.4	–	pF
C_{c-f}	collector-flange capacitance		–	2	–	pF



V_{CE} = 25 V.

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

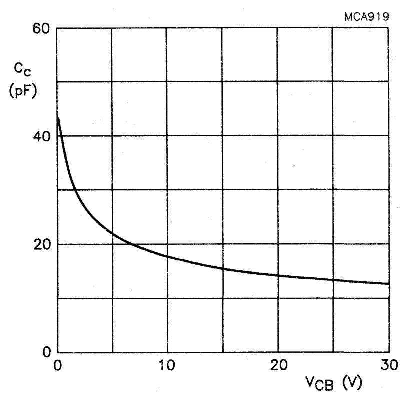


Fig.5 Output capacitance as a function of collector-base voltage, typical values.

APPLICATION INFORMATION

RF performance in a class-AB circuit; T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W, unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-AB	960	24	20	8	> 8 typ. 9	> 50 typ. 55

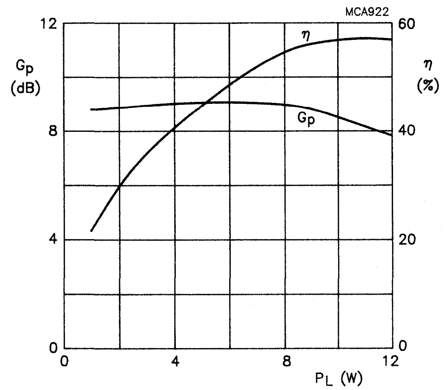


Fig.6 Gain and efficiency as functions of load power, typical values.

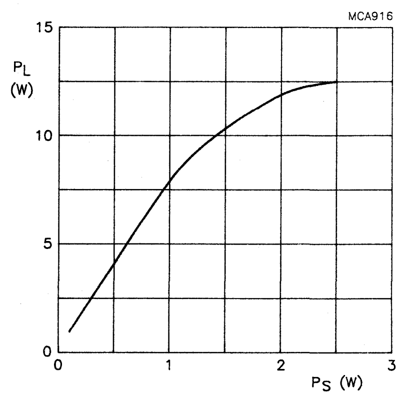


Fig.7 Load power as a function of drive power, typical values.

Ruggedness in class-AB operation

The BLV100 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases, under the following conditions:

V_{CE} = 24 V, f = 960 MHz, and rated output power.

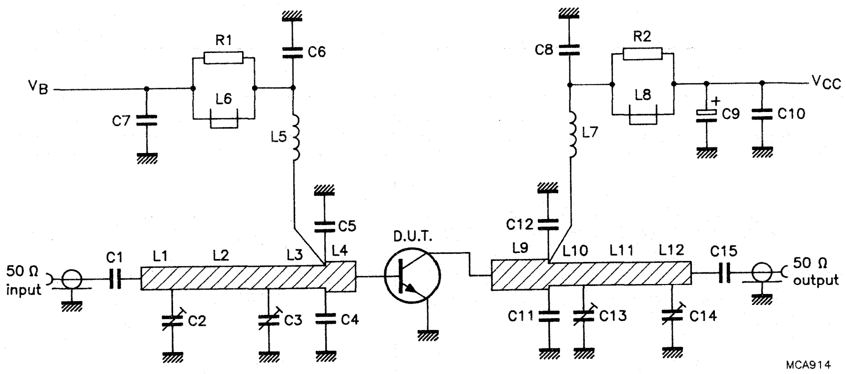


Fig.8 Class-AB test circuit at f = 960 MHz.

List of components (see test circuit)

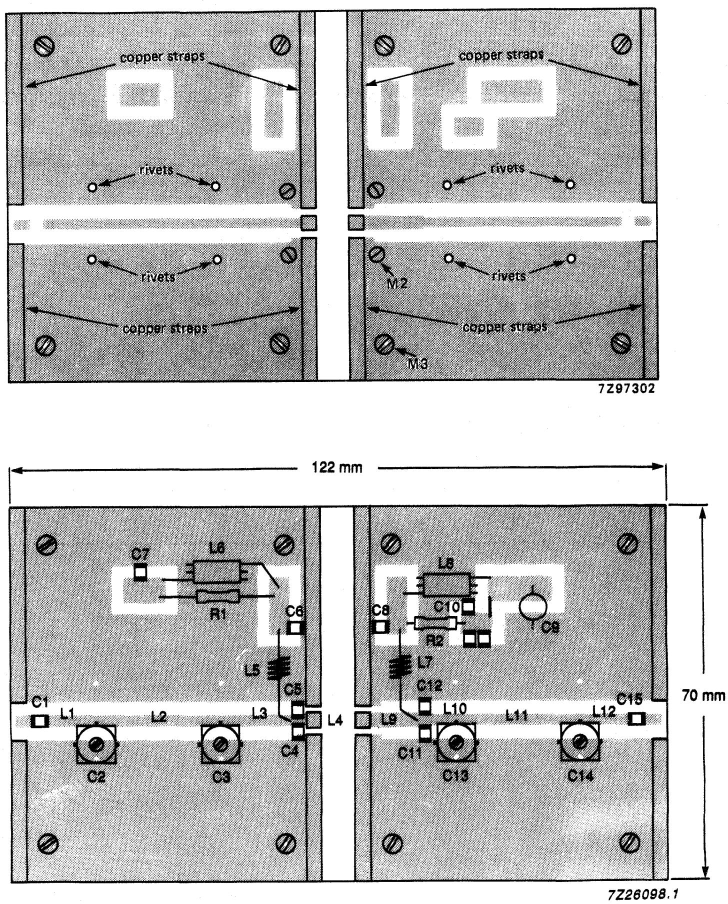
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C7, C8, C15	multilayer ceramic chip capacitor	330 pF		
C2, C3, C13, C14	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor (note 1)	5.1 pF		
C9	35 V solid aluminium capacitor	2.2 μF		2222 128 50228
C10	multilayer ceramic chip capacitor	3 x 100 pF in parallel		
C11, C12	multilayer ceramic chip capacitor (note 2)	6.2 pF		
L1, L12	microstrip (note 3)	50 Ω	9 x 2.4 mm	
L2, L11	microstrip (note 3)	50 Ω	23 x 2.4 mm	
L3	microstrip (note 3)	50 Ω	16 x 2.4 mm	
L4	microstrip (note 3)	43 Ω	3 x 3 mm	
L5	3 turns enamelled 0.8 mm copper wire		int. dia. 3 mm; length 5 mm; leads 2 x 5 mm	
L6, L8	grade 3B Ferroxcube wideband RF choke			4312 020 36642

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L7	4 turns enamelled 0.8 mm copper wire		int. dia. 4 mm; length 5 mm; leads 2 x 5 mm	
L9	microstrip (note 3)	43 Ω	14.5 mm x 3 mm;	
L10	microstrip (note 3)	50 Ω	4.5 mm x 2.4 mm;	
R1, R2	0.4 W metal film resistor	10 Ω		2322 151 71009

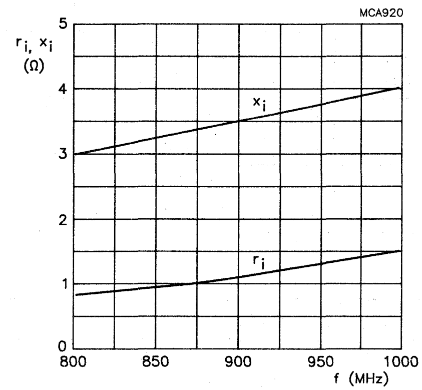
Notes

1. American Technical Ceramics capacitor type 100A, or capacitor of the same quality.
2. American Technical Ceramics capacitor type 100B, or capacitor of the same quality.
3. The microstrips are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$), thickness $1/32$ inch.



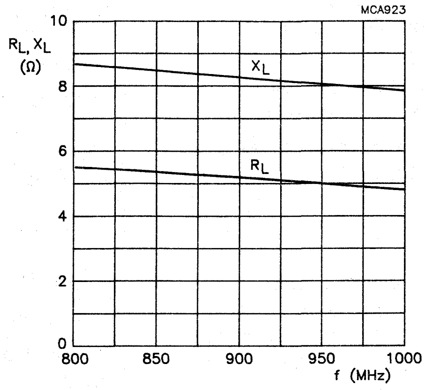
The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 960 MHz test circuit.



V_{CE} = 24 V; I_{CQ} = 20 mA; P_L = 8 W.

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



V_{CE} = 24 V; I_{CQ} = 20 mA; P_L = 8 W.

Fig.11 Load impedance (series components) as a function of frequency, typical values.

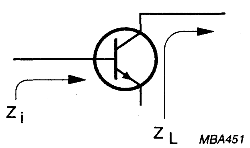
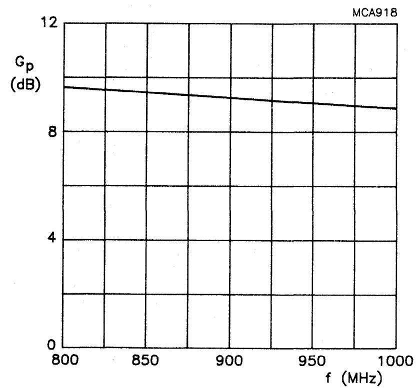


Fig.12 Definition of transistor impedance.



V_{CE} = 24 V; I_{CQ} = 20 mA; P_L = 8 W.

Fig.13 Power gain as a function of frequency, typical values.

UHF power transistors

BLV101A/BLV101B

FEATURES

- High input and output impedances promote easy matching
- Implanted ballast resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistors intended for common emitter, class-AB operation in base station transmitters in the frequency range 850 to 960 MHz. Both transistors have a SOT273 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT273

PIN	DESCRIPTION
1	emitter
2	emitter
3	collector
4	base
5	emitter
6	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit. Mode of operation: c.w. class-AB.

TYPE	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
BLV101A	900	26	50	> 8.5	> 48
	960	26	50	typ. 9.8	typ. 45
BLV101B	960	26	50	> 7.5	> 46
	900	26	50	typ. 8.1	typ. 57

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

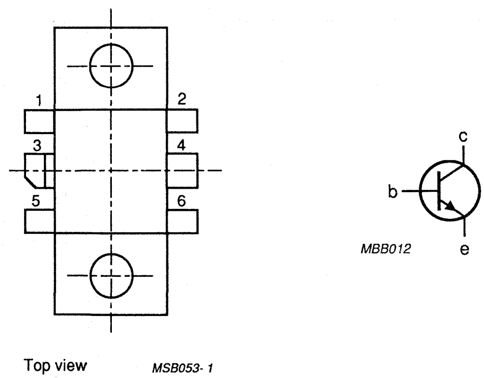


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current	DC or average value	–	10	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; f > 1 MHz	–	100	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		–	200	°C

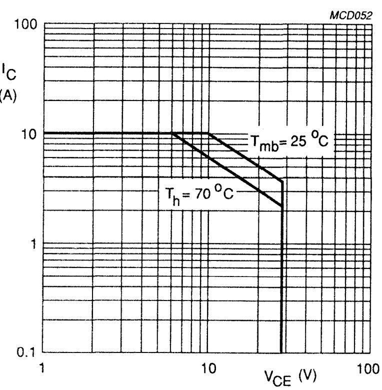
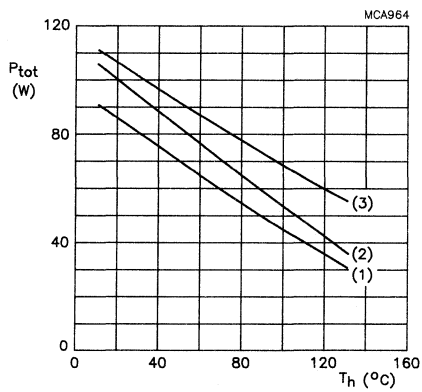


Fig.2 DC SOAR.



(1) DC operation.
(2) Continuous RF operation (f > 1 MHz).
(3) Short time operation during mismatch (f > 1 MHz).

Fig.3 Power/temperature derating.

THERMAL RESISTANCE

The following values apply to both transistors. P_{Diss} (DC) = 100 W; T_{mb} = 25 °C.

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	from junction to mounting base (DC)	1.75 K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.3 K/W

CHARACTERISTICS

The following values apply to both transistors. $T_j = 25\ °C$.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 75$ mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 150$ mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 15$ mA	3.5	–	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 27$ V	–	–	15	mA
h_{FE}	DC current gain	$V_{CE} = 20$ V; $I_C = 3$ A	15	62	–	
C_{ob}	output capacitance (note 1)	$V_{CB} = 26$ V; $I_E = I_e = 0$; f = 1 MHz	–	–	75	pF

Note

1. The value of C_{ob} is that of the die only; it is not measurable, because of the internal matching network.

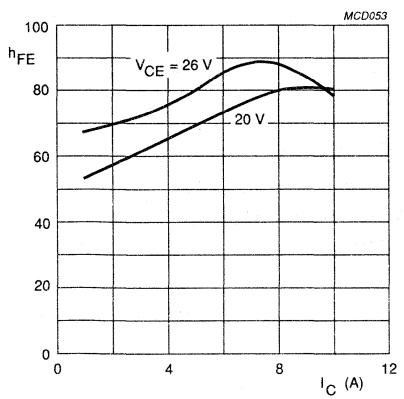


Fig.4 DC current gain as a function of collector current; typical values.

APPLICATION INFORMATION

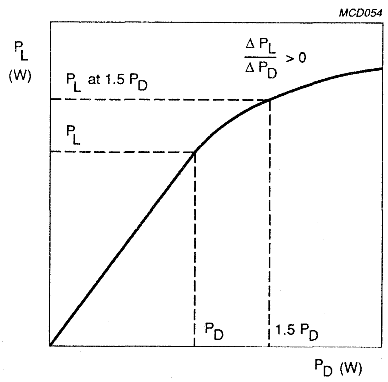
RF performance in a common emitter test circuit; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; mode of operation: c.w. class-AB.

TYPE	f (MHz)	V_{CE} (V)	$I_{C(ZS)}$ (mA)	P_L (W)	G_p (dB)	η_c (%)
BLV101A	900	26	200	50	> 8.5 typ. 9.5	> 48 typ. 53
	900	26	200	60	typ. 8.3	typ. 50
	960	26	200	50	typ. 9.8	typ. 45
	900	24	200	45	typ. 9.3	typ. 55
BLV101B	960	26	200	50	> 7.5 typ. 8.4	> 46 typ. 51
	900	26	200	50	typ. 8.1	typ. 57
	960	24	200	45	typ. 8.2	typ. 51

Ruggedness in class-B operation

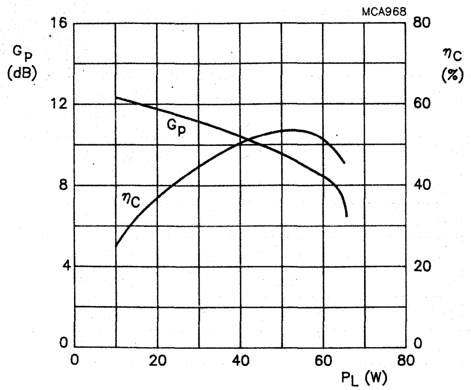
The BLV101A and 101B are capable of withstanding a load mismatch corresponding to VSWR = 5:1 through all phases under the following conditions:

V_{CE} = 26 V, f = 900 MHz (BLV101A), f = 960 MHz (BLV101B), at P_L = 50 W.



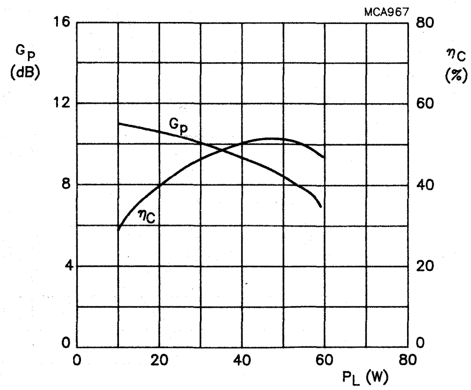
To guarantee the ratio $\frac{\Delta P_L}{\Delta P_D} > 0$, a 50% input overdrive is permitted for a load power ≤ 50 W.

Fig.5 Overdrive conditions.



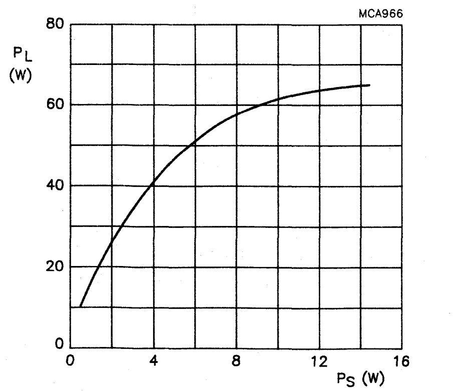
BLV101A; f = 900 MHz.

Fig.6 Power gain and efficiency as functions of load power, typical values.



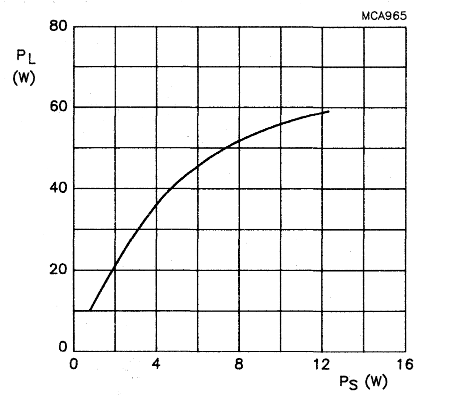
BLV101B; f = 960 MHz.

Fig.7 Power gain and efficiency as functions of load power, typical values.



BLV101A; f = 900 MHz.

Fig.8 Load power as a function of drive power; typical values.



BLV101B; f = 960 MHz.

Fig.9 Load power as a function of drive power; typical values.

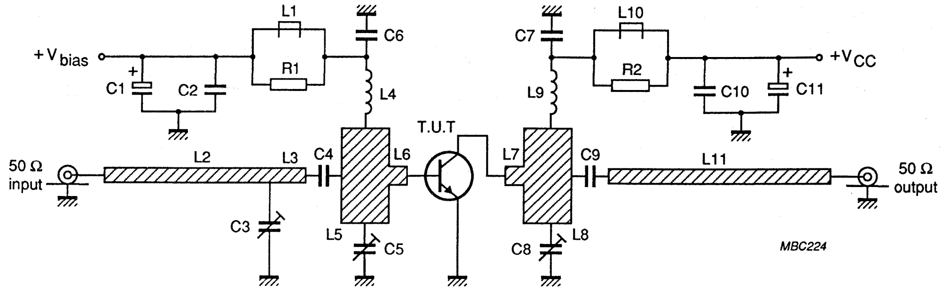


Fig.10 900 MHz test circuit BLV101A, class-AB.

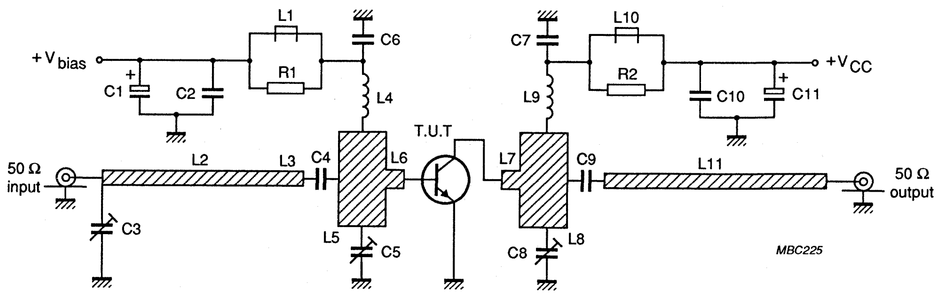


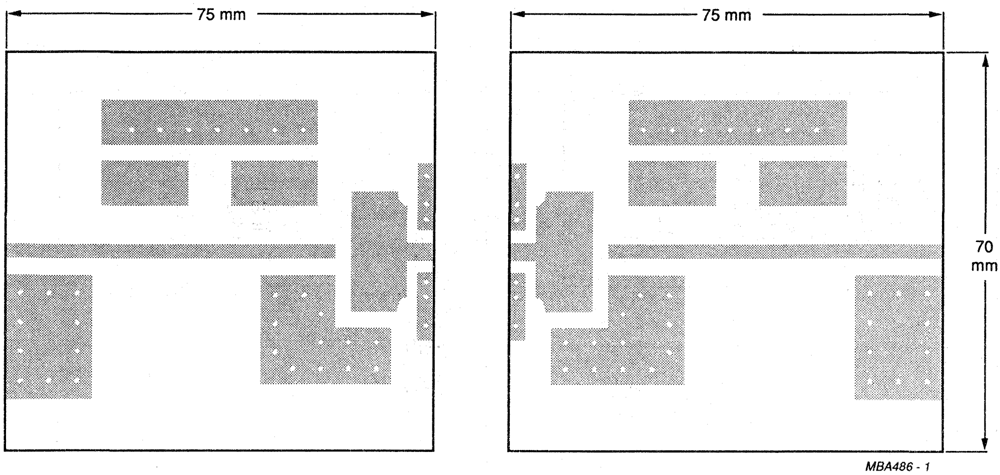
Fig.11 960 MHz test circuit BLV101B, class-AB.

List of components (see test circuits)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C11	50 V multilayer ceramic chip capacitor	100 nF		2222 581 76641
C2, C10	63 V electrolytic capacitor	10 μF		2222 030 28109
C3, C5, C8	Tekelec type 5201 trimming capacitor	0.8 to 10 pF		
C4, C9	500 V multilayer ceramic chip capacitor (note 2)	68 pF		
C6, C7	500 V multilayer ceramic chip capacitor (note 2)	39 pF		
L1, L10	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L2	stripline (note 1)		width 2.2 mm length 50 mm	
L3	stripline (note 1)		width 2.2 mm length 8 mm	
L4	microchoke	2.2 μH		4322 057 02281
L5, L8	stripline (note 1)		width 20 mm length 10 mm	
L6, L7	stripline (note 1)		width 3.5 mm length 4.5 mm	
L9	4 turns 1 mm closely wound enamelled copper wire		int. dia. 4 mm	
L11	stripline (note 1)		width 2.2 mm length 58 mm	
R1, R2	0.4 W metal film resistor	10 Ω		

Notes

1. The striplines on a double copper-clad printed circuit board, with a PTFE micro-fibreglass dielectric (ε_r = 2.2); thickness 1⁄32 inch; thickness of copper sheet 2 x 35 μm.
2. American Technical Ceramics capacitor type 100B, or capacitor of the same quality.



The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections from the component side to the ground plane are made by means of through plated holes.

Fig.12 Printed circuit board for 900/960 MHz test circuits.

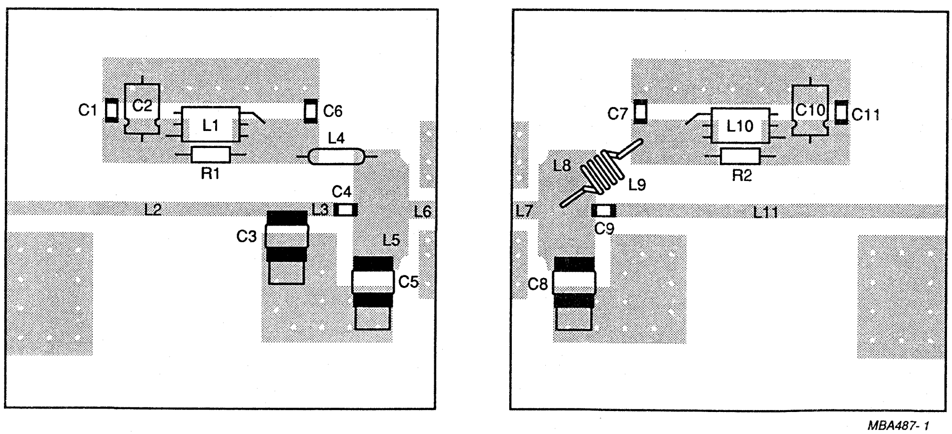


Fig.13 Component layout for 900 MHz test circuit, BLV101A.

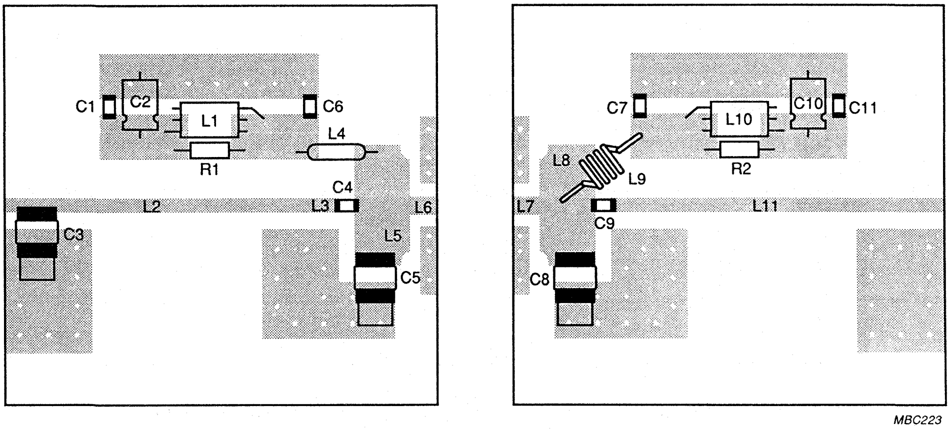
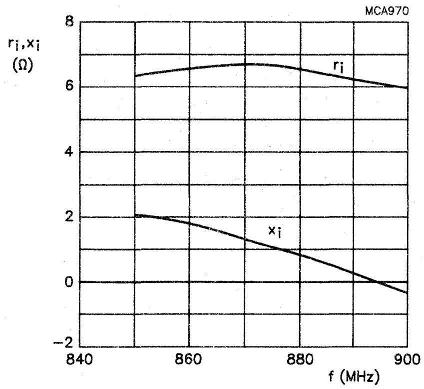


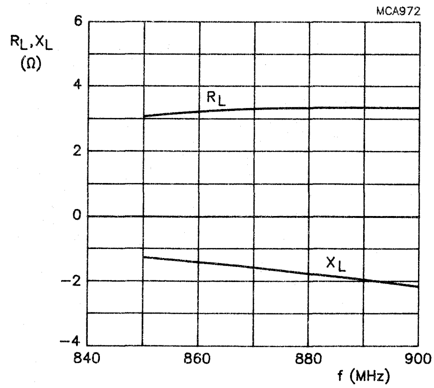
Fig.14 Component layout for 960 MHz test circuit, BLV101B.



BLV101A

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

Fig.15 Input impedance (series components).



BLV101A

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

Fig.16 Load impedance (series components).

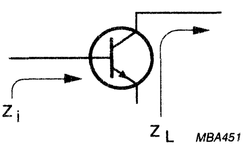
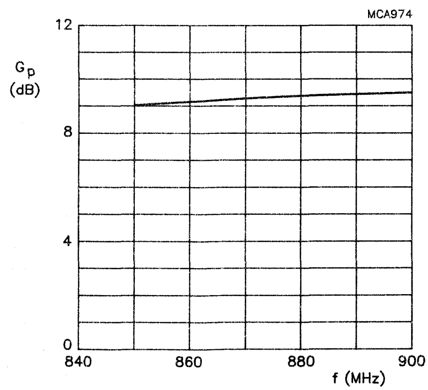


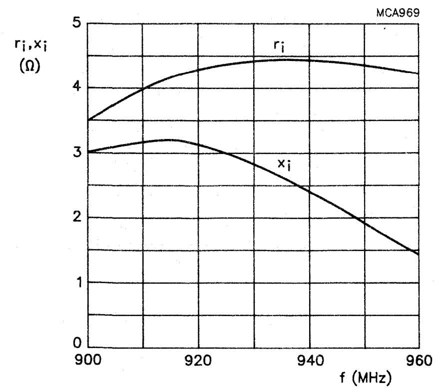
Fig.17 Definition of transistor impedance.



BLV101A

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

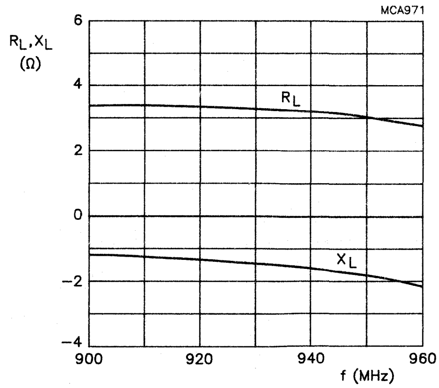
Fig.18 Power gain, class-AB operation.



BLV101B

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

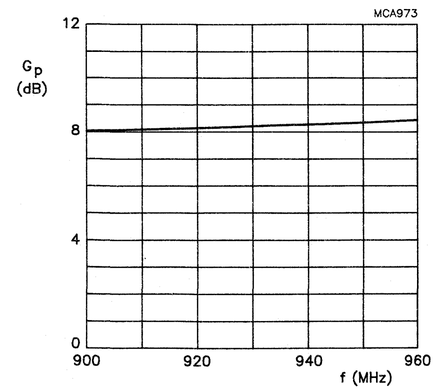
Fig.19 Input impedance (series components).



BLV101B

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

Fig.20 Load impedance (series components).



BLV101B

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

Fig.21 Power gain, class-AB operation.

UHF power transistor

BLV103

FEATURES

- Internal matching for an optimum wideband capability and high gain
- Emitter-ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 6-lead SOT171 flange envelope with a ceramic cap. It is intended for common emitter, class-AB operation in cellular radio base stations in the 960 MHz frequency band. All leads are isolated from the mounting base.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

QUICK REFERENCE DATA

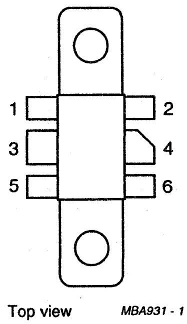
RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-AB	960	24	4	> 11.5	> 45

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION



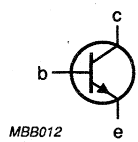
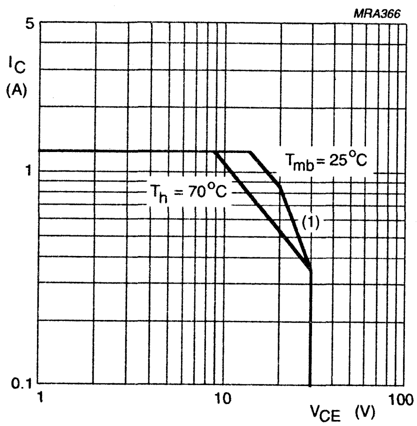


Fig.1 Simplified outline and symbol.

LIMITING VALUES

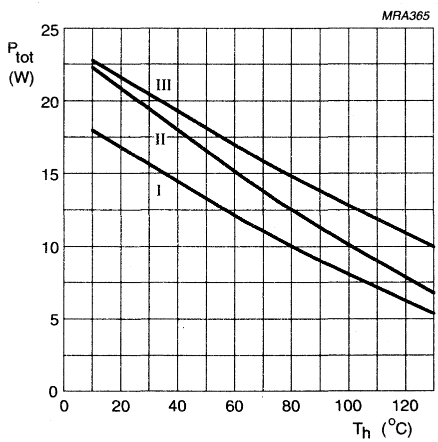
In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	50	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current	DC or average value	–	1.25	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	17	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C



(1) Second breakdown limit (independent of temperature).

Fig.2 DC SOAR.



(I) Continuous DC operation.

(II) Continuous RF operation.

(III) Short time operation during mismatch.

Fig.3 Power/temperature derating.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	T_{mb} = 25 °C; P_{dis} = 17 W	10.3	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.4	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 4 mA	50	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 30 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 2 mA	4	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 30 V	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 300 mA	20	40	–	
C_c	collector capacitance	V_{CB} = 25 V; $I_E = I_e$ = 0; f = 1 MHz	–	6.6	8	pF
C_{re}	feedback capacitance	V_{CE} = 25 V; I_C = 20 mA; f = 1 MHz	–	3.5	4.5	pF

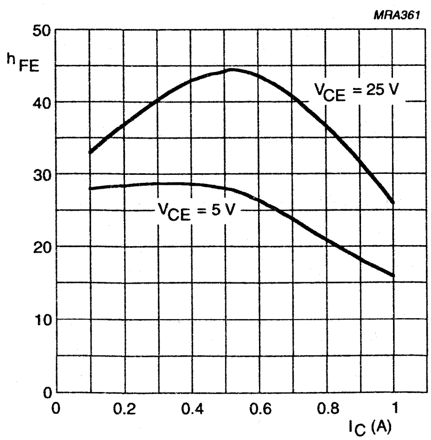
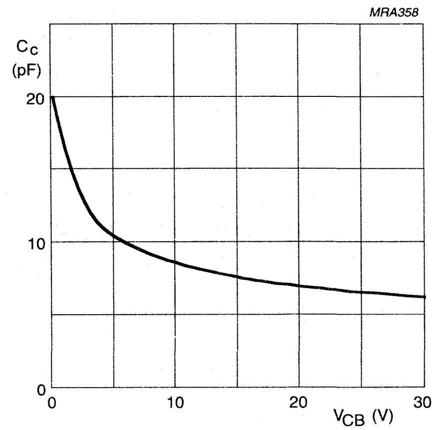


Fig.4 DC current gain as a function of collector current, typical values.



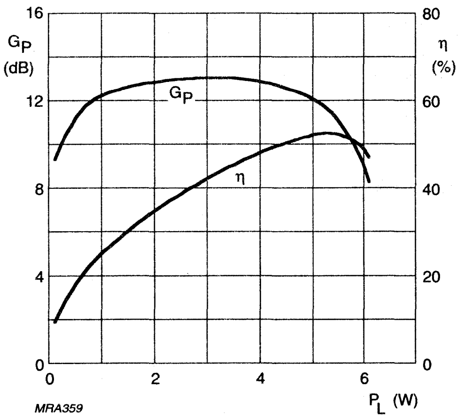
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

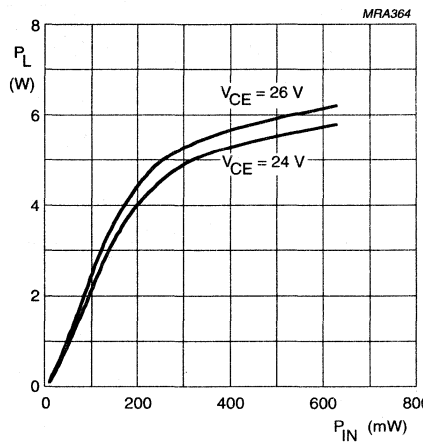
RF performance at T_h = 25 °C in a common emitter test circuit, $R_{th\ mb\text{-}h}$ = 0.4 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-AB	960	24	5	4	> 11.5 typ. 13	> 45 typ. 48
	960	26	5	4	typ. 14	typ. 50



Class-AB operation; I_{CQ} = 5 mA; f = 960 MHz; V_{CE} = 24 V.

Fig.6 Gain and efficiency as functions of load power, typical values.



Class-AB operation; I_{CQ} = 5 mA; f = 960 MHz.

Fig.7 Load power as a function of drive power, typical values.

Ruggedness in class-AB operation

The BLV103 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power under the following conditions:

V_{CE} = 24 V; f = 960 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

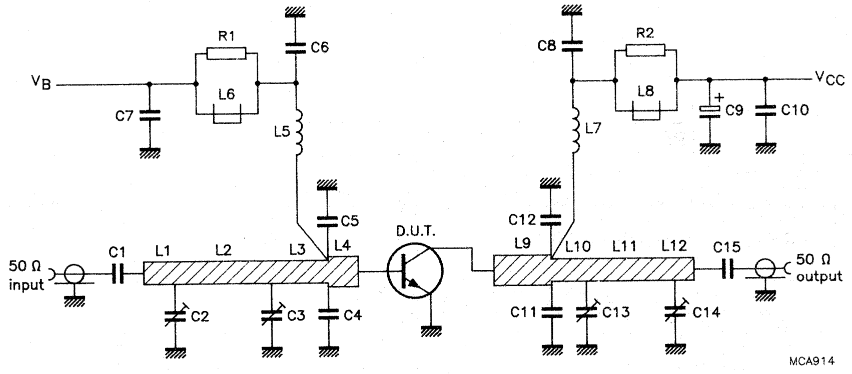


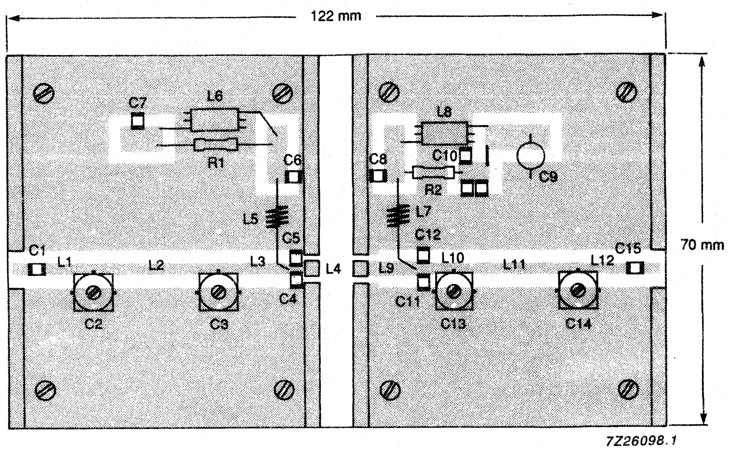
Fig.8 Class-AB test circuit at f = 960 MHz.

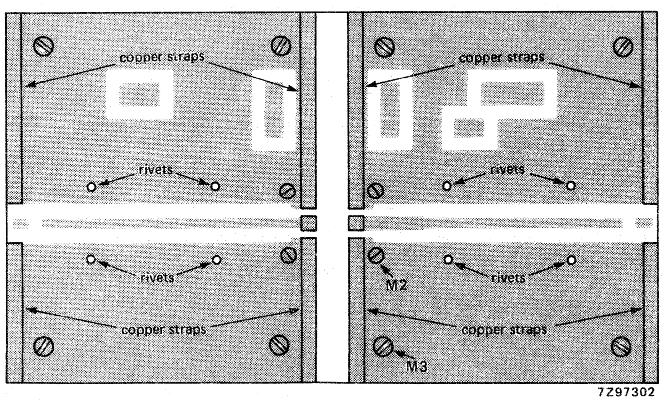
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C7, C8, C15	multilayer ceramic chip capacitor	330 pF		
C2, C3, C13, C14	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor (note 1)	5.1 pF		
C9	35 V solid aluminium capacitor	2.2 μF		2222 128 50228
C10	multilayer ceramic chip capacitor	3 x 100 nF in parallel		
C11, C12	multilayer ceramic chip capacitor (note 2)	6.2 pF		
L1, L12	stripline (note 3)	50 Ω	9 mm x 2.4 mm	
L2, L11	stripline (note 3)	50 Ω	23 mm x 2.4 mm	
L3	stripline (note 3)	50 Ω	16 mm x 2.4 mm	
L4	stripline (note 3)	43 Ω	3 mm x 3 mm	
L5	3 turns enamelled 0.8 mm copper wire		int. dia. 3 mm; length 5 mm; leads 2 mm x 5 mm	
L6, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L7	4 turns enamelled 0.8 mm copper wire		int. dia. 4 mm; length 5 mm; leads 2 mm x 5 mm	
L9	stripline (note 3)	43 Ω	14.5 mm x 3 mm	
L10	stripline (note 3)	50 Ω	4.5 mm x 2.4 mm	
R1, R2	0.4 W metal film resistor	10 Ω		2322 151 71009

Notes

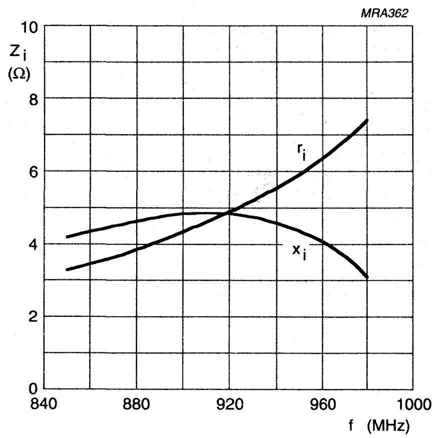
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄32 inch.





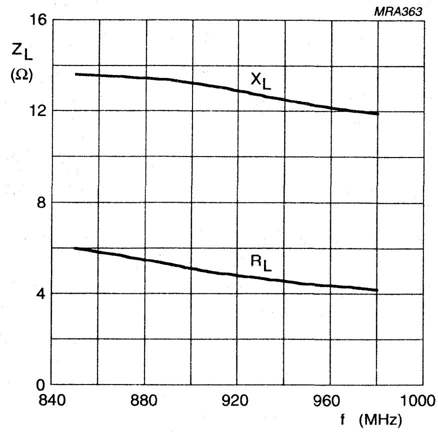
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is fully metallized and serves as a ground plane. Connections are made by means of fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact between the components side and the ground plane.

Fig.9 Component layout for 960 MHz class-AB test circuit.



Class-AB operation; V_{CE} = 24 V; I_{CQ} = 5 mA;
P_L = 4 W; T_h = 25 °C.

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



Class-AB operation; V_{CE} = 24 V; I_{CQ} = 5 mA;
P_L = 4 W; T_h = 25 °C.

Fig.11 Load impedance (series components) as a function of frequency, typical values.

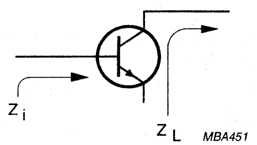
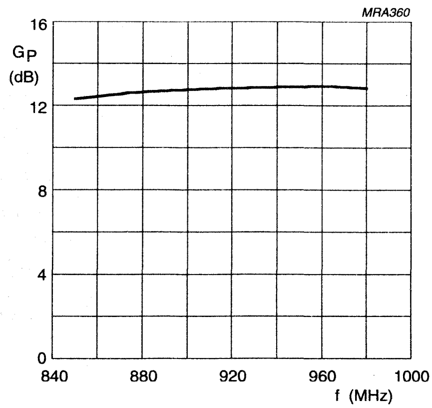


Fig.12 Definition of transistor impedance.



Class-AB operation; V_{CE} = 24 V; I_{CQ} = 5 mA;
P_L = 4 W; T_h = 25 °C.

Fig.13 Power gain as a function of frequency, typical values.

UHF power transistor BLV193

FEATURES

- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-A and class-AB operation in the 900 MHz communications band.

The transistor has a SOT171 flange envelope with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	d_{im} (dB) (note 1)
c.w. class-AB	900	12.5	12	≥ 6.5	≥ 50	–
c.w. class-A	900	12	6 (PEP)	typ. 11	–	typ. −30

Note

1. 2-tone measurement, f_p = 900 MHz, f_q = 901 MHz.

PIN CONFIGURATION

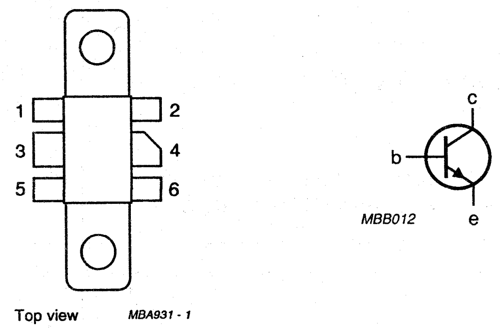


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	DC or average value	–	3.5	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	44	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	200	°C

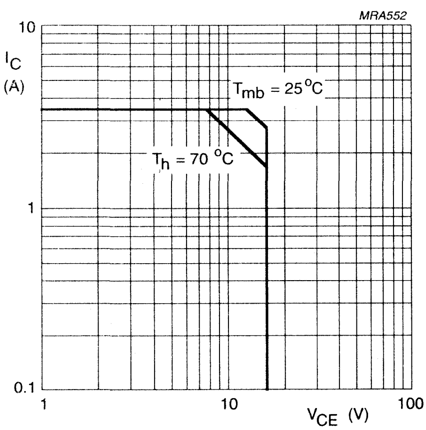
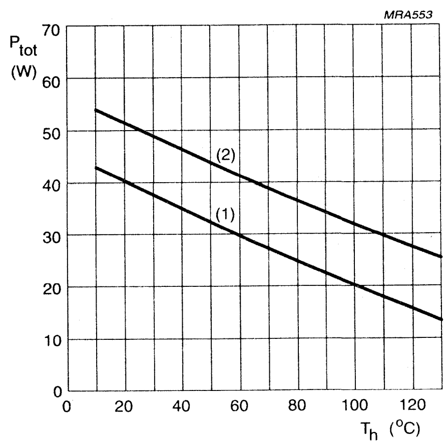


Fig.2 DC SOAR.



(1) Continuous operation.

(2) Short time operation during mismatch.

Fig.3 Power derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	from junction to mounting base	P_{dis} = 44 W; T_{mb} = 25 °C	4.0 K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.4 K/W

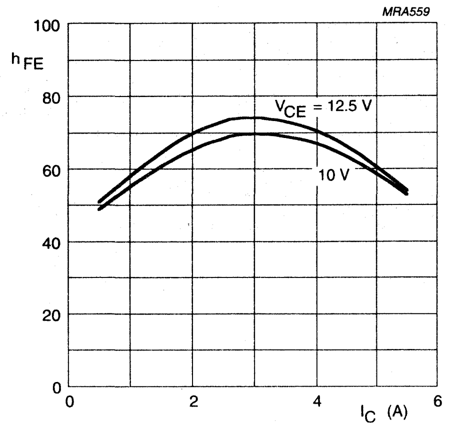
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 40 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{CE} = 16 V; V_{BE} = 0	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 1.2 A; note 1	25	60	–	
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	24.5	–	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	13	–	pF
$C_{c\text{-}mb}$	collector-mounting base capacitance		–	2	–	pF

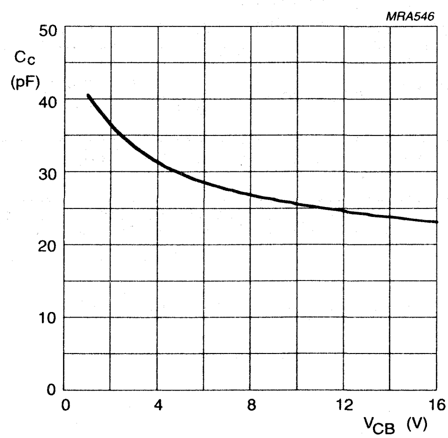
Note

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



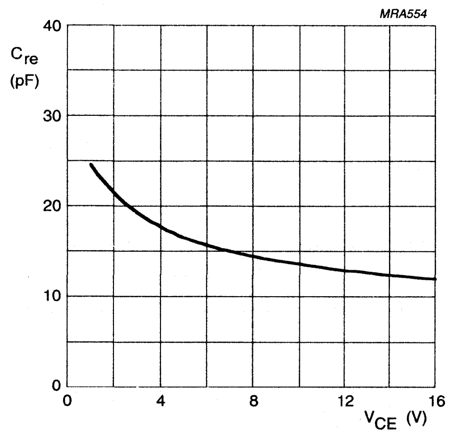
Measured under pulse conditions: $t_p \leq 200$ µs; $\delta \leq 0.02$.

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



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

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



f = 1 MHz.

Fig.6 Feedback capacitance as a function of collector-emitter voltage, typical values.

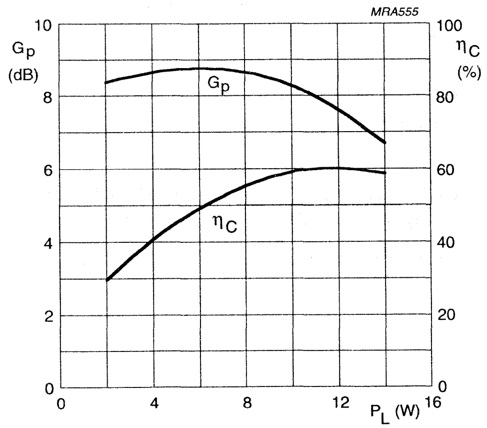
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit; $R_{th\ j\text{-}mb}$ = 0.4 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (A)	P_L (W)	G_p (dB)	η_c (%)	d_{im} (dB) (note 1
c.w. class-AB	900	12.5	0.01	12	≥ 6.5 typ. 7.5	> 50 typ. 60	–
c.w. class-A	900	12	1.3	6 (PEP)	typ. 11	–	typ. –30

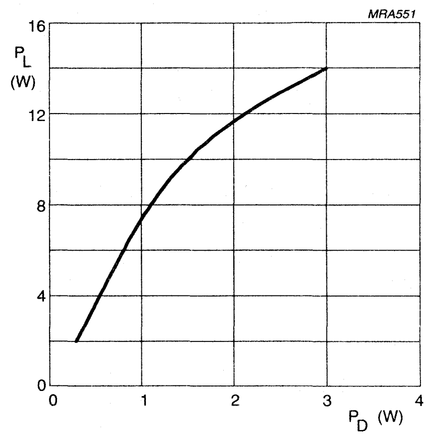
Note

1. 2-tone measurement, f_p = 900 MHz, f_q = 901 MHz.



Class-AB operation; V_{CE} = 12.5 V; f = 900 MHz; I_{CQ} = 10 mA.

Fig.7 Gain and efficiency as functions of load power, typical values.



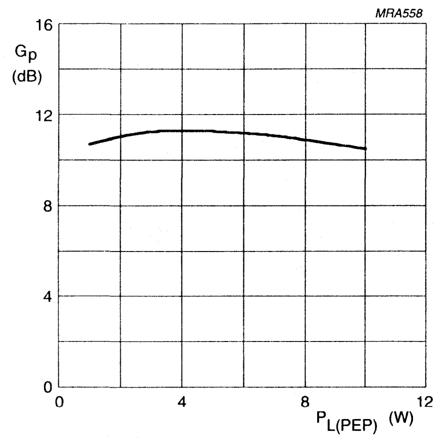
Class-AB operation; V_{CE} = 12.5 V; f = 900 MHz; I_{CQ} = 10 mA.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-AB operation

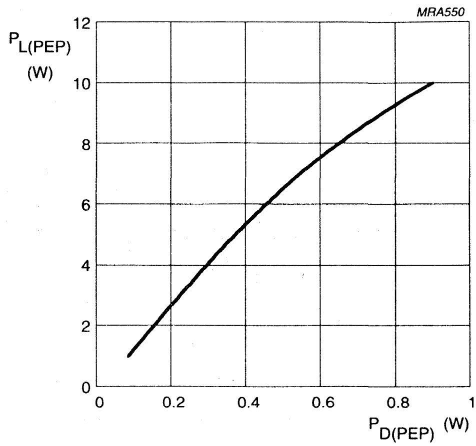
The BLV193 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases under the following conditions:

V_{CE} = 15.5 V, f = 900 MHz, T_h = 25 °C, $R_{th\ j\text{-}mb}$ = 0.4 K/W, and rated output power.



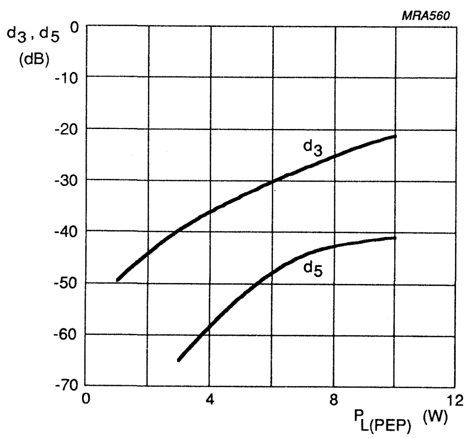
Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.9 Gain as a function of load power (PEP), typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.10 Load power (PEP) as a function of drive power (PEP), typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.11 Intermodulation products as a function of load power (PEP), typical values.

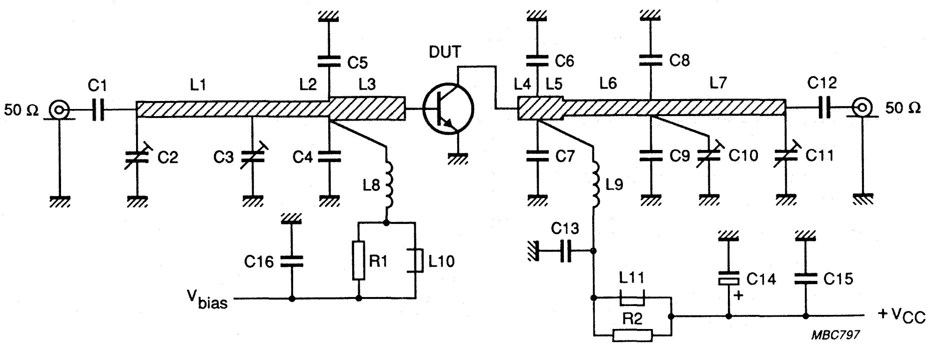


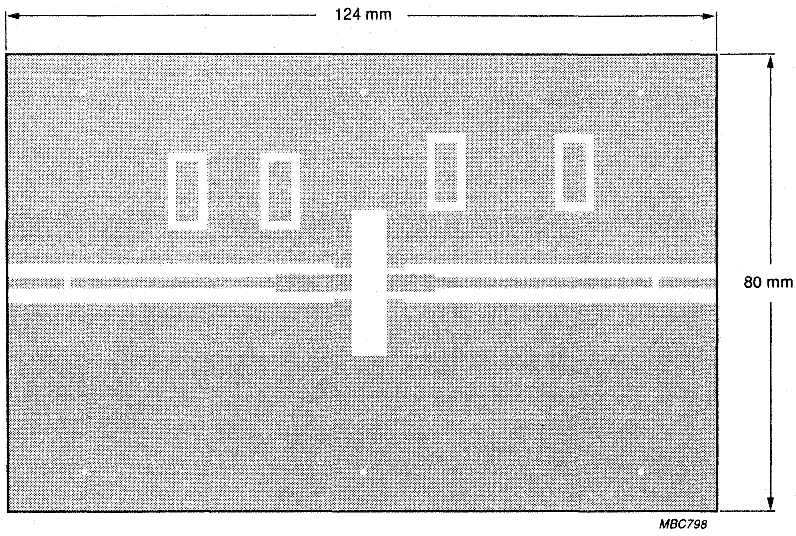
Fig.12 Class-A and class-AB test circuit at f = 900 MHz.

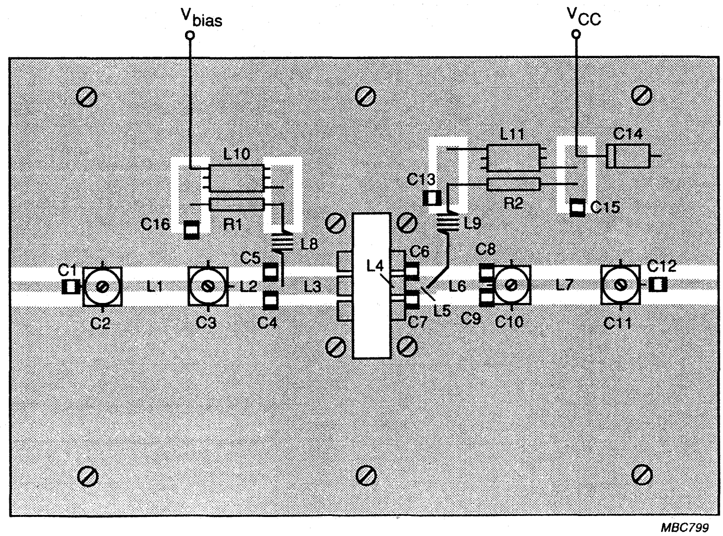
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C12	multilayer ceramic chip capacitor (note 1)	33 pF		
C2, C3, C10, C11	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor (note 1)	4.7 pF		
C6, C7	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C8, C9	multilayer ceramic chip capacitor (note 1)	3.3 pF		
C13	multilayer ceramic chip capacitor (note 1)	10 pF		
C14	electrolytic capacitor	6.8 µF, 63 V		
C15	multilayer ceramic chip capacitor (note 1)	330 pF		
C16	multilayer ceramic chip capacitor	100 nF		2222 852 47104
L1, L7	stripline (note 2)	50 Ω	length 29 mm; width 2.4 mm	
L2	stripline (note 2)	50 Ω	length 6 mm; width 2.4 mm	
L3	stripline (note 2)	42.7 Ω	length 13.1 mm; width 3 mm	
L4	stripline (note 2)	42.7 Ω	length 4.4 mm; width 3 mm	
L5	stripline (note 2)	42.7 Ω	length 4.6 mm; width 3 mm	
L6	stripline (note 2)	50 Ω	length 7 mm; width 2.4 mm	
L8	4 turns closely wound enamelled 0.4 mm copper wire	60 nH	int. dia 3 mm; leads 2 x 5 mm	
L9	4 turns enamelled 1 mm copper wire	45 nH	int. dia. 4 mm; leads 2x 5 mm	
L10, L11	grade 3B Ferroxcube wideband HF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω, 0.25 W		

Notes

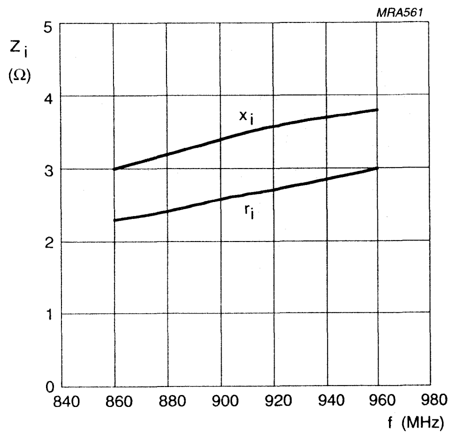
1. American Technical Ceramics type 100A or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 1⁄32 inch.





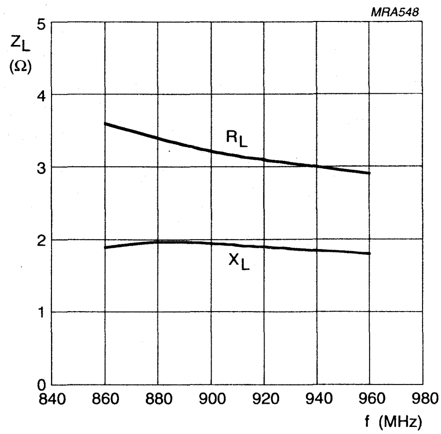
The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws and copper straps under the emitter leads.

Fig.13 Printed circuit board and component layout for 900 MHz test circuit.



Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA; P_L = 12 W; T_h = 25 °C.

Fig.14 Input impedance (series components) as a function of frequency, typical values.



Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA; P_L = 12 W; T_h = 25 °C.

Fig.15 Load impedance (series components) as a function of frequency, typical values.

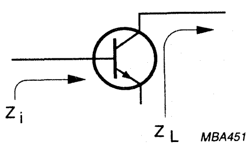
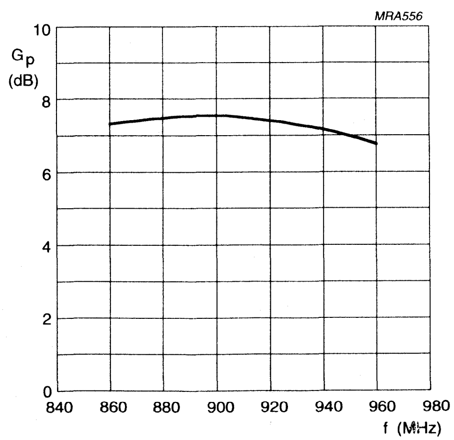
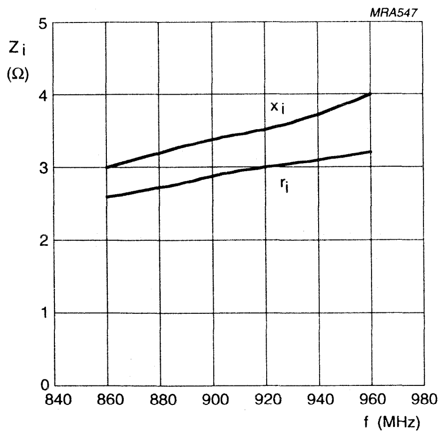


Fig.16 Definition of transistor impedance.



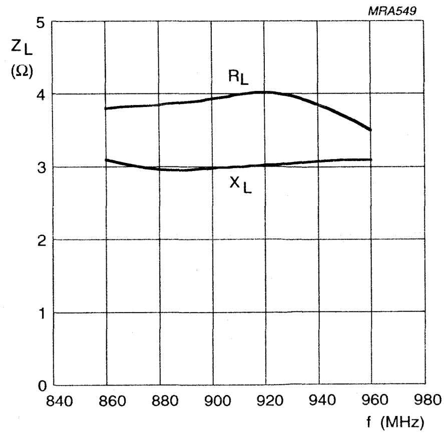
Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA; P_L = 12 W; T_h = 25 °C.

Fig.17 Power gain as a function of frequency, typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A; T_h = 25 °C.

Fig.18 Input impedance (series components) as a function of frequency, typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A; T_h = 25 °C.

Fig.19 Load impedance (series components) as a function of frequency, typical values.

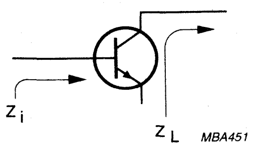
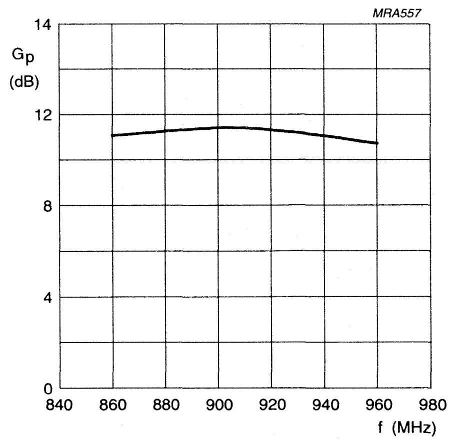


Fig.20 Definition of transistor impedance.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A; T_h = 25 °C.

Fig.21 Power gain as a function of frequency, typical values.

UHF power transistor | BLV194

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-AB operation in the 900 MHz communications band.

The transistor has a SOT171 flange envelope with a ceramic cap.

All leads are isolated from the mounting base.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	12.5	16	≥ 7	≥ 50

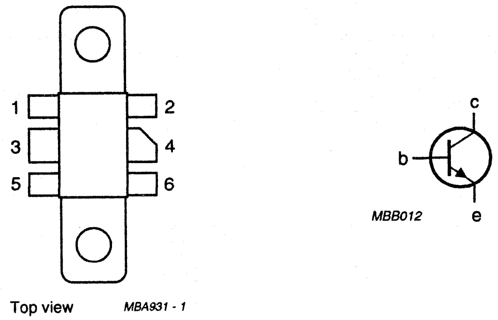


Fig.1 Simplified outline and symbol.

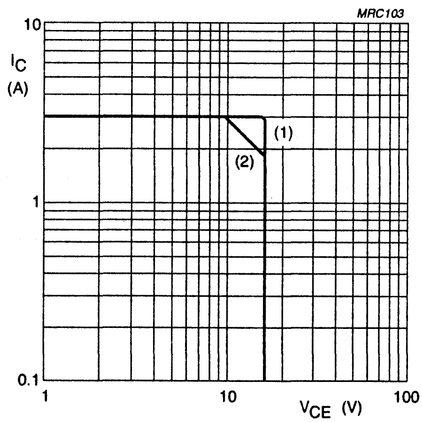
WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

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

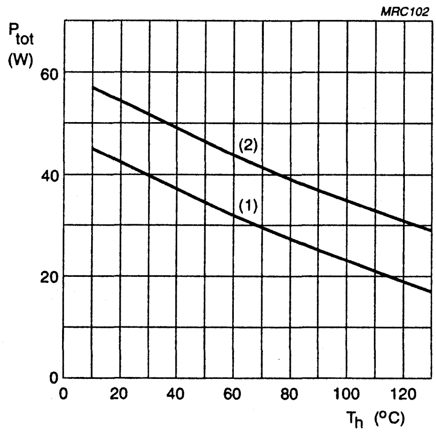
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{CES}	collector-emitter voltage	base short-circuited	–	32	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	3	A
$I_{C(AV)}$	average collector current		–	3	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	46	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C



(1) T_{mb} = 25 °C.

(2) T_h = 70 °C.

Fig.2 DC SOAR.



(1) Continuous operation.

(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	P_{dis} = 46 W; T_{mb} = 25 °C	3.8 K/W
$R_{th\ mb-h}$	thermal resistance from mounting base to heatsink		0.4 K/W

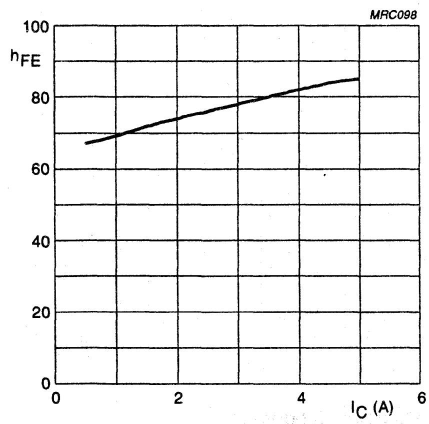
CHARACTERISTICS

T_j = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_B = 0$; $I_C = 40$ mA	16	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	$I_C = 20$ mA; $V_{BE} = 0$	32	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_C = 0$; $I_E = 5$ mA	3	–	–	V
I_{CER}	collector leakage current	$R_{BE} = 700\ \Omega$; $V_{CE} = 16$ V	–	–	1	mA
h_{FE}	DC current gain	$I_C = 1.2$ A; $V_{CE} = 10$ V (note 1)	25	70	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 12.5$ V; f = 1 MHz	–	26	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 12.5$ V; f = 1 MHz	–	19	–	pF
$C_{c\text{-}mb}$	collector-mounting base capacitance		–	2	–	pF

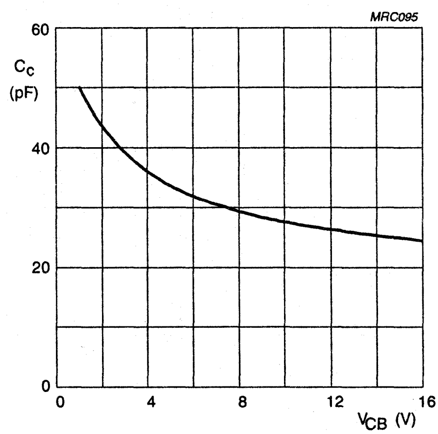
Note

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



$V_{CE} = 10$ V.
Measured under pulse conditions: $t_p \leq 200$ µs; $\delta \leq 0.02$.

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



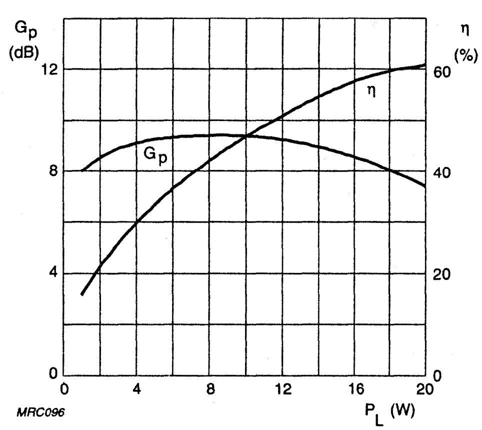
$I_E = i_e = 0$; f = 1 MHz.

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

APPLICATION INFORMATION

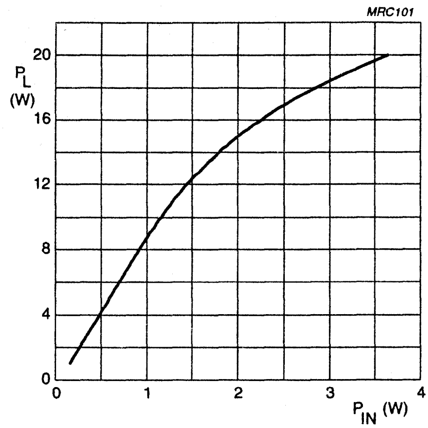
RF performance at T_h = 25 °C in a common emitter test circuit.
$R_{th\ j\text{-}mb}$ = 0.4 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	12.5	10	16	≥ 7 typ. 8.5	≥ 50 typ. 57



Class-AB operation: I_{CQ} = 10 mA; V_{CE} = 12.5 V; f = 900 MHz.

Fig.6 Power gain and efficiency as functions of load power, typical values.



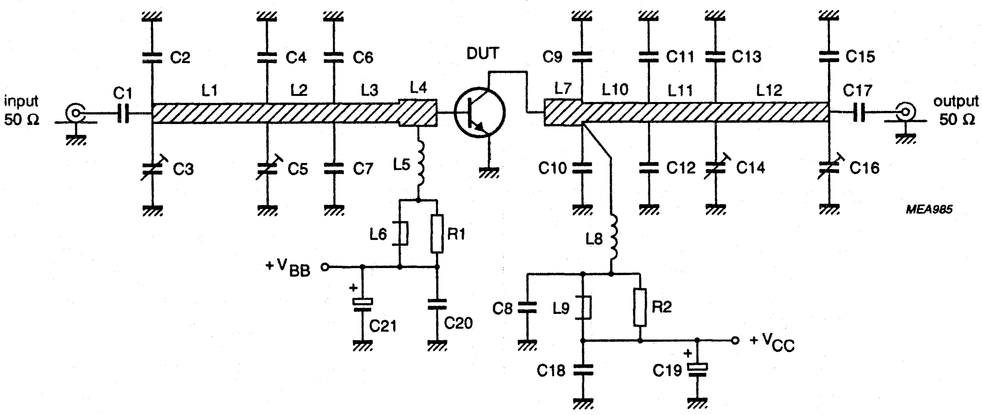
Class-AB operation: I_{CQ} = 10 mA; V_{CE} = 12.5 V; f = 900 MHz.

Fig.7 Load power as a function of input power, typical values.

Ruggedness in class-AB operation

The BLV194 is capable of withstanding a load mismatch corresponding to VSWR = 20:1 through all phases at rated output power under the following conditions:

V_{CE} = 15.5 V; T_h = 25 °C; $R_{th\ j\text{-}mb}$ = 0.4 K/W; f = 900 MHz.



f = 900 MHz.

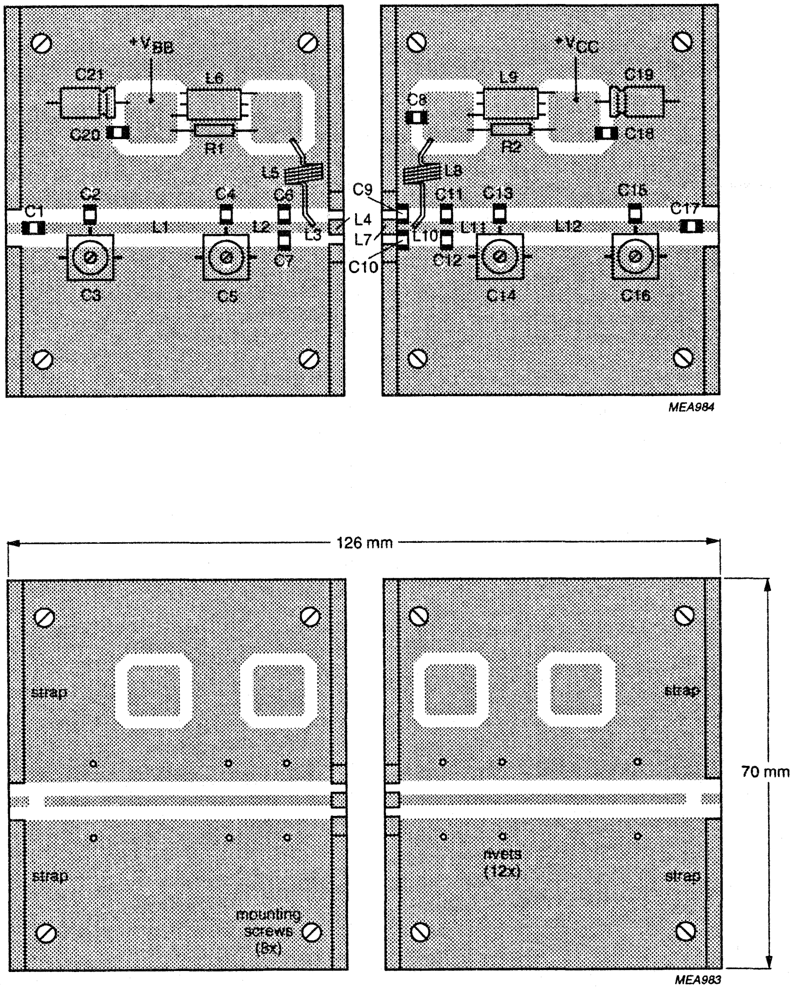
Fig.8 Class-AB test circuit.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8, C17	multilayer ceramic chip capacitor (note 1)	330 pF		
C3, C5, C14, C16	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C2, C6, C7	multilayer ceramic chip capacitor (note 1)	4.3 pF		
C4	multilayer ceramic chip capacitor (note 1)	3.9 pF		
C13, C15	multilayer ceramic chip capacitor (note 1)	4.7 pF		
C9, C10	multilayer ceramic chip capacitor (note 2)	5.6 pF		
C11, C12	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C18	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C19, C21	electrolytic capacitor	10 µF, 63 V		2222 030 37688
L1, L12	stripline (note 3)	50 Ω	length 24 mm width 2.4 mm	
L2, L11	stripline (note 3)	50 Ω	length 10 mm width 2.4 mm	
L3	stripline (note 3)	50 Ω	length 8 mm width 2.4 mm	
L4, L7	stripline (note 3)	41 Ω	length 3 mm width 3.2 mm	
L5, L8	4 turns enamelled 1 mm copper wire	45 nH	int. dia. 4 mm leads 2 x 5 mm	
L6, L9	grade 3B Ferroxcube wideband HF choke			4312 020 36642
L10	stripline (note 3)	50 Ω	length 7 mm width 2.4 mm	
R1, R2	0.25 W metal film resistor	10 Ω		

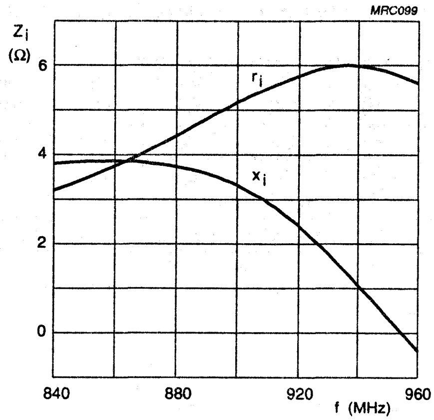
Notes

1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed- circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$), thickness 1⁄32 inch.



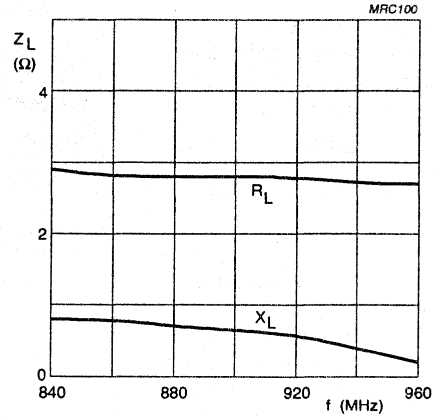
The components are mounted on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws and copper straps under the emitter leads.

Fig.9 Component layout for 900 MHz class-AB test circuit.



Class-AB operation: I_{CQ} = 10 mA; V_{CE} = 12.5 V; T_h = 25 °C; P_L = 16 W.

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



Class-AB operation: I_{CQ} = 10 mA; V_{CE} = 12.5 V; T_h = 25 °C; P_L = 16 W.

Fig.11 Load impedance as a function of frequency (series components), typical values.

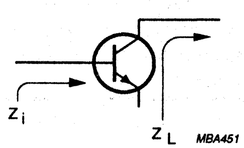
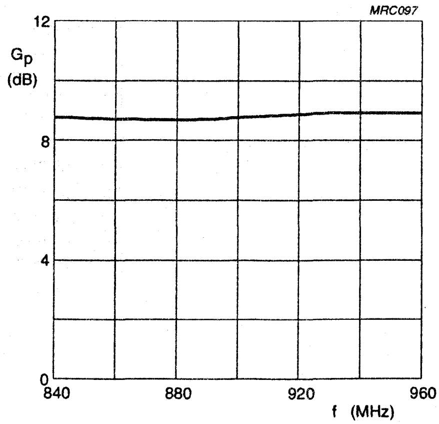


Fig.12 Definition of transistor impedance.



Class-AB operation: I_{CQ} = 10 mA; V_{CE} = 12.5 V; T_h = 25 °C; P_L = 16 W.

Fig.13 Power gain as a function of frequency, typical values.

UHF push-pull power transistor — BLV945A

FEATURES

- Double internal input matching for easy matching and high gain
- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation in base station transmitters in the 800 to 900 MHz range. The device has double internal input matching.

The transistor is encapsulated in a 4-lead SOT324 flange envelope with a ceramic cap. The flange provides the common emitter connection for both transistors.

PINNING - SOT324

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter (connected to flange)

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter class-AB push-pull test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	900	25	25	≥ 9	≥ 45	–
2-tone, class-AB	900	25	30 (PEP)	≥ 9	≥ 35	≤ –32
2-tone, class-A	900	25	6 (PEP)	typ. 13	–	typ. –43

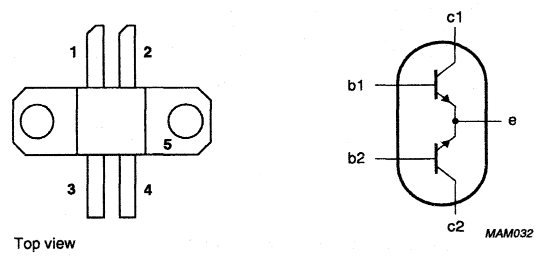


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

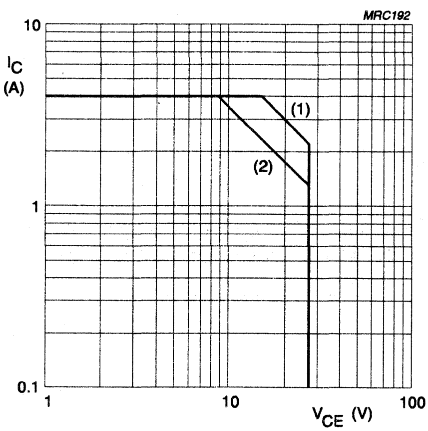
LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{CES}	collector-emitter voltage	$V_{BE} = 0$	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	DC collector current		–	2	A
$I_{C(AV)}$	average collector current		–	2	A
P_{tot}	total power dissipation	DC; $T_{mb} = 25$ °C; total device; both sections equally loaded	–	60	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

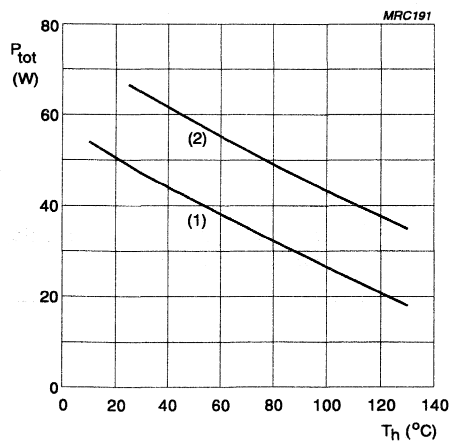
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	$P_{tot} = 60$ W; $T_{mb} = 25$ °C; total device; both sections equally loaded	max. 2.9 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	max. 0.5 K/W



(1) $T_{mb} = 25$ °C.
(2) $T_h = 70$ °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



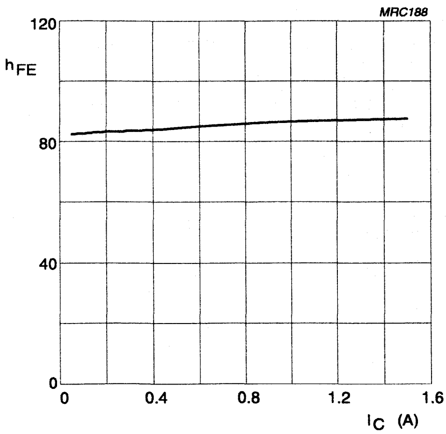
(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curve.

CHARACTERISTICS

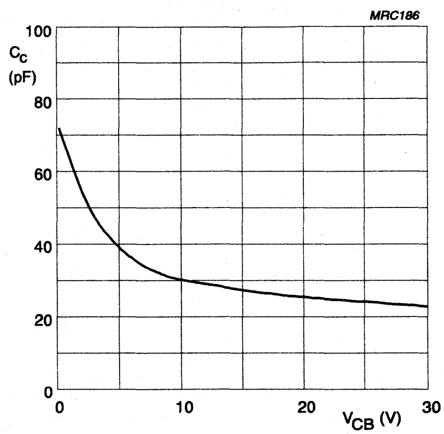
T_j = 25 °C unless otherwise specified.
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 25 mA	27	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 10 mA; V_{BE} = 0	50	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 5 mA	3.5	–	–	V
I_{CES}	collector-emitter cut-off current	V_{BE} = 0; V_{CE} = 27 V	–	–	1	mA
h_{FE}	DC current gain	I_C = 0.85 A; V_{CE} = 25 V	30	–	120	
C_c	collector capacitance	$I_E = i_e = 0$; V_{CB} = 25 V; f = 1 MHz	–	24	30	pF



V_{CE} = 25 V.

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



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

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

APPLICATION INFORMATION

RF performance in class-AB at T_h = 25 °C in a common emitter push-pull test circuit.
$R_{th\ mb\text{-}h}$ = 0.5 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dBc)	η_C (%)	d_3 (dB)
CW, class-AB	900	25	2 x 75	25	≥ 9 typ. 10	≥ 45 typ. 50	–
2-tone, class-AB	900 (note 1)	25	2 x 75	30 (PEP)	≥ 9 typ. 10.5	≥ 35 typ. 40	≤ –32 typ. –36

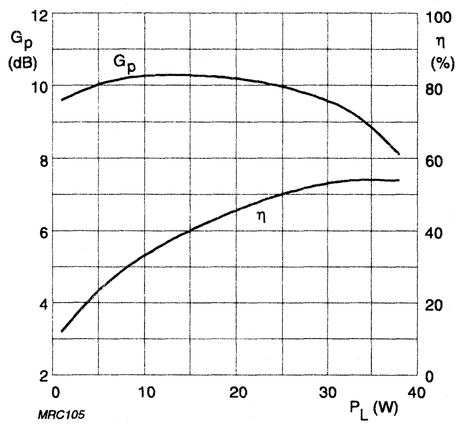
Note

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Ruggedness in class-AB operation

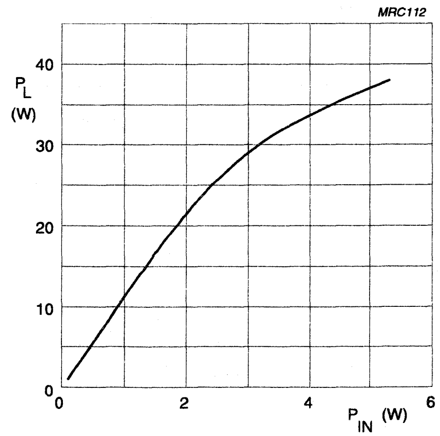
The BLV945A is capable of withstanding a load mismatch corresponding to VSWR = 3:1 through all phases under the following conditions: I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C; P_L = 25 W; f = 900 MHz.

The BLV945A is capable of withstanding a load mismatch corresponding to VSWR = 5:1 through all phases under the following conditions: I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C; P_L = 30 W (PEP); f_1 = 900.0 MHz; f_2 = 900.1 MHz.



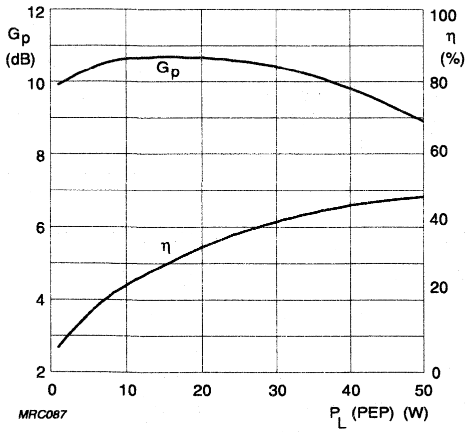
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f = 900 MHz.

Fig.6 Power gain and efficiency as functions of load power, typical values.



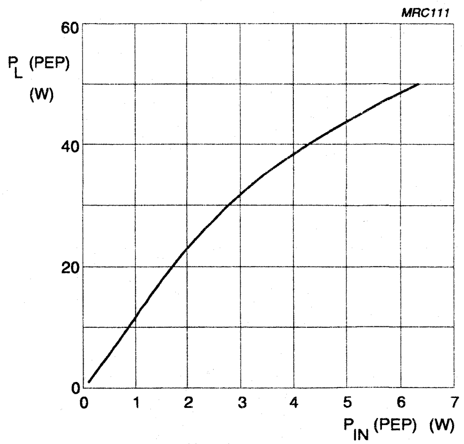
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f = 900 MHz.

Fig.7 Load power as a function of input power, typical values.



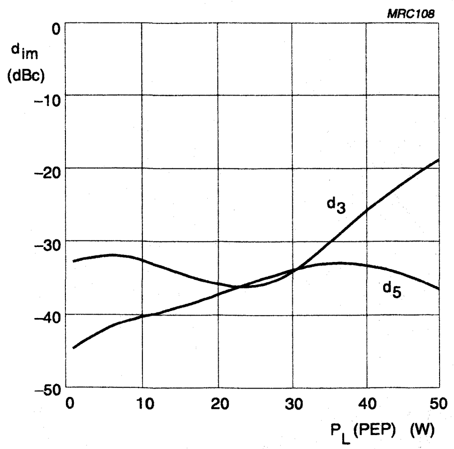
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

Fig.8 Power gain and efficiency as functions of peak envelope load power, typical values.



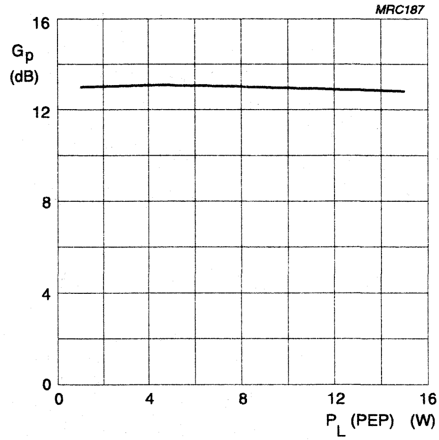
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

Fig.9 Peak envelope load power as a function of peak envelope input power, typical values.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.10 Intermodulation products as functions of peak envelope load power, typical values.



Class-A operation:
I_{CQ} = 2 x 850 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

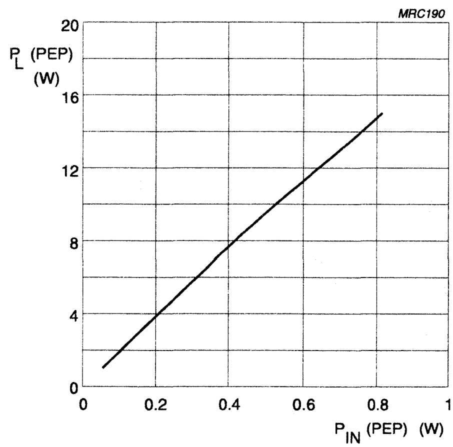
Fig.11 Power gain as a function of peak envelope load power, typical values.

RF performance in class-A at T_h = 25 °C in a common emitter push-pull test circuit.
$R_{th\ mb-h}$ = 0.5 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	d_3 (dBc)
CW, class-A	900 (note 1)	25	2 x 850	6 (PEP)	typ. 13	typ. −43

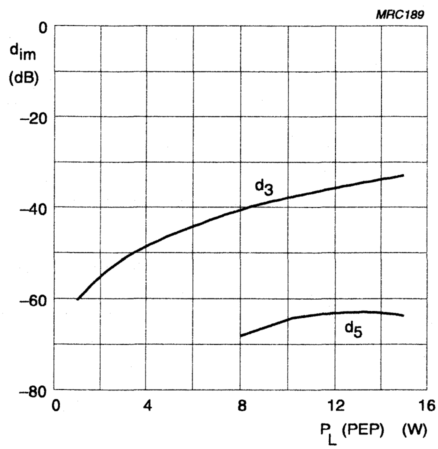
Note

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.



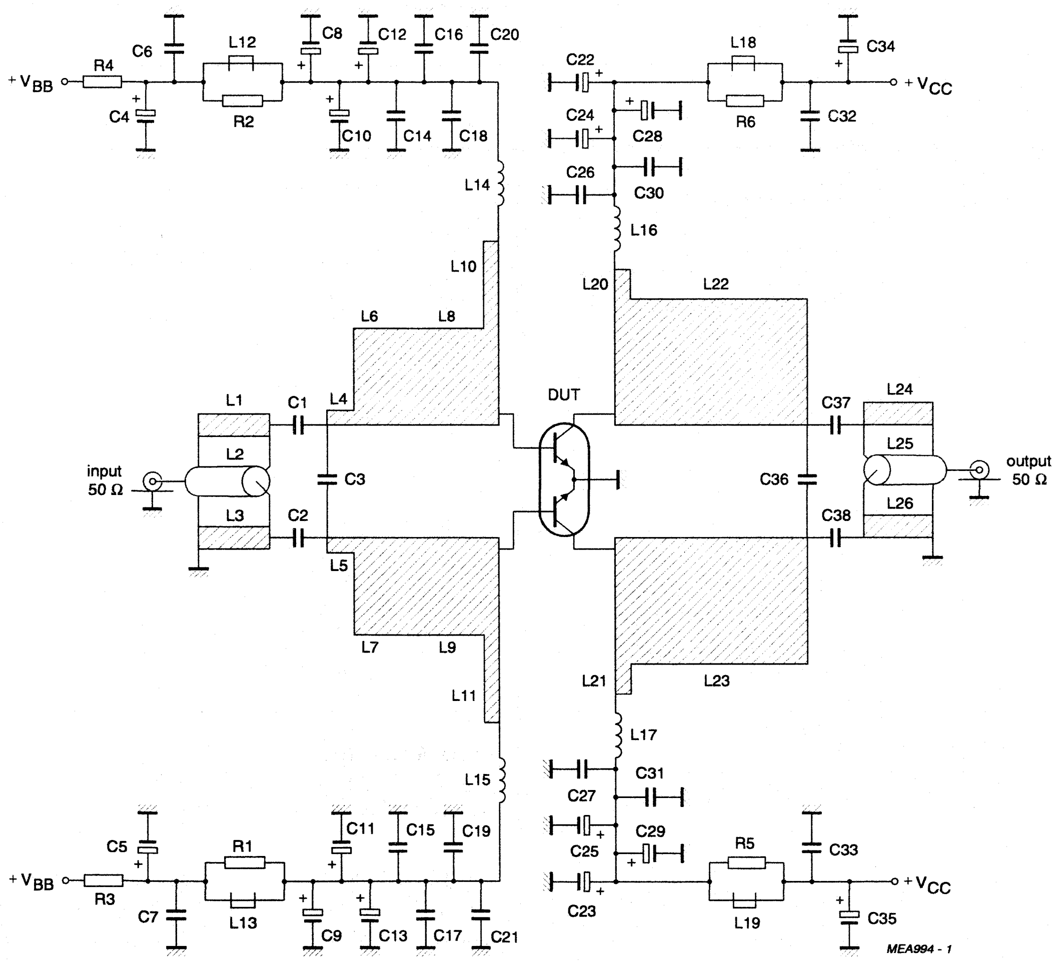
Class-A operation:
I_{CQ} = 2 x 850 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

Fig.12 Peak envelope load power as a function of peak envelope input power, typical values.



Class-A operation:
I_{CQ} = 2 x 850 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.5 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.13 Intermodulation products as functions of peak envelope load power, typical values.



f = 900 MHz.

Fig.14 Class-AB test circuit.

List of components (see Figs 14 and 15)

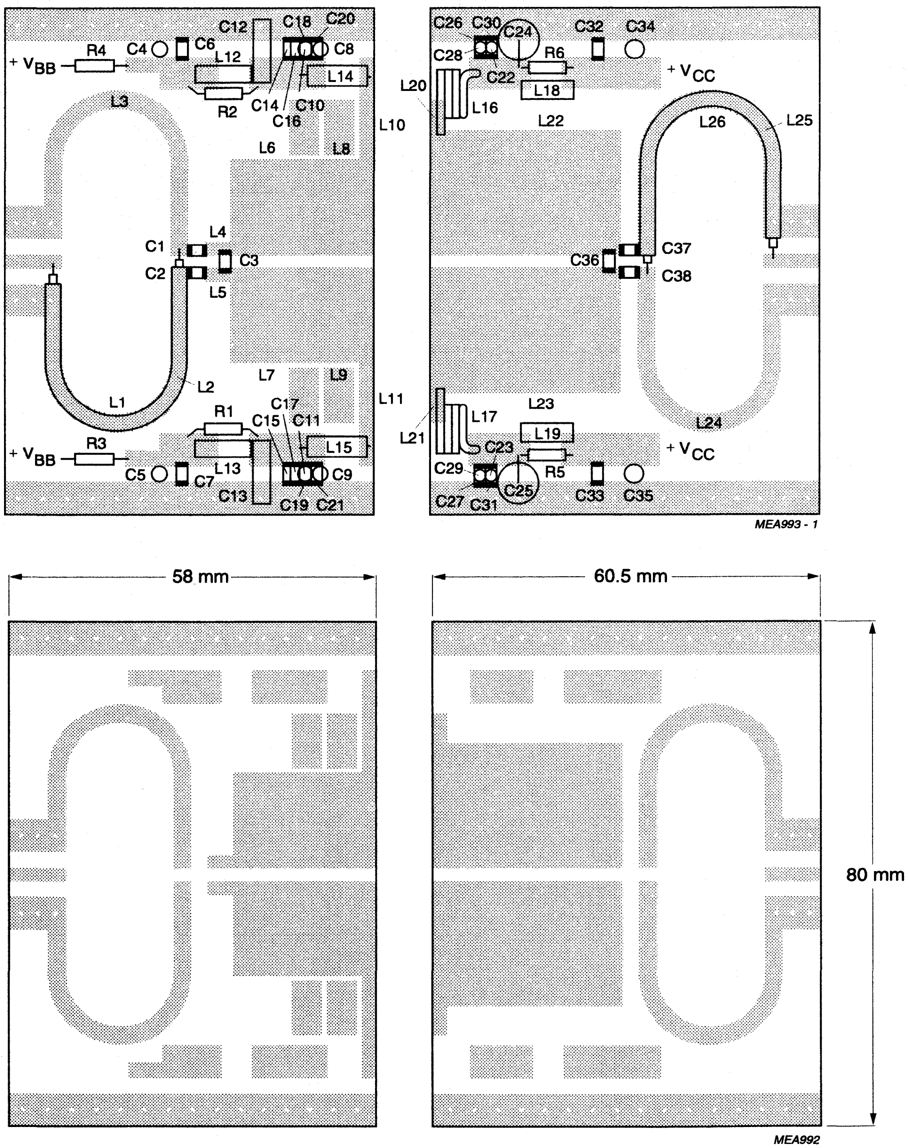
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	47 pF, 500 V		
C3	multilayer ceramic chip capacitor (note 1)	1 pF, 500 V		
C4, C5, C8, C9, C22, C23, C34, C35	tantalum capacitor	1 μF, 35 V		2022 019 00056
C6, C7, C18, C19, C30, C31, C32, C33	multilayer ceramic chip capacitor (note 1)	300 pF, 200 V		
C10, C11, C28, C29	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C12, C13	electrolytic capacitor	10 μF, 10 V		2222 085 75109
C14, C15	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C16, C17	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C20, C21, C26, C27	multilayer ceramic chip capacitor (note 1)	39 pF, 500 V		
C24, C25	electrolytic capacitor	10 μF, 63 V		2222 030 28109
C36	multilayer ceramic chip capacitor (note 1)	3.3 pF, 500 V		
C37, C38	multilayer ceramic chip capacitor (note 1)	27 pF, 500 V		
L1, L3, L24, L25	stripline (note 2)		length 57.1 mm width 3 mm	
L2, L25	semi-rigid cable (note 3)	50 Ω	length 57.1 mm ext. dia. 2.2 mm	
L4, L5	stripline (note 2)		length 4 mm width 2.5 mm	
L6, L7	stripline (note 2)		length 9 mm width 15 mm	
L8, L9	stripline (note 2)		length 11 mm width 15 mm	
L10, L11	stripline (note 2)		length 3 mm width 31.5 mm	
L12, L13, L18, L19	grade 4S2 Ferroxcube chip bead			4330 030 36300
L14, L15	microchoke	470 nH		4322 057 04771

List of components (see Figs 14 and 15) *(Continued)*

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L16, L17	4 turns enamelled 1 mm copper wire		int. dia. 6 mm close wound	
L20, L21	stripline (note 2)		length 3 mm width 24 mm	
L22, L23	stripline (note 2)		length 27 mm width 20 mm	
R1, R2, R5, R6	metal film resistor	5.11 Ω, 0.4 W		2322 151 75118
R3, R4	metal film resistor	7.5 Ω, 0.4 W		2322 151 77508

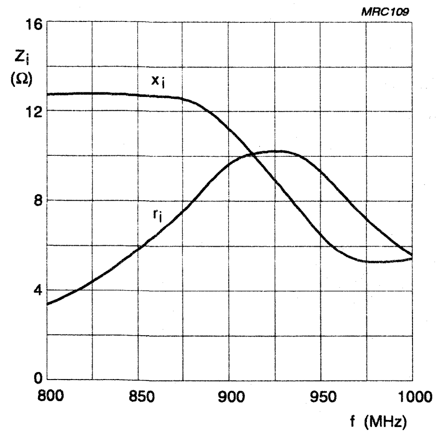
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric ($\varepsilon_r = 2.2$), thickness $\frac{1}{32}$ inch; thickness of copper sheet 2 x 35 μm.
3. Cables soldered to striplines L1 and L26 respectively.



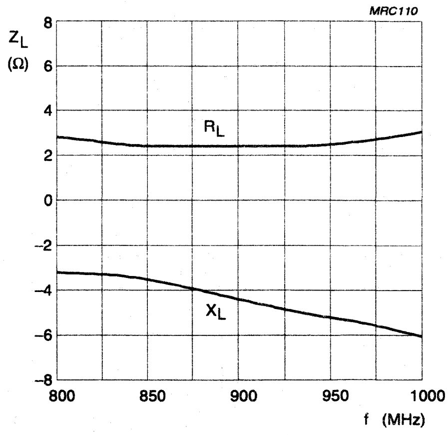
The components are mounted on one side of a copper-clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.15 Component layout for 900 MHz class-AB test circuit.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; P_L = 25 W (total device).

Fig.16 Input impedance as a function of frequency (series components), typical values per section.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; P_L = 25 W (total device).

Fig.17 Load impedance as a function of frequency (series components), typical values per section.

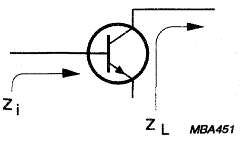
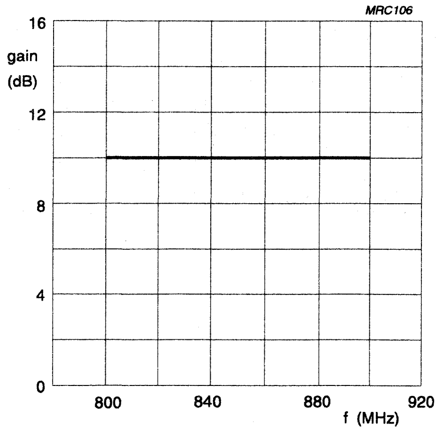
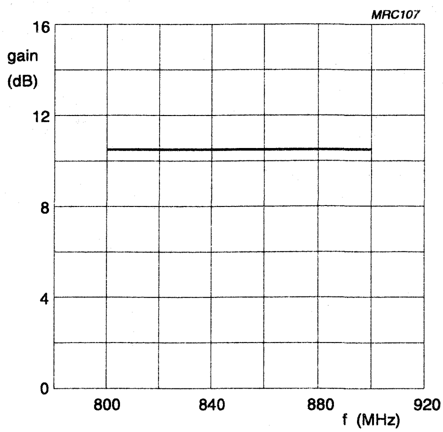


Fig.18 Definition of transistor impedance.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.5 K/W; P_L = 25 W (total device).

Fig.19 Gain as a function of frequency, typical values.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.5 K/W; P_L = 30 W (PEP) (total device).

Fig.20 Gain as a function of frequency, typical values.

UHF push-pull power transistor BLV945B

FEATURES

- Double internal input matching for easy matching and high gain
- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation in base station transmitters in the 900 to 960 MHz range. The device has double internal input matching.

The transistor is encapsulated in a 4-lead SOT324 flange envelope with a ceramic cap. The flange provides the common emitter connection for both transistors.

PINNING – SOT324

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter (connected to flange)

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter class-AB push-pull test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	960	25	25	≥ 8.5	≥ 45	–
2-tone, class-AB	960	25	30 (PEP)	≥ 8.5	≥ 35	≤ –32

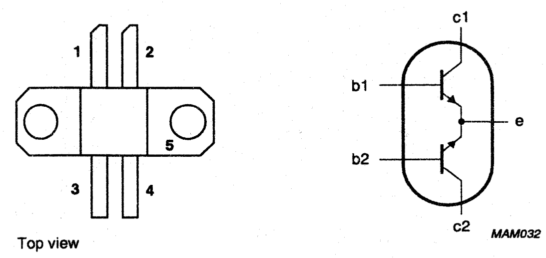


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{CES}	collector-emitter voltage	V_{BE} = 0	–	50	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	DC collector current		–	5	A
P_{tot}	total power dissipation	DC; T_{mb} = 25 °C; total device; both sections equally loaded	–	60	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 60 W; T_{mb} = 25 °C; total device; both sections equally loaded	max. 2.9 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 25 mA	27	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 10 mA; I_E = 0	50	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 5 mA	3.5	–	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 20 V	–	–	1	mA
h_{FE}	DC current gain	I_C = 0.85 A; V_{CE} = 25 V	30	–	120	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 25 V; f = 1 MHz	–	24	–	pF

APPLICATION INFORMATION

Class-AB; common-emitter; T_h = 25 °C; $R_{th\ mb\text{-}h} \leq$ 2.9 K/W.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
G_p	power gain	P_L = 30 W (PEP); V_{CE} = 25 V; I_{CQ} = 2 x 75 mA; note 1	8.5	–	dB
		P_L = 25 W; V_{CE} = 25 V; I_{CQ} = 2 x 75 mA; f = 960 MHz	8.5	–	dB
η	efficiency	P_L = 30 W (PEP); V_{CE} = 25 V; I_{CQ} = 2 x 75 mA; note 1	35	–	%
		P_L = 25 W; V_{CE} = 25 V; I_{CQ} = 2 x 75 mA; f = 960 MHz	45	–	%
d_{im}	intermodulation distortion	P_L = 30 W (PEP); V_{CE} = 25 V; I_{CQ} = 2 x 75 mA; note 1	–	–32	dBc

Note

1. f_1 = 960 MHz; f_2 = 960.1 MHz.

UHF power transistor BLV946

FEATURES

- Double internal input matching for easy matching and high gain
- Poly-silicon emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter, class-AB operation in base station transmitters in the frequency range 900 to 960 MHz. The device has double internal input matching.

The transistor is encapsulated in a SOT273 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT273

PIN	DESCRIPTION
1	emitter
2	emitter
3	collector
4	base
5	emitter
6	emitter

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
CW, class-AB	960	26	30	typ. 10	typ. 55

PIN CONFIGURATION

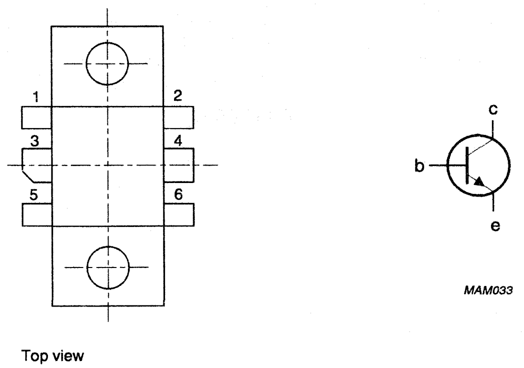


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	55	V
V_{CEO}	collector-emitter voltage	open base	–	28	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	4	A
P_{tot}	total power dissipation		–	65	W
T_{stg}	storage temperature		–65	150	°C
T_j	operating junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 65 W; T_{mb} = 25 °C.	max. 2.7 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		max. 0.3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	55	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 28 V	–	–	3	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 1.5 A	30	–	120	

APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	960	26	200	30	typ. 10	typ. 55

UHF push-pull power transistor BLV947

FEATURES

- Double input and output matching for easy matching and high gain
- Poly-silicon emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation in base station transmitters in the 800 to 960 MHz range.

The transistor is encapsulated in a 4-lead SOT262A2 flange envelope, with two ceramic caps. The flange provides the common emitter connection for both transistors.

PINNING - SOT262A2

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter (connected to flange)

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	960	26	100	typ. 9	typ. 50

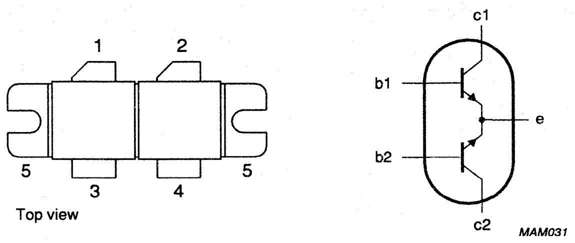

Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
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LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	28	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	16.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; note 1	–	200	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

Note

1. Total device; both sections equally loaded.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 200 W; T_{mb} = 25 °C; note 1	max. 0.88 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	max. 0.15 K/W

Note

1. Total device; both sections equally loaded.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 40 mA	60	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	28	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 2 mA	3	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 25 V	–	10	mA
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 10 V	30	120	

APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	960	26	2 x 100	100	typ. 9	typ. 50

UHF push-pull power transistor | BLV948

FEATURES

- Double input and output matching for easy matching and high gain
- Poly-silicon emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation in base station transmitters in the 800 to 960 MHz range.

The transistor is encapsulated in a 4-lead SOT262A2 flange envelope, with two ceramic caps. The flange provides the common emitter connection for both transistors.

PINNING - SOT262A2

PIN	DESCRIPTION
1	collector 1
2	collector 2
3	base 1
4	base 2
5	emitter (connected to flange)

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	900	26	150	≥ 7	≥ 48	–
	960	26	150	≥ 6.5	≥ 45	–
2-tone, class-AB	900	26	150 (PEP)	≥ 7.5	≥ 34	≤ –24
	960	26	150 (PEP)	≥ 7.5	≥ 34	≤ –22

WARNING

Product and environmental safety - toxic materials

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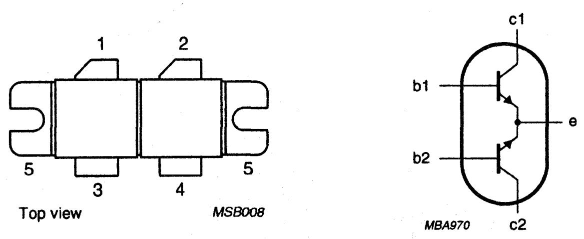


Fig.1 Simplified outline and symbol.

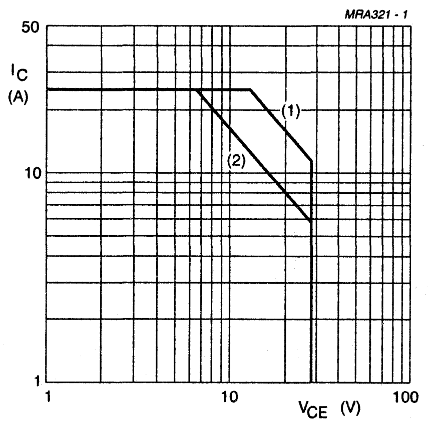
LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	28	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	12.5	A
$I_{C(AV)}$	average collector current		–	12.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; total device; both sections equally loaded	–	320	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

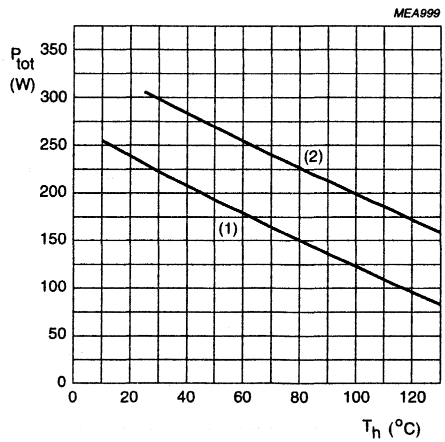
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 320 W; T_{mb} = 25 °C; total device; both sections equally loaded	max. 0.55 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	max. 0.15 K/W



(1) T_{mb} = 25 °C.
(2) T_h = 70 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curve.

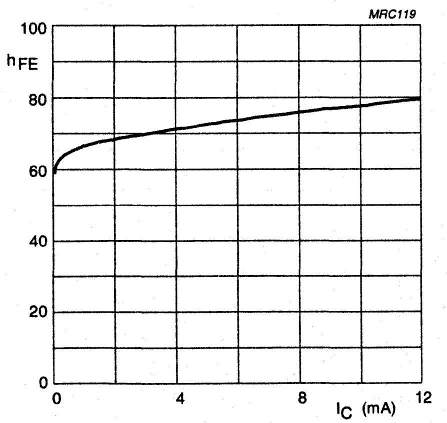
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 60 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 150 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	3	–	–	V
I_{CES}	collector-emitter cut-off current	V_{BE} = 0; V_{CE} = 25 V	–	–	10	mA
h_{FE}	DC current gain	I_C = 1.5 A; V_{CE} = 10 V	30	–	120	
Δh_{FE}	DC current gain ratio of both sections	I_C = 1.5 A; V_{CE} = 10 V	0.67	–	1.5	
C_c	collector capacitance (note1)	$I_E = i_e$ = 0; V_{CB} = 25 V; f = 1 MHz	–	80	90	pF

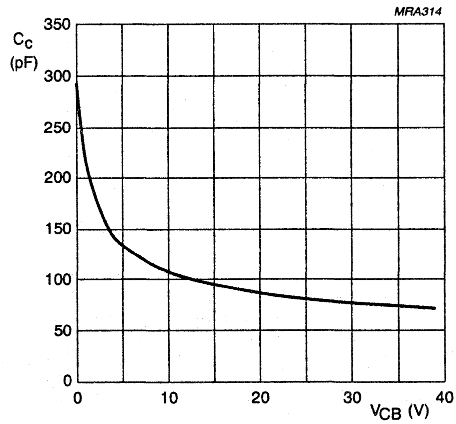
Note

1. Value C_c is that of the die only, it is not measurable because of the internal matching network.



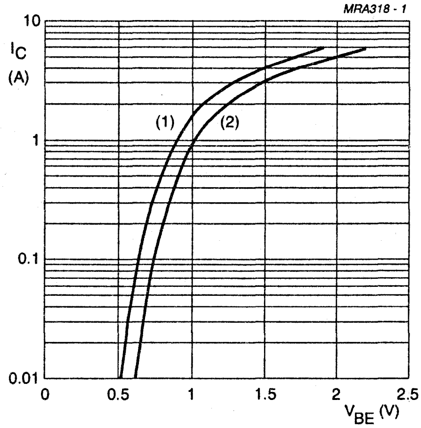
V_{CE} = 10 V.

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



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

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



V_{CE} = 25 V.
(1) T_h = 70 °C.
(2) T_h = 25 °C.

Fig.6 Collector current as a function of base-emitter voltage, typical values.

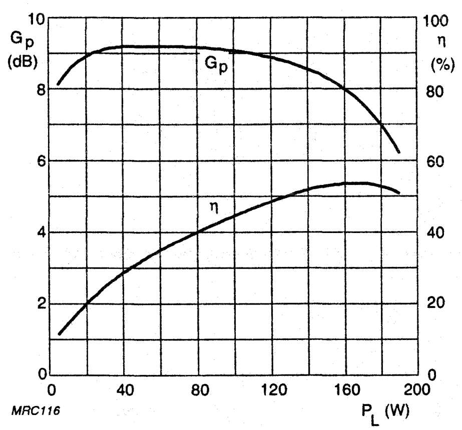
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit.
$R_{th\ mb-h}$ = 0.15 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	26	2 x 100	150	≥ 7 typ. 8.3	≥ 48 typ. 53
	960	26	2 x 100	150	≥ 6.5 typ. 7.9	≥ 45 typ. 50

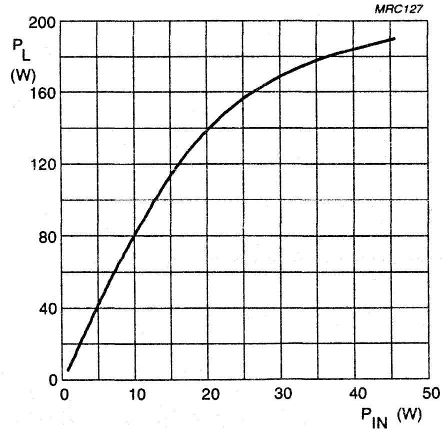
Ruggedness in class-AB operation

The BLV948 is capable of withstanding a load mismatch corresponding to VSWR = 2:1 through all phases under the following conditions: V_{CE} = 26 V; T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W; P_L = 150 W; f = 960 MHz.



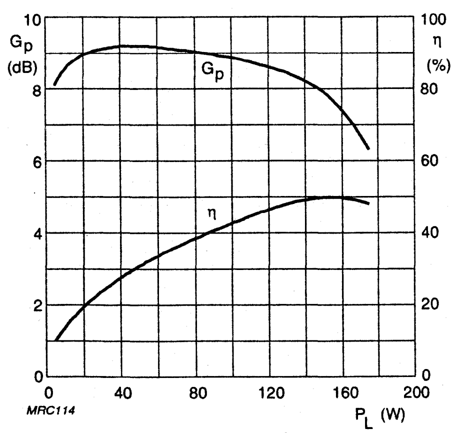
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 900 MHz.

Fig.7 Power gain and efficiency as functions of load power, typical values.



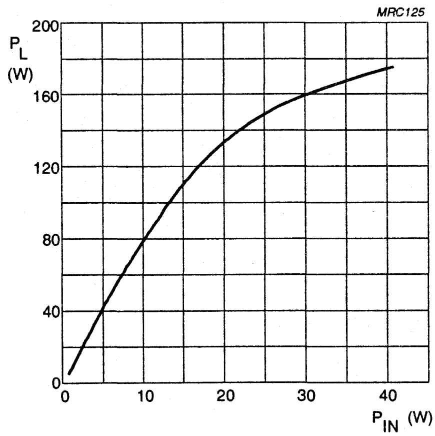
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 900 MHz.

Fig.8 Load power as a function of input power, typical values.



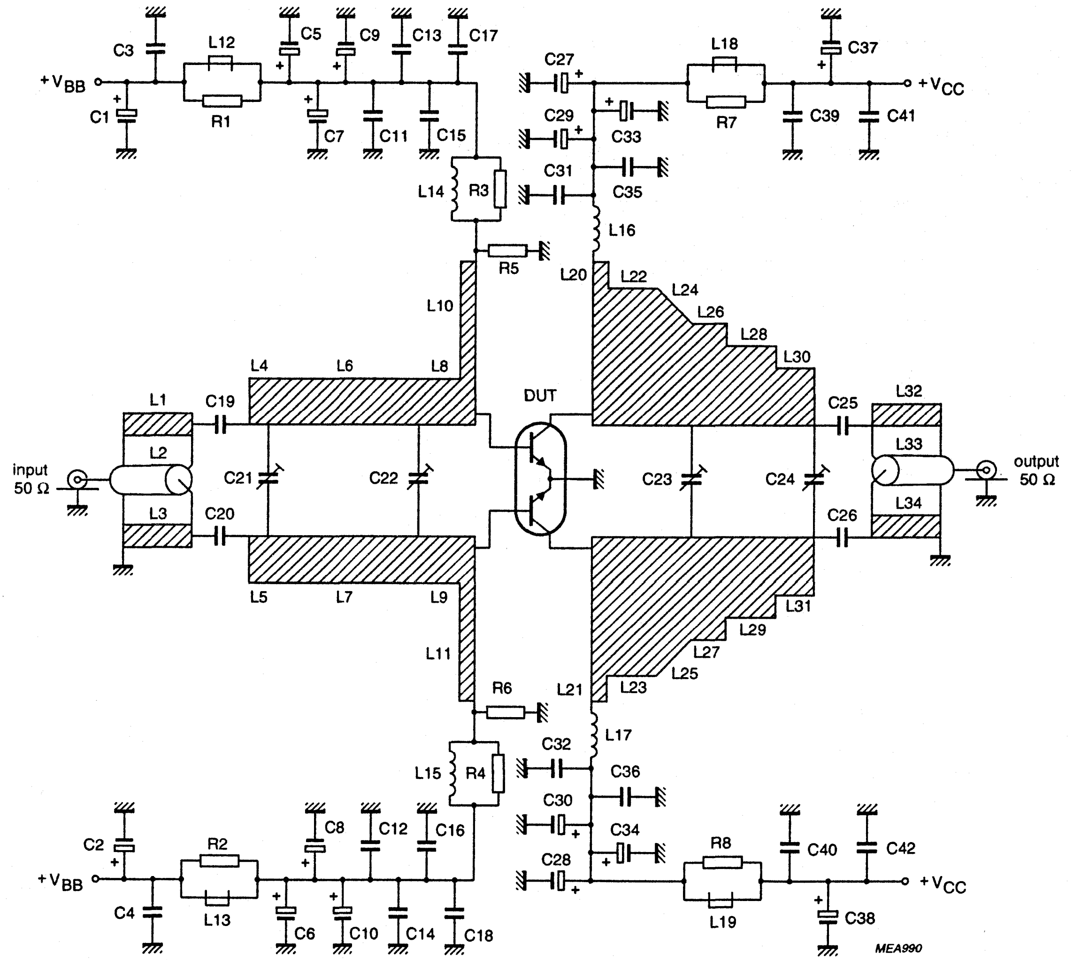
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 960 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 960 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 860 to 900 MHz.

Fig.11 Class-AB test circuit.

List of components (see Figs 11 and 12)

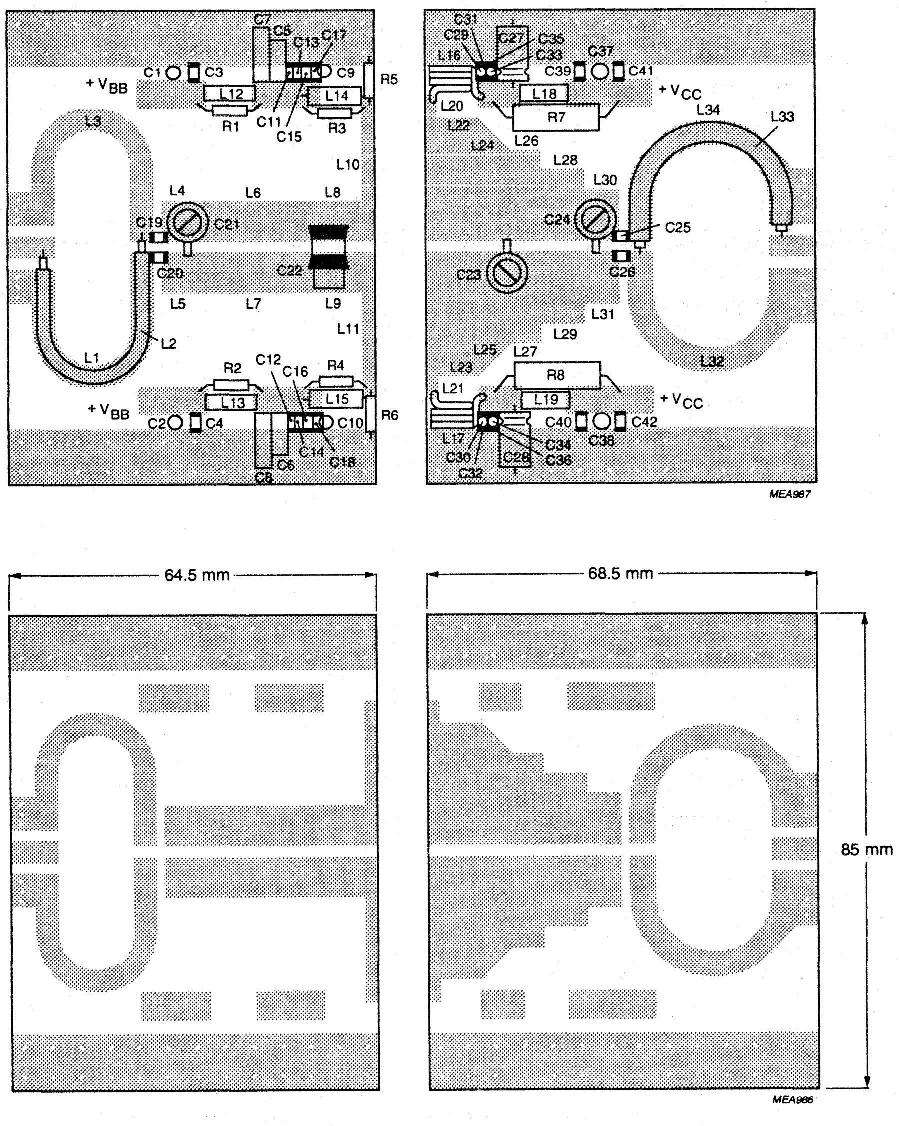
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C33, C34	tantalum capacitor	2.2 µF, 35 V		2022 019 00058
C3, C4, C35, C36, C39, C40	multilayer ceramic chip capacitor (note 1)	300 pF, 200 V		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C5, C6	electrolytic capacitor	1 μF, 63 V		2222 085 78108
C7, C8	electrolytic capacitor	10 μF, 10 V		2222 085 75109
C9, C10, C29, C30, C37, C38	tantalum capacitor	1 μF, 35 V		2022 019 00056
C11, C12, C41, C42	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C13, C14	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C15, C16	multilayer ceramic chip capacitor (note 1)	330 pF, 200 V		
C17, C18, C19, C20, C31, C32	multilayer ceramic chip capacitor (note 1)	39 pF, 500 V		
C21, C22, C23, C24	trimming capacitor (Tekelec, type 5201)	0.8 to 10 pF		
C25, C26	multilayer ceramic chip capacitor (note 1)	68 pF, 500 V		
C27, C28	electrolytic capacitor	10 μF, 63 V		2222 030 28109
L1, L3	stripline (note 2)		length 50.7 mm width 4 mm	
L2	semi-rigid cable (note 3)	50 Ω	length 50.7 mm ext. dia. 2.2 mm	
L4, L5	stripline (note 2)		length 4 mm width 8 mm	
L6, L7	stripline (note 2)		length 26 mm width 8 mm	
L8, L9	stripline (note 2)		length 6 mm width 8 mm	
L10, L11, L20, L21	stripline (note 2)		length 2.5 mm width 27 mm	
L12, L13, L18, L19	grade 4S2 Ferroxcube chip bead			4330 030 36300
L14, L15	microchoke	2.2 μH		4322 057 02281
L16, L17	4 turns enamelled 1 mm copper wire		int. dia. 6 mm close wound	
L22, L23	stripline (note 2)		length 8.5 mm width 22 mm	
L24, L25	stripline (note 2)		length 5 mm width 16/22 mm	
L26, L27	stripline (note 2)		length 5 mm width 16 mm	
L28, L29	stripline (note 2)		length 7.5 mm width 13 mm	
L30, L31	stripline (note 2)		length 6 mm width 9.5 mm	
L32, L34	stripline (note 2)		length 49.3 mm width 5 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L33	semi-rigid cable (note 3)	50 Ω	length 49.3 mm ext. dia. 3.6 mm	
R1, R2, R3, R4, R5, R6	metal film resistor	5.11 Ω, 0.4 W		2322 151 75118
R7, R8	metal film resistor	5.11 Ω, 1 W		2322 153 55118

Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric (ε_r = 2.2), thickness 1⁄32 inch; thickness of copper sheet 2 x 35 μm.
3. Cables soldered to striplines L1 and L32 respectively.



The components are mounted on one side of a copper-clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.12 Component layout for 860 to 900 MHz class-AB test circuit.

APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit.
$R_{th\ mb\text{-}h}$ = 0.15 K/W; 2-tone operation.

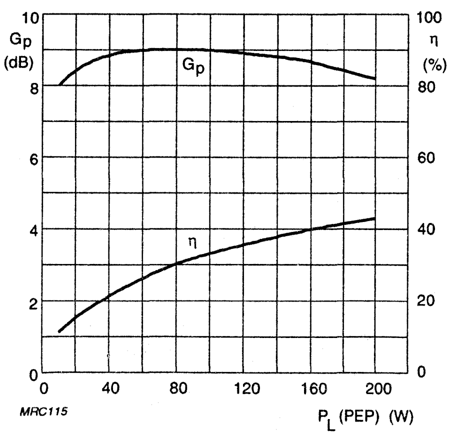
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (PEP) (W)	G_p (dB)	η_C (%)	d_3 (dBc)
2-tone, class-AB	note 1	26	2 x 100	150	≥ 7.5 typ. 8.7	≥ 34 typ. 39	≤ −24 typ. −26
	note 2	26	2 x 100	150	≥ 7.5 typ. 8.7	≥ 34 typ. 39	≤ −22 typ. −24

Notes

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.
2. f_2 = 960.0 MHz; f_2 = 960.1 MHz.

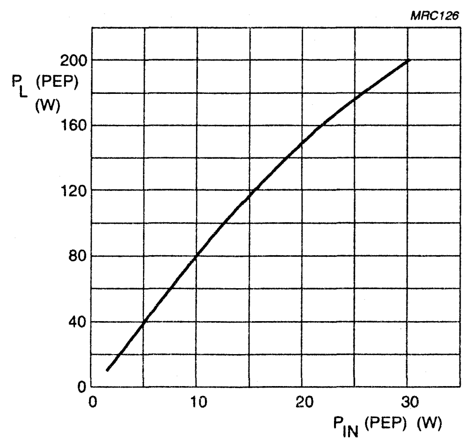
Ruggedness in class-AB operation

The BLV948 is capable of withstanding a load mismatch corresponding to VSWR = 5:1 through all phases under the following conditions: V_{CE} = 26 V; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W; P_L = 150 W (PEP); f_1 = 960.0 MHz; f_2 = 960.1 MHz.



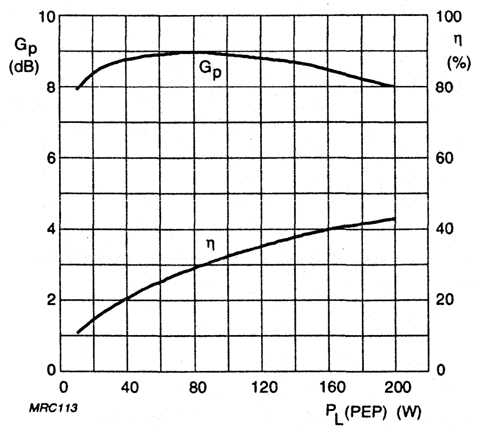
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.13 Power gain and efficiency as functions of peak envelope load power, typical values.



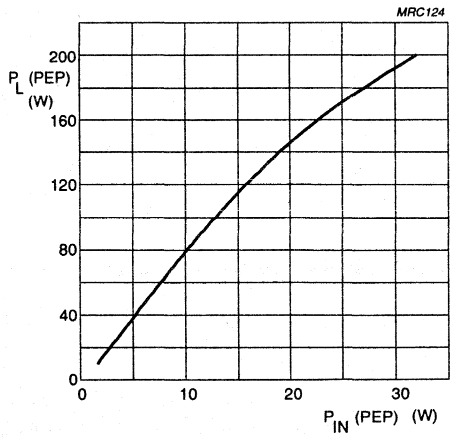
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.14 Peak envelope load power as a function of input power, typical values.



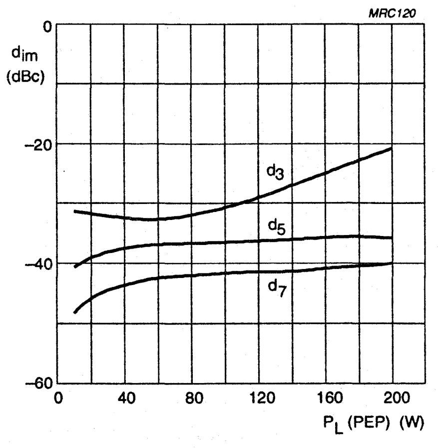
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.15 Power gain and efficiency as functions of peak envelope load power, typical values.



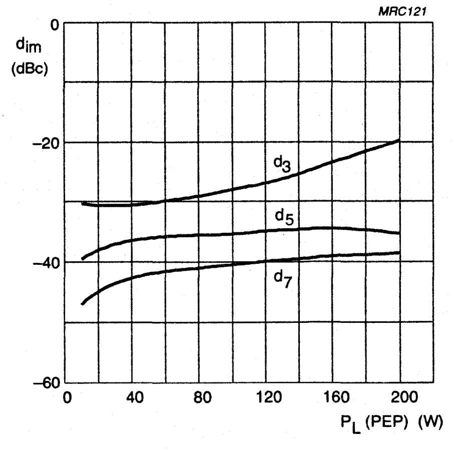
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.16 Peak envelope load power as a function of input power, typical values.



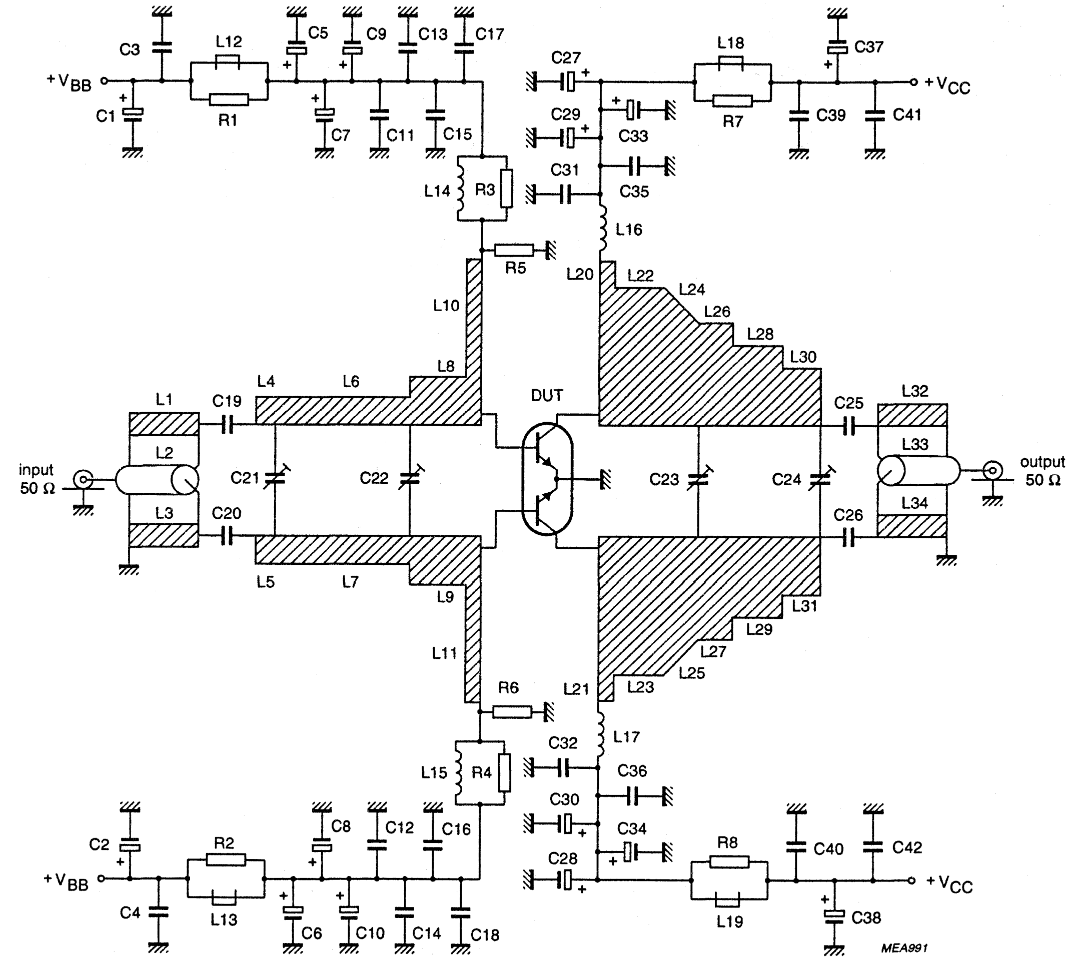
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.17 Intermodulation products as functions of peak envelope load power, typical values.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.18 Intermodulation products as functions of peak envelope load power, typical values.



f = 915 to 960 MHz.

Fig.19 Class-AB test circuit.

List of components (see Figs 19 and 20)

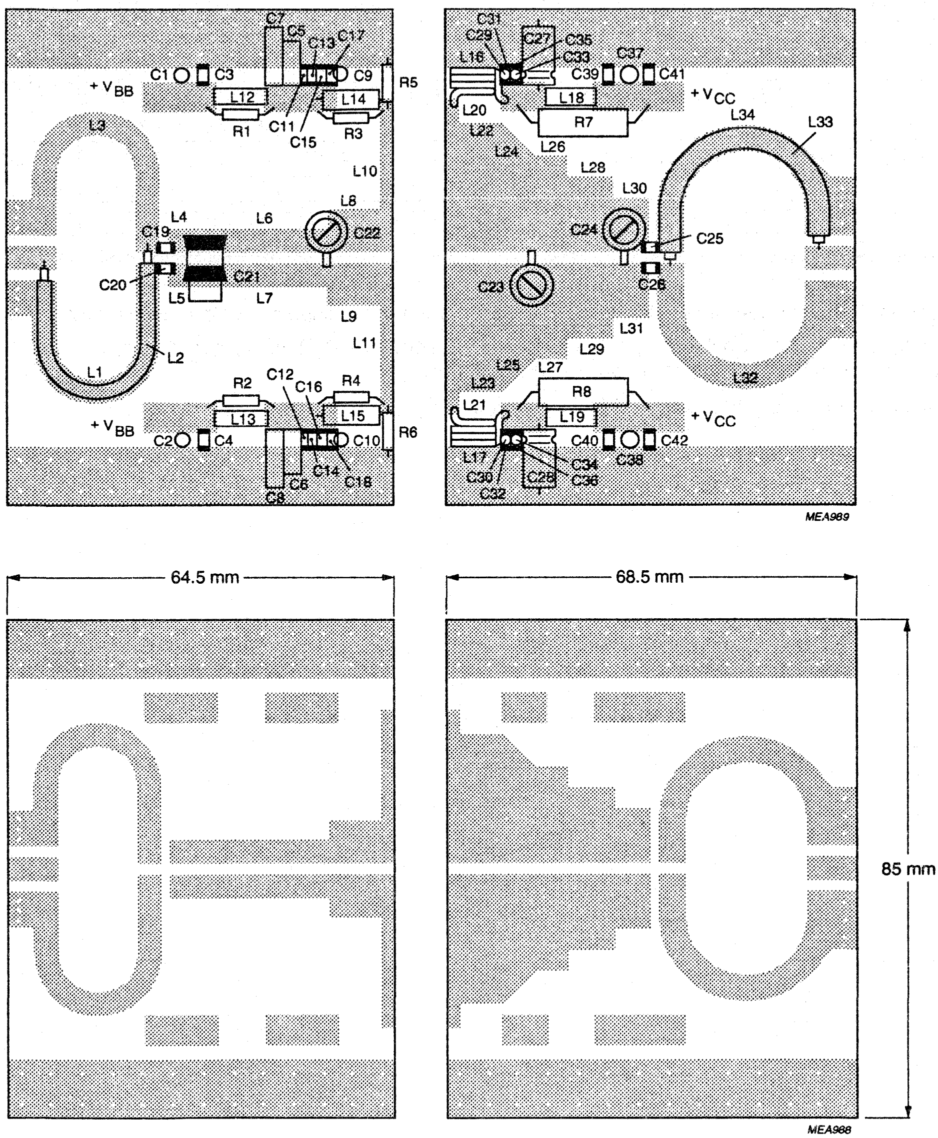
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C33, C34	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C3, C4, C35, C36, C39, C40	multilayer ceramic chip capacitor (note 1)	300 pF, 200 V		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C5, C6	electrolytic capacitor	1 µF, 63 V		2222 085 78108
C7, C8	electrolytic capacitor	10 µF, 10 V		2222 085 75109
C9, C10, C29, C30, C37, C38	tantalum capacitor	1 µF, 35 V		2022 019 00056
C11, C12, C41, C42	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C13, C14	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C15, C16	multilayer ceramic chip capacitor (note 1)	330 pF, 200 V		
C17, C18, C19, C20, C31, C32	multilayer ceramic chip capacitor (note 1)	39 pF, 500 V		
C21, C22, C23, C24	trimming capacitor (Tekelec, type 5201)	0.8 to 10 pF		
C25, C26	multilayer ceramic chip capacitor (note 1)	68 pF, 500 V		
C27, C28	electrolytic capacitor	10 µF, 63 V		2222 030 28109
L1, L3	stripline (note 2)		length 50.7 mm width 4 mm	
L2	semi-rigid cable (note 3)	50 Ω	length 50.7 mm ext. dia. 2.2 mm	
L4, L5	stripline (note 2)		length 4 mm width 4 mm	
L6, L7	stripline (note 2)		length 22 mm width 4 mm	
L8, L9	stripline (note 2)		length 10 mm width 8 mm	
L10, L11, L20, L21	stripline (note 2)		length 2.5 mm width 27 mm	
L12, L13, L18, L19	grade 4S2 Ferroxcube chip bead			4330 030 36300
L14, L15	microchoke	2.2 µH		4322 057 02281
L16, L17	4 turns enamelled 1 mm copper wire		int. dia. 6 mm; close wound	
L22, L23	stripline (note 2)		length 8.5 mm width 22 mm	
L24, L25	stripline (note 2)		length 5 mm width 16/22 mm	
L26, L27	stripline (note 2)		length 5 mm width 16 mm	
L28, L29	stripline (note 2)		length 7.5 mm width 13 mm	
L30, L31	stripline (note 2)		length 6 mm width 9.5 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L32, L34	stripline (note 2)		length 49.3 mm width 5 mm	
L33	semi-rigid cable (note 3)	50 Ω	length 49.3 mm ext. dia. 3.6 mm	
R1, R2, R3, R4, R5, R6	metal film resistor	5.11 Ω, 0.4 W		2322 151 75118
R7, R8	metal film resistor	5.11 Ω, 1 W		2322 153 55118

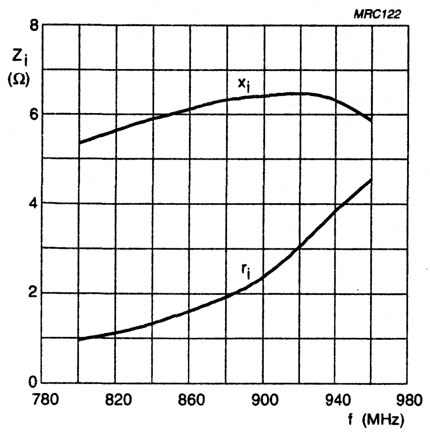
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric ($\varepsilon_r = 2.2$), thickness $\frac{1}{32}$ inch; thickness of copper sheet 2 x 35 μm.
3. Cables soldered to striplines L1 and L32 respectively.



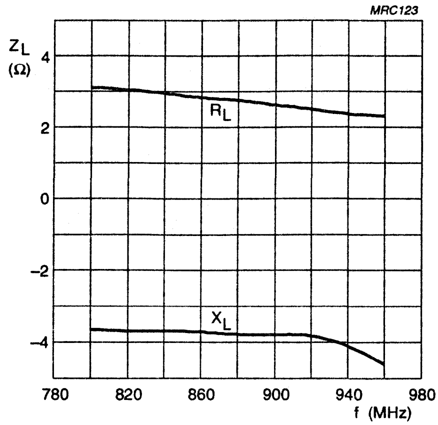
The components are mounted on one side of a copper-clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.20 Component layout for 915 to 960 MHz class-AB test circuit.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; P_L = 150 W (total device).

Fig.21 Input impedance as a function of frequency (series components), typical values per section.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; P_L = 150 W (total device).

Fig.22 Load impedance as a function of frequency (series components), typical values per section.

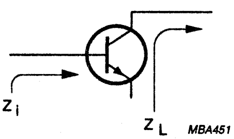
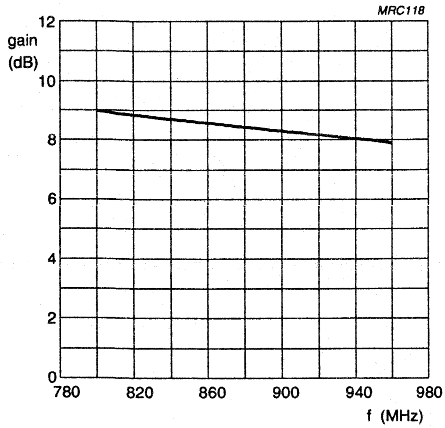
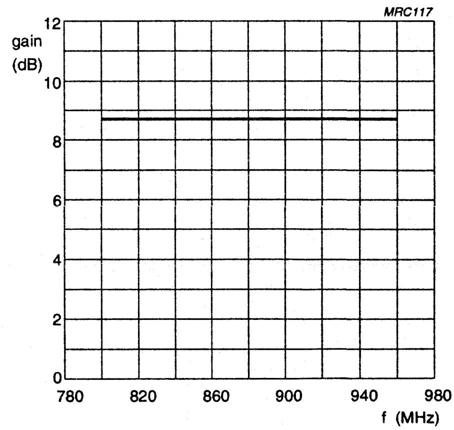


Fig.23 Definition of transistor impedance.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; P_L = 150 W (total device).

Fig.24 Gain as a function of frequency, typical values.



Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; P_L = 150 W (PEP) (total device).

Fig.25 Gain as a function of frequency, 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

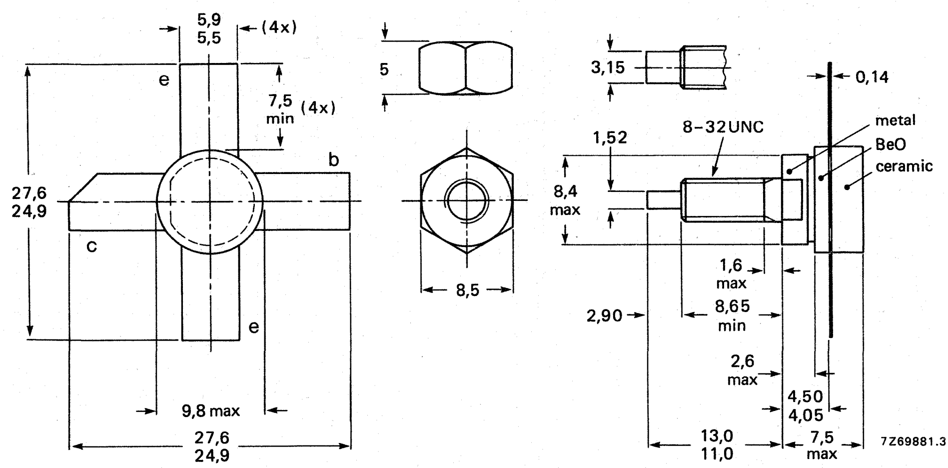
R.F. performance up to T_h = 25 °C

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

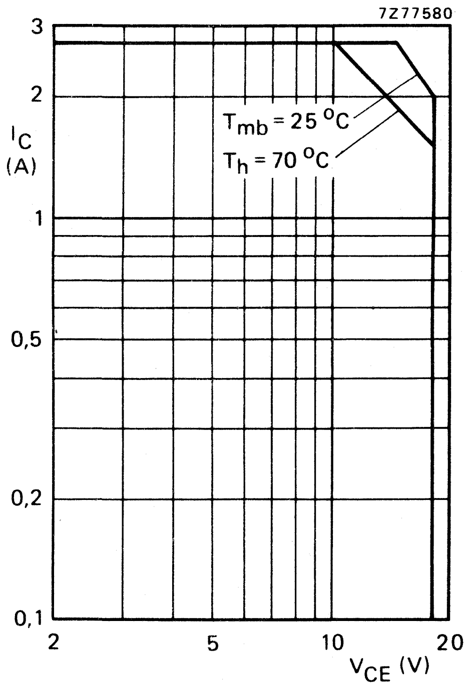


Fig. 2 D.C. SOAR.

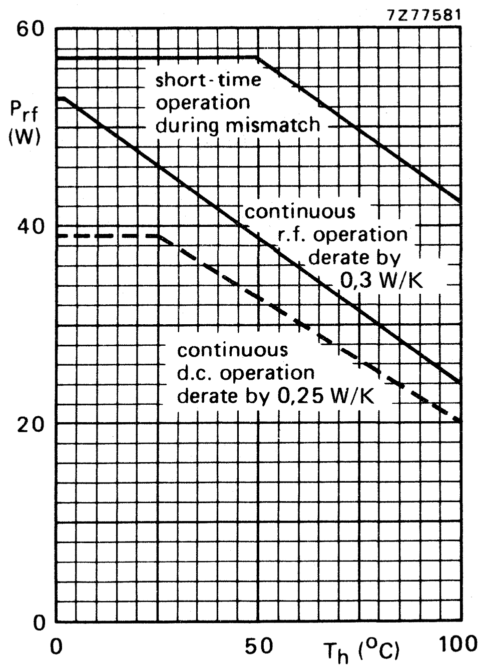


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ⩾ 1 MHz.

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

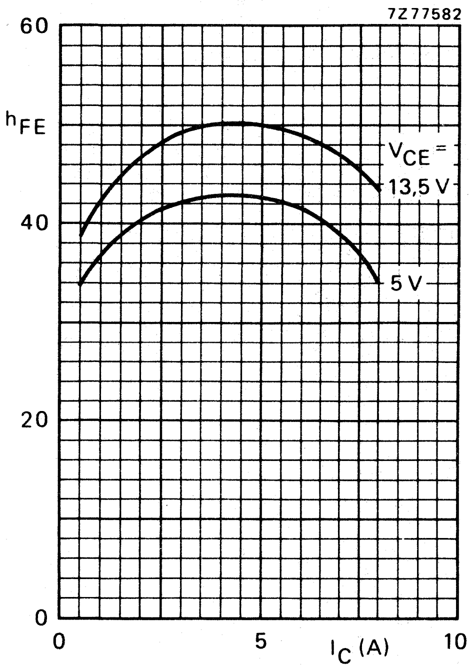


Fig. 4 Typical values; T_j = 25 °C.

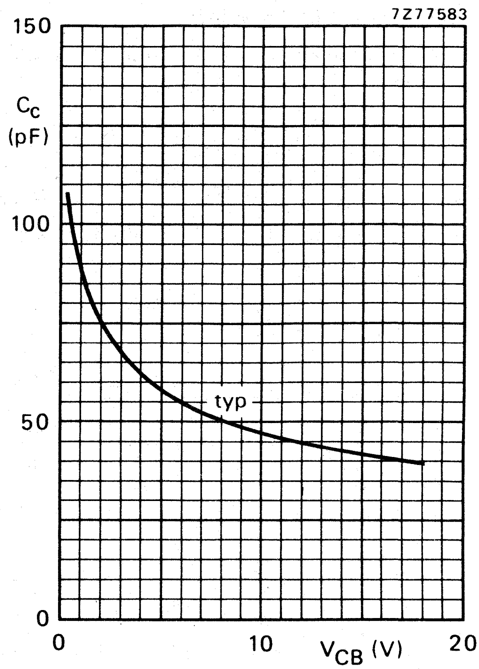


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

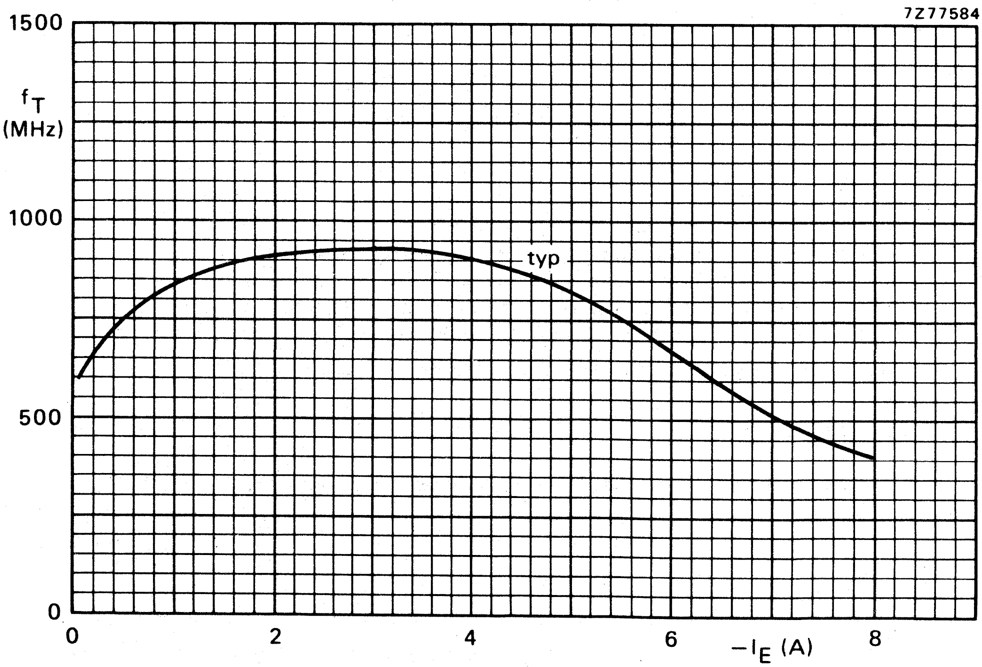


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

T_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**	**< 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	–	–

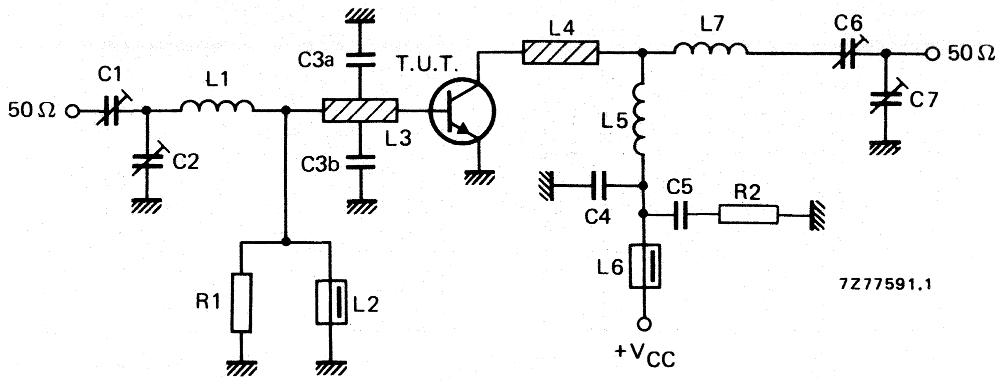


Fig. 7 Test circuit; c.w. class-B.

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

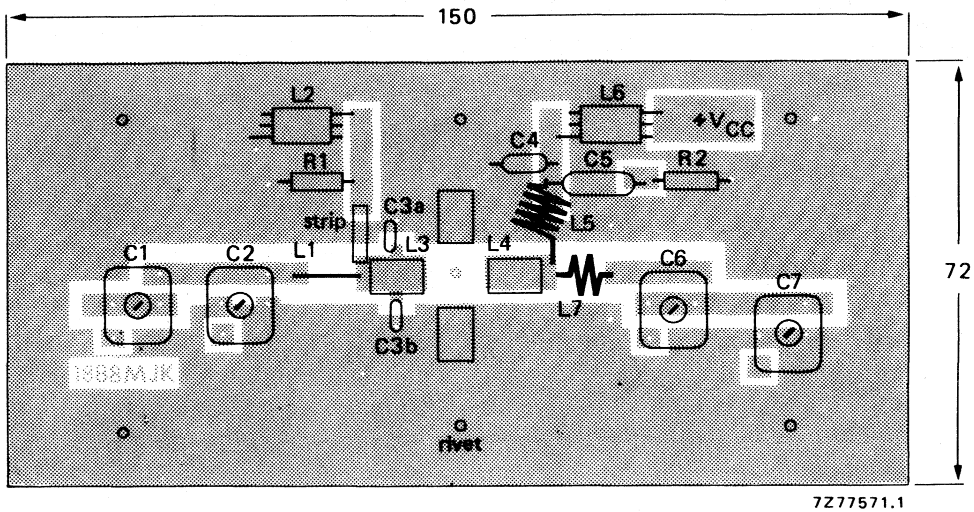
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = L6 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = L4 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
L5 = 4½ turns closely wound enamelled Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 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)



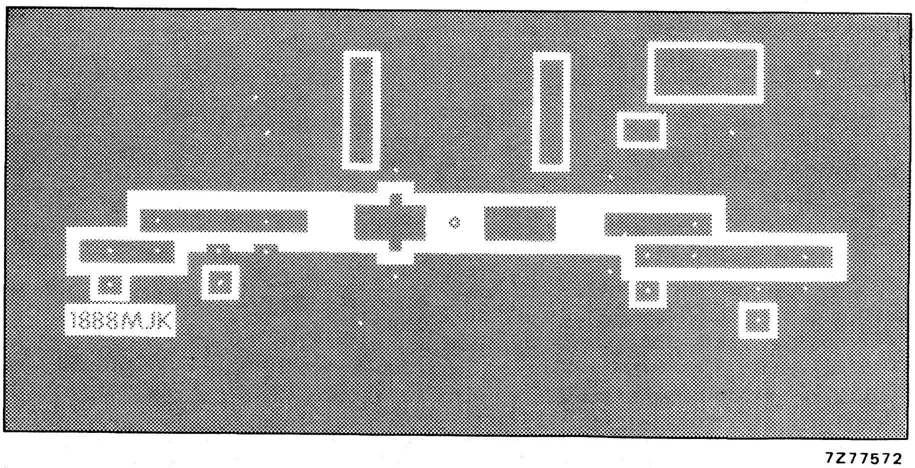


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

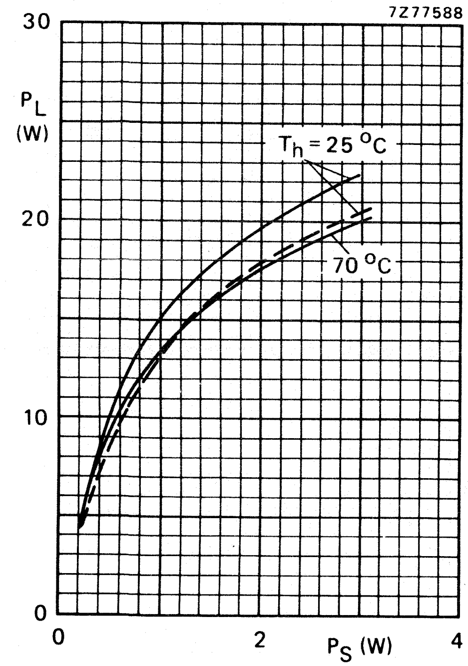


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

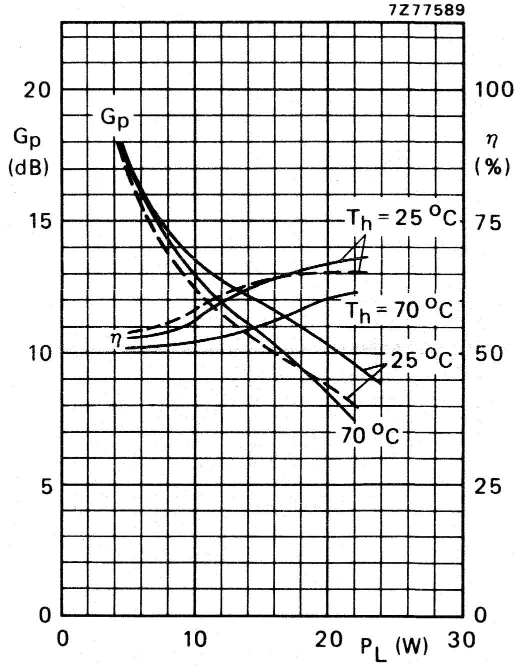


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

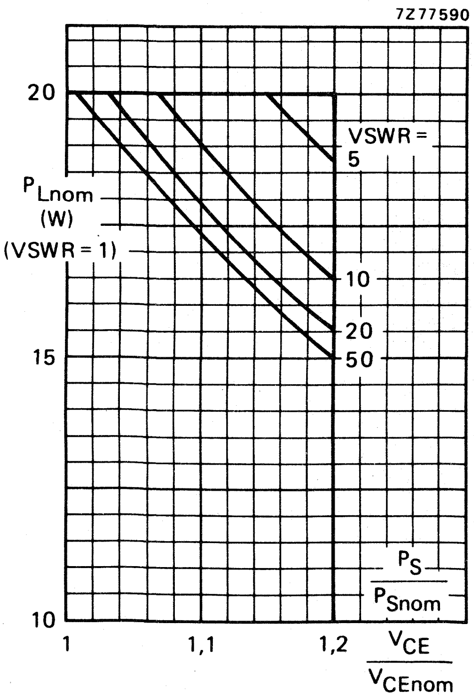


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,45 K/W ; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1

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.

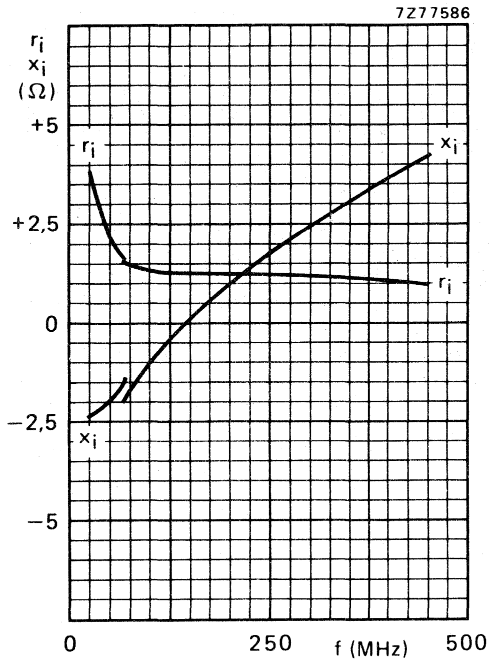


Fig. 12.

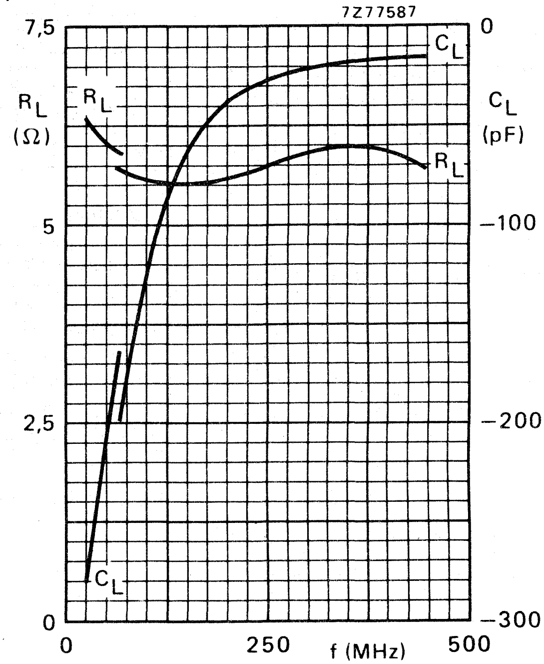
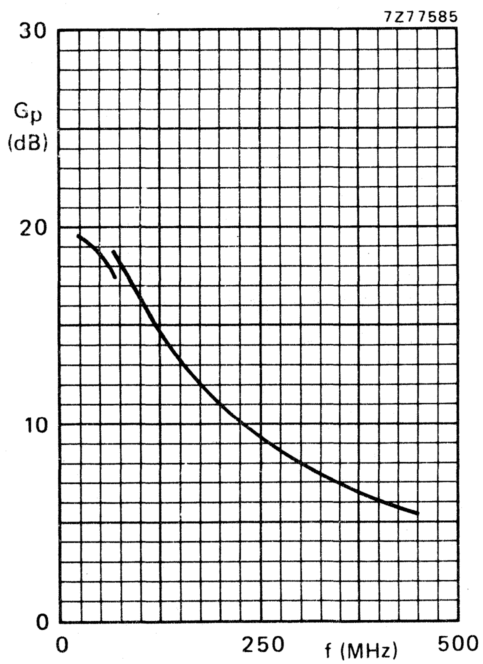


Fig. 13.



Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 13,5 V; P_L = 15 W; T_h = 25 °C.

Fig. 14.

VHF power transistor — BLW30

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Excellent reliability
- Withstands full load mismatch.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead ⅜ inch SOT120 capstan envelope with a ceramic cap. It is designed for common emitter, class-B operation in mobile VHF transmitters with a supply voltage of 12.5 V. All leads are isolated from the stud.

PINNING - SOT120

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	30	> 10	> 55

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

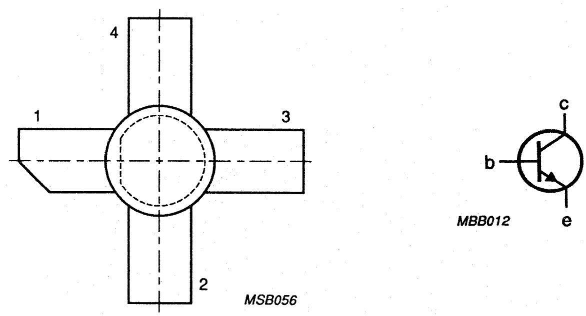
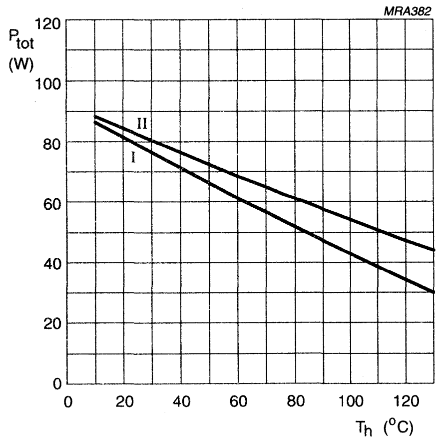


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	6	A
I_{CM}	collector current	peak value f > 1 MHz	–	18	A
P_{tot}	total power dissipation	RF operation; f > 1 MHz; T_{mb} = 25 °C	–	100	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C



(I) Continuous RF operation (f > 1 MHz).

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

Fig.2 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 100 W; T_{mb} = 25 °C	1.75	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.45	K/W

CHARACTERISTICS

$T_j = 25$ °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 10$ mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 25$ mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 2$ mA	3	–	–	V
I_{CES}	collector-emitter leakage current	$V_{BE} = 0$; $V_{CE} = 16$ V	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 4$ A	25	35	–	
f_T	transition frequency	$V_{CE} = 12.5$ V; $I_E = 4$ A; f = 500 MHz	–	1.6	–	GHz
C_c	collector capacitance	$V_{CB} = 12.5$ V; $I_E = I_e = 0$; f = 1 MHz	–	90	100	pF
C_{re}	feedback capacitance	$V_{CE} = 12.5$ V; $I_C = 0$; f = 1 MHz	–	60	70	pF
C_{c-s}	collector-stud capacitance	f = 1 MHz	–	2	–	pF

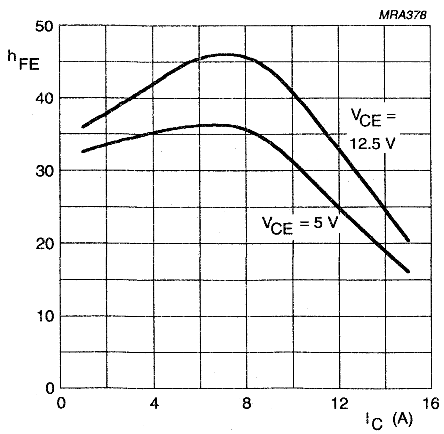
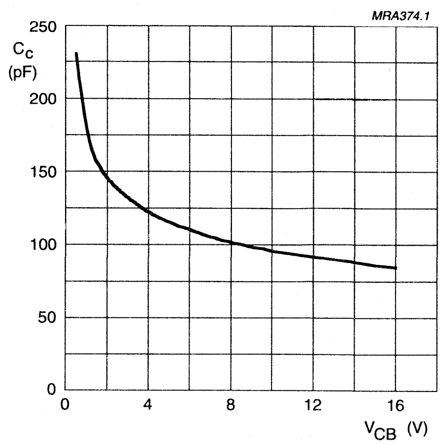
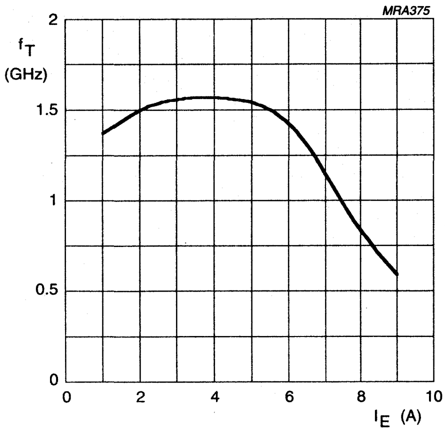


Fig.3 DC current gain as a function of collector current, typical values.



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

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



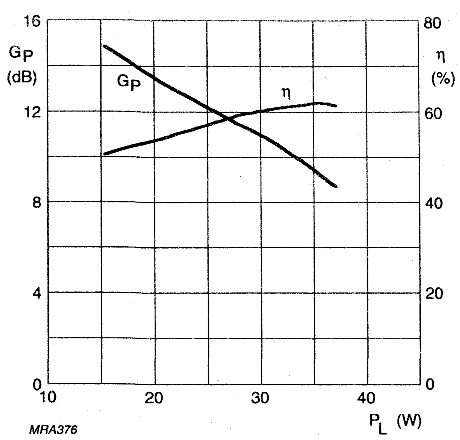
V_{CB} = 12.5 V.

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

APPLICATION INFORMATION

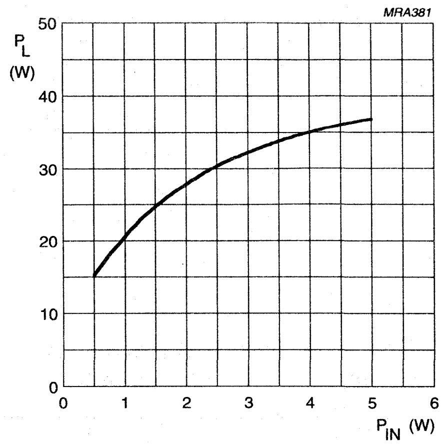
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	30	> 10 typ. 11	> 55 typ. 60



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.6 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.7 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLW30 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 15.5 V, and f = 175 MHz.

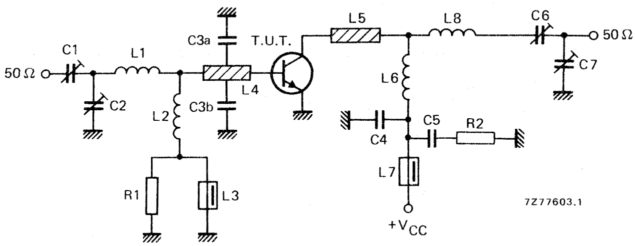


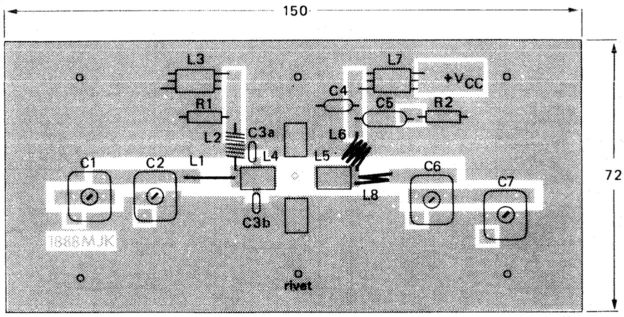
Fig.8 Class-B test circuit at f = 175 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C2, C7	film dielectric trimmer	4 to 40 pF		2222 809 07008
C3a, C3b	500 V ceramic capacitor	47 pF		
C4	ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
C6	film dielectric trimmer	7 to 100 pF		2222 809 07015
L1	½ turn enamelled 1.6 mm copper wire		int. dia. 6 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire	100 nH	int. dia. 3 mm; leads 2 x 5 mm	
L3, L7	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 1)		12 mm x 6 mm; note 2	
L6	3½ turns closely wound enamelled 1.6 mm copper wire		int. dia. 6 mm; leads 2 x 5 mm	
L8	1 turn enamelled 1.6 mm copper wire		int. dia. 6 mm; leads 2 x 5 mm	
R1, R2	0.25 W carbon resistor	10 Ω, 5%		

Notes

1. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric, thickness 1⁄16 inch.
2. Taps for capacitors C3a and C3b are situated 5 mm from the transistor.



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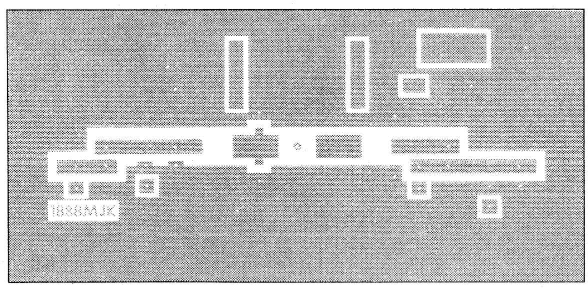
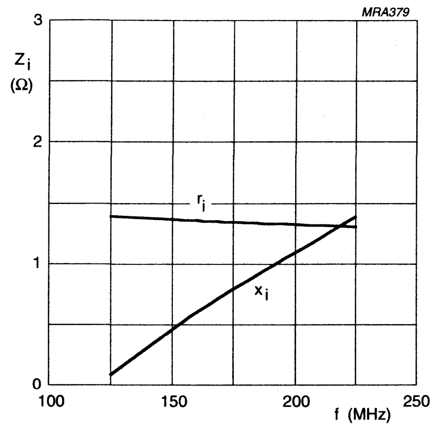


7Z77574

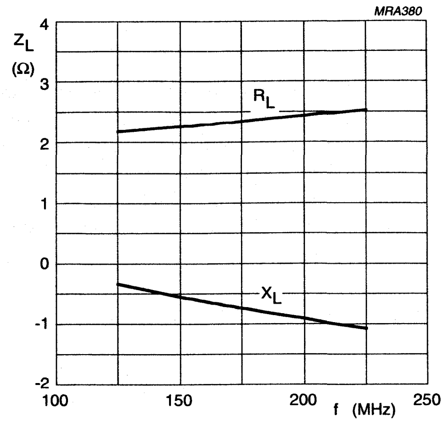
The circuit and components are situated on one side of an epoxy fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections are made by means of hollow rivets and copper straps under the emitters, to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 175 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

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



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

Fig.11 Load impedance (series components) as a function of frequency, typical values.

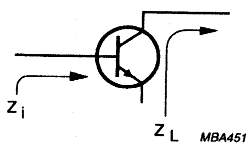
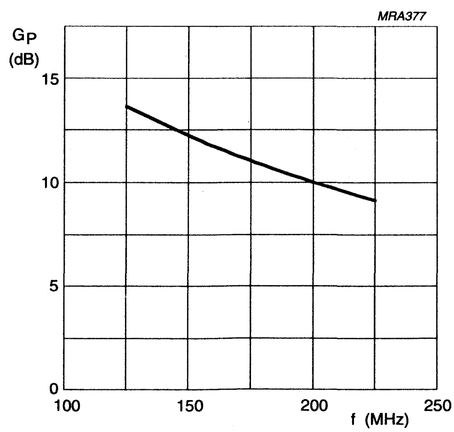


Fig.12 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 30 W.

Fig.13 Power gain as a function of frequency, 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 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

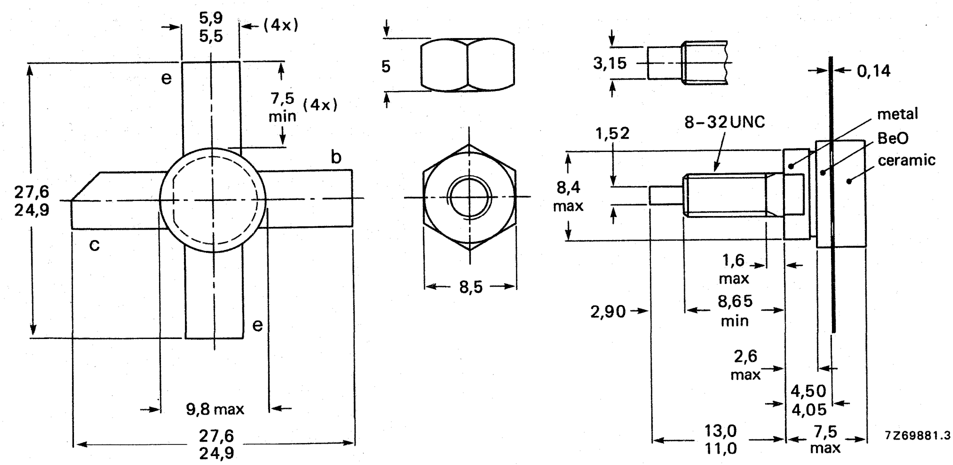
R.F. performance up to T_h = 25 °C

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 °C	P_{rf}	max.	96	W
Storage temperature	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

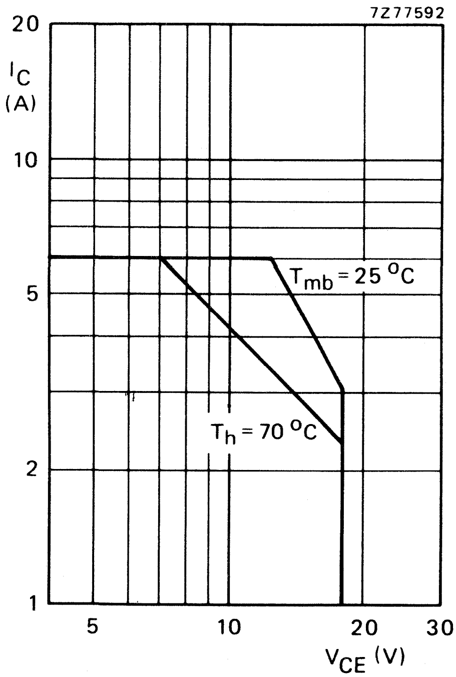


Fig. 2 D.C. SOAR.

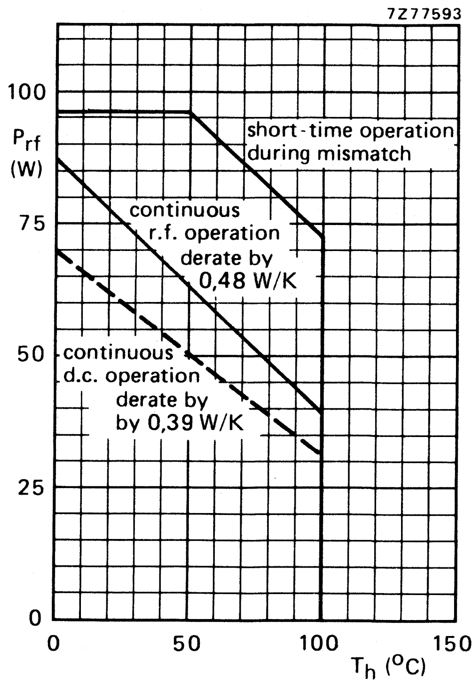


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f ⩾ 1 MHz.

THERMAL RESISTANCE (dissipation = 25 W; T_{mb} = 81 °C, i.e. T_h = 70 °C)

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

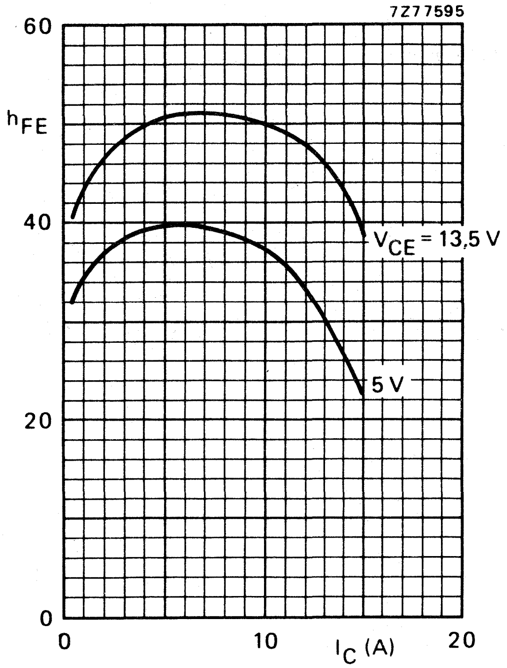


Fig. 4 Typical values; T_j = 25 °C.

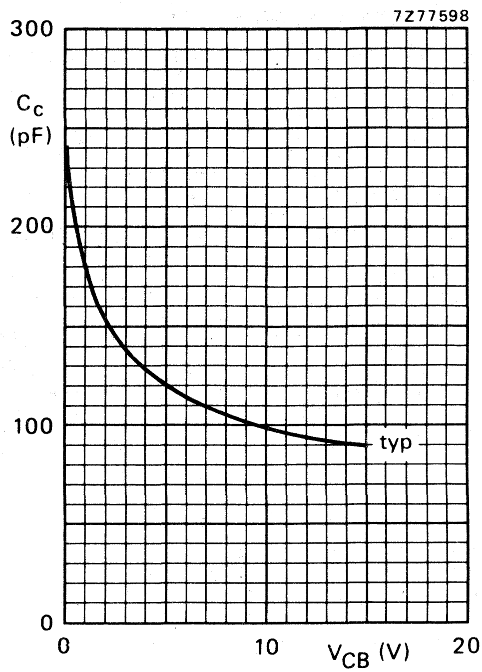


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

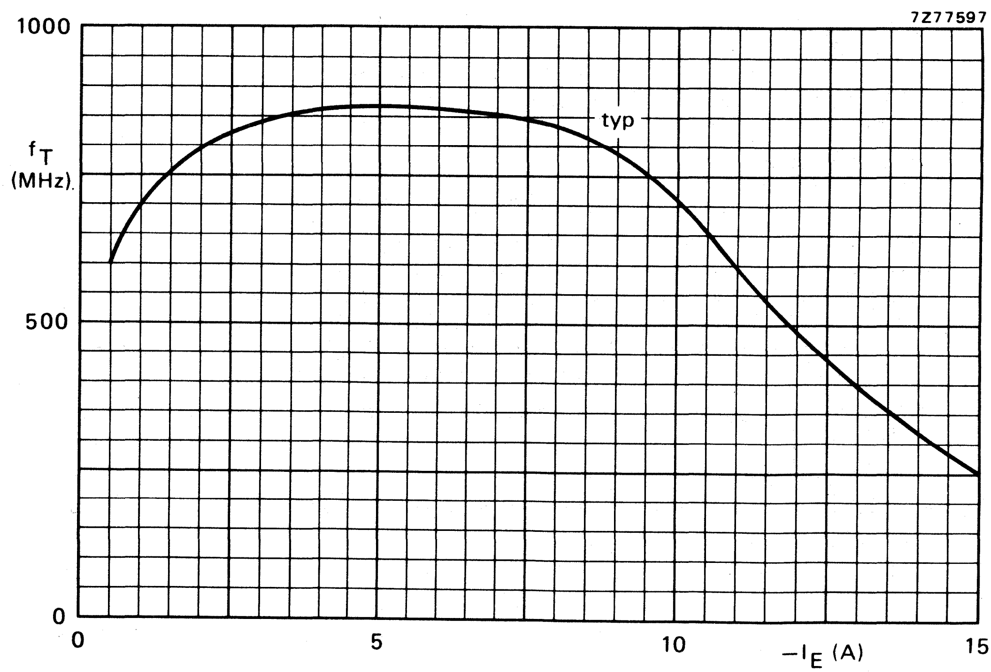


Fig. 6 V_{CB} = 13,5 V; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

T_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**	**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	–	–

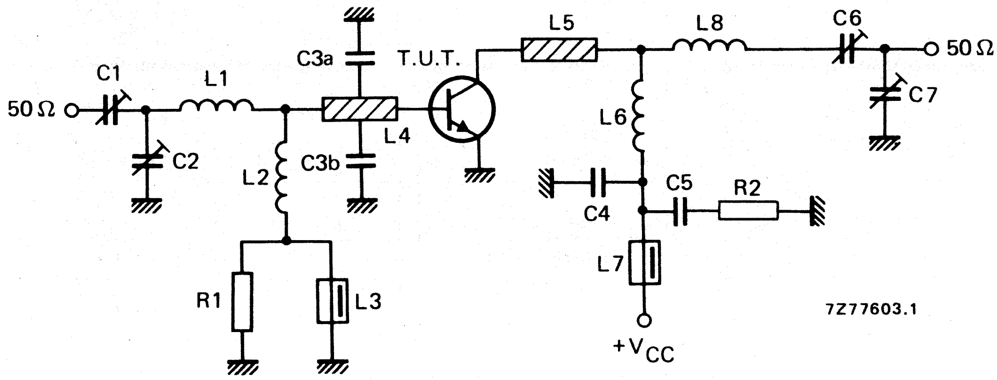


Fig. 7 Test circuit; c.w. class-B.

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)

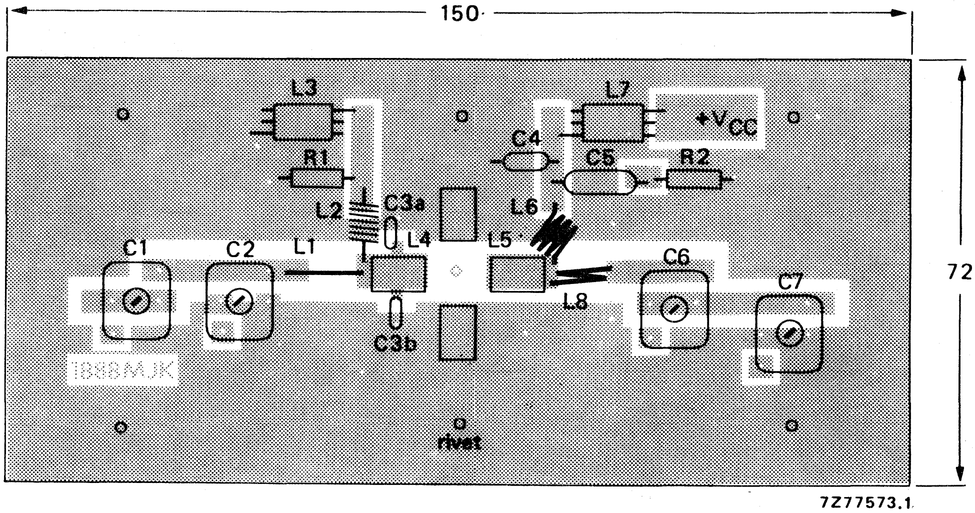
L1 = ½ turn Cu wire (1,6 mm); int. dia. 6,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from 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)



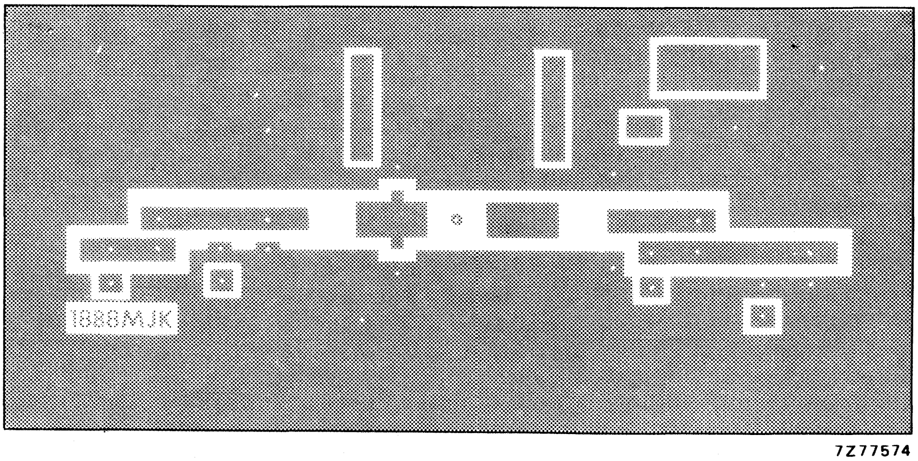


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

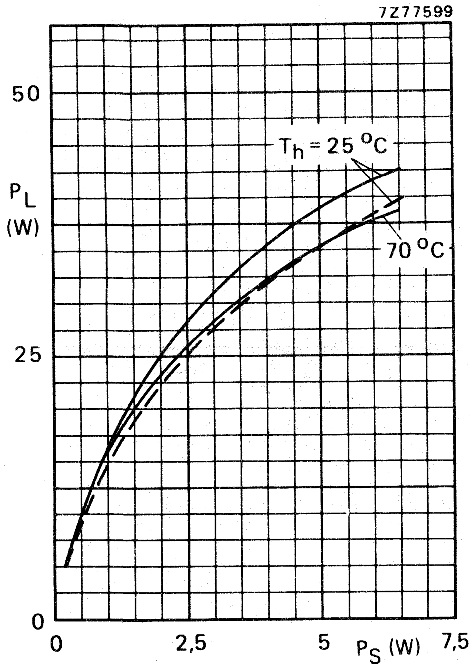


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

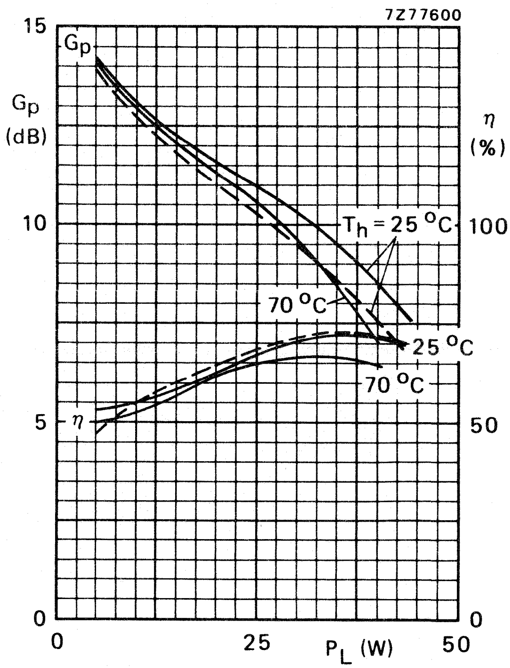


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

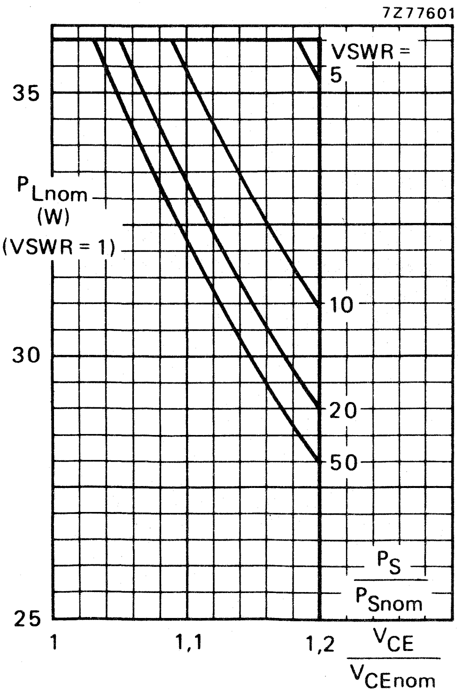


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,45 K/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1

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.

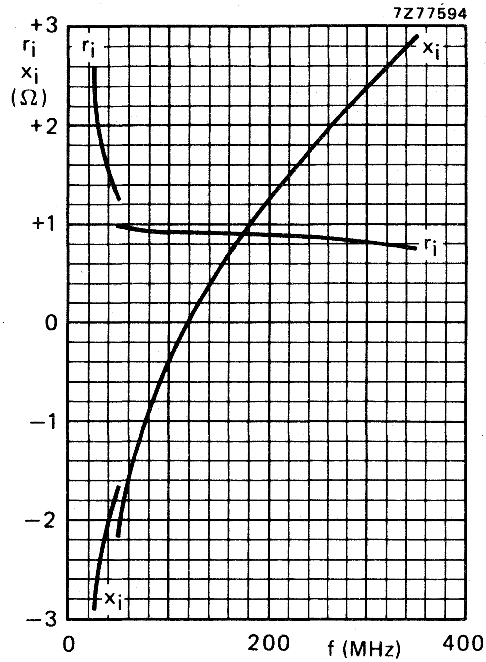


Fig. 12.

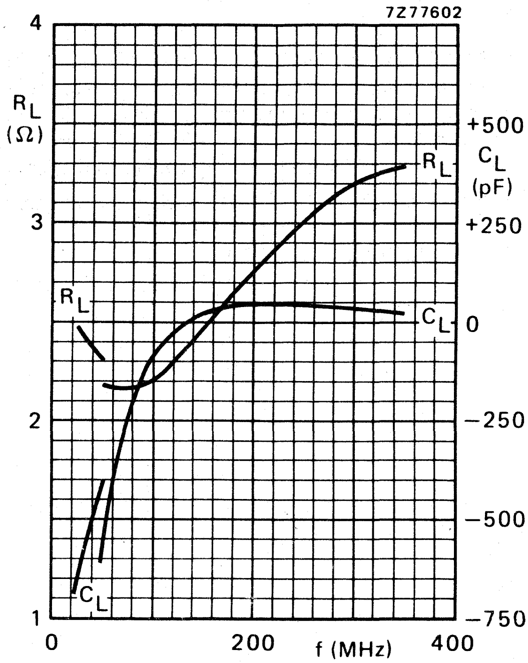
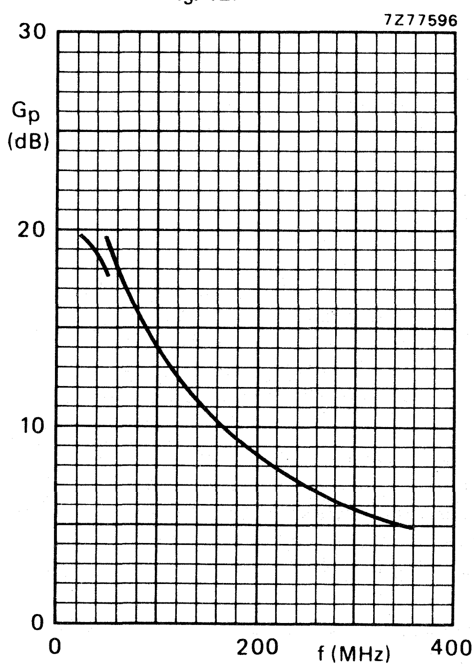


Fig. 13.



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

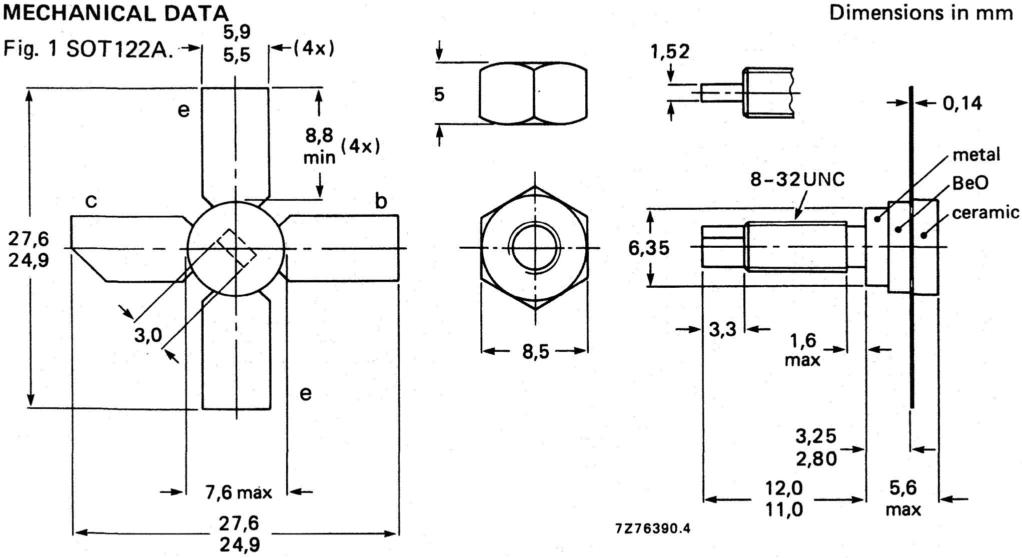
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	150	70	−60	> 0,5	> 11
	860	25	150	25	−60	typ. 0,63	typ. 12,2

* 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 SOT122A.



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.

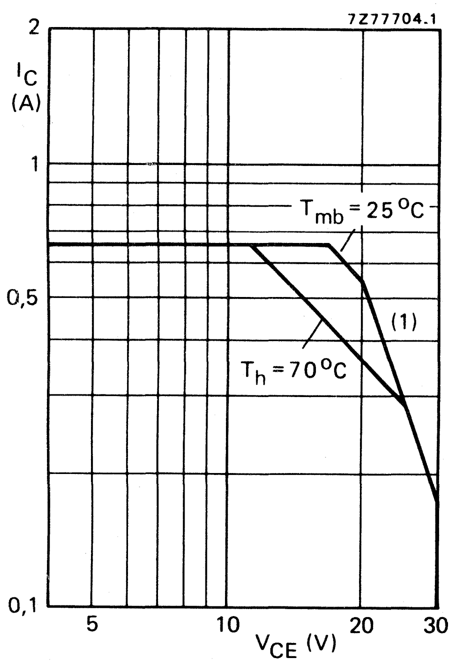
When locking is required an adhesive is preferred instead of a lock washer.

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.

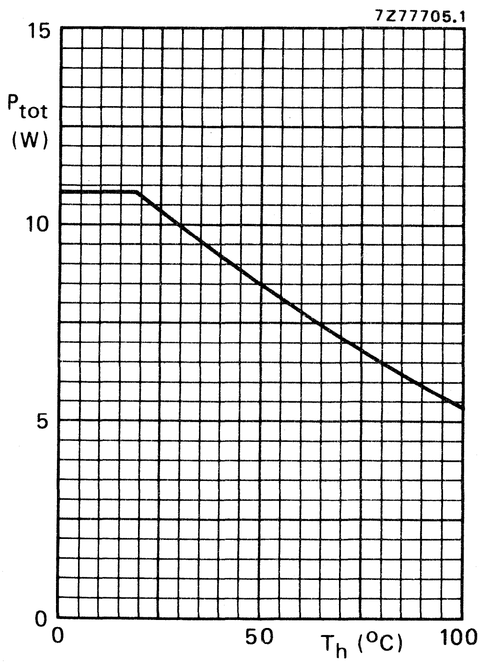


Fig. 3 Power derating curve vs. temperature.

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

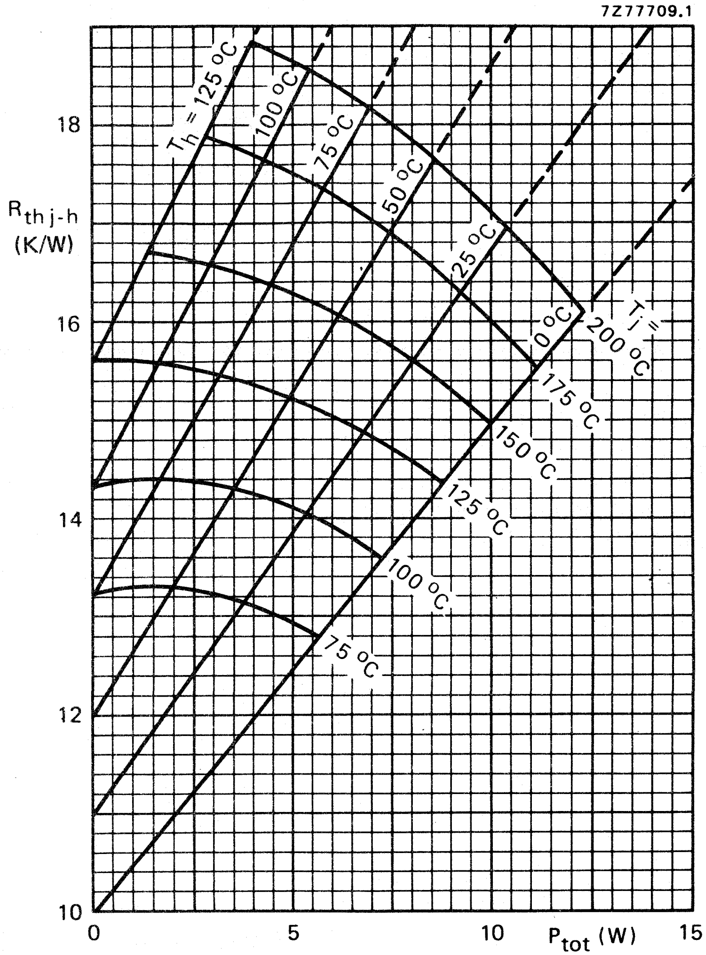


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

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 °C 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 °C	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 °C	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: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

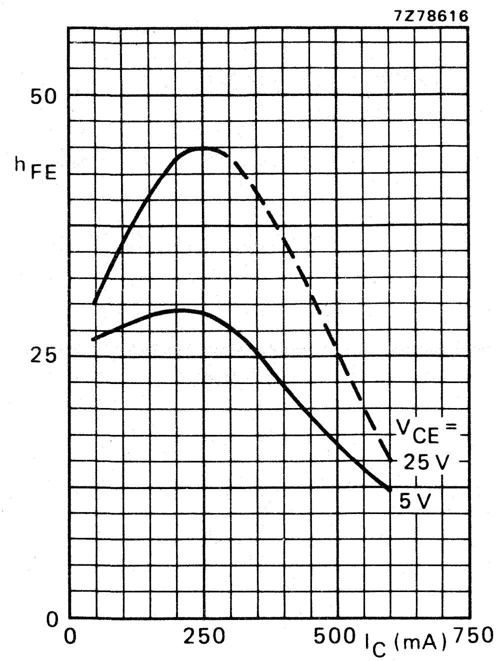


Fig. 5 Typical values; T_j = 25 °C.

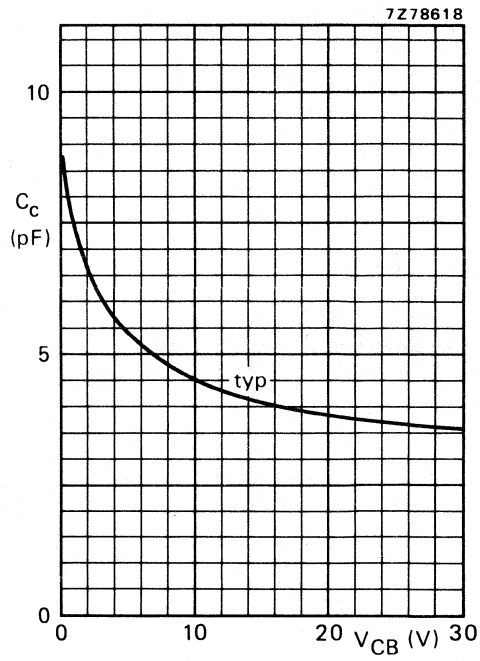


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

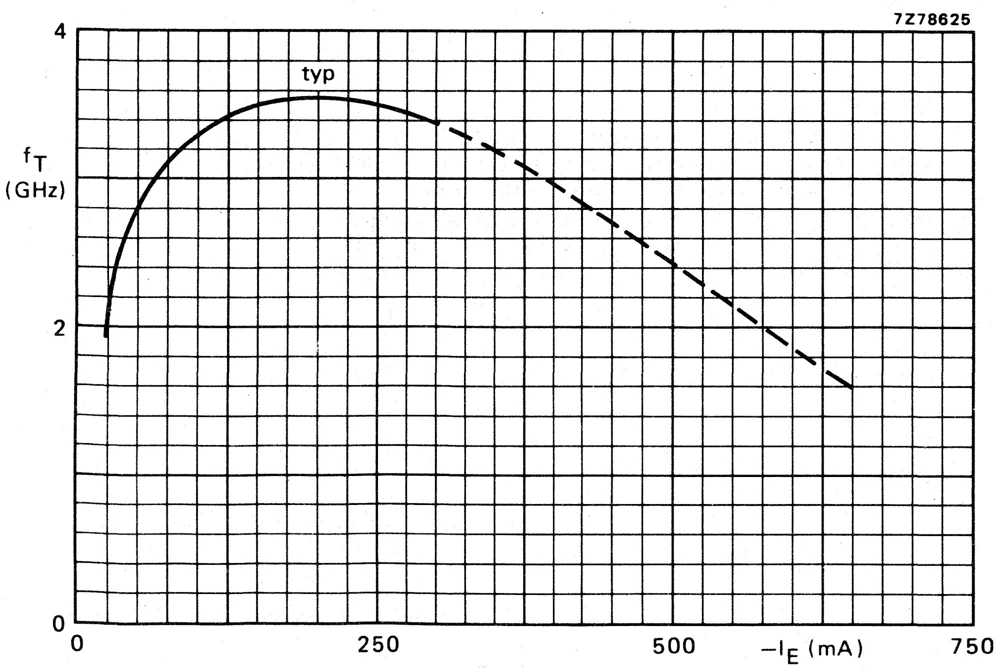


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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.

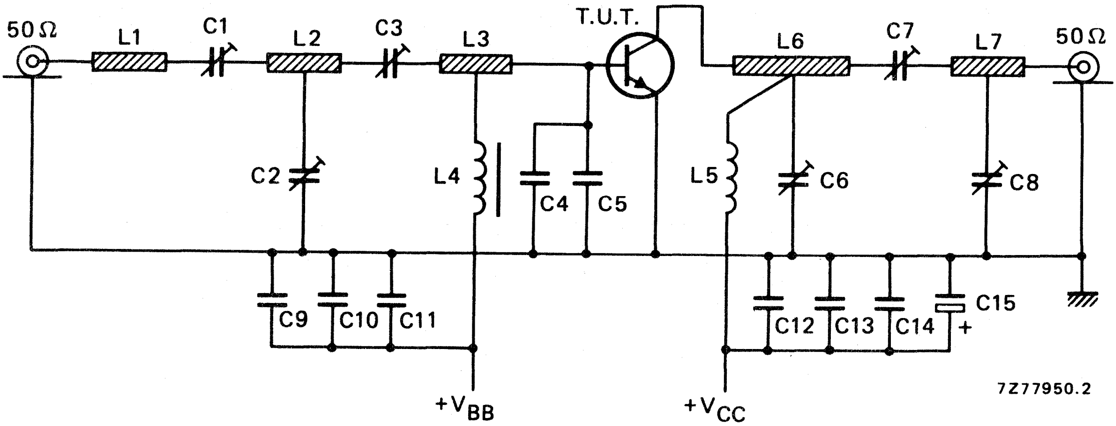


Fig. 8 Test circuit at f_{vision} = 860 MHz.

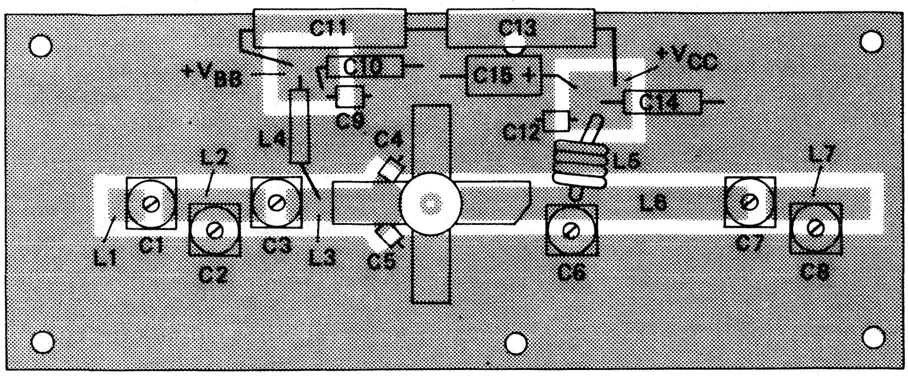
List of components:

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.



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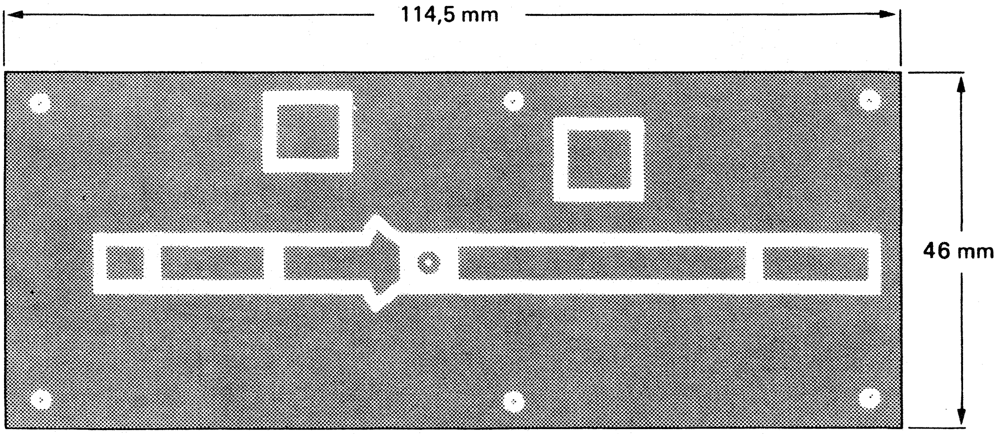
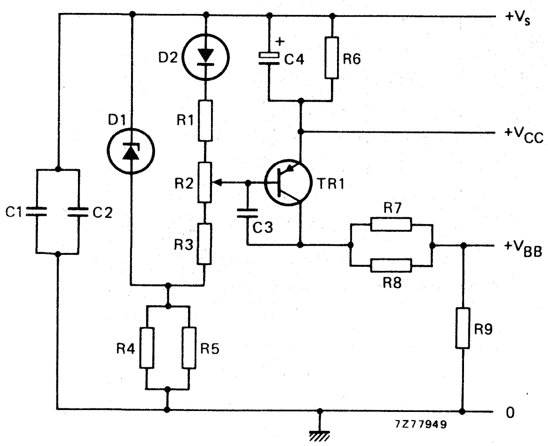


7Z78878

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.

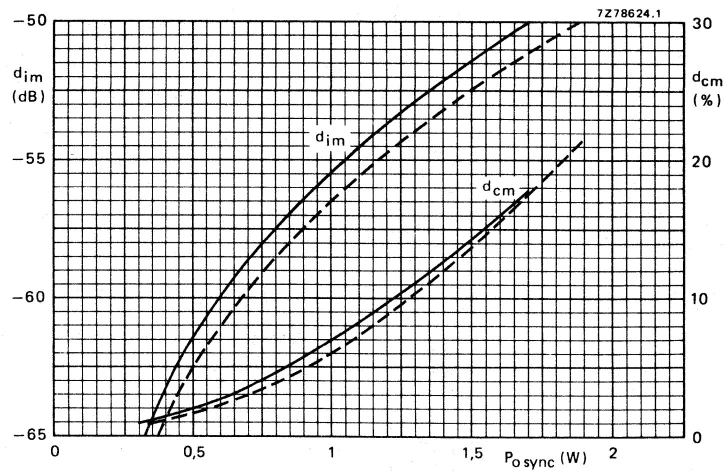


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 150 mA; f_{vision} = 860 MHz; ---- T_h = 25 °C; —— T_h = 70 °C.

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.

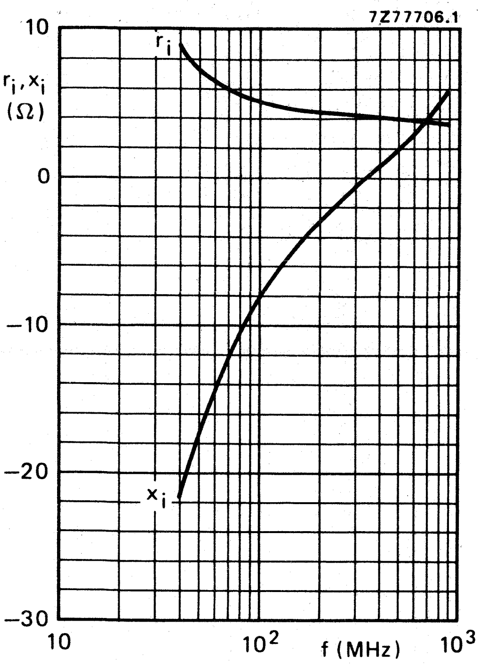


Fig. 12 Input impedance (series components).

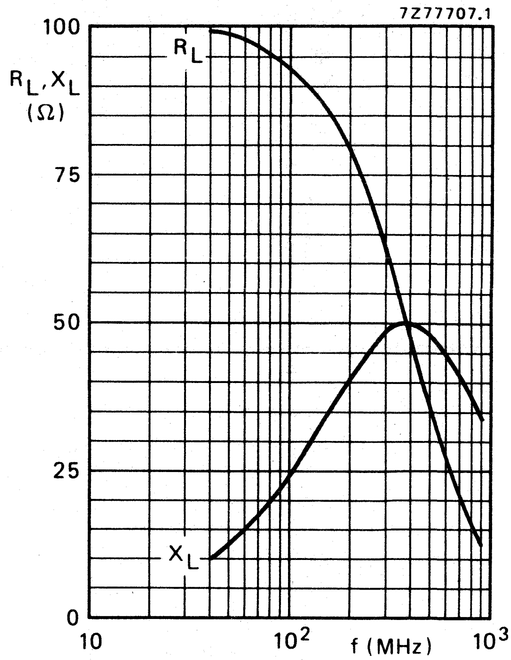


Fig. 13 Load impedance (series components).

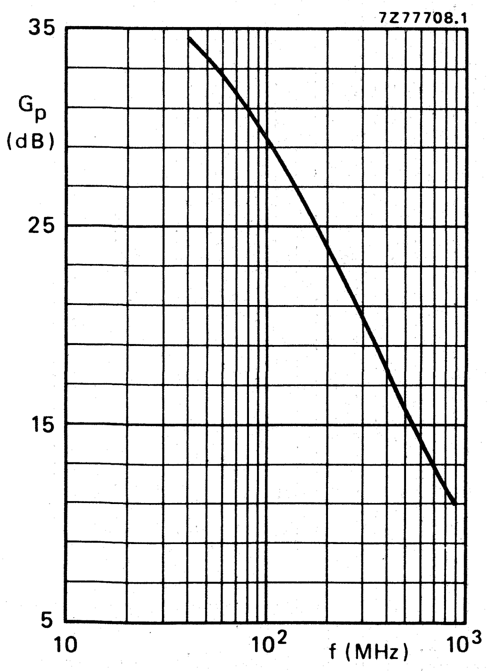


Fig. 14.

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

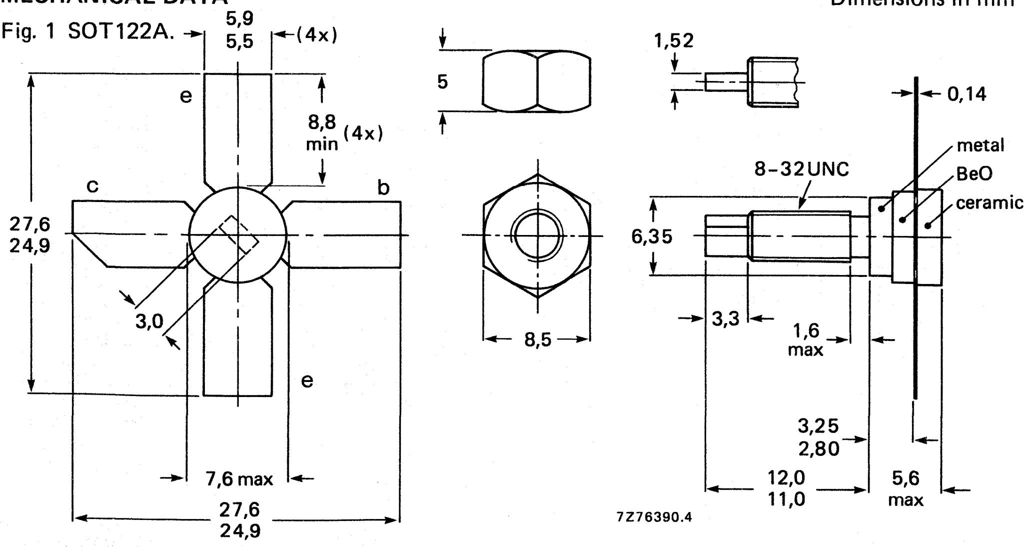
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	300	70	−60	> 1,0	> 10,0
	860	25	300	25	−60	typ. 1,15	typ. 10,5

* 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 SOT122A.



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.

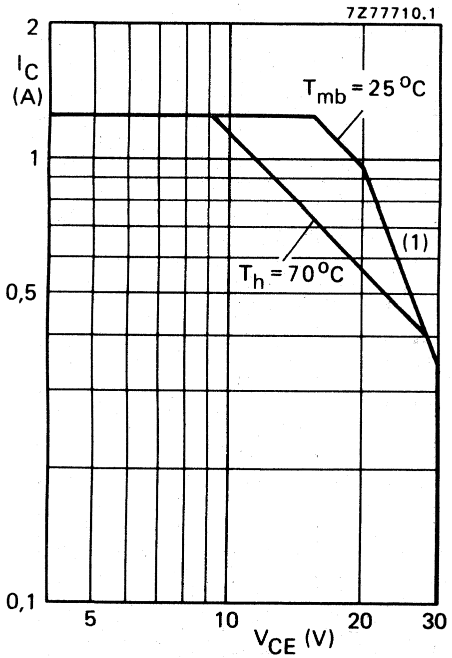
When locking is required an adhesive is preferred instead of a lock washer.

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 $T_{mb} = 25\ ^oC$	P_{tot}	max.	19,3	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.

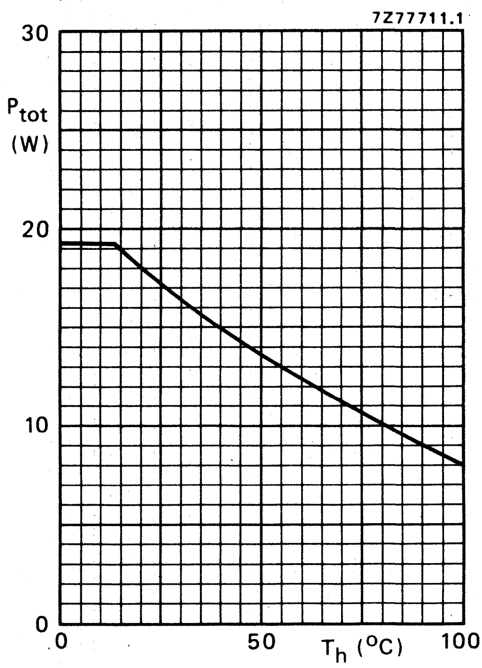


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (see Fig. 4)

From junction to mounting base				
(dissipation = 7,5 W; $T_{mb} = 74{,}5\ ^oC$; i.e. $T_h = 70\ ^oC$)	$R_{th\ j\text{-}mb}$	=	10,1	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

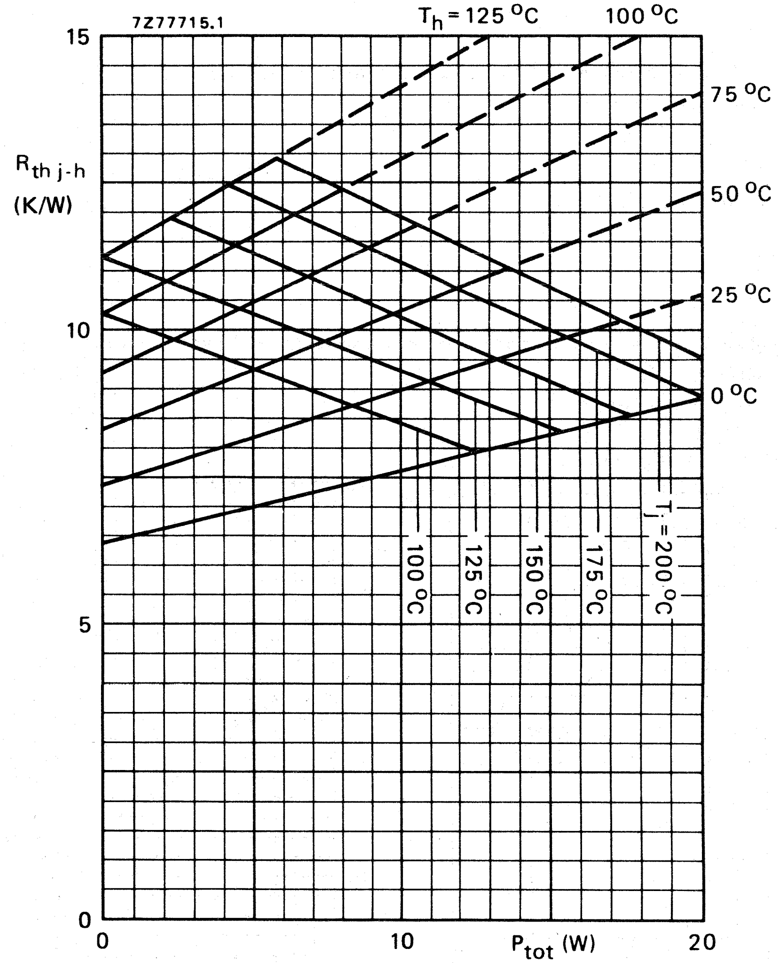


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb-h}$ = 0,6 K/W.)

Example

Nominal class-A operation: V_{CE} = 25 V; I_C = 300 mA; T_h = 70 °C.

Fig. 4 shows:	$R_{th\ j-h}$	max.	10,7	K/W
	T_j	max.	150	°C
Typical device:	$R_{th\ j-h}$	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: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

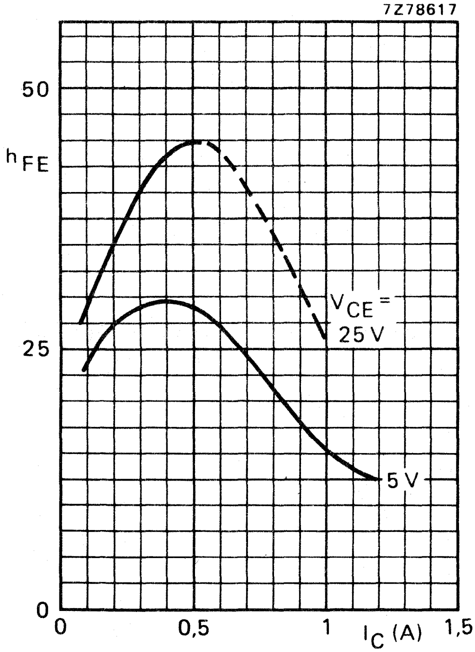


Fig. 5 Typical values; T_j = 25 °C.

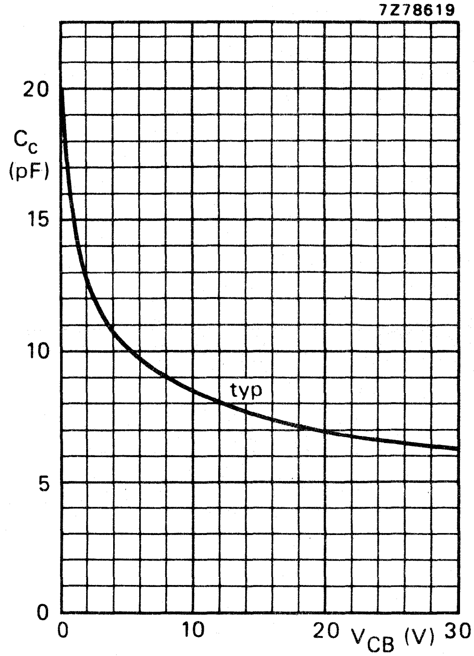


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

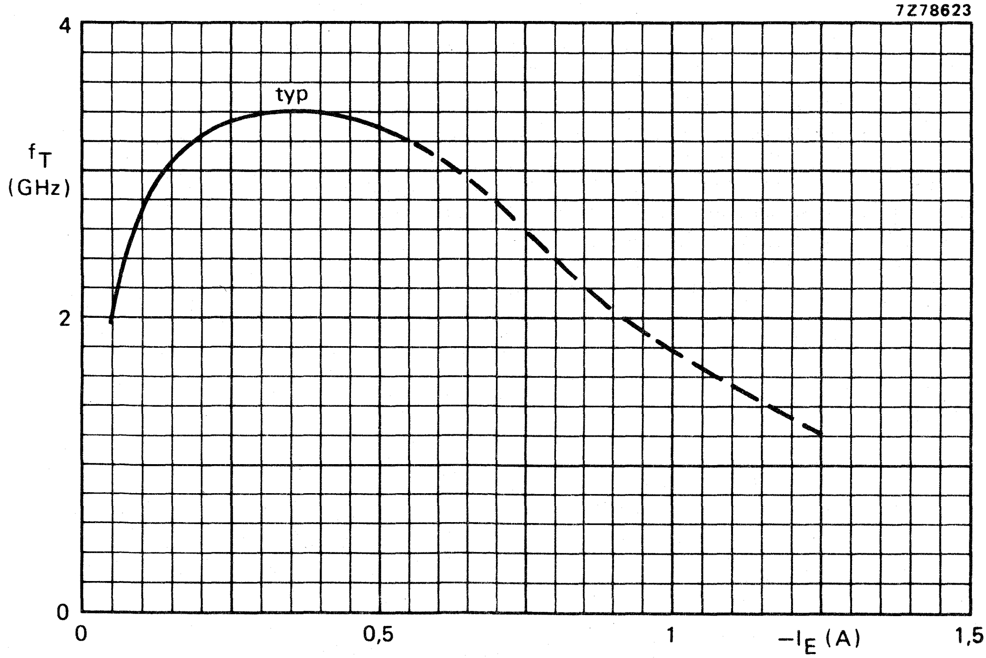


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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.

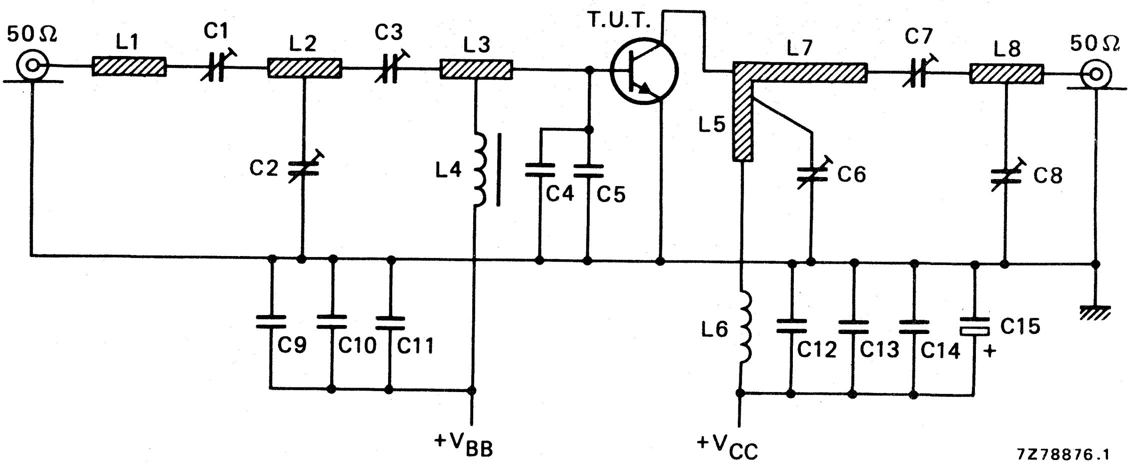


Fig. 8 Test circuit at f_{vision} = 860 MHz.

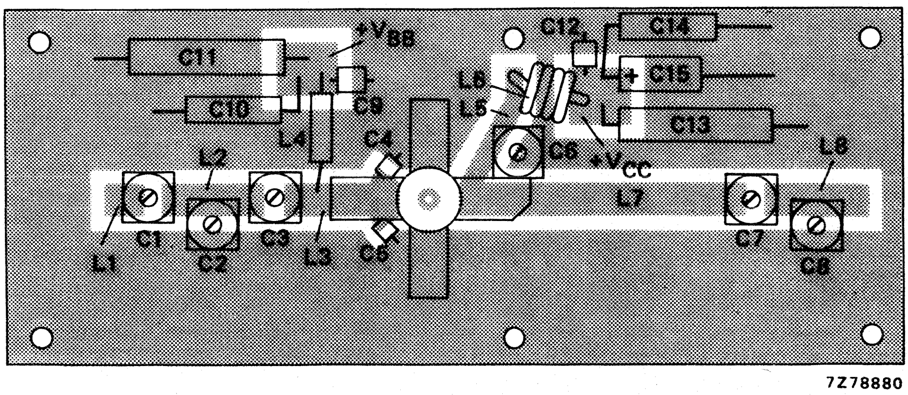
List of components:

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.



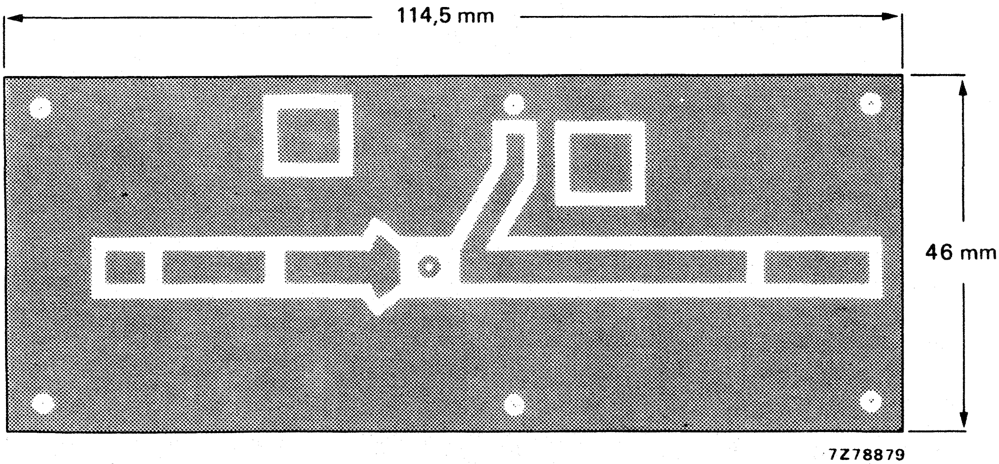


Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

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.

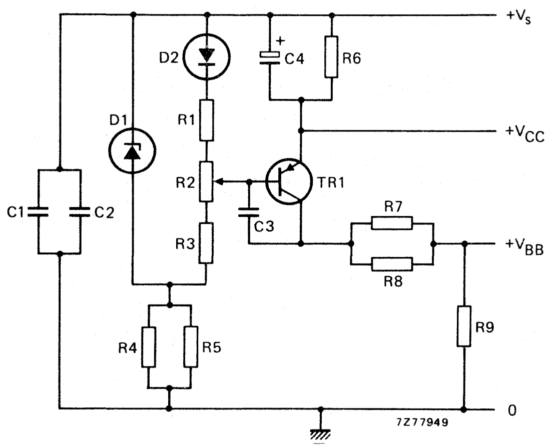


Fig. 10 Bias circuit for class-A linear amplifier at f_{vision} = 860 MHz.

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

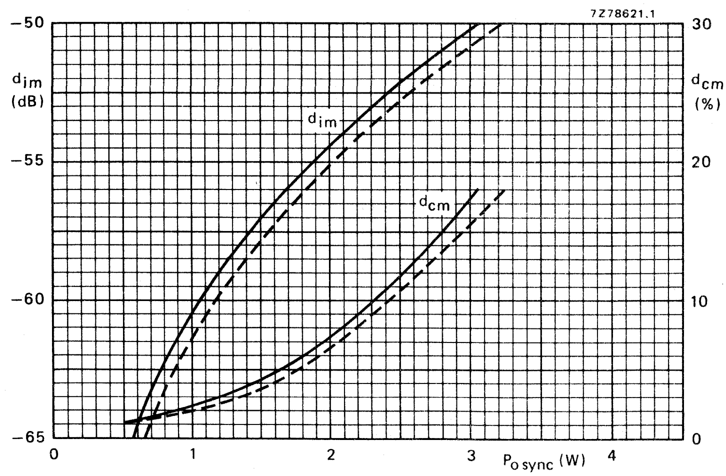


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 300 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

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.

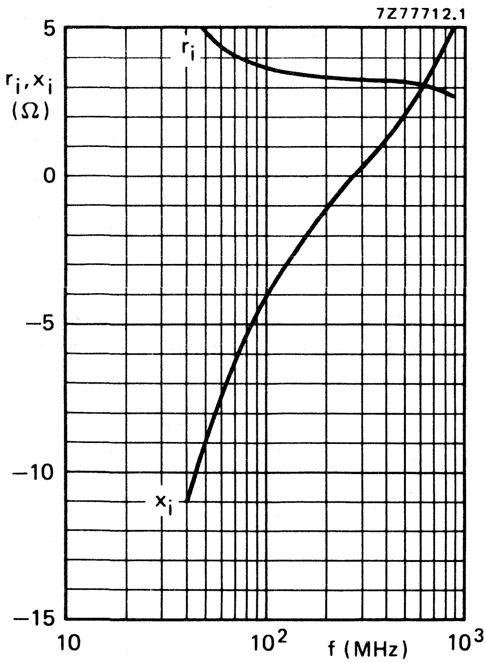


Fig. 12 Input impedance (series components).

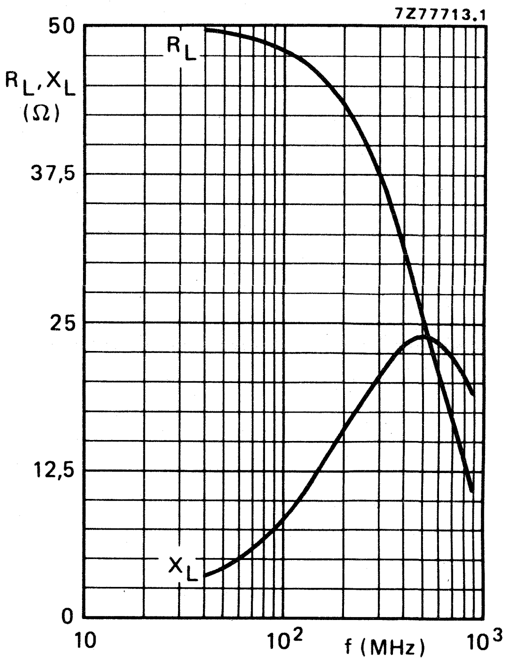


Fig. 13 Load impedance (series components).

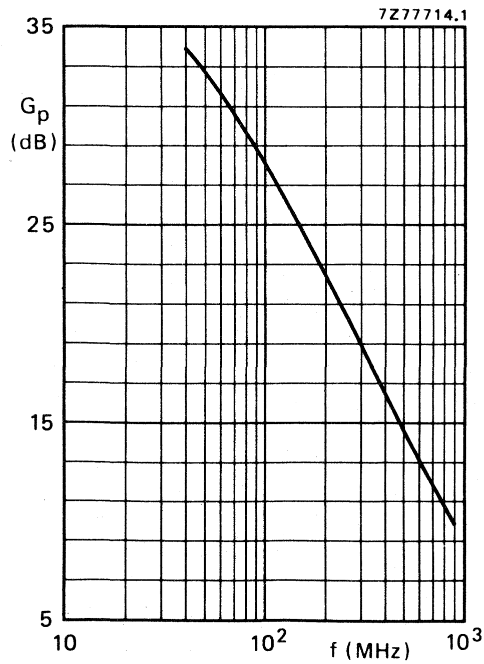


Fig. 14.

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

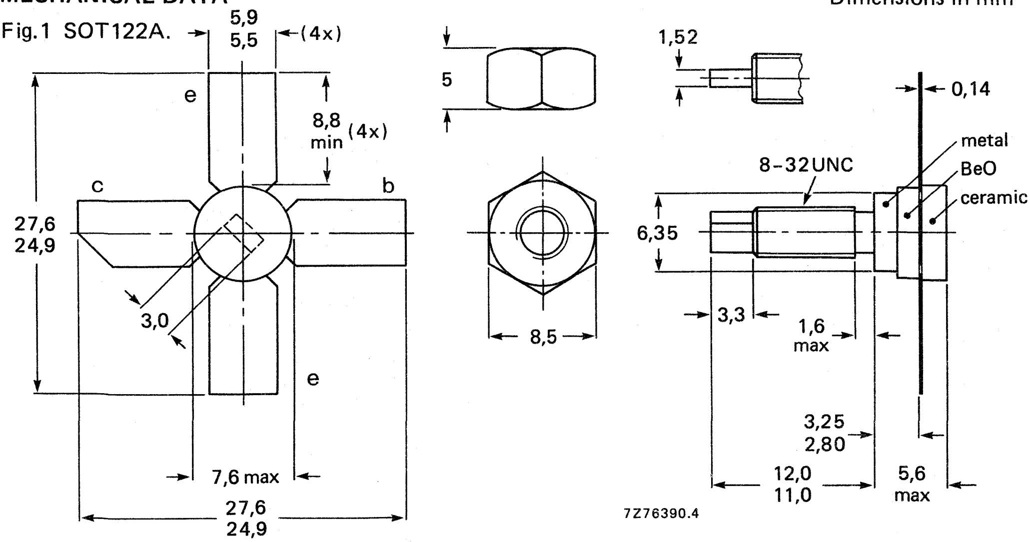
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im} * dB	$P_{o\ sync}$ * W	G_p dB
class-A; linear amplifier	860	25	600	70	−60	> 1,8	> 9
	860	25	600	25	−60	typ. 2,15	typ. 10,2

* 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 SOT122A.



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.

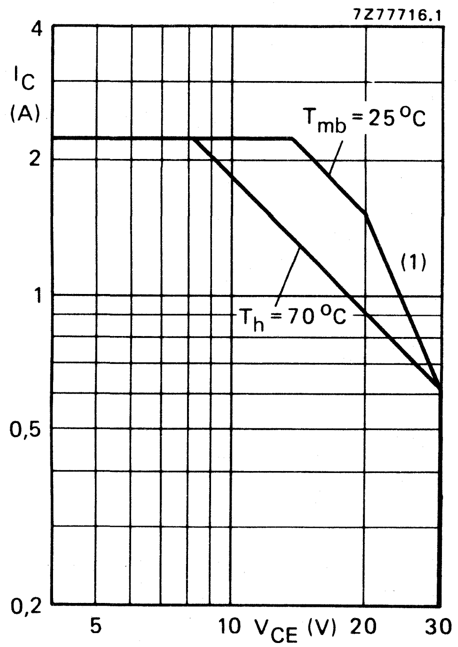
When locking is required an adhesive is preferred instead of a lock washer.

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.

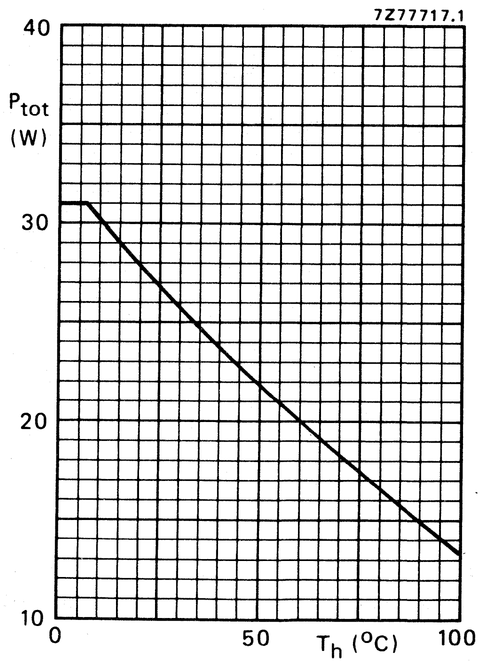


Fig. 3 Power derating curve vs. temperature.

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

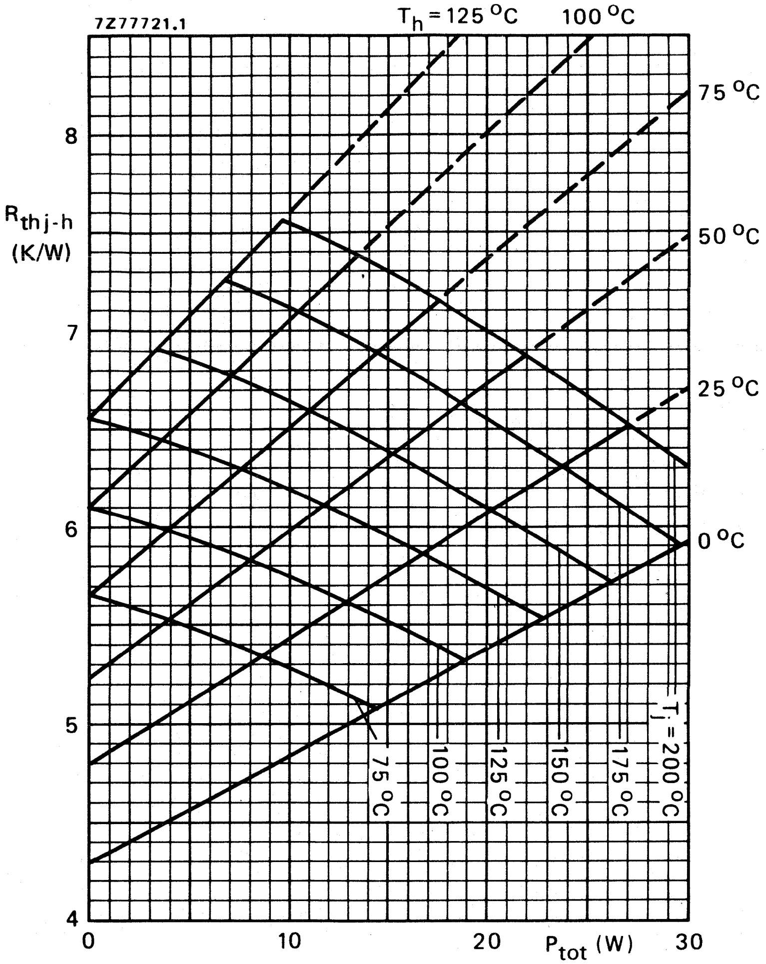


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

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: $t_p \leqslant 300$ µs; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50$ µs; $\delta \leqslant 0,01$.

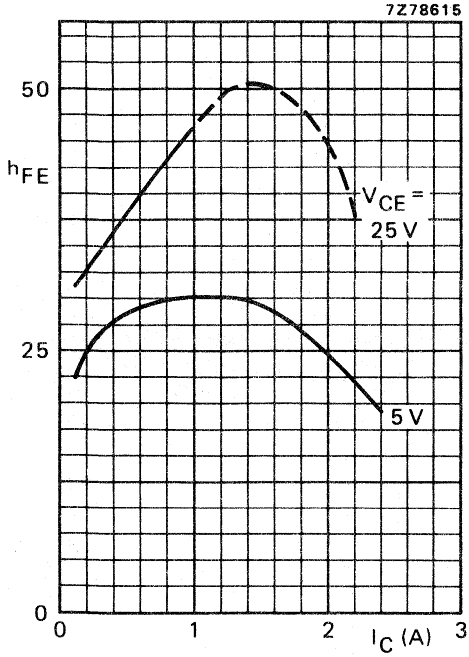


Fig. 5 Typical values; T_j = 25 ^oC.

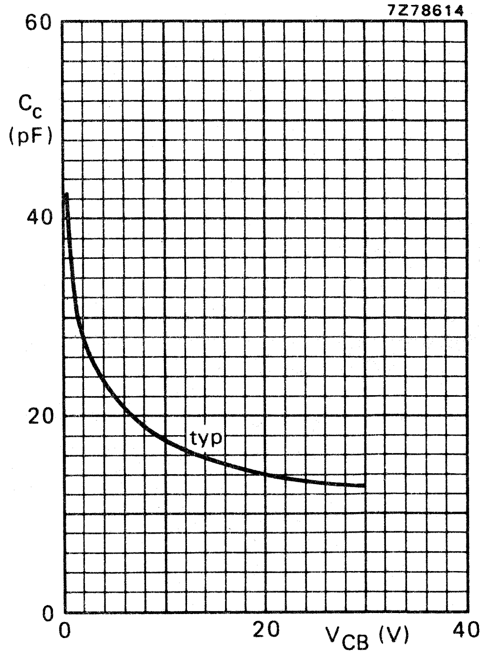


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 ^oC.

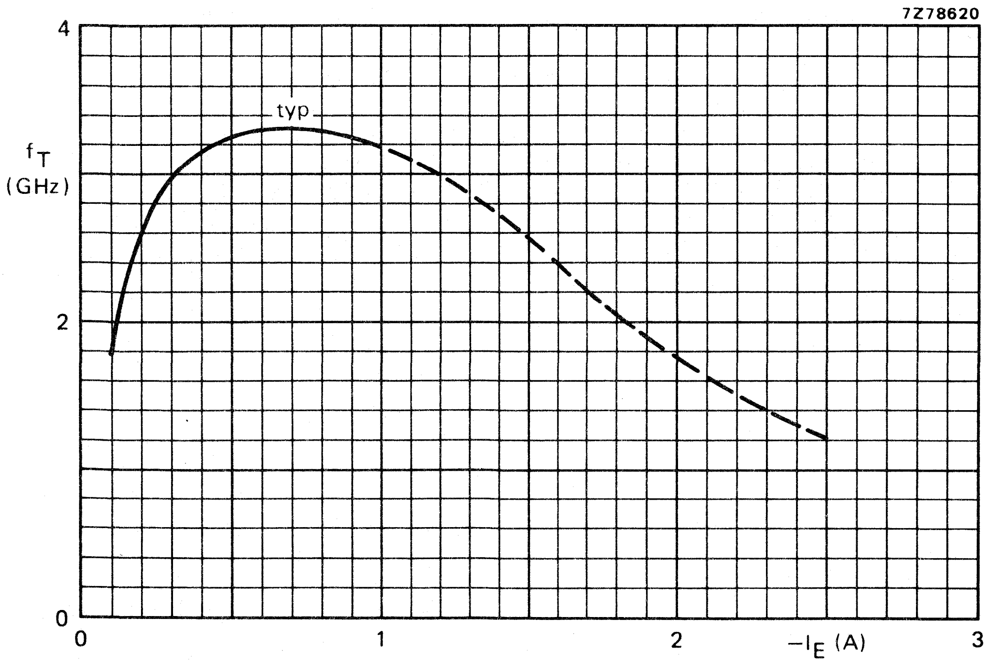


Fig. 7 V_{CB} = 25 V; f = 500 MHz; T_j = 25 ^oC

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.

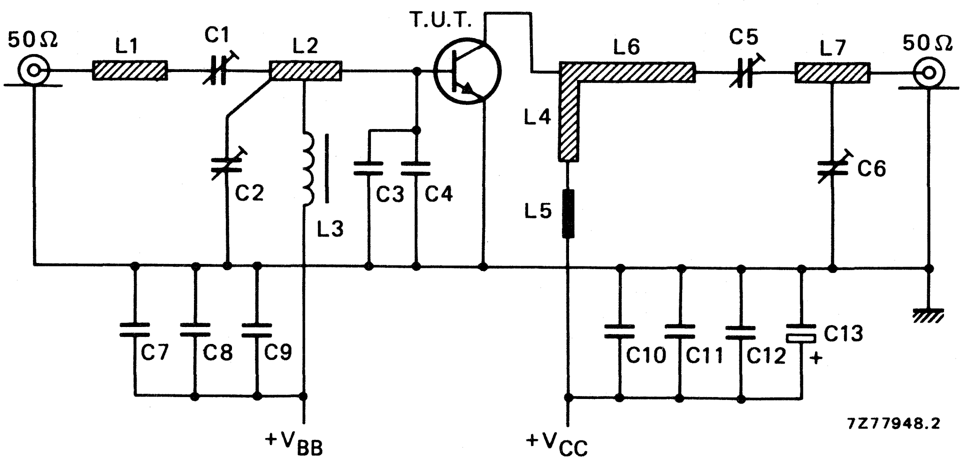


Fig. 8 Test circuit at f_{vision} = 860 MHz.

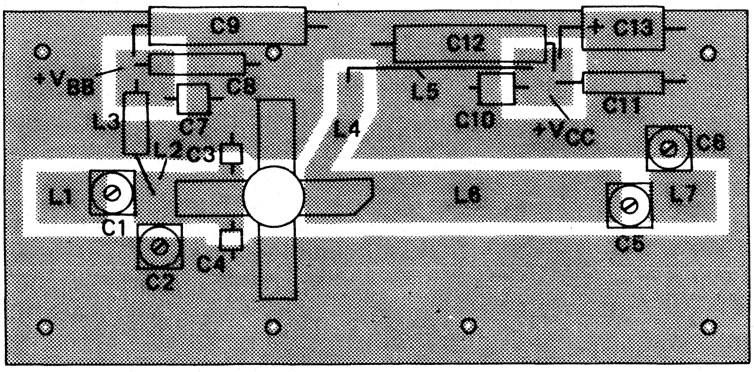
List of components:

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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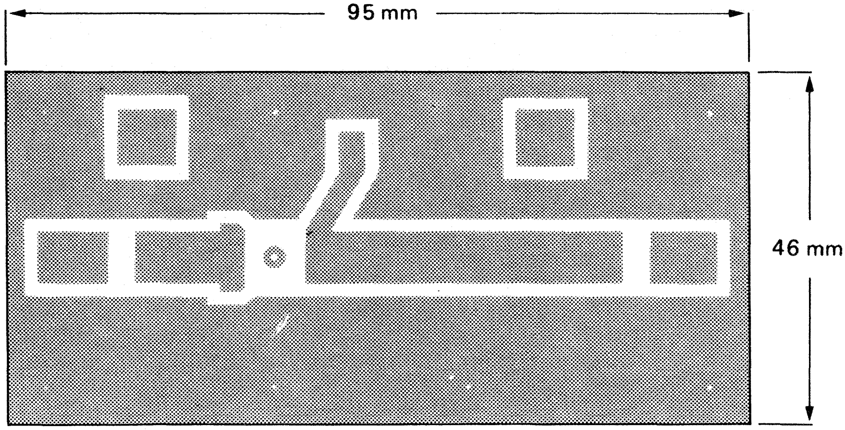

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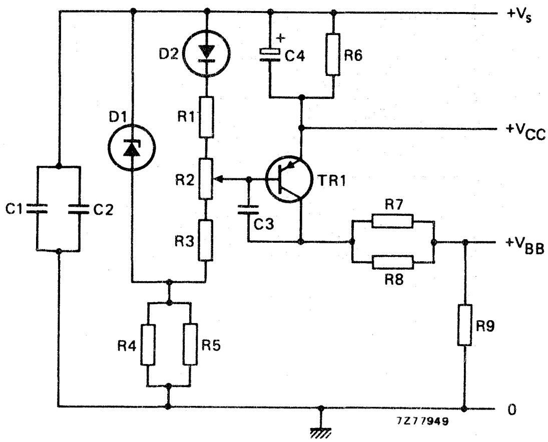
Fig. 9 Component layout and printed-circuit board for 860 MHz test circuit.

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.

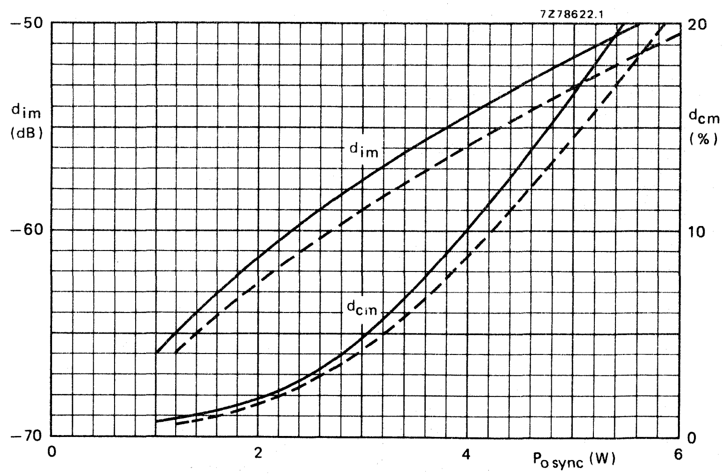


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of output power. Typical values; V_{CE} = 25 V; I_C = 600 mA; f_{vision} = 860 MHz; ––– T_h = 25 °C; —— T_h = 70 °C.

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.

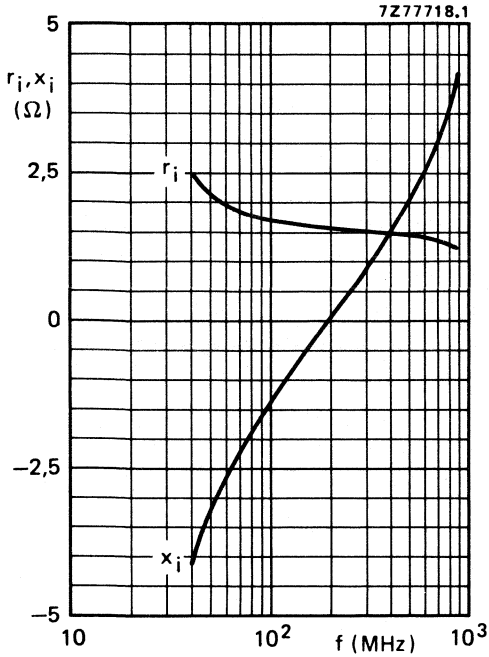


Fig. 12 Input impedance (series components).

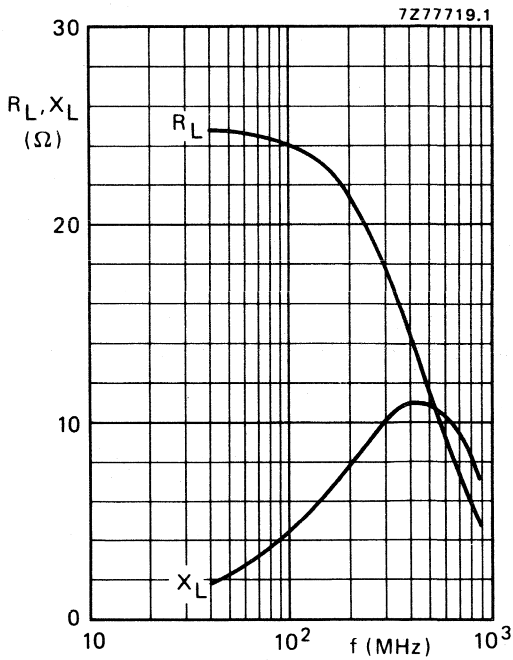


Fig. 13 Load impedance (series components).

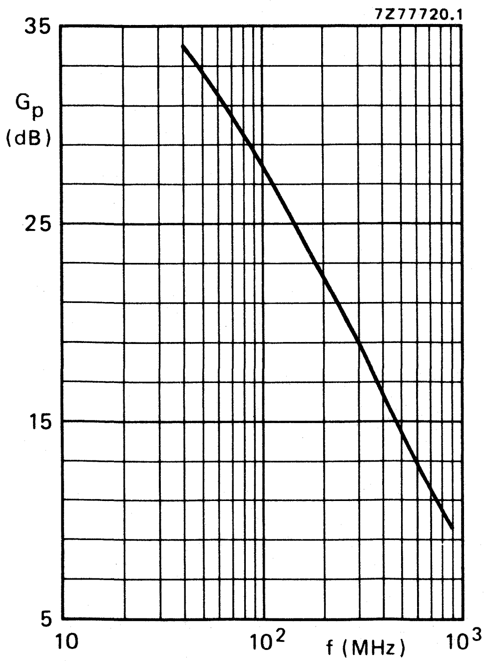


Fig. 14.

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.

VHF power transistor | BLW40

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT120 stud envelope with a ceramic cap. It is designed for common emitter, class-B operation in mobile VHF transmitters with a supply voltage of 12.5 V. All leads are isolated from the mounting flange.

PINNING - SOT120

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	40	> 10	> 55

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

PIN CONFIGURATION

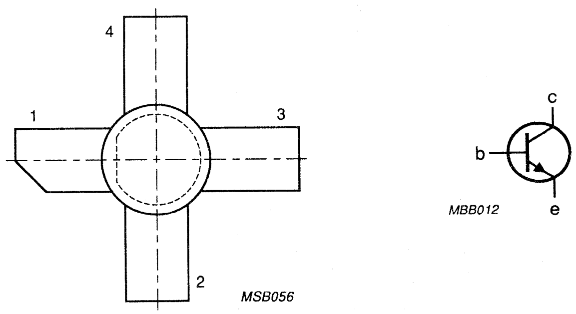


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16.5	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	8	A
I_{CM}	collector current	peak value $f > 1$ MHz	–	25	A
P_{tot}	total power dissipation	RF operation; $f > 1$ MHz; $T_{mb} = 25$ °C	–	106	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

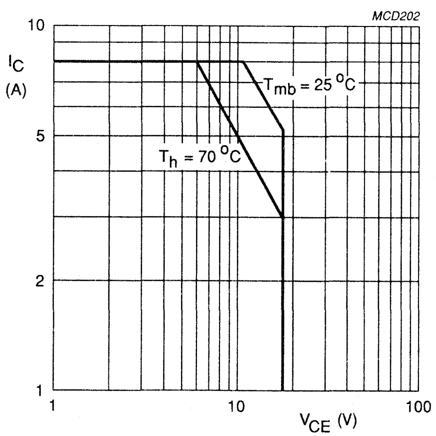
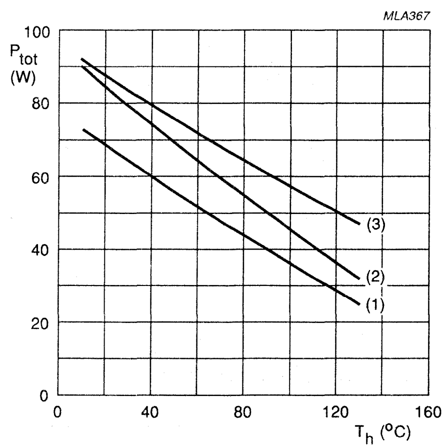


Fig.2 DC SOAR.



(1) Continuous DC operation.

(2) Continuous RF operation (f > 1 MHz).

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

Fig.3 Power derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	1.65	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.45	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 50 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 100 mA	16.5	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 mA	4	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 20 V	–	–	25	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 5.4 A	15	60	–	
f_T	transition frequency	V_{CE} = 12.5 V; I_E = 5 A	–	1.65	–	GHz
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	105	–	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_C = 0; f = 1 MHz	–	65	–	pF
$C_{c\text{-}s}$	collector-stud capacitance	f = 1 MHz	–	2	–	pF

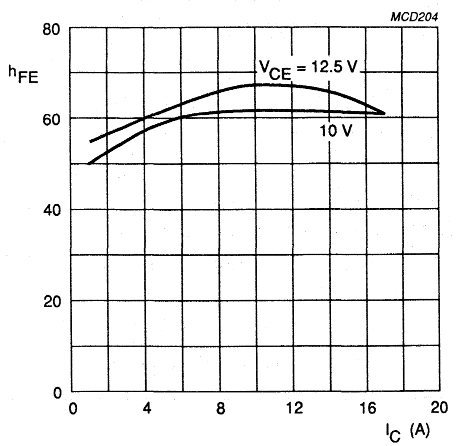
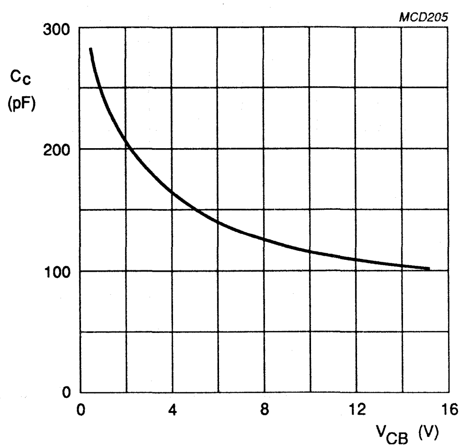
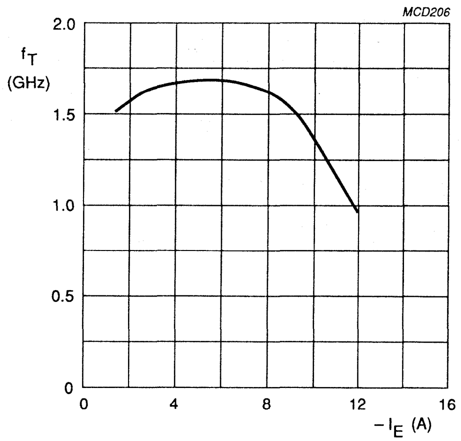


Fig.4 DC current gain as a function of collector current, typical values.



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

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



V_{CB} = 12.5 V.

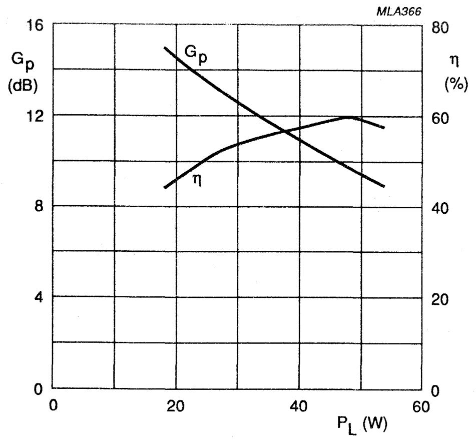
Fig.6 Transition frequency as a function of emitter current, typical values.

VHF power transistor BLW40

APPLICATION INFORMATION

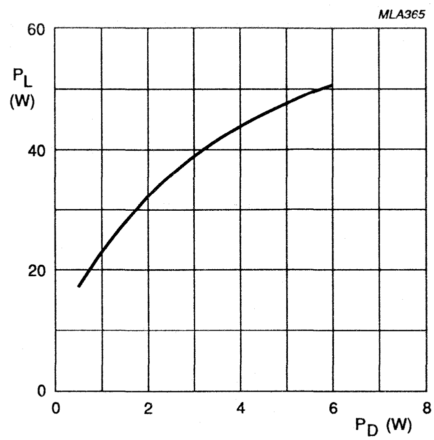
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	175	12.5	40	> 10 typ. 11	> 55 typ. 57



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.7 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 12.5 V; f = 175 MHz.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLW40 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases at rated output power, up to a supply voltage of 15.5 V, and f = 175 MHz.

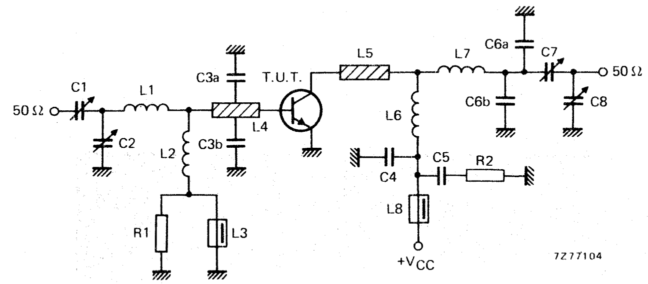


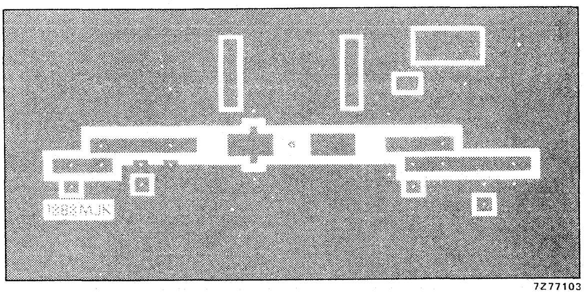
Fig.9 Class-B test circuit at f = 175 MHz.

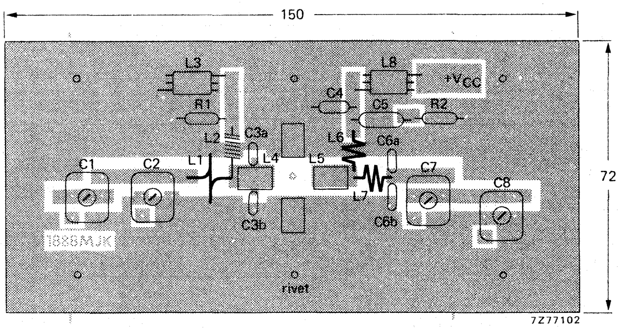
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2.5 to 20 pF		2222 809 07004
C2, C8	film dielectric trimmer	4 to 40 pF		2222 809 07008
C3a, C3b	500 V ceramic capacitor	47 pF		
C4	500 V ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
C6a, C6b	500 V ceramic capacitor	8.2 pF		
C7	film dielectric trimmer	5 to 60 pF		2222 809 07011
L1	1 turn enamelled 1.6 mm copper wire		int. dia. 9 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire	100 nH	int. dia. 3 mm; leads 2 x 5 mm	
L3, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 1)		12 mm x 6 mm; note 2	
L6	2 turns enamelled 1.6 mm copper wire		int. dia. 5 mm; length 6 mm; leads 2 x 5 mm	
L7	2 turns enamelled 1.6 mm copper wire		int. dia. 4.5 mm; length 6 mm; leads 2 x 5 mm	
R1	0.25 W carbon resistor	10 Ω, 5%		
R2	0.25 W carbon resistor	4.7 Ω, 5%		

Notes

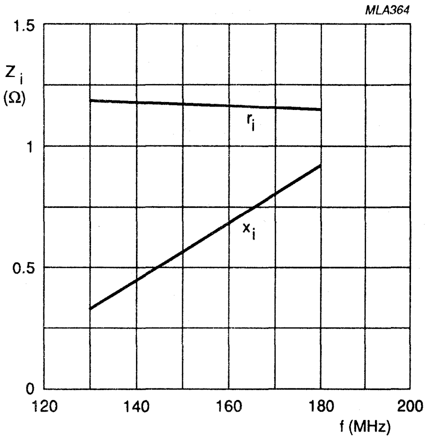
1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric, thickness 1⁄16 inch.
2. Taps for capacitors C3a and C3b are situated 5 mm from the transistor.





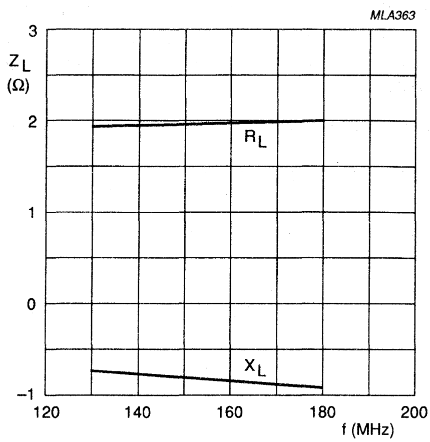
The circuit and components are situated on one side of an epoxy fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of hollow rivets and copper straps under the emitters.

Fig.10 Component layout for 175 MHz class-B test circuit.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.11 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.12 Load impedance (series components) as a function of frequency, typical values.

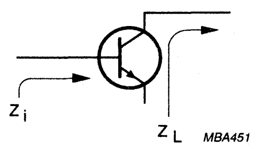
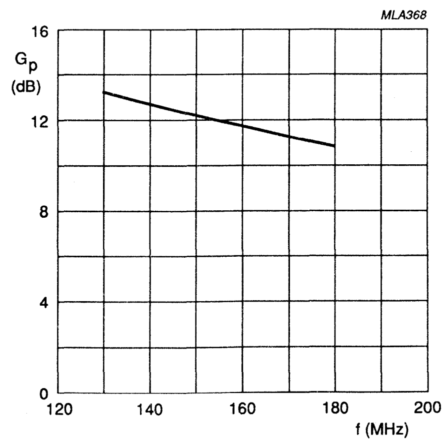


Fig.13 Definition of transistor impedance.



Class-B operation; V_{CE} = 12.5 V; P_L = 40 W.

Fig.14 Power gain as a function of frequency, typical values.

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

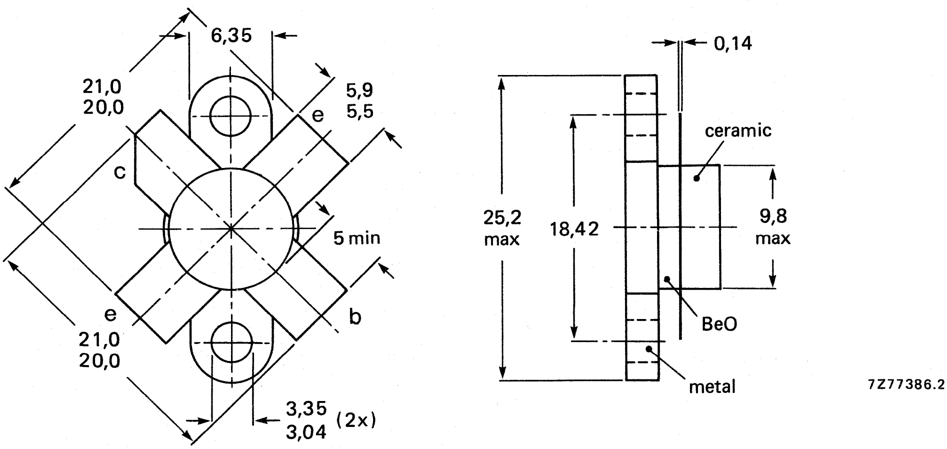
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	$I_{C(ZS)}$ mA	d_3 dB	T_h °C
s.s.b. (class-A)	45	1,6 - 28	0 - 16 (P.E.P.)	> 19,5	–	1,2	–	< –40	70
s.s.b. (class-AB)	50	1,6 - 28	10 - 65 (P.E.P.)	typ. 18	typ. 45*	1,45	50	typ. –30	25

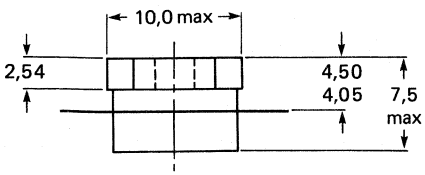
* At 65W P.E.P.

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

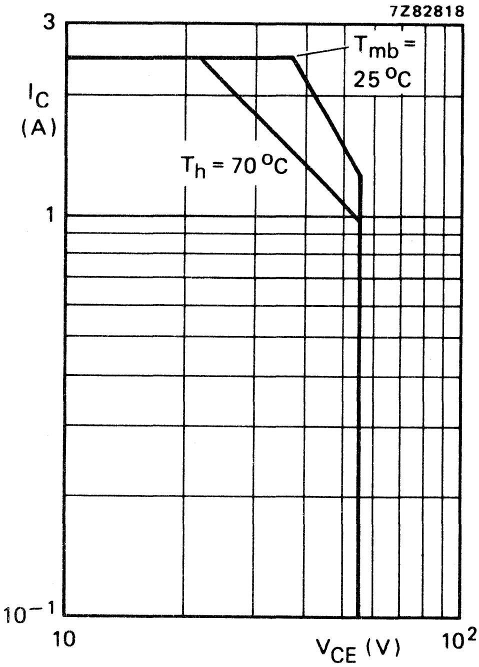


Fig. 2 D.C. SOAR.

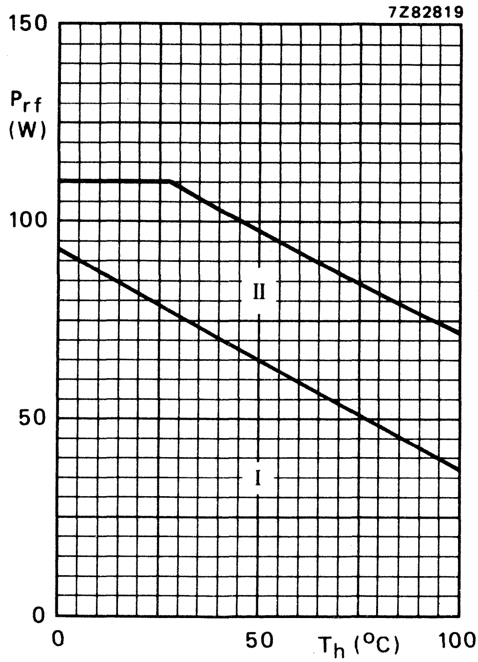


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

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 °C

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 Ω	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

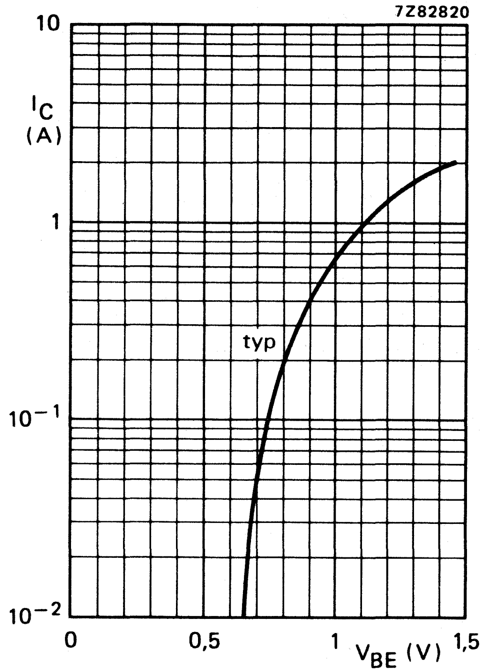


Fig. 4 $V_{CE} = 40$ V; $T_{mb} = 25$ °C.

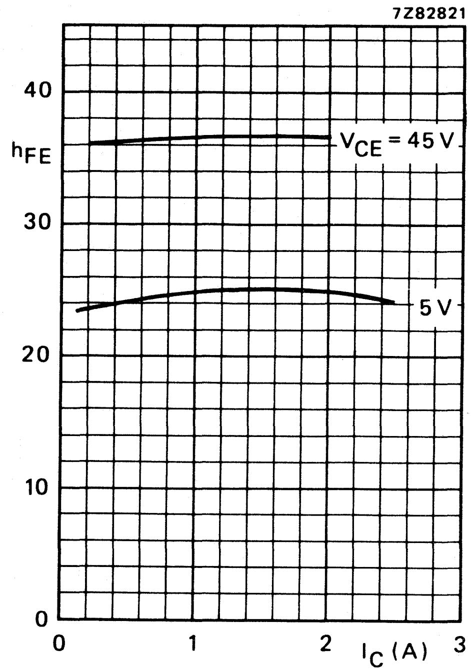


Fig. 5 Typical values; $T_j = 25$ °C.

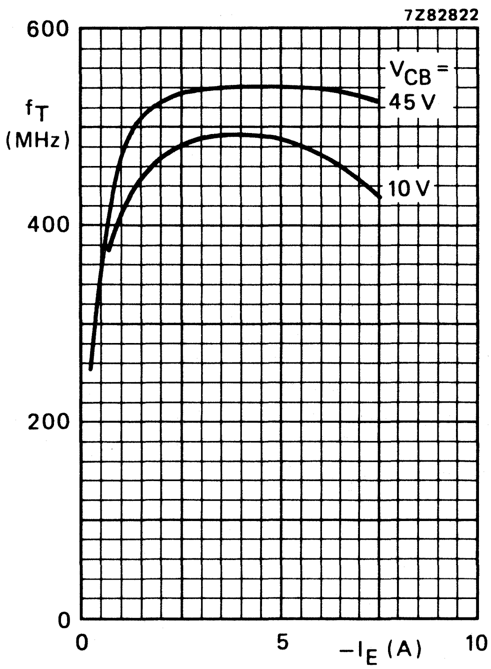


Fig. 6 Typical values; f = 100 MHz; $T_j = 25$ °C.

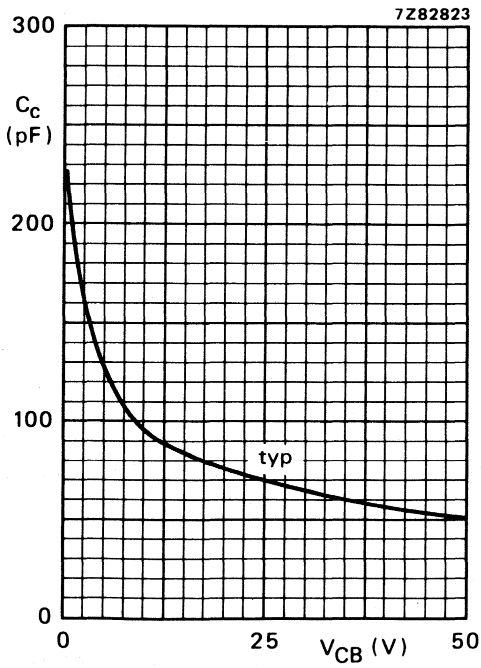


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25$ °C.

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

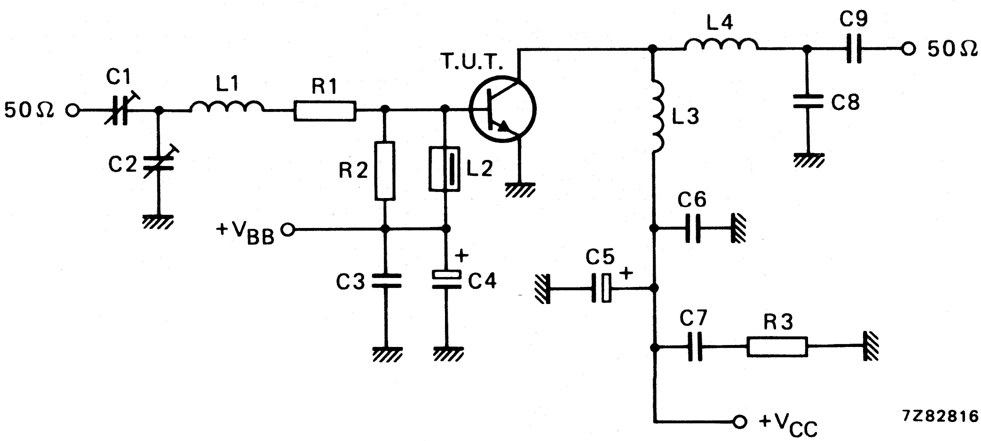


Fig. 8 Test circuit; s.s.b. class-A.

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.

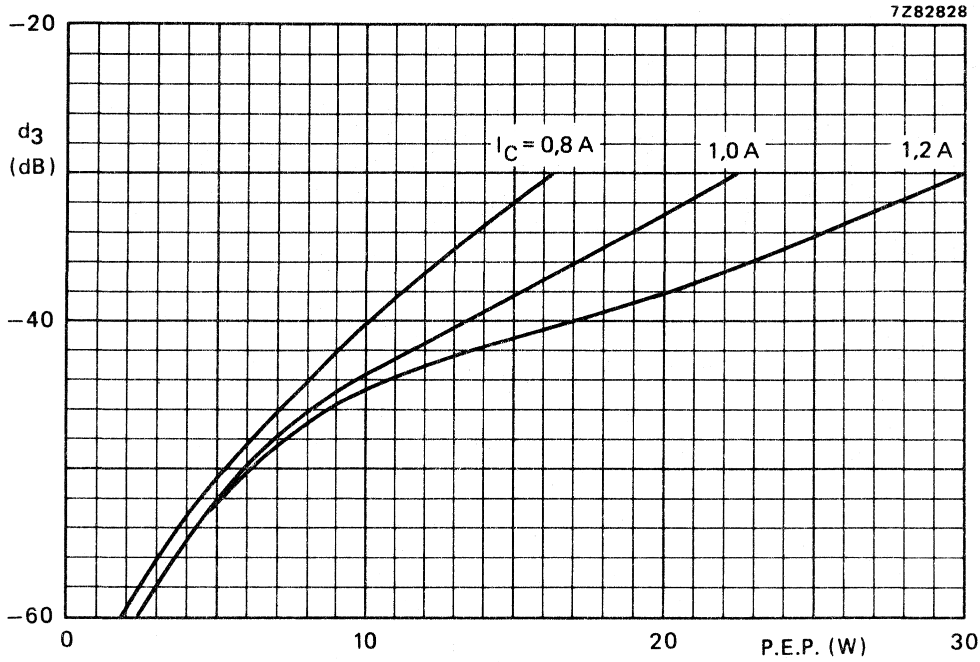


Fig. 9 Intermodulation distortion (see note on page 5) as a function of output power. Typical values; V_{CE} = 45 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 70 °C.

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

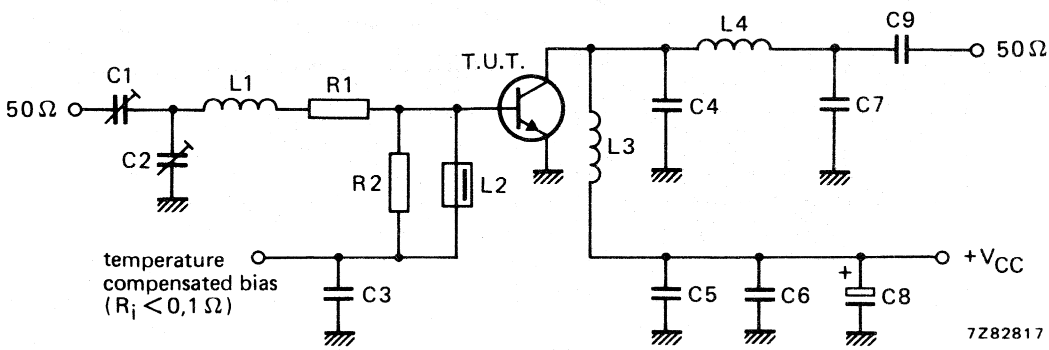


Fig. 10 Test circuit; s.s.b. class-AB.

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.

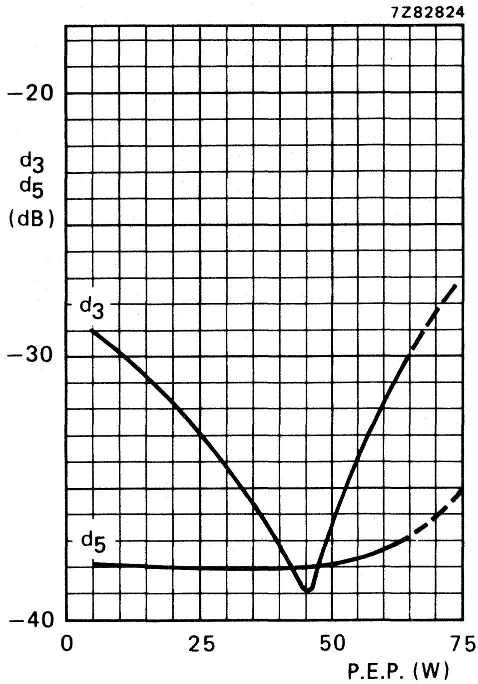


Fig. 11 Intermodulation distortion as a function of output power*.

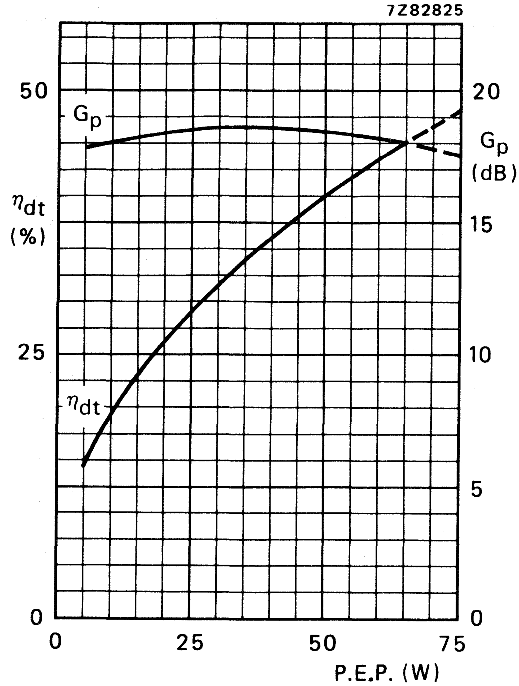


Fig. 12 Double-tone efficiency and power gain as a function of output power.

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; $R_{th\ mb\text{-}h}$ = 0,3 K/W.

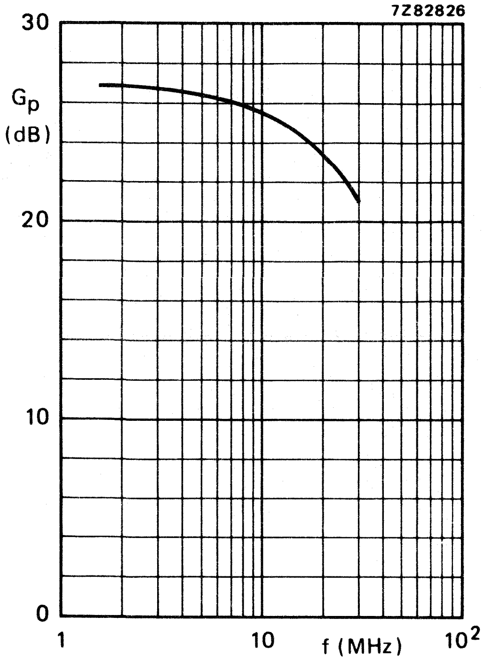


Fig. 13 Power gain as a function of frequency.

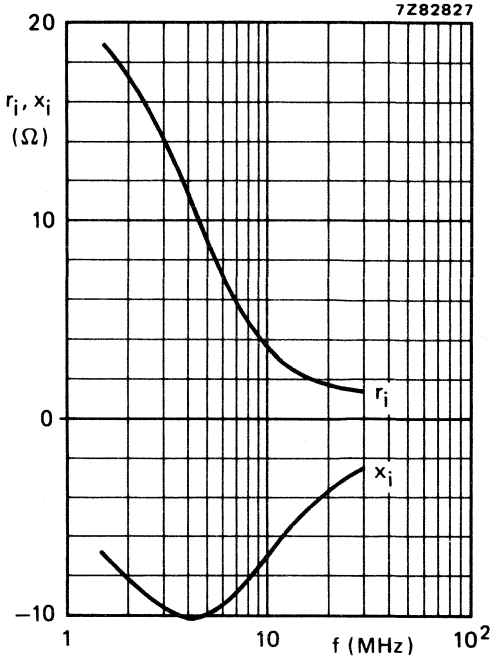


Fig. 14 Input impedance (series components) as a function of frequency.

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

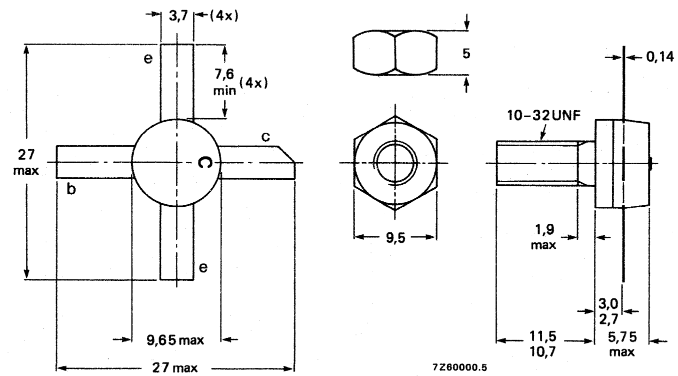
R.F. performance up to T_h = 25 °C

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.

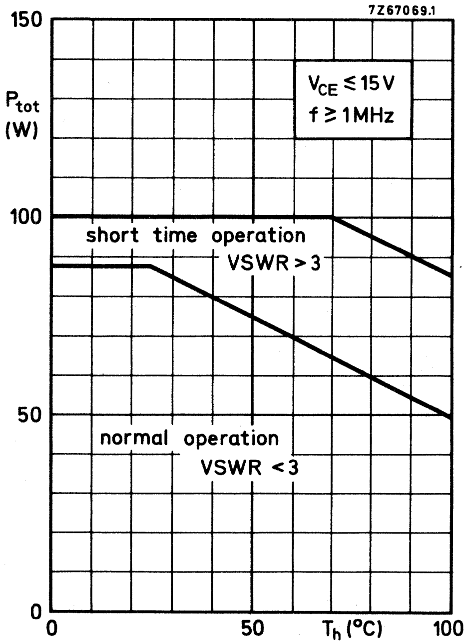
Torque on nut: min. 1,5 Nm (15 kg cm)
max. 1,7 Nm (17 kg cm)

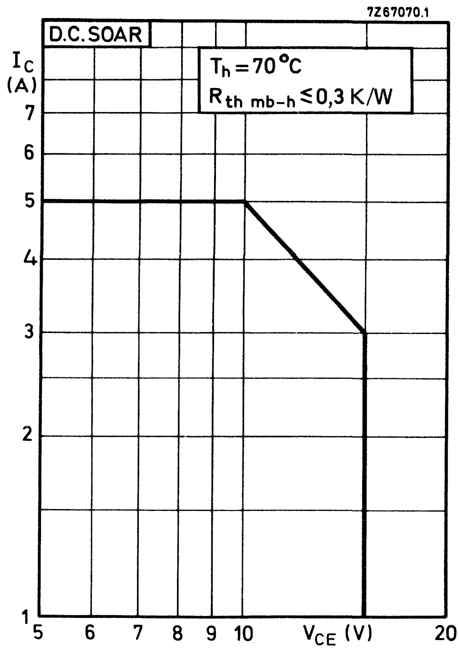
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

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

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

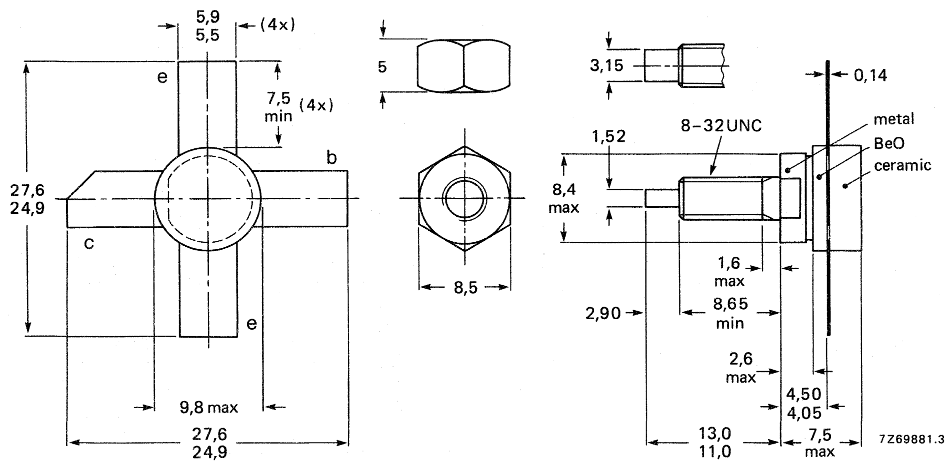
R.F. performance up to T_h = 25 °C

mode of operation	V_{CC} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ 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-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.	16	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

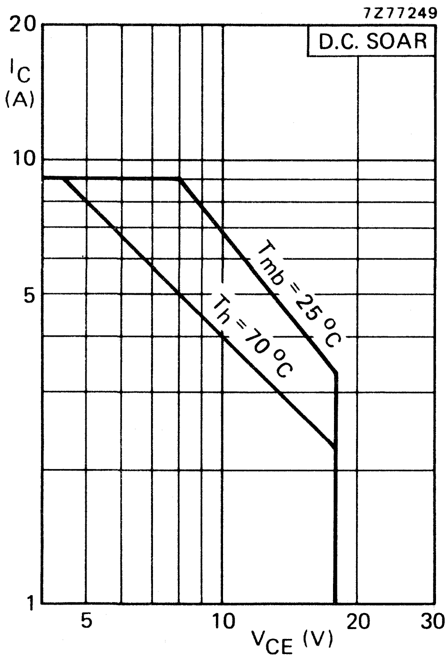


Fig. 2 D.C. SOAR.

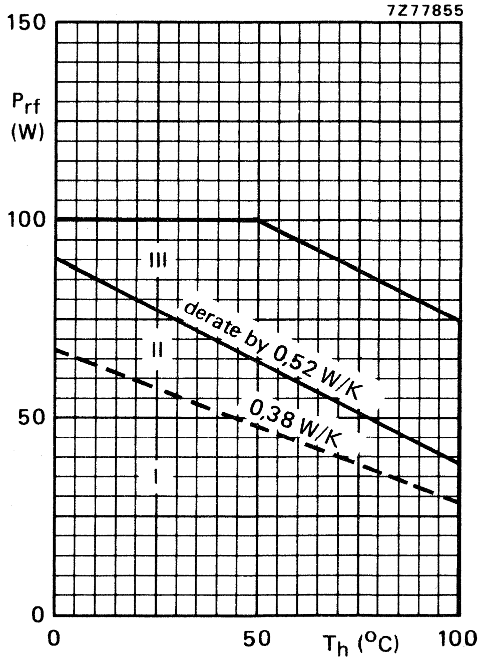


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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 °C

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	$V_{(BR)CEO}$	>	16	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 Ω	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

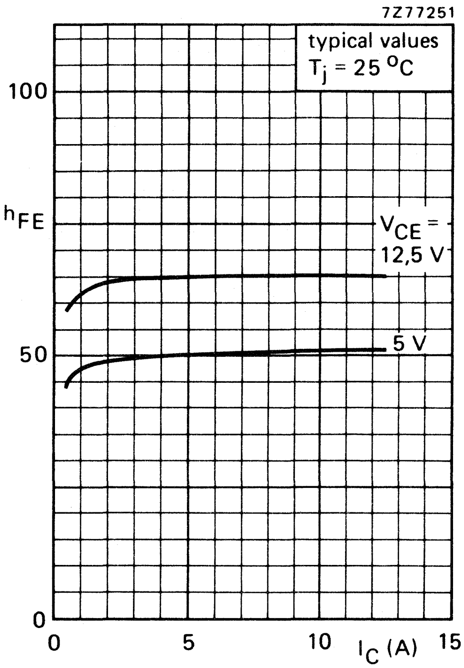


Fig.4 DC current gain as a function of collector current.

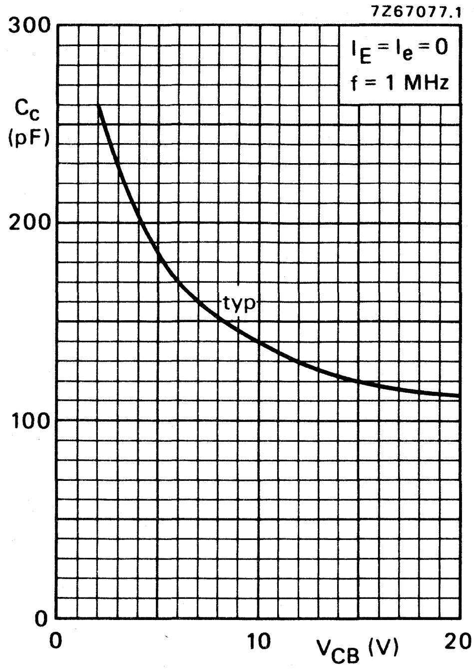


Fig.5 Collector capacitance as a function of collector-base voltage.

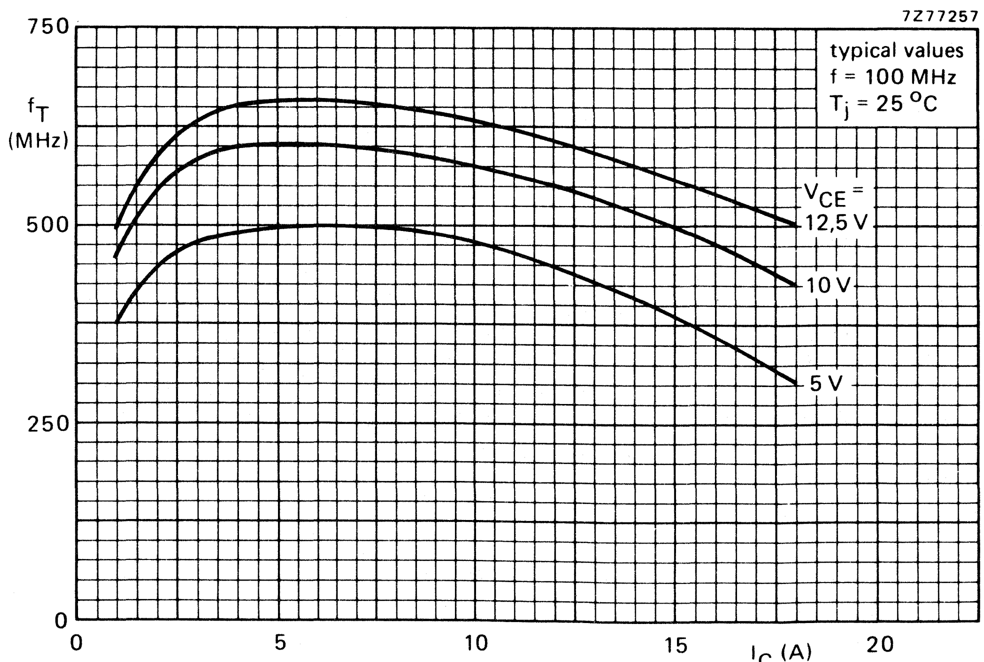


Fig.6 Transition frequency as a function of collector current.

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

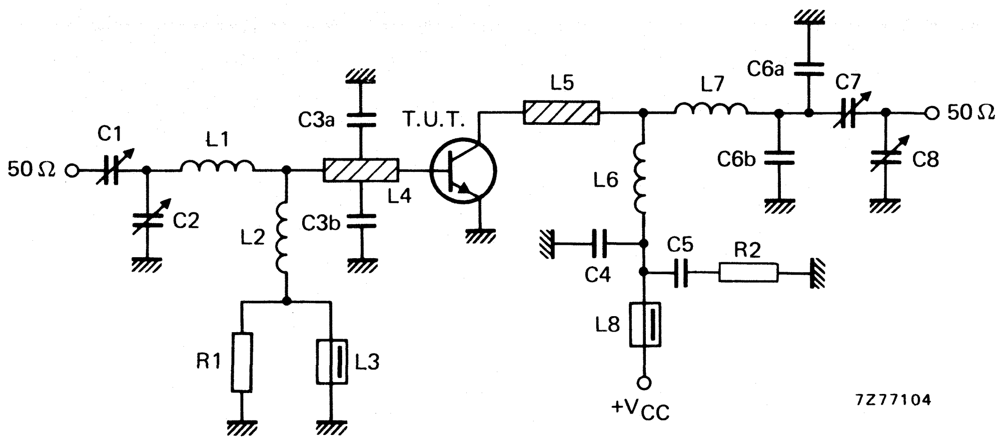


Fig. 7 Class-B test circuit at f = 175 MHz.

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)

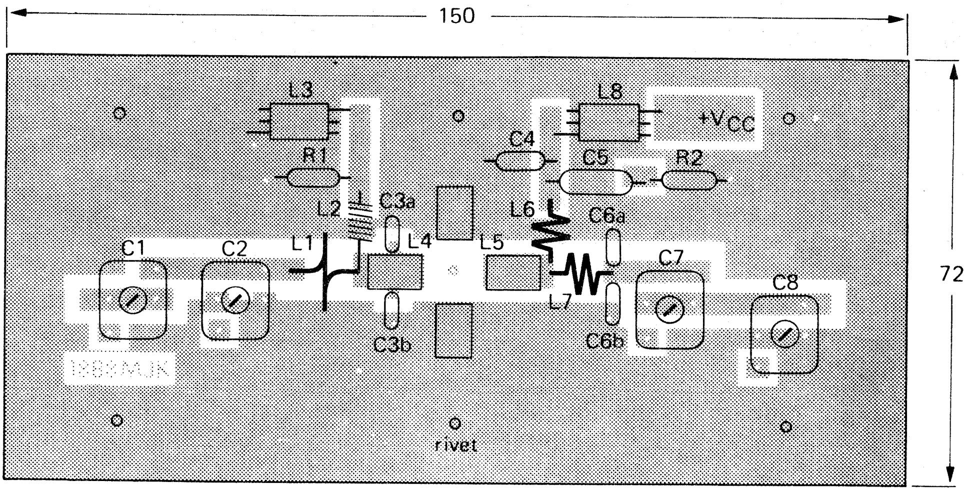
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from 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

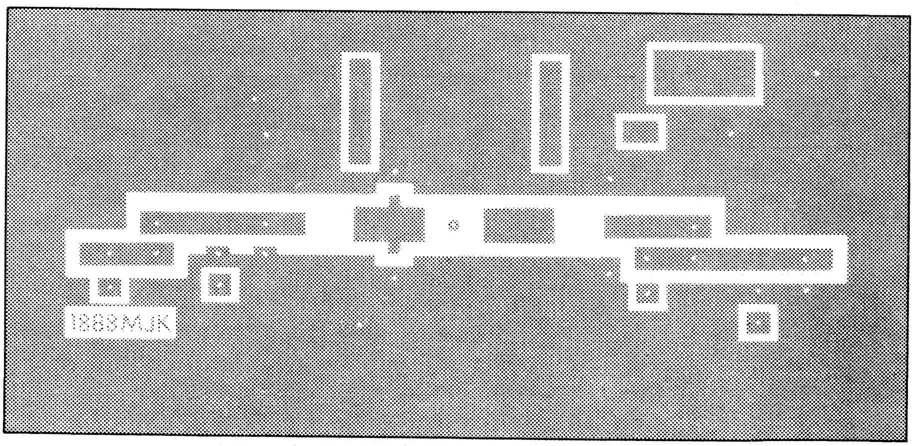
L4 and L5 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

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)





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

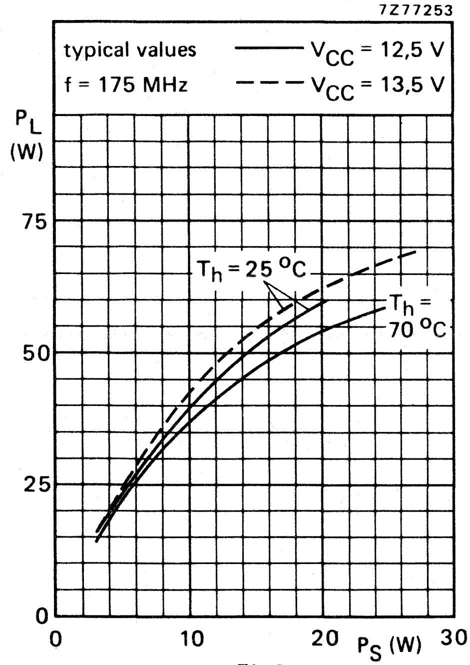


Fig.9.

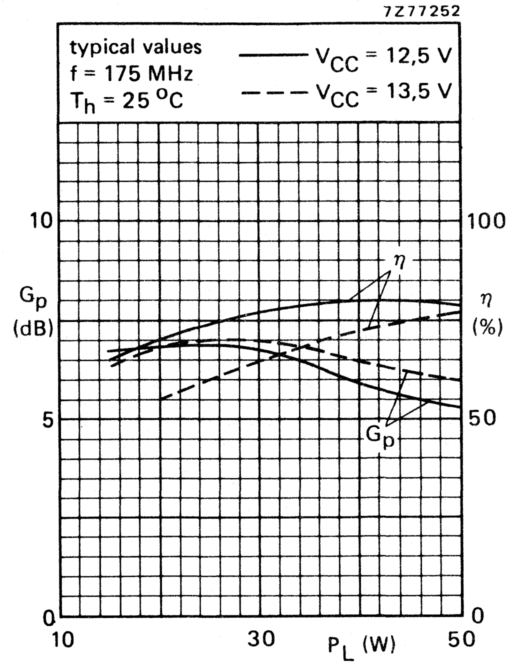


Fig.10.

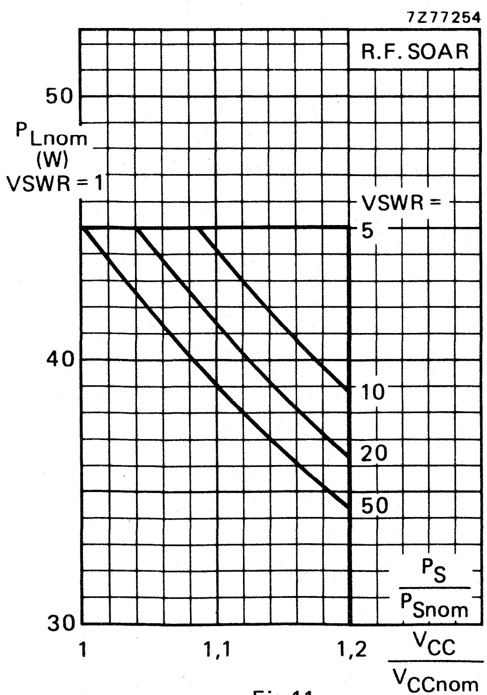


Fig.11.

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
measured in circuit of Fig.7.

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.

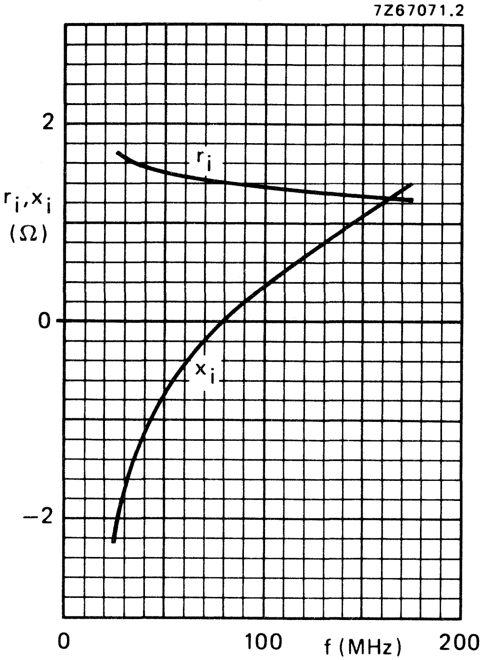


Fig. 12 Input impedance (series components).

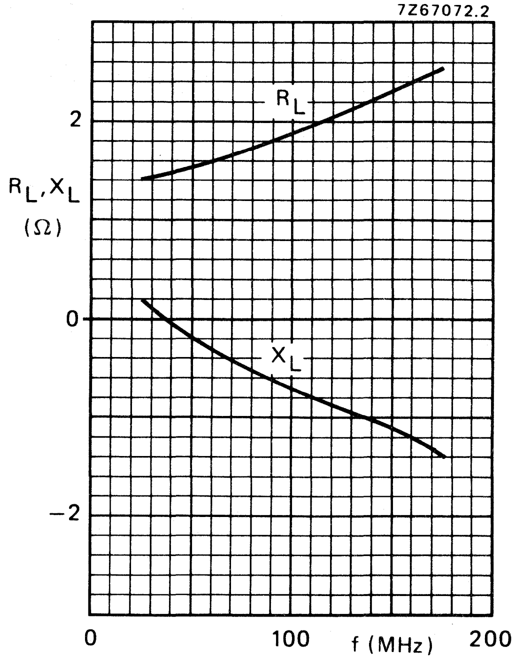


Fig. 13 Load impedance (series components).

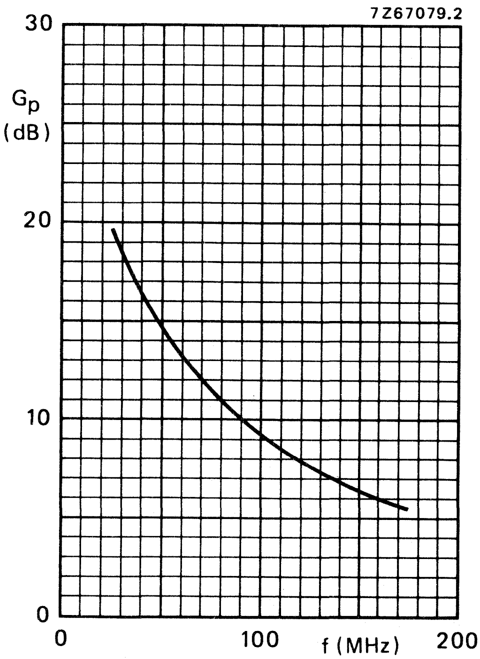


Fig. 14.

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; $R_{th\ mb-h} \leqslant$ 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

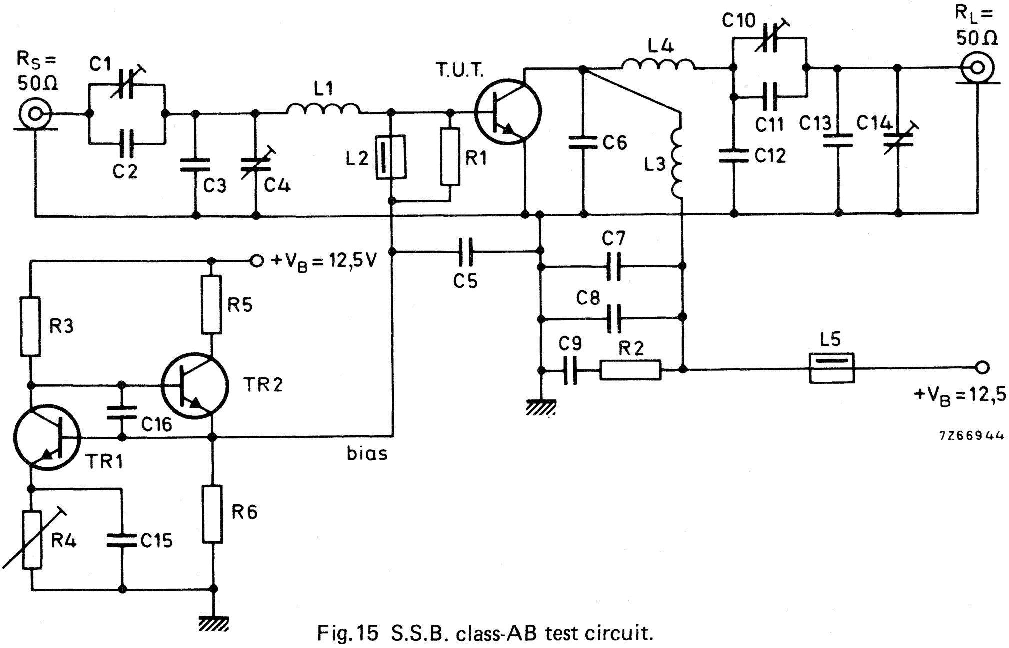


Fig.15 S.S.B. class-AB test circuit.

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 Figs 16 and 17:

V_{CC} = 12,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leq$ 0,45 °K/W
$I_{C(ZS)}$ = 25 mA
typical values

Measuring conditions for Figs 18 and 19:

V_{CC} = 13,5 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
$R_{th\ mb\text{-}h} \leq$ 0,45 °K/W
$I_{C(ZS)}$ = 25 mA
typical values

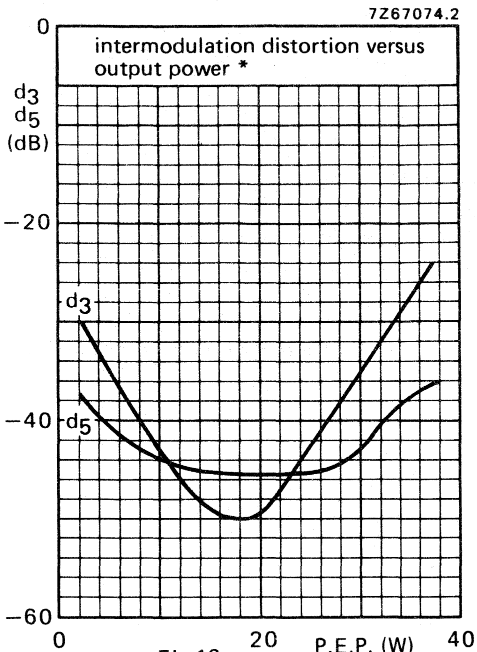


Fig.16.

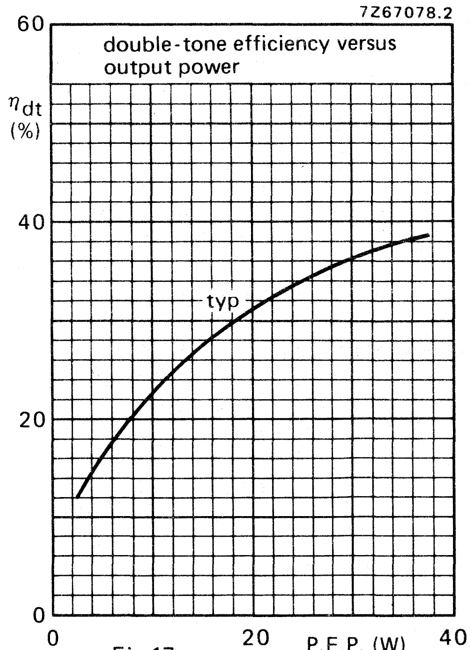


Fig.17.

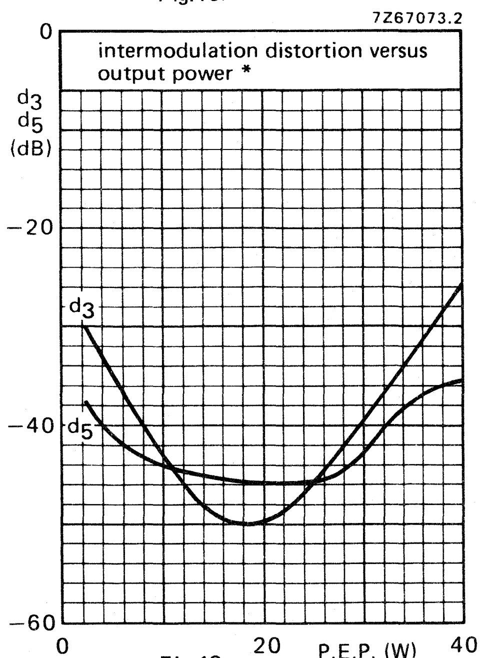


Fig.18.

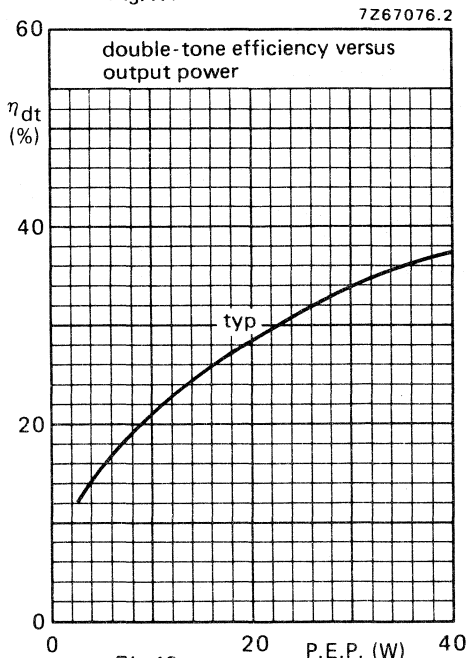


Fig.19.

* 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.

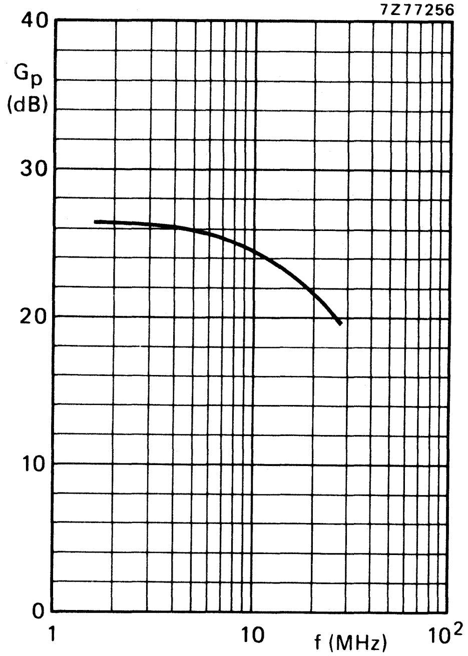


Fig.20.

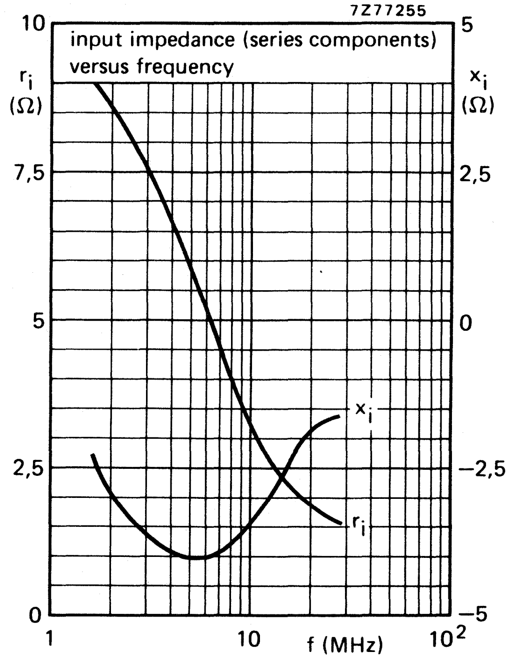


Fig.21.

S.S.B. class-AB operation

Conditions for Figs 20 and 21:

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

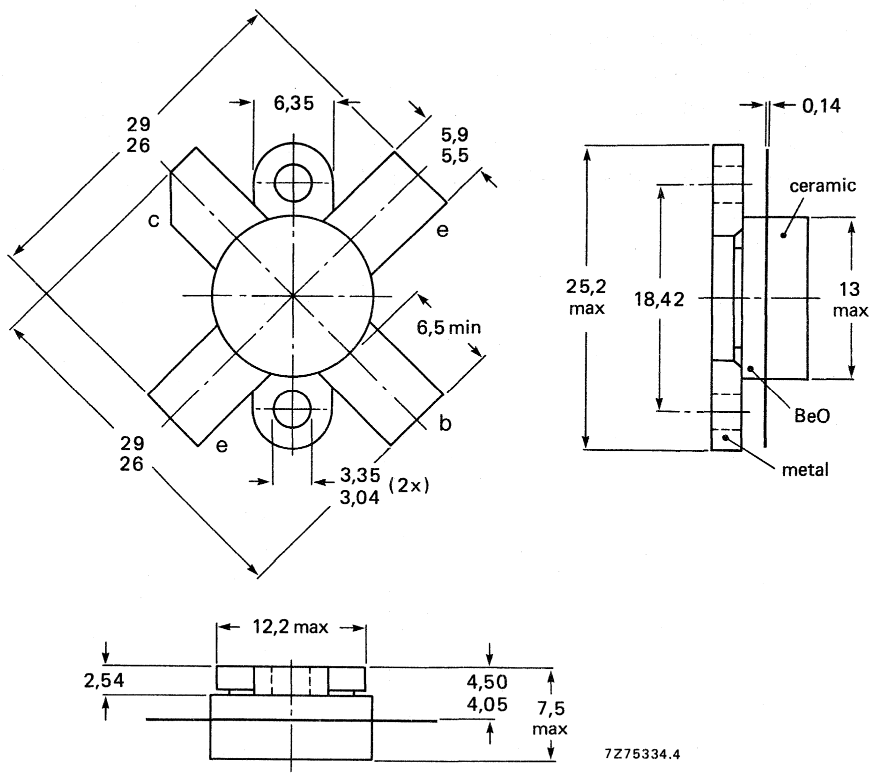
SOT-121 (see Fig.1).

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

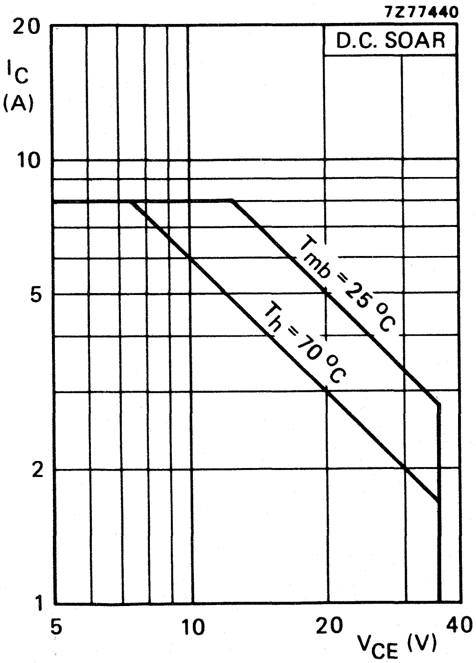


Fig. 2 D.C. SOAR.

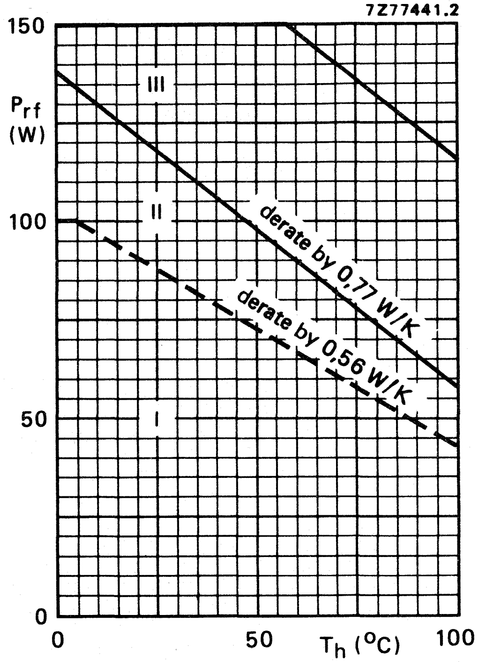


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.

I Continuous d.c. operation

II Continuous r.f. operation

III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 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

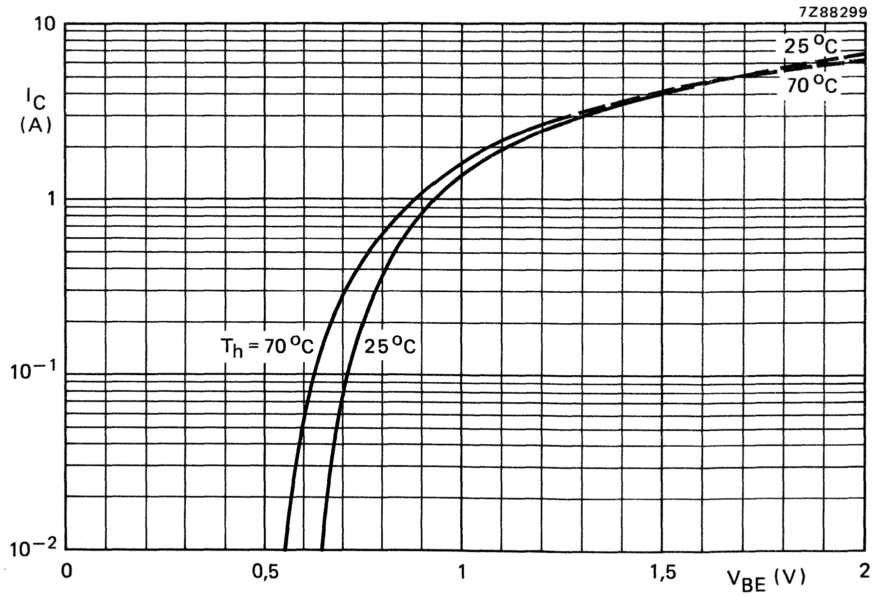


Fig. 4 Typical values; V_{CE} = 20 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0{,}02$.

** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}01$.

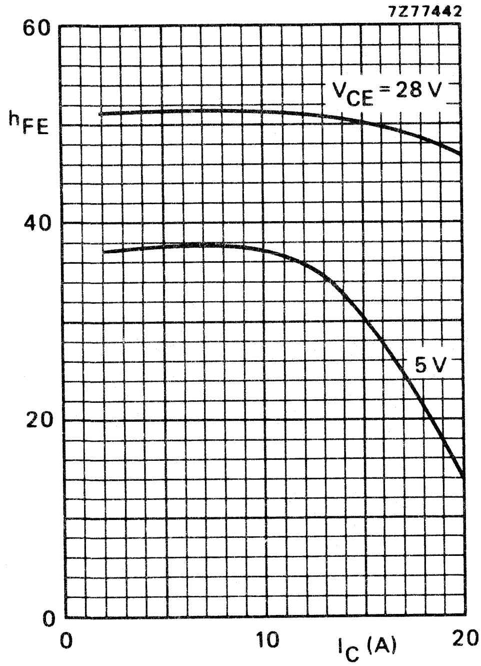


Fig. 5 Typical values; T_j = 25 °C.

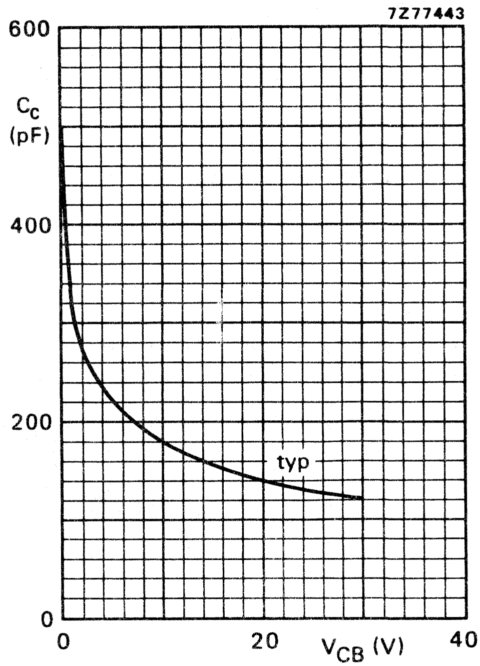


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

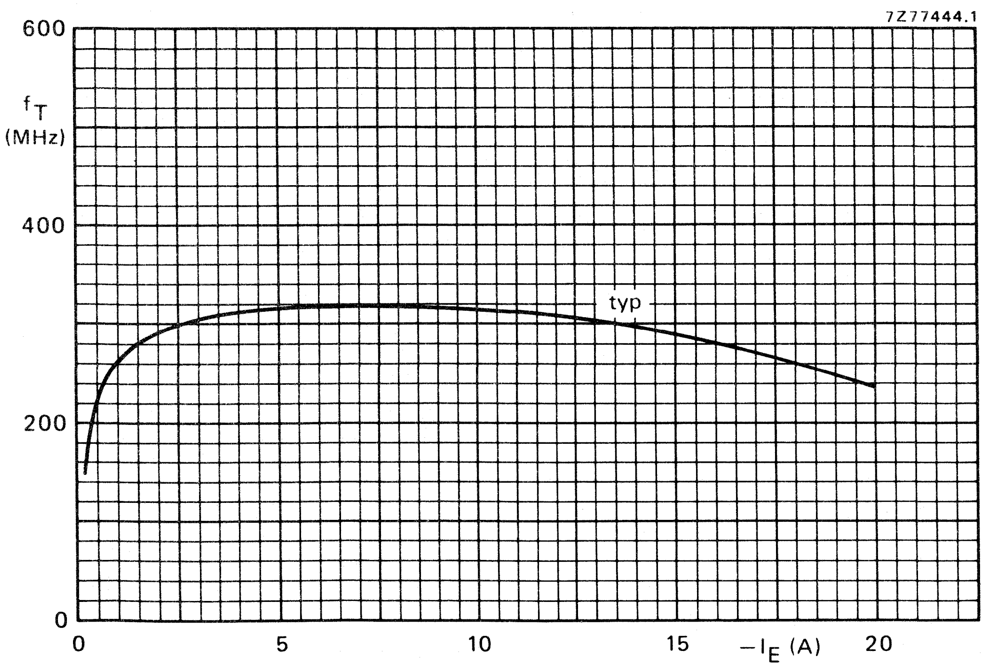


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

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**

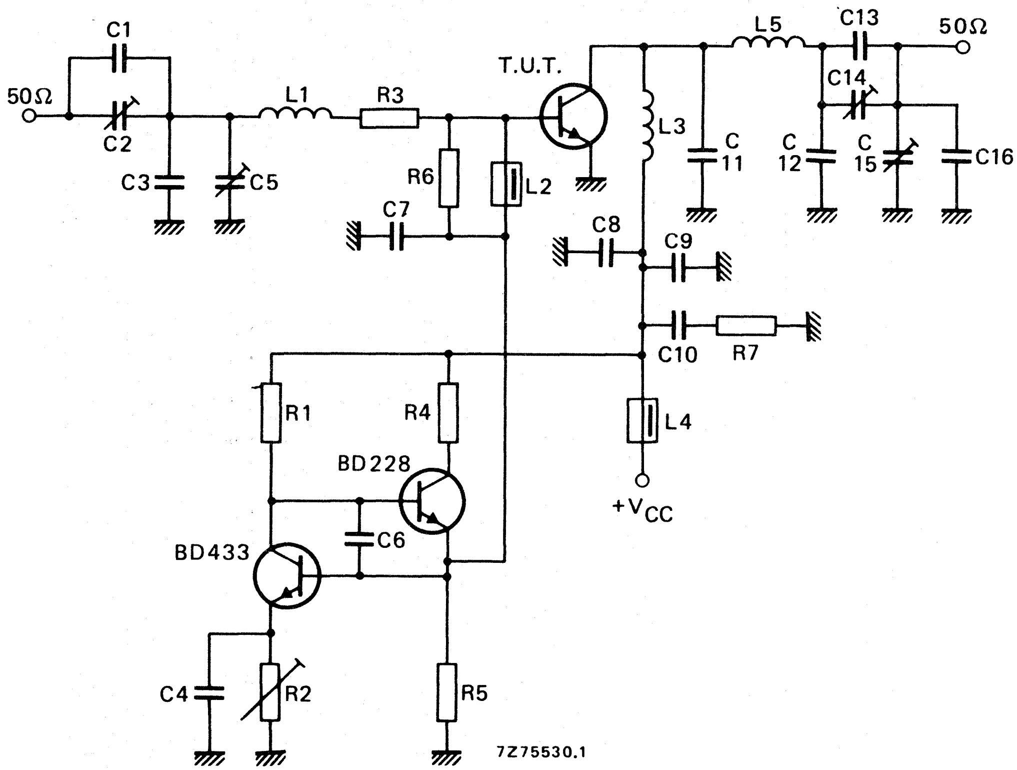


Fig. 8 Test circuit; s.s.b. class-AB.

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)

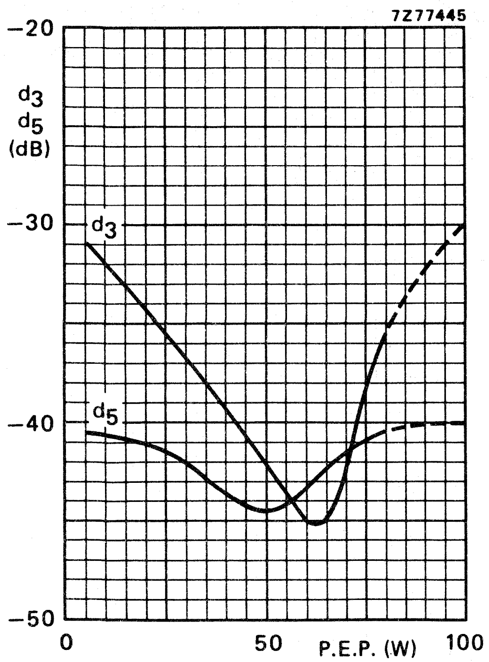


Fig. 9 Intermodulation distortion as a function of output power.*

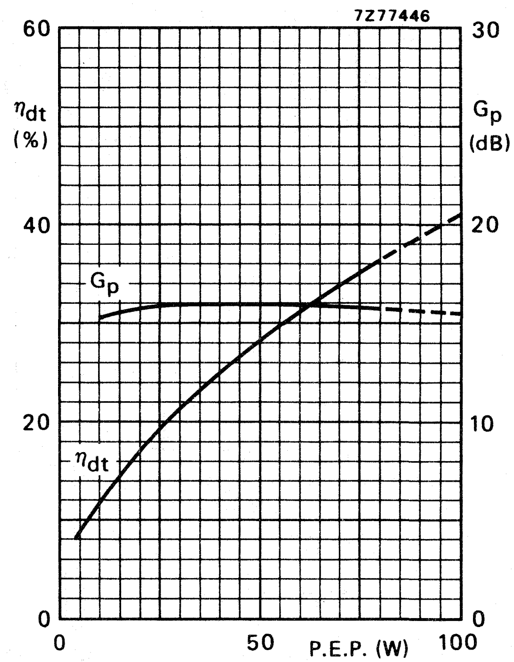


Fig. 10 Double-tone efficiency and power gain as a function of output power.

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)

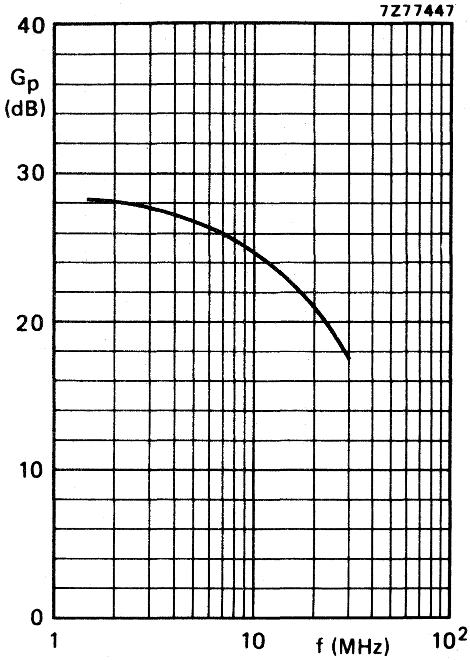


Fig. 11 Power gain as a function of frequency.

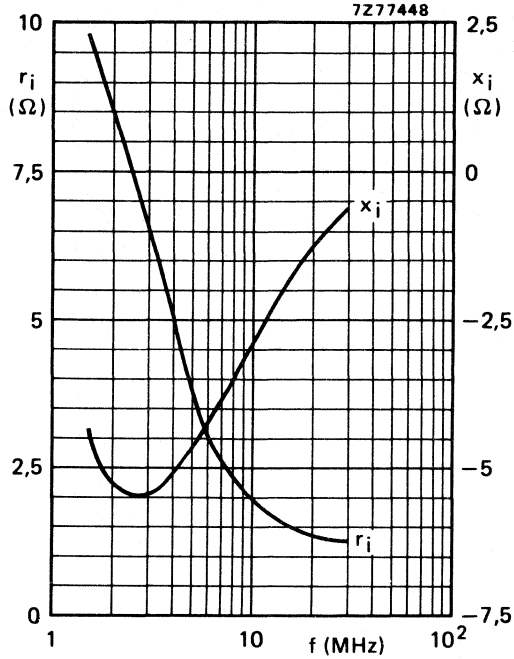


Fig. 12 Input impedance (series components) as a function of frequency.

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.

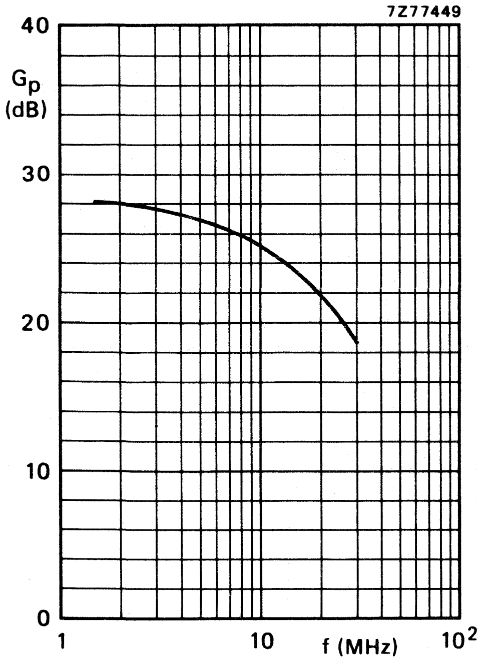


Fig. 13 Power gain as a function of frequency.

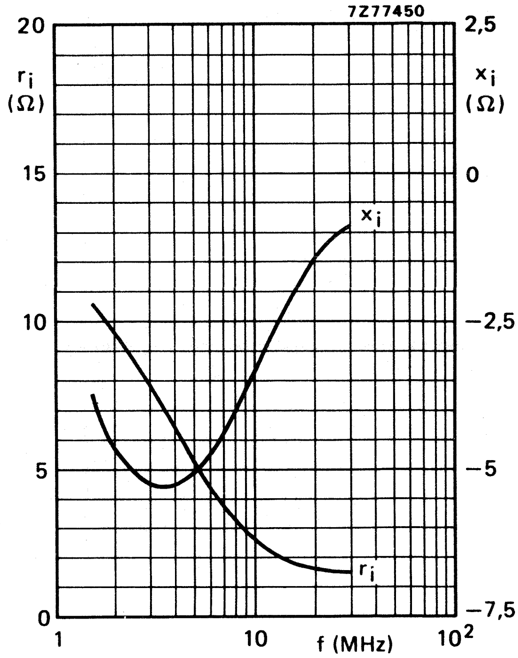


Fig. 14 Input impedance (series components) as a function of frequency.

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)

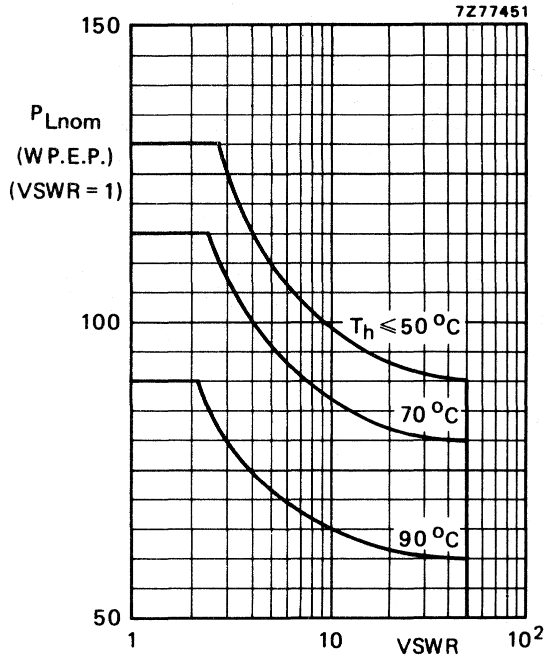


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures 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**

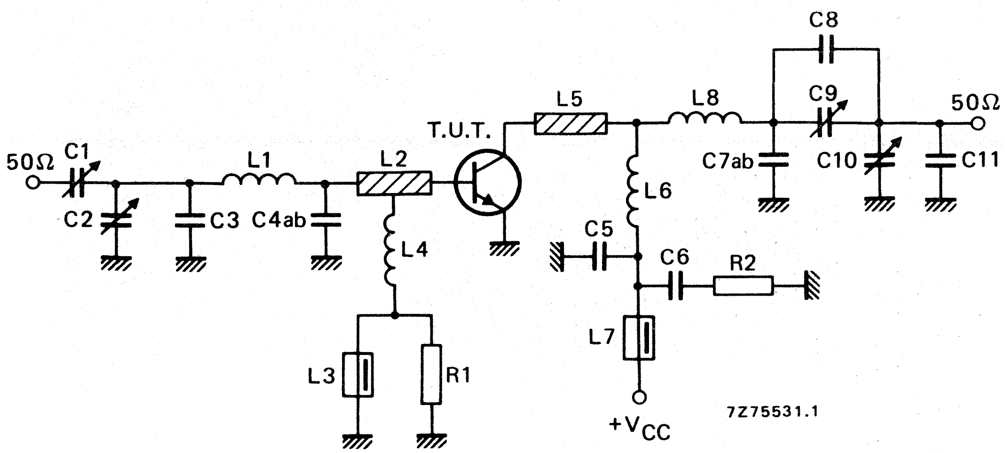


Fig. 16 Test circuit; c.w. class-B.

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)

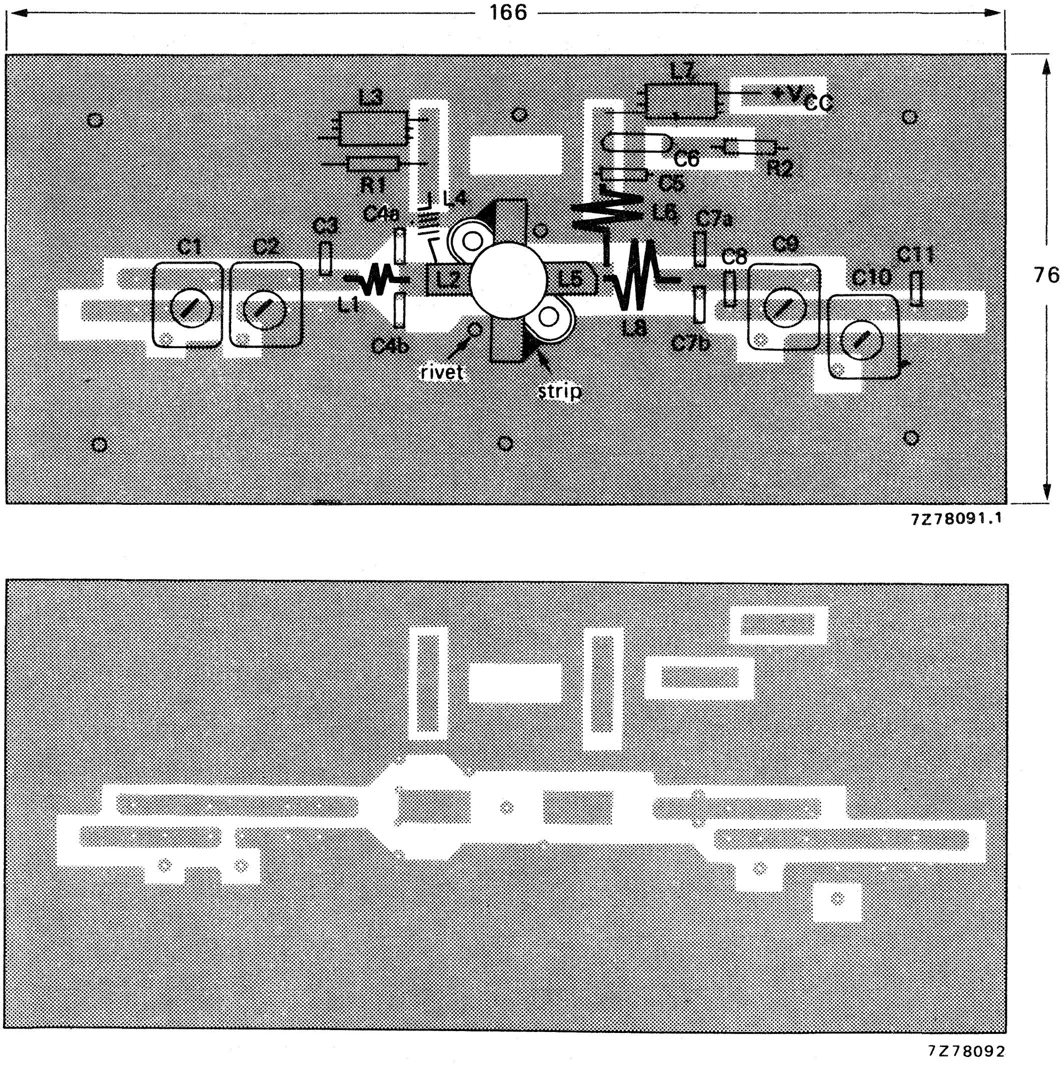


Fig. 17 Component layout and printed-circuit board for 108 MHz test circuit.

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.

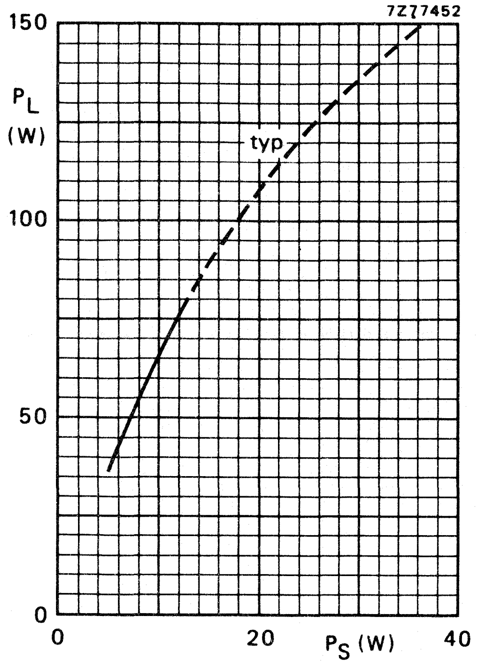


Fig. 18 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C.

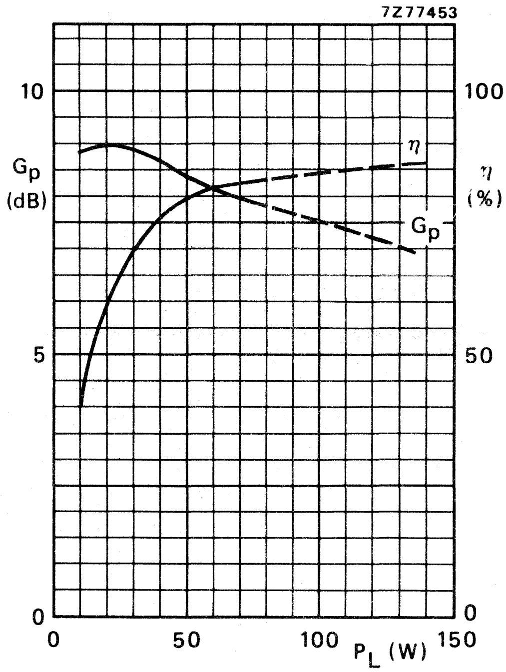


Fig. 19 V_{CE} = 28 V; f = 108 MHz; T_h = 25 °C; typical values.

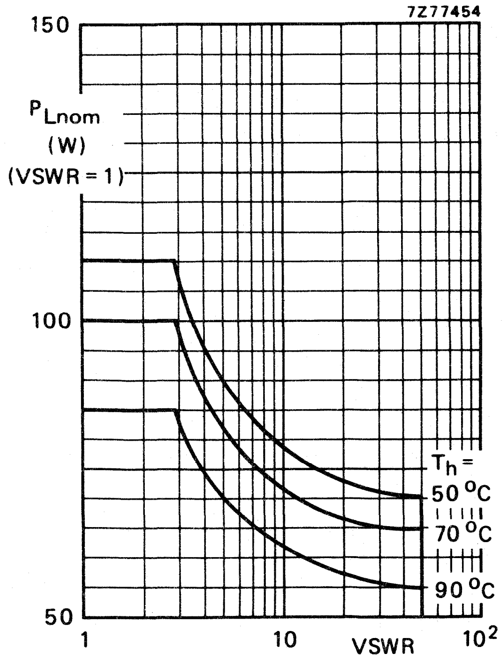


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 108 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

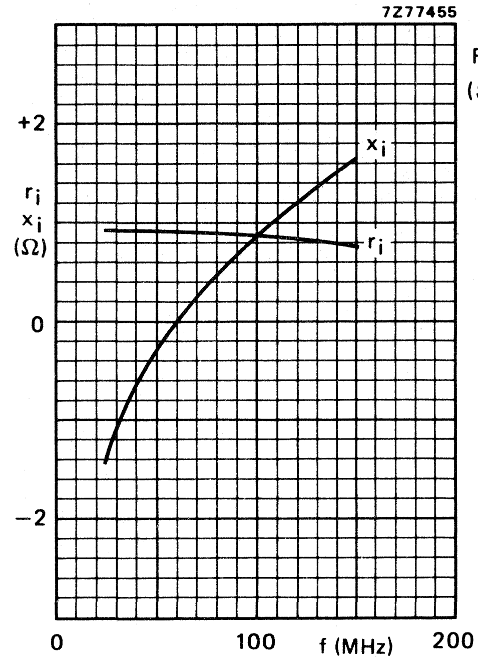


Fig. 21 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; typical values.

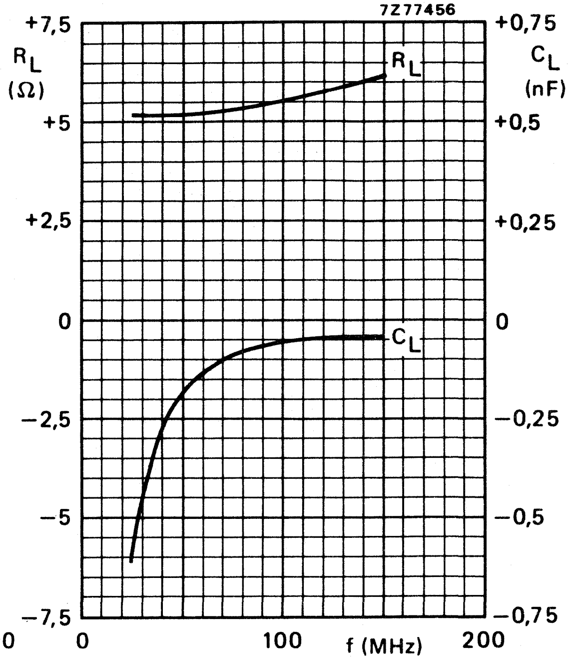


Fig. 22 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C; typical values.

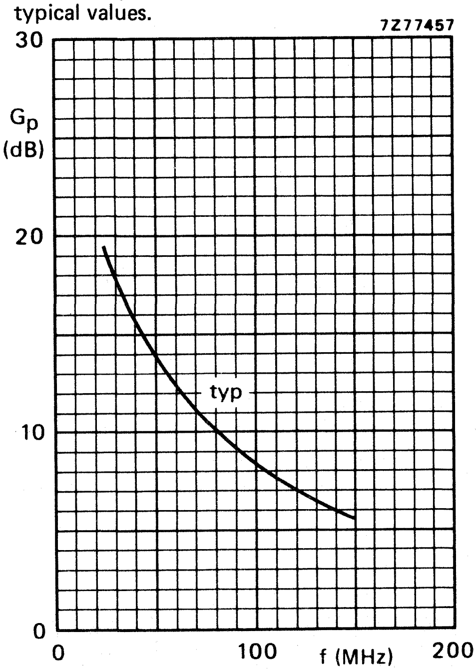


Fig. 23 V_{CE} = 28 V; P_L = 80 W; T_h = 25 °C.

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

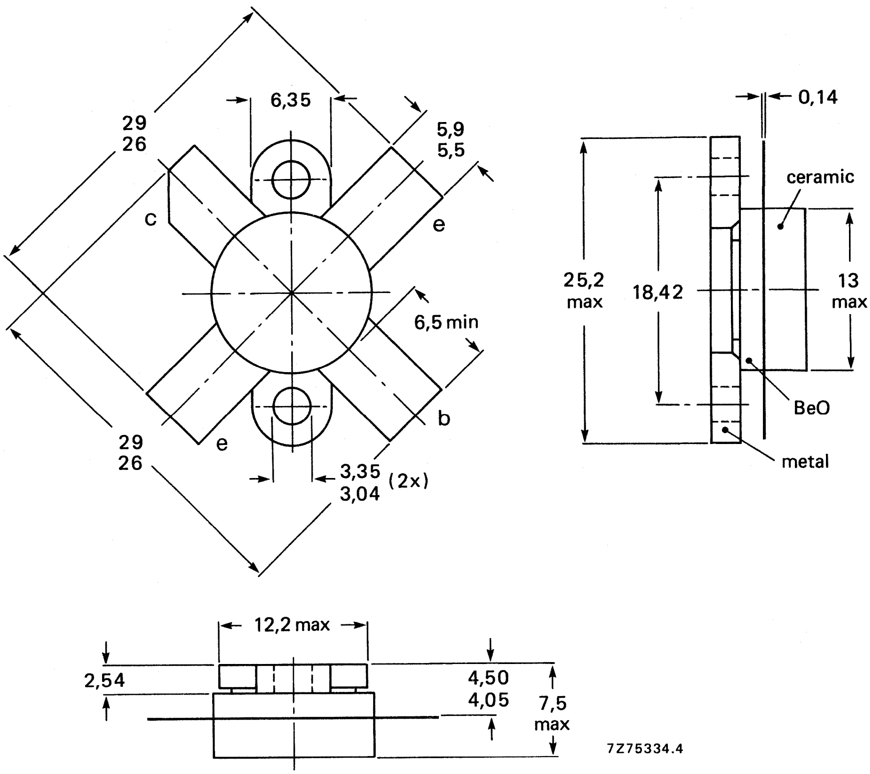
SOT-121 (see Fig. 1).

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

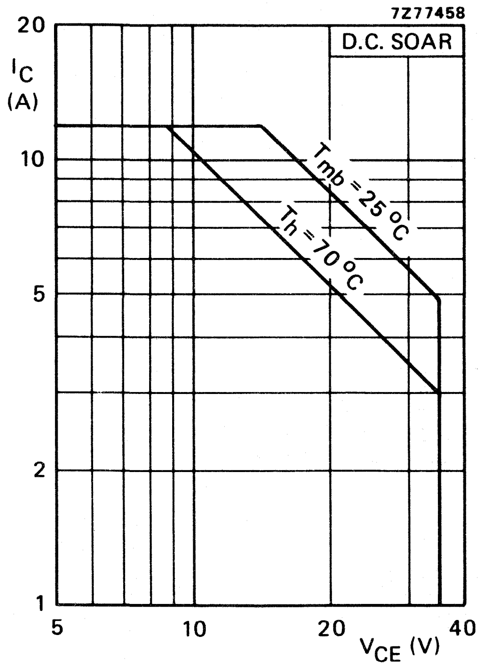


Fig. 2 D.C. SOAR.

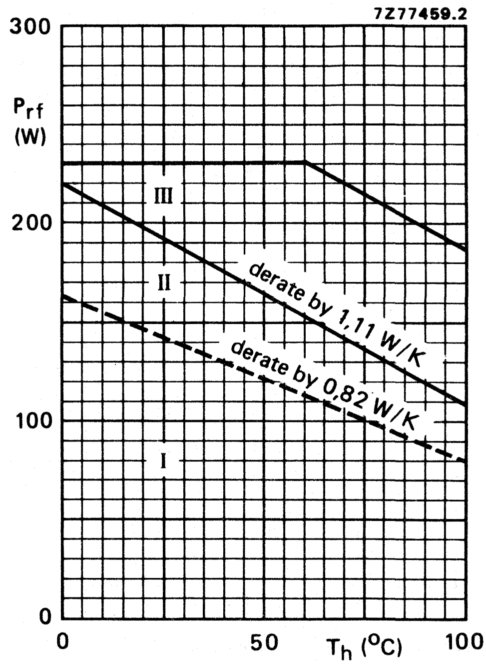


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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 °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 = 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

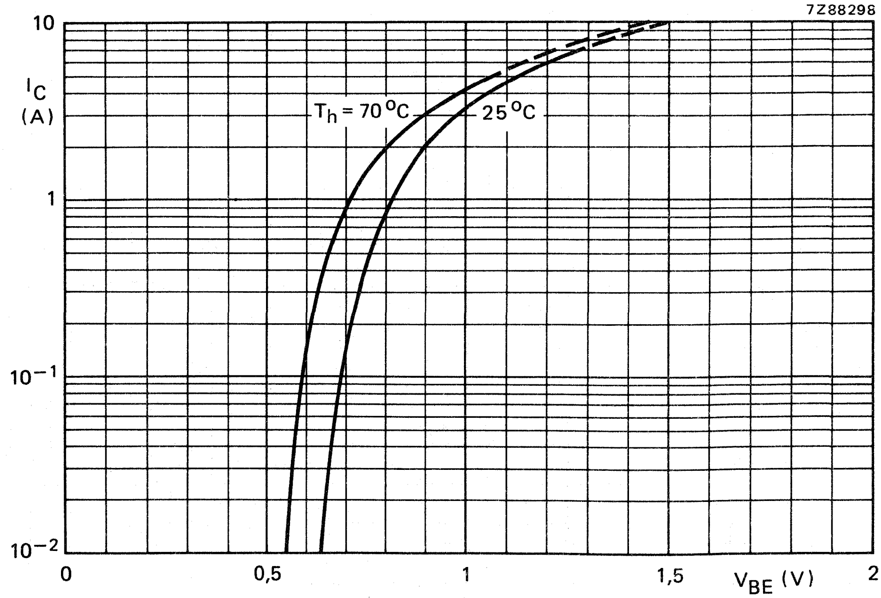


Fig. 4 Typical values; V_{CE} = 20 V.

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.

** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

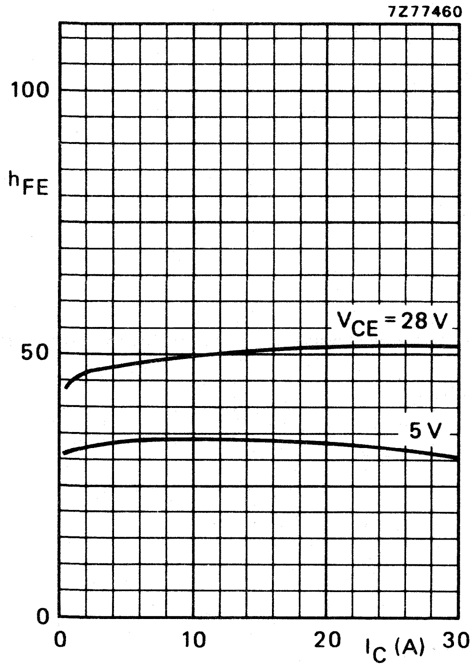


Fig. 5 Typical values; T_j = 25 °C.

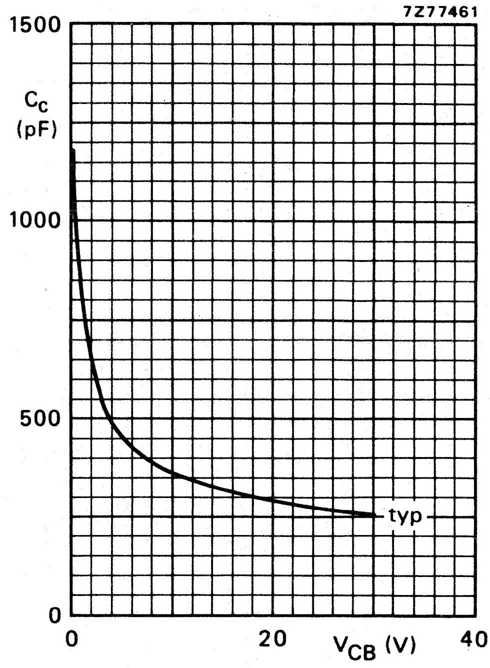


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

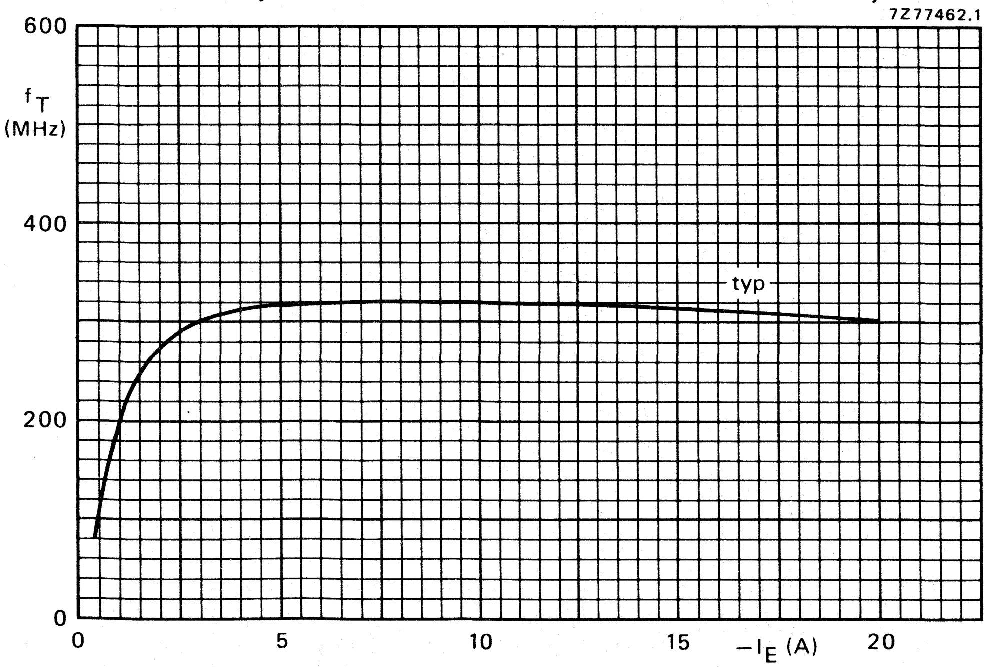


Fig. 7 V_{CB} = 28 V; f = 100 MHz; T_j = 25 °C.

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**

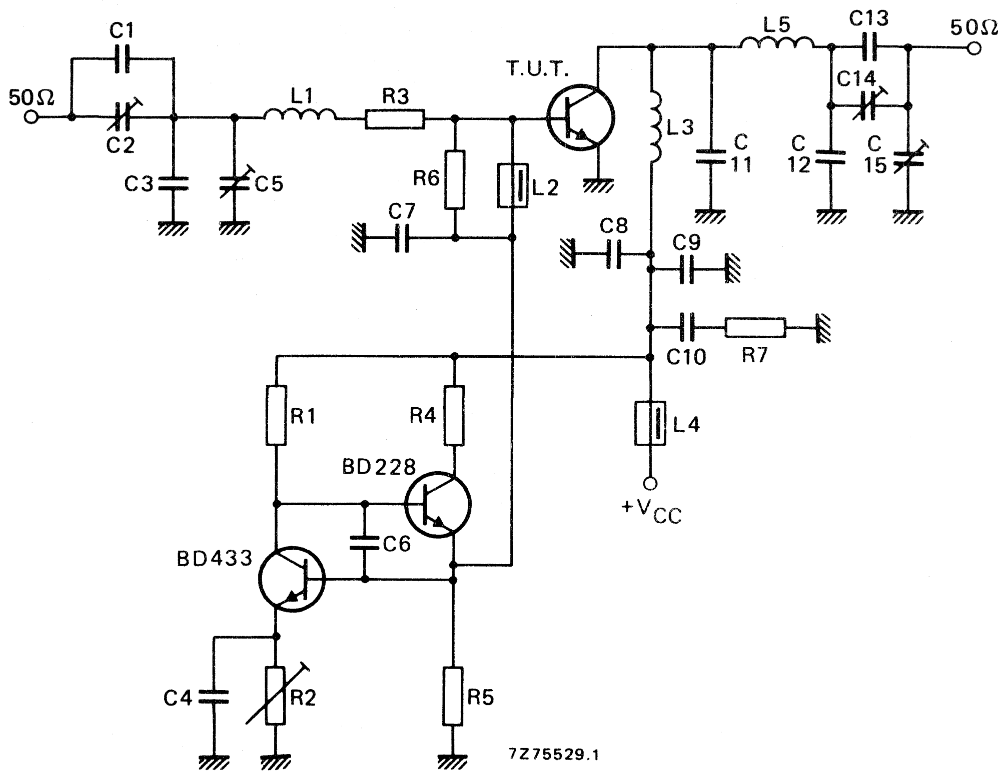


Fig. 8 Test circuit; s.s.b. class-AB.

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)

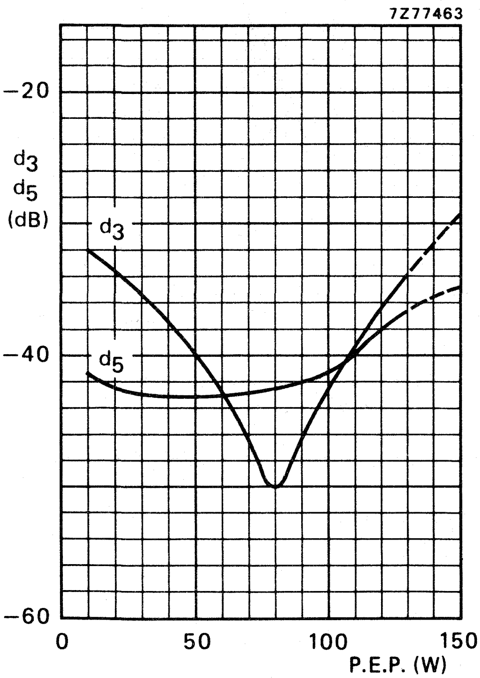


Fig. 9 Intermodulation distortion as a function of output power.*

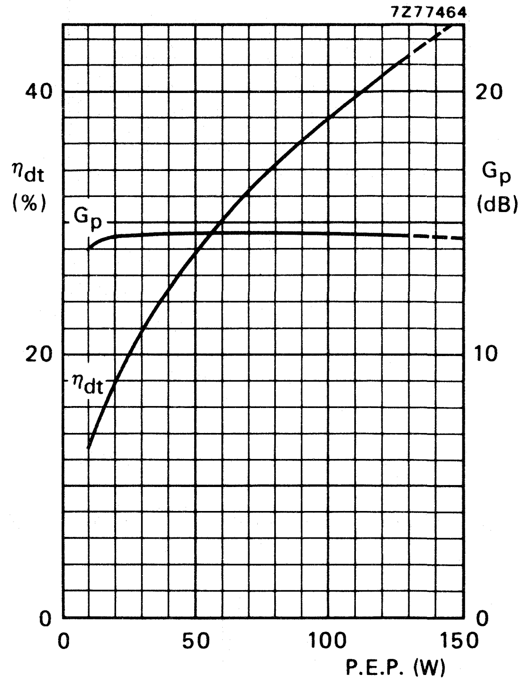


Fig. 10 Double-tone efficiency and power gain as a function of output power.

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)

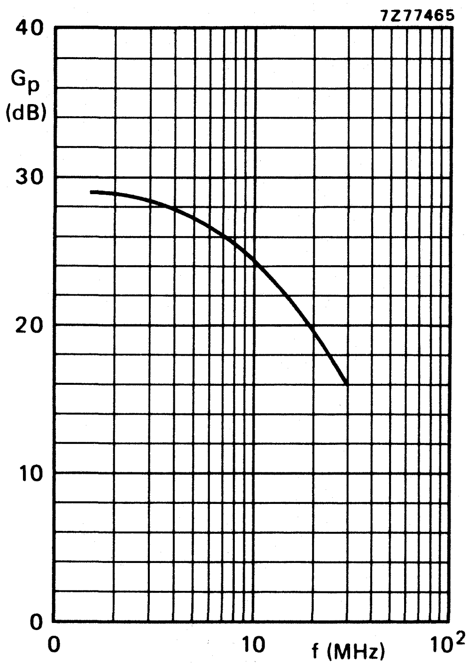


Fig. 11 Power gain as a function of frequency.

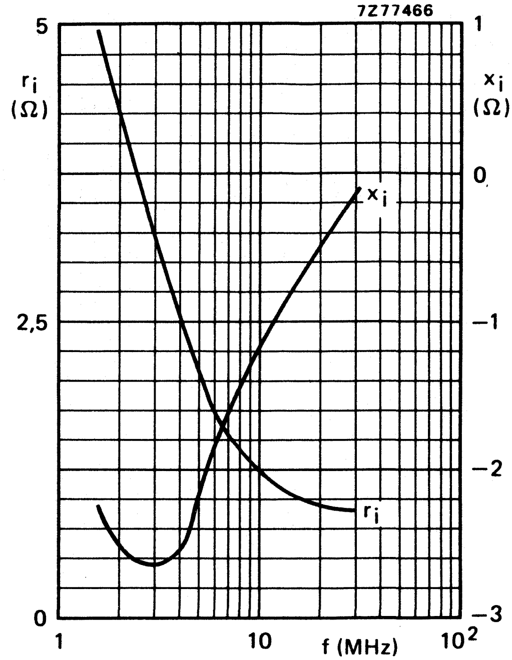


Fig. 12 Input impedance (series components) as a function of frequency.

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.

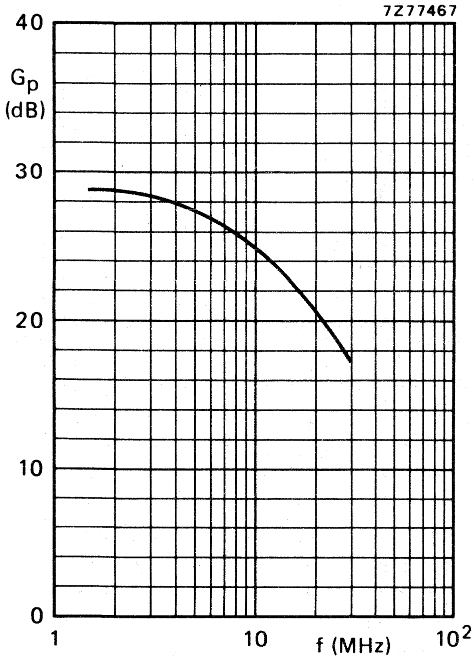


Fig. 13 Power gain as a function of frequency.

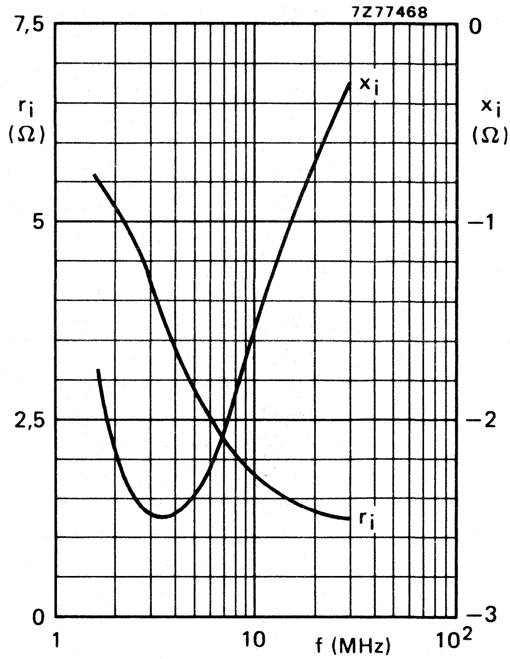


Fig. 14 Input impedance (series components) as a function of frequency.

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)

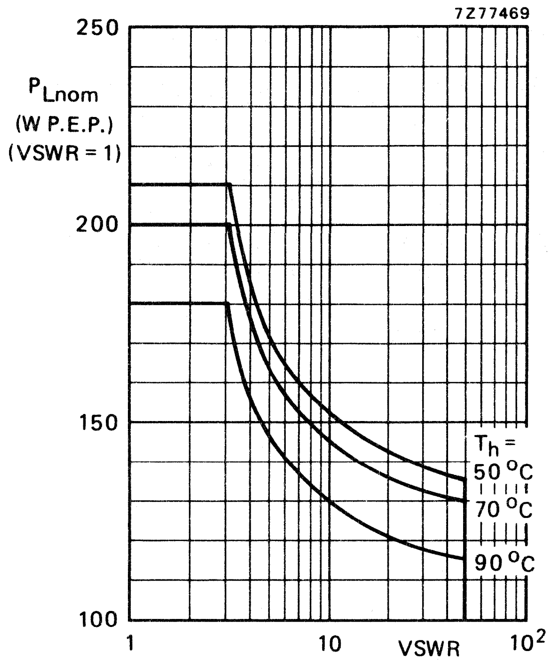


Fig. 15 R.F. SOAR; s.s.b. class-AB operation; f_1 = 28,000 MHz; f_2 = 28,001 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W.
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures 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 (%)	$\overline{z_i}$ (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**

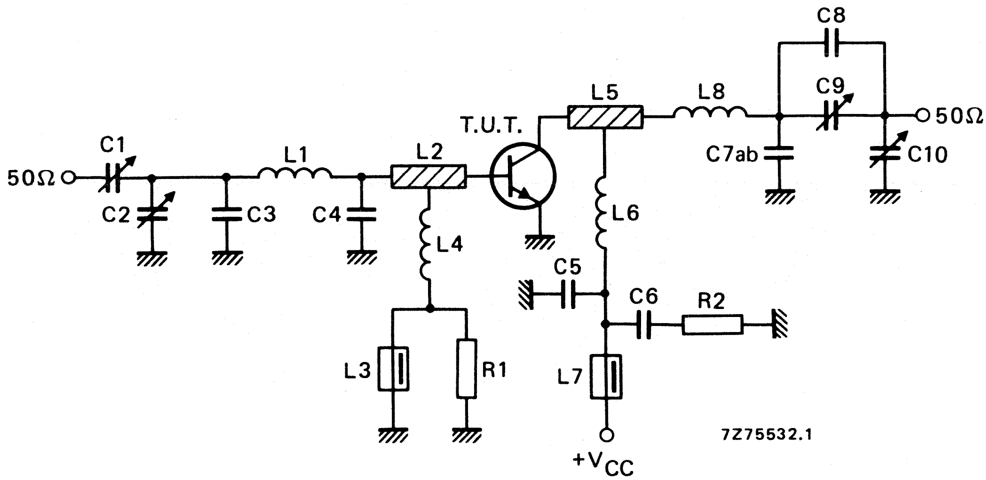


Fig. 16 Test circuit; c.w. class-B.

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)

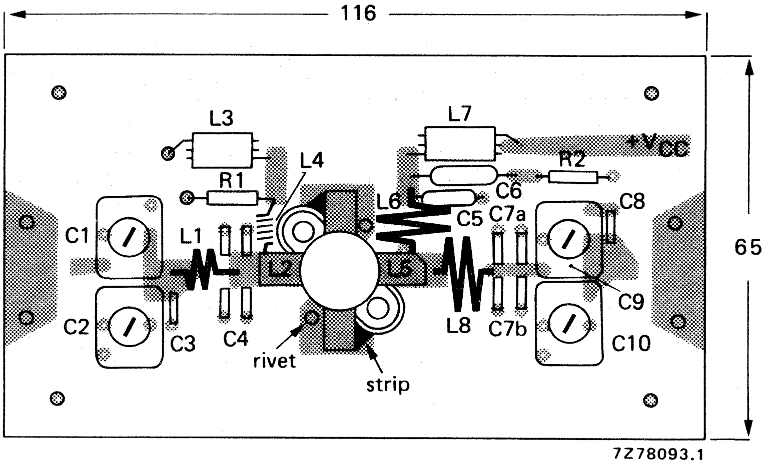
L1 = 25 nH; 2 turns Cu wire (1,6 mm); int. dia. 5,0 mm; length 4,6 mm; leads 2 x 5 mm
L2 = L5 = 2,4 nH; strip (12 mm x 6 mm); tap for L4 and L6 at 5 mm from transistor
L3 = L7 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 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)



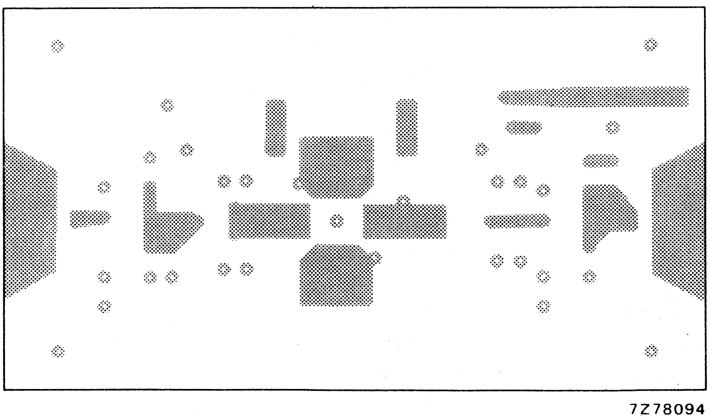


Fig. 17 Component layout and printed-circuit board for 87,5 MHz test circuit.

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.

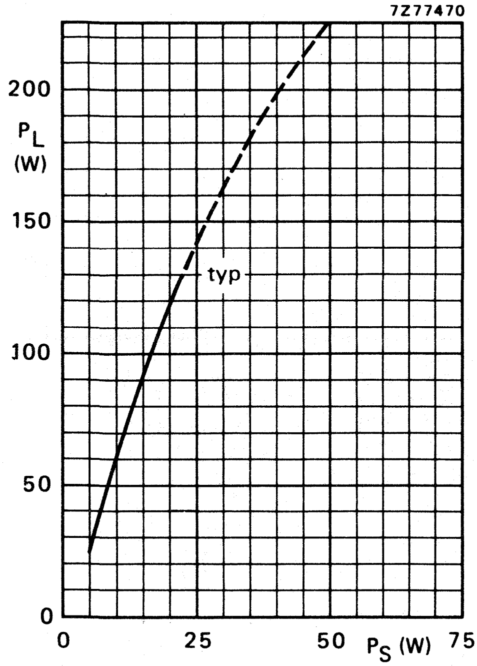


Fig. 18 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C.

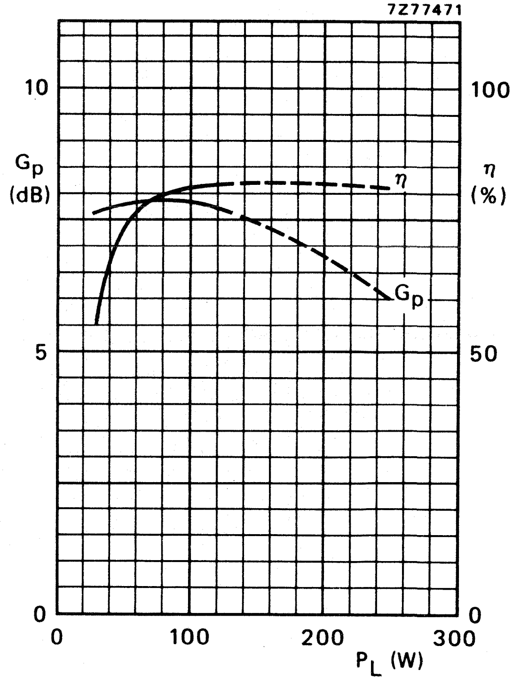


Fig. 19 V_{CE} = 28 V; f = 87,5 MHz; T_h = 25 °C; typical values.

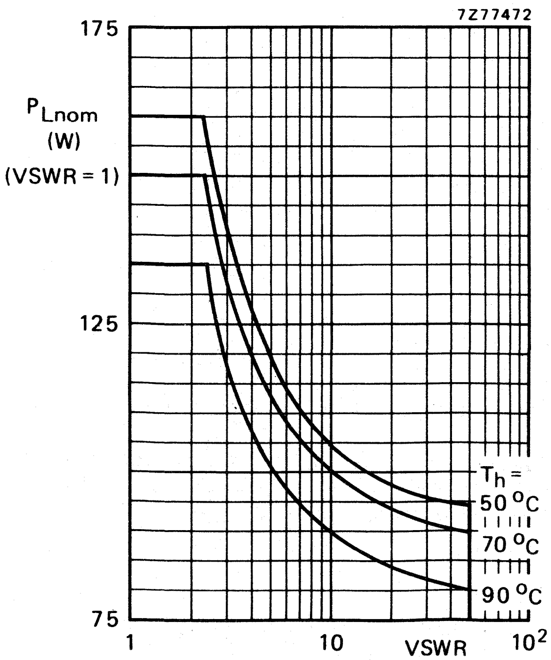


Fig. 20 R.F. SOAR; c.w. class-B operation; f = 87,5 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

APPLICATION INFORMATION (continued)

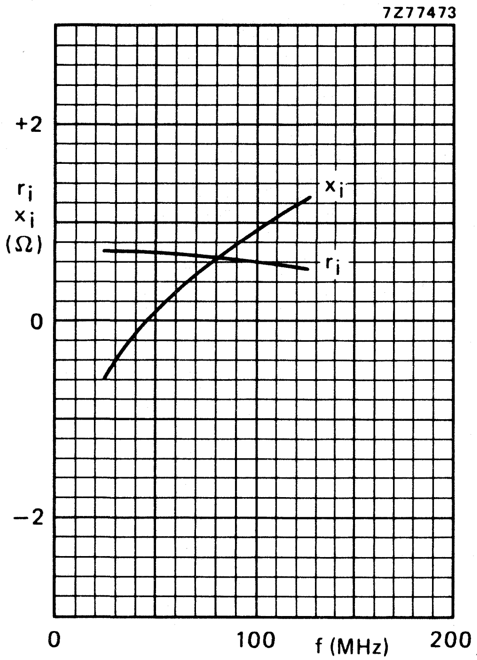


Fig. 21 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

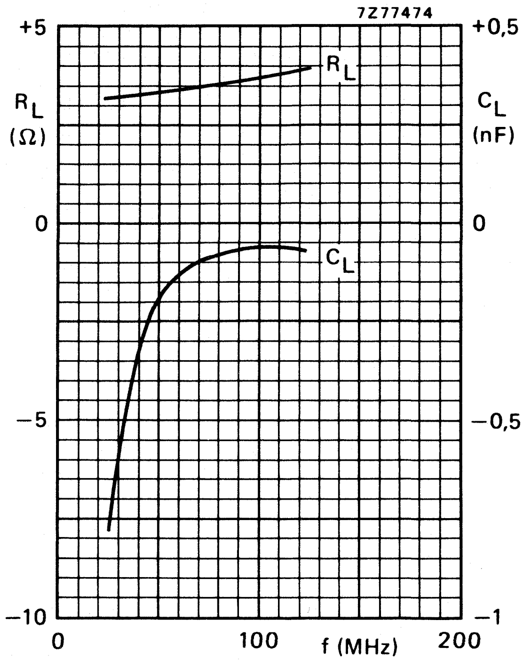


Fig. 22 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C; typical values.

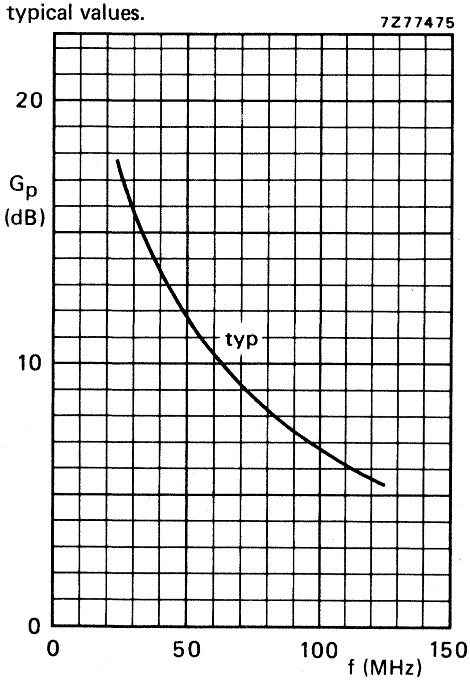


Fig. 23 V_{CE} = 28 V; P_L = 130 W; T_h = 25 °C.

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

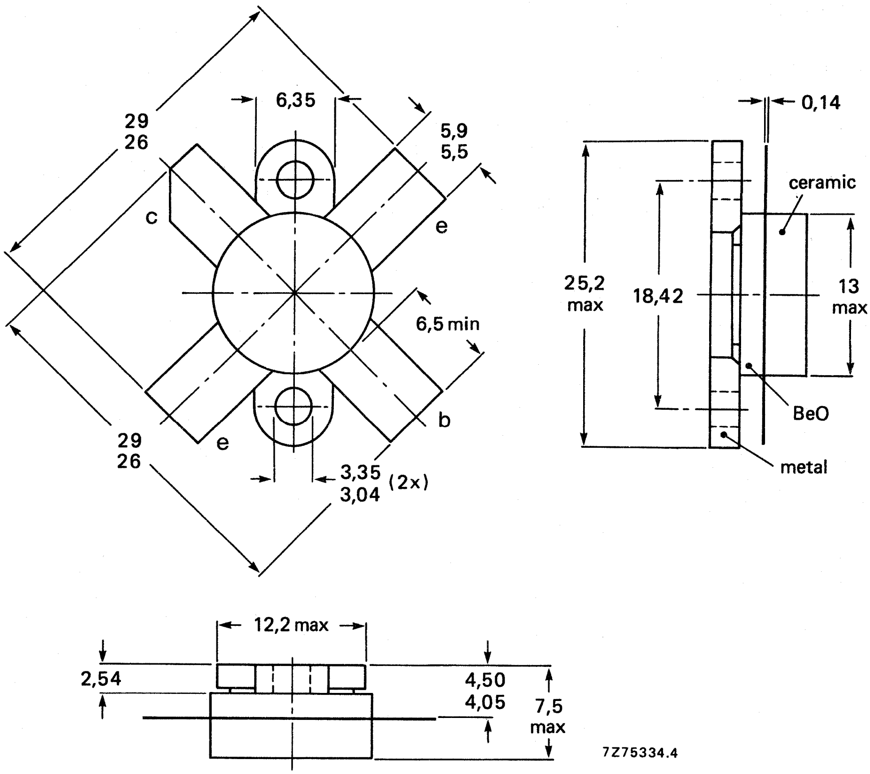
SOT-121 (see Fig. 1).

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

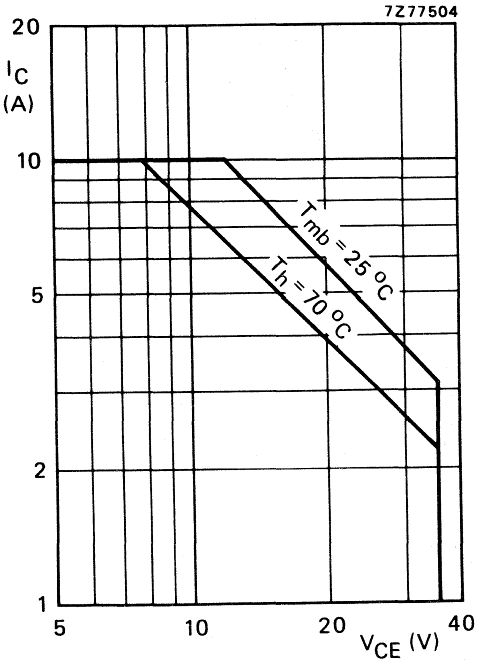


Fig. 2 D.C. SOAR.

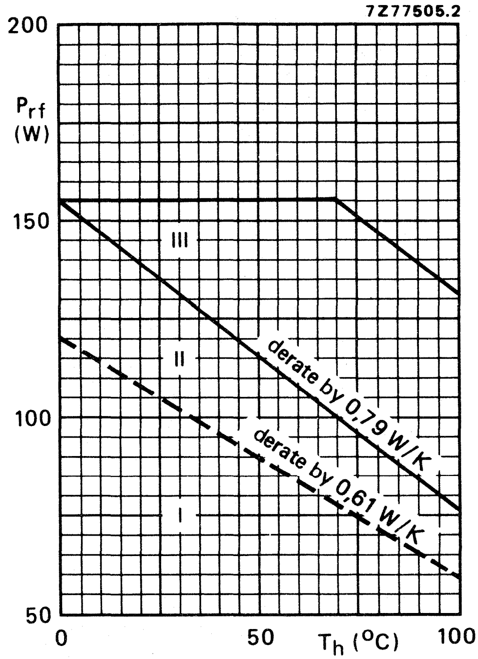


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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

$T_j = 25\ ^oC$

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: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

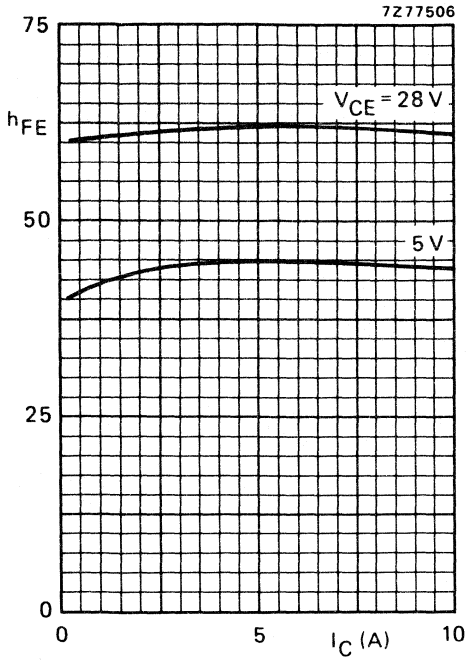


Fig. 4 Typical values; T_j = 25 °C.

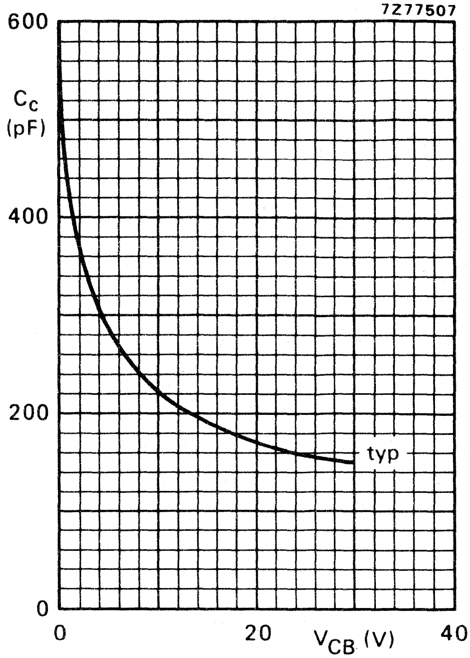


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

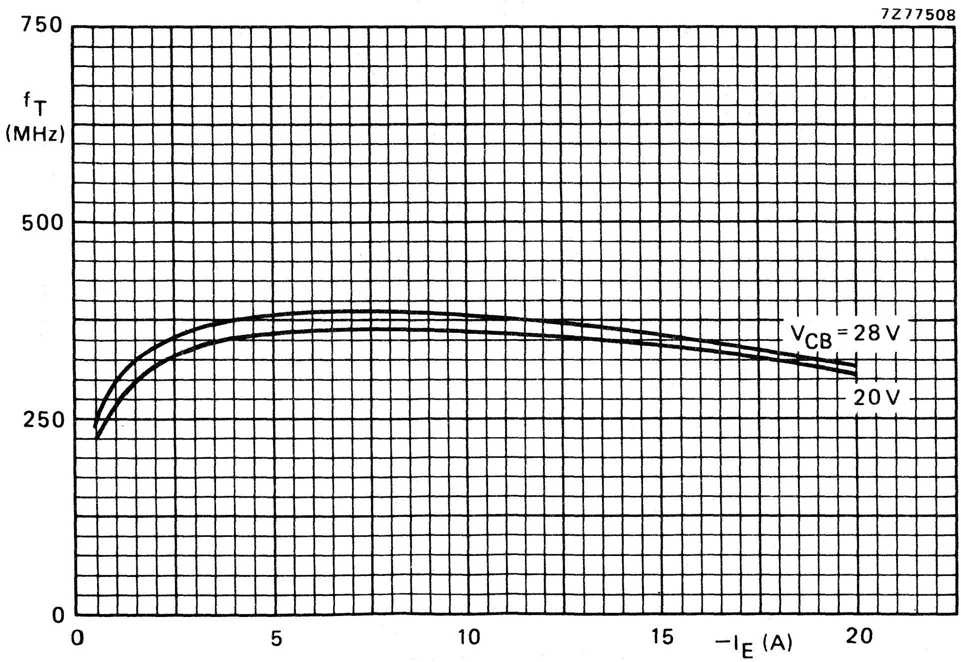


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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**

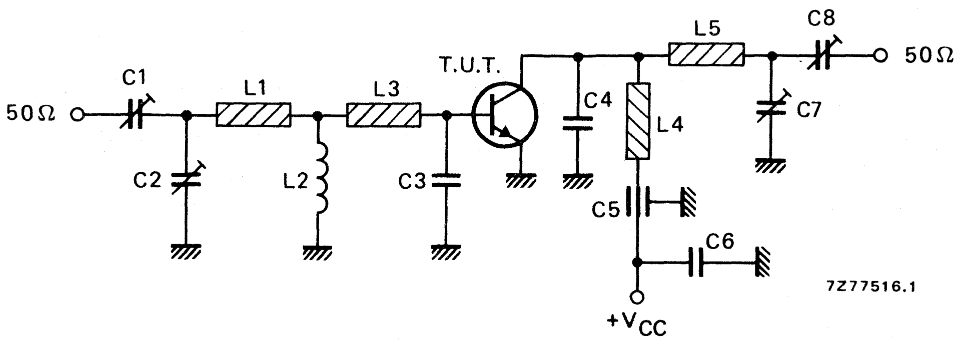


Fig. 7 Test circuit; c.w. class-B; f = 150 MHz.

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.

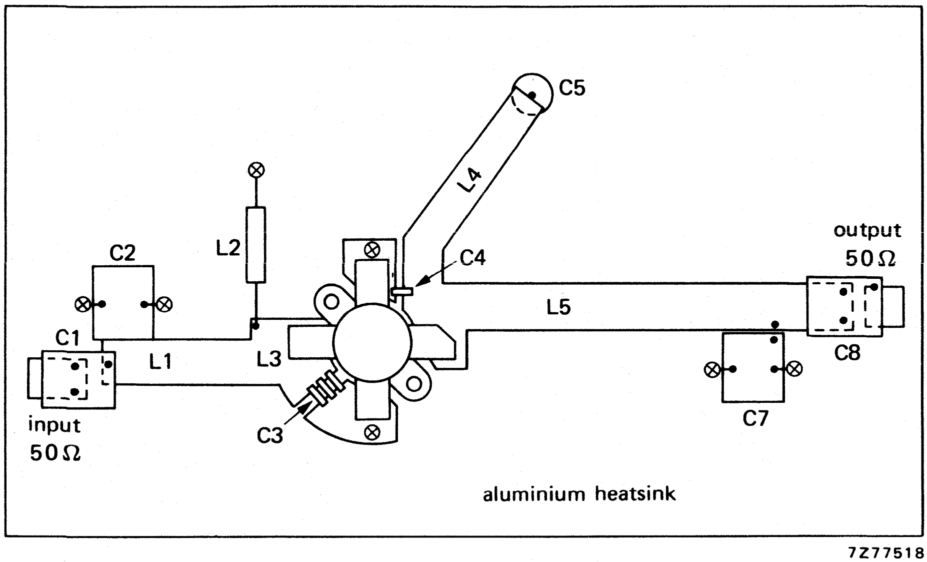


Fig. 8 Component layout on an aluminium heatsink for 150 MHz test circuit. ⊗ Earthing bolts.

APPLICATION INFORMATION (continued)

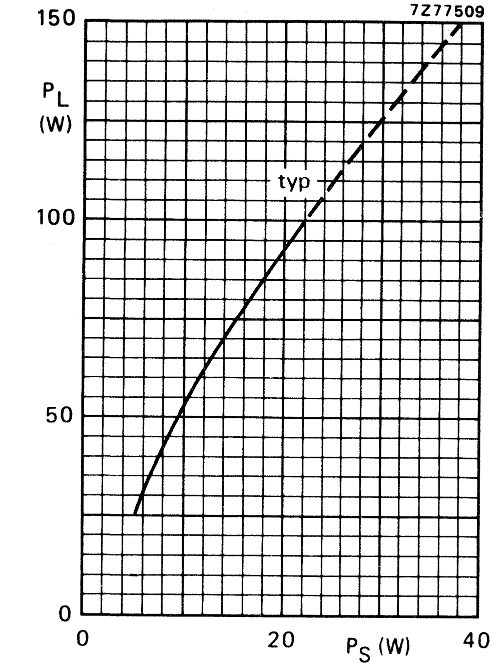


Fig. 9 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C.

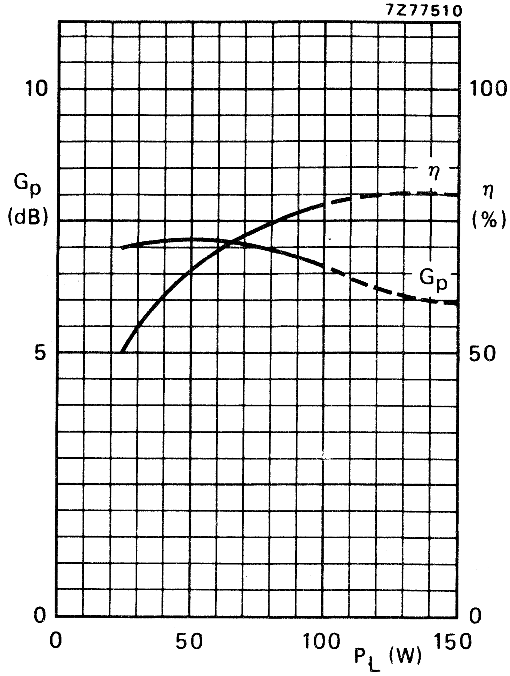


Fig. 10 V_{CE} = 28 V; f = 150 MHz; T_h = 25 °C; typical values.

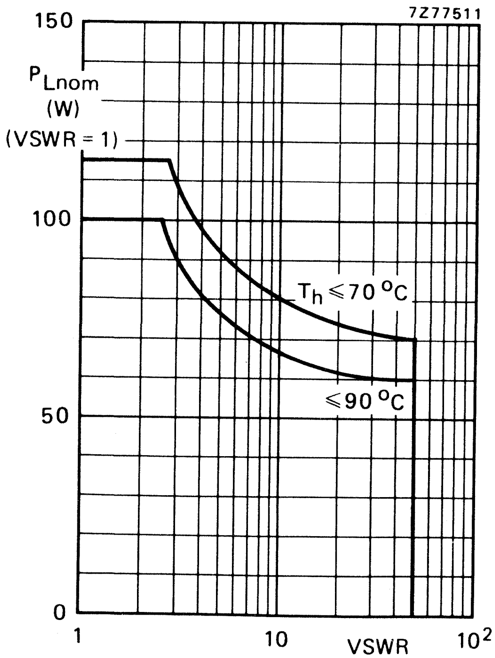


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 150 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W. The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

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.

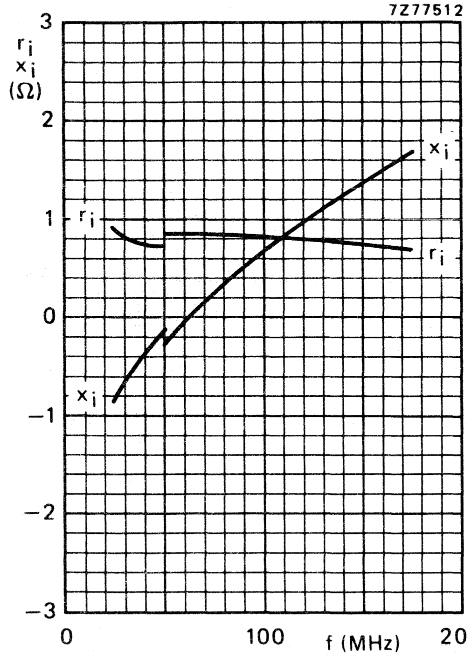


Fig. 12 Input impedance (series components).

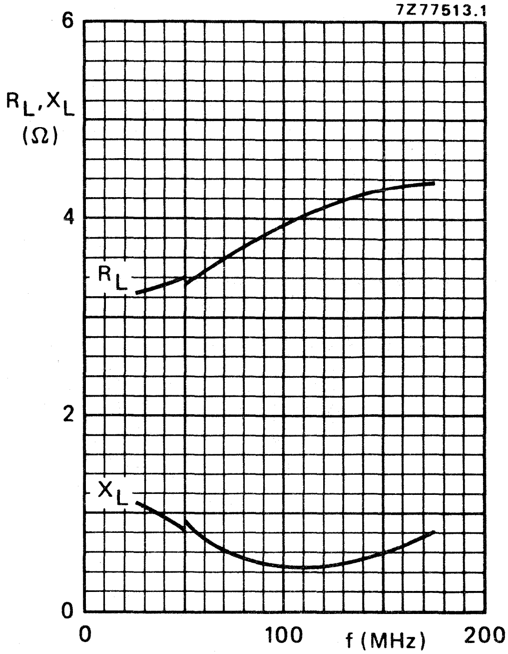
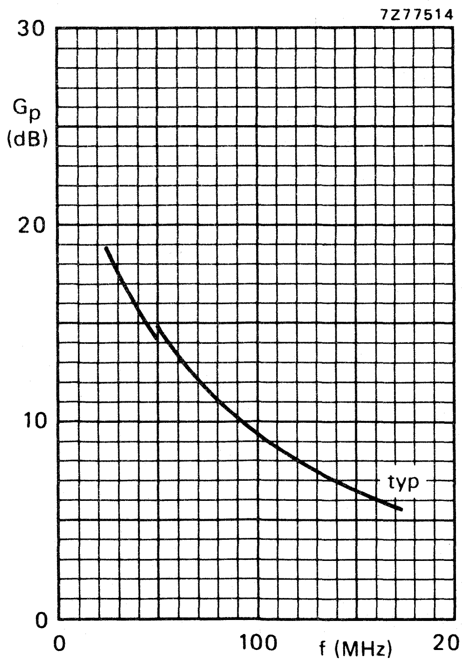


Fig. 13 Load impedance (series components).



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

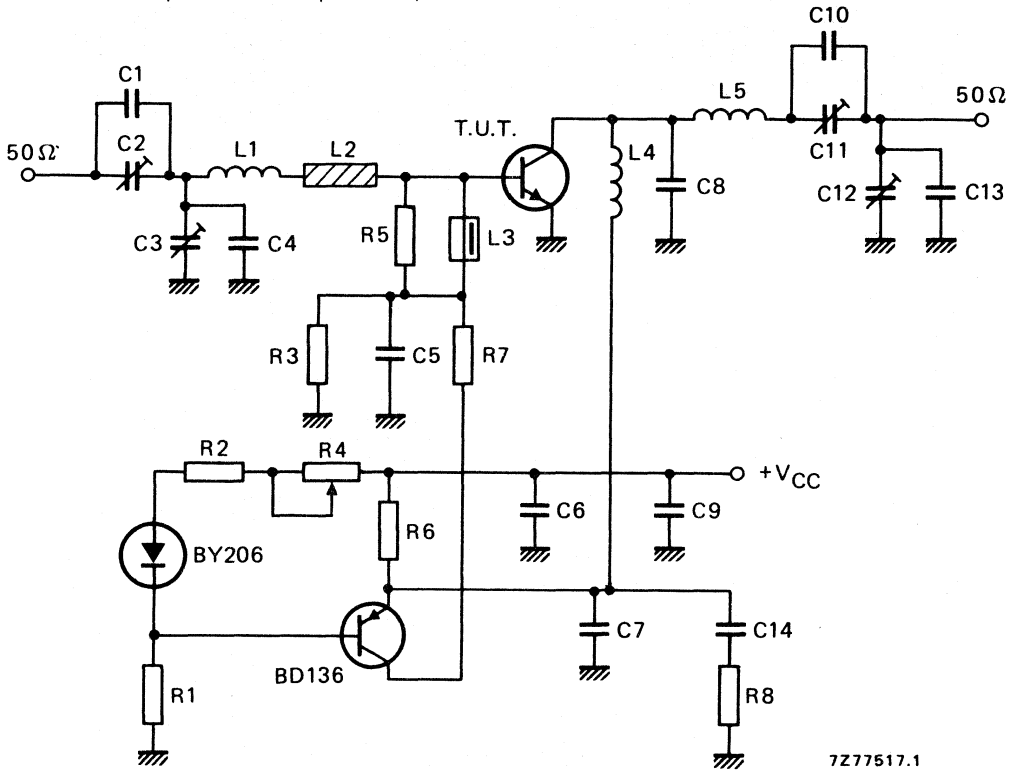


Fig. 15 Test circuit; s.s.b. class-A; f = 28 MHz.

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)

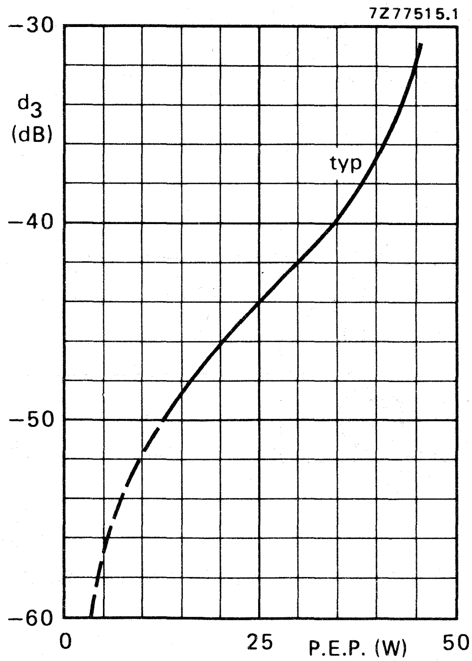


Fig. 16 Intermodulation distortion as a function of output power; V_{CE} = 26 V; I_C = 3 A; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 40 °C.

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

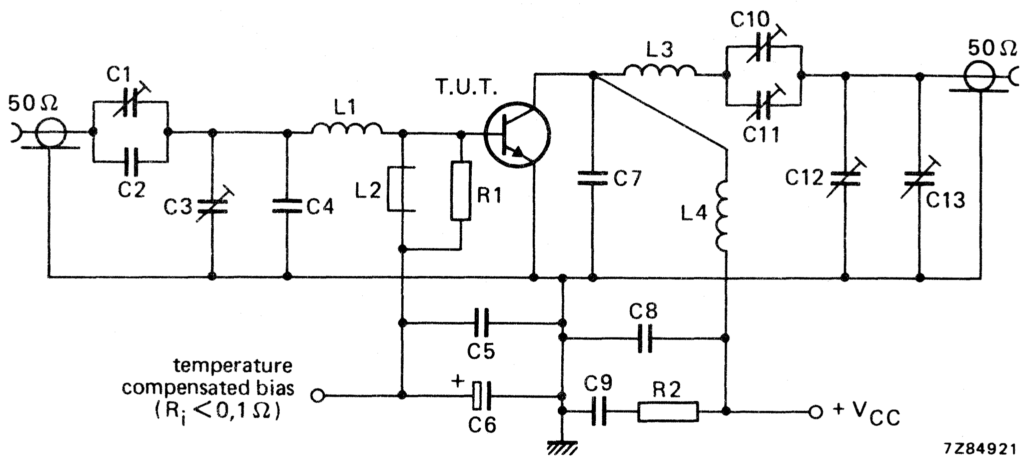


Fig. 17 Test circuit; s.s.b. class-AB; f = 28 MHz.

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.

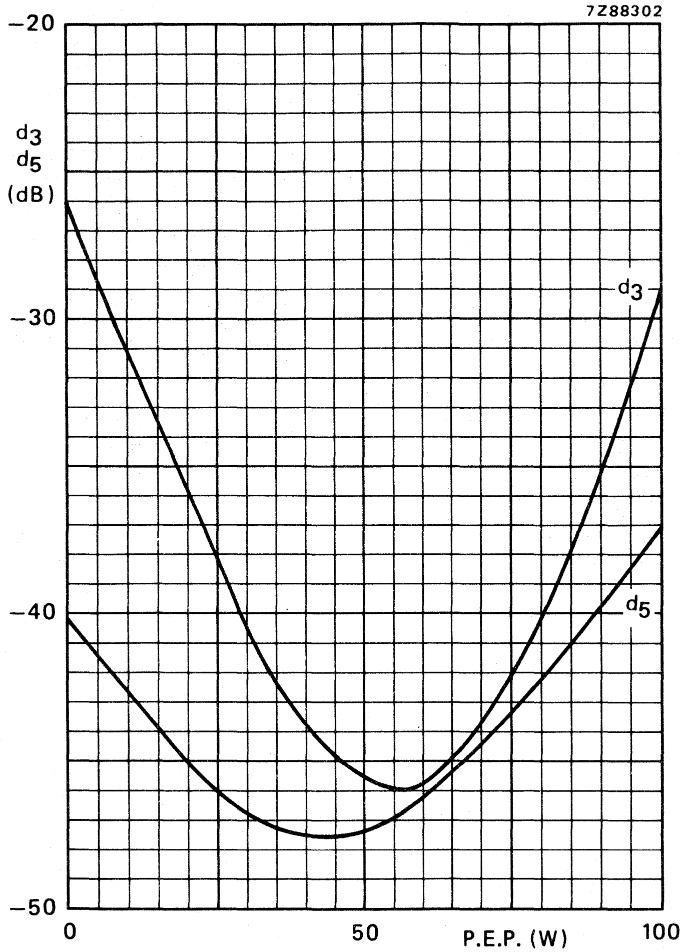


Fig. 18 Intermodulation distortion* as a function of output power.
Typical values; V_{CE} = 28 V; $I_{C(ZS)}$ = 50 mA; f_1 = 28,000 MHz; f_2 = 28,001 MHz; T_h = 25 °C.

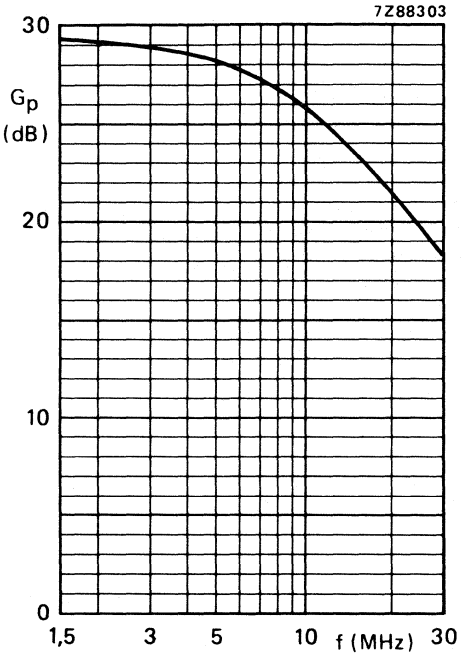


Fig. 19 Power gain as a function of frequency.

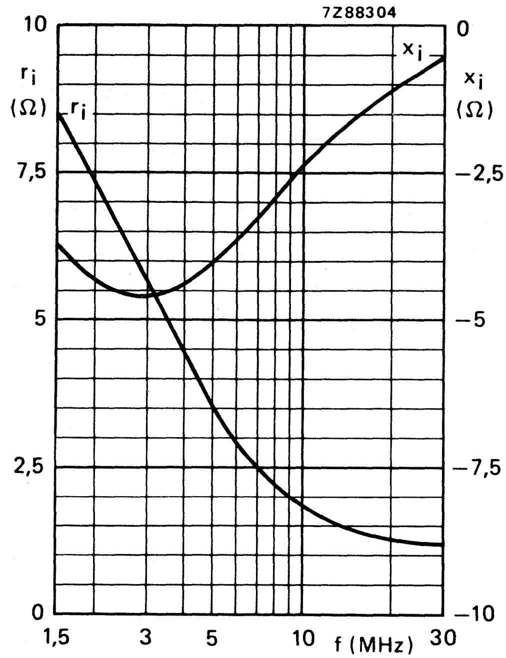


Fig. 20 Input impedance (series components).

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

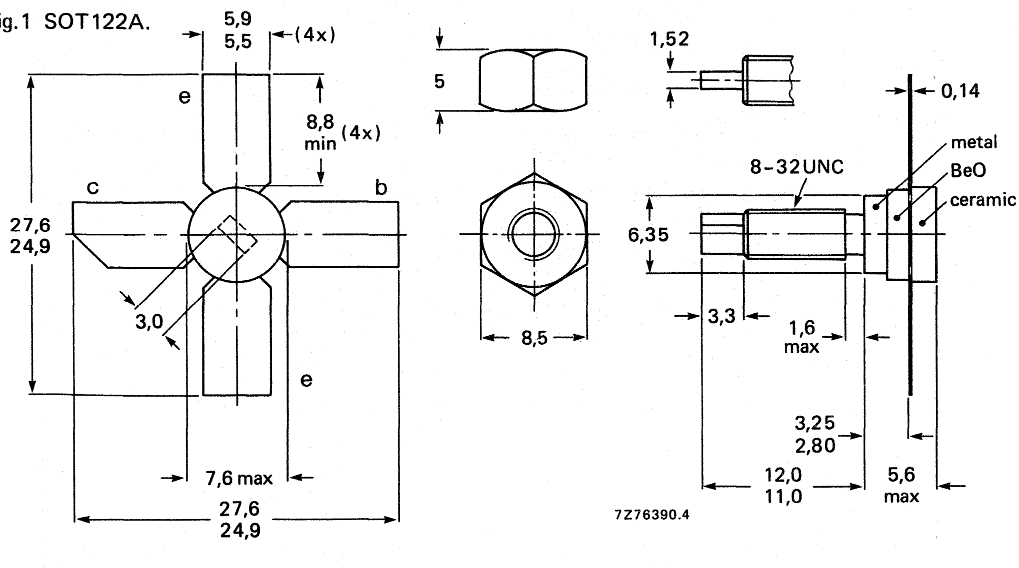
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} 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 SOT122A.



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

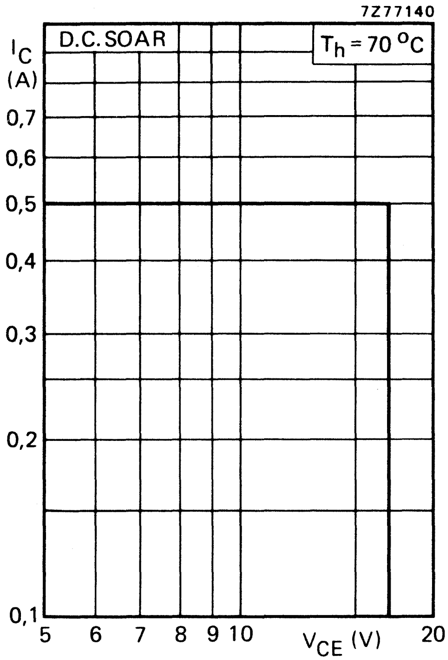


Fig.2.

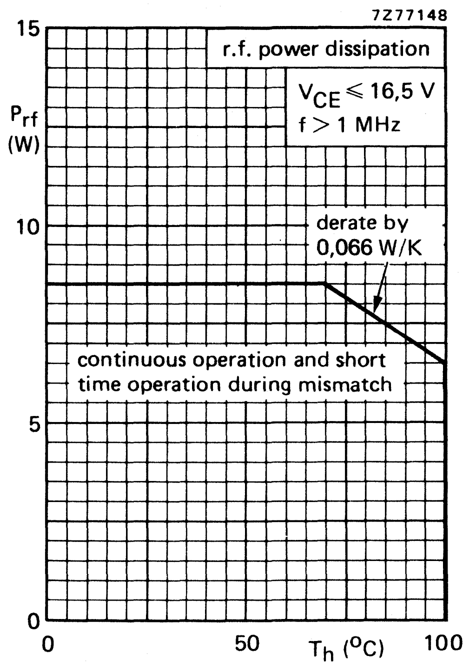


Fig.3.

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

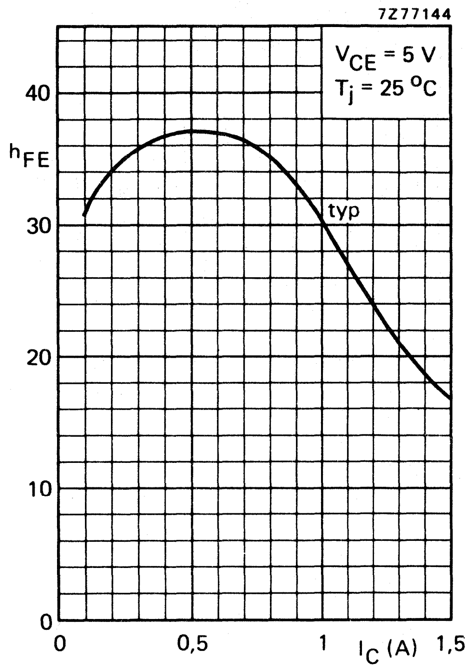


Fig.4.

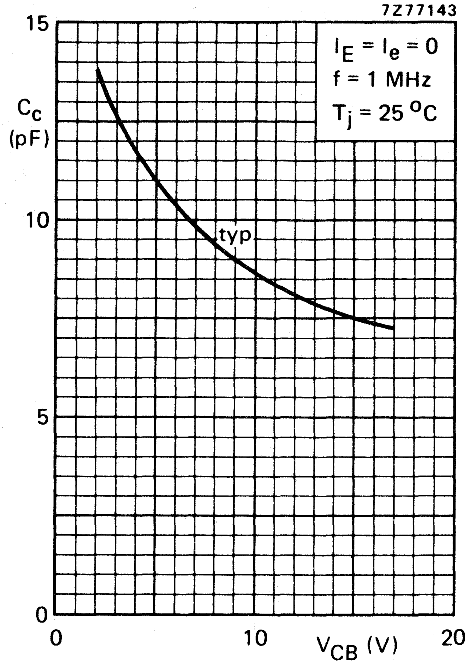


Fig.5.

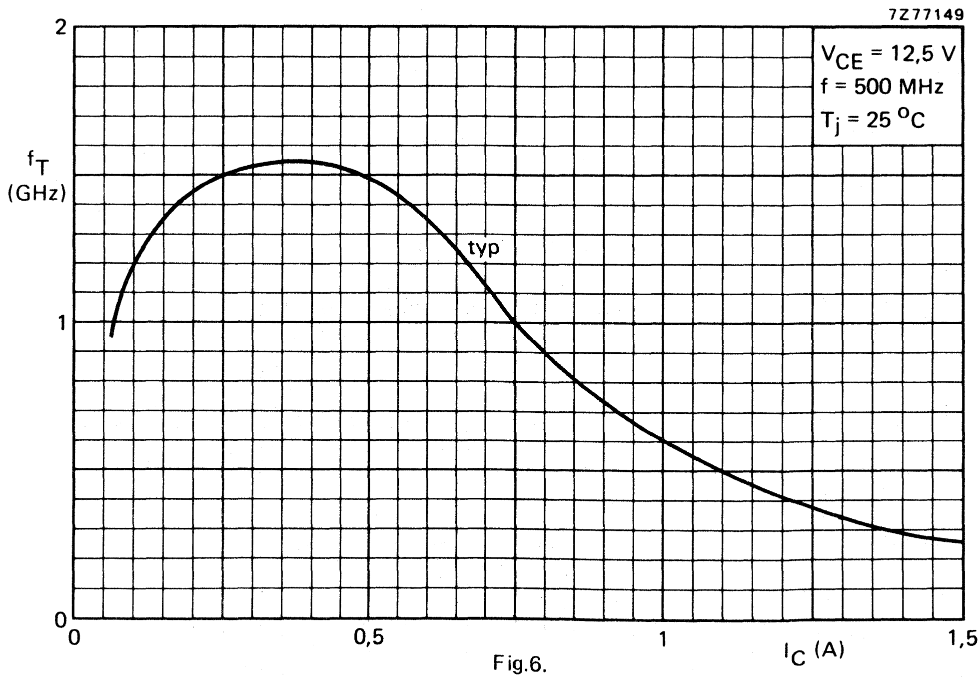


Fig.6.

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 (%)	$\overline{z_i}$ (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

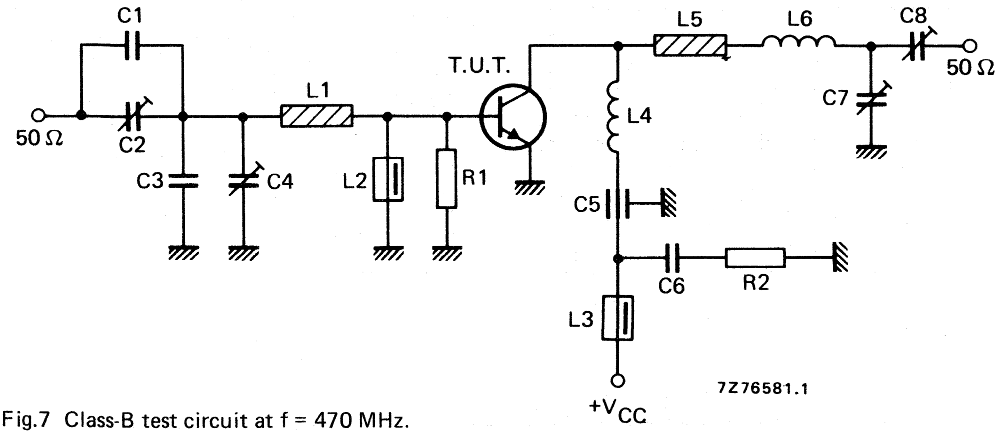


Fig.7 Class-B test circuit at f = 470 MHz.

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)

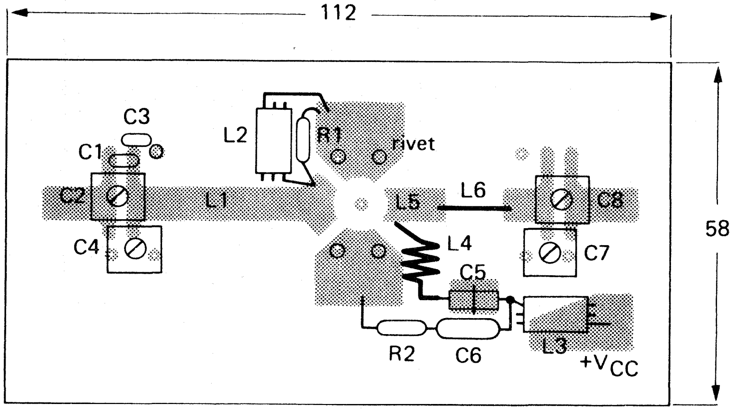
L1 = stripline (35,6 mm x 6,0 mm)
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 178 nH; 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
L5 = stripline (10,0 mm x 6,0 mm)
L6 = 28 nH; ½ turn Cu wire (1 mm); int. dia. 10 mm

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 (Fig.8).

APPLICATION INFORMATION (continued)



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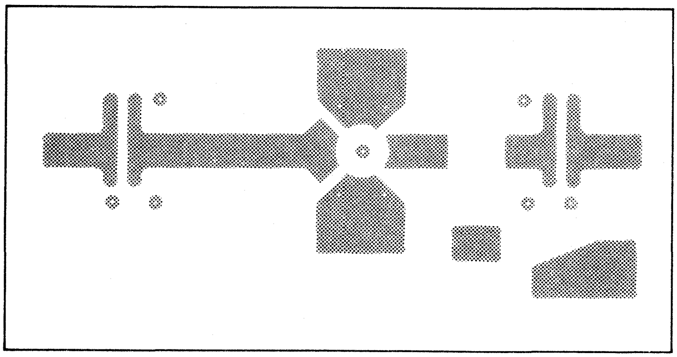

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The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Fig.8 Component layout and printed-circuit board for 470 MHz circuit test.

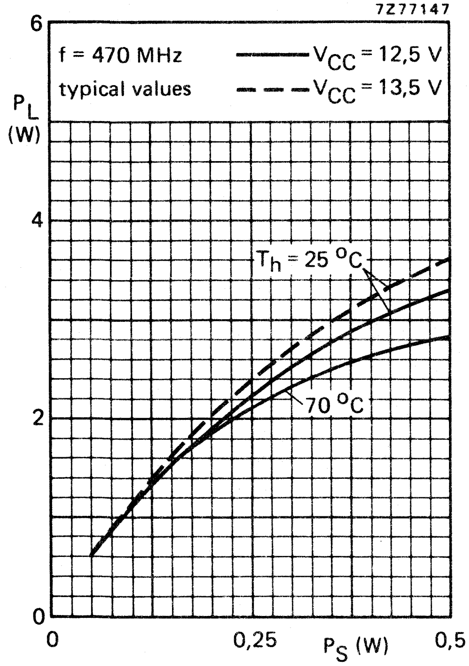


Fig.9.

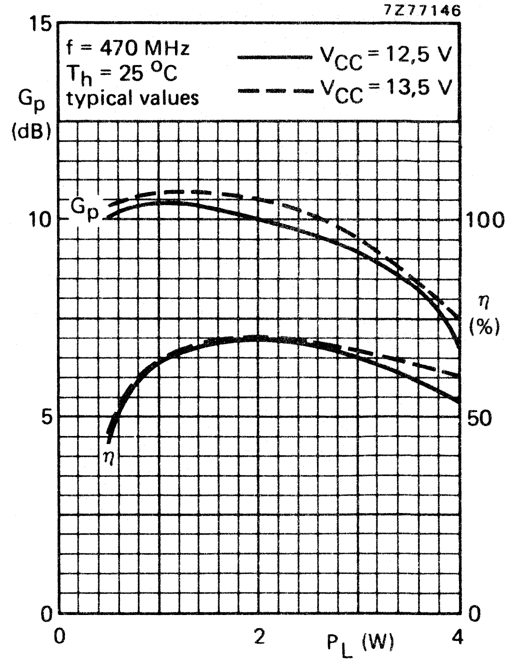


Fig.10.

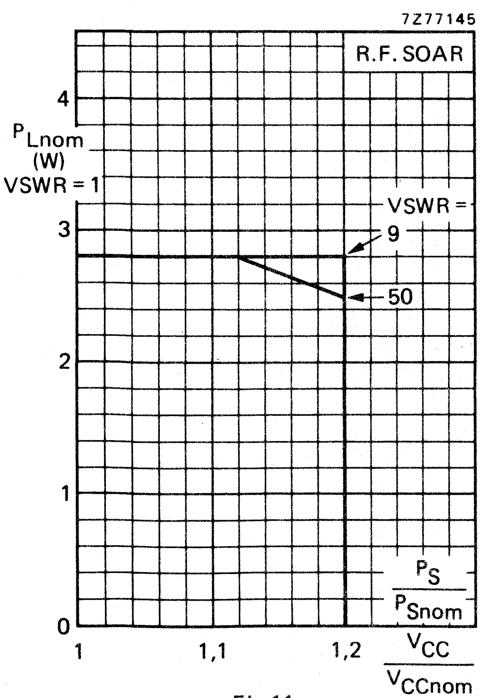


Fig.11.

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
measured in the circuit of Fig.7.

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.

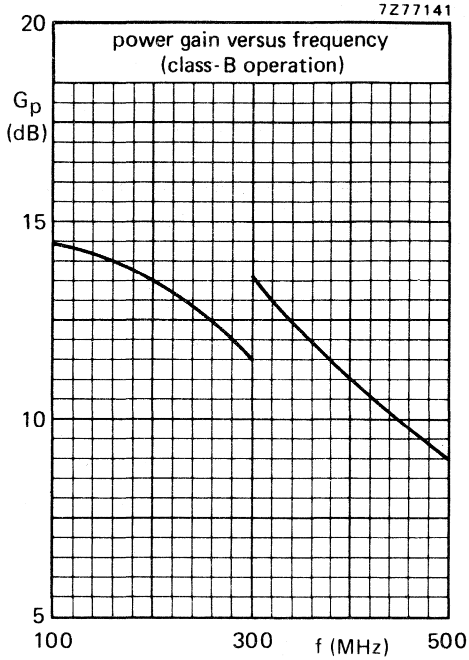


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 2 W
T_h = 25 °C
typical values

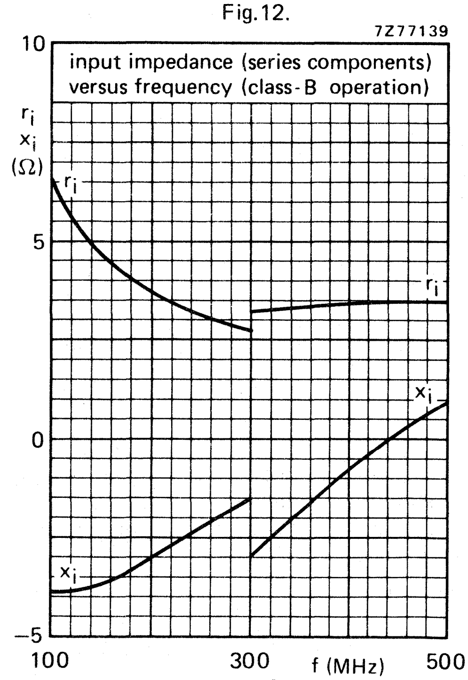


Fig.13.

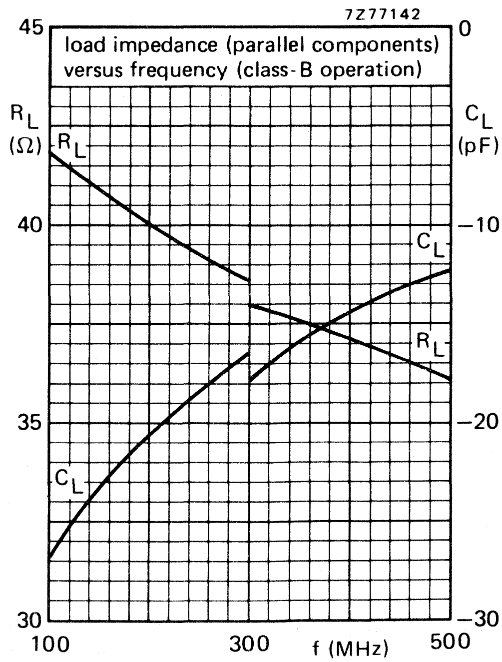


Fig.14.

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

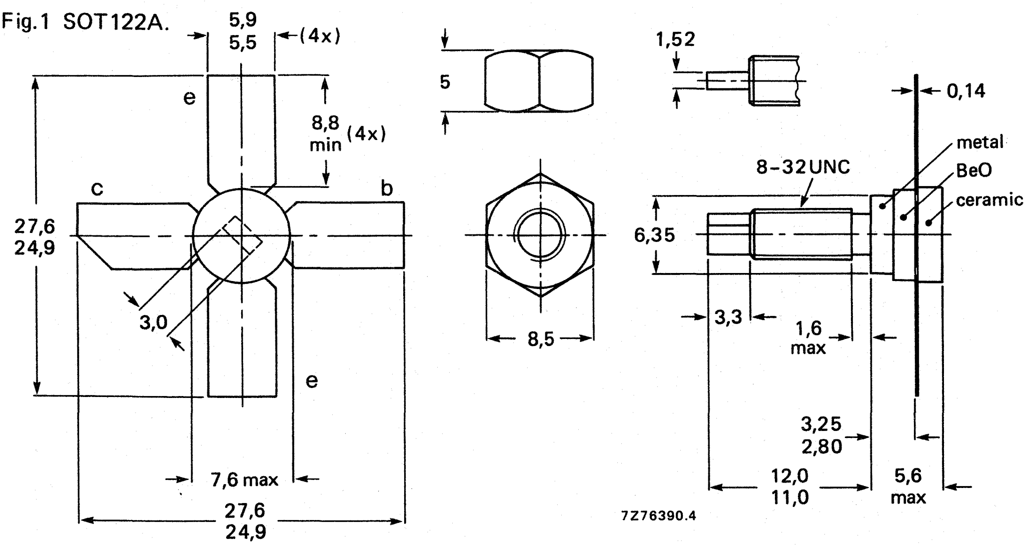
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} 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 SOT122A.



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 $T_{mb} = 25\ ^oC$	P_{tot}	max	17	W

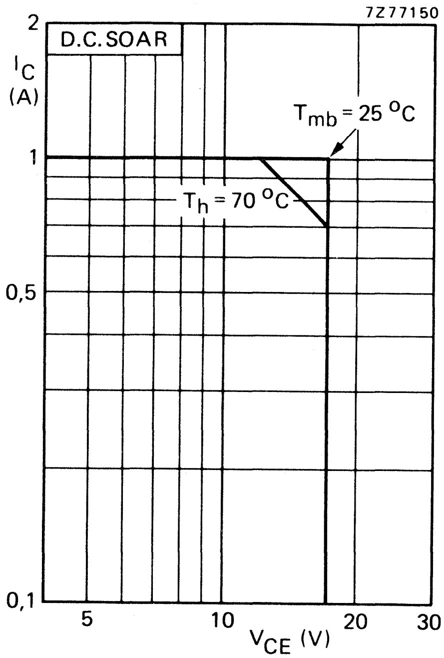


Fig.2.

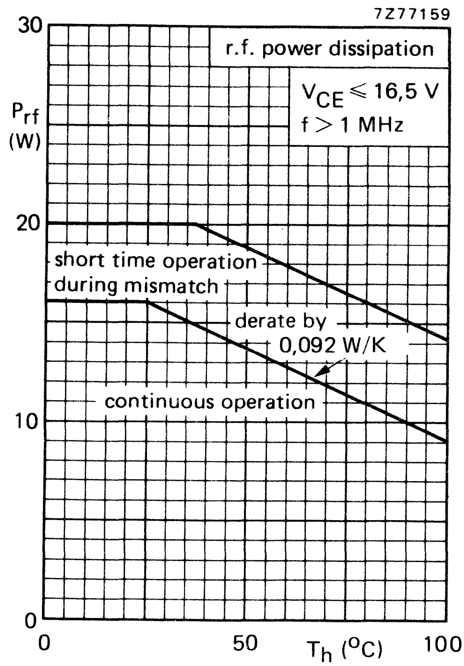


Fig.3.

Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max	200	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	10,3	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			
$V_{BE} = 0$; $I_C = 10$ 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}	>	10
		typ	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

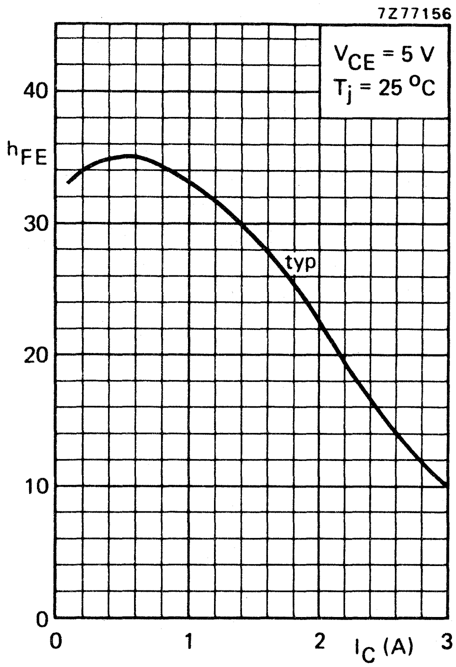


Fig.4.

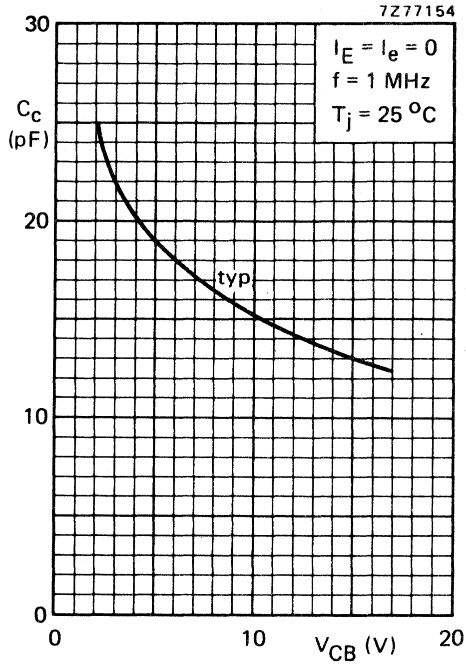


Fig.5.

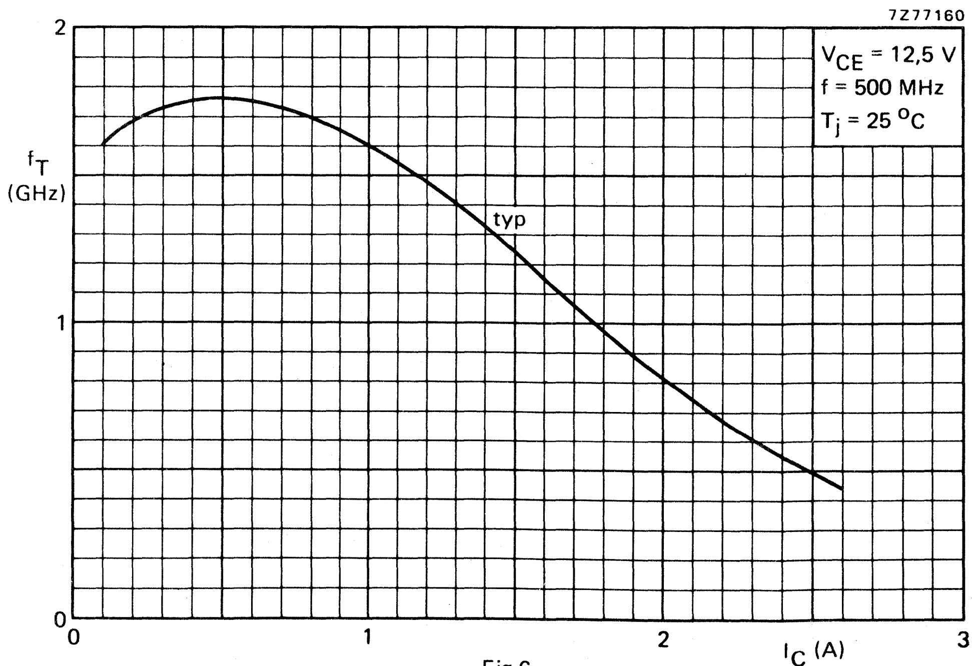


Fig.6.

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 (%)	$\overline{z_i}$ (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

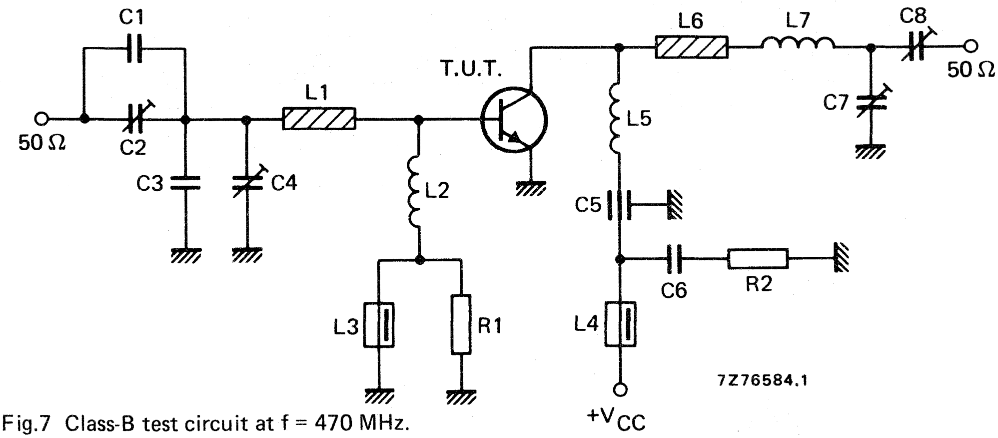


Fig.7 Class-B test circuit at f = 470 MHz.

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

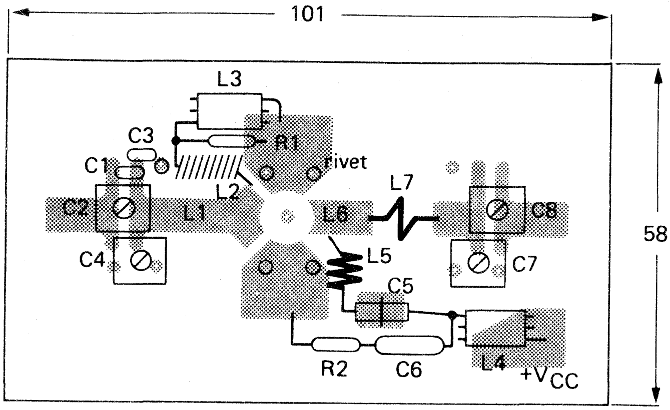
L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (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 (Fig.8).

APPLICATION INFORMATION (continued)



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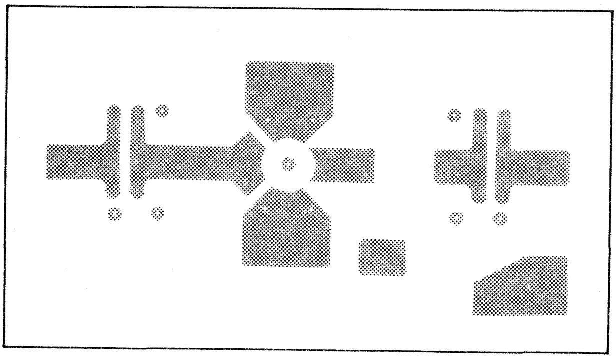

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The circuit and the components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets.

Fig.8 Component layout and printed-circuit board for 470 MHz test circuit.

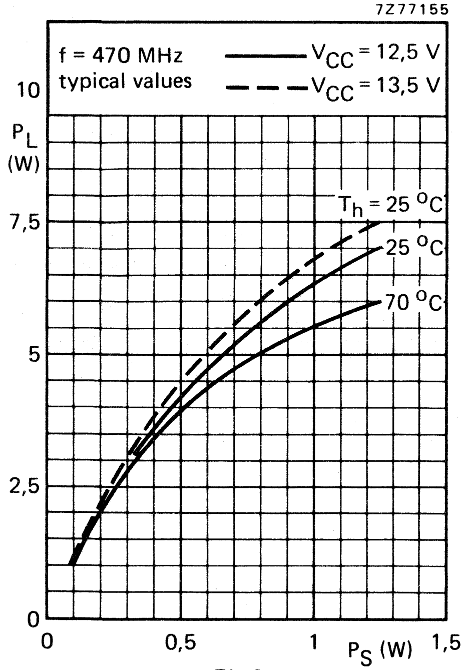


Fig.9.

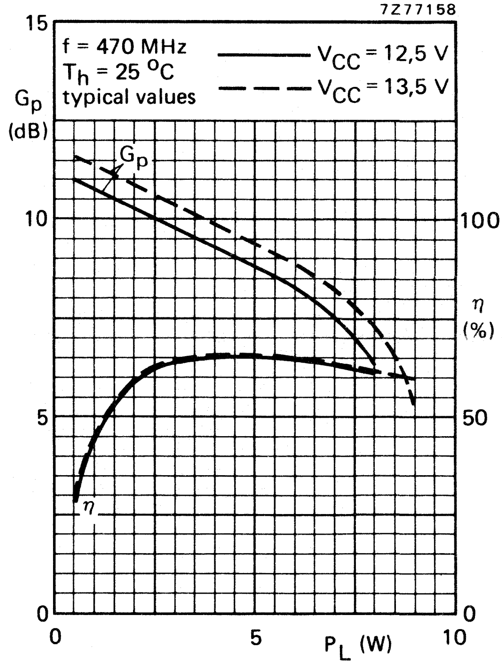


Fig.10.

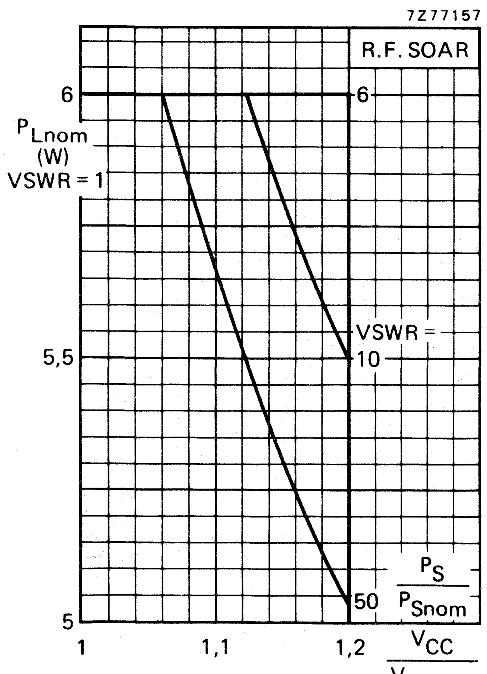


Fig.11.

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
measured in the circuit of Fig.7.

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.

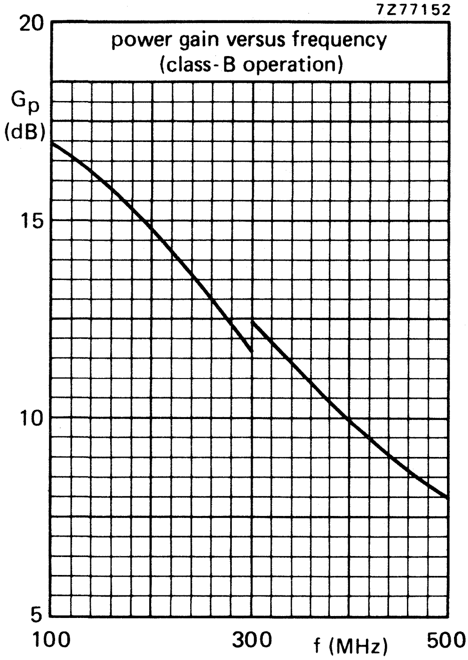


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 4 W
T_h = 25 °C
typical values

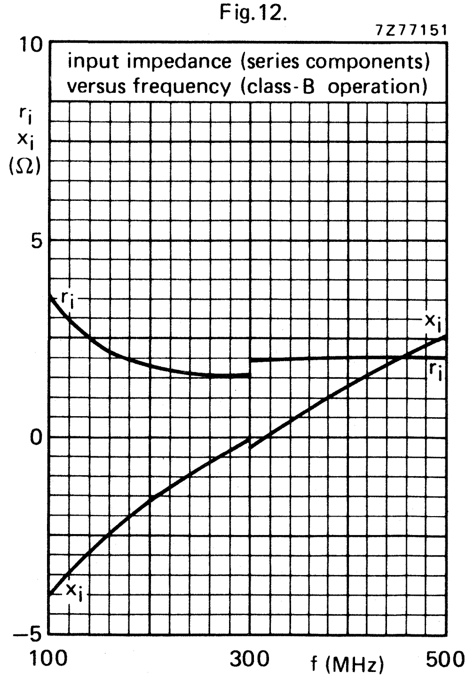


Fig.13.

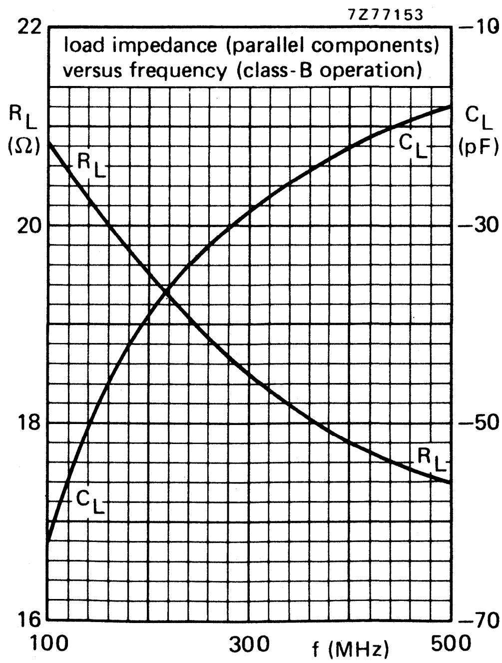


Fig.14.

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

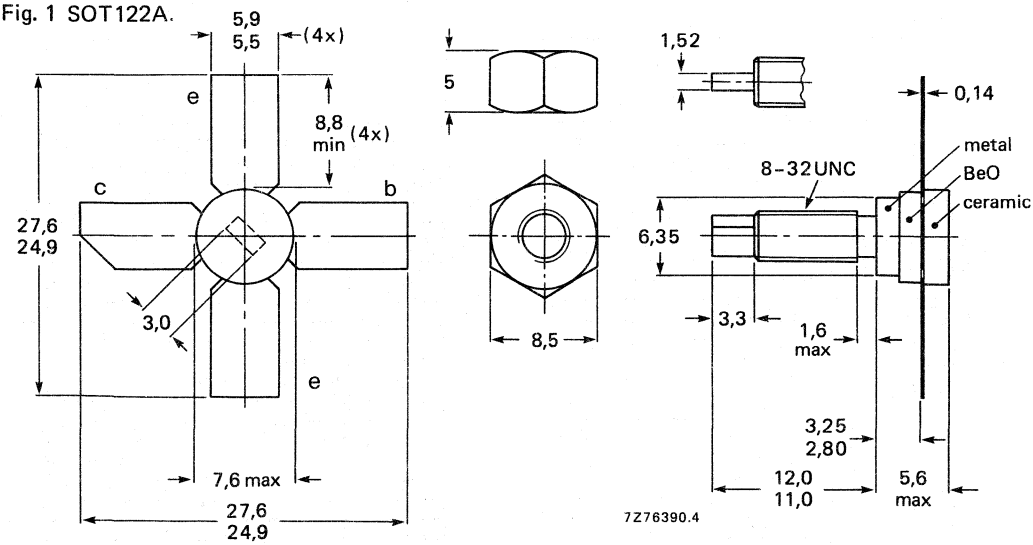
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} 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 SOT122A.



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

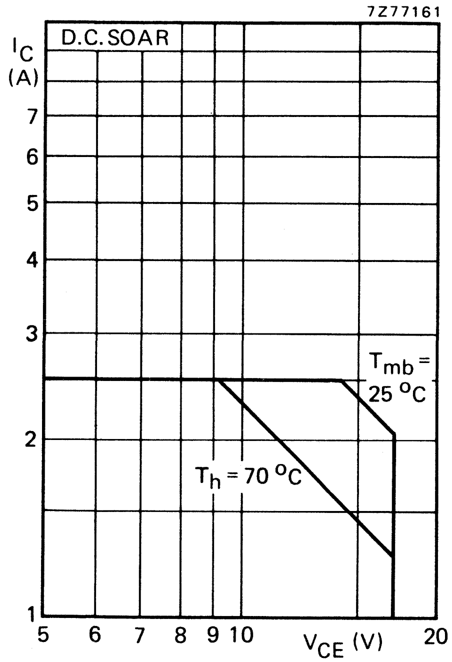


Fig.2.

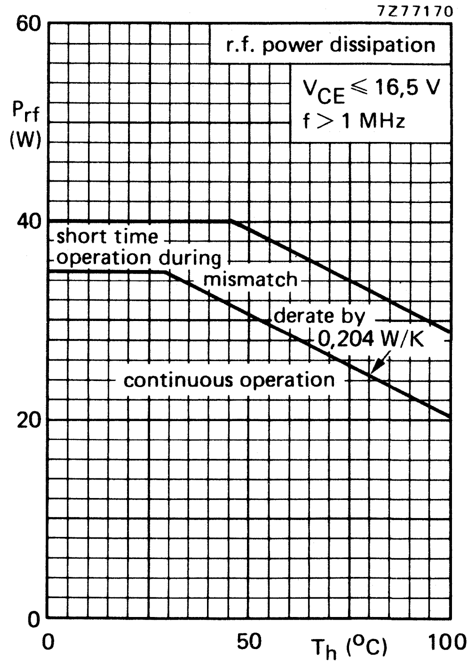


Fig.3.

Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	4,3	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

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}	> typ	10 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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

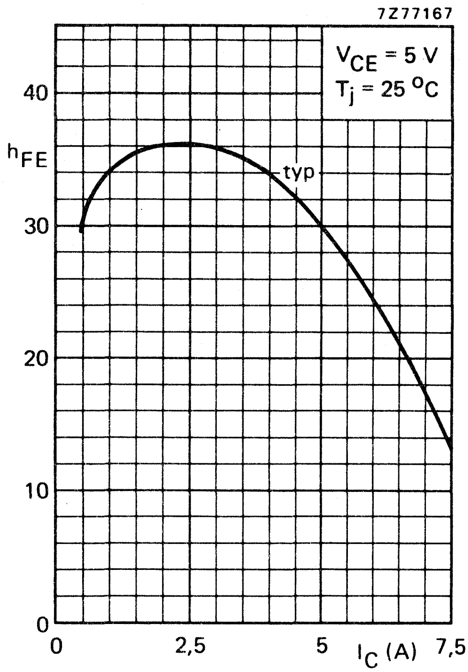


Fig.4.

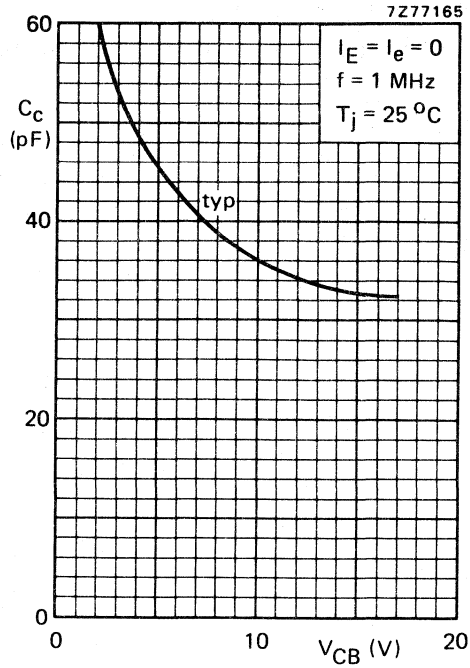


Fig.5.

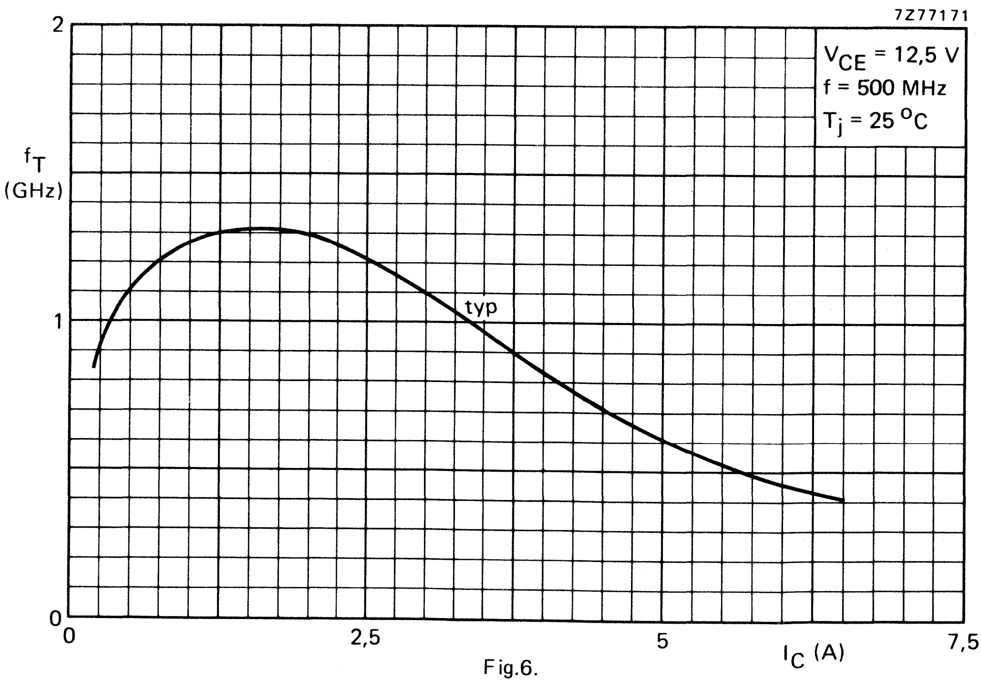


Fig.6.

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 (%)	$\overline{z_i}$ (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

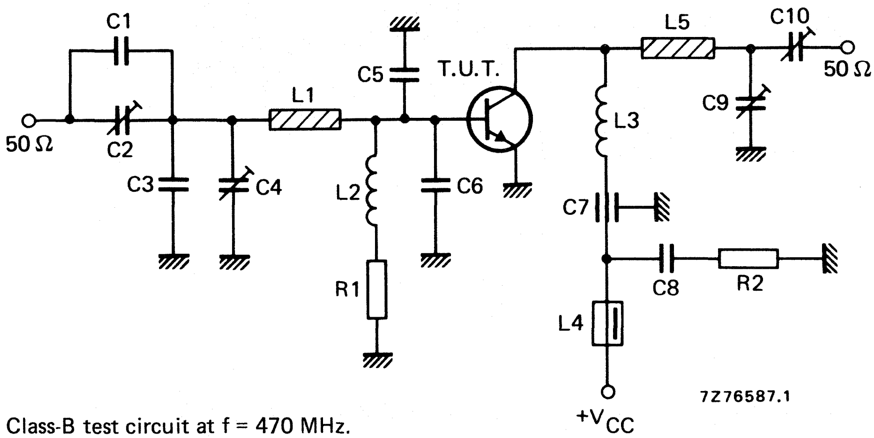


Fig.7 Class-B test circuit at f = 470 MHz.

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

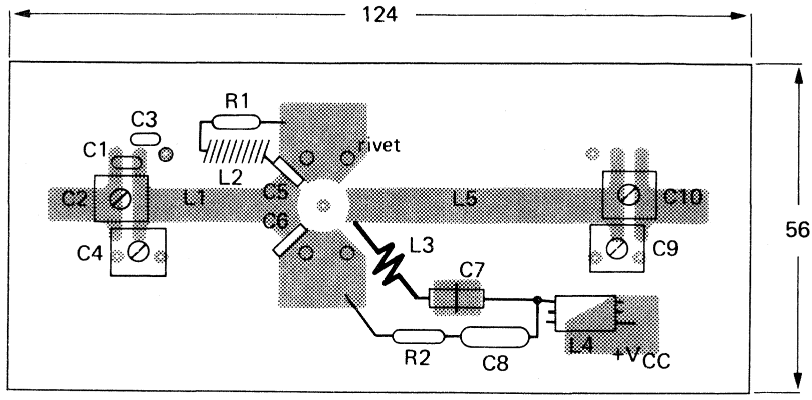
L1 = stripline (27,9 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm
L3 = 17 nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm
L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = stripline (45,8 mm x 6,0 mm)

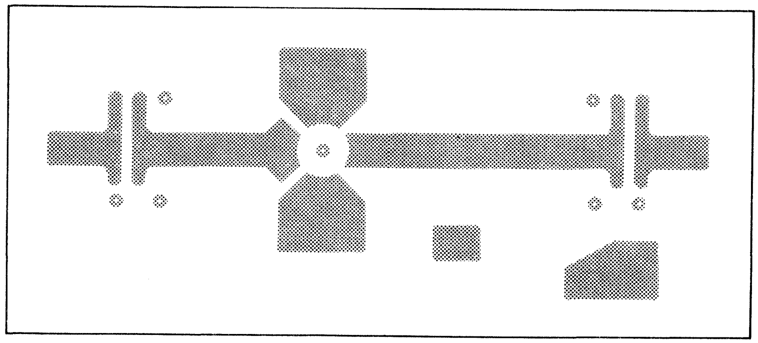
L1 and L5 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = 1 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit (Fig.8).

APPLICATION INFORMATION (continued)





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.8 Component layout and printed-circuit board for 470 MHz test circuit.

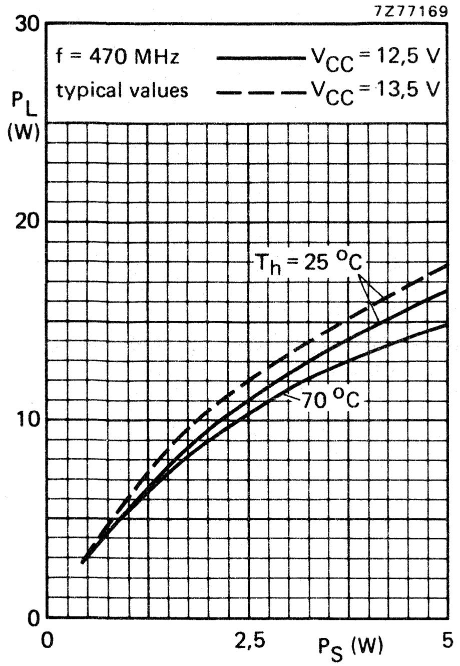


Fig.9.

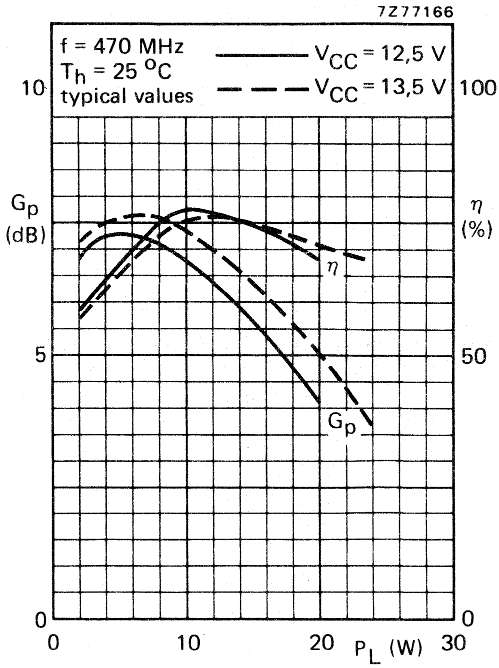


Fig.10.

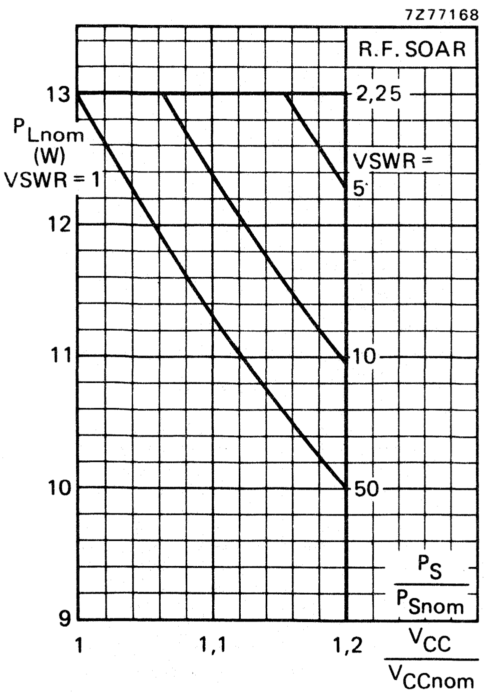


Fig.11.

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 measured in the circuit of Fig.7.

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.

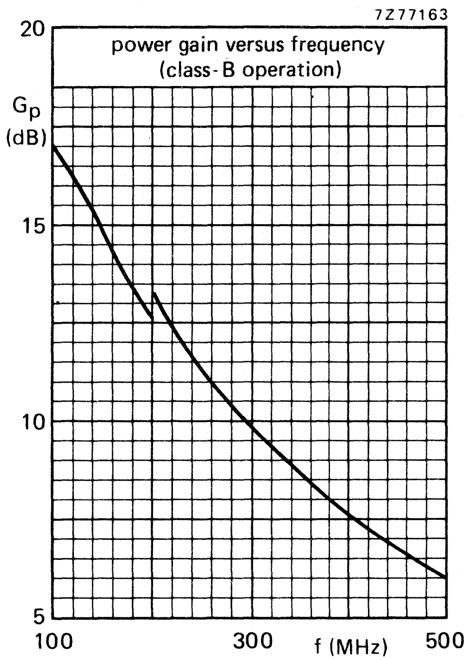


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 10 W
T_h = 25 °C
typical values

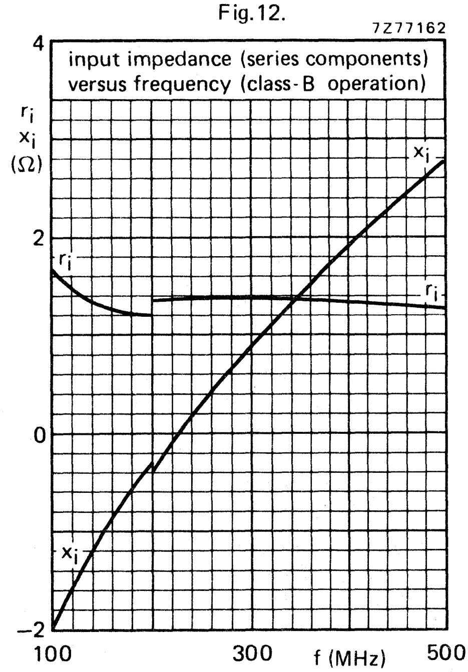


Fig.13.

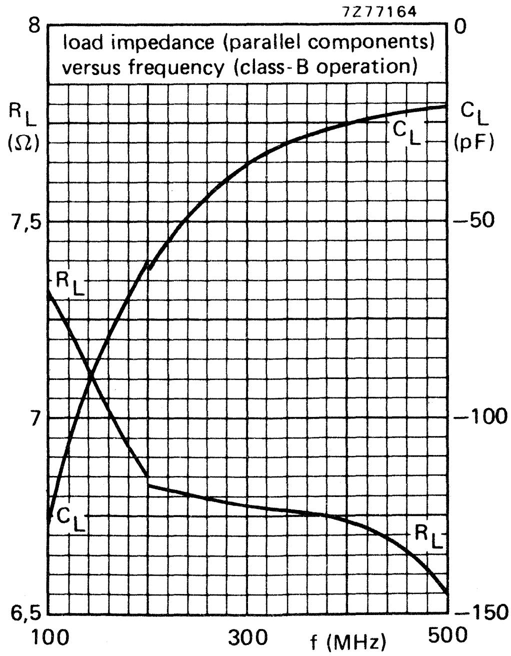


Fig.14.

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

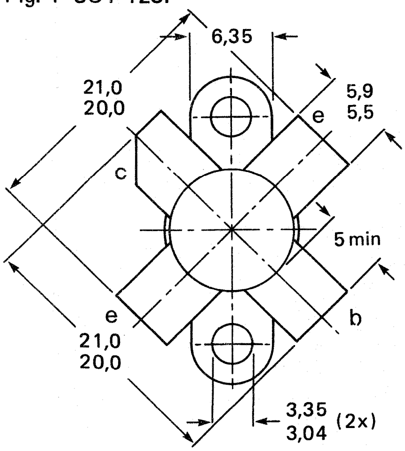
R.F. performance

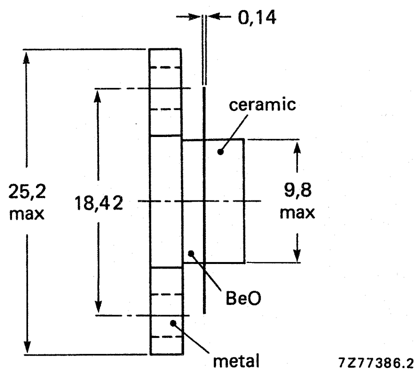
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η_{dt} %	I_C A	d_3 dB	T_h °C
s.s.b. (class-A)	**26**	**1,6 – 28**	**0 – 10** (P.E.P.)	> **20**	–	**1,35**	< **–40**	**70**
s.s.b. (class-AB)	28	1,6 – 28	3 – 30 (P.E.P.)	typ. 21	typ. 40	typ. 1,34	typ. –30	25

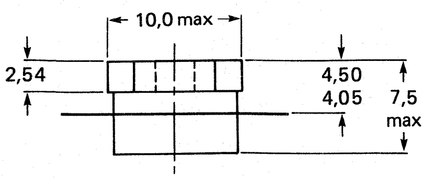
MECHANICAL DATA

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

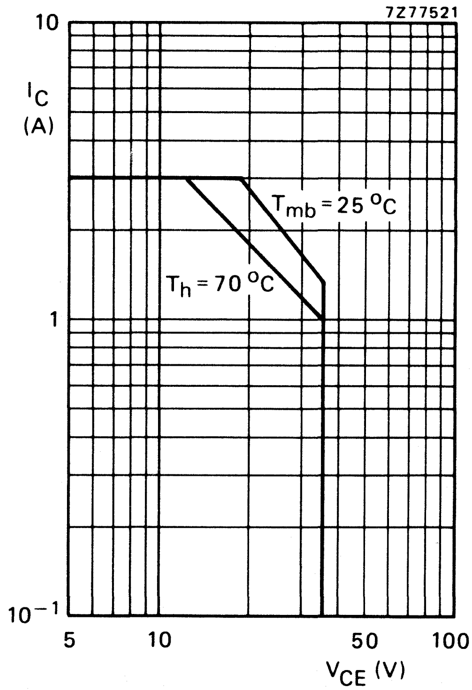


Fig. 2 D.C. SOAR.

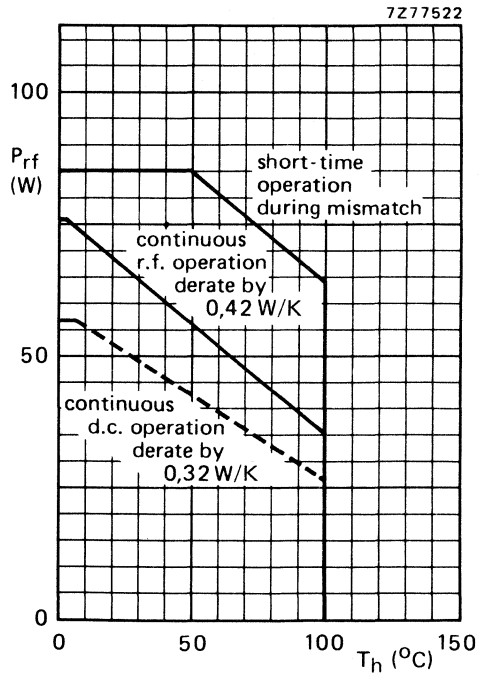


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.

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

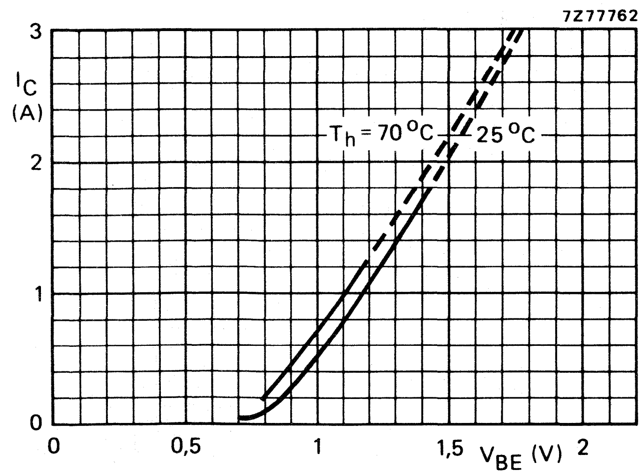


Fig. 4 Typical values; V_{CE} = 28 V.

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

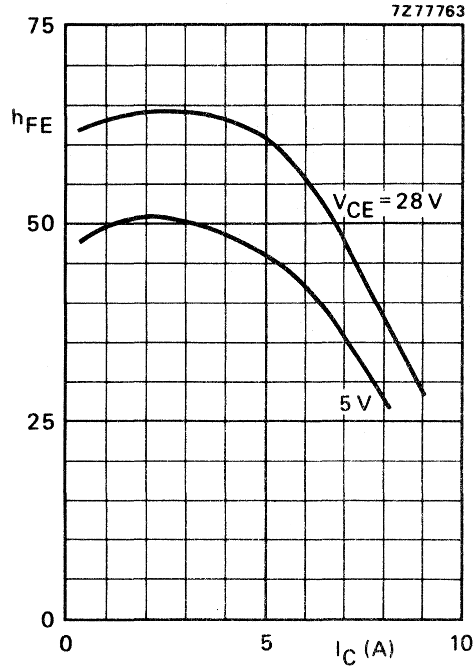


Fig. 5 Typical values; T_j = 25 °C.

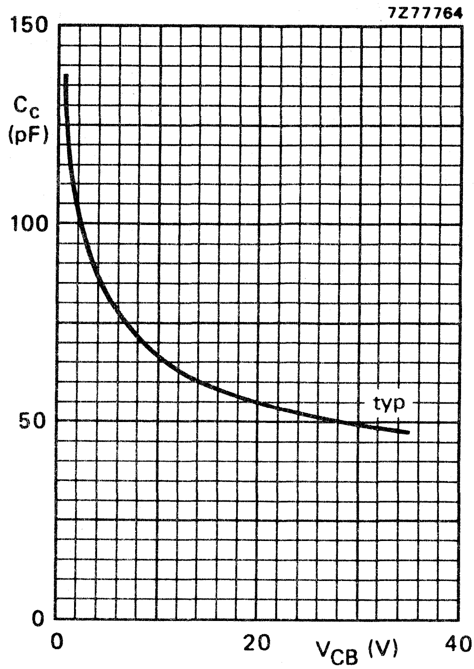


Fig. 6 I_E = I_e = 0; f = 1 MHz; T_j = 25 °C.

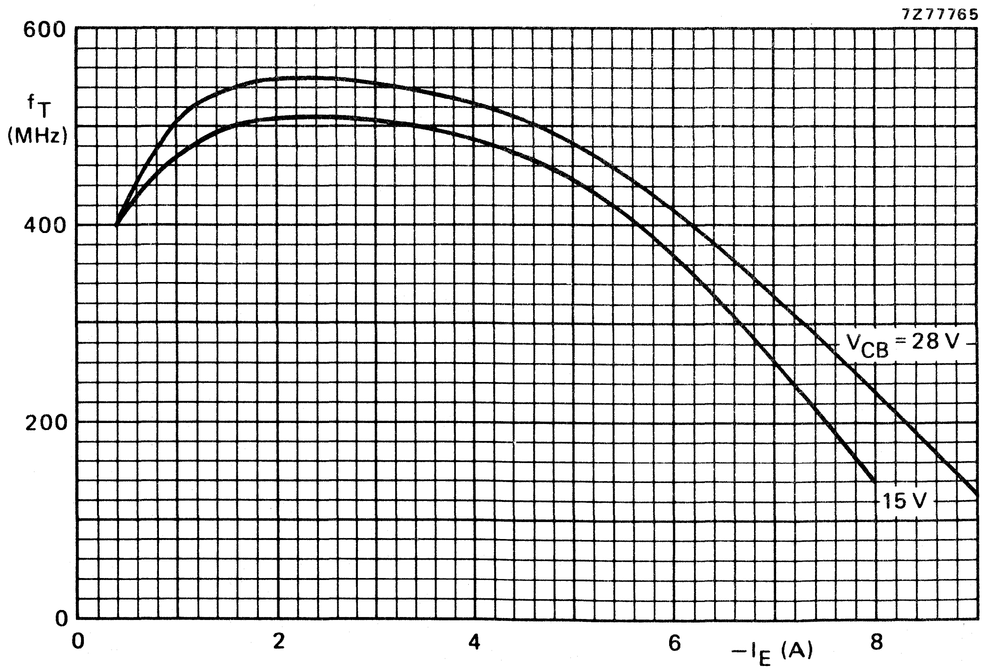


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

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
> 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

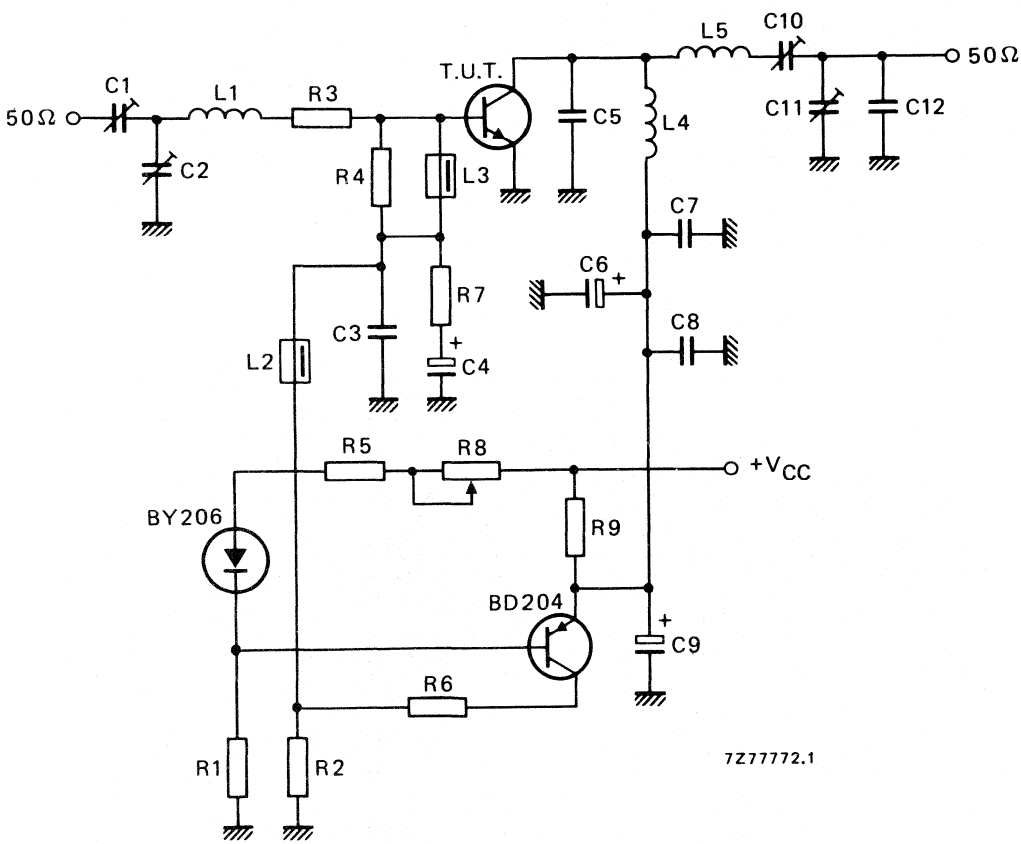


Fig. 8 Test circuit; s.s.b. class-A.

* 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)

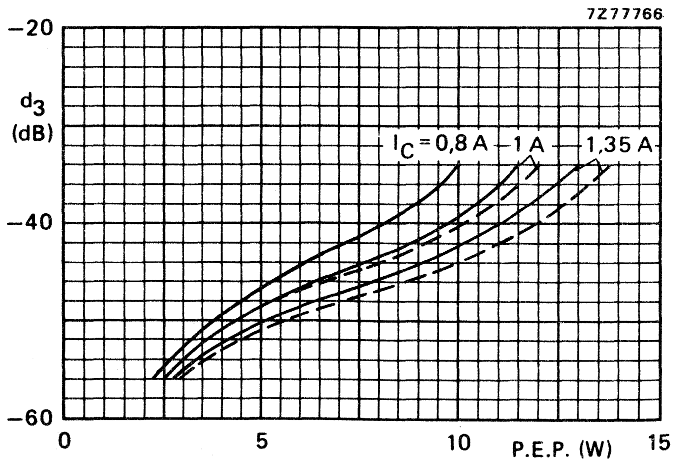


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; —— T_h = 70 °C; – – – T_h = 25 °C.

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

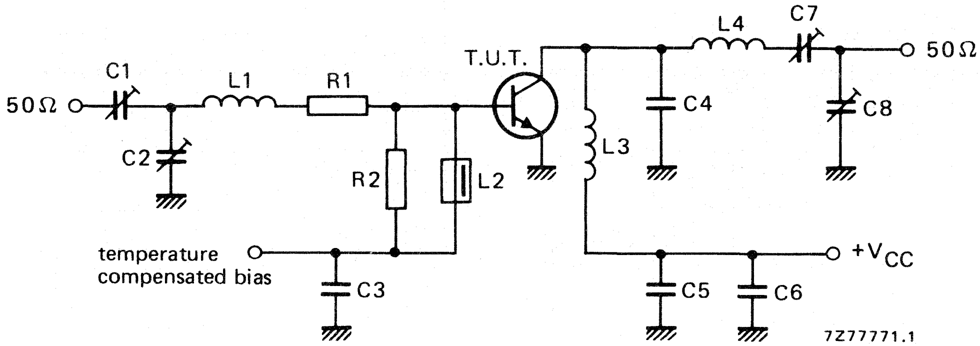


Fig. 10 Test circuit; s.s.b. class-AB.

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.

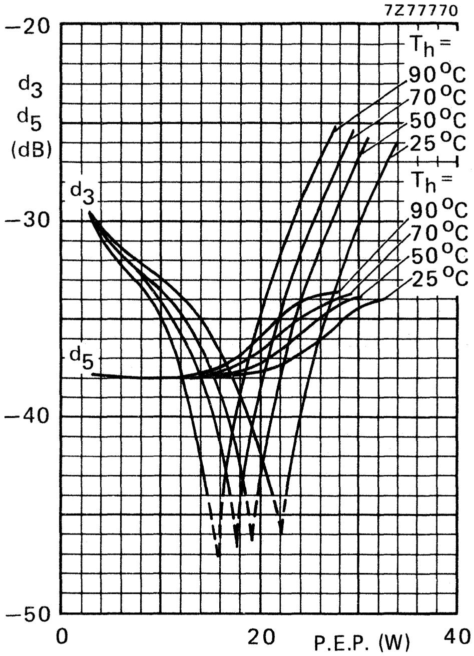


Fig. 11 Intermodulation distortion as a function of output power.*

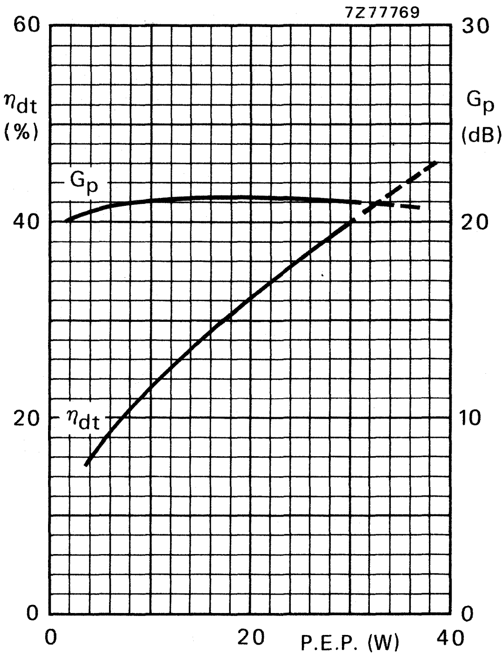


Fig. 12 Double-tone efficiency and power gain as a function of output power.

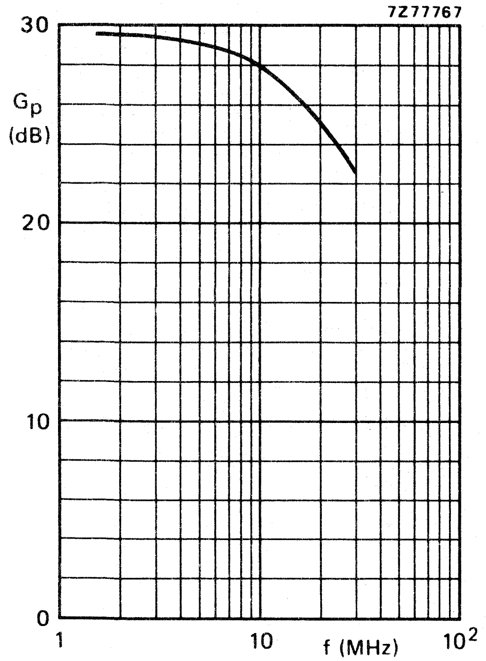
Conditions for Fig. 11:

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.



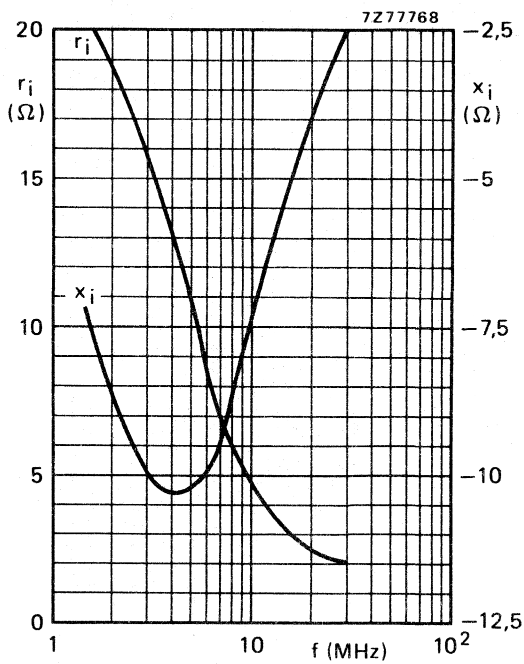


Fig. 13 Power gain as a function of frequency.

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

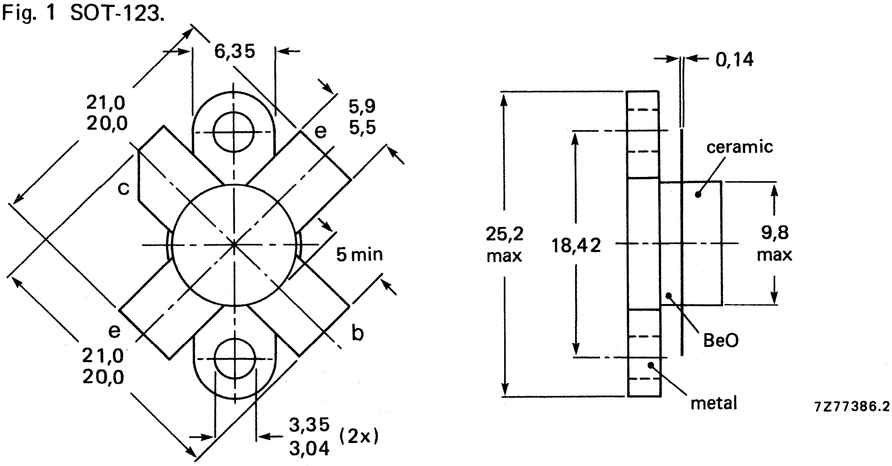
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

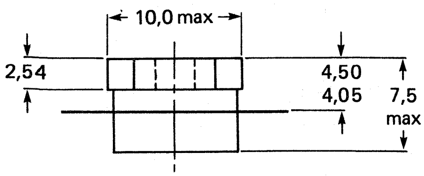
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**28**	**175**	**25**	**> 9**	**> 60**	**1,0 + j1,2**	**59 − j54**

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

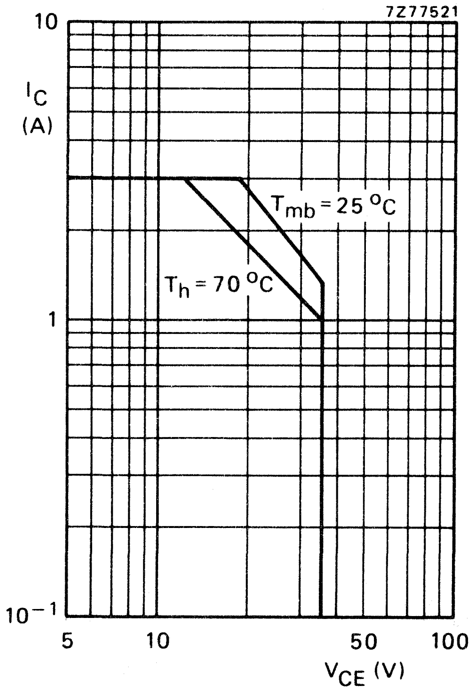


Fig. 2 D.C. SOAR.

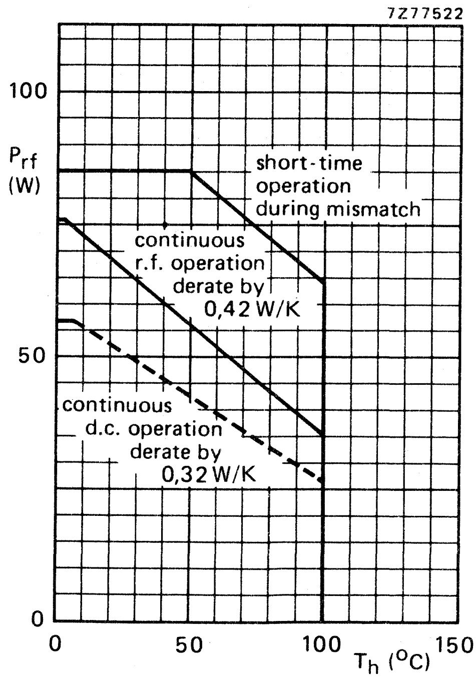


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

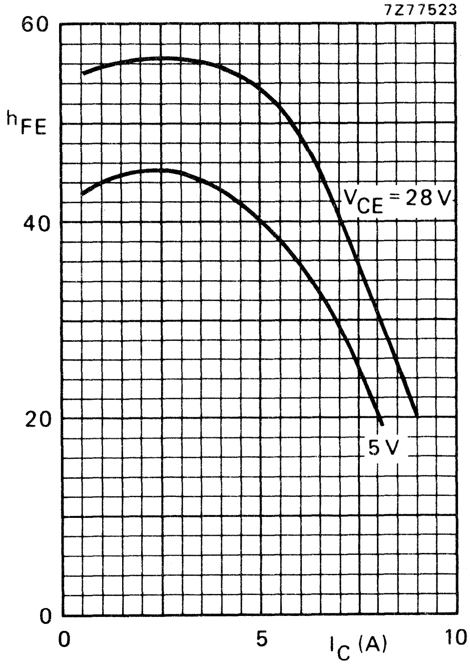


Fig. 4 Typical values; T_j = 25 °C.

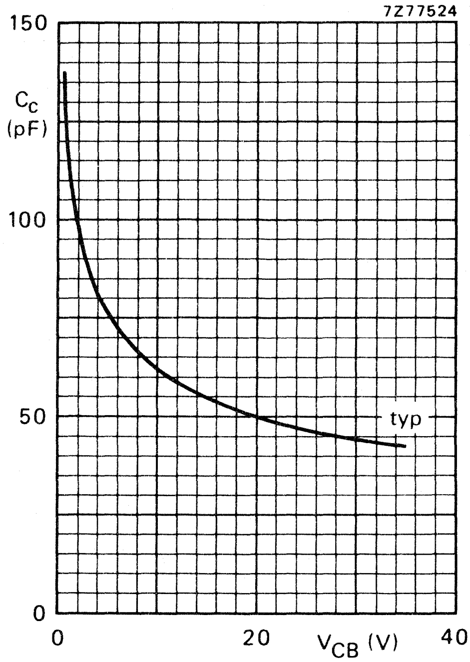


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

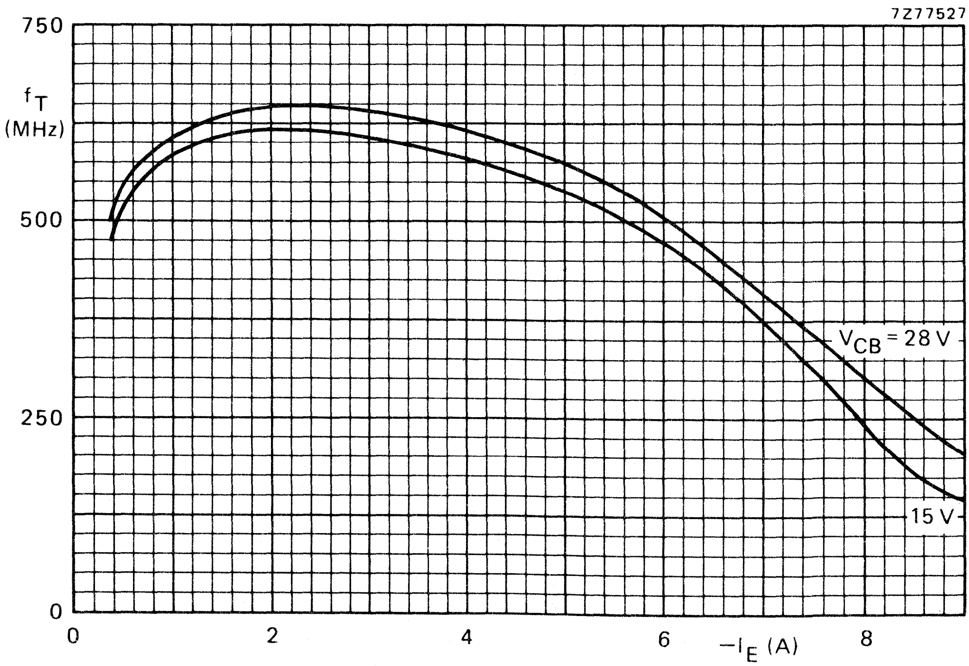


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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**

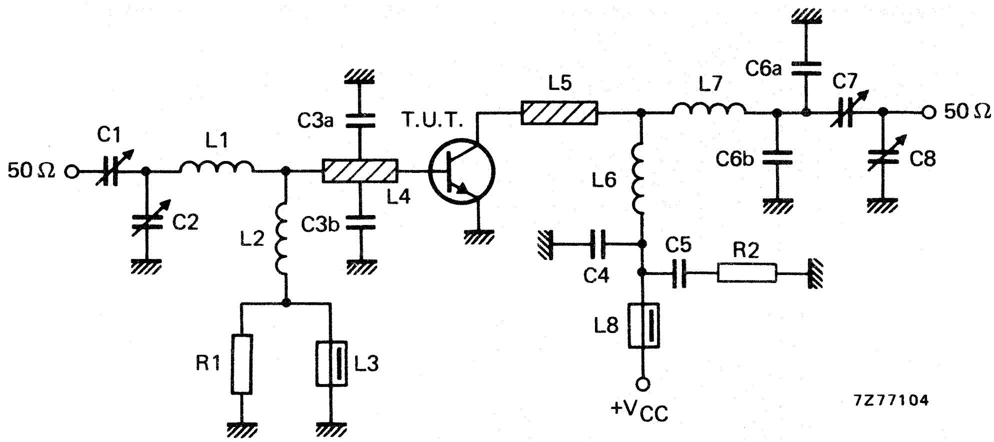


Fig. 7 Test circuit; c.w. class-B.

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)

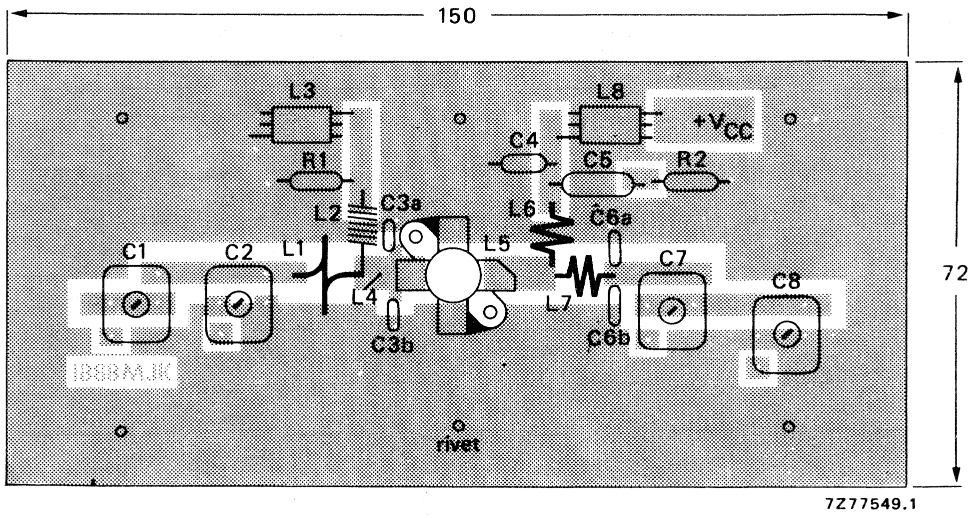
L1 = 14 nH; 1 turn enamelled Cu wire (1,6 mm); int. dia. 7,7 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and 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)



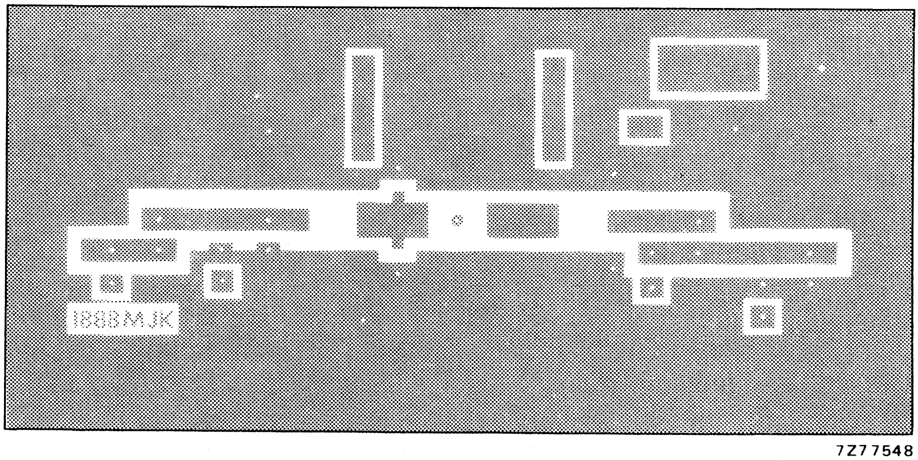


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

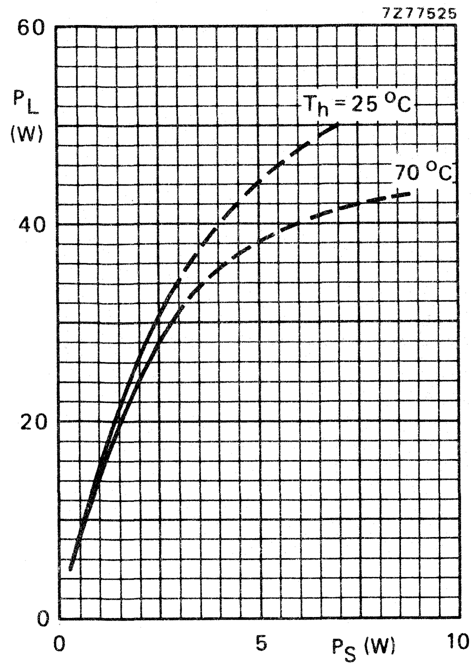


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

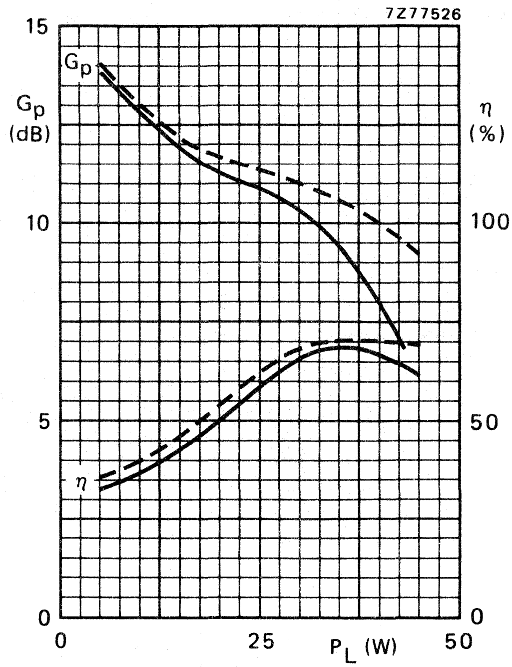


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values;
– – – T_h = 25 °C; ——— T_h = 70 °C.

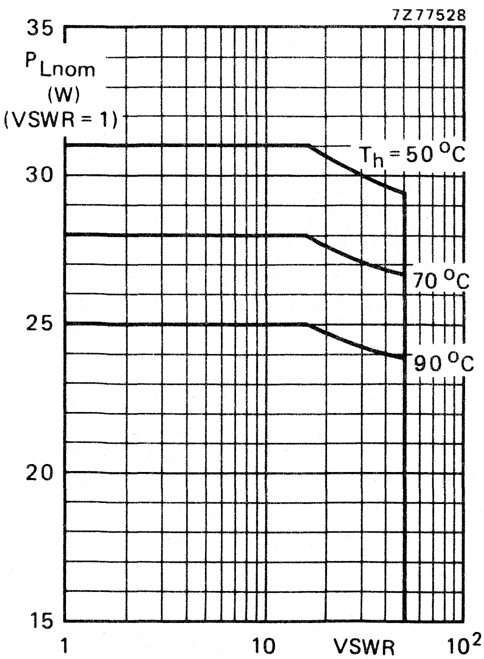


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

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.

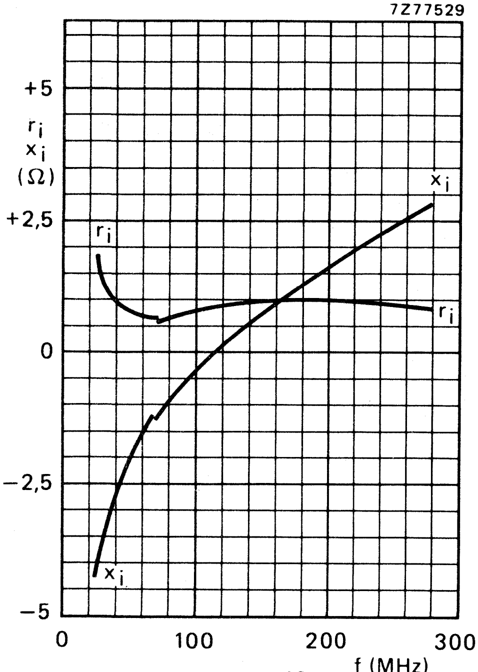


Fig. 12.

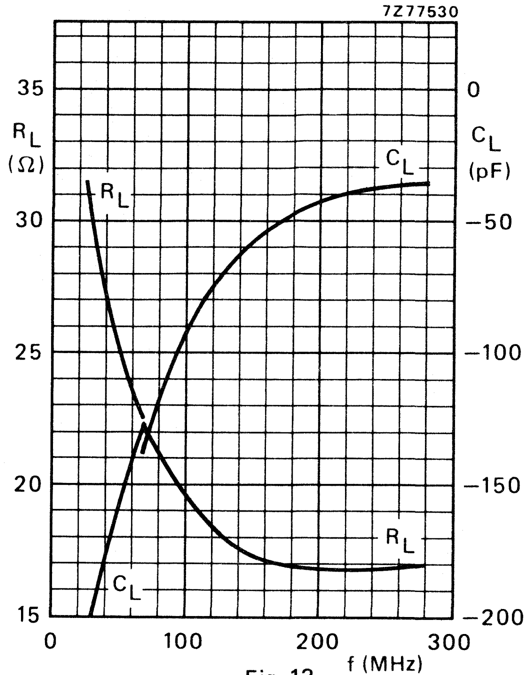
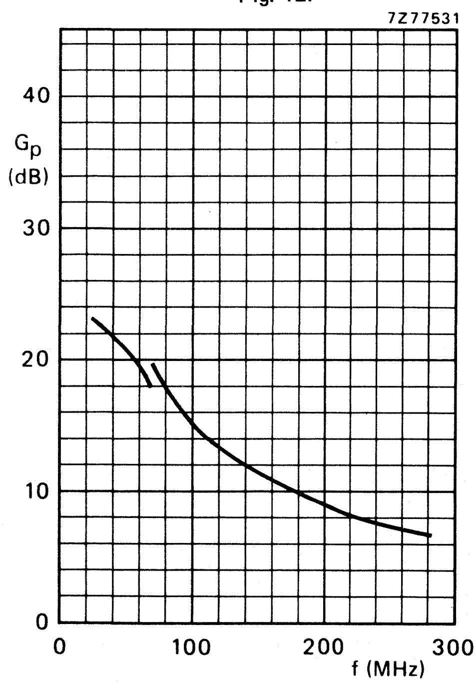


Fig. 13.



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

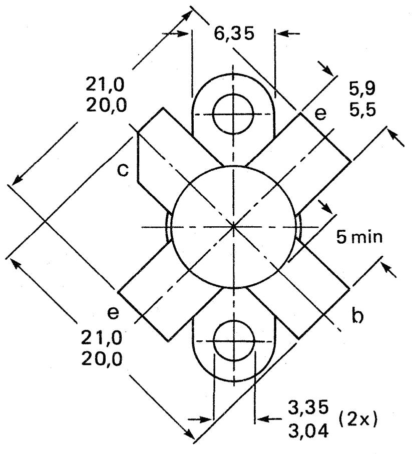
R.F. performance up to T_h = 25 °C

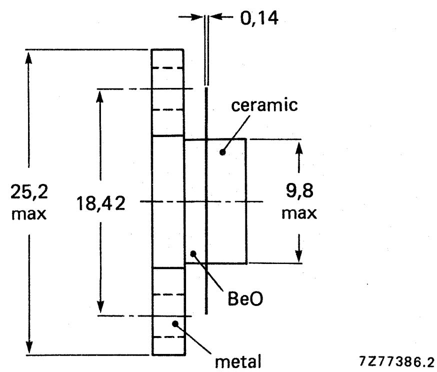
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Z_L}$ Ω	d_3 dB
c.w. (class-B)	**12,5**	**175**	**45**	**> 4,5**	**> 75**	**1,4 + j1,5**	**2,7 − j1,3**	**—**
s.s.b. (class-AB)	12,5	1,6–28	3–30 (P.E.P.)	typ. 19,5	typ. 35	—	—	typ. −33

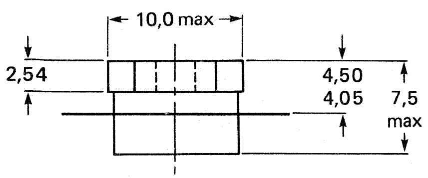
MECHANICAL DATA

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.	16	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

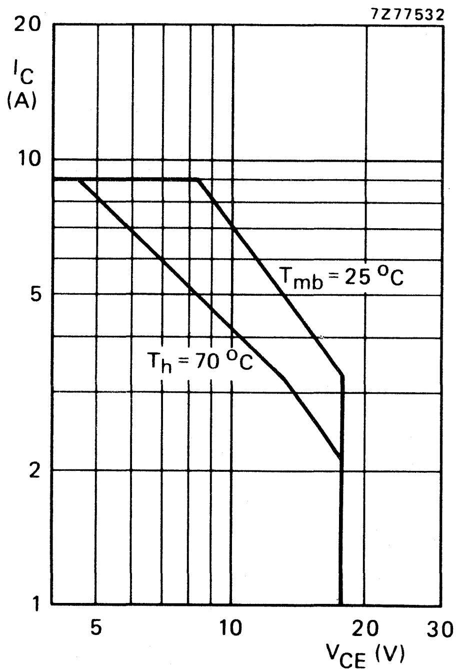


Fig. 2 D.C. SOAR.

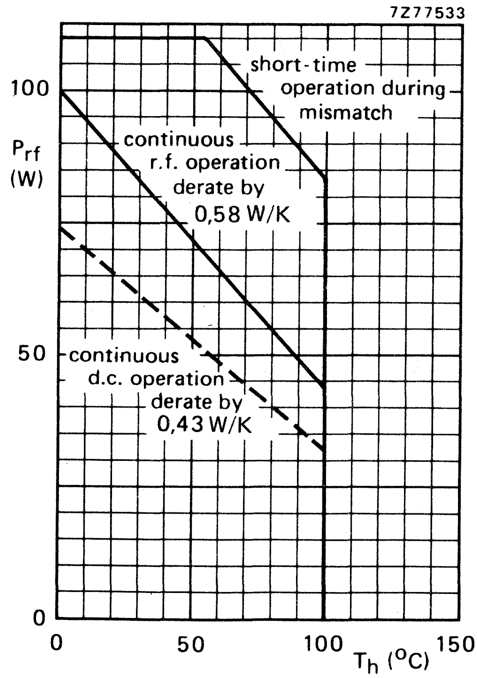


Fig. 3 R.F. power dissipation; V_{CE} ≤ 16,5 V; f ≥ 1 MHz.

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	$V_{(BR)CEO}$	>	16 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.	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* $-I_E = 4$ 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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

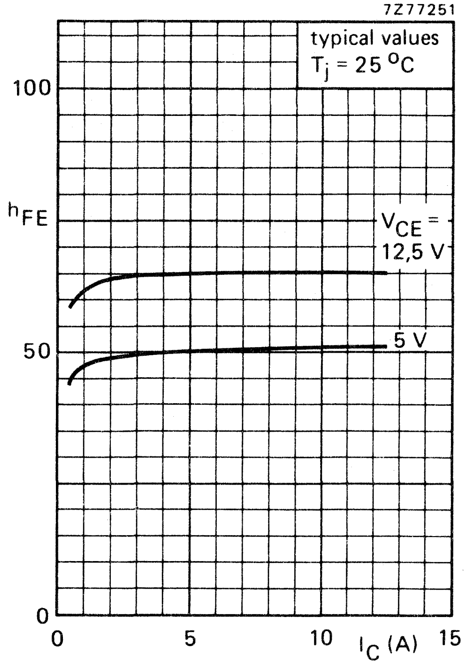


Fig. 4.

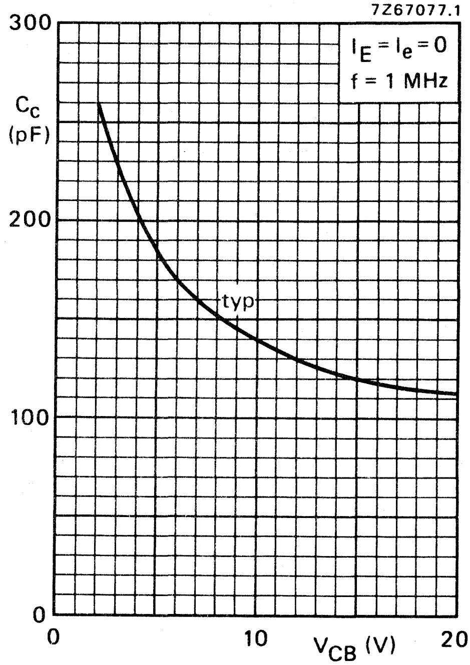


Fig. 5 T_j = 25 °C.

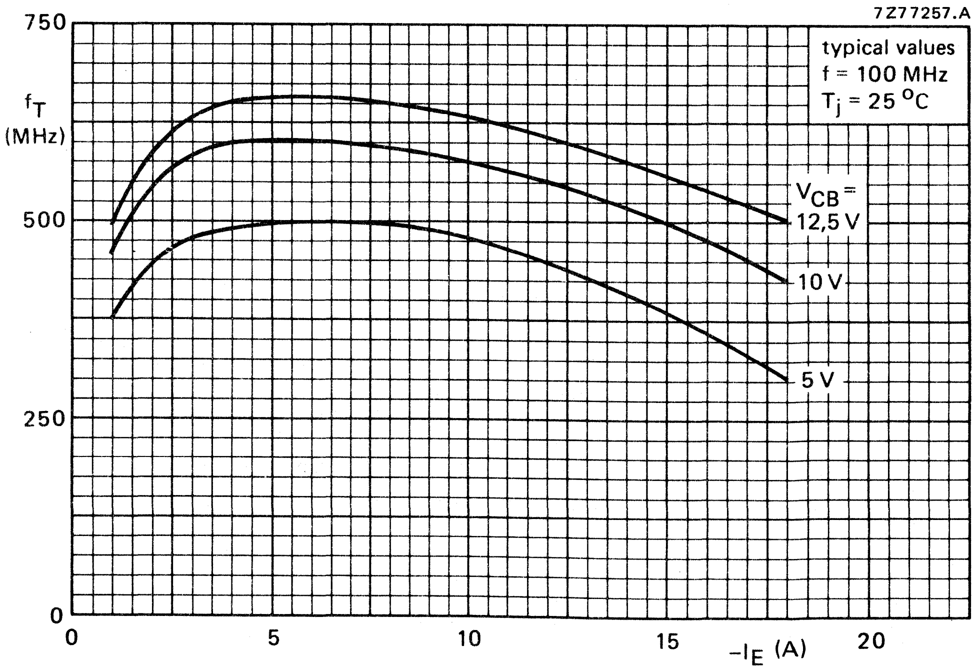


Fig. 6.

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)	$\bar{Z_L}$ (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	–	–

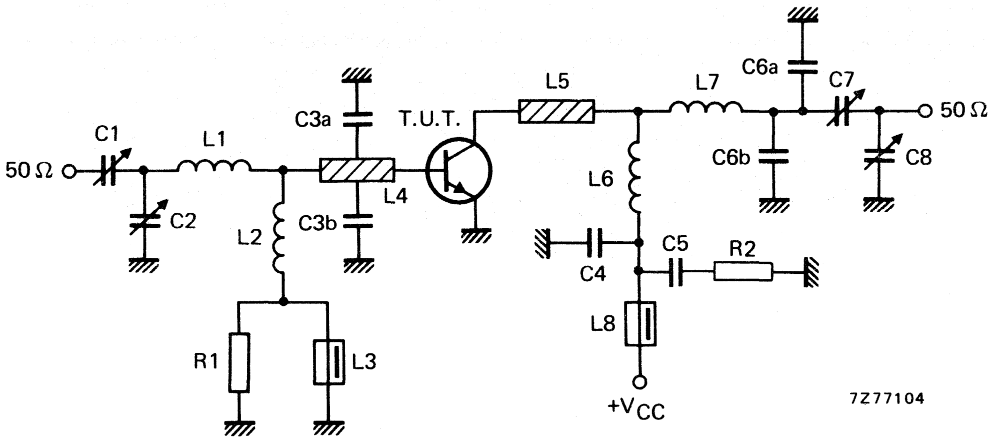


Fig. 7 Test circuit; c.w. class-B.

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)

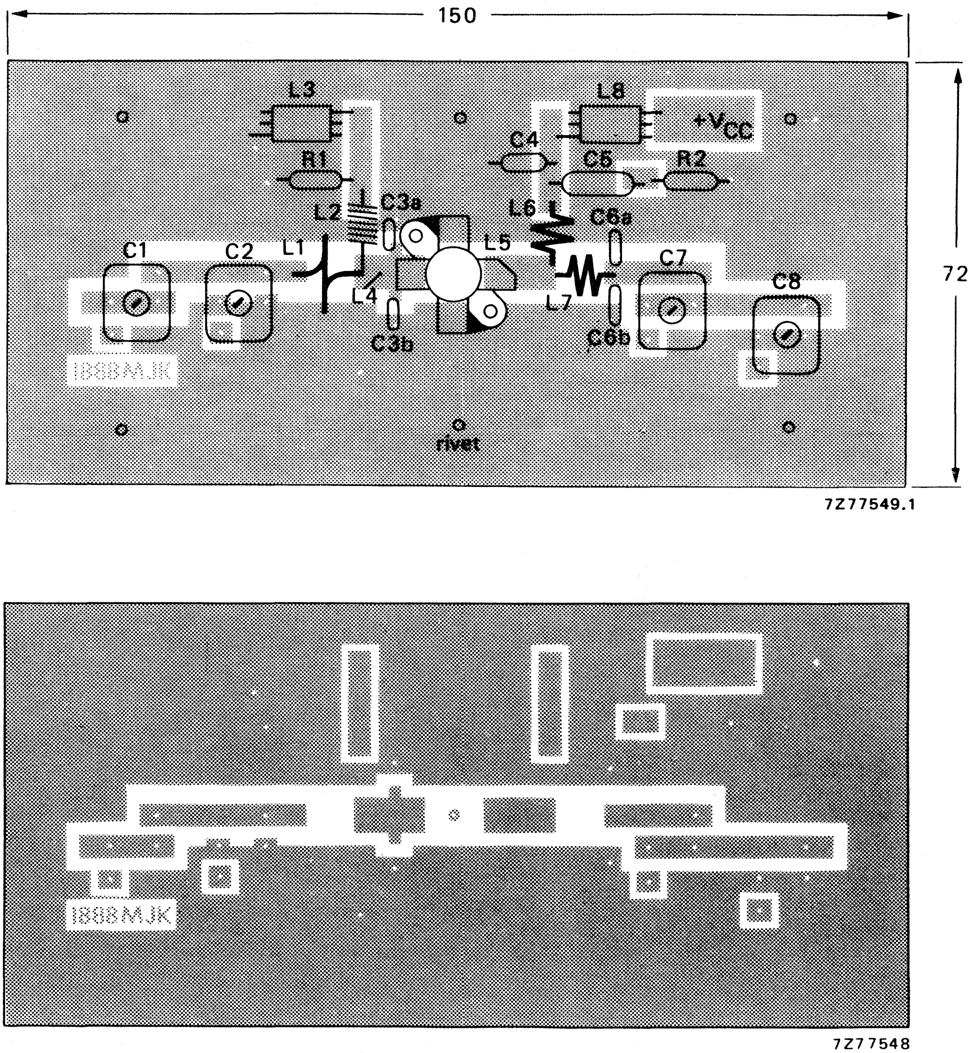


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

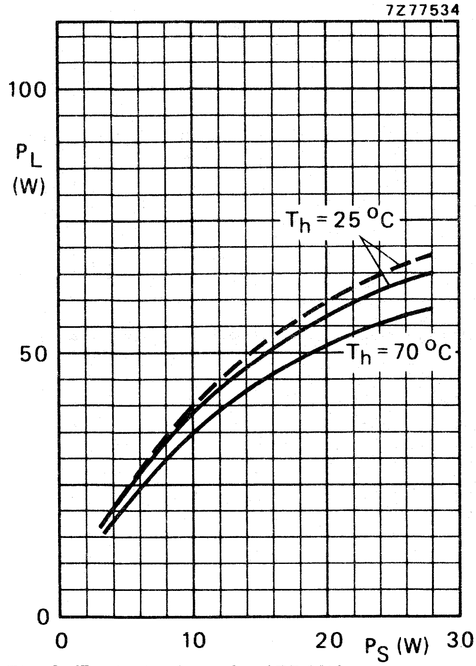


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 12,5 V; ---- V_{CE} = 13,5 V.

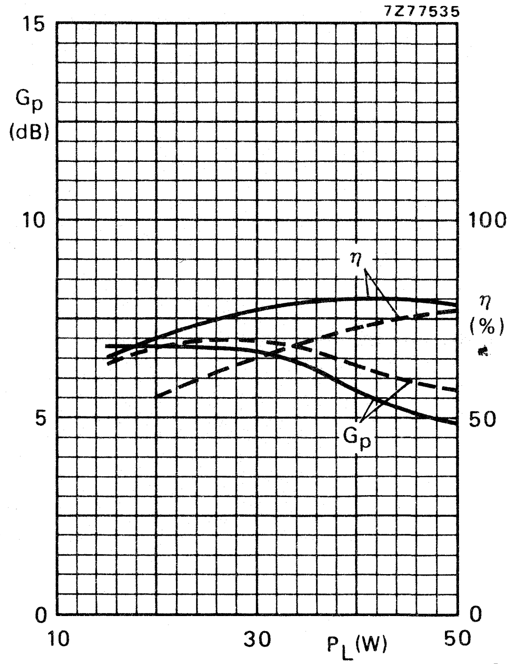


Fig. 10 Typical values; f = 175 MHz; T_h = 25 °C;
—— V_{CE} = 12,5 V; ---- V_{CE} = 13,5 V.

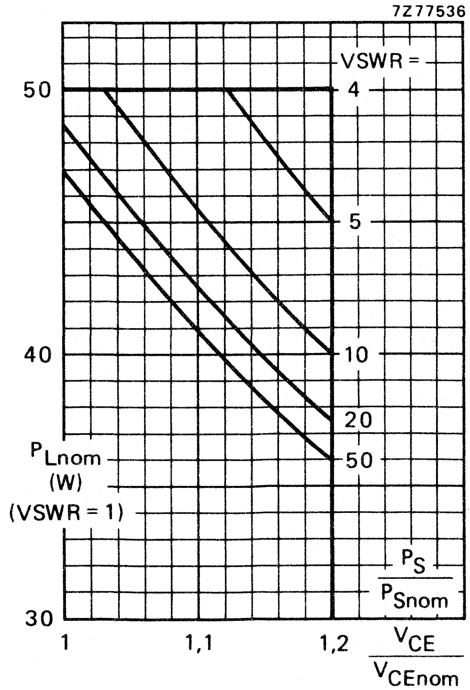


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb\text{-}h}$ = 0,3 K/W ; V_{CEnom} = 12,5 V or 13,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1 measured in the circuit of Fig.7.

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.

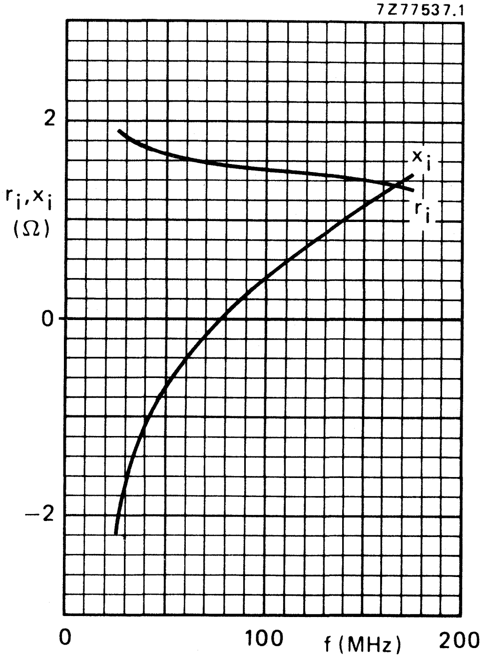


Fig. 12 Input impedance (series components).

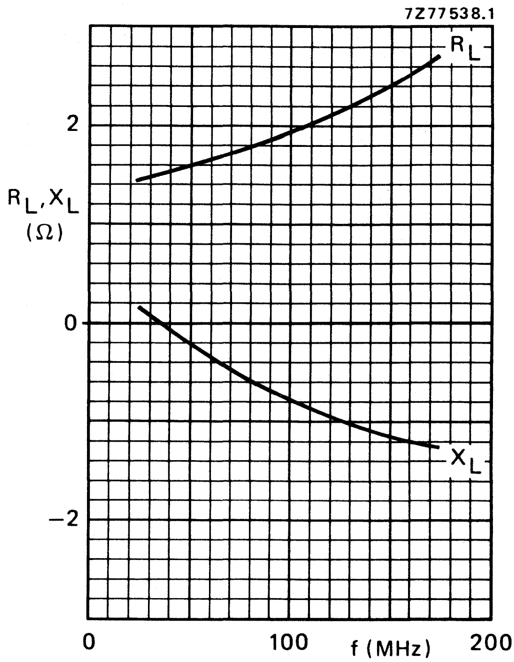


Fig. 13 Load impedance (series components).

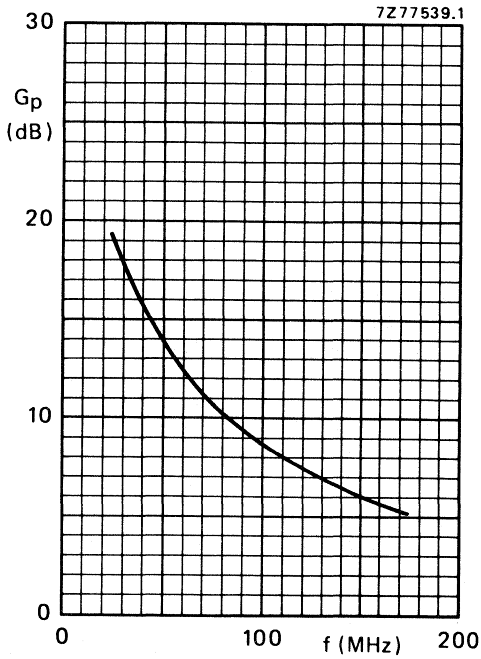


Fig. 14.

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; $R_{th\ mb\text{-}h} \leqslant$ 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

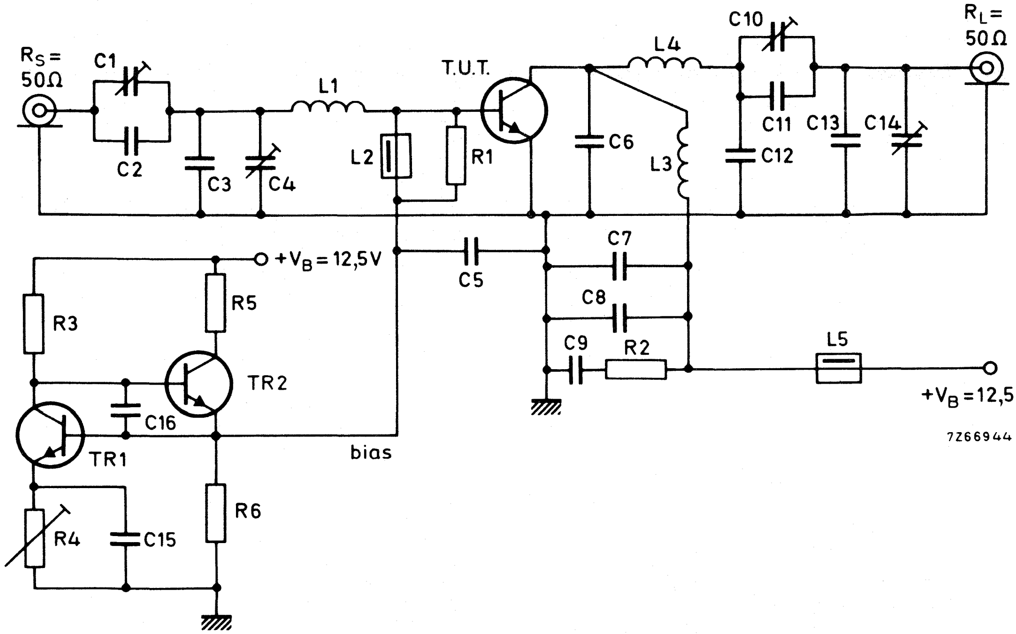


Fig. 15 Test circuit; s.s.b. class-AB.

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)

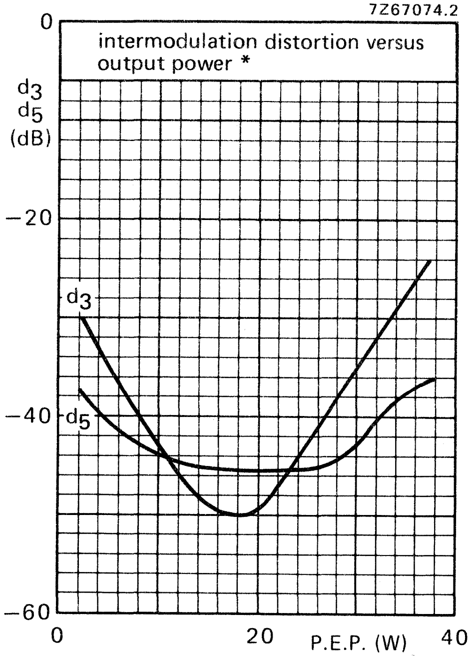


Fig. 16.

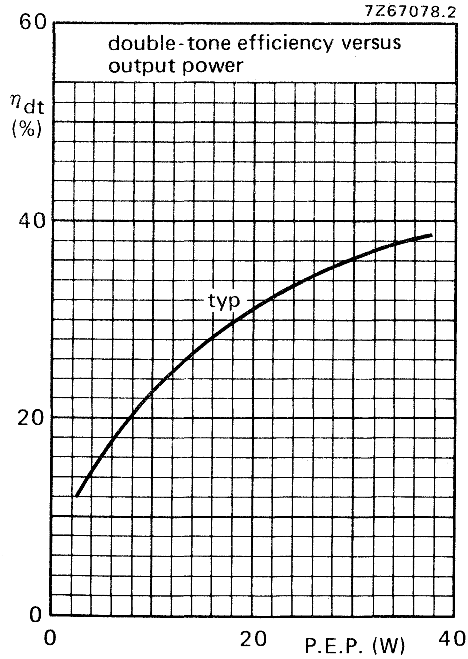


Fig. 17.

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; $R_{th\ mb\text{-}h}$ ≤ 0,3 °K/W; $I_{C(ZS)}$ = 25 mA; typical values.

* See next page.

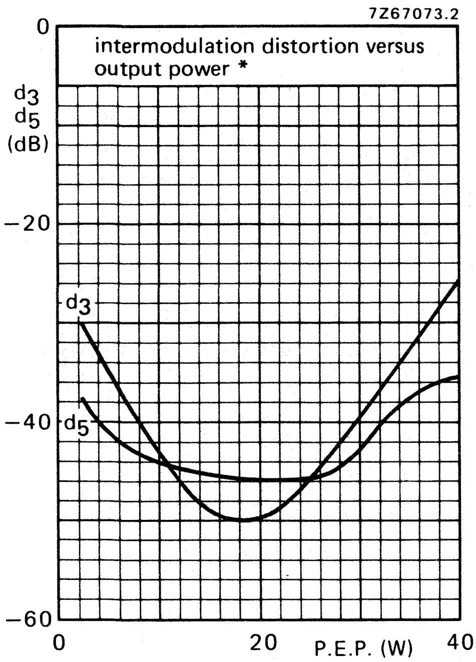


Fig. 18.

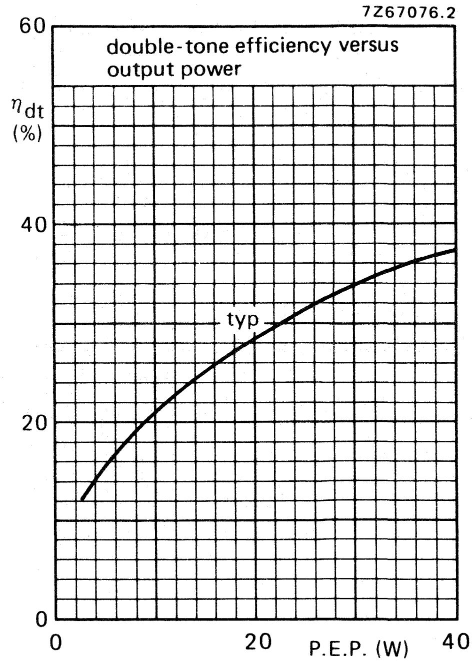


Fig. 19.

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)

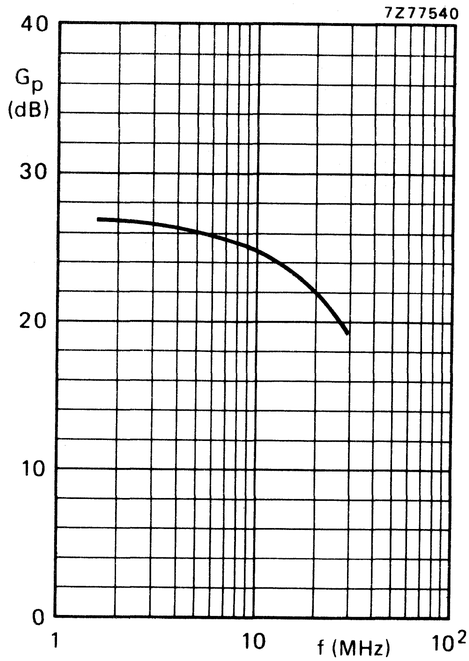


Fig. 20 Power gain as a function of frequency.

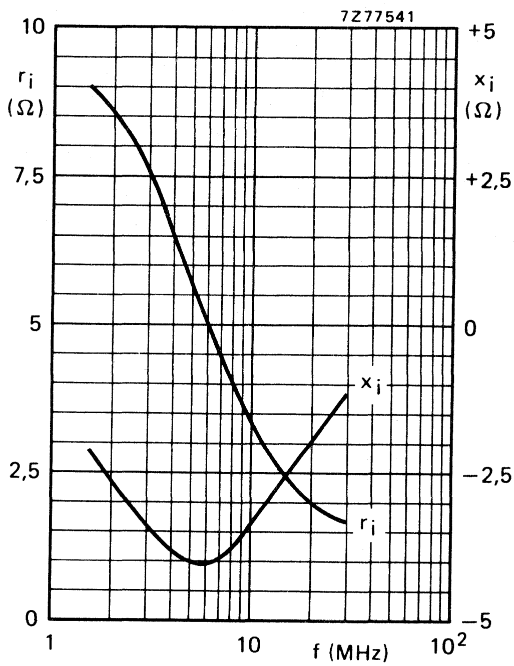


Fig. 21 Input impedance (series components) as a function of frequency.

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
$R_{th\ mb\text{-}h} \leq$ 0,3 K/W	$R_{th\ mb\text{-}h} \leq$ 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

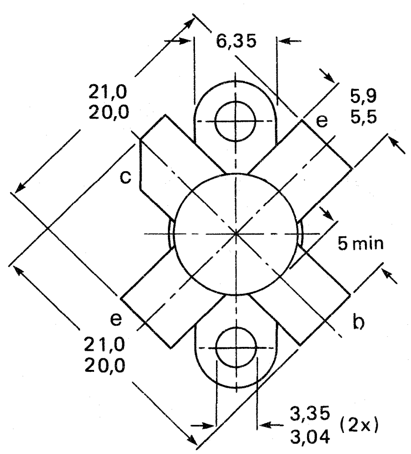
R.F. performance up to T_h = 25 °C

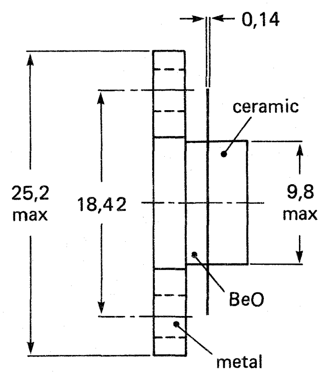
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS	d_3 dB
c.w. (class-B)	**28**	**175**	**45**	**> 7,5**	**> 70**	**0,7 + j1,3**	**110 − j62**	**−**
s.s.b. (class-AB)	28	1,6 − 28	5−47,5(P.E.P.)	typ. 19	typ. 45	−	−	typ. −30
s.s.b. (class-A)	26	1,6 − 28	17(P.E.P.)	typ. 22	−	−	−	typ. −42

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-123.





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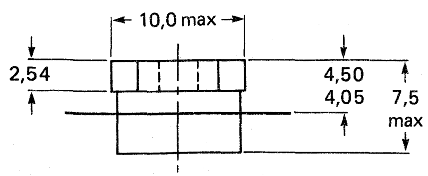


Torque on screw: min. 0,6 Nm (6 kg cm)
max. 0,75 Nm (7,5 kg cm)

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

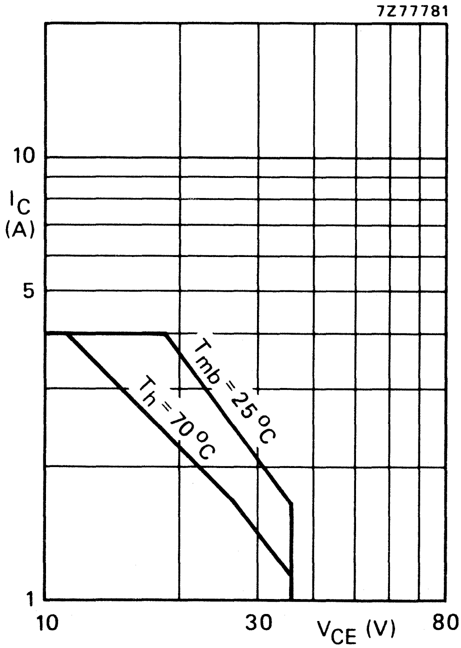


Fig. 2 D.C. SOAR.

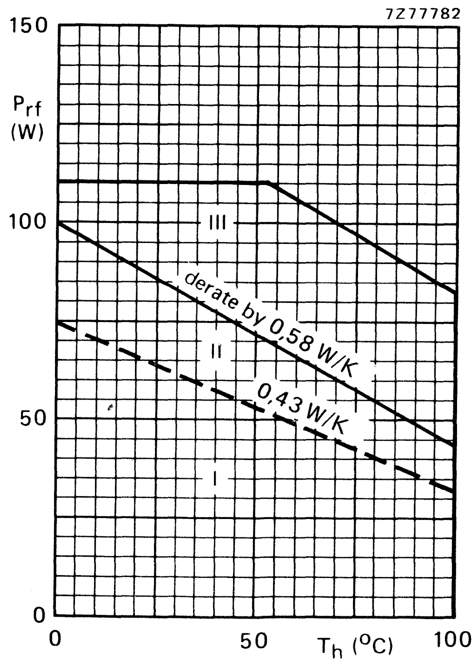


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 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

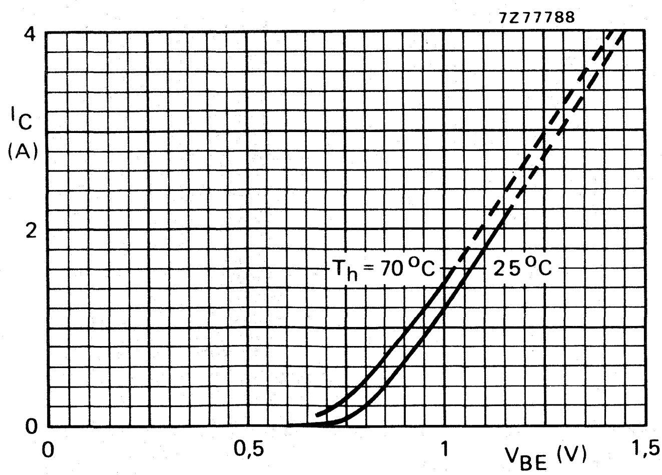


Fig. 4 Typical values; V_{CE} = 28 V.

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

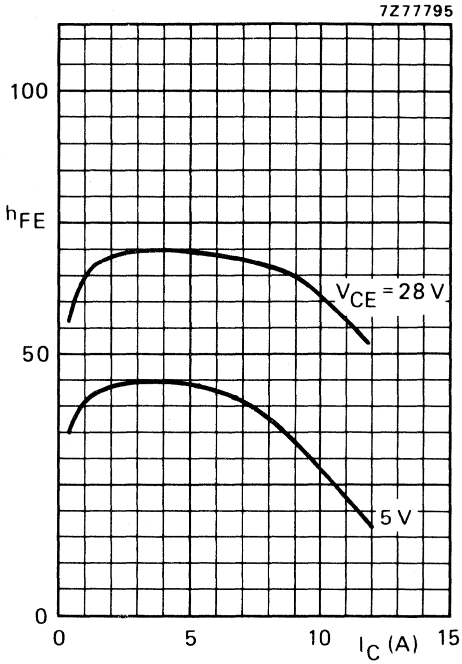


Fig. 5 Typical values; T_j = 25 °C.

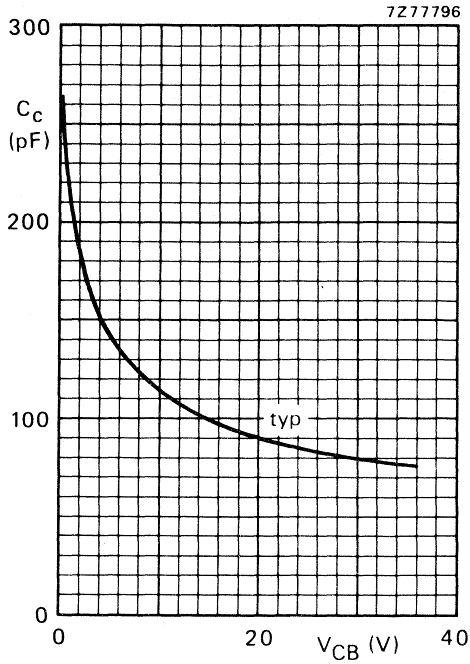


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

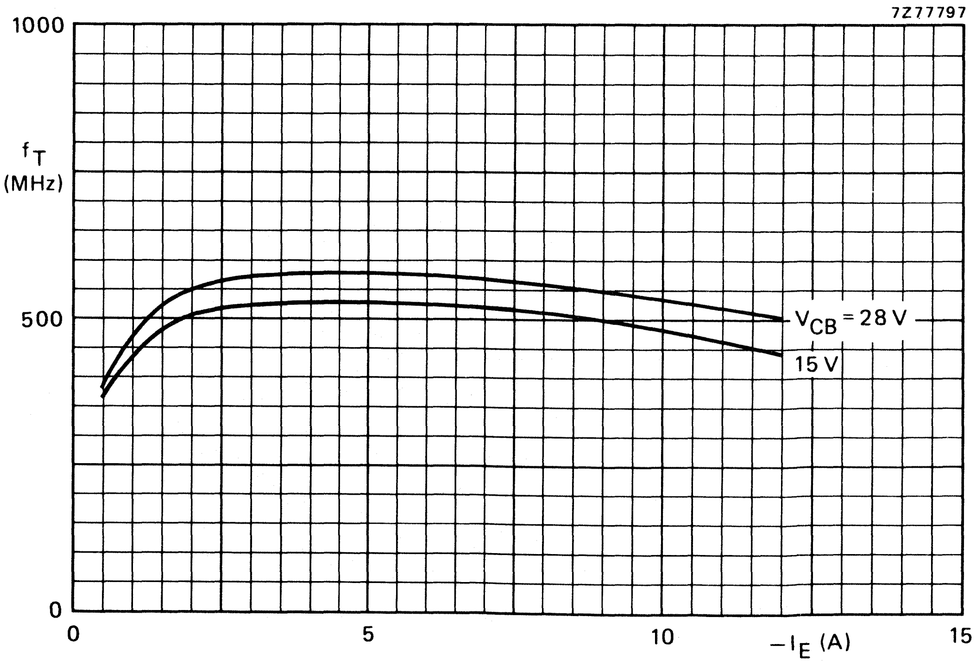


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

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

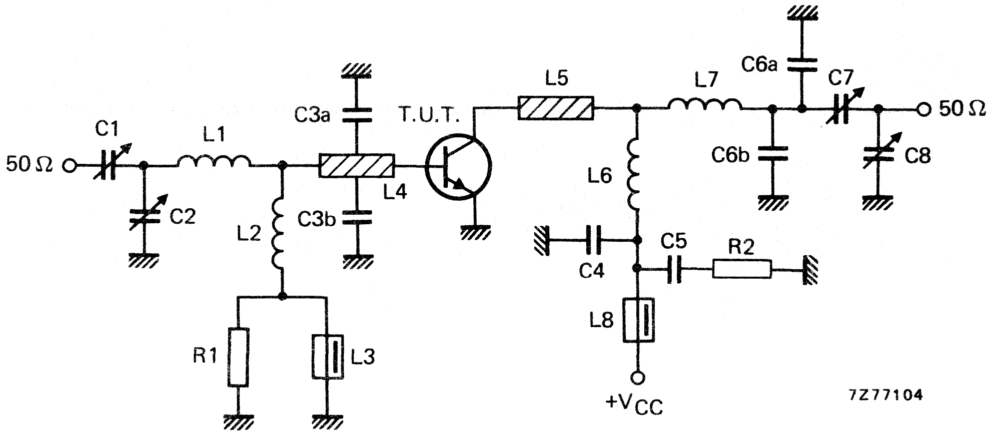


Fig. 8 Test circuit; c.w. class-B.

List of components:

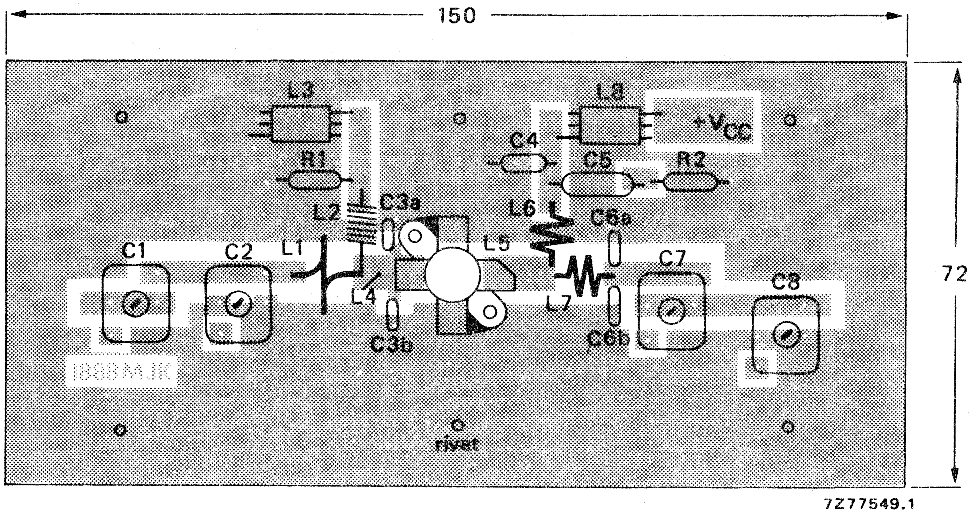
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic 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.



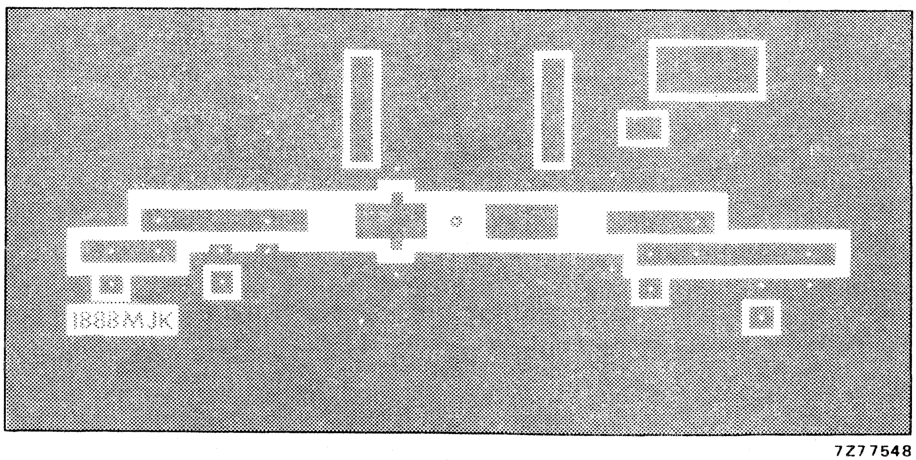


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

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.

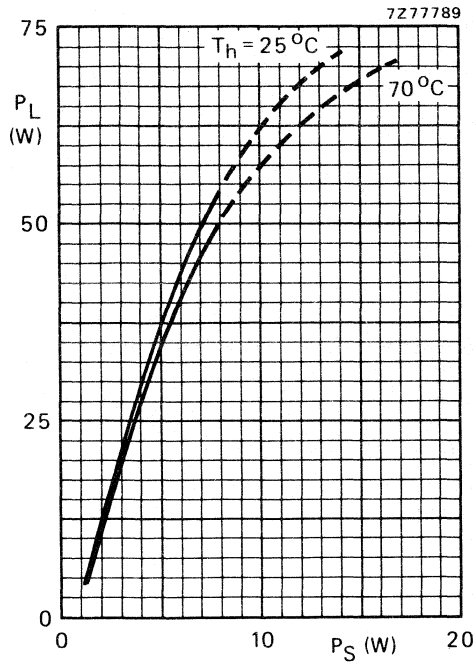


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

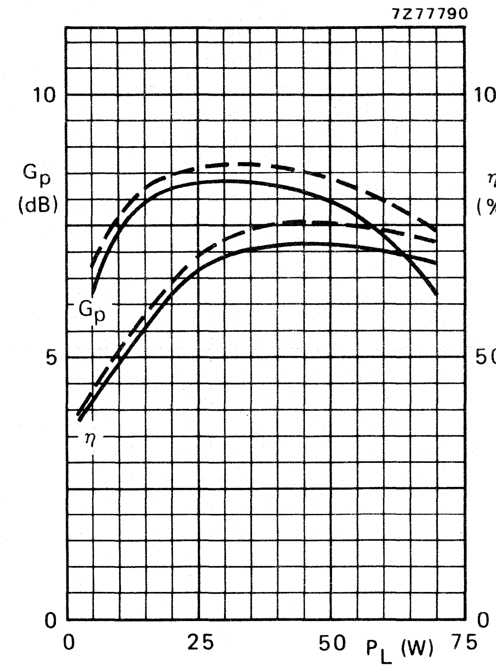


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz;
– – – T_h = 25 °C; —— T_h = 70 °C.

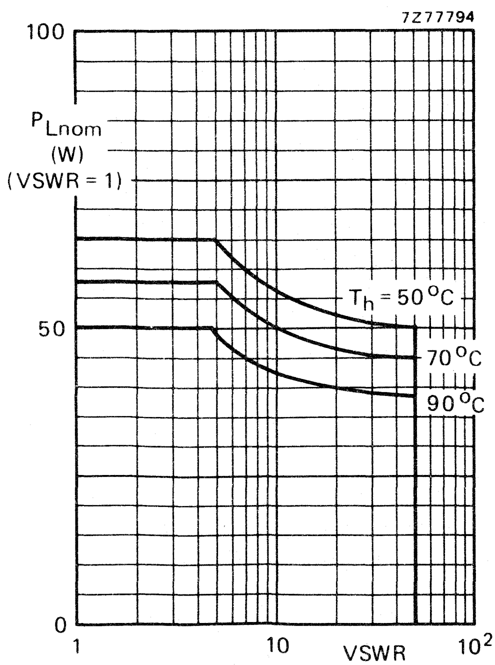


Fig. 12 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,3 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

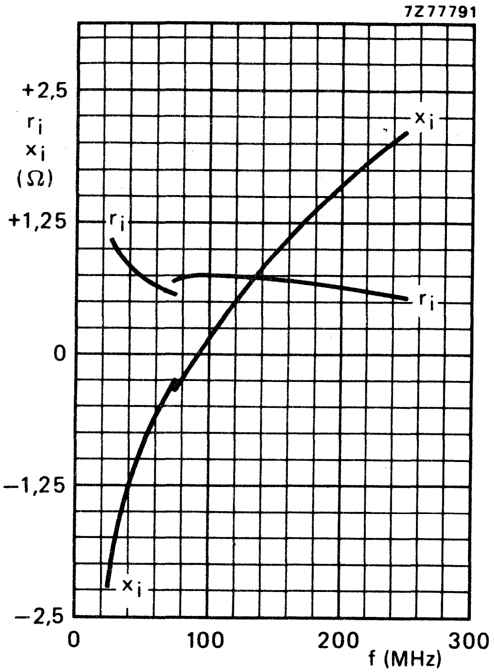


Fig. 13 Input impedance (series components).

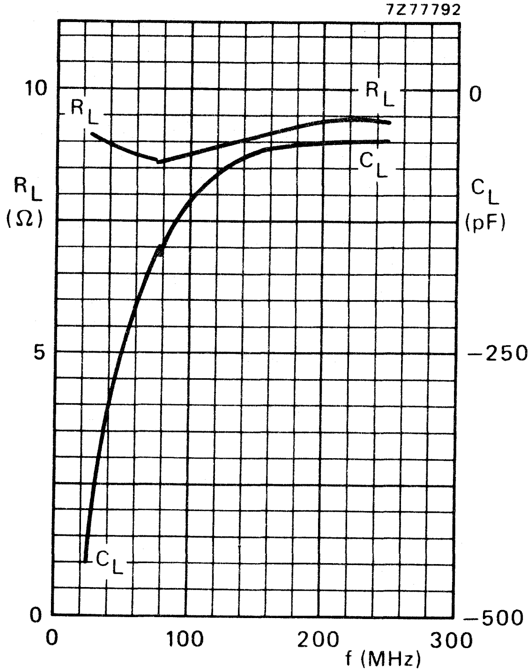


Fig. 14 Load impedance (parallel components).

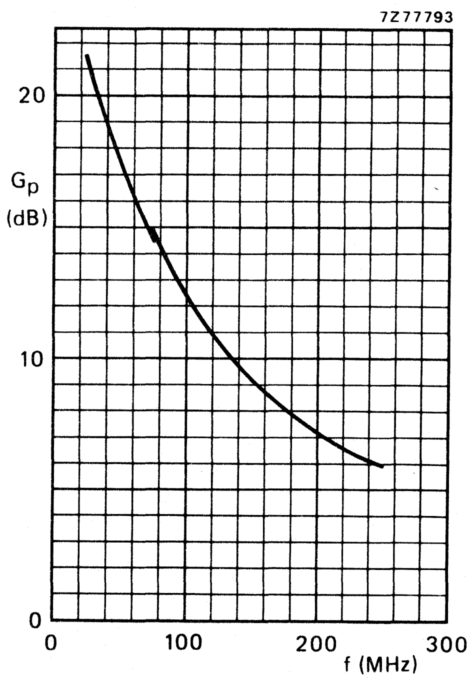


Fig. 15 Power gain versus frequency.

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 (P.E.P.)	I_C (A) at 47,5 W (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

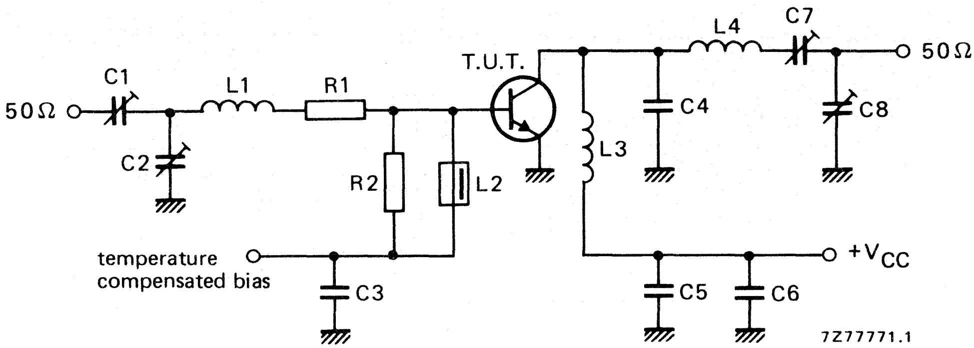


Fig. 16 Test circuit; s.s.b. class-AB.

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.

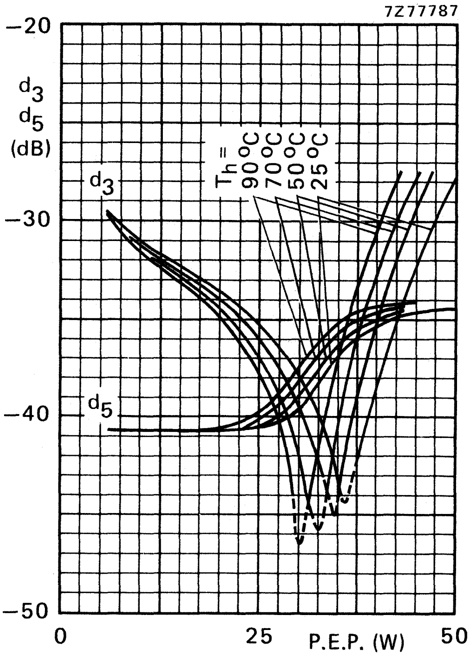


Fig. 17 Intermodulation distortion as a function of output power.*

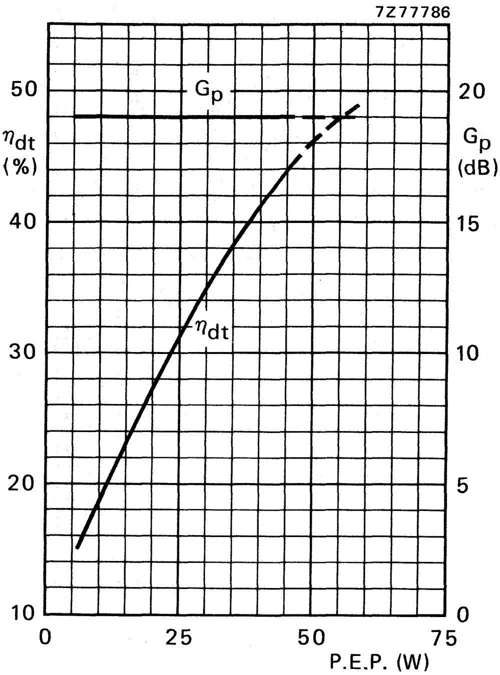


Fig. 18 Double-tone efficiency and power gain as a function of output power.

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.

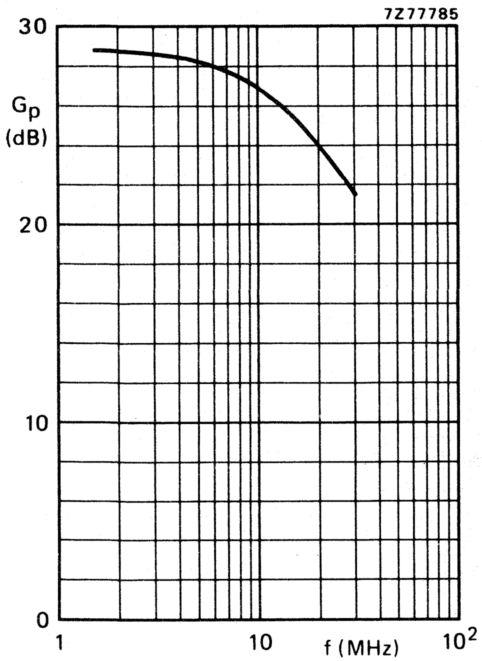


Fig. 19 Power gain as a function of frequency.

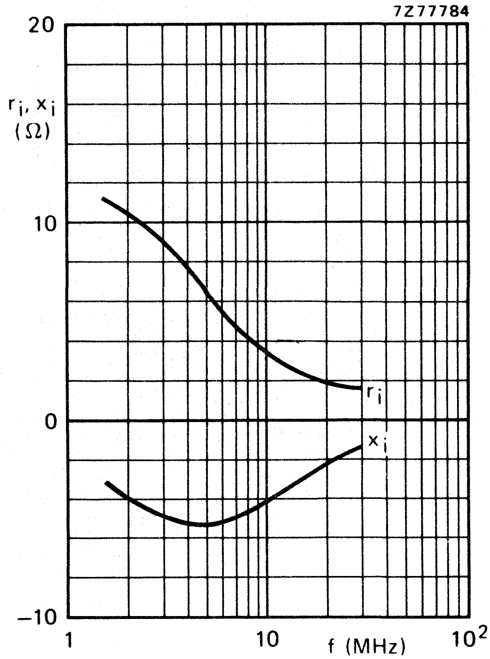


Fig. 20 Input impedance (series components) as a function of frequency.

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

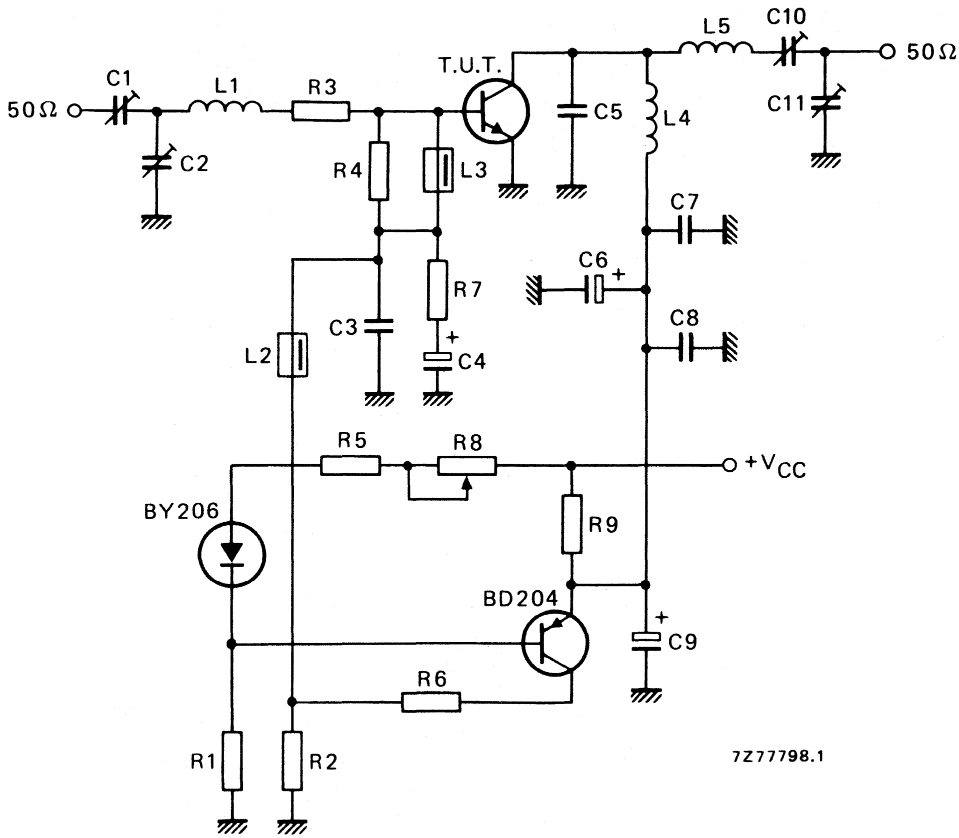


Fig. 21 Test circuit; s.s.b. class-A.

* 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)

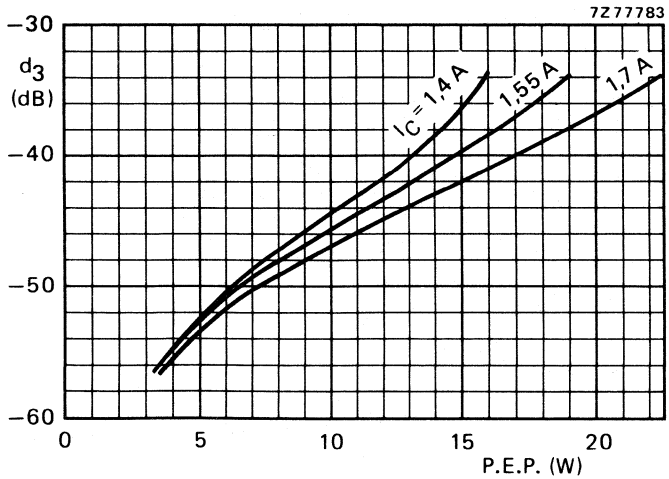


Fig. 22 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

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

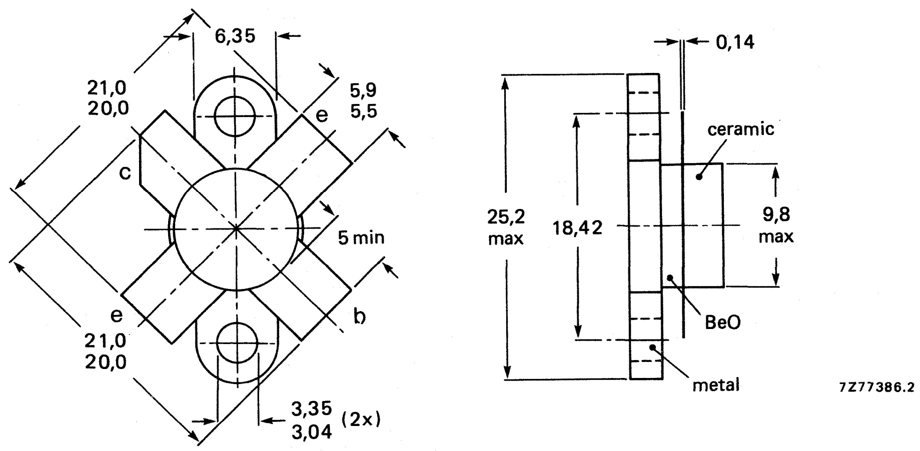
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

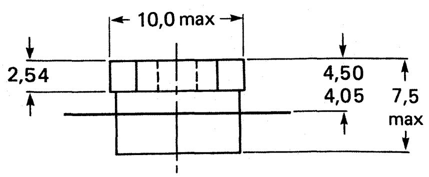
mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	**13,5**	**175**	**25**	**> 6**	**> 70**	**1,6 + j1,4**	**210 + j5,5**

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

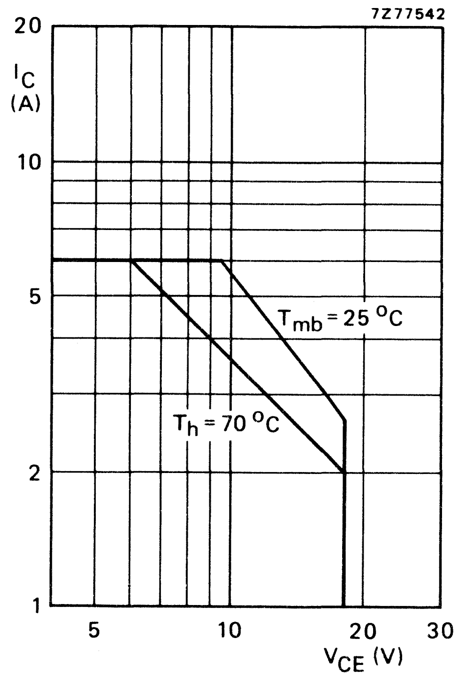


Fig. 2 D.C. SOAR.

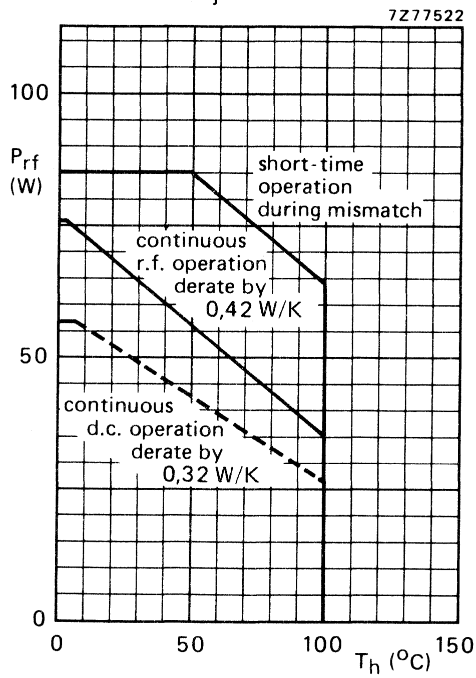


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16{,}5$ V; f ⩾ 1 MHz.

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

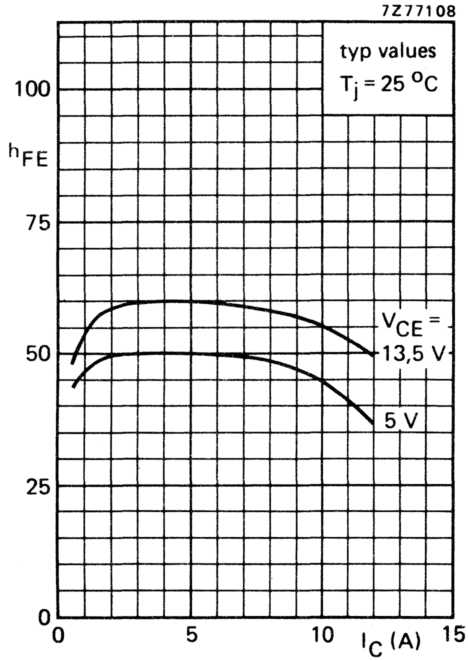


Fig. 4.

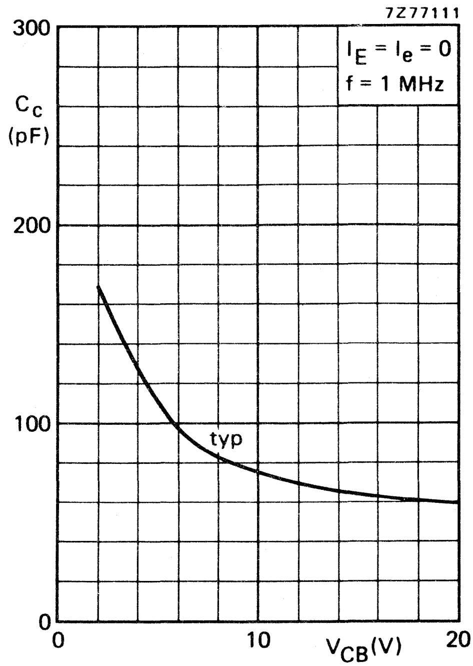


Fig. 5 T_j = 25 °C.

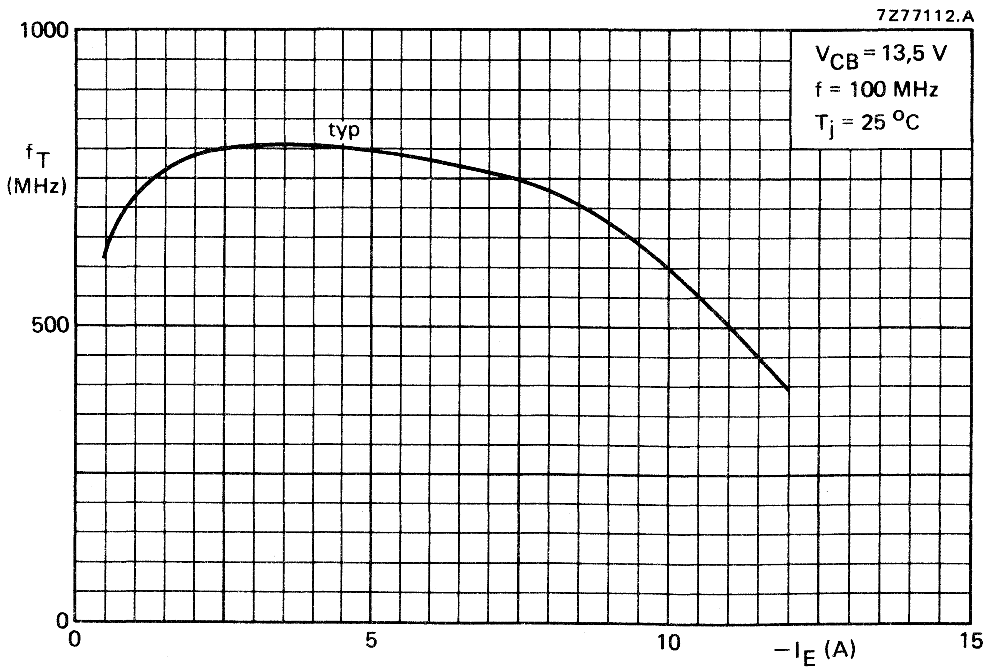


Fig. 6.

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 (%)	$\overline{z_i}$ (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	–	–

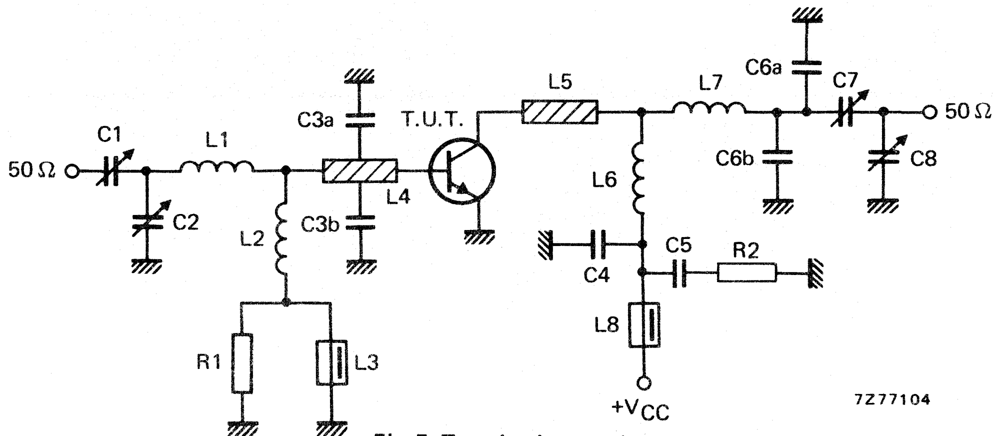


Fig. 7 Test circuit; c.w. class-B.

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)

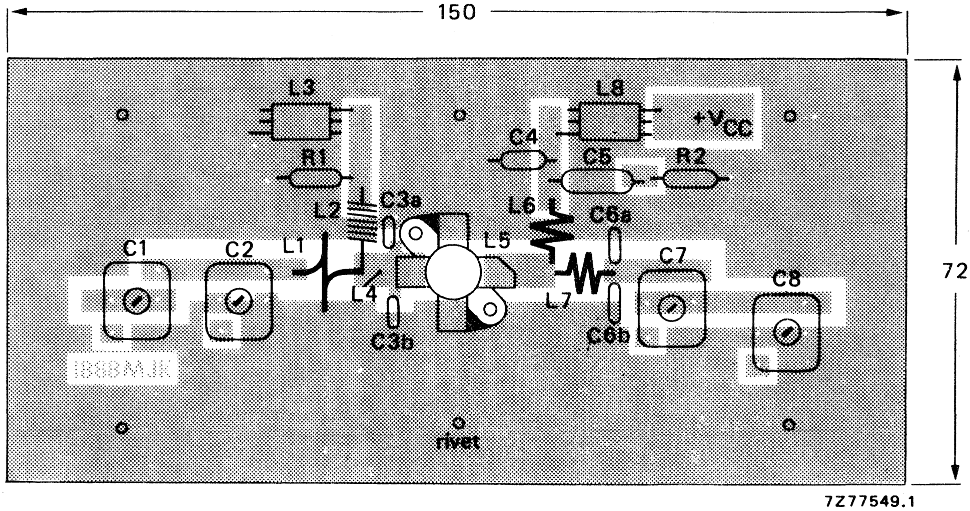
L1 = 1 turn Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from 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)



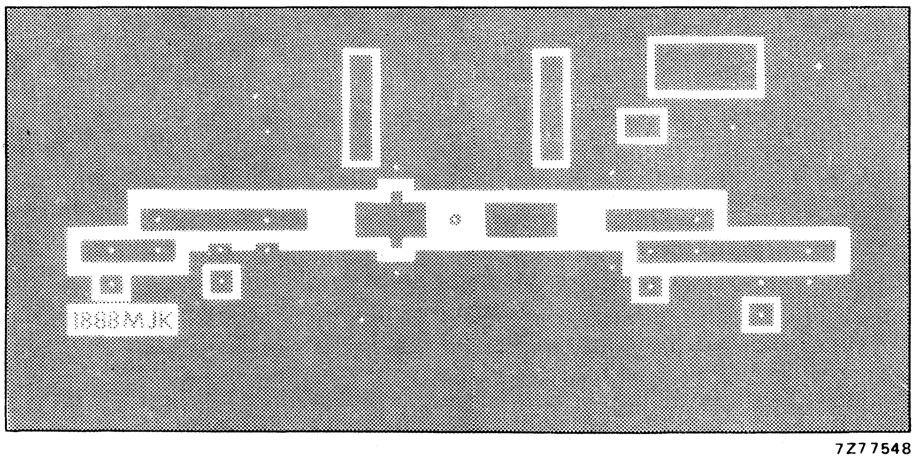


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

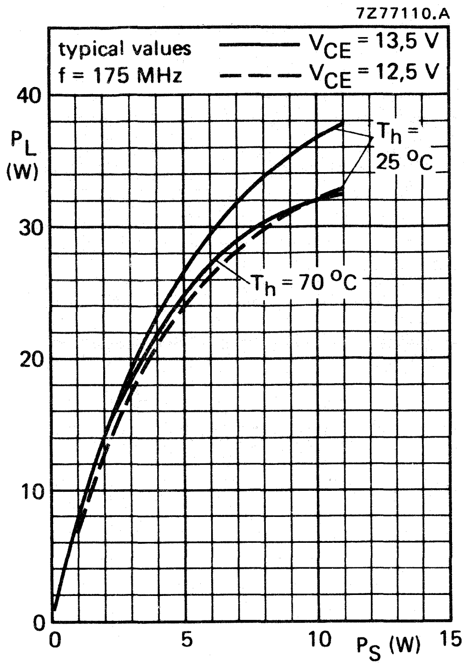


Fig. 9.

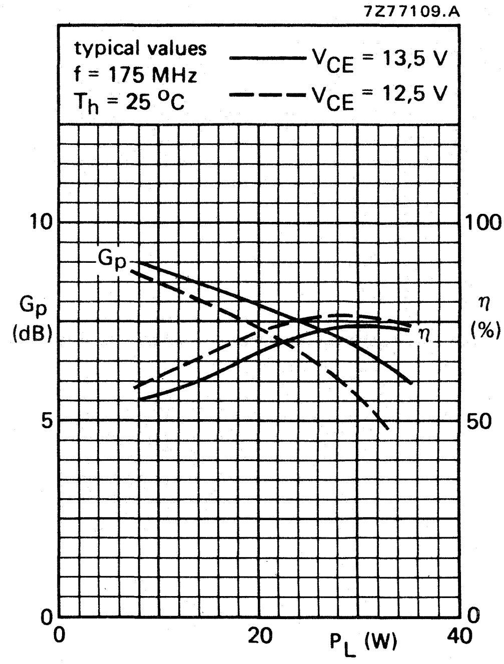


Fig. 10.

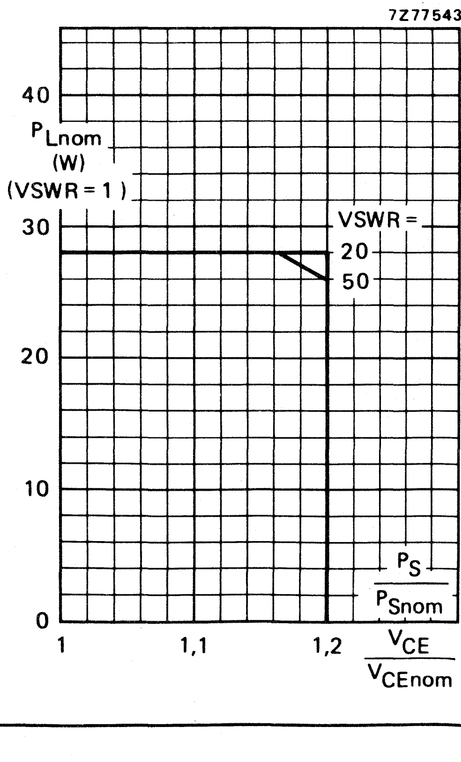


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,3 K/W ; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1; measured in the circuit of Fig.7.

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.

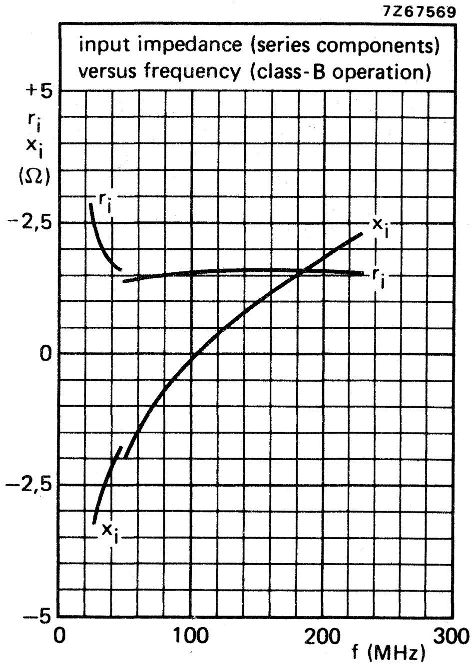


Fig. 12.

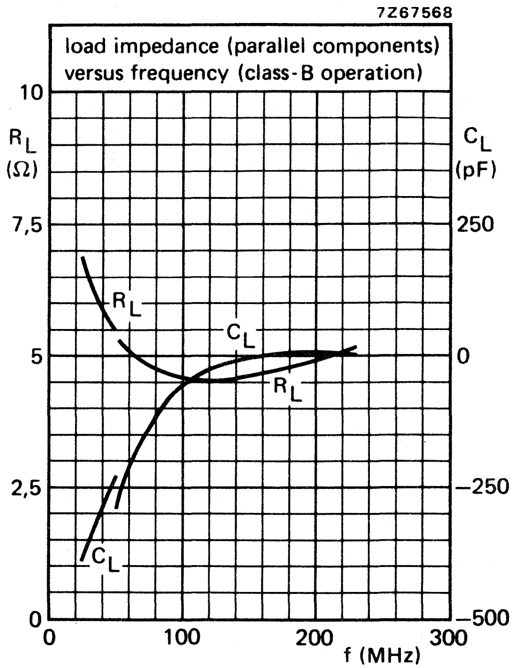
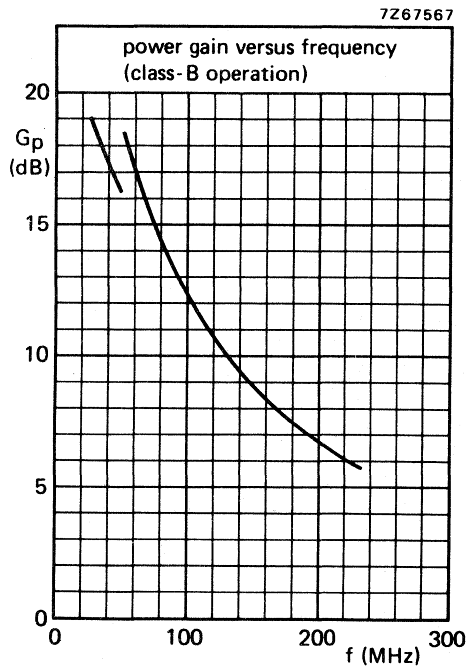


Fig. 13.



Conditions for Figs 12, 13 and 14:
Typical values; V_{CE} = 13,5 V; P_L = 25 W;
T_h = 25 °C.

Fig. 14.

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

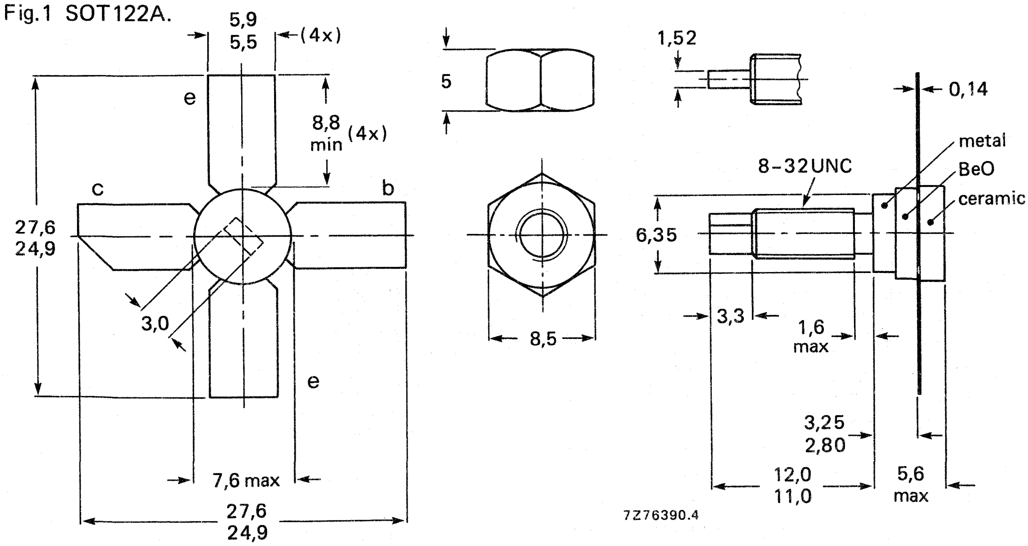
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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 SOT122A.



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

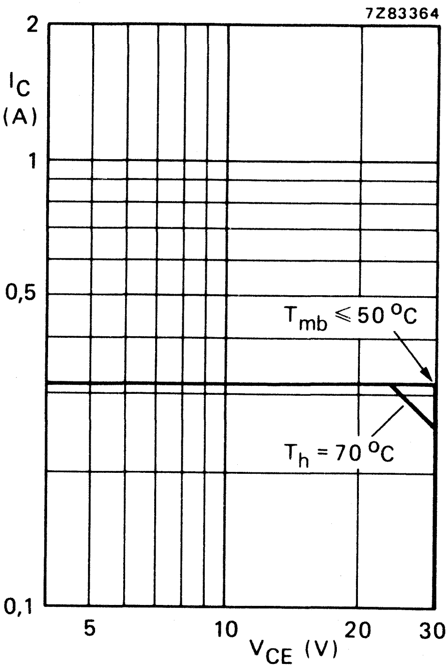


Fig. 2 D.C. SOAR.

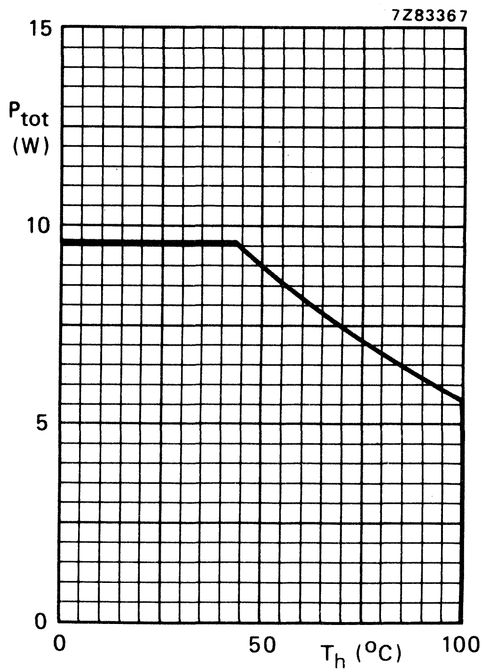


Fig. 3 Power derating curve vs. temperature.

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

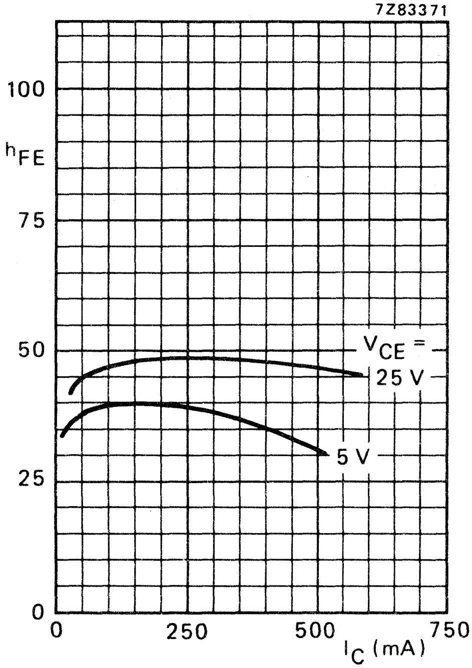


Fig. 4 Typical values; T_j = 25 °C.

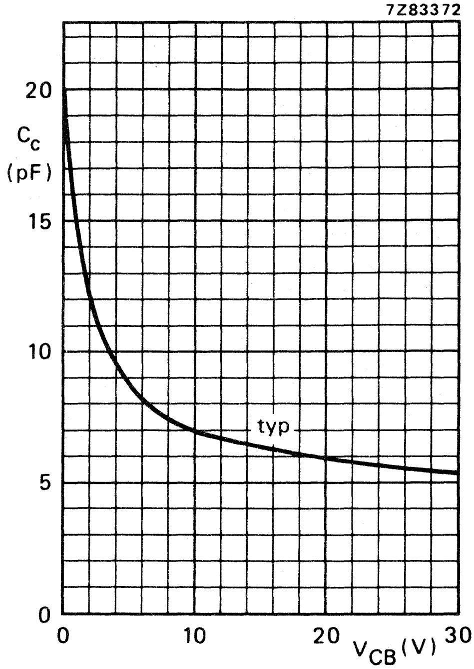


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

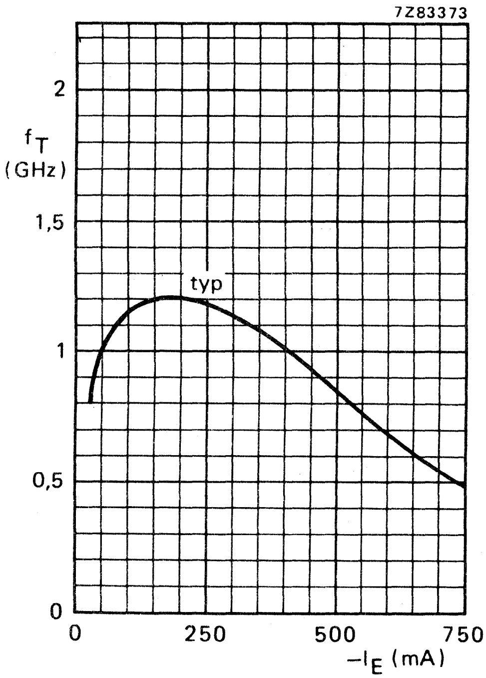


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

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**	**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	–	–

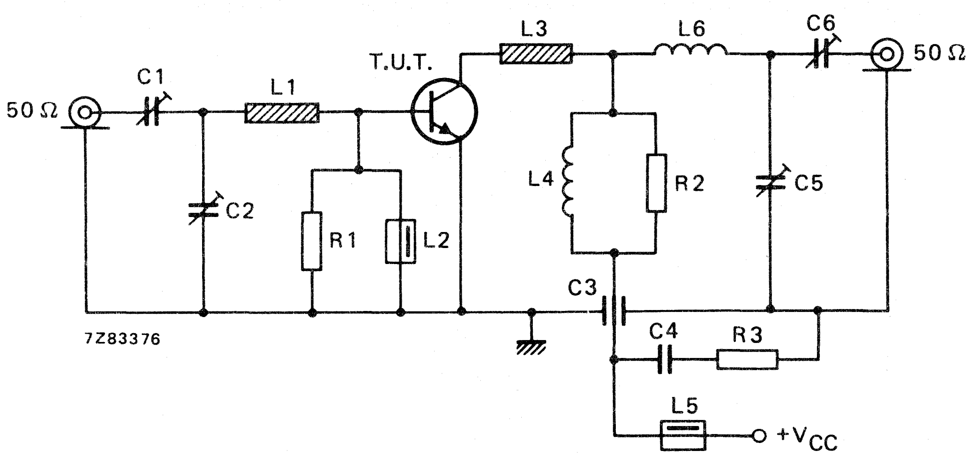


Fig. 7 Test circuit; c.w. class-B.

List of components:

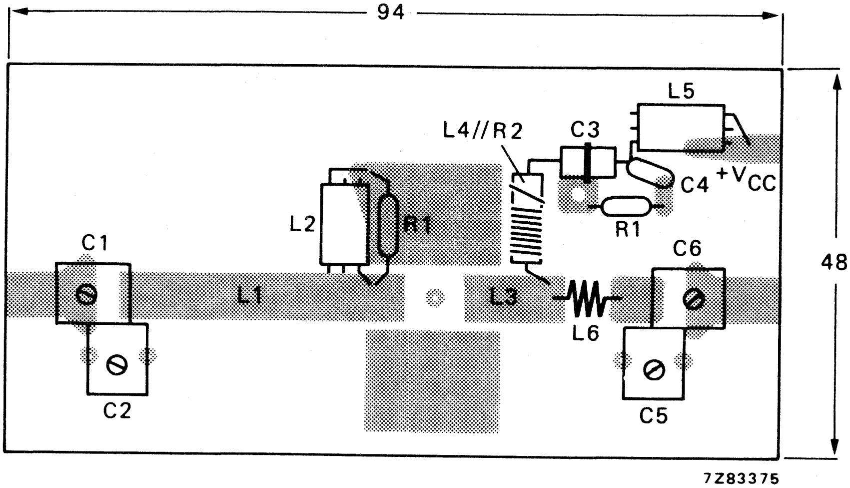
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF ceramic feed-through capacitor
C4 = 100 nF polyester capacitor

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.



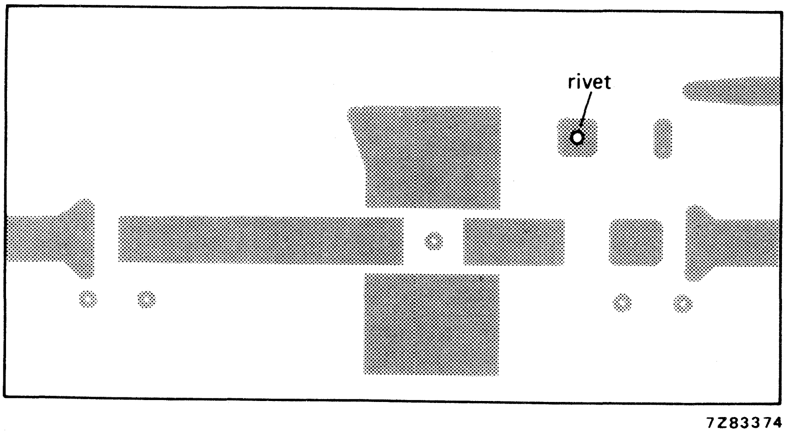


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

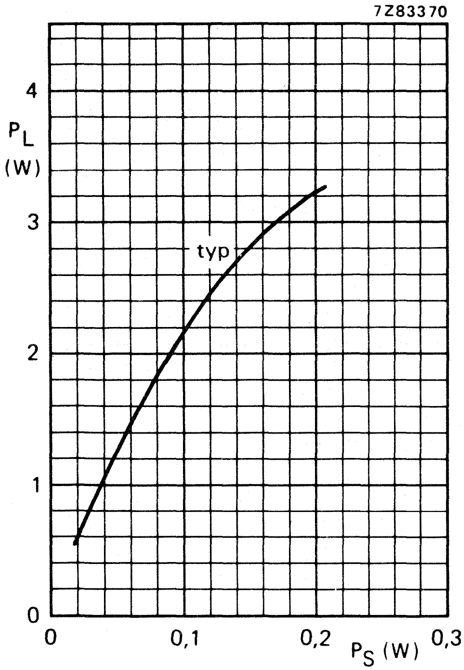


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

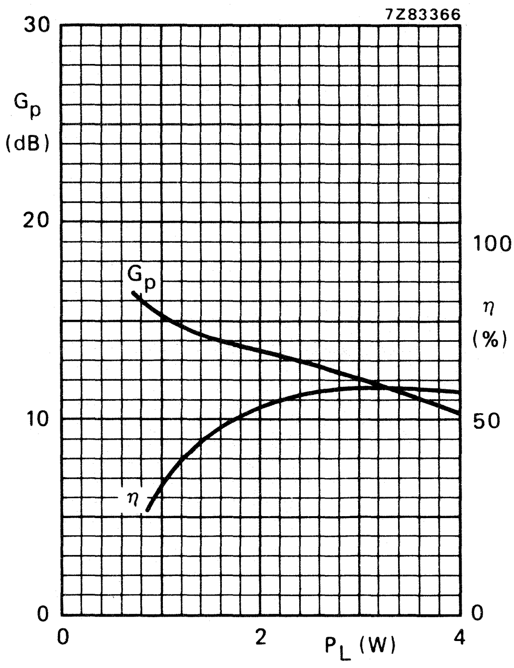


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

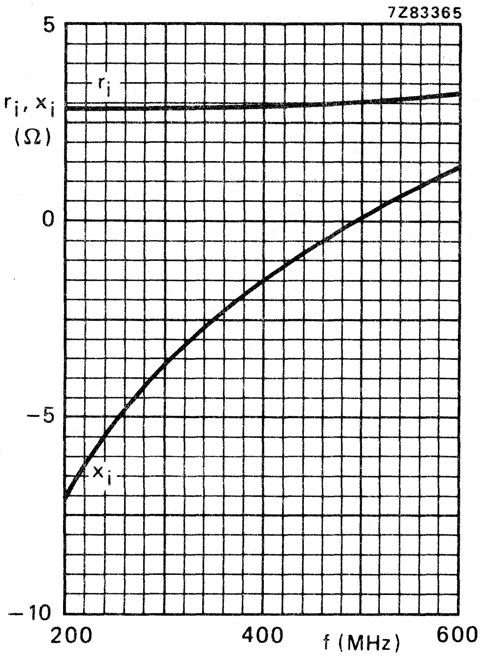


Fig. 11 Input impedance (series components).

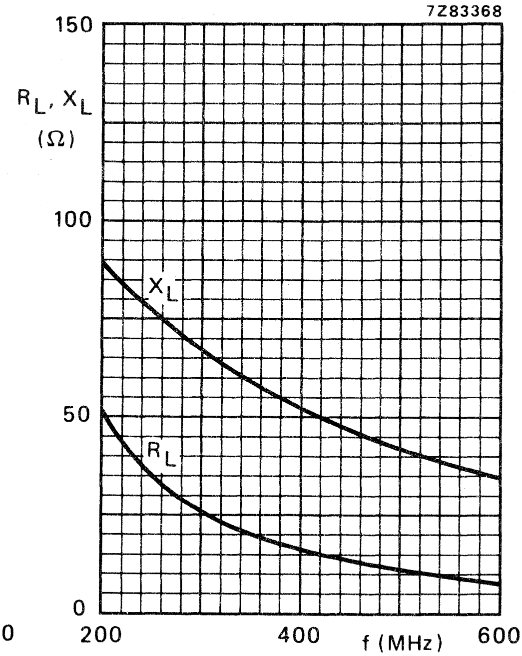


Fig. 12 Load impedance (series components).

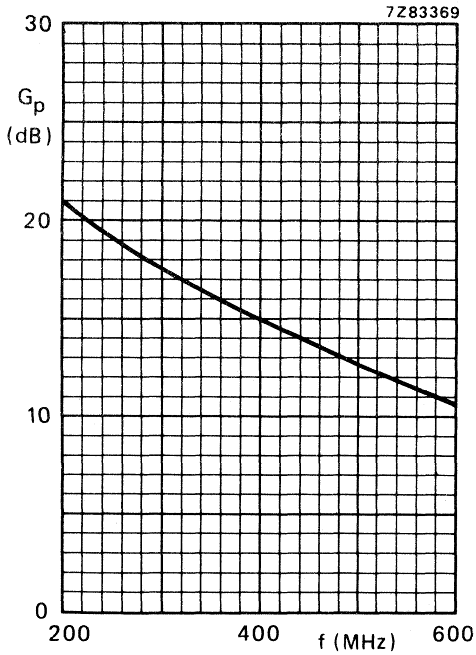


Fig. 13.

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

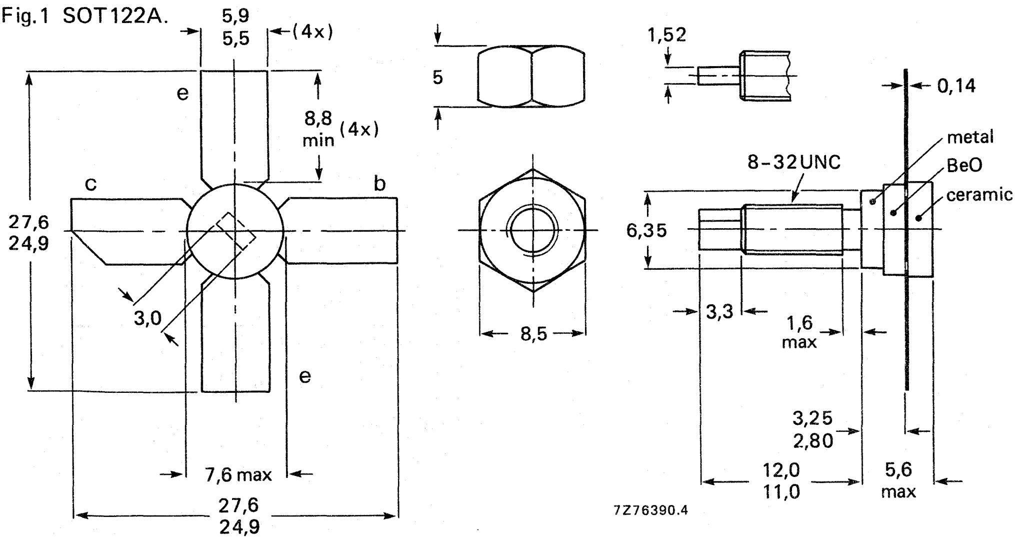
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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 SOT122A.



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

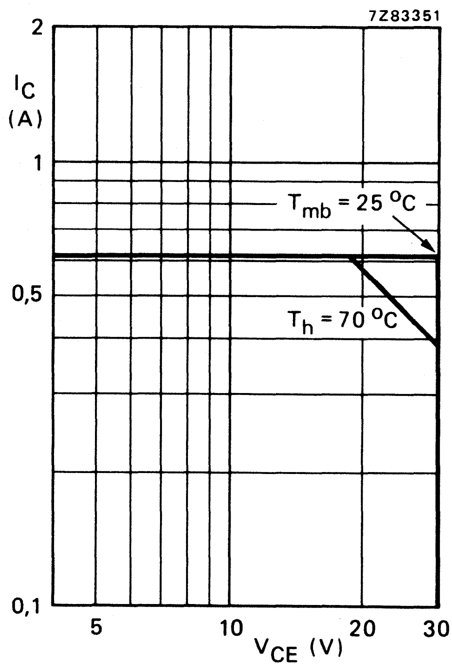


Fig. 2 D.C. SOAR.

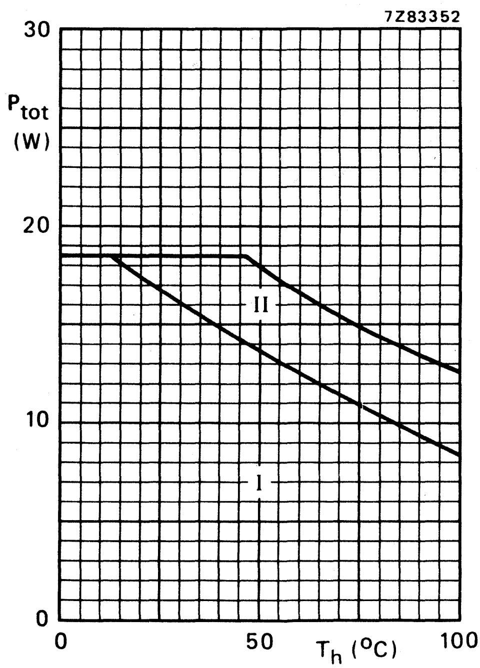


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

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

$T_j = 25\ ^oC$

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
$R_{BE} = 10\ \Omega$	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

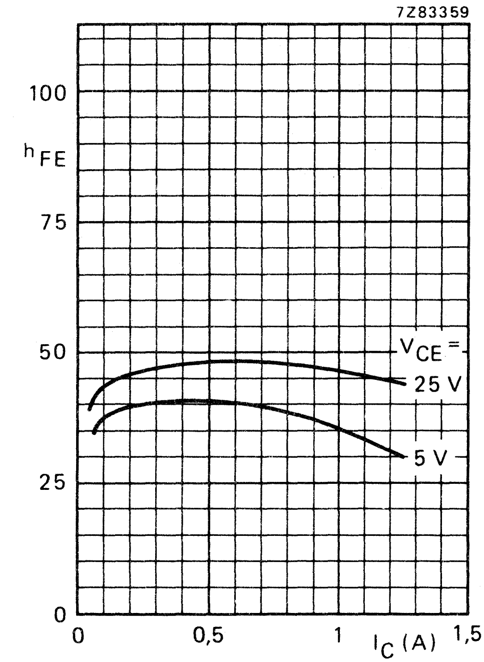


Fig. 4 Typical values; T_j = 25 °C.

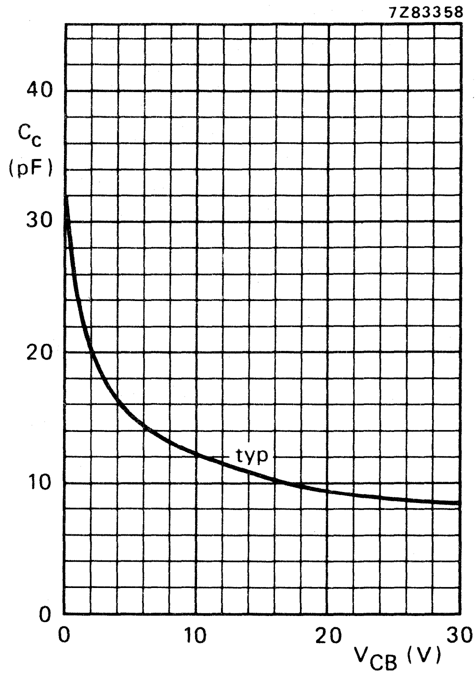


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

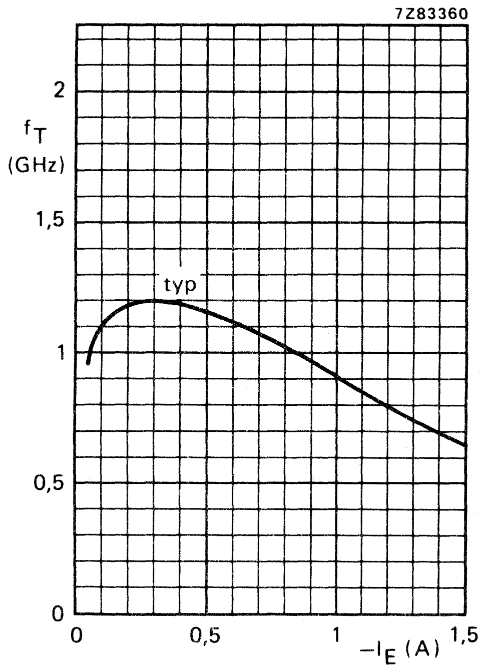


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

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	–	–

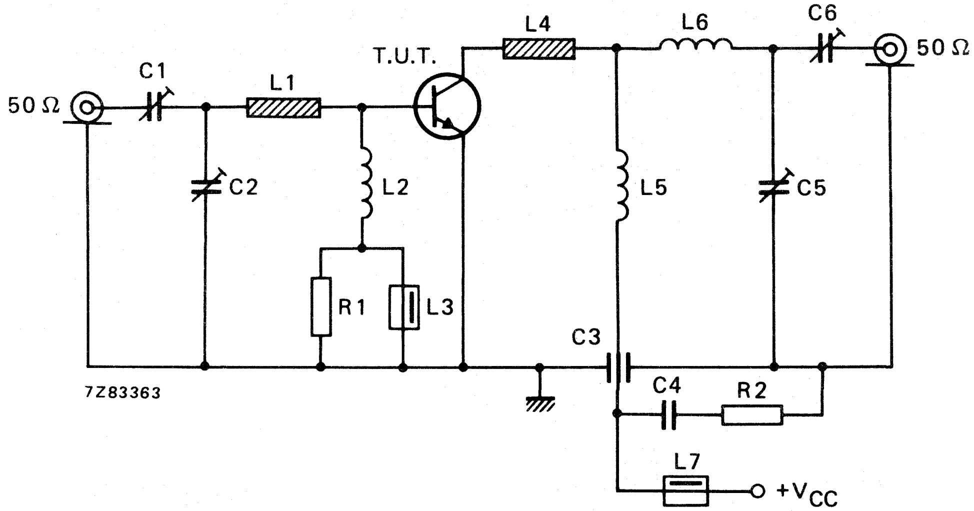


Fig. 7 Test circuit; c.w. class-B.

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.

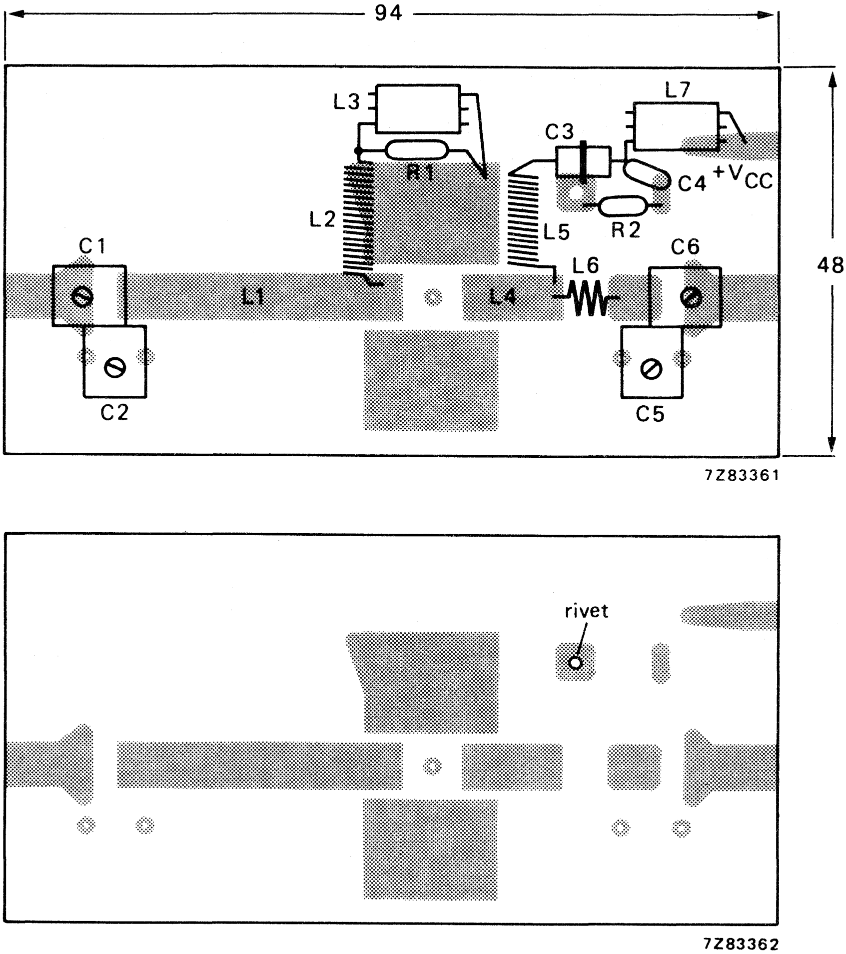


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

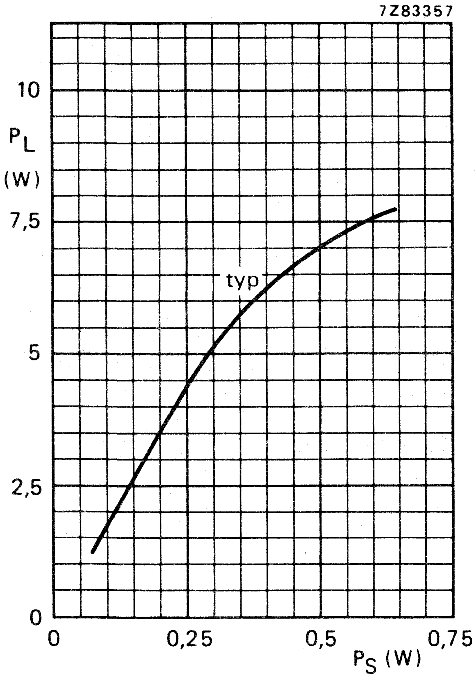


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

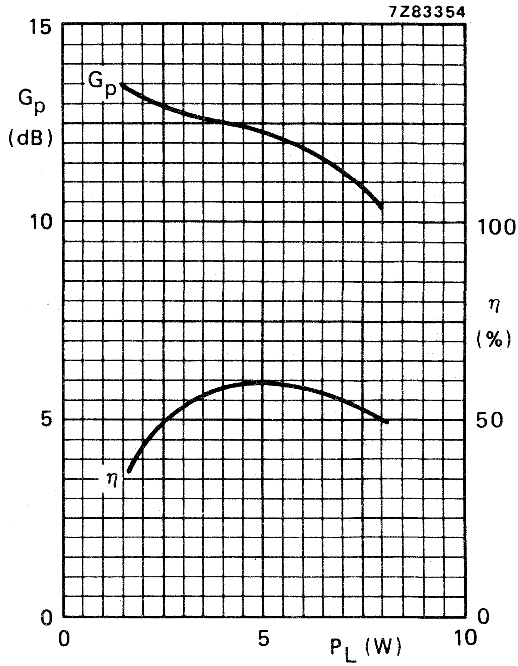


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

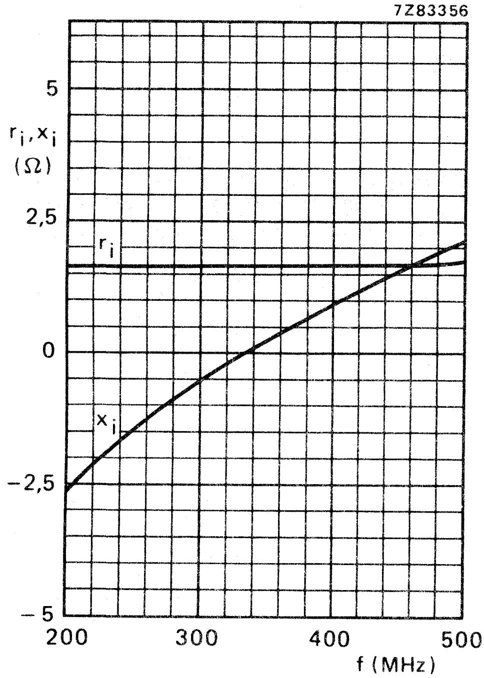


Fig. 11 Input impedance (series components).

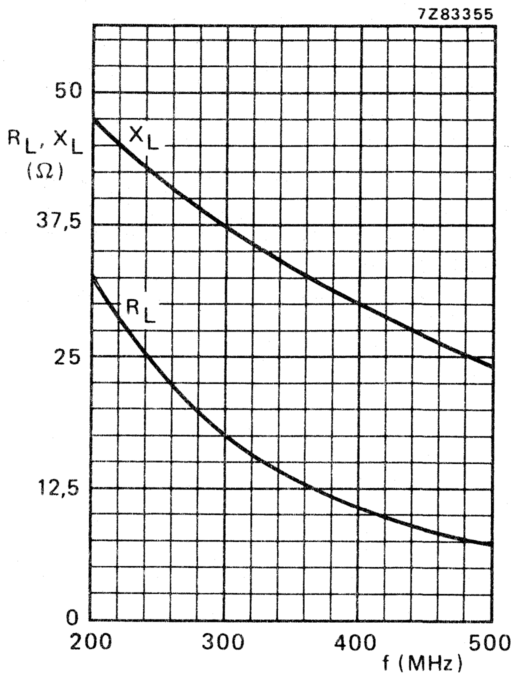


Fig. 12 Load impedance (series components).

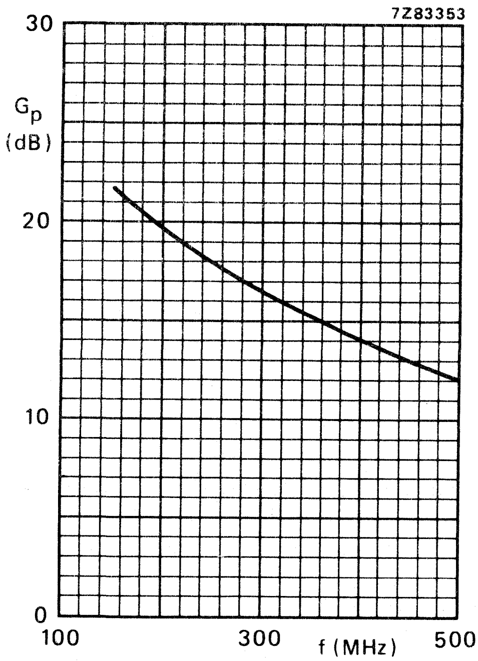


Fig. 13.

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

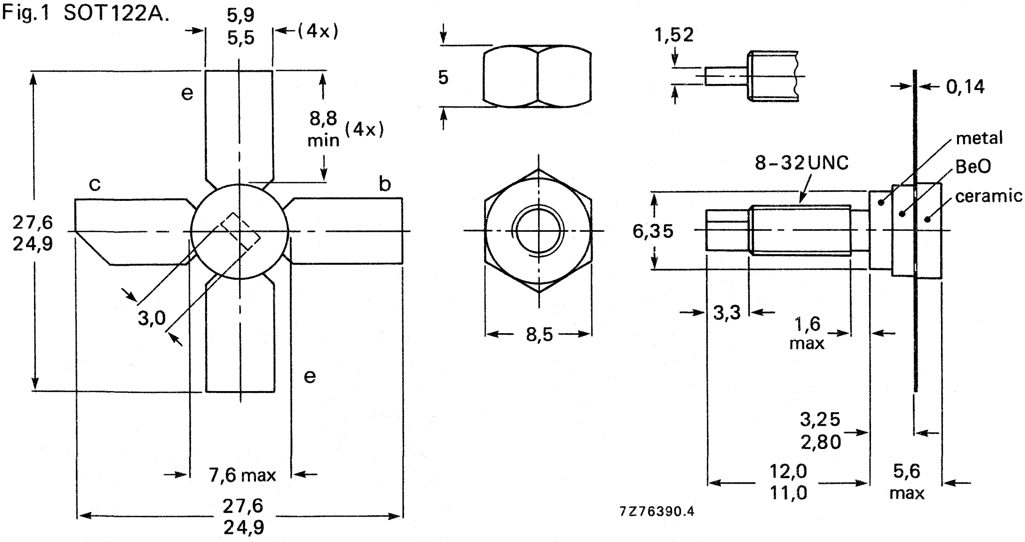
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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 SOT122A.



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

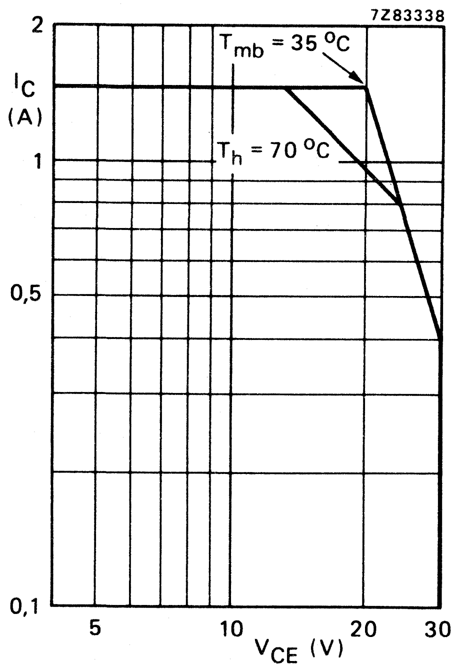


Fig. 2 D.C. SOAR.

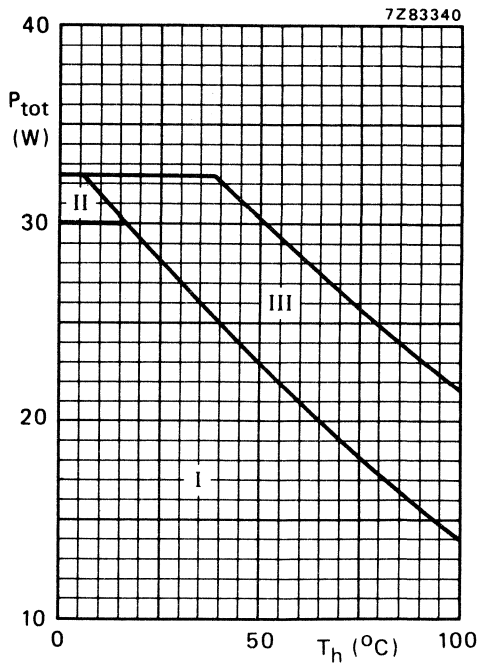


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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 Ω	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

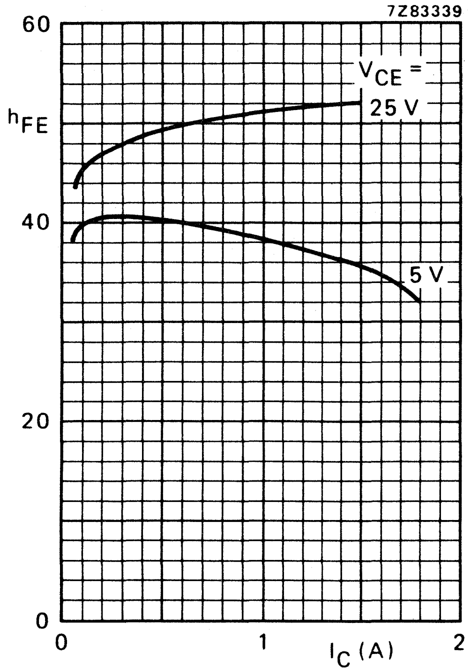


Fig. 4 Typical values; T_j = 25 ^oC.

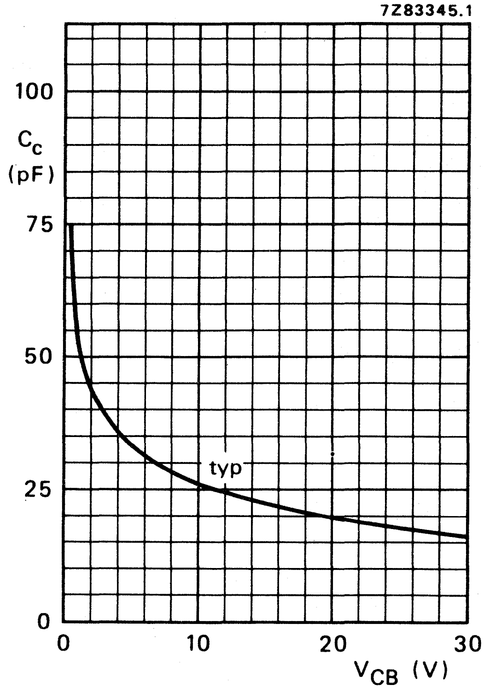


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 ^oC.

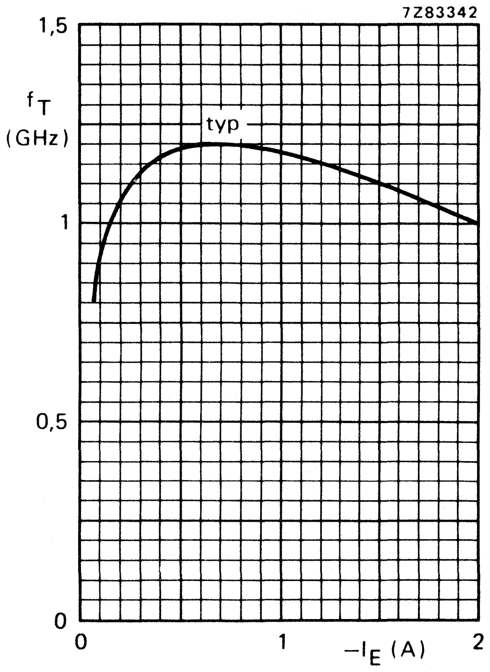


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 ^oC.

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)	$\overline{Z_L}$ (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	—	—

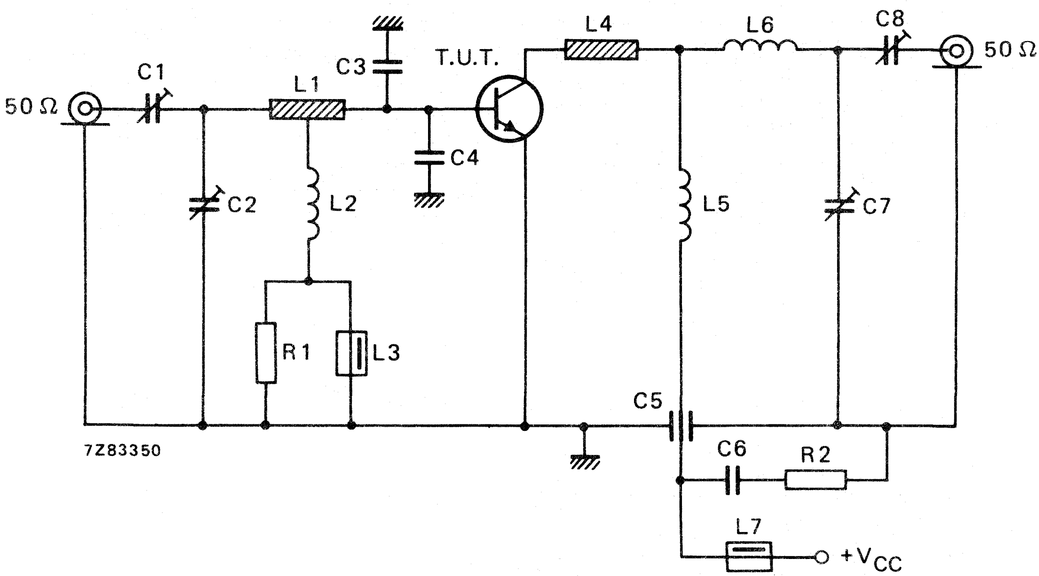


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

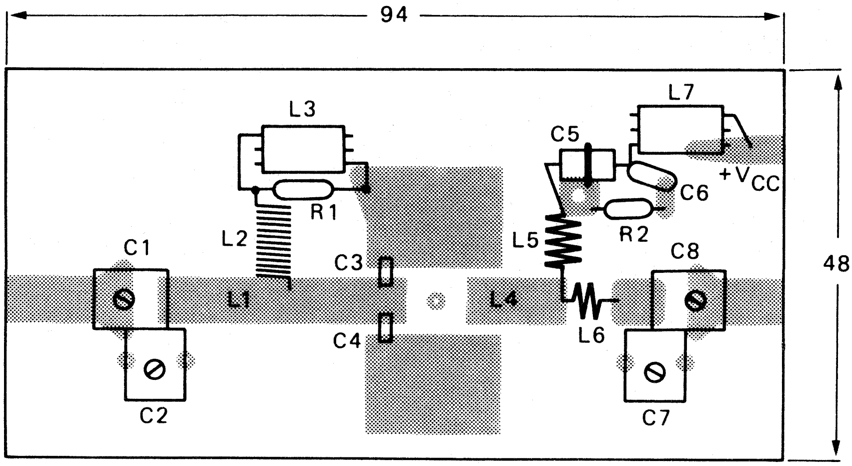
List of components:

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



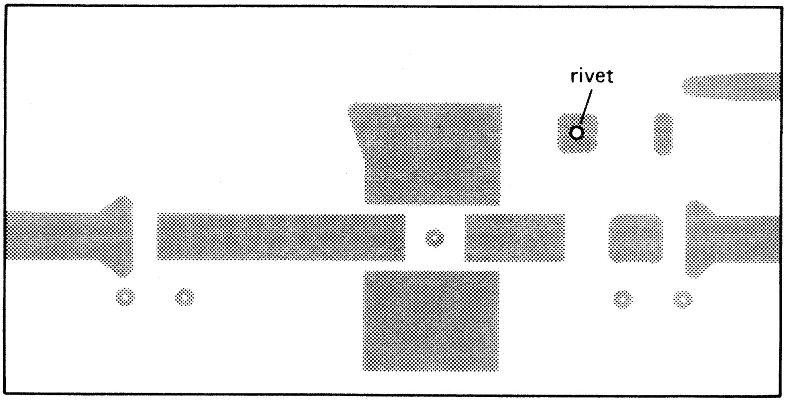


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

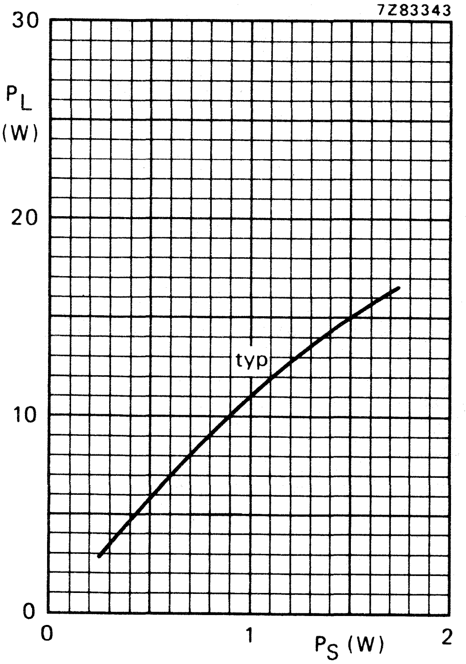


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

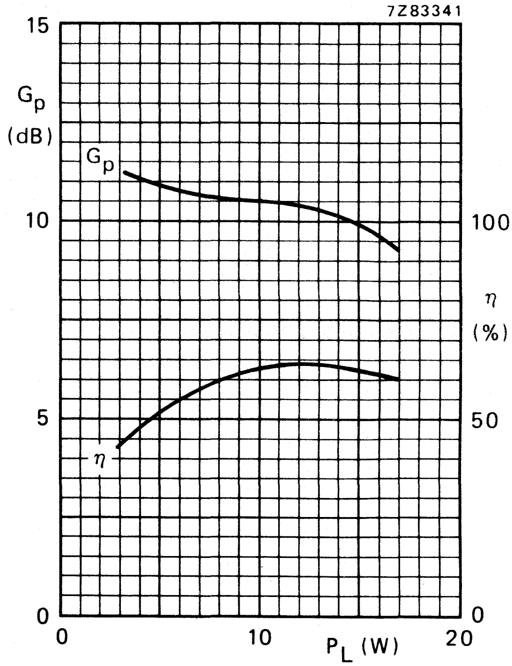


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

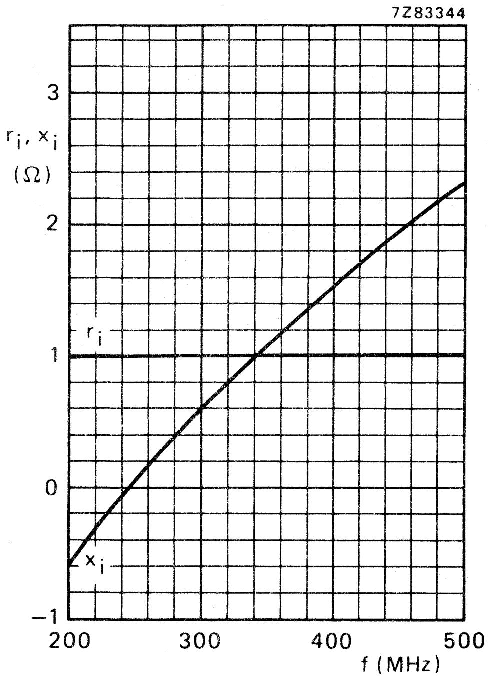


Fig. 11 Input impedance (series components).

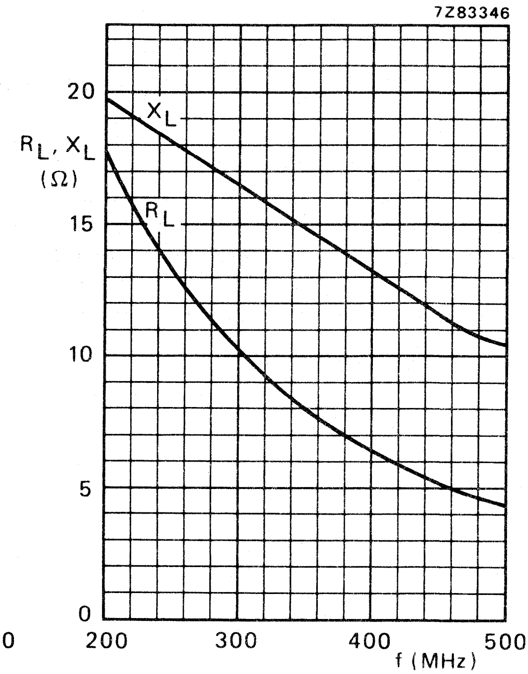


Fig. 12 Load impedance (series components).

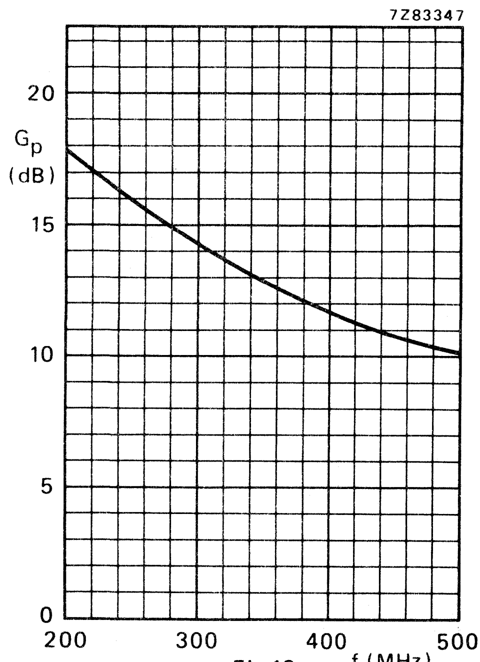


Fig. 13.

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

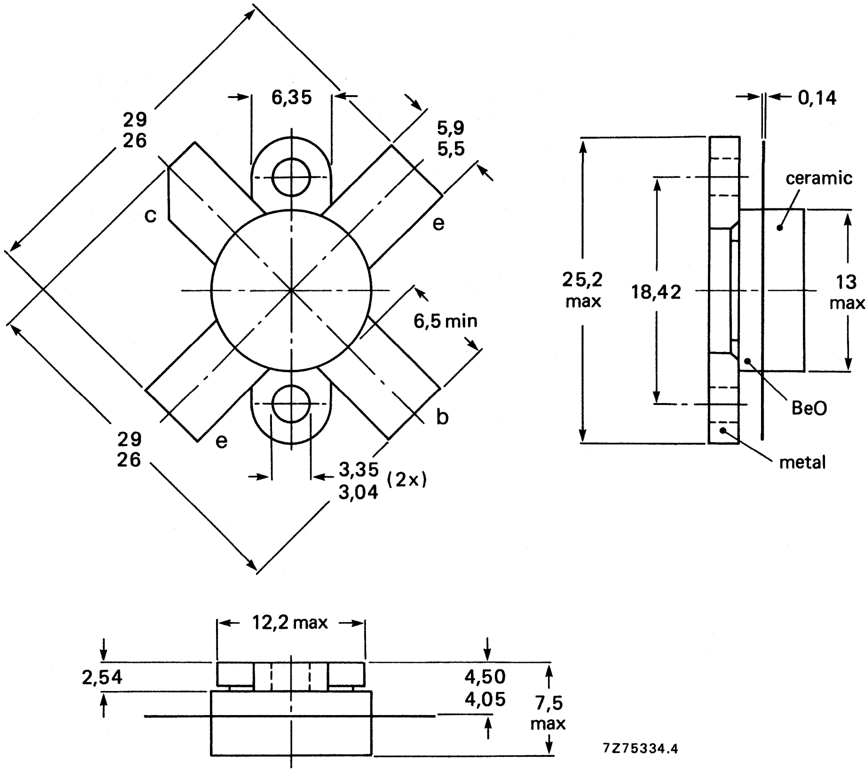
SOT-121A (see Fig. 1).

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

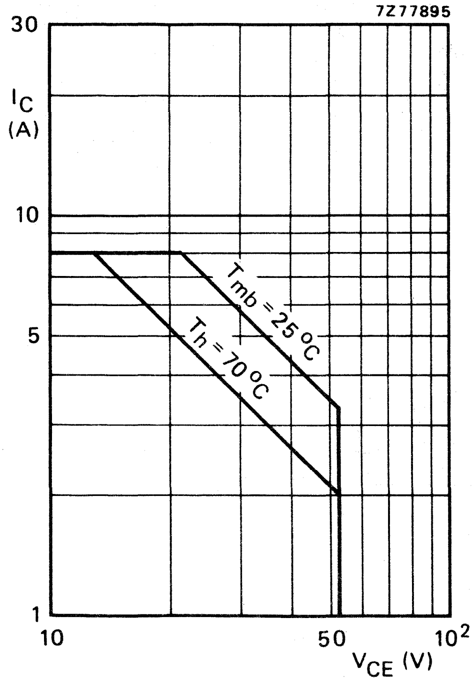


Fig. 2 D.C. SOAR.

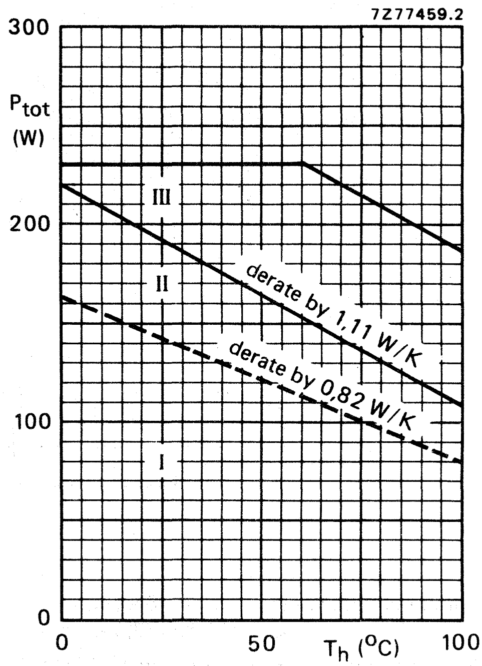


Fig. 3 R.F. power dissipation; V_{CE} ≤ 50 V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 100 W; T_{mb} = 90 °C, i.e. T_h = 70 °C)

From junction to mounting base (d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	=	1,0 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: $t_p \leq 200\ \mu s$; $\delta \leq 0,02$.

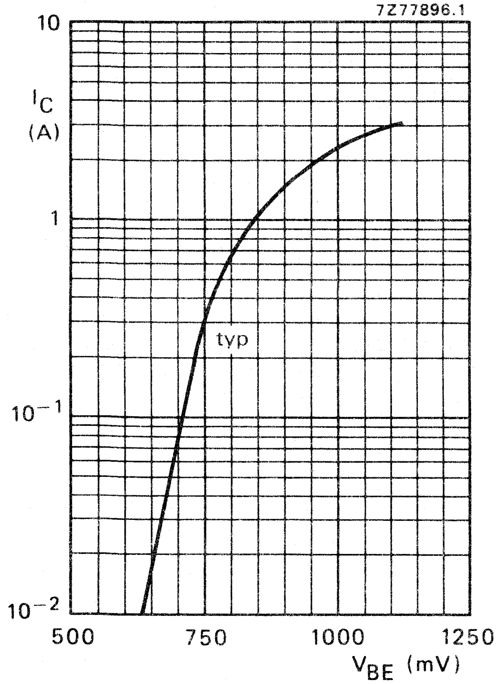


Fig. 4 V_{CE} = 40 V; T_h = 25 °C.

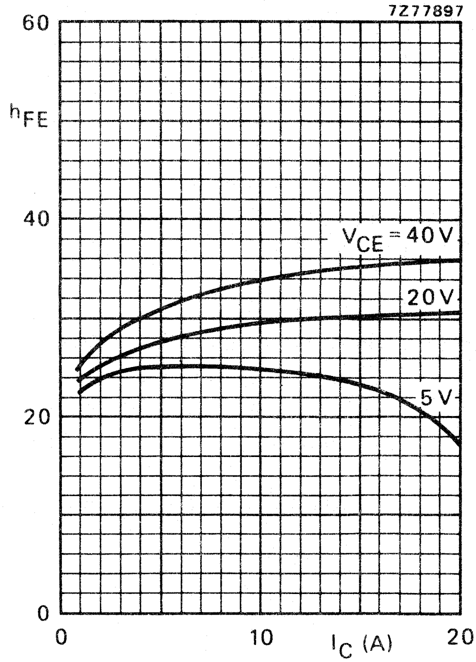


Fig. 5 Typical values; T_j = 25 °C.

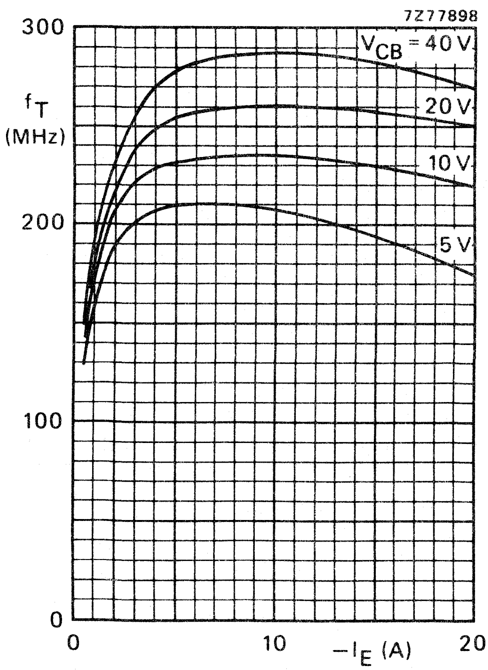


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

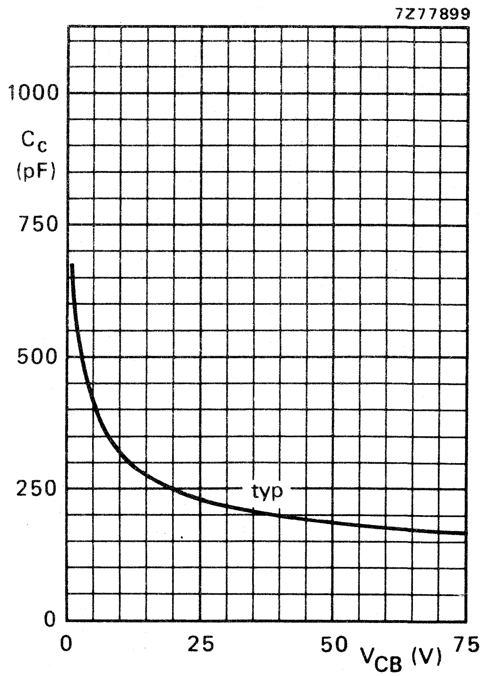


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

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

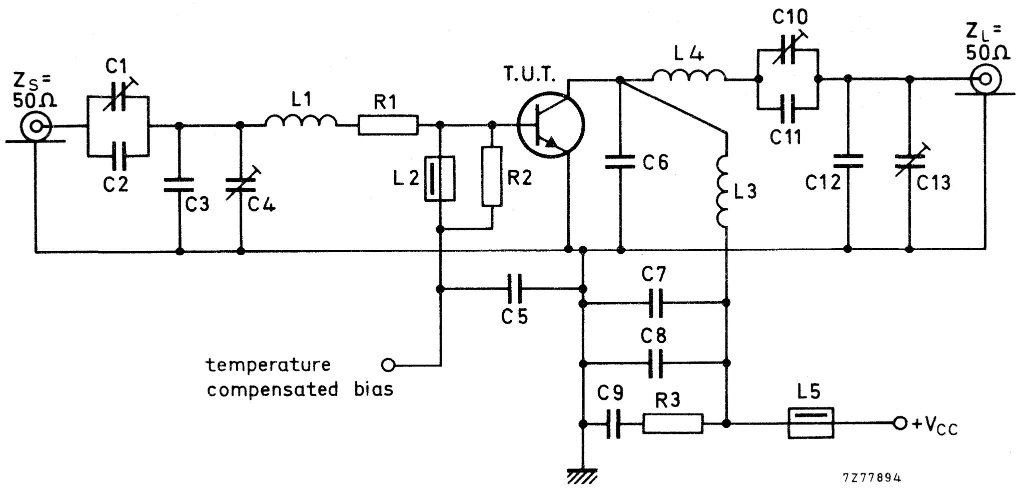


Fig. 8 Test circuit; s.s.b. class-AB.

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.

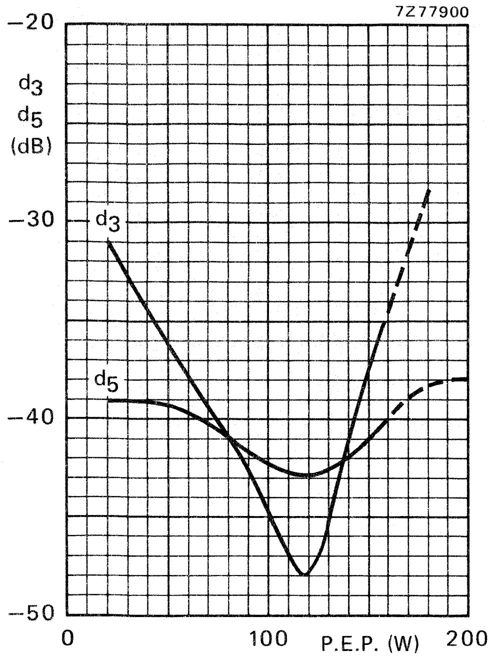


Fig. 9 Intermodulation distortion as a function of output power.*

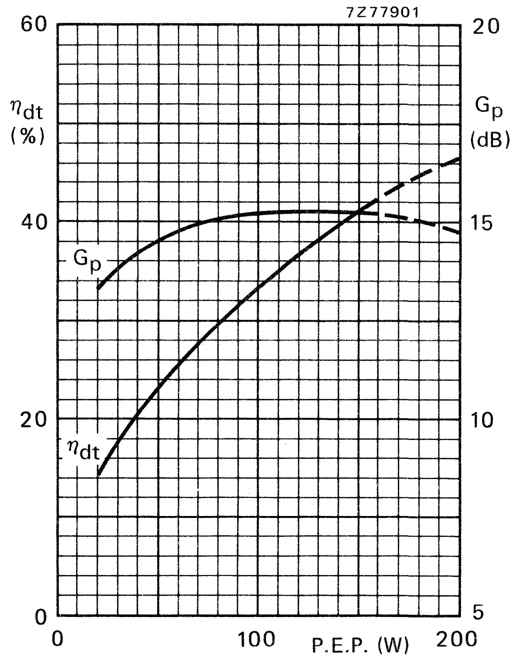


Fig. 10 Double-tone efficiency and power gain as a function of output power.

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.

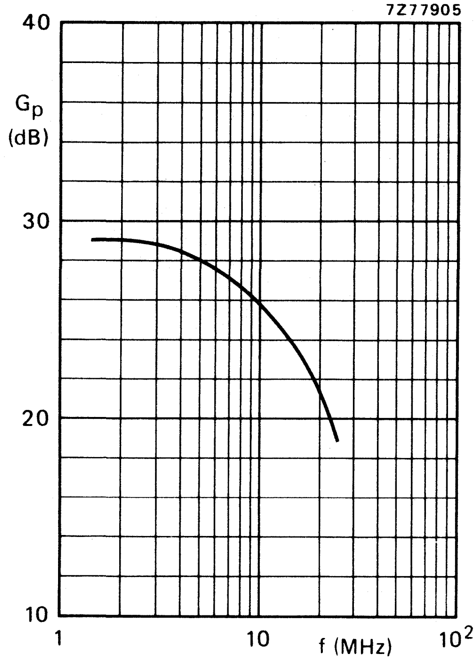


Fig. 11 Power gain as a function of frequency.

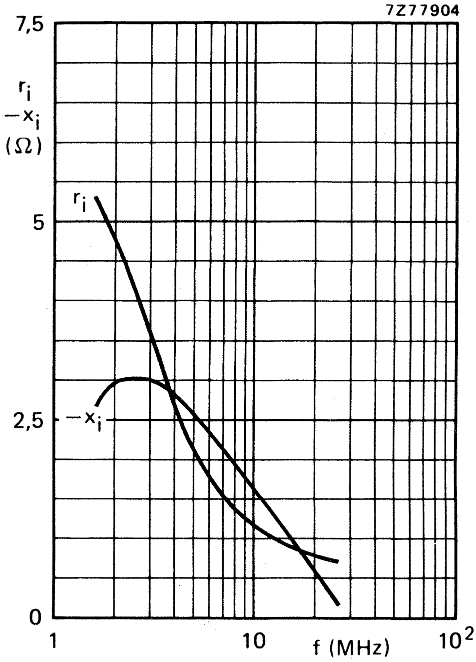


Fig. 12 Input impedance (series components) as a function of frequency.

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).

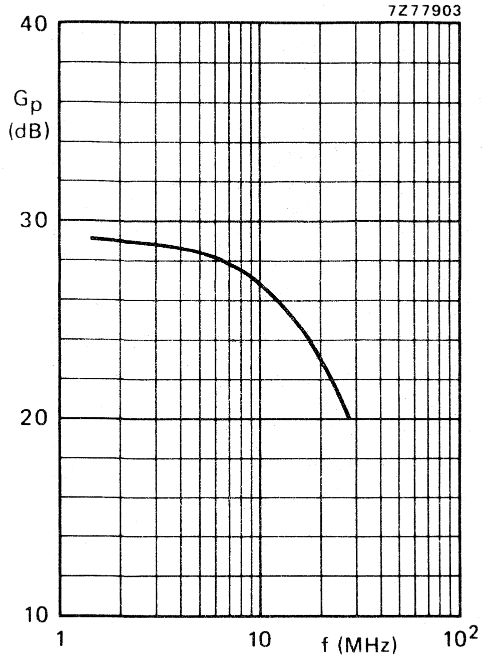


Fig. 13 Power gain as a function of frequency.

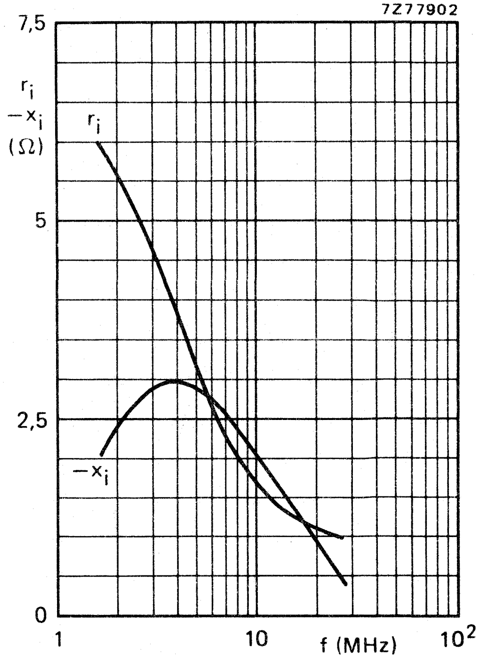


Fig. 14 Input impedance (series components) as a function of frequency.

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

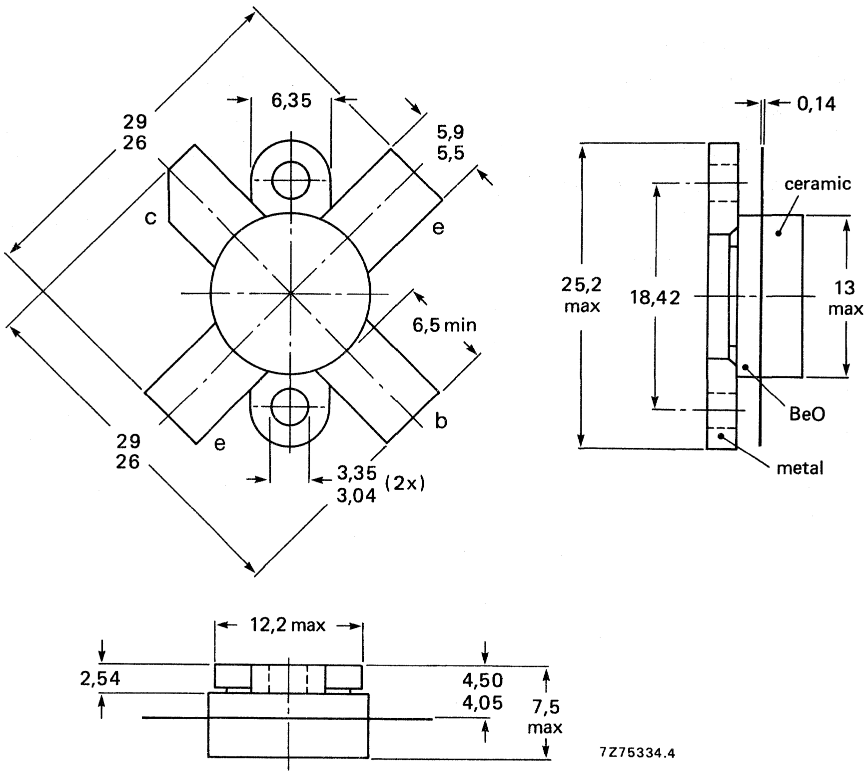
SOT-121 (see Fig. 1).

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

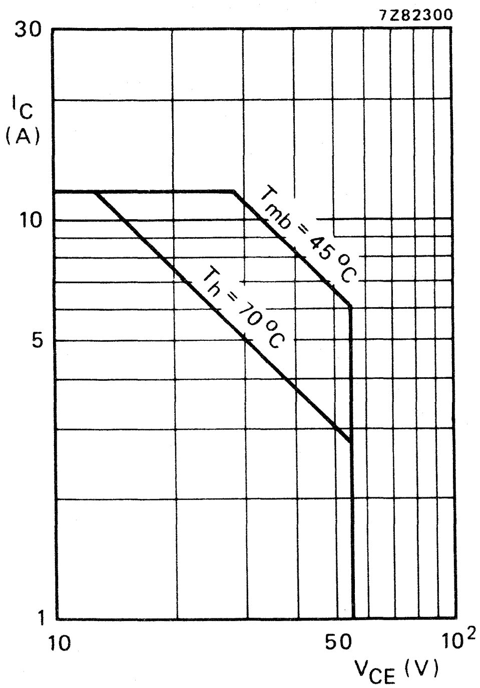


Fig. 2 D.C. SOAR.

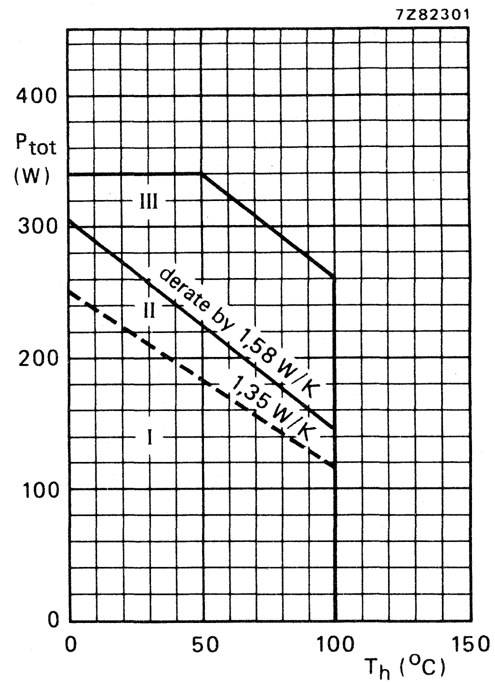


Fig. 3 Power/temperature derating curves.
I Continuous d.c. operation
II Continuous r.f. operation; f > 1 MHz
III Short-time operation during mismatch; f > 1 MHz

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: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

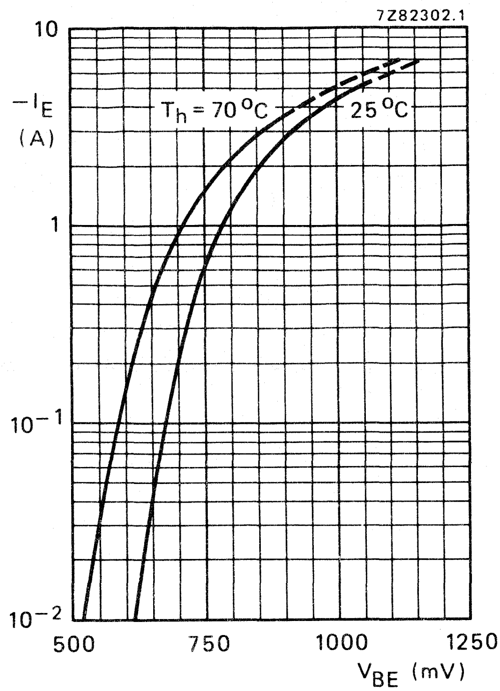


Fig. 4 Typical values; $V_{CE} = 40$ V.

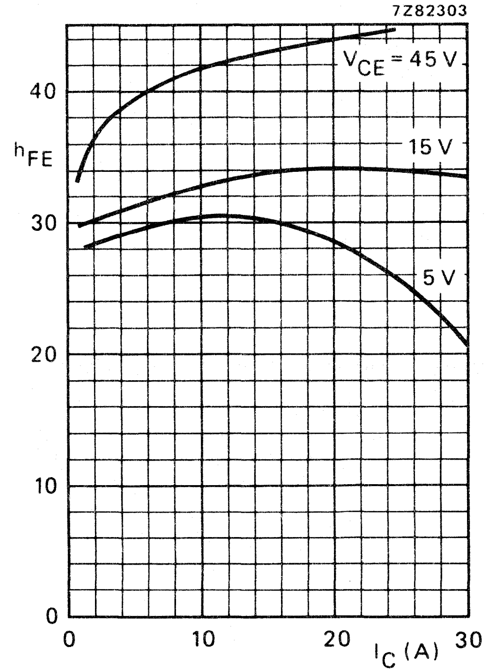


Fig. 5 Typical values; $T_j = 25\ ^oC$.

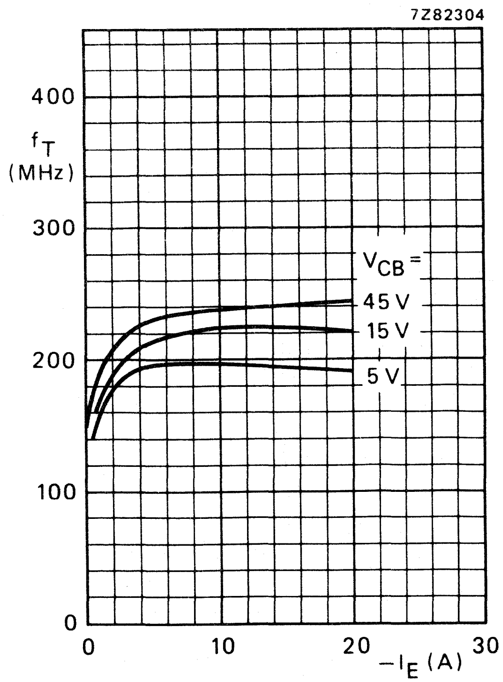


Fig. 6 Typical values; f = 100 MHz; $T_j = 25\ ^oC$.

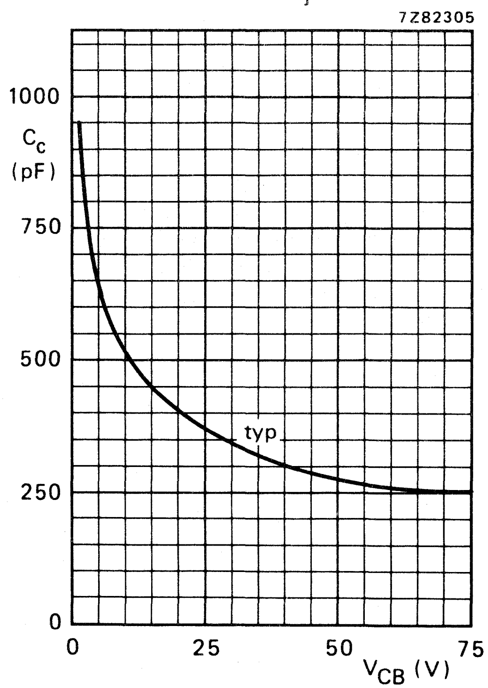


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

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

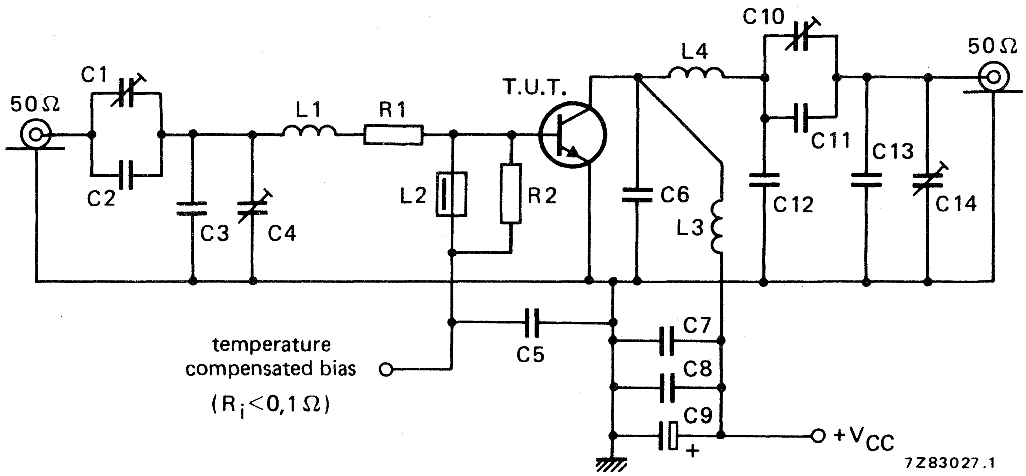


Fig. 8 Test circuit; s.s.b. class-AB.

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.

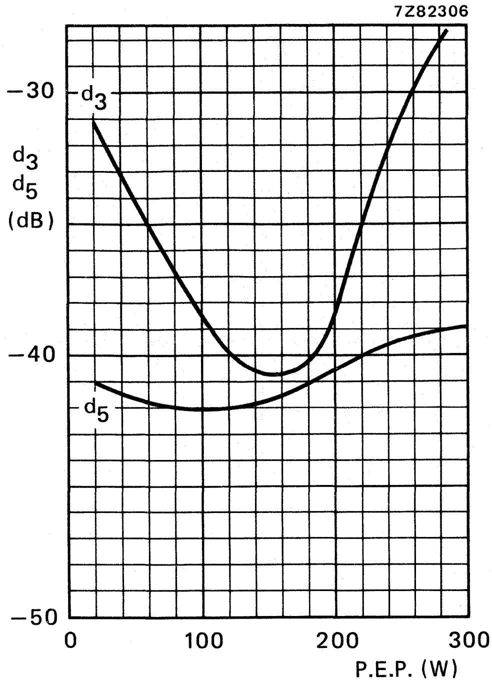


Fig. 9 Intermodulation distortion as a function of output power.*

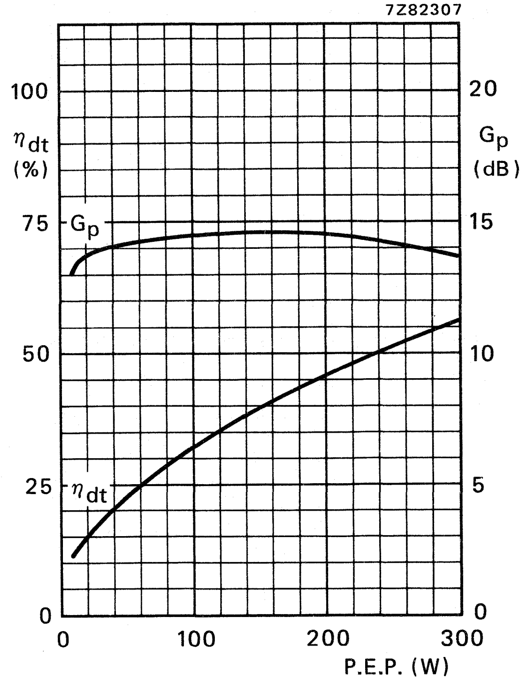


Fig. 10 Double-tone efficiency and power gain as a function of output power.

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.

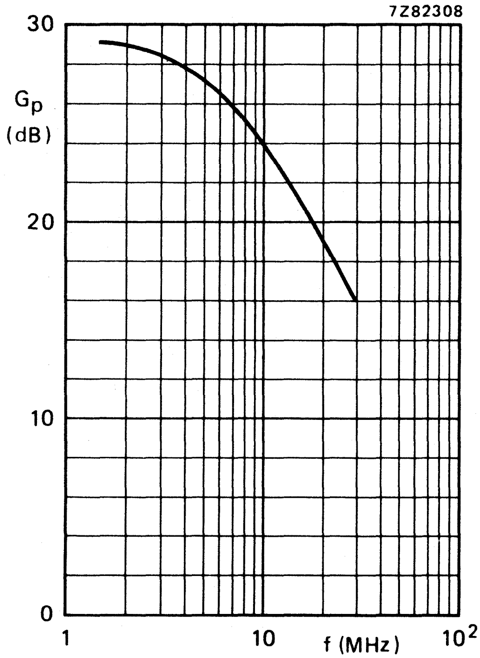


Fig. 11 Power gain as a function of frequency.

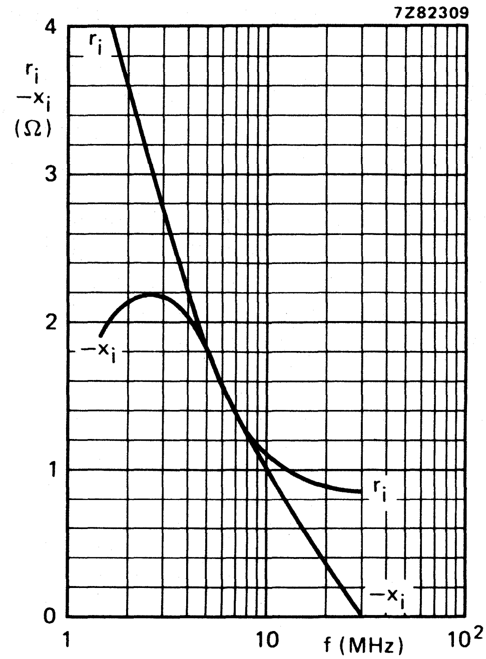


Fig. 12 Input impedance (series components) as a function of frequency.

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)

$T_h = 25\ ^oC$

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

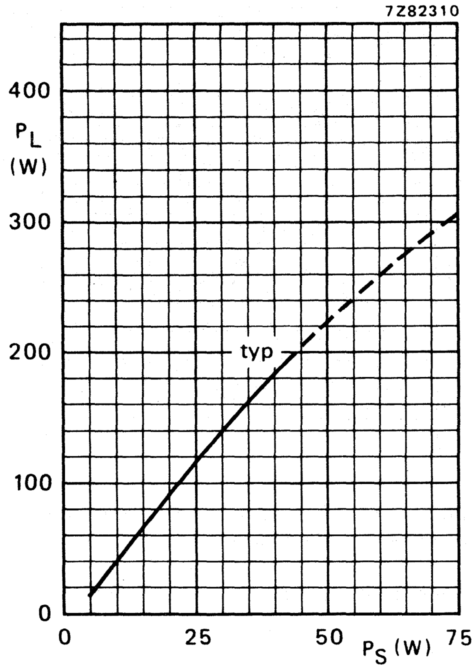


Fig. 13 V_{CE} = 50 V; f = 108 MHz; $T_h = 25\ ^oC$.

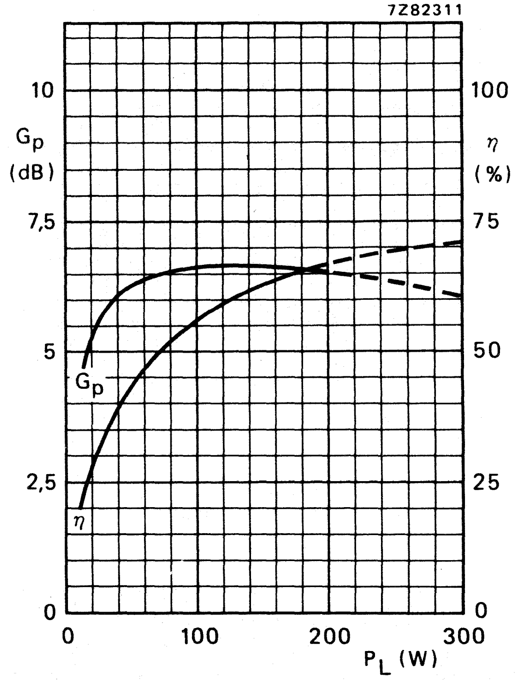


Fig. 14 V_{CE} = 50 V; f = 108 MHz; $T_h = 25\ ^oC$; typical values.

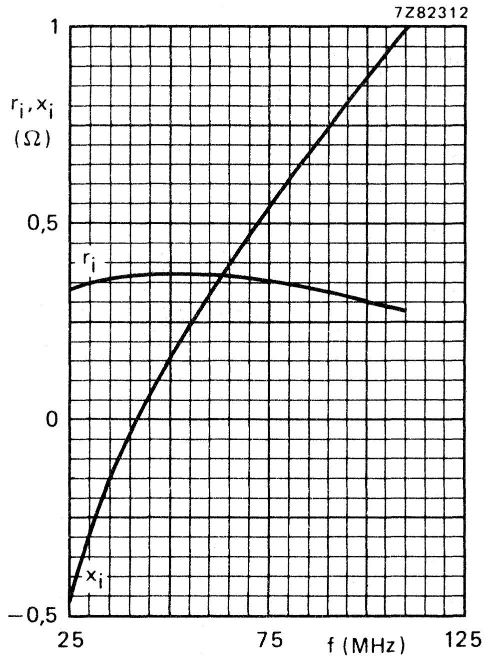


Fig. 15 Input impedance (series components).

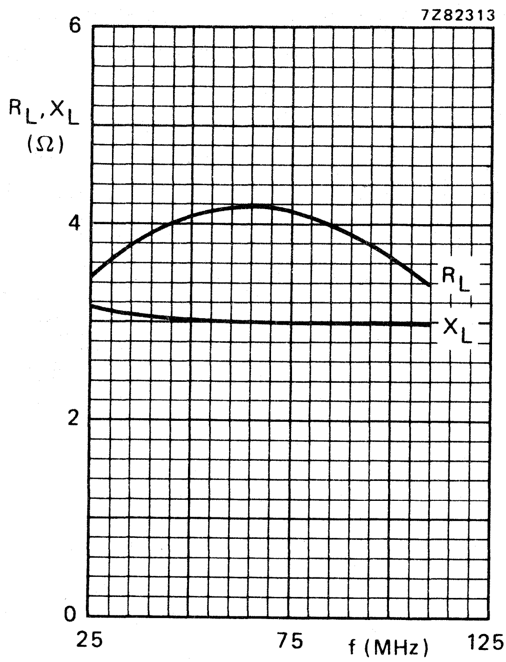


Fig. 16 Load impedance (series components).

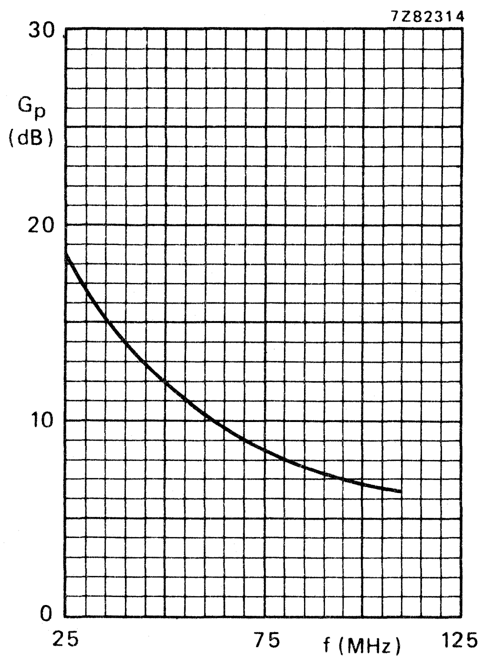


Fig. 17.

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

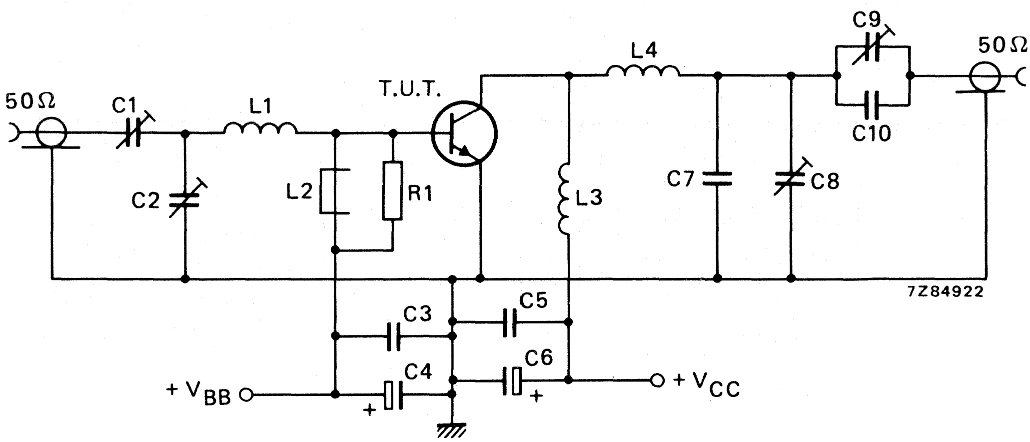


Fig. 18 Test circuit; s.s.b. class-A.

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.

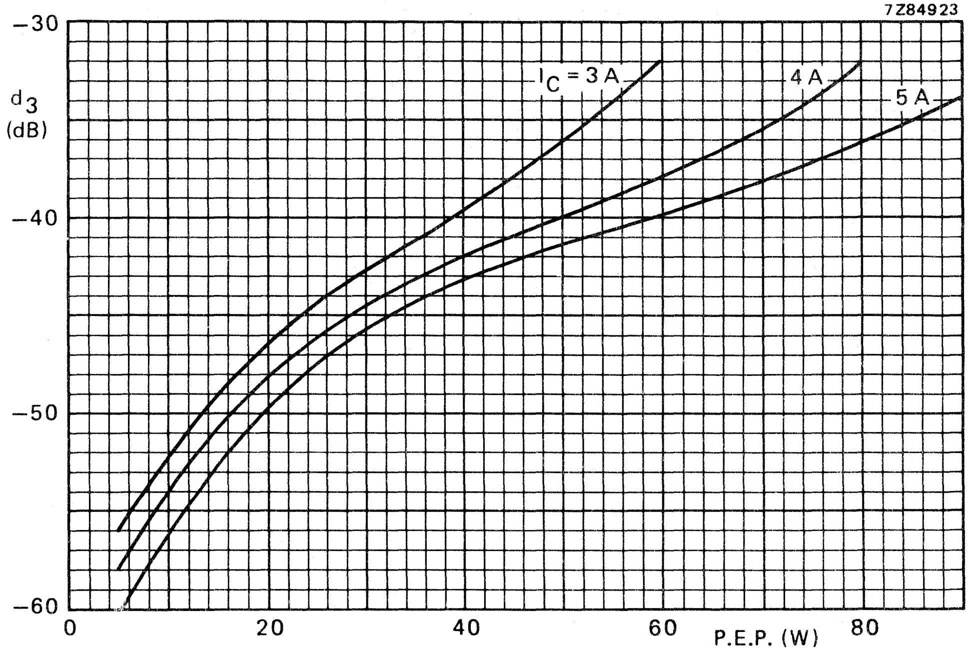


Fig. 19 Third order intermodulation distortion as a function of output power.*
Typical values; V_{CE} = 40 V; T_h = 25 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

* 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

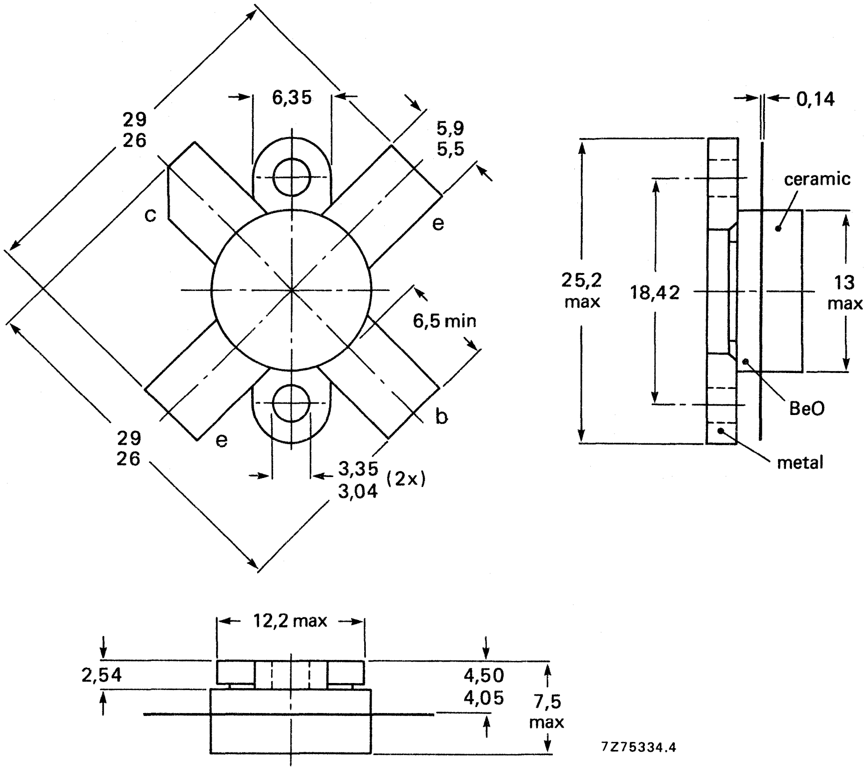
SOT-121 (see Fig. 1).

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

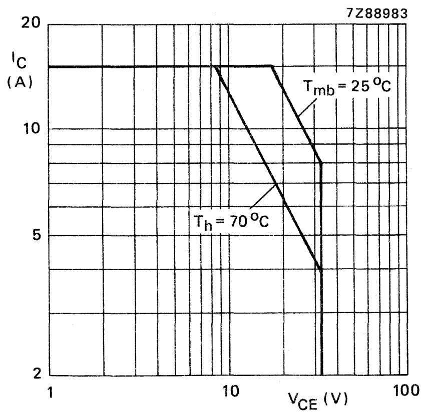


Fig. 2 D.C. SOAR.

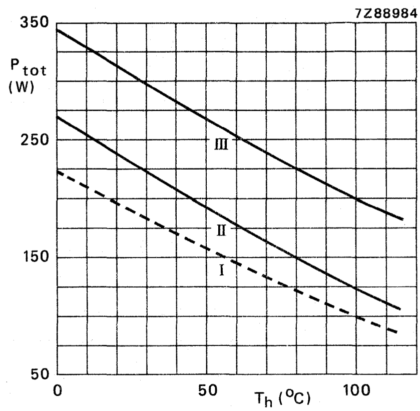


Fig. 3 Power/temperature derating curves.

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.

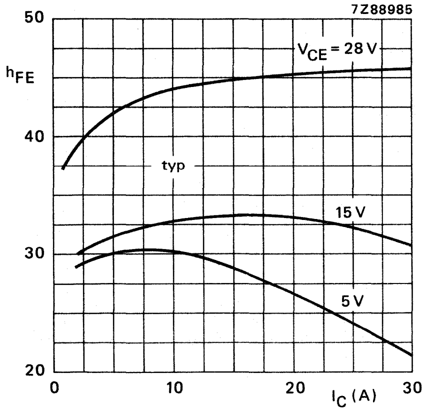


Fig. 4 $T_j = 25\ ^oC$.

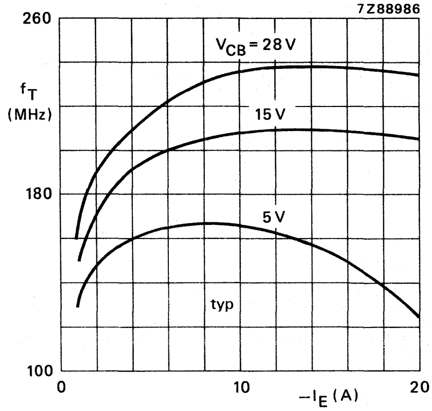


Fig. 5 $T_j = 25\ ^oC$; f = 100 MHz; $t_p = 300\ \mu s$.

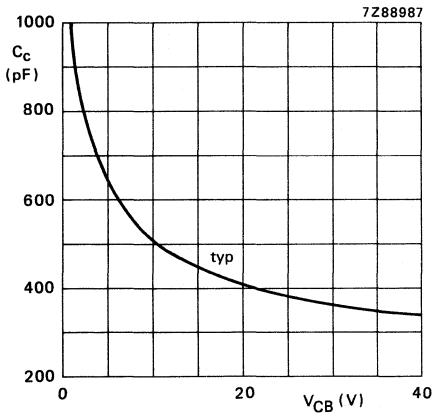


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; $T_j = 25\ ^oC$.

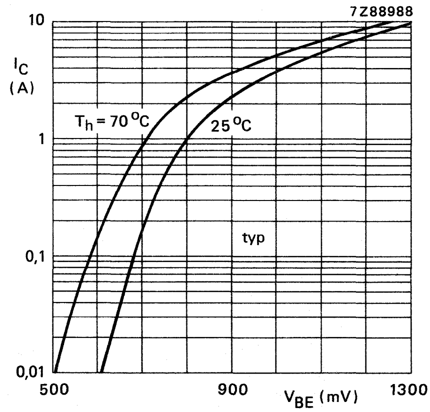


Fig. 7 V_{CE} = 28 V.

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.

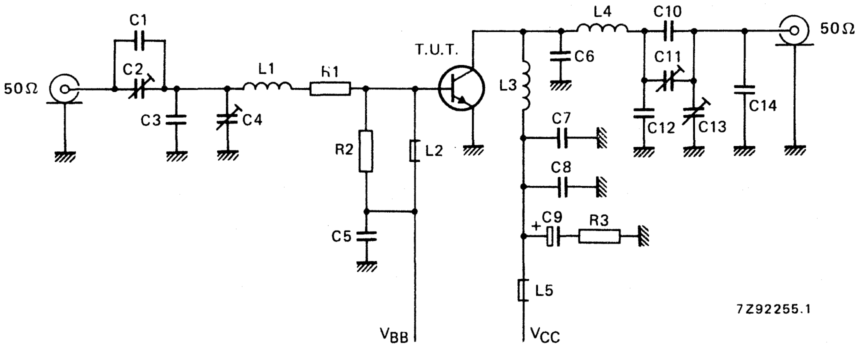


Fig. 8 Class-AB (s.s.b.) test circuit.

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

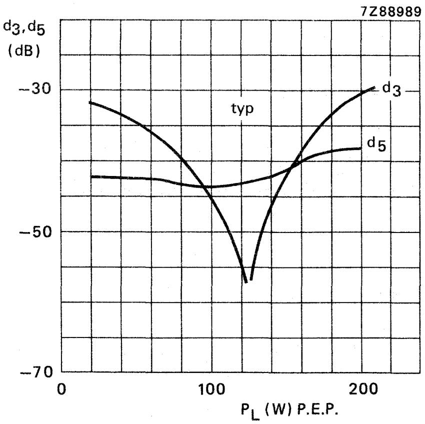


Fig. 9 Intermodulation distortion (see note on preceding page).

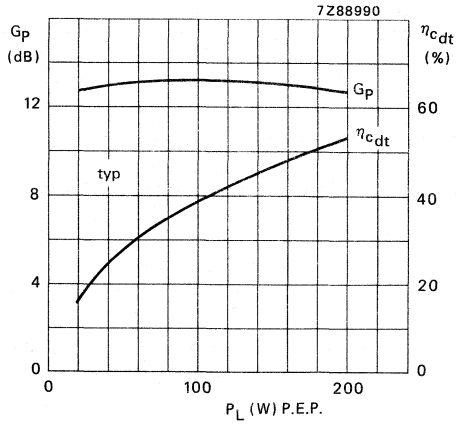


Fig. 10 Power gain and double-tone efficiency.

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.

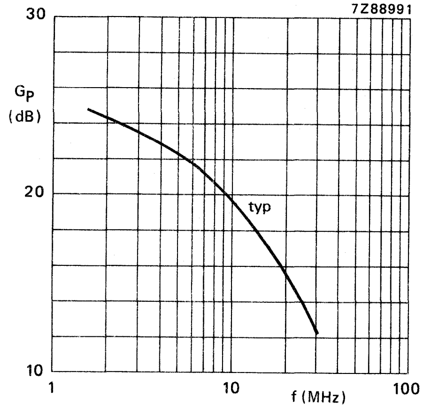


Fig. 11 Power gain.

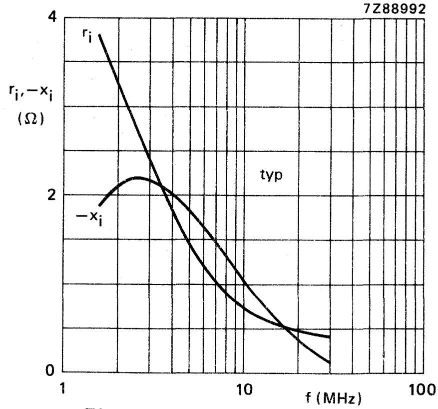


Fig. 12 Input impedance (series components).

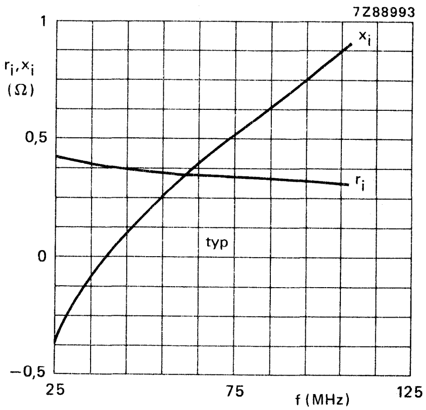


Fig. 13 Input impedance (series components).

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.

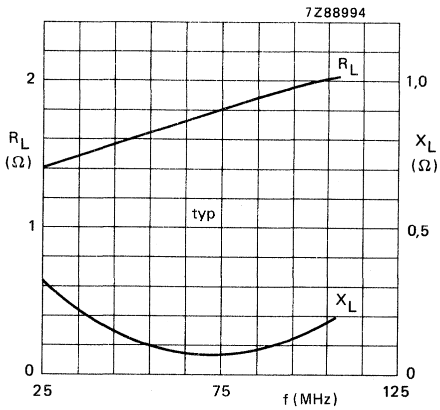


Fig. 14 Load impedance (series components).

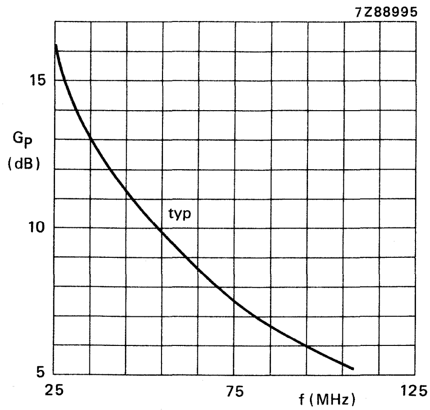


Fig. 15 Power gain.

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

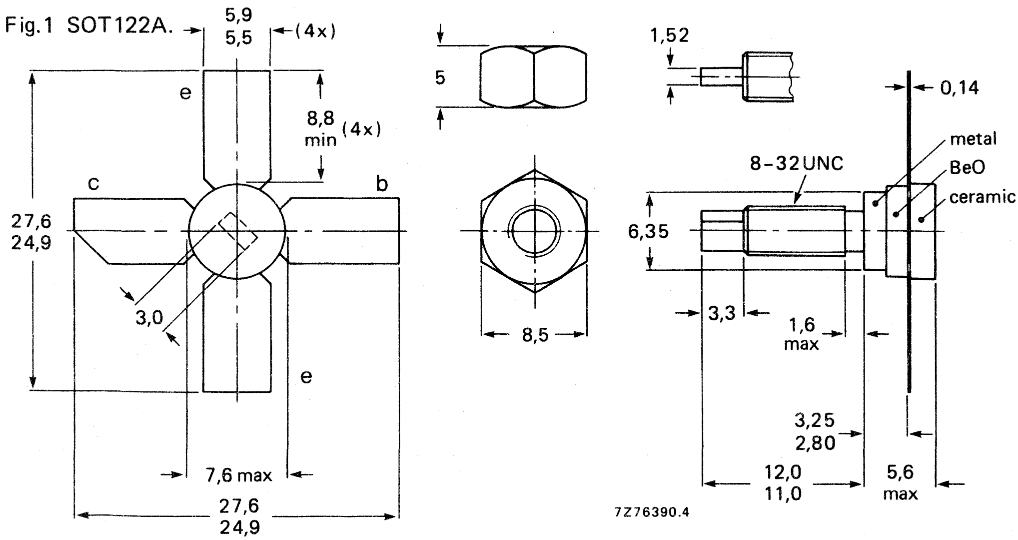
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 6,5
class-A	860	25	850	25	−60	typ. 4,4	typ. 7,0

* 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 SOT122A.



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.

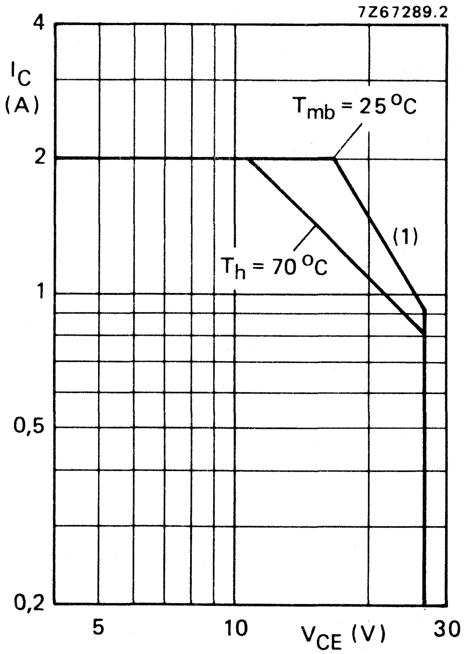
When locking is required an adhesive is preferred instead of a lock washer.

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 + 150		^oC
Operating junction temperature	T_j	max.	200	^oC



(1) Second breakdown limit (independent of temperature).

Fig. 2 D.C. SOAR.

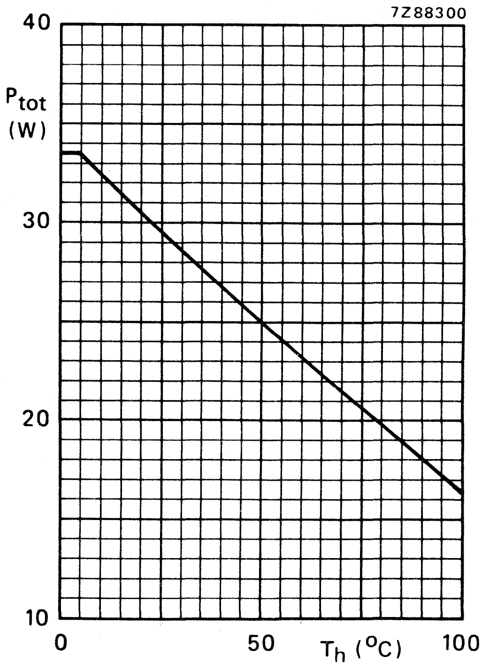


Fig. 3 Power derating curve vs. temperature.

THERMAL RESISTANCE (dissipation = 21,25 W; $T_{mb} = 82,75\ ^oC$, $T_h = 70\ ^oC$)

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

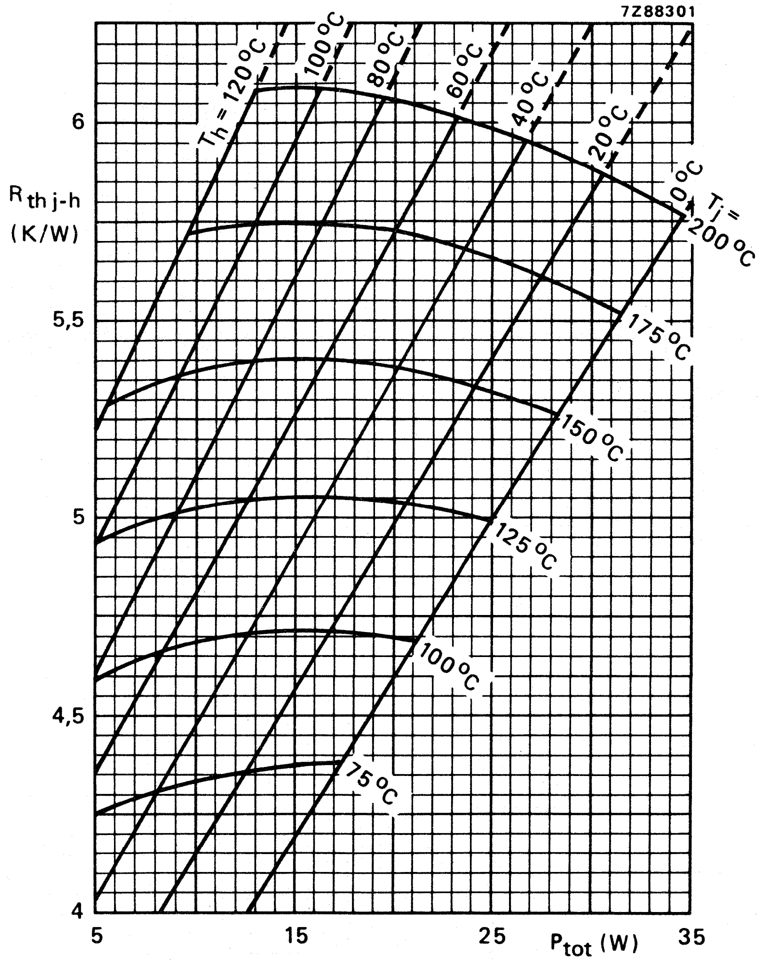


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\ mb\text{-}h}$ = 0,6 K/W.)

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.	1,2	pF

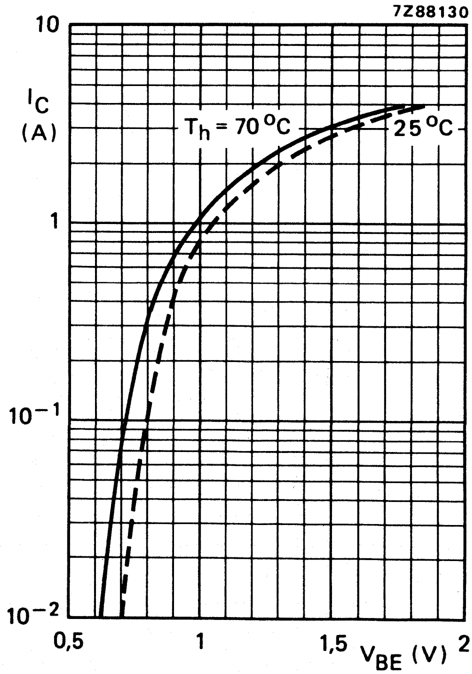


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leqslant 300\ \mu s$; $\delta \leqslant 0,02$.
** Measured under pulse conditions: $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,01$.

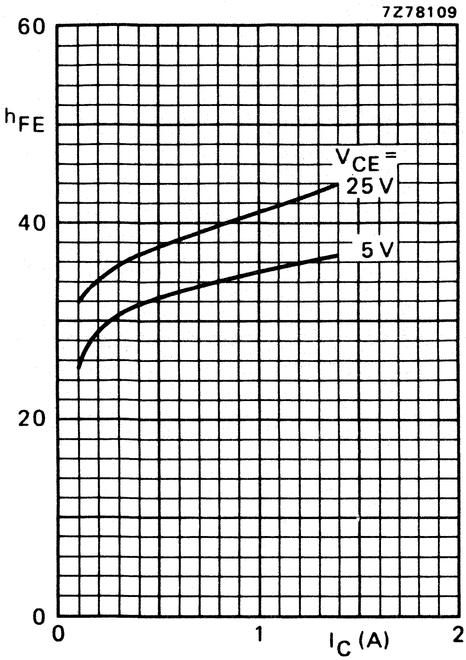


Fig. 6 Typical values; T_j = 25 °C.

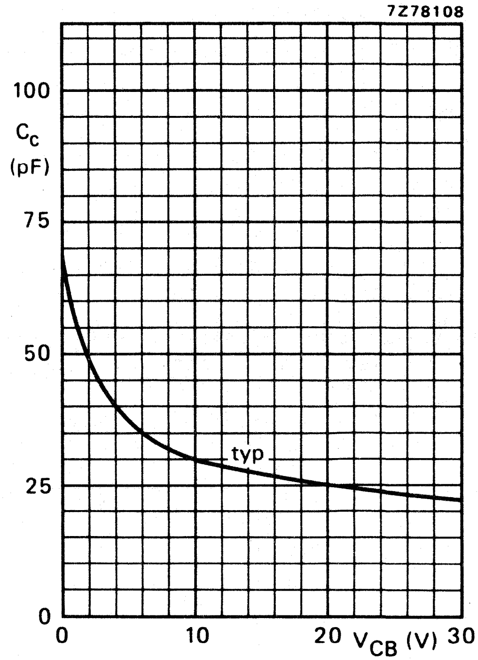


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

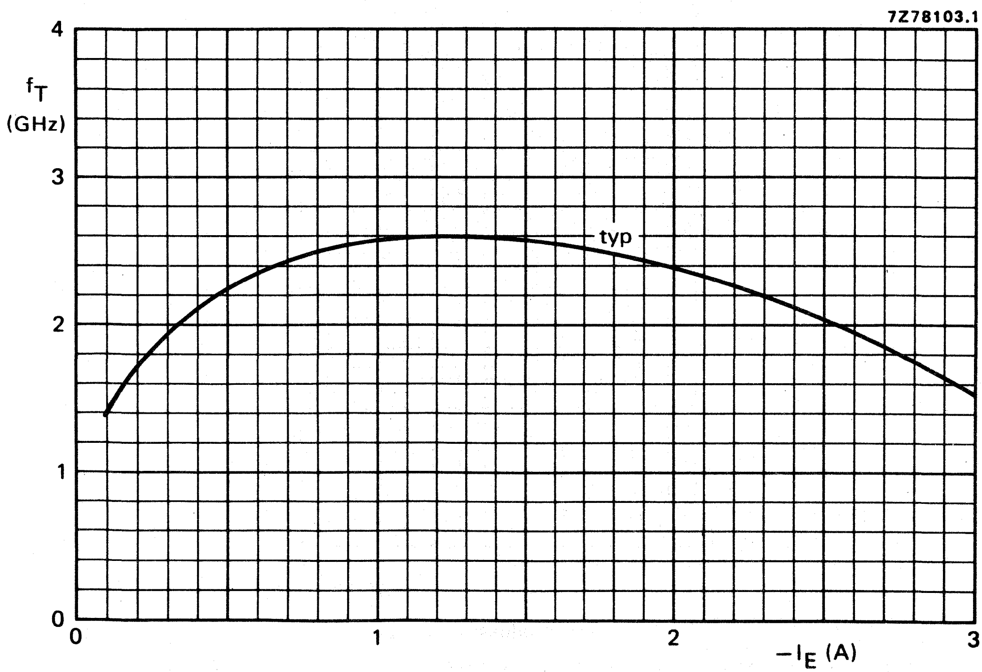


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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.

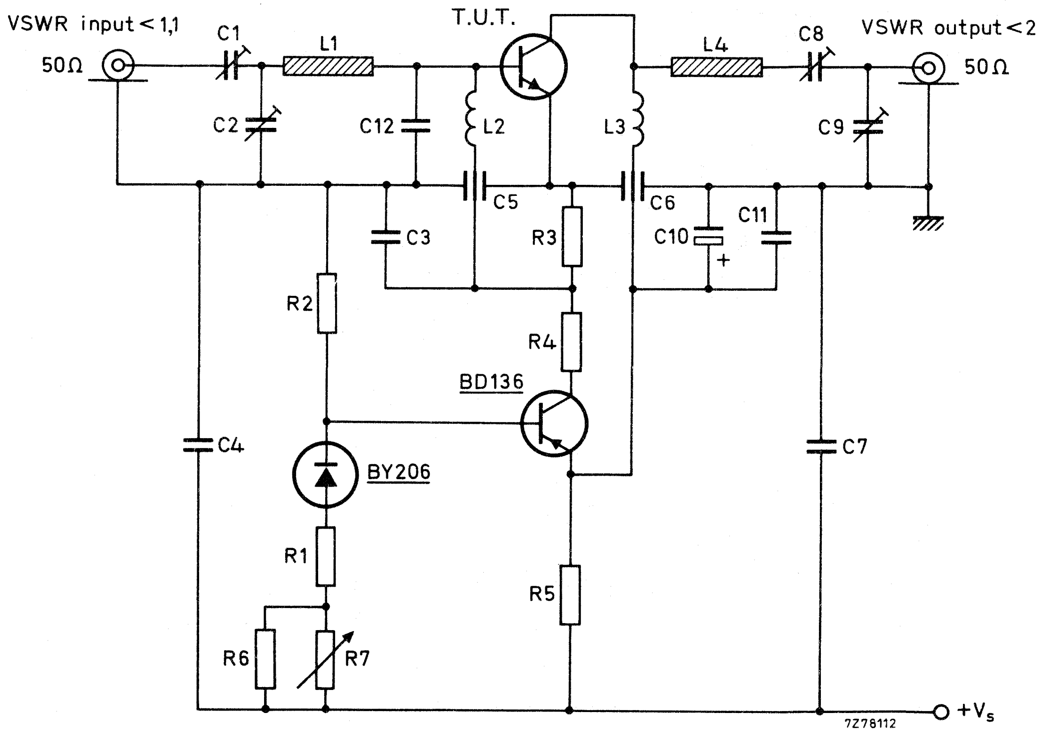


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

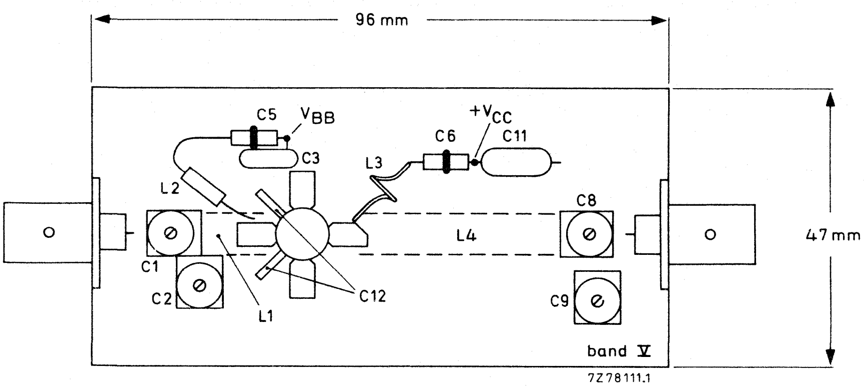
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 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)

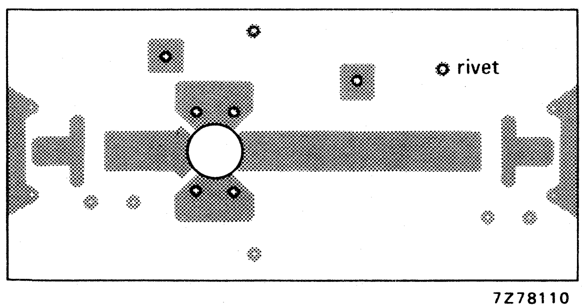
List of components: (continued)

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.

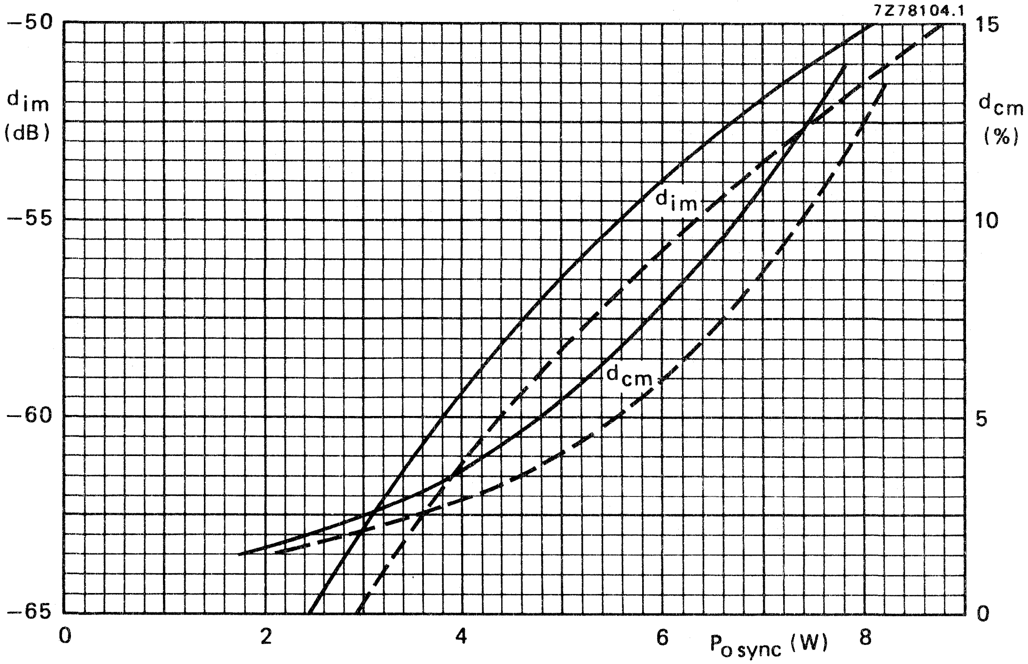


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\ sync}$. Typical values; V_{CE} = 25 V; I_C = 850 mA;– – –T_h = 25 °C;——T_h = 70 °C; f_{vision} = 860 MHz.

* 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.

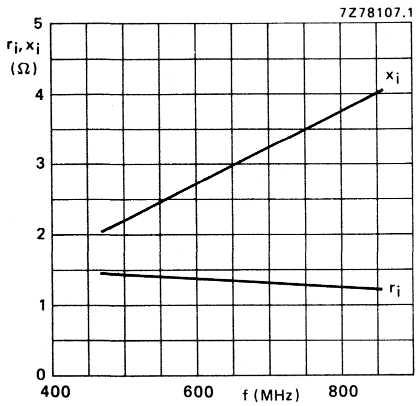


Fig. 12 Input impedance (series components).

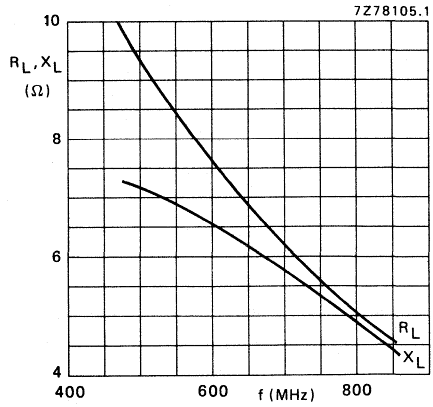


Fig. 13 Load impedance (series components).

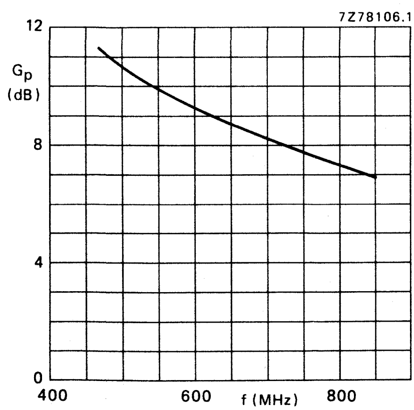


Fig. 14.

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

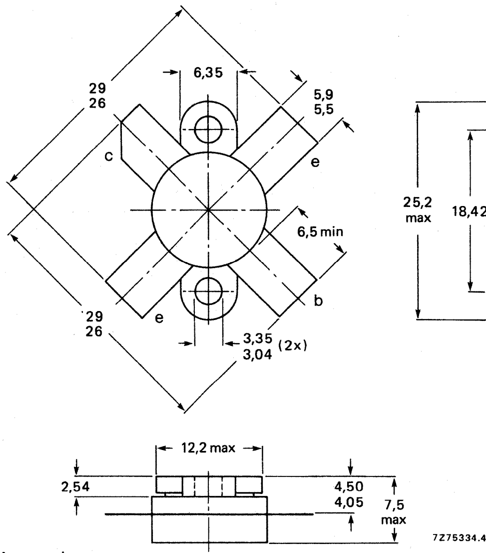
R.F. performance at T_h = 25 °C

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 °C	$P_{tot(d.c.)}$	max.	154	W
R.F. power dissipation f > 1 MHz; T_{mb} = 25 °C	$P_{tot(rf)}$	max.	192	W
Storage temperature	T_{stg}	−65 to +150		°C
Operating junction temperature	T_j	max.	200	°C

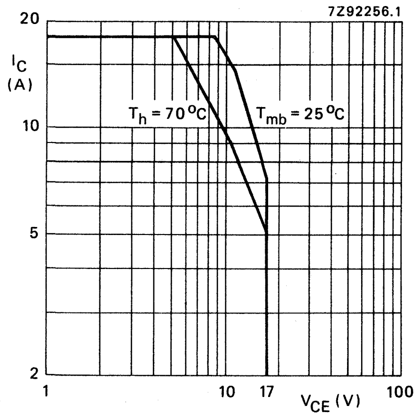


Fig. 2 D.C. SOAR.

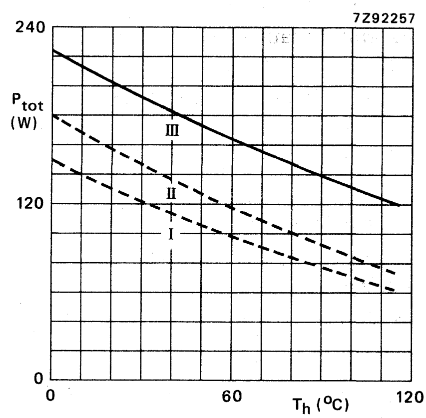


Fig. 3 Power/temperature derating curves.

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 = 100 W; T_{mb} = 25 °C

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 °C

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 Ω	E_{SBR}	>	12,5	mJ
D.C. current gain*				
I_C = 10 A; V_{CE} = 5 V	h_{FE}	typ.	35	
		15 to	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

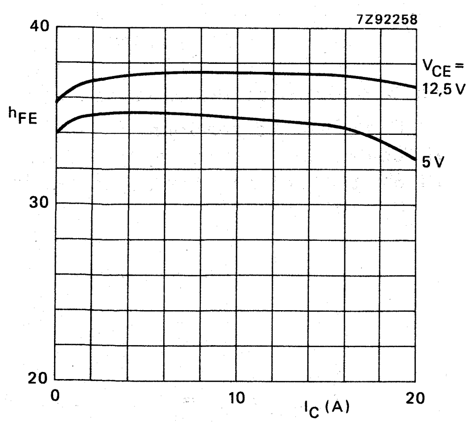


Fig. 4 T_j = 25 °C.

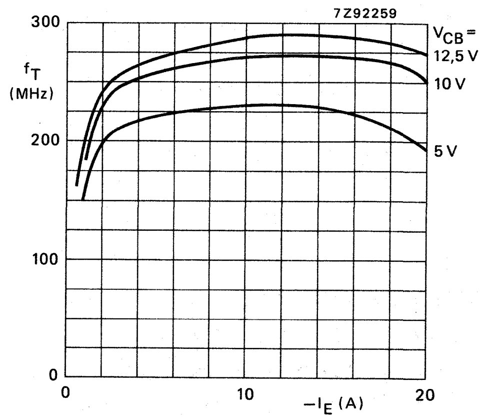


Fig. 5 f = 100 MHz; T_j = 25 °C.

* Measured under pulse conditions: t_p = 500 μs.
** Measured under pulse conditions: t_p = 300 μs; δ = 0,02.

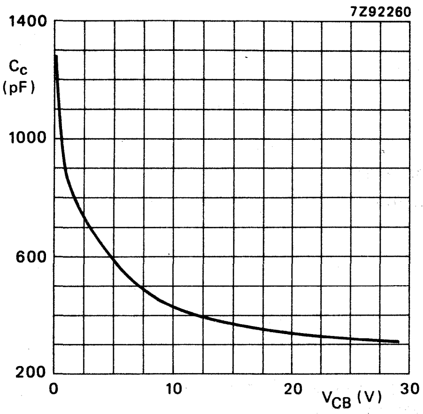


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; T_j = 25 °C.

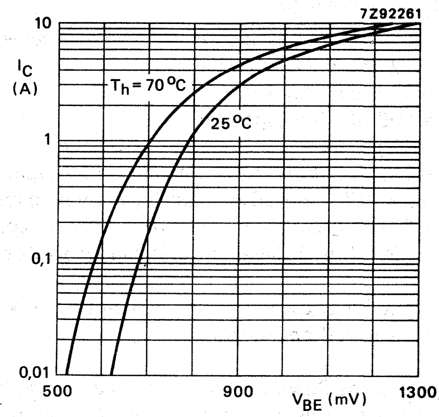


Fig. 7 V_{CE} = 12,5 V; typ. values.

APPLICATION INFORMATION

R.F. performance in s.s.b. class-AB operation (linear power amplifier) V_{CE} = 12,5 V; T_h = 25 °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
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.

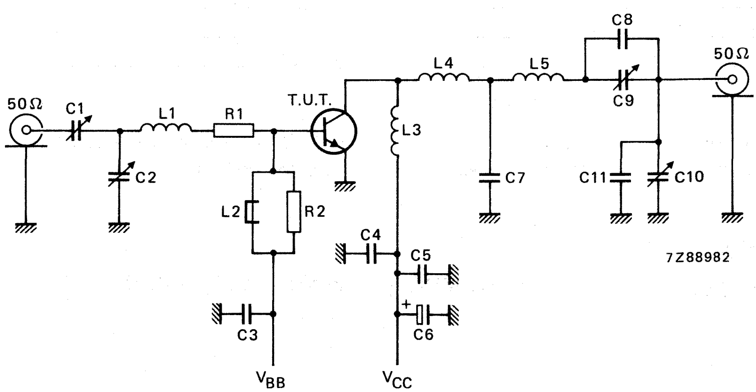


Fig. 8 Class-AB test circuit, s.s.b.

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.

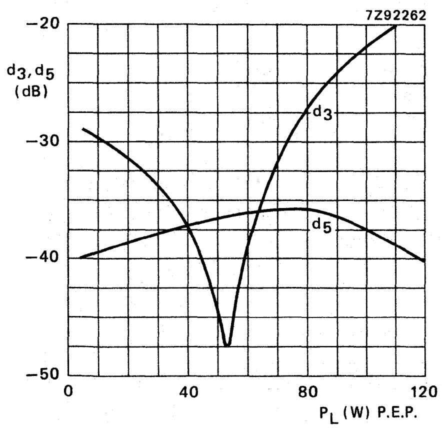


Fig. 9 Intermodulation distortion (see note on preceding page); typ. values.

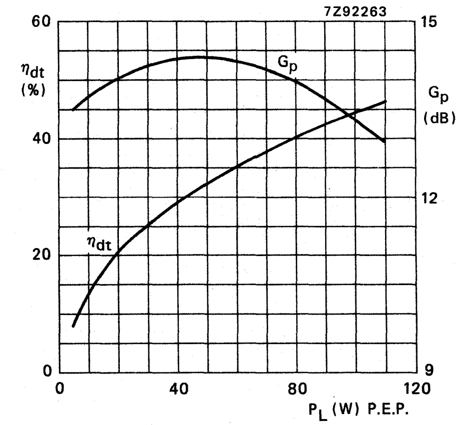


Fig. 10 Double-tone efficiency and power gain; typ. values.

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.

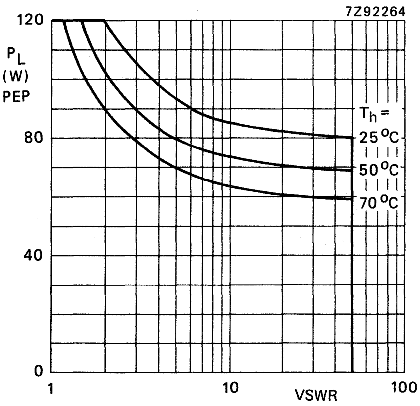


Fig. 11 R.F. SOAR: s.s.b. class-AB operation; V_{CE} = 15 V; $R_{th\ mb\text{-}h}$ = 0,2 K/W; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

This graph shows the permissible output power as a function of VSWR during mismatch conditions with the heatsink temperature as parameter.

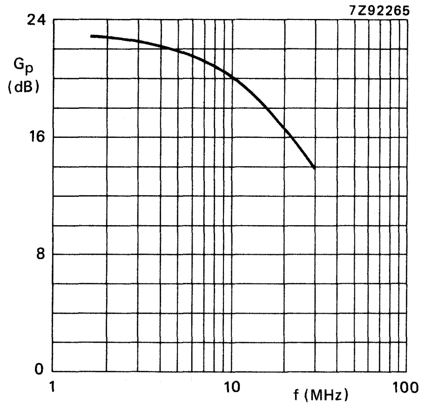


Fig. 12 Power gain.

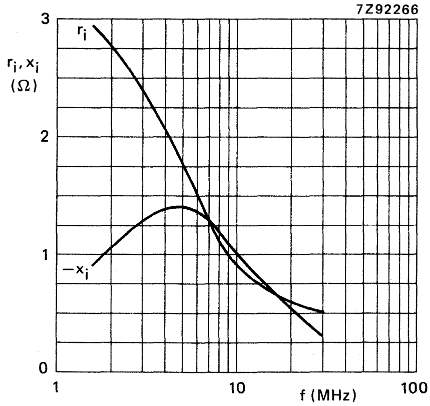


Fig. 13 Input impedance (series components).

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

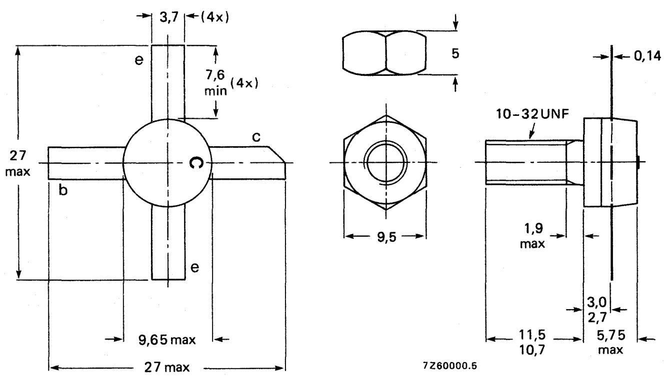
mode of operation	V_{CE} V	f_1 MHz	f_2 MHz	P_L W	G_p dB	d_3 dB	I_C A	η_{dt} %
s.s.b. (class-A)	26	28,000	28,001	0-8(P.E.P.)	> 18	< −40	< 1,2	–
s.s.b. (class-AB)	28	28,000	28,001	25(P.E.P.)	> 18	typ. −35	typ. 1,28	typ. 35

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

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

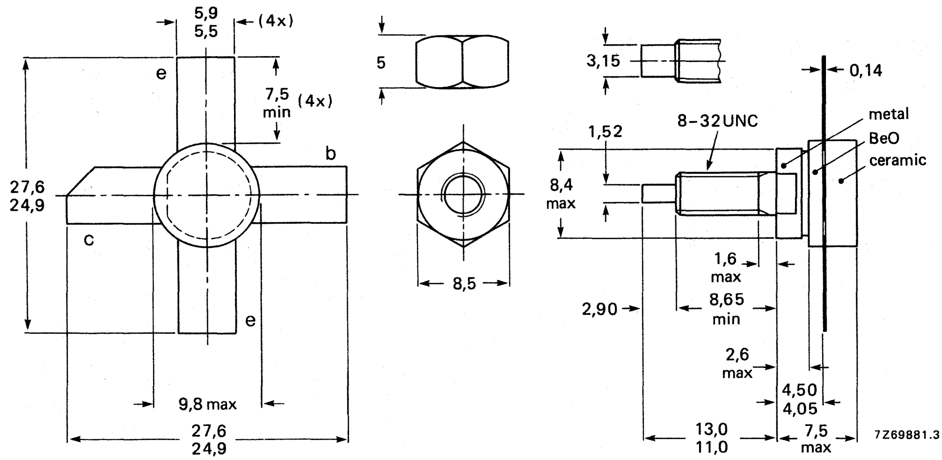
R.F. performance

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

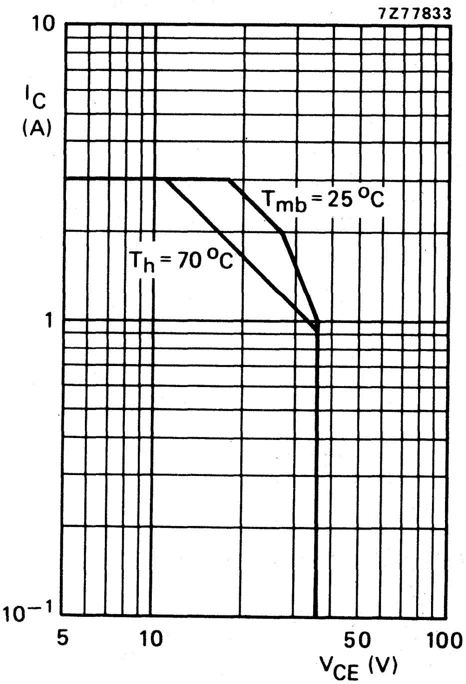


Fig. 2 D.C. SOAR.

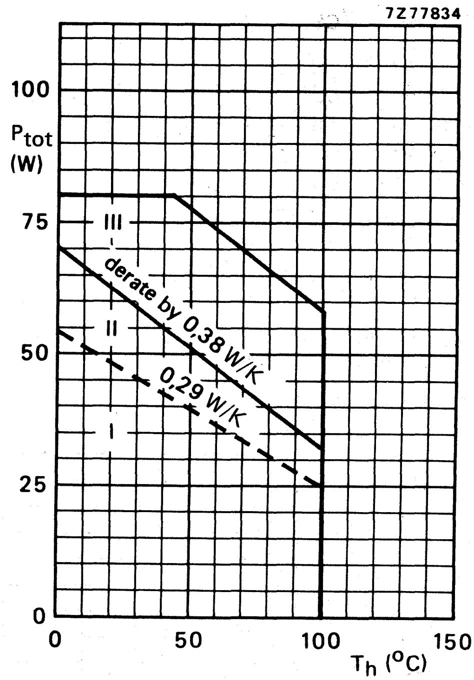


Fig. 3 R.F. power dissipation; $V_{CE} \leq 28$ V; f ≥ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operating during mismatch

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

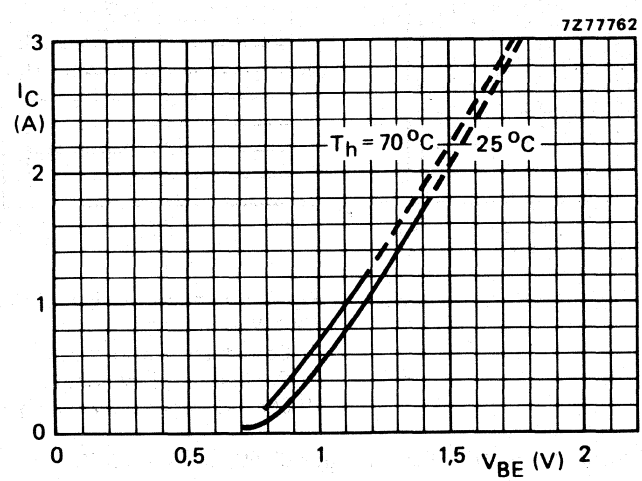


Fig. 4 Typical values; V_{CE} = 28 V.

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

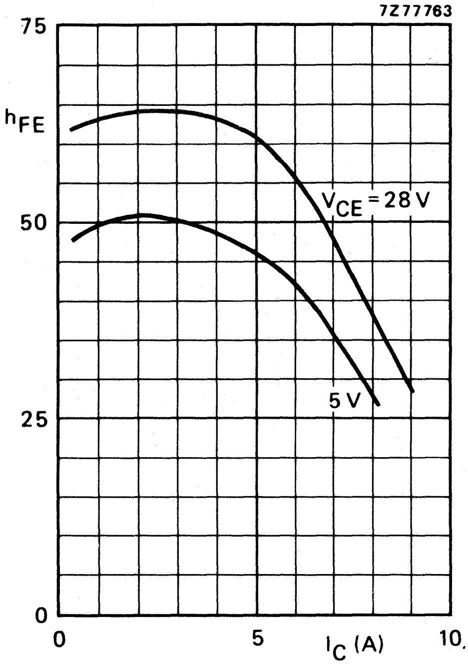


Fig. 5 Typical values; T_j = 25 °C.

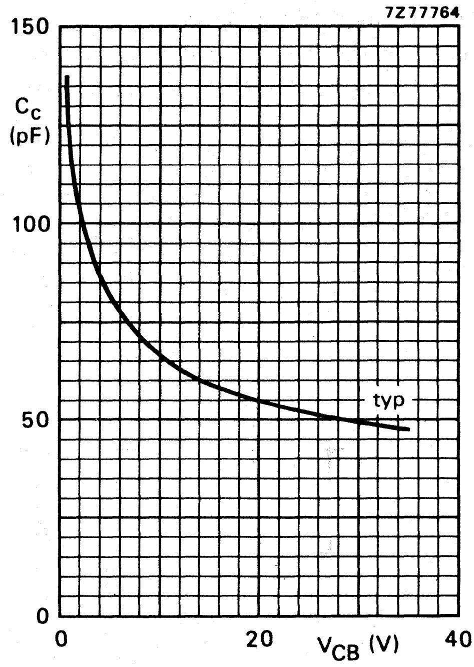


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

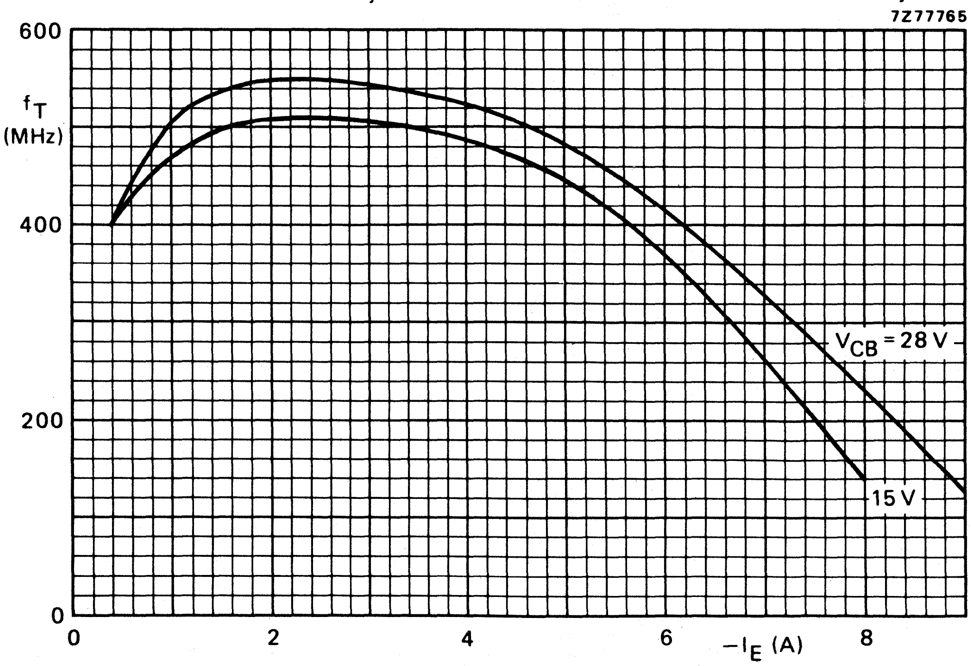


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

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

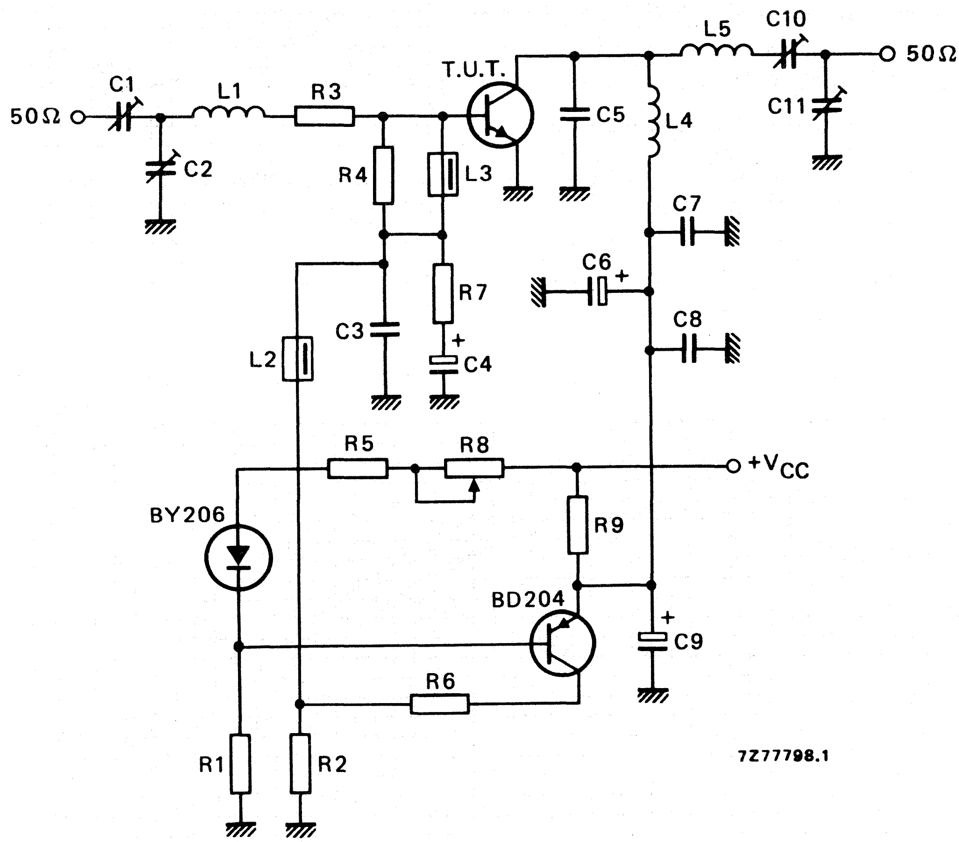


Fig. 8 Test circuit; s.s.b. class-A.

* 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)

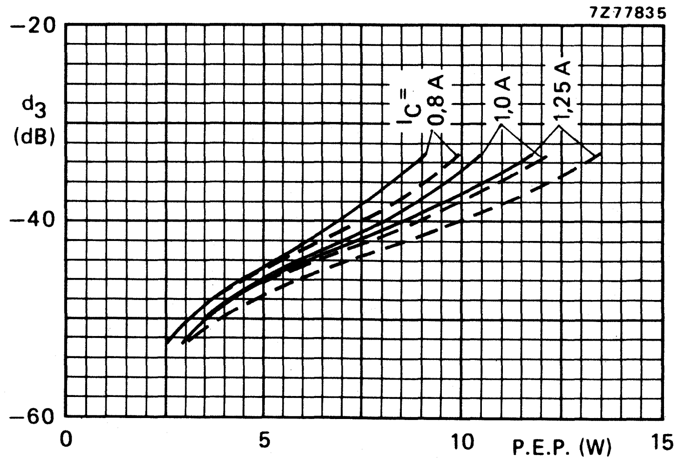


Fig. 9 Intermodulation distortion as a function of output power.
Typical values; V_{CE} = 26 V; f_1 = 28,000 MHz; f_2 = 28,001 MHz;
—— T_h = 70 °C; – – – T_h = 25 °C.

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

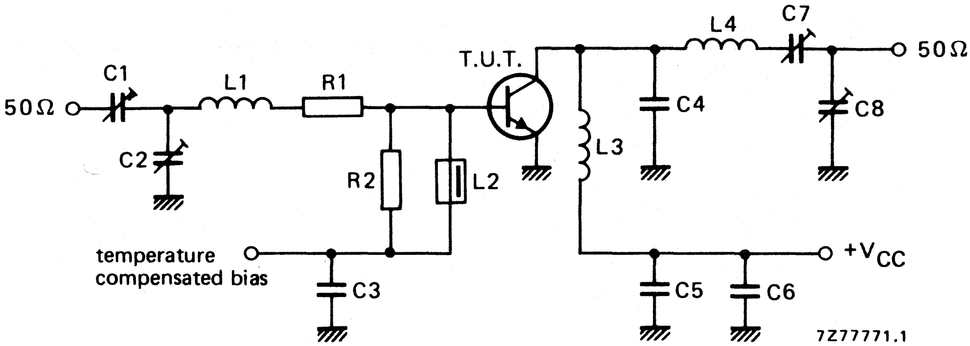


Fig. 10 Test circuit; s.s.b. class-AB.

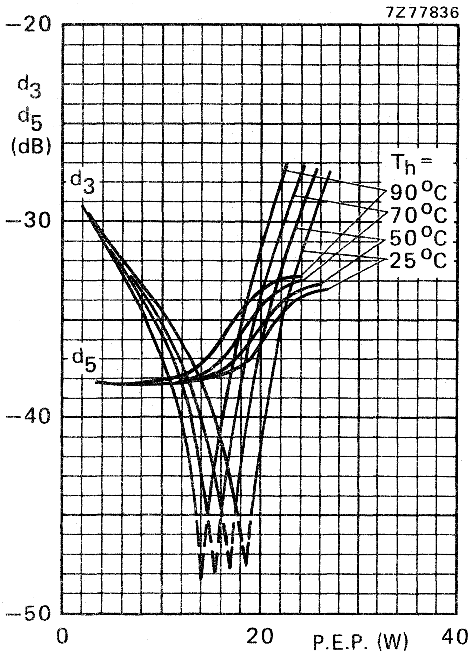
List of components:

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.



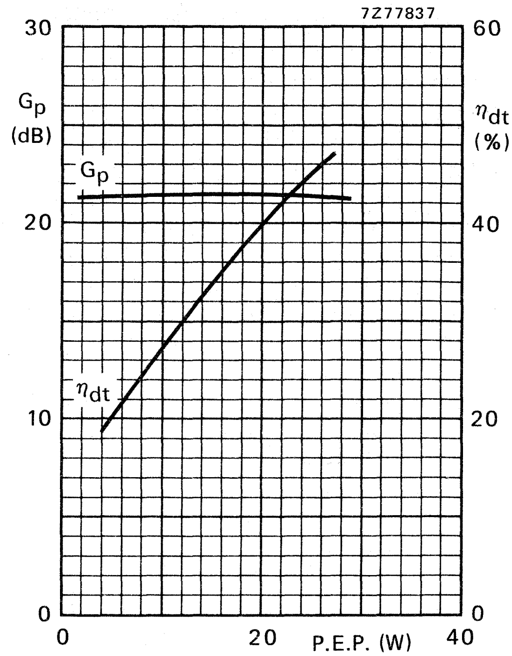


Fig. 11 Intermodulation distortion as a function of output power. *

Fig. 12 Double-tone efficiency and power gain as a function of output power.

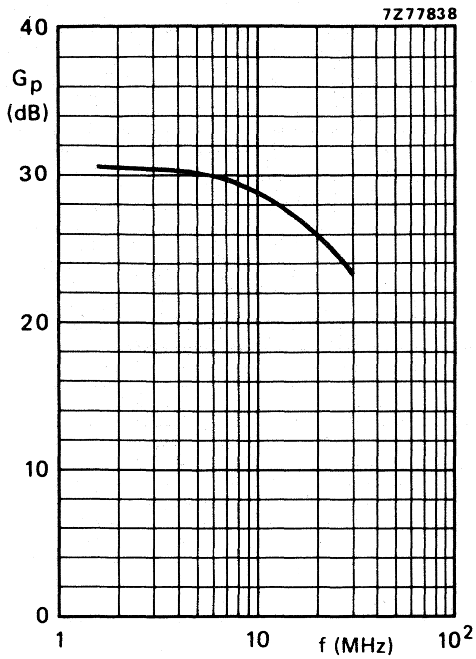
Conditions for Fig. 11:

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.



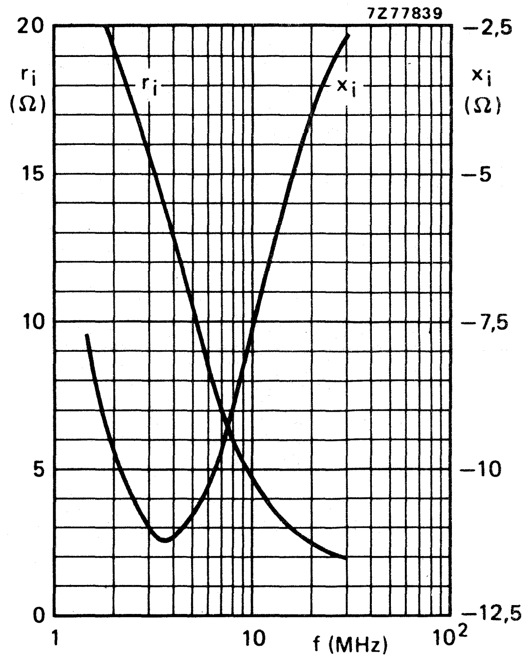


Fig. 13 Power gain as a function of frequency.

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

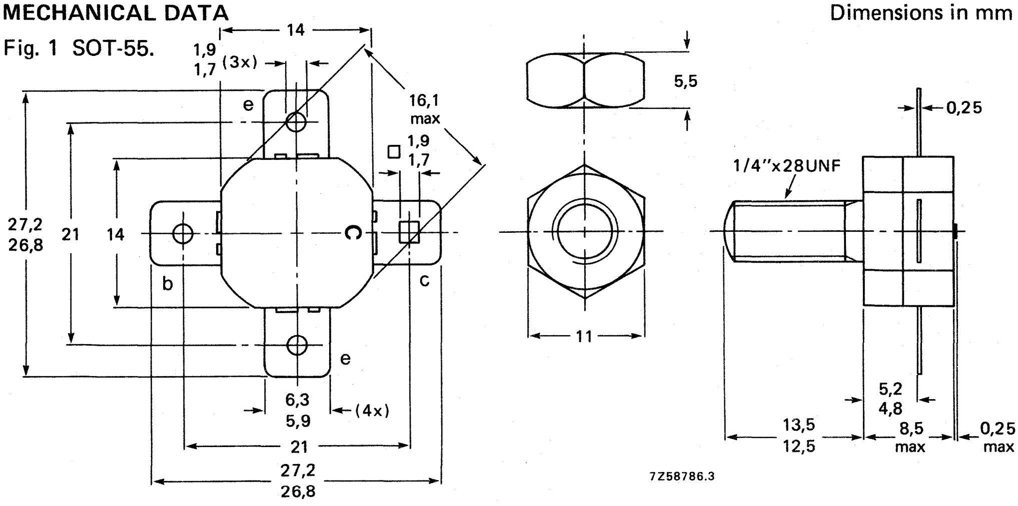
QUICK REFERENCE DATA

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

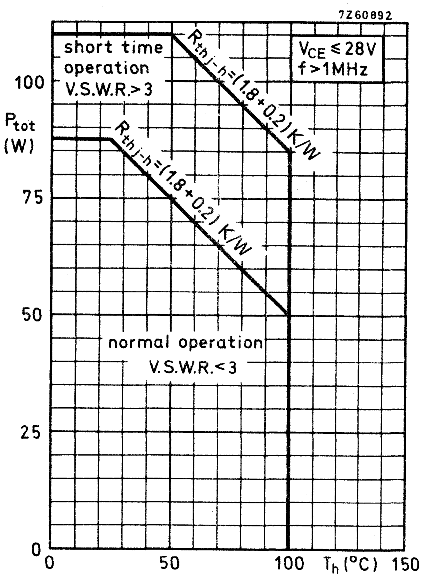


Fig.2.

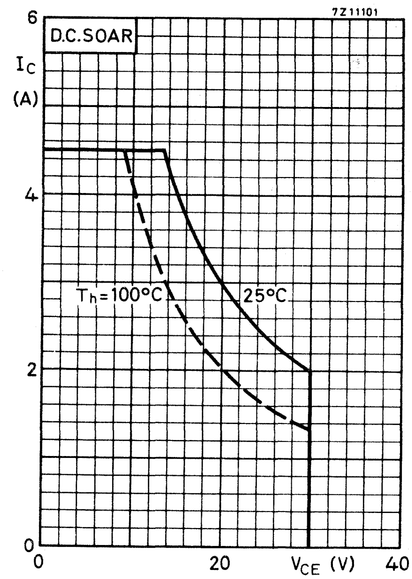


Fig.3.

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

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	1.8	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.2	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$

Collector-base breakdown voltage				
open emitter; $I_C = 25$ mA	$V_{(BR)CBO}$	>	85	V
Collector-emitter breakdown voltage				
$R_{BE} = 10\ \Omega$; $I_C = 25$ 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
$R_{BE} = 33\ \Omega$	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

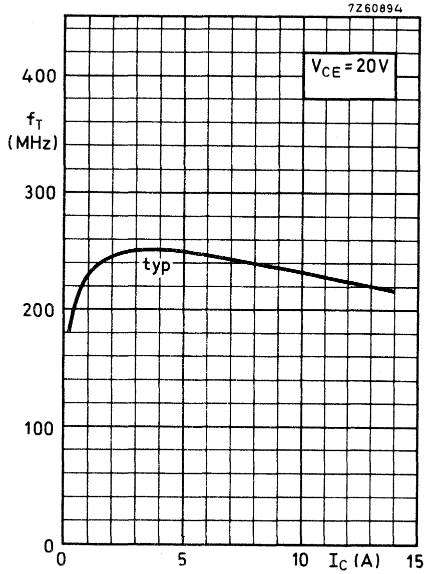


Fig.4.

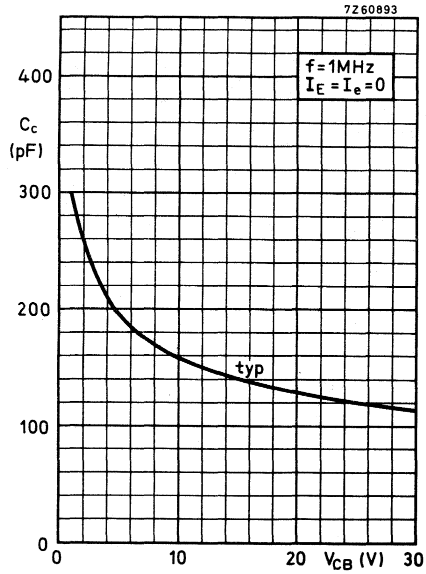


Fig.5.

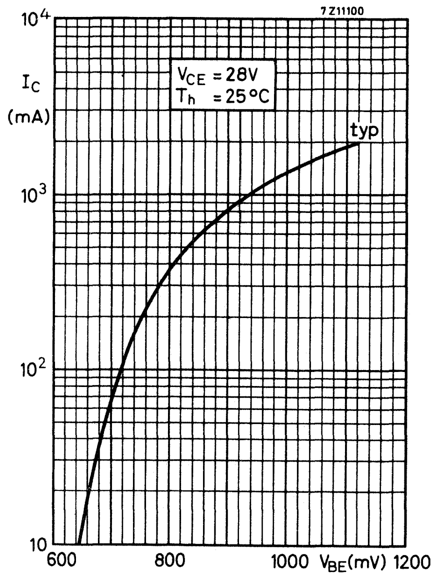


Fig.6.

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.

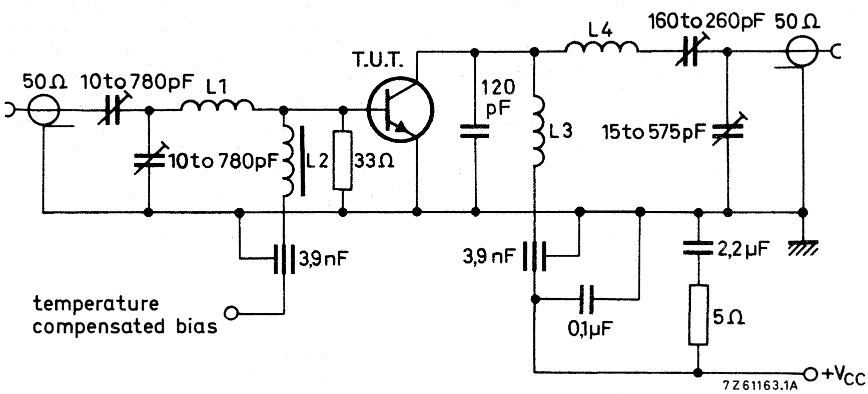


Fig. 7 Test circuit; s.s.b. class-AB.

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.

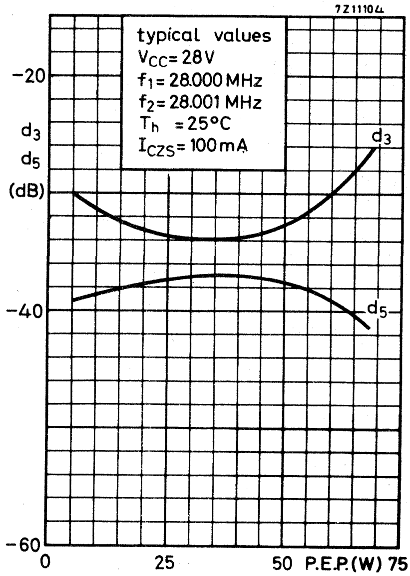


Fig.8.

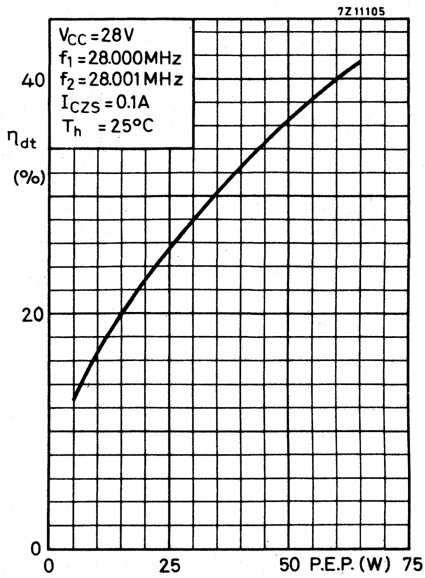


Fig.9.

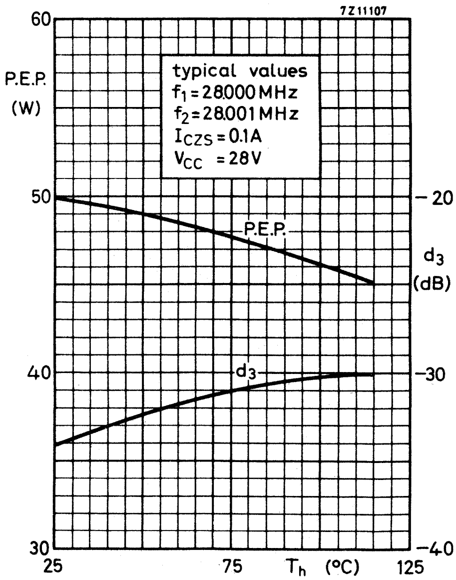


Fig.10.

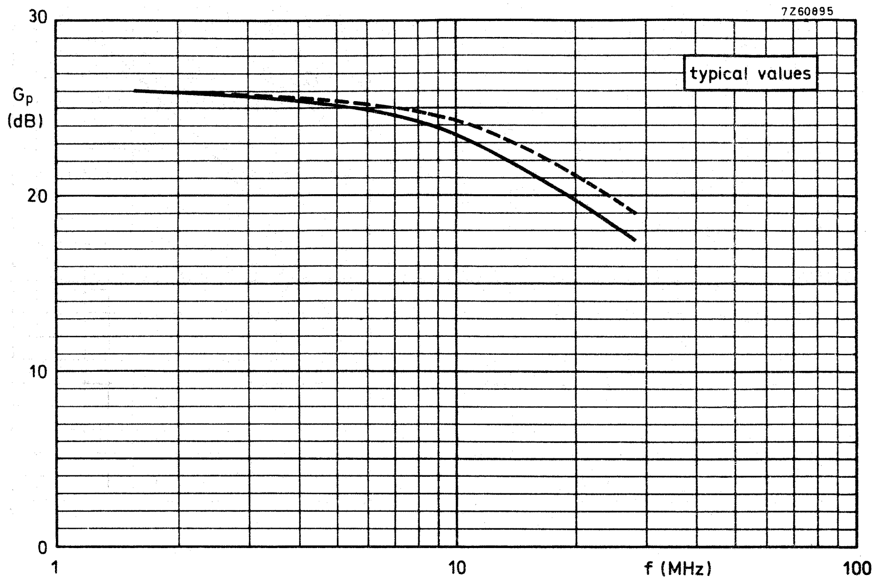


Fig.11.

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

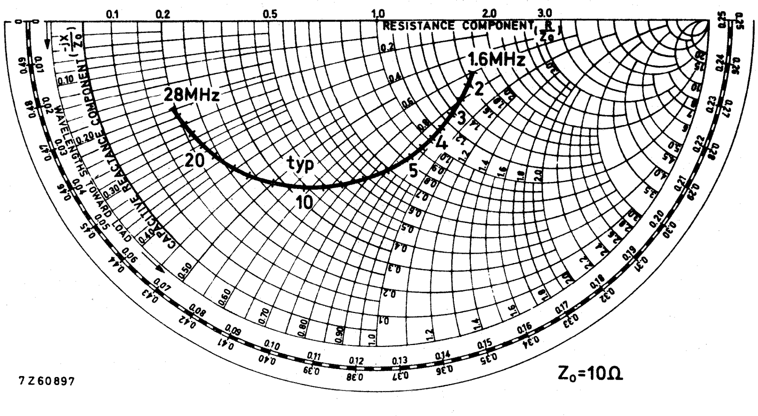


Fig.12.

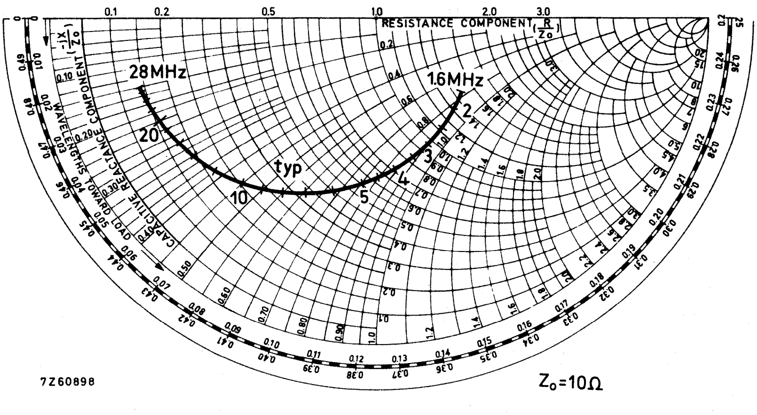


Fig.13.

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

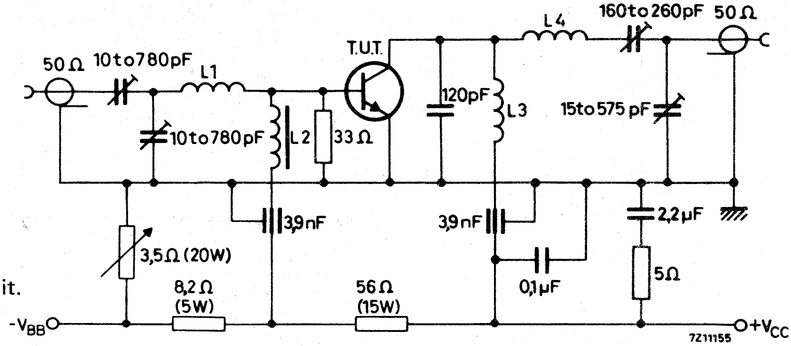


Fig.14 S.S.B. class A test circuit.

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

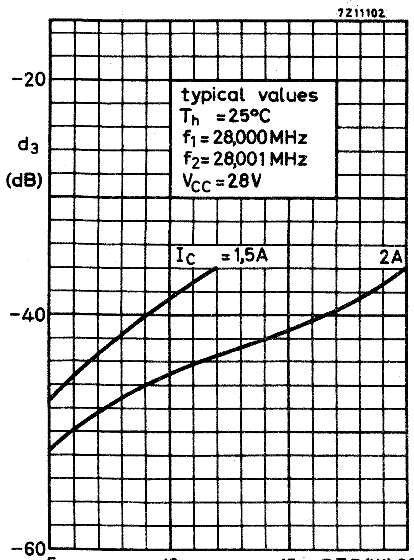


Fig.15.

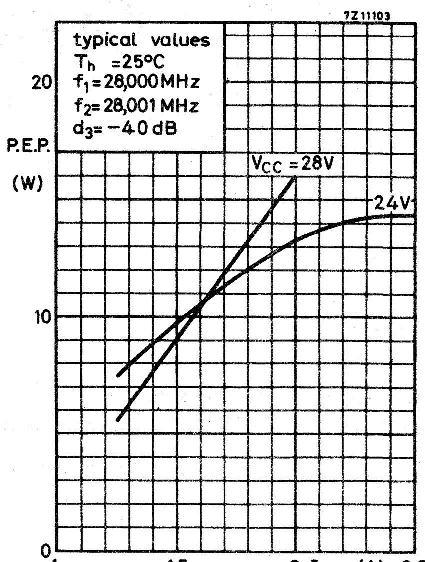


Fig.16.

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.

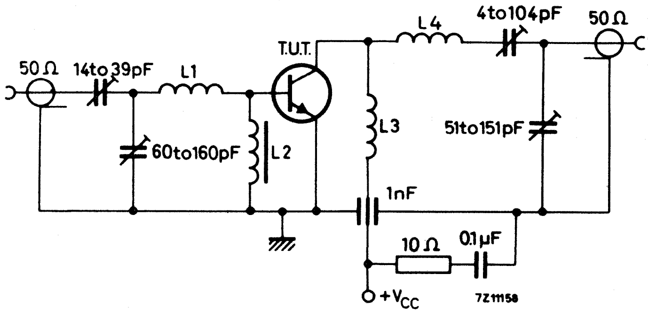


Fig.17 C.W. 70 MHz test circuit.

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

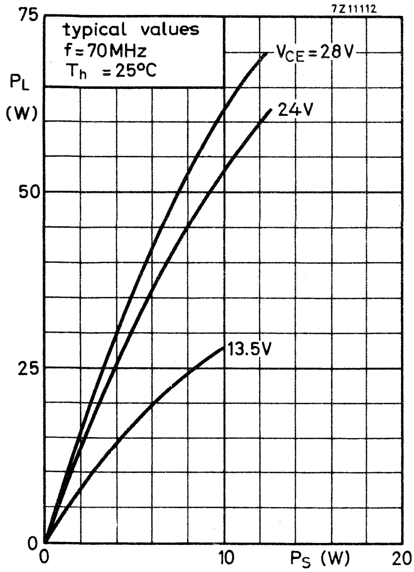


Fig.18.

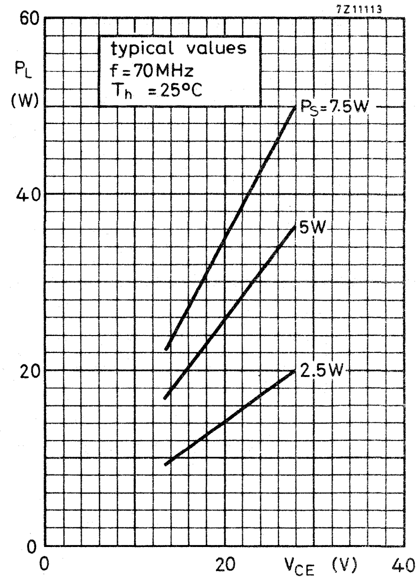


Fig.19.

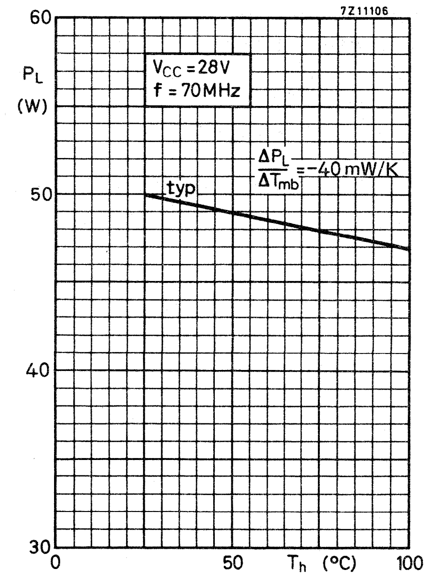


Fig.20.

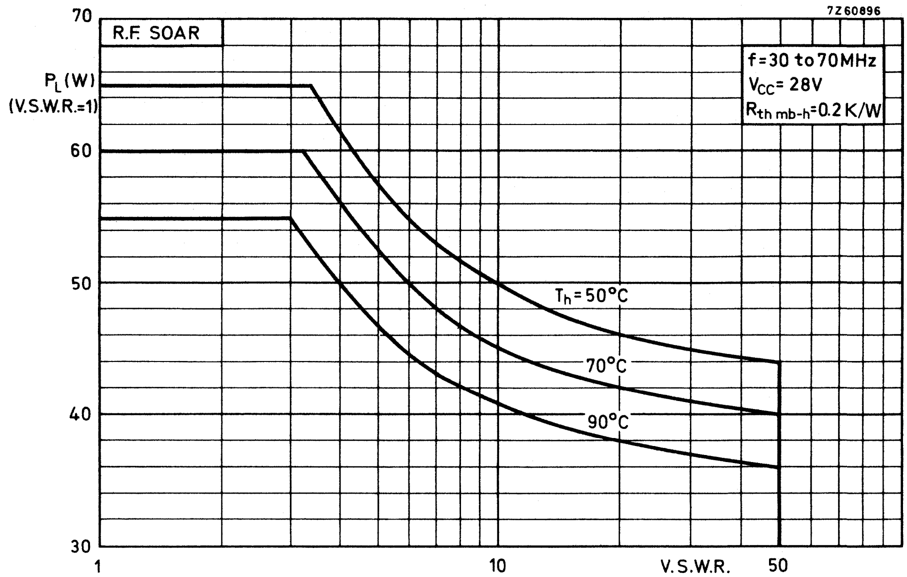


Fig.21.

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.

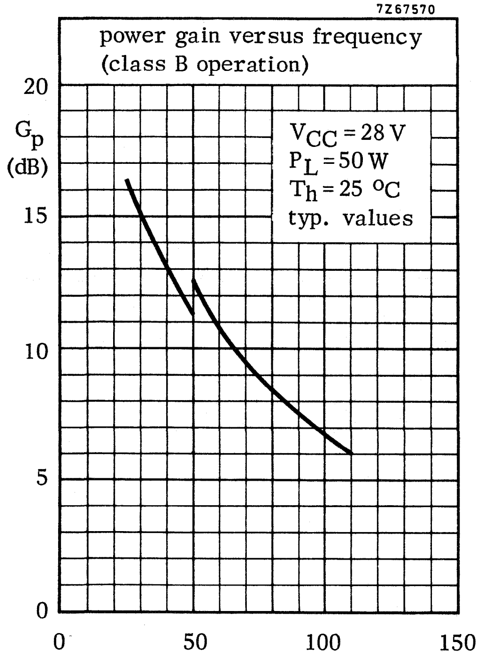


Fig.22.

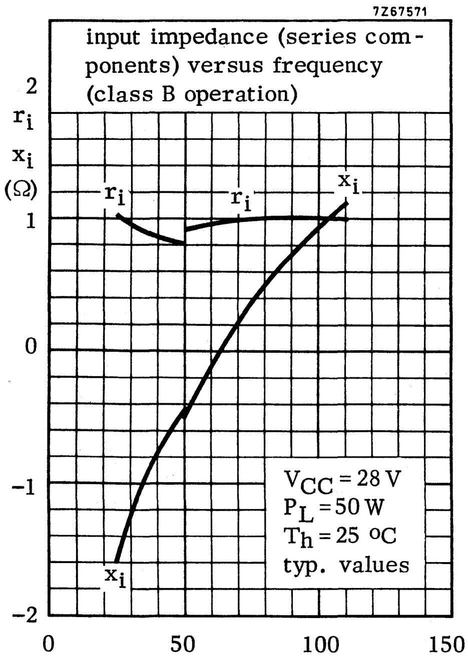


Fig.23.

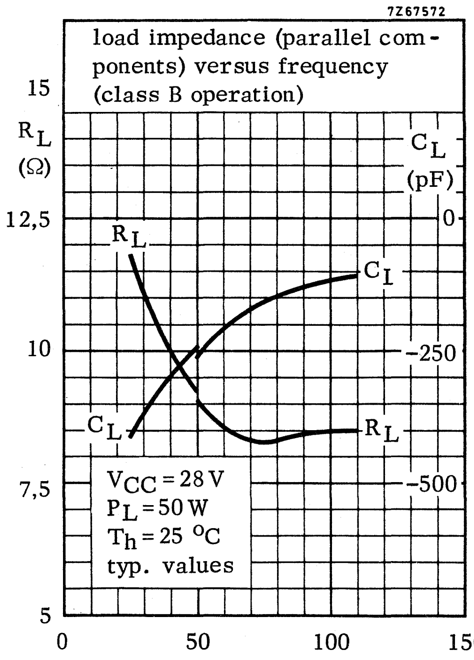


Fig.24.

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

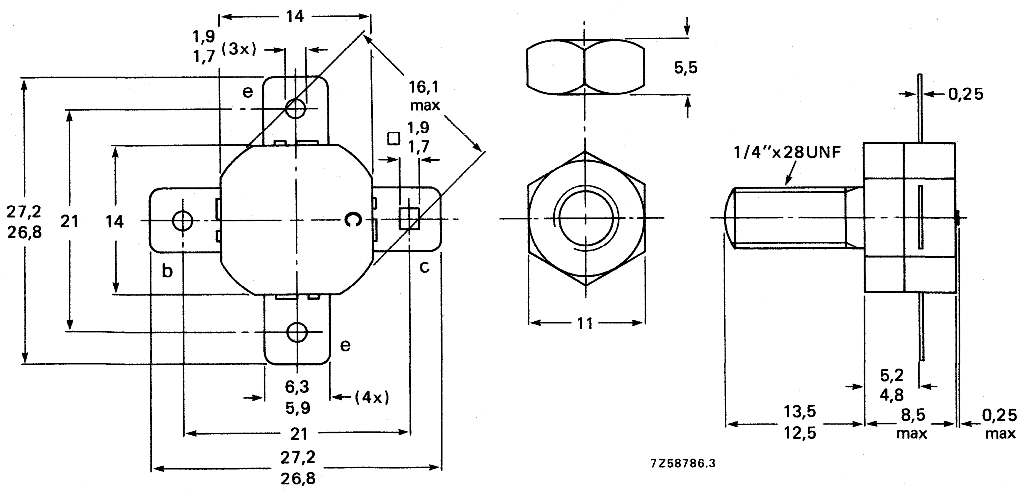
QUICK REFERENCE DATA

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.

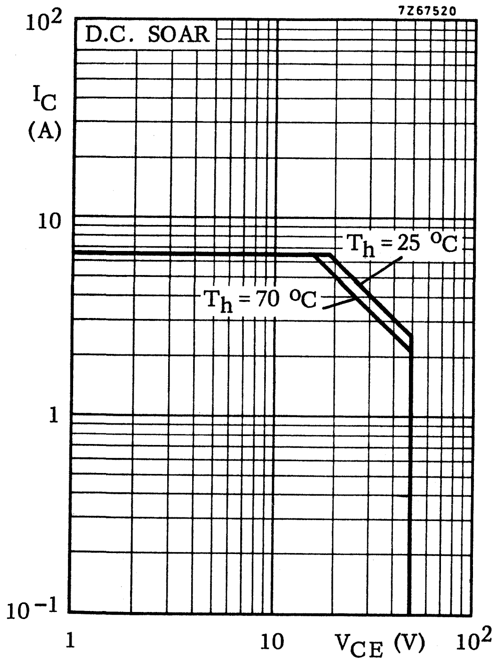
Torque on nut: min. 2,3 Nm (23 kg cm)
max. 2,7 Nm (27 kg cm)

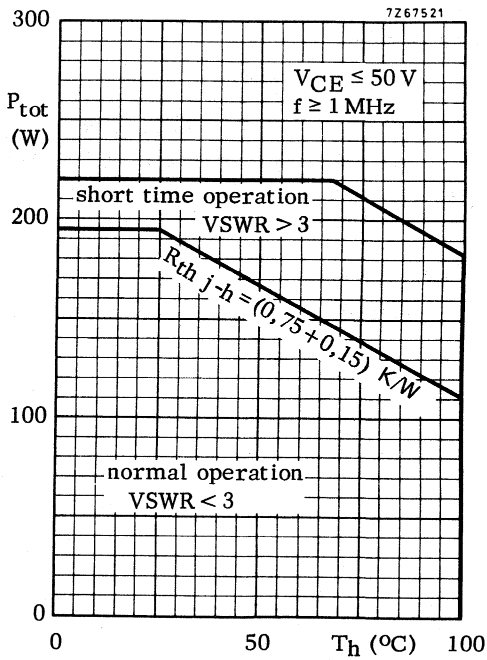
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

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

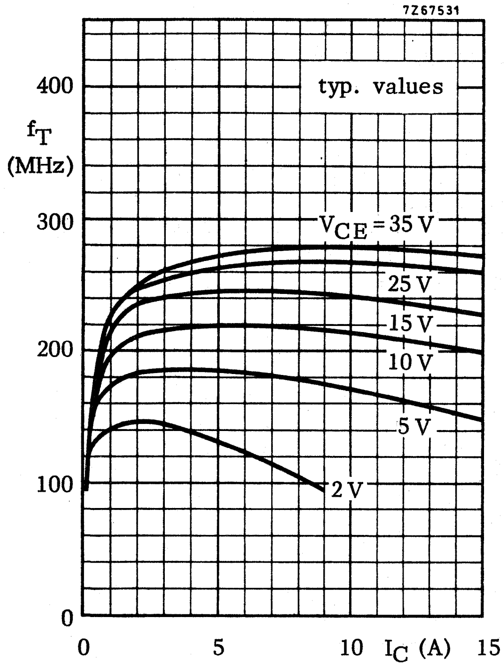
THERMAL RESISTANCE

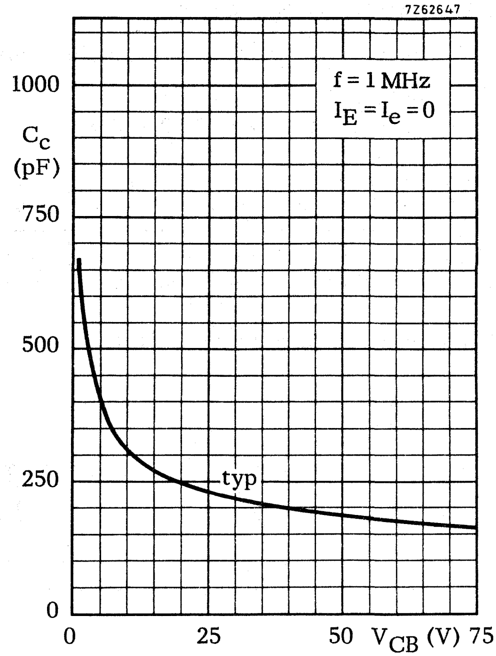
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,75	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,15	K/W

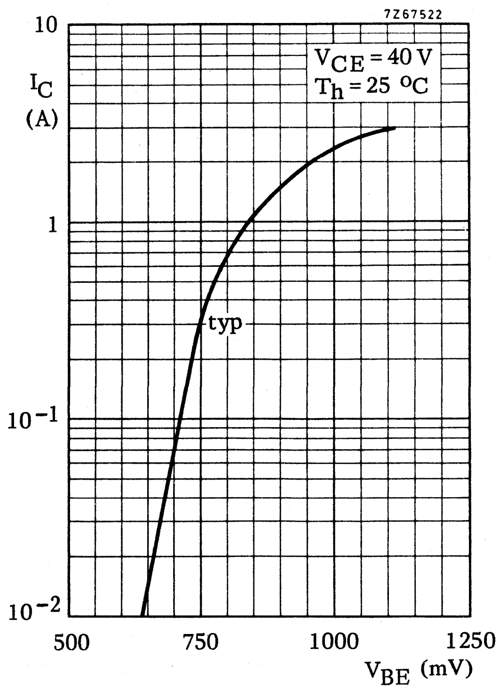
CHARACTERISTICS

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	pF
		<	220	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
15
I_C (A)


7Z62647
f = 1 MHz
$I_E = I_e = 0$
C_c (pF)
1000
750
500
250
0
typ
0
25
50
75
V_{CB} (V)


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)

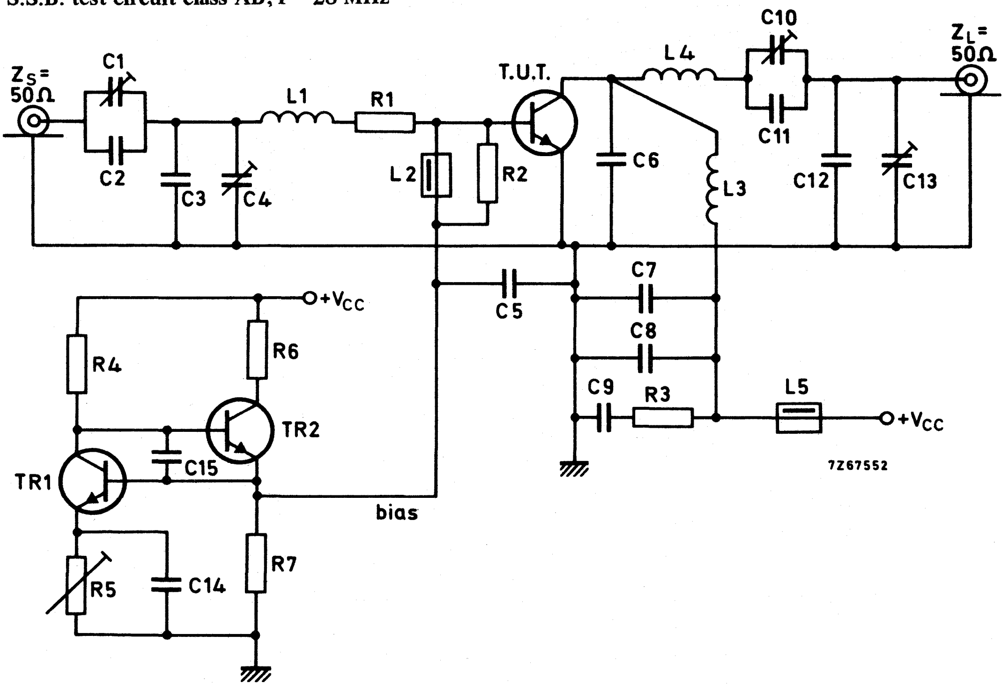
APPLICATION INFORMATION

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 next page.

[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)

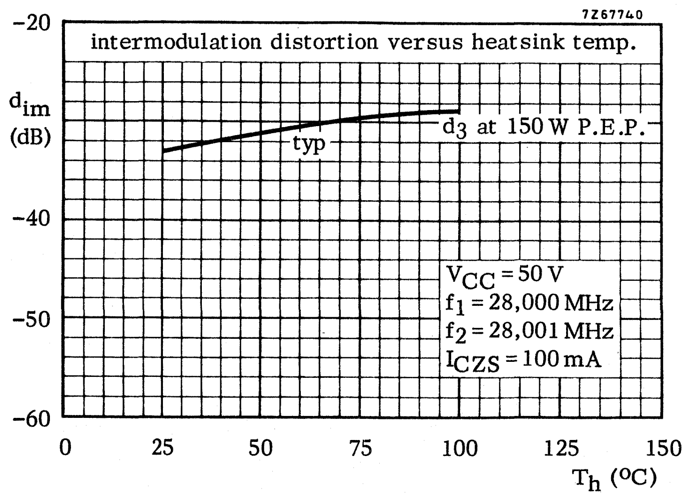
List of components:

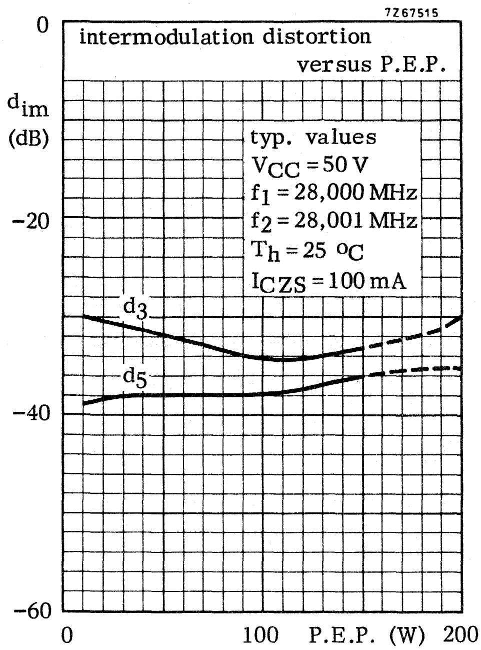
Tr1 = BD135
Tr2 = BD228

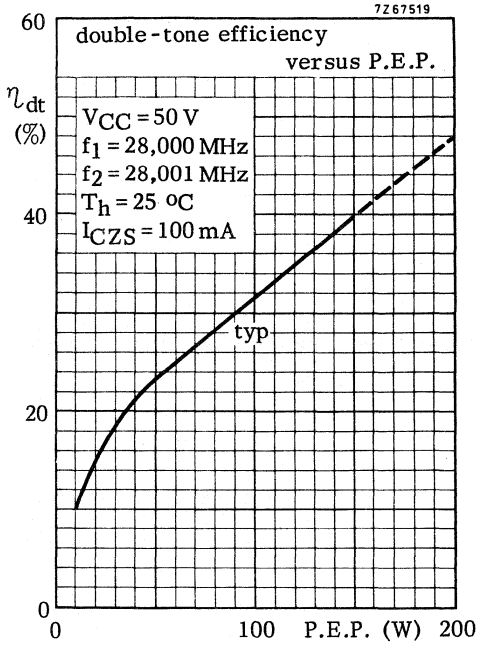
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = C14 = C15 = 100 nF polyester capacitor (±10%)
C9 = 2,2 μF moulded metallized polyester capacitor
C11 = 68 pF ceramic capacitor
C12 = 220 pF ceramic capacitor

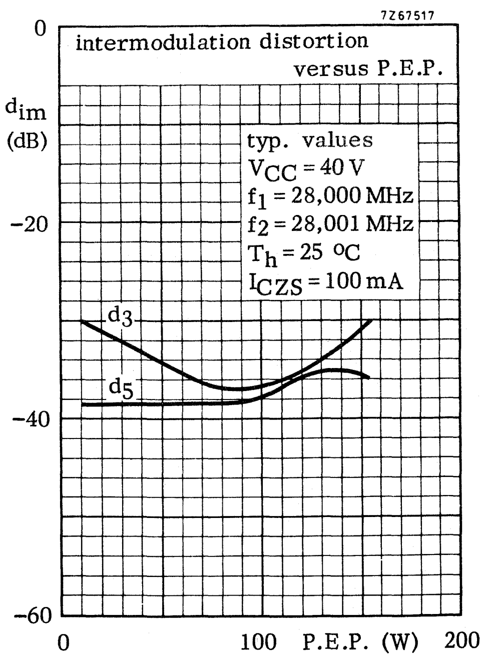
L1 = 88 nH; 3 turns Cu wire (1,0 mm); internal diameter 9 mm; coil length 6,1 mm; leads 2 x 5 mm
L2 = L5 = ferroxcube bead, grade 3B (code number 4312 020 36640)
L3 = 180 nH; 4 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 9,9 mm; leads 2 x 10 mm
L4 = 350 nH; 7 turns enamelled Cu wire (1,5 mm); internal diameter 12 mm; coil length 19,1 mm; leads 2 x 10 mm

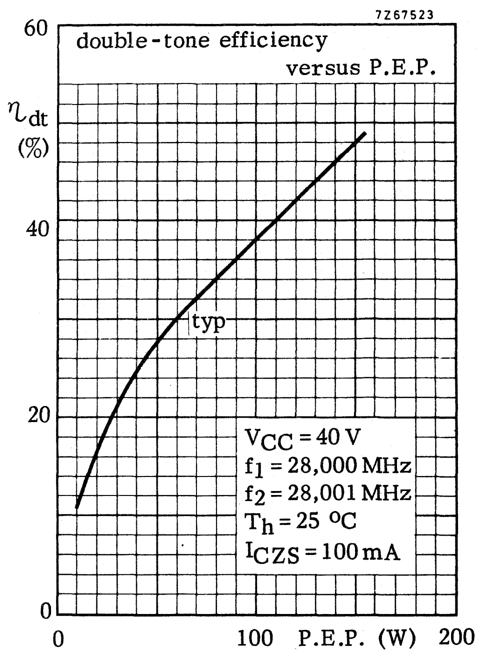
R1 = 0,66 Ω parallel connection of 5 x 3,3 Ω carbon resistors (±5%; 0,5 W each)
R2 = 27 Ω carbon resistor (±5%; 0,5 W)
R3 = 4,7 Ω carbon resistor (±5%; 0,5 W)
R4 = 5,6 kΩ carbon resistor (±5%; 1 W)
R5 = 15 Ω wire-wound potentiometer (3W)
R6 = 157 Ω parallel connection of 3 x 470 Ω wire-wound resistors (5,5W each)
R7 = 68 Ω carbon resistor (±5%; 0,5 W)

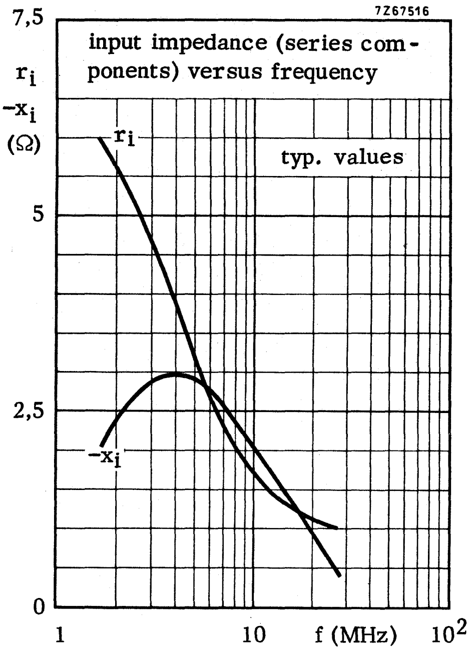


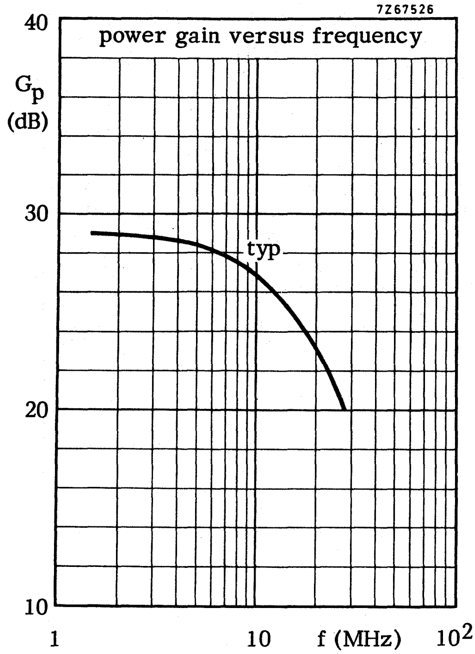

7Z67515
intermodulation distortion versus P.E.P.
d_{im} (dB)
typ. values
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
d_3
d_5
0
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67519
double-tone efficiency versus P.E.P.
η_{dt} (%)
V_{CC} = 50 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
typ
60
40
20
0
0
100
P.E.P. (W)
200


7Z67517
intermodulation distortion versus P.E.P.
d_{im} (dB)
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
−20
−40
−60
0
100
P.E.P. (W)
200


7Z67523
double-tone efficiency versus P.E.P.
η_{dt} (%)
typ
V_{CC} = 40 V
f_1 = 28,000 MHz
f_2 = 28,001 MHz
T_h = 25 °C
I_{CZS} = 100 mA
60
40
20
0
0
100
P.E.P. (W)
200

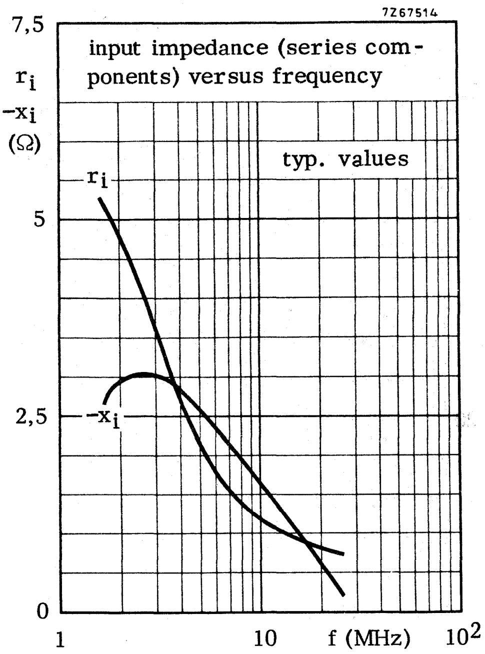


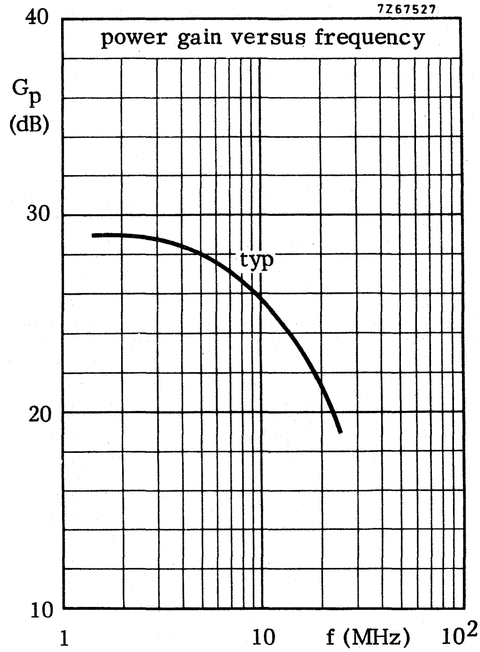


S.S.B. class AB operation

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 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.





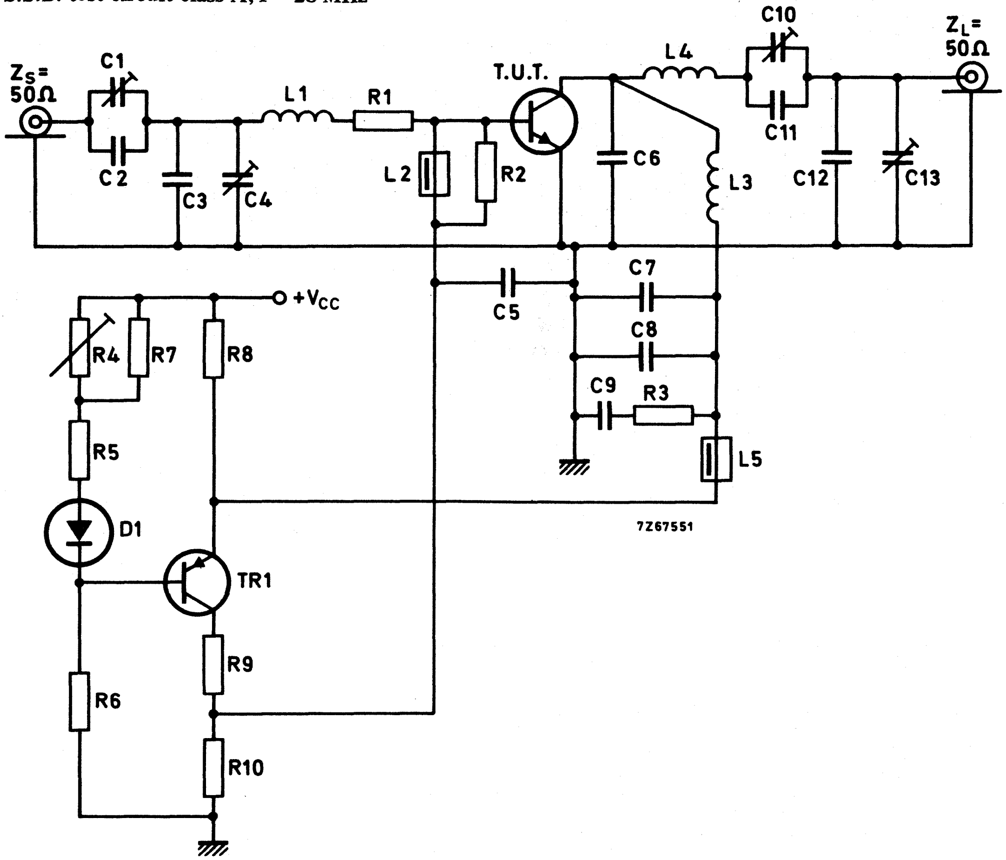
S.S.B. class AB operation

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:

D1 = BY206
TR1 = BD204

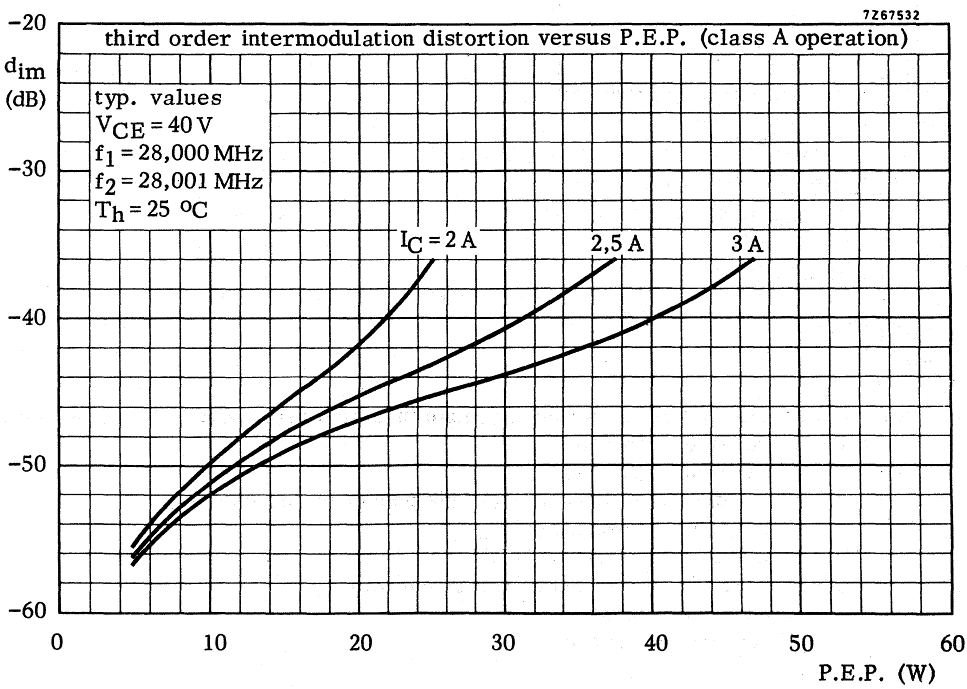
C1 = C10 = 100 pF air dielectric capacitor (single insulated rotor type)
C2 = C6 = 27 pF ceramic capacitor
C3 = 180 pF ceramic capacitor
C4 = C13 = 100 pF air dielectric capacitor (single non-insulated rotor)
C5 = C7 = 3,9 nF polyester capacitor (±10%)
C8 = 100 nF polyester capacitor (±10%)
C9 = 2,2 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)



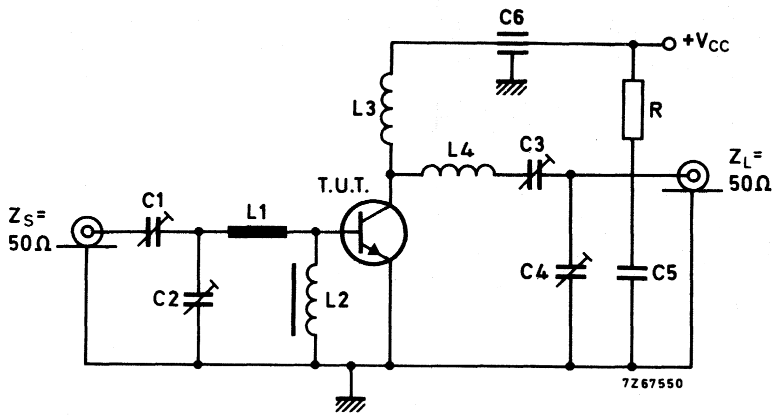
APPLICATION INFORMATION (continued)

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.



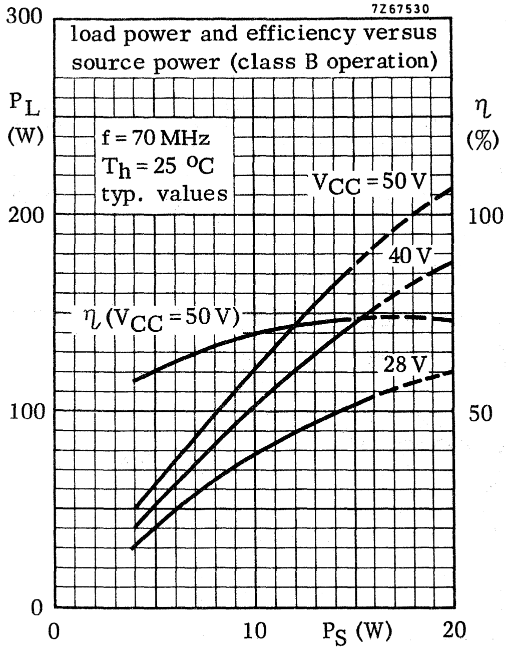
List of components:

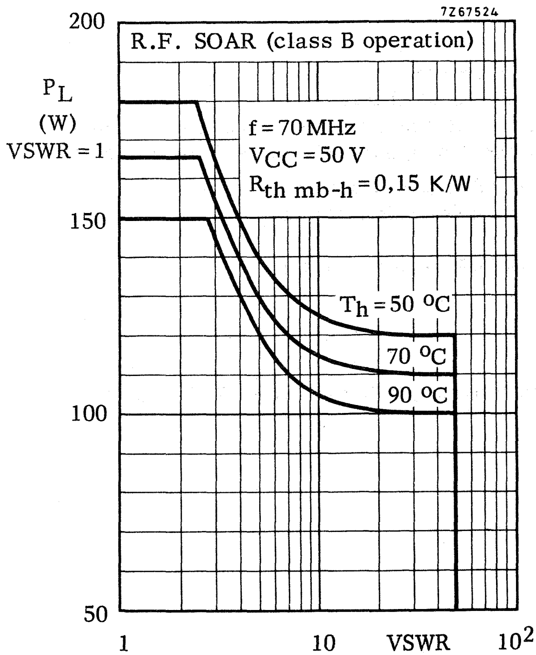
L1 = 60 mm straight enamelled Cu wire (1,6 mm); 9 mm above chassis
L2 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L3 = 18 turns enamelled Cu wire (1,6 mm); internal diameter 10 mm; pitch 2 mm; leads 55 mm totally
L4 = 3 turns enamelled Cu wire (1,6 mm); internal diameter 10 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.



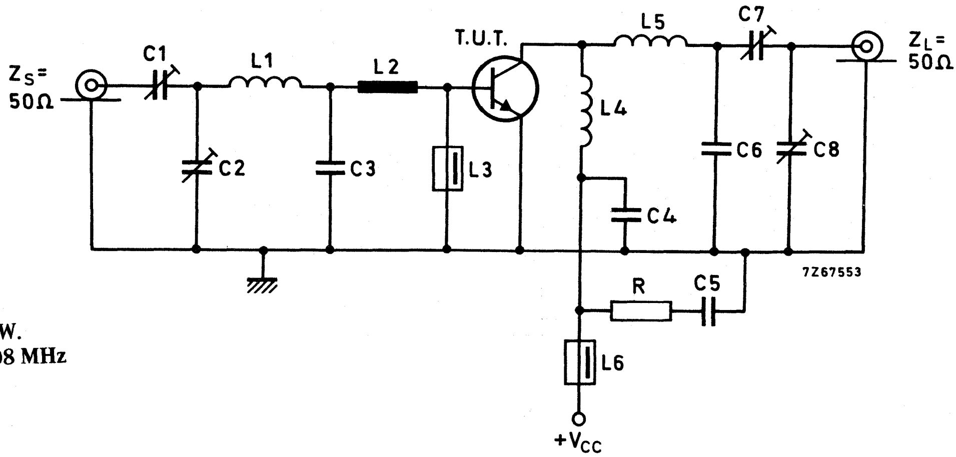


Indicated load power as a function of overload.

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:



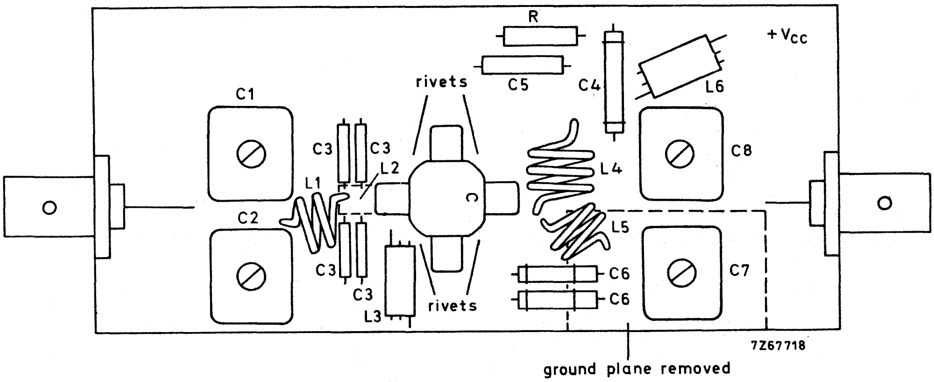
C.W.
108 MHz

List of components:

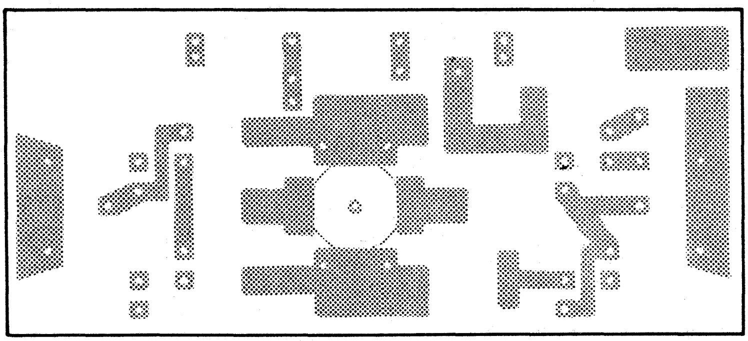
C1 = C2 =	40 pF film dielectric trimmer
C3 =	400 pF parallel connection of 4 x 100 pF ceramic capacitors
C4 =	270 pF ceramic capacitor
C5 =	100 nF polyester capacitor (± 10%)
C6 =	20 pF parallel connection of 2 x 10 pF ceramic capacitors
C7 = C8 =	60 pF film dielectric trimmer
L1 =	49 nH; 2 turns enamelled 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.

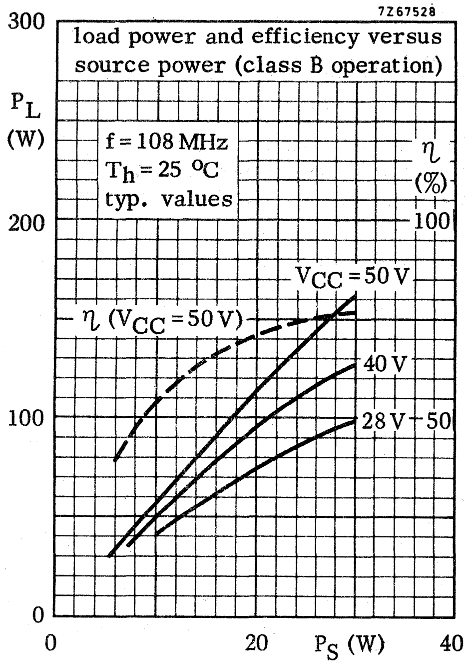


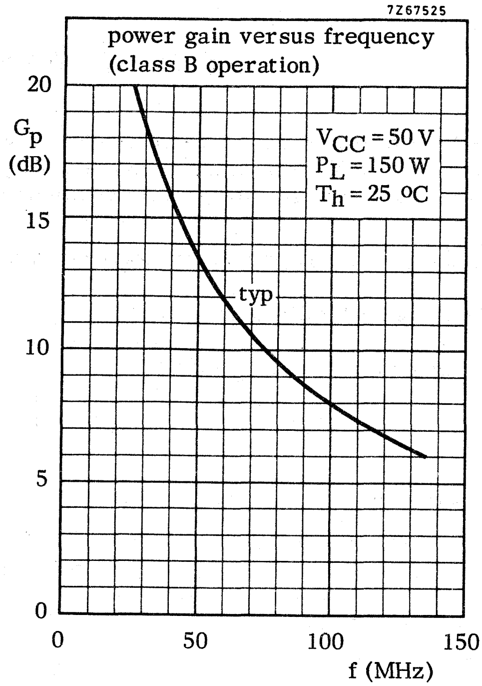
Dimensions of printed circuit board 123 mm x 55 mm.

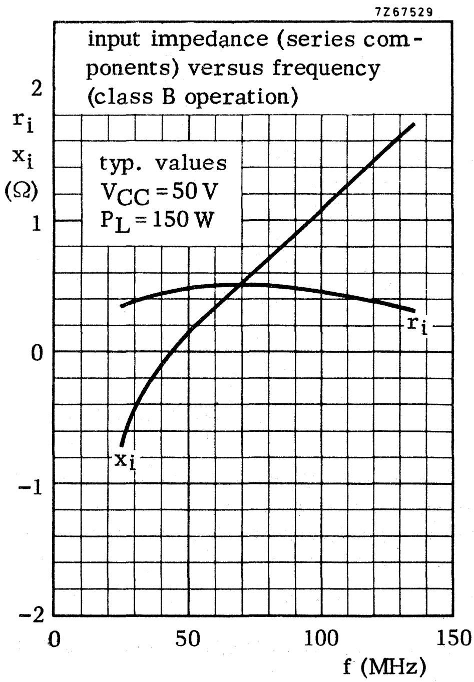


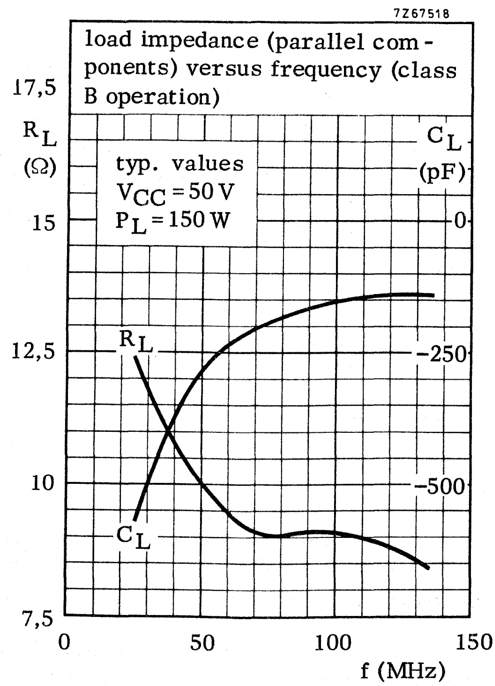
7Z67664

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)
η (%)
f = 108 MHz
T_h = 25 °C
typ. values
V_CC = 50 V
η (V_CC = 50 V)
40 V
28 V
300
200
100
0
100
50
0
20
P_S (W)
40


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

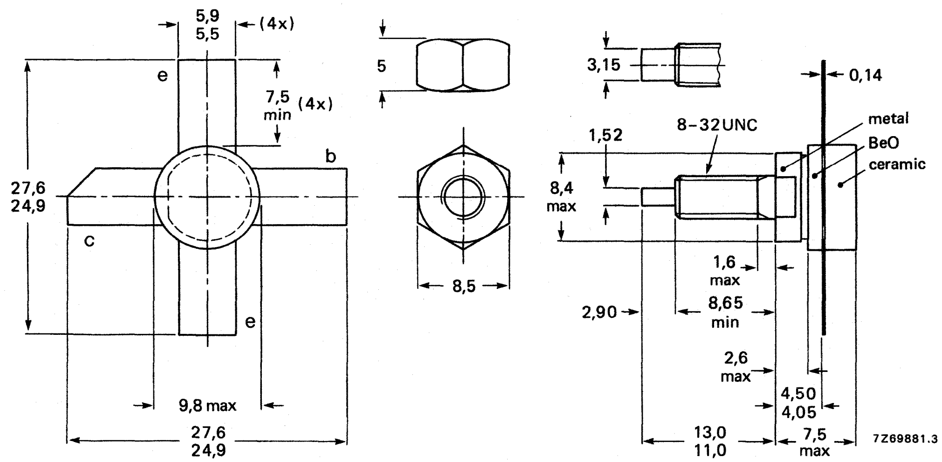
R.F. performance up to T_h = 25 °C

mode of operation	V_{CE} V	f MHz	P_L W	G_p dB	η %	$\bar{z}_i$ Ω	$\bar{Y}_L$ 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

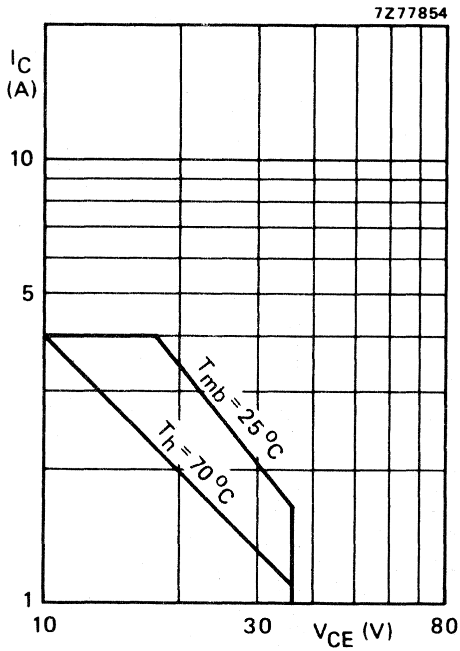


Fig. 2 D.C. SOAR.

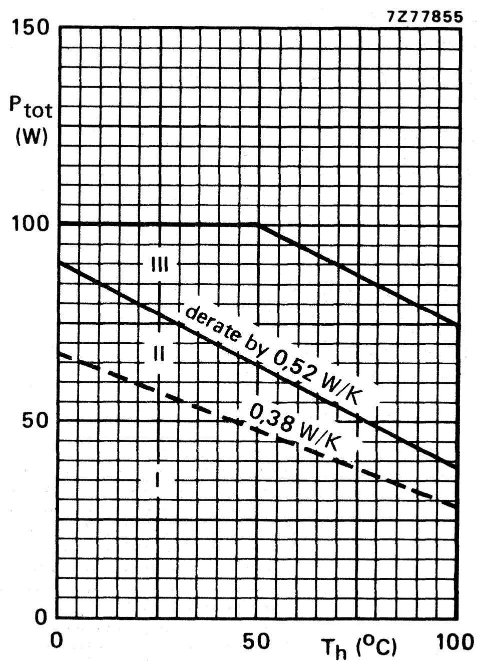


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.

I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 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

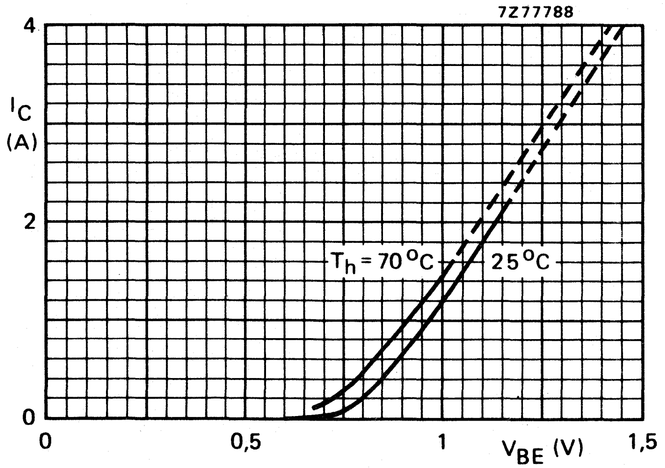


Fig. 4 Typical values; V_{CE} = 28 V.

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

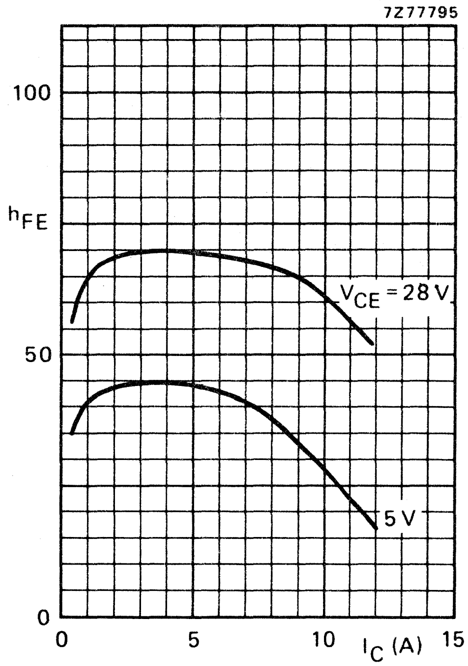


Fig. 5 Typical values; T_j = 25 °C.

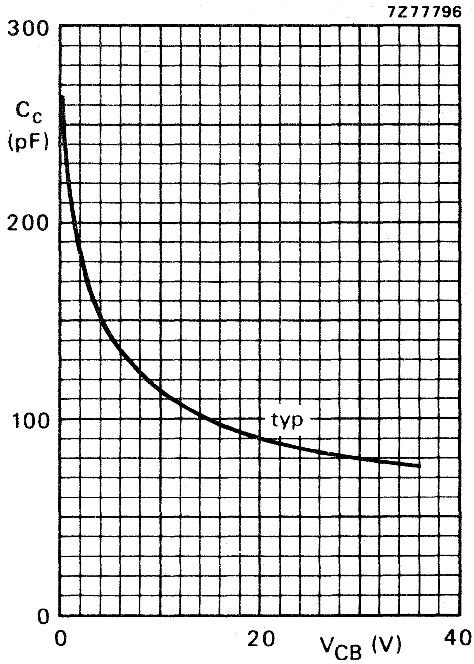


Fig. 6 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

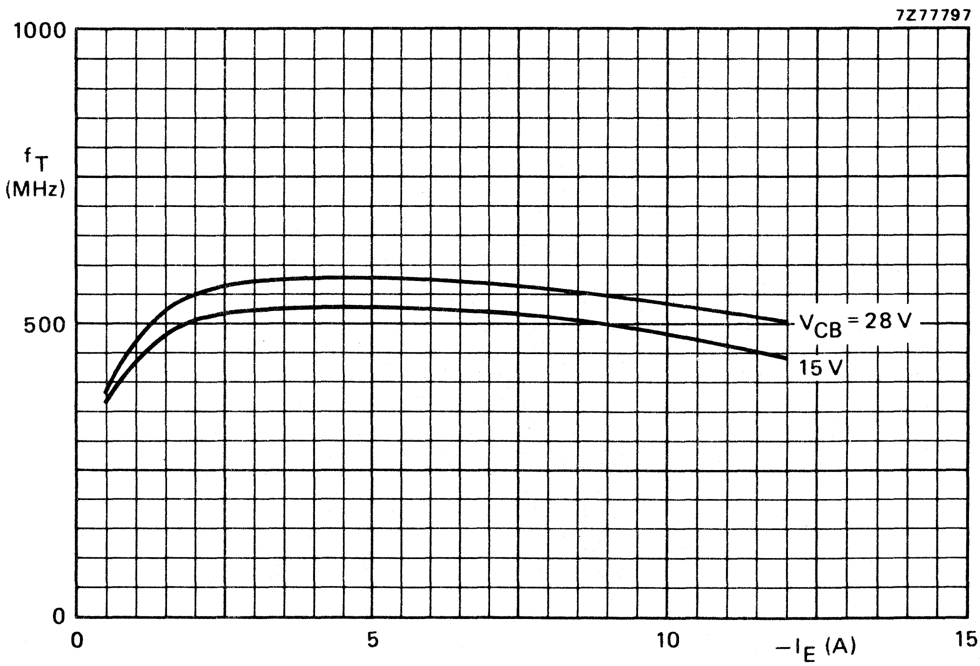


Fig. 7 Typical values; f = 100 MHz; T_j = 25 °C.

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

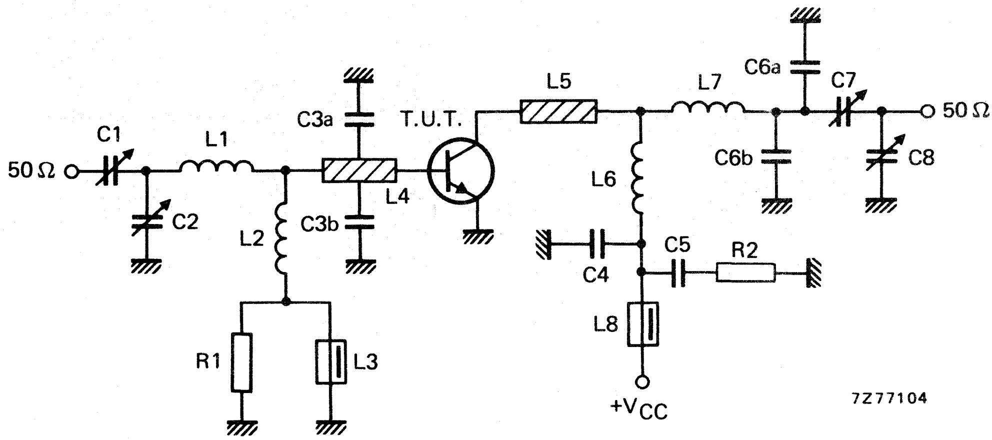


Fig. 8 Test circuit; c.w. class-B.

List of components:

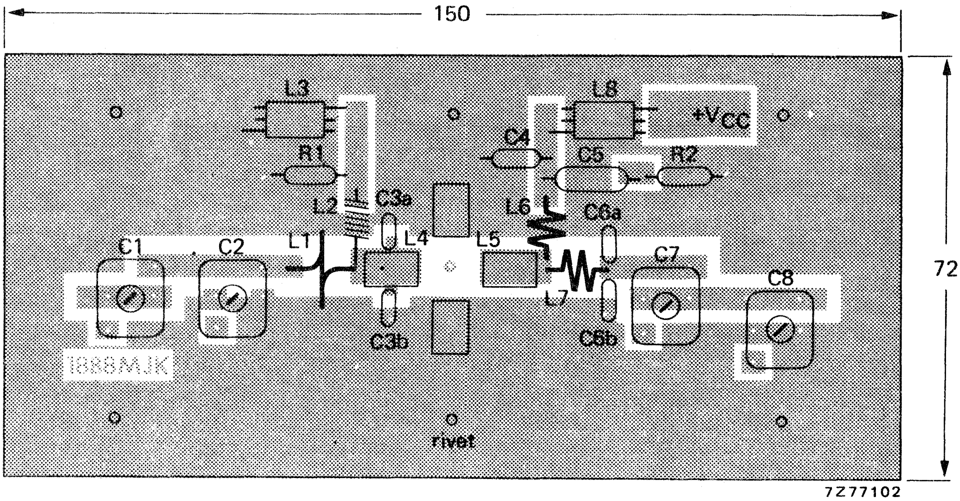
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 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.



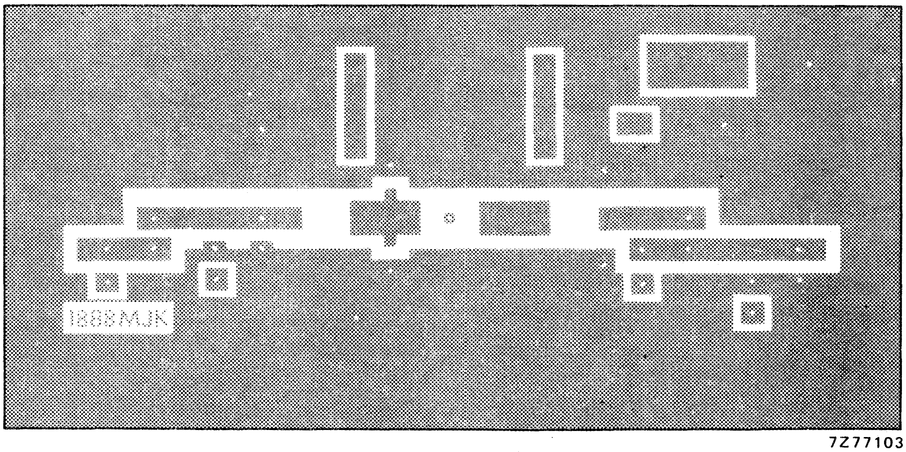


Fig. 9 Component layout and printed-circuit board for 175 MHz test circuit.

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.

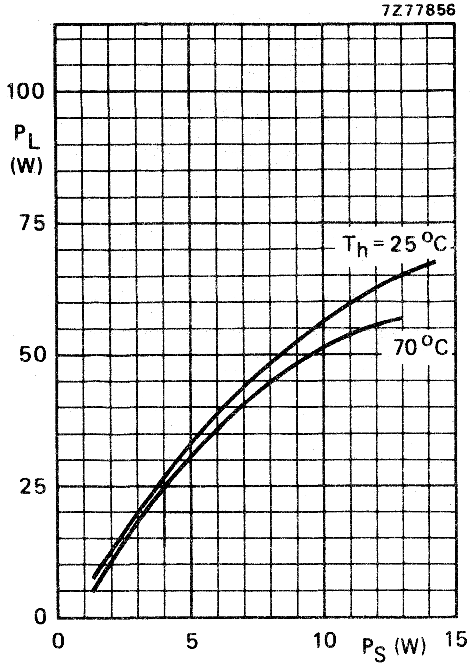


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

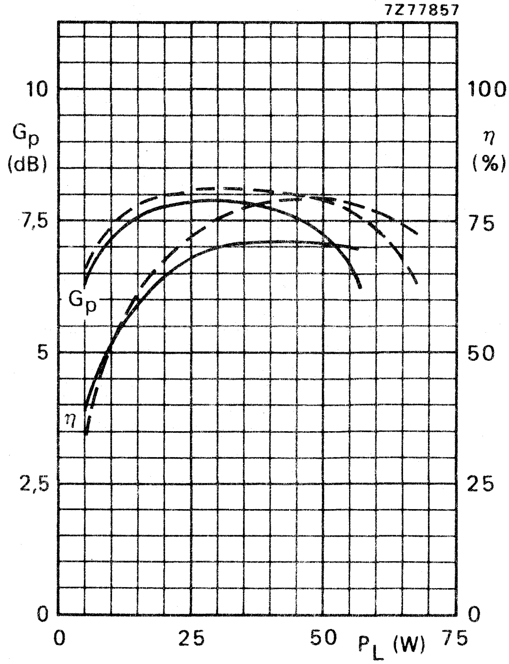


Fig. 11 Typical values; V_{CE} = 28 V; f = 175 MHz; – – – T_h = 25 °C; —— T_h = 70 °C.

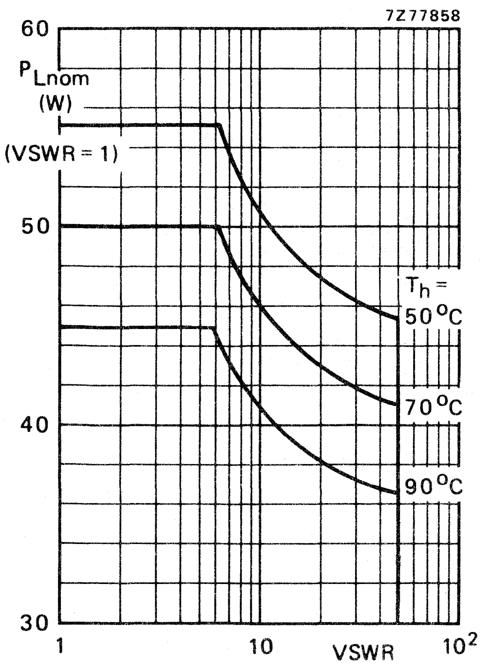


Fig. 12 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W.

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.

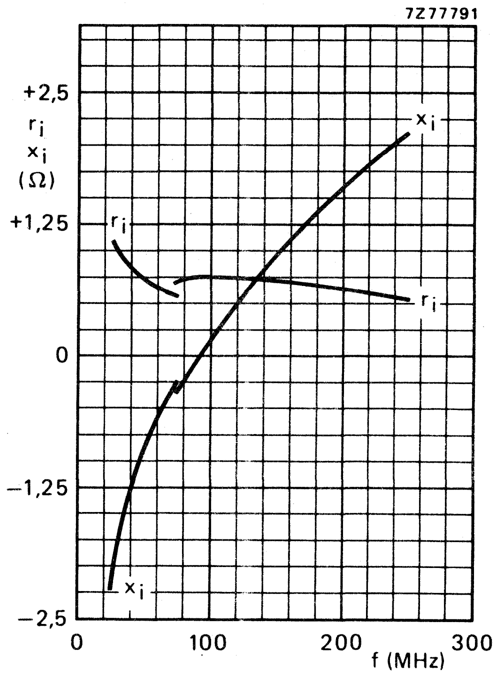


Fig. 13 Input impedance (series components).

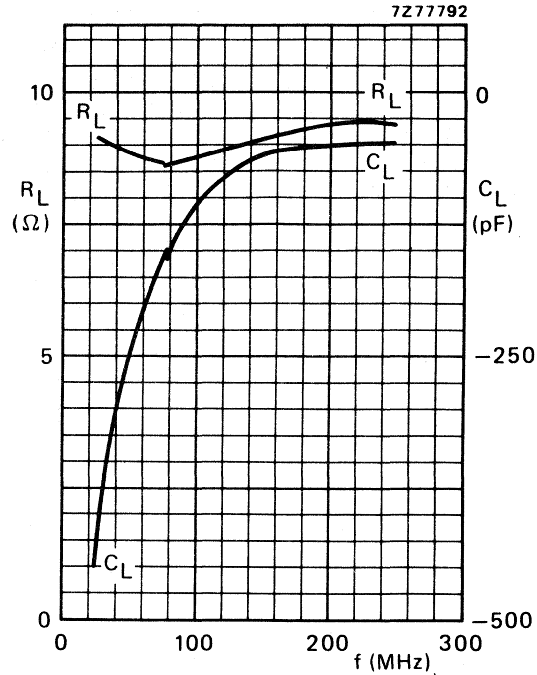


Fig. 14 Load impedance (parallel components).

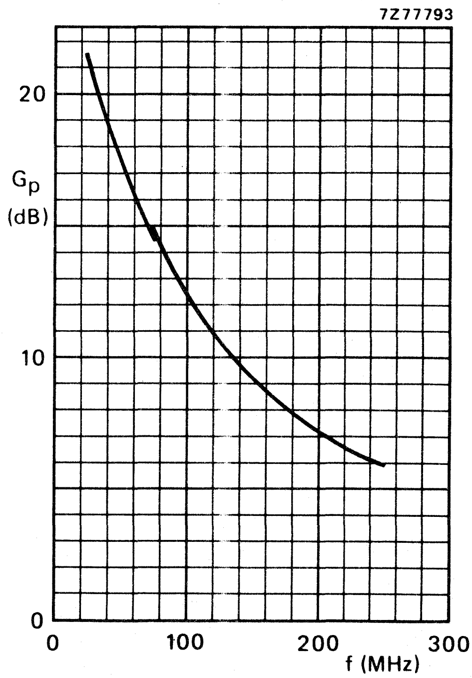


Fig. 15 Power gain versus frequency.

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

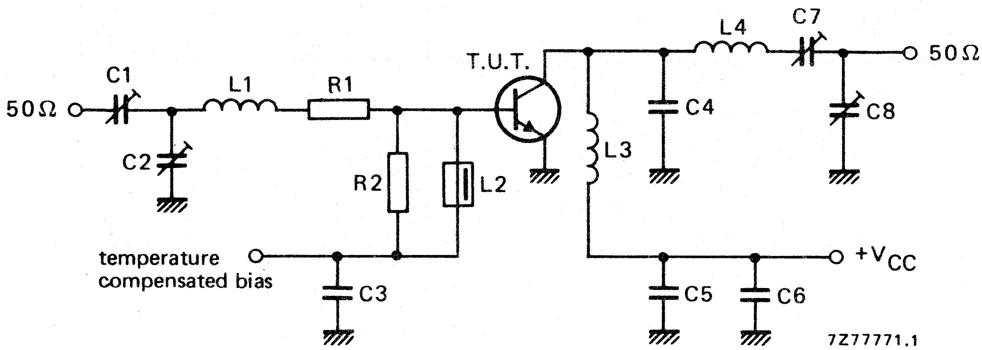


Fig. 16 Test circuit; s.s.b. class-AB.

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.

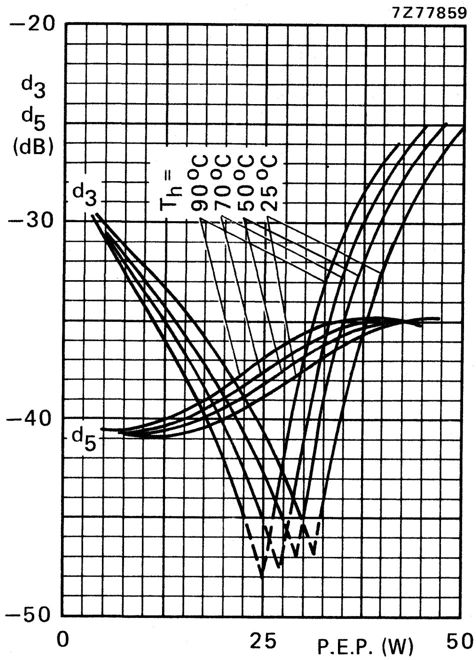


Fig. 17 Intermodulation distortion as a function of output power.*

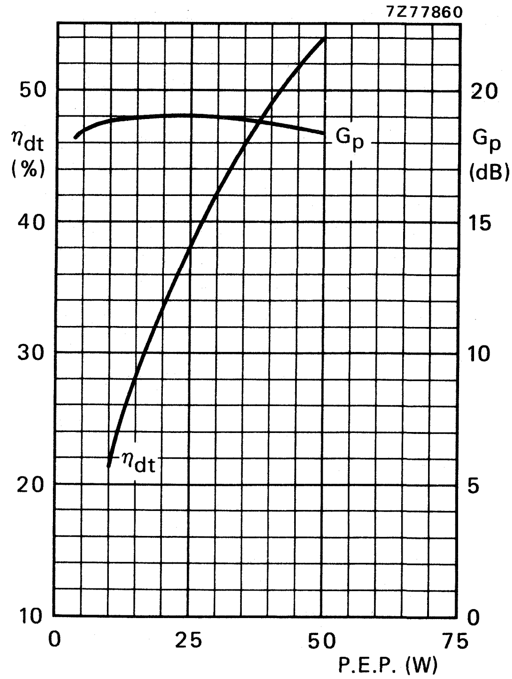


Fig. 18 Double-tone efficiency and power gain as a function of output power.

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.

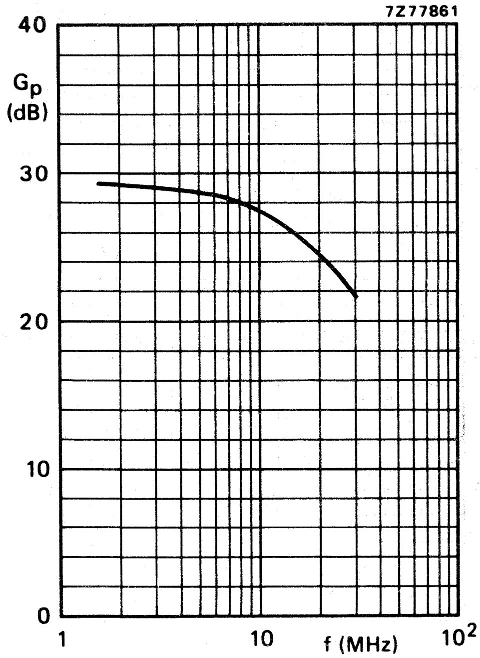


Fig. 19 Power gain as a function of frequency.

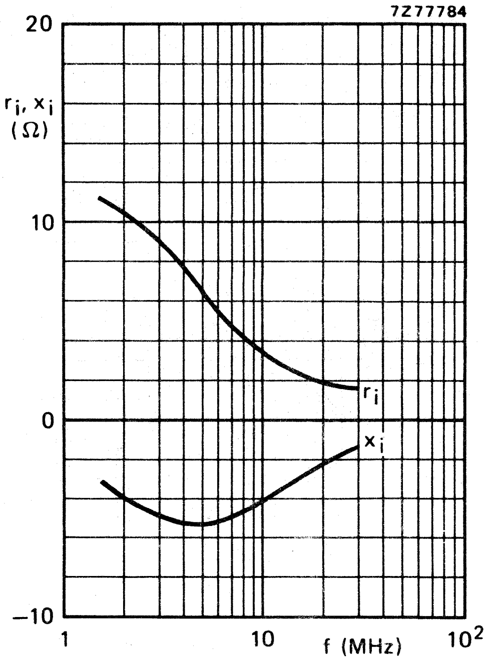


Fig. 20 Input impedance (series components) as a function of frequency.

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

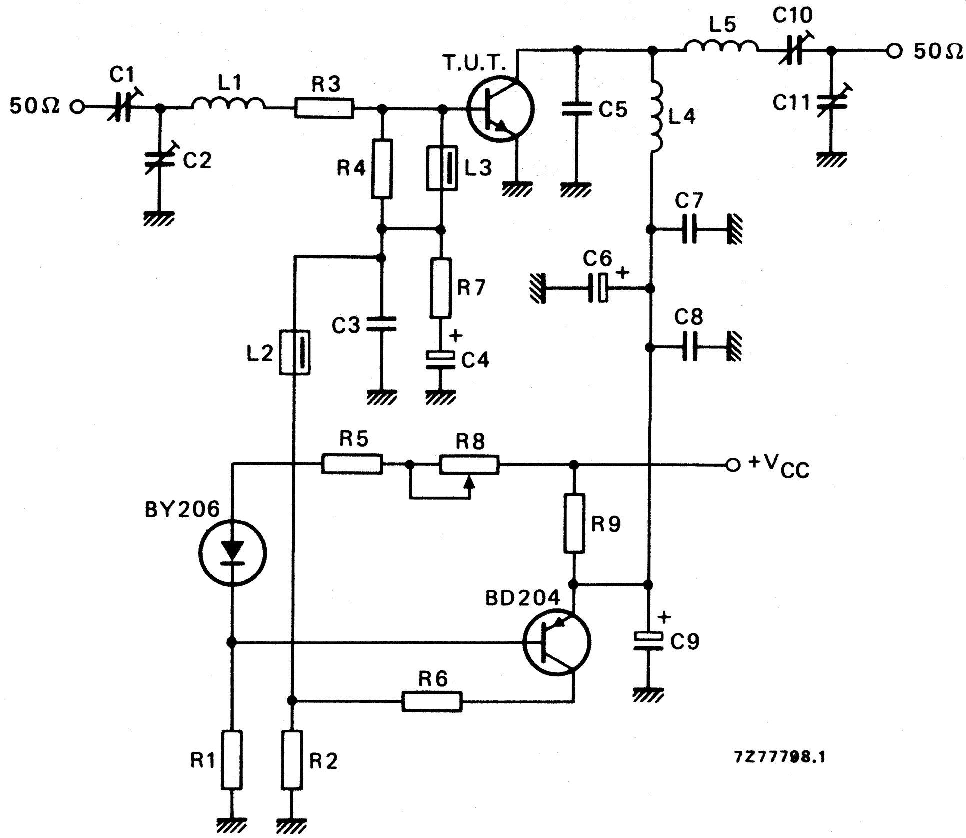


Fig. 21 Test circuit; s.s.b. class-A.

* 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)

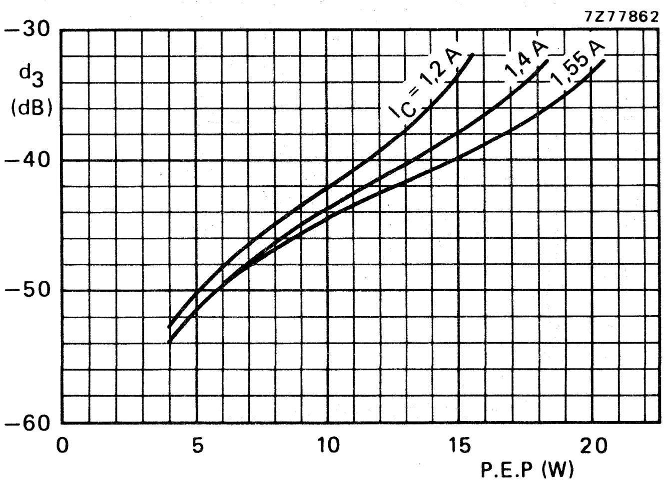


Fig. 22 Intermodulation distortion as a function of output power. Typical values; V_{CE} = 26 V; T_h = 70 °C; f_1 = 28,000 MHz; f_2 = 28,001 MHz.

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

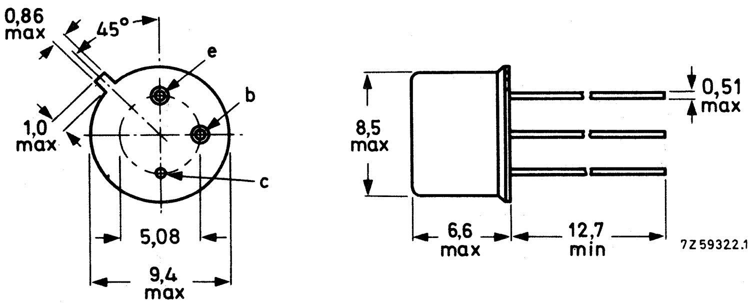
R.F. performance up to T_{case} = 25 °C in an unneutralized common-emitter class-B circuit

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-39/1; 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 ^{o}C f > 10 MHz	P_{tot}	max.	3.0	W
Storage temperature	T_{stg}	−65 to +150		^{o}C
Operating junction temperature	T_j	max	165	^{o}C

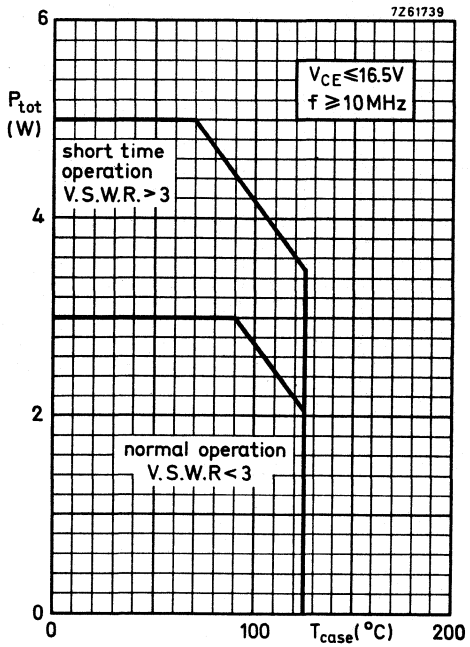
THERMAL RESISTANCE

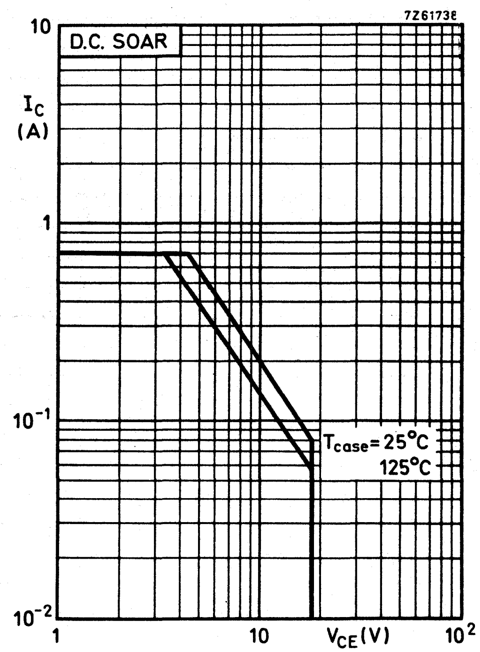
From junction to case	$R_{th\ j-c}$	=	25	K/W
From mounting base to heatsink with a boron nitride washer for electrical insulation	$R_{th\ mb-h}$	=	2.5	K/W

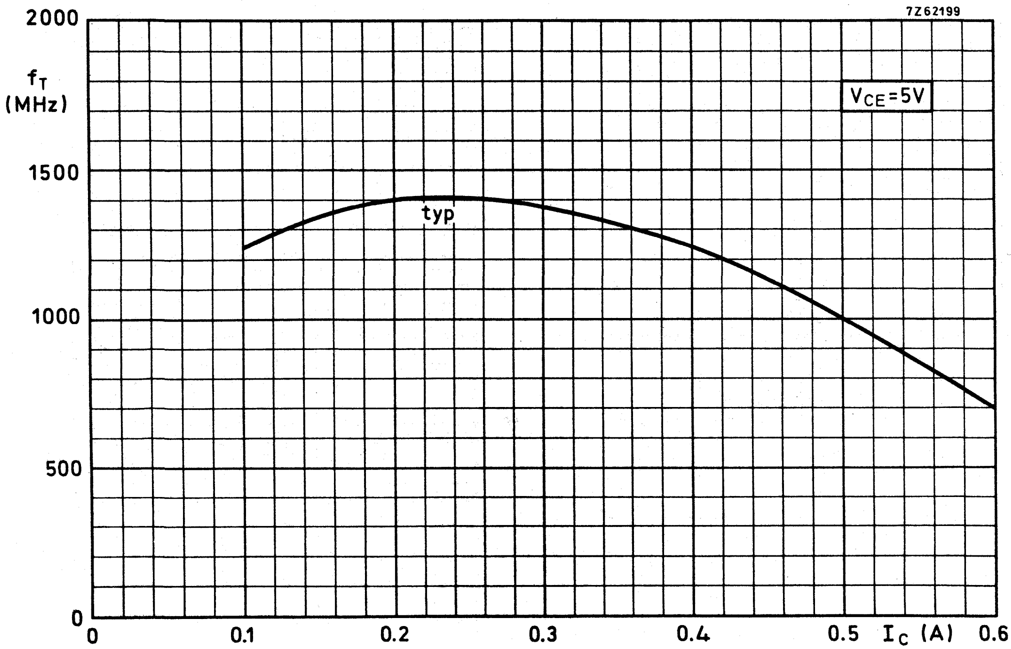
CHARACTERISTICS

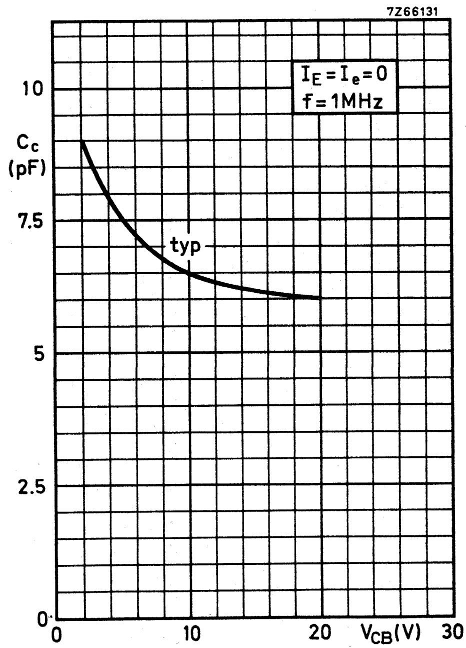
T_j = 25 °C unless otherwise specified

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
6
4
2
0
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
0
100
T_{case} (°C)
200


7Z61738
D.C. SOAR
10
1
10^{-1}
10^{-2}
I_C (A)
T_{case} = 25°C
125°C
1
10
V_{CE} (V)
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

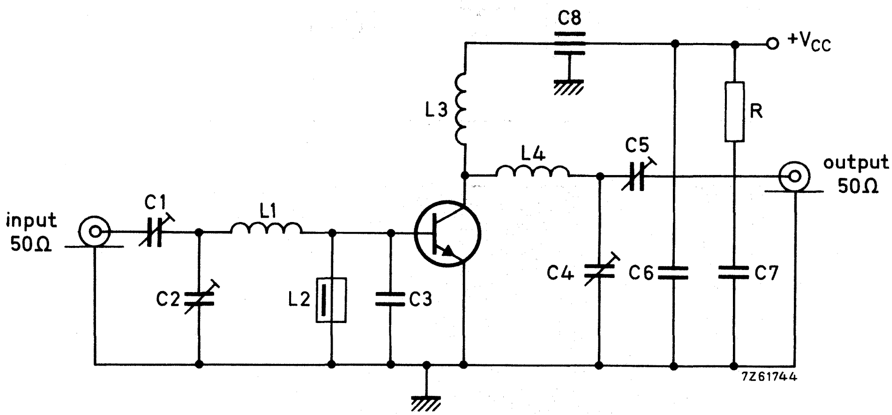
APPLICATION INFORMATION

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

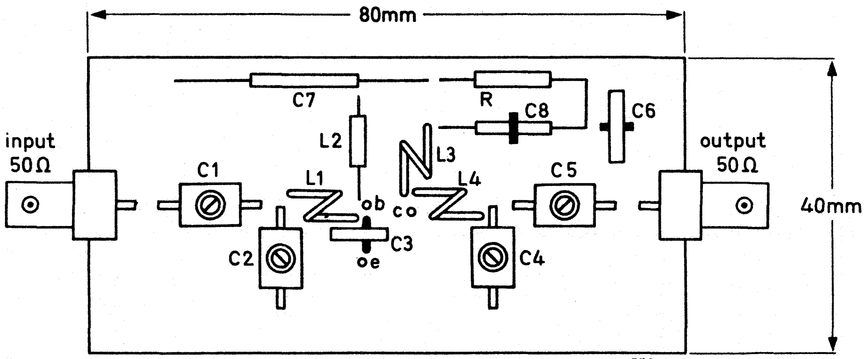
R = 10 Ω carbon

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.

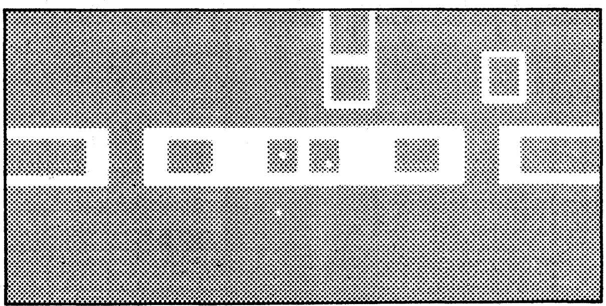
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions : V_{CC} = 16.5 V; f = 470 MHz; T_{case} = 70 °C
V.S.W.R. = 50 : 1 through all phases; $P_S = P_{Snom}$ + 20 %
where $P_{Snom} = P_S$ for 1.4 W transistor output into 50 Ω load at V_{CC} = 13.8 V.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 470 MHz test circuit.



7Z61747

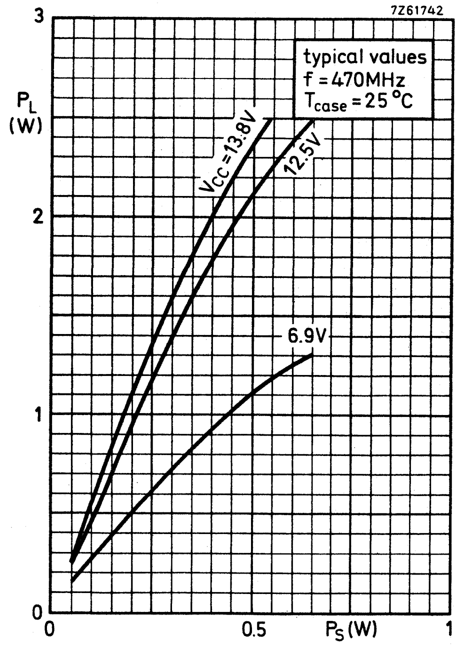


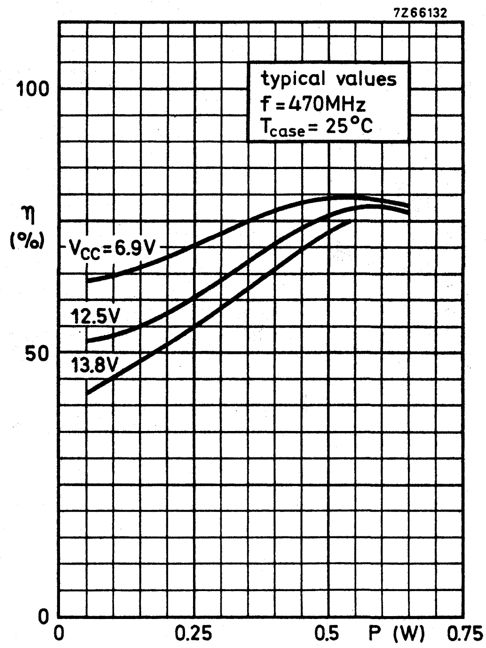
7Z61746.1

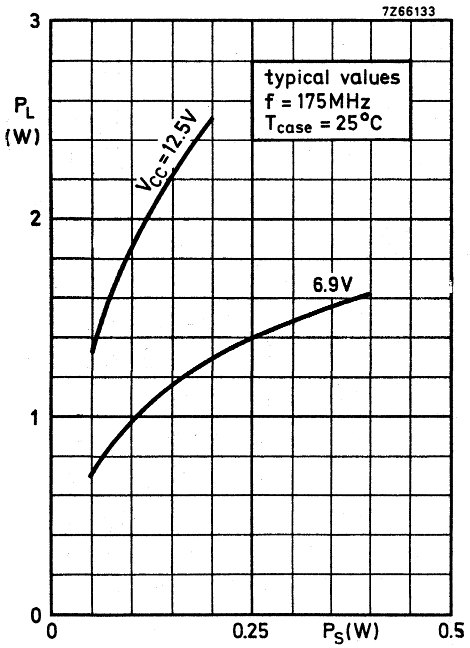
Shaded area copper

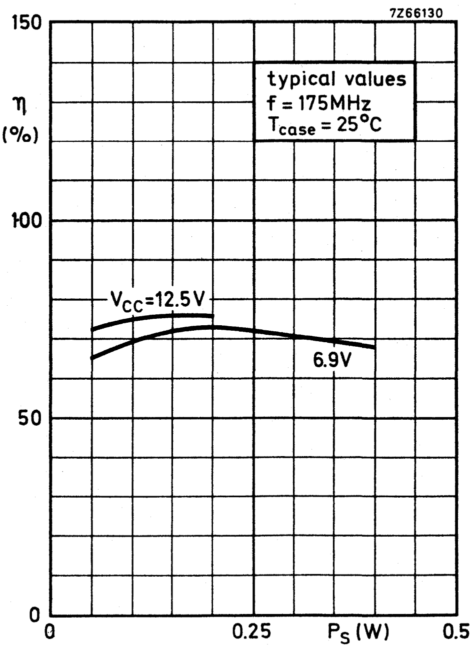
Back area not metalized

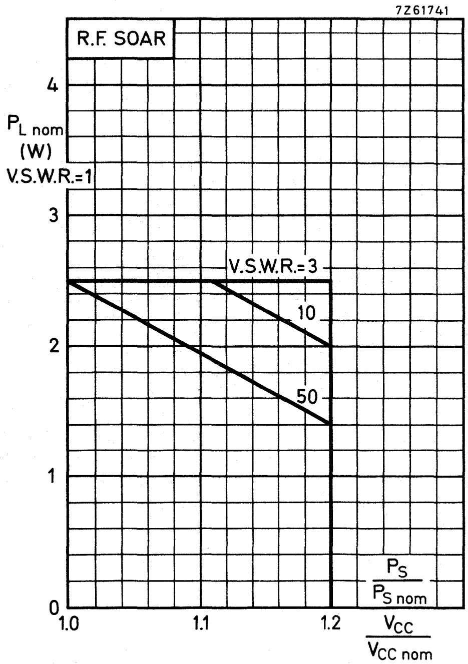
Material of printed circuit board: 1.5 mm epoxy fibre-glass


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
100
50
0
0.25
0.5
P (W)
0.75


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)
150
100
50
0
0.25
0.5



Conditions for R.F. SOAR

f = 470 MHz

T_{case} = 70 °C

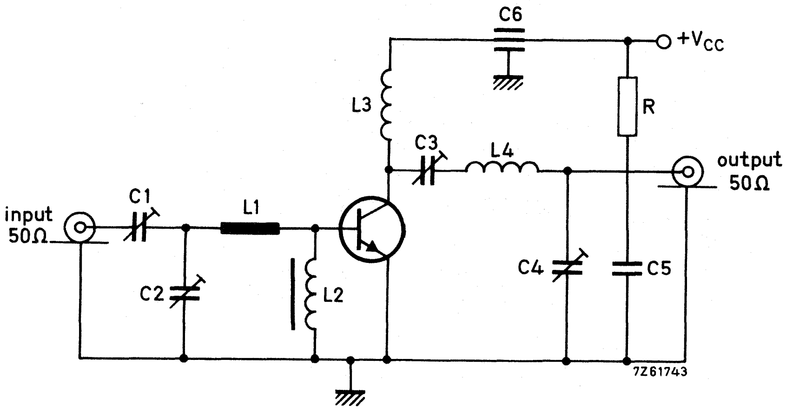
V_{CCnom} = 13.8 V

$P_{Snom} = P_S$ 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 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)



To obtain optimum gain performance the emitter lead length should not exceed 1.6 mm

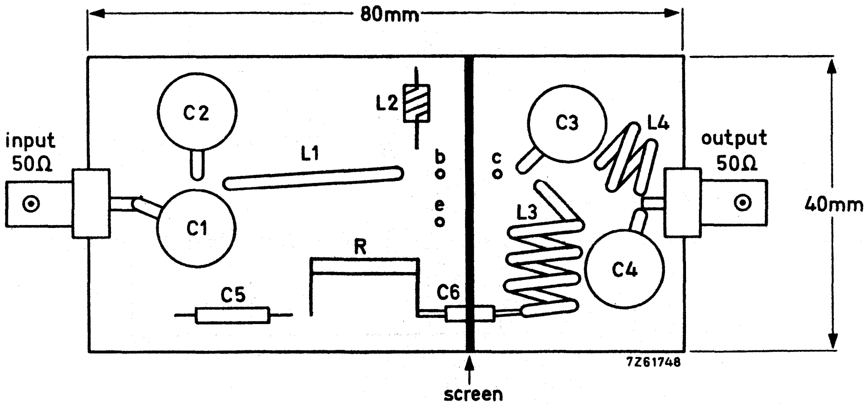
C1 = C4 = 60 pF concentric air trimmer
C2 = C3 = 30 pF concentric air trimmer
C5 = 0.25 μF polyester capacitor
C6 = 4 nF feed-through capacitor

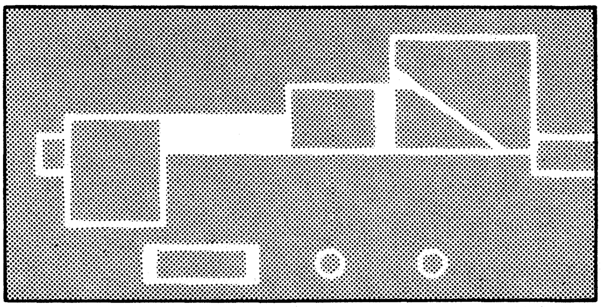
L1 = 25 mm straight Cu wire (1.2 mm); height above print 3 mm
L2 = 3 turns Cu wire (0.5 mm) on ferrite FX1115, d = 2 mm, D = 4 mm, l = 5 mm, material 3B (code number 3113 991 16740)
L3 = 5 turns closely wound Cu wire (1.2 mm); int. diam. 10 mm; lead length 5 mm
L4 = 3 turns closely wound Cu wire (1.2 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:





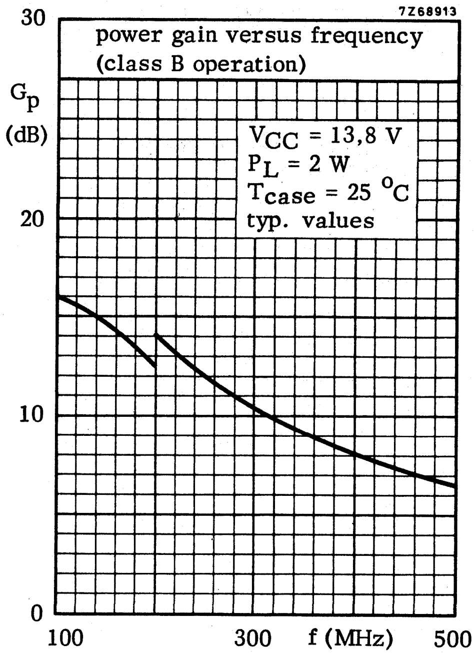
7Z61745.1

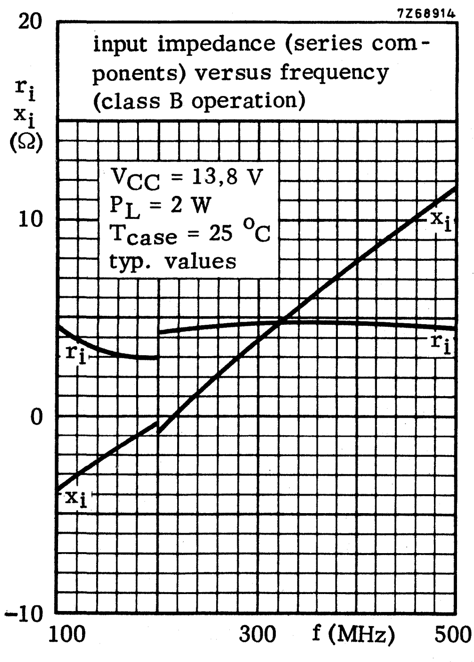
Shaded area copper

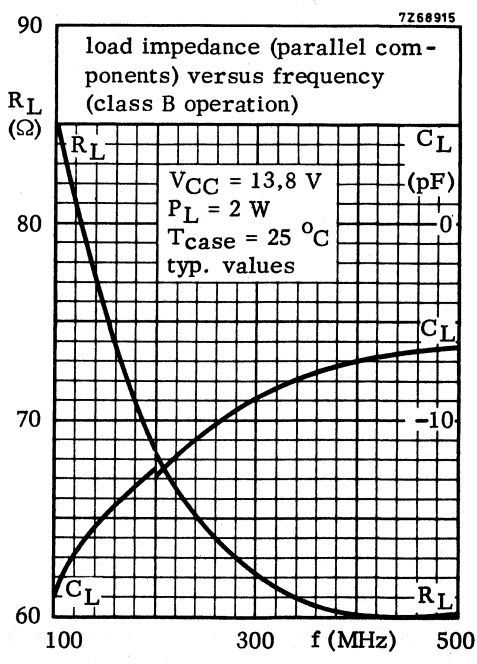
Back area not metallized

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

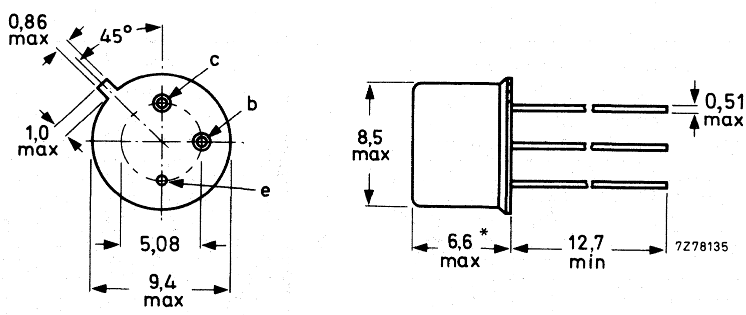
R.F. performance at T_c = 25 °C in a common-emitter class-B circuit.

mode of operation	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); $f \geq 1$ MHz	I_{CM}	max.	2,0	A
Total power dissipation at $T_{mb} \leq 90$ °C; $f \geq 1$ 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	–	–

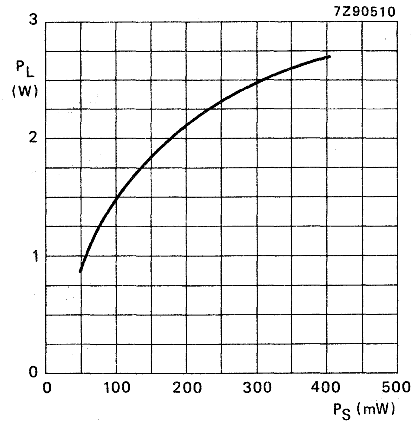


Fig. 2 Load power vs. source power; V_{CE} = 12,5 V; f = 470 MHz; T_{mb} = 25 °C; class-B operation; typical values.

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

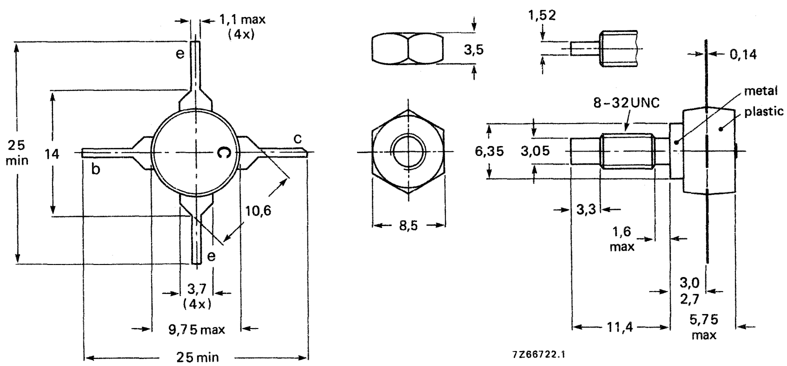
R.F. performance up to T_h = 25 ^oC in an unneutralized common-emitter class-B circuit

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

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

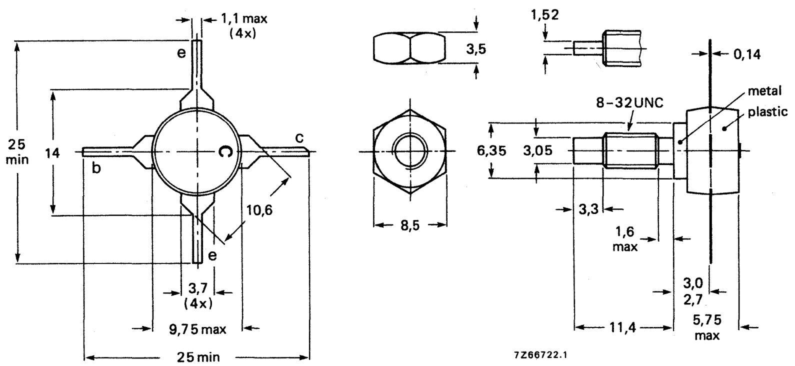
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

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	$R_{th\ j\text{-}mb}$	=	7.0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	K/W

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

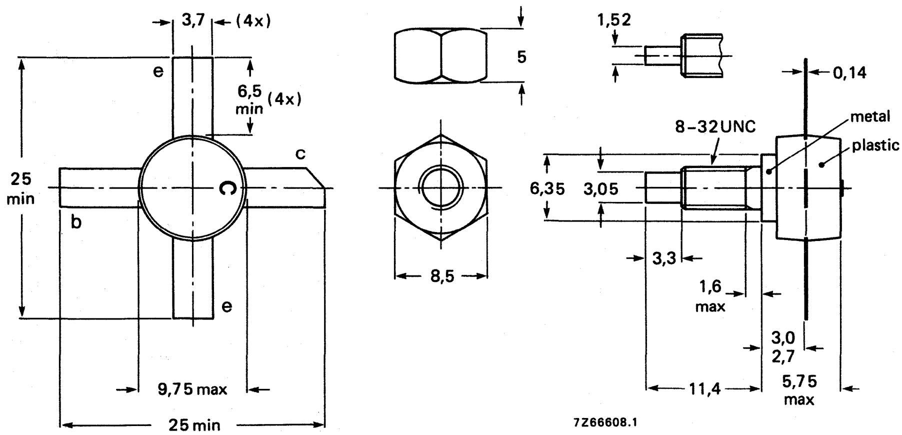
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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

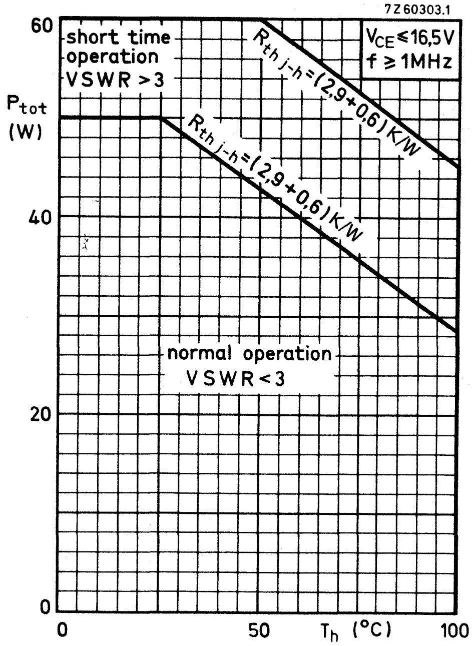
Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	18	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4	V

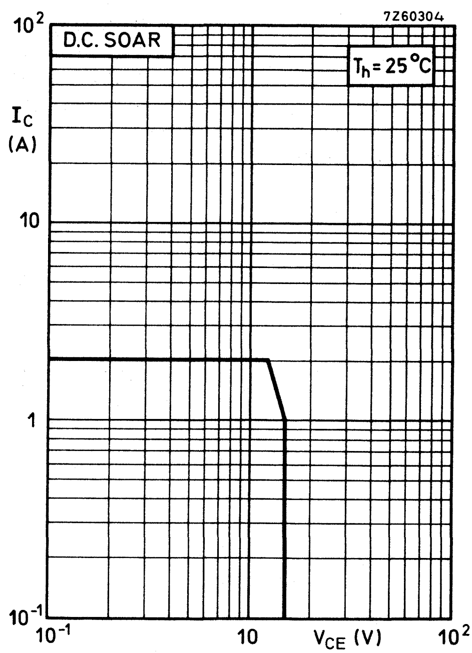
Currents

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 °C f ≥ 1 MHz	P_{tot}	max.	50	W





Temperatures

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

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j-mb}$	=	2,9	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

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

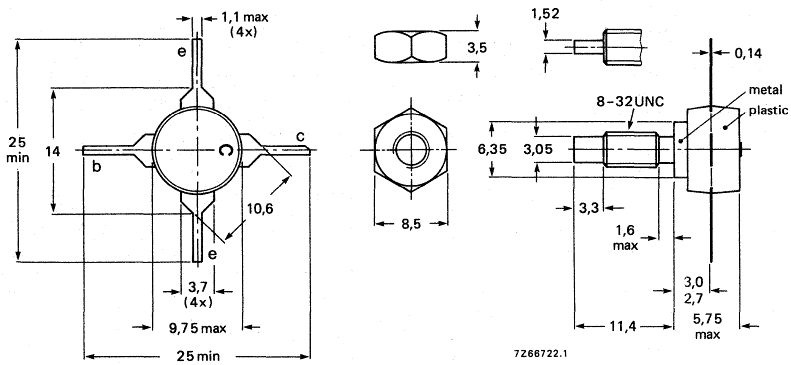
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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	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	$R_{th\ j-mb}$	=	32,5	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

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.

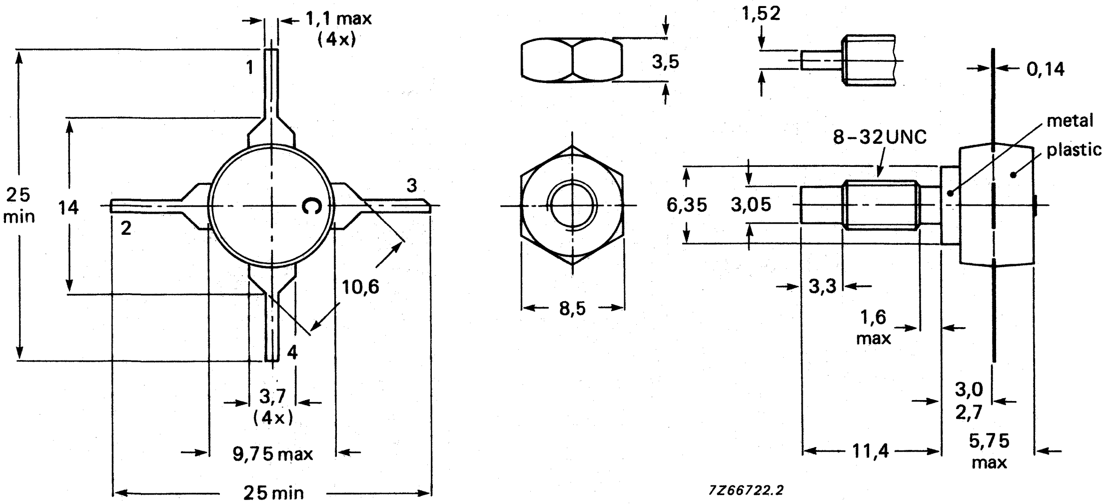
MECHANICAL DATA

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

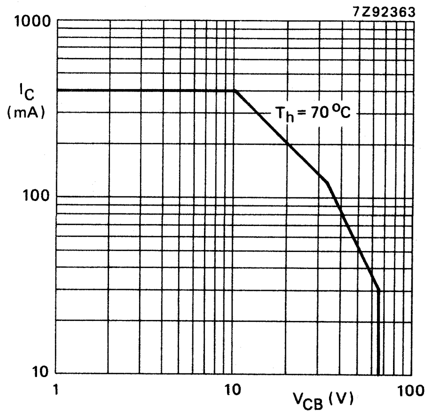


Fig. 2 D.C. SOAR.

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

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

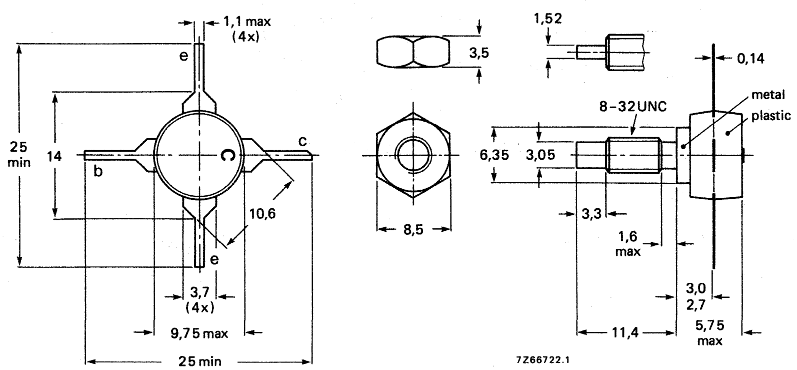
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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	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	$R_{th\ j-mb}$	=	21,4	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,6	K/W

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

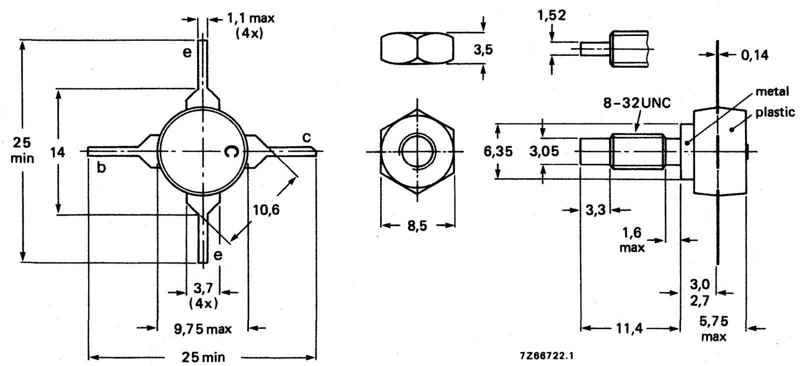
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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 ≥ 10 MHz	I_{CM}	max.	3,0	A
Total power dissipation up to T_h = 70 °C f ≥ 10 MHz	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

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

SOT48/2 (see Fig.1a).
SOT122A (see Fig.1b).

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOT48/2 **(BLX94A)**

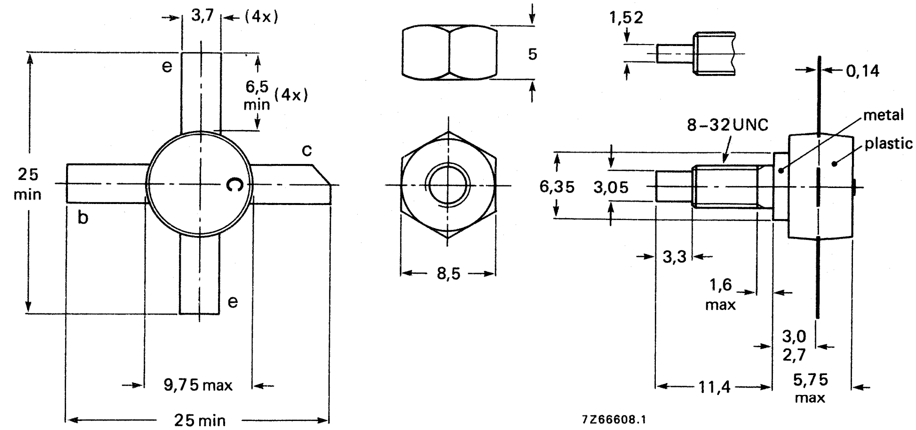
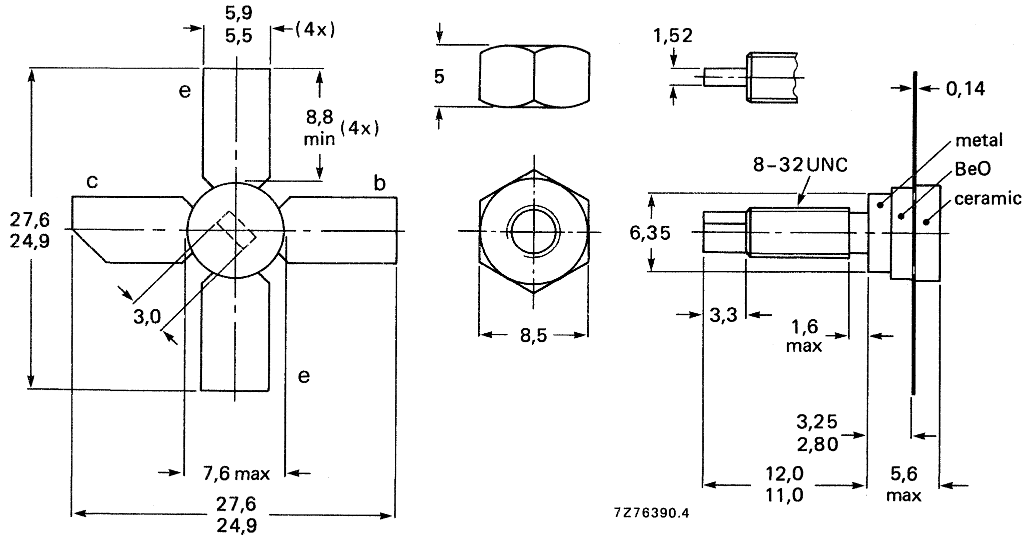


Fig. 1b SOT122A **(BLX94C)**



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.

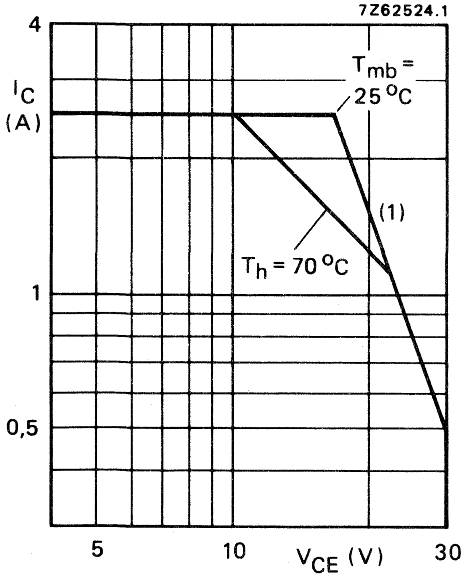
When locking is required an adhesive is preferred instead of a lock washer.

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.

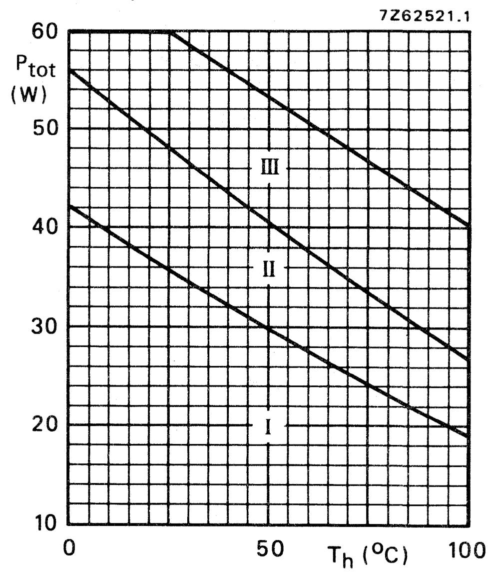


Fig. 3 Power derating curve vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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}	>	15	
		typ.	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

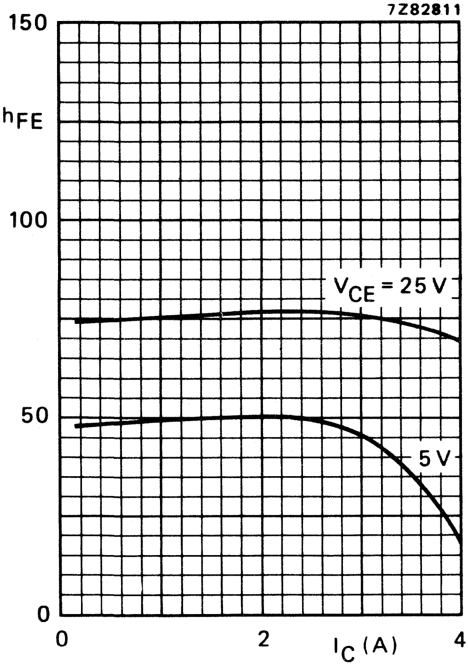


Fig. 4 Typical values; T_j = 25 °C.

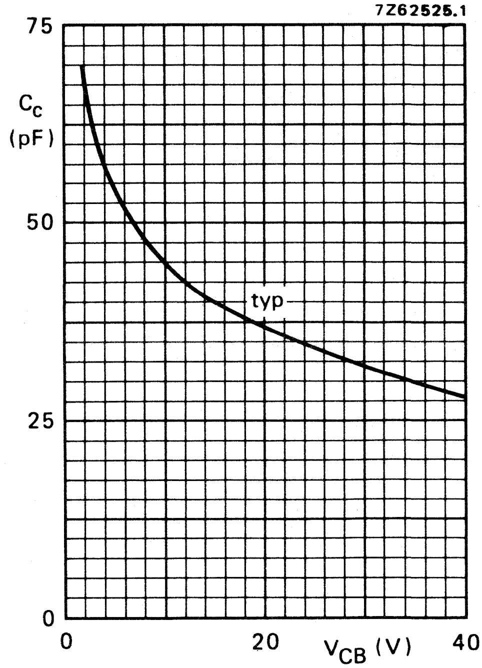


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

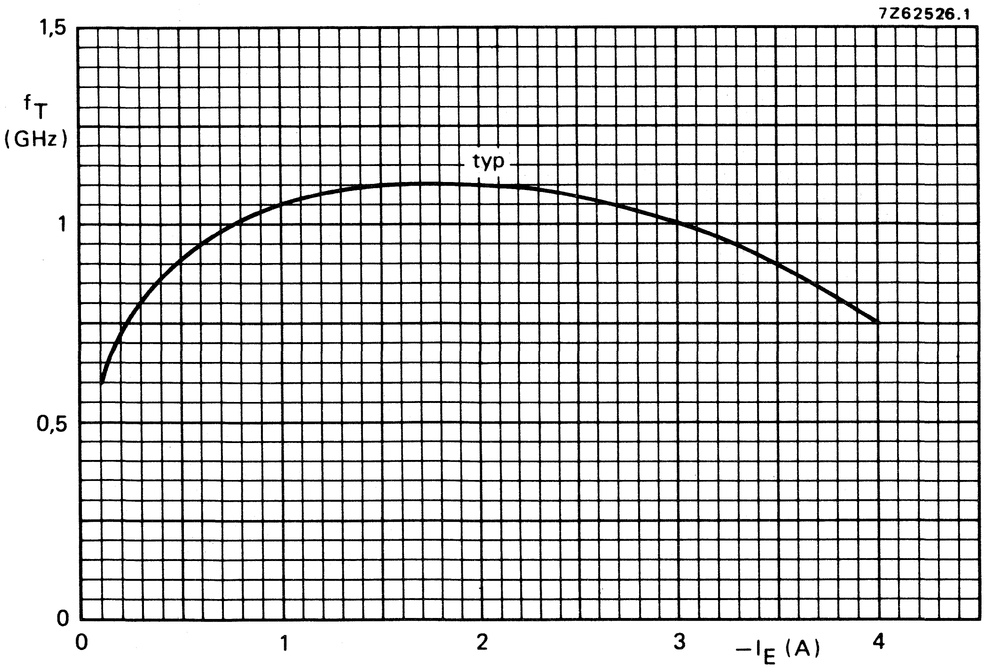


Fig. 6 V_{CB} = 28 V; T_j = 25 °C.

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

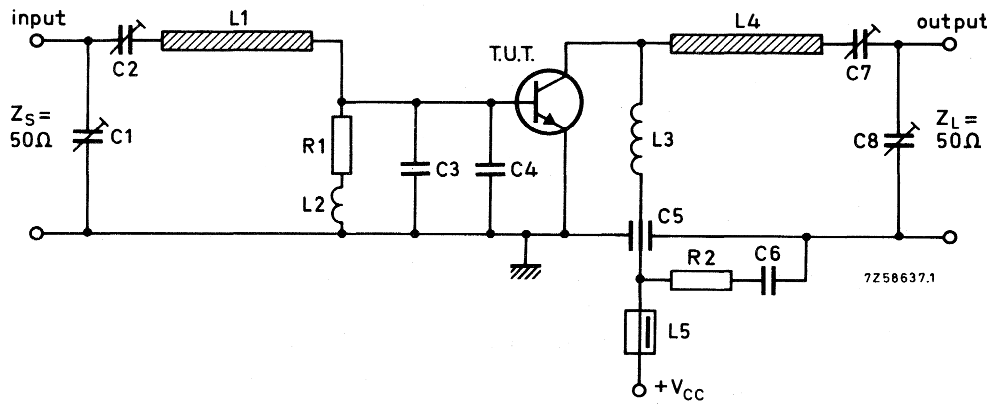


Fig. 7 470 MHz test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

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.

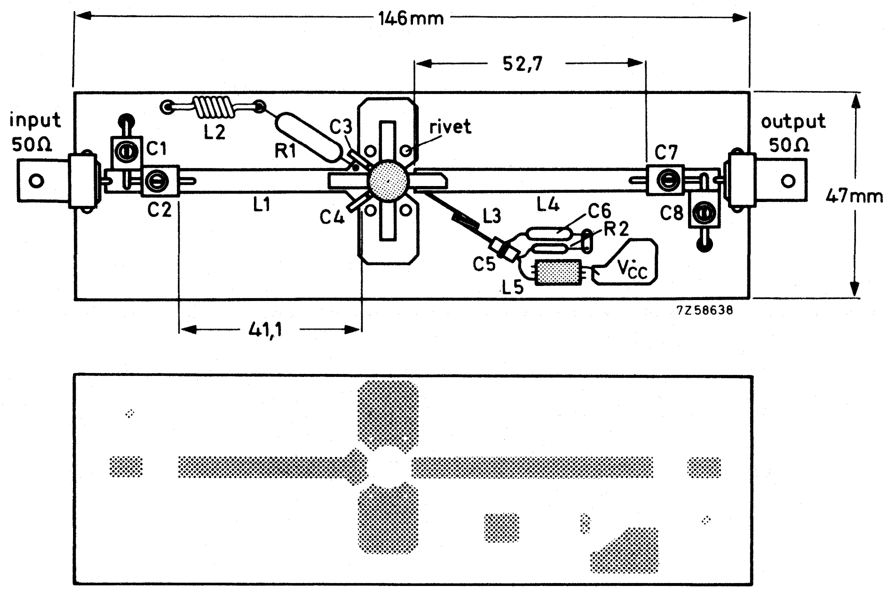


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

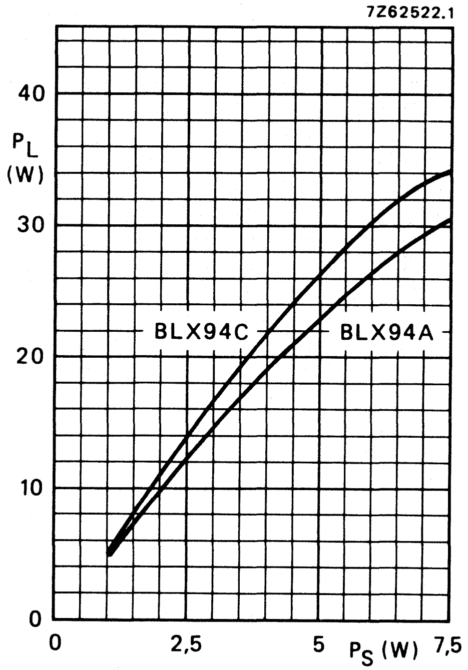


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typical values.

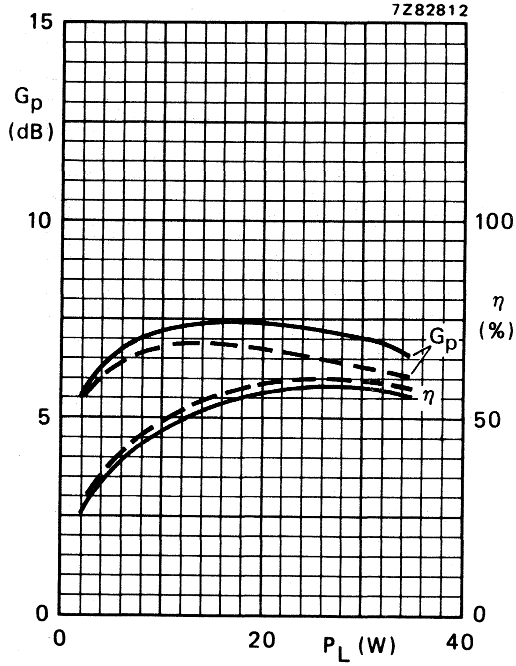


Fig. 10 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C; typ. values; ---- **BLX94A**; —— **BLX94C.**

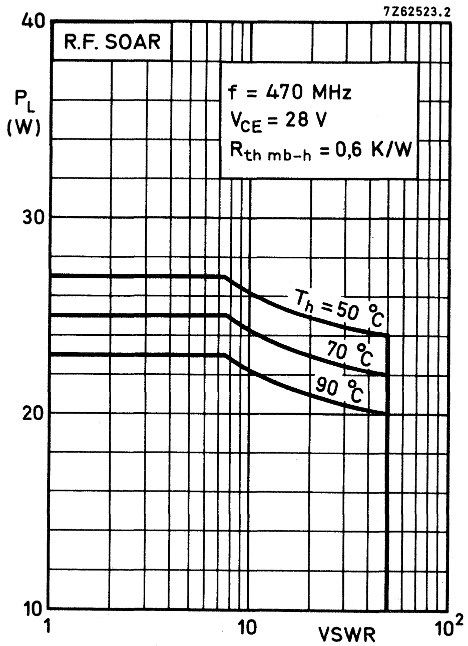


Fig. 11 For high voltage operation, a stabilized power supply is generally used. The graph shows the permissible output power under nominal conditions as a function of the VSWR, with heatsink temperature as parameter.

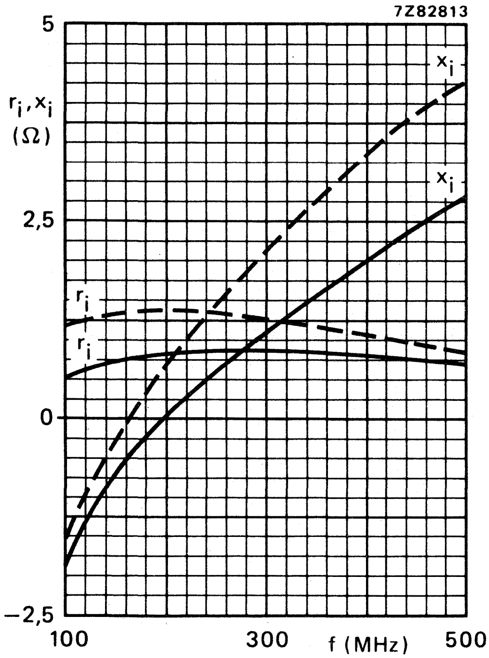


Fig. 12 Input impedance (series components).

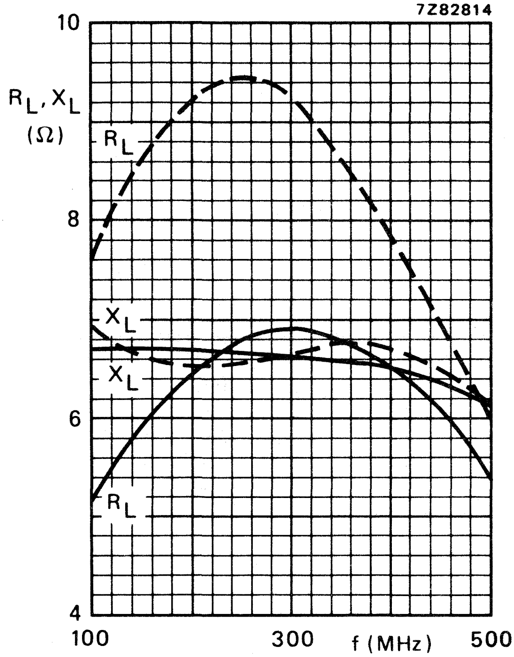


Fig. 13 Load impedance (series components).

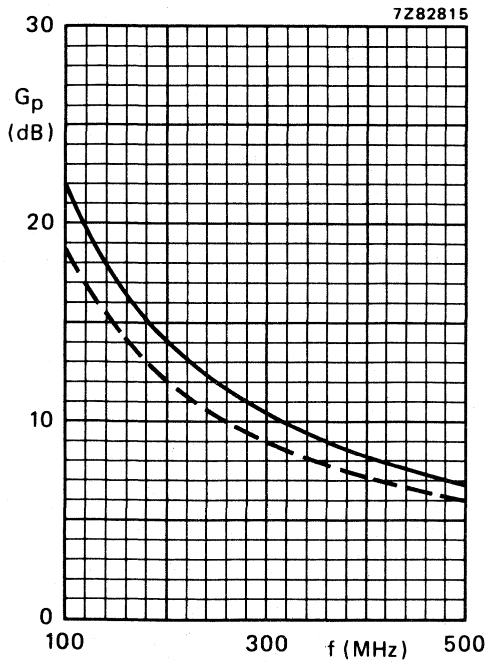


Fig. 14.

Conditions for Figs 12, 13 and 14:

Typical values; V_{CE} = 28 V; P_L = 25 W;
T_h = 25 ^oC; 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

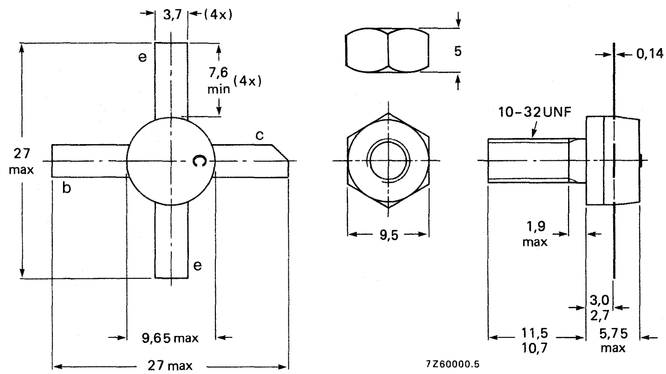
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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)

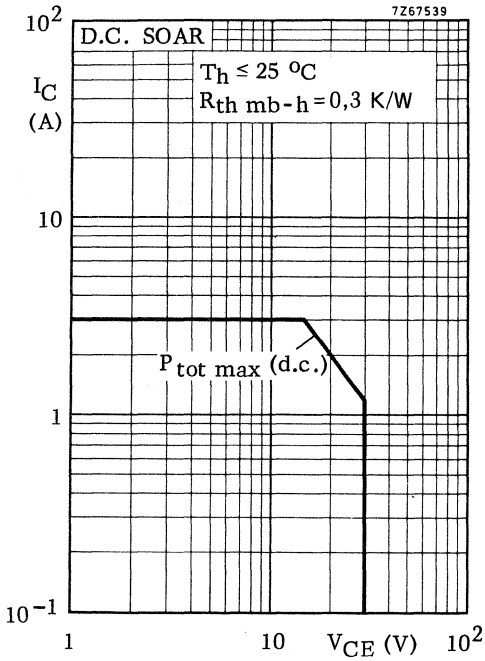
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

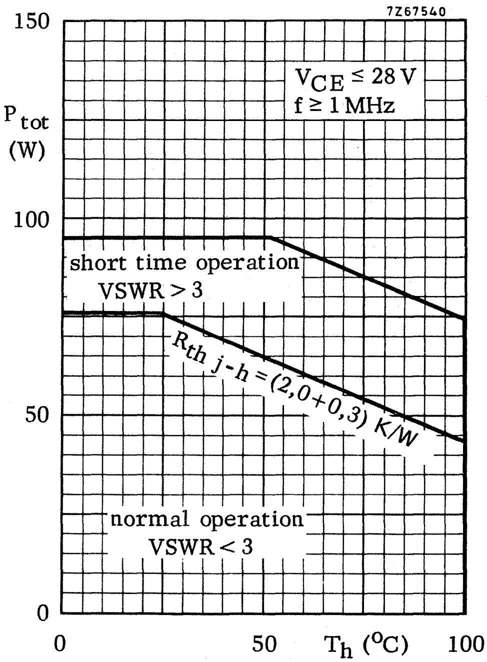
When locking is required an adhesive is preferred instead of a lock washer.

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

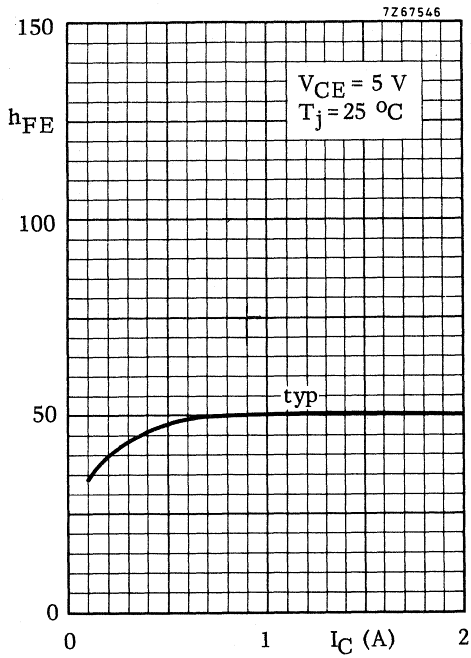
THERMAL RESISTANCE

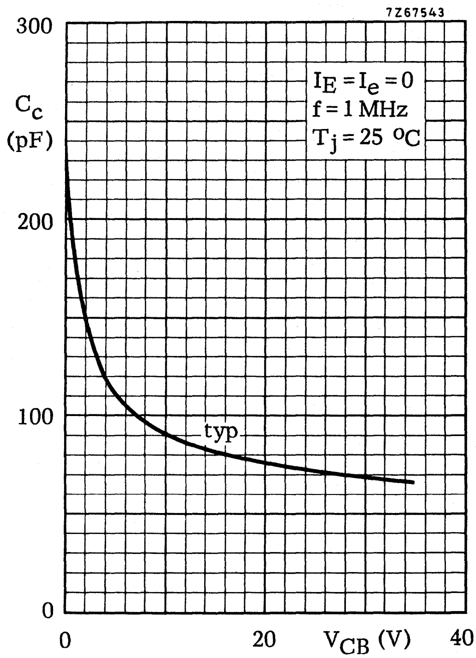
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,0	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,3	K/W

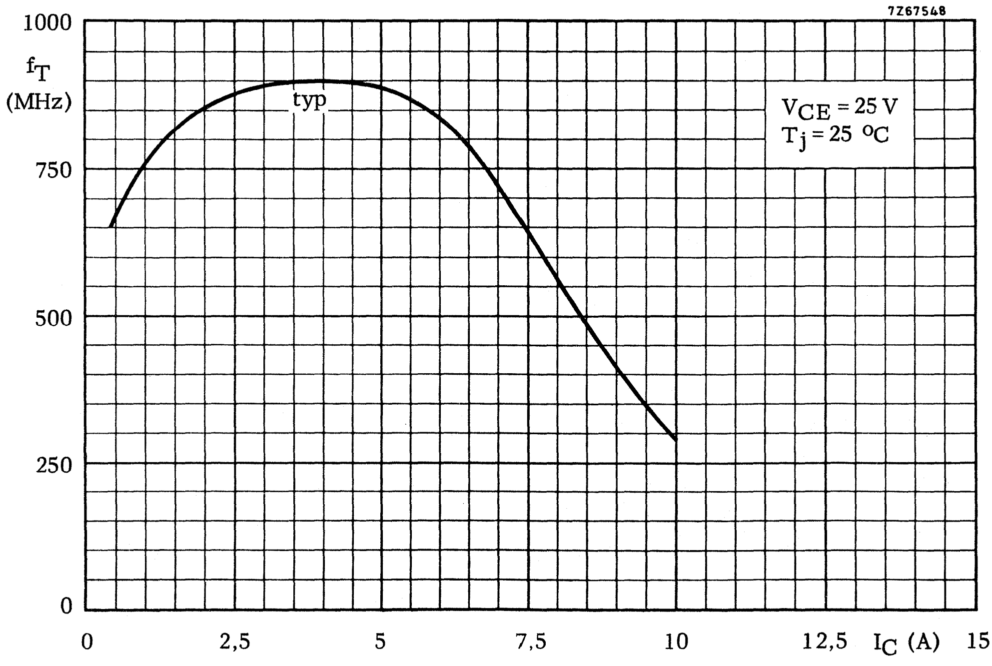
CHARACTERISTICS

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 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
I_C (A)
2


7Z67543
300
200
100
0
C_c
(pF)
I_E = I_e = 0
f = 1 MHz
T_j = 25 °C
typ
0
20
V_{CB} (V)
40


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
I_C (A)
15

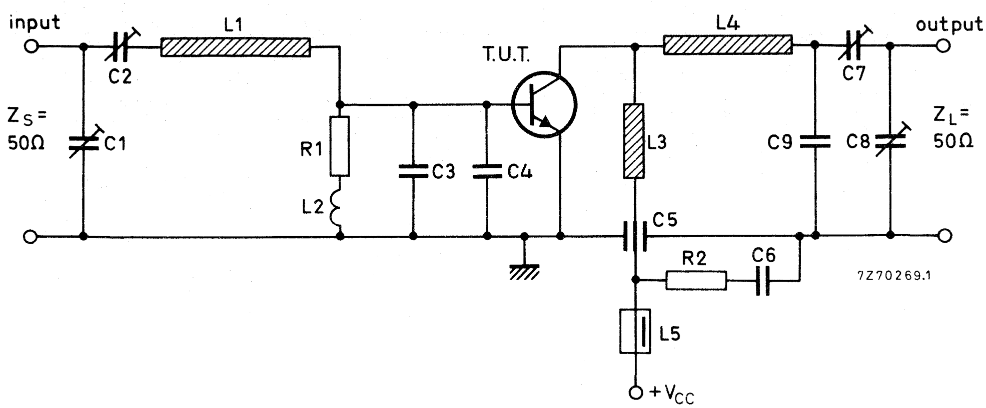
APPLICATION INFORMATION

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)

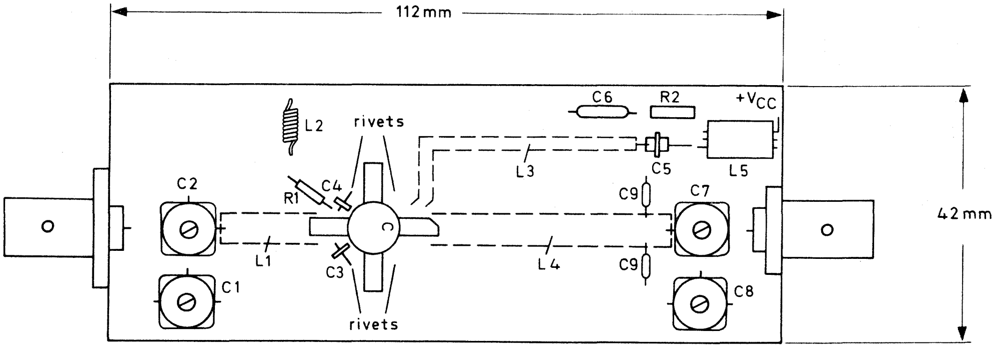
L1; L3; L4 are striplines on a double Cu-clad print plate with PTFE fibre-glass dielectric. (ϵ_r = 2,74); thickness 1/32".

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.

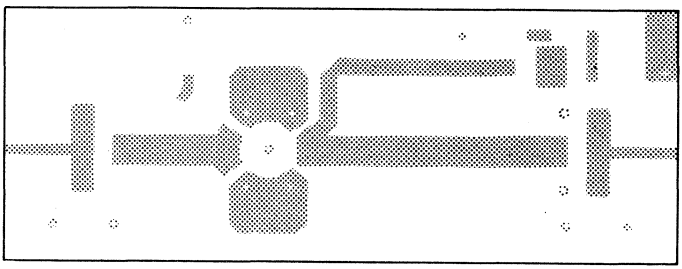
The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CE} = 28 V; f = 470 MHz; T_h = 70 °C.
VSWR = 50 through all phases; P_L = 36 W.

APPLICATION INFORMATION (continued)

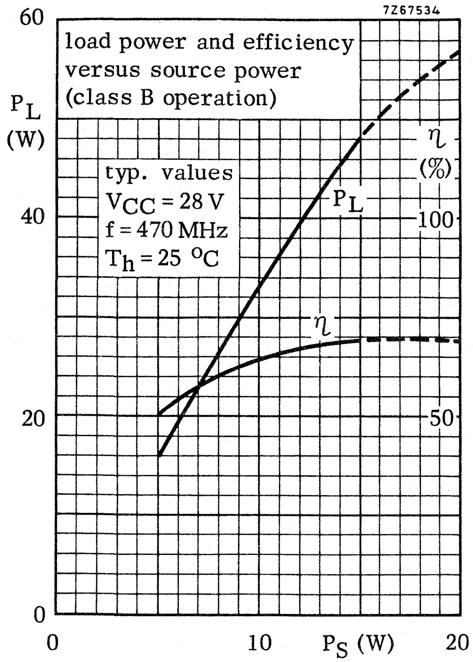
Component layout and printed-circuit board for 470 MHz test circuit.

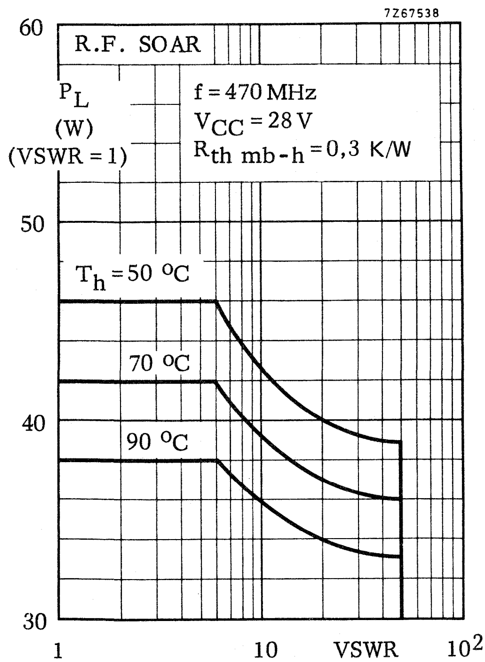


7Z67605.1



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.



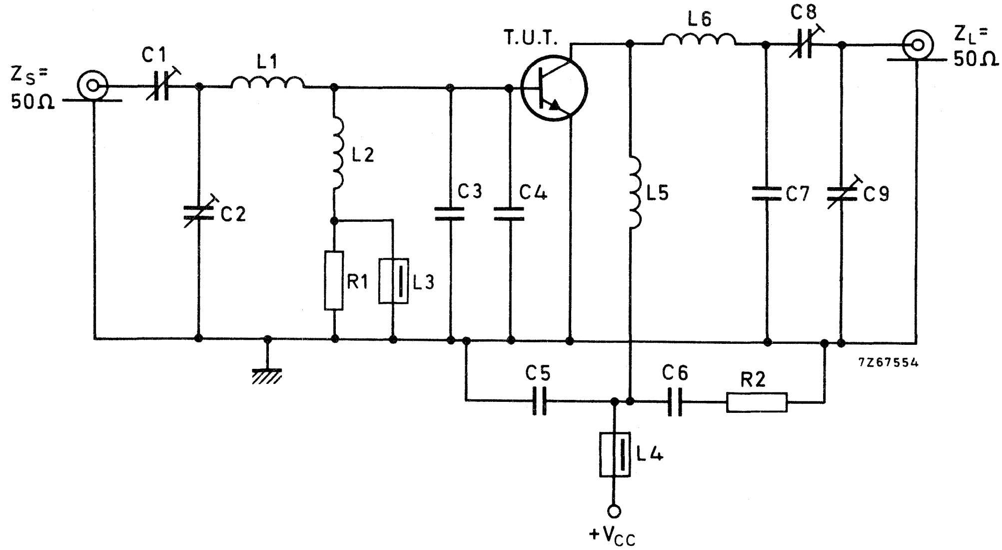


Indicated load power as a function of overload.

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:

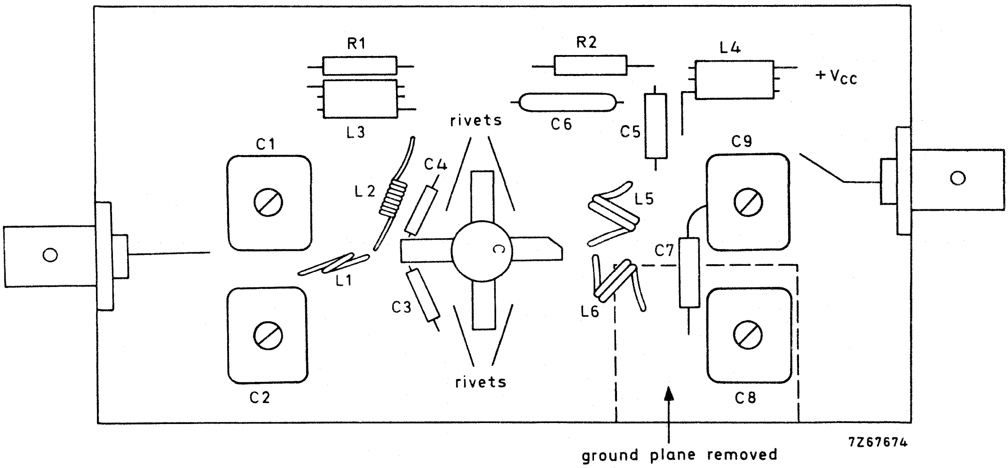
C1 = 2,5 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 47 pF ceramic capacitor
C5 = 100 pF ceramic capacitor
C6 = 100 nF polyester capacitor
C7 = 6,8 pF ceramic capacitor
C8 = 4 to 60 pF film dielectric trimmer (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

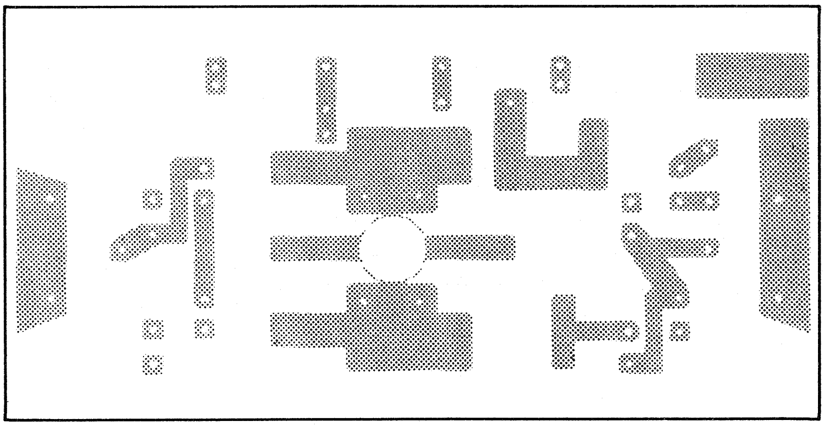
R1 = R2 = 10 Ω carbon resistor (0,25 W)

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.

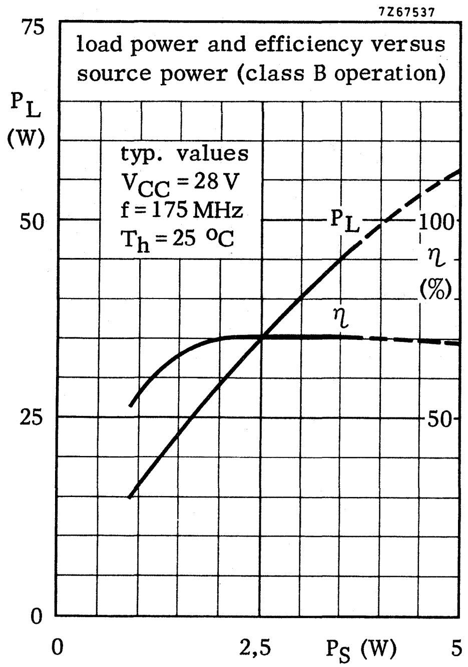


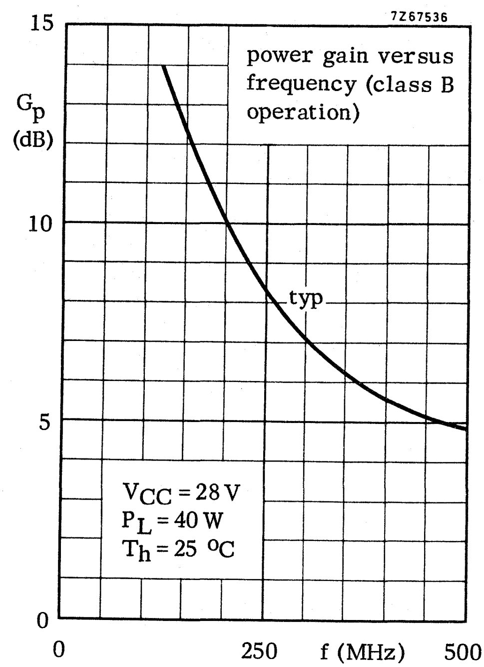
Dimensions of printed circuit board 123 mm x 55 mm.

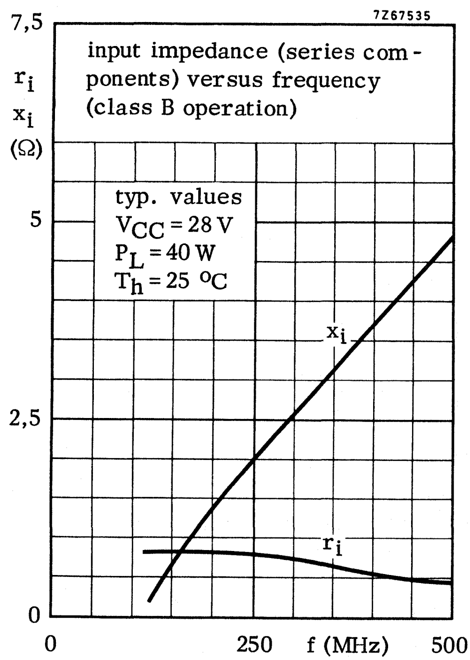


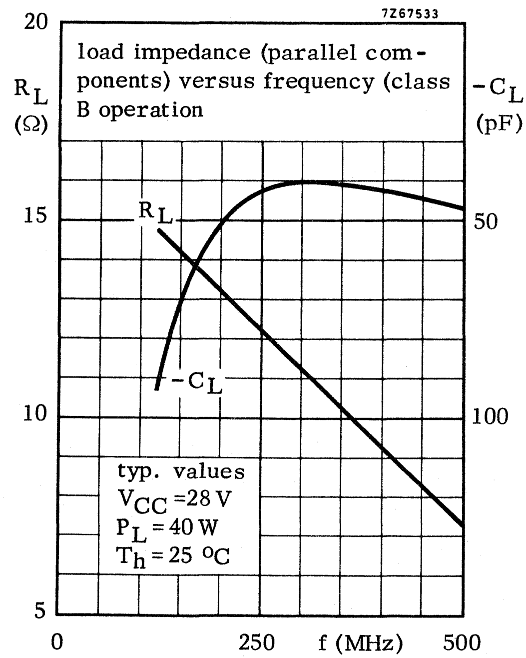
7Z66943

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)
P_L (W)
75
50
25
0
typ. values
V_{CC} = 28 V
f = 175 MHz
T_h = 25 °C
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

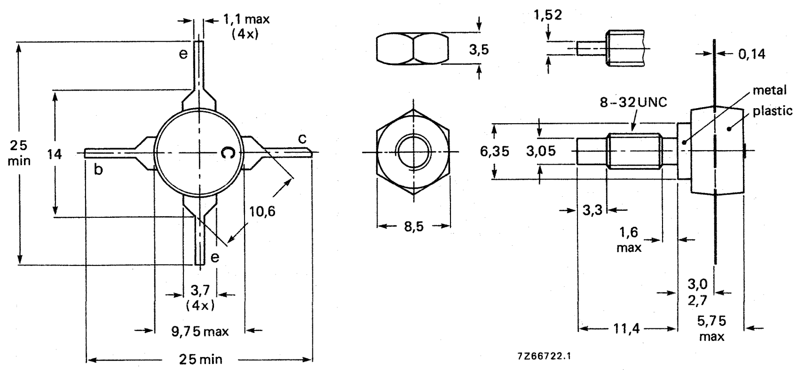
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	250	25	−60	> 0,5	> 6
class-A	860	25	250	25	−60	typ. 0,6	typ. 7

* 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)

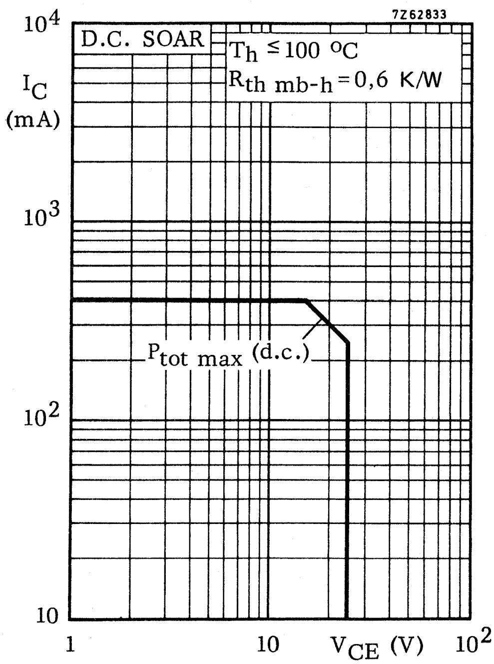
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

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

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

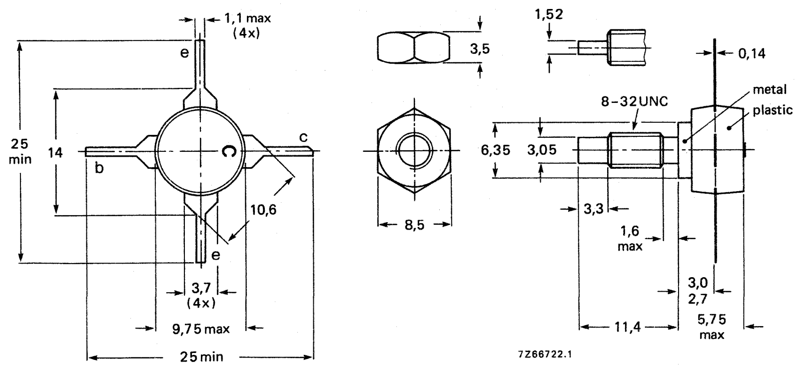
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\ sync}$* W	G_p dB
class-A	860	25	500	25	–60	> 1,0	> 5,5
class-A	860	25	500	25	–60	typ. 1,1	typ. 6,5

* 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)

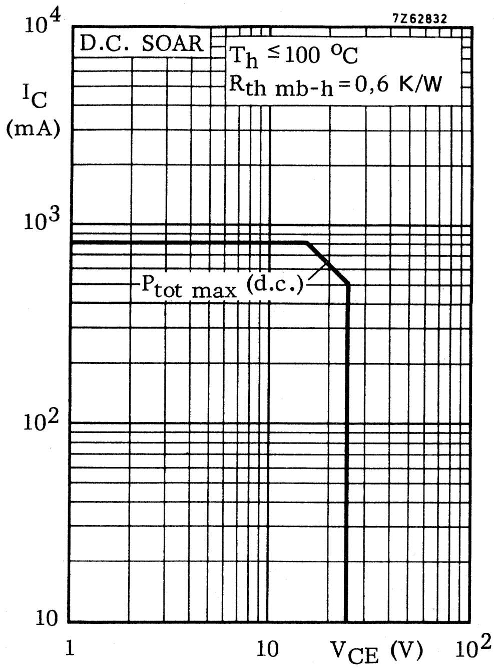
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

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

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

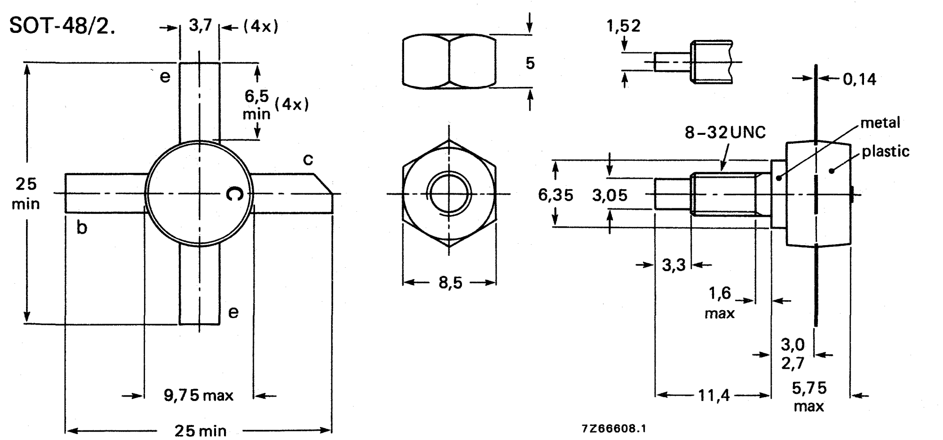
mode of operation	f_{vision} MHz	V_{CE} V	I_C mA	T_h °C	d_{im}* dB	$P_{o\,sync}$* W	G_p dB
class-A	860	25	850	70	−60	> 3,5	> 5,0
class-A	860	25	850	70	−60	typ. 4,0	typ. 5,5

* 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.

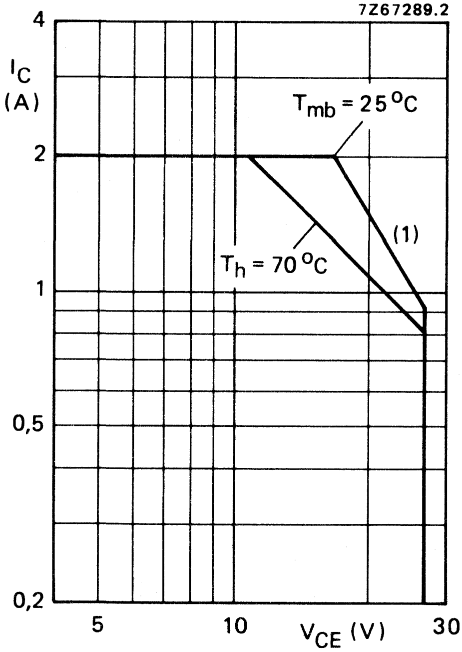
When locking is required an adhesive is preferred instead of a lock washer.

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.

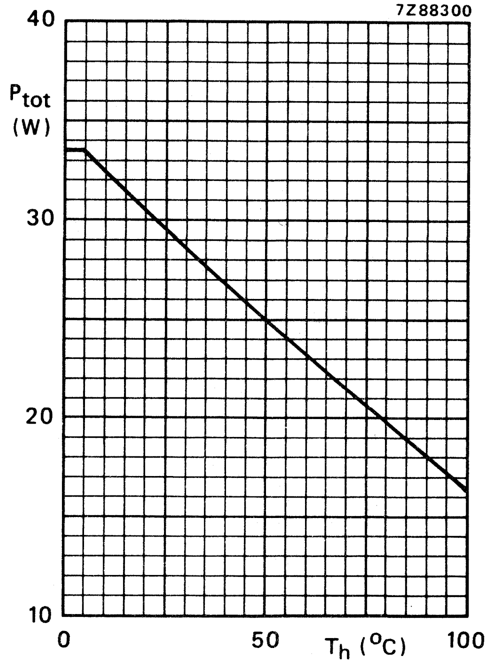


Fig. 3 Power derating curve vs. temperature.

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

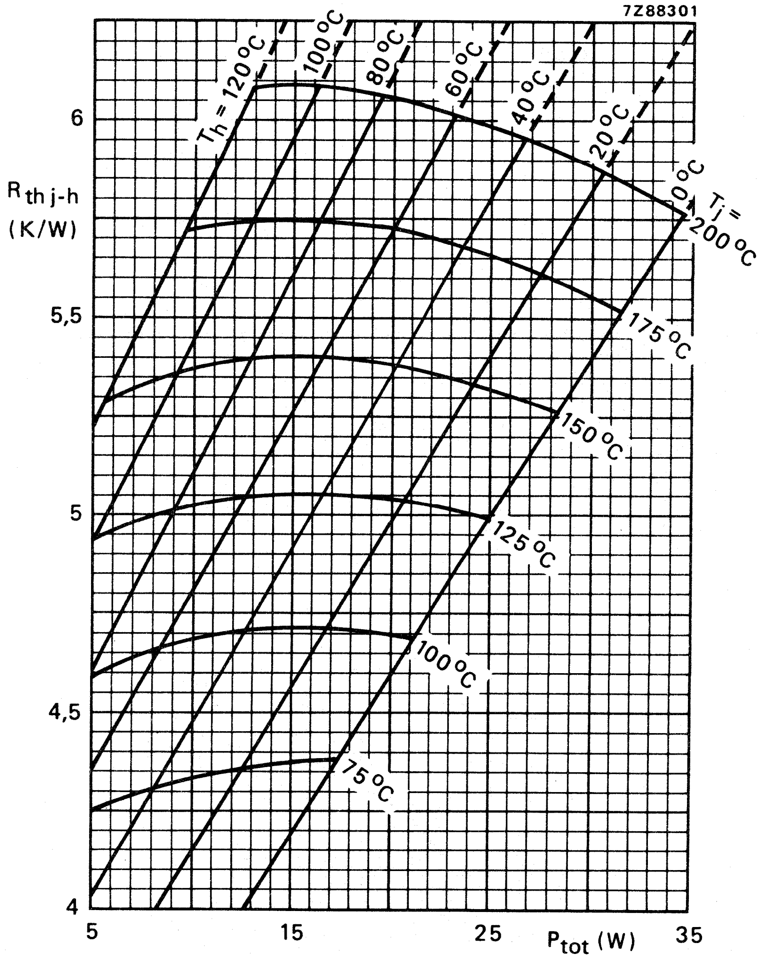


Fig. 4 Maximum thermal resistance from junction to heatsink as a function of power dissipation, with heatsink and junction temperature as parameters. ($R_{th\,mb\text{-}h}$ = 0,6 K/W.)

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

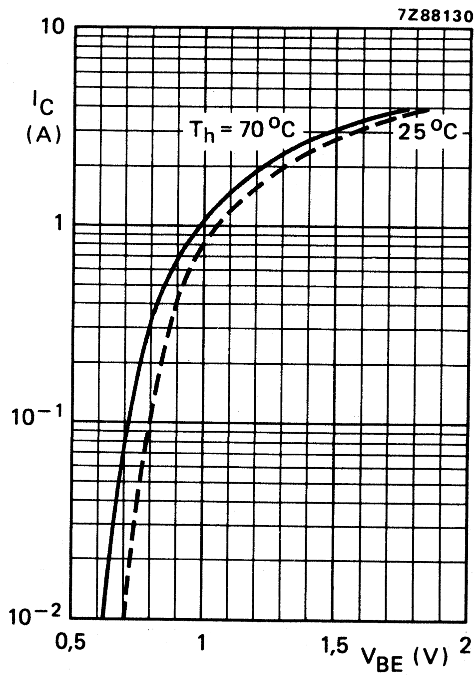


Fig. 5 Typical values; V_{CE} = 25 V.

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta \leq 0,02$.
** Measured under pulse conditions: $t_p \leq 50\ \mu s$; $\delta \leq 0,01$.

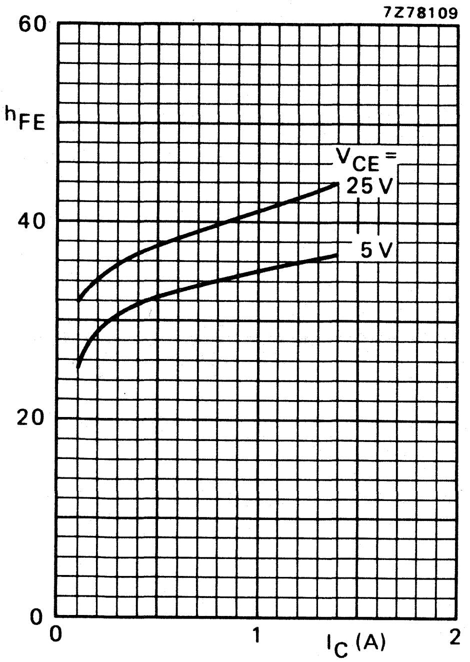


Fig. 6 Typical values; T_j = 25 °C.

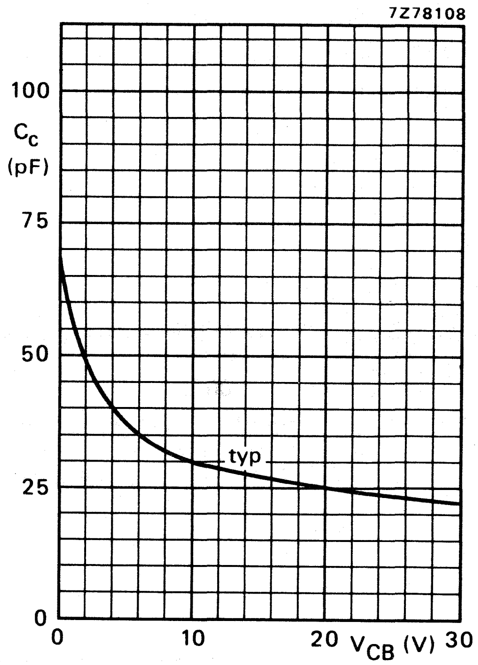


Fig. 7 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

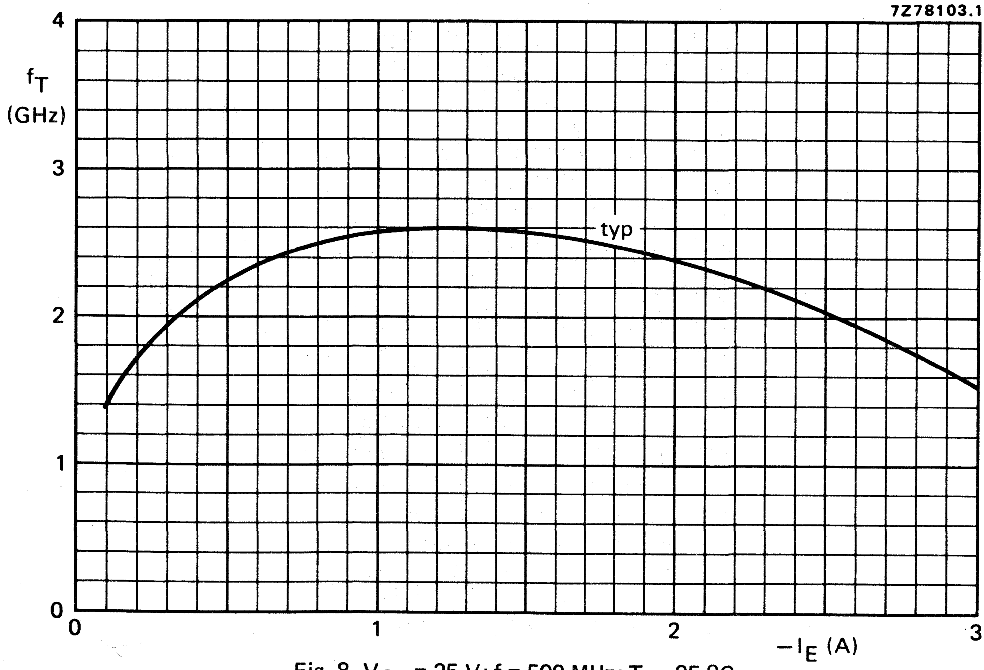


Fig. 8 V_{CB} = 25 V; f = 500 MHz; T_j = 25 °C.

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.

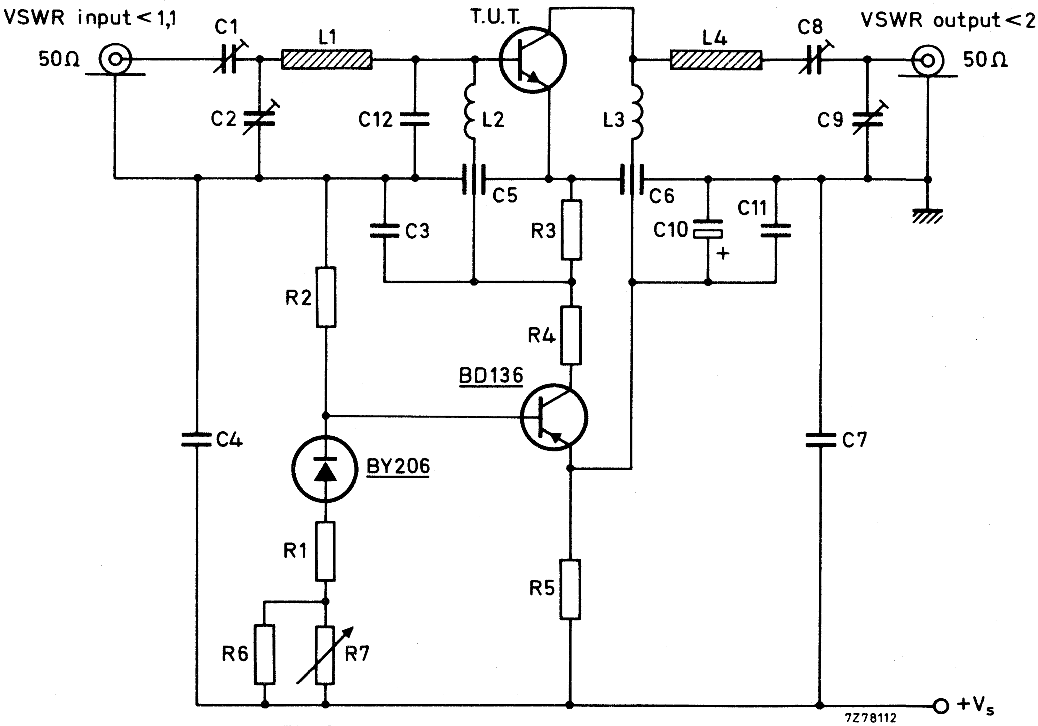


Fig. 9 Class-A test circuit at f_{vision} = 860 MHz.

List of components:

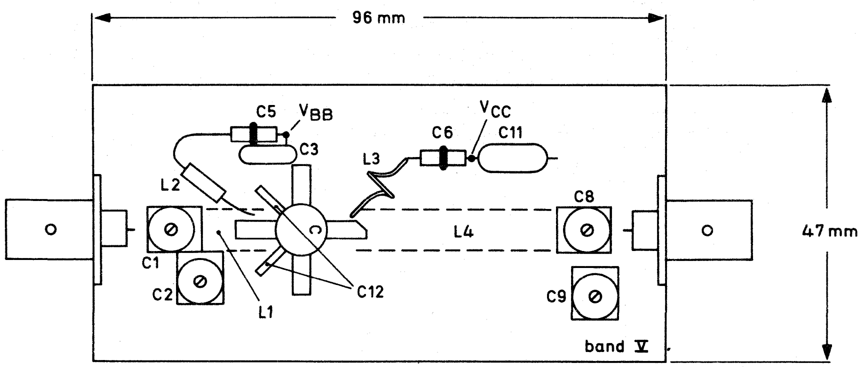
C1 = C2 = 1,4 to 5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = C4 = 100 nF polyester capacitor
C5 = C6 = 1 nF feed-through capacitor
C7 = 5,6 pF ceramic capacitor
C8 = 2 to 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C9 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 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)

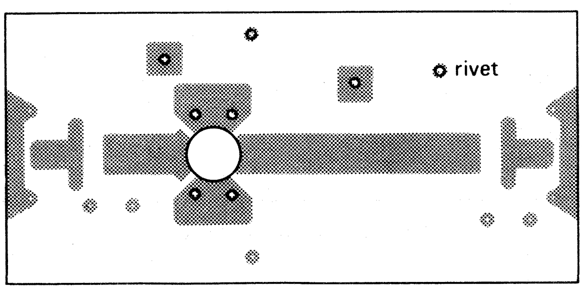
List of components: (continued)

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.

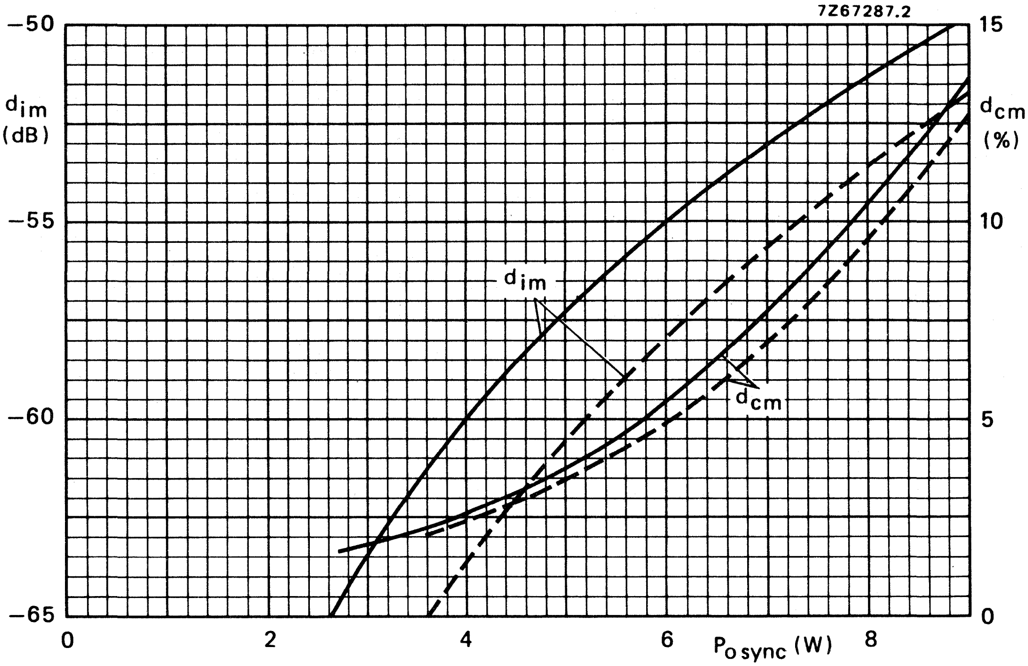


Fig. 11 Intermodulation distortion (d_{im})* and cross-modulation distortion (d_{cm})** as a function of $P_{o\,sync}$. Typical values; V_{CE} = 25 C; I_C = 850 mA; — — — T_h = 25 °C; —— T_h = 70 °C; f_{vision} = 860 MHz.

* 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.

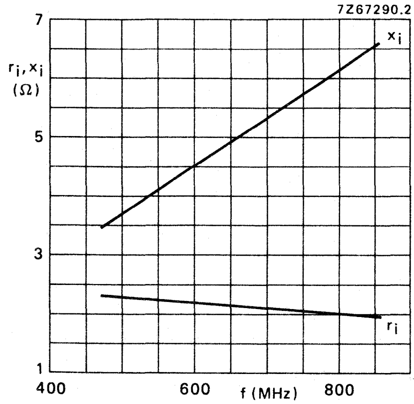


Fig. 12 Input impedance (series components).

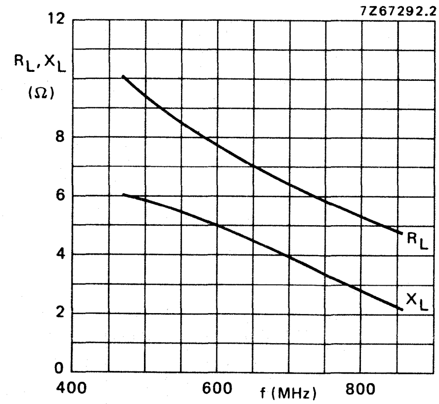


Fig. 13 Load impedance (series components).

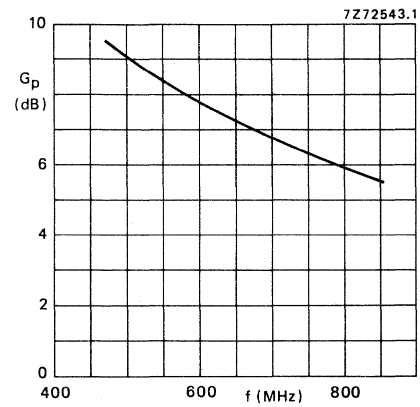


Fig. 14.

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

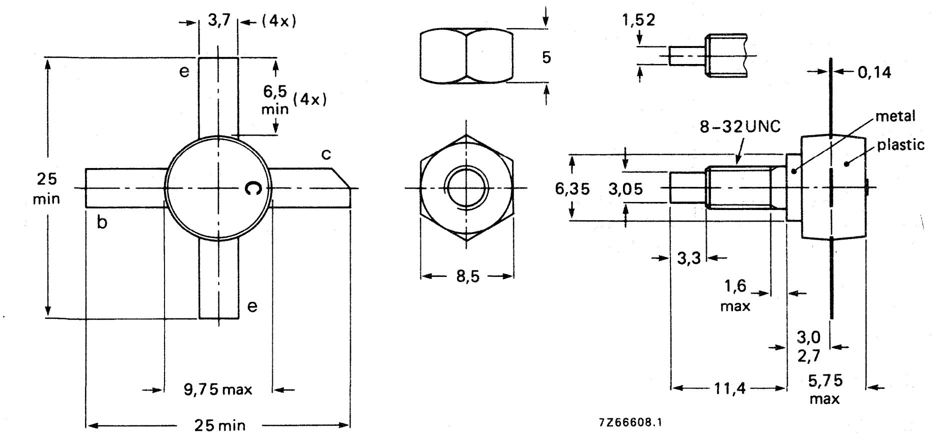
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

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)

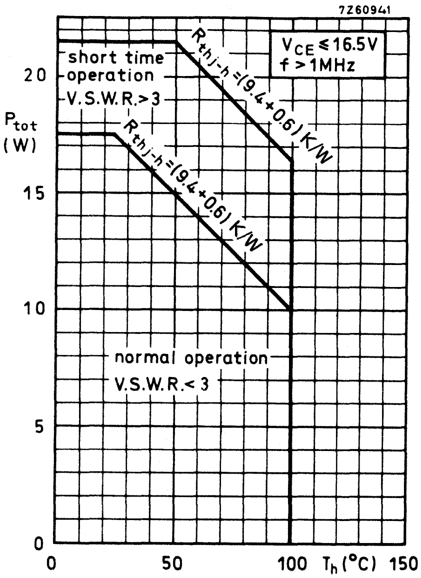
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

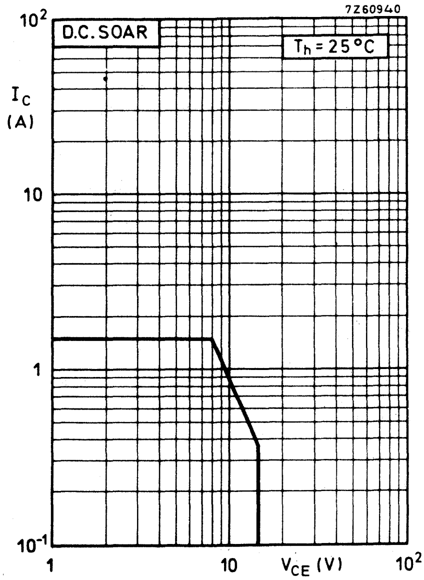
When locking is required an adhesive is preferred instead of a lock washer.

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

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

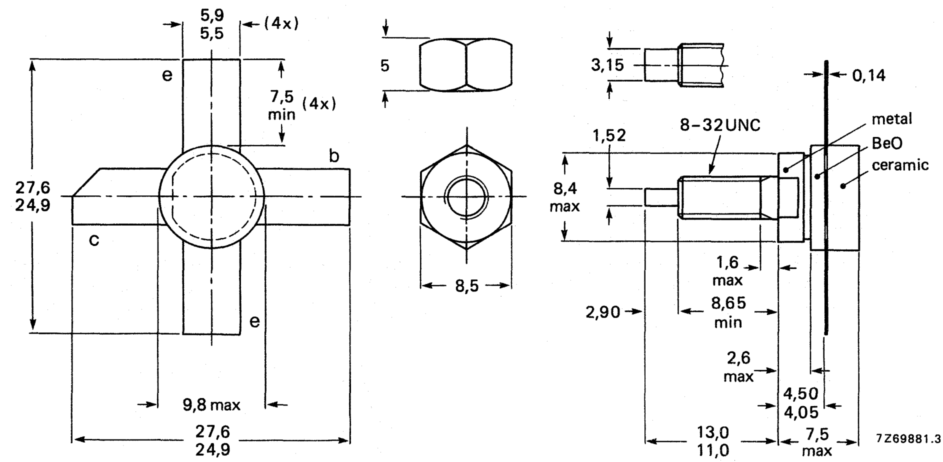
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

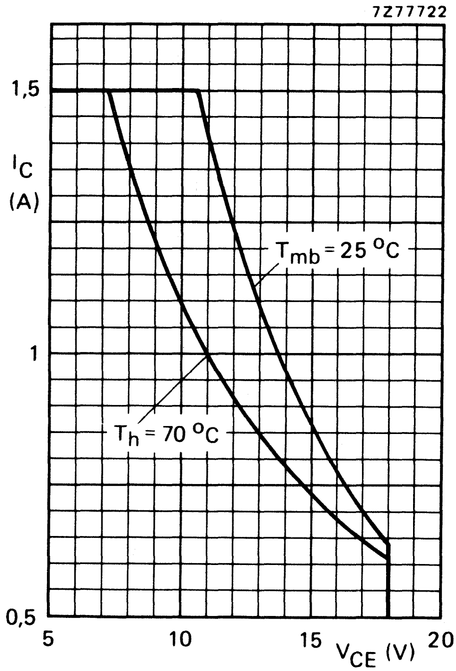


Fig. 2 D.C. SOAR.

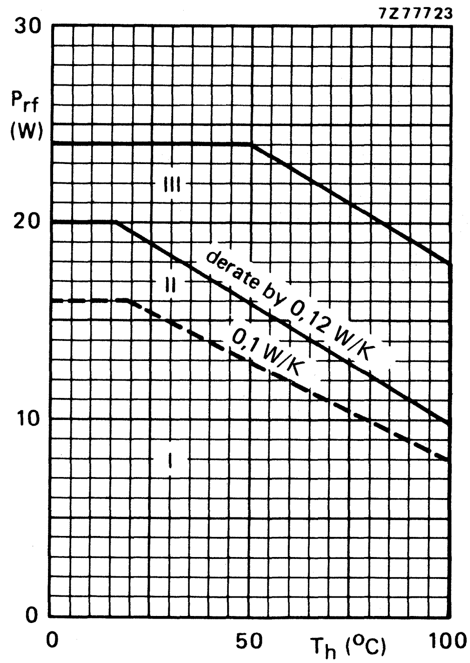


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 16,5$ V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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

$T_j = 25\ ^oC$

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-stud capacitance	C_{cs}	typ.	2	pF

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

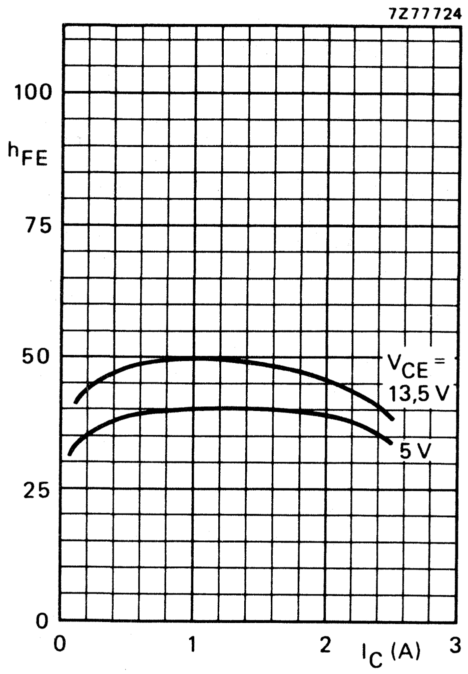


Fig. 4 Typical values; T_j = 25 °C.

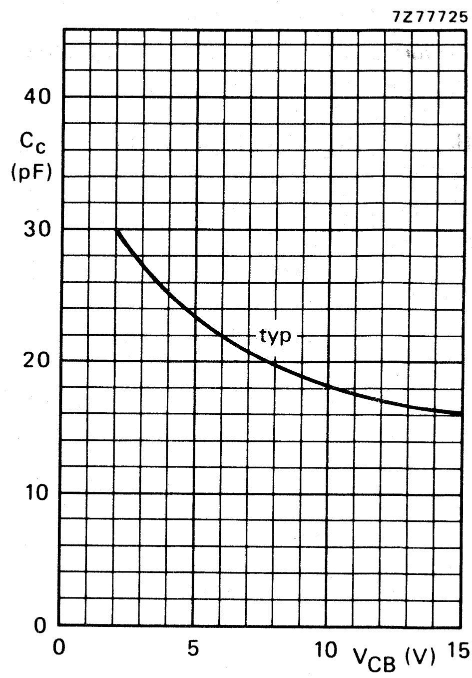


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

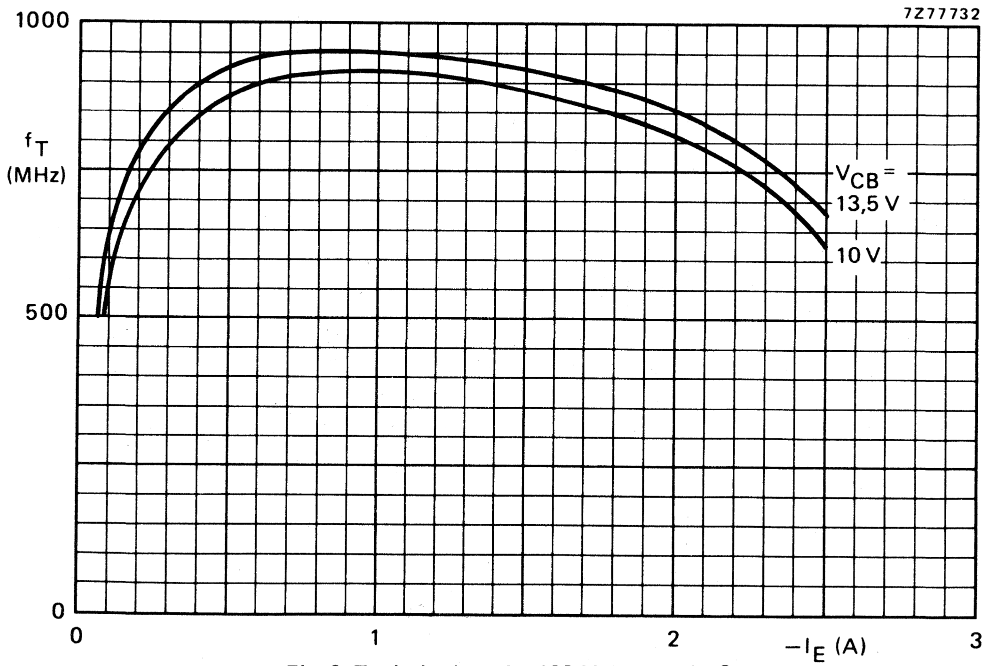


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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	–	–

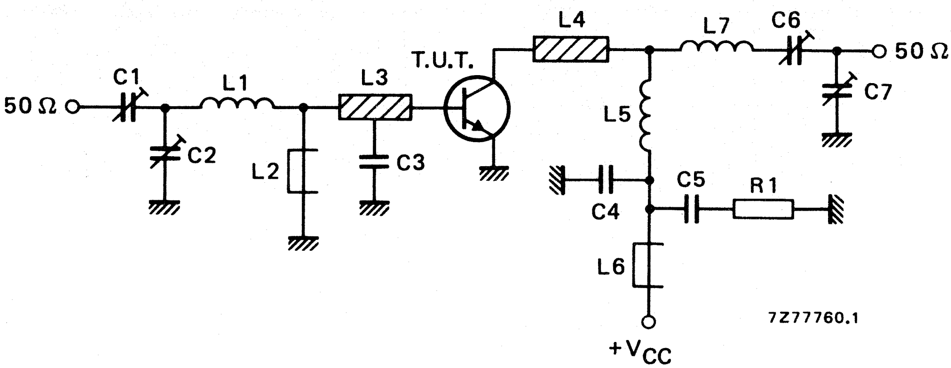


Fig. 7 Test circuit; c.w. class-B.

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.

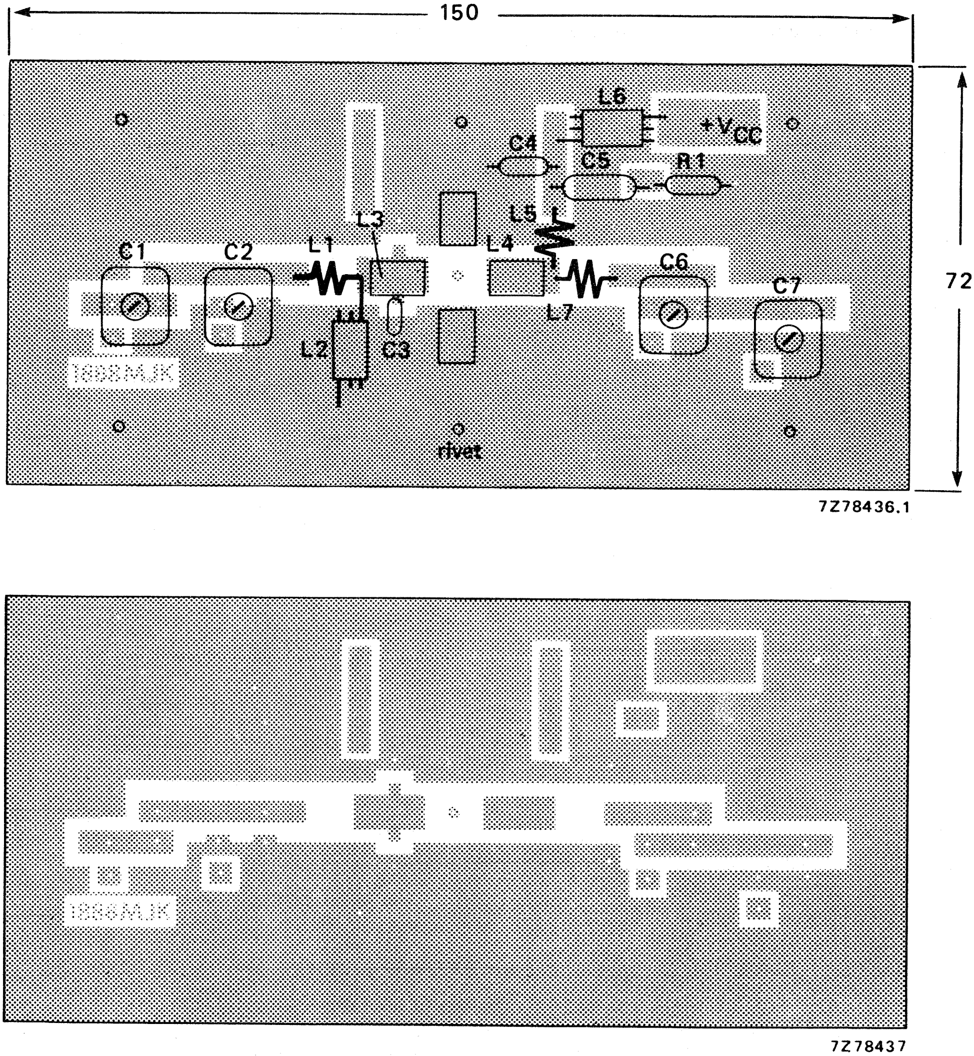


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

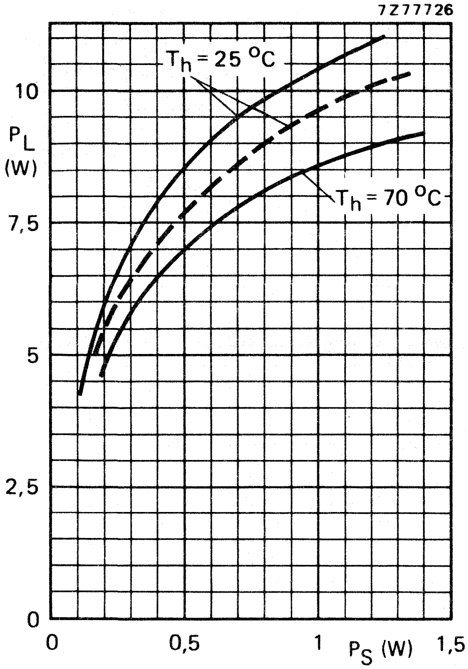


Fig. 9 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

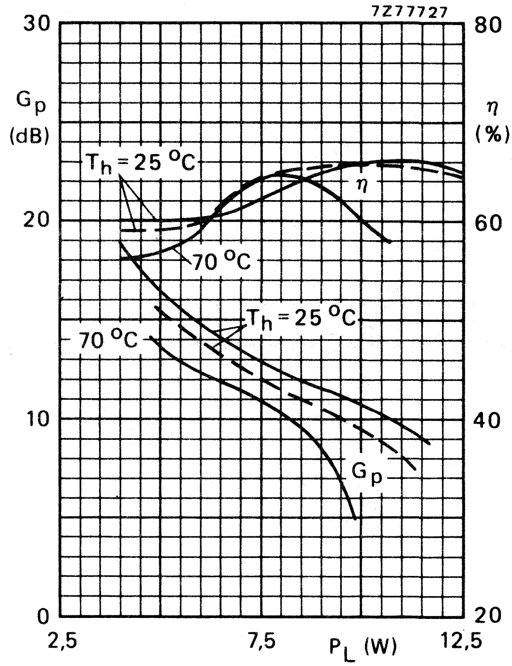


Fig. 10 Typical values; f = 175 MHz;
—— V_{CE} = 13,5 V; – – – V_{CE} = 12,5 V.

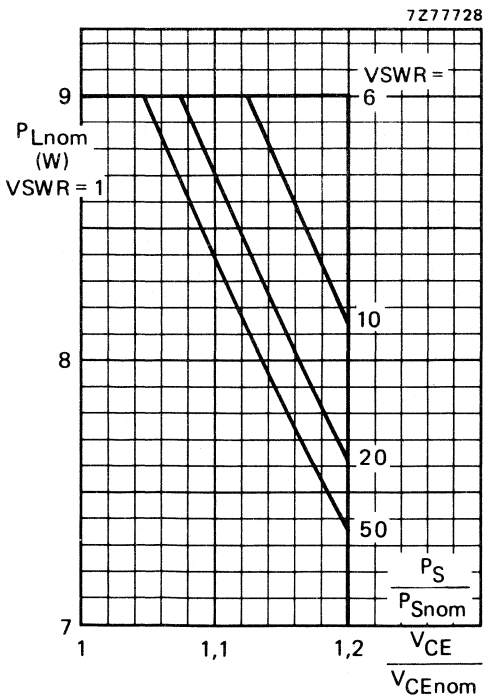


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\ mb-h}$ = 0,45 K/W; V_{CEnom} = 13,5 V or 12,5 V; P_S = P_{Snom} at V_{CEnom} and VSWR = 1.

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.

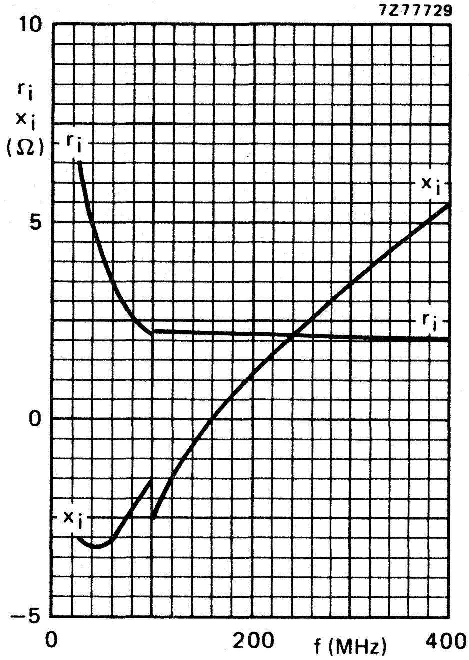


Fig. 12 Input impedance (series components).

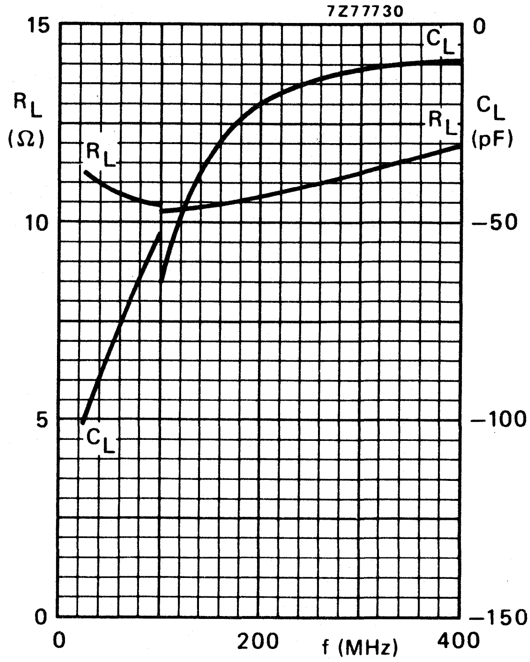


Fig. 13 Load impedance (parallel components).

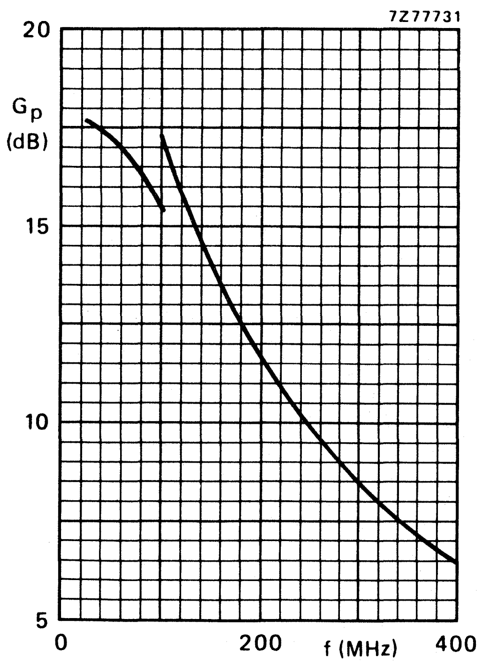


Fig. 14.

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 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 ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

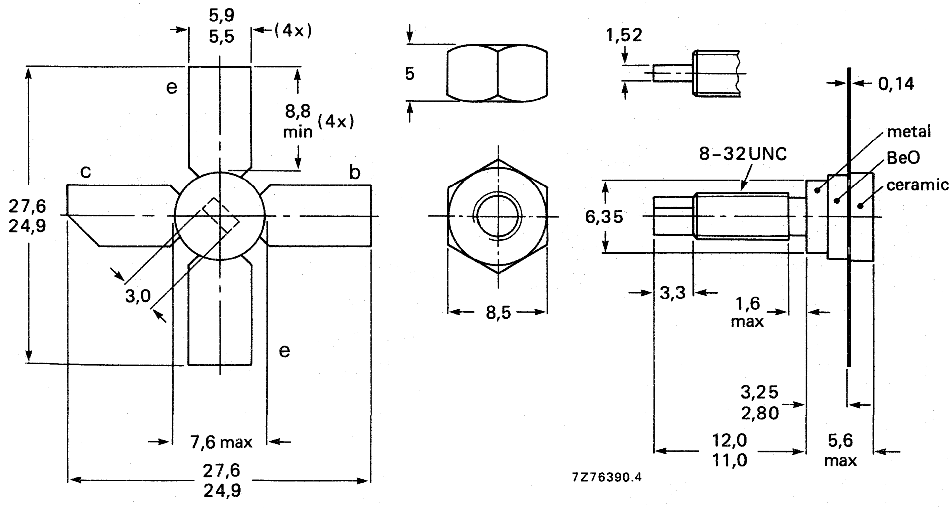
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

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 SOT122A.



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

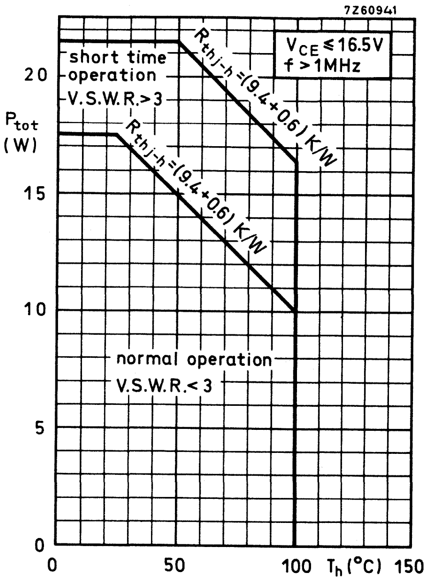
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

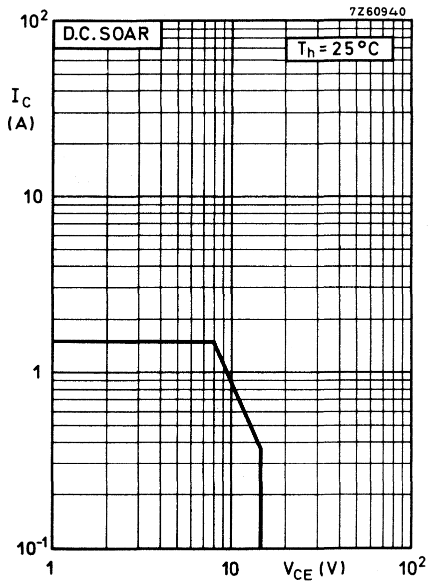
When locking is required an adhesive is preferred instead of a lock washer.

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

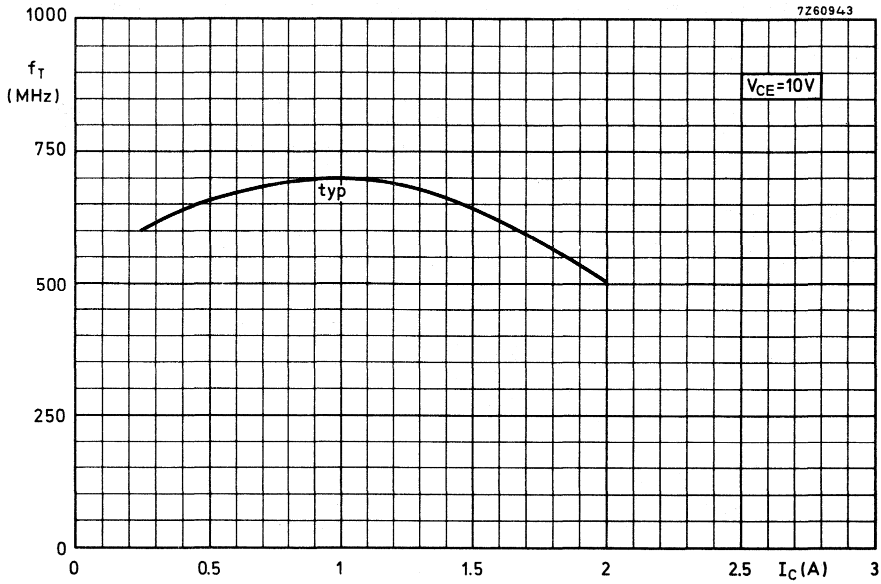
THERMAL RESISTANCE

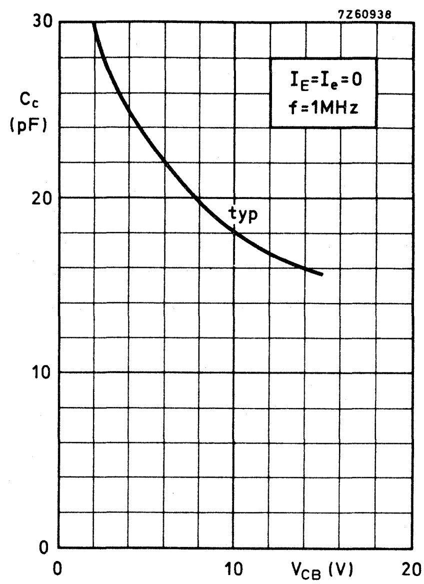
From junction to mounting base	$R_{th\ j-mb}$	=	9.4	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25°C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ 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
0
0.5
1
1.5
2
2.5
I_C (A)
3
V_{CE}=10V
typ


7Z60938
30
C_c (pF)
20
10
0
0
10
V_{CB} (V)
20
I_E=I_e=0
f=1MHz
typ

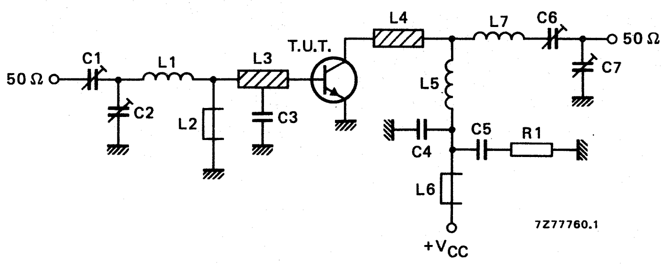
APPLICATION INFORMATION

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(%)	$\bar{z}_i$ (Ω)	$\bar{Y}_L$(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



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

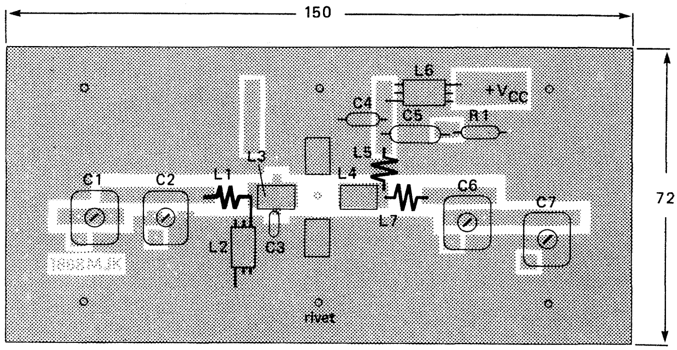
L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

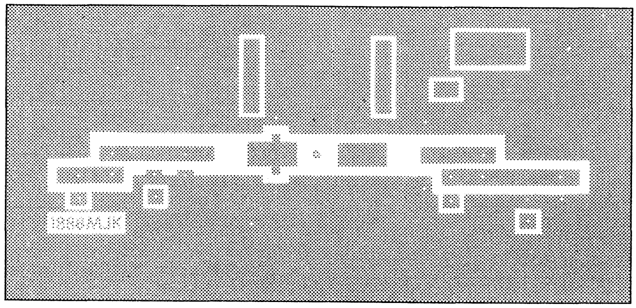
Component layout and printed-circuit board for 175 MHz test circuit see following page.

APPLICATION INFORMATION (continued)

Component layout and printed circuit board for 175 MHz test circuit.



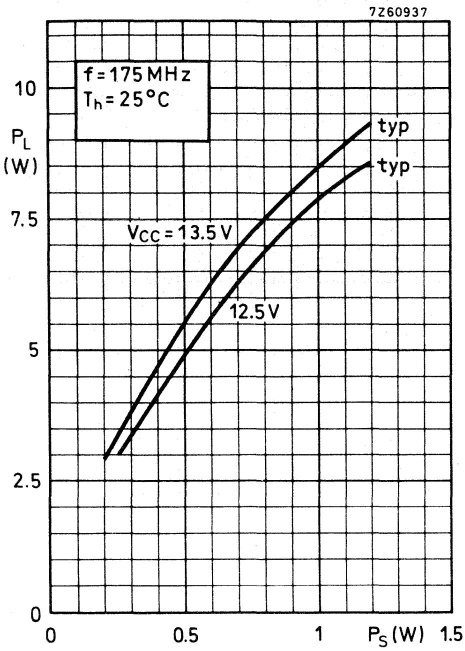
7Z78436.1

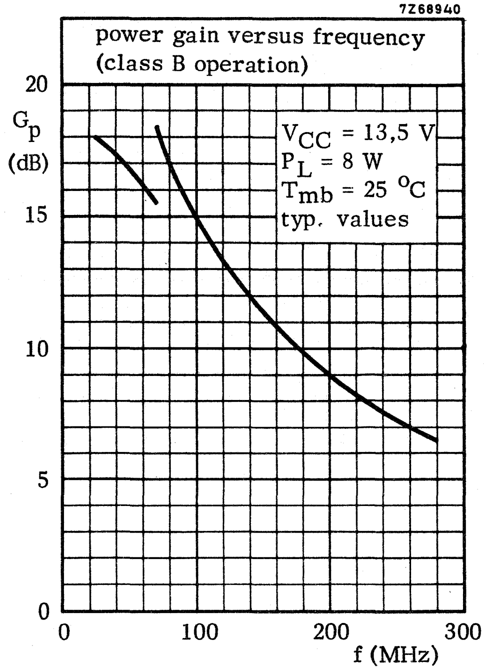


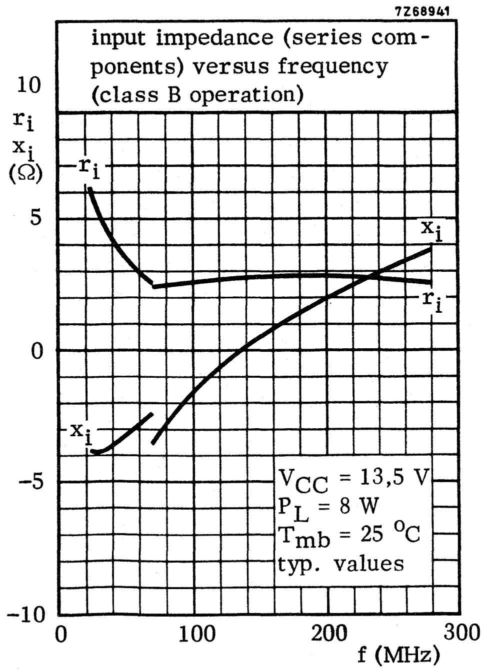
7Z78437

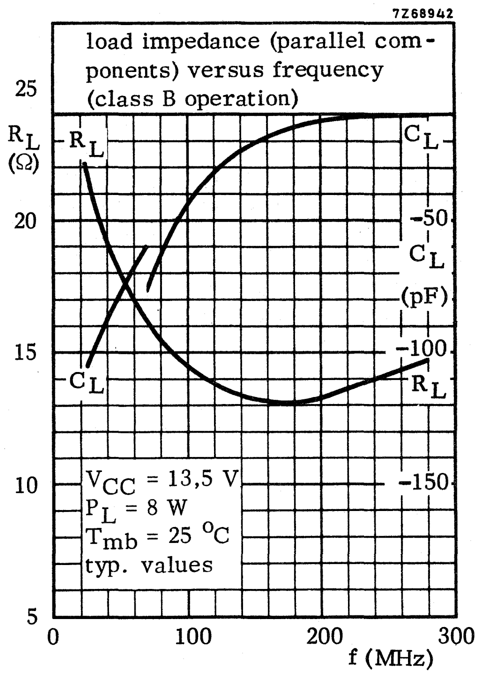
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

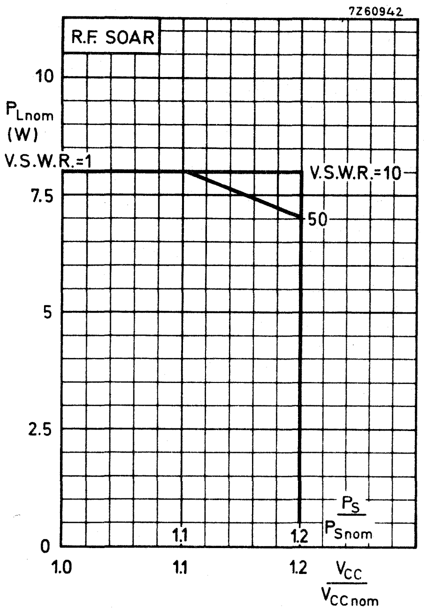
OPERATING NOTE Below 70 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

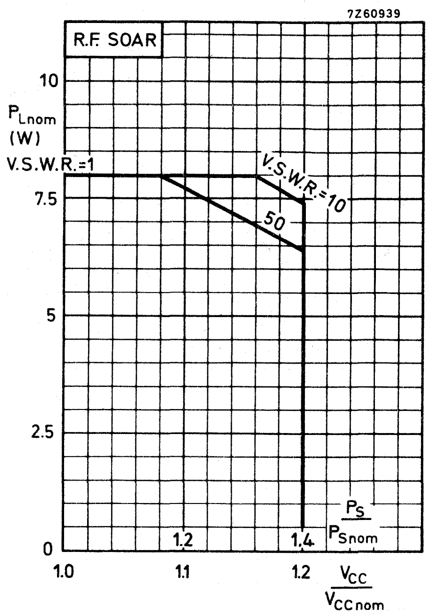












Conditions for R.F. SOAR:

f = 175 MHz
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
$R_{th\ mb\text{-}h} \cong 0.6$ K/W

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 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

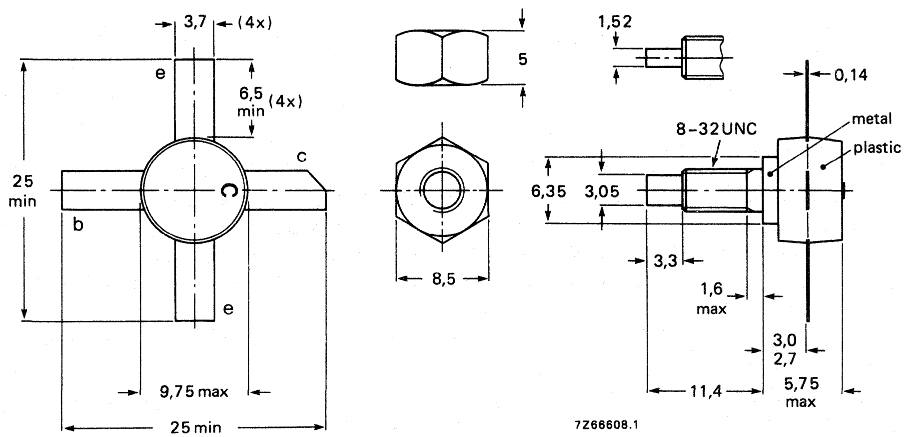
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

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)

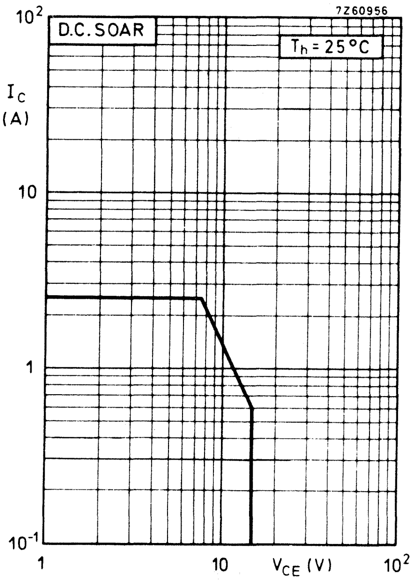
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

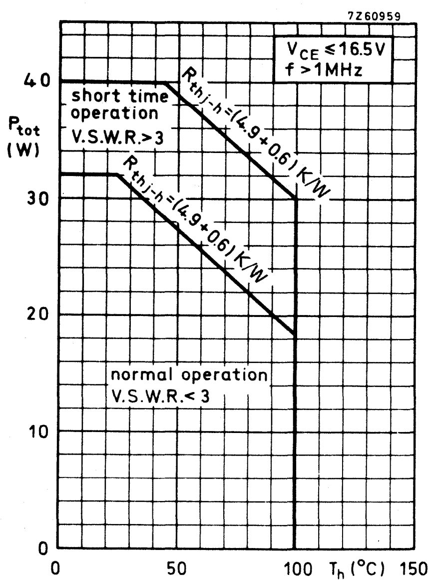
When locking is required an adhesive is preferred instead of a lock washer.

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	$R_{th\ j\text{-}mb}$	=	4.9	K/W
From mounting base to heatsink	$R_{mb\text{-}h}$	=	0.6	K/W

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

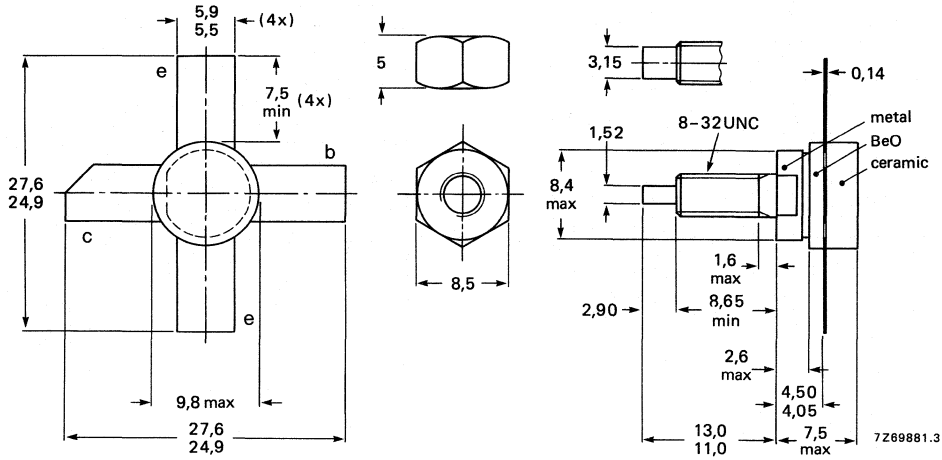
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

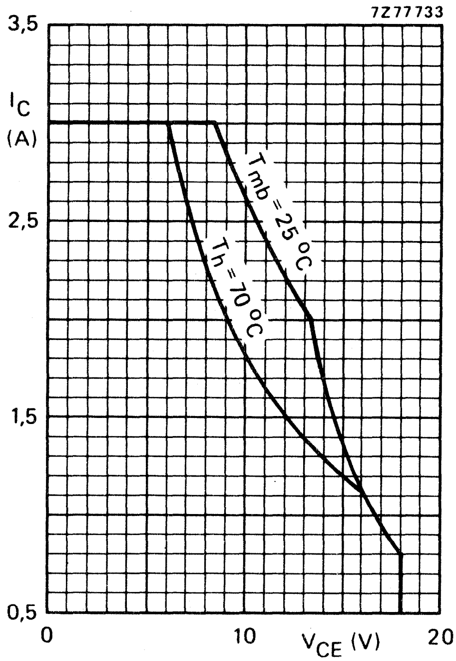


Fig. 2 D.C. SOAR.

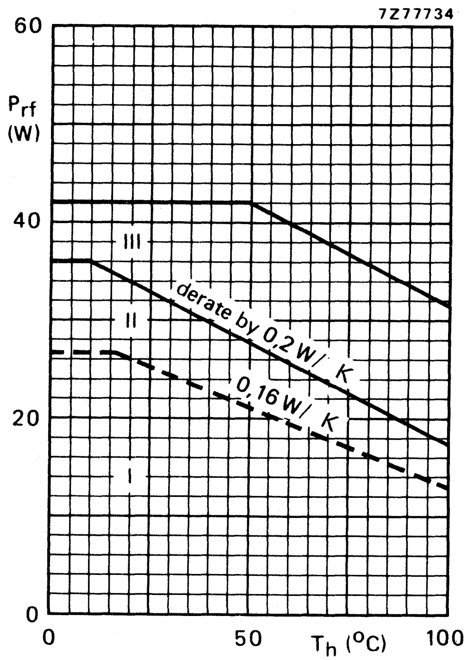


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 16,5 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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 °C

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 Ω	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-stud capacitance	C_{cs}	typ.	2 pF

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

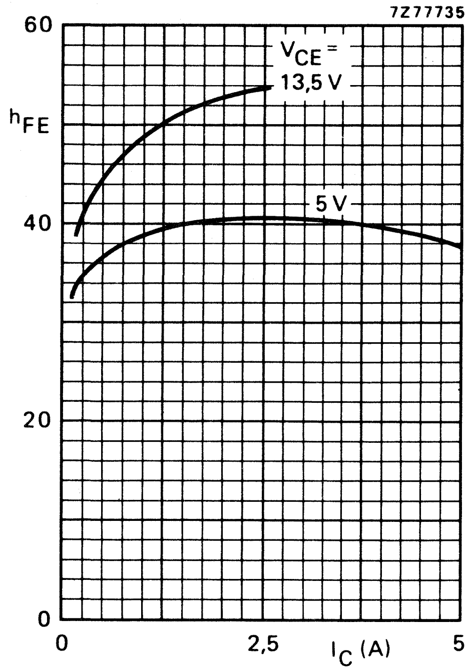


Fig. 4 Typical values; T_j = 25 °C.

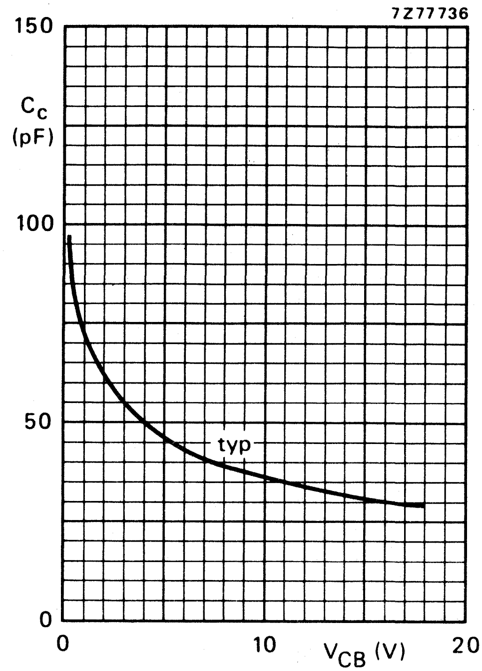


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

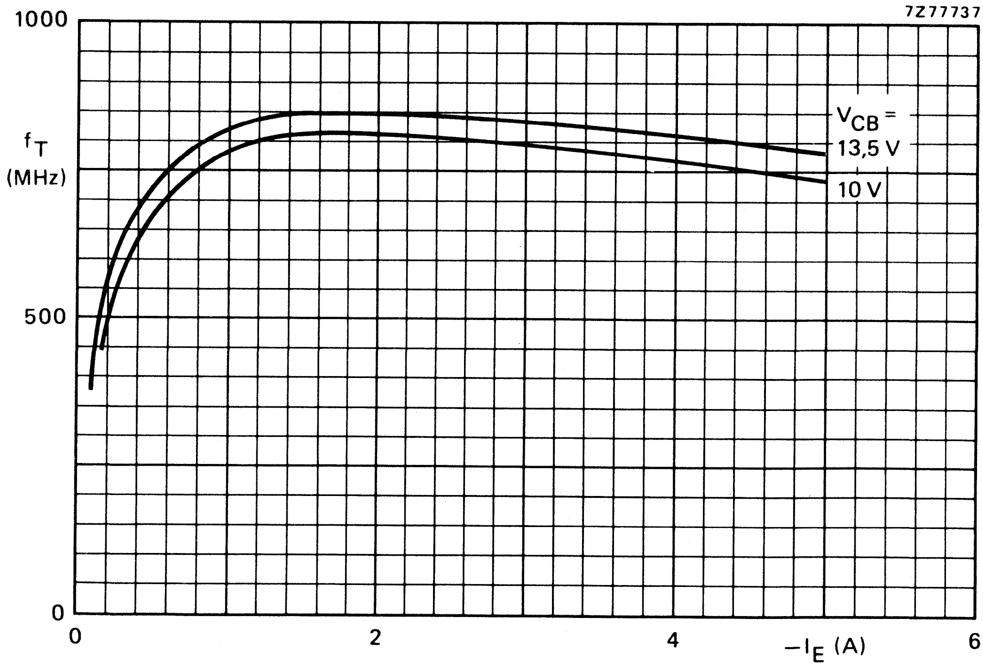


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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	–	–

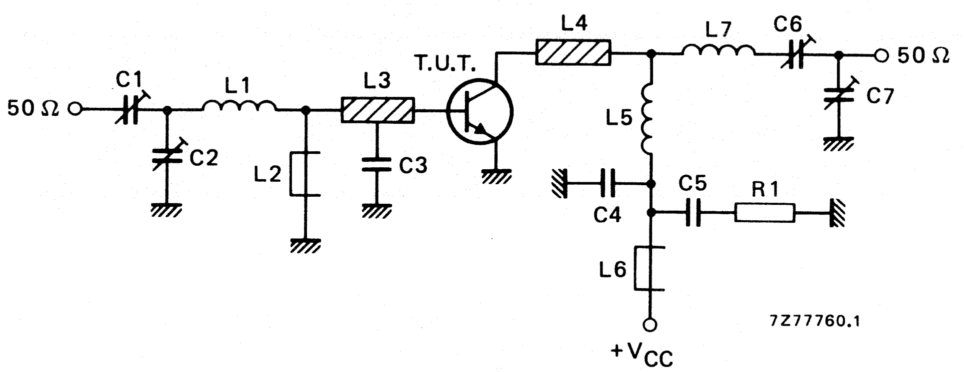


Fig. 7 Test circuit; c.w. class-B.

List of components:

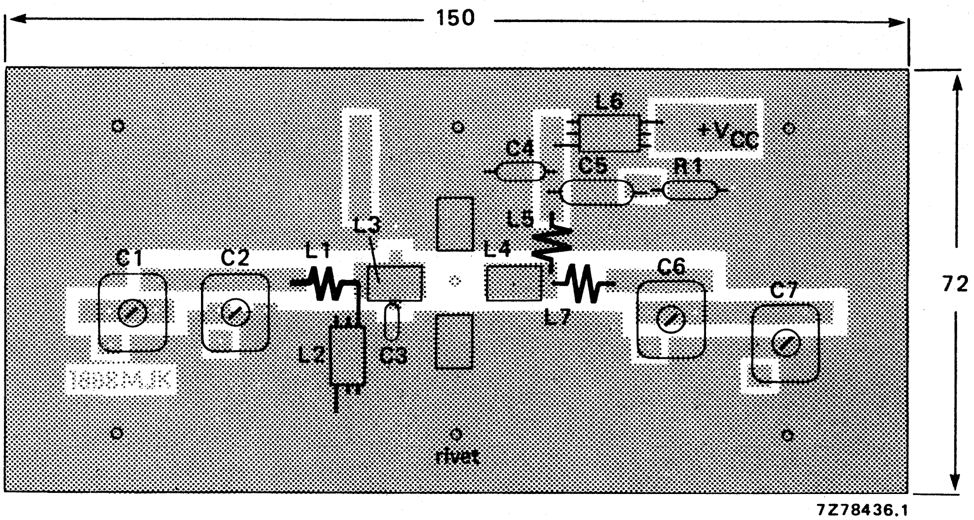
C1 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 07008)
C3 = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor
C7 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 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.



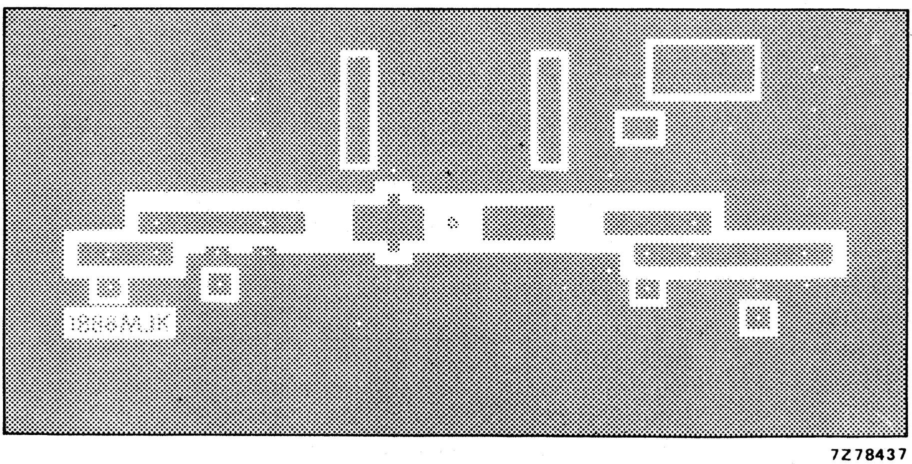


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

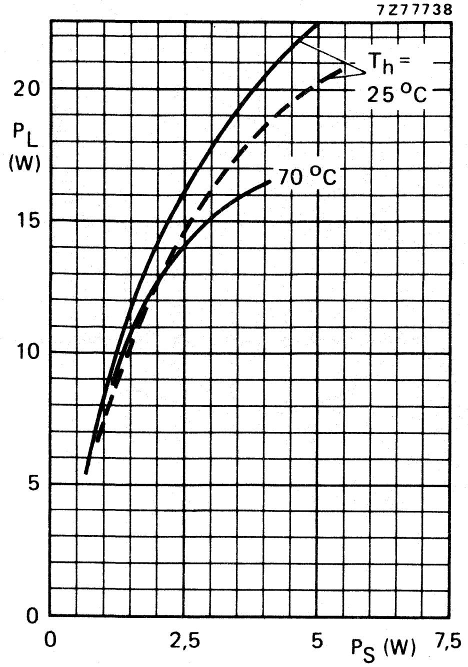


Fig. 9 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

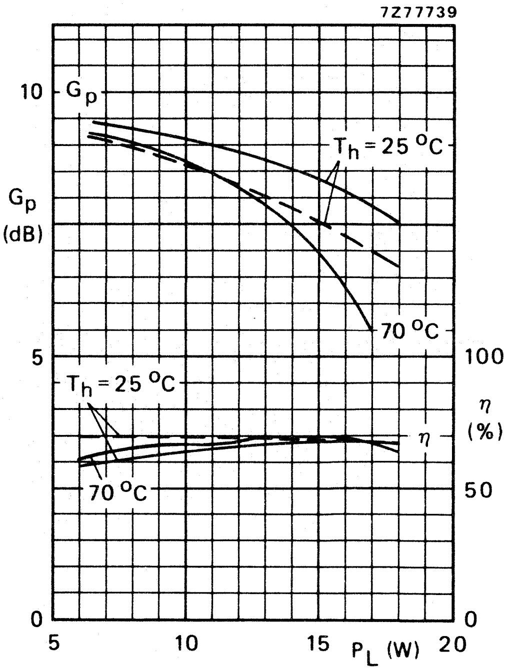


Fig. 10 Typical values; f = 175 MHz;
——— V_{CE} = 13,5 V; – – – – V_{CE} = 12,5 V.

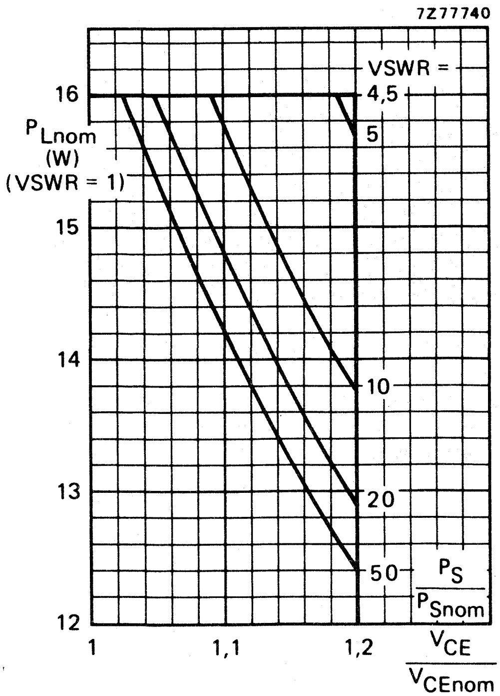


Fig. 11 R.F. SOAR (short-time operation during mismatch); f = 175 MHz; T_h = 70 °C; $R_{th\,mb\text{-}h}$ = 0,45 K/W; V_{CEnom} = 13,5 V or 12,5 V; $P_S = P_{Snom}$ at V_{CEnom} and VSWR = 1.

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.

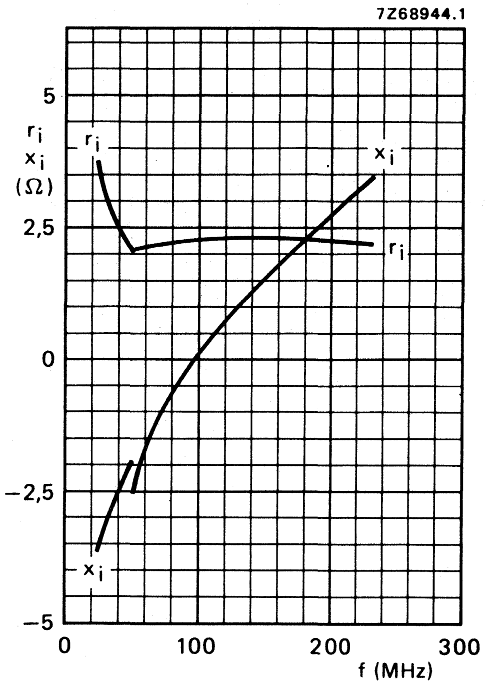


Fig. 12 Input impedance (series components).

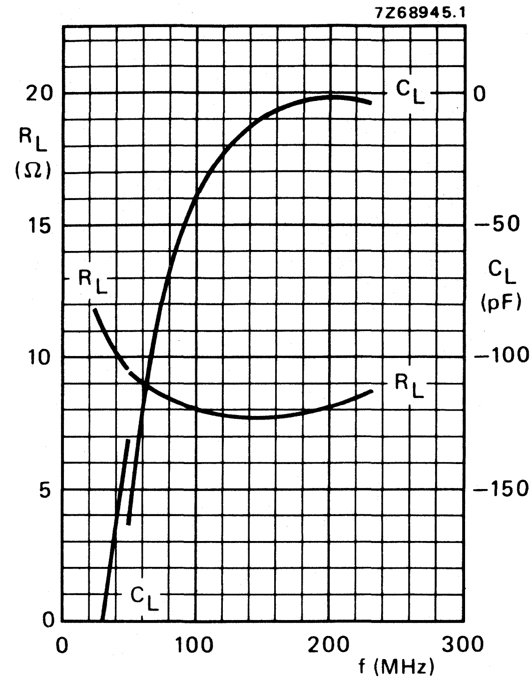


Fig. 13 Load impedance (parallel components).

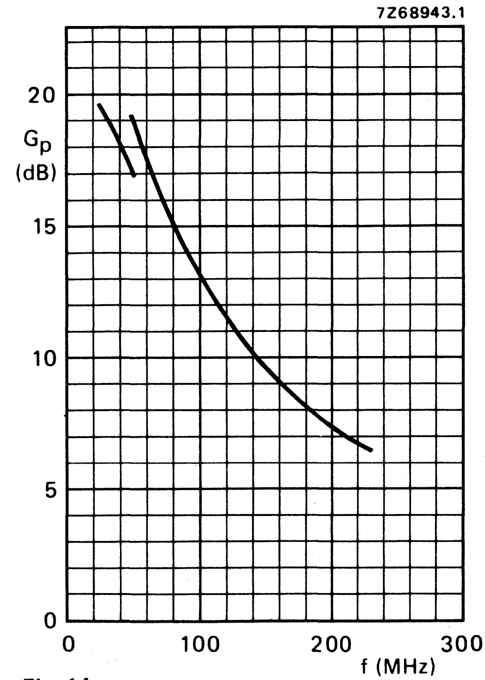


Fig. 14.

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 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 ceramic cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

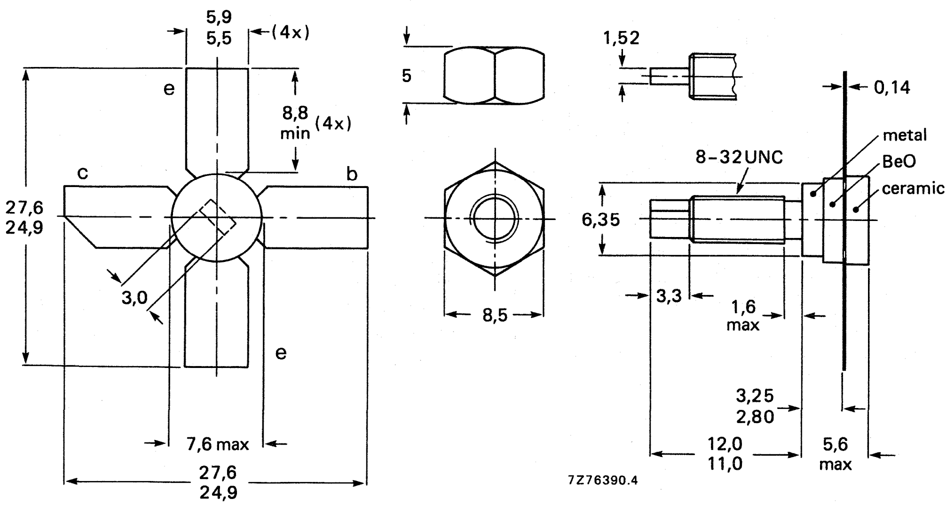
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit.

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 SOT122A.



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

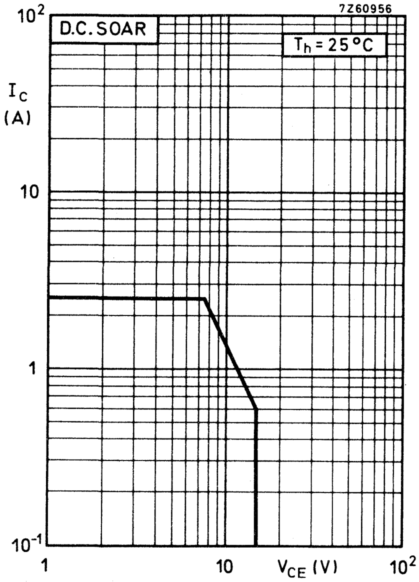
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

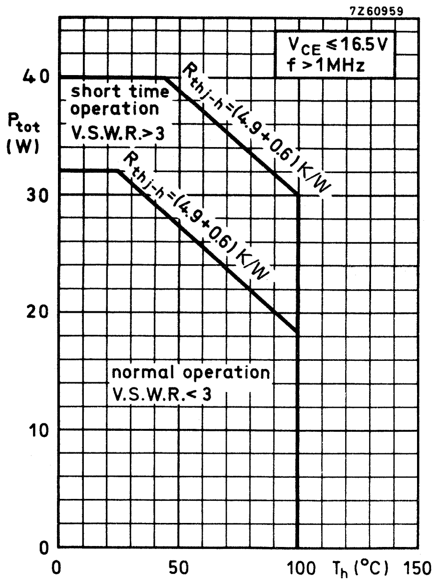
When locking is required an adhesive is preferred instead of a lock washer.

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

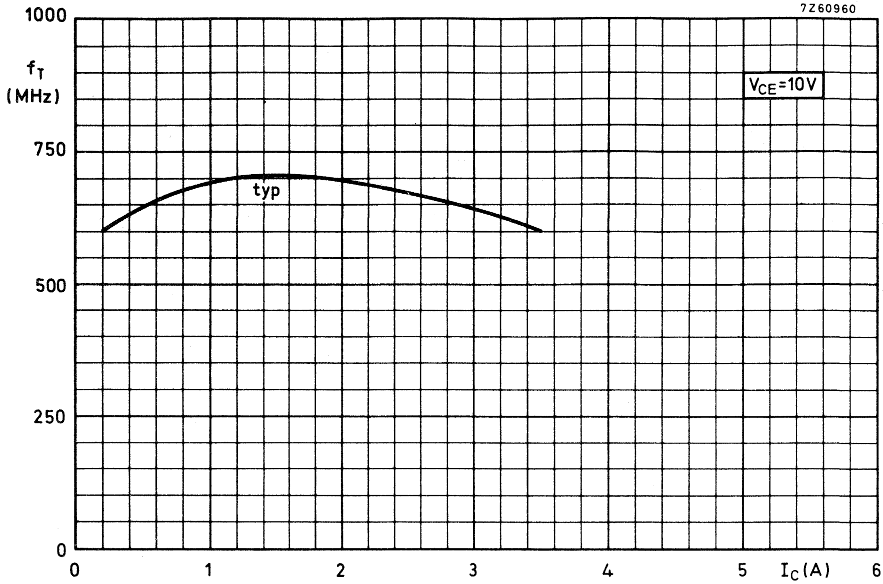
THERMAL RESISTANCE

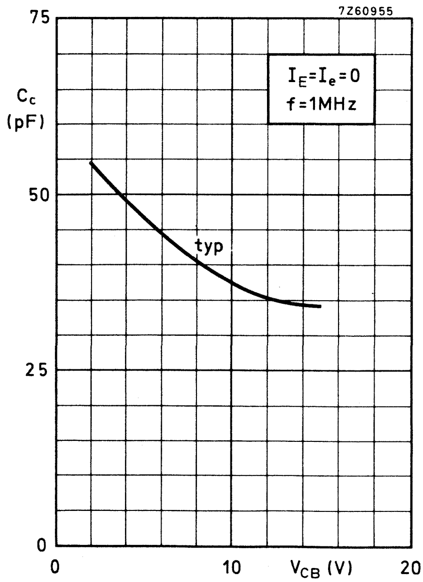
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4.9	K/W
From mounting base to heatsink	$R_{mb\text{-}h}$	=	0.6	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector cut-off current				
$I_B = 0$; $V_{CE} = 14$ V	I_{CEO}	<	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

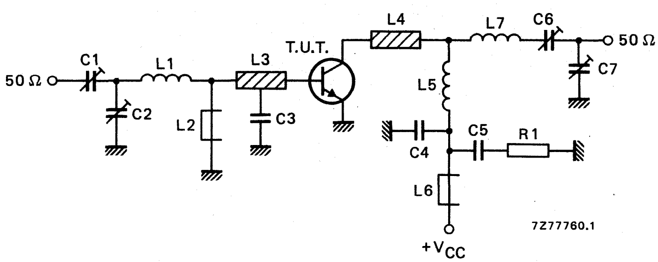
APPLICATION INFORMATION

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



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

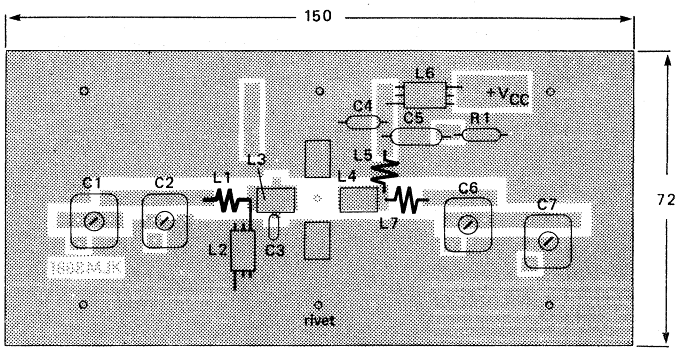
L3 and L4 are strips on a double Cu-clad printed-circuit board with epoxy fibre-glass dielectric, thickness 1/16".

R1 = 10 Ω carbon resistor

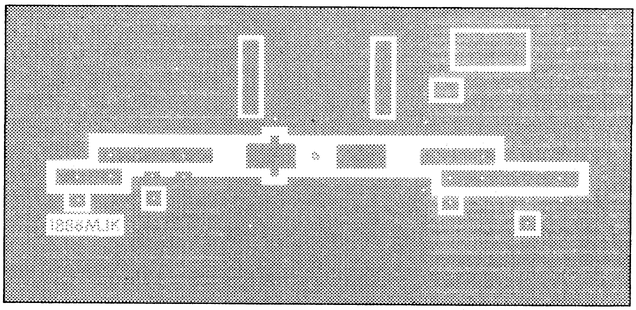
Component layout and printed-circuit board for 175 MHz test circuit see following page.

APPLICATION INFORMATION (continued)

Component lay-out and printed circuit board for 175 MHz test circuit.



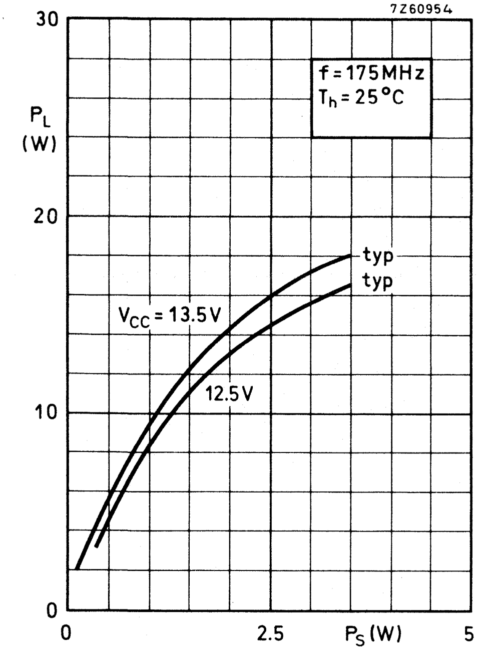
7Z78436.1

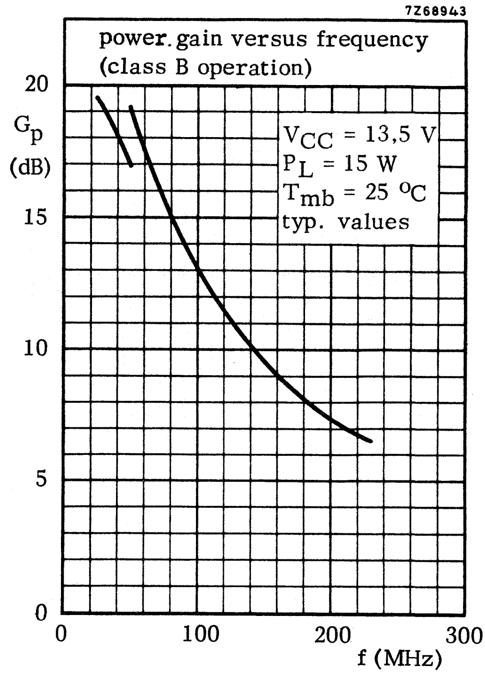


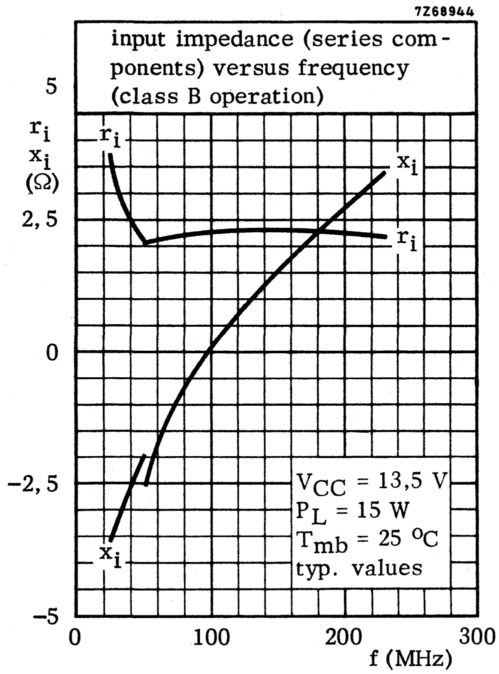
7Z78437

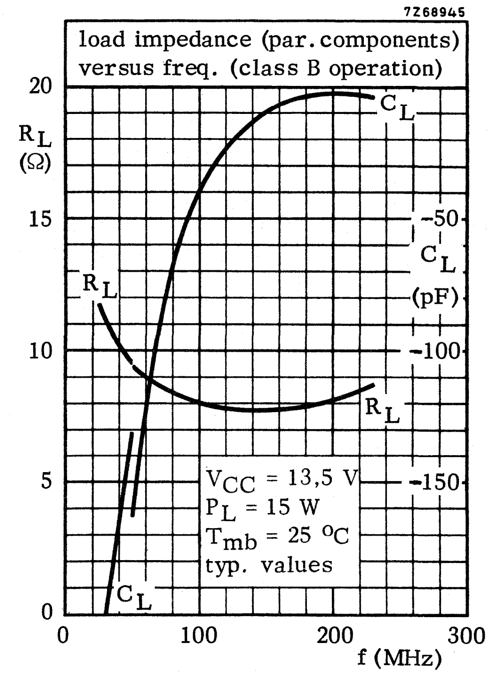
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by means of hollow rivets, whilst under the emitter leads Cu straps are used for a direct contact between upper and lower sheets.

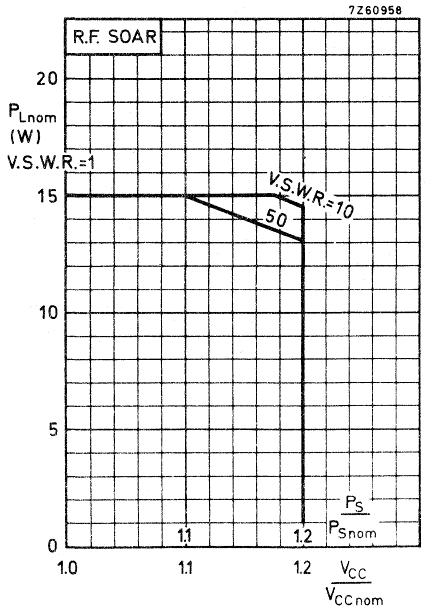
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.

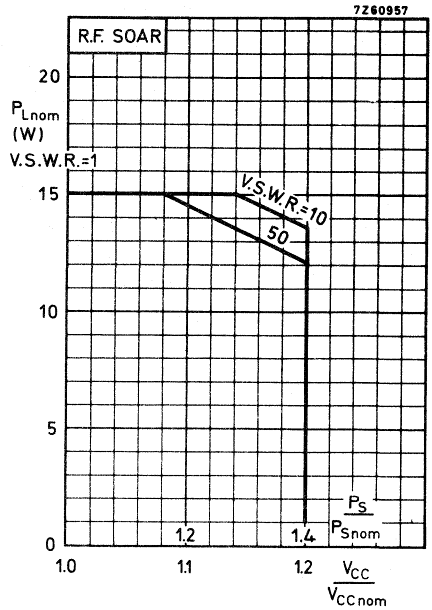












Conditions for R.F. SOAR:

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
$R_{th\ mb\text{-}h}$ = 0.6 K/W

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 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

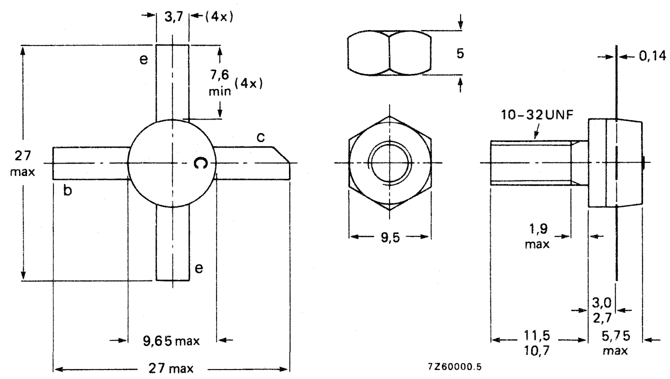
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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)

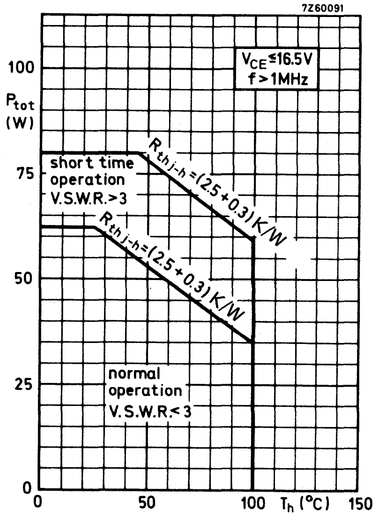
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

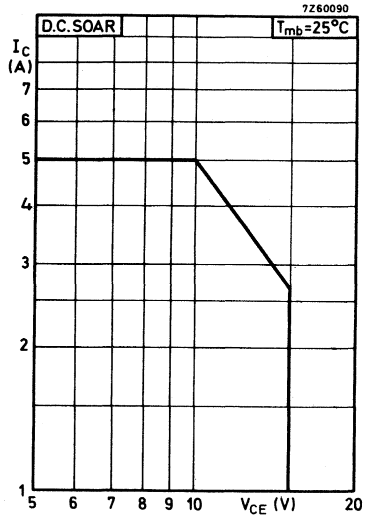
When locking is required an adhesive is preferred instead of a lock washer.

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	$R_{th\,j-mb}$	=	2.5	K/W
From mounting base to heatsink	$R_{th\,mb-h}$	=	0.3	K/W

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

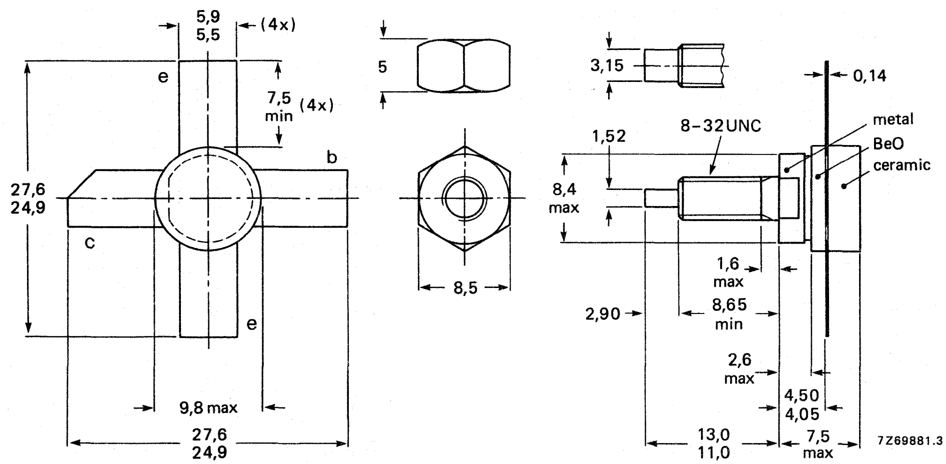
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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.

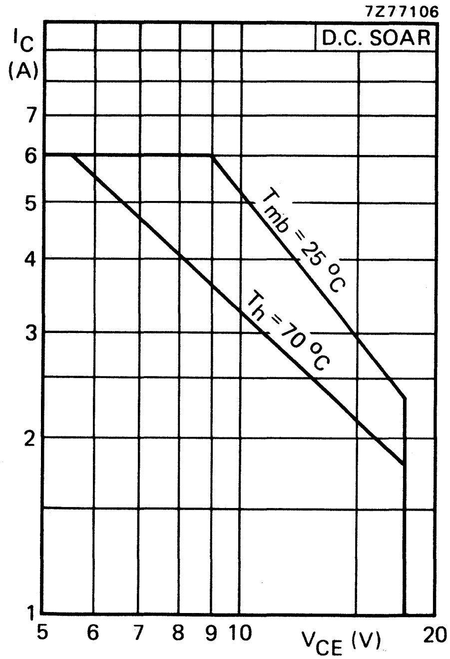
When locking is required an adhesive is preferred instead of a lock washer.

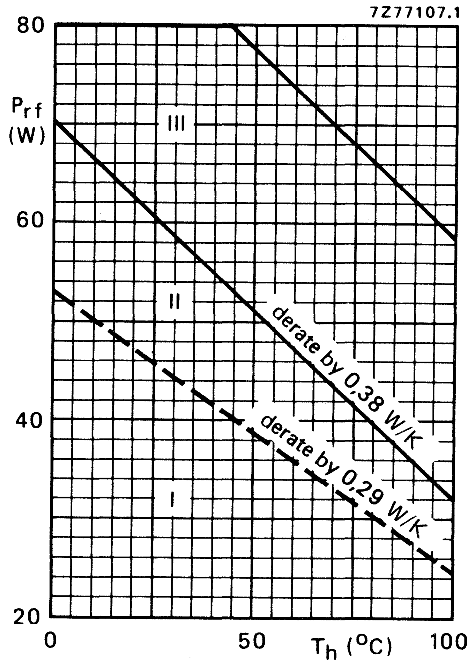
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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; $V_{CE} \leqslant$ 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 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

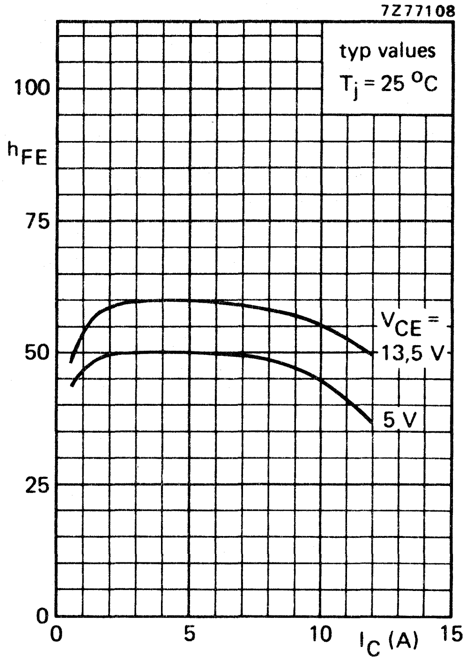
CHARACTERISTICS

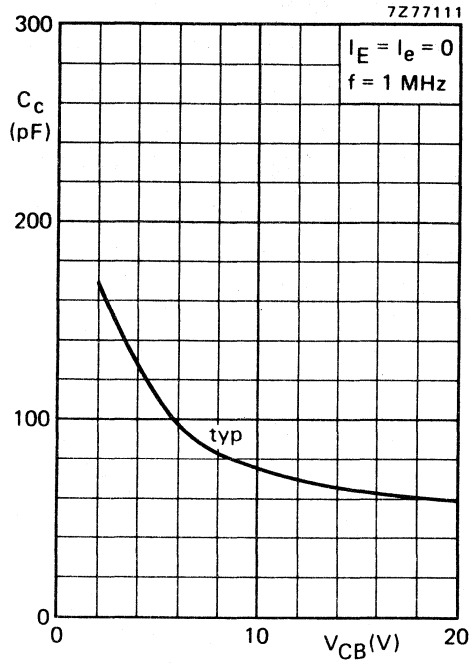
$T_j = 25\ ^oC$

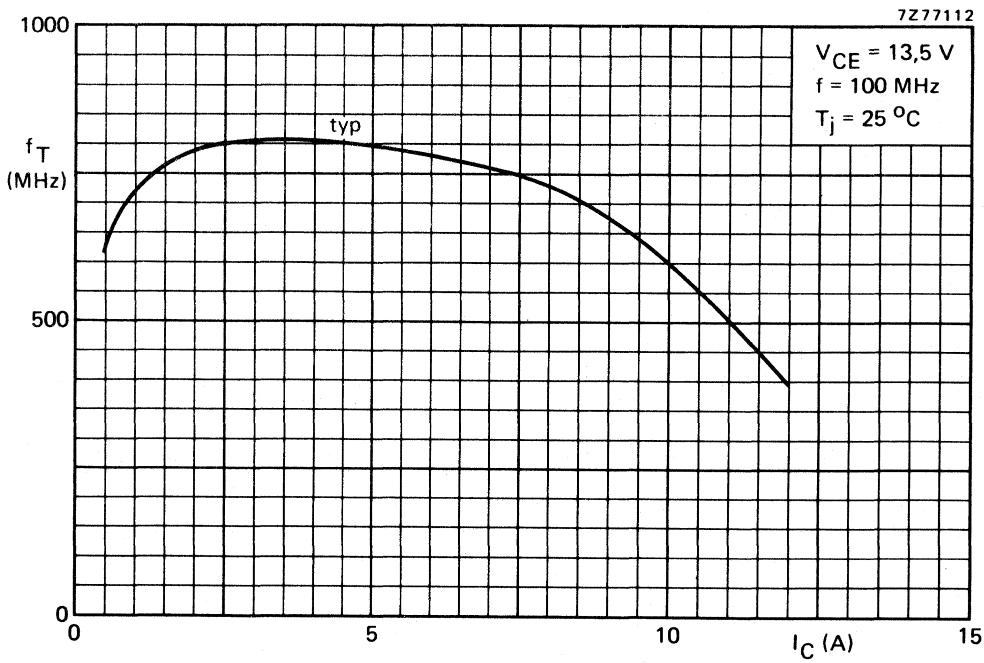
Breakdown voltage

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
15
I_C (A)


7Z77111
I_E = I_e = 0
f = 1 MHz
C_c
(pF)
300
200
100
0
typ
0
10
20
V_{CB}(V)


7Z77112
V_{CE} = 13,5 V
f = 100 MHz
T_j = 25 °C
f_T
(MHz)
1000
500
0
typ
0
5
10
15
I_C (A)

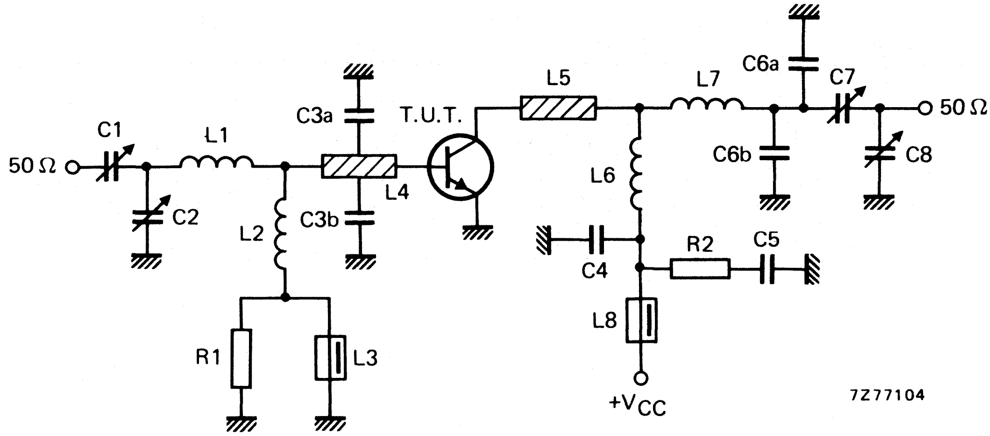
APPLICATION INFORMATION

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

T_h = 25 °C

f (MHz)	V_{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)

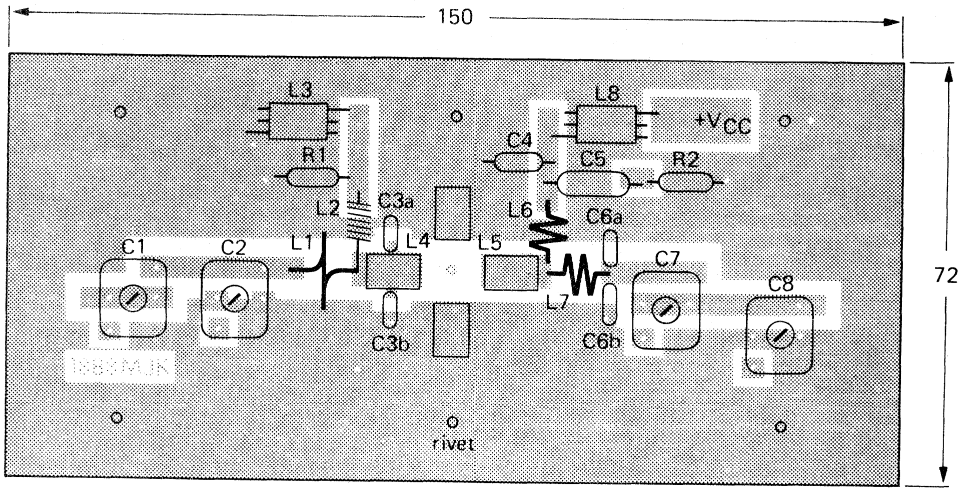
L1 = 1 turn enamelled Cu wire (1,6 mm); int. dia. 9,0 mm; leads 2 x 5 mm
L2 = 100 nH; 7 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = L8 = Ferroxcube choke coil (cat. no. 4312 020 36640)
L4 = L5 = strip (12 mm x 6 mm); taps for C3a and C3b at 5 mm from transistor
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".

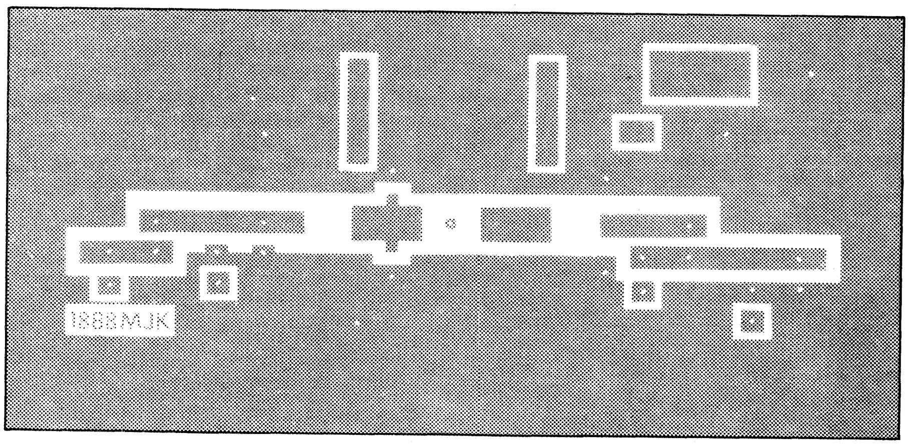
R1 = 10 Ω (± 10%) carbon resistor
R2 = 4,7 Ω (± 5%) carbon resistor

APPLICATION INFORMATION (continued)

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



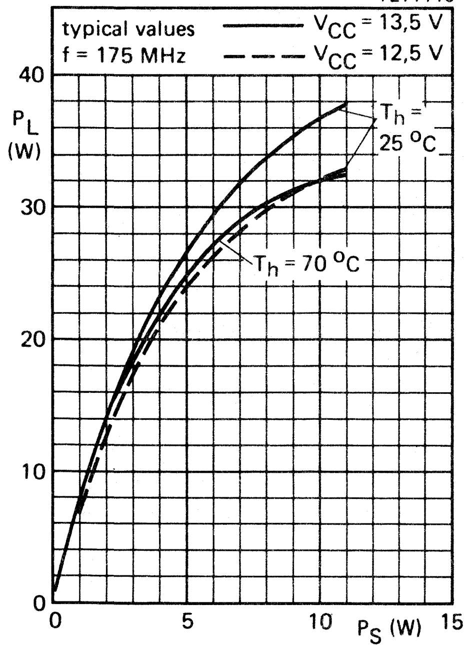
7Z77102



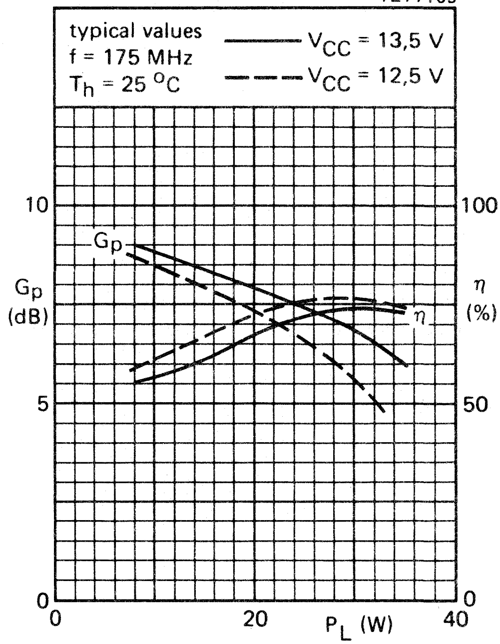
7Z77103

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.

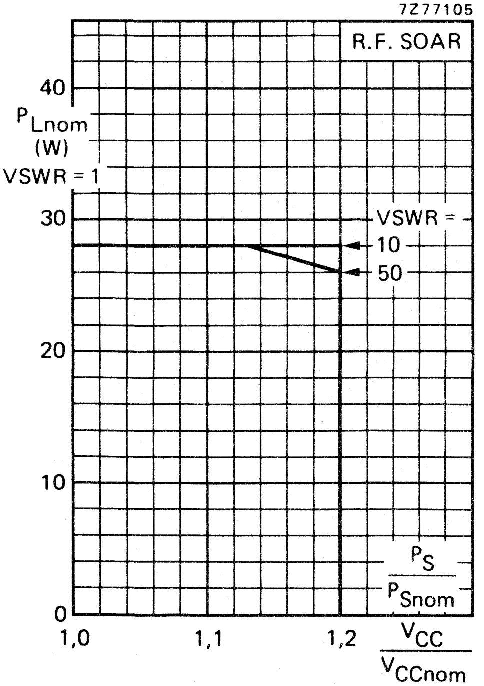
7Z77110



7Z77109



7Z77105



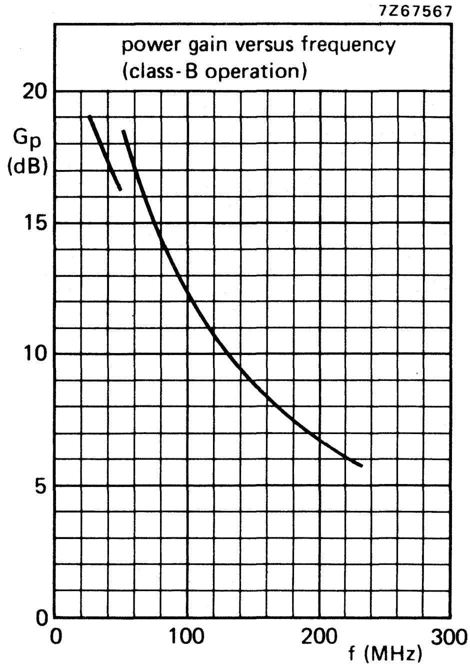
Conditions for R.F. SOAR

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

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.

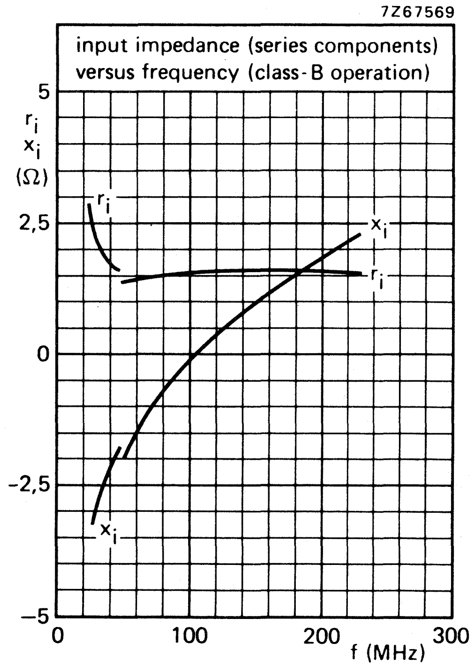
The graph applies to the situation in which the drive (P_S/P_{Snom}) increases linearly with supply over-voltage ratio.

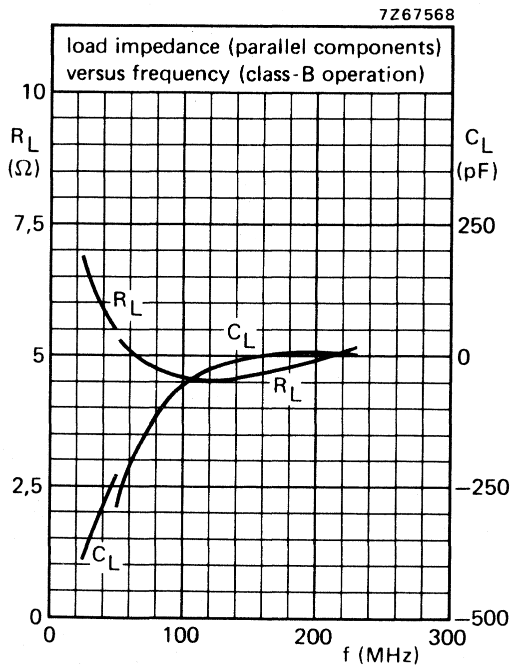
OPERATING NOTE Below 50 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for r.f. only.



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

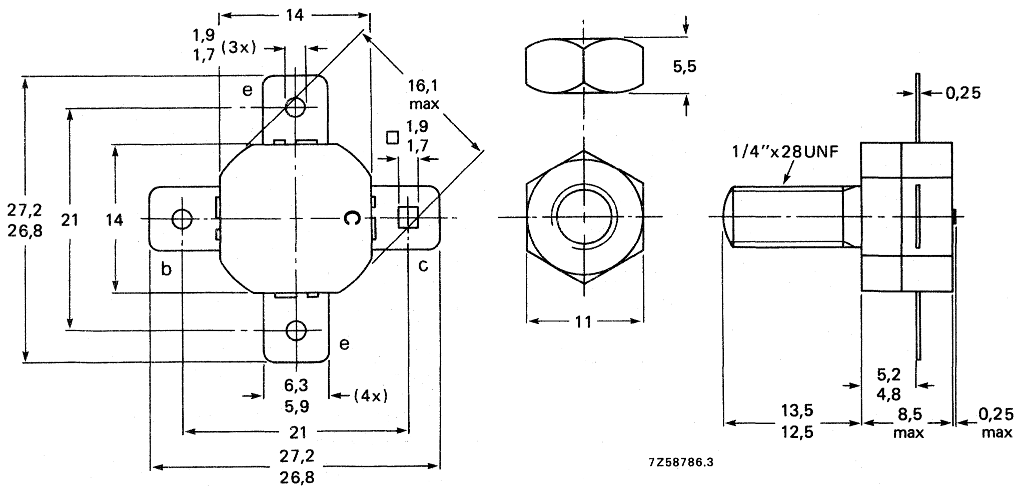
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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)

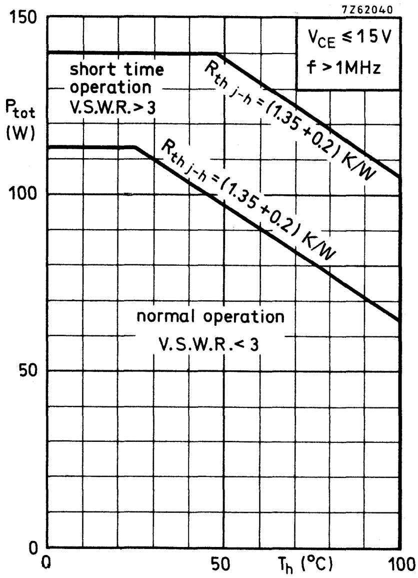
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

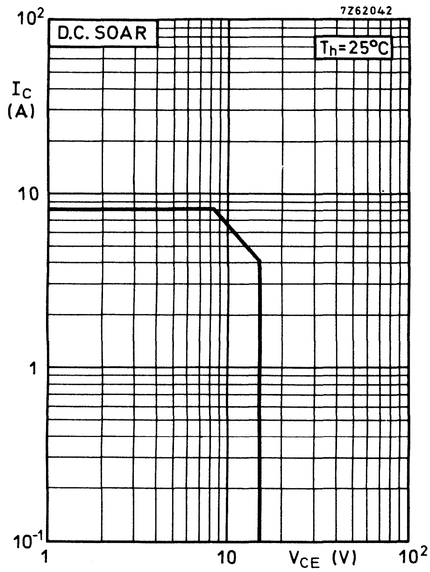
When locking is required an adhesive is preferred instead of a lock washer.

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 $T_{mb} = 25\,^{o}C$ $f > 1$ MHz	P_{tot}	max.	130	W





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

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

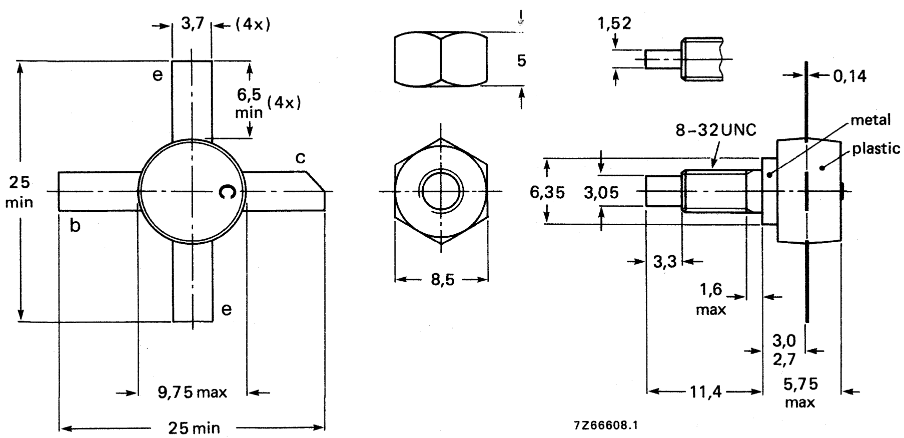
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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)

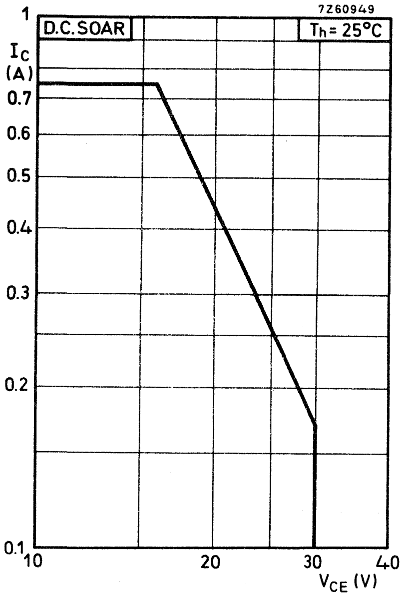
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

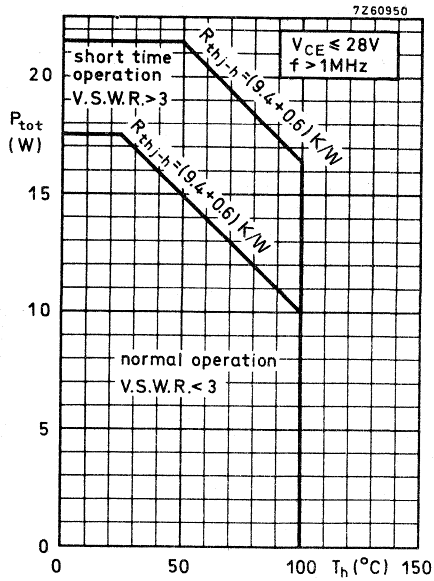
When locking is required an adhesive is preferred instead of a lock washer.

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

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

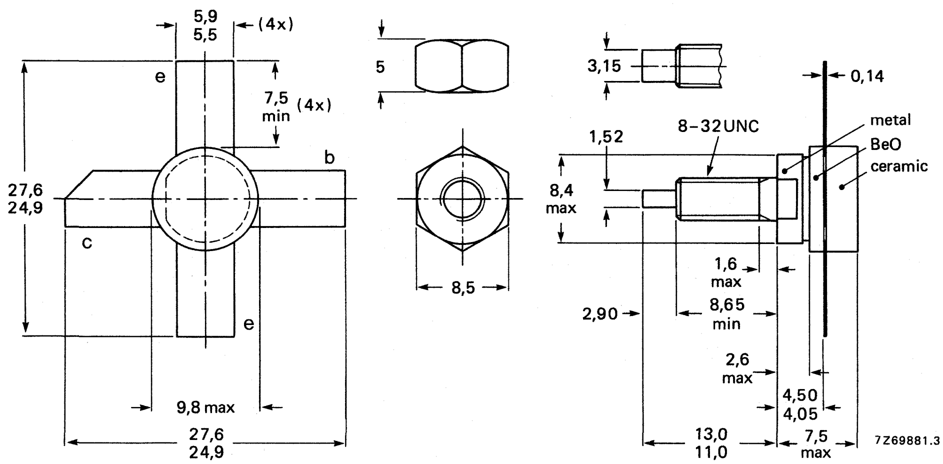
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit.

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

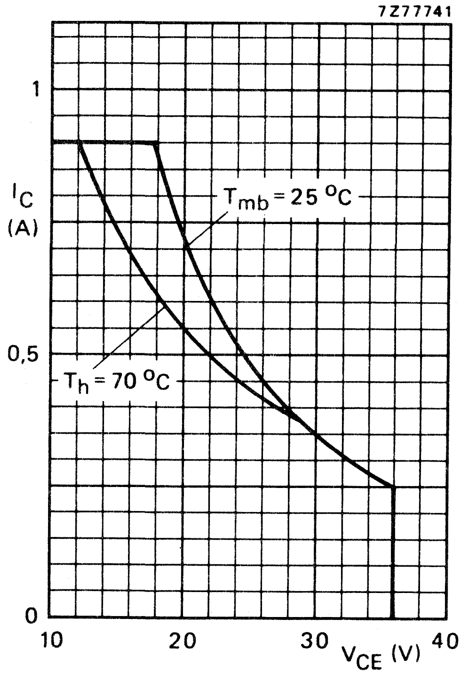


Fig. 2 D.C. SOAR.

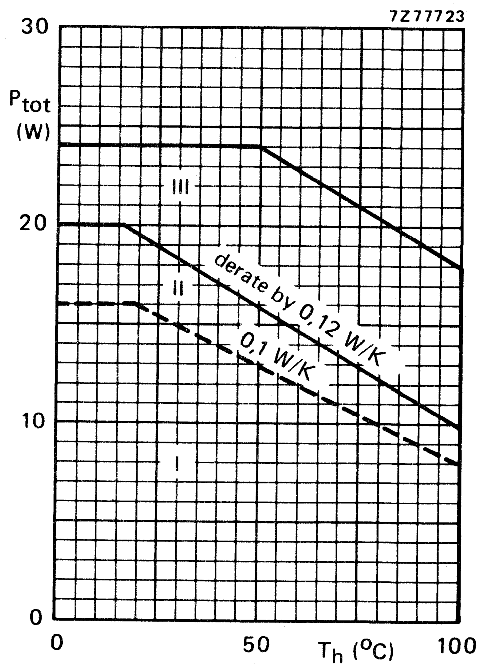


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f > 1 MHz.
I Continuous d.c operation
II Continuous r.f. operation
III Short-time operation during mismatch

THERMAL RESISTANCE (dissipation = 8 W; T_{mb} = 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

$T_j = 25\ ^oC$

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.	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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0,02$.

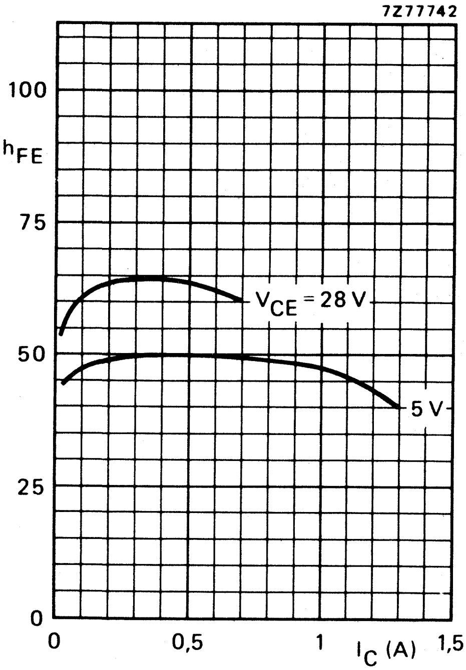


Fig.4 Typical values; T_j = 25 °C.

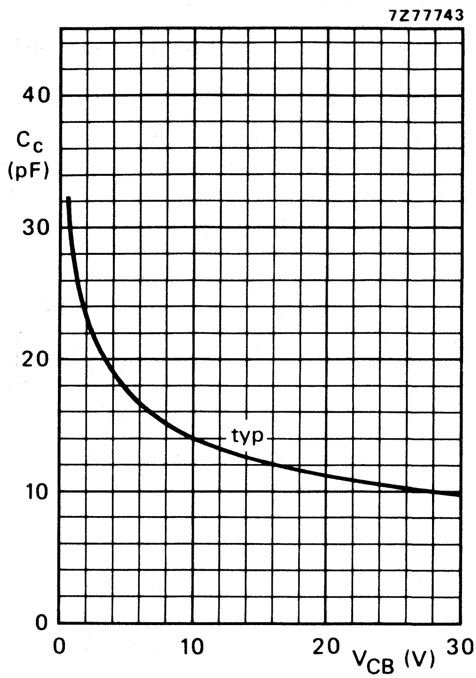


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

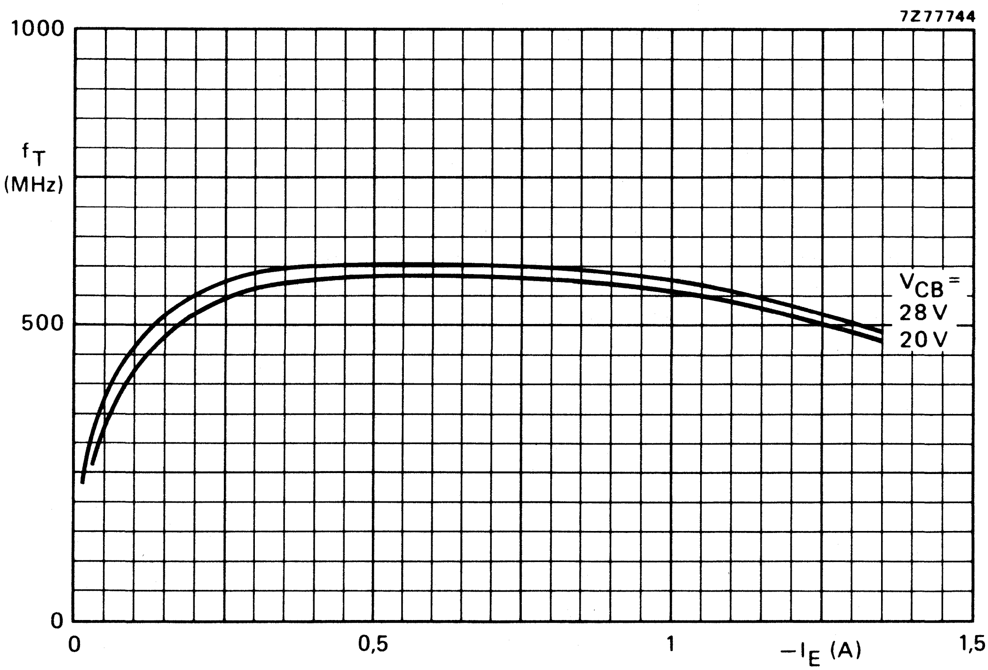


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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

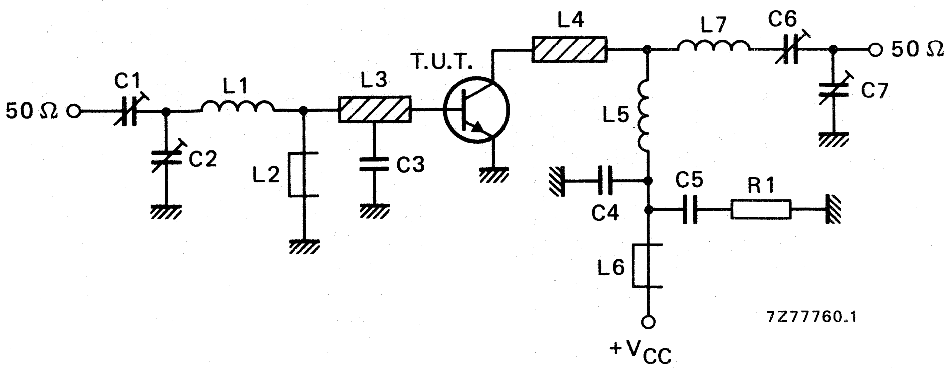


Fig. 7 Test circuit; c.w. class-B.

List of components:

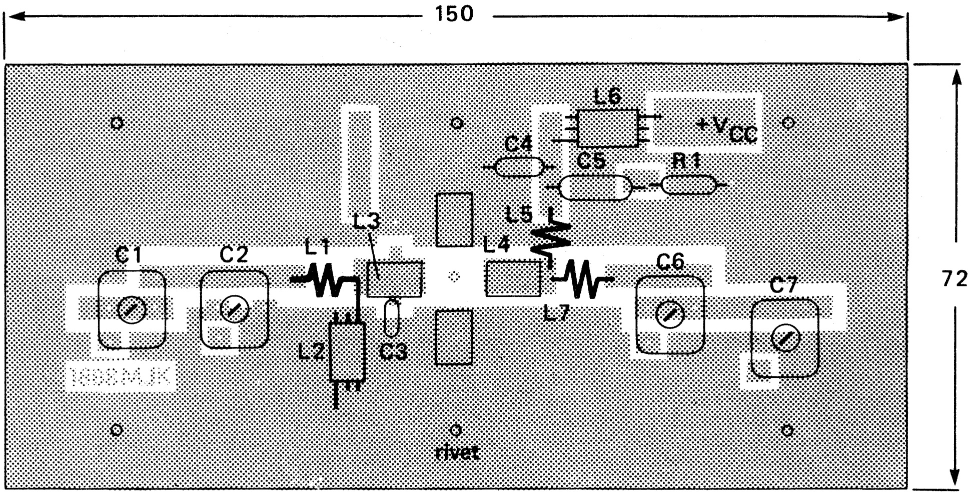
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = C6 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 27 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor (500 V)
C5 = 100 nF polyester capacitor

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.



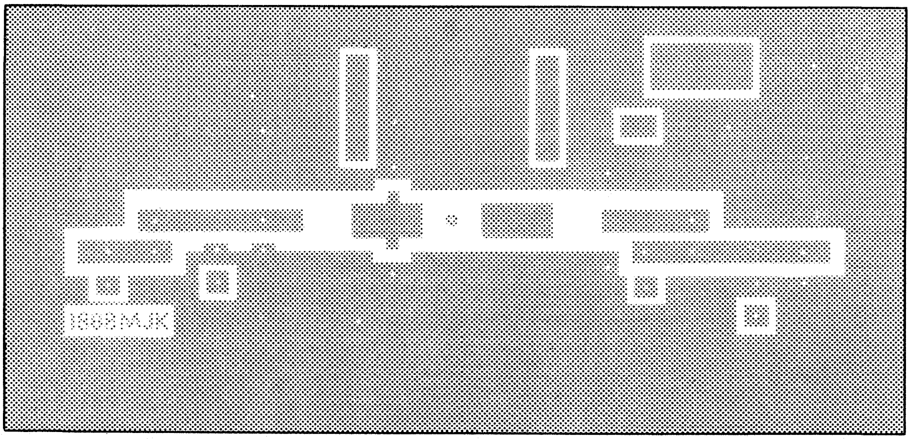


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

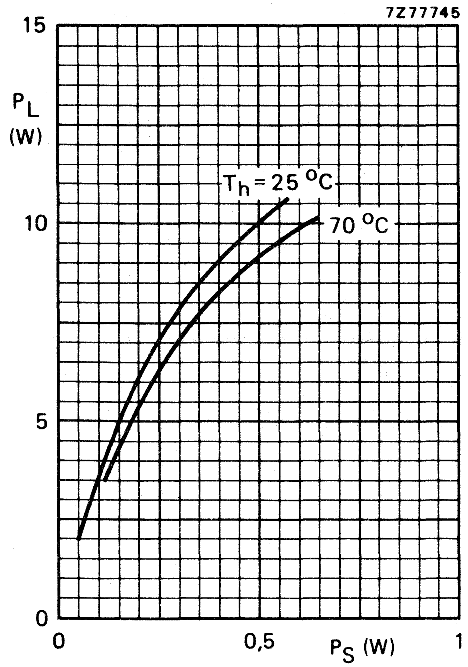


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

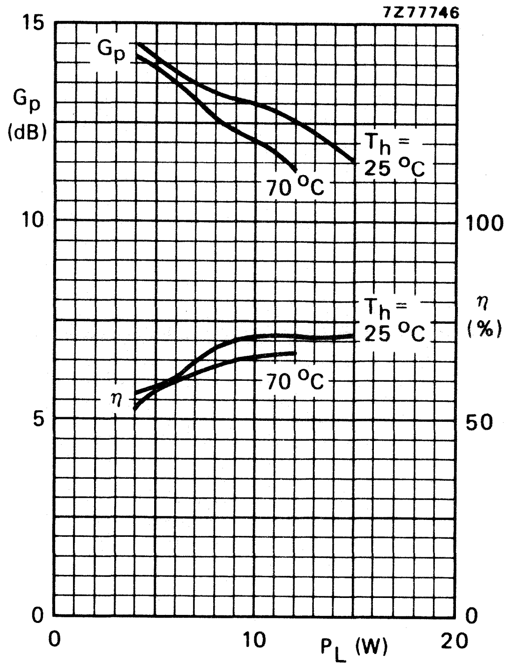


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

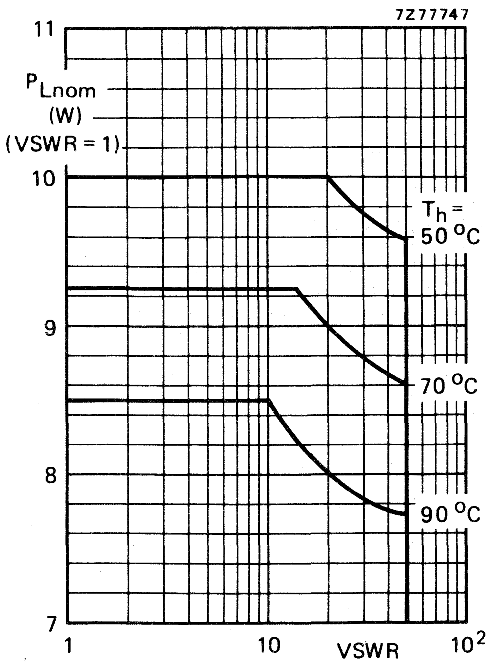


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

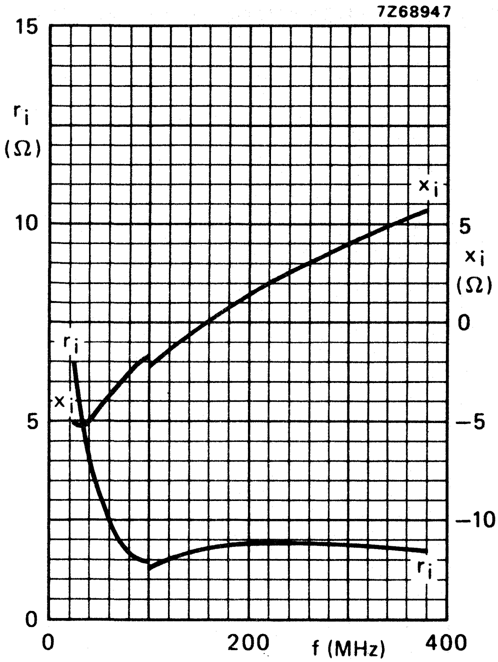


Fig. 12 Input impedance (series components).

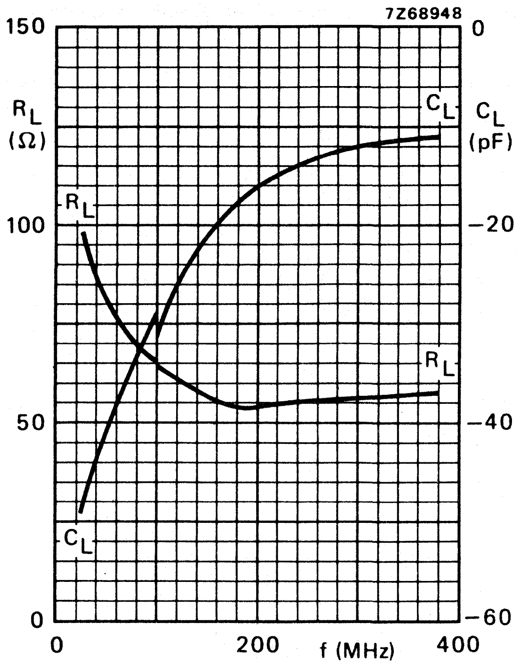


Fig. 13 Load impedance (parallel components).

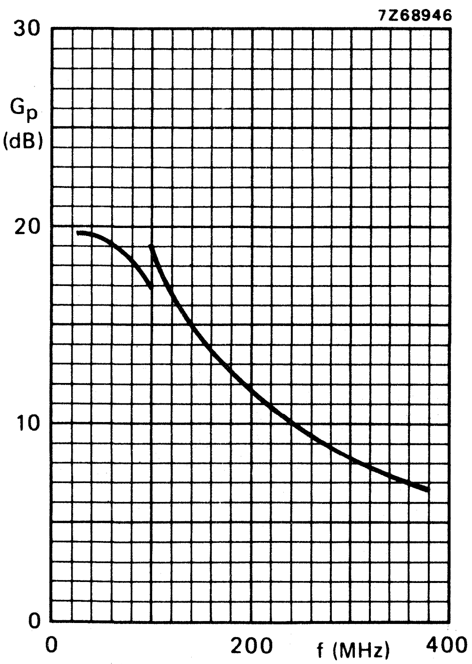


Fig. 14.

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.

VHF power transistor BLY91C/01

DESCRIPTION

NPN silicon planar epitaxial transistor designed 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 SOT122F ¼ inch capstan envelope with a ceramic cap. All leads are isolated from the stud.

PIN CONFIGURATION

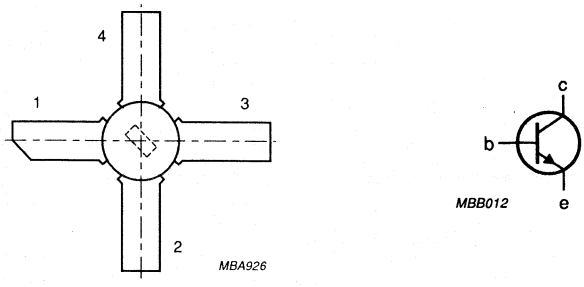


Fig.1 Simplified outline and symbol.

PINNING - SOT122F

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in an un-neutralized common emitter class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	$\overline{Z}_i$ (Ω)	$\overline{Y}_L$ (mS)
c.w. class-B	175	28	8	> 12	> 65	1.8 + j0.7	18 − j20

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBOM}	collector-base voltage	open emitter; peak value	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	36	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
$I_{C(AV)}$	collector current	average value	–	0.75	A
I_{CM}	collector current	peak value f > 1 MHz	–	2.25	A
P_{tot}	total power dissipation	f > 1 MHz; T_h = 25 °C	–	17.5	W
T_{stg}	storage temperature range		–30	200	°C
T_j	junction operating temperature		–	200	°C

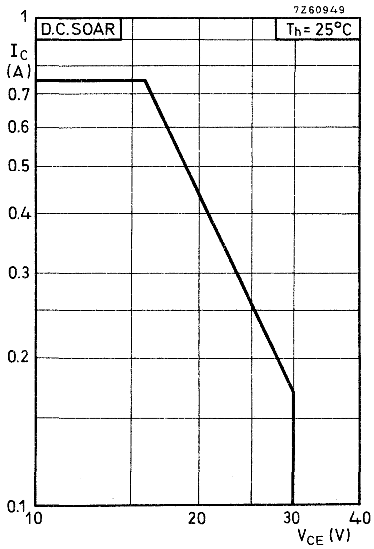


Fig.2 DC SOAR.

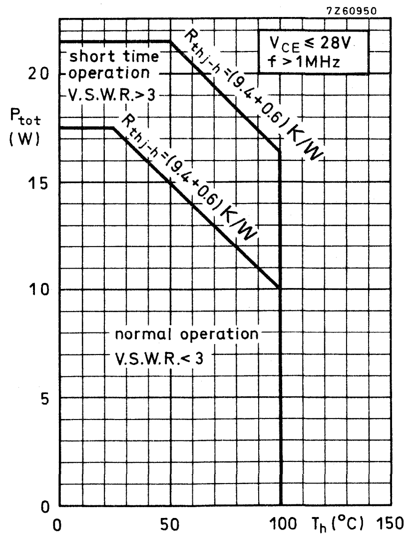


Fig.3 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	9.4	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.6	K/W

VHF power transistor BLY91C/01

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 1 mA	65	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	36	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	4	–	–	V
I_{CEO}	collector-emitter leakage current	V_{CE} = 28 V; I_B = 0	–	–	5	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 0.5 A	5	–	–	
f_T	transition frequency	V_{CE} = 20 V; I_E = 0.4 A	–	500	–	MHz
E_{SBR}	second breakdown energy	open base; L = 25 mH; f = 50 Hz	0.5	–	–	mJ
		$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω; L = 25 mH; f = 50 Hz	0.5	–	–	mJ
C_c	collector capacitance	V_{CB} = 30 V; $I_E = I_e$ = 0; f = 1 MHz	–	10	15	pF
C_{re}	feedback capacitance	V_{CE} = 30 V; I_C = 50 mA; f = 1 MHz	–	7.5	–	pF
C_{c-s}	collector-stud capacitance	f = 1 MHz	–	2	–	pF

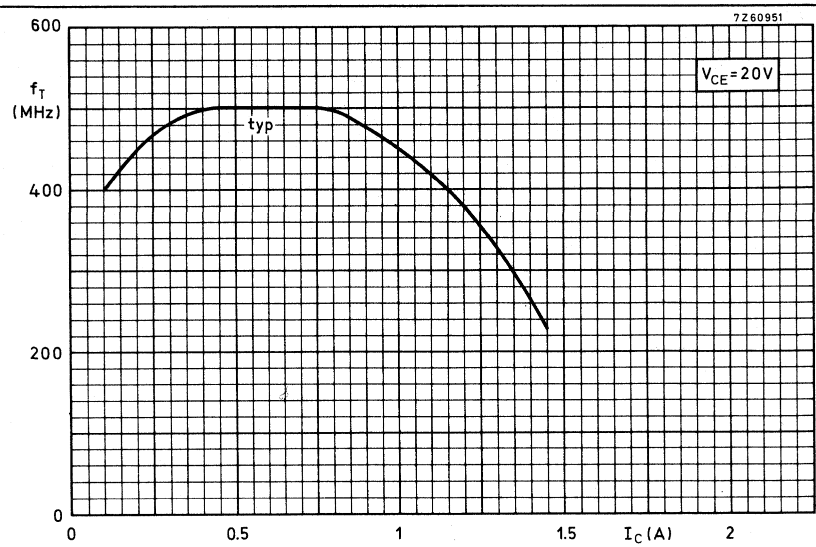
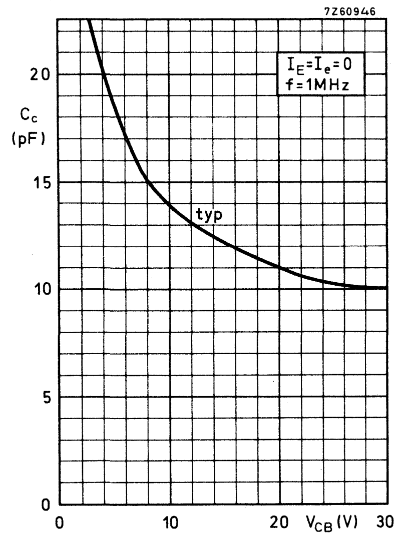


Fig.4 Transition frequency as a function of collector current, typical values.



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

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

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	$\overline{Z_i}$ (Ω)	$\overline{Y_L}$ (mS)
c.w. class-B	175	28	8	> 12	> 65	1.8 + j0.7	18 − j20

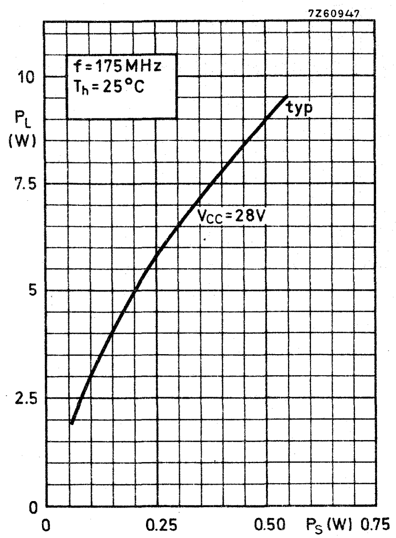
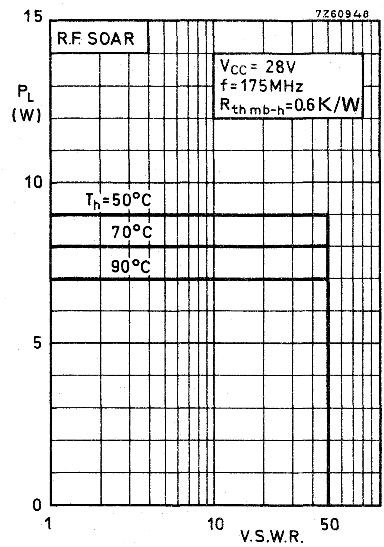


Fig.6 Load power as a function of drive power, typical values.



For high voltage operation, a stabilized supply is generally used. The graph shows allowable output power under nominal conditions of the VSWR, with heatsink temperature as parameter.

Fig.7 RF SOAR.

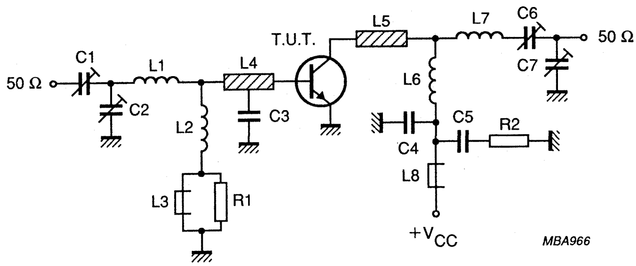


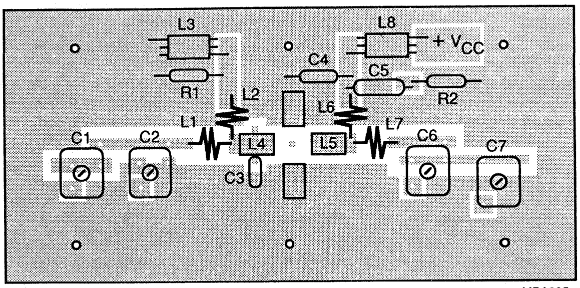
Fig.8 Class-B test circuit at f = 175 MHz.

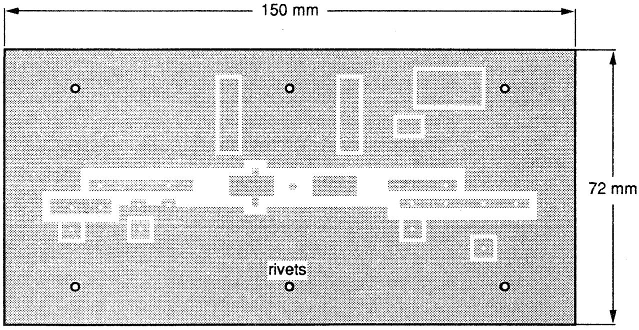
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C7	film dielectric trimmer	2.2 to 20 pF		2222 809 07004
C2, C6	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	500 V ceramic capacitor	47 pF	(note 1)	
C4	500 V ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
L1	1 turn 1.6 mm copper wire		int. dia. 8.4 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire		int. dia. 3 mm; leads 2 x 5 mm	
L3, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 2)		12 mm x 6 mm	
L6	3 turns closely enamelled 1 mm copper wire		int. dia. 9 mm; leads 2 x 5 mm	
L7	3 turns closely wound enamelled 1 mm copper wire		int. dia. 8.2 mm; leads 2 x 5 mm	
R1, R2	carbon resistor	10 Ω		

Notes

1. Tap for capacitor C3 situated 5 mm from the transistor.
2. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric, thickness 1⁄16 inch.





The circuit and components are situated on one side of an epoxy fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by means of hollow rivets. Copper straps are used under the emitter leads, for a direct contact between upper and lower sheets

Fig.9 Component layout for 175 MHz class-B test circuit.

Operating note

Below 100 MHz, a base-emitter resistor of 10 Ω is recommended, to avoid oscillation. This resistor must be effective for both DC and RF.

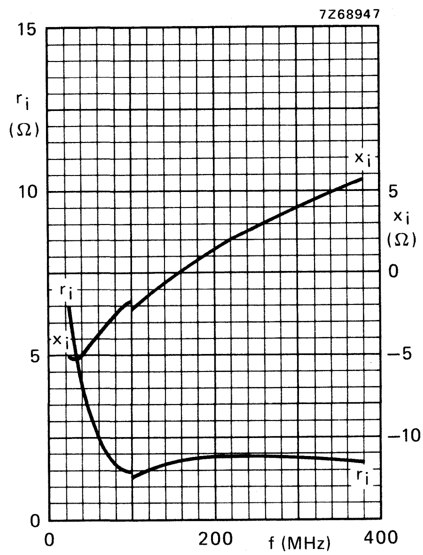


Fig.10 Input impedance (series components) as a function of frequency, typical values.

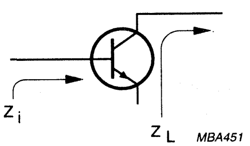


Fig.12 Definition of transistor impedance.

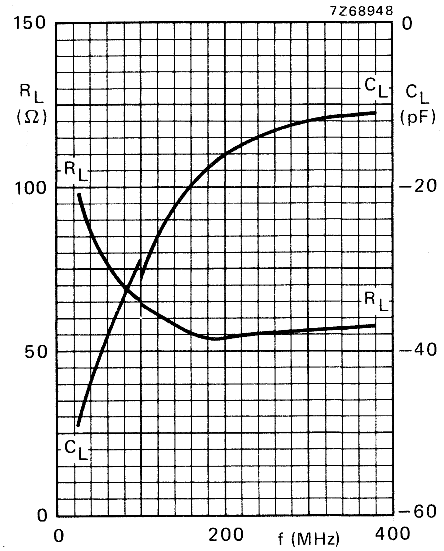


Fig.11 Load impedance (parallel components) as a function of frequency, typical values.

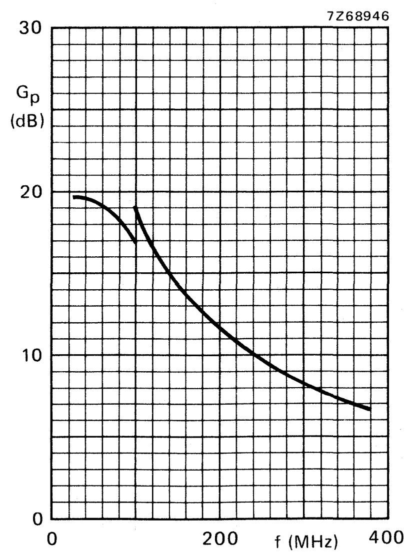


Fig.13 Power gain as a function of frequency, typical values.

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

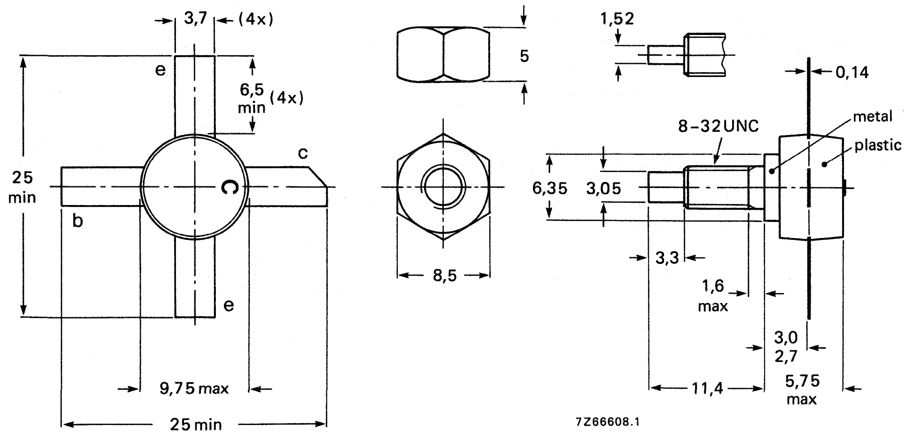
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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)

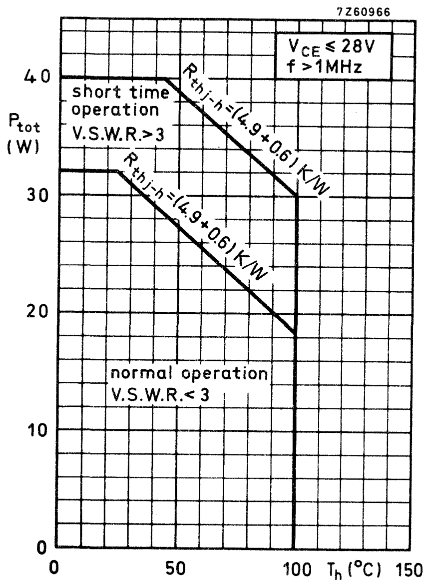
Diameter of clearance hole in heatsink: max. 4,2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

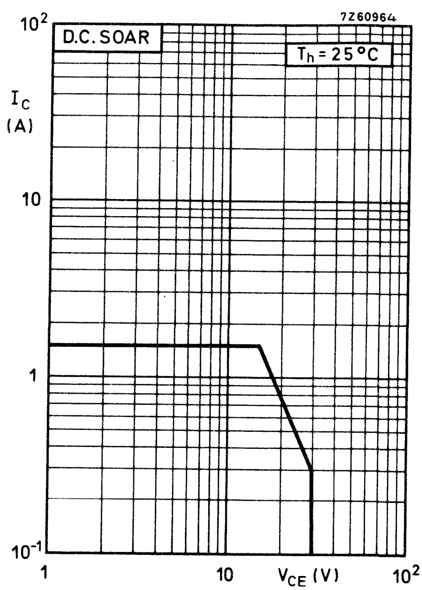
When locking is required an adhesive is preferred instead of a lock washer.

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	$R_{th\ j\text{-}mb}$	=	4.9	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.6	K/W

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

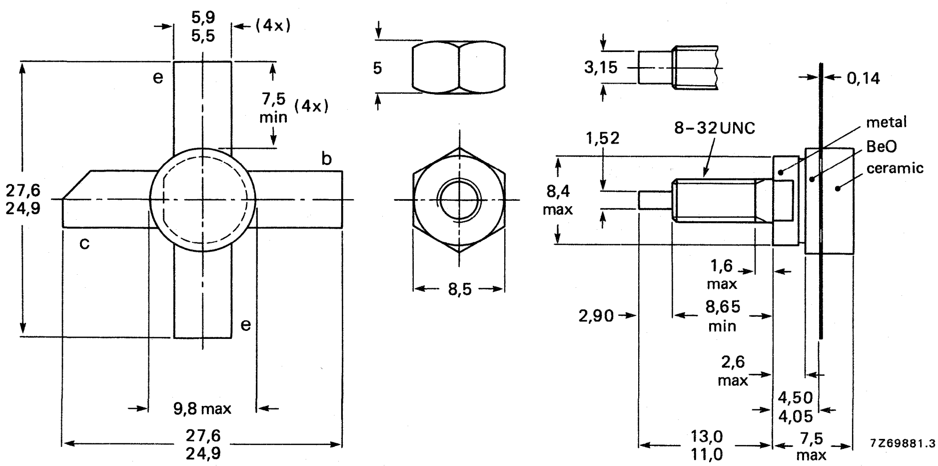
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

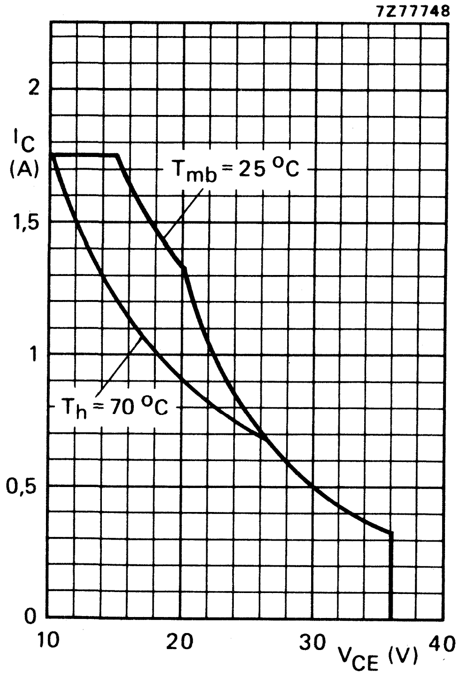


Fig. 2 D.C. SOAR.

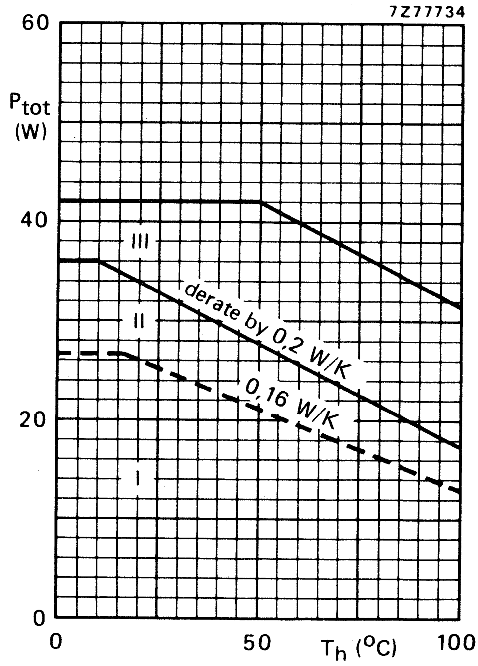


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant$ 28 V; f > 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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 °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-stud capacitance	C_{cs}	typ.	2 pF

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

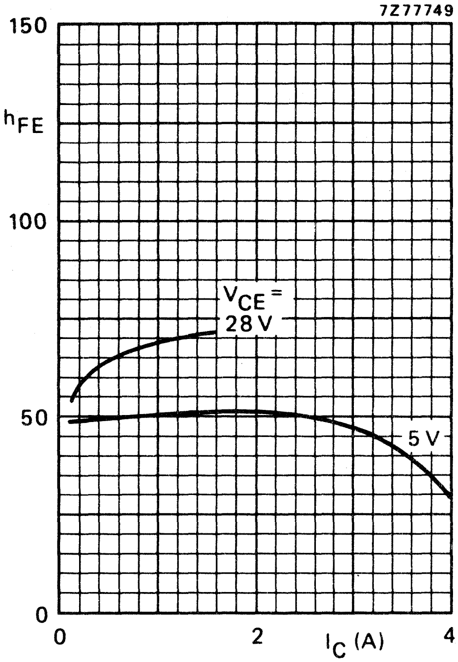


Fig. 4 Typical values; T_j = 25 °C.

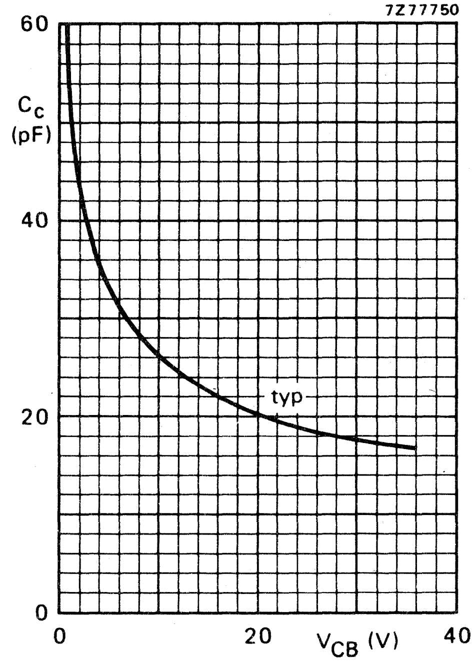


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

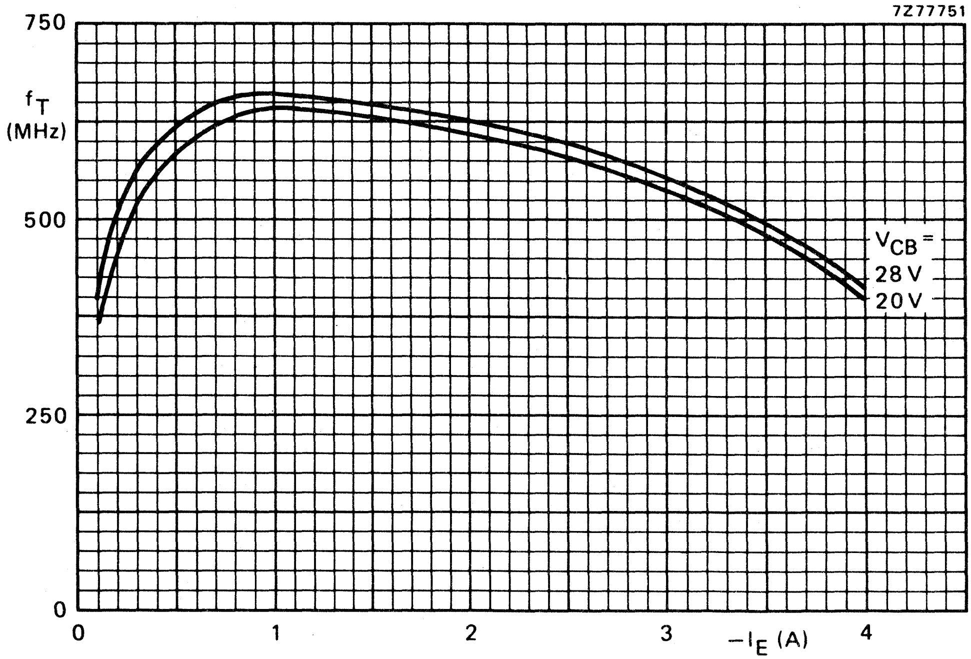


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

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	15	< 1,5	> 10	< 0,83	> 65	1,4 + j1,85	33 − j27,5

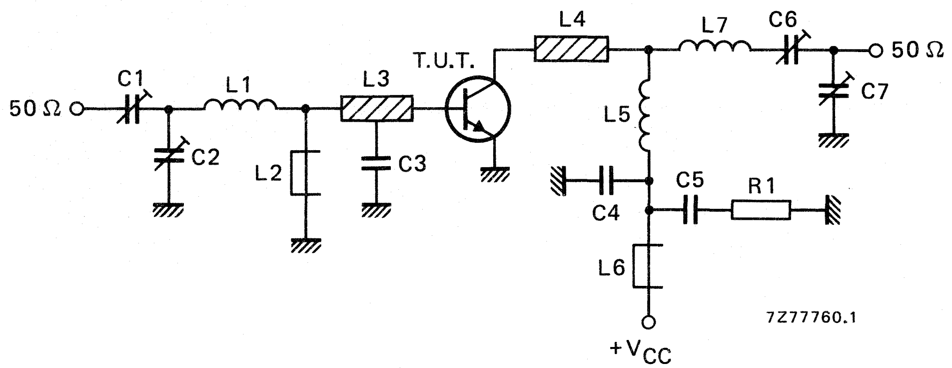


Fig. 7 Test circuit; c.w. class-B.

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.

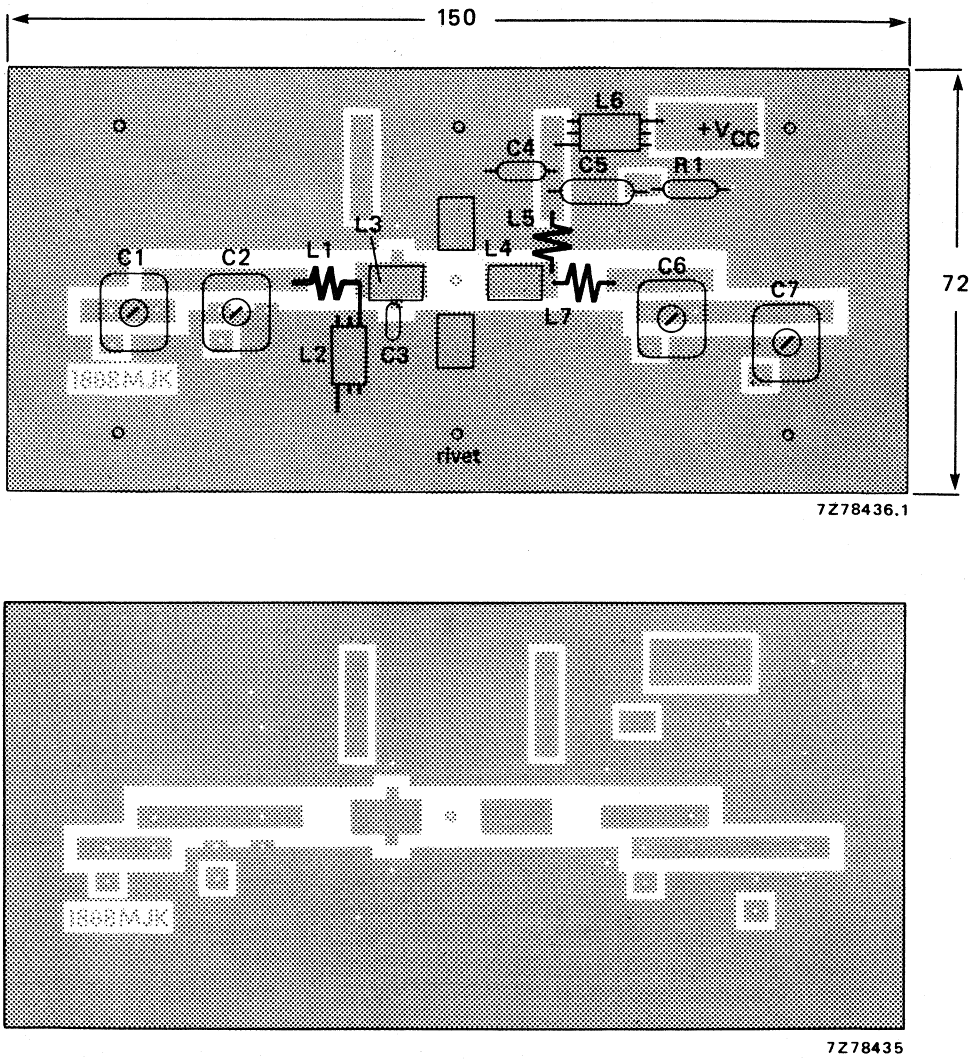


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

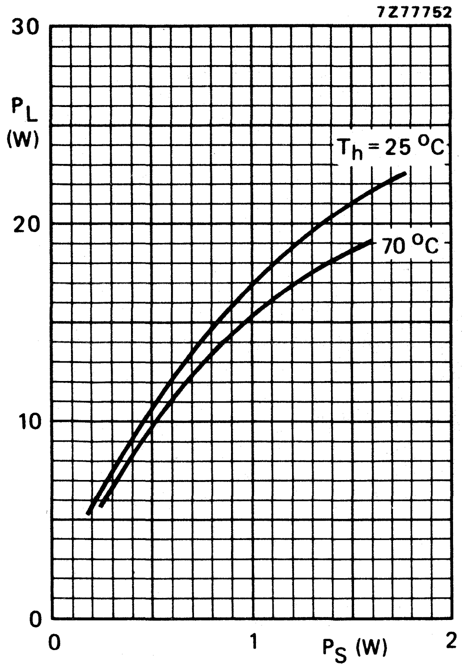


Fig. 9 Typical values; V_{CE} = 28 V; f = 175 MHz.

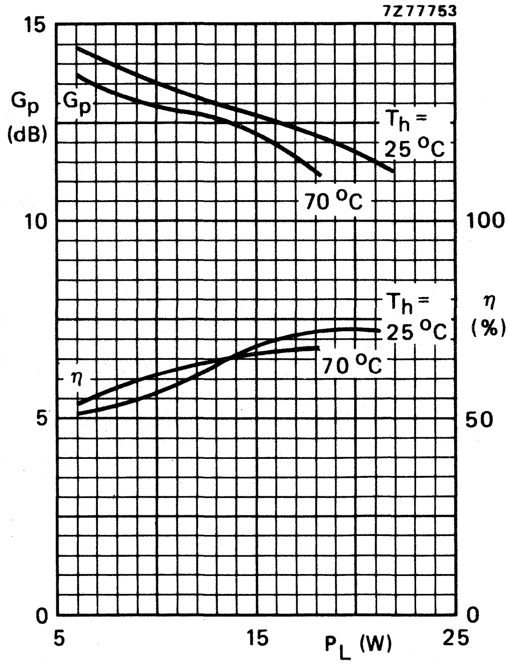


Fig. 10 Typical values; V_{CE} = 28 V; f = 175 MHz.

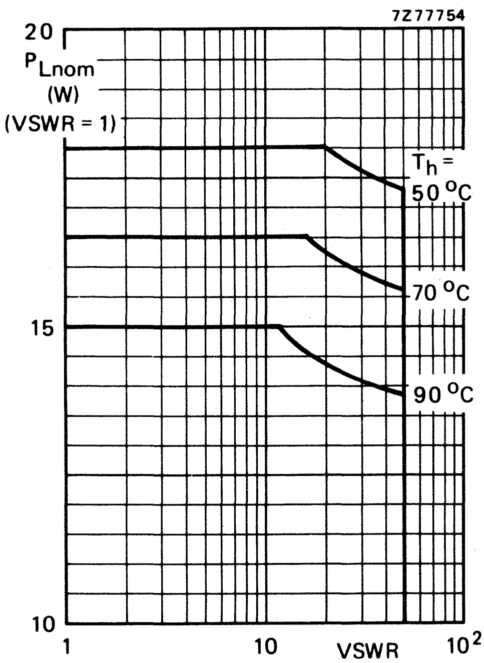


Fig. 11 R.F. SOAR; c.w. class-B operation; f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

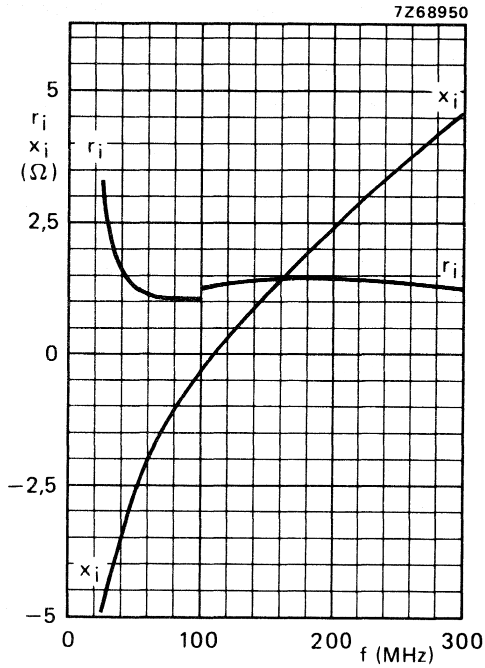


Fig. 12 Input impedance (series components).

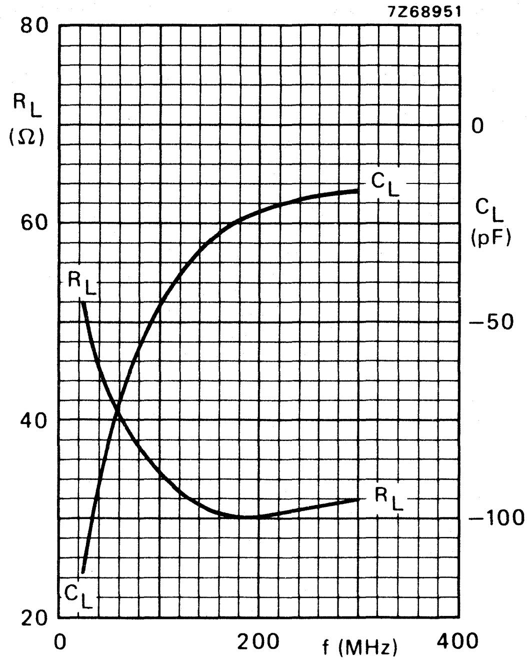


Fig. 13 Load impedance (parallel components).

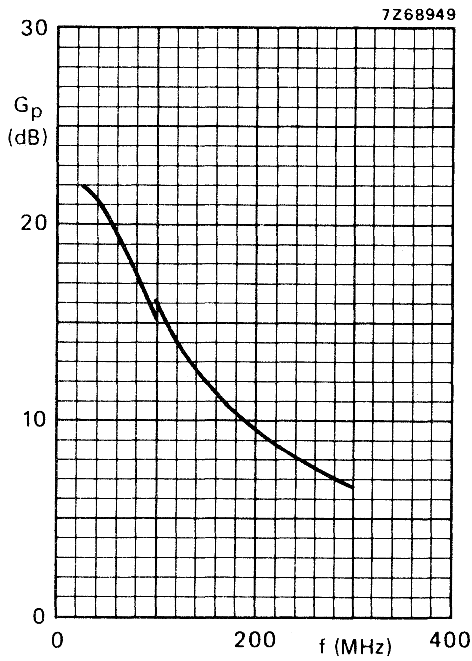


Fig. 14.

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.

VHF power transistor BLY92C/01

DESCRIPTION

NPN silicon planar epitaxial transistor designed 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 SOT122F ¼ inch capstan envelope with a ceramic cap. All leads are isolated from the stud.

PIN CONFIGURATION

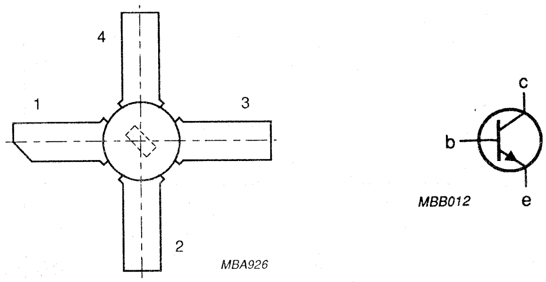


Fig.1 Simplified outline and symbol.

PINNING - SOT122F

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in an un-neutralized common emitter class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	$\overline{Z}_i$ (Ω)	$\overline{Y}_L$ (mS)
c.w. class-B	175	28	15	> 10	> 65	1.4 + j1.85	33 – j27.5

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBOM}	collector-base voltage	open emitter; peak value	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	36	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
$I_{C(AV)}$	collector current	average value	–	1.5	A
I_{CM}	collector current	peak value f > 1 MHz	–	4.5	A
P_{tot}	total power dissipation	f > 1 MHz; T_h = 25 °C	–	32	W
T_{stg}	storage temperature range		–30	200	°C
T_j	junction operating temperature		–	200	°C

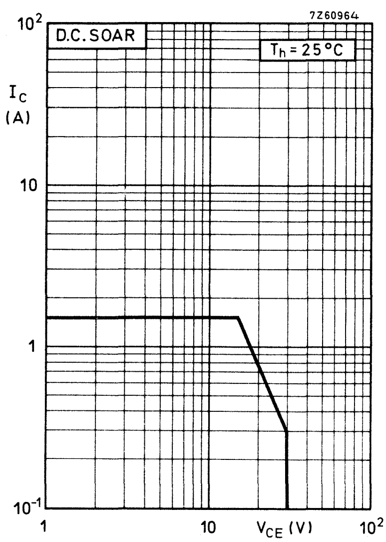


Fig.2 DC SOAR.

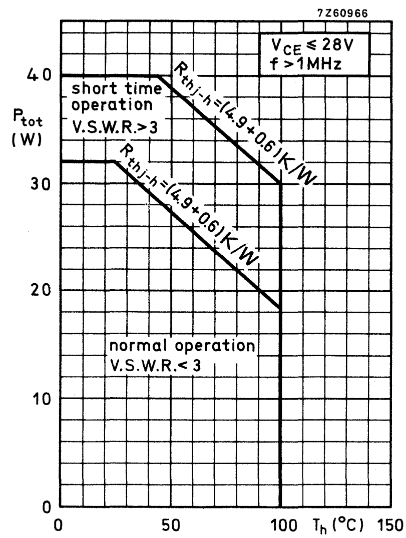


Fig.3 Power/temperature derating curve.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	4.9	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.6	K/W

CHARACTERISTICS

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 3 mA	65	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 25 mA	36	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	4	–	–	V
I_{CEO}	collector-emitter leakage current	V_{CE} = 28 V; I_B = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 0.5 A	5	–	–	
f_T	transition frequency	V_{CE} = 20 V; I_E = 0.6 A	–	500	–	MHz
E_{SBR}	second breakdown energy	open base; L = 25 mH; f = 50 Hz	2	–	–	mJ
		$-V_{BE}$ = 1.5 V; R_{BE} = 33 Ω; L = 25 mH; f = 50 Hz	4.5	–	–	mJ
C_c	collector capacitance	V_{CB} = 30 V; I_E = I_e = 0; f = 1 MHz	–	20	30	pF
C_{re}	feedback capacitance	V_{CE} = 30 V; I_C = 50 mA; f = 1 MHz	–	15	–	pF
$C_{c\text{-}s}$	collector-stud capacitance	f = 1 MHz	–	2	–	pF

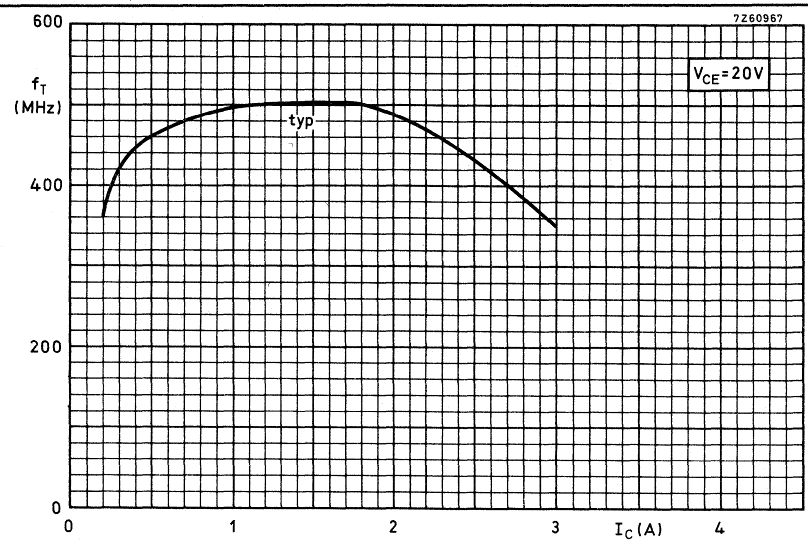
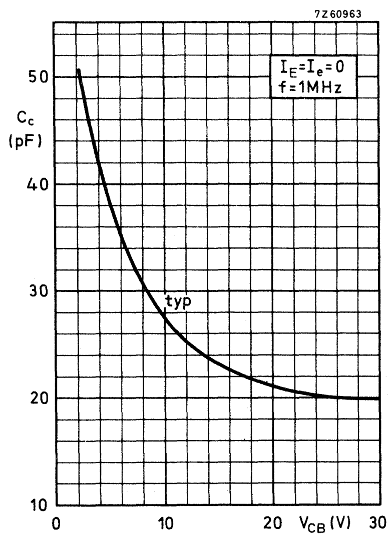


Fig.4 Transition frequency as a function of collector current, typical values.



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

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

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)	$\overline{Z_i}$ (Ω)	$\overline{Y_L}$ (mS)
c.w. class-B	175	28	15	> 10	> 65	1.4 + j1.85	33 − j27.5

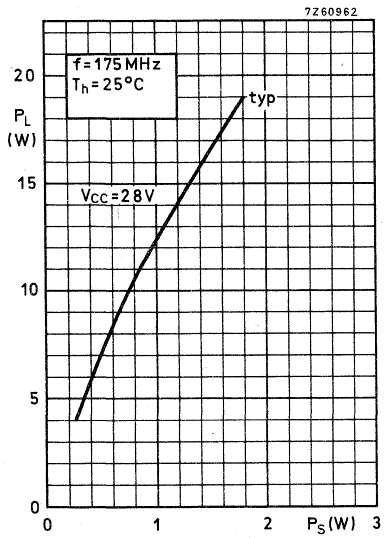
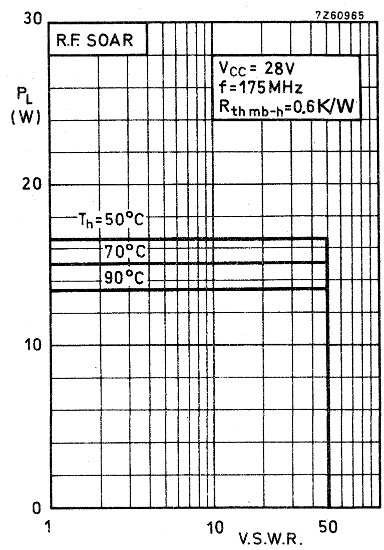


Fig.6 Load power as a function of drive power, typical values.



For high voltage operation, a stabilized supply is generally used. The graph shows allowable output power under nominal conditions of the VSWR, with heatsink temperature as parameter.

Fig.7 RF SOAR.

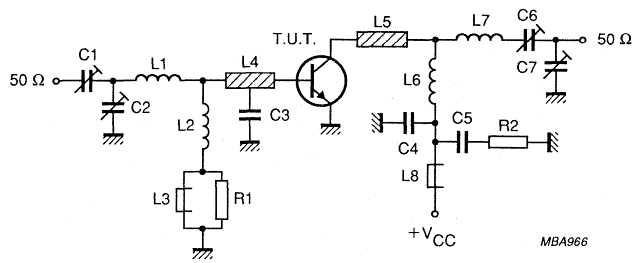


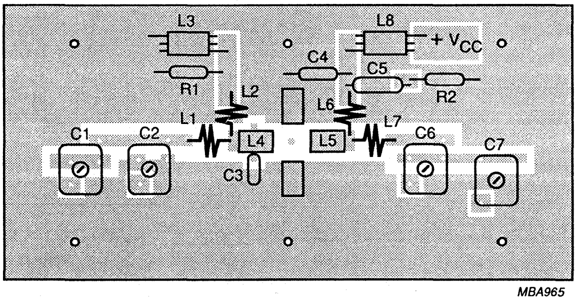
Fig.8 Class-B test circuit at f = 175 MHz.

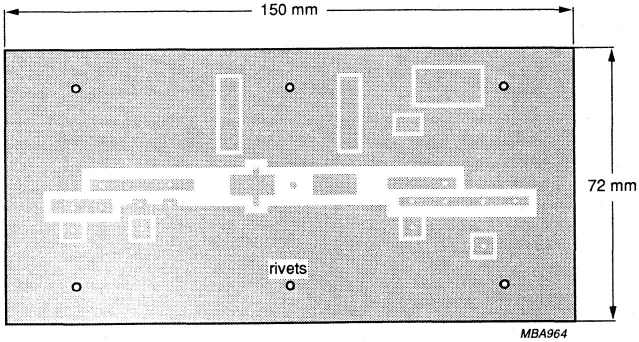
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C7	film dielectric trimmer	2.2 to 20 pF		2222 809 07004
C2, C6	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	500 V ceramic capacitor	47 pF	(note 1)	
C4	500 V ceramic capacitor	120 pF		
C5	polyester capacitor	100 nF		
L1	1 turn 1.6 mm copper wire		int. dia. 8.4 mm; leads 2 x 5 mm	
L2	7 turns closely wound enamelled 0.5 mm copper wire		int. dia. 3 mm; leads 2 x 5 mm	
L3, L8	grade 3B Ferroxcube wideband HF choke			4312 020 36640
L4, L5	stripline (note 2)		12 mm x 6 mm	
L6	3 turns closely enamelled 1 mm copper wire		int. dia. 9 mm; leads 2 x 5 mm	
L7	3 turns closely wound enamelled 1 mm copper wire		int. dia. 8.2 mm; leads 2 x 5 mm	
R1, R2	carbon resistor	10 Ω		

Notes

1. Tap for capacitor C3 situated 5 mm from the transistor.
2. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric, thickness 1⁄16 inch.





The circuit and components are situated on one side of an epoxy fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by means of hollow rivets. Copper straps are used under the emitter leads, for a direct contact between upper and lower sheets

Fig.9 Component layout for 175 MHz class-B test circuit.

Operating note

Below 100 MHz, a base-emitter resistor of 10 Ω is recommended, to avoid oscillation. This resistor must be effective for both DC and RF.

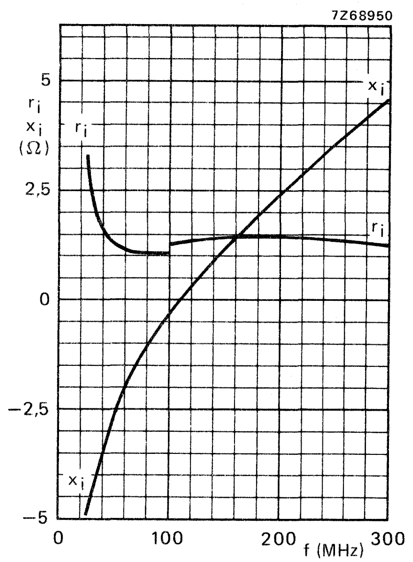


Fig.10 Input impedance (series components) as a function of frequency, typical values.

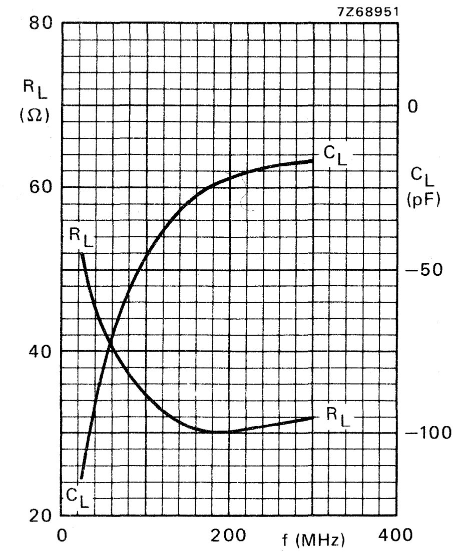


Fig.11 Load impedance (parallel components) as a function of frequency, typical values.

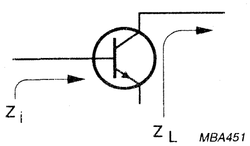


Fig.12 Definition of transistor impedance.

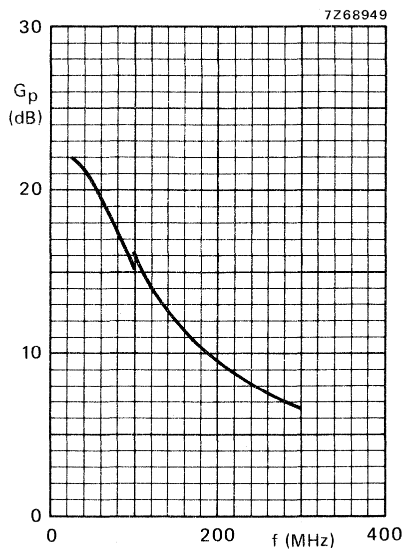


Fig.13 Power gain as a function of frequency, typical values.

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 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

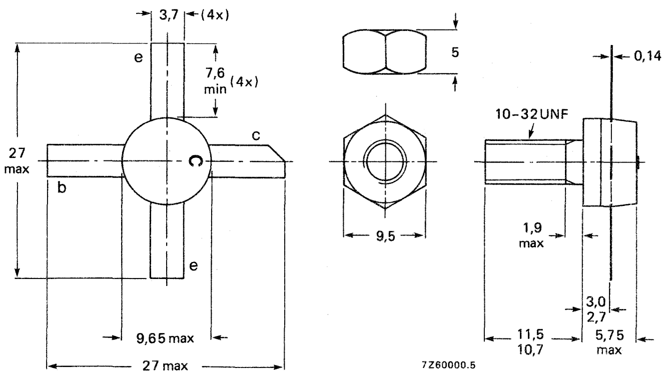
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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)

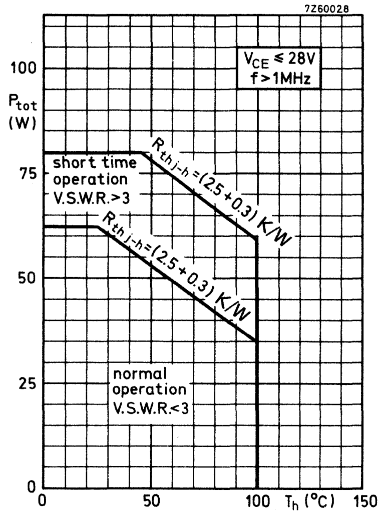
Diameter of clearance hole in heatsink: max. 4,9 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

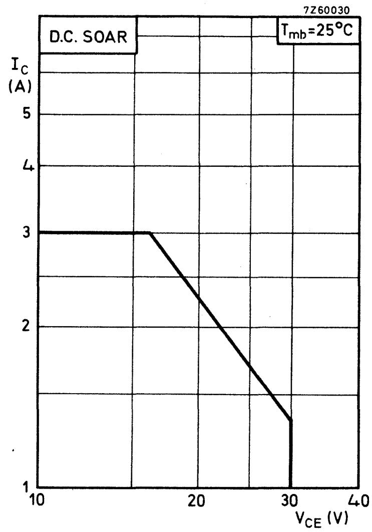
When locking is required an adhesive is preferred instead of a lock washer.

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	$R_{th\ j-mb}$	=	2.5	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.3	K/W

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

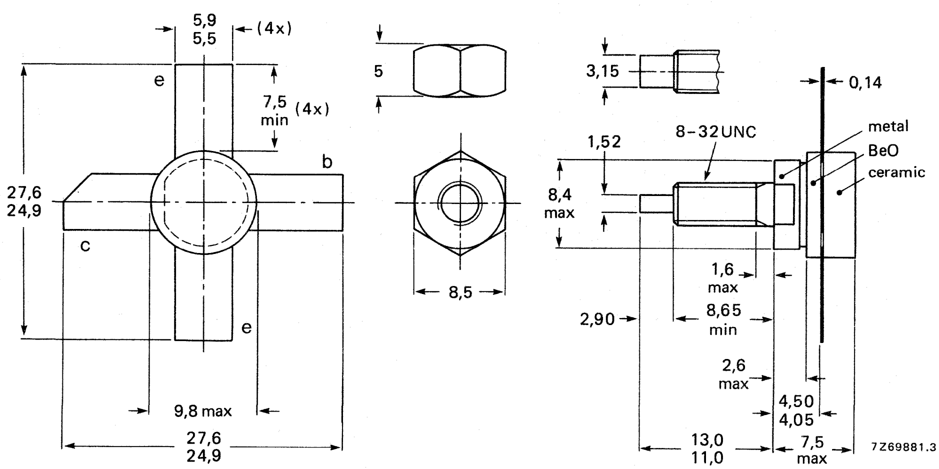
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

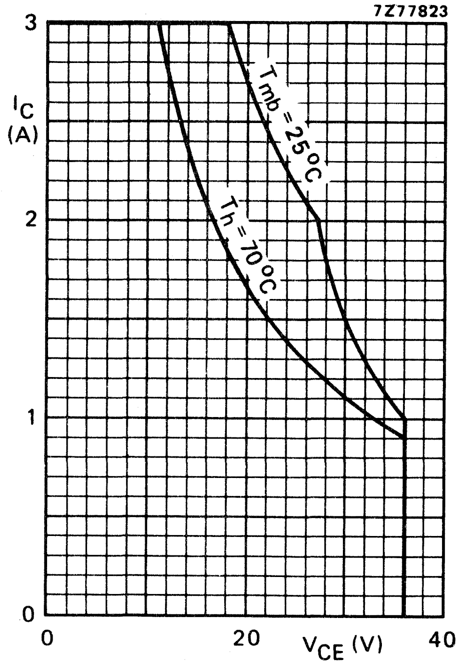


Fig. 2 D.C. SOAR.

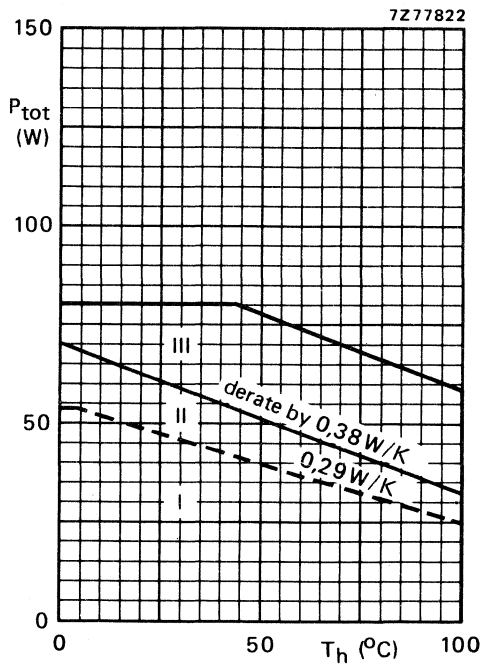


Fig. 3 R.F. power dissipation; $V_{CE} \leqslant 28$ V; f ⩾ 1 MHz.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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: $t_p \leqslant 200\ \mu s$; $\delta \leqslant 0{,}02$.

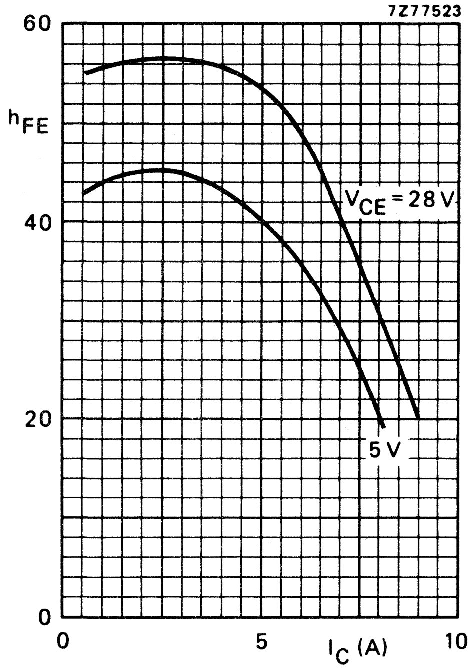


Fig. 4 Typical values; T_j = 25 °C.

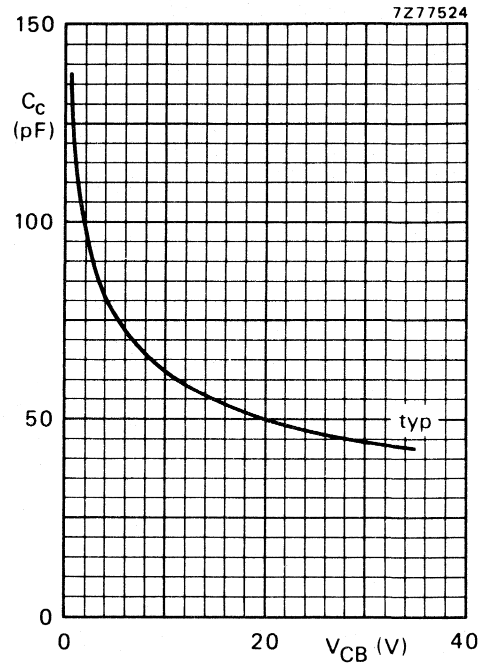


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

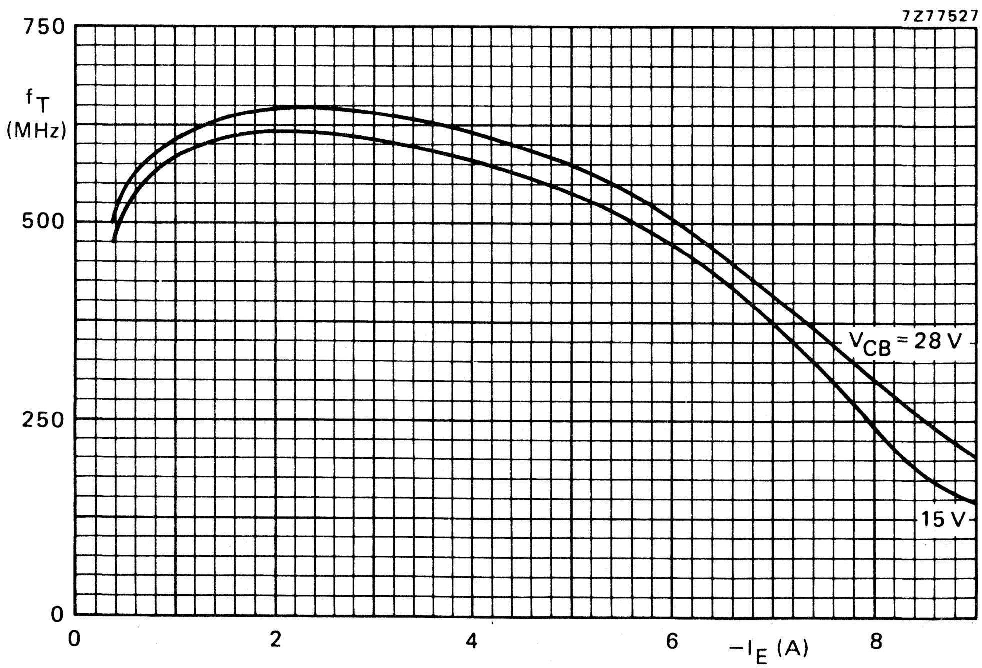


Fig. 6 Typical values; f = 100 MHz; T_j = 25 °C.

APPLICATION INFORMATION

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

$T_h = 25\ ^oC$

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**	**25**	**< 3,15**	**> 9**	**< 1,5**	**> 60**	**1,0 + j1,2**	**59–j54**

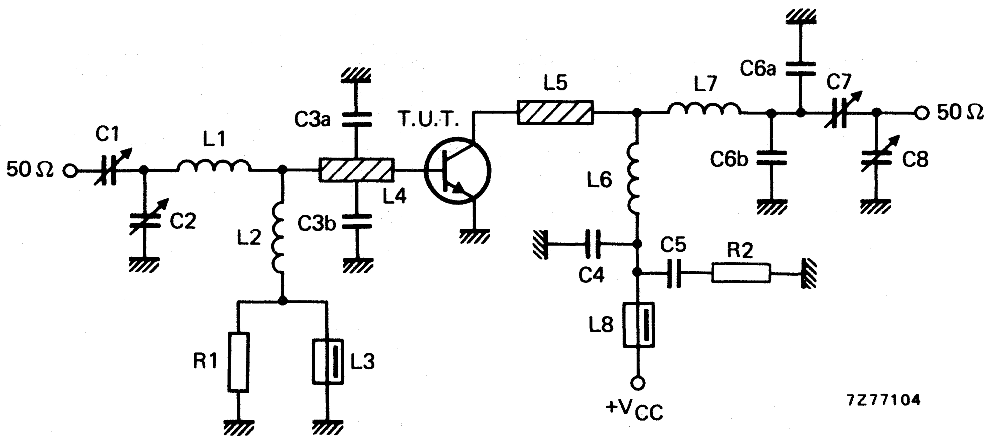


Fig. 7 Test circuit; c.w. class-B.

List of components

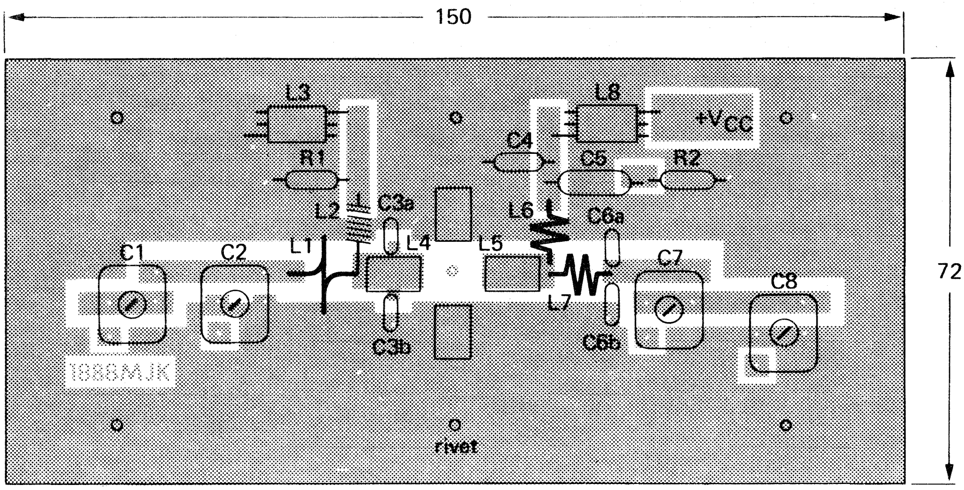
C1 = C7 = 2,5 to 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C2 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3a = C3b = 47 pF ceramic capacitor (500 V)
C4 = 120 pF ceramic capacitor
C5 = 100 nF polyester capacitor
C6a = 2,2 pF ceramic capacitor (500 V)
C6b = 1,8 pF ceramic 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.



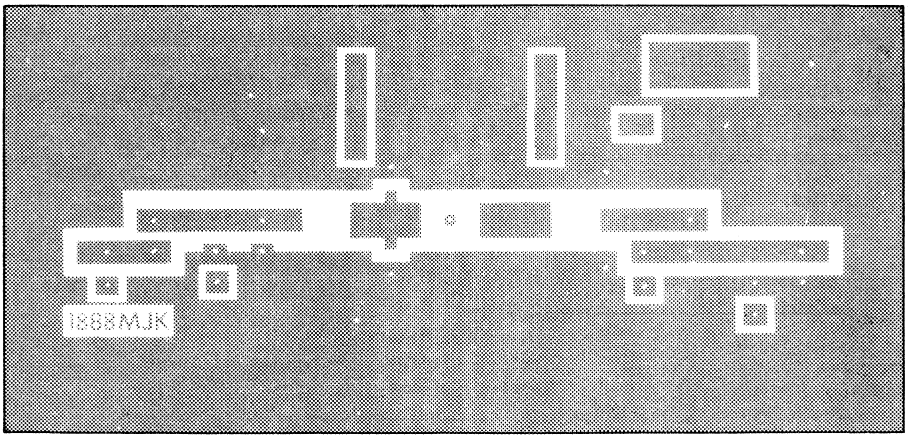


Fig. 8 Component layout and printed-circuit board for 175 MHz test circuit.

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.

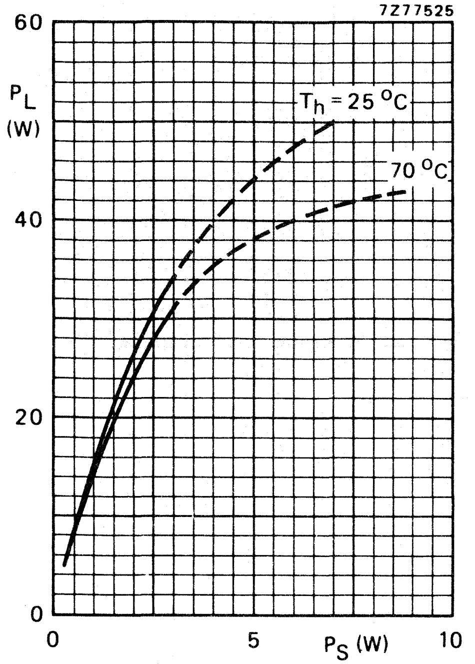


Fig. 9 V_{CE} = 28 V; f = 175 MHz; typical values.

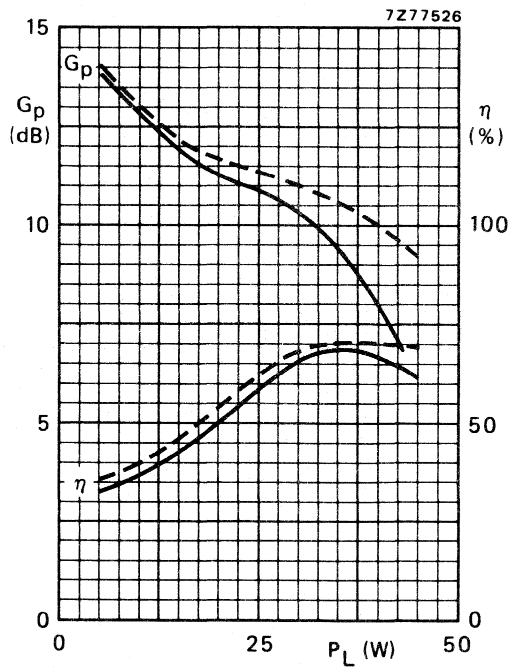


Fig. 10 V_{CE} = 28 V; f = 175 MHz; typical values; – – – T_h = 25 °C; ——— T_h = 70 °C.

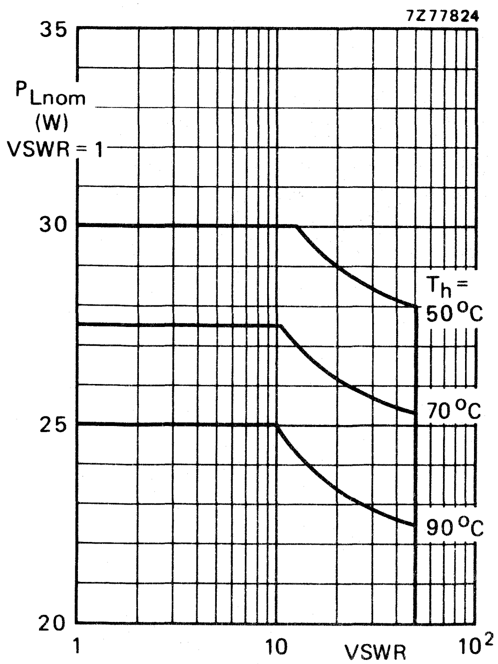


Fig. 11 R.F. SOAR; c.w. class-B operation;
f = 175 MHz; V_{CE} = 28 V; $R_{th\ mb\text{-}h}$ = 0,45 K/W
The graph shows the permissible output power under nominal conditions (VSWR = 1) as a function of the expected VSWR during short-time mismatch conditions with heatsink temperatures as parameter.

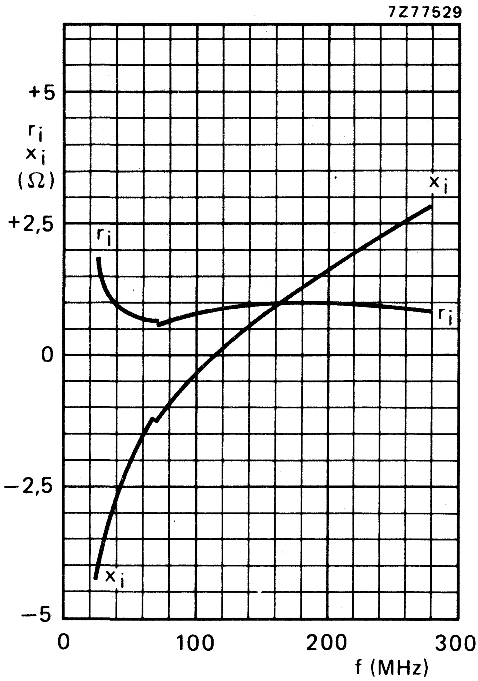


Fig. 12 Input impedance (series components).

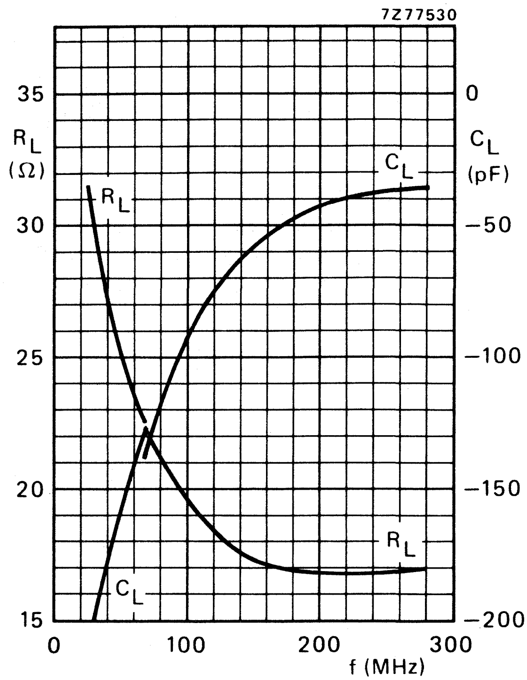


Fig. 13 Load impedance (parallel components).

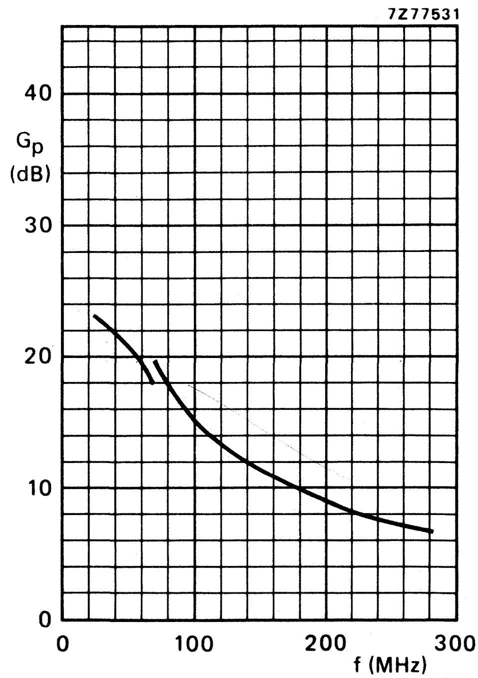


Fig. 14 Power gain versus frequency.

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

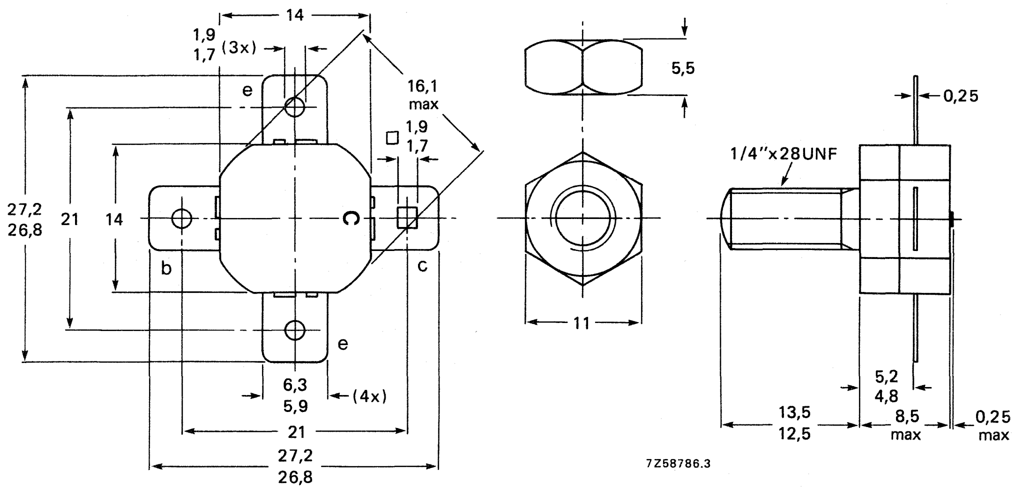
R.F. performance up to T_{mb} = 25 °C in an unneutralized common-emitter class-B circuit

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)

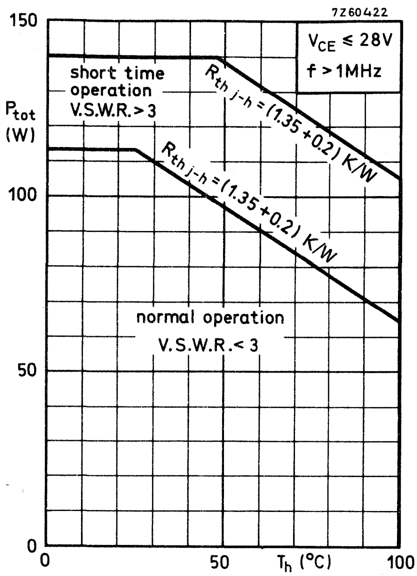
Diameter of clearance hole in heatsink: max. 6,4 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.

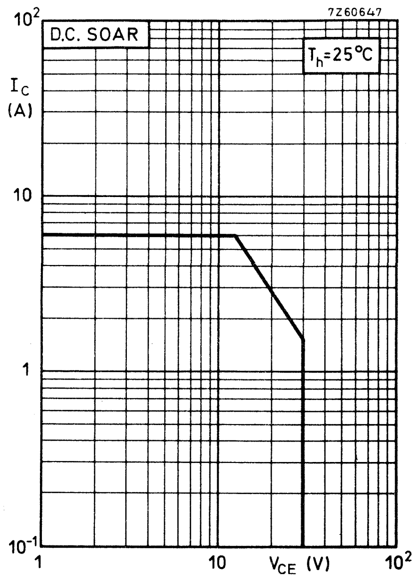
When locking is required an adhesive is preferred instead of a lock washer.

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

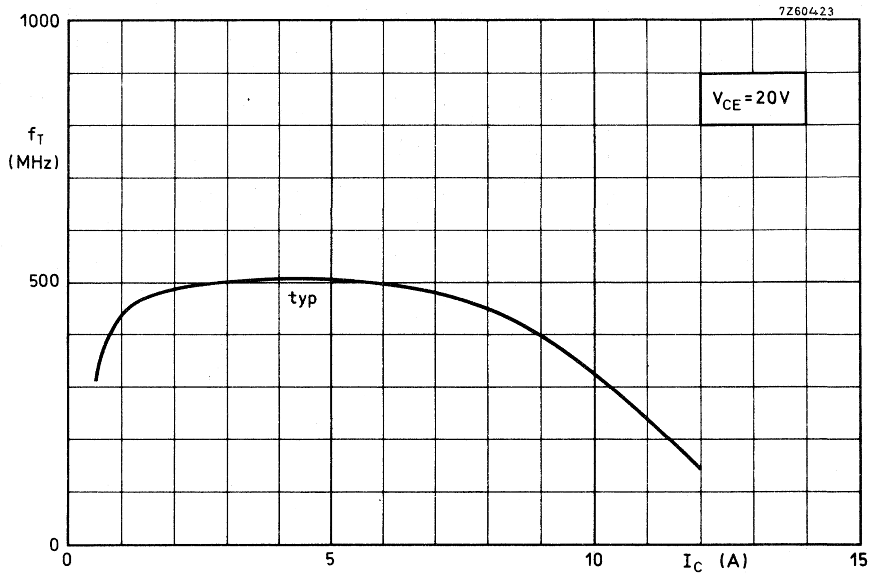
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.35	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	K/W

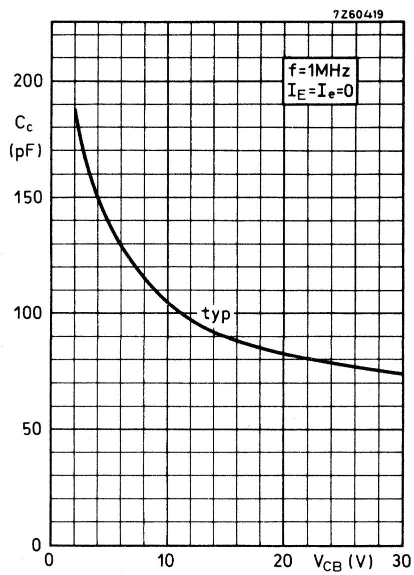
CHARACTERISTICS

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
f_T
(MHz)
500
0
$V_{CE} = 20V$
typ
0
5
10
I_C (A)
15


7Z60419
200
C_c
(pF)
150
100
50
0
f = 1MHz
$I_E = I_e = 0$
typ
0
10
20
V_{CB} (V)
30

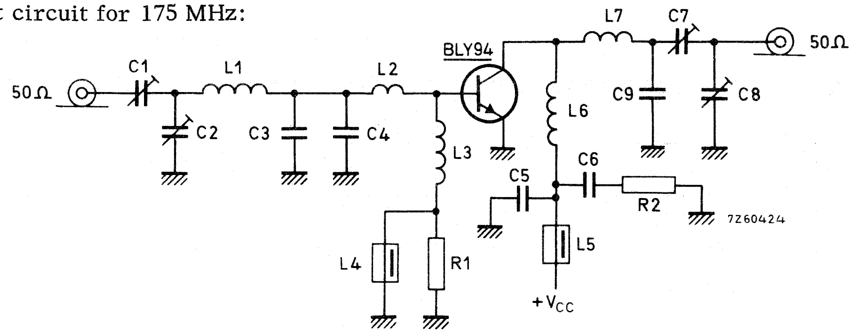
APPLICATION INFORMATION

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:

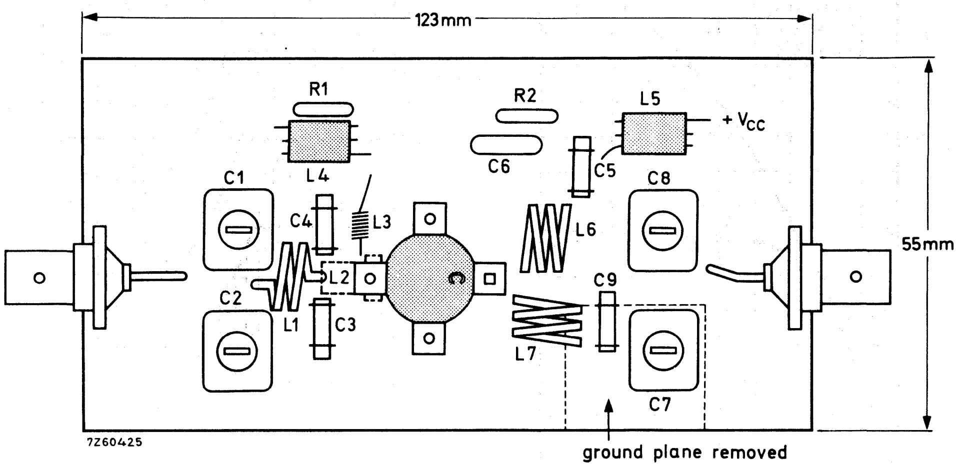
C1 = 2 to 20 pF film dielectric trimmer (code number 2222 809 07004)
C2 = 4 to 40 pF film dielectric trimmer (code number 2222 809 07008)
C3 = C4 = 56 pF ceramic
C5 = 100 pF ceramic
C6 = 100 nF polyester
C7 = 4 to 60 pF film dielectric trimmer (code number 2222 809 07011)
C8 = 4 to 100 pF film dielectric trimmer (code number 2222 809 07015)
C9 = 6.8 pF ceramic

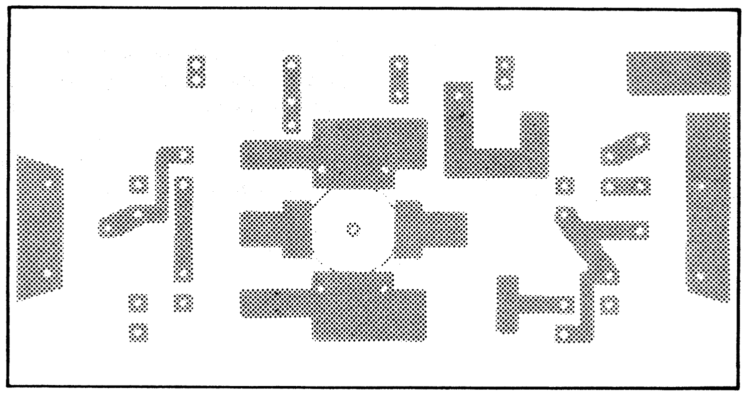
L1 = 36 nH; 2 turns enamelled Cu wire (1.5 mm); int. diam. 7 mm; length 5 mm; lead length 2 x 5 mm
L2 = formed by the metallization on the p.c. board; see component lay-out
L3 = 100 nH; 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam 3 mm; lead length 2 x 5 mm
L4 = L5 = ferroxcube choke (code 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

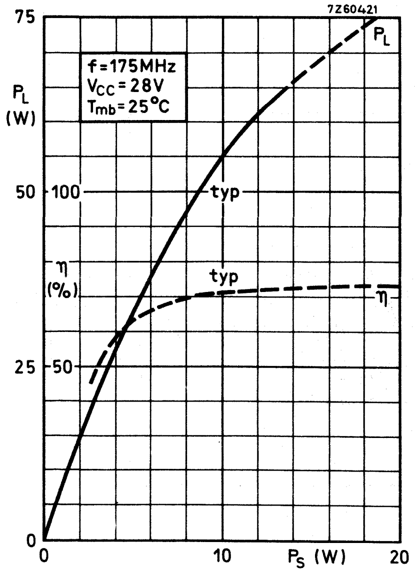
APPLICATION INFORMATION (continued)

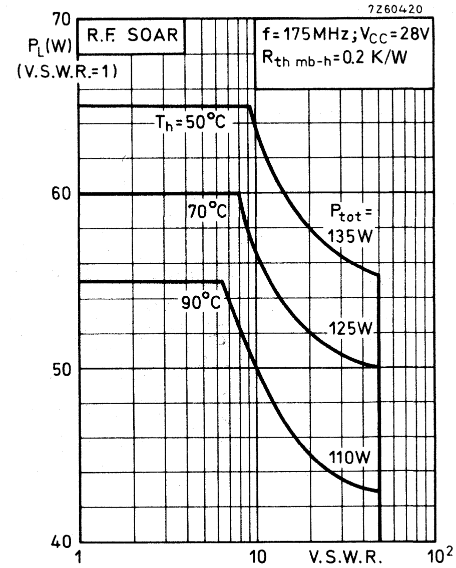
Component lay-out and printed circuit board for 175 MHz test circuit.





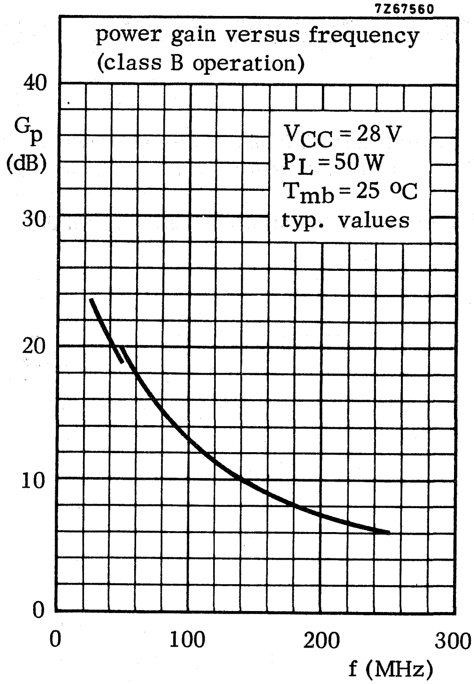
The circuit and the components are situated on one side of the epoxy fibre-glass board, the other side being fully metallised to serve as earth. Earth connections are made by means of hollow rivets.

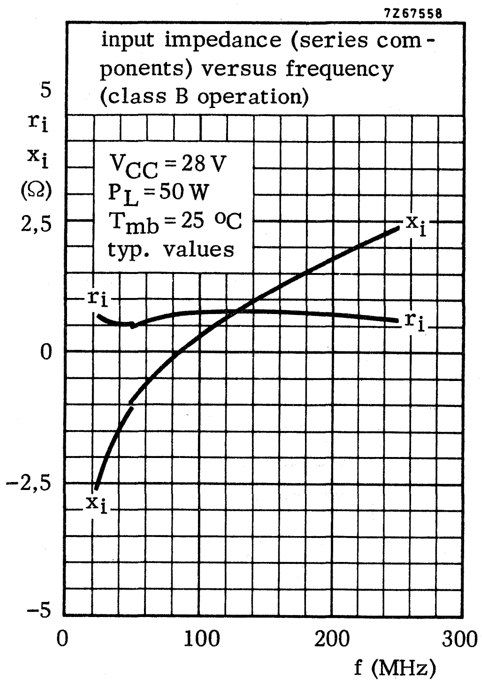


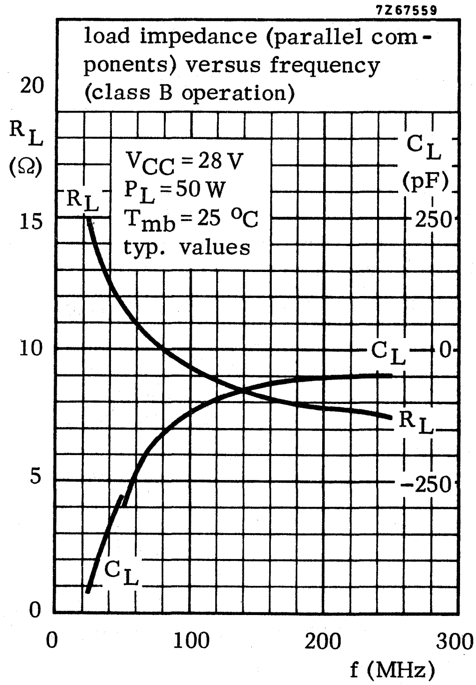


For high voltage operation, a stabilized power supply is generally used.
The graph shows the allowable output power under nominal conditions as a function of the V.S.W.R., with heat-sink temperature as parameter.

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

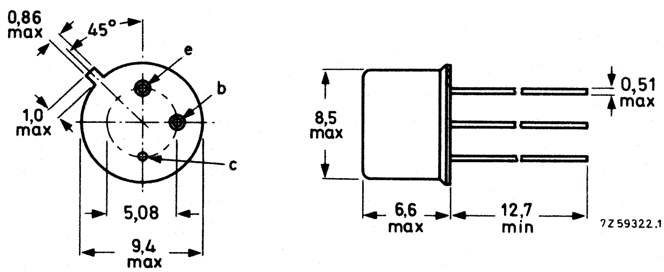
type number	f (MHz)	P_o (W)	P_i (W)	η (%)
2N3553	175	2,5	< 0,25	> 50
2N3375	100	7,5	< 1	> 65
2N3375	400	> 3	1	> 40
2N3632	175	> 13,5	3,5	> 70

MECHANICAL DATA

Dimensions in mm

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

2N3553



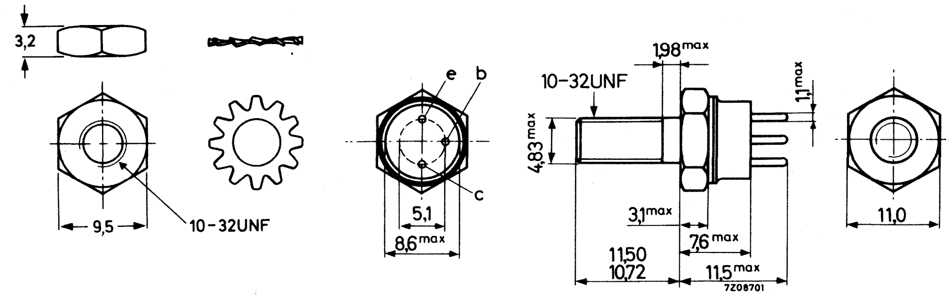
Maximum lead diameter is guaranteed only for 12,7 mm.

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.

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)

			2N3553	2N3375	2N3632	
Collector-base voltage (open emitter)	V_{CBO}	max.		65		V
Collector-emitter voltage						
$I_C \leqslant 200$ mA; $-V_{BE} = 1{,}5$ V	V_{CEX}	max.		65		V
(open base); $I_C \leqslant 200$ mA	V_{CEO}	max.		40		V
Emitter-base voltage (open collector)	V_{EBO}	max.		4		V
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

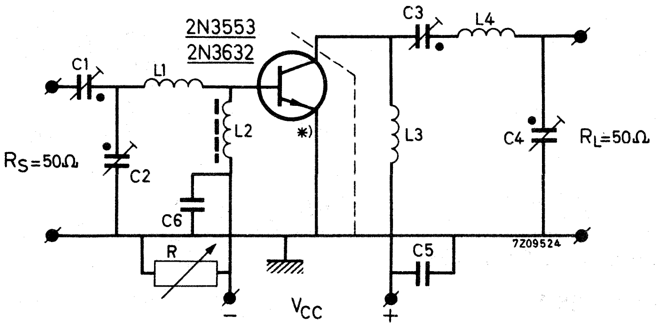
	f (MHz)	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit
2N3553	175	2.5	< 0.25	< 180	> 50	I
2N3375	100	7.5	< 1	< 410	> 65	II
2N3375	400	> 3	1	270	> 40	III
2N3632	175	> 13.5	3.5	690	> 70	I

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

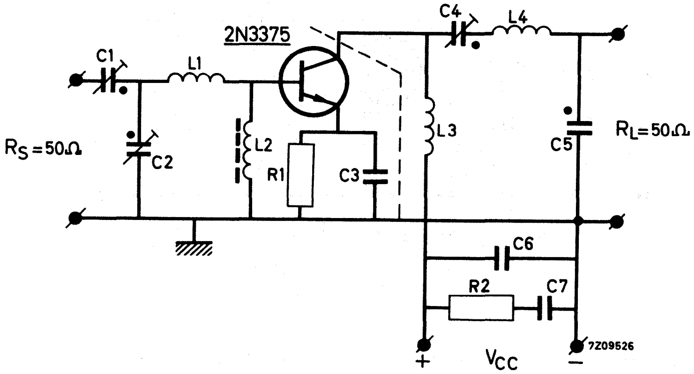
L4 = 3 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 20 mm

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

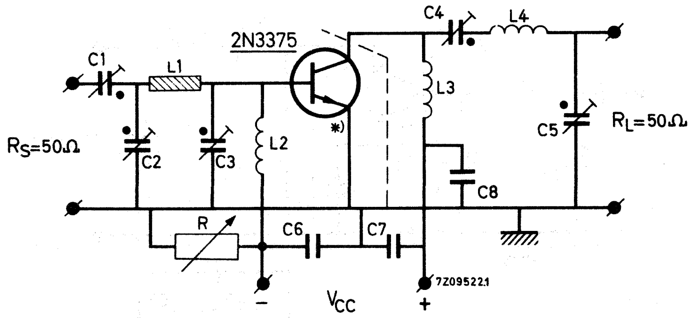
L4 = 5 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 12 mm; leads 2 x 10 mm

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

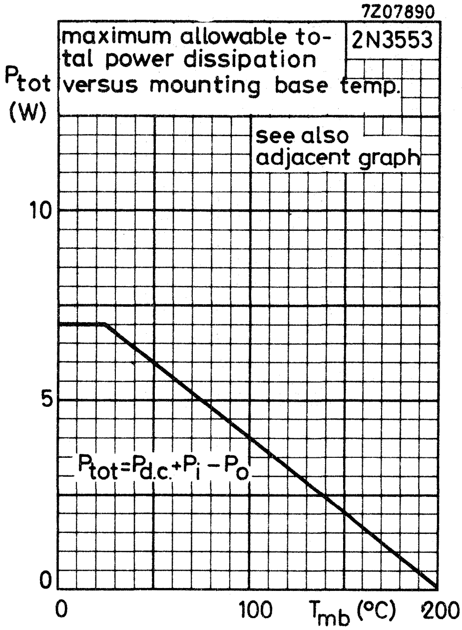
L1 = 20 mm straight Cu wire; diam. 1.5 mm; spaced 8 mm from chassis

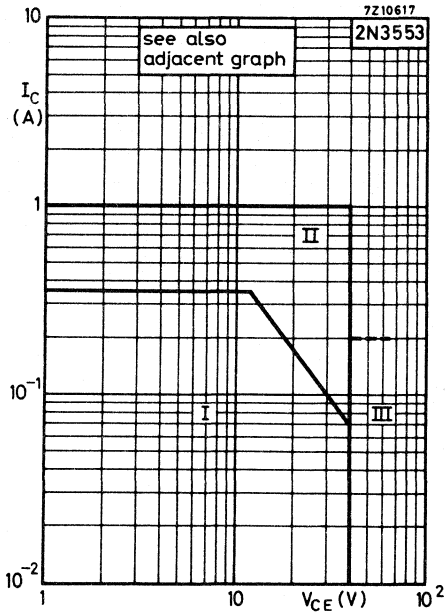
L2 = 17 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

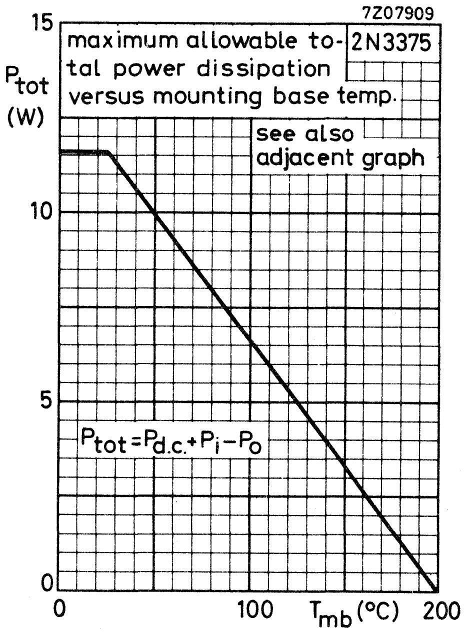
L3 = 7 turns closely wound enamelled Cu wire (0.5 mm); int. diam. 3 mm

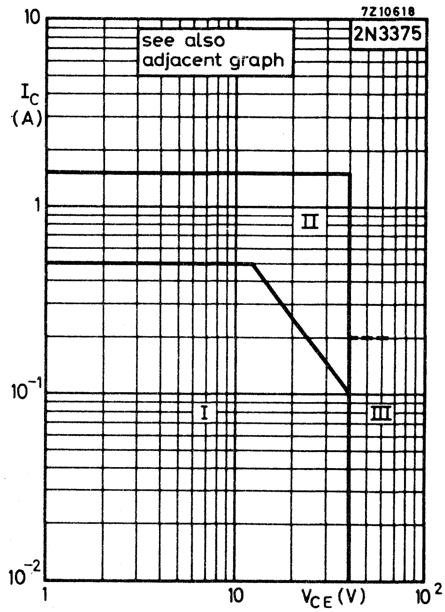
L4 = 1 turn Cu wire (1.5 mm); int. diam. 10 mm; leads 2 x 5 mm

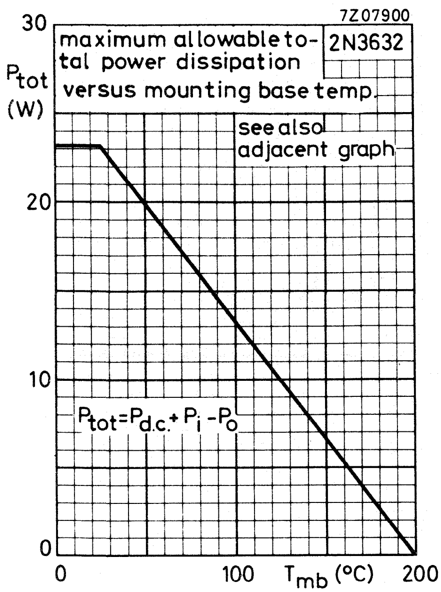
R = 0 to 5 Ω

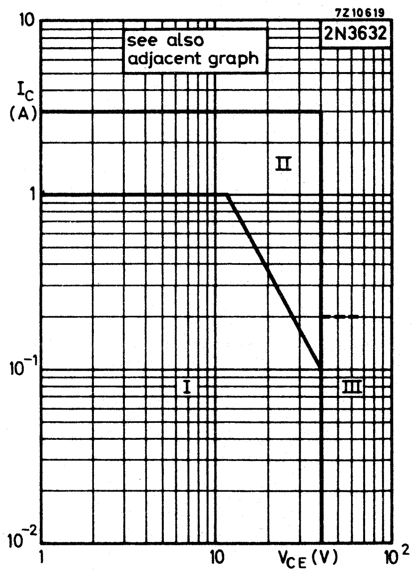

7Z07890
maximum allowable total power dissipation versus mounting base temp.
2N3553
see also adjacent graph
P_{tot} (W)
10
5
0
$P_{tot} = P_{d.c.} + P_i - P_o$
0
100
T_{mb} (°C)
200


7Z10617
see also adjacent graph
2N3553
I_C (A)
10
1
10^{-1}
10^{-2}
II
I
III
1
10
V_{CE} (V)
10^2


7Z07909
maximum allowable total power dissipation versus mounting base temp.
2N3375
see also adjacent graph
15
P_{tot} (W)
10
5
0
$P_{tot} = P_{d.c.} + P_i - P_o$
0
100
T_{mb} (°C)
200


7Z10618
see also adjacent graph
2N3375
I_C (A)
10
1
10^{-1}
10^{-2}
II
I
III
1
10
V_{CE} (V)
10^2

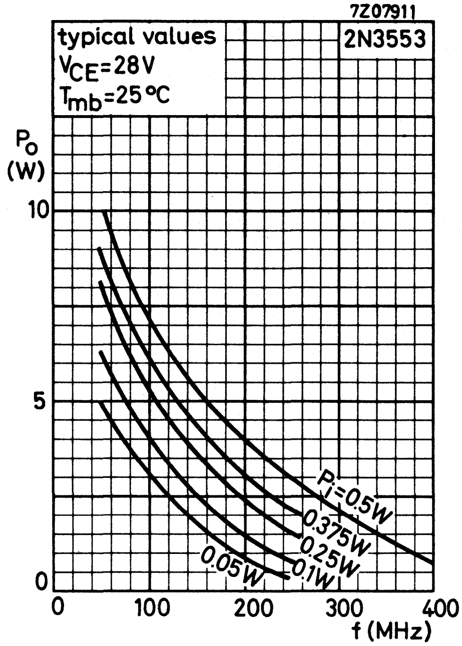


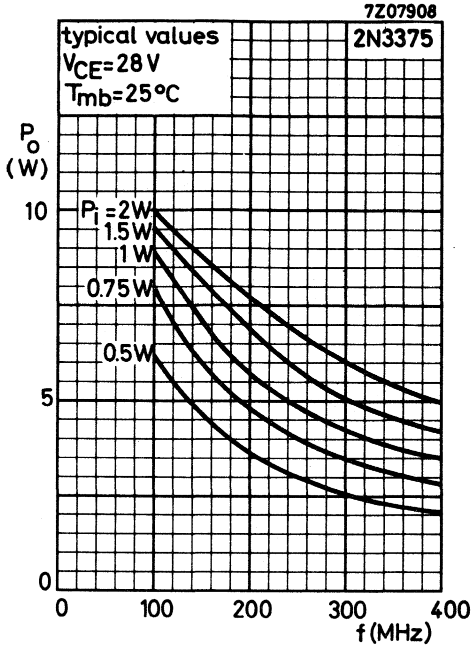


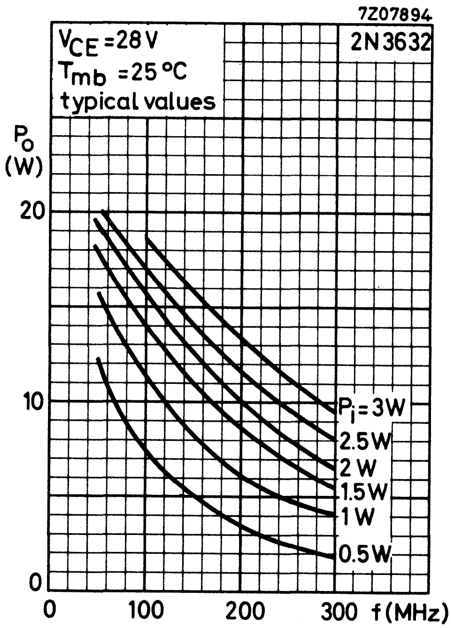
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

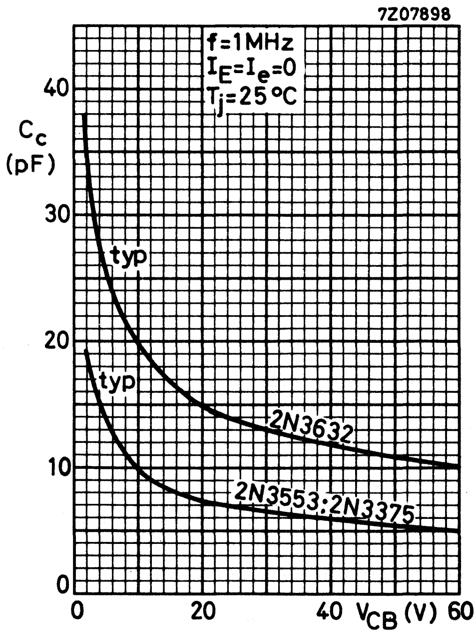
II Additional region of operation at f ≥ 1 MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

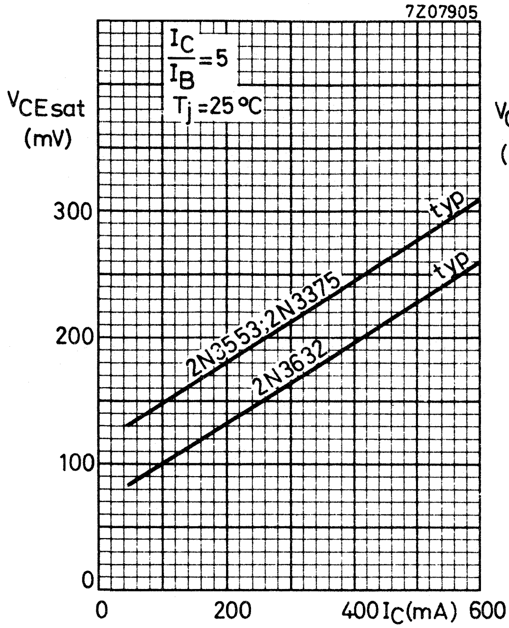
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 200$ mA and the transient energy does not exceed 0.5 mWs.

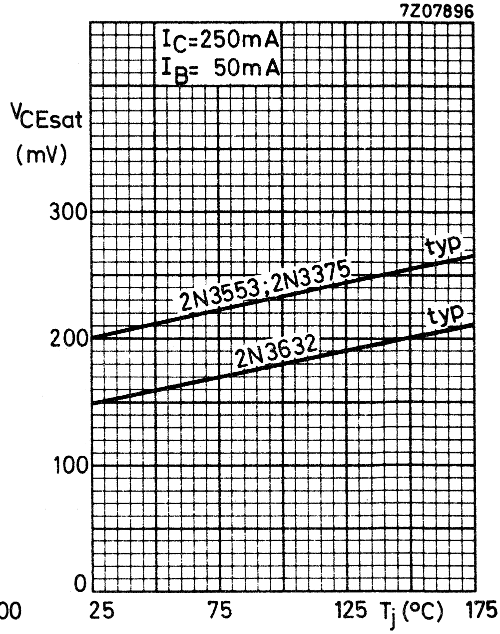

7Z07911
typical values
VCE=28V
Tmb=25°C
2N3553
Po
(W)
10
5
0
0
100
200
300
400
f (MHz)
Pi=0.5W
0.375W
0.25W
0.1W
0.05W

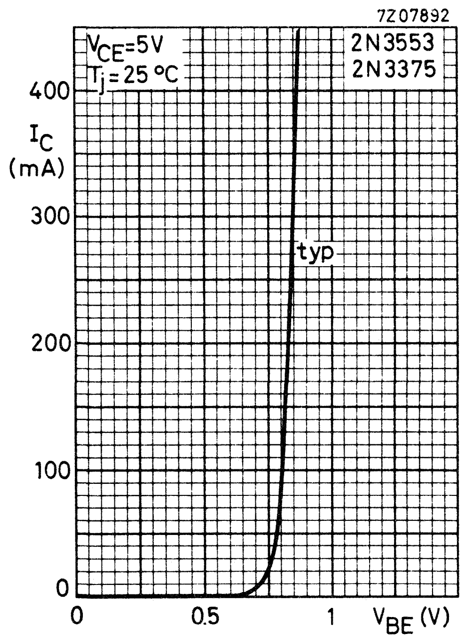

7Z07908
typical values
VCE=28V
Tmb=25°C
2N3375
Po
(W)
10
5
0
Pi=2W
1.5W
1W
0.75W
0.5W
0
100
200
300
400
f (MHz)

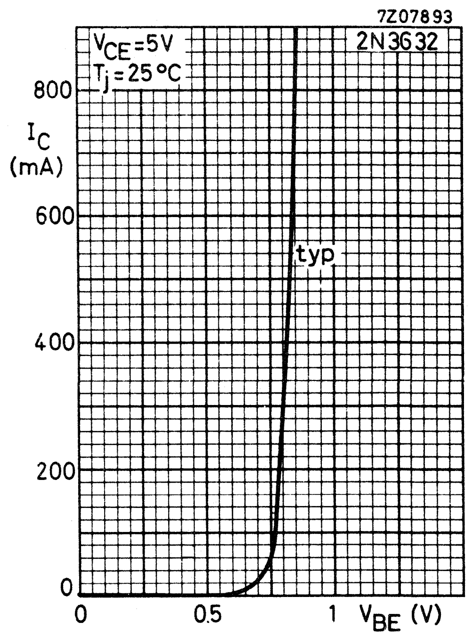

7Z07894
VCE=28V
Tmb=25°C
typical values
2N3632
Po
(W)
20
10
0
Pi=3W
2.5W
2W
1.5W
1W
0.5W
0
100
200
300
f (MHz)

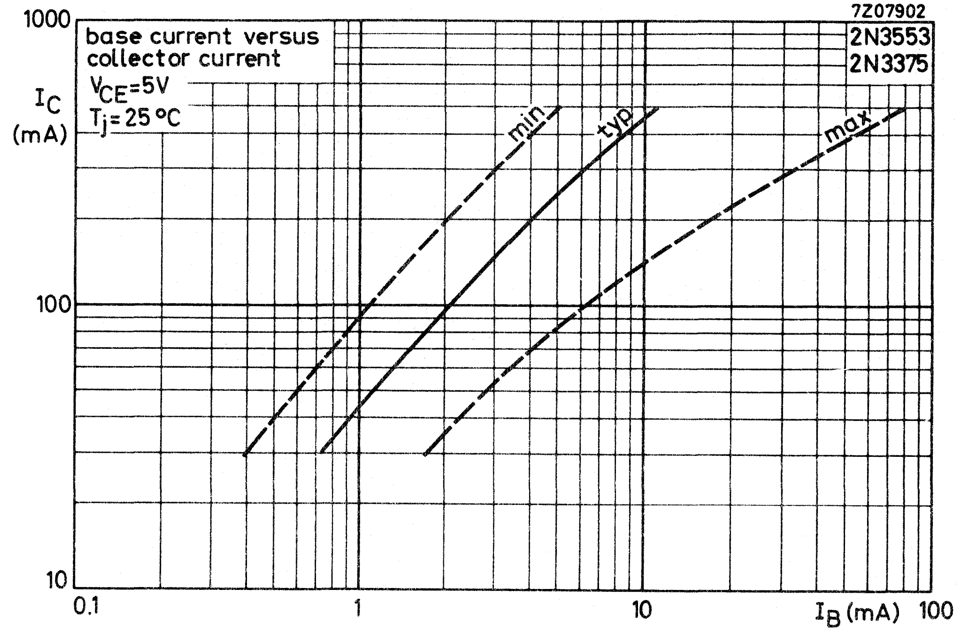

7Z07898
f=1MHz
IE=Ie=0
Tj=25°C
Cc
(pF)
40
30
20
10
0
typ
typ
2N3632
2N3553;2N3375
0
20
40
VCB (V)
60

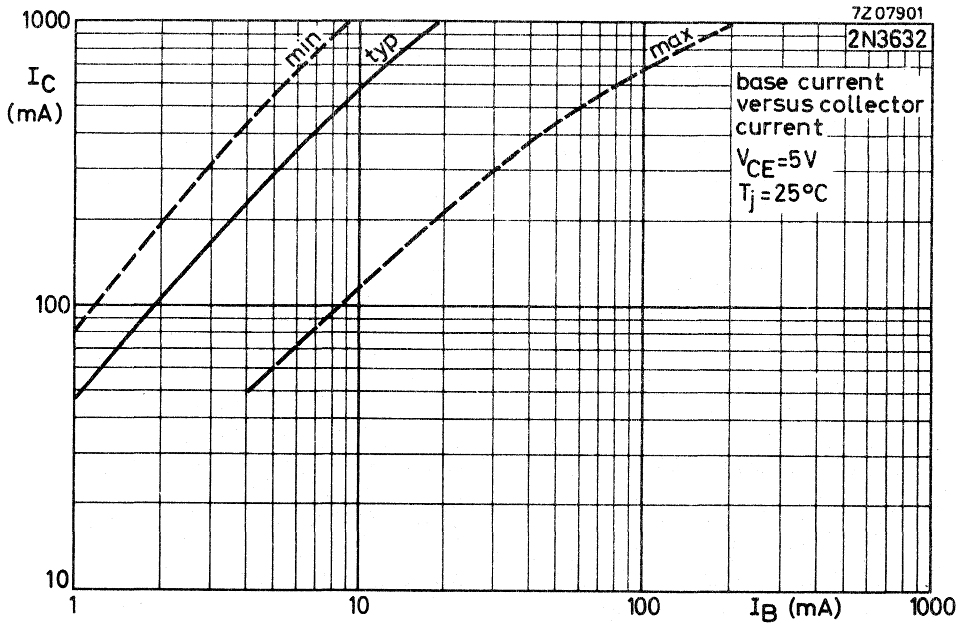

7Z07905
$I_C/I_B = 5$
$T_j = 25\ °C$
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
0
200
400
600
I_C (mA)

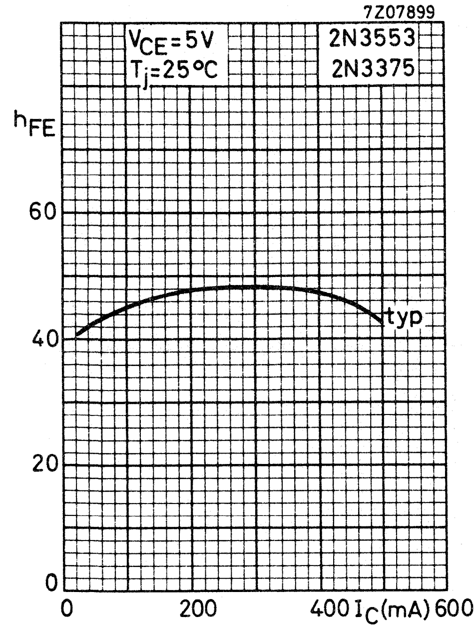

7Z07896
$I_C = 250\ mA$
$I_B = 50\ mA$
V_{CEsat} (mV)
300
200
100
0
typ
typ
2N3553;2N3375
2N3632
25
75
125
175
T_j (°C)

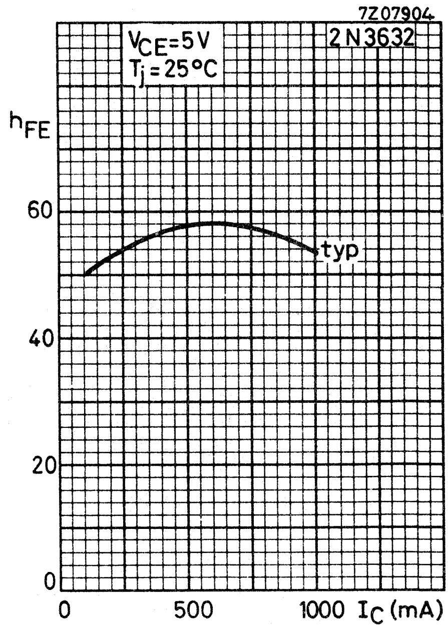

7Z07892
$V_{CE} = 5\ V$
$T_j = 25\ °C$
2N3553
2N3375
I_C (mA)
400
300
200
100
0
typ
0
0.5
1
V_{BE} (V)

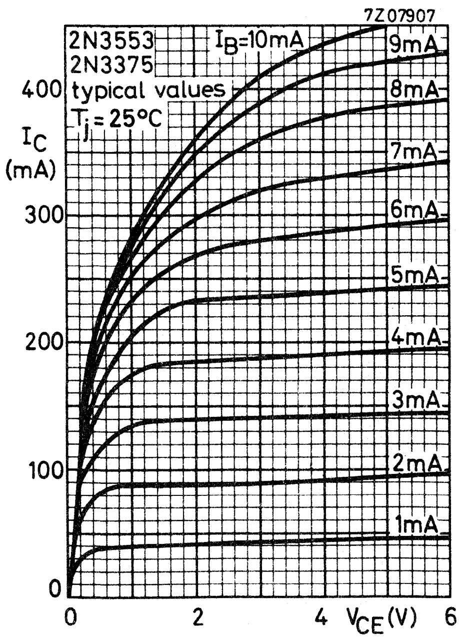

7Z07893
$V_{CE} = 5\ V$
$T_j = 25\ °C$
2N3632
I_C (mA)
800
600
400
200
0
typ
0
0.5
1
V_{BE} (V)

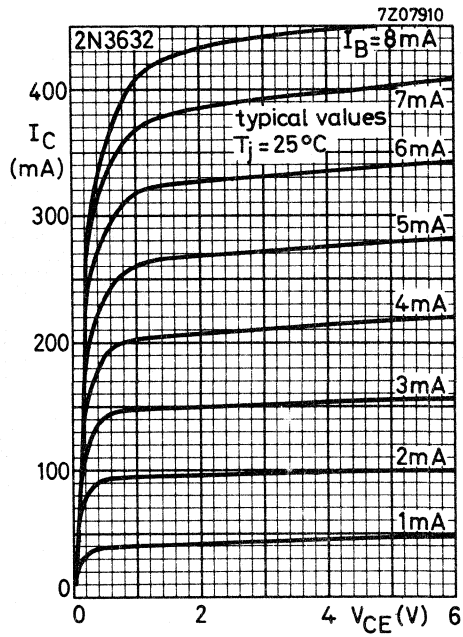

7Z07902
2N3553
2N3375
base current versus
collector current
V_{CE}=5V
T_j=25 °C
I_C
(mA)
1000
100
10
min
typ
max
0.1
1
10
I_B (mA)
100

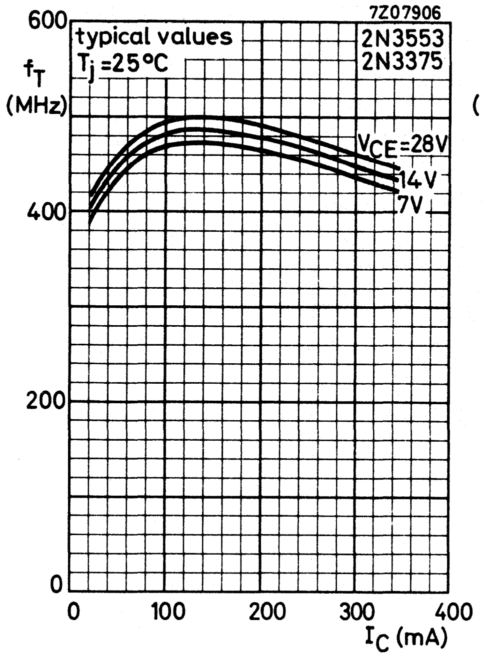

7Z07901
2N3632
base current
versus collector
current
V_{CE}=5V
T_j=25 °C
I_C
(mA)
1000
100
10
min
typ
max
1
10
100
I_B (mA)
1000

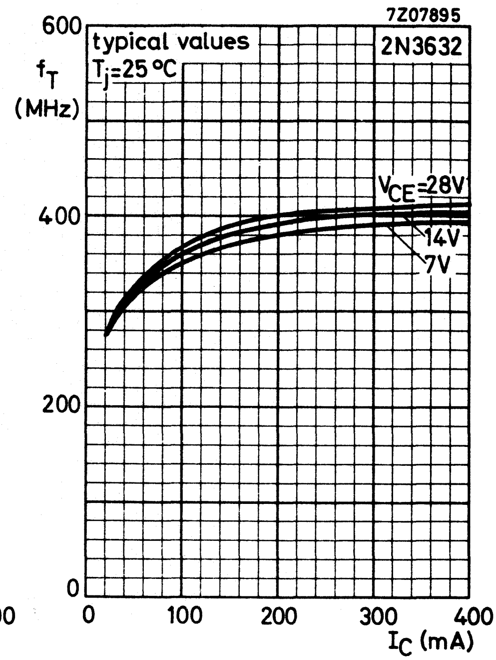

7Z07899
V_{CE} = 5 V
T_j = 25 °C
2N3553
2N3375
h_{FE}
60
40
20
0
typ
0
200
400
I_C (mA)
600

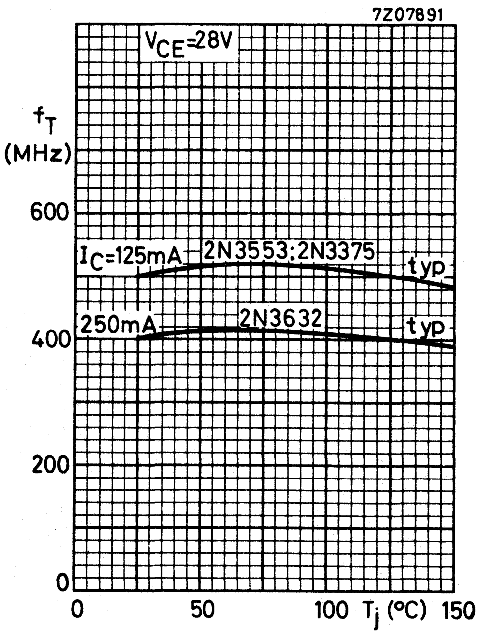

7Z07904
V_{CE} = 5 V
T_j = 25 °C
2N3632
h_{FE}
60
40
20
0
typ
0
500
1000
I_C (mA)

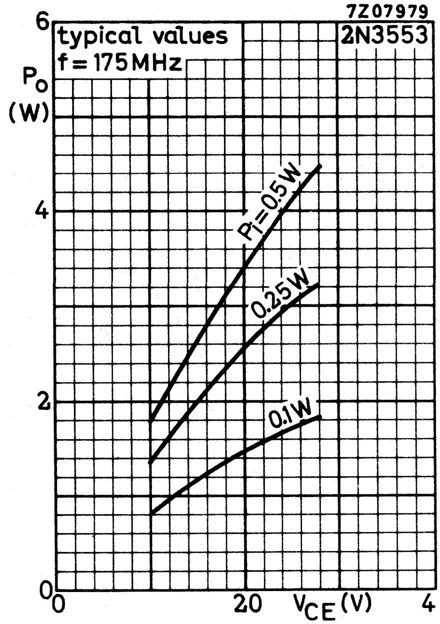

7Z07907
2N3553
2N3375
typical values
T_j = 25 °C
I_B = 10 mA
9mA
8mA
7mA
6mA
5mA
4mA
3mA
2mA
1mA
400
I_C (mA)
300
200
100
0
0
2
4
V_{CE} (V)
6

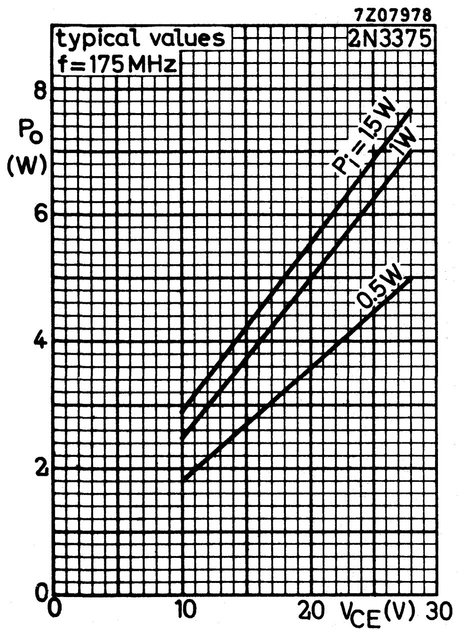

7Z07910
2N3632
I_B = 8 mA
7mA
typical values
T_j = 25 °C
6mA
5mA
4mA
3mA
2mA
1mA
400
I_C (mA)
300
200
100
0
0
2
4
V_{CE} (V)
6

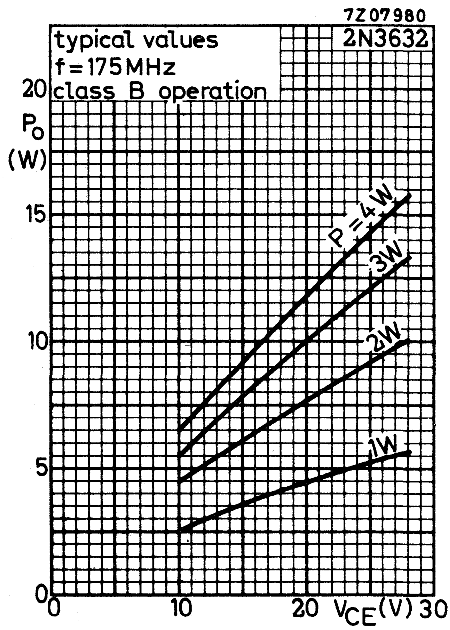

7Z07906
typical values
T_j = 25 °C
2N3553
2N3375
f_T (MHz)
600
400
200
0
V_{CE} = 28V
14V
7V
0
100
200
300
400
I_C (mA)


7Z07895
typical values
T_j = 25 °C
2N3632
f_T (MHz)
600
400
200
0
V_{CE} = 28V
14V
7V
0
100
200
300
400
I_C (mA)


7Z07891
V_{CE} = 28V
f_T (MHz)
600
400
200
0
I_C = 125mA
2N3553; 2N3375
typ
250mA
2N3632
typ
0
50
100
T_j (°C)
150


7Z07979
typical values
f = 175 MHz
2N3553
P_o
(W)
P_i = 0.5 W
0.25 W
0.1 W
V_{CE} (V)
0
2
4
6
0
20
4


7Z07978
typical values
f = 175 MHz
2N3375
P_o
(W)
P_i = 1.5 W
1 W
0.5 W
V_{CE} (V)
0
2
4
6
8
0
10
20
30


7Z07980
typical values
f = 175 MHz
class B operation
2N3632
P_o
(W)
P_i = 4 W
3 W
2 W
1 W
V_{CE} (V)
0
5
10
15
20
0
10
20
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

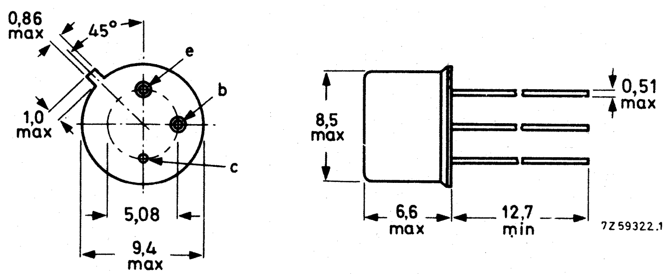
R.F. performance

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-39/1; 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

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

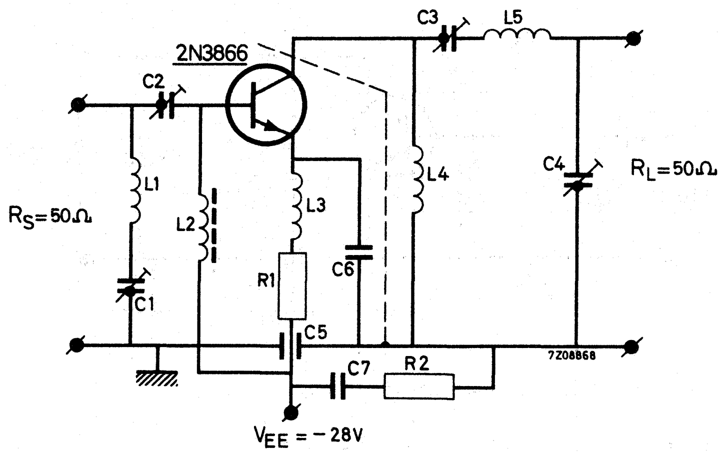
R.F. performance at T_{mb} = 25 °C

	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)

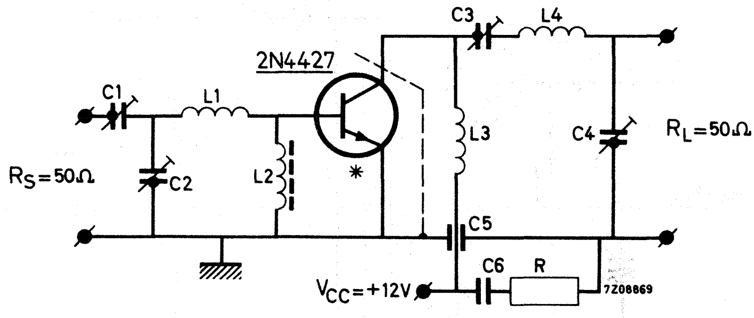


C1 = C2 = C3 =	4 to 29 pF	air trimmer
C4 =	4 to 14 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 pF	
C7 =	12 nF	
R1 =	5.6 Ω	
R2 =	10 Ω	

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)

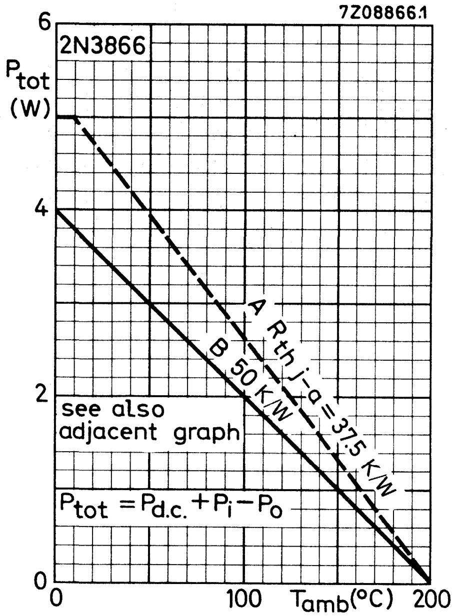
Test circuit II **(with the 2N4427 at f = 175 MHz)**

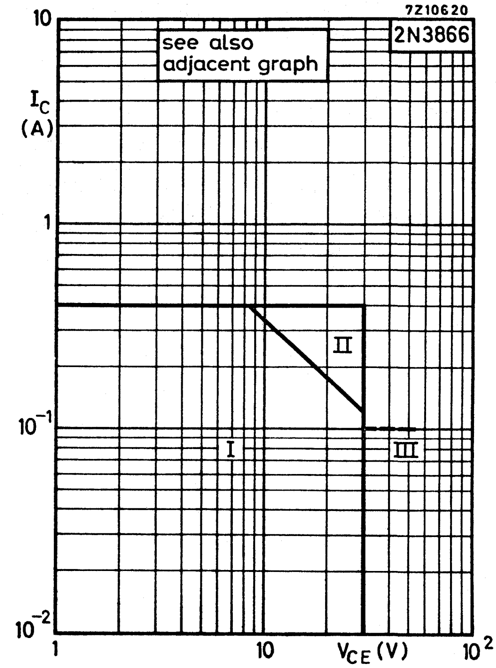


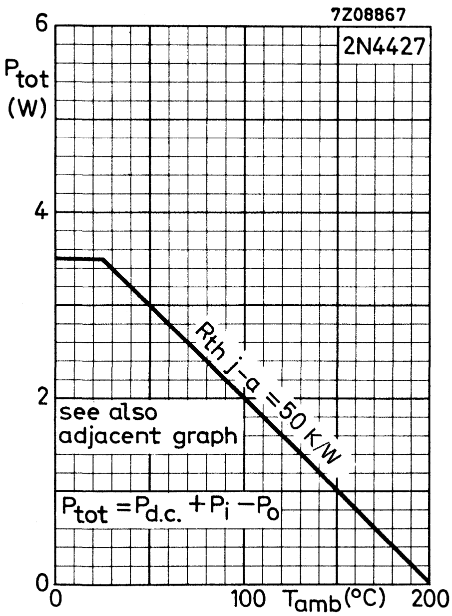
*) The length of the external emitter wire is 1.6 mm

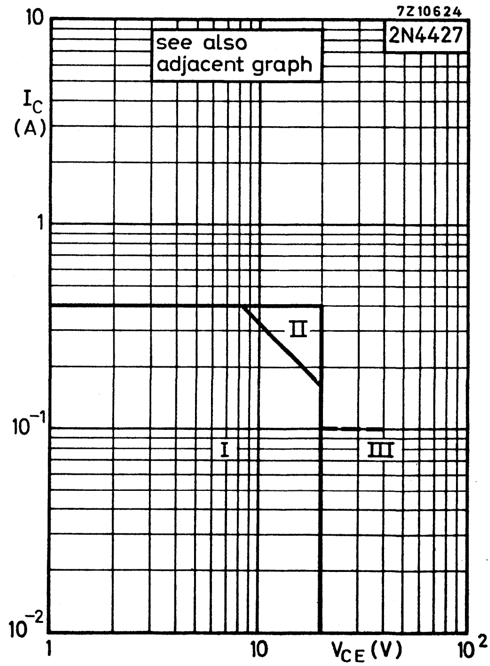
C1 = C2 = C3 = C4 =	4 to 29 pF	air trimmer
C5 =	1 nF	feed through
C6 =	12 nF	
R =	10 Ω	

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 K/W
B 50 K/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 K/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

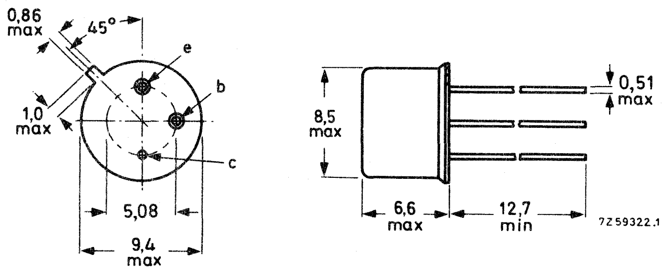
type number	P_o (W)	P_i (W)	η (%)
2N3924	4	< 1	> 70
2N3926	7	< 2	> 70
2N3927	12	< 4	> 80

MECHANICAL DATA

Dimensions in mm

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

2N3924

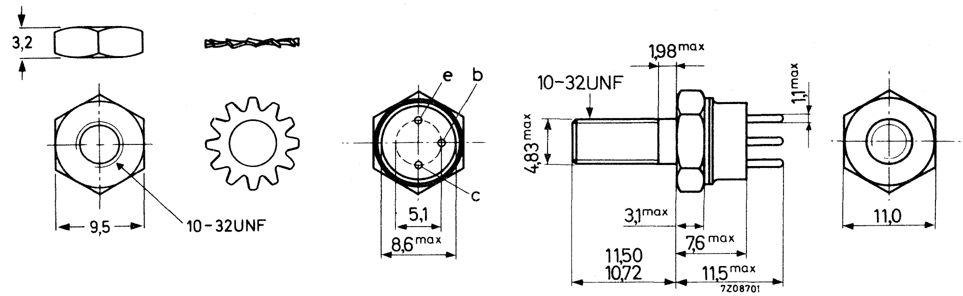


Maximum lead diameter is guaranteed only for 12,7 mm.
Accessories: 56245 (distance disc).

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.

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						
$I_C \leqslant 400$ mA; $-V_{BE} = 1{,}5$ V	V_{CEX}	max.		36		V
(open base); $I_C \leqslant 400$ 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 °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	$R_{th\ j\text{-}mb}$	=	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

			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

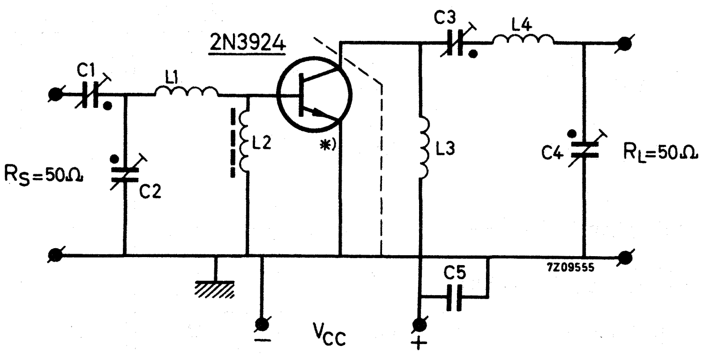
	P_o (W)	P_i (W)	I_C (mA)	η %	Test circuit
2N3924	4	< 1	< 420	> 70	I
2N3926	7	< 2	< 740	> 70	II
2N3927	12	< 4	< 1100	> 80	II

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

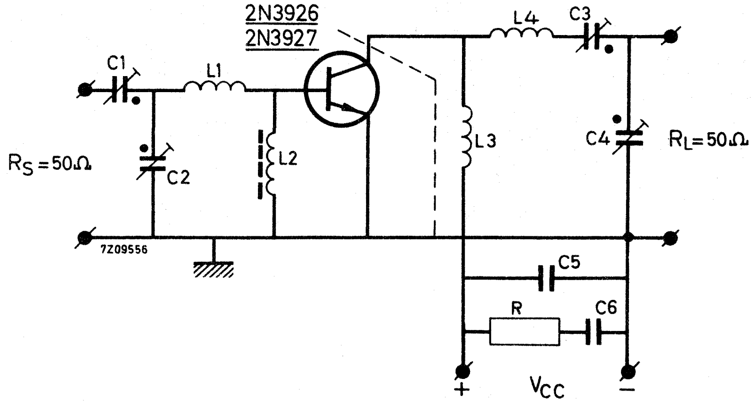
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 36640)

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

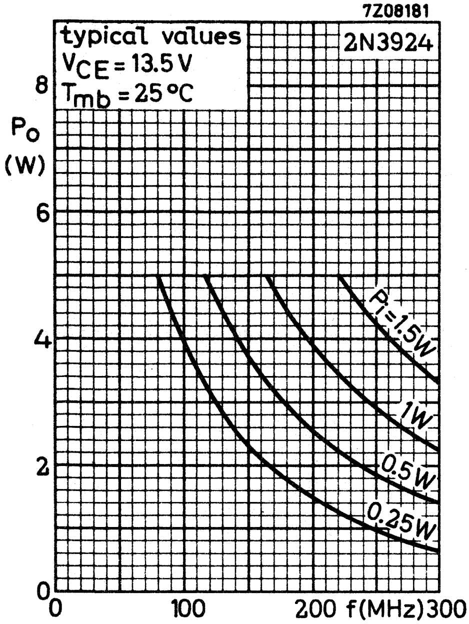
L1 = 1 turn Cu wire (1.0 mm); int. diam. 10 mm; leads 2 x 10 mm

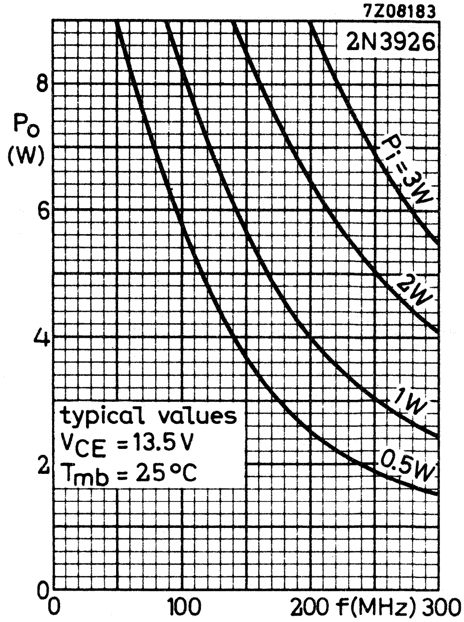
L2 = Ferroxcube choke coil. Z (at f = 175 MHz) = 550 Ω ± 20% (code number 4312 020 **36640)**

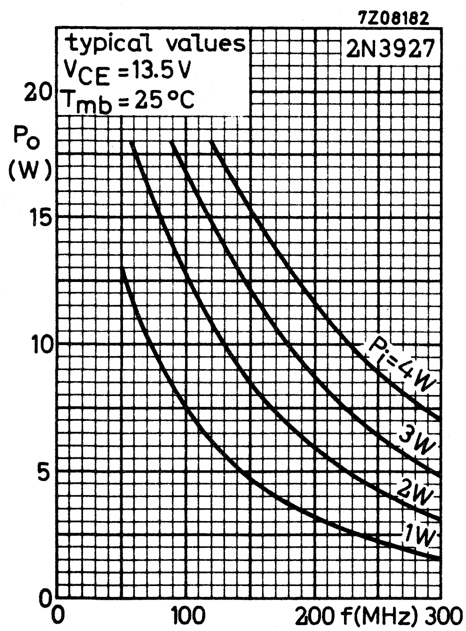
L3 = 15 turns closely wound enamelled Cu wire (0.7 mm); int. diam. 4 mm

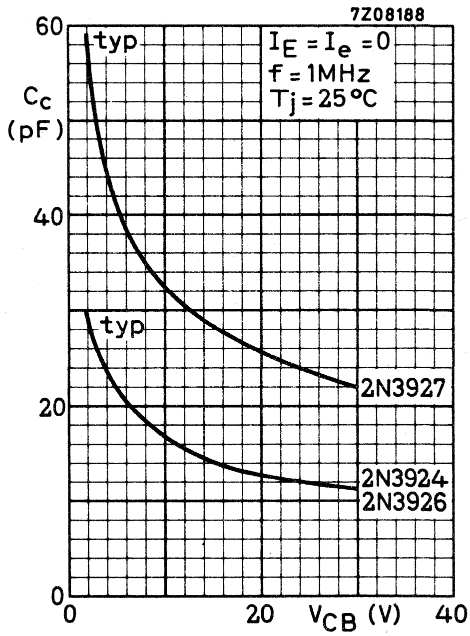
L4 = 2 turns closely wound enamelled Cu wire (1.5 mm); int. diam. 8.5 mm; leads 2 x 20 mm

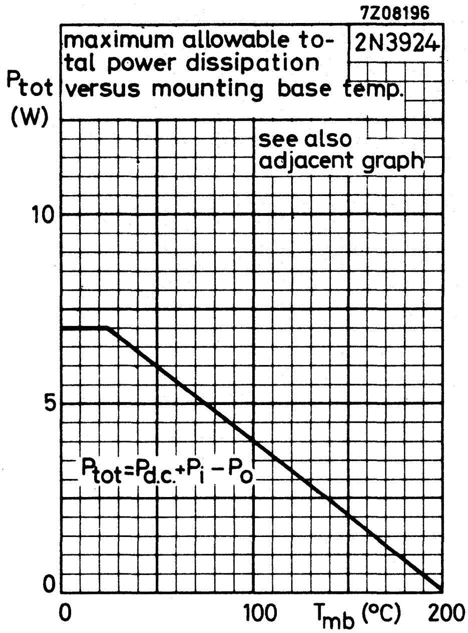
R = 10 Ω carbon

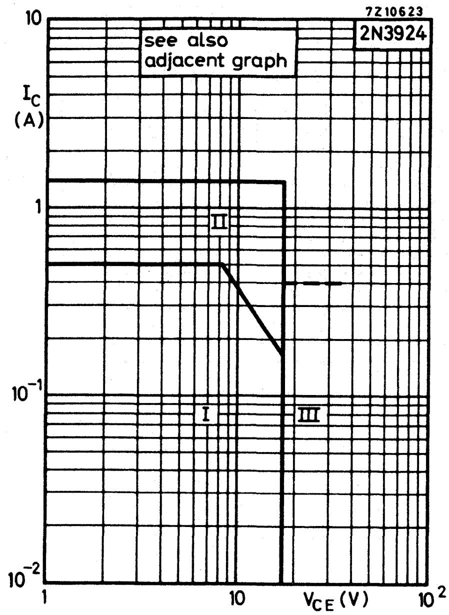

7Z08181
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3924
P_o (W)
P_i = 1.5W
1W
0.5W
0.25W
f(MHz)
0
100
200
300
2
4
6
8

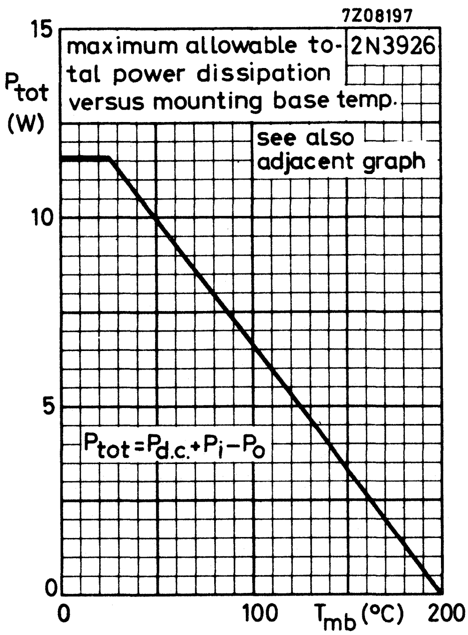

7Z08183
2N3926
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
P_o (W)
P_i = 3W
2W
1W
0.5W
f(MHz)
0
100
200
300
2
4
6
8

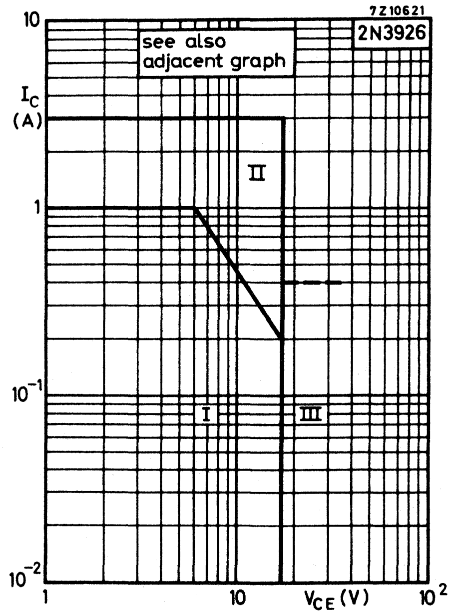

7Z08182
typical values
V_{CE} = 13.5 V
T_{mb} = 25 °C
2N3927
P_o (W)
P_i = 4W
3W
2W
1W
f(MHz)
0
100
200
300
5
10
15
20

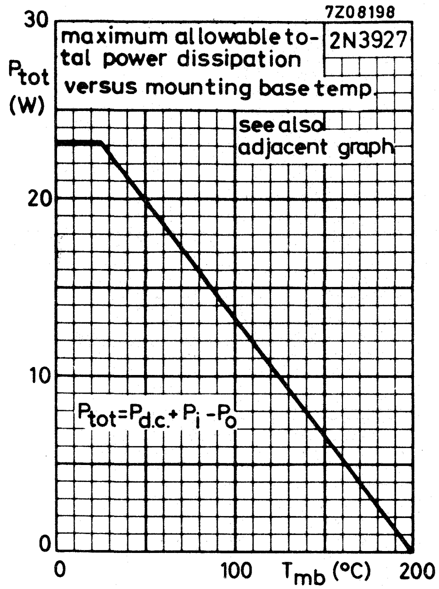

7Z08188
C_c (pF)
$I_E = I_e = 0$
f = 1MHz
T_j = 25 °C
typ
typ
2N3927
2N3924
2N3926
V_{CB} (V)
0
20
40
60

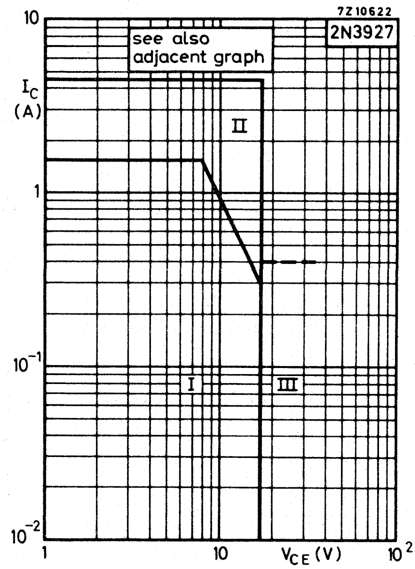

7Z08196
maximum allowable total power dissipation versus mounting base temp.
2N3924
P_{tot} (W)
see also adjacent graph
10
5
0
$P_{tot} = P_{d.c.} + P_i - P_o$
0
100
T_{mb} (°C)
200


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
15
10
5
0
$P_{tot} = P_{d.c.} + P_i - P_o$
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

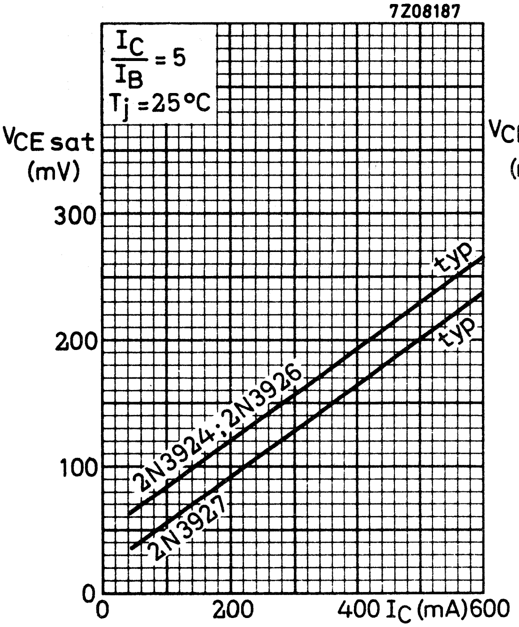


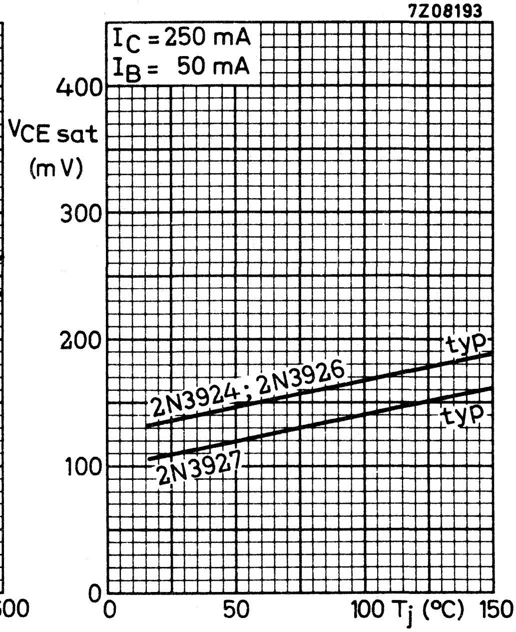


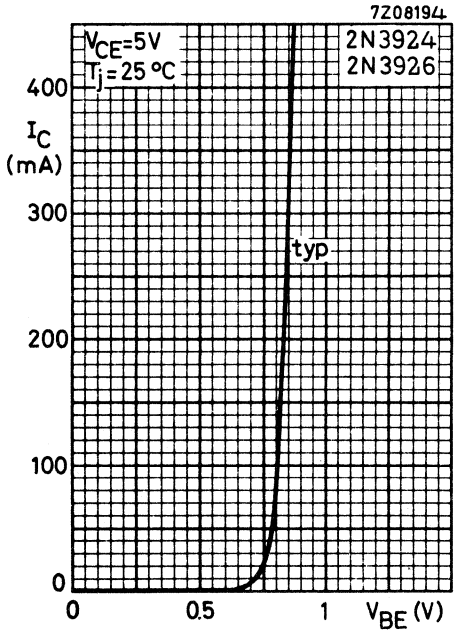
I Region of permissible operation under all base-emitter conditions and at all frequencies, including d.c.

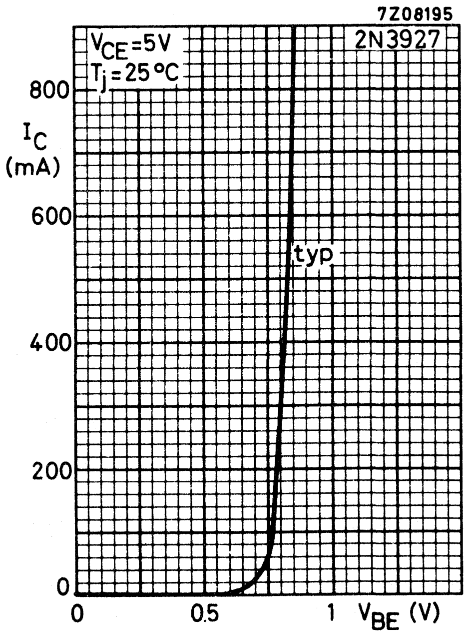
II Additional region of operation at $f \geq 1$ MHz.
Care must be taken to reduce the d.c. adjustment to region I before removing the a.c. signal. This may be achieved by an appropriate bias in class A, B or C.

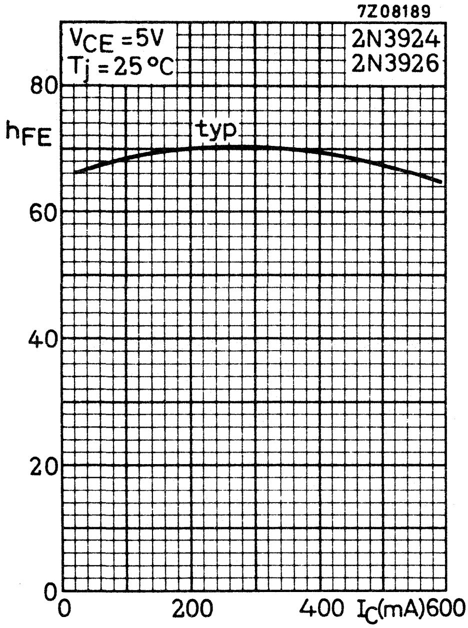
III Operating during switching off in this region is allowed, provided the transistor is cut-off with $-V_{BB} \leq 1.5$ V and $R_{BE} \geq 33\ \Omega$, $I_C \leq 400$ mA and the transient energy does not exceed 2 mWs.

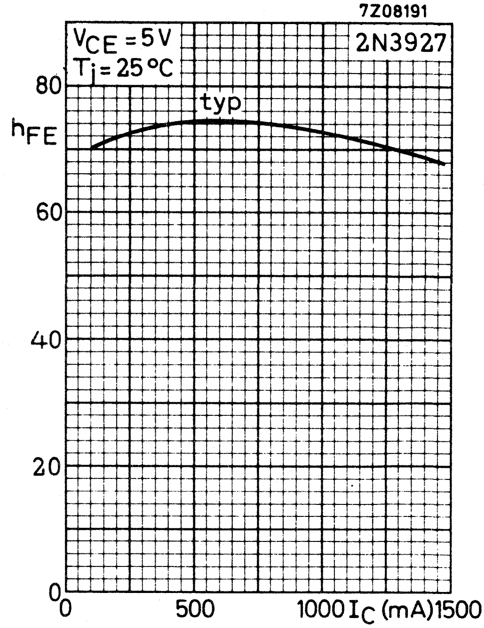

7Z08187
$\frac{I_C}{I_B} = 5$
$T_j = 25\,^{\circ}C$
$V_{CE\,sat}$ (mV)
0
100
200
300
0
200
400
I_C (mA)
600
typ
typ
2N3924; 2N3926
2N3927

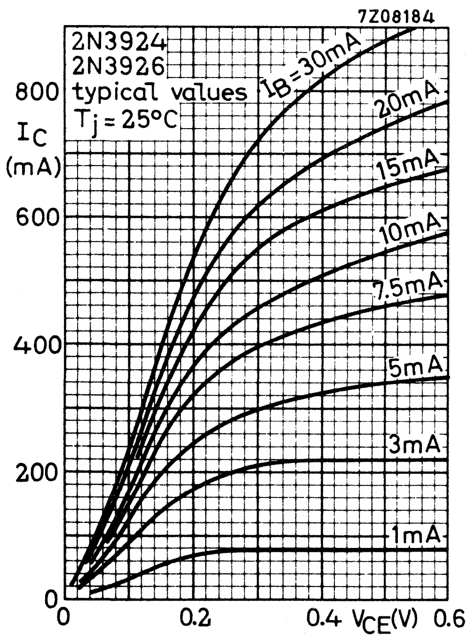

7Z08193
$I_C = 250$ mA
$I_B = 50$ mA
$V_{CE\,sat}$ (mV)
0
100
200
300
400
0
50
100
T_j (°C)
150
typ
typ
2N3924; 2N3926
2N3927

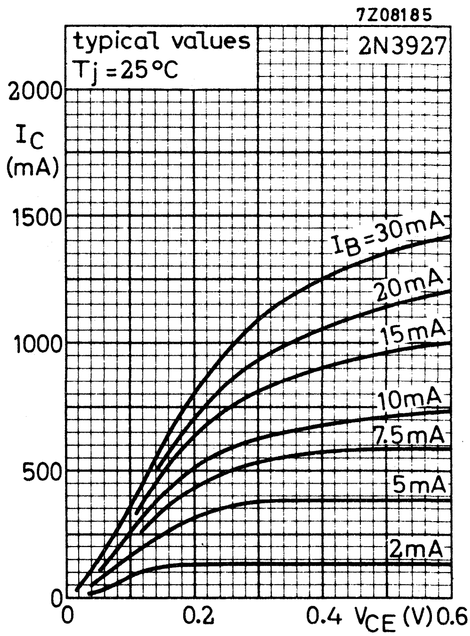

7Z08194
$V_{CE} = 5$ V
$T_j = 25\,^{\circ}C$
2N3924
2N3926
I_C (mA)
0
100
200
300
400
0
0.5
1
V_{BE} (V)
typ

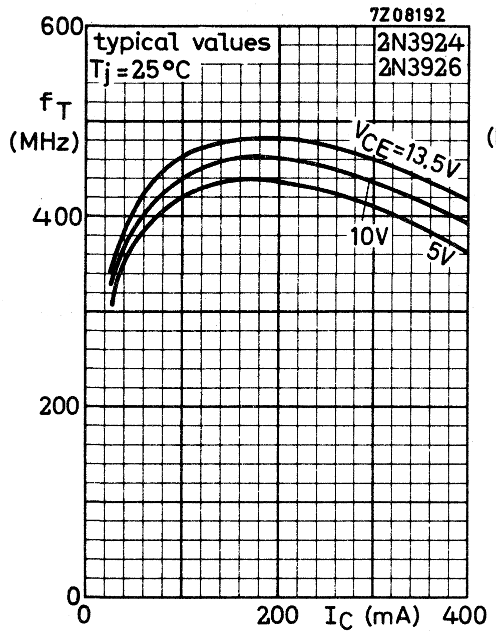

7Z08195
$V_{CE} = 5$ V
$T_j = 25\,^{\circ}C$
2N3927
I_C (mA)
0
200
400
600
800
0
0.5
1
V_{BE} (V)
typ

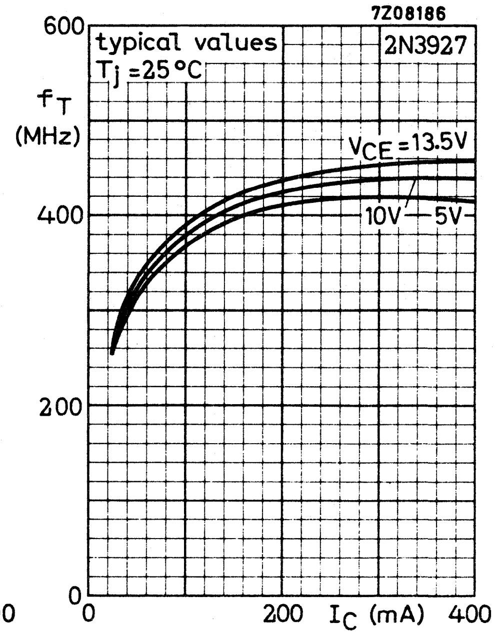

7Z08189
V_{CE} = 5V
T_j = 25 °C
2N3924
2N3926
h_{FE}
typ
80
60
40
20
0
0
200
400
I_C(mA)600

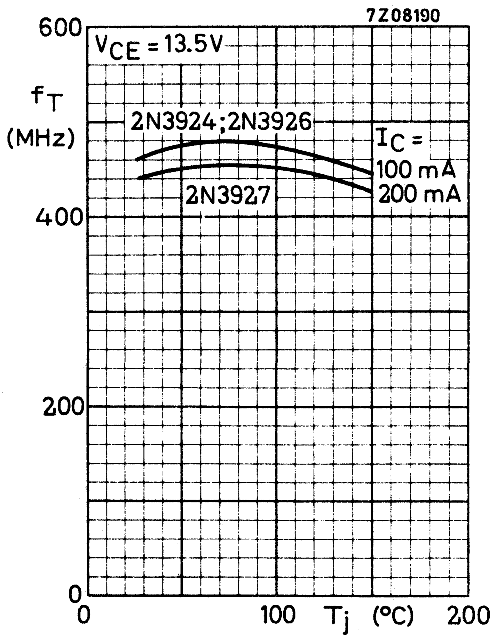

7Z08191
V_{CE} = 5 V
T_j = 25 °C
2N3927
h_{FE}
typ
80
60
40
20
0
0
500
1000 I_C (mA) 1500


7Z08184
2N3924
2N3926
typical values
T_j = 25°C
I_B=30mA
20mA
15mA
10mA
7.5mA
5mA
3mA
1mA
I_C
(mA)
800
600
400
200
0
0
0.2
0.4 V_{CE}(V) 0.6

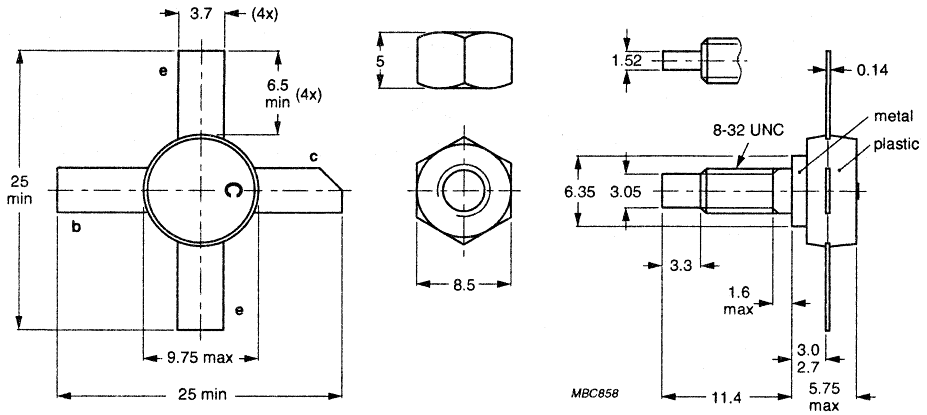

7Z08185
typical values
T_j = 25 °C
2N3927
I_B=30mA
20mA
15mA
10mA
7.5mA
5mA
2mA
I_C
(mA)
2000
1500
1000
500
0
0
0.2
0.4 V_{CE} (V) 0.6


7Z08192
typical values
$T_j = 25\,°C$
2N3924
2N3926
f_T
(MHz)
$V_{CE} = 13.5V$
10V
5V
600
400
200
0
0
200
I_C (mA)
400


7Z08186
typical values
$T_j = 25\,°C$
2N3927
f_T
(MHz)
$V_{CE} = 13.5V$
10V
5V
600
400
200
0
0
200
I_C (mA)
400


7Z08190
$V_{CE} = 13.5V$
f_T
(MHz)
2N3924;2N3926
2N3927
I_C =
100 mA
200 mA
600
400
200
0
0
100
T_j (°C)
200

ENVELOPES



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

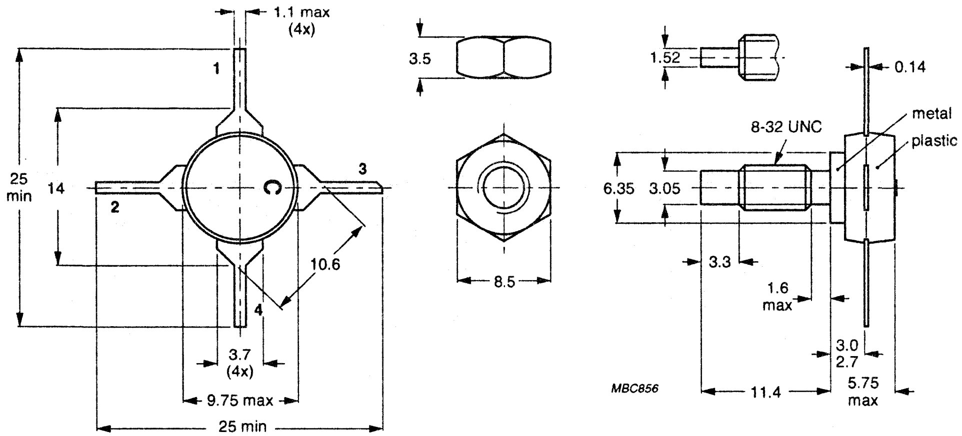
Diameter of clearance hole in heatsink: max. 4.2 mm.

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.

Fig.1 SOT48/2.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

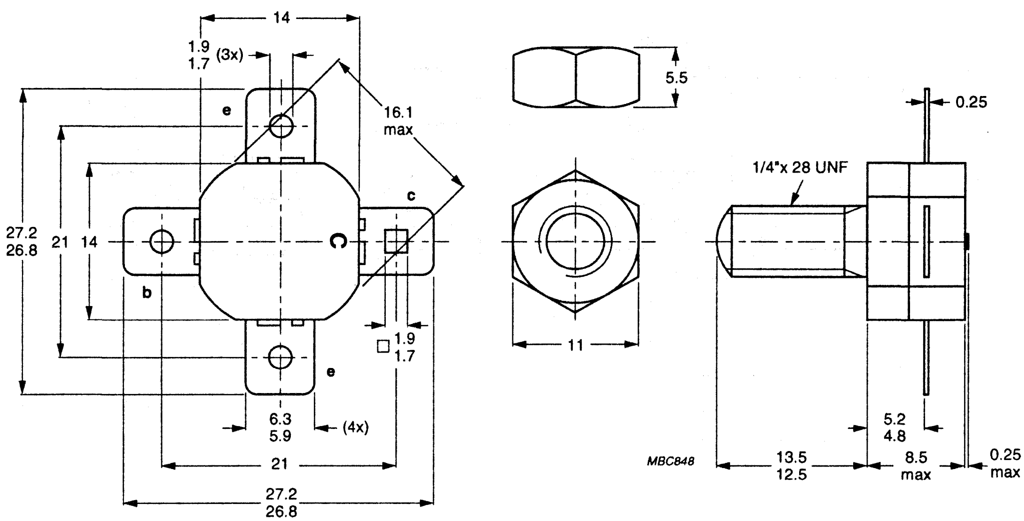
Diameter of clearance hole in heatsink: max. 4.2 mm.

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.

Fig.2 SOT48/3.



Dimensions in mm.

Torque on nut: min. 2.3 Nm; max. 2.7 Nm.

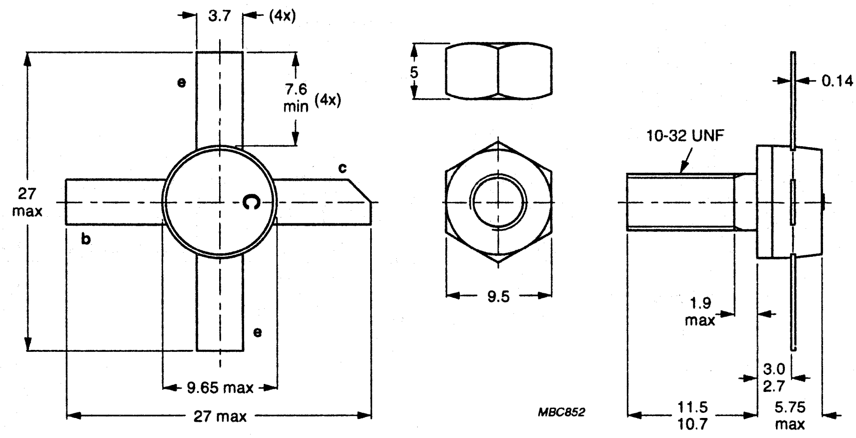
Diameter of clearance hole in heatsink: max. 6.4 mm.

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.

Fig.3 SOT55.



Dimensions in mm.

Torque on nut: min. 1.5 Nm; max. 1.7 Nm.

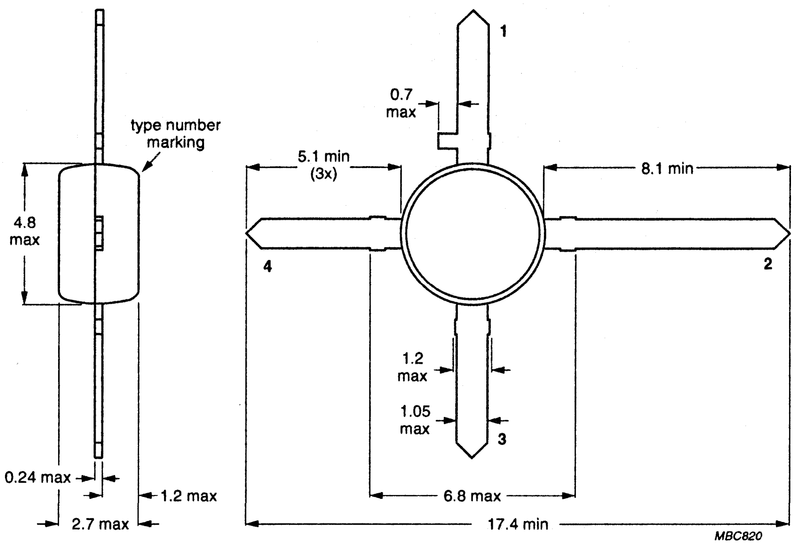
Diameter of clearance hole in heatsink: max. 4.9 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

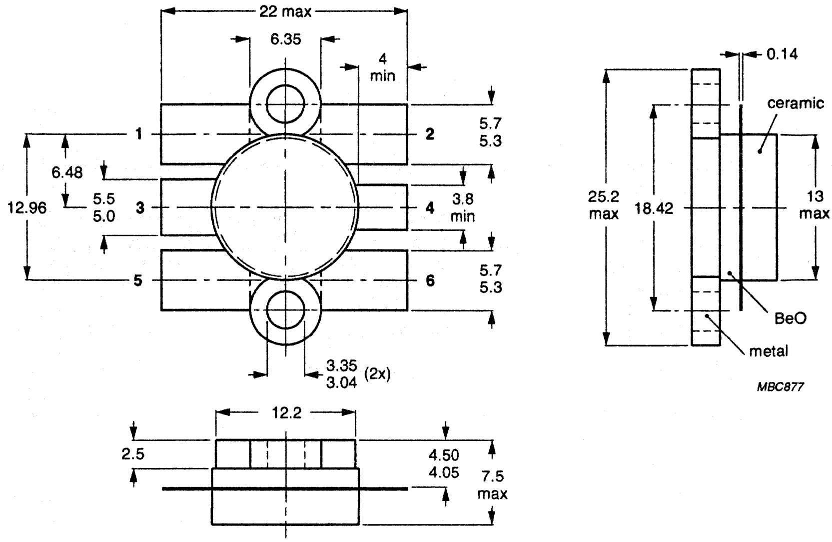
When locking is required an adhesive is preferred instead of a lock washer.

Fig.4 SOT56.



Dimensions in mm.

Fig.5 SOT103.



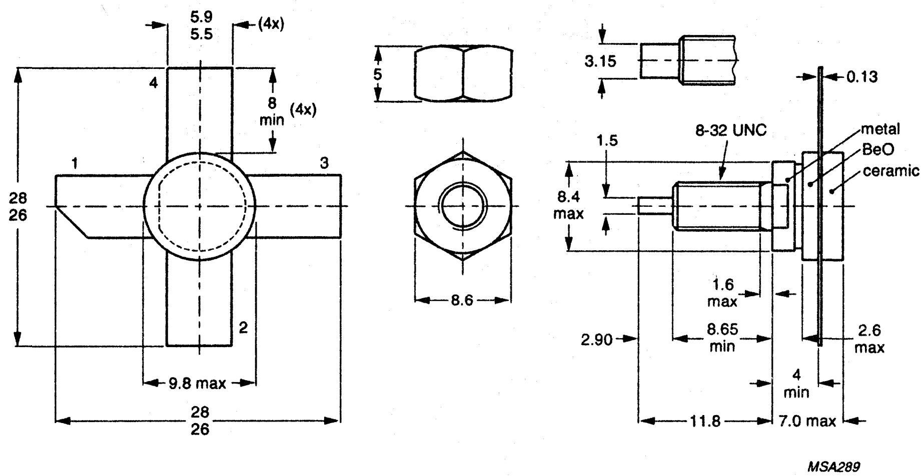
Dimensions in mm.

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.

Fig.6 SOT119.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

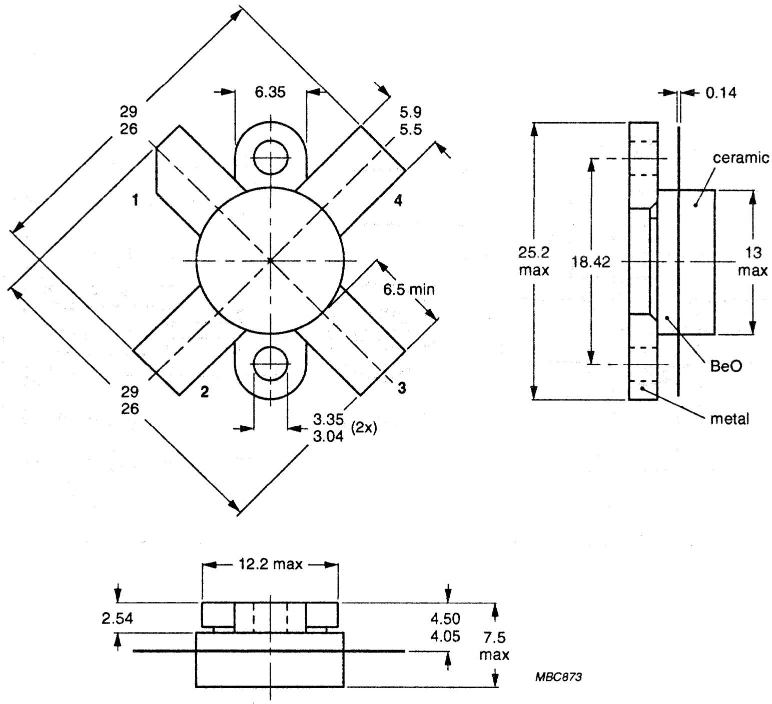
Diameter of clearance hole in heatsink: max. 4.2 mm.

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.

Fig.7 SOT120.



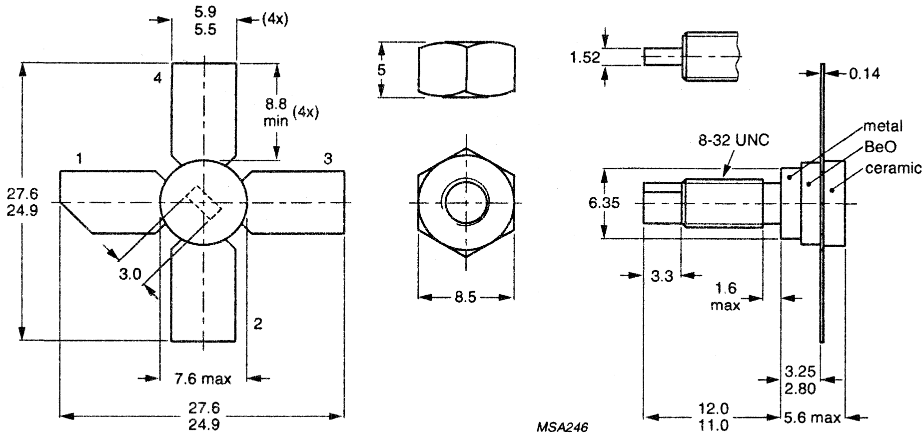
Dimensions in mm.

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.

Fig.8 SOT121.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

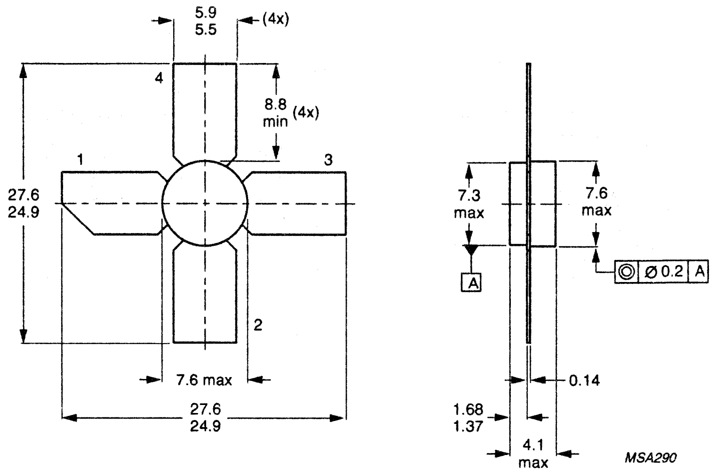
Diameter of clearance hole in heatsink: max. 4.2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

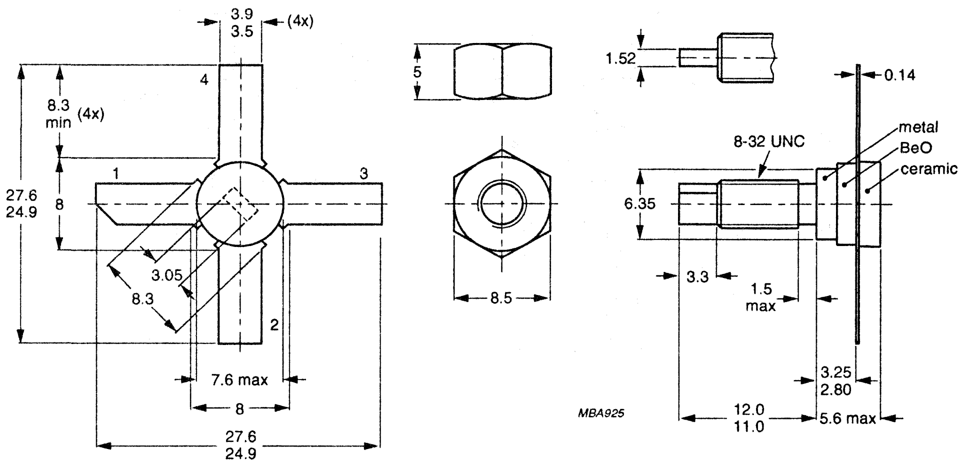
When locking is required an adhesive is preferred instead of a lock washer.

Fig.9 SOT122A.



Dimensions in mm.

Fig.10 SOT122D.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

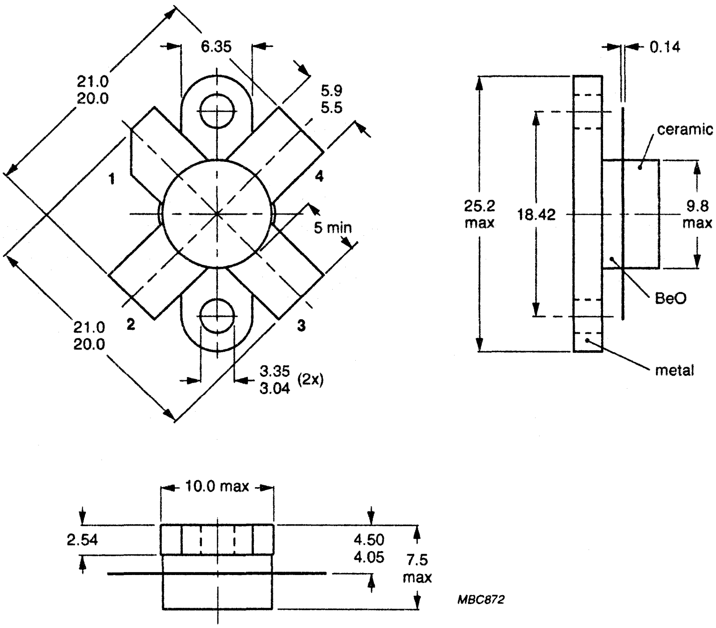
Diameter of clearance hole in heatsink: max. 4.2 mm.

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.

Fig.11 SOT122F.



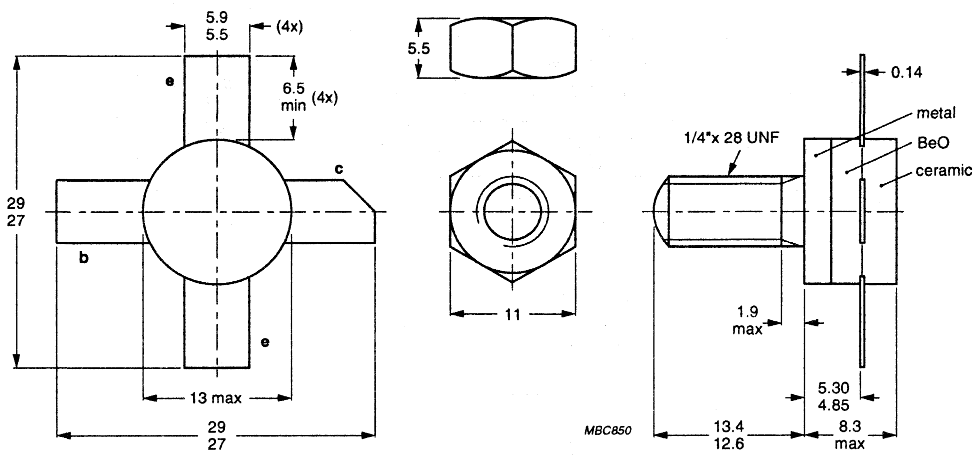
Dimensions in mm.

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.

Fig.12 SOT123.



Dimensions in mm.

Torque on nut: min. 2.3 Nm; max. 2.7 Nm.

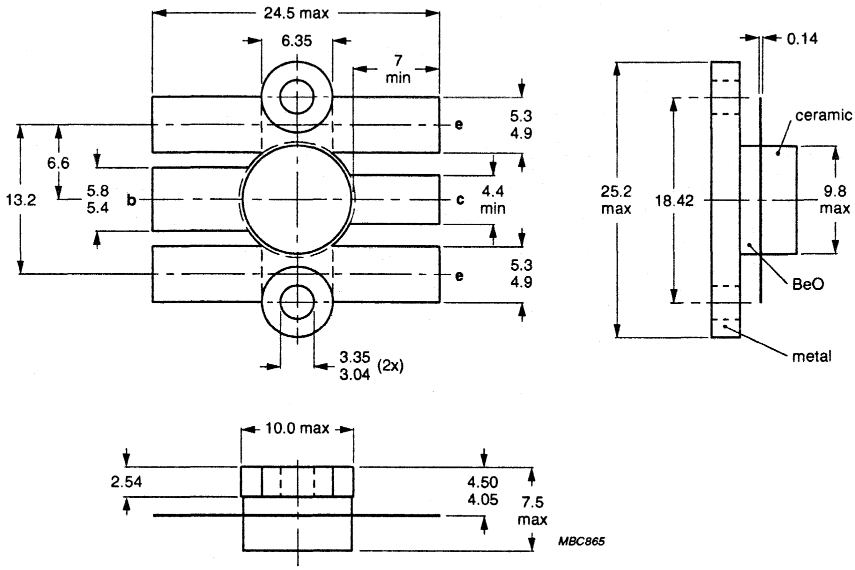
Diameter of clearance hole in heatsink: max. 6.4 mm.

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.

Fig.13 SOT147.



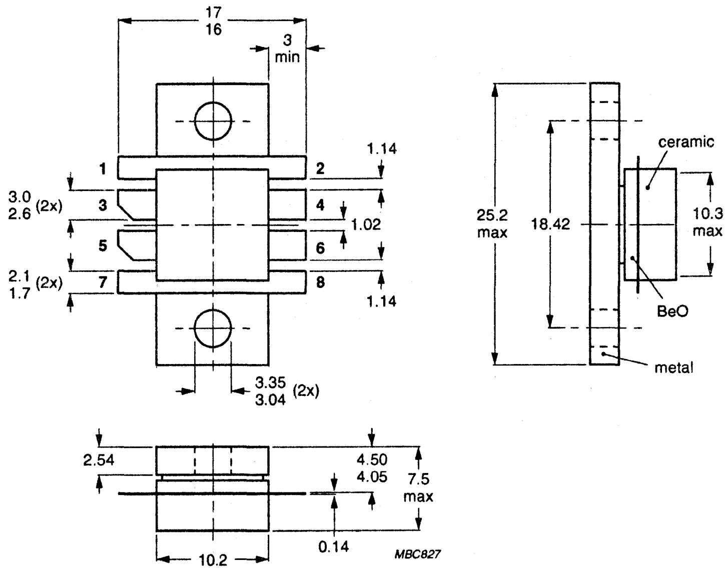
Dimensions in mm.

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.

Fig.14 SOT160.



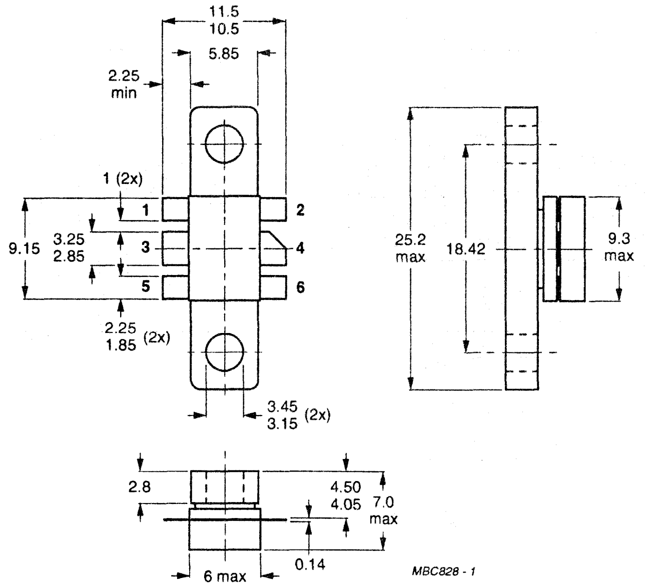
Dimensions in mm.

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.

Fig.15 SOT161.



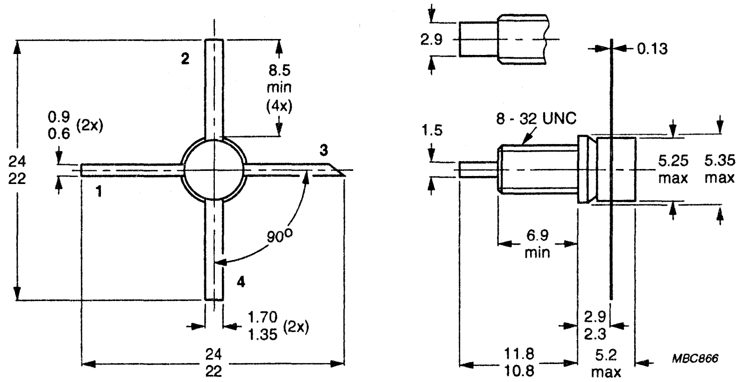
Dimensions in mm.

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.

Fig.16 SOT171.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

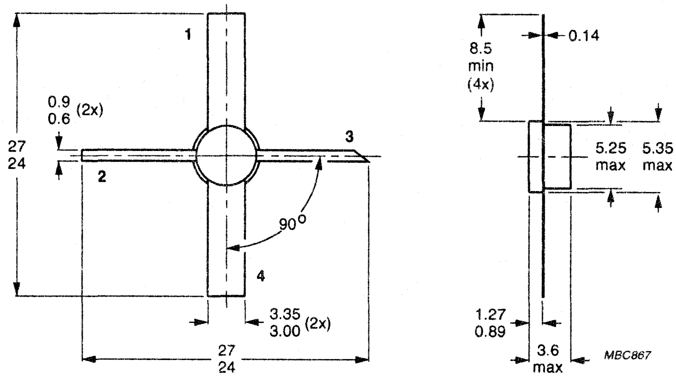
Diameter of clearance hole in heatsink: max. 4.2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

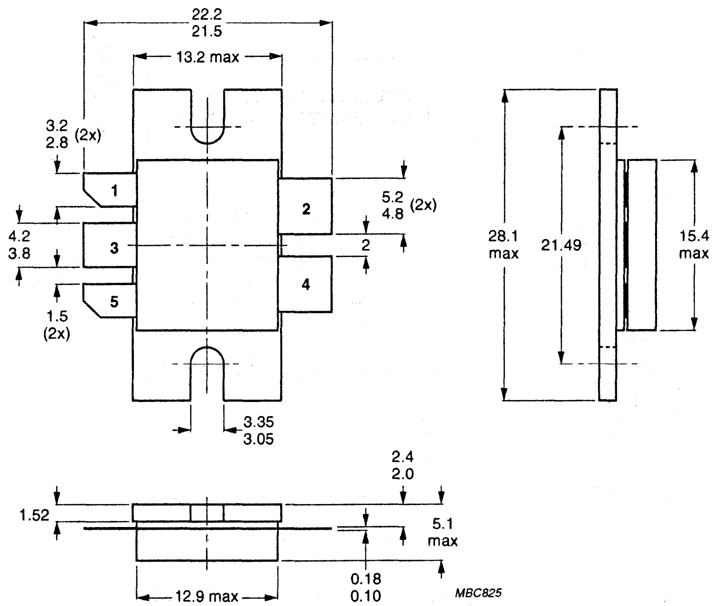
When locking is required an adhesive is preferred instead of a lock washer.

Fig.17 SOT172A1.



Dimensions in mm.

Fig.18 SOT172D.



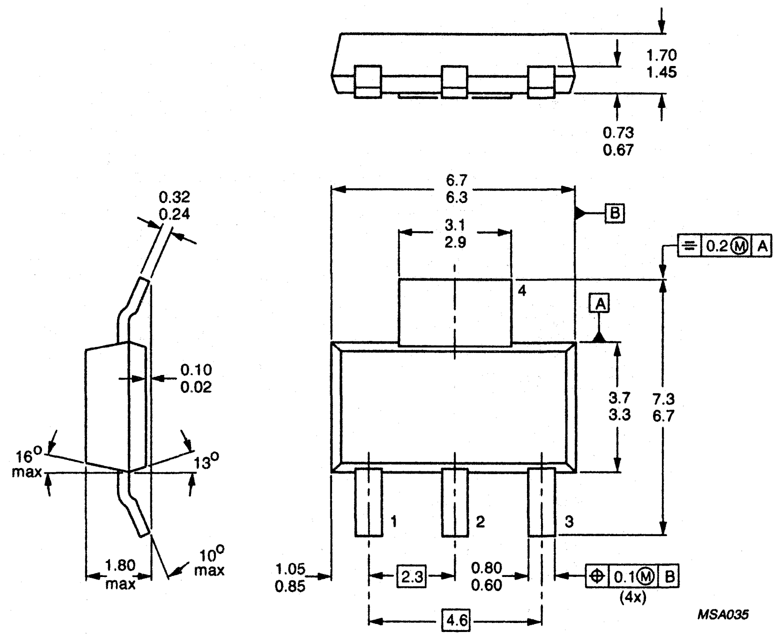
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

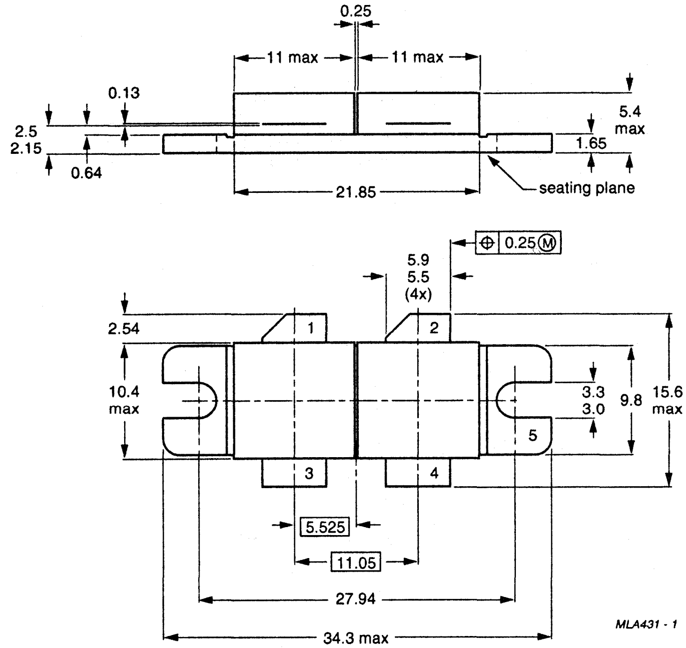
Heatsink compound must be applied sparingly and evenly distributed.

Fig.19 SOT179.



Dimensions in mm.

Fig.20 SOT223.



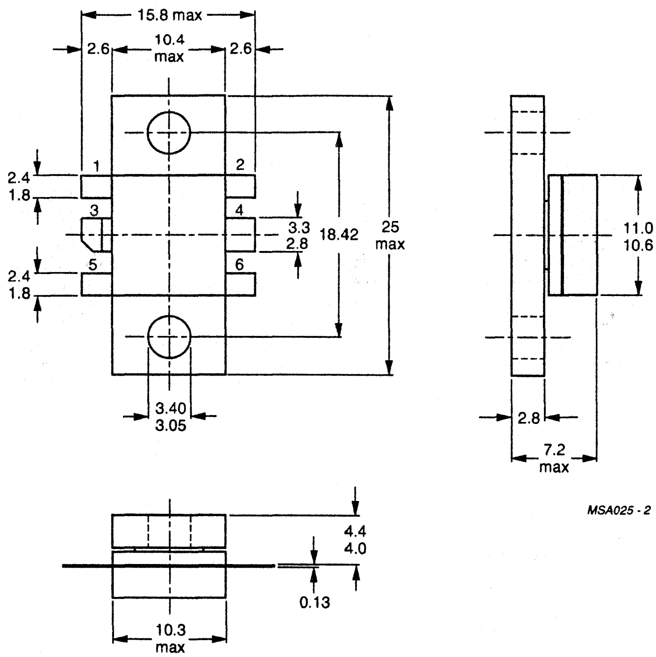
Dimensions in mm.

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.

Fig.21 SOT262A2.



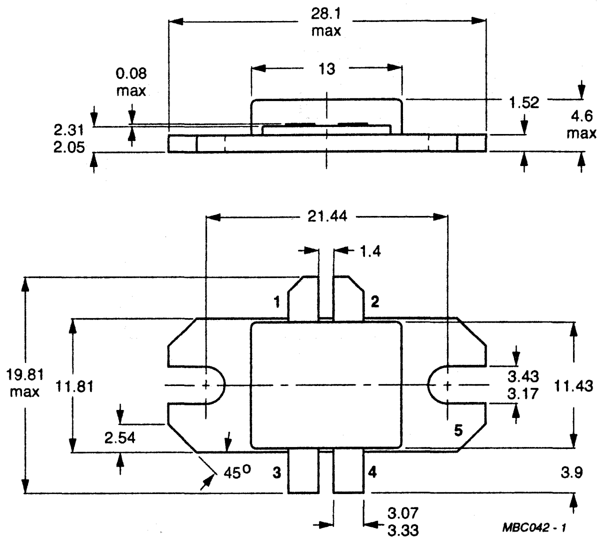
Dimensions in mm.

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.

Fig.22 SOT273.



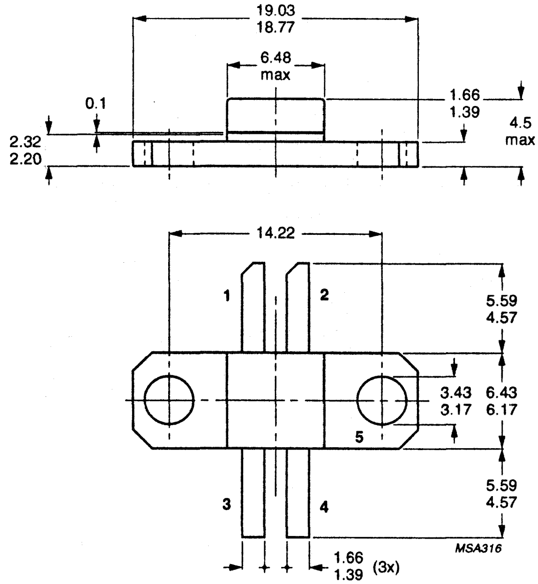
Dimensions in mm.

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.

Fig.23 SOT289.



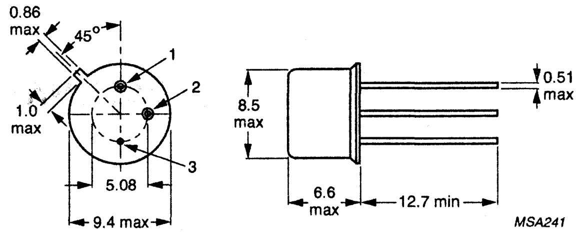
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

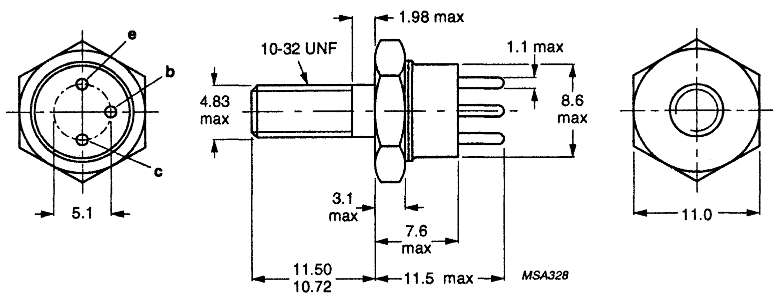
Heatsink compound must be applied sparingly and evenly distributed.

Fig.24 SOT324.



Dimensions in mm.

Fig.25 TO-39/1; TO-39/3.



The top pins should not be bent.

Dimensions in mm.

Torque on nut: min. 0.8 Nm; max. 1.7 Nm.

Diameter of clearance hole in heatsink: 4.8 mm. to 5.2 mm.

Fig.26 TO-60 (SOT16).

DATA HANDBOOK SYSTEM

Data handbook system

DATA HANDBOOK SYSTEM

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Our data handbook titles are listed here.

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Book	*Title*
IC01	Semiconductors for Radio and Audio Systems
IC02	Semiconductors for Television and Video Systems
IC03	Semiconductors for Telecom Systems
IC04	CMOS HE4000B Logic Family
IC05	Advanced Low-power Schottky (ALS) Logic Series
IC06	High-speed CMOS Logic Family
IC08	100K ECL Logic Family
IC10	Memories
IC11	General-purpose/Linear ICs
IC12	Display Drivers and Microcontroller Peripherals (planned)
IC13	Programmable Logic Devices (PLD)
IC14	8048-based 8-bit Microcontrollers
IC15	FAST TTL Logic Series
IC16	ICs for Clocks and Watches
IC18	Semiconductors for In-car Electronics and General Industrial Applications (planned)
IC19	Semiconductors for Datacom: LANs, UARTs, Multi-protocol Controllers and Fibre Optics
IC20	8051-based 8-bit Microcontrollers
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IC23	QUBIC Advanced BiCMOS Interface Logic ABT, MULTIBYTE™
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SC05	Low-frequency Power Transistors and Hybrid IC Power Modules
SC06	High-voltage and Switching NPN Power Transistors
SC07	Small-signal Field-effect Transistors
SC08a	RF Power Bipolar Transistors
SC08b	RF Power MOS Transistors
SC09	RF Power Modules
SC10	Surface Mounted Semiconductors
SC13	PowerMOS Transistors
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PC06	Circulators and Isolators

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Data handbook system

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Book	*Title*
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DC02	Monochrome Monitor Tubes and Deflection Units
DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC05	Flyback Transformers, Mains Transformers and General-purpose FXC Assemblies

Liquid crystal displays

LCD01	Liquid Crystal Displays and Driver ICs for LCDs

Magnetic products

MA01	Soft Ferrites
MA03	Piezoelectric Ceramics Specialty Ferrites

Passive components

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PA02	Varistors, Thermistors and Sensors
PA03	Potentiometers and Switches
PA04	Variable Capacitors
PA05	Film Capacitors
PA06	Ceramic Capacitors
PA07	Quartz Crystals for Special and Industrial Applications
PA08	Fixed Resistors
PA10	Quartz Crystals for Automotive and Standard Applications
PA11	Quartz Oscillators

Professional components

PC04	Photo Multipliers
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PC07	Vidicon and Newvicon Camera Tubes and Deflection Units
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PC12	Electron Multipliers

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