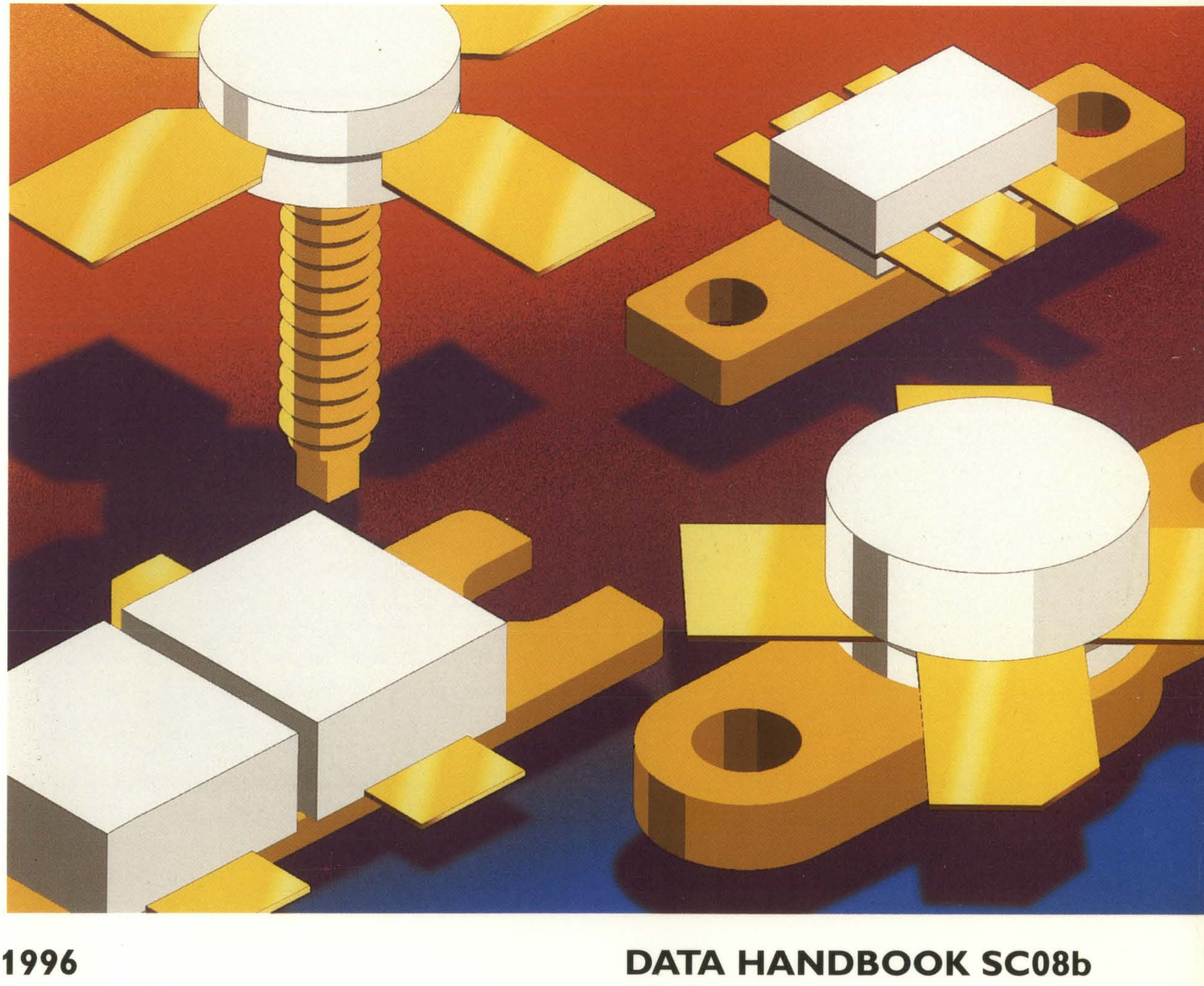
DISCRETE SEMICONDUCTORS

RF Power Transistors for UHF



1996

DATA HANDBOOK SC08b

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 Transistors for UHF

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.

INDEX

ALPHANUMERIC INDEX

New types are shown in bold.

SELECTION GUIDE

INTRODUCTION

The following tables represent our complete range of bipolar and MOS transmitting transistors, grouped according to the main RF power application area. The data in each table is subsequently divided into different voltage groups and sorted within each voltage group in order of increasing power.

BIPOLAR: 400 to 512 MHz

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
Class-B; 7.5 V; portable					
BLT53	8	7.5	6.8	SOT122D	184
BLT50	1.2	7.5	11.2	SOT223	173
Class-B; 12.5 V; car mobile					
2N4427	0.4	12.5	>10	SOT5 (TO39/1)	750
BLU56	1	12.5	>12	SOT223	299
BLX65	2	12.5	>6	SOT5 (TO39/3)	641
BLX65E	2	12.5	10.6	SOT5 (TO39/3)	641
BLX65ES	2	12.5	10.6	SOT5 (TO39/1)	641
BLW79	2	12.5	>9	SOT122	593
BLU11/SL	2.5	12.5	>10	SOT122D	268
BLW80	4	12.5	15	SOT122	601
BLU99	5	12.5	>10.5	SOT122	337
BLU99/SL	5	12.5	>10.5	SOT122D	337
BLU97	7	12.5	11	SOT122	329
BLW81	10	12.5	>6	SOT122	609
BLU20/12	20	12.5	7.8	SOT119	275
BLU30/12	30	12.5	7.4	SOT119	283
BLU45/12	45	12.5	5.8	SOT119	291
BLU60/12	60	12.5	5.5	SOT119	307
Class-B; 28 V; base stations					
2N3866	1	28	>10	SOT5 (TO39/1)	750
BLW89	2	28	13.5	SOT122	617
BLW90	4	28	12.5	SOT122	625
BLX93A	7	28	9	SOT48-3	645
BLW91	10	28	10.5	SOT122	633
BLX94C	25	28	>6.5	SOT122	655
BLU60/28	60	28	>7	SOT119	315

MOS: 100 to 500 MHz

TYPE NUMBER	P_L (W)	V_{DS} (V)	G_P (dB)	PACKAGE	PAGE
Class-B; 225 to 400 MHz					
BLF242	5	28	16	SOT123	44
BLF244	15	28	17	SOT123	52
BLF245	30	28	15.5	SOT123	61
Class-B; 100 to 500 MHz					
BLF521	2	12.5	13	SOT172D	70
BLF522	5	12.5	11	SOT171	81
BLF542	5	28	16.5	SOT171	90
BLF543	10	28	15	SOT171	99
BLF544	20	28	14	SOT171	110
BLF544B	20	28	15	SOT268	121
BLF545	40	28	13	SOT268	130
BLF546	80	28	13	SOT268	139
BLF547	100	28	12	SOT262A2	148
BLF548	150	28	11	SOT262A2	157

BIPOLAR: 900 to 960 MHz

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
Class-B; 7.5 V; portable					
BLT80	0.8	7.5	8	SOT223	222
BLT81	1.2	7.5	8	SOT223	229
BLT91/SL	1.5	7.5	7	SOT172D	245
BLT92/SL	3	7.5	8.5	SOT122D	253
BLT93/SL	6	7.5	7	SOT122D	261
Class-B; 9.6 V; car mobile					
BLV90	0.75	9.6	7.9	SOT172A1	349
BLV91	1.5	9.6	6.6	SOT172A1	357
BLV91/SL	1.5	9.6	6.6	SOT172D	357
BLV92	3	9.6	7.3	SOT171	365
BLV93	6	9.6	6	SOT171	373
Class-B; 12.5 V; car mobile					
BLU86	1	12.5	7.7	SOT223	322
BLV90	1	12.5	9	SOT172A1	349
BLV91	2	12.5	7.8	SOT172A1	357
BLV91/SL	2	12.5	7.8	SOT172D	357
BLU99	4	12.5	7	SOT122	337

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
BLU99/SL	4	12.5	7	SOT122D	337
BLV92	4	12.5	8.5	SOT171	365
BLV93	8	12.5	7.3	SOT171	373
BLV193	12	12.5	7.5	SOT171	442
BLV194	16	12.5	8.5	SOT171	453
BLV95	22	12.5	>5.5	SOT171	383
Class-B; 24 V; base stations					
BLV99	2	24	9.3	SOT172A1	408
BLV99/SL	2	24	9.3	SOT172D	408
Class-AB; 24 to 26 V base stations					
BLV902[(1)]	2	26	12	SO8 (SOT409)	461
BLV103	4	24	13	SOT171	434
BLV904[(1)]	5	26	12	SO8 (SOT409)	464
BLV100	8	24	9	SOT171	415
BLV909 [(1)]	9	26	12	SO8 (SOT409)	467
BLV910	10	26	>11	SOT171	476
BLV98CE	15	24	8.5	SOT171	399
BLV920	20	26	>10	SOT171	484
BLV945A	25	25	10	SOT324	508
BLV934	30	26	>9	SOT171	492
BLV935	30	26	>10	SOT273	500
BLV97CE	35	24	8.5	SOT171	390
BLV946	40	26	11	SOT273	531
BLV101A	50	26	9.8	SOT273	423
BLV101B	50	26	8.1	SOT273	423
BLV958	75	26	9.5	SOT391	567
BLV948	150	26	8.3	SOT262A2	539
BLV950	150	26	9	SOT262A2	556

Note

1. Preliminary specification.

MOS: 860 to 960 MHz

TYPE NUMBER	P_L (W)	V_{DS} (V)	G_P (dB)	PACKAGE	PAGE
Class-B; 28 V base stations					
BLF543	10	28	8	SOT171	99
BLF544	20	28	7	SOT171	110

BIPOLAR: 1500 MHz

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
Class-AB; 24 V					
LLE15180X	≥15	24	≥7.8	FO229	685
LLE15370X	≥33	24	≥8	FO229	692
LXE15450X	≥45	24	≥8	FO229	736
LFE15600X	≥55	24	≥8	FO231	671

BIPOLAR: 1800 to 2100 MHz

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
Class-A; 16 to 18 V					
LBE2009S	≥0.7	18	≥9	FO45	663
LVE21050R	5.5	16	8	FO83	733
Class-AB; 24 to 26 V					
BLV2040 (1)	1	26	12	SO8 (SOT409)	575
LLE18010X	≥1	24	≥8.5	FO229	699
BLV2042 (1)	4	26	12	SO8 (SOT409)	578
LLE18040X	≥4	24	≥8.5	FO229	706
LLE18100X	≥9	24	≥8	FO229	713
LLE18150X	≥12	24	≥7.8	FO229	719
BLV2044	15	26	8	FO229	582
BLV2045	25	26	8.5	SOT390	587
LLE18300X	≥27	24	≥7.8	FO229	726
LXE18400X	≥39	24	≥7	FO91B	743
LFE18500X	≥48	24	≥7	FO231	678

Note

1. Preliminary specification.

BIPOLAR: CELLULAR PHONE HANDSETS

TYPE NUMBER	P_L (W)	V_{CE} (V)	G_P (dB)	PACKAGE	PAGE
Class-B: analog cellular (900 MHz)					
BLT70	0.6	4.8	>6	SOT223	198
BLT80	0.8	6	7	SOT223	220
	0.8	7.5	8	SOT223	220
BLT61[(1)]	1.2	3.6	>8	SO8 (SOT96)	192
BLT71	1.2	4.8	>6	SOT223	206
BLT81	1.2	6	6.5	SOT223	229
	1.2	7.5	8	SOT223	229
Class-B: digital cellular (470 MHz)					
BLT52[(1)]	3	6	≥8	SO8 (SOT409)	180
	7	7.5	≥8	SO8 (SOT409)	180
Class-B: digital cellular (900 MHz)					
BLT71/8	1.2	4.8	≥11	SO8 (SOT96)	215
BLT62[(1)]	3	3.6	≥8	SO8 (SOT96)	195
BLT72[(1)]	3	4.8	>7	SO8 (SOT96)	219
BLT82	3.5	6	>8	SO8 (SOT96)	237
Class-B: digital cellular (1800 MHz)					
BLT13[(1)]	2	6	>6	SO8 (SOT96)	167
BLT14[(1)]	1.6	4.8	≥6	SO8 (SOT96)	170

Note

1. Preliminary specification.

LINEAR: HYBRID AMPLIFIERS

TYPE NUMBER	V_{S1} (V)	V_{S2} (V)	P_L (W)	G_P (dB)	PACKAGE	PAGE
Cellular (920 to 960 MHz)						
BGY916[(1)]	26	26	16	≥28	SOT365	38
Cellular (1805 to 1880 MHz)						
BGY1816[(1)]	5	26	16	≥24	SOT365	41

Note

1. Preliminary specification.

LINE-UPS

RF Power Transistors for UHF — 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"*.

AM AIRCRAFT TRANSMITTERS (100 to 400 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	$P_{L(carr)}$ (W)	V_{CE} (V)	S = stud F = flange
40	BLW89	2 × BLW90	2 × BLX94C	40	28	S
60	BLW89	2 × BLW91	2 × BLU60/28	60	28	S/F
500	BLW90	2 × BLX94C	2 × BLU60/28	120	28	S/F

PowerMOS

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	$P_{L(carr)}$ (W)	V_{CE} (V)
30	BLF521(1)	BLF522(1)	BLF545	40	28
25	BLF521(1)	BLF543	BLF546	80	28
30	BLF521(1)	BLF543	BLF547	100	28
100	BLF521(1)	BLF544	BLF548	150	28

Note

1. V_{DS} = 12.5 V.

PORTABLE and MOBILE TRANSMITTERS (400 to 512 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
45	BLV90	BLU99		3	7.5
15	BFR96S	BLU99	BLW81	10	13
400	BLU99	BLU20/12		20	
280	BLU99	BLU20/12	BLU45/12	45	13
400	BLU99	BLU20/12	BLU60/12	60	13

PowerMOS

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
50	BLF521	BLF522		5	12.5

BASE STATIONS (400 to 470 MHz)

Bipolar

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

PowerMOS

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
35	BLF521(1)	BLF522(1)	BLF545	40	28
40	BLF521(1)	BLF543	BLF546	80	28
150	BLF521(1)	BLF544	BLF548	150	28
45	BLF521(1)	BLF544	BLF547	100	28

Note

1. V_{DS} = 12.5 V.

ANALOG CELLULAR (900 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
10	BFG10W/X	BLT71/8		1.2	4.8
1	BFG540/X	BLT80	BLT81	1.2	6
1	BFG540/X	BLT70	BLT71	1.2	4.8
1	BFG520W/X	BFG10W/X	BLT61	1.2	3.6

DIGITAL CELLULAR (900 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
1	BFG540W/X	BFG10W/X	BLT72	3(1)	4.8
1	BFG540W/X	BFG10W/X	BLT62	3	3.6
1	BFG540W/X	BFG10W/X	BLT82	3.5(1)	6

Note

1. Pulsed.

PORTABLE TRANSMITTERS (860 to 960 MHz))

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
1	BFG540	BLT80	BLT81	1.2	6
15	BFG91A	BLT80	BLT92/SL	3	7.5

MOBILE TRANSMITTERS (860 to 960 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)	S = stud F = flange
110	BLU86	BLV91/SL	BLV93		8	13	S/F
100	BLV90	BLV92	BLV94		15	13	S/F
100	BLU86	BLV91/SL	BLV93	BLV95	22	13	S/F

BASE STATIONS (860 to 960 MHz) CLASS AB OPERATION

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)	f (MHz)
270	BLV103(1)	BLV934			30	26	960
220	BLV103(1)	BLV935			30	26	960
65	BLV99/SL(2)	BLV910	BLV946		40	26	960
64	BLV99/SL	BLV100(3)	BLV101A		45	25	900
100	BLV99/SL	BLV100(3)	BLV101B		45	25	960
25	BGY916	BLV958			75	26	960
75	BLV103(1)	BLV920	BLV958		75	26	960
75	BLV103(1)	BLV920	2 × BLV946		80	26	960
25	BLV99/SL	BLV103	BLV98CE	2 × BLV101A	85	25	900
30	BLV99/SL	BLV103	BLV97CE	2 × BLV101B	85	25	960
35	BLV99/SL	BLV103	BLV945A	BLV950	120	25	900
20	BLV99/SL	BLV103	BLV945A	BLV950	150 (PEP)	25	900(4)
250	BLV103(1)	BLV934	BLV950		150	26	960

Notes

1. BLV904 is a comparable transistor in a SMD package.
2. BLV902 is a comparable transistor in a SMD package.
3. BLV909 is a comparable transistor in a SMD package.
4. d_{IM} = –30 dB.

DIGITAL CELLULAR (1800 MHz)

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
2	BFG540W/X	BFG10W/X	BLT14	1.6	4.8
1	BFG540W/X	BFG10W/X	BLT13	2	6

BASE STATIONS (1800 to 1900 MHz)

Bipolar

1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)
LLE18010X	LLE18040X	LLE18150X		15	24
LLE18010X	LLE18040X	LLE18150X	2 × LLE18300X	50	24
BGY1916	LFE20500X			50	26
LLE18010X	LLE18040X	LLE18150X	2 × LXE18400X	75	24
LLE18010X	LLE18040X	LLE18300X	2 × LFE20500X	90	24

BASE STATIONS (1900 to 2000 MHz)

Bipolar

1st STAGE	2nd STAGE	3rd STAGE	4th STAGE	P_L (W)	V_{CE} (V)
LLE18010X	LLE18040X	LLE18150X		15	24
LLE18010X	LLE18040X	LLE18150X	2 × LLE18300X	50	24
BGY1816	LFE18500X			50	26
LLE18010X	LLE18040X	LLE18150X	2 × LXE18400X	75	24
LLE18010X	LLE18040X	LLE18300X	2 × LFE18500X	90	24

BASE STATIONS (1800 to 2000 MHz) CLASS AB OPERATION

Bipolar

INPUT POWER (mW)	1st STAGE	2nd STAGE	3rd STAGE	P_L (W)	V_{CE} (V)
25	BGY1816; BGY1916			15	26
60	BLV2040(1)	BLV2042(1)	BLV2044	15	26
120	BLV2040(1)	BLV2044	BLV2045	25	26
250	BLV2042(1)	BLV2044	2 × BLV2045	50	26

Note

1. In a SOT409 SMD package.

GENERAL

QUALITY

Total Quality Management

Philips Semiconductors is 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 described in the following paragraphs.

QUALITY ASSURANCE

Based on ISO 9000 standards, customer standards such as Ford TQE and IBM MDQ. Our factories are certified to ISO 9000 by external inspectorates.

PARTNERSHIPS WITH CUSTOMERS

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

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 (FMEA) 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 Original Equipment Manufacturer (OEM) equipment, component reliability must be extremely high. Our research laboratories and development departments study the failure mechanisms of semiconductors. Their studies result 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 customers' inputs and we invite constructive comments on all aspects of our performance. Please contact our local sales representative.

Recognition

The high quality of our products and services is demonstrated by many Quality Awards granted by major customers and international organizations.

PRO ELECTRON TYPE NUMBERING

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).

(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.

Version letter(s)

One or two letters may be added to the basic type number to indicate minor electrical or mechanical variants of the basic type. The letters never have a fixed meaning, except that the letter 'R' indicates reverse polarity and the letter 'W' indicates a surface mounted device (SMD).

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 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.

DC CURRENT DRAINING

For RF power MOS transistors, the DC drain current rating is based on the maximum operating junction temperature of the device. The value specified will raise the temperature of the die to its maximum allowable temperature while the case is held at 25 °C. The power dissipation in the die equals $I_D^2 \times R_{DS(on)}$. From the maximum $R_{DS(on)}$ at T_j = 200 °C and the published values of maximum allowable dissipation, the current rating at T_{mb} = 25 °C is $(P_{D(max)}/R_{DS(on)})^{0.5}$.

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.

(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.

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

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

Subscripts

Upper-case subscripts are used for the indication of:

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

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

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

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_D, i_B, i_D, i_b, i_d, I_{bm}, I_{dm}.

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_{GS}, v_{BE}, v_{GS}, v_{be}, v_{gs}, V_{bem}, V_{gsm}.

SUPPLY VOLTAGES OR CURRENTS

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

Examples: V_{DD}, V_{CC}, I_{EE}, I_{SS}.

A reference terminal is indicated by a third subscript.

Examples: V_{CCE}, V_{DDS}.

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 base terminal
- I_{G2} continuous (DC) current flowing into the second gate terminal
- V_{B2-E} continuous (DC) voltage between the terminals of second base and emitter terminals
- V_{G2-S} continuous (DC) voltage between the terminals of second gate and source terminals.

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 collector terminal of the second unit
- I_{2D} continuous (DC) current flowing into the drain terminal of the second unit
- V_{1C-2C} continuous (DC) voltage between the collector terminals of the first and second units.
- V_{1D-2D} 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)
- g_{FS} static value of forward transconductance in common-source configuration (DC current gain)
- R_E DC value of the external emitter resistance.
- R_{DS} DC value of the drain-source 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
- g_{fs} small-signal value of the short-circuit forward transconductance in common-source configuration
- $Z_i = R_i + jX_i$ small-signal value of 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 ($h<6\sim_{ib}$) etc. for the real part of h_{ib}

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

MARKING CODES

For the purposes of matched pair applications, RF power MOS transistors are marked with a code that indicates their gate-source voltage range (see Table 1).

Table 1 Marking codes for V_{GS} selection

CODE	V_{GS}	CODE	V_{GS}
0	1.00 to 1.10	J	2.80 to 2.90
1	1.10 to 1.20	K	2.90 to 3.00
2	1.20 to 1.30	L	3.00 to 3.10
3	1.30 to 1.40	M	3.10 to 3.20
4	1.40 to 1.50	N	3.20 to 3.30
5	1.50 to 1.60	O	3.30 to 340
6	1.60 to 1.70	P	3.40 to 3.50
7	1.70 to 1.80	Q	3.50 to 3.60
8	1.80 to 1.90	R	3.60 to 3.70
9	1.90 to 2.00	S	3.70 to 3.80
A	2.00 to 2.10	T	3.80 to 3.90
B	2.10 to 2.20	U	3.90 to 4.00
C	2.20 to 2.30	V	4.00 to 4.10
D	2.30 to 2.40	W	4.10 to 4.20
E	2.40 to 2.50	X	4.20 to 4.30
F	2.50 to 2.60	Y	4.30 to 4.40
G	2.60 to 2.70	Z	4.40 to 4.50
H	2.70 to 2.80		

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.

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

Reflow soldering

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 1 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.2. This reflow method is often applied in double-sided prints.

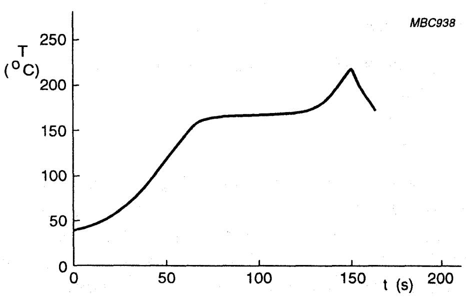


Fig.1 Theoretical time/temperature curve for a typical thermal conductive reflow cycle.

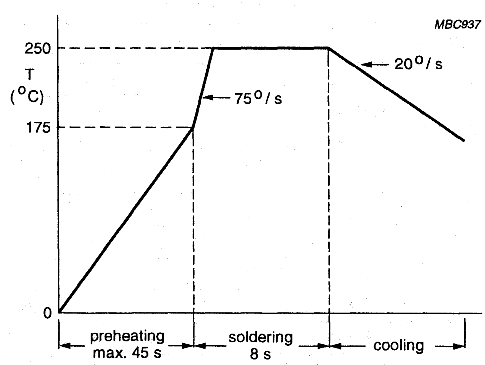


Fig.2 Typical temperature profile of an infrared oven operating at a belt speed of 0.41 mm/min.

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.3.

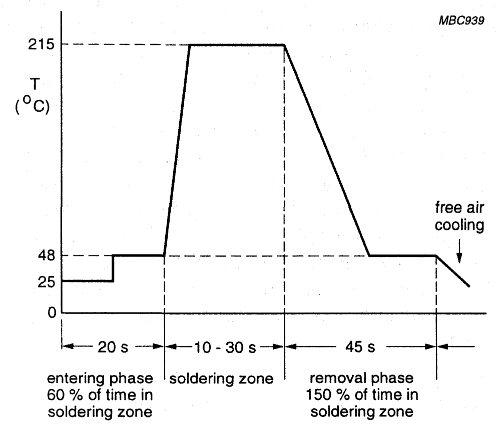


Fig.3 Theoretical time/temperature curve relationship for dual vapour reflow soldering.

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 (see Fig.4) 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 (see Fig.5), 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 6 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.

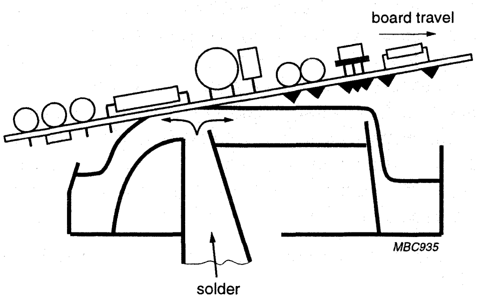


Fig.4 Single wave soldering principle.

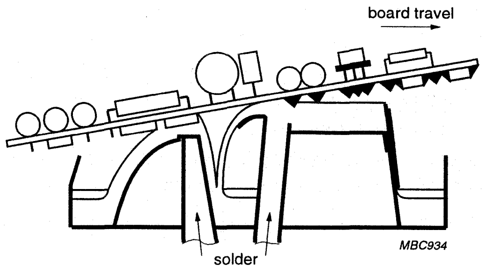


Fig.5 Dual wave soldering principle.

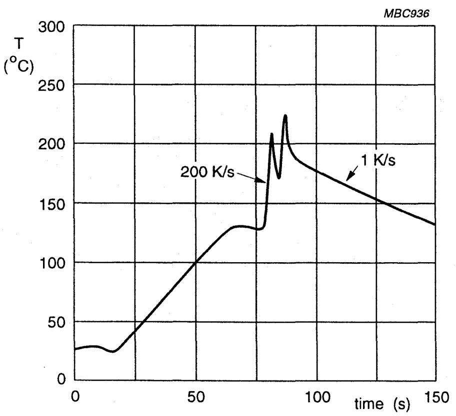


Fig.6 Typical time-temperature curve measured at the soldering site.

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.

Hand soldering microminiature components

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

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

THERMAL CONSIDERATIONS

Thermal resistance

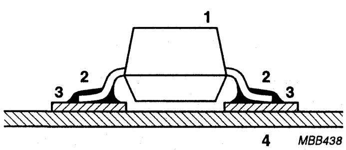
Circuit performance and long-term reliability are affected by the temperature of the transistor die. Normally, both are improved by keeping the die temperature (junction temperature) low.

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 a printed board, a substrate or heatsink. Referring to Fig.7 (for surface mounted devices mounted on a substrate), heat conducts from its source (the junction) via the package leads and soldered connections to the substrate. Some heat radiates from the package into the surrounding air where it is dispersed by convection or by forced cooling air. Heat that radiates from the substrate is dispersed in the same way.

The elements of thermal resistance shown in Fig.8 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
$R_{th\ c\text{-}a}$	thermal resistance from case to ambient
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient.



Heat radiates from the package '1' to ambient.
Heat conducts via leads '2', solder joints '3' to the substrate '4'.

Fig.7 Heat losses.

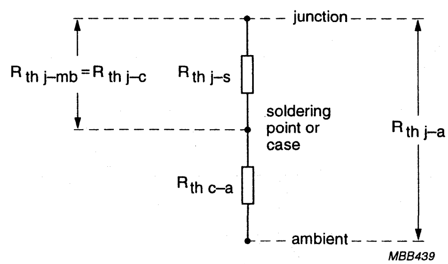


Fig.8 Representation of thermal resistance paths of a device mounted on a substrate or printed board.

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

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

where:

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

T_{amb} is the ambient temperature

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

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

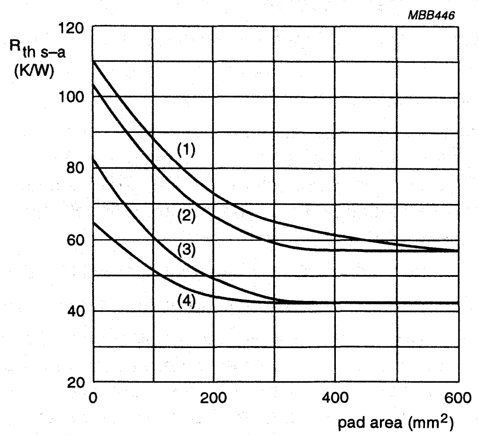
For applications where the temperature of the case is stabilized by a large or temperature-controlled heatsink, the junction temperature can be calculated from

$T_j = T_{case} + P_{tot} \times R_{th\,j\text{-}c}$ or, using the soldering point definition, from $T_j = T_{solder} + P_{tot} \times R_{th\,j\text{-}s}$.

Values of $T_{j\,max}$ and $R_{th\,j\text{-}s}$, or $R_{th\,j\text{-}c}$ or $R_{th\,j\text{-}a}$ are given in the device data sheets.

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

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 Figure 9.



(1) Single-sided, unplated.
(2) Single-sided, plated.
(3) Double-sided, unplated.
(4) Double-sided, plated.

Fig.9 Thermal resistance ($R_{th\,s\text{-}a}$) as a function of pad area on different configurations of FR4 epoxy fibre-glass circuit board.

FLANGE-MOUNTED POWER TRANSISTORS

Mounting recommendations

- Ensure holes in heatsinks are free from burrs.
- 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.
- Mounting area roughness 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, almost certainly, will 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 package outlines 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.

Mounting recommendations SOT365

To ensure a good thermal contact and to prevent mechanical stresses when bolted down, the flatness of the mounting base is designed to be typically better than 100 μm. The mounting area of the heatsink should be flat and free from burrs and loose particles. The heatsink should be rigid and not prone to bowing under thermal cycling conditions. The thickness of a solid heatsink should not be less than 5 mm, to ensure a rigid assembly.

A thin, even layer of thermal compound should be used between the mounting base and the heatsink to achieve the best possible thermal conduction. Excessive use of thermal compound will result in an increase in thermal resistance and possible bowing of the mounting base; too little will also result in poor thermal conduction.

The module should be mounted to the heatsink using 3 mm bolts with flat washers. The bolts should first be tightened to “finger tight” and then further tightened in alternating steps to a maximum torque of 0.4 to 0.6 Nm.

Once mounted on the heatsink, the module leads can be soldered to the printed-circuit board. A soldering iron may be used up to a temperature of 250 °C for a maximum of 10 seconds at a distance of 2 mm from the plastic cap. ESD precautions must be taken to protect the device from electro-static damage.

Mounting recommendations SOT409

Both the metallized ground plate and leads contribute to the heatflow. For the best results it is recommended to mount the transistor on a grounded metallized area on the printed-circuit board equipped with a large number of metallized through-holes filled with solder. A thermal resistance ($R_{th\ mb\text{-}h}$) of 0.9 K/W can be achieved if a heatsink compound is used when the printed-circuit board is mounted on the heatsink.

Thermal behaviour

The coefficients of linear thermal expansion (α) shown in Table 2 can be used to calculate the thermal expansion of the different header parts.

Table 2 Coefficients of linear thermal expansion of flange-mounted packages

SYMBOL	PACKAGE	FLANGE	LEAD FRAME	UNIT
α	SOT119	18.3×10^{-6}	7.5×10^{-6} to 8.5×10^{-6}	K^{-1}
	SOT123			
	SOT171			
	SOT273			
	SOT262	6.5×10^{-6}	7.5×10^{-6} to 8.5×10^{-6}	K^{-1}
	SOT268			
	SOT324			

CAPSTAN HEADERS

Table 3 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

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 package outline 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.

HANDLING MOS DEVICES

Electrostatic charges

Electrostatic charges can exist in many things; for example, man-made-fibre clothing, moving machinery, objects with air blowing across them, plastic storage bins, sheets of paper stored in plastic envelopes, paper from electrostatic copying machines, and people. The charges are caused by friction between two surfaces, at least one of which is non-conductive. The magnitude and polarity of the charges depend on the different affinities for electrons of the two materials rubbing together, the friction force and the humidity of the surrounding air.

Electrostatic discharge is the transfer of an electrostatic charge between bodies at different potentials and occurs with direct contact or when induced by an electrostatic field. Our RF Power MOS transistors are sensitive to electrostatic discharge and, to avoid damage, the following precautions must be taken.

Work station

Figure 10 shows a working area suitable for safely handling electrostatic sensitive devices. It has a work bench, the surface of which is conductive or covered by an antistatic sheet. Typical resistivity for the bench surface is between 1 and 500 kΩ per cm^2. The floor should also be covered with antistatic material.

The following precautions should be observed:

- Persons at a work bench should be earthed via a wrist strap and a resistor.
- All mains-powered electrical equipment should be connected via an earth leakage switch.
- Equipment cases should be earthed.
- Relative humidity should be maintained between 50 and 65%.
- An ionizer should be used to neutralize objects with immobile static charges.

Receipt and storage

Our devices are packed for dispatch in antistatic conductive containers, usually boxes, tubes or blister tape. The fact that the contents are sensitive to electrostatic discharge is shown by warning labels on both primary and secondary packing.

The devices should be kept in their original packing whilst in storage. If a bulk container is partially unpacked, the unpacking should be performed at a protected work station. Any devices that are stored temporarily should be packed in conductive or antistatic packing or carriers.

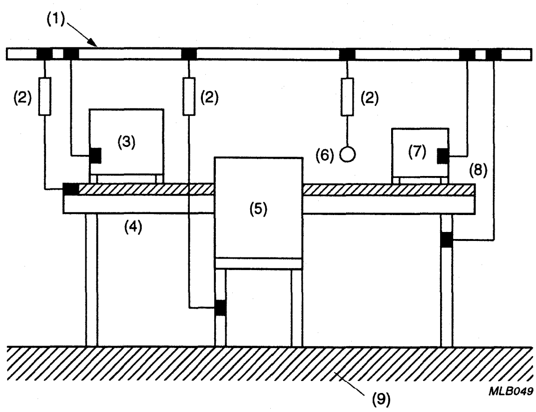
Assembly

The devices must be removed from their protective packing with earthed component pincers or short-circuit clips. Short-circuit clips must remain in place during mounting, soldering and cleansing/drying processes. Do not remove more devices from the storage packing than are needed at any one time. Production/assembly documents should state that the product contains electrostatic sensitive devices and that special precautions need to be taken.

All tools used during assembly, including soldering tools and solder baths, must be earthed. All hand tools should be of conductive or antistatic material and, where possible, should not be insulated.

Measuring and testing of completed circuit boards must be done at a protected work station. Place the soldered side of the circuit board on conductive or antistatic foam and remove the short-circuit clips. Remove the circuit board from the foam, holding the board only at the edges. Make sure the circuit board does not touch the conductive surface of the work bench. After testing, replace the circuit board on the conductive foam to await packing.

Assembled circuit boards should be handled in the same way as unmounted devices. They should also carry warning labels and be packed in conductive or antistatic packing.



(1) Earthing rail.
(2) Resistor (500 kΩ ±10%, 0.5 W).
(3) Ionizer.
(4) Work bench.
(5) Chair.
(6) Wrist strap.
(7) Electrical equipment.
(8) Conductive surface/antistatic sheet.
(9) Antistatic floor.

Fig.10 Protected work station.

DEVICE DATA

in alphanumeric sequence

UHF amplifier module BGY916

FEATURES

- 26 V nominal supply voltage
- 16 W output power into a load of 50 Ω with an RF drive power of 25 mW

APPLICATION

- Base station transmitting equipment operating in the 920 to 960 MHz frequency range.

PINNING-SOT365

PIN	DESCRIPTION
1	RF input
2	V_{S1}
3	V_{S2}
4	RF output
flange	ground

DESCRIPTION

The BGY916 is a three-stage UHF amplifier module in a SOT365 package. It consists of one NPN silicon planar transistor chip and two silicon MOS-FET chips mounted on a metallized ceramic AlN substrate, together with matching and bias circuitry.

PRELIMINARY
See Philips Semiconductors for Design-in information

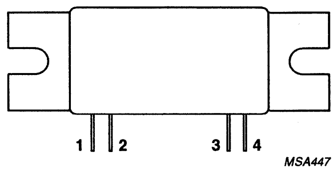


Fig.1 Simplified outline.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C.

MODE OF OPERATION	f (MHz)	V_{S1}; V_{S2} (V)	P_L (W)	G_p (dB)	η (%)	Z_S; Z_L (Ω)
CW	920 to 960	26	16	≥28	≥35	50

LIMITING VALUES

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

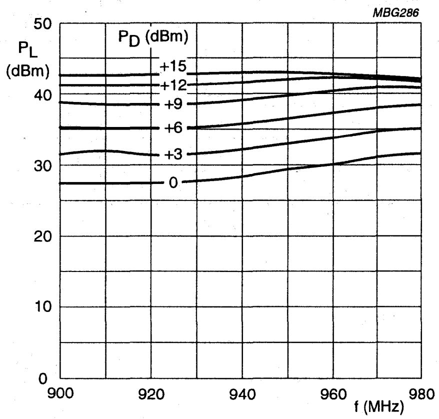
SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{S1}	DC supply voltage	–	28	V
V_{S2}	DC supply voltage	–	28	V
P_D	input drive power	–	80	mW
P_L	load power	–	25	W
T_{stg}	storage temperature	–30	+100	°C
T_{mb}	operating mounting base temperature	–10	+90	°C

CHARACTERISTICS

T_{mb} = 25 °C; V_{S1} = V_{S2} = 26 V; P_L = 16 W; Z_S = Z_L = 50 Ω unless otherwise specified.

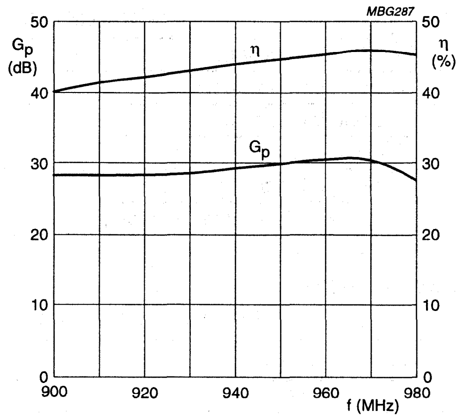
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency		920	–	960	MHz
I_{S1}	supply current		–	50	–	mA
I_{S2}	supply current	P_D < –60 dBm	–	150	–	mA
P_L	load power		16	19	–	W
G_p	power gain		28	30	32	dB
ΔG_p	gain ripple	40 dB dynamic range at f = 920 to 960 MHz	–	1	4	dB
η	efficiency		35	40	–	%
H_2	second harmonic		–	–47	–35	dBc
H_3	third harmonic		–	–55	–45	dBc
$VSWR_{in}$	input VSWR		–	1 : 1.5	2 : 1	
	isolation	V_{S1} = 0	–	–	–40	dBm
	stability	VSWR ≤ 3 : 1 through all phases; V_{S2} = 24 to 28 V	–	–	–60	dBc
	reverse intermodulation	$P_{carrier}$ = 16 W; $P_{interference}$ = 16 μW; f_i = f_c ±600 kHz	–	–68	–65	dBc
F	noise figure		–	5	8	dBc
B	AM bandwidth		2	–	–	MHz
	ruggedness	VSWR ≤ 5 : 1 through all phases	no degradation			

UHF amplifier module BGY916



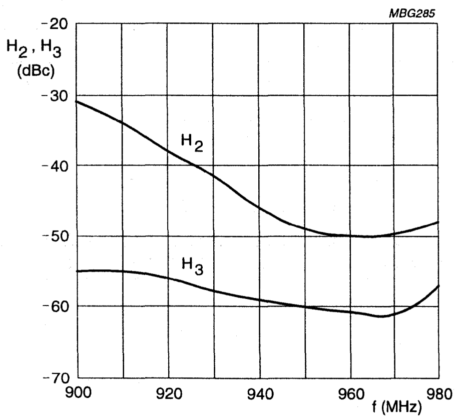
$V_{S1} = V_{S2} = 26$ V; $Z_S = Z_L = 50$ W; $T_{mb} = 25$ °C.

Fig.2 Load power as a function of frequency; typical values.



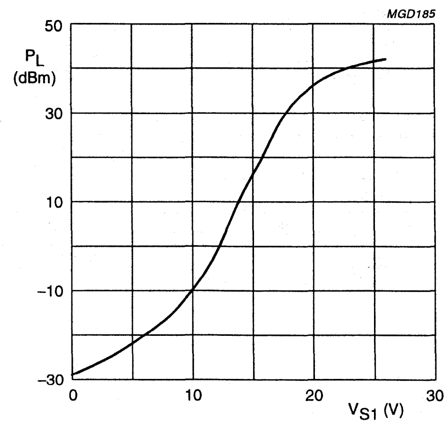
$V_{S1} = V_{S2} = 26$ V; $P_L = 16$ W; $Z_S = Z_L = 50$ W; $T_{mb} = 25$ °C.

Fig.3 Power gain and efficiency as functions of frequency; typical values.



$V_{S1} = V_{S2} = 26$ V; $P_L = 16$ W; $Z_S = Z_L = 50$ W; $T_{mb} = 25$ °C.

Fig.4 Harmonics as a function of frequency; typical values.



f = 940 MHz; $V_{S2} = 26$ V; $Z_S = Z_L = 50$ W; $T_{mb} = 25$ °C.

Fig.5 Load power as a function of supply voltage; typical values.

UHF amplifier module BGY1816

FEATURES

- 26 V nominal supply voltage
- 16 W output power into a load of 50 Ω with an RF drive power of 18 dBm.

APPLICATION

- Base station transmitting equipment operating in the 1805 to 1880 MHz frequency band.

PINNING-SOT365

PIN	DESCRIPTION
1	RF input
2	V_{S1}
3	V_{S2}
4	RF output
flange	ground

DESCRIPTION

The BGY1816 is a three-stage UHF amplifier module in a SOT365 package with a plastic cap. It consists of three NPN silicon planar transistors mounted on a metallized ceramic AlN substrate, together with matching and bias circuitry.

PRELIMINARY
See Philips Semiconductors for Design-in information

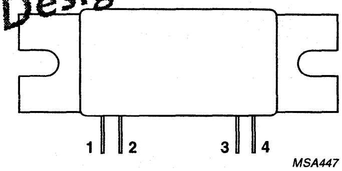


Fig.1 Simplified outline.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C.

MODE OF OPERATION	f (MHz)	V_{S1} (V)	V_{S2} (V)	P_L (W)	G_p (dB)	η (%)	Z_S; Z_L (Ω)
CW	1805 to 1880	5	26	16	≥24	≥33	50

LIMITING VALUES

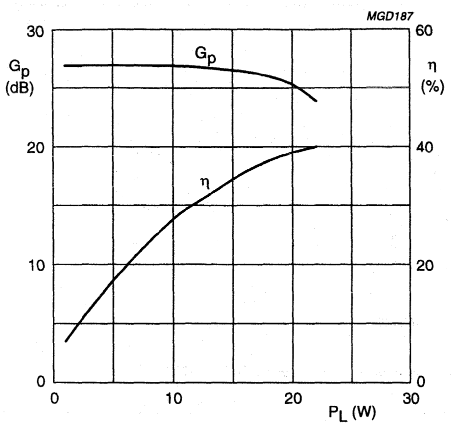
In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{S1}	DC supply voltage		4.5	5.5	V
V_{S2}	DC supply voltage		–	28	V
P_D	input drive power		–	120	mW
P_L	load power	T_{mb} = 25 °C	–	20	W
T_{stg}	storage temperature		–30	+100	°C
T_{mb}	operating mounting base temperature		–10	+90	°C

CHARACTERISTICS

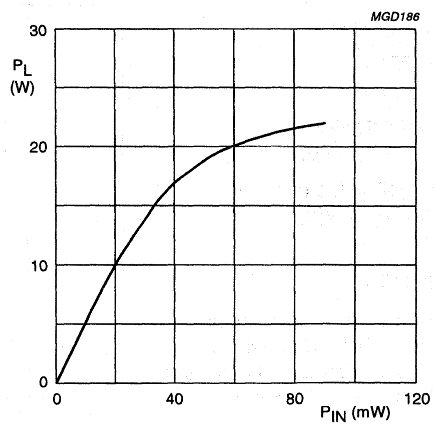
T_{mb} = 25 °C; V_{S1} = 5 V; V_{S2} = 26 V; P_L = 16 W; $Z_S = Z_L$ = 50 Ω unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f	frequency		1805	–	1880	MHz
I_{S1}	supply current		–	–	50	mA
I_{S2}	supply current	P_D < –60 dBm	–	310	–	mA
P_L	load power		16	–	–	W
G_P	power gain		24	–	28	dB
ΔG_P	gain ripple	peak to peak	–	–	1	dB
η	efficiency		33	–	–	%
H_2	second harmonic		–	–	–35	dBc
H_3	third harmonic		–	–	–45	dBc
$VSWR_{in}$	input VSWR		–	–	1.6 : 1	
	isolation	V_{S1} = 0	–	–	–40	dBm
	stability	VSWR ≤ 2 : 1 through all phases; P_L ≤ 16 W; V_{S2} = 25 to 27 V	–	–	–60	dBc
	reverse intermodulation	$P_{carrier}$ = 16 W; $P_{reverse}$ = –40 dBc; $f_i = f_c$ ±200 kHz	–	–	–53	dBc
F	noise figure	20 MHz offset from carrier	–	–	–97	dBm/Hz
	ruggedness	VSWR ≤ 5 : 1 through all phases	no degradation			



f = 1850 MHz; V_{S1} = 5 V; V_{S2} = 26 V; Z_S =Z_L = 50 W; T_{mb} = 25 °C.

Fig.2 Power gain and efficiency as functions of load power; typical values.



f = 1850 MHz; V_{S1} = 5 V; V_{S2} = 26 V; Z_S =Z_L = 50 W; T_{mb} = 25 °C.

Fig.3 Load power as a function of input power; typical values.

HF/VHF power MOS transistor — BLF242

FEATURES

- High power gain
- Low noise
- Easy power control
- Good thermal stability
- Withstands full load mismatch
- Gold metallization ensures excellent reliability.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for professional transmitter applications in the HF/VHF frequency range.

The transistor is encapsulated in a 4-lead, SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT123

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION

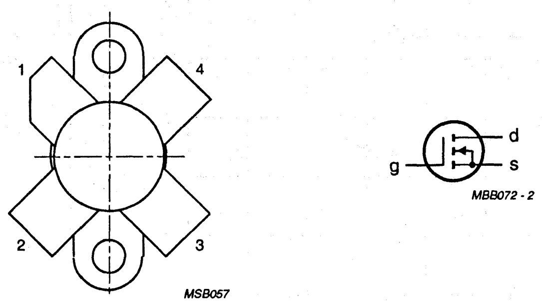


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	28	5	> 13 typ. 16	> 50 typ. 60

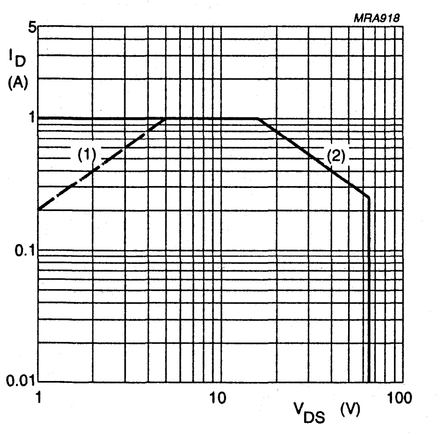
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	1	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	16	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

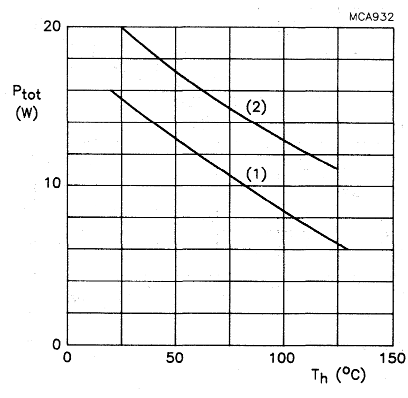
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 16 W	11 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_{mb} = 25 °C; P_{tot} = 16 W	0.3 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



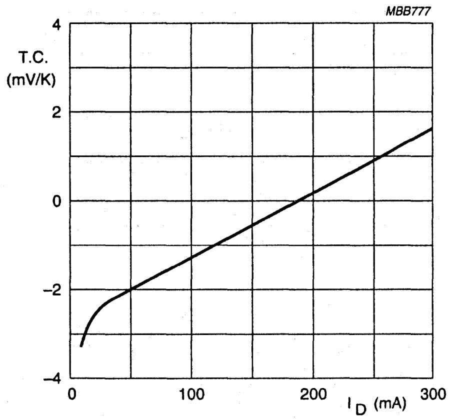
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

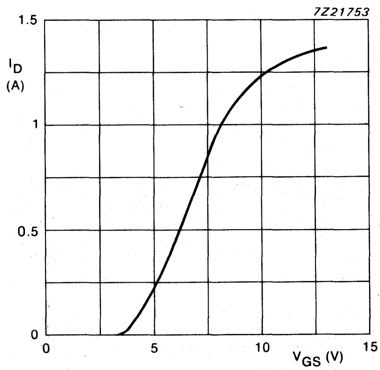
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 0.1 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	10	μA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 3 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	0.16	0.24	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.3 A; V_{GS} = 1 V	–	3.3	5	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	1.2	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	13	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	9.4	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	1.7	–	pF



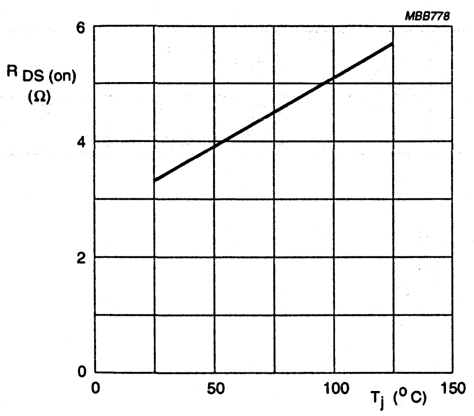
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



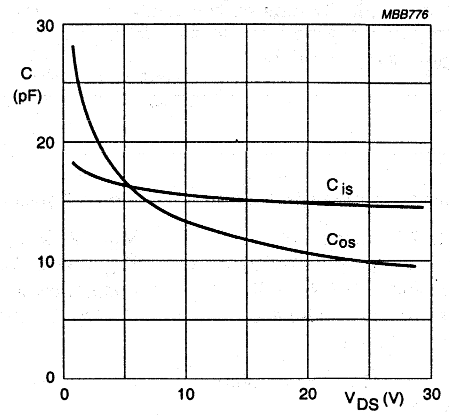
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



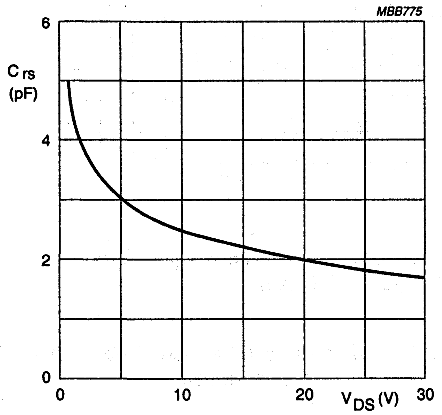
I_D = 0.3 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W; unless otherwise specified.
RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	R_{GS} (Ω)
CW, class-B	175	28	10	5	> 13 typ. 16	> 50 typ. 60	47

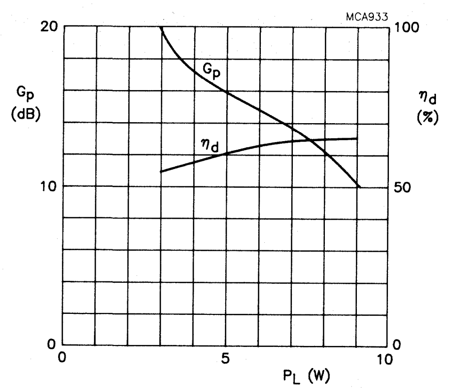
Ruggedness in class-B operation

The BLF242 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 28 V; f = 175 MHz at rated output power.

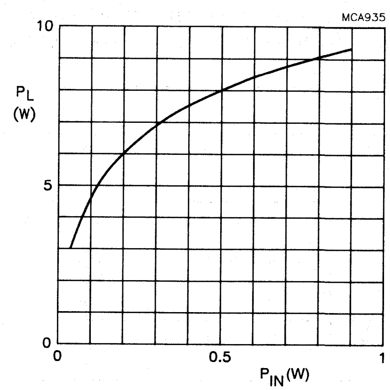
Noise figure (see Fig.11)

V_{DS} = 28 V; I_D = 0.2 A; f = 175 MHz; R_{GS} = 47 Ω; T_h = 25 °C. Input and output power matched for P_L = 5 W; F = typ. 5.5 dB.



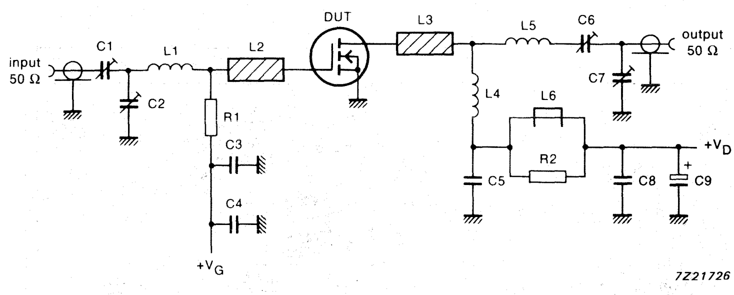
Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω; f = 175 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



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

Fig.10 Load power as a function of input power, typical values.



f = 175 MHz.

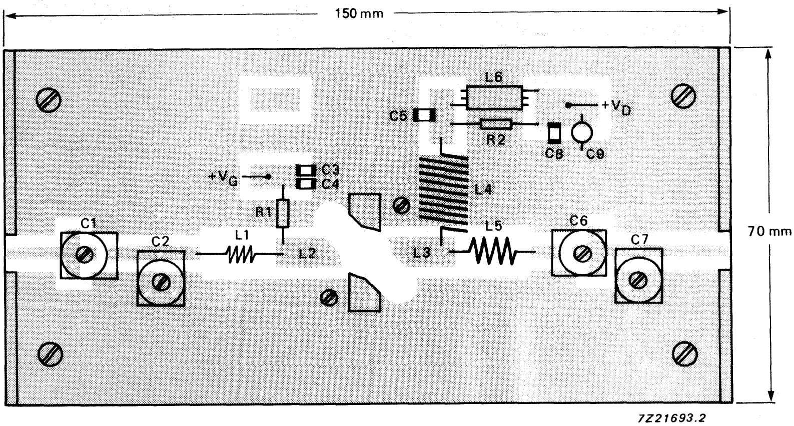
Fig.11 Test circuit for class-B operation.

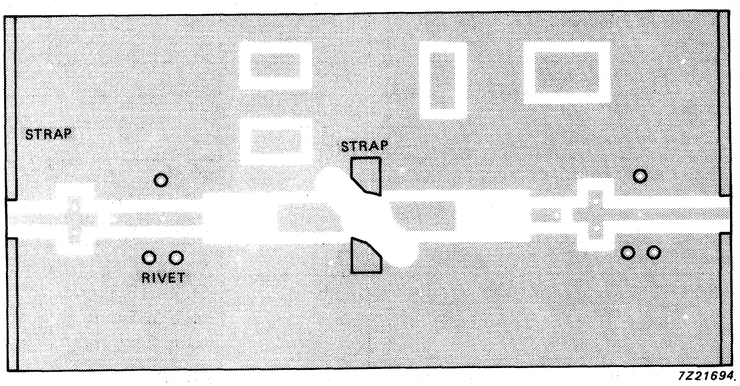
List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C7	film dielectric trimmer	4 to 40 pF		2222 809 08002
C3	multilayer ceramic chip capacitor (note 1)	100 pF		
C4, C8	ceramic chip capacitor	100 nF		2222 852 47104
C6	film dielectric trimmer	5 to 60 pF		2222 809 08003
C9	electrolytic capacitor	2.2 µF, 40 V		
L1	5 turns enamelled 0.7 mm copper wire	53 nH	length 5.4 mm int. dia. 3 mm leads 2 x 5 mm	
L2, L3	stripline (note 2)	30 Ω	10 x 6 mm	
L4	11 turns enamelled 1 mm copper wire	500 nH	length 15.5 mm int. dia. 8 mm leads 2 x 5 mm	
L5	5 turns enamelled 1 mm copper wire	79 nH	length 9.1 mm int. dia. 5 mm leads 2 x 5 mm	
L6	grade 3B Ferroxcube RF choke			4312 020 36640
R1	0.5 W metal film resistor	47 Ω		
R2	0.5 W metal film resistor	10 Ω		

Notes

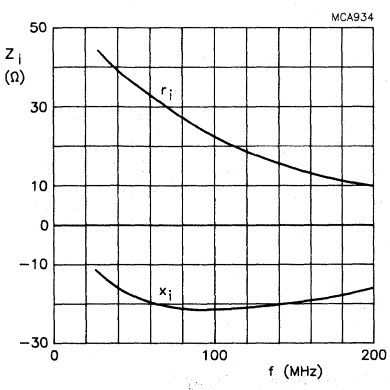
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric ($\varepsilon_r = 4.5$), thickness 1⁄16 inch.





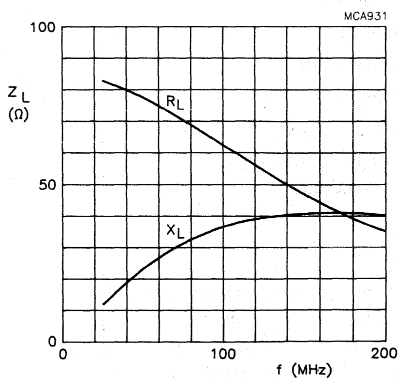
The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as earth. Earth connections are made by fixing screws, copper straps and hollow rivets at the edges of the board and under the source.

Fig.12 Component layout for 175 MHz class-B test circuit.



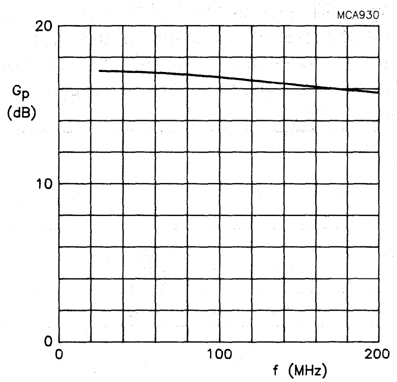
Class-B operation; V_{DS} = 28 V; P_L = 30 W;
R_{GS} = 47 Ω; T_h = 25 °C.

Fig.13 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; P_L = 30 W;
R_{GS} = 47 Ω; T_h = 25 °C.

Fig.14 Load impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; P_L = 30 W;
R_{GS} = 47 Ω; T_h = 25 °C.

Fig.15 Power gain as a function of frequency, typical values.

FEATURES

- High power gain
- Low noise figure
- Easy power control
- Good thermal stability
- Withstands full load mismatch
- Gold metallization ensures excellent reliability.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the VHF frequency range.

The transistor is encapsulated in a 4-lead SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange.

Matched gate-source voltage (V_{GS}) groups are available on request.

PINNING - SOT123

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION

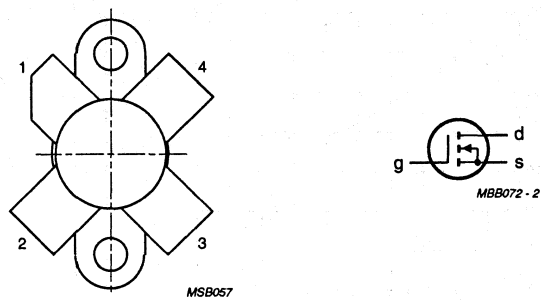


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	28	15	> 13	> 50

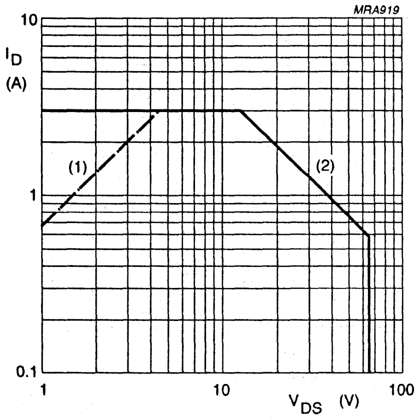
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	3	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	38	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

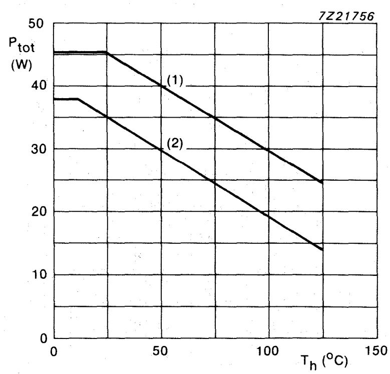
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 38 W	4.6 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_{mb} = 25 °C; P_{tot} = 38 W	0.3 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



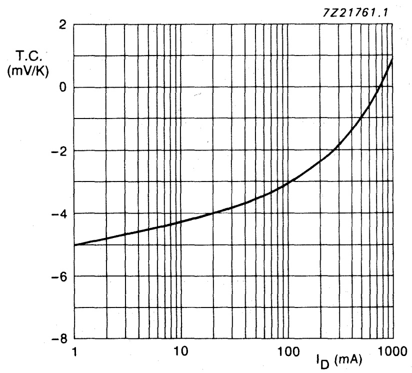
(1) Short-time operation during mismatch.
(2) Continuous operation.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

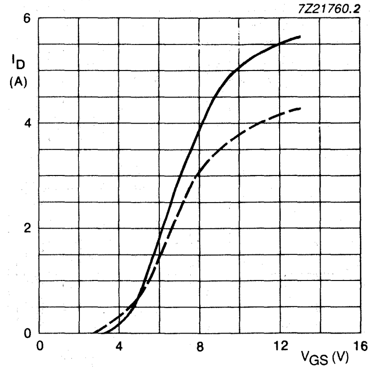
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 5 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	1	mA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 5 mA; V_{DS} = 10 V	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched devices	I_D = 5 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 0.75 A; V_{DS} = 10 V	0.6	–	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.75 A; V_{GS} = 10 V	–	0.8	1.5	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	5	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	60	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	40	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	4.5	–	pF
F	noise figure (see Fig.13)	I_D = 0.5 A; V_{DS} = 28 V; R1 = 23 Ω; T_h = 25 °C; f = 175 MHz; $R_{th\ mb-h}$ = 0.3 K/W	–	4.3	–	dB



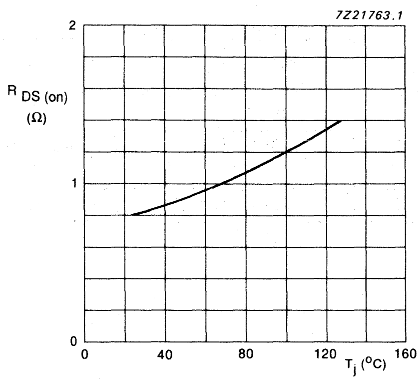
V_{DS} = 10 V; valid for T_j = 25 to 125 °C.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



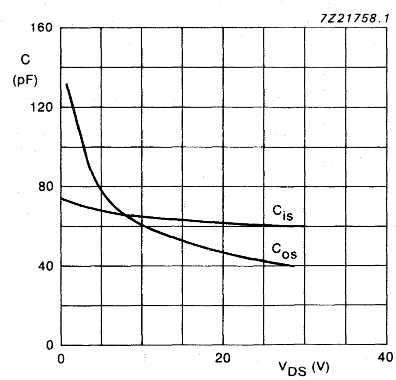
V_{DS} = 10 V.
solid line: T_j = 25 °C.
dotted line: T_j = 125 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



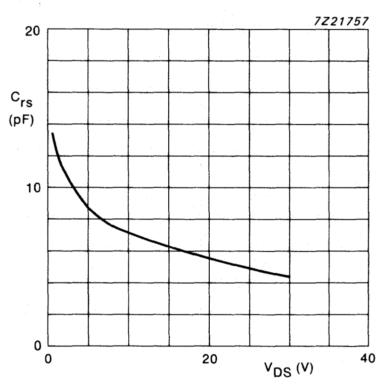
V_{GS} = 10 V; I_D = 0.75 A.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W; unless otherwise specified.
RF performance in CW operation in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	Z_i (Ω) (note 1)	Z_L (Ω)	R1 (Ω)
CW, class-B	175	28	25	15	> 13 typ. 17	> 50 typ. 65	3.0 – j4.0	6.3 + j9.8	46.4//46.4
	175	12.5	25	6	typ. 15	typ. 60	3.0 – j4.0	4.5 + j3.3	100

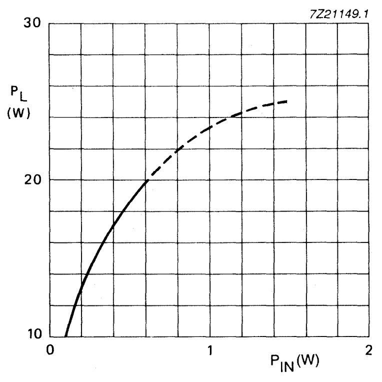
Note

1. R1 included.

Ruggedness in class-B operation

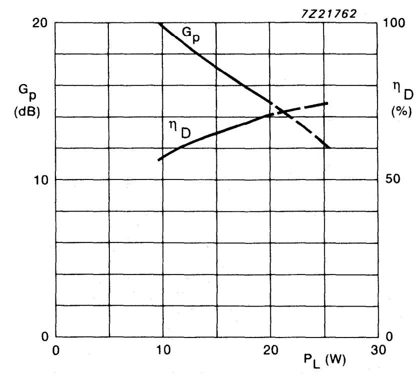
The BLF244 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W; at rated load power.



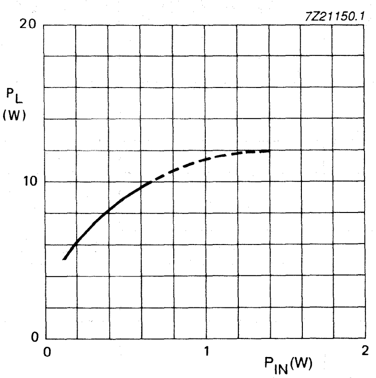
Class-B operation; V_{DS} = 28 V; I_{DQ} = 25 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W.

Fig.9 Load power as a function of input power, typical values.



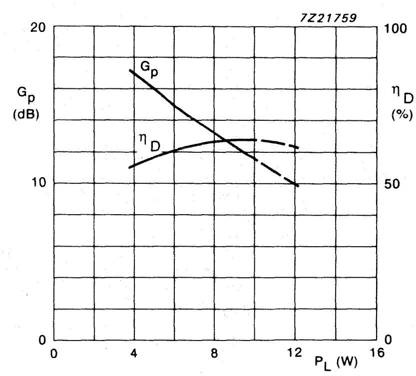
Class-B operation; V_{DS} = 28 V; I_{DQ} = 25 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W.

Fig.10 Power gain and efficiency as functions of load power, typical values.



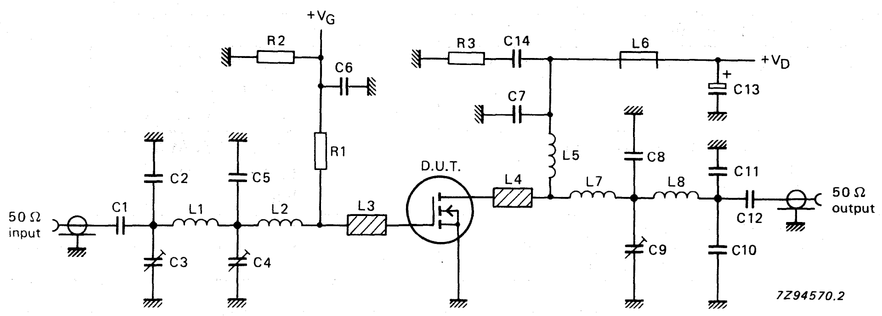
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 25 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.11 Load power as a function of input power, typical values.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 25 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.12 Power gain and efficiency as functions of load power, typical values.



f = 175 MHz.

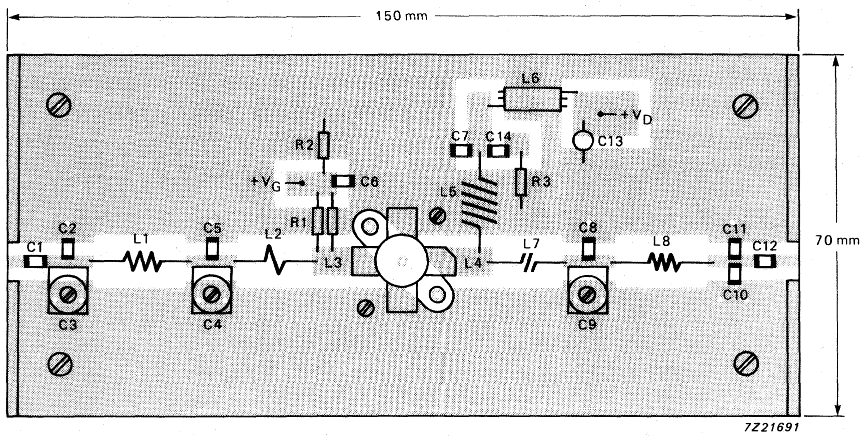
Fig.13 Test circuit for class-B operation.

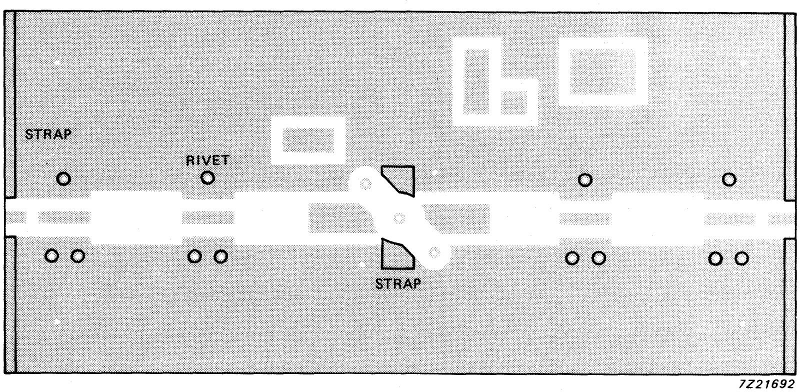
List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C12	multilayer ceramic chip capacitor (note 1)	680 nF		
C2	multilayer ceramic chip capacitor (note 1)	20 pF		
C3, C4, C9	film dielectric trimmer	5 to 60 pF		2222 809 08003
C5	multilayer ceramic chip capacitor (note 1)	75 pF		
C6	multilayer ceramic chip capacitor	10 nF		2222 852 47103
C7	multilayer ceramic chip capacitor (note 1)	100 pF		
C8	multilayer ceramic chip capacitor (note 1)	47 pF		
C10, C11	multilayer ceramic chip capacitor (note 1)	11 pF		
C13	solid tantalum capacitor	2.2 μF		
C14	multilayer ceramic chip capacitor	100 nF		2222 852 47104
L1	4 turns enamelled 1 mm copper wire	32 nH	length 6.3 mm int. dia. 3 mm leads 2 x 5 mm	
L2	1 turn enamelled 1 mm copper wire	12.2 nH	int. dia. 5.6 mm leads 2 x 5 mm	
L3, L4	stripline (note 2)	30 Ω	15 x 6 mm	
L5	6 turns enamelled 1 mm copper wire	119 nH	length 10.4 mm int. dia. 6 mm leads 2 x 5 mm	
L6	grade 3B Ferroxcube RF choke			4312 020 36640
L7	2 turns enamelled 1 mm copper wire	19 nH	length 2.4 mm int. dia. 3 mm leads 2 x 5 mm	
L8	4 turns enamelled 1 mm copper wire	28.5 nH	length 8.5 mm int. dia. 3 mm leads 2 x 5 mm	
R1	metal film resistor (note 3)			
R2	0.4 W metal film resistor	1 MΩ		
R3	0.4 W metal film resistor	10 Ω		

Notes

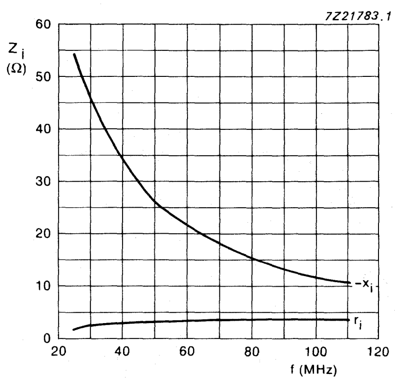
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with epoxy fibre-glass dielectric (ε_r = 4.5), thickness 1⁄16 inch.
3. Refer to Application Information for value.





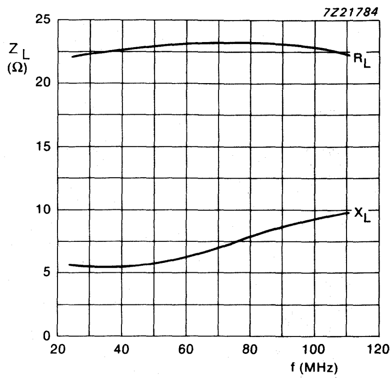
The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being unetched copper to serve as ground plane. Earth connections are made by fixing screws, copper straps and hollow rivets under the sources and around the edges to provide a direct contact between the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

Fig.14 Component layout for 175 MHz class-B test circuit.



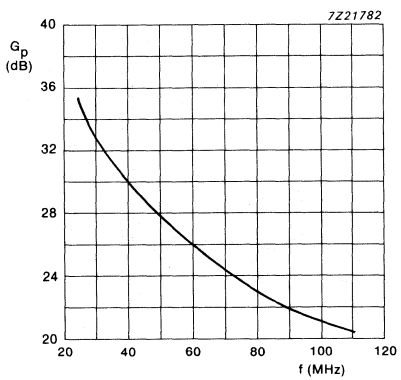
Class-B operation; V_{DS} = 28 V; I_{DQ} = 25 mA;
P_L = 15 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.15 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 25 mA;
P_L = 15 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.16 Load impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 25 mA;
P_L = 15 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.17 Power gain as a function of frequency, typical values.

VHF power MOS transistor BLF245

FEATURES

- High power gain
- Low noise figure
- Easy power control
- Good thermal stability
- Withstands full load mismatch.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the VHF frequency range.

The transistor is encapsulated in a 4-lead SOT123 flange envelope, with a ceramic cap. All leads are isolated from the flange.

Matched gate-source voltage (V_{GS}) groups are available on request.

PINNING - SOT123

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION

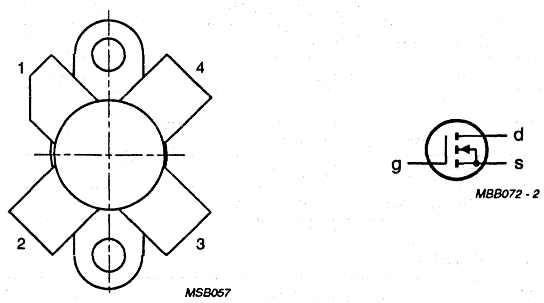


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	175	28	30	> 13	> 50

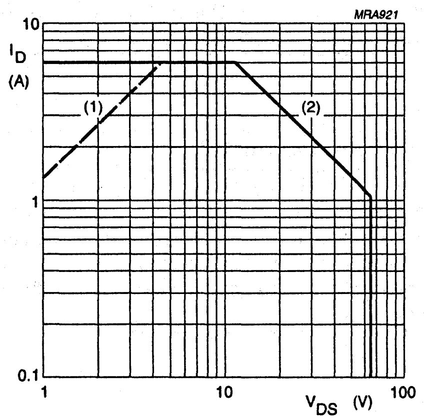
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage	$V_{GS} = 0$	–	65	V
$\pm V_{GS}$	gate-source voltage	$V_{DS} = 0$	–	20	V
I_D	DC drain current		–	6	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	68	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

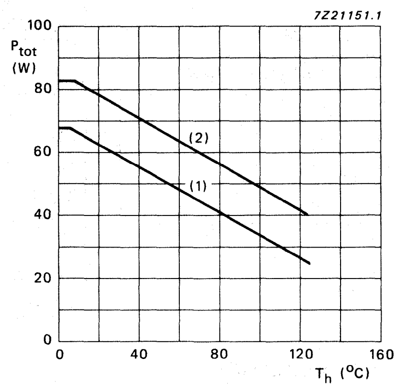
SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 68 W	2.6 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_{mb} = 25 °C; P_{tot} = 68 W	0.3 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Continuous operation.

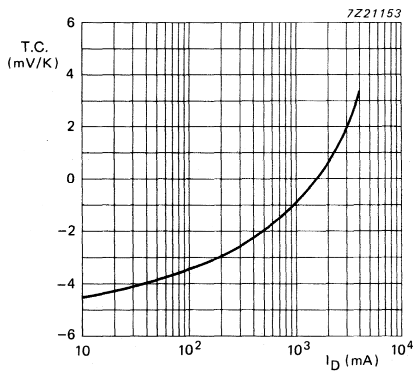
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

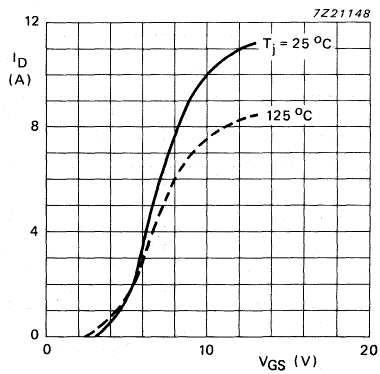
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 10 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	2	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 10 mA; V_{DS} = 10 V	2	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched devices	I_D = 10 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 1.5 A; V_{DS} = 10 V	1.2	1.9	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 1.5 A; V_{GS} = 10 V	–	0.4	0.75	Ω
I_{DSX}	on-state drain current	V_{GS} = 10 V; V_{DS} = 10 V	–	10	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	125	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	75	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	7	–	pF
F	noise figure (see Fig.14)	input and output power matched for: I_D = 1 A; V_{DS} = 28 V; P_L = 30 W; R1 = 1 kΩ; T_h = 25 °C; f = 175 MHz	–	2	–	dB



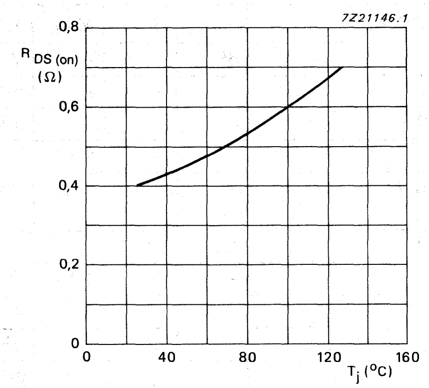
V_{DS} = 10 V; valid for T_j = 25 to 125 °C.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



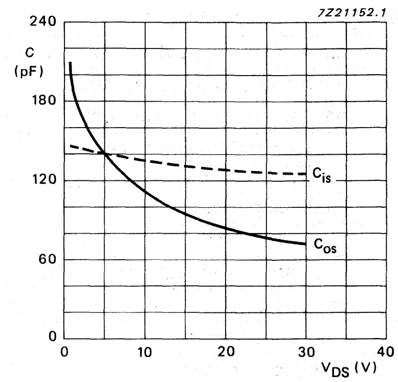
V_{DS} = 10 V.

Fig.5 Drain current as a function of gate-source voltage, typical values.



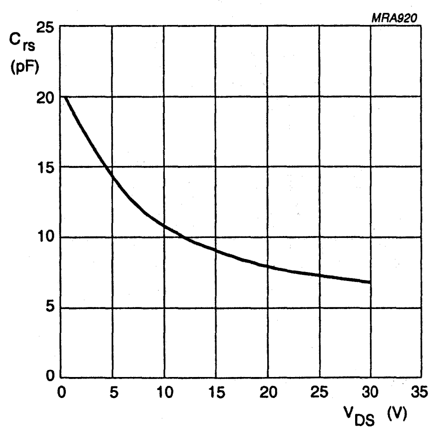
V_{GS} = 10 V; I_D = 1.5 A.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R1 = 1 kΩ.

RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)	Z_i (Ω) (note 1)	Z_L (Ω)
CW, class-B	175	28	50	30	> 13 typ. 15.5	< 50 typ. 67	2.0 − j2.7	3.9 + j4.4
	175	12.5	50	12	typ. 12	typ. 66	2.4 − j2.5	3.8 + j1.3

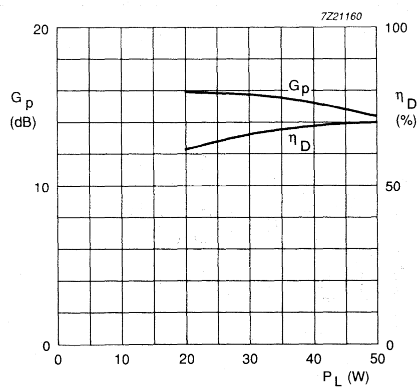
Note

1. R1 included.

Ruggedness in class-B operation

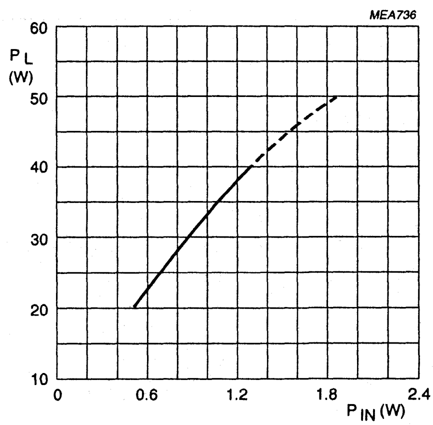
The BLF245 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; at rated load power.



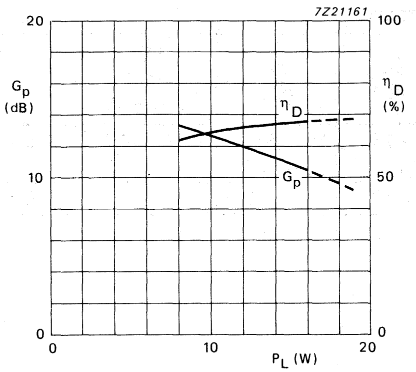
Class-B operation; V_{DS} = 28 V; I_{DQ} = 50 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.9 Power gain and efficiency as functions of load power, typical values.



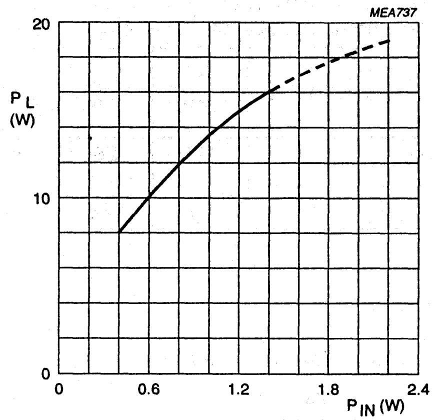
Class-B operation; V_{DS} = 28 V; I_{DQ} = 50 mA; f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.10 Load power as a function of input power, typical values.



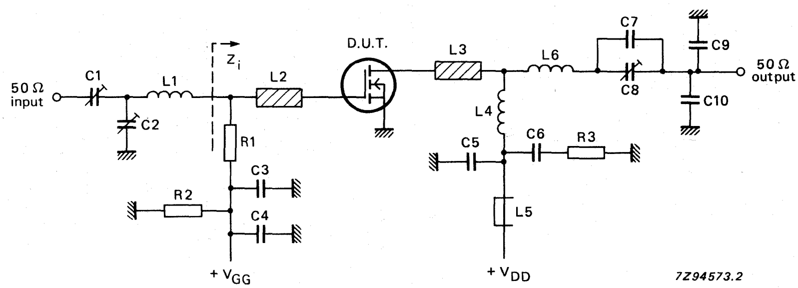
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.11 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA;
f = 175 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

Fig.12 Load power as a function of input power, typical values.



f = 175 MHz.

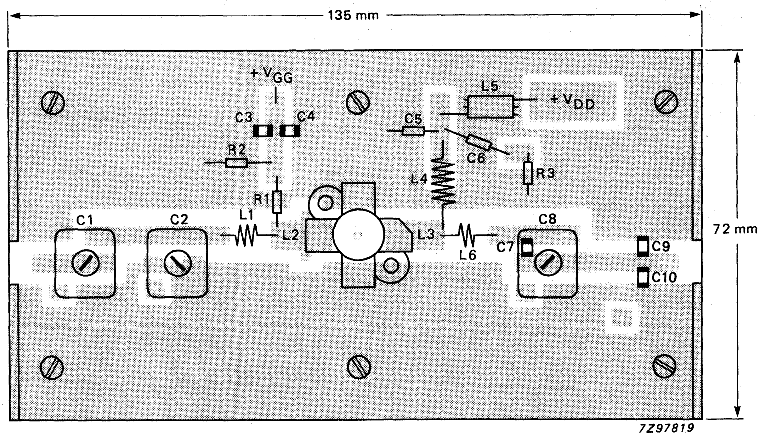
Fig.13 Test circuit for class-B operation.

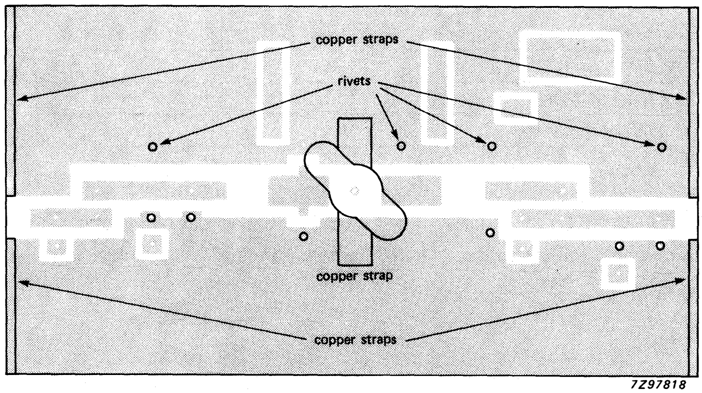
List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	4 to 40 pF		2222 809 07008
C2, C8	film dielectric trimmer	5 to 60 pF		2222 809 07011
C3	multilayer ceramic chip capacitor	100 pF		2222 854 13101
C4, C6	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C5	ceramic capacitor	100 pF		2222 680 10101
C7	multilayer ceramic chip capacitor (note 1)	18 pF		
C9	multilayer ceramic chip capacitor (note 1)	27 pF		
C10	multilayer ceramic chip capacitor (note 1)	24 pF		
L1	3 turns enamelled 0.5 mm copper wire	13.5 nH	length 3.5 mm int. dia. 2 mm leads 2 x 2 mm	
L2, L3	stripline (note 2)	30 Ω	10 x 6 mm	
L4	6 turns enamelled 1.5 mm copper wire	98 nH	length 12.5 mm int. dia. 5 mm leads 2 x 2 mm	
L5	grade 3B Ferroxcube RF choke			4312 020 36640
L6	2 turns enamelled 1.5 mm copper wire	24.5 nH	length 4 mm int. dia. 5 mm leads 2 x 2 mm	
R1	metal film resistor	1 kΩ		
R2	metal film resistor	1 MΩ		
R3	metal film resistor	10 Ω		

Notes

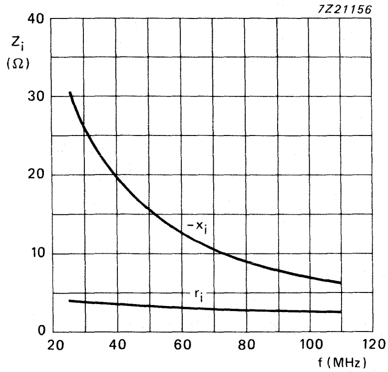
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad PCB with epoxy fibre-glass dielectric (ε_r = 4.5), thickness 1⁄16 inch.





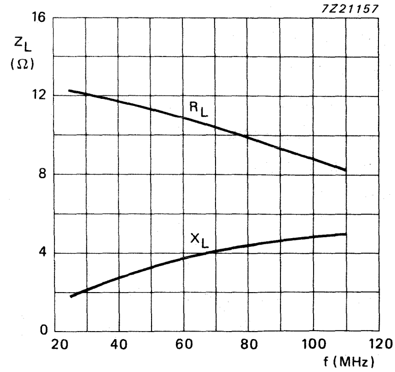
The circuit and components are situated on one side of the epoxy fibre-glass board; the other side is unetched copper and serves as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps under the sources and around the edges, to provide a direct contact between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

Fig.14 Component layout for 175 MHz class-B test circuit.



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

Fig.15 Input impedance as a function of frequency (series components), typical values.



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

Fig.16 Load impedance as a function of frequency (series components), typical values.

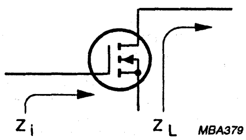
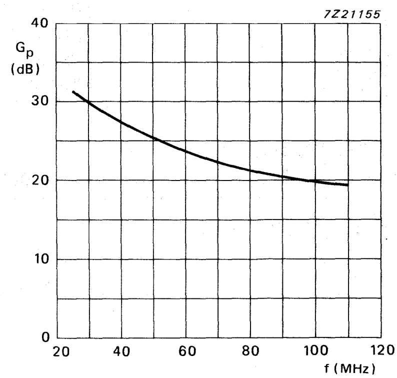


Fig.17 Definition of MOS impedance.



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

Fig.18 Power gain as a function of frequency, typical values.

UHF power MOS transistor BLF521

FEATURES

- High power gain
- Easy power control
- Gold metallization
- Good thermal stability
- Withstands full load mismatch
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT172D studless envelope, with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT172D

PIN	DESCRIPTION
1	source
2	gate
3	drain
4	source

PIN CONFIGURATION

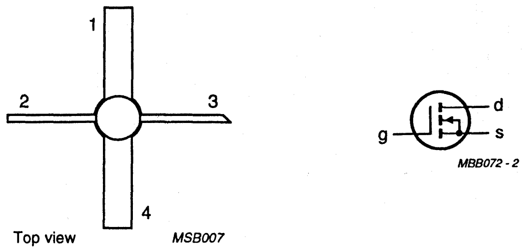


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_{amb} = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	12.5	2	> 10	> 50

LIMITING VALUES

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

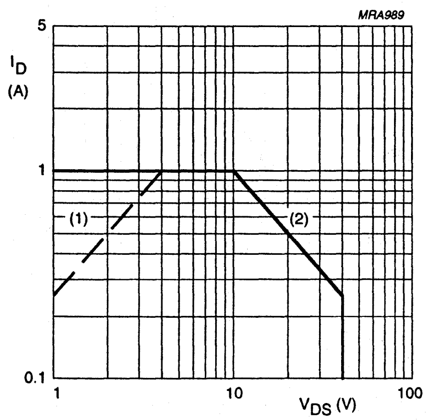
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	40	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	1	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	10	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	17.5 K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient (note 1)	75 K/W

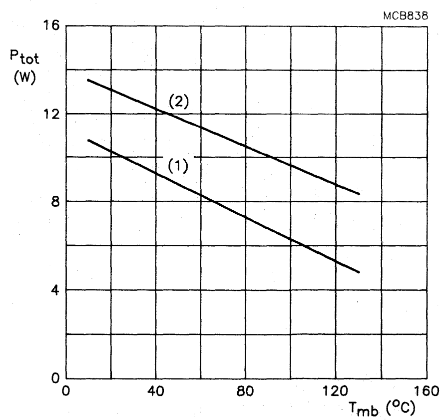
Note

1. Mounted on printed circuit board, see Fig.12.



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



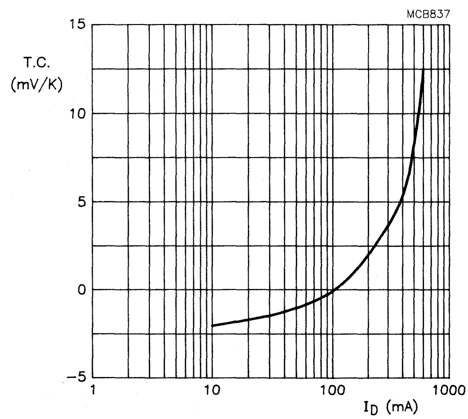
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

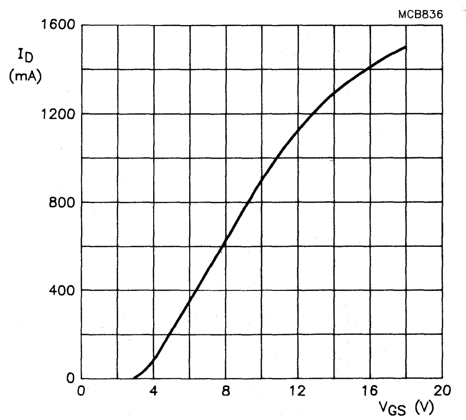
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 3 mA	40	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 12.5 V	–	–	10	μA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 3 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	80	135	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.3 A; V_{GS} = 15 V	–	3.5	4	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	1.3	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	5.3	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	7.8	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	1.8	–	pF



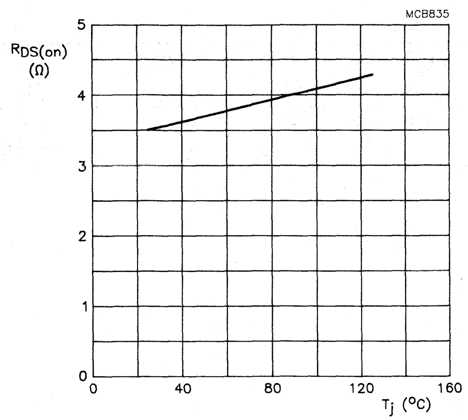
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



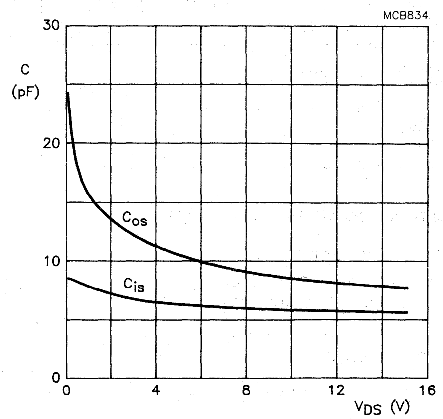
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



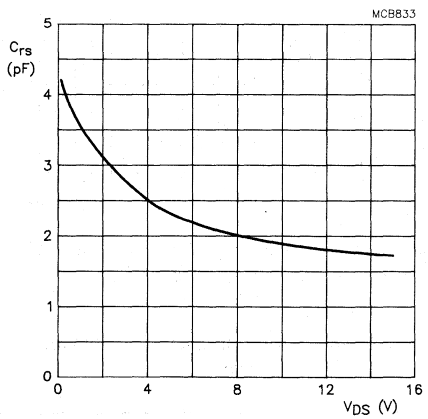
I_D = 0.3 A; V_{GS} = 15 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

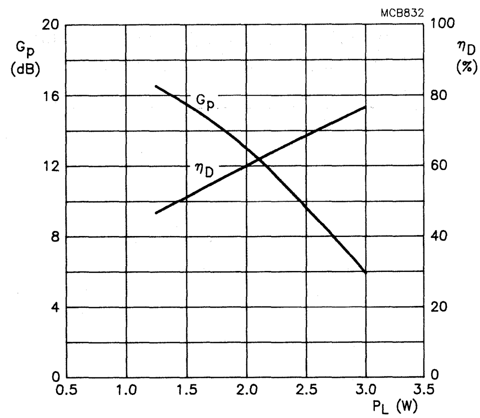
T_{amb} = 25 °C; R_{GS} = 274 Ω, unless otherwise specified.
RF performance in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	12.5	10	2	> 10 typ. 13	> 50 typ. 60

Ruggedness in class-B operation

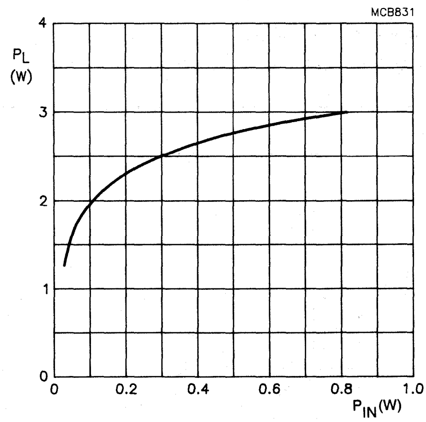
The BLF521 is capable of withstanding a load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{DS} = 15.5 V; f = 500 MHz at rated output power.



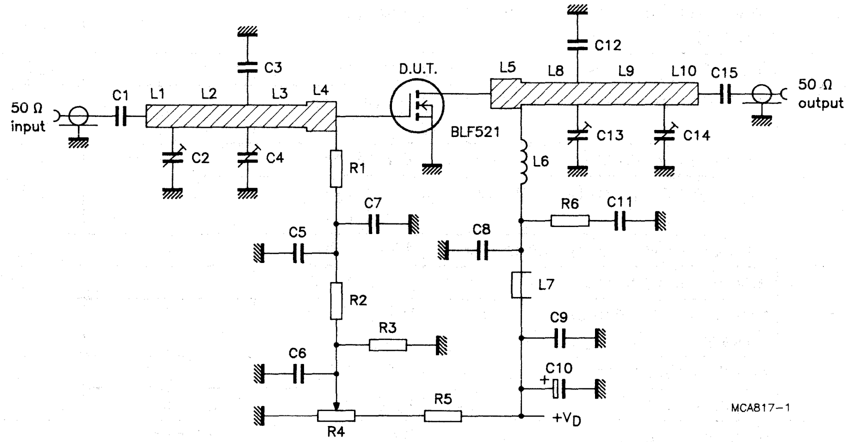
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA; Z_L = 9.5 + j12.8; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 20 mA; Z_L = 9.5 + j12.8; f = 175 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

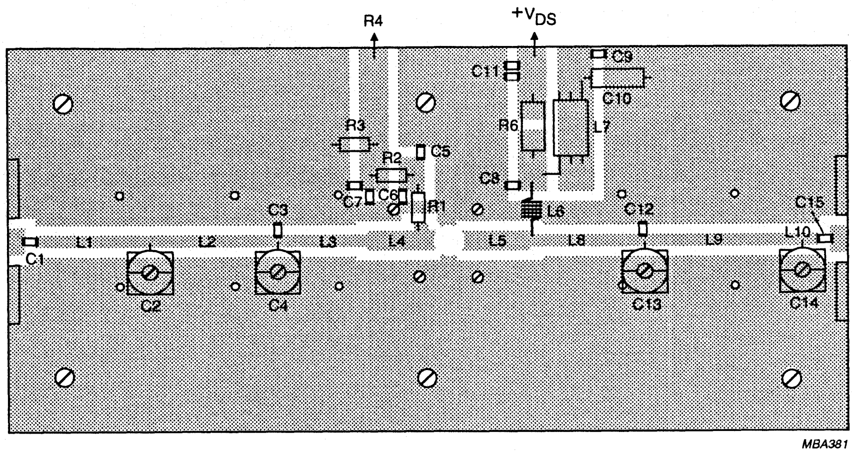
Fig.11 Test circuit for class-B operation.

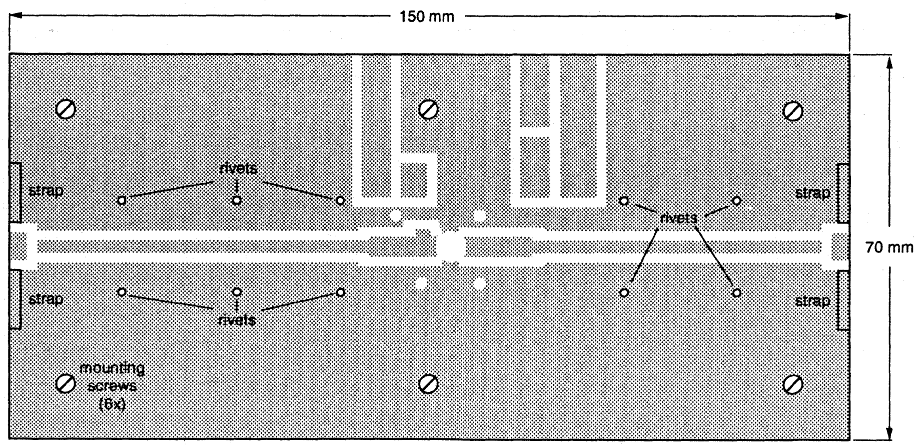
List of components (class-AB test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C5, C8, C15	multilayer ceramic chip capacitor (note 1)	390 pF, 500 V		
C2, C13	film dielectric trimmer	2 to 9 pF		2222 809 09002
C3	multilayer ceramic chip capacitor (note 2)	5.6 pF, 500 V		
C4	film dielectric trimmer	2 to 18 pF		2222 809 09003
C6, C11	multilayer ceramic chip capacitor	2 x 100 nF in parallel, 50 V		2222 852 47104
C7, C9	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C10	electrolytic capacitor	10 µF, 63 V		2222 030 38109
C12	multilayer ceramic chip capacitor (note 2)	9.1 pF, 50 V		
C14	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
L1	stripline (note 3)	83 Ω	20 x 2 mm	
L2	stripline (note 3)	83 Ω	21 x 2 mm	
L3	stripline (note 3)	83 Ω	19 x 2 mm	
L4, L5	stripline (note 3)	67 Ω	12 x 3 mm	
L6	5 turns enamelled 0.5 mm copper wire	62 nH	length 3.75 mm int. dia. 3 mm leads 2 x 4 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L8	stripline (note 3)	83 Ω	18.6 x 2 mm	
L9	stripline (note 3)	83 Ω	31.6 x 2 mm	
L10	stripline (note 3)	83 Ω	2 x 2 mm	
R1	0.4 W metal film resistor	274 Ω		2322 151 72741
R2	0.4 W metal film resistor	1.96 kΩ		2322 151 71962
R3	0.4 W metal film resistor	1 MΩ		2322 151 71005
R4	cermet potentiometer	5 kΩ		
R5	0.4 W metal film resistor	7.5 kΩ		2322 151 77502
R6	1 W metal film resistor	10 Ω		2322 153 51009

Notes

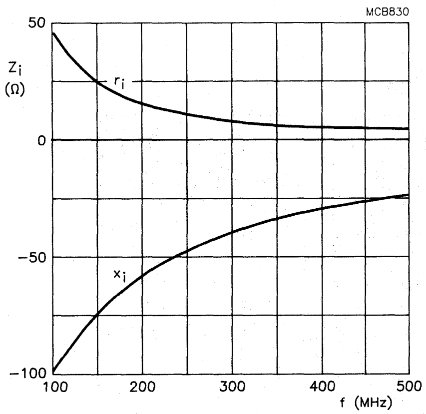
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 1.6 mm.





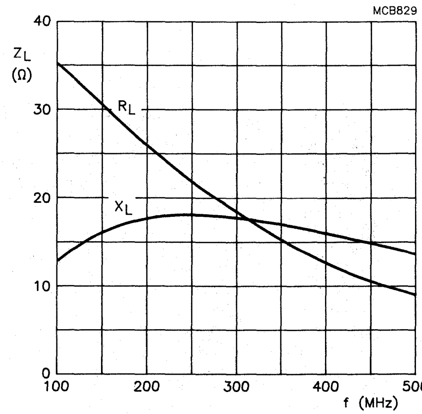
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz test circuit.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA; R_{GS} = 274 Ω; P_L = 2 W.

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA; R_{GS} = 274 Ω; P_L = 2 W.

Fig.14 Load impedance as a function of frequency (series components), typical values.

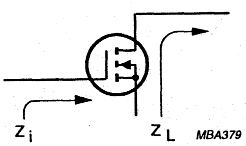
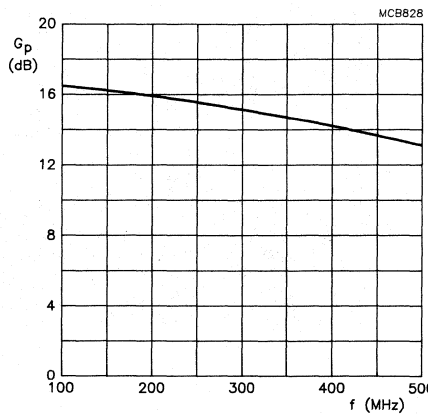


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 10 mA; R_{GS} = 274 Ω; P_L = 2 W.

Fig.16 Power gain as a function of frequency, typical values.

Common emitter S-parameters

Measured at V_{DS} = 12.5 V and I_D = 100 mA.

f (MHz)	S_{11} MAGNITUDE (ratio)	S_{11} ANGLE (deg)	S_{21} MAGNITUDE (ratio)	S_{21} ANGLE (deg)	S_{12} MAGNITUDE (ratio)	S_{12} ANGLE (deg)	S_{22} MAGNITUDE (ratio)	S_{22} ANGLE (deg)
40	0.968	−24.0	10.749	161.5	0.044	72.6	0.900	−27.4
100	0.864	−55.4	9.105	138.3	0.094	51.7	0.828	−62.4
200	0.701	−91.0	6.353	112.7	0.130	29.7	0.735	−100.8
300	0.626	−112.4	4.693	97.0	0.140	17.2	0.693	−122.7
400	0.587	−127.0	3.622	85.6	0.141	9.4	0.678	−136.3
500	0.580	−137.1	2.959	76.5	0.139	4.0	0.675	−145.4
600	0.580	−144.6	2.498	68.8	0.135	0.0	0.675	−152.1
700	0.581	−151.7	2.131	61.4	0.130	−2.5	0.677	−157.5
800	0.588	−157.6	1.874	54.7	0.123	−4.3	0.677	−162.3
900	0.596	−163.5	1.656	48.8	0.115	−4.8	0.683	−166.9
1000	0.605	−168.8	1.473	43.0	0.107	−4.4	0.689	−171.2

Measured at V_{DS} = 12.5 V and I_D = 150 mA.

f (MHz)	S_{11} MAGNITUDE (ratio)	S_{11} ANGLE (deg)	S_{21} MAGNITUDE (ratio)	S_{21} ANGLE (deg)	S_{12} MAGNITUDE (ratio)	S_{12} ANGLE (deg)	S_{22} MAGNITUDE (ratio)	S_{22} ANGLE (deg)
40	0.965	−25.9	11.435	160.6	0.044	72.0	0.876	−29.2
100	0.857	−58.7	9.534	136.8	0.092	50.1	0.804	−65.7
200	0.691	−95.1	6.529	111.3	0.125	28.6	0.715	−104.3
300	0.622	−116.7	4.783	96.0	0.134	16.7	0.678	−125.8
400	0.588	−130.3	3.663	84.8	0.135	9.2	0.666	−138.8
500	0.580	−140.8	2.988	75.9	0.133	4.3	0.665	−147.5
600	0.582	−147.8	2.515	68.4	0.128	0.7	0.666	−154.0
700	0.586	−154.9	2.154	61.2	0.123	−1.3	0.668	−159.1
800	0.588	−160.5	1.897	54.6	0.117	−2.6	0.669	−163.8
900	0.599	−166.3	1.673	48.8	0.111	−2.6	0.675	−168.1
1000	0.609	−171.7	1.493	43.0	0.103	−1.7	0.681	−172.3

Measured at V_{DS} = 12.5 V and I_D = 200 mA.

f (MHz)	S11 MAGNITUDE (ratio)	S11 ANGLE (deg)	S21 MAGNITUDE (ratio)	S21 ANGLE (deg)	S12 MAGNITUDE (ratio)	S12 ANGLE (deg)	S22 MAGNITUDE (ratio)	S22 ANGLE (deg)
40	0.965	−26.7	11.660	160.1	0.044	71.4	0.854	−30.4
100	0.851	−60.7	9.625	135.9	0.091	49.4	0.783	−67.7
200	0.688	−97.5	6.524	110.5	0.123	27.9	0.699	−106.5
300	0.623	−118.8	4.751	95.2	0.131	16.4	0.666	−127.6
400	0.590	−132.7	3.644	84.3	0.132	9.2	0.657	−140.3
500	0.585	−142.4	2.968	75.3	0.130	4.3	0.658	−148.7
600	0.583	−150.0	2.495	67.8	0.126	1.0	0.659	−155.0
700	0.589	−156.7	2.137	60.7	0.120	−0.8	0.662	−160.0
800	0.593	−162.2	1.877	54.3	0.114	−1.9	0.664	−164.6
900	0.602	−167.8	1.656	48.4	0.108	−1.7	0.670	−168.9
1000	0.612	−173.0	1.476	42.8	0.100	−0.5	0.677	−173.0

Measured at V_{DS} = 12.5 V and I_D = 250 mA.

f (MHz)	S11 MAGNITUDE (ratio)	S11 ANGLE (deg)	S21 MAGNITUDE (ratio)	S21 ANGLE (deg)	S12 MAGNITUDE (ratio)	S12 ANGLE (deg)	S22 MAGNITUDE (ratio)	S22 ANGLE (deg)
40	0.963	−27.3	11.640	159.7	0.045	70.8	0.832	−31.3
100	0.848	−62.0	9.567	135.2	0.092	48.9	0.766	−69.2
200	0.686	−99.3	6.434	109.8	0.123	27.4	0.688	−108.2
300	0.624	−120.3	4.674	94.6	0.130	16.0	0.657	−128.9
400	0.594	−134.2	3.582	83.8	0.130	8.9	0.651	−141.3
500	0.585	−143.9	2.914	74.7	0.128	4.2	0.651	−149.6
600	0.590	−150.8	2.447	67.4	0.124	0.9	0.654	−155.8
700	0.595	−157.6	2.097	60.3	0.119	−0.6	0.658	−160.7
800	0.601	−163.1	1.840	53.8	0.113	−1.7	0.660	−165.2
900	0.607	−168.8	1.625	48.0	0.106	−1.3	0.667	−169.4
1000	0.613	−174.1	1.447	42.2	0.099	−0.1	0.673	−173.3

UHF power MOS transistor — BLF522

FEATURES

- High power gain
- Easy power control
- Gold metallization
- Good thermal stability
- Withstands full load mismatch
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 6-lead, SOT171 flange envelope, with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT171

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION

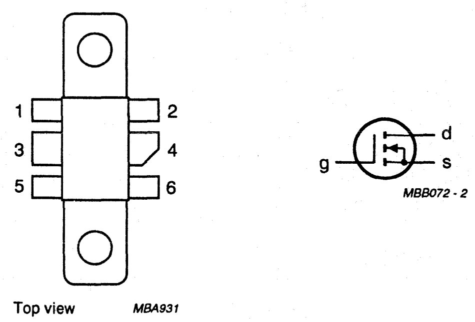


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	12.5	5	> 10	> 50

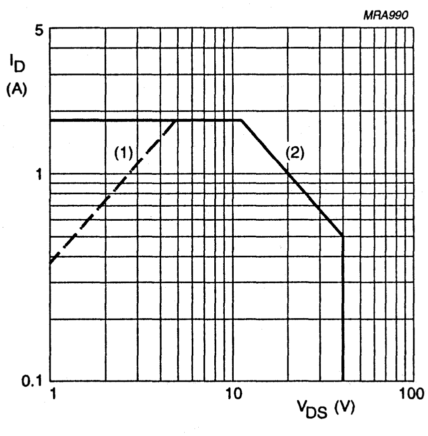
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	40	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	1.8	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	20	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

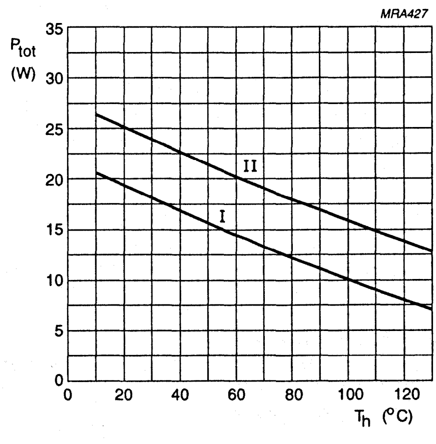
SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 20 W	8.8 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_{mb} = 25 °C; P_{tot} = 20 W	0.4 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(I) Continuous operation.

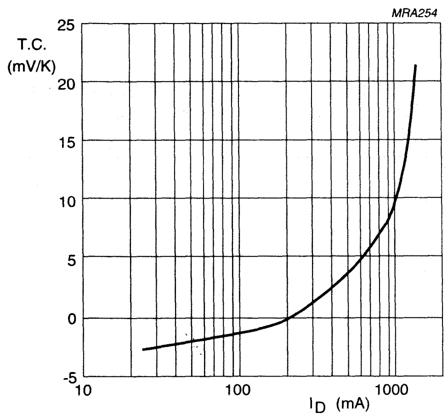
(II) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

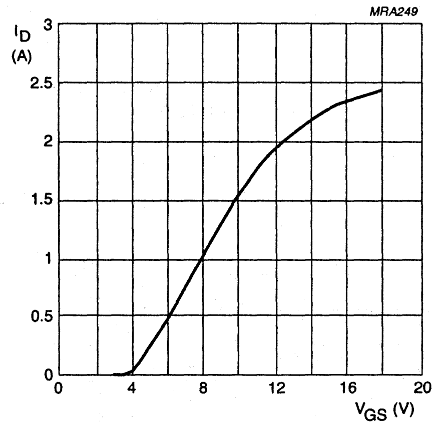
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 5 mA	40	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 12.5 V	–	–	0.5	mA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 50 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.7 A; V_{DS} = 10 V	200	270	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.7 A; V_{GS} = 15 V	–	1.8	2.7	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	2.3	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	14	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	17	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 12.5 V; f = 1 MHz	–	3	–	pF



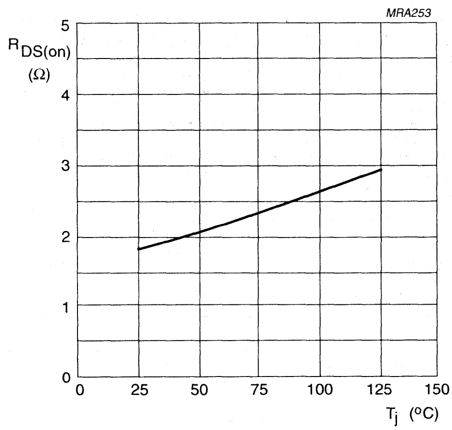
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



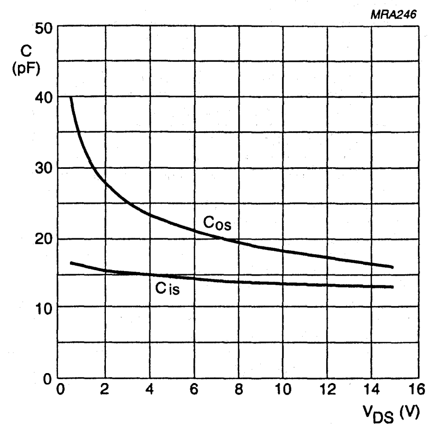
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



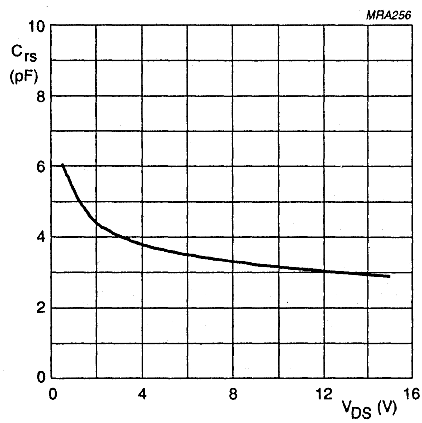
$I_D = 0.7$ A; $V_{GS} = 15$ V;

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



$V_{GS} = 0$; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



$V_{GS} = 0$; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

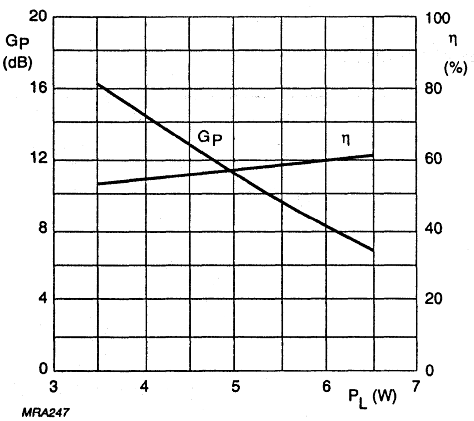
T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W, unless otherwise specified.
RF performance in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	12.5	50	5	> 10 typ. 11	> 50 typ. 55

Ruggedness in class-B operation

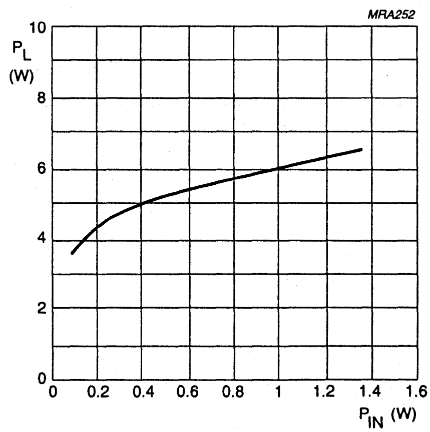
The BLF522 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

V_{DS} = 15.5 V; f = 500 MHz at rated output power.



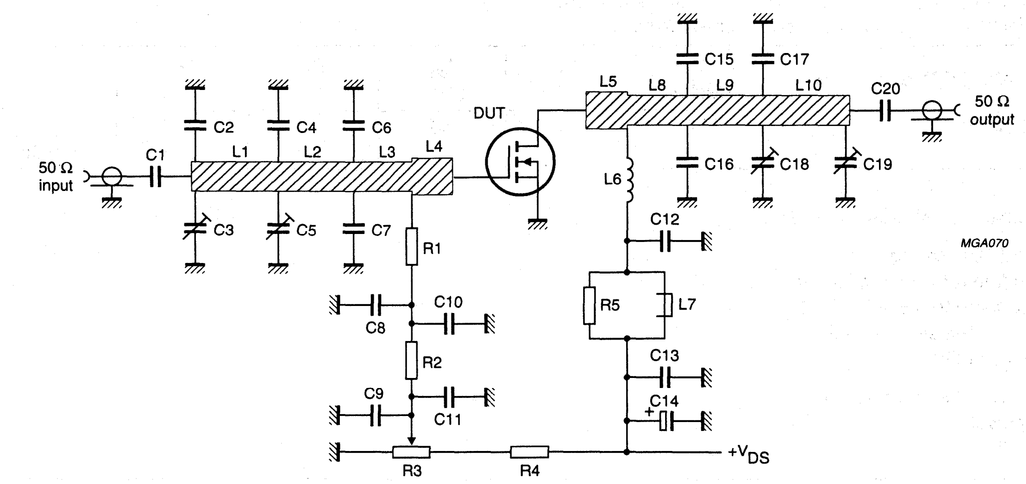
Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

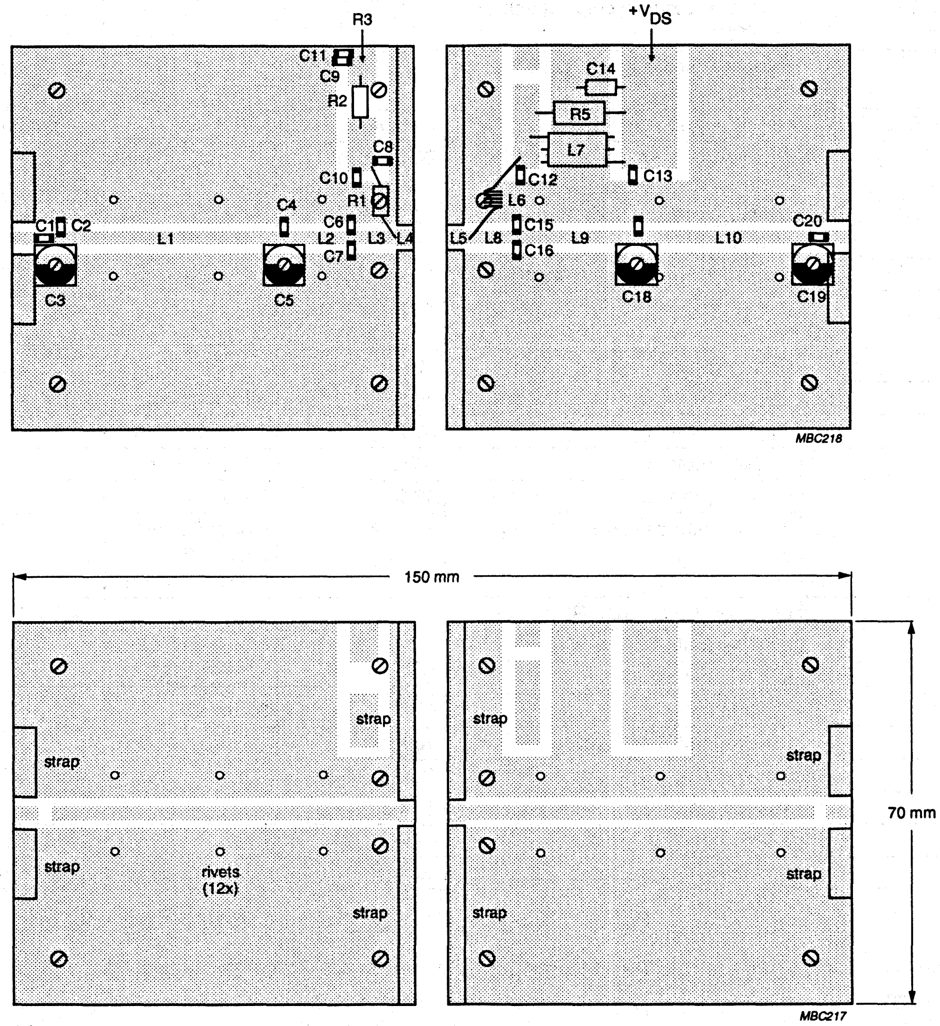
Fig.11 Test circuit for class-B operation.

List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8, C20	multilayer ceramic chip capacitor (note 1)	430 pF, 50 V		
C2	multilayer ceramic chip capacitor (note 2)	3.9 pF, 50 V		
C3, C5, C18, C19	film dielectric trimmer	2 to 18 pF		2222 809 09003
C4	multilayer ceramic chip capacitor (note 2)	20 pF, 50 V		
C6, C7, C15, C16, C17	multilayer ceramic chip capacitor (note 2)	10 pF, 50 V		
C9, C10, C11, C13	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C12	multilayer ceramic chip capacitor (note 1)	390 pF, 50 V		
C14	electrolytic capacitor	10 μF, 63 V		2222 030 38109
L1	stripline (note 3)	50 Ω	36.6 x 2.5 mm	
L2	stripline (note 3)	50 Ω	16.7 x 2.5 mm	
L3	stripline (note 3)	50 Ω	7.7 x 2.5 mm	
L4, L5	stripline (note 3)	42 Ω	3 x 3 mm	
L6	4 turns enamelled 0.8 mm copper wire	24.9 nH	length 6.9 mm int. dia. 2.5 mm leads 2 x 5 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L8	stripline (note 3)	50 Ω	10 x 2.5 mm	
L9	stripline (note 3)	50 Ω	16.5 x 2.5 mm	
L10	stripline (note 3)	50 Ω	34.5 x 2.5 mm	
R1	0.4 W metal film resistor	10 kΩ		2322 151 51003
R2	0.4 W metal film resistor	1 kΩ		2322 151 51002
R3	10 turns cermet potentiometer	50 kΩ		
R4	0.4 W metal film resistor	47 kΩ		2322 151 54703
R5	1 W metal film resistor	10 Ω		2322 153 51009

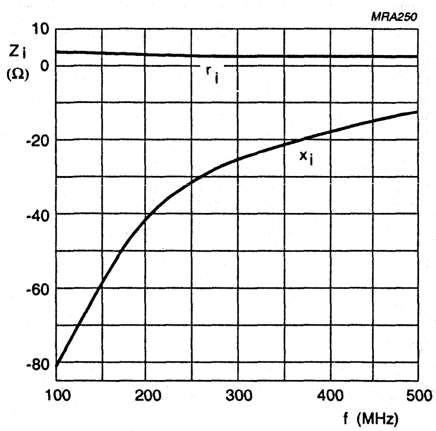
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A 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 0.79 mm.



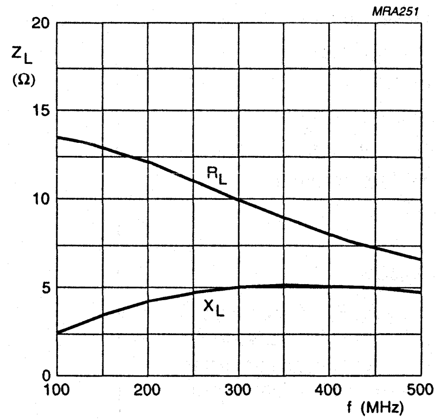
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA; P_L = 5 W.

Fig.13 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA; P_L = 5 W.

Fig.14 Load impedance as a function of frequency (series components), typical values.

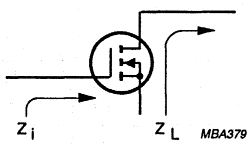
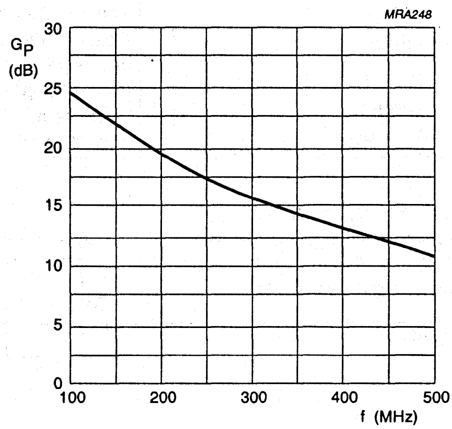


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 12.5 V; I_{DQ} = 50 mA; P_L = 5 W.

Fig.16 Power gain as a function of frequency, typical values.

UHF power MOS transistor BLF542

FEATURES

- High power gain
- Easy power control
- Gold metallization
- Good thermal stability
- Withstands full load mismatch
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the UHF frequency range.

The transistor is encapsulated in a 6-lead, SOT171 flange envelope, with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT171

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION

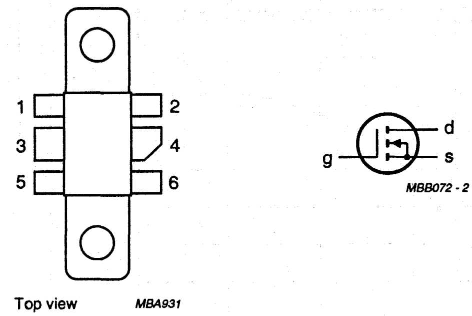


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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 source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	5	> 13	> 50

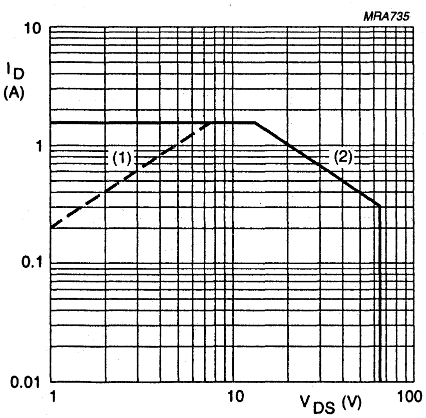
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	1.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	20	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

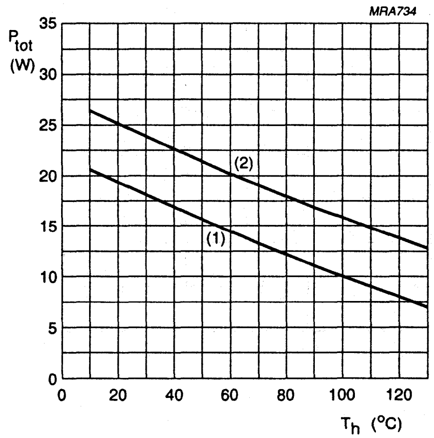
SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	8.8 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.4 K/W



(1) Current in this area may be limited by $R_{DS(on)}$.

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Continuous operation.

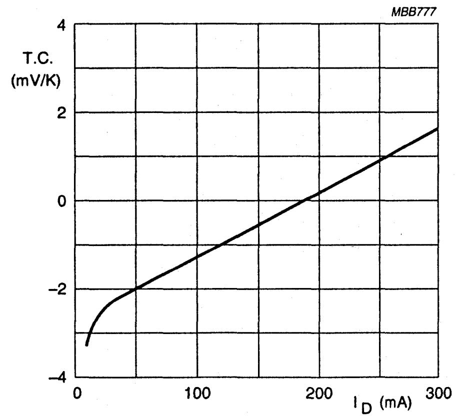
(2) Short time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

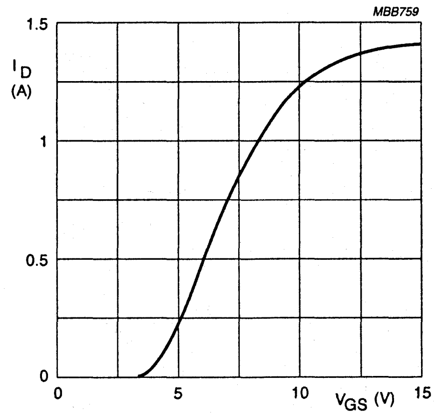
T_j = 25 °C unless otherwise specified..

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.1 mA; V_{GS} = 0	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	10	μA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 10 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	160	240	–	mS
$R_{DS(on)}$	drain-source on-resistance	I_D = 0.3 A; V_{GS} = 15 V	–	3.3	5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	1.4	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	14	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	9.4	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	1.7	–	pF



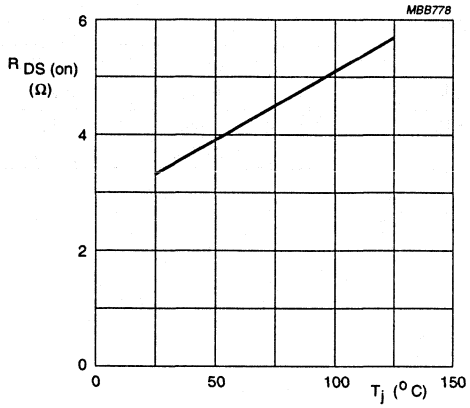
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



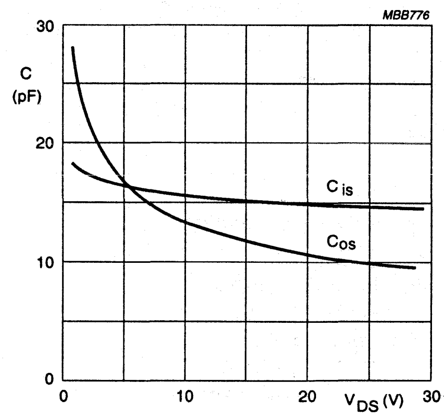
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



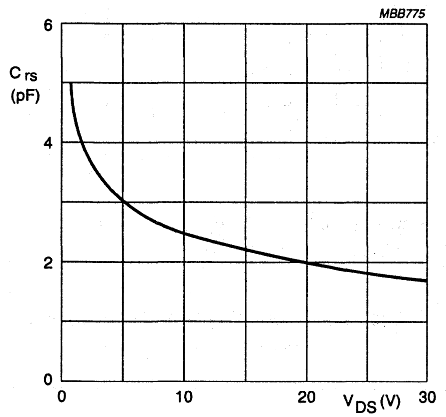
I_D = 0.3 A; V_{GS} = 15 V

Fig.6 Drain-source on-resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

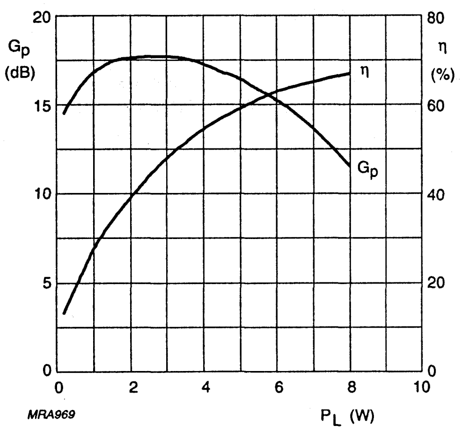
APPLICATION INFORMATION FOR CLASS-B OPERATION

T_{mb} = 25 °C unless otherwise specified.
RF performance in CW operation in a common-source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	50	5	> 13 typ. 16.5	> 50 typ. 59

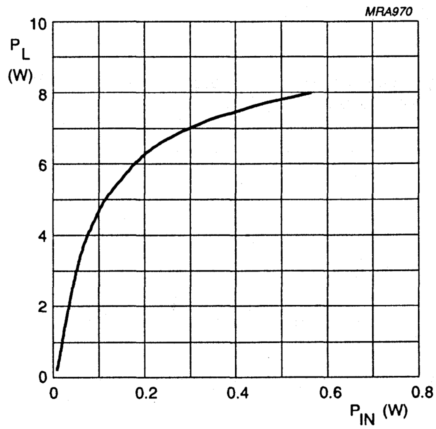
Ruggedness in class-B operation

The BLF542 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions: V_{DS} = 28 V; f = 500 MHz at rated output power.



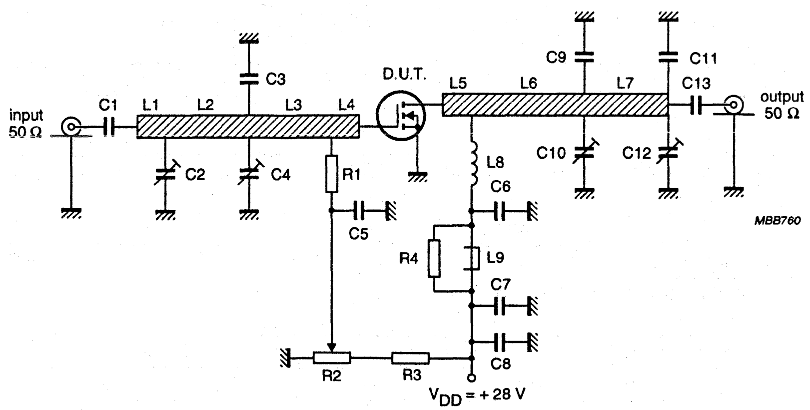
Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

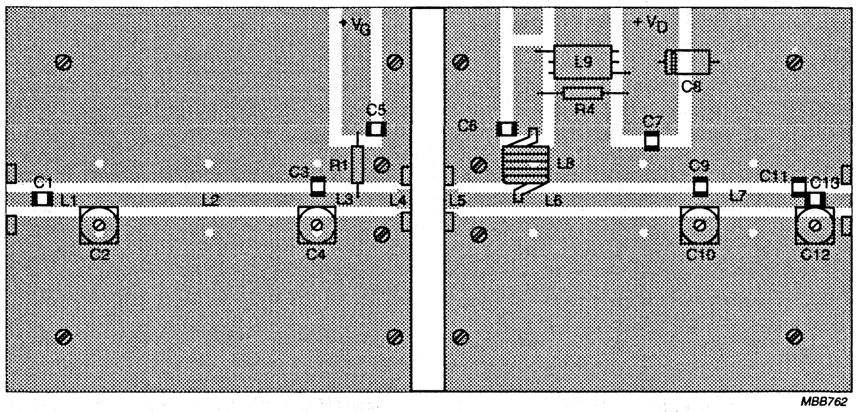
Fig.11 Test circuit for class-B operation.

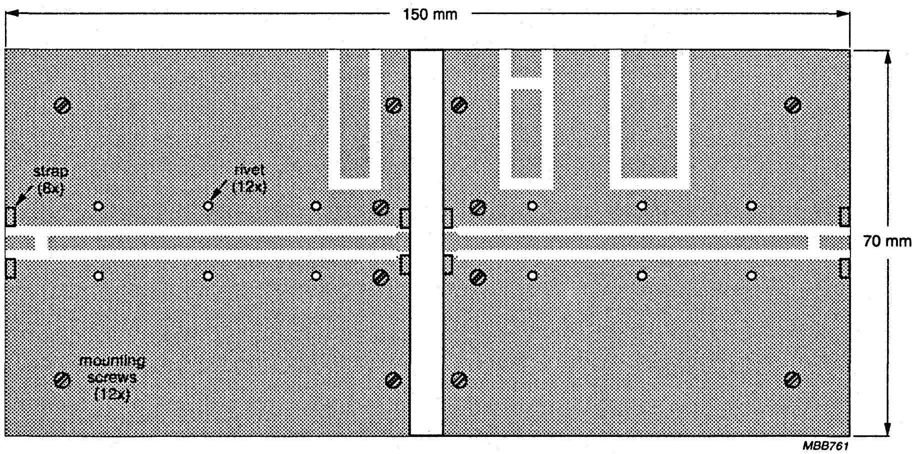
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C5, C13	multilayer ceramic chip capacitor (note 1)	390 pF		
C2, C4, C10, C12	film dielectric trimmer	2 to 18 pF		2222 809 05217
C3, C9	multilayer ceramic chip capacitor (note 1)	39 pF		
C6	multilayer ceramic chip capacitor (note 2)	220 pF		
C7	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C8	electrolytic capacitor	63 V, 10 μF		2222 030 28109
C11	multilayer ceramic chip capacitor (note 1)	10 pF		
L1	stripline (note 3)	50 Ω	11 mm x 2.5 mm	
L2	stripline (note 3)	50 Ω	37 mm x 2.5 mm	
L3	stripline (note 3)	50 Ω	13 mm x 2.5 mm	
L4, L5	stripline (note 3)	42 Ω	3 mm x 3 mm	
L6	stripline (note 3)	50 Ω	39 mm x 2.5 mm	
L7	stripline (note 3)	50 Ω	22 mm x 2.5 mm	
L8	8 turns 0.8 mm enamelled copper wire	250 nH	length 9 mm int. dia. 6 mm leads 2 x 5 mm	
L9	grade 3B Ferroxcube wideband RF choke			4312 020 36640
R1	metal film resistor	10 kΩ, 0.4 W		2322 151 71003
R2	10 turn potentiometer	50 kΩ		
R3	metal film resistor	205 kΩ, 0.4 W		2322 151 72054
R4	metal film resistor	10 Ω, 0.4 W		2322 151 71009

Notes

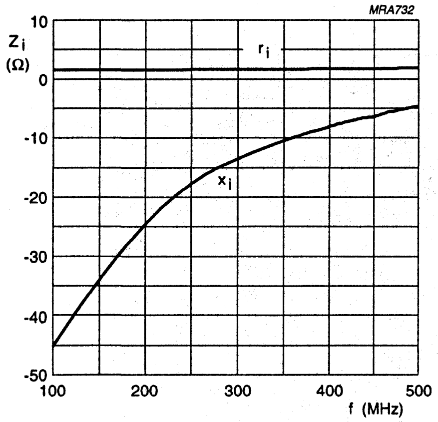
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄32 inch.





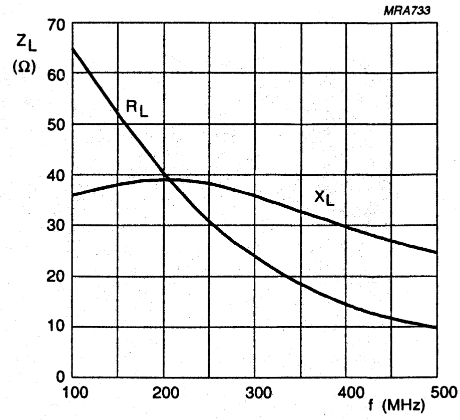
The components are mounted on one side of a copper-clad printed circuit board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.12 Component layout for 500 MHz test circuit.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

Fig.13 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

Fig.14 Load impedance as a function of frequency (series components), typical values.

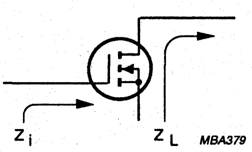
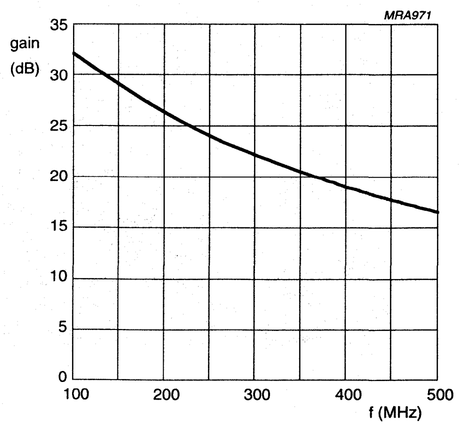


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; P_L = 5 W.

Fig.16 Power gain as a function of frequency, typical values.

UHF power MOS transistor — BLF543

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 6-lead, SOT171 flange envelope, with a ceramic cap. All leads are isolated from the flange.

The devices are marked with a V_{GS} indication intended for matched pair applications.

PINNING - SOT171

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION

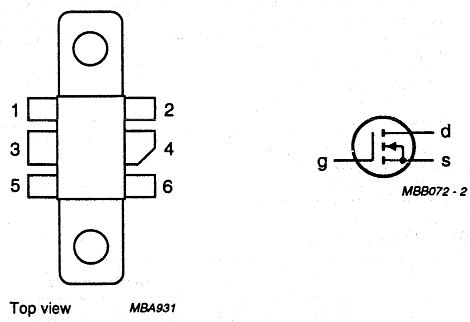


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	10	> 12	> 50
CW, class-B	960	28	10	typ. 8	typ. 50

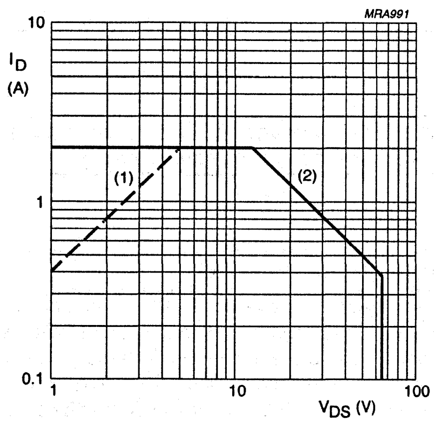
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	2	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	25	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

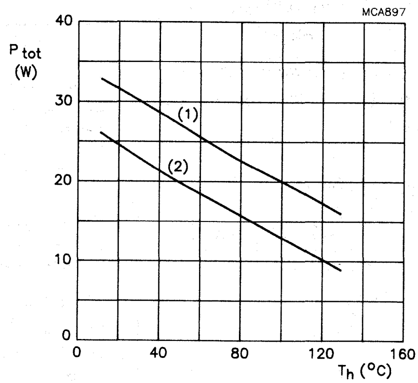
THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	7 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.4 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



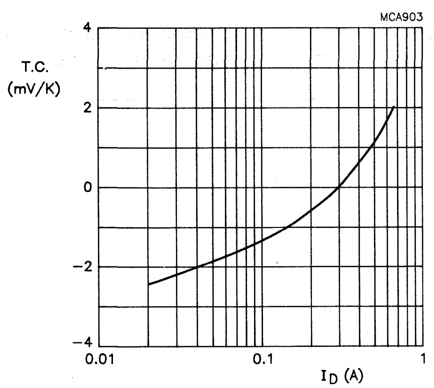
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

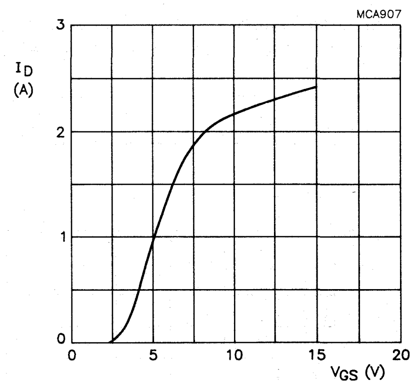
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 5 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	0.5	mA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 20 mA; V_{DS} = 10 V	1	–	4	V
$\Delta V_{GS(th)}$	gate-source voltage difference of matched pairs	I_D = 20 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 0.6 A; V_{DS} = 10 V	300	450	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.6 A; V_{GS} = 10 V	–	1.7	2.5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	2.4	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	16	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	12	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	3.2	–	pF



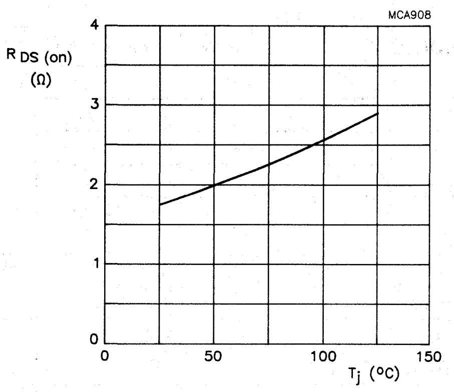
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



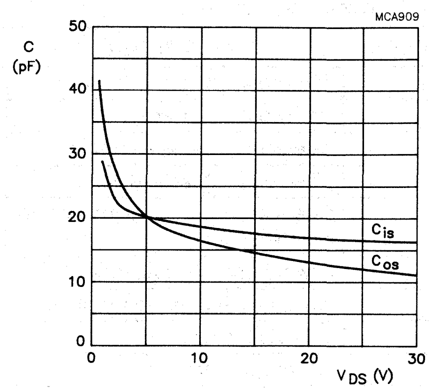
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



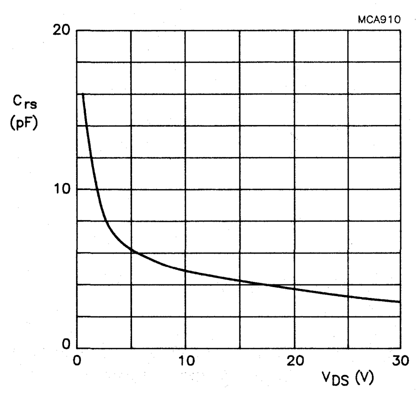
$I_D = 0.6$ A; $V_{GS} = 10$ V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



$V_{GS} = 0$; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



$V_{GS} = 0$; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

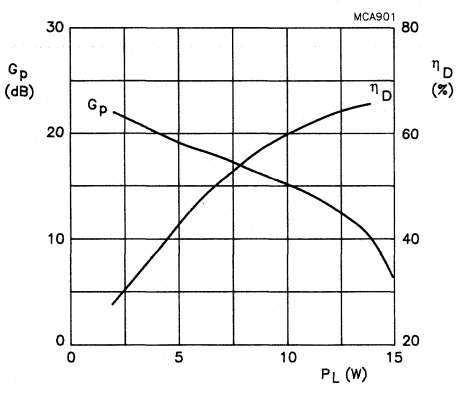
T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W, unless otherwise specified.
RF performance in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW class-B	500	28	20	10	> 12 typ. 15	> 50 typ. 60
CW class-B	960	28	20	10	typ. 8	typ. 50
CW class-B	960	24	20	7.5	typ. 8	typ. 50

Ruggedness in class-B operation

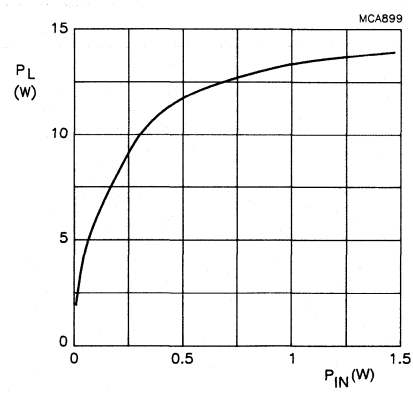
The BLF543 is capable of withstanding a full load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA;
Z_L = 8.4 + j14.3 Ω; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA;
Z_L = 8.4 + j14.3 Ω; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.

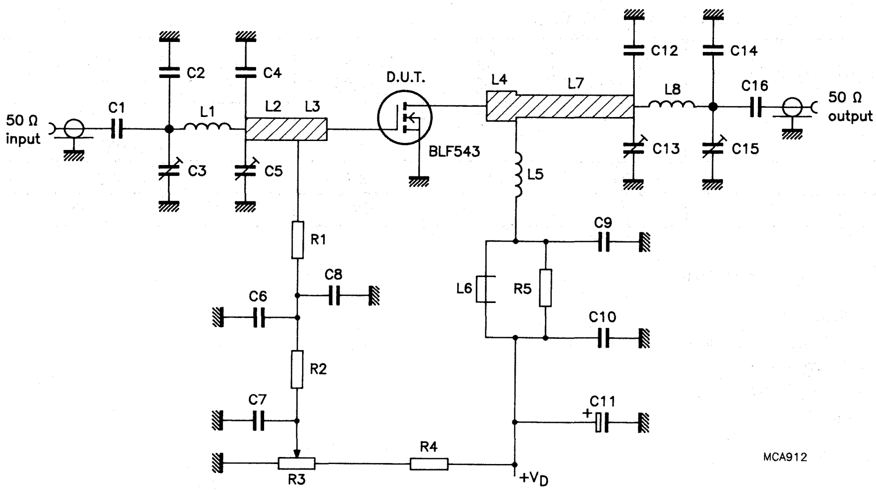


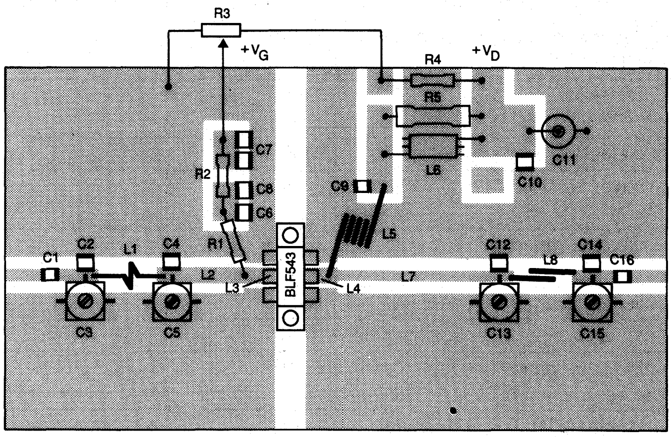
Fig.11 Test circuit for class-B operation at 500 MHz.

List of components (class-B test circuit at 500 MHz)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C9, C16	multilayer ceramic chip capacitor (note 1)	390 pF		
C2, C14	multilayer ceramic chip capacitor (note 1)	7.5 pF		
C3, C5, C13, C15	film dielectric trimmer	9 pF		2222 809 09002
C4	multilayer ceramic chip capacitor (note 1)	20 pF		
C7	multilayer ceramic chip capacitor	2 x 100 nF in parallel, 50 V		2222 852 47104
C8, C10	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C11	aluminium electrolytic capacitor	10 μF, 63 V		2222 030 28109
C12	multilayer ceramic chip capacitor (note 1)	22 pF		
L1	1 turn enamelled 0.8 mm copper wire	11 nH	int. dia. 4.7 mm leads 2 x 5 mm	
L2	stripline (note 2)	42.5 Ω	14.5 x 3 mm	
L3, L4	stripline (note 2)	42.5 Ω	6 x 3 mm	
L5	7 turns enamelled 1 mm copper wire	124 nH	length 7.8 mm int. dia. 4 mm leads 2 x 5 mm	
L6	grade 3B Ferroxcube RF choke			4312 020 36640
L7	stripline (note 2)	55.7 Ω	31 x 2 mm	
L8	1 turn enamelled 1 mm copper wire	8 nH	int. dia. 3.2 mm leads 2 x 5 mm	
R1, R2	0.4 W metal film resistor	1 kΩ		2322 151 71002
R3	10 turns cermet potentiometer	5 kΩ		
R4	0.4 W metal film resistor	19.6 kΩ		2322 151 71963
R5	1 W metal film resistor	10 Ω		2322 153 51009

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 glass microfibre reinforced PTFE ($\varepsilon_r = 2.2$); thickness 1⁄32 inch.



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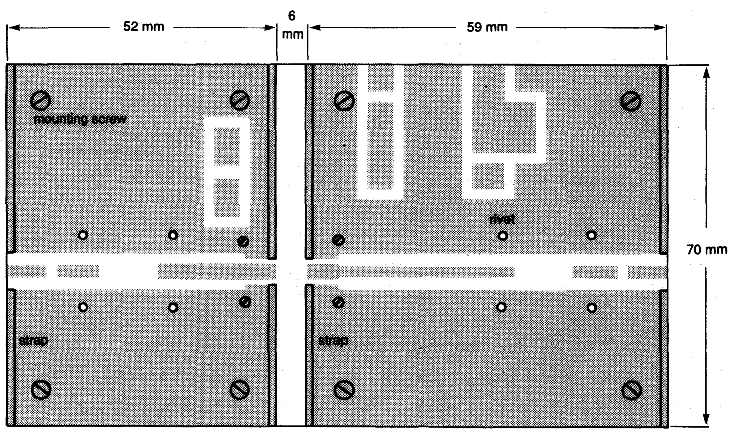


7Z22998

The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.

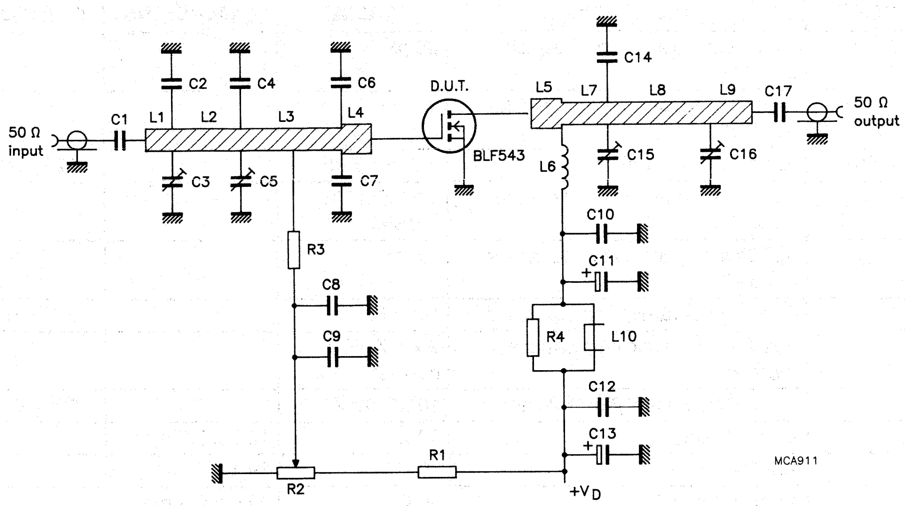


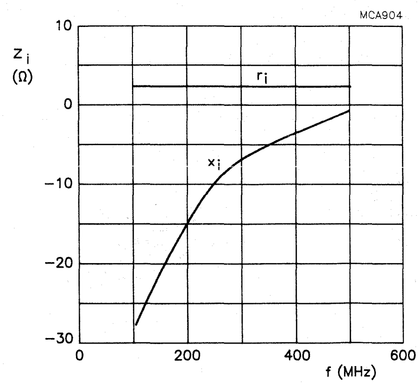
Fig.13 Test circuit for class-B operation at 960 MHz.

List of components (class-B test circuit at 960 MHz)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8, C10, C17	multilayer ceramic chip capacitor (note 1)	68 pF		
C2	multilayer ceramic chip capacitor (note 2)	4.7 pF		
C3, C5, C15, C16	film dielectric trimmer	1.2 to 5.5 pF		2222 808 00004
C4	multilayer ceramic chip capacitor (note 2)	2 x 5.6 pF in parallel		
C6, C7	multilayer ceramic chip capacitor (note 2)	7.5 pF		
C9, C12	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C14	multilayer ceramic chip capacitor (note 2)	2 x 4.7 pF in parallel		
C11, C13	aluminium electrolytic capacitor	10 μF, 63 V		2222 030 28109
L1	stripline (note 3)	50 Ω	12.5 x 2.5 mm	
L2	stripline (note 3)	50 Ω	19 x 2.5 mm	
L3	stripline (note 3)	50 Ω	29.5 x 2.5 mm	
L4, L5	stripline (note 3)	42.5 Ω	3 x 3 mm	
L6	3 turns enamelled 0.8 mm copper wire	35 nH	length 4.6 mm int. dia. 4 mm leads 2 x 5 mm	
L7	stripline (note 3)	50 Ω	12.5 x 2.5 mm	
L8	stripline (note 3)	50 Ω	28.5 x 2.5 mm	
L9	stripline (note 3)	50 Ω	20.5 x 2.5 mm	
L10	grade 3B Ferroxcube RF choke			4312 020 36640
R1	0.4 W metal film resistor	205 kΩ		2322 151 72054
R2	10 turns potentiometer	50 kΩ		
R3	0.4 W metal film resistor	10 kΩ		2322 151 71003
R4	0.4 W metal film resistor	10 Ω		2322 153 51009

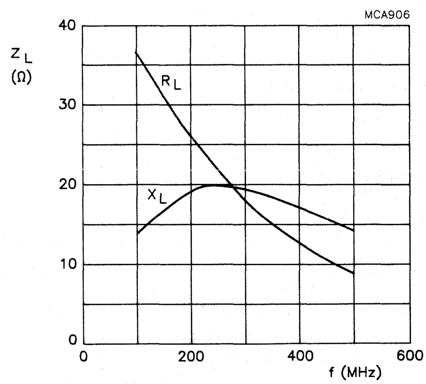
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE (ε_r = 2.2); thickness 1⁄32 inch.



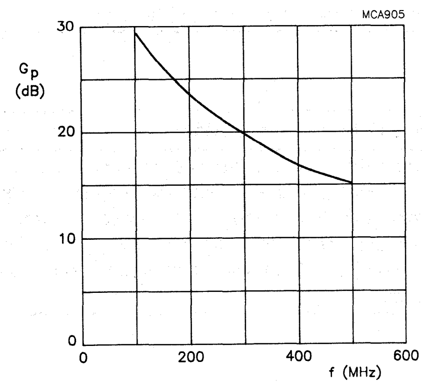
Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA;
P_L = 10 W.

Fig.14 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA;
P_L = 10 W.

Fig.15 Load impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA;
P_L = 10 W.

Fig.16 Power gain as a function of frequency, typical values.

Optimum input and load impedances

Optimum input impedance: 2.3 + j9.5 Ω.
Optimum load impedance: 4.3 + j8.6 Ω.
Conditions: class-B operation; V_{DS} = 24 V;
I_{DQ} = 20 mA; f = 960 MHz; P_L = 7.5 W; typical values.

UHF power MOS transistor — BLF544

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 6-lead, SOT171 flange envelope, with a ceramic cap. All leads are isolated from the flange.

A marking code, showing gate-source voltage (V_{GS}) information is provided for matched pair applications. Refer to the 'General' section for further information.

PINNING - SOT171

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION

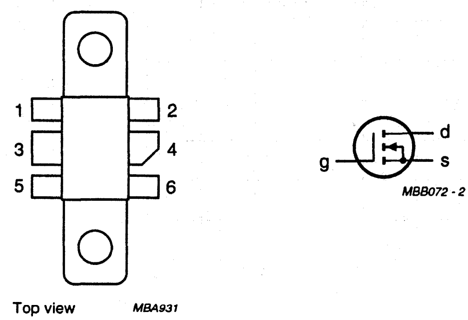


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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_h = 25 °C in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	20	> 11	> 50
CW, class-B	960	28	20	typ. 7	typ. 50

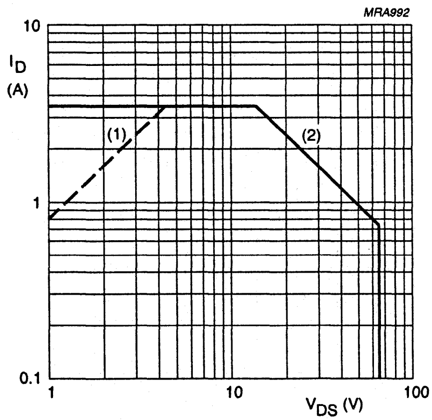
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	3.5	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	48	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

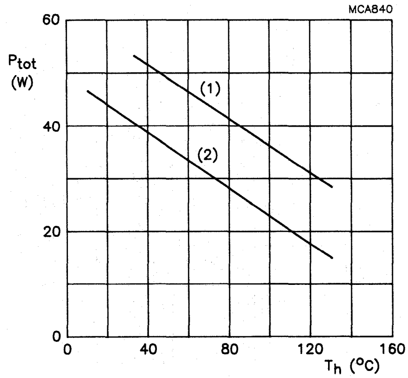
SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	3.7 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.4 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.

(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



(1) Short-time operation during mismatch.

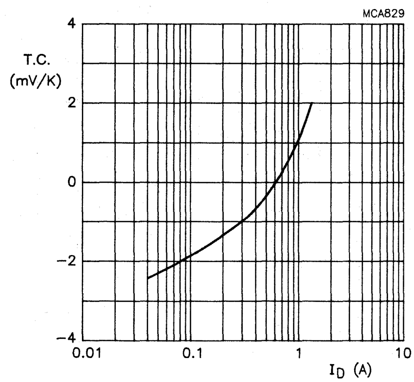
(2) Continuous operation.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS

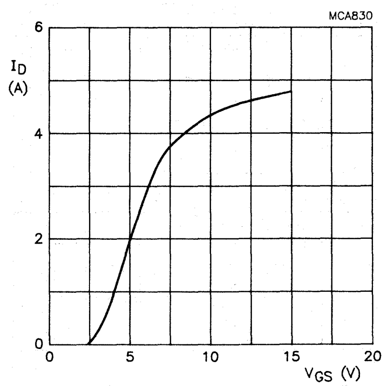
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 10 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	1	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 40 mA; V_{DS} = 10 V	1	–	4	V
$\Delta V_{GS(th)}$	gate-source voltage difference of matched pairs	I_D = 40 mA; V_{DS} = 10 V	–	–	100	mV
g_{fs}	forward transconductance	I_D = 1.2 A; V_{DS} = 10 V	600	900	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 1.2 A; V_{GS} = 10 V	–	0.85	1.25	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	4.8	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	32	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	24	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	6.4	–	pF



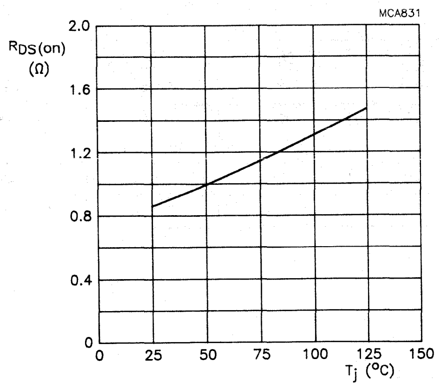
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



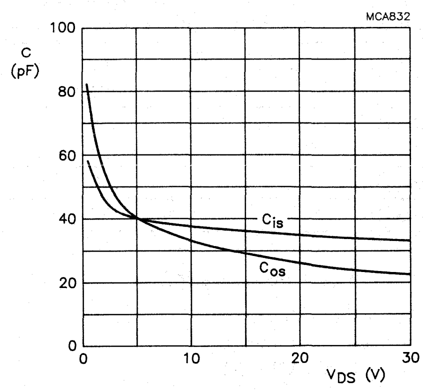
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



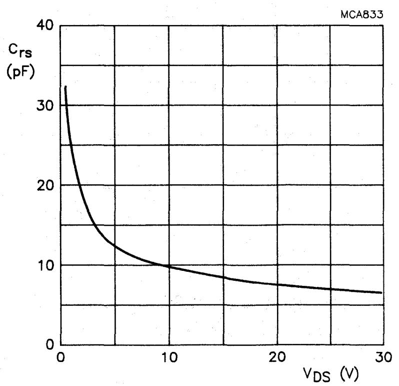
I_D = 1.2 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

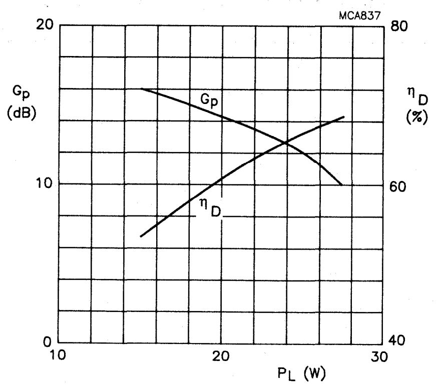
T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W, unless otherwise specified.
RF performance in a common source class-B circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	40	20	> 11 typ. 14	> 50 typ. 60
CW, class-B	960	28	40	20	typ. 7	typ. 50
CW, class-B	960	24	40	15	typ. 7	typ. 50

Ruggedness in class-B operation

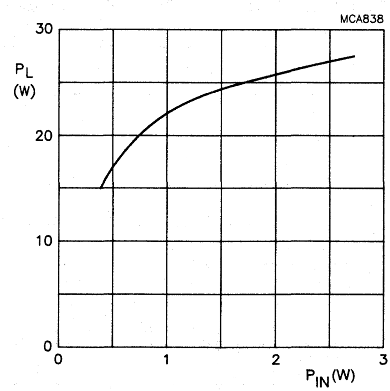
The BLF544 is capable of withstanding a full load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



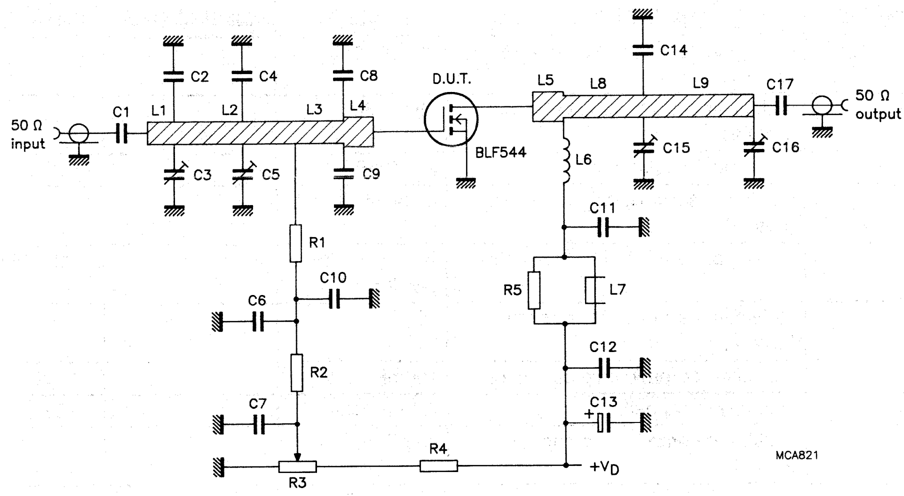
Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; Z_L = 4.3 + j6.3 Ω; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; Z_L = 4.3 + j6.3 Ω; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz

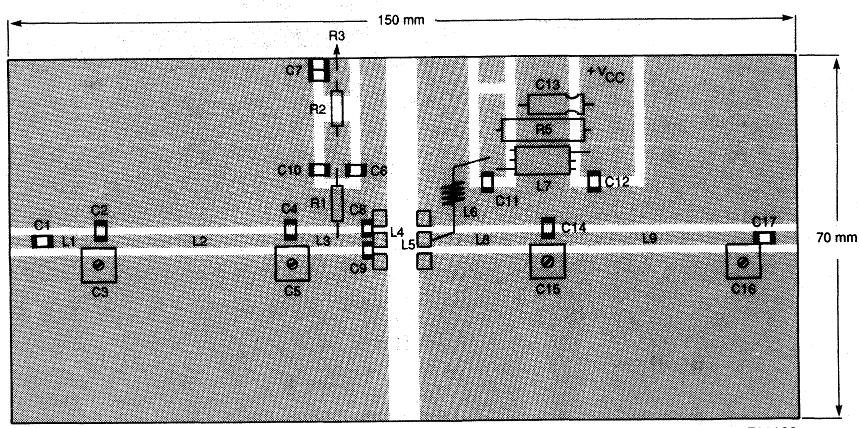
Fig.11 Test circuit for class-B operation.

List of components (class-B test circuit at 500 MHz)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C11, C17	multilayer ceramic chip capacitor (note 1)	390 pF, 500 V		
C2	multilayer ceramic chip capacitor (note 2)	16 pF, 50 V		
C3, C5	film dielectric trimmer	2 to 9 pF		2222 809 09002
C4	multilayer ceramic chip capacitor (note 2)	27 pF, 50 V		
C7	multilayer ceramic chip capacitor	2 x 100 nF in parallel, 50 V		2222 852 47104
C8, C9	multilayer ceramic chip capacitor (note 2)	39 pF		
C10, C12	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C13	electrolytic capacitor	4.7 µF, 63 V		2222 030 38478
C14	multilayer ceramic chip capacitor (note 1)	20 pF, 500 V		
C15, C16	film dielectric trimmer	2 to 18 pF		2222 809 09003
L1	stripline (note 3)	50 Ω	9.5 x 2.5 mm	
L2	stripline (note 3)	50 Ω	34.5 x 2.5 mm	
L3	stripline (note 3)	50 Ω	17.5 x 2.5 mm	
L4, L5	stripline (note 3)	42 Ω	3 x 3 mm	
L6	4 turns enamelled 0.8 mm copper wire	31 nH	length 7.5 mm int. dia. 3 mm leads 2 x 5 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L8	stripline (note 3)	50 Ω	22 x 2.5 mm	
L9	stripline (note 3)	50 Ω	39.5 x 2.5 mm	
R1, R2	0.4 W metal film resistor	1 kΩ		2322 151 11002
R3	10 turns cermet potentiometer	50 kΩ		
R4	0.4 W metal film resistor	140 kΩ		2322 151 11404
R5	1 W metal film resistor	10 Ω		2322 153 51009

Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE ($\varepsilon_r = 2.2$); thickness 1⁄32 inch.



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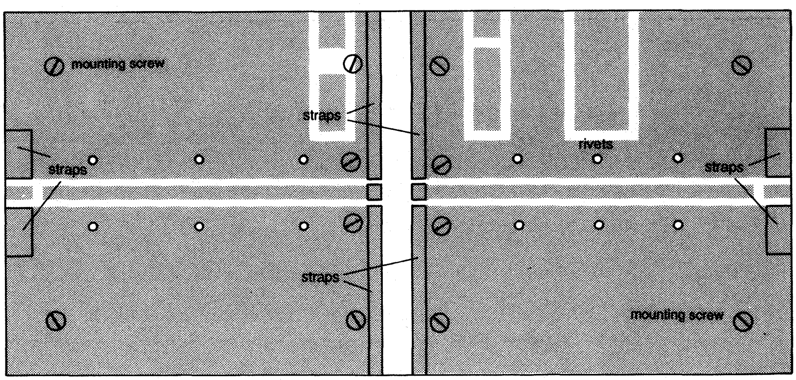

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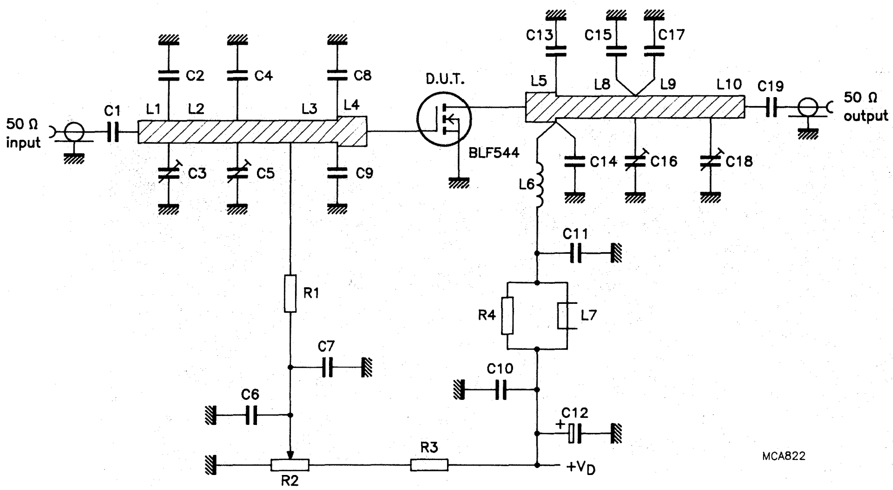
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.



f = 960 MHz

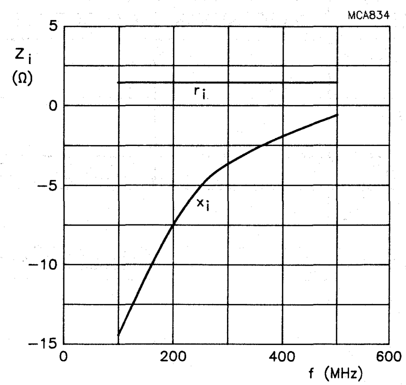
Fig.13 Test circuit for class-B operation.

List of components (class-B test circuit at 960 MHz)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	multilayer ceramic chip capacitor (note 1)	68 pF, 500 V		
C2	multilayer ceramic chip capacitor (note 2)	1.6 pF, 50 V		
C3, C5, C16, C18	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4	multilayer ceramic chip capacitor (note 2)	1 pF, 50 V		
C6	multilayer ceramic chip capacitor	10 nF, 50 V		2222 852 47103
C7, C11	multilayer ceramic chip capacitor (note 1)	56 F, 500 V		
C8, C9, C15, C17	multilayer ceramic chip capacitor (note 2)	6.8 F, 50 V		
C10	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C12	electrolytic capacitor	4.7 μF, 63 V		2222 030 38478
C13	multilayer ceramic chip capacitor (note 2)	16 pF, 50 V		
C14	multilayer ceramic chip capacitor (note 2)	18 pF, 50 V		
C19	multilayer ceramic chip capacitor (note 1)	62 pF, 500 V		
L1, L8	stripline (note 3)	50 Ω	6 x 2.5 mm	
L2	stripline (note 3)	50 Ω	38 x 2.5 mm	
L3	stripline (note 3)	50 Ω	17.5 x 2.5 mm	
L4, L5	stripline (note 3)	42 Ω	3 x 3 mm	
L6	2 turns enamelled 1 mm copper wire	16 nH	length 3.4 mm int. dia. 3 mm leads 2 x 5 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L9	stripline (note 3)	50 Ω	21 x 2.5 mm	
L10	stripline (note 3)	50 Ω	34.5 x 2.5 mm	
R1	0.4 W metal film resistor	15 kΩ		2322 151 11473
R2	10 turns potentiometer	50 kΩ		
R3	0.4 W metal film resistor	140 kΩ		2322 151 11404
R4	0.4 W metal film resistor	10 Ω		2322 153 51009

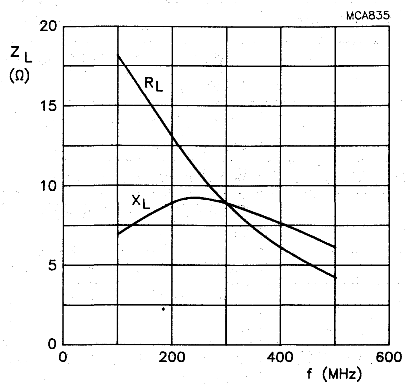
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE ($\varepsilon_r = 2.2$); thickness 1⁄32 inch.



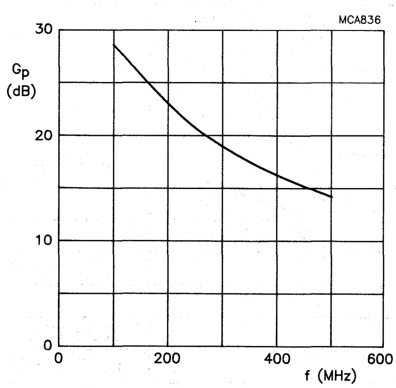
Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; P_L = 20 W.

Fig.14 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; P_L = 20 W.

Fig.15 Load impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; P_L = 20 W.

Fig.16 Power gain as a function of frequency, typical values.

Optimum input and load impedances

Optimum input impedance: 1.2 + j4.8 Ω.
Optimum load impedance: 2.6 – j3.1 Ω.
Conditions: class-B operation; V_{DS} = 24 V; I_{DQ} = 40 mA; f = 960 MHz; P_L = 15 W; typical values.

UHF push-pull power MOS transistor

BLF544B

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

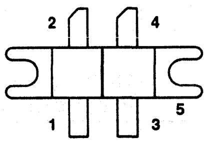
Silicon N-channel enhancement mode vertical D-MOS push-pull transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT268 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PINNING - SOT268

PIN	DESCRIPTION
1	gate 1
2	drain 1
3	gate 2
4	drain 2
5	source

PIN CONFIGURATION



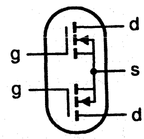


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a push-pull common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	20	> 12	> 50

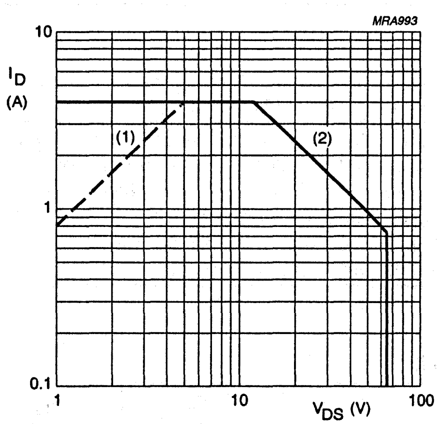
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	2	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C; total device; both sections equally loaded	–	48	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

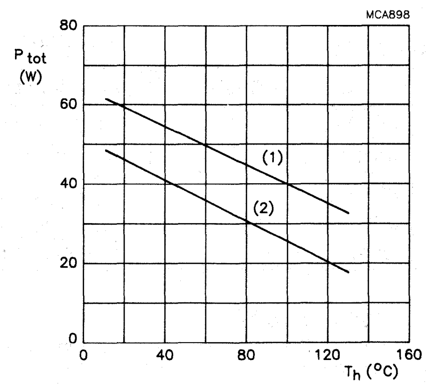
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	total device; both sections equally loaded	3.7 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.25 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



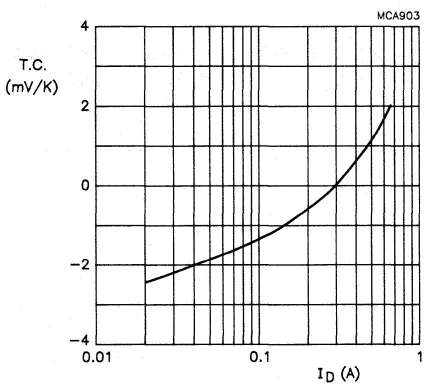
(1) Short-time operation during mismatch.
(2) Continuous operation.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS (per section)

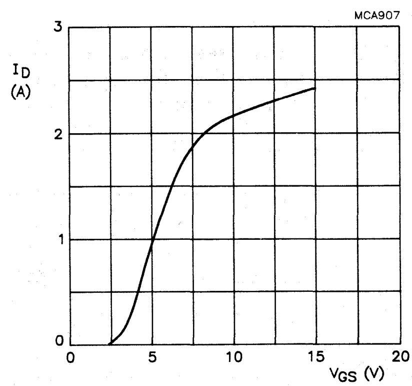
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 5 mA; V_{GS} = 0	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	0.5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 20 mA; V_{DS} = 10 V	1	–	4	V
g_{fs}	forward transconductance	I_D = 0.6 A; V_{DS} = 10 V	300	450	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 0.6 A; V_{GS} = 10 V	–	0.7	2.5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	2.4	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	16	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	12	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	3.2	–	pF



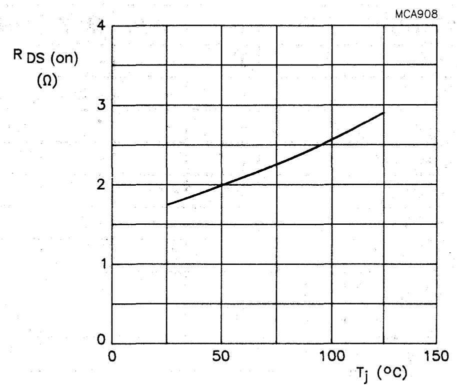
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values per section.



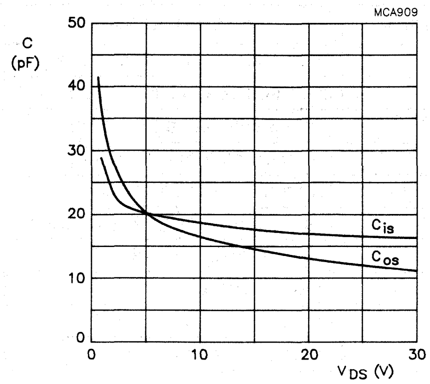
V_{DS} = 10 V.

Fig.5 Drain current as a function of gate-source voltage, typical values per section.



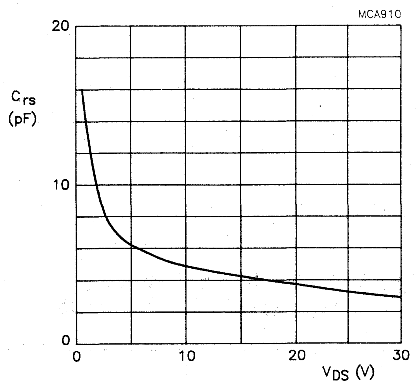
I_D = 0.6 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values per section.

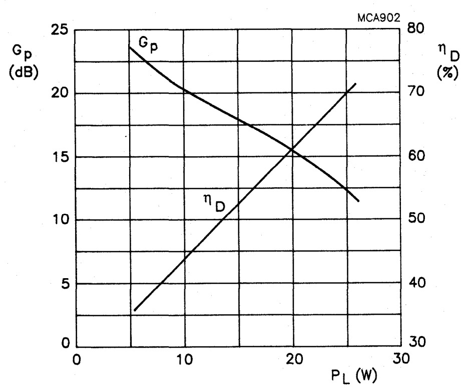
APPLICATION INFORMATION FOR CLASS-B OPERATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W; unless otherwise specified.
RF performance in a push-pull, common source, class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	2 x 20	20	> 12 typ. 15	> 50 typ. 60

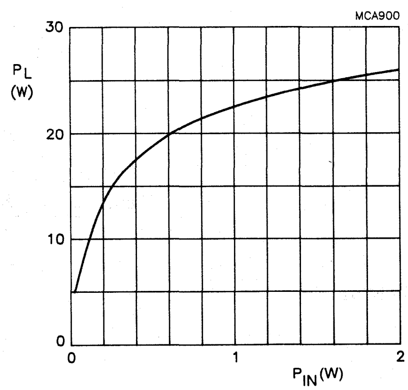
Ruggedness in class-B operation

The BLF544B is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions:
V_{DS} = 28 V, f = 500 MHz at rated output power.



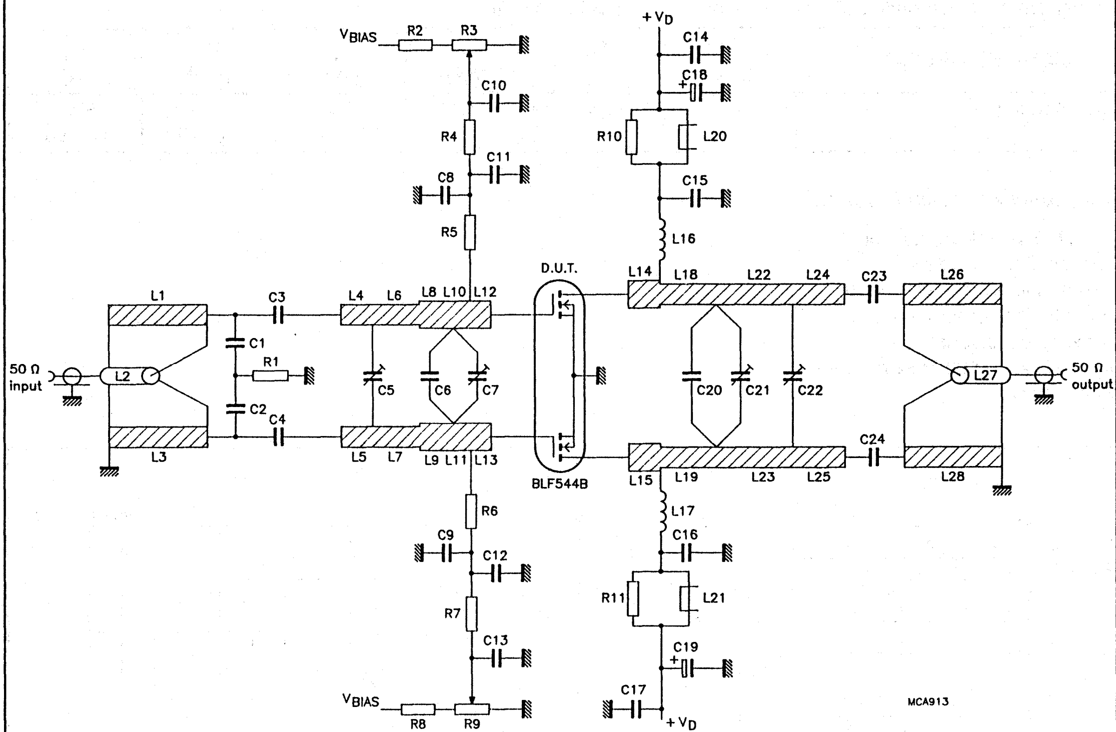
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA;
Z_L = 8.4 + j14.3 Ω; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of output power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA;
Z_L = 8.4 + j14.3 Ω; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

Fig.11 Test circuit for class-B operation.

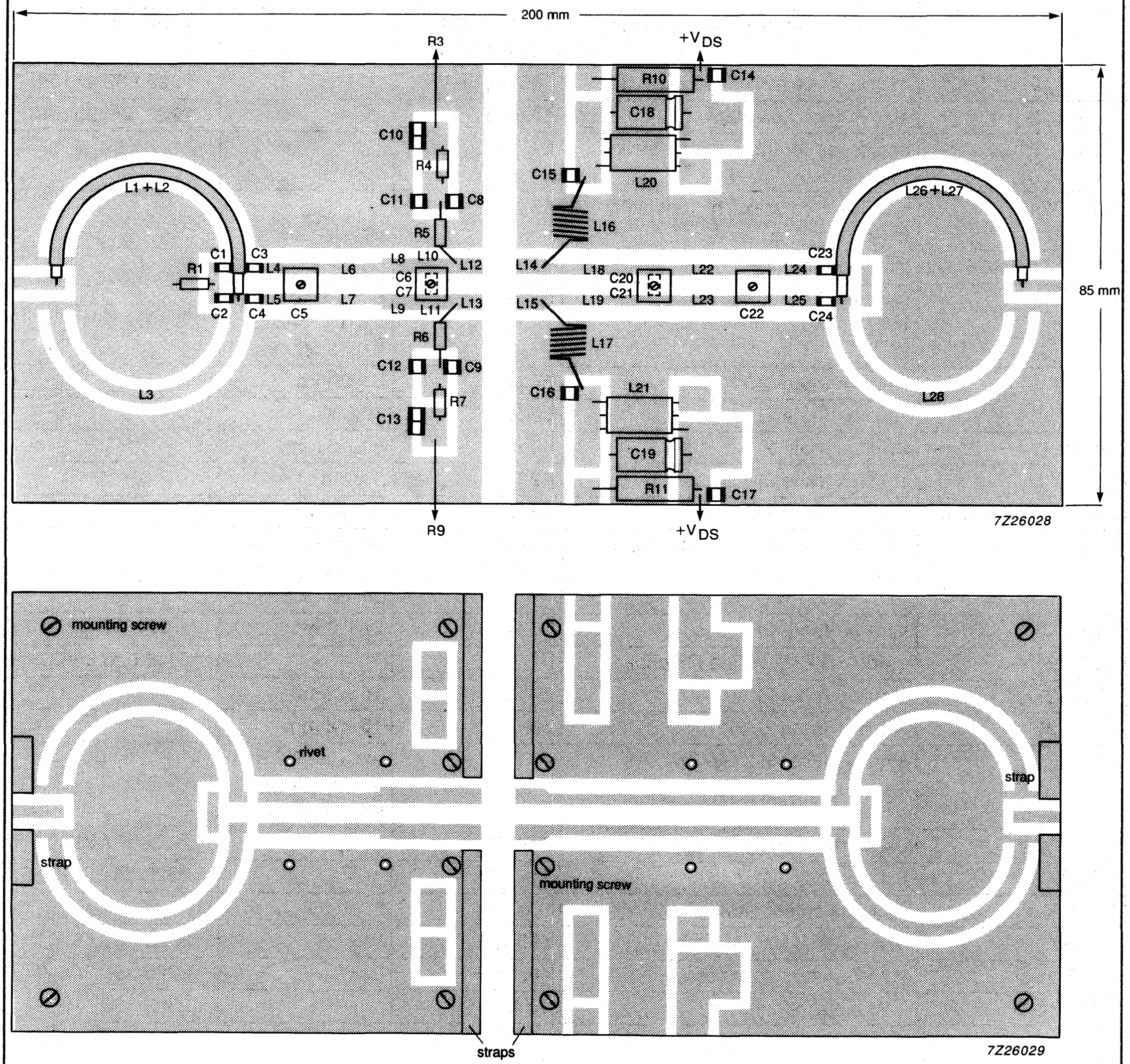
List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	9.1 pF, 500 V		
C3, C4, C6	multilayer ceramic chip capacitor (note 1)	18 pF, 500 V		
C5	film dielectric trimmer	2 to 9 pF		2222 809 09005
C7, C21, C22	film dielectric trimmer	2 to 18 pF		2222 809 09006
C8, C9, C15, C16	multilayer ceramic chip capacitor (note 1)	390 pF, 500 V		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C10, C13	multilayer ceramic chip capacitor	2 x 100 nF in parallel, 50 V		2222 852 47104
C11, C12, C14, C17	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C18, C19	electrolytic capacitor	10 μF, 63 V		2222 030 38109
C20	multilayer ceramic chip capacitor (note 1)	6.8 pF, 500 V		
C23, C24	multilayer ceramic chip capacitor (note 1)	16 pF, 500 V		
L1, L3, L26, L28	stripline (note 2)	50 Ω	56 x 2.4 mm	
L2	semi-rigid cable (note 3)	50 Ω	ext. dia. 2.2 mm ext. conductor length 56 mm	
L4, L5	stripline (note 2)	56 Ω	8 x 2 mm	
L6, L7	stripline (note 2)	56 Ω	15.5 x 2 mm	
L8, L9	stripline (note 2)	42 Ω	10 x 3 mm	
L10, L11	stripline (note 2)	42 Ω	5 x 3 mm	
L12, L13, L14, L15	stripline (note 2)	42 Ω	6 x 3 mm	
L16, L17	6 turns enamelled 1 mm copper wire	124 nH	length 8.5 mm int. dia. 5.4 mm leads 2 x 5 mm	
L18, L19	stripline (note 2)	56 Ω	22 x 2 mm	
L20, L21	grade 3B Ferroxcube RF choke			4312 020 36642
L22, L23	stripline (note 2)	56 Ω	18 x 2 mm	
L24, L25	stripline (note 2)	56 Ω	16 x 2 mm	
L27	semi-rigid cable (note 3)	50 Ω	ext. dia. 2.2 mm ext. conductor length 56 mm	
R1	0.4 W metal film resistor	5.62 Ω		2322 151 75628
R2, R8	0.4 W metal film resistor	11.5 kΩ		2322 151 71159
R3, R9	10 turns potentiometer	5 kΩ		
R4, R7	0.4 W metal film resistor	590 Ω		2322 151 75901
R5, R6	0.4 W metal film resistor	46.4 Ω		2322 151 74649
R10, R11	1 W metal film resistor	10 Ω		2322 153 51009

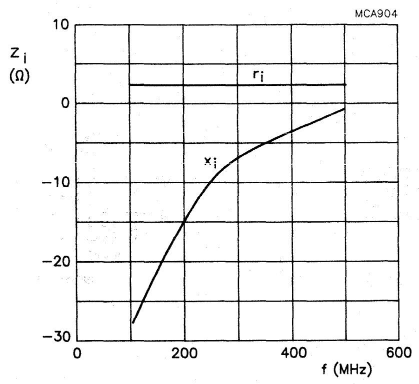
Notes

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 epoxy glass dielectric (ε_r =2.2), thickness $\frac{1}{32}$ inch.
3. Semi-rigid cables L2 and L27 are soldered on to striplines L1 and L26.



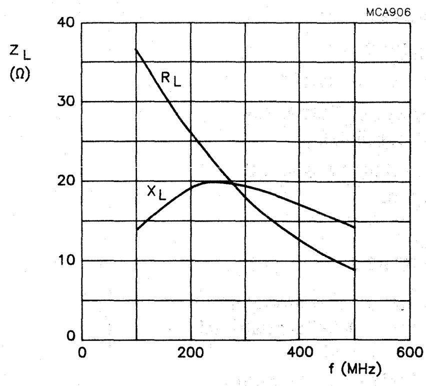
The circuit and components are situated on one side of the epoxy fibre-glass board, the other side being fully metallized to serve as a ground. Earth connections are made by means of copper straps and hollow rivets for a direct contact between the upper and lower sheets.

Fig.12 Component layout for 500 MHz test circuit.



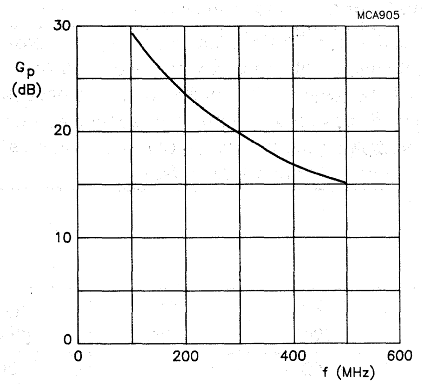
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA; P_L = 20 W.

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA; P_L = 20 W.

Fig.14 Load impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA; P_L = 20 W.

Fig.15 Power gain as a function of frequency, typical values per section.

UHF push-pull power MOS transistor

BLF545

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS push-pull transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT268 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PIN CONFIGURATION

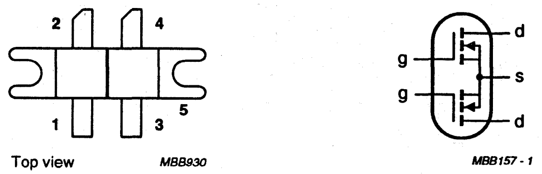


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

PINNING - SOT268

PIN	DESCRIPTION
1	gate 1
2	drain 1
3	gate 2
4	drain 2
5	source

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.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a push-pull common source circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	40	> 11	> 50

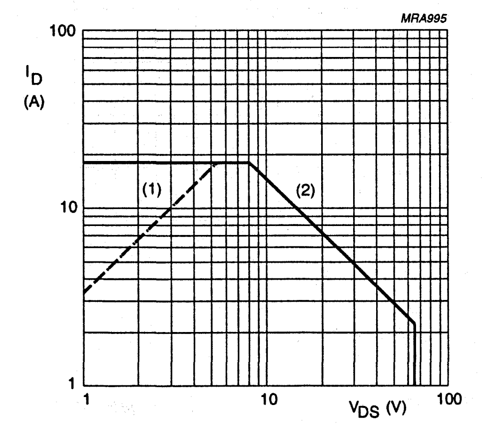
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	3.5	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C; total device; both sections equally loaded	–	92	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

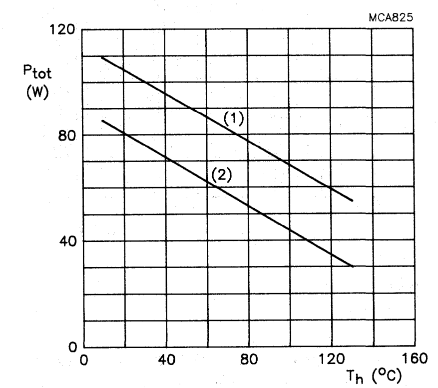
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	total device; both sections equally loaded	1.9 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.25 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



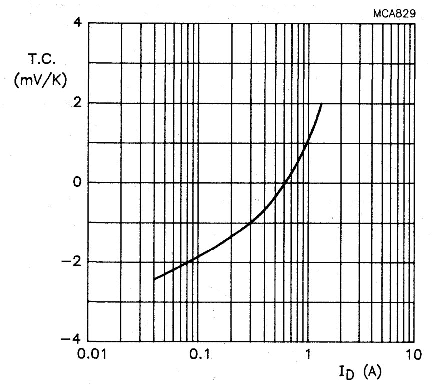
(1) Short-time operation during mismatch.
(2) Continuous operation.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS (per section)

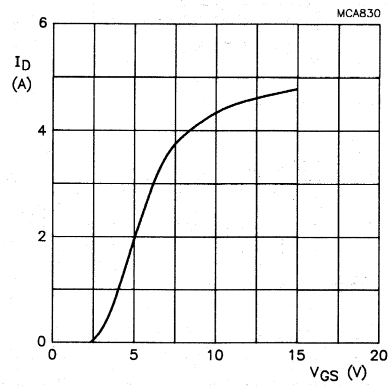
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 10 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	1	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 40 mA; V_{DS} = 10 V	1	–	4	V
g_{fs}	forward transconductance	I_D = 1.2 A; V_{DS} = 10 V	600	900	–	mS
$R_{DS(on)}$	drain-source on-state resistance	I_D = 1.2 A; V_{GS} = 10 V	–	0.85	1.25	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	4.8	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	32	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	24	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	6.4	–	pF



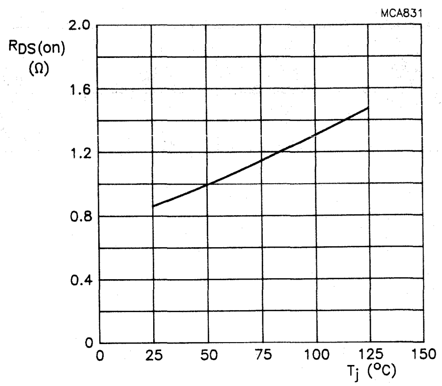
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values per section.



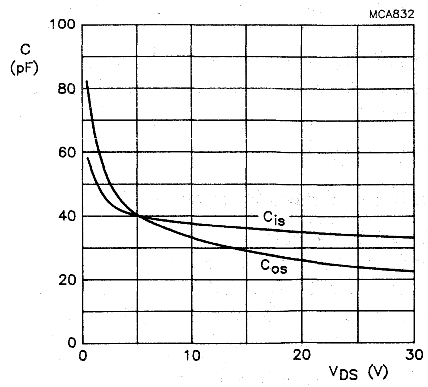
V_{DS} = 10 V; T_j =25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values per section.



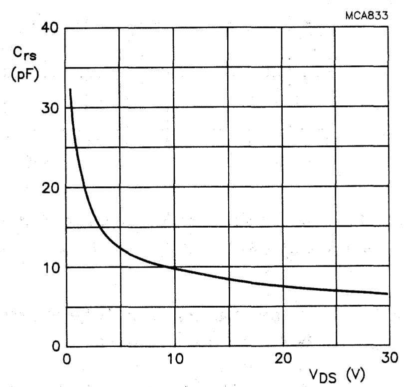
I_D = 1.2 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values per section.

APPLICATION INFORMATION FOR CLASS-B OPERATION

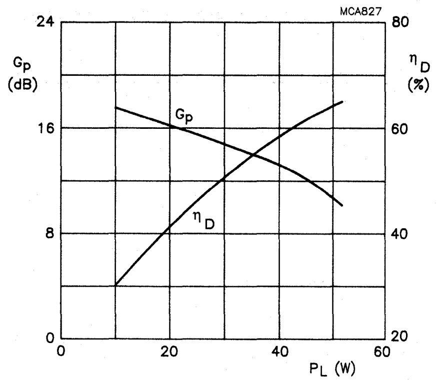
T_h = 25 °C; $R_{th\ mb-h}$ = 0.25 K/W, unless otherwise specified.
RF performance in a common source, class-B, push-pull circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	2 x 40	40	> 11 typ. 13	> 50 typ. 60

Ruggedness in class-B operation

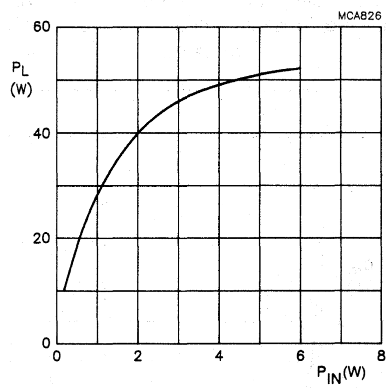
The BLF545 is capable of withstanding a full load mismatch corresponding to VSWR = 50 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



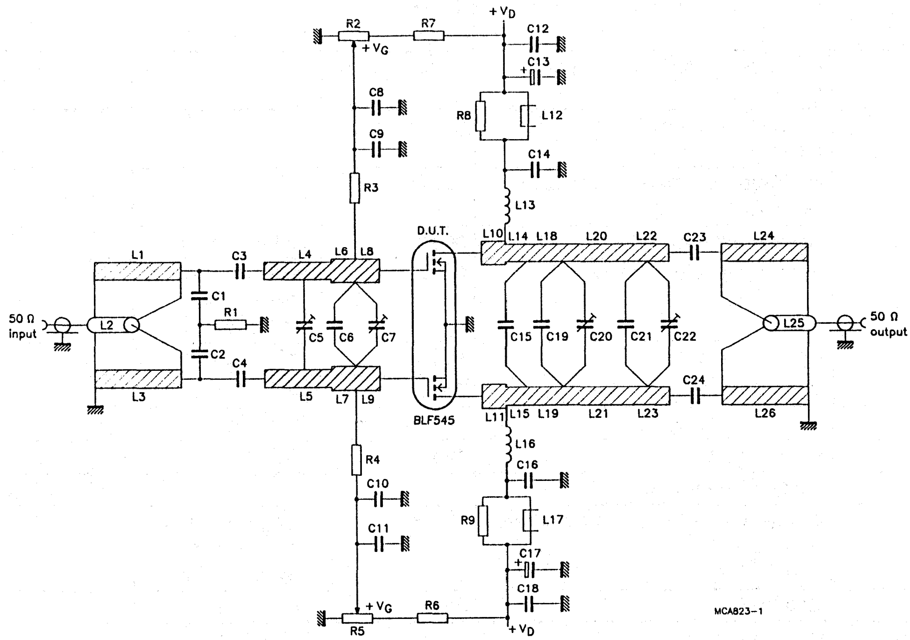
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA;
Z_L = 4.2 + j6.2 Ω (per section); f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA;
Z_L = 4.2 + j6.2 Ω (per section); f = 500 MHz.

Fig.10 Load power as a function of input power, typical values per section.



f = 500 MHz.

Fig.11 Test circuit for class-B operation.

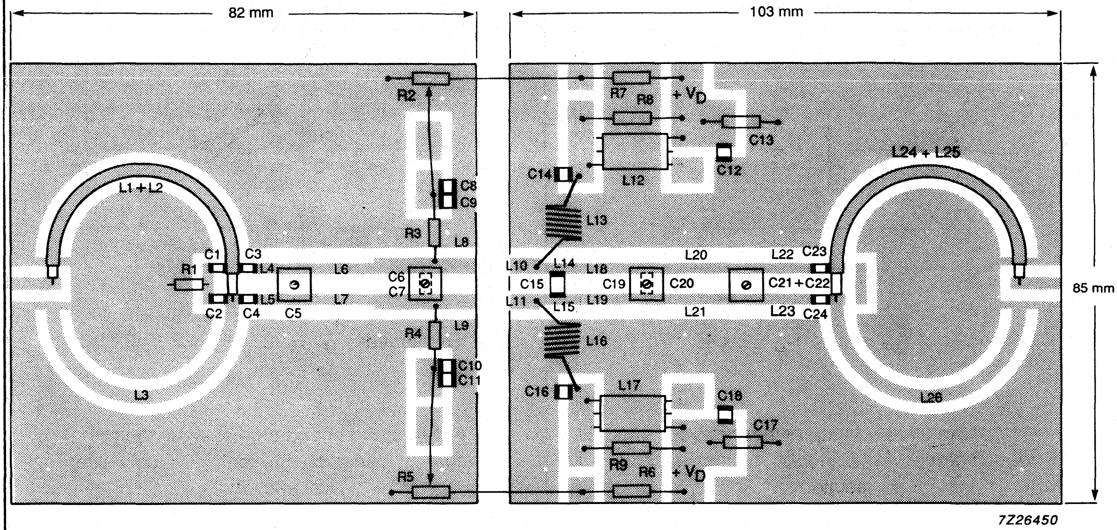
List of components (class-B test circuit)

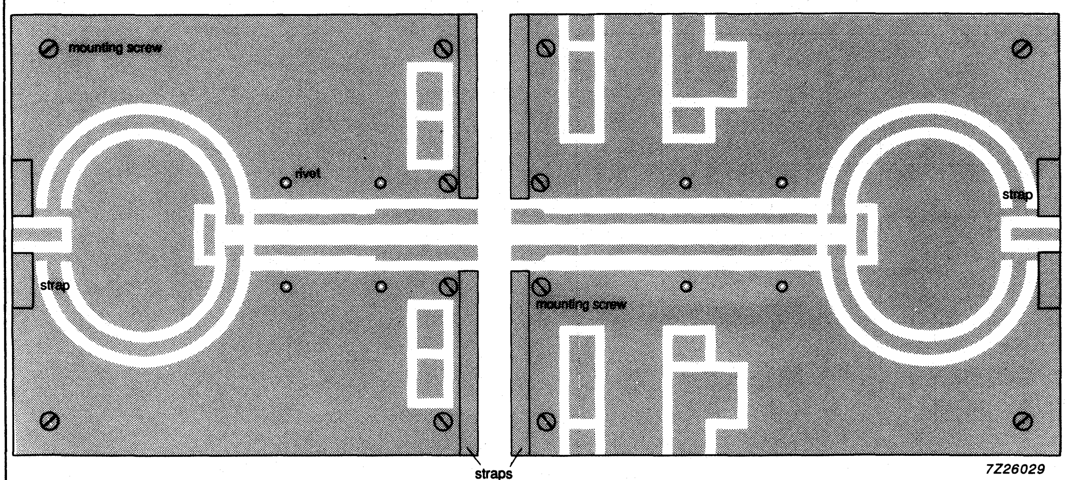
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	5.1 pF		
C3, C4	multilayer ceramic chip capacitor (note 1)	16 pF		
C5, C7, C20, C22	film dielectric trimmer	1.8 to 10 pF		2222 809 05002
C6	multilayer ceramic chip capacitor (note 1)	22 pF		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C8, C11, C12, C18	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C9, C10, C14, C16	multilayer ceramic chip capacitor (note 1)	390 pF		
C13, C17	electrolytic capacitor	10 µF, 63 V		
C15	multilayer ceramic chip capacitor (note 1)	18 pF		
C19	multilayer ceramic chip capacitor (note 1)	13 pF		
C21	multilayer ceramic chip capacitor (note 1)	6.2 pF		
C23, C24	multilayer ceramic chip capacitor (note 1)	10 pF		
L1, L3, L24, L26	stripline (note 2)	50 Ω	56 x 2.4 mm	
L2, L25	semi-rigid cable (note 3)	50 Ω	ext. dia. 2.2 mm ext. conductor length 56 mm	
L4, L5	stripline (note 2)	56 Ω	13.4 x 2 mm	
L6, L7	stripline (notes 2 and 4)	56 Ω	9.6 x 2 mm	
L8, L9	stripline (note 2)	42 Ω	9 x 3 mm	
L10, L11	stripline (note 2)	42 Ω	6 x 3 mm	
L12, L17	grade 3B Ferroxcube RF choke			4312 020 36642
L13, L16	4 turns enamelled 1.2 mm copper wire	62 nH	length 7.6 mm int. dia. 5 mm leads 2 x 5 mm	
L14, L15	stripline (note 2)	56 Ω	8 x 2 mm	
L18, L19	stripline (note 2)	56 Ω	13 x 2 mm	
L20, L21	stripline (note 2)	56 Ω	18 x 2 mm	
L22, L23	stripline (note 2)	56 Ω	14 x 2 mm	
R1	0.4 W metal film resistor	5.11 Ω		2322 151 75118
R2, R5	10 turns cermet potentiometer	50 kΩ		
R3, R4	0.4 W metal film resistor	10 kΩ		2322 151 71003
R6, R7	0.4 W metal film resistor	205 kΩ		2322 151 72054
R8, R9	1 W metal film resistor	10 Ω		2322 151 71009

Notes

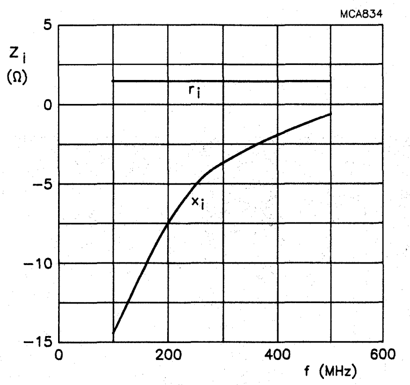
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE (ε_r = 2.2); thickness 1⁄32 inch.
3. Semi-rigid cables L2 and L25 are soldered on to striplines L1 and L26.
4. Striplines L6 and L7 are used in series with a 42 Ω stripline (11 x 3 mm).





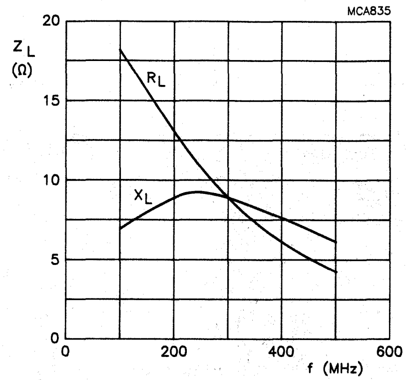
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.



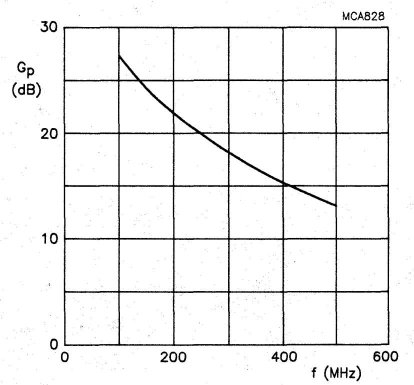
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA; P_L = 40 W.

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA; P_L = 40 W.

Fig.14 Load impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA; P_L = 40 W.

Fig.15 Power gain as a function of frequency, typical values per section.

UHF push-pull power MOS transistor

BLF546

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Silicon N-channel enhancement mode vertical D-MOS push-pull transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT268 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PINNING - SOT268

PIN	DESCRIPTION
1	gate 1
2	drain 1
3	gate 2
4	drain 2
5	source

PIN CONFIGURATION

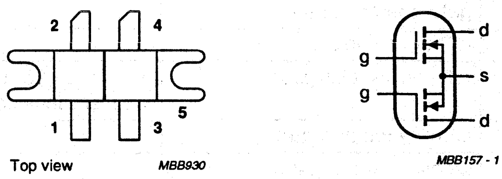


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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 us 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_h = 25 °C in a push-pull common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	80	> 11	> 50

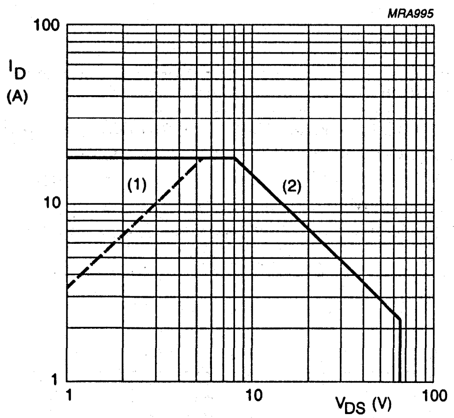
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	9	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C; total device; both sections equally loaded	–	145	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

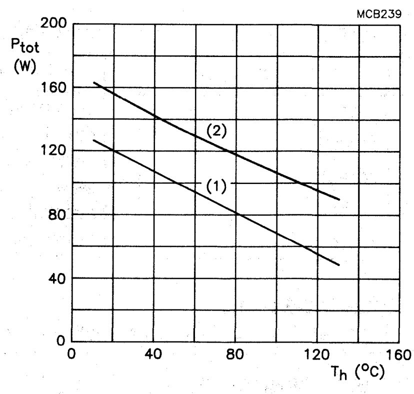
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	total device; both sections equally loaded	1.2 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.25 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



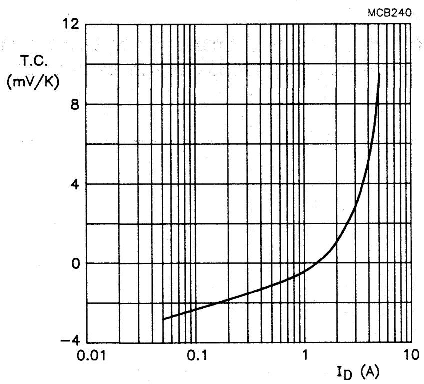
(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS (per section)

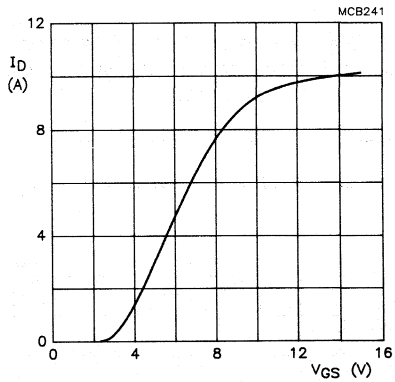
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 20 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	2	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 80 mA; V_{DS} = 10 V	1	–	4	V
g_{fs}	forward transconductance	I_D = 2.4 A; V_{DS} = 10 V	1.2	1.7	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 2.4 A; V_{GS} = 10 V	–	0.4	0.6	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	10	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	60	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	46	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	15	–	pF



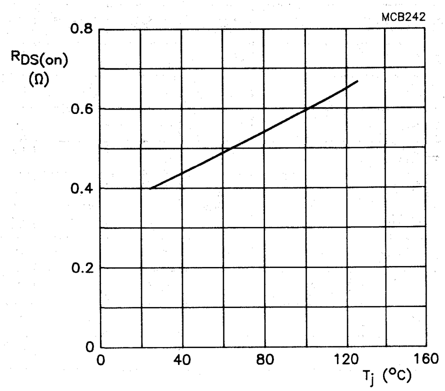
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values per section.



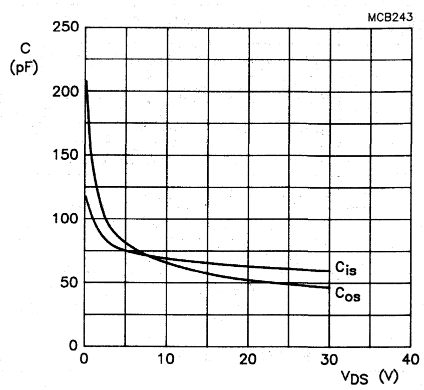
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values per section.



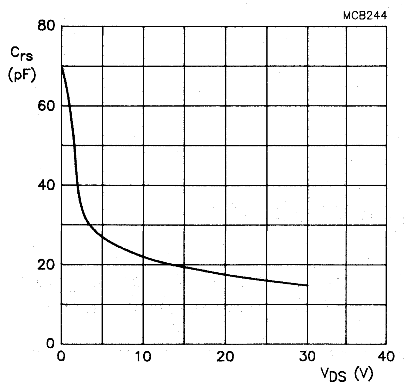
I_D = 2.4 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values per section.

APPLICATION INFORMATION FOR CLASS-B OPERATION

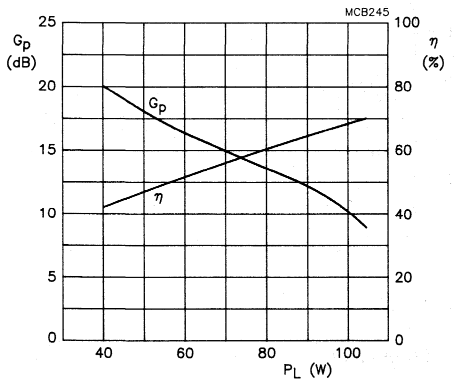
T_h = 25 °C; $R_{th\ mb-h}$ = 0.25 K/W, unless otherwise specified.
RF performance in a common source, class-B, push-pull circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	2 x 80	80	> 11 typ. 13	> 50 typ. 60

Ruggedness in class-B operation

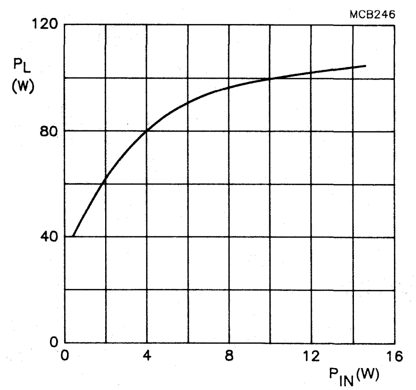
The BLF546 is capable of withstanding a full load mismatch corresponding to VSWR = 10 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



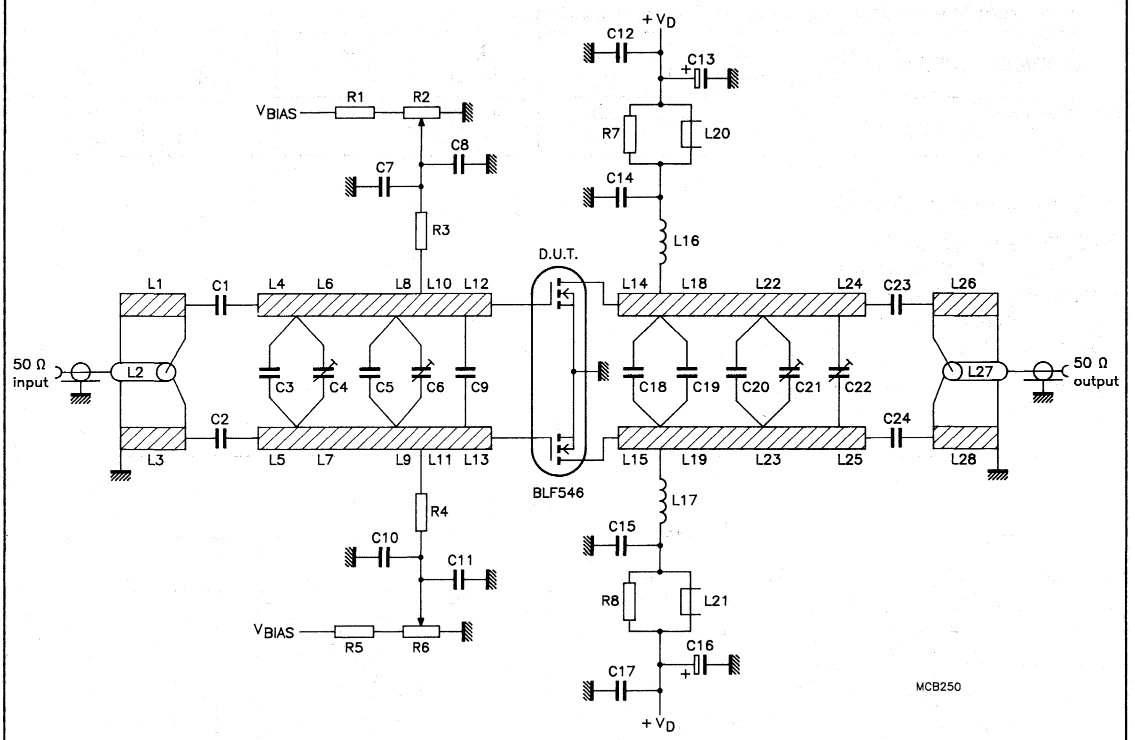
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; Z_L = 2.3 + j2.7 Ω (per section); f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; Z_L = 2.3 + j2.7 Ω (per section); f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

Fig.11 Test circuit for class-B operation.

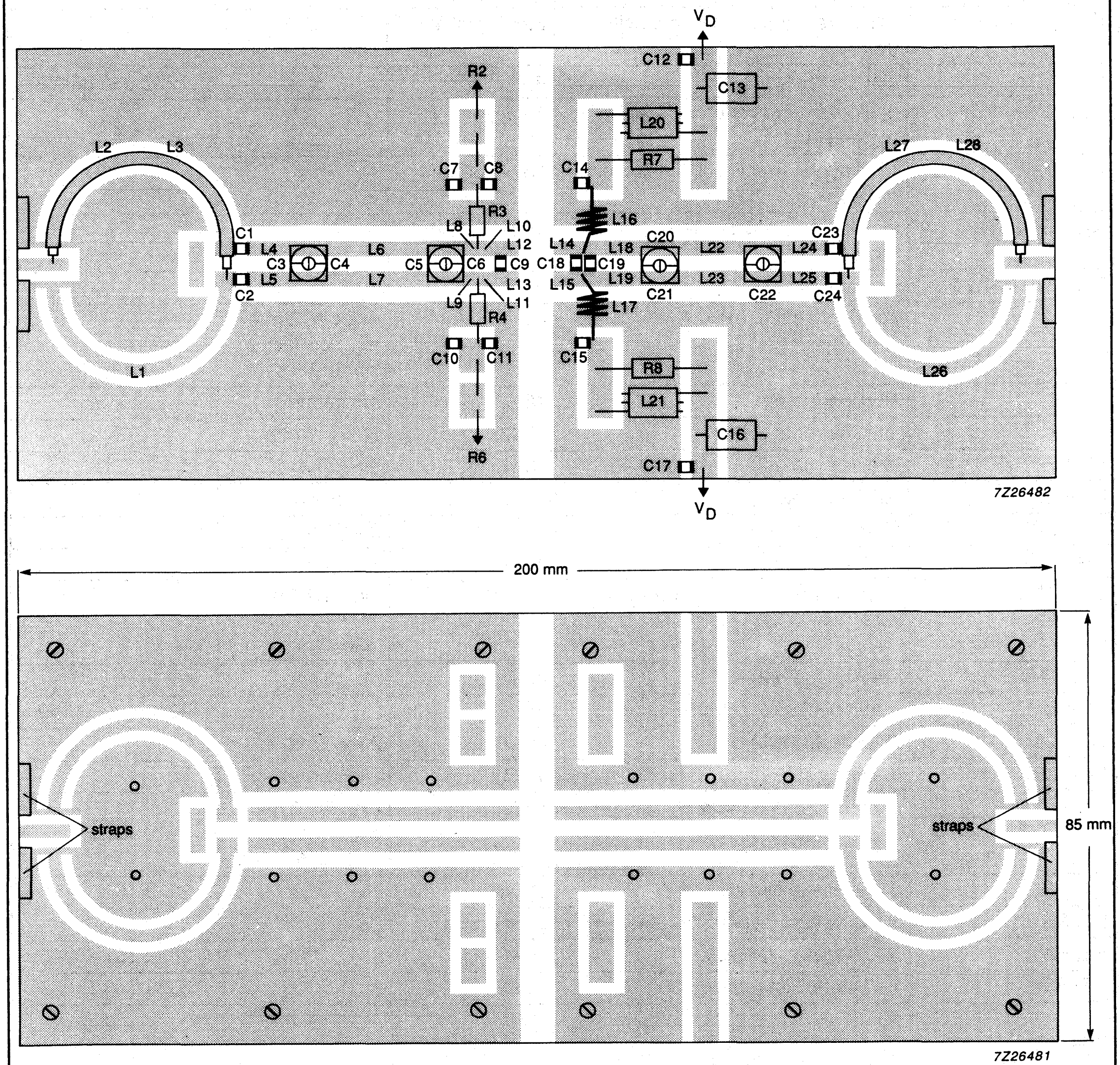
List of components (class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	33 pF, 500 V		
C3	multilayer ceramic chip capacitor (note 1)	11 pF, 500 V		
C4, C6, C21, C22	film dielectric trimmer	2 to 9 pF		2222 809 09005
C5	multilayer ceramic chip capacitor (note 2)	12 pF, 500 V		
C7, C10, C14, C15	multilayer ceramic chip capacitor (note 1)	390 pF, 500 V		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C8, C11, C12, C17	multilayer ceramic chip capacitor	100 nF, 50 V		2222 852 47104
C9	multilayer ceramic chip capacitor (note 2)	39 pF, 500 V		
C13, C16	electrolytic capacitor	4.7 µF, 63 V		2222 030 38478
C18, C19	multilayer ceramic chip capacitor (note 2)	18 pF, 500 V		
C20	multilayer ceramic chip capacitor (note 2)	15 pF, 500 V		
C23, C24	multilayer ceramic chip capacitor (note 1)	15 pF, 500 V		
L1, L3, L26, L28	stripline (note 3)	50 Ω	55.6 x 2.4 mm	
L2	semi-rigid cable (note 4)	50 Ω	ext. dia. 2 mm ext. conductor length 55.6 mm	
L4, L5	stripline (note 3)	42 Ω	12 x 3 mm	
L6, L7	stripline (note 3)	42 Ω	26.5 x 3 mm	
L8, L9	stripline (note 3)	42 Ω	5.5 x 3 mm	
L10, L11	stripline (note 3)	42 Ω	6 x 3 mm	
L12, L13	stripline (note 3)	42 Ω	3 x 3 mm	
L14, L15	stripline (note 3)	42 Ω	7 x 3 mm	
L16, L17	3 turns enamelled 1 mm copper wire	15.6 nH	length 8.5 mm int. dia. 5.4 mm leads 2 x 5 mm	
L18, L19	stripline (note 3)	42 Ω	12 x 3 mm	
L20, L21	grade 3B Ferroxcube RF choke			4312 020 36642
L22, L23	stripline (note 3)	42 Ω	20 x 3 mm	
L24, L25	stripline (note 3)	42 Ω	14 x 3 mm	
L27	semi-rigid cable (note 5)	50 Ω	ext. dia. 2 mm ext. conductor length 55.6 mm	
R1, R5	0.4 W metal film resistor	11.5 kΩ		2322 151 71153
R2, R6	10 turns cermet potentiometer	50 kΩ		
R3, R4	0.4 W metal film resistor	10 kΩ		2322 151 71003
R7, R8	1 W metal film resistor	10 Ω		2322 153 51009

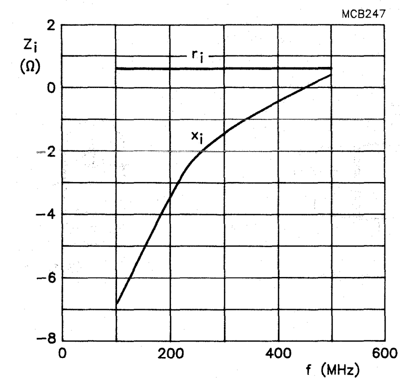
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 175B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with glass microfibre reinforced PTFE ($\varepsilon_r = 2.2$); thickness 1⁄32 inch.
4. Semi-rigid cable L2 is soldered on to stripline L3.
5. Semi-rigid cable L27 is soldered on to stripline L28.



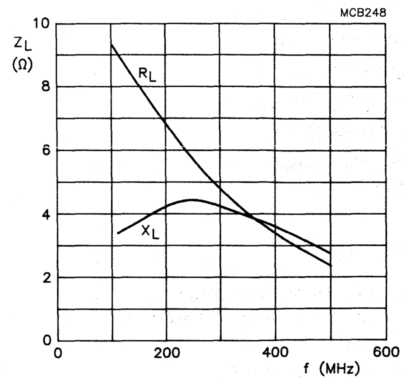
The circuit and components are situated on one side of the printed circuit board, the other side being fully metallized, to serve as a ground plane. Earth connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz test circuit.



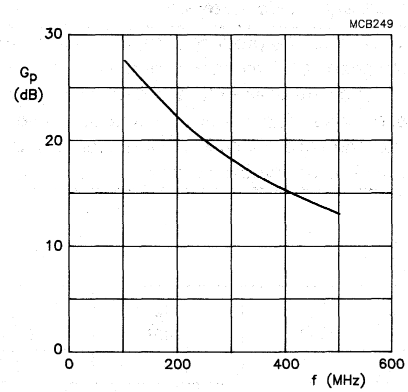
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W.

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W.

Fig.14 Load impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W.

Fig.15 Power gain as a function of frequency, typical values per section.

UHF push-pull power MOS transistor

BLF547

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Dual push-pull silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT262A2 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PINNING - SOT262A2

PIN	DESCRIPTION
1	drain 1
2	drain 2
3	gate 1
4	gate 2
5	source

PIN CONFIGURATION

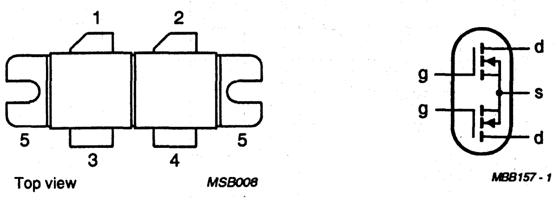


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a push-pull common-source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	100	> 10	> 50

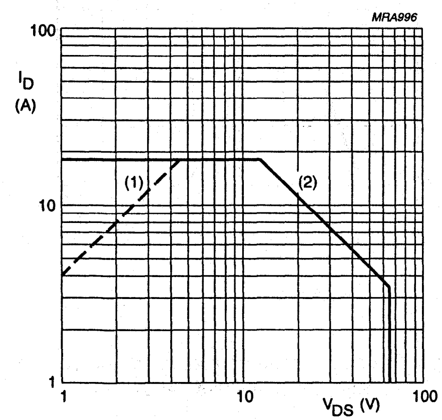
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	9	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C; total device; both sections equally loaded	–	225	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

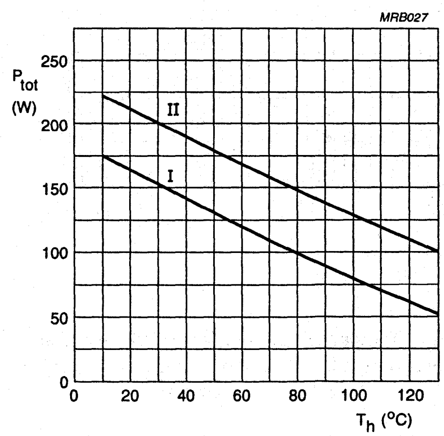
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 225 W total device; both sections equally loaded	max. 0.78 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) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C;
Total device; both sections equally loaded.

Fig.2 DC SOAR.



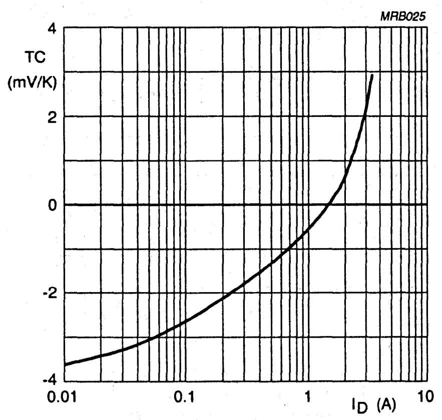
(I) Continuous operation.
(II) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS (per section)

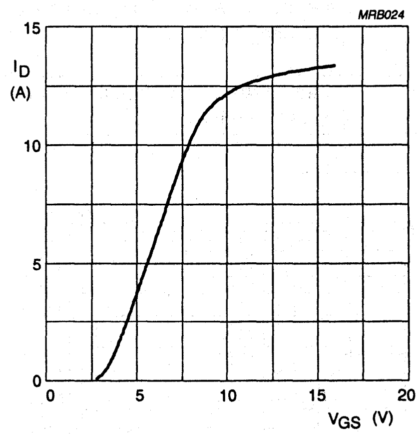
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 25 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	2.5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 100 mA; V_{DS} = 10 V	1	–	4	V
g_{fs}	forward transconductance	I_D = 3 A; V_{DS} = 10 V	1.5	2.1	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 3 A; V_{GS} = 10 V	–	0.4	0.5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	10	13	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	77	85	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	62	70	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	18	21	pF



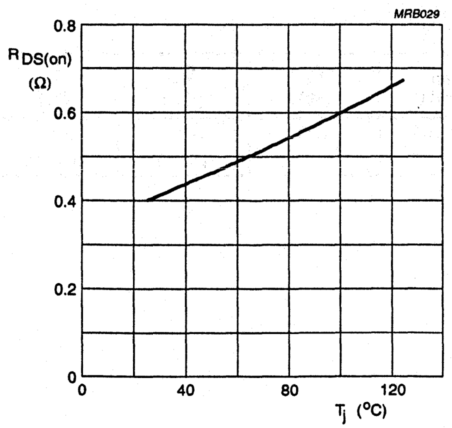
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values per section.



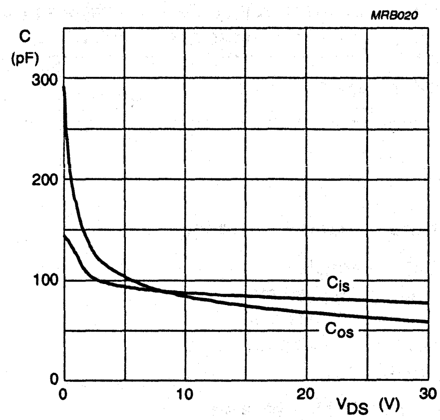
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values per section.



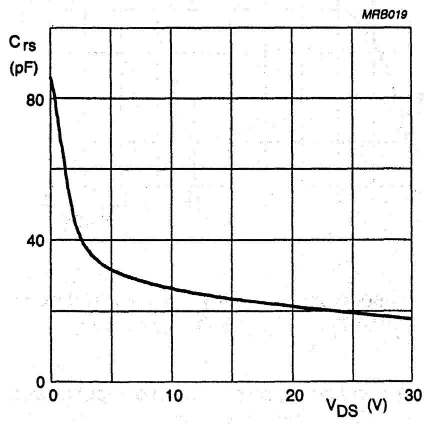
I_D = 3 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values per section.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values per section.

APPLICATION INFORMATION FOR CLASS-B OPERATION

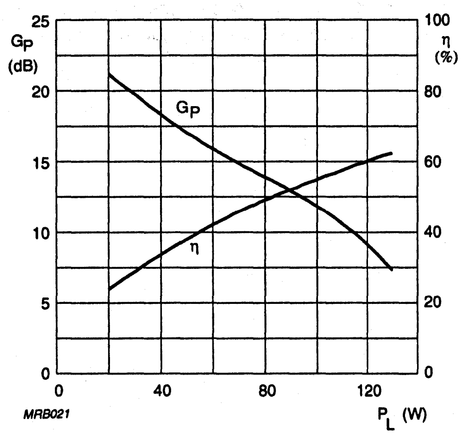
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W, unless otherwise specified.
RF performance in a common source, push-pull, class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	2 x 100	100	> 10 typ. 12	> 50 typ. 55

Ruggedness in class-B operation

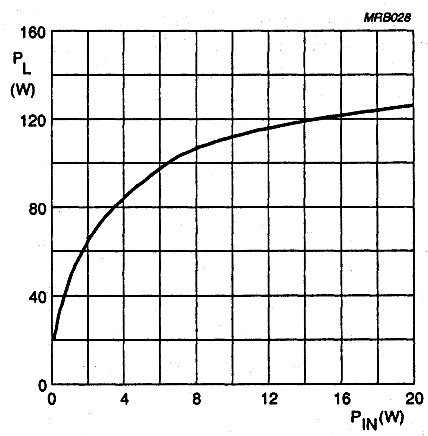
The BLF547 is capable of withstanding a load mismatch corresponding to VSWR = 10 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



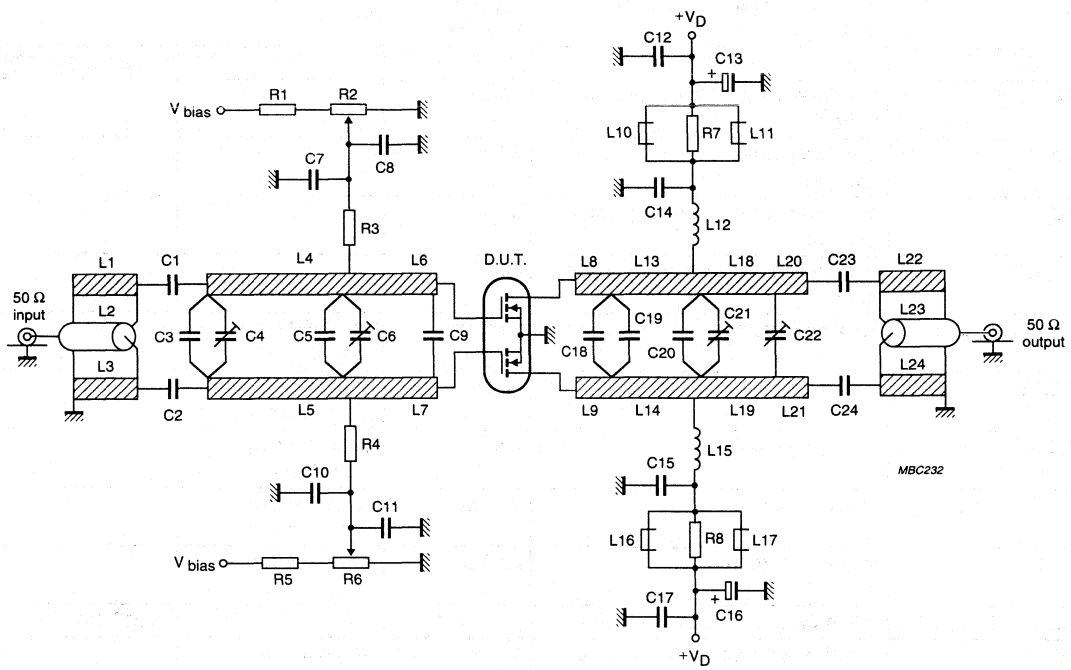
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 100 mA; f = 500 MHz; Z_L = 1.5 + j1.8 Ω (per section).

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 100 mA; f = 500 MHz; Z_L = 1.5 + j1.8 Ω (per section).

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

Fig.11 Test circuit for class-B operation.

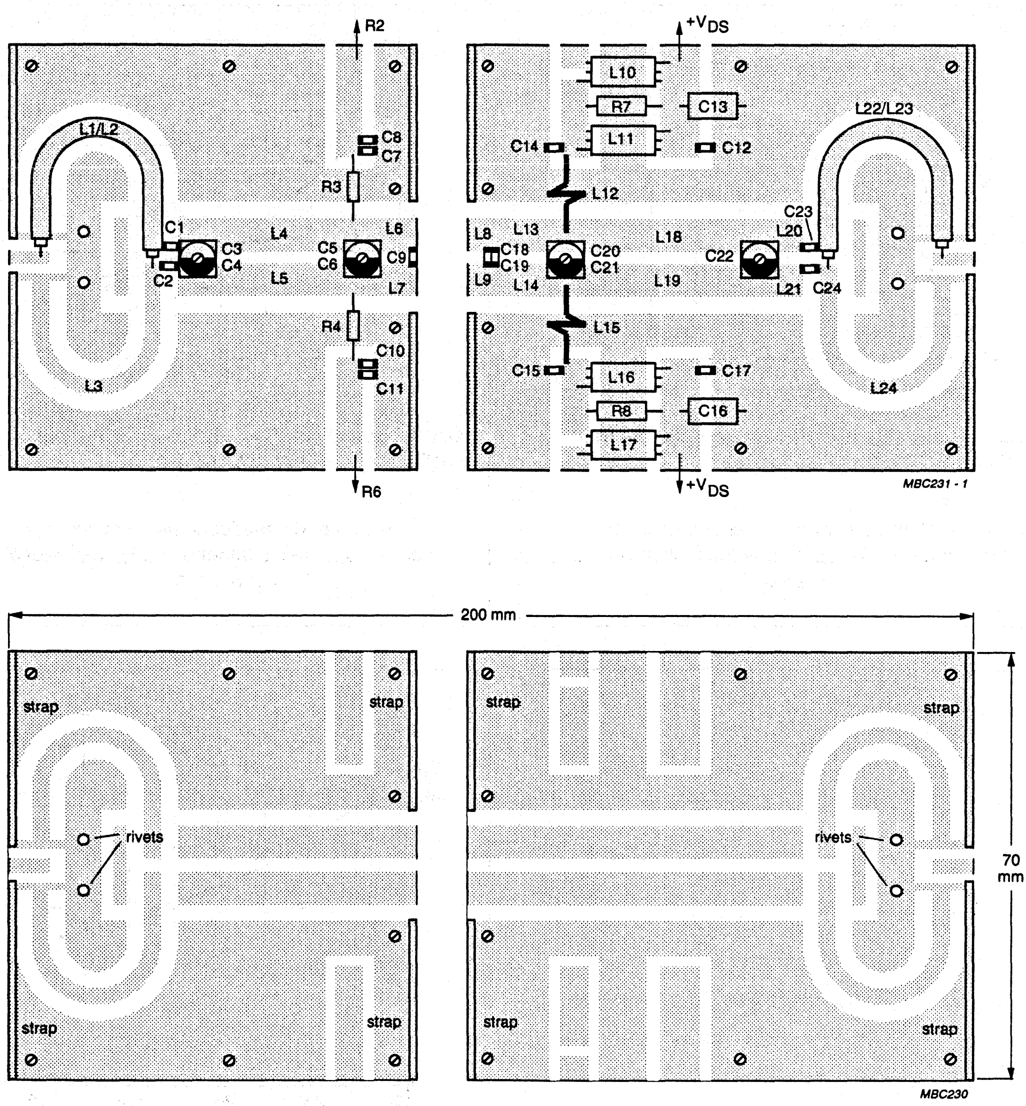
List of components (see class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	15 pF		
C3	multilayer ceramic chip capacitor (note 1)	16 pF		
C4	film dielectric trimmer	2 to 9 pF		2222 809 09005
C5	multilayer ceramic chip capacitor (note 2)	15 pF		
C6, C21, C22	film dielectric trimmer	2 to 18 pF		2222 809 09006
C7, C10, C14, C15	multilayer ceramic chip capacitor (note 1)	390 pF		

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C8, C11, C12, C17	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C9	multilayer ceramic chip capacitor (note 3)	2 x 68 pF in series		
C13, C16	electrolytic capacitor	10 μF, 63 V		2222 030 28109
C18	multilayer ceramic chip capacitor (note 2)	10 pF		
C19	multilayer ceramic chip capacitor (note 2)	27 pF		
C20	multilayer ceramic chip capacitor (note 2)	8.2 pF		
C23, C24	multilayer ceramic chip capacitor (note 1)	30 pF		
L1, L3, L22, L24	stripline (note 4)	34.5 Ω	length 66.5 mm width 4 mm	
L2, L23	semi-rigid cable	50 Ω	length 66.5 mm width 3.6 mm	
L4, L5	stripline (note 4)	22.3 Ω	length 35 mm width 7 mm	
L6, L7	stripline (note 4)	22.3 Ω	length 10 mm width 7 mm	
L8, L9	stripline (note 4)	22.3 Ω	length 5.5 mm width 7 mm	
L10, L11, L16, L17	grade 3B Ferroxcube RF choke			4312 020 36640
L12, L15	1 turn enamelled 1.5 mm copper wire	17 nH	length 5 mm int. dia. 9 mm leads 2 x 5 mm	
L13, L14	stripline (note 4)	22.3 Ω	length 15 mm width 7 mm	
L18, L19	stripline (note 4)	22.3 Ω	length 36 mm width 7 mm	
L20, L21	stripline (note 4)	22.3 Ω	length 8.5 mm width 7 mm	
R1, R5	0.4 W metal film resistor	24.7 kΩ		2322 151 72473
R2, R6	10 turn potentiometer	5 kΩ		
R3, R4	0.4 W metal film resistor	10.5 kΩ		2322 151 71053
R7, R8	1 W metal film resistor	10 Ω		2322 151 71009

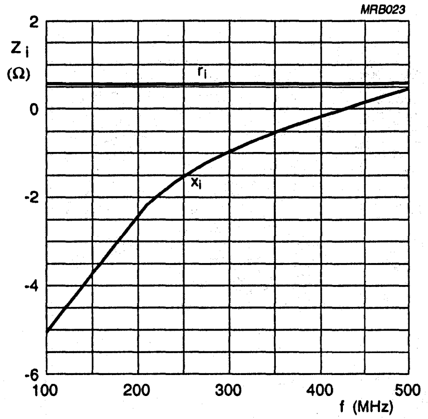
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 175B or other capacitor of the same quality.
3. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
4. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$), thickness 0.79 mm.



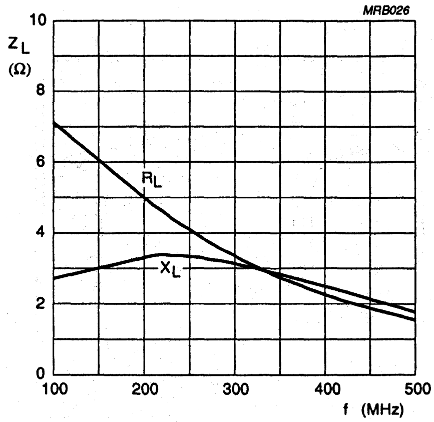
The circuit and components are situated on one side of the printed ciruit board, the other side being fully metallized to serve as a ground plane. Connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 100 mA (per section); P_L = 100 W (total device).

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 100 mA (per section); P_L = 100 W (total device).

Fig.14 Load impedance as a function of frequency (series components), typical values per section.

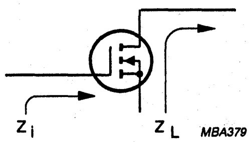
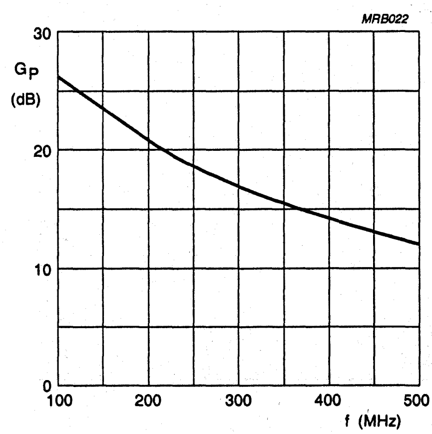


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 100 mA (per section); P_L = 100 W (total device).

Fig.16 Power gain as a function of frequency, typical values per section.

UHF push-pull power MOS transistor

BLF548

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability
- Designed for broadband operation.

DESCRIPTION

Dual push-pull silicon N-channel enhancement mode vertical D-MOS transistor designed for communications transmitter applications in the UHF frequency range.

The transistor is encapsulated in a 4-lead, SOT262A2 balanced flange envelope, with two ceramic caps. The mounting flange provides the common source connection for the transistors.

PINNING - SOT262A2

PIN	DESCRIPTION
1	drain 1
2	drain 2
3	gate 1
4	gate 2
5	source

PIN CONFIGURATION

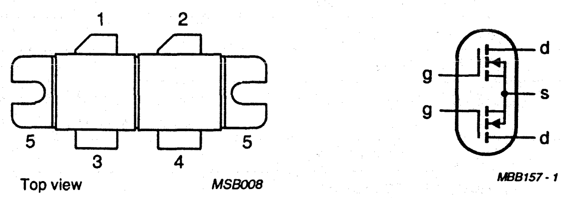


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

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.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a push-pull common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	150	> 10	> 50

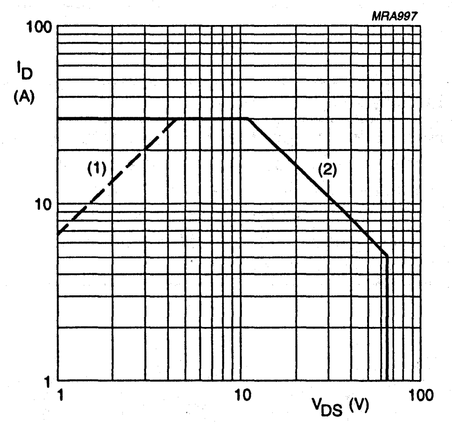
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).
Per transistor section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	15	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C; total device; both sections equally loaded	–	330	W
T_{stg}	storage temperature		−65	150	°C
T_j	junction temperature		–	200	°C

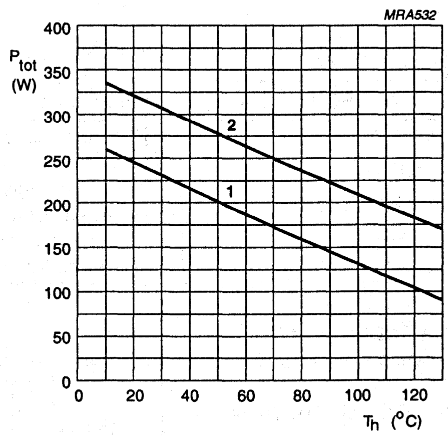
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C; P_{tot} = 330 W; total device; both sections equally loaded	0.5 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.15 K/W



(1) Current is this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.
Total device; both sections equally loaded.

Fig.2 DC SOAR.



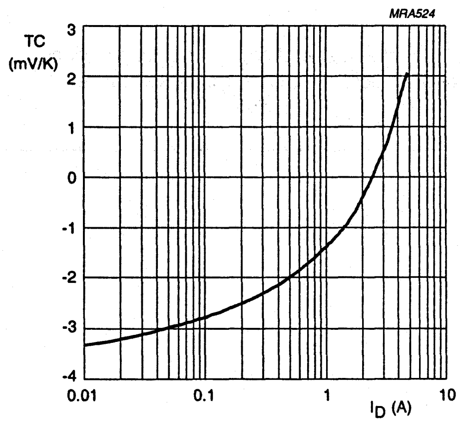
(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curves.

CHARACTERISTICS (per section)

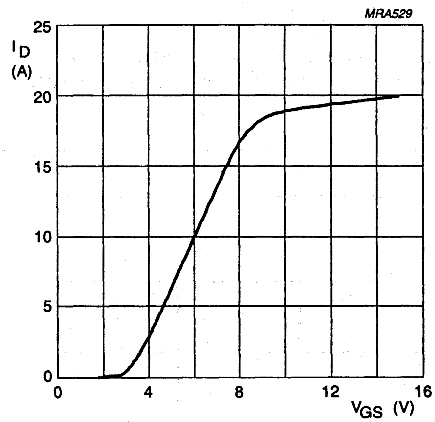
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = 40 mA	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	0.5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 160 mA; V_{DS} = 10 V	2	–	4	V
g_{fs}	forward transconductance	I_D = 4.8 A; V_{DS} = 10 V	2.4	3.5	–	S
$R_{DS(on)}$	drain-source on-state resistance	I_D = 4.8 A; V_{GS} = 10 V	–	0.25	0.3	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	16	20	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	105	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	90	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	25	–	pF



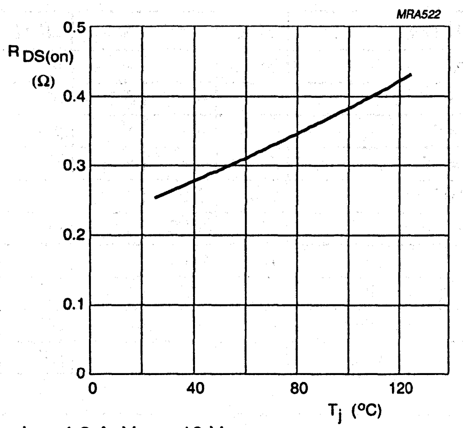
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values per section.



V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values per section.



I_D = 4.8 A; V_{GS} = 10 V.

Fig.6 Drain-source on-state resistance as a function of junction temperature, typical values per section.

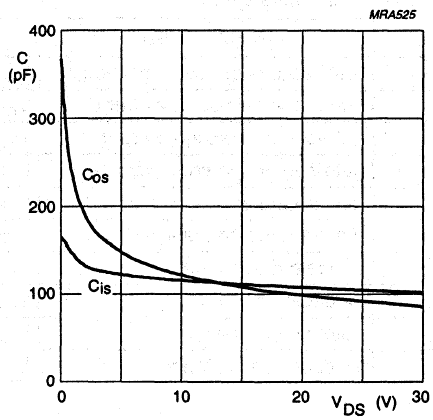


Fig.7 Input and output capacitance as functions of drain-source voltage, typical values per section.

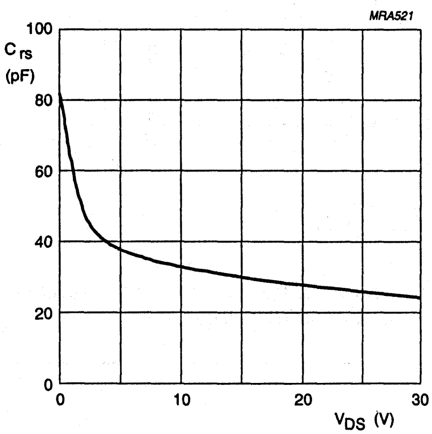


Fig.8 Feedback capacitance as a function of drain-source voltage, typical values per section.

APPLICATION INFORMATION FOR CLASS-B OPERATION

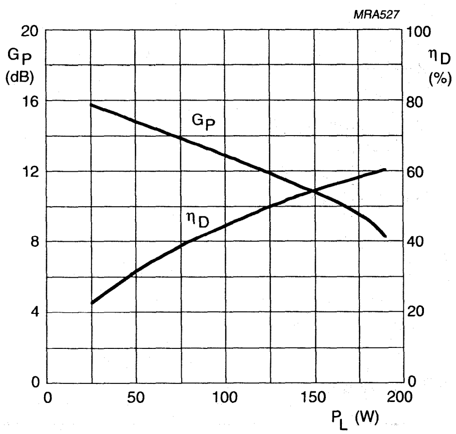
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W, unless otherwise specified.
RF performance in a common source, push-pull, class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
CW, class-B	500	28	2 x 160	150	> 10 typ. 11	> 50 typ. 55

Ruggedness in class-B operation

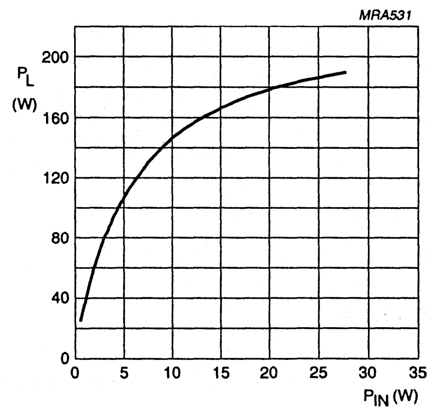
The BLF548 is capable of withstanding a load mismatch corresponding to VSWR = 10 through all phases under the following conditions:

V_{DS} = 28 V; f = 500 MHz at rated output power.



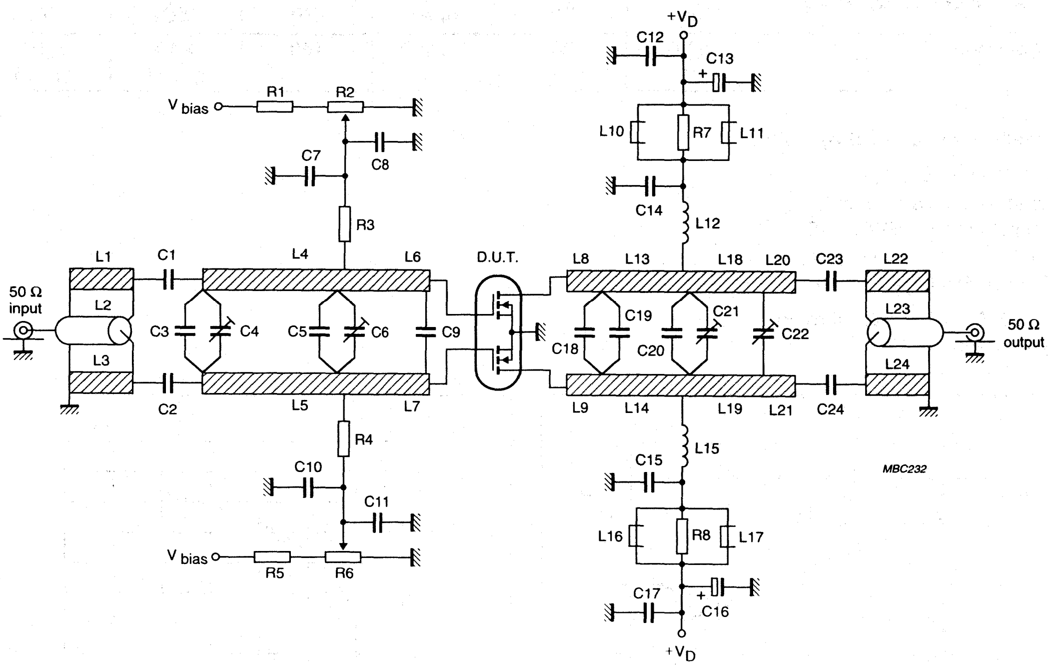
Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 160 mA; f = 500 MHz; Z_L = 1.1 + j0.6 Ω (per section).

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 160 mA; f = 500 MHz; Z_L = 1.1 + j0.6 Ω (per section).

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

Fig.11 Test circuit for class-B operation.

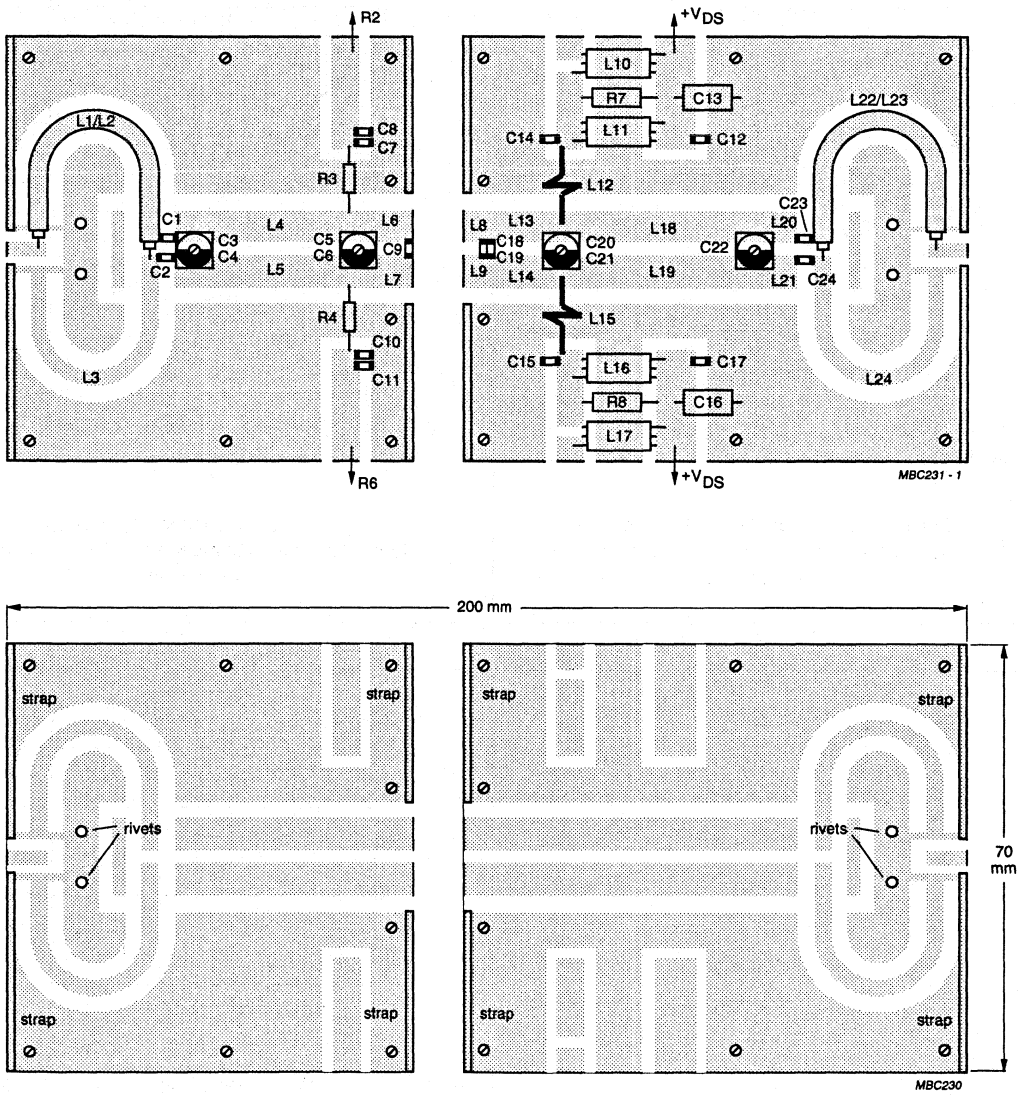
List of components (see class-B test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	22 pF		
C3	multilayer ceramic chip capacitor (note 1)	16 pF		
C4	film dielectric trimmer	2 to 9 pF		2222 809 09005
C5	multilayer ceramic chip capacitor (note 2)	27 pF		
C6, C21, C22	film dielectric trimmer	2 to 18 pF		2222 809 09006
C7, C10, C14, C15	multilayer ceramic chip capacitor (note 1)	390 pF		
C8, C11, C12, C17	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C9	multilayer ceramic chip capacitor (note 3)	2 x 56 pF in series		
C13, C16	electrolytic capacitor	10 μF, 63 V		2222 030 38109
C18	multilayer ceramic chip capacitor (note 2)	18 pF		
C19	multilayer ceramic chip capacitor (note 2)	12 pF		
C20	multilayer ceramic chip capacitor (note 2)	8.2 pF		
C23, C24	multilayer ceramic chip capacitor (note 1)	30 pF		
L1, L3, L22, L24	stripline (note 4)	34.5 Ω	length 66.5 mm width 4 mm	
L2, L23	semi-rigid cable (note 5)	50 Ω	length 66.5 mm width 3.6 mm	
L4, L5	stripline (note 4)	22.3 Ω	length 35 mm width 7 mm	
L6, L7	stripline (note 4)	22.3 Ω	length 10 mm width 7 mm	
L8, L9	stripline (note 4)	22.3 Ω	length 5.5 mm width 7 mm	
L10, L11, L16, L17	grade 3B Ferroxcube wideband RF choke			4312 020 36642
L12, L15	1 turn enamelled 1.5 mm copper wire	17 nH	length 5 mm int. dia. 9 mm leads 2 x 5 mm	
L13, L14	stripline (note 4)	22.3 Ω	length 15 mm width 7 mm	
L18, L19	stripline (note 4)	22.3 Ω	length 36 mm width 7 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L20, L21	stripline (note 4)	22.3 Ω	length 8.5 mm width 7 mm	
R1, R5	0.4 W metal film resistor	24.7 kΩ		2322 151 72473
R2, R6	10 turn potentiometer	5 kΩ		
R3, R4	0.4 W metal film resistor	10.5 kΩ		2322 151 71053
R7, R8	1 W metal film resistor	10 Ω		2322 151 51009

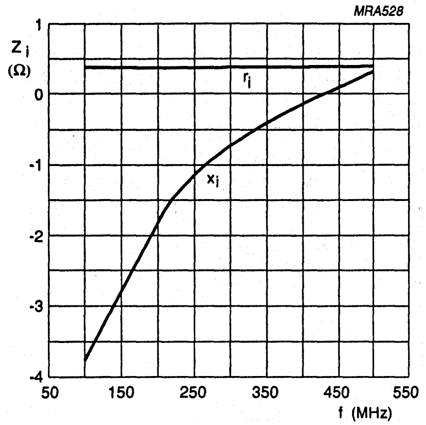
Notes

1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 175B or other capacitor of the same quality.
3. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
4. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 0.79 mm.
5. Cables L2 and L23 are soldered to striplines L1 and L22 respectively.



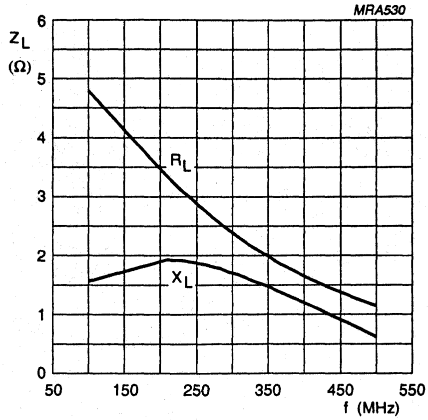
The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as a ground plane. Connections are made by means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

Fig.12 Component layout for 500 MHz class-B test circuit.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 160 mA (per section); P_L = 150 W (total device).

Fig.13 Input impedance as a function of frequency (series components), typical values per section.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 160 mA (per section); P_L = 150 W (total device).

Fig.14 Load impedance as a function of frequency (series components), typical values per section.

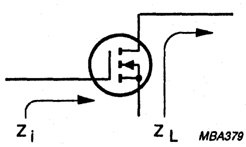
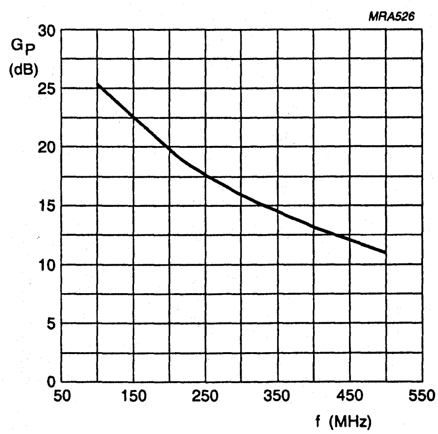


Fig.15 Definition of MOS impedance.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 160 mA (per section); P_L = 150 W (total device).

Fig.16 Power gain as a function of frequency, typical values per section.

UHF power transistor | BLT13

PRELIMINARY
See Philips Semiconductors for Design-in information

FEATURES

- High efficiency
- High gain
- Internal pre-matched input.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 1.8 GHz Time Division Multiple Axis (TDMA) communication systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

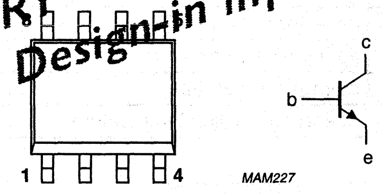


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB	1800	6	2	≥6	≥50

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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	1	A
P_{tot}	total power dissipation	T_s = 130 °C; note 1	–	1	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 1 W; T_s = 130 °C; note 1	45	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 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	2.5	–	V
I_{CES}	collector leakage current	V_{CE} = 6 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	30	150	
C_c	collector capacitance	V_{CB} = 6 V; $I_E = i_e$ = 0; f = 1 MHz	–	8	pF
C_{re}	feedback capacitance	V_{CE} = 6 V; I_C = 0; f = 1 MHz	–	6	pF

APPLICATION INFORMATION

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

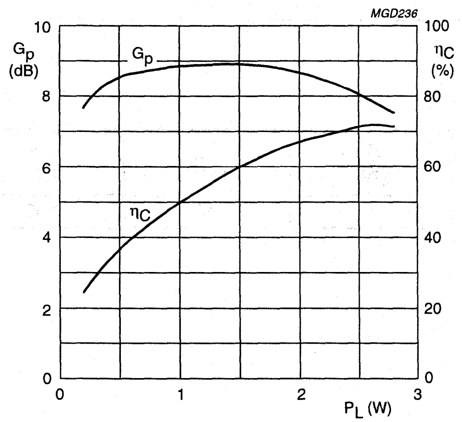
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms	1800	6	2	2	≥6 typ. 8.5	≥50 typ. 65

Note

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

Ruggedness in class-AB operation

The BLT13 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 1800 MHz; $V_{CE} = 8.5$ V; $P_L = 2$ W; $T_s \leq 60$ °C.



Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms; f = 1800 MHz; $V_{CE} = 6$ V; $I_{CQ} = 2$ mA; tuned at $P_L = 2$ W; $T_s \leq 60$ °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.

UHF power transistor BLT14

FEATURES

- High efficiency
- High gain
- Internal pre-matched input.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 1.8 GHz Time Division Multiple Axis (TDMA) communications systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

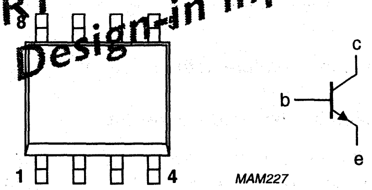


Fig.1 Simplified outline and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB	1 800	4.8	1.6	≥6	≥50

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	–	16	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	1	A
P_{tot}	total power dissipation	T_s = 130 °C; note 1	–	1	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 1 W; T_s = 130 °C; note 1	45	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 5 mA	16	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	2.5	–	V
I_{CES}	collector leakage current	V_{CE} = 4.8 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	30	150	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	8	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	6	pF

APPLICATION INFORMATION

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

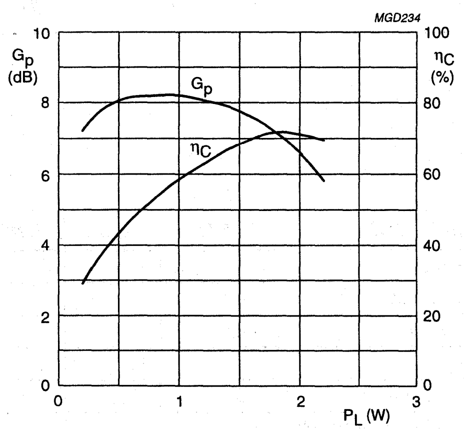
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms	1800	4.8	2	1.6	≥6 typ. 7.5	≥50 typ. 65

Note

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

Ruggedness in class-AB operation

The BLT14 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 1800 MHz; $V_{CE} = 6.5$ V; $P_L = 1.6$ W; $T_s \leq 60$ °C.



Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms; f = 1800 MHz; $V_{CE} = 4.8$ V; $I_{CQ} = 1.6$ mA; tuned at $P_L = 1.6$ W; $T_s \leq 60$ °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.

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

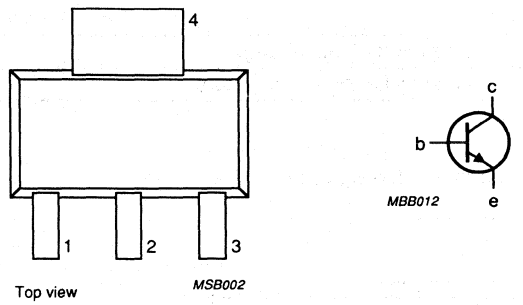


Fig.1 Simplified outline and symbol.

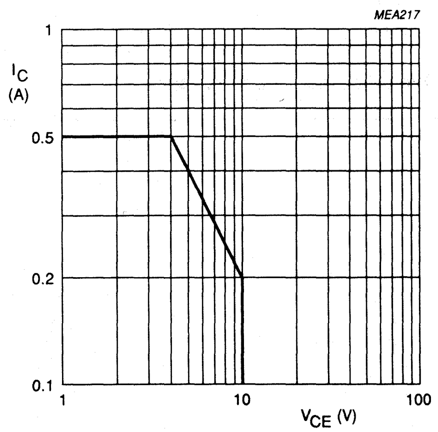
LIMITING VALUES

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.

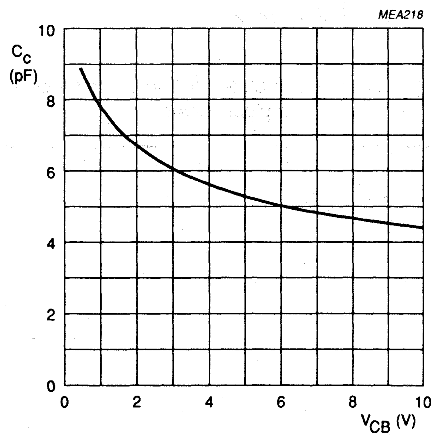
THERMAL RESISTANCE

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



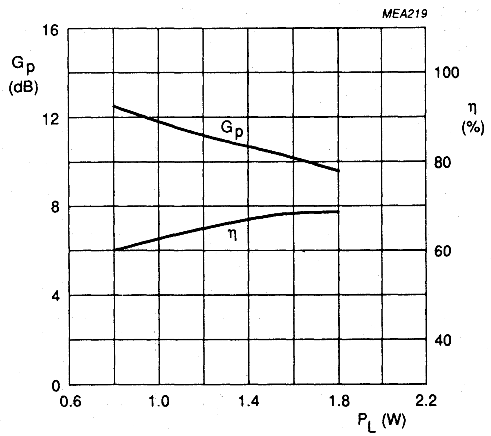
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

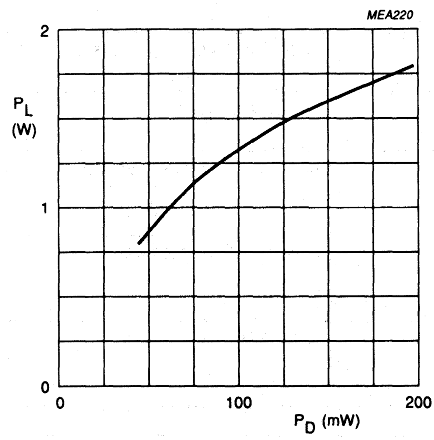
RF performance at $T_s \leq 60$ °C in a common emitter class-B test circuit.

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.

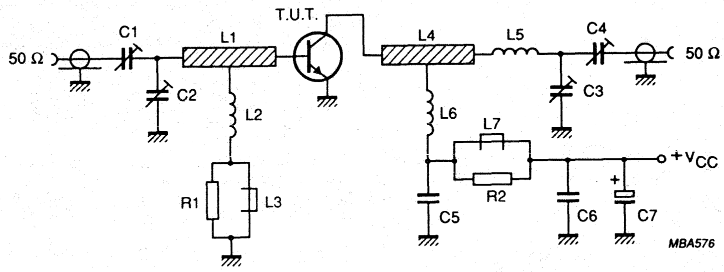


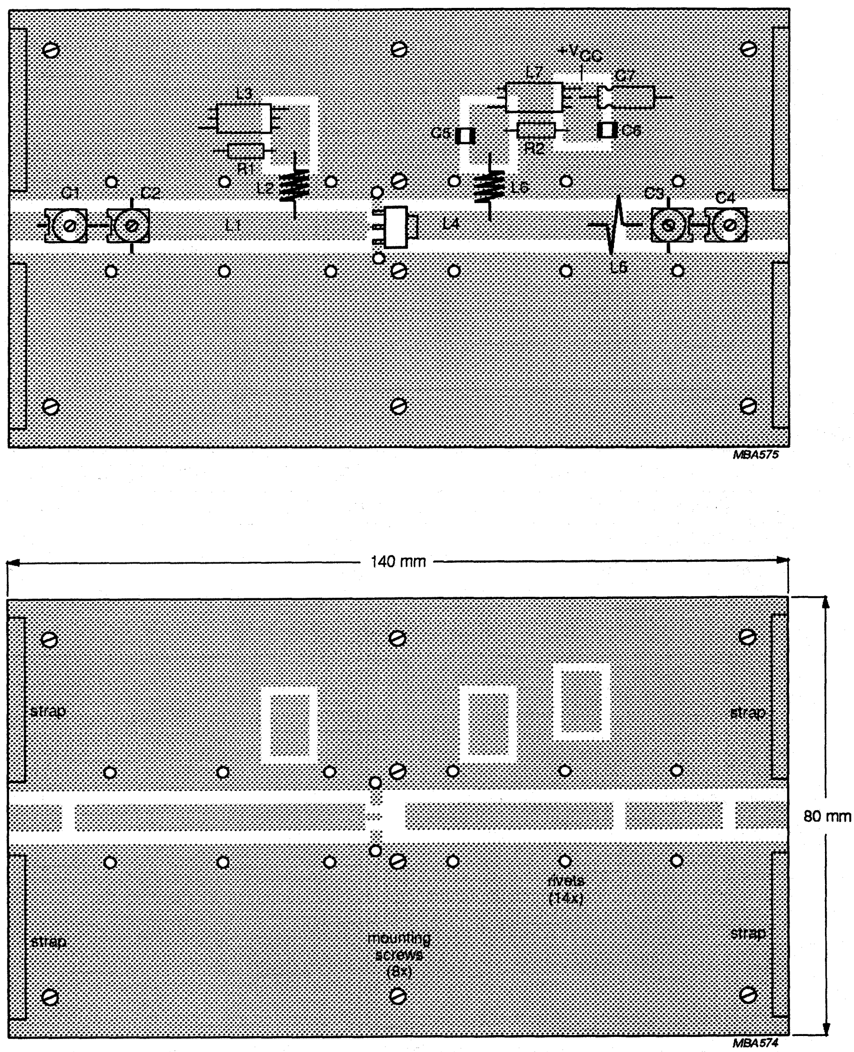
Fig.6 Class-B test circuit at f = 470 MHz.

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%		

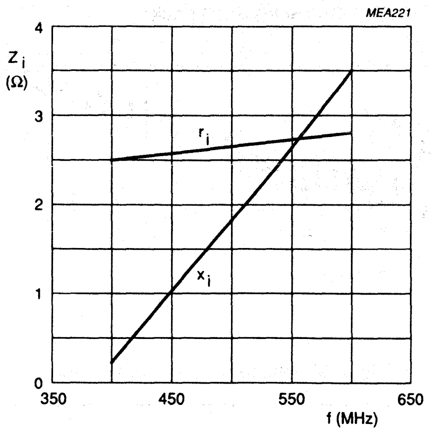
Notes

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.



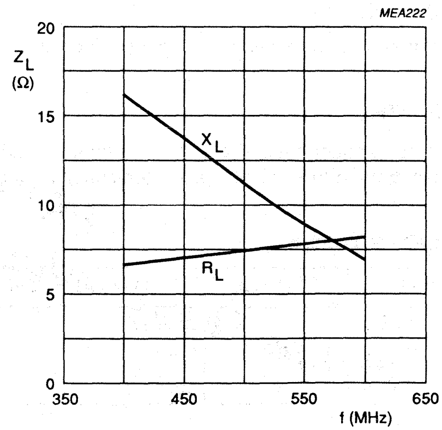
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

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.

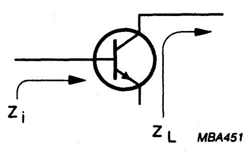
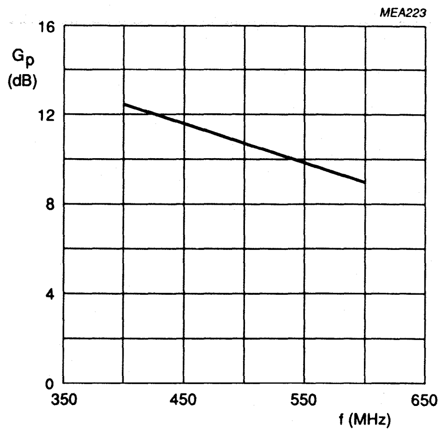


Fig.10 Definition of transistor impedance.



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 — BLT52

FEATURES

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

APPLICATIONS

- Common emitter class-B operation in portable radio transmitters in the 470 MHz communication band.

PINNING - SOT409A

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a ceramic SOT409A (SO8) SMD package.

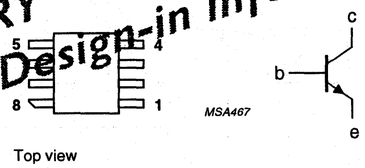


Fig.1 Simplified outline and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °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-B	470	7.5	7	≥8 typ. 9.5	≥50 typ. 65
		6	3	≥8 typ. 9.5	≥50 typ. 55

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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2.5	A
P_{tot}	total power dissipation	$T_s \leq 60$ °C	–	23	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	$P_{tot} = 23$ W; $T_s \leq 60$ °C	6	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	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 leakage current	$V_{CE} = 7.5$ V; $V_{BE} = 0$	–	–	1	mA
h_{FE}	DC current gain	$V_{CE} = 5$ V; $I_C = 1.2$ A	25	–	–	
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

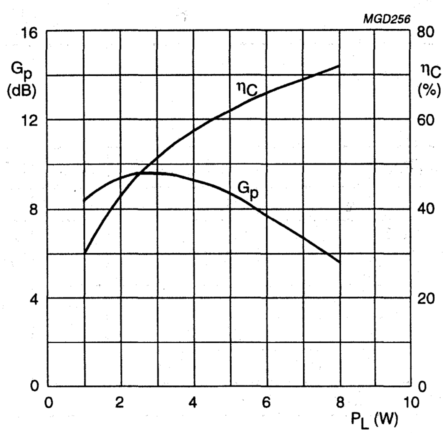
APPLICATION INFORMATION

RF performance at $T_s \leq 60$ °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-B	470	7.5	7	≥8 typ. 9.5	≥50 typ. 65
		6	3	≥8 typ. 9.5	≥50 typ. 55

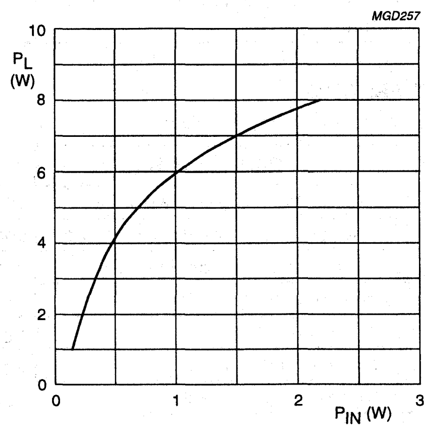
Ruggedness in class-B operation

The BLT52 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: f = 470 MHz; V_{CE} = 9 V; P_L = 7 W; $T_s \leq 60$ °C.



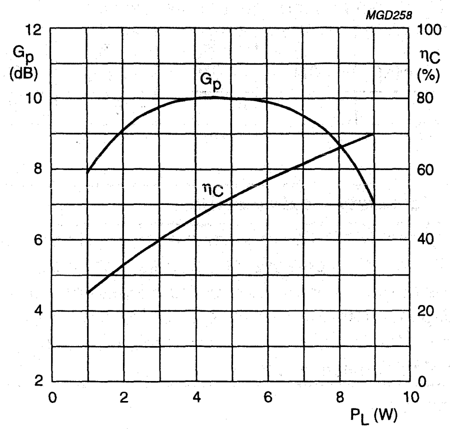
CW, class-B; f = 470 MHz; V_{CE} = 6 V; tuned at P_L = 3 W; $T_s \leq 60$ °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



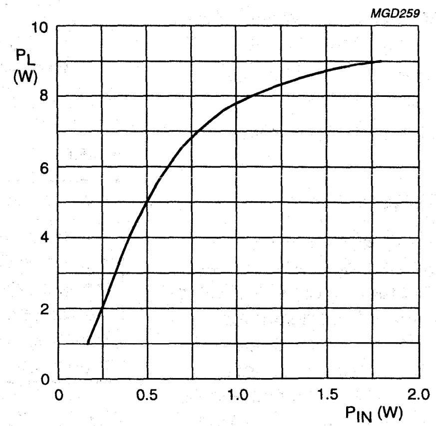
CW, class-B; f = 470 MHz; V_{CE} = 6 V; tuned at P_L = 3 W; $T_s \leq 60$ °C.

Fig.3 Load power as a function of input power; typical values.



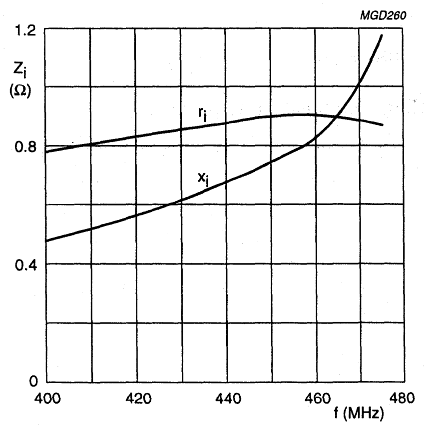
CW, class-B; f = 470 MHz; V_{CE} = 7.5 V; tuned at P_L = 7 W; $T_s \leq 60$ °C.

Fig.4 Power gain and collector efficiency as functions of load power; typical values.



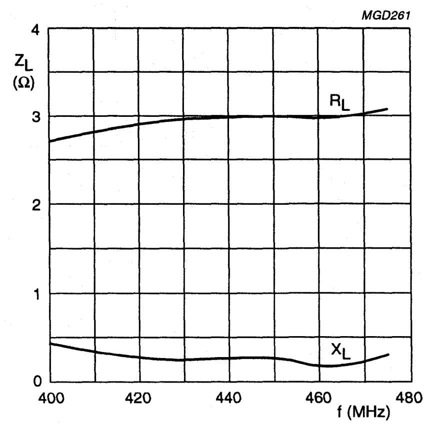
CW, class-B; f = 470 MHz; V_{CE} = 7.5 V; tuned at P_L = 7 W; $T_s \leq 60$ °C.

Fig.5 Load power as a function of input power; typical values.



CW, class-B; V_{CE} = 7.5 V; P_L = 7 W; $T_s \leq 60$ °C.

Fig.6 Input impedance as a function of frequency (series components); typical values.



CW, class-B; V_{CE} = 7.5 V; P_L = 7 W; $T_s \leq 60$ °C.

Fig.7 Load impedance as a function of frequency (series components); 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

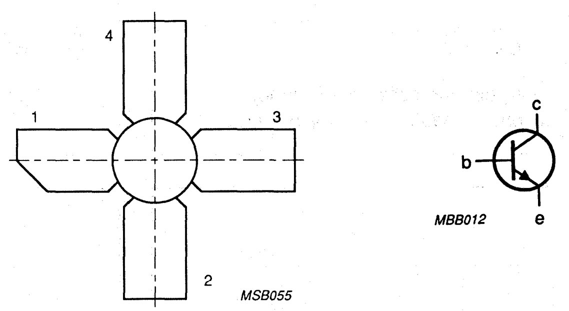


Fig.1 Simplified outline and symbol.

UHF power transistor BLT53

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

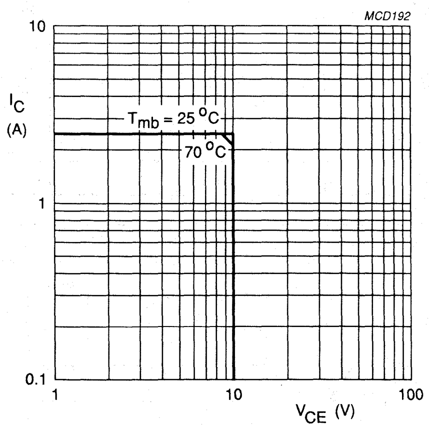
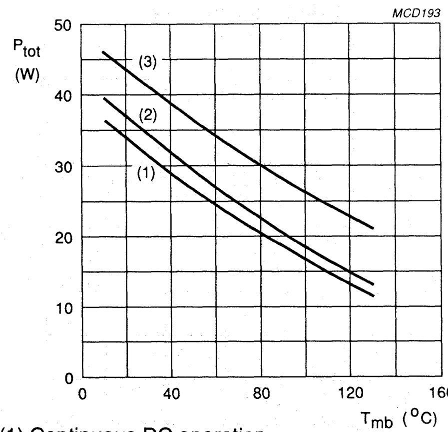


Fig.2 DC SOAR.



(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.

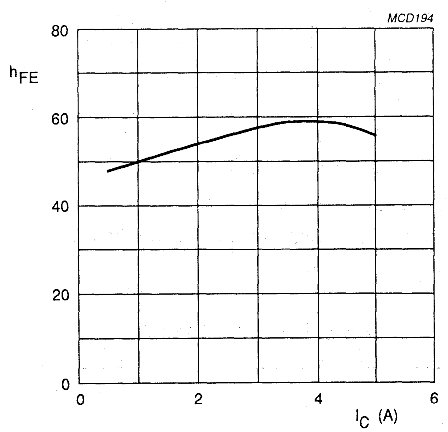
THERMAL RESISTANCE

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

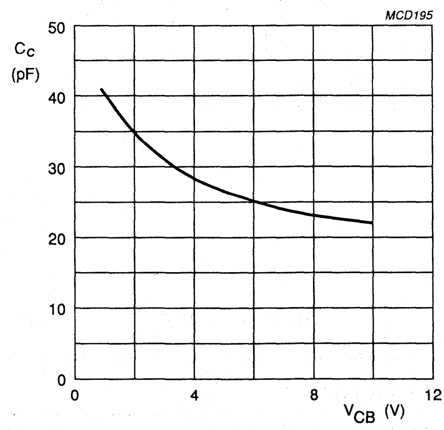
T_j = 25 °C.

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



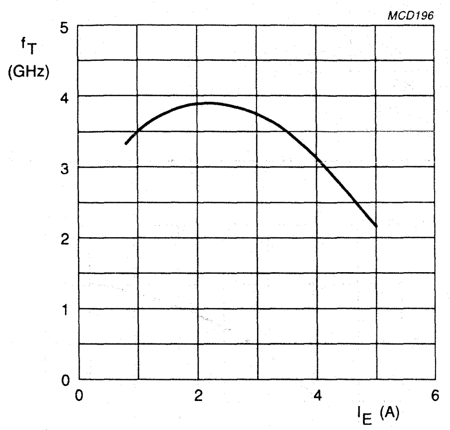
V_{CE} = 5 V.

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.



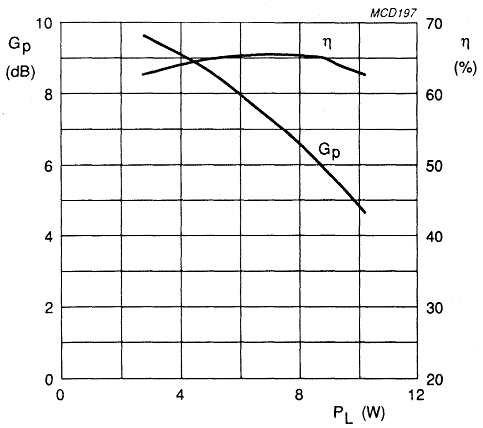
V_{CB} = 7.5 V.

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

APPLICATION INFORMATION

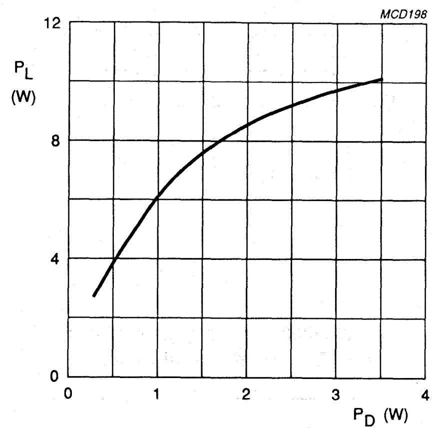
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

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.

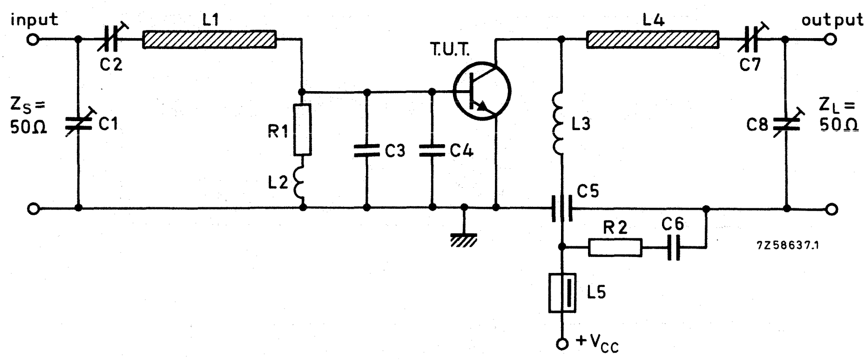


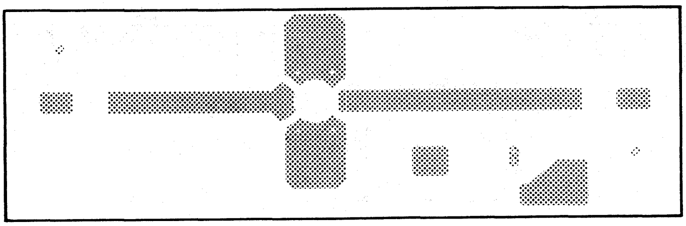
Fig.9 Class-B test circuit at f = 470 MHz.

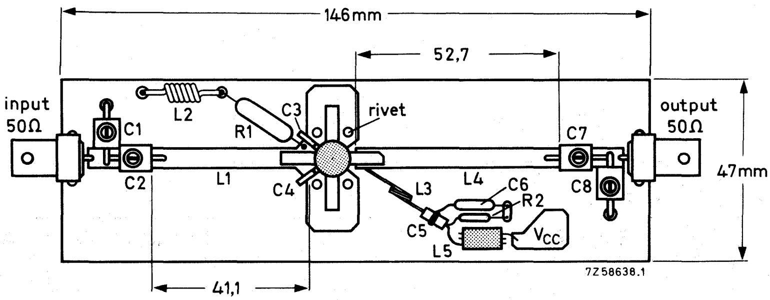
List of components (see test circuit)

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

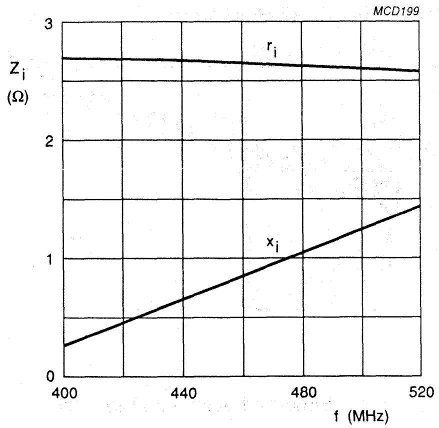
1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.74); thickness 1⁄16 inch.





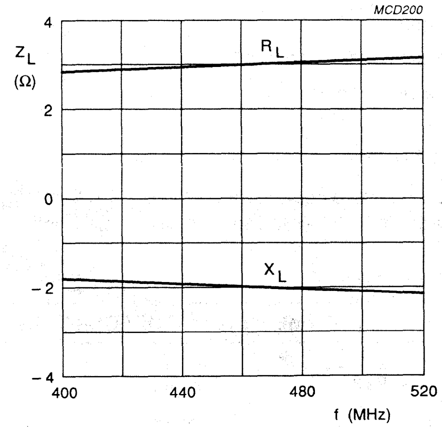
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of hollow rivets.

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.

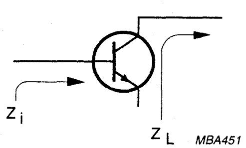
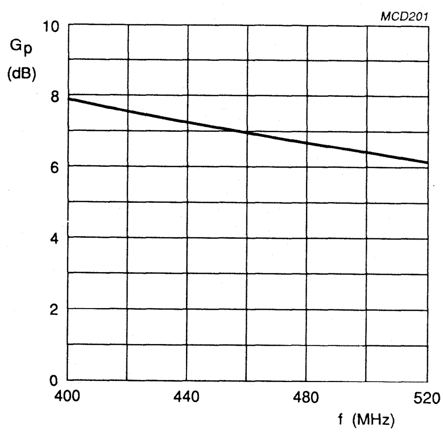


Fig.13 Definition of transistor impedance.



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 BLT61

FEATURES

- High efficiency
- High gain
- Internal pre-matched input
- Low supply voltage.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 900 MHz communication systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

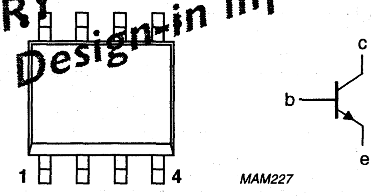


Fig.1 Simplified outline and symbol.

See Philips Semiconductors PRELIMINARY for Design-in information

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °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	3.6	1.2	typ. 13	typ. 63

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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current (DC)		–	650	mA
P_{tot}	total power dissipation	T_s = 115 °C; note 1	–	2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2 W; T_s = 115 °C; note 1	35	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 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	3.5	–	V
I_{CES}	collector leakage current	V_{CE} = 3.6 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 3.6 V; I_C = 100 mA	30	150	
C_c	collector capacitance	V_{CB} = 3.6 V; I_E = i_e = 0; f = 1 MHz	–	tbf	pF
C_{re}	feedback capacitance	V_{CE} = 3.6 V; I_C = 0; f = 1 MHz	–	tbf	pF

APPLICATION INFORMATION

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

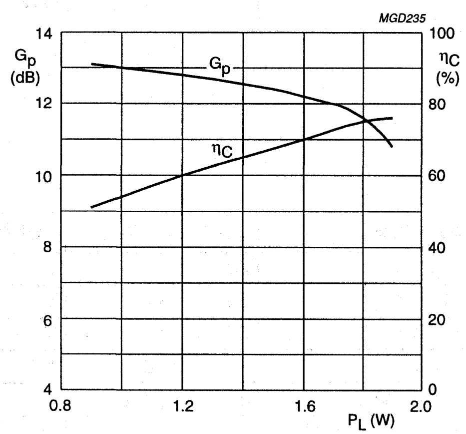
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	3.6	2	1.2	≥ 10 typ. 13	≥ 50 typ. 63

Note

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

Ruggedness in class-AB operation

The BLT61 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: f = 900 MHz; V_{CE} = 5 V; I_{CQ} = 2 mA; P_L = 1.45 W; $T_s \leq 60$ °C.



f = 900 MHz; V_{CE} = 3.6 V; I_{CQ} = 2 mA; tuned at P_L = 1.2 W.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.

UHF power transistor BLT62

PRELIMINARY
See Philips Semiconductors for Design-in information

FEATURES

- High efficiency
- High gain
- Internal pre-matched input.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 900 MHz Time Division Multiple Axis (TDMA) communication systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

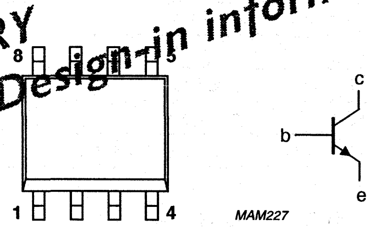


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB	900	3.6	3	typ. 9.5	typ. 63

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	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current (DC)		–	650	mA
P_{tot}	total power dissipation	T_s = 115 °C; note 1	–	2	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2 W; T_s = 115 °C; note 1	30	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 5 mA	15	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3.5	–	V
I_{CES}	collector leakage current	V_{CE} = 3.6 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 3.6 V; I_C = 100 mA	30	150	
C_c	collector capacitance	V_{CB} = 3.6 V; I_E = i_e = 0; f = 1 MHz	–	tbf	pF
C_{re}	feedback capacitance	V_{CE} = 3.6 V; I_C = 0; f = 1 MHz	–	tbf	pF

APPLICATION INFORMATION

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

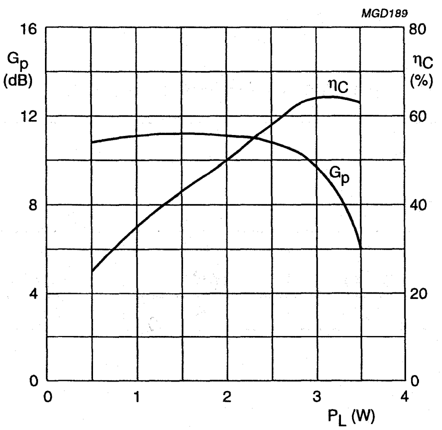
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms	900	3.6	2	3	≥8 typ. 9.5	≥50 typ. 63

Note

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

Ruggedness in class-AB operation

The BLT62 is capable of withstanding a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 900 MHz; $V_{CE} = 5$ V; $I_{CQ} = 2$ mA; $P_L = 3.5$ W; $T_s \leq 60$ °C.



Pulsed, class AB; f = 900 MHz; V_{CE} = 3.6 V; I_{CQ} = 2 mA; P_L = 3.5 W; Ts ≤ 60 °.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.

UHF power transistor — BLT70

FEATURES

- Very high efficiency
- Low supply voltage.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation in the 900 MHz communication band.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT223H SMD package.

PINNING - SOT223H

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	b	base
3	e	emitter
4	c	collector

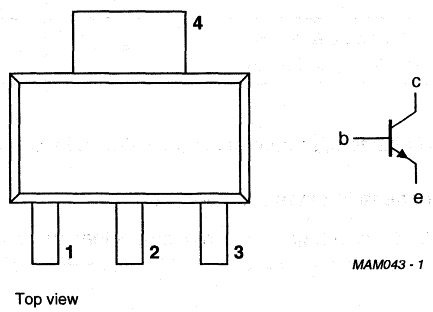


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see Fig.7).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (mW)	G_p (dB)	η_C (%)
CW, class-AB	900	4.8	600	≥6	≥60

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	–	16	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	250	mA
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	2.1	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2.1 W; T_s = 60 °C; note 1	55	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

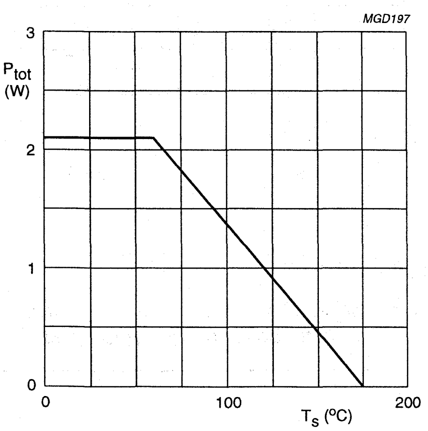
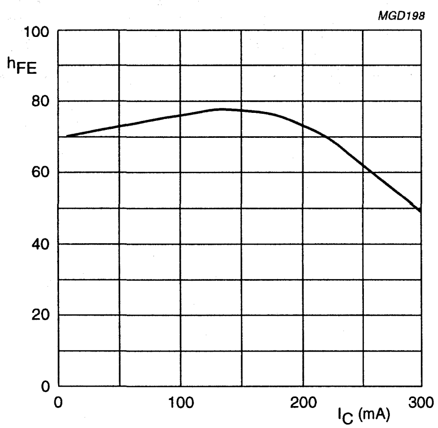


Fig.2 DC SOAR.

CHARACTERISTICS

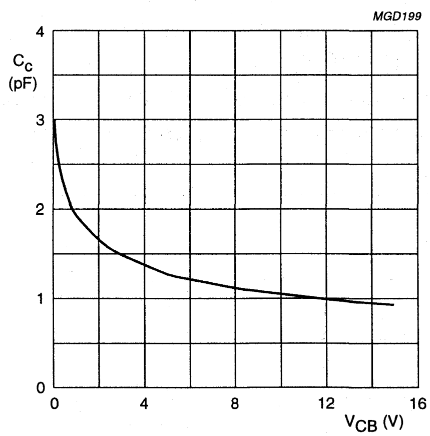
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.5 mA	16	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 5 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.2 mA	2.5	–	V
I_{CES}	collector leakage current	V_{CE} = 7 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 4.8 V; I_C = 100 mA	25	–	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	3.5	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	2.5	pF



V_{CE} = 4.8 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; T_j = 25 °C.

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 and Fig.7).

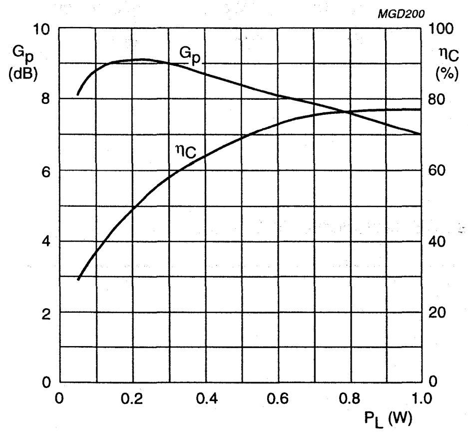
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	4.8	0.01	0.6	≥6 typ. 8.1	≥60 typ. 73

Note

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

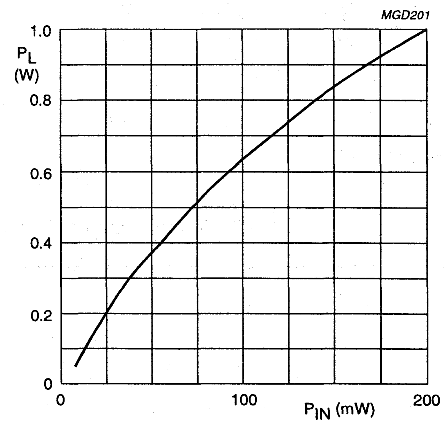
Ruggedness in class-AB operation

The BLT70 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: f = 900 MHz; V_{CE} = 6.5 V; P_L = 0.5 W; $T_s \leq 60$ °C.



f = 900 MHz; V_{CE} = 4.8 V; I_{CQ} = 0.01 mA; $T_s \leq 60$ °C.

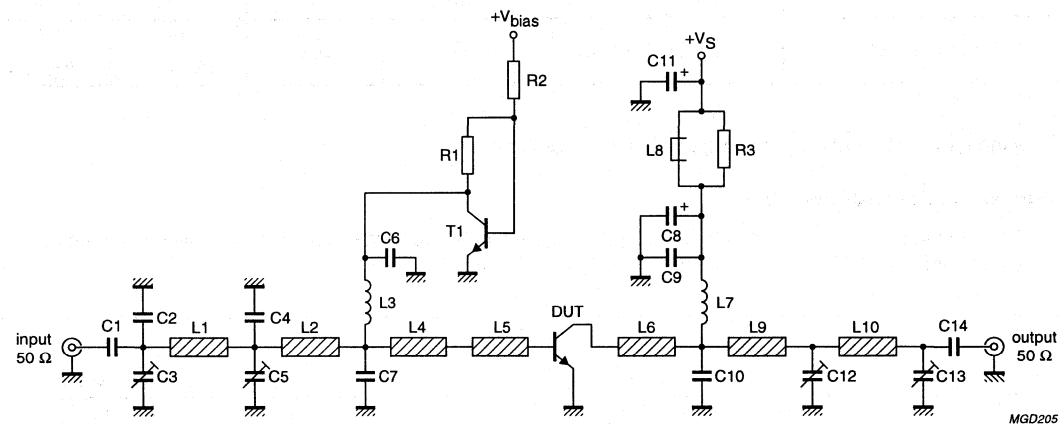
Fig.5 Power gain and collector efficiency as functions of load power; typical values.



f = 900 MHz; V_{CE} = 4.8 V; I_{CQ} = 0.01 mA; $T_s \leq 60$ °C.

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

Test circuit information



$V_S = V_{bias}$ = typ. 4.8 V.

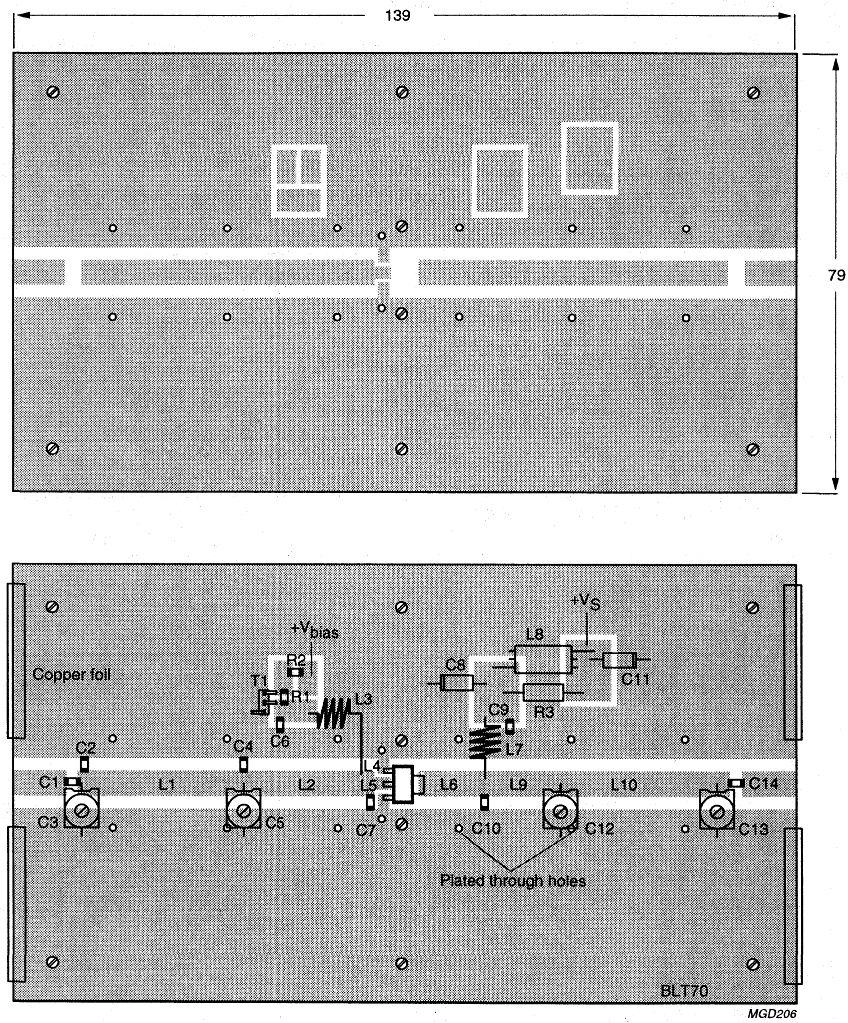
Fig.7 Common emitter test circuit for class-AB operation at 900 MHz.

List of components used in test circuit (see Figs 7 and 8)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C6, C9, C14	multilayer ceramic chip capacitor; note 1	100 pF		
C2	multilayer ceramic chip capacitor; note 1	1 pF		
C4	multilayer ceramic chip capacitor; note 1	2.4 pF		
C3, C5, C12, C13	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09004
C7	multilayer ceramic chip capacitor; note 1	5.1 pF		
C8	tantalum capacitor	1 μF, 35 V		
C10	multilayer ceramic chip capacitor; note 1	2.7 pF		
C11	tantalum capacitor	100 μF, 20 V		
L1	stripline; note 2	50 Ω	length 29.1 mm width 5 mm	
L2	stripline; note 2	50 Ω	length 21 mm width 5 mm	
L3	8 turns enamelled 0.8 mm copper wire	216 nH	length 7 mm internal dia. 4.5 mm	
L4	stripline; note 2	50 Ω	length 1 mm width 5 mm	
L5	stripline; note 2	50 Ω	length 3 mm width 2.5 mm	
L6	stripline; note 2	50 Ω	length 12 mm width 5 mm	
L7	8 turns enamelled 0.8 mm copper wire	105 nH	length 7 mm internal dia. 3.4 mm	
L8	grade 3B Ferroxcube wideband HF choke			4132 020 36640
L9	stripline; note 2	50 Ω	length 12 mm width 5 mm	
L10	stripline; note 2	50 Ω	length 28 mm width 5 mm	
R1	metal film resistor	0.1 W, 15 Ω		
R2	metal film resistor	0.1 W, 390 Ω		
R3	metal film resistor	0.6 W, 10 Ω		
T1	NPN transistor	BD139		

Notes

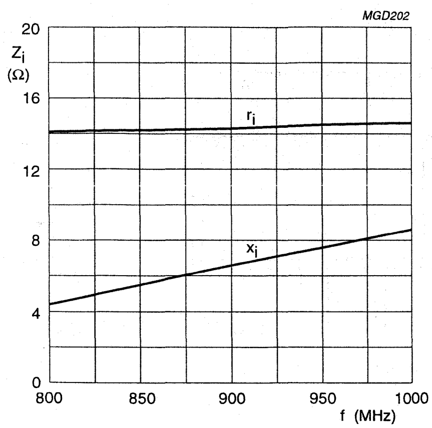
1. American Technical Ceramics type 100A or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with DUROID dielectric ($\varepsilon_r = 2.2$); thickness $^1/_{16}$"; thickness of the copper sheet 2×35 μm.



Dimensions in mm.

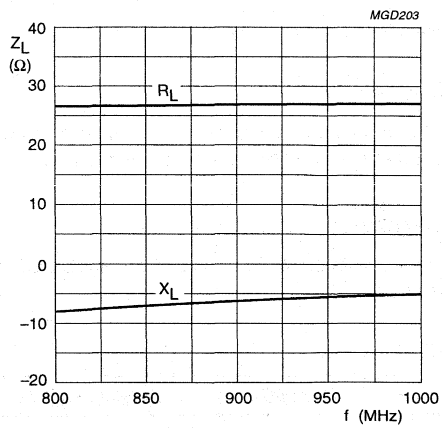
The components are situated on one side of the copper-clad PCB, the other side is unetched and serves as a ground plane.
Earth connections from the component side to the ground plane are made by through metallization.

Fig.8 Printed-circuit board and component lay-out for 900 MHz class-AB test circuit in Fig.7.



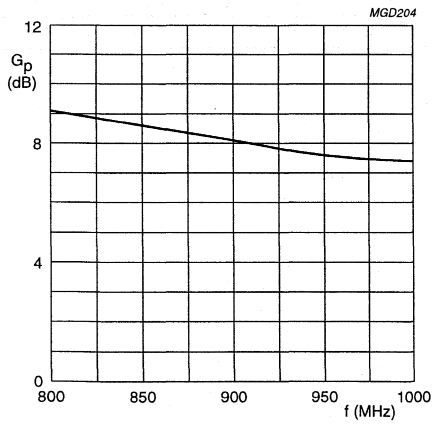
V_{CE} = 4.8 V; I_{CQ} = 0.01 mA; P_L = 0.6 W; $T_s \leq 60$ °C.

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



V_{CE} = 4.8 V; I_{CQ} = 0.01 mA; P_L = 0.6 W; $T_s \leq 60$ °C.

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



V_{CE} = 4.8 V; I_{CQ} = 0.01 mA; P_L = 0.6 W; $T_s \leq 60$ °C.

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

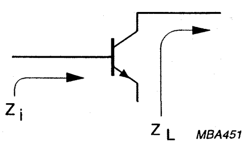


Fig.12 Definition of transistor impedance.

UHF power transistor | BLT71

FEATURES

- Very high efficiency
- Low supply voltage.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation in the 900 MHz communications band.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT223 envelope.

PINNING - SOT223

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	b	base
3	e	emitter
4	c	collector

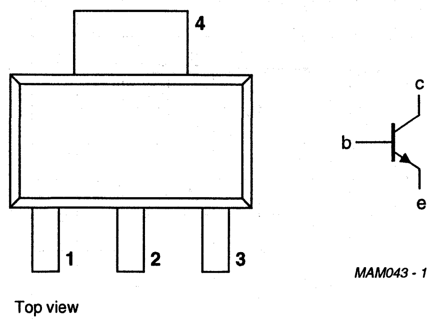


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °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	4.8	1.2	≥6	≥60

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	–	16	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	500	mA
P_{tot}	total power dissipation	up to T_s = 90 °C	–	3.5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 3.5 W; up to T_s = 90 °C; note 1	24	K/W

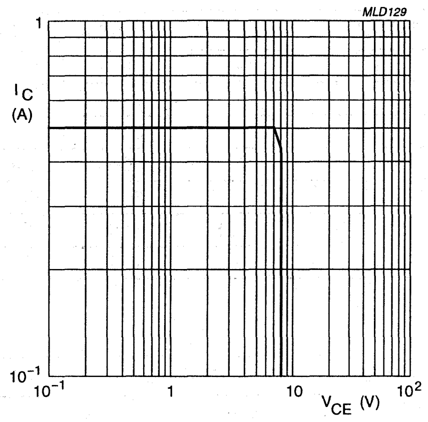
Note

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

CHARACTERISTICS

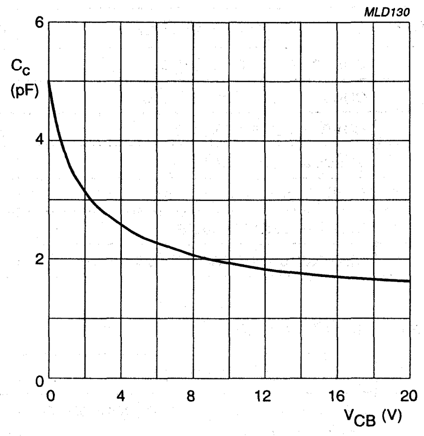
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 0.5 mA	16	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	–	V
I_{CES}	collector leakage current	V_{CE} = 8 V; V_{BE} = 0	–	–	100	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	25	–	–	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	–	7	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	–	5	pF



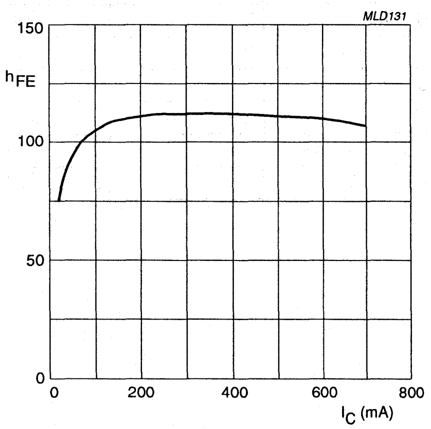
T_s = 90 °C.

Fig.2 DC SOAR.



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

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



Measured under pulsed conditions: $t_p \leq 300$ µs; $\delta \leq 0.01$.
V_{CE} = 4.8 V.

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

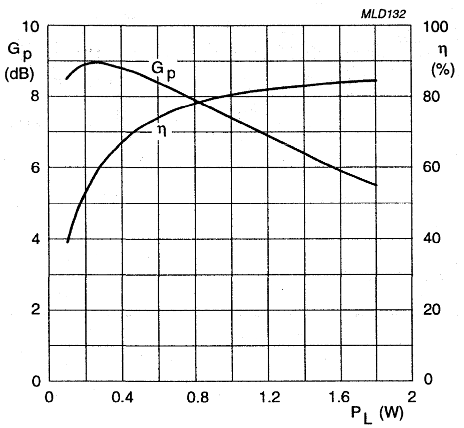
APPLICATION INFORMATION

RF performance at $T_s \leq 60$ °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	900	4.8	1	1.2	≥6	≥60

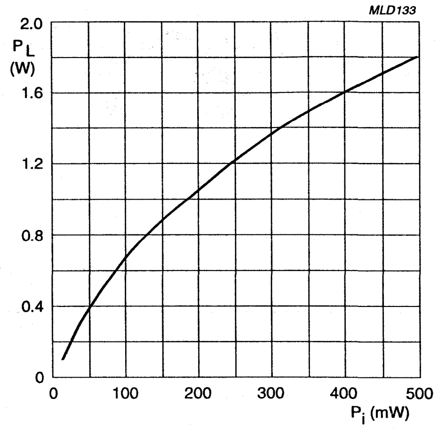
Ruggedness in class-AB operation

The BLT71 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: P_L = 1.2 W; V_{CE} = 6.5 V; f = 900 MHz.



V_{CE} = 4.8 V.
I_{CQ} = 1 mA.
f = 900 MHz.

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



V_{CE} = 4.8 V.
I_{CQ} = 1 mA.
f = 900 MHz.

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

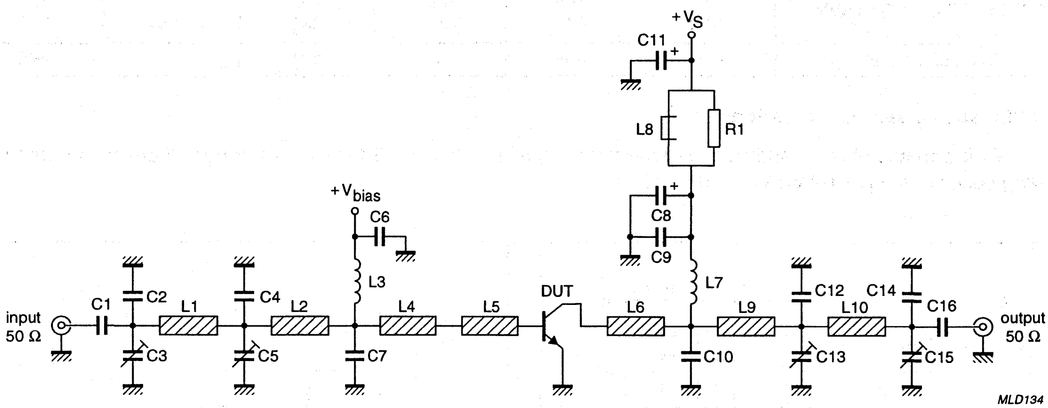


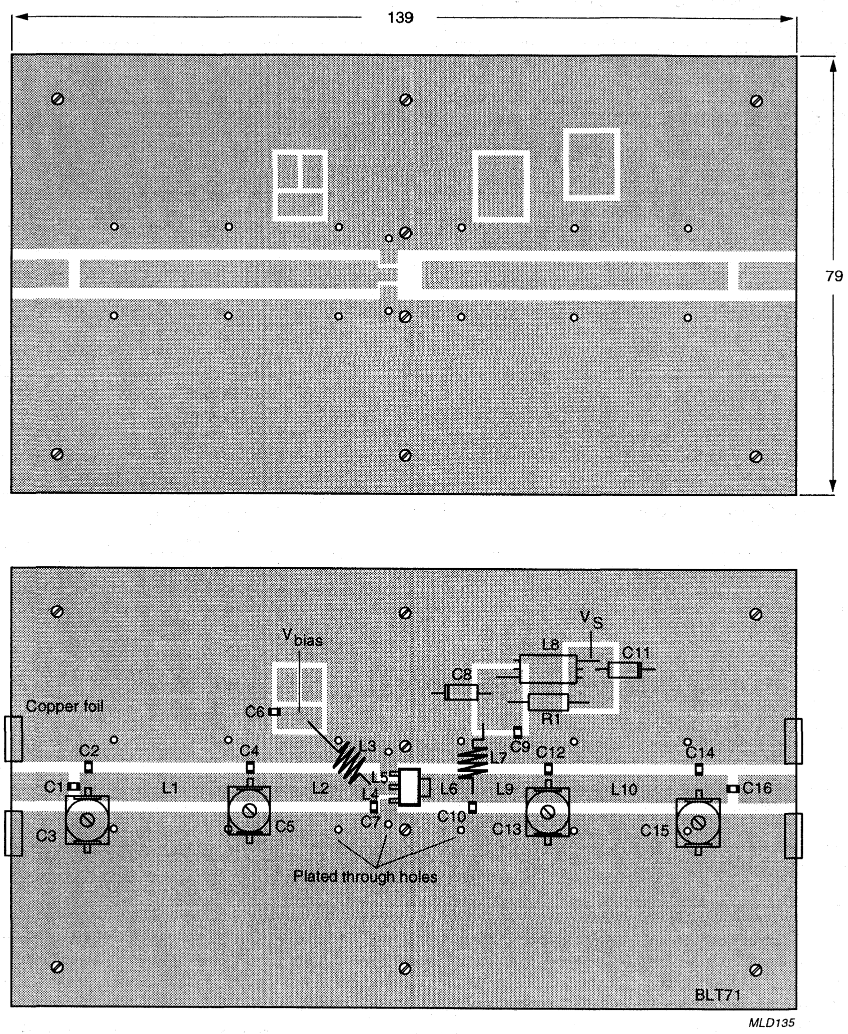
Fig.7 Class-AB test circuit at 900 MHz.

List of components (see Figs 7 and 8)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C6, C9, C16	multilayer ceramic chip capacitor; note 1	100 pF		
C2, C4, C12, C14	multilayer ceramic chip capacitor; note 1	1 pF		
C3, C5, C13, C15	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09004
C7	multilayer ceramic chip capacitor; note 1	6.8 pF		
C8	tantalum capacitor	1 μF, 35 V		
C10	multilayer ceramic chip capacitor; note 1	5.1 pF		
C11	tantalum capacitor	100 μF, 20 V		
L1	stripline; note 2	50 Ω	length 28.5 mm width 5 mm	
L2	stripline; note 2	50 Ω	length 23 mm width 5 mm	
L3	11 turns enamelled 0.6 mm copper wire	100 nH	length 7.5 mm internal dia. 3.3 mm	
L4	stripline; note 2	50 Ω	length 1 mm width 5 mm	
L5	stripline; note 2	50 Ω	length 3 mm width 2.5 mm	
L6	stripline; note 2	50 Ω	length 9 mm width 5 mm	
L7	7 turns enamelled 0.6 mm copper wire	37 nH	length 7.3 mm internal dia. 3.3 mm	
L8	grade 3B Ferroxcube wideband HF choke			4132 020 36640
L9	stripline; note 2	50 Ω	length 13.5 mm width 5 mm	
L10	stripline; note 2	50 Ω	length 26.5 mm width 5 mm	
R1	metal film resistor	0.1 W, 10 Ω		

Notes

1. American Technical Ceramics type 100A or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with DUROID dielectric ($\varepsilon_r = 2.2$); thickness $^1\!/_{16}$"; thickness of the copper sheet 2 × 35 μm.



Dimensions in mm.

The components are situated on one side of the copper-clad PCB, 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.

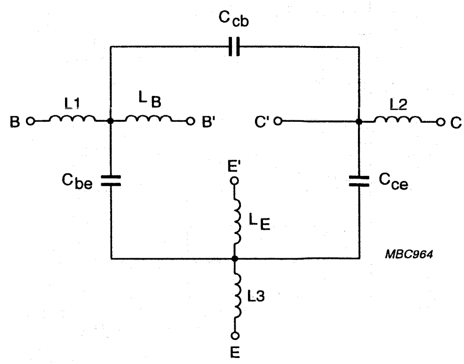
Fig.8 Component lay-out and printed-circuit board for 900 MHz class-AB test circuit.

SPICE parameters for the BLT71 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	3.503	fA
2	BF	190.5	–
3	NF	0.981	–
4	VAF	35.45	V
5	IKF	24.52	A
6	ISE	184.9	fA
7	NE	1.475	–
8	BR	12.61	–
9	NR	1.042	–
10	VAR	1.476	V
11	IKR	2.206	A
12	ISC	866.5	aA
13	NC	1.025	–
14	RB	2.000	Ω
15	IRB	1.000	μA
16	RBM	2.000	Ω
17	RE	373.8	mΩ
18	RC	330.6	mΩ
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	9.746	pF
23	VJE	0.600	V
24	MJE	0.288	–
25	TF	11.99	ps
26	XTF	0.979	–
27	VTF	19.52	mV
28	ITF	0.137	A
29	PTF	0.000	deg
30	CJC	5.028	pF
31	VJC	0.609	V
32	MJC	0.368	–
33	XCJC	0.150	–
34	TR	3.841	ns
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.813	–

Note

1. These parameters have not been extracted, the default values are shown.

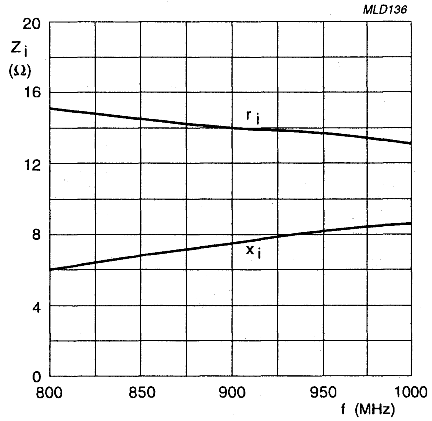


$QL_B = 50$; $QL_E = 50$; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/Fc)}$;
Fc = scaling frequency = 1 GHz.

Fig.9 Package equivalent circuit SOT223H.

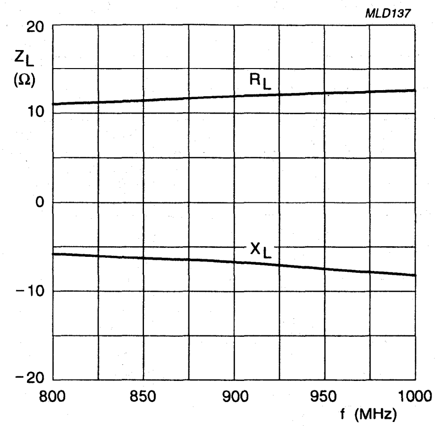
List of components (see Fig.9)

DESIGNATION	VALUE	UNIT
C_{be}	182	fF
C_{cb}	16	fF
C_{ce}	249	fF
L1	0.025	nH
L2	1.19	nH
L3	0.6	nH
L_B	1.85	nH
L_E	1.22	nH



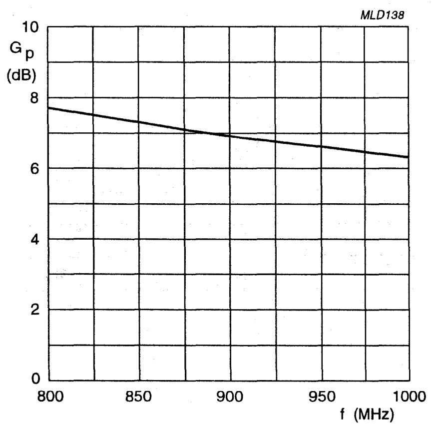
V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

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



V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

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



V_{CE} = 4.8 V; I_{CQ} = 1 mA.
P_L = 1.2 W; T_{amb} = 25 °C.

Fig.12 Gain as a function of frequency; typical values.

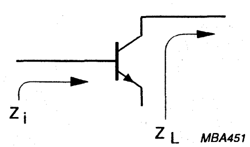


Fig.13 Definition of transistor impedance.

UHF power transistor BLT71/8

FEATURES

- High efficiency
- Very high gain
- Internal pre-matched input
- Low supply voltage.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 900 MHz communication band.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

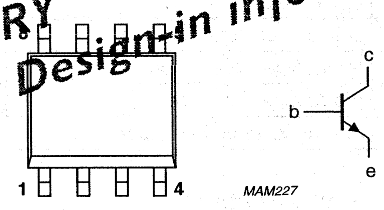


Fig.1 Simplified outline and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °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	4.8	1.2	≥11 typ. 13	≥55 typ. 63

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	–	16	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	500	mA
P_{tot}	total power dissipation	T_s = 60 °C; note 1	–	2.9	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2.9 W; T_s = 60 °C; note 1	40	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 0.5 mA	16	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.1 mA	2.5	–	V
I_{CES}	collector leakage current	V_{CE} = 8 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	25	–	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	7	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	5	pF

APPLICATION INFORMATION

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

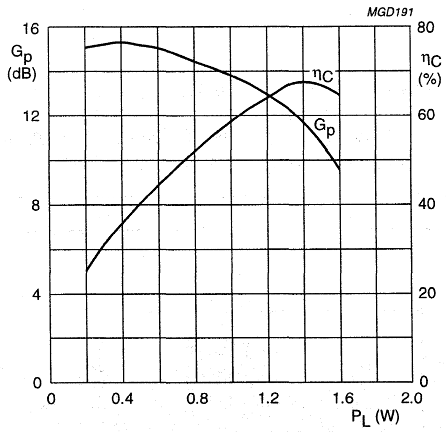
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	900	4.8	3	1.2	≥11 typ. 13	≥55 typ. 63

Note

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

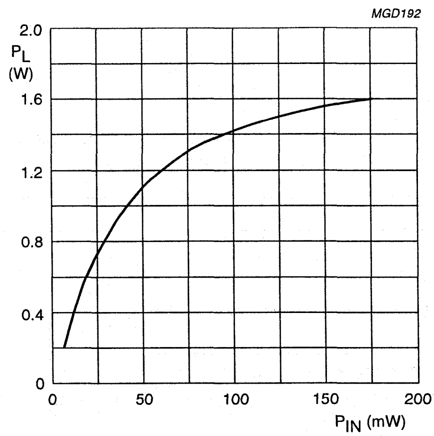
Ruggedness in class-AB operation

The BLT71/8 is capable of withstanding a load mismatch corresponding to VSWR = 6 : 1 through all phases under the following conditions: f = 900 MHz; V_{CE} = 6.5 V; I_{CQ} = 3 mA; P_L = 1.2 W; $T_s \leq 60$ °C.



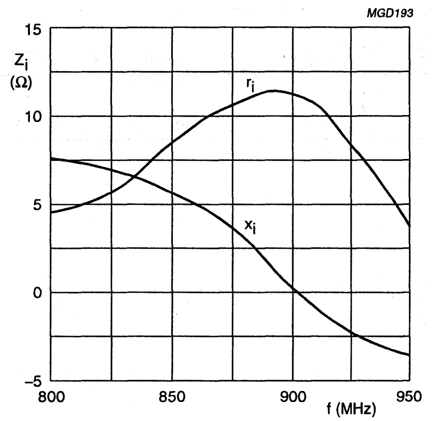
f = 900 MHz; V_{CE} = 4.8 V; I_{CQ} = 3 mA; $T_s \leq 60$ °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



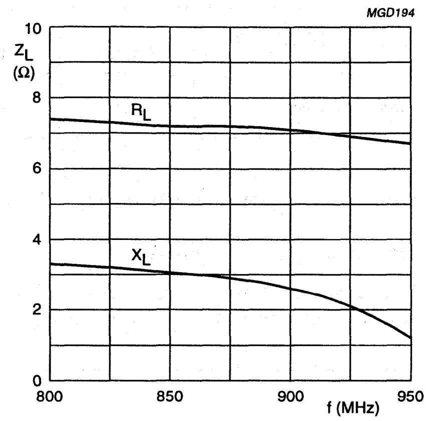
f = 900 MHz; V_{CE} = 4.8 V; I_{CQ} = 3 mA; $T_s \leq 60$ °C.

Fig.3 Load power as a function of input power; typical values.



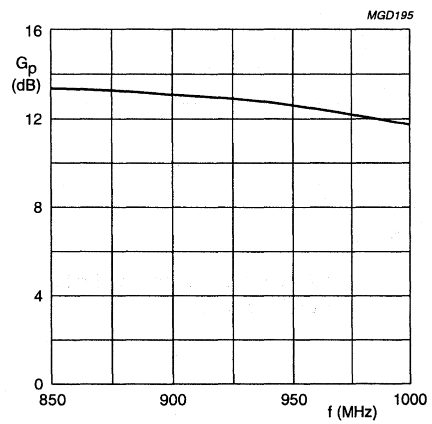
V_{CE} = 4.8 V; I_{CQ} = 3 mA; P_L = 1.2 W; T_{amb} = 25 °C.

Fig.4 Input impedance as a function of frequency (series components); typical values.



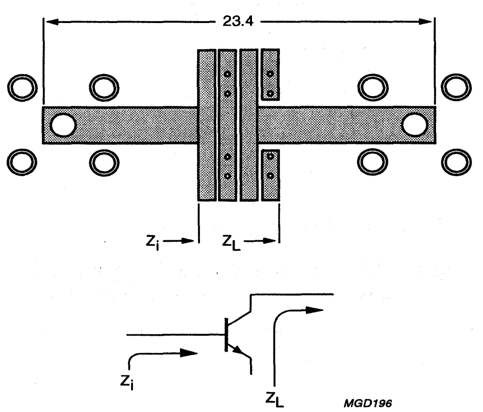
V_{CE} = 4.8 V; I_{CQ} = 3 mA; P_L = 1.2 W; T_{amb} = 25 °C.

Fig.5 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 4.8 V; I_{CQ} = 3 mA; P_L = 1.2 W; T_{amb} = 25 °C.

Fig.6 Power gain as a function of frequency (series components); typical values.



Dimensions in mm.

Fig.7 RF test print and definition of transistor impedance.

FEATURES

- High efficiency
- High gain
- Internal pre-matched input
- Low supply voltage.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 900 MHz Time Division Multiple Axis (TDMA) communication systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

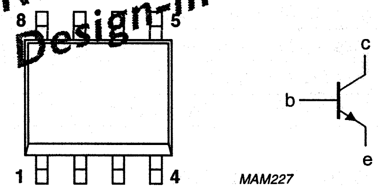


Fig.1 Simplified outline and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB	900	4.8	3	typ. 11.5	typ. 70

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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current (DC)		–	650	mA
P_{tot}	total power dissipation	T_s = 115 °C; note 1	–	2	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 2 W; T_s = 115 °C; note 1	30	K/W

Note to the "Limiting values" and "Thermal characteristics"

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

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 = 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	3.5	–	V
I_{CES}	collector leakage current	V_{CE} = 4.8 V; V_{BE} = 0	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 4.8 V; I_C = 100 mA	30	150	
C_c	collector capacitance	V_{CB} = 4.8 V; I_E = i_e = 0; f = 1 MHz	–	tbf	pF
C_{re}	feedback capacitance	V_{CE} = 4.8 V; I_C = 0; f = 1 MHz	–	tbf	pF

APPLICATION INFORMATION

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

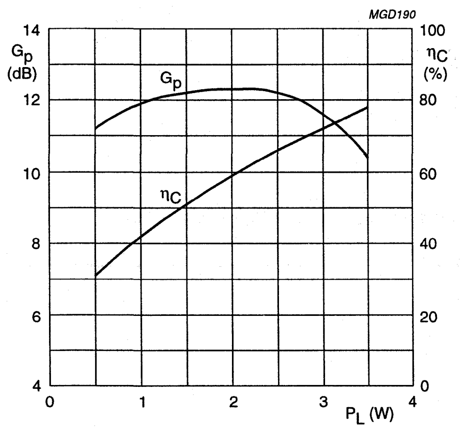
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms	900	4.8	2	3	≥ 9 typ. 11.5	≥ 55 typ. 70

Note

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

Ruggedness in class-AB operation

The BLT72 is capable of with standing a load mismatch corresponding to VSWR = 10 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 900 MHz; $V_{CE} = 6.5$ V; $I_{CQ} = 3$ mA; $P_L = 3.5$ W; $T_s \leq 60$ °C.



Pulsed, class AB; f = 900 MHz; $V_{CE} = 4.8$ V; $I_{CQ} = 2$ mA; tuned at $P_L = 3.2$ W.

Fig.2 Power gain and collector efficiency as functions of load power; 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.

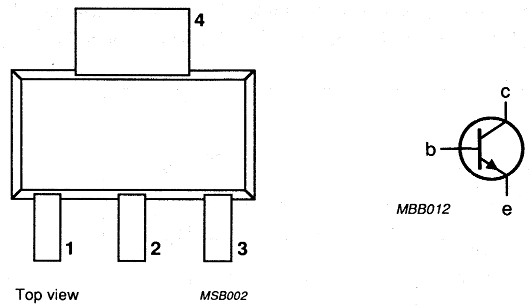


Fig.1 Simplified outline (SOT223) and symbol.

LIMITING VALUES

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

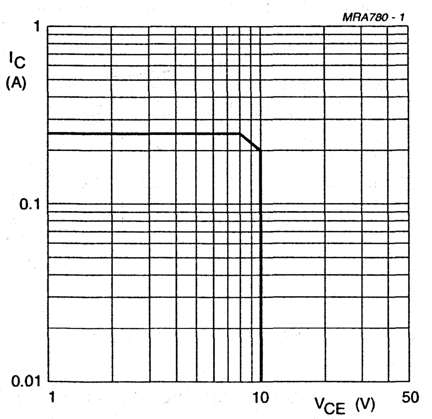
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC or average collector current		–	250	mA
I_{CM}	peak collector current	f > 1 MHz	–	750	mA
P_{tot}	total 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.

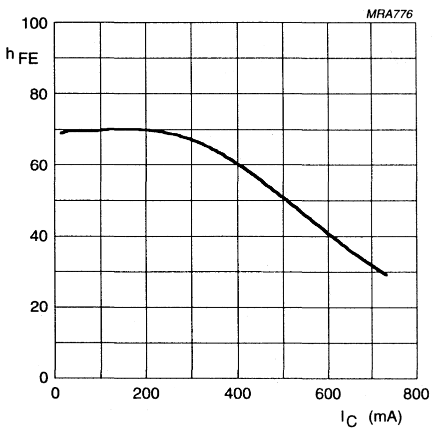
CHARACTERISTICS

$T_j = 25$ °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

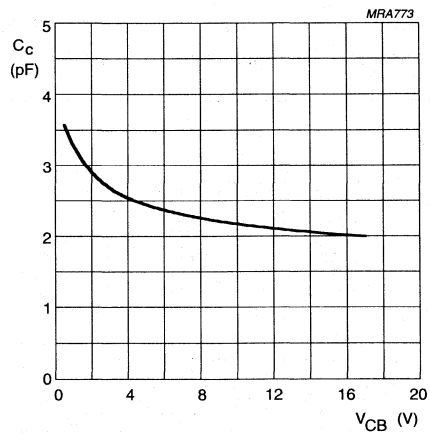
Note

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



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

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.

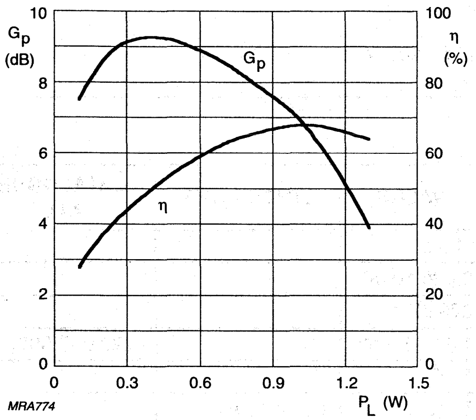
APPLICATION INFORMATION

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

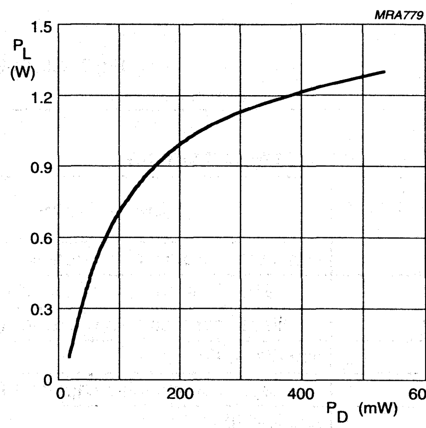
Note

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.

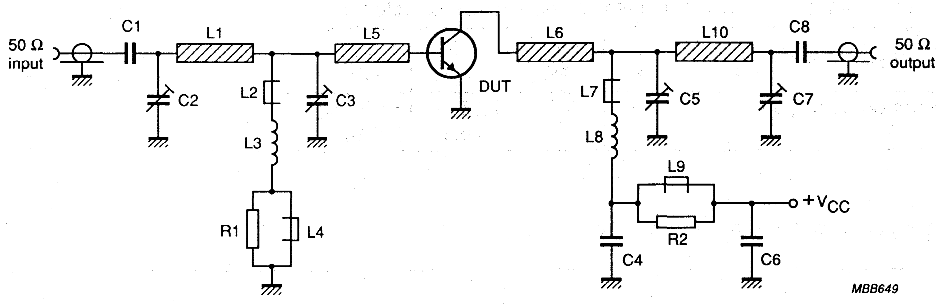


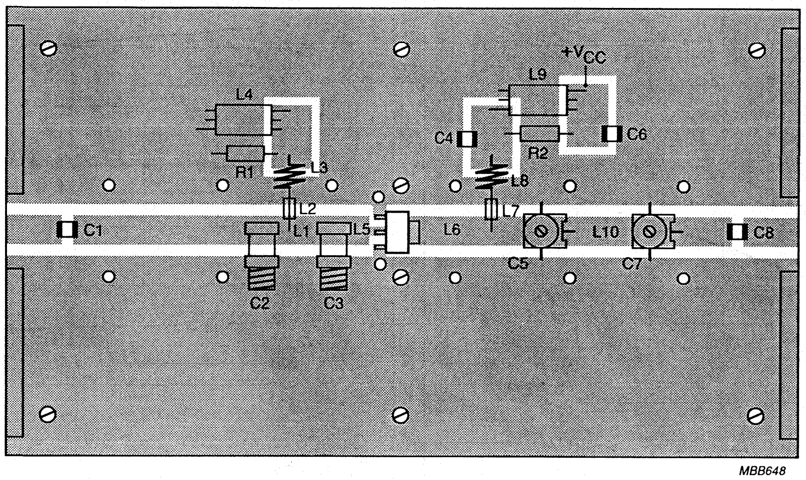
Fig.7 Class-B test circuit at f = 900 MHz.

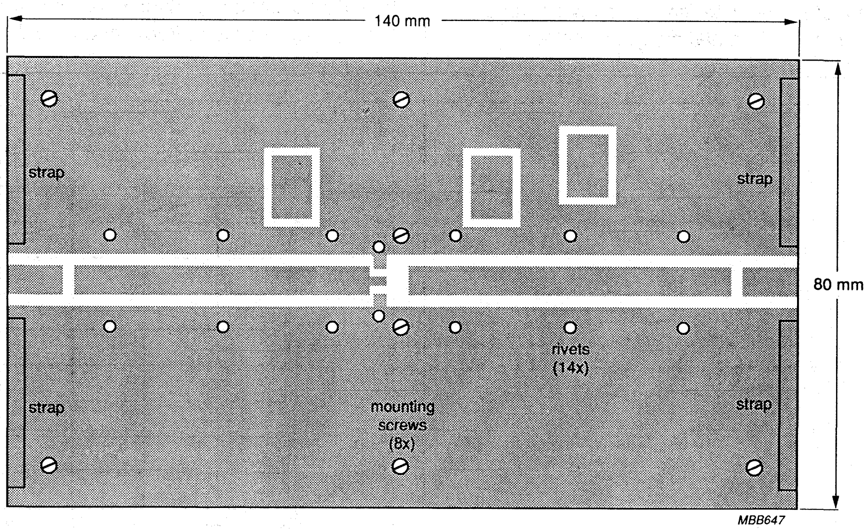
List of components (see test circuit)

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

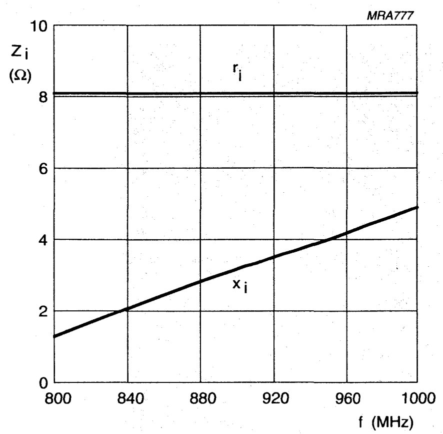
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.





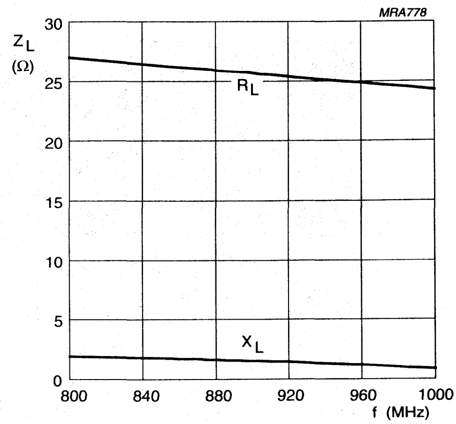
The components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws and copper straps under the emitter leads.

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; $T_s \leq$ 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; $T_s \leq$ 60 °C.

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

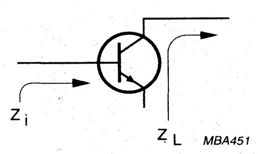
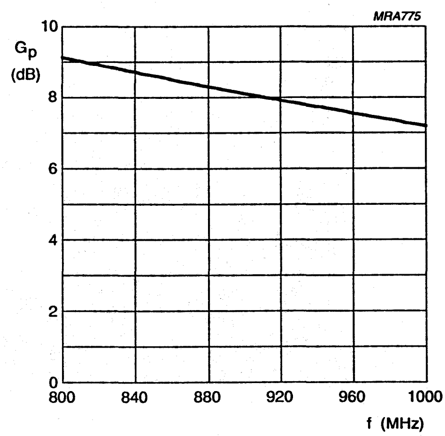


Fig.11 Definition of transistor impedance.



Class-B operation; V_{CE} = 7.5 V; P_L = 0.8 W; $T_s \leq$ 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.

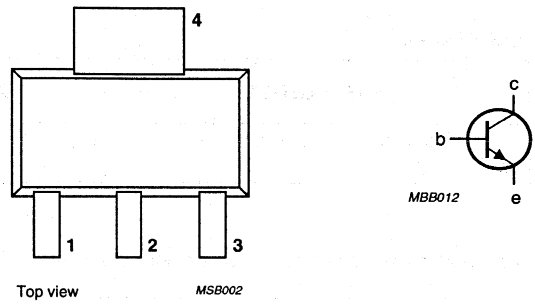


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

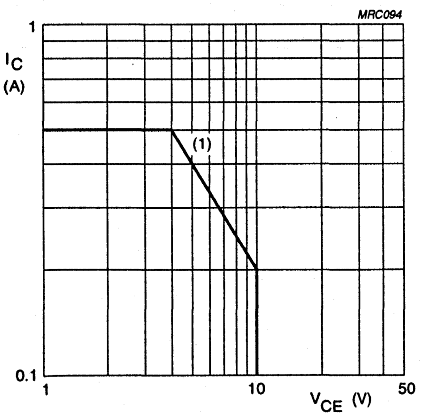
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	9.5	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	500	mA
P_{tot}	total power dissipation	T_s = 110 °C (note 1)	–	2	W
T_{stg}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

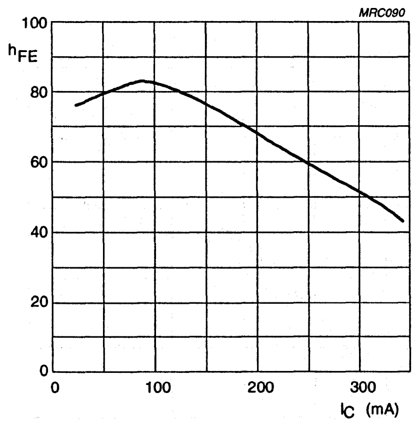
CHARACTERISTICS

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

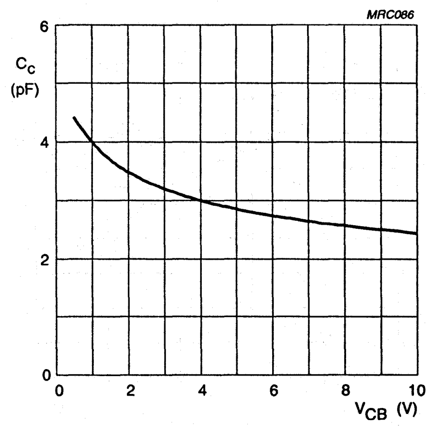
Note

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



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

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).

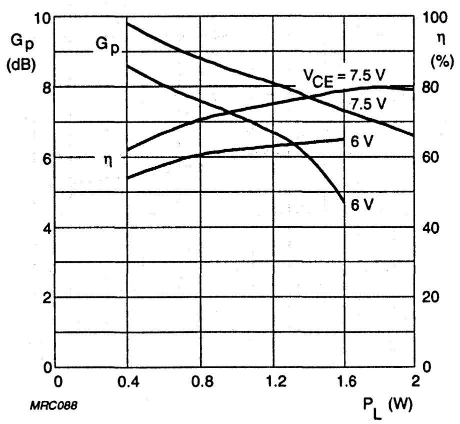
MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CW class-B, narrow band	900	7.5	1.2	≥ 6 typ. 8	≥ 60 typ. 70
	900	6	1.2	typ. 6.5	typ. 70

Note

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

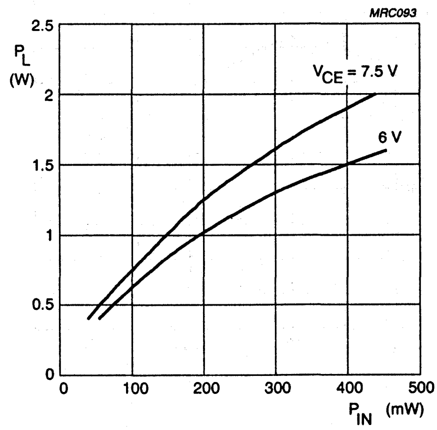
Ruggedness in class-B operation

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.



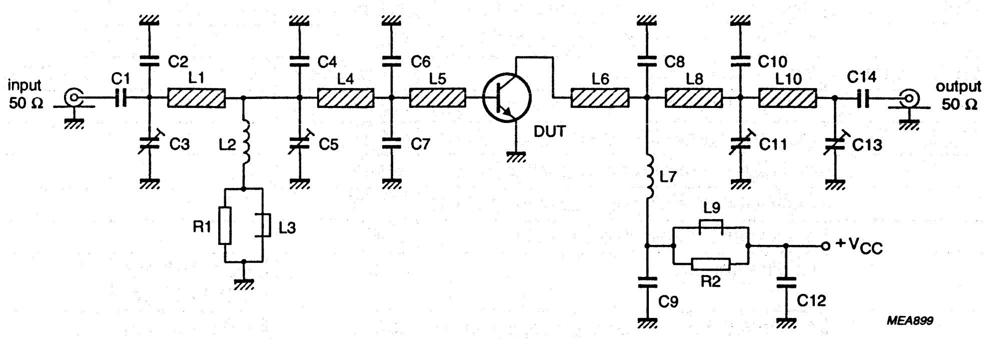
Class-B operation;
f = 900 MHz.

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.

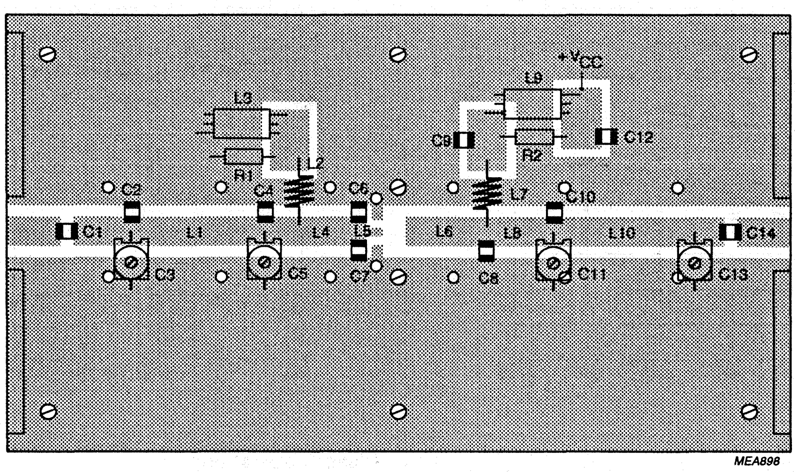
Fig.7 Class-B test circuit.

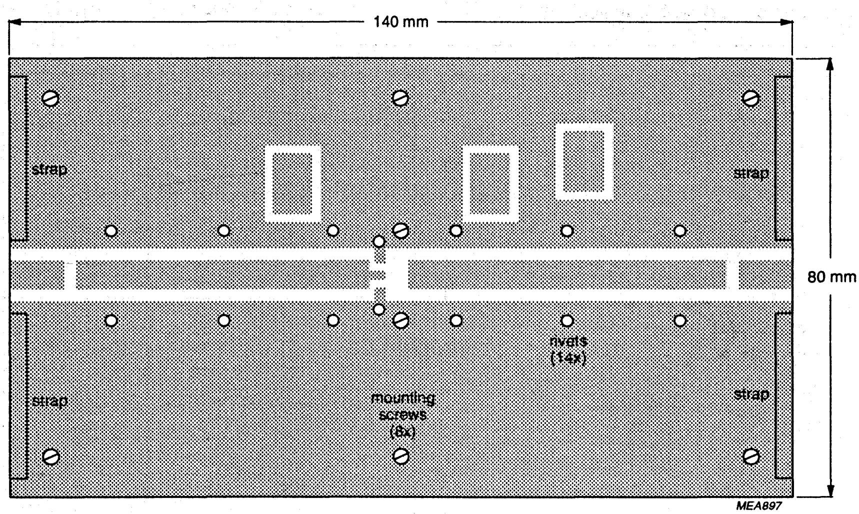
List of components (see Figs 7 and 8)

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

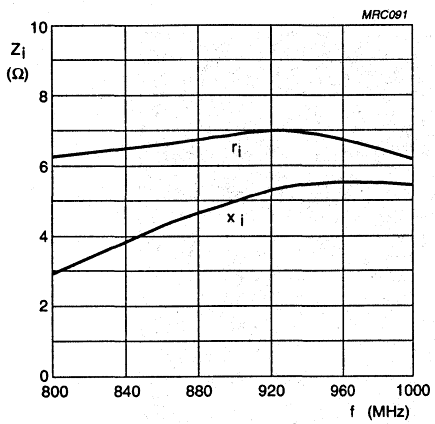
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1⁄16 inch.





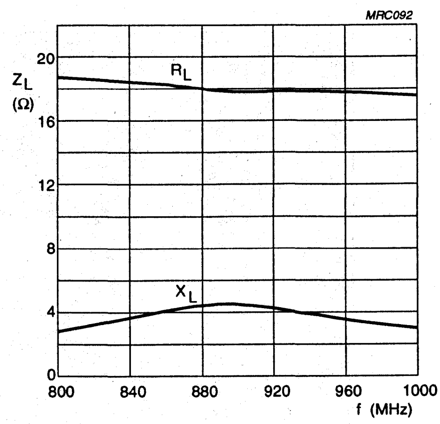
The components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws and copper foil straps under the emitter leads.

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.

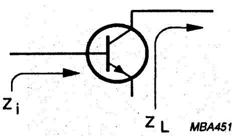
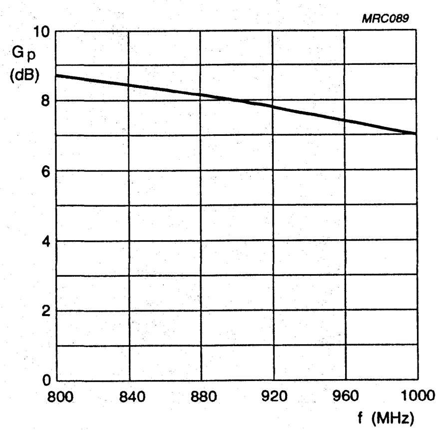


Fig.11 Definition of transistor impedance.



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.

UHF power transistor | BLT82

FEATURES

- High efficiency
- High gain
- Internal pre-matched input.

APPLICATIONS

- Hand-held radio equipment in common emitter class-AB operation for 900 MHz Time Division Multiple Axis (TDMA) communication systems.

PINNING - SOT96-1

PIN	SYMBOL	DESCRIPTION
1, 8	b	base
2, 4, 5, 7	e	emitter
3, 6	c	collector

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a plastic SOT96-1 (SO8) SMD package.

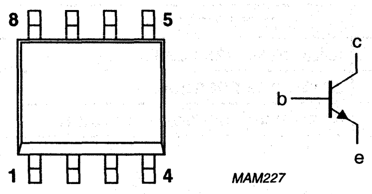


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see Fig.5).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB	900	6	3.5	≥8 typ. 10	≥50 typ. 65
			2.8	≥9	≥57

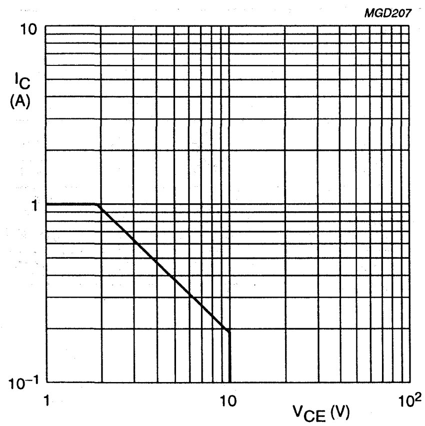
LIMITING VALUES

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	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3.5	V
I_C	collector current (DC)		–	1	A
P_{tot}	total power dissipation	T_s = 115 °C; note 1	–	1.9	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	175	°C

Note

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



T_s = 115 °C.

Fig.2 DC SOAR.

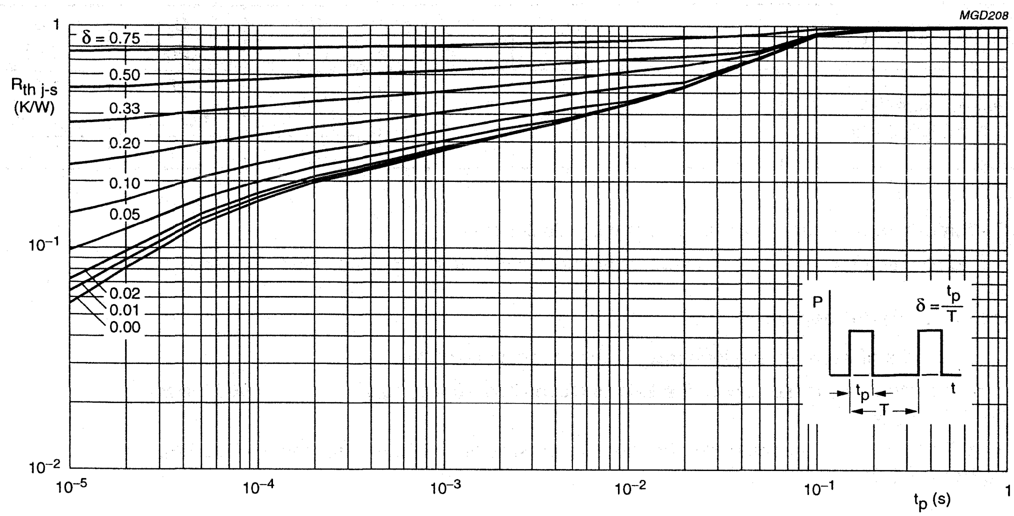


Fig.3 Normalized thermal resistance as a function of pulse time.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	P_{tot} = 1.9 W; T_s = 115 °C; note 1	32	K/W

Note

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

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 = 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	3.5	–	–	V
I_{CES}	collector leakage current	V_{CE} = 6 V; V_{BE} = 0	–	–	0.1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 100 mA	30	–	150	
C_c	collector capacitance	V_{CB} = 6 V; I_E = i_e = 0; f = 1 MHz	–	17	–	pF
C_{re}	feedback capacitance	V_{CE} = 6 V; I_C = 0; f = 1 MHz	–	10	–	pF

APPLICATION INFORMATION

RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see notes 1, 2 and Fig.5).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
Pulsed, class-AB; $\delta = 1:8$; $t_p \leq 5$ ms	900	6	2	3.5	≥8 typ. 10	≥50 typ. 65
				2.8	≥9	≥57

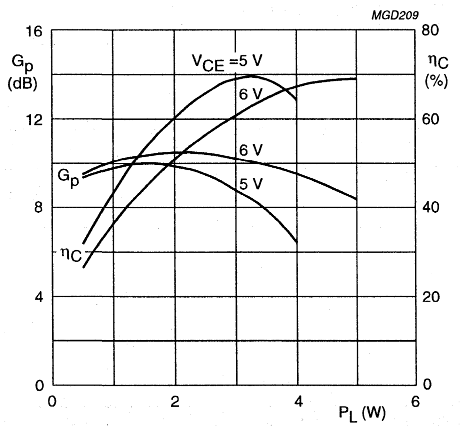
Notes

1. T_s is the temperature at the soldering point of the collector pin.
2. See also application report:. *"G.S.M. Power Amplifier for 900 MHz at 6 V (no.: RNR-T45-95-T-246)"*

Ruggedness in class-AB operation

The BLT82 is capable of withstanding load mismatches corresponding to:

- VSWR = 6 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 900 MHz; $V_{CE} = 8.3$ V; $P_L = 4$ W.
- VSWR = 10 : 1 through all phases under the following conditions: $\delta = 1:8$; $t_p \leq 5$ ms; f = 900 MHz; $V_{CE} = 8.6$ V; $P_L = 2.8$ W.



Pulsed, class-AB; f = 900 MHz; $I_{CQ} = 2$ mA; tuned at $P_L = 3.5$ W; $T_s \leq 60$ °C.

Fig.4 Power gain and collector efficiency as functions of load power; typical values.

Test circuit information

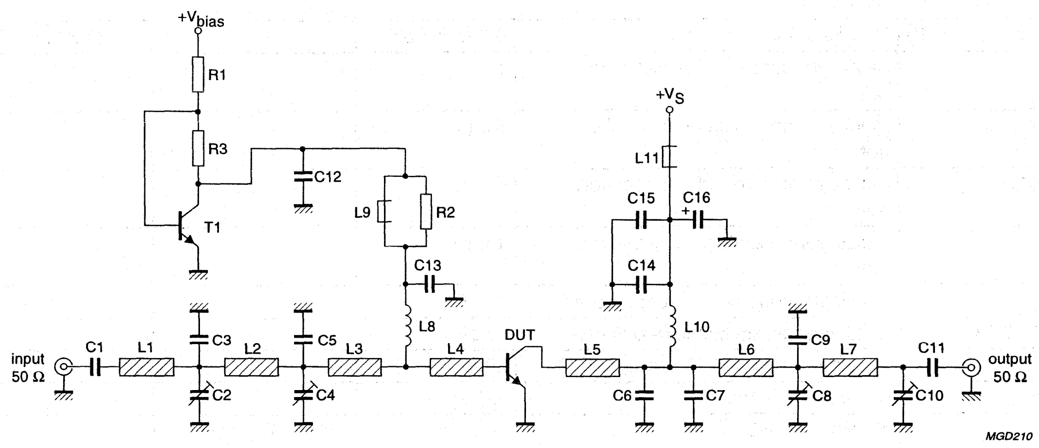


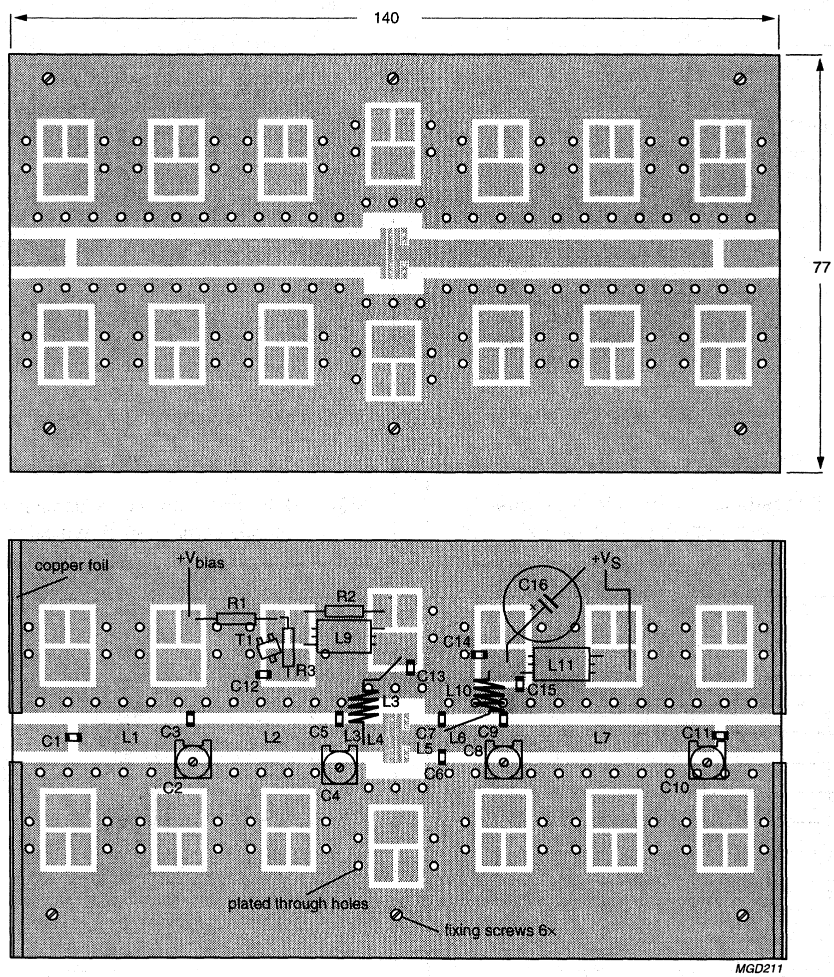
Fig.5 Common emitter test circuit for class-AB operation at 900 MHz.

List of components used in test circuit (see Figs 5 and 6)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C11	multilayer ceramic chip capacitor; note 1	62 pF		
C2, C4, C8, C10	film dielectric trimmer	0.8 to 3.5 pF		2222 809 05001
C3	multilayer ceramic chip capacitor; note 1	1 pF		
C5	multilayer ceramic chip capacitor; note 1	8.2 pF		
C6, C7	multilayer ceramic chip capacitor; note 1	6.2 pF		
C9	multilayer ceramic chip capacitor; note 1	1.2 pF		
C12	multilayer ceramic chip cap.; note 2	10 nF		
C13, C14	multilayer ceramic chip cap.; note 1	18 pF		
C15	multilayer ceramic chip cap.; note 2	39 nF		
C16	electrolytic capacitor	2200 µF		
L1	stripline; note 3	50 Ω	length 20.6 mm width 5 mm	
L2	stripline; note 3	50 Ω	length 27.4 mm width 5 mm	
L3, L4	stripline; note 3	50 Ω	length 4 mm width 5 mm	
L5	stripline; note 3	50 Ω	length 5.8 mm width 5 mm	
L6	stripline; note 3	50 Ω	length 12.4 mm width 5 mm	
L7	stripline; note 3	50 Ω	length 36 mm width 5 mm	
L8	8 turns enamelled 1 mm copper wire	80 nH	internal dia. 3 mm leads 2 × 5 mm	
L9, L11	grade 3B Ferroxcube wideband HF choke			4132 020 36640
L10	4 turns enamelled 1 mm copper wire	35 nH	internal dia. 3 mm leads 2 × 5 mm	
R1	metal film resistor	0.6 W, 38.3 Ω		2322 156 13839
R2	metal film resistor	0.6 W, 10 Ω		2322 156 11009
R3	metal film resistor	0.6 W, 1 Ω		2322 156 11008
T1	NPN transistor	BC817		

Notes

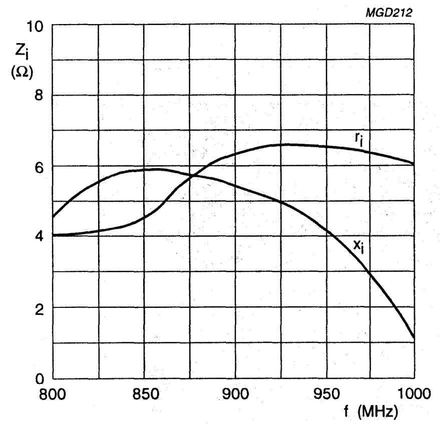
1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 200B or capacitor of same quality.
3. The striplines are on a double copper-clad printed-circuit board, with DUROID dielectric ($\varepsilon_r = 2.2$); thickness $\frac{1}{32}$"; thickness of the copper sheet 2 × 35 µm.



Dimensions in mm.

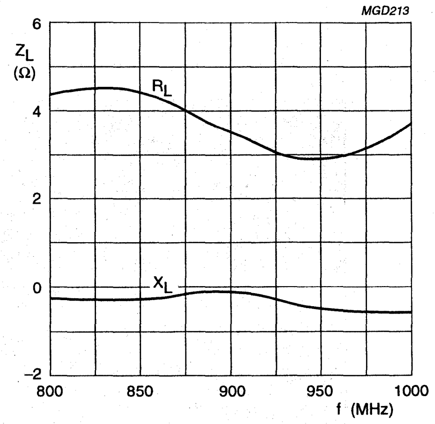
The components are situated on one side of the copper-clad PCB, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws, through metallization and copper straps around the board.

Fig.6 Printed-circuit board and component lay-out for 900 MHz class-AB test circuit in Fig.5.



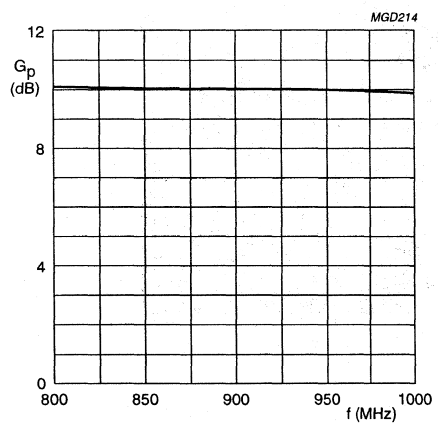
V_{CE} = 6 V; I_{CQ} = 2 mA; P_L = 3.5 W; T_{amb} = 25 °C.

Fig.7 Input impedance as a function of frequency (series components); typical values.



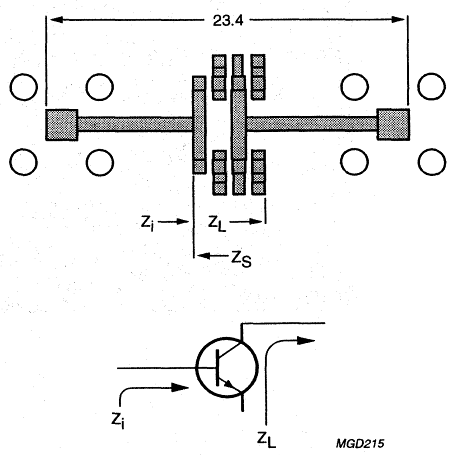
V_{CE} = 6 V; I_{CQ} = 2 mA; P_L = 3.5 W; T_{amb} = 25 °C.

Fig.8 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 6 V; I_{CQ} = 2 mA; P_L = 3.5 W; T_{amb} = 25 °C.

Fig.9 Power gain as a function of frequency; typical values.



Dimensions in mm.

Fig.10 SO8, RF test print and definition of transistor impedance.

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

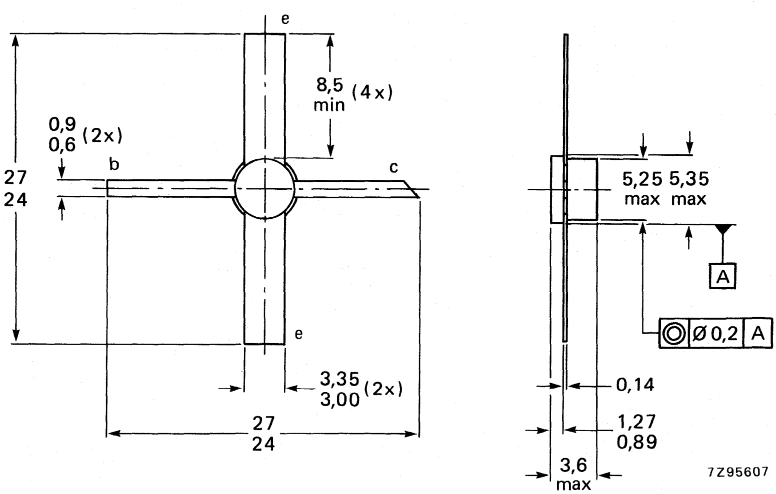
R.F. performance at T_a = 25 °C in a common-emitter class-B circuit.

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	$C_{c\text{-}mb}$	typ.	0,5 pF

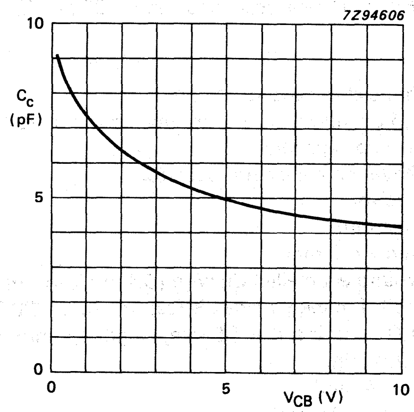


Fig. 2 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

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

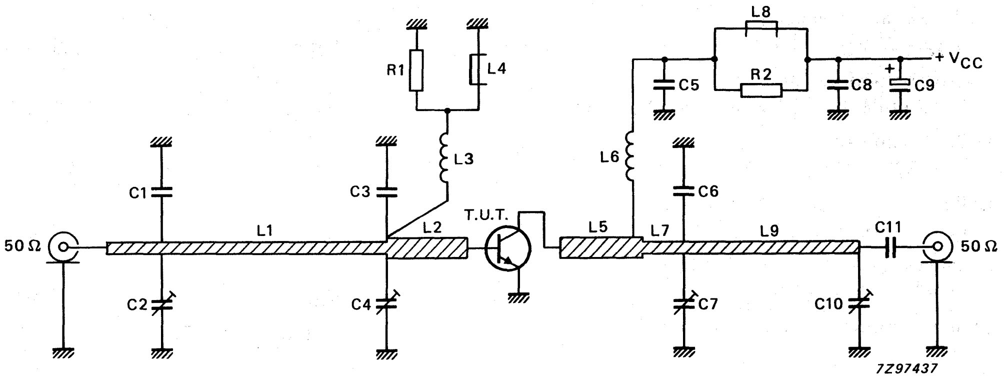


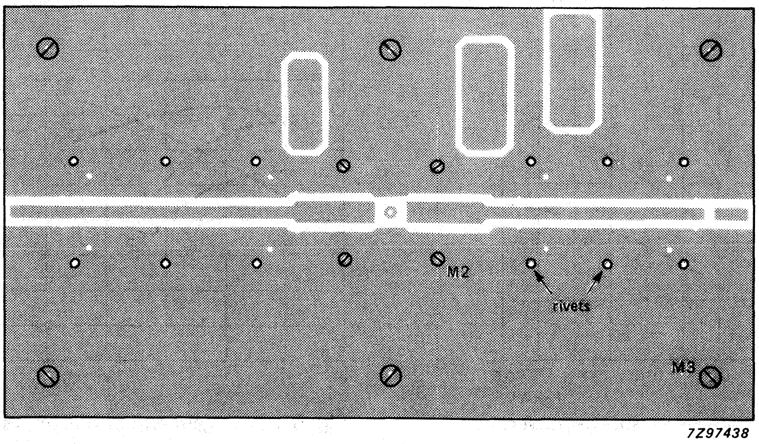
Fig. 3 Class-B test circuit at f = 900 MHz.

List of components:

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

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

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



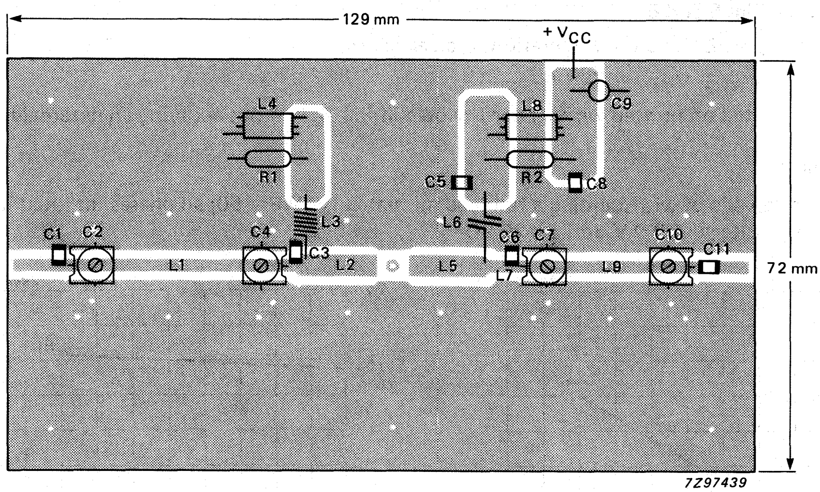


Fig. 4 Printed wiring board and component lay-out for 900 MHz class-B test circuit.

Note

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

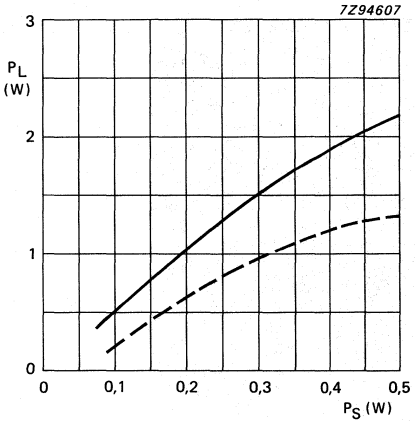


Fig. 5 Load power vs. source power.

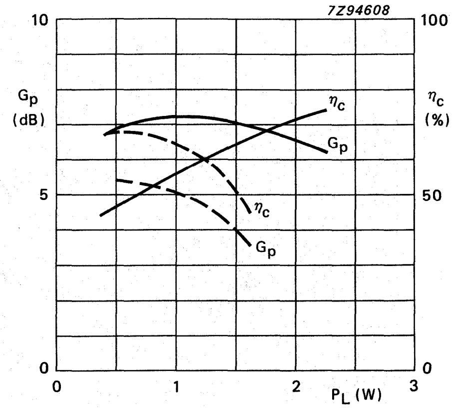


Fig. 6 Power gain and efficiency vs. load power.

Conditions for Figs 5 and 6:

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

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

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

RUGGEDNESS

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

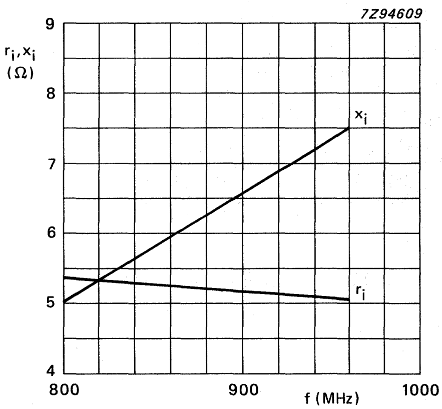


Fig. 7 Input impedance (series components).

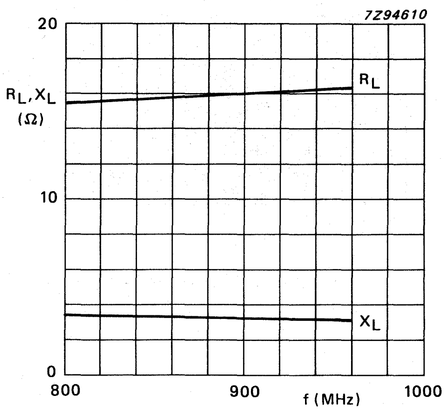


Fig. 8 Load impedance (series components).

Conditions for Figs 7, 8 and 9:

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

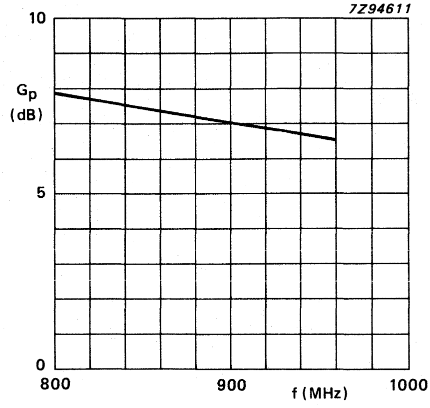


Fig. 9 Power gain vs. frequency.

UHF POWER TRANSISTOR

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

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

Features

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

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

QUICK REFERENCE DATA

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

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

MECHANICAL DATA

Dimensions in mm

Pinning:

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

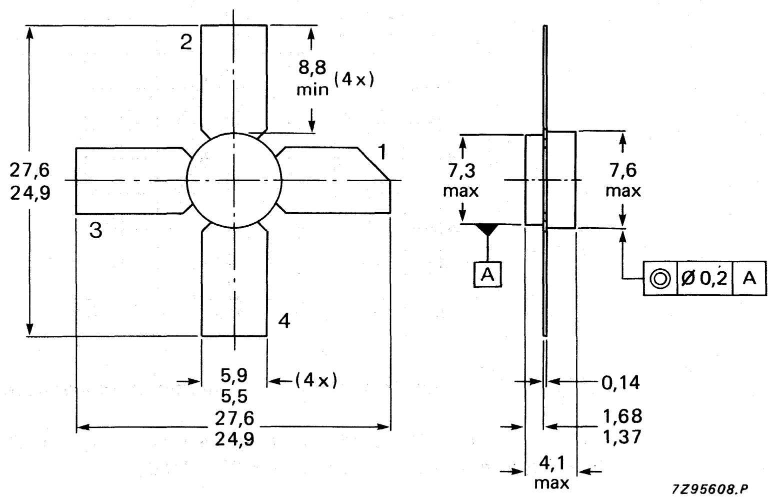


Fig.1 SOT122D.

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

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	20 V
Collector-emitter voltage (open base)	V_{CEO}	max.	10 V
Emitter-base voltage (open collector)	V_{EBO}	max.	3.0 V
Collector current			
DC or average	I_C; $I_{C(AV)}$	max.	1.2 A
(peak value); f > 800 MHz	I_{CM}	max.	3.6 A
Total power dissipation			
at T_{amb} < 120 °C; f > 800 MHz	P_{tot}	max.	10 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

Dissipation = 10 W; T_{mb} = 25 °C

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

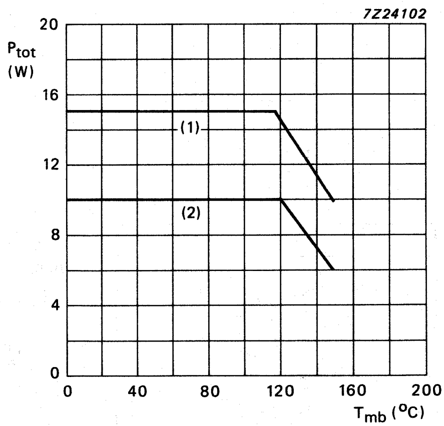


Fig. 2 Total power dissipation as a function of temperature.

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

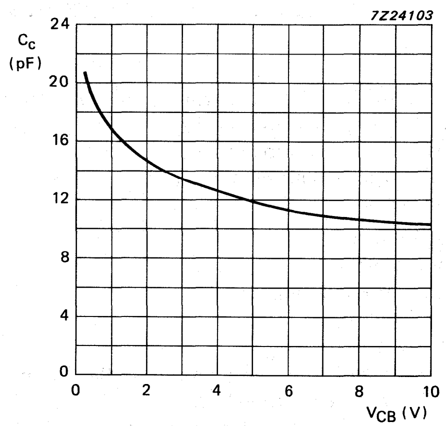


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; I_E = i_e = 0; typical values.

APPLICATION INFORMATION

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

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

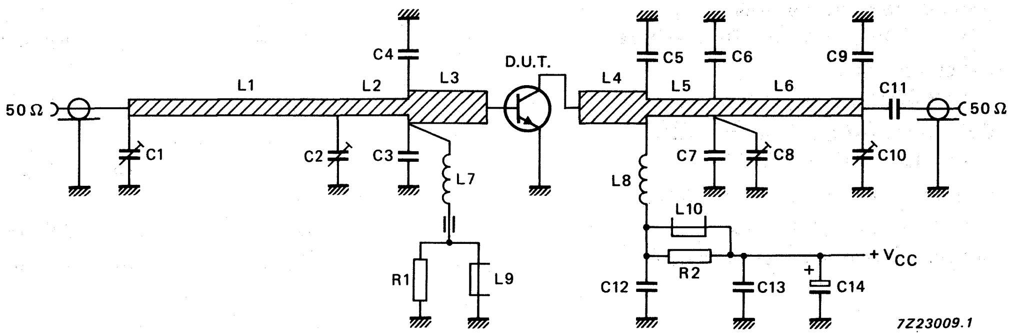


Fig.4 Class-B test circuit at f = 900 MHz.

List of components:

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

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

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

The striplines on a double Cu-clad printed circuit board with PTFE fibreglass dielectric (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.

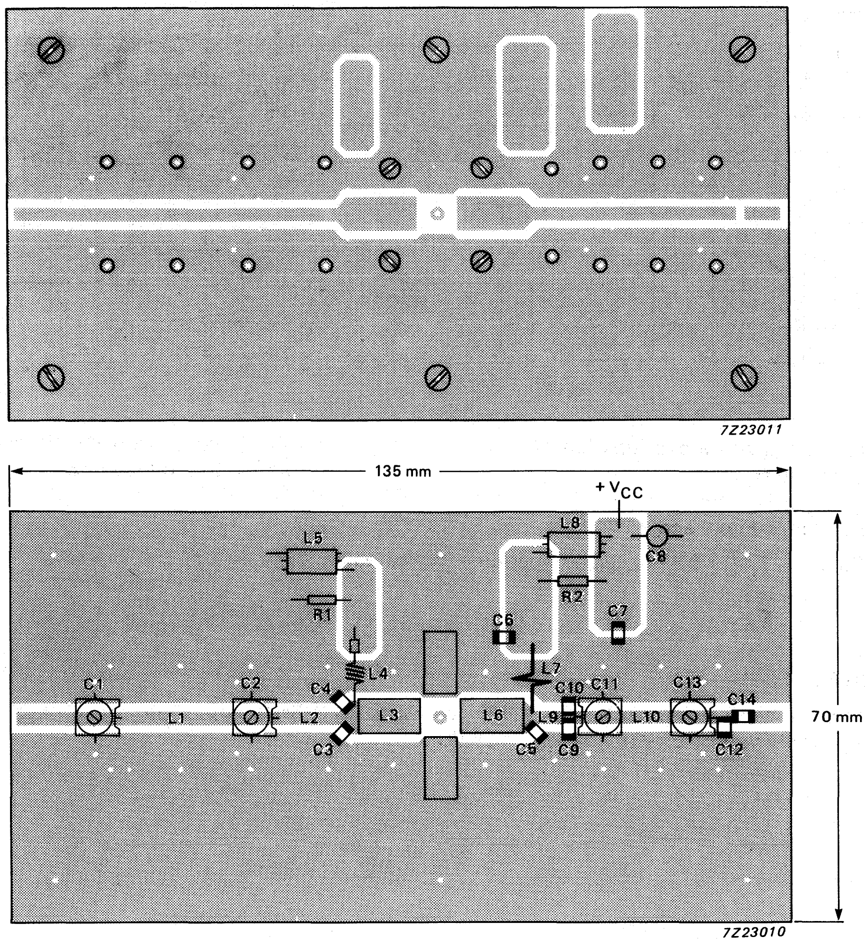


Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

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.

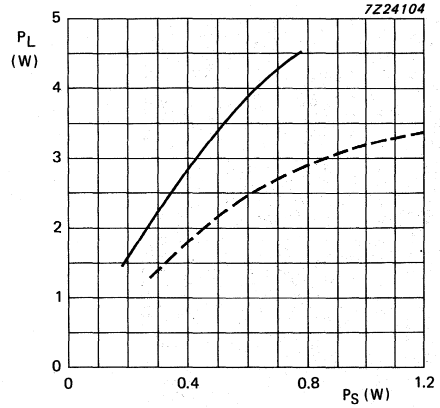


Fig. 6 Load power as a function of source power.

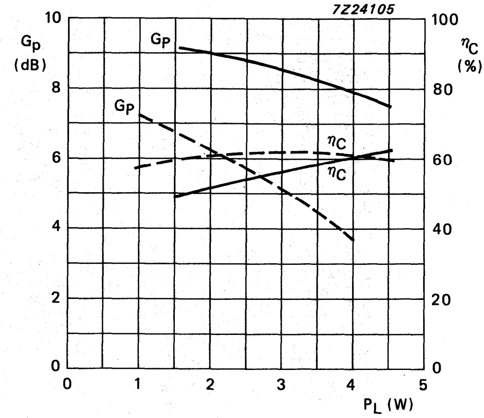


Fig. 7 Power gain and efficiency as a function of load power.

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.

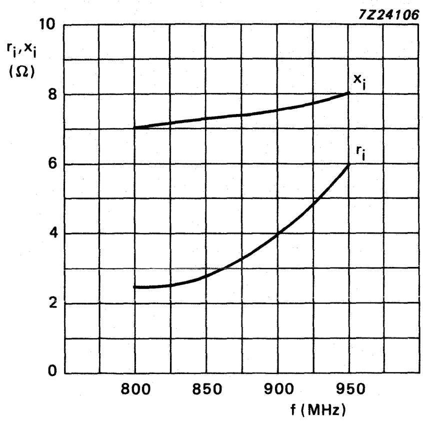


Fig. 8 Input impedance as a function of frequency (series components).

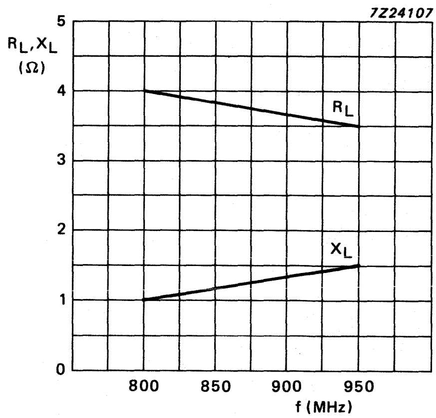


Fig. 9 Load impedance as a function of frequency (series components).

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.

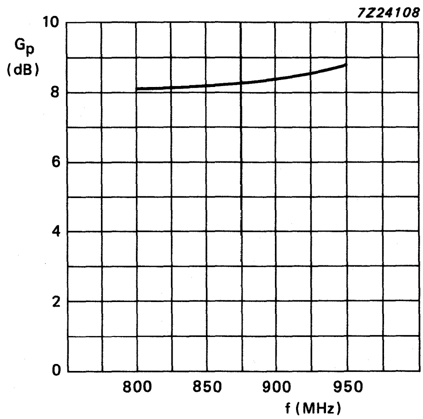


Fig. 10 Power gain as a function of frequency.

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

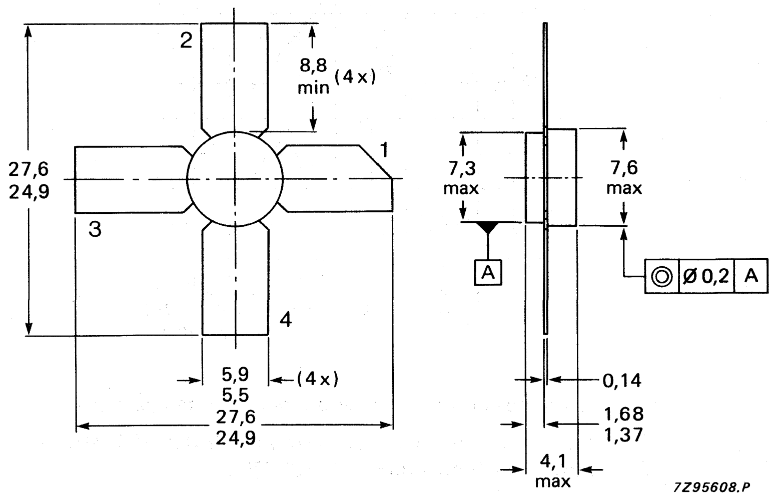


Fig.1 SOT122D.

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

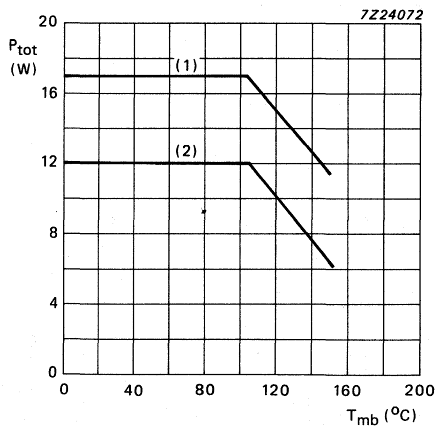


Fig. 2 Total power dissipation as a function of temperature.

(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

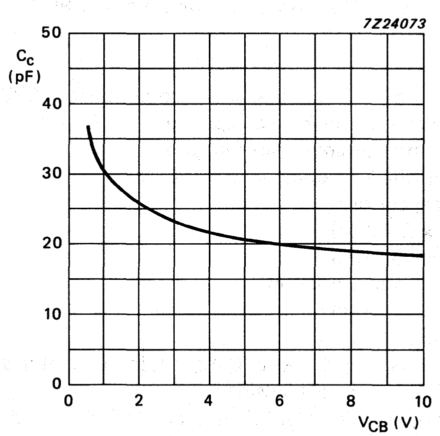


Fig. 3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $I_E = i_e$ = 0; typical values.

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

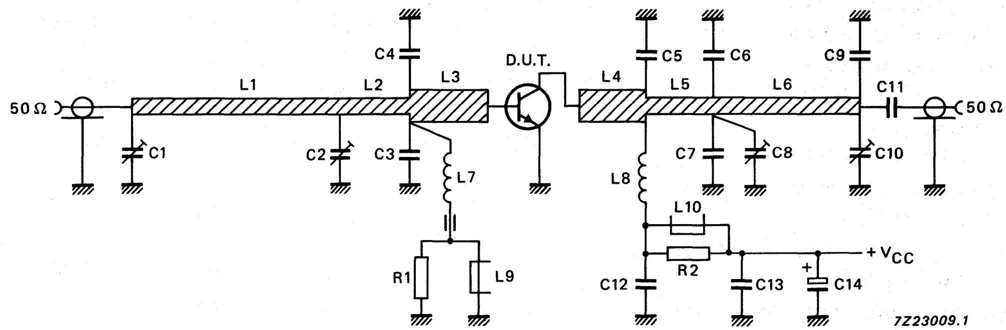


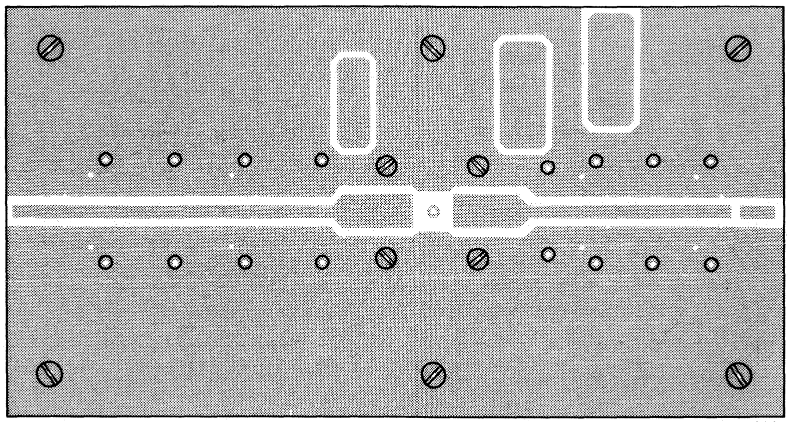
Fig. 4 Class-B test circuit at f = 900 MHz.

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.



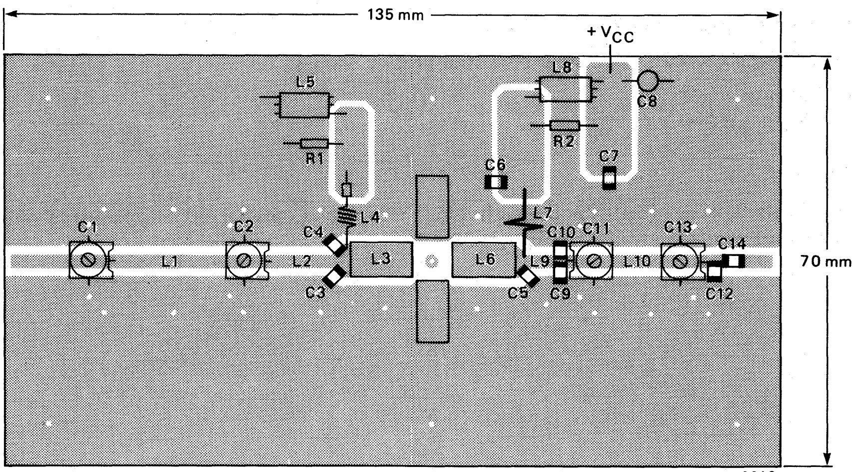


Fig. 5 Printed circuit board and component layout for 900 MHz class-B test circuit.

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.

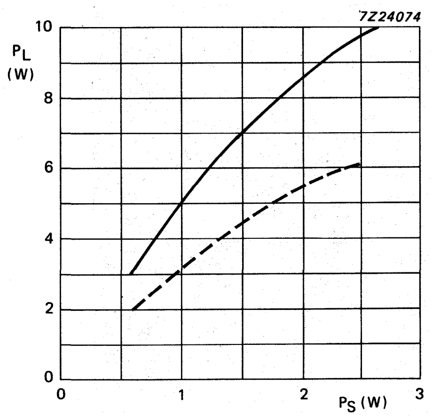


Fig. 6 Load power as a function of source power.

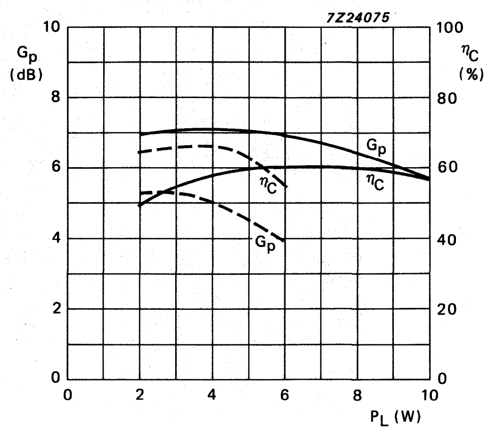


Fig. 7 Power gain and efficiency as a function of load power.

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.

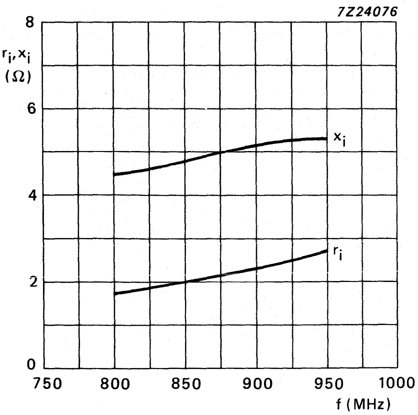


Fig. 8 Input impedance as a function of frequency (series components).

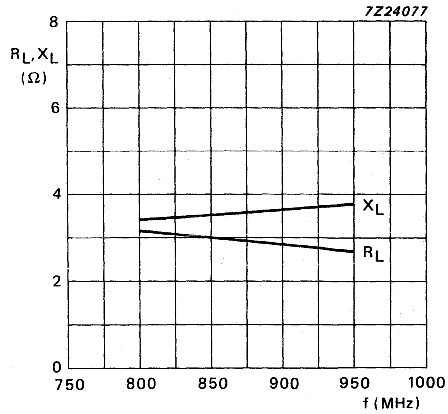


Fig. 9 Load impedance as a function of frequency (series components).

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.

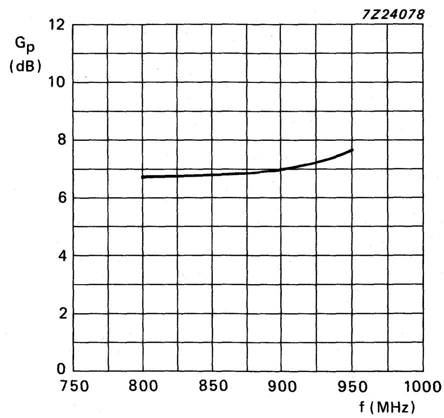


Fig. 10 Power gain as a function of frequency.

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.

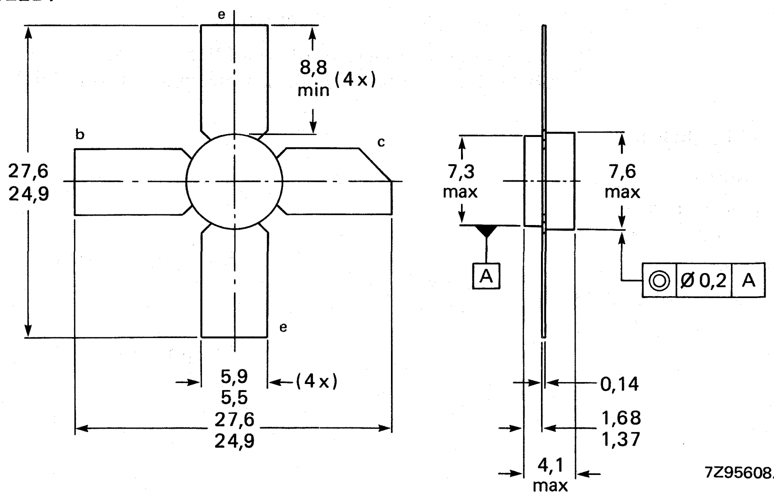
mode of operation	T °C	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	T_{mb} = 25	12,5	470	2,5	> 10	> 55
	T_a = 25*	12,5	470	1,5	> 12	> 55

* 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

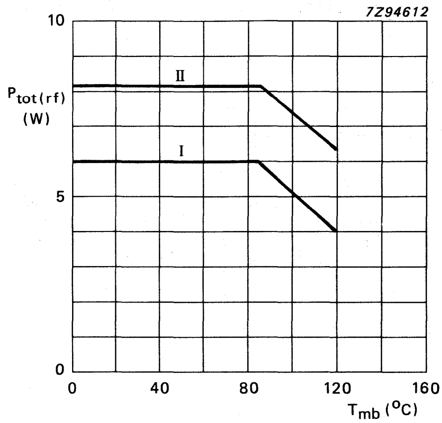


Fig. 2 Power/temperature derating curves.

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

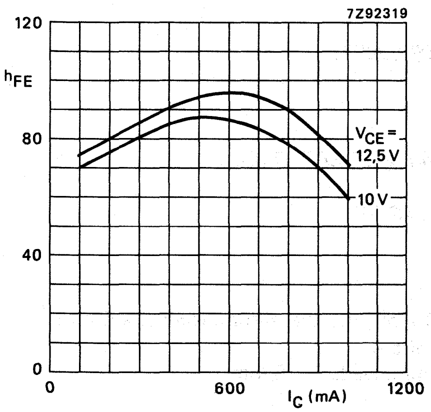


Fig. 3 T_j = 25 °C; typical values.

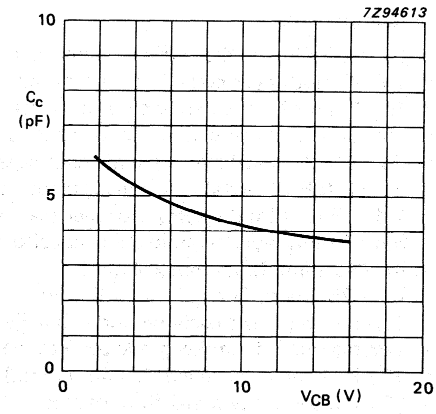


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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 °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_{mb} = 25				typ. 12	typ. 60
	T_a = 25**	12,5	470	1,5	> 12	> 55

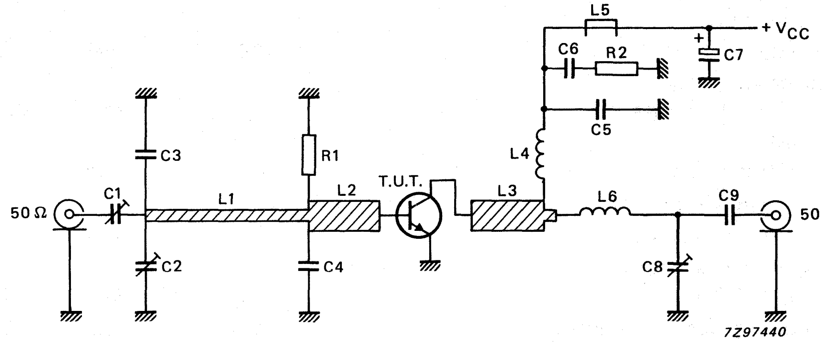


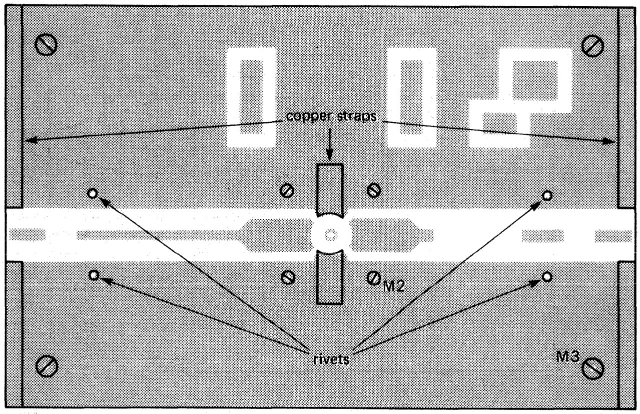
Fig. 5 Class-B test circuit at f = 470 MHz.

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).



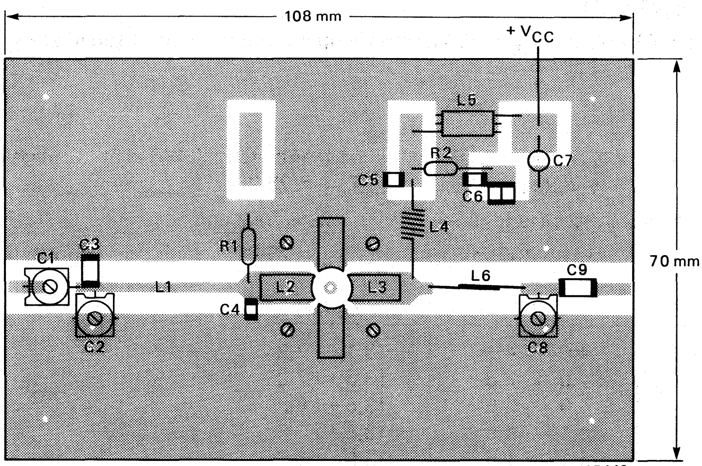


Fig. 6 Printed wiring board and component lay-out for 470 MHz class-B test circuit.

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.

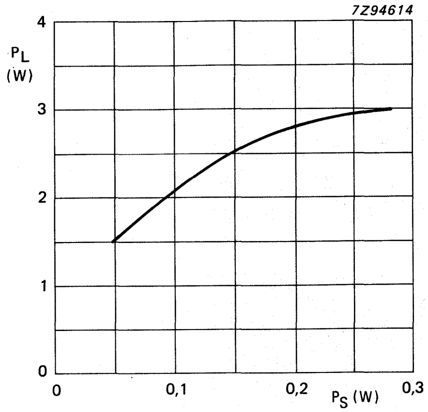


Fig. 7 Load power versus source power.

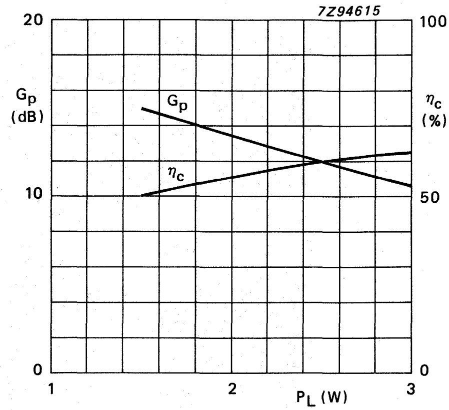


Fig. 8 Power gain and efficiency versus load power.

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

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	°C

MECHANICAL DATA

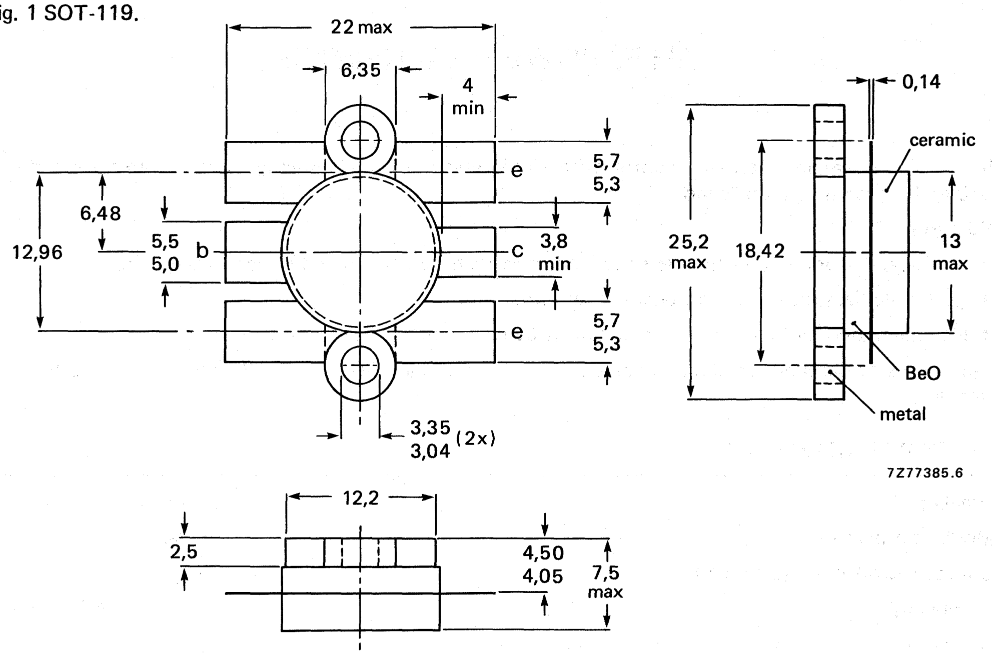
SOT-119 (see Fig. 1).

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119.



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

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

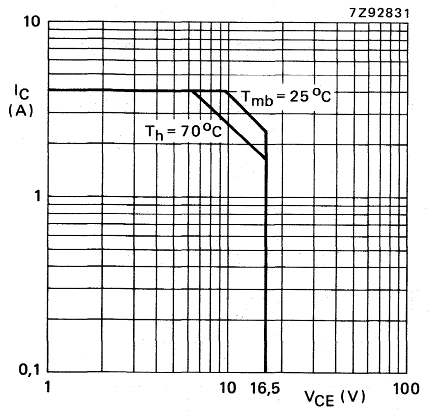


Fig. 2 D.C.SOAR.
$R_{th\ mb\text{-}h}$ = 0,2 K/W

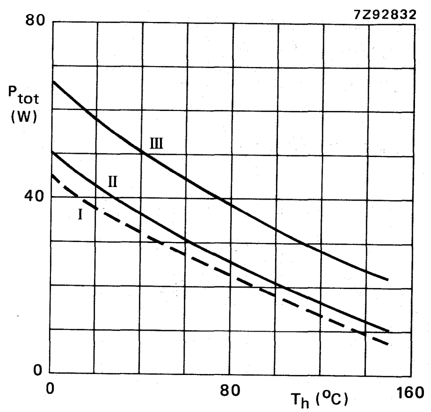


Fig. 3 Power/temperature derating curves
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

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

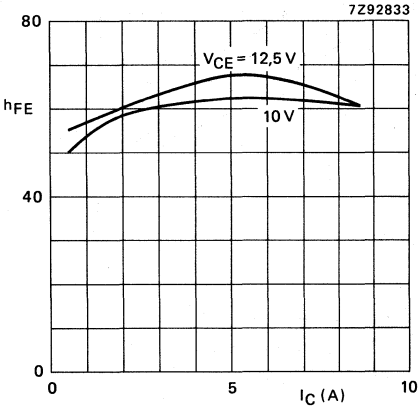


Fig. 4 T_j = 25 °C; typ. values.

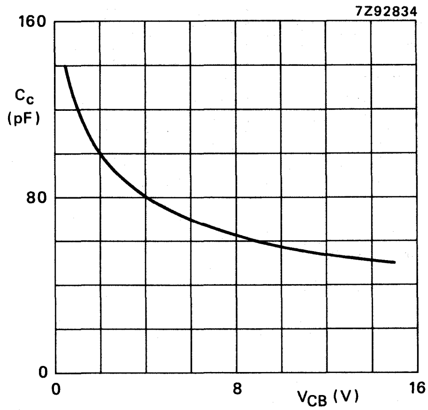


Fig. 5 I_E = i_e = 0; f = 1 MHz; typ. values.

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

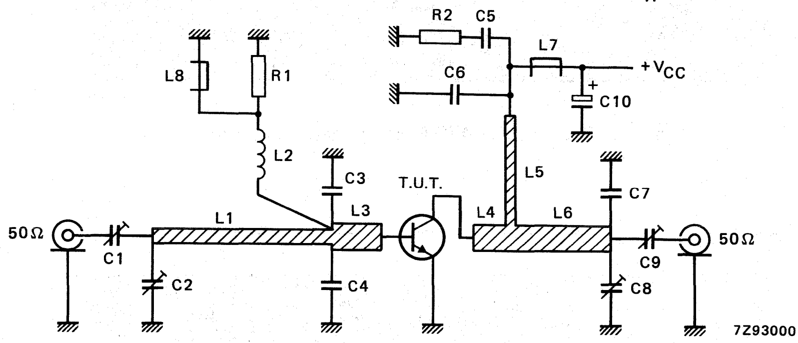


Fig. 6 Class-B test circuit at f = 470 MHz.

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.

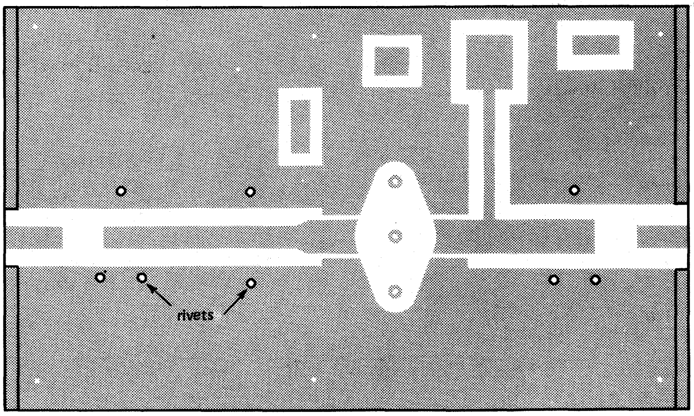


Fig. 7 P.C. board for 470 MHz, class-B test circuit.

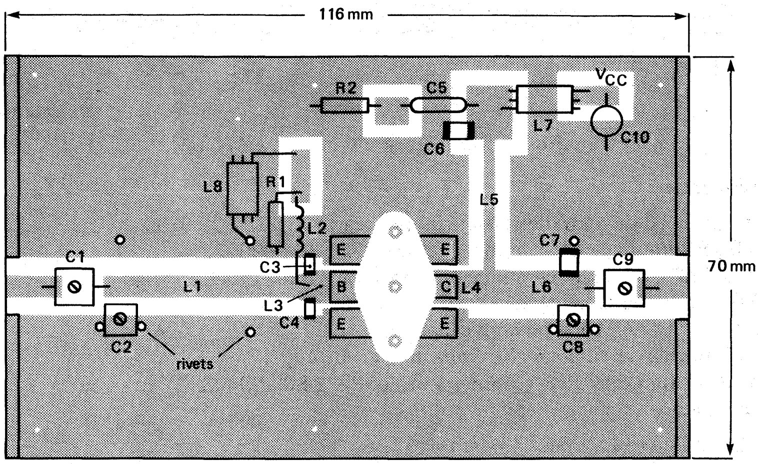


Fig. 8 Component lay-out of 470 MHz, class-B test circuit.

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.

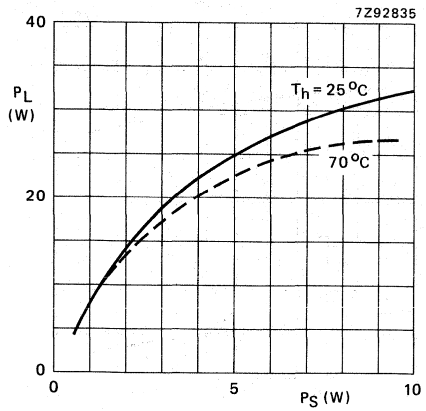


Fig. 9 Load power vs. source power.

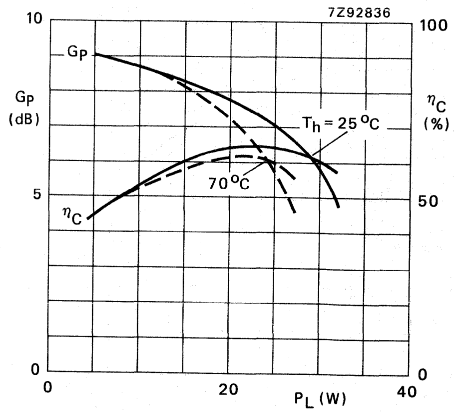


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs. 9 and 10:

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

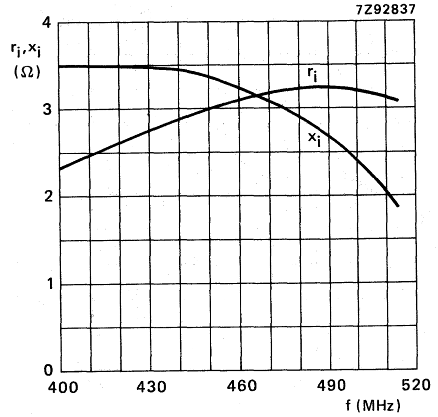


Fig. 11 Input impedance (series components).

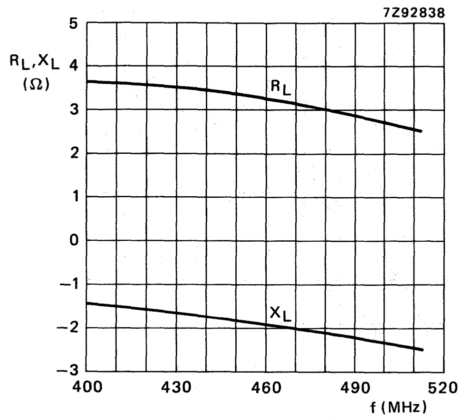


Fig. 12 Load impedance (series components).

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

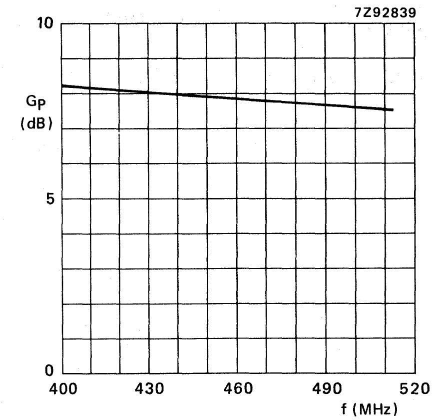


Fig. 13 Power gain versus frequency.

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

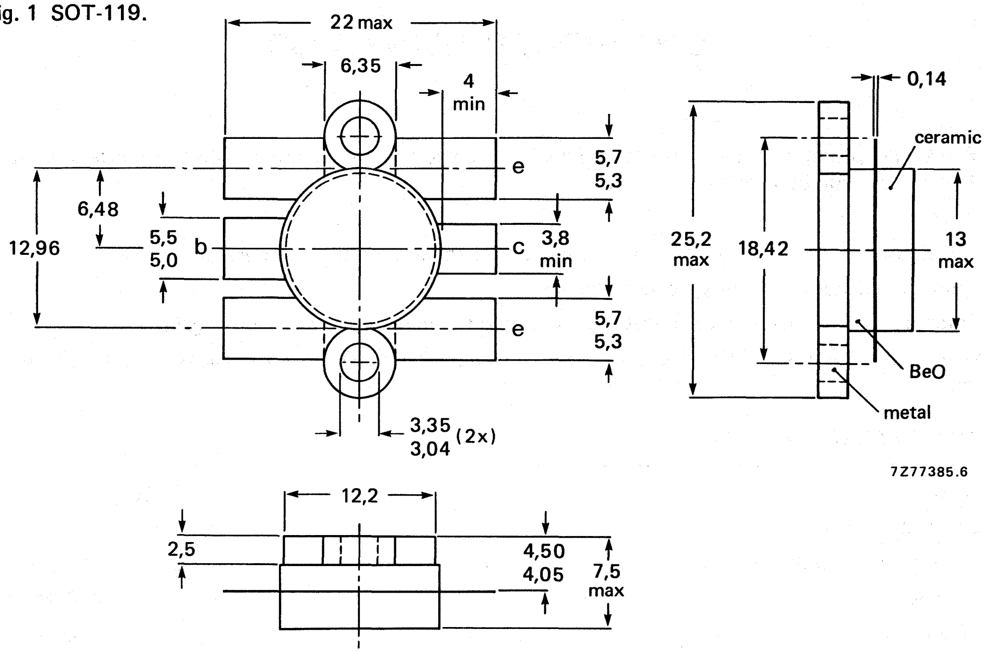
SOT-119 (see Fig. 1).

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

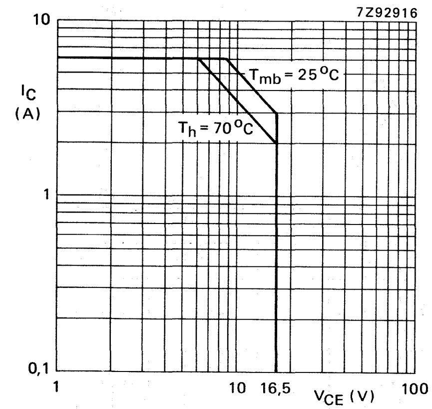


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,2 K/W

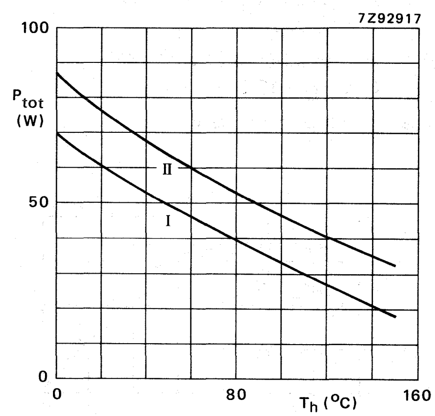


Fig. 3 Power/temperature derating curves
I Continuous operation (f > 1 MHz)
II Short-time operation during mismatch; (f > 1 MHz)

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

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

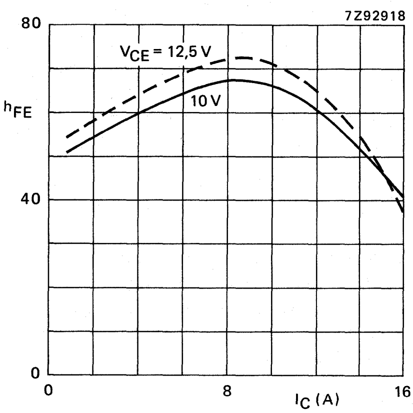


Fig. 4 T_j = 25 °C; typ. values.

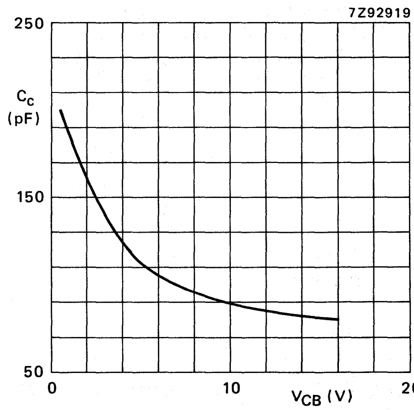


Fig. 5 $I_E = i_e$ = 0; f = 1 MHz; typ. values.

* Device mounted in SOT-119 envelope without inputmatching.

APPLICATION INFORMATION

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

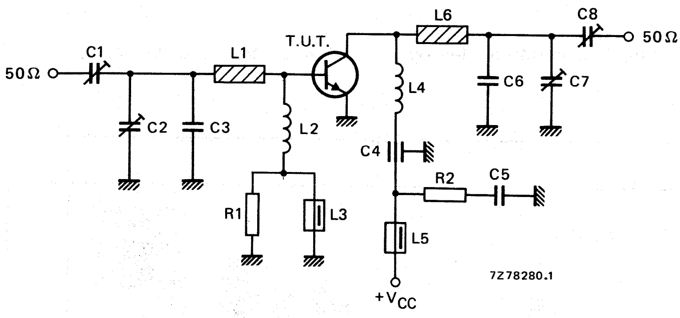


Fig. 6 Class-B test circuit at f = 470 MHz.

List of components:

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

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

R1 = R2 = 10 Ω carbon resistor

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

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

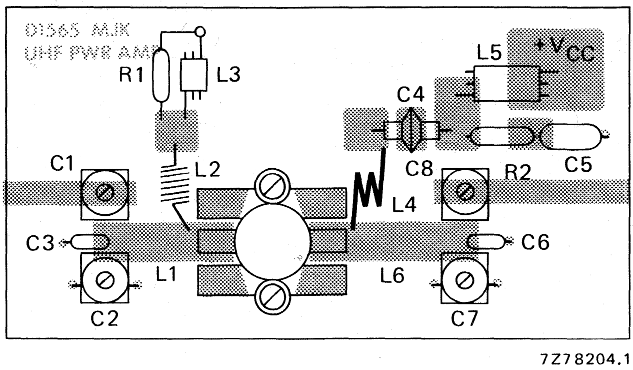


Fig. 7 Component lay-out of 470 MHz, class-B test circuit.

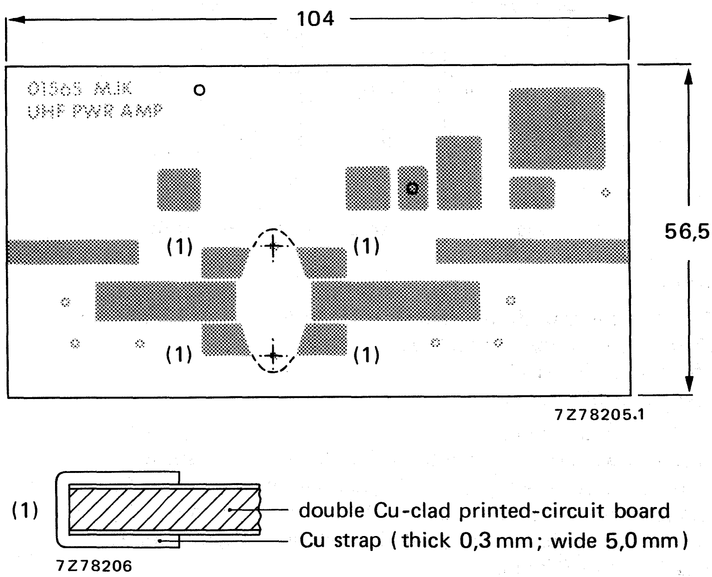


Fig. 8 P.c. board for 470 MHz, class-B test circuit.

Note:

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

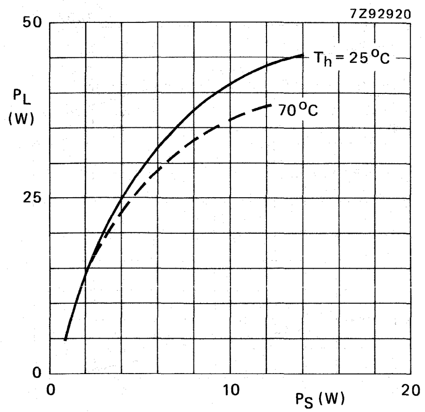


Fig. 9 Load power vs. source power.

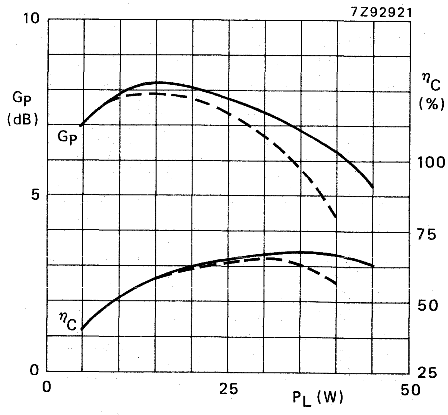


Fig. 10 Power gain and efficiency vs. load power.
——— T_h = 25 °C;
– – – T_h = 70 °C.

Conditions for Figs 9 and 10:

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

RUGGEDNESS

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

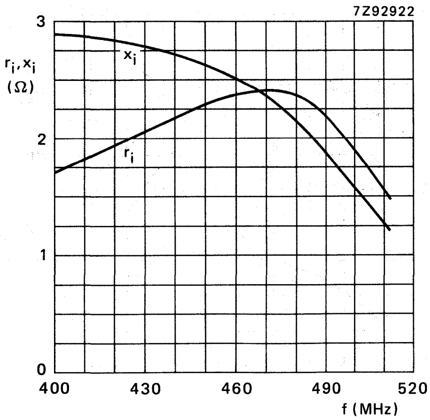


Fig. 11 Input impedance (series components).

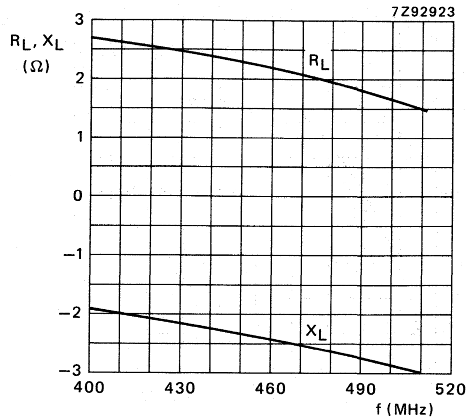


Fig. 12 Load impedance (series components).

Conditions for Figs 11, 12 and 13:

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

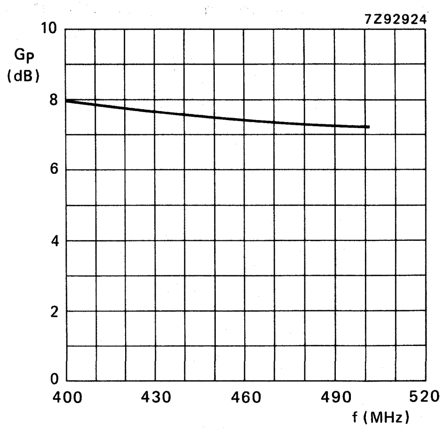


Fig. 13 Power gain versus frequency.

U.H.F. POWER TRANSISTOR

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

Features

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

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

QUICK REFERENCE DATA

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

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

MECHANICAL DATA

Dimensions in mm

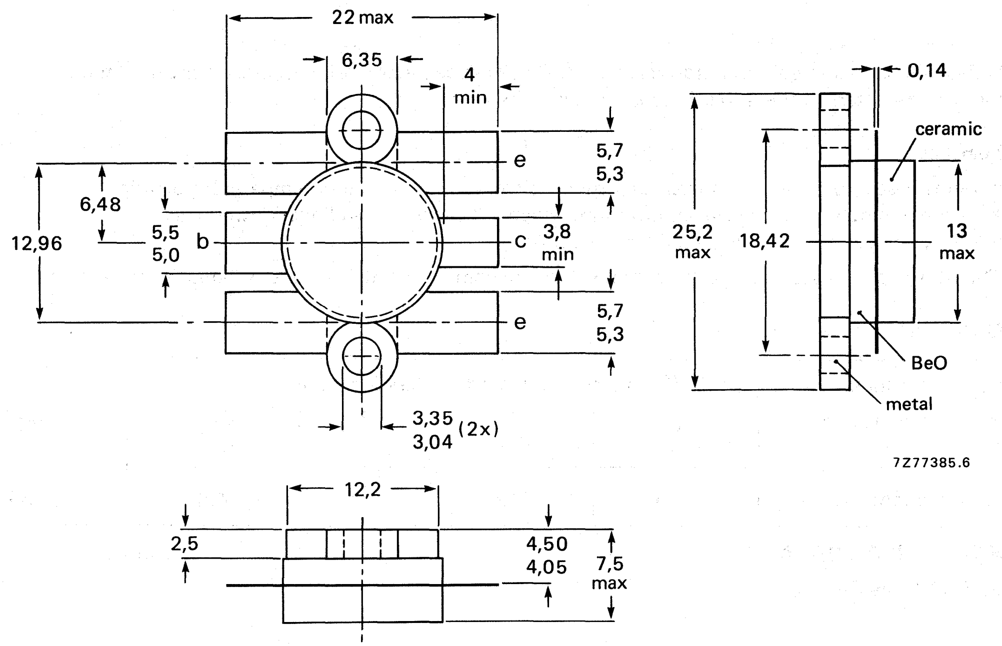
SOT-119 (see Fig. 1).

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

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-119



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

Heatsink compound must be applied and evenly distributed.

RATINGS

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

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

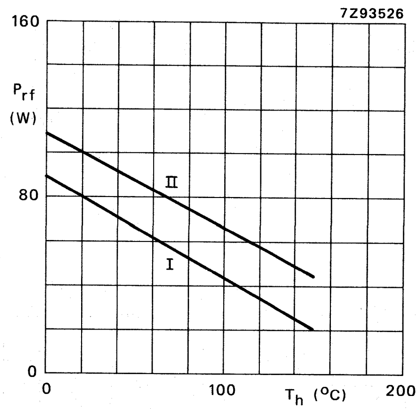


Fig. 2 Power/temperature derating curves.
I Continuous operation (f > 1 MHz).
II Short-time operation during mismatch (f > 1 MHz).

MAXIMUM THERMAL RESISTANCE

Dissipation = 54 W; T_{amb} = 25 °C

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

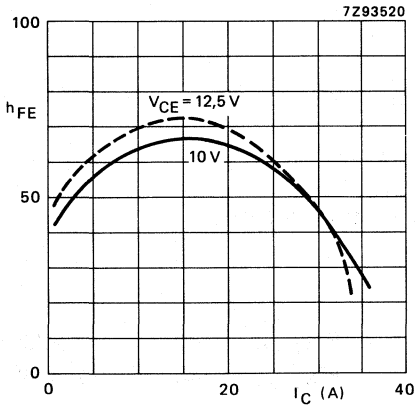


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

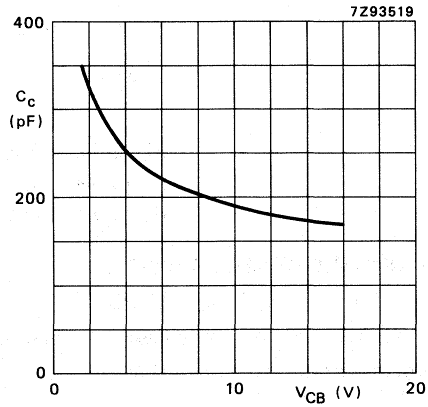


Fig. 4 Output capacitance versus V_{CB}; I_E = i_e = 0; f = 1 MHz.

APPLICATION INFORMATION

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

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

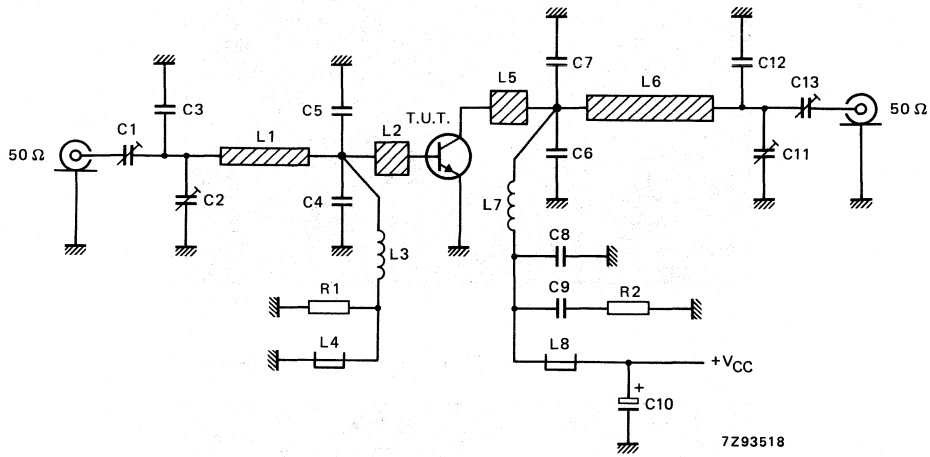


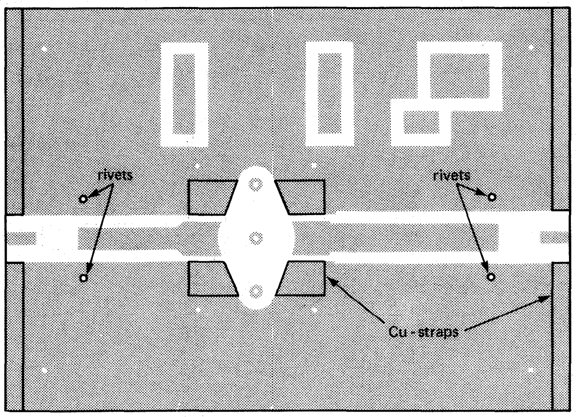
Fig. 5 Class-B test circuit at f = 470 MHz.

List of components:

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

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

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



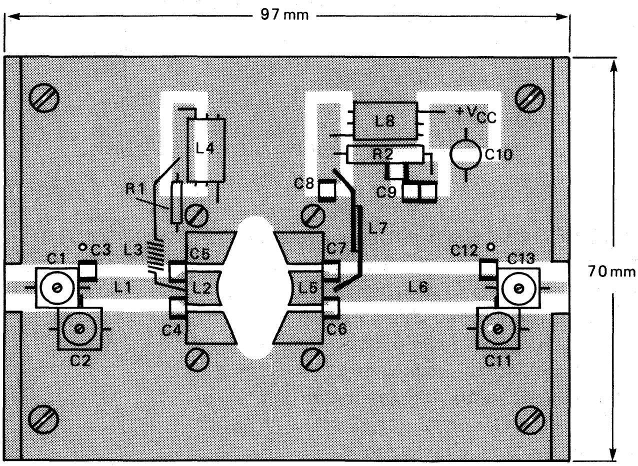


Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

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.

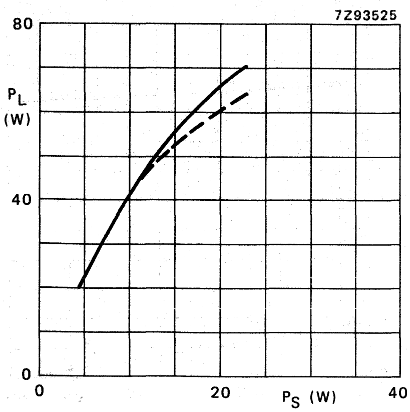


Fig. 7 Load power versus source power.

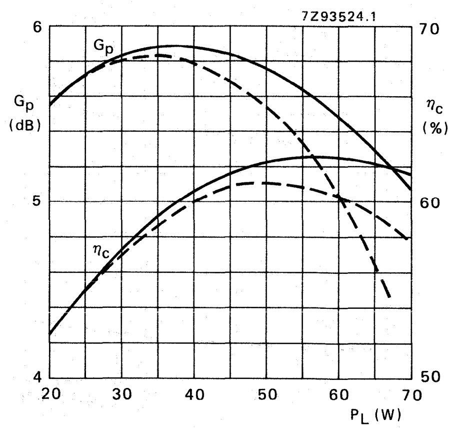


Fig. 8 Power gain and efficiency versus load power.

Conditions for Figs 7 and 8:

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

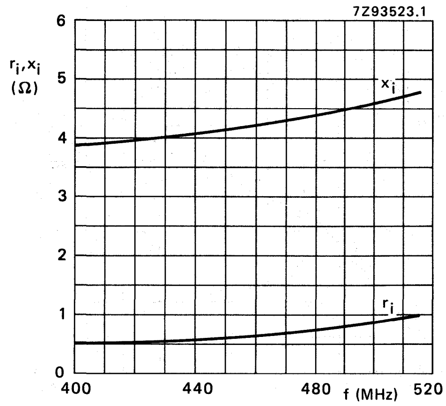


Fig. 9 Input impedance
(series components).

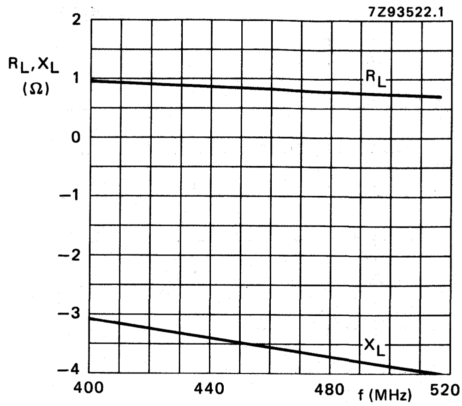


Fig. 10 Load impedance
(series components).

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.

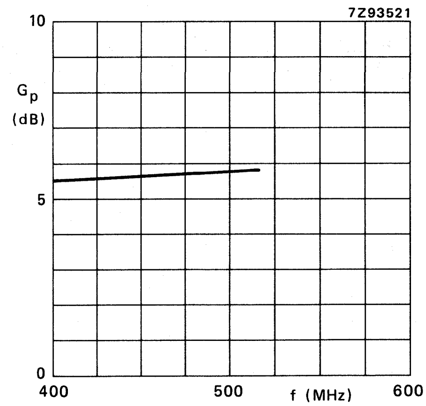


Fig. 11 Power gain versus frequency.

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

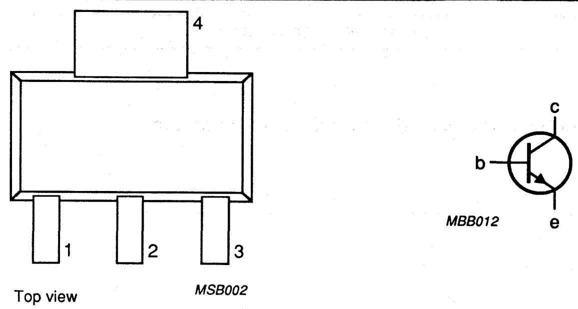


Fig.1 Simplified outline and symbol.

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.

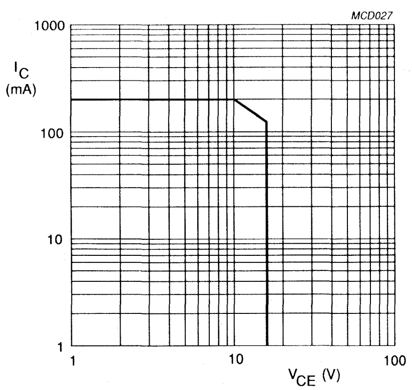


Fig.2 DC SOAR; T_S = 105 °C.

THERMAL RESISTANCE

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

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

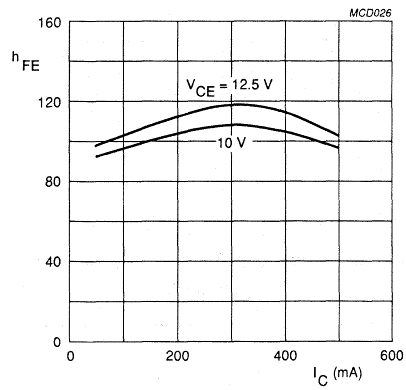


Fig.3 DC current gain as a function of drain current; typical values.

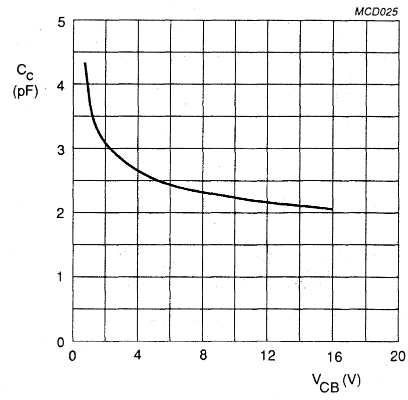


Fig.4 Collector capacitance as a function of collector-base voltage; $I_E = I_e = 0$; f = 1 MHz; typical values.

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.

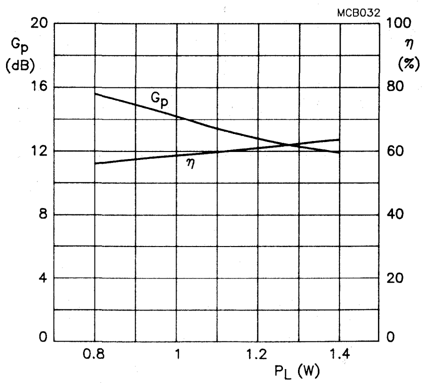


Fig.5 Gain and efficiency as functions of load power; typical values.

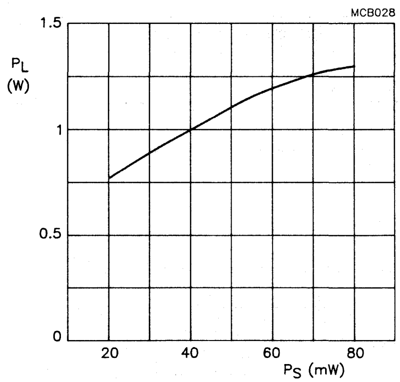


Fig.6 Load power as a function of drive power; typical values.

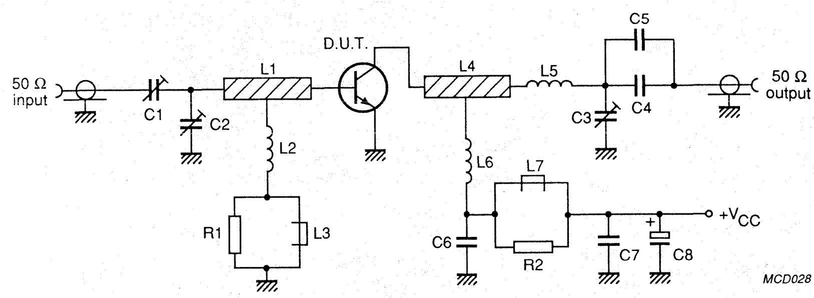


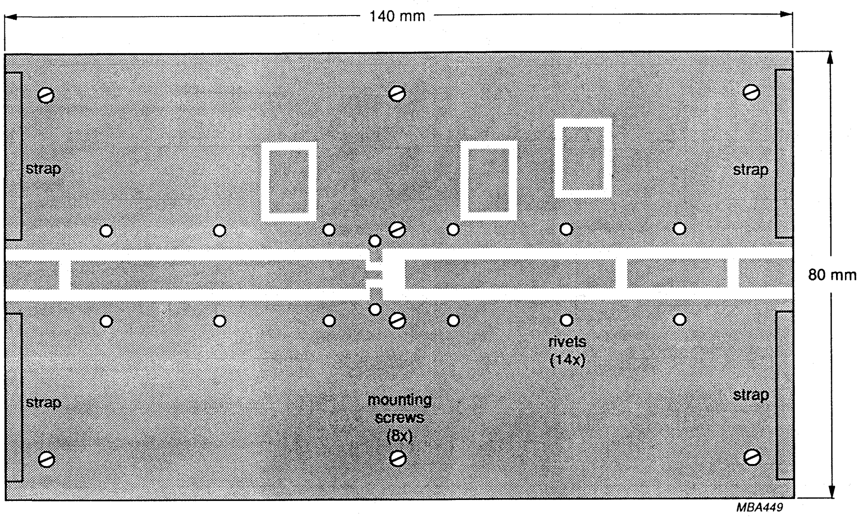
Fig.7 Class-B test circuit at f = 470 MHz.

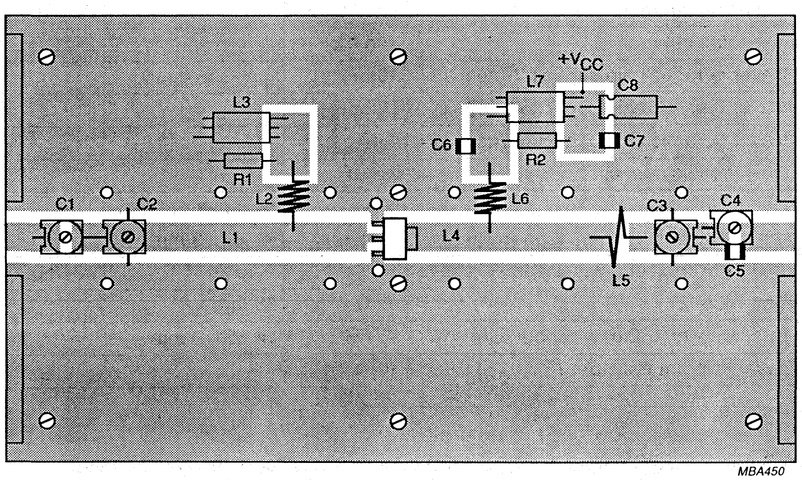
List of components (see test circuit)

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.

UHF power transistor BLU56

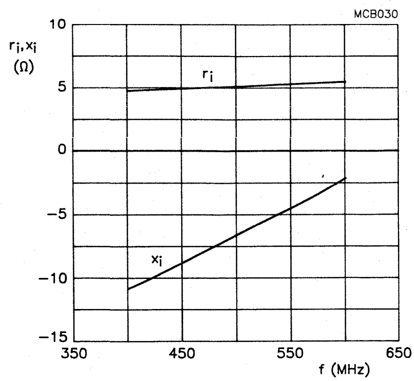


Fig.9 Input impedance (series components) as a function of frequency; class-B operation; V_{CE} = 12.5 V; P_L = 1 W; typical values.

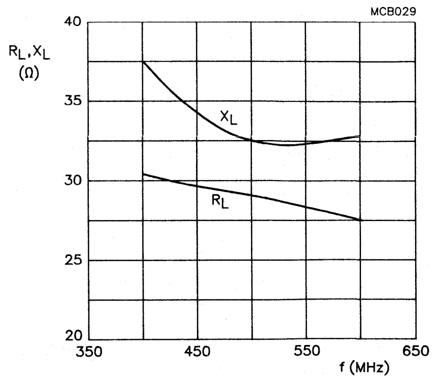


Fig.10 Load impedance (series components) as a function of frequency; class-B operation; V_{DS} = 12.5 V; P_L = 1 W; typical values.

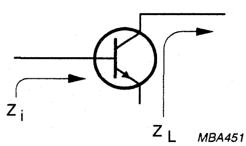


Fig.11 Definition of transistor impedance.

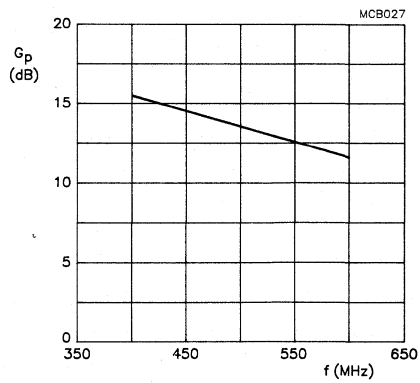


Fig.12 Power gain as a function of frequency; class-B operation; V_{DS} = 12.5 V; P_L = 1 W; typical values.

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

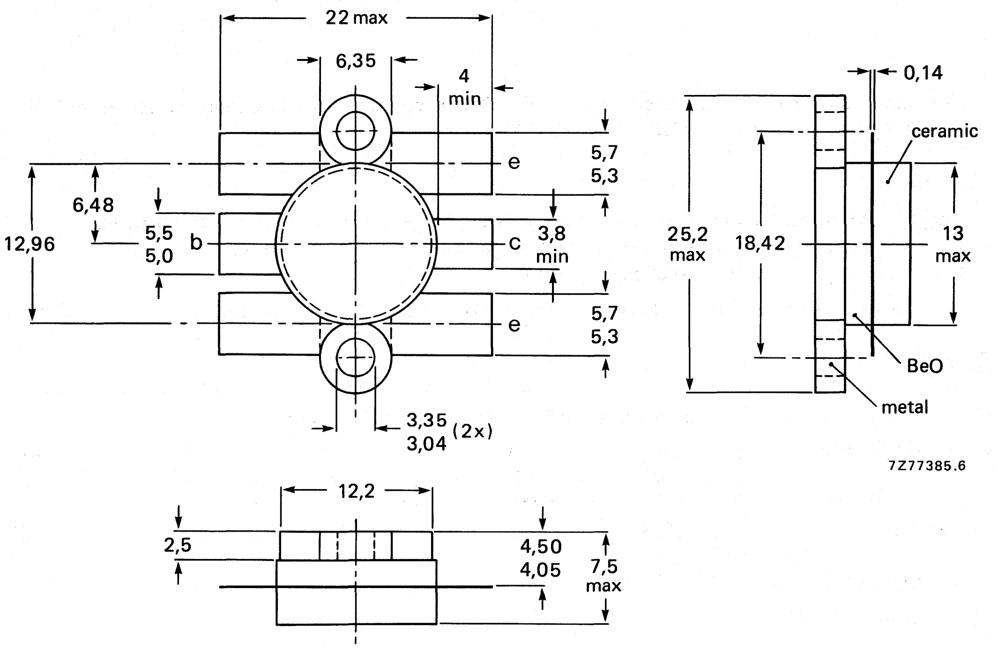
SOT-119 (see Fig. 1).

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

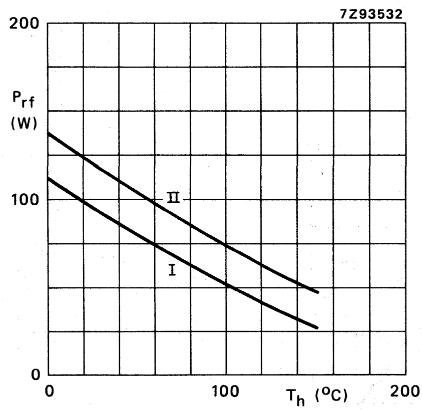


Fig. 2 Power/temperature derating curves.

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

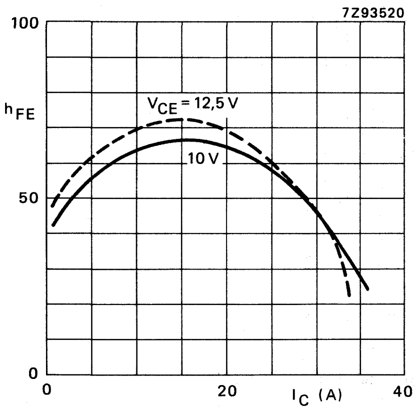


Fig. 3 D.C. current gain versus collector current; T_j = 25 °C.

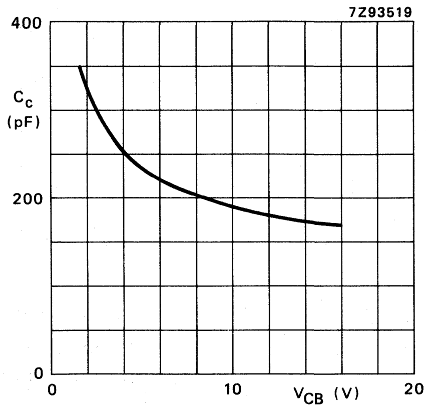


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; f = 1 MHz.

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

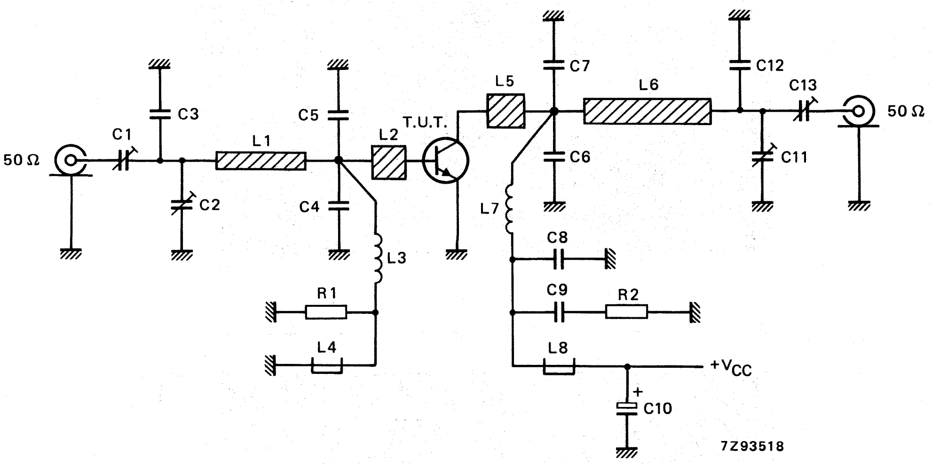


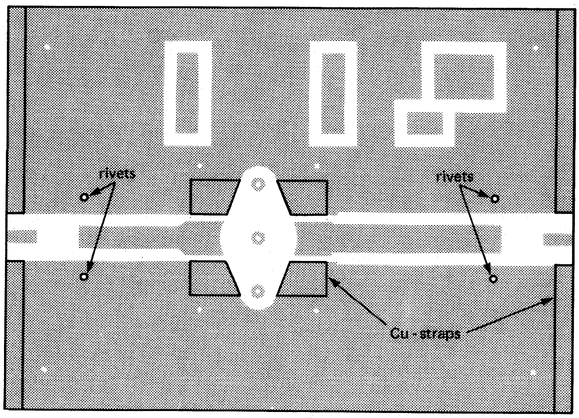
Fig. 5 Class-B test circuit at f = 470 MHz.

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.



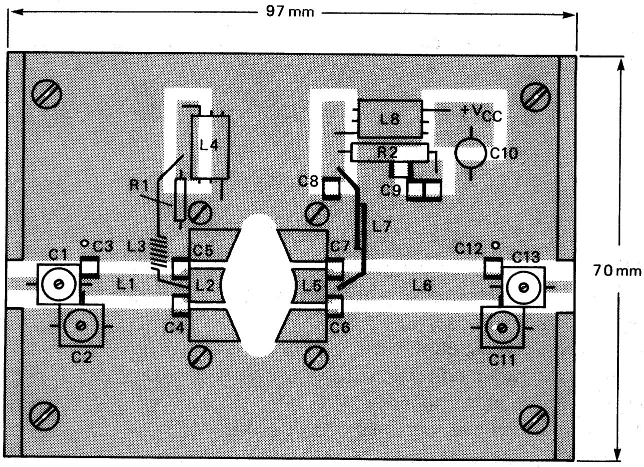


Fig. 6 Printed circuit board and component layout for 470 MHz class-B test circuit.

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.

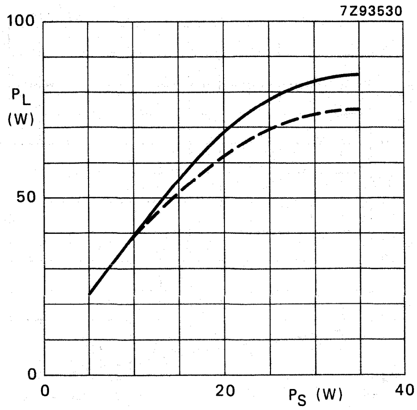


Fig. 7 Load power versus source power.

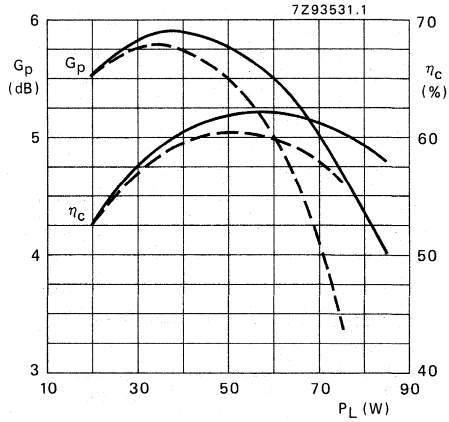


Fig. 8 Power gain and efficiency versus load power.

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.

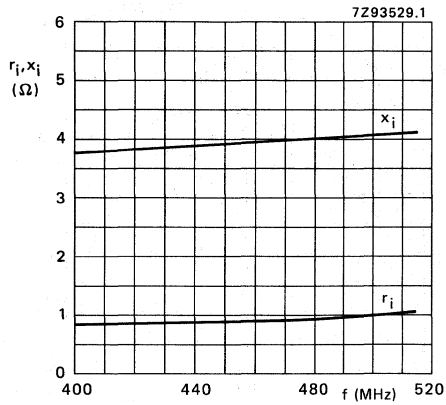


Fig. 9 Input impedance (series components).

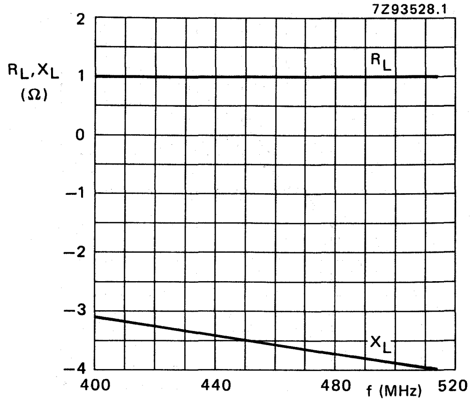


Fig. 10 Load impedance (series components).

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.

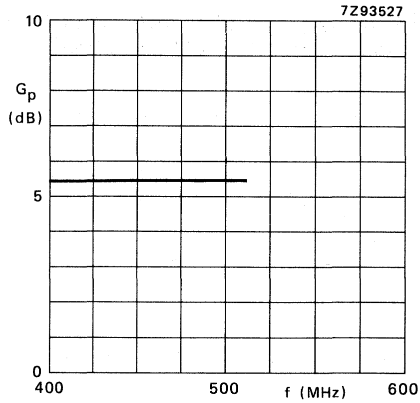


Fig. 11 Power gain versus frequency.

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.

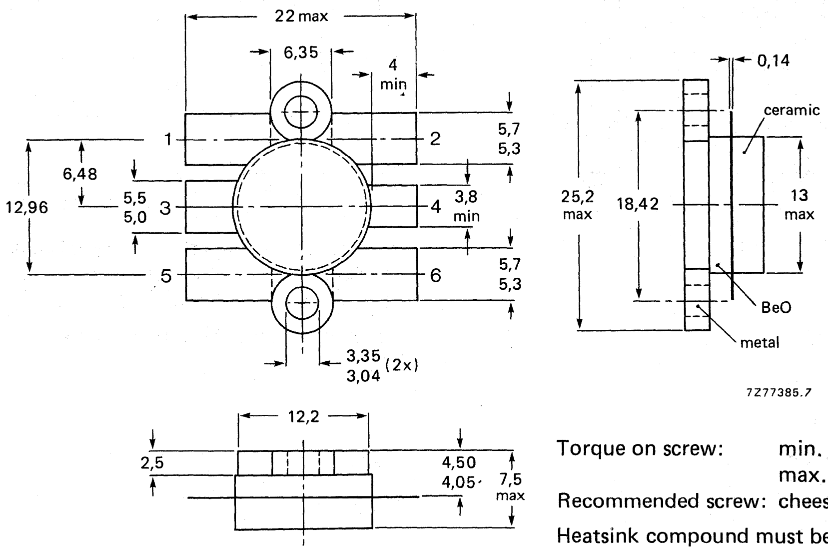
QUICK REFERENCE DATA

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

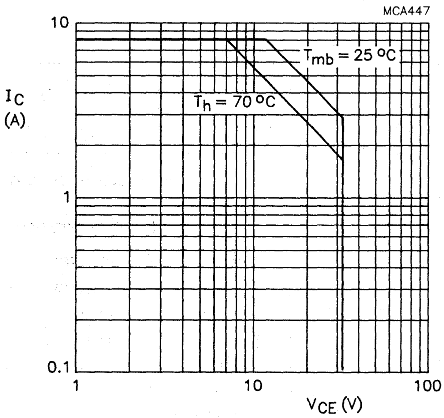
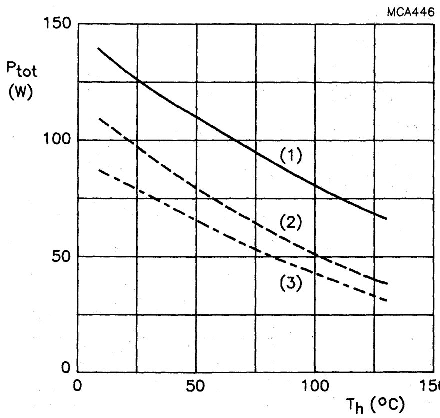


Fig.2 DC SOAR.



(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

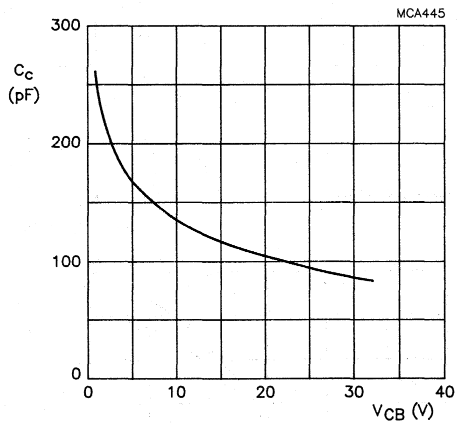
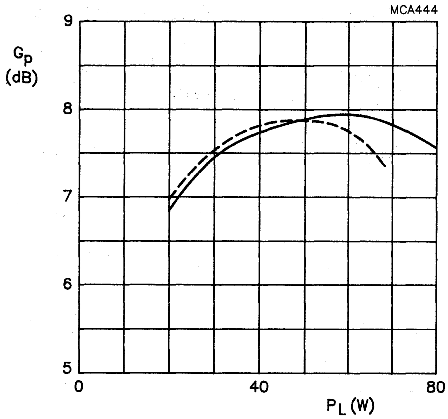


Fig.4 Collector capacitance as a function of base-collector voltage; $I_E = I_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

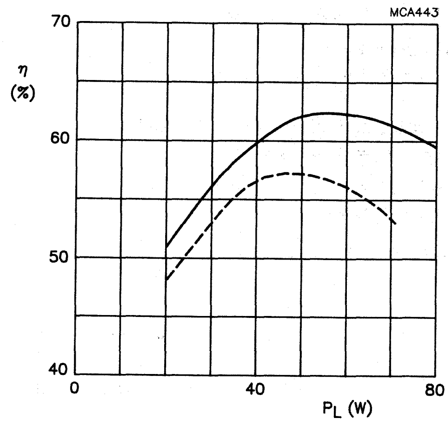
RF performance at T_h = 25 °C in a class-B test circuit

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



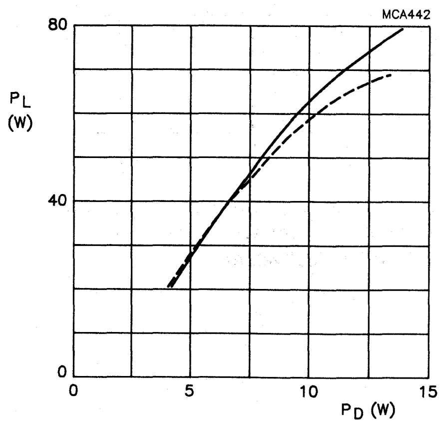
—— T_h = 25 °C
– – – T_h = 70 °C

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 ^oC; $R_{th\ mb\text{-}h}$ = 0.2 K/W, at rated output power.

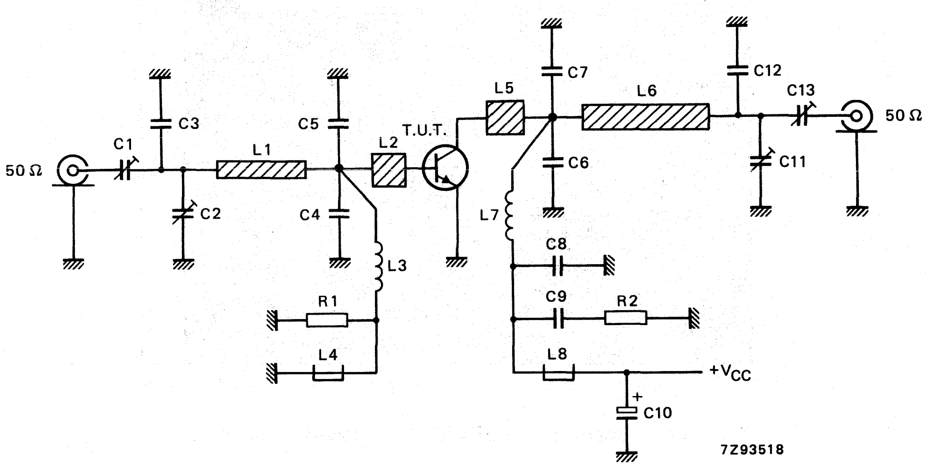


Fig.8 Class-B test circuit at f = 470 MHz.

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)

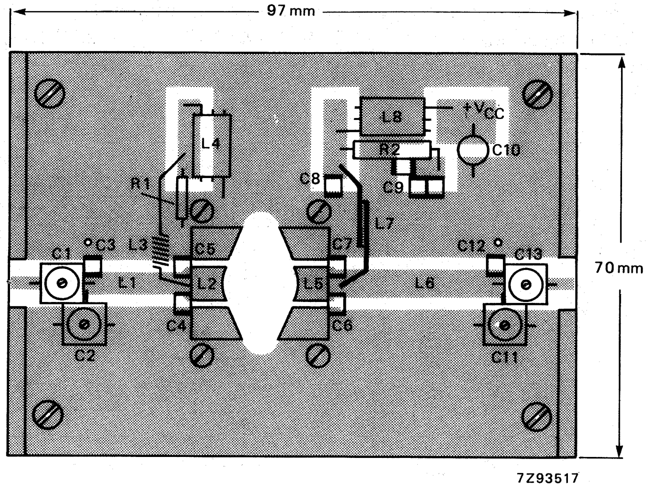


Fig.9 Component layout of 470 MHz, class-B test circuit.

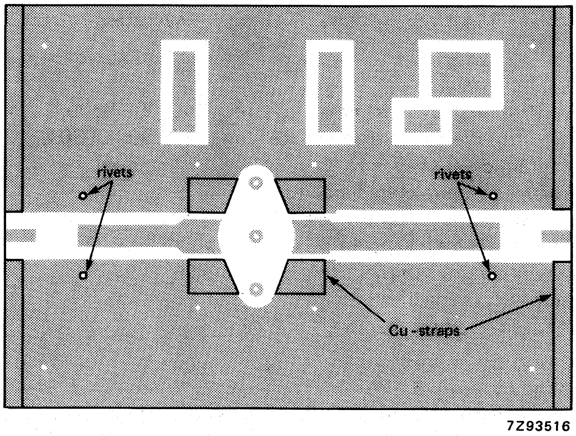


Fig.10 Printed-circuit board for 470 MHz, class-B test circuit.

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.

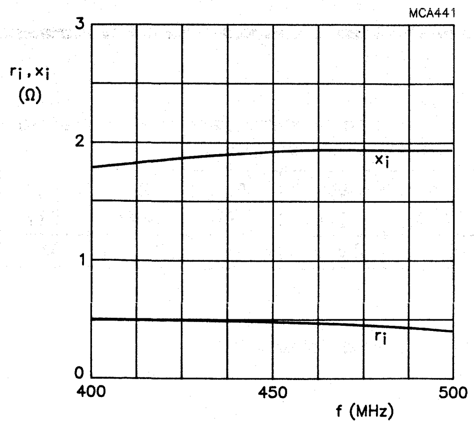


Fig.11 Input impedance as a function of frequency (series components); typical values.

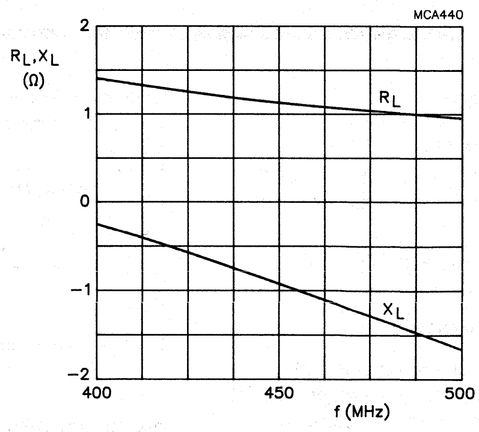


Fig.12 Load impedance as a function of frequency (series components); typical values.

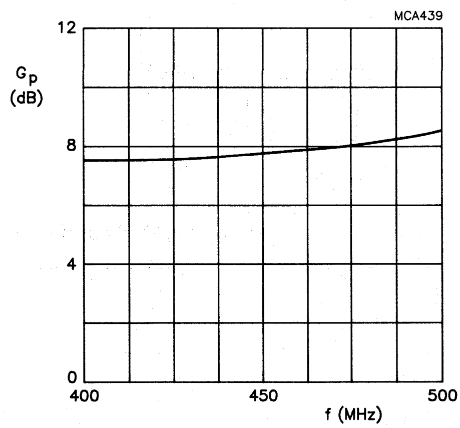


Fig.13 Gain as a function of frequency; typical values.

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

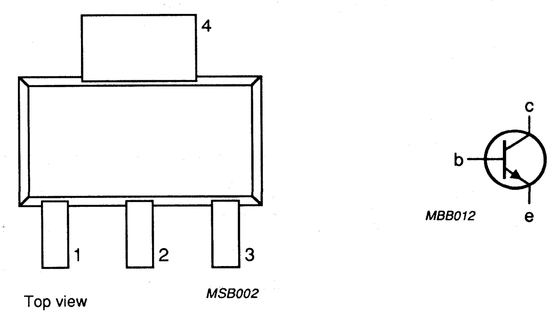


Fig.1 Simplified outline and symbol.

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.

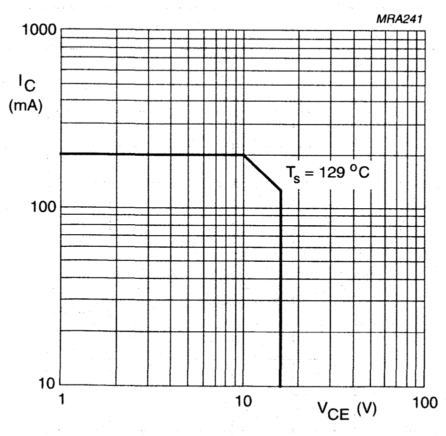


Fig.2 DC SOAR.

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

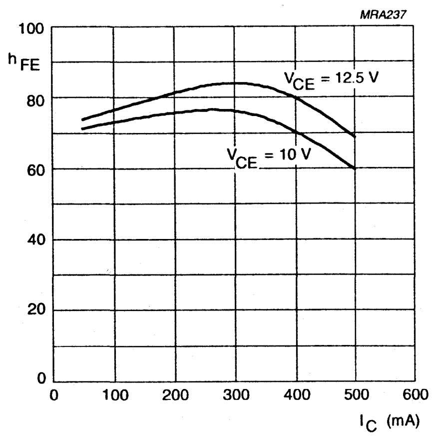


Fig.3 DC current gain as a function of collector current; typical values.

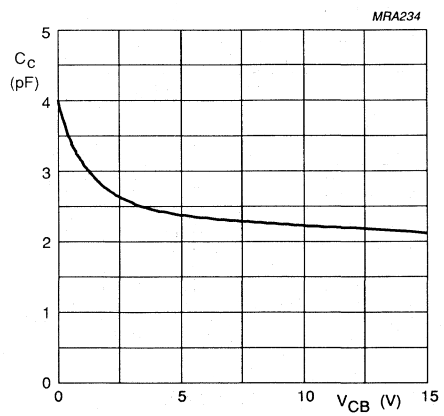


Fig.4 Collector capacitance as a function of collector-base voltage, typical values.

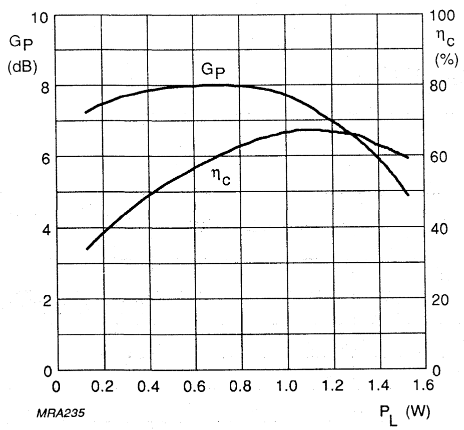
APPLICATION INFORMATION

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

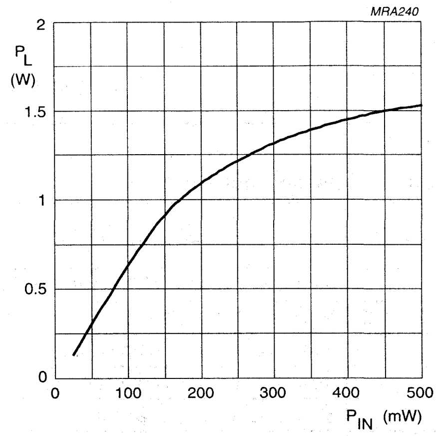
Note

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.

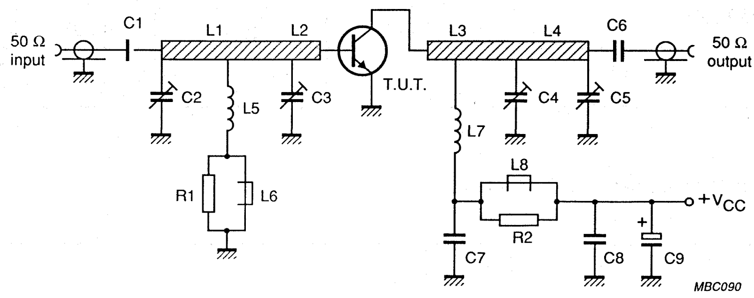


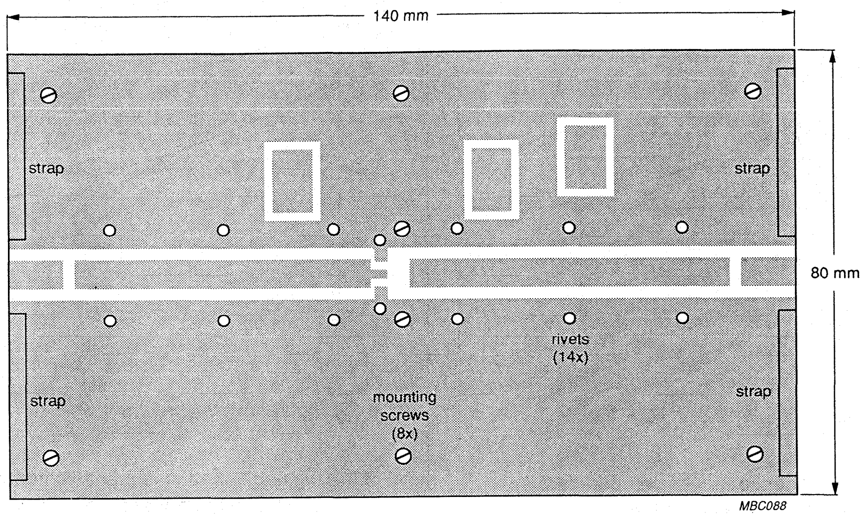
Fig.7 Class-B test circuit at f = 900 MHz.

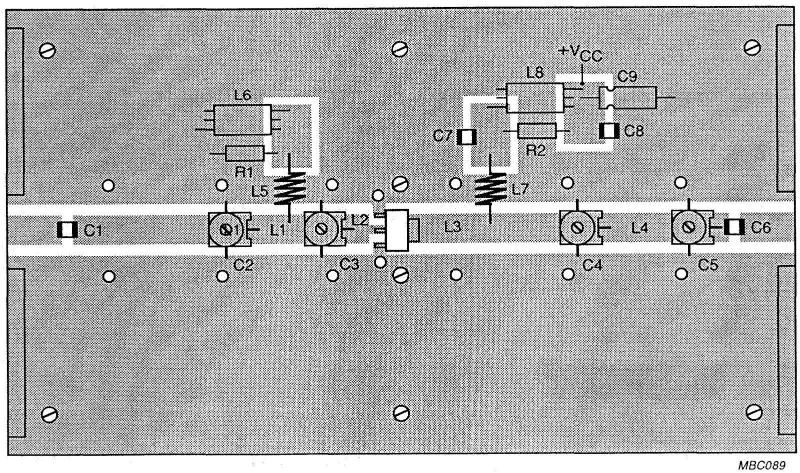
List of components (see test circuit)

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

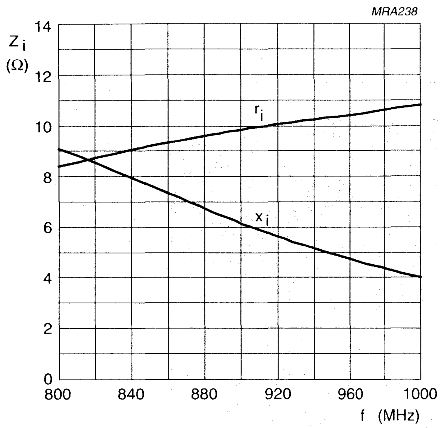
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2); thickness 1⁄16 inch.





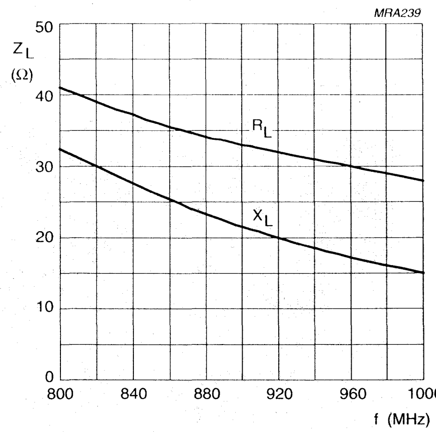
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

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.

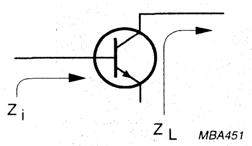
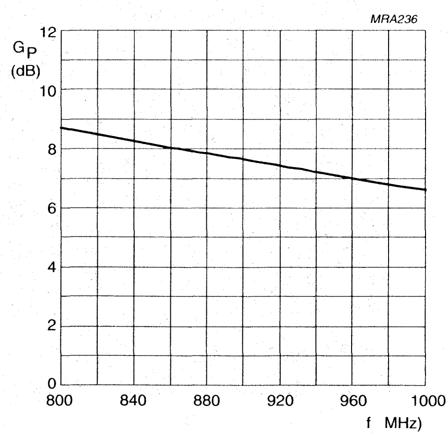


Fig.11 Definition of transistor impedance.



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

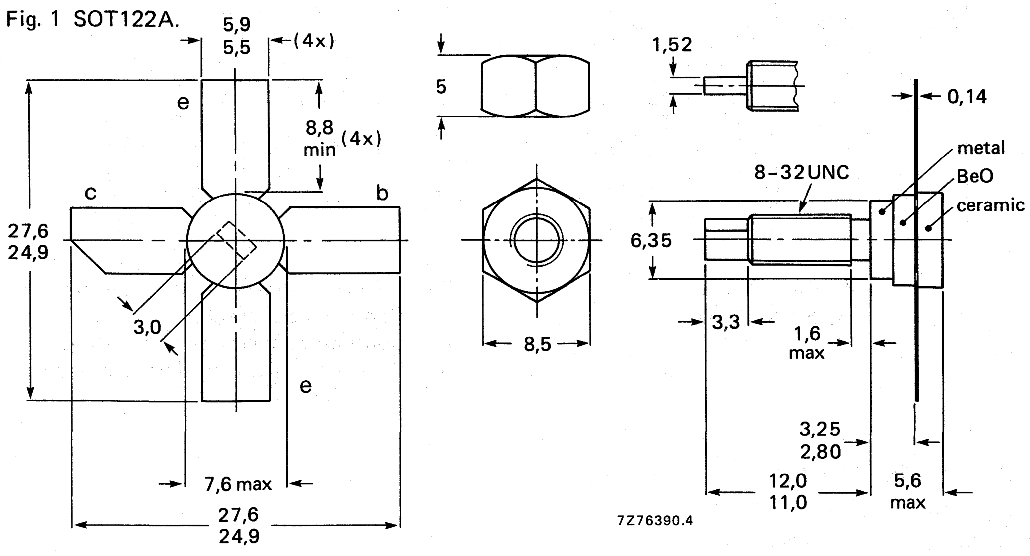
R.F. performance at T_h = 25 °C in a common-emitter class-B circuit

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

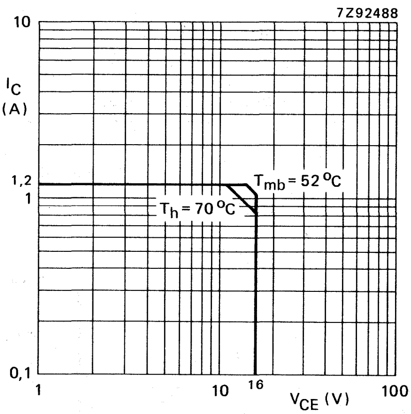


Fig. 2 D.C. SOAR.
$R_{th\ mb-h}$ = 0,6 K/W.

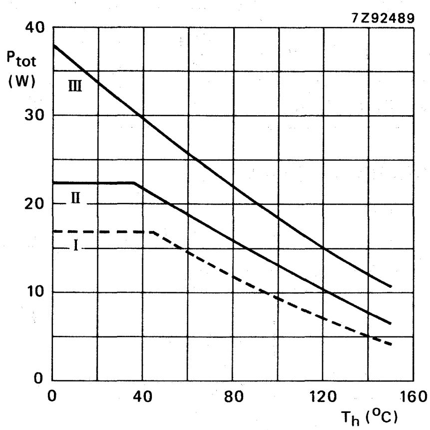


Fig. 3 Power/temperature derating curves.
I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz).

THERMAL RESISTANCE

Dissipation = 15 W; T_{mb} = 25 °C

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage, open emitter; I_C = 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}	>	25	
		typ.	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

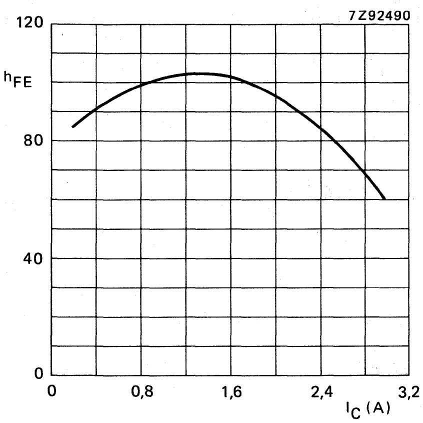


Fig. 4 T_j = 25 °C; V_{CE} = 10 V; typical values.

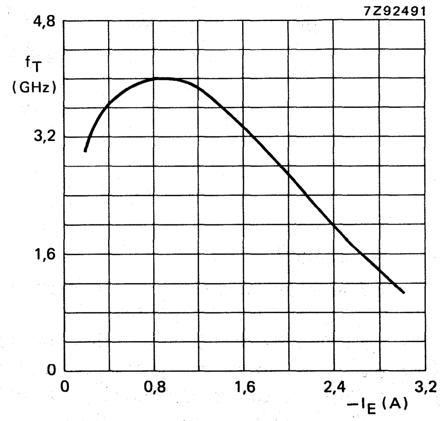


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; t_p = 50 μs; T_j = 25 °C; typical values.

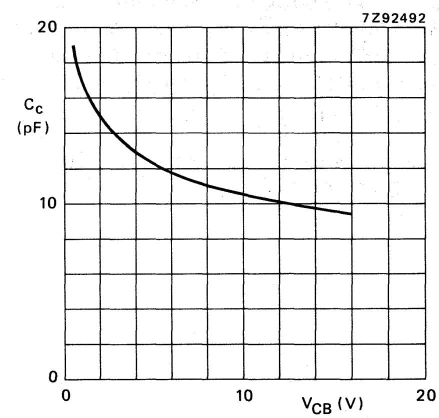


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

* 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

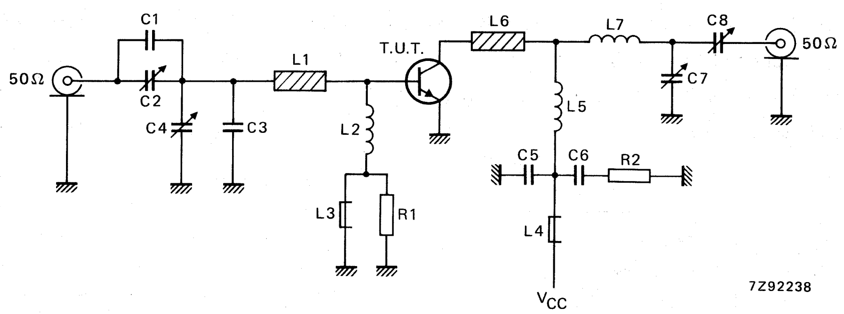


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

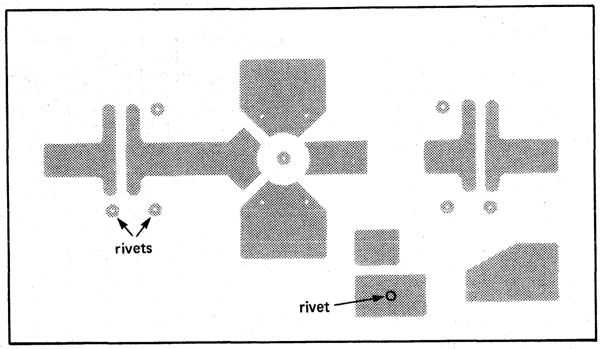
C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor
C6 = 100 nF metallized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



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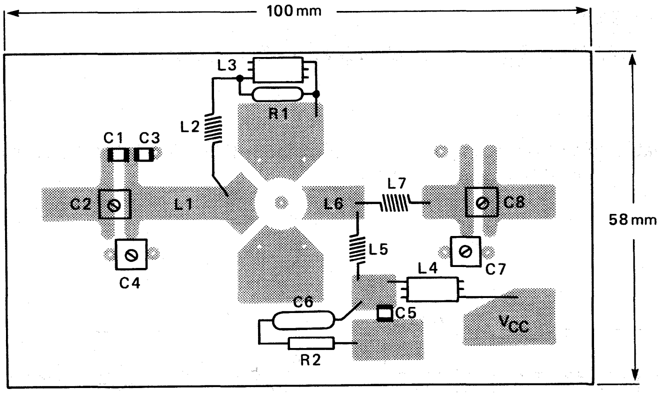


7Z90361

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.

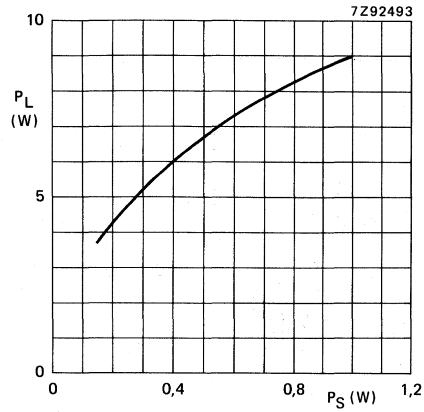


Fig. 9 Load power vs. source power.

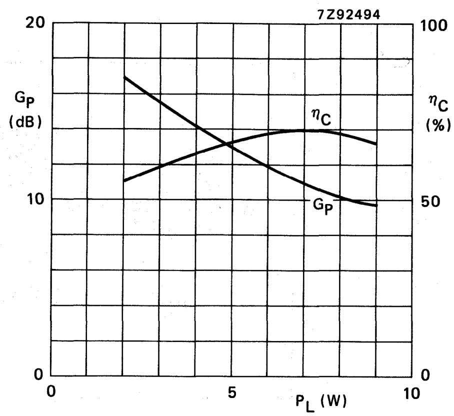


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:

V_{CE} = 12,5 V; f = 470 MHz; T_h = 25 °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 T_h = 25 °C.

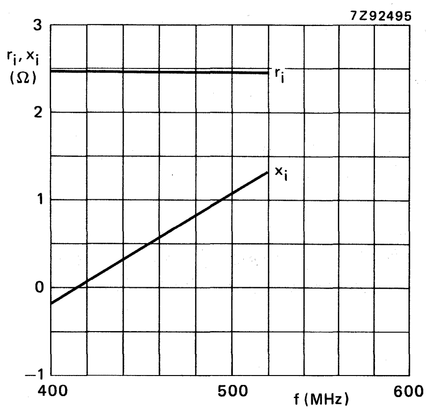


Fig. 11 Input impedance (series components).

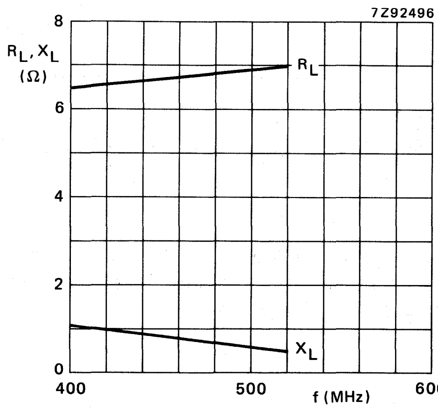


Fig. 12 Load impedance (series components).

Conditions for Figs 11 and 12:

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

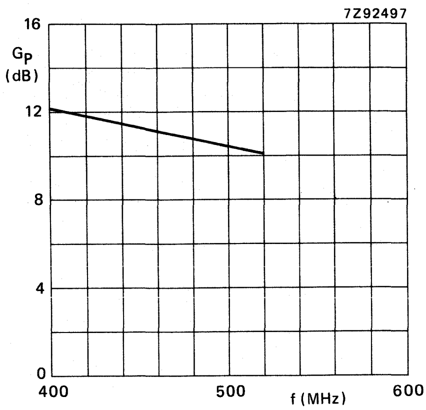


Fig. 13 Power gain vs. frequency.
V_{CE} = 12,5 V; P_L = 7 W; f = 400-520 MHz; T_h = 25 ^oC;
class-B operation; typical values.

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 °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

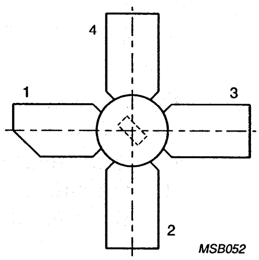


Fig.1a SOT122A (BLU99).

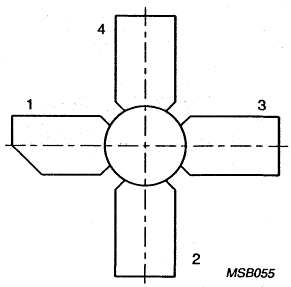


Fig.1b SOT122D (BLU99/SL).

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

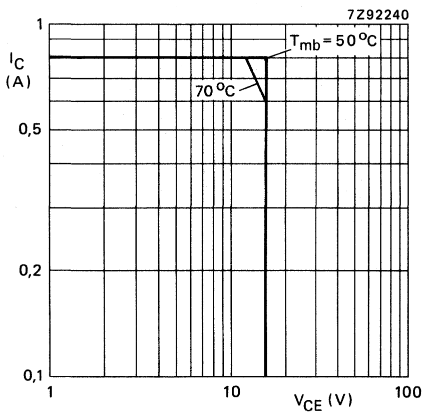


Fig. 2 D.C. SOAR.
$R_{th\ mb\text{-}h}$ = 0,6 K/W.

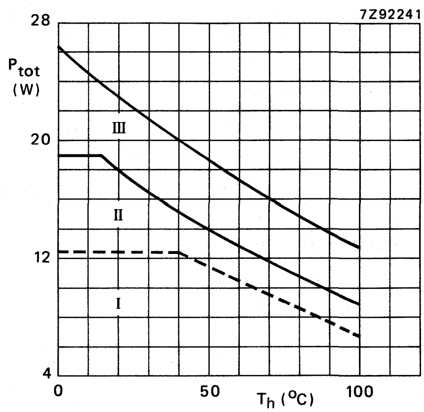


Fig. 3 Power/temperature derating curves.

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; $\delta < 0,01$.

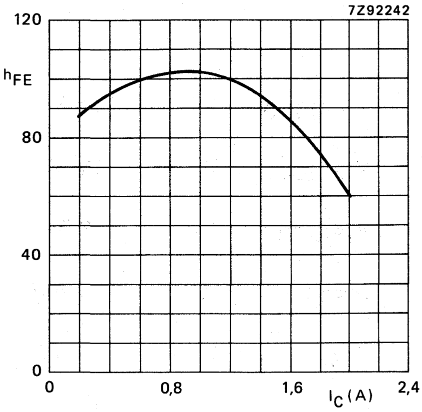


Fig. 4 V_{CE} = 10 V; T_j = 25 °C; typ. values.

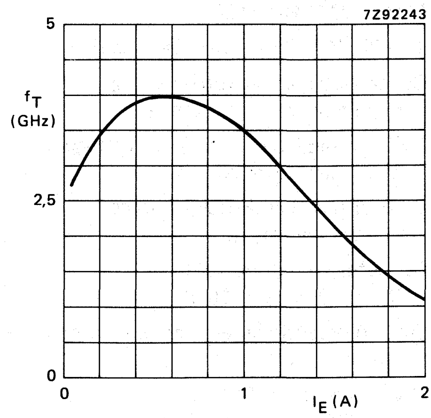


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typ. values.

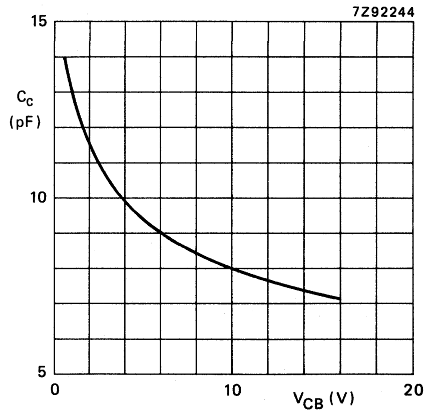


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; typ. values.

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

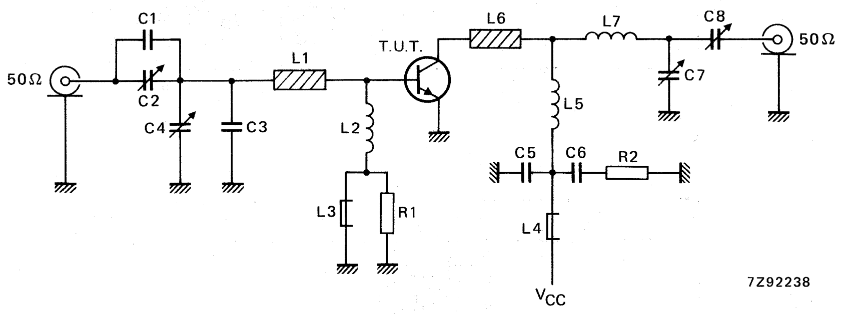


Fig. 7 Class-B test circuit at f = 470 MHz.

List of components:

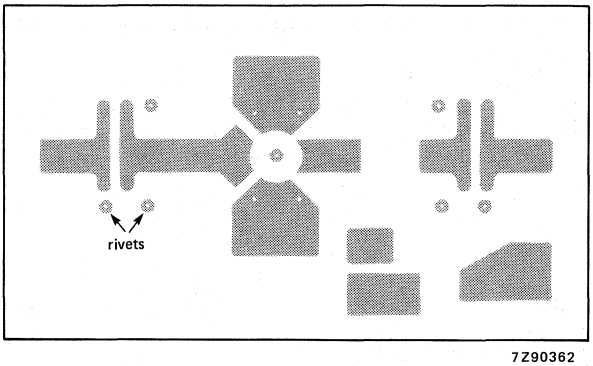
C1 = 2,7 pF multilayer ceramic chip capacitor*
C2 = C7 = C8 = 1,4-5,5 pF film dielectric trimmer (cat.no. 2222 809 09001)
C3 = 7,5 pF multilayer ceramic chip capacitor*
C4 = 2-9 pF film dielectric trimmer (cat.no. 2222 809 09002)
C5 = 100 pF multilayer ceramic chip capacitor (cat. no. 2222 852 13101)
C6 = 100 nF metallized fllm capacitor (cat. no. 2222 352 45104)

L1 = stripline, 22,5 mm x 6,0 mm
L2 = 1 turn Cu-wire (1,0 mm), int. dia. 5,5 mm, leads 2 x 5 mm
L3 = L4 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
L5 = 4 turns enamelled Cu-wire (1,0 mm), int. dia. 6 mm, length 7,5 mm, leads 2 x 5 mm
L6 = stripline, 10,0 mm x 6,0 mm
L7 = 1 turn Cu-wire (1,0 mm), int. dia. 5 mm, leads 2 x 5 mm

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

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

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



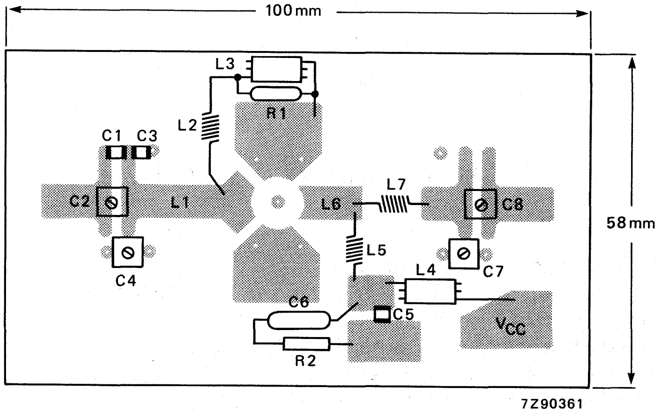


Fig. 8 Printed circuit board and component layout for 470 MHz.

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.

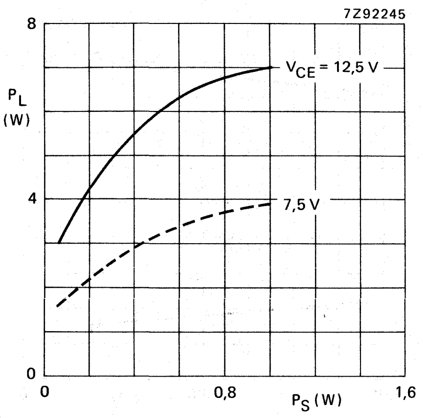


Fig. 9 Output power.

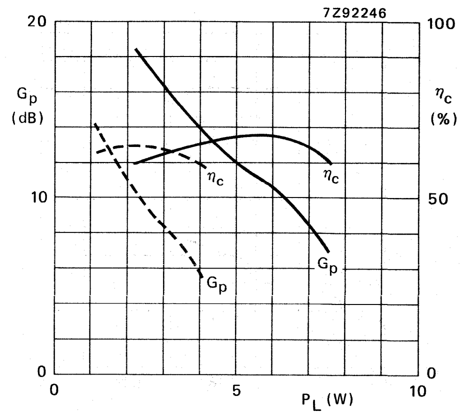


Fig. 10 Power gain and efficiency;
——— : V_{CE} = 12,5 V
– – – – : V_{CE} = 7,5 V.

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.

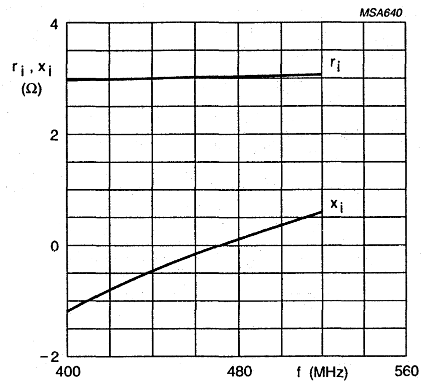


Fig. 11 Input impedance (series components).

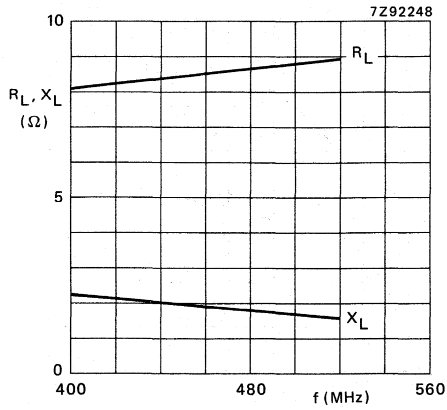


Fig. 12 Load impedance (series components).

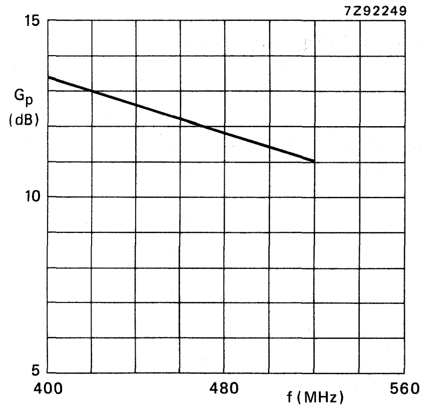


Fig. 13 Power gain.

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

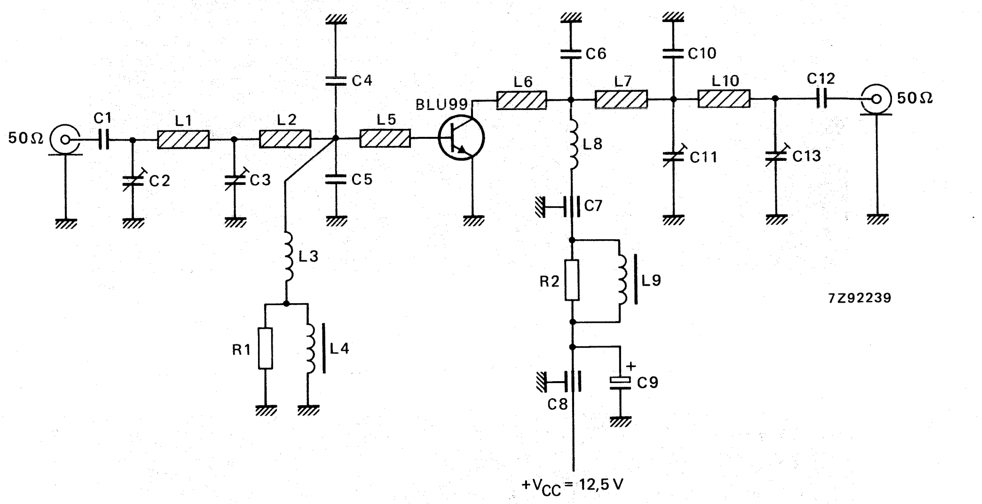


Fig. 14 Class-B test circuit at f = 900 MHz.

List of components:

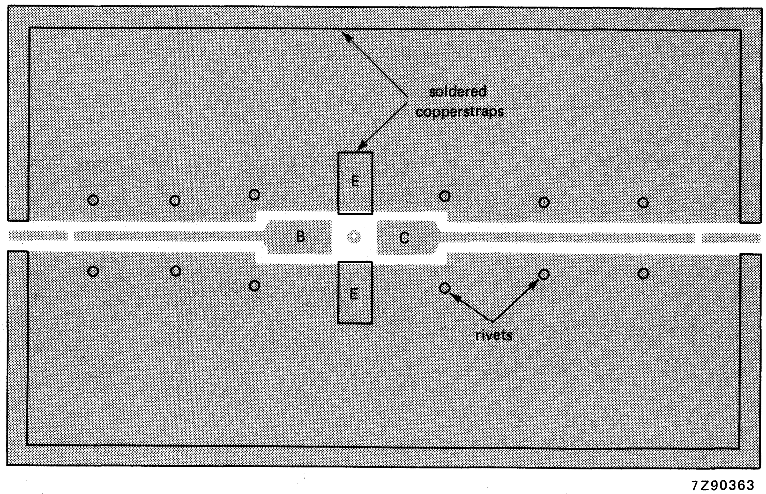
C1 = C12 = 33 pF multilayer ceramic chip capacitor*
C2 = C13 = 1,4-5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = C11 = 1,2-3,5 pF film dielectric trimmer (cat. no. 2222 809 05001)
C4 = C5 = C10 = 6,2 pF multilayer ceramic chip capacitor*
C6 = 1 pF multilayer ceramic chip capacitor*
C7 = 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.



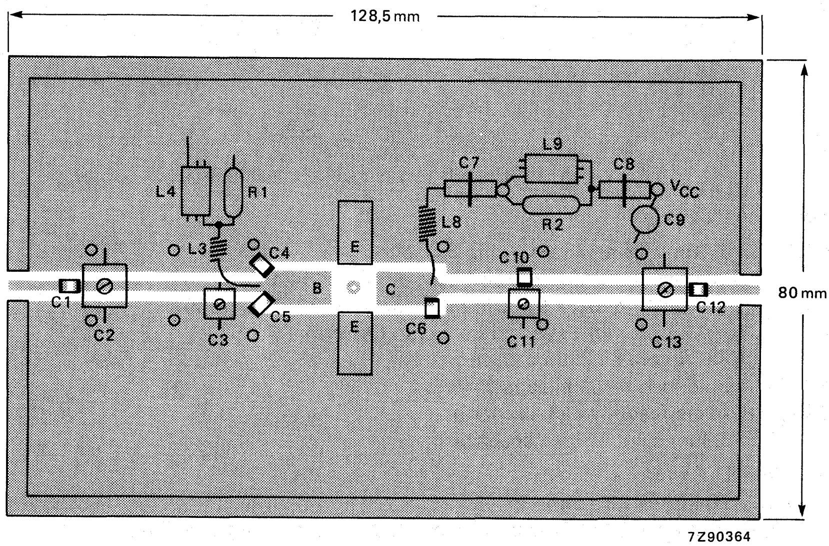


Fig. 15 Printed circuit board and component layout for a 900 MHz test circuit.

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.

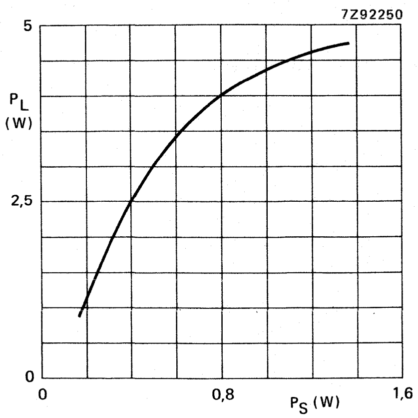


Fig. 16 Output power.

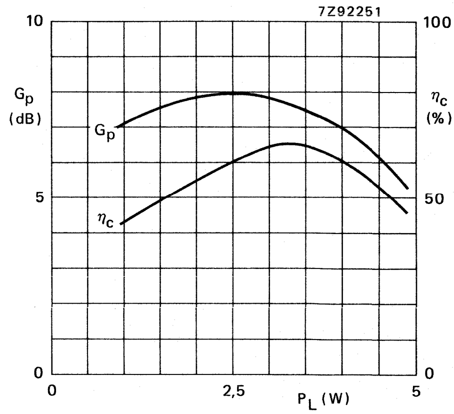


Fig. 17 Power gain and efficiency.

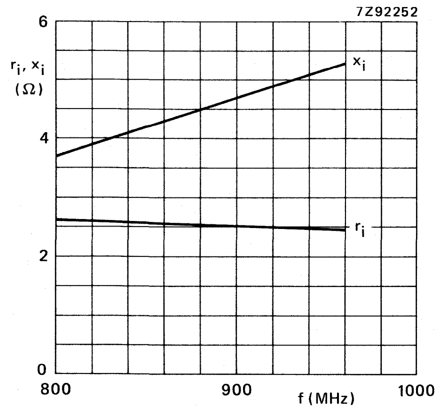


Fig. 18 Input impedance (series components).

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.

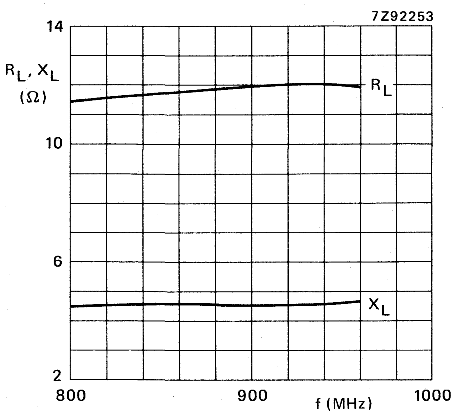


Fig. 19 Load impedance (series components).

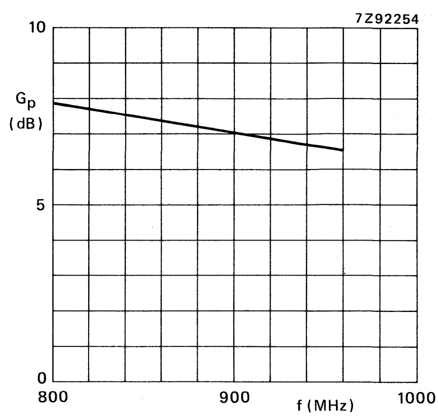


Fig. 20 Power gain.

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).

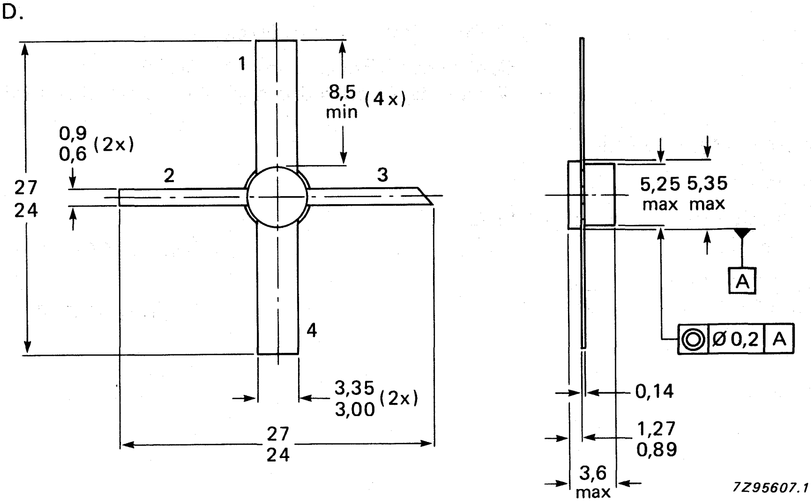
MECHANICAL DATA

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

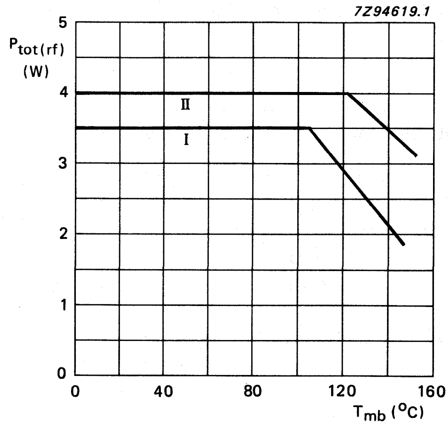


Fig. 2 Power/temperature curve

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-mb}	typ.	0.5 pF

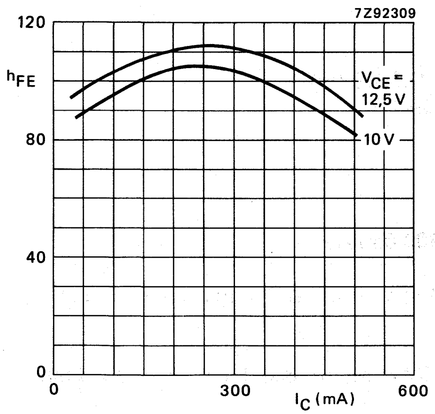


Fig. 3 T_j = 25 °C; typical values.

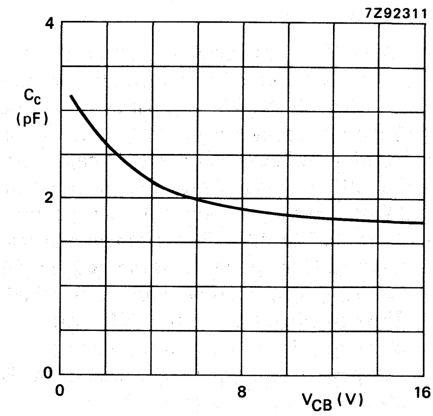


Fig. 4 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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

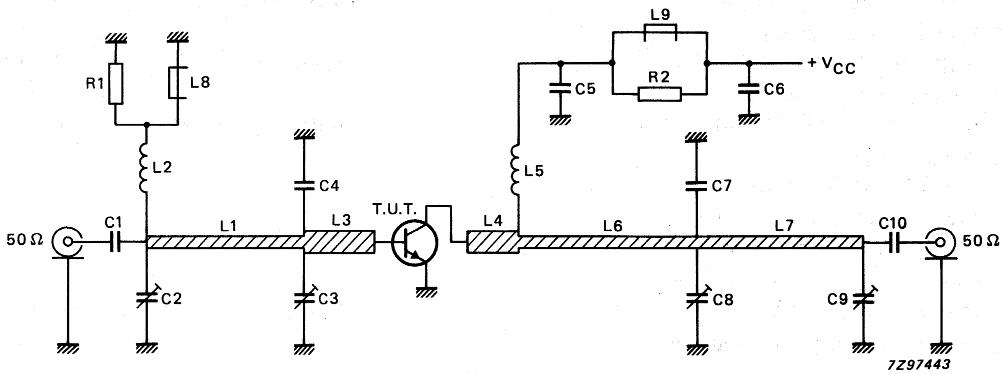


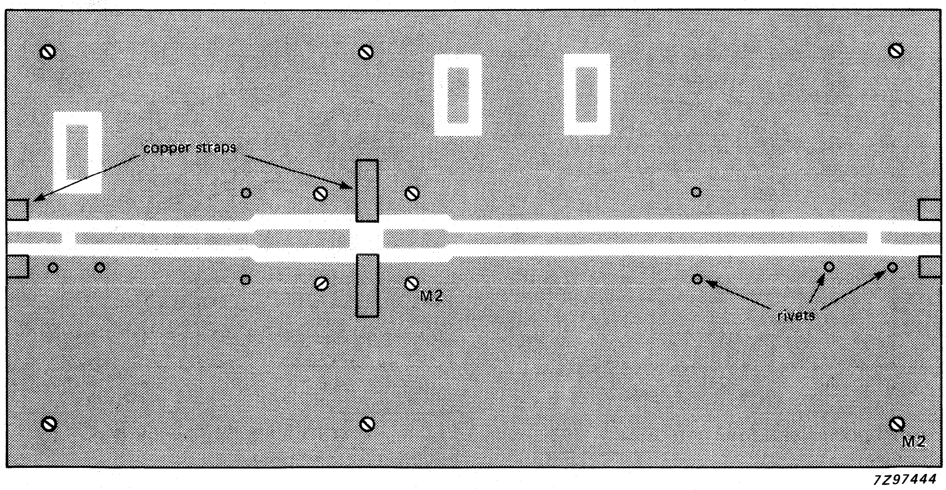
Fig. 5 Class-B test circuit at f = 900 MHz.

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).



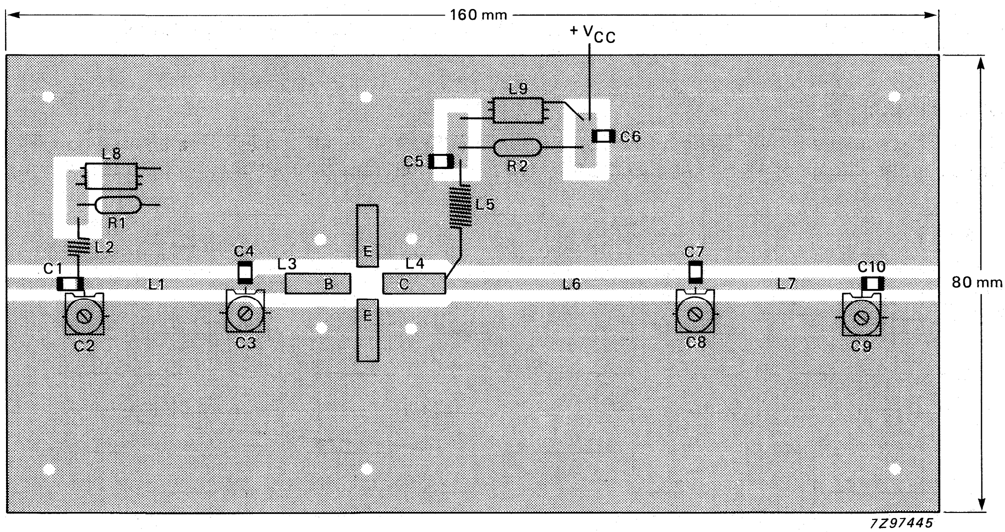


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

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.

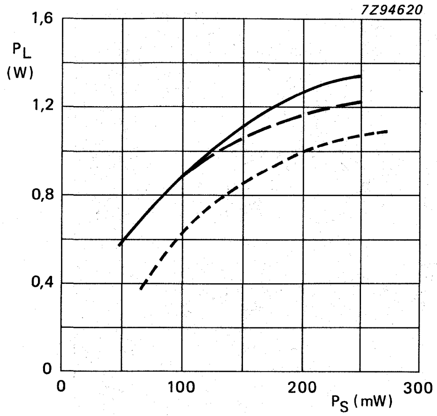


Fig. 7 Load power as a function of source power.

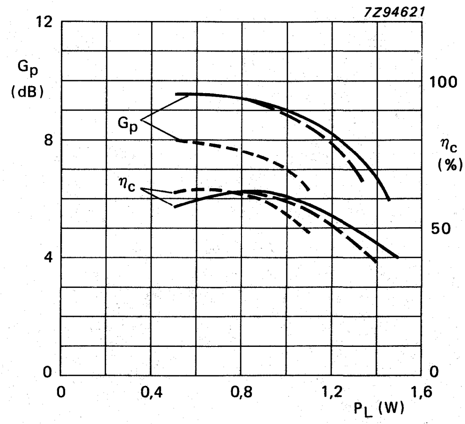


Fig. 8 Power gain and efficiency as a function of load power.

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).

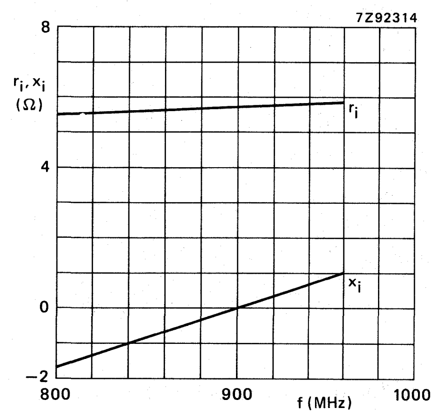


Fig. 9 Input impedance (series components).

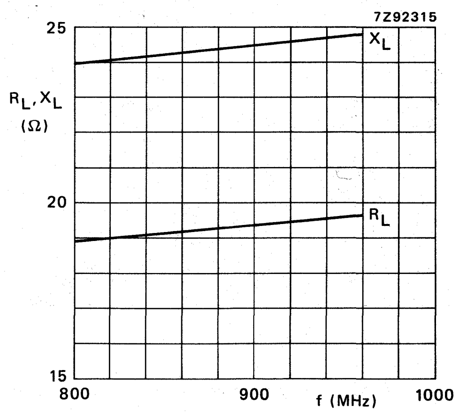


Fig. 10 Load impedance (series components).

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.

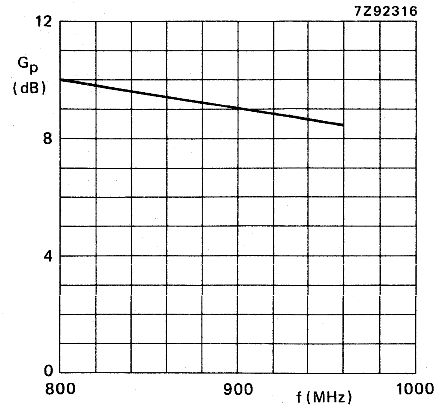


Fig. 11 Power gain as a function of frequency.

V_{CE} = 12.5 V; P_L = 1 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

UHF POWER TRANSISTOR

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

Features:

- diffused emitter-ballasting resistors for an optimum temperature profile.
- gold metallization ensures excellent reliability.
- the device can be applied at rated load power, without an external heatsink, when it is mounted on a printed-circuit board (see Fig. 6).

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

QUICK REFERENCE DATA

RF performance in a common-emitter class-B circuit.

mode of operation	T °C	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; CW	T_{mb} = 25	12.5	900	2	> 6.5	> 50
	T_a = 25*	12.5	900	1.5	> 6.5	> 50
	T_a = 25*	9.6	900	1.5	typ. 6.6	typ. 60

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

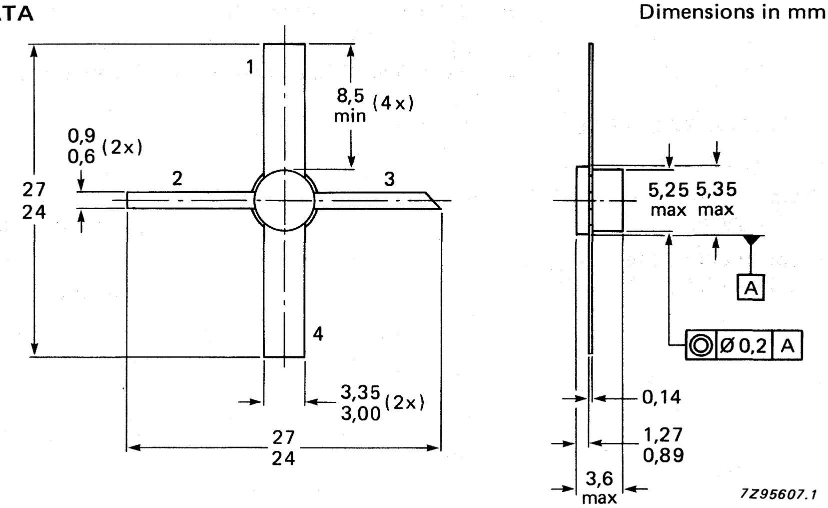
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-172D.

Pinning:

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



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

RATINGS

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

Collector-base voltage (open emitter)	V_{CBO}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
DC or average	I_C; $I_{C(AV)}$	max.	0.4	A
(peak value); f > 1 MHz	I_{CM}	max.	1.2	A
Total power dissipation				
f > 1 MHz; $T_{mb} \leqslant 90$ °C	$P_{tot(RF)}$	max.	6	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

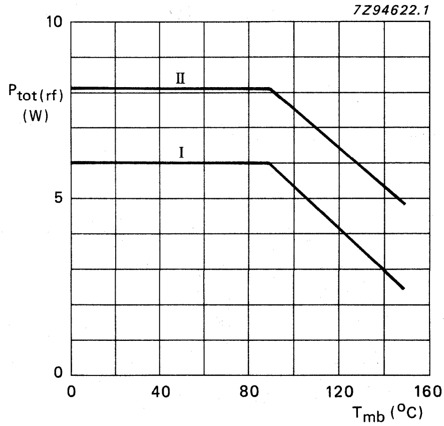


Fig. 2 Power/temperature curve.

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

THERMAL RESISTANCE

Dissipation = 4.5 W

From junction to ambient* (f > 1 MHz) $T_a = 25$ °C	$R_{th\ j\text{-}a\ (RF)}$	max.	55	K/W
From junction to mounting base $T_{mb} = 25$ °C (f > 1 MHz)	$R_{th\ j\text{-}mb\ (RF)}$	max.	15	K/W

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 5 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 10 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 0.5 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	2.5 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	0.55 mJ
D.C. current gain I_C = 0.3 A; V_{CE} = 10 V	h_{FE}	>	25
Collector capacitance at f = 1 MHz I_E = i_e = 0; V_{CB} = 12.5 V	C_c	typ.	3.5 pF
Feedback capacitance at f = 1 MHz I_C = 0; V_{CE} = 12.5 V	C_{re}	typ.	2.0 pF
Collector-mounting base capacitance	C_{c-mb}	typ.	0.5 pF

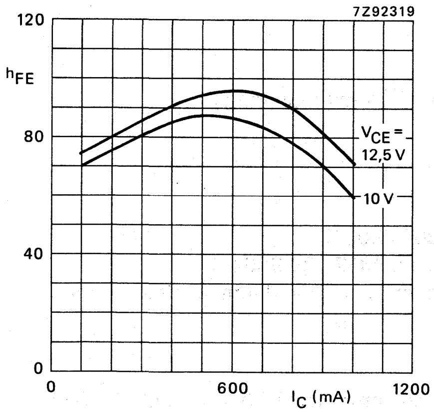


Fig. 3 T_j = 25 °C; typical values.

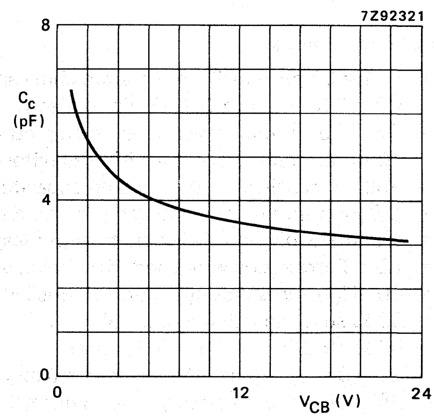


Fig. 4 I_E = i_e = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit; class-B): f = 900 MHz

mode of operation	V_{CE} V	P_L W	G_p dB	η_C %	T °C
narrow band; CW	12.5	2	> 6.5	> 50	T_{mb} = 25
	12.5	2	typ. 7.8	typ. 60	T_{mb} = 25
	12.5	1.5	> 6.5	> 50	T_a = 25**
	9.6	1.5	typ. 6.6	typ. 60	T_a = 25**

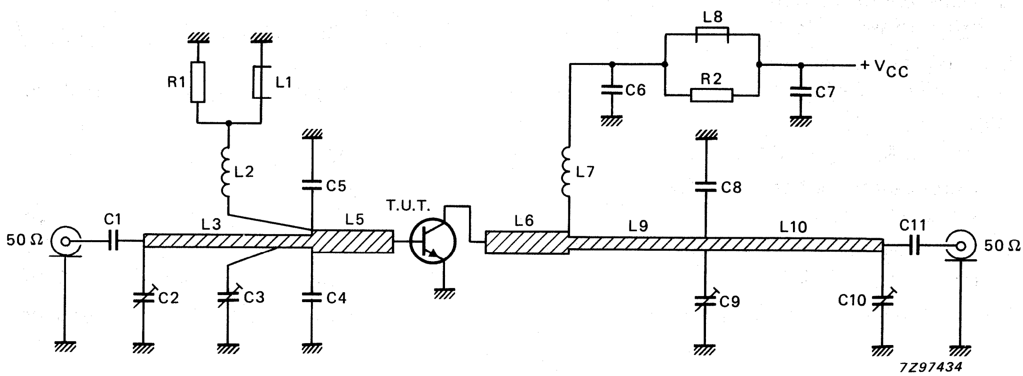


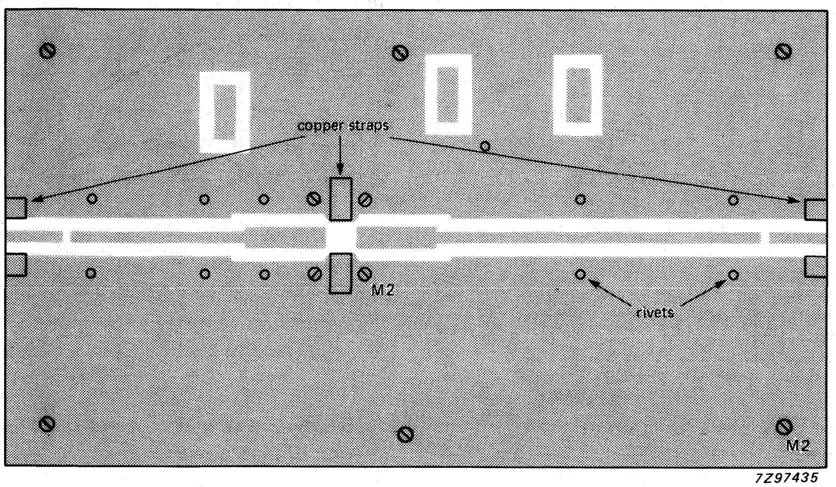
Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

C1 = C11 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 5.6 pF multilayer ceramic chip capacitor*
C6 = 10 pF multilayer ceramic chip capacitor
C7 = 330 pF multilayer ceramic chip capacitor
C8 = 3.9 pF multilayer ceramic chip capacitor*
C9 = 1.2 to 3.5 pF film dielectric trimmer (cat. no. 2222 809 05001)
L1 = L8 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)
L2 = 60 nH; 4 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L3 = 50 Ω stripline (25.4 mm x 2.4 mm)
L4 = 50 Ω stripline (4.4 mm x 2.4 mm)
L5 = L6 = 34 Ω stripline (14.0 mm x 4.0 mm)
L7 = 280 nH; 15 turns closely wound enamelled Cu wire (0.4 mm); int. dia. 3 mm; leads 2 x 5 mm
L9 = 50 Ω stripline (24.8 mm x 2.4 mm)
L10 = 50 Ω stripline (30.5 mm x 2.4 mm)
R1 = R2 = 10 Ω ± 5%; 0.25 W metal film resistor

L3, L4, L5, L6, L9 and L10 are striplines on a double Cu-clad printed-circuit board with P.T.F.E. fibre-glass dielectric (ϵ_r = 2.2); thickness 1/32 inch; thickness of copper-sheet 2 x 35 μm.

* American Technical Ceramics capacitor type 100A or capacitor of same quality.
** Device mounted on a printed-circuit board (see Fig. 6).



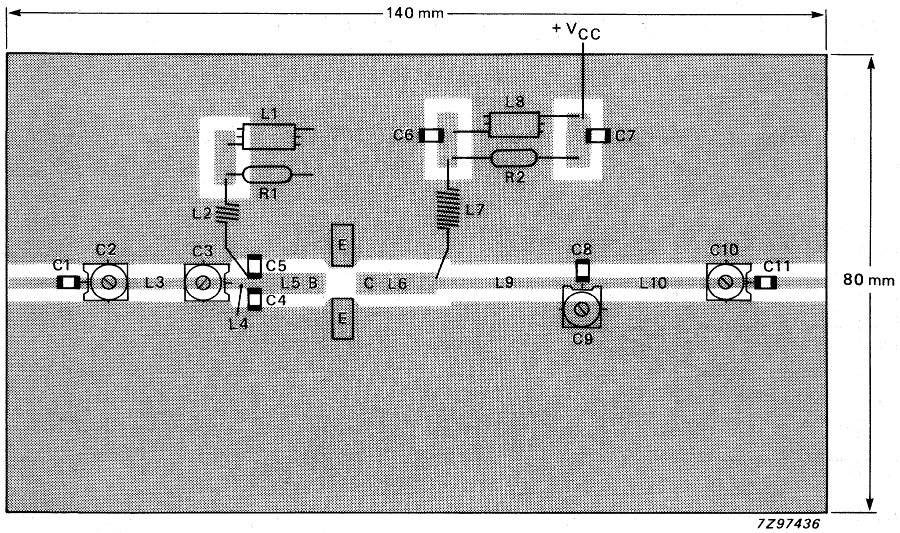


Fig. 6 Printed-circuit board and component lay-out for 900 MHz class-B test circuit.

Note

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

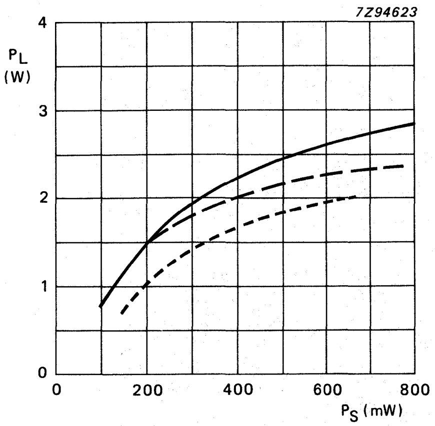


Fig. 7 Load power as a function of source power.

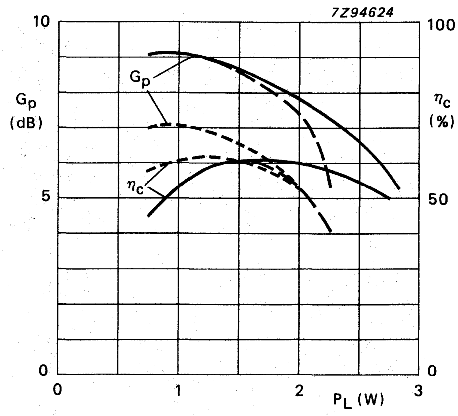


Fig. 8 Power gain and efficiency as a function of load power.

Conditions for Figs 7 and 8:

f = 900 MHz; class-B operation; typical values.

(——— T_{mb} = 25 °C; V_{CE} = 12.5 V; – – – – T_a = 25 °C; V_{CE} = 12.5 V; --------- T_a = 25 °C; V_{CE} = 9.6 V)

RUGGEDNESS

The device is capable to withstand a full load mismatch (VSWR = 50; all phases) at P_L = 1.5 W up to a supply voltage of 15.5 V at T_a = 25 °C. Device mounted on a printed-circuit board (see Fig. 6).

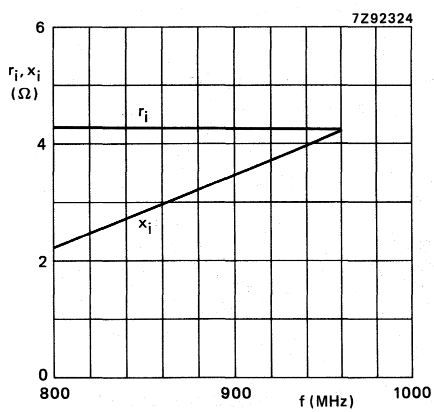


Fig. 9 Input impedance (series components).

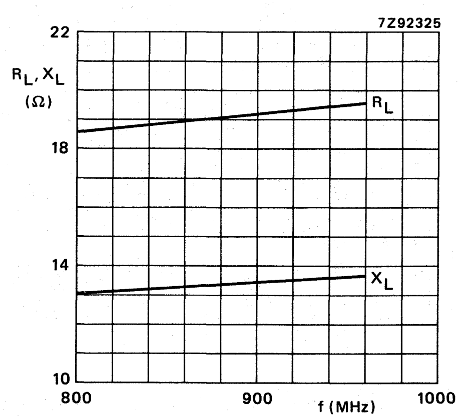


Fig. 10 Load impedance (series components).

Conditions for Figs 9 and 10:

V_{CE} = 12.5 V; P_L = 2 W; f = 800 - 960 MHz; T_{mb} = 25 °C; class-B operation; typical values.

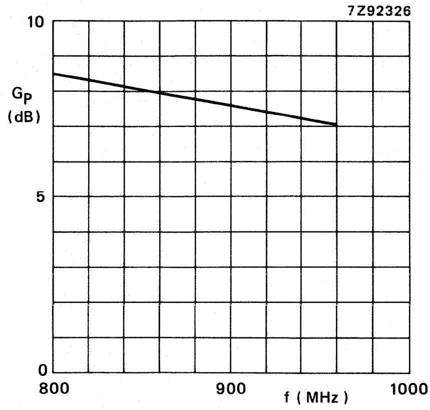


Fig. 11 Power gain as a function of frequency.

V_{CE} = 12.5 V; P_L = 2 W; f = 800 - 960 MHz; T_{mb} = 25 ^oC; 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 ^oC 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.

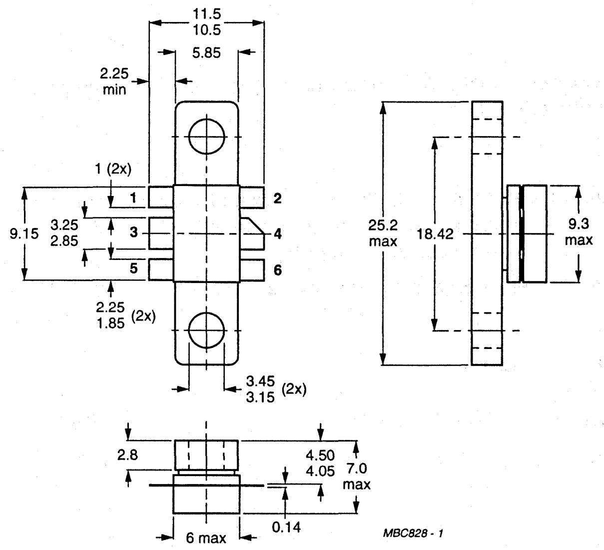
MECHANICAL DATA

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

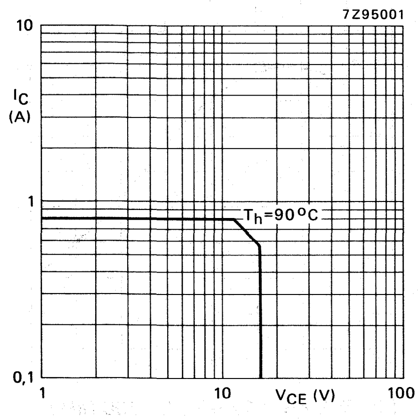


Fig. 2 D.C. SOAR.

$R_{th\ mb\text{-}h}$ = 0,4 K/W.

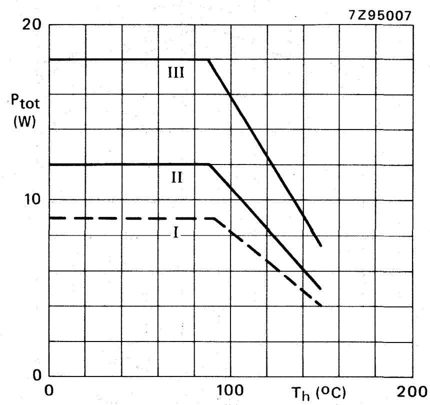


Fig. 3 Power/temperature derating curves.

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

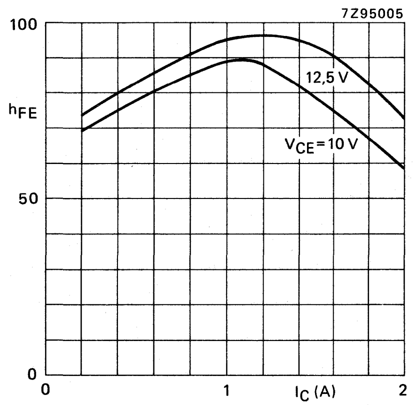


Fig. 4 T_j = 25 °C; typical values.

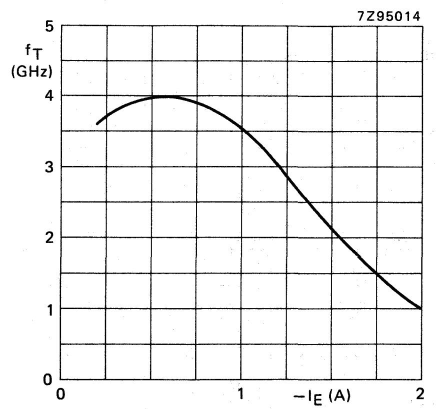


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

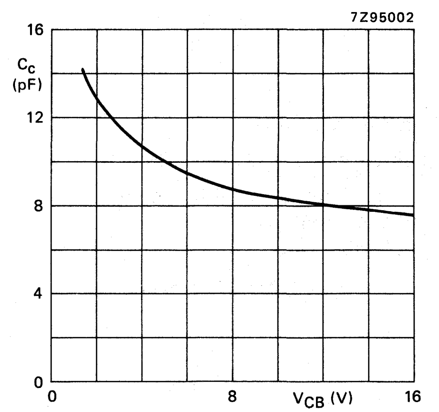


Fig. 6 $I_E = i_e$ = 0; f = 1 MHz; typical values.

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

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

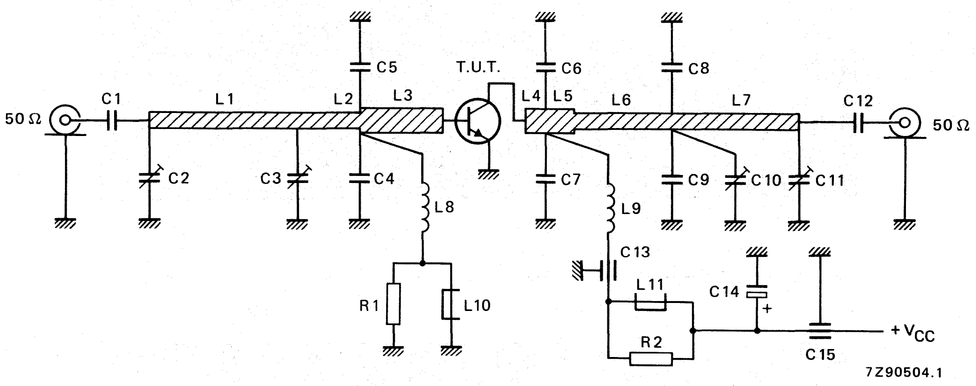


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

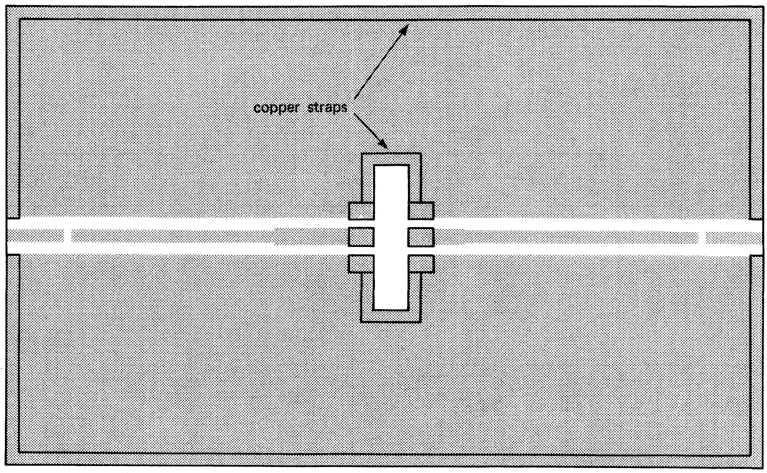
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 3,9 pF multilayer ceramic chip capacitor*
C6 = C7 = C8 = C9 = 6,2 pF multilayer ceramic chip capacitor*
C13 = 10 pF ceramic feed-through capacitor
C14 = 6,8 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.



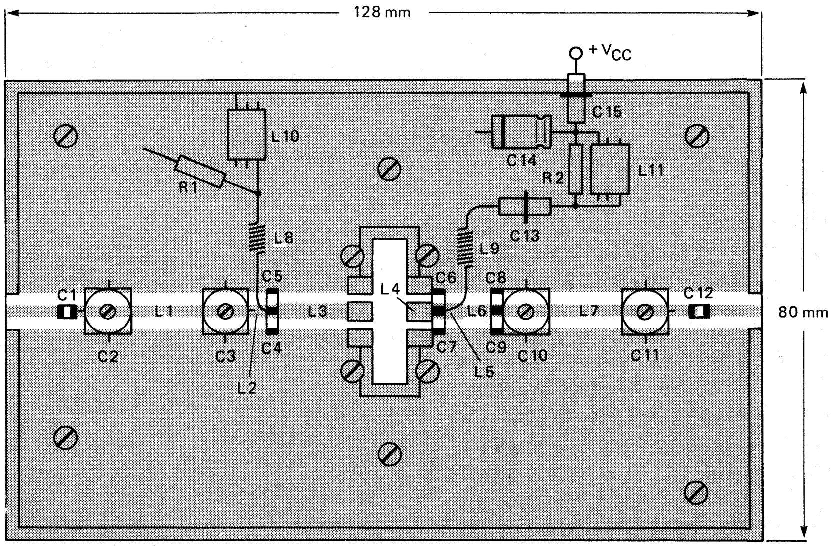


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

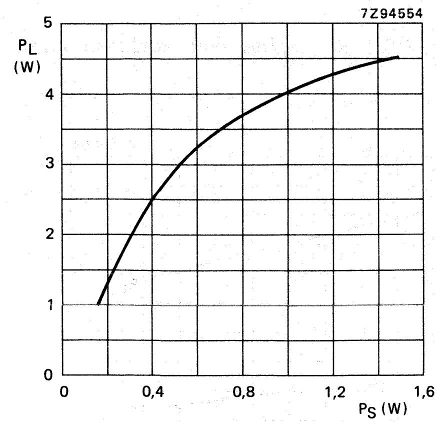


Fig. 9 Load power vs. source power.

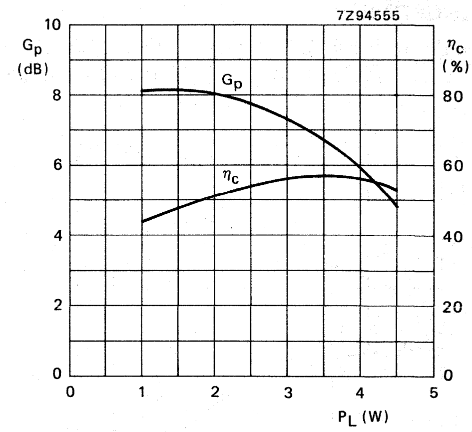


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C; class-B operation; typical values.

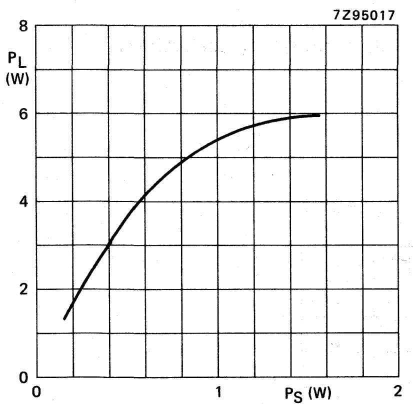


Fig. 11 Load power vs. source power.

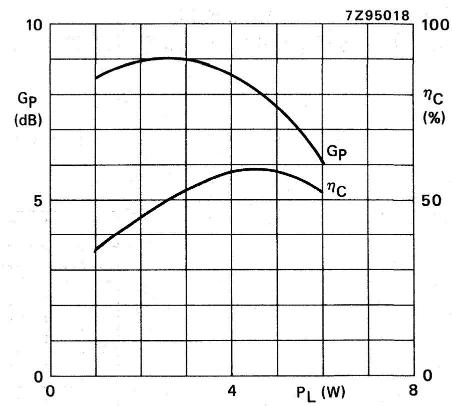


Fig. 12 Power gain and efficiency vs. load power.

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.

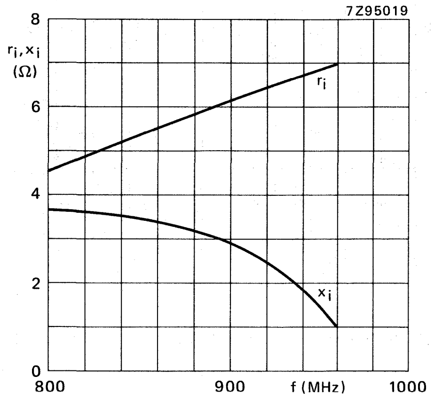


Fig. 13 Input impedance (series components).

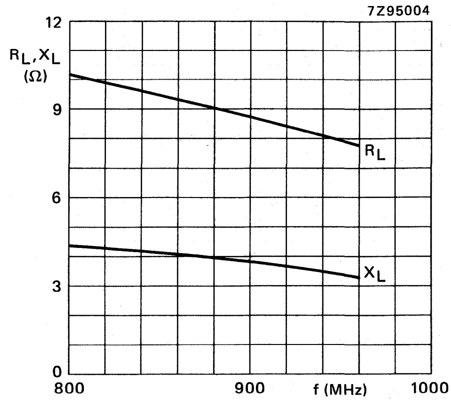


Fig. 14 Load impedance (series components).

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.

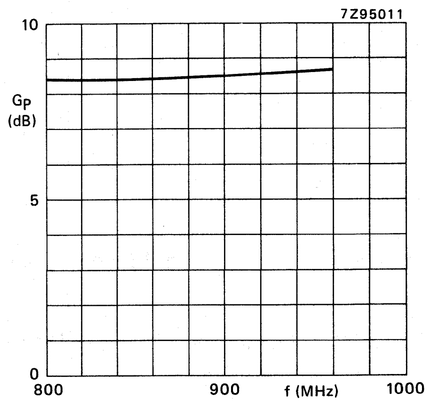


Fig. 15 Power gain vs. frequency.

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 9,6	900 900	8 6	> 6,5 typ. 6,0	> 50 typ. 59

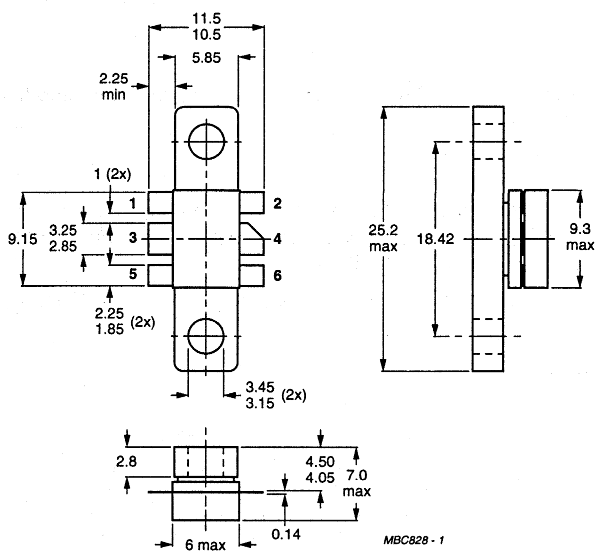
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the BeO disc is not damaged.

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

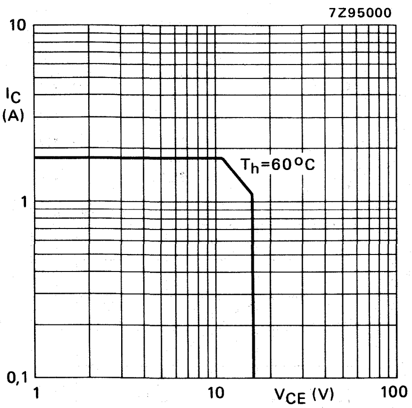


Fig. 2 D.C.-SOAR.

$R_{th\ mb-h}$ = 0,4 K/W

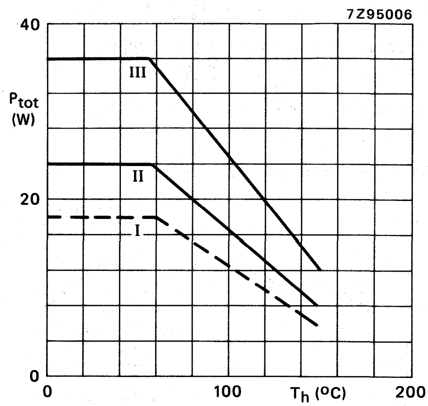


Fig. 3 Power/temperature derating curves.

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

THERMAL RESISTANCE

Dissipation = 12 W; T_{mb} = 112 °C

From junction to mounting base (d.c. dissipation)	$R_{th\ j-mb(dc)}$	max.	7,0	K/W
(r.f. dissipation)	$R_{th\ j-mb\ (rf)}$	max.	5,2	K/W
From mounting base to heatsink	$R_{th\ mb-h}$	max.	0,4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage open emitter; I_C = 20 mA	$V_{(BR)CBO}$	>	36 V
Collector-emitter breakdown voltage open base; I_C = 40 mA	$V_{(BR)CEO}$	>	16 V
Emitter-base breakdown voltage open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	3 V
Collector cut-off current V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	10 mA
Second breakdown energy L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	2 mJ
D.C. current gain I_C = 1,2 A; V_{CE} = 10 V	h_{FE}	>	25
Transition frequency at f = 500 MHz* $-I_E$ = 1,2 A; V_{CE} = 12,5 V	f_T	typ.	4 GHz
Collector capacitance at f = 1 MHz $I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	15 pF
Feed-back capacitance at f = 1 MHz I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	9 pF
Collector-flange capacitance	C_{cf}	typ.	2 pF

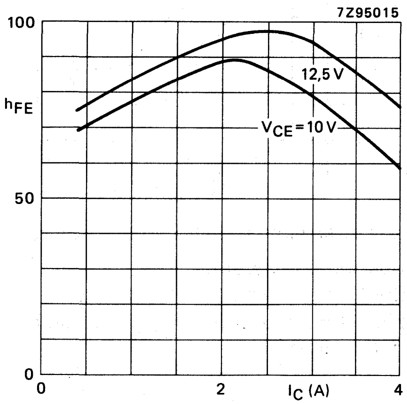


Fig. 4 T_j = 25 °C; typical values.

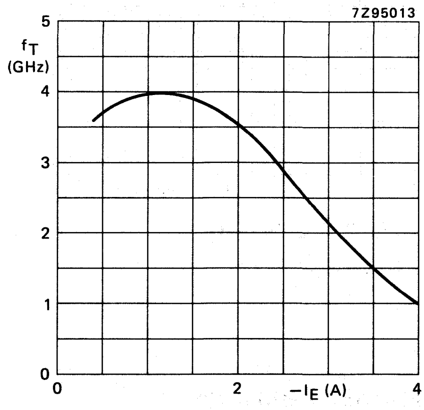


Fig. 5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

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

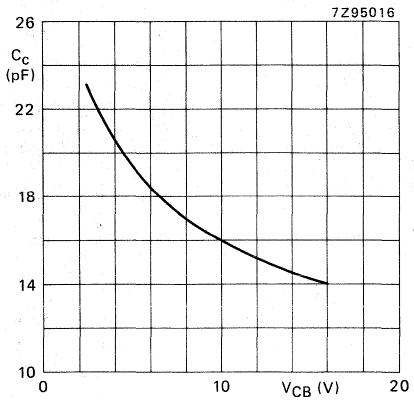


Fig. 6 $I_E = i_e = 0$; f = 1 MHz; typical values.

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

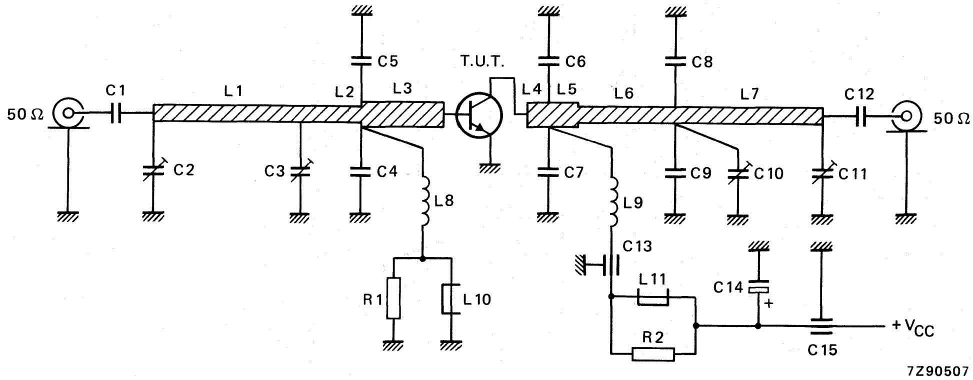


Fig. 7 Class-B test circuit at f = 900 MHz.

List of components:

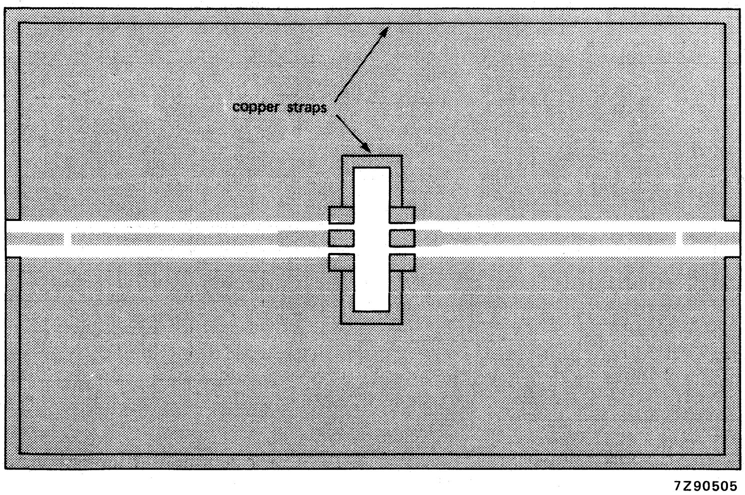
C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer
(cat. no. 2222 809 09001)
C4 = C5 = 4,7 pF multilayer ceramic chip capacitor*
C6 = C7 = 5,6 pF multilayer ceramic chip capacitor*
C8 = C9 = 3,3 pF multilayer ceramic chip capacitor*
C13 = 10 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.



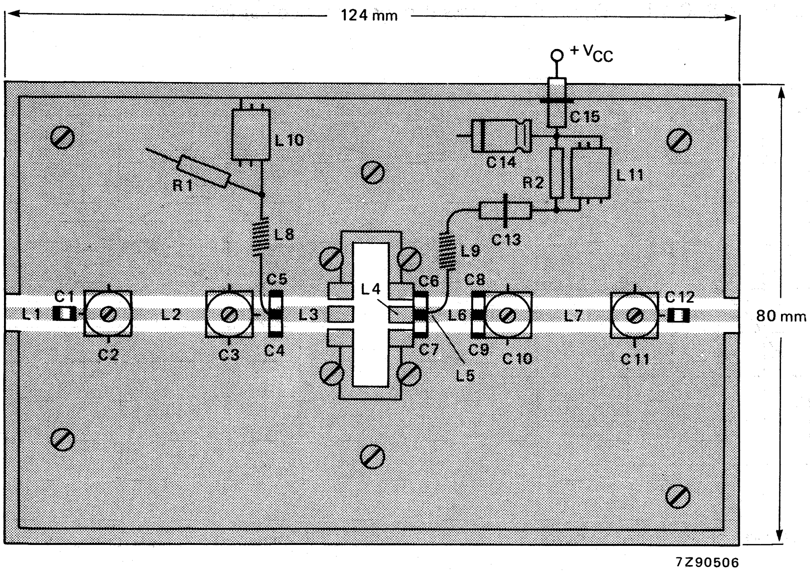


Fig. 8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

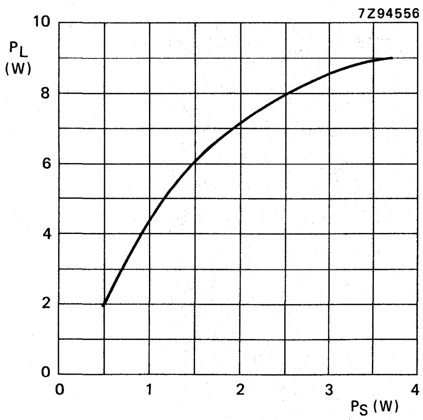


Fig. 9 Load power vs. source power.

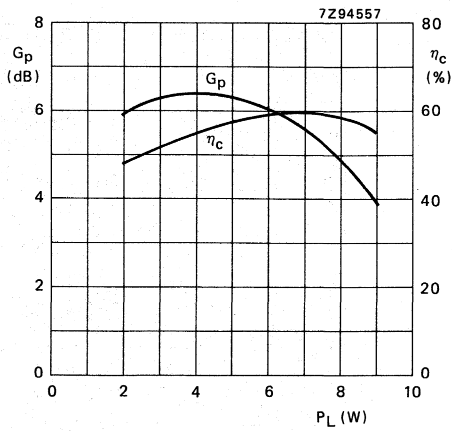


Fig. 10 Power gain and efficiency vs. load power.

Conditions for Figs 9 and 10:
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 ^{o}C; class-B operation; typical values.

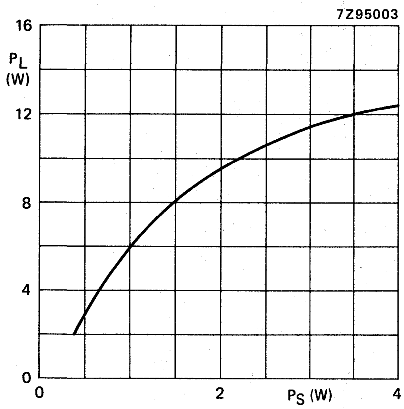


Fig. 11 Load power vs. source power.

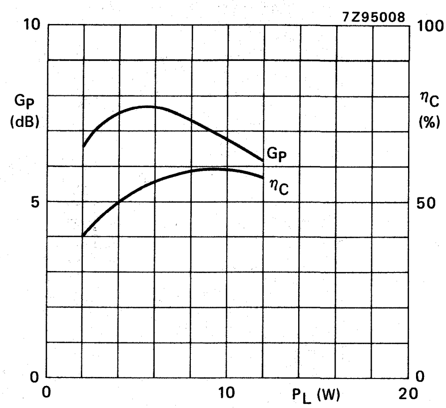


Fig. 12 Power gain and efficiency vs. load power.

Conditions for Figs 11 and 12:
V_{CE} = 12,5 V; f = 900 MHz; T_h = 25 ^{o}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.

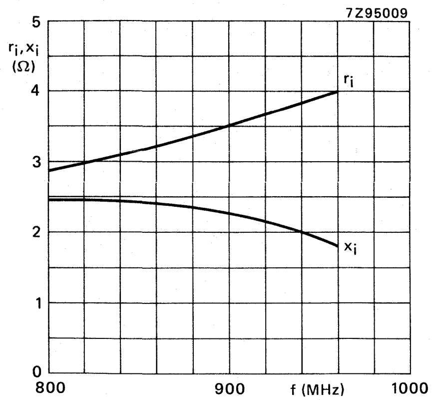


Fig. 13 Input impedance (series components).

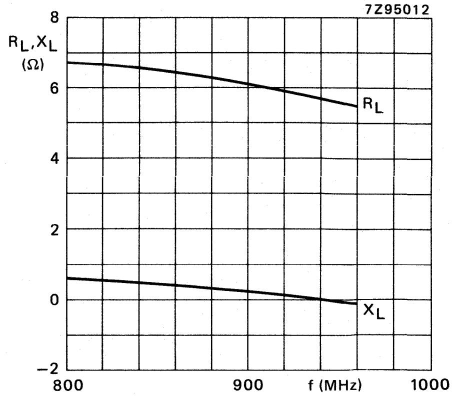


Fig. 14 Load impedance (series components).

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.

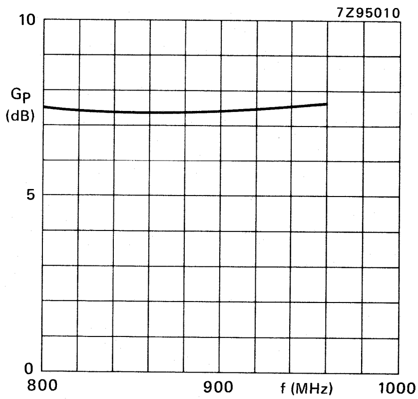


Fig. 15 Power gain vs. frequency.

V_{CE} = 12,5 V; P_L = 8 W; f = 800–960 MHz; T_h = 25 °C; class-B operation; typical values.

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.

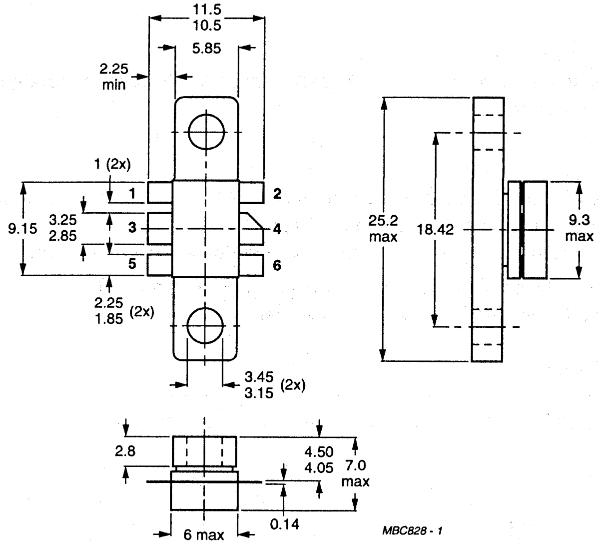
MECHANICAL DATA

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

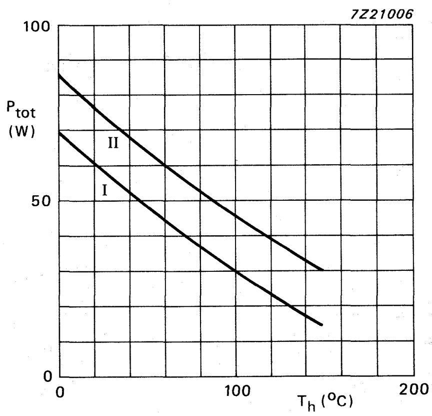


Fig. 2 Power/temperature derating curves.

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

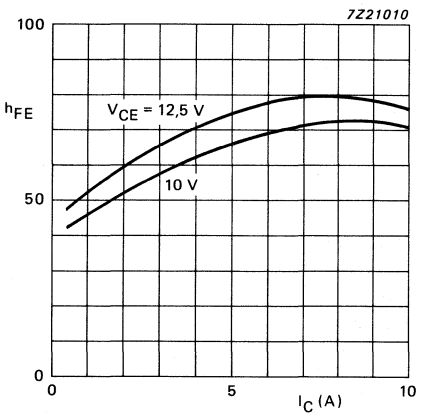


Fig. 3 D.C. current gain versus collector current; T_h = 25 °C. Typical values.

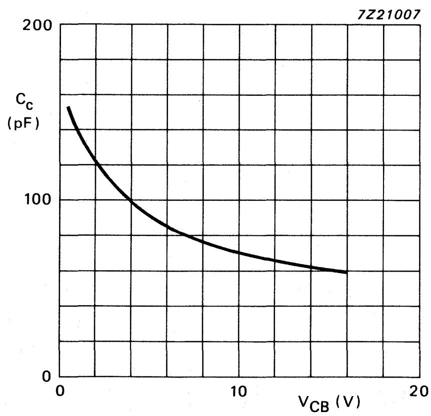


Fig. 4 Output capacitance versus V_{CB}; $I_E = i_e$ = 0; typical values.

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

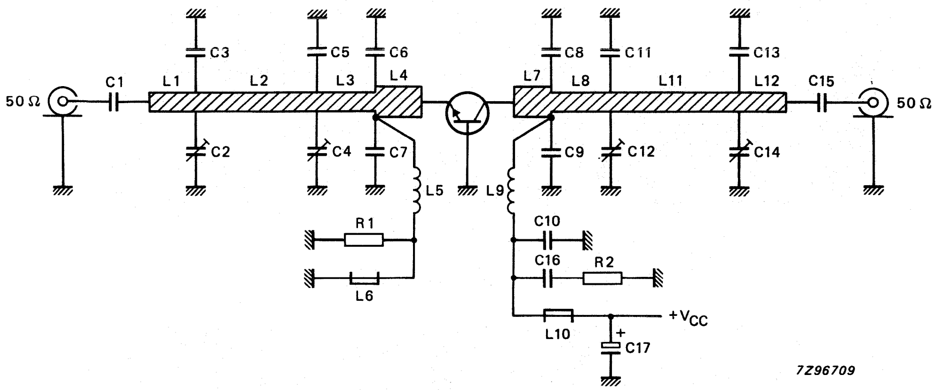


Fig. 5 Class-B test circuit at f = 900 MHz.

List of components:

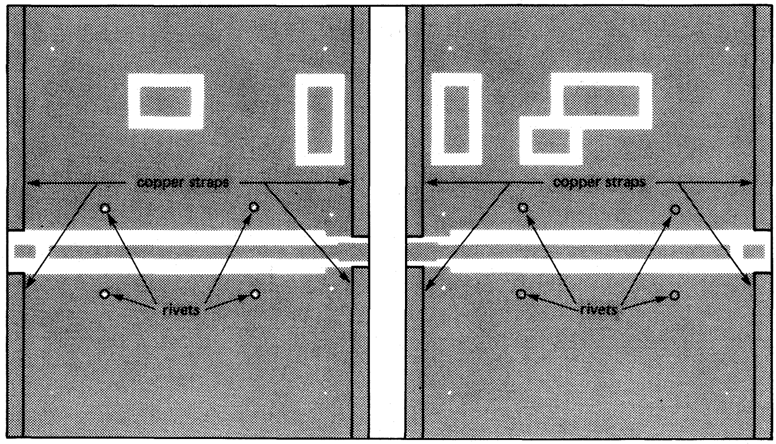
C1 = C15 = 47 pF multilayer ceramic chip capacitor*
C2 = C4 = C12 = C14 = 1,4 - 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C3 = 3,3 pF multilayer ceramic chip capacitor*
C5 = C11 = C13 = 6,2 pF multilayer ceramic chip capacitor*
C6 = C7 = 6,2 pF multilayer ceramic chip capacitor**
C8 = 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.



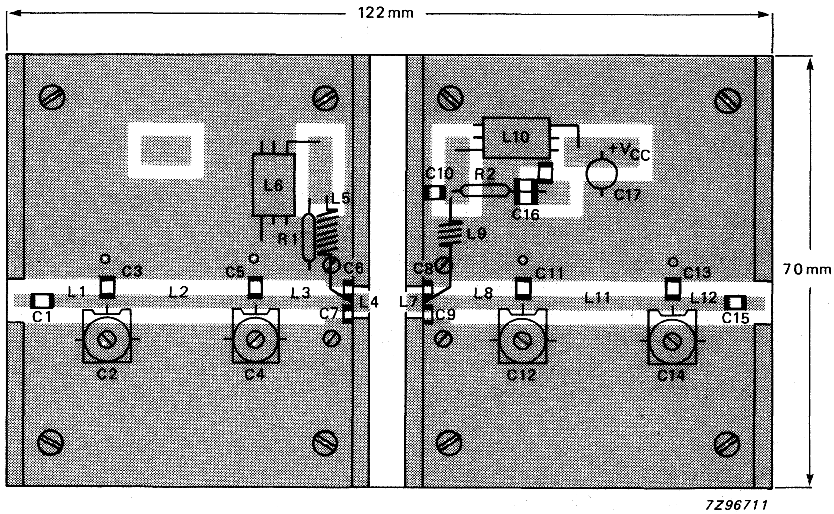


Fig. 6 Printed circuit board and component lay-out for 900 MHz class-B test circuit.

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.

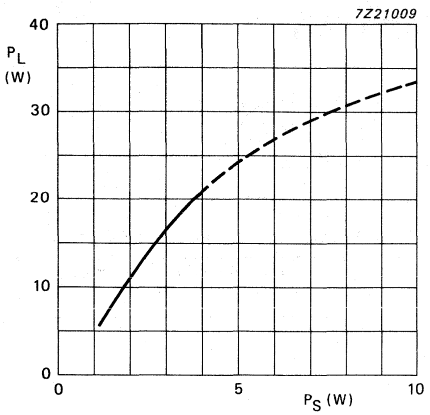


Fig. 7 Load power versus source power.

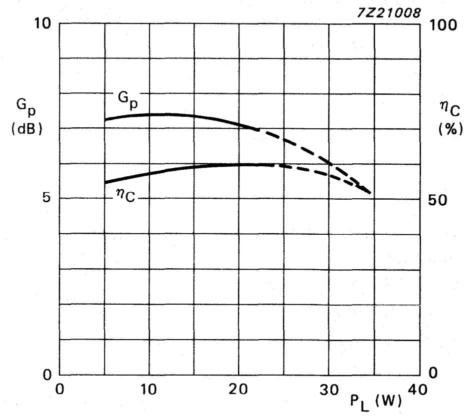


Fig. 8 Power gain and efficiency versus load power.

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

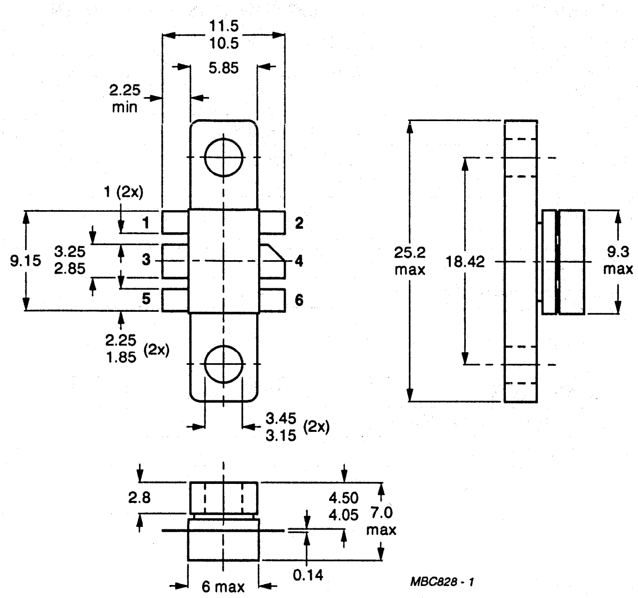
SOT171 - see Fig.1.

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

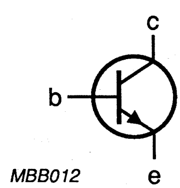


Fig.2 Pin configuration.

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
$R_{thj\text{-}mb}$	from junction to mounting base (RF)		–	2.3	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		–	0.4	K/W

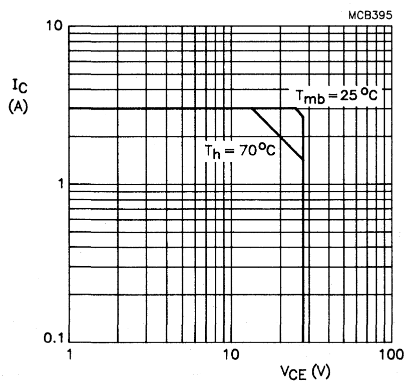


Fig.3 DC SOAR.

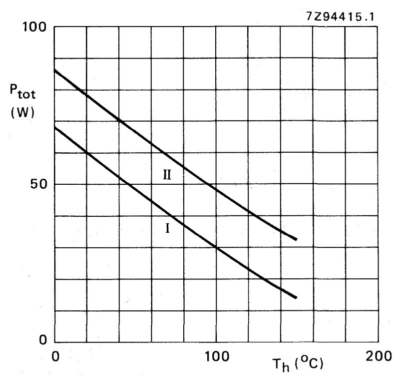


Fig.4 Power/temperature derating;
(I): DC or RF operation;
(II): short-term operation during mismatch.

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

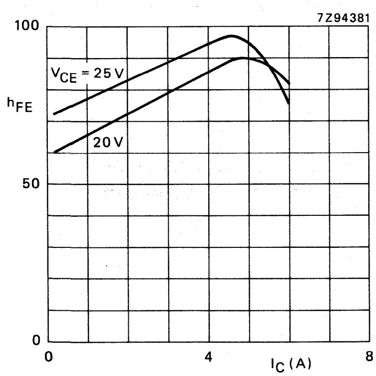


Fig.5 DC current gain as a function of collector current; typical values.

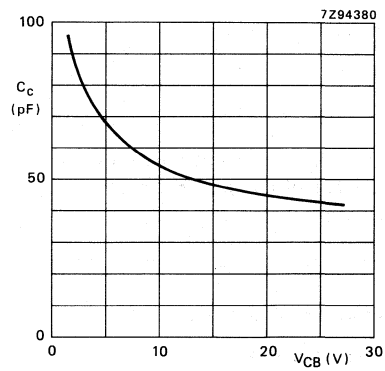


Fig.6 Output capacitance as a function of collector-base voltage; typical values.

APPLICATION INFORMATION

RF performance in a common emitter test circuit.
T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 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

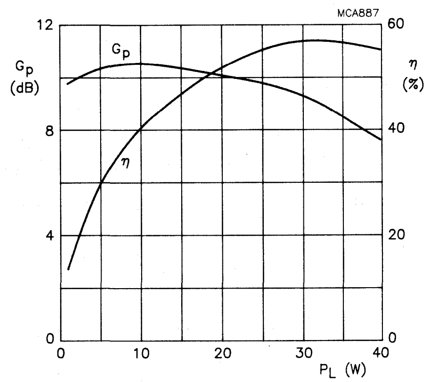


Fig.7 Power gain and efficiency as a function of load power; typical values.

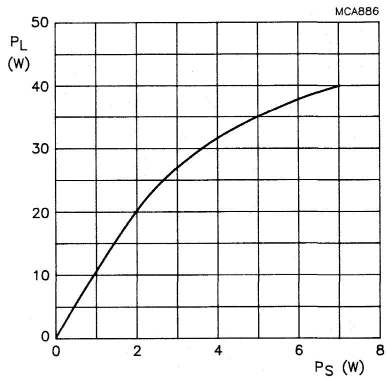


Fig.8 Load power as a function of input power; typical values.

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)

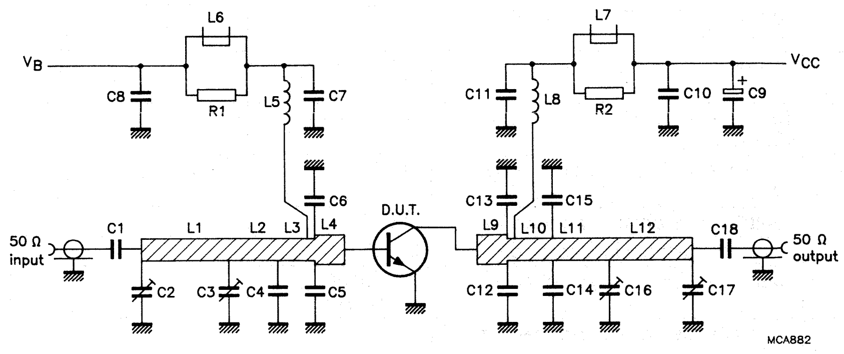


Fig.9 Test circuit BLV97CE class-AB.

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)

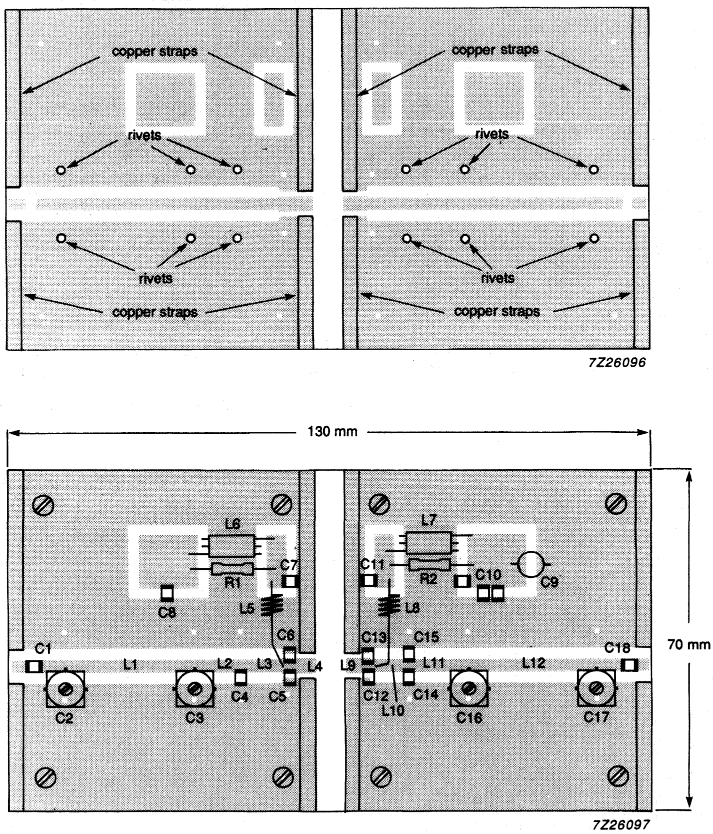


Fig.10 Printed circuit board and component layout for 960 MHz test circuit.

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)

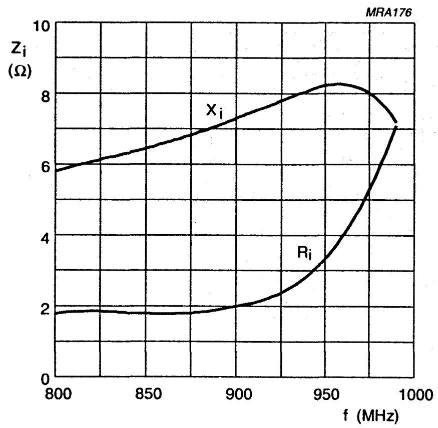


Fig.11 Input impedance; series components; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

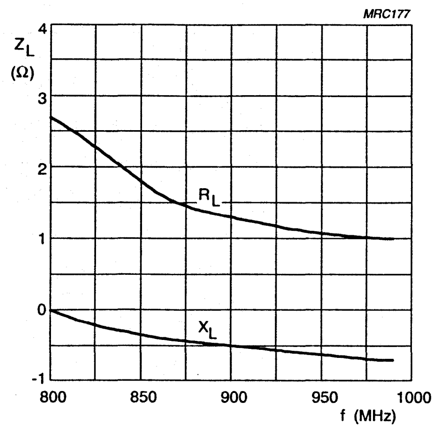


Fig.12 Load impedance; series components; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

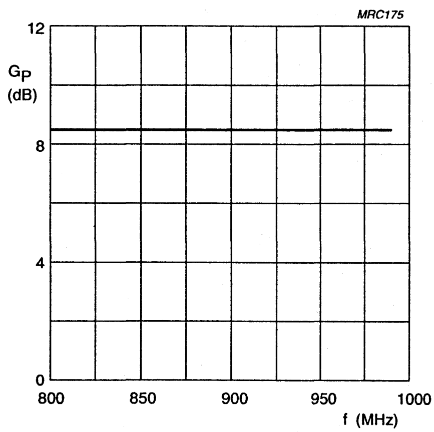


Fig.13 Power gain; class-AB operation; V_{CE} = 24 V; P_L = 35 W; $R_{th\ mb\text{-}h}$ = 0.4 K/W; typical values.

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

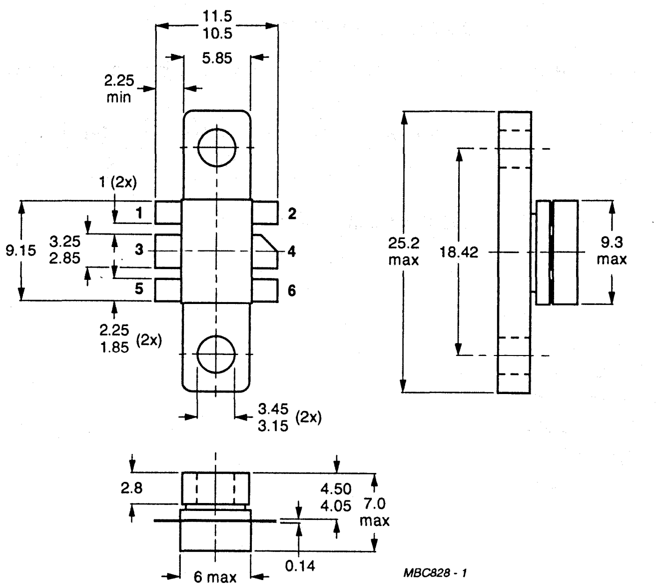
SOT171 - see Fig.1.

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.**

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

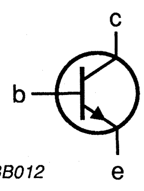


Fig.2 Pin configuration.

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
$R_{th j-mb}$	from junction to mounting base (RF)		–	4.4	K/W
$R_{th\ mb-h}$	from mounting base to heatsink		–	0.4	K/W

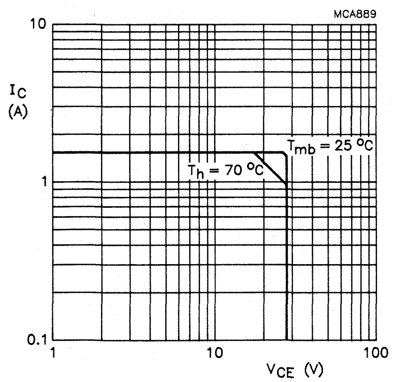


Fig.3 DC SOAR.

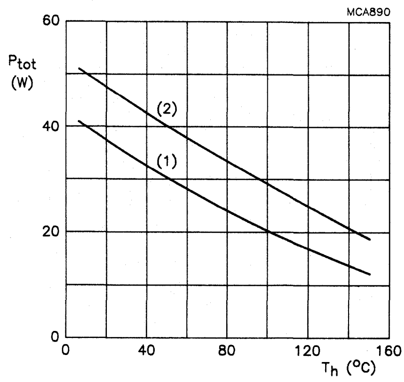


Fig.4 Power/temperature derating;
I: DC or RF operation;
II: short-term operation during mismatch.

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

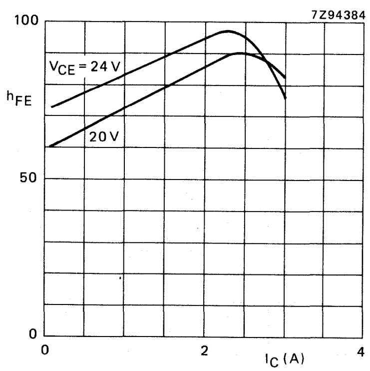


Fig.5 DC current gain as a function of collector current; typical values.

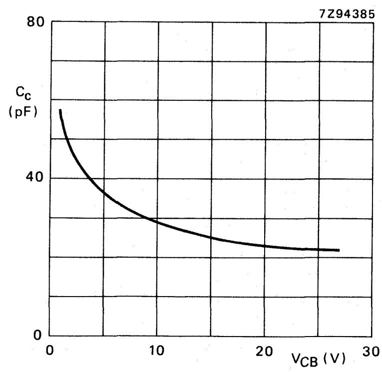


Fig.6 Output capacitance as a function of V_{CB}; typical values.

APPLICATION INFORMATION

RF performance in a common emitter test circuit.
T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 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

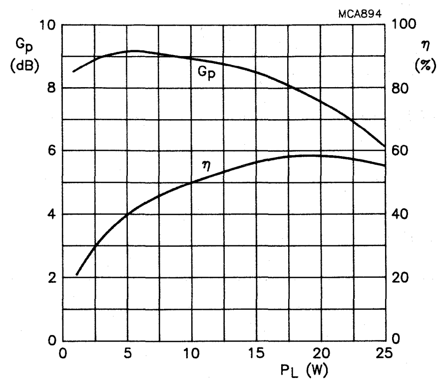


Fig.7 Power gain and efficiency as a function of load power; typical values.

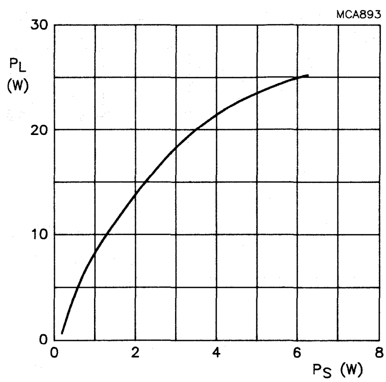


Fig.8 Load power as a function of input power; typical values.

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)

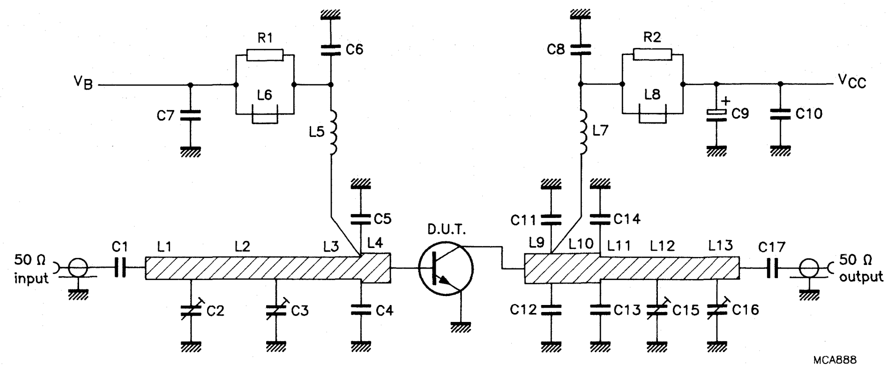


Fig.9 Test circuit BLV98CE class-AB.

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)

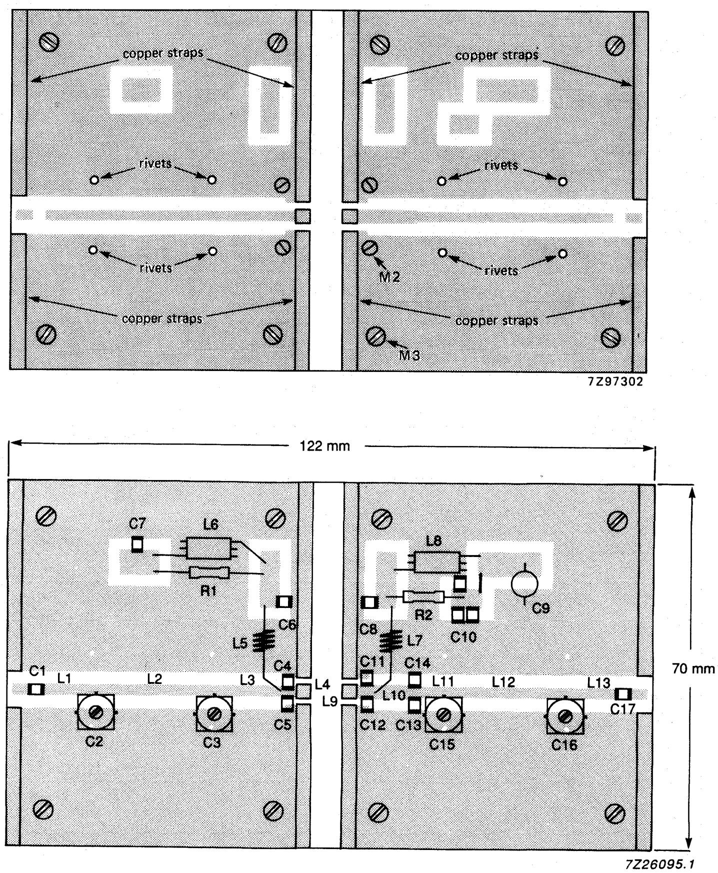


Fig.10 Printed circuit board and component layout for 960 MHz test circuit.

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)

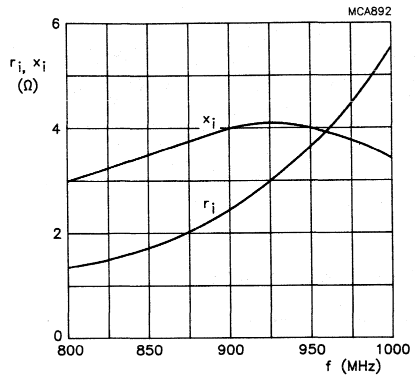


Fig.11 Input impedance; series components; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb-h}$ = 0.4 K/W; typical values.

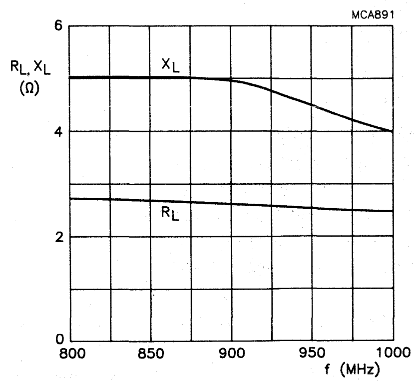


Fig.12 Load impedance; series components; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb-h}$ = 0.4 K/W; typical values.

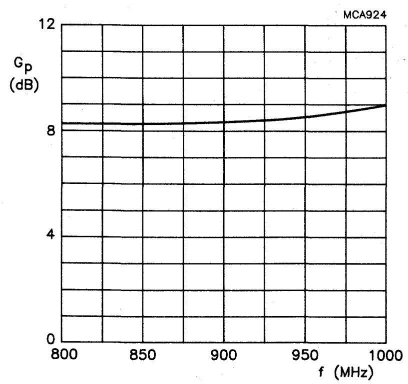


Fig.13 Power gain; class-AB operation; V_{CE} = 24 V; P_L = 15 W; $R_{th\ mb-h}$ = 0.4 K/W; typical values.

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

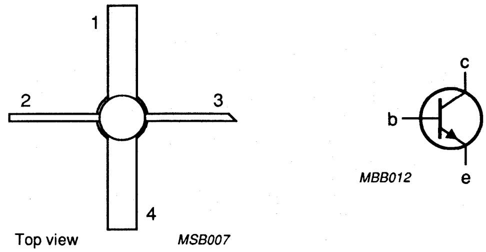


Fig.1 Simplified outline and symbol.

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

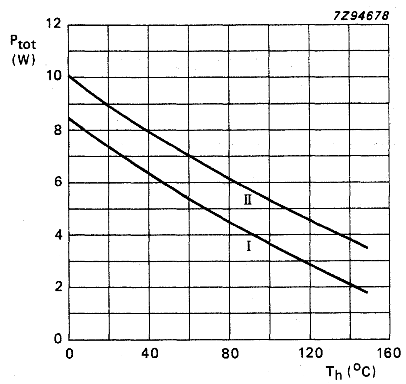
RF performance at T_{mb} = 25 °C in a common emitter class-B test circuit.

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.

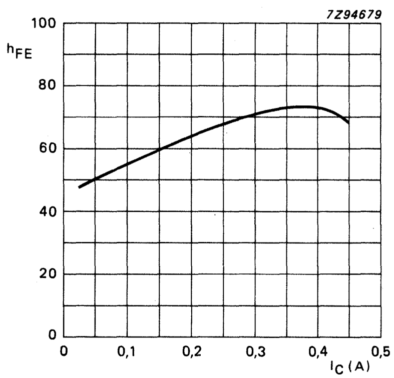
THERMAL RESISTANCE

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

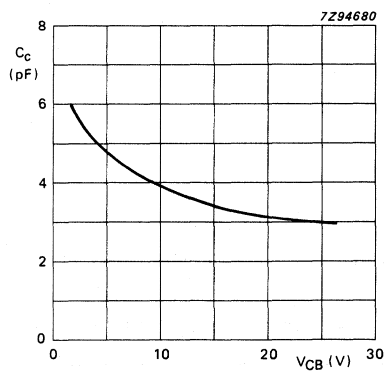
T_j = 25 °C.

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.



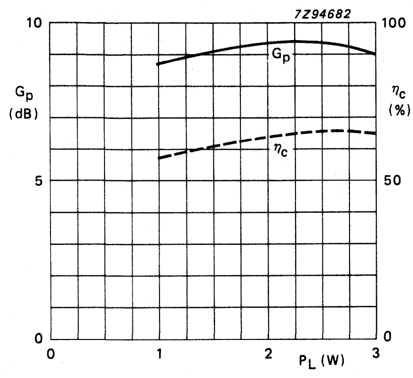
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

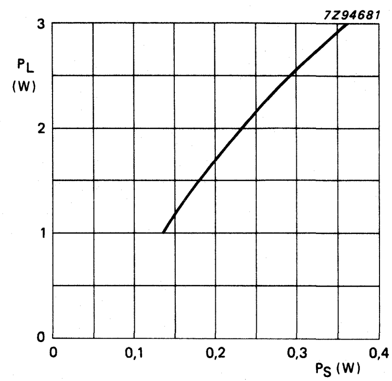
RF performance at T_{mb} = 25 °C in a common emitter class-B test circuit.

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.

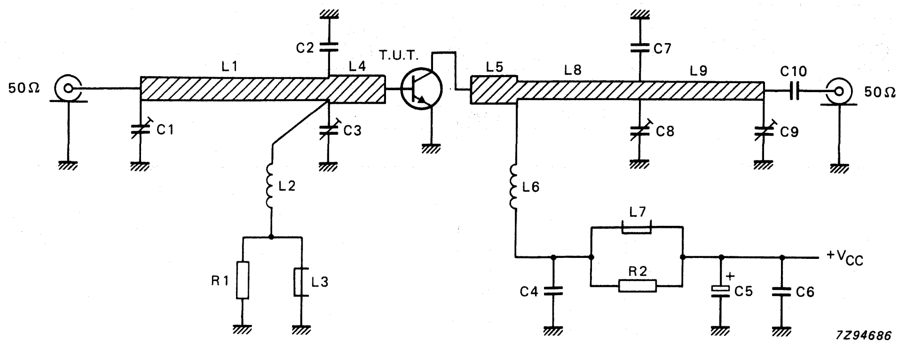


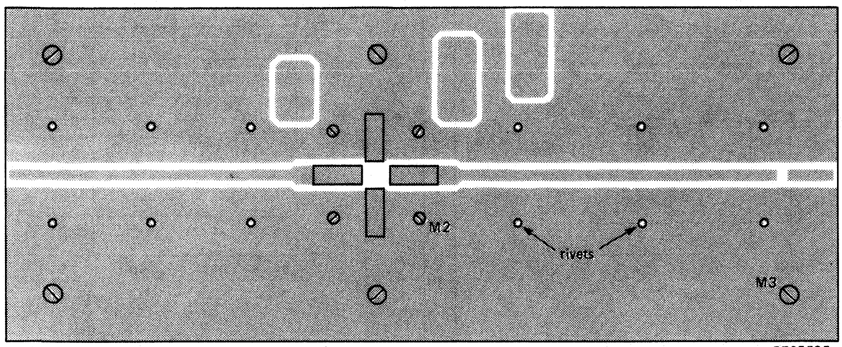
Fig.7 Class-B test circuit at f = 900 MHz.

List of components (see test circuit)

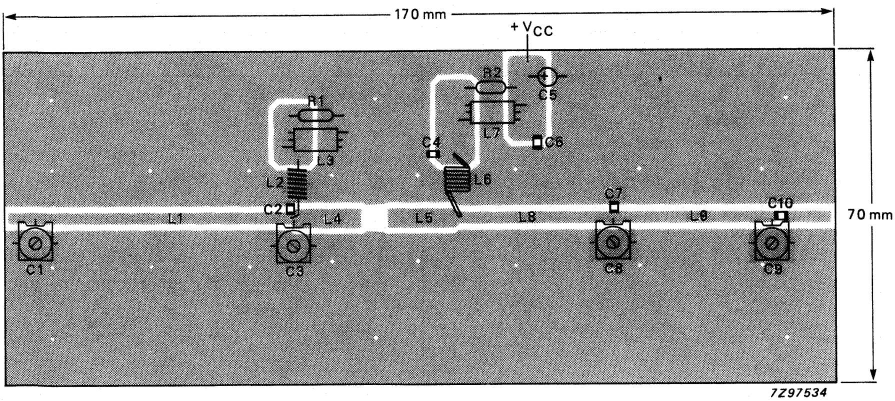
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C8, C9	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C2	multilayer ceramic chip capacitor (note 1)	4.7 pF		
C4, C6, C10	multilayer ceramic chip capacitor	220 pF		
C5	63 V electrolytic capacitor	1 µF		
C7	multilayer ceramic chip capacitor (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.



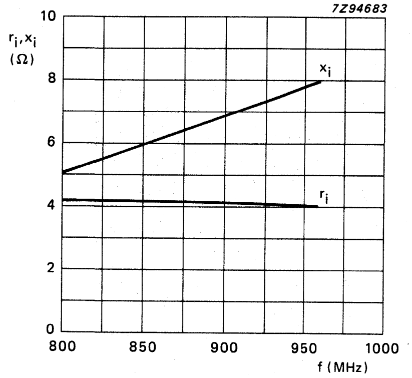
7Z97535



7Z97534

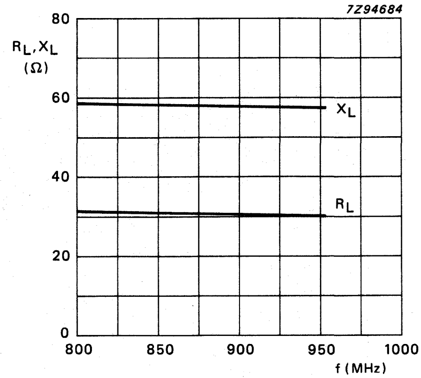
The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws, hollow rivets and copper straps under the emitters.

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



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.

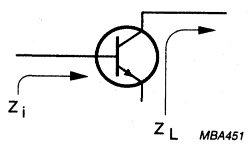
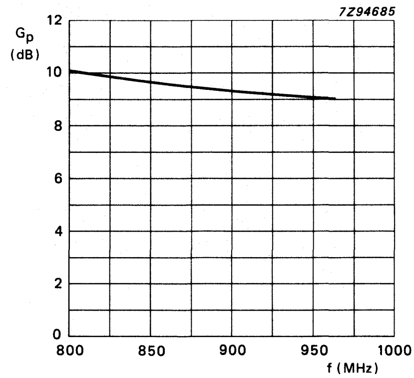


Fig.11 Definition of transistor impedance.



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.

PIN CONFIGURATION

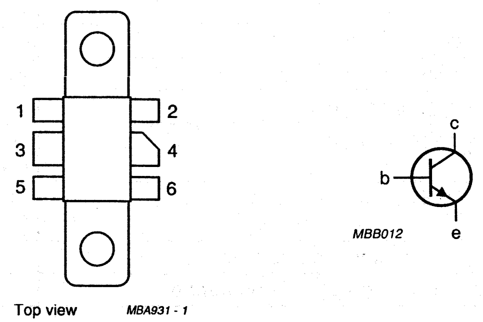


Fig.1 Simplified outline and symbol.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	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

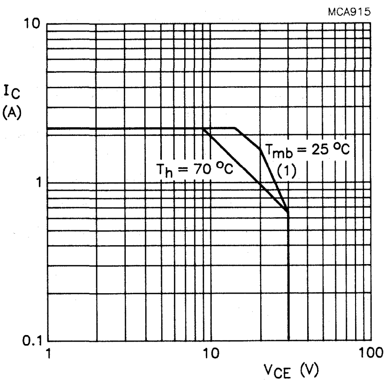
RF performance up to T_h = 25 °C in a common emitter class-AB test circuit.

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

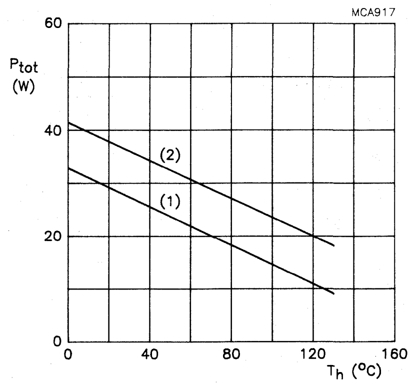
In accordance with the Absolute Maximum System (IEC 134).

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

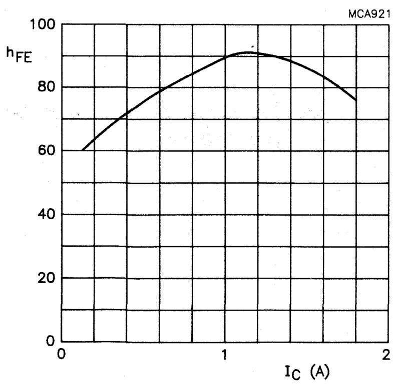
Dissipation = 31 W; $T_{mb} = 25$ °C.

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
$C_{c\text{-}f}$	collector-flange capacitance		–	2	–	pF



V_{CE} = 25 V.

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

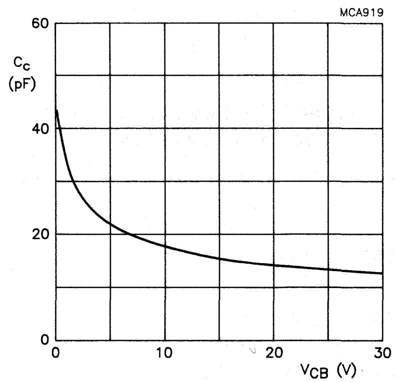


Fig.5 Output capacitance as a function of collector-base voltage, typical values.

APPLICATION INFORMATION

RF performance in a class-AB circuit; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 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

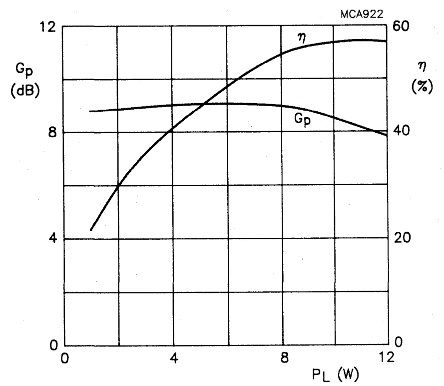


Fig.6 Gain and efficiency as functions of load power, typical values.

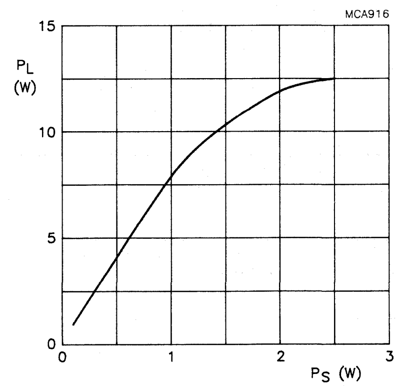


Fig.7 Load power as a function of drive power, typical values.

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.

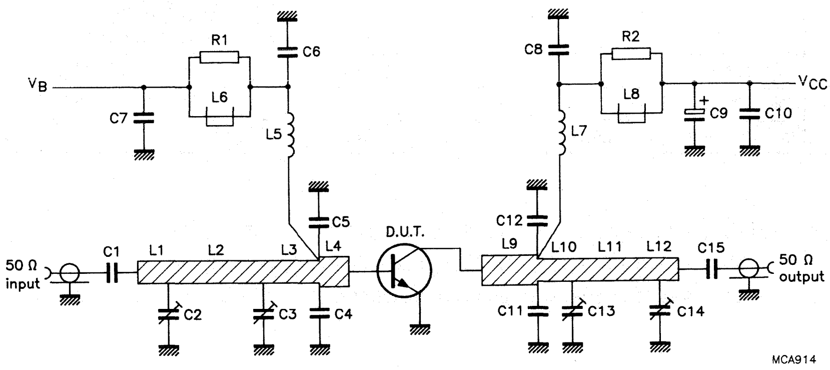


Fig.8 Class-AB test circuit at f = 960 MHz.

List of components (see test circuit)

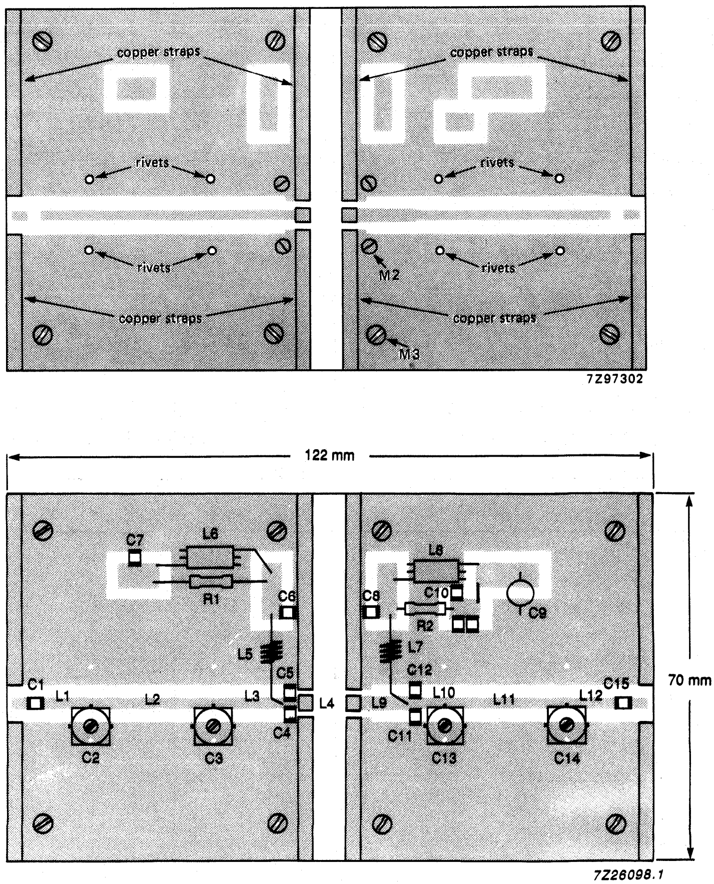
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C6, C7, C8, C15	multilayer ceramic chip capacitor	330 pF		
C2, C3, C13, C14	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor (note 1)	5.1 pF		
C9	35 V solid aluminium capacitor	2.2 μF		2222 128 50228
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

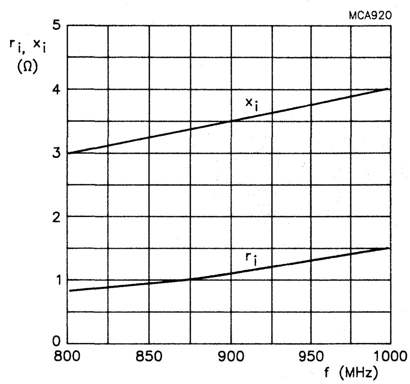
Notes

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 (ε_r = 2.2), thickness $\frac{1}{32}$ inch.



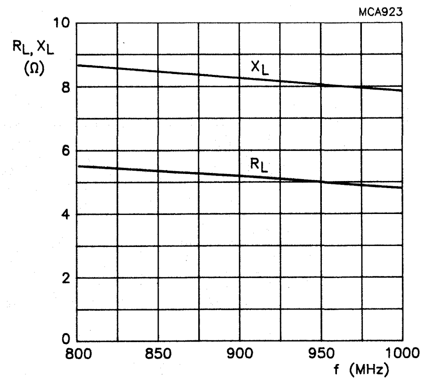
The circuit and components are situated on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by means of fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact between 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.

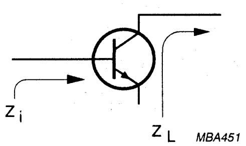
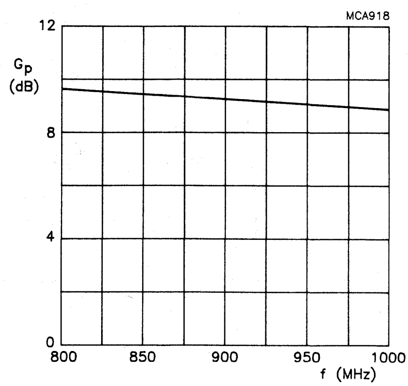


Fig.12 Definition of transistor impedance.



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

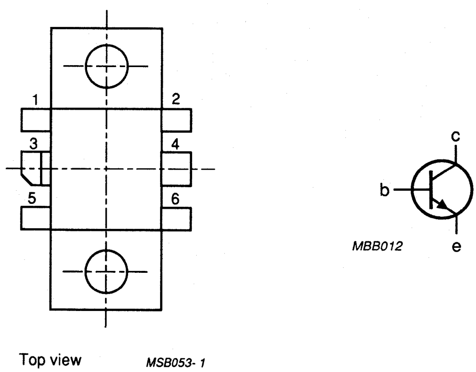


Fig.1 Simplified outline and symbol.

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

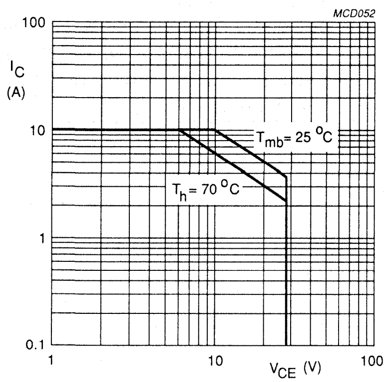
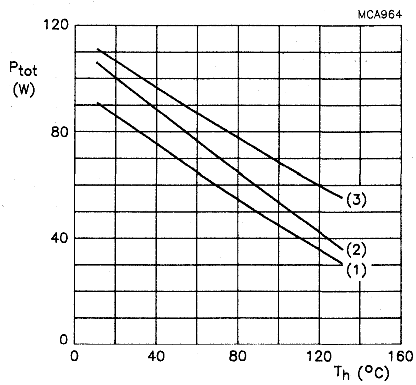


Fig.2 DC SOAR.



(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.

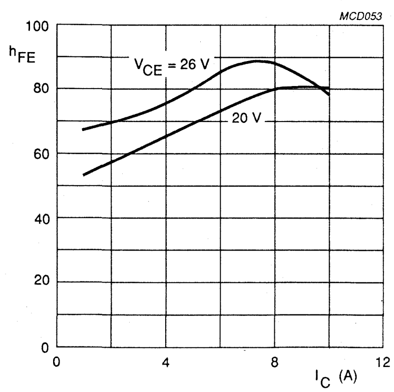


Fig.4 DC current gain as a function of collector current; typical values.

APPLICATION INFORMATION

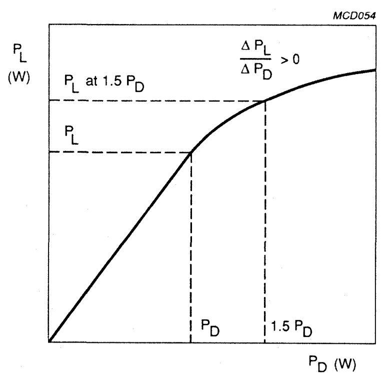
RF performance in a common emitter test circuit; T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W; mode of operation: c.w. class-AB.

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

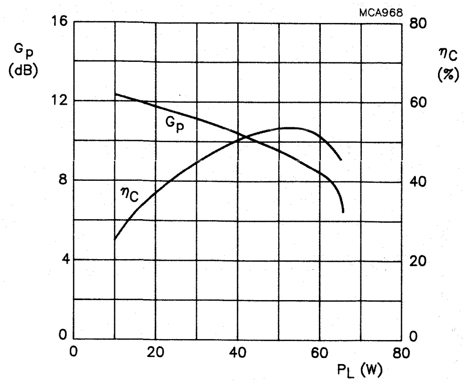
The BLV101A and 101B are capable of withstanding a load mismatch corresponding to VSWR = 5:1 through all phases under the following conditions:

V_{CE} = 26 V, f = 900 MHz (BLV101A), f = 960 MHz (BLV101B), at P_L = 50 W.



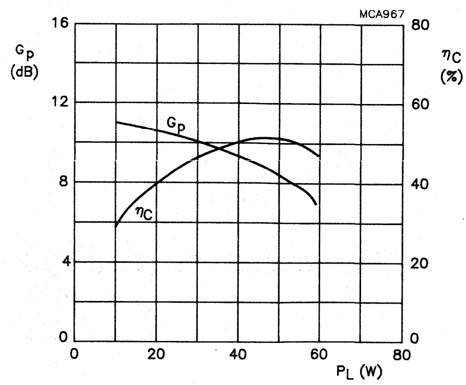
To guarantee the ratio $\frac{\Delta P_L}{\Delta P_D} > 0$, a 50% input overdrive is permitted for a load power ≤ 50 W.

Fig.5 Overdrive conditions.



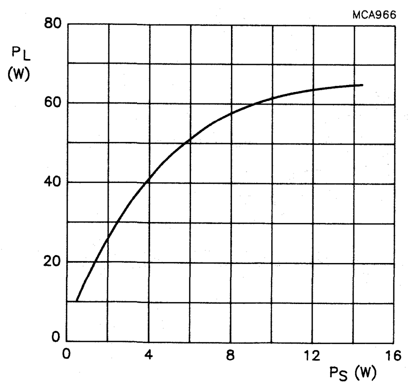
BLV101A; f = 900 MHz.

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



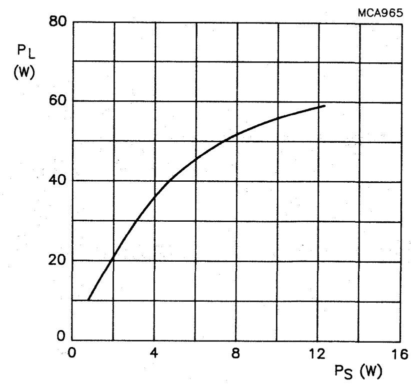
BLV101B; f = 960 MHz.

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.

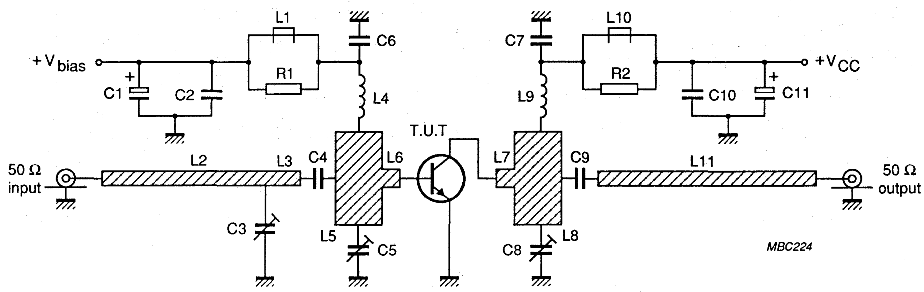


Fig.10 900 MHz test circuit BLV101A, class-AB.

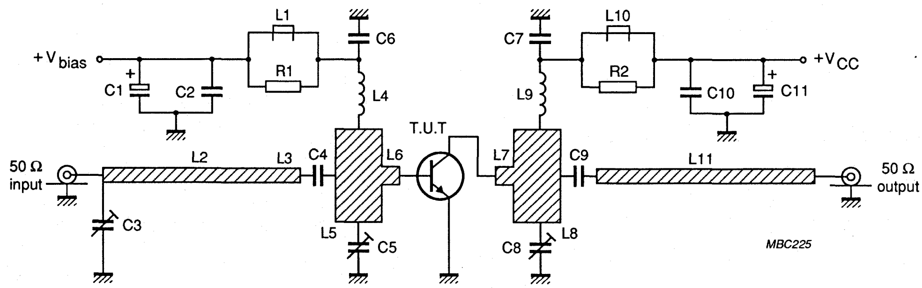


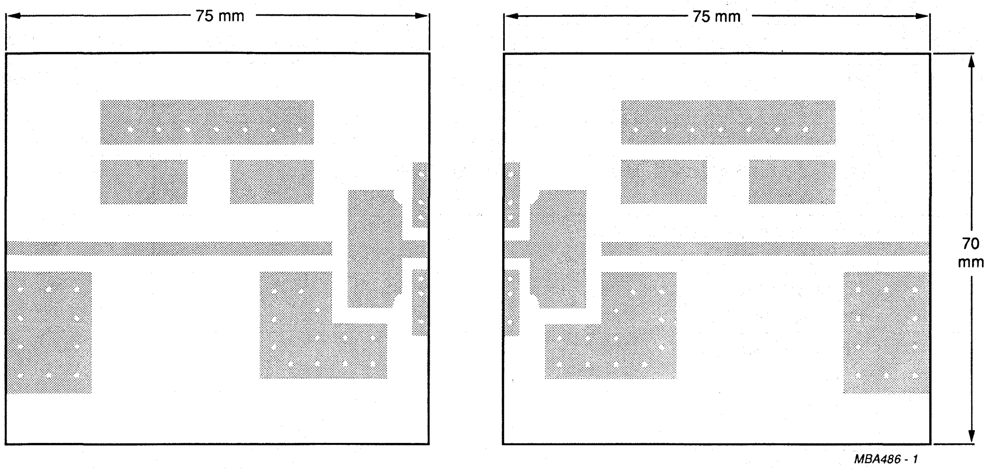
Fig.11 960 MHz test circuit BLV101B, class-AB.

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 ($\varepsilon_r = 2.2$); 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.

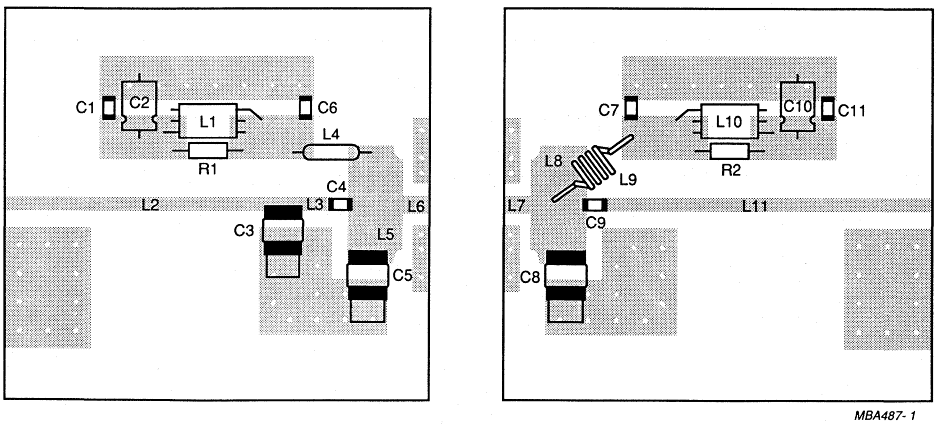


Fig.13 Component layout for 900 MHz test circuit, BLV101A.

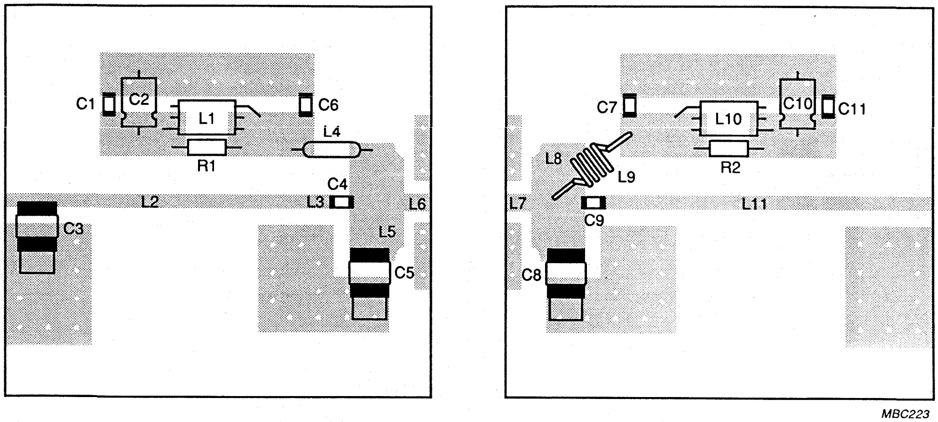
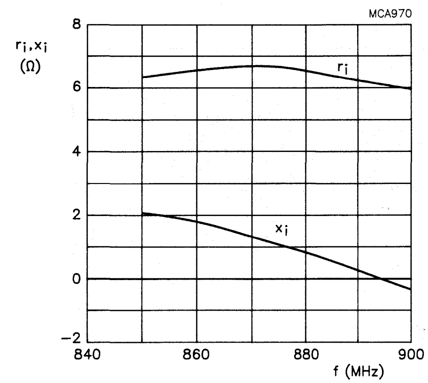


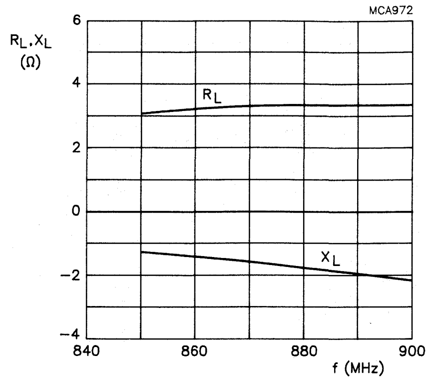
Fig.14 Component layout for 960 MHz test circuit, BLV101B.



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).

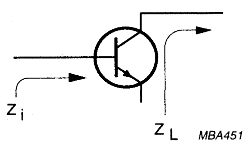
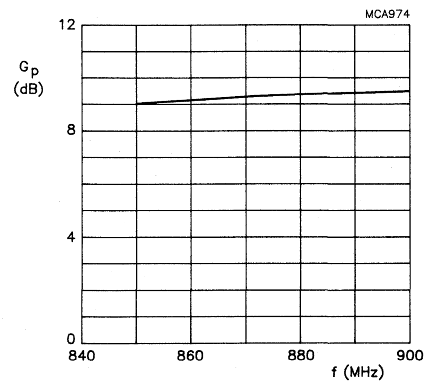


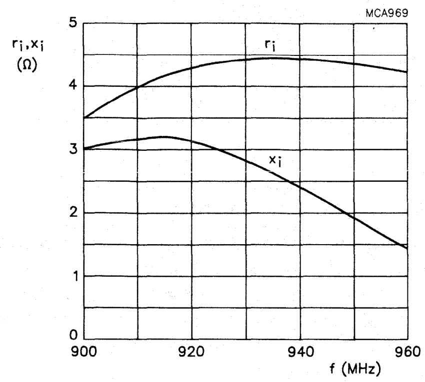
Fig.17 Definition of transistor impedance.



BLV101A

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

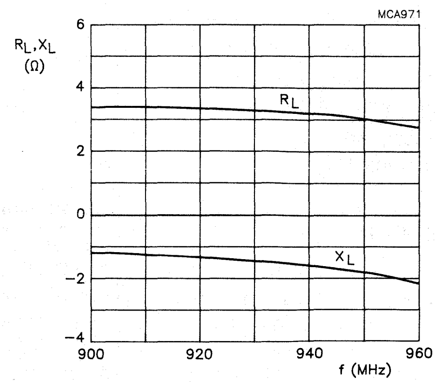
Fig.18 Power gain, class-AB operation.



BLV101B

V_{CE} = 26 V; P_L = 50 W; $I_{C(ZS)}$ = 200 mA; typical values.

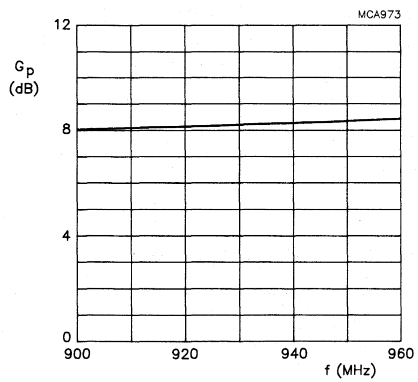
Fig.19 Input impedance (series components).



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.

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

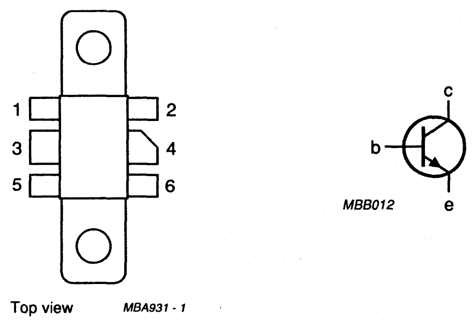
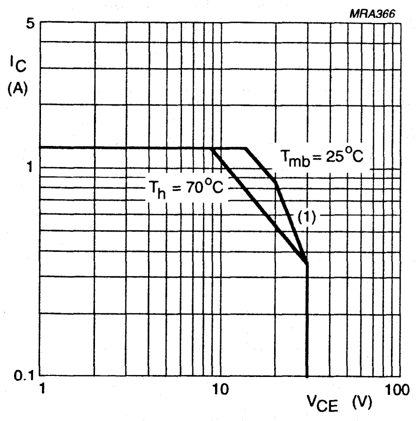


Fig.1 Simplified outline and symbol.

LIMITING VALUES

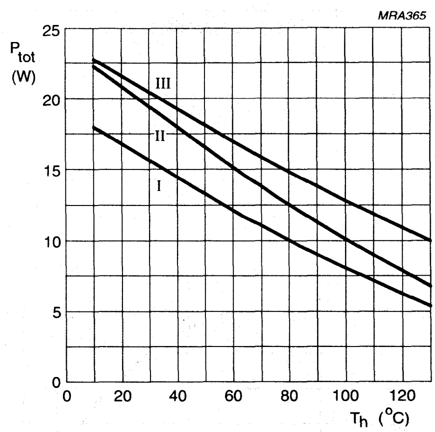
In accordance with the Absolute Maximum System (IEC 134).

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

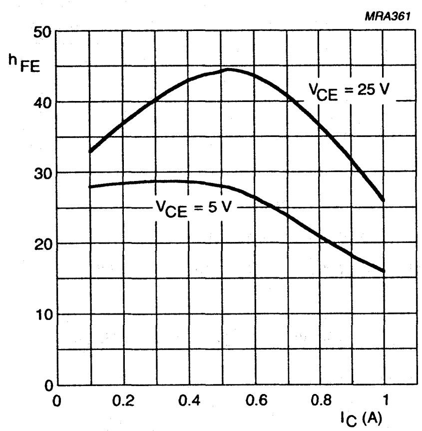
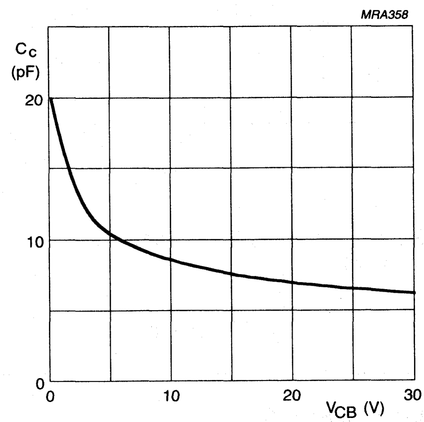


Fig.4 DC current gain as a function of collector current, typical values.



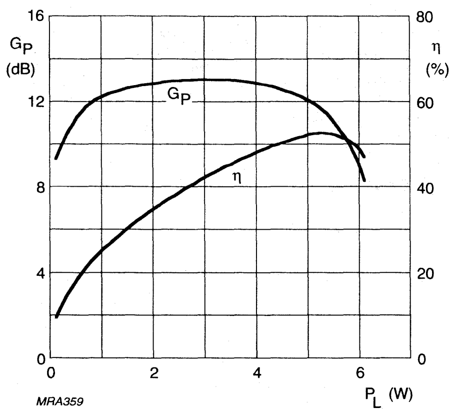
$I_E = i_e = 0$; f = 1 MHz.

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

APPLICATION INFORMATION

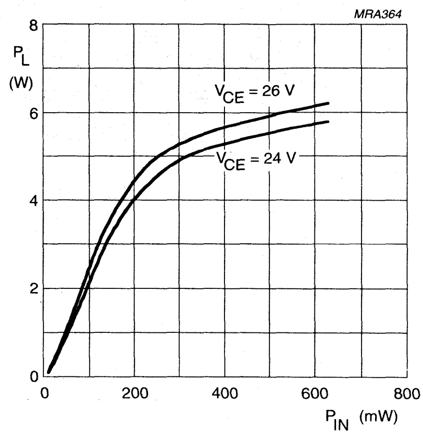
RF performance at T_h = 25 °C in a common emitter test circuit, $R_{th\ mb-h}$ = 0.4 K/W.

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; $R_{th\ mb-h}$ = 0.4 K/W.

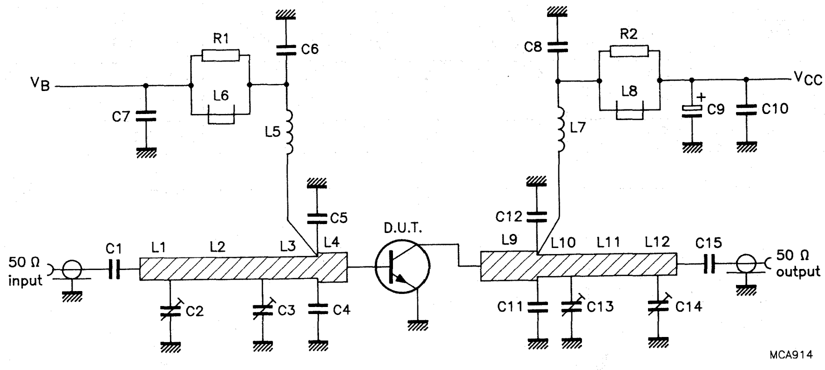


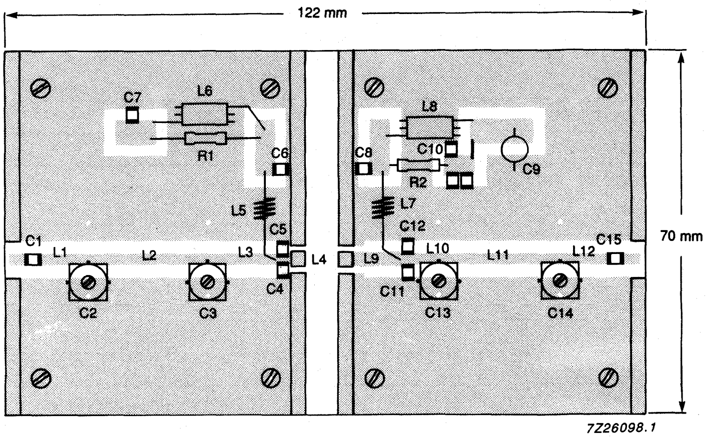
Fig.8 Class-AB test circuit at f = 960 MHz.

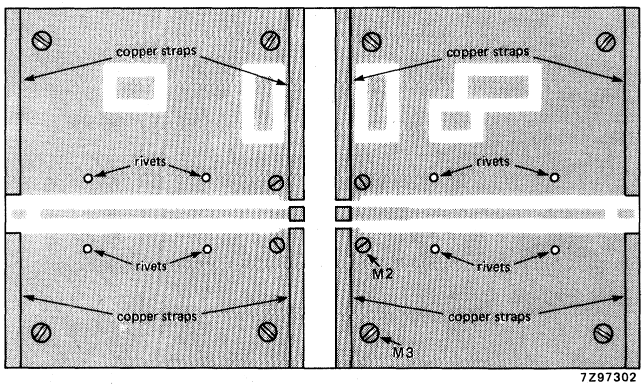
List of components (see test circuit)

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

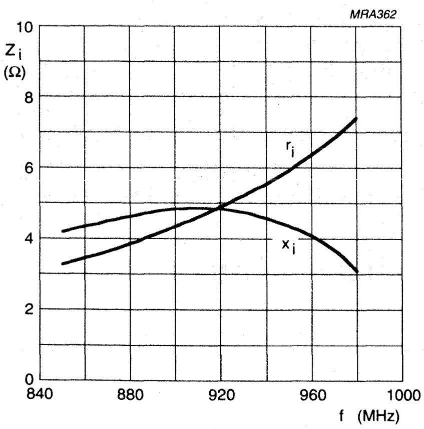
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness 1⁄32 inch.





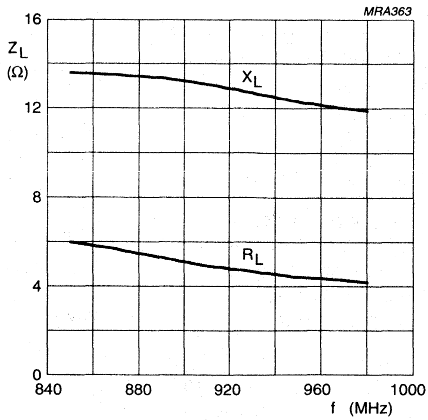
The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is fully metallized and serves as a ground plane. Connections are made by means of fixing screws, hollow rivets and copper straps around the board and under the emitters, to provide a direct contact 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.

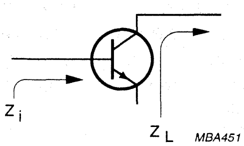
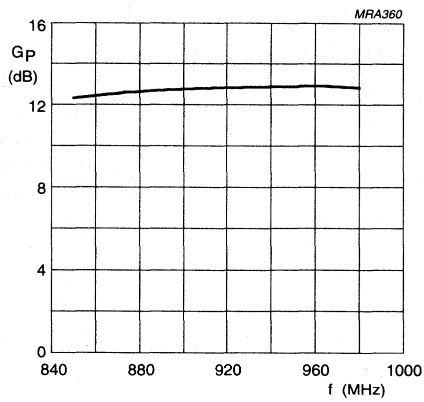


Fig.12 Definition of transistor impedance.



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

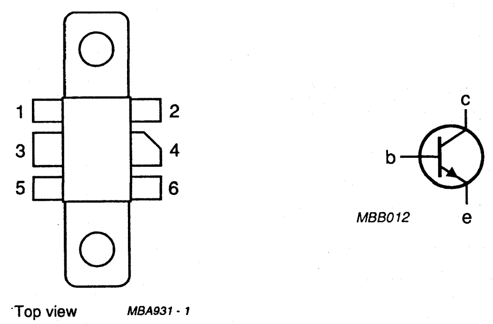


Fig.1 Simplified outline and symbol.

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

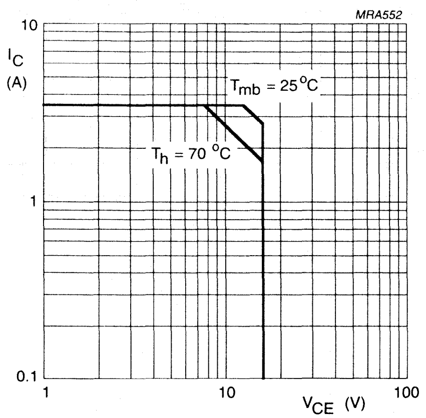
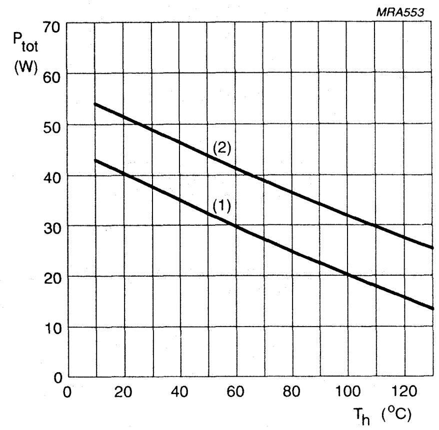


Fig.2 DC SOAR.



(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

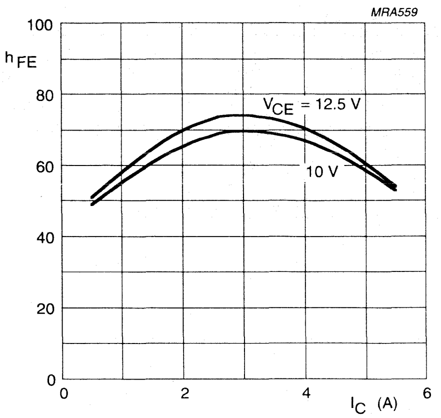
CHARACTERISTICS

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

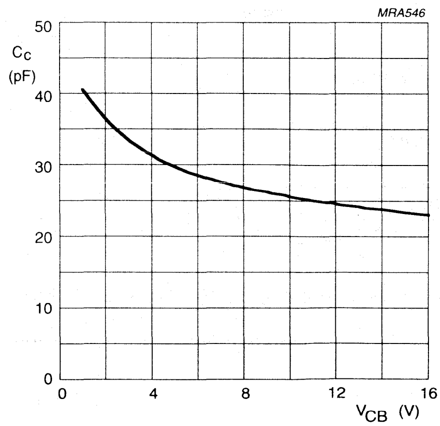
Note

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



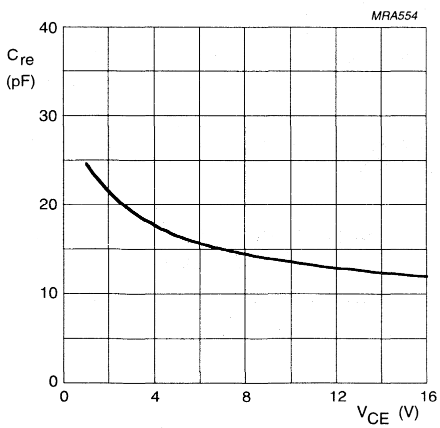
Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0.02$.

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.

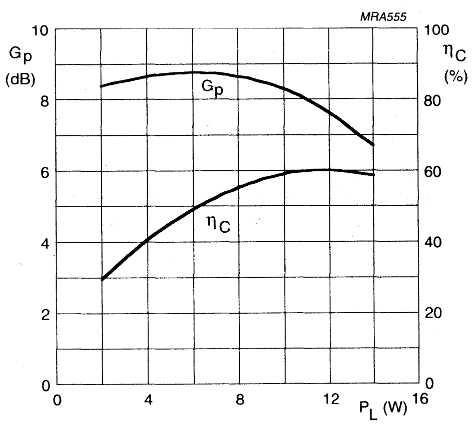
APPLICATION INFORMATION

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

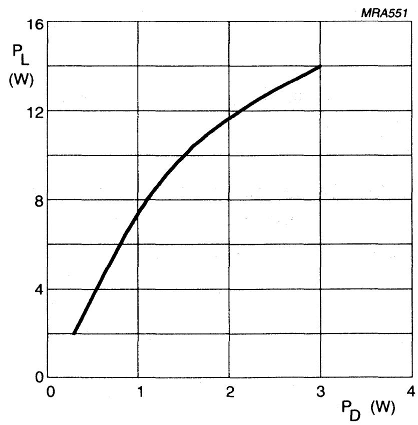
Note

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.



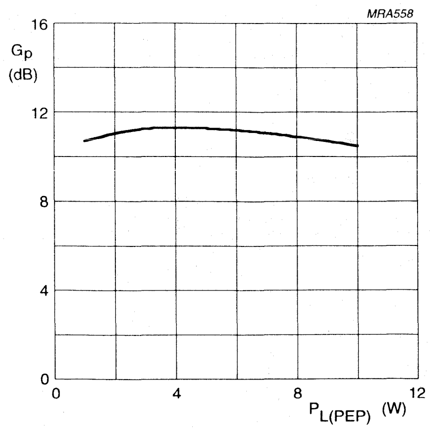
Class-AB operation; $V_{CE} = 12.5$ V; f = 900 MHz; $I_{CQ} = 10$ mA.

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

Ruggedness in class-AB operation

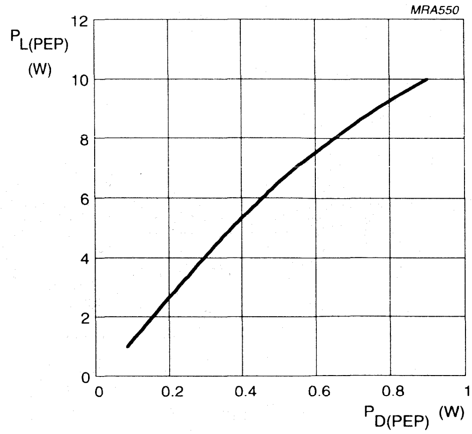
The BLV193 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases under the following conditions:

$V_{CE} = 15.5$ V, f = 900 MHz, $T_h = 25\ °C$, $R_{th\ j\text{-}mb} = 0.4$ K/W, and rated output power.



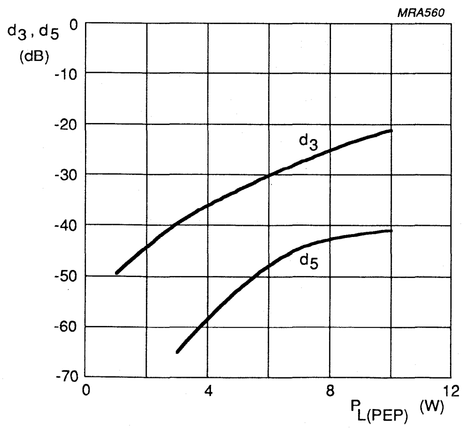
Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

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.

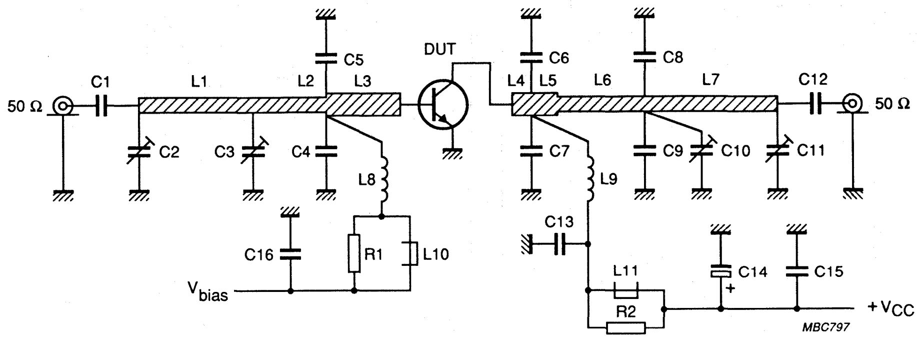


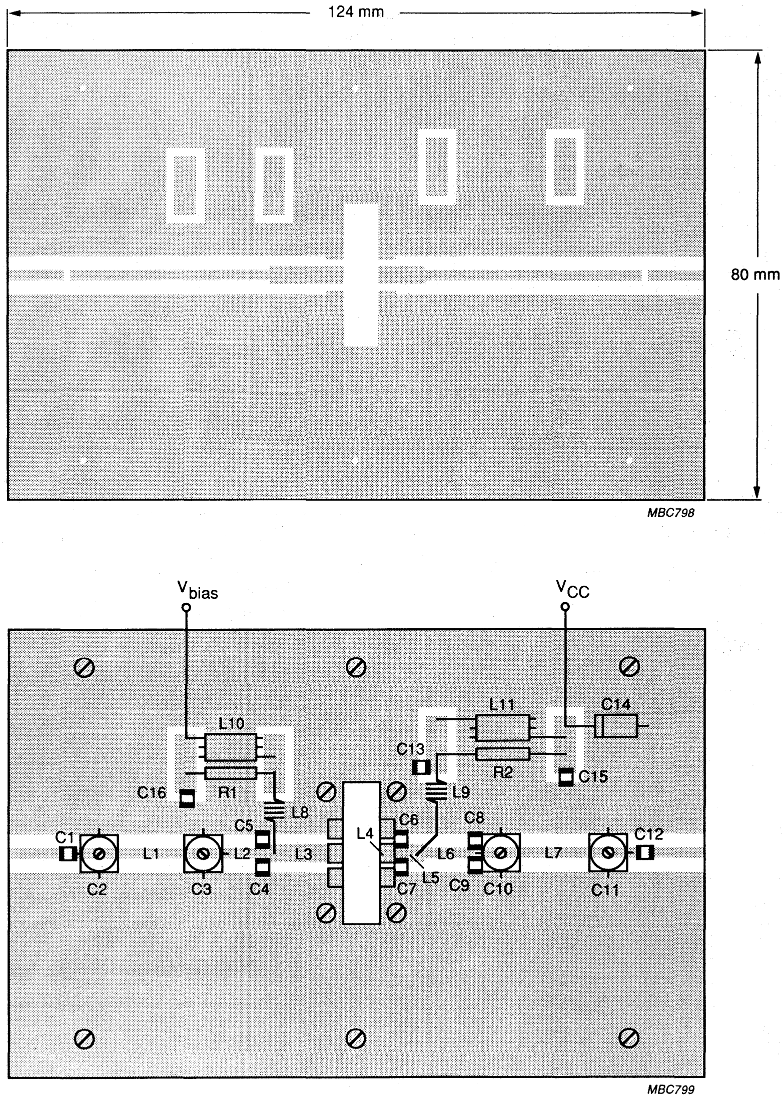
Fig.12 Class-A and class-AB test circuit at f = 900 MHz.

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		

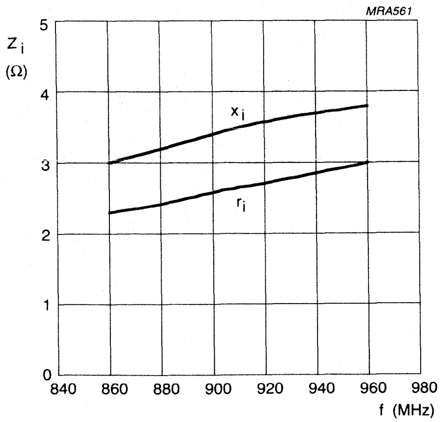
Notes

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 ($\varepsilon_r = 2.2$), thickness 1⁄32 inch.



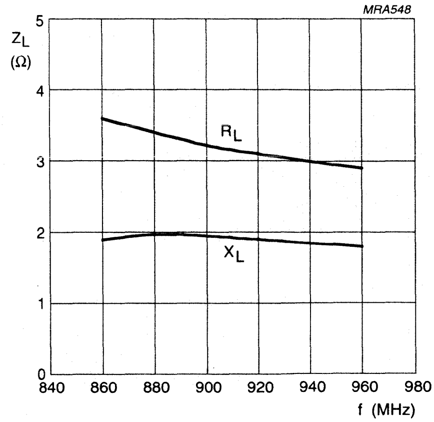
The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws and copper straps under the emitter leads.

Fig.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.

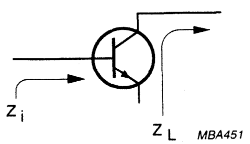
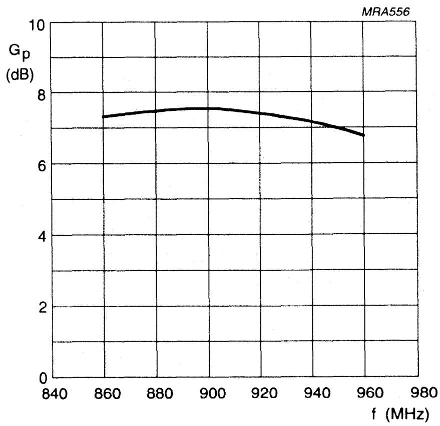
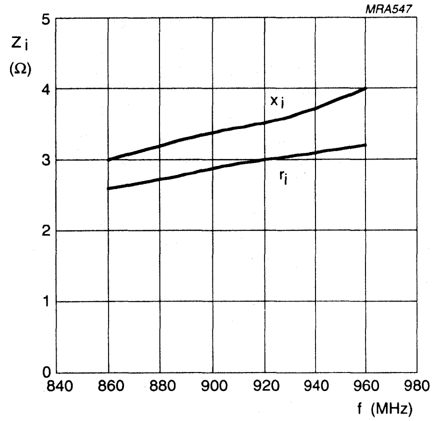


Fig.16 Definition of transistor impedance.



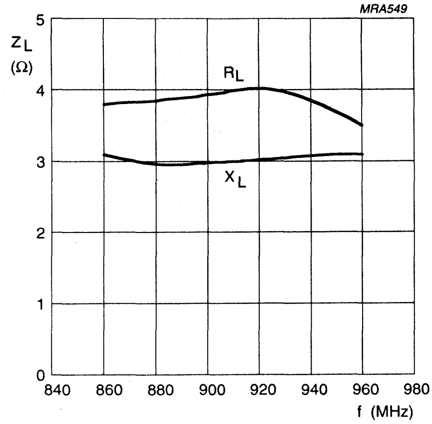
Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA;
P_L = 12 W; T_h = 25 °C.

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.

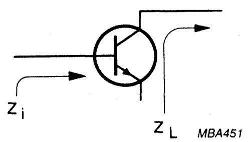
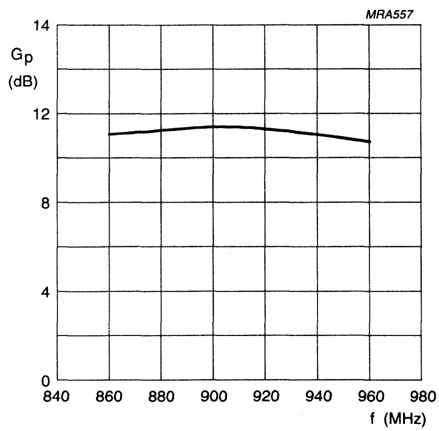


Fig.20 Definition of transistor impedance.



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.

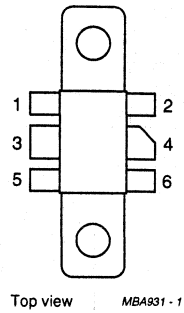
PINNING - SOT171

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



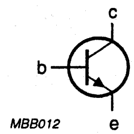


Fig.1 Simplified outline and symbol.

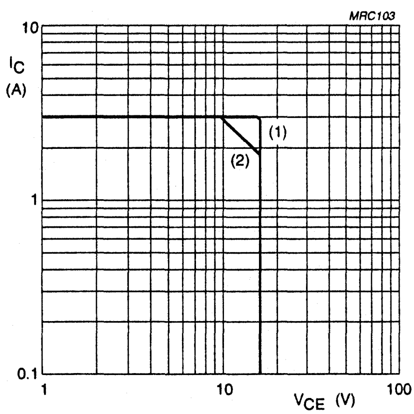
WARNING

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

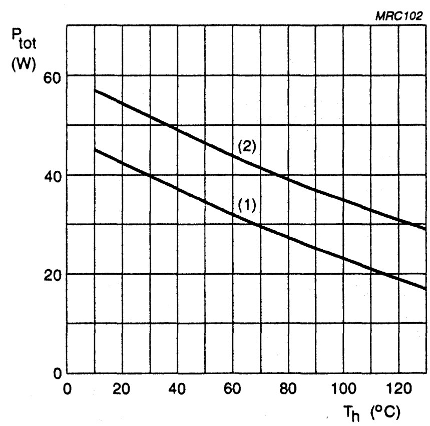
In accordance with the Absolute Maximum System (IEC 134).

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
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{dis} = 46 W; T_{mb} = 25 °C	3.8 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.4 K/W

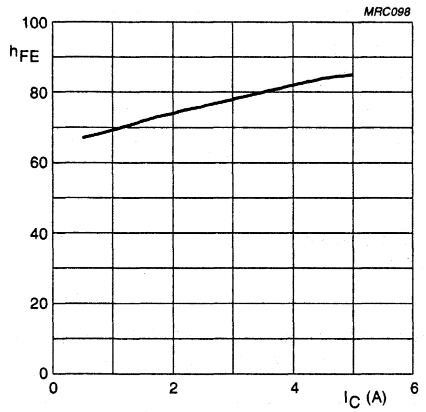
CHARACTERISTICS

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 Ω; 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

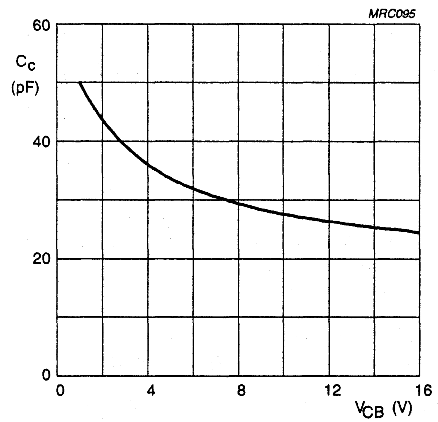
1. Measured under pulse conditions: $t_p \leq 200$ µs; $\delta \leq 0.02$.



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.



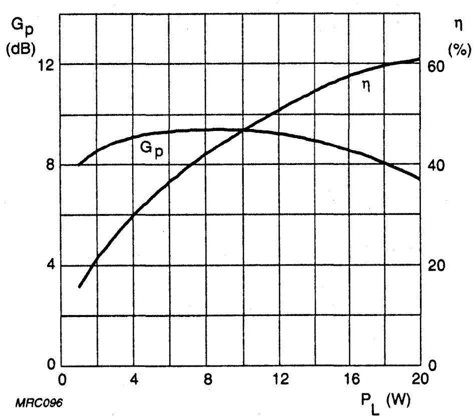
$I_E = i_e$ = 0; f = 1 MHz.

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

APPLICATION INFORMATION

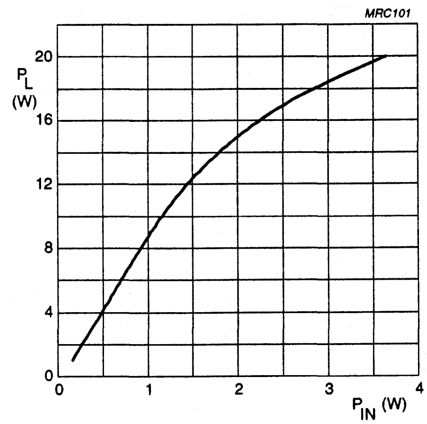
RF performance at $T_h = 25\ °C$ in a common emitter test circuit.
$R_{th\ j\text{-}mb} = 0.4\ K/W$.

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.



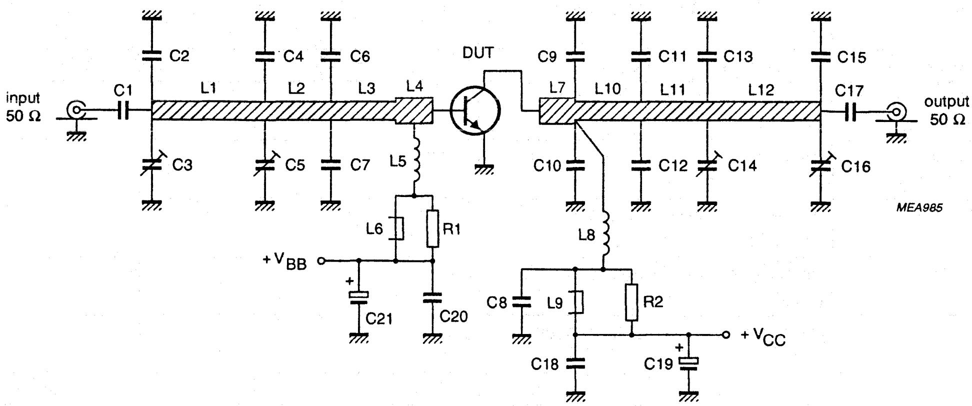
Class-AB operation: $I_{CQ} = 10$ mA; $V_{CE} = 12.5$ V; f = 900 MHz.

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.

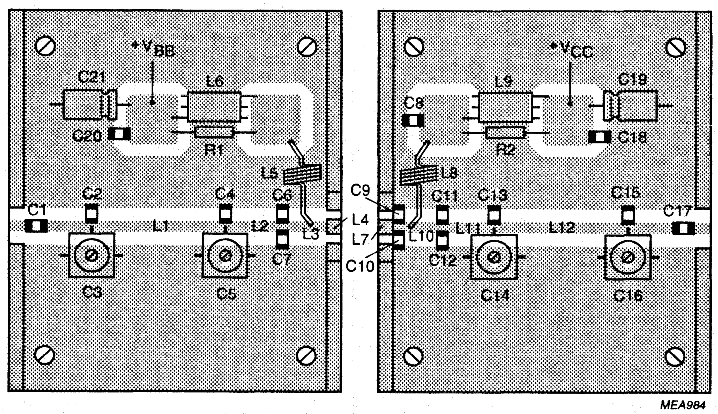
Fig.8 Class-AB test circuit.

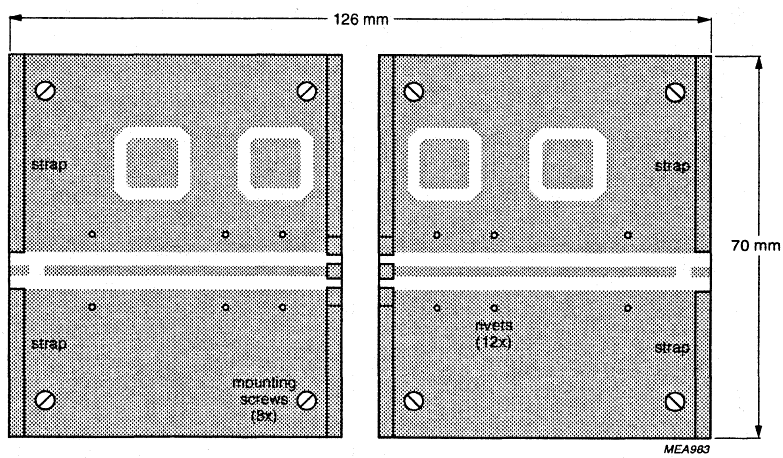
List of components (see test circuit)

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

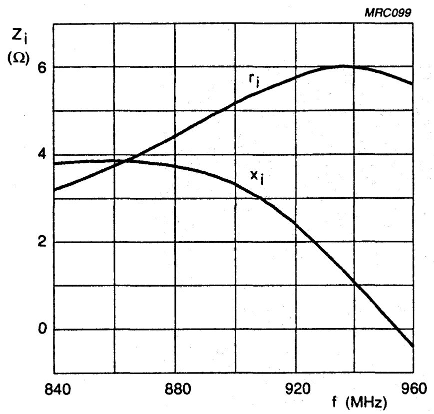
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed- circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness 1⁄32 inch.





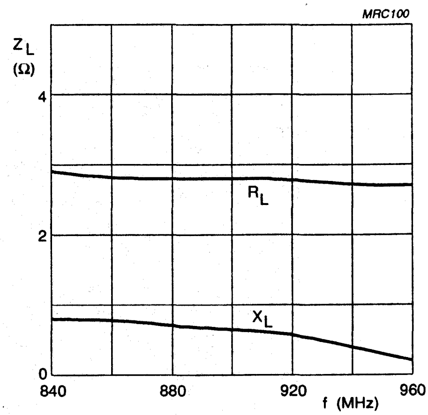
The components are mounted on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws and copper straps under the emitter leads.

Fig.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.

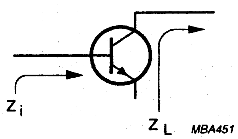
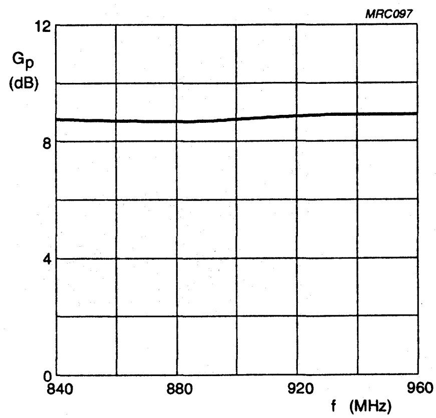


Fig.12 Definition of transistor impedance.



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 power transistor — BLV902

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

APPLICATIONS

- Common emitter class-AB operation in base stations in the 820 to 960 MHz frequency range.

PRELIMINARY for Design-in information
See Philips Semiconductors

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 8-lead SOT409B SMD package with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT409B

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

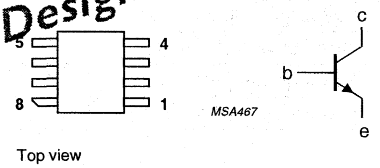


Fig.1 Simplified outline and symbol.

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 (%)
CW, class-AB	960	26	2	≥11	≥50

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	–	4	V
I_C	collector current (DC)		–	600	mA
$I_{C(AV)}$	average collector current		–	600	mA
P_{tot}	total power dissipation	T_{mb} = 25 °C; note 1	–	6	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 6 W; T_{mb} = 25 °C; note 1	29.2	K/W

Note to the “Limiting values” and “Thermal characteristics”

1. Transistor with metallized ground plane mounted on a printed-circuit board, see *“This handbook, Section Mounting and soldering”*.

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 = 2 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 5 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.4 mA	4	–	–	V
I_{CES}	collector leakage current	V_{CE} = 28 V; V_{BE} = 0	–	–	2	mA
h_{FE}	DC current gain	V_{CE} = 20 V; I_C = 200 mA	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	1.4	–	pF

APPLICATION INFORMATION

RF performance at T_{mb} = 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	10	2	≥11 typ. 12	≥50

Ruggedness in class-AB operation

The BLV902 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 10 mA; P_L = 2 W; T_{mb} = 25 °C.

UHF power transistor — BLV904

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 8-lead SOT409B SMD package with a ceramic cap.
All leads are isolated from the mounting base.

PINNING - SOT409B

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

APPLICATIONS

- Common emitter class-AB operation in base stations in the 820 to 960 MHz frequency range.

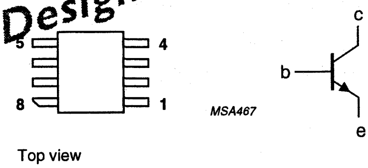


Fig.1 Simplified outline and symbol.

PRELIMINARY
See Philips Semiconductors for Design-in information

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 (%)
CW, class-AB	960	26	5	≥11	≥50

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	–	4	V
I_C	collector current (DC)		–	1.2	A
$I_{C(AV)}$	average collector current		–	1.2	A
P_{tot}	total power dissipation	T_{mb} = 60 °C; note 1	–	14	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 14 W; T_{mb} = 60 °C; note 1	10	K/W

Note to the "Limiting values" and "Thermal characteristics"

1. Transistor with metallized ground plane mounted on a printed-circuit board, see *"This handbook, Section Mounting and soldering"*.

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 = 5 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	4	–	–	V
I_{CES}	collector leakage current	V_{CE} = 28 V; V_{BE} = 0	–	–	3	mA
h_{FE}	DC current gain	V_{CE} = 20 V; I_C = 600 mA	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	2.5	–	pF

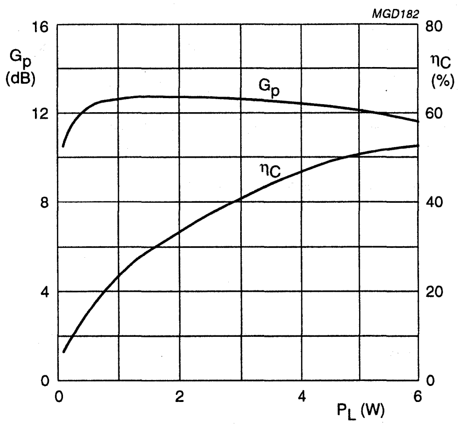
APPLICATION INFORMATION

RF performance at T_{mb} = 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	15	5	≥11 typ. 12	≥50

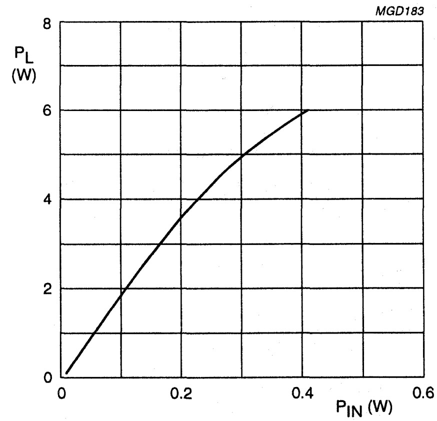
Ruggedness in class-AB operation

The BLV904 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 15 mA; P_L = 5 W; T_{mb} = 25 °C.



CW, class-AB; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 15 mA; T_{mb} = 25 °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



CW, class-AB; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 15 mA; T_{mb} = 25 °C.

Fig.3 Load power as a function of input power; typical values.

UHF power transistor | BLV909

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 8-lead SOT409B SMD package with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT409B

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

APPLICATIONS

- Common emitter class-AB operation in base stations in the 820 to 960 MHz frequency range.

PRELIMINARY
See Philips Semiconductors for Design-in information

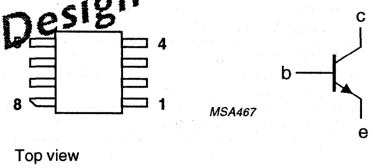


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in a common emitter test circuit (see Fig.9).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)
CW, class-AB	960	26	9	≥9	≥40	–
2-tone, class-AB	880	26	9 (PEP)	typ. 11.5	typ. 45	typ. –30

LIMITING VALUES

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

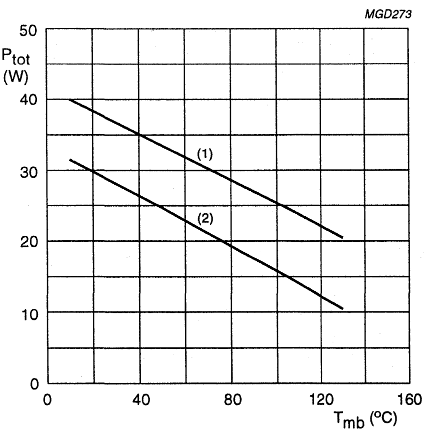
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	1.5	A
$I_{C(AV)}$	collector current (average)		–	1.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; note 1	–	29	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 29 W; T_{mb} = 25 °C; note 1	6	K/W

Note to the "Limiting values" and "Thermal characteristics"

1. Transistor with metallized ground plane mounted on a printed-circuit board, see *"This handbook, Section Mounting and soldering"*.



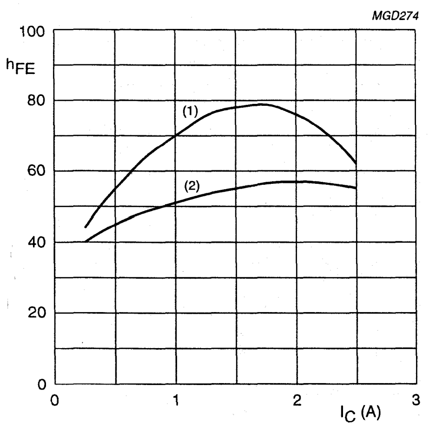
(1) Short-time operation during mismatch.
(2) Continuous operation.

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

CHARACTERISTICS

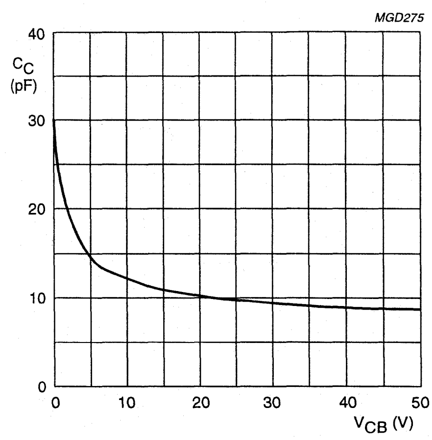
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 15 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.3 mA	3	–	–	V
I_{CES}	collector leakage current	V_{CE} = 28 V; V_{BE} = 0	–	–	0.75	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 500 mA	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	6	–	pF



(1) V_{CE} = 26 V; $\delta \leq 0.01$; $t_p \leq 500$ µs.
(2) V_{CE} = 10 V.

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.

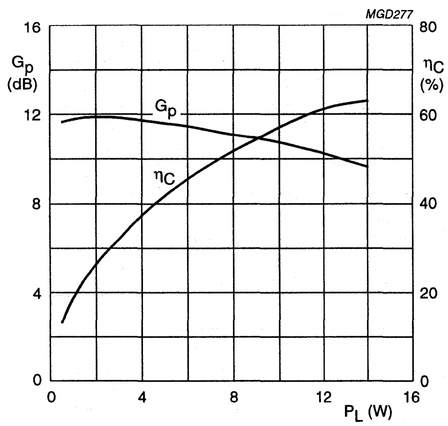
APPLICATION INFORMATION

RF performance at T_{mb} = 25 °C in a common emitter test circuit (see Figs 9 and 10).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)
CW, class-AB	960	26	25	9	≥9 typ. 12	≥50 typ. 57	–
2-tone, class-AB	880	26	25	9 (PEP)	typ. 11.5	typ. 45	typ. –30

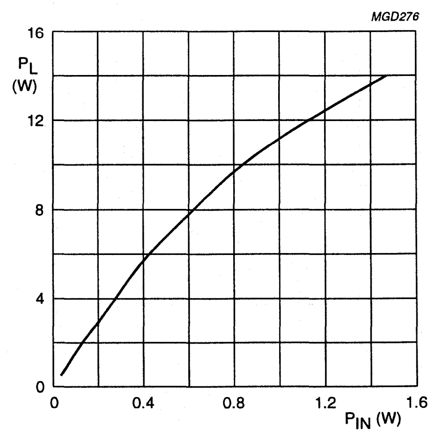
Ruggedness in class-AB operation

The BLV909 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 9 W; T_{mb} = 25 °C.



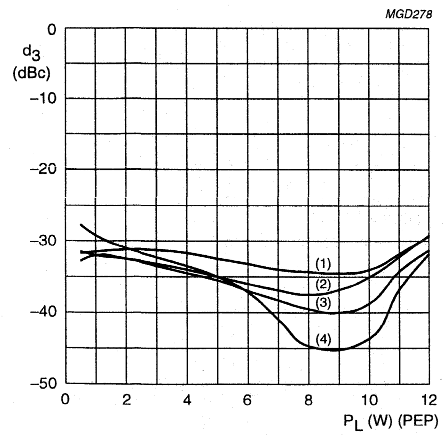
CW, class-AB; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA; T_{mb} = 25 °C.

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



CW, class-B; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 15 mA; T_{mb} = 25 °C.

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



2-tone, class-AB; f = 880 MHz; V_{CE} = 26 V.

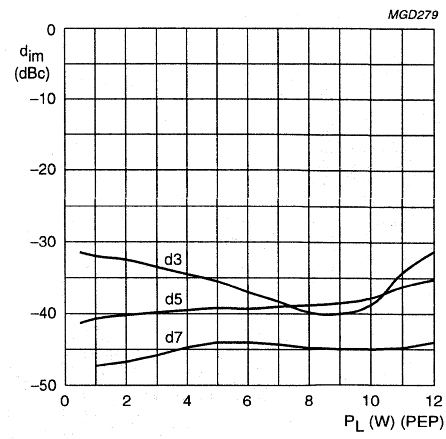
(1) I_{CQ} = 60 mA.

(2) I_{CQ} = 40 mA.

(3) I_{CQ} = 25 mA.

(4) I_{CQ} = 10 mA.

Fig.7 Third order Intermodulation distortion as a function of peak envelope load power; typical values.



2-tone, class-AB; f = 880 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA.

Fig.8 Intermodulation distortion as a function of peak envelope load power; typical values.

Test circuit information

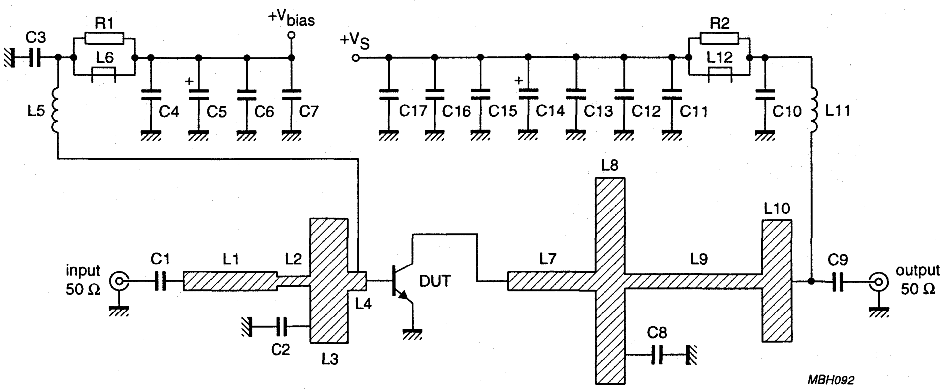


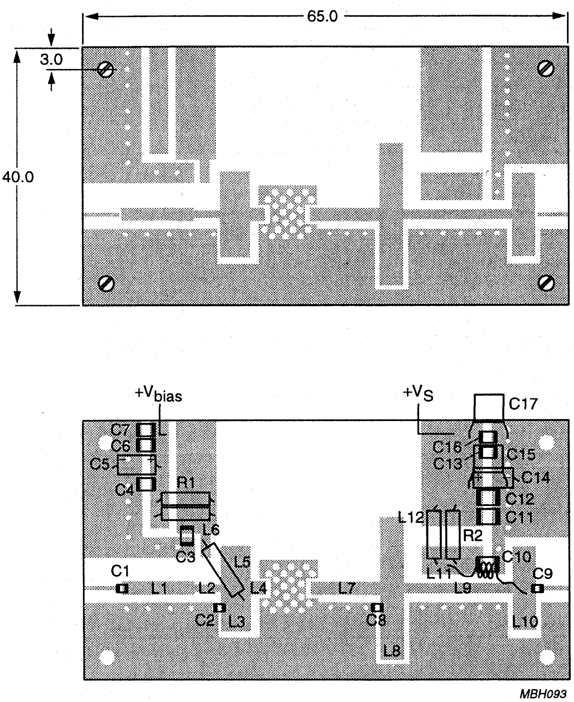
Fig.9 Common emitter test circuit for class-AB operation at 820-960 MHz.

List of components used in test circuit (see Figs 9 and 10)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C9	multilayer ceramic chip capacitor; note 1	24 pF		
C2	multilayer ceramic chip capacitor; note 1	note 2		
C3, C7, C10, C16	multilayer ceramic chip capacitor; note 3	200 pF		
C4, C11	multilayer ceramic chip capacitor; note 3	110 pF		
C5, C14	tantalum SMD capacitor	10 μF, 35 V		
C6, C12, C15	ceramic chip capacitor	100 nF		2222 852 47104
C8	multilayer ceramic chip capacitor; note 1	8.2 pF		
C13	ceramic chip capacitor	47 nF, 500 V		2222 655 09561
C17	ceramic chip capacitor	22 nF, 63 V		2222 629 08223
L1	stripline; note 4		length 9.85 mm width 2 mm	
L2	stripline; note 4		length 3.63 mm width 1 mm	
L3	stripline; note 4		length 4.1 mm width 13.3 mm	
L4	stripline; note 4		length 2 mm width 2 mm	
L5	RF choke	0.22 μH		
L6, L12	grade 4S2 ferroxcube chip-bead			
L7	stripline; note 4	105 nH	length 9.2 mm width 2 mm	
L8	stripline; note 4		length 3.1 mm width 22 mm	
L9	stripline; note 4		length 14.4 mm width 1.5 mm	
L10	stripline; note 4		length 3.2 mm width 13 mm	
L11	5 turns enamelled 1 mm copper wire		pitch 1.23 mm internal dia. 3.2 mm	
R1, R2	metal film resistor	0.4 W, 100 Ω		

Notes

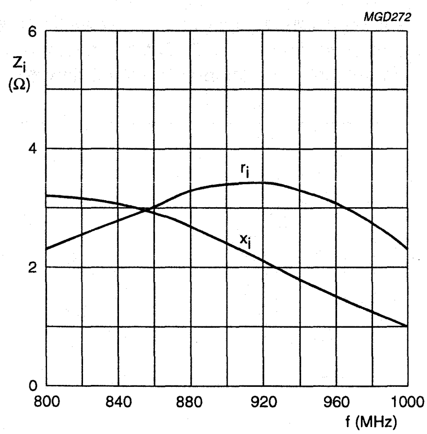
1. American Technical Ceramics type 100A or capacitor of same quality.
2. For operation at 820 to 900 MHz: C2 = 6.2 pF; at 900 to 960 MHz: C2 = 5.6 pF; at 869 to 894 MHz: C2 = 5.1 pF.
3. American Technical Ceramics type 100B or capacitor of same quality
4. The striplines are on a double copper-clad printed-circuit board, with PTFE fibre-glass dielectric (ε_r = 10.2); thickness 0.64 mm; thickness of the copper sheet 2 × 35 μm.



Dimensions in mm.

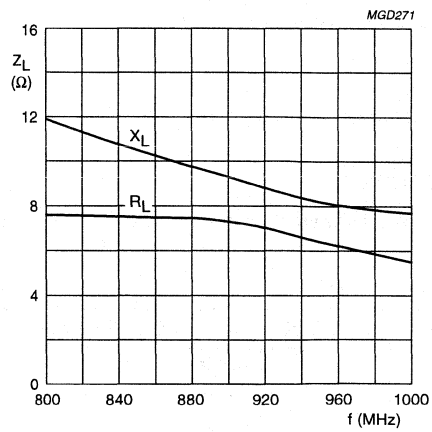
The components are situated on one side of the copper-clad PCB, the other side is unetched and serves as a ground plane.
Earth connections from the component side to the ground plane are made by through metallization.

Fig.10 Printed-circuit board and component lay-out for 820 to 960 MHz class-AB test circuit in Fig.9.



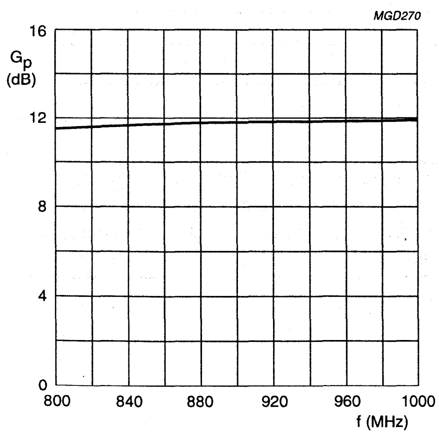
V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 9 W; T_{mb} = 25 °C.

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



V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 9 W; T_{mb} = 25 °C.

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



V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 9 W; T_{mb} = 25 °C.

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

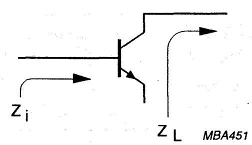


Fig.14 Definition of transistor impedance.

UHF power transistor BLV910

FEATURES

- Internal input matching to achieve high power gain and easy design of wideband circuits
- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base station transmitters in the 820 to 960 MHz range.

PINNING - SOT171

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	b	base
4	c	collector
5	e	emitter
6	e	emitter

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-AB operation. The transistor is encapsulated in a 6-lead SOT171 flange envelope with a ceramic cap. All leads are isolated from the flange.

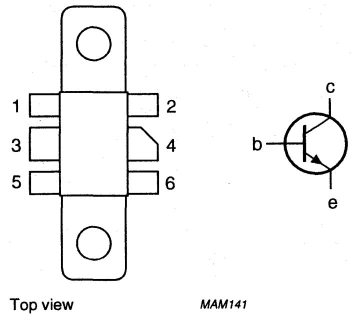


Fig.1 Simplified outline and symbol.

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 (%)
CW, class-AB	960	26	10	≥ 11	≥ 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.

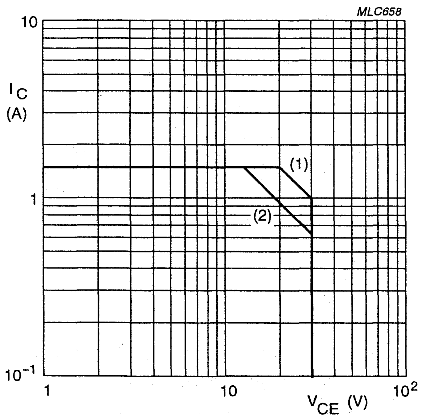
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	1.5	A
$I_{C(AV)}$	average collector current		–	1.5	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	30	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

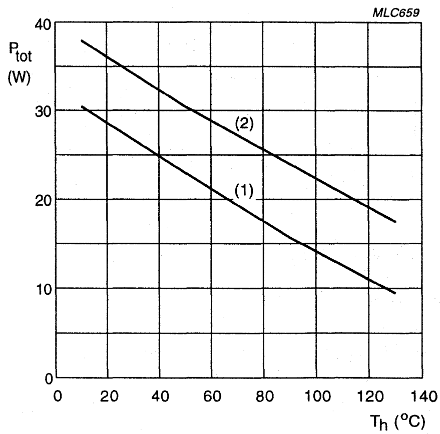
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 30 W; T_{mb} = 25 °C	5.85	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.4	K/W



(1) T_{mb} = 25 °C.
(2) T_h = 70 °C.

Fig.2 DC SOAR.



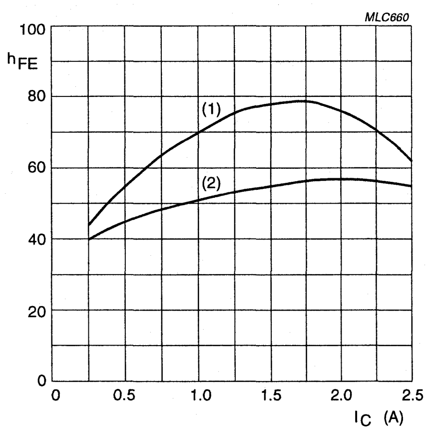
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

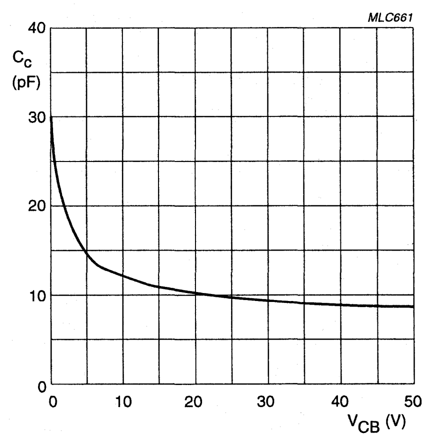
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 5 mA	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 15 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.3 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	0.75	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 0.5 A;	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; I_E = i_e = 0; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	6	–	pF



(1) V_{CE} = 26 V: measured under pulsed conditions; $t_p \leq 500$ µs; $\delta < 0.01$.
(2) 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.

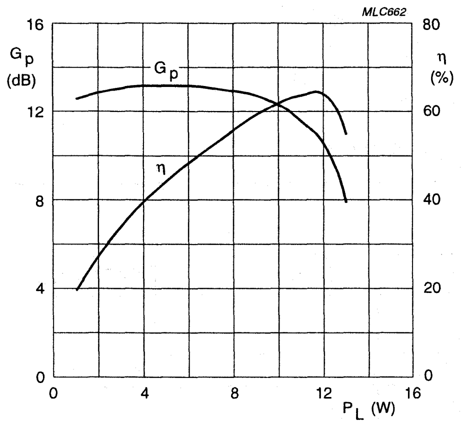
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB 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	25	10	≥11	≥55

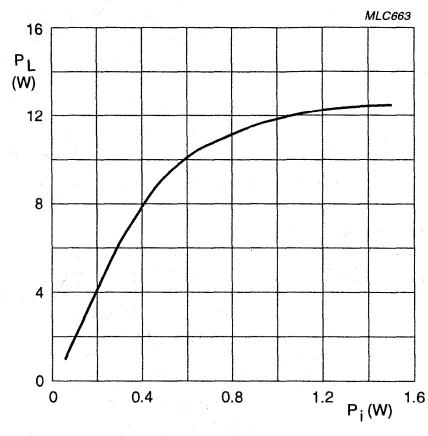
Ruggedness in class-AB operation

The BLV910 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} = 26 V; f = 960 MHz; I_{CQ} = 25 mA; T_{mb} = 25 °C.



V_{CE} = 26 V.
I_{CQ} = 25 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 25 mA.
f = 960 MHz.

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

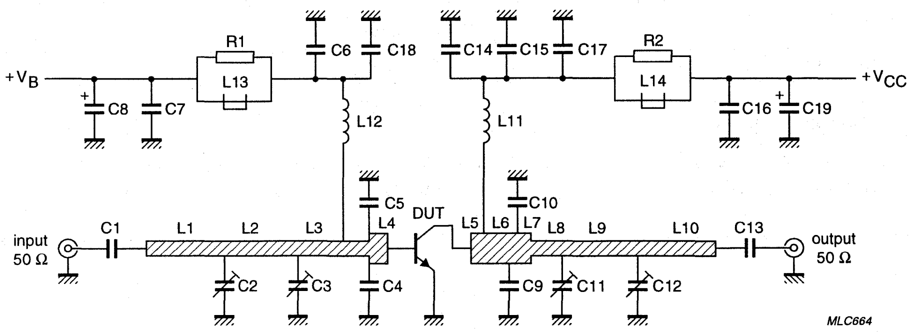


Fig.8 Class-AB test circuit at f = 960 MHz.

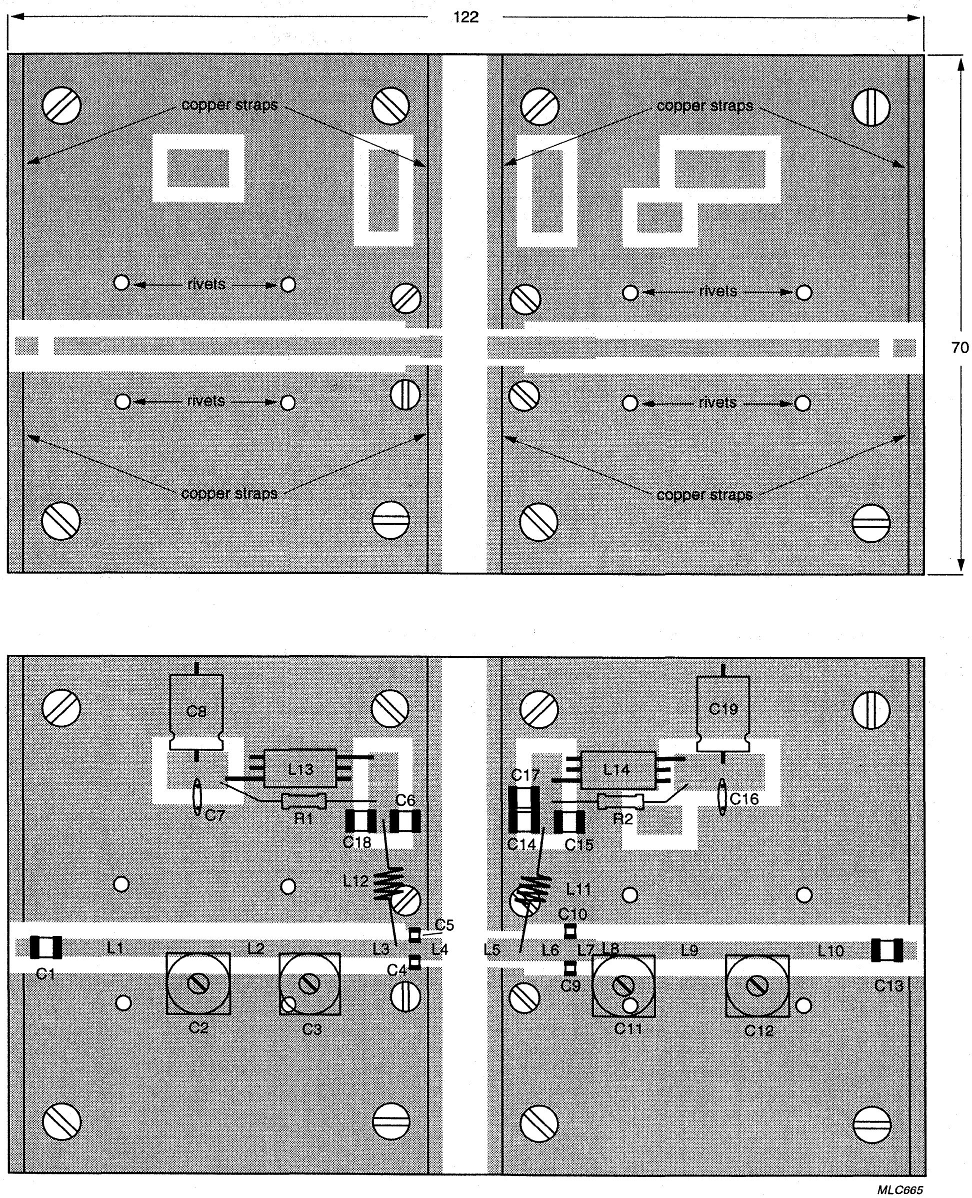
List of components (see Figs 8 and 9)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C13	multilayer ceramic chip capacitor; note 1	43 pF		
C2, C3, C11, C12	film dielectric trimmer	1.4 pF to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor; note 2	10 pF		
C6	multilayer ceramic chip capacitor; note 1	150 pF		
C7, C16	ceramic capacitor	22 nF		2222 640 08223
C8, C19	solid aluminium capacitor	10 μF, 63 V		2222 030 38109
C14	multilayer ceramic chip capacitor; note 1	20 pF		
C9, C10	multilayer ceramic chip capacitor; note 2	8.2 pF		
C17	multilayer ceramic chip capacitor; note 1	220 pF		
C15, C18	multilayer ceramic chip capacitor; note 1	62 pF		
L1	stripline; note 3	50 Ω	length 17 mm width 2.4 mm	
L2, L3	stripline; note 3	50 Ω	length 14 mm width 2.4 mm	
L4	stripline; note 3	43 Ω	length 4 mm width 3 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L5, L6	stripline; note 3	43 Ω	length 3 mm width 3 mm	
L7	stripline; note 3	43 Ω	length 3.4 mm width 3 mm	
L8	stripline; note 3	50 Ω	length 6.3 mm width 2.4 mm	
L9	stripline; note 3	50 Ω	length 18 mm width 2.4 mm	
L10	stripline; note 3	50 Ω	length 15 mm width 2.4 mm	
L11	4 turns enamelled 0.8 mm copper wire		int. diameter 4mm length 5 mm leads 2 × 5 mm	
L12	3 turns enamelled 0.8 mm copper wire		int. diameter 3mm length 5 mm leads 2 × 5 mm	
L13, L14	grade 3B Ferroxcube wideband RF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω, 0.4 W		2322 151 71009

Notes

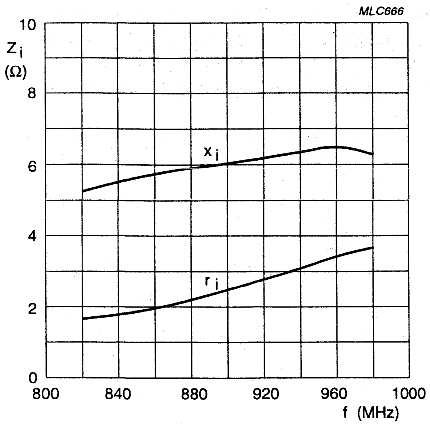
1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. The striplines are on double-clad PCB with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness $\frac{1}{32}$".



Dimensions in mm.

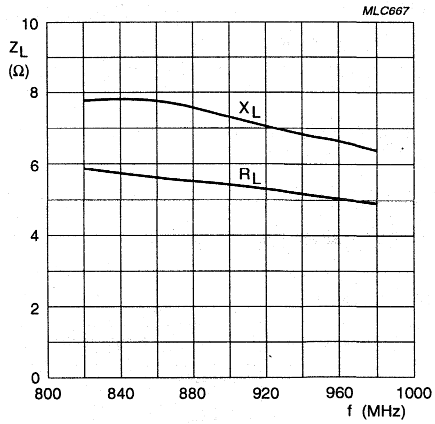
The components are located on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 960 MHz class-AB test circuit.



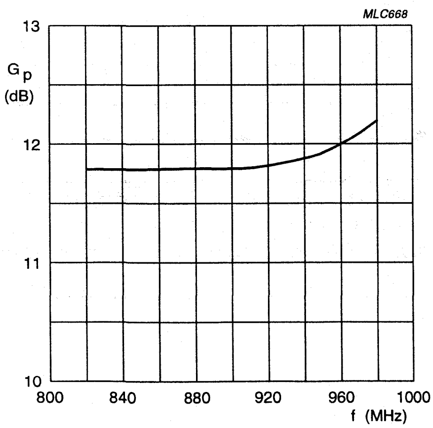
V_{CE} = 26 V.
I_{CQ} = 25 mA.
T_{mb} = 25 °C.
P_L = 10 W.

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



V_{CE} = 26 V.
I_{CQ} = 25 mA.
T_{mb} = 25 °C.
P_L = 10 W.

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



V_{CE} = 26 V.
I_{CQ} = 25 mA.
T_{mb} = 25 °C.
P_L = 10 W.

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

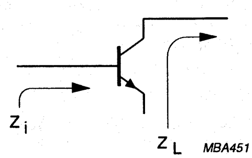


Fig.13 Definition of transistor impedance.

UHF power transistor | BLV920

FEATURES

- Internal input matching to achieve high power gain and easy design of wideband circuits
- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base station transmitters in the 820 to 960 MHz range.

PINNING - SOT171

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	b	base
4	c	collector
5	e	emitter
6	e	emitter

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-AB operation. The transistor is encapsulated in a 6-lead SOT171 flange envelope with a ceramic cap. All leads are isolated from the flange.

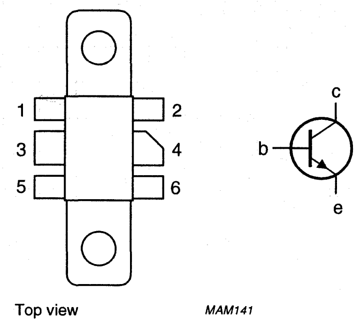


Fig.1 Simplified outline and symbol.

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	20	≥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.

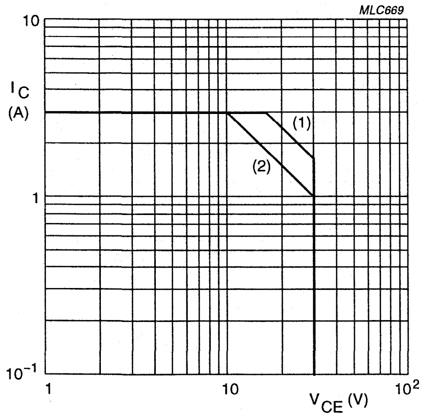
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	3	A
$I_{C(AV)}$	average collector current		–	3	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

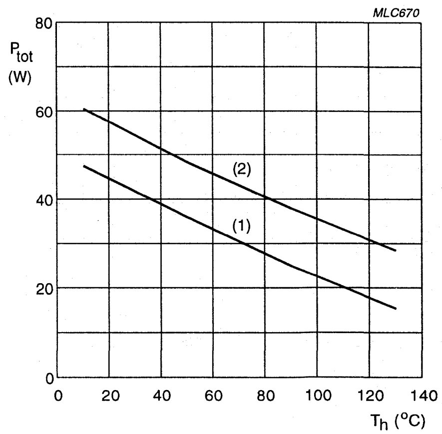
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 49 W; T_{mb} = 25 °C	3.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.4	K/W



(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 derating curves.

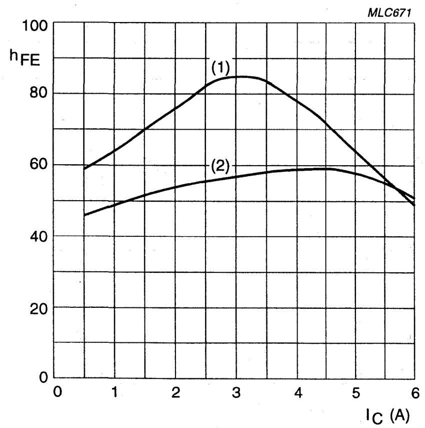
CHARACTERISTICS

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 = 15 mA	70	–	–	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 = 0.6 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	1.5	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 1 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	17	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	11	–	pF

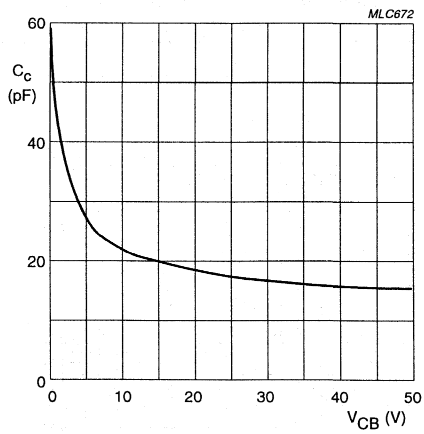
Note

1. Measured under pulsed conditions: $t_p \leq 500$ μs; $\delta \leq 0.01$.



Measured under pulsed conditions; $t_p \leq 500$ μs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) 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.

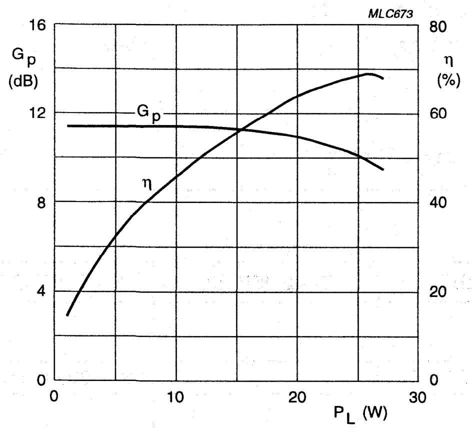
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB test circuit; $R_{th\ mb-h}$ = 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	960	26	50	20	≥10	≥55

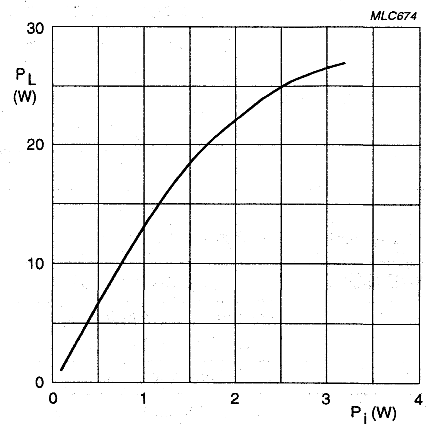
Ruggedness in class-AB operation

The BLV920 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} = 26 V; f = 960 MHz; I_{CQ} = 50 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W.



V_{CE} = 26 V.
I_{CQ} = 50 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 50 mA.
f = 960 MHz.

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

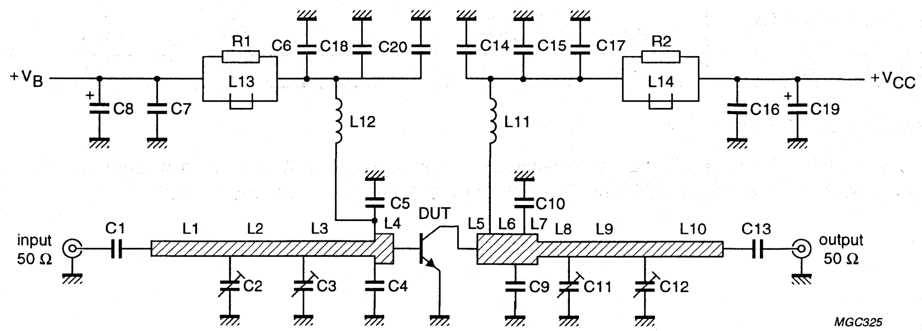


Fig.8 Class-AB test circuit at f = 960 MHz.

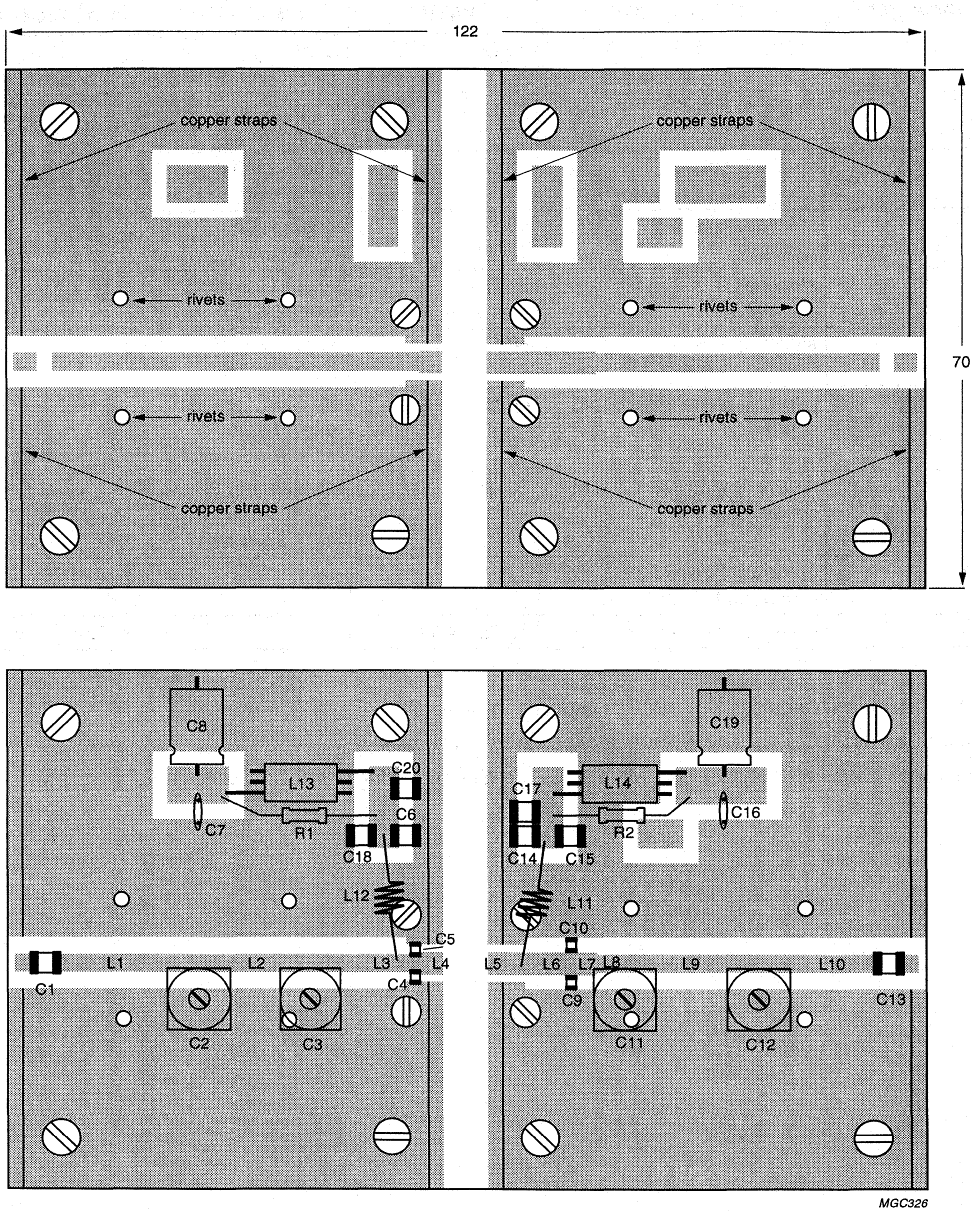
List of components (see Figs 8 and 9)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C13	multilayer ceramic chip capacitor; note 1	43 pF		
C2, C3, C11, C12	film dielectric trimmer	1.4 pF to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor; note 2	10 pF		
C6, C17	multilayer ceramic chip capacitor; note 1	150 pF		
C7, C16	ceramic capacitor	22 nF		2222 640 08223
C8, C19	solid aluminium capacitor	10 μF, 63 V		2222 030 38109
C14	multilayer ceramic chip capacitor; note 1	20 pF		
C9, C10	multilayer ceramic chip capacitor; note 2	11 pF		
C20	multilayer ceramic chip capacitor; note 1	1 nF		
C15, C18	multilayer ceramic chip capacitor; note 1	62 pF		
L1	stripline; note 3	50 Ω	length 16.8 mm width 2.4 mm	
L2	stripline; note 3	50 Ω	length 14.8 mm width 2.4 mm	
L3	stripline; note 3	50 Ω	length 13.7 mm width 2.4 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L4	stripline; note 3	43 Ω	length 3.5 mm width 3 mm	
L5	stripline; note 3	43 Ω	length 6.4 mm width 3 mm	
L6	stripline; note 3	43 Ω	length 5.8 mm width 3 mm	
L7	stripline; note 3	43 Ω	length 2.4 mm width 3 mm	
L9	stripline; note 3	50 Ω	length 15.5 mm width 2.4 mm	
L10	stripline; note 3	50 Ω	length 20 mm width 2.4 mm	
L11	4 turns enamelled 0.8 mm copper wire	45 nH	int. diameter 4mm length 5 mm leads 2 × 5 mm	
L12	3 turns enamelled 0.8 mm copper wire	30 nH	int. diameter 3mm length 5 mm leads 2 × 5 mm	
L13, L14	grade 3B Ferroxcube wideband RF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω, 0.4 W		2322 151 71009

Notes

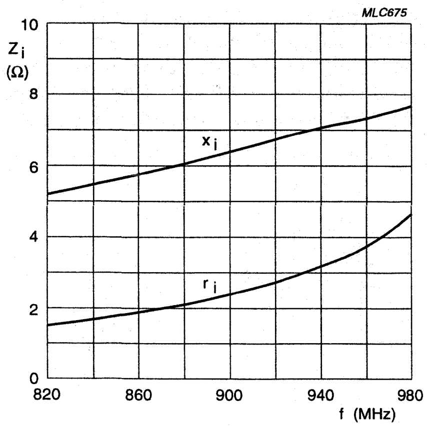
1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. The striplines are on double-clad PCB with PTFE fibre-glass dielectric (ε_r = 2.2); thickness $^1/_{32}$".



Dimensions in mm.

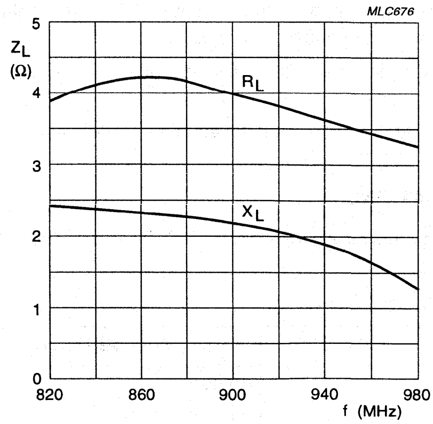
The components are located on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 960 MHz class-AB test circuit.



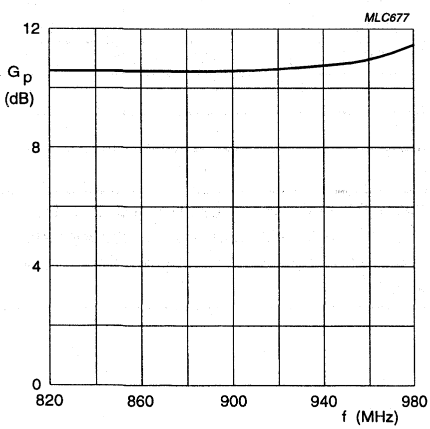
V_{CE} = 26 V; I_{CQ} = 50 mA; P_L = 20 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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



V_{CE} = 26 V; I_{CQ} = 50 mA; P_L = 20 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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



V_{CE} = 26 V; I_{CQ} = 50 mA; P_L = 20 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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

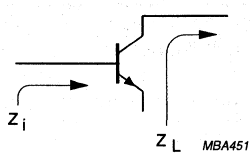


Fig.13 Definition of transistor impedance.

UHF power transistor | BLV934

FEATURES

- Internal input matching to achieve high power gain and easy design of wideband circuits
- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base station transmitters in the 820 to 960 MHz range.

PINNING - SOT171

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	b	base
4	c	collector
5	e	emitter
6	e	emitter

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-AB operation. The transistor has internal input matching by means of MOS capacitors and is encapsulated in a 6-lead SOT171 flange envelope with a ceramic cap. All leads are isolated from the flange.

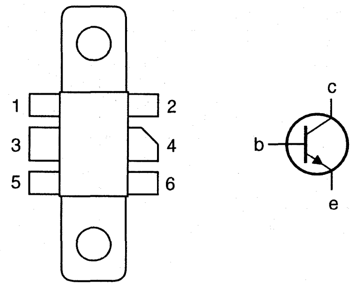


Fig.1 Simplified outline and symbol.

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	≥ 9	≥ 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.

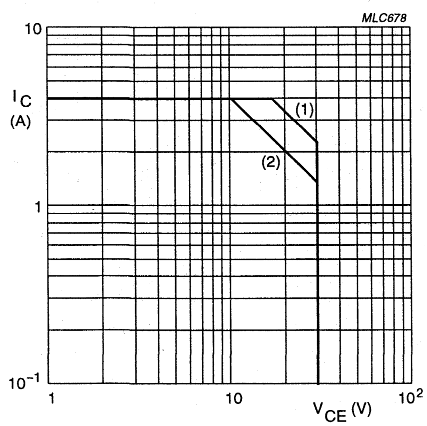
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	4	A
$I_{C(AV)}$	average collector current		–	4	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	68	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

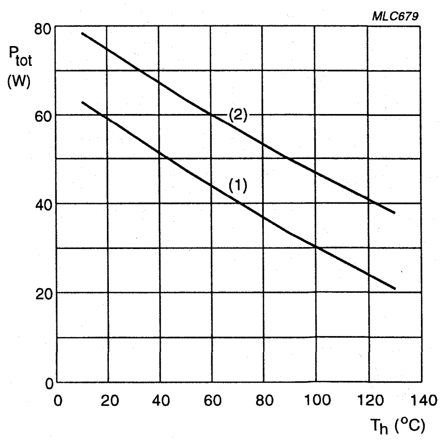
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 68 W; T_{mb} = 25 °C	2.57	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.4	K/W



(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 derating curves.

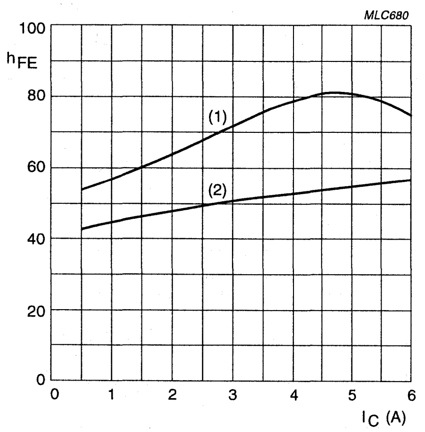
CHARACTERISTICS

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	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	2	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 1.5 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	25	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	17	–	pF

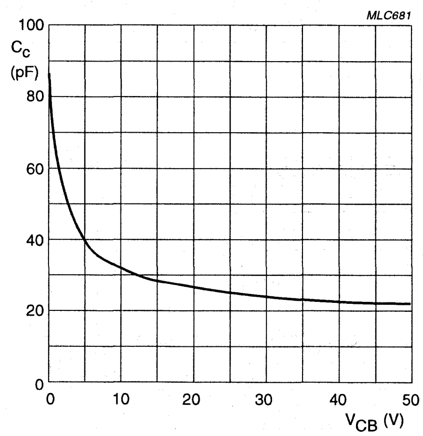
Note

1. Measured under pulsed conditions: $t_p \leq 500$ µs; $\delta \leq 0.01$.



Measured under pulsed conditions; $t_p \leq 500$ µs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) 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.

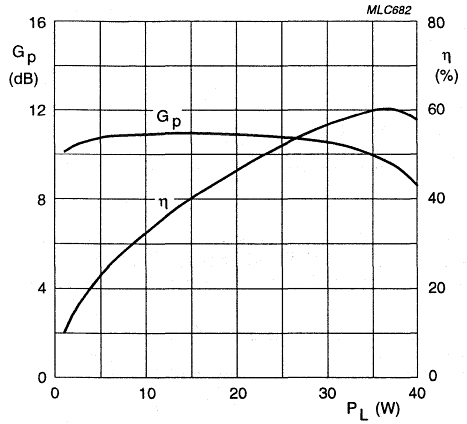
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB test circuit; $R_{th\ mb-h}$ = 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	960	26	100	30	≥9	≥55

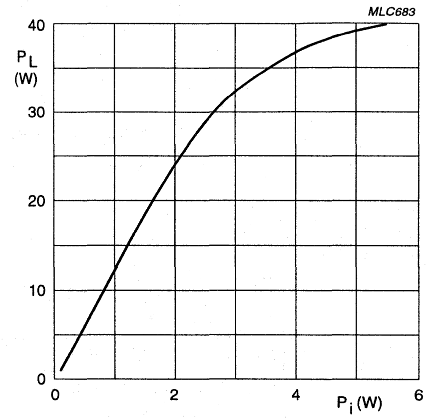
Ruggedness in class-AB operation

The BLV934 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} = 26 V; f = 960 MHz; I_{CQ} = 100 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.4 K/W.



V_{CE} = 26 V.
I_{CQ} = 100 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 100 mA.
f = 960 MHz.

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

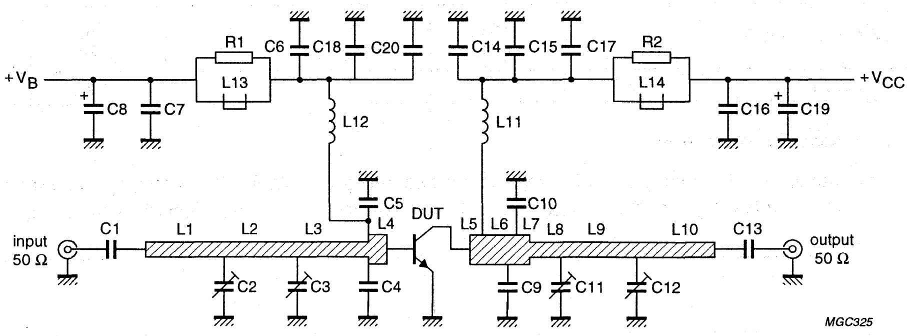


Fig.8 Class-AB test circuit at f = 960 MHz.

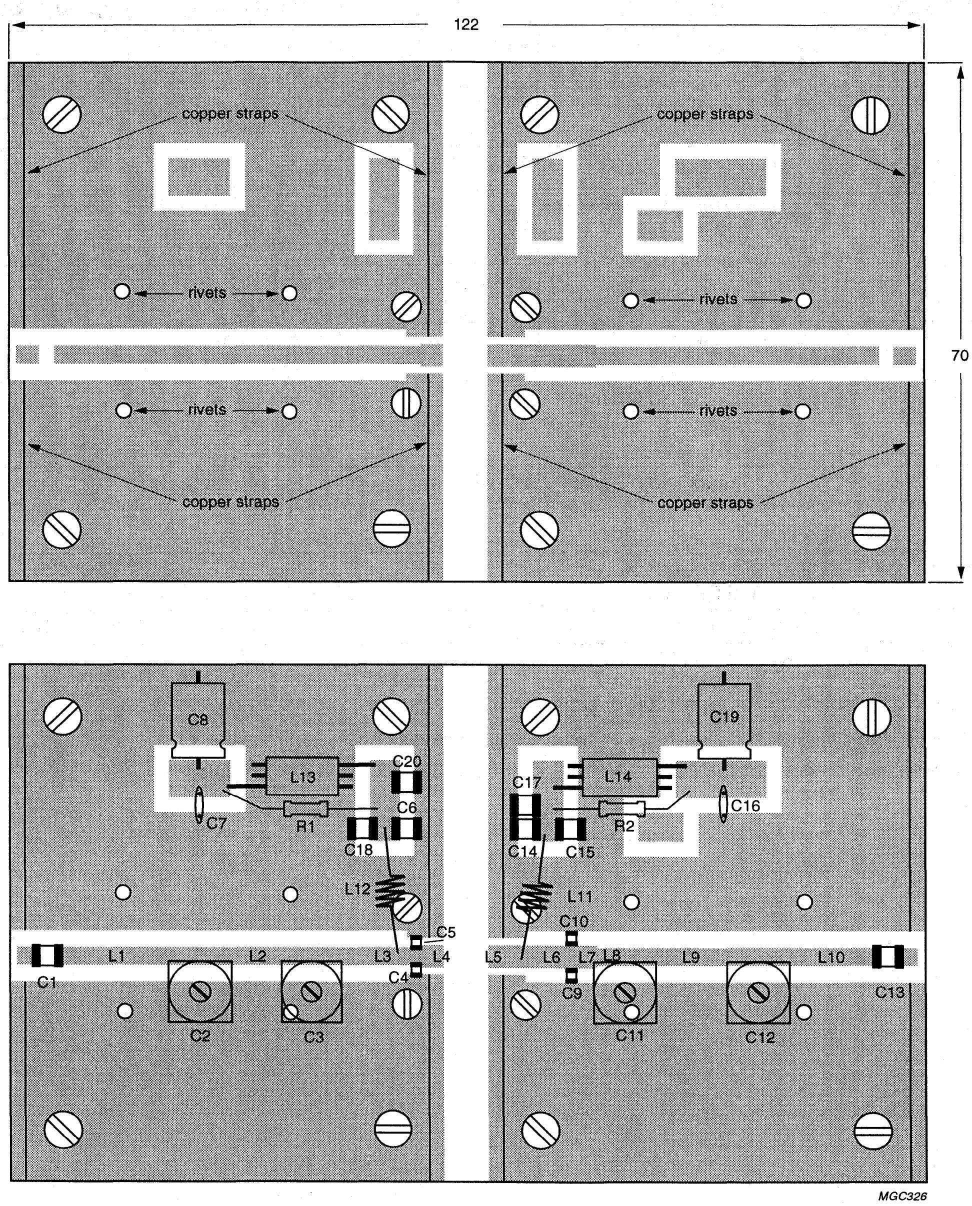
List of components (see Figs 8 and 9)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C13	multilayer ceramic chip capacitor; note 1	43 pF		
C2, C3, C11, C12	film dielectric trimmer	1.4 pF to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor; note 2	10 pF		
C6, C17	multilayer ceramic chip capacitor; note 1	150 pF		
C7, C16	ceramic capacitor	22 nF		2222 640 08223
C8, C19	solid aluminium capacitor	10 µF, 63 V		2222 030 38109
C14	multilayer ceramic chip capacitor; note 1	20 pF		
C9, C10	multilayer ceramic chip capacitor; note 2	11 pF		
C20	multilayer ceramic chip capacitor; note 1	1 nF		
C15, C18	multilayer ceramic chip capacitor; note 1	62 pF		
L1	stripline; note 3	50 Ω	length 16.8 mm width 2.4 mm	
L2	stripline; note 3	50 Ω	length 14.8 mm width 2.4 mm	
L3	stripline; note 3	50 Ω	length 13.7 mm width 2.4 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L4	stripline; note 3	43 Ω	length 3.5 mm width 3 mm	
L5	stripline; note 3	43 Ω	length 6.4 mm width 3 mm	
L6	stripline; note 3	43 Ω	length 5.8 mm width 3 mm	
L7	stripline; note 3	43 Ω	length 2.4 mm width 3 mm	
L9	stripline; note 3	50 Ω	length 15.5 mm width 2.4 mm	
L10	stripline; note 3	50 Ω	length 20 mm width 2.4 mm	
L11	4 turns enamelled 0.8 mm copper wire	45 nH	int. diameter 4mm length 5 mm leads 2 × 5 mm	
L12	3 turns enamelled 0.8 mm copper wire	30 nH	int. diameter 3mm length 5 mm leads 2 × 5 mm	
L13, L14	grade 3B Ferroxcube wideband RF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω; 0.4 W		2322 151 71009

Notes

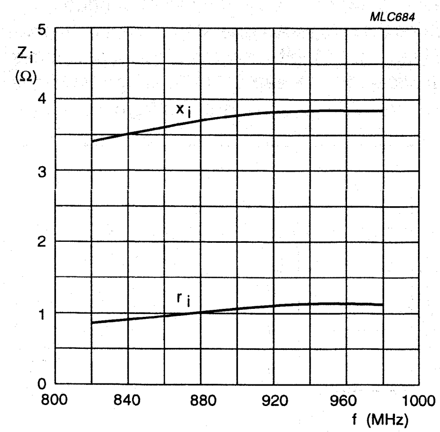
1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. The striplines are on double-clad PCB with PTFE fibre-glass dielectric ($\varepsilon_r = 2.2$); thickness $^1/_{32}$".



Dimensions in mm.

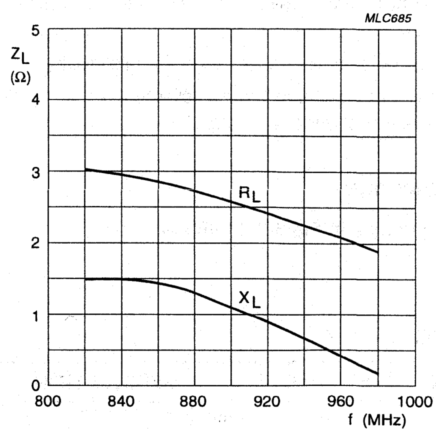
The components are located on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters to provide a direct contact between the component side and the ground plane.

Fig.9 Component layout for 960 MHz class-AB test circuit.



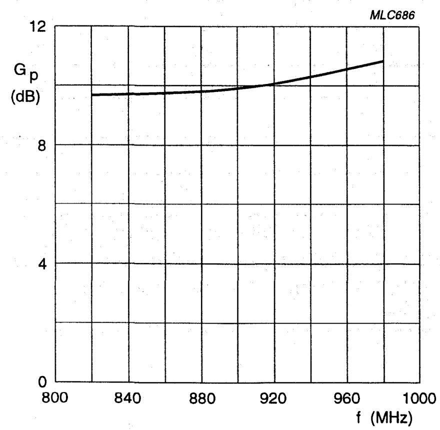
V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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



V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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



V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.4 K/W.

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

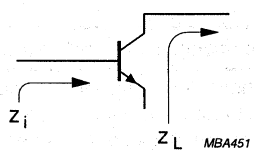


Fig.13 Definition of transistor impedance.

UHF power transistor BLV935

FEATURES

- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

APPLICATIONS

- Base stations in the 820 to 980 MHz range.

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-AB operation. The transistor has internal input matching by means of MOS capacitors and is encapsulated in a 6-lead SOT273 flange envelope with a ceramic cap. All leads are isolated from the flange.

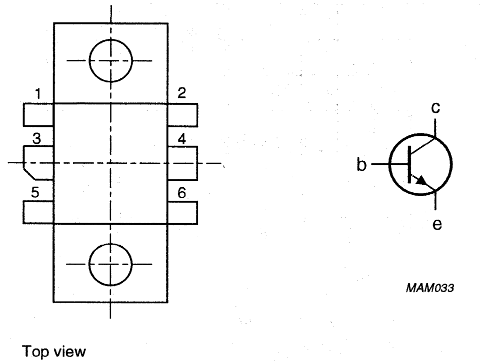


Fig.1 Simplified outline and symbol.

PINNING - SOT273

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	c	collector
4	b	base
5	e	emitter
6	e	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	≥ 9	≥ 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.

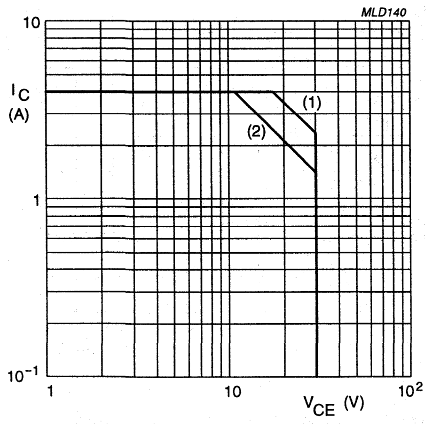
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	4	A
$I_{C(AV)}$	average collector current		–	4	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	70	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	+200	°C

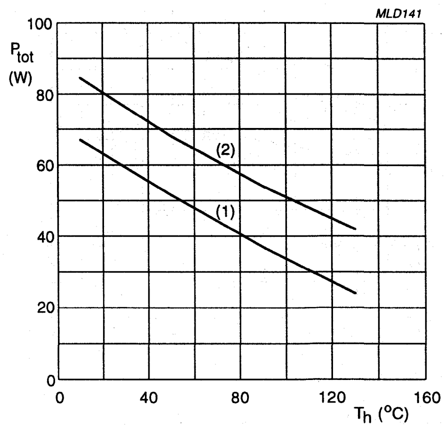
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 70 W; T_{mb} = 25 °C	2.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.3	K/W



(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 derating curves.

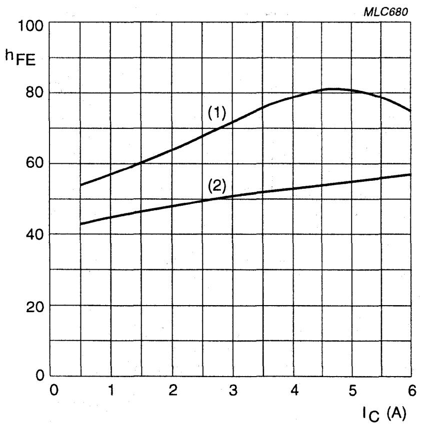
CHARACTERISTICS

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	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 50 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	2	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 1.5 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; I_E = i_e = 0; f = 1 MHz; note 2	–	25	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	17	–	pF

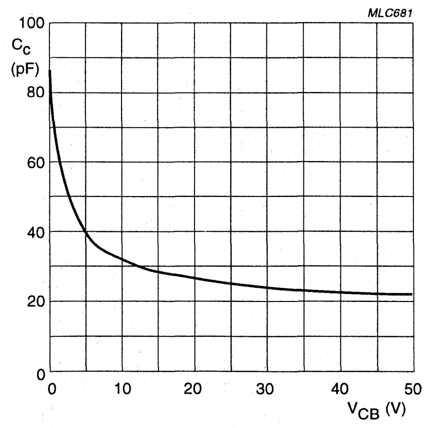
Notes

1. Measured under pulsed conditions: $t_p \leq 500$ µs; $\delta \leq 0.01$.
2. C_C value is that of the die only; it is not measurable because of internal matching network.



Measured under pulsed conditions; $t_p \leq 500$ µs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) V_{CE} = 10 V.

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



C_c value is that of the die only; it is not measurable because of internal matching network.
f = 1 MHz.

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

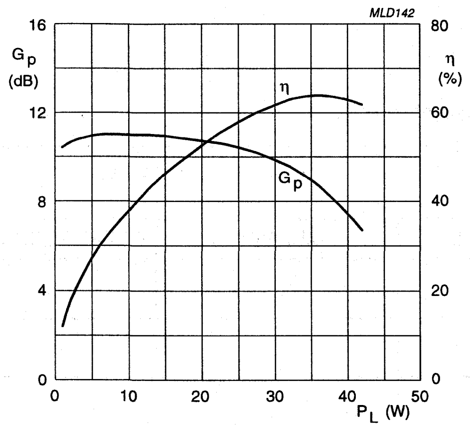
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB test circuit; $R_{th\ mb-h}$ = 0.3 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	960	26	100	30	≥9 typ. 10	≥55 typ. 60

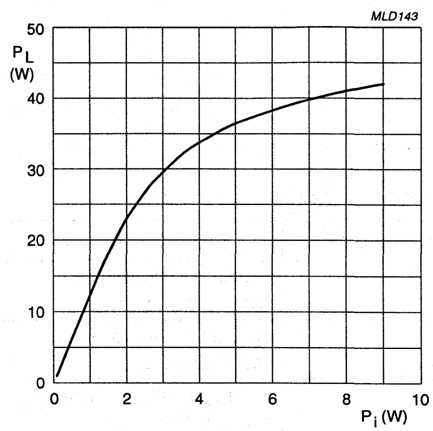
Ruggedness in class-AB operation

The BLV935 is capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases at rated output power, under the following conditions: V_{CE} = 26 V; f = 960 MHz; I_{CQ} = 100 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W.



V_{CE} = 26 V.
I_{CQ} = 100 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 100 mA.
f = 960 MHz.

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

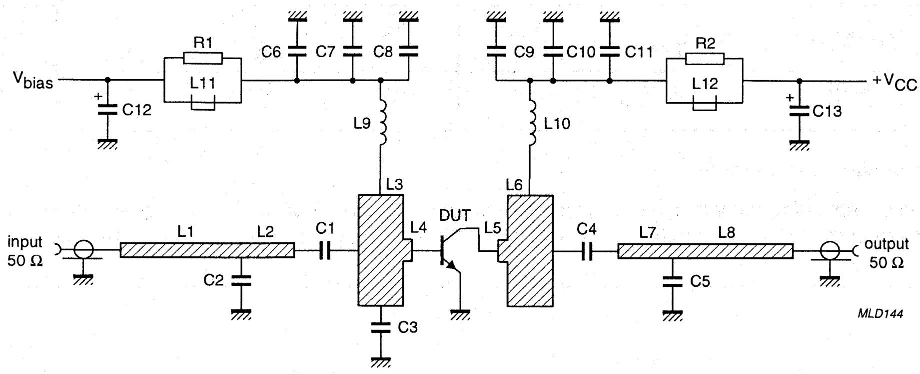


Fig.8 Class-AB broadband test circuit at 850 to 980 MHz.

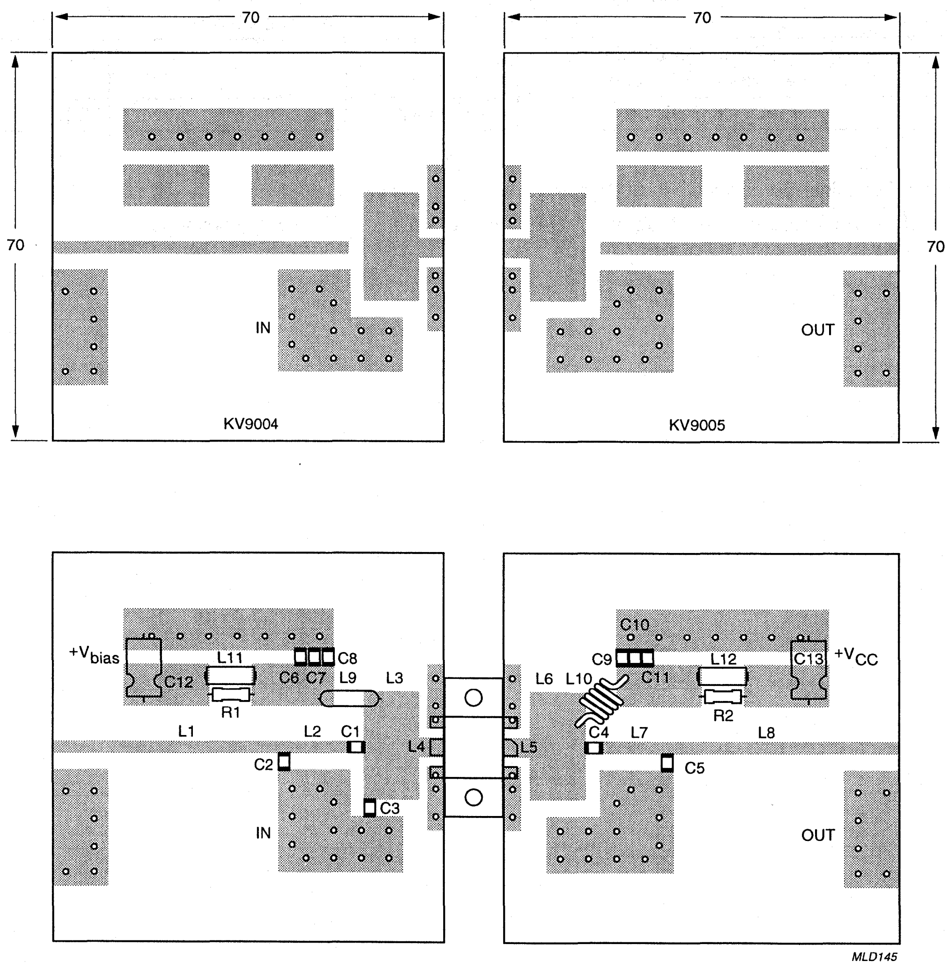
List of components (see Figs 8 and 9)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C4	multilayer ceramic chip capacitor; note 1	68 pF		
C2	multilayer ceramic chip capacitor; note 1	0.7 pF		
C3	multilayer ceramic chip capacitor; note 1	3.9 pF		
C5	multilayer ceramic chip capacitor; note 1	2 pF		
C6, C11	multilayer ceramic chip capacitor; note 1	1 nF		
C7, C8, C9, C10	multilayer ceramic chip capacitor; note 1	20 pF		
C12, C13	63 V solid aluminium capacitor	10 μF		2222 030 38109
L1, L8	stripline; note 2	50 Ω	41 × 2.4 mm	
L2, L7	stripline; note 2	50 Ω	12 × 2.4 mm	
L3, L6	stripline; note 2	9 Ω	10 × 20 mm	
L4, L5	stripline; note 2	38 Ω	4.5 × 3.5 mm	
L9	microchoke	100 nH		4322 057 01071

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L10	4 turns 1 mm enamelled copper wire (close wound)	65 nH	internal diameter: 4 mm length: 4 mm leads: 2 × 5 mm	
L11, L12	grade 3B Ferroxcube wideband RF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω; 0.4 W		2322 151 71009

Notes

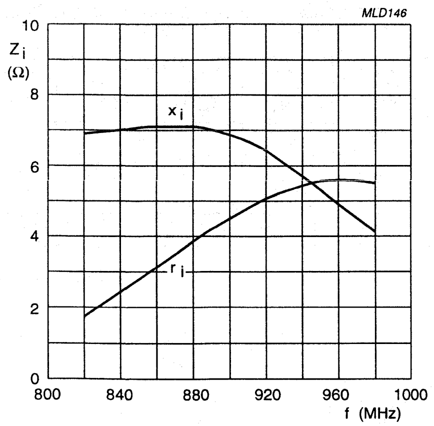
1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on double-clad PCB with PTFE fibre-glass dielectric (ε_r = 2.2); thickness $\frac{1}{32}$".



Dimensions in mm.

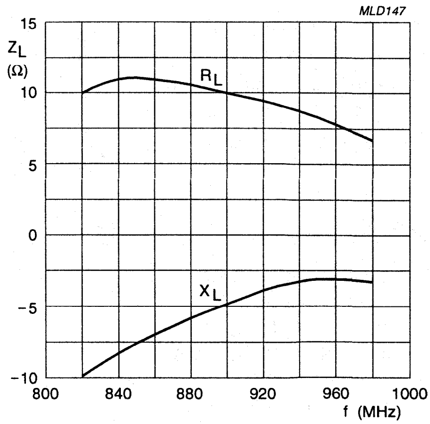
The components are located on one side of the PTFE fibre-glass board, the other side being fully metallized to serve as an earth. Earth connections are made by fixing screws, hollow rivets and copper straps around the board and under the emitters to provide a direct contact between the component side and the ground plane.

Fig.9 Printed circuit board and component layout for class-AB test circuit (850-980 MHz).



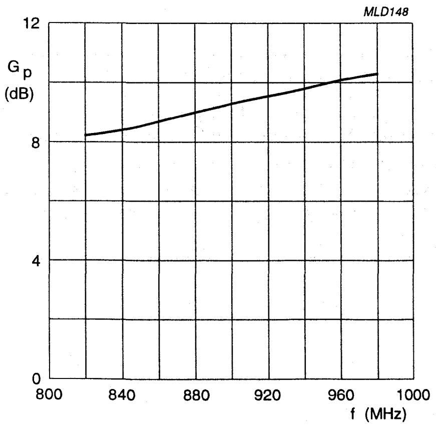
V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



V_{CE} = 26 V; I_{CQ} = 100 mA; P_L = 30 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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

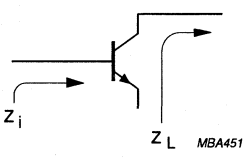


Fig.13 Definition of transistor impedance.

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

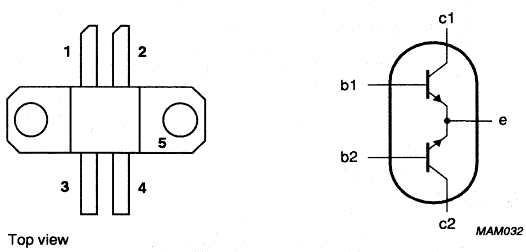


Fig.1 Simplified outline and symbol.

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.

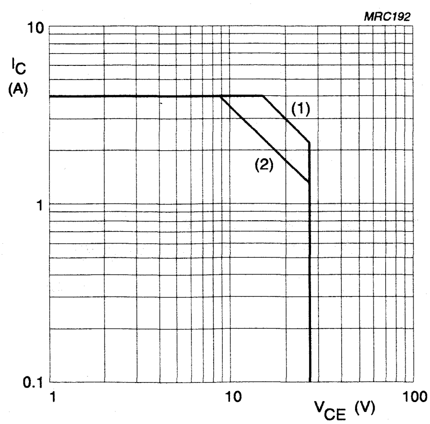
LIMITING VALUES

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

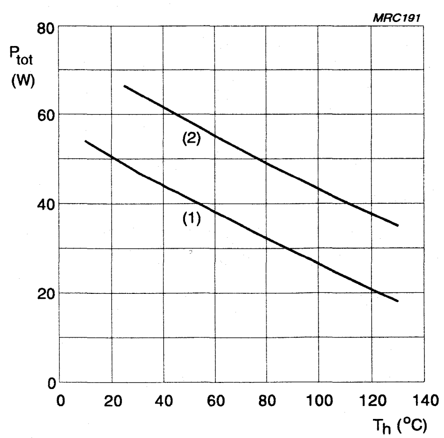
THERMAL RESISTANCE

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.



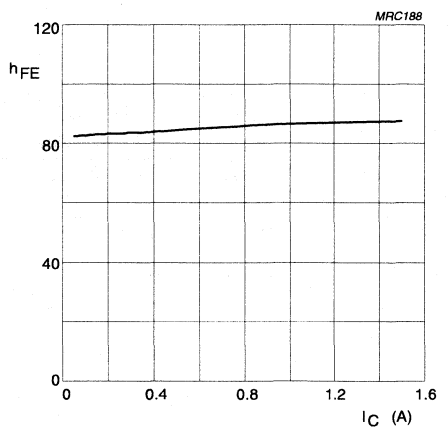
(1) Continuous operation.
(2) Short-time operation during mismatch.
Total device; both sections equally loaded.

Fig.3 Power/temperature derating curve.

CHARACTERISTICS

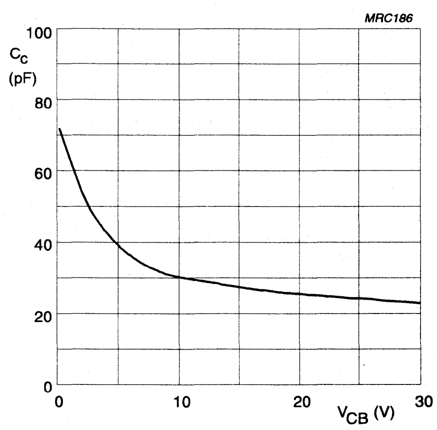
T_j = 25 °C unless otherwise specified.
Per transistor section unless otherwise specified.

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

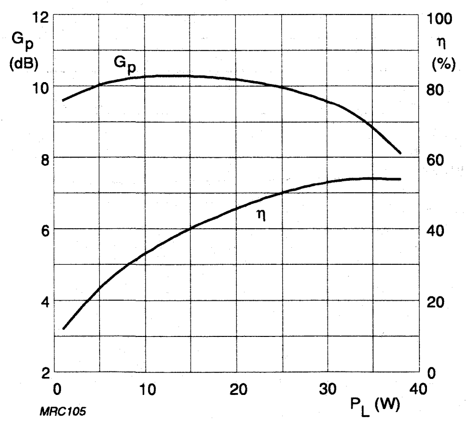
Note

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Ruggedness in class-AB operation

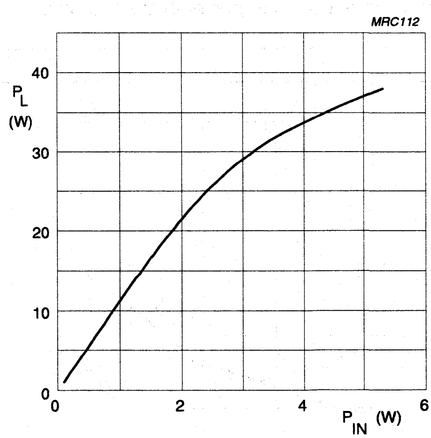
The BLV945A is capable of withstanding a load mismatch corresponding to VSWR = 3:1 through all phases under the following conditions: I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C; P_L = 25 W; f = 900 MHz.

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.



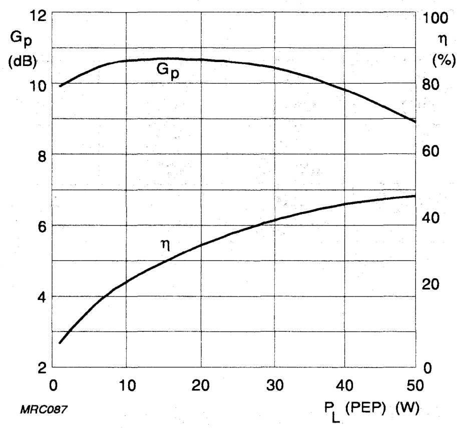
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f = 900 MHz.

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



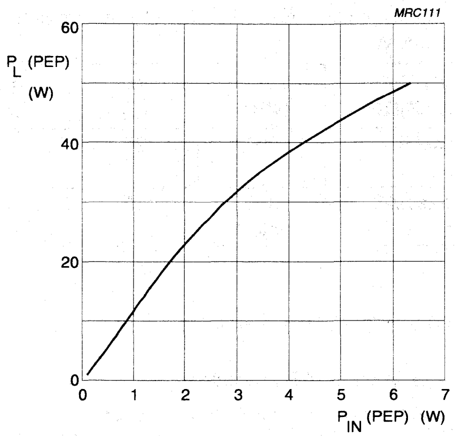
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f = 900 MHz.

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



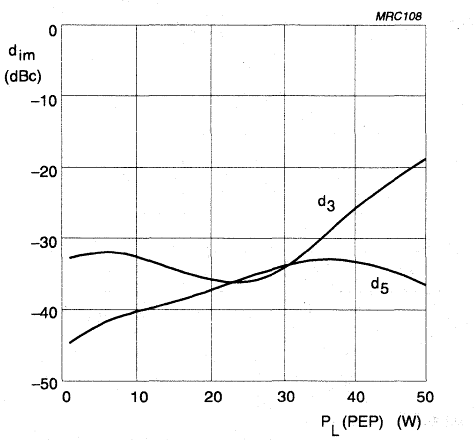
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

Fig.8 Power gain and efficiency as functions of peak envelope load power, typical values.



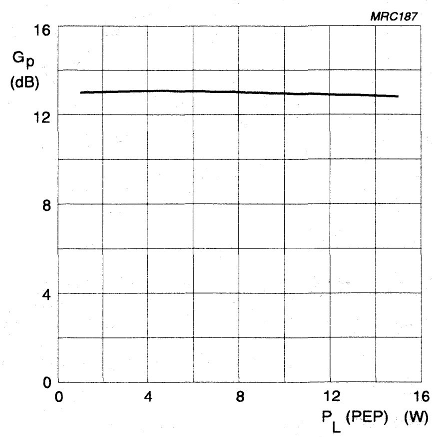
Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

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.

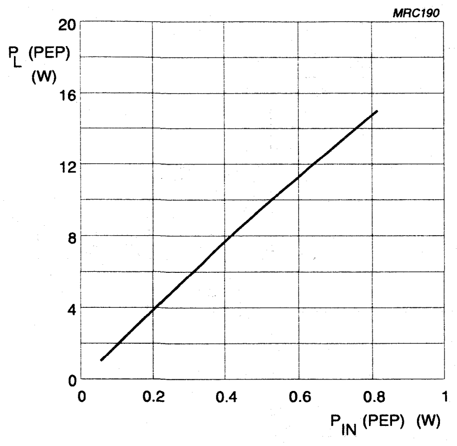
Fig.11 Power gain as a function of peak envelope load power, typical values.

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

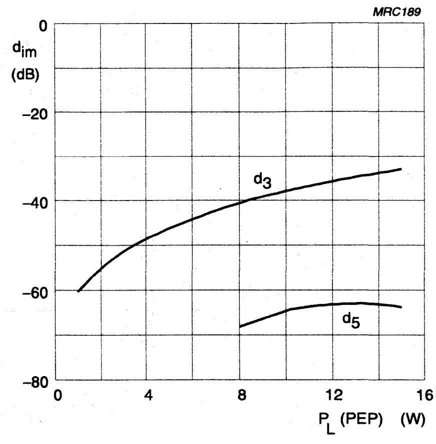
Note

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.



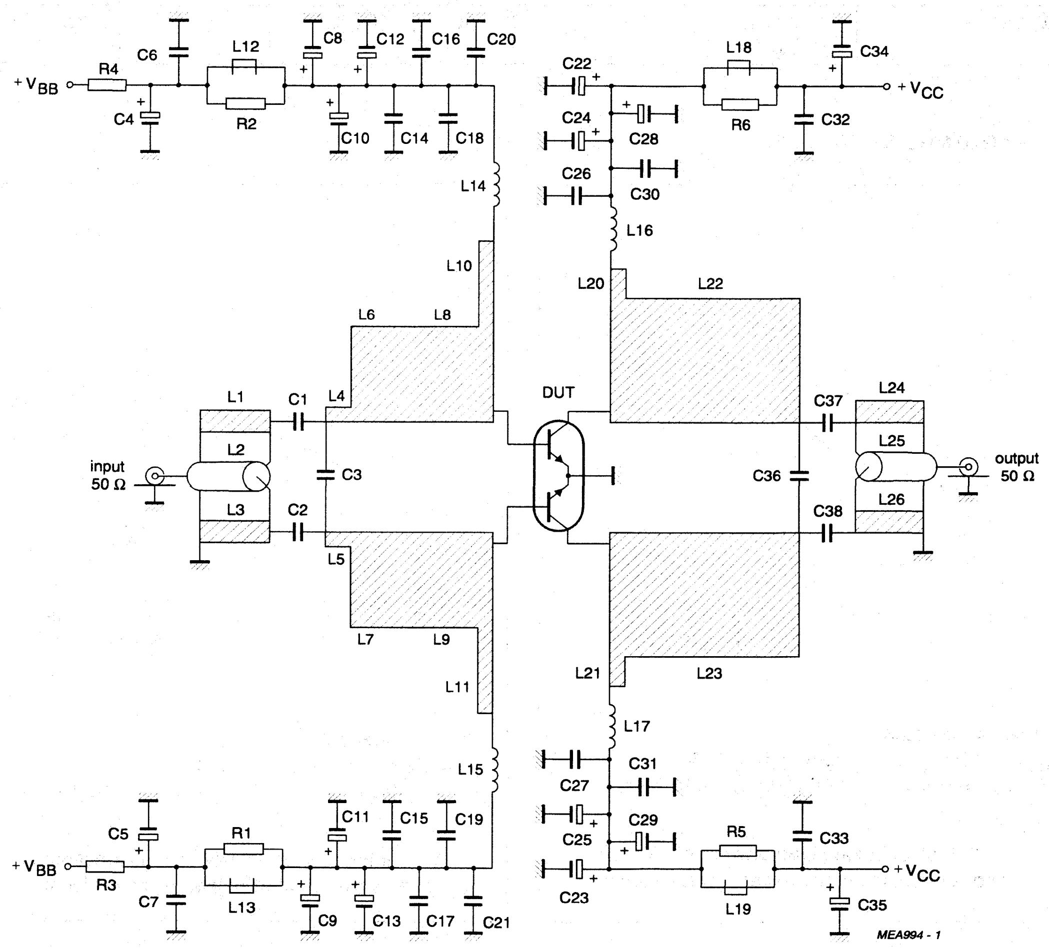
Class-A operation:
I_{CQ} = 2 x 850 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.5 K/W; f_1 = 900 MHz; f_2 = 900.1 MHz.

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)

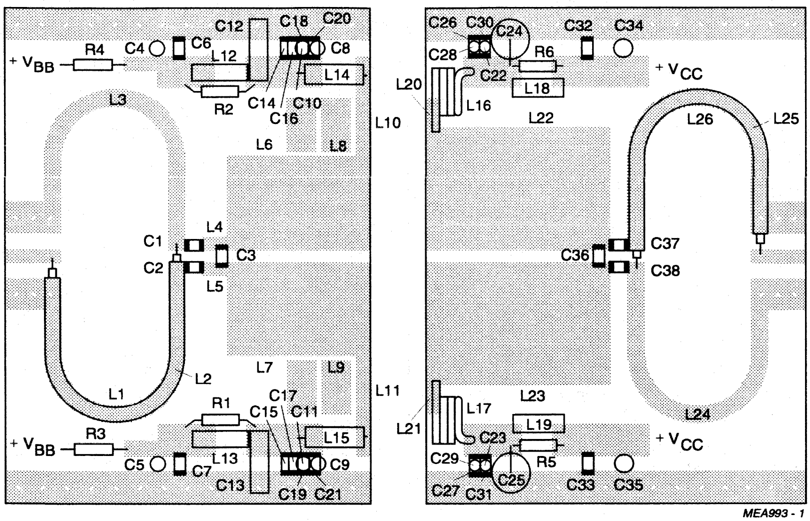
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor (note 1)	47 pF, 500 V		
C3	multilayer ceramic chip capacitor (note 1)	1 pF, 500 V		
C4, C5, C8, C9, C22, C23, C34, C35	tantalum capacitor	1 µF, 35 V		2022 019 00056
C6, C7, C18, C19, C30, C31, C32, C33	multilayer 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

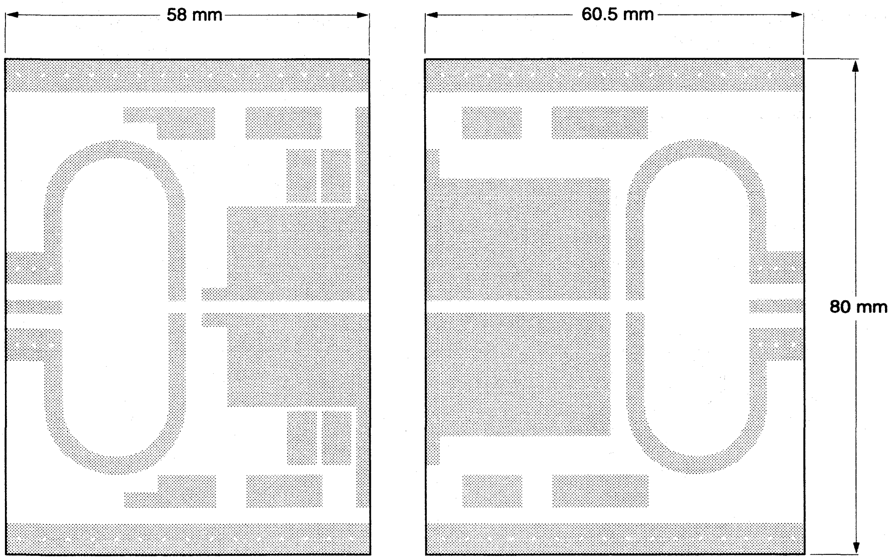
List of components (see Figs 14 and 15) *(Continued)*

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

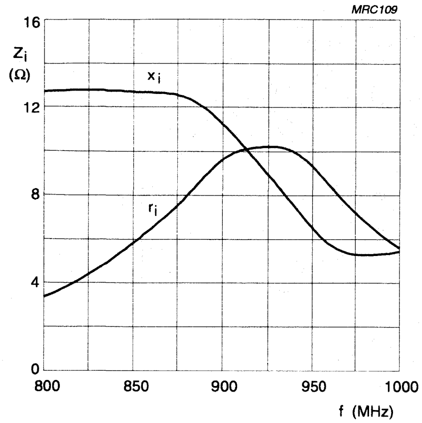
1. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE microfibre-glass dielectric ($\varepsilon_r = 2.2$), thickness $1/32$ inch; thickness of copper sheet 2 x 35 μm.
3. Cables soldered to striplines L1 and L26 respectively.





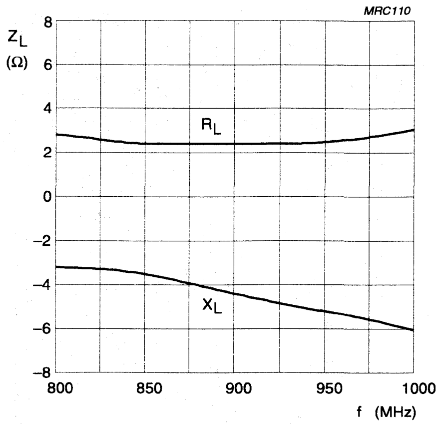
The components are mounted on one side of a copper-clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

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.

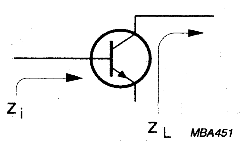
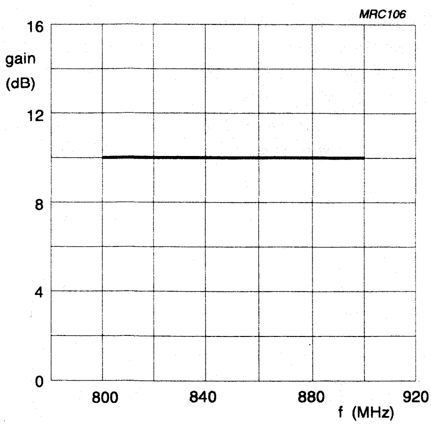
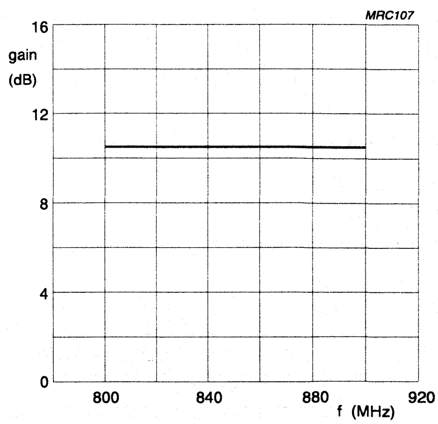


Fig.18 Definition of transistor impedance.



Class-AB operation:
I_{CQ} = 2 x 75 mA; V_{CE} = 25 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 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;
$R_{th\ mb\text{-}h}$ = 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.

APPLICATIONS

- Base station transmitters in the 900 to 960 MHz range.

PINNING - SOT324

PIN	SYMBOL	DESCRIPTION
1	c1	collector 1
2	c2	collector 2
3	b1	base 1
4	b2	base 2
5	e	emitter connected to flange

DESCRIPTION

Two NPN silicon planar epitaxial transistors in push-pull configuration, intended for linear common emitter class-AB operation. 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.

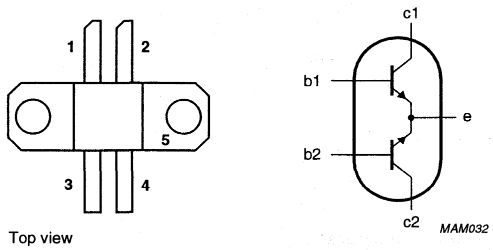


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter 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
2-tone, class-A	960	25	6 (PEP)	typ. 12.5	–	typ. –43

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.

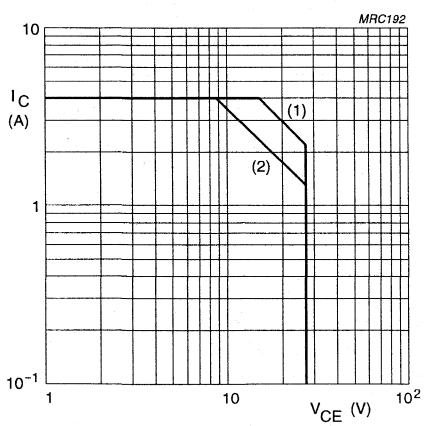
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Per transistor section					
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	collector current (DC)		–	2	A
$I_{C(AV)}$	average collector current		–	2	A
P_{tot}	total power dissipation (DC)	up to $T_{mb} = 25$ °C; total device; both sections equally loaded	–	60	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

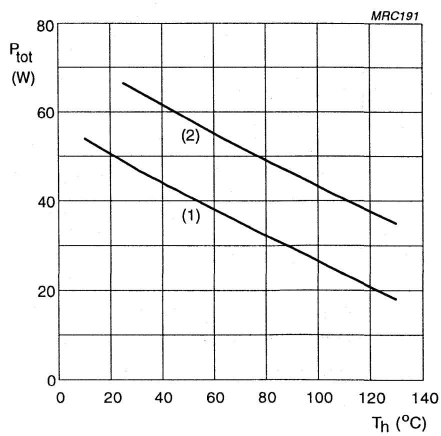
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	$P_{tot} = 60$ W; $T_{mb} = 25$ °C; total device; both sections equally loaded	2.9	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	total device; both sections equally loaded	0.5	K/W



Total device; both sections equally loaded.
(1) $T_{mb} = 25$ °C.
(2) $T_h = 70$ °C.

Fig.2 DC SOAR.



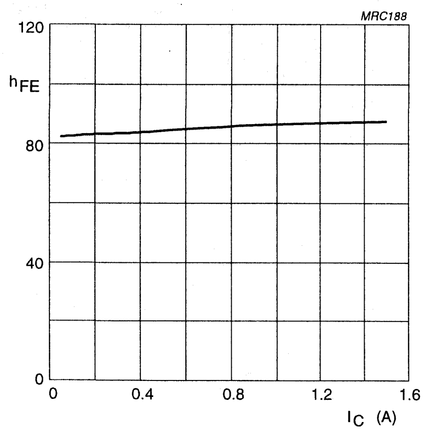
Total device; both sections equally loaded.
(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

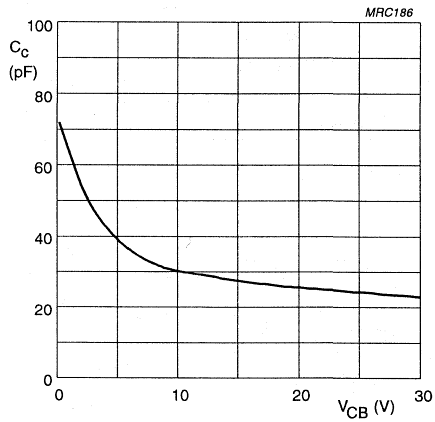
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Per transistor section						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 25 mA	27	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	V_{BE} = 0; I_C = 10 mA	50	–	–	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	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 25 V; I_C = 0.85 A	30	–	120	
C_c	collector capacitance	V_{CB} = 25 V; I_E = i_e = 0; 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 at T_h = 25 °C in a common emitter push-pull, class-AB test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	960	25	2 × 75	25	≥8.5 typ. 9.5	≥45 typ. 48	–
2-tone, class-AB	960(1)	25	2 × 75	30 (PEP)	≥8.5 typ. 9.5	≥35 typ. 42	≤−32 typ. −34

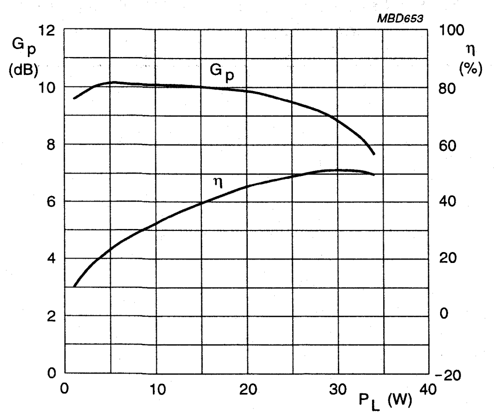
Note

1. f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Ruggedness in class-AB operation

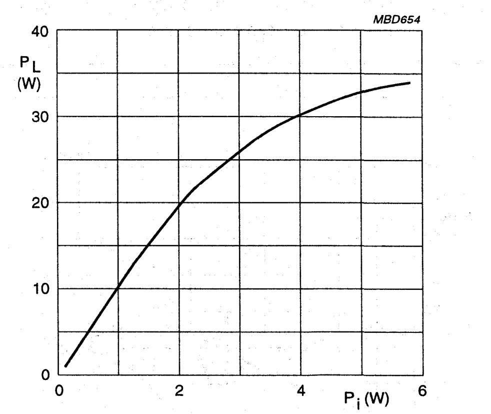
The BLV945B is capable of withstanding a full load mismatch corresponding to VSWR = 3 : 1 through all phases under the following conditions: P_L = 25 W; f = 960 MHz; V_{CE} = 25 V; T_h = 25 °C; I_{CQ} = 2 × 75 mA; $R_{th\ mb\text{-}h}$ = 0.5 K/W.

It is capable of withstanding a full load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: P_L = 30 W (PEP); f_1= 960 MHz; f_2 = 960.1 MHz; V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.5 K/W.



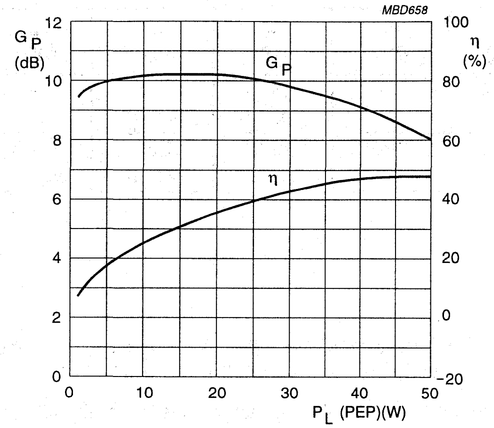
Class-AB operation.
V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; f = 960 MHz.

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



Class-AB operation.
V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; f = 960 MHz.

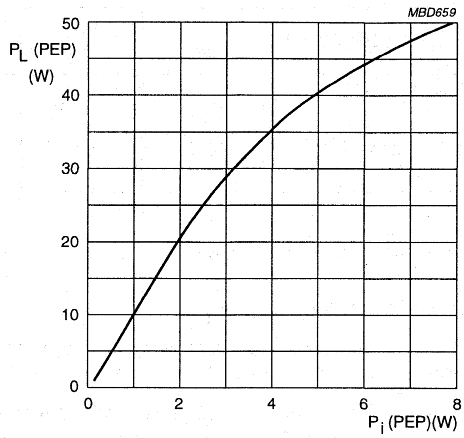
Fig.7 Load power as a function of input power; typical values.



Class-AB operation.

V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.5 K/W.

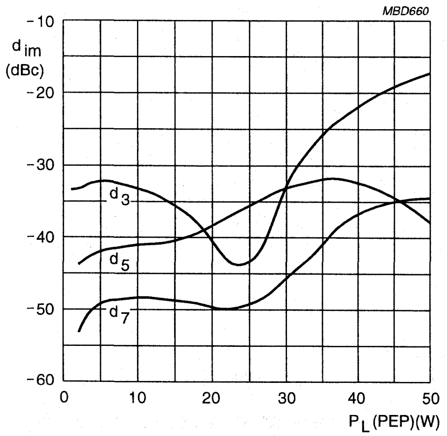
Fig.8 Power gain and efficiency as functions of load power; typical values.



Class-AB operation.

V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.5 K/W.

Fig.9 Load power as a function of input power; typical values.



Class-AB operation.

V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.5 K/W.

Fig.10 Intermodulation distortion as functions of load power; typical values.

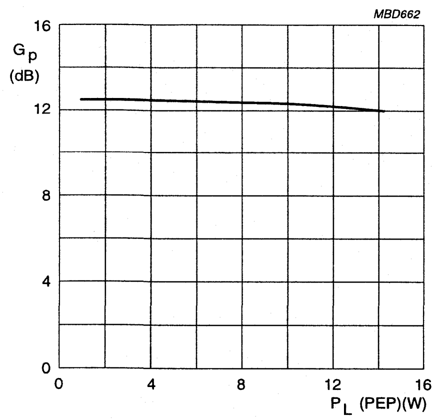
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter push-pull, class-A test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	d_3 (dBc)
2-tone, class-A	960[(1)]	25	2 × 850	6 (PEP)	typ. 12.5	typ. −43

Note

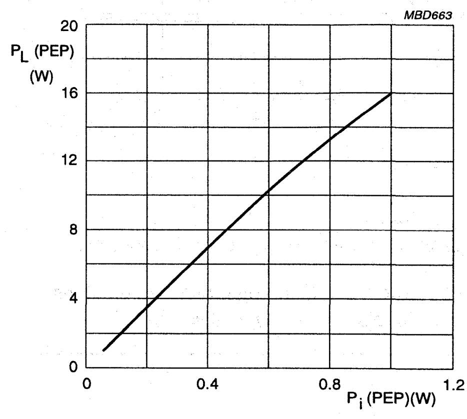
1. f_1 = 960.0 MHz; f_2 = 960.1 MHz.



Class-A operation.

V_{CE} = 25 V; I_{CQ} = 2 × 850 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.11 Power gain as a function of load power; typical values.

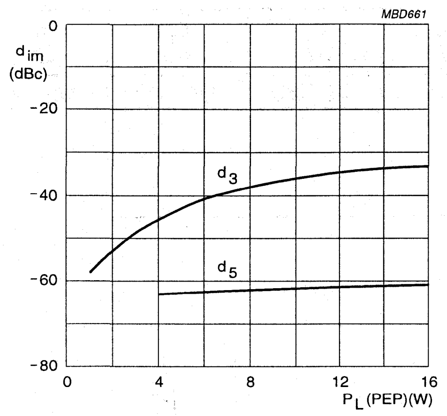


Class-A operation.

V_{CE} = 25 V; I_{CQ} = 2 × 850 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.12 Load power as a function of input power; typical values.

UHF push-pull power transistor BLV945B



Class-A operation.

V_{CE} = 25 V; I_{CQ} = 2 × 850 mA; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.13 Intermodulation distortion as functions of load power; typical values.

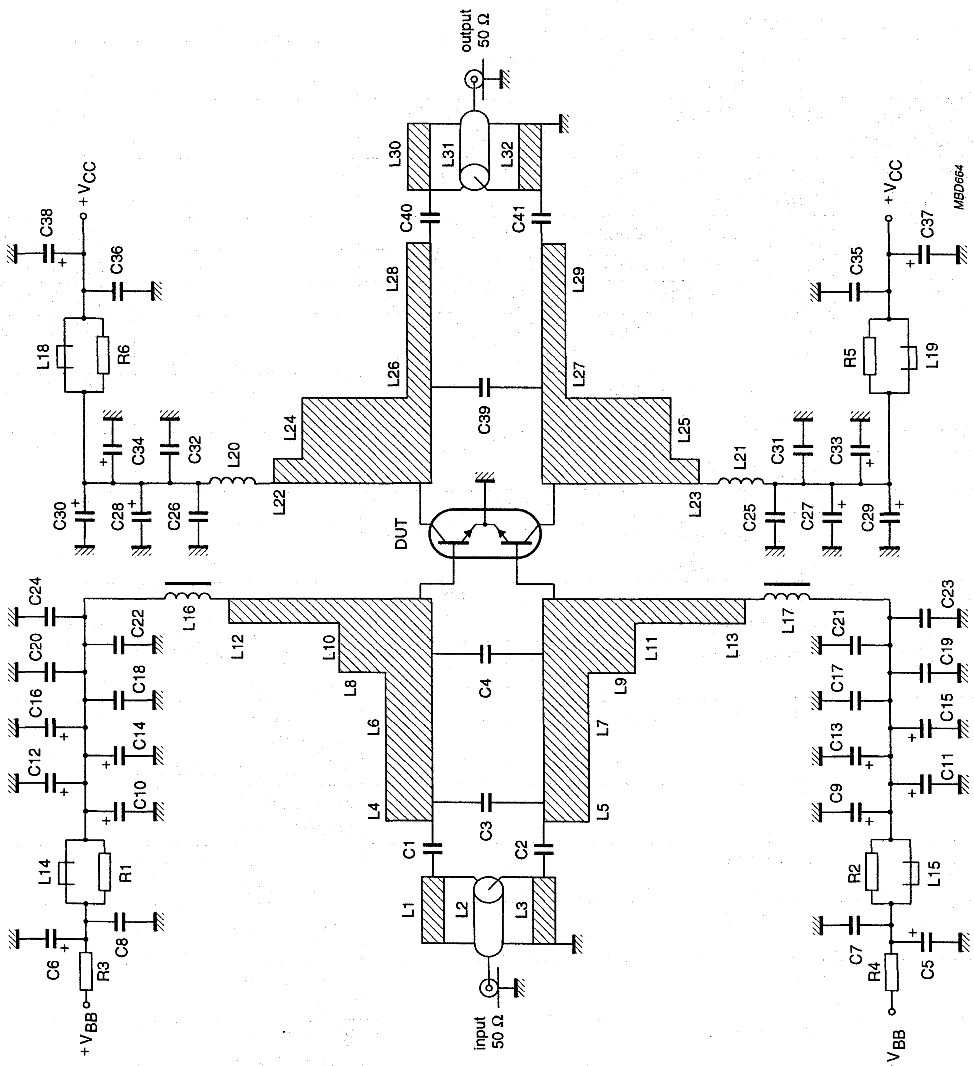


Fig.14 Test circuit for class-AB.

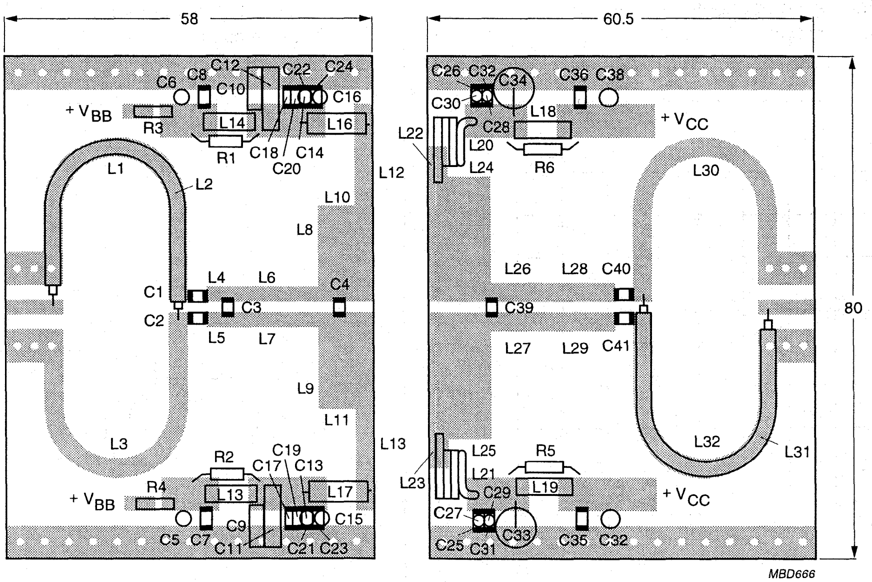
List of components (see Figs 14 and 15)

COMPONENT	DESCRIPTION	VALUE	DIMENSION	CATALOGUE NO.
C1, C2	multilayer ceramic chip capacitor; note 1	47 pF, 500 V		
C3	multilayer ceramic chip capacitor; note 1	1.2 pF, 500 V		
C4	multilayer ceramic chip capacitor; note 1	3.6 pF, 500 V		
C5, C6, C15, C16, C27, C28, C37, C38	tantalum capacitor	1 μF, 35 V		2022 019 00056
C7, C8, C21, C22, C31, C32, C35, C36	multilayer ceramic chip capacitor; note 1	300 pF, 200 V		
C9, C10	SMD electrolytic capacitor	1 μF, 63 V		2222 085 78108
C11, C12	SMD electrolytic capacitor	10 μF, 16 V		2222 085 75109
C13, C14, C29, C30	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C17, C18	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C19, C20	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C23, C24, C25, C26	multilayer ceramic chip capacitor; note 1	39 pF, 500V		
C33, C34	electrolytic capacitor	10 μF, 63 V		2222 030 28109
C39	multilayer ceramic chip capacitor; note 1	6.2 pF, 500 V		
C40, C41	multilayer ceramic chip capacitor; note 1	27 pF, 500 V		
L1, L3, L30, L32	stripline; note 2	50 Ω	length 57.1 mm width 3 mm	
L2, L31	semi-rigid cable; note 3	50 Ω	ext. conductor; length 57.1 mm ext. diameter 2.2 mm	
L4, L5	stripline; note 2		length 3 mm width 2.6 mm	
L6, L7	stripline; note 2		length 15 mm width 2.6 mm	
L8, L9	stripline; note 2		length 2.8 mm width 15 mm	
L10, L11	stripline; note 2		length 3 mm width 15 mm	
L12, L13	stripline; note 2		length 3 mm width 31.5 mm	
L14, L15, L18, L19	grade 4S2 Ferroxcube chip-bead			4330 030 36300
L16, L17	microchoke	470 nH		4322 057 04771
L20, L21	4 turns enamelled 1 mm copper wire		int. diameter 6 mm close wound	

COMPONENT	DESCRIPTION	VALUE	DIMENSION	CATALOGUE NO.
L22, L23	stripline; note 2		length 3 mm width 24 mm	
L24, L25	stripline; note 2		length 7.5 mm width 20 mm	
L26, L27	stripline; note 2		length 3.6 mm width 3 mm	
L28, L29	stripline; note 2		length 15.9 mm width 3 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

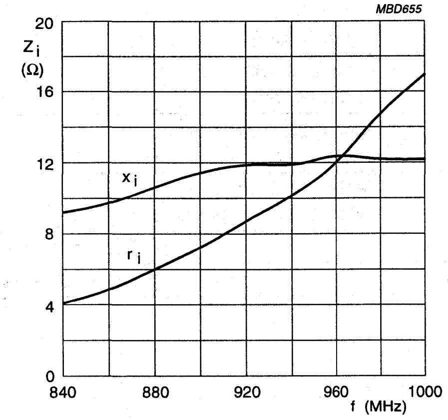
1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board with microfibre-glass dielectric ($\varepsilon_r = 2.2$); thickness $1/32$ inch; thickness of the copper sheet 2×35 μm.
3. Semi-rigid cables L2 and L31 are soldered onto striplines L1 and L30.



Dimensions in mm.

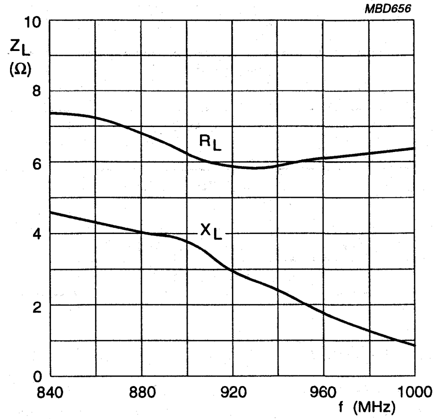
The components are situated on one side of the copper-clad PTFE microfibre-glass board. The other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through-metallization.

Fig.15 Component layout for 960 MHz class-AB test circuit.



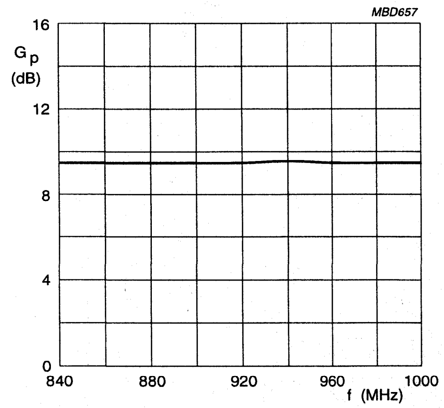
V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.5 K/W;
P_L = 25 W.

Fig.16 Input impedance as a function of frequency (series components); typical values per section.



V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.5 K/W;
P_L = 25 W.

Fig.17 Load impedance as a function of frequency (series components); typical values per section.



V_{CE} = 25 V; I_{CQ} = 2 × 75 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.5 K/W;
P_L = 25 W.

Fig.18 Gain as a function of frequency, total device; typical values.

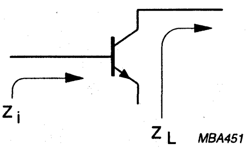


Fig.19 Definition of transistor impedance.

UHF power transistor BLV946

FEATURES

- Internal input and output matching for easy matching, high gain and efficiency
- Poly-silicon emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base stations in the 850 to 960 MHz frequency range.

DESCRIPTION

NPN silicon planar transistor intended for common emitter class-AB operation. The transistor has internal input and output matching by means of MOS capacitors. The encapsulation is a SOT273 flange envelope with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT273

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	c	collector
4	b	base
5	e	emitter
6	e	emitter

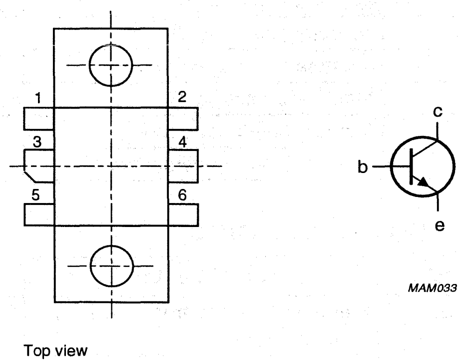


Fig.1 Simplified outline and symbol.

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	40	≥ 9	≥ 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.

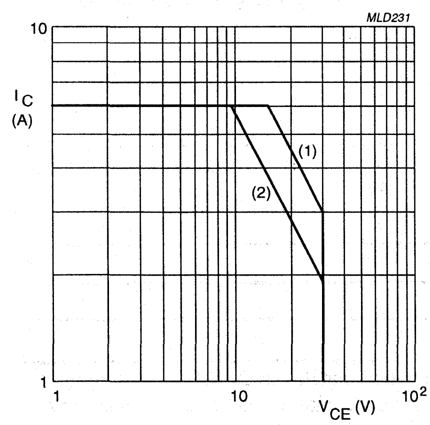
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	6	A
$I_{C(AV)}$	average collector current		–	6	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	90	W
T_{stg}	storage temperature range		–65	+150	°C
T_j	operating junction temperature		–	+200	°C

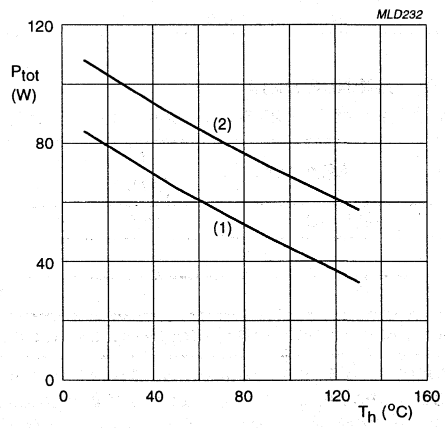
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 90 W; T_{mb} = 25 °C	1.94	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.3	K/W



(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 derating curve.

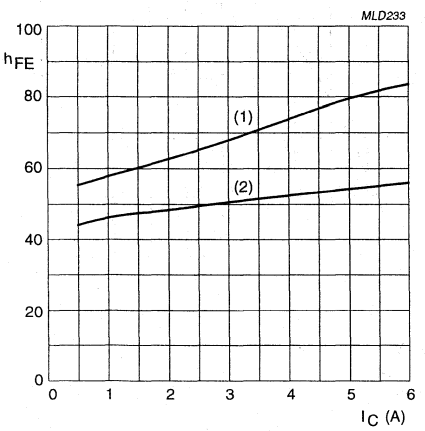
CHARACTERISTICS

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 = 30 mA	70	–	–	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 = 1.2 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	3	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 2 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 2	–	33	–	pF

Notes

1. Measured under pulsed conditions: $t_p \leq 500$ µs; $\delta \leq 0.01$.
2. C_C value is that of the die only; it is not measurable because of internal matching network.



Measured under pulsed conditions; $t_p \leq 500$ µs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) V_{CE} = 10 V.

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

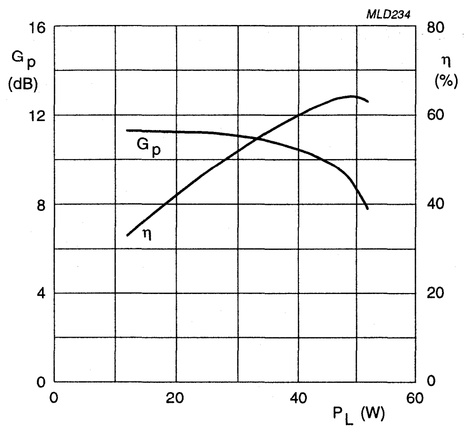
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB test circuit; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)
CW, class-AB	960	26	130	40	≥9 typ. 11	≥55 typ. 60

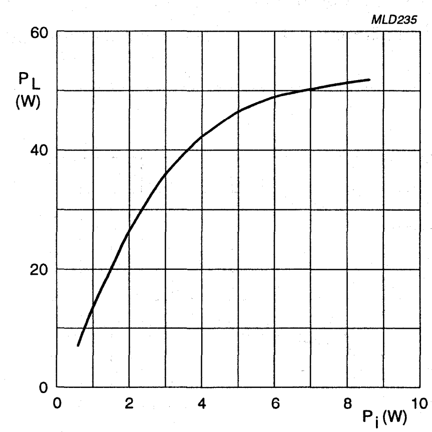
Ruggedness in class-AB operation

The BLV946 is capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases at rated output power, under the following conditions: V_{CE} = 26 V; f = 960 MHz; I_{CQ} = 130 mA; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.



V_{CE} = 26 V.
I_{CQ} = 130 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 130 mA.
f = 960 MHz.

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

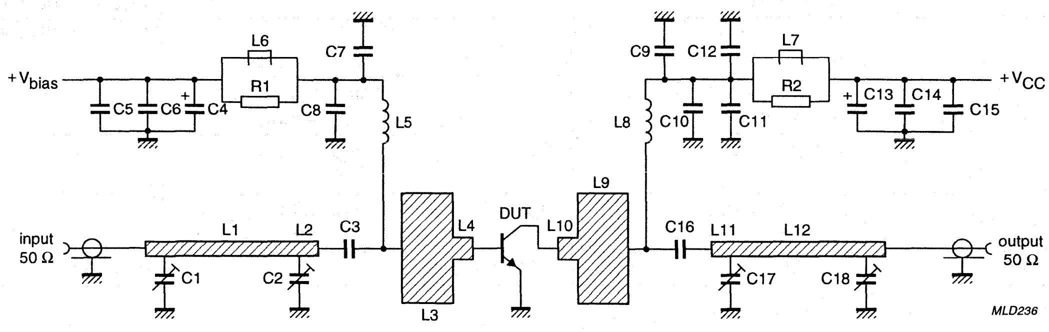


Fig.7 Class-AB test circuit at 960 MHz.

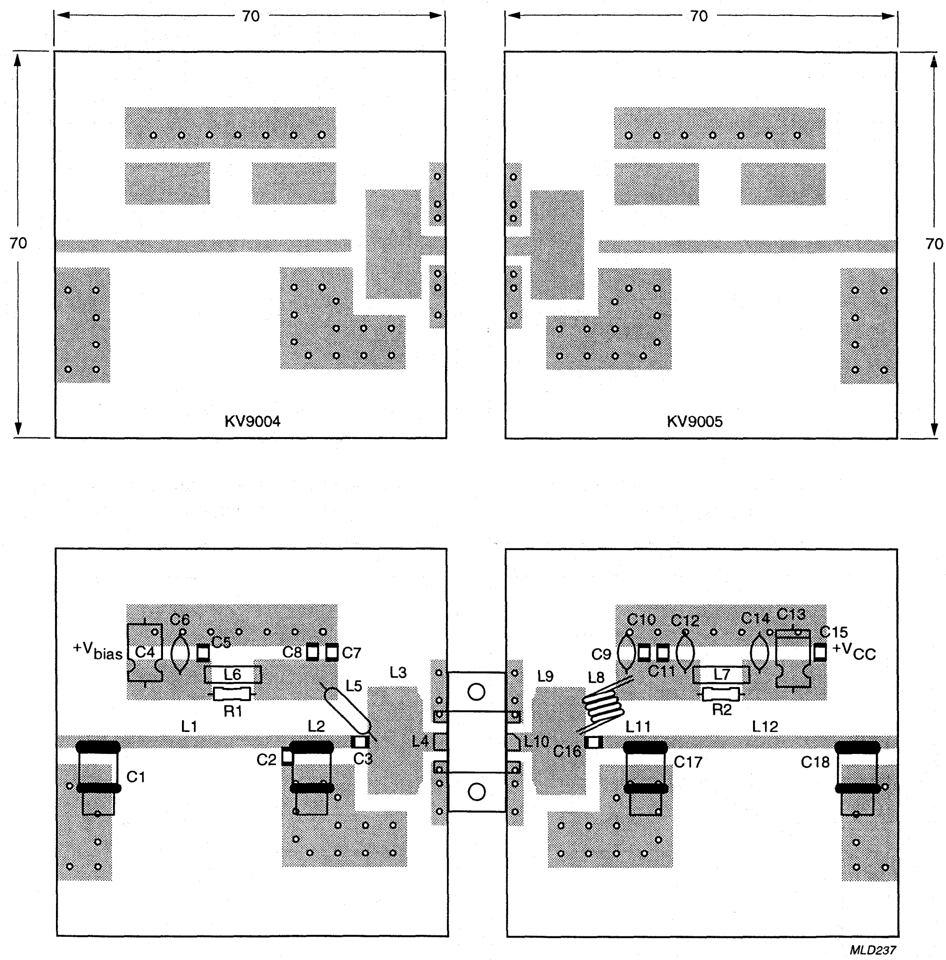
List of components

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C2, C17, C18	TEKELEC variable capacitor type 6451	12 pF		
C3, C16	multilayer ceramic chip capacitor; note 1	68 pF, 500 V		
C4, C13	electrolytic capacitor	10 µF, 63 V		2222 030 28109
C5, C8, C10, C13, C15	multilayer ceramic chip capacitor; note 1	20 pF, 500 V		
C6	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C7, C11	multilayer ceramic chip capacitor; note 1	100 pF, 500 V		
C9	multilayer ceramic chip capacitor	470 pF, 50 V		2222 731 18471
C12	multilayer ceramic chip capacitor	10 nF, 50 V		2222 731 18103
C14	multilayer ceramic chip capacitor	22 nF, 50 V		2222 731 18223
L1	stripline; note 2	50 Ω	length 36 mm width 2.2 mm	
L2	stripline; note 2	50 Ω	length 8 mm width 2.2 mm	
L3, L9	stripline; note 2	8 Ω	length 10 mm width 20 mm	
L4, L10	stripline; note 2	37 Ω	length 4.5 mm width 3.5 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L5	microchoke	2.2 μH		4322 057 02281
L6, L7	Ferroxcube wide band HF choke, grade 3B			4312 020 36642
L8	4.5 turns enamelled 1 mm copper wire	50 nH	internal dia. 4 mm close wound	
L11	stripline; note 2	50 Ω	length 7 mm width 2.2 mm	
L12	stripline; note 2	50 Ω	length 37 mm width 2.2 mm	
R1, R2	metal film resistor	100 Ω; 0.4 W		2322 171 11001

Notes

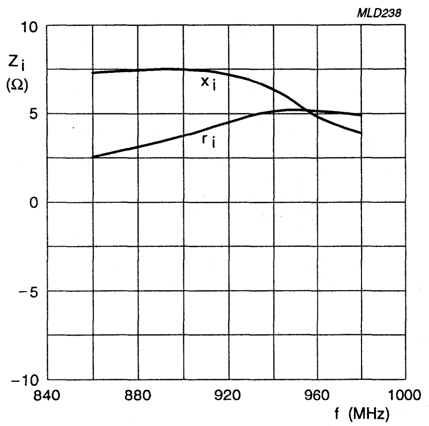
1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with microfibre-glass dielectric (ε_r = 2.2); thickness $^1/_{32}$"; thickness of the copper sheet 2 x 35 μm.



Dimensions in mm.

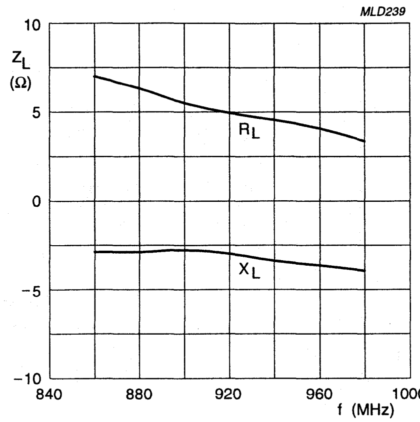
The components are located on one side of the copper-clad PTFE microfibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.8 Component layout and printed circuit board for 960 MHz class-AB test circuit.



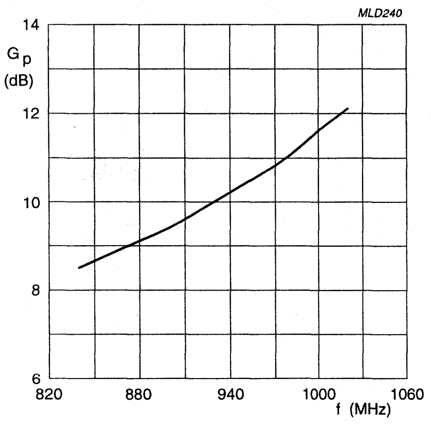
V_{CE} = 26 V; I_{CQ} = 130 mA; P_L = 40 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



V_{CE} = 26 V; I_{CQ} = 130 mA; P_L = 40 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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



V_{CE} = 26 V; I_{CQ} = 130 mA; P_L = 40 W;
T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W.

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

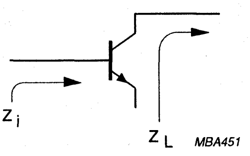


Fig.12 Definition of transistor impedance.

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

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.

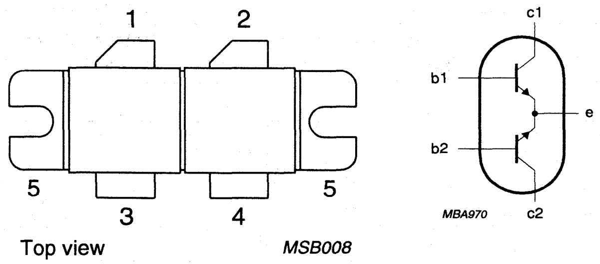


Fig.1 Simplified outline and symbol.

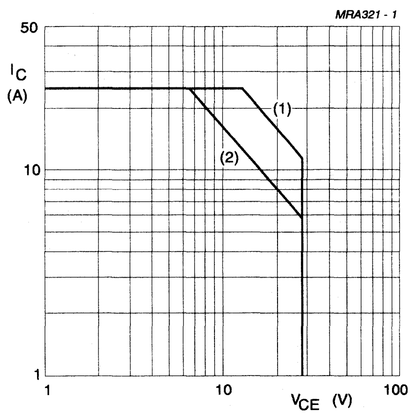
LIMITING VALUES

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

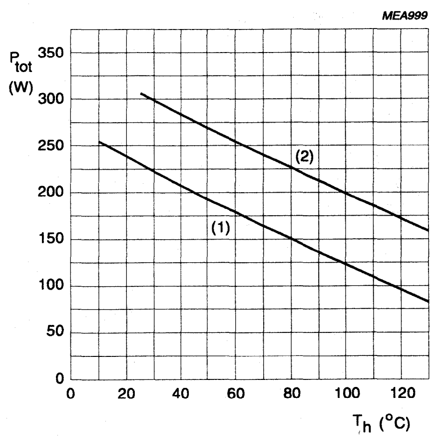
THERMAL RESISTANCE

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.

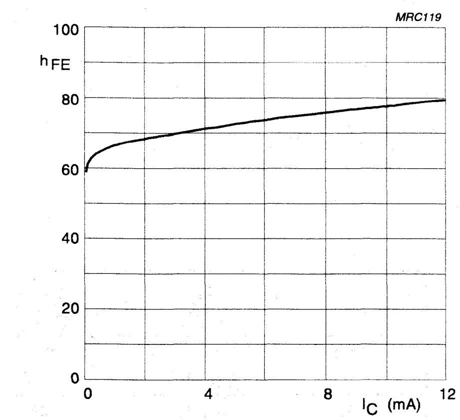
CHARACTERISTICS

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

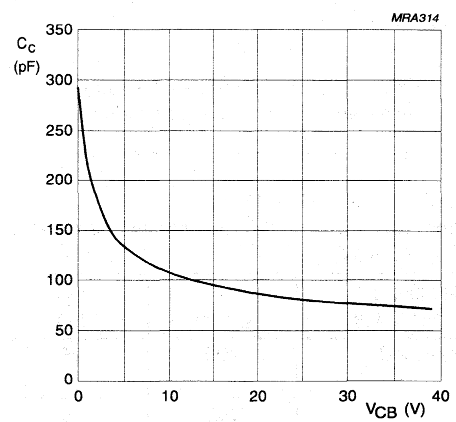
Note

1. Value C_c is that of the die only, it is not measurable because of the internal matching network.



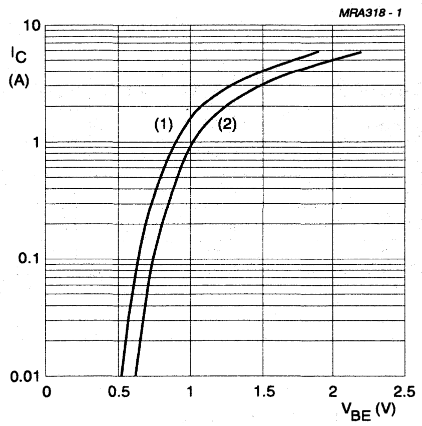
V_{CE} = 10 V.

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.

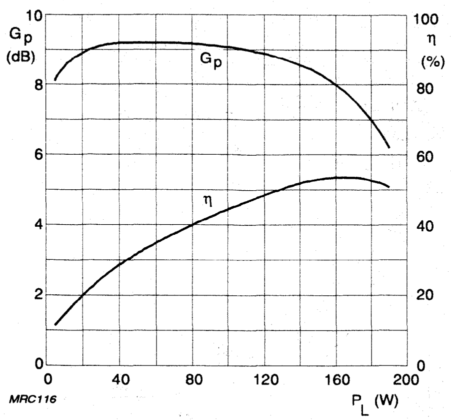
APPLICATION INFORMATION

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

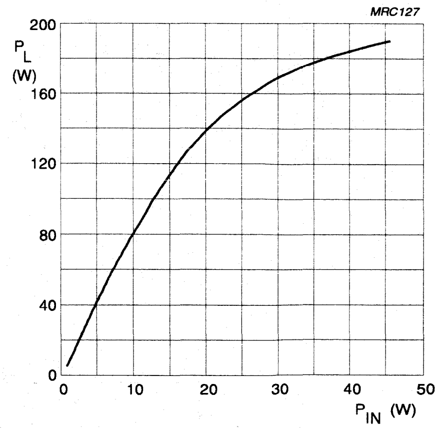
Ruggedness in class-AB operation

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.



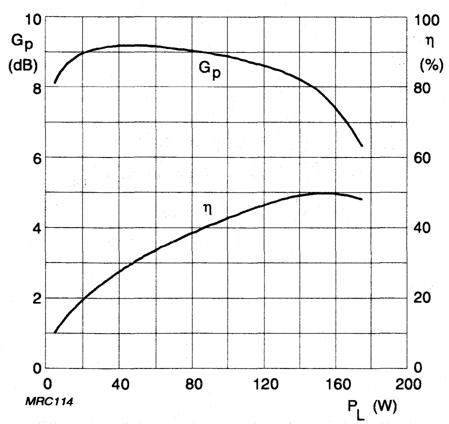
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 900 MHz.

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



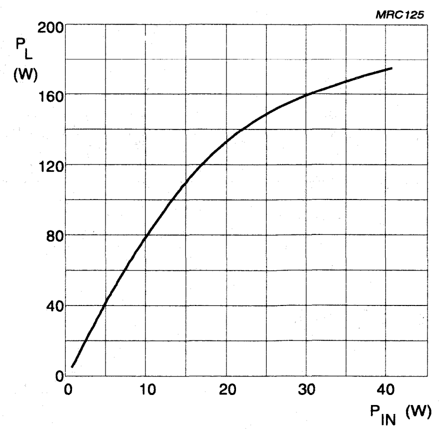
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 900 MHz.

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



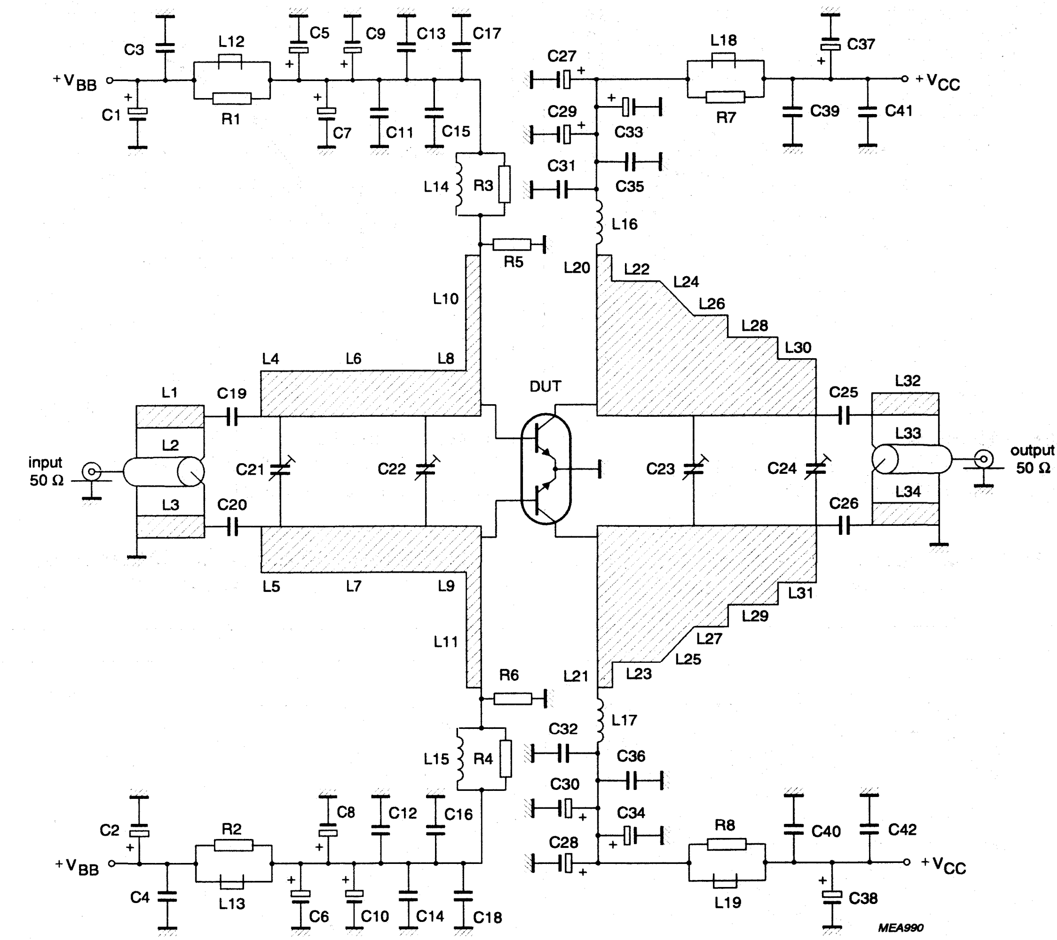
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f = 960 MHz.

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)

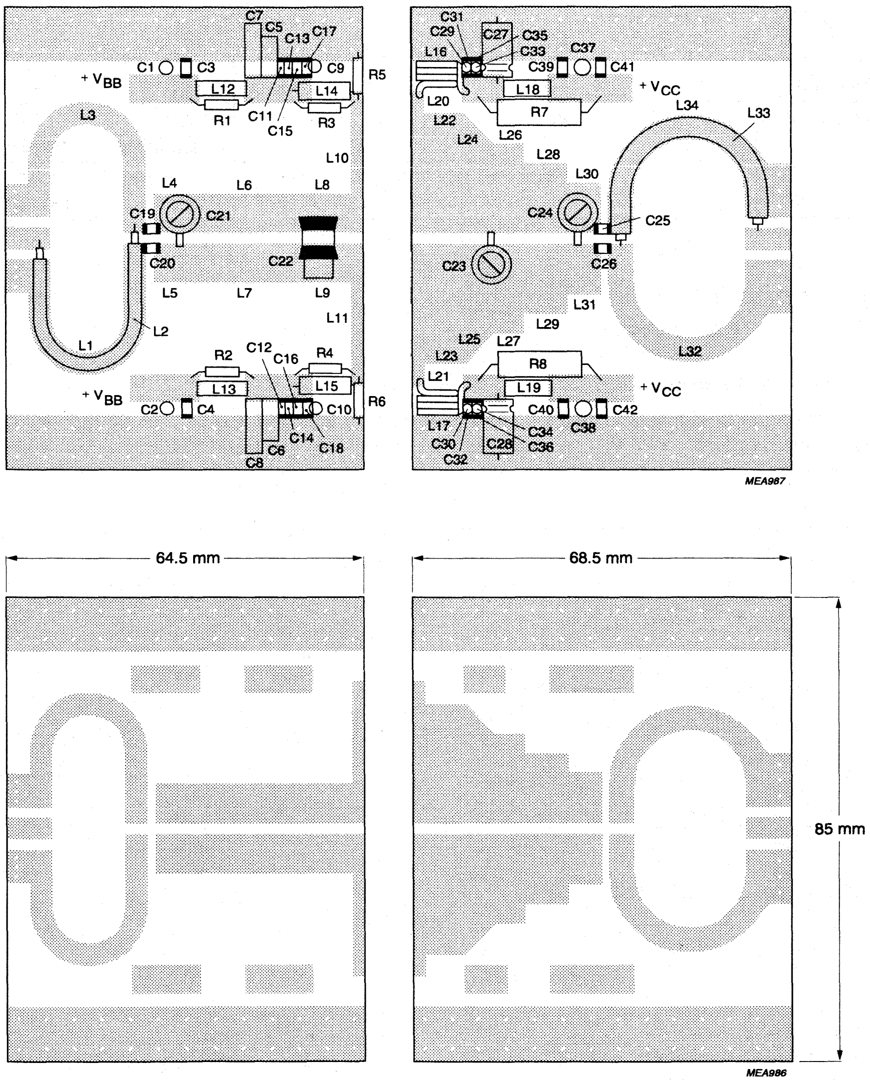
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C33, C34	tantalum capacitor	2.2 µF, 35 V		2022 019 00058
C3, C4, C35, C36, C39, C40	multilayer ceramic chip capacitor (note 1)	300 pF, 200 V		

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 ($\varepsilon_r = 2.2$), 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.
$R_{th\ mb-h}$ = 0.15 K/W; 2-tone operation.

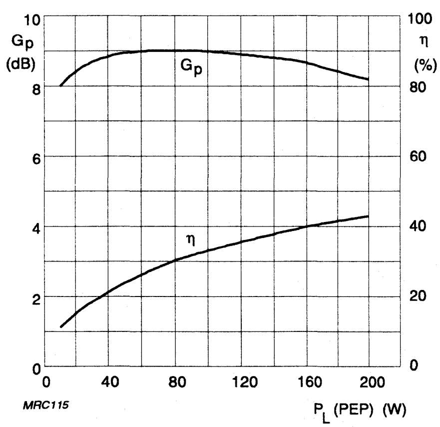
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (PEP) (W)	G_p (dB)	η_C (%)	d_3 (dBc)
2-tone, class-AB	note 1	26	2 x 100	150	≥ 7.5 typ. 8.7	≥ 34 typ. 39	≤ −24 typ. −26
	note 2	26	2 x 100	150	≥ 7.5 typ. 8.7	≥ 34 typ. 39	≤ −22 typ. −24

Notes

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.
2. f_2 = 960.0 MHz; f_2 = 960.1 MHz.

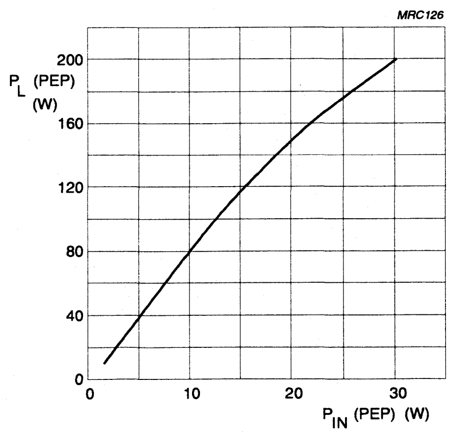
Ruggedness in class-AB operation

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; $R_{th\ mb-h}$ = 0.15 K/W; P_L = 150 W (PEP); f_1 = 960.0 MHz; f_2 = 960.1 MHz.



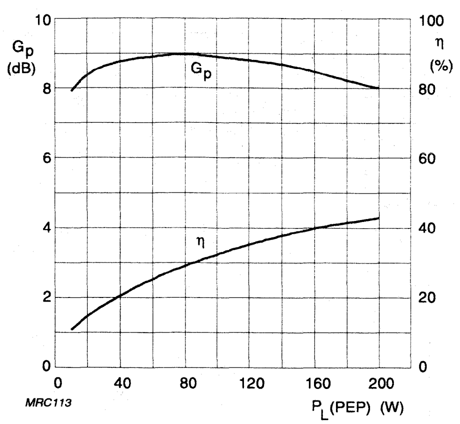
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.13 Power gain and efficiency as functions of peak envelope load power, typical values.



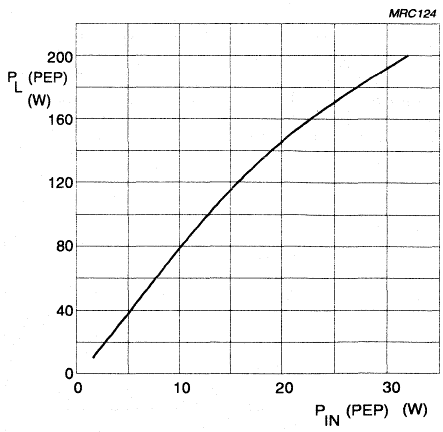
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb-h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

Fig.14 Peak envelope load power as a function of input power, typical values.



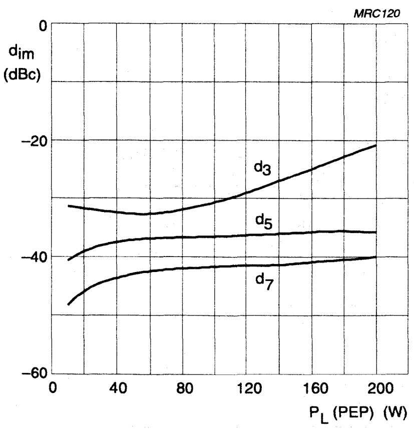
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.15 Power gain and efficiency as functions of peak envelope load power, typical values.



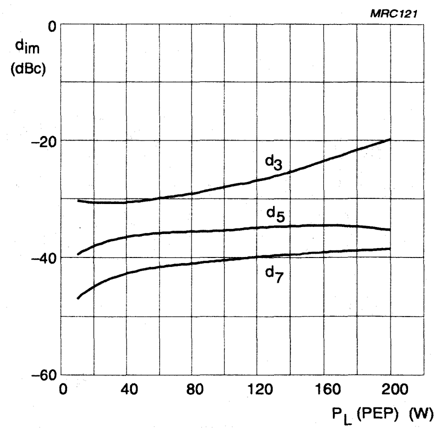
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f_1 = 960.0 MHz; f_2 = 960.1 MHz.

Fig.16 Peak envelope load power as a function of input power, typical values.



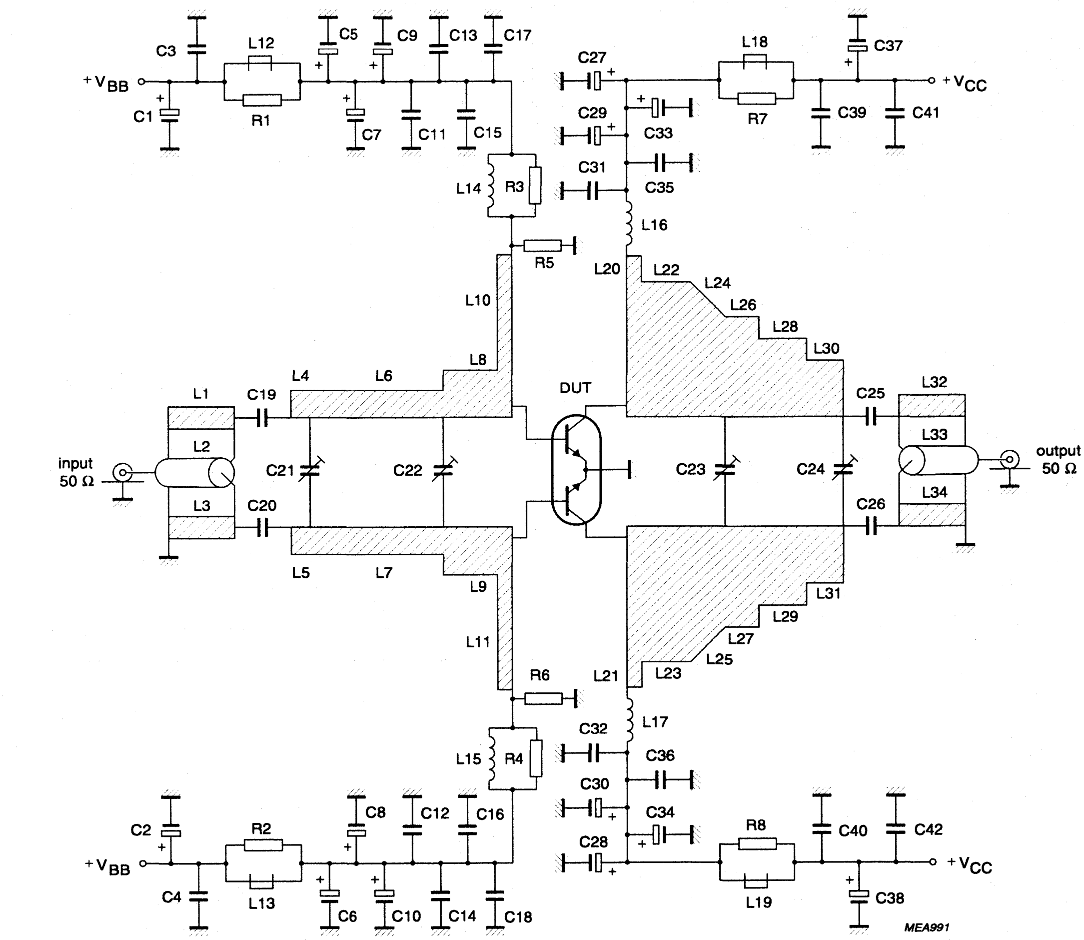
Class-AB operation:
I_{CQ} = 2 x 100 mA; V_{CE} = 26 V; T_h = 25 °C;
$R_{th\ mb\text{-}h}$ = 0.15 K/W; f_1 = 900.0 MHz; f_2 = 900.1 MHz.

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;
$R_{th\ mb\text{-}h}$ = 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)

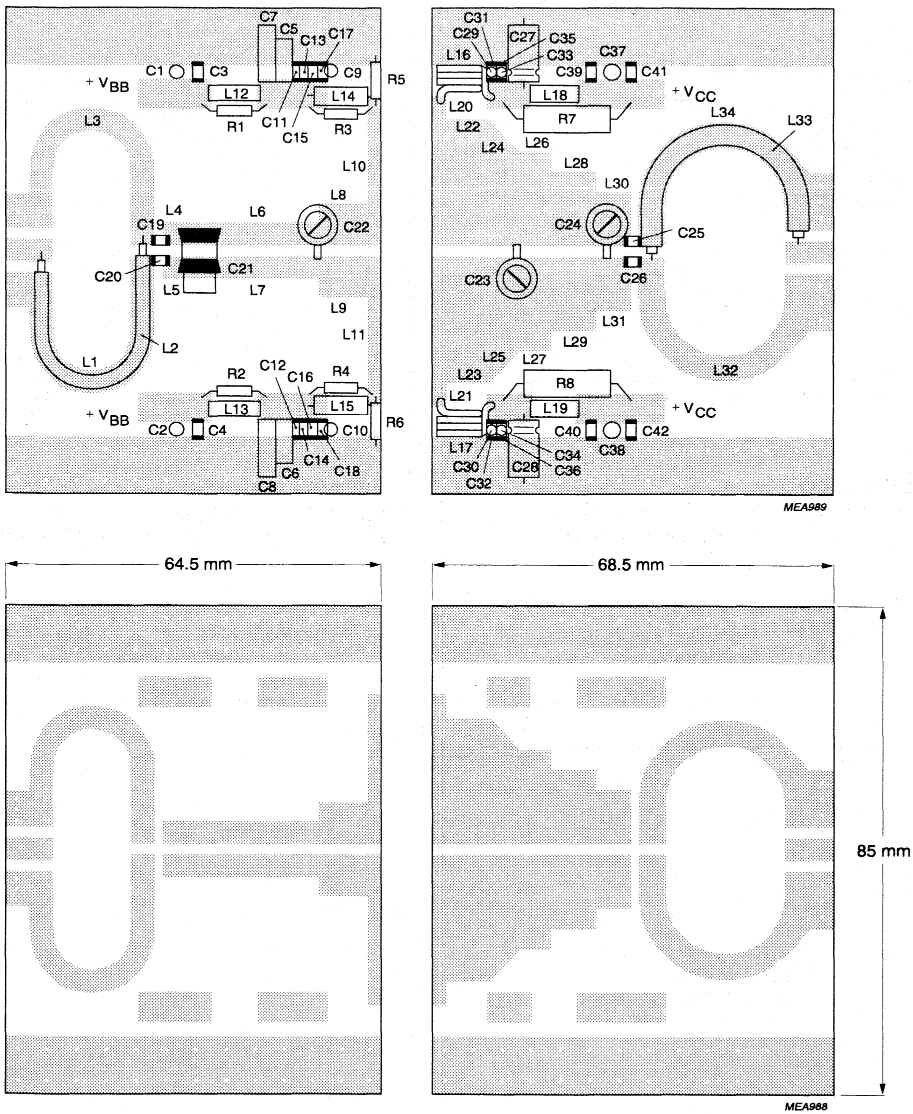
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C33, C34	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C3, C4, C35, C36, C39, C40	multilayer ceramic chip capacitor (note 1)	300 pF, 200 V		

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

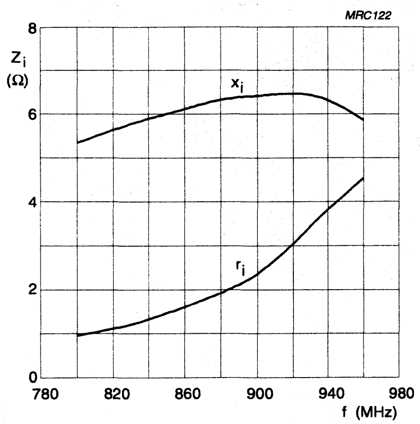
Notes

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 (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.



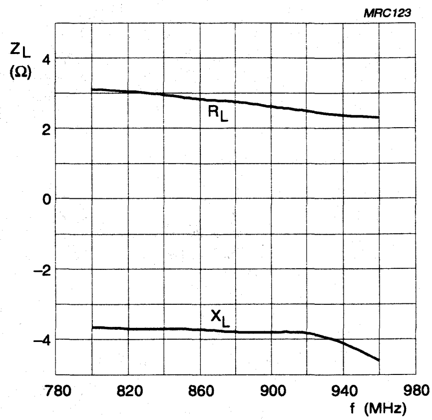
The components are mounted on one side of a copper-clad PTFE microfibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.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;
$R_{th\ mb\text{-}h}$ = 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;
$R_{th\ mb\text{-}h}$ = 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.

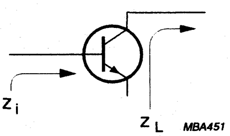
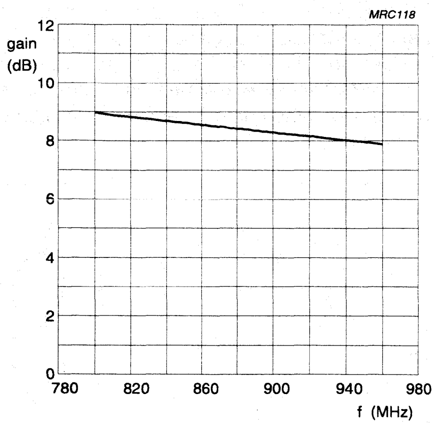
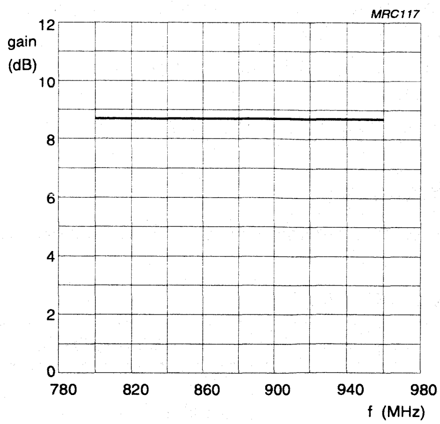


Fig.23 Definition of transistor impedance.



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.

UHF push-pull power transistor

FEATURES

- Internal input and output matching for easy matching, high gain and efficiency
- 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. The transistor is encapsulated in a 4-lead SOT262A2 flange envelope with 2 ceramic caps. The flange provides the common emitter connection for both transistors.

APPLICATIONS

- Base station transmitters in the 800 to 960 MHz range.

PINNING - SOT262A2

PIN	SYMBOL	DESCRIPTION
1	c1	collector 1
2	c2	collector 2
3	b1	base 1
4	b2	base 2
5	e	emitter

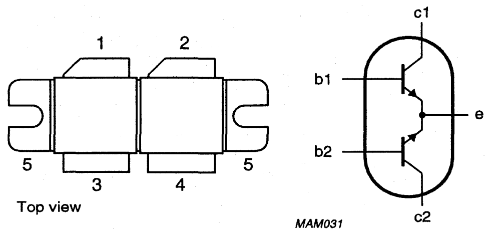


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter 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	26	150	≥8	≥45	–
	960	26	150	≥7.5	≥45	–
2-tone, class-AB	900	26	150 (PEP)	≥8.5	≥35	≤–30
	960	26	150 (PEP)	≥8	≥35	≤–30

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

In accordance with the Absolute Maximum Rating System (IEC 134).
Per transistor section unless otherwise specified.

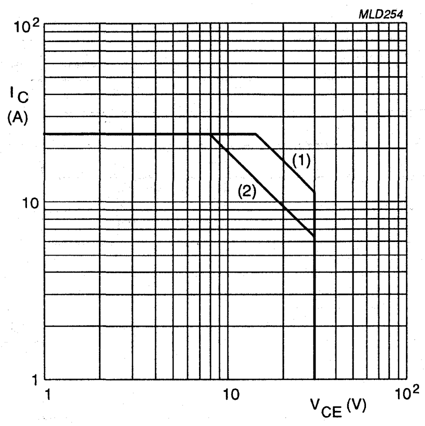
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	12	A
$I_{C(AV)}$	average collector current		–	12	A
P_{tot}	total power dissipation (DC)	T_{mb} = 25 °C; note 1	–	340	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 340 W; T_{mb} = 25 °C; note 1	0.52	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.15	K/W

Note to "Limiting values" and "Thermal characteristics"

1. Total device; both sections equally loaded.

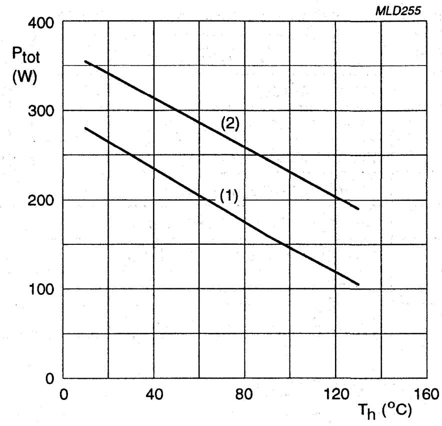


Total device; both sections equally loaded.

(1) T_{mb} = 25 °C.

(2) T_h = 70 °C.

Fig.2 DC SOAR.



Total device; both sections equally loaded.

(1) Continuous operation.

(2) Short time during mismatch.

Fig.3 Power derating curve.

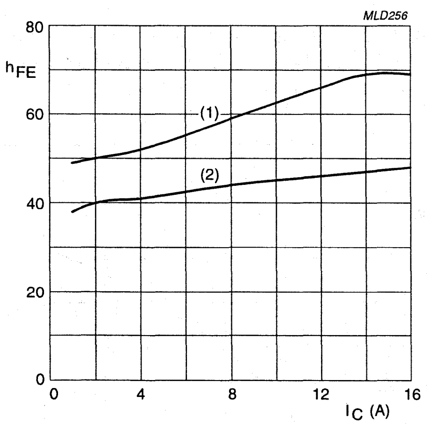
CHARACTERISTICS

Values apply to either transistor section; 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 = 60 mA	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 150 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	5	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4.5 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 2	–	75	–	pF

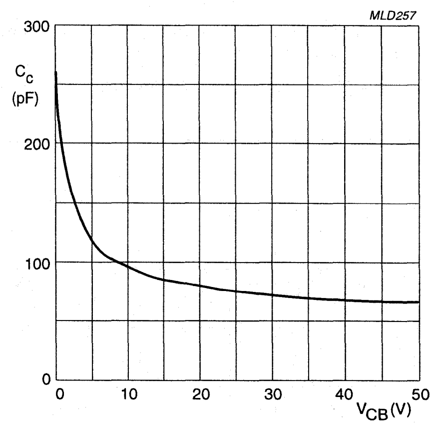
Notes

1. Measured under pulse conditions: $t_p \leq 300$ µs; $\delta \leq 0.01$.
2. Value C_c is that of the die only, it is not measurable because of internal matching network.



Measured under pulsed conditions; $t_p \leq 300$ µs; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) V_{CE} = 10 V.

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



Value C_c is that of the die only, it is not measurable because of internal matching network.
$I_E = i_e$ = 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; $R_{th\ mb\text{-}h}$ = 0.15 K/W.

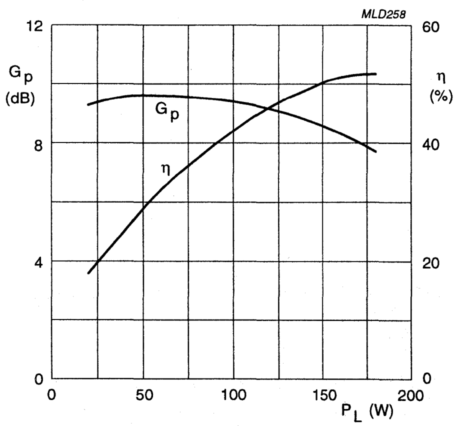
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_3 (dBc)
CW, class-AB	900	26	2 × 100	150	≥8 typ. 9	≥45 typ. 50	–
	960	26	2 × 100	150	≥7.5 typ. 8.5	≥45 typ. 50	–
2-tone, class-AB	note 1	26	2 × 100	150 (PEP)	≥8.5 typ. 9.5	≥35 typ. 40	≤–28 typ. –31
	note 2	26	2 × 100	150 (PEP)	≥8 typ. 9	≥35 typ. 40	≤–30 typ. –33

Notes

1. f_1 = 900.0 MHz; f_2 = 900.1 MHz.
2. f_1 = 960.0 MHz; f_2 = 960.1 MHz.

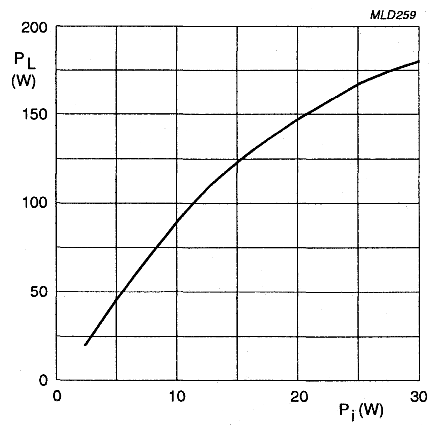
Ruggedness in class-AB operation

The BLV950 is capable of withstanding a load mismatch corresponding to VSWR = 2 : 1 through all phases under the conditions: P_L = 150 W; f = 960 MHz; V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.15 K/W and also a load mismatch of VSWR = 5 : 1 through all phases at P_L = 150 W (PEP) and f_1 = 960.0 MHz and f_2 = 960.1 MHz.



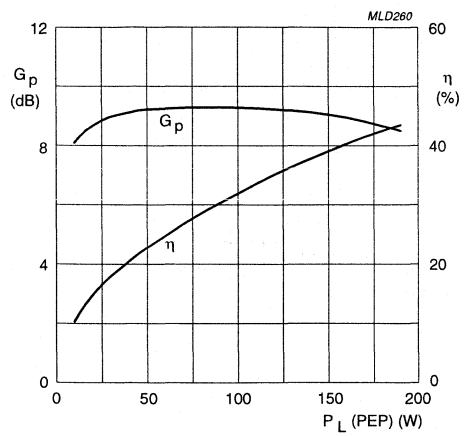
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f = 960 MHz.

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



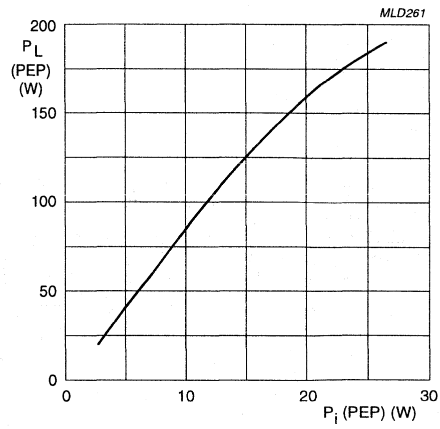
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f = 960 MHz.

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



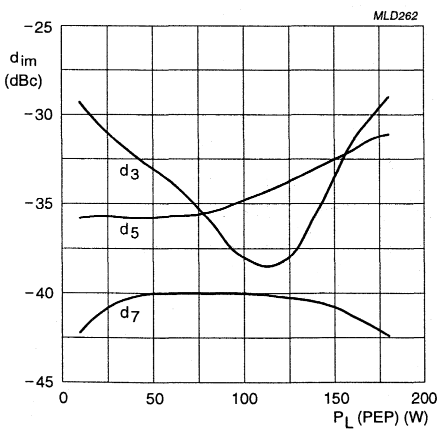
V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.8 Power gain and efficiency as functions of load power; typical values.



V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.9 Load power as a function of input power; typical values



V_{CE} = 26 V.
I_{CQ} = 2 × 100 mA.
f_1 = 960.0 MHz.
f_2 = 960.1 MHz.

Fig.10 Intermodulation distortion as a function of load power; typical values.

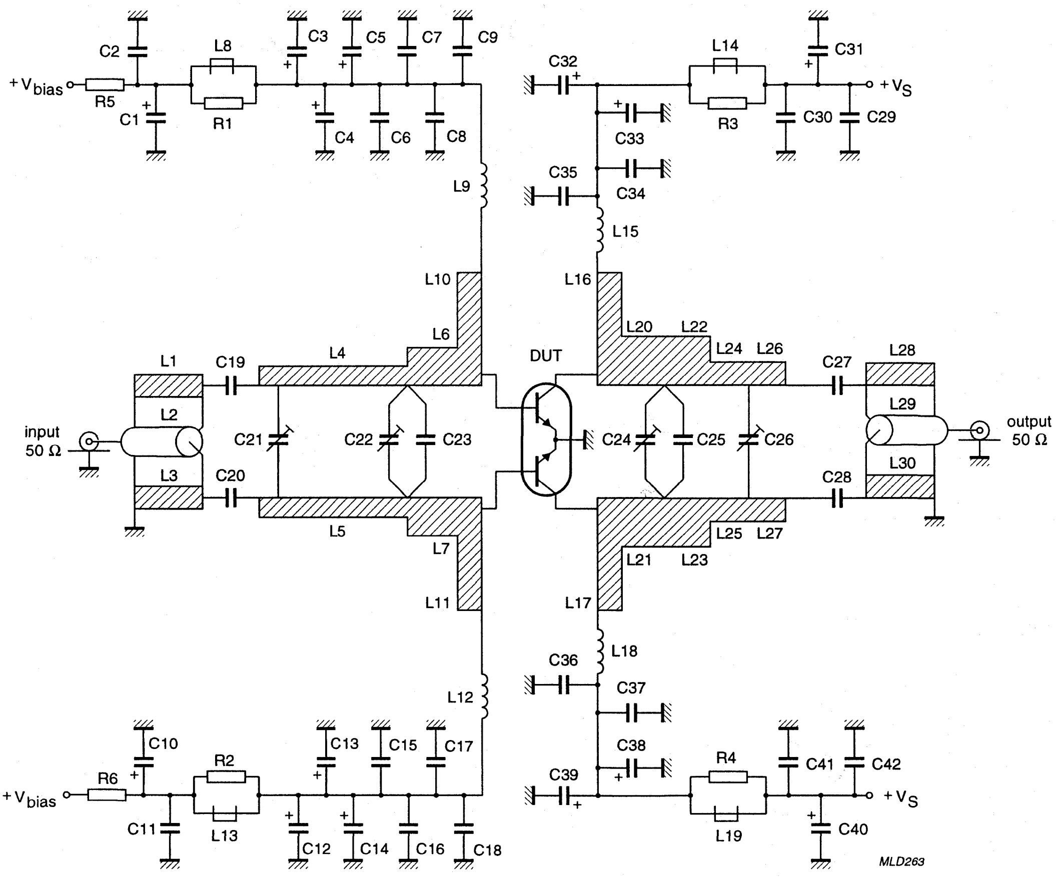


Fig.11 Class-AB test circuit at 900 to 960 MHz.

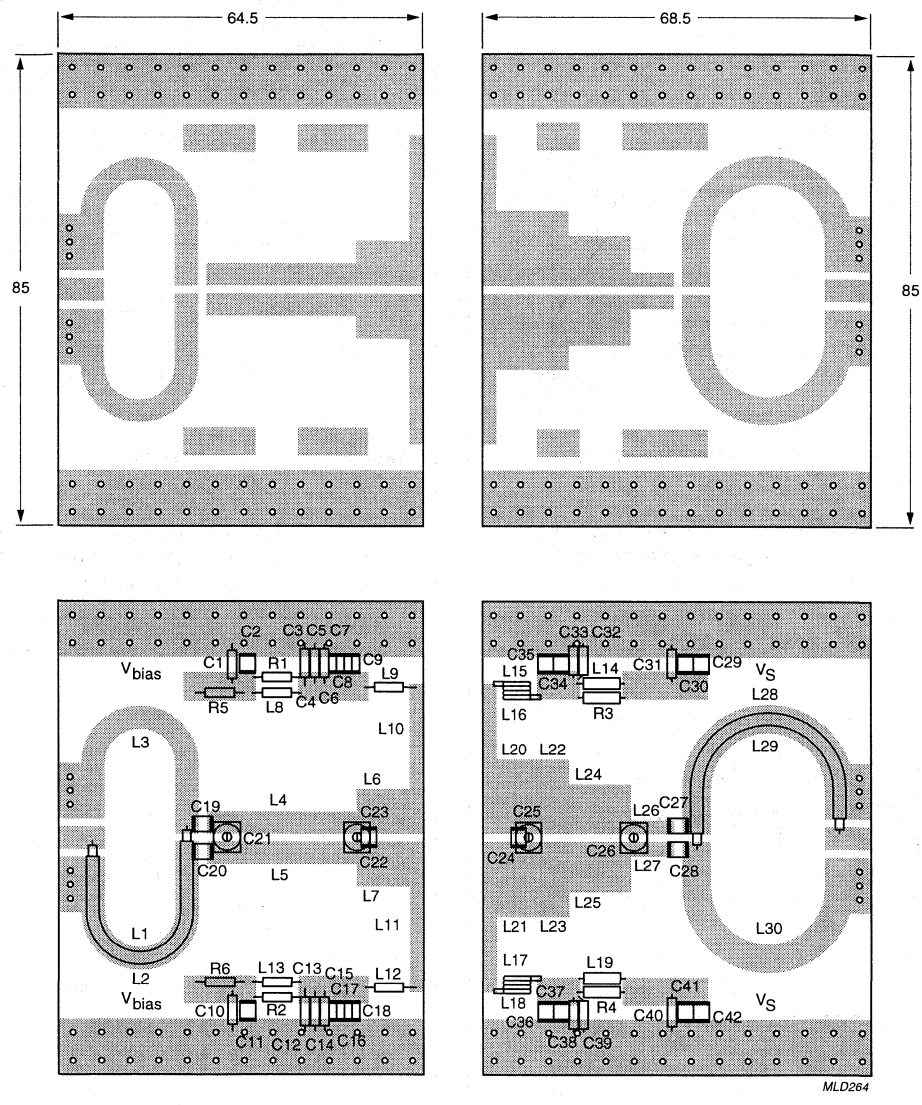
List of components (see Figs 11 and 12)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C10	tantalum capacitor	2.2 μF, 35 V		2022 019 00058
C2, C11, C30, C34, C37, C41	multilayer ceramic chip capacitor; note 1	300 pF, 200 V		
C3, C12	electrolytic capacitor	1 μF, 63 V		2222 085 78108
C4, C13	electrolytic capacitor	10 μF, 16 V		2222 085 75109
C5, C14, C31, C40	tantalum capacitor	1 μF, 35 V		2022 019 00056
C6, C15, C29, C42	multilayer ceramic chip capacitor	100 nF, 50 V		2222 581 76641
C7, C16	multilayer ceramic chip capacitor	10 nF, 50 V		2222 581 76627
C8, C17	multilayer ceramic chip capacitor; note 1	330 pF, 200 V		
C9, C18, C19, C20, C35, C36	multilayer ceramic chip capacitor; note 1	39 pF, 500 V		
C23	multilayer ceramic chip capacitor; note 1	2 pF, 500 V		
C25	multilayer ceramic chip capacitor; note 1	3.9 pF, 500 V		
C21, C22	film dielectric trimmer	9 pF		2222 809 09005
C24, C26	film dielectric trimmer	3.5 pF		2222 809 05215
C27, C28	multilayer ceramic chip capacitor; note 1	68 pF, 500 V		
C32, C39	electrolytic capacitor	10 μF, 63 V		2222 030 28109
C33, C38	electrolytic capacitor	1 μF, 63 V		2222 030 38108
L1, L3	stripline; note 2	35 Ω	length 50.7 mm width 4 mm	
L2	semi-rigid cable; note 3	50 Ω	ext. conductor length 50.7 mm ext. diameter 2.2 mm	
L4, L5	stripline; note 2	35 Ω	length 26.5 mm width 4 mm	
L6, L7	stripline; note 2	20 Ω	length 9.2 mm width 8 mm	
L10, L11, L16, L17	stripline; note 2	7 Ω	length 2.5 mm width 27 mm	
L8, L13, L14, L19	grade 4S2 Ferroxcube chip-bead			4330 030 36300
L9, L12	microchoke	4.7 μH		4322 057 04781
L15, L18	4 turns enamelled 1 mm copper wire	100 nH	int. diameter 6 mm close wound	
L20, L21	stripline; note 2	14 Ω	length 6 mm width 12.5 mm	

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
L22, L23	stripline; note 2	14 Ω	length 7 mm width 12.5 mm	
L24, L25	stripline; note 2	18 Ω	length 11 mm width 9 mm	
L26, L27	stripline; note 2	50 Ω	length 6.5 mm width 2.5 mm	
L28, L30	stripline; note 2	30 Ω	length 49.3 mm width 5 mm	
L29	semi-rigid cable; note 3	50 Ω	ext. conductor length 49.3 mm ext. diameter 3.6 mm	
R5, R6	metal film resistor	0.4 W, 1 Ω		2322 151 71008
R1, R2	metal film resistor	0.4 W, 5.11 Ω		2322 151 75118
R3, R4	metal resistor	1 W, 5.11 Ω		2322 153 75118

Notes

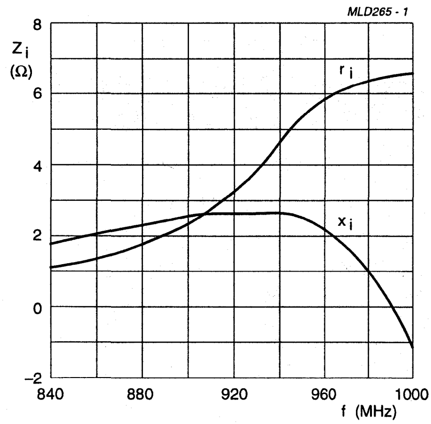
1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board, with microfibre-glass dielectric ($\varepsilon_r = 2.2$); thickness $^1/_{32}$"; thickness of the copper sheet 2×35 μm.
3. Semi-rigid cables soldered respectively on striplines L1 and L28.



Dimensions in mm.

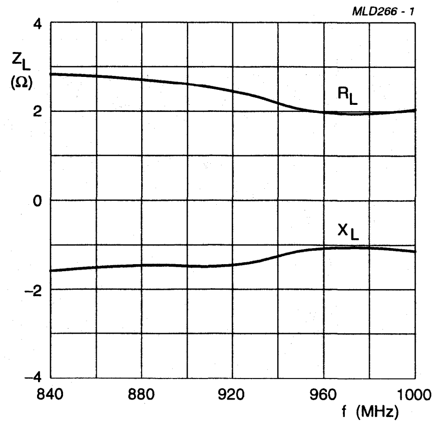
The components are situated on one side of the copper-clad PTFE microfibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.12 Component layout and printed-circuit board for 900 to 960 MHz class-AB test circuit.



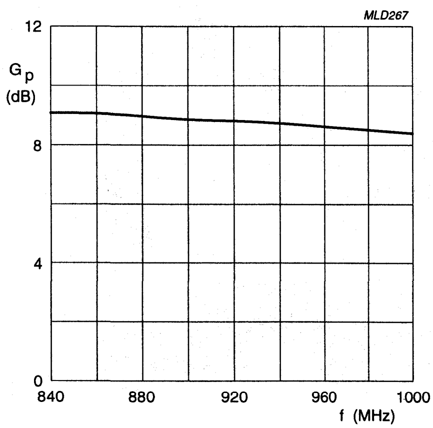
V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W.

Fig.13 Input impedance as a function of frequency (series components); typical values per section.



V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W.

Fig.14 Load impedance as a function of frequency (series components); typical values per section.



V_{CE} = 26 V; I_{CQ} = 2 × 100 mA; P_L = 150 W (total device);
T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W.

Fig.15 Power gain as a function of frequency; typical values.

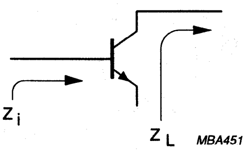


Fig.16 Definition of transistor impedance.

FEATURES

- Internal input and output matching for easy matching, high gain and efficiency
- Poly-silicon emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

APPLICATIONS

- Base stations in the 800 to 960 MHz frequency range.

DESCRIPTION

NPN silicon planar epitaxial transistors primarily intended for common emitter class-AB operation. The transistors have internal input and output matching by means of MOS capacitors. The encapsulations are a 2-lead rectangular SOT391 flange package and a SOT391B flangeless package, both with a ceramic cap.

PINNING - SOT391

PIN	SYMBOL	DESCRIPTION
1	c	collector
2	b	base
flange	e	emitter

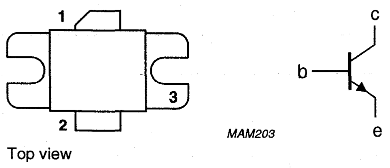


Fig.1 Simplified outline (SOT391) and symbol.

PINNING - SOT391B

PIN	SYMBOL	DESCRIPTION
1	c	collector
2	b	base
ground plane	e	emitter

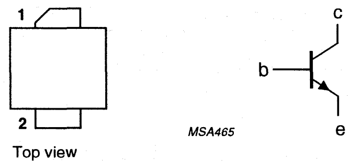


Fig.2 Simplified outline (SOT391B) and symbol.

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	26	75	≥8	≥50
	960	26	75	≥8.5	≥50

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.

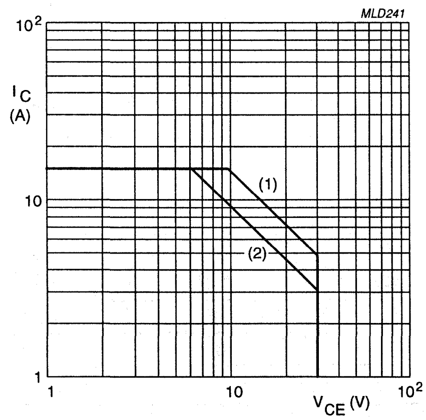
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	15	A
$I_{C(AV)}$	average collector current		–	15	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	145	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		–	200	°C

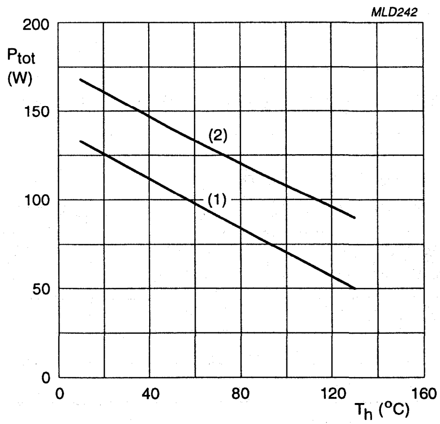
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 145 W; T_{mb} = 25 °C	1.21	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W



(1) T_{mb} = 25 °C.
(2) T_h = 70 °C.

Fig.3 DC SOAR.



(1) Continuous operation.
(2) Short-time operation during mismatch.

Fig.4 Power derating curves.

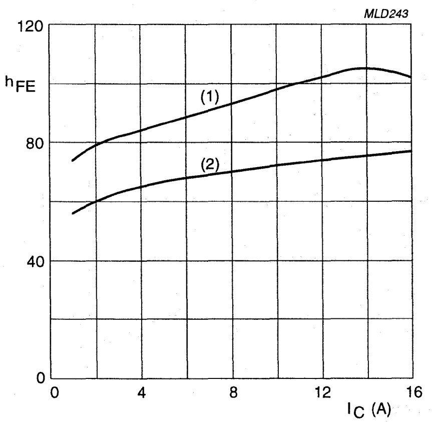
CHARACTERISTICS

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 = 60 mA	70	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 150 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 3 mA	3	–	–	V
I_{CES}	collector leakage current	V_{BE} = 0; V_{CE} = 28 V	–	–	5	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4.5 A; note 1	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 2	–	75	–	pF

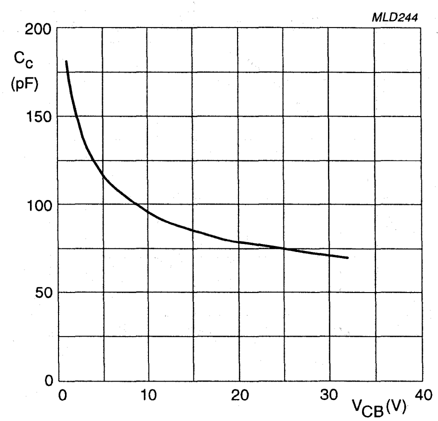
Notes

1. Measured under pulsed conditions: $t_p \leq 500\ \mu s$; $\delta \leq 0.01$.
2. Value of C_c is that of the die only, it is not measurable because of internal matching network.



Measured under pulsed conditions; $t_p \leq 500\ \mu s$; $\delta \leq 0.01$.
(1) V_{CE} = 26 V.
(2) V_{CE} = 10 V.

Fig.5 DC current gain as a function of collector current; typical values.



Value C_c is that of the die only, it is not measurable because of internal matching network.
$I_E = i_e$ = 0; f = 1 MHz.

Fig.6 Collector capacitance as a function of collector-base voltage; typical values.

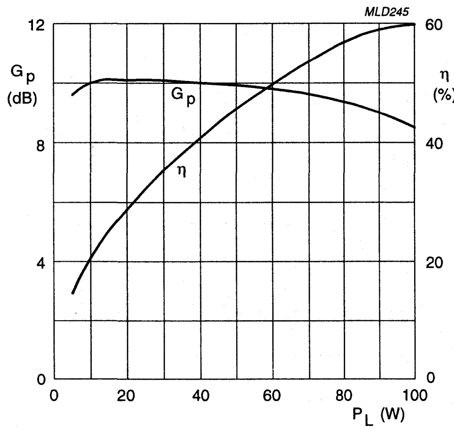
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter, class-AB test circuit; $R_{th\ mb-h}$ = 0.2 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	200	75	≥8 typ. 9.5	≥50 typ. 55
	960	26	200	75	≥8.5 typ. 9.5	≥50 typ. 55

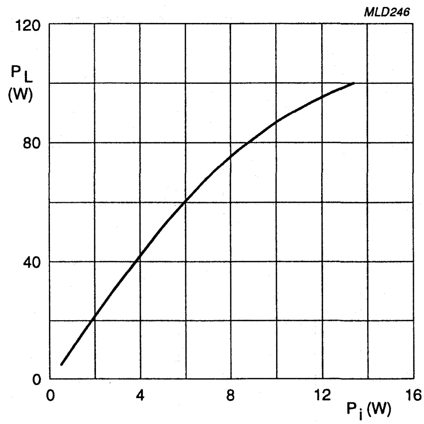
Ruggedness in class-AB operation

The transistors are capable of withstanding a load mismatch corresponding to VSWR = 4 : 1 through all phases at rated output power, under the following conditions: V_{CE} = 26 V; f = 960 MHz; I_{CQ} = 200 mA; T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.



V_{CE} = 26 V.
I_{CQ} = 200 mA.
f = 960 MHz.

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



V_{CE} = 26 V.
I_{CQ} = 200 mA.
f = 960 MHz.

Fig.8 Load power as a function of input power; typical values.

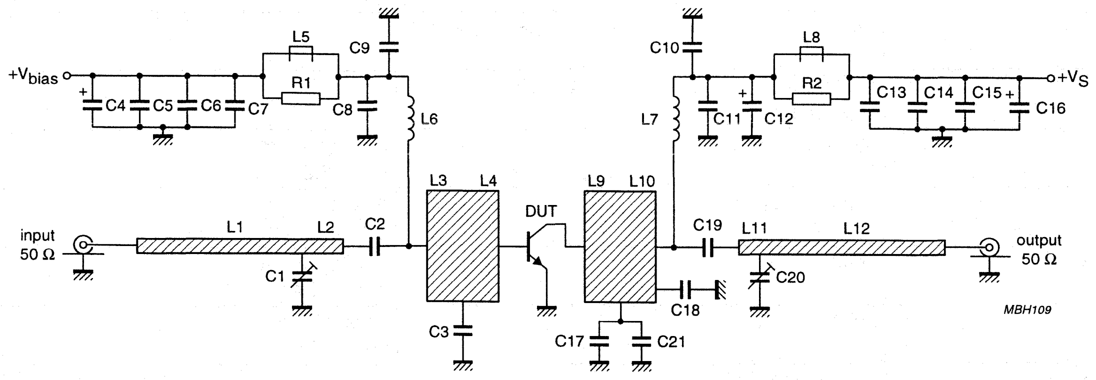


Fig.9 Class-AB test circuit at f = 960 MHz.

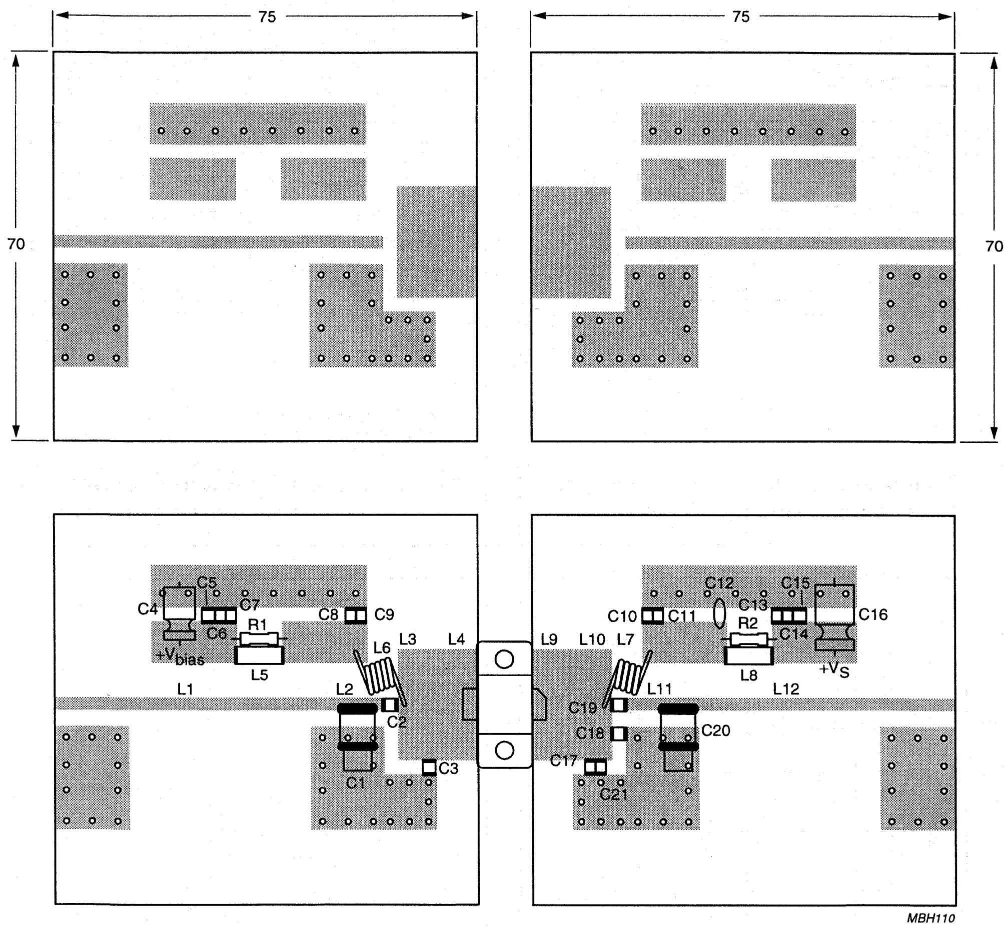
List of components (see Figs 9 and 10)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C20	Tekelec, type 5201	0.8 to 10 pF		
C2, C19	multilayer ceramic chip capacitor; note 1	15 pF, 500 V		
C3	multilayer ceramic chip capacitor; note 1	6.2 pF, 500 V		
C4	electrolytic capacitor	10 μF, 63 V		
C5	multilayer ceramic chip capacitor	22 nF, 50 V		
C6	multilayer ceramic chip capacitor; note 1	1 nF, 500 V		
C7	multilayer ceramic chip capacitor; note 1	33 pF, 500 V		2222 030 28109
C8, C11, C14	multilayer ceramic chip capacitor; note 1	100 pF, 500 V		
C9, C10, C13	multilayer ceramic chip capacitor; note 1	20 pF, 500 V		
C12	solid tantalum capacitor	1 μF, 35 V		
C15	multilayer ceramic chip capacitor	100 nF, 50 V		
C16	electrolytic capacitor	47 μF, 40 V		2222 036 68479

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C17	multilayer ceramic chip capacitor; note 1	4.7 pF, 500 V		
C18	multilayer ceramic chip capacitor; note 1	3.3 pF, 500 V		
C21	multilayer ceramic chip capacitor; note 1	2.7 pF, 500 V		
L1	stripline; note 2		length 51 mm width 2.2 mm	
L2	stripline; note 2		length 7 mm width 2.2 mm	
L3	stripline; note 2		length 5.5 mm width 20 mm	
L4	stripline; note 2		length 9 mm width 20 mm	
L5, L8	Ferroxcube chip-bead grade 4S2			4330 030 36300
L6	5 turns enamelled 1 mm copper wire		int. diameter 4 mm close wound	
L7	4 turns enamelled 1 mm copper wire		int. diameter 4 mm close wound	
L9	stripline; note 2		length 12.5 mm width 20 mm	
L10	stripline; note 2		length 2 mm width 20 mm	
L11	stripline; note 2		length 17 mm width 2.2 mm	
L12	stripline; note 2		length 41 mm width 2.2 mm	
R1, R2	metal film resistor	0.4 W, 100 Ω		

Notes

1. American Technical Ceramics type 100B or capacitor of same quality.
2. The striplines are on double-clad PCB with PTFE fibre-glass dielectric (ε_r = 2.25); thickness $^1/_{32}$".

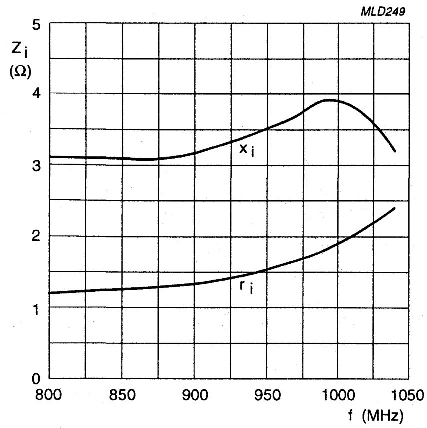


FL version without flange.

Dimensions in mm.

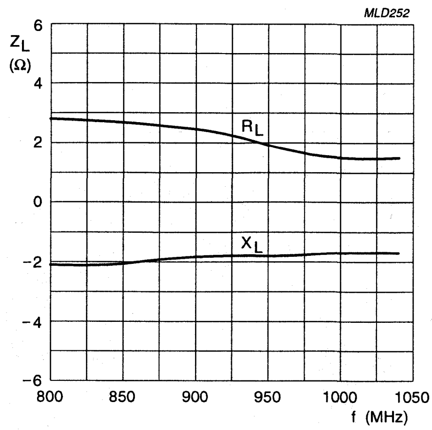
The components are located on one side of the copper-clad PTFE microfibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.10 Component layout and printed-circuit board for 960 MHz class-AB test circuit.



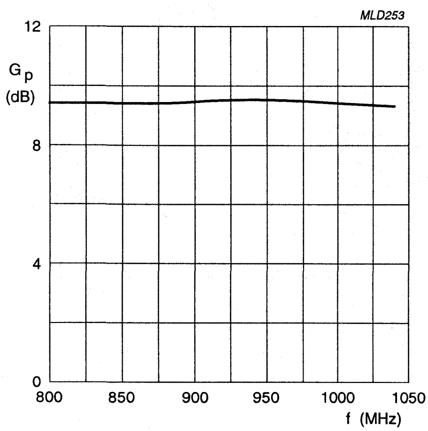
V_{CE} = 26 V; I_{CQ} = 200 mA; P_L = 75 W;
T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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



V_{CE} = 26 V; I_{CQ} = 200 mA; P_L = 75 W;
T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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



V_{CE} = 26 V; I_{CQ} = 200 mA; P_L = 75 W;
T_h = 25 °C; $R_{th\ mb-h}$ = 0.2 K/W.

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

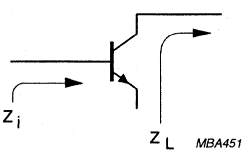


Fig.14 Definition of transistor impedance.

UHF power transistor

BLV2040

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

APPLICATIONS

- Common emitter class-AB operation in base stations in the 1800 to 1970 MHz frequency range.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 8-lead SOT409B SMD package with a ceramic cap. All leads are isolated from the mounting base.

PRELIMINARY
See Philips Semiconductors for Design-in information

PINNING - SOT409B

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

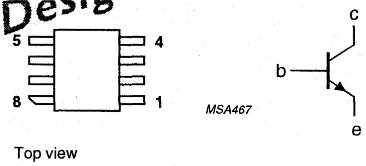


Fig.1 Simplified outline and symbol.

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 (%)
CW, class-AB	1950	26	1	≥8	≥40

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	–	4	V
I_C	collector current (DC)		–	0.3	A
$I_{C(AV)}$	collector current (average)		–	0.3	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; note 1	–	3	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 3 W; T_{mb} = 25 °C; note 1	58.3	K/W

Note to the “Limiting values” and “Thermal characteristics”

1. Transistor with metallized ground plane mounted on a printed-circuit board, see *“This handbook, Section Mounting and soldering”*.

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	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 2.5 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.2 mA	4	–	–	V
I_{CES}	collector leakage current	V_{CE} = 28 V; V_{BE} = 0	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 20 V; I_C = 100 mA	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; I_E = i_e = 0; f = 1 MHz	–	3	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	0.7	–	pF

APPLICATION INFORMATION

RF performance at T_{mb} = 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	1950	26	10	1	≥8 typ. 12	≥40 typ. 45

Ruggedness in class-AB operation

The BLV2040 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 10 mA; P_L = 1 W; T_{mb} = 25 °C.

PRELIMINARY for Design-in information
See Philips Semiconductors

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input matching to achieve high power gain and easy design of wideband circuits.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 8-lead SOT409B SMD package with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT409B

PIN	SYMBOL	DESCRIPTION
1, 4, 5, 8	e	emitter
2, 3	b	base
6, 7	c	collector

APPLICATIONS

- Common emitter class-AB operation in base stations in the 1800 to 1970 MHz frequency range.

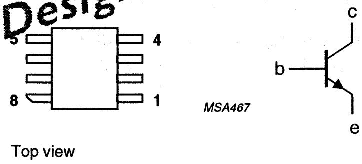


Fig.1 Simplified outline and symbol.

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 (%)
CW, class-AB	1950	26	4	≥8	≥40

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	–	4	V
I_C	collector current (DC)		–	1.2	A
$I_{C(AV)}$	collector current (average)		–	1.2	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; note 1	–	12	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 12 W; T_{mb} = 25 °C; note 1	14.6	K/W

Note to the "Limiting values" and "Thermal characteristics"

1. Transistor with metallized ground plane mounted on a printed-circuit board, see *"This handbook, Section General; Mounting and soldering"*.

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 = 5 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	4	–	–	V
I_{CES}	collector leakage current	V_{CE} = 28 V; V_{BE} = 0	–	–	3	mA
h_{FE}	DC current gain	V_{CE} = 20 V; I_C = 600 mA	30	–	120	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz	–	6	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	2.5	–	pF

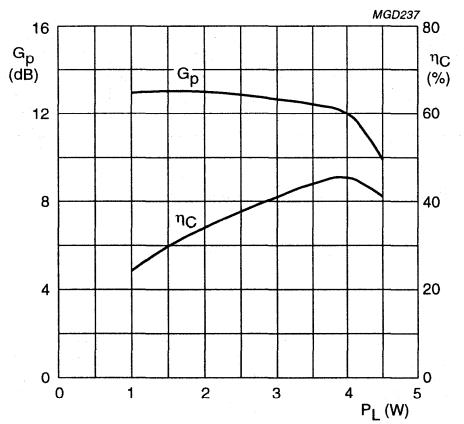
APPLICATION INFORMATION

RF performance at T_{mb} = 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	1950	26	25	4	≥8 typ. 12	≥40 typ. 45

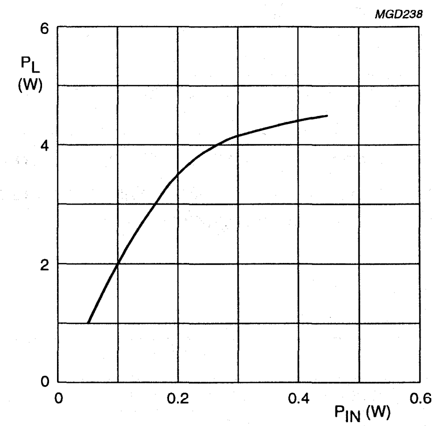
Ruggedness in class-AB operation

The BLV2042 is capable of withstanding a load mismatch corresponding to VSWR = 20 : 1 through all phases under the following conditions: f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 4 W; T_{mb} = 25 °C.



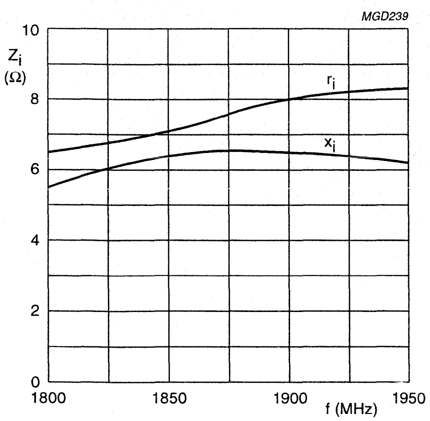
CW, class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA; T_{mb} = 25 °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



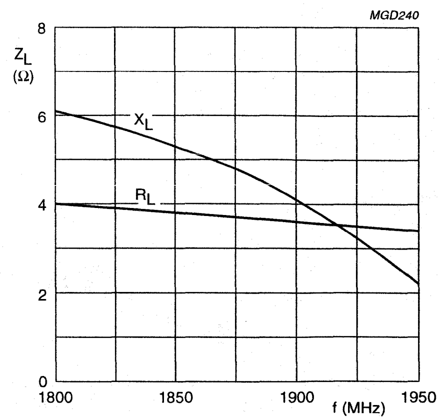
CW, class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 25 mA; T_{mb} = 25 °C.

Fig.3 Load power as a function of input power; typical values.



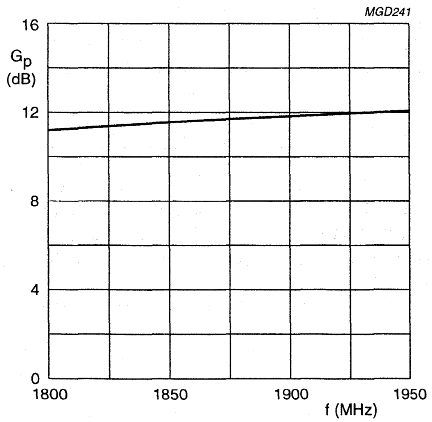
V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 4 W; T_{mb} = 25 °C.

Fig.4 Input impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 4 W; T_{mb} = 25 °C.

Fig.5 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 25 mA; P_L = 4 W; T_{mb} = 25 °C.

Fig.6 Power gain as a function of frequency; typical values.

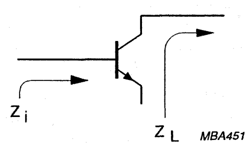


Fig.7 Definition of transistor impedance.

UHF power transistor

BLV2044

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input and output matching to achieve high power gain and collector efficiency for an easy design of wideband circuits.

APPLICATIONS

- Common emitter class-AB operation in base station transmitters in the 1800 to 1970 MHz frequency range.

PRELIMINARY
See Philips Semiconductors for Design-in information

DESCRIPTION

NPN silicon planar transistor encapsulated in a 2-lead SOT437A flange package with a ceramic cap. The emitter is connected to the flange.

PINNING - SOT437A

PIN	SYMBOL	DESCRIPTION
1	c	collector
2	b	base
3 (flange)	e	emitter

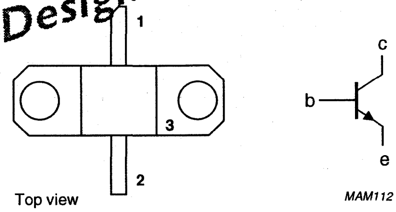


Fig.1 Simplified outline and symbol.

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} (dBc)
CW, class-AB	1950	26	15	≥8	≥40	–
2-tone, class-AB	1950	26	15 (PEP)	typ. 8.5	typ. 35	typ. –30

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).

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	–	2.5	V
I_C	collector current (DC)		–	3	A
$I_{C(AV)}$	collector current (average)		–	3	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 50 W; T_{mb} = 25 °C	3.5	K/W
$R_{th\ mb\text{-}h}$	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
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	2.5	–	–	V
I_{CES}	collector leakage current	V_{CE} = 12.5 V; V_{BE} = 0	–	–	4	mA
h_{FE}	DC current gain	V_{CE} = 24 V; I_C = 1 A	45	60	–	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 1	–	16	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	10	–	pF

Note

1. Capacitance of die only.

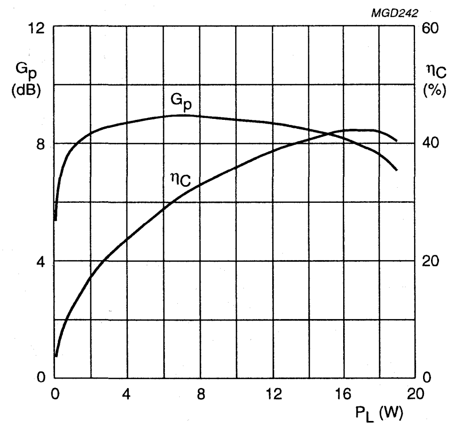
APPLICATION INFORMATION

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 (%)	d_{im} (dBc)
CW, class-AB	1950	26	40	15	≥8 typ. 8.5	≥40 typ. 45	–
2-tone, class-AB	1950	26	40	15 (PEP)	typ. 8.5	typ. 35	typ. –30

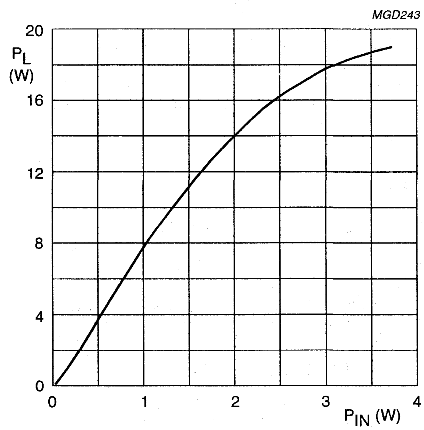
Ruggedness in class-AB operation

The BLV2044 is capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 40 mA; P_L = 15 W; T_{mb} = 25 °C.



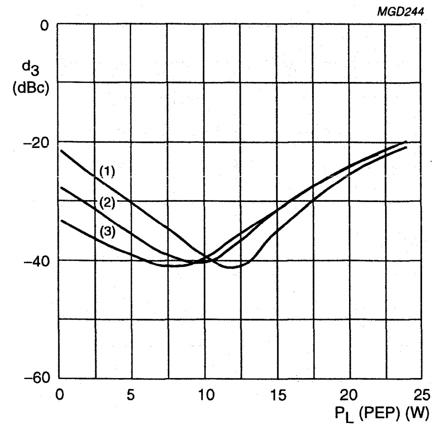
CW class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 40 mA; T_h = 25 °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



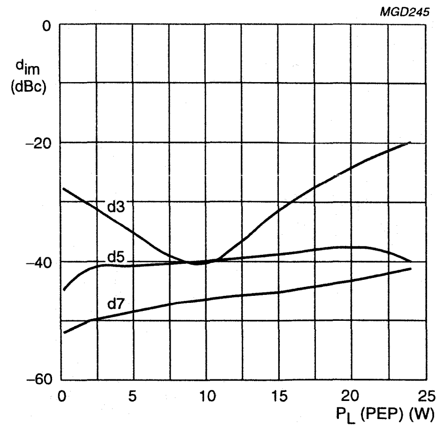
CW class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 40 mA; T_h = 25 °C.

Fig.3 Load power as a function of input power; typical values.



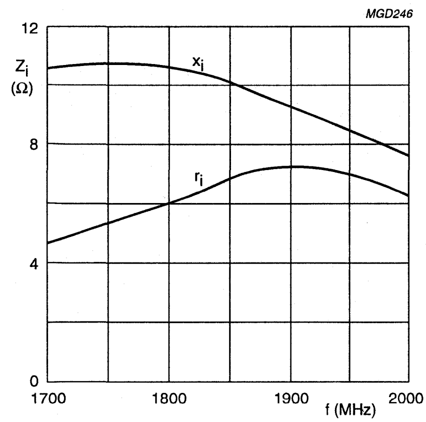
2-tone, class-AB; f = 1950 MHz; V_{CE} = 26 V.
(1) I_{CQ} = 20 mA. (2) I_{CQ} = 40 mA. (3) I_{CQ} = 60 mA.

Fig.4 Third order Intermodulation distortion as a function of peak envelope load power; typical values.



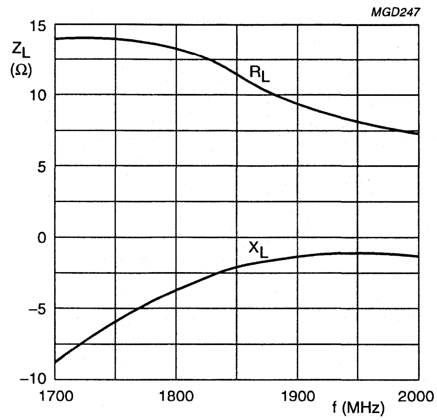
2-tone, class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 40 mA.

Fig.5 Intermodulation distortion as a function of peak envelope load power; typical values.



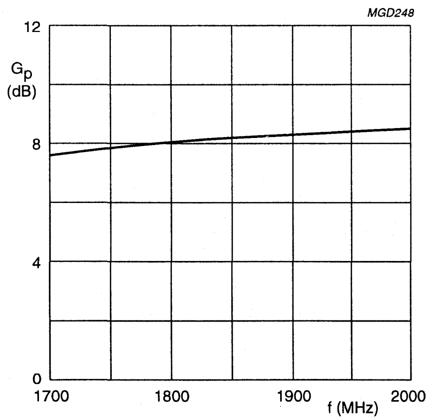
V_{CE} = 26 V; I_{CQ} = 40 mA; P_L = 15 W; T_{mb} = 25 °C.

Fig.6 Input impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 40 mA; P_L = 15 W; T_{mb} = 25 °C.

Fig.7 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 40 mA; P_L = 15 W; T_{mb} = 25 °C.

Fig.8 Power gain as a function of frequency; typical values.

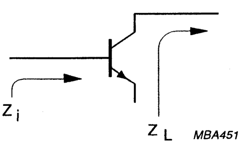


Fig.9 Definition of transistor impedance.

UHF power transistor BLV2045

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input and output matching to achieve high power gain and collector efficiency for an easy design of wideband circuits.

DESCRIPTION

NPN silicon planar transistor encapsulated in a 2-lead SOT390A flange package with a ceramic cap. The emitter is connected to the flange.

PINNING - SOT390A

PIN	SYMBOL	DESCRIPTION
1	c	collector
2	b	base
3 (flange)	e	emitter

APPLICATIONS

- Common emitter class-AB operation in base station transmitters in the 1800 to 1970 MHz frequency range.

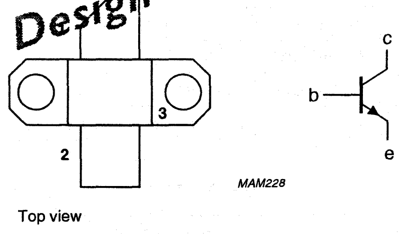


Fig.1 Simplified outline and symbol.

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} (dBc)
CW, class-AB	1950	26	30	≥8	≥40	–
2-tone, class-AB	1950	26	30 (PEP)	typ. 9	typ. 35	typ. –30

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.

PRELIMINARY
See Philips Semiconductors for Design-in information

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	–	2.5	V
I_C	collector current (DC)		–	7	A
$I_{C(AV)}$	collector current (average)		–	7	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	100	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 100 W; T_{mb} = 25 °C	1.75	K/W
$R_{th\ mb\text{-}h}$	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
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 40 mA	60	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 20 mA	28	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 1 mA	2.5	–	–	V
I_{CES}	collector leakage current	V_{CE} = 12.5 V; V_{BE} = 0	–	–	8	mA
h_{FE}	DC current gain	V_{CE} = 24 V; I_C = 2 A	45	60	–	
C_c	collector capacitance	V_{CB} = 26 V; $I_E = i_e$ = 0; f = 1 MHz; note 1	–	32	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	20	–	pF

Note

1. Capacitance of die only.

UHF power transistor BLV2045

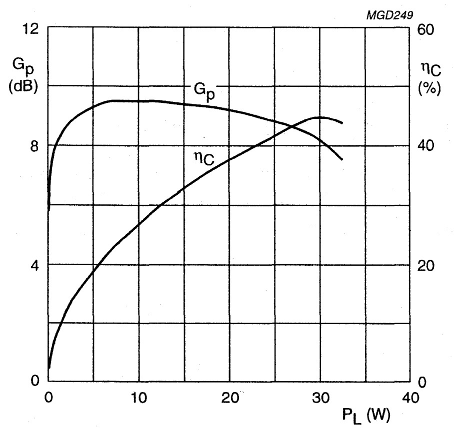
APPLICATION INFORMATION

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 (%)	d_{im} (dBc)
CW, class-AB	1950	26	80	30	≥8 typ. 8.5	≥40 typ. 45	–
2-tone, class-AB	1950	26	80	30 (PEP)	typ. 9	typ. 35	typ. –30

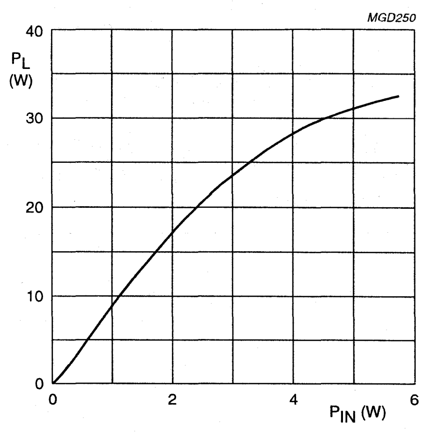
Ruggedness in class-AB operation

The BLV2045 is capable of withstanding a load mismatch corresponding to VSWR = 5 : 1 through all phases under the following conditions: f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 80 mA; P_L = 30 W; T_{mb} = 25 °C.



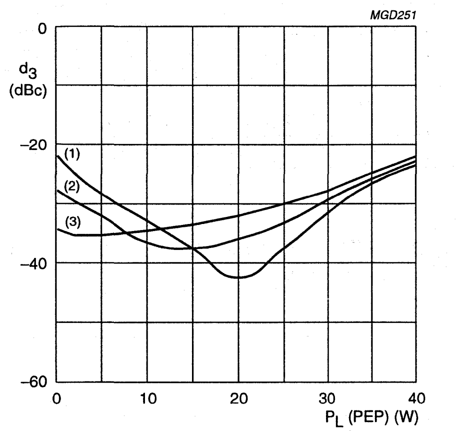
CW class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 80 mA; T_h = 25 °C.

Fig.2 Power gain and collector efficiency as functions of load power; typical values.



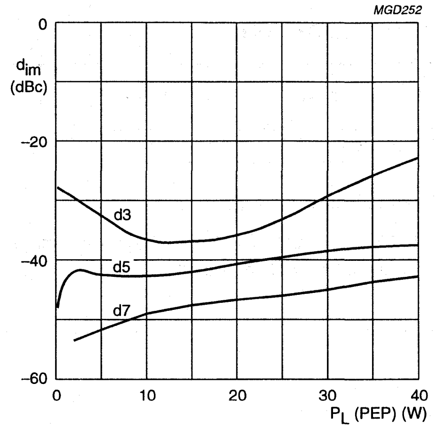
CW class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 80 mA; T_h = 25 °C.

Fig.3 Load power as a function of input power; typical values.



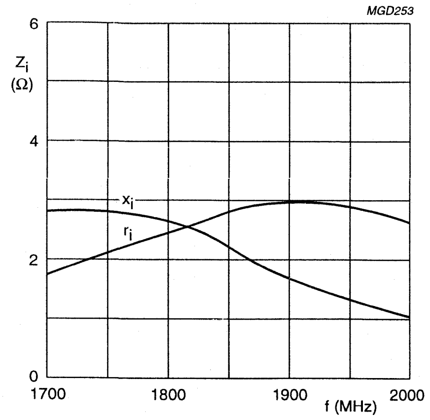
2-tone, class-AB; f = 1950 MHz; V_{CE} = 26 V.
(1) I_{CQ} = 40 mA. (2) I_{CQ} = 80 mA. (3) I_{CQ} = 120 mA.

Fig.4 Third order Intermodulation distortion as a function of peak envelope load power; typical values.



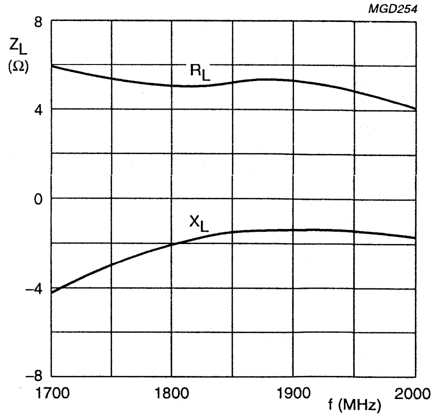
2-tone, class-AB; f = 1950 MHz; V_{CE} = 26 V; I_{CQ} = 80 mA.

Fig.5 Intermodulation distortion as a function of peak envelope load power; typical values.



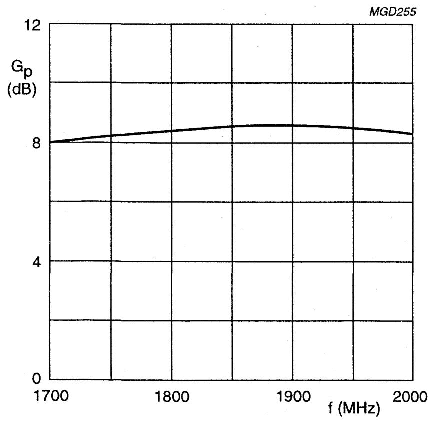
V_{CE} = 26 V; I_{CQ} = 80 mA; P_L = 30 W; T_{mb} = 25 °C.

Fig.6 Input impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 80 mA; P_L = 30 W; T_{mb} = 25 °C.

Fig.7 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 80 mA; P_L = 30 W; T_{mb} = 25 °C.

Fig.8 Power gain as a function of frequency; typical values.

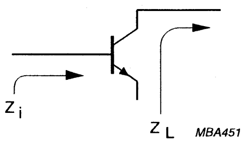


Fig.9 Definition of transistor impedance.

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

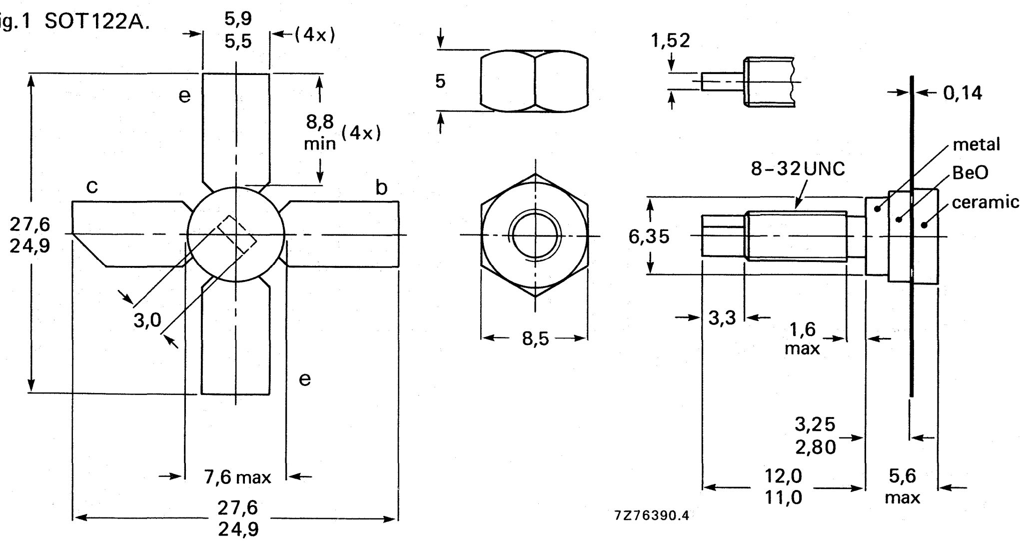
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

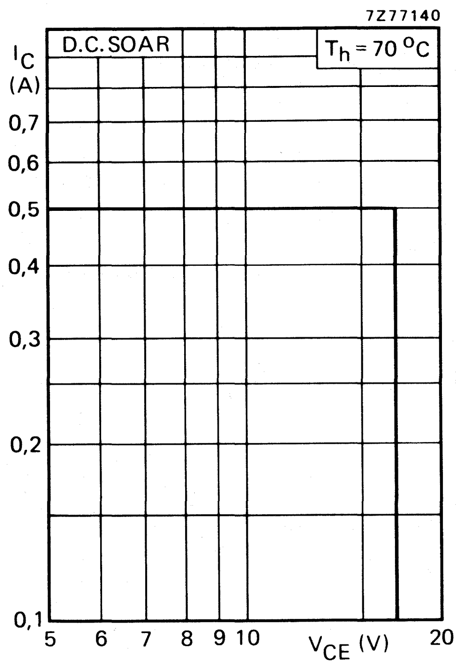


Fig.2.

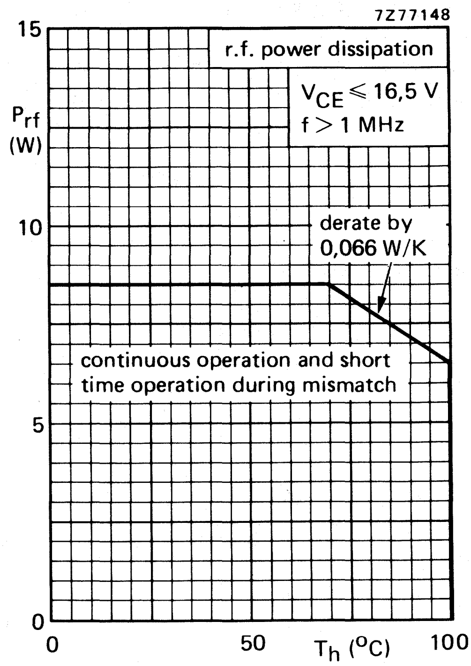


Fig.3.

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

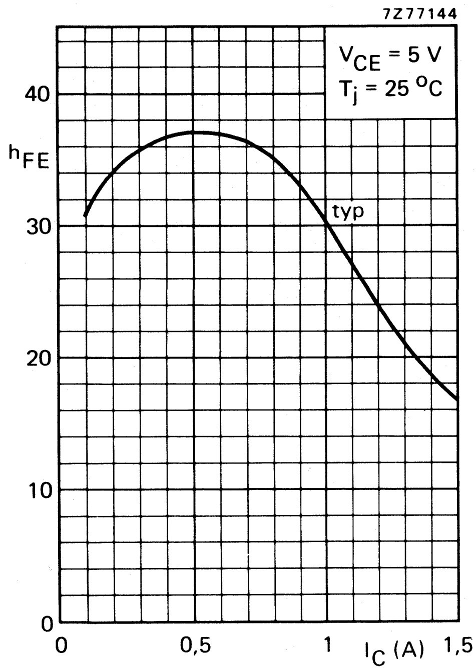


Fig.4.

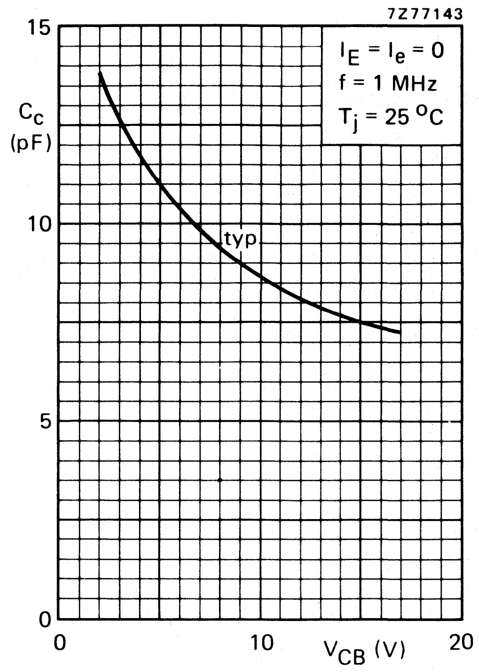


Fig.5.

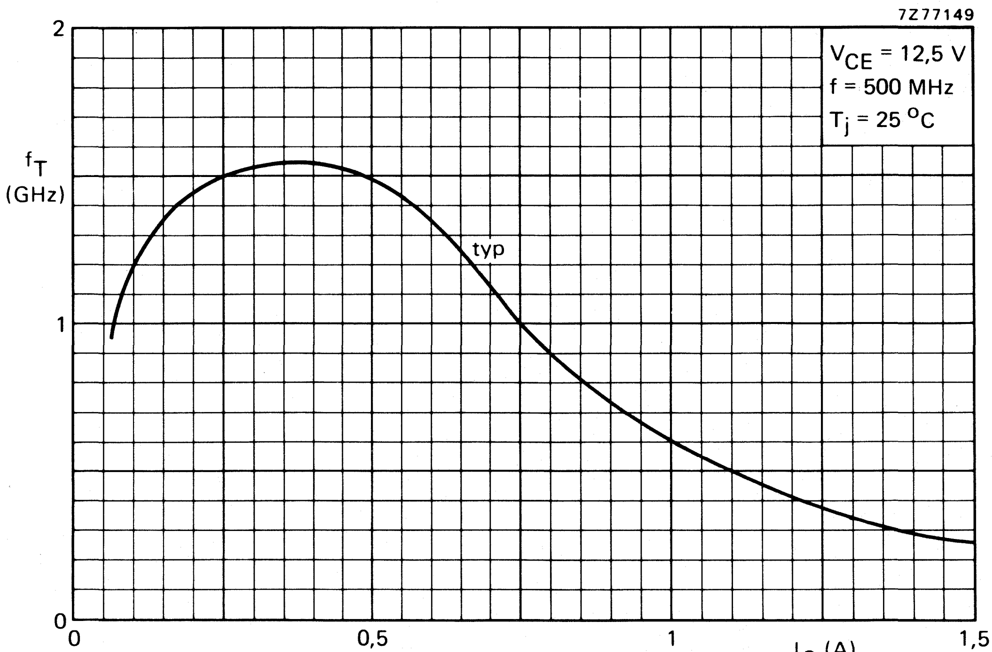


Fig.6.

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

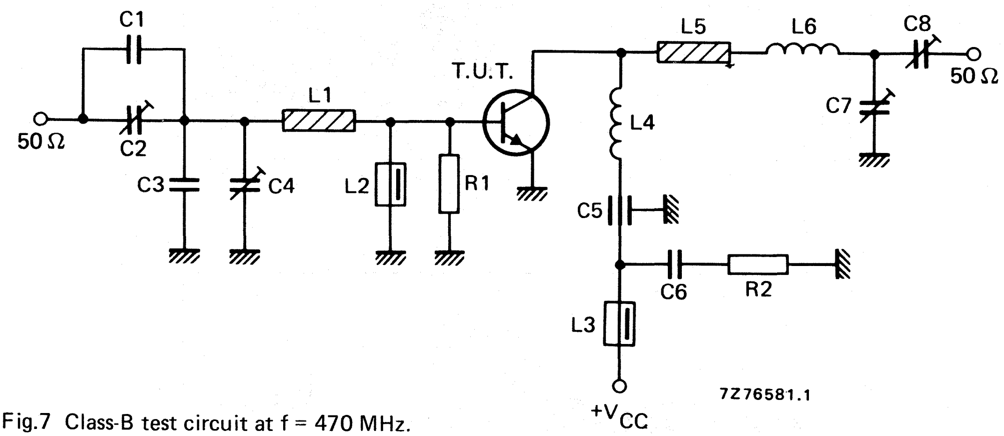


Fig.7 Class-B test circuit at f = 470 MHz.

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)

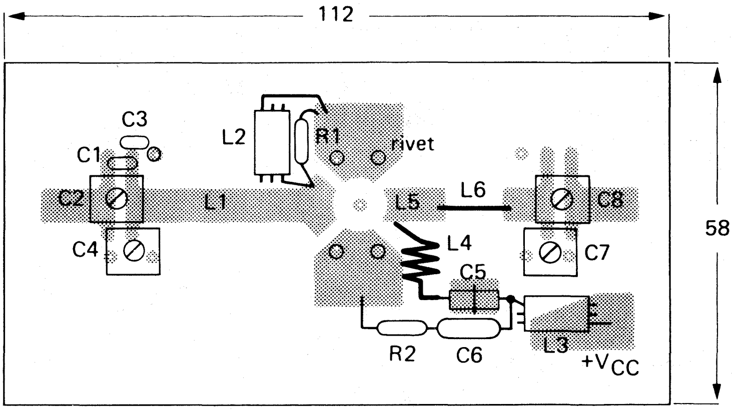
L1 = stripline (35,6 mm x 6,0 mm)
L2 = L3 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L4 = 178 nH; 4 turns Cu wire (1 mm); int. dia. 6 mm; length 7 mm; leads 2 x 5 mm
L5 = stripline (10,0 mm x 6,0 mm)
L6 = 28 nH; ½ turn Cu wire (1 mm); int. dia. 10 mm

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".

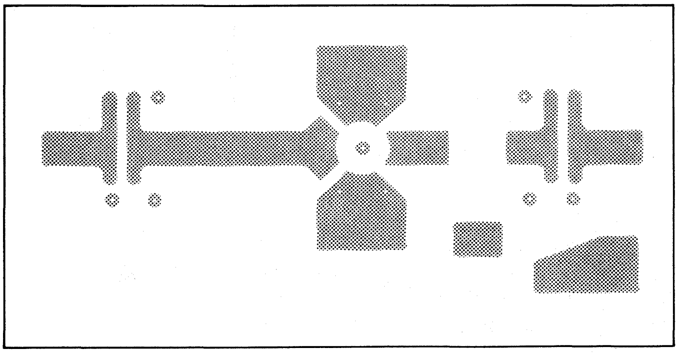
R1 = 100 Ω (± 5%) carbon resistor
R2 = 10 Ω (± 5%) carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit (Fig.8).

APPLICATION INFORMATION (continued)



7Z76579



7Z76580

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

Fig.8 Component layout and printed-circuit board for 470 MHz circuit test.

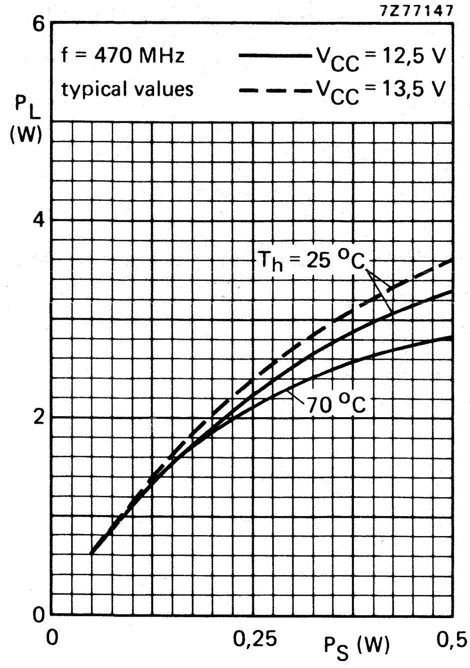


Fig.9.

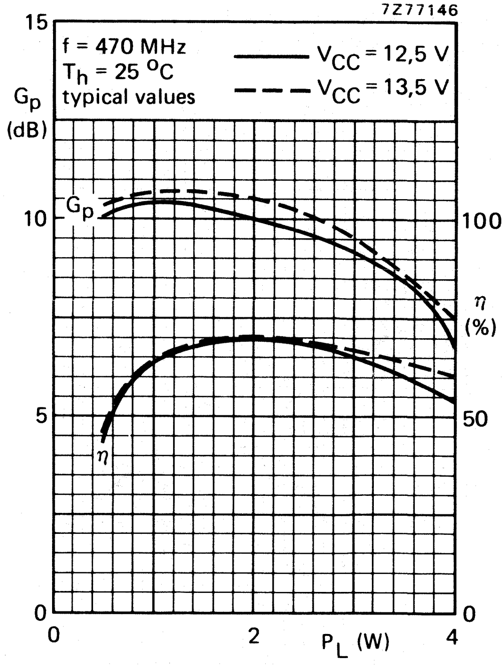


Fig.10.

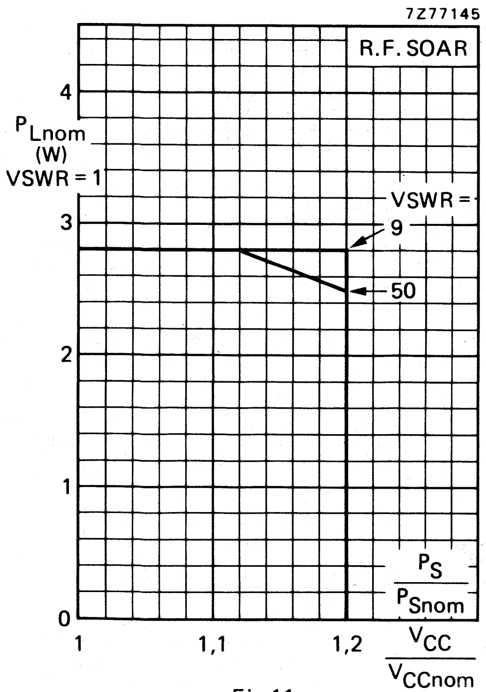


Fig.11.

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.

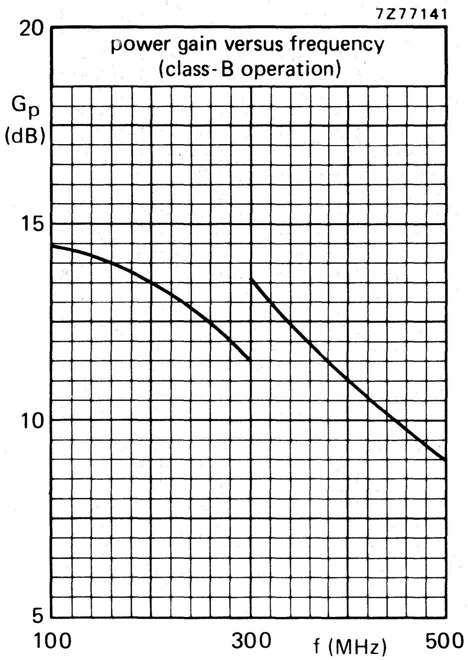


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 2 W
T_h = 25 °C
typical values

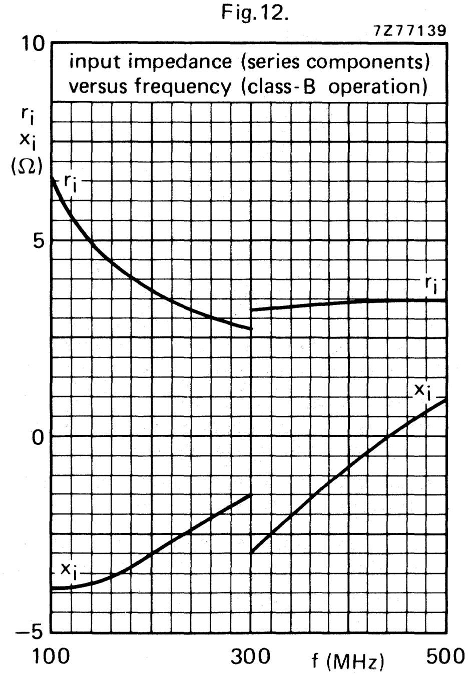


Fig.13.

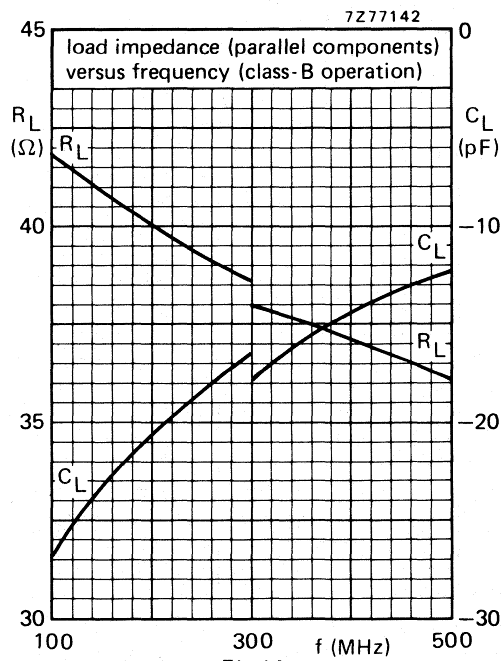


Fig.14.

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

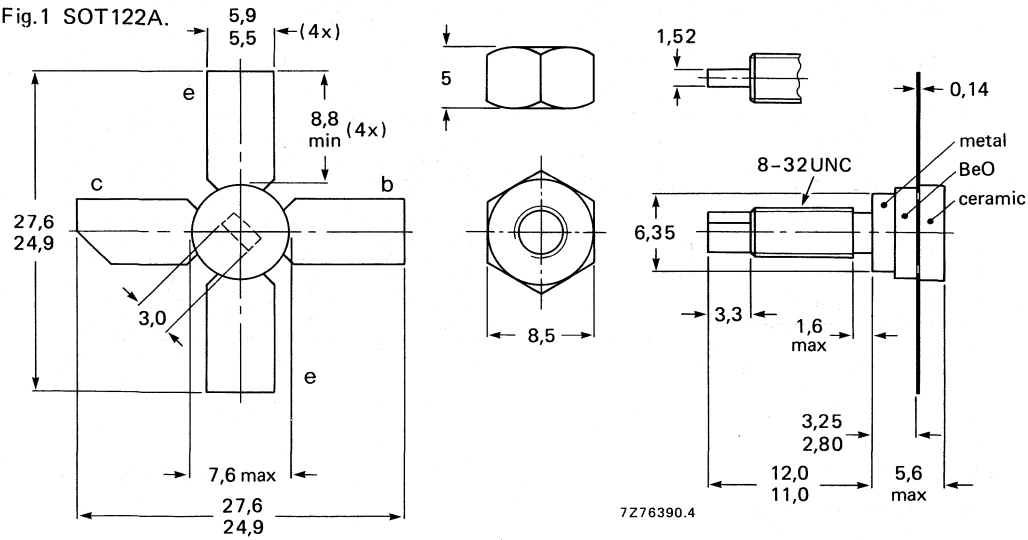
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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 °C	P_{tot}	max	17	W

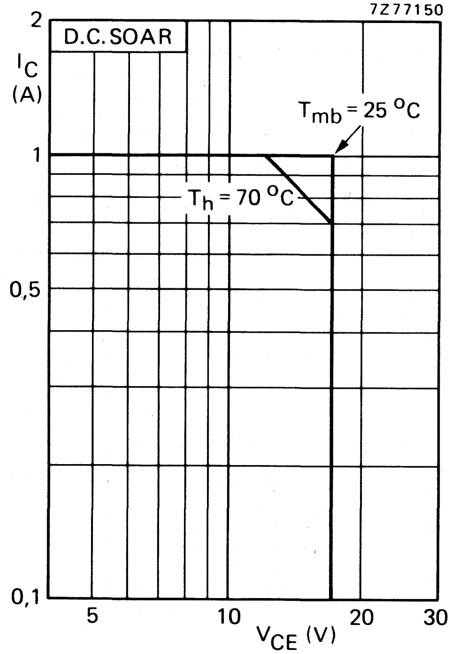


Fig.2.

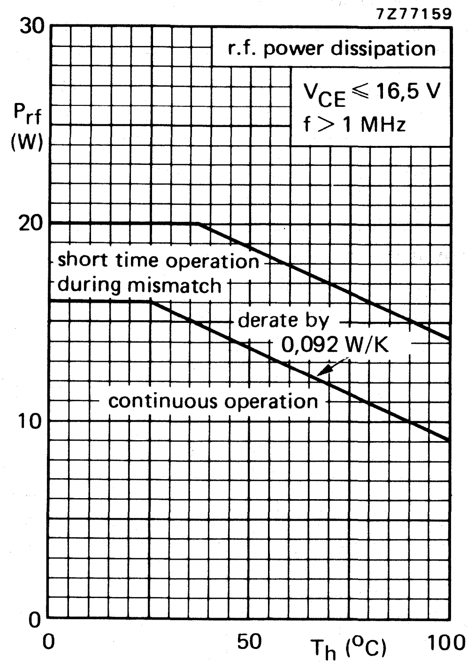


Fig.3.

Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max	200	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	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}	> typ	10 35
Collector-emitter saturation voltage *			
$I_C = 1,5$ A; $I_B = 0,3$ A	V_{CEsat}	typ	0,75 V
Transition frequency at f = 500 MHz *			
$I_C = 0,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,75 GHz
$I_C = 1,5$ A; $V_{CE} = 12,5$ V	f_T	typ	1,25 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	14 pF
Feedback capacitance at f = 1 MHz			
$I_C = 40$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	7,1 pF
Collector-stud capacitance	C_{cs}	typ	1,2 pF

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

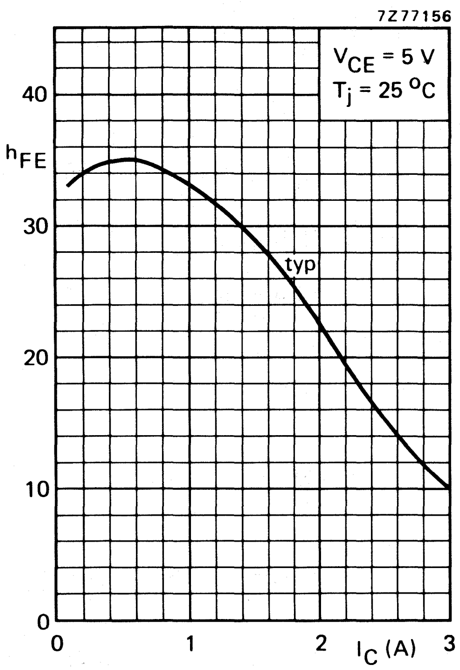

7Z77156
VCE = 5 V
Tj = 25 °C
hFE
40
30
20
10
0
typ
0
1
2
IC (A)
3

Fig.4.

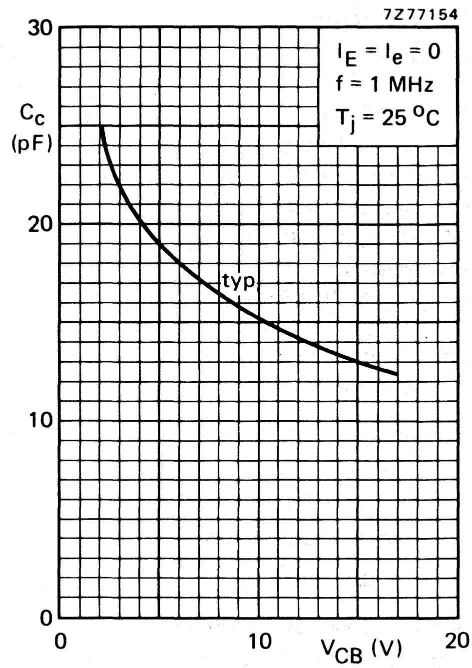
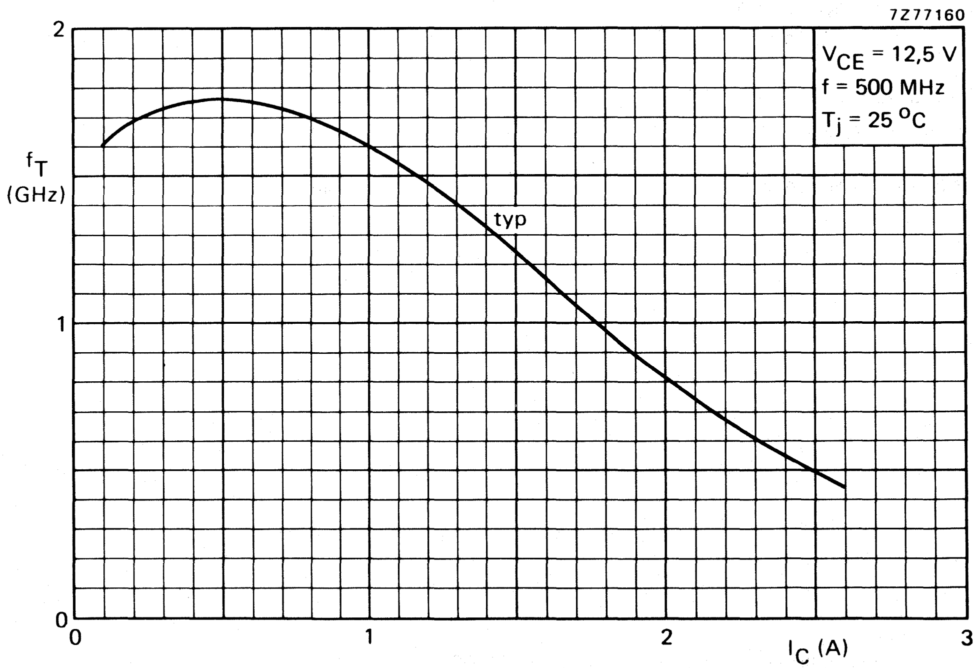

7Z77154
IE = Ie = 0
f = 1 MHz
Tj = 25 °C
Cc
(pF)
30
20
10
0
typ
0
10
VCB (V)
20

Fig.5.


7Z77160
VCE = 12,5 V
f = 500 MHz
Tj = 25 °C
fT
(GHz)
2
1
0
typ
0
1
2
IC (A)
3

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

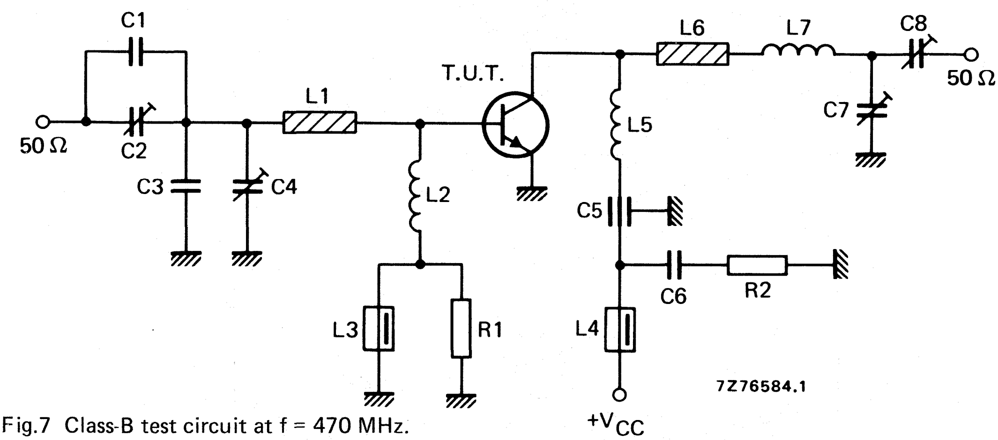


Fig.7 Class-B test circuit at f = 470 MHz.

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

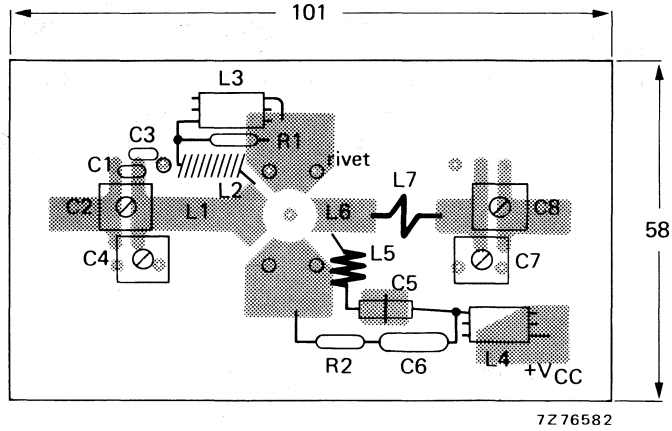
L1 = stripline (22,5 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4 mm; leads 2 x 5 mm
L3 = L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = 51 nH; 3,5 turns Cu wire (1 mm); int. dia. 6 mm; coil length 7 mm; leads 2 x 5 mm
L6 = stripline (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

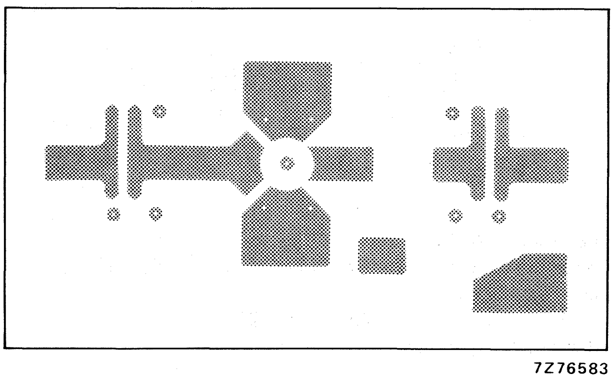
L1 and L6 are striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric (ϵ_r = 2,74); thickness 1/16".

R1 = R2 = 10 Ω (± 5%) carbon resistor

Component layout and printed-circuit board for 470 MHz test circuit (Fig.8).

APPLICATION INFORMATION (continued)





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.

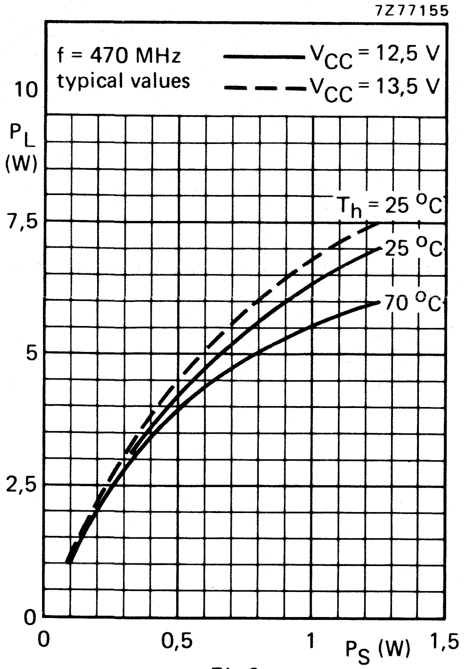


Fig.9.

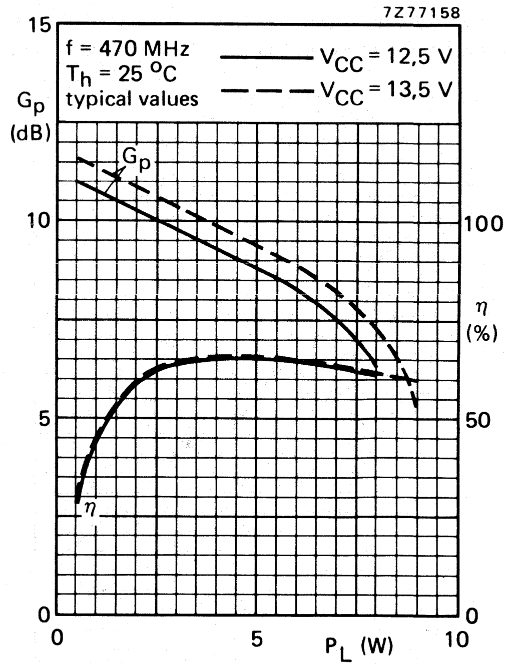


Fig.10.

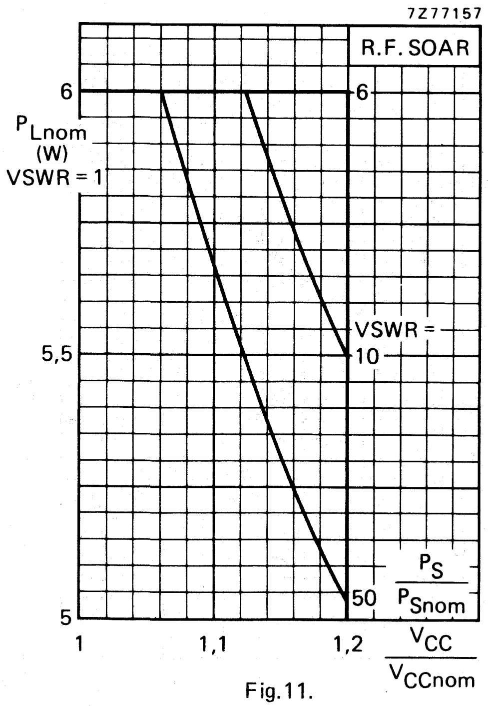


Fig.11.

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.

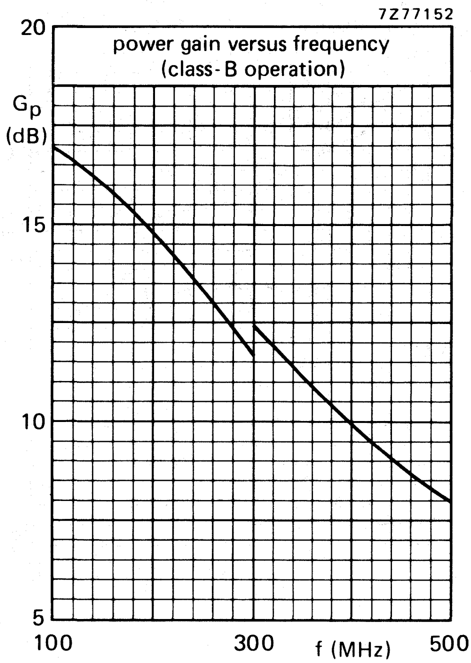


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 4 W
T_h = 25 °C
typical values

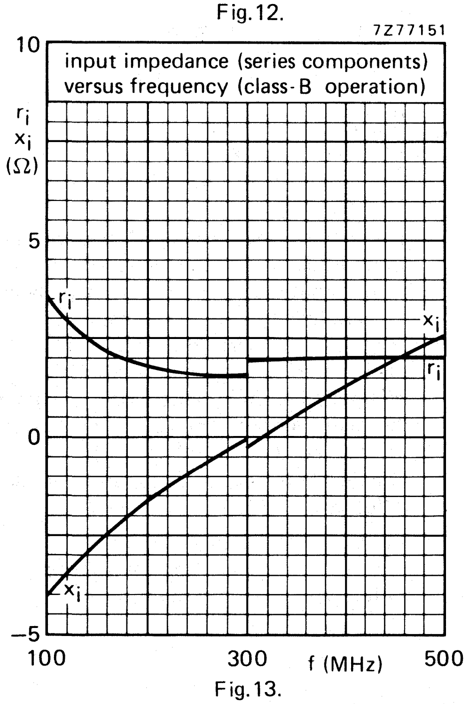


Fig.13.

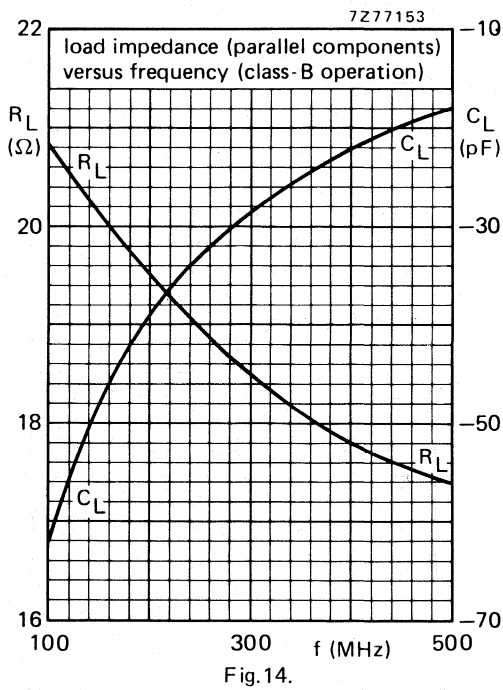


Fig.14.

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

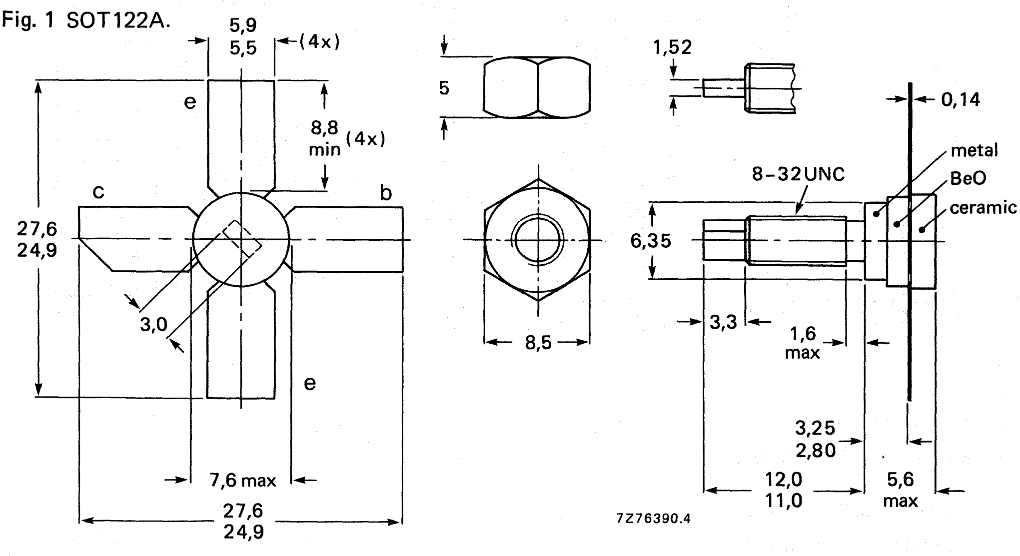
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

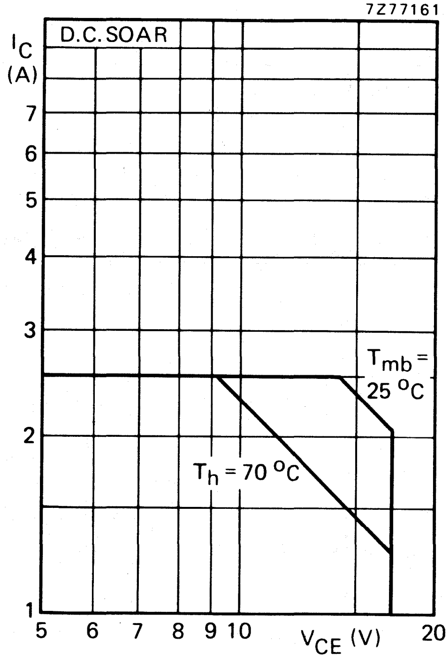


Fig.2.

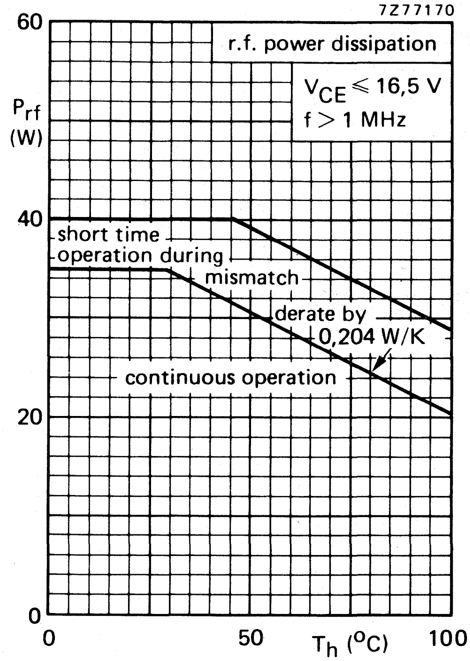


Fig.3.

Storage temperature	T_{stg}		−65 to +150 °C
Operating junction temperature	T_j	max	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4,3 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 $V_{BE} = 0$; $I_C = 25$ mA	$V_{(BR)CES}$	>	36	V
Collector-emitter voltage open base; $I_C = 100$ mA	$V_{(BR)CEO}$	>	17	V
Emitter-base voltage open collector; $I_E = 10$ mA	$V_{(BR)EBO}$	>	4	V
Collector cut-off current				
$V_{BE} = 0$; $V_{CE} = 17$ V	I_{CES}	<	10	mA
D.C. current gain *				
$I_C = 1,25$ A; $V_{CE} = 5$ V	h_{FE}	>	10	
		typ	35	
Collector-emitter saturation voltage *				
$I_C = 3,75$ A; $I_B = 0,75$ A	V_{CEsat}	typ	0,75	V
Transition frequency at f = 500 MHz *				
$I_C = 1,25$ A; $V_{CE} = 12,5$ V	f_T	typ	1,3	GHz
$I_C = 3,75$ A; $V_{CE} = 12,5$ V	f_T	typ	0,9	GHz
Collector capacitance at f = 1 MHz				
$I_E = I_e = 0$; $V_{CB} = 12,5$ V	C_c	typ	34	pF
Feedback capacitance at f = 1 MHz				
$I_C = 100$ mA; $V_{CE} = 12,5$ V	C_{re}	typ	18	pF
Collector-stud capacitance	C_{cs}	typ	1,2	pF

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

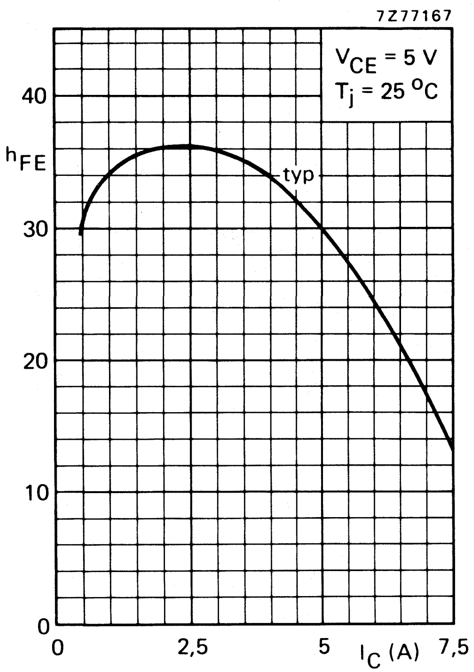


Fig.4.

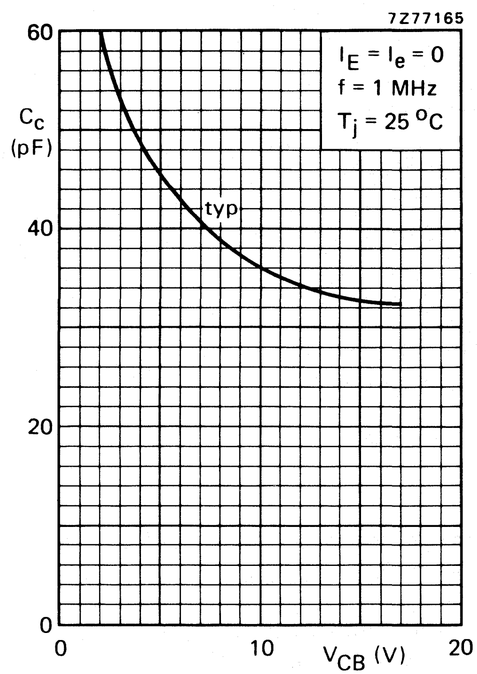


Fig.5.

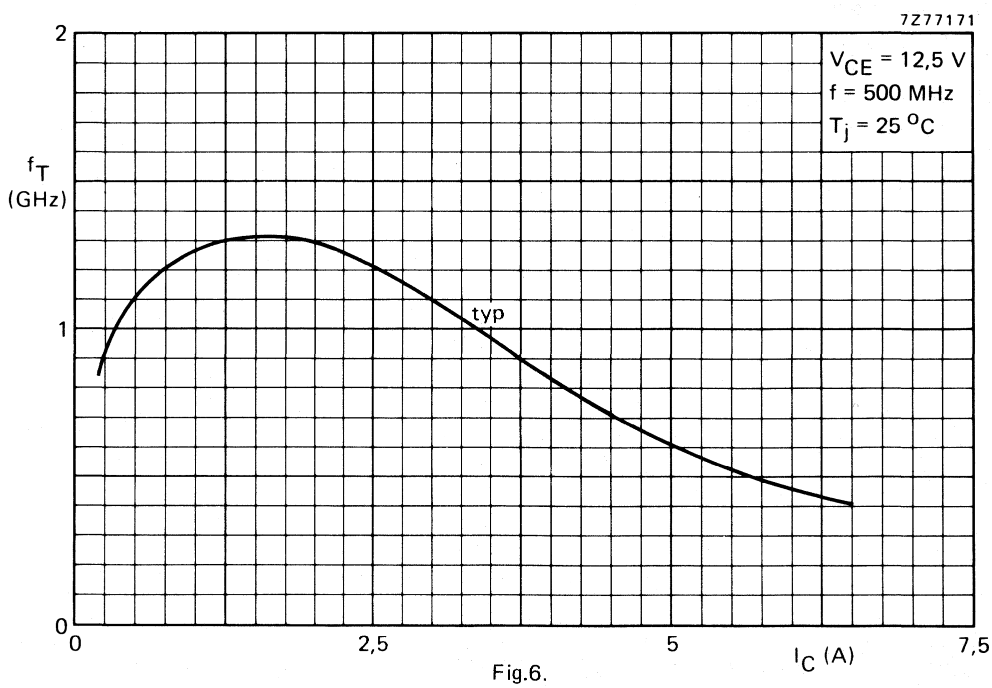


Fig.6.

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)
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

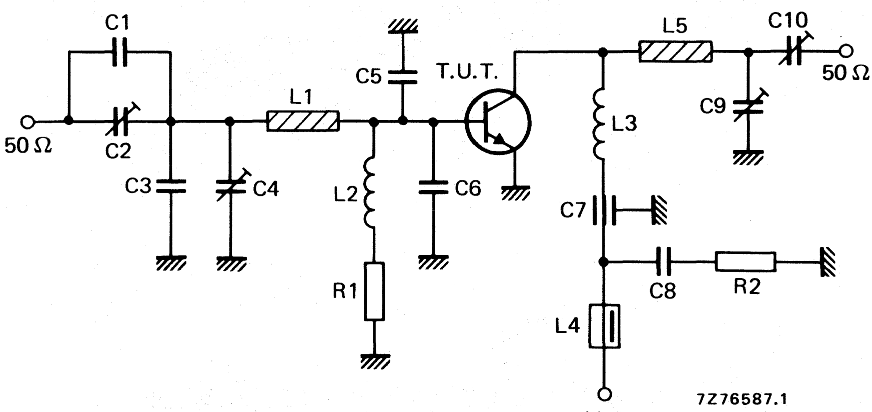


Fig.7 Class-B test circuit at f = 470 MHz.

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

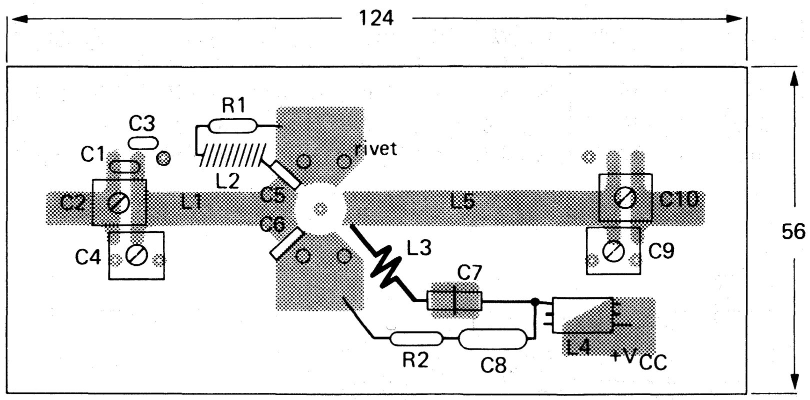
L1 = stripline (27,9 mm x 6,0 mm)
L2 = 13 turns closely wound enamelled Cu wire (0,5 mm); int. dia. = 4 mm; leads 2 x 5 mm
L3 = 17 nH; 1½ turns enamelled Cu wire (1 mm); spacing 1 mm; int. dia. = 6 mm; leads 2 x 5 mm
L4 = Ferroxcube wide-band h.f. choke, grade 3B (cat. no. 4312 020 36640)
L5 = stripline (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 ($\epsilon_r = 2,74$); 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)



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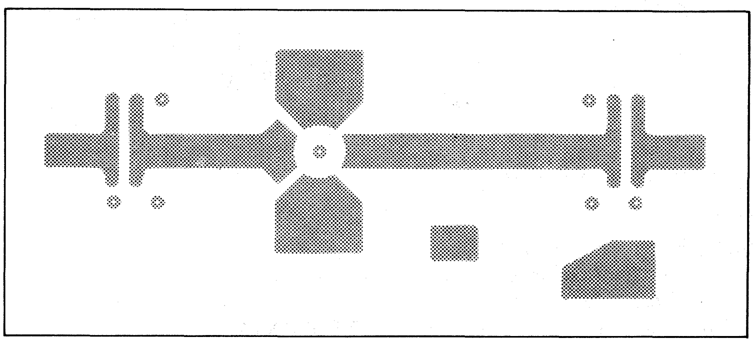


7Z76586

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

Fig.8 Component layout and printed-circuit board for 470 MHz test circuit.

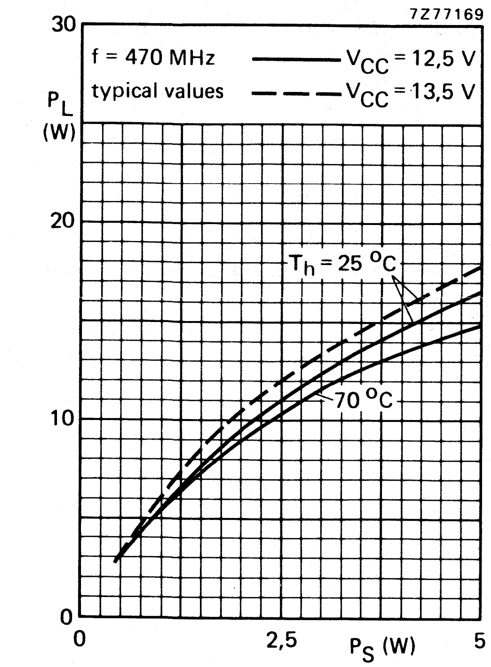


Fig.9.

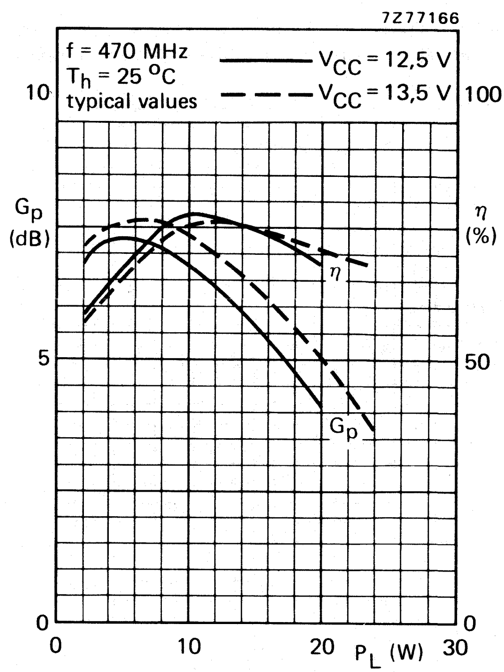


Fig.10.

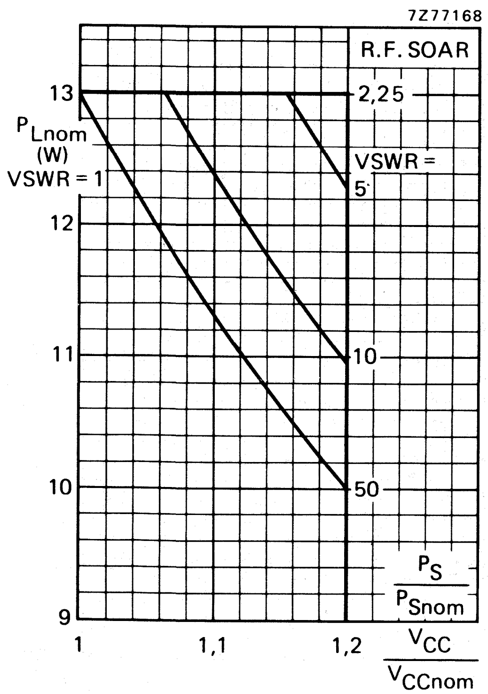


Fig.11.

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.

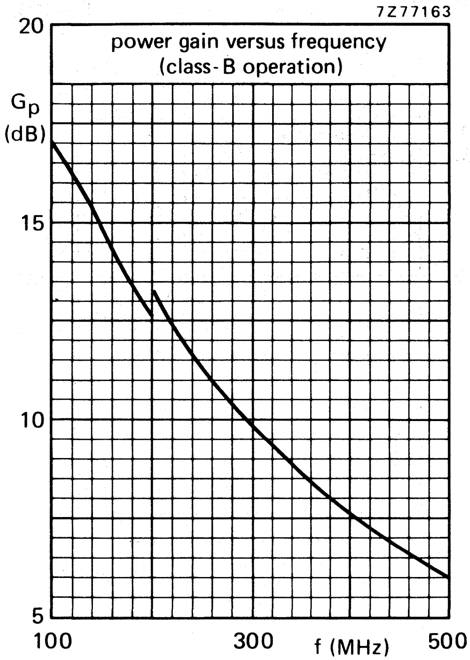


Fig.12.

Measuring conditions for the graphs on this page

V_{CC} = 12,5 V
P_L = 10 W
T_h = 25 °C
typical values

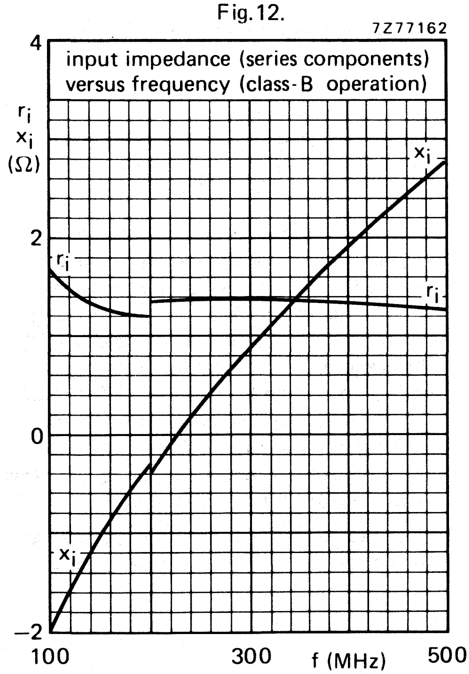


Fig.13.

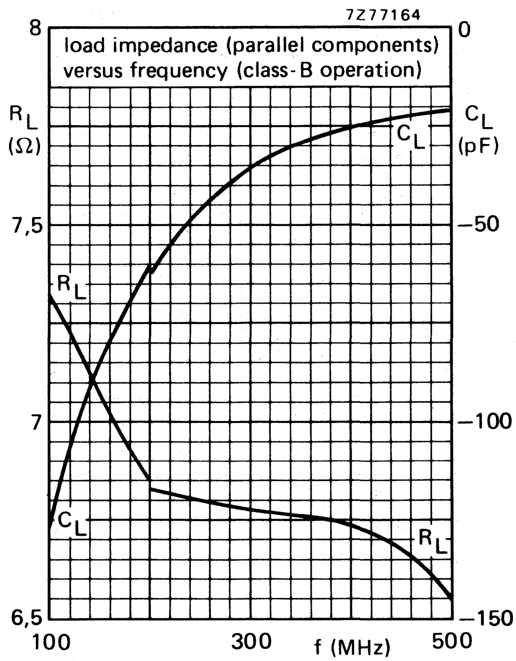


Fig.14.

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

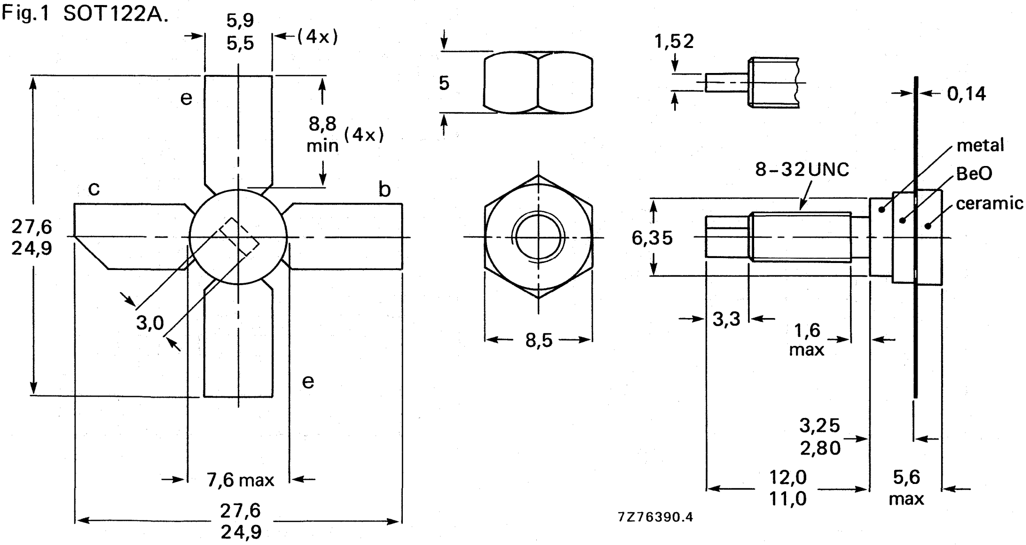
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

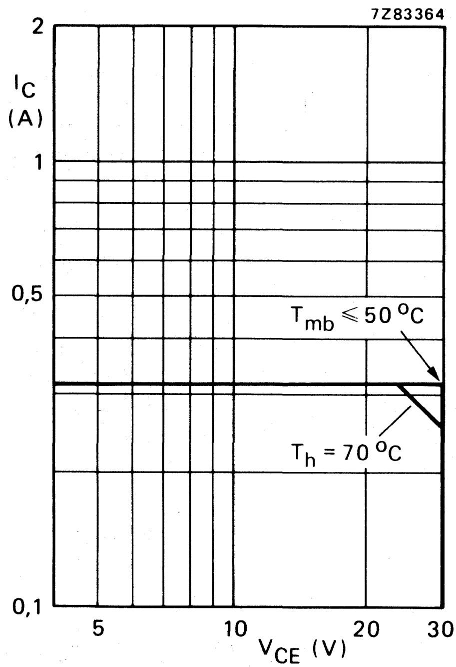


Fig. 2 D.C. SOAR.

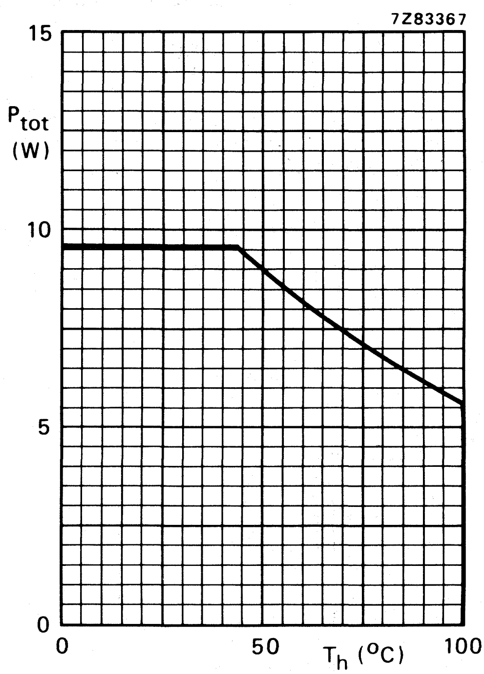


Fig. 3 Power derating curve vs. temperature.

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

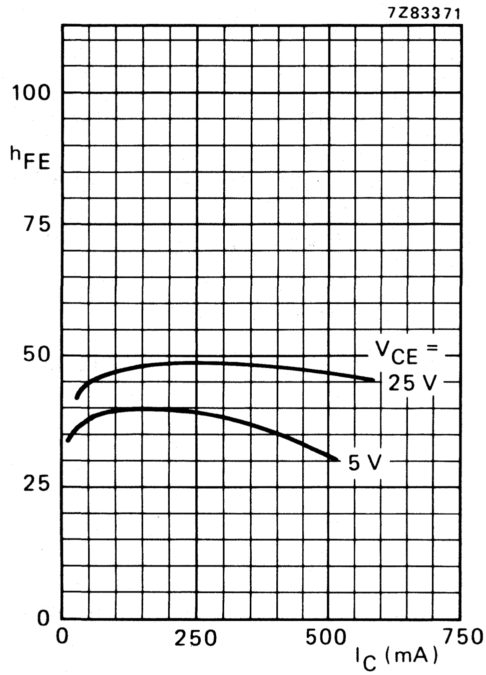


Fig. 4 Typical values; T_j = 25 °C.

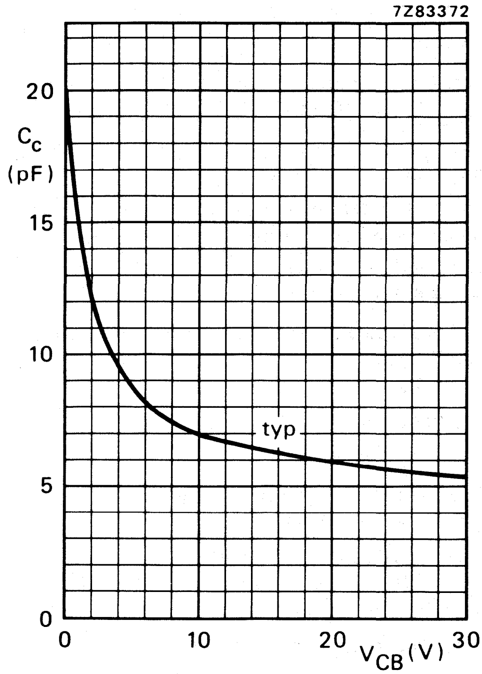


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

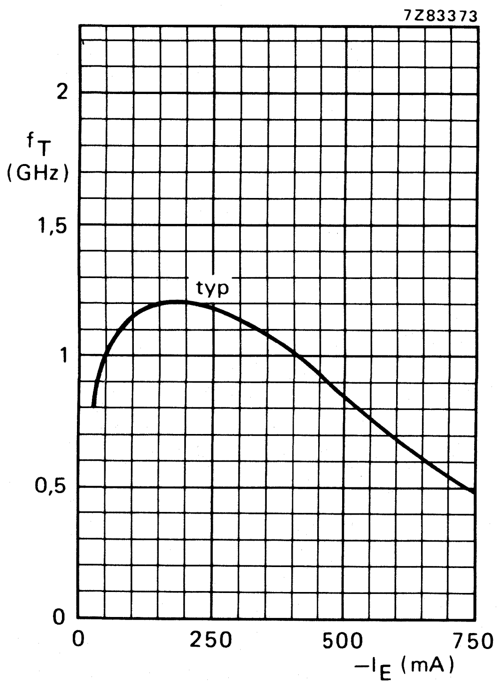


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

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	–	–

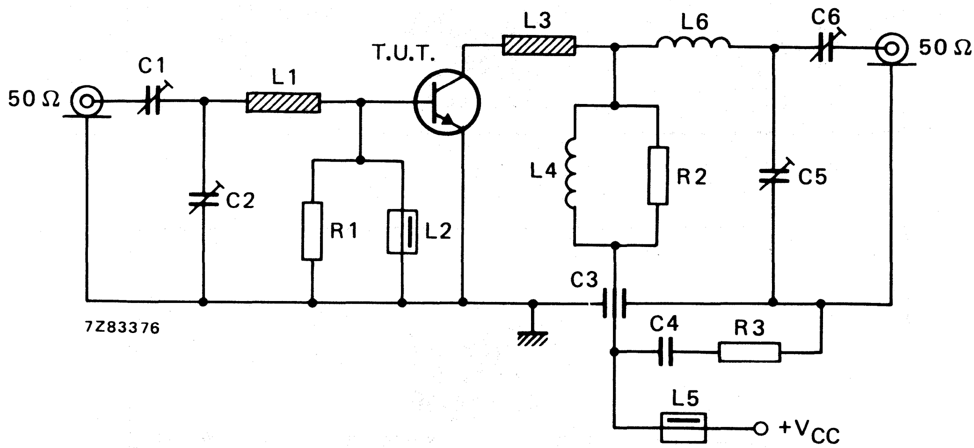


Fig. 7 Test circuit; c.w. class-B.

List of components:

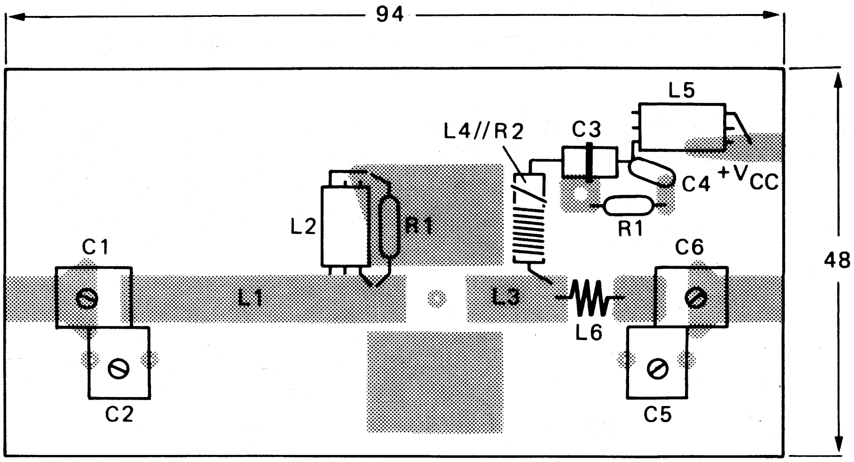
C1 = C5 = C6 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C2 = 2 to 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 100 pF ceramic feed-through capacitor
C4 = 100 nF polyester capacitor

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.



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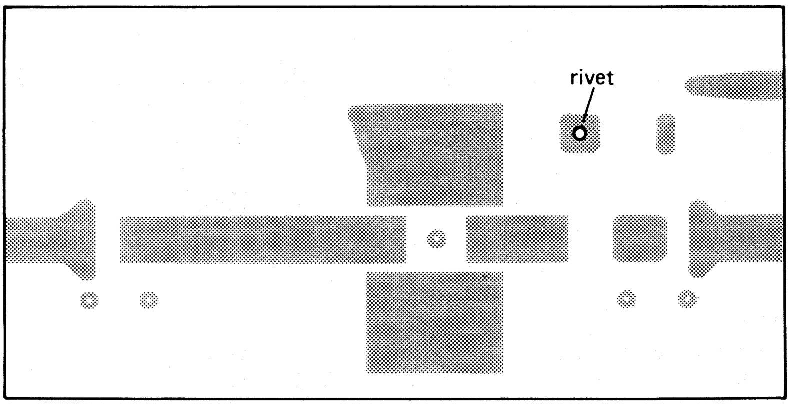


7Z83374

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.

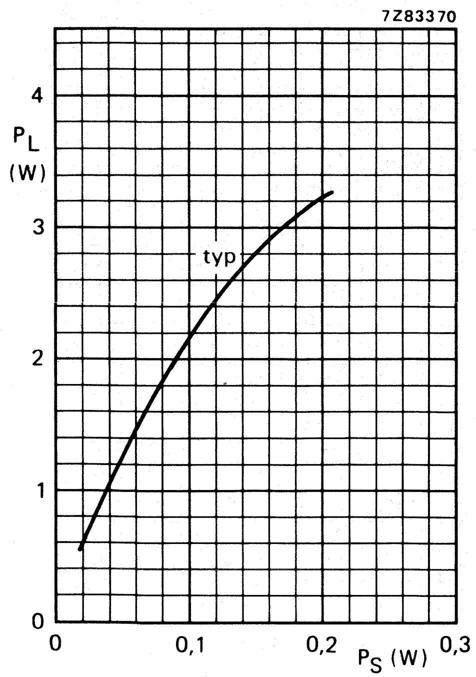


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

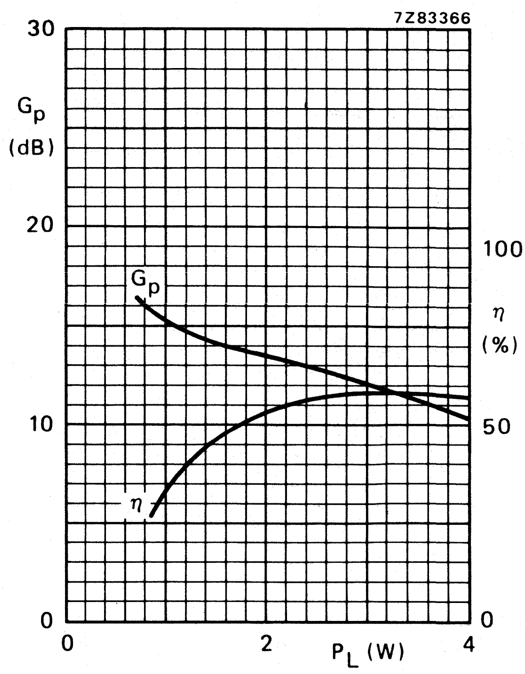


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

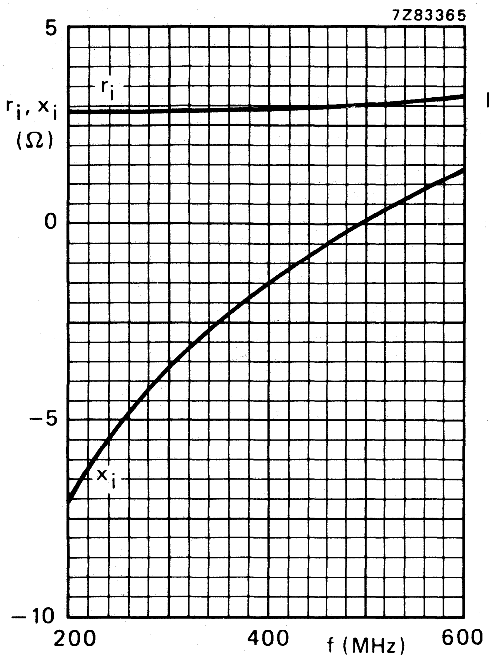


Fig. 11 Input impedance (series components).

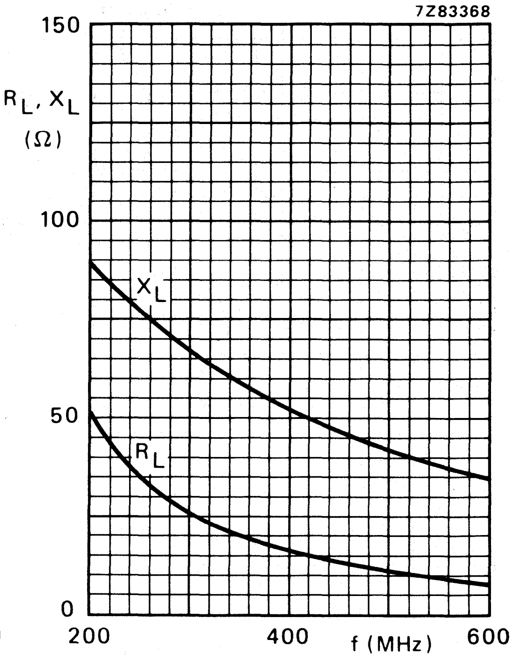


Fig. 12 Load impedance (series components).

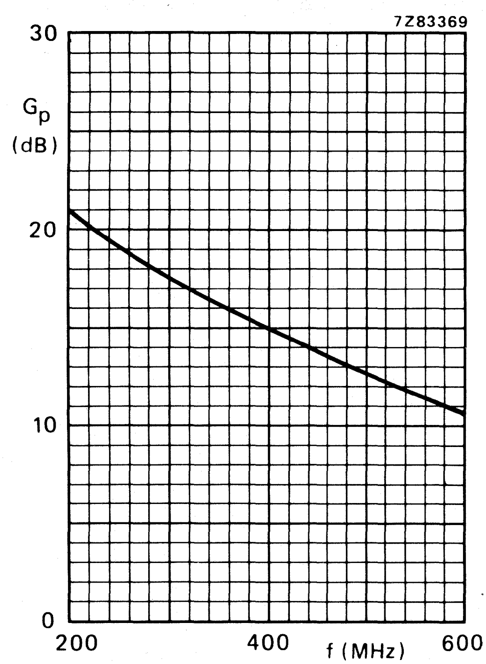


Fig. 13.

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

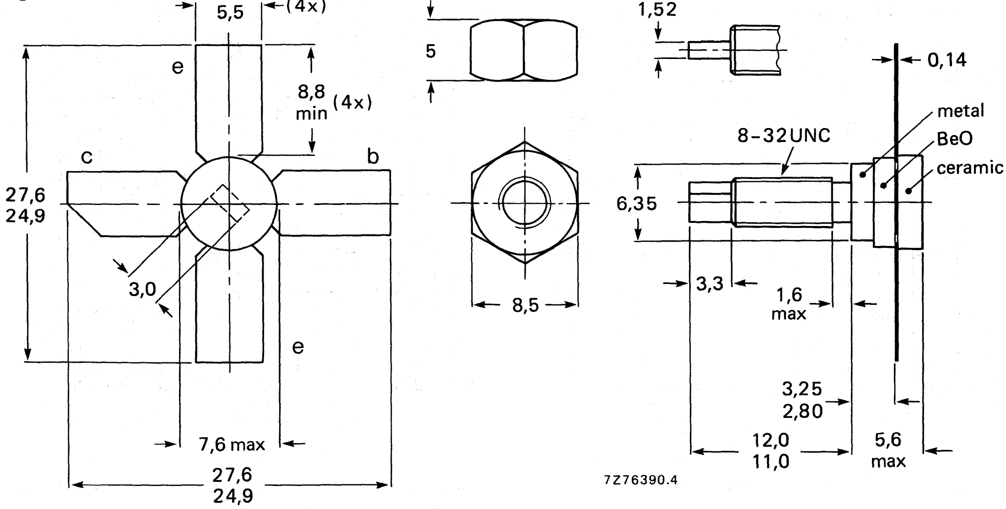
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

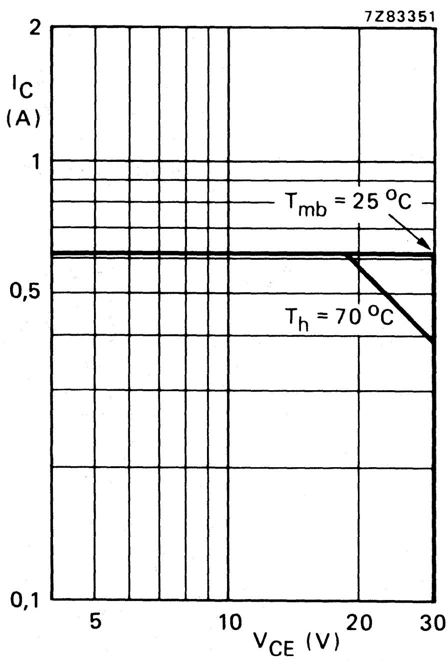


Fig. 2 D.C. SOAR.

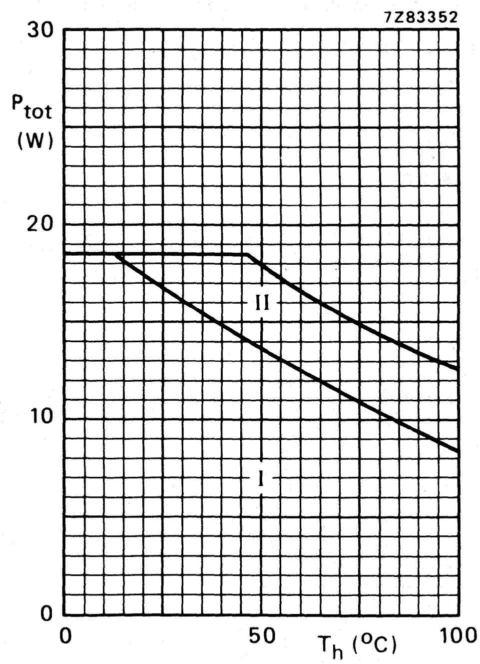


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. and r.f. operation
II Short-time operation during mismatch

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

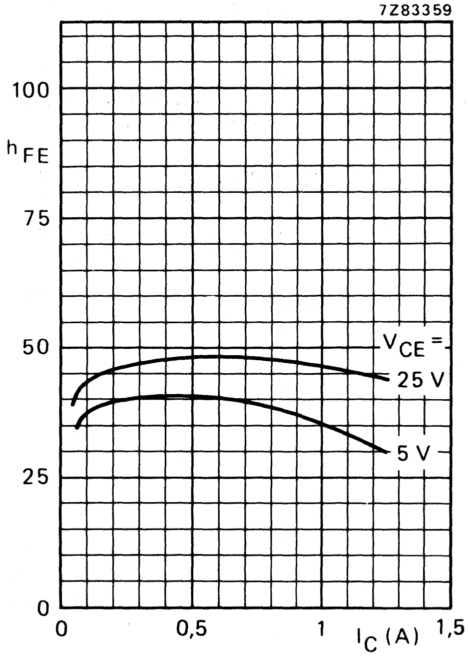


Fig. 4 Typical values; T_j = 25 °C.

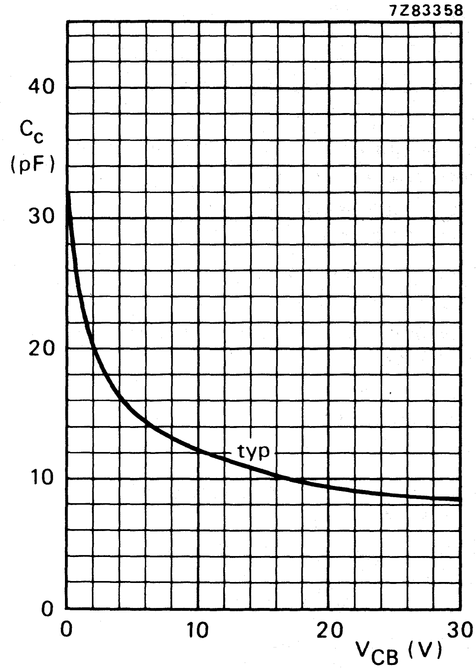


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 °C.

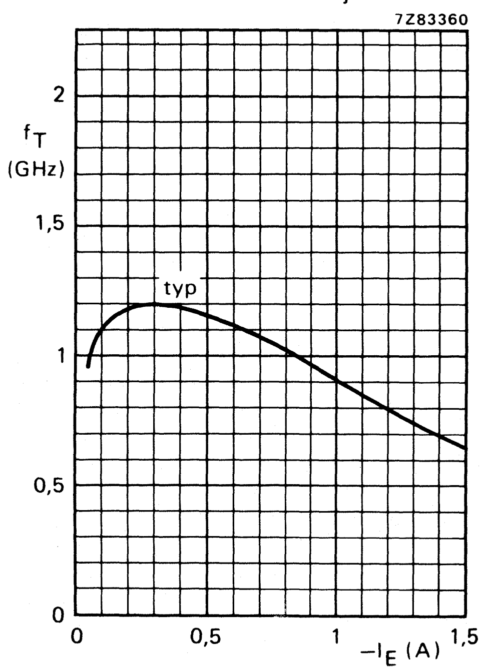


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 °C.

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	–	–

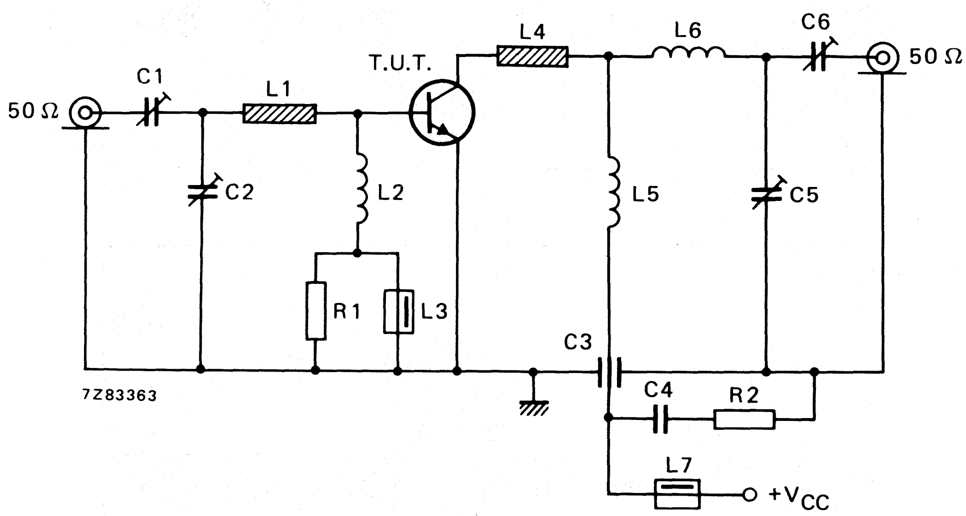


Fig. 7 Test circuit; c.w. class-B.

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.

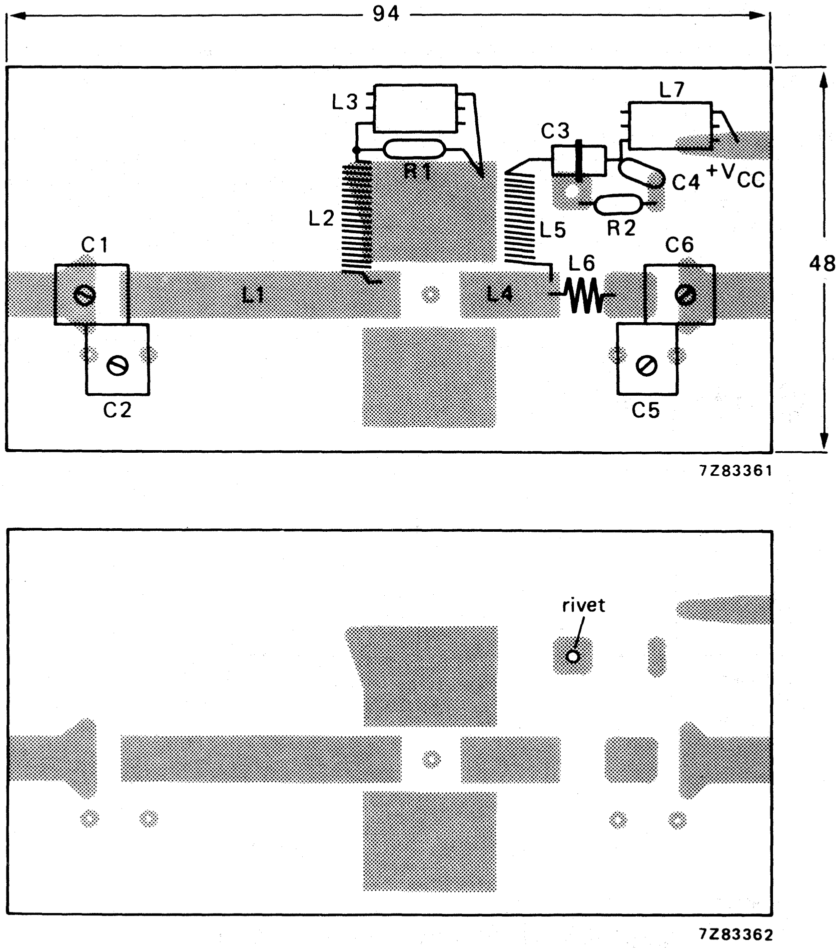


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

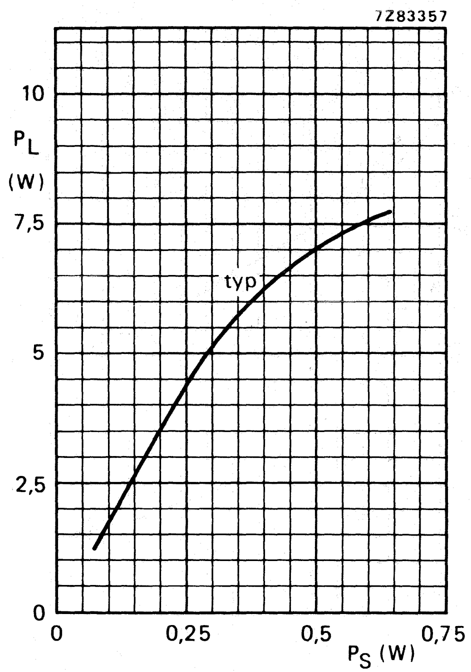


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 ^oC.

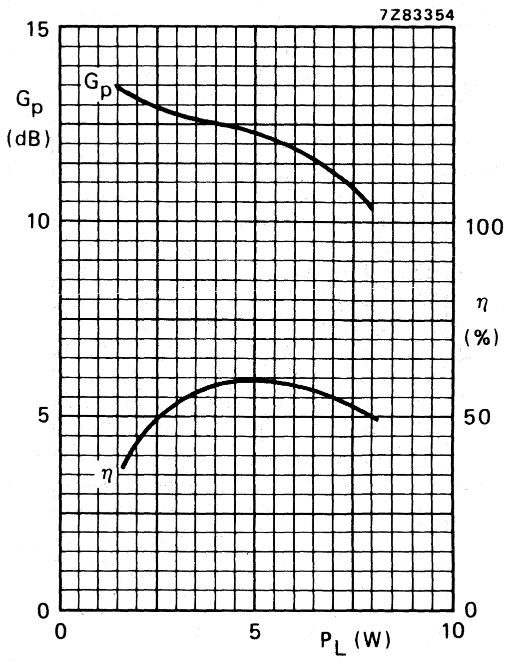


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 ^oC.

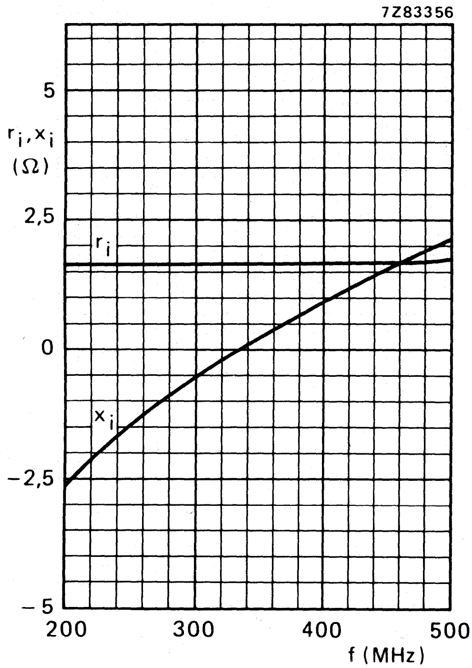


Fig. 11 Input impedance (series components).

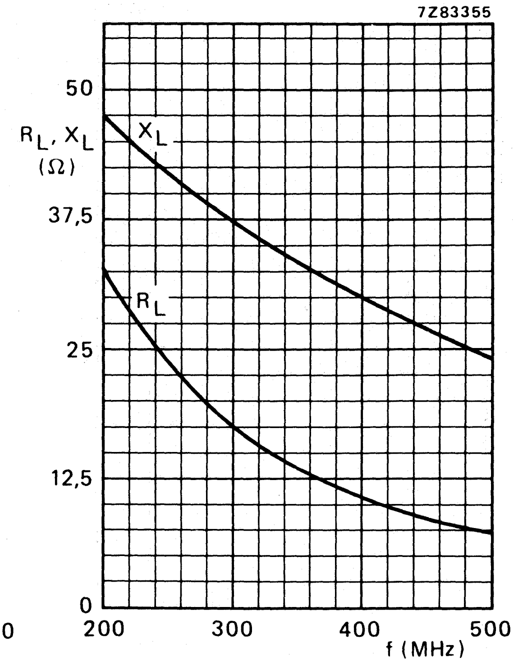


Fig. 12 Load impedance (series components).

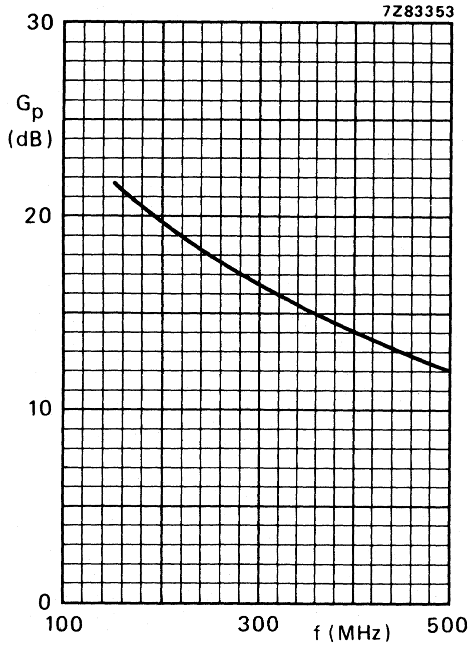


Fig. 13.

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

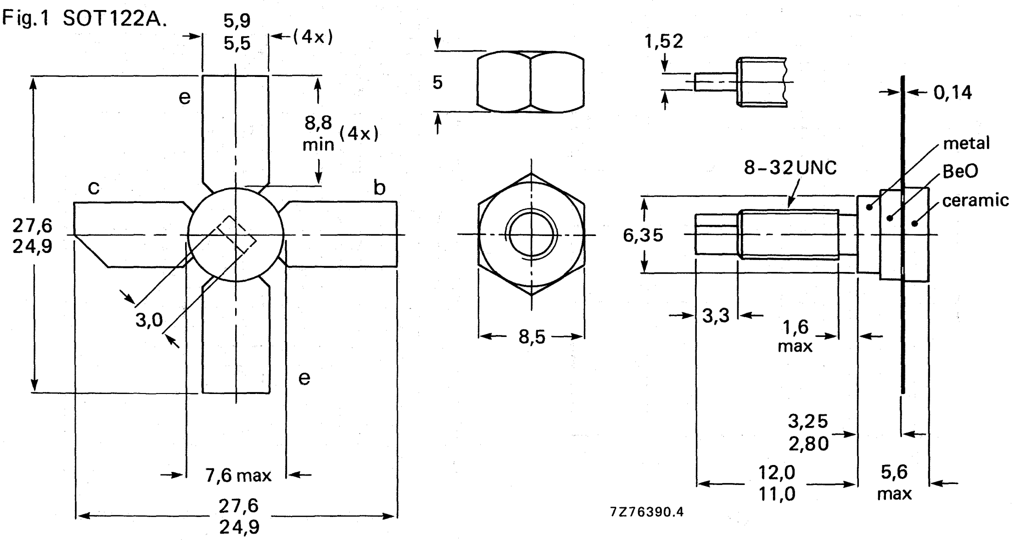
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

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

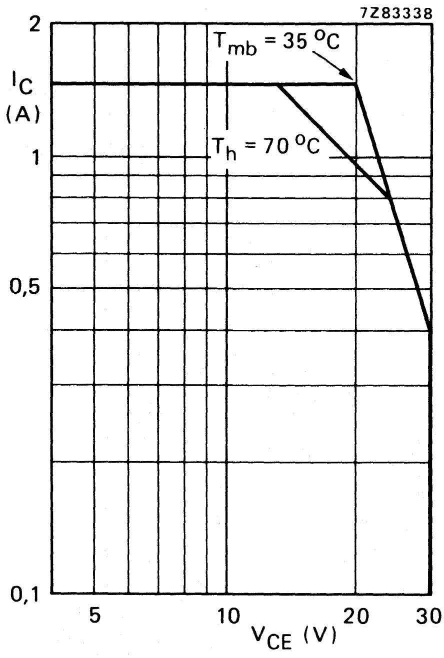


Fig. 2 D.C. SOAR.

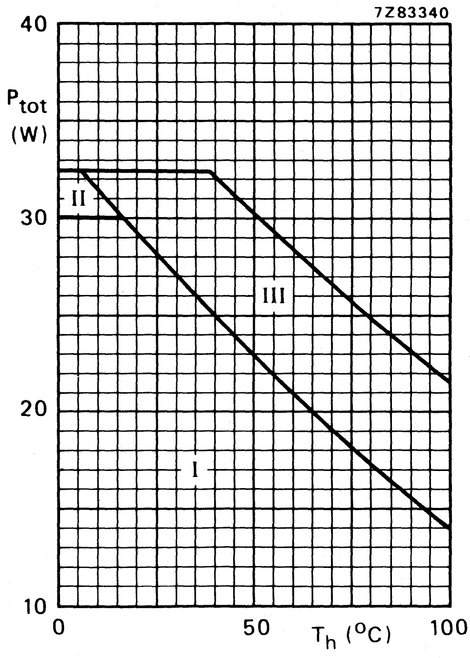


Fig. 3 Power derating curves vs. temperature.
I Continuous d.c. operation
II Continuous r.f. operation
III Short-time operation during mismatch

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
$R_{BE} = 10\ \Omega$	E_{SBR}	>	2 mJ
D.C. current gain *			
$I_C = 0,6$ A; $V_{CE} = 5$ V	h_{FE}	typ.	40
			10 to 100
Collector-emitter saturation voltage *			
$I_C = 2,0$ A; $I_B = 0,4$ A	V_{CEsat}	typ.	1,0 V
Transition frequency at f = 500 MHz *			
$-I_E = 0,6$ A; $V_{CB} = 28$ V	f_T	typ.	1,2 GHz
$-I_E = 2,0$ A; $V_{CB} = 28$ V	f_T	typ.	1,0 GHz
Collector capacitance at f = 1 MHz			
$I_E = I_e = 0$; $V_{CB} = 28$ V	C_c	typ.	17 pF
Feedback capacitance at f = 1 MHz			
$I_C = 20$ mA; $V_{CE} = 28$ V	C_{re}	typ.	8,5 pF
Collector-stud capacitance	C_{cs}	typ.	1,2 pF

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

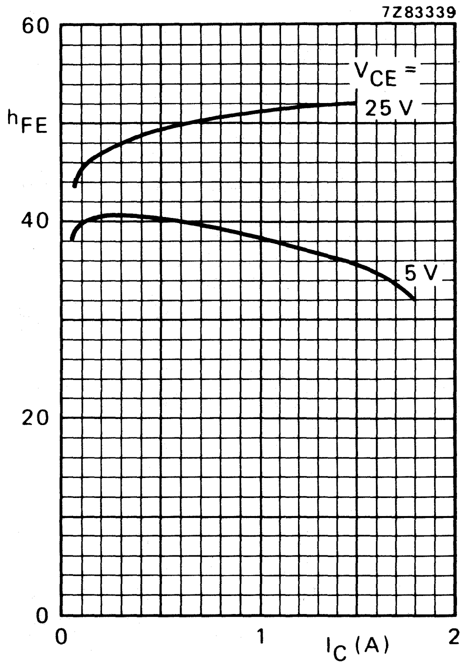


Fig. 4 Typical values; T_j = 25 ^oC.

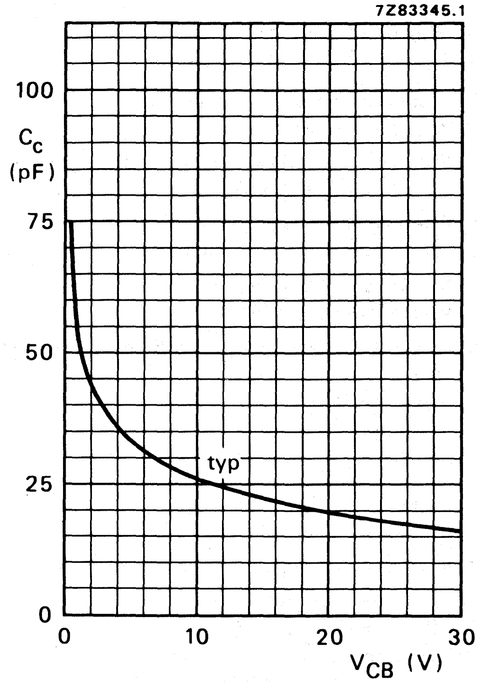


Fig. 5 $I_E = I_e = 0$; f = 1 MHz; T_j = 25 ^oC.

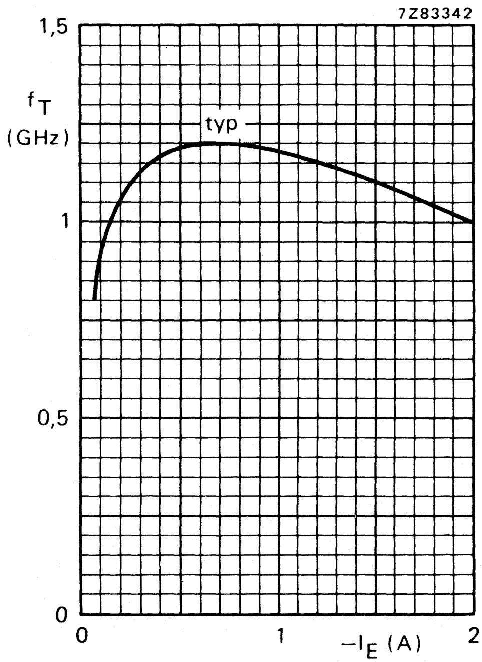


Fig. 6 V_{CB} = 28 V; f = 500 MHz; T_j = 25 ^oC.

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	–	–

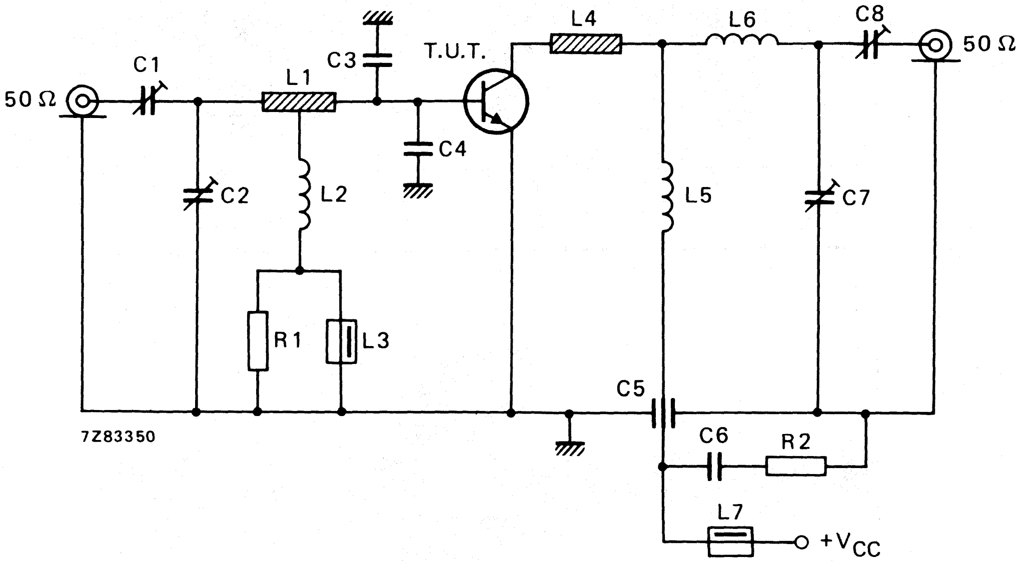


Fig. 7 Test circuit; c.w. class-B. For component layout and p.c.b. see Fig. 8.

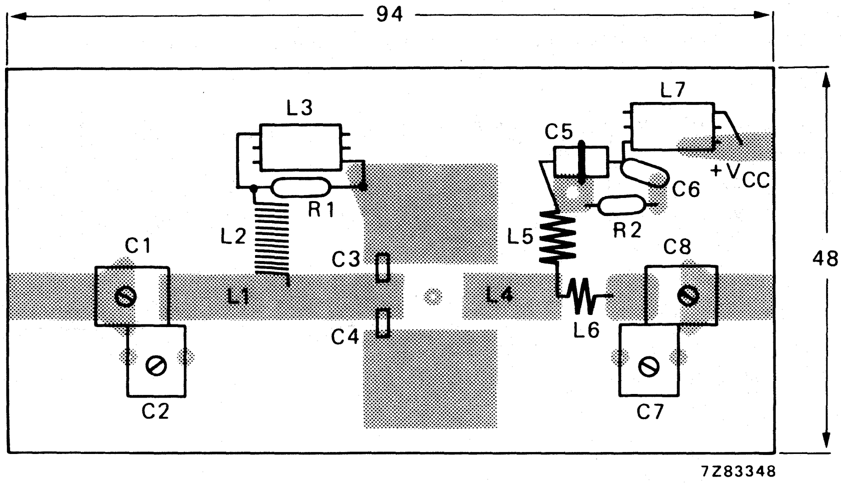
List of components:

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



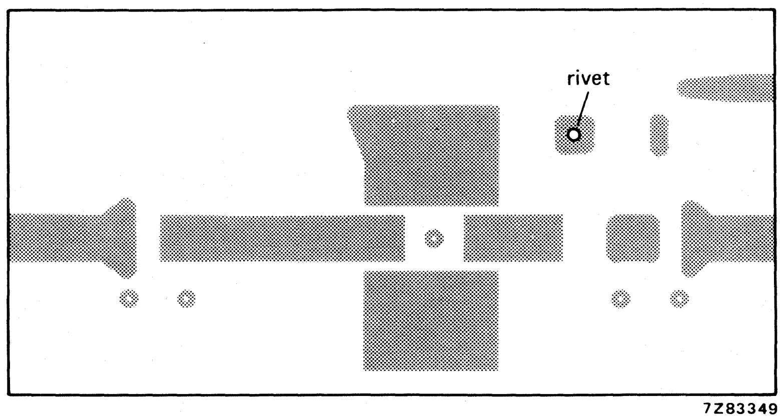


Fig. 8 Component layout and printed-circuit board for 470 MHz test circuit.

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.

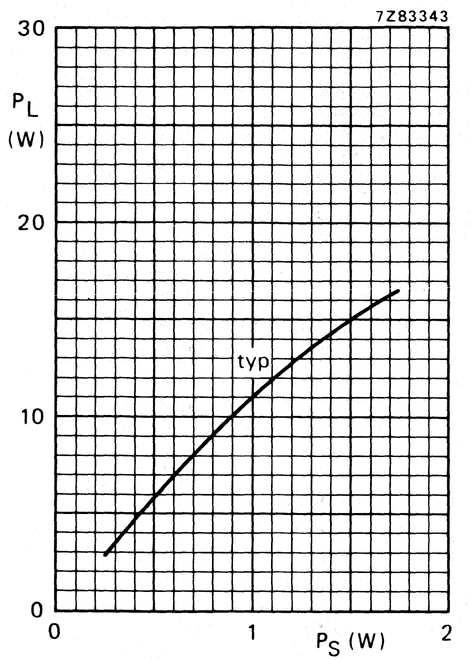


Fig. 9 V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

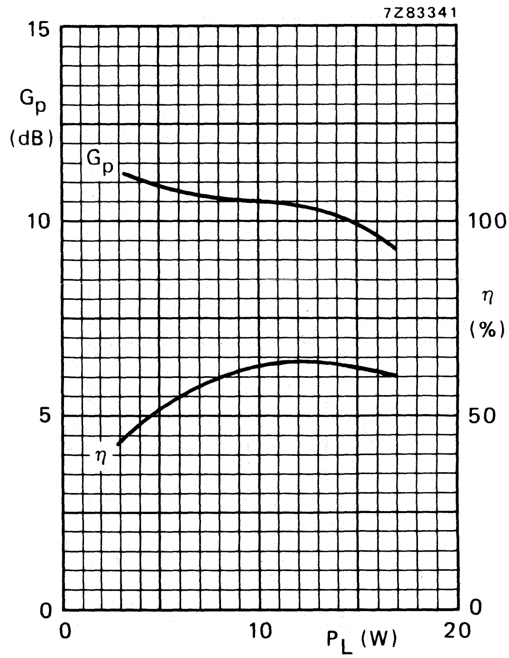


Fig. 10 Typical values; V_{CE} = 28 V; f = 470 MHz; T_h = 25 °C.

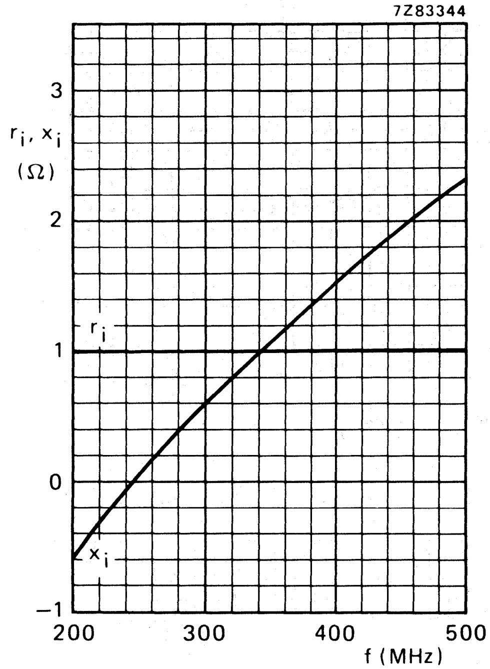


Fig. 11 Input impedance (series components).

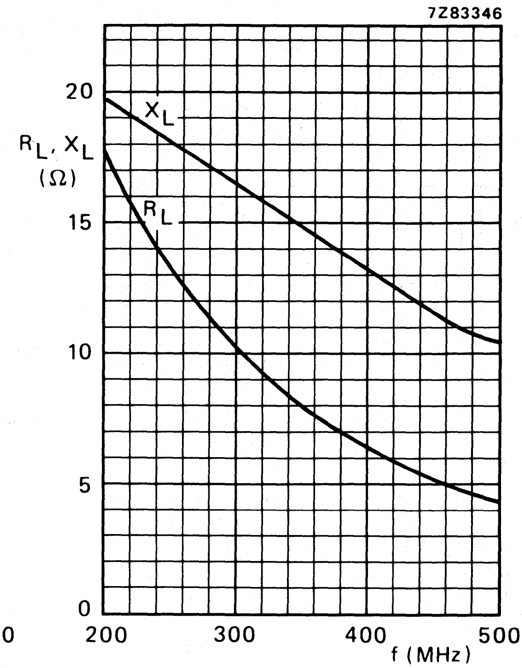


Fig. 12 Load impedance (series components).

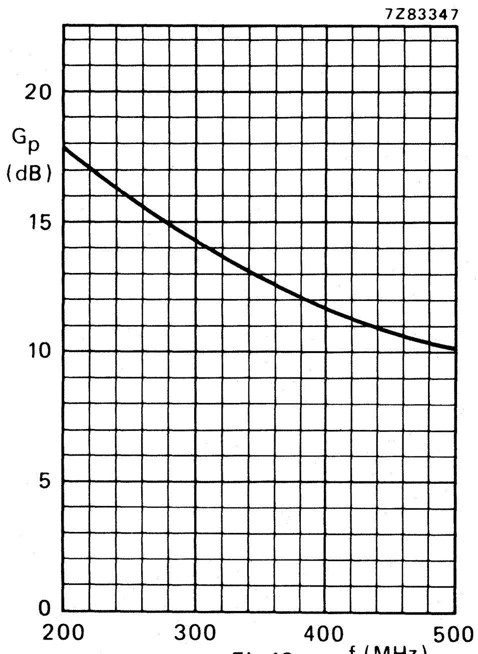


Fig.13.

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.

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

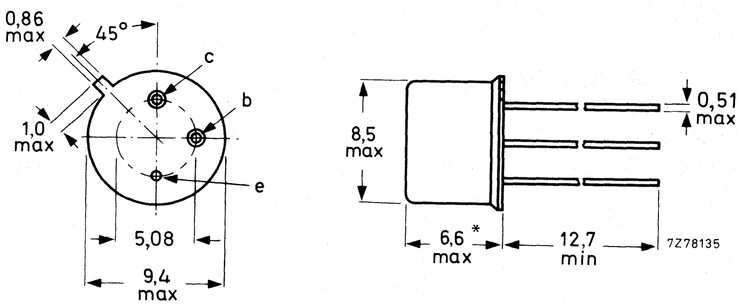
R.F. performance at T_c = 25 °C in a common-emitter class-B circuit.

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	–	–

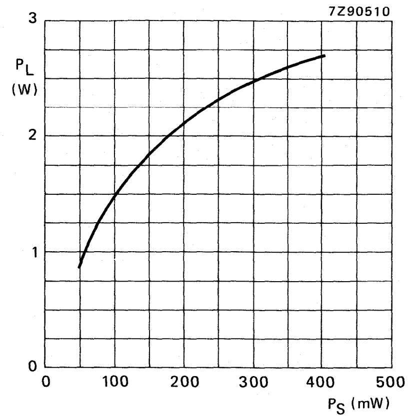


Fig. 2 Load power vs. source power; V_{CE} = 12,5 V; f = 470 MHz; T_{mb} = 25 °C; class-B operation; typical values.

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. POWER TRANSISTOR

N-P-N silicon planar epitaxial transistor intended for transmitting applications in class-A, B or C with a supply voltage up to 28 V. The transistor is resistance stabilized and is guaranteed to withstand severe load mismatch conditions. Gold metallization ensures extremely high reliability.

It has a capstan envelope with a moulded cap. All leads are isolated from the stud.

QUICK REFERENCE DATA

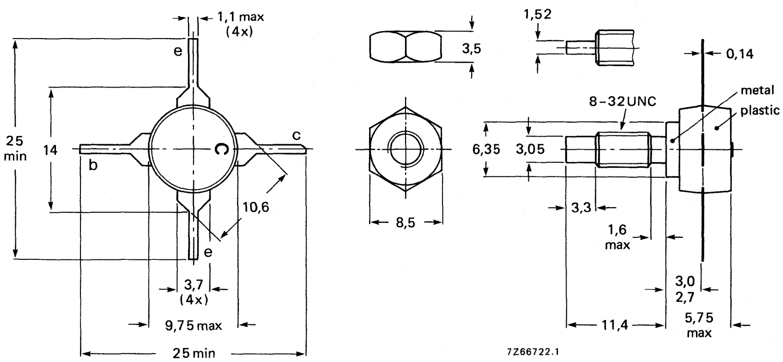
R.F. performance up to T_h = 25 °C in an unneutralized common-emitter class-B circuit

mode of operation	V_{CE} V	f MHz	P_S W	P_L W	I_C A	G_p dB	η %	$\overline{z_i}$ Ω	$\overline{Y_L}$ mS
c.w.	24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	—	—
c.w.	28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	—	—
c.w.	28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 − j32
c.w.	28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	—	—

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-48/3.



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

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

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

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

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Collector-base voltage (open emitter) peak value	V_{CBOM}	max.	65	V
Collector-emitter voltage ($V_{BE} = 0$) peak value	V_{CESM}	max.	65	V
Collector-emitter voltage (open base)	V_{CEO}	max.	33	V
Emitter-base voltage (open collector)	V_{EBO}	max.	4,0	V
Collector current (d.c.)	I_C	max.	1,0	A
Collector current (peak value) $f \geq 10$ MHz	I_{CM}	max.	3,0	A
Total power dissipation up to $T_h = 70\ ^oC$ $f \geq 10$ MHz	P_{tot}	max.	12,5	W
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	200	^oC

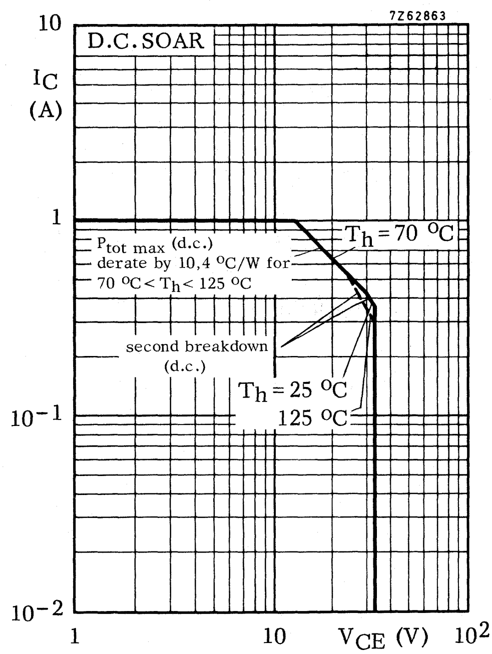
THERMAL RESISTANCE

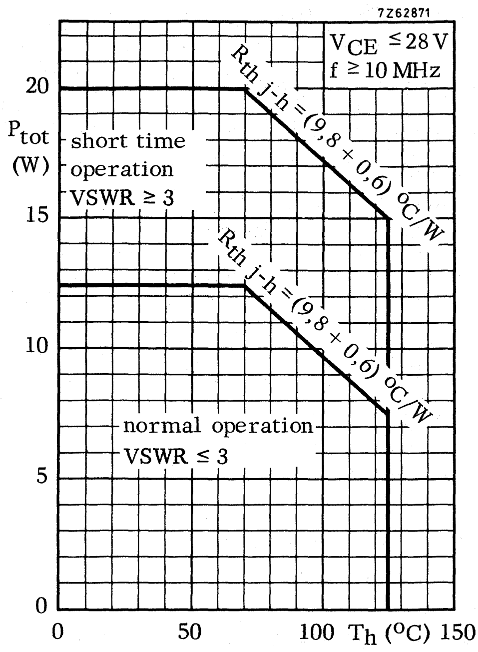
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	9,8	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,6	K/W

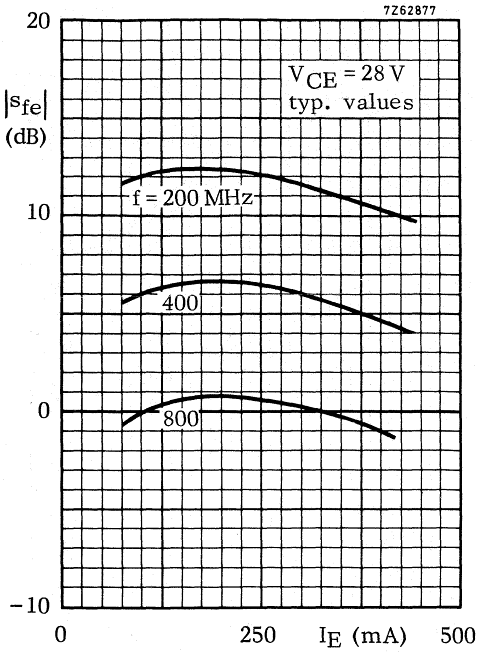
CHARACTERISTICS

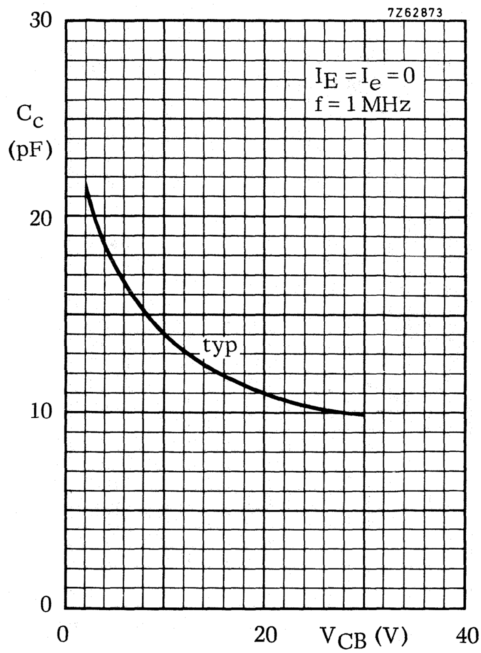
T_j = 25 ^oC unless otherwise specified

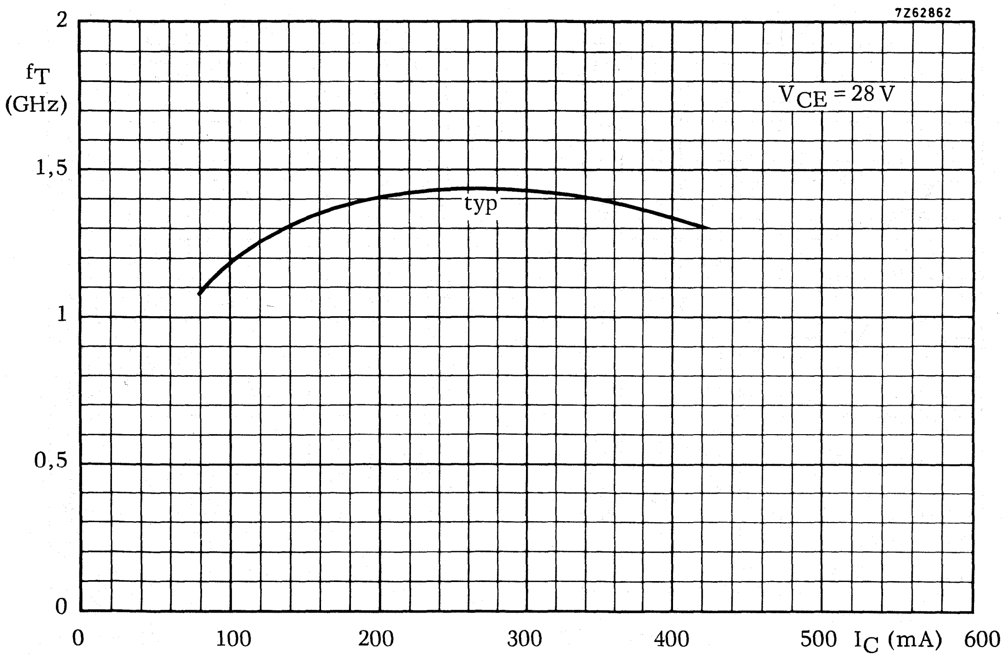
Breakdown voltages				
Collector-base voltage open emitter, I_C = 10 mA	$V_{(BR)CBO}$	>	65	V
Collector-emitter voltage open base, I_C = 10 mA	$V_{(BR)CES}$	>	65	V
Collector-emitter voltage open base, I_C = 25 mA	$V_{(BR)CEO}$	>	33	V
Emitter-base voltage open collector, I_E = 1,0 mA	$V_{(BR)EBO}$	>	4,0	V
D.C. current gain				
I_C = 100 mA; V_{CE} = 5,0 V	h_{FE}	> typ.	10 35	
Transition frequency				
I_C = 200 mA; V_{CE} = 5,0 V	f_T	typ.	1,2	GHz
Collector capacitance at f = 1 MHz				
I_E = I_e = 0; V_{CB} = 10 V	C_c	typ.	14	pF
Emitter capacitance at f = 1 MHz				
I_C = I_c = 0; V_{EB} = 0	C_e	typ.	60	pF
Feedback capacitance at f = 1 MHz				
I_C = 20 mA; V_{CE} = 10 V	C_{re}	typ.	10	pF
Collector-stud capacitance	C_{cs}	typ.	2,0	pF

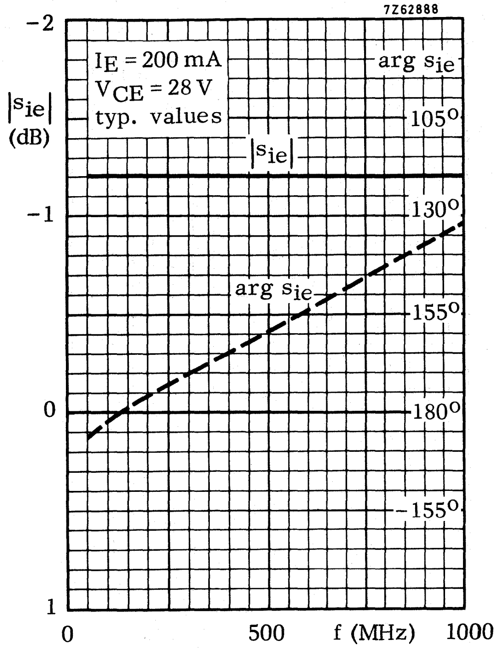

7Z62863
D.C. SOAR
I_C (A)
10
1
10^{-1}
10^{-2}
$P_{tot\ max}$ (d.c.)
derate by 10,4 °C/W for
70 °C < T_h < 125 °C
T_h = 70 °C
second breakdown
(d.c.)
T_h = 25 °C
125 °C
1
10
V_{CE} (V)
10^2

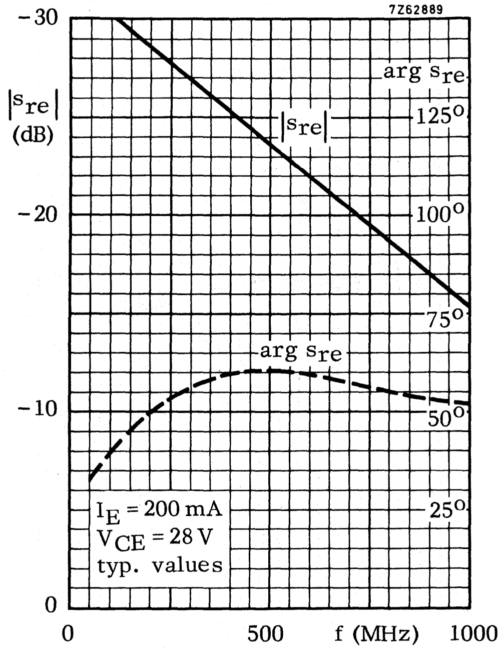

7Z62871
V_{CE} ≤ 28 V
f ≥ 10 MHz
P_{tot} (W)
20
15
10
5
0
short time
operation
VSWR ≥ 3
$R_{th\ j\text{-}h}$ = (9,8 + 0,6) °C/W
$R_{th\ j\text{-}h}$ = (9,8 + 0,6) °C/W
normal operation
VSWR ≤ 3
0
50
100
T_h (°C)
150

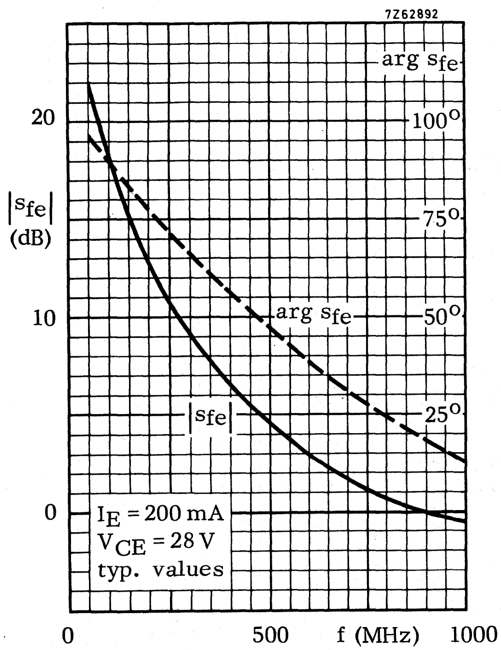

7Z62877
20
|s_fe|
(dB)
10
0
−10
0
250
I_E (mA)
500
V_CE = 28 V
typ. values
f = 200 MHz
400
800

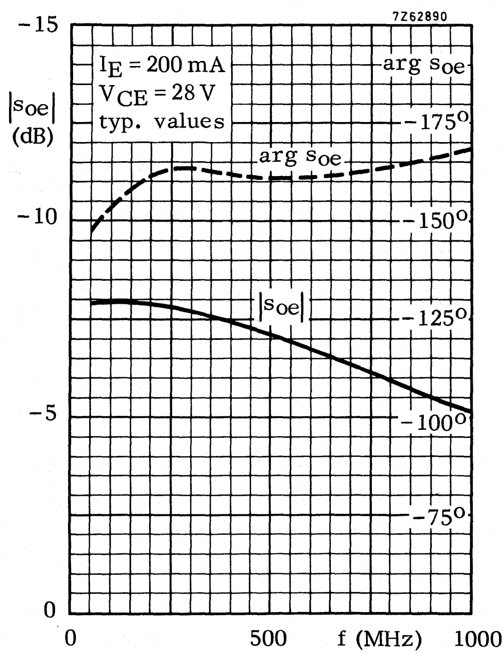

7Z62873
30
C_c
(pF)
20
10
0
0
20
V_CB (V)
40
I_E = I_e = 0
f = 1 MHz
typ


7Z62862
2
f_T
(GHz)
1,5
1
0,5
0
0
100
200
300
400
500
I_C (mA)
600
V_CE = 28 V
typ


7Z62888
I_E = 200 mA
V_{CE} = 28 V
typ. values
|s_{ie}|
(dB)
arg s_{ie}
-2
-1
0
1
105°
130°
155°
180°
-155°
0
500
f (MHz)
1000


7Z62889
|s_{re}|
(dB)
arg s_{re}
I_E = 200 mA
V_{CE} = 28 V
typ. values
-30
-20
-10
0
125°
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62892
|s_{fe}|
(dB)
arg s_{fe}
I_E = 200 mA
V_{CE} = 28 V
typ. values
20
10
0
100°
75°
50°
25°
0
500
f (MHz)
1000


7Z62890
I_E = 200 mA
V_{CE} = 28 V
typ. values
|s_{oe}|
(dB)
arg s_{oe}
-15
-10
-5
0
-175°
-150°
-125°
-100°
-75°
0
500
f (MHz)
1000

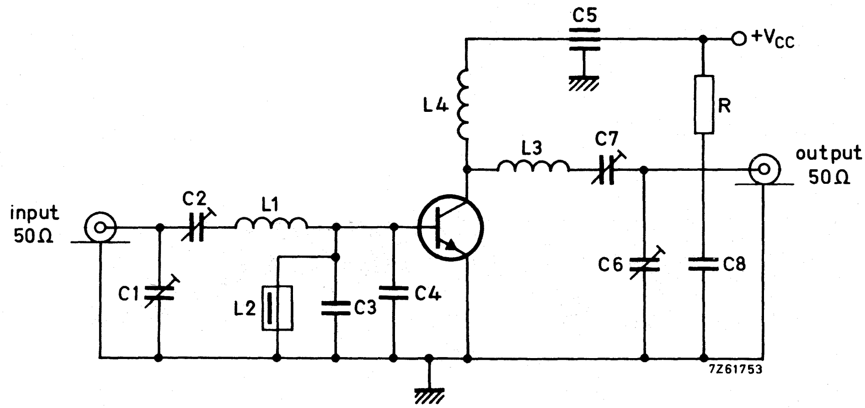
APPLICATION INFORMATION

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

T_h = 25 °C

V_{CC} (V)	f (MHz)	P_S (W)	P_L (W)	I_C (A)	G_p (dB)	η (%)	$\overline{z_i}$ (Ω)	$\overline{Y_L}$ (mS)
24	470	typ. 1,0	7,0	typ. 0,42	typ. 8,5	typ. 70	–	–
28	470	< 1,0	7,0	< 0,42	> 8,5	> 60	–	–
28	470	typ. 1,0	8,0	typ. 0,38	typ. 9,0	typ. 75	1,8 + j5,3	19 – j32
28	1000	typ. 1,5	5,0	typ. 0,40	typ. 5,2	typ. 45	–	–

Test circuit for 470 MHz:



C1 = C2 = 1,8 to 18 pF film dielectric trimmer
C3 = C4 = 18 pF disc ceramic capacitor
C5 = 1 nF feed-through capacitor
C6 = C7 = 1,0 to 9,0 pF film dielectric trimmer
C8 = 0,1 μF polyester capacitor

L1 = 1 turn Cu wire (1,2 mm); int. dia. 5 mm; lead length = 2 mm
L2 = 0,47 μH choke
L3 = 2 turns closely wound enamelled Cu wire (1,2 mm); int. dia. 6,5 mm; lead length = 4 mm
L4 = 3 turns closely wound enamelled Cu wire (0,5 mm); int. dia. 4,0 mm; lead length = 5 mm

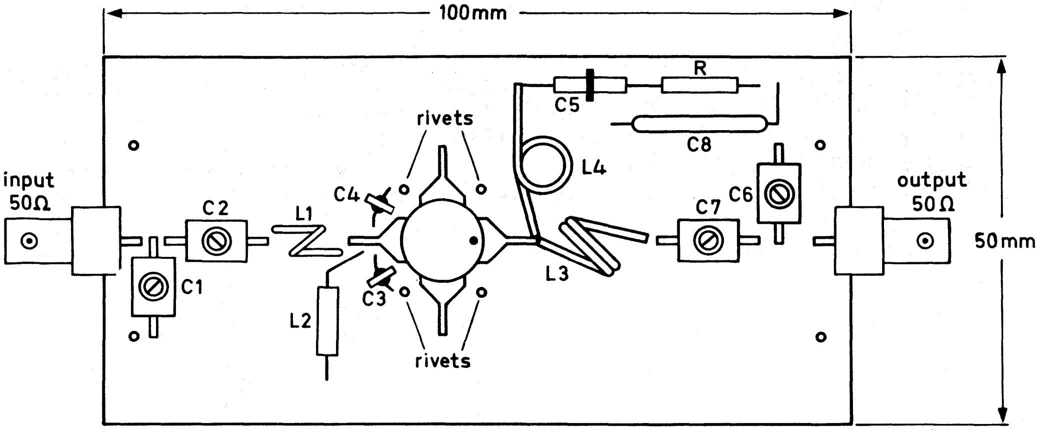
R = 10 Ω carbon

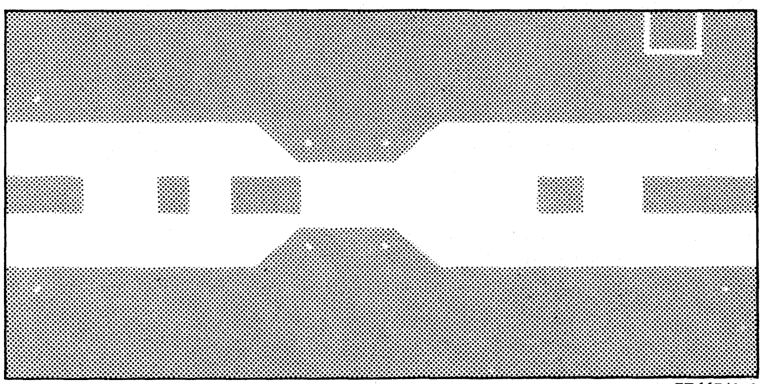
At P_L = 7,0 W and V_{CC} = 28 V, the output power at heatsink temperatures between 25 °C and 90 °C relative to that at 25 °C is diminished by typ. 10 mW/K

The transistor is designed to withstand full load mismatch in the test circuit under the following conditions: V_{CC} = 28 V; f = 470 MHz; T_h = 90 °C.
VSWR = 50 : 1 through all phases; P_L = 7,0 W.

APPLICATION INFORMATION (continued)

Component layout and printed-circuit board for 470 MHz test circuit.



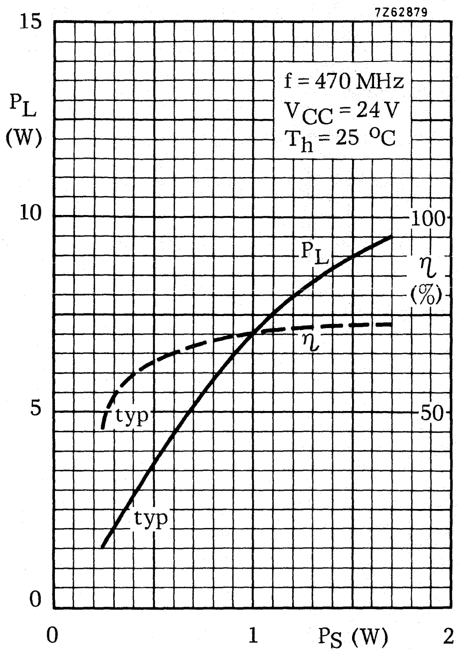


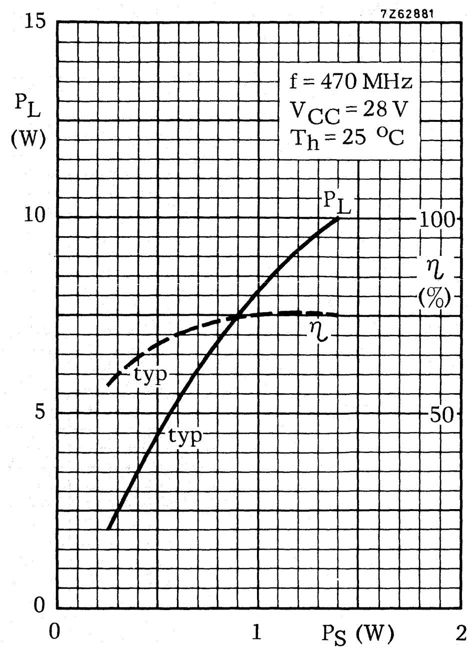
7Z66741.1

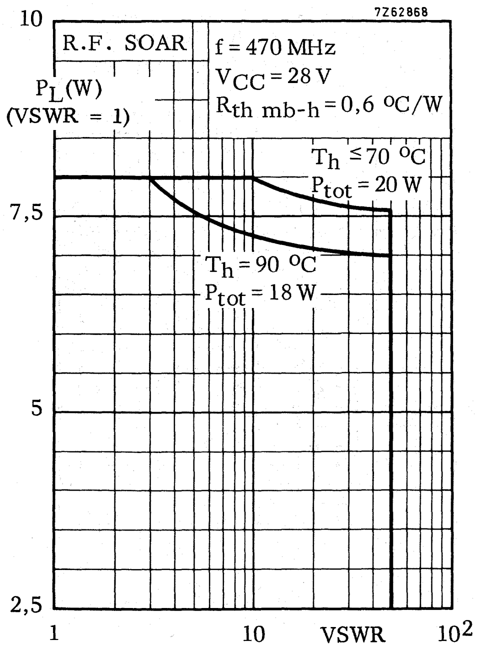
Shaded area copper

Back area completely copper clad

Material of printed-circuit board: 1,5 mm epoxy fibre-glass



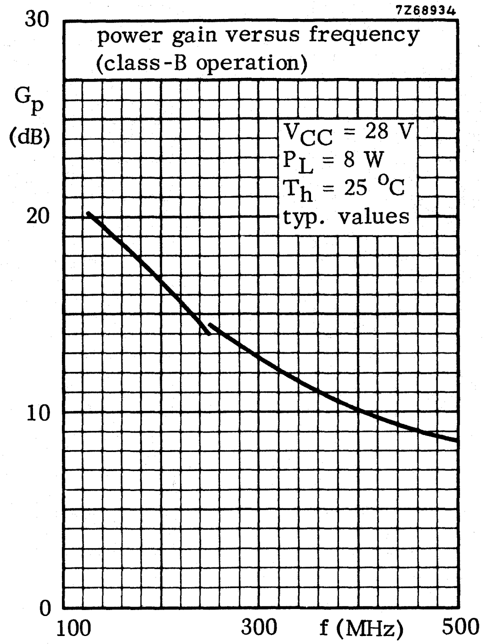


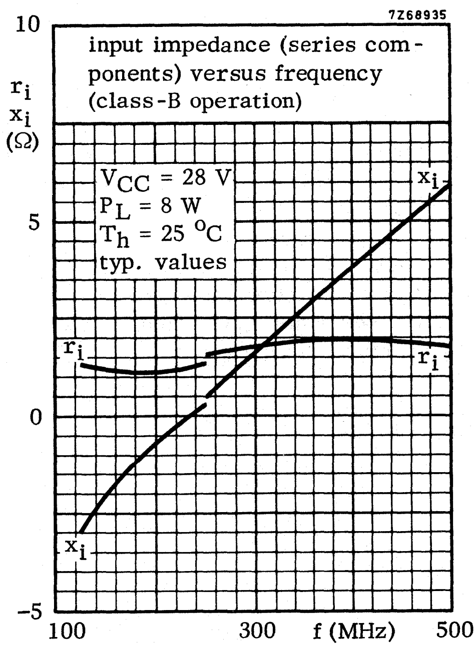


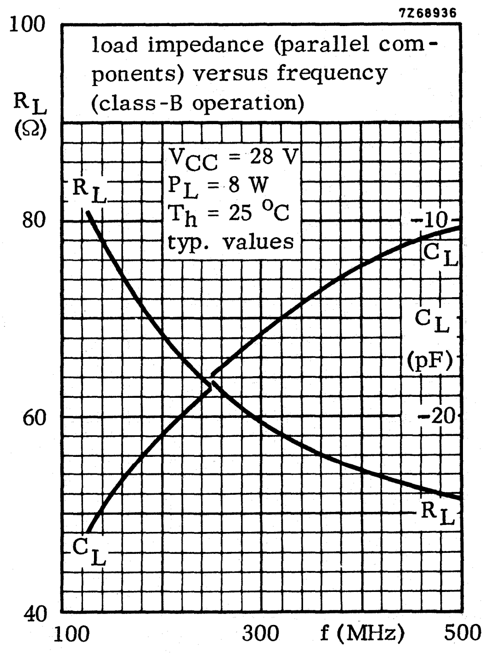
Indicated load power as a function of overload

The graph has been derived from an evaluation of the performance of transistors matched up to 8 W load power in the test amplifier and subsequently subjected to various mismatch conditions at 28 V with VSWR up to 50 and elevated heatsink temperatures. This indicates a restriction to the load power matched under nominal conditions in the recommended test configuration.

OPERATING NOTE Below 250 MHz a base-emitter resistor of 10 Ω is recommended to avoid oscillation. This resistor must be effective for both d.c. and r.f.







UHF power transistor BLX94C

FEATURES

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

APPLICATIONS

- Transmitting applications in the UHF range with a nominal supply voltage up to 28 V.

PINNING - SOT122A

PIN	SYMBOL	DESCRIPTION
1	c	collector
2	e	emitter
3	b	base
4	e	emitter

DESCRIPTION

NPN silicon planar epitaxial transistor primarily intended for class-A, B or C operation. The transistor is encapsulated in a 4-lead SOT122A stud envelope with a ceramic cap.

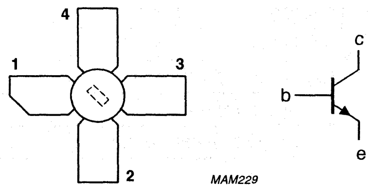


Fig.1 Simplified outline and symbol.

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-B	470	28	25	>6.5	>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.

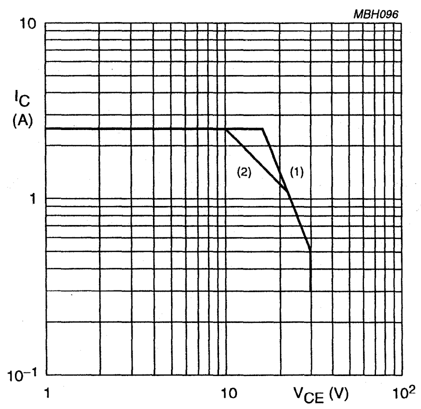
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	collector-emitter voltage (peak value)	$V_{BE} = 0$	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{EBO}	emitter-base voltage	open collector	–	4	V
I_C	collector current (DC)		–	2.5	A
$I_{C(AV)}$	average collector current		–	2.5	A
I_{CM}	peak collector current	f > 1 MHz	–	6	A
P_{tot}	total power dissipation	$\leq T_{mb} = 25$ °C	–	60	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

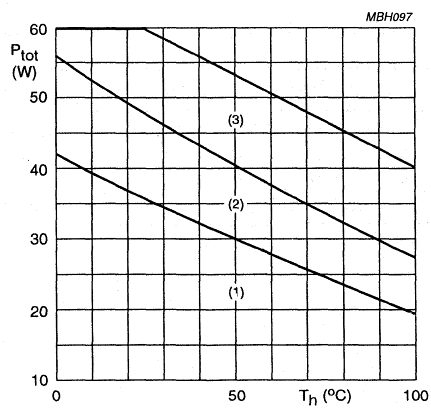
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base (DC dissipation)	$P_{tot} = 20$ W; $T_{mb} = 82$ °C; $T_h = 70$ °C	4	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base (RF dissipation)	$P_{tot} = 20$ W; $T_{mb} = 82$ °C; $T_h = 70$ °C	2.7	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	$P_{tot} = 20$ W; $T_{mb} = 82$ °C; $T_h = 70$ °C	0.6	K/W



(1) $T_{mb} = 25$ °C.
(2) $T_h = 70$ °C.

Fig.2 DC SOAR.



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

Fig.3 Power derating curves.

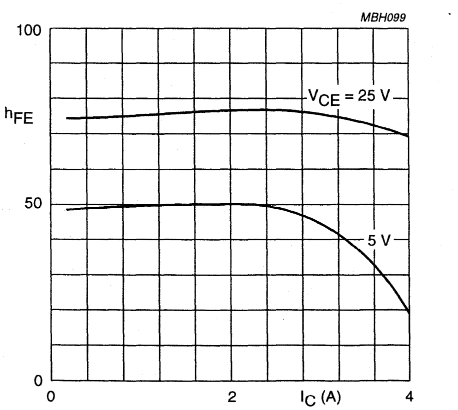
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CES}$	collector-emitter breakdown voltage	V_{BE} = 0; I_C = 25 mA	65	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 100 mA	30	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 mA	4	–	–	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 4 A; I_B = 0.8 A; note 1	–	1.5	–	V
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 30 V	–	–	10	mA
E_{SBR}	second breakdown energy	open base; L = 25 mH; f = 50 Hz	3	–	–	mJ
		R_{BE} = 10 Ω; L = 25 mH; f = 50 Hz	3	–	–	mJ
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 1.5 A; note 1	15	50	–	
f_T	transition frequency	V_{CB} = 28 V; I_E = −1.5 A; f = 500 MHz; note 1	–	1.1	–	f_T
		V_{CB} = 28 V; I_E = −4 A; f = 500 MHz; note 1	–	0.75	–	f_T
C_c	collector capacitance	V_{CB} = 28 V; I_E = i_e = 0; f = 1 MHz	–	33	–	pF
C_{re}	feedback capacitance	V_{CE} = 28 V; I_C = 20 mA; f = 1 MHz;	–	18	–	pF
$C_{c\text{-}s}$	collector-stud capacitance		–	1.2	–	pF

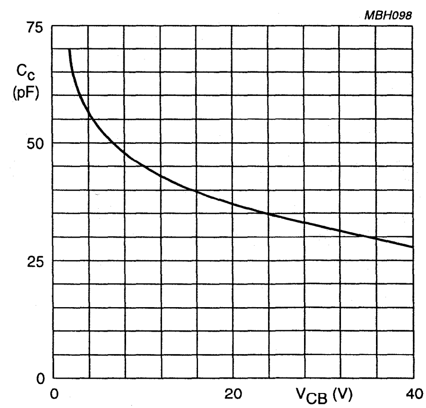
Note

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



Measured under pulsed conditions; $t_p \leq 200$ μs; $\delta \leq 0.02$; T_j = 25 °C.
(1) V_{CE} = 25 V.
(2) V_{CE} = 5 V.

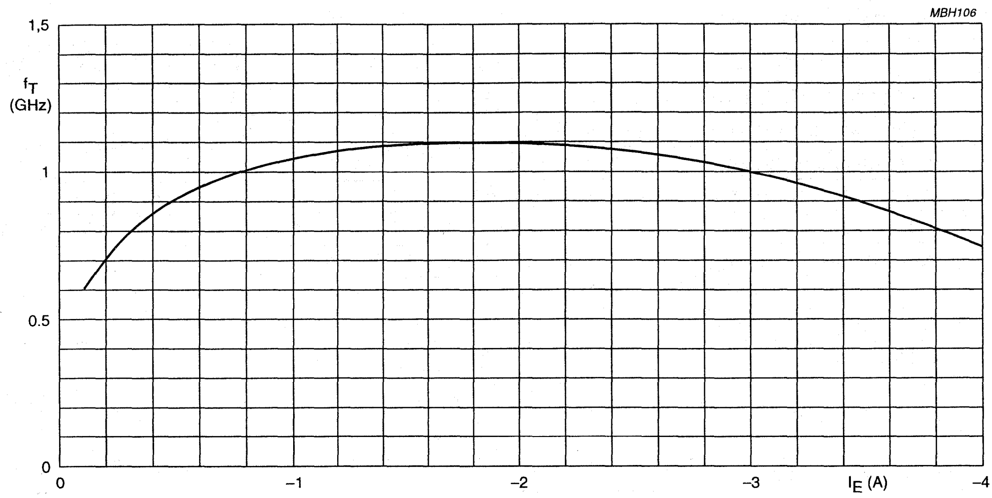
Fig.4 DC current gain as a function of collector current; typical values.



I_E = i_e = 0; f = 1 MHz; T_j = 25 °C.

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

UHF power transistor BLX94C



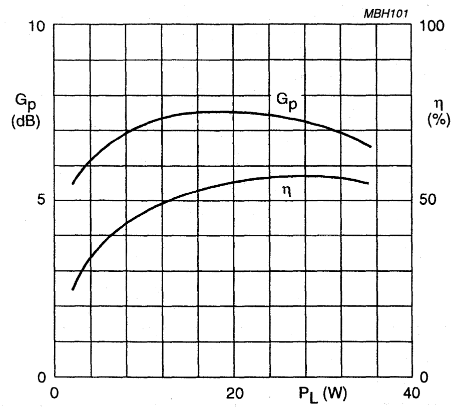
V_{CB} = 28 V; T_j = 25 °.

Fig.6 Transmission frequency as a function of emitter current; typical values.

APPLICATION INFORMATION

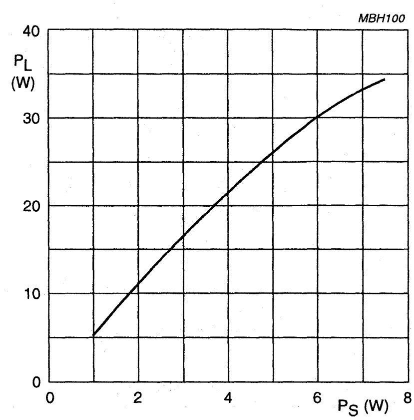
RF performance at T_h = 25 °C in a common emitter, class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	P_S (W)	G_p (dB)	I_C (A)	η_C (%)
CW, class-B	470	28	25	<5.6 typ. 4.7	>6.5 typ. 7.25	<1.62 typ. 1.54	>55 typ. 58



V_{CE} = 28 V.
I_{CQ} = 200 mA.
f = 470 MHz.

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



V_{CE} = 28 V.
T_h = 25 °C.
f = 470 MHz.

Fig.8 Load power as a function of source power; typical values.

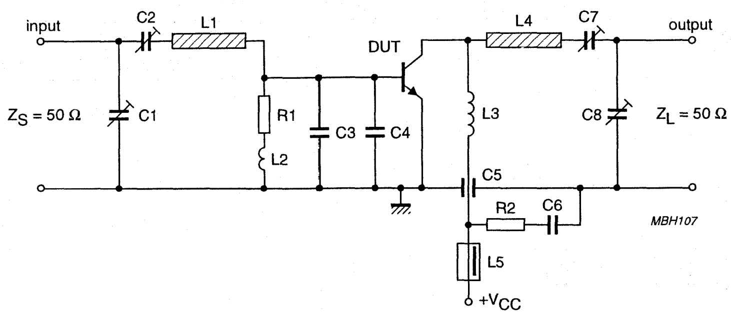


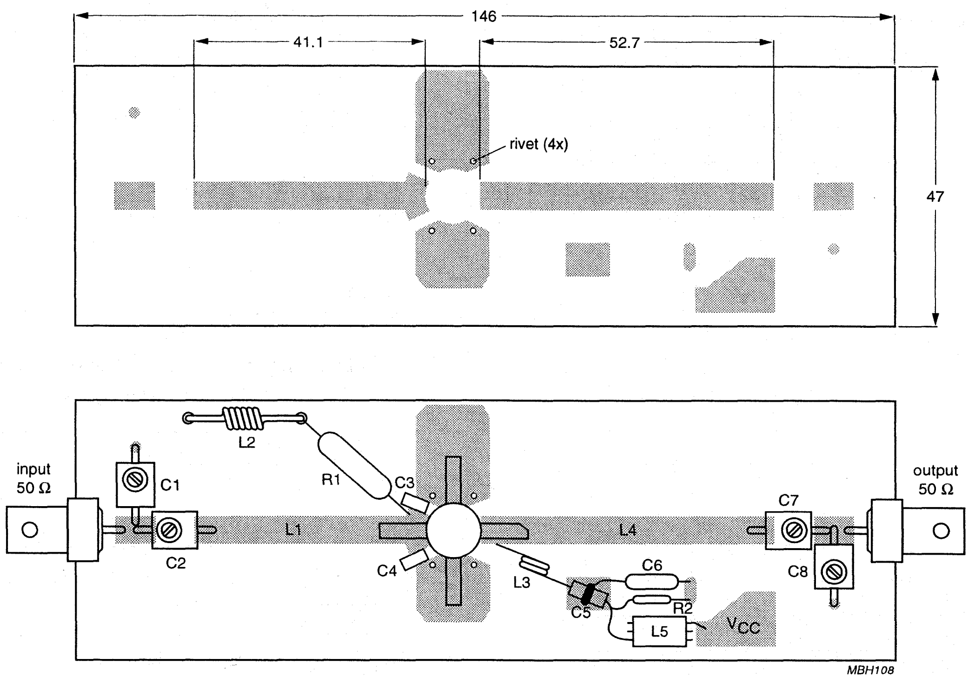
Fig.9 Class-B test circuit at f = 470 MHz.

List of components (see Figs 9 and 10)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C2, C8	film dielectric trimmer capacitor	2 to 9 pF		2222 809 09002
C3, C4	chip capacitor	15 pF		
C5	feed through capacitor	100 pF		
C6	polyester capacitor	33 nF		
C6	chip capacitor	22 nF, 63 V		
C7	film dielectric trimmer capacitor	2 to 18 pF		2222 809 09003
L1	stripline; note 1		length 41.1 mm width 5 mm	
L2	13 turns enamelled 0.5 mm copper wire		int. diameter 4 mm close wound	
L3	2 turns 1 mm copper wire		int. diameter 4 mm winding pitch 1.5 mm leads 2 x 5 mm	
L4	stripline; note 1		length 52.7 mm width 5 mm	
L5	Ferroxcube choke coil	750 Ω; ± 20%		4312 020 36640
R1	carbon resistor	1 Ω		
R2	carbon resistor	10 Ω		

Note

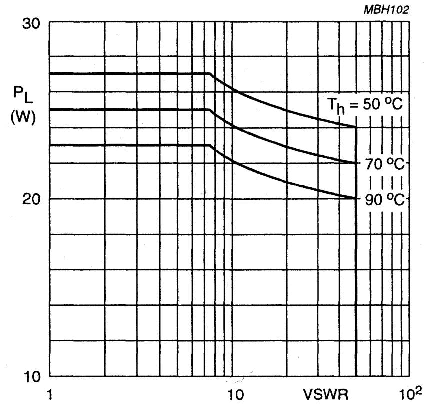
1. The striplines are on double-clad PCB with PTFE fibre-glass dielectric (ε_r = 2.74); thickness 1.45 mm.



Dimensions in mm.

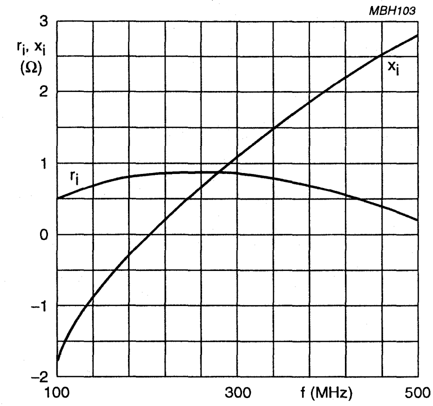
The components are located on one side of the copper-clad PTFE microfibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

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



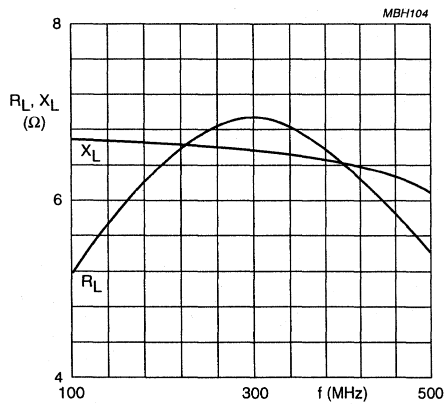
V_{CE} = 28 V; f = 470 MHz; $R_{th\ mb\text{-}h}$ = 0.6 K/W.

Fig.11 Load power as a function of VSWR.



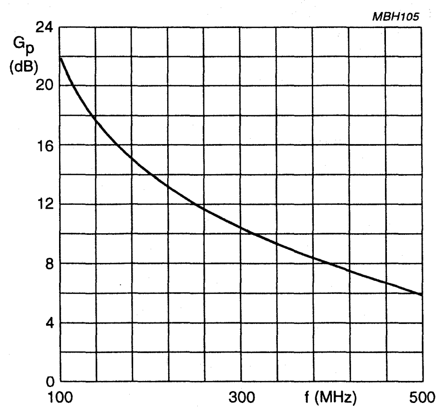
V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C; Class-B operation.

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



V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C; Class-B operation.

Fig.13 Load impedance as a function of frequency (series components); typical values.



V_{CE} = 28 V; P_L = 25 W;
T_h = 25 °C; Class-B operation.

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

MICROWAVE LINEAR POWER TRANSISTORS

NPN transistors for use in a common-emitter class-A linear power amplifier up to 4 GHz.

Diffused emitter ballasting resistors, self-aligned process entirely ion implanted and gold metallization ensure an optimum temperature profile, excellent performance and reliability.

The **LBE2003S** and **LBE2009S** have a metal ceramic studless envelope.

The **LCE2009S** has a metal ceramic capstan envelope.

The **LBE2009SA** and **LCE2009SA** are tested by sampling on RF parameters.

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common-emitter class-A circuit

type number	mode of operation	f GHz	V_{CE} V	I_C mA	P_{L1} mW	G_{po} dB	z_i Ω	Z_L Ω
LBE2003S	CW; linear amplifier	2	18	30	⩾ 200	⩾ 10	6.2 + j30	17.5 + j7
LBE/LCE2009S	CW; linear amplifier	2	18	110	⩾ 700	⩾ 9	7.5 + j15	17.5 + j39

MECHANICAL DATA

Dimensions in mm

Fig.1a **LBE2003S** and **LBE2009S**.

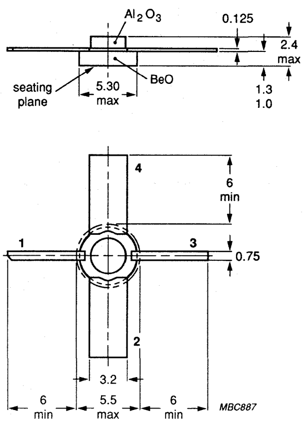
FO-45

Marking code:

407 = LBE2003S
409 = LBE2009S
445 = LBE2009SA

Pinning:

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 general industrial or domestic waste.

MECHANICAL DATA (continued)

Dimensions in mm

Fig. 1b **LCE2009S.**

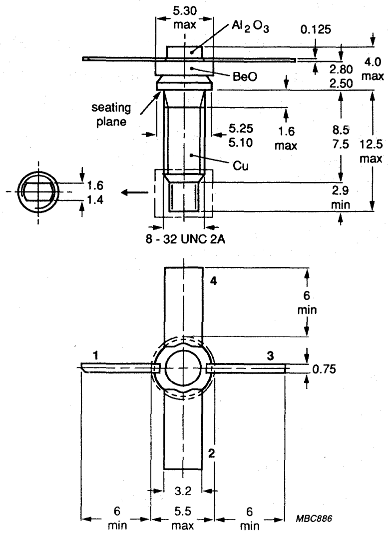
FO-46

Marking code:

408 = LCE2009S
446 = LCE2009SA

Torque on nut: min. 0.75 Nm
max. 0.85 Nm

Diameter of clearance hole in heatsink: max. 4.2 mm.



Pinning:

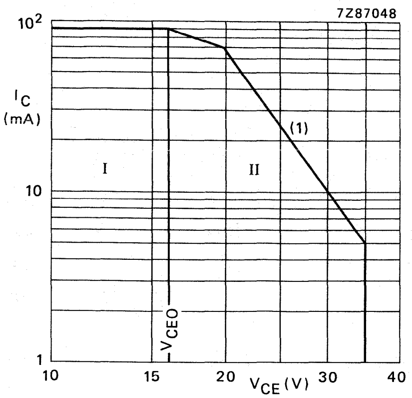
1 = collector
2 = emitter
3 = base
4 = emitter

RATINGS

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

			LBE 2003S	LBE/LCE 2009S	
Collector-base voltage (open emitter)	V_{CBO}	max.	40	40	V
Collector-emitter voltage					
R_{BE} = 100 Ω	V_{CER}	max.	–	35	V
R_{BE} = 220 Ω	V_{CER}	max.	35	–	V
(open base)	V_{CEO}	max.	16	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	3	V
Collector current (DC)	I_C	max.	90	250	mA
Total power dissipation up to T_{mb} = 75 °C	P_{tot}	max.	1.4	3.5	W
Storage temperature	T_{stg}		–65 to + 150		°C
Operating junction temperature	T_j	max.	200		°C
Lead soldering temperature at 0.3 mm from the case; t_{sld} = 10 s	T_{sld}	max.	235		°C

LBE2003S



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

Fig. 2 DC SOAR at $T_{mb} \leqslant 75\ ^{o}C$.

I Region of permissible DC operation.

II Permissible extension provided $R_{BE} \leqslant 220\ \Omega$.

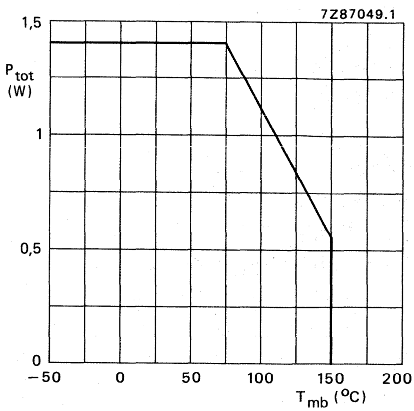
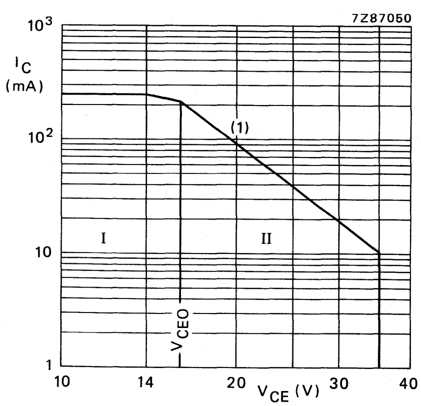


Fig. 3 Power derating curve vs. mounting base temperature.

LBE/LCE2009S



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

Fig. 4 DC SOAR at $T_{mb} \leqslant 75\ ^{o}C$.

I Region of permissible DC operation.

II Permissible extension provided $R_{BE} \leqslant 100\ \Omega$.

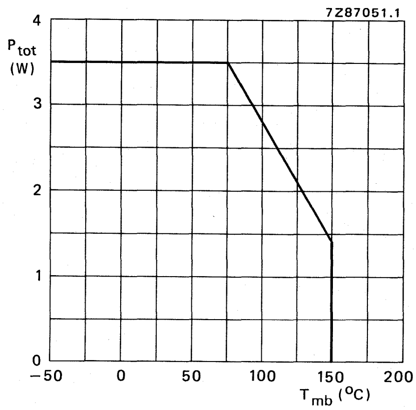


Fig. 5 Power derating curve vs. mounting base temperature.

THERMAL RESISTANCE (at T_j = 75 °C)

			LBE 2003S	LBE/LCE 2009S	
From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	65	36	K/W*
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	1.5	1.5	K/W*

CHARACTERISTICS

T_{mb} = 25 °C

			LBE 2003S	LBE/LCE 2009S	
Collector cut-off current					
$I_E = 0$; V_{CB} = 20 V	I_{CBO}	<	0.1	0.1	μA
$I_E = 0$; V_{CB} = 40 V	I_{CBO}	<	150	250	μA
V_{CB} = 35 V; R_{BE} = 220 Ω	I_{CER}	<	500	–	μA
V_{CB} = 35 V; R_{BE} = 100 Ω	I_{CER}	<	–	1000	μA
Emitter cut-off current					
$I_C = 0$; V_{EB} = 1.5 V	I_{EBO}	<	0.05	0.2	μA
DC current gain					
I_C = 30 mA; V_{CE} = 5 V	h_{FE}	>	15	–	
		<	150	–	
I_C = 110 mA; V_{CE} = 5 V	h_{FE}	>	–	15	
		<	–	150	
Collector-base capacitance at f = 1 MHz					
$I_E = I_C = 0$; V_{CB} = 18 V; V_{EB} = 1.5 V	C_{cb}	typ.	0.3	0.6	pF
Collector-emitter capacitance at f = 1 MHz					
$I_E = I_C = 0$; V_{CE} = 18 V; V_{EB} = 1.5 V	C_{ce}	typ.	0.45	0.6	pF
Emitter-base capacitance at f = 1 MHz					
$I_E = I_C = 0$; V_{EB} = 1 V; V_{CB} = 10 V	C_{eb}	typ.	1.7	3.3	pF

* K/W is SI unit for °C/W.

s-parameters (common emitter)

LBE2003S: Typical values; V_{CE} = 18 V*; I_C = 30 mA*; T_{mb} = 25 °C; Z_o = 50 Ω

f GHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
0,5	0,56/−143°	0,037(−28,6)/ 41°	9,50(19,6)/101°	0,56/ −34°
0,6	0,55/−154°	0,040(−28,0)/ 39°	8,28(18,4)/ 93°	0,51/ −35°
0,7	0,55/−164°	0,040(−27,9)/ 40°	7,13(17,1)/ 88°	0,50/ −36°
0,8	0,55/−171°	0,041(−27,7)/ 40°	6,35(16,1)/ 82°	0,49/ −37°
0,9	0,55/−178°	0,043(−27,4)/ 41°	5,69(15,1)/ 77°	0,47/ −38°
1,0	0,55/+176°	0,045(−26,9)/ 40°	5,14(14,2)/ 72°	0,46/ −39°
1,1	0,55/+170°	0,048(−26,4)/ 40°	4,72(13,5)/ 68°	0,46/ −39°
1,2	0,55/+165°	0,051(−25,9)/ 41°	4,37(12,8)/ 64°	0,45/ −41°
1,3	0,56/+159°	0,056(−25,1)/ 41°	4,05(12,2)/ 60°	0,44/ −44°
1,4	0,55/+158°	0,060(−24,5)/ 41°	3,76(11,5)/ 57°	0,45/ −46°
1,5	0,55/+149°	0,062(−24,2)/ 40°	3,52(10,9)/ 53°	0,43/ −48°
1,6	0,55/+146°	0,065(−23,8)/ 42°	3,33(10,5)/ 50°	0,43/ −50°
1,7	0,56/+142°	0,068(−23,3)/ 42°	3,15(10,0)/ 46°	0,43/ −53°
1,8	0,57/+137°	0,070(−23,1)/ 41°	2,96(9,4)/ 42°	0,43/ −54°
1,9	0,57/+132°	0,072(−22,9)/ 40°	2,80(8,9)/ 39°	0,43/ −56°
2,0	0,58/+128°	0,074(−22,7)/ 40°	2,66(8,5)/ 36°	0,42/ −57°
2,2	0,60/+121°	0,081(−21,8)/ 39°	2,43(7,7)/ 28°	0,41/ −61°
2,4	0,62/+114°	0,091(−20,8)/ 37°	2,24(7,0)/ 23°	0,40/ −67°
2,6	0,64/+108°	0,099(−20,1)/ 36°	2,08(6,4)/ 16°	0,39/ −75°
2,8	0,66/+102°	0,105(−19,6)/ 33°	1,90(5,6)/ 10°	0,38/ −82°
3,0	0,68/ +96°	0,108(−19,4)/ 31°	1,79(5,1)/ 4°	0,39/ −87°
3,2	0,71/ +92°	0,124(−18,7)/ 29°	1,63(4,3)/ −2°	0,37/ −94°
3,4	0,73/ +89°	0,125(−18,0)/ 27°	1,58(4,0)/ −7°	0,40/−101°
3,6	0,75/ +86°	0,137(−17,3)/ 25°	1,46(3,3)/−13°	0,39/−112°
3,8	0,76/ +82°	0,142(−17,0)/ 23°	1,40(2,9)/−18°	0,38/−120°
4,0	0,77/ +79°	0,149(−16,6)/ 20°	1,31(2,3)/−24°	0,38/−128°
4,2	0,78/ +75°	0,155(−16,2)/ 17°	1,25(1,9)/−28°	0,38/−133°
4,4	0,80/ +73°	0,167(−15,5)/ 15°	1,20(1,6)/−34°	0,39/−142°
4,6	0,81/ +69°	0,177(−15,0)/ 12°	1,14(1,1)/−38°	0,39/−151°
4,8	0,81/ +68°	0,187(−14,6)/ 10°	1,10(0,8)/−43°	0,42/−159°
5,0	0,81/ +65°	0,194(−14,3)/ 6°	1,04(0,4)/−47°	0,44/−165°
5,2	0,80/ +60°	0,203(−13,8)/ 4°	1,03(0,3)/−53°	0,47/−169°
5,4	0,81/ +56°	0,219(−13,2)/ −1°	0,98(−0,2)/−57°	0,48/−175°
5,6	0,81/ +51°	0,229(−12,8)/ −3°	0,97(−0,3)/−62°	0,49/+178°
5,8	0,81/ +48°	0,243(−12,3)/ −8°	0,92(−0,7)/−68°	0,51/+171°
6,0	0,80/ +44°	0,245(−12,2)/−12°	0,90(−0,9)/−72°	0,55/+165°

The figures given between brackets are values in dB.

* V_{CE} and I_C regulated.

s-parameters (common emitter)

LBE/LCE2009S: Typical values; V_{CE} = 18 V*; I_C = 110 mA*; T_{mb} = 25 °C; Z_o = 50 Ω

f GHz	s_{ie}	s_{re}	s_{fe}	s_{oe}
0,5	0,70/177°	0,029(−30,7)/50°	7,55(17,6)/ 83°	0,25/ −48°
0,6	0,70/171°	0,033(−29,6)/51°	6,43(16,2)/ 77°	0,22/ −50°
0,7	0,70/168°	0,036(−29,0)/53°	5,46(14,6)/ 73°	0,23/ −52°
0,8	0,70/163°	0,039(−28,4)/54°	4,80(13,6)/ 68°	0,22/ −54°
0,9	0,71/159°	0,041(−27,8)/54°	4,27(12,6)/ 64°	0,22/ −56°
1,0	0,71/155°	0,045(−27,0)/55°	3,84(11,7)/ 60°	0,21/ −59°
1,1	0,71/151°	0,049(−26,2)/54°	3,53(11,0)/ 56°	0,21/ −62°
1,2	0,71/148°	0,054(−25,4)/54°	3,27/10,3)/ 52°	0,21/ −65°
1,3	0,71/144°	0,060(−24,5)/53°	3,01(9,6)/ 48°	0,20/ −74°
1,4	0,72/143°	0,066(−23,6)/54°	2,80(9,0)/ 45°	0,20/ −79°
1,5	0,72/136°	0,070(−23,1)/52°	2,61(8,3)/ 41°	0,21/ −80°
1,6	0,72/133°	0,075(−22,5)/53°	2,47(7,9)/ 38°	0,21/ −83°
1,7	0,72/130°	0,080(−21,9)/51°	2,33(7,3)/ 34°	0,22/ −87°
1,8	0,73/127°	0,084(−21,5)/49°	2,18(6,8)/ 30°	0,22/ −90°
1,9	0,73/123°	0,087(−21,2)/48°	2,05(6,3)/ 26°	0,22/ −94°
2,0	0,74/120°	0,090(−20,9)/46°	1,97(5,9)/ 23°	0,22/ −97°
2,2	0,75/114°	0,100(−20,0)/43°	1,78(5,0)/ 15°	0,22/−109°
2,4	0,77/108°	0,112(−19,0)/40°	1,63(4,3)/ 10°	0,21/−122°
2,6	0,79/103°	0,123(−18,2)/37°	1;51(3,6)/ 2°	0,24/−133°
2,8	0,80/ 97°	0,129(−17,8)/33°	1,36(2,7)/ −4°	0,25/−143°
3,0	0,81/ 92°	0,134(−17,5)/30°	1,28(2,1)/−11°	0,27/−151°
3,2	0,83/ 88°	0,143(−16,9)/26°	1,15(1,2)/−17°	0,28/−163°
3,4	0,85/ 85°	0,152(−16,4)/24°	1,10(0,9)/−21°	0,30/−173°
3,6	0,86/ 82°	0,163(−15,8)/20°	1,00(0)/−28°	0,34/+178°
3,8	0,87/ 79°	0,168(−15,5)/17°	0,96(−0,4)/−32°	0,37/+173°
4,0	0,88/ 75°	0,175(−15,2)/14°	0,88(−1,1)/−39°	0,41/+168°
4,2	0,88/ 71°	0,180(−14,9)/11°	0,83(−1,6)/−42°	0,42/+162°
4,4	0,89/ 69°	0,193(−14,3)/ 8°	0,79(−2,1)/−48°	0,45/+155°
4,6	0,90/ 66°	0,200(−14,0)/ 5°	0,74(−2,6)/−51°	0,48/+149°
4,8	0,90/ 64°	0,211(−13,5)/ 2°	0,71(−3,0)/−56°	0,52/+145°
5,0	0,90/ 61°	0,214(−13,4)/−2°	0,66(−3,6)/−59°	0,55/+144°

The figures given between brackets are values in dB.

* V_{CE} and I_C regulated.

APPLICATION INFORMATION

Microwave performance in CW operation for the **LBE2003S** up to T_{mb} = 25 °C in a common-emitter class-A circuit*

f GHz	V_{CE} (1) V	I_C (1) mA	P_{L1} (2) mW(dBm)	G_{po} (3) dB	z_i Ω	Z_L Ω
2	18	30	⩾ 200(23) typ. 250(24)	⩾ 10 typ. 11	6.2 + j30	17.5 + j7

Notes

1. V_{CE} and I_C regulated.
2. Load power for 1 dB compressed power gain.
3. Low-level power gain associated with P_{L1}.

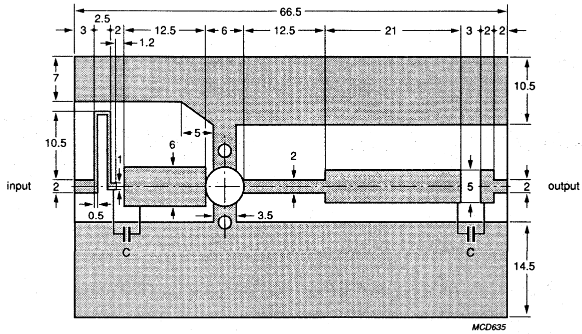


Fig. 6 Prematching test circuit board for 2 GHz. (Dimensions in mm.)

Striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\epsilon_r \approx 2.54$); thickness 0,8 mm.

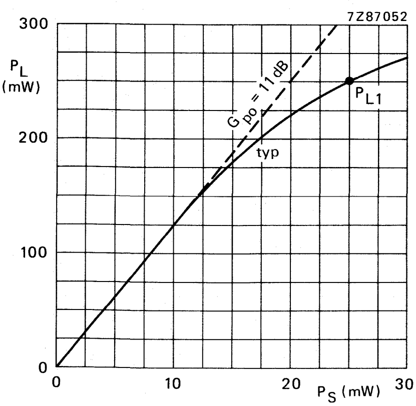


Fig. 7 V_{CE} = 18 V; I_C = 30 mA; f = 2 GHz; T_{mb} = 25 °C.

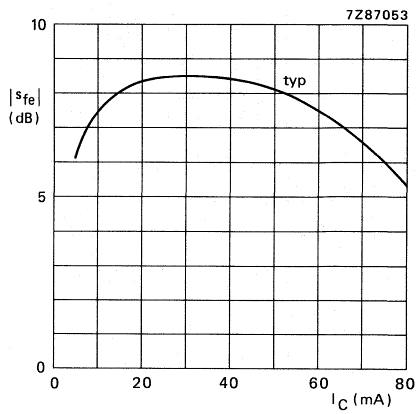


Fig. 8 V_{CE} = 18 V; class-A operation; f = 2 GHz; T_{mb} = 25 °C.

* Circuit consists of prematching circuit board in combination with input and output slug tuners.

APPLICATION INFORMATION

Microwave performance in CW operation for the **LBE/LCE2009S** up to T_{mb} = 75 °C in a common-emitter class-A circuit*

f GHz	V_{CE} (1) V	I_C (1) mA	P_{L1} (2) mW(dBm)	G_{po} (3) dB	z_i Ω	Z_L Ω
2	18	100	⩾ 700(28.5) typ. 900(29.5)	⩾ 9 typ. 9.8	7.5 + j14.5	17.5 + j38.5

Notes

1. V_{CE} and I_C regulated.
2. Load power for 1 dB compressed power gain.
3. Low-level power gain associated with P_{L1}.

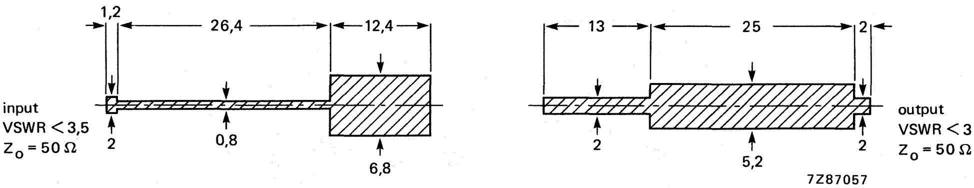


Fig. 9 Prematching test circuit board for 2 GHz. (Dimensions in mm.)

Striplines on a double Cu-clad printed-circuit board with PTFE fibre-glass dielectric ($\epsilon_r \approx 2.54$); thickness 0.8 mm.

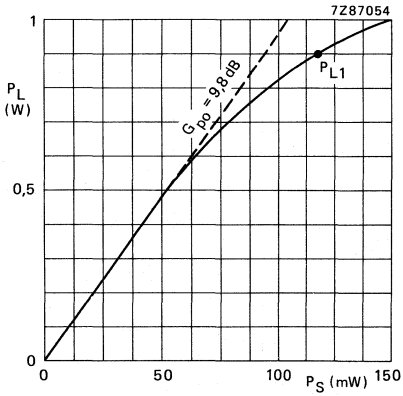


Fig. 10 V_{CE} = 18 V; I_C = 110 mA; f = 2 GHz; T_{mb} = 25 °C.

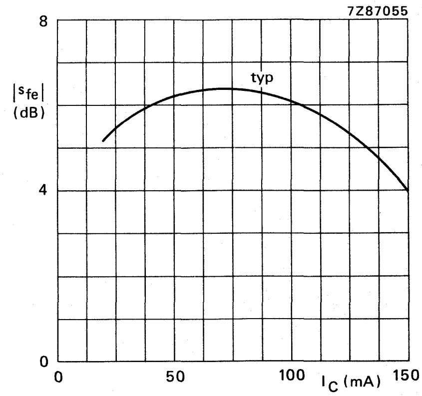


Fig. 11 V_{CE} = 18 V; class-A operation; f = 2 GHz; T_{mb} = 25 °C.

* Circuit consists of prematching circuit board in combination with input and output slug tuners.

NPN silicon planar epitaxial microwave power transistor

LFE15600X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.7 GHz

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-231 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
class AB (CW)	1.5	24	0.2	≥55	≥8	typ.50	see Figs 7 and 8

PINNING - FO-231

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

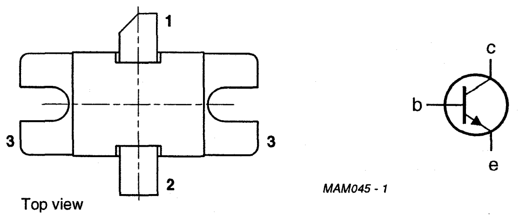


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	$R_{BE} = 56\ \Omega$	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	12	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	20	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	80	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

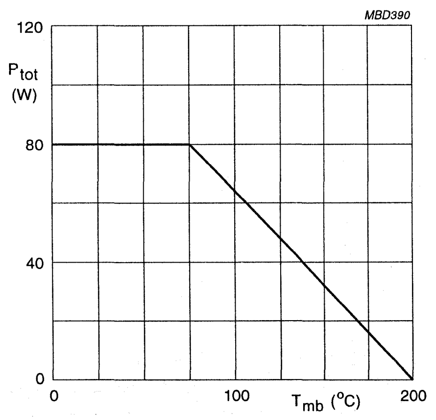


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.2 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2 K/W

CHARACTERISTICS

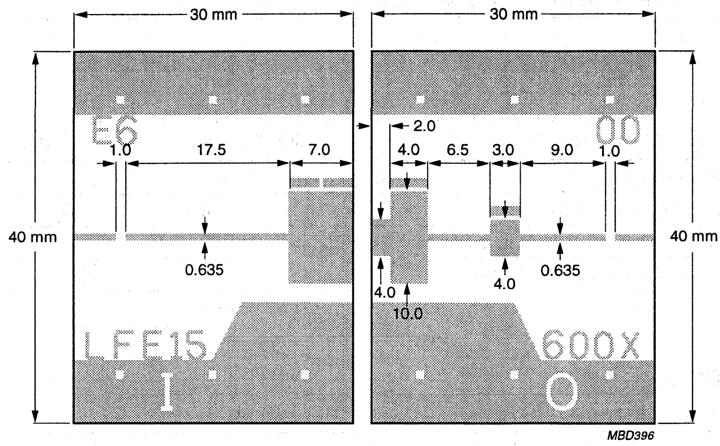
T_{mb} = 25 °C unless otherwise specified.

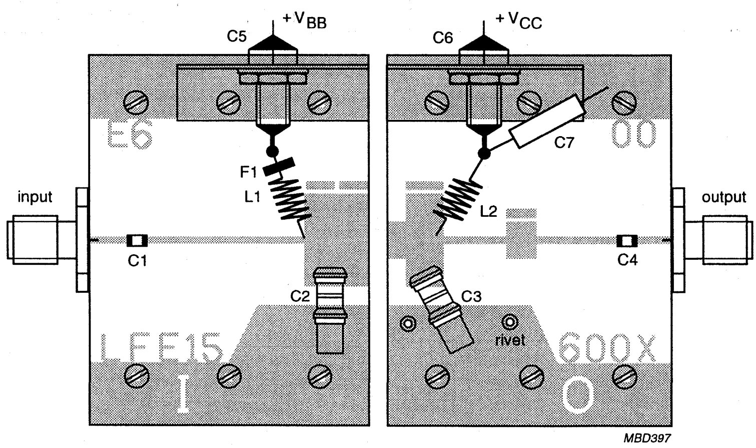
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB}= 20 V	–	6	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 30 mA; R_{BE} =56 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 30 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 30 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
class AB (CW)	1.5	24	0.2	≥ 55 typ. 60	≥ 8 typ. 8.5	typ. 50	see Figs 7 and 8





The test circuit is split into 2 independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

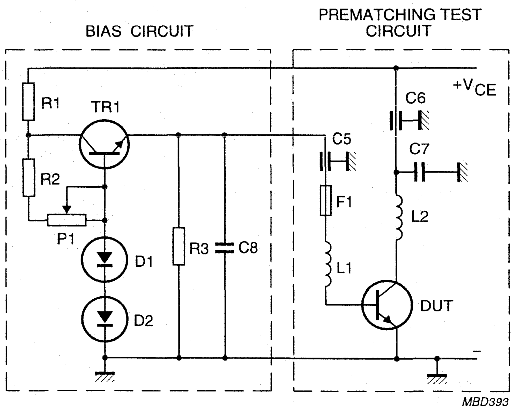


Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

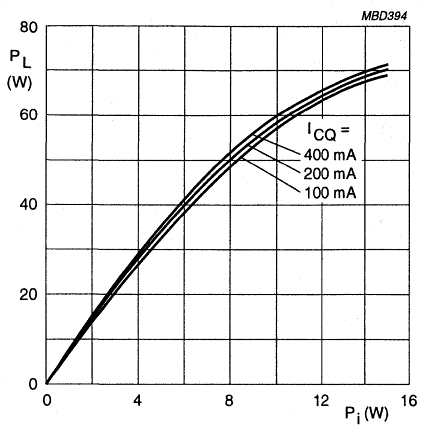
COMPONENT	DESCRIPTION	VALUE	TYPE NUMBERS
TR1	transistor		BDT91 or equivalent
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie, ref. 1250-003
C7, C8	tantalum capacitor	10 µF, 50 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	50 Ω, 0.25 W	
F1	ferrite bead		Philips tube 3.7 x 1.2 x 3.5 mm (3B)

Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.

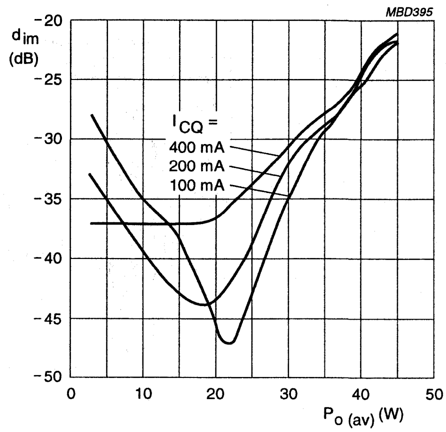
NPN silicon planar epitaxial microwave power transistor

LFE15600X



V_{CE} = 24 V; f = 1500 MHz.

Fig.5 Load power as a function of input power.



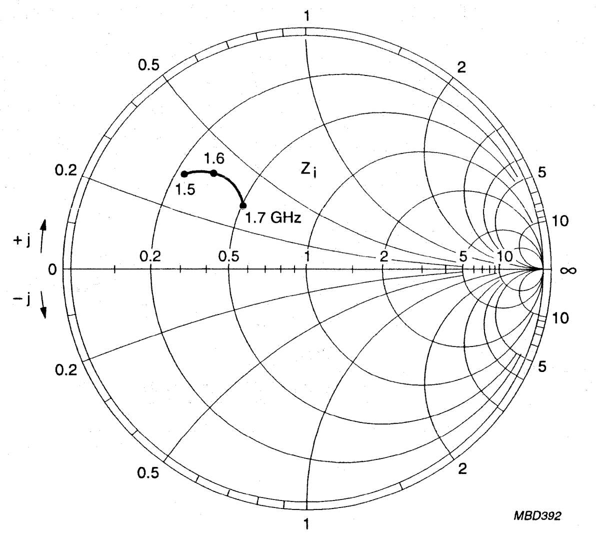
V_{CE} = 24 V; f_1 = 1500 MHz; f_2 = 1500.2 MHz.

Fig.6 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

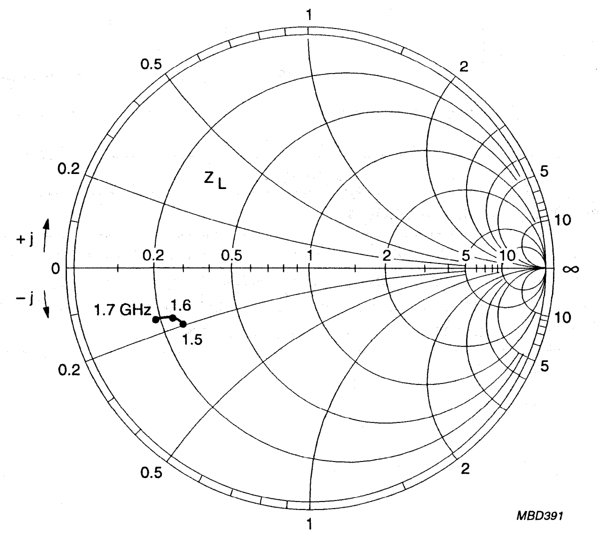
V_{CE} = 24 V; I_{CQ} = 0.2 A.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.50	2.4 + j3.4	2.4 − j1.8
1.55	3.0 + j3.6	2.3 − j1.7
1.60	3.5 + j3.8	2.2 − j1.6
1.65	4.2 + j3.8	2.1 − j1.5
1.70	4.8 + j2.5	1.8 − j1.5



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.7 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.8 Optimum load impedance as a function of frequency; typical values.

NPN silicon planar epitaxial microwave power transistor

LFE18500X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.8 GHz and 1.9 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-231 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.2	≥48	≥7	typ. 42	see Figs 7 and 8

PINNING - FO-231

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

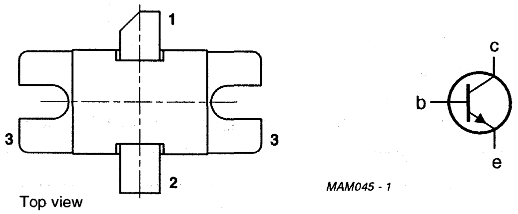


Fig.1 Simplified outline and symbol.

WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	12	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	20	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	120	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

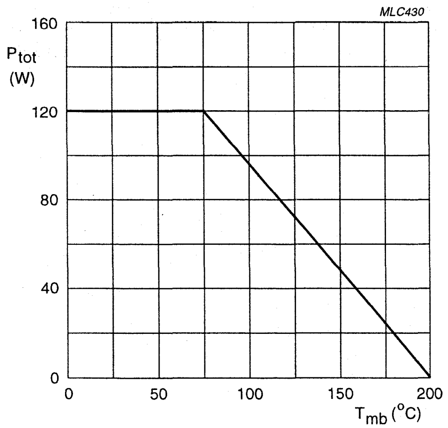


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

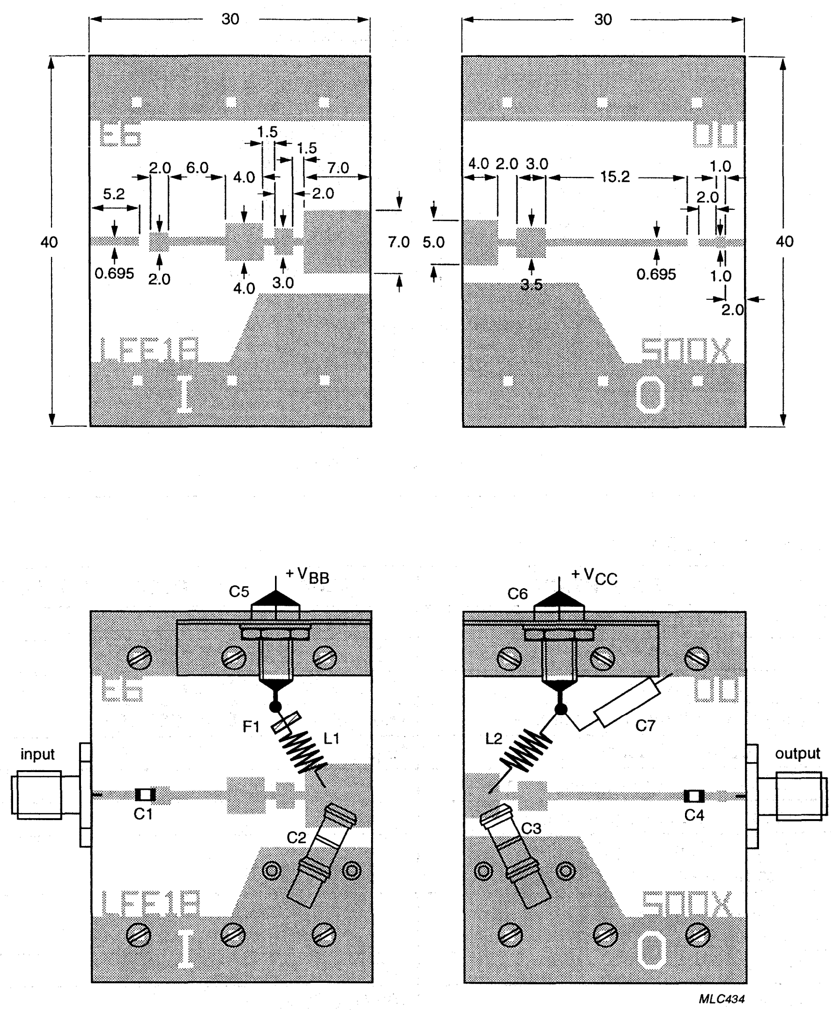
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	6	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 30 mA; R_{BE} = 56 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 30 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 30 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.2	≥48 typ. 53	≥7 typ. 7.5	typ. 42	see Figs 7 and 8



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

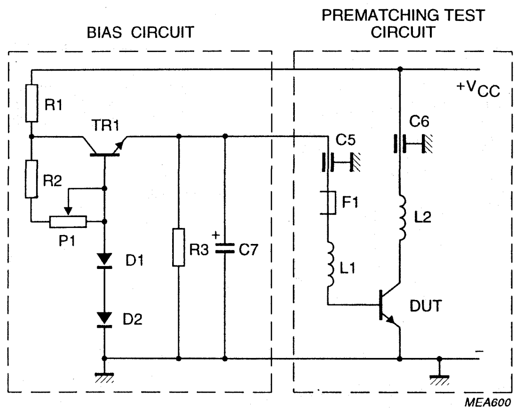


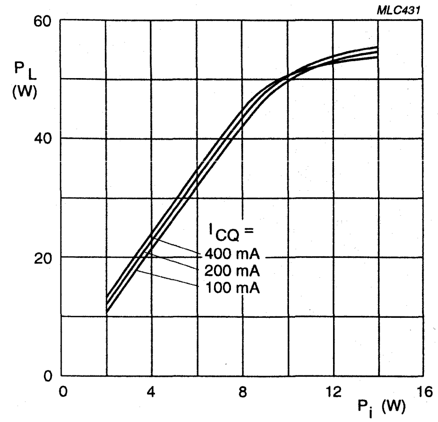
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, 50 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)

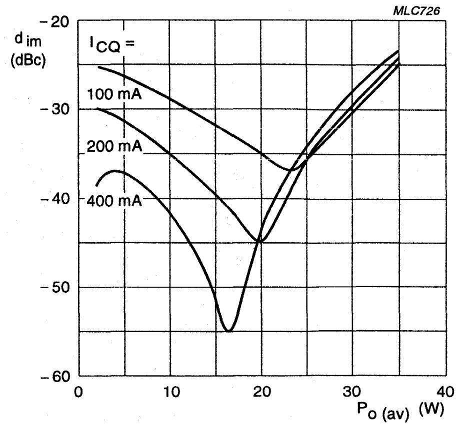
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1850 MHz.

Fig.5 Load power as a function of input power.



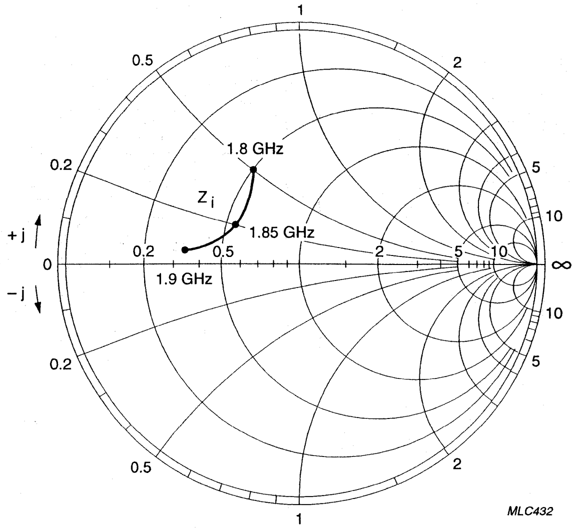
V_{CE} = 24 V; f_1 = 1849.9 MHz; f_2 = 1850.1 MHz.

Fig.6 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

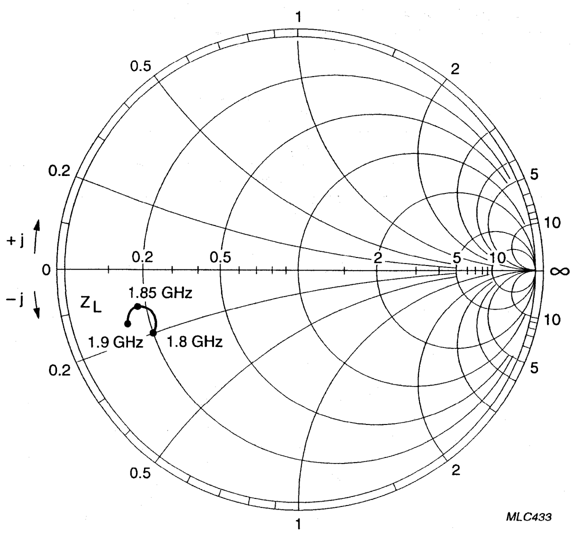
V_{CE} = 24 V; I_{CQ} = 0.2 A; Z_o = 10 Ω; typical values at $P_L = P_{L1}$ (see Figs 7 and 8).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.80	5.0 + j4.9	2.0 − j2.0
1.85	5.5 + j2.0	1.8 − j1.2
1.90	3.7 + j0.6	1.6 − j1.6



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.7 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.8 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN silicon planar epitaxial microwave power transistor

LLE15180X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.4 GHz and 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.05	≥15	≥7.8	typ. 50	see Figs 6 and 7

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

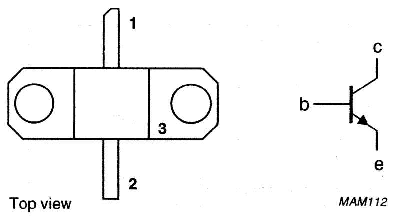


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	3	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	4	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

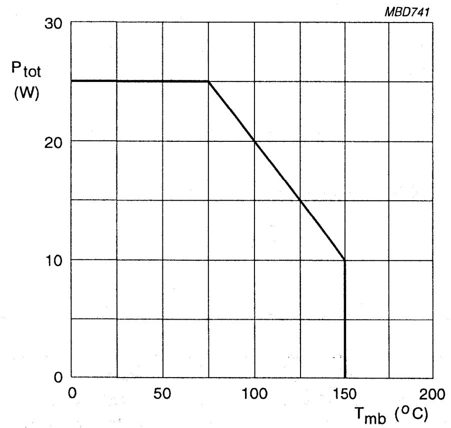


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	3.6 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2 K/W

CHARACTERISTICS

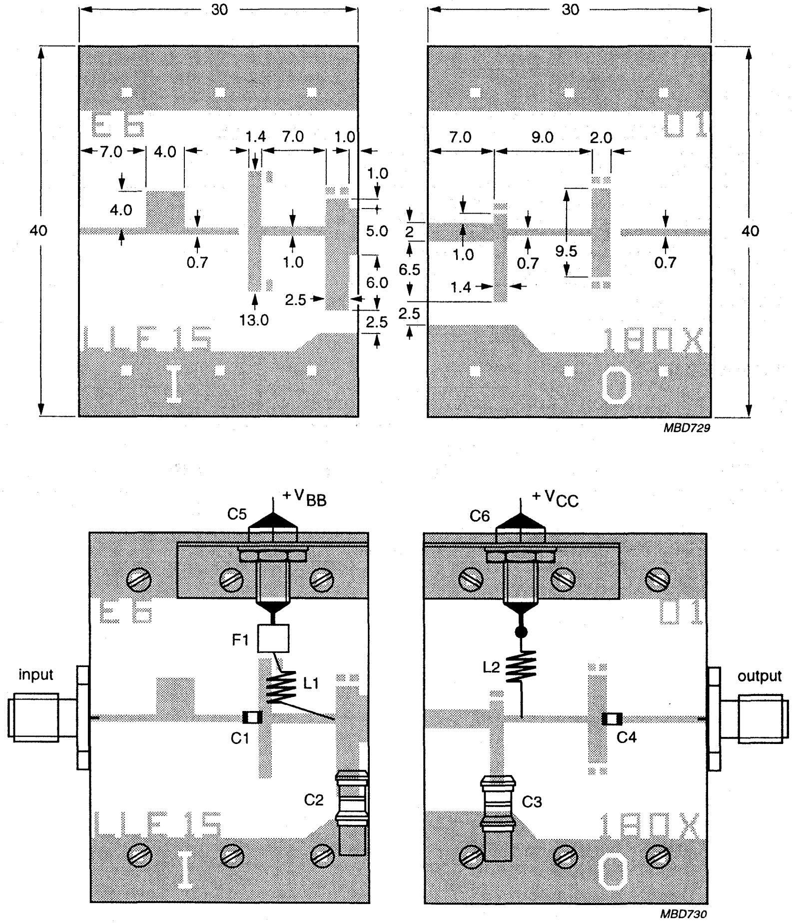
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	1.5	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 10 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 10 mA	3	–	V
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.05	≥15 typ. 18	≥7.8 typ. 8.2	typ. 50	see Figs 6 and 7



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

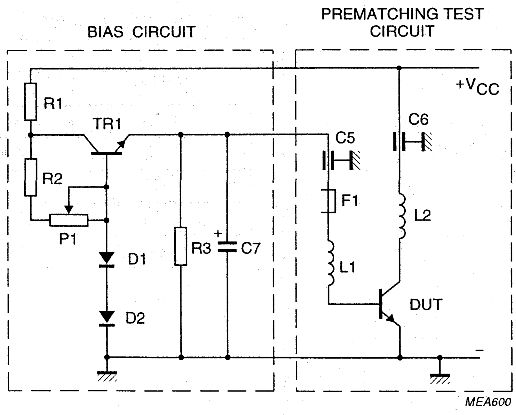


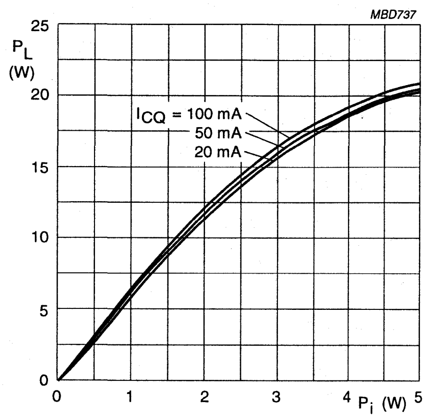
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie1250-003
C7	electrolytic capacitor	10 µF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)

Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



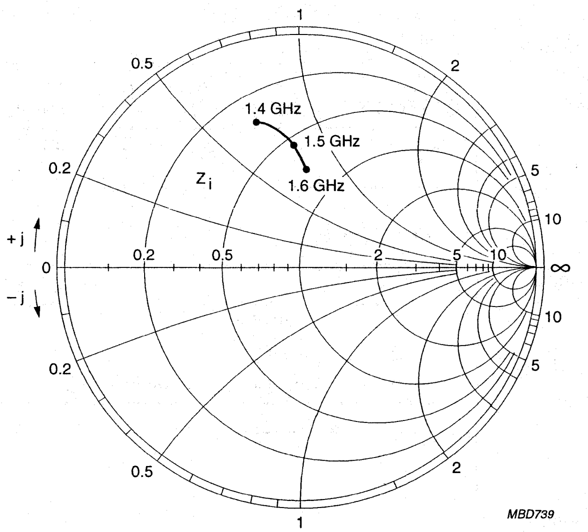
V_{CE} = 24 V; f = 1 850 MHz.

Fig.5 Load power as a function of input power.

Input and optimum load impedances

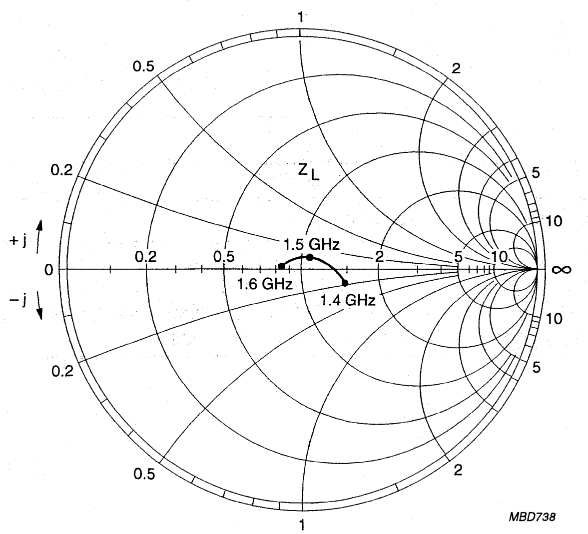
V_{CE} = 24 V; I_{CQ} = 50 mA; Z_o = 10 Ω (see Figs 6 and 7); typical values at $P_L = P_{L1}$.

f (GHz)	**Z_i (Ω)**	**Z_L (Ω)**
1.40	3.7 + j6.9	14.0 − j1.8
1.45	4.6 + j7.4	12.5 + j0.5
1.50	5.8 + j7.7	11.0 + j0.1
1.55	7.4 + j7.8	9.7 f+ j0.4
1.60	9.3 + j7.4	8.5 + j0.3



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 50 mA.

Fig.6 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 50 mA.

Fig.7 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN silicon planar epitaxial microwave power transistor

LLE15370X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.4 GHz and 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.3	≥33	≥8	typ. 52	see Figs 8 and 9

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

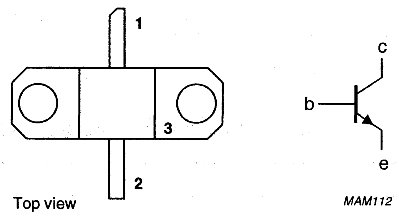


Fig.1 Simplified outline and symbol.

WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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.

NPN silicon planar epitaxial microwave power transistor

LLE15370X

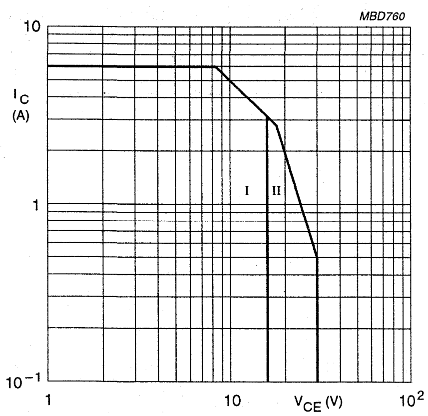
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	6	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	8	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

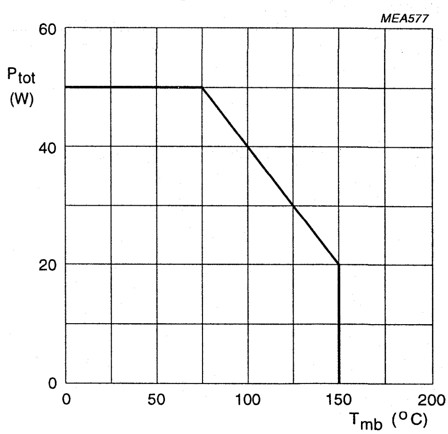


Fig.3 Power derating curve.

NPN silicon planar epitaxial microwave power transistor

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	3	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 15 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 15 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 15 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 3 V	15	100	

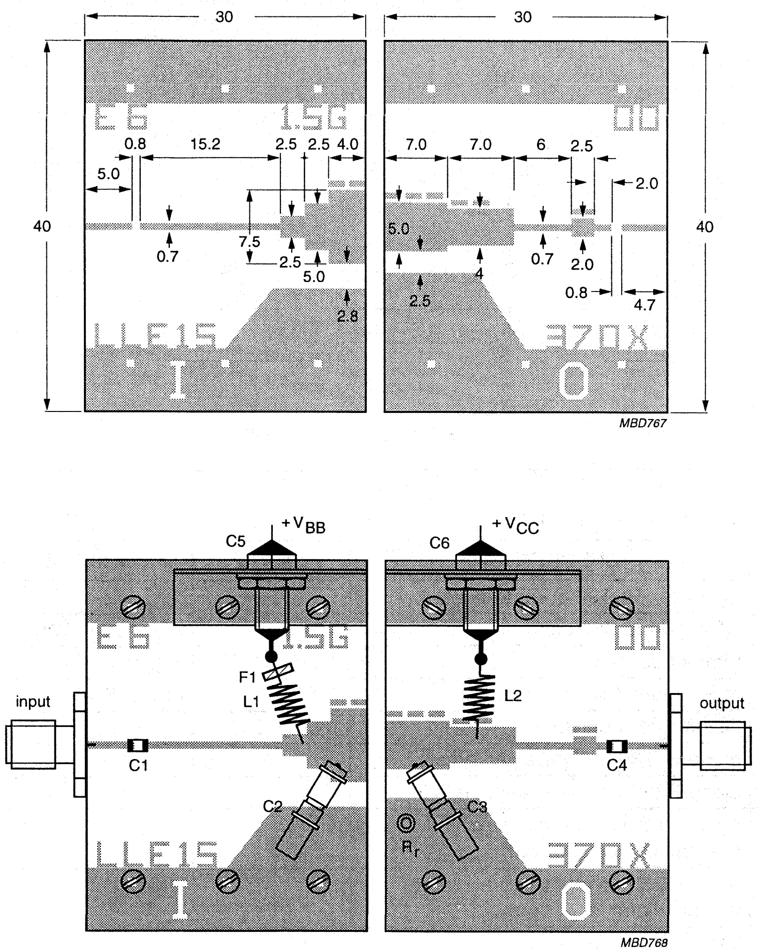
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW) note 1	1.5	24	0.3	≥33; typ. 37	≥8; typ. 8.7	typ. 43	see Figs 8 and 9

Note

1. d_{im} is less than –30 dBc at P_o = 15 W (av); f = 200 kHz.



The test circuit is split into two independent halves, each being 30 x 30 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

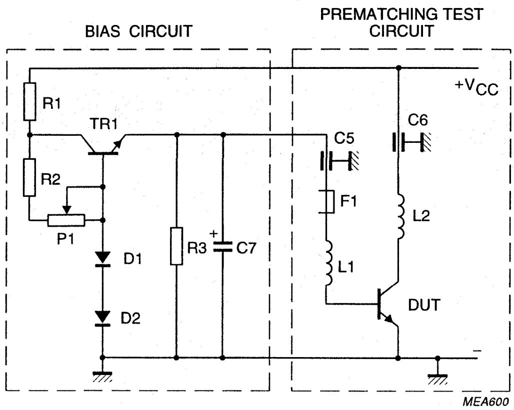


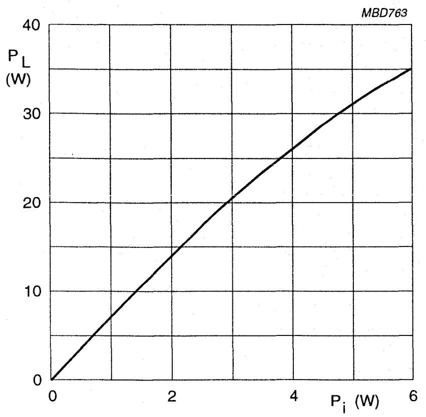
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 µF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)
R_r	copper rivet		

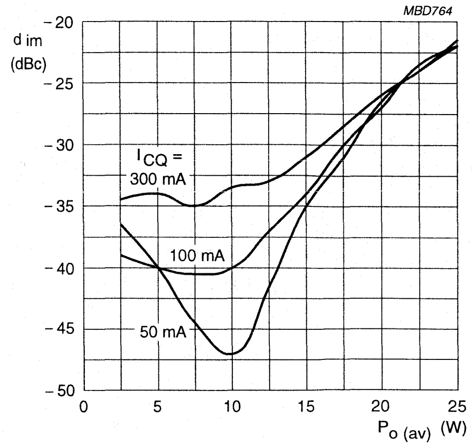
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1500 MHz.

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



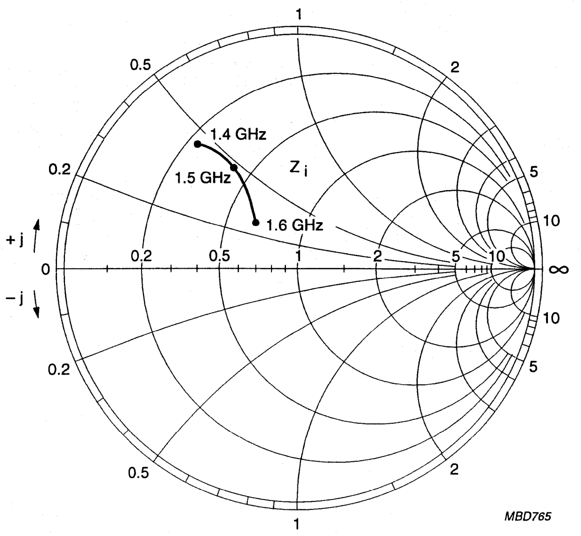
V_{CE} = 24 V; f_1 = 1500 MHz; f_2 = 1500.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

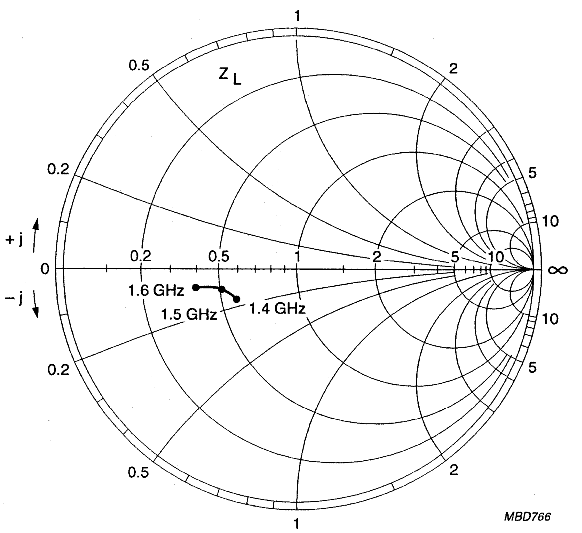
V_{CE} = 24 V; I_{CQ} = 0.3 A (see Figs 8 and 9).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.40	2.4 + j4.4	5.5 − j1.8
1.45	3.2 + j4.6	5.1 − j1.3
1.50	4.2 + j4.5	4.7 − j1.0
1.55	5.3 + j3.8	4.2 − j0.9
1.60	6.2 + j2.5	3.8 − j0.8



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.3 A.

Fig.8 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.3 A.

Fig.9 Optimum load impedance as a function of frequency; typical values.

NPN silicon planar epitaxial microwave power transistor

LLE18010X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications up to 2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	10	≥1	≥8.5	see Figs 6 and 7

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

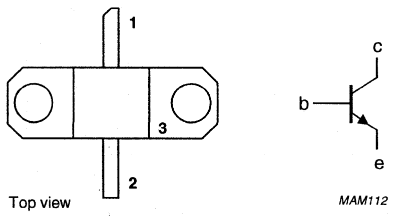


Fig.1 Simplified outline and symbol.

WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	250	mA
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	4.5	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

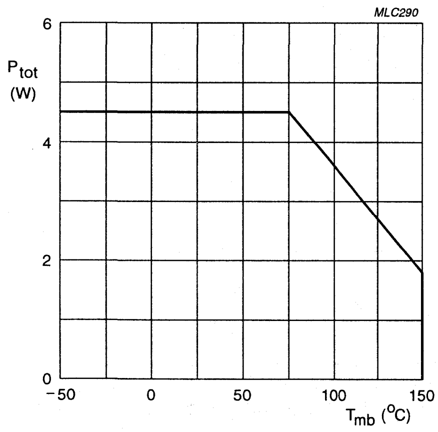


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	22	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

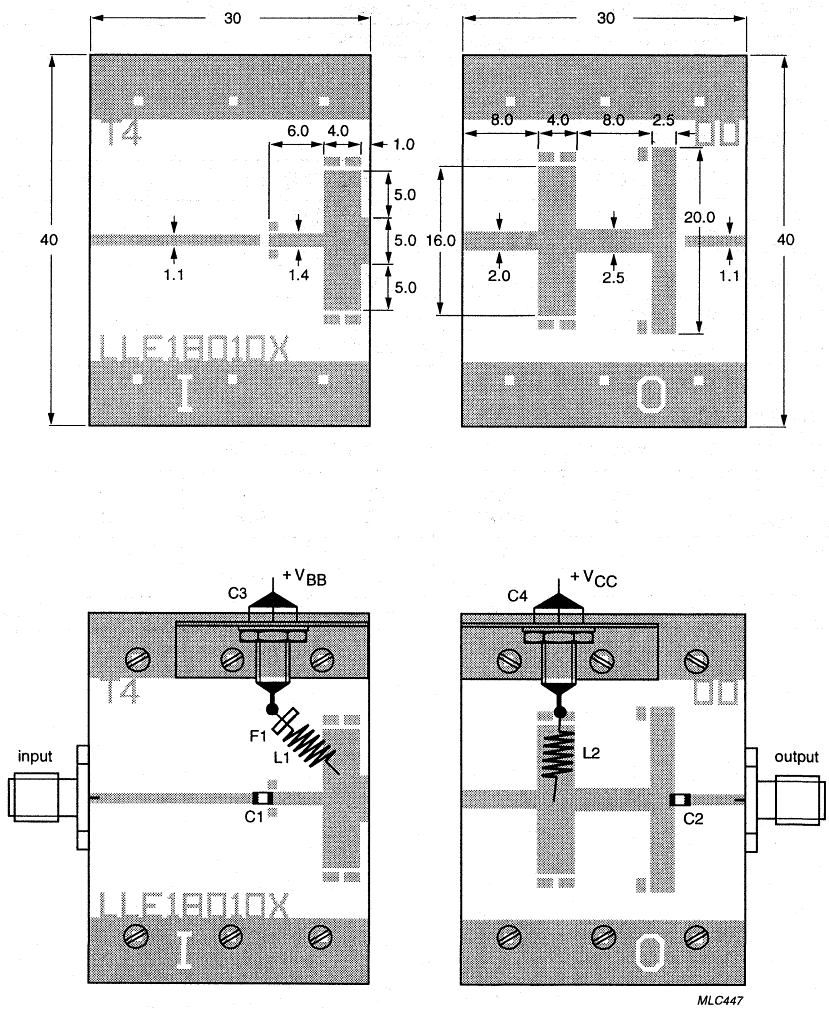
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	11	μA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 1 mA	40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.5 mA	3	–	V
h_{FE}	DC current gain	I_C = 125 mA; V_{CE} = 5 V	15	150	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	10	≥1 typ. 1.5	≥8.5 typ. 10	typ. 40	see Figs 6 and 7
	1.65	24	10	typ. 2	typ. 11	typ. 47	see Figs 6 and 7



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Teflon fibreglass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.3 Prematching test circuit board.

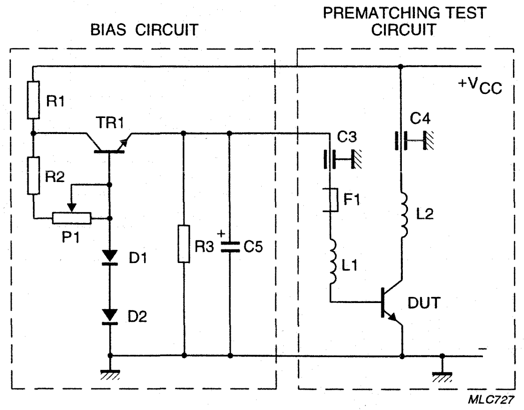


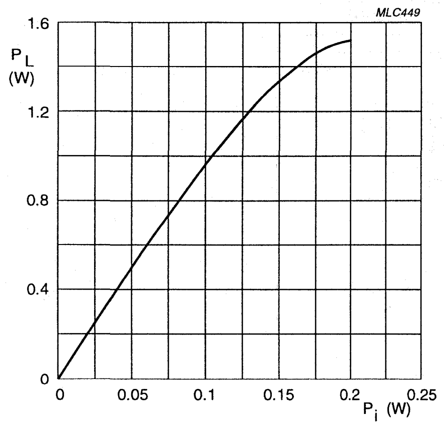
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C2	DC blocking chip capacitor	100 pF	ATC 100A101kp
C3, C4	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C5	electrolytic capacitor	10 µF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)

Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



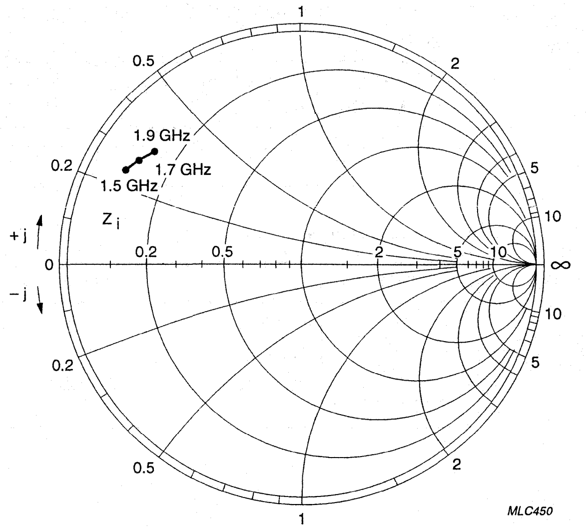
V_{CE} = 24 V; f = 1.85 GHz; I_{CQ} = 10 mA.

Fig.5 Load power as a function of input power.

Input and optimum load impedances

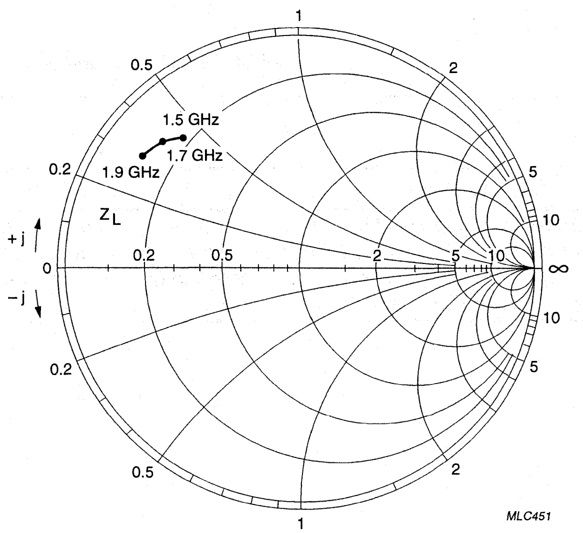
V_{CE} = 24 V; I_{CQ} = 50 mA (see Figs 6 and 7); typical values at P_L = P_{L1}.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.50	4.7 + j12.0	8.2 + j21.7
1.60	5.0 + j13.0	7.3 + j20.5
1.70	5.5 + j14.0	6.5 + j19.0
1.80	6.0 + j15.2	6.2 + j17.5
1.90	6.7 + j16.5	5.9 + j16.0



V_{CE} = 24 V; Z_o = 50 Ω; I_{CQ} = 10 mA.

Fig.6 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 50 Ω; I_{CQ} = 10 mA.

Fig.7 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN silicon planar epitaxial microwave power transistor

LLE18040X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.7 GHz and 2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.04	≥4	≥8.5	typ. 48	see Figs 8 and 9

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

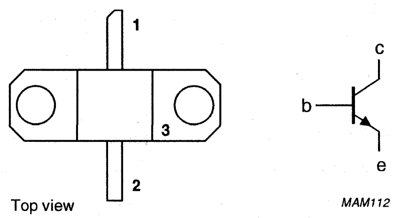


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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.

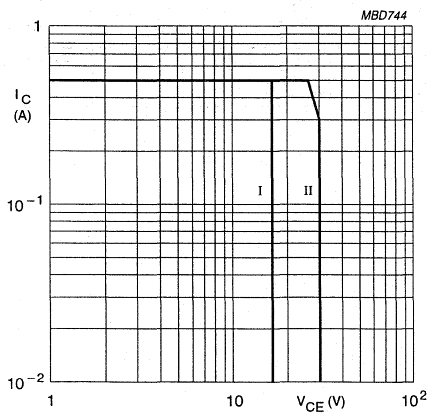
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	0.5	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	1	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	11	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

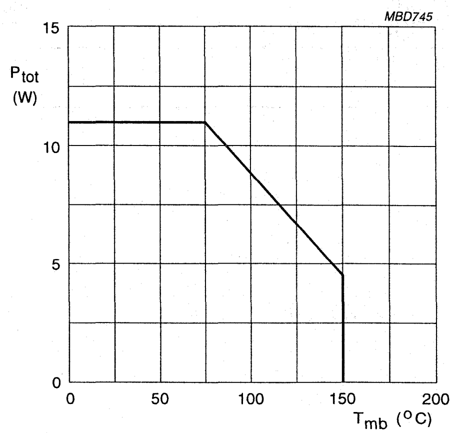


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	8.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

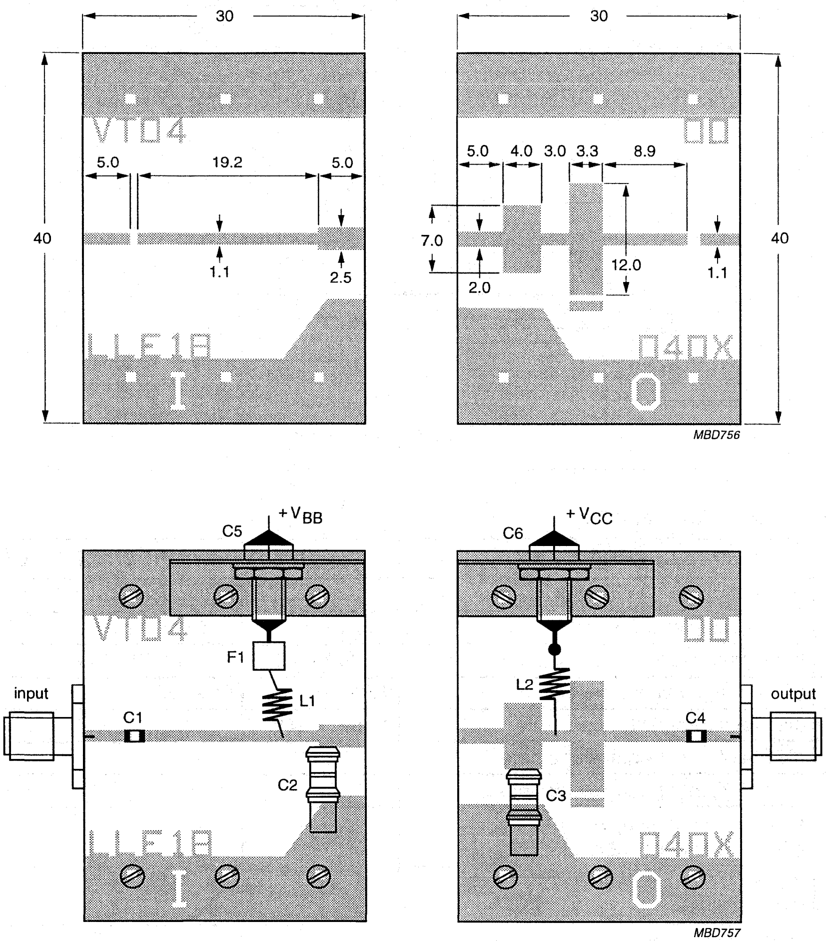
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	75	μA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 1 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 1 mA	3	–	V
h_{FE}	DC current gain	I_C = 0.25 A; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.04	≥4 typ. 5.5	≥8.5 typ. 9.5	typ. 48	see Figs 8 and 9



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Teflon fibreglass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.4 Prematching test circuit board.

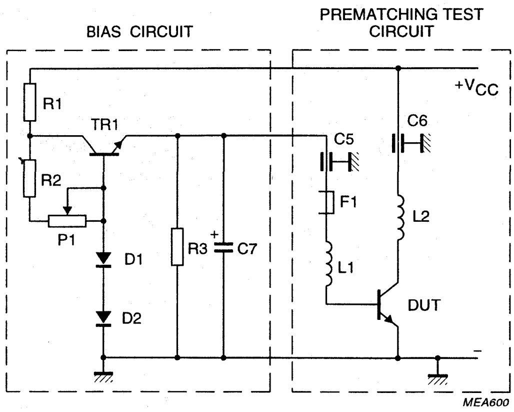


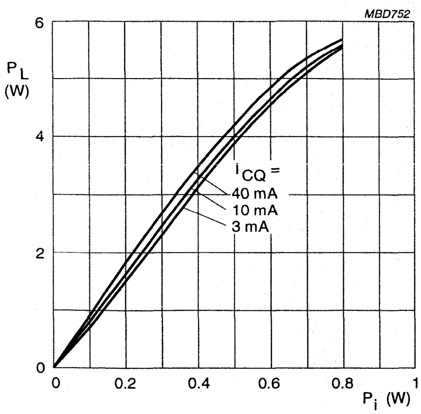
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5).

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT239 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1 SL
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	1.5 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)

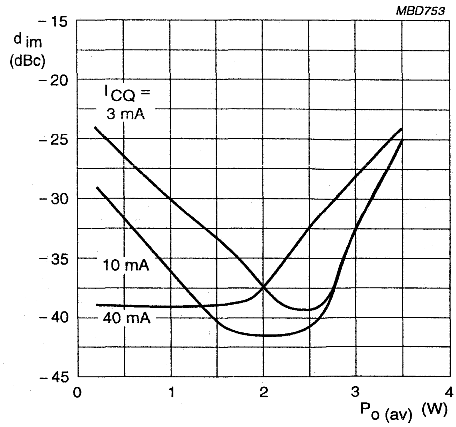
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1850 MHz.

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



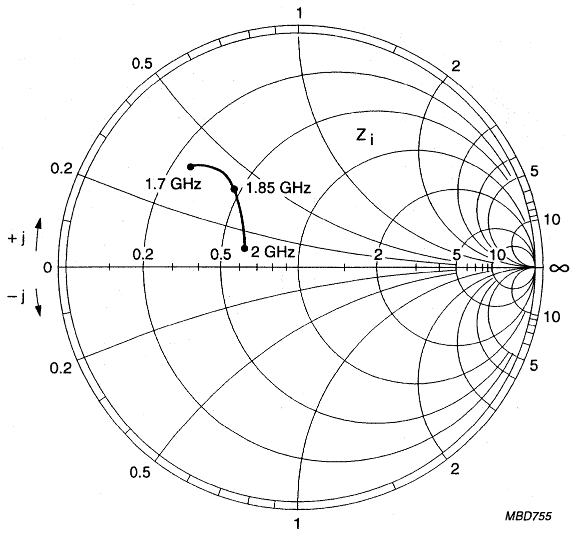
V_{CE} = 24 V; f_1 = 1850 MHz; f_2 = 1850.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances.

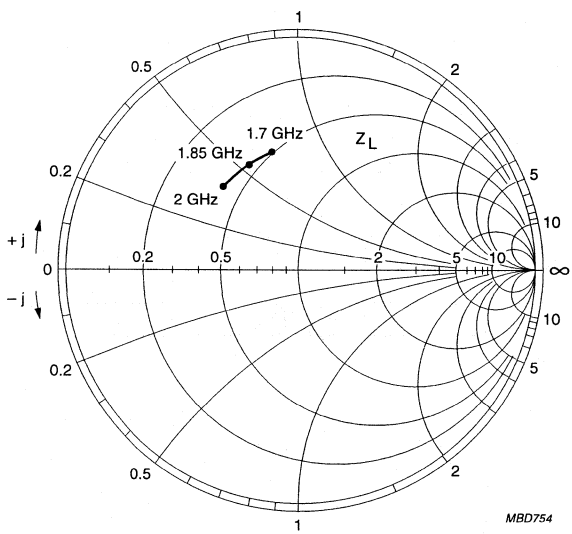
V_{CE} = 24 V; I_{CQ} = 40 mA (see Figs 8 and 9); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.70	13.0 + j17.5	5.2 + j6.4
1.75	15.5 + j17.8	5.0 + j6.0
1.80	18.6 + j17.6	4.8 + j5.5
1.85	22.1 + j16.5	4.7 + j5.1
1.90	25.7 + j14.0	4.5 + j4.6
1.95	28.5 + j10.0	4.4 + j4.2
2.00	29.8 + j4.9	4.3 + j3.8



V_{CE} = 24 V; Z_o = 50 Ω; I_{CQ} = 40 mA.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 40 mA.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN silicon planar epitaxial microwave power transistor

LLE18100X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input prematching ensures good stability and allows an easier design of wideband circuits.

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

APPLICATIONS

Intended for use in common emitter, class AB power amplifiers in CW conditions for professional applications at 1.85 GHz.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	Z_i/Z_L (Ω)
class AB (CW)	1.85	24	0.1	≥ 9	≥ 8	see Figs 8 and 9

PIN CONFIGURATION

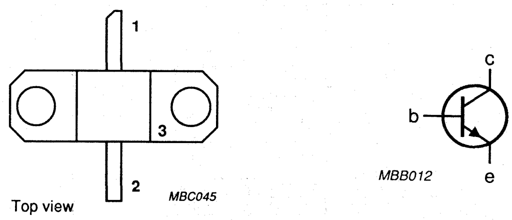


Fig.1 Simplified outline and symbol.

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.

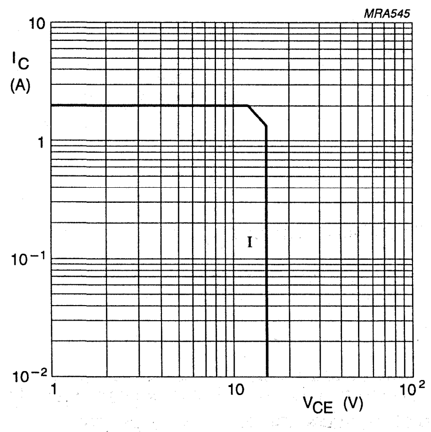
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	$R_{BE} = 220\ \Omega$	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	2	A
P_{tot}	total power dissipation	$T_{mb} = 75$ °C	–	23	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s note 1	–	235	°C

Note

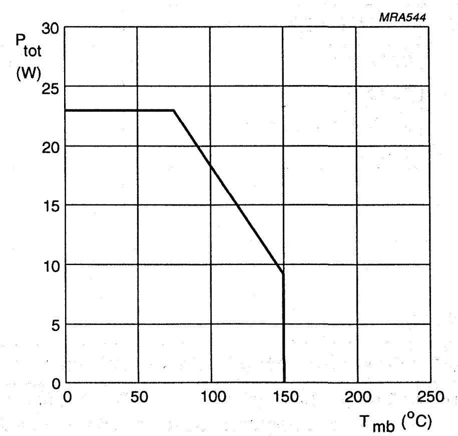
1. Up to 0.2 mm from ceramic.



$T_{mb} \leq 75$ °C

(I) Region of permissible DC operation

Fig.2 DC SOAR.



P_{tot} max = 23 W.

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	4.2 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2 K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	1	mA
I_{CER}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 220 Ω	–	10	mA
I_{CEO}	collector cut-off current	V_{CE} = 20 V; I_B = 0	–	10	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	100	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 1 A	15	100	

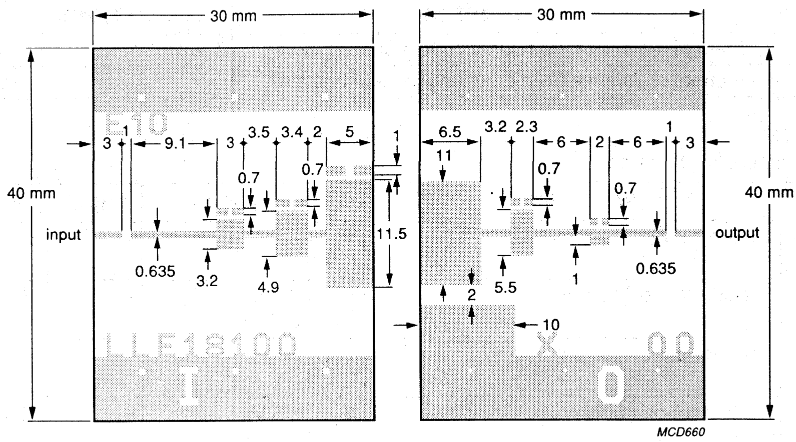
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier (note 1).

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	Z_i/Z_L (Ω)
class AB (CW)	1.85	24	0.1	≥ 9; typ.11	≥ 8; typ.10	see Figs 8 and 9

Note

1. The test circuit is split into 2 independant halves each being 30 x 40 mm in size.



Dimensions in mm

Substrate : Epsilam 10

Thickness : 0.635 mm

Permittivity : $\varepsilon_r = 10$

Fig.4 Prematching test circuit board.

List of components (see bias circuit)

COMPONENT	DESCRIPTION	VALUE	CATALOGUE NO.
TR1	transistor, BDT85 (or equivalent)		
D1	diode, BY239800 (or equivalent) note 1		
D2	diode, BY239800 note 2		
R1	resistor	100 Ω	
R2	resistor	3.3 kΩ	
R3	resistor	56 Ω	
P1	potentiometer, 10 turns (sfernice)	4.7 kΩ	
C1	electrolytic capacitor	10 µF, 40 V	
C5, C6	feedthrough bypass capacitor	1500 pF	Erie, ref. 1250-003
L1	5 turns 0.5 mm copper wire with ferrite bead		
L2	5 turns 0.5 mm copper wire		

Notes

1. In thermal contact with TR1.
2. In thermal contact with D.U.T.

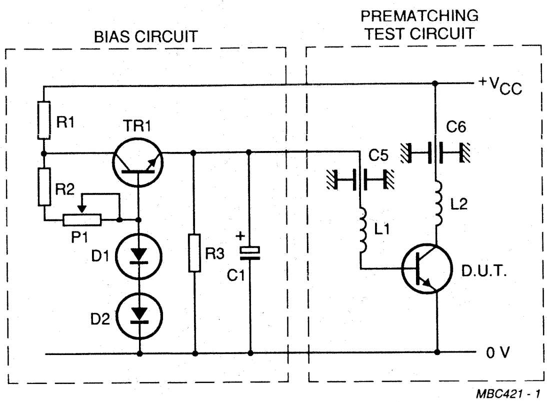
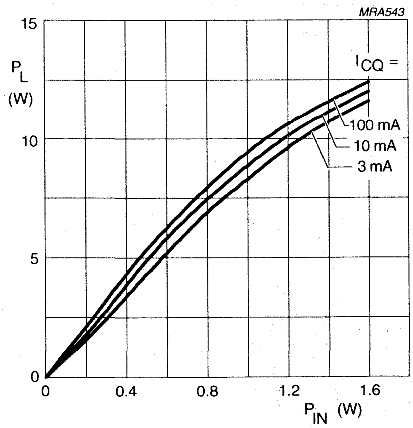
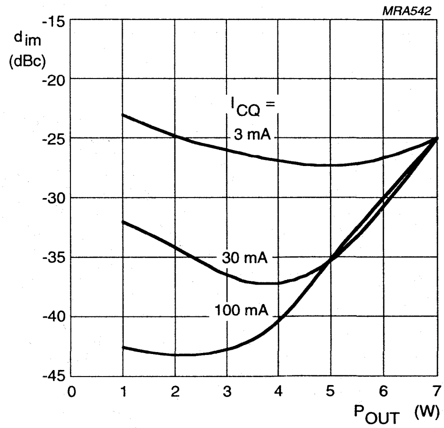


Fig.5 Class AB bias circuit at 1.85 GHz.



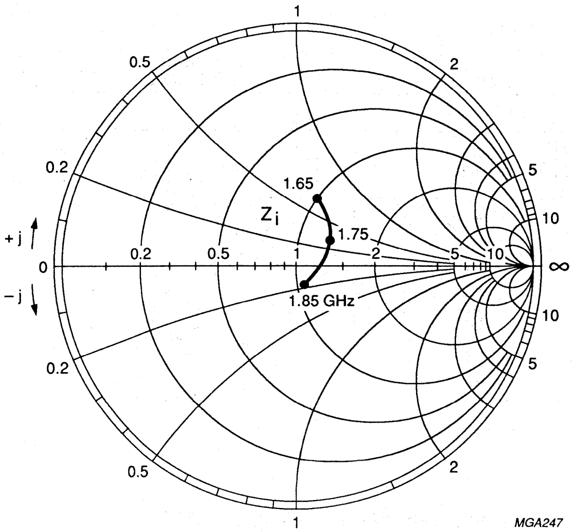
V_{CE} = 24 V
f = 1.85 GHz

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



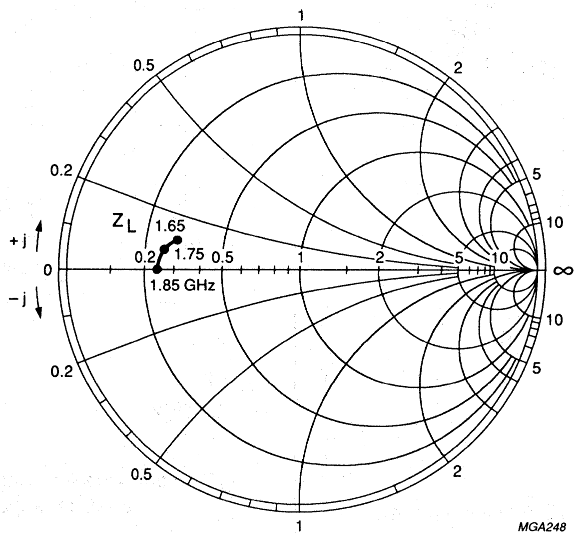
V_{CE} = 24 V
f = 1.85 GHz

Fig.7 Intermodulation distortion as a function of average output power.



V_{CE} = 24 V;
Z_O = 10 Ω;
I_{CQ} = 0.1 A.

Fig.8 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V;
Z_O = 10 Ω;
I_{CQ} = 0.1 A.

Fig.9 Optimum load impedance as a function of frequency; typical values.

NPN silicon planar epitaxial microwave power transistor

LLE18150X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.7 GHz and 2.0 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.05	≥12	≥7.8	typ. 43	see Figs 6 and 7

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

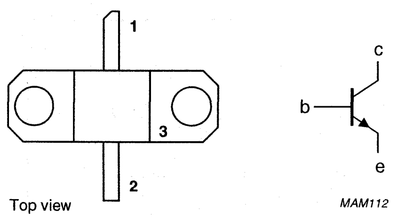


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	3	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	4	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

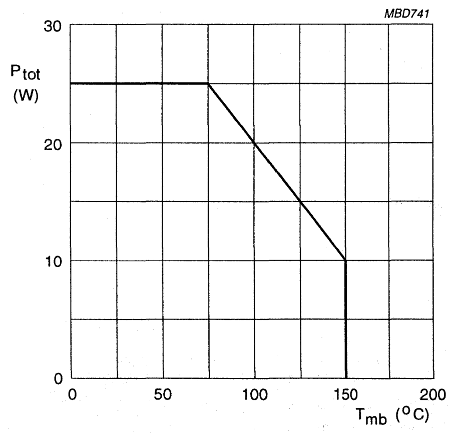


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	$T_j = 100\ °C$	3.6	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

$T_{mb} = 25\ °C$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 20\ V$	–	1.5	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	$I_C = 0\ mA$; $R_{BE} = 220\ \Omega$	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 10\ mA$	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 10\ mA$	3	–	V
h_{FE}	DC current gain	$I_C = 0.5\ A$; $V_{CE} = 3\ V$	15	100	

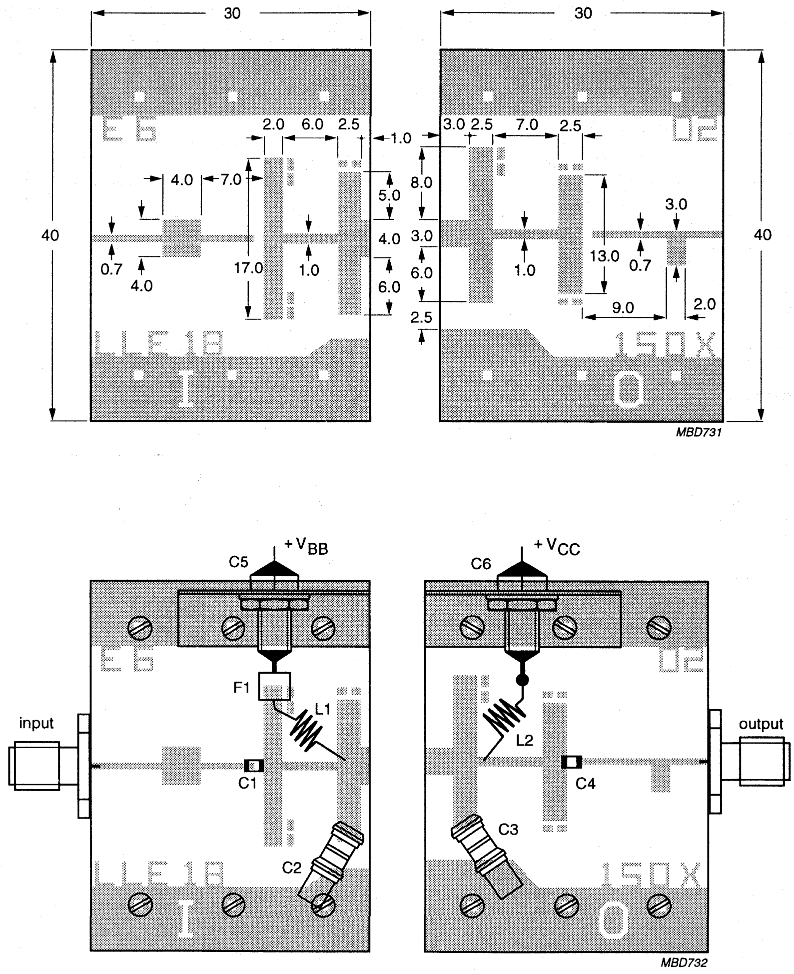
APPLICATION INFORMATION

Microwave performance up to $T_{mb} = 25\ °C$ in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.05	≥12 typ. 15	≥7.8 typ. 8.5	typ. 43	see Figs 6 and 7

NPN silicon planar epitaxial microwave power transistor

LLE18150X



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

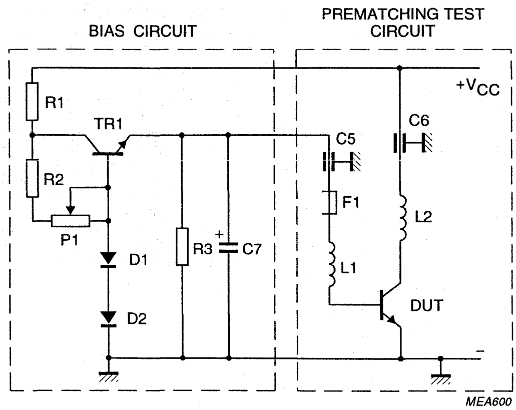


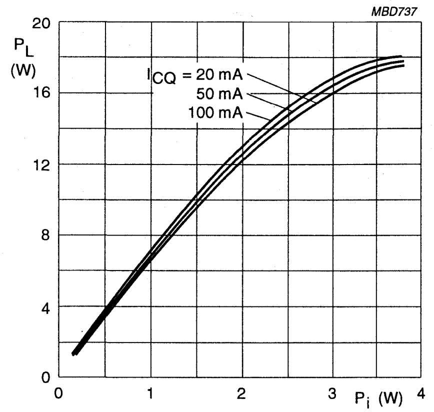
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4).

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)

Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



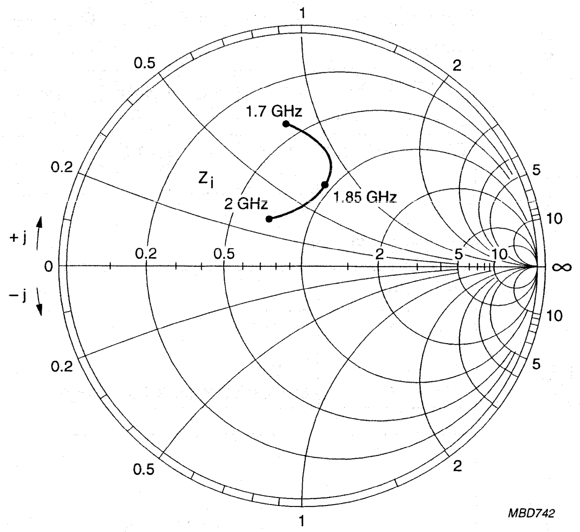
V_{CE} = 24 V; f = 1850 MHz.

Fig.5 Load power as a function of input power.

Input and optimum load impedances.

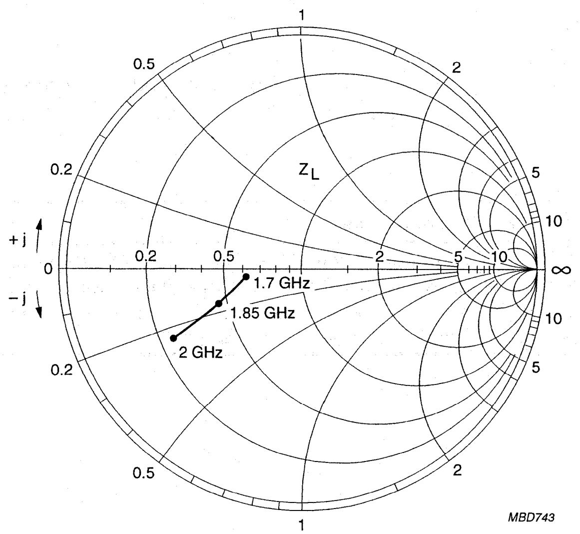
V_{CE} = 24 V; I_{CQ} = 50 mA; Z_o = 10 Ω (see Figs 6 and 7); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.70	4.5 + j8.0	6.2 – j0.5
1.80	7.5 + j9.0	5.7 – j1.0
1.85	9.2 + j8.2	4.7 – j1.7
1.90	9.5 + j6.5	3.9 – j2.2
2.00	7.0 + j3.0	2.7 – j2.4



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 50 mA.

Fig.6 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 50 mA.

Fig.7 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN silicon planar epitaxial microwave power transistor

LLE18300X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.7 GHz and 2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-229 glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.1	≥27	≥7.8	typ. 40	see Figs 8 and 9

PINNING - FO-229

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

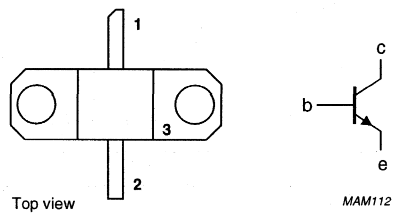


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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.

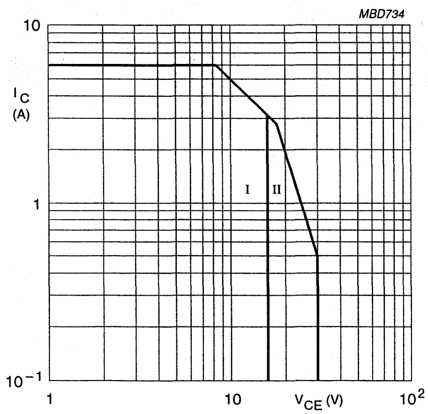
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	6	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	8	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

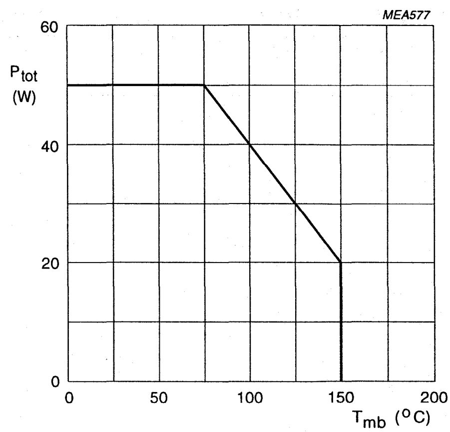


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

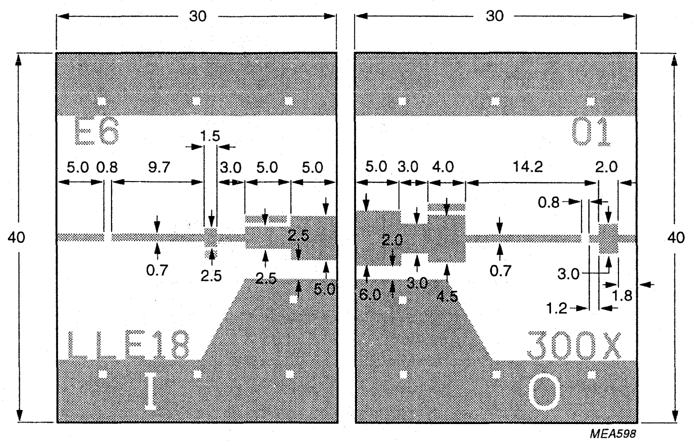
T_{mb} = 25 °C unless otherwise specified.

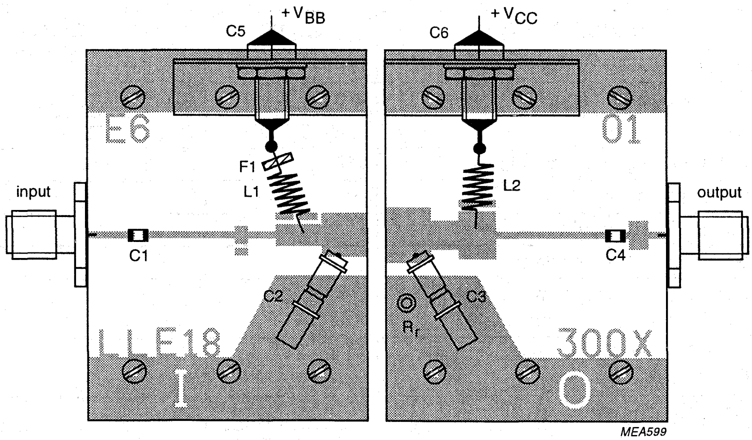
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	3	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 15 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 15 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 15 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.1	≥27 typ. 30	≥7.8 typ. 8.6	typ. 40	see Figs 8 and 9





The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

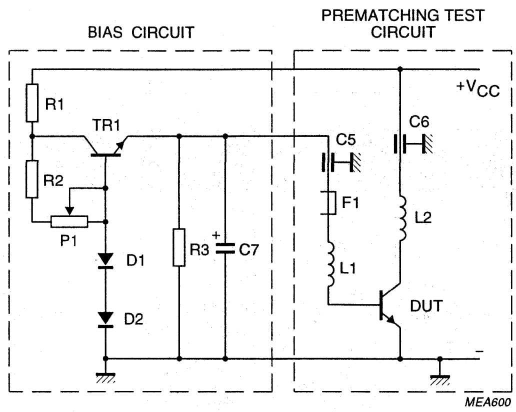


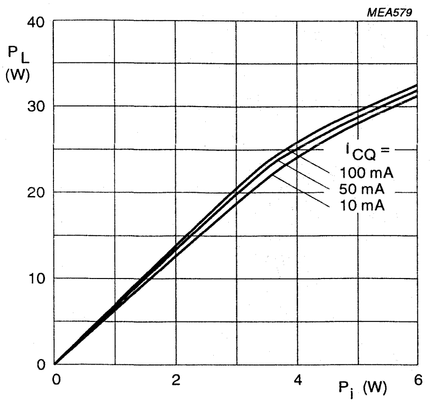
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5).

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 µF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)
R_r	copper rivet		

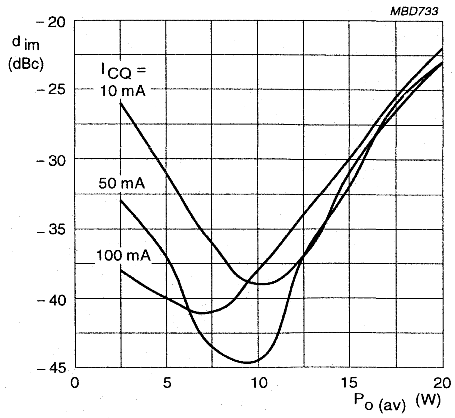
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1850 MHz.

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



V_{CE} = 24 V; f_1 = 1850 MHz; f_2 = 1850.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

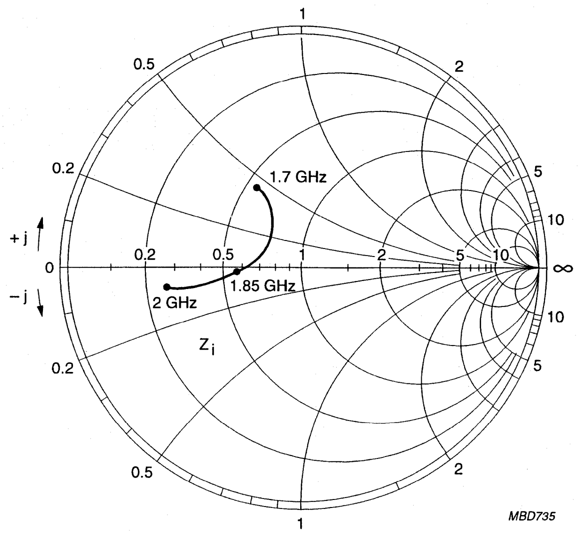
Input and optimum load impedances.

V_{CE} = 24 V; I_{CQ} = 0.1 A; Z_o = 10 Ω (see Figs 8 and 9); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.70	5.6 + j4.0	3.0 − j1.6
1.75	6.4 + j2.7	2.7 − j1.7
1.80	6.3 + j1.1	2.4 − j1.8
1.85	5.5 + j0.2	2.2 − j1.9
1.90	4.4 − j0.8	2.0 − j2.1
1.95	3.4 − j1.0	1.8 − j2.3
2.00	2.6 − j0.8	1.7 − j2.5

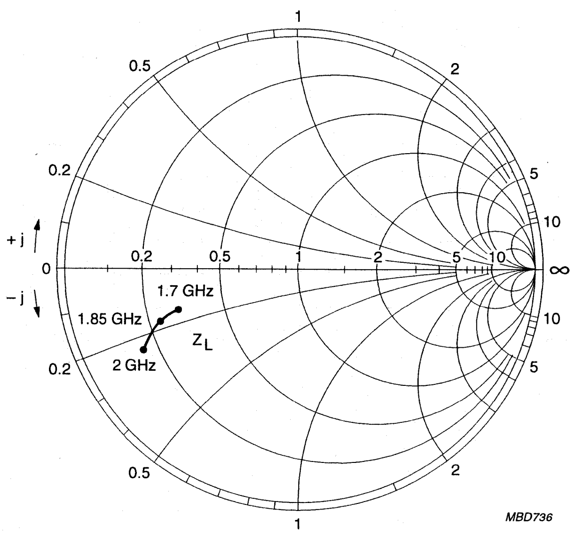
NPN silicon planar epitaxial microwave power transistor

LLE18300X



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.1 A.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.1 A.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

MICROWAVE LINEAR POWER TRANSISTOR

NPN silicon transistor for use in common-emitter class-A linear power amplifiers up to 4.2 GHz.

Diffused emitter ballasting resistors, self-aligned process entirely ion implanted, and gold sandwich metallization ensure an optimum temperature profile with excellent performance and reliability.

An input matching cell improves the input impedance and facilitates the design of wideband circuits.

The transistor is housed in a metal-ceramic envelope (FO-83).

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common-emitter class-A circuit

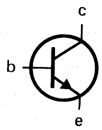
Mode of operation	f GHz	V_{CC} V	I_C A	P_{L1} W	G_{po} dB
CW; class-A	2.1	16	1.1	typ. 5.5	typ. 8.0

MECHANICAL DATA

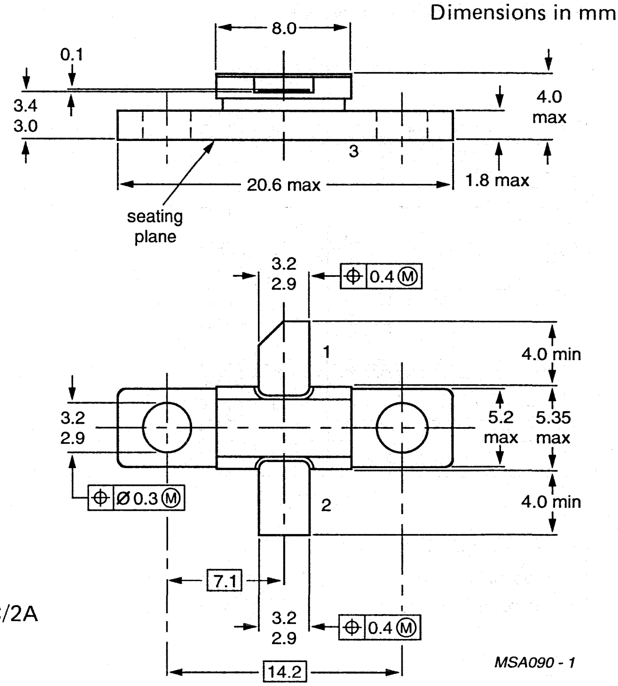
Dimensions in mm

Fig. 1 FO-83.

Pinning
1 = collector
2 = base
3 = emitter



Emitter is connected to the seating plane



Torque on screw: max. 0.4 Nm

Recommended screw: M2.5 or 4-40 UNC/2A

WARNING

Product and environmental safety — toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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 general industrial or domestic waste.

RATINGS

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

Collector-base voltage			
open emitter	V_{CBO}	max.	40 V
Collector-emitter voltage			
R_{BE} = 47 Ω	V_{CER}	max.	20 V
open base	V_{CEO}	max.	16 V
Emitter-base voltage			
open collector	V_{EBO}	max.	3.0 V
Collector current (DC)	I_C	max.	2 A
Total power dissipation			
up to T_{mb} = 75 °C	P_{tot}	max.	18 W
Storage temperature range	T_{stg}	−65 to + 200 °C	
Junction temperature	T_j	max.	200 °C
Lead soldering temperature at			
0,3 mm from case; $t_{sld} \leqslant 10$ s	T_{sld}	max.	235 °C

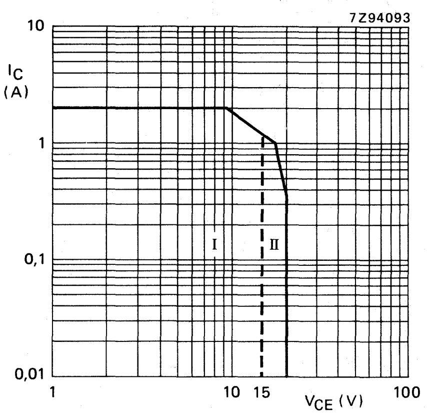


Fig. 2 DC SOAR at $T_{mb} \leqslant 75$ °C.

I Region of permissible DC operation.

II Permissible extention provided $R_{BE} \leqslant 47$ Ω.

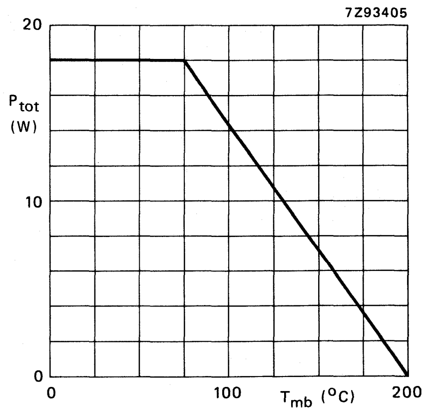


Fig. 3 Power derating curve.

THERMAL RESISTANCE (T_j = 75 °C)

From junction to mounting base	$R_{th\,j\text{-}mb}$	typ.	4 K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	max.	0.7 K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

Collector cut-off currents			
$I_E = 0$; V_{CB} = 20 V	I_{CBO}	max.	0.5 mA
$I_E = 0$; V_{CB} = 40 V		max.	2.5 mA
V_{CE} = 20 V; R_{BE} = 47 Ω	I_{CER}	max.	25 mA
V_{CE} = 15 V; $I_B = 0$	I_{CEO}	max.	2 mA
Emitter cut-off current			
$I_C = 0$; V_{EB} = 1.5 V	I_{EBO}	max.	100 μA
DC current gain			
I_C = 1 A; V_{CE} = 3 V	h_{FE}		15 to 100

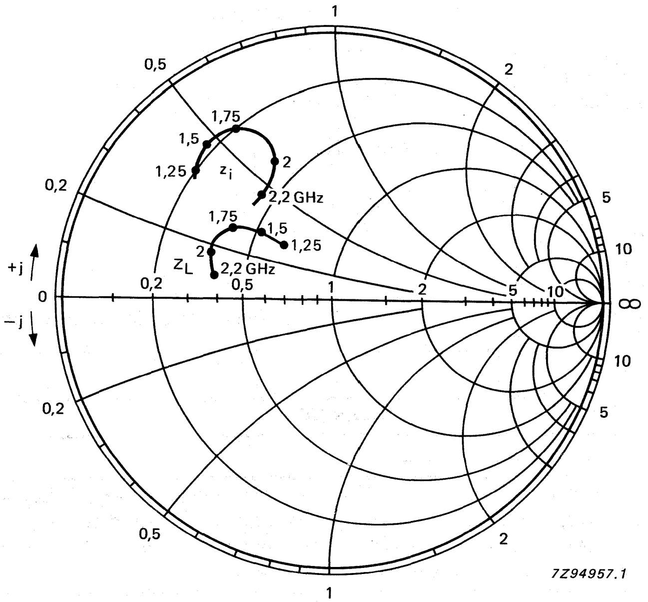


Fig. 4 Input and optimum load impedance as a function of frequency; Z_0 = 10 Ω; typical values.

NPN silicon planar epitaxial microwave power transistor

LXE15450X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated common-emitter structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures a good stability and allows an easier design of circuits.

APPLICATIONS

Intended for use in common-emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.7 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-91B metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.15	≥45	≥8	typ. 48	see Figs 8 and 9

PINNING - FO-91B

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

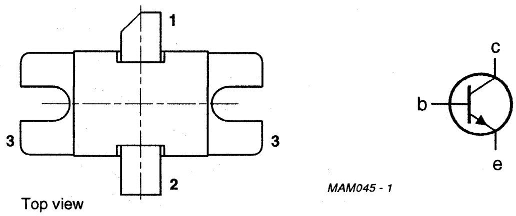


Fig.1 Simplified outline and symbol.

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.

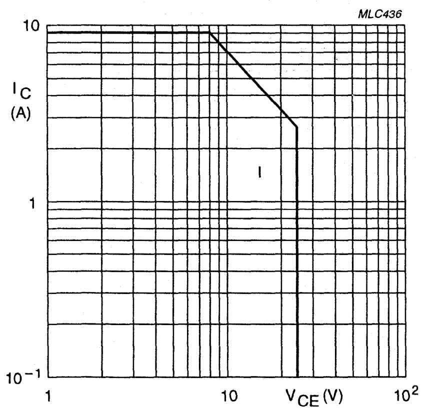
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	9	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	12	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	70	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.

(I) Region of permissible DC operation.

Fig.2 DC SOAR.

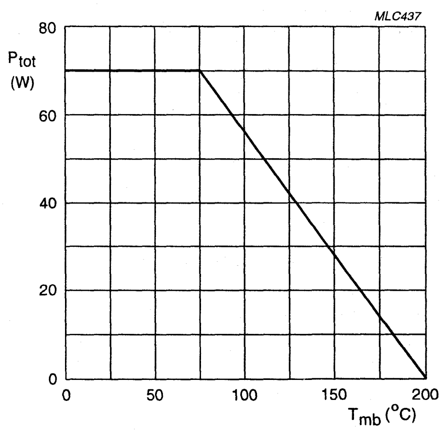


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.3	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

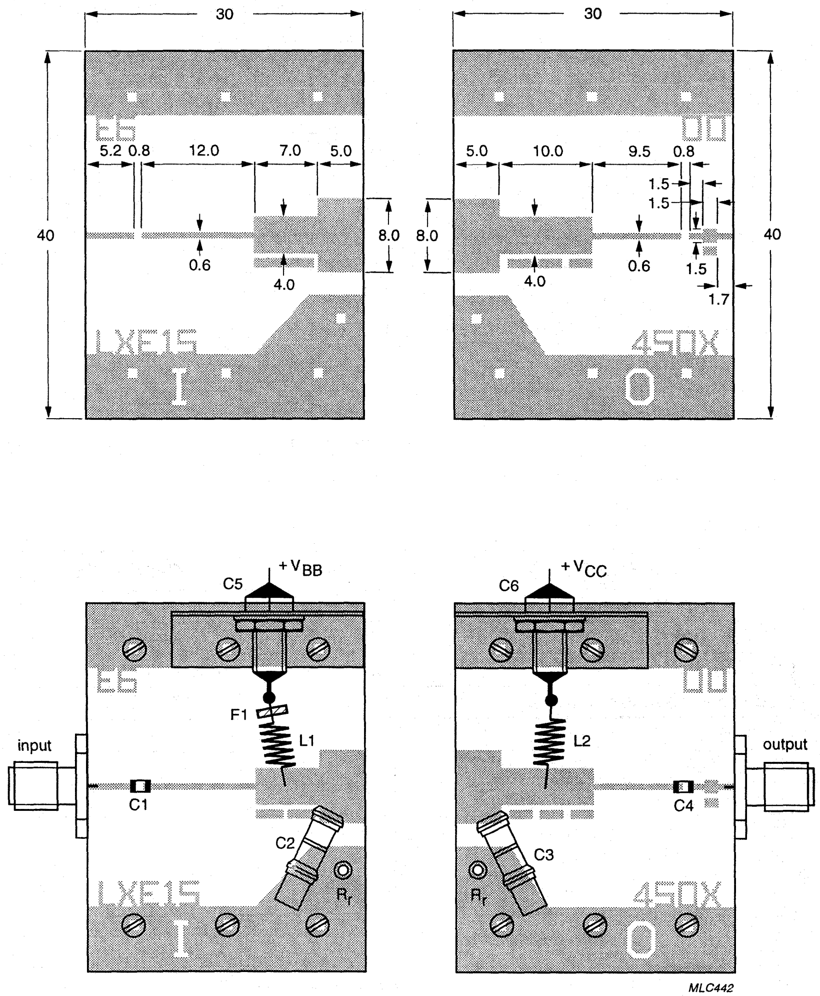
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	4.5	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 22 mA	45	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 150 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 22 mA	3	–	V
h_{FE}	DC current gain	I_C = 4.5 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.15	≥45 typ. 50	≥8 typ. 8.8	typ. 48	see Figs 8 and 9



The test circuit is split into two independent halves each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Test circuit.

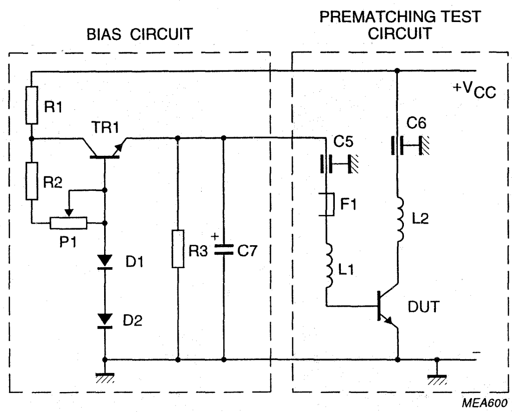


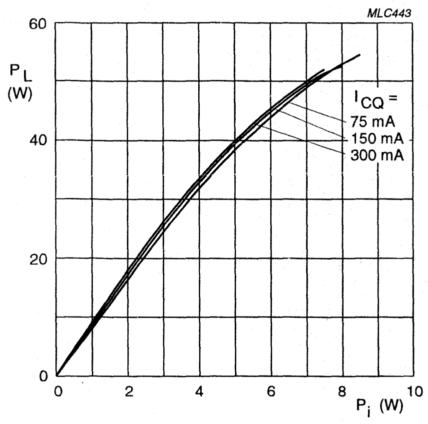
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BD239 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A1201kp
C2, C3	trimmer capacitor	0.5 to 5 pF	Tekelec 721-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie1250-003
C7	electrolytic capacitor	10 µF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)
R_r	copper rivet		

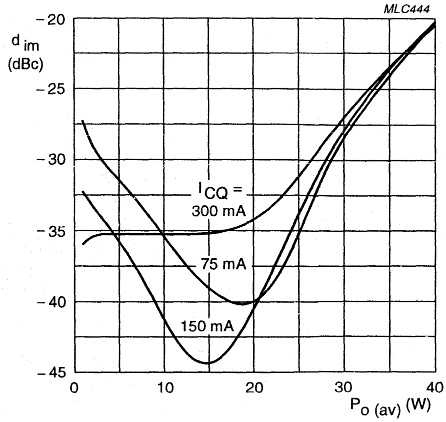
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V.
f = 1500 MHz.

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



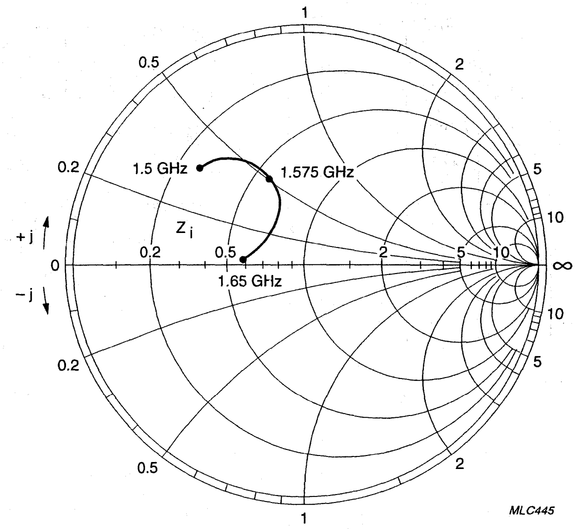
V_{CE} = 24 V.
f_1 = 1500 MHz.
f_2 = 1500.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

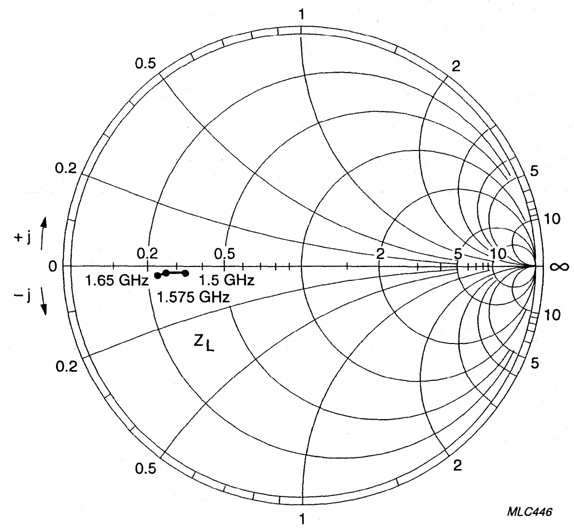
V_{CE} = 24 V; I_{CQ} = 0.15 A; typical values at $P_L = P_{L1}$ (see Figs 8 and 9).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.500	2.8 + j3.5	3.2 – j0.25
1.575	5.7 + j5.0	2.5 – j0.15
1.650	6.0 + j0.4	2.4 – j0.20



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$

NPN silicon planar epitaxial microwave power transistor

LXE18400X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for military and professional applications between 1.7 and 2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a FO-91B metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.15	≥39	≥7	typ. 42	see Figs 8 and 9

PINNING - FO-91B

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

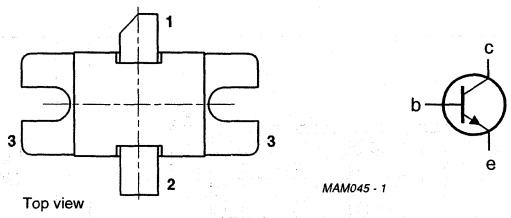


Fig.1 Simplified outline and symbol.

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.

NPN silicon planar epitaxial microwave power transistor

LXE18400X

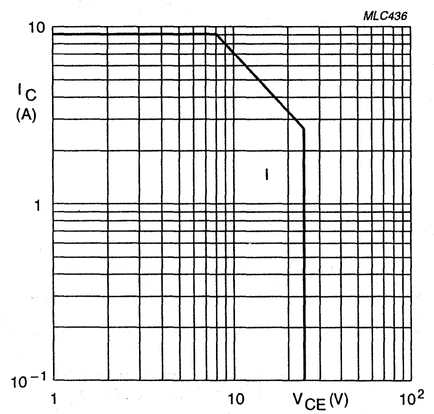
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	9	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	12	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	70	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.

(I) Region of permissible DC operation.

Fig.2 DC SOAR.

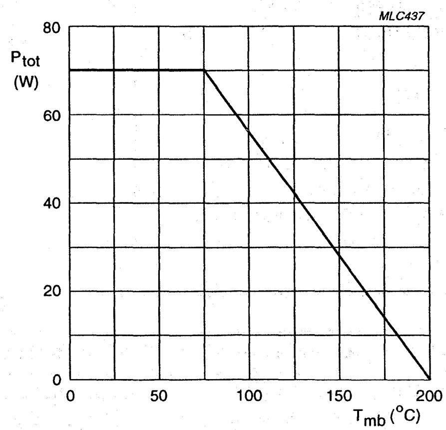


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	$T_j = 100\ °C$	1.3	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

CHARACTERISTICS

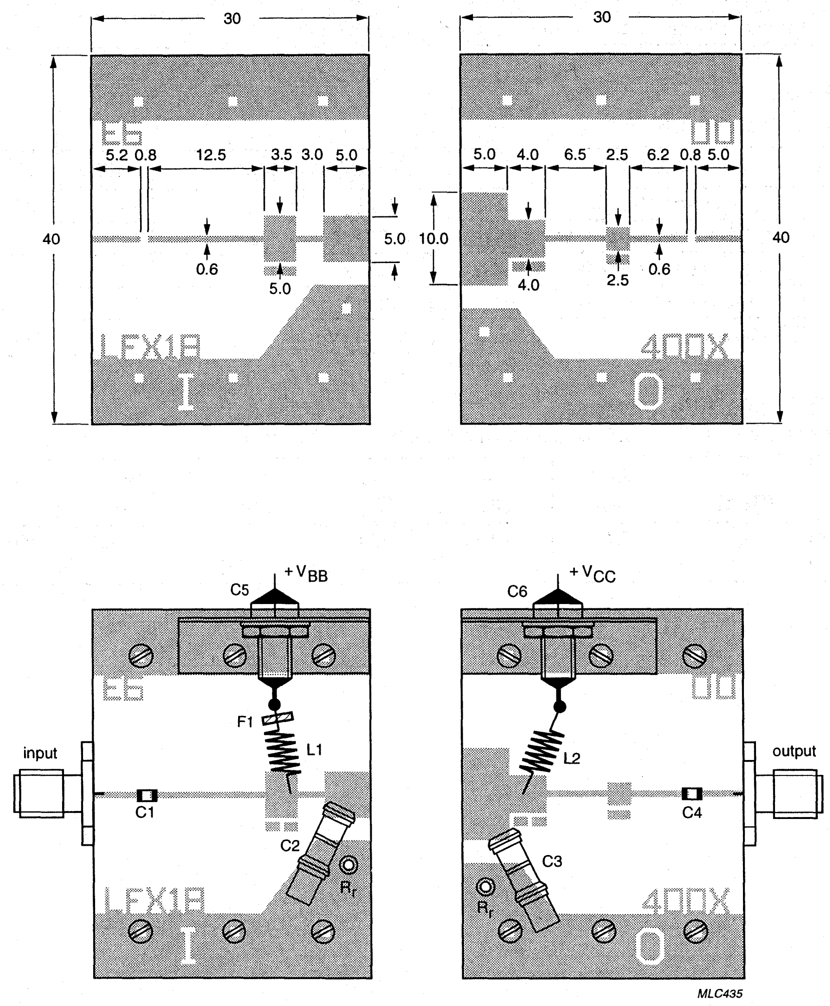
$T_{mb} = 25\ °C$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 20\ V$	–	4.5	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	$I_C = 150\ mA$; $R_{BE} = 220\ \Omega$	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 22\ mA$	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 22\ mA$	3	–	V
h_{FE}	DC current gain	$I_C = 4.5\ A$; $V_{CE} = 3\ V$	15	100	

APPLICATION INFORMATION

Microwave performance up to $T_{mb} = 25\ °C$ in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.85	24	0.15	≥39 typ. 44	≥7 typ. 7.8	typ. 42	see Figs 8 and 9



The test circuit is split into two independent halves, each being 30 x 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

NPN silicon planar epitaxial microwave power transistor

LXE18400X

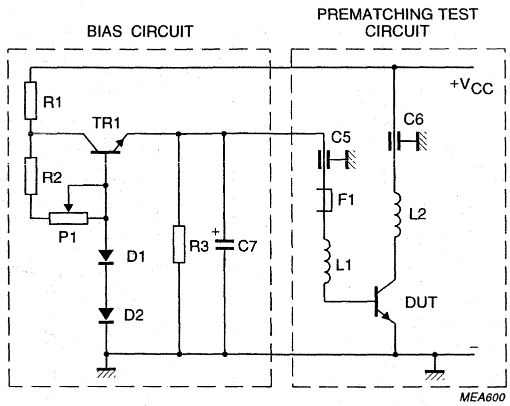


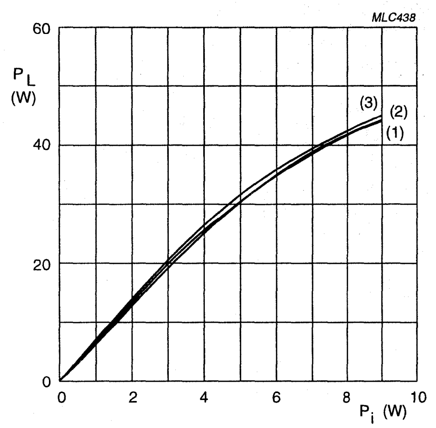
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BD239 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A1201kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 x 2.2 x 3.2 mm (4B1)
R_r	copper rivet		

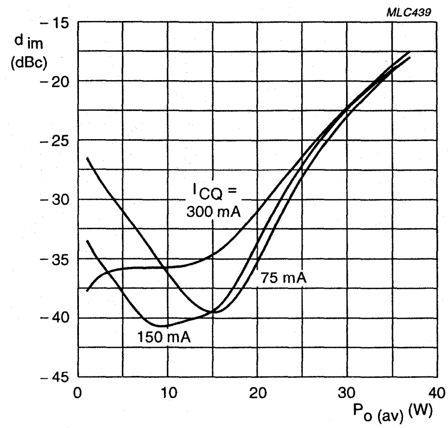
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



(1) I_{CQ} = 75 mA.
(2) I_{CQ} = 150 mA.
(3) I_{CQ} = 300 mA.
V_{CE} = 24 V; f = 1850 MHz.

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



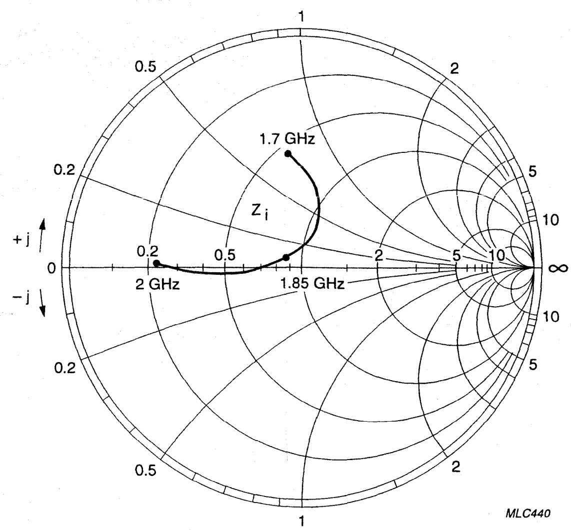
V_{CE} = 24 V; f_1 = 1850 MHz; f_2 = 1850.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

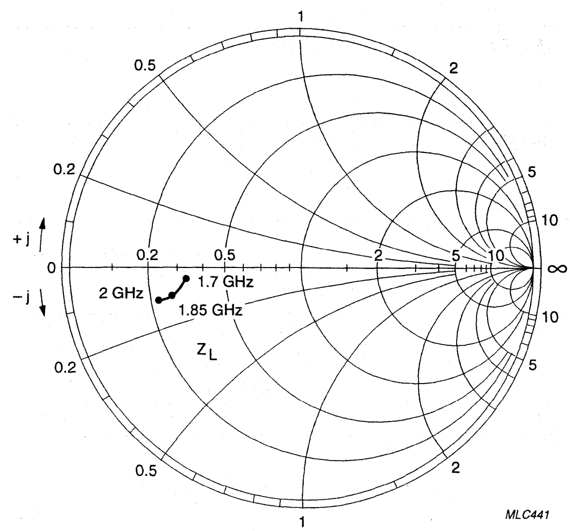
V_{CE} = 24 V; I_{CQ} = 0.15 mA; typical values at $P_L = P_{L1}$ (see Figs 8 and 9).

f **(GHz)**	Z_i **(Ω)**	Z_L **(Ω)**
1.70	5.4 + j7.2	3.3 − j0.3
1.85	8.3 + j0.7	2.4 − j1.0
2.00	2.1 + j0.2	2.2 − j1.0



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 mA.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 mA.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

Silicon planar epitaxial overlay transistors

2N3866; 2N4427

DESCRIPTION

NPN overlay transistors in TO-39 metal packages with the collector connected to the case. The devices are primarily intended for class-A, B or C amplifiers, frequency multiplier and oscillator circuits.

APPLICATIONS

- The transistors are intended for use in output, driver or pre-driver stages in VHF and UHF equipment.

PINNING - TO-39/1

PIN	DESCRIPTION
1	emitter
2	base
3	collector

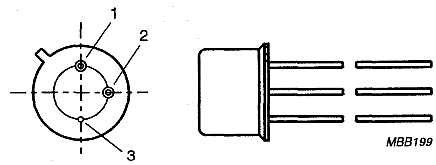


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CER}	collector-emitter voltage	$R_{BE} = 10\ \Omega$			
	2N3866		–	55	V
	2N4427		–	40	V
V_{CEO}	collector-emitter voltage	open base			
	2N3866		–	30	V
	2N4427		–	20	V
V_{EBO}	emitter-base voltage	open collector			
	2N3866		–	3.5	V
	2N4427		–	2.0	V
I_C	collector current (DC)		–	0.4	A
$I_{C(AV)}$	average collector current	measured over any 20 ms period	–	0.4	A
P_{tot}	total power dissipation	up to $T_{mb} = 25$ °C	–	3.5	W
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 15$ V; f = 200 MHz	500	–	MHz
T_j	junction temperature		–	200	°C

RF 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

LIMITING VALUES

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

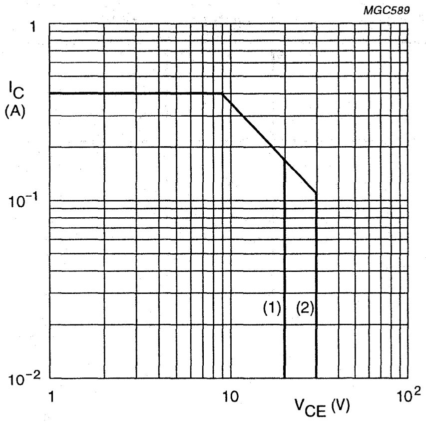
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter			
	2N3866		–	55	V
	2N4427		–	40	V
V_{CER}	collector-emitter voltage	$R_{BE} = 10\ \Omega$			
	2N3866		–	55	V
	2N4427		–	40	V
V_{CEO}	collector-emitter voltage	open base			
	2N3866		–	30	V
	2N4427		–	20	V
V_{EBO}	emitter-base voltage	open collector			
	2N3866		–	3.5	V
	2N4427		–	2.0	V
I_C	collector current (DC)		–	0.4	A
$I_{C(AV)}$	average collector current	measured over any 20 ms period	–	0.4	A
I_{CM}	collector current peak value		–	0.4	A
P_{tot}	total power dissipation	up to $T_{mb} = 25$ °C	–	3.5	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air		200	K/W
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base		50	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	1.0	K/W
		note 2	2.5	K/W

Notes

1. Mounted with top clamping washer 56218.
2. Mounted with top clamping washer 56218 and a boron nitride washer for electrical insulation.



T_{mb} = 25 °C.
(1) 2N4427.
(2) 2N3866.

Fig.2 DC SOAR.

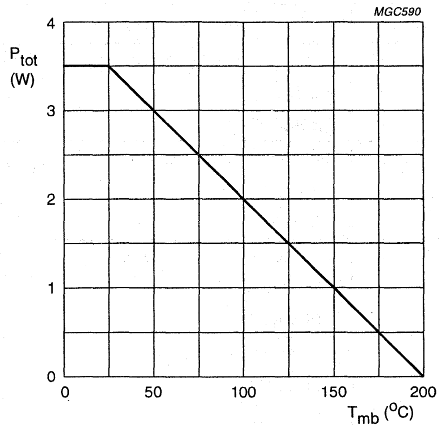


Fig.3 Power derating curve.

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 = 100 μA			
	2N3866		55	–	V
	2N4427		40	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 5 mA			
	2N3866		30	–	V
	2N4427		20	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	R_{BE} = 10 Ω; I_C = 5 mA			
	2N3866		55	–	V
	2N4427		40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 100 μA			
	2N3866		3.5	–	V
	2N4427		2	–	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 20 mA			
	2N3866		–	1	V
	2N4427		–	0.5	V
I_{CEO}	collector leakage current				
	2N3866	open base; V_{CE} = 28 V	–	20	μA
	2N4427	open base; V_{CE} = 12 V	–	20	μA
h_{FE}	DC current gain				
	2N3866	I_C = 50 mA; V_{CE} = 5 V	10	200	
	2N3866	I_C = 360 mA; V_{CE} = 5 V	5	–	
	2N4427	I_C = 100 mA; V_{CE} = 5 V	10	200	
	2N4427	I_C = 360 mA; V_{CE} = 5 V	5	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 15 V; f = 200 MHz	500	–	MHz
C_c	collector capacitance				
	2N3866	V_{CB} = 28 V; I_E = I_e = 0; f = 1 MHz	–	3	pF
	2N4427	V_{CB} = 12 V; I_E = I_e = 0; f = 1 MHz	–	4	pF

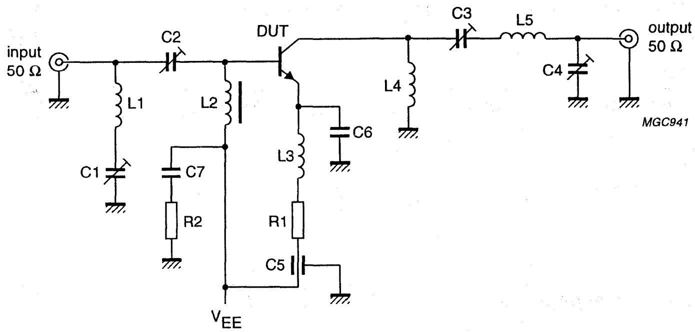
APPLICATION INFORMATION

Table 1 RF performance at T_{mb} = 25 °C.

TYPE NUMBER	f (MHz)	V_{CE} (V)	P_o (W)	G_p (dB)	I_C (mA)	η (%)
2N3866	100	28	1.8	>10	<107	>60
	250	28	1.5	>10	<107	>50
	400	28	1.0	>10	<79	>45
2N4427	175	12	1.0	>10	<167	>50
	470	12	0.4	>10	67	50

Ruggedness

The transistors are capable of withstanding a load mismatch corresponding to VSWR = 3 : 1 varied through all phases, under the conditions mentioned in Table 1.

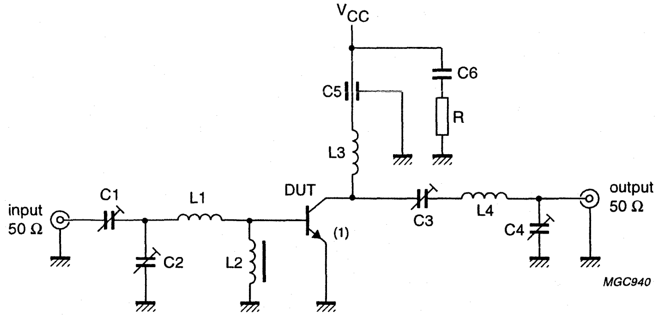


$V_{EE} = -28$ V

Fig.4 Test circuit for the 2N3866 at 400 MHz.

List of components (see Fig.4)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C2, C3	air trimmer capacitor	4 to 29 pF		
C4	air trimmer capacitor	4 to 14 pF		
C5	feed-through capacitor	1 nF		
C6	capacitor	12 pF		
C7	capacitor	12 nF		
R1	resistor	5.6 Ω		
R2	resistor	10 Ω		
L1	2 turns 1.0 mm copper wire	–	int. diameter 6 mm; winding pitch 3 mm	
L2	Ferroxcube choke coil	Z = 450 Ω; f = 250 MHz		4312 020 36690
L3, L4	6 turns enamelled 0.5 mm copper wire	100 nH	int. diameter 3.5 mm	
L5	2 turns 1.0 mm copper wire	–	int. diameter 7 mm; winding pitch 2.5 mm; leads 2 × 15 mm	



V_{CC} = +12 V.

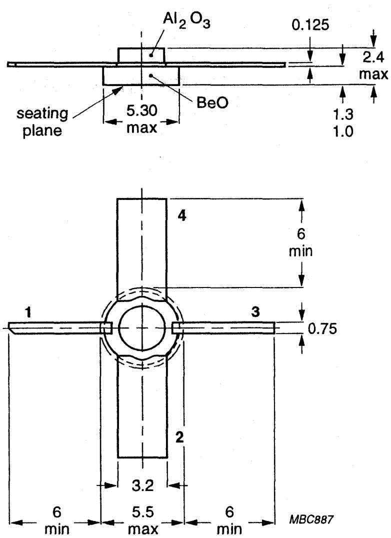
(1) The length of the external emitter wire is 1.6 mm.

Fig.5 Test circuit for the 2N4427 at 175 MHz.

List of components (see Fig.5)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C2, C3, C4	air trimmer capacitor	4 to 29 pF		
C5	feed-through capacitor	1 nF		
C6	capacitor	12 nF		
R	resistor	10 Ω		
L1	2 turns 1.0 mm copper wire	–	int. diameter 6 mm; winding pitch 2 mm; leads 2 × 10 mm	
L2	Ferroxcube choke coil	Z = 550 Ω; f = 175 MHz		4312 020 36640
L3	2 turns 1.0 mm copper wire	–	int. diameter 5 mm; winding pitch 2 mm; leads 2 × 10 mm	
L4	3 turns 1.5 mm copper wire	–	int. diameter 10 mm; winding pitch 2 mm; leads 2 × 15 mm	

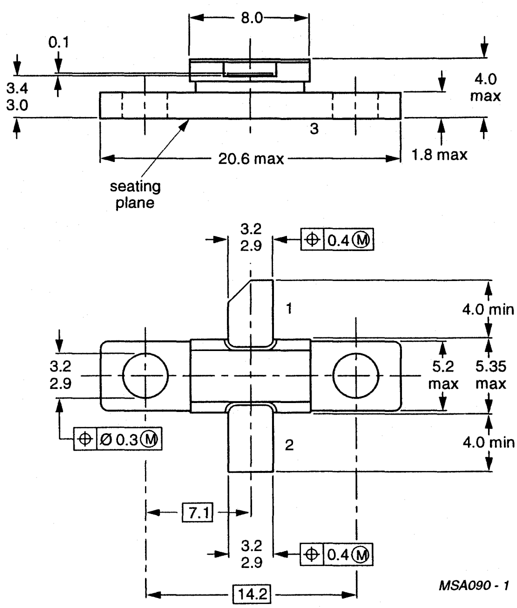
PACKAGE OUTLINES



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.4 Nm.

Fig.1 FO-45.

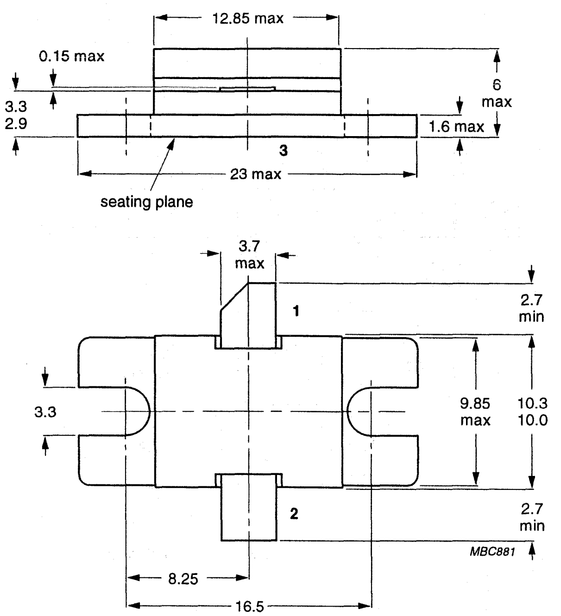


Dimensions in mm.

Torque on nut: max. 0.4 Nm.

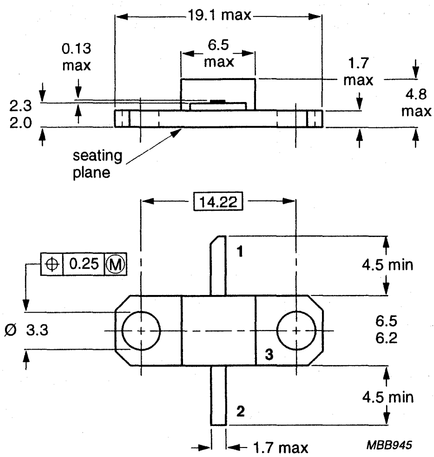
Recommended screw: M2.5.

Fig.2 FO-83A.



Dimensions in mm.
Torque on nut: max. 0.4 Nm.
Recommended screw: M3.
Recommended pitch for mounting screw: 19 mm.

Fig.3 FO-91.



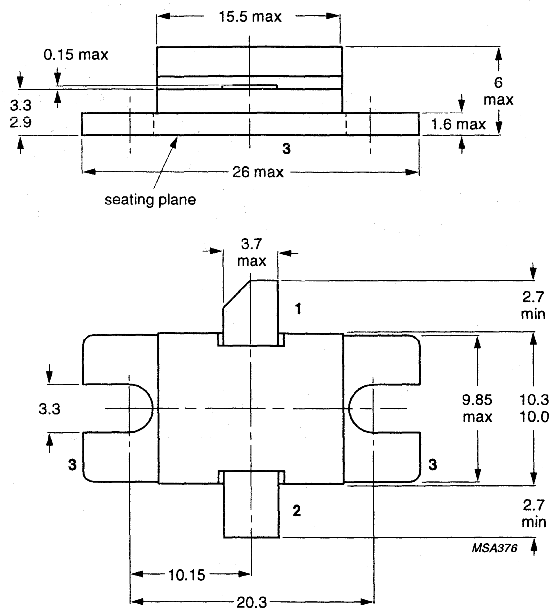
Dimensions in mm.

Torque on nut: max. 0.5 Nm.

Recommended screw: M3.

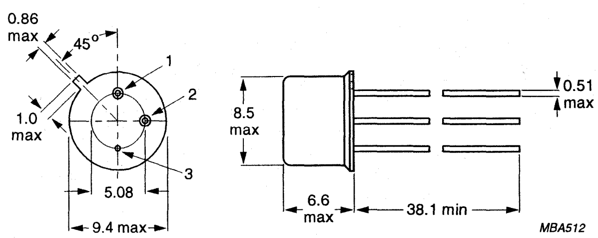
Recommended pitch for mounting screw: 19 mm.

Fig.4 FO-229.



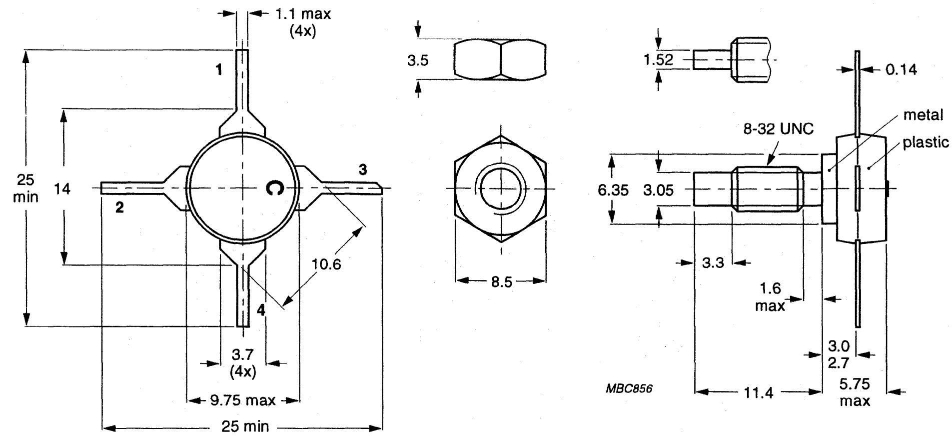
Dimensions in mm.
Torque on screws: max. 0.5 Nm.
Recommended screw: M3.

Fig.5 FO-231.



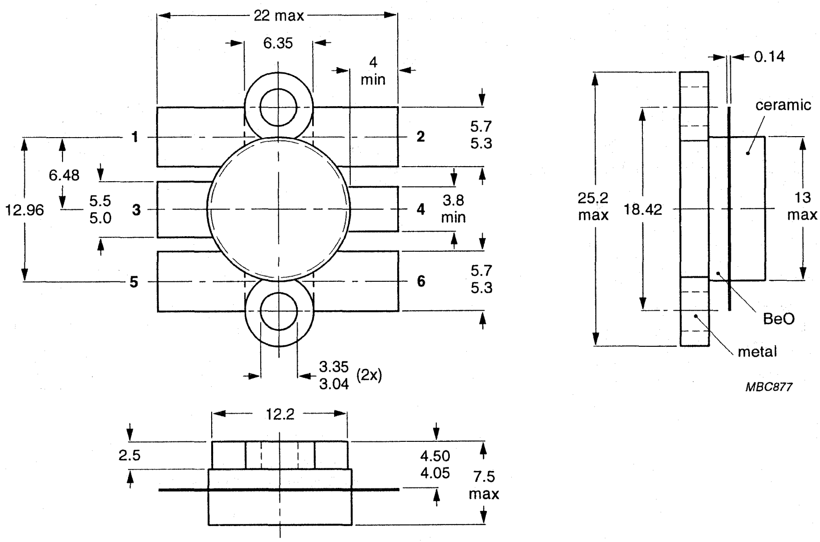
Dimensions in mm.

Fig.6 SOT5 (TO-39/1; TO-39/3).



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 SOT48/3.



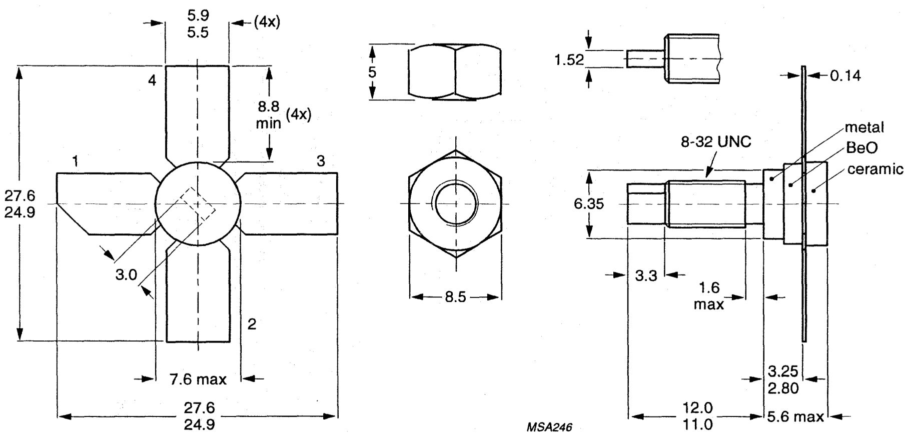
Dimensions in mm.

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 SOT119A.



Dimensions in mm.

Torque on nut: min. 0.75 Nm; max. 0.85 Nm.

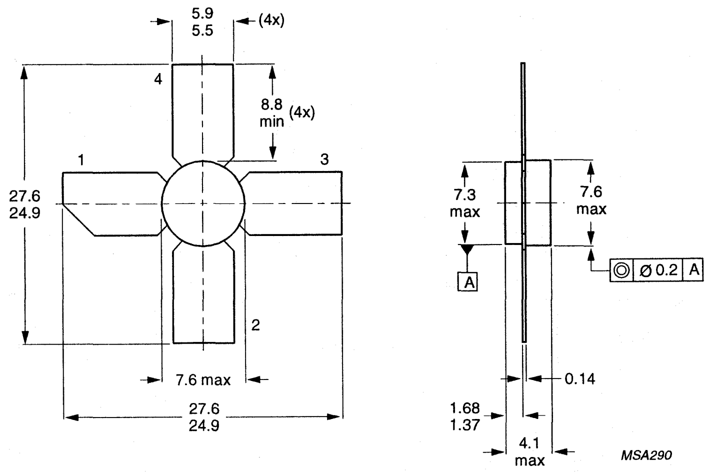
Diameter of clearance hole in heatsink: max. 4.2 mm.

Mounting hole to have no burrs at either end.

De-burring must leave surface flat; do not chamfer or countersink either end of hole.

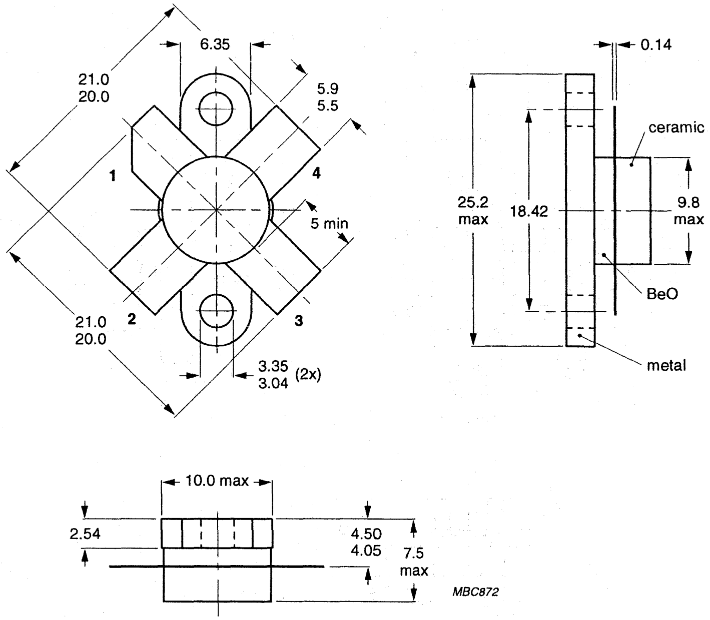
When locking is required an adhesive is preferred instead of a lock washer.

Fig.9 SOT122A.



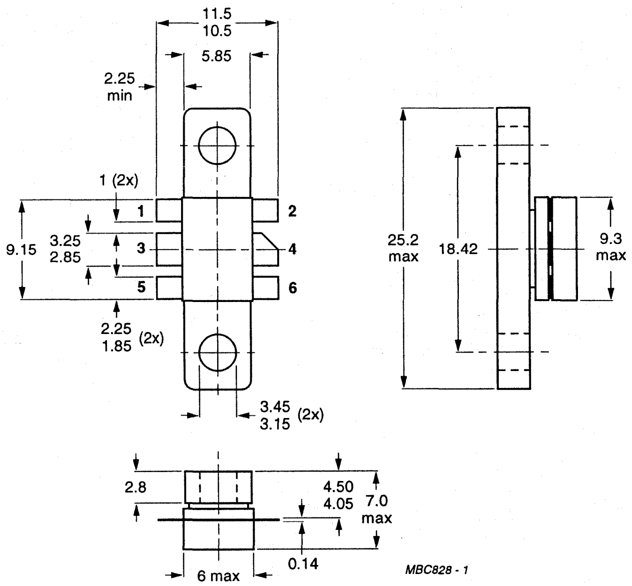
Dimensions in mm.

Fig.10 SOT122D.



Dimensions in mm.
Torque on 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.11 SOT123.



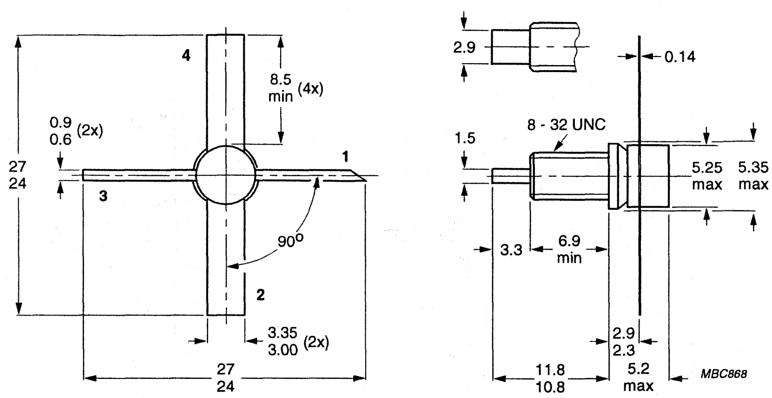
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

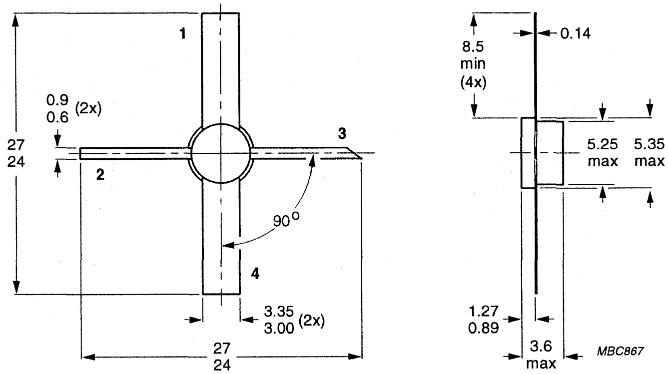
Heatsink compound must be applied sparingly and evenly distributed.

Fig.12 SOT171.



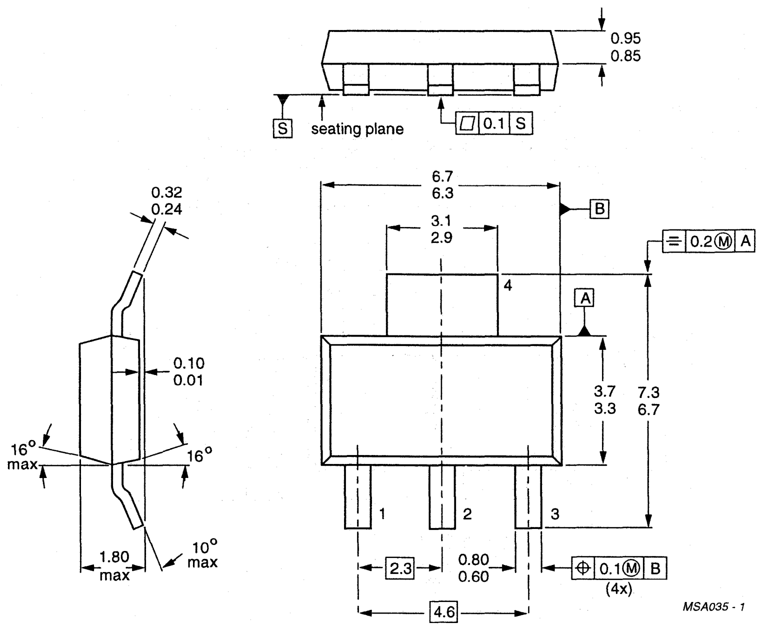
Dimensions in mm.
Torque on nut: min. 0.75 Nm; max. 0.85 Nm.
Diameter of clearance hole in heatsink: max. 4.2 mm.
Mounting hole to have no burrs at either end.
De-burring must leave surface flat; do not chamfer or countersink either end of hole.
When locking is required an adhesive is preferred instead of a lock washer.

Fig.13 SOT172A1.



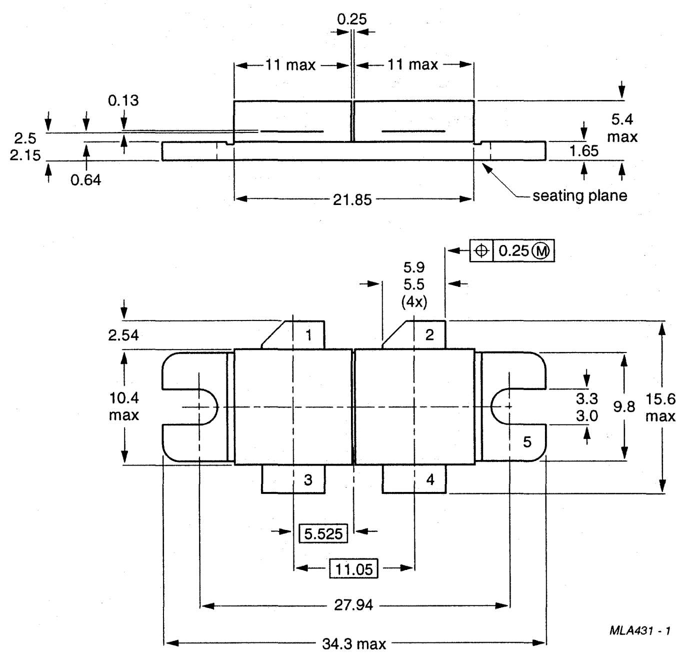
Dimensions in mm.

Fig.14 SOT172D1.



Dimensions in mm.

Fig.15 SOT223.



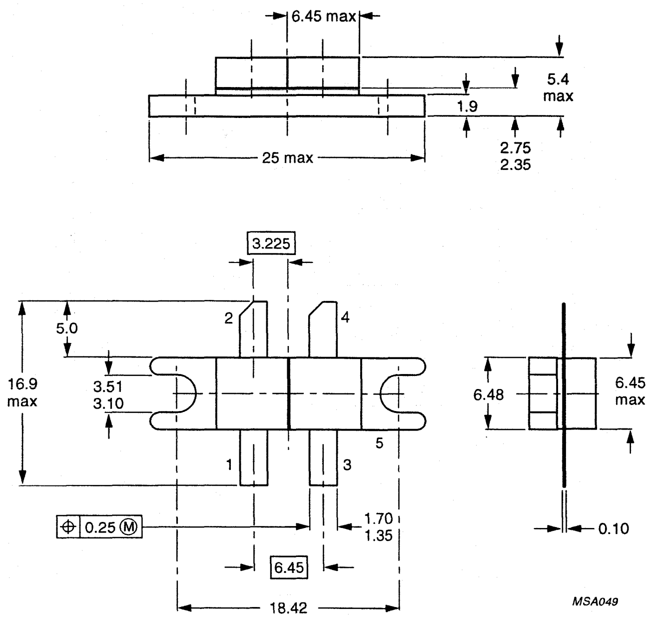
Dimensions in mm.

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.16 SOT262A2.



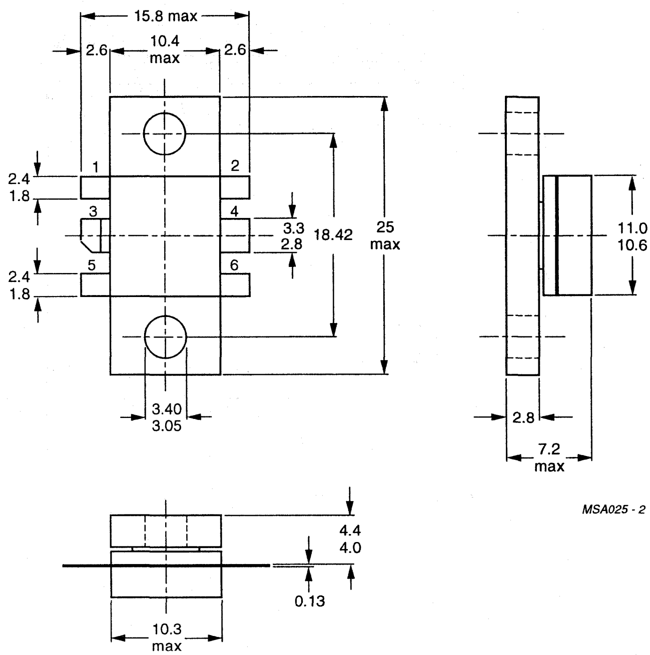
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

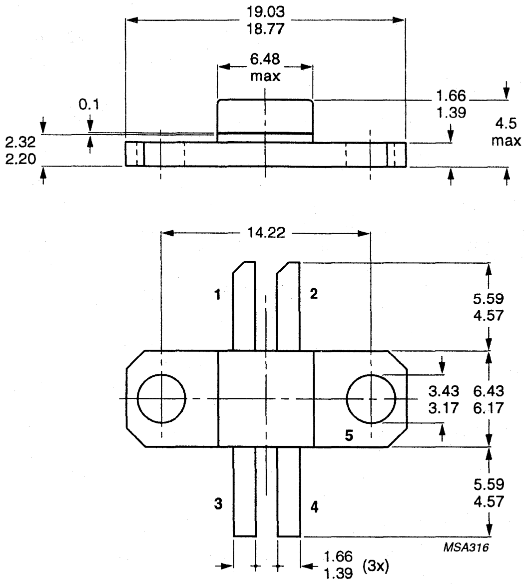
Heatsink compound must be applied sparingly and evenly distributed.

Fig.17 SOT268.



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.18 SOT273.



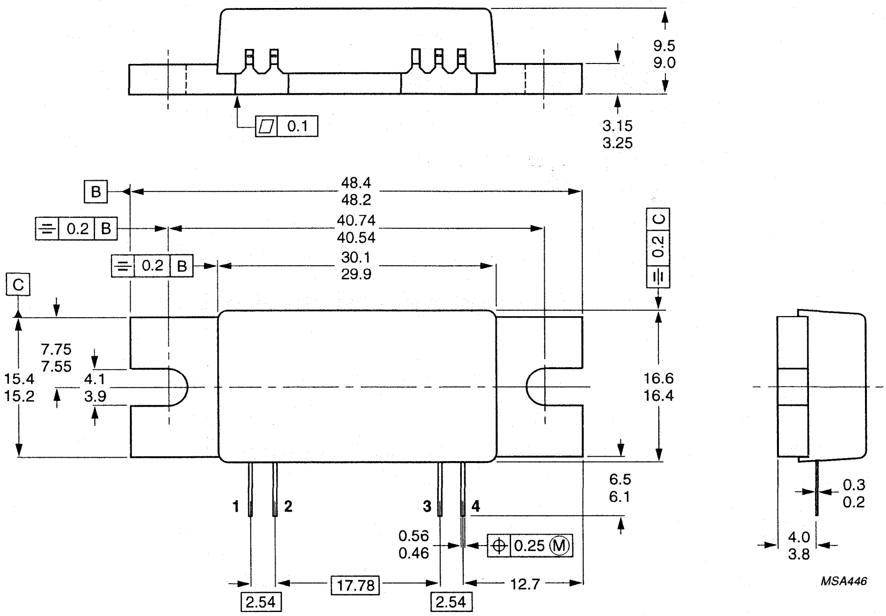
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

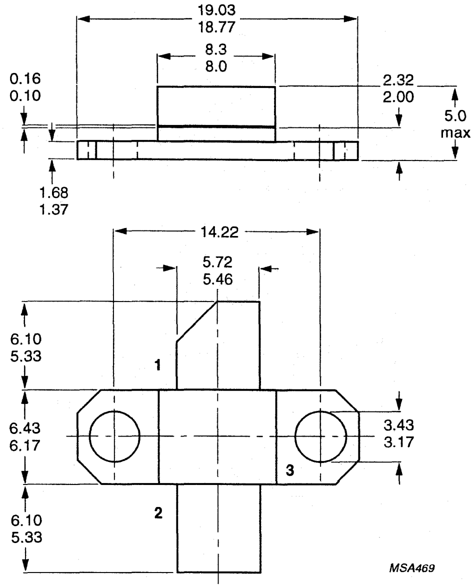
Heatsink compound must be applied sparingly and evenly distributed.

Fig.19 SOT324.



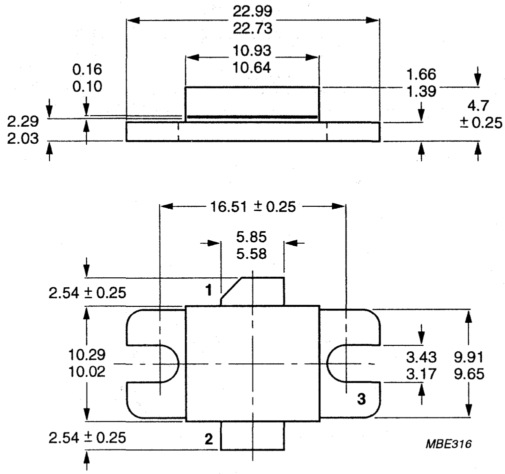
Dimensions in mm.

Fig.20 SOT365A.



Dimensions in mm.
Recommended screw: M3.
Torque on screws: max. 0.5 Nm.

Fig.21 SOT390A.



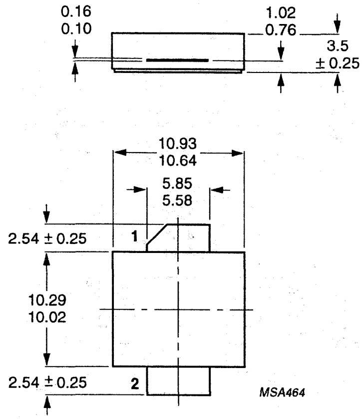
Dimensions in mm.

Torque on screw: min. 0.6 Nm; max. 0.75 Nm.

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

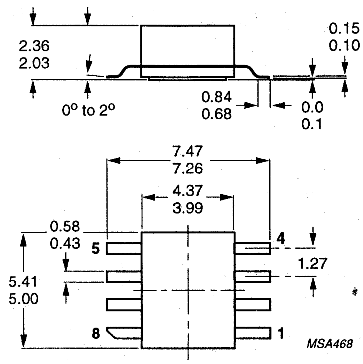
Heatsink compound must be applied sparingly and evenly distributed.

Fig.22 SOT391.



Dimensions in mm.

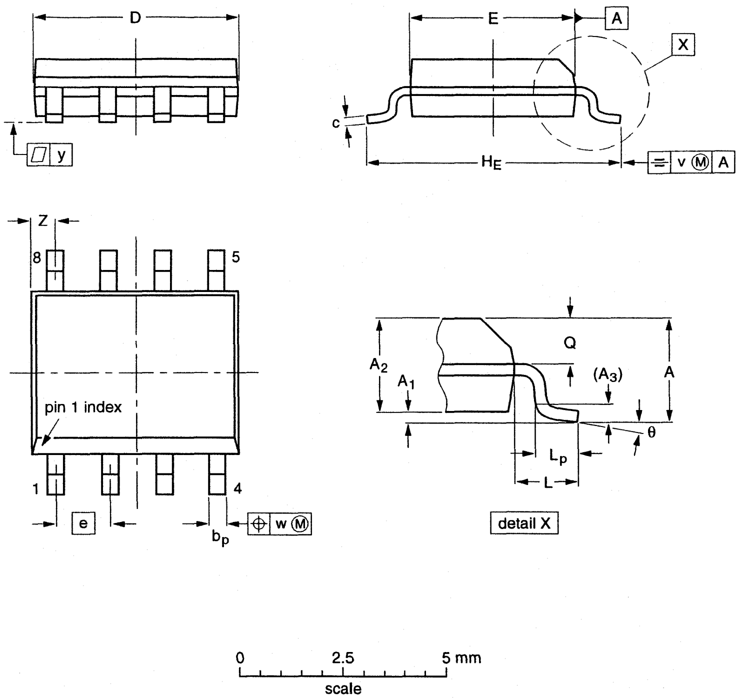
Fig.23 SOT391B.



Dimensions in mm.

Fig.24 SOT409B (SO8).

SO8: plastic small outline package; 8 leads; body width 3.9 mm **SOT96-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(2)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.20 0.19	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

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	IEC	JEDEC	EIAJ			
SOT96-1	076E03S	MS-012AA				~~92-11-17~~ 95-02-04

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