DISCRETE SEMICONDUCTORS

RF Power MOS Transistors

BOOK SC08b 1991

Philips Components

PHILIPS

RF POWER MOS TRANSISTORS

Selection guide

RF Power MOS Transistors

Selection guide

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

SSB CLASS-AB

f = 28 MHz; $d_3;d_5 < -30$ dB; 28 V and 50 V supply voltages.

P_L (PEP) W	V_{DS} V	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
30	28	20 (note 1)	SOT123	BLF145	35
30	50	23 (note 1)	SOT123	BLF175	57
80 (note 1)	28	20 (note 1)	SOT121	BLF246	147
150	28	17	SOT121	BLF147	47
150	50	20	SOT121	BLF177	71

SSB CLASS-A

f = 1.5 - 30 MHz; $d_3;d_5 < -40$ dB; 28 V and 50 V supply voltages.

P_L (PEP) W	V_{DS} V	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
2 (note 1)	28	23 (note 1)	SOT123	BLF242	111
4 (note 1)	28	23 (note 1)	SOT123	BLF244	121
8	28	24	SOT123	BLF145	35
20 (note 1)	28	23 (note 1)	SOT121	BLF246	147
8	50	24	SOT123	BLF175	57

VHF BASE STATIONS

25 - 175 MHz; class-B operation; 28 V and 50 V supply voltages.

P_L W	V_{DS} V	f MHz	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
3	28	175	14 (note 1)	SOT5/11	BLF241	101
5	28	175	13	SOT123	BLF242	111
15	28	175	13	SOT123	BLF244	121
30	28	175	13	SOT123	BLF245	131
30	28	175	18 (note 1)	SOT279	BLF245B	141
30	50	108	20 (note 1)	SOT123	BLF175	57
60	28	175	18 (note 1)	SOT161	BLF246B	159
80	28	108	16	SOT121	BLF246	147
150	28	108	13 (note 1)	SOT121	BLF147	47
150	50	108	19 (note 1)	SOT121	BLF177	71
150	50	108	20 (note 1)	SOT119	BLF277	165
300	50	108	20	SOT262	BLF278	173

VHF MOBILE TRANSMITTERS

25 - 175 MHz; class-B operation; 12.5 V supply voltage.

P_L W	V_{DS} V	f MHz	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
2	12.5	175	10	TO39/3	BLF221	85
2	12.5	175	10	SOT5/11	BLF241	101
6	12.5	175	15 (note 1)	SOT123	BLF244	121
12	12.5	175	12 (note 1)	SOT123	BLF245	131
30	12.5	175	8.5	SOT123	BLF225	91

UHF BASE STATIONS

225 - 400 MHz; class-B operation; 28 V supply voltage.

P_L W	V_{DS} V	f MHz	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
5	28	400	13 (note 1)	SOT123	BLF242	111
15	28	400	11 (note 1)	SOT123	BLF244	121
30	28	400	10 (note 1)	SOT123	BLF245	131

UHF BASE STATIONS

100 - 500 MHz; class-B operation; 28 V supply voltage.

P_L W	V_{DS} V	f MHz	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
2	12.5	500	10	SOT172D	BLF521	223
5	12.5	500	10	SOT171	BLF522	229
10	28	500	12	SOT171	BLF543	235
20	28	500	11	SOT171	BLF544	245
20	28	500	12	SOT268	BLF544B	255
40	28	500	11	SOT268	BLF545	265
80	28	500	11	SOT268	BLF546	275
150	28	500	9	SOT262	BLF548	287

UHF BASE STATIONS

860 - 960 MHz; class-B operation; 28 V supply voltage.

P_L W	V_{DS} V	f MHz	G_p dB	ENVELOPE	TYPE NUMBER	PAGE
10	28	960	8 (note 1)	SOT171	BLF543	235
20	28	960	7 (note 1)	SOT171	BLF544	245

TV TRANSPOSERS

Band 3: 174 - 230 MHz; class-A operation; 28 V supply voltage.

$P_{o\ sync}$ W	V_{DS} V	f MHz	G_p dB	d_{im} dB	I_D A	ENVELOPE	TYPE NUMBER	PAGE
30	28	225	14 (note 1)	–52	3	SOT119	BLF346	183
67 (note 3)	28	225	11	–52	2 x 4.6	SOT262	BLF348	193

TV TRANSMITTERS

Band 3: 174 - 230 MHz; class-AB operation.

$P_{o\ sync}$ W	V_{DS} V	f MHz	G_p dB	d_{im} dB	I_D A	ENVELOPE	TYPE NUMBER	PAGE
300 (note 2)	32	225	12	-	2 x 8.52	SOT262	BLF368	203
250 (note 2)	50	225	14	-	2 x 5	SOT262	BLF378	213

Notes

1. Typical value.
2. At 1 dB power gain compression.
3. At T_{hs} = 70 °C.

Line-ups

RF Power MOS Transistors

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.

In some cases, detailed application reports are available. In all other cases, additional information concerning power gain and input impedance and distortion are available on request.

GENERAL

In the following tables, for TV transposers and transmitters, the input powers quoted relate to the peak sync levels.

$P_{o\ sync}$ for transposers is the peak sync output power for a three-tone intermodulation distortion of –54 dB (vision carrier –8 dB, sound carrier –7 dB, sideband signal –16 dB) without pre-correction.

$P_{o\ sync}$ is the peak sync output power of a transposer before the sound carrier has been added. After addition of the sound carrier, the peak output power will be approximately twice $P_{o\ sync}$. In transposers with pre-correction, the intermodulation distortion is reduced and therefore $P_{o\ sync}$ can be increased. However, there is a limit formed by the saturated output power of the transistor. Taking this into account, $P_{o\ sat}$ is the maximum value of $P_{o\ sync}$ in pre-corrected systems.

In the transmitter line-ups, the output stage operates in class-AB, the driver stages in class-A.

$P_{o\ sync}$ for transmitters is the peak sync output power at 1 dB power gain compression.

SSB TRANSMITTERS

1.5 - 30 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L (PEP) W	V_{DS} V
15	BLF244 (note 1)	2 x BLF246	150	28
30	BLF145 (note 1)	2 x BLF147	300	28
60	BLF246 (note 1)	4 x BLF147	550	28

SSB TRANSMITTERS

1.5 - 30 MHz; 50 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L (PEP) W	V_{DS} V
15	BLF244 (notes 1 & 2)	2 x BLF177	300	50
10	BLF175 (note 1)	4 x BLF177	550	50
20	2 x BLF175 (note 1)	8 x BLF177	1000	50

MILITARY COMMUNICATION TRANSMITTERS

25 - 110 MHz; 12.5 V and 28 V supply voltages.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	P_L W	V_{DS} V
150	BLF242 (note 1)	2 x BLF244	-	12	12.5
500	BLF244 (note 1)	2 x BLF245	-	60	28
100	BLF242 (note 1)	BLF245 (note 1)	2 x BLF246	150	28

MOBILE TRANSMITTERS

68 - 87.5 MHz; 12.5 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L W	V_{DS} V
15	BLF221	BLF245	12	12.5
25	BLF221	BLF225	25	12.5

BASE STATIONS

68 - 87.5 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L W	V_{DS} V
30	BLF241	BLF245	30	28
80	BLF242	BLF246	80	28
150	BLF244	BLF147	150	28

FM BROADCAST TRANSMITTERS

87.5 - 108 MHz; 28 V and 50 V supply voltages.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L W	V_{DS} V
240	BLF244	BLF248	300	28
120	BLF244 (note 2)	BLF278	300	50
240	BLF244 (note 2)	2 x BLF278	550	50
320	BLF175	4 x BLF278	1000	50

RF Power MOS Transistors — Line-ups

AM AIRCRAFT TRANSMITTERS

108 - 144 MHz; 28 V and 50 V supply voltages.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L (carr.) W	V_{DS} V
100	BLF242	BLF246	20	28
280	BLF244	BLF147	35	28
120	BLF242 (note 2)	BLF278	75	50

MOBILE TRANSMITTERS

132 - 174 MHz; 12.5 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	P_L W	V_{DS} V
100	BLF221	BLF245	12	12.5
150	BLF522	BLF225	25	12.5

BASE STATIONS

132 - 174 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	P_L W	V_{DS} V
120	BLF241	BLF245	-	30	28
220	BLF242	BLF246	-	80	28
70	BLF241	BLF245	BLF147	150	28

TV TRANSPOSERS

Band 3: 174 - 230 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	$P_{o\ sync}$ W	$P_{o\ sat}$ W	V_{DS} V
5	BLF242 (note 3)	2 x BLF244 (note 3)	BLF348	40	60	28
12	BLF244 (note 3)	2 x BLF245 (note 3)	2 x BLF348	75	115	28
20	BLF244 (note 3)	2 x BLF346	4 x BLF348	140	220	28

TV TRANSMITTERS

Band 3: 174 - 230 MHz; 32 V and 50 V supply voltages.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	$P_{o\ sync}$ W	V_{DS} V
50	BLF242 (note 3)	2 x BLF244 (note 3)	BLF368	300	32
100	BLF242 (note 3)	2 x BLF245 (note 3)	2 x BLF368	550	32
160	BLF242 (note 3)	2 x BLF346	4 x BLF368	1000	32
50	BLF242 (notes 2 & 3)	2 x BLF175 (note 3)	6 x BLF378	1250	50

AM MILITARY AIRCRAFT TRANSMITTERS

100 - 400 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	$P_{L\ (PEP)}$ W	V_{DS} V
30	BLF521 (note 4)	BLF522 (note 4)	BLF545	40	28
25	BLF521 (note 4)	BLF543	BLF546	80	28
100	BLF521 (note 4)	BLF544	BLF548	150	28

BASE STATIONS

400 - 470 MHz; 28 V supply voltage.

INPUT POWER mW	1st STAGE	2nd STAGE	3rd STAGE	P_L W	V_{DS} V
35	BLF521 (note 4)	BLF522 (note 4)	BLF545	40	28
40	BLF521 (note 4)	BLF543	BLF546	80	28
150	BLF521 (note 4)	BLF544	BLF548	150	28

Notes

1. Class-A.
2. V_{DS} = 28 V.
3. Recommended types based on typical behaviour. Bipolar alternatives are: BLV30, BLV31 and BLV32F. See Handbook SC08a.
4. V_{DS} = 12.5 V.

Type number survey

RF Power MOS Transistors

Type number survey

TYPE	ENVELOPE	MODE OF OPERATION	V_{DS} V	FREQUENCY MHz	OUTPUT POWER W	POWER GAIN dB	PAGE
BLF145	SOT123	SSB; class-A SSB; class-AB	28 28	28 28	8 (note 1) 30 (note 2)	min. 24 typ. 20	**35**
BLF147	SOT121	SSB; class-AB CW; class-B	28 28	28 108	150 (note 3) 150	min. 17 typ. 14	**47**
BLF175	SOT123	SSB; class-A SSB; class-AB CW; class-B	50 50 50	28 28 108	8 (note 1) 30 (note 2) 30	min. 24 typ. 24 typ. 30	**57**
BLF177	SOT121	SSB; class-AB CW; class-B	50 50	28 108	150 (note 3) 150	min. 20 typ. 19	**71**
BLF221	TO-39/3	CW; class-B	12.5	175	2	min. 10	**85**
BLF225	SOT123	CW; class-B	12.5	175	30	min. 8.5	**91**
BLF241	SOT5/11	CW; class-AB CW; class-B	12.5 28	175 175	2 3	min. 10 typ. 12.5 typ. 14	**101**
BLF242	SOT123	CW; class-B	28	175	5	min. 13	**111**
BLF244	SOT123	CW; class-B CW; class-B	28 12.5	175 175	15 6	min. 13 typ. 17 typ. 15	**121**
BLF245	SOT123	CW; class-B CW; class-B	28 12.5	175 175	30 12	min. 13 typ. 15.5 typ. 12	**131**
BLF245B	SOT279	CW; class-B	28	175	30	min. 14 typ. 18	**141**
BLF246	SOT121	CW; class-B CW; class-B CW; class-C	28 28 28	108 108 108	80 80 80	min. 16 typ. 16 typ. 15	**147**
BLF246B	SOT161	CW; class-B	28	175	60	min. 14 typ. 18	**159**
BLF277	SOT119	CW; class-B	50	108	150	typ. 20	**165**
BLF278	NO-298	CW; class-B CW; class-C	50 50	108 108	300 300	min. 20 typ. 22 typ. 18	**173**
BLF346	SOT119	CW; class-A	28	224.25	typ. 27 (note 4) typ. 20 (note 5)	typ. 13 typ. 13.5	**183**
BLF348	SOT262	CW; class-A	28	224.25	min. 67 (note 4) min. 54 (note 5)	min. 11 min. 11	**193**
BLF368	NO-298	CW; class-AB CW; class-AB CW; class-AB	32 35 28	225 225 175	300 300 300	min. 12 typ. 14 typ. 15	**203**
BLF378	NO-298	CW; class-AB CW; class-AB	50 50	225 225	250 250	min. 14 typ. 16	**213**
BLF521	SOT172D	CW; class-B	12.5	500	2	min. 10 typ. 12	**223**
BLF522	SOT171	CW; class-B	12.5	500	5	min. 10 typ. 11	**229**
BLF543	SOT171	CW; class-B CW; class-B	28 28	500 960	10 10	min. 12 typ. 8	**235**
BLF544	NO-297	CW; class-B CW; class-B	28 28	500 960	20 20	min. 11 typ. 7	**245**

RF Power MOS Transistors

Type number survey

TYPE	ENVELOPE	MODE OF OPERATION	V_{DS} V	FREQUENCY MHz	OUTPUT POWER W	POWER GAIN dB	PAGE
BLF544B	SOT268	CW; class-B	28	500	20	min. 12 typ. 15	255
BLF545	NO-297	CW; class-B	28	500	40	min. 11 typ. 13	265
BLF546	SOT268	CW; class-B	28	500	80	min. 11 typ. 13	275
BLF548	NO-298	CW; class-B	28	500	150	min. 10	287

Notes

1. PEP at d_3 max. –40 dB.
2. PEP at d_3 typ. –35 dB.
3. PEP at d_3 max. –30 dB.
4. $P_{o\ sync}$ at d_{im} = –52 dB, T_h = 70 °C.
5. $P_{o\ sync}$ at d_{im} = –55 dB, T_h = 70 °C.

General

Type designation
Rating systems
Letter symbols
Mounting recommendations
Antistatic handling precautions

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

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

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

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

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

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

SECOND LETTER

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

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

SERIAL NUMBER

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

VERSION LETTER

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

SUFFIX

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

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

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

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

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

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

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

RATING SYSTEMS

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

DEFINITIONS OF TERMS USED

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

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

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

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

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

Note
Limiting conditions may be either maxima or minima.

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

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

ABSOLUTE MAXIMUM RATING SYSTEM

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

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

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

DESIGN MAXIMUM RATING SYSTEM

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

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

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

DESIGN CENTRE RATING SYSTEM

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

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

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

DRAIN CURRENT

The drain DC current rating of the devices in this handbook is based on the maximum current needed for the recommended application and not on the actual physical limitation of the device. Between these two, there is a considerable margin, e.g. the MOS transistor BLF246 has a DC drain current rating of 7 A. The maximum current needed to deliver 80 W at 28 V with an efficiency of 55% is 5.2 A. However, the chip metallization allows at least 12 A and the bonding wires allow an even greater figure. Similar information on other types can be obtained upon special request.

THERMAL RESISTANCE

The $R_{th\ j\text{-}mb}$ specified is a maximum value. The actual value is lower. In addition, this value is determined by means of infrared scanning equipment at a heatsink temperature of 70 °C and a dissipation causing a peak junction temperature of 200 °C. For the BLF246, this means that the specified $R_{th\ j\text{-}mb}$ is 1.35 K/W, and that actually measured is 1.10 – 1.25 K/W, at a 120 W dissipation level.

At moderate dissipation and 25 °C case temperature, this drops to 0.8 – 0.9 K/W, so the actual T_j is much lower than that calculated from the specified $R_{th\ j\text{-}mb}$.

On special request, graphs are available, showing the typical $R_{th\ j\text{-}mb}$ as a function of power dissipation and case or heatsink temperature. This holds true for all transmitting types.

Due to the gold sandwich metallization system and the gold bonding wires, the mean time to failure (MTTF) of all the RF PowerMOS transistors in this handbook will be in excess of 70 000 hours, provided that the devices are used within the published ratings. It must be kept in mind that an increase of T_j by 10 °C will reduce the MTTF by a factor of 2.3.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

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

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

Subscripts

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

Note: No additional subscript is used for DC values.

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

a) continuous (DC) values (without signal)

Example I_D

b) instantaneous total values

Example i_D

c) average total values

Example $I_{D(AV)}$

d) peak total values

Example I_{DM}

e) root-mean-square total values

Example $I_{D(RMS)}$

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

a) instantaneous values

Example i_d

b) root-mean-square values

Example $I_{d(rms)}$

c) peak values

Example I_{dm}

d) average values

Example $I_{d(av)}$

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

Additional rules for subscripts

Subscripts for currents

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

Examples: I_D, i_D, i_d, I_{dm}

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

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

Subscripts for voltages

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

Examples: V_{GS}, v_{GS}, v_{gs}, V_{gsm}

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

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

Subscripts for supply voltages or supply currents

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

Examples: V_{DD}, I_{SS}

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

Example : V_{DDS}

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

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

Examples: I_{G2} = continuous (DC) current flowing into the second gate terminal

$V_{G2\text{-}S}$ = continuous (DC0 voltage between the terminals of second gate and source

Subscripts for multiple devices

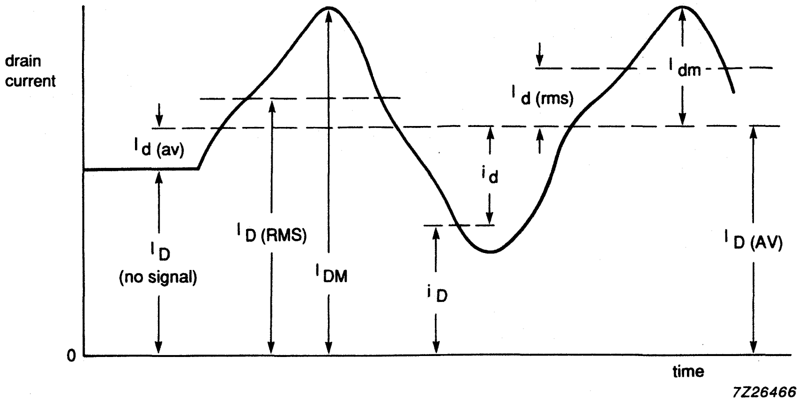
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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

$V_{1D\text{-}2D}$ = continuous (DC) voltage between the drain terminals of the first and the second unit

Application of the rules

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



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Defenition

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

Basic letters

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

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

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

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

b) all inductances and capacitances.

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

Subscripts

General subscripts

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

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

Examples: Z_S, h_f, h_F

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

Examples : g_{FS} = static value of forward transconductance in common-source configuration (DC current gain)

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

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

Examples: g_{FS} = small-signal value of the short-circuit forward transconductance in common-source configuration

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

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

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

Subscripts for four-pole matrix parameters

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

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

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

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

Distinction between real and imaginary parts

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

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

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

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

RECOMMENDATIONS FOR MOUNTING FLANGE RF POWER TRANSISTORS

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

- Holes or tapped holes in the heatsink should be free from burrs. They must have a depth of at least 6 mm.
  Recommended screw: for SOT119, SOT121 and SOT161 cheese-head 4-40 UNC/2A, for SOT123 and SOT160 also M3. A washer to spread the joint pressure is also recommended.
- For transistors dissipating up to 80 W the heatsink thickness should be at least 3 mm copper ($>$ 99,9%, ETP-Cu) or 5 mm aluminium ($>$ 99,0% Al). For transistors dissipating more power, the thickness should be increased proportionally.
- The flatness of the heatsink mounting surface must be $>$ 0,02 mm with a surface roughness $R_a < 0{,}5\ \mu m$ (preferably by grinding or lapping).
- The sparing use of evenly distributed heatsink compound on the transistor flange is recommended. Suitable heatsink compound brands are: Dow Corning 340, Eccotherm TC-5 (E&C), Wakefield 120.
- The screws through the flange holes should first both be tightened to 0,05 Nm (finger tight), and then tightened to 0,6 to 0,75 Nm, to achieve the published thermal resistance between the mounting base and heatsink.
- When a transistor is removed from the heatsink, the flange will almost certainly have been distorted by the joint pressure. Grinding or lapping of the flange according to the information above is necessary if the transistor is remounted.

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

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

Screw threads, diameter and nuts:

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

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

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

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

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

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

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

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

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

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

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

ANTISTATIC HANDLING PRECAUTIONS

ELECTROSTATIC CHARGES

Electrostatic charges can be stored in many things, e.g. 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 depends 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. MOS devices can be damaged if the following precautions are not taken.

WORK STATION

Figure 1 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 1 kΩ to 0.5 MΩ 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 electrical equipment should be connected to the mains via an earth-leakage switch and the 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

RF PowerMOS transistors are packed for despatch in antistatic boxes. The fact that the devices are sensitive to electrostatic discharge is shown by warning labels on both primary and secondary packing.

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

ASSEMBLY

MOS 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 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, not 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 doesn't touch the conductive surface of the work bench. After testing, replace the circuit board on the conductive foam, to await packing.

Handle assembled circuit boards containing MOS devices in the same way as unmounted devices. They should also carry warning labels and be packed in conductive or antistatic packing.

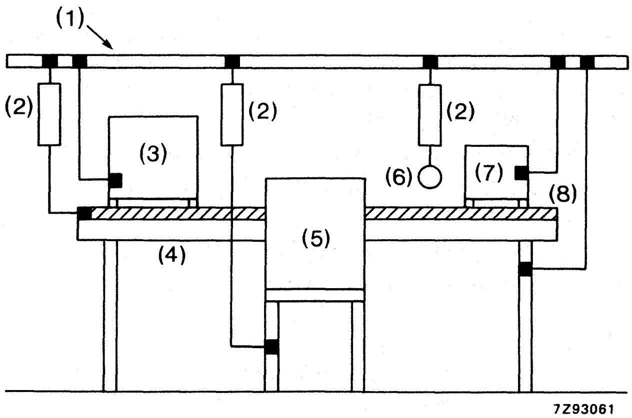


Fig.1 Protected work station.

(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

Device data

HF POWER MOS TRANSISTOR

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

Features

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

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

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

QUICK REFERENCE DATA

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

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

MECHANICAL DATA

SOT123 (see Fig. 1).

Note

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

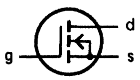
PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



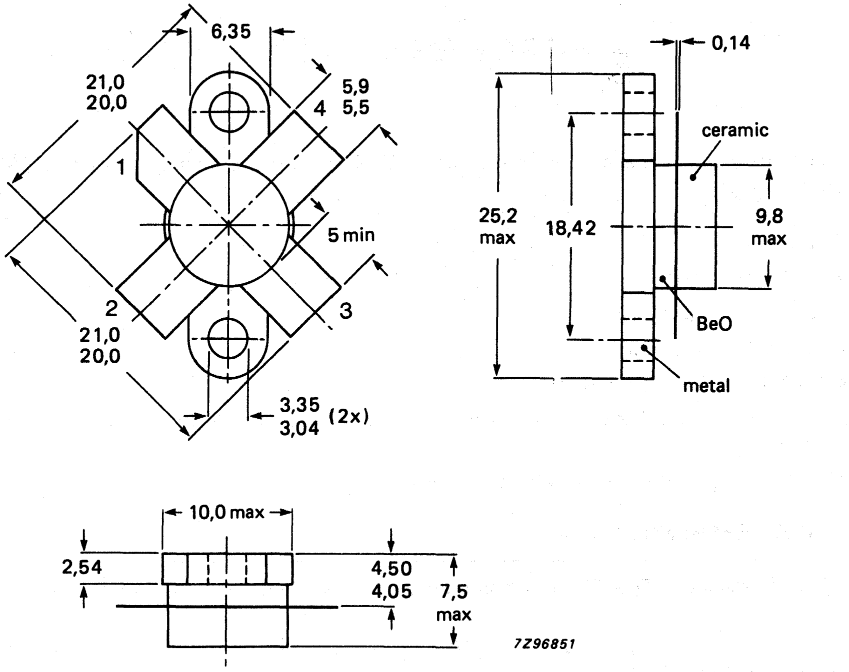


Fig. 1 SOT123.

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

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

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

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

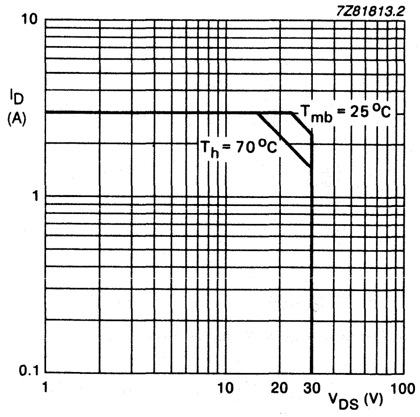


Fig.2 Drain current as a function of drain-source voltage.

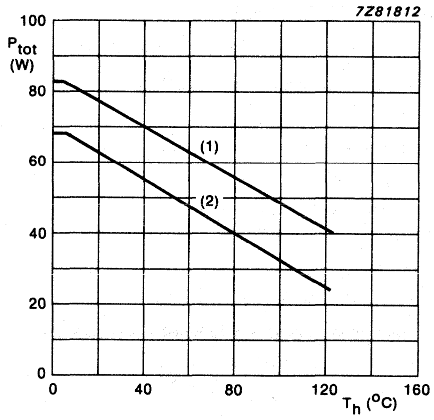


Fig. 3 Power/temperature derating curves.
(1) Short-time operation during mismatch.
(2) Continuous operation.

THERMAL RESISTANCE

$P = 68$ W; $T_{mb} = 25$ °C

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

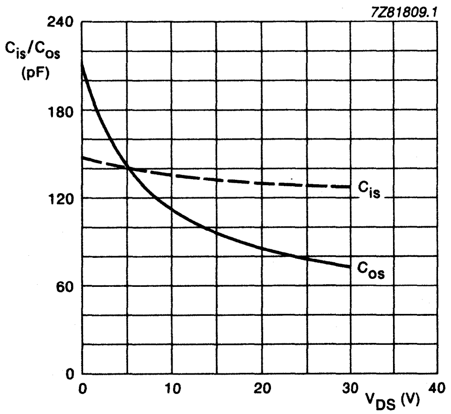


Fig. 4 Input and output capacitances as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

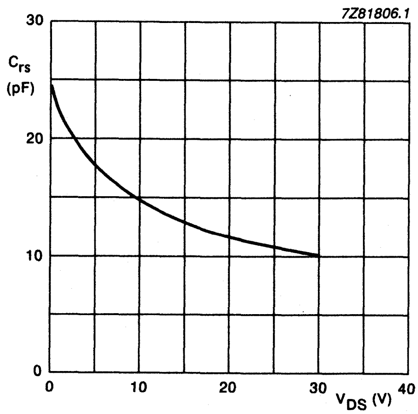


Fig. 5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

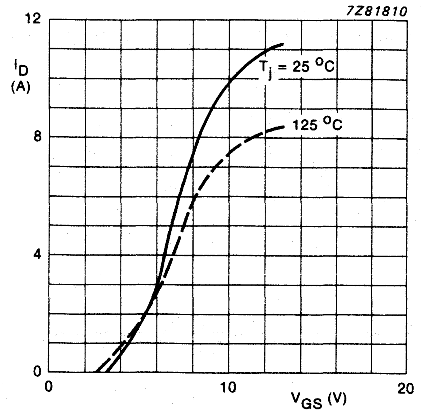


Fig. 6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

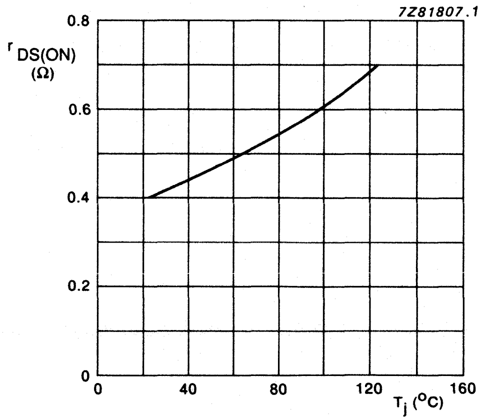


Fig. 7 Drain-source on-state resistance as a function of junction temperature; I_D = 1.5 A; V_{DS} = 10 V; typical values.

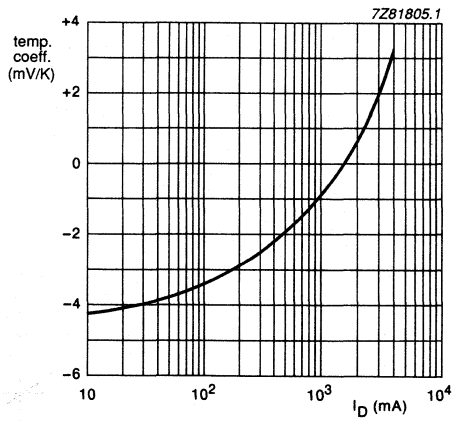


Fig. 8 Temperature coefficient of gate-source voltage as a function of drain current; V_{DS} = 10 V; typical values.

APPLICATION INFORMATION

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

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

*** Note**

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

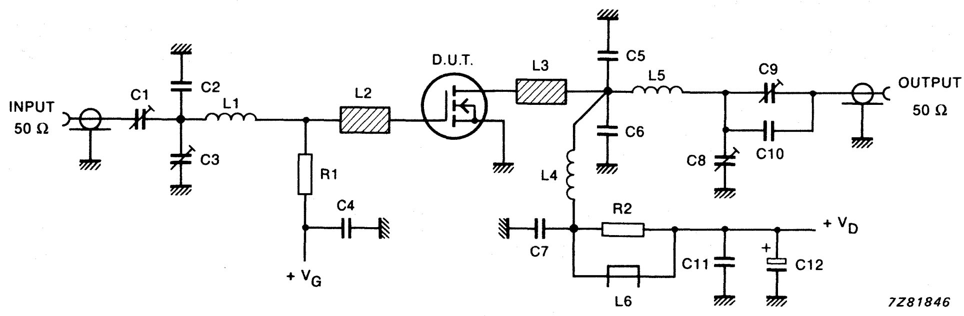


Fig. 9 Class-A test circuit at f = 28 MHz.

List of components: (class-A test circuit)

R1	= 26 Ω; metal film resistor (0.25 W)
R2	= 10 Ω; metal film resistor (0.25 W)
C1, C3, C8, C9	= 7 - 100 pF, film dielectric trimmer, cat. no. 2222 809 07015
C2, C10	= 39 pF, ceramic multilayer chip capacitor*
C4, C7	= 100 nF, ceramic multilayer chip capacitor, cat. no. 2222 852 47104
C5, C6	= 27 pF, ceramic multilayer chip capacitor*
C11	= 3 x 100 nF, ceramic multilayer chip capacitor, cat. no. 2222 852 47104
C12	= 2.2 μF (63 V), electrolytic capacitor, cat. no. 2222 030 38228
L1	= 307 nH; 12 turns of enamelled Cu-wire (0.5 mm), int. diam. 4 mm, length 8 mm
L2, L3	= 30 Ω stripline, (15 mm x 6 mm)
L4	= 1039 nH; 14 turns of enamelled Cu-wire (1 mm), int. diam. 9 mm, length 14 mm
L5	= 305 nH; 9 turns of enamelled Cu-wire (1 mm), int. diam. 6 mm, length 10 mm
L6	= Ferroxcube wide-band HF choke, grade 3B, cat. no. 4312 020 36640

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

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

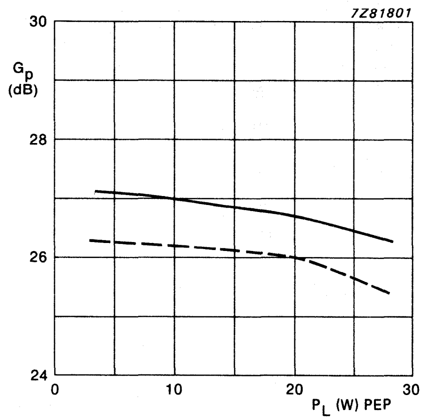


Fig. 10 Power gain as a function of load power.
——— T_h = 25 °C.
- - - - T_h = 70 °C.

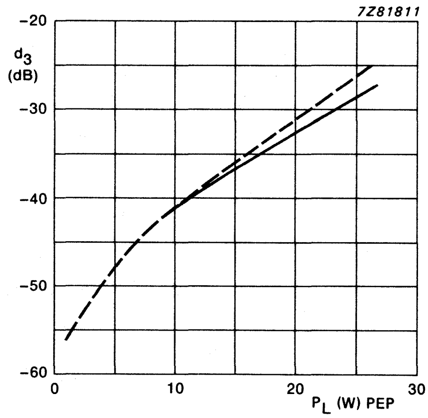


Fig. 11 Third order intermodulation distortion as a function of load power.
——— T_h = 25 °C.
- - - - T_h = 70 °C.

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

APPLICATION INFORMATION

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

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

*** Note**

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

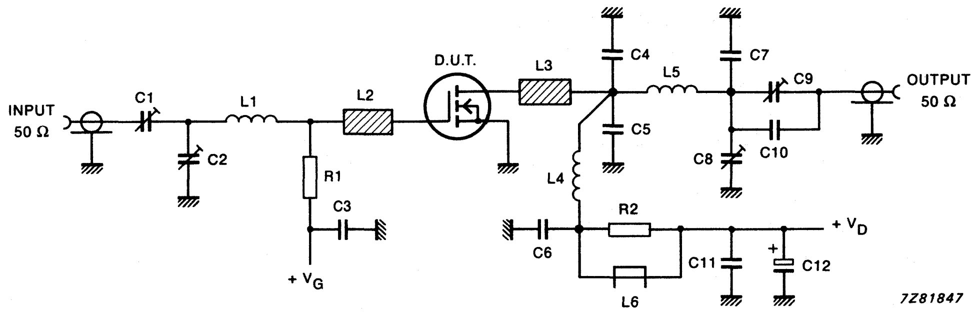


Fig. 12 Class-AB test circuit at f = 28 MHz.

List of components: (class-AB test circuit)

R1	= 34 Ω; metal film resistor (0.5 W)
R2	= 10 Ω; metal film resistor (0.25 W)
C1, C2	= 5 - 60 pF, film dielectric trimmer, cat. no. 2222 809 07011
C3, C6	= 100 nF, ceramic multilayer chip capacitor, cat. no. 2222 852 47104
C4, C5	= 27 pF, ceramic multilayer chip capacitor*
C7, C10	= 39 pF, ceramic multilayer chip capacitor*
C8, C9	= 7 - 100 pF, film dielectric trimmer, cat. no. 2222 809 07015
C11	= 3 x 100 nF, ceramic multilayer chip capacitor, cat. no. 2222 852 47104
C12	= 2.2 μF (63 V), electrolytic capacitor, cat. no. 2222 030 38228
L1	= 415 nH; 13 turns of enamelled Cu-wire (0.5 mm), int. diam. 5 mm, length 10 mm
L2, L3	= 30 Ω stripline, (15 mm x 6 mm)
L4	= 390 nH; 10 turns of enamelled Cu-wire (1 mm), int. diam. 7 mm, length 13 mm
L5	= 245 nH; 9 turns of enamelled Cu-wire (1 mm), int. diam. 5 mm, length 10 mm
L6	= Ferroxcube wide-band HF choke, grade 3B, cat. no. 4312 020 36640

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

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

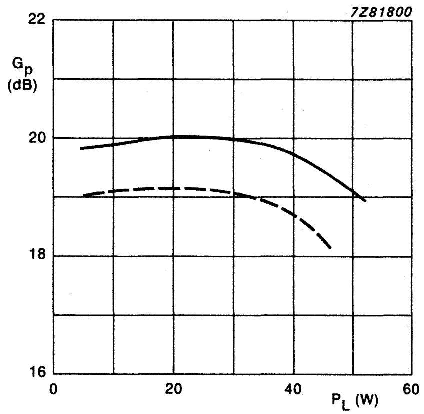


Fig. 13 Power gain as a function of load power.
——— T_h = 25 °C.
– – – – T_h = 70 °C.

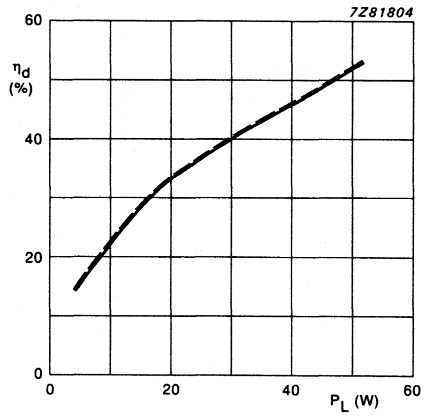


Fig. 14 Two tone efficiency as a function of load power.
——— T_h = 25 °C.
– – – T_h = 70 °C.

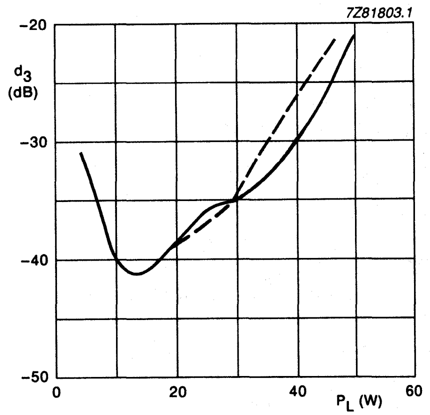


Fig.15 Third order intermodulation distortion as a function of load power.
——— T_h = 25 °C.
– – – – T_h = 70 °C.

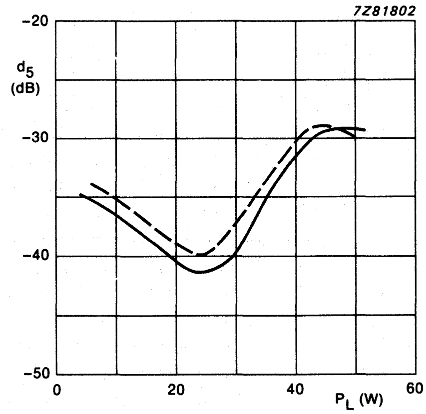


Fig.16 Fifth order intermodulation distortion as a function of load power.
——— T_h = 25 °C.
– – – – T_h = 70 °C.

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

RUGGEDNESS

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

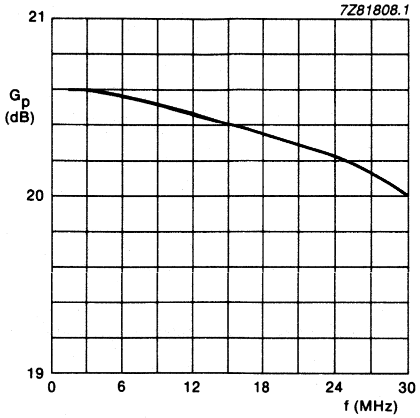


Fig. 17 Power gain as a function of frequency.

Conditions for Fig.17 and Table 1:
V_{DS} = 28 V; I_{DQ} = 0.25 A; P_L = 30 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.3 K/W; R_1 = 34 Ω; Z_L = 8.9 + j1 Ω; class-AB operation; typical values.

Table 1 Input impedance as a function of frequency

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

VHF POWER MOS TRANSISTOR

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in industrial and military equipment operating in the HF and VHF range.

Features

- High power gain
- Low intermodulation distortion
- Easy power control
- Good thermal stability
- Withstands full load mismatch

The BLF147 has a 4-lead flange envelope with a ceramic cap (SOT121). All leads are isolated from the flange.

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

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 %	d_3 dB	d_5 dB
SSB class-AB	28	28	150*	> 17	> 35	< −30	< −30
CW class-B	108	28	150	typ. 14	typ. 70		

MECHANICAL DATA

SOT121 (see Fig.1).

*PEP

NOTE

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

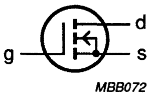
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



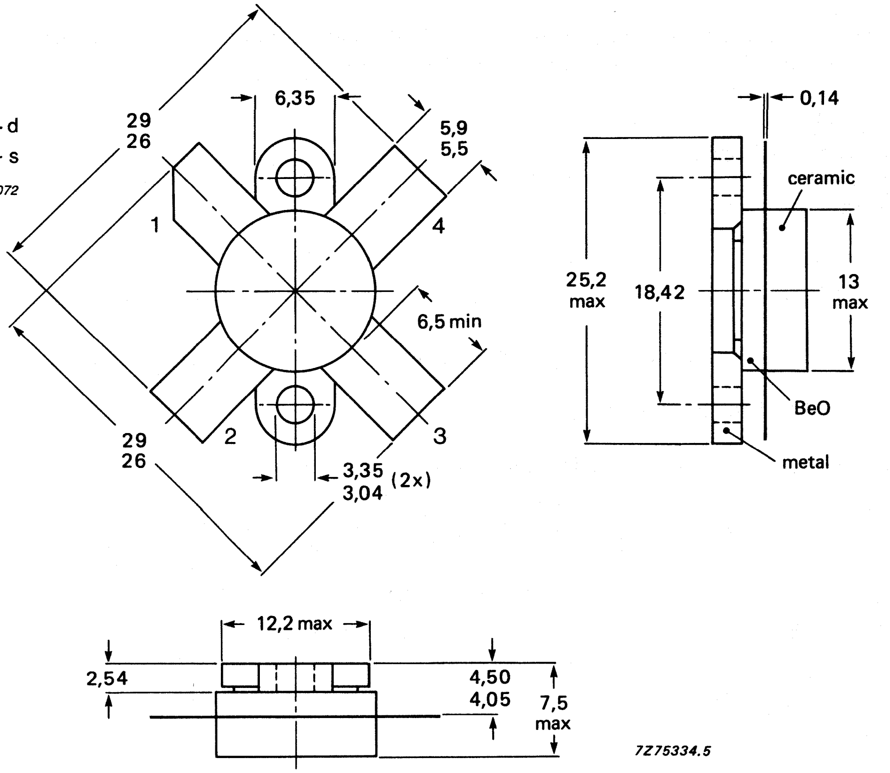


Fig.1 SOT121.

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

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

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current (DC)	I_D	max.	13 A
peak value; f > 1 MHz	I_{DM}	max.	40 A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	220 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

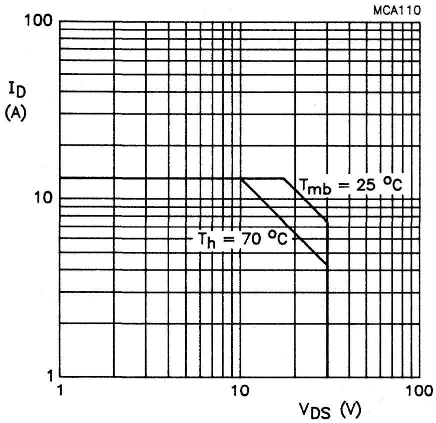
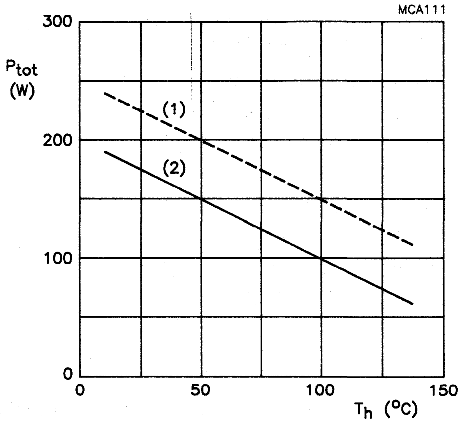


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 mA; V_{GS} = 0	$V_{(BR)DS}$	min.	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	max.	5.0 mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0 μA
Gate threshold voltage I_D = 100 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate-source voltage difference of matched pairs I_D = 100 mA; V_{DS} = 10 V	ΔV_{GS}	max.	100 mV
Forward transconductance I_D = 8 A; V_{DS} = 10 V	G_{fs}	min. typ.	5.0 S 7.5 S
Drain-source on-state resistance I_D = 8 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.1 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	37 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{is}	typ.	500 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0 V	C_{os}	typ.	360 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rs}	typ.	45 pF

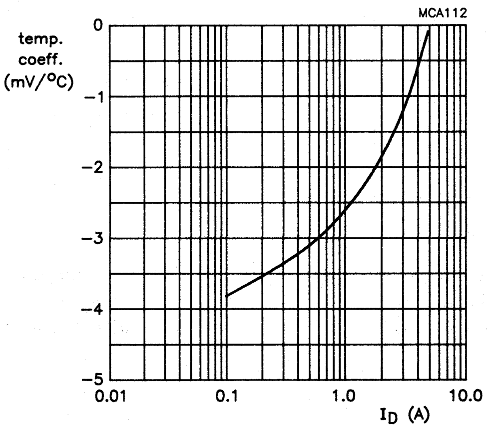


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 28 V; valid for T_h = 25 to 70 °C; typical values.

CHARACTERISTICS (continued)

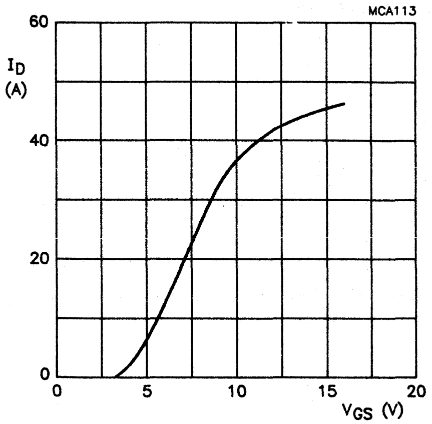


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

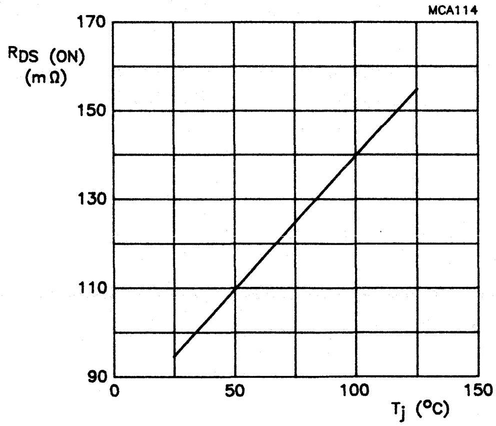


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 8 A; typical values.

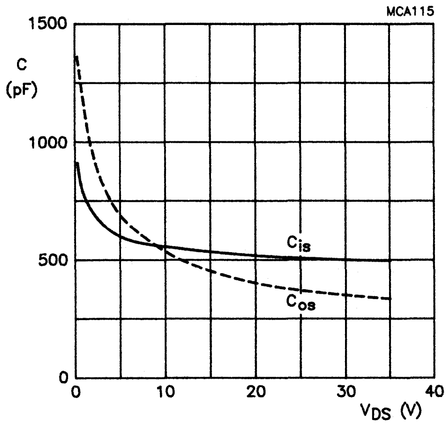


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

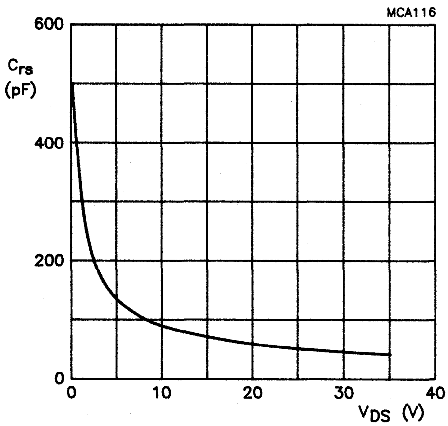


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; R_{GS} = 9.8 Ω (unless otherwise specified.)

RF performance in SSB operation (common-source Class-B circuit).
f_1 = 28.000 MHz; f_2 = 28.001 MHz.

output power W	f MHz	V_{DS} V	I_{DQ} A	G_P dB	η_D %	d_3* dB	d_5* dB
20 to 150 (PEP)	28	28	1	> 17 typ. 19	> 35 typ. 40	< −30 typ. −34	< −30 typ. −40

Optimum load impedance: 2.1 + j0 Ω

Ruggedness in class-AB operation

The BLF147 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 28 V and f = 28 MHz at rated load power.

* Stated figures are maxima encountered at any driving level between the specified value of PEP and are referred to the according level of either the equal amplified tones. Related to the according peak envelope power these figures should be decreased by 6 dB.

APPLICATION INFORMATION (continued)

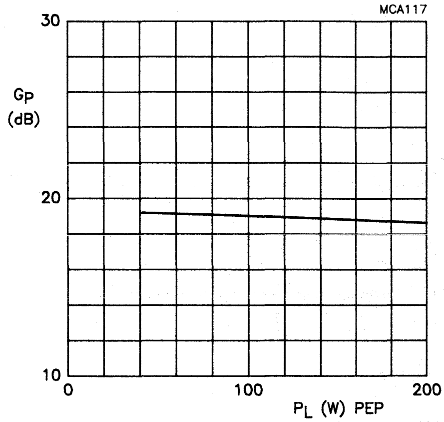


Fig.9 Gain as a function of load power; typical values.

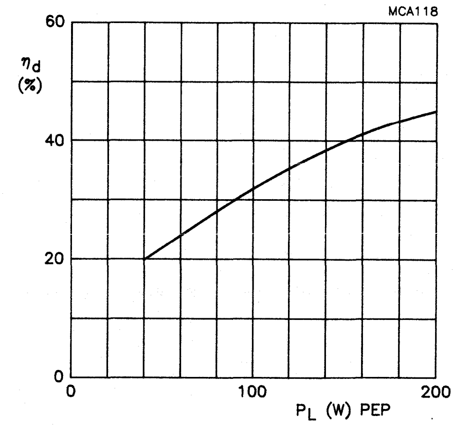


Fig.10 Efficiency as a function of load power; typical values.

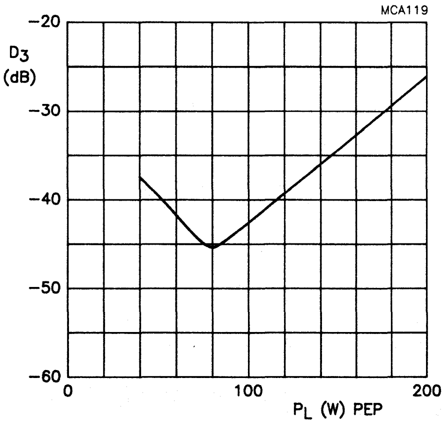


Fig.11 Third intermodulation product as a function of load power; typical values.

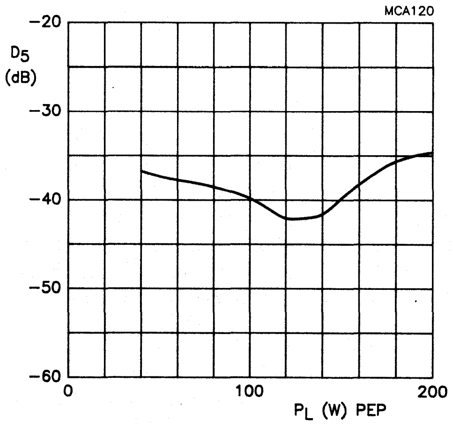


Fig.12 Fifth intermodulation product as a function of load power; typical values.

Conditions: Class-AB operation; V_{DS} = 28 V; I_{DQ} = 1 A; R_{GS} = 9.8 Ω; f_1 = 28.000 MHz; f_2 = 28.001 MHz.

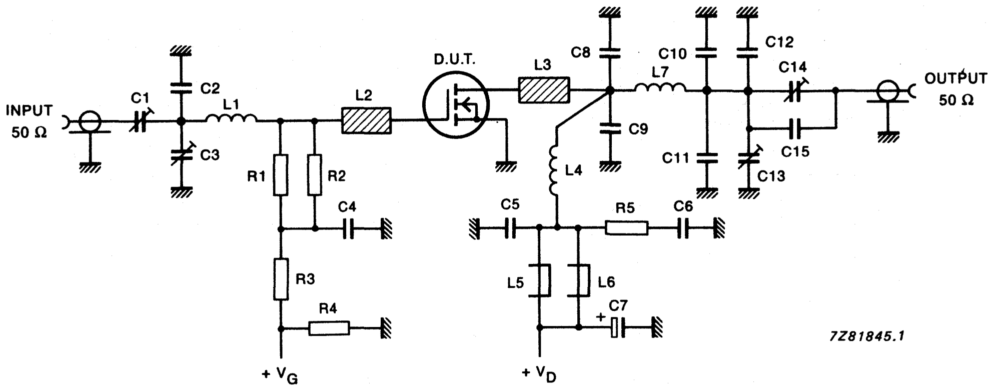


Fig.13 Class-AB test circuit at f = 28 MHz.

List of components:

C1 = C3 = C13 = C14 = 7 - 100 pF film dielectric trimmer (cat. no. 2222 809 07015)
C2 = C8 = C9 = 75 pF multilayer ceramic chip capacitor*
C4 = C5 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C6 = 3 x 100 nF multilayer ceramic chip capacitors in parallel (cat. no. 2222 852 47104)
C7 = 2.2 μF (63 V) electrolytic capacitor
C10 = 100 pF multilayer ceramic chip capacitor*
C11 = C12 = 150 pF multilayer ceramic chip capacitor*
C15 = 240 pF multilayer ceramic chip capacitor*

L1 = 145 nH, 6 turns enamelled Cu-wire (0.7 mm), int. dia: 6 mm; length 5 mm; leads 2 x 5 mm
L2 = L3 = 41.1 Ω stripline (13 mm x 6 mm)
L4 = 148 nH, 4 turns enamelled Cu-wire (1.5 mm), int. dia: 10 mm; length 8 mm; leads 2 x 5 mm
L5 = L6 = Ferroxcube HF choke, grade 3B (cat. no. 4312 020 36642)
L7 = 79 nH, 3 turns enamelled Cu-wire (2.2 mm), int. dia: 8 mm; length 8 mm; leads 2 x 5 mm

R1 = R2 = 19.6 Ω metal film resistor (1 W)	(cat.no. 2322 153 51969)
R3 = 10 kΩ metal film resistor (0.4 W)	(cat.no. 2322 151 71003)
R4 = 1 MΩ metal film resistor (0.4 W)	(cat.no. 2322 151 71005)
R5 = 10 Ω metal film resistor (1 W)	(cat.no. 2322 153 51009)

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

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

APPLICATION INFORMATION (continued)

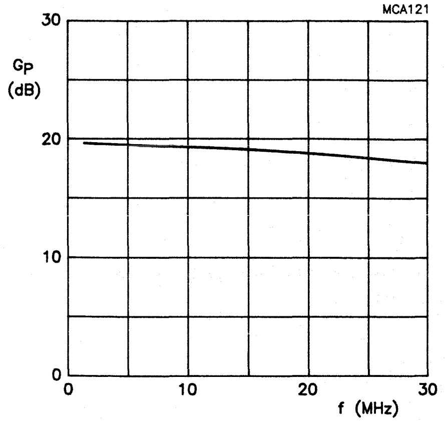


Fig.14 Gain as a function of frequency; typical values.

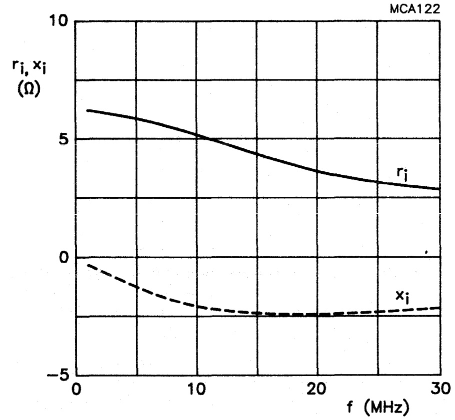


Fig.15 Input impedance as a function of frequency (series components); typical values.

Conditions for Figs 14 and 15:

Class-AB operation; V_{DS} = 28 V; I_{DQ} = 1 A; R_{GS} = 6.25 Ω; P_L = 150 W (PEP); R_L = 2.1 Ω.

APPLICATION INFORMATION (continued)

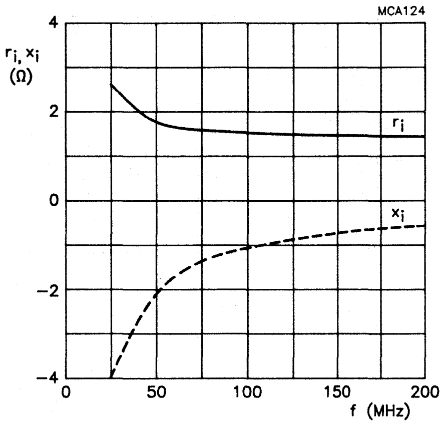


Fig.16 Input impedance as a function of frequency (series components); typical values.

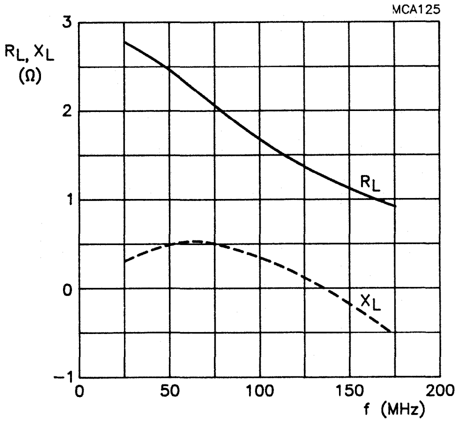


Fig.17 Load impedance as a function of frequency (series components); typical values.

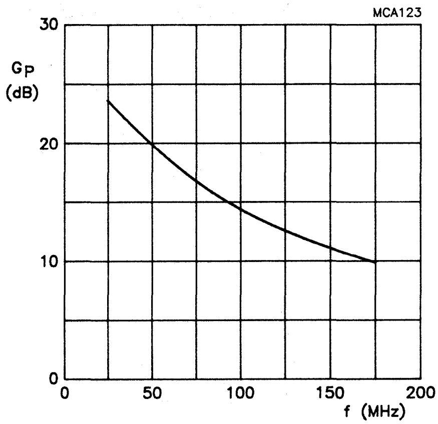


Fig.18 Power gain as a function of frequency; typical values.

Conditions for Figs 16 to 18:

Class-B operation; V_{DS} = 28 V; I_{DQ} = 0.2 A; P_L = 150 W; R_{GS} = 15 Ω.

HF/VHF POWER MOS TRANSISTOR

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

Features

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

The BLF175 has a 4-lead flange envelope with a ceramic cap (SOT123). All leads are isolated from the flange.

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

QUICK REFERENCE DATA

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

Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_P dB	η_D %	d_3 dB
Class-A	28	50	800	8.0*	> 24	–	< –40
Class-AB	28	50	150	30*	typ. 24	typ. 40**	typ. –35
CW Class-B	108	50	30	30	typ. 20	typ. 65	–

MECHANICAL DATA

SOT123 (see Fig.1).

Note

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

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

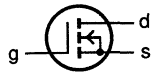
* PEP.
** 2-tone efficiency.

MECHANICAL DATA

Dimensions in mm

Pinning

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



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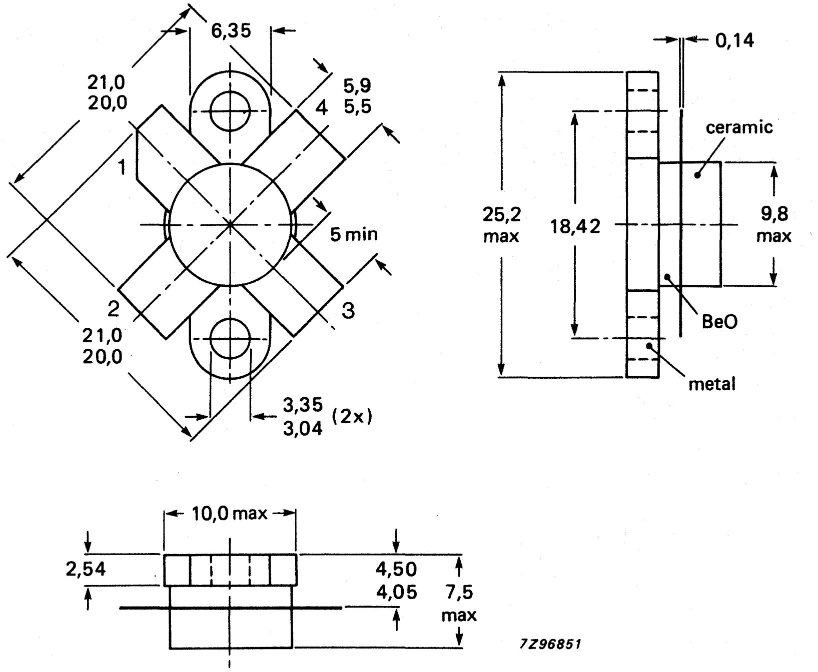

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Fig.1 SOT123.

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

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

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage	V_{DS}	max.	110	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
Drain current (DC)	I_D	max.	1.5	A
peak value; f > 1 MHz	I_{DM}	max.	5	A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	68	W
Storage temperature range	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

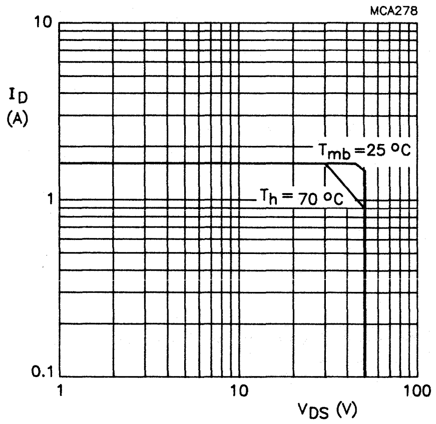
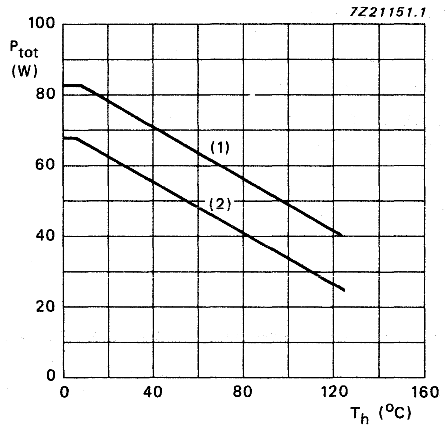


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

T_{mb} = 25 °C, P_{dis} = 68 W

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 10 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	110 V
Drain-source leakage current V_{DS} = 50 V; V_{GS} = 0	I_{DSS}	max.	100 μA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0 μA
Gate threshold voltage I_D = 10 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate-source voltage difference of matched pairs V_{DS} = 10 V; I_D = 10 mA	ΔV_{GS}	max.	100 mV
Forward transconductance I_D = 1 A; V_{DS} = 10 V	G_{fs}	min. typ.	1.1 S 1.6 S
Drain-source on-state resistance I_D = 1 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.75 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	5.5 A
Input capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{is}	typ.	130 pF

CHARACTERISTICS (continued)

Output capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0 V	C_{os}	typ.	36 pF
Feedback capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{rs}	typ.	3.7 pF

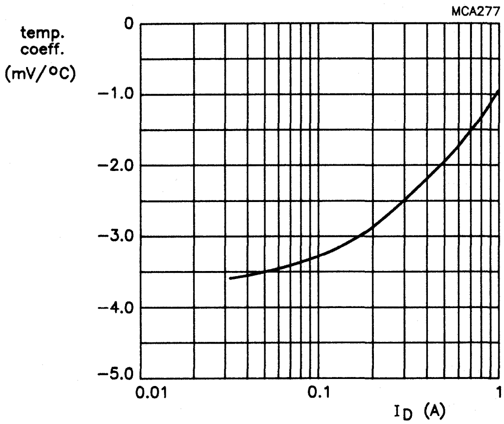


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

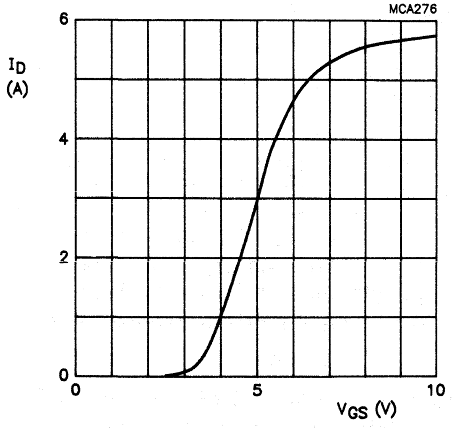


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

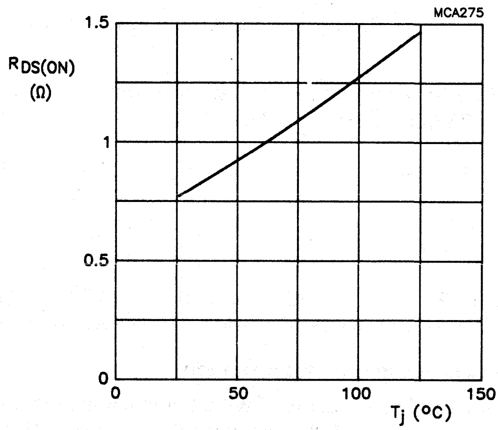


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 1 A; typical values.

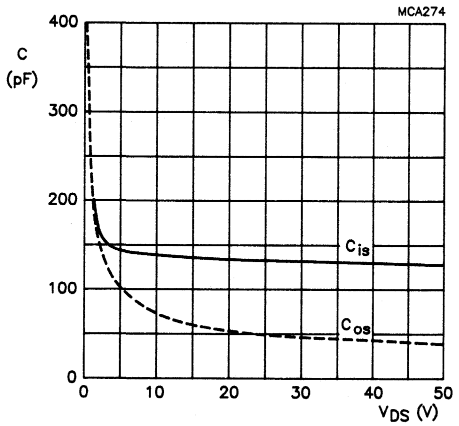


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

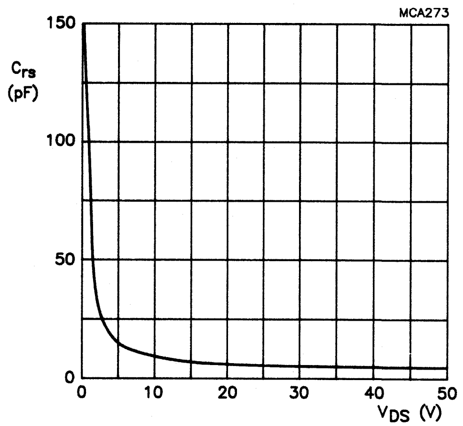


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

T_h = 25 °C; $R_{th\ mb-h}$ = 0.3 K/W, unless otherwise specified

RF performance in SSB operation (common-source circuit).
f_1 = 28 000 MHz; f_2 = 28 001 MHz.

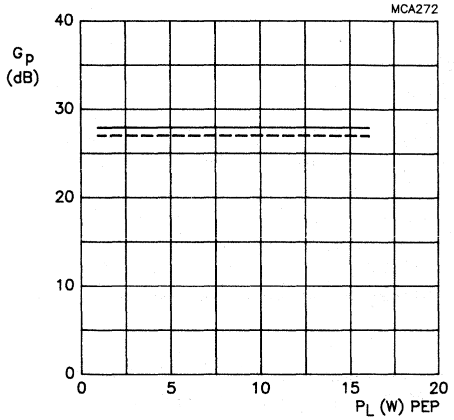
Output power W	f MHz	V_{DS} V	I_{DQ} mA	G_p dB	η_D %	d_3** dB	d_5** dB	R_{GS} Ω
0 to 8 (PEP)	28	50	800	> 24	–	< –40	< –40	24
				typ. 28	–	typ. –44	typ. –64	24
30 (PEP)	28	50	150	typ. 24	typ. 40*	typ. –35	typ. –40	22

Ruggedness in class-AB operation

The BLF175 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 50 V and f = 28 MHz at P_L = 30 W single tone.

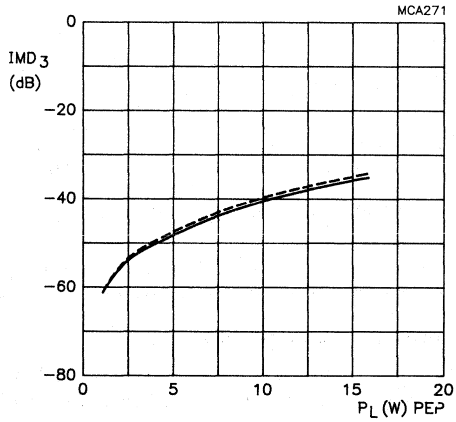
* 2-tone efficiency.

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



- - - - T_h = 70 °C
——— T_h = 25 °C

Fig.9 Power gain as a function of load power; typical values.



- - - - T_h = 70 °C
——— T_h = 25 °C

Fig.10 Third intermodulation product as a function of load power; typical values.

Conditions: Class-A operation, V_{DS} = 50 V, I_{DQ} = 0.8 A, R_{GS} = 24 Ω, f_1 = 28.000 MHz, f_2 = 28.001 MHz.

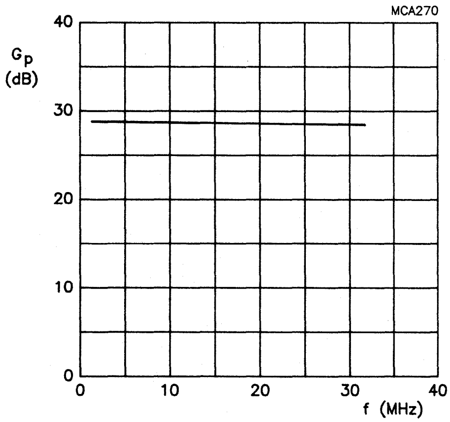


Fig.11 Power gain as a function of frequency; typical values.

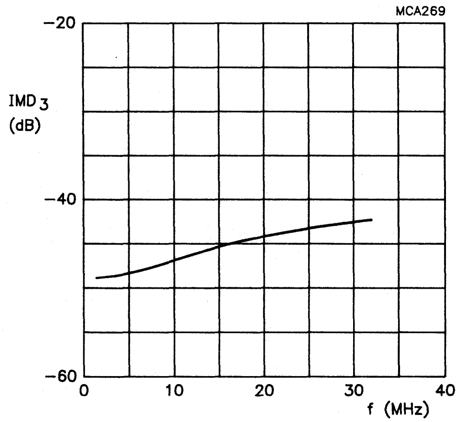


Fig.12 Third intermodulation product as a function of frequency; typical values.

Conditions: Class-A operation; P_L = 8 W PEP; V_{DS} = 50 V; I_{DQ} = 0.8 A; R_{GS} = 24 Ω; $f_1 - f_2$ = 1 kHz.

APPLICATION INFORMATION (continued)

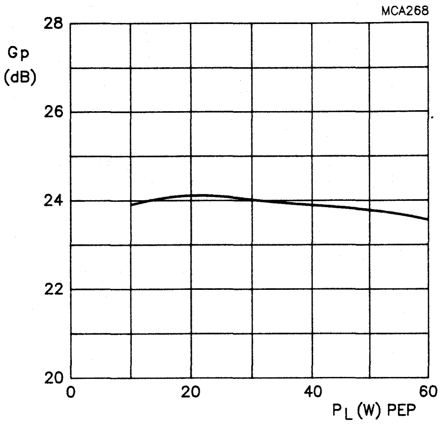


Fig. 13 Power gain as a function of load power; typical values.

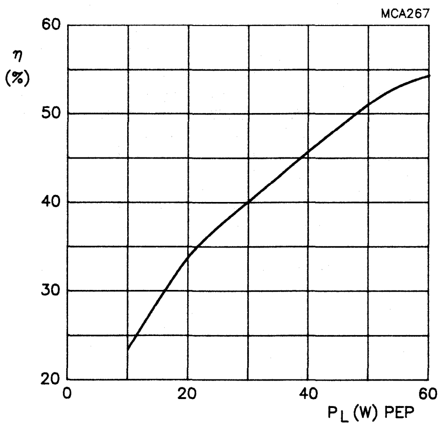


Fig. 14 Efficiency as a function of load power; typical values.

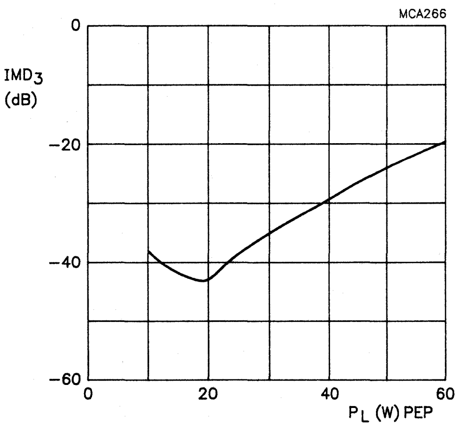


Fig. 15 Third intermodulation product as a function of load power; typical values.

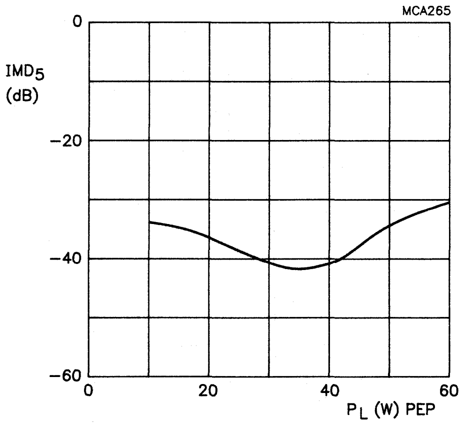


Fig. 16 Fifth intermodulation product as a function of load power; typical values.

Conditions: Class-AB operation; V_{DS} = 50 V; I_{DQ} = 0.15 A; R_{GS} = 22 Ω; f_1 = 28.000 MHz, f_2 = 28.001 MHz.

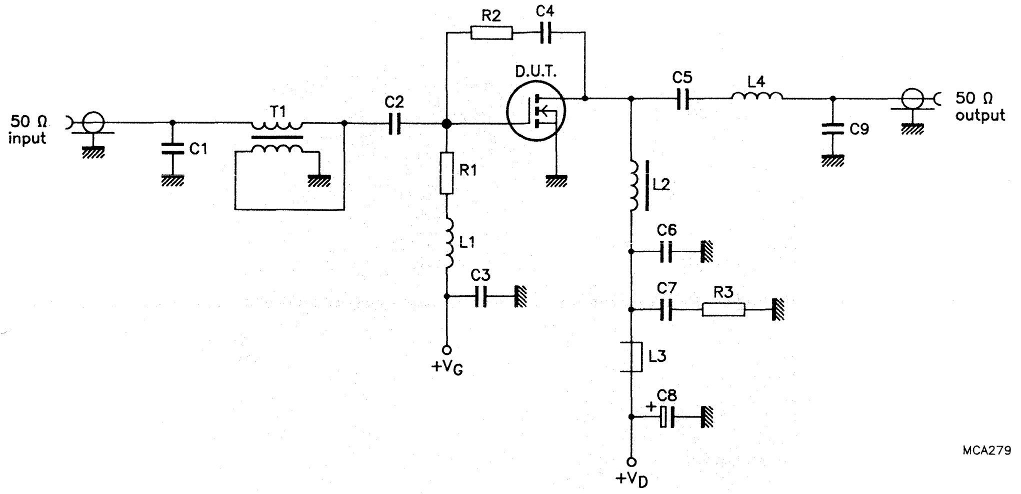


Fig.17 Class-A test circuit at f = 28 MHz.

List of components:

C1 = 3.9 pF multilayer ceramic chip capacitor*
C2 = 3 x 10 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47103)
C3 = C4 = C6 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C5 = 10 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47103)
C7 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C8 = 10 μF 63 V aluminium electrolytic capacitor (cat. no. 2222 030 28109)
C9 = 24 pF multilayer ceramic chip capacitor*

L1 = 86 nH; 4 turns enamelled Cu-wire (0.6 mm); int. diam. 5 mm; length 3.3 mm; leads 2 x 2 mm
L2 = 20 μH; drain choke; 36 turns enamelled Cu-wire (0.7 mm) wound on a Ferroxcube rod grade 4B1; int. diam. 5 mm; length 30 mm; (cat. no. 4330 030 30031)
L3 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)
L4 = 189 nH; 8 turns enamelled Cu-wire (1 mm); int. diam. 5 mm; length 9.5 mm; leads 2 x 3 mm

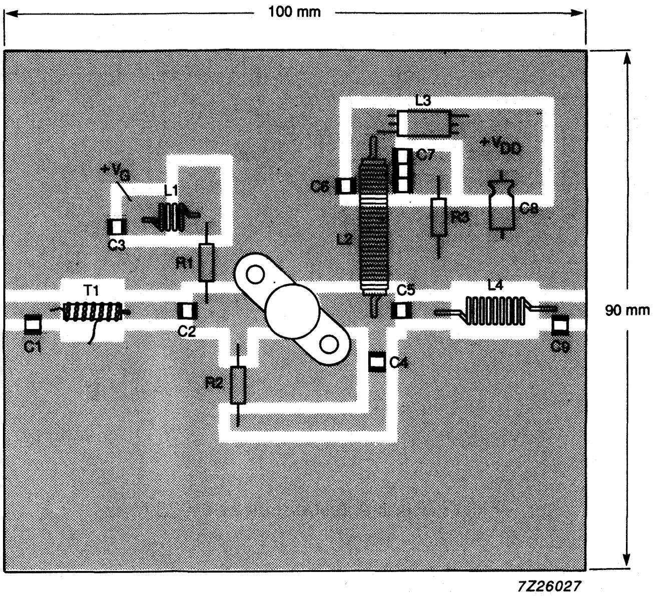
T1 = 4 : 1 transformer; 18 turns twisted pair of Cu-wire (0.25 mm) with 10 twists per cm, wound on a toroidal core grade 4C6; dimensions 9 x 6 x 3 mm (cat. no. 4322 020 97171)

R1 = 24 Ω metal film resistor (0.4 W)
R2 = 1500 Ω metal film resistor (0.4 W)
R3 = 10 Ω metal film resistor (0.4 W)

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

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

APPLICATION INFORMATION (continued)



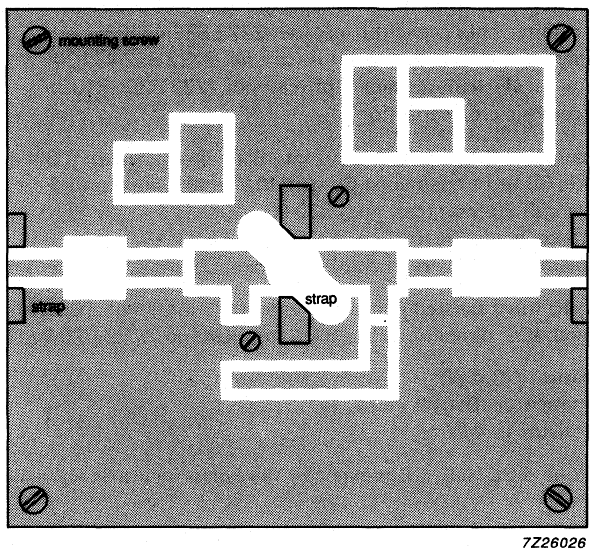


Fig.18 Component layout and printed-circuit board for 28 MHz class-A test circuit.

Note: 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 means of hollow rivets and straps at the two edges and under the source contacts.

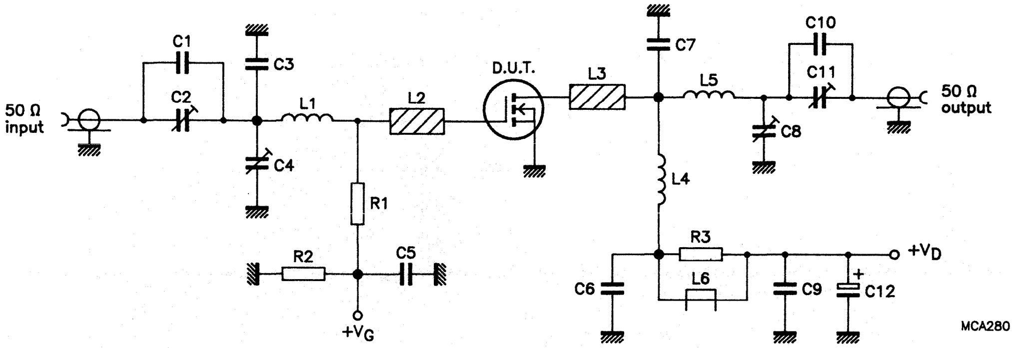


Fig.19 Class-AB test circuit at f = 28 MHz.

List of components:
C1 = C10 = 62 pF multilayer ceramic chip capacitor*
C2 = C4 = C8 = C11 = 5 - 60 pF film dielectric trimmer (cat. no. 2222 809 07011)
C3 = 51 pF multilayer ceramic chip capacitor*
C5 = C6 = C9 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = 10 pF multilayer ceramic chip capacitor*
C12 = 10 μF, 63 V aluminium electrolytic capacitor (cat. no. 2222 030 28109)

L1 = 280 nH; 9 turns enamelled Cu-wire (1 mm); int. diam. 6 mm; length 11 mm; leads 2 x 4 mm
L2 = L3 = 30 Ω stripline; length 10 mm; width 6 mm
L4 = 1650 nH; 16 turns enamelled Cu-wire (1 mm); int. diam. 12 mm; length 20 mm; leads 2 x 2 mm
L5 = 380 nH; 10 turns enamelled Cu-wire (1 mm); int. diam. 7 mm; length 13 mm; leads 2 x 3 mm
L6 = Ferroxcube RF-choke, grade 3B (cat. no. 4312 020 36640)

R1 = 22 Ω metal film resistor (0.4 W)
R2 = 1 MΩ metal film resistor (0.4 W)
R3 = 10 Ω metal film resistor (0.4 W)

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

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

APPLICATION INFORMATION (continued)

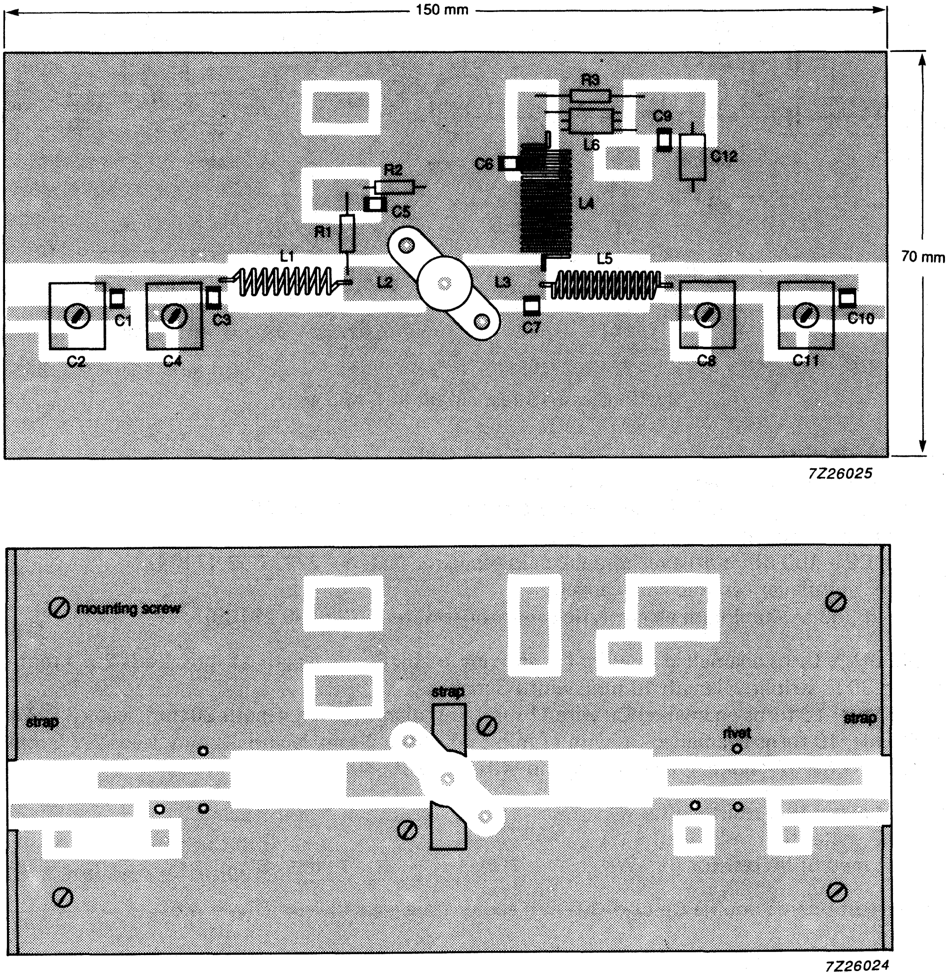


Fig.20 Component layout and printed-circuit board for 28 MHz class-AB test circuit.

Note: 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 means of hollow rivets and straps at the two edges and under the source contacts.

APPLICATION INFORMATION (continued)

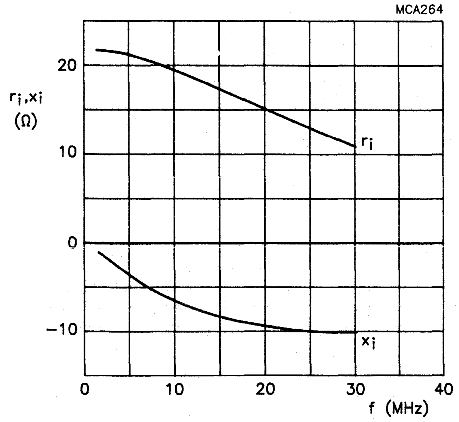


Fig.21 Input impedance as a function of frequency (series components).

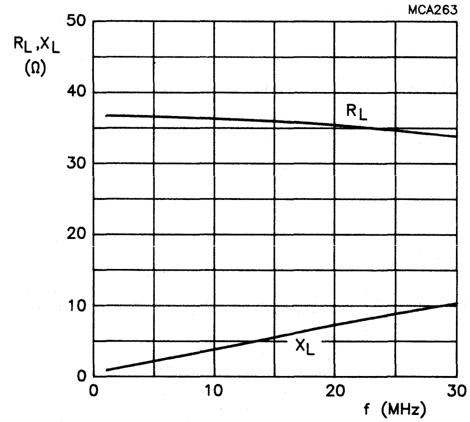


Fig.22 Load impedance as a function of frequency (series components).

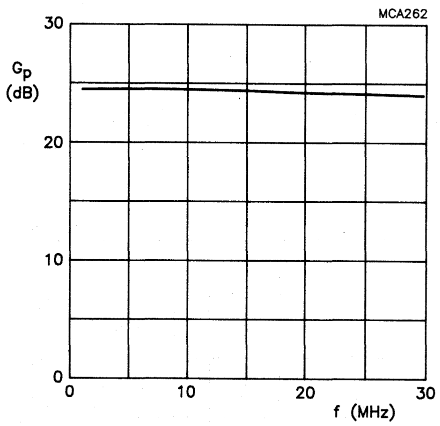


Fig.23 Power gain as a function of frequency.

Conditions for Figs 21 to 23:

V_{DS} = 50 V; I_{DQ} = 0.15 A; P_L = 30 W (PEP); R_{GS} = 22 Ω; class-AB operation; typical values.

APPLICATION INFORMATION (continued)

RF performance in CW operation (common-source 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	108	50	30	30	typ. 20	typ. 65	10

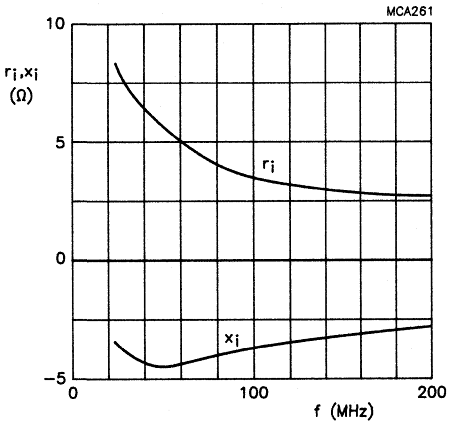


Fig.24 Input impedance as a function of frequency (series components).

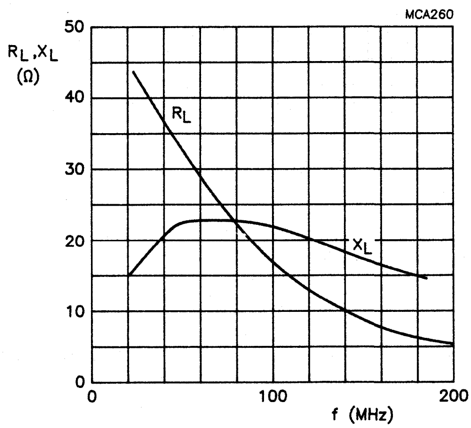


Fig.25 Load impedance as a function of frequency (series components).

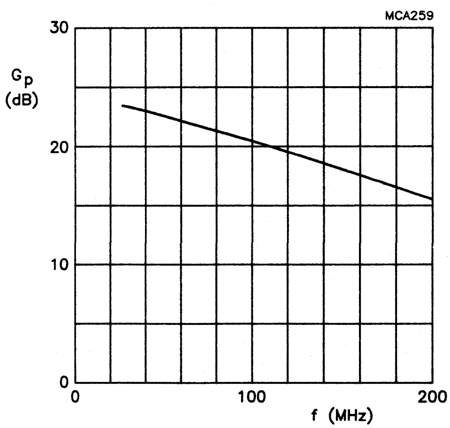


Fig.26 Power gain as a function of frequency.

Conditions for Figs 24 to 26:

V_{DS} = 50 V; I_{DQ} = 30 mA; P_L = 30 W; R_{GS} = 10 Ω; class-B operation; typical values.

VHF POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS transistor intended for use in industrial and military equipment operating in the HF and VHF range.

Features

- High power gain
- Low intermodulation distortion
- Easy power control
- Good thermal stability
- Withstands full load mismatch

The BLF177 has a 4-lead flange envelope with a ceramic cap (SOT121). All leads are isolated from the flange.

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

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 %	d_3 dB	d_5 dB
SSB class-AB	28	50	150 (PEP)	> 20	> 35	< −30	< −30
CW class-B	108	50	150	typ. 19	typ. 70		

MECHANICAL DATA

SOT121 (see Fig.1).

Note

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

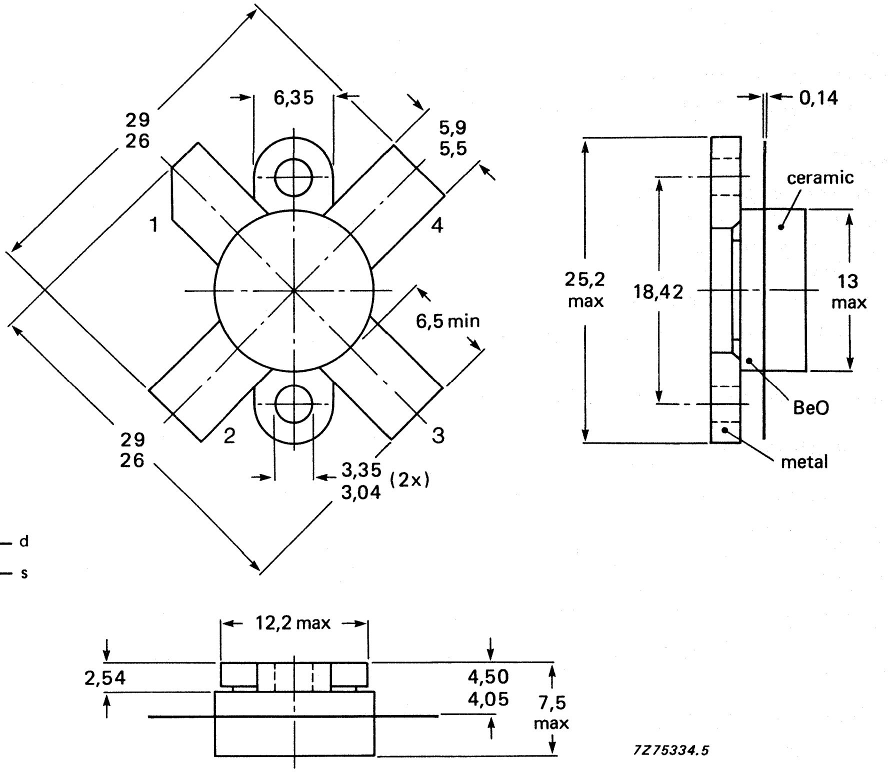
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



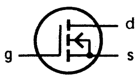


Fig.1 SOT121.

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

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

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

Drain-source voltage	V_{DS}	max.	110	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
Drain current (DC)	I_D	max.	7	A
peak value; f > 1 MHz	I_{DM}	max.	20	A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	220	W
Storage temperature range	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C

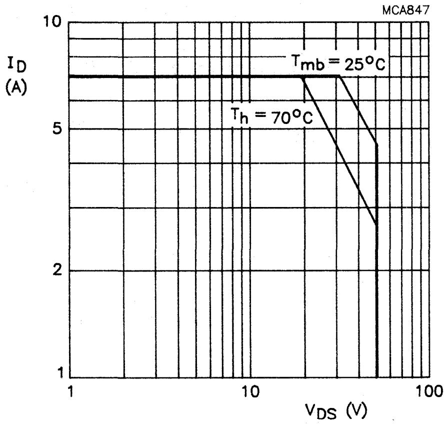
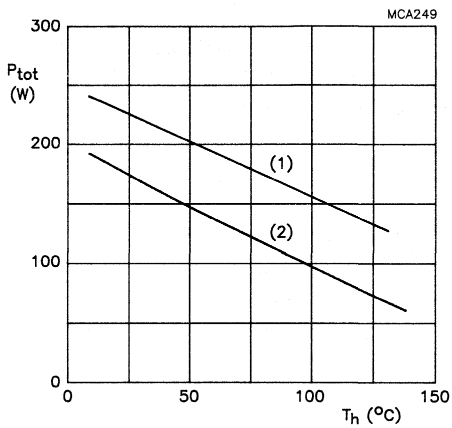


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 50 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	110 V
Drain-source leakage current V_{DS} = 50 V; V_{GS} = 0	I_{DSS}	max.	2.5 mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0 μA
Gate threshold voltage I_D = 50 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate-source voltage difference of matched pairs V_{DS} = 10 V; I_D = 50 mA	ΔV_{GS}	max.	100 mV
Forward transconductance I_D = 5 A; V_{DS} = 10 V	G_{fs}	min. typ.	4.5 S 6.2 S
Drain-source on-state resistance I_D = 5 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.2 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	25 A
Input capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{is}	typ.	580 pF
Output capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0 V	C_{os}	typ.	190 pF
Feedback capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{rs}	typ.	14 pF

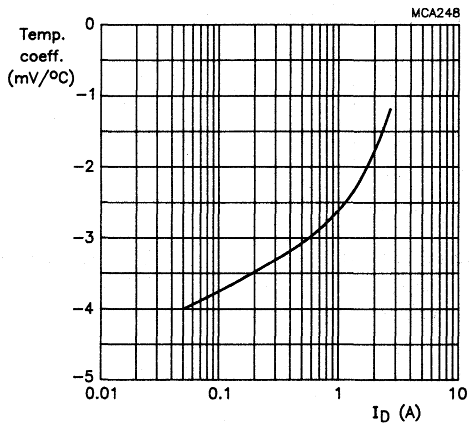


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; valid for T_h = 25 to 70 °C; typical values.

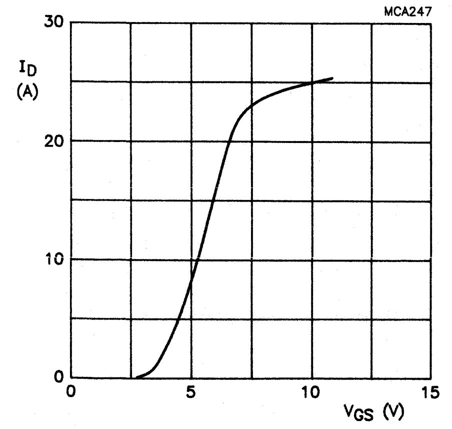


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

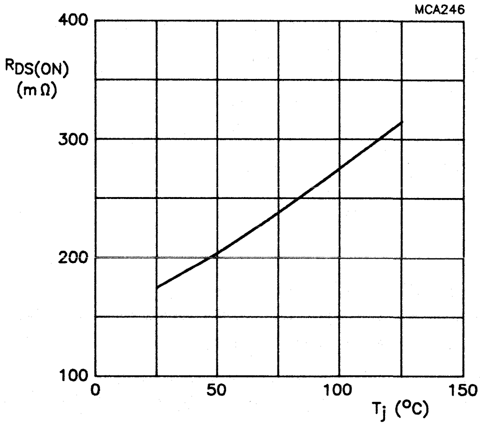


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 5 A; typical values.

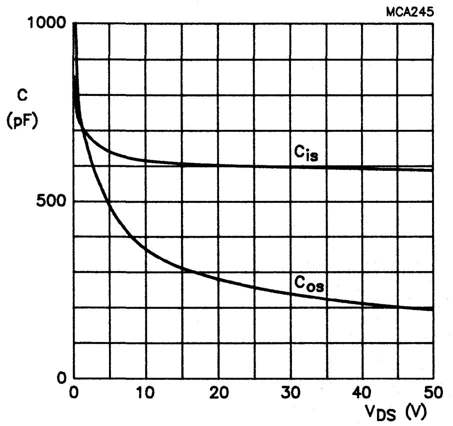


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

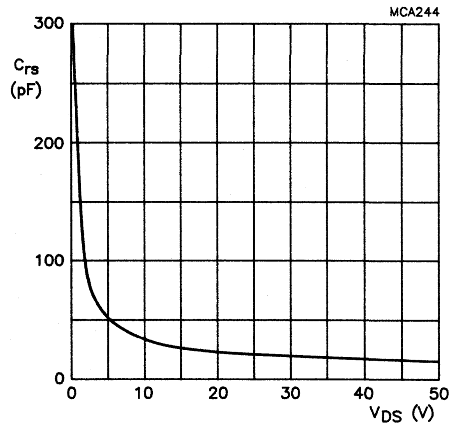


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W, unless otherwise specified

RF performance in SSB operation (common-source class-AB circuit)
f_1 = 28.000 MHz; f_2 = 28.001 MHz.

Output power W	f MHz	V_{DS} V	I_{DQ} mA	G_P dB	η_D %	d_3* dB	d_5* dB
20 to 150 (PEP)	28	50	0.7	> 20 typ. 22	< 35 typ. 40	< −30 typ. −35	< −30 typ. −38

Optimum load impedance: 6.25 + j 0 Ω

Ruggedness in class-AB operation

The BLF177 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 50 V; f = 28 MHz at rated output power.

RF performance in CW operation (common-source circuit)
R_{GS} = 15.8 Ω; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W

Mode of operation	f MHz	V_{DS} V	I_{DQ} A	P_L W	G_P dB	η_D %
CW class-B	108	50	0.1	150	typ. 19	typ. 70

* Stated figures are maxima encountered at any driving level between the specified values of PEP and are referred to the according level of either of the equal amplified tones. Related to the according peak envelope power these figures should be decreased by 6 dB.

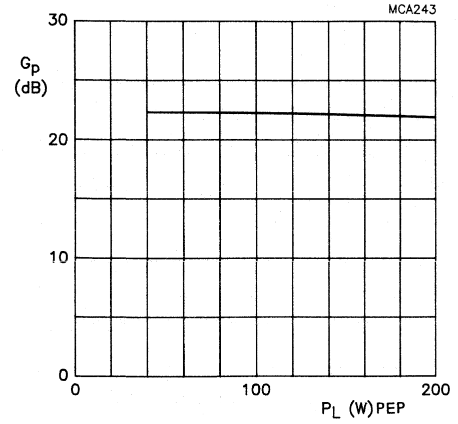


Fig.9 Gain as a function of load power; typical values.

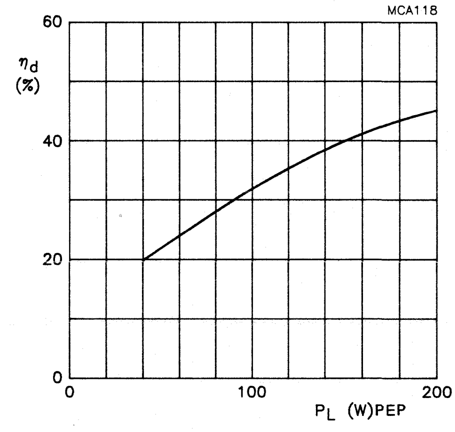


Fig.10 Efficiency as a function of load power; typical values.

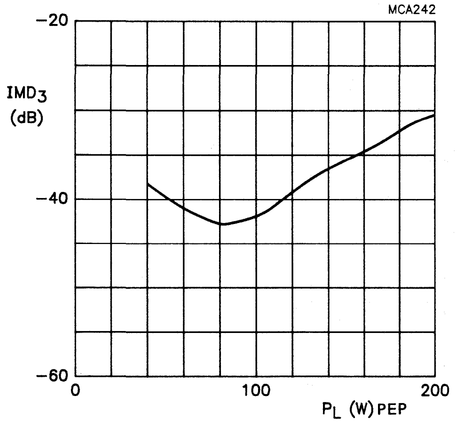


Fig.11 Third intermodulation product as a function of load power; typical values.

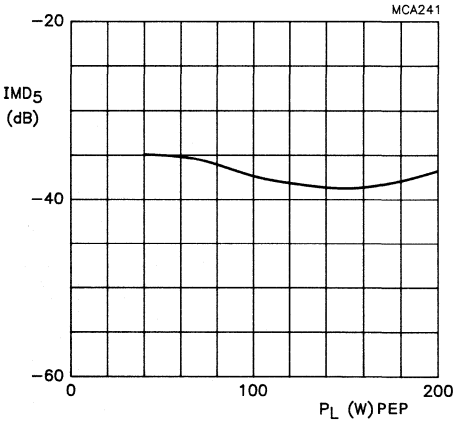


Fig.12 Fifth intermodulation product as a function of load power; typical values.

Conditions: Class-AB operation; V_{DS} = 50 V; I_{DQ} = 0.7 A; f_1 = 28.000 MHz; f_2 = 28.001 MHz; R_{GS} = 5 Ω.

APPLICATION INFORMATION (continued)

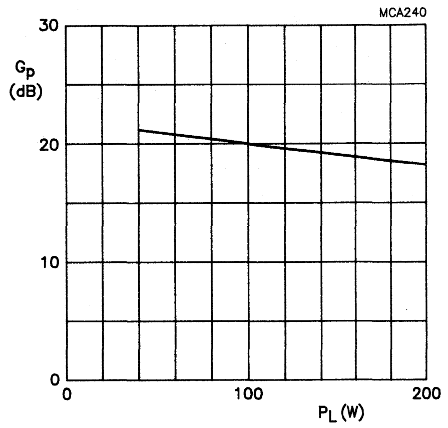


Fig.13 Gain as a function of load power; typical values.

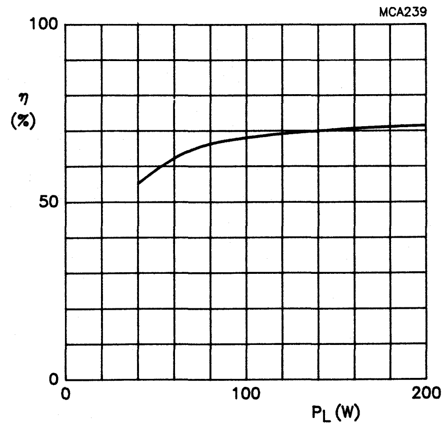


Fig.14 Efficiency as a function of load power; typical values.

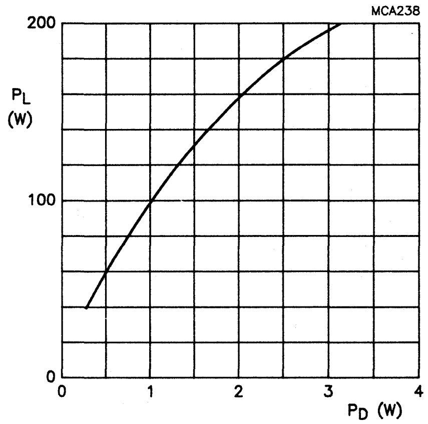


Fig.15 Load power as a function of drive power; typical values.

Conditions: Class-B operation; V_{DS} = 50 V; I_{DQ} = 100 mA; R_{GS} = 15.8 Ω; f = 108 MHz; typical values.

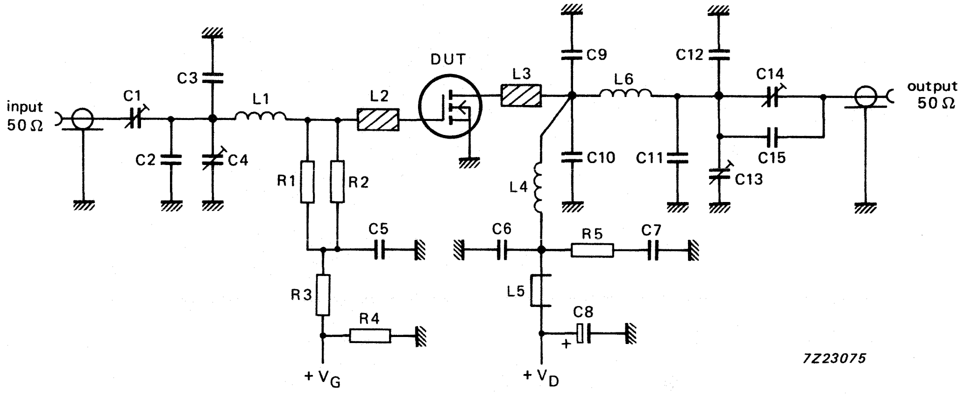


Fig.16 Class-AB test circuit at f = 28 MHz.

List of components:

C1 = C4 = C13 = C14 = 7 - 100 pF, film dielectric trimmer (cat. no. 2222 809 07015)
C2 = 56 pF multilayer ceramic chip capacitor*
C3 = C11 = 62 pF multilayer ceramic chip capacitor*
C5 = C6 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C8 = 2.2 μF 63 V electrolytic capacitor
C9 = C10 = 20 pF multilayer ceramic chip capacitor*
C12 = 100 pF multilayer ceramic chip capacitor*
C15 = 150 pF multilayer ceramic chip capacitor*

L1 = 133 nH, 5 turns enamelled Cu-wire (0.7 mm); int. diam. 6 mm; length 4.5 mm; leads 2 x 5 mm
L2 = L3 = 41.1 Ω stripline (13 mm x 6 mm)
L4 = 236 nH, 7 turns enamelled Cu-wire (1.5 mm); int. diam. 8 mm; length 12.5 mm; leads 2 x 5 mm
L5 = Ferroxcube HF choke, grade 3B (cat. no. 4312 020 36642)
L6 = 170 nH, 5 turns enamelled Cu-wire (2 mm); int. diam. 8 mm; length 11.5 mm; leads 2 x 5 mm

R1 = R2 = 10 Ω metal film resistor (1 W)
R3 = 10 kΩ metal film resistor (0.4 W)
R4 = 1 MΩ metal film resistor (0.4 W)
R5 = 10 Ω metal film resistor (1 W)

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

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

APPLICATION INFORMATION (continued)

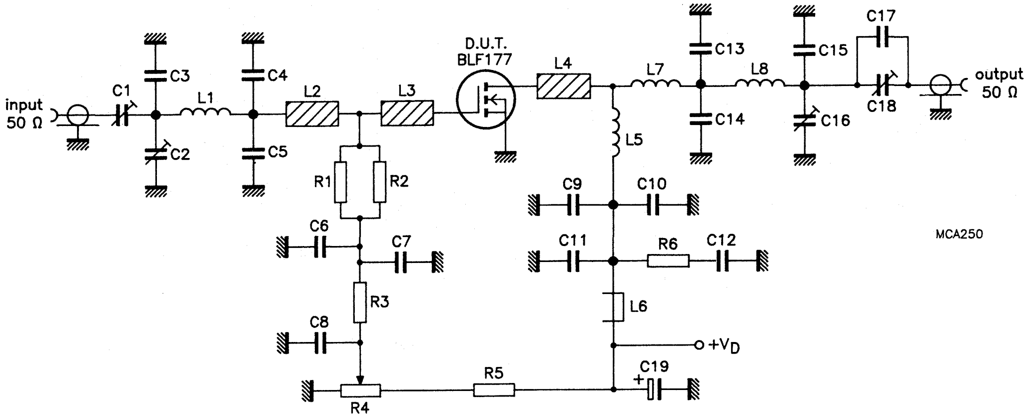


Fig.17 Class-B test circuit at 108 MHz.

List of components:

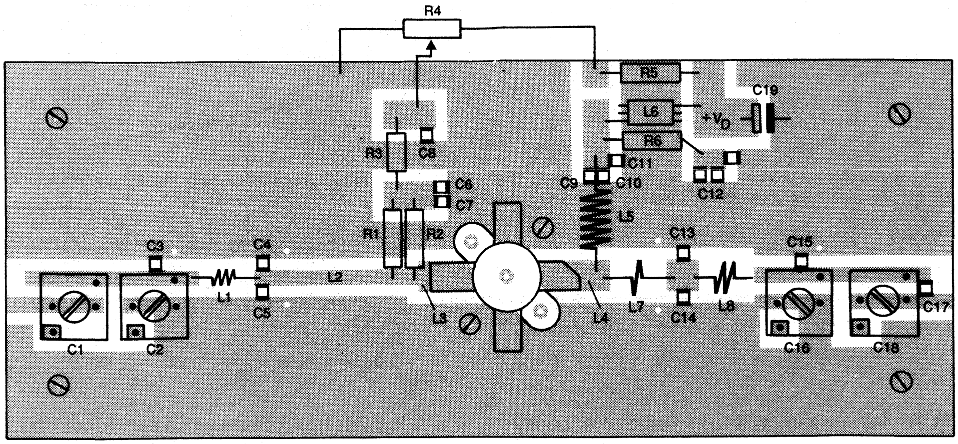
C1 = C2 = C16 = C18 = 2.5 - 20 pF film dielectric trimmer (cat. no. 2222 809 07004)
C3 = 20 pF multilayer ceramic chip capacitor*
C4 = C5 = 62 pF multilayer ceramic chip capacitor*
C6 = C7 = C9 = C10 = 1 nF multilayer ceramic chip capacitor*
C8 = 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C11 = 10 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47103)
C12 = 3 x 100 nF multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C13 = C14 = 36 pF multilayer ceramic chip capacitor*
C15 = 12 pF multilayer ceramic chip capacitor*
C17 = 5.6 pF multilayer ceramic chip capacitor*
C19 = 4.4 μF 63 V electrolytic capacitor (cat. no. 2222 030 28478)

L1 = 22 nH, 3 turns enamelled Cu-wire (0.8 mm); int. diam. 3 mm; length 5.5 mm; leads 2 x 5 mm
L2 = 64.7 Ω stripline (31 mm x 3 mm)
L3 = L4 = 41.1 Ω stripline (10 mm x 6 mm)
L5 = 122 nH, 6 turns enamelled Cu-wire (1.6 mm); int. diam. 6 mm; length 13.8 mm; leads 2 x 5 mm
L6 = Ferroxcube HF choke, grade 3B (cat. no. 4312 020 36642)
L7 = 16.5 nH, 1 turn enamelled Cu-wire (1.6 mm); int. diam. 9 mm; leads 2 x 5 mm
L8 = 34.4 nH, 2 turns enamelled Cu-wire (1.6 mm) int. diam. 6 mm; length 3.9 mm; leads 2 x 5 mm

R1 = R2 = 31.6 Ω metal film resistor (1 W)
R3 = 1 kΩ metal film resistor (0.4 W)
R4 = 5 kΩ cermet potentiometer
R5 = 44.2 kΩ metal film resistor (0.4 W)
R6 = 10 Ω metal film resistor (1 W)

Printed-circuit board: double Cu-clad, 1.6 mm PTFE fibre-glass dielectric ($\epsilon_r = 2.2$)

* American Technical Ceramics type 100B or equivalent.



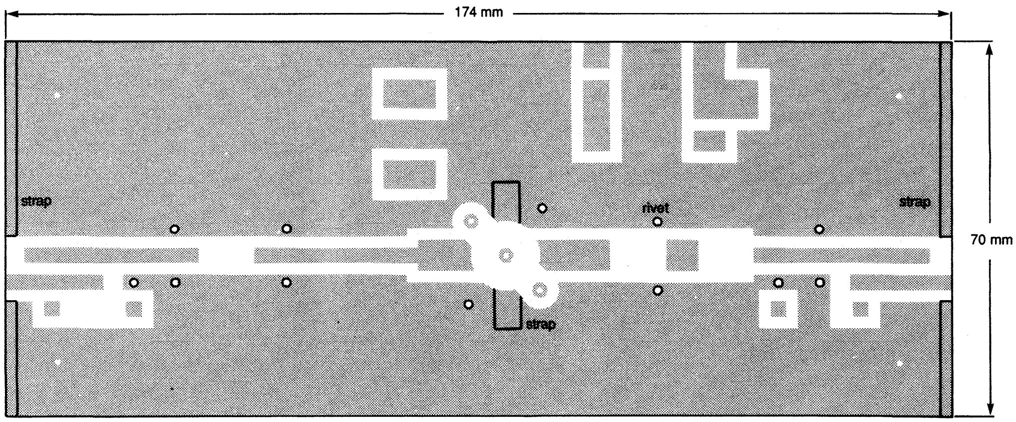


Fig.18 Component lay-out and printed-circuit board for 108 MHz test circuit.

Note:

The circuit and 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 source leads and at the input and output Cu straps are used for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

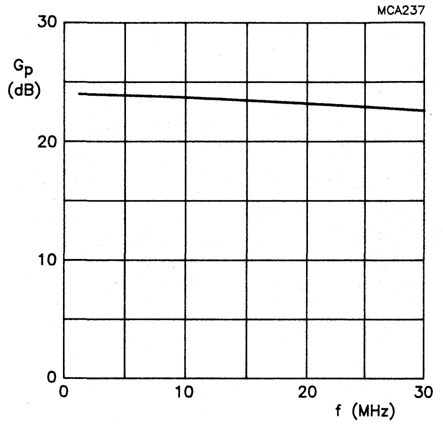


Fig.19 Power gain as a function of frequency.

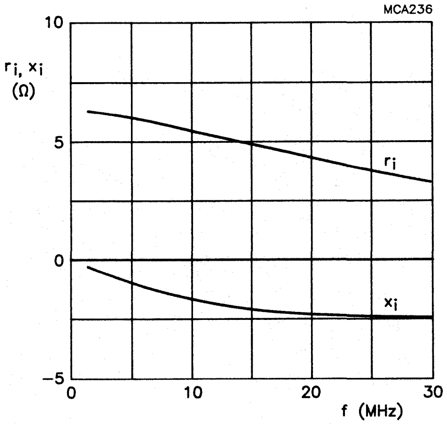


Fig.20 Input impedance as a function of frequency (series components).

Conditions for Figs 19 and 20:

Class-AB operation; V_{DS} = 50 V; I_{DQ} = 0.7 A; P_L = 150 W PEP; R_{GS} = 6.25 Ω; R_L = 6.25 Ω; typical values.

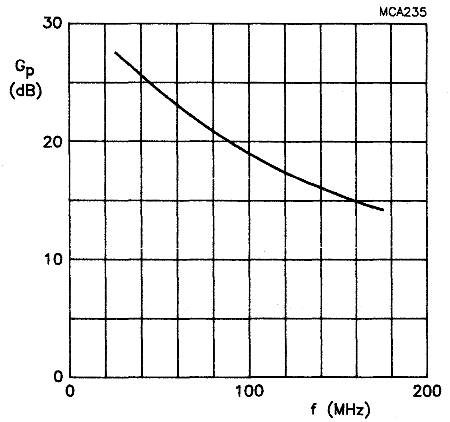


Fig.21 Power gain as a function of frequency.

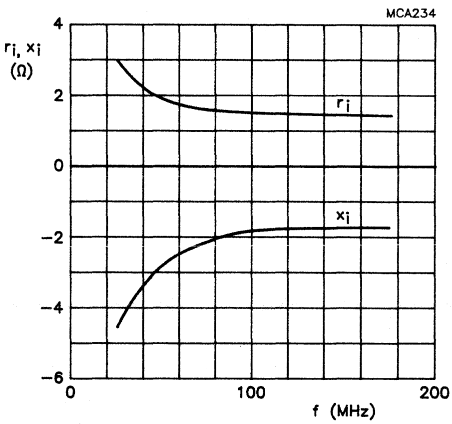


Fig.22 Input impedance as a function of frequency (series components).

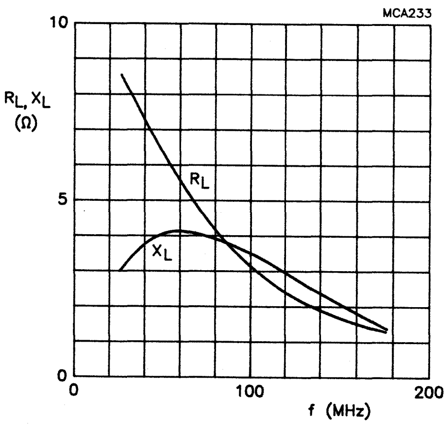


Fig.23 Load impedance as a function of frequency (series components).

Conditions for Figs 21 to 23:

Class-B operation; V_{DS} = 50 V; I_{DQ} = 0.1 A; P_L = 150 W; R_{GS} = 15 Ω; typical values.

VHF POWER MOS TRANSISTOR

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

The BLF221 has a TO-39 metal envelope with the source connected to the case.

QUICK REFERENCE DATA

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

Mode of operation	f MHz	V_{DS} V	P_L W	G_p dB	η_D %
CW class-B	175	12.5	2	> 10	> 50

MECHANICAL DATA

Dimensions in mm

Pinning

1 = drain
2 = gate
3 = source

Source connected to case.

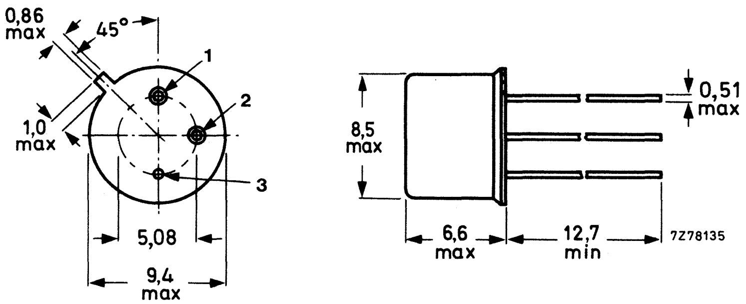


Fig.1 TO-39.

Note:

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

RATINGS

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

Drain-source voltage	V_{DS}	max.	40 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC	I_D	max.	0.4 A
Total power dissipation			
T_{mb} = 70 °C	P_{tot}	max.	6.0 W
Storage temperature range	T_{stg}	−65 to + 150	°C
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	22 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	3 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 3 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	40	V
Drain-source leakage current V_{DS} = 12.5 V; V_{GS} = 0	I_{DSS}	max.	10	μA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	max.	1	μA
Gate threshold voltage I_D = 3 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5	V
Forward transconductance I_D = 0.3 A; V_{DS} = 10 V	G_{fs}	min. typ.	80 120	mS mS
Drain-source on-state resistance I_D = 0.3 A; V_{GS} = 15 V	$R_{DS(ON)}$	typ.	3.5	Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 15 V	I_{DSX}	typ.	1.3	A
Input capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{is}	typ.	6.1	pF
Output capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{os}	typ.	8.6	pF
Feedback capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{rs}	typ.	1.9	pF

APPLICATION INFORMATION

RF performance in a common-source class-B circuit
R_{GS} = 240 Ω, T_{mb} = 25 °C

Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_p dB	η_D %
CW class-B	175	12.5	20	2	> 10	> 50
CW class-B	175	12.5	20	2	typ. 13	typ. 55

Optimum load impedance : 21 + j11 Ω

Input impedance : 28 − j76 Ω (R_{GS} included)

Ruggedness in class-B operation

The BLF221 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 12.5 V, f = 175 MHz, and T_{mb} = 25 °C at rated output power.

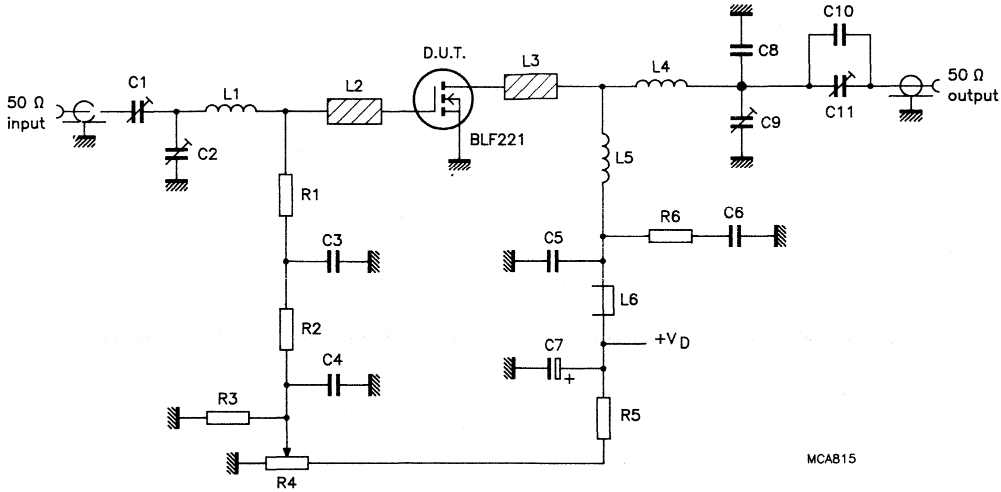


Fig.2 Test circuit for 175 MHz.

DEVELOPMENT DATA

List of components

C1 = C11 = 1.8 - 10 pF, film dielectric trimmer (cat.no. 2222 809 05002)
C2 = C9 = 2 - 9 pF, film dielectric trimmer (cat. no. 2222 809 09002)
C3 = C5 = 1 nF (500 V) multilayer ceramic chip capacitor*
C4 = C6 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitors
C7 = 2.2 μF (35 V) electrolytic tantal capacitor
C8 = 5.1 pF (500 V) multilayer ceramic chip capacitor*
C10 = 9.1 pF (500 V) multilayer ceramic chip capacitor*

L1 = 117 nH, 6 turns enamelled Cu-wire (0.8 mm); int. diam. 4 mm; length 5.1 mm; leads 2 x 5 mm
L2 = L3 = 81 Ω stripline (8 mm x 2 mm)
L4 = 57 nH, 3 turns enamelled Cu-wire (1 mm); int. diam. 6 mm; length 5 mm; leads 2 x 5 mm
L5 = 355 nH, 9 turns enamelled Cu-wire (1 mm); int. diam. 7 mm; length 11 mm; leads 2 x 5 mm
L6 = Ferroxdure HF choke, grade 3B (cat. no. 4312 020 36642)

R1 = 237 Ω, metal film resistor, 0.4 W (cat. no. 2322 151 72371)
R2 = 1 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71002)
R3 = 1 MΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71005)
R4 = 5 kΩ, potentiometer (ten turn)
R5 = 7.5 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 51009)
R6 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

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

* American Technical Ceramics type 100B or equivalent.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF225
VHF PowerMOS transistor

FEATURES

- Easy power control
- Good thermal stability
- Withstands full load mismatch

DESCRIPTION

Silicon n-channel enhancement mode vertical D-MOS transistor intended for communication transmitters in the VHF range with a nominal voltage supply of 12.5 V.

The BLF225 has a 4-lead SOT123 envelope with a ceramic cap. All leads are isolated from the flange.

Note

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

PRODUCT SAFETY

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

QUICK REFERENCE DATA

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

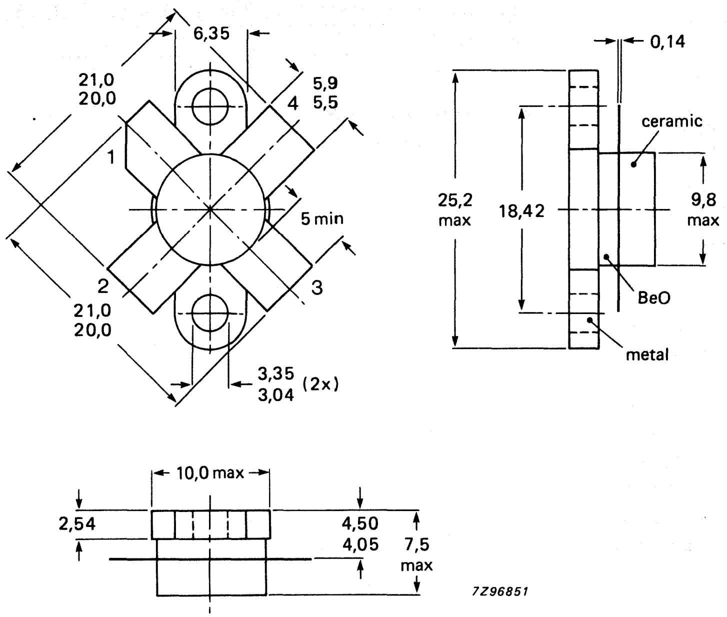
MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_P (dB)	η_C (%)
c.w. class-B	175	12.5	30	> 8.5	> 60

MECHANICAL DATA

SOT123 - see Fig.1.

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 SOT123.

PINNING

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

LIMITING VALUES

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	drain current	DC	-	6	A
I_{DM}	drain current	peak value f > 1 MHz	-	18	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	-	68	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

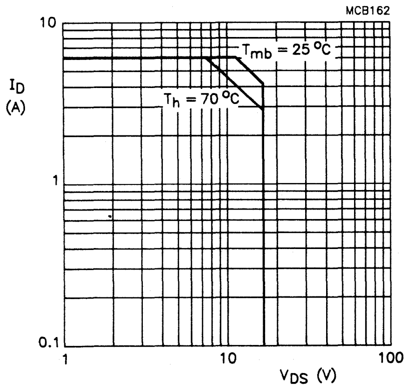


Fig.2 DC SOAR.

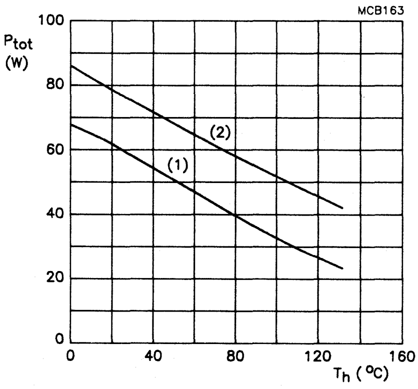


Fig.3 Power/temperature derating;
(1) continuous operation;
(2) short-time operation during mismatch.

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	2.6	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.3	K/W

VHF PowerMOS transistor BLF225

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 = 30 mA	40	-	-	V
I_{DSS}	drain-source leakage current	V_{DS} = 12.5 V V_{GS} = 0	-	-	1	mA
I_{GSS}	gate-source leakage current	± V_{GS} = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 30 mA	2.0	-	4.5	V
G_{fs}	forward transconductance	V_{DS} = 10 V I_D = 3 A	1.5	2.2	-	S
$R_{DS(on)}$	drain-source ON-resistance	V_{GS} = 15 V I_D = 3 A	-	0.25	-	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 15 V	-	16	-	A
C_{is}	input capacitance	V_{DS} = 12.5 V V_{GS} = 0 f = 1 MHz	-	120	-	pF
C_{os}	output capacitance	V_{DS} = 12.5 V V_{GS} = 0 f = 1 MHz	-	140	-	pF
C_{rs}	feedback capacitance	V_{DS} = 12.5 V V_{GS} = 0 f = 1 MHz	-	15	-	pF

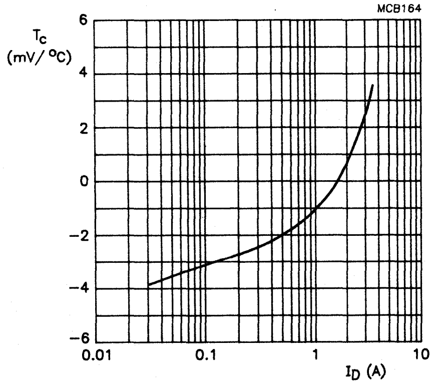


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

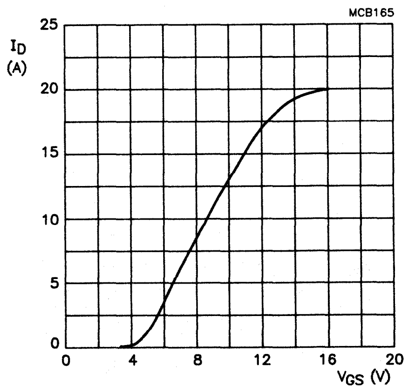


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

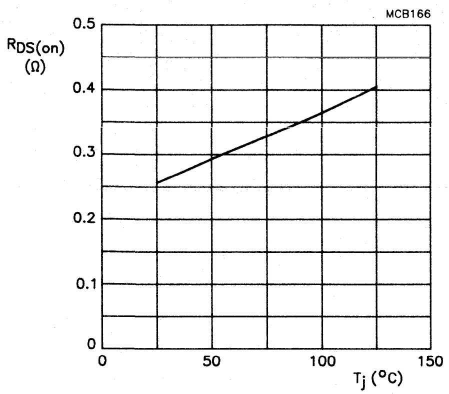


Fig.6 Drain-source ON-resistance as a function of junction temperature; V_{GS} = 15 V; I_D = 3.5 A; typical values.

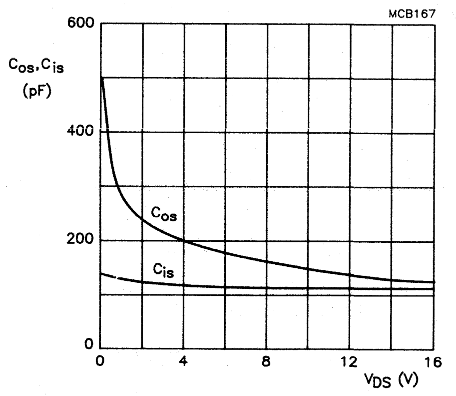


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

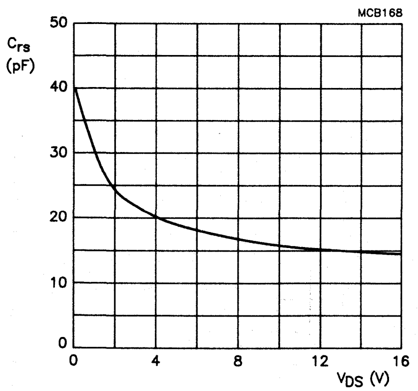


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_P (dB)	η_c (%)
c.w. class-B	175	12.5	100	30	> 8.5 typ. 9.5	> 60 typ. 70

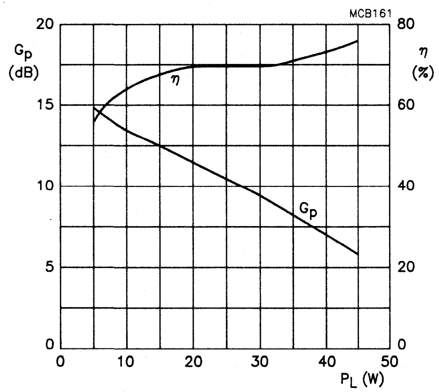


Fig.9 Power gain and efficiency as functions of load power; class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; f = 175 MHz; typical values.

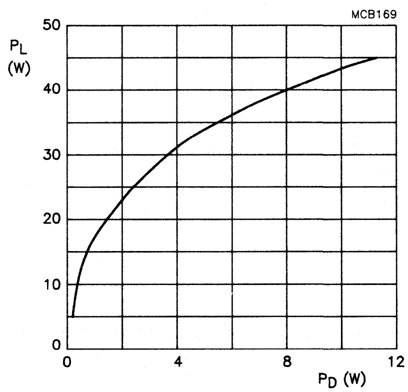


Fig.10 Load power as a function of input power; class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; f = 175 MHz; typical values.

Ruggedness in class-B operation

The BLF225 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: V_{DS} = 15.5 V, f = 175 MHz at rated output power.

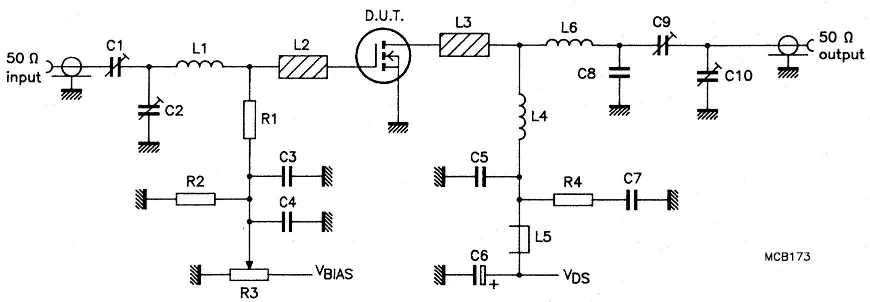


Fig.11 175 MHz test circuit.

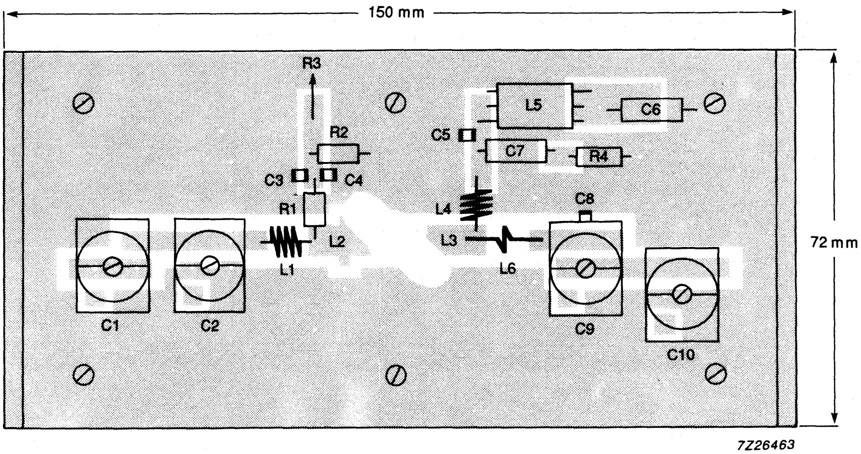
List of components (Fig. 11)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	4 - 40 pF		2222 809 07008
C2, C10	film dielectric trimmer	5 - 60 pF		2222 809 07011
C3	500 V multilayer ceramic chip capacitor (note 1)	100 pF		
C4	50 V ceramic chip capacitor	100 nF		2222 852 47104
C5	500 V multilalyer ceramic chip capacitor (note 1)	680 pF		
C6	63 V electrolytic capacitor	10 μF		2222 030 38109
C7	250 V polyester capacitor	100 nF		
C8	500 V multilayer ceramic chip capacitor (note 1)	43 pF		
C9	film dielectric trimmer	7 - 100 pF		2222 809 07015
L1	3 turns enamelled 0.5 mm copper wire	18 nH	int. dia 2.0 mm length 3.3 mm leads 2 x 5 mm	
L2, L3	stripline (note 2)	31 Ω	12.0 x 6 mm	
L4	3 turns enamelled 1.5 mm copper wire	28 nH	int. dia 4.0 mm length 8.2 mm leads 2 x 5 mm	
L5	grade 3B Ferroxcube RF choke			4312 020 36642
L6	1 turn enamelled 1.5 mm copper wire	36 nH	int. dia 3.5 mm length 4.0 mm leads 2 x 5 mm	
R1	0.4 W metal film resistor	1 kΩ		2322 151 51002
R2	0.4 W metal film resistor	1 MΩ		2322 151 51005
R3	10 turn cermet potentiometer	5 kΩ		
R4	0.4 W metal film resistor	10 Ω		2322 151 51009

Notes

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

VHF PowerMOS transistor BLF225



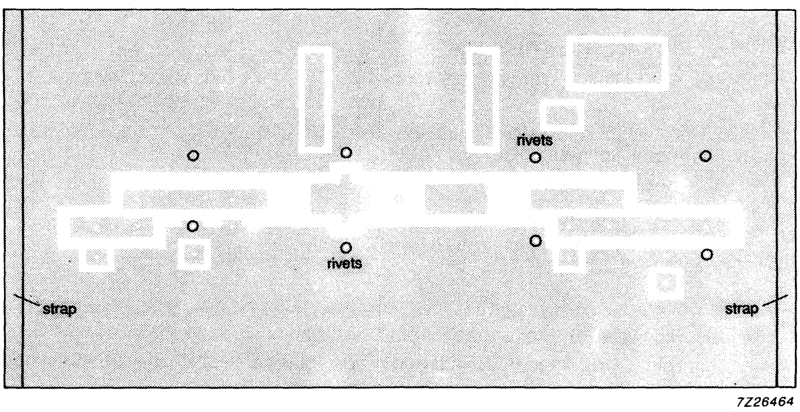


Fig.12 Printed circuit board and component layout for 175 MHz test circuit.

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 means of copper straps and hollow rivets for a direct contact between upper and lower sheets.

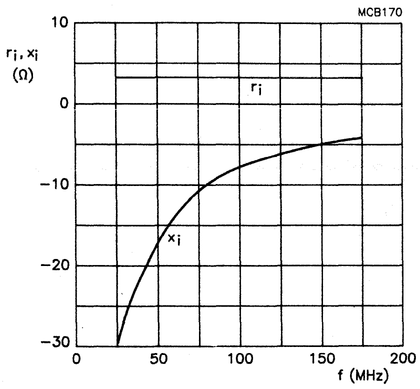


Fig.13 Input impedance, series components; class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W; typical values.

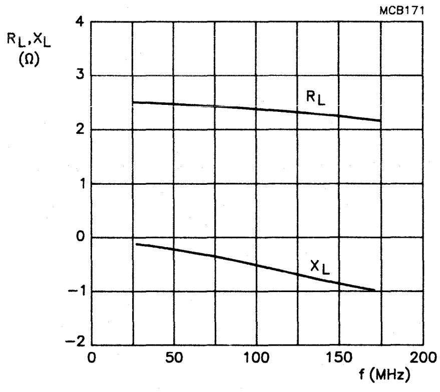


Fig.14 Load impedance, series components; class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W; typical values.

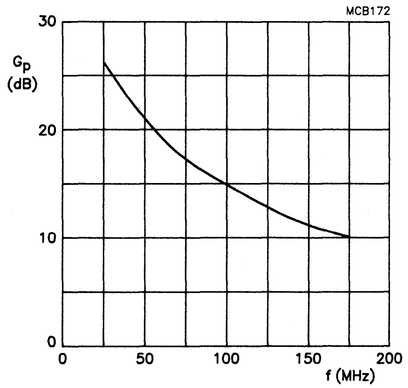


Fig.15 Power gain, class-B operation; V_{DS} = 12.5 V; I_{DQ} = 100 mA; P_L = 30 W; typical values.

VHF POWER MOS TRANSISTOR

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

Features

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

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

QUICK REFERENCE DATA

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

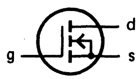
Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_p dB	η_D %
CW class-AB	175	12.5	100	2	> 10 typ. 12.5	> 50 typ. 55
CW class-B	175	28	10	3	typ. 14	typ. 50

MECHANICAL DATA

Dimensions in mm

Pinning

1 = source
2 = gate
3 = drain



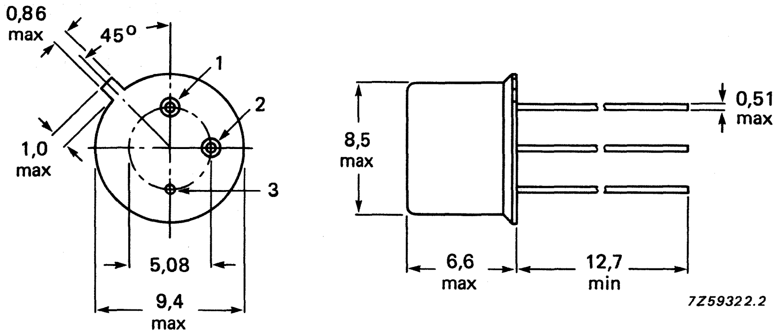


Fig.1 SOT5/11.

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

RATINGS

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

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

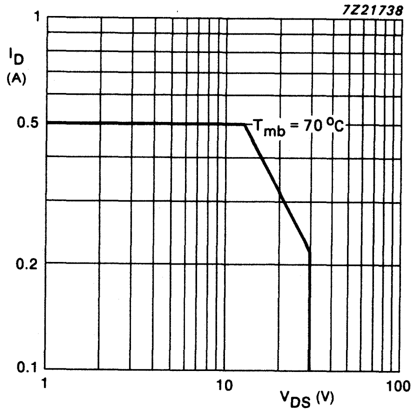


Fig.2 DC SOAR.

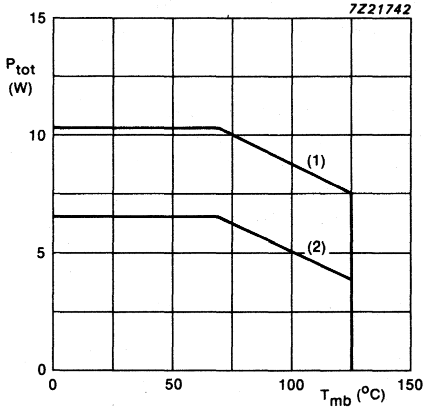


Fig.3 Total power dissipation as a function of mounting base temperature.

(1) short time operation during mismatch.

(2) continuous operation.

THERMAL RESISTANCE

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

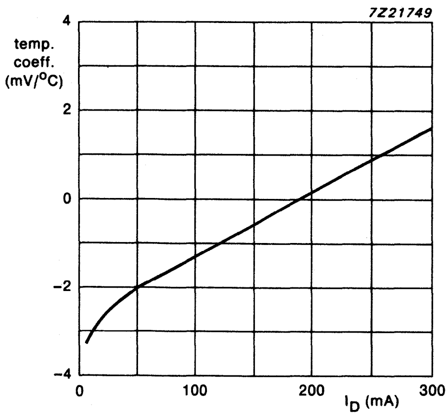


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 12.5 V; typical values.

CHARACTERISTICS (continued)

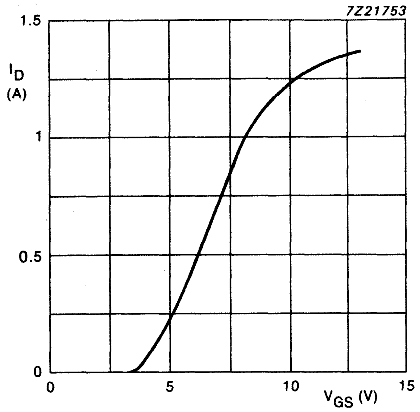


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

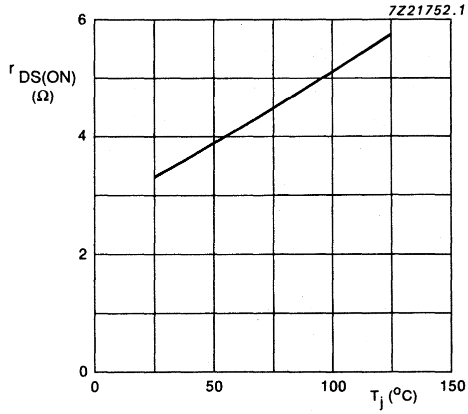


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{DS} = 10 V; I_D = 0.3 A; typical values.

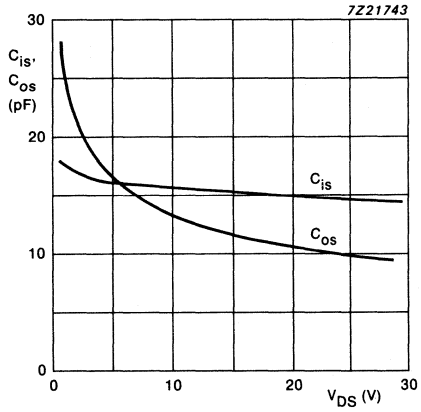


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

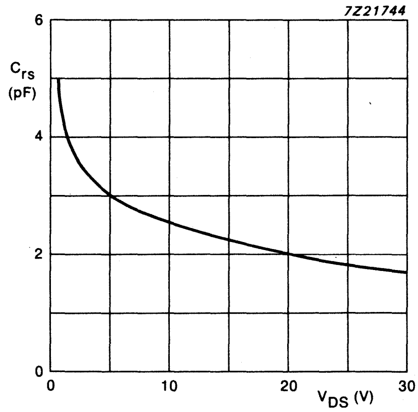


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

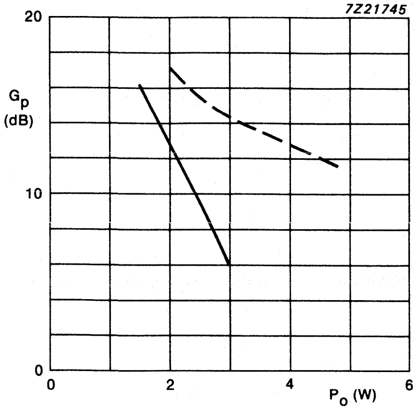


Fig.9 Gain as a function of output power; typical values.

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

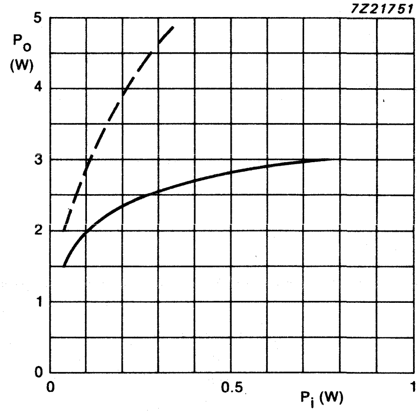


Fig.10 Output power as a function of input power; typical values.

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

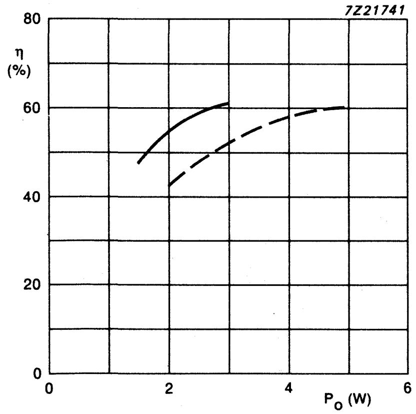


Fig.11 Efficiency as a function of output power; typical values.

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

Ruggedness in class-B operation

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

APPLICATION INFORMATION (continued)

RF performance at T_h = 25 °C in common-source 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-AB	175	12.5	100	2	> 10 typ. 12.5	> 50 typ. 55	220
CW class-B	175	28	10	3	typ. 14	typ. 50	47

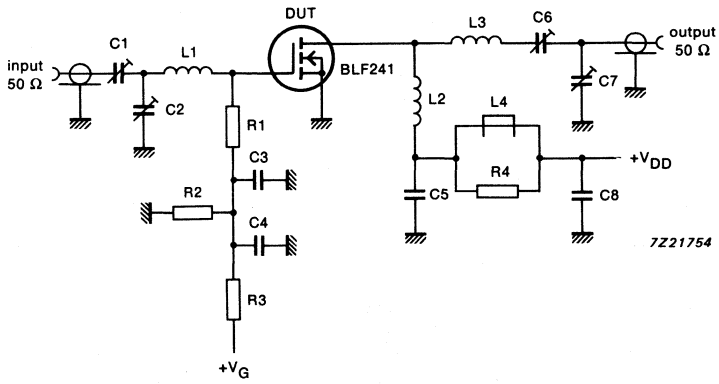


Fig.12 Test circuit for 175 MHz.

List of components:

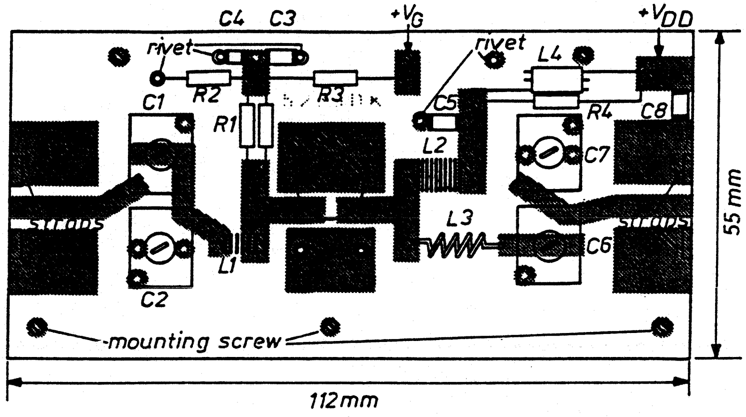
C1 = C6 = 4-40 pF, film dielectric trimmer (cat. no. 2222 809 07008)
C2 = C7 = 2.5-20 pF, film dielectric trimmer (cat. no. 2222 809 07004)
C3 = C5 = 1 nF, multilayer ceramic chip capacitor (cat. no. 2222 851 3102)
C4 = C8 = 100 nF, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
L1 = 64.7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

R1 = 2 x 442 Ω in parallel; metal film resistor (0.4 W)
R2 = 100 kΩ; metal film resistor (0.4 W)
R3 = 1 kΩ; metal film resistor (0.4 W)
R4 = 10 Ω; metal film resistor (0.4 W)

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

Note

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



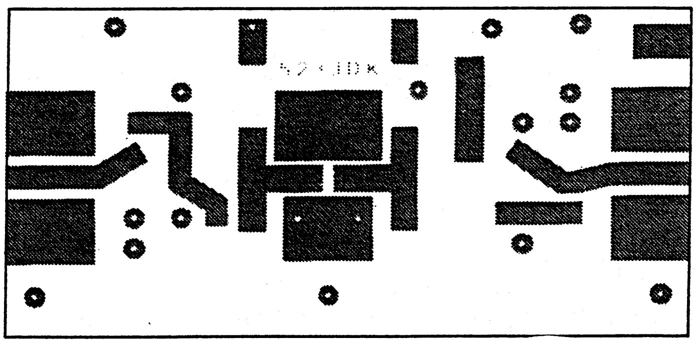


Fig.13 Printed-circuit board and component lay-out for 175 MHz test circuit.

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

APPLICATION INFORMATION (continued)

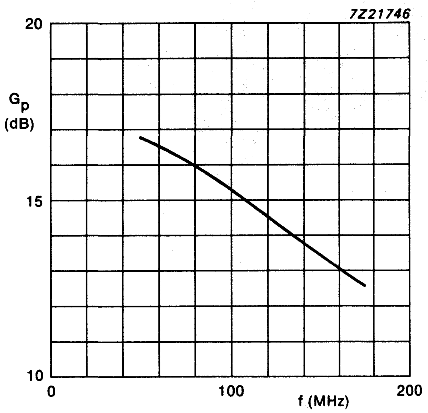


Fig.14 Gain as a function of frequency.

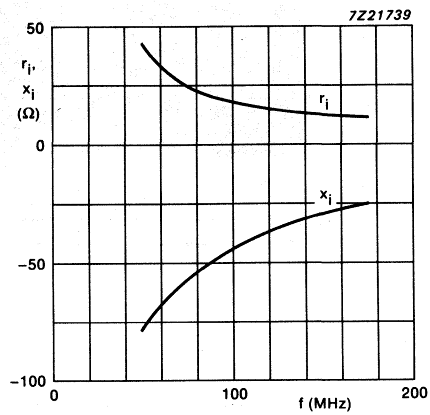


Fig.15 Input resistance and reactance as functions of frequency; series components.

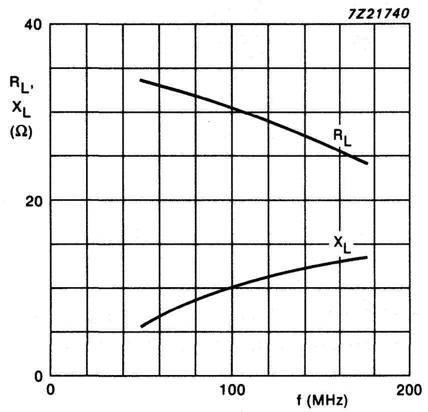


Fig.16 Load resistance and reactance as functions of frequency; series components.

Conditions for Figs 14 to 16:
Class-AB; V_{DS} = 12.5 V; I_{DQ} = 100 mA; R_{GS} = 220 Ω; typical values.

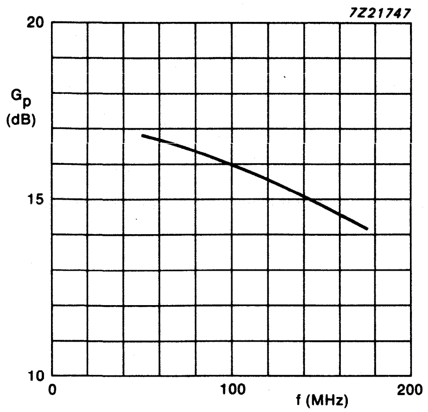


Fig.17 Gain as a function of frequency.

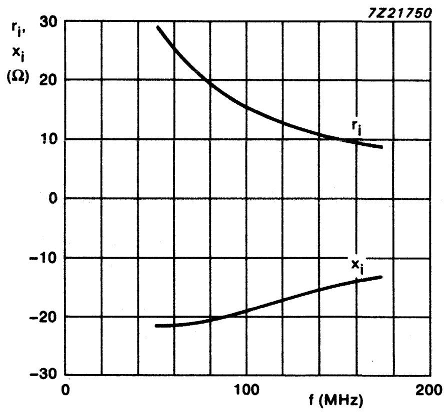


Fig.18 Input resistance and reactance as functions of frequency; series components.

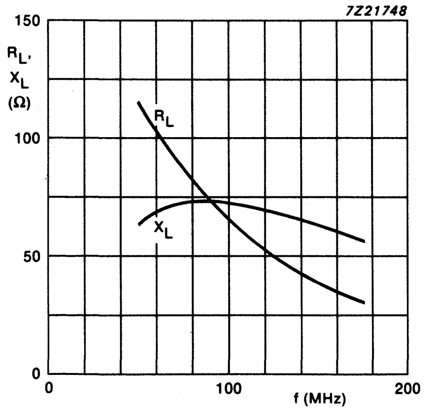


Fig.19 Load resistance and reactance as functions of frequency; series components.

Conditions for Figs 17 to 19:
Class-B; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω; typical values.

Philips Components

Data sheet	
status	Product specification
date of issue	September 1990

BLF242
VHF PowerMOS transistor

FEATURES

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

DESCRIPTION

N-channel enhancement mode vertical D-MOS transistor intended for use in professional transmitters in the HF and VHF range with a nominal voltage supply of 28 V. The transistor has a 4-lead flange envelope, with a ceramic cap (SOT123). All leads are isolated from the flange.

Note

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

QUICK REFERENCE DATA

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

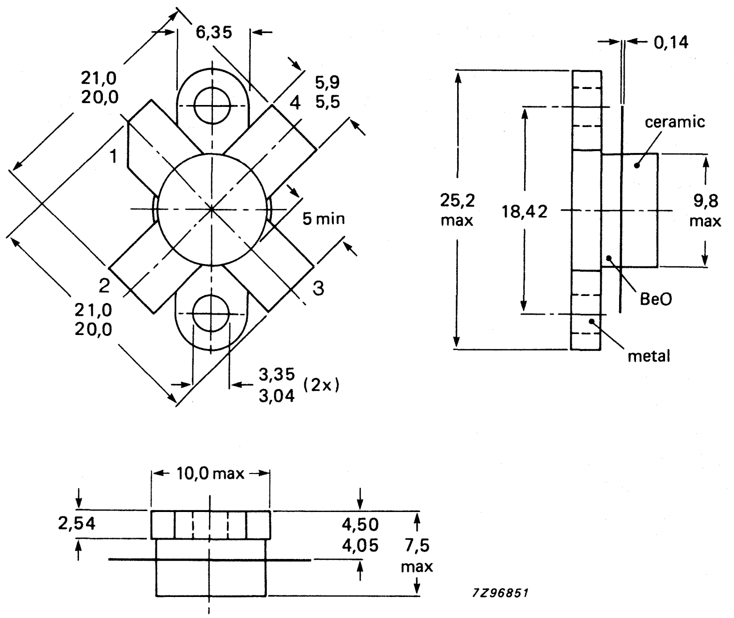
MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_P (dB)	η_D (%)
c.w. class-B	175	28	5	> 13 typ. 16	> 50 typ. 60

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.**

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 SOT123.

PINNING

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

PIN CONFIGURATION

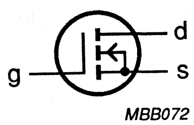


Fig.2 Pin configuration.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	drain current	DC	–	0.5	A
I_{DM}	drain current	peak value f > 1 MHz	–	1.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	16	W
T_{stg}	storage temperature		−65	150	°C
T_j	operating junction temperature		–	200	°C

THERMAL RESISTANCE

T_{mb} = 25 °C, P_{dis} = 16 W.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base		–	11	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		–	0.3	K/W

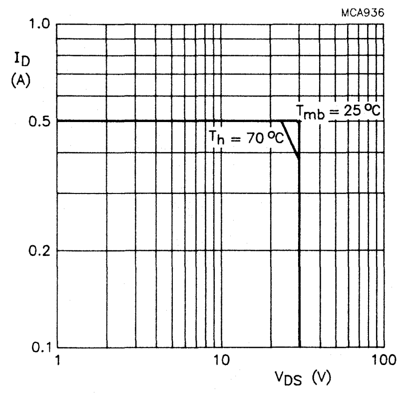


Fig.3 DC SOAR.

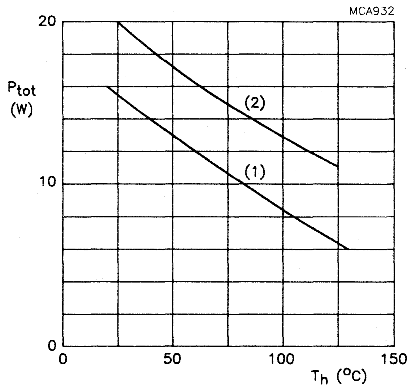


Fig.4 Power/temperature derating;
(1): continuous operation,
(2): short-time operation during mismatch.

VHF PowerMOS transistor BLF242

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_{DS} = 28 V V_{GS} = 0	–	–	10	μA
I_{GSS}	gate-source leakage current	± V_{GS} = 20 V V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate threshold voltage	I_D = 3 mA V_{DS} = 10 V	2.0	–	4.5	V
G_{fs}	forward transconductance	V_{DS} = 10 V I_D = 0.3 A	0.16	0.24	–	S
$R_{DS(on)}$	drain-source ON-resistance	I_D = 0.3 A V_{GS} = 10 V	–	3.3	–	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 10 V	–	1.2	–	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	13	–	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	9.4	–	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	1.7	–	pF

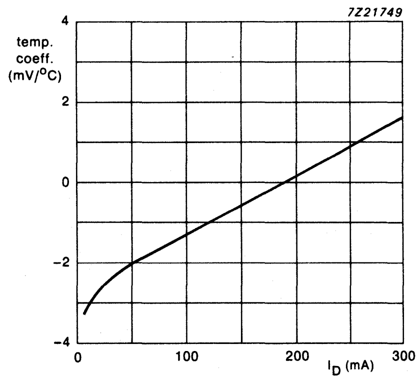


Fig.5 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

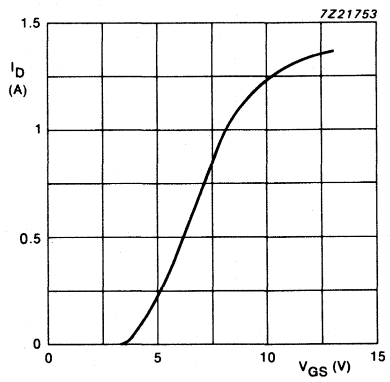


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

VHF PowerMOS transistor

BLF242

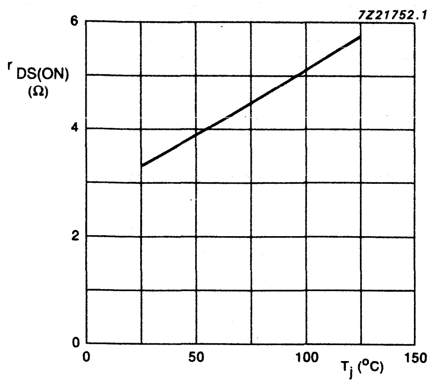


Fig.7 Drain-source ON-state resistance as a function of junction temperature; I_D = 0.3 A; V_{DS} = 10 V; typical values.

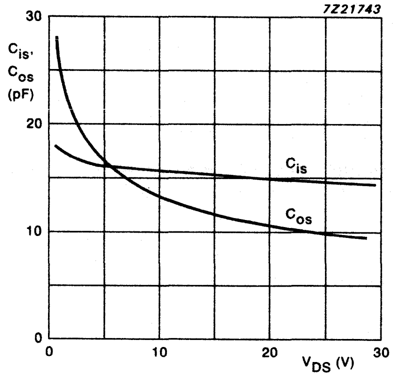


Fig.8 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

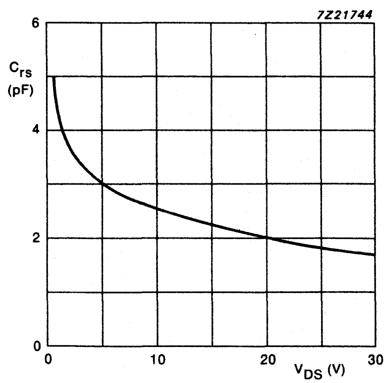


Fig.9 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

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

Noise figure (test circuit, Fig. 12)

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; NF = typ. 5.5 dB.

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.

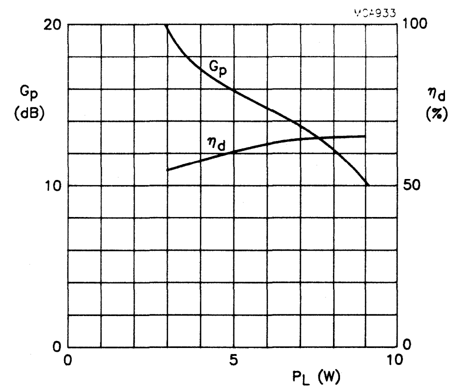


Fig.10 Power gain and efficiency as functions of load power; class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω; f = 175 MHz; typical values.

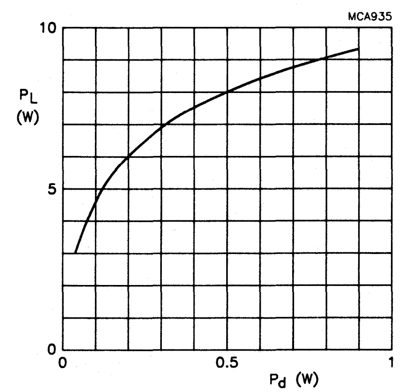


Fig.11 Load power as a function of input power; class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; R_{GS} = 47 Ω; f = 175 MHz; typical values.

VHF PowerMOS transistor BLF242

List of components (Fig. 12)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C7	film dielectric trimmer	4 - 40 pF		2222 809 08002
C3, C5	multilayer ceramic chip capacitor note 1	100 pF		
C4, C8	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C6	film dielectric trimmer	5 - 60 pF		2222 809 08003
C9	40 V electrolytic capacitor	2.2 μF		
L1	5 turns enamelled 0.7 mm copper wire	53 nH	int. dia. 3 mm length 5.4 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	int. dia. 8 mm length 15.5 mm leads 2 x 5 mm	
L5	5 turns enamelled 1 mm copper wire	79 nH	int. dia. 5 mm length 9.1 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. ATC capacitor type B or capacitor of the same quality.
2. The striplines are on a double copper-clad PCB with epoxy fibre-glass dielectric ($\varepsilon = 4.5$); thickness 1/16 inch.

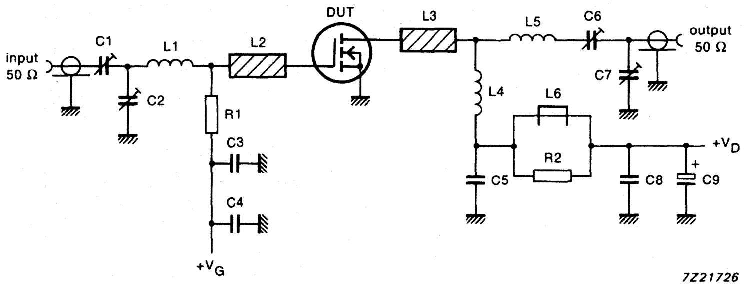
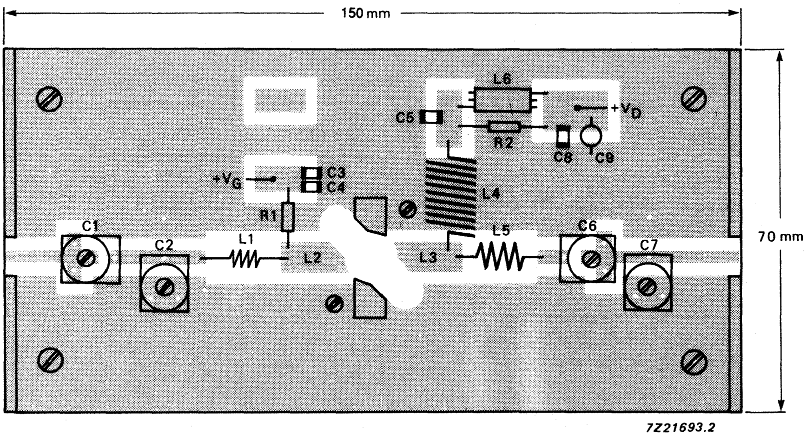


Fig.12 175 MHz class-B test circuit.

The circuit and components are located on one side of the epoxy 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 at the edges of the board and under the source.



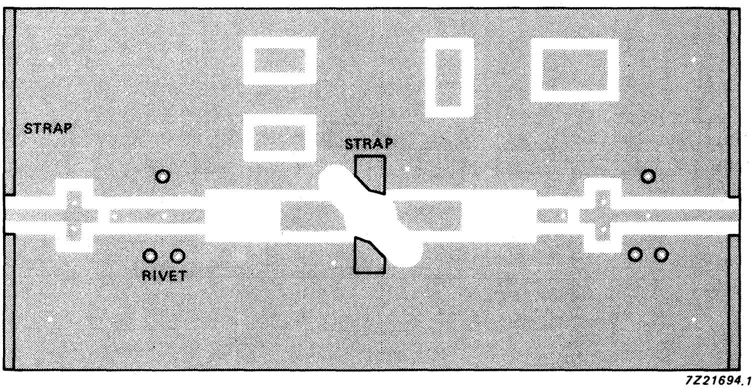


Fig.13 Printed-circuit board and component layout of the BLF242 test circuit at 175 MHz.

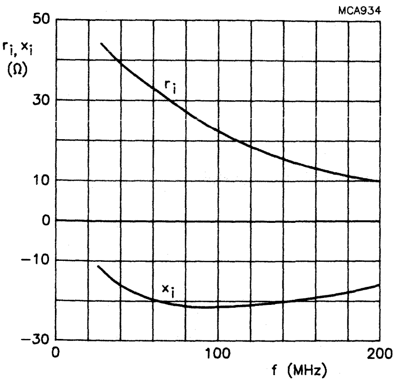


Fig.14 Input impedance; series components; V_{CE} = 28 V, P_L = 5 W; R_{GS} = 47 Ω; T_h = 25 °C; typical values.

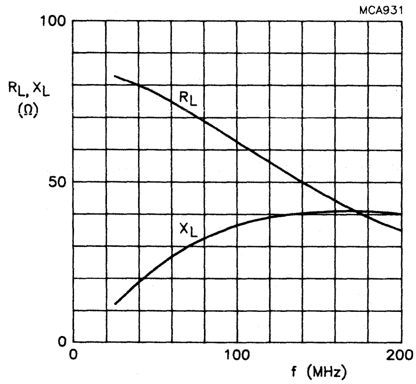


Fig.15 Load impedance; series components; V_{CE} = 28 V, P_L = 5 W; R_{GS} = 47 Ω; T_h = 25 °C; typical values.

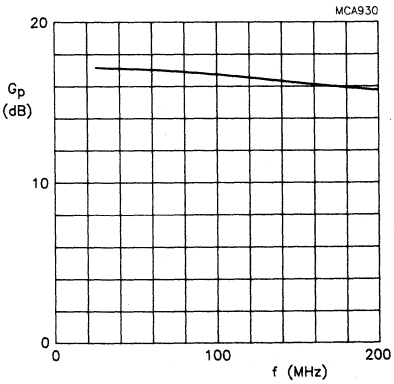


Fig.16 Power gain; class-B operation; V_{CE} = 28 V, P_L = 5 W; R_{GS} = 47 Ω; T_h = 25 °C; typical values.

VHF POWER MOS TRANSISTOR

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

Features

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

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

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

QUICK REFERENCE DATA

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

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

MECHANICAL DATA

SOT123 (see Fig.1).

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

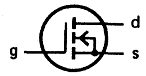
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



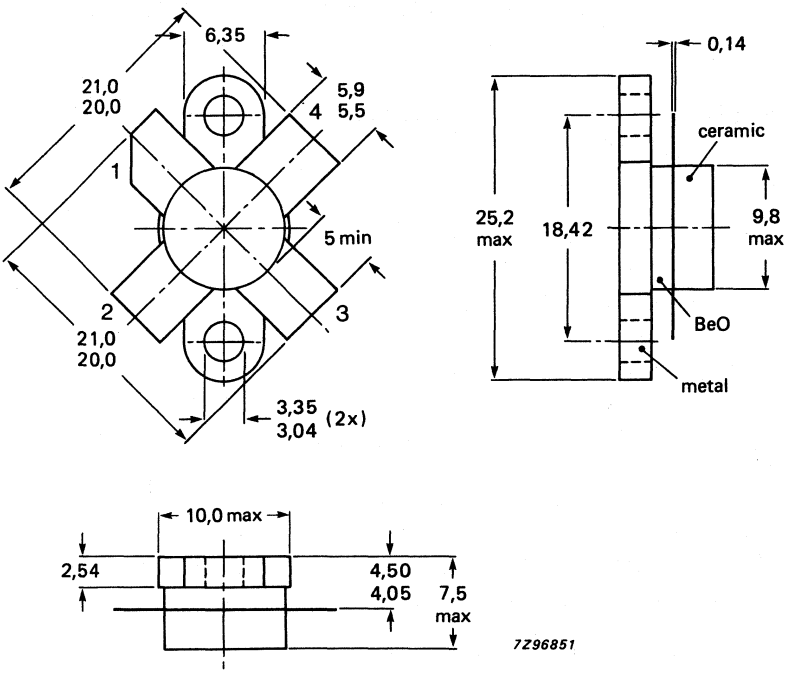


Fig.1 SOT123.

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

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

Heatsink compound must be applied
sparingly, and evenly distributed.

RATINGS

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

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

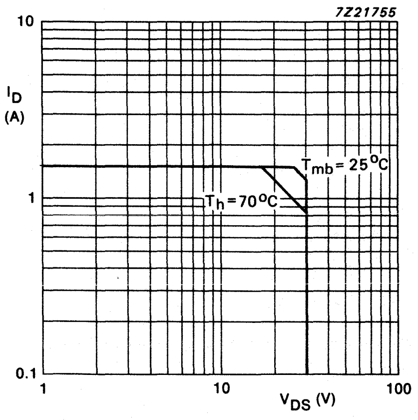


Fig.2 DC SOAR.
($R_{th\ mb-h}$ = 0.3 K/W).

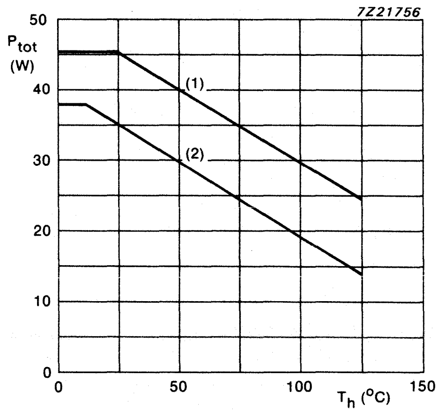


Fig.3 Power/temperature derating curves.

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

THERMAL RESISTANCE
(P = 38 W; T_{mb} = 25 °C)

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

CHARACTERISTICS (continued)

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

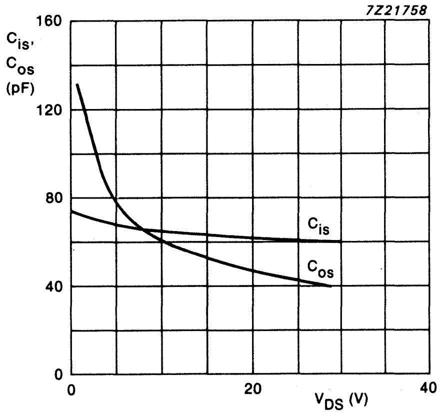


Fig.4 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

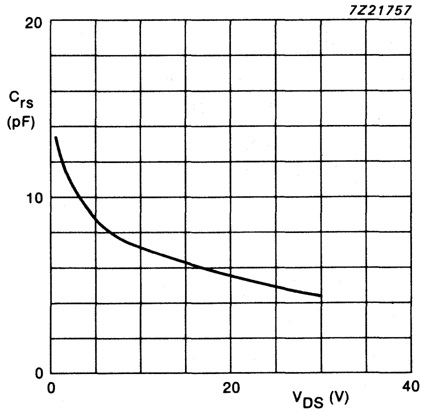


Fig.5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

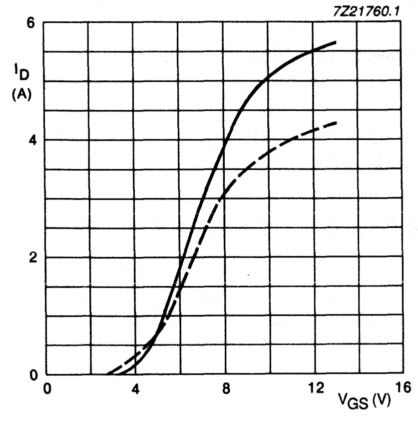


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

——— T_j = 25 °C
– – – T_j = 125 °C

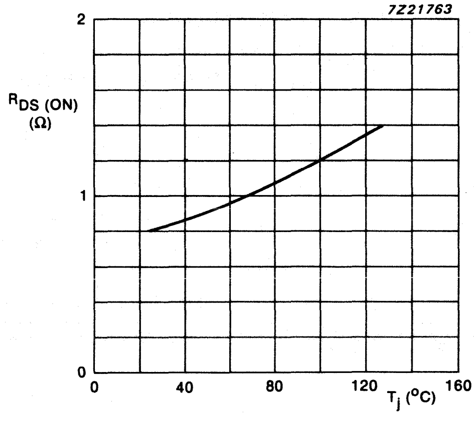


Fig.7 Drain-source on-state resistance as a function of junction temperature; I_D = 0.75 A; V_{GS} = 10 V; typical values.

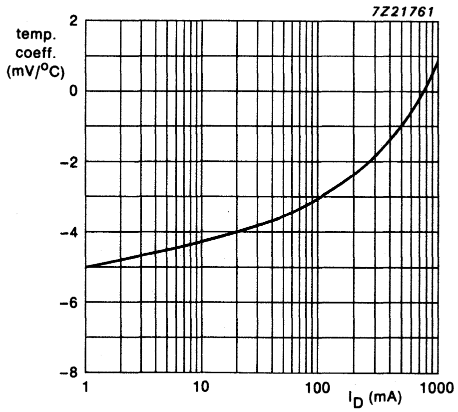


Fig.8 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; valid for T_j = 25 to 125 °C; typical values.

APPLICATION INFORMATION

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

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

* R_1 included.

RUGGEDNESS

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

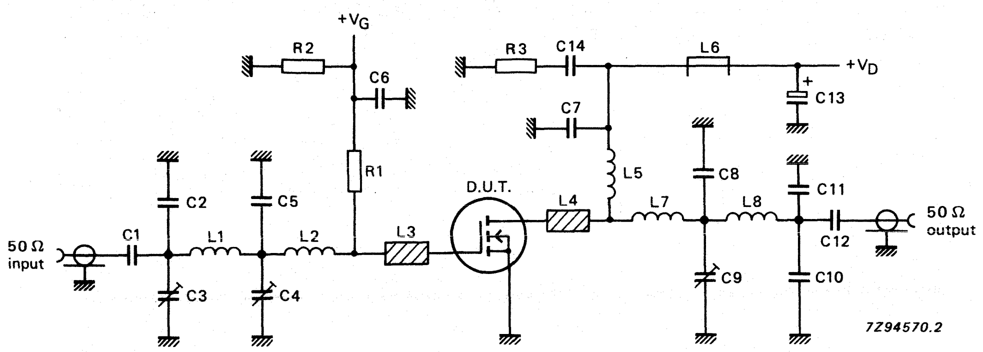


Fig.9 Class-B test circuit at f = 175 MHz.

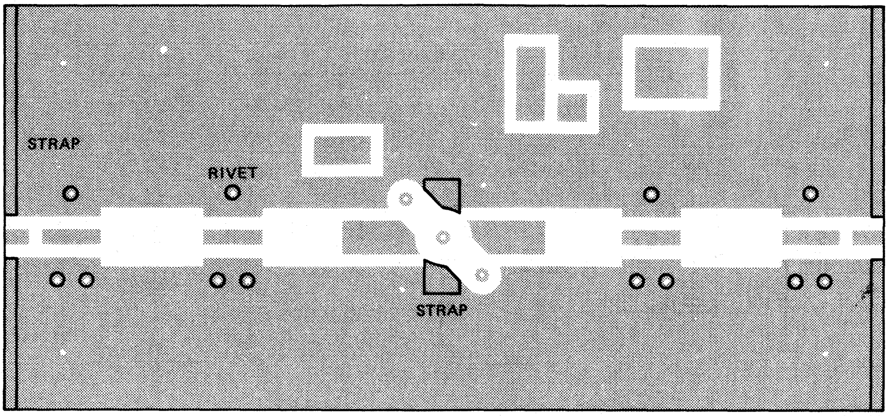
List of components:

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

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

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

APPLICATION INFORMATION (continued)



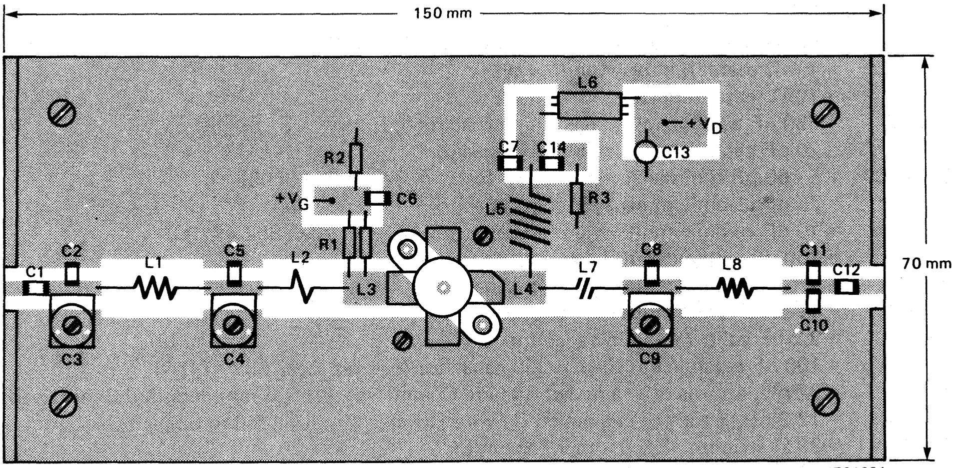


Fig.10 Printed-circuit board and component lay-out for 175 MHz class-B test circuit.

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

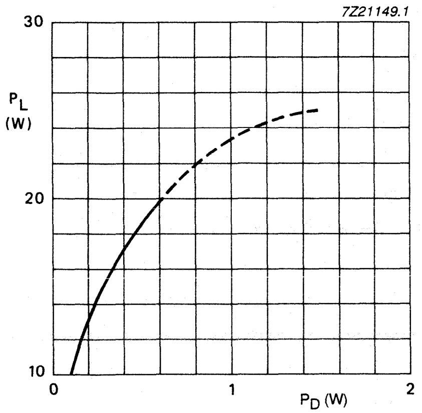


Fig.11 Load power as a function of drive power; V_{DS} = 28 V.

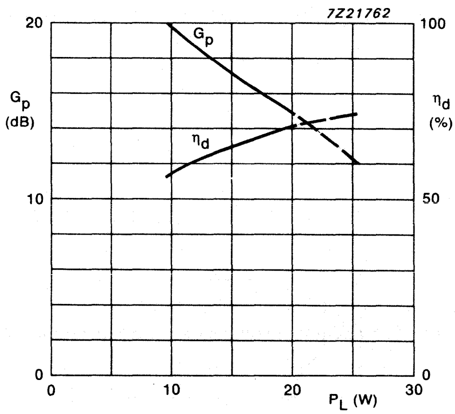


Fig.12 Power gain and efficiency as functions of load power; V_{DS} = 28 V.

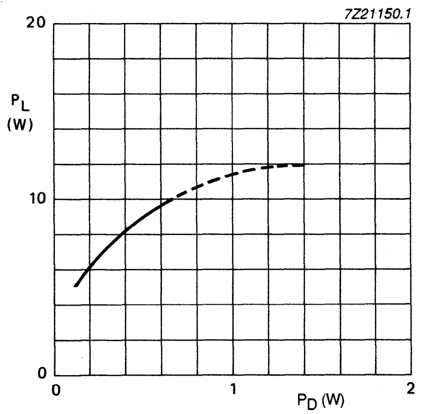


Fig.13 Load power as a function of drive power; V_{DS} = 12.5 V.

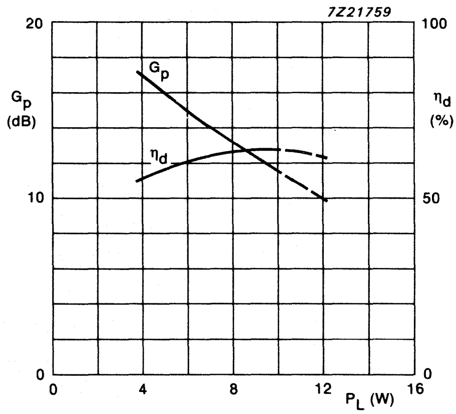


Fig.14 Power gain and efficiency as functions of load power; V_{DS} = 12.5 V.

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

APPLICATION INFORMATION (continued)

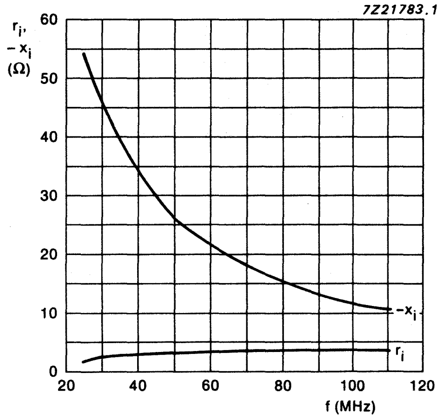


Fig.15 Input impedance as a function of frequency.

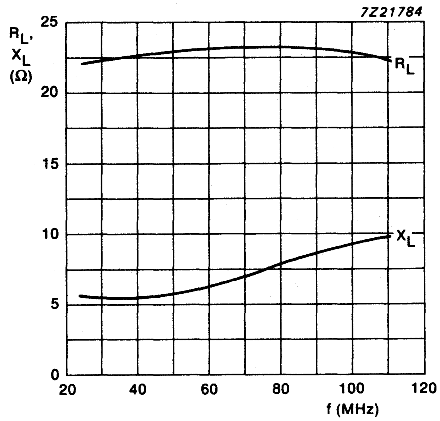


Fig.16 Load impedance as a function of frequency.

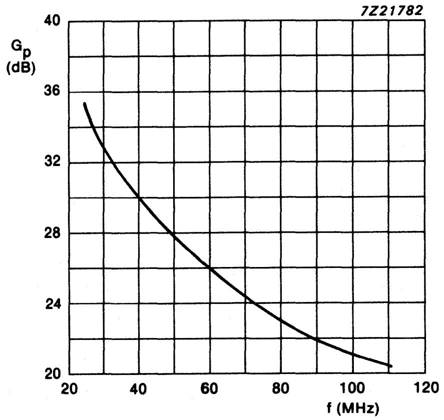


Fig.17 Power gain as a function of frequency.

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

VHF POWER MOSFET

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

Features

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

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

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

QUICK REFERENCE DATA

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

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

MECHANICAL DATA

SOT-123 (see Fig.1)

Note

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

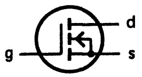
PRODUCT SAFETY This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged. See also page 3.

MECHANICAL DATA

Dimensions in mm

Pinning:

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



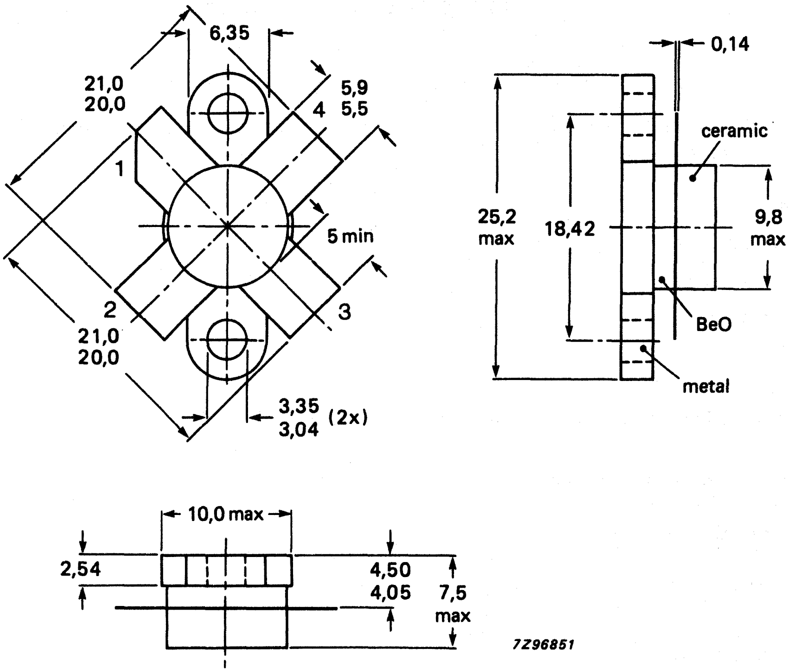


Fig.1 SOT-123.

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

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

Heatsink compound must be applied sparingly, and evenly distributed.

RATINGS

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

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

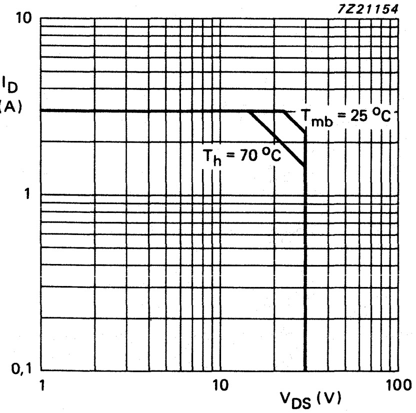


Fig.2 DC SOAR.
($R_{th\ mb\text{-}h}$ = 0.3 K/W).

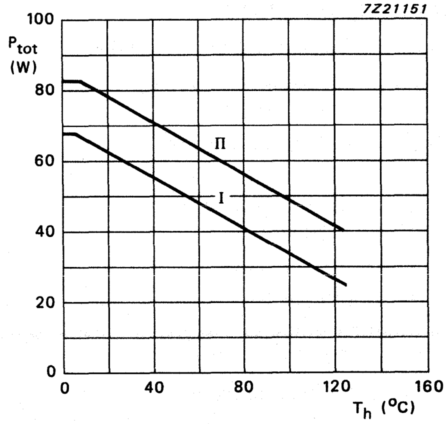


Fig.3 Power/temperature derating curves.
I Continuous operation.
II Short-time operation during mismatch.

THERMAL RESISTANCE

(P = 68 W; T_{mb} = 25 °C)

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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

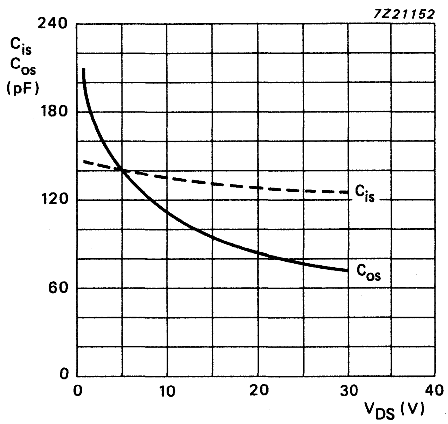


Fig.4. Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

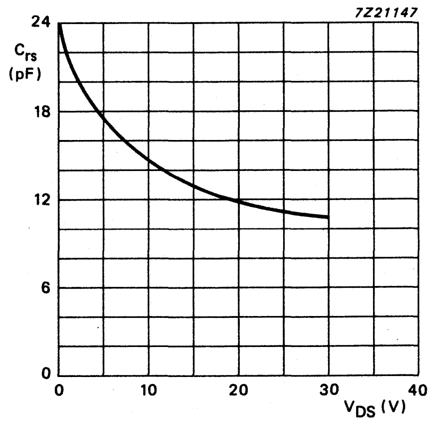


Fig.5 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

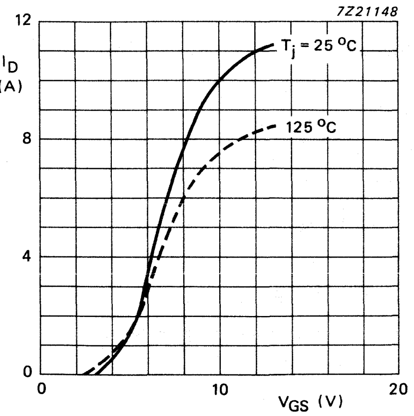


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values.

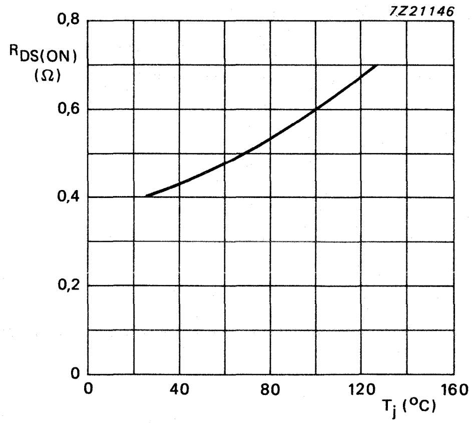


Fig.7 Drain-source on-state resistance as a function of junction temperature; I_D = 1.5 A; V_{DS} = 10 V; typical values.

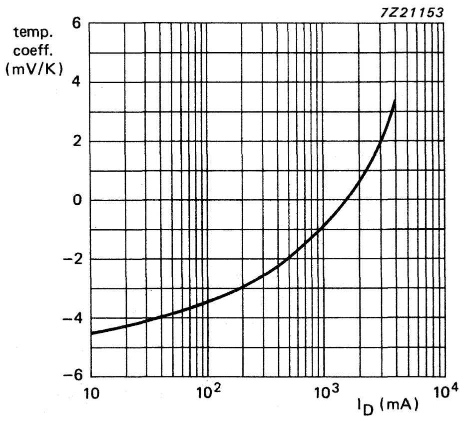


Fig.8 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; valid for T_j = 25 to 125 °C; typical values.

APPLICATION INFORMATION

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

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

* R_1 included.

RUGGEDNESS

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

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

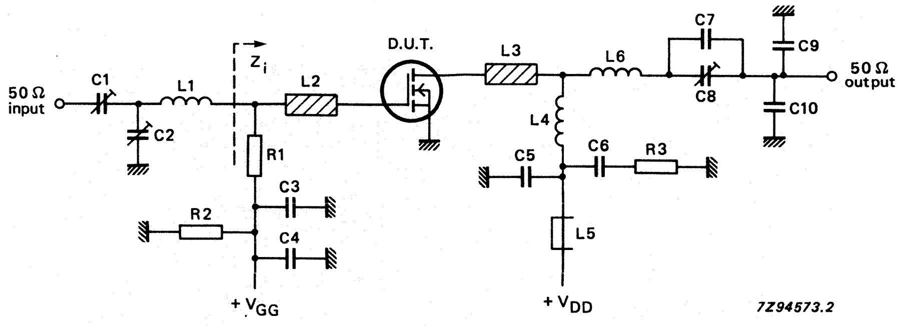


Fig.9 Class-B test circuit at f = 175 MHz.

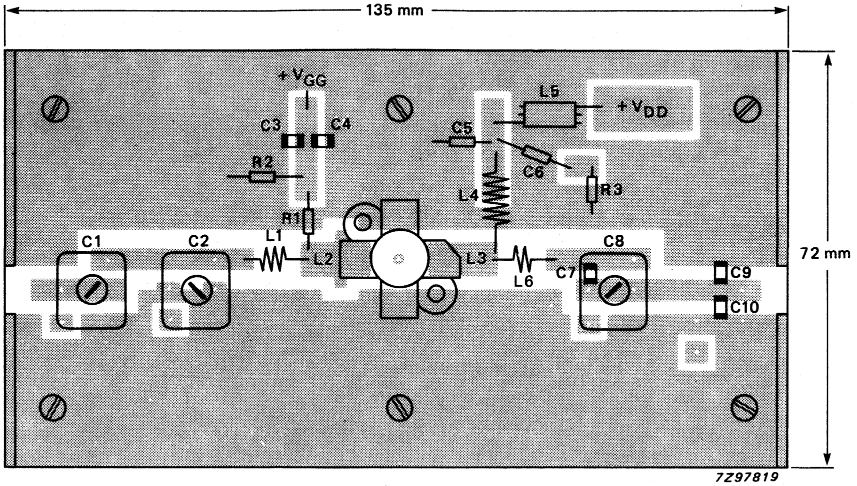
List of components:

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

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

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

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



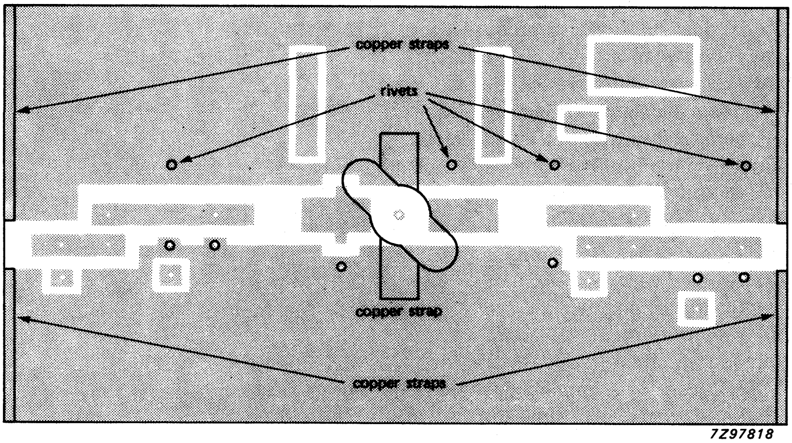


Fig.10 Printed-circuit board and component lay-out for 175 MHz class-B test circuit.

Note

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

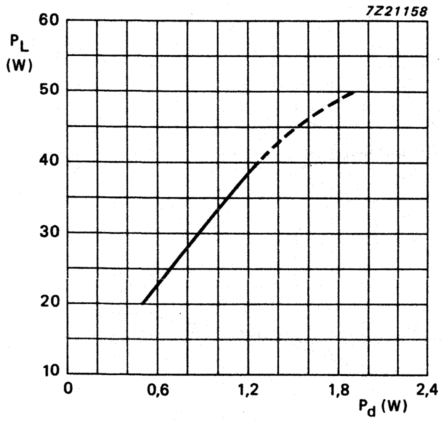


Fig.11 Load power as a function of drive power; V_{DS} = 28 V.

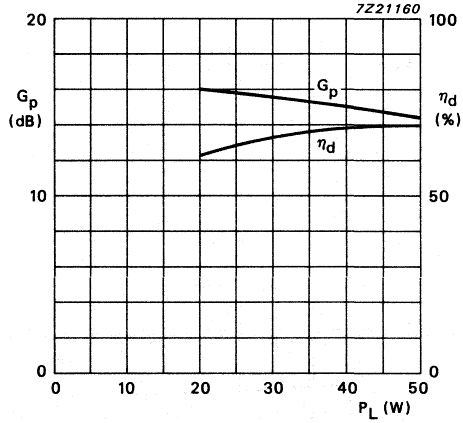


Fig.12 Power gain and efficiency as functions of load power; V_{DS} = 28 V.

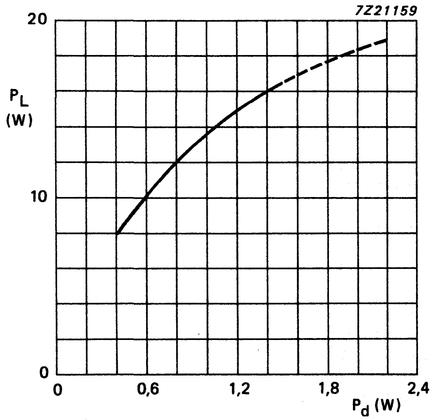


Fig.13 Load power as a function of drive power; V_{DS} = 12.5 V.

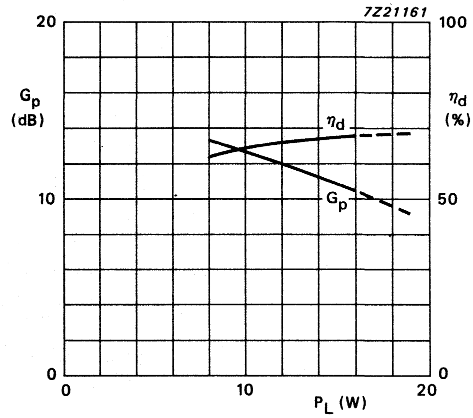


Fig.14 Power gain and efficiency as functions of load power; V_{DS} = 12.5 V.

Conditions for Figs 11 to 14:

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

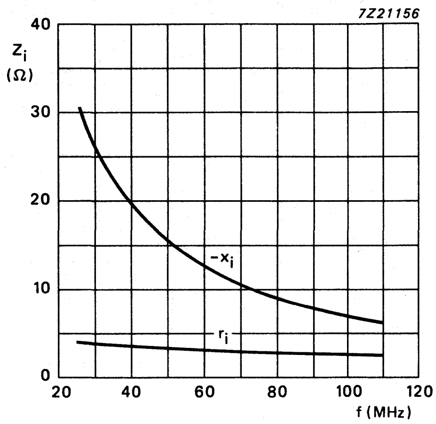


Fig.15 Input impedance as a function of frequency.

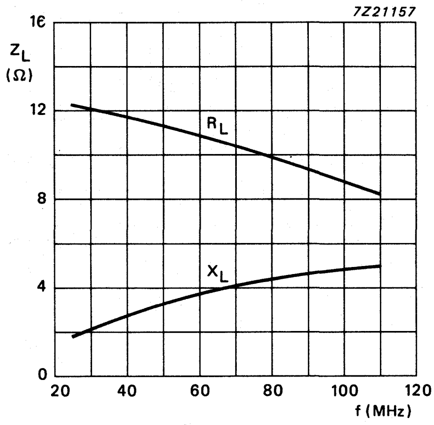


Fig.16 Load impedance as a function of frequency.

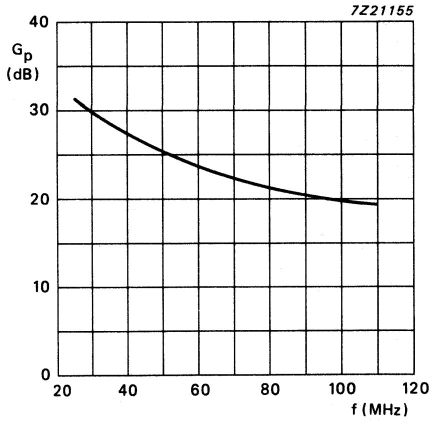


Fig.17 Power gain as a function of frequency.

Conditions for Figs 15 to 17:

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

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF245B
VHF push-pull PowerMOS transistor

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

DESCRIPTION

The BLF245B is a silicon n-channel enhancement mode vertical D-MOS push-pull transistor intended for large-signal amplifier applications in the VHF range with a nominal voltage supply of 28 V.

The BLF245B has a 4-lead balanced flange envelope with a ceramic cap. The flange is the source connection.

Note

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

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 (%)
c.w. class-B	175	28	30	typ. 18	typ. 65

MECHANICAL DATA

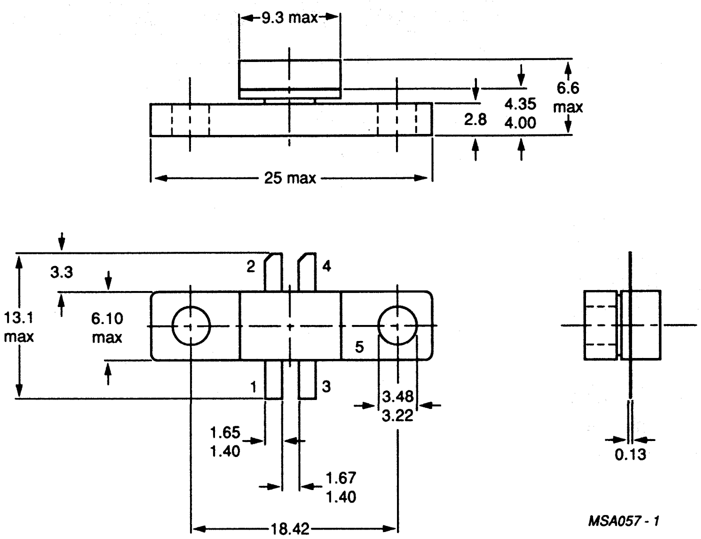
SOT279 - see Fig.1.

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 SOT279.

PINNING

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

VHF push-pull PowerMOS transistor BLF245B

LIMITING VALUES (per transistor section unless otherwise specified)

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	drain current	DC or average	-	1.5	A
I_{DM}	drain current	peak value f > 1 MHz	-	5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C both sections equally loaded, total device	-	75	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

Total device, both sections equally loaded.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	2.3	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.3	K/W

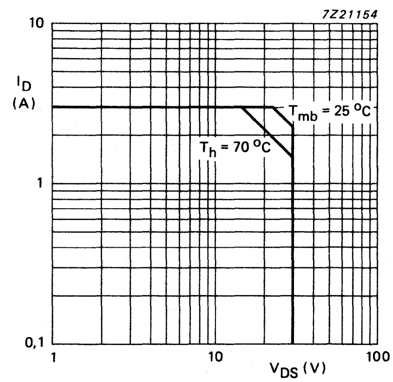


Fig.2 DC SOAR, total device; both sections equally loaded.

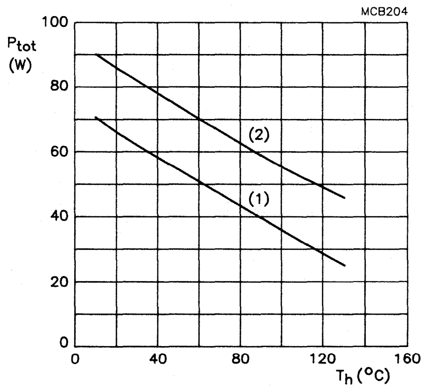


Fig.3 Power/temperature derating, total device; both sections equally loaded; (1) continuous operation; (2) short-time operation during mismatch.

CHARACTERISTICS (per transistor section)

T_j = 25 °C.

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_{DS} = 28 V V_{GS} = 0	-	-	1	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 5 mA	2	-	4.5	V
g_{fs}	forward transconductance	V_{DS} = 10 V I_D = 0.75 A	600	850	-	mS
$r_{DS(on)}$	drain-source on-resistance	V_{GS} = 10 V I_D = 0.75 A	-	0.8	-	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 10 V	-	5	-	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	60	-	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	40	-	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	4.5	-	pF

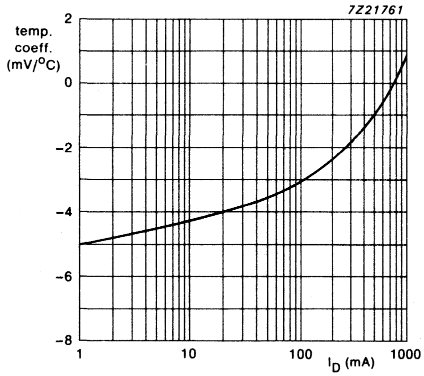


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

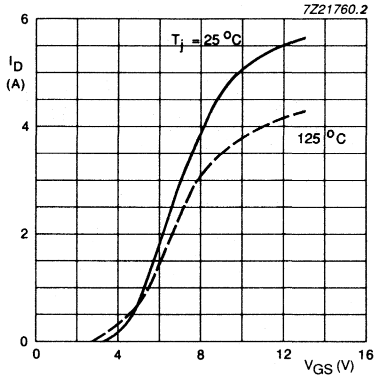


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values per section.

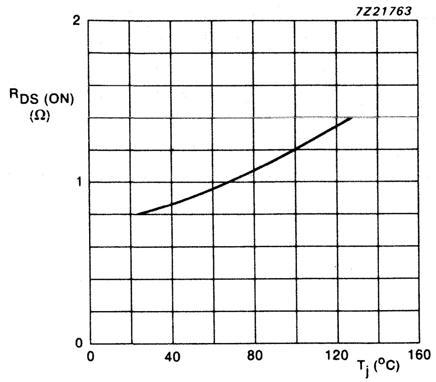


Fig.6 Drain-source on-resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 0.75 A; typical values per section.

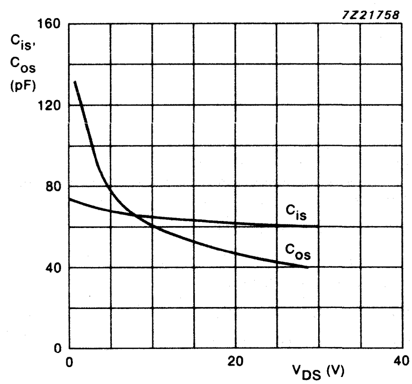


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

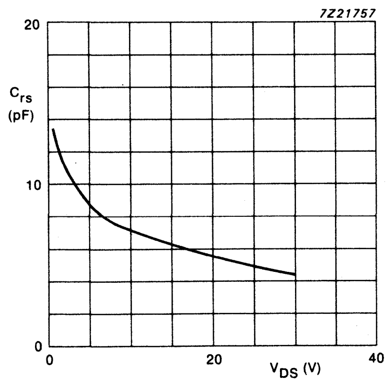


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 0.3 K/W unless otherwise specified.
RF performance in a common-source push-pull circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
c.w. class-B	175	28	2 x 25	30	> 14 typ. 18	> 55 typ. 65

Ruggedness in class-B operation

The BLF245B 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.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF246
VHF PowerMos transistor

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 intended for use in large signal amplifiers in the VHF range. The transistor has a 4-lead flange envelope, with a ceramic cap (SOT121). All leads are isolated from the flange. The devices are marked with a V_{GS} indication, intended for matched pair applications.

Note

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

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_P (dB)	η_C (%)
c.w. class-B	108	28	80	≥ 16	≥ 55

MECHANICAL DATA

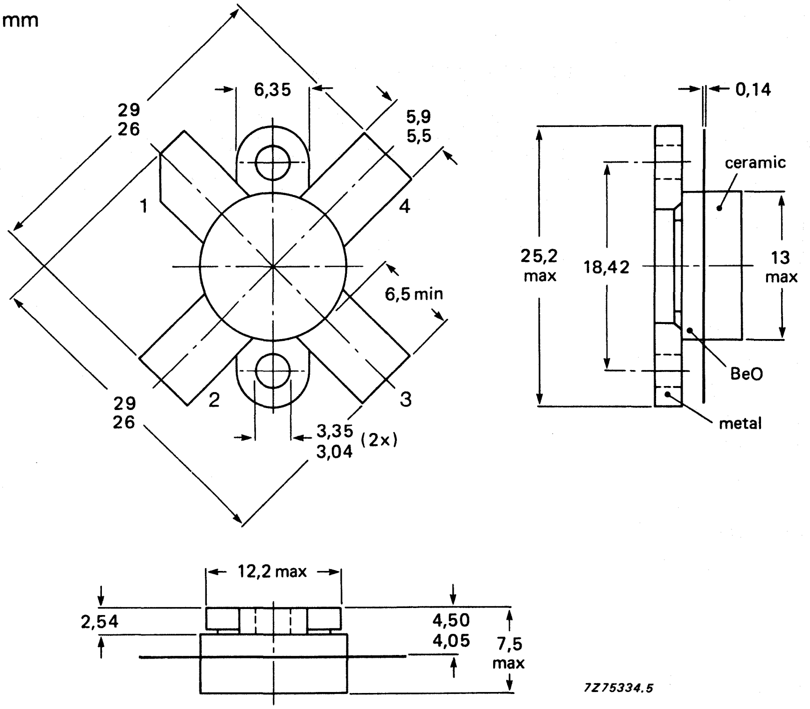
SOT121 - see Fig.1.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The products is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispoe of this product should be aware of its nature and of the necessary safety precautions. **After use, dispose of as chemical or special wast according to the regulations applyting 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 SOT121.

PIN CONFIGURATION

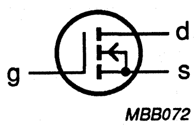


Fig.2 Pin configuration.

PINNING

PIN	DESCRIPTION
1	drain
2	source
3	gate
4	source

LIMITING VALUES

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	drain current	DC	–	7	A
I_{DM}	drain current	peak value f > 1 MHz	–	20	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	130	W
T_{stg}	storage temperature		–65	150	°C
T_j	operating junction temperature		–	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	1.35	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.2	K/W

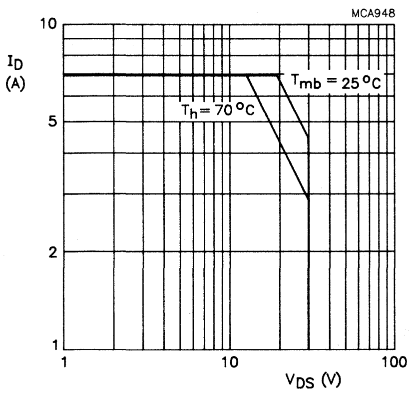


Fig.3 DC SOAR.

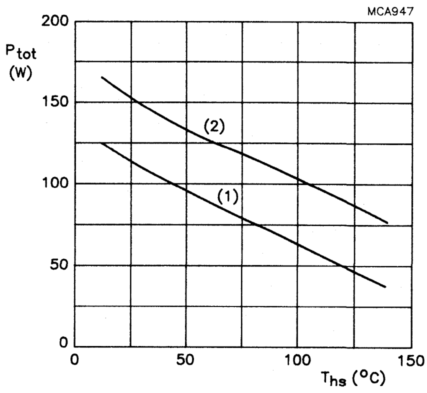


Fig.4 Power/temperature derating;
(1) continuous operation;
(2) short-time operation during mismatch.

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 = 50 mA	65.	–	–	V
I_{DSS}	drain-source leakage current	V_{DS} = 28 V V_{GS} = 0	–	–	2.5	mA
I_{GSS}	gate-source leakage current	± V_{GS} = 20 V V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate threshold voltage	I_D = 50 mA V_{DS} = 10 V	2.0	–	4.5	V
ΔV_{GS}	gate-source voltage difference of matched pairs	V_{DS} = 10 V I_D = 50 mA	–	–	100	mV
g_{fs}	transfer conductance	V_{DS} = 10 V I_D = 2.5 A or 5 A	3.0	3.8	–	S
$R_{DS(on)}$	drain-source on-resistance	I_D = 5 A V_{GS} = 10 V	–	0.2	–	Ω
I_{DSX}	on-state drain current	V_{DS} = 10 V V_{GS} = 10 V	–	22	–	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	250	–	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	180	–	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	–	23	–	pF

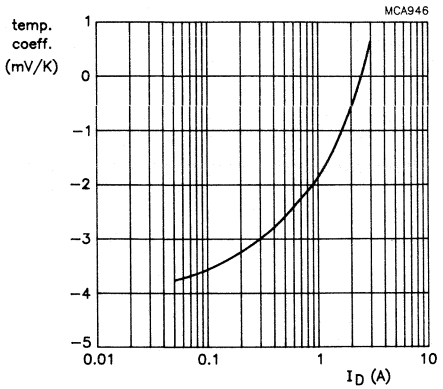


Fig.5 Temperature coefficient of gate-source voltage as a function of drain current; V_{DS} = 10 V; T_h = 25 - 70 °C; typical values.

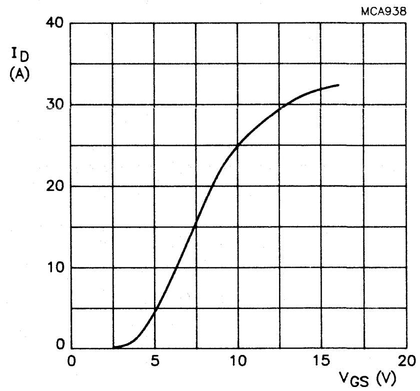


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

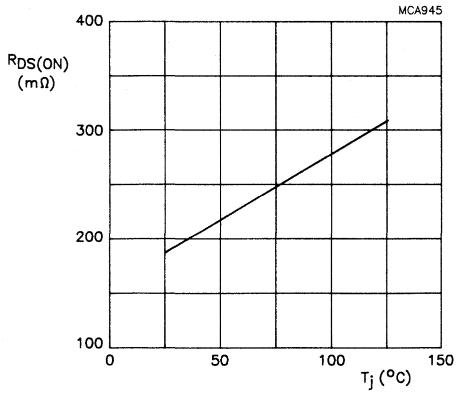


Fig.7 Drain-source on-state resistance as a function of junction temperature; I_D = 5 A; V_{GS} = 10 V; typical values.

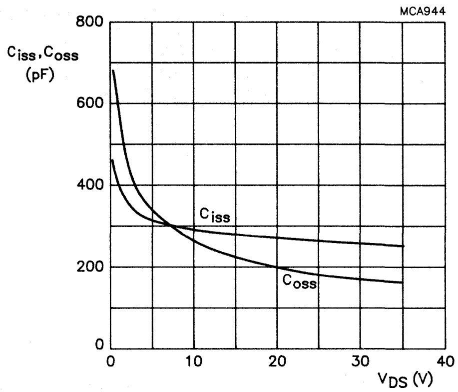


Fig.8 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

VHF PowerMos transistor BLF246

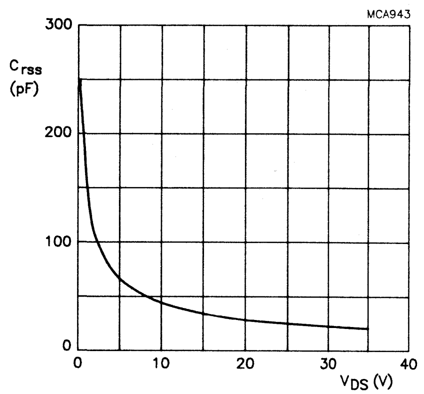


Fig.9 Feedback capacitance as a function of drain-source voltage; $V_{GS} = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

RF performance in c.w. operation (common-source circuit).
$R_{GS} = 12\ \Omega$; $T_h = 25$ °C, $R_{th\ mb\text{-}h} = 0.2$ K/W unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (A)	P_L (W)	G_P (dB)	η_D (%)
c.w class-B	108	28	0.1	80	> 16	> 55
c.w. class-B	108	28	0.1	80	typ. 18	typ. 65
c.w. class-C	108	28	0 note 1	80	typ. 15	typ. 72

Note

1. $V_{GS} = 0$ (class-C).

Noise figure

Measured with 80 W power-matched source and load in the test circuit (Fig.12) with $R_{GS} = 27\ \Omega$. $V_{DS} = 28$ V; $I_D = 2$ A; f = 108 MHz; $T_h = 25$ °C; $R_{th\ mb\text{-}h} = 0.2$ K/W; NF = typ. 3 dB.

Ruggedness in class-B operation

The BLF246 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: $V_{DS} = 28$ V, f = 108 MHz, $T_h = 25$ °C, $R_{th\ mb\text{-}h} = 0.2$ K/W at rated output power.

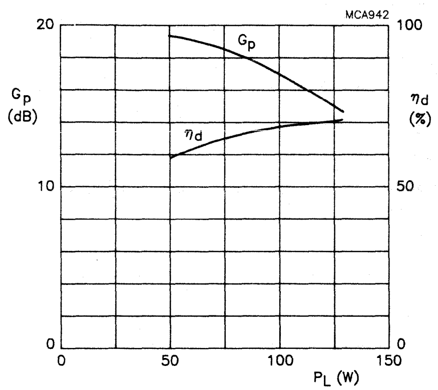


Fig.10 Power gain and efficiency as functions of load power; class-B operation; V_{DS} = 28 V; I_{DQ} = 100 mA; R_{GS} = 12 Ω; f = 108 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; typical values.

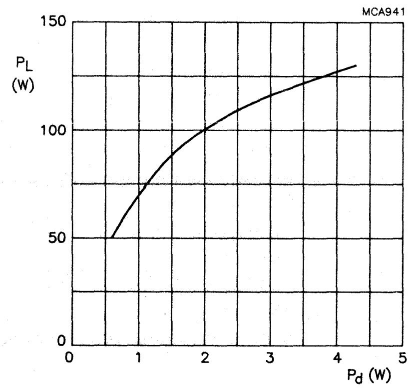


Fig.11 Load power as a function of input power; class-B operation; V_{DS} = 28 V; I_{DQ} = 100 mA; R_{GS} = 12 Ω; f = 108 MHz; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; typical values.

List of components (Fig. 12)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C4, C5, C8, C14	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C2, C3, C6, C7	film dielectric trimmer capacitor	5-60 pF		2222 809 08003
C9	63 V electrolytic capacitor	2.2 μF		2222 030 38228
C10	multilayer ceramic chip capacitor (note 1)	68 pF+39 pF in parallel		
C11	multilayer ceramic chip capacitor (note 1)	69 pF+100 pF in parallel		
C12	multilayer ceramic chip capacitor (note 1)	2 x 100 pF in parallel		
C13	multilayer ceramic chip capacitor (note 1)	62 pF		
L1	5 turns enamelled 0.6 mm copper wire	52 nH	int. dia. 3 mm length 6.5 mm leads 2 x 10 mm	
L2	2 turns enamelled 0.6 mm copper wire	19 nH	int. dia. 3 mm length 3.5 mm leads 2 x 7.5 mm	
L3, L4	stripline (note 2)	31 Ω	length 13 mm width 6 mm	
L5	3 turns enamelled 1.6 mm copper wire	36 nH	int. dia. 6 mm length 12 mm leads 2 x 5 mm	
L6	enamelled 1.6 mm copper wire hairpin	14 nH	length 20 mm	
L7	grade 3B Ferroxcube HF choke			4312 020 36640
L8	3 turns enamelled 1.6 mm copper wire	52 nH	length 8 mm leads 2 x 9 mm	
R1	0.4 W metal film resistor	2 x 24 Ω in parallel		
R2	0.4 W metal film resistor	100 kΩ		
R3	0.4 W metal film resistor	10 Ω		

Notes

1. ATC capacitor type 100B or capacitor of the same quality.
2. The striplines are on a double copper-clad PCB with epoxy fibre-glass dielectric ($\varepsilon = 4.5$); thickness 1.6 mm.

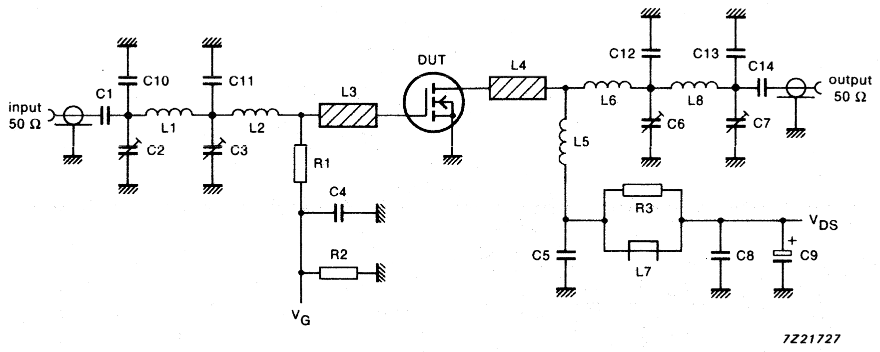
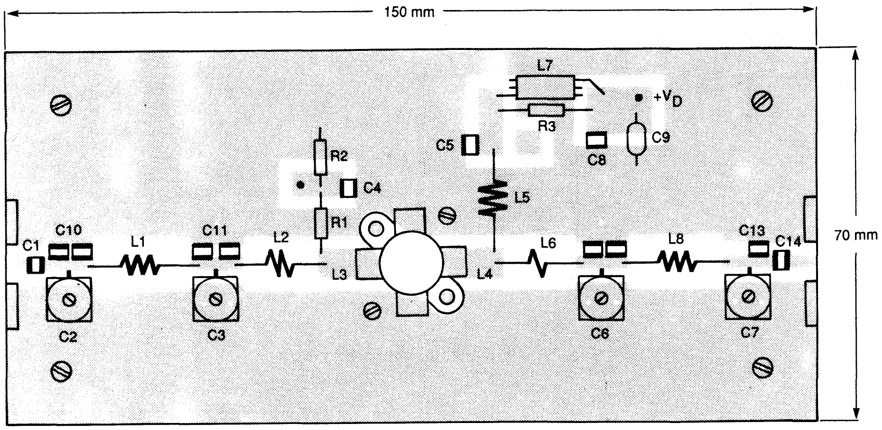


Fig.12 108 MHz class-B test circuit.

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



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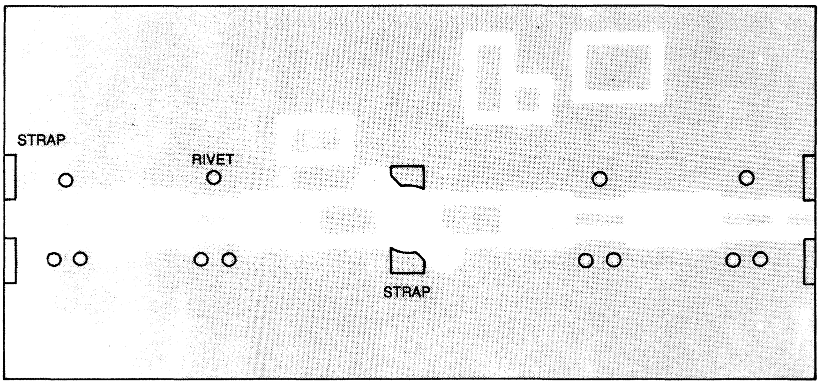

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Fig.13 Printed-circuit board and component layout of the BLF242 test circuit at 108 MHz.

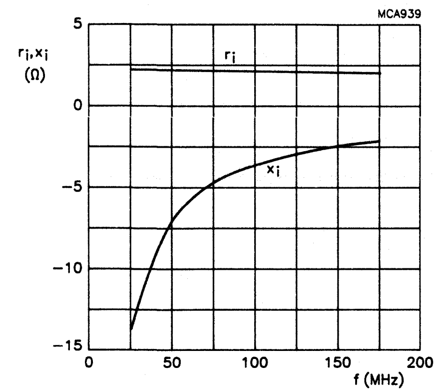


Fig.14 Input impedance; series components; V_{CE} = 28 V, I_{DQ} = 100 mA; R_{GS} = 12 Ω; P_O = 80 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; typical values.

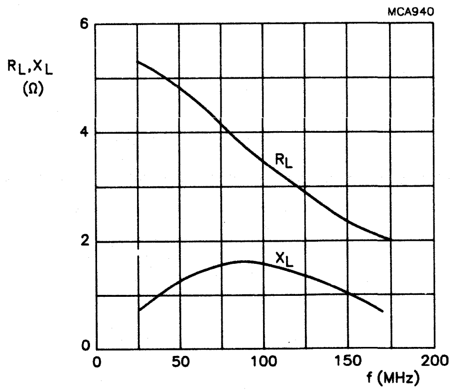


Fig.15 Load impedance; series components; V_{CE} = 28 V, I_{DQ} = 100 mA; R_{GS} = 12 Ω; P_O = 80 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; typical values.

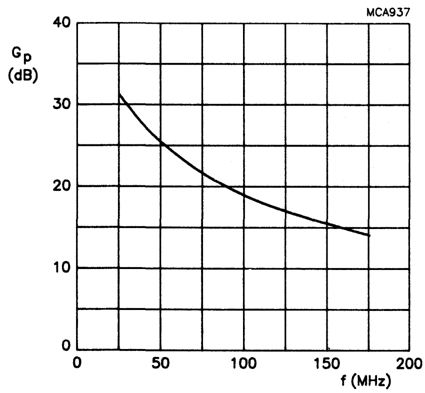


Fig.16 Power gain; class-B operation; V_{CE} = 28 V, I_{DQ} = 100 mA; R_{GS} = 12 Ω; P_O = 80 W; T_h = 25 °C; $R_{th\ mb\text{-}h}$ = 0.2 K/W; typical values.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF246B

VHF push-pull PowerMOS transistor

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

DESCRIPTION

The BLF246B is a silicon n-channel enhancement mode vertical D-MOS transistor intended for large-signal amplifier applications in the VHF range with a nominal voltage supply of 28 V.

The encapsulation is a SOT161 flange type, with a ceramic cap. All leads are isolated from the flange.

Note

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

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 (%)
c.w. class-B	175	28	60	typ. 19	typ. 65

MECHANICAL DATA

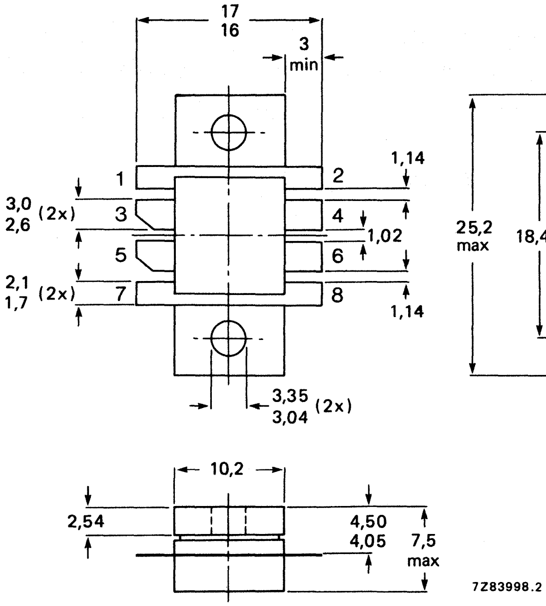
SOT161 - see Fig.1.

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 SOT161.

PINNING

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

LIMITING VALUES (per transistor section unless otherwise specified)

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	drain current	DC or average	-	3	A
I_{DM}	drain current	peak value f > 1 MHz	-	10	A
P_{tot}	total power dissipation	T_{mb} = 25 °C both sections equally loaded, total device	-	130	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

Total device, both sections equally loaded.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	1.35	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.25	K/W

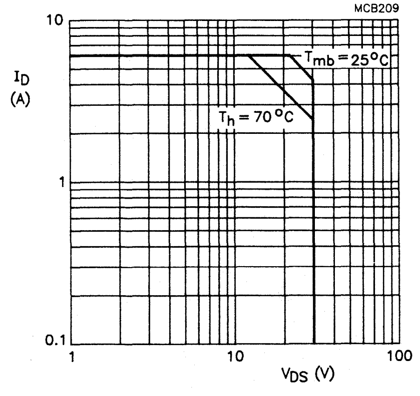


Fig.2 DC SOAR, total device; both sections equally loaded.

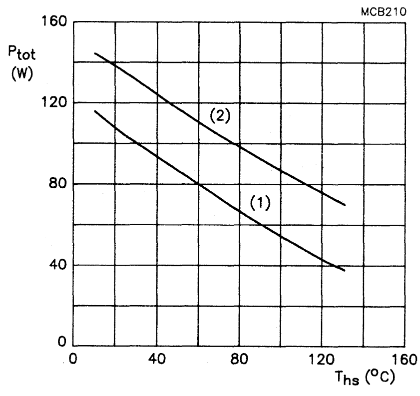


Fig.3 Power/temperature derating, total device; both sections equally loaded;
(1) continuous operation;
(2) short-time operation during mismatch.

CHARACTERISTICS (per transistor section)

T_j = 25 °C.

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_{DS} = 28 V V_{GS} = 0	-	-	2	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 10 mA	2	-	4.5	V
g_{fs}	forward transconductance	V_{DS} = 10 V I_D = 1.5 A	1.2	1.8	-	S
$r_{DS(on)}$	drain-source on-resistance	V_{GS} = 10 V I_D = 1.5 A	-	0.4	-	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 10 V	-	10	-	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	125	-	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	75	-	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	11	-	pF

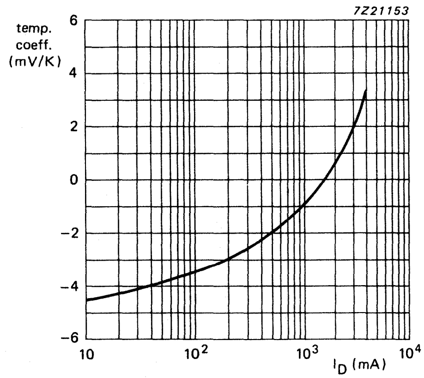


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

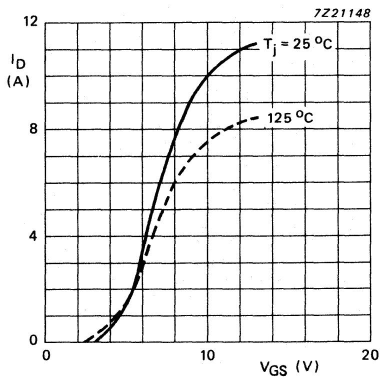


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; typical values per section.

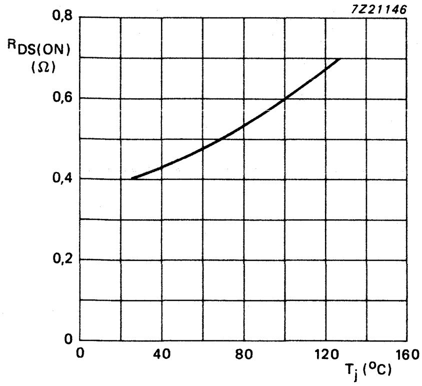


Fig.6 Drain-source on-resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 1.5 A; typical values per section.

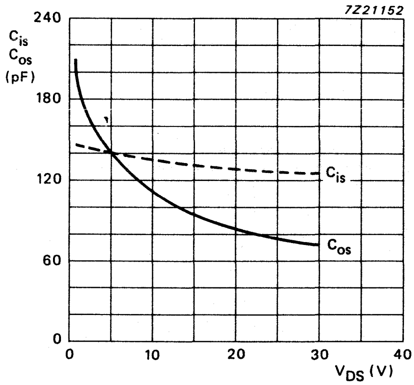


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

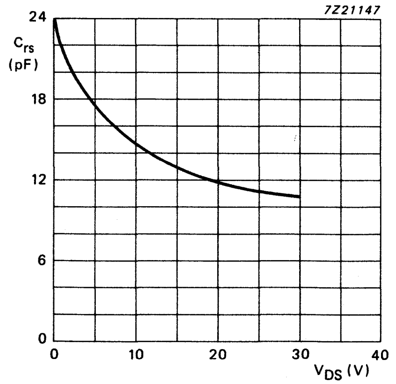


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
c.w. class-B	175	28	2 x 50	60	> 14 typ. 19	> 55 typ. 65

Ruggedness in class-B operation

The BLF246B 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.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF277

VHF PowerMOS transistor

DESCRIPTION

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

The transistor has a 6-lead envelope with a ceramic cap (SOT119). All leads are isolated from the flange.

CAUTION

The gate-source input must be protected against static charge during transport and handling.

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
class-B	175	50	150	$>$ 14	$<$ 50

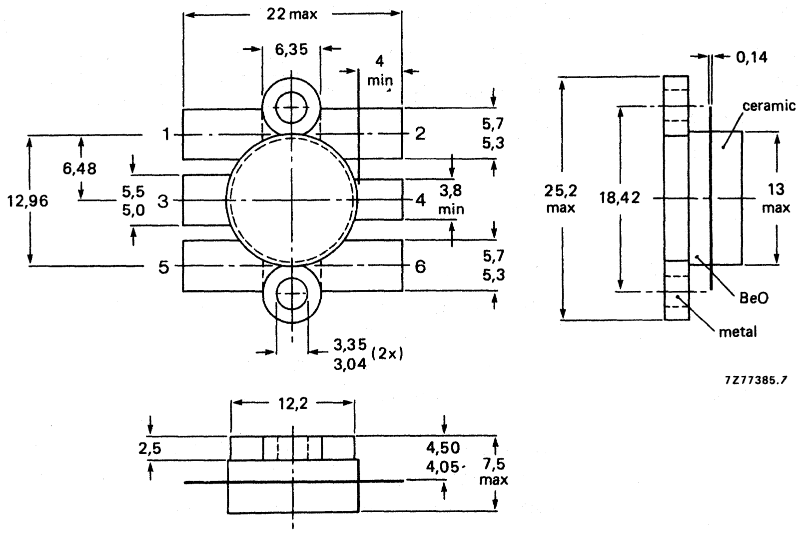
WARNING

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.**

VHF PowerMOS transistor BLF277

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 SOT119.

PINNING

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

PIN CONFIGURATION

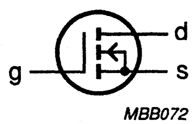


Fig.2 Pin configuration.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		-	110	V
$\pm V_{GS}$	gate-source voltage		-	20	V
I_D	drain current	DC	-	16	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	-	220	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	0.8	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.2	K/W

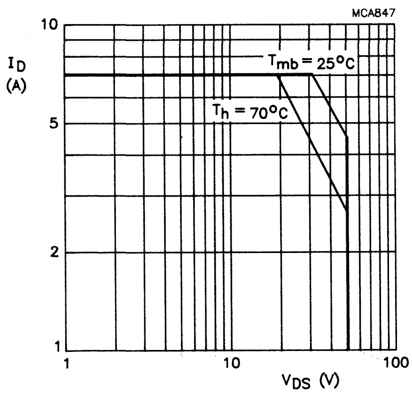


Fig.3 DC SOAR.

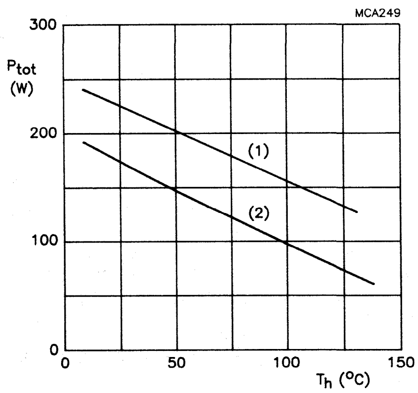


Fig.4 Power/temperature derating;
(1) continuous operation;
(2) short-time operation during mismatch.

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 = 50 mA	110	-	-	V
I_{DSS}	drain-source leakage current	V_{DS} = 50 V V_{GS} = 0	-	-	2.5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 50 mA	2.0	-	4.5	V
g_{fs}	forward transconductance	V_{DS} = 10 V I_D = 5 A	4.5	6.2	-	S
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = 10 V I_D = 5 A	-	0.2	0.3	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 10 V	-	25	-	A
C_{is}	input capacitance	V_{DS} = 50 V V_{GS} = 0 f = 1 MHz	-	580	-	pF
C_{os}	output capacitance	V_{DS} = 50 V V_{GS} = 0 f = 1 MHz	-	190	-	pF
C_{rs}	feedback capacitance	V_{DS} = 50 V V_{GS} = 0 f = 1 MHz	-	14	-	pF

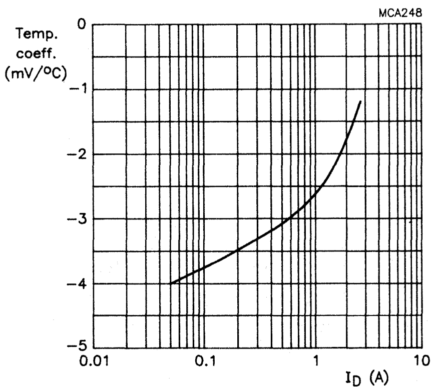


Fig.5 Temperature coefficient of gate-source voltage as a function of drain current; V_{DS} = 10 V; typical values.

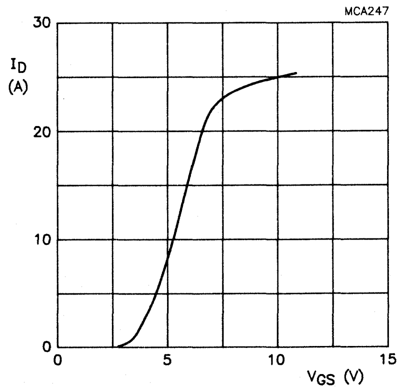


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; $I_D = f(V_{GS})$; T_j = 25 °C; typical values.

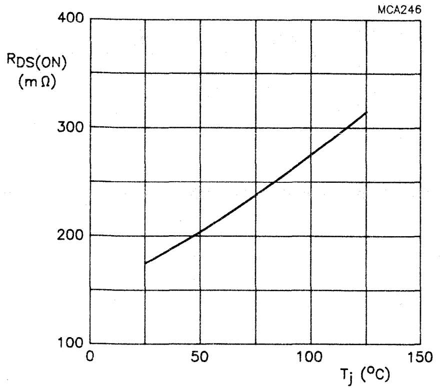


Fig.7 Drain-source on-state resistance as a function of junction temperature; $R_{DS(on)} = f(T_j)$; $V_{GS} = 10$ V; $I_D = 5$ A; typical values.

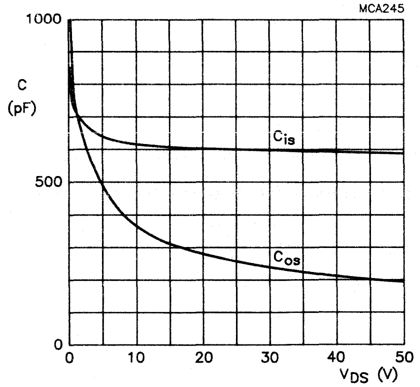


Fig.8 Input and output capacitance as functions of drain-source voltage; C_{is}, $C_{os} = f(V_{DS})$; $V_{GS} = 0$; f = 1 MHz; typical values.

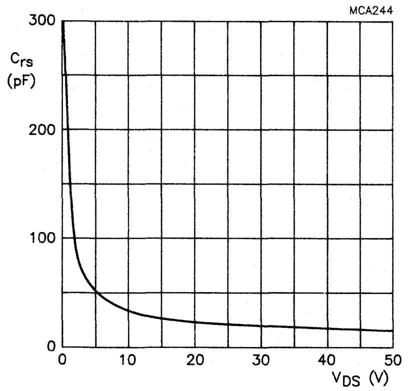


Fig.9 Feedback capacitance as a function of drain-source voltage; $C_{rs} = f(V_{DS})$; $V_{GS} = 0$; f = 1 MHz; typical values.

VHF PowerMOS transistor BLF277

APPLICATION INFORMATION

RF performance in c.w. operation (common-source circuit) R_{GS} = 16 Ω, T_h = 25 °C, $R_{th\ mb-h}$ = 0.2 K/W unless otherwise specified.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (A)	P_L (W)	G_p (dB)	η_D (%)
c.w. class-B	175	50	0.1	150	> 14 typ. 17	< 50 typ. 58

Ruggedness in class-B operation

The BLF277 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: V_{DS} = 50 V, f = 28 MHz at rated output power.

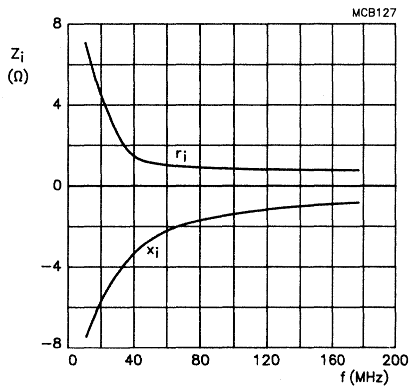


Fig.10 Input impedance, series components; class-B operation; V_{DS} = 50 V; I_{DQ} = 100 mA; P_L = 150 W; R_{GS} = 16 Ω; typical values.

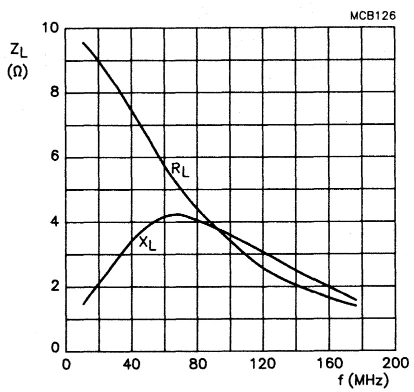


Fig.11 Load impedance, series components; class-B operation; V_{DS} = 50 V; I_{DQ} = 100 mA; P_L' = 150 W; R_{GS} = 16 Ω; typical values.

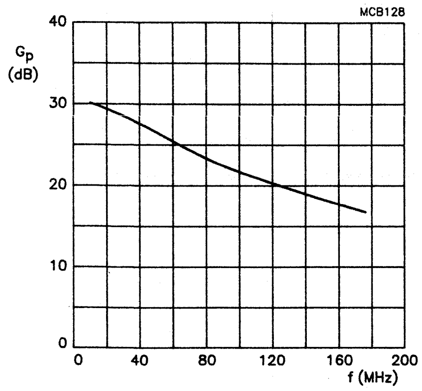


Fig.12 Power gain, class-B operation; V_{DS} = 50 V; I_{DQ} = 100 mA; P_L = 150 W; R_{GS} = 16 Ω; typical values.

VHF PUSH-PULL POWER MOS TRANSISTOR

Push-pull silicon N-channel enhancement mode vertical DMOS transistor intended for use in VHF broadcast transmitters.

Features

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

The transistor has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

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	108	50	300	> 20	> 60
CW class-C	108	50	300	typ. 18	typ. 80

MECHANICAL DATA

SOT262 (see Fig.1)

NOTE

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

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

MECHANICAL DATA

Dimensions in mm

Pinning

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

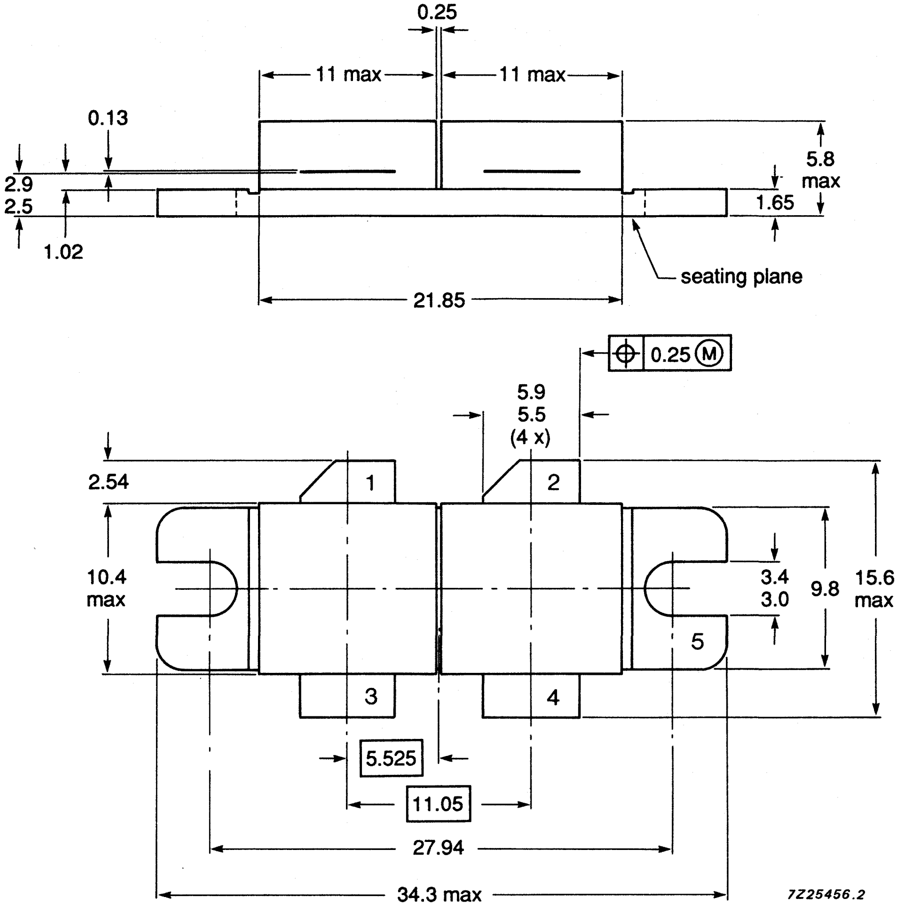


Fig.1 SOT262.

Torque on screw: min. 0.60 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

(per transistor section unless otherwise specified)

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

Drain-source voltage	V_{DS}	max.	110 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC or average	$I_D, I_{D(AV)}$	max.	7 A
peak value; f > 1 MHz	I_{DM}	max.	20 A
Total power dissipation at T_{mb} = 25 °C, both sections equally loaded	P_{tot}	max.	500 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

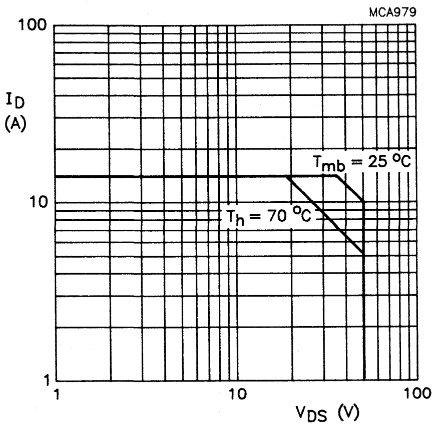
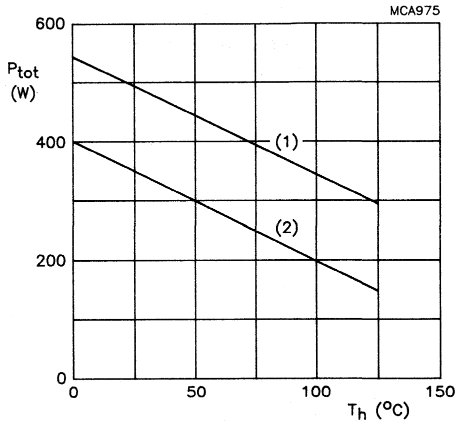


Fig.2 DC SOAR (total device) both sections equally loaded.



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

THERMAL RESISTANCE (total device) both sections equally loaded

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	0.35 K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.15 K/W

CHARACTERISTICS (per section)

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 50 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	110	V
Drain-source leakage current V_{DS} = 50 V; V_{GS} = 0	I_{DSS}	max.	2.5	mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	max.	1	μA
Gate threshold voltage I_D = 50 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5	V
Gate threshold voltage difference of both transistor sections V_{DS} = 10 V; I_D = 50 mA	$\Delta V_{GS(th)}$	max.	100	mV
Forward transconductance V_{DS} = 10 V; I_D = 5 A	G_{fs}	min. typ.	4.5 6.2	S S
Forward transconductance ration of both sections V_{DS} = 10 V; I_D = 5 A	G_{fs1}/G_{fs2}		0.9 to 1.1	
Drain-source on-state resistance I_D = 5 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.2	Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	25	A
Input capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{is}	typ.	580	pF
Output capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{os}	typ.	190	pF
Feedback capacitance at f = 1 MHz V_{DS} = 50 V; V_{GS} = 0	C_{rs}	typ.	14	pF
Drain-flange capacitance	C_{df}	typ.	5.4	pF

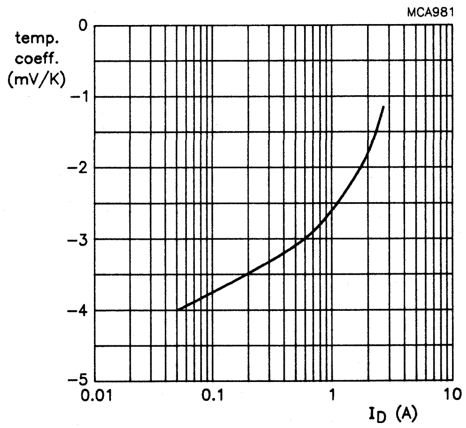


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

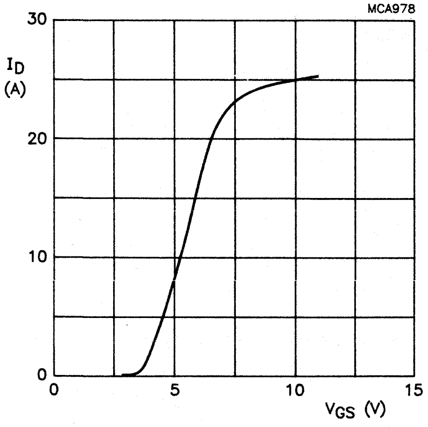


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

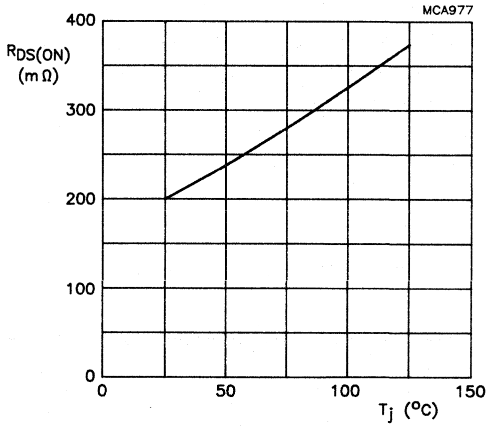


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 5 A; typical values per section.

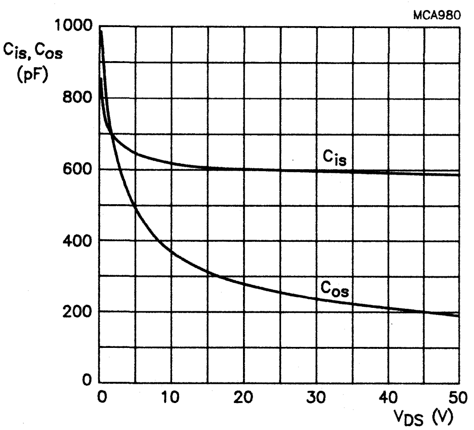


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

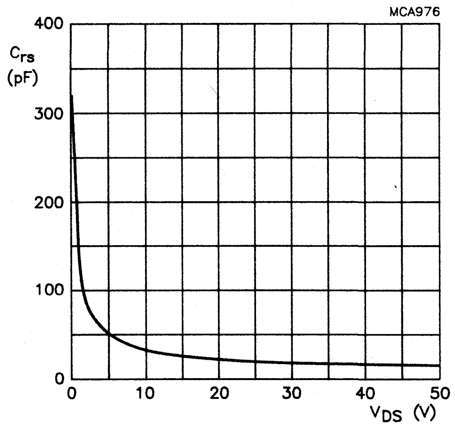


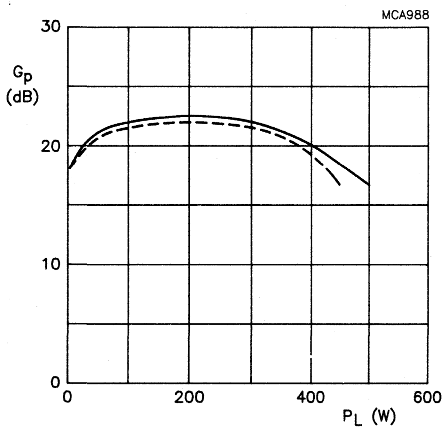
Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

T_h = 25 °C, $R_{th\,mb\text{-}h}$ = 0.15 K/W, unless otherwise specified.

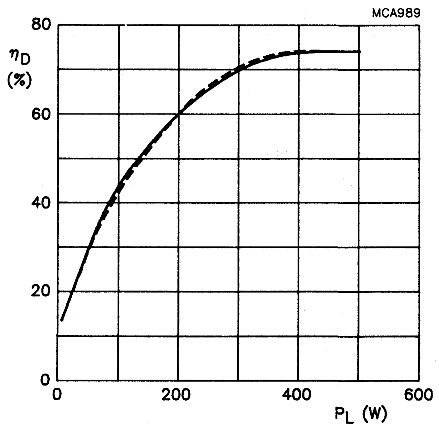
RF performance in CW operation (common-source circuit). R_{GS} = 4 Ω per section; optimum load impedance per section = 3.2 + j 4.3 Ω (V_{DS} = 50 V).

Mode of operation	f MHz	V_{DS} V	I_{DQ} A	P_L W	G_p dB	η_D %
CW class-B	108	50	2 x 0.1	300	> 20 typ. 22	> 60 typ. 70
CW class-C	108	50	V_{GS} = 0	300	typ. 18	typ. 80



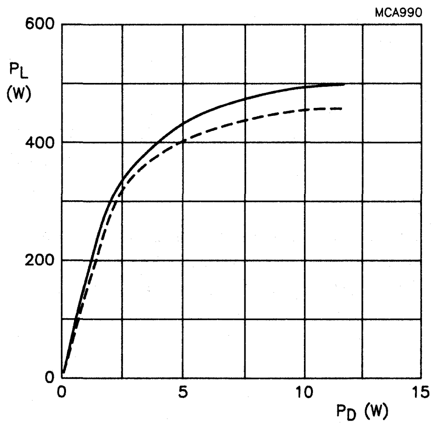
— — — T_h = 70 °C; ——— T_h = 25 °C

Fig.9 Power gain as a function of load power.



— — — T_h = 70 °C; ——— T_h = 25 °C

Fig.10 Efficiency as a function of load power.



— — — T_h = 70 °C; ——— T_h = 25 °C

Fig.11 Load power as a function of drive power.

Conditions for Figs 9 to 11

Class-B operation; V_{DS} = 50 V; I_{DQ} = 2 x 100 mA; Z_L = 3.2 + j 4.3 Ω (per section); R_{GS} = 4 Ω (per section); f = 108 MHz; typical values.

Ruggedness in class-B operation

The BLF278 is capable of withstanding a load mismatch corresponding with VSWR = 7 through all phases under the following conditions: V_{DS} = 50 V, f = 108 MHz, at rated output power.

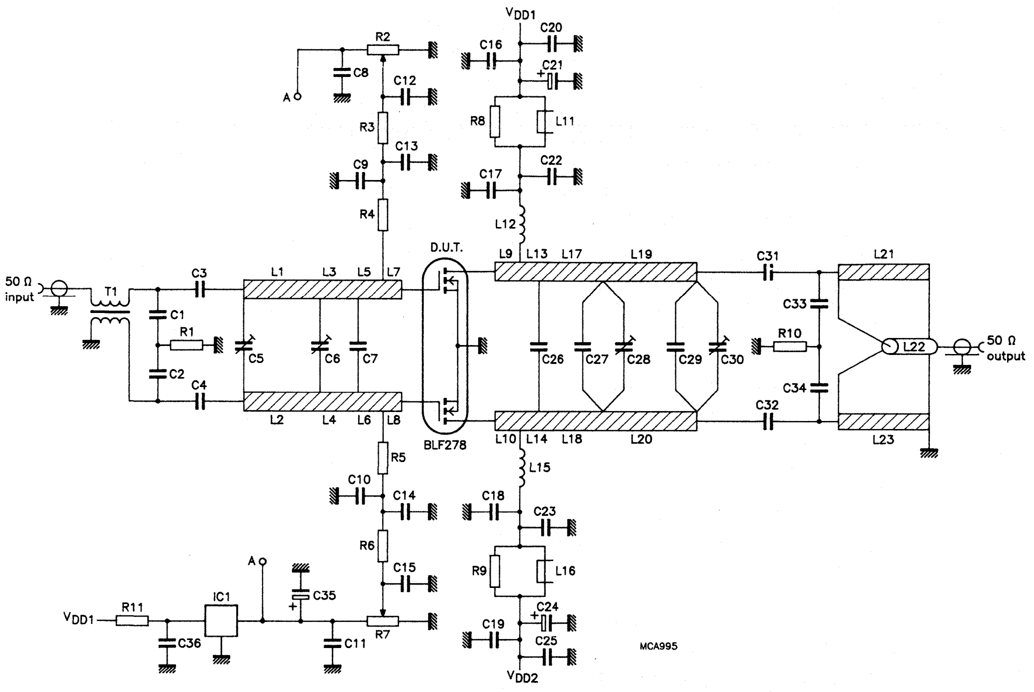


Fig.12 108 MHz Class-B test circuit.

APPLICATION INFORMATION (continued)

List of components:

C1 = C2 = C33 = C34 = 22 pF (500 V) multilayer ceramic chip capacitor*
C3 = C4 = 100 pF (500 V) + 68 pF (500 V) multilayer ceramic chip capacitors in parallel*
C5 = C6 = C28 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C7 = 2 x 100 pF (500 V) + 120 pF (500 V) multilayer ceramic chip capacitor in parallel*
C8 = C11 = C12 = C15 = C16 = C19 = C36 = 100 nF (500 V) multilayer ceramic chip capacitor (cat. not. 2222 852 47104)
C9 = C10 = C13 = C14 = C20 = C25 = 1 nF (500 V) multilayer ceramic chip capacitor*
C17 = C18 = C22 = C23 = 470 pF (500 V) multilayer ceramic chip capacitor*
C21 = C24 = C35 = 10 μF (63 V) electrolytic capacitor
C26 = 2 x 15 pF (500 V) + 18 pF multilayer ceramic chip capacitors in parallel*
C27 = 3 x 15 pF (500 V) multilayer ceramic chip capacitors in parallel*
C29 = 15 pF (500 V) 2 x 18 pF multilayer ceramic chip capacitors in parallel*
C30 = 2 - 18 pF film dielectric trimmer (cat. no. 2222 809 09006)
C31 = C32 = 3 x 43 (500 V) multilayer ceramic chip capacitors in parallel*

L1 = L2 = 43 Ω stripline (6.0 mm x 57.5 mm)
L3 = L4 = 43 Ω stripline (6.0 mm x 29.5 mm)
L5 = L6 = 43 Ω stripline (6.0 mm x 14.0 mm)
L7 = L8 = 43 Ω stripline (6.0 mm x 6.0 mm)
L9 = L10 = 43 Ω stripline (6.0 mm x 17.5 mm)
L11 = L16 = 2 x Ferroxcube wideband HF choke; grade 3B (cat. no. 4312 020 36642) in parallel
L12 = L15 = 85 nH; 4 turns enamelled Cu wire (2.0 mm); int. dia. 10 mm; leads 2 x 7 mm; length 13.5 mm
L13 = L14 = 43 Ω stripline (6.0 mm x 19.5 mm)
L17 = L18 = 43 Ω stripline (6.0 mm x 24.5 mm)
L19 = L20 = 43 Ω stripline (6.0 mm x 66.0 mm)
L21 = L23 = 50 Ω stripline (4.8 mm x 160.0 mm)
L22 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 160.0 mm; soldered on stripline L21

R1 = 10 Ω metal film resistor (0.4 W)
R2 = R7 = 50 kΩ potentiometer (ten turns)
R3 = R6 = 1 kΩ metal film resistor (0.4 W)
R4 = R5 = 3 x 12.1 Ω metal film resistors (0.4 W) in parallel
R8 = R9 = 10 Ω ± 5%; 1.0 W metal film resistor
R10 = 4 x 42.2 Ω metal film resistors (1.0 W) in parallel
R11 = 5.11 kΩ metal film resistor (1.0 W)

IC1 = voltage regulator 78L05
T1 = 1:1 Balun; 7 turns 50 Ω coax-cable wound on a toroid; type 4C6; dimensions: 14 x 9 x 5 mm (cat. no. 4322 020 90770)

L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L13, L14, L17, L18, L19, L20, L21 and L23 are micro-striplines on a double Cu-clad printed circuit board with glass microfibre reinforced PTFE dielectric (ϵ_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.

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

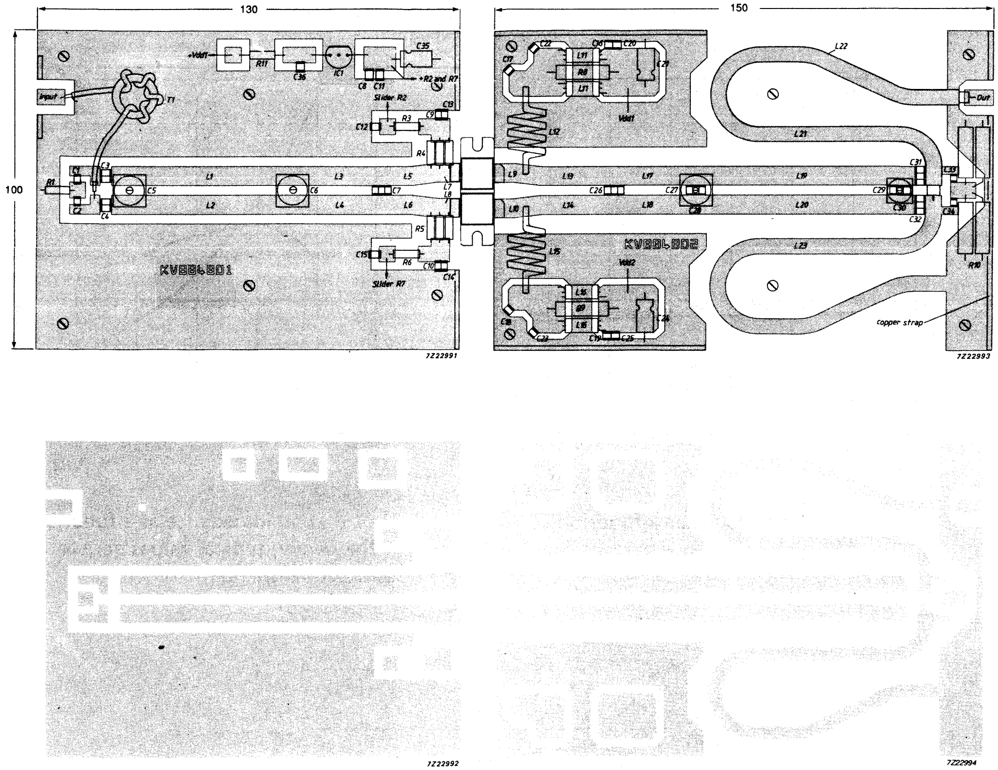


Fig.13 Component layout and printed-circuit board for 108 MHz Class-B test circuit.

NOTE

The circuit and components are 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 copper straps for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

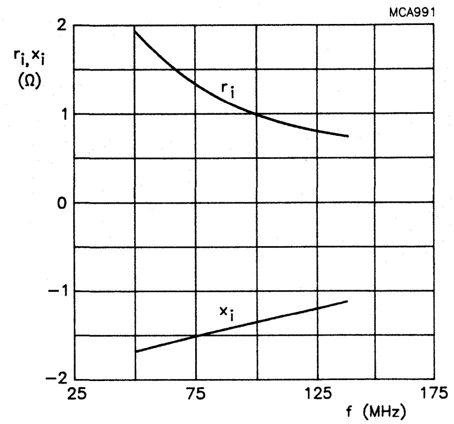


Fig.14 Input impedance as a function of frequency; typical values per section (series components).

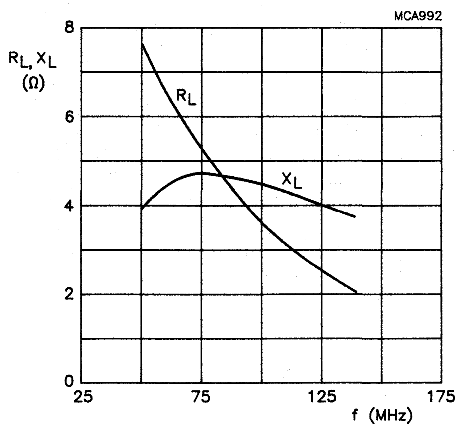


Fig.15 Load impedance as a function of frequency; typical values per section (series components).

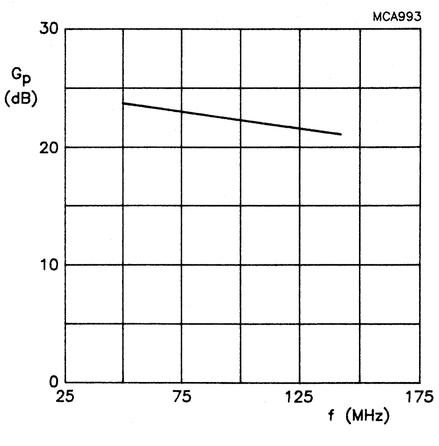


Fig.16 Power gain as a function of frequency; typical values per section.

Conditions for Figs 14 to 16

Class-B; V_{DS} = 50 V; I_{DQ} = 2 x 100 mA; R_{GS} = 4 Ω (per section); P_L = 300 W; typical values per section.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF346

VHF linear PowerMOS transistor

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

DESCRIPTION

Silicon n-channel enhancement mode vertical D-MOS transistor intended for use in linear amplifiers for television transmitters and transposers.

The encapsulation is a SOT119 6-lead flange envelope with a ceramic cap. All leads are isolated from the flange.

CAUTION

The gate-source input must be protected against static charge during transport and handling.

QUICK REFERENCE DATA

RF performance in a linear amplifier.

MODE OF OPERATION	f_{vision} (MHz)	V_{DS} (V)	I_D (A)	T_h (°C)	d_{im} (dB) (note 1)	$P_{o\ sync}$ (W)	G_p (dB)
class-A	224.25	28	3	70 25	−52 −52	> 25 typ. 30	> 14 typ. 16.5

Note

1. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak synchronization level.

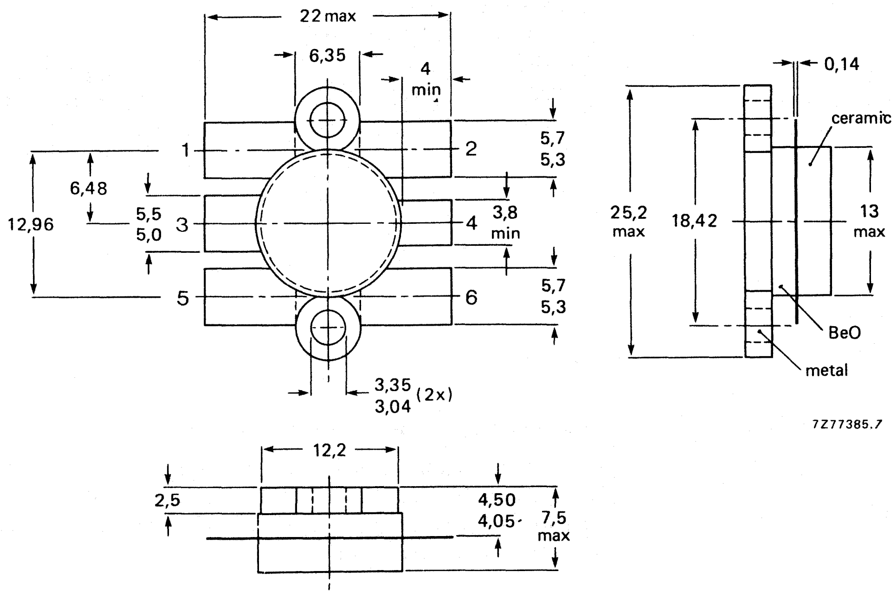
WARNING

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.**

VHF linear PowerMOS transistor BLF346

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 SOT119.

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	drain current	DC or average	-	7	A
I_{DM}	drain current	peak value f > 1 MHz	-	20	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	-	130	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

VHF linear PowerMOS transistor **BLF346**

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	1.35	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.20	K/W

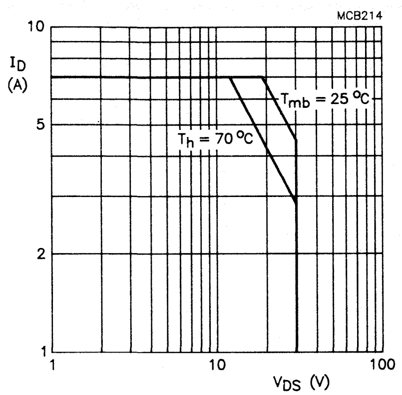


Fig.2 DC SOAR.

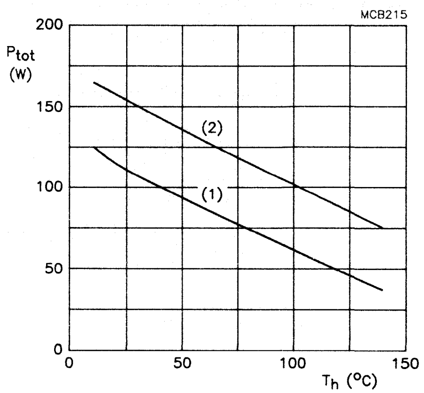


Fig.3 Power/temperature derating; (1) continuous operation; (2) short-time operation during mismatch.

CHARACTERISTICS

$T_j = 25$ °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	$V_{GS} = 0$ $I_D = 50$ mA	65	-	-	V
I_{DSS}	drain-source leakage current	$V_{DS} = 28$ V $V_{GS} = 0$	-	-	2.5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS} = 20$ V $V_{DS} = 0$	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	$V_{DS} = 10$ V $I_D = 50$ mA	2	-	4.5	V
g_{fs}	forward transconductance	$V_{DS} = 10$ V $I_D = 5$ A	3	3.8	-	S
$R_{DS(on)}$	drain-source on-resistance	$V_{GS} = 10$ V $I_D = 5$ A	-	0.2	-	Ω
I_{DSX}	ON-state drain current	$V_{DS} = 10$ V $V_{GS} = 10$ V	-	22	-	A
C_{is}	input capacitance	$V_{DS} = 28$ V $V_{GS} = 0$ f = 1 MHz	-	250	-	pF
C_{os}	output capacitance	$V_{DS} = 28$ V $V_{GS} = 0$ f = 1 MHz	-	180	-	pF
C_{rs}	feedback capacitance	$V_{DS} = 28$ V $V_{GS} = 0$ f = 1 MHz	-	23	-	pF

VHF linear PowerMOS transistor

BLF346

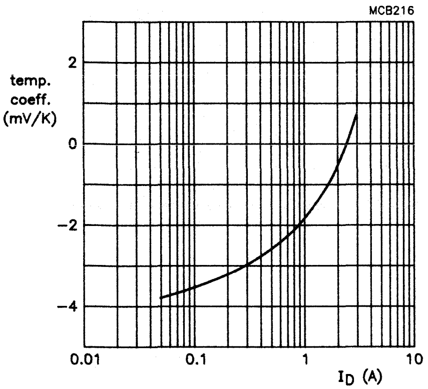


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

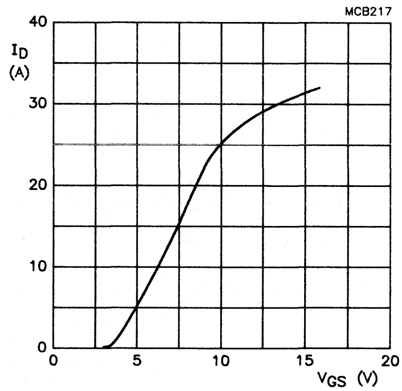


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

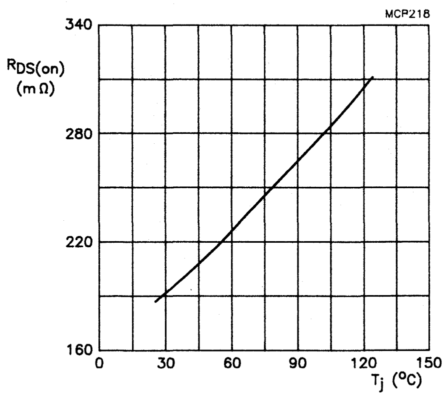


Fig.6 Drain-source on-resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 5 A; typical values.

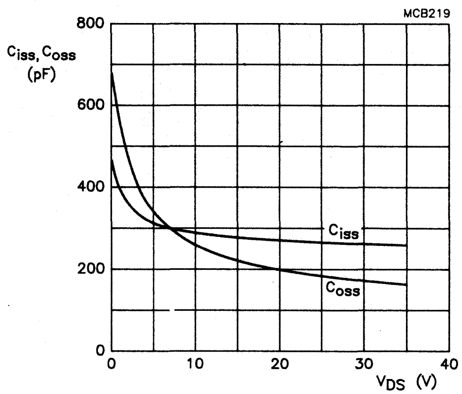


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

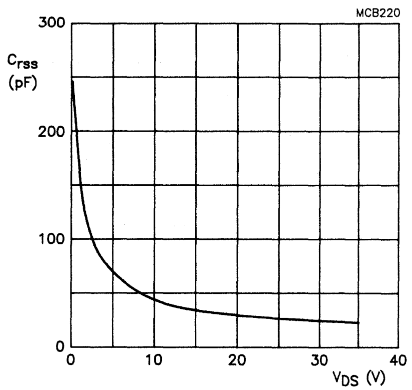


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 0.2 K/W, unless otherwise specified. RF performance in a linear amplifier (common source circuit); optimum load impedance = 1.1 + j 0.2 Ω.

MODE OF OPERATION	f_{vision} (MHz)	V_{DS} (V)	I_D (A)	T_h (°C)	D_{IM} (dB) (note 1)	$P_{o\ sync}$ (W)	G_p (dB)
class-A	224.25	28	3	70	–52	typ. 25	typ. 14
class-A	224.25	28	3	25	–52	typ. 30	typ. 16.5
class-A	224.25	28	3	70	–55	typ. 20	typ. 14.5
class-A	224.25	28	3	25	–55	typ. 22	typ. 15

Note

1. Three-tone test method (vision carrier –8 dB, sound carrier –7 dB, sideband signal –16 dB), zero dB corresponds to peak synchronization level.

Ruggedness in class-A operation

The BLF346 is capable of withstanding a load mismatch corresponding to VSWR = 50 through all phases, under the following conditions: V_{DS} = 28 V, f = 225 MHz at rated output power.

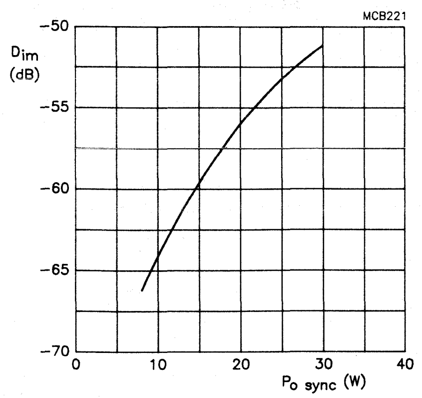


Fig.9 Intermodulation distortion as a function of peak synchronized output power.

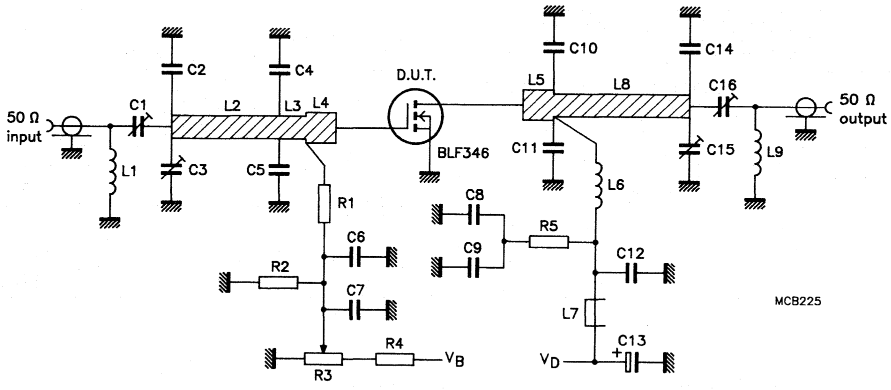


Fig.10 225 MHz, class-A test circuit.

List of components (Fig.10)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2 - 18 pF		2222 809 09003
C2	500 V multilayer ceramic chip capacitor (note 1)	10 pF		
C3, C15, C16	film dielectric trimmer	4 - 40 pF		2222 809 08002
C4	500 V multilayer ceramic chip capacitor (note 1)	9.1 pF		
C5	500 V multilayer ceramic chip capacitor (note 1)	12 pF		
C6, C12	500 V multilayer ceramic chip capacitor (note 1)	680 pF		
C7, C8, C9	50 V ceramic chip capacitor	100 nF		2222 852 47104
C10, C11	500 V multilayer ceramic chip capacitor (note 1)	43 pF		
C13	63 V electrolytic capacitor	10 μF		2222 030 38109
C14	500 V multilayer ceramic chip capacitor (note 1)	27 pF		
L1	4 turns enamelled 0.7 mm copper wire	42.4 nH	length 4 mm int. dia. 3 mm leads 2 x 5 mm	
L2	stripline (note 2)	50 Ω	43 mm x 2.8 mm	
L3	stripline (note 2)	50 Ω	6 mm x 2.8 mm	
L4	stripline (note 2)	31 Ω	10.5 mm x 6 mm	
L5	stripline (note 2)	31 Ω	11.5 mm x 6 mm	
L6	2 turns enamelled 1.5 mm copper wire	18.7 nH	length 5.2 mm int. dia. 4 mm leads 2 x 5 mm	
L7	grade 3B Ferroxcube RF choke			4312 020 36642
L8	stripline (note 2)	31 Ω	40 mm x 6 mm	
L9	3 turns enamelled 1.5 mm copper wire	28.8 nH	length 8 mm int. dia. 4 mm leads 2 x 5 mm	
R1	0.4 W metal film resistor	1 kΩ		2322 151 71002
R2	0.4 W metal film resistor	100 kΩ		2322 151 71004
R3	10 turn cermet potentiometer	100 Ω		
R4	0.4 W metal film resistor	316 Ω		2322 153 53161
R5	0.4 W metal film resistor	10 Ω		2322 153 51009

Notes

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

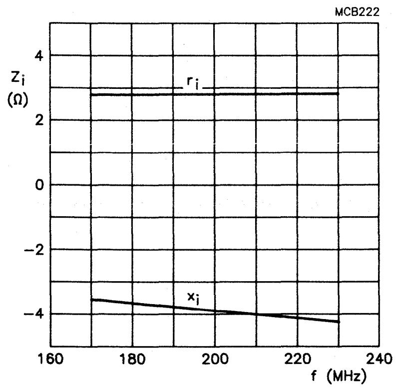


Fig.11 Input impedance, series components; class-A operation; V_{DS} = 28 V; I_D = 3 A; P_L = 30 W; typical values.

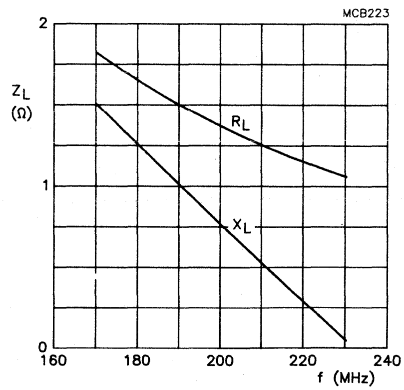


Fig.12 Load impedance, series components; class-A operation; V_{DS} = 28 V; I_D = 3 A; P_L = 30 W; typical values.

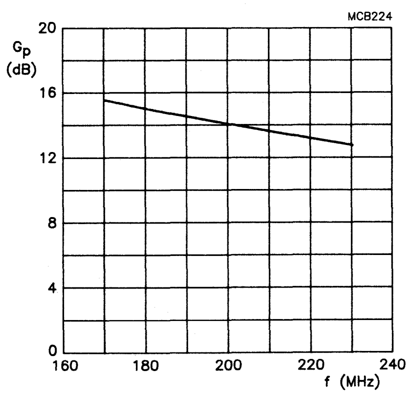


Fig.13 Power gain, class-A operation; V_{DS} = 28 V; I_D = 3 A; P_L = 30 W; typical values.

Philips Components

Data sheet	
status	Product specification
date of issue	September 1990

BLF348
VHF linear push-pull PowerMOS transistor

FEATURES

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

DESCRIPTION

Push-pull silicon n-channel enhancement mode vertical D-MOS transistor intended for use in VHF television transmitters and transposers.

The transistor has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

Note

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

PRODUCT SAFETY

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

QUICK REFERENCE DATA

RF performance in a push-pull common source test circuit.

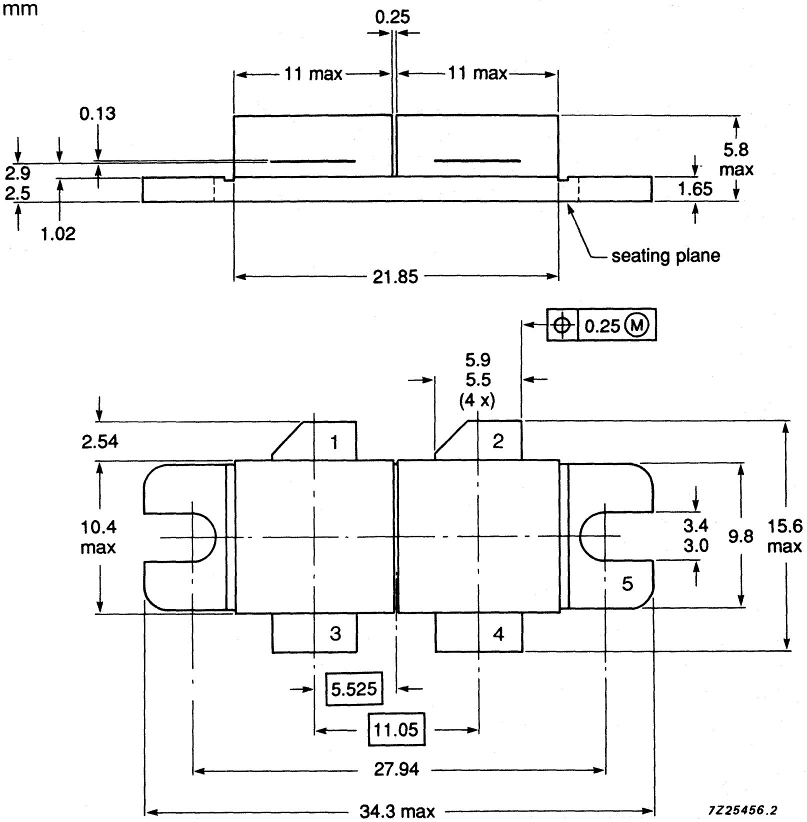
MODE OF OPERATION	f_{vision} (MHz)	V_{DS} (V)	I_D (A)	T_h (°C)	d_{im} (dB) (note 1)	$P_{o\ sync}$ (W)	G_p (dB)
class-A	224.25	28	2 x 4.6	70 25	−52 −52	typ. 67 typ. 75	typ. 11 typ. 13

Note

1. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak synchronization level.

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 SOT262.

PINNING

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

LIMITING VALUES (per transistor section unless otherwise specified)

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	drain current	DC or average	-	13	A
I_{DM}	drain current	peak value f > 1 MHz	-	40	A
P_{tot}	total power dissipation	T_{mb} = 25 °C both sections equally loaded, total device	-	500	W
T_{stg}	storage temperature range		–65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

Total device, both sections equally loaded.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	0.35	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.15	K/W

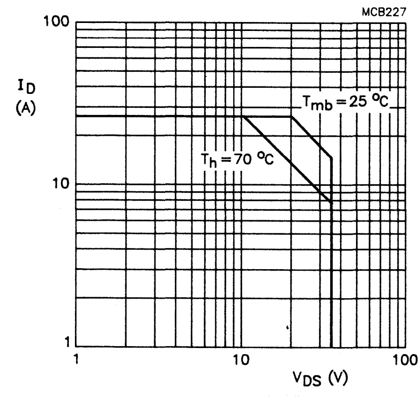


Fig.2 DC SOAR, total device; both sections equally loaded.

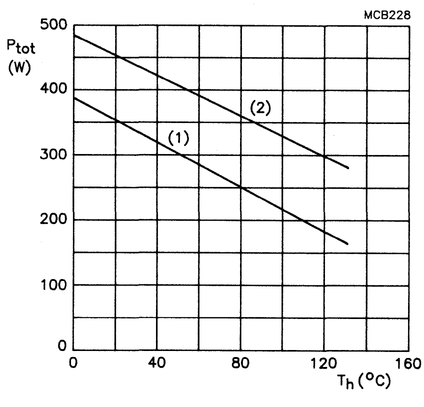


Fig.3 Power/temperature derating, total device; (1) continuous operation; (2) short-time operation during mismatch.

CHARACTERISTICS (per section)

T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0 I_D = 100 mA	65	-	-	V
I_{DSS}	drain-source leakage current	V_{DS} = 32 V V_{GS} = 0	-	-	5	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 100 mA	2	-	4.5	V
$\Delta V_{GS(th)}$	gate threshold voltage difference of both transistor sections	V_{DS} = 10 V I_D = 100 mA	-	-	100	mV
g_{fs}	forward transconductance	V_{DS} = 10 V I_D = 8 A	5	7.5	-	S
g_{fs1}/g_{fs2}	forward transconductance ratio of both transistor sections	V_{DS} = 10 V I_D = 8 A	-	0.9:1.1	-	
$r_{DS(on)}$	drain-source on-resistance	V_{GS} = 10 V I_D = 8 A	-	0.1	-	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 10 V	-	37	-	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	495	-	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	340	-	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	40	-	pF

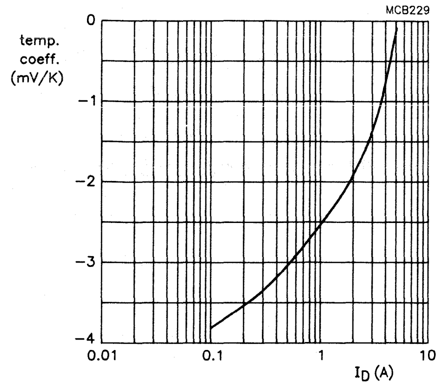


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

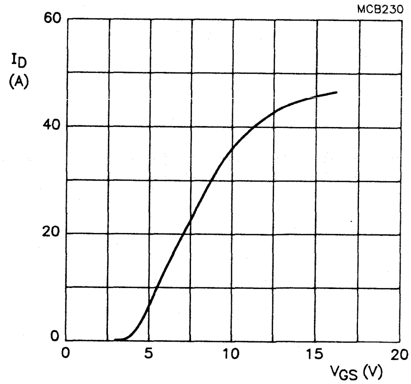


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

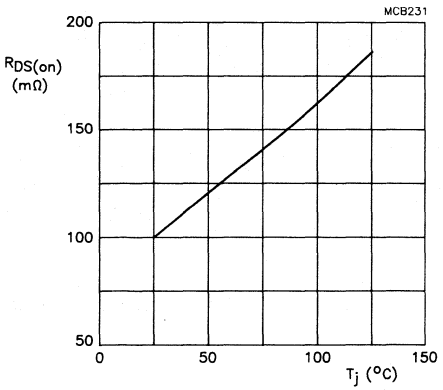


Fig.6 Drain-source on-resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 8 A; typical values per section.

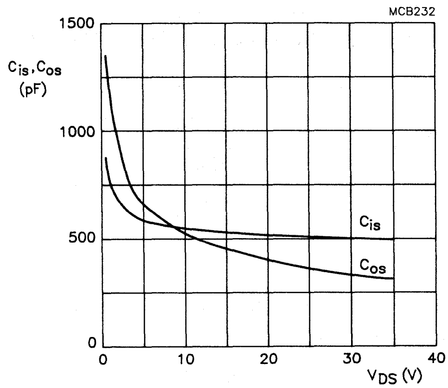


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

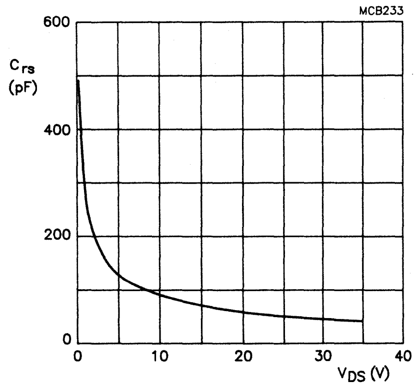


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section

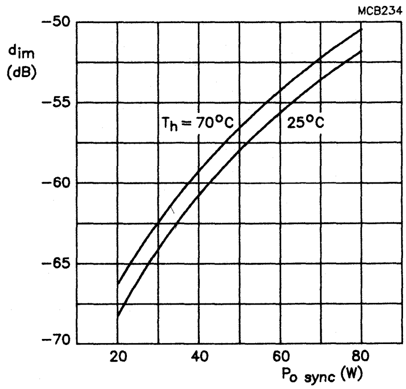


Fig.9 Intermodulation distortion as a function of peak sync output power.

APPLICATION INFORMATION

T_h = 70 °C, $R_{th\ mb-h}$ = 0.15 K/W, unless otherwise specified. RF performance in a linear amplifier (common source circuit); R_{GS} = 82 Ω per section. Optimum load impedance = 0.14 + j 0.14 Ω (per section).

MODE OF OPERATION	f_{vision} (MHz)	V_{DS} (V)	I_D (A)	T_h (°C)	d_{im} (dB) (note 1)	$P_{o\ sync}$ (W)	G_p (dB)
class-A	224.25	28	2 x 4.6	70	−52	> 67 typ. 70	> 11 typ. 12.5
class-A	224.25	28	2 x 4.6	25	−52	typ. 75	typ. 13
class-A	224.25	28	2 x 4.6	70	−55	> 54 typ. 57	> 11 typ. 12.5
class-A	224.25	28	2 x 4.6	25	−55	typ. 62	typ. 13

Notes

1. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −16 dB), zero dB corresponds to peak synchronization level.

Ruggedness in class-A operation

The BLF348 is capable of withstanding a load mismatch corresponding to VSWR = 20 through all phases, under the following conditions: V_{DS} = 28 V, f = 224.25 MHz at rated output power.

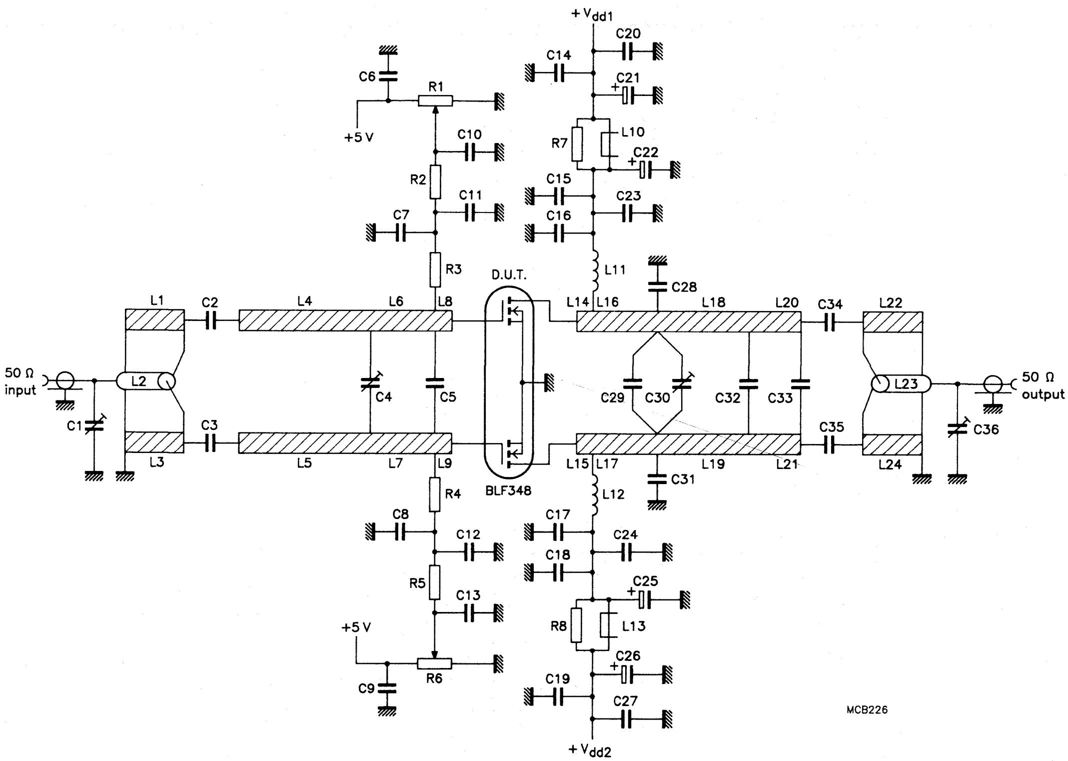


Fig.10 225 MHz, class-A test circuit.

List of components (Fig.10)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1	film dielectric trimmer	2 - 9 pF		2222 809 09006
C2, C3	multilayer ceramic chip capacitors (note 1)	2 x 10 pF in parallel + 22 pF		
C4, C30	film dielectric trimmer	5 - 60 pF		2222 809 08003
C5	500 V multilayer ceramic chip capacitor (note 1)	82 pF		
C6, C9, C10, C13, C14, C19	50 V multilayer ceramic chip capacitor	100 nF		2222 852 47104
C11, C12, C20, C27	500 V multilayer ceramic chip capacitor (note 1)	1 nF		
C7, C8, C16, C17	63 V MKT film capacitor	1 µF		2222 371 11105
C21, C26	63 V electrolytic capacitor	10 µF		
C22, C25	63 V electrolytic capacitor	220 µF		
C15, C18, C23, C24	500 V multilayer ceramic chip capacitor (note 1)	510 pF		
C28, C31	500 V multilayer ceramic chip capacitors (note 1)	2 x 8.2 pF in parallel		
C29	500 V multilayer ceramic chip capacitors (note 1)	3 x 39 pF in parallel		
C32	500 V multilayer ceramic chip capacitor (note 1)	33 pF		
C33	500 V multilayer ceramic chip capacitor (note 1)	18 pF		
C34, C35	500 V multilayer ceramic chip capacitors (note 1)	10 pF + 18 pF + 62 pF (3 in parallel)		
C36	film dielectric trimmer	2 - 18 pF		2222 809 09003
L1, L3, L22, L24	stripline (note 2)	50 Ω	4.8 mm x 80 mm	
L2, L23	semi-rigid cable (note 3)	50 Ω	ext. conductor length 80 mm ext. dia. 3.6 mm	
L4, L5	stripline (note 2)	43 Ω	6 mm x 32 mm	
L6, L7	stripline (note 2)	43 Ω	6 mm x 7 mm	
L8, L9	stripline (note 2)	43 Ω	6 mm x 7 mm	
L10, L13	grade 3B Ferroxcube wideband HF choke	2 in parallel		4312 020 36642

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L11, L12	3/4 turn enamelled 2 mm copper wire	40 nH	space 1 mm int. dia. 10 mm leads 2 x 7 mm	
L14, L15	stripline (notes 2 and 4)	43 Ω	6 mm x 6 mm	
L16, L17	stripline (notes 2 and 4)	43 Ω	6 mm x 9.5 mm	
L18, L19	stripline (notes 2 and 4)	43 Ω	6 mm x 27.5 mm	
L20, L21	stripline (notes 2 and 4)	43 Ω	6 mm x 13 mm	
R1, R6	10 turn Bourns potentiometer	50 kΩ		
R2, R5	0.4 W metal film resistor	1 kΩ		
R3, R4	0.4 W metal film resistor	82 Ω		
R7, R8	1 W, ±5% metal film resistor	10 Ω		

Notes

1. American Technical Ceramics type 100B or capacitor of same quality.
2. Striplines L1, L3 - L9, L14 - L22, and L24 are on a double copper-clad PCB with glass microfibre reinforced PTFE dielectric (ε_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.
3. Semi-rigid cables L2 and L23 are soldered on to striplines L1 and L24.
4. A copper strap, thickness 0.8 mm, is soldered on to striplines L14 - L21.

VHF linear push-pull PowerMOS transistor BLF348

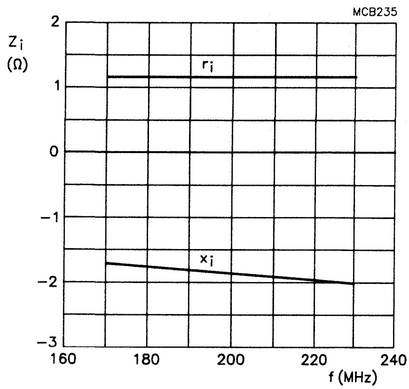


Fig.11 Input impedance, series components; class-A operation; V_{DS} = 28 V; I_{DQ} = 2 x 4.6 A; R_{GS} = 82 Ω (per section); T_h = 70 °C; typical values.

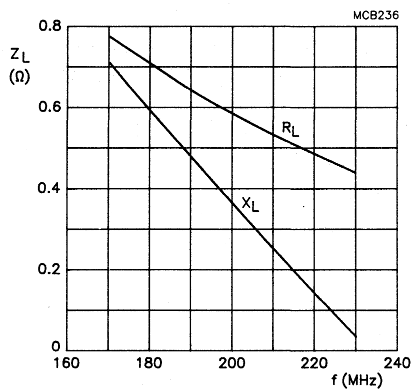


Fig.12 Load impedance, series components; class-A operation; V_{DS} = 28 V; I_{DQ} = 2 x 4.6 A; R_{GS} = 82 Ω (per section); T_h = 70 °C; typical values.

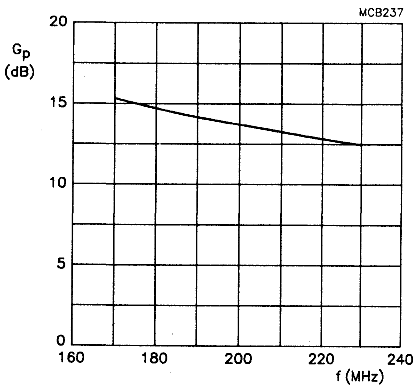


Fig.13 Power gain, class-A operation; V_{DS} = 28 V; I_{DQ} = 2 x 4.6 A; R_{GS} = 82 Ω (per section); T_h = 70 °C; typical values.

VHF PUSH-PULL POWER MOS TRANSISTOR

Push-pull silicon N-channel enhancement mode vertical D-MOS transistor intended for use in VHF television transmitters (vision or sound amplifier).

Features

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

The transistor has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

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 %	ΔG_p dB*
CW class-AB	225	32	300	> 12.0 typ. 13.5	> 55 typ. 62	< 1.0 typ. 0.4

MECHANICAL DATA

SOT262 (see Fig.1)

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (neg. modulation, CCIR system).

NOTE

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

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

MECHANICAL DATA

Dimensions in mm

Pinning

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

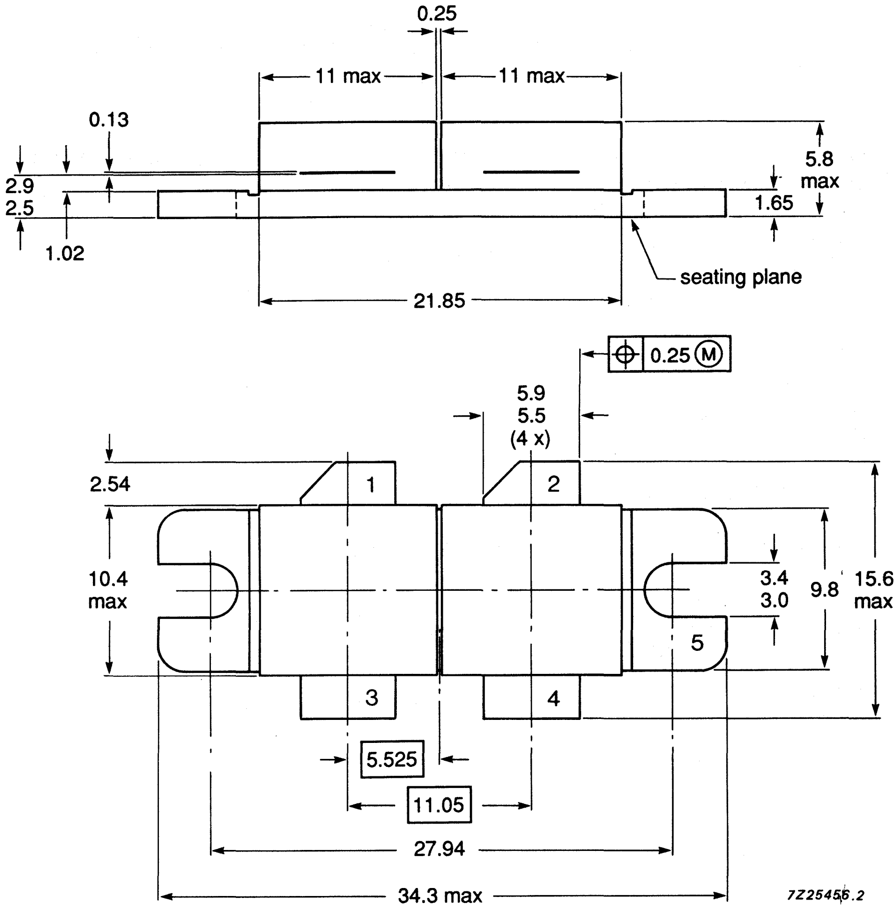


Fig.1 SOT262.

Torque on screw: min. 0.60 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

(per transistor section unless otherwise specified)

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current (per section)			
DC or average	$I_D, I_{D(AV)}$	max.	13 A
(peak value); f > 1 MHz	I_{DM}	max.	40 A
Total power dissipation			
at T_{mb} = 25 °C, both sections equally loaded	P_{tot}	max.	500 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

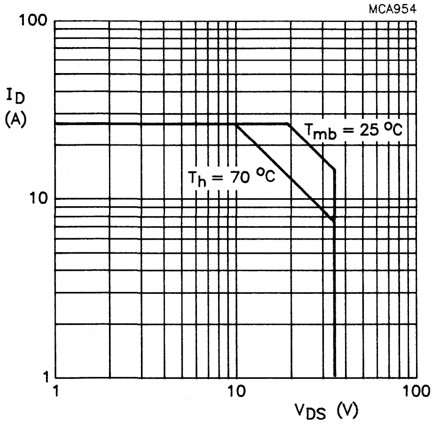
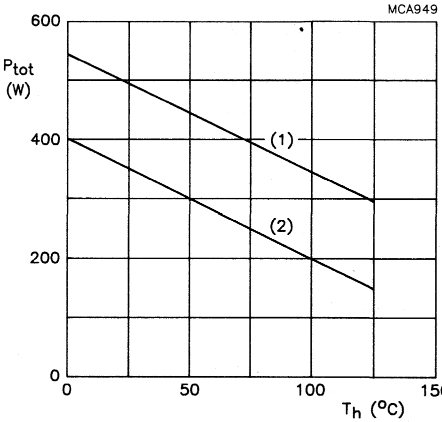


Fig.2 DC SOAR (total device) both sections equally loaded.



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

THERMAL RESISTANCE

total device, both sections equally loaded

From junction to mounting base	$R_{th\,j\text{-}mb}$	max.	0.35 K/W
From mounting base to heatsink	$R_{th\,mb\text{-}h}$	max.	0.15 K/W

CHARACTERISTICS (per section)

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 100 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	65 V
Drain-source leakage current V_{DS} = 32 V; V_{GS} = 0	I_{DSS}	max.	5 mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	max.	1 μA
Gate threshold voltage I_D = 100 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate threshold voltage difference of both transistor sections V_{DS} = 10 V; I_D = 100 mA	$\Delta V_{GS(th)}$	max.	100 mV
Forward transconductance V_{DS} = 10 V; I_D = 8 A	G_{fs}	min. typ.	5.0 S 7.5 S
Forward transconductance ration of both sections V_{DS} = 10 V; I_D = 8 A	G_{fs1}/G_{fs2}		0.9 to 1.1
Drain-source on-state resistance I_D = 8 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.1 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	37 A
Input capacitance at f = 1 MHz V_{DS} = 32 V; V_{GS} = 0	C_{is}	typ.	495 pF
Output capacitance at f = 1 MHz V_{DS} = 32 V; V_{GS} = 0	C_{os}	typ.	340 pF
Feedback capacitance at f = 1 MHz V_{DS} = 32 V; V_{GS} = 0	C_{rs}	typ.	40 pF
Drain/flange capacitance	C_{df}	typ.	5.4 pF

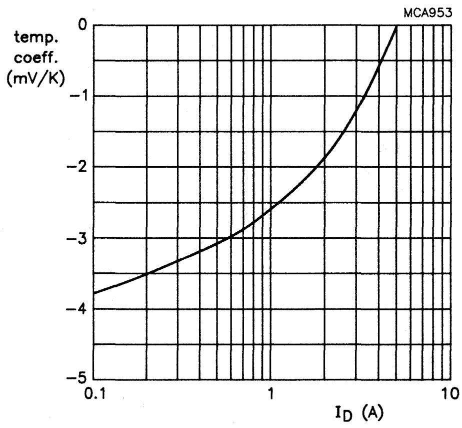


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

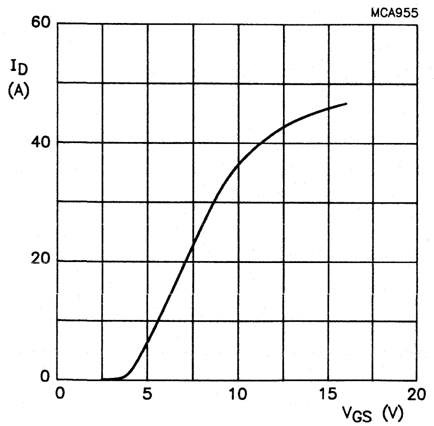


Fig.5 Drain-current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

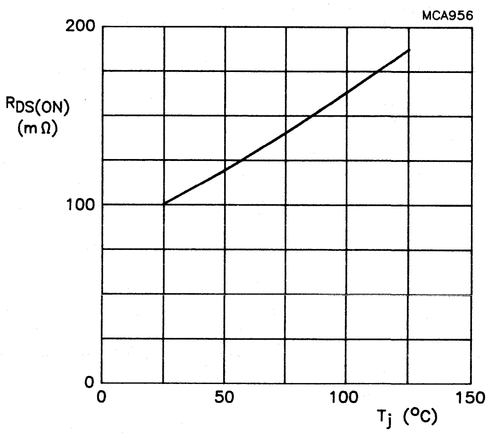


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 8 A; typical values per section.

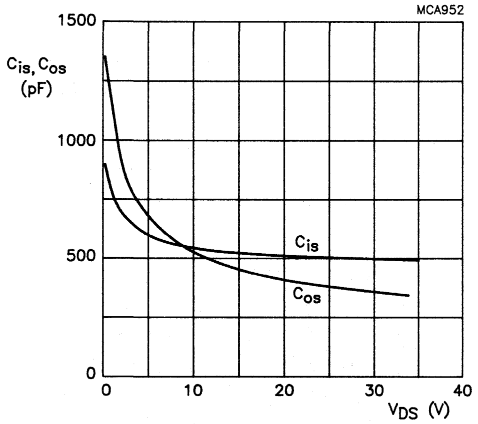


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

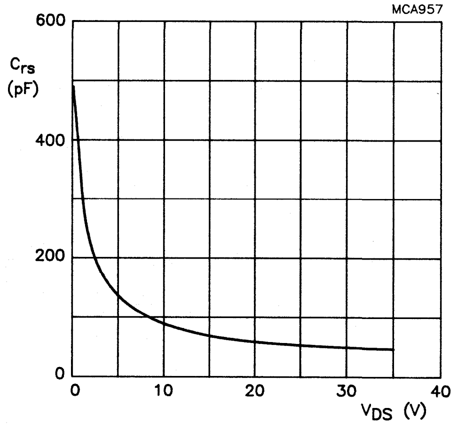
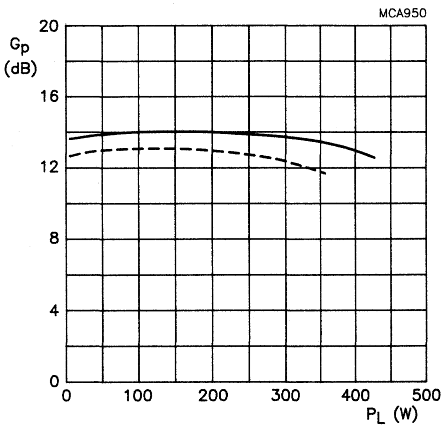


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

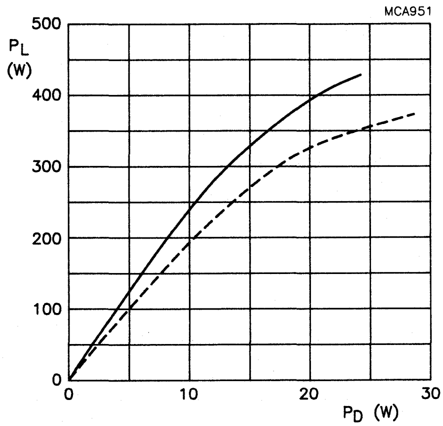
APPLICATION INFORMATION

T_h = 25 °C, $R_{th\ mb\text{-}h}$ = 0.15 K/W unless otherwise specified.
RF performance in CW operation (common-source circuit). R_{GS} = 536 Ω per section; optimum load impedance per section = 1.34 + j 0.34 Ω (V_{DS} = 32 V).

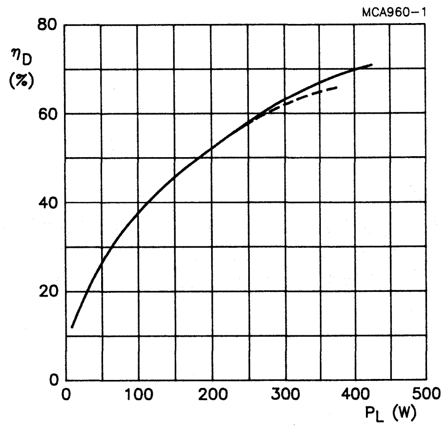
Mode of operation	f MHz	V_{DS} V	I_{DQ} mA	P_L W	G_p dB	η_D %	ΔG_p dB*
CW class-AB	225	32	2 x 250	300	> 12 typ. 13.5	> 55 typ. 62	< 1 typ. 0.4
CW class-AB	225	28	2 x 250	300	typ. 13	typ. 68	typ. 0.7
CW class-AB	225	35	2 x 250	300	typ. 14	typ. 60	typ. 0.2
CW class-AB	175	28	2 x 250	300	typ. 15	typ. 70	typ. 0.5



— — — T_h = 70 °C; —— T_h = 25 °C
Fig.9 Power gain as a function of load power; typical values per section.



— — — T_h = 70 °C; —— T_h = 25 °C
Fig.10 Load power as a function of drive power; typical values per section.



— — — T_h = 70 °C; —— T_h = 25 °C
Fig.11 Efficiency as a function of load power; typical values per section.

Conditions for Figs 9 to 11

Class-AB operation; V_{DS} = 32 V;
I_{DQ} = 2 x 250 mA; Z_L = 1.34 + j 0.34 Ω (per section); R_{GS} = 536 Ω (per section); f = 225 MHz; typical values.

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (neg. modulation, CCIR system).

Ruggedness in class-AB operation

The BLF368 is capable of withstanding a load mismatch corresponding with VSWR = 10 through all phases under the following conditions: V_{DS} = 32 V; f = 225 MHz at rated output power.

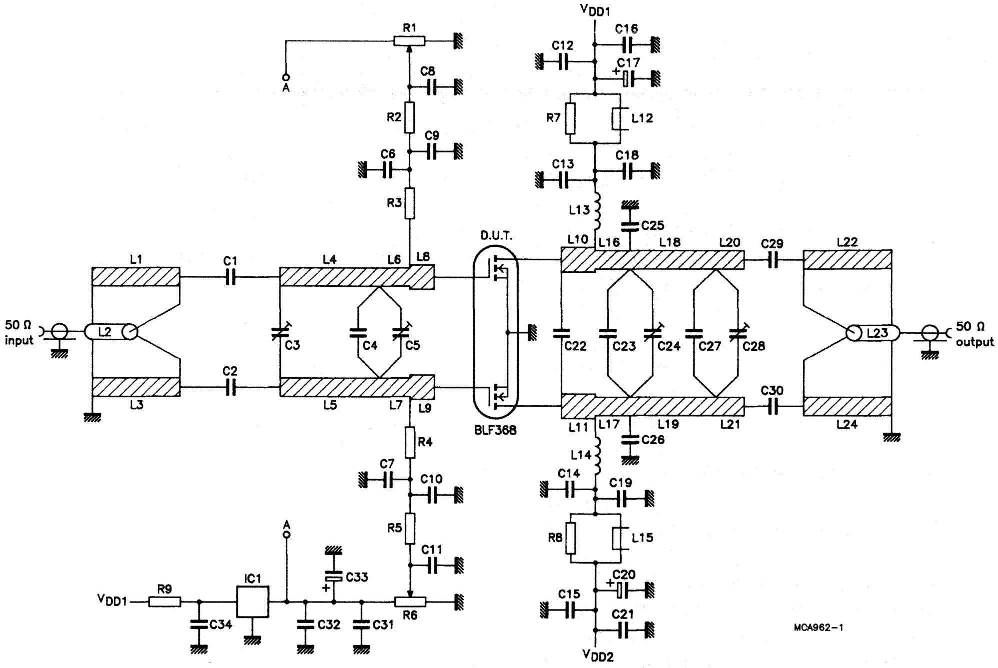


Fig.12 225 MHz class-AB test circuit.

APPLICATION INFORMATION (continued)

List of components:

C1 = C2 = 2 x 56 pF (500 V) + 18 pF (500 V) multilayer ceramic chip capacitors in parallel*
C3 = 2 - 9 pF film dielectric trimmer (cat. no. 2222 809 09005)
C4 = 47 pF (500 V) multilayer ceramic chip capacitor*
C5 = 5 to 60 pF film dielectric trimmer (cat. no. 2222 809 08003)
C6 = C7 = C9 = C10 = C12 = C15 = C31 = C34 = 1 nF (500 V) multilayer ceramic chip capacitor*
C8 = C11 = C16 = C21 = C32 = 100 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C13 = C14 = C18 = C19 = 510 pF (500 V) multilayer ceramic chip capacitor*
C17 = C20 = C33 = 10 μF (63 V) electrolytic capacitor
C22 = 82 pF (500 V) multilayer ceramic chip capacitor*
C23 = 10 pF (500 V) + 30 pF (500 V) multilayer ceramic chip capacitors in parallel*
C24 = C28 = 2 - 18 pF film dielectric trimmer (cat. no. 2222 809 09006)
C25 = C26 = 39 pF (500 V) + 47 pF (500 V) multilayer ceramic chip capacitors in parallel*
C27 = 18 pF (500 V) multilayer ceramic chip capacitor*
C29 = C30 = 3 x 100 pF (500 V) multilayer ceramic chip capacitors in parallel*

L1 = L3 = L22 = L24 = 50 Ω stripline (4.8 mm x 80.0 mm)
L2 = L23 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 80.0 mm; soldered on striplines L1 and L24 respectively
L4 = L5 = 43 Ω stripline (6.0 mm x 32.5 mm)
L6 = L7 = 43 Ω stripline (6.0 mm x 10.5 mm)
L8 = L9 = 43 Ω stripline (6.0 mm x 3.0 mm)
L10 = L11 = 43 Ω stripline (6.0 mm x 10.5 mm)
L12 = L15 = 2 x Ferroxcube wideband HF choke; grade 3B (cat. no. 4312 020 36642) in parallel
L13 = L14 = 25 nH; 2 turns enamelled Cu wire (1.6 mm); int. dia. 5.0 mm; leads 2 x 7 mm; space 2.5 mm
L16 = L17 = 43 Ω stripline (6.0 mm x 3.0 mm)
L18 = L19 = 43 Ω stripline (6.0 mm x 35.0 mm)
L20 = L21 = 43 Ω stripline (6.0 mm x 9.0 mm)

R1 = R6 = 50 kΩ potentiometer (ten turns)
R2 = R5 = 1 kΩ metal film resistor (0.4 W)
R3 = R4 = 536 Ω metal film resistor (0.4 W)
R7 = R8 = 10 Ω ± 5%; 1.0 W metal film resistor
R9 = 3.16 kΩ metal film resistor (1.0 W)

IC1 = voltage regulator 78L05

L1, L3, L4, L5, L6, L7, L8, L9, L10, L11, L16, L17, L18, L19, L20, L21, L22 and L24 are micro-striplines on a double Cu-clad printed-circuit board with glass microfibre reinforced PTFE dielectric (ϵ_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.

A copper strap (thickness 0.8 mm) is soldered on the striplines L16, L17, L18, L19, L20 and L21.

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

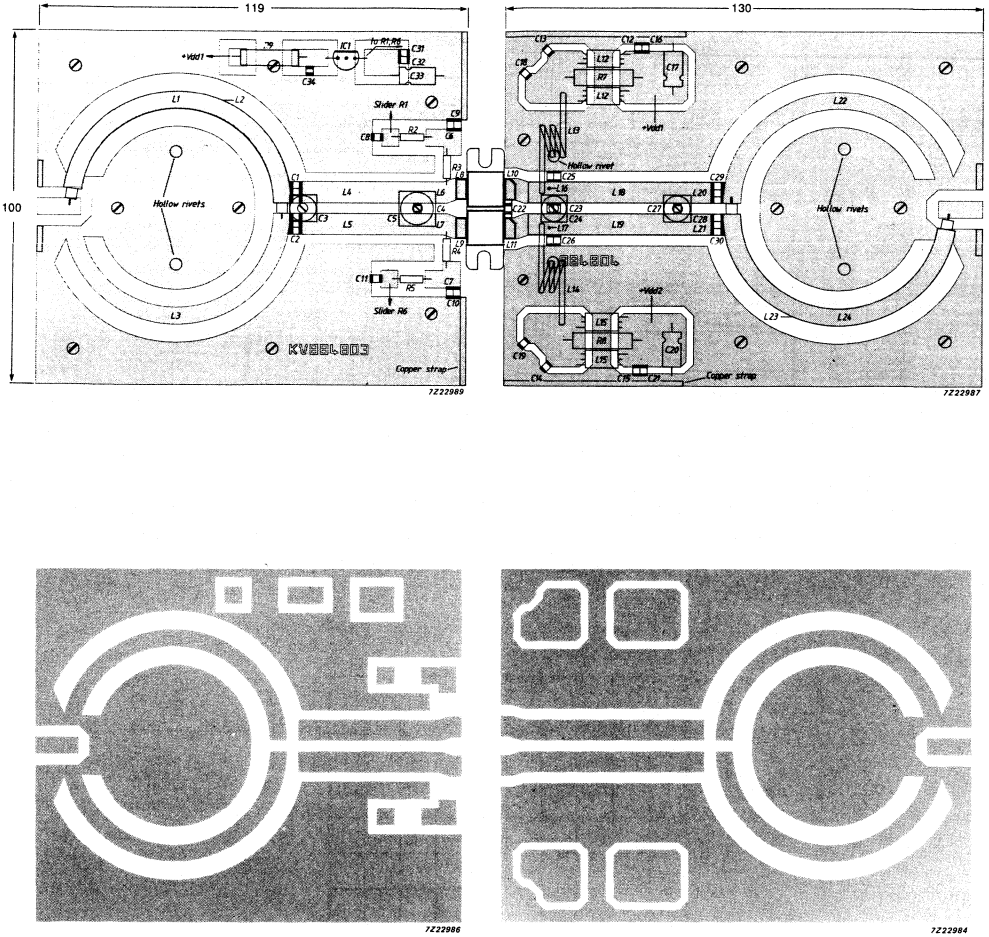


Fig.13 Component layout and printed-circuit board for 225 MHz test circuit.

NOTE

The circuit and components are 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

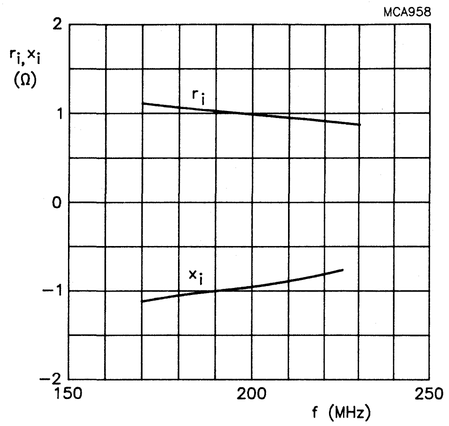


Fig.14 Input impedance as a function of frequency; typical values per section (series components).

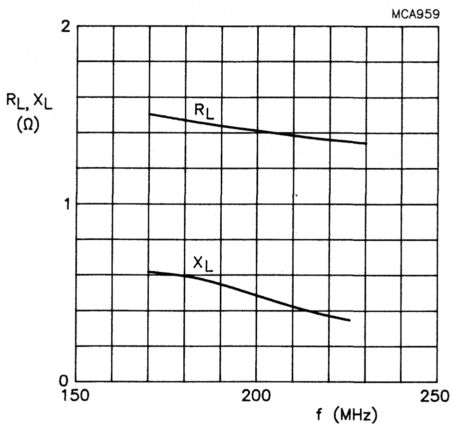


Fig.15 Load impedance as a function of frequency; typical values per section (series components).

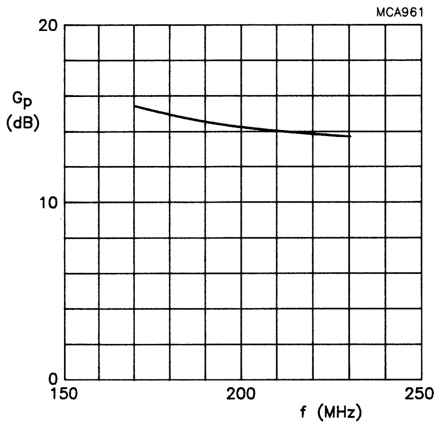


Fig.16 Power gain as a function of frequency; typical values per section.

Conditions for Figs 14 to 16

Class-AB; V_{DS} = 32 V; I_{DQ} = 2 x 250 mA; R_{GS} = 536 Ω (per section); P_L = 300 W; typical values per section.

VHF PUSH-PULL POWER MOS TRANSISTOR

Push-pull silicon N-channel enhancement mode vertical D-MOS transistor intended for use in VHF television transmitters (vision or sound amplifier).

Features

- High power gain
- Easy power control
- Good thermal stability
- Gold metallization ensures excellent reliability

The transistor has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

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 %	ΔG_p dB*
CW Class-AB	225	50	250	> 14.0 typ. 16	> 50 typ. 55	< 1.0 typ. 0.6

MECHANICAL DATA

SOT262 (see Fig.1)

* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (neg. modulation, CCIR system).

NOTE

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

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

MECHANICAL DATA

Dimensions in mm

Pinning

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

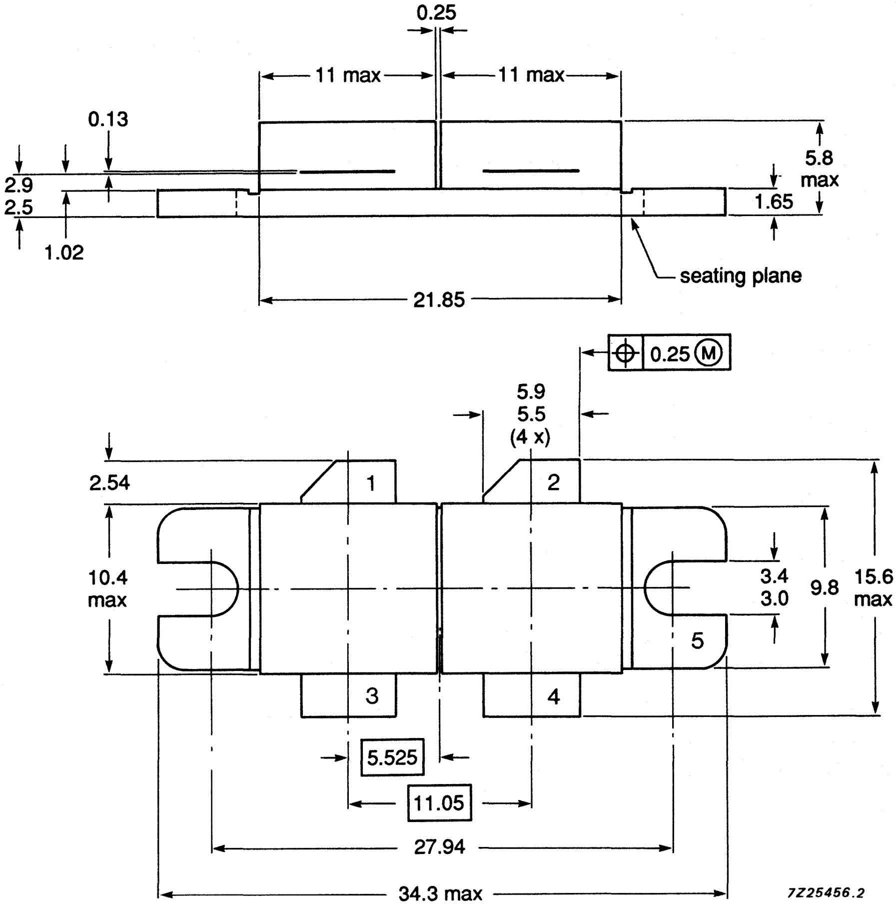


Fig.1 SOT262.

Torque on screw: min. 0.60 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

(per transistor section unless otherwise specified)

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

Drain-source voltage	V_{DS}	max.	110	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
Drain current (per section)				
DC or average	$I_D, I_{D(AV)}$	max.	7	A
(peak value); $f > 1$ MHz	I_{DM}	max.	20	A
Total power dissipation				
at T_{mb} = 25 °C, both sections equally loaded	P_{tot}	max.	500	W
Storage temperature range	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

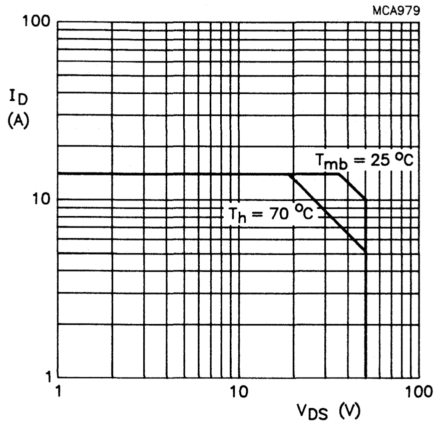
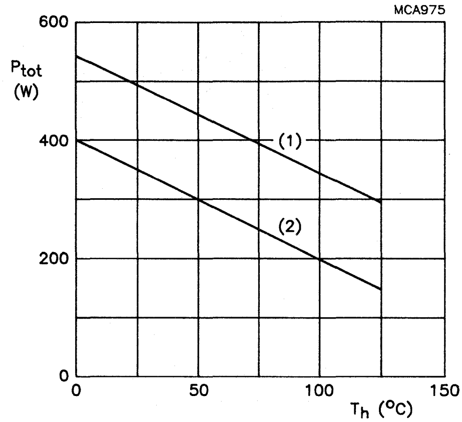


Fig.2 DC SOAR (total device) both sections equally loaded.



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

THERMAL RESISTANCE

total device, both sections equally loaded

From junction to mounting base	$R_{th\ j\text{-}mb}$	max.	0.35	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.15	K/W

CHARACTERISTICS (per section)

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 50 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	110 V
Drain-source leakage current V_{DS} = 50 V; V_{GS} = 0	I_{DSS}	max.	2.5 mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	min.	1 μA
Gate threshold voltage I_D = 50 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Gate threshold voltage difference of both transistor sections V_{DS} = 10 V; I_D = 50 mA	$\Delta V_{GS(th)}$	max.	100 mV
Forward transconductance V_{DS} = 10 V; I_D = 5 A	G_{fs}	min. typ.	4.5 S 6.2 S
Forward transconductance ration of both sections V_{DS} = 10 V; I_D = 5 A	G_{fs1}/G_{fs2}		0.9 to 1.1
Drain-source on-state resistance I_D = 5 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.2 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 10 V	I_{DSX}	typ.	25 A
Input capacitance at f = 1 MHz; V_{DS} = 50 V; V_{GS} = 0	C_{is}	typ.	580 pF
Output capacitance at f = 1 MHz; V_{DS} = 50 V; V_{GS} = 0	C_{os}	typ.	190 pF
Feedback capacitance at f = 1 MHz; V_{DS} = 50 V; V_{GS} = 0	C_{rs}	typ.	14 pF
Drain/flange capacitance	C_{df}	typ.	5.4 pF

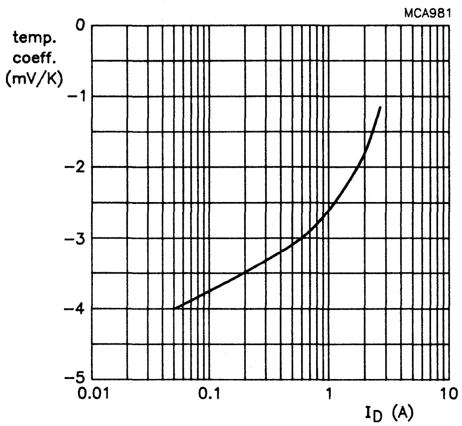


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

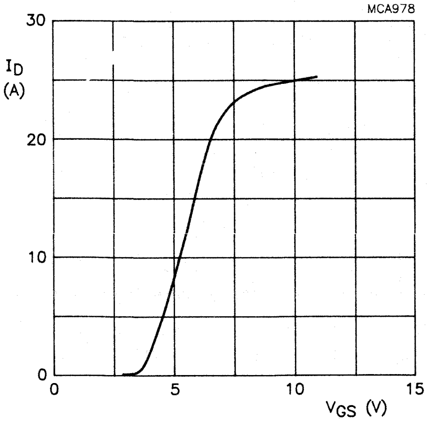


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

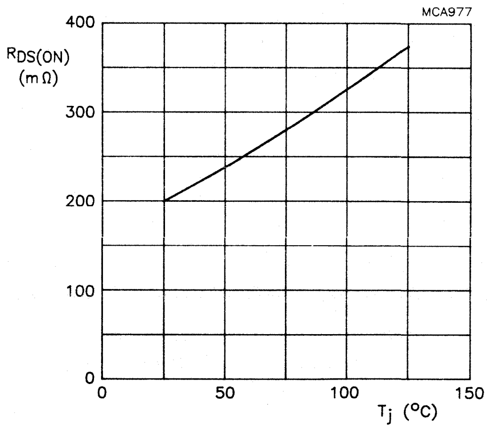


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 5 A; typical values per section.

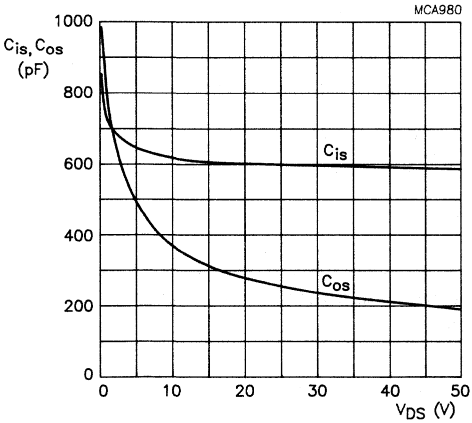


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

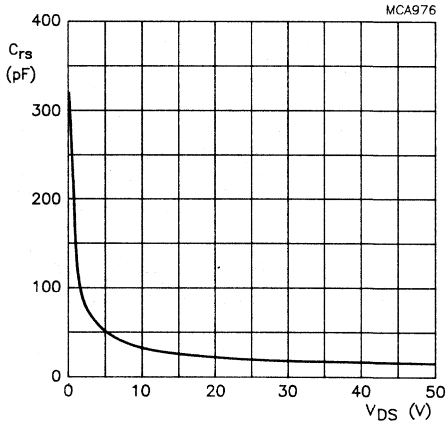


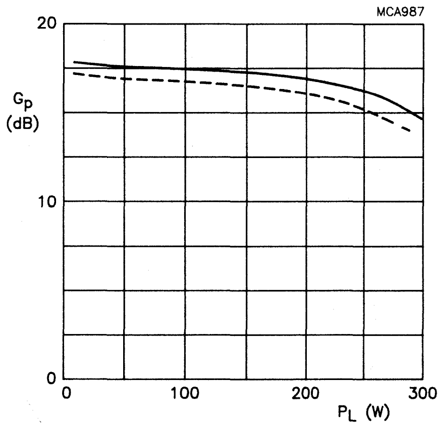
Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

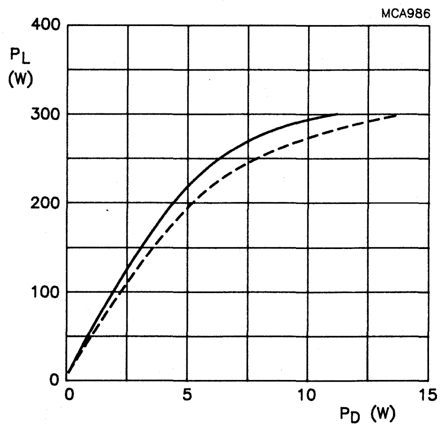
T_h = 25 °C; $R_{th\ mb-h}$ = 0.15 K/W unless otherwise specified.
RF performance in CW operation (common-source circuit). R_{GS} = 2.8 Ω per section; optimum load impedance per section = 0.74 + j 2 Ω (V_{DS} = 50 V).

Mode of operation	f MHz	V_{DS} V	I_{DQ} A	P_L W	G_p dB	η_D %	ΔG_p dB*
CW Class-AB	225	50	2 x 0.5	250	> 14 typ. 16	> 50 typ. 55	< 1 typ. 0.6
CW Class-AB	225	45	2 x 0.5	250	typ. 15	typ. 60	typ. 1.0

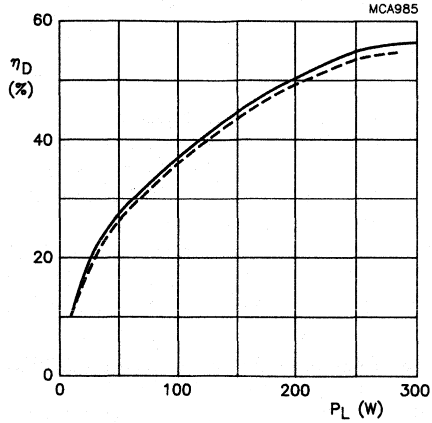
* Assuming a 3rd order amplitude transfer characteristic, 1 dB gain compression corresponds with 30% sync input/25% sync output compression in television service (neg. modulation, CCIR system).



– – – T_h = 70 °C; —— T_h = 25 °C
Fig.9 Power gain as a function of load power.



– – – T_h = 70 °C; —— T_h = 25 °C
Fig.10 Load power as a function of drive power.



— — — T_h = 70 °C; —— T_h = 25 °C

Fig.11 Efficiency as a function of load power.

Conditions for Figs 9 to 11

Class-AB operation; V_{DS} = 50 V; I_{DQ} = 2 x 500 mA; Z_L = 0.74 + j 2 Ω (per section); R_{GS} = 2.8 Ω (per section); f = 225 MHz; typical values.

Ruggedness in class-AB operation

The BLF378 is capable of withstanding a load mismatch corresponding with VSWR = 7 through all phases under the following conditions: V_{DS} = 50 V; f = 225 MHz at rated output power.

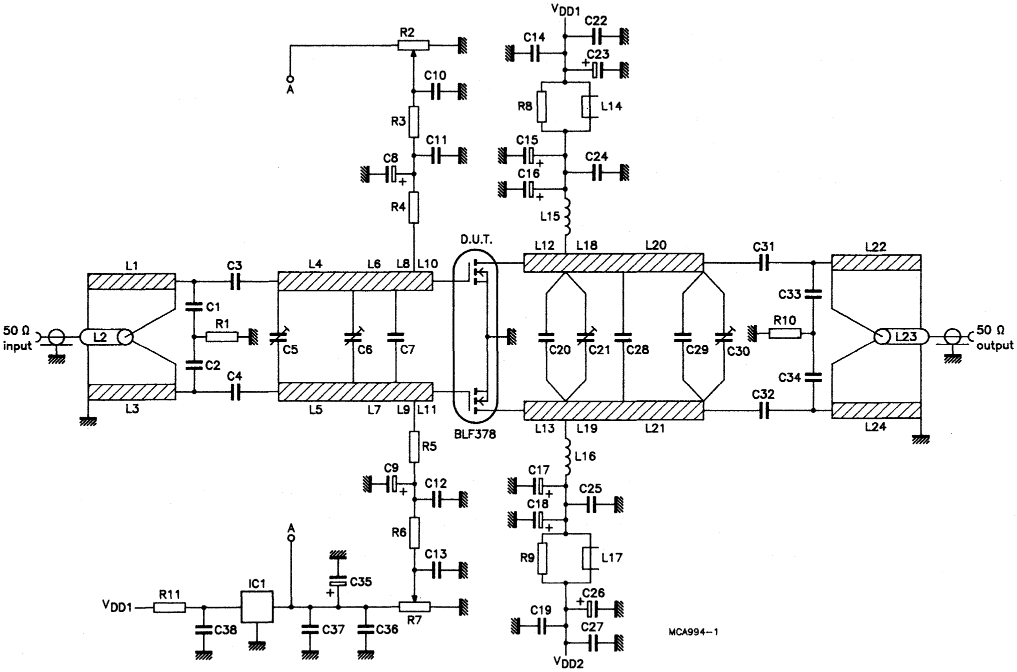


Fig.12 225 MHz Class-AB test circuit.

APPLICATION INFORMATION (continued)

List of components:

C1 = C2 = 27 pF (500 V), multilayer ceramic chip capacitor*
C3 = C4 = C31 = C32 = 3 x 18 pF (500 V) multilayer ceramic chip capacitors in parallel*
C5 = 4 to 40 pF film dielectric trimmer (cat. no. 2222 809 08002)
C6 = C30 = 2 - 18 pF film dielectric trimmer (cat. no. 2222 809 09006)
C7 = 100 pF (500 V) multilayer ceramic chip capacitor*
C8 = C9 = C15 = C18 = 1 μF (63 V) MKT film capacitor (cat. no. 2222 371 11105)
C10 = C13 = C14 = C19 = C36 = 100 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C11 = C12 = 2 x 1 nF (500 V) multilayer ceramic chip capacitors in parallel*
C16 = C17 = 220 μF (63 V), electrolytic capacitor
C20 = 3 x 33 pF (500 V), multilayer ceramic chip capacitors in parallel*
C21 = 2 - 9 pF film dielectric trimmer (cat. no. 2222 809 09005)
C22 = C27 = C37 = C38 = 1 nF (500 V), multilayer ceramic chip capacitor*
C23 = C26 = C35 = 10 μF (63 V), electrolytic capacitor
C24 = C25 = 2 x 470 pF (500 V) multilayer ceramic chip capacitors in parallel*
C28 = 2 x 10 pF (500 V) + 18 pF (500 V) multilayer ceramic chip capacitors in parallel*
C29 = 2 x 5.6 pF (500 V) multilayer ceramic capacitors in parallel*
C33 = C34 = 5.6 pF (500 V) multilayer ceramic chip capacitor*

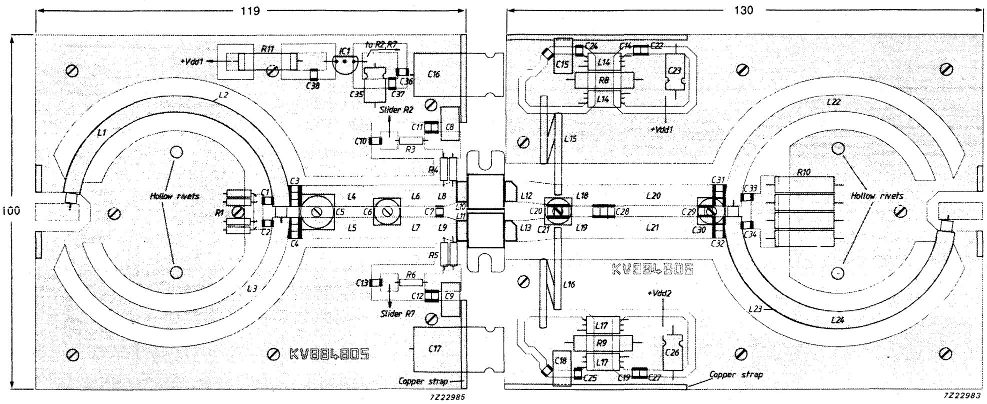
L1 = L3 = L22 = L24 = 50 Ω stripline (4.8 mm x 80.0 mm)
L2 = L23 = 50 Ω semi-rigid cable; outer dia. 3.6 mm; outer conductor length 80.0 mm; soldered on striplines L1 and L24
L4 = L5 = 43 Ω stripline (6.0 mm x 24.0 mm)
L6 = L7 = 43 Ω stripline (6.0 mm x 14.5 mm)
L8 = L9 = 43 Ω stripline (6.0 mm x 4.4 mm)
L10 = L11 = 43 Ω stripline (6.0 mm x 3.2 mm)
L12 = L13 = 43 Ω stripline (6.0 mm x 15.0 mm)
L14 = L17 = 2 x Ferroxcube wideband HF choke; grade 3 B (cat. no. 4312 020 36642) in parallel
L15 = L16 = 40 nH; 1¾ turns enamelled Cu wire (2.0 mm); int. dia. 10 mm; leads 2 x 7 mm; space 1 mm
L18 = L19 = 43 Ω stripline (6.0 mm x 13.0 mm)
L20 = L21 = 43 Ω stripline (6.0 mm x 29.5 mm)

R1 = 10 Ω metal film resistor (0.4 W)
R2 = R7 = 50 kΩ potentiometer (ten turns)
R3 = R6 = 1 kΩ metal film resistor (0.4 W)
R4 = R5 = 2 x 5.62 Ω metal film resistors (0.4 W) in parallel
R8 = R9 = 10 Ω ± 5%; 1.0 W metal film resistor
R10 = 4 x 42.2 Ω metal film resistors (1.0 W) in parallel
R11 = 5.11 kΩ metal film resistor (1.0 W)

IC1 = voltage regulator 78L05

L1, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L18, L19, L20, L21, L22 and L24 are micro-striplines on a double Cu-clad printed-circuit board with glass microfibre reinforced PTFE dielectric (ϵ_r = 2.2); thickness 1/16 inch; thickness of copper sheet 2 x 35 μm.

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



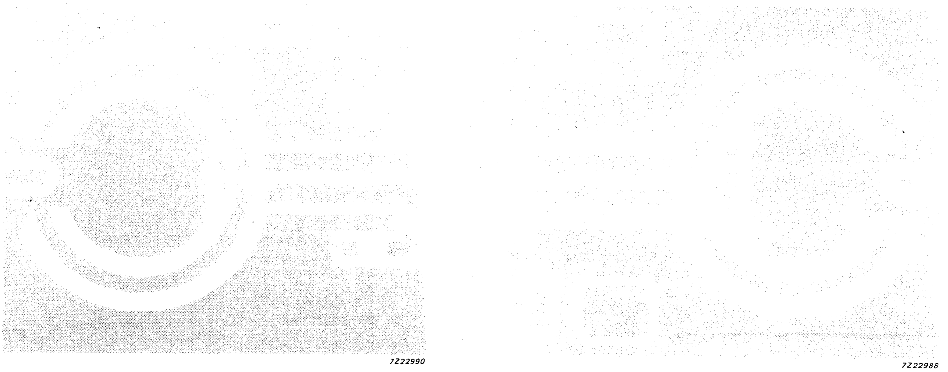


Fig.13 Component layout and printed-circuit board for 225 MHz Class-AB test circuit.

NOTE

The circuit and components are 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

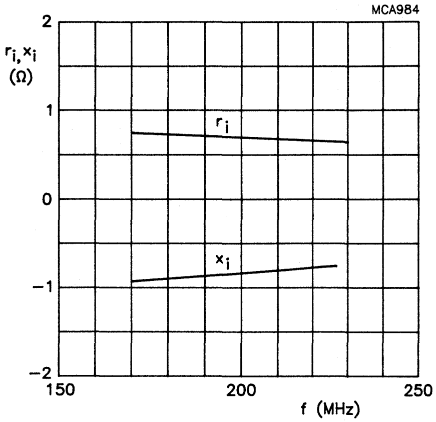


Fig.14 Input impedance as a function of frequency; typical values per section (series components).

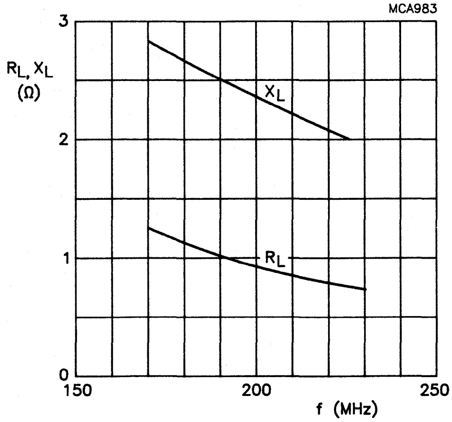


Fig.15 Load impedance as a function of frequency; typical values per section (series components).

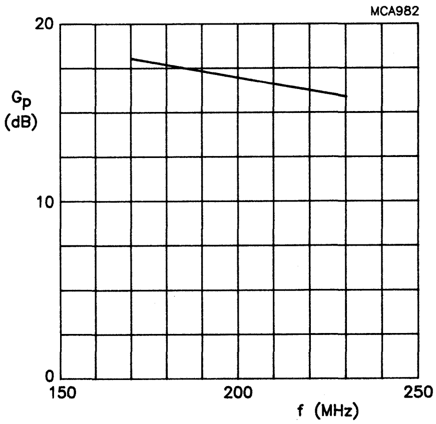


Fig.16 Power gain as a function of frequency; typical values per section.

Conditions for Figs 14 to 16

Class-AB; V_{DS} = 50 V; I_{DQ} = 2 x 500 mA; R_{GS} = 2.8 Ω (per section); P_L = 250 W; typical values per section.

UHF POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 12.5 V.

The BLF521 has a 4-lead SOT172D studless envelope with a ceramic cap.

QUICK REFERENCE DATA

RF performance at T_{amb} = 25 °C in 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	2	> 10	> 50

MECHANICAL DATA

Dimensions in mm

Pinning

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

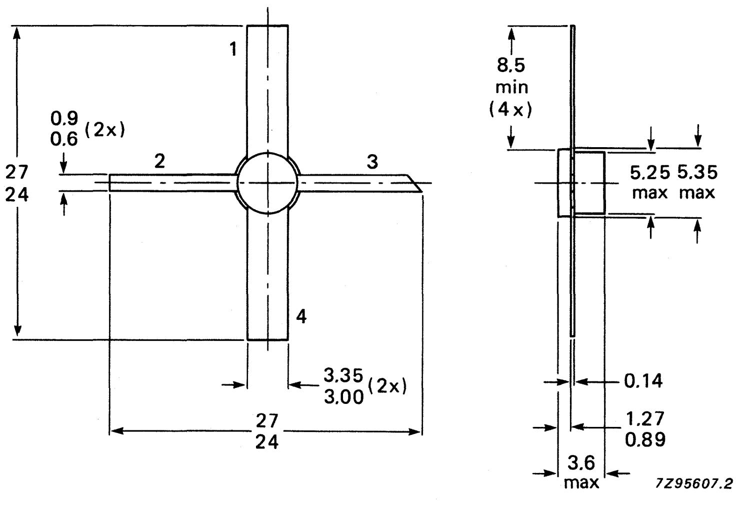


Fig.1 SOT172D.

NOTE

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

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

RATINGS

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

Drain-source voltage	V_{DS}	max.	40 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC	I_D	max.	0.4 A
Total power dissipation*			
T_{amb} = 25 °C	P_{tot}	max.	2.35 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

THERMAL RESISTANCE

From junction to ambient*	$R_{th\ j\text{-}amb}$	max.	75 K/W
From junction to mounting-base	$R_{th\ j\text{-}mb}$	max.	20 K/W

* Mounted on a printed-circuit board of 150 mm x 70 mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 3 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	40 V
Drain-source leakage current V_{DS} = 12.5 V; V_{GS} = 0	I_{DSS}	max.	10 μA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	max.	1 μA
Gate threshold voltage I_D = 10 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance I_D = 0.3 A; V_{DS} = 10 V	G_{fs}	min. typ.	80 mS 120 mS
Drain-source on-state resistance I_D = 0.3 A; V_{GS} = 15 V	$R_{DS(ON)}$	typ.	3.5 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 15 V	I_{DSX}	typ.	1.3 A
Input capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{is}	typ.	5.6 pF
Output capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{os}	typ.	8.1 pF
Feedback capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{rs}	typ.	1.9 pF

DEVELOPMENT DATA

APPLICATION INFORMATION

RF performance in a common-source class-B circuit
R_{GS} = 274 Ω, T_{amb} = 25 °C

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	> 50
CW class-B	500	12.5	10	2	typ. 12	typ. 55

Optimum load impedance: 6.6 + j10.4 Ω

Input impedance : 3.0 – j35 Ω (R_{GS} included)

Ruggedness in class-B operation

The BLF521 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 12.5 V, f = 500 MHz, and T_{amb} = 25 °C at rated output power, and when mounted on a printed-circuit board of 150 mm x 70 mm.

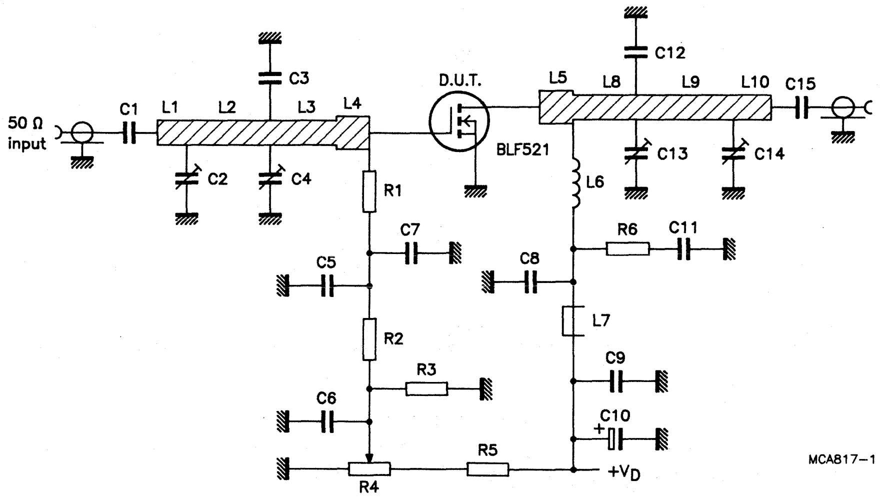


Fig.2 Test circuit for 500 MHz.

DEVELOPMENT DATA

List of components

C1 = C5 = C8 = C15 = 390 pF (500 V), multilayer ceramic chip capacitor*
C2 = C13 = 2 - 9 pF, film dielectric trimmer (cat. no. 2222 809 09002)
C3 = 5.6 pF (500 V), multilayer ceramic chip capacitor**
C4 = 2 - 18 pF film dielectric trimmer (cat. no. 2222 809 09003)
C6 = C11 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = C9 = 100 nF (50 V) multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C10 = 10 μF (63 V) electrolytic capacitor (cat. no. 2222 030 38109)
C12 = 9.1 pF (50 V), multilayer ceramic chip capacitor**
C14 = 1.4 - 5.5 pF, film dielectric trimmer (cat. no. 2222 809 09001)

L1 = 83 Ω stripline (20.0 x 2.0 mm)
L2 = 83 Ω stripline (21.0 x 2.0 mm)
L3 = 83 Ω stripline (19.0 x 2.0 mm)
L4 = L5 = 67 Ω stripline (12.0 x 3.0 mm)
L6 = 62 nH, 5 turns enamelled Cu-wire (0.5 mm); int. diam. 3 mm; length 3.75 mm; leads 2 x 4 mm
L7 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L8 = 83 Ω stripline (18.6 x 2.0 mm)
L9 = 83 Ω stripline (33.6 x 2.0 mm)

R1 = 274 Ω, metal film resistor, 0.4 W (cat. no. 2322 151 72741)
R2 = 1.96 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71962)
R3 = 1 MΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71005)
R4 = 5 kΩ, Cermet potentiometer
R5 = 7.5 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 77502)
R6 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

Printed-circuit board: double Cu-clad 1.575 mm Duroid (ϵ_r = 2.2).

* American Technical Ceramics type 100B or equivalent.
** American Technical Ceramics type 100A or equivalent.

UHF POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 12.5 V.

The BLF522 has a 6-lead SOT171 envelope with a ceramic cap.

QUICK REFERENCE DATA

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

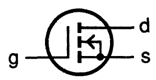
Mode of operation	f MHz	V_{DS} V	P_L W	G_P dB	η_D %
CW class-B	500	12.5	5	> 10	> 50

MECHANICAL DATA

Dimensions in mm

Pinning:

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



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

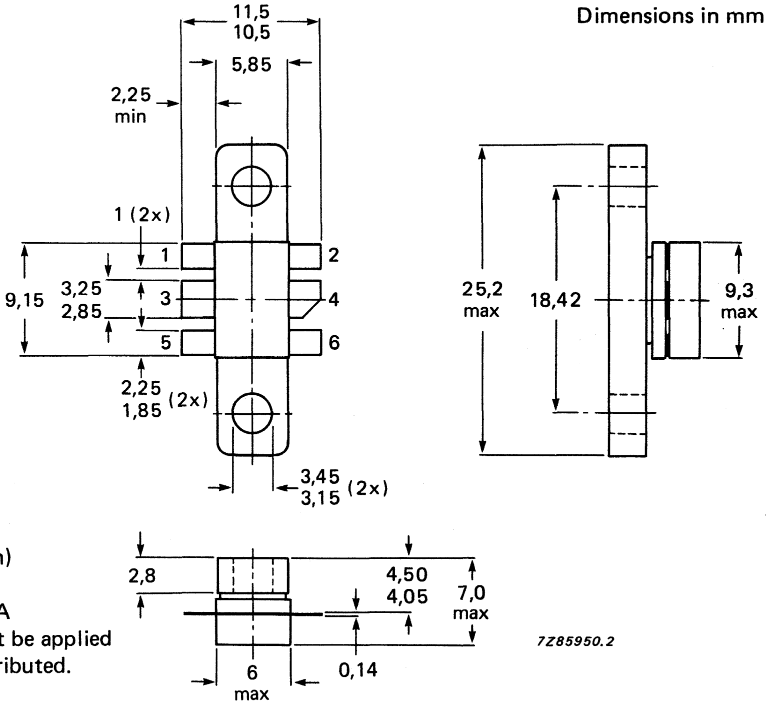


Fig.1 SOT171.

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

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

RATINGS

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

Drain-source voltage	V_{DS}	max.	40	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
DC drain current	I_D	max.	1.0	A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	15	W
Storage temperature range	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

THERMAL RESISTANCE

From junction to mounting-base	$R_{th\ j\text{-}mb}$	=	12	K/W
From mounting-base to heatsink	$R_{th\ mb\text{-}h}$	=	0.4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Drain-source breakdown voltage I_D = 5 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	40 V
Drain-source leakage current V_{DS} = 12.5 V; V_{GS} = 0	I_{DSS}	max.	0.5 mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1 μA
Gate threshold voltage I_D = 20 mA; V_{DS} = 10 V	$V_{GS(th)}$		2 to 4.5 V
Forward transconductance I_D = 0.7 A; V_{DS} = 10 V	G_{fs}	min. typ.	200 mS 270 mS
Drain-source on-state resistance I_D = 0.7 A; V_{GS} = 15 V	$R_{DS(ON)}$	typ.	1.7 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 15 V	I_{DSX}	typ.	2.6 A
Input capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{is}	typ.	14 pF
Output capacitance at f = 1 MHz V_{DS} = 12.5 V; V_{GS} = 0	C_{os}	typ.	17 pF
Feedback capacitance at f = 1 MHz V_{DS} = 12 V; V_{GS} = 0	C_{rs}	typ.	3.0 pF

DEVELOPMENT DATA

APPLICATION INFORMATION

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

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	min. 10 typ. 11	min. 50 typ. 55

Optimum load impedance : 5.4 + j3.6 Ω
Input impedance : 3.4 − j12.7 Ω

Ruggedness in class-B operation

The BLF522 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 12.5 V, f = 500 MHz, T_h = 25 °C and $R_{th\ mb\text{-}h}$ = 0.4 K/W at rated output power.

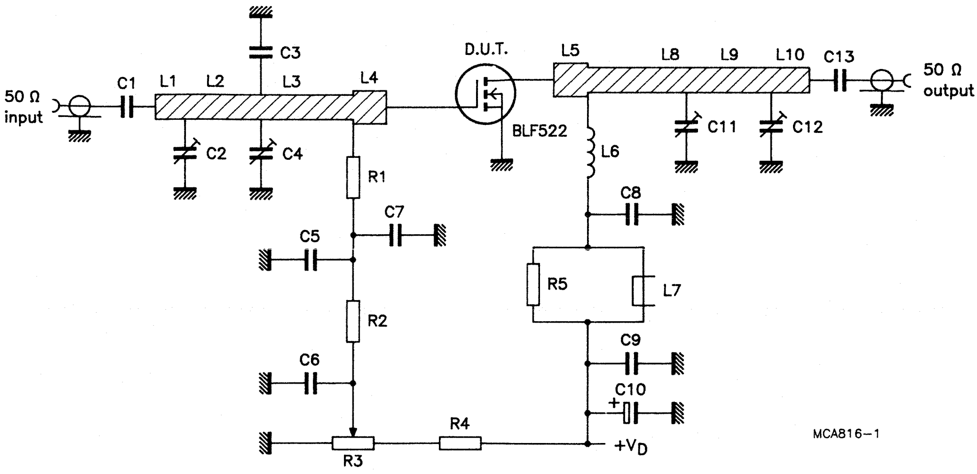


Fig.2 Test circuit for 500 MHz.

List of components

C1 = C5 = C13 = 430 pF (500 V), multilayer ceramic chip capacitor*
C2 = C4 = C11 = C12 = 2-18 pF, film dielectric trimmer (cat. no. 2222 809 09003)
C3 = 30 pF (50 V), multilayer ceramic chip capacitor**
C6 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C7 = C9 = 100 nF (50 V), multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C8 = 390 pF (500 V), multilayer ceramic chip capacitor*
C10 = 10 μF (63 V), electrolytic capacitor (cat no. 2222 030 38109)

L1 = 50 Ω stripline (7.8 x 2.5 mm)
L2 = 50 Ω stripline (36.7 x 2.5 mm)
L3 = 50 Ω stripline (20.0 x 2.5 mm)
L4 = L5 = 42 Ω stripline (3.0 x 3.0 mm)
L6 = 25 nH, 4 turns enamelled Cu-wire (0.8 mm); int. diam. 2.5 mm; length 6.9 mm; leads 2 x 5 mm
L7 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L8 = 50 Ω stripline (15.3 x 2.5 mm)
L9 = 50 Ω stripline (36.7 x 2.5 mm)
L10 = 50 Ω stripline (12.5 x 2.5 mm)

R1 = 100 Ω, metal film resistor, 0.4 W (cat. no. 2322 151 51001)
R2 = 1 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 51002)
R3 = 50 kΩ, potentiometer (ten turn)
R4 = 47 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 54703)
R5 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

Printed-circuit board: double Cu-clad 0.79 mm Duroid (ϵ_r = 2.2).

* American Technical Ceramics type 100B or equivalent.
** American Technical Ceramics type 100A or equivalent.

UHF POWER MOS TRANSISTOR

Silicon n-channel enhancement mode vertical D-MOS transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

Features

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

The BLF543 has a 6-lead SOT171 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.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in 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

MECHANICAL DATA

SOT171 (see Fig.1).

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

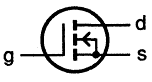
PRODUCT SAFETY. This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning:

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



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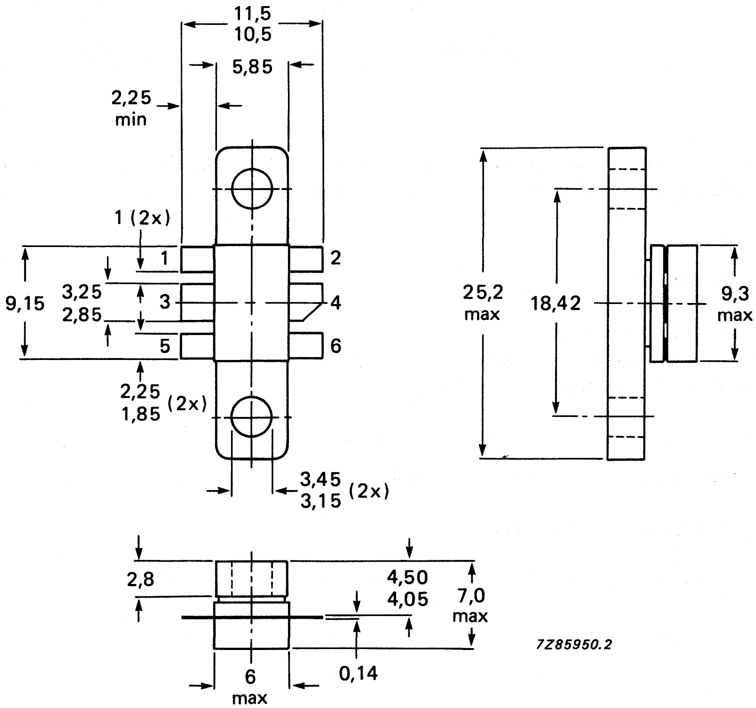


Fig.1 SOT171.

Torque on screw: min. 0.60 Nm (6 kg/cm)
max. 0.75 Nm (7.5 kg/cm)
Recommended screw: cheese head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC or average	I_D	max.	1.0 A
peak value; f > 1 MHz	I_{DM}	max.	3.0 A
Total power dissipation T_{mb} = 25 °C	P_{tot}	max.	25 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

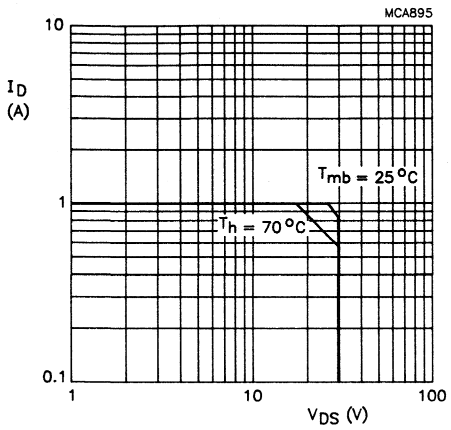
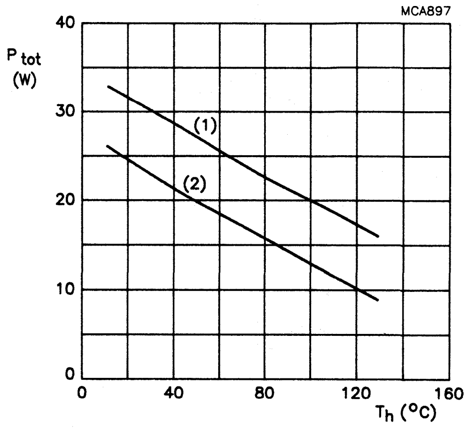


Fig.2 DC SOAR.



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

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

From junction to mounting-base	$R_{th\ j\text{-}mb}$	max.	7.0 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

Drain-source leakage current I_D = 5 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	max.	0.5 mA
Gate-source leakage current $\pm V_{GS}$ = 20 V; V_{DS} = 0	I_{GSS}	max.	1 μA
Gate threshold voltage I_D = 20 mA; V_{DS} = 10 V	$V_{GS(th)}$		1 to 4 V
Gate-source voltage difference of matched pairs V_{DS} = 10 V; I_D = 20 mA	ΔV_{GS}	max.	100 mV
Forward transconductnace I_D = 0.6 A; V_{DS} = 10 V	G_{fs}	min. typ.	300 mS 450 mS
Drains-ource on-state resistance I_D = 0.6 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	1.7 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 15 V	I_{DSX}	typ.	2.4 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{is}	typ.	16 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{os}	typ.	12 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rs}	typ.	3.2 pF

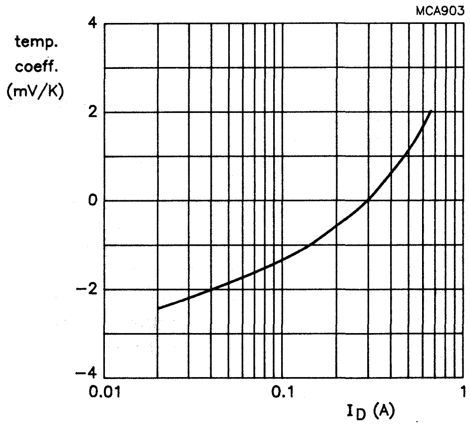


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

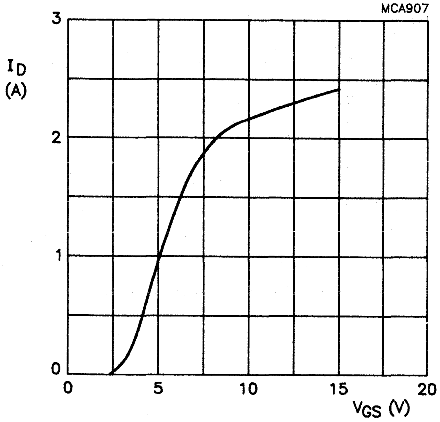


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

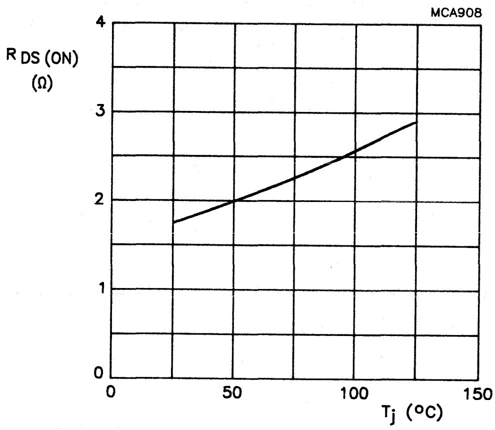


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 0.6 A; typical values.

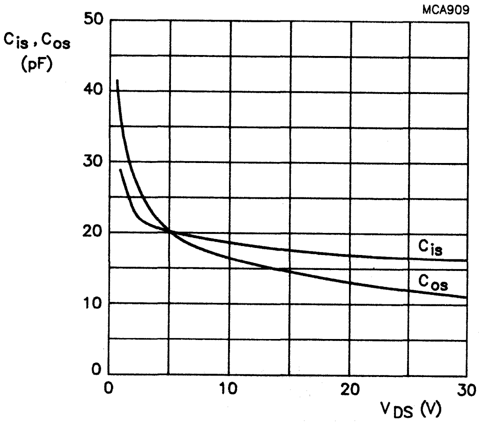


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

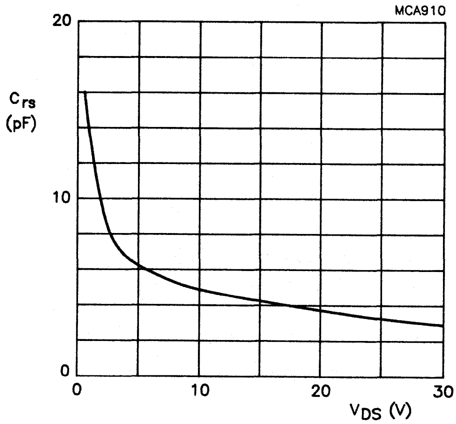


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

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 24	20	10 7.5	typ. 8 typ. 8	typ. 50 typ. 50

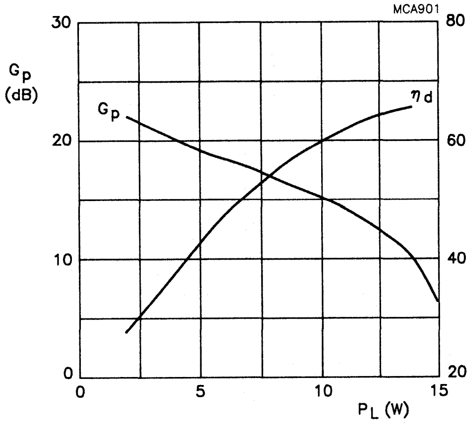


Fig.9 Power gain and efficiency as a function of load power.

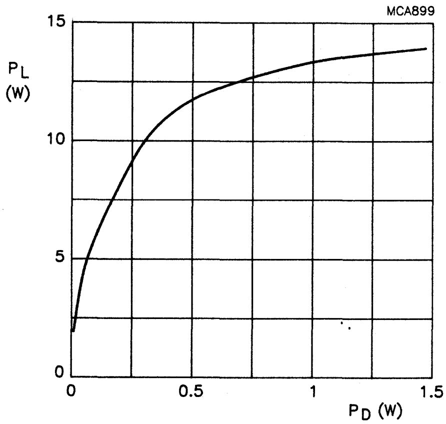


Fig.10 Load power as a function of drive power.

Conditions for Figs 9 and 10:

Class-B operation; V_{DS} = 28 V; I_{DQ} = 20 mA; Z_L = 8.4 + j 14.3 Ω; f = 500 MHz; typical values.

Ruggedness in class-B operation

The BLF 543 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 28 V; f = 500 MHz at rated output power.

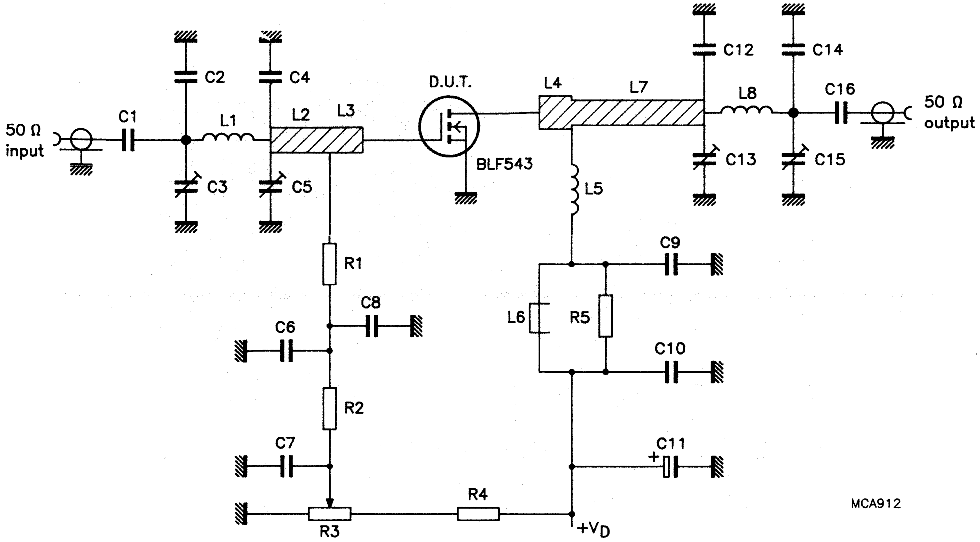


Fig.11 Test circuit for 500 MHz.

List of components

C1 = C6 = C9 = C16 = 390 pF, multilayer ceramic chip capacitor*
C2 = C14 = 7.5 pF, multilayer ceramic chip capacitor*
C3 = C5 = C13 = C15 = 9 pF, film dielectric trimmer (cat. no. 2222 809 09002)
C4 = 20 pF, multilayer ceramic chip capacitor*
C7 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitors (cat. no. 2222 852 47104)
C8 = C10 = 100 nF, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C11 = 10 μF, (63 V) aluminium electrolytic capacitor (cat. no. 2222 030 28109)
C12 = 22 pF, multilayer ceramic chip capacitor*

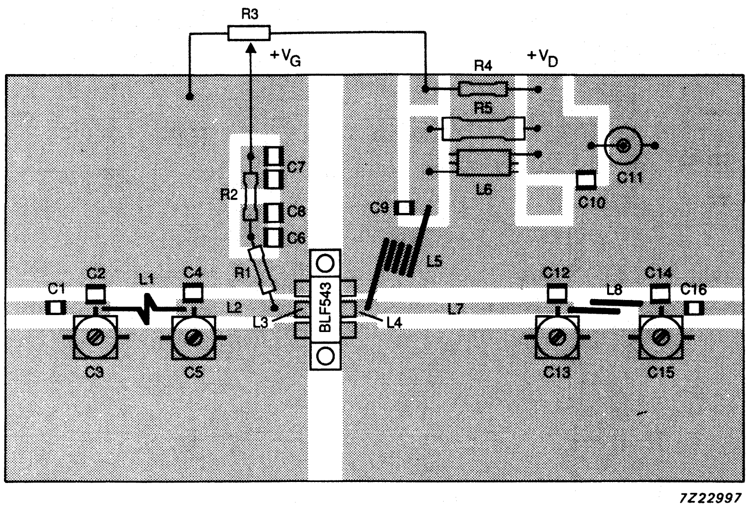
L1 = 11 nH, 1 turn enamelled Cu-wire (0.8 mm); int. diam. 4.7 mm; leads 2 x 5 mm
L2 = 42.5 Ω stripline; 14.5 x 3.0 mm
L3 = L4 = 42.5 Ω stripline; 6.0 mm x 3.0 mm
L5 = 124 nH; 7 turns enamelled Cu-wire (1.0 mm); int. diam. 4 mm; length 7.8 mm; leads 2 x 5 mm
L6 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)
L7 = 55.7 Ω stripline; 31.0 mm x 2.0 mm
L8 = 8 nH, 1 turn enamelled Cu-wire (1.0 mm); int. diam. 3.2 mm; leads 2 x 5 mm

R1 = R2 = 1 kΩ metal film resistor, 0.4 V (cat. no. 2322 151 71002)
R3 = 5 kΩ, Cermet potentiometer (ten turn)
R4 = 19.6 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71963)
R5 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

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

* American Technical Ceramics type 100B or equivalent.

APPLICATION INFORMATION (continued)



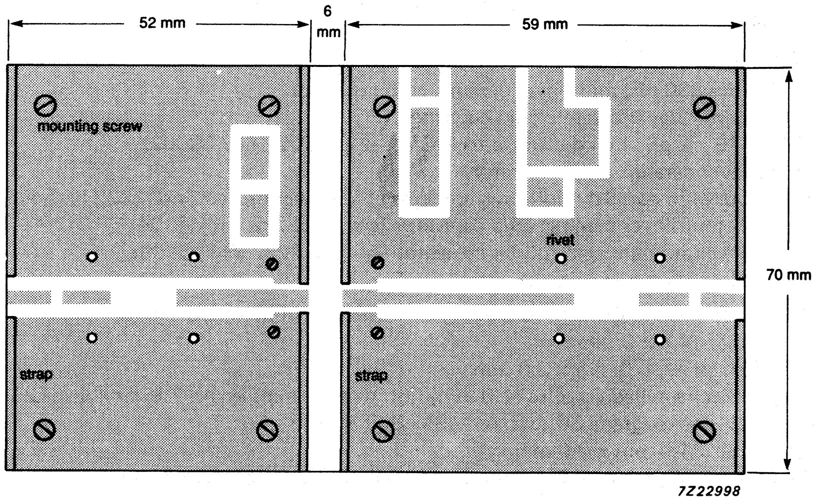


Fig.12 Component and circuit layout for 500 MHz test circuit.

Note

The circuit and 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

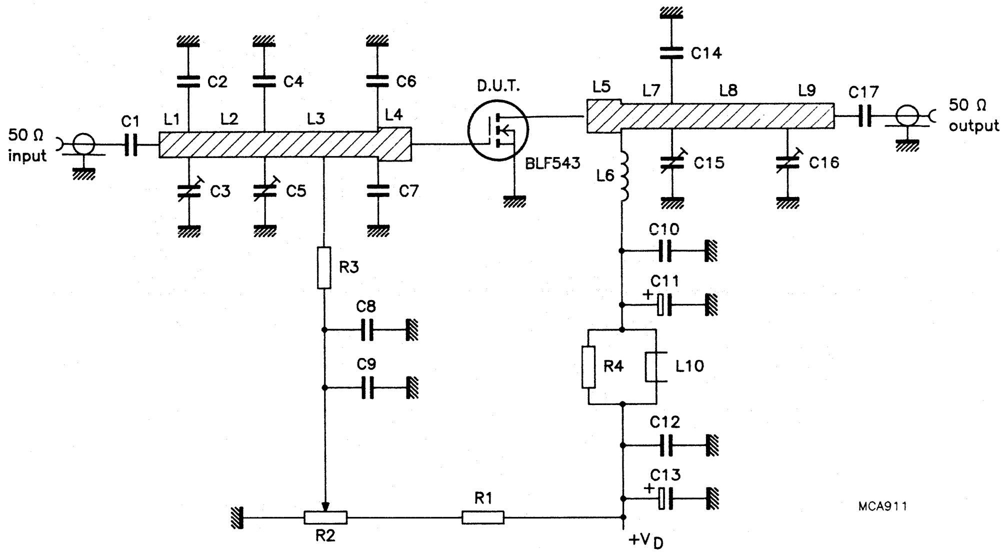


Fig.13 BLF543 class-B test circuit at 960 MHz.

List of components

C1 = C8 = C10 = C17 = 68 pF, multilayer ceramic chip capacitor*
C2 = 4.7 pF, multilayer ceramic chip capacitor**
C3 = C5 = C15 = C16 = 1.2-5.5 pF, film dielectric trimmer (cat. no. 2222 808 00004)
C4 = 2 x 5.6 pF in parallel, multilayer ceramic chip capacitors**
C6 = C7 = 7.5 pF, multilayer ceramic chip capacitor**
C9 = C12 = 100 nF, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C14 = 2 x 4.7 pF in parallel, multilayer ceramic chip capacitors**
C11 = C13 = 10 μF (63 V), aluminium electrolytic capacitor (cat. no. 2222 030 28109)

L1 = 50 Ω, stripline, 12.5 mm x 2.5 mm
L2 = 50 Ω, stripline, 19 mm x 2.5 mm
L3 = 50 Ω, stripline, 29.5 mm x 2.5 mm
L4 = L5 = 42.5 Ω, stripline, 3 mm x 3 mm
L6 = 35 nH, 3 turns enamelled Zu-wire (0.8 mm); int. diam. 4.0 mm; length 4.6 mm; leads 2 x 5 mm
L7 = 50 Ω, stripline, 12.5 mm x 2.5 mm
L8 = 50 Ω, stripline, 28.5 mm x 2.5 mm
L9 = 50 Ω, stripline, 20.5 mm x 2.5 mm
L10 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36640)

R1 = 205 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 72054)
R2 = 50 kΩ, 10 turn potentiometer
R3 = 10 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71003)
R4 = 10 Ω, metal film resistor, 0.4 W (cat. no. 2322 153 51009)

Striplines are on a double Cu-clad printed-circuit board with glass microfibre reinforced PTFE, thickness 1/32 inch ($\epsilon_r = 2.2$).

* American Technical Ceramics type 100B or equivalent.
** American Technical Ceramics type 100A or equivalent.

APPLICATION INFORMATION (continued)

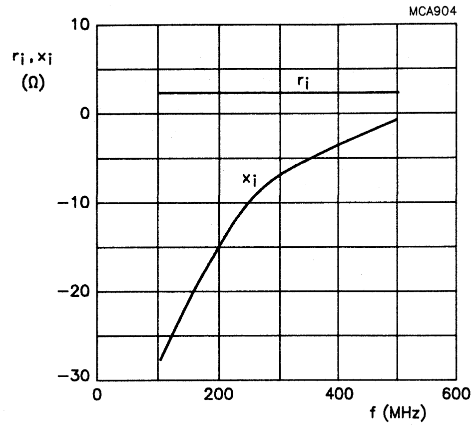


Fig.14 Input impedance as a function of frequency (series components).

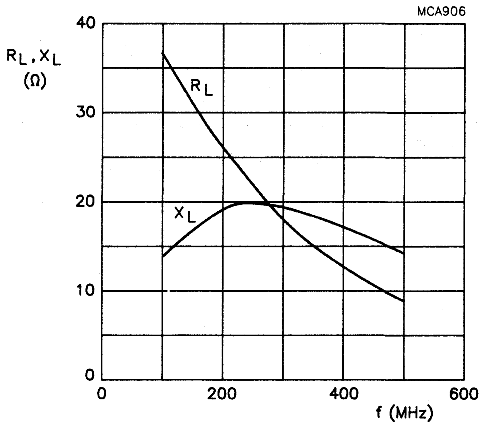


Fig.15 Load impedance as a function of frequency (series components).

960 MHz: Optimum load impedance: 4.3 + j 8.6 Ω
Input impedance: 2.3 + j 9.5 Ω

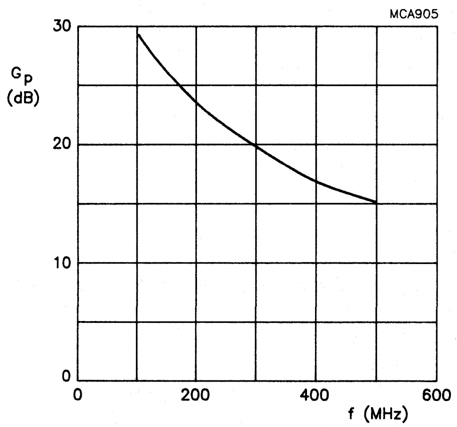


Fig.16 Power gain as a function of frequency.

Conditions for Figs 14 to 16:

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

UHF POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

Features

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

The BLF544 has a 6-lead SOT171 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.

QUICK REFERENCE DATA

RF performance at T_h = 25 ^oC in 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

MECHANICAL DATA

SOT171 (see Fig.1)

NOTE

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

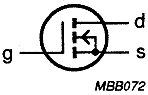
PRODUCT SAFETY This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



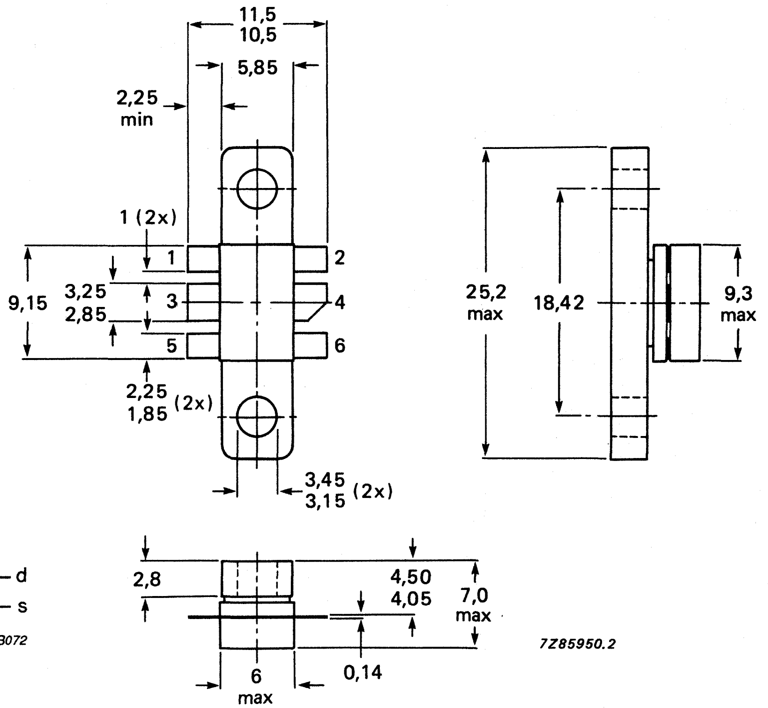


Fig.1 SOT171.

Torque on screw: min. 0.60 Nm (6 kg cm)
max. 0.75 Nm (7.5 kg cm)
Recommended screw: cheese-head 4-40 UNC/2A
Heatsink compound must be applied sparingly and evenly distributed.

RATINGS

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC or average	I_D	max.	2.0 A
peak value, f > 1 MHz	I_{DM}	max.	6.0 A
Total power dissipation			
T_{mb} = 25 °C	P_{tot}	max.	48 W
Storage temperature range	T_{stg}	−65 to + 150 °C	
Operating junction temperature	T_j	max.	200 °C

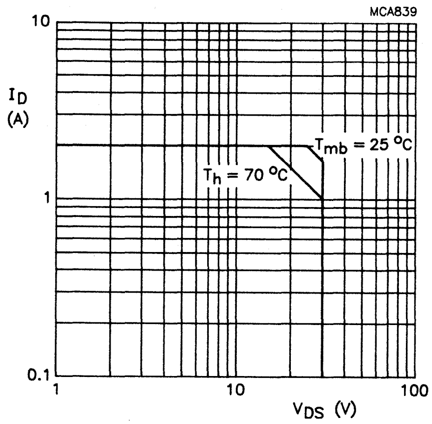
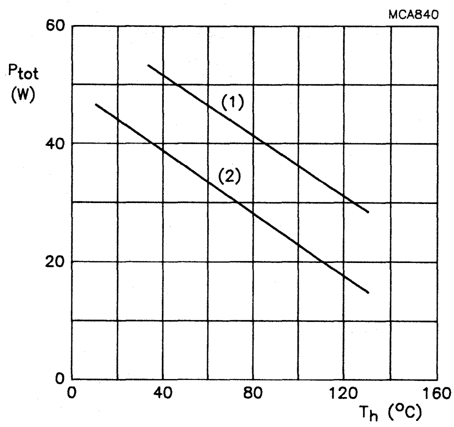


Fig.2 DC SOAR.



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

THERMAL RESISTANCE

From junction to mounting-base	$R_{th\,j\text{-}mb}$	max.	3.7 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

Drain-source breakdown voltage I_D = 10 mA; V_{GS} = 0	$V_{(BR)DSS}$	min.	65 V
Drain-source leakage current V_{DS} = 28 V; V_{GS} = 0	I_{DSS}	max.	1.0 mA
Gate-source leakage current ± V_{GS} = 20 V; V_{DS} = 0	I_{GSS}	max.	1.0 μA
Gate threshold voltage I_D = 40 mA; V_{DS} = 10 V	$V_{GS(th)}$		1 to 4 V
Gate-source voltage difference of matched pairs V_{DS} = 10 V; I_D = 40 mA	ΔV_{GS}	max.	100 mV
Forward transconductance I_D = 1.2 A; V_{DS} = 10 V	G_{fs}	min. typ.	600 mS 900 mS
Drain-source on-state resistance I_D = 1.2 A; V_{GS} = 10 V	$R_{DS(ON)}$	typ.	0.85 Ω
On-state drain current V_{DS} = 10 V; V_{GS} = 15 V	I_{DSX}	typ.	4.8 A
Input capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{is}	typ.	32 pF
Output capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{os}	typ.	24 pF
Feedback capacitance at f = 1 MHz V_{DS} = 28 V; V_{GS} = 0	C_{rs}	typ.	6.4 pF

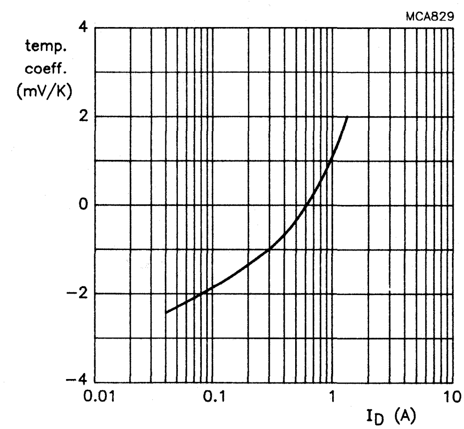


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values.

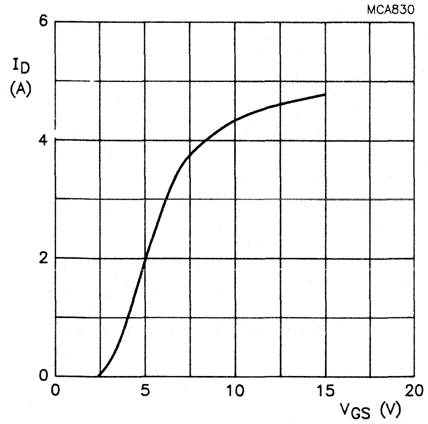


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values.

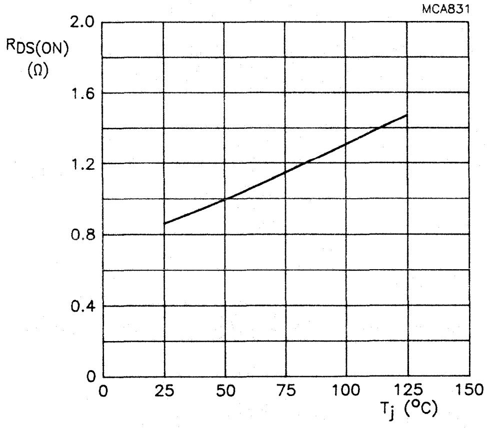


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 1.2 A; typical values.

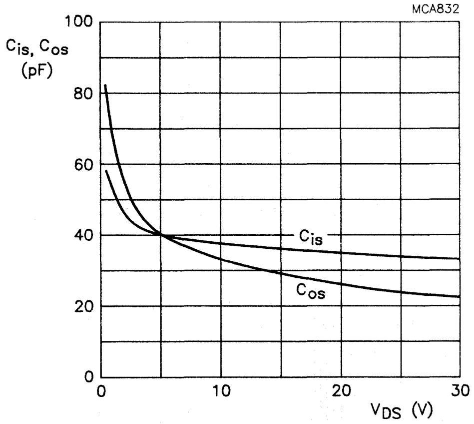


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

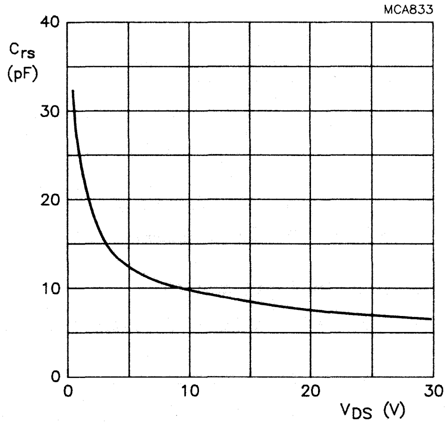


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values.

APPLICATION INFORMATION

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

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 24	40 40	20 15	typ. 7 typ. 7	typ. 50 typ. 50

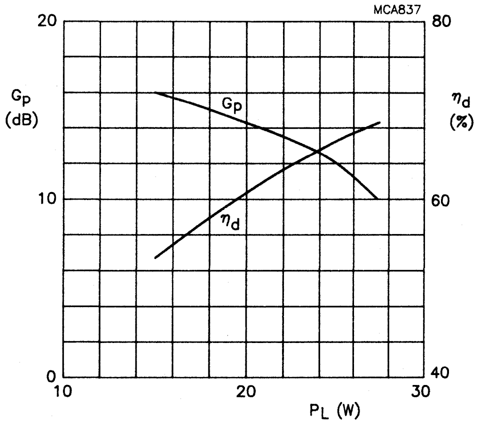


Fig.9 Power gain and efficiency as functions of load power.

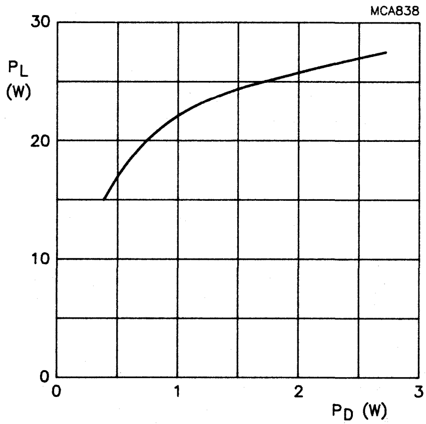


Fig.10 Load power as a function of drive power.

Conditions for Figs 9 and 10

Class-B operation; V_{DS} = 28 V; I_{DQ} = 40 mA; Z_L = 4.3 + j 6.3 Ω; f = 500 MHz; typical values.

Ruggedness in class-B operation

The BLF544 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 28 V, f = 500 MHz, at rated output power.

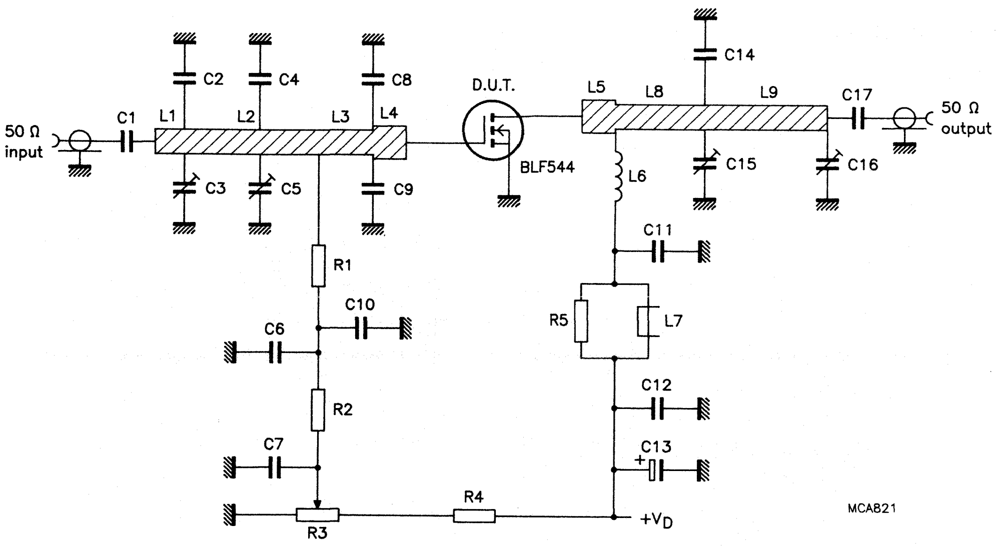


Fig.11 Test circuit for 500 MHz.

List of components:

C1 = C6 = C11 = C17 = 390 pF (500 V), multilayer ceramic chip capacitor*
C2 = 16 pF (50 V), multilayer ceramic chip capacitor**
C3 = C5 = 2 - 9 pF film dielectric trimmer (cat. no. 2222 809 09002)
C4 = 27 pF (50 V), multilayer ceramic chip capacitor**
C7 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitors (cat. no. 2222 852 47104)
C8 = C9 = 39 pF, multilayer ceramic chip capacitor**
C10 = C12 = 100 nF (50 V), multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C13 = 4.7 μF (63 V), electrolytic capacitor (cat. no. 2222 030 38478)
C14 = 20 pF (500 V), multilayer ceramic chip capacitor*
C15 = C16 = 2 - 18 pF, film dielectric trimmer (cat. no. 2222 809 09003)

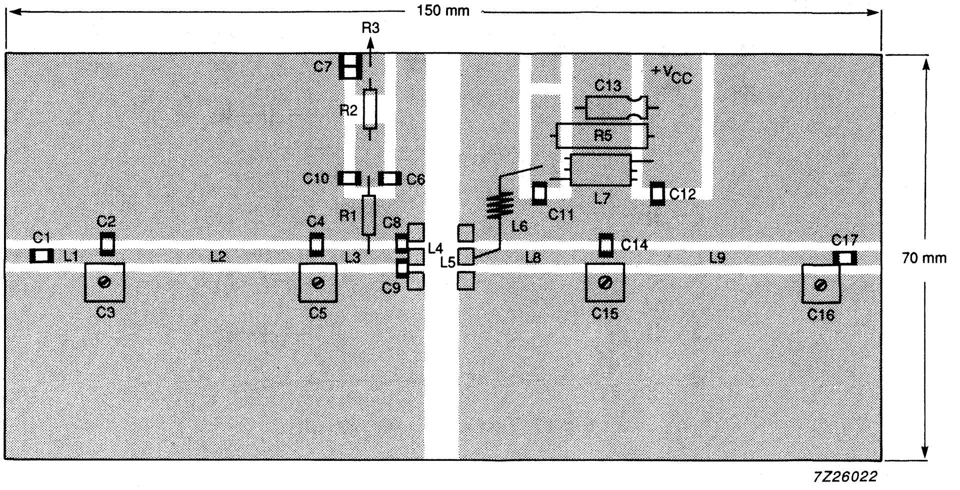
L1 = 50 Ω stripline; 9.5 mm x 2.5 mm
L2 = 50 Ω stripline; 34.5 mm x 2.5 mm
L3 = 50 Ω stripline; 17.5 mm x 2.5 mm
L4 = L5 = 42 Ω stripline; 3.0 mm x 3.0 mm
L6 = 31 nH; 4 turns enamelled Cu-wire (0.8 mm); int. diam. 3 mm; length 7.5 mm; leads 2 x 5 mm
L7 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L8 = 50 Ω stripline; 22.0 mm x 2.5 mm
L9 = 50 Ω stripline; 39.5 mm x 2.5 mm

R1 = R2 = 1 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 11002)
R3 = 50 kΩ, Cermet potentiometer (ten turns)
R4 = 140 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 11404)
R5 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

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

* American Technical Ceramics type 100B or equivalent.
** American Technical Ceramics type 100A or equivalent.

APPLICATION INFORMATION (continued)



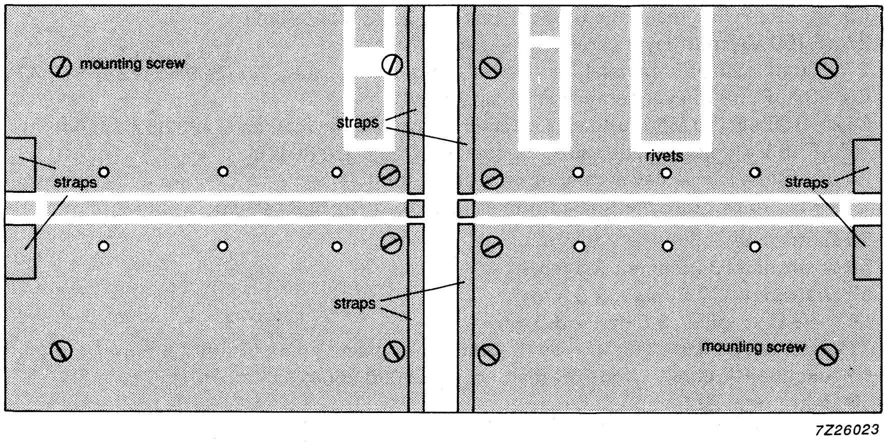


Fig.12 Component and circuit layout for 500 MHz test circuit.

NOTE

The circuit and 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

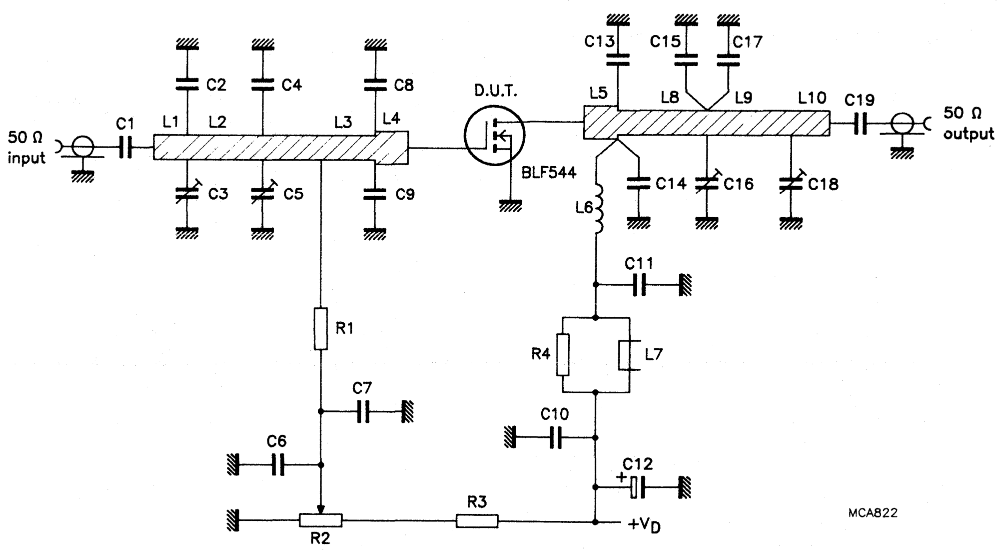


Fig.13 BLF544 class-B test circuit at 960 MHz.

List of components:

C1 = 68 pF (500 V), multilayer ceramic chip capacitor*
C2 = 1.6 pF (50 V), multilayer ceramic chip capacitor**
C3 = C5 = C16 = C18 = 1.4 - 5.5 pF, film dielectric trimmer (cat. no. 2222 809 09001)
C4 = 1.0 pF (50 V), multilayer ceramic chip capacitor**
C6 = 10 nF (50 V), multilayer ceramic chip capacitor (cat. no. 2222 852 47103)
C7 = C11 = 56 pF (500 V), multilayer ceramic chip capacitor*
C8 = C9 = C15 = C17 = 6.8 pF (50 V), multilayer ceramic chip capacitor**
C10 = 100 nF (50 V), multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C12 = 4.7 μF (63 V), electrolytic capacitor (cat. no. 2222 030 38478)
C13 = 16 pF (50 V), multilayer ceramic chip capacitor**
C14 = 18 pF (50 V), multilayer ceramic chip capacitor**
C19 = 62 pF (500 V), multilayer ceramic chip capacitor*

L1 = L8 = 50 Ω, stripline, 6.0 mm x 2.5 mm
L2 = 50 Ω, stripline, 38.0 mm x 2.5 mm
L3 = 50 Ω, stripline, 17.5 mm x 2.5 mm
L4 = L5 = 42 Ω, stripline, 3 mm x 3 mm
L6 = 16 nH, 2 turns enamelled Cu-wire (1.0 mm); int. diam. 3.0 mm; length 3.4 mm; leads 2 x 5 mm
L7 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L9 = 50 Ω, stripline, 21.0 mm x 2.5 mm
L10 = 50 Ω, stripline, 34.5 mm x 2.5 mm

R1 = 15 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 11473)
R2 = 50 kΩ, Cermet potentiometer (ten turn)
R3 = 140 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 11404)
R4 = 10 Ω, metal film resistor, 0.4 W (cat. no. 2322 153 51009)

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

* American Technical Ceramics type 100B or equivalent.
** American Technical Ceramics type 100A or equivalent.

APPLICATION INFORMATION (continued)

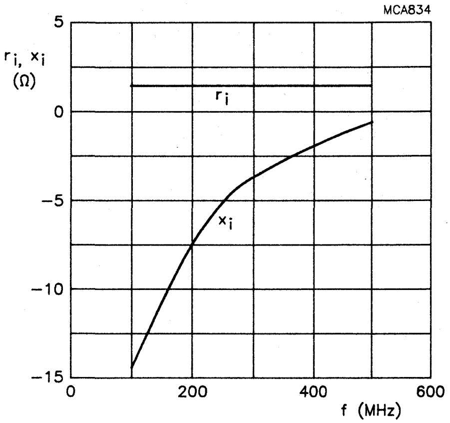


Fig.14 Input impedance as a function of frequency (series components).

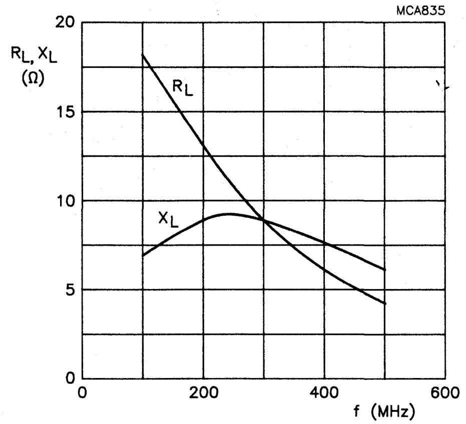


Fig.15 Load impedance as a function of frequency (series components).

960 MHz: Optimum load impedance: 2.6 − j 3.1 Ω
Input impedance: 1.2 + j 4.8 Ω

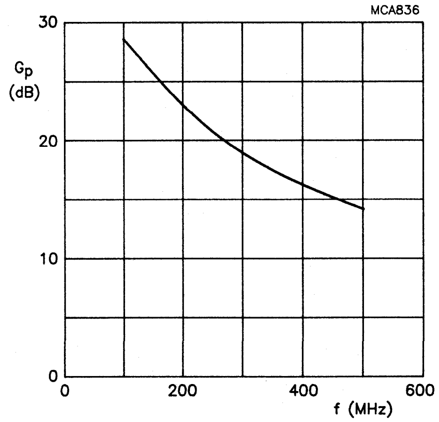


Fig.16 Power gain as a function of frequency.

Conditions for Figs 14 to 16

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

UHF PUSH-PULL POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS push-pull transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

Features

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

The BLF544B has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

QUICK REFERENCE DATA

RF performance at T_h = 25 ^oC 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

MECHANICAL DATA

SOT268 (see Fig.1).

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

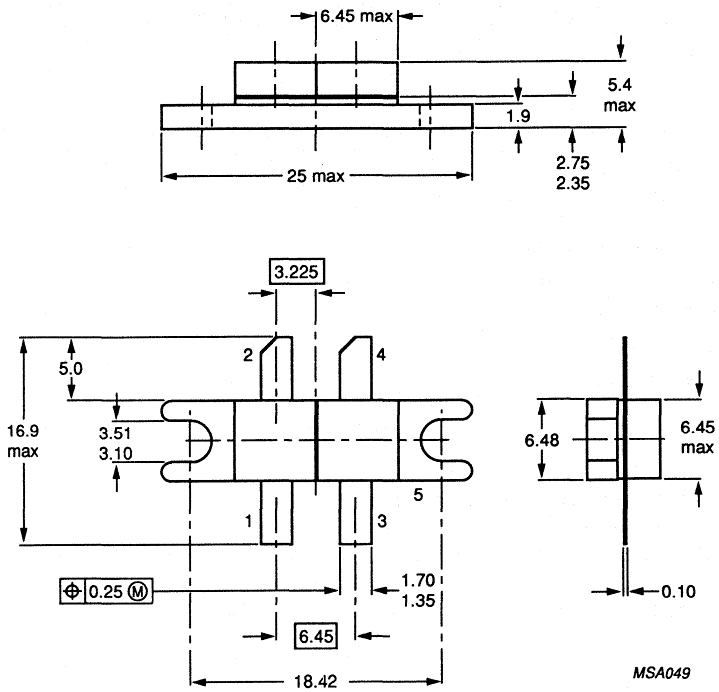
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO discs are not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



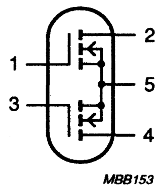


Fig.1 SOT268.

Torque on screw: min. 0.60 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 (per transistor section unless otherwise specified)

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

Drain-source voltage	V_{DS}	max.	65	V
Gate-source voltage	$\pm V_{GS}$	max.	20	V
Drain current				
DC or average	I_D	max.	1.0	A
peak value, f > 1 MHz	I_{DM}	max.	3.0	A
Total power dissipation				
T_{mb} = 25 °C, both sections equally loaded	P_{tot}	max.	48	W
Storage temperature range	T_{stg}		−65 to + 150	°C
Operating junction temperature	T_j	max.	200	°C

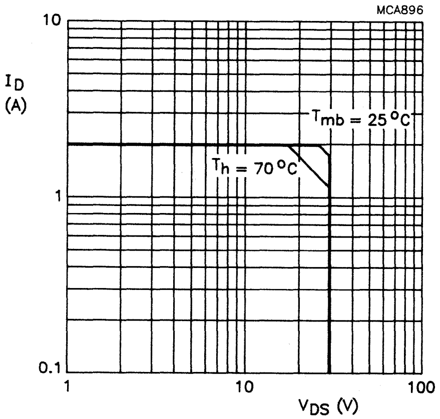


Fig.2 DC SOAR (total device) both sections equally loaded.

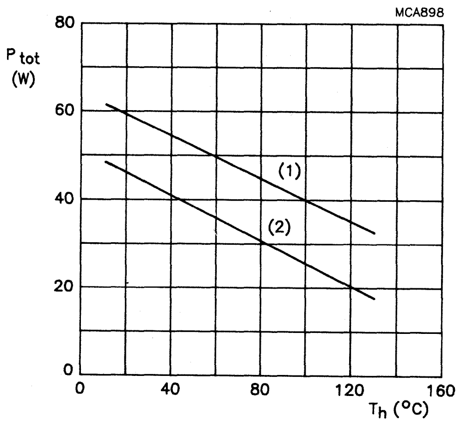


Fig.3 Power/temperature derating curves (total device).

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

THERMAL RESISTANCE

Total device, both sections equally loaded

From junction to mounting-base	$R_{th\ j\text{-}mb}$	max.	3.7	K/W
From mounting-base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.25	K/W

CHARACTERISTICS

(per transistor section) $T_j = 25\ ^oC$

Drain-source breakdown voltage $I_D = 5$ mA; $V_{GS} = 0$	$V_{(BR)DSS}$	min.	65 V
Drain-source leakage current $V_{DS} = 28$ V; $V_{GS} = 0$	I_{DSS}	max.	0.5 mA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	max.	1.0 μA
Gate threshold voltage $I_D = 10$ mA; $V_{DS} = 10$ V	$V_{GS(th)}$		1 to 4 V
Forward transconductance $I_D = 0.6$ A; $V_{DS} = 10$ V	G_{fs}	min. typ.	300 mS 450 mS
Drain-source on-state resistance $I_D = 0.6$ A; $V_{GS} = 10$ V	$R_{DS(ON)}$	typ.	1.7 Ω
On-state drain current $V_{DS} = 10$ V; $V_{GS} = 15$ V	I_{DSX}	typ.	2.4 A
Input capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{is}	typ.	16 pF
Output capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{os}	typ.	12 pF
Feedback capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{rs}	typ.	3.2 pF

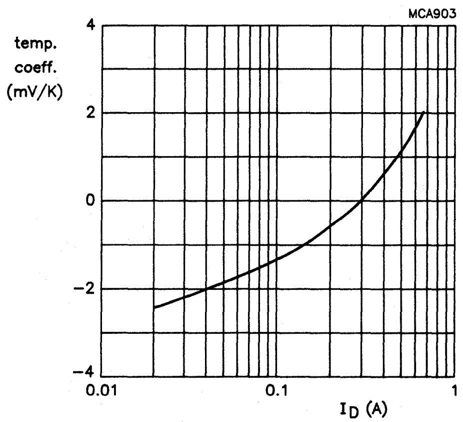


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; $V_{DS} = 10$ V; typical values per section.

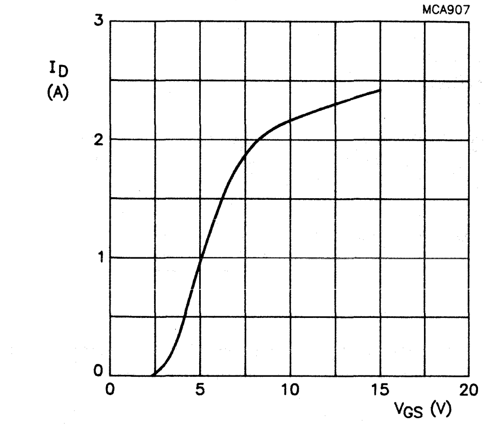


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

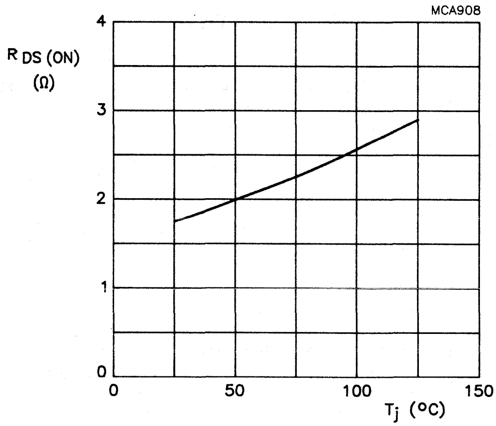


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 0.6 A; typical values per section.

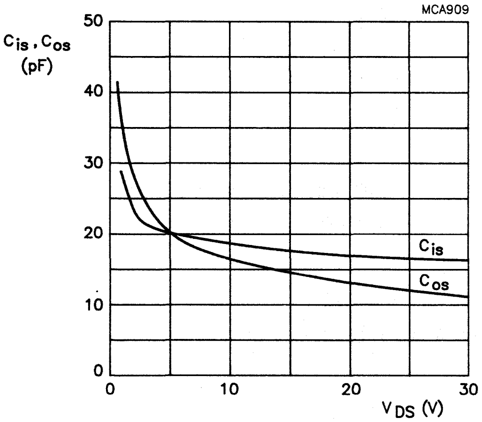


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

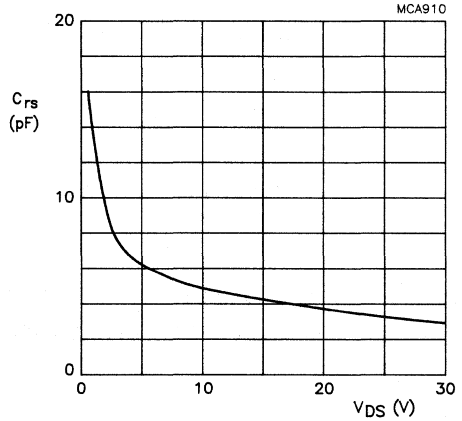


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

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

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

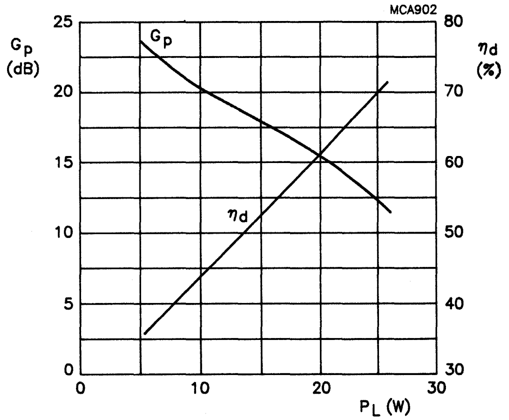


Fig.9 Power gain and efficiency as a function of load power.

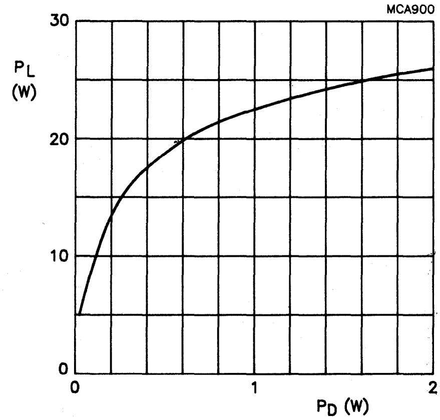


Fig.10 Load power as a function of drive power.

Conditions for Figs 9 and 10

Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 20 mA; Z_L = 8.4 +j 14.3 Ω (per section); f = 500 MHz; typical values.

Ruggedness in class-B operation

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

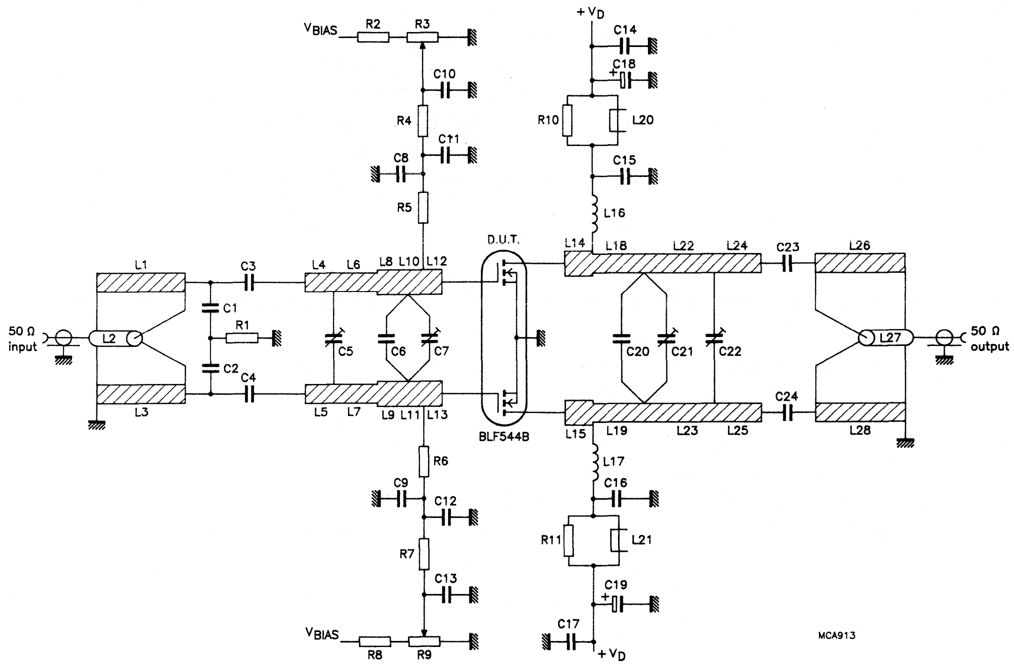


Fig.11 Test circuit for 500 MHz.

APPLICATION INFORMATION (continued)

List of components

C1 = C2 = 9.1 pF (500 V), multilayer ceramic chip capacitor*
C3 = C4 = C6 = 18 pF (500 V), multilayer ceramic chip capacitor*
C5 = 2 - 9 pF film dielectric trimmer (cat. no. 2222 809 09005)
C7 = C21 = C22 = 2 - 18 pF, film dielectric trimmer (cat. no. 2222 809 09006)
C8 = C9 = C15 = C16 = 390 pF (500 V), multilayer ceramic chip capacitor*
C10 = C13 = 2 x 100 nF (50 V) in parallel, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C11 = C12 = C14 = C17 = 100 nF (50 V), multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C18 = C19 = 10 μF (63 V), electrolytic capacitor (cat. no. 2222 030 38109)
C20 = 6.8 pF (500 V), multilayer ceramic chip capacitor*
C23 = C24 = 16 pF (500 V), multilayer ceramic chip capacitor*

L1 = L3 = L26 = L28 = 50 Ω stripline; 56 x 2.4 mm
L2 = 50 Ω semi-rigid coax cable, soldered on L1; out. diam. 2.2 mm; outer conductor length 56 mm.
L4 = L5 = 56 Ω stripline; 8.0 x 2.0 mm
L6 = L7 = 56 Ω stripline; 15.5 x 2.0 mm
L8 = L9 = 42 Ω stripline; 10.0 x 3.0 mm
L10 = L11 = 42 Ω stripline; 5.0 x 3.0 mm
L12 = L13 = L14 = L15 = 42 Ω stripline; 6.0 x 3.0 mm
L16 = L17 = 124 nH; 6 turns (1.0 mm) enamelled Cu-wire; int. diam. 5.4 mm; length 8.5 mm; leads 2 x 5 mm
L18 = L19 = 56 Ω stripline; 22.0 x 2.0 mm
L20 = L21 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L22 = L23 = 56 Ω stripline; 18.0 x 2.0 mm
L24 = L25 = 56 Ω stripline; 16.0 x 2.0 mm
L27 = 50 Ω semi-rigid coax cable, soldered on L26; out. diam. 2.2 mm; outer conductor length 56 mm

R1 = 5.62 Ω metal film resistor, 0.4 W (cat. no. 2322 151 75628)
R2 = R8 = 11.5 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71159)
R3 = R9 = 5 kΩ, Cermet potentiometer (ten turn)
R4 = R7 = 590 Ω, metal film resistor, 0.4 W (cat. no. 2322 151 75901)
R5 = R6 = 46.4 Ω, metal film resistor, 0.4 W (cat. no. 2322 151 74649)
R10 = R11 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 153 51009)

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

* American Technical Ceramics type 100B or equivalent.

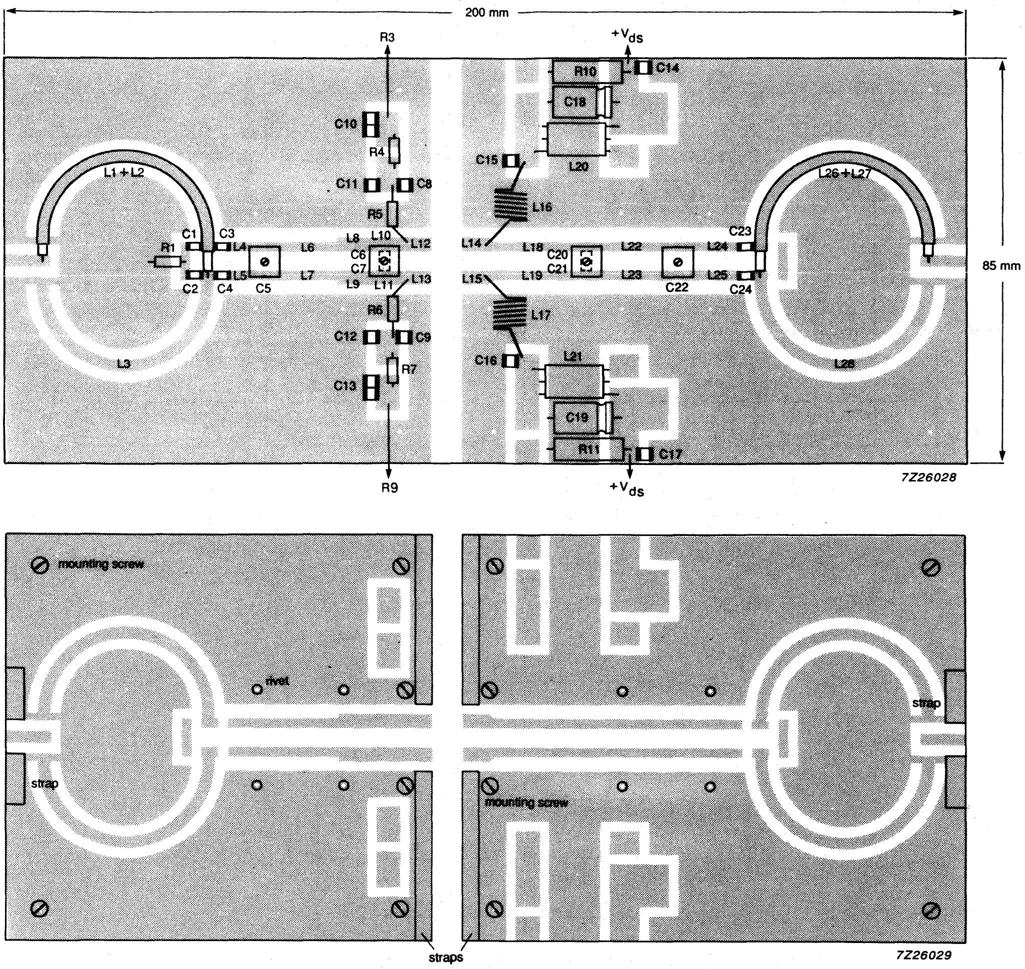


Fig.12 Component and circuit layout for 500 MHz test circuit.

NOTE

The circuit and 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

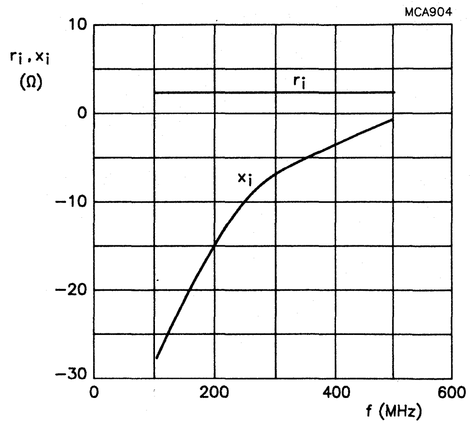


Fig.13 Input impedance as a function of frequency (series components).

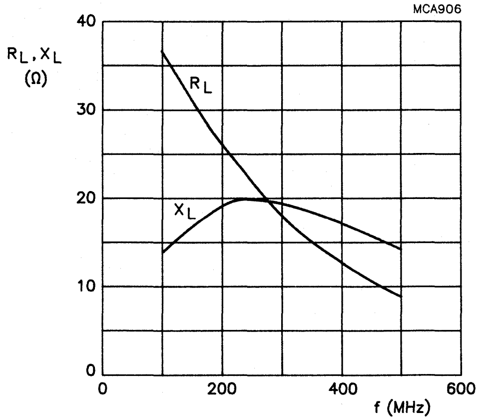


Fig.14 Load impedance as a function of frequency (series components).

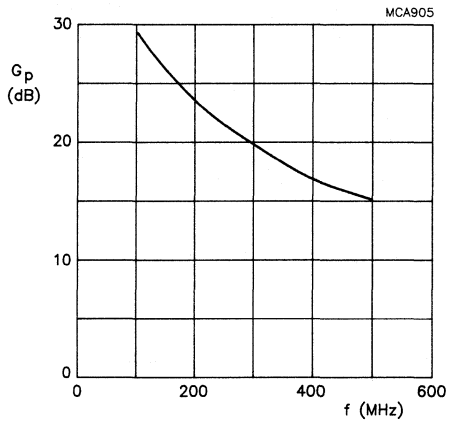


Fig.15 Power gain as a function of frequency.

Conditions for Figs 13 to 15

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

UHF PUSH-PULL POWER MOS TRANSISTOR

Silicon N-channel enhancement mode vertical D-MOS push-pull transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

Features

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

The BLF545 has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

QUICK REFERENCE DATA

RF performance at T_h = 25 ^oC 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	40	> 11	> 50

MECHANICAL DATA

SOT268 (see Fig.1).

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

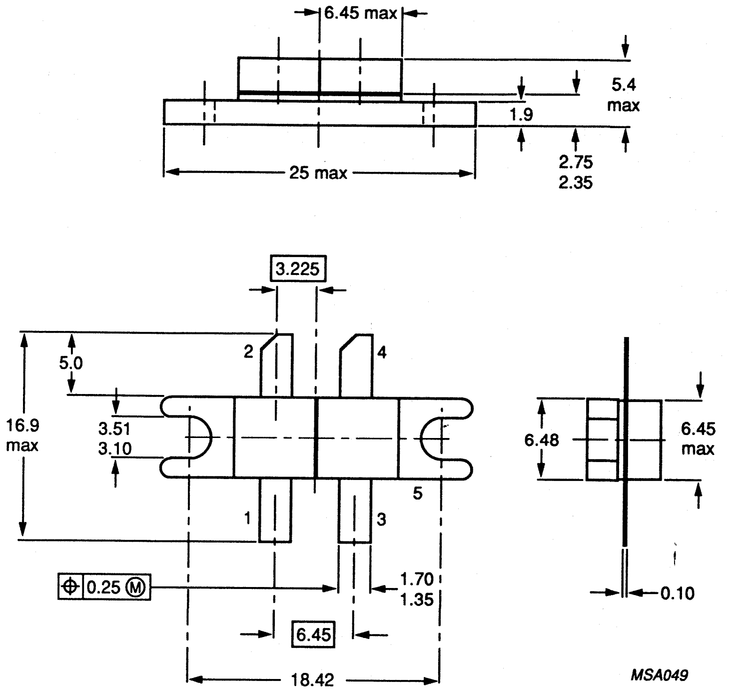
PRODUCT SAFETY: This device incorporates beryllium oxide, the dust of which is toxic. The device is entirely safe provided that the internal BeO discs are not damaged.

MECHANICAL DATA

Dimensions in mm

Pinning

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



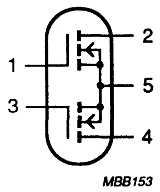


Fig.1 SOT268.

Torque on screw: min. 0.60 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 (per transistor section unless otherwise specified)

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

Drain-source voltage	V_{DS}	max.	65 V
Gate-source voltage	$\pm V_{GS}$	max.	20 V
Drain current			
DC or average	I_D	max.	2.0 A
peak value, f > 1 MHz	I_{DM}	max.	6.0 A
Total power dissipation			
T_{mb} = 25 °C, both sections equally loaded	P_{tot}	max.	92 W
Storage temperature range	T_{stg}		−65 to + 150 °C
Operating junction temperature	T_j	max.	200 °C

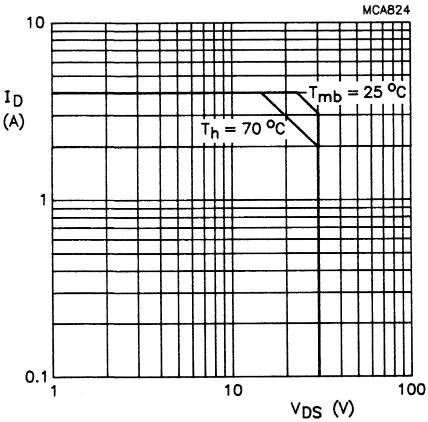


Fig.2 DC SOAR (total device) both sections equally loaded.

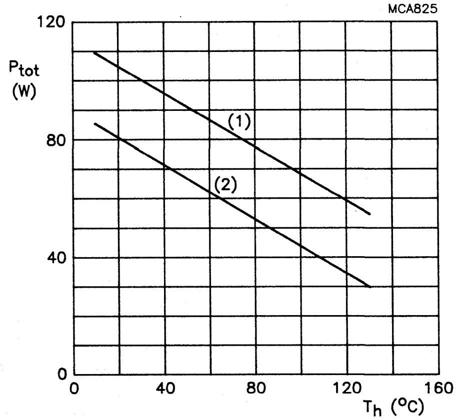


Fig.3 Power/temperature derating curves (total device) both sections equally loaded.

(1) Short-time operation during mismatch

(2) Continuous operation

THERMAL RESISTANCE

Total device, both sections equally loaded

From junction to mounting-base	$R_{th\ j\text{-}mb}$	max.	1.9 K/W
From mounting-base to heatsink	$R_{th\ mb\text{-}h}$	max.	0.25 K/W

CHARACTERISTICS

(per transistor section) $T_j = 25\ ^{o}C$

Drain-source breakdown voltage $I_D = 10$ mA; $V_{GS} = 0$	$V_{(BR)DSS}$	min.	65 V
Drain-source leakage current $V_{DS} = 28$ V; $V_{GS} = 0$	I_{DSS}	max.	1.0 mA
Gate-source leakage current $\pm V_{GS} = 20$ V; $V_{DS} = 0$	I_{GSS}	max.	1.0 μA
Gate threshold voltage $I_D = 40$ mA; $V_{DS} = 10$ V	$V_{GS(th)}$		1 to 4 V
Forward transconductance $I_D = 1.2$ A; $V_{DS} = 10$ V	G_{fs}	min. typ.	600 mS 900 mS
Drain-source on-state resistance $I_D = 1.2$ A; $V_{GS} = 10$ V	$R_{DS(ON)}$	typ.	0.85 Ω
On-state drain-current $V_{DS} = 10$ V; $V_{GS} = 15$ V	I_{DSX}	typ.	4.8 A
Input capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{is}	typ.	32 pF
Output capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{os}	typ.	24 pF
Feedback capacitance at f = 1 MHz $V_{DS} = 28$ V; $V_{GS} = 0$	C_{rs}	typ.	6.4 pF

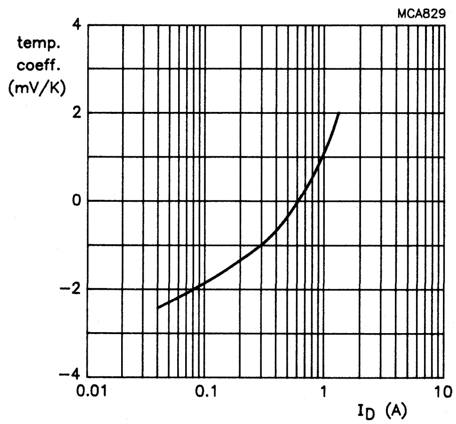


Fig.4 Temperature coefficient of V_{GS} as a function of drain current; $V_{DS} = 10$ V; typical values per section.

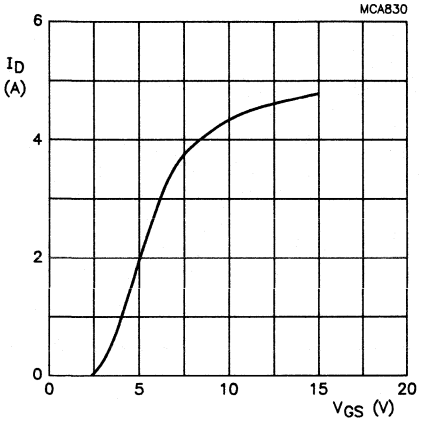


Fig.5 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

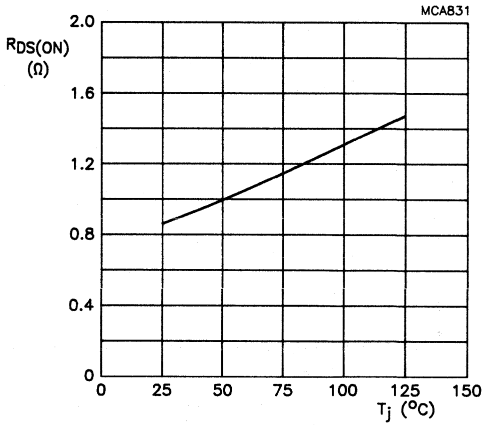


Fig.6 Drain-source on-state resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 1.2 A; typical values per section.

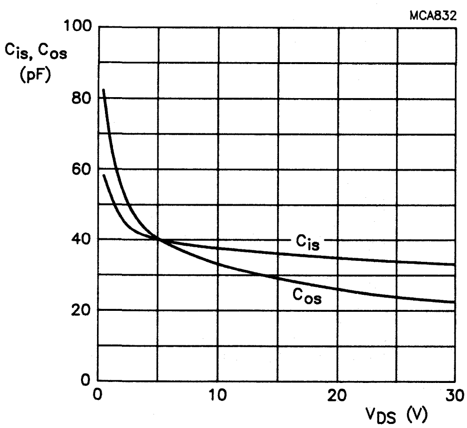


Fig.7 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

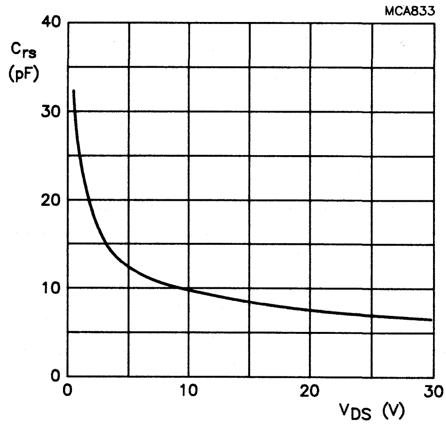


Fig.8 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

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

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

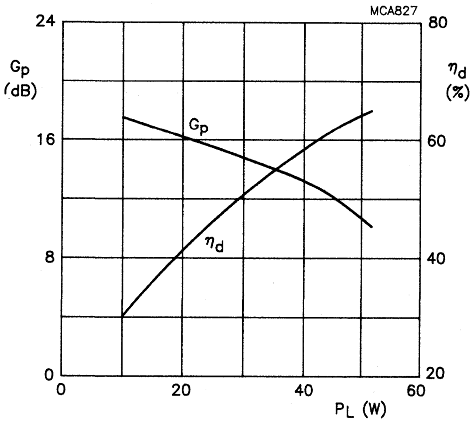


Fig.9 Power gain and efficiency as a function of load power; typical values per section.

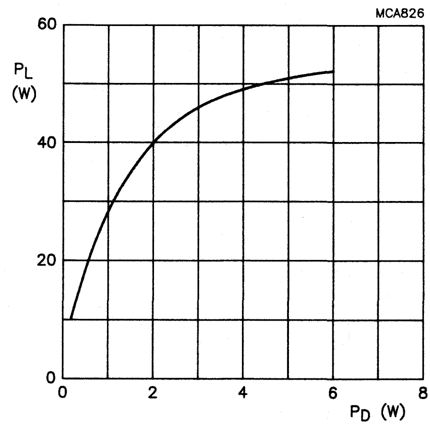


Fig.10 Load power as a function of drive power; typical values per section.

Conditions for Figs 9 and 10

Class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 40 mA; Z_L = 4.2 +j 6.2 Ω (per section); f = 500 MHz; typical values.

Ruggedness in class-B operation

The BLF545 is capable of withstanding a load mismatch corresponding with VSWR = 50 through all phases under the following conditions: V_{DS} = 28 V, f = 500 MHz, at rated output power.

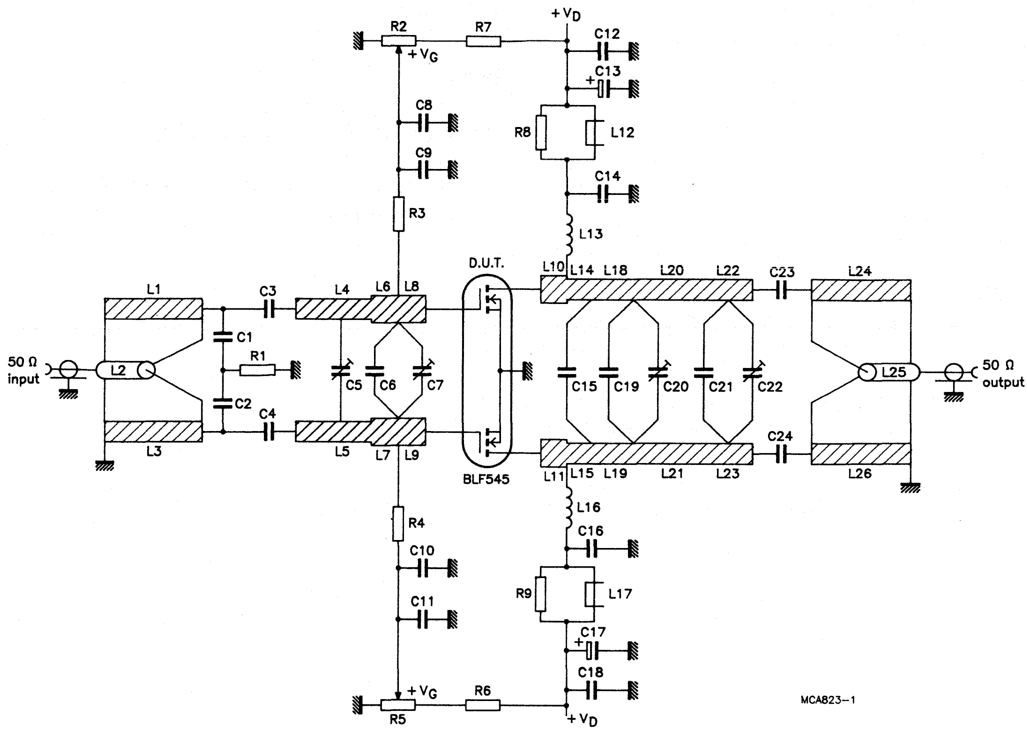


Fig.11 Test circuit for 500 MHz.

APPLICATION INFORMATION (continued)

List of components

C1 = C2 = 5.1 pF, multilayer ceramic chip capacitor*
C3 = C4 = 16 pF, multilayer ceramic chip capacitor*
C5 = C7 = C20 = C22 = 1.8 - 10 pF film dielectric trimmer (cat. no. 2222 809 05002)
C6 = 22 pF, multilayer ceramic chip capacitor*
C8 = C11 = C12 = C18 = 100 nF, multilayer ceramic chip capacitor (cat. no. 2222 852 47104)
C9 = C10 = C14 = C16 = 390 pF, multilayer ceramic chip capacitor*
C13 = C17 = 10 μF, (63 V) electrolytic capacitor
C15 = 18 pF, multilayer ceramic chip capacitor*
C19 = 13 pF, multilayer ceramic chip capacitor*
C21 = 6.2 pF, multilayer ceramic chip capacitor*
C23 = C24 = 10 pF, multilayer ceramic chip capacitor*

L1 = L3 = L24 = L26 = 50 Ω stripline; 56.0 x 2.4 mm
L2 = L25 = 50 Ω semi-rigid coax cable, soldered on L1 and L26 outer conductor; length 56 mm; out. diam. 2.2 mm
L4 = L5 = 56 Ω stripline; 13.4 x 2.0 mm
L6 = L7 = 56 Ω stripline; 9.6 x 2.0 mm (in series with a 42 Ω stripline (11 mm x 3.0 mm))
L8 = L9 = 42 Ω stripline; 9.0 x 3.0 mm
L10 = L11 = 42 Ω stripline; 6.0 x 3.0 mm
L12 = L17 = Ferroxcube RF choke, grade 3B (cat. no. 4312 020 36642)
L13 = L16 = 62 nH; 4 turns (1.2 mm) enamelled Cu-wire; int. diam. 5 mm; length 7.6 mm; leads 2 x 5 mm
L14 = L15 = 56 Ω stripline; 8.0 x 2.0 mm
L18 = L19 = 56 Ω stripline; 13.0 x 2.0 mm
L20 = L21 = 56 Ω stripline; 18.0 x 2.0 mm
L22 = L23 = 56 Ω stripline; 14.0 x 2.0 mm

R1 = 5.11 Ω metal film resistor, 0.4 W (cat. no. 2322 151 75118)
R2 = R5 = 50 kΩ, Cermet potentiometer (ten turn)
R3 = R4 = 10 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 71003)
R6 = R7 = 205 kΩ, metal film resistor, 0.4 W (cat. no. 2322 151 72054)
R8 = R9 = 10 Ω, metal film resistor, 1.0 W (cat. no. 2322 151 71009)

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

* American Technical Ceramic type 100B or equivalent.

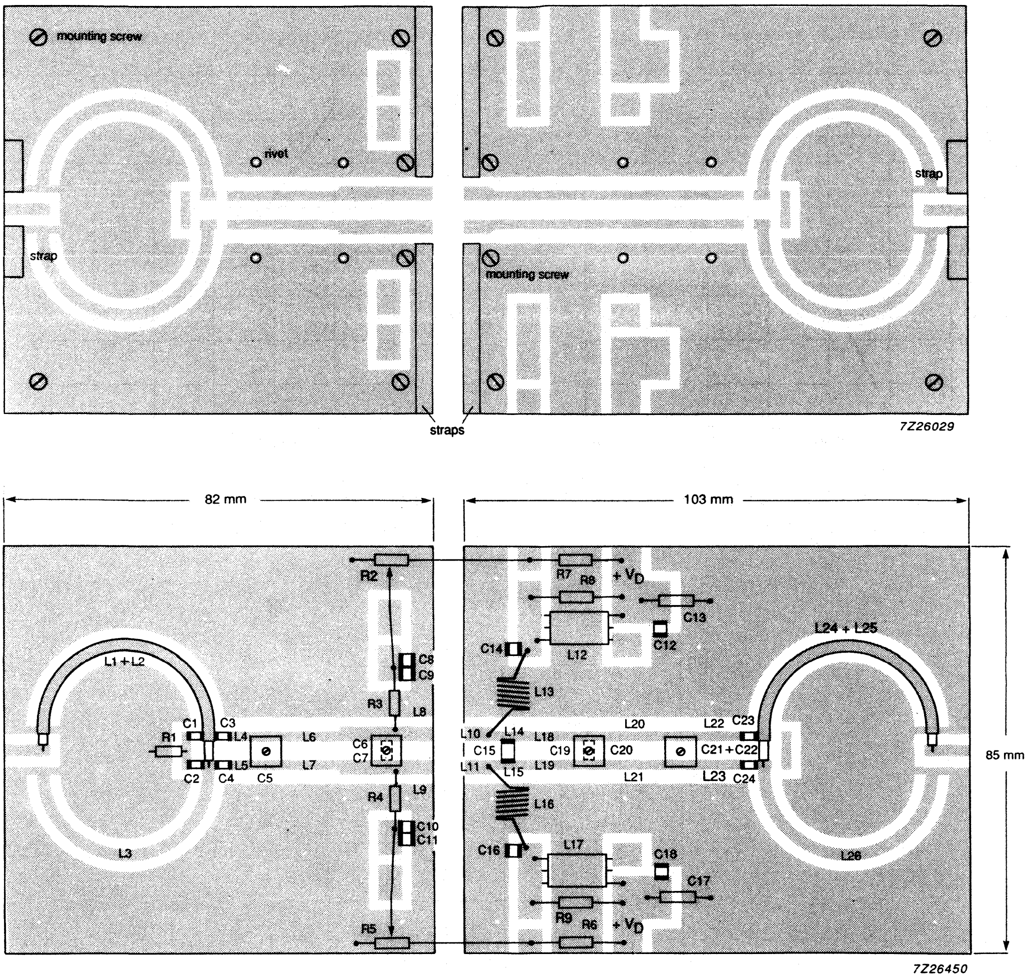


Fig.12 Component and circuit layout for 500 MHz test circuit.

NOTE

The circuit and 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 copper straps and hollow rivets for a direct contact between upper and lower sheets.

APPLICATION INFORMATION (continued)

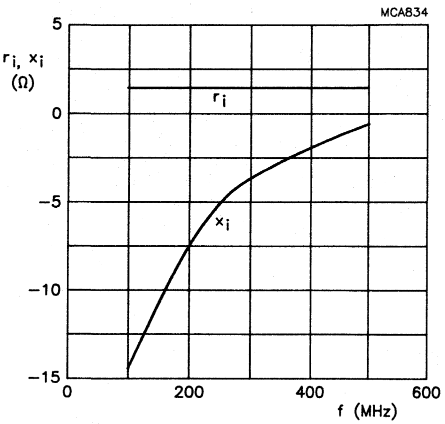


Fig.13 Input impedance as a function of frequency (series components).

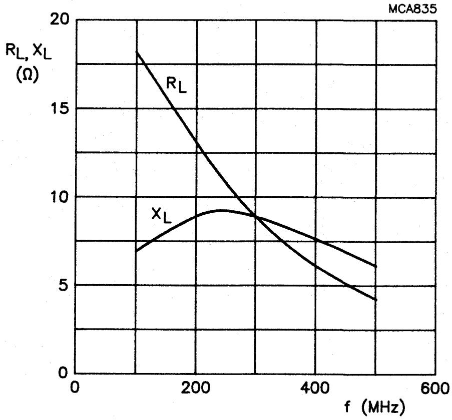


Fig.14 Load impedance as a function of frequency (series components).

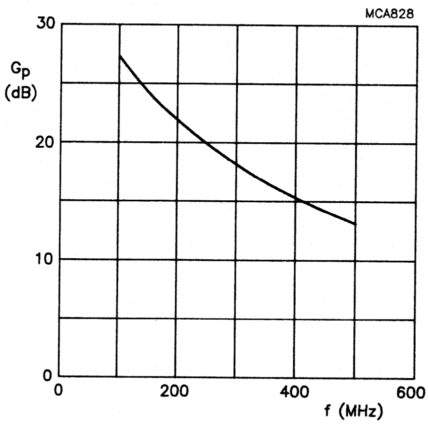


Fig.15 Power gain as a function of frequency.

Conditions for Figs 13 to 15

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

Philips Components

Data sheet	
status	Product specification
date of issue	September 1990

BLF546
UHF push-pull PowerMOS transistor

FEATURES

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

DESCRIPTION

The BLF546 is a silicon n-channel enhancement mode vertical D-MOS push-pull transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

The BLF546 has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

Note

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

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 (%)
c.w. class-B	500	28	80	> 11	> 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.**

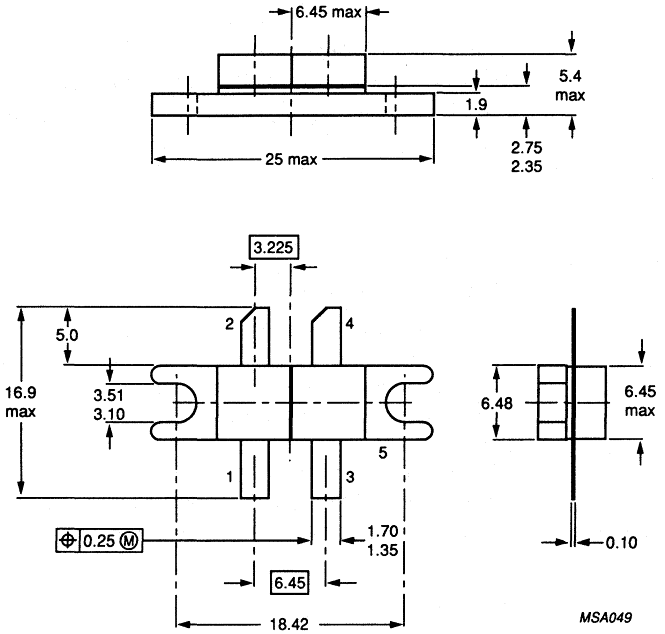
MECHANICAL DATA

SOT268 - see Fig.1.

UHF push-pull PowerMOS transistor **BLF546**

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 SOT268.

PIN CONFIGURATION

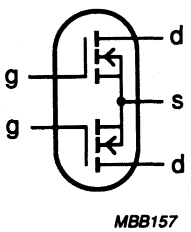


Fig.2 Pin configuration.

PINNING

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

LIMITING VALUES (per transistor section unless otherwise specified)

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	drain current	DC or average	-	4	A
I_{DM}	drain current	peak value f > 1 MHz	-	12	A
P_{tot}	total power dissipation	T_{mb} = 25 °C total device both sections equally loaded	-	145	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

Total device, both sections equally loaded.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j-mb}$	from junction to mounting base	1.2	K/W
$R_{th\ mb-h}$	from mounting base to heatsink	0.25	K/W

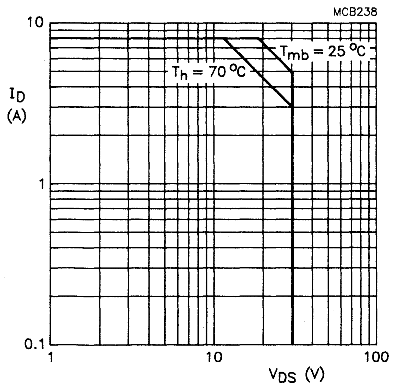


Fig.3 DC SOAR, total device; both sections equally loaded.

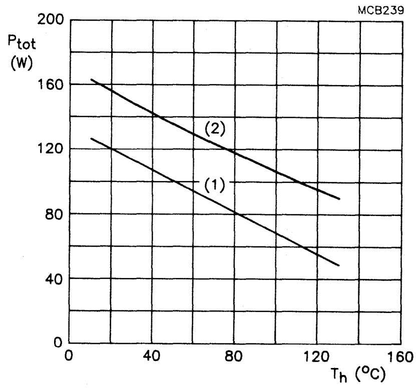


Fig.4 Power/temperature derating, total device; both sections equally loaded; (1) continuous operation; (2) short-time operation during mismatch.

CHARACTERISTICS (per transistor section)

T_j = 25 °C.

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

UHF push-pull PowerMOS transistor **BLF546**

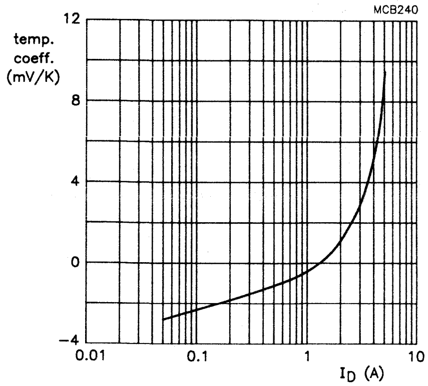


Fig.5 Temperature coefficient of V_{GS} as a function of drain current; V_{DS} = 10 V; typical values per section.

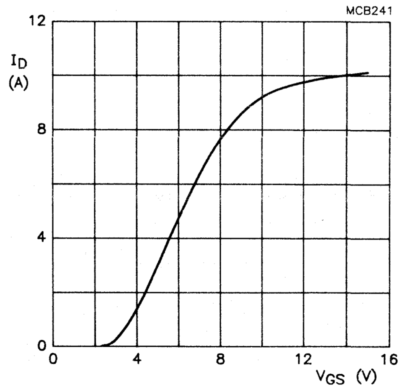


Fig.6 Drain current as a function of gate-source voltage; V_{DS} = 10 V; T_j = 25 °C; typical values per section.

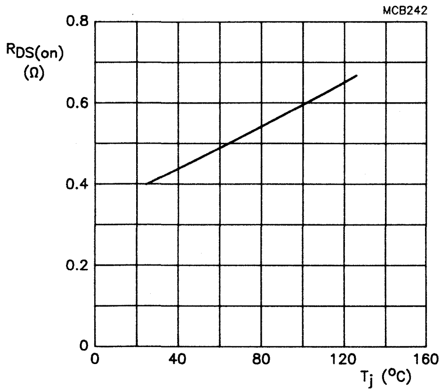


Fig.7 Drain-source on-resistance as a function of junction temperature; V_{GS} = 10 V; I_D = 2.4 A; typical values per section.

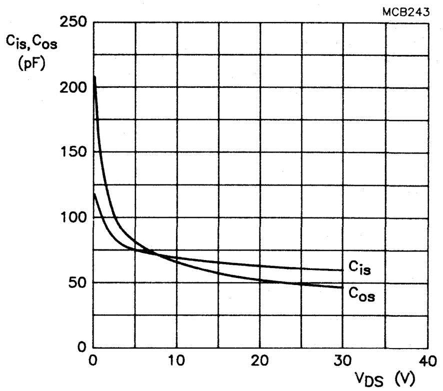


Fig.8 Input and output capacitance as functions of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

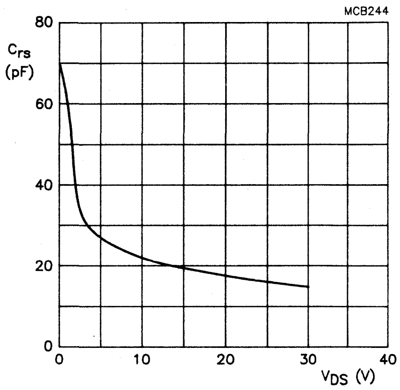


Fig.9 Feedback capacitance as a function of drain-source voltage; V_{GS} = 0; f = 1 MHz; typical values per section.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_p (dB)	η_D (%)
c.w. 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 load mismatch corresponding to VSWR = 10 through all phases, under the following conditions: V_{DS} = 28 V, f = 500 MHz at rated output power.

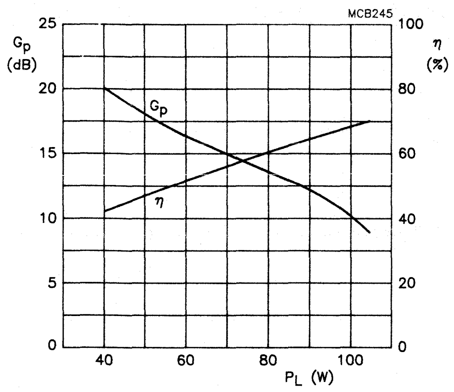


Fig.10 Gain and efficiency as functions of load power; class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; Z_L = 2.3 + j 2.7 Ω (per section); f = 500 MHz; typical values.

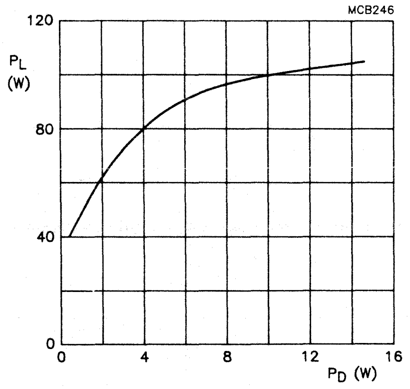


Fig.11 Load power as a function of drive power; class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; Z_L = 2.3 + j 2.7 Ω (per section); f = 500 MHz; typical values.

List of components (Fig.12)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2	500 V multilayer ceramic chip capacitor (note 1)	33 pF		
C3	500 V multilayer ceramic chip capacitor (note 1)	11 pF		
C4, C6, C21, C22	film dielectric trimmer	2 - 9 pF		2222 809 09005
C5	500 V multilayer ceramic chip capacitor (note 2)	12 pF		
C7, C10, C14, C15	500 V multilayer ceramic chip capacitor (note 1)	390 pF		
C8, C11, C12, C17	50 V multilayer ceramic chip capacitor	100 nF		2222 852 47104
C9	500 V multilayer ceramic chip capacitor (note 2)	39 pF		
C13, C16	63 V electrolytic capacitor	4.7 μF		2222 030 38478
C18, C19	500 V multilayer ceramic chip capacitor (note 2)	18 pF		
C20	500 V multilayer ceramic chip capacitor (note 2)	15 pF		
C23, C24	500 V multilayer ceramic chip capacitor (note 1)	15 pF		
L1, L3, L26, L28	stripline (note 3)	50 Ω	55.6 x 2.4 mm	
L2	semi-rigid cable (note 4)	50 Ω	ext. conductor length 55.6 mm ext. dia. 2 mm	
L4, L5	stripline (note 3)	42 Ω	12 mm x 3 mm	
L6, L7	stripline (note 3)	42 Ω	26.5 mm x 3 mm	
L8, L9	stripline (note 3)	42 Ω	5.5 mm x 3 mm	
L10, L11	stripline (note 3)	42 Ω	6 mm x 3 mm	
L12, L13	stripline (note 3)	42 Ω	3 mm x 3 mm	
L14, L15	stripline (note 3)	42 Ω	7 mm 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 mm x 3 mm	
L20, L21	grade 3B Ferroxcube RF choke			4312 020 36642
L22, L23	stripline (note 3)	42 Ω	20 mm x 3 mm	
L24, L25	stripline (note 3)	42 Ω	14 mm x 3 mm	
L27	semi-rigid cable (note 5)	50 Ω	ext. conductor length 55.6 mm ext. dia. 2 mm	
R1, R5	0.4 W metal film resistor	11.5 kΩ		2322 151 71153
R2, R6	10 turn 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 type 100B or capacitor of same quality.
2. American Technical Ceramics type 175B or capacitor of same quality.
3. The striplines are on a double copper-clad PCB 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.

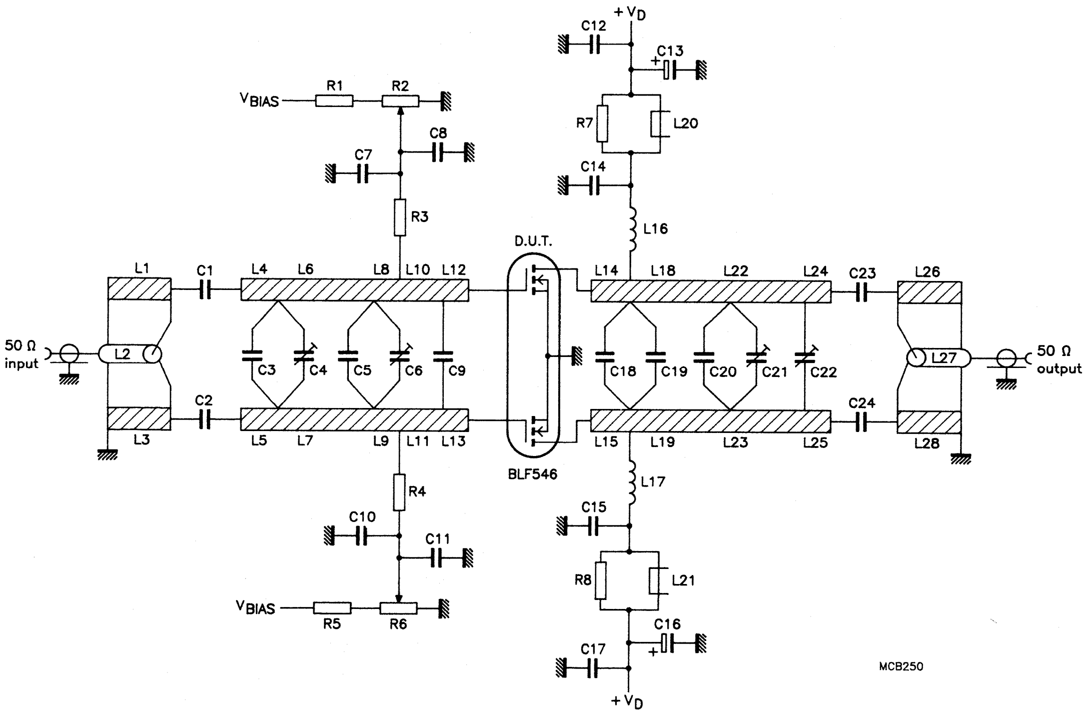


Fig.12 500 MHz, class-B test circuit.

UHF push-pull PowerMOS transistor

BLF546

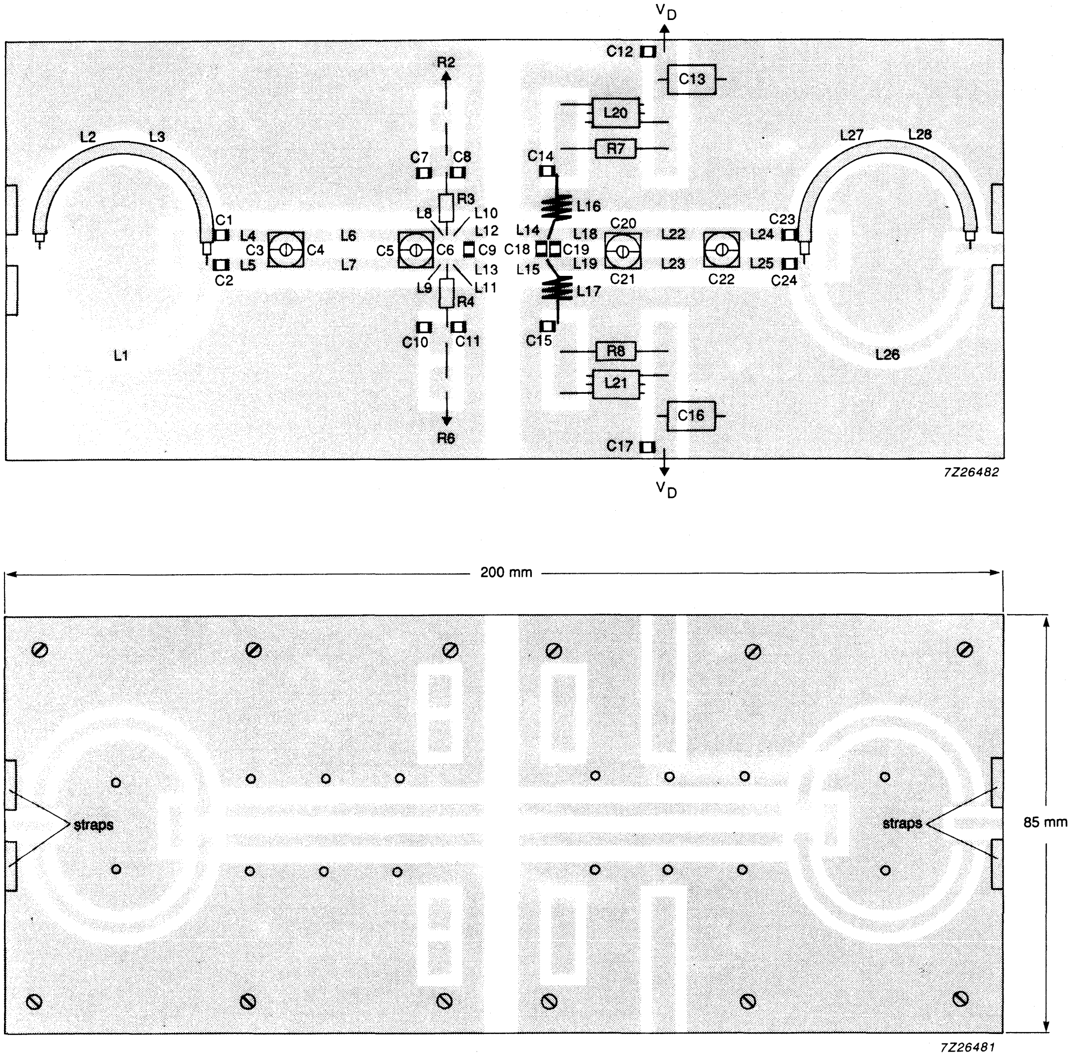


Fig.13 Printed circuit board and component layout for 500 MHz test circuit.

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 copper straps and hollow rivets for a direct contact between the upper and lower sheets.

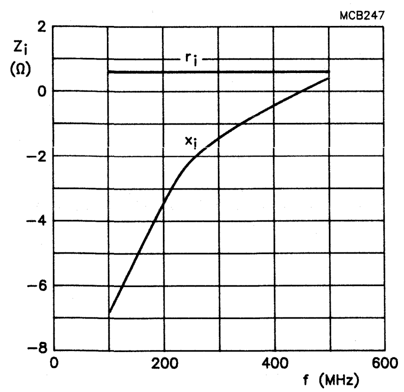


Fig.14 Input impedance, series components; class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W; typical values per section.

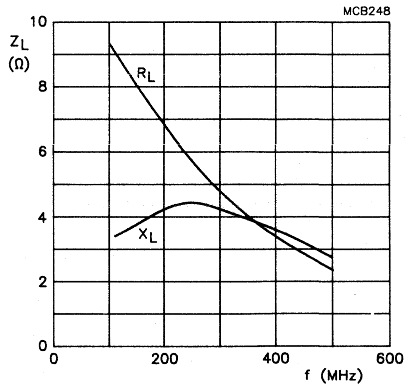


Fig.15 Load impedance, series components; class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W; typical values per section.

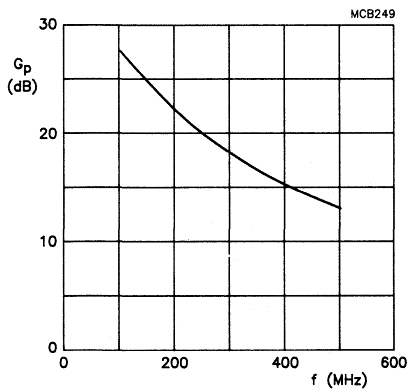


Fig.16 Power gain, class-B operation; V_{DS} = 28 V; I_{DQ} = 2 x 80 mA; P_L = 80 W; typical values per section.

Philips Components

Data sheet	
status	Preliminary specification
date of issue	September 1990

BLF548

UHF push-pull PowerMOS transistor

FEATURES

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

DESCRIPTION

The BLF548 is a silicon n-channel enhancement mode vertical D-MOS push-pull transistor intended for communication transmitters in the UHF range with a nominal voltage supply of 28 V.

The BLF548 has a 4-lead balanced flange envelope with 2 ceramic caps. The flange is the source connection.

Note

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

PRODUCT SAFETY

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

QUICK REFERENCE DATA

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

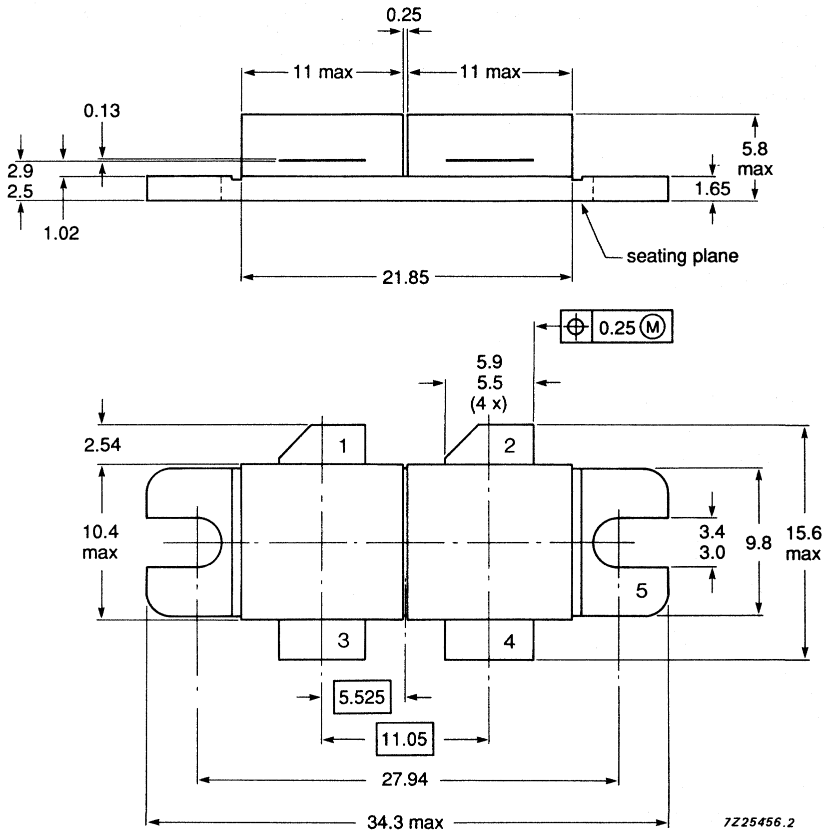
MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_p (dB)	η_D (%)
c.w. class-B	500	28	150	> 10	> 55

MECHANICAL DATA

SOT262 - see Fig.1.

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 SOT262.

PIN CONFIGURATION

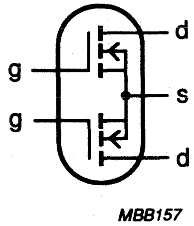


Fig.2 Pin configuration.

PINNING

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

LIMITING VALUES (per transistor section unless otherwise specified)

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	drain current	DC or average	-	8	A
I_{DM}	drain current	peak value f > 1 MHz	-	24	A
P_{tot}	total power dissipation	T_{mb} = 25 °C total device, both sections equally loaded	-	250	W
T_{stg}	storage temperature range		−65	150	°C
T_j	operating junction temperature		-	200	°C

THERMAL RESISTANCE

Total device, both sections equally loaded.

SYMBOL	PARAMETER	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	0.7	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	0.15	K/W

CHARACTERISTICS (per transistor section)
T_j = 25 °C.

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_{DS} = 28 V V_{GS} = 0	-	-	4	mA
I_{GSS}	gate-source leakage current	$\pm V_{GS}$ = 20 V V_{DS} = 0	-	-	1	μA
$V_{GS(th)}$	gate threshold voltage	V_{DS} = 10 V I_D = 160 mA	1	-	4	V
g_{fs}	forward transconductance	V_{DS} = 10 V I_D = 4.8 A	2.4	3.5	-	S
$R_{DS(on)}$	drain-source on-resistance	V_{GS} = 10 V I_D = 4.8 A	-	0.2	-	Ω
I_{DSX}	ON-state drain current	V_{DS} = 10 V V_{GS} = 15 V	-	20	-	A
C_{is}	input capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	120	-	pF
C_{os}	output capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	90	-	pF
C_{rs}	feedback capacitance	V_{DS} = 28 V V_{GS} = 0 f = 1 MHz	-	30	-	pF

APPLICATION INFORMATION

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

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

Index

INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

Key to handbook sections

A = Accessories
FET = Field-effect transistors
I = Infrared devices
LED = Light-emitting diodes
LCD = Liquid crystal displays
Mm = Surface-mounted devices
M = Microwave transistors
P = Low-frequency power transistors and modules
PDT = Photodiodes or transistors
Ph = Photoconductive devices
PhC = Photocouplers
PM = Power MOS transistors
R = Rectifier diodes
RFP = RF power transistors and modules
RT = Triplers
Sen = Semiconductor sensors
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
SP = Low-frequency switching power diodes
St = Rectifier stacks
T = Tuner diodes
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

* series.

Type no.	book	section	Type no.	book	section	Type no.	book	section
BB405B	SC01	T	BC557	SC04	Sm	BCP69	SC10	Mm
BB417	SC01	T	BC558	SC04	Sm	BCV26	SC10	Mm
BB804	SC01/10	T/Mm	BC559	SC04	Sm	BCV27	SC10	Mm
BB809	SC01	T	BC560	SC04	Sm	BCV28	SC10	Mm
BB909A	SC01	T	BC635	SC04	Sm	BCV29	SC10	Mm
BB909B	SC01	T	BC636	SC04	Sm	BCV46	SC10	Mm
BB910	SC01	T	BC637	SC04	Sm	BCV47	SC10	Mm
BB911	SC01	T	BC638	SC04	Sm	BCV48	SC10	Mm
BBY31	SC01/10	T/Mm	BC639	SC04	Sm	BCV49	SC10	Mm
BBY39	SC01	T	BC640	SC04	Sm	BCV61	SC10	Mm
BBY40	SC01/10	T/Mm	BC807	SC10	Mm	BCV62	SC10	Mm
BBY42	SC01	T	BC808	SC10	Mm	BCV63	SC10	Mm
BBY62	SC01	T	BC817	SC10	Mm	BCV64	SC10	Mm
BC107	SC04	Sm	BC818	SC10	Mm	BCV65	SC10	Mm
BC108	SC04	Sm	BC846	SC10	Mm	BCV71	SC10	Mm
BC109	SC04	Sm	BC847	SC10	Mm	BCV71R	SC10	Mm
BC140	SC04	Sm	BC848	SC10	Mm	BCV72	SC10	Mm
BC141	SC04	Sm	BC849	SC10	Mm	BCV72R	SC10	Mm
BC160	SC04	Sm	BC850	SC10	Mm	BCW29	SC10	Mm
BC161	SC04	Sm	BC856	SC10	Mm	BCW29R	SC10	Mm
BC177	SC04	Sm	BC857	SC10	Mm	BCW30	SC10	Mm
BC178	SC04	Sm	BC858	SC10	Mm	BCW30R	SC10	Mm
BC179	SC04	Sm	BC859	SC10	Mm	BCW31	SC10	Mm
BC264A	SC07	FET	BC860	SC10	Mm	BCW31R	SC10	Mm
BC264B	SC07	FET	BC868	SC10	Mm	BCW32	SC10	Mm
BC246C	SC07	FET	BC869	SC10	Mm	BCW32R	SC10	Mm
BC264D	SC07	FET	BCF29	SC10	Mm	BCW33	SC10	Mm
BC327	SC04	Sm	BCF29R	SC10	Mm	BCW33R	SC10	Mm
BC327A	SC04	Sm	BCF30	SC10	Mm	BCW60*	SC10	Mm
BC328	SC04	Sm	BCF30R	SC10	Mm	BCW61*	SC10	Mm
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BC368	SC04	Sm	BCF33R	SC10	Mm	BCW70R	SC10	Mm
BC369	SC04	Sm	BCF70	SC10	Mm	BCW71	SC10	Mm
BC375	SC04	Sm	BCF70R	SC10	Mm	BCW71R	SC10	Mm
BC376	SC04	Sm	BCF81	SC10	Mm	BCW72	SC10	Mm
BC516	SC04	Sm	BCF81R	SC10	Mm	BCW72R	SC10	Mm
BC517	SC04	Sm	BCP51	SC10	Mm	BCW81	SC10	Mm
BC546	SC04	Sm	BCP52	SC10	Mm	BCW81R	SC10	Mm
BC547	SC04	Sm	BCP53	SC10	Mm	BCW89	SC10	Mm
BC548	SC04	Sm	BCP54	SC10	Mm	BCW89R	SC10	Mm
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BC550	SC04	Sm	BCP56	SC10	Mm	BCX17R	SC10	Mm
BC556	SC04	Sm	BCP68	SC10	Mm	BCX18	SC10	Mm

Type no.	book	section	Type no.	book	section	Type no.	book	section
BCX18R	SC10	Mm	BD204F	SC05	P	BD337	SC05	P
BCX19	SC10	Mm	BD226	SC05	P	BD338	SC05	P
BCX19R	SC10	Mm	BD227	SC05	P	BD433	SC05	P
BCX20	SC10	Mm	BD228	SC05	P	BD434	SC05	P
BCX20R	SC10	Mm	BD229	SC05	P	BD435	SC05	P
BCX51	SC10	Mm	BD230	SC05	P	BD436	SC05	P
BCX52	SC10	Mm	BD231	SC05	P	BD437	SC05	P
BCX53	SC10	Mm	BD233	SC05	P	BD438	SC05	P
BCX54	SC10	Mm	BD234	SC05	P	BD643	SC05	P
BCX55	SC10	Mm	BD235	SC05	P	BD643F	SC05	P
BCX56	SC10	Mm	BD236	SC05	P	BD644	SC05	P
BCX58	SC04	Sm	BD237	SC05	P	BD644F	SC05	P
BCX59	SC04	Sm	BD238	SC05	P	BD645	SC05	P
BCX70*	SC10	Mm	BD239	SC05	P	BD645F	SC05	P
BCX71*	SC10	Mm	BD239A	SC05	P	BD646	SC05	P
BCX78	SC04	Sm	BD239B	SC05	P	BD646F	SC05	P
BCX79	SC04	Sm	BD239C	SC05	P	BD647	SC05	P
BCY56	SC04	Sm	BD240	SC05	P	BD647F	SC05	P
BCY57	SC04	Sm	BD240A	SC05	P	BD648	SC05	P
BCY58	SC04	Sm	BD240B	SC05	P	BD648F	SC05	P
BCY59	SC04	Sm	BD240C	SC05	P	BD649	SC05	P
BCY65	SC04	Sm	BD241	SC05	P	BD649F	SC05	P
BCY70	SC04	Sm	BD241A	SC05	P	BD650	SC05	P
BCY71	SC04	Sm	BD241B	SC05	P	BD650F	SC05	P
BCY72	SC04	Sm	BD241C	SC05	P	BD651	SC05	P
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BCY87	SC04	Sm	BD242B	SC05	P	BD652F	SC05	P
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BCY89	SC04	Sm	BD243	SC05	P	BD676	SC05	P
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BDT63C	SC05	P	BDT96F	SC05	P	BDX65A	SC05	P
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BDT87F	SC05	P	BDX47	SC05	P	BDY92	SC05	P
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BDT88F	SC05	P	BDX62A	SC05	P	BF199	SC04	Sm
BDT91	SC05	P	BDX62B	SC05	P	BF240	SC04	Sm
BDT91F	SC05	P	BDX62C	SC05	P	BF241	SC04	Sm
BDT92	SC05	P	BDX63	SC05	P	BF245A	SC07	FET
BDT92F	SC05	P	BDX63A	SC05	P	BF245B	SC07	FET
BDT93	SC05	P	BDX63B	SC05	P	BF245C	SC07	FET

Type no.	book	section
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BF256C	SC07	FET
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BF370	SC04	Sm
BF410A	SC07	FET
BF410B	SC07	FET
BF410C	SC07	FET
BF410D	SC07	FET
BF420	SC04	Sm
BF421	SC04	Sm
BF422	SC04	Sm
BF423	SC04	Sm
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BF510	SC07/10	FET/Mm
BF511	SC07/10	FET/Mm
BF512	SC07/10	FET/Mm
BF513	SC07/10	FET/Mm
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BF550R	SC10	Mm
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BF579	SC10	Mm
BF620	SC10	Mm
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BFG23	SC14	WBT
BFG25AX	SC14/10	WBT/Mm
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BFG51	SC14	WBT
BFG65	SC14	WBT
BFG67	SC14/10	WBT/Mm
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BFG97	SC14/10	WBT/Mm
BFG135	SC14/10	WBT/Mm
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BFQ32S	SC14	WBT
BFQ33	SC14	WBT
BFQ33C	SC14	WBT
BFQ34	SC14	WBT
BFQ34T	SC14	WBT
BFQ42	SC08	RFP
BFQ43	SC08	RFP
BFQ43S	SC08	RFP

Type no.	book	section	Type no.	book	section	Type no.	book	section
BFQ51	SC14	WBT	BFR53	SC14/10	WBT/Mm	BFW16A	SC14	WBT
BFQ51C	SC14	WBT	BFR54	SC04	Sm	BFW17A	SC14	WBT
BFQ52	SC14	WBT	BFR64	SC14	WBT	BFW30	SC14	WBT
BFQ53	SC14	WBT	BFR65	SC14	WBT	BFW61	SC07	FET
BFQ63	SC14	WBT	BFR84	SC07	FET	BFW92	SC14	WBT
BFQ65	SC14	WBT	BFR90	SC14	WBT	BFW92A	SC14	WBT
BFQ66	SC14	WBT	BFR90A	SC14	WBT	BFW93	SC14	WBT
BFQ67	SC14/10	WBT/Mm	BFR91	SC14	WBT	BFX34	SC04	Sm
BFQ68	SC14	WBT	BFR91A	SC14	WBT	BFX89	SC14	WBT
BFQ135	SC14	WBT	BFR92	SC14/10	WBT/Mm	BFY50	SC04	Sm
BFQ136	SC14	WBT	BFR92A	SC14/10	WBT/Mm	BFY51	SC04	Sm
BFQ149	SC14/10	WBT/Mm	BFR93	SC14/10	WBT/Mm	BFY52	SC04	Sm
BFQ161	SC14	WBT	BFR93A	SC14/10	WBT/Mm	BFY55	SC04	Sm
BFQ162	SC14	WBT	BFR94	SC14	WBT	BFY90	SC14	WBT
BFQ163	SC14	WBT	BFR95	SC14	WBT	BG2000	SC01	RT
BFQ231	SC14	WBT	BFR96	SC14	WBT	BG2097	SC01	RT
BFQ231A	SC14	WBT	BFR96S	SC14	WBT	BGD102	SC14	WBM
BFQ232	SC14	WBT	BFR106	SC14/10	WBT/Mm	BGD102E	SC14	WBM
BFQ232A	SC14	WBT	BFR101A	SC07/10	FET/Mm	BGD104	SC14	WBM
BFQ233	SC14	WBT	BFR101B	SC07/10	FET/Mm	BGD104E	SC14	WBM
BFQ233A	SC14	WBT	BFR134	SC14	WBT	BGD106	SC14	WBM
BFQ234	SC14	WBT	BFS17	SC14/10	WBT	BGD108	SC14	WBM
BFQ235	SC14	WBT	BFS17A	SC14	WBT	BGD502	SC14	WBM
BFQ235A	SC14	WBT	BFS18	SC10	Mm	BGD504	SC14	WBM
BFQ251	SC14	WBT	BFS18R	SC10	Mm	BGD506	SC14	WBM
BFQ251A	SC14	WBT	BFS19	SC10	Mm	BGD508	SC14	WBM
BFQ252	SC14	WBT	BFS19R	SC10	Mm	BGE85A	SC14	WBM
BFQ252A	SC14	WBT	BFS20	SC10	Mm	BGE88	SC14	WBM
BFQ253	SC14	WBT	BFS20R	SC10	Mm	BGE88-01	SC14	WBM
BFQ253A	SC14	WBT	BFS21	SC07	FET	BGE885	SC14	WBM
BFQ254	SC14	WBT	BFS21A	SC07	FET	BGE887	SC14	WBM
BFQ255	SC14	WBT	BFS22A	SC08	RFP	BGX885	SC14	WBM
BFQ255A	SC14	WBT	BFS23A	SC08	RFP	BGY22	SC09	RFP
BFQ262	SC14	WBT	BFT24	SC14	WBT	BGY22A	SC09	RFP
BFQ262A	SC14	WBT	BFT25	SC14/10	WBT/Mm	BGY23	SC09	RFP
BFQ263	SC14	WBT	BFT25A	SC14	WBT	BGY23A	SC09	RFP
BFQ263A	SC14	WBT	BFT44	SC04	Sm	BGY32	SC09	RFP
BFQ265	SC14	WBT	BFT45	SC04	Sm	BGY33	SC09	RFP
BFQ265A	SC14	WBT	BFT46	SC07/10	FET/Mm	BGY35	SC09	RFP
BFQ268	SC14	WBT	BFT92	SC14/10	WBT/Mm	BGY36	SC09	RFP
BFQ270	SC14	WBT	BFT93	SC14/10	WBT/Mm	BGY40A	SC09	RFP
BFR29	SC07	FET	BFW10	SC07	FET	BGY40B	SC09	RFP
BFR30	SC07/10	FET/Mm	BFW11	SC07	FET	BGY41A	SC09	RFP
BFR31	SC07/10	FET/Mm	BFW12	SC07	FET	BGY41B	SC09	RFP
BFR49	SC14	WBT	BFW13	SC07	FET	BGY43	SC09	RFP

Type no.	book	section	Type no.	book	section	Type no.	book	section
BGY45A	SC09	RFP	BGY87B	SC14	WBM	BLF346	SC08b	RFP/FET
BGY45B	SC09	RFP	BGY88	SC14	WBM	BLF348	SC08b	RFP/FET
BGY45C	SC09	RFP	BGY90A	SC09	RFP	BLF368	SC08b	RFP/FET
BGY46A	SC09	RFP	BGY90B	SC09	RFP	BLF378	SC08b	RFP/FET
BGY46B	SC09	RFP	BGY91A	SC09	RFP	BLF521	SC08b	RFP/FET
BGY47A	SC09	RFP	BGY91B	SC09	RFP	BLF522	SC08b	RFP/FET
BGY47F	SC09	RFP	BGY93A	SC09	RFP	BLF543	SC08b	RFP/FET
BGY48A	SC09	RFP	BGY93B	SC09	RFP	BLF544	SC08b	RFP/FET
BGY48B	SC09	RFP	BGY93C	SC09	RFP	BLF544B	SC08b	RFP/FET
BGY48C	SC09	RFP	BGY94A	SC09	RFP	BLF545	SC08b	RFP/FET
BGY49A	SC09	RFP	BGY94B	SC09	RFP	BLF546	SC08b	RFP/FET
BGY49B	SC09	RFP	BGY94C	SC09	RFP	BLF548	SC08b	RFP/FET
BGY50	SC14	WBM	BGY95A	SC09	RFP	BLT90/SL	SC08	RFP
BGY51	SC14	WBM	BGY95B	SC09	RFP	BLT91/SL	SC08	RFP
BGY52	SC14	WBM	BGY96A	SC09	RFP	BLT92/SL	SC08	RFP
BGY53	SC14	WBM	BGY96B	SC09	RFP	BLT93/SL	SC08	RFP
BGY54	SC14	WBM	BGY110A	SC09	RFP	BLU20/12	SC08	RFP
BGY55	SC14	WBM	BGY110B	SC09	RFP	BLU30/12	SC08	RFP
BGY56	SC14	WBM	BGY580	SC14	WBM	BLU30/28	SC08	RFP
BGY57	SC14	WBM	BGY581	SC14	WBM	BLU45/12	SC08	RFP
BGY58	SC14	WBM	BGY582	SC14	WBM	BLU50	SC08	RFP
BGY58A	SC14	WBM	BGY583	SC14	WBM	BLU51	SC08	RFP
BGY59	SC14	WBM	BGY584	SC14	WBM	BLU52	SC08	RFP
BGY60	SC14	WBM	BGY584A	SC14	WBM	BLU53	SC08	RFP
BGY61	SC14	WBM	BGY585	SC14	WBM	BLU60/12	SC08	RFP
BGY65	SC14	WBM	BGY585A	SC14	WBM	BLU60/28	SC08	RFP
BGY67	SC14	WBM	BGY586	SC14	WBM	BLU97	SC08	RFP
BGY67A	SC14	WBM	BGY587	SC14	WBM	BLU98	SC08	RFP
BGY70	SC14	WBM	BGY587B	SC14	WBM	BLU99	SC08	RFP
BGY71	SC14	WBM	BGY588	SC14	WBM	BLV10	SC08	RFP
BGY74	SC14	WBM	BLF145	SC08b	RFP/FET	BLV11	SC08	RFP
BGY75	SC14	WBM	BLF147	SC08b	RFP/FET	BLV20	SC08	RFP
BGY78	SC14	WBM	BLF175	SC08b	RFP/FET	BLV21	SC08	RFP
BGY80	SC14	WBM	BLF177	SC08b	RFP/FET	BLV25	SC08	RFP
BGY81	SC14	WBM	BLF221	SC08b	RFP/FET	BLV30	SC08	RFP
BGY82	SC14	WBM	BLF225	SC08b	RFP/FET	BLV30/12	SC08	RFP
BGY83	SC14	WBM	BLF241	SC08b	RFP/FET	BLV31	SC08	RFP
BGY84	SC14	WBM	BLF242	SC08b	RFP/FET	BLV32F	SC08	RFP
BGY84A	SC14	WBM	BLF244	SC08b	RFP/FET	BLV33	SC08	RFP
BGY85	SC14	WBM	BLF245	SC08b	RFP/FET	BLV33F	SC08	RFP
BGY85A	SC14	WBM	BLF245B	SC08b	RFP/FET	BLV36	SC08	RFP
BGY85H	SC14	WBM	BLF246	SC08b	RFP/FET	BLV37	SC08	RFP
BGY85H/01	SC14	WBM	BLF246B	SC08b	RFP/FET	BLV38	SC08	RFP
BGY86	SC14	WBM	BLF277	SC08b	RFP/FET	BLV45/12	SC08	RFP
BGY87	SC14	WBM	BLF278	SC08b	RFP/FET	BLV57	SC08	RFP

Type no.	book	section	Type no.	book	section	Type no.	book	section
BLV59	SC08	RFP	BLX39	SC08	RFP	BS250	SC07	FET
BLV75/12	SC08	RFP	BLX65	SC08	RFP	BSD10	SC07	FET
BLV80/28	SC08	RFP	BLX65E	SC08	RFP	BSD12	SC07	FET
BLV90	SC08	RFP	BLX65ES	SC08	RFP	BSD20	SC07/10	FET/m
BLV90/SL	SC08	RFP	BLX67	SC08	RFP	BSD22	SC07/10	FET/M
BLV91	SC08	RFP	BLX68	SC08	RFP	BSD212	SC07	FET
BLV91/SL	SC08	RFP	BLX69A	SC08	RFP	BSD213	SC07	FET
BLV92	SC08	RFP	BLX91A	SC08	RFP	BSD214	SC07	FET
BLV93	SC08	RFP	BLX91CB	SC08	RFP	BSD215	SC07	FET
BLV94	SC08	RFP	BLX92A	SC08	RFP	BSJ111	SC07	FET
BLV95	SC08	RFP	BLX93A	SC08	RFP	BSJ112	SC07	FET
BLV97	SC08	RFP	BLX94A	SC08	RFP	BSJ113	SC07	FET
BLV98	SC08	RFP	BLX94C	SC08	RFP	BSJ174	SC07	FET
BLV99	SC08	RFP	BLX95	SC08	RFP	BSJ175	SC07	FET
BLW29	SC08	RFP	BLX96	SC08	RFP	BSJ176	SC07	FET
BLW31	SC08	RFP	BLX97	SC08	RFP	BSJ177	SC07	FET
BLW32	SC08	RFP	BLX98	SC08	RFP	BSN205	SC07	FET
BLW33	SC08	RFP	BLY87A	SC08	RFP	BSN205A	SC07	FET
BLW34	SC08	RFP	BLY87C	SC08	RFP	BSN254	SC07	FET
BLW50F	SC08	RFP	BLY88A	SC08	RFP	BSN254A	SC07	FET
BLW60	SC08	RFP	BLY88C	SC08	RFP	BSP15	SC10	Mm
BLW60C	SC08	RFP	BLY89A	SC08	RFP	BSP16	SC10	Mm
BLW76	SC08	RFP	BLY89C	SC08	RFP	BSP19	SC10	Mm
BLW77	SC08	RFP	BLY90	SC08	RFP	BSP20	SC10	Mm
BLW78	SC08	RFP	BLY91A	SC08	RFP	BSP30	SC10	Mm
BLW79	SC08	RFP	BLY91C	SC08	RFP	BSP31	SC10	Mm
BLW80	SC08	RFP	BLY92A	SC08	RFP	BSP32	SC10	Mm
BLW81	SC08	RFP	BLY92C	SC08	RFP	BSP33	SC10	Mm
BLW83	SC08	RFP	BLY93A	SC08	RFP	BSP40	SC10	Mm
BLW84	SC08	RFP	BLY93C	SC08	RFP	BSP41	SC10	Mm
BLW85	SC08	RFP	BLY94	SC08	RFP	BSP42	SC10	Mm
BLW86	SC08	RFP	BR100/03	SC03	Th	BSP43	SC10	Mm
BLW87	SC08	RFP	BR101	SC04	Sm	BSP50	SC10	Mm
BLW89	SC08	RFP	BR210*	SC02	R	BSP51	SC10	Mm
BLW90	SC08	RFP	BR211*	SC02	R	BSP52	SC10	Mm
BLW91	SC08	RFP	BR213*	SC02	R	BSP60	SC10	Mm
BLW95	SC08	RFP	BR216*	SC02	R	BSP61	SC10	Mm
BLW96	SC08	RFP	BR220*	SC02	R	BSP62	SC10	Mm
BLW97	SC08	RFP	BRY39	SC04	Sm	BSP204	SC07	FET
BLW98	SC08	RFP	BRY56	SC04	Sm	BSP204A	SC07	FET
BLW99	SC08	RFP	BRY61	SC10	Mm	BSR12	SC10	Mm
BLX13	SC08	RFP	BRY62	SC10	Mm	BSR12R	SC10	Mm
BLX13C	SC08	RFP	BS107	SC07	FET	BSR13	SC10	Mm
BLX14	SC08	RFP	BS107A	SC07	FET	BSR13R	SC10	Mm
BLX15	SC08	RFP	BS170	SC07	FET	BSR14	SC10	Mm

Type no.	book	section	Type no.	book	section	Type no.	book	section
BSR14R	SC10	Mm	BSS60	SC04	Sm	BSV79	SC07	FET
BSR15	SC10	Mm	BSS61	SC04	Sm	BSV80	SC07	FET
BSR15R	SC10	Mm	BSS62	SC04	Sm	BSV81	SC07	FET
BSR16	SC10	Mm	BSS63	SC10	Mm	BSW66A	SC04	Sm
BSR16R	SC10	Mm	BSS63R	SC10	Mm	BSW67A	SC04	Sm
BSR17	SC10	Mm	BSS64	SC10	Mm	BSW68A	SC04	Sm
BSR17R	SC10	Mm	BSS64R	SC10	Mm	BSX19	SC04	Sm
BSR17A	SC10	Mm	BSS68	SC04	Sm	BSX20	SC04	Sm
BSR17AR	SC10	Mm	BSS83	SC07/10	FET/Mm	BSX32	SC04	Sm
BSR18	SC10	Mm	BSS87	SC07	FET	BSX45	SC04	Sm
BSR18R	SC10	Mm	BSS89	SC07	FET	BSX46	SC04	Sm
BSR18A	SC10	Mm	BSS91	SC07	FET	BSX47	SC04	Sm
BSR18AR	SC10	Mm	BSS92	SC07	FET	BSX59	SC04	Sm
BSR19	SC10	Mm	BST15	SC10	Mm	BSX60	SC04	Sm
BSR19A	SC10	Mm	BST16	SC10	Mm	BSX61	SC04	Sm
BSR20	SC10	Mm	BST39	SC10	Mm	BT134*	SC03	Tri
BSR20A	SC10	Mm	BST40	SC10	Mm	BT134W*	SC03	Tri
BSR30	SC10	Mm	BST50	SC10	Mm	BT136*	SC03	Tri
BSR31	SC10	Mm	BST51	SC10	Mm	BT136F*	SC03	Tri
BSR32	SC10	Mm	BST52	SC10	Mm	BT137*	SC03	Tri
BSR33	SC10	Mm	BST60	SC10	Mm	BT137F*	SC03	Tri
BSR40	SC10	Mm	BST61	SC10	Mm	BT138*	SC03	Tri
BSR41	SC10	Mm	BST62	SC10	Mm	BT138F*	SC03	Tri
BSR42	SC10	Mm	BST70A	SC07	FET	BT139*	SC03	Tri
BSR43	SC10	Mm	BST72A	SC07	FET	BT139F*	SC03	Tri
BSR50	SC04	Sm	BST74A	SC07	FET	BT145*	SC03	Tri
BSR51	SC04	Sm	BST76A	SC07	FET	BT148*	SC03	Th
BSR52	SC04	Sm	BST78	SC07	FET	BT149*	SC03	Th
BSR56	SC07/10	FET/Mm	BST80	SC07/10	FET/Mm	BT150	SC03	Th
BSR57	SC07/10	FET/Mm	BST82	SC07/10	FET/Mm	BT151*	SC03	Th
BSR58	SC07/10	FET/Mm	BST84	SC07/10	FET/Mm	BT151F*	SC03	Th
BSR60	SC04	Sm	BST86	SC07/10	FET/Mm	BT152*	SC03	Th
BSR61	SC04	Sm	BST95	SC07	FET	BT153	SC03	Th
BSR62	SC04	Sm	BST97	SC07	FET	BT169*	SC03	Th
BSR111	SC07/10	FET/Mm	BST100	SC07	FET	BT169W*	SC03	Th
BSR112	SC07/10	FET/Mm	BST110	SC07	FET	BTA140*	SC03	Tri
BSR113	SC07/10	FET/Mm	BST120	SC07/10	FET/Mm	BTR59*	SC03	Tri
BSR174	SC07/10	FET/Mm	BST122	SC07/10	FET/Mm	BTS59*	SC03	Tri
BSR175	SC07/10	FET/Mm	BSV15	SC04	Sm	BTV58*	SC03	Th
BSR176	SC07/10	FET/Mm	BSV16	SC04	Sm	BTW38*	SC03	Th
BSR177	SC07/10	FET/Mm	BSV17	SC04	Sm	BTW40*	SC03	Th
BSS38	SC04	Sm	BSV52	SC10	Mm	BTW42*	SC03	Th
BSS50	SC04	Sm	BSV52R	SC10	Mm	BTW43*	SC03	Tri
BSS51	SC04	Sm	BSV64	SC04	Sm	BTW45*	SC03	Th
BSS52	SC04	Sm	BSV78	SC07	FET	BTW58*	SC03	Th

Type no.	book	section
BTY79*	SC03	Th
BTY91*	SC03	Th
BU306	SC06	SP
BU306F	SC06	SP
BU505	SC06	SP
BU506	SC06	SP
BU506D	SC06	SP
BU508A	SC06	SP
BU508D	SC06	SP
BU705	SC06	SP
BU706	SC06	SP
BU706D	SC06	SP
BU806	SC06	SP
BU807	SC06	SP
BU808	SC06	SP
BU824	SC06	SP
BU826	SC06	SP
BUP22*	SC06	SP
BUP23*	SC06	SP
BUS11	SC06	SP
BUS11A	SC06	SP
BUS12	SC06	SP
BUS12A	SC06	SP
BUS13	SC06	SP
BUS13A	SC06	SP
BUS14	SC06	SP
BUS14A	SC06	SP
BUS21*	SC06	SP
BUS22*	SC06	SP
BUS23*	SC06	SP
BUS24*	SC06	SP
BUS131*	SC06	SP
BUS132*	SC06	SP
BUS133*	SC06	SP
BUT11	SC06	SP
BUT11A	SC06	SP
BUT11F	SC06	SP
BUT11AF	SC06	SP
BUT12	SC06	SP
BUT12A	SC06	SP
BUT12F	SC06	SP
BUT12AF	SC06	SP
BUT18	SC06	SP
BUT18A	SC06	SP
BUT18F	SC06	SP

Type no.	book	section
BUT18AF	SC06	SP
BUT21B	SC06	SP
BUT21C	SC06	SP
BUT21BF	SC06	SP
BUT21CF	SC06	SP
BUT22B	SC06	SP
BUT22C	SC06	SP
BUT22BF	SC06	SP
BUT22CF	SC06	SP
BUT131	SC06	SP
BUV26	SC06	SP
BUV26A	SC06	SP
BUV26F	SC06	SP
BUV26AF	SC06	SP
BUV27	SC06	SP
BUV27A	SC06	SP
BUV27F	SC06	SP
BUV27AF	SC06	SP
BUV28	SC06	SP
BUV28A	SC06	SP
BUV28F	SC06	SP
BUV28AF	SC06	SP
BUV47	SC06	SP
BUV47A	SC06	SP
BUV48	SC06	SP
BUV48A	SC06	SP
BUV82	SC06	SP
BUV83	SC06	SP
BUV89	SC06	SP
BUV90	SC06	SP
BUV90F	SC06	SP
BUV98(V)	SC06	SP
BUV98A	SC06	SP
BUV298(V)	SC06	SP
BUV298A	SC06	SP
BUW11	SC06	SP
BUW11A	SC06	SP
BUW12	SC06	SP
BUW12A	SC06	SP
BUW12F	SC06	SP
BUW12AF	SC06	SP
BUW13	SC06	SP
BUW13A	SC06	SP
BUW13F	SC06	SP
BUW13AF	SC06	SP

Type no.	book	section
BUW84	SC06	SP
BUW85	SC06	SP
BUW86	SC06	SP
BUW87	SC06	SP
BUW87A	SC06	SP
BUW131*	SC06	SP
BUW132*	SC06	SP
BUW133*	SC06	SP
BUX46	SC06	SP
BUX46A	SC06	SP
BUX47	SC06	SP
BUX47A	SC06	SP
BUX48	SC06	SP
BUX48A	SC06	SP
BUX84	SC06	SP
BUX84F	SC06	SP
BUX85	SC06	SP
BUX85F	SC06	SP
BUX86	SC06	SP
BUX87	SC06	SP
BUX88	SC06	SP
BUX98	SC06	SP
BUX98A	SC06	SP
BUX99	SC06	SP
BUY89	SC06	SP
BUZ10	S9	PM
BUZ11	S9	PM
BUZ11A	S9	PM
BUZ14	S9	PM
BUZ15	S9	PM
BUZ20	S9	PM
BUZ21	S9	PM
BUZ23	S9	PM
BUZ24	S9	PM
BUZ25	S9	PM
BUZ31	S9	PM
BUZ32	S9	PM
BUZ34	S9	PM
BUZ35	S9	PM
BUZ36	S9	PM
BUZ41A	S9	PM
BUZ42	S9	PM
BUZ45	S9	PM
BUZ45A	S9	PM
BUZ45B	S9	PM

Type no.	book	section	Type no.	book	section	Type no.	book	section
BUZ50A	S9	PM	BUZ358	S9	PM	BY723	SC01	R
BUZ50B	S9	PM	BUZ384	S9	PM	BY724	SC01	R
BUZ50C	S9	PM	BUZ385	S9	PM	BYD11*	SC01	R
BUZ53A	S9	PM	BY228	SC01	R	BYD13*	SC01	R
BUZ54	S9	PM	BY229*	SC02	R	BYD14*	SC01	R
BUZ54A	S9	PM	BY229F*	SC02	R	BYD17*	SC01/10	R/Mm
BUZ60	S9	PM	BY249*	SC02	R	BYD31*	SC01	R
BUZ63	S9	PM	BY249F*	SC02	R	BYD33*	SC01	R
BUZ64	S9	PM	BY260*	SC02	R	BYD34*	SC01	R
BUZ71	S9	PM	BY328	SC01	SD	BYD37*	SC01/10	R/Mm
BUZ71A	S9	PM	BY329*	SC02	R	BYD73*	SC01	R
BUZ72	S9	PM	BY359*	SC02	R	BYD74*	SC01	R
BUZ72A	S9	PM	BY359F	SC02	R	BYD77*	SC01	R
BUZ73	S9	PM	BY438	SC01	R	BYM26*	SC01	R
BUZ73A	S9	PM	BY448	SC01	R	BYM36*	SC01	R
BUZ74	S9	PM	BY458	SC01	R	BYM56*	SC01	R
BUZ74A	S9	PM	BY505	SC01	R	BYP20*	SC02	R
BUZ76	S9	PM	BY509	SC01	R	BYP21*	SC02	R
BUZ76A	S9	PM	BY527	SC01	R	BYP22*	SC02	R
BUZ78	S9	PM	BY584	SC01	R	BYQ27*	SC01	R
BUZ80	S9	PM	BY588	SC01	R	BYQ28*	SC02	R
BUZ80A	S9	PM	BY609	SC01	R	BYQ28F*	SC02	R
BUZ83	S9	PM	BY610	SC01	R	BYR28*	SC02	R
BUZ83A	S9	PM	BY614	SC01	R	BYR29*	SC02	R
BUZ84	S9	PM	BY619	SC01	R	BYR29F*	SC02	R
BUZ84A	S9	PM	BY620	SC01	R	BYR30*	SC02	R
BUZ90	S9	PM	BY627	SC01	R	BYR34*	SC02	R
BUZ90A	S9	PM	BY705	SC01	R	BYR79*	SC02	R
BUZ94	S9	PM	BY706	SC01	R	BYT28*	SC02	R
BUZ211	S9	PM	BY707	SC01	R	BYT79*	SC02	R
BUZ307	S9	PM	BY708	SC01	R	BYT230PIV	SC02	R
BUZ308	S9	PM	BY709	SC01	R	BYV10*	SC01	R
BUZ310	S9	PM	BY710	SC01	R	BYV24*	SC02	R
BUZ311	S9	PM	BY711	SC01	R	BYV26*	SC01	R
BUZ326	S9	PM	BY712	SC01	R	BYV27*	SC01	R
BUZ330	S9	PM	BY713	SC01	R	BYV28*	SC01	R
BUZ331	S9	PM	BY714	SC01	R	BYV29*	SC02	R
BUZ347	S9	PM	BY715	SC01	R	BYV29F*	SC02	R
BUZ348	S9	PM	BY716	SC01	R	BYV30*	SC02	R
BUZ349	S9	PM	BY717	SC01	R	BYV31*	SC02	R
BUZ350	S9	PM	BY718	SC01	R	BYV32*	SC02	R
BUZ351	S9	PM	BY719	SC01	R	BYV32F*	SC02	R
BUZ355	S9	PM	BY720	SC01	R	BYV34*	SC02	R
BUZ356	S9	PM	BY721	SC01	R	BYV36*	SC01	R
BUZ357	S9	PM	BY722	SC01	R	BYV42*	SC02	R

Type no.	book	section	Type no.	book	section	Type no.	book	section
BYV44*	SC02	R	BYX90G	SC01	R	CNX38	SC12	PhC
BYV54V	SC02	R	BYX96*	SC02	R	CNX38U	SC12	PhC
BYV72*	SC02	R	BYX97*	SC02	R	CNX39	SC12	PhC
BYV72F*	SC02	R	BYX98*	SC02	R	CNX39U	SC12	PhC
BYV74*	SC02	R	BYX99*	SC02	R	CNX48	SC12	PhC
BYV74F*	SC02	R	BZD23	SC01	Vrg	CNX48U	SC12	PhC
BYV79*	SC02	R	BZD27	SC01/10	Vrg/Mm	CNX62	SC12	PhC
BYV92*	SC02	R	BZT03	SC01	Vrg	CNX62A	SC12	PhC
BYV95A	SC01	R	BZV10	SC01	Vrf	CNX71	SC12	PhC
BYV95B	SC01	R	BZV11	SC01	Vrf	CNX72A	SC12	PhC
BYV95C	SC01	R	BZV12	SC01	Vrf	CNX82A	SC12	PhC
BYV96D	SC01	R	BZV13	SC01	Vrf	CNX83A	SC12	PhC
BYV96E	SC01	R	BZV14	SC01	Vrf	CNY17-1	SC12	PhC
BYV118*	SC02	R	BZV37	SC01	Vrf	CNY17-2	SC12	PhC
BYV118F*	SC02	R	BZV49*	SC01/10	Vrg/Mm	CNY17-3	SC12	PhC
BYV120*	SC02	R	BZV55*	SC10	Mm	CNY17-4	SC12	PhC
BYV121*	SC02	R	BZV60	SC01	Vrg	CQW58A	S8a	I
BYV133*	SC02	R	BZV80	SC01	Vrf	CQW89A	S8a	I
BYV133F*	SC02	R	BZV81	SC01	Vrf	CQW89B	S8a	I
BYV143*	SC02	R	BZV85*	SC01	Vrg	CQY58A	S8a	I
BYV143F*	SC02	R	BZV86	SC01	SD	CQY89A	S8a	I
BYW25*	SC02	R	BZW03*	SC01	Vrg	CQY89F	S8a	I
BYW29*	SC02	R	BZW14	SC01	Vrg	ESM3045A(V)	SC06	SP
BYW29F*	SC02	R	BZW86*	SC02	TS	ESM3045D(V)	SC06	SP
BYW30*	SC02	R	BZX55*	SC01	Vrg	ESM4045A(V)	SC06	SP
BYW31*	SC02	R	BZX70*	SC02	Vrg	ESM4045D(V)	SC06	SP
BYW54	SC01	R	BZX75*	SC01	Vrg	ESM5045D(V)	SC06	SP
BYW55	SC01	R	BZX79*	SC01	Vrg	ESM6045A(V)	SC06	SP
BYW56	SC01	R	BZX84*	SC01/10	Vrg/Mm	ESM6045D(V)	SC06	SP
BYW92*	SC02	R	BZY91*	SC02	Vrg	Fresnel-lens	SC12	A
BYW93*	SC02	R	BZY93*	SC02	Vrg	H11A1	SC12	PhC
BYW95A	SC01	R	CNG35	SC12	PhC	H11A2	SC12	PhC
BYW95B	SC01	R	CNG36	SC12	PhC	H11A3	SC12	PhC
BYW95C	SC01	R	CNG40	SC12	PhC	H11A4	SC12	PhC
BYW96D	SC01	R	CNG82	SC12	PhC	H11A5	SC12	PhC
BYW96E	SC01	R	CNG83	SC12	PhC	H11B1	SC12	PhC
BYX10G	SC01	R	CNR36	SC12	PhC	H11B2	SC12	PhC
BYX25*	SC02	R	CNS35	SC12	PhC	H11B3	SC12	PhC
BYX30*	SC02	R	CNW82	SC12	PhC	H11B255	SC12	PhC
BYX38*	SC02	R	CNW83	SC12	PhC	KGZ10	SC17	SEN
BYX39*	SC02	R	CNX21	SC12	PhC	KGZ20	SC17	SEN
BYX42*	SC02	R	CNX35	SC12	PhC	KGZ21	SC17	SEN
BYX46*	SC02	R	CNX35U	SC12	PhC	KMZ10A	SC17	SEN
BYX52*	SC02	R	CNX36	SC12	PhC	KMZ10A1	SC17	SEN
BYX56*	SC02	R	CNX36U	SC12	PhC	KMZ10B	SC17	SEN

Type no.	book	section
KMZ10C	SC17	SEN
KP100A	SC17	SEN
KP100A1	SC17	SEN
KP101A	SC17	SEN
KP130AE	SC17	SEN
KP131AE	SC17	SEN
KPZ20G	SC17	SEN
KPZ21G	SC17	SEN
KPZ21GE	SC17	SEN
KRX10	SC17	SEN
KRX11	SC17	SEN
KTY81-100*	SC17	SEN
KTY81-200*	SC17	SEN
KTY83-100*	SC17	SEN
KTY84-100*	SC17	SEN
KTY85-100*	SC10/17	SEN
KTY86-205	SC17	SEN
KTY87-205	SC17	SEN
LAE4001R	SC15	M
LAE4002S	SC15	M
LAE6000Q	SC15	M
LBE2003S	SC15	M
LBE2009S	SC15	M
LCE2003S	SC15	M
LCE2009S	SC15	M
LJE42002T	SC15	M
LKE21004R	SC15	M
LKE21015T	SC15	M
LKE21050T	SC15	M
LTE21009R	SC15	M
LTE21015R	SC15	M
LTE21025R	SC15	M
LTE4002S	SC15	M
LTE42005S	SC15	M
LTE42008R	SC15	M
LTE42012R	SC15	M
LUE2003S	SC15	M
LUE2009S	SC15	M
LV172E50R	SC15	M
LV2024E45R	SC15	M
LV2327E40R	SC15	M
LV2931E50S	SC15	M
LVE21050R	SC15	M
LWE2015R	SC15	M
LWE2025R	SC15	M

Type no.	book	section
LZ1418E100R	SC15	M
LZE18100R	SC15	M
MCA230	SC12	PhC
MCA231	SC12	PhC
MCA255	SC12	PhC
MCT2	SC12	PhC
MCT26	SC12	PhC
MJE13004	SC06	SP
MJE13005	SC06	SP
MJE13006	SC06	SP
MJE13007	SC06	SP
MJE13008	SC06	SP
MJE13009	SC06	SP
MPS6513	SC04	Sm
MPS6514	SC04	Sm
MPS6515	SC04	Sm
MPS6517	SC04	Sm
MPS6518	SC04	Sm
MPS6519	SC04	Sm
MPS6520	SC04	Sm
MPS6521	SC04	Sm
MPS6522	SC04	Sm
MPS6523	SC04	Sm
MPSA05	SC04	Sm
MPSA06	SC04	Sm
MPSA13	SC04	Sm
MPSA14	SC04	Sm
MPSA42	SC04	Sm
MPSA43	SC04	Sm
MPSA55	SC04	Sm
MPSA56	SC04	Sm
MPSA63	SC04	Sm
MPSA64	SC04	Sm
MPSA92	SC04	Sm
MPSA93	SC04	Sm
MRB11175Y	SC15	M
MRB11350Y	SC15	M
MSB11900Y	SC15	M
MX0912B250Y	SC15	M
MX0912B350Y	SC15	M
MZ0912B50Y	SC15	M
MZ0912B100Y	SC15	M
OM286	SC17	SEN
OM286M	SC17	SEN
OM287	SC17	SEN

Type no.	book	section
OM287M	SC17	SEN
OM320	SC14	WBM
OM321	SC14	WBM
OM322	SC14	WBM
OM323	SC14	WBM
OM323A	SC14	WBM
OM335	SC14	WBM
OM336	SC14	WBM
OM337	SC14	WBM
OM337A	SC14	WBM
OM339	SC14	WBM
OM345	SC14	WBM
OM350	SC14	WBM
OM360	SC14	WBM
OM361	SC14	WBM
OM370	SC14	WBM
OM386B	SC17	SEN
OM386M	SC17	SEN
OM387B	SC17	SEN
OM387M	SC17	SEN
OM388B	SC17	SEN
OM389B	SC17	SEN
OM390	SC17	SEN
OM391	SC17	SEN
OM931	SC05	P
OM961	SC05	P
OM2860	SC17	SEN
OM2870	SC17	SEN
OSB/M/S9115*	SC02	St
OSB/M/S9215*	SC02	St
OSB/M/S9415*	SC02	St
OSM9510-12	SC02	St
PBYR635/40/45CT	SC02	R
PBYR735/40/45	SC02	R
PBYR735/40/45F	SC02	R
PBYR1035/40/45	SC02	R
PBYR1035/40/45F	SC02	R
PBYR1535/40/45CT	SC02	R
PBYR1535/40/45CTF	SC02	R
PBYR1635/40/45	SC02	R
PBYR1635/40/45F	SC02	R
PBYR2035/40/45CT	SC02	R
PBYR2035/40/45CTF	SC02	R
PBYR2535/40/45CT	SC02	R
PBYR2535/40/45CTF	SC02	R

Type no.	book	section	Type no.	book	section	Type no.	book	section
PBYR3035/40/45PT	SC02	R	PLED-0513M	S8a	LED	PMBT2907	SC10	Mm
PBYR12035/40/45TV	SC02	R	PLED-0514M	S8a	LED	PMBT2907A	SC10	Mm
PBYR16035/40/45TV	SC02	R	PLED-P313N	S8a	LED	PMBT3903	SC10	Mm
PBYR30035/40/45CT	SC02	R	PLED-P314N	S8a	LED	PMBT3904	SC10	Mm
PBYR40035/40/45CT	SC02	R	PLED-P513M	S8a	LED	PMBT3906	SC10	Mm
PH2222/A	SC04	Sm	PLED-P514M	S8a	LED	PMBT4401	SC10	Mm
PH2369	SC04	Sm	PLED-T512B	S8a	LED	PMBT4403	SC10	Mm
PH2907	SC04	Sm	PLED-TR12E	S8a	LED	PMBT5088	SC10	Mm
PH2907A	SC04	Sm	PLED-TR12F	S8a	LED	PMBT5401	SC10	Mm
PH5415	SC04	Sm	PLED-TR12G	S8a	LED	PMBT5550	SC10	Mm
PH5416	SC04	Sm	PLED-TR42DL	S8a	LED	PMBT5551	SC10	Mm
PH6659	SC07	FET	PLED-Y313A	S8a	LED	PMBT6428	SC10	Mm
PH6660	SC07	FET	PLED-Y313N	S8a	LED	PMBT6429	SC10	Mm
PH6661	SC07	FET	PLED-Y314A	S8a	LED	PMBTA05	SC10	Mm
PH13002	SC06	SP	PLED-Y314N	S8a	LED	PMBTA06	SC10	Mm
PH13003	SC06	SP	PLED-Y511C	S8a	LED	PMBTA13	SC10	Mm
PKB12005U	SC15	M	PLED-Y513C	S8a	LED	PMBTA14	SC10	Mm
PKB20010U	SC15	M	PLED-Y513M	S8a	LED	PMBTA42	SC10	Mm
PLED-G313A	S8a	LED	PLED-Y514B	S8a	LED	PMBTA43	SC10	Mm
PLED-G313N	S8a	LED	PLED-Y514M	S8a	LED	PMBTA55	SC10	Mm
PLED-G314A	S8a	LED	PLED-Y544KL	S8a	LED	PMBTA56	SC10	Mm
PLED-G314N	S8a	LED	PLED-Y544LL	S8a	LED	PMBTA63	SC10	Mm
PLED-G511C	S8a	LED	PLED-YR14E	S8a	LED	PMBTA64	SC10	Mm
PLED-G513C	S8a	LED	PLED-YR14F	S8a	LED	PMBTA92	SC10	Mm
PLED-G513M	S8a	LED	PLED-YR14G	S8a	LED	PMBTA93	SC10	Mm
PLED-G514B	S8a	LED	PLED-YR44DL	S8a	LED	PMBZ5226	SC01	SD
PLED-G514M	S8a	LED	PMBD914	SC01	SD	PMLL4148	SC01/10	SD/Mm
PLED-G544KL	S8a	LED	PMBD2835	SC01	SD	PMLL4150	SC10/10	SD/Mm
PLED-G544LL	S8a	LED	PMBD2836	SC01	SD	PMLL4151	SC10/10	SD/Mm
PLED-GR14E	S8a	LED	PMBD2837	SC01	SD	PMLL4153	SC10/10	SD/Mm
PLED-GR14F	S8a	LED	PMBD2838	SC01	SD	PMLL4446	SC10/10	SD/Mm
PLED-GR14G	S8a	LED	PMBD6050	SC01	SD	PMLL4448	SC10/10	SD/Mm
PLED-GR44DL	S8a	LED	PMBD6100	SC01	SD	PMLL5225B to	SC10/10	SD/Mm
PLED-H313A	S8a	LED	PMBD7000	SC01	SD	PMLL5267B	SC01/10	SD/Mm
PLED-H314A	S8a	LED	PMBF170	SC07/10	FET/Mm	PN2222	SC04	Sm
PLED-H511C	S8a	LED	PMBF4391	SC07/10	FET/Mm	PN2222A	SC04	Sm
PLED-H514B	S8a	LED	PMBF4392	SC07/10	FET/Mm	PN2369	SC04	Sm
PLED-H544KL	S8a	LED	PMBF4393	SC07/10	FET/Mm	PN2907	SC04	Sm
PLED-H544LL	S8a	LED	PMBFJ174	SC07/10	FET/Mm	PN2907A	SC04	Sm
PLED-HR14E	S8a	LED	PMBJF175	SC07/10	FET/Mm	PN3439	SC04	Sm
PLED-HR14F	S8a	LED	PMBJF176	SC07/10	FET/Mm	PN3440	SC04	Sm
PLED-HR14G	S8a	LED	PMBJF177	SC07/10	FET/Mm	PN4391	SC07	FET
PLED-HR44DL	S8a	LED	PMBT2222	SC10	Mm	PN4392	SC07	FET
PLED-0313N	S8a	LED	PMBT2222A	SC10	Mm	PN4393	SC07	FET
PLED-0314N	S8a	LED	PMBT2369	SC10	Mm	PN5415	SC04	Sm

Type no.	book	section	Type no.	book	section	Type no.	book	section
PN5416	SC04	Sm	PZTA14	SC10	Mm	RZ2731B16W	SC15	M
P044	SC12	PhC	PZTA42	SC10	Mm	RZ2731B32W	SC15	M
P044A	SC12	PhC	PZTA43	SC10	Mm	RZ2731B48W	SC15	M
PPC5001T	SC15	M	PZTA63	SC10	Mm	RZ2731B60W	SC15	M
PQC5001T	SC15	M	PZTA64	SC10	Mm	RZ3135B14W	SC15	M
PTB23001X	SC15	M	PZTA92	SC10	Mm	RZ3135B28W	SC15	M
PTB23003X	SC15	M	PZTA93	SC10	Mm	RZ3135B42W	SC15	M
PTB23005X	SC15	M	RPW100	SC17	SEN	RZ3135B50W	SC15	M
PTB32001X	SC15	M	RPW101	SC17	SEN	RZB12050Y	SC15	M
PTB32003X	SC15	M	RPW102	SC17	SEN	RZB12100Y	SC15	M
PTB32005X	SC15	M	RPY98A	SC17	SEN	RZB12250Y	SC15	M
PTB42001X	SC15	M	RPY98C	SC17	SEN	SL5500	SC12	PhC
PTB42002X	SC15	M	RPY98F	SC17	SEN	SL5501	SC12	PhC
PTB42003X	SC15	M	RPY98G	SC17	SEN	SL5504	SC12	PhC
PVB42004X	SC15	M	RPY98S	SC17	SEN	SL5505S	SC12	PhC
PXB16050U	SC15	M	RPY99A	SC17	SEN	SL5511	SC12	PhC
PXT2222	SC10	Mm	RPY99C	SC17	SEN	TIP29*	SC05	P
PXT2222A	SC10	Mm	RPY99D	SC17	SEN	TIP30*	SC05	P
PXT2907	SC10	Mm	RPY99F	SC17	SEN	TIP31*	SC05	P
PXT2907A	SC10	Mm	RPY99G	SC17	SEN	TIP32*	SC05	P
PXT3904	SC10	Mm	RPY99S	SC17	SEN	TIP33*	SC05	P
PXT3906	SC10	Mm	RPY99P/P5206	SC17	SEN	TIP34*	SC05	P
PXT4401	SC10	Mm	RPY100	SC17	SEN	TIP41*	SC05	P
PXT4403	SC10	Mm	RPY102	SC17	SEN	TIP42*	SC05	P
PXTA14	SC10	Mm	RPY104A	SC17	SEN	TIP47	SC06	P
PXTA27	SC10	Mm	RPY104C	SC17	SEN	TIP48	SC06	P
PXTA64	SC10	Mm	RPY104D	SC17	SEN	TIP49	SC06	P
PXTA77	SC10	Mm	RPY104F	SC17	SEN	TIP50	SC06	P
PZ1418B15U	SC15	M	RPY104G	SC17	SEN	TIP110	SC05	P
PZ1418B30U	SC15	M	RPY104S	SC17	SEN	TIP111	SC05	P
PZ1721B12U	SC15	M	RPY105P/P5206	SC17	SEN	TIP112	SC05	P
PZ1721B25U	SC15	M	RPY107	SC17	SEN	TIP115	SC05	P
PZ2024B10U	SC15	M	RPY108P/P5211	SC17	SEN	TIP116	SC05	P
PZ2024B20U	SC15	M	RPY109	SC17	SEN	TIP117	SC05	P
PZ2327B15U	SC15	M	RPY109B/P2105	SC17	SEN	TIP120	SC05	P
PZB16035U	SC15	M	RPY222	SC17	SEN	TIP121	SC05	P
PZB16040U	SC15	M	RV3135B5X	SC15	M	TIP122	SC05	P
PZB27020U	SC15	M	RX1011B350Y	SC15	M	TIP125	SC05	P
PZT2222	SC10	Mm	RX1214B150Y	SC15	M	TIP126	SC05	P
PZT2222A	SC10	Mm	RX1214B300Y	SC15	M	TIP127	SC05	P
PZT2907	SC10	Mm	RX2731B90W	SC15	M	TIP130	SC05	P
PZT2907A	SC10	Mm	RX3034B70W	SC15	M	TIP131	SC05	P
PZT3904	SC10	Mm	RXB12350Y	SC15	M	TIP132	SC05	P
PZT3906	SC10	Mm	RZ1214B35Y	SC15	M	TIP135	SC05	P
PZTA13	SC10	Mm	RZ1214B65Y	SC15	M	TIP136	SC05	P

Type no.	book	section	Type no.	book	section	Type no.	book	section
TIP137	SC05	P	1N4933	SC01	R	2N3966	SC07	FET
TIP140	SC05	P	1N5059	SC01	R	2N4030	SC04	Sm
TIP141	SC05	P	1N5060	SC01	R	2N4031	SC04	Sm
TIP142	SC05	P	1N5061	SC01	R	2N4032	SC04	Sm
TIP145	SC05	P	1N5062	SC01	R	2N4033	SC04	Sm
TIP146	SC05	P	1N5225 to	SC01	R	2N4091	SC07	FET
TIP147	SC05	P	1N5267B	SC01	R	2N4092	SC07	FET
TIP2955	SC05	P	2N918	SC14	WBT	2N4093	SC07	FET
TIP2955T	SC05	P	2N930	SC04	Sm	2N4123	SC04	Sm
TIP3055	SC05	P	2N1613	SC04	Sm	2N4124	SC04	Sm
TIP3055T	SC05	P	2N1711	SC04	Sm	2N4125	SC04	Sm
1N821	SC01	Vrf	2N1893	SC04	Sm	2N4126	SC04	Sm
1N821A	SC01	Vrf	2N2219	SC04	Sm	2N4391	SC07	FET
1N823	SC01	Vrf	2N2219A	SC04	Sm	2N4392	SC07	FET
1N823A	SC01	Vrf	2N2222	SC04	Sm	2N4393	SC07	FET
1N825	SC01	Vrf	2N2222A	SC04	Sm	2N4400	SC04	Sm
1N825A	SC01	Vrf	2N2297	SC04	Sm	2N4401	SC04	Sm
1N827	SC01	Vrf	2N2369	SC04	Sm	2N4402	SC04	Sm
1N827A	SC01	Vrf	2N2369A	SC04	Sm	2N4403	SC04	Sm
1N829	SC01	Vrf	2N2483	SC04	Sm	2N4427	SC08	RFP
1N829A	SC01	Vrf	2N2484	SC04	Sm	2N4856	SC07	FET
1N914	SC01	SD	2N2904	SC04	Sm	2N4857	SC07	FET
1N916	SC01	SD	2N2904A	SC04	Sm	2N4858	SC07	FET
1N4001D	SC01	R	2N2905	SC04	Sm	2N4859	SC07	FET
1N4002D	SC01	R	2N2905A	SC04	Sm	2N4860	SC07	FET
1N4003D	SC01	R	2N2906	SC04	Sm	2N4861	SC07	FET
1N4004D	SC01	R	2N2906A	SC04	Sm	2N5064	SC03	Tri
1N4005D	SC01	R	2N2907	SC04	Sm	2N5086	SC04	Sm
1N4006D	SC01	R	2N2907A	SC04	Sm	2N5087	SC04	Sm
1N4007D	SC01	R	2N3019	SC04	Sm	2N5088	SC04	Sm
1N4001G	SC01	R	2N3020	SC04	Sm	2N5089	SC04	Sm
1N4002G	SC01	R	2N3053	SC04	Sm	2N5400	SC04	Sm
1N4003G	SC01	R	2N3375	SC08	RFP	2N5401	SC04	Sm
1N4004G	SC01	R	2N3553	SC08	RFP	2N5415	SC04	Sm
1N4005G	SC01	R	2N3632	SC08	RFP	2N5416	SC04	Sm
1N4006G	SC01	R	2N3822	SC07	FET	2N5550	SC04	Sm
1N4007G	SC01	R	2N3823	SC07	FET	2N5551	SC04	Sm
1N4148	SC01	SD	2N3866	SC08	RFP	2N6659	SC07	FET
1N4150	SC01	SD	2N3903	SC04	Sm	2N6660	SC07	FET
1N4151	SC01	SD	2N3904	SC04	Sm	2N6661	SC07	FET
1N4153	SC01	SD	2N3905	SC04	Sm	4N25	SC12	PhC
1N4446	SC01	SD	2N3906	SC04	Sm	4N25A	SC12	PhC
1N4448	SC01	SD	2N3924	SC08	RFP	4N26	SC12	PhC
1N4531	SC01	SD	2N3926	SC08	RFP	4N27	SC12	PhC
1N4532	SC01	SD	2N3927	SC08	RFP	4N28	SC12	PhC

Type no.	book	section		
4N29	SC12	PhC		
4N30	SC12	PhC		
4N31	SC12	PhC		
4N32	SC12	PhC		
4N33	SC12	PhC		
4N35	SC12	PhC		
4N36	SC12	PhC		
4N37	SC12	PhC		
4N38	SC12	PhC		
4N38A	SC12	PhC		
4N46	SC12	PhC		
6N135	SC12	PhC		
6N136	SC12	PhC		
56201d	SC06	A		
56201j	SC06	A		
56245	SC04/14	A		
56246	SC04/14	A		
56261a	SC06	A		
56264	SC03	A		
56264a	SC02/03	A		
56264b	SC02/03	A		
56295	SC03	A		
56295a	SC02/03	A		
56295b	SC02/03	A		
56295c	SC02/03	A		
56326	SC06	A		
56339	SC06	A		
56352	SC06	A		
56353	SC06/03	A		
56354	SC06/03	A		
56359b	SC02/03	A		
56359c	SC02/03	A		
56359d	SC02/03	A		
56360a	SC02/03	A		
56363	SC02/03	A		
56364	SC02/03	A		
56367	SC02/03	A		
56368b	SC02/03	A		
56368c	SC02/03	A		
56369	SC02/03	A		
56378	SC02/03	A		
56379	SC02/03	A		
56387a	SC06	A		
56387b	SC06	A		
56397	SC01	A		

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of seven series of handbooks:

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MAGNETIC PRODUCTS*

LIQUID CRYSTAL DISPLAYS

The contents of each series are listed on pages iii to ix.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where application is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Components is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

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This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
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IC05	**Advanced Low-power Schottky (ALS) Logic Series**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**Advanced CMOS logic (ACL)**
IC08	**10/100K ECL Logic/Memory/PLD**
IC09	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** NMOS, CMOS
IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**
IC23*	**Solid state image sensors and peripheral integrated circuits**

* Not yet issued in this series of handbooks: previously issued as PC11.

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S2b	**SC03**	**Thyristors and triacs**
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S4a	**SC05**	**Low-frequency power transistors and hybrid IC power modules**
S4b	**SC06**	**High-voltage and switching power transistors**
S5	**SC07**	**Small-signal field-effect transistors**
S6	**SC08a***	**RF bipolar transistors**
	SC08b*	**RF power transistors**
	SC09	**RF power modules**
S7	**SC10**	**Surface mounted semiconductors**
S8b	**SC12**	**Optocouplers**
S9	**SC13***	**PowerMOS transistors**
S10	**SC14**	**Wideband transistors and wideband hybrid IC modules**
S11	**SC15**	**Microwave transistors**
S15**	**SC16**	**Laser diodes**
S13	**SC17**	**Semiconductor sensors**

* Not yet issued with the new code in this series of handbooks.

** New handbook in this series; will be issued shortly.

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code	handbook title
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DC04	**Loudspeakers**
DC05	**Flyback transformers, mains transformers and general-purpose FXC assemblies**

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current code	new code	handbook title
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C12	**PA03**	**Potentiometers and switches**
C7	**PA04**	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08**	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

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This series of data handbooks comprises:

current code	new code	handbook title
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T5	**PC02***	**Cathode-ray tubes**
T6	**PC03***	**Geiger-Müller tubes**
T9	**PC04**	**Photo multipliers**
T10	**PC05**	**Plumbicon camera tubes and accessories**
T11	**PC06**	**Circulators and Isolators**
T12	**PC07**	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08**	**Image intensifiers**
T15	**PC09**	**Dry-reed switches**
	PC11**	**Solid state image sensors and peripherals integrated circuits**
T9	**PC12***	**Electron multipliers**

* Not yet issued with the new code in this series of handbooks.

** Will be issued as IC23 in the future.

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This series of data handbooks comprises:

current code	new code	handbook title
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C16	**MA02***	**Permanent magnet materials**
C19	**MA03***	**Piezoelectric ceramics**

* Not yet issued with the new code in this series of handbooks.

LIQUID CRYSTAL DISPLAYS

current code	new code	handbook title
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