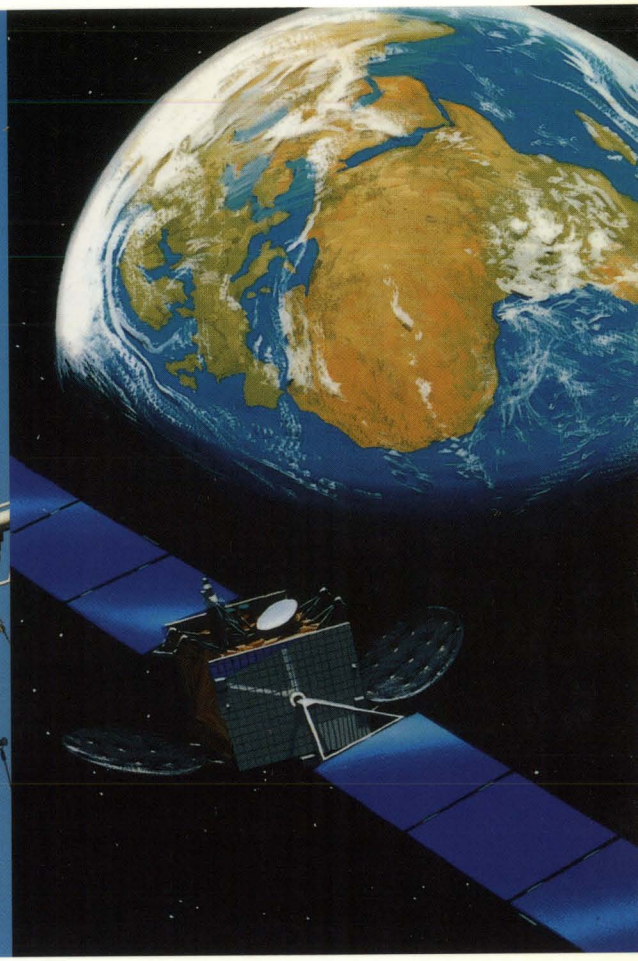
DISCRETE SEMICONDUCTORS

Microwave Transistors



1997

Data Handbook SC15

Let's make things better.

Philips
Semiconductors

PHILIPS

QUALITY ASSURED

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

PRODUCT SAFETY

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

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

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

Microwave Transistors

CONTENTS

DEFINITIONS

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

LIFE SUPPORT APPLICATIONS

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

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Microwave Transistors — Index

ALPHANUMERIC INDEX

Types added to the range since the last issue of Handbook SC15 (1995 issue) are shown in bold print.

MAINTENANCE TYPES

SELECTION GUIDE

PULSED POWER TRANSISTORS FOR RADAR

L-band

TYPE NUMBER	f (GHz)	V_{CC} (V)	t_p (μS)	at δ (%)	P_L (W)	G_p (dB)	η_C (%)	PAGE
RX1214B80W	1.2 to 1.4	40	500	10	≥80	≥7	≥35	316
RX1214B130Y	1.2 to 1.4	50	150	5	≥130	≥7	≥35	316
RX1214B170W	1.2 to 1.4	42	500	10	≥170	≥6.7	≥40	322
RX1214B300Y	1.2 to 1.4	50	150	5	≥250	≥7	≥35	327
RX1214B350Y	1.2 to 1.4	50	130	6	≥280	≥7	≥40	332
RZ1214B35Y	1.2 to 1.4	50	150	5	≥35	≥7	≥30	338
RZ1214B65Y	1.2 to 1.4	50	150	5	≥70	≥7	≥35	342

S-band

TYPE NUMBER	f (GHz)	V_{CE} (V)	t_p (μS)	at δ (%)	P_L (W)	G_p (dB)	η_C (%)	PAGE
BLS2731-10	2.7 to 3.1	40	100	10	typ. 12.5	typ. 8	typ. 40	30
BLS2731-20	2.7 to 3.1	40	100	10	typ. 25	typ. 8	typ. 40	33
BLS2731-50	2.7 to 3.1	40	100	10	typ. 60	typ. 8	typ. 40	36
BLS2731-110	2.7 to 3.1	40	100	10	typ. 120	typ. 7	typ. 35	39
BLS2731-150	2.7 to 3.1	40	100	10	typ. 170	typ. 8	typ. 40	42

PULSED POWER TRANSISTORS FOR AVIONICS

TYPE NUMBER	f (GHz)	V_{CC} (V)	t_p (μS)	at δ (%)	P_L (W)	G_p (dB)	η_C (%)	PAGE
MF1011B900Y	1.09	50	10	1	800	≥6	≥40	189
MTB10010U	1.03	24	1	1	>9.5	>9.5	>50	196
MX0912B100Y	0.96 to 1.215	50	10	10	>100	>7	>42	201
MX1011B200Y	1.09	50	10	1	200	≥7.5	≥45	222
MX0912B251Y	0.96 to 1.215	50	10	10	>235	>7	>42	208
MX0912B351Y	0.96 to 1.215	50	10	10	>325	>7	>40	215
MX1011B700Y	1.09	50	10	1	650	≥6	≥48	230
MZ0912B50Y	0.96 to 1.215	50	10	10	>50	>7	>42	236
MZ0912B100Y	0.96 to 1.215	50	10	10	>100	>7	>42	201

LINEAR POWER TRANSISTORS

Class-A

TYPE NUMBER	f (GHz)	V_{CE} (V)	I_c (mA)	P_{L1} (W) note 1	G_{po} (dB) note 2	PAGE
LBE2003S	2	18	30	≥0.2	≥10	51
LBE2009S	2	18	110	≥0.7	≥9	51
LTE21015R	2	16	250	≥1.5	≥8.5	108
LTE21009R	2.1	16	150	≥0.6	≥10	104
LTE21025R	2.1	16	400	≥2.8	≥7.8	113
LTE42005S	4.2	18	110	≥0.45	≥6.6	117
LTE42008R	4.2	16	250	≥0.8	≥7	123
LTE42012R	4.2	16	400	≥1	≥6	130
LV1721E50R	1.7 to 2.1	16	1100	≥5	≥7	136
LV2024E45R	2 to 2.4	16	1100	≥4	≥6	140
LVE21050R	2.1	16	1100	≥5.5	≥8	146
LWE2010S	2.3	18	110	≥0.8	≥8	149
LWE2015R	2.3	16	250	≥1.2	≥7.5	155
LZ1418E100R	1.4 to 1.8	16	2000	≥9	≥10	184

Notes

1. Load power for 1 dB compressed power gain.
2. Low level power gain associated with P_{L1}.

Class-AB

TYPE NUMBER	f (GHz)	V_{CE} (V)	I_c (mA)	P_{L1} (W)	G_{po} (dB)	PAGE
LX1214E500X	1.2 to 1.4	24	150	≥50	≥11	160
LLE15180X	1.5	24	50	≥15	≥7.8	71
LLE15370X	1.5	24	300	≥33	≥8	78
LXE15450X	1.5	24	150	≥45	≥8	85
LFE15600X	1.5	24	200	≥55	≥8	64
LLE16045X	1.65	24	40	≥4.5	≥8.5	85
LLE16120X	1.65	24	100	≥11	≥8.7	92
LLE16350X	1.65	24	100	≥29	≥8	98
LXE16350X	1.65	24	300	≥32	≥9	174

CW POWER TRANSISTORS

TYPE NUMBER	CLASS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	PAGE
PLB16004U	C	1.6	28	≥4.5	≥8.5	≥40	242
PLB16012U	C	1.6	28	≥10	≥8	≥45	247
PLB16030U	B	1.6	28	≥30	≥7	≥45	252
PTB23001X	B	2	24	≥1	≥7	≥45	261
PTB23002U	B	2.3	28	≥2	≥9	≥45	267
PTB23003X	B	2	24	≥3	≥8.75	≥45	261
PTB23005X	B	2	24	≥5	≥9.2	≥50	261
PTB23006U	C	2	28	≥5	≥9	≥40	272
PTB32001X	B	3	24	≥1.3	≥8	≥35	278
PTB32003X	B	3	24	≥2.5	≥8	≥35	278
PTB32005X	B	3	24	≥4.5	≥8	≥35	278
PVB42004X	B	2	24	≥10	≥10	≥48	287
PXB16050U	C	1.65	28	≥45	≥8.5	≥45	291
PZ1418B15U	B	1.4 to 1.8	28	≥12.5	≥7	≥38	297
PZ1418B30U	B	1.4 to 1.8	28	≥27	≥7.3	≥38	302
PZ1721B25U	B	1.7 to 2.1	28	≥25	≥7	≥35	302
PZ2024B20U	B	2.0 to 2.4	28	≥20	≥6	≥35	302
PZB16035U	B	1.55	28	≥35	≥8	≥45	311

OSCILLATOR POWER TRANSISTORS

TYPE NUMBER	f (GHz)	V_{CE} (V)	I_C (mA)	P_L (mW)	PACKAGE	PAGE
PTC4001T	2.88 to 3.0	20; note 1	200	≥550	SOT440A	284
PPC5001T	5	20	200	≥450	SOT447A	257

Note

1. V_{CC} value.

MARKING CODES

MARKING CODES

The microwave transistors in this book are normally marked with manufacturer's name or trademark, type designation and lot identification code. If space on the transistor package is insufficient for full type designation, the following marking codes may be used for identification.

TYPE NUMBER	MARKING CODE
LAE4001R	R8
LAE4002S	R9
LBE2003S	407
LBE2009S	409
LCE2009S	408
LEE1015T	1015T
LTE21009R	435
LTE21015R	436
LTE21025R	439
LTE42005S	502
LTE42008R	196
LTE42012R	198
LV1721E50R	1721E50R
LV2024E45R	2024E45R
LV2327E40R	2327E40R
LWE2015R	411
MTB10010U	10010U
MX1011B430W	MX1011B430W
PPC5001T	395
PTB23001X	2301X
PTB23003X	2303X
PTB23005X	2305X
PTB32001X	3201X
PTB32003X	3203X
PTB32005X	3205X
PTC4001T	440

GENERAL

QUALITY

Total Quality Management

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

QUALITY ASSURANCE

Based on ISO 9000 standards, customer standards such as FDC, QS9000 and IBM MDQ. Our factories are certified to ISO 9000 by external inspectorates.

PARTNERSHIPS WITH CUSTOMERS

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

PARTNERSHIPS WITH SUPPLIERS

Ship-to-stock, statistical process control and ISO 9000 audits.

QUALITY IMPROVEMENT PROGRAMME

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

Advanced quality planning

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

Product conformance

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

- Incoming material management through partnerships with suppliers.
- In-line quality assurance to monitor process reproducibility during manufacture and initiate any necessary corrective action. Process steps are under statistical process control.
- Acceptance tests on finished products to verify conformance with the device specification. The test results are used for quality feedback and corrective actions. The inspection and test requirements are detailed in the general quality specifications SNW-EQ-611 part A.
- Periodic inspections to monitor and measure the conformance of products.
- Qualification tests (see SNW-EQ-611 part A).

Product reliability

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

Customer response

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

Recognition

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

RELIABILITY GRADES

Microwave transistors are available from different quality levels which are listed as follows:

- **Standard grade**

  This applies to devices following the designation rules as listed in the chapters "Type designation code" and "Pro Electron type numbering for BLS-types".

- **Grade "X" and "Y"**

  These grades correspond respectively to the equivalent MIL-STD 19500 grades JANTX and JANTXV.

  They have been subject to additional screening tests than those normally applied to the standard grade. The local sales organisation can confirm whether they are available for the type you have selected.

  The majority of the devices included in this book may also be available in accordance with a space screening file similar to JANS or ESA/SCC5010.

Reliability grades (only for brazed cap devices and orders in excess of 50 parts)

OPERATION	MIL STD 750 METHOD	CONDITIONS	REQUIREMENTS (%)		
			STD GRADE	GRADE "X"(1)	GRADE "Y"(2)
Assembly			100	100	100
Internal visual inspection		note 3	100	100	100
Capping			100	100	100
Stabilization bake	1032	T = 200 °C; duration 48 hours	100	100	100
Temperature cycling	1051	condition C; 20 cycles; no dwell at 25 °C	–	100	100
Constant acceleration	2006	20000 g axis Y1; $P_{tot} \leq 5$ W	–	–	100
		10000 g axis Y1; $P_{tot} > 5$ W	–	–	100
Hermetic seal (brazed cap)	1071	condition H - FC43			
fine			100	100	100
gross			100	100	100
Serialisation			–	–	100
Initial electrical parameters		note 4	–	100 GO/NOGO	100 GO/NOGO
High temperature reverse bias (HTRB)	1039	T_{amb} = 150 °C; V_{CBmin} = 80% of published V_{CB}; duration 48 hours	–	100	100
Interim electrical parameters		note 5	–	–	100 read and record

OPERATION	MIL STD 750 METHOD	CONDITIONS	REQUIREMENTS (%)		
			STD GRADE	GRADE "X"(1)	GRADE "Y"(2)
Power burn-in	1039	T_{amb} = 125 °C; V_{CB} = 10 V; I_C reached when T_j average = 175 °C; duration 160 hours	–	–	100
Delta calculation		note 6	–	–	100
Other electrical parameters		note 4	100	100 GO/NOGO	read and record
Marking		as specified	100	100	100
External visual inspection	2071		100	100	100
Packing			100	100	100
Check for delivery		note 3			

Notes

1. Grade "X" is equivalent to JANTX.
2. Grade "Y" is equivalent to JANTXV.
3. As per Philips component specification.
4. Published DC, R_{th} and RF parameters.
5. Interim electrical parameters are published.
6. Published collector cut off current and forward current ratio. Delta limits are: Delta h_{FE} max = ±20% of initial value; Delta cut off current max = ±100% of initial value or ±10% of published parameter limit (whichever is greater).

BATCH RELEASE TESTS FOR GRADE "X" AND "Y" EQUIVALENTS

Group B; note 1.

INSPECTIONS	MIL STD 750 METHOD	CONDITIONS	SAMPLING PLAN LTPD(2)	SMALL LOT QUALITY CONFORMANCE INSPECTION	
				NO. OF DEVICES	NO. OF FAILURES
Subgroup 1					
Solderability	2026	the sampling plan applies to the number of leads inspected. A minimum of 3 devices shall be tested.	15	4	0
Resistance to solvents	1022				
Subgroup 2					
Temperature cycling (air to air)	1051	no dwell at 25 °C; test condition C, except step 3 at 175 °C; 45 cycles including screening	10	6	0
Thermal shock	1056	10 cycles; condition A			
Hermetic seal fine leak gross leak	1071	 test condition H; max. leak rate = 5 x 10^{-7} atm cc/s test condition C			
Electrical measurements		DC parameters of the relevant data sheet			
Subgroup 3					
Steady-state operation life	1027	as power burn-in except T_{mb} = 150 °C; duration 340 hours	10	12	0
Electrical measurements		DC parameters of the relevant data sheet			
Bond strength	2037	the sample shall include a minimum of 3 devices and shall include all wire sizes	20 (wires)	20 (wires)	0
Subgroup 4					
Decap internal visual (design criteria)	2075	visual criteria in accordance with qualified design		1	0
Subgroup 5 (not applicable)					
Subgroup 6					
High temperature life (non operating)	1032	340 hours at T_{amb} = 200 °C (brazed cap)	10	12	0
Electrical measurements		DC parameters of the relevant data sheet			

Notes

1. Optional for grades "X" and "Y" (minimum order quantity = 50 devices).
2. Sampling according to MIL-STD 19500. Small lot sampling applies for batches up to 500 devices.

TYPE DESIGNATION CODE

Code structure

The standard structures of type designation code for microwave transistors can be shown as follows, where X represents a letter and 0 represents a numeral:

XXX0000X	for transistors without matching cell
XXX00000X	for transistors with input matching cell and specified for narrowband applications
XXX0000X00X or XXX0000X000X	for transistors specified for wideband applications

Letters

FIRST LETTER

The first letter shows the mode of operation:

L linear

M short pulse

P CW class B

R long pulse.

SECOND LETTER

The second letter shows the encapsulation:

A SOT100

B SOT441A (FO-45)

C SOT442A (FO-46)

E SOT122A

F SOT448A (FO-231)

L SOT437A (FO-229)

P SOT447A (FO-102)

T SOT440A (FO-41B)

V SOT445A (FO-83A and FO-83B)

W SOT446A (FO-93)

X SOT439A (FO-91B)

Z SOT443A (FO-57C).

THIRD LETTER

The third letter indicates the common potential:

E common emitter

B common base

C common collector.

FOURTH LETTER (SUFFIX LETTER)

The fourth letter indicates the supply voltage:

Q 10 to 12 V

R 15 to 16 V

S 18 V

T 20 V or 18 to 21 V

U 28 to 30 V

W 40 to 45 V

X 24 V

Y 50 V

Z 48 V.

Numbers

TRANSISTORS WITHOUT MATCHING CELL (XXX0000X)

1st digit indicates frequency of measurement (GHz).

2nd, 3rd and 4th digits indicate power:

in watts for P, M and R modes of operation

in multiples of 100 mW for L mode of operation.

TRANSISTORS SPECIFIED FOR NARROWBAND APPLICATIONS (XXX00000X)

1st and 2nd digits indicate frequency of measurement (× 0.1 GHz).

3rd, 4th and 5th digits give the power:

in watts for P, M and R modes of operation

in multiples of 100 mW for L mode of operation.

TRANSISTORS SPECIFIED FOR WIDEBAND APPLICATIONS

1st and 2nd digits indicate the lower frequency of use (in 0.1 GHz).

3rd and 4th digits indicate the higher frequency of use (in 0.1 GHz).

Last digit indicates the power:

in watts for P, M and R modes of operation

in multiples of 100 mW for L mode of operation.

PRO ELECTRON TYPE NUMBERING FOR BLS-TYPES

Basic type number

This type designation code applies to discrete semiconductor devices (not integrated circuits), multiples of such devices, semiconductor chips and Darlington transistors. For this data handbook, only the relevant designation codes for BLS-types are described.

FIRST LETTER

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

B silicon or other material with a band gap of 1 to 1.3 eV.

SECOND LETTER

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

L transistor; power, high frequency.

The same letter can be used for multi-chip devices with similar elements. Power types are defined by $R_{th\ j\text{-}mb} \leq 15$ K/W.

SERIAL NUMBER

The number comprises of one letter followed by four digits for devices primarily intended for industrial or professional equipment. A hyphen followed by a number indicates the power in Watts of the device.

Example: BLS2731-10.

RATING SYSTEMS

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

Definitions of terms used

ELECTRONIC DEVICE

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

CHARACTERISTIC

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

BOGEY ELECTRONIC DEVICE

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

RATING

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

RATING SYSTEM

The set of principles upon which ratings are established and which determine their interpretation. The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

Absolute maximum rating system

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

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

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

Design maximum rating system

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

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

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

Design centre rating system

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

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

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

LETTER SYMBOLS

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

Letter symbols for currents, voltages and powers

BASIC LETTERS

I, i current

V, v voltage

P, p power.

Upper-case letter symbols are used to represent all values except instantaneous values that vary with time, these are represented by lower-case letters.

SUBSCRIPTS

A, a	anode terminal
(AV), (av)	average value
B, b	base terminal
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-circuit
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 (FETs only). As second subscript: non-repetitive (not 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 reference diodes.

No additional subscript is used for DC values.

Upper-case subscripts are used for the indication of:

- Continuous (DC) values (without signal), e.g. I_B
- Instantaneous total values, e.g. i_B
- Average total values, e.g. $I_{B(AV)}$
- Peak total values, e.g. I_{BM}
- Root-mean-square total values, e.g. $I_{B(RMS)}$.

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

- Instantaneous values, e.g. i_b

- Root-mean-square values, e.g. $I_{b(rms)}$
- Peak values, e.g. I_{bm}
- Average values, e.g. $I_{b(av)}$.

If more than one subscript is used, the subscript for which both styles exist are either all upper-case or all lower-case.

ADDITIONAL RULES FOR SUBSCRIPTS

Transistor currents

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

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

Diode currents

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, $I_{f(rms)}$.

Transistor voltages

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

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

Diode voltages

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}.

Supply voltages or currents

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

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

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

Example: V_{CCE}.

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

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

Examples:

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

$V_{B2\text{-}E}$ continuous (DC) voltage between the terminals of second base and emitter terminals.

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 confusion.

Examples:

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

$V_{1C\text{-}2C}$ continuous (DC) voltage between the collector terminals of the first and second units.

Application of the rules

Fig.1 represents a transistor collector current as a function of time. It comprises a continuous (DC) current and a varying component.

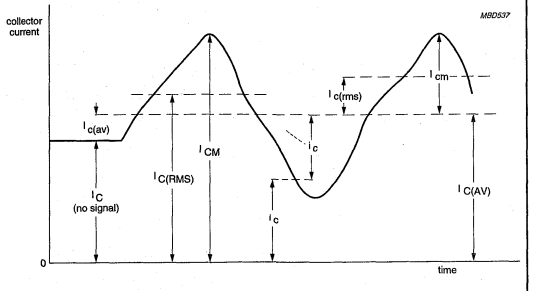


Fig.1 Collector current as a function of time.

Letter symbols for electrical parameters

DEFINITION

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 list comprises 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 are used for the representation of:

- Electrical parameters of external circuits and of circuits in which the device forms only a part.
- All inductances and capacitances.

Lower-case letters are used for the representation of electrical parameters inherent in the device, with the exception of inductances and capacitances.

SUBSCRIPTS

General subscripts

The following list comprises 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 is used for the designation of static (DC) values.

Examples:

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

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

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

Examples:

h_{fe}	small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration
$Z_e = R_e + jX_e$	small-signal value of the external impedance.

If more than one subscript is used, subscripts for which both styles exist are either all upper-case or all lower-case.

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

Subscripts for four-pole matrix parameters

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

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

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

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

DISTINCTION BETWEEN REAL AND IMAGINARY PARTS

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

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

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

Examples:

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

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

Scattering parameters

In distinction to the conventional h-, y- and z-parameters, scattering parameters (s-parameters) relate to travelling wave conditions. Fig.2 shows a two-port network with the incident and reflected waves a_1, b_1, a_2 and b_2.

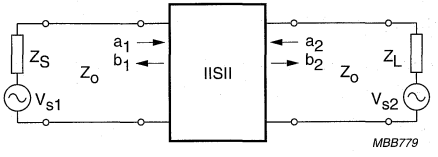


Fig.2 Two-port network.

From Fig.2: $a_1 = \frac{V_{i1}}{\sqrt{Z_0}}$; $a_2 = \frac{V_{i2}}{\sqrt{Z_0}}$; $b_1 = \frac{V_{r1}}{\sqrt{Z_0}}$; $b_2 = \frac{V_{r2}}{\sqrt{Z_0}}$

The squares of these quantities have the dimension of power.

Z_0 = characteristic impedance of the transmission line in which the two-port is connected

V_i = incident voltage

V_r = reflected (generated) voltage.

The four-pole equations for s-parameters are:

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

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

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

$$s_i = s_{11} = \frac{b_1}{a_1} \mid a_2 = 0$$

$$s_r = s_{12} = \frac{b_1}{a_2} \mid a_1 = 0$$

$$s_f = s_{21} = \frac{b_2}{a_1} \mid a_2 = 0$$

$$s_o = s_{22} = \frac{b_2}{a_2} \mid a_1 = 0$$

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

$s_i = s_{11}$ input reflection coefficient: the complex ratio of the reflected wave and the incident wave at the input, under the conditions $Z_L = Z_0 = 50\ \Omega$ and $V_{s2} = 0$

$s_r = s_{12}$ reverse transmission coefficient: the complex ratio of the generated wave at the input and the incident wave at the output, under the conditions $Z_S = Z_0 = 50\ \Omega$ and $V_{s1} = 0$

$s_f = s_{21}$ forward transmission coefficient: the complex ratio of the generated wave at the output and the incident wave at the input, under the conditions $Z_L = Z_0 = 50\ \Omega$ and $V_{s2} = 0$

$s_o = s_{22}$ output reflection coefficient: the complex ratio of the reflected wave and the incident wave at the output, under the conditions $Z_S = Z_0 = 50\ \Omega$ and $V_{s1} = 0$.

SUMMARY OF SYMBOLS FOR MICROWAVE TRANSISTORS

C_{cb}	collector-base capacitance
C_{ce}	collector-emitter capacitance
C_{eb}	emitter-base capacitance
d_{im}	intermodulation distortion
δ	duty factor
F_{min}	noise factor
f	signal frequency
G_a	associated gain (for a low-noise transistor)
G_{ma}	maximum available gain
G_{ms}	maximum stable gain
G_p	power gain under specified conditions
G_{po}	low level power gain associated with P_{L1}
h_{FE}	DC current gain
I_C	DC collector current
I_{CBO}	collector cut-off current, open emitter
I_{CER}	collector cut-off current, with specified R_{BE}
I_{CES}	collector cut-off current, base connected to emitter
I_{CQ}	quiescent current
I_{EBO}	emitter cut-off current, open collector
η_C	collector efficiency $P_L / (I_C \times V_{CC})$
η_{add}	power added efficiency $(P_{out} - P_{in}) / (I_C \times V_{CC})$

P_{in}	input power
P_L	load power under specified conditions
P_{L1}	load power for 1 dB compressed power gain
P_{out}	output power
P_{tot}	total power dissipation
$R_{th\ j\text{-}c}$	thermal resistance from junction to case
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base
$R_{th\ mb\text{-}j}$	thermal resistance from mounting base to heatsink
T_j	junction temperature
t_p	pulse width
T_{sld}	lead soldering temperature
T_{stg}	storage temperature
V_{CBO}	collector-base voltage, open emitter
V_{CC}	collector supply voltage
V_{CE}	collector-emitter voltage
V_{CEO}	collector-emitter voltage, open base
V_{CER}	collector-emitter voltage with specified R_{BE}
V_{CES}	collector-emitter voltage, base connected to emitter
V_{EBO}	emitter-base voltage, open collector
VSWR	voltage standing wave ratio
z_i	complex transistor impedance as seen by the generator
Z_L	complex transistor load impedance as seen by the transistor
Z_{th}	thermal impedance from junction to heatsink.

OPERATING RECOMMENDATIONS

These recommendations are included for the avoidance of damage or destruction of silicon bipolar transistors operating at high frequencies and high power during testing, setting-up procedures and final operation.

Polarization

A current-limiting power supply should be used when testing transistors in a new circuit.

Initial testing at reduced supply voltage is discouraged because the resulting change in output impedance could cause oscillation due to mismatch.

The RF blocking choke in the supply line, together with the DC blocking capacitor of the internal output prematching circuit of the transistor, could sometimes cause oscillations at very low frequencies. The oscillations can often be removed by bypassing the choke with a low value resistor.

Operation

INPUT POWER

When the circuit has not been optimized, the average power input should be kept a lower level than specified. Initial testing of CW amplifiers is best performed in pulsed operation at 50% duty factor. For pulsed amplifiers, the duty factor should be reduced.

OUTPUT WAVEFORM

The output waveform should be checked with a spectrum analyser or similar equipment to ensure that no parasitic effects causing unwanted modulation are present.

FREQUENCY

Microwave performance is published in the data sheet at a single frequency or for a range of frequencies. Devices whose data is published for narrow band application can normally be used at frequencies other than that specified. However, for high power types in particular, broadband operation may be difficult to obtain and the gain of transistors with an internal input prematching network may decrease sharply at higher frequencies.

Broadband transistors (generally those with type numbers starting with two letters followed by four digits) also have an output prematching network. This is essentially a high-pass filter with a resonance frequency below the lowest operating frequency. The transistor could be damaged if operated at this resonance frequency, therefore the manufacturer should be consulted if extended frequency operation is required.

Thermal considerations

The junction temperature is of paramount importance in the reliability of transistors and every effort should be made to keep this temperature as low as possible. This is affected by mechanical aspects of the fitting, therefore mounting recommendations given by the manufacturer should be followed.

Values of thermal resistance given in the data sheets are for a specific junction temperature. Note that thermal resistance from junction to mounting base increases with junction temperature at approximately 0.3%/K.

For transistors required for pulsed operation, an equivalent thermal impedance is given for a specified pulse format

(pulse width and duty factor). This allows for calculation of peak junction temperature (at the end of a pulse). For widely differing pulse formats the manufacturer should be consulted.

The maximum power dissipation is defined as $P_{tot} = V_{CE} \times I_C - P_o + P_i$ at $T_j = 200$ °C.

MOUNTING FLANGED MICROWAVE TRANSISTORS

Flanged microwave transistors are easy to mount but for best performance we offer the following recommendations.

Holes or tapped holes in the heatsink should be free from burrs and spaced between centres at:

14.2 mm for SOT440A, SOT445A and SOT437A

16.5 mm for SOT443A

19.0 mm for SOT439A, SOT422A and SOT423A.

Use a washer to spread the joint pressure.

Mounting recommendations

- Minimum depth of tapped holes in heatsinks is 6 mm.
- Use 4-40 UNC-2A cheese-head screws with a flat washer to spread the joint pressure.
- For transistors dissipating up to 80 W, the heatsink thickness should be at least 3 mm copper (> 99.9% ETP-Cu) or 5 mm aluminium (99% Al). The thickness of the heatsink should be increased proportionally for transistors dissipating more power.
- The minimum flatness of the mounting area is 0.02 mm.
- Mounting area roughness should be less than 0.5 μm.
- Connections between transistor and amplifier circuits should be as short as possible. Also, the distance between input and output printed circuit board should be the minimum required to accept the maximum specified dimensions of the transistor header. If any tolerance remains, the best performance is usually obtained by pushing the transistor towards the output side.
- Avoid, as much as possible, use of flux or flux solutions because flux can penetrate even hermetically sealed ceramic-capped transistors. Tin and wash the printed-circuit boards **before** mounting the power transistors, then solder the transistors into place without using flux.
- Transistor leads may be tinned by dipping them full-length into a solder bath at a temperature of about 230 °C. No flux should be used during tinning.
- Recommended heatsink compounds: WPS II (silicone-free) from Austerlitz-Electronics; Comp. Trans. from KF; 340 from Dow Corning; Trans-Heat from E. Friis-Mikkelsen.
- When a transistor is removed from a heatsink, the flange, almost certainly, will have been distorted by the joint pressure. Grinding or lapping of the flange to the required flatness and smoothness is necessary before the transistor is remounted.

Mounting sequence

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

APPLICATION INFORMATION

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	TYPE NUMBER
A	amplifier			1/4 MC3403 or equivalent
D.U.T.	microwave transistor			
TR	transistor			2N2219 or equivalent
D	diode			1N4148 or equivalent
C1; C2	tantalum capacitor	22 μF, 50 V		
R1	resistor	2.2 kΩ ±5%		
R2, R3, R5, R6	resistor	10 kΩ ±5%		
R4	resistor	4.7 kΩ ±5%		
R_p	resistor	10 kΩ ±5%	10 turns	
R_b, R_c, R_e, R_x	resistor	note 1		

Note

1. Values to be adapted to I_c of the D.U.T.

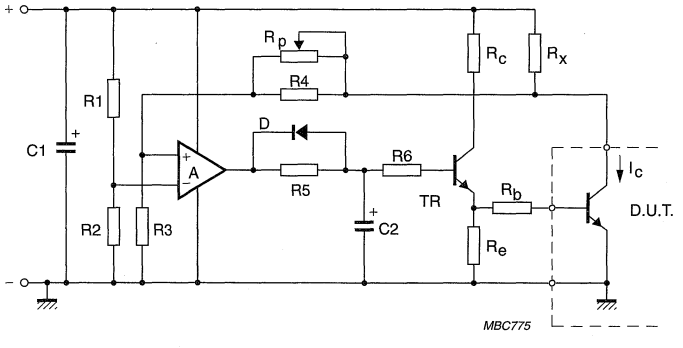


Fig.3 Bias circuit for a class-A linear microwave transistor.

DEVICE DATA

in alphanumeric sequence

Microwave power transistor BLS2731-10

FEATURES

- Suitable for short and medium pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATION

- Common base class-C pulsed power amplifiers for radar applications in the 2.7 to 3.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT445A) with the common base connected to the flange.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

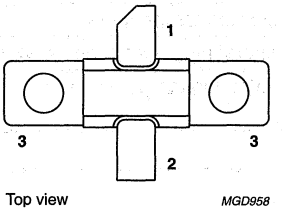


Fig.1 Simplified outline SOT445A.

QUICK REFERENCE DATA

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

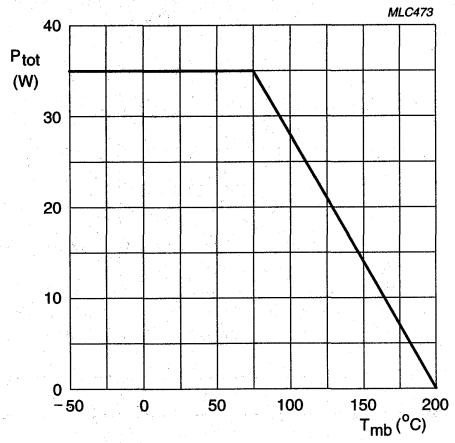
MODE OF OPERATION	f (GHz)	V_{CB} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed class-C	2.7 to 3.1	40	12.5	typ. 8	typ. 40

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_{CM}	peak collector current	$t_p \leq 100\ \mu s$; $\delta \leq 10\%$	–	1.5	A
P_{tot}	total power dissipation	$t_p = 100\ \mu s$; $\delta = 10\%$; $T_{mb} = 25\ °C$	–	35	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic cap; $t \leq 10$ s	–	235	°C



$t_p = 100\ \mu s$; $\delta = 10\%$.

Fig.2 Power dissipation derating as a function of mounting-base temperature.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 2.5 mA; open emitter	70	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 2.5 mA; V_{BE} = 0	65	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 40 V; I_E = 0	–	–	0.3	mA
I_{CES}	collector leakage current	V_{CE} = 40 V; V_{BE} = 0	–	–	0.5	mA
I_{EBO}	emitter leakage current	V_{EB} = 1.5 V; I_C = 0	–	–	0.1	mA
h_{FE}	DC current gain	V_{CB} = 5 V; I_C = 0.25 A	25	–	–	
C_c	collector capacitance (die only)	V_{CE} = 1 V; $I_E = i_e$ = 0; f = 1 MHz	–	10	–	pF

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 100 °C	6.7	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink		0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 100 µs; δ = 10%; note 1	2.46	K/W

Note

1. Equivalent thermal impedance under pulsed microwave operating conditions.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Class-C; t_p = 100 µs; δ = 10 %	2.7 to 2.9	40	≥ 10 typ. 12.5	≥ 7 typ. 8	≥ 35 typ. 40

Microwave power transistor | BLS2731-20

FEATURES

- Suitable for short and medium pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATION

- Common base class-C pulsed power amplifiers for radar applications in the 2.7 to 3.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT445A) with the common base connected to the flange.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

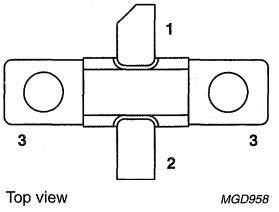


Fig.1 Simplified outline SOT445A.

QUICK REFERENCE DATA

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

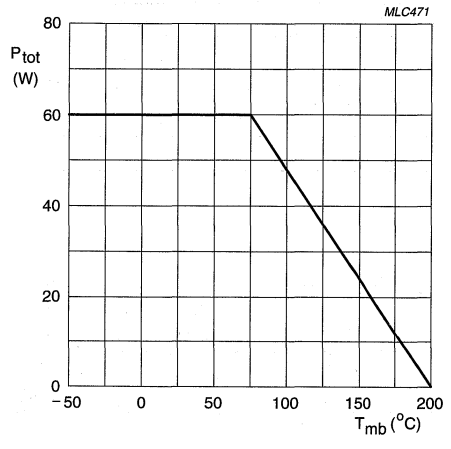
MODE OF OPERATION	f (GHz)	V_{CB} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed class-C	2.7 to 3.1	40	25	typ. 8	typ. 40

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_{CM}	peak collector current	$t_p \leq 100$ μs; $\delta \leq 10\%$	–	3	A
P_{tot}	total power dissipation	t_p = 100 μs; δ = 10%; T_{mb} = 25 °C	–	60	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic cap; $t \leq 10$ s	–	235	°C



t_p = 100 μs; δ = 10%.

Fig.2 Power dissipation derating as a function of mounting-base temperature.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 5 mA; open emitter	70	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 5 mA; V_{BE} = 0	65	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 40 V; I_E = 0	–	–	0.5	mA
I_{CES}	collector leakage current	V_{CE} = 40 V; V_{BE} = 0	–	–	1	mA
I_{EBO}	emitter leakage current	V_{EB} = 1.5 V; I_C = 0	–	–	0.1	mA
h_{FE}	DC current gain	V_{CB} = 5 V; I_C = 0.5 A	25	–	–	
C_c	collector capacitance (die only)	V_{CE} = 1 V; $I_E = i_e$ = 0; f = 1 MHz	–	10	–	pF

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 100 °C	4.16	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink		0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 100 μs; δ = 10%; note 1	1.44	K/W

Note

1. Equivalent thermal impedance under pulsed microwave operating conditions.

APPLICATION INFORMATION

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

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Class-C; t_p = 100 μs; δ = 10 %	2.7 to 2.9	40	≥ 20 typ. 25	≥ 7 typ. 8	≥ 35 typ. 40

Microwave power transistor BLS2731-50

FEATURES

- Suitable for short and medium pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

- Common base class-C pulsed power amplifiers for radar applications in the 2.7 to 3.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT422A) with the common base connected to the flange.

PINNING SOT422A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

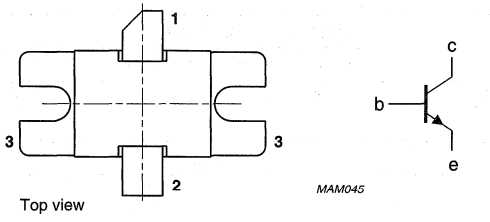


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (GHz)	V_{CB} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed class-C	2.7 to 3.1	40	60	typ. 8	typ. 40

WARNING
Product and environmental safety - toxic materials
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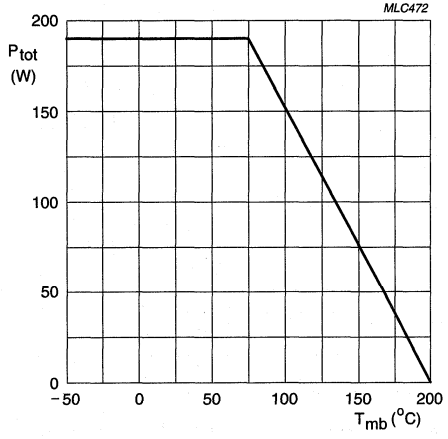
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_{CM}	peak collector current	$t_p \leq 100$ μs; $\delta \leq 10$ %	–	6	A
P_{tot}	total power dissipation	t_p = 100 μs; δ = 10 %; T_{mb} = 25 °C	–	180	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	+200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic cap; $t \leq 10$ s	–	+235	°C



t_p = 100 μs; δ = 10 %

Fig.2 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 100 °C	1.69	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 100 μs; δ = 10 %; notes 1 and 2	0.44	K/W

Notes

1. See "*Mounting recommendations in the General part of handbook SC15*".
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 15 mA; open emitter	70	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 15 mA; V_{BE} = 0	65	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 40 V; I_E = 0	–	–	1.5	mA
I_{CES}	collector leakage current	V_{CE} = 40 V; V_{BE} = 0	–	–	3	mA
I_{EBO}	emitter leakage current	V_{EB} = 1.5 V; I_C = 0	–	–	0.3	mA
h_{FE}	DC current gain	V_{CB} = 5 V; I_C = 1.5 A	25	–	–	
C_c	collector capacitance (die only)	V_{CE} = 1 V; $I_E = i_e$ = 0; f = 1 MHz	–	30	–	pF

APPLICATION INFORMATION

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

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Class-C; t_p = 100 μs; δ = 10 %	2.7 to 2.9	40	≥ 50 typ. 60	≥ 7 typ. 8	≥ 35 typ. 40

Microwave power transistor — BLS2731-110

FEATURES

- Suitable for short and medium pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

- Common base class-C pulsed power amplifiers for radar applications in the 2.7 to 3.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT423A) with the common base connected to the flange.

PINNING - SOT423A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

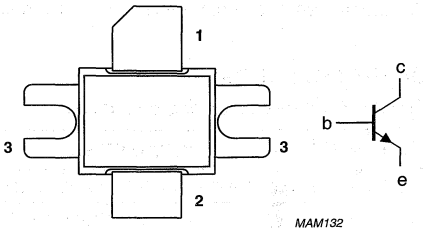


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

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

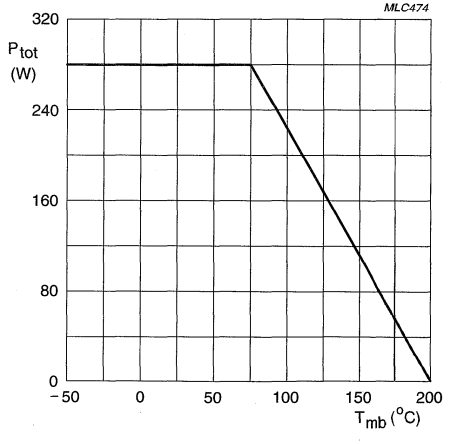
MODE OF OPERATION	f (GHz)	V_{CB} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed class-C	2.7 to 3.1	40	120	typ. 7	typ. 35

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_{CM}	peak collector current	$t_p \leq 100$ μs; $\delta \leq 10$ %	–	12	A
P_{tot}	total power dissipation	t_p = 100 μs; δ = 10 %; T_{mb} = 25 °C	–	280	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic cap; t ≤ 10 s	–	235	°C



t_p = 100 μs; δ = 10 %.

Fig.2 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 100 °C	1	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 100 μs; δ = 10 %; notes 1 and 2	0.3	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 45 mA; open emitter	70	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 45 mA; V_{BE} = 0	65	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 40 V; I_E = 0	–	–	3	mA
I_{CES}	collector leakage current	V_{CE} = 40 V; V_{BE} = 0	–	–	6	mA
I_{EBO}	emitter leakage current	V_{EB} = 1.5 V; I_C = 0	–	–	0.6	mA
h_{FE}	DC current gain	V_{CB} = 5 V; I_C = 3 A	25	–	–	
C_c	collector capacitance (die only)	V_{CE} = 1 V; $I_E = i_e$ = 0; f = 1 MHz	–	60	–	pF

APPLICATION INFORMATION

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

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_P (dB)	η_C (%)
Class-C; t_p = 100 μs; δ = 10 %	2.7 to 3.1	40	≥ 110 typ. 120	≥ 6.5 typ. 7	≥ 33 typ. 35

Microwave power transistor | BLS2731-150

FEATURES

- Matched internally to 50 Ω
- Suitable for short and medium and long pulse applications
- Internal input and output matching networks for an easy circuit design
- Emitter ballasting resistors improve ruggedness
- Gold metallization ensures excellent reliability
- Interdigitated emitter-base structure provides high emitter efficiency
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

- Common base class-C pulsed power amplifiers for radar applications in the 2.7 to 3.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT469A) with the common base connected to the flange.

PINNING - SOT469A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

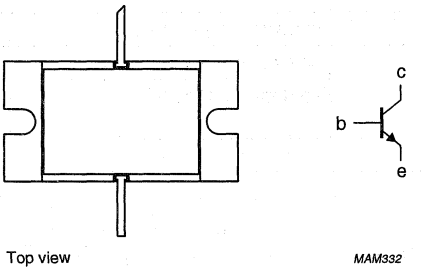


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

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

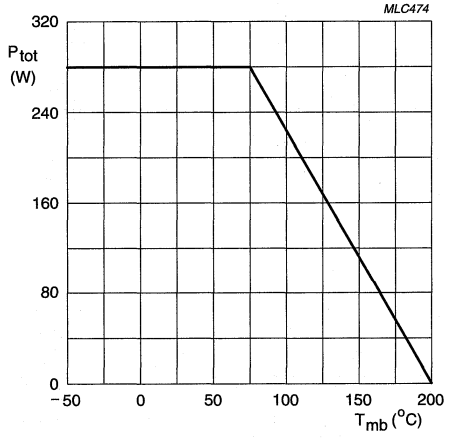
MODE OF OPERATION	f (GHz)	V_{CB} (V)	P_L (W)	G_p (dB)	η_C (%)
Pulsed class-C	2.7 to 3.1	40	typ.170	typ. 8	typ. 40

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	70	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_{CM}	peak collector current	$t_p \leq 300$ μs; $\delta \leq 10\%$	–	12	A
P_{tot}	total power dissipation	t_p = 300 μs; δ = 10%; T_{mb} = 25 °C	–	280	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	+200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic cap; $t \leq 10$ s	–	+235	°C



t_p = 100 μs; δ = 10%.

Fig.2 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 100 °C	1	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 100 μs; δ = 10 %; notes 1 and 2	0.3	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15".*
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 45 mA; open emitter	70	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 45 mA; V_{BE} = 0	65	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 40 V; I_E = 0	–	–	3	mA
I_{CES}	collector leakage current	V_{CE} = 40 V; V_{BE} = 0	–	–	6	mA
I_{EBO}	emitter leakage current	V_{EB} = 1.5 V; I_C = 0	–	–	0.6	mA
h_{FE}	DC current gain	V_{CB} = 5 V; I_C = 3 A	25	–	–	
C_c	collector capacitance (die only)	V_{CE} = 1 V; $I_E = i_e$ = 0; f = 1 MHz	–	60	–	pF

APPLICATION INFORMATION

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

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
Class-C; t_p = 100 μs; δ = 10%	2.7 to 3.1	40	≥ 150 typ. 170	≥ 7 typ. 8	≥ 35 typ. 40

NPN microwave power transistor LAE4001R

FEATURES

- Self-aligned process entirely ion implanted and gold sandwich metallization
- Optimum temperature profile
- Excellent performance and reliability.

APPLICATIONS

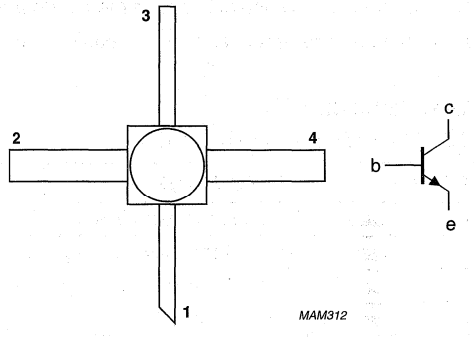
Common emitter class A linear power amplifiers up to 4 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT100 metal ceramic package with emitter connected to the metallized lid. A miniature ceramic encapsulation is used for compatibility with stripline microwave circuits.

PINNING - SOT100

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



Marking code: R8.

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{case} = 25 °C in a common emitter class A circuit.

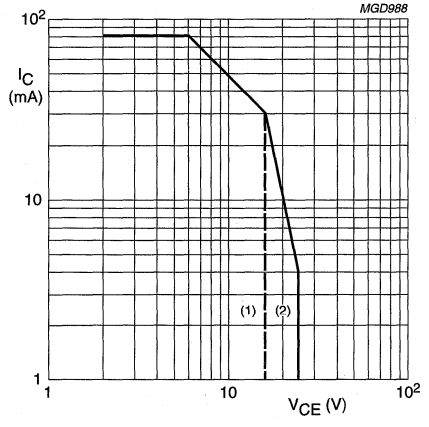
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
CW linear amplifier	4	15	25	>85	>8.5	typ.7 + j22	typ. 10 + j38

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	30	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	collector current (DC)		–	80	mA
P_{tot}	total power dissipation	$T_{case} \leq 100$ °C	–	480	mW
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s	–	235	°C



$T_{case} \leq 100$ °C; $R_{BE} < 220$ Ω.
(1) V_{CEO}.
(2) V_{CER}.

Fig.2 DC SOAR.

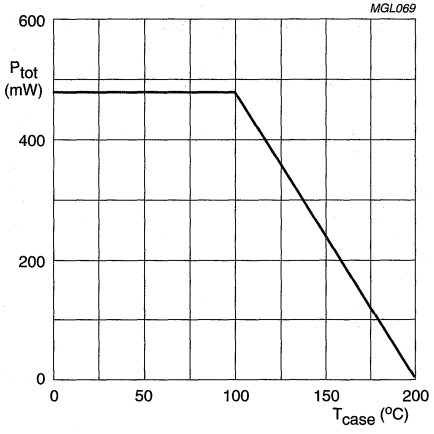


Fig.3 Power derating curve.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	T_j = 75 °C	210	K/W

CHARACTERISTICS

T_{case} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 15 V; I_E = 0	–	–	100	nA
		V_{CB} = 30 V; I_E = 0	–	–	100	μA
I_{CER}	collector cut-off current	V_{CB} = 25 V; R_{BE} = 220 Ω	–	–	500	μA
I_{EBO}	emitter cut-off current	I_C = 0 V; V_{EB} = 1.5 V	–	–	35	nA
C_{cb}	collector-base capacitance	$I_E = I_C$ = 0; V_{CB} = 15 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.25	–	pF
C_{ce}	collector-base capacitance	$I_E = I_C$ = 0; V_{CE} = 15 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.5	–	pF
C_{eb}	collector-base capacitance	$I_E = I_C$ = 0; V_{EB} = 1.0 V; V_{CB} = 15 V; f = 1 MHz	–	1.3	–	pF
$\lvert s_{fe}\rvert^2$	forward power gain	I_C = 25 mA; V_{CE} = 15 V; f = 2 GHz	–	9.6	–	dB
		I_C = 25 mA; V_{CE} = 15 V; f = 4 GHz	–	3.8	–	dB
G_{AM}	maximum available gain	I_C = 25 mA; V_{CE} = 15 V; f = 2 GHz	–	16	–	dB
		I_C = 25 mA; V_{CE} = 15 V; f = 4 GHz	–	10	–	dB
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 25 mA	20	–	220	

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor LAE4002S

FEATURES

- Diffused emitter ballasting resistors
- Self-aligned process entirely ion implanted and gold sandwich metallization
- Optimum temperature profile
- Excellent performance and reliability.

APPLICATIONS

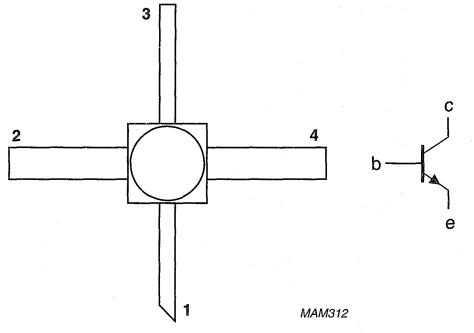
Common emitter class A linear power amplifiers up to 4 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT100 metal ceramic package with emitter connected to the metallized lid. A miniature ceramic encapsulation is used for compatibility with stripline microwave circuits.

PINNING - SOT100

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



Marking code: R9.

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{case} = 25 °C in a common emitter class A circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
CW linear amplifier	4	18	30	>126	>7.5	typ. 4 + j23	typ. 6.5 + j32

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

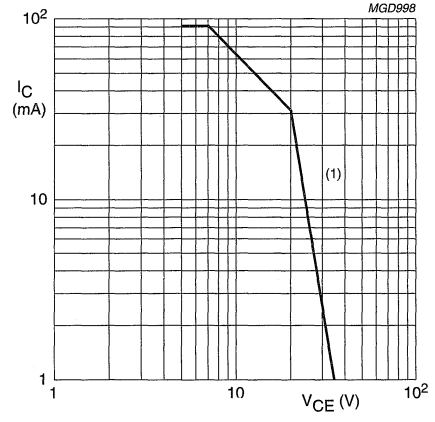
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	35	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	90	mA
P_{tot}	total power dissipation	$T_{case} \leq 75$ °C	–	625	mW
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.1 mm from ceramic.



$T_{case} \leq 75$ °C; $R_{BE} < 220\Omega$.
(I) Second breakdown limit (independent of temperature).

Fig.2 DC SOAR.

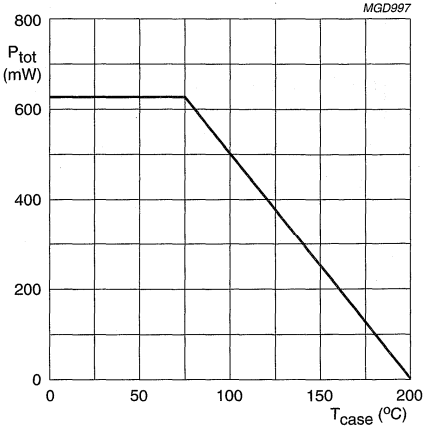


Fig.3 Power derating curve.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	T_j = 75 °C	200	K/W

CHARACTERISTICS

T_{case} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	100	nA
		V_{CB} = 40 V; I_E = 0	–	–	150	μA
I_{CER}	collector cut-off current	V_{CB} = 35 V; R_{BE} = 220 Ω	–	–	500	μA
I_{EBO}	emitter cut-off current	I_C = 0 V; V_{EB} = 1.5 V	–	–	50	nA
C_{cb}	collector-base capacitance	$I_E = I_C$ = 0; V_{CB} = 18 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.3	–	pF
C_{ce}	collector-base capacitance	$I_E = I_C$ = 0; V_{CE} = 18 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.55	–	pF
C_{eb}	collector-base capacitance	$I_E = I_C$ = 0; V_{EB} = 1.0 V; V_{CB} = 18 V; f = 1 MHz	–	1.8	–	pF
$\lvert s_{fe}\rvert^2$	forward power gain	I_C = 30 mA; V_{CE} = 18 V; f = 2 GHz	–	8.8	–	dB
		I_C = 30 mA; V_{CE} = 18 V; f = 4 GHz	–	2.8	–	dB
G_{AM}	maximum available gain	I_C = 30 mA; V_{CE} = 18 V; f = 2 GHz	–	14	–	dB
		I_C = 30 mA; V_{CE} = 18 V; f = 3 GHz	–	11	–	dB
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 30 mA	15	–	150	

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistors

LBE2003S; LBE2009S; LCE2009S

FEATURES

- Diffused emitter ballasting resistors
- Self-aligned process entirely ion implanted and gold metallization
- Optimum temperature profile
- Excellent performance and reliability.

APPLICATIONS

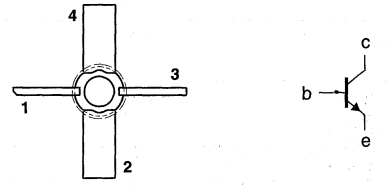
- Common emitter class-A linear power amplifiers up to 4 GHz.

DESCRIPTION

The LBE2003S and LBE2009S are NPN silicon planar epitaxial microwave power transistors in a SOT441A metal ceramic studless package.The LCE2009S is a maintenance type in a SOT442A metal ceramic capstan package.

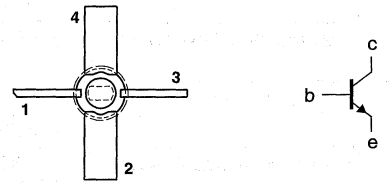
PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



Marking code: LBE2003S = 407; LBE2009S = 409.

Fig.1 Simplified outline and symbol (SOT441A).



Marking code: LCE2009S = 408.

Fig.2 Simplified outline and symbol (SOT442A).

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A amplifier.

TYPE NUMBER	MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
LBE2003S	Class-A (CW) linear	2	18	30	≥200	≥10	6.2 + j30	17.5 + j7
LBE2009S	Class-A (CW) linear	2	18	110	≥700	≥9	7.5 + j15	17.5 + j39
LCE2009S								

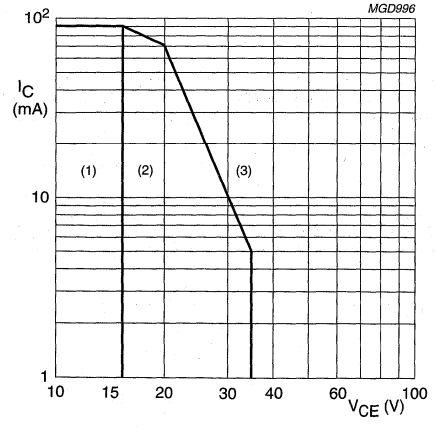
WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After 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.

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter		40	V
V_{CER}	collector-emitter voltage				
	LBE2003S	R_{BE} = 220 Ω	–	35	V
	LBE2009S; LCE2009S	R_{BE} = 100 Ω	–	35	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)				
	LBE2003S		–	90	mA
	LBE2009S; LCE2009S		–	250	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C			
	LBE2003S		–	1.4	W
	LBE2009S; LCE2009S		–	3.5	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.3 mm from case; t = 10 s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 220$ Ω.
(3) Second breakdown limit (independent of temperature).

Fig.3 DC SOAR; LBE2003S.

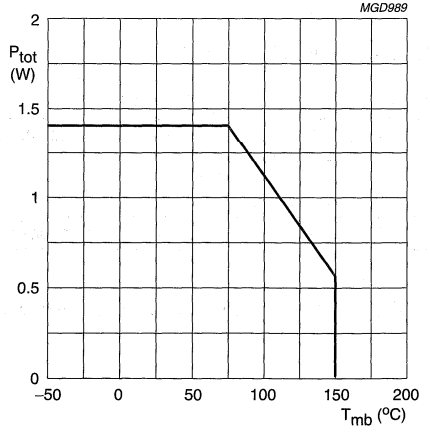


Fig.4 Power dissipation derating as a function of mounting-base temperature; LBE2003S.

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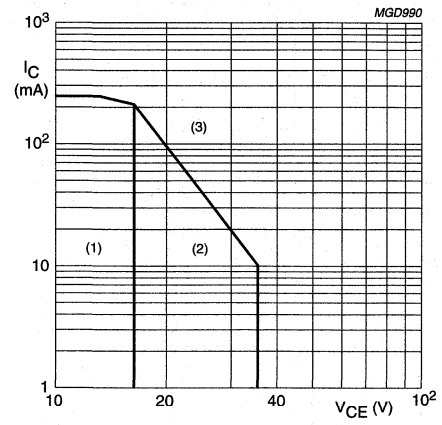

$T_{mb} \leq 75$ °C.

(1) Region of permissible DC operation.

(2) Permissible extension provided $R_{BE} \leq 100\ \Omega$.

(3) Second breakdown limit (independant of temperature).

Fig.5 DC SOAR; LBE2009S, LCE2009S

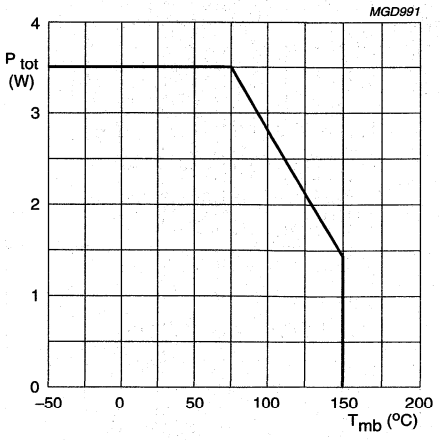

Fig.6 Power dissipation derating as a function of mounting-base temperature; LBE2009S, LCE2009S.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	$T_j = 75$ °C; note 1		
	LBE2003S		65	K/W
	LBE2009S; LCE2009S		36	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	$T_j = 75$ °C; note 1	1.5	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

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CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	0.1	μA
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0				
	LBE2003S		–	–	150	μA
	LBE2009S; LCE2009S		–	–	250	μA
I_{CER}	collector cut-off current					
	LBE2003S	V_{CB} = 35 V; R_{BE} = 220 Ω	–	–	500	μA
	LBE2009S; LCE2009S	V_{CB} = 35 V; R_{BE} = 100 Ω	–	–	1000	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0				
	LBE2003S		–	–	0.05	μA
	LBE2009S; LCE2009S		–	–	0.2	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 30 mA	15	–	150	
		V_{CE} = 5 V; I_C = 110 mA	15	–	150	
C_{cb}	collector-base capacitance	V_{CB} = 18 V; V_{EB} = 1.5 V; I_E = I_C = 0; f = 1 MHz				
	LBE2003S		–	0.3	–	pF
	LBE2009S; LCE2009S		–	0.6	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 18 V; V_{EB} = 1.5 V; I_E = I_C = 0; f = 1 MHz				
	LBE2003S		–	0.45	–	pF
	LBE2009S; LCE2009S		–	0.6	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; I_E = I_C = 0; f = 1 MHz				
	LBE2003S		–	1.7	–	pF
	LBE2009S; LCE2009S		–	3.3	–	pF

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

Table 1 Scattering parameters LBE2003S: V_{CE} = 18 V; I_C = 30 mA (V_{CE} and I_C regulated); T_{mb} = 25 °C; Z_o = 50 Ω; typical values. (The figures given between brackets are values in dB).

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
500	0.56	−143	0.037 (−28.6)	41	9.50 (19.6)	101	0.56	−34
600	0.55	−154	0.040 (−28.0)	39	8.28 (18.4)	93	0.51	−35
700	0.55	−164	0.040 (−27.9)	40	7.13 (17.1)	88	0.50	−36
800	0.55	−171	0.041 (−27.7)	40	6.35 (16.1)	82	0.49	−37
900	0.55	−178	0.043 (−27.4)	41	5.69 (15.1	77	0.47	−38
1000	0.55	176	0.045 (−26.9)	40	5.14 (14.2	72	0.46	−39
1100	0.55	170	0.048 (−26.4)	40	4.72 (13.5	68	0.46	−39
1200	0.55	165	0.051 (−25.9)	41	4.37 (12.8	64	0.45	−41
1300	0.56	159	0.056 (−25.1)	41	4.05 (12.2	60	0.44	−44
1400	0.55	158	0.060 (−24.5)	41	3.76 (11.5	57	0.45	−46
1500	0.55	149	0.062 (−24.2)	40	3.52 (10.9	53	0.43	−48
1600	0.55	146	0.065 (−23.8)	42	3.33 (10.5	50	0.43	−50
1700	0.56	142	0.068 (−23.3)	42	3.15 (10.0	46	0.43	−53
1800	0.57	137	0.070 (−23.1)	41	2.96 (9.4)	42	0.43	−54
1900	0.57	132	0.072 (−22.9)	40	2.80 (8.9)	39	0.43	−56
2000	0.58	128	0.074 (−22.7)	40	2.66 (8.5)	36	0.42	−57
2200	0.60	121	0.081 (−21.8)	39	2.43 (7.7)	28	0.41	−61
2400	0.62	114	0.091 (−20.8)	37	2.24 (7.0)	23	0.40	−67
2600	0.64	108	0.099 (−20.1)	36	2.08 (6.4)	16	0.39	−75
2800	0.66	102	0.105 (−19.6)	33	1.90 (5.6)	10	0.38	−82
3000	0.68	96	0.108 (−19.4)	31	1.79 (5.1)	4	0.39	−87
3200	0.71	92	0.124 (−18.7)	29	1.63 (4.3)	−2	0.37	−94
3400	0.73	89	0.125 (−18.0)	27	1.58 (4.0)	−7	0.40	−101
3600	0.75	86	0.137 (−17.3)	25	1.46 (3.3)	−13	0.39	−112
3800	0.76	82	0.142 (−17.0)	23	1.40 (2.9)	−18	0.38	−120
4000	0.77	79	0.149 (−16.6)	20	1.31 (2.3)	−24	0.38	−128
4200	0.78	75	0.155 (−16.2)	17	1.25 (1.9)	−28	0.38	−133
4400	0.80	73	0.167 (−15.5)	15	1.20 (1.6)	−34	0.39	−142
4600	0.81	69	0.177 (−15.0)	12	1.14 (1.1)	−38	0.39	−151
4800	0.81	68	0.187 (−14.6)	10	1.10 (0.8)	−43	0.42	−159
5000	0.81	65	0.194 (−14.3)	6	1.04 (0.4)	−47	0.44	−165
5200	0.80	60	0.203 (−13.8)	4	1.03 (0.3)	−53	0.47	−169
5400	0.81	56	0.219 (−13.2)	−1	0.98 (−0.2)	−57	0.48	−175
5600	0.81	51	0.229 (−12.8)	−3	0.97 (−0.3)	−62	0.49	−178
5800	0.81	48	0.243 (−12.3)	−8	0.92 (−0.7)	−68	0.51	−171
6000	0.80	44	0.245 (−12.2)	−12	0.90 (−0.9)	−72	0.55	−165

Table 2 Scattering parameters LBE2009S; LCE2009S: V_{CE} = 18 V; I_C = 110 mA (V_{CE} and I_C regulated); T_{mb} = 25 °C; Z_o = 50 Ω; typical values. (The figures given between brackets are values in dB).

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
500	0.70	177	0.029 (–30.7)	50	7.55 (17.6)	83	0.25	–48
600	0.70	171	0.033 (–29.6)	51	6.43 (16.2)	77	0.22	–50
700	0.70	168	0.036 (–29.0)	53	5.46 (14.6)	73	0.23	–52
800	0.70	163	0.039 (–28.4)	54	4.80 (13.6)	68	0.22	–54
900	0.71	159	0.041 (–27.8)	54	4.27 (12.6)	64	0.22	–56
1000	0.71	155	0.045 (–27.0)	55	3.84 (11.7)	60	0.21	–59
1100	0.71	151	0.049 (–26.2)	54	3.53 (11.0)	56	0.21	–62
1200	0.71	148	0.054 (–25.4)	54	3.27 (10.3)	52	0.21	–65
1300	0.71	144	0.060 (–24.5)	53	3.01 (9.6)	48	0.20	–74
1400	0.72	143	0.066 (–23.6)	54	2.80 (9.0)	45	0.20	–79
1500	0.72	136	0.070 (–23.1)	52	2.61 (8.3)	41	0.21	–80
1600	0.72	133	0.075 (–22.5)	53	2.47 (7.9)	38	0.21	–83
1700	0.72	130	0.080 (–21.9)	51	2.33 (7.3)	34	0.22	–87
1800	0.73	127	0.084 (–21.5)	49	2.18 (6.8)	30	0.22	–90
1900	0.73	123	0.087 (–21.2)	48	2.05 (6.3)	26	0.22	–94
2000	0.74	120	0.090 (–20.9)	46	1.97 (5.9)	23	0.22	–97
2200	0.75	114	0.100 (–20.0)	43	1.78 (5.0)	15	0.22	–109
2400	0.77	108	0.112 (–19.0)	40	1.63 (4.3)	10	0.21	–122
2600	0.79	103	0.123 (–18.2)	37	1.51 (3.6)	2	0.24	–133
2800	0.80	97	0.129 (–17.8)	33	1.36 (2.7)	–4	0.25	–143
3000	0.81	92	0.134 (–17.5)	30	1.28 (2.1)	–11	0.27	–151
3200	0.83	88	0.143 (–16.9)	26	1.15 (1.2)	–17	0.28	–163
3400	0.85	85	0.152 (–16.4)	24	1.10 (0.9)	–21	0.30	–173
3600	0.86	82	0.163 (–15.8)	20	1.00 (0)	–28	0.34	178
3800	0.87	79	0.168 (–15.5)	17	0.96 (–0.4)	–32	0.37	173
4000	0.88	75	0.175 (–15.2)	14	0.88 (–1.1)	–39	0.41	168
4200	0.88	71	0.180 (–14.9)	11	0.83 (–1.6)	–42	0.42	162
4400	0.89	69	0.193 (–14.3)	8	0.79 (–2.1)	–48	0.45	155
4600	0.90	66	0.200 (–14.0)	5	0.74 (–2.6)	–51	0.48	149
4800	0.90	64	0.211 (–13.5)	2	0.71 (–3.0)	–56	0.52	145
5000	0.90	61	0.214 (–13.4)	–2	0.66 (–3.6)	–59	0.55	144

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

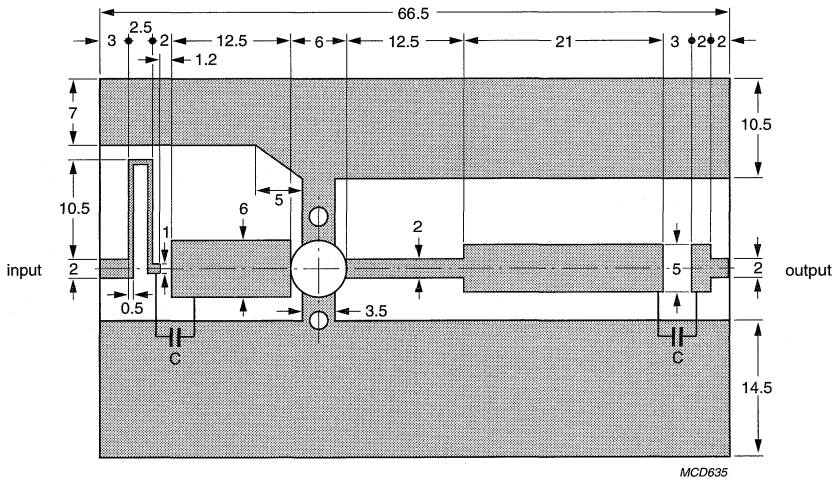
APPLICATION INFORMATION

Microwave performance for LBE2003S up to T_{mb} = 25 °C in a common emitter class-A test circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V) (2)	I_C (mA) (2)	P_{L1} (mW) (3)	G_{po} (dB) (4)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	2	18	30	≥200 (23) typ. 250 (24)	≥10 typ. 11	6.2 + j30	17.5 + j7

Notes

1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.
2. I_C and V_{CE} regulated.
3. Load power for 1 dB compressed power gain.
4. Low level power gain associated with P_{L1}.

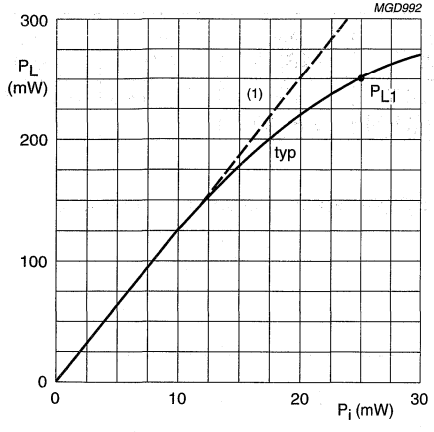


Dimensions in mm.

Striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.54); thickness: 0.8 mm.

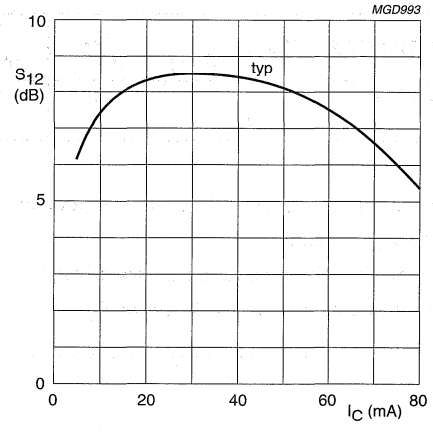
Fig.7 Prematching test circuit board for 2 GHz.

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15



f = 2 GHz; T_{mb} = 25 °C.
V_{CE} = 18 V; I_C = 30 mA.
(1) G_{po} = 11 dB.

Fig.8 Load power as a function of input power.



Class-A operation.
f = 2 GHz; T_{mb} = 25 °C; V_{CE} = 18 V.

Fig.9 s_{12} as a function of collector current.

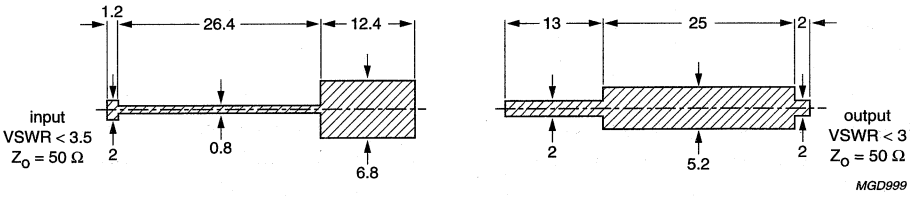
LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

Microwave performance for LBE2009S; LCE2009S up to T_{mb} = 75 °C in a common emitter class-A test circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V) (2)	I_C (mA) (2)	P_{L1} (mW) (3)	G_{po} (dB) (4)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	2	18	110	≥700 (28.5) typ. 900 (29.5)	≥9 typ. 9.8	7.5 + j14.5	17.5 + j38.5

Notes

1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.
2. I_C and V_{CE} regulated.
3. Load power for 1 dB compressed power gain.
4. Low level power gain associated with P_{L1}.

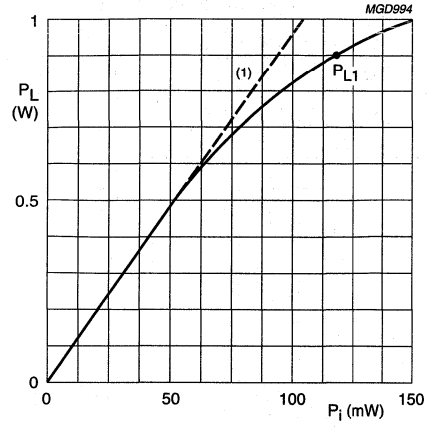


Dimensions in mm.

Striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.54); thickness: 0.8 mm.

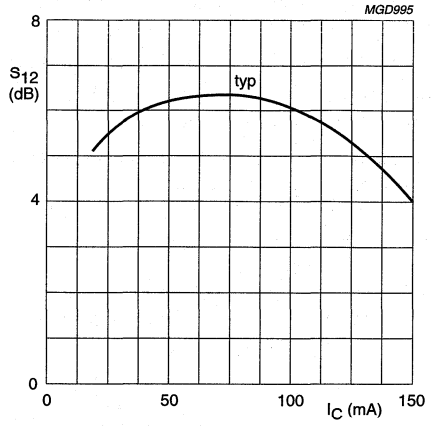
Fig.10 Prematching test circuit board for 2 GHz.

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15



f = 2 GHz; T_{mb} = 25 °C.
V_{CE} = 18 V; I_C = 110 mA.
(1) G_{po} = 9.8 dB.

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



Class-A operation.
f = 2 GHz; T_{mb} = 25 °C; V_{CE} = 18 V.

Fig.12 s_{12} as a function of collector current.

LCE2009S IS A MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor LEE1015T

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

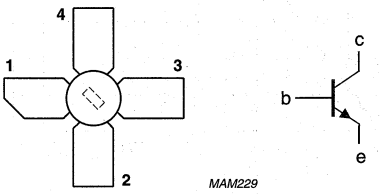
Intended for use in common emitter, class A power amplifiers for applications that require a high level of linearity.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT122A metal ceramic package.

PINNING - SOT122A

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



Marking code: 1015T.

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class A narrowband amplifier (guaranteed values).

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	d_{im} (dB)
Class A (CW)	860	20	140	>1	>13	<–57 note 1

Note

1. The stated intermodulation distortion level is referred to the total output power of 18.25 dBm, which corresponds to the sum of the power carried by each of the two equal amplitude tones at f_1 = 859 MHz and f_2 = 861 MHz.

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.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 10 Ω	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	500	mA
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	7.5	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

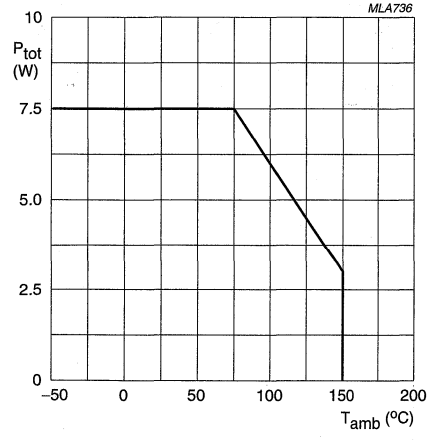
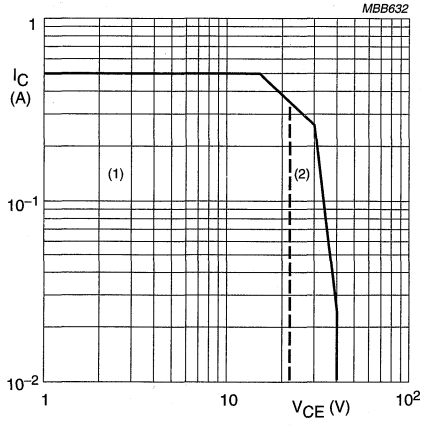


Fig.2 Maximum power dissipation derating as a function of mounting base temperature.



T_{mb} = 75 °C.
(1) Region of permissible DC operation.
(2) Possible extension provided $R_{BE} \leq 10\ \Omega$.

Fig.3 DC SOAR.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	12	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.6	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0	400	μA
I_{CER}	collector cut-off current	V_{CE} = 40 V; R_{BE} = 10 Ω	20	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	400	μA

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in the test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)
Class A	860	20	140	>1; typ. 1.3	>13; typ. 14.5

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor | LFE15600X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Common emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.7 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT448A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class AB (CW)	1.5	24	0.2	≥55	≥8	typ.50	see Figs 7 and 8

PINNING - SOT448A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

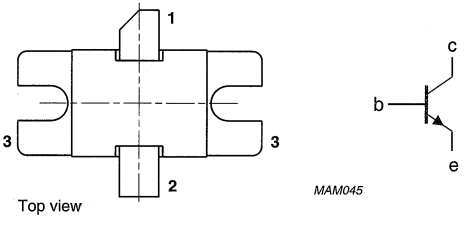


Fig.1 Simplified outline and symbol.

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 56 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	12	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	20	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	80	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

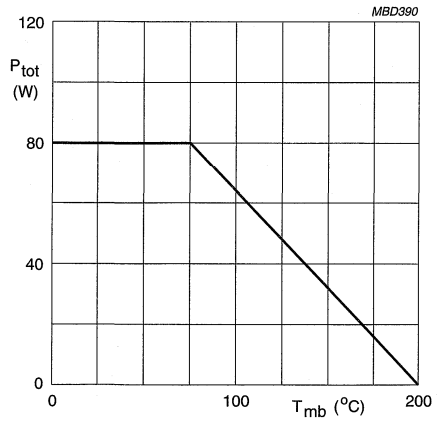


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

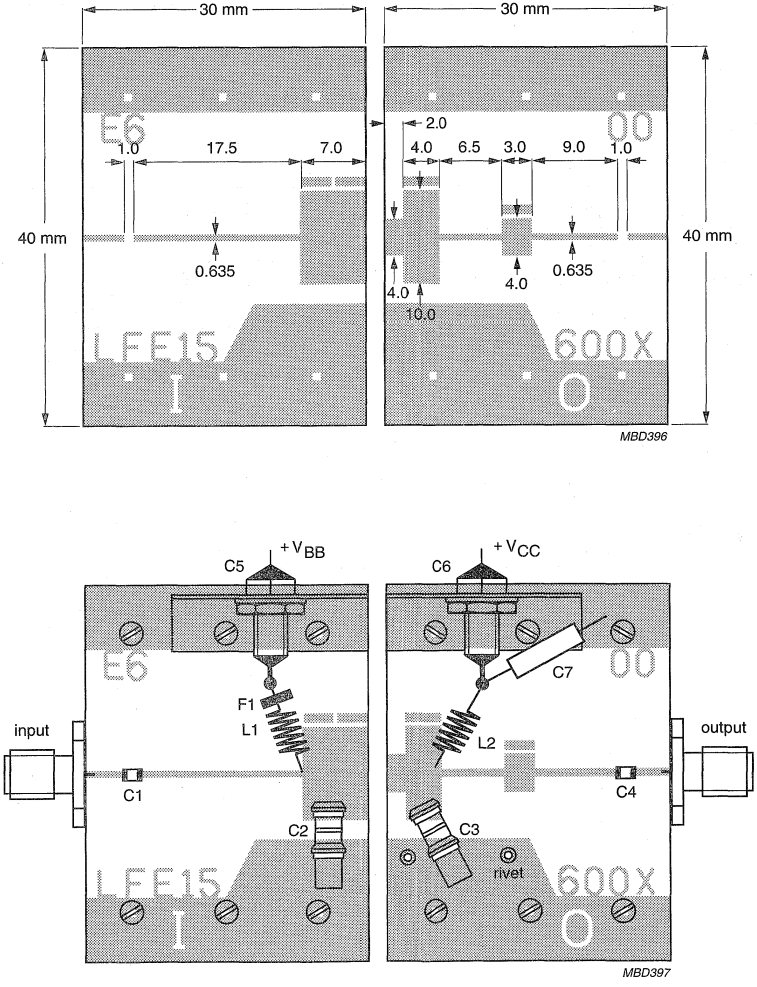
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	6	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 30 mA; R_{BE} = 56 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 30 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 30 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class AB (CW)	1.5	24	0.2	≥55 typ. 60	≥8 typ. 8.5	typ. 50	see Figs 7 and 8



The test circuit is split into 2 independent halves, each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

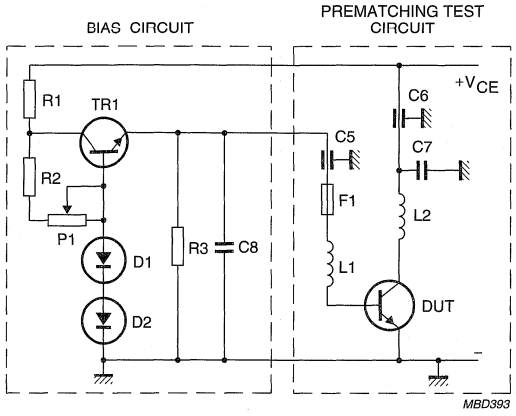


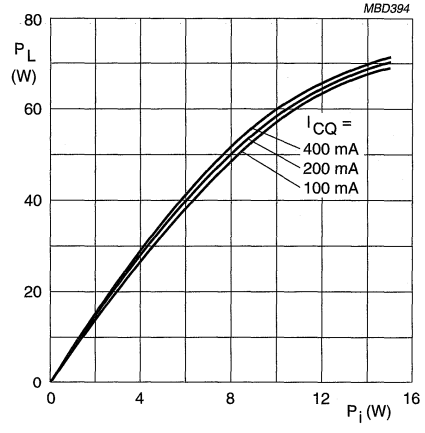
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

COMPONENT	DESCRIPTION	VALUE	TYPE NUMBERS
TR1	transistor		BDT91 or equivalent
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie, ref. 1250-003
C7, C8	tantalum capacitor	10 μF, 50 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	50 Ω, 0.25 W	
F1	ferrite bead		Philips tube 3.7 × 1.2 × 3.5 mm (3B)

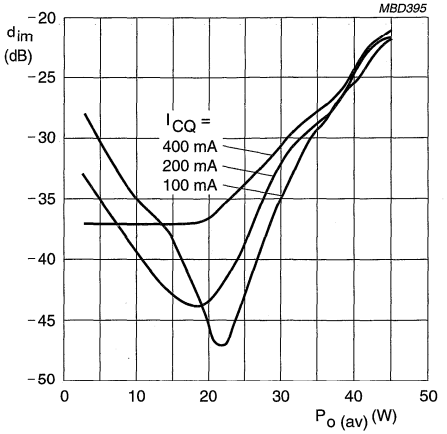
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1500 MHz.

Fig.5 Load power as a function of input power.



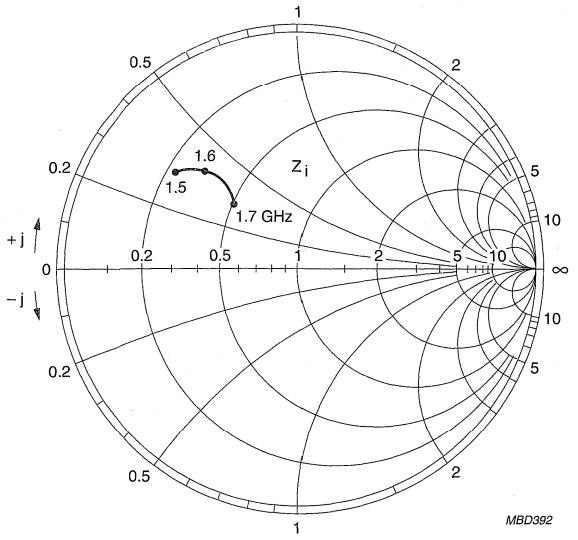
V_{CE} = 24 V; f_1 = 1500 MHz; f_2 = 1500.2 MHz.

Fig.6 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

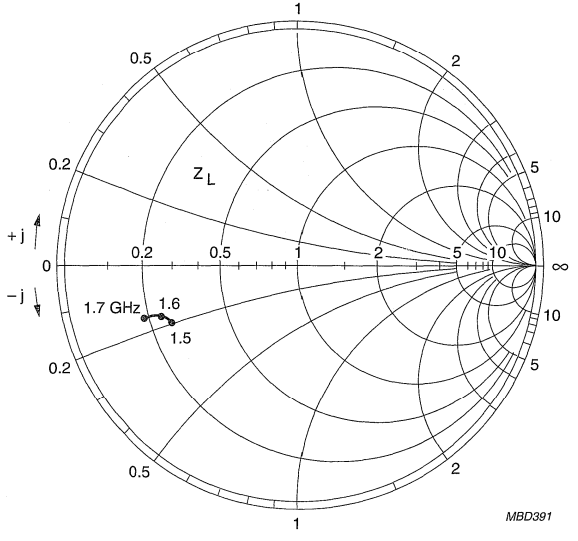
V_{CE} = 24 V; I_{CQ} = 0.2 A.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.50	2.4 + j3.4	2.4 − j1.8
1.55	3.0 + j3.6	2.3 − j1.7
1.60	3.5 + j3.8	2.2 − j1.6
1.65	4.2 + j3.8	2.1 − j1.5
1.70	4.8 + j2.5	1.8 − j1.5



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.7 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.2 A.

Fig.8 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor — LLE15180X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.4 GHz and 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.05	≥15	≥7.8	typ. 50	see Figs 6 and 7

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

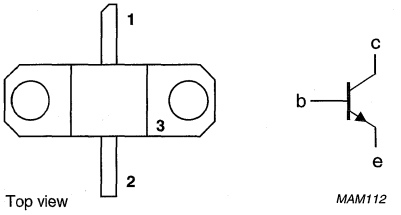


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	22	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	3	A
P_i	input power	f = 1.85 GHz; V_{CE} = 24 V; class AB	–	4	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	25	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

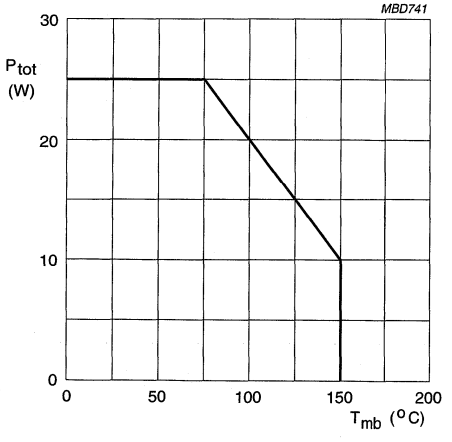


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	3.6	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

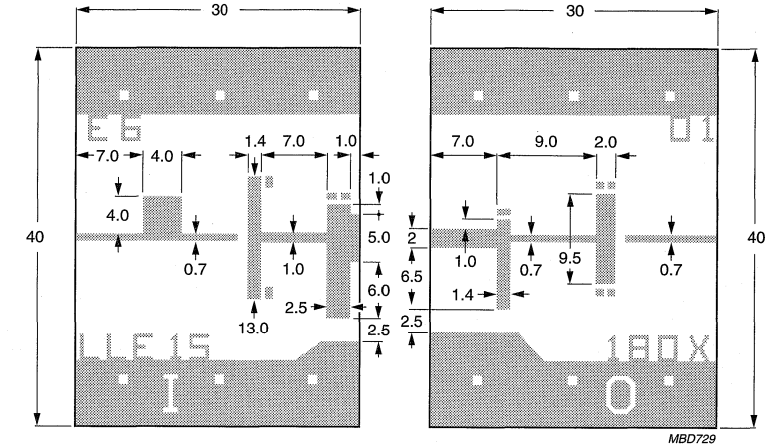
T_{mb} = 25 °C unless otherwise specified.

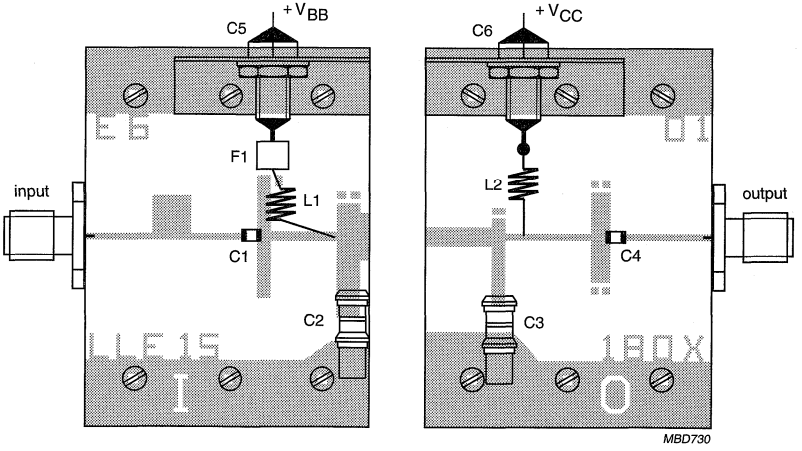
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	1.5	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 10 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 10 mA	3	–	V
h_{FE}	DC current gain	I_C = 0.5 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.05	≥15 typ. 18	≥7.8 typ. 8.2	typ. 50	see Figs 6 and 7





The test circuit is split into two independent halves, each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Prematching test circuit board.

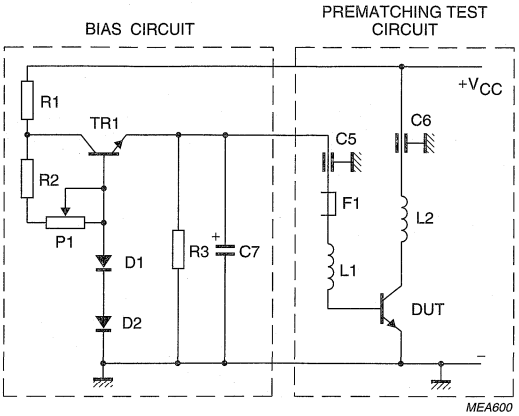


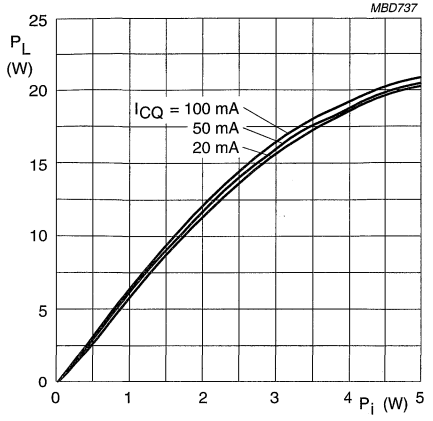
Fig.4 Class AB bias circuit.

List of components (see Figs 3 and 4)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)

Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



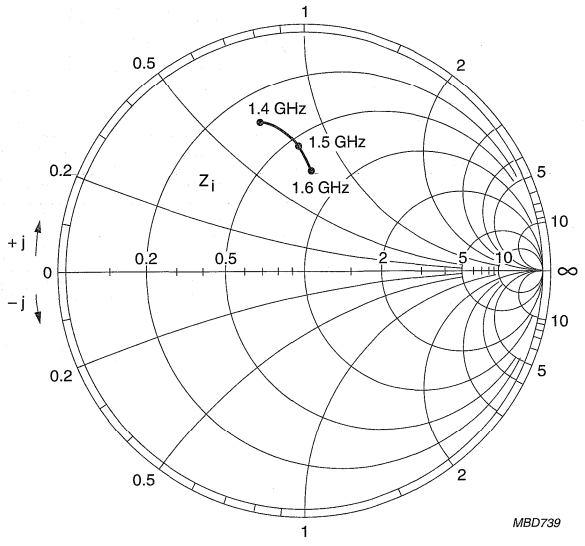
V_{CE} = 24 V; f = 1850 MHz.

Fig.5 Load power as a function of input power.

Input and optimum load impedances

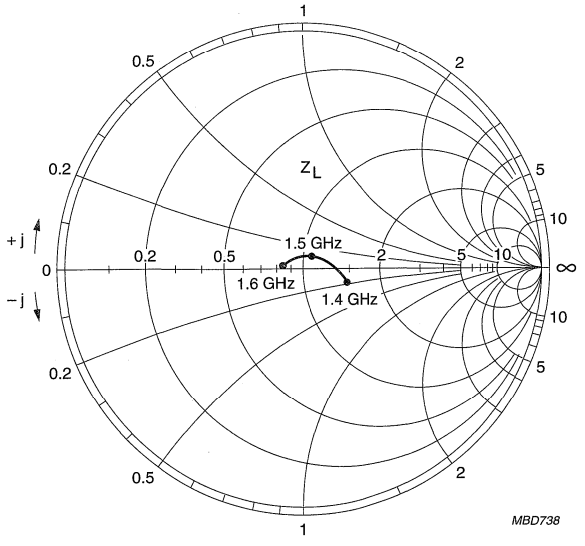
V_{CE} = 24 V; I_{CQ} = 50 mA; Z_o = 10 Ω (see Figs 6 and 7); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.40	3.7 + j6.9	14.0 – j1.8
1.45	4.6 + j7.4	12.5 + j0.5
1.50	5.8 + j7.7	11.0 + j0.1
1.55	7.4 + j7.8	9.7 + j0.4
1.60	9.3 + j7.4	8.5 + j0.3



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 50 mA.

Fig.6 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 W; I_{CQ} = 50 mA.

Fig.7 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN microwave power transistor LLE15370X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATION

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.4 GHz and 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.3	≥33	≥8	typ. 43	see Figs 8 and 9

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

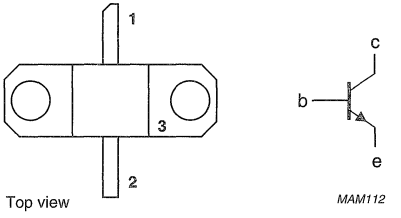


Fig.1 Simplified outline and symbol.

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

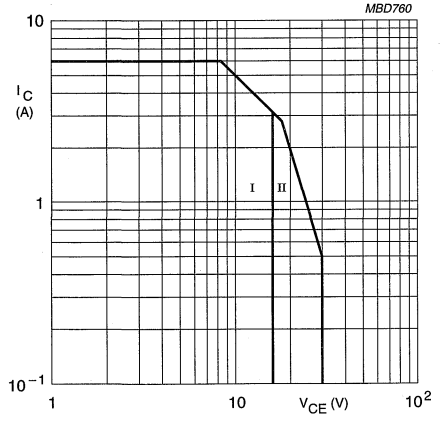
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	6	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	8	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	50	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

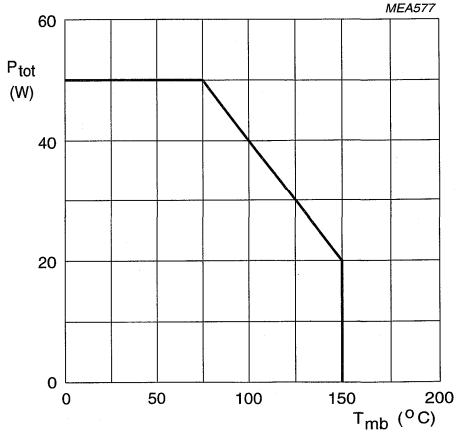


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	3	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 15 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 15 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 15 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 3 V	15	100	

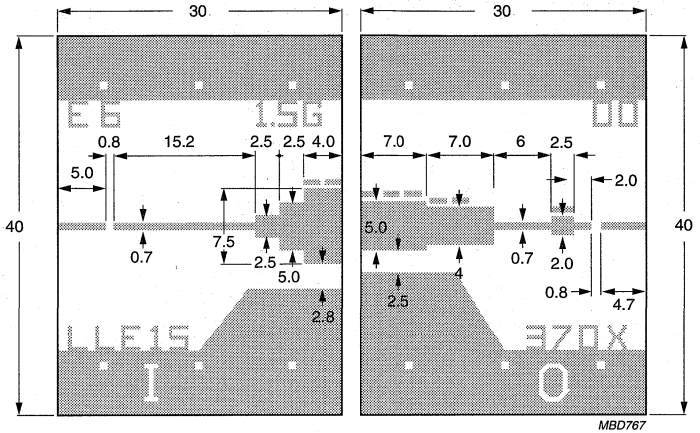
APPLICATION INFORMATION

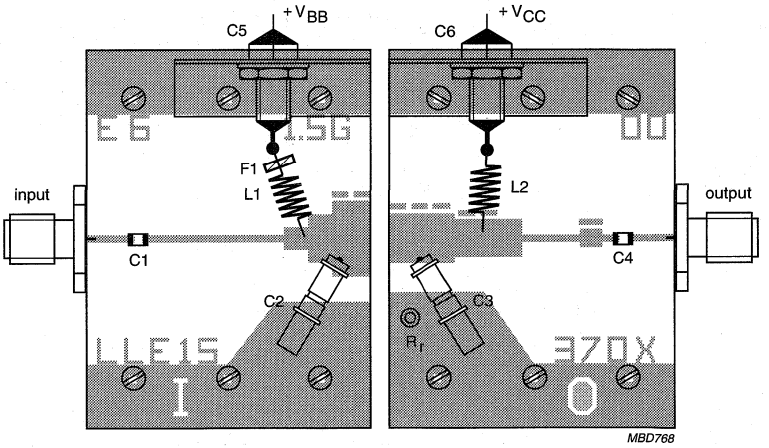
Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW) note 1	1.5	24	0.3	≥33; typ. 37	≥8; typ. 8.7	typ. 43	see Figs 8 and 9

Note

1. d_{im} is less than –30 dBc at P_o = 15 W (av); f = 200 kHz.





The test circuit is split into two independent halves, each being 30 × 30 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

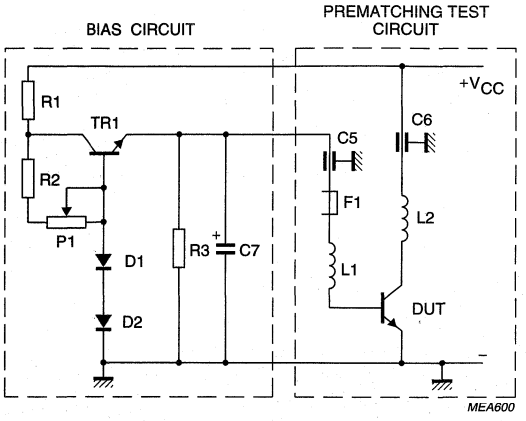


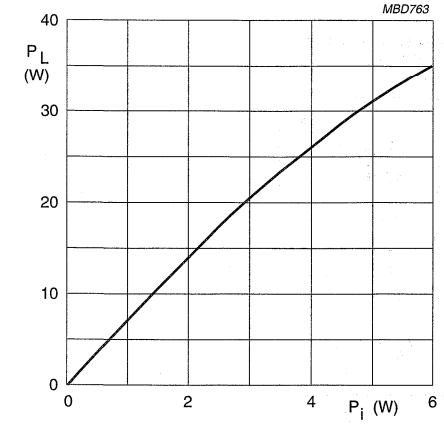
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)
R_r	copper rivet		

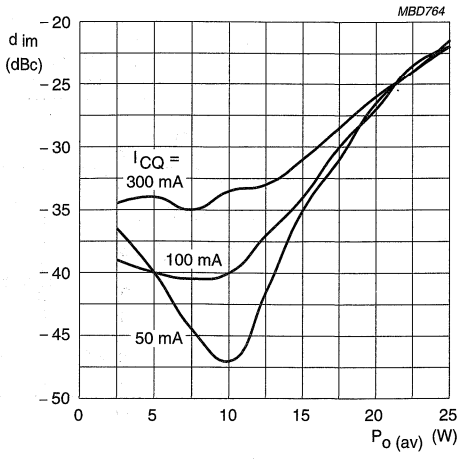
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1500 MHz.

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



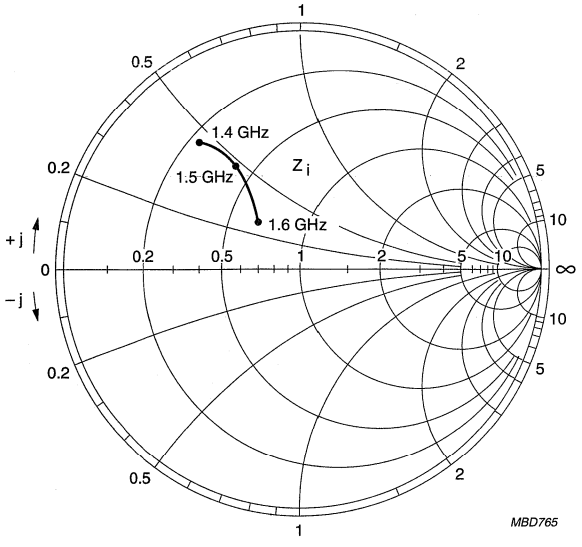
V_{CE} = 24 V; f_1 = 1500 MHz; f_2 = 1500.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

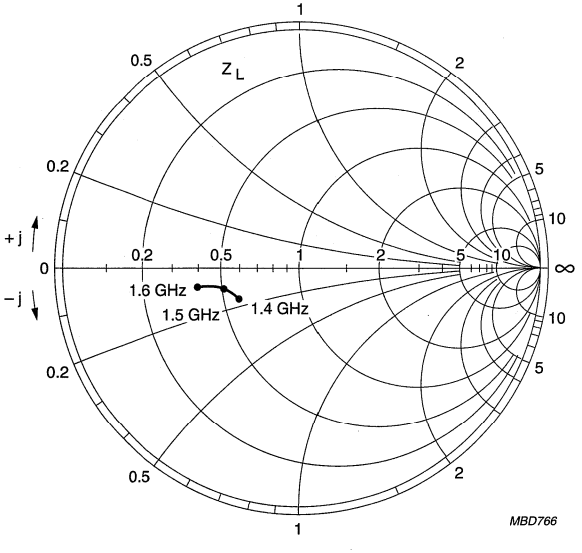
V_{CE} = 24 V; I_{CQ} = 0.3 A (see Figs 8 and 9).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.40	2.4 + j4.4	5.5 − j1.8
1.45	3.2 + j4.6	5.1 − j1.3
1.50	4.2 + j4.5	4.7 − j1.0
1.55	5.3 + j3.8	4.2 − j0.9
1.60	6.2 + j2.5	3.8 − j0.8



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.3 A.

Fig.8 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 W; I_{CQ} = 0.3 A.

Fig.9 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor — LLE16045X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.8 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_I; Z_L (Ω)
Class AB (CW)	1.65	24	0.04	≥4.5	≥8.5	typ. 50	see Figs 8 and 9

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

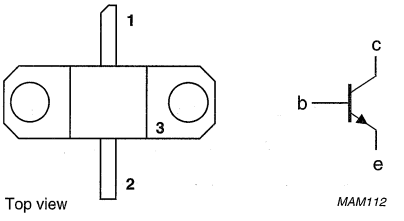


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

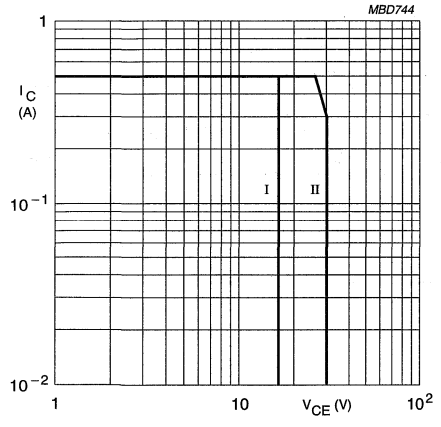
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	0.5	A
P_i	input power	f = 1.65 GHz; V_{CE} = 24 V; class AB	–	1	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	11	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

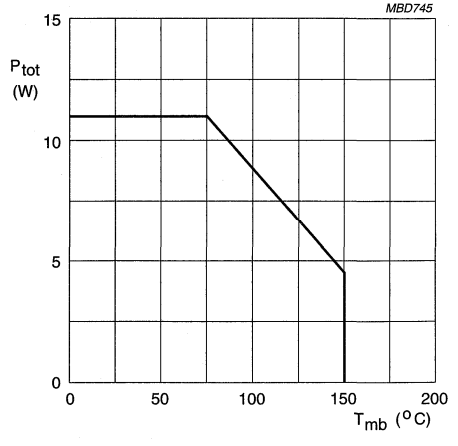


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	8.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

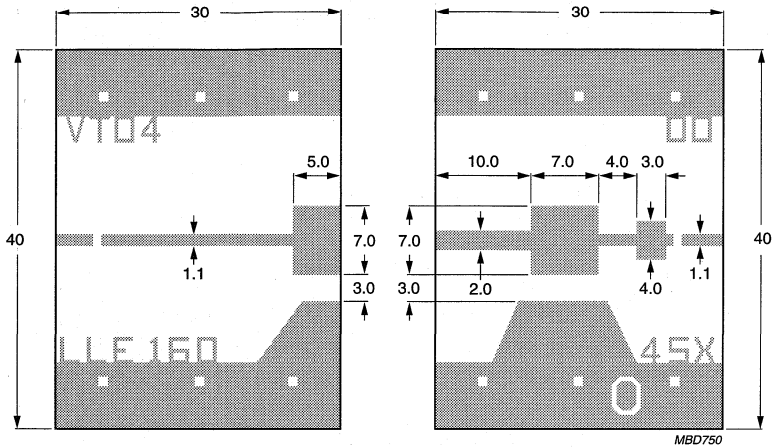
T_j = 25 °C unless otherwise specified.

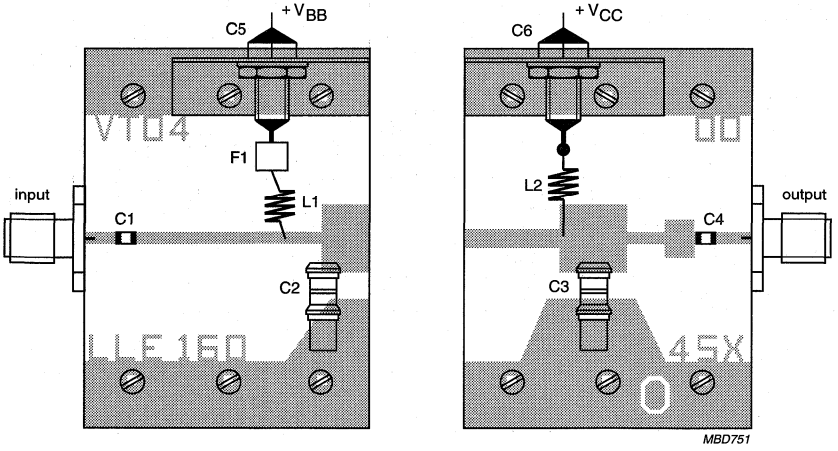
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	75	μA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 1 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 1 mA	3	–	V
h_{FE}	DC current gain	I_C = 0.25 A; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.04	≥4.5 typ. 5.5	≥8.5 typ. 9.5	typ. 50	see Figs 8 and 9





The test circuit is split into two independent halves, each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Teflon fibreglass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.4 Prematching test circuit board.

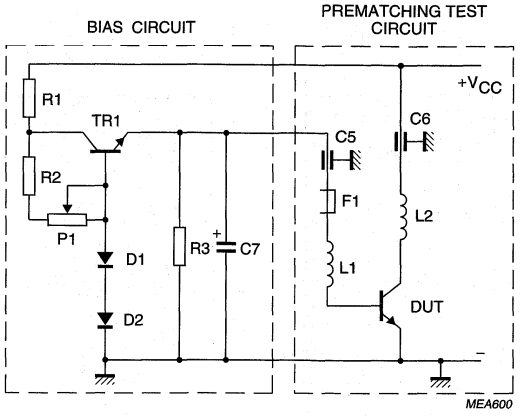


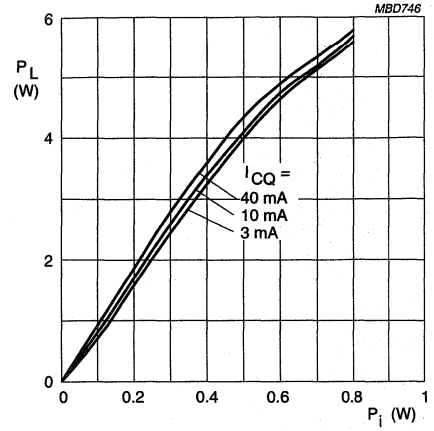
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BD239 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1SL
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	1.5 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)

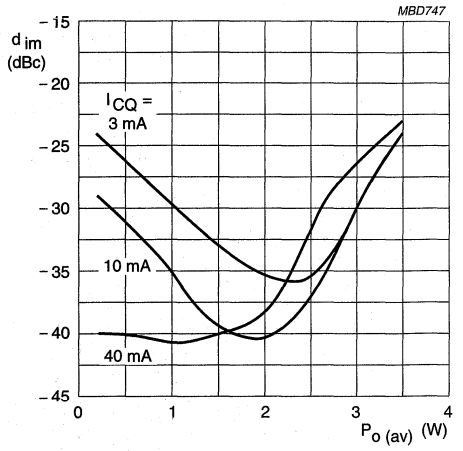
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1650 MHz.

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



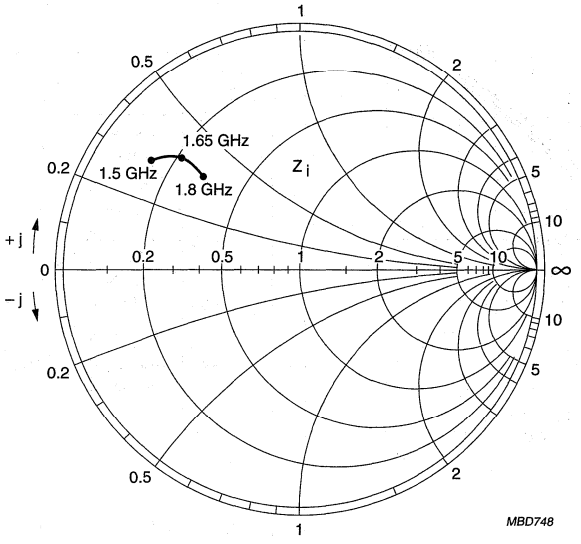
V_{CE} = 24 V; f_1 = 1650 MHz; f_2 = 1650.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

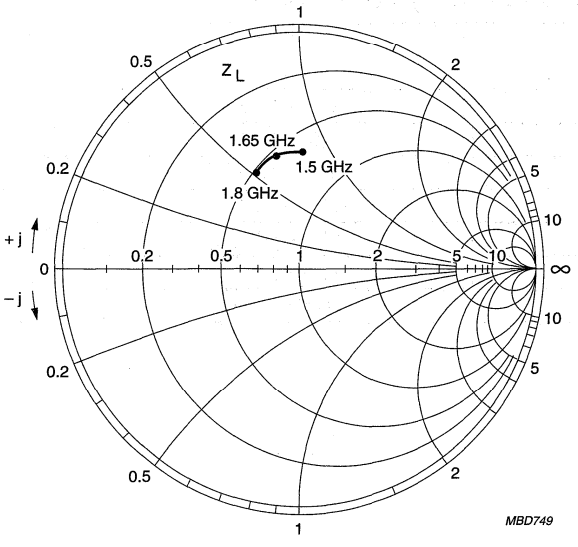
V_{CE} = 24 V; I_{CQ} = 40 mA (see Figs 8 and 9); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.50	6.8 + j14.2	6.1 + j8.3
1.55	7.9 + j15.1	5.8 + j7.8
1.60	9.2 + j16.0	5.6 + j7.3
1.65	10.9 + j16.8	5.4 + j6.9
1.70	13.0 + j17.5	5.2 + j6.4
1.75	15.5 + j17.8	5.0 + j6.0
1.80	18.6 + j17.6	4.8 + j5.5



V_{CE} = 24 V; Z_o = 50 Ω; I_{CQ} = 40 mA.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 W; I_{CQ} = 40 mA.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN microwave power transistor — LLE16120X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB power amplifiers in CW conditions for professional applications at 1.65 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.1	≥11	≥8.7	see Figs 8 and 9

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

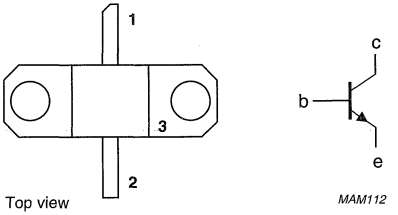


Fig.1 Simplified outline and symbol.

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

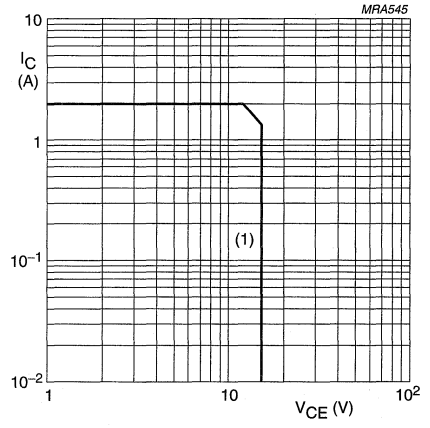
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	23	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note1	–	235	°C

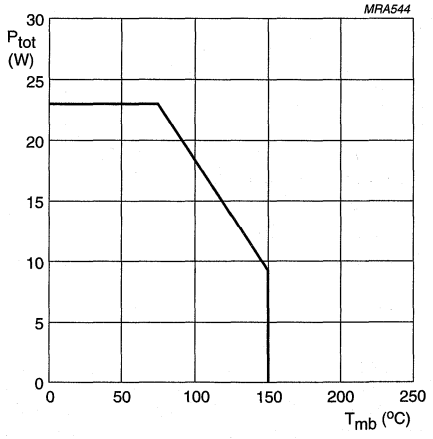
Note

1. Up to 0.2 mm from ceramic.



$T_{mb} \leq 75$ °C.
(I) Region of permissible DC operation.

Fig.2 DC SOAR.



$P_{tot\ max}$ = 23 W.

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	4.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	1	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 5 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 5 mA; I_B = 0	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 5 mA; I_C = 0	3	–	V
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 1 A	15	100	

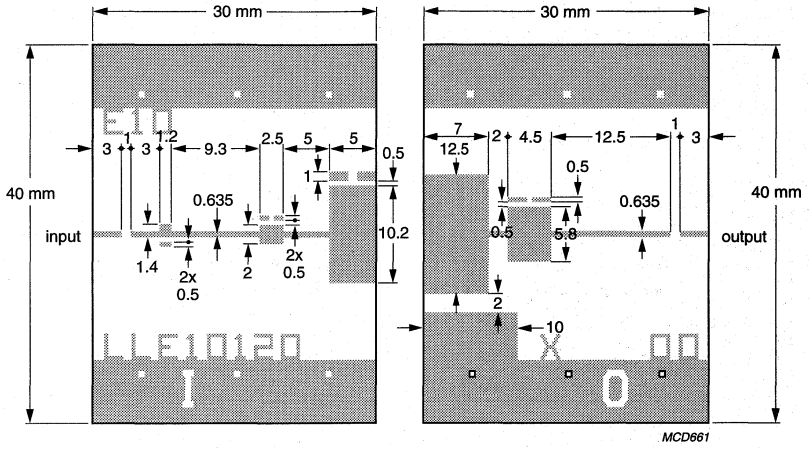
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier (note 1).

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.1	≥11; typ. 13	≥8.7; typ. 10.8	typ. 45	see Figs 8 and 9

Note

1. The test circuit is split into 2 independant halves each being 30 × 40 mm in size.



Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

List of components (see bias circuit)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT85 (or equivalent)		
D1	diode, BY239800 (or equivalent); note 1		
D2	diode, BY239800; note 2		
R1	resistor	100 Ω	
R2	resistor	3.3 kΩ	
R3	resistor	56 Ω	
P1	potentiometer, 10 turns (sfernice)	4.7 kΩ	
C1	electrolytic capacitor	10 μF, 40 V	
C5, C6	feedthrough bypass capacitor	1500 pF	Erie, ref. 1250-003
L1	5 turns 0.5 mm copper wire with ferrite bead		
L2	5 turns 0.5 mm copper wire		

Notes

1. In thermal contact with TR1.
2. In thermal contact with D.U.T.

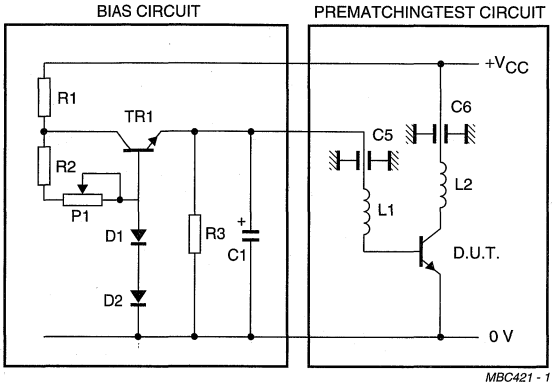
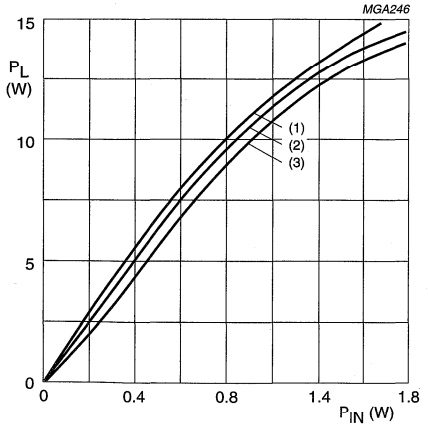
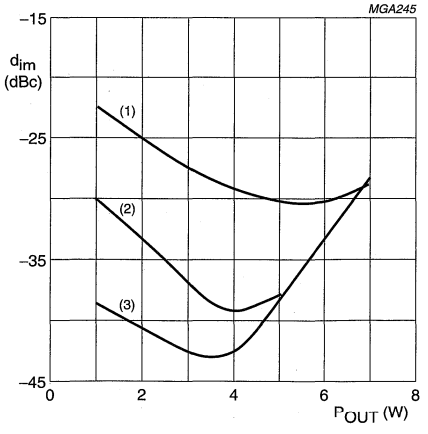


Fig.5 Class AB bias circuit at 1.65 GHz.



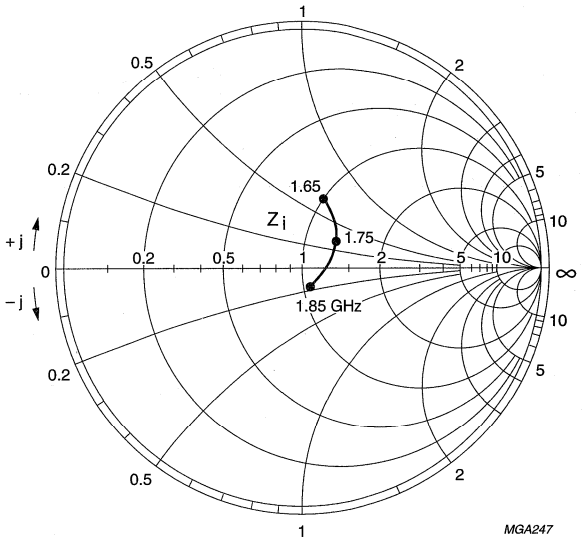
V_{CE} = 24 V; f = 1.65 GHz.
(1) I_{CQ} = 100 mA.
(2) I_{CQ} = 30 mA.
(3) I_{CQ} = 3 mA.

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



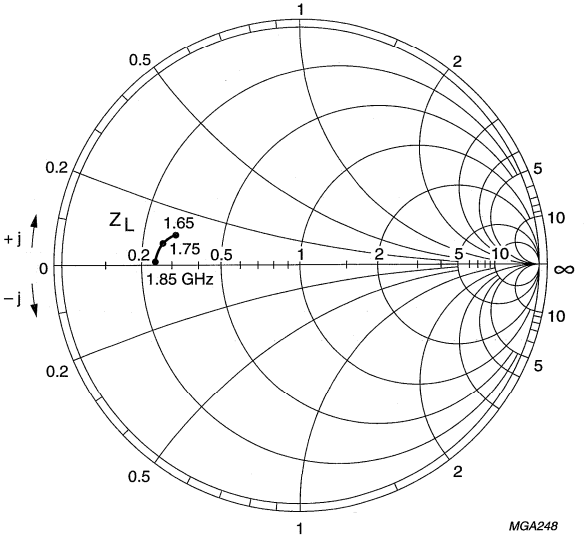
V_{CE} = 24 V; f_1 = 1.65 GHz; f_2 = 1.6502 GHz.
(1) I_{CQ} = 3 mA.
(2) I_{CQ} = 30 mA.
(3) I_{CQ} = 100 mA.

Fig.7 Intermodulation distortion as a function of average output power.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.1 A.

Fig.8 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.1 A.

Fig.9 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor LLE16350X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.8 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.1	≥29	≥8	typ. 48	see Figs 8 and 9

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

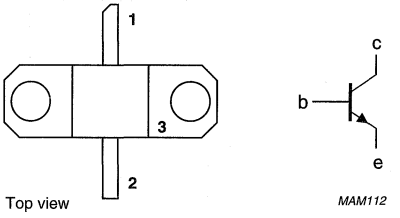


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

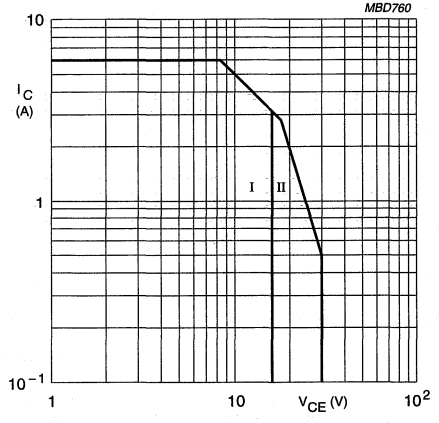
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	6	A
P_i	input power	f = 1.65 GHz; V_{CE} = 24 V; class AB	–	8	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	50	W
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} ≤ 220 Ω.

Fig.2 DC SOAR.

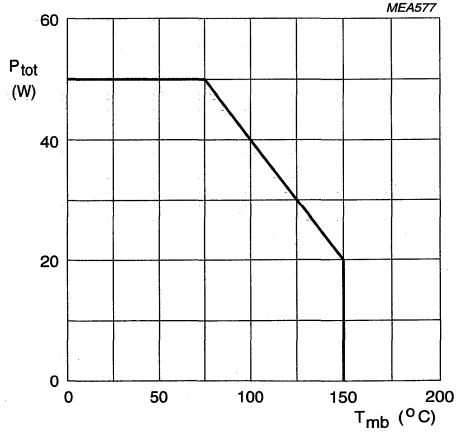


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	max. 2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		typ. 0.2	K/W

CHARACTERISTICS

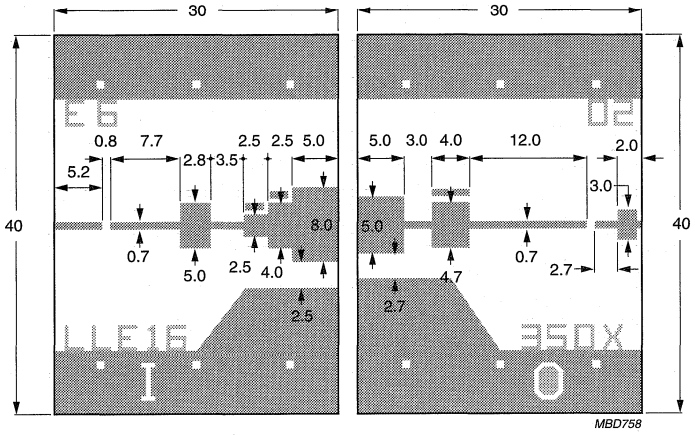
T_{mb} = 25 °C unless otherwise specified.

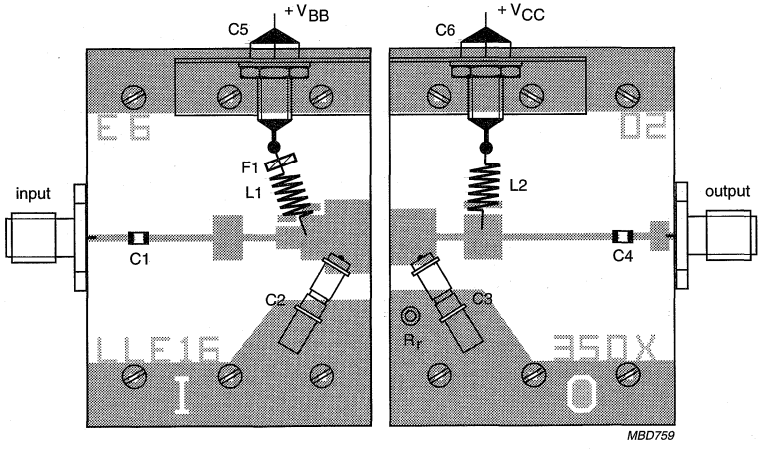
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	3	mA
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 15 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 15 mA	45	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 15 mA	3	–	V
h_{FE}	DC current gain	I_C = 1 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.1	≥29 typ. 32	≥8 typ. 9	typ. 48	see Figs 8 and 9





The test circuit is split into two independent halves, each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

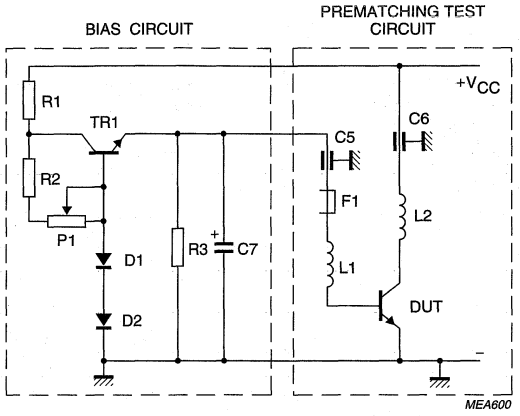


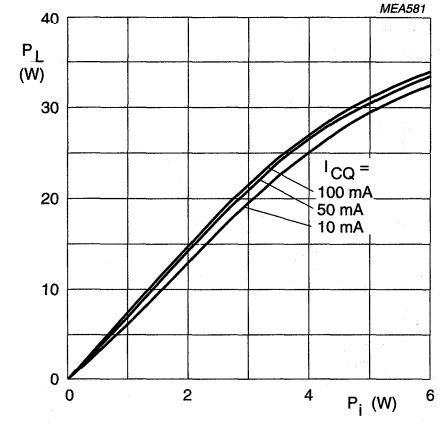
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BDT91 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A101kp
C2, C3	trimmer capacitor	0.5 to 5.0 pF	Tekelec 727-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)
R_r	copper rivet		

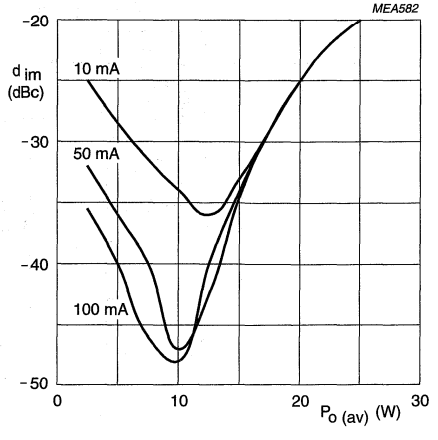
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V; f = 1650 MHz.

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



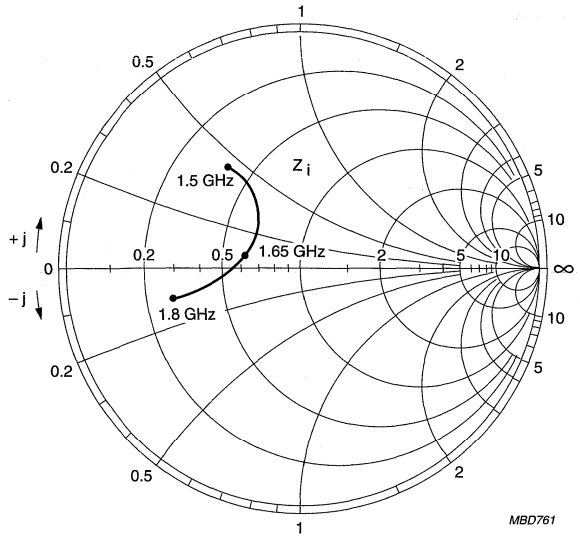
V_{CE} = 24 V; f_1 = 1650 MHz; f_2 = 1650.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

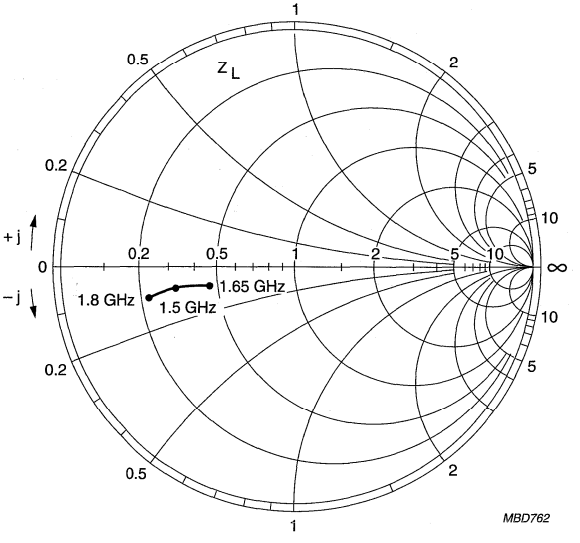
V_{CE} = 24 V; I_{CQ} = 0.1 A (see Figs 8 and 9); typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.50	4.15 + j4.45	4.6 – j1.0
1.55	5.3 + j3.8	4.2 – j0.85
1.60	6.2 + j2.45	3.8 – j0.8
1.65	6.1 + j0.7	3.4 – j0.8
1.70	5.1 – j0.6	3.05 – j0.9
1.75	3.9 – j1.1	2.75 – j1.0
1.80	2.9 – j1.1	2.5 – j1.15



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.1 A.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 100 W; I_{CQ} = 0.1 A.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN microwave power transistor LTE21009R

FEATURES

- Diffused emitter ballasting resistors
- Self-aligned process entirely ion implanted and gold sandwich metallization
- optimum temperature profile
- excellent performance and reliability
- Input matching cell improves input impedance and facilitates the design of wideband circuits.

APPLICATIONS

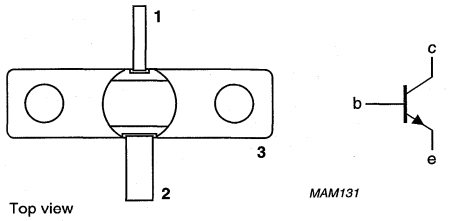
- Common emitter class-A linear power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 435

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A amplifier.

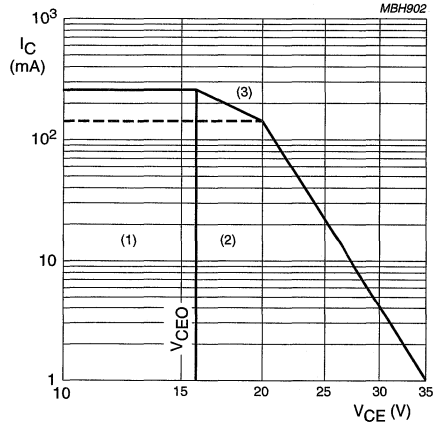
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)
Class-A	2.1	16	150	≥0.6	≥10

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	35	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current (DC)		–	250	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	4	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.3 mm from case; $t \leq 10$ s	–	235	°C



T_{mb} = 75 °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided R_{BE} < 100 Ω.
(3) Second breakdown limit (independent of temperature).

Fig.2 DC SOAR.

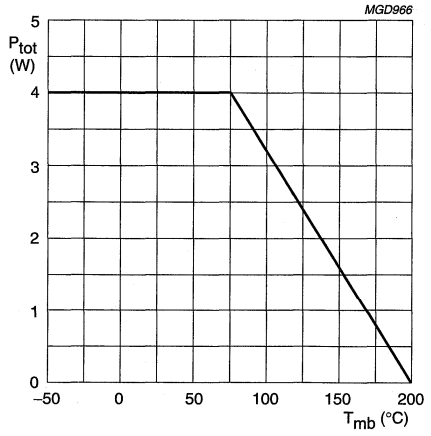


Fig.3 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_{mb} = 25 °C	36	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.7	K/W

Note

1. See "*Mounting recommendations in the General part of handbook SC15*".

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	50	μA
		V_{CB} = 40 V; I_E = 0	–	0.4	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	200	nA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 150 mA	15	150	

NPN microwave power transistor LTE21015R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors provide excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Input matching cell allows an easier design of circuits.

APPLICATIONS

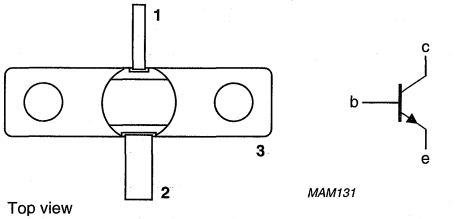
- Common emitter class-A linear power amplifiers up to 2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 436

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A amplifier.

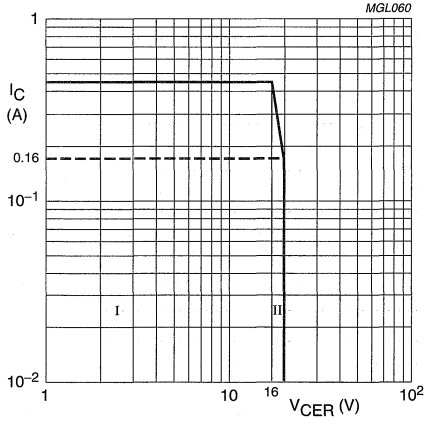
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A	2	16	250	≥1.5	≥8.5	see Figs 6 and 7

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

LIMITING VALUES

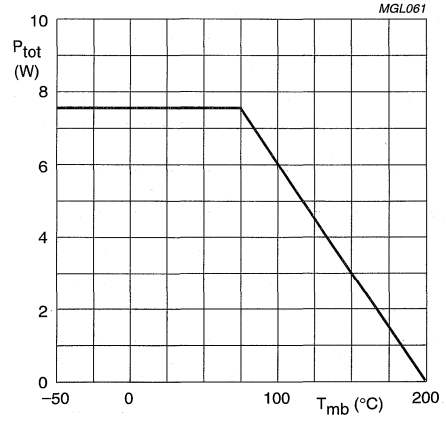
In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 250 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	450	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	7.5	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic; $t \leq 10$ s	–	235	°C



T_{mb} = 75 °C.
(I) Region of permissible DC operation.
(II) Permissible extension provided R_{BE} < 250 Ω.

Fig.2 DC SOAR.



$P_{tot\ max}$ = 7.5 W

Fig.3 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 70 °C	12	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	150	μA
		V_{CB} = 40 V; I_E = 0	–	1	mA
I_{CER}	collector cut-off current	V_{CE} = 20 V; R_{BE} = 270 Ω	–	0.5	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	1.5	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 250 mA	15	150	

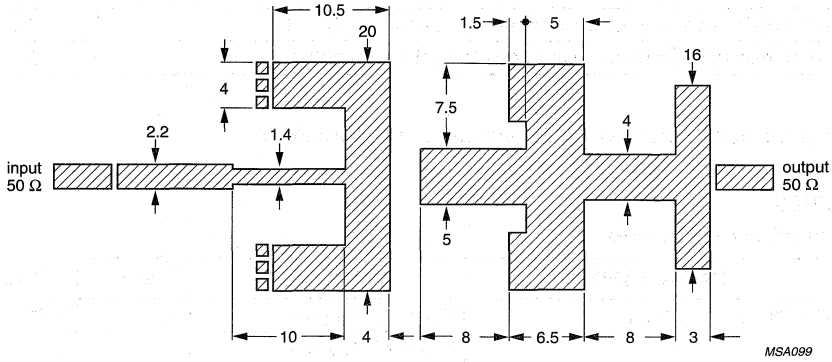
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A test circuit.(see Fig.4)

MODE OF OPERATION	f (GHz)	V_{CC} (V)(1)	I_C (mA) (1)	P_{L1} (W) (2)	G_{po} (dB) (3)	Z_i; Z_L (Ω)
Class-A (CW)	2	16	250	≥1.5 typ. 1.8	≥8.5 typ. 9.5	see Figs 6 and 7

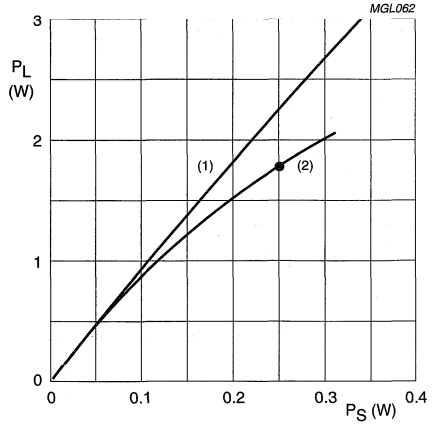
Notes

1. I_C and V_{CE} regulated.
2. Load power for 1 dB compression of gain.
3. Linear gain.



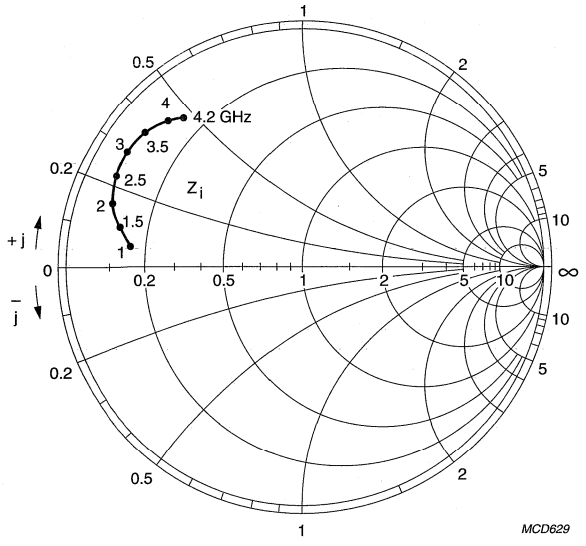
Dimensions in mm.
Substrate: Teflon fibreglass.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.4 Narrowband test circuit.



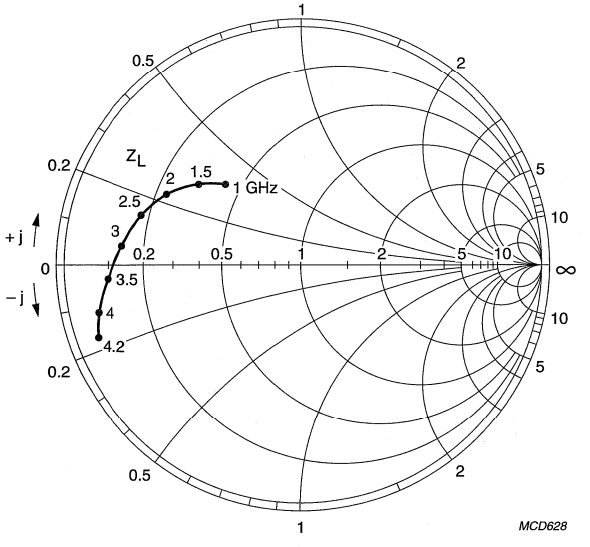
$V_{CE} = 16$ V; $I_C =$ 250 mA (regulated).
In narrowband test circuit as shown in Fig.4
(1) $G_{po} = 9.5$ dB.
(2) $P_{L1} = 1.8$ W.

Fig.5 Load power as a function of source power.



V_{CE} = 16 V; Z_o = 50 Ω; I_C = 250 mA.

Fig.6 Input impedance as a function of frequency for P_{L1}; associated with optimum load impedance.



V_{CE} = 16 V; Z_o = 50 Ω; I_C = 250 mA.

Fig.7 Optimum load impedance as a function of frequency for P_{L1}; associated with input impedance.

NPN microwave power transistor LTE21025R

FEATURES

- Diffused emitter ballasting resistors provide excellent current sharing and withstanding a high VSWR
- Self-aligned process entirely ion implanted
- Gold metallization realizes very stable characteristics and excellent lifetime
- Input matching cell improves input impedance and allows an easier design of wideband circuits.

APPLICATIONS

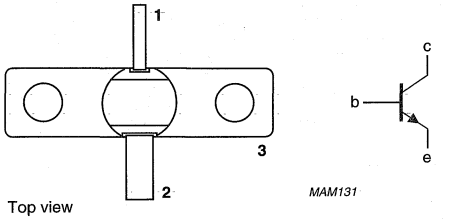
- Common emitter class-A linear power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Top view

Marking code: 439

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common emitter class-A test circuit.

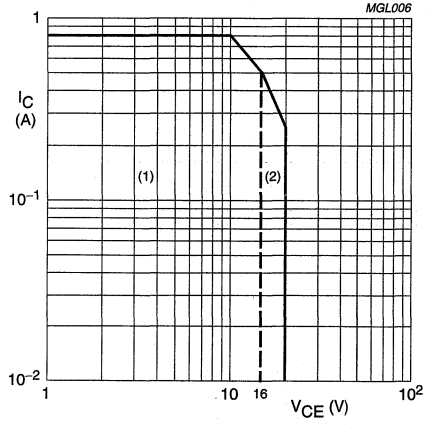
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)
Class-A (CW)	2.1	16	400	typ. 2.8	typ. 7.8

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 70 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	800	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	8	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.3 mm from ceramic; $t \leq 10$ s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 70$ Ω.

Fig.2 DC SOAR.

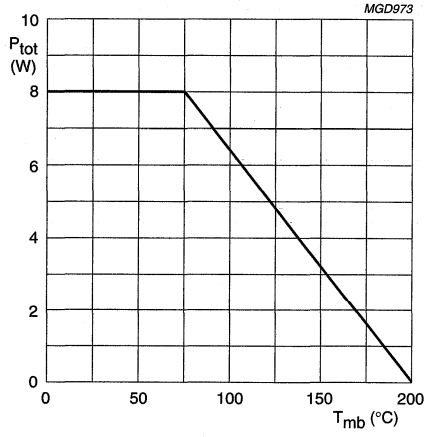


Fig.3 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	10	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	225	μA
		V_{CB} = 40 V; I_E = 0	–	–	1.5	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	0.6	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 400 mA	15	–	150	
C_{cb}	collector-base capacitance	V_{CB} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	3	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.5	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	28	–	pF

Table 1 Scattering parameters: V_{CE} = 16 V; I_C = 400 mA (V_{CE} and I_C regulated); T_{mb} = 25 °C; Z_o = 50 Ω; typical values. (The figures given between brackets are values in dB).

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
500	0.94	176	0.017 (–35.4)	43	2.79 (8.9)	81	0.49	–173
600	0.94	174	0.018 (–34.7)	46	2.39 (7.6)	77	0.54	–173
700	0.94	173	0.019 (–34.4)	47	2.07 (6.3)	72	0.52	–176
800	0.93	172	0.020 (–34.1)	49	1.85 (5.3)	68	0.52	–177
900	0.93	170	0.021 (–33.8)	49	1.66 (4.4)	64	0.53	–179
1000	0.93	168	0.022 (–33.3)	50	1.50 (3.5)	60	0.53	179
1100	0.92	167	0.023 (–32.6)	50	1.39 (2.9)	57	0.53	179
1200	0.93	166	0.026 (–31.6)	50	1.31 (2.4)	53	0.54	177
1300	0.93	164	0.029 (–30.6)	49	1.23 (1.8)	49	0.54	176
1400	0.93	167	0.032 (–29.9)	54	1.16 (1.3)	48	0.55	179
1500	0.93	163	0.037 (–28.7)	54	1.11 (0.9)	43	0.54	176
1600	0.93	162	0.040 (–27.9)	53	1.07 (0.6)	39	0.55	175
1700	0.93	161	0.042 (–27.5)	51	1.03 (0.3)	35	0.55	176
1800	0.92	159	0.043 (–27.3)	49	0.99 (–0.1)	30	0.56	174
2000	0.88	151	0.046 (–26.7)	46	0.99 (–0.1)	22	0.56	170
2200	0.89	148	0.052 (–25.7)	43	0.92 (–0.7)	14	0.57	168
2400	0.90	147	0.059 (–24.6)	41	0.88 (–1.1)	9	0.58	168
2600	0.90	147	0.069 (–23.2)	38	0.90 (–0.9	1	0.59	168
2800	0.87	142	0.073 (–22.8)	32	0.88 (–1.1)	–8	0.60	169
3000	0.83	134	0.075 (–22.5)	26	0.90 (–0.9)	–18	0.61	168
3200	0.82	129	0.077(–22.2)	21	0.87 (–1.2)	–27	0.63	166
3400	0.83	130	0.085 (–21.4)	18	0.90 (–1.0)	–37	0.65	165
3600	0.80	130	0.091 (–20.8)	11	0.91 (–0.8)	–50	0.69	165
3800	0.73	127	0.091 (–20.8)	3	0.94 (–0.5)	–64	0.74	164
4000	0.69	122	0.087 (–21.2)	–7	0.95 (–0.5)	–82	0.79	162
4200	0.67	122	0.078 (–22.2)	–15	0.89 (–1.0)	–100	0.84	157
4400	0.69	126	0.071 (–23.0)	–19	0.83 (–1.7)	–121	0.89	150
4600	0.72	130	0.059 (–24.6)	–18	0.70 (–3.1)	–141	0.92	143
4800	0.76	128	0.054 (–25.4)	–11	0.60 (–4.4)	–160	0.94	136

NPN microwave power transistor LTE42005S

FEATURES

- Diffused emitter ballasting resistors provide excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Input matching cell improves input impedance and allows an easier design of circuits

APPLICATION

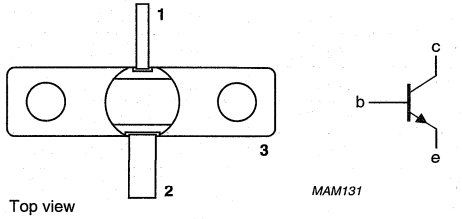
- Common emitter class-A linear power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Top view

Marking code: 502

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A amplifier.

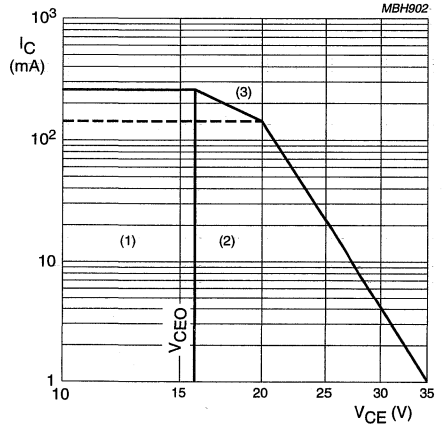
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A (CW) linear	4.2	18	110	≥450	≥6.6	100 + j40	4 + j4

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 100 Ω	–	35	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	250	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	4	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.3 mm from case; t = 10 s	–	235	°C



$T_{mb} \leq 75$ °C.

(1) Region of permissible DC operation.

(2) Permissible extension provided $R_{BE} \leq 100$ Ω.

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

Fig.2 DC SOAR.

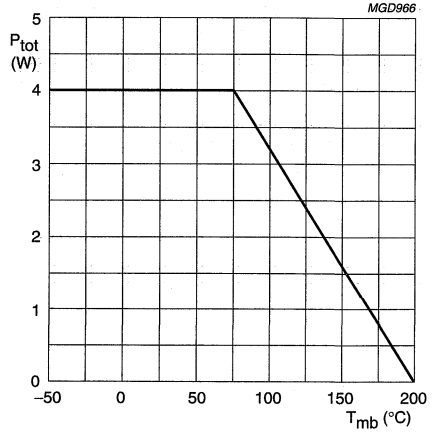


Fig.3 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	36	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See "*Mounting recommendations in the General part of handbook SC15*".

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	0.1	μA
		V_{CB} = 40 V; I_E = 0	–	–	0.25	mA
I_{CER}	emitter cut-off current	V_{CE} = 35 V; R_{BE} = 100 Ω	–	–	1	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	0.2	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 110 mA	15	–	150	
C_{cb}	collector-base capacitance	V_{CB} = 20 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	0.5	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 20 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.5	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	6.5	–	pF

Table 1 Scattering parameters: V_{CE} = 18 V; I_C = 110 mA (V_{CE} and I_C regulated); T_{mb} = 25 °C; Z_o = 50 Ω; typical values. (The figures given between brackets are values in dB).

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
500	0.76	–176	0.022 (–33.2)	37	8.13 (18.2)	85	0.35	–62
600	0.75	180	0.023 (–32.8)	37	6.95 (16.8)	78	0.34	–66
700	0.76	177	0.023 (–32.8)	40	5.95 (15.5)	73	0.34	–71
800	0.76	174	0.024 (–32.5)	41	5.25 (14.4)	67	0.35	–75
900	0.76	171	0.024 (–32.3)	42	4.69 (13.4)	62	0.35	–79
1000	0.75	168	0.026 (–31.8)	43	4.23 (12.5)	57	0.36	–83
1100	0.75	165	0.028 (–31.0)	43	3.88 (11.8)	53	0.37	–87
1200	0.74	163	0.031 (–30.1)	43	3.61 (11.2)	49	0.39	–90
1300	0.75	160	0.035 (–29.2)	43	3.36 (10.5)	44	0.40	–95
1400	0.74	162	0.037 (–28.5)	44	3.12 (9.9)	41	0.43	–98
1500	0.73	157	0.041 (–27.8)	46	2.95 (9.4)	37	0.43	–101
1600	0.73	155	0.045 (–27.0)	46	2.83 (9.0)	32	0.45	–104
1700	0.71	154	0.047 (–26.5)	44	2.70 (8.6)	28	0.47	–107
1800	0.70	151	0.049 (–26.1)	43	2.56 (8.2)	23	0.48	–110
1900	0.69	148	0.050 (–25.9)	42	2.44 (7.7)	19	0.50	–114
2000	0.68	143	0.051 (–25.9)	39	2.34 (7.4)	14	0.51	–116
2200	0.67	138	0.058 (–24.7)	36	2.16 (6.7)	4	0.55	–124
2400	0.65	134	0.067 (–23.5	34	2.02(6.1)	–2	0.59	–129
2600	0.62	129	0.077 (–22.3)	31	1.95 (5.8)	–12	0.64	–134
2800	0.57	122	0.082 (–21.7)	25	1.84 (5.3)	–21	0.68	–138
3000	0.52	113	0.086 (–21.3)	21	1.78 (5.0)	–32	0.72	–143
3200	0.49	104	0.093 (–20.6)	16	1.67 (4.5)	–42	0.74	–150
3400	0.45	99	0.102 (–19.8)	13	1.62 (4.2)	–52	0.80	–157
3600	0.38	92	0.113 (–18.9)	8	1.52 (3.6)	–64	0.80	–163
3800	0.29	83	0.119 (–18.5)	6	1.43 (3.1)	–76	0.82	–170
4000	0.24	69	0.137 (–17.3)	2	1.27 (2.1)	–88	0.80	–179
4200	0.20	54	0.165 (–15.7)	–5	1.08 (0.7)	–98	0.68	171
4400	0.15	28	0.202 (–13.9)	–20	0.92 (0.8	–100	0.51	172
4600	0.12	–36	0.206 (–13.7)	–38	0.93 (0.6)	–102	0.52	–174
4800	0.17	–86	0.195 (–14.2)	–52	0.97 (–0.3)	–110	0.63	–171
5000	0.24	–114	0.177 (–15.0)	–65	0.97 (–0.3)	–122	0.73	–174
5200	0.31	–137	0.164 (–15.7	–73	0.93 (–0.6)	–133	0.79	–180
5400	0.41	–152	0.154 (–16.2)	–83	0.88 (–1.1)	–145	0.83	174
5600	0.48	–161	0.134 (–17.4)	–90	0.81 (–1.8)	–156	0.85	166
5800	0.53	–168	0.122 (–18.2)	–97	0.77 (–2.3)	–167	0.87	160
6000	0.56	–179	0.105 (–19.6)	–104	0.70 (–3.1)	–178	0.89	154

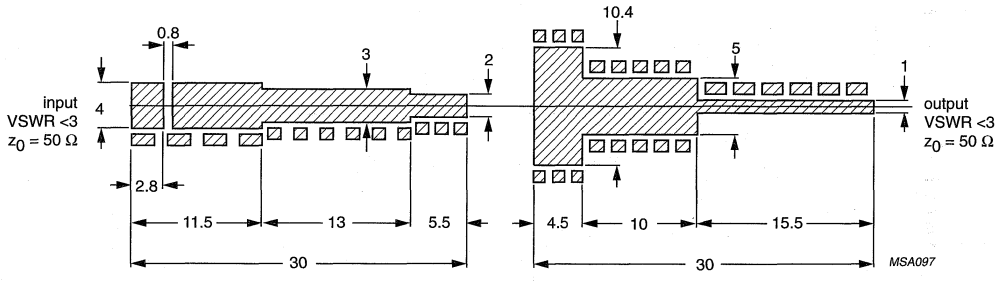
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A test circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V) (2)	I_C (mA) (2)	P_{L1} (mW) (3)	G_{po} (dB) (4)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	4.2	18	110	≥450 (26.5) typ. 550 (27.4)	≥6.6 typ. 7.2	100 + j40	4 + j4

Notes

1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.
2. I_C and V_{CE} regulated.
3. Load power for 1 dB compressed power gain.
4. Low level power gain associated with P_{L1}.

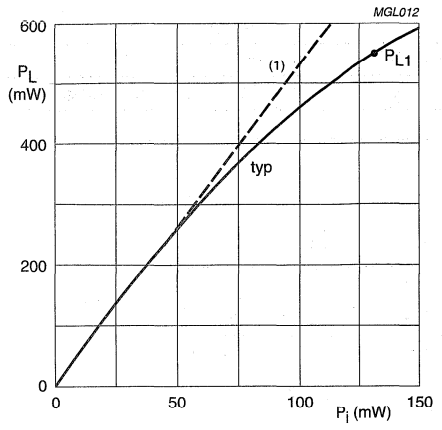


Dimensions in mm.

Input striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.54); thickness: 1.6 mm.

Output striplines on a double copper-clad Rexolite printed-circuit board with dielectric (ε_r = 2.4); thickness: 0.25 mm.

Fig.4 Prematching test circuit board.



f = 4.2 GHz; T_{mb} = 25 °C.
V_{CE} = 18 V; I_C = 110 mA (both regulated).
(1) G_{po} = 7.2 dB.

Fig.5 Load power as a function of input power.

NPN microwave power transistor — LTE42008R

FEATURES

- Diffused emitter ballasting resistors provide excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Input matching cell improves input impedance and allows an easier design of circuits.

APPLICATION

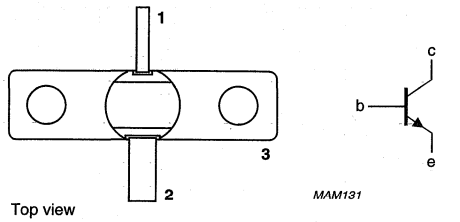
- Common emitter class-A linear power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 196

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A amplifier.

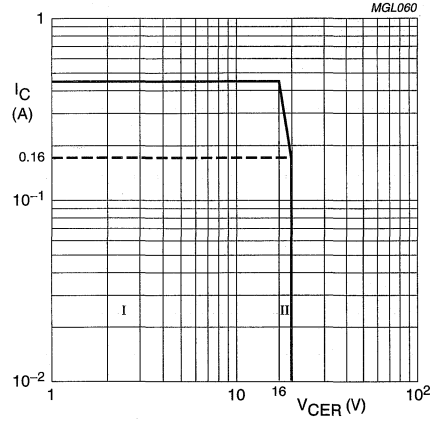
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (mW)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A (CW) linear	4.2	16	250	≥800	>7	7.5 + j23.5	2.5 – j9

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 250 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	450	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	7.5	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.3 mm from case; t = 10 s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 250$ Ω.

Fig.2 DC SOAR.

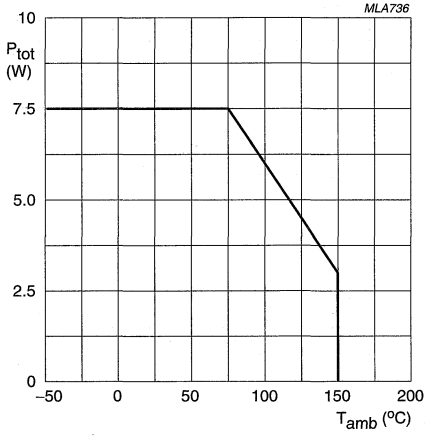


Fig.3 Power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 70 °C	12	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 70 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	150	μA
		V_{CB} = 40 V; I_E = 0	–	–	1	mA
I_{CER}	emitter cut-off current	V_{CE} = 20 V; R_{BE} = 250 Ω	–	–	0.5	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	0.4	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 250 mA	15	–	150	
C_{cb}	collector-base capacitance	V_{CB} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	2	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.5	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	20	–	pF

Table 1 Common-emitter scattering parameters: V_{CE} = 16 V; I_C = 250 mA; T_{mb} = 25 °C; Z_o = 50 Ω; typical values

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
2000	0.80	160	0.061	61.5	1.40	42.4	0.45	−172.7
2100	0.79	157	0.065	59.4	1.37	38.0	0.44	−173.7
2200	0.79	155	0.068	56.5	1.36	34.0	0.44	−175.5
2300	0.80	153	0.071	54.3	1.35	29.9	0.45	−176.5
2400	0.79	151	0.074	52.2	1.35	25.3	0.45	−176.9
2500	0.79	150	0.079	50.1	1.35	21.1	0.45	−177.6
2600	0.78	148	0.085	48.4	1.34	16.2	0.46	−178.0
2700	0.77	147	0.090	45.1	1.34	11.8	0.47	−178.3
2800	0.75	146	0.095	41.7	1.35	7.6	0.48	−178.6
2900	0.73	144	0.099	38.3	1.38	2.9	0.50	−178.9
3000	0.71	143	0.104	35.4	1.40	−2.6	0.52	−178.8
3100	0.67	143	0.111	31.8	1.42	−8.3	0.55	−179.2
3200	0.64	141	0.116	27.4	1.43	−14.1	0.58	−179.9
3300	0.60	141	0.121	21.7	1.44	−20.4	0.62	178.8
3400	0.56	142	0.124	15.7	1.48	−28.1	0.66	176.9
3500	0.52	143	0.124	11.2	1.49	−36.4	0.70	174.4
3600	0.49	146	0.124	5.2	1.48	−45.1	0.74	171.3
3700	0.47	149	0.122	−2.2	1.47	−53.9	0.79	166.8
3800	0.46	154	0.118	−9.7	1.45	−63.1	0.84	161.9
3900	0.48	159	0.112	−15.7	1.41	−72.9	0.87	156.7
4000	0.51	161	0.106	−22.8	1.34	−82.5	0.91	150.7
4100	0.56	162	0.096	−29.4	1.26	−91.7	0.94	144.8
4200	0.61	161	0.083	−34.5	1.18	−100.1	0.96	138.6
4300	0.67	158	0.068	−37.4	1.08	−108.8	0.97	132.5
4400	0.71	155	0.054	−38.7	0.99	−117.8	0.98	127.3
4500	0.76	152	0.042	−35.4	0.90	−126.5	0.99	122.2
4600	0.79	147	0.031	−26.6	0.81	−134.7	0.99	117.2
4700	0.81	143	0.025	−5.6	0.73	−143.0	0.99	113.7
4800	0.82	140	0.026	28.8	0.66	−151.2	0.99	110.0
4900	0.82	136	0.034	40.1	0.59	−158.8	0.99	106.5
5000	0.82	132	0.043	52.4	0.53	−167.3	0.98	103.2

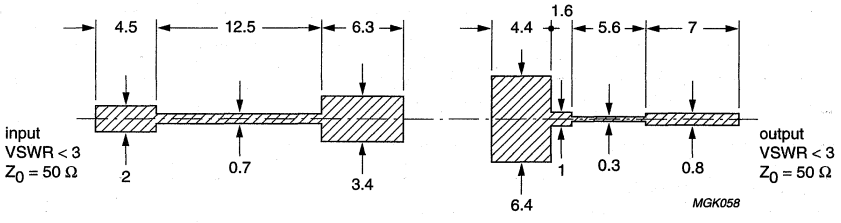
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A test circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V) (2)	I_C (mA) (2)	P_{L1} (mW) (3)	G_{po} (dB) (4)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	4.2	16	250	≥800 (29) typ. 940 (29.7)	≥7 typ. 7.5	7.5 + j40	4 + j4

Notes

1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.
2. I_C and V_{CE} regulated.
3. Load power for 1 dB compressed power gain.
4. Low level power gain associated with P_{L1}.

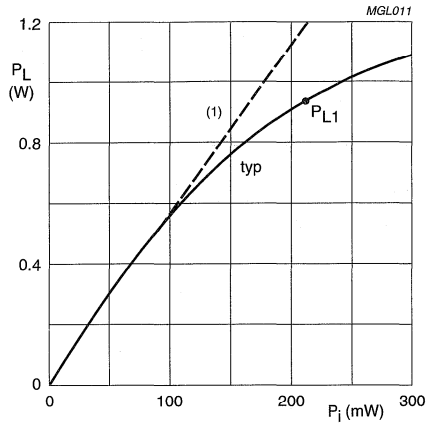


Dimensions in mm.

Input striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.54); thickness: 1.6 mm.

Output striplines on a double copper-clad Rexolite printed-circuit board with dielectric (ε_r = 2.4); thickness: 0.25 mm.

Fig.4 Prematching test circuit board.



f = 4.2 GHz; T_{mb} = 25 °C.
V_{CE} = 16 V; I_C = 250 mA (regulated).
(1) G_{po} = 7.5 dB.

Fig.5 Load power as a function of input power.

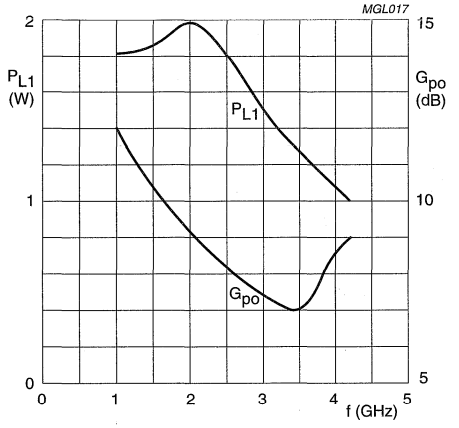
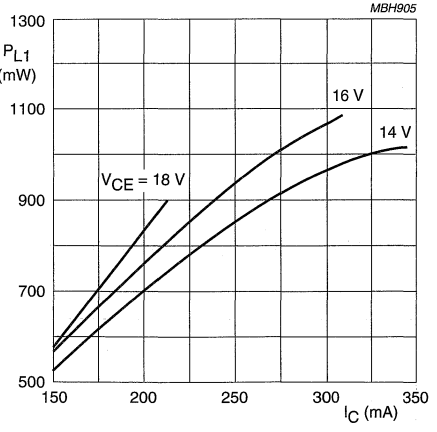
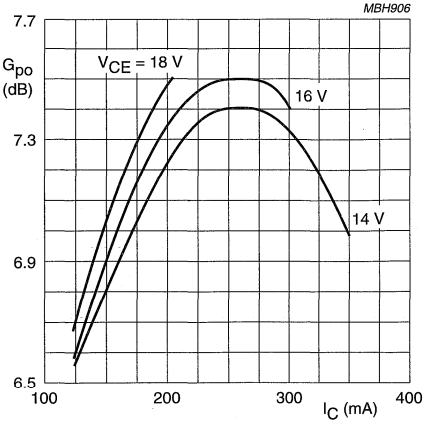


Fig.6 Load power and power gain associated with 1 dB compressed power gain as a function of frequency.



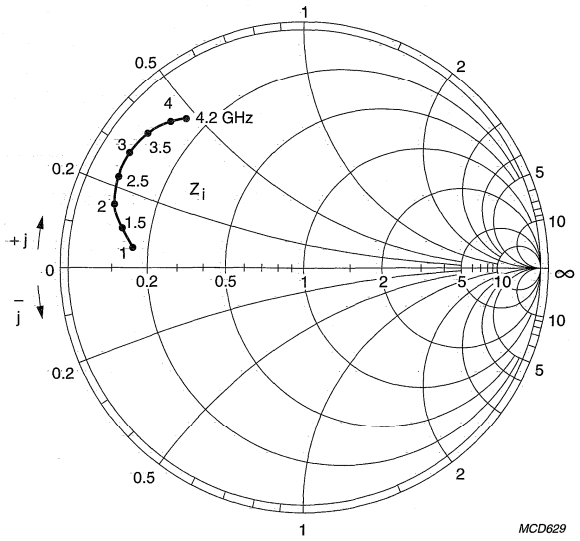
T_{mb} = 25 °C; V_{CE} and I_C regulated.

Fig.7 Load power associated with 1 dB compressed power gain as a function of collector current; typical values.



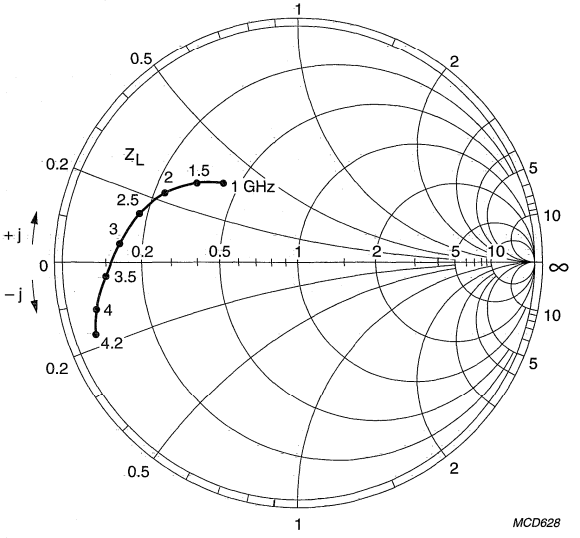
T_{mb} = 25 °C; V_{CE} and I_C regulated.

Fig.8 Low level power gain associated with P_{L1} as a function of collector current; typical values.



V_{CE} = 16 V; I_C = 250 mA (regulated).
Z_o = 50 Ω; T_{mb} = 25 °C.

Fig.9 Input impedance as a function of frequency for P_{L1}; typical values.



V_{CE} = 16 V; I_C = 250 mA (regulated).
Z_o = 50 Ω; T_{mb} = 25 °C.

Fig.10 Optimum load impedance as a function of frequency for P_{L1}; typical values.

NPN microwave power transistor LTE42012R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor provides excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Input matching cell improves input impedance and allows an easier design of wideband circuits.

APPLICATIONS

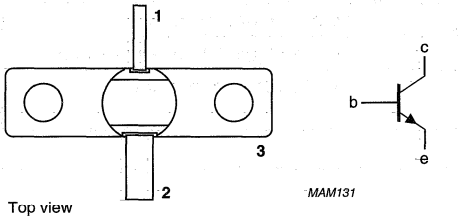
- Common emitter class-A power amplifiers up to 4.2 GHz in CW conditions for military and professional applications.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 198

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A selective amplifier.

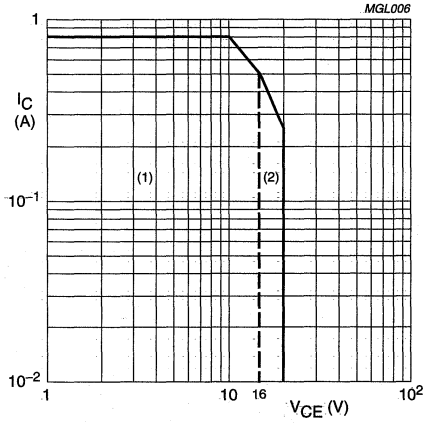
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	4.2	16	400	≥1	≥6	7.5 + j12	4 – j8

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 70 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
I_C	collector current (DC)		–	800	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	8	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.1 mm from ceramic; $t \leq 10$ s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 70$ Ω.

Fig.2 DC SOAR.

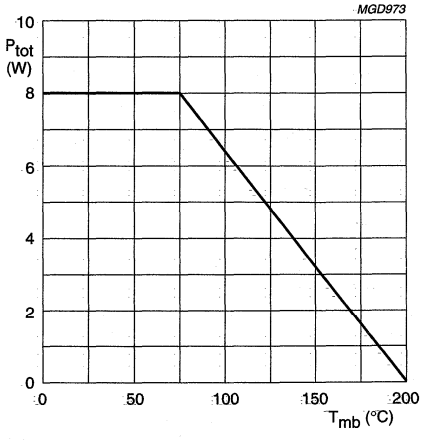


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	10	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	200	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	600	nA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 400 mA	15	–	100	
C_{cb}	collector-base capacitance	V_{CB} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	3	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.5	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	28	–	pF

Table 1 Common-emitter scattering parameters: V_{CE} = 16 V; I_C = 400 mA; T_{mb} = 25 °C; Z_o = 50 Ω; typical values.

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}	
	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)	MAGNITUDE (ratio)	ANGLE (deg)
2000	0.84	163	0.049	64	0.96	47.2	0.60	179.3
2100	0.84	161	0.051	62.7	0.94	43.3	0.59	178.0
2200	0.84	159	0.054	60.4	0.93	39.8	0.59	175.6
2300	0.85	158	0.055	58.8	0.91	36.2	0.59	174.2
2400	0.85	156	0.057	57.5	0.91	32.2	0.60	172.6
2500	0.85	155	0.060	56.1	0.90	29.1	0.60	171.1
2600	0.85	154	0.064	54.9	0.89	24.6	0.60	169.8
2700	0.85	153	0.067	53.1	0.89	21.2	0.60	168.6
2800	0.85	152	0.071	51.3	0.89	17.2	0.61	167.1
2900	0.84	150	0.073	49.5	0.90	13.8	0.62	165.7
3000	0.83	149	0.076	48.0	0.90	9.3	0.62	164.7
3100	0.82	149	0.080	46.0	0.91	5.2	0.63	163.8
3200	0.80	147	0.084	44.1	0.92	0.6	0.64	163.0
3300	0.78	146	0.088	40.5	0.93	−4.3	0.65	161.5
3400	0.76	145	0.091	36.1	0.95	−9.7	0.67	160.9
3500	0.74	144	0.093	34.4	0.97	−16.1	0.69	159.6
3600	0.71	143	0.095	30.7	0.98	−23.2	0.70	158.3
3700	0.70	142	0.095	26.3	0.99	−30.6	0.73	156.2
3800	0.67	142	0.093	21.6	0.99	−37.9	0.76	153.6
3900	0.66	142	0.091	17.0	1.00	−46.6	0.79	150.7
4000	0.64	142	0.088	13.2	0.98	−55.8	0.82	147.0
4100	0.64	142	0.084	9.7	0.95	−64.9	0.85	143.1
4200	0.65	143	0.077	7.0	0.91	−73.8	0.88	138.4
4300	0.67	143	0.068	5.9	0.86	−82.6	0.90	133.6
4400	0.69	143	0.060	8.2	0.81	−92.3	0.93	129.3
4500	0.72	141	0.054	13.8	0.74	−101.7	0.94	124.9
4600	0.75	139	0.050	20.5	0.68	−110.6	0.95	120.1
4700	0.76	137	0.050	31.2	0.61	−119.7	0.96	116.5
4800	0.78	135	0.054	43.5	0.56	−129.1	0.97	113.5
4900	0.79	133	0.061	46.6	0.50	−139.5	0.97	110.1
5000	0.77	130	0.068	54.3	0.44	−148.6	0.97	106.7

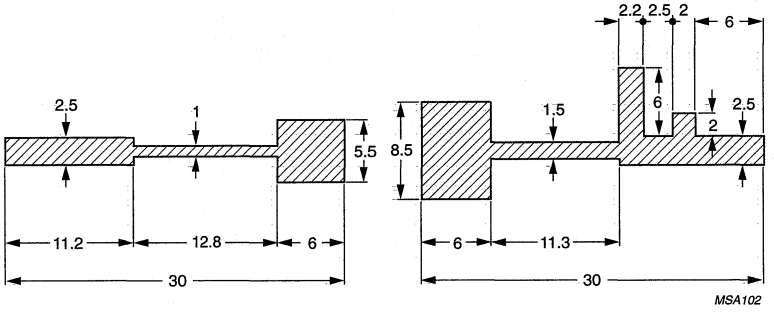
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A selective circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A	4.2	16	400	>1 typ. 1.25	>6 typ. 7	7.5 + j12	4 – j8

Note

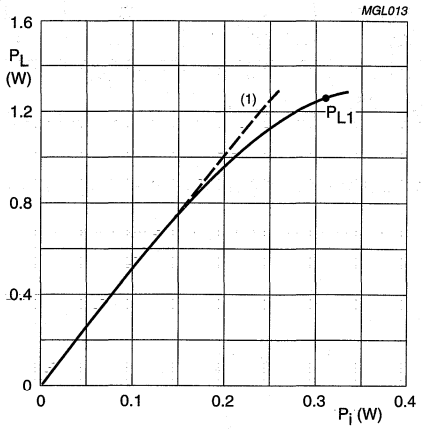
1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.



Dimensions in mm.

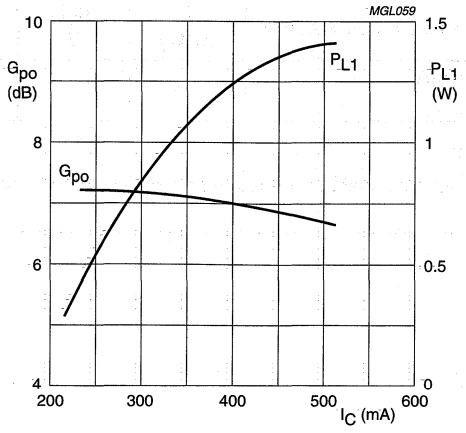
Input striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.54); thickness: 0.8 mm.

Fig.4 Prematching test circuit board.



f = 4.2 GHz; V_{CE} = 16 V; I_C = 400 mA (regulated).
(1) G_{po} = 7 dB.

Fig.5 Load power as a function of input power.



f = 4.2 GHz; V_{CE} = 16 V.

Fig.6 Low level power gain associated with P_{L1} as a function of collector current.

NPN microwave power transistor LV1721E50R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor provides excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

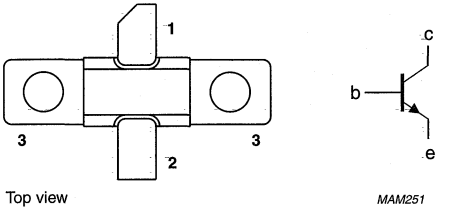
- Common emitter class-A amplifiers in CW conditions for military and professional applications in the 1.7 GHz to 2.1 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT445A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT445A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 1721E50R

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A wideband amplifier.

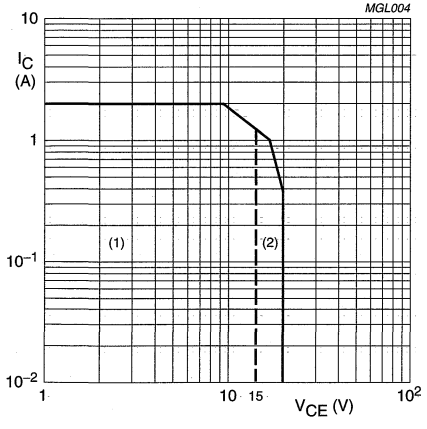
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	1.7 to 2.1	16	1.1	≥5	≥7	see Fig 6

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 47 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	18	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.1 mm from case; t ≤ 10 s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 47$ Ω.

Fig.2 DC SOAR.

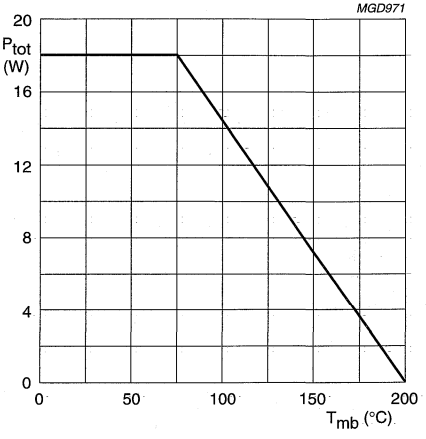


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	4	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

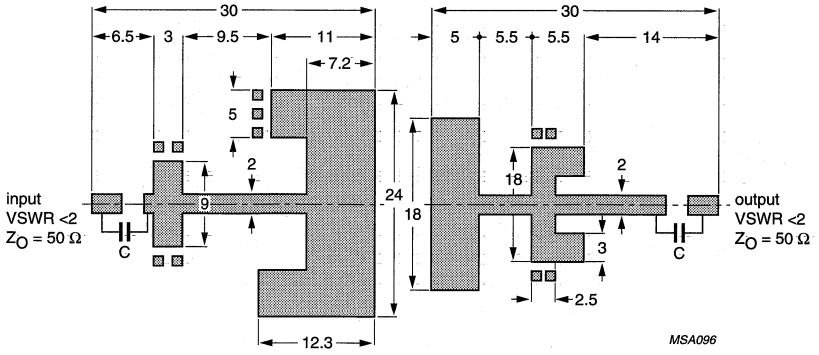
T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	0.5	mA
		V_{CB} = 40 V; I_E = 0	–	–	2.5	mA
I_{CER}	collector cut-off current	V_{CE} = 20 V; R_{BE} = 47 Ω	–	–	25	mA
I_{CEO}	collector cut-off current	V_{CE} = 15 V; I_B = 0	–	–	2	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	100	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 1 A	15	–	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A wideband amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	1.7 to 2.1	16	1.1	≥5; typ. 5.5	≥7; typ. 8	see Fig 6

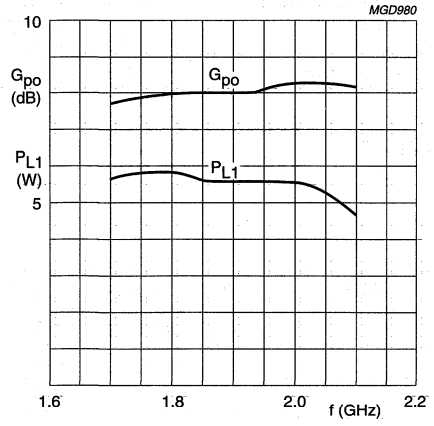


Dimensions in mm.

Striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.5); thickness: 0.8 mm.

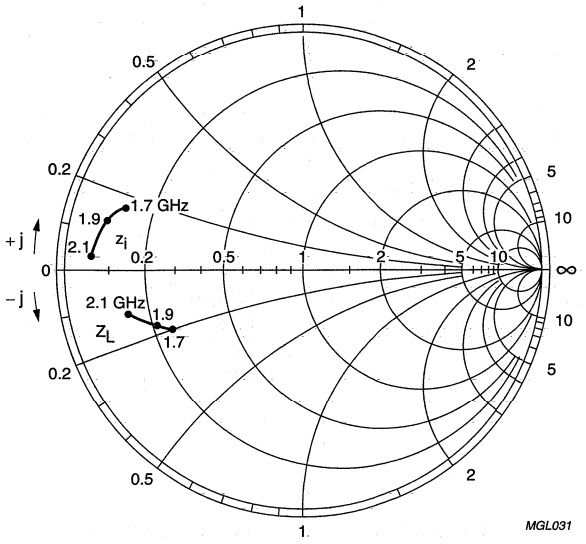
Frequency = 1.7 to 2.1 GHz, CW, class-A application.

Fig.4 Wideband test circuit board.



V_{CE} = 16 V; I_C = 1.1 A (V_{CE} and I_C regulated).

Fig.5 Load power and power gain as functions of frequency.



Z_o = 50 Ω; P_{L1} = 5.5 W.

Fig.6 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor LV2024E45R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor provides excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

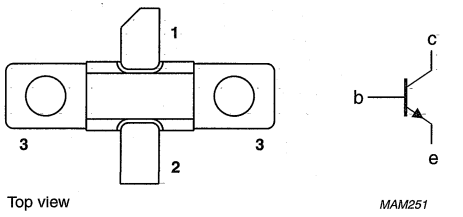
- Common emitter class-A amplifiers in CW conditions for military and professional applications in the 2 to 2.4 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT445A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT445A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 2024E45R

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A wideband amplifier.

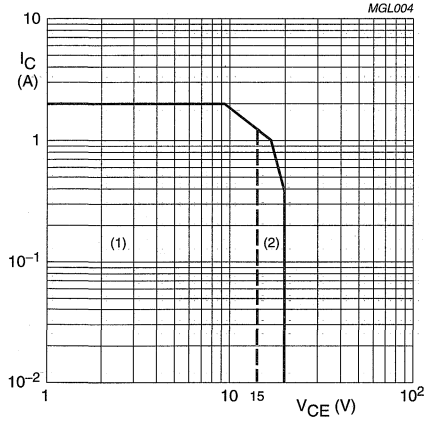
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	2 to 2.4	16	1.1	≥4	≥6	see Fig 6

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 47 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	18	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.1 mm from case; t ≤ 10 s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 47$ Ω.

Fig.2 DC SOAR.

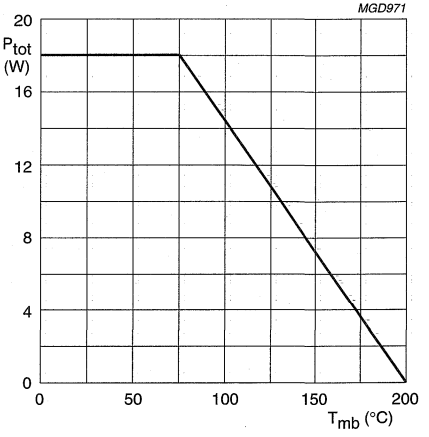


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	4	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

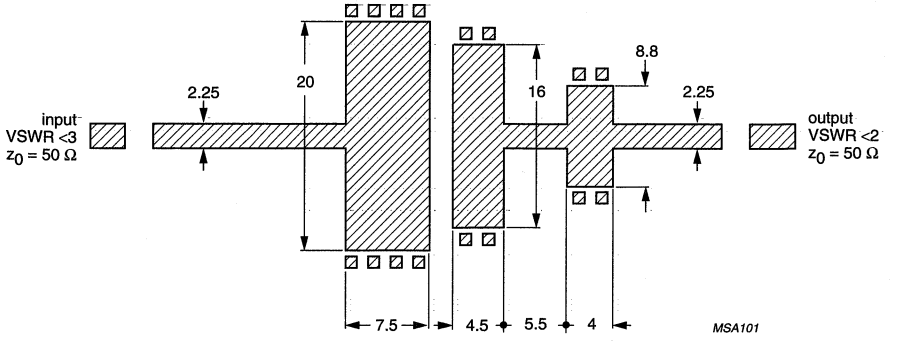
T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	0.5	mA
		V_{CB} = 40 V; I_E = 0	–	2.5	mA
I_{CER}	collector cut-off current	V_{CE} = 20 V; R_{BE} = 47 Ω	–	25	mA
I_{CEO}	collector cut-off current	V_{CE} = 15 V; I_B = 0	–	2	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	100	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 1 A	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A wideband amplifier.

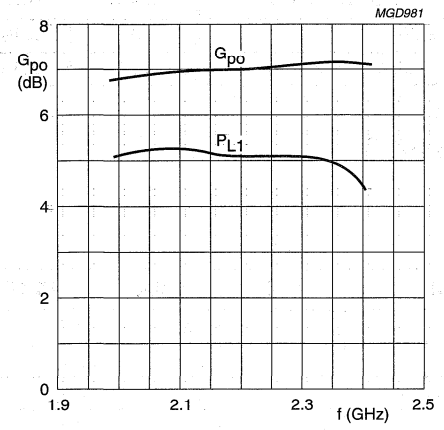
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	2 to 2.4	16	1.1	≥4; typ. 5	≥6; typ. 7	see Fig 6



Dimensions in mm.

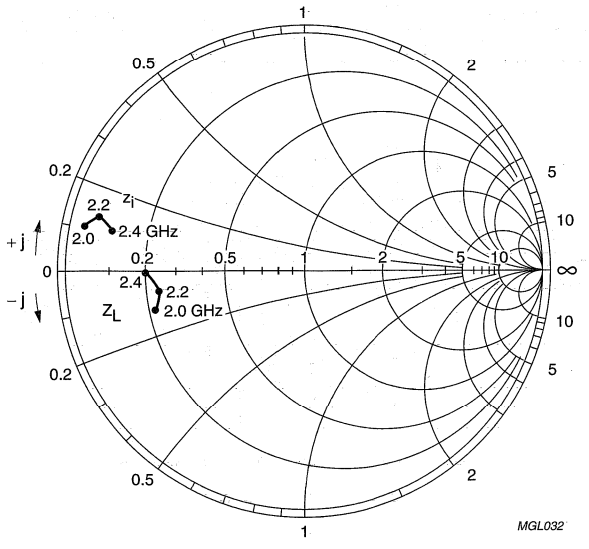
Striplines on a double copper-clad printed-circuit board with PTFE fibreglass dielectric (ε_r = 2.55); thickness: 0.8 mm.

Fig.4 Wideband test circuit board.



V_{CE} = 16 V; I_C = 1.1 A (V_{CE} and I_C regulated).

Fig.5 Load power and power gain as functions of frequency.



Z_o = 50 Ω.

Fig.6 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor LV2327E40R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.
- Input and output matching cell improves the impedances and facilitates the design of wideband circuits.

APPLICATIONS

Common emitter class A linear wideband power amplifiers in the 2.3 to 2.7 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT445B metal ceramic flange package, with emitter connected to the flange.

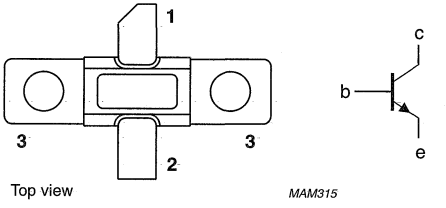
QUICK REFERENCE DATA

Microwave performance for T_{case} = 25 °C in a wideband common-emitter class A circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{PO} (dB)	Z_i (Ω)	Z_L (Ω)
CW; linear amplifier	2.3 to 2.7	16	1	≥4	≥7	11 + j3	7.5 – j9

PINNING - SOT445B

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange



Marking code: 2327E40R.

Fig.1 Simplified outline and symbol.

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

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CER}	collector-emitter voltage	R_{BE} = 47 Ω	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	18	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. At 0.3 mm from the case.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor LVE21050R

FEATURES

- Diffused emitter ballasting resistors provide excellent current sharing and withstanding a high VSWR
- Self-aligned process entirely ion implanted
- Gold metallization ensures an optimum temperature profile with excellent performance and reliability
- Input matching cell improves input impedance and allows an easier design of wideband circuits.

APPLICATIONS

- Common emitter class-A linear power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT445A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT445A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

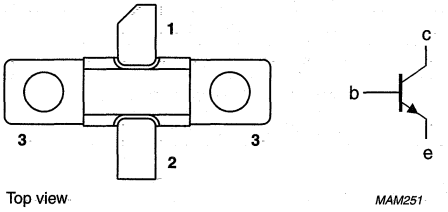


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A circuit.

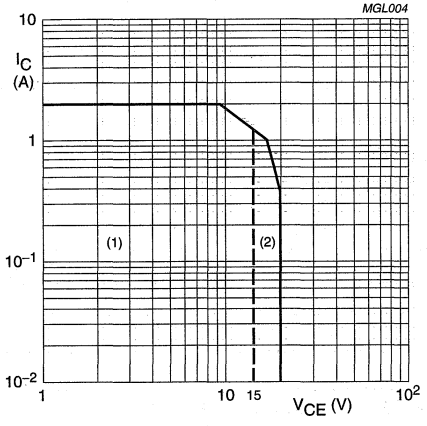
MODE OF OPERATION	f (GHz)	V_{CC} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	2.1	16	1.1	typ. 5.5	typ. 8	see Fig 4

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 47 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	18	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.3 mm from case; $t \leq 10$ s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 47$ Ω.

Fig.2 DC SOAR.

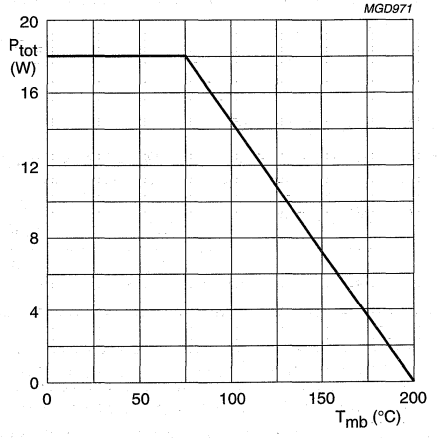


Fig.3 Power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	4	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

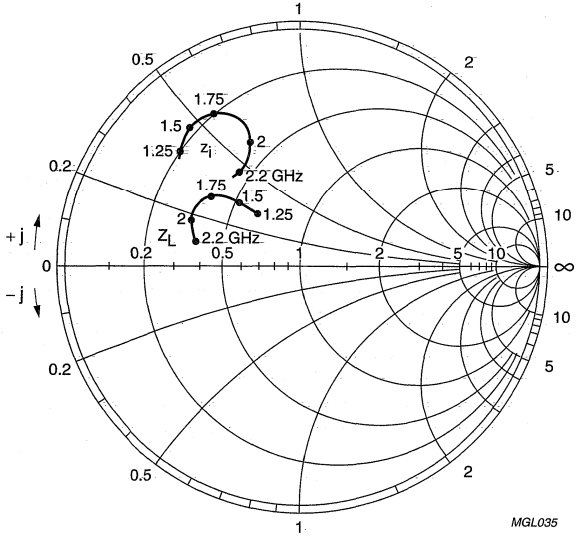
Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	–	0.5	mA
		V_{CB} = 40 V; I_E = 0	–	–	2.5	mA
I_{CER}	collector cut-off current	V_{CE} = 20 V; R_{BE} = 47 Ω	–	–	25	mA
I_{CEO}	collector cut-off current	V_{CE} = 15 V; I_B = 0	–	–	2	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	100	µA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 1 A	15	–	100	



Z_o = 10 Ω.

Fig.4 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor LWE2010S

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common emitter class A power amplifiers at frequencies up to 2.3 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT446A metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class A selective amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_I/Z_L (Ω)
class A (CW)	2.3	18	110	≥0.8	≥8	see Figs 6 and 7

PINNING - SOT446A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

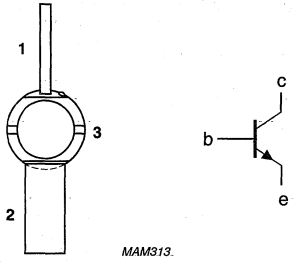


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

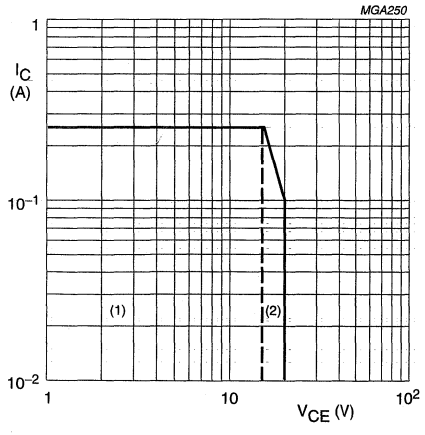
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 250 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	250	mA
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	4.8	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

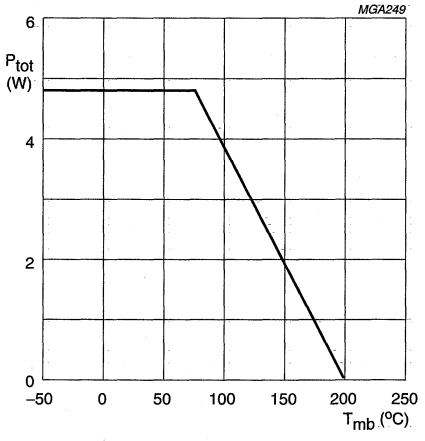
Note

1. Up to 0.1 mm from ceramic.



T_{mb} ≤ 75 °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided R_{BE} ≤ 250 Ω.

Fig.2 DC SOAR.



$P_{tot\ max}$ = 4.8 W.

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	22	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	75	μA
		V_{CB} = 40 V; I_E = 0	–	500	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	200	nA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 110 mA	15	150	

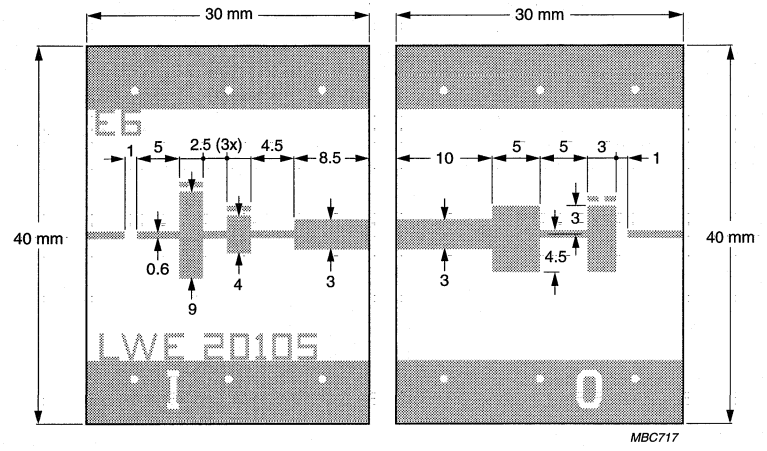
APPLICATION INFORMATION

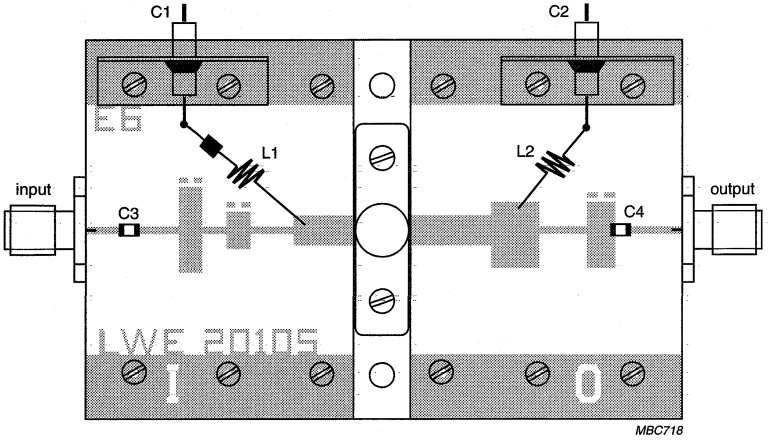
Microwave performance up to T_{mb} = 25 °C in a common emitter class A selective amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_I (Ω)	Z_L (Ω)
Class A (CW); note 1	2.3	18	110	≥0.8; typ. 0.9	≥8; typ. 9	5.2 + j 16.5	7.5 + j 8.75

Note

1. In narrowband test circuit shown in Fig.4.



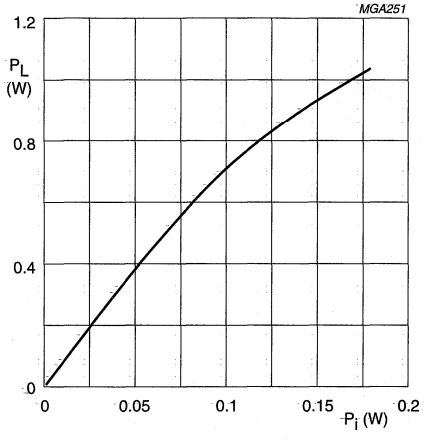


Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

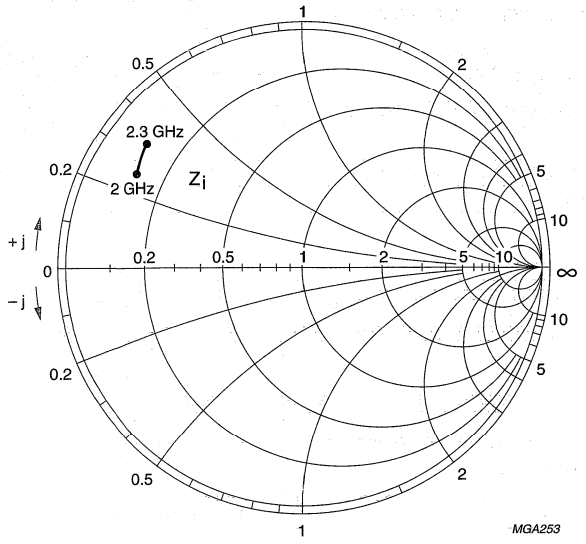
List of components (see Fig.4)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	3 turns 0.2 mm copper wire with ferrite bead		int. dia. 2 mm	
L2	5 turns 0.5 mm copper wire		int. dia. 2 mm	
C1, C2	feedthrough bypass capacitor			Erie, ref. 1214-001
C3, C4	DC block capacitor	100 pF		



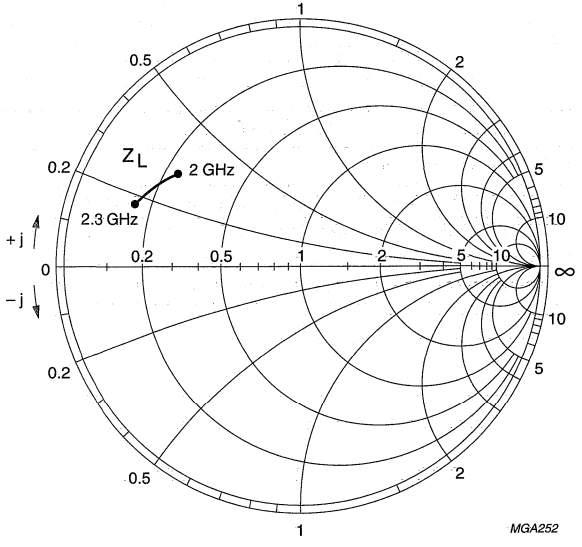
f = 2.3 GHz; V_{CE} = 18 V; I_C = 110 mA (regulated).

Fig.5 Load power as a function of input power.



P_{L1} = 0.8 W;
V_{CE} = 18 V;
Z_O = 50 Ω;
I_C = 110 mA.

Fig.6 Input impedance as a function of frequency associated with optimum load impedances.



P_{L1} = 0.8 W;
V_{CE} = 18 V;
Z_O = 50 Ω;
I_C = 110 mA.

Fig.7 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor LWE2015R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor provides excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

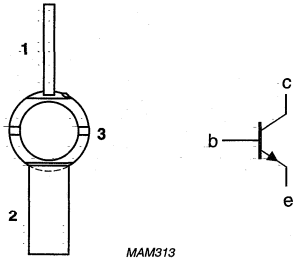
- Common emitter class-A amplifiers up to 2.3 GHz in CW conditions for military and professional applications.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT446A metal ceramic studless package.

PINNING - SOT446A

PIN	DESCRIPTION
1	collector
2	base
3	emitter



Marking code: 411

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A selective amplifier.

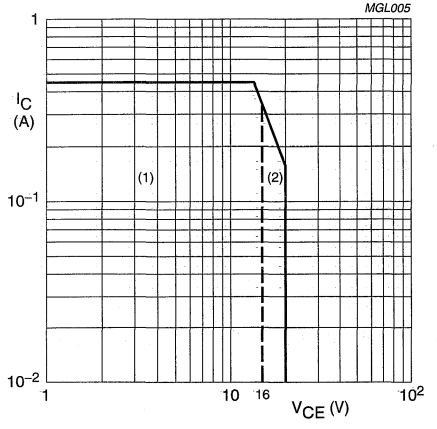
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	2.3	16	250	≥1.2	≥7.5	3.5 + j11	6.4 + j2

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	35	V
V_{CER}	collector-emitter voltage	R_{BE} = 70 Ω	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	450	mA
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	6	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.1 mm from case; t ≤ 10 s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 70$ Ω.

Fig.2 DC SOAR.

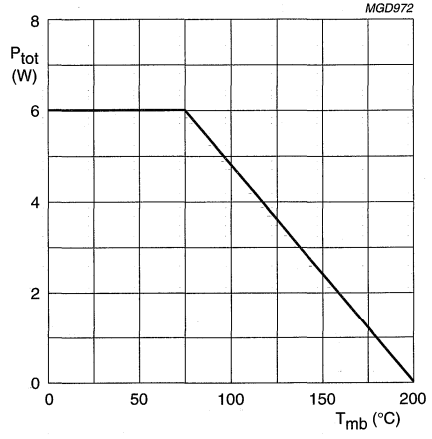


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	12	K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 25 V; I_E = 0	–	–	≤ 10	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	≤ 10	μA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 230 mA	–	40	–	
C_{cb}	collector-base capacitance	V_{CB} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	2	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 16 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	2	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	15	–	pF

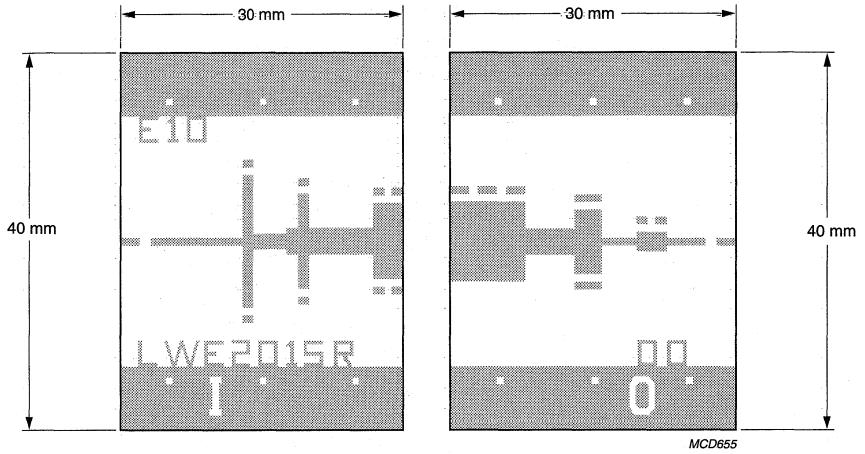
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A selective circuit; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{po} (dB)	Z_i (Ω)	Z_L (Ω)
Class-A (CW)	2.3	16	250	≥1.2 typ. 1.6	≥7.5 typ. 8.1	3.5 + j11	6.4 + j2

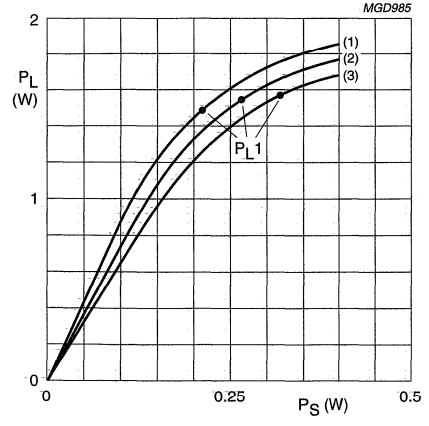
Note

1. Circuit consists of prematching circuit boards in combination with complementary input and output slug tuners.



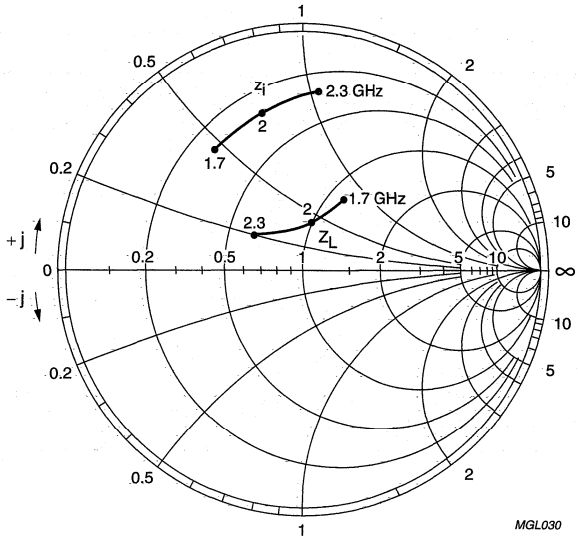
PTFE fibreglass dielectric (ε_r = 2.54); thickness: 0.8 mm.

Fig.4 Prematching test circuit board.



V_{CE} = 16 V; I_C = 250 mA (regulated).
(1) 1.7 GHz.
(2) 2 GHz.
(3) 2.3 GHz.

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



Z_o = 10 Ω; P_{L1} = 1.6 W.T_{mb} = 25 °C.

Fig.6 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor — LX1214E500X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures a good stability and allows an easier design of wideband circuits.

APPLICATIONS

Intended for use in common emitter, class AB amplifiers in CW conditions for professional applications between 1.2 and 1.4 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.2 to 1.4	24	0.15	typ. 50	typ. 11	typ. 50	see Figs 6 and 7

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

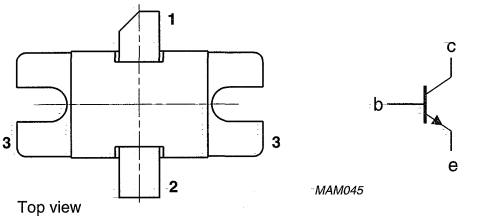


Fig.1 Simplified outline and symbol.

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

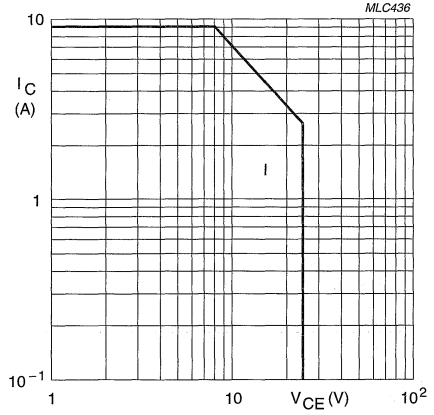
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	9	A
P_i	input power	f = 1.2 to 1.4 GHz; V_{CC} = 24 V; class AB	–	7	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	70	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$T_{mb} \leq 75$ °C.

(1) Region of permissible DC operation.

Fig.2 DC SOAR.

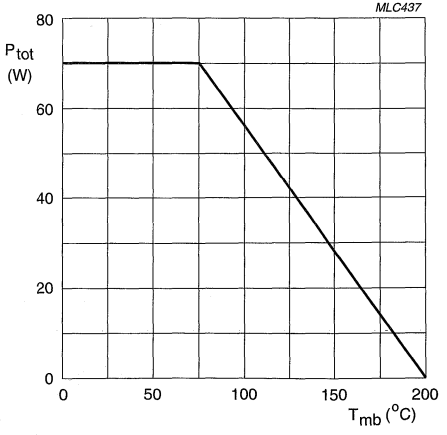


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.3	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

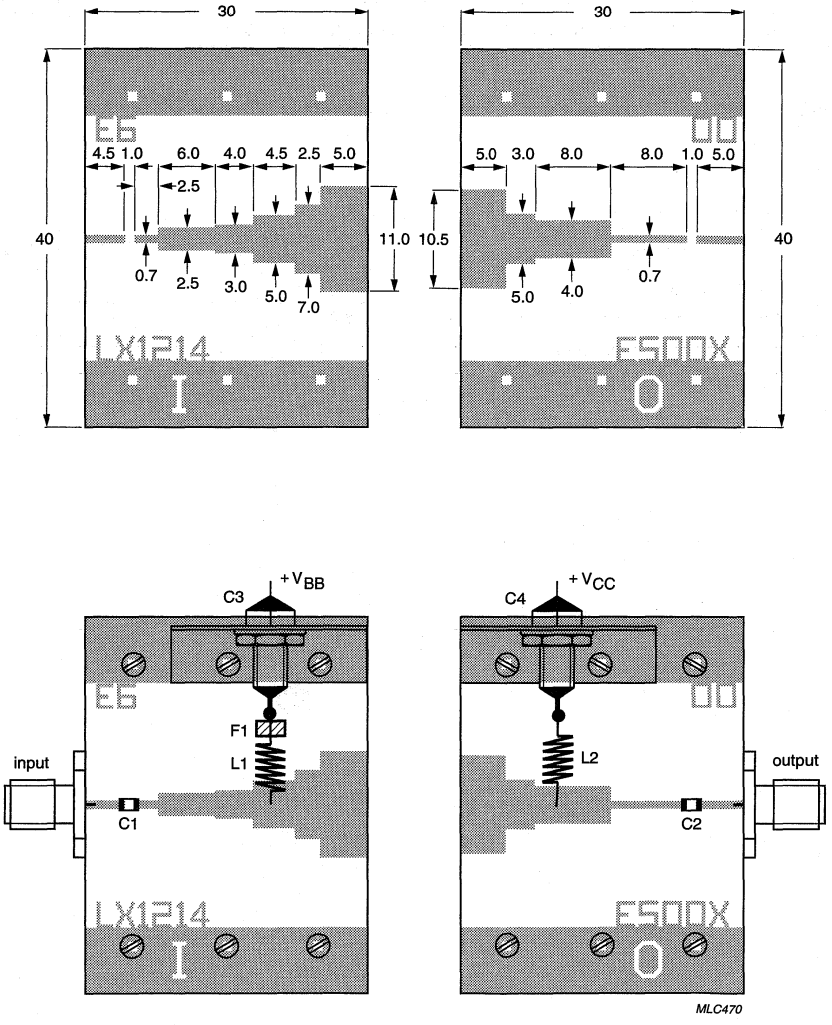
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	4.5	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 22 mA	45	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 150 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 22 mA	3	–	V
h_{FE}	DC current gain	I_C = 4.5 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.2 to 1.4	24	0.15	typ. 50	typ. 11	typ. 50	see Figs 6 and 7



The test circuit is split into two independent halves each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Test circuit.

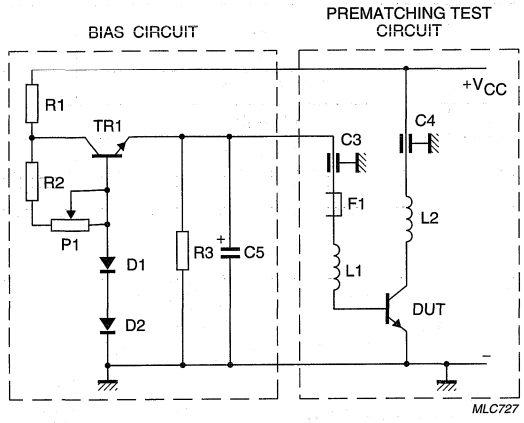


Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BD239 or equivalent		
C1, C2	DC blocking chip capacitor	100 pF	ATC 100A1201kp
C3, C4	feedthrough bypass capacitor	1500 pF	Erie1250-003
C5	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	3.5 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	1 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)

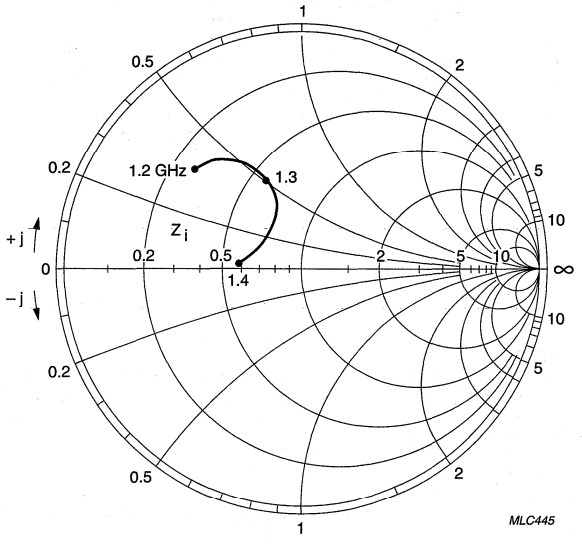
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.

Input and optimum load impedances

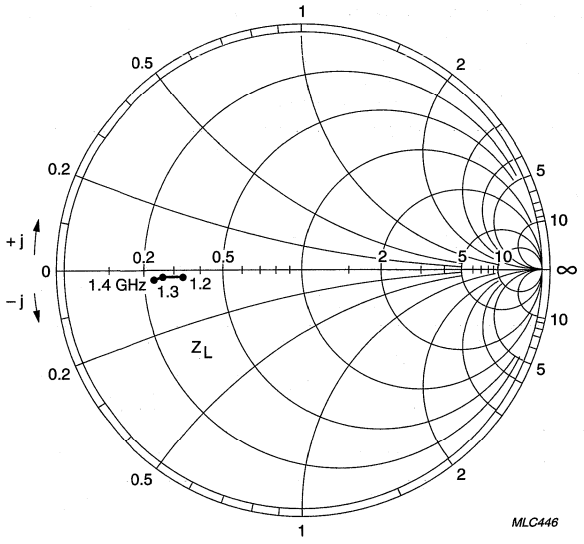
V_{CE} = 24 V; I_{CQ} = 0.15 A; typical values at $P_L = P_{L1}$.

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.2	1.8 + j2.6	4.0 – j2.2
1.3	4.0 + j2.1	3.8 – j0.5
1.4	3.2 + j1.0	3.2 – j0.5



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.6 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.7 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN microwave power transistor LXE15450X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated common-emitter structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures a good stability and allows an easier design of circuits.

APPLICATIONS

Intended for use in common-emitter, class AB amplifiers in CW conditions for professional applications between 1.5 GHz and 1.7 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.15	≥45	≥8	typ. 48	see Figs 8 and 9

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

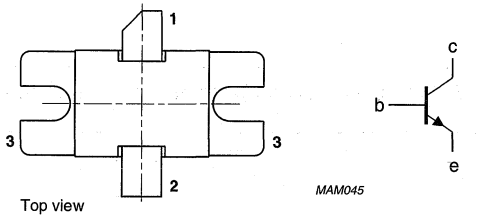


Fig.1 Simplified outline and symbol.

WARNING
Product and environmental safety - toxic materials
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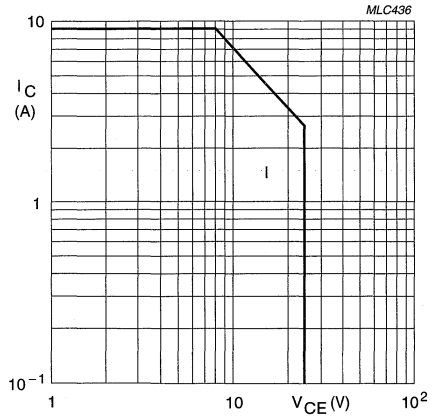
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	25	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	9	A
P_i	input power	f = 1.5 GHz; V_{CE} = 24 V; class AB	–	12	W
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	70	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 75 °C.
(I) Region of permissible DC operation.

Fig.2 DC SOAR.

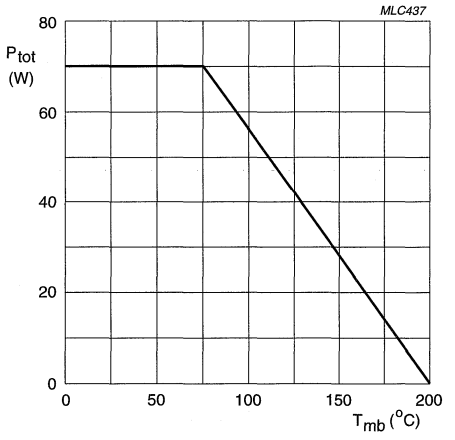


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.3	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

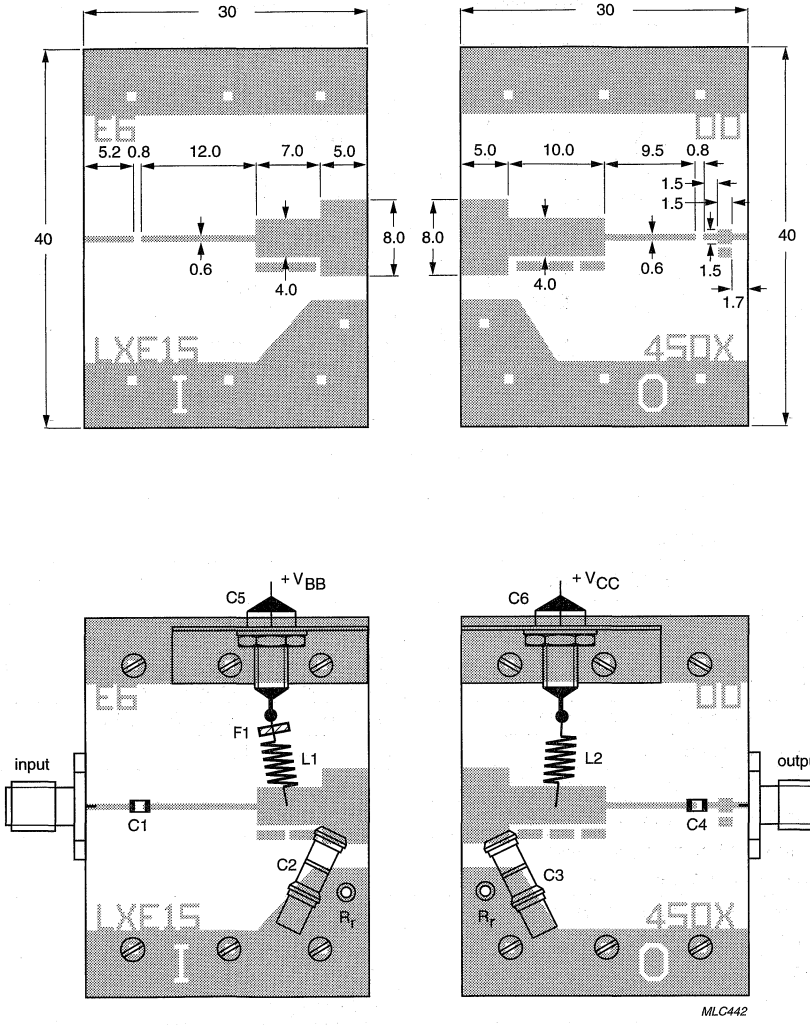
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 20 V	–	4.5	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 22 mA	45	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 150 mA; R_{BE} = 220 Ω	30	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 22 mA	3	–	V
h_{FE}	DC current gain	I_C = 4.5 A; V_{CE} = 3 V	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	η_C (%)	Z_i; Z_L (Ω)
Class AB (CW)	1.5	24	0.15	≥45 typ. 50	≥8 typ. 8.8	typ. 48	see Figs 8 and 9



The test circuit is split into two independent halves each being 30 × 40 mm in size.
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Test circuit.

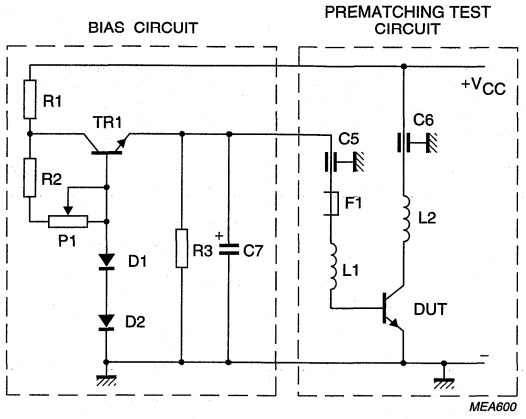


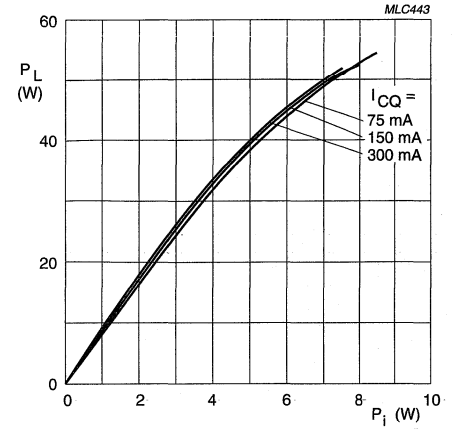
Fig.5 Class AB bias circuit.

List of components (see Figs 4 and 5)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
TR1	transistor, BD239 or equivalent		
C1, C4	DC blocking chip capacitor	100 pF	ATC 100A1201kp
C2, C3	trimmer capacitor	0.5 to 5 pF	Tekelec 721-1
C5, C6	feedthrough bypass capacitor	1500 pF	Erie 1250-003
C7	electrolytic capacitor	10 μF, >30 V	
D1	diode BY239 or equivalent; note 1		
D2	diode BY239 or equivalent; note 2		
L1	4 turns 0.5 mm copper wire; internal diameter = 2 mm		
L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		
P1	linear potentiometer	4.7 kΩ	
R1	resistor	100 Ω, 0.25 W	
R2	resistor	10 kΩ, 0.25 W	
R3	resistor	56 Ω, 0.25 W	
F1	ferrite bead		Philips tube, 12NC = 4330 030 43081 4.2 × 2.2 × 3.2 mm (4B1)
R_r	copper rivet		

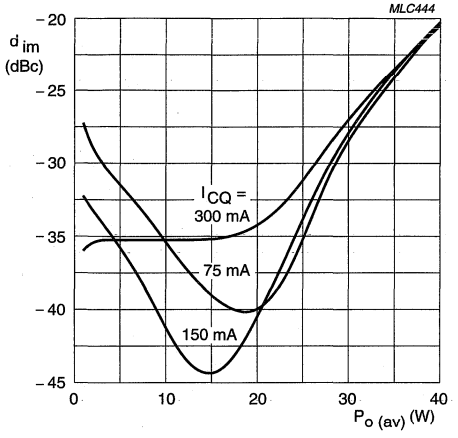
Notes

1. In thermal contact with TR1.
2. In thermal contact with DUT.



V_{CE} = 24 V.
f = 1500 MHz.

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



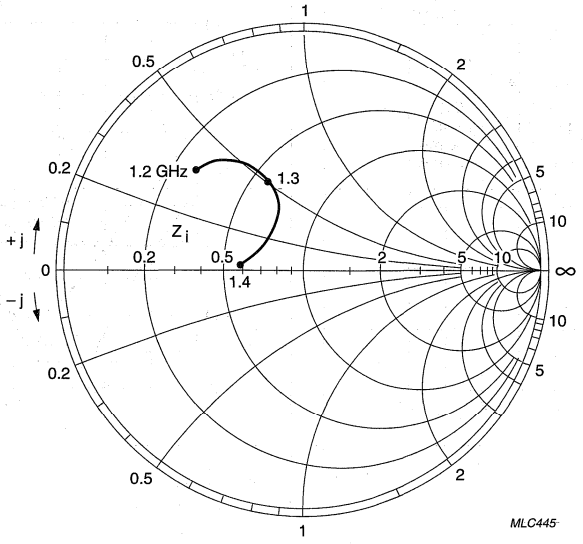
V_{CE} = 24 V.
f_1 = 1500 MHz.
f_2 = 1500.2 MHz.

Fig.7 Intermodulation distortion as a function of average output power.

Input and optimum load impedances

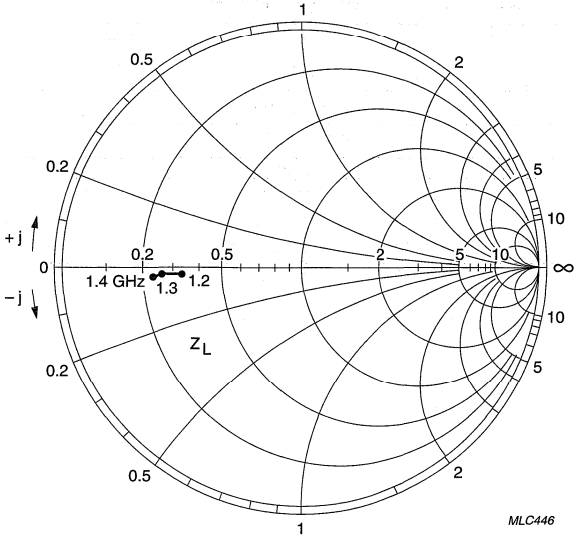
V_{CE} = 24 V; I_{CQ} = 0.15 A; typical values at $P_L = P_{L1}$ (see Figs 8 and 9).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.500	2.8 + j3.5	3.2 − j0.25
1.575	5.7 + j5.0	2.5 − j0.15
1.650	6.0 + j0.4	2.4 − j0.20



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.8 Input impedance as a function of frequency; typical values at $P_L = P_{L1}$.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.15 A.

Fig.9 Optimum load impedance as a function of frequency; typical values at $P_L = P_{L1}$.

NPN microwave power transistor LXE16350X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

Common emitter class AB power amplifiers for military and professional applications at 1.65 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic package, with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.3	≥32	≥9	see Figs 8 and 9

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

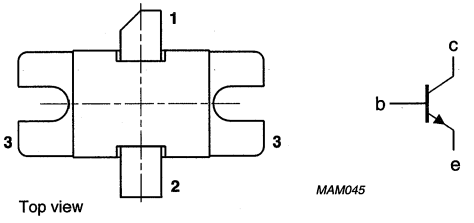


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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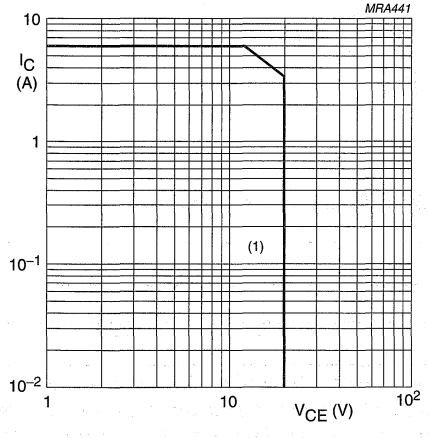
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	6	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	57	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

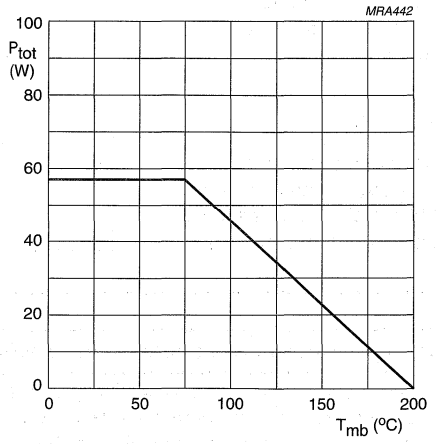
1. Up to 0.2 mm from ceramic.



$T_{mb} \leq 75$ °C.

(1) Region of permissible DC operation.

Fig.2 DC SOAR.



$P_{tot\ max}$ = 57 W.

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.7	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	3	mA
		V_{CB} = 40 V; I_E = 0	–	30	mA
I_{CER}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 220 Ω	–	30	mA
I_{CEO}	collector cut-off current	V_{CE} = 20 V; I_B = 0	–	30	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	300	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 3 A	15	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-emitter class AB amplifier (note 1).

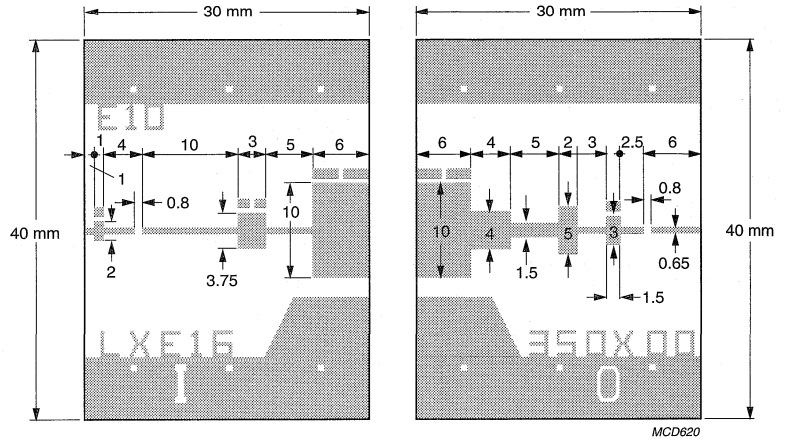
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class AB (CW)	1.65	24	0.3	≥32 typ. 35	≥9 typ. 10	see Figs 8 and 9

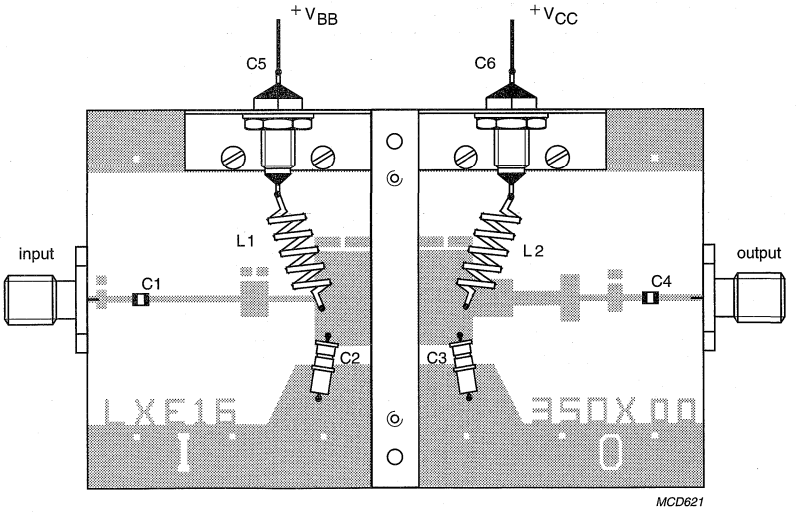
Note

1. The test circuit is split into 2 independent halves each being 30 × 40 mm in size.

List of components (see Fig 4).

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	5 turns 0.5 mm diameter copper wire with ferrite bead		int. dia. 2 mm	
L2	5 turns 0.5 mm diameter copper wire		int. dia. 2 mm	
C1, C4	DC blocking chip capacitor	100 pF		
C2, C3	trimmer capacitor	0.5 to 5 pF		Tekelec
C5, C6	feedthrough bypass capacitor	1500 pF		Erie, ref. 1250-003





Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Prematching test circuit board.

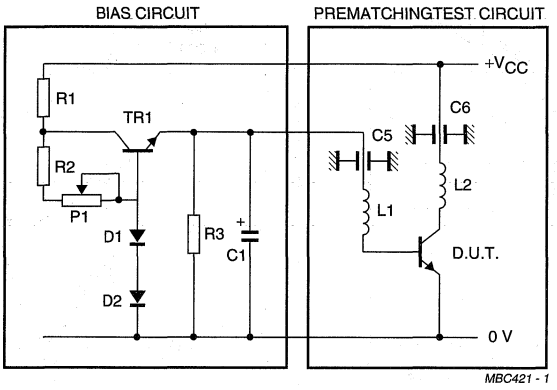


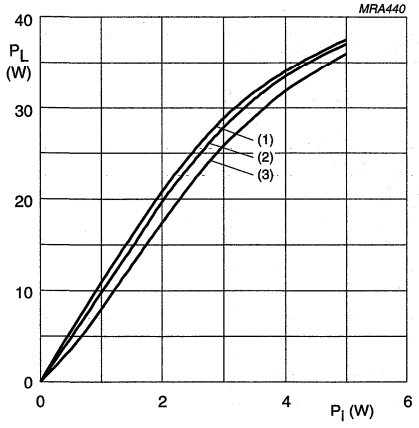
Fig.5 Class AB bias circuit at 1.65 GHz.

List of components (see Fig 5)

COMPONENT	DESCRIPTION	VALUE	CATALOGUE NO.
TR1	transistor, BDT85 (or equivalent)		
D1	diode, IN4148 (or equivalent); note 1		
D2	diode, BY239800; note 2		
R1	resistor	100 Ω	
R2	resistor	10 kΩ	
R3	resistor	56 Ω	
P1	potentiometer, 10 turns (sfernice)	4.7 kΩ	
C1	electrolytic capacitor	10 μF (>30 V)	
C5, C6	feedthrough bypass capacitor	1500 pF	Erie, ref. 1250-003
L1	5 turns 0.5 mm copper wire with ferrite bead		
L2	5 turns 0.5 mm copper wire		

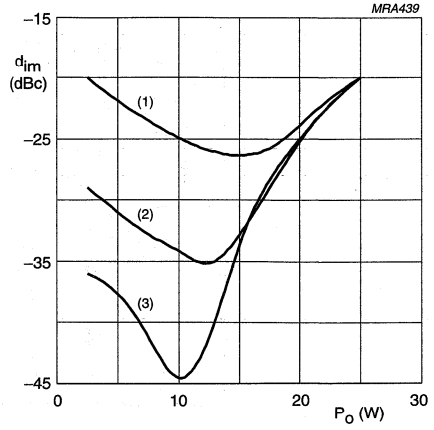
Notes

1. In thermal contact with TR1.
2. In thermal contact with D.U.T.



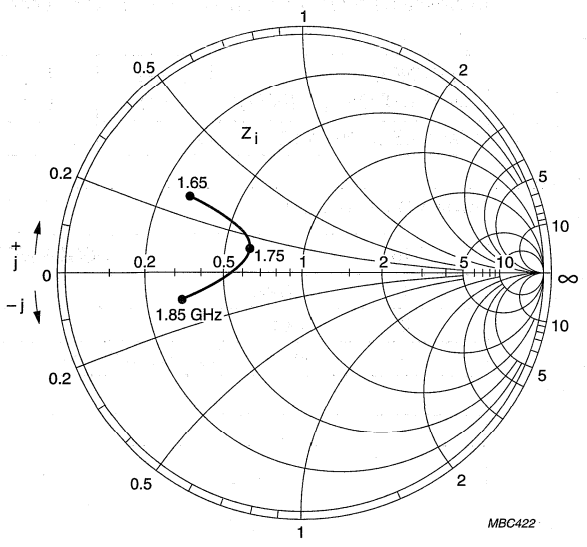
V_{CE} = 24 V.
(1) I_{CQ} = 300 mA.
(2) I_{CQ} = 100 mA.
(3) I_{CQ} = 10 mA.

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



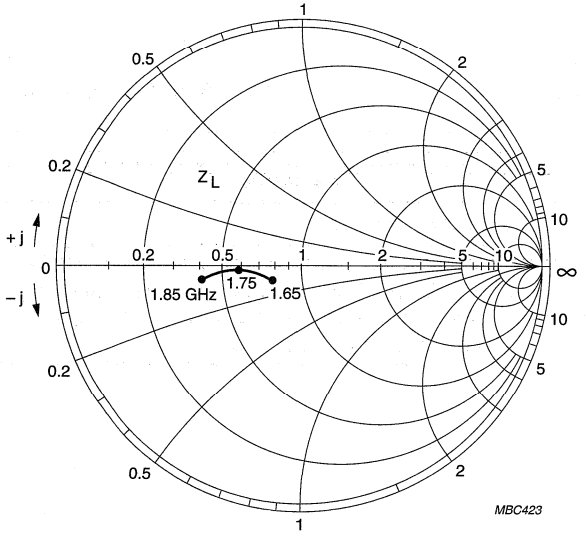
V_{CE} = 24 V.
f_1 = 1.65 GHz
f_2 = 1.6502 GHz.
(1) I_{CQ} = 10 mA.
(2) I_{CQ} = 100 mA.
(3) I_{CQ} = 300 mA.

Fig.7 Intermodulation distortion as a function of average output power.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.3 A.

Fig.8 Input impedance as a function of frequency; typical values.



V_{CE} = 24 V; Z_o = 10 Ω; I_{CQ} = 0.3 A.

Fig.9 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor — LXE18300X

FEATURES

- Internal input and output prematching ensures a good stability and allows an easier design of wideband circuits
- Diffused emitter ballasting resistors provide excellent current sharing and withstanding at a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Intended for use in common emitter class AB power amplifiers for military and professional applications at frequencies from 1.6 to 1.85 GHz, in CW conditions.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with emitter connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{PO} (dB)
Class AB (CW)	1.85	24	0.3	≥27	≥8

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

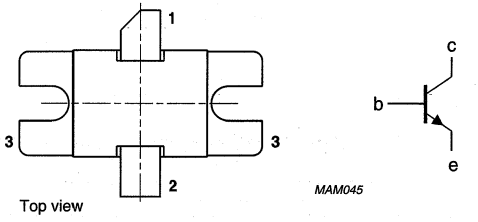


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor LXE18300X

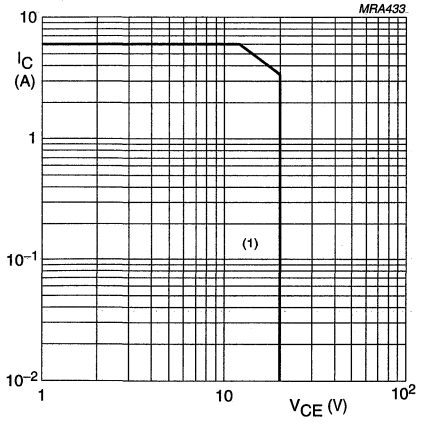
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	6	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	57	W
T_{stg}	storage temperature range		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

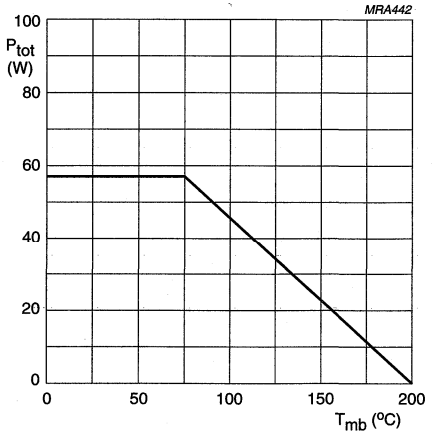
Note

1. Up to 0.2 mm from ceramic.



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.

Fig.2 DC SOAR.



$P_{tot\ max}$ = 57 W.

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

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	T_j = 100 °C	1.7	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	3	mA
		V_{CB} = 40 V; I_E = 0	–	30	mA
I_{CER}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 220 Ω	–	30	mA
I_{CEO}	collector cut-off current	V_{CE} = 20 V; I_B = 0	–	30	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	300	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 3 A	20	100	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class AB amplifier.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (A)	P_{L1} (W)	G_{PO} (dB)
Class AB (CW)	1.85	24	0.3	≥27; typ. 30	≥8; typ. 9

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor LZ1418E100R

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor provides excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

- Common emitter class A amplifiers in CW conditions for military and professional applications between 1.4 to 1.8 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the emitter connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	base
3	emitter connected to flange

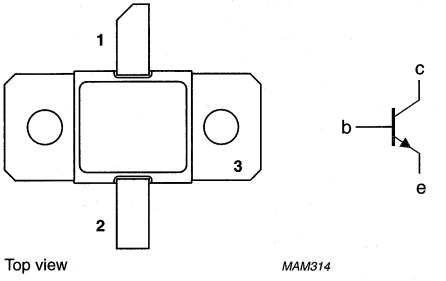


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common emitter class A wideband amplifier.

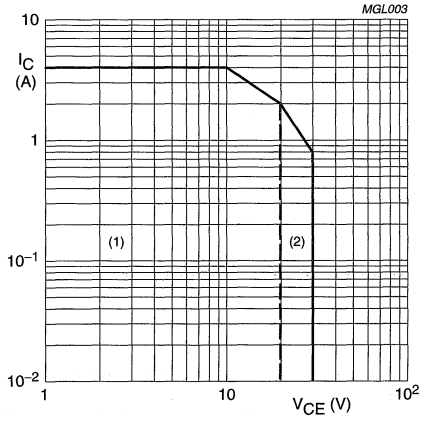
MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	1.4 to 1.8	16	2	≥9	≥10	see Fig 7

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CER}	collector-emitter voltage	R_{BE} = 220 Ω	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	4	A
P_{tot}	total power dissipation	$T_{mb} \geq 75$ °C	–	45	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.2 mm from flange; $t \leq 10$ s	–	235	°C



$T_{mb} \leq 75$ °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided $R_{BE} \leq 220$ Ω.

Fig.2 DC SOAR.

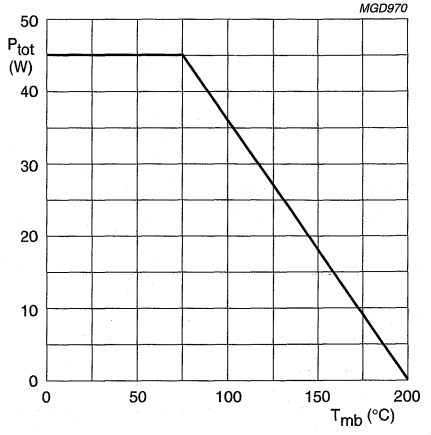


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	2.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 20 V; I_E = 0	–	2	mA
		V_{CB} = 40 V; I_E = 0	–	20	mA
I_{CER}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 220 Ω	–	20	mA
I_{CEO}	collector cut-off current	V_{CE} = 20 V; I_B = 0	–	20	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	200	μA
h_{FE}	DC current gain	V_{CE} = 3 V; I_C = 2 A	15	–	100

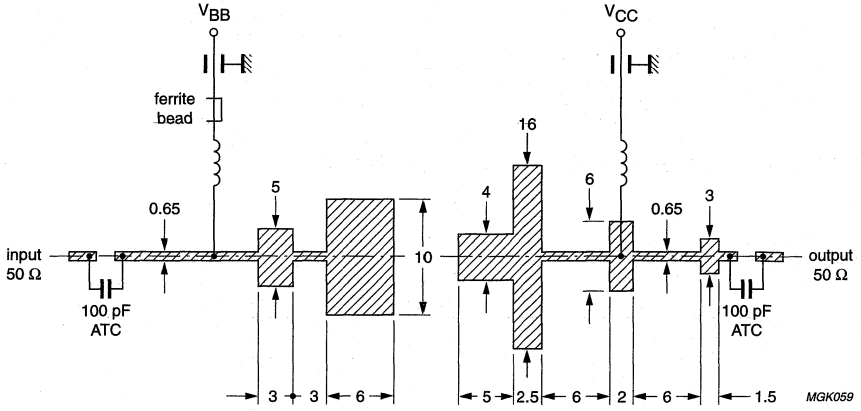
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common emitter class-A wideband amplifier; note 1.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (A)	P_{L1} (W)	G_{po} (dB)	Z_i; Z_L (Ω)
Class-A (CW)	1.4 to 1.8	16	2	≥9 typ. 10	≥10 typ. 11	see Fig 7

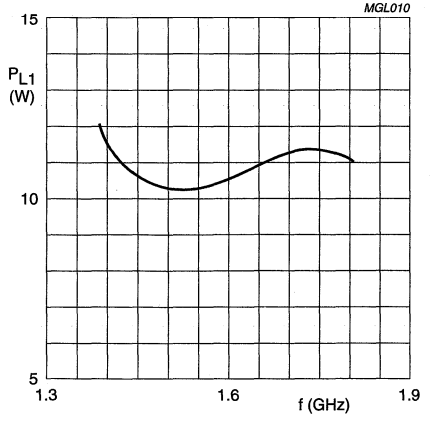
Note

1. Amplifier consists of test circuit board without any additional tuning.



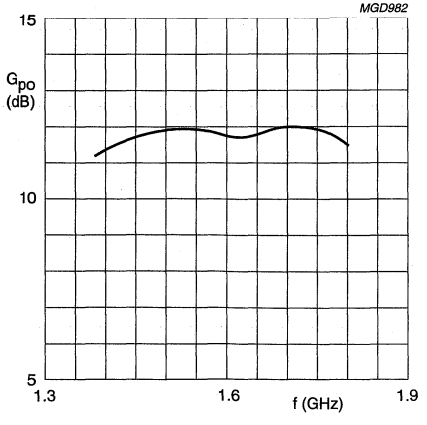
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.4 Wideband test circuit board for 1.4 to1.8 GHz, CW class A application.



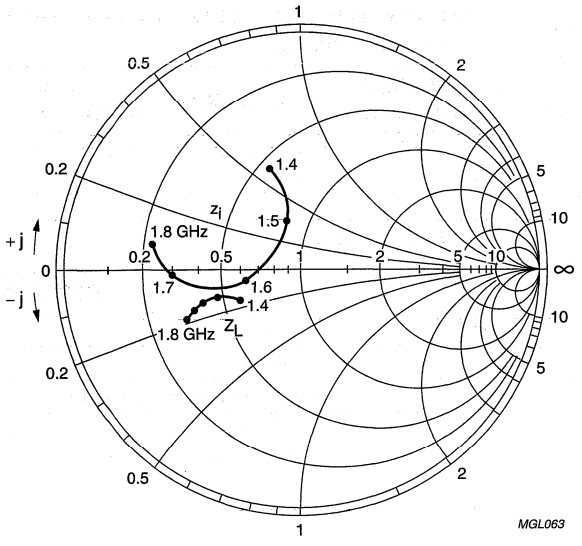
V_{CE} = 16 V; I_C = 2 A (regulated); T_{mb} = 25 °C.

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



V_{CE} = 16 V; I_C = 2 A (regulated); T_{mb} = 25 °C.

Fig.6 Linear power gain as a function of frequency; typical values.



Z_o = 10 Ω; V_{CE} = 16 V; I_C = 2 A (regulated); T_{mb} = 25 °C.

Fig.7 Input and load impedances as functions of frequency; typical values.

Microwave power transistor MF1011B900Y

FEATURES

- Suitable for short and medium pulse applications up to 100 µs pulse width, duty factor 10%
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance
- Internal input and output prematching networks allow an easier design of circuits.

APPLICATIONS

Intended for use in common base class C broadband pulsed power amplifiers for IFF, TCAS and Mode S applications in the 1030 MHz to 1090 MHz band. Also suitable for medium pulse, heavy duty operation within this band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT448A glued cap metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class C narrowband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 10 µs; δ = 1%	1.09	50	800	≥6	≥40

PINNING - SOT448A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

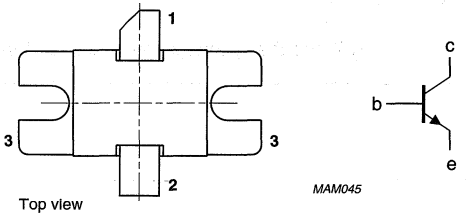


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

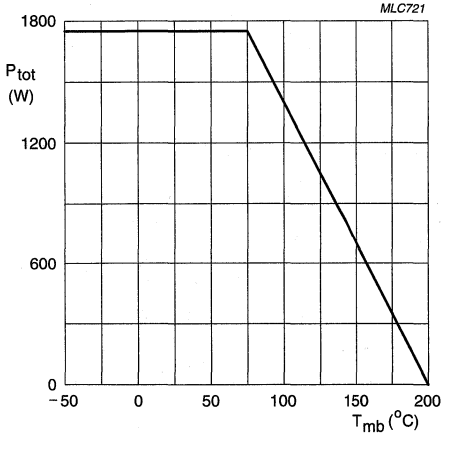
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current	$t_p = 10\ \mu s$; $\delta = 1\%$	–	50	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 1\%$	–	1750	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 1\%$.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	0.84	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
Z_{th}	thermal impedance from junction to heatsink	t_p = 10 μs; δ = 1%; notes 1and 2	0.01	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

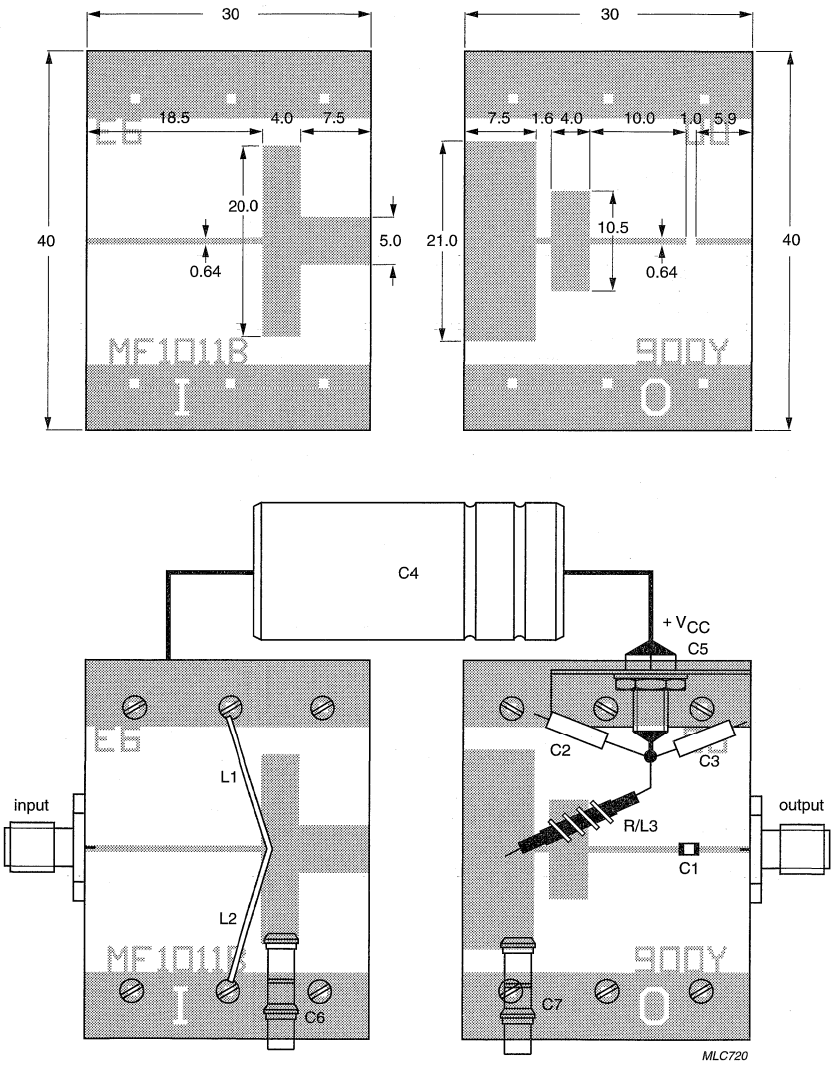
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	27	mA
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 50 V	27	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 1.5 V	7	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 180 mA	65	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 180 mA; V_{BE} = 0	65	V

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 10 μs; δ = 1%	1.09	50	≥800 typ. 900	≥6 typ. 6.5	≥40 typ. 48
	t_p = 0.5 μs; δ = 50% t_p = 112 μs; δ = 1%	1.03 to 1.09	50	typ. 750	typ. 5.7	typ. 36
	t_p = 32 μs; δ = 1%	1.09	50	typ. 870	typ. 6.3	typ. 46

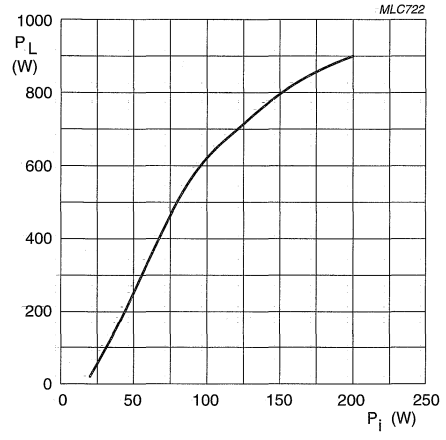


Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.

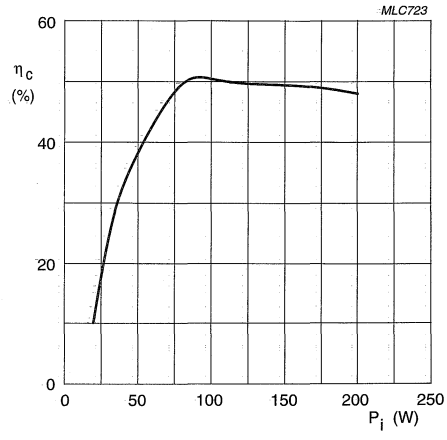
List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
C1	capacitor	100 pF	ATC 100A101kp50x
C2,C3	tantalum capacitor	10 μF; 50 V	
C4	electrolytic capacitor	1 mF; 63 V	
C5	feedthrough bypass capacitor		Erie 1250-003
C6, C7	variable gigatrim capacitor	0.8 to 8 pF	Tekelec 729-1
L1, L2	0.65 mm copper wire; total length = 26 mm; height of loop = 10 mm		
L3	4 turns 0.65 mm copper wire; total length = 48 mm		
R	resistor	4.7 Ω; 0.5 W	



Class C pulse operation.
t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz.
In broadband test circuit as shown in Fig.3.

Fig.4 Load power as a function of input power.



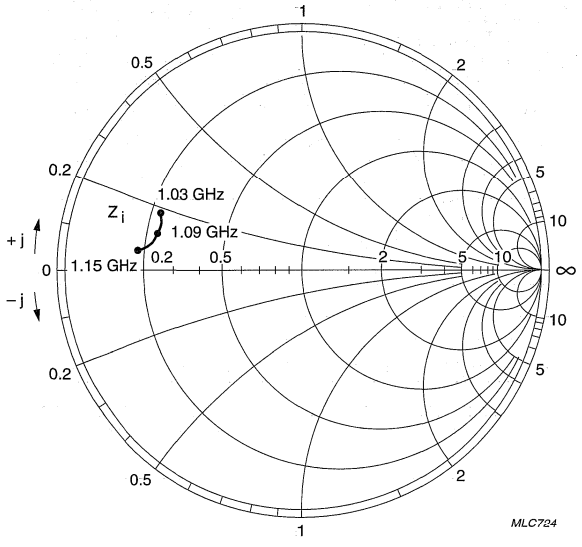
Class C pulse operation.
t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz.
In broadband test circuit as shown in Fig.3.

Fig.5 Collector efficiency as a function of input power.

Input and optimum load impedances

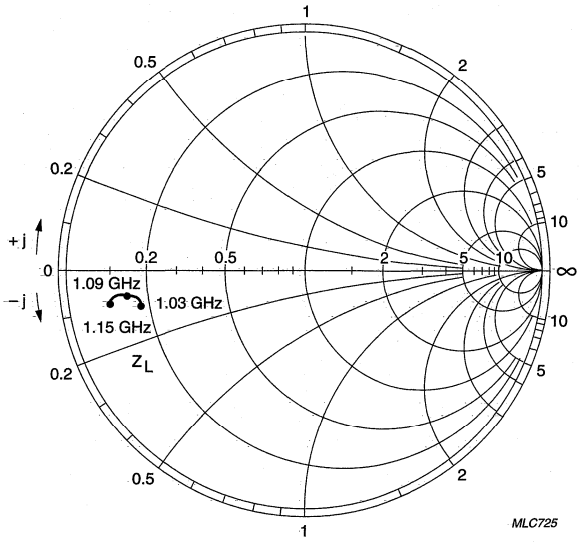
V_{CE} = 50 V; typical values at $P_L = P_{L1}$ (see Figs 6 and 7).

f (GHz)	Z_i (Ω)	Z_L (Ω)
1.03	0.22 + j0.19	0.14 – j0.10
1.09	0.23 + j0.12	0.12 – j0.08
1.15	0.19 + j0.06	0.09 – j0.09



V_{CC} = 50 V; Z_o = 10 Ω; P_o = 240 W.

Fig.6 Input impedance as a function of frequency.



V_{CC} = 50 V; Z_o = 50 Ω; P_o = 240 W.

Fig.7 Optimum load impedance as a function of frequency.

NPN microwave power transistor | MTB10010U

FEATURES

- Input prematching cell allows an easier design of circuits
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good characteristics stability and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common base class C narrowband pulsed power amplifiers at 1030 MHz for IFF applications.

DESCRIPTION

NPN silicon planar epitaxial microwave transistor with internal input prematching cell in a SOT440A metal ceramic package with base connected to flange.

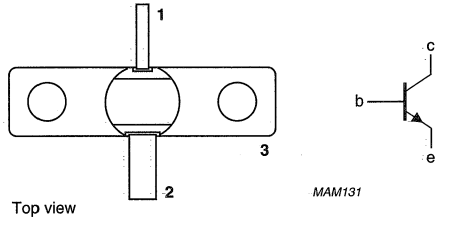
QUICK REFERENCE DATA

Microwave performance for T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	CONDITIONS	f (MHz)	V_{CC} (V)	P_L (W)	G_{PO} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C	t_p = 1 μs; δ = 1%	1030	24	>9.5	>9.5	>50	see Figs 5 and 6

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange



Top view

Marking code: 10010U.

Fig.1 Simplified outline and symbol.

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

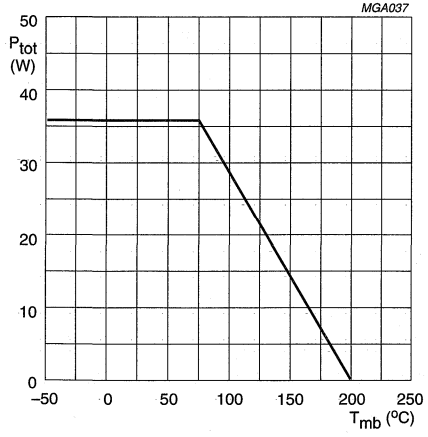
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (average)		–	0.75	A
P_{tot}	total power dissipation	$T_{mb} < 75$ °C; $t_p = 1$ µs; $\delta = 1\%$	–	36	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

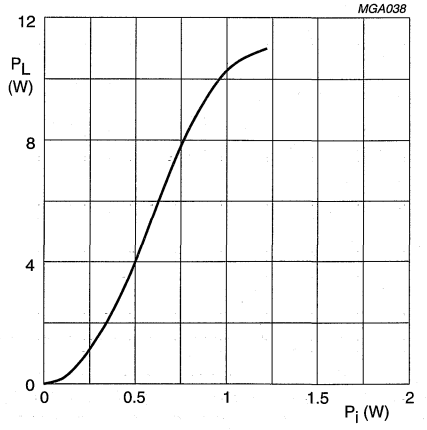
Note

1. Up to 0.3 mm from ceramic.



$P_{tot\ max}$ = 36 W under the nominal pulse conditions.

Fig.2 Power derating curve.



V_{CC} = 24 V; $t_p = 1$ µs; $\delta = 1\%$; f = 1030 MHz.

Fig.3 Load power as a function of input power.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	10.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.7	K/W
$Z_{th\ j\text{-}mb}$	thermal impedance from junction to mounting base	t_p = 1 μs; δ = 1%; note 1	2.5	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 30 V; I_E = 0	45	μA
I_{CES}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 0	300	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	4.5	μA

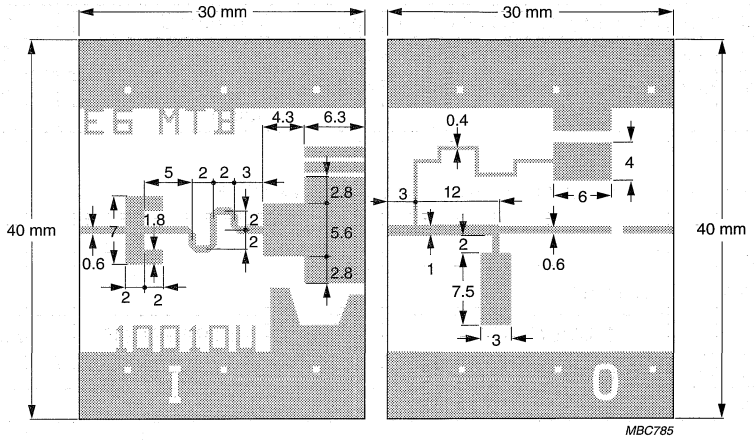
APPLICATION INFORMATION

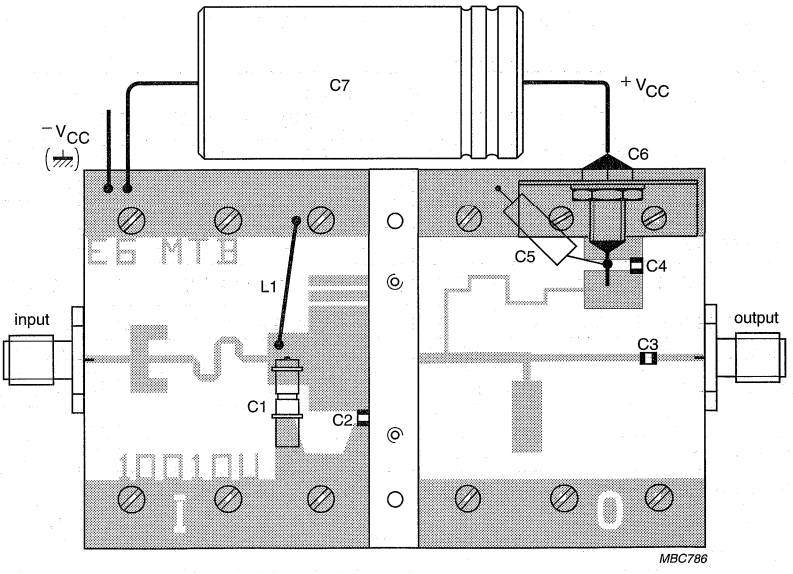
Microwave performance up to T_{mb} = 25 °C and working in pulsed conditions in a narrowband test circuit as shown in Fig.4.

MODE OF OPERATION	CONDITIONS	f (MHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C	t_p = 1 μs; δ = 1 %	1030	24	>9.5; typ. 11	>9.5; typ. 10	>50; typ. 55	see Figs 5 and 6

List of components (see Fig.4)

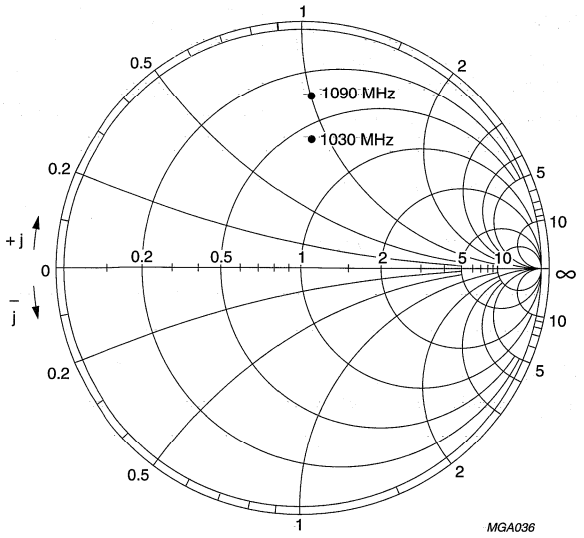
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	0.4 mm diameter copper wire	–	rectangular loop	–
C1	tuning capacitor	0.5 – 5 pF	–	Tekelec 5855
C2	chip capacitor	3 pF	–	Eurofarad CEC 23
C3	chip capacitor	10 pF	–	Eurofarad CEC 23
C4	chip capacitor	47 pF	–	Eurofarad CEC 23
C5	tantalum capacitor	10 μF, 50 V	–	–
C6	feedthrough bypass capacitor	–	–	Erie 1250-003
C7	capacitor	220 μF, 63 V	–	–





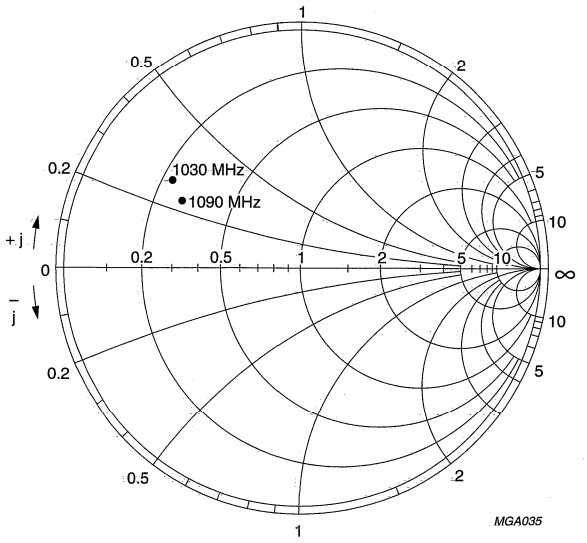
Dimensions in mm.
Substrate: Duroid 6010.
Permittivity: $\varepsilon_r = 10.2$.

Fig.4 Narrowband test circuit.



V_{CC} = 24 V; Z_O = 5 Ω; P_L = 10 W.

Fig.5 Input impedance as a function of frequency, associated with optimum load impedance.



V_{CC} = 24 V; Z_O = 50 Ω; P_L = 10 W.

Fig.6 Optimum load impedance as a function of frequency; associated with input impedance.

NPN microwave power transistors MX0912B100Y; MZ0912B100Y

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and low thermal resistance
- Input and output matching cell allows an easier design of circuits.

APPLICATIONS

- Common base class-C broadband pulse power amplifiers operating at 960 to 1215 MHz for TACAN application.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistors.

The MX0912B100Y has a SOT439A metal ceramic flange package and improved output prematching cells. It is recommended for new designs.

The MZ0912B100Y has a SOT443A metal ceramic flange package with the base connected to the flange. It is mounted in common base configuration and specified in class C.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

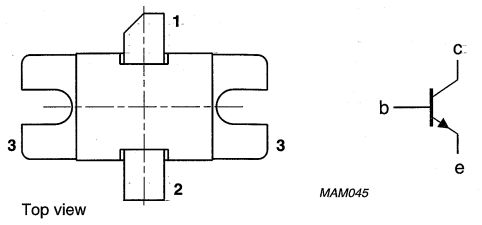


Fig.1 Simplified outline and symbol (SOT439A).

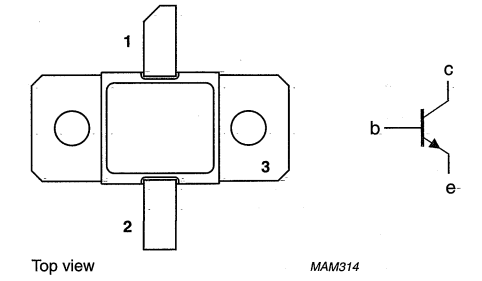


Fig.2 Simplified outline and symbol (SOT443A).

QUICK REFERENCE DATA

Microwave performance at $T_{mb} \leq 25$ °C in a common base class-C broadband amplifier.

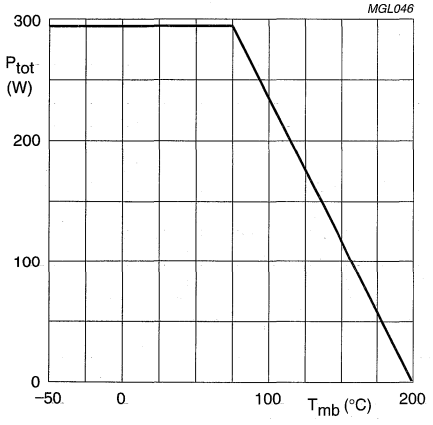
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-C; t_p = 10 μs; δ = 10 %	0.960 to 1.215	50	>100	>7	>42	see Figs 8 and 9

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 10$ µs; $\delta \leq 10$ %	–	6	A
P_{tot}	total power dissipation (peak power)	$t_p \leq 10$ µs; $\delta \leq 10$ %; T_{mb} = 75 °C	–	290	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	up to 0.2 mm from ceramic; t ≤ 10 s	–	235	°C



t_p = 10 µs; δ = 10 %; $P_{tot\ max}$ = 290 W.

Fig.3 Maximum power dissipation derating as a function of mounting-base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 125 °C	3.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 125 °C; note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 10 µs; δ = 10 %; T_j = 125 °C; notes 1 and 2	0.43	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 65 V; I_E = 0	40	mA
		V_{CB} = 50 V; I_E = 0	4	mA
I_{CES}	collector cut-off current	V_{CB} = 60 V; R_{BE} = 0	40	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	400	µA

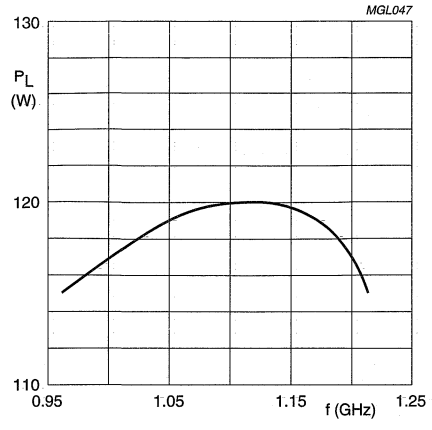
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C measured in the test jig as shown in Fig.7 and working in class C broadband in pulse mode; note 1.

MODE OF OPERATION	f (GHz)	V_{CC} (V)[2]	P_L (W)	G_p (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C; t_p = 10 µs; δ = 10%	0.960 to 1.215	50	≥100 typ. 115	≥7 typ. 7.6	≥42 typ. 44	see Figs 8 and 9
t_p = 300 µs; δ = 10%; see Fig.6	1.03 to 1.09	50	typ. 125	typ. 8	typ. 50	

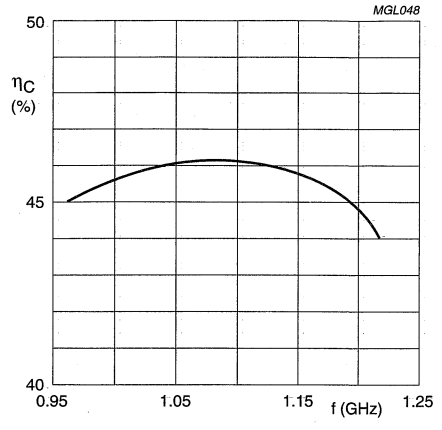
Notes

1. Operating conditions and performance for other pulse formats can be made available on request.
2. V_{CC} during pulse.



V_{CC} = 50 V; t_p = 10 μs; δ = 10%.

Fig.4 Load power as a function of frequency. (In broadband test circuit as shown in Fig.7)



V_{CC} = 50 V; t_p = 10 μs; δ = 10%.

Fig.5 Collector efficiency as a function of frequency. (In broadband test circuit as shown in Fig.7)

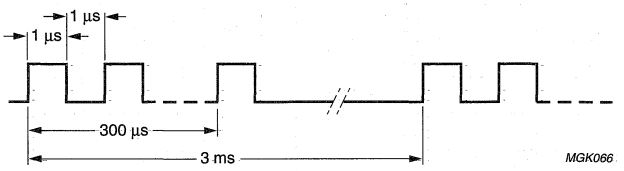
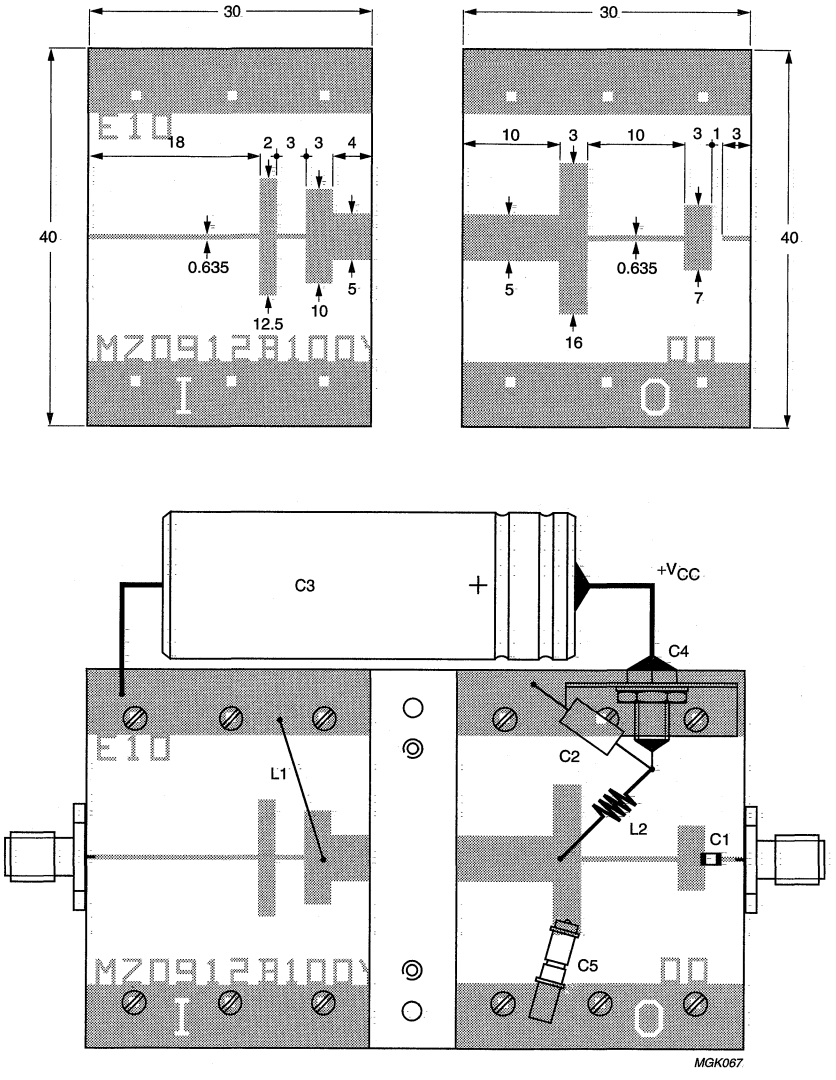


Fig.6 Pulse definition.

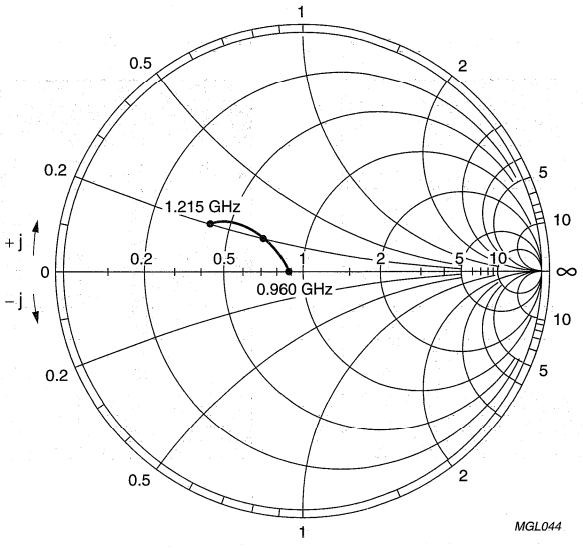
List of components

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	0.65 mm diameter copper wire	–	total length = 12 mm; height of loop = 12 mm	–
L2	4 turns 0.65 mm diameter copper wire	–	int. dia. 3 mm; L = 5 mm	–
C1	capacitor	100 pF	–	ATC, ref. 100A101KP50X
C2	tantalum capacitor	10 µF; 50 V	–	–
C3	electrolytic capacitor	470 µF; 63 V	–	–
C4	feedthrough bypass capacitor	–	–	Erie, ref. 1250-003
C5, C6	variable gigatrim capacitor	0.6 to 4.5 pF	–	Tekelec, ref. 727.1



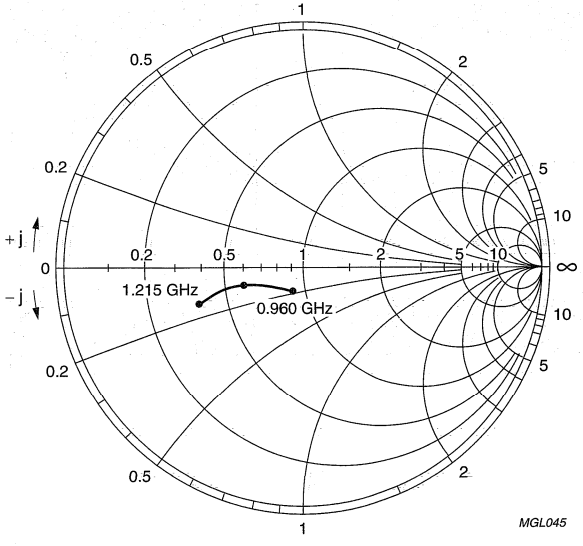
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.7 Broadband test circuit.



V_{CC} = 50 V; Z_o = 10 Ω; P_L = 100 W.

Fig.8 Input impedance as a function of frequency associated with optimum load impedance.



V_{CC} = 50 V; Z_o = 10 Ω.; P_L = 100 W.

Fig.9 Optimum load impedance as a function of frequency associated with input impedance.

NPN microwave power transistor MX0912B251Y

FEATURES

- Interdigitated structure; high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Input and output matching cell allows an easier design of circuits.

APPLICATIONS

Intended for use in common base class C broadband pulse power amplifier from 960 to 1215 MHz for TACAN application.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with base connected to flange. It is mounted in common base configuration, and specified in class C.

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

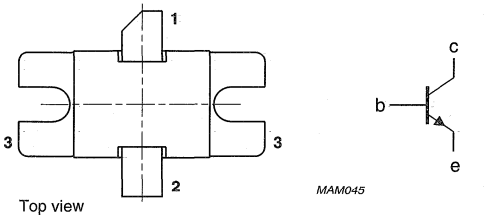


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C t_p = 10 μs; δ = 10%	0.960 to 1.215	50	>235	>7	>42	see Figs 7 and 8

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

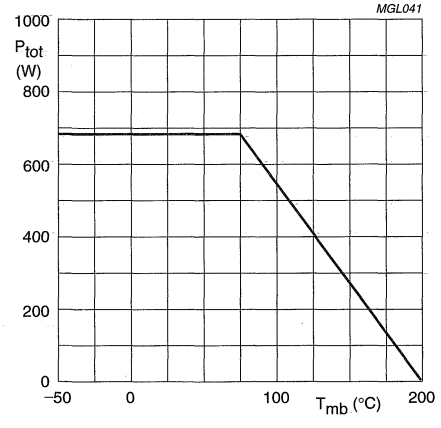
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	$t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	15	A
P_{tot}	total power dissipation (peak power)	$T_{mb} = 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	690	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 10\%$; $P_{tot\ max} = 690$ W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

T_j = 125 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	CW	1.9	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	CW; note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 10 μs; δ = 10% notes 1 and 2	0.28	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under nominal pulse microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 65 V; I_E = 0	100	mA
		V_{CB} = 50 V; I_E = 0	10	mA
I_{CES}	collector cut-off current	V_{CE} = 60 V; R_{BE} = 0	100	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	1	mA

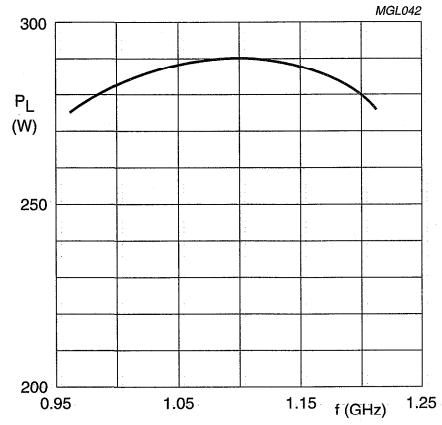
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C measured in the test jig as shown in Fig.6 and working in class C broadband mode in pulse; note 1.

MODE OF OPERATION	f (GHz)	V_{CC} (V)[2]	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C; t_p = 10 μs; δ = 10%	0.960 to 1.215	50	>235 typ. 275	>7 typ. 7.4	>42 typ. 47	see Figs 7 and 8
t_p = 300 μs; δ = 10%; see Fig.5	1.03 to 1.09	50	typ. 280	typ. 8	typ. 48	

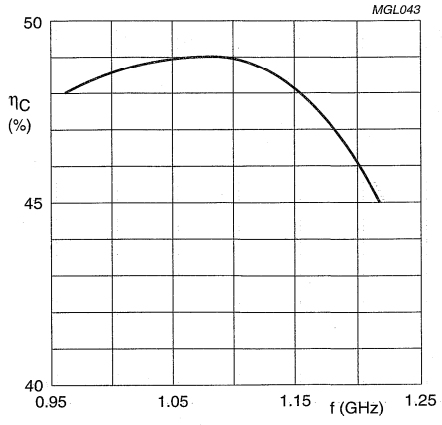
Notes

1. Operating conditions and performance for other pulse formats can be made available on request.
2. V_{CC} during pulse.



V_{CC} = 50 V; t_p = 10 µs; δ = 10%.

Fig.3 Load power as a function of frequency. (In broadband test circuit as shown in Fig.6)



V_{CC} = 50 V; t_p = 10 µs; δ = 10%.

Fig.4 Collector efficiency as a function of frequency. (In broadband test circuit as shown in Fig.6)

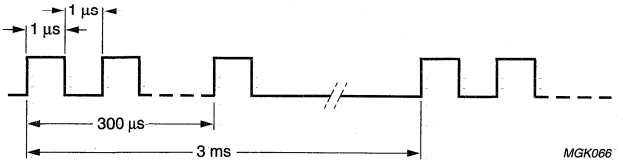
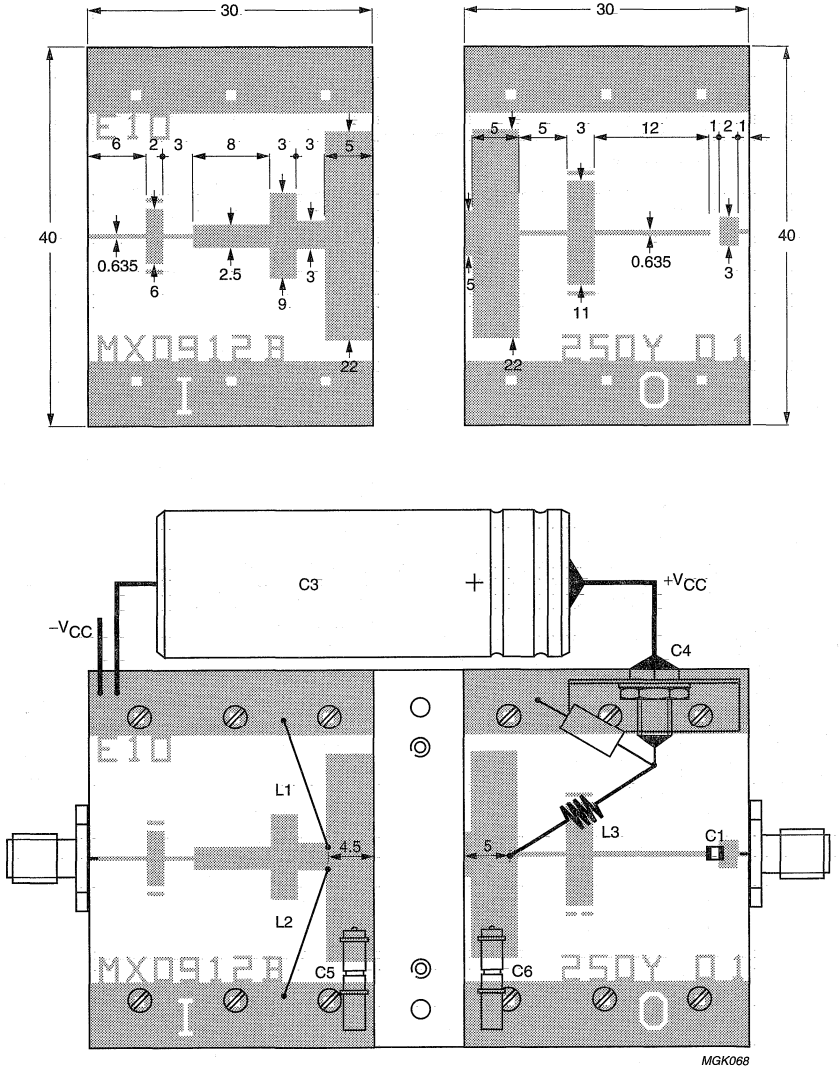


Fig.5 Pulse definition.

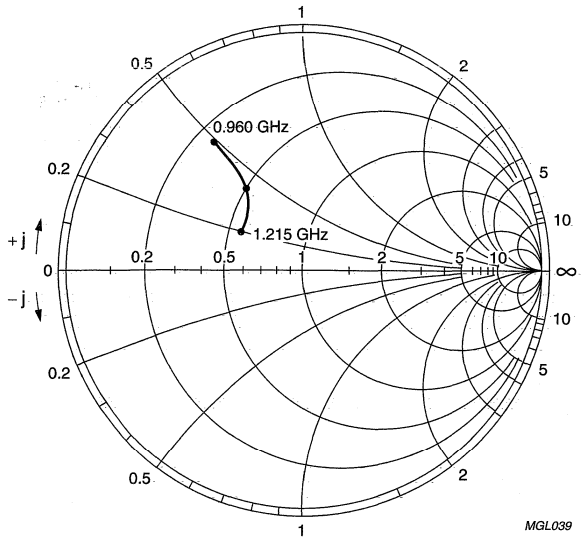
List of components

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	0.65 mm diameter copper wire	–	total length = 12 mm; height of loop = 9 mm	–
L3	4 turns 0.65 mm diameter copper wire	–	int. diameter 3 mm; L = 5 mm	–
C1	DC block	100 pF		ATC, ref. 100A101KP50X
C2	tantalum capacitor	10 µF; 50 V		
C3	electrolytic capacitor	470 µF; 63 V		
C4	feedthrough bypass capacitor			Erie, ref. 1250-003
C5, C6	variable gigatrim capacitor	0.8 to 8 pF		Tekelec, ref. 729.1



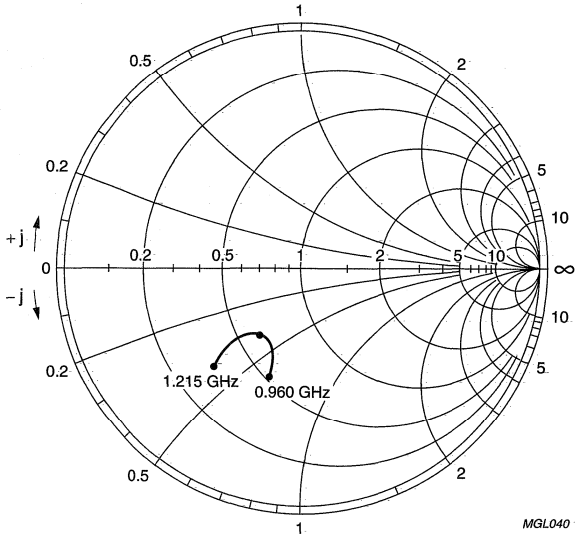
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.6 Broadband test circuit.



V_{CC} = 50 V; Z_o = 5 Ω; P_L = 235 W.

Fig.7 Input impedance as a function of frequency associated with optimum load impedance.



V_{CC} = 50 V; Z_o = 5 Ω; P_L = 235 W.

Fig.8 Optimum load impedance as a function of frequency associated with input impedance.

NPN microwave power transistor MX0912B351Y

FEATURES

- Interdigitated structure; high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Input and output matching cell allows an easier design of circuits.

APPLICATIONS

Intended for use in common base class C broadband pulse power amplifier from 960 to 1215 MHz for TACAN application.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with base connected to flange. It is mounted in common base configuration and specified in class C.

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

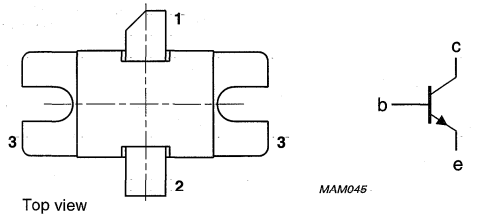


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C t_p = 10 μs; δ = 10%	0.960 to 1.215	50	>325	>7	>40	see Figs 7 and 8

WARNING

Product and environmental safety - toxic materials

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

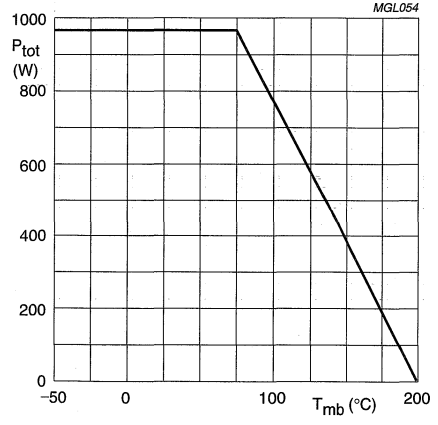
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	$t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	21	A
P_{tot}	total power dissipation (peak power)	$T_{mb} = 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	960	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 10\%$; $P_{tot\ max} = 960$ W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

T_j = 125 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	CW	1.7	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	CW; note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 10 μs; δ = 10% notes 1 and 2	0.13	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under nominal pulse microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 65 V; I_E = 0	140	mA
		V_{CB} = 50 V; I_E = 0	14	mA
I_{CES}	collector cut-off current	V_{CE} = 60 V; R_{BE} = 0 Ω	140	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	1.4	mA

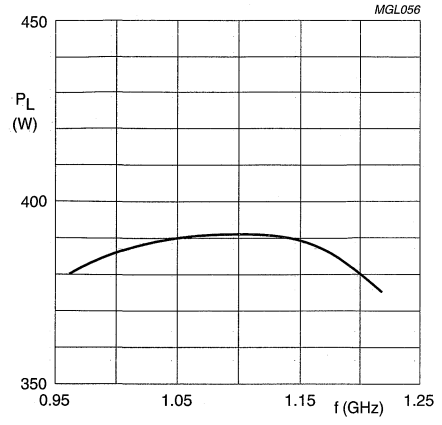
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C measured in the test circuit as shown in Fig.6 and working in class C broadband in pulse mode; note 1.

MODE OF OPERATION	f (GHz)	V_{CC} (V)[2]	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C; t_p = 10 μs; δ = 10%	0.960 to 1.215	50	>325 typ. 375	>7 typ. 7.6	>40 typ. 47	see Figs 7 and 8
t_p = 300 μs; δ = 10%; see Fig.5	1.03 to 1.09	50	typ. 350	typ. 8	typ. 48	

Notes

1. Operating conditions and performance for other pulse formats can be made available on request.
2. V_{CC} during pulse.



V_{CC} = 50 V; t_p = 10 μs; δ = 10%.

Fig.3 Load power as a function of frequency. (In broadband test circuit as shown in Fig.6)

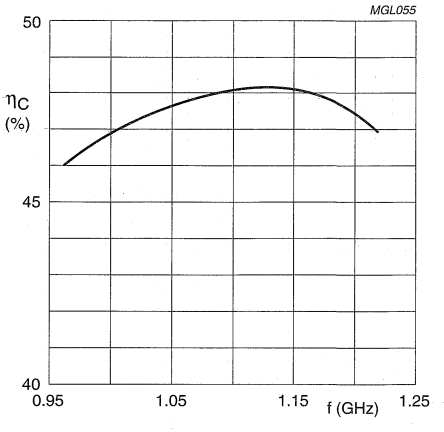


Fig.4 Collector efficiency as a function of frequency. (In broadband test circuit as shown in Fig.6)

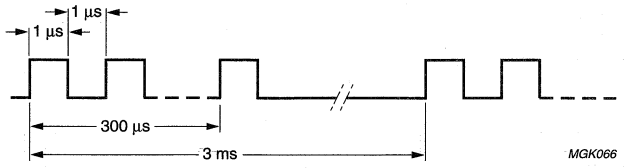
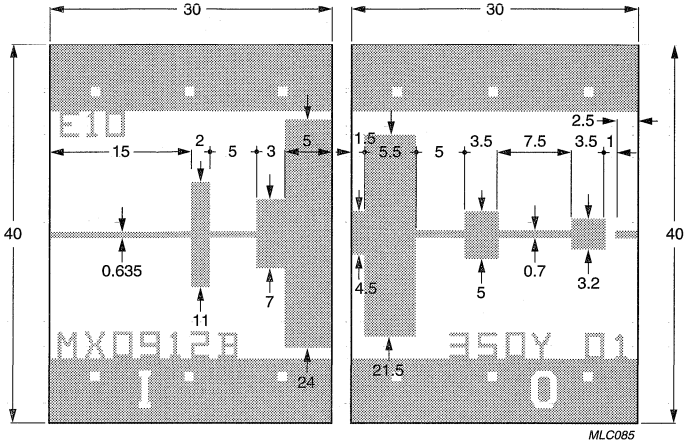
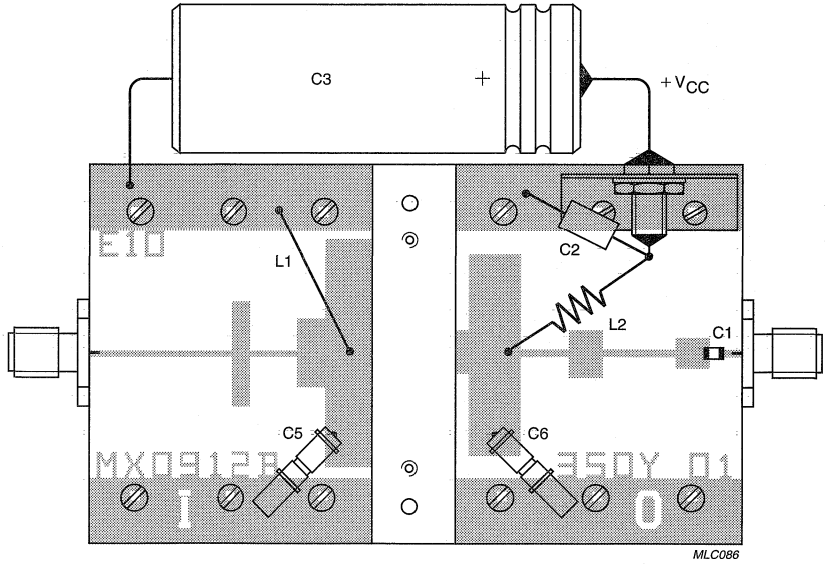


Fig.5 Pulse definition.

List of components

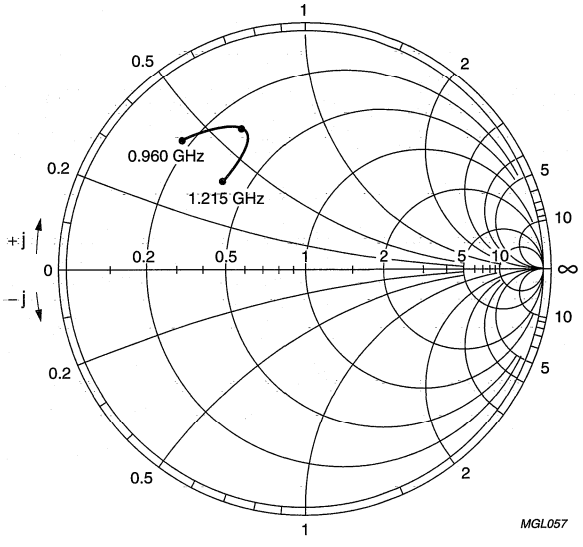
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	0.65 mm diameter copper wire	–	total length = 12 mm; height of loop = 9 mm	–
L2	4 turns 0.65 mm diameter copper wire	–	int. diameter. 3 mm; L = 5 mm	–
C1	DC block	100 pF		ATC, ref. 100A101KP50X
C2	tantalum capacitor	10 µF; 50 V		
C3	electrolytic capacitor	470 µF; 63 V		
C4	feedthrough bypass capacitor			Erie, ref. 1250-003
C5, C6	variable gigatrim capacitor	0.8 to 8 pF		Tekelec, ref. 729.1





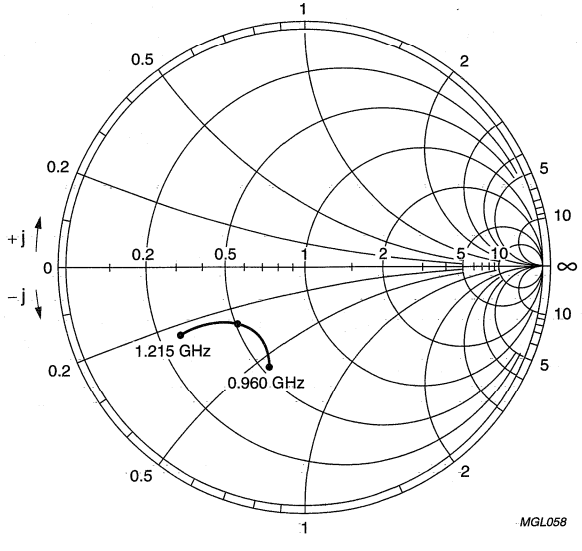
Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.6 Broadband test circuit.



V_{CC} = 50 V; Z_o = 5 Ω; P_L = 325 W.

Fig.7 Input impedance as a function of frequency associated with optimum load impedance.



V_{CC} = 50 V; Z_o = 5 Ω; P_L = 325 W.

Fig.8 Optimum load impedance as a function of frequency associated with input impedance.

Microwave power transistor — MX1011B200Y

FEATURES

- Suitable for short and medium pulse applications up to 100 μs pulse width, 10% duty factor
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing reduces thermal resistance
- Internal input and output prematching networks allow an easier design of circuits.

APPLICATIONS

Intended for use in common base class C broadband pulsed power amplifiers for IFF, TCAS and Mode S applications in the 1030 MHz to 1090 MHz bandwidth. Also suitable for medium pulse, heavy duty operation within the 1030 MHz to 1150 MHz bandwidth.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 10 μs; δ = 1%	1.09	50	200	≥7.5	≥45

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

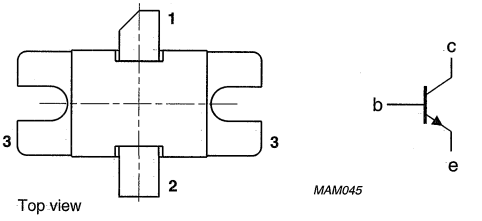


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

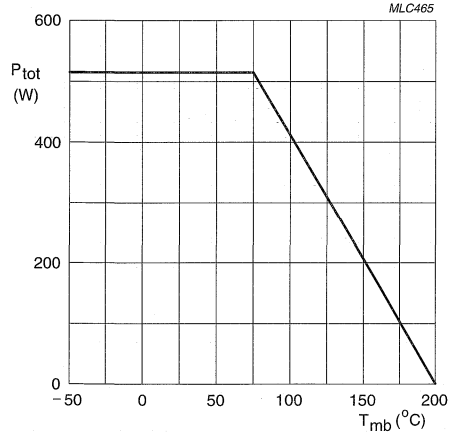
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current	$t_p = 10\ \mu s$; $\delta = 1\%$	–	11.5	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 1\%$	–	515	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 1\%$.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	2.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
Z_{th}	thermal impedance from junction to heatsink	t_p = 10 µs; δ = 1%; notes 1 and 2	0.16	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

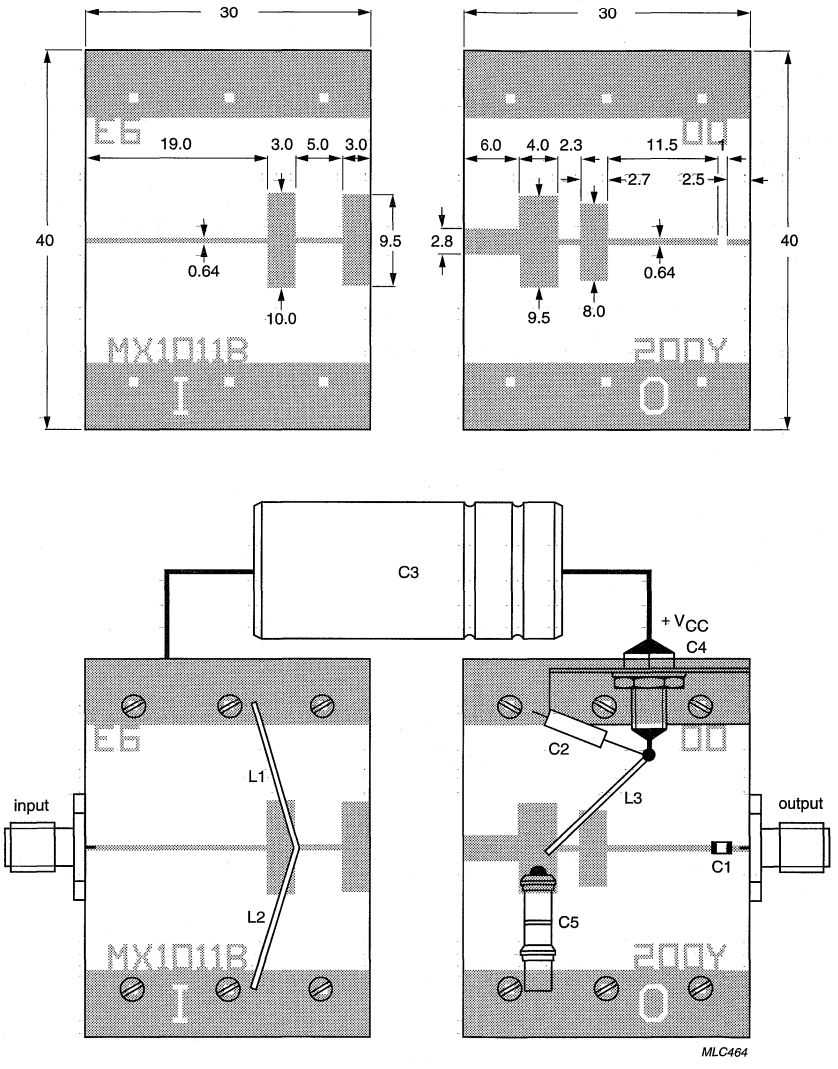
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	6	mA
I_{CES}	collector cut-off current	V_{BE} = 0; V_{CE} = 50 V	6	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 1.5 V	1.5	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 40 mA	65	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 40 mA; V_{BE} = 0	65	V

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 10 µs; δ = 1%	1.09	50	≥200 typ. 220	≥7.5 typ. 8.3	≥45 typ. 52
	t_p = 0.5 µs; δ = 50% t_p = 112 µs; δ = 1%	1.03 to 1.09	50	typ. 220	typ. 7.5	typ. 50
	t_p = 6.6 µs; δ = 51% t_p = 3.3 µs; δ = 43%	1.03 to 1.15	50	typ. 100	typ. 6	typ. 35
	t_p = 32 µs; δ = 1%	1.09	50	typ. 210	typ. 7.5	typ. 47

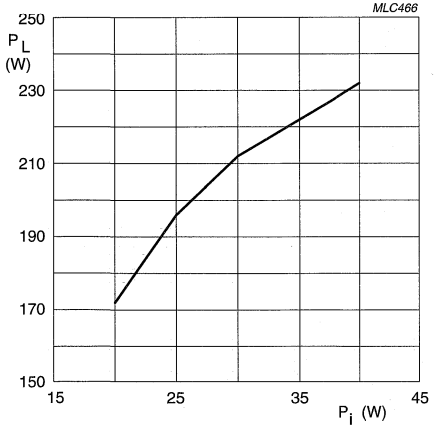


Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.

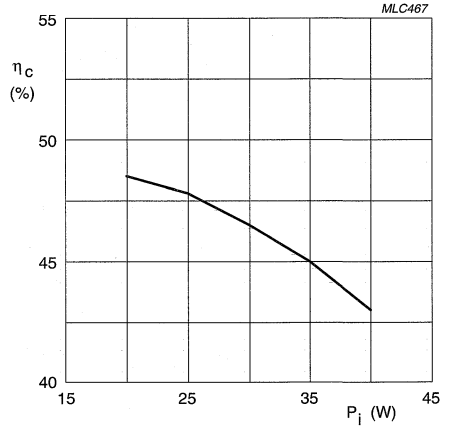
List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
C1	capacitor	100 pF	ATC 100A101kp50x
C2	tantalum capacitor	10 μF; 50 V	–
C3	electrolytic capacitor	63 V; 1000 μF	–
C4	feedthrough bypass capacitor	–	Erie1250-003
C5	variable gigatrim capacitor	0.8 to 8 pF	Tekelec 729-1
L1, L2	0.65 mm copper wire; total length = 26 mm; height of loop = 10 mm	–	–
L3	0.85 mm silver wire; total length = 30 mm; height of loop = 15 mm	–	–



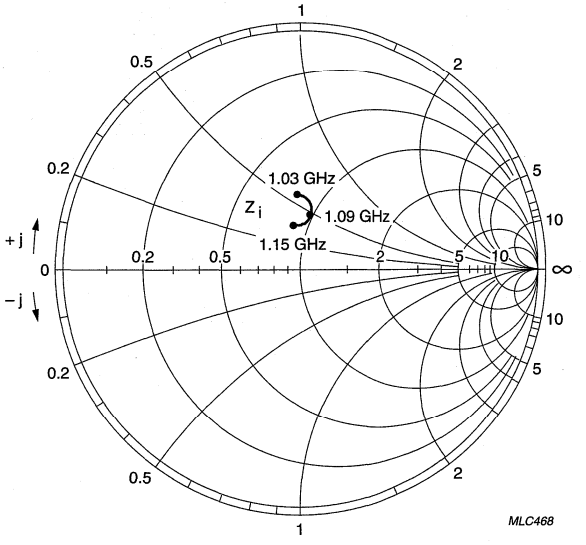
Class C pulse operation.
t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz.
In broadband test circuit as shown in Fig.3.

Fig.4 Load power as a function of input power.



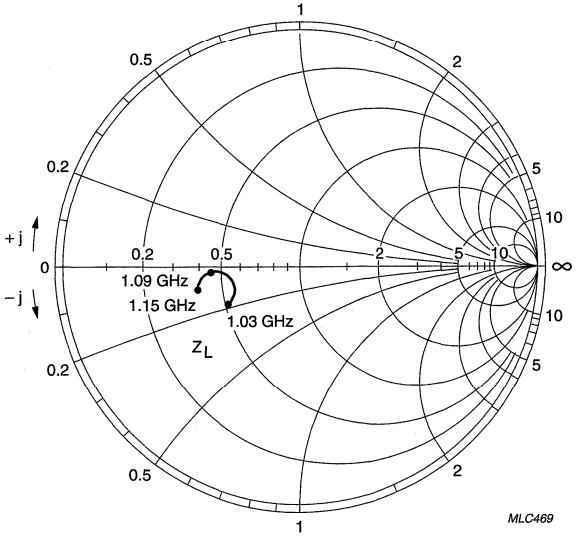
Class C pulse operation.
t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz.
In broadband test circuit as shown in Fig.3.

Fig.5 Collector efficiency as a function of input power.



V_{CC} = 50 V; Z_o = 10 Ω; P_o = 240 W.

Fig.6 Input impedance as a function of frequency.



V_{CC} = 50 V; Z_o = 50 Ω; P_o = 240 W.

Fig.7 Optimum load impedance as a function of frequency.

NPN microwave power transistor — MX1011B430W

FEATURES

- Suitable for short and medium pulse applications up to 500 μs/10%
- Internal input and output prematching networks allow an easier design of circuits
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

Intended for use in common base, class C, broadband, pulsed power amplifiers for TCAS applications in the 1030 to 1090 MHz band. Also suitable for medium pulse, heavy duty operation within this band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with base connected to flange.

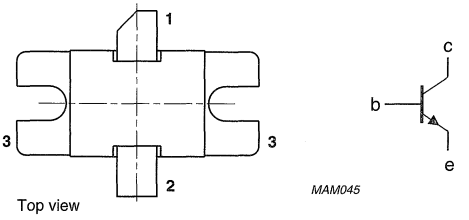
QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)
Class C	t_p = 30 μs; δ = 1%	1.03	45	≥480	≥6.7	≥45

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange



Marking code: MX1011B430W.

Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

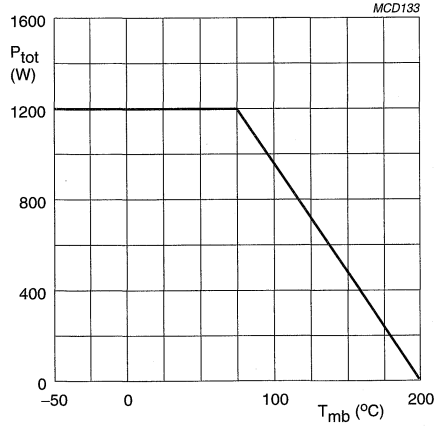
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	$t_p \leq 30$ µs; $\delta \leq 1\%$	–	35	A
P_{tot}	total power dissipation	$t_p \leq 30$ µs; $\delta \leq 1\%$; $T_{mb} < 75$ °C	–	1200	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



t_p = 30 µs; δ = 1%; $P_{tot\ max}$ = 1200 W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

MAINTENANCE TYPE - NOT RECOMMENDED FOR NEW DESIGNS; SEE INDEX SECTION OF SC15

NPN microwave power transistor | MX1011B700Y

FEATURES

- Suitable for short and medium pulse applications up to 100 µs/10%
- Internal input and output prematching networks allow an easier design of circuits
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very good stability of the characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

Intended for use in common base, class C, broadband, pulsed power amplifiers for IFF, TCAS and Mode S applications in the 1030 to 1090 MHz band. Also suitable for medium pulse, heavy duty operation within the 1030 to 1150 MHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)
Class C	t_p = 10 µs; δ = 1%	1.09	50	650	≥6	≥48

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

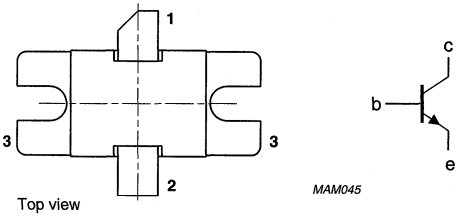


Fig.1 Simplified outline and symbol.

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

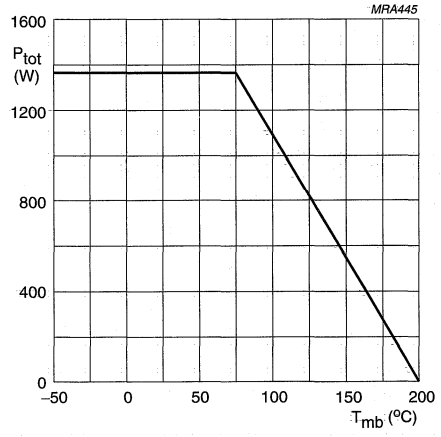
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_{CM}	peak collector current	$t_p \leq 10\ \mu s$; $\delta \leq 1\%$	–	40	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 1\%$	–	1365	W
T_{stg}	storage temperature		−65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 1\%$; $P_{tot\ max} = 1365$ W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	1.12	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 10 μs; δ = 1%; notes 1 and 2	0.06	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under nominal pulse microwave operating conditions.

CHARACTERISTICS

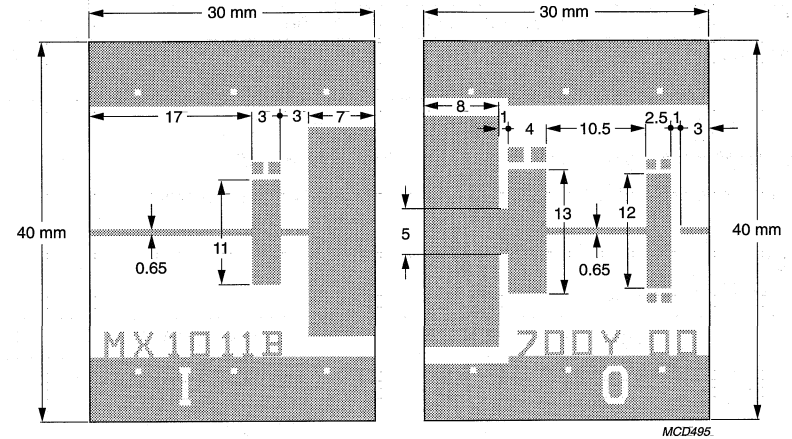
T_{mb} = 25 °C unless otherwise specified.

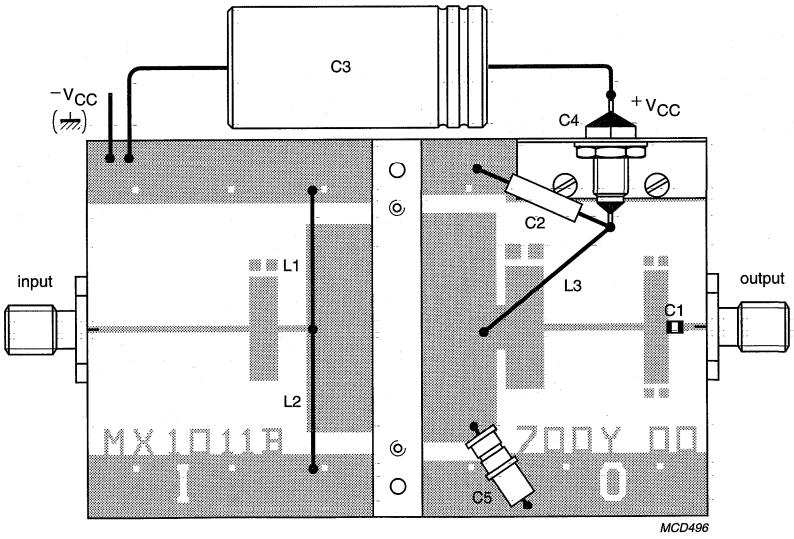
SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 50 V; I_E = 0	20	mA
I_{CES}	collector cut-off current	V_{CE} = 50 V; V_{BE} = 0	20	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	5	mA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 140 mA; V_{BE} = 0	65	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 140 mA; V_{BE} = 0	65	V

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a broadband test circuit as shown in Fig.3.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)
Class C	t_p = 10 μs; δ = 1%	1.09	50	650; typ. 740	≥6.0; typ. 7	≥48; typ. 55
	t_p = 0.5 μs; δ = 50%; t_p = 112 μs; δ = 1%	1.03 to 1.09	50	typ. 650	typ. 6.4	typ. 45
	t_p = 6.6 μs; δ = 51%; t_p = 3.3 ms; δ = 43%	1.03 to 1.15	50	typ. 300	typ. 7	typ. 45
	t_p = 32 μs; δ = 1%	1.09	50	typ. 700	typ. 6.7	typ. 55



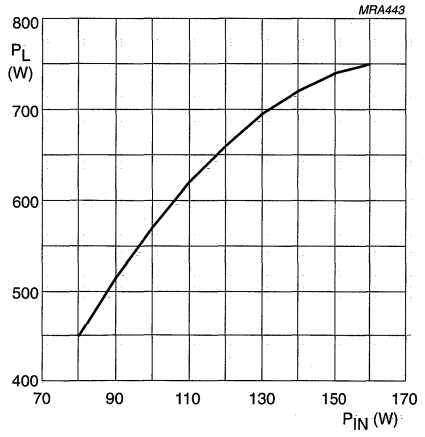


Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.

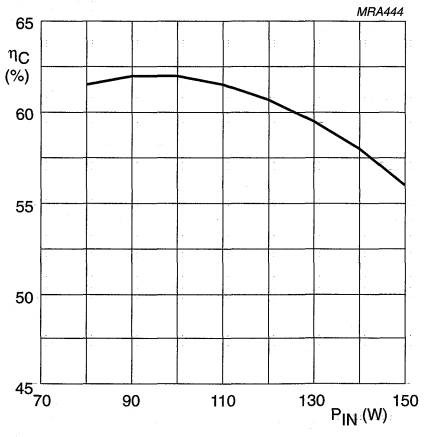
List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	0.65 mm diameter copper wire	–	total length = 26 mm; height of loop = 10 mm	–
L3	0.85 mm diameter silver wire	–	total length = 30 mm; height of loop = 15 mm	–
C1	capacitor	100 pF	–	ATC, ref.100A101KP50X
C2	tantalum capacitor	10 μF; 50 V	–	–
C3	electrolytic capacitor	1000 μF; 63 V	–	–
C4	feedthrough bypass capacitor		–	Erie, ref.1250-003
C5	variable gigatrim capacitor	0.8 – 8 pF	–	Tekelec, ref.729.1



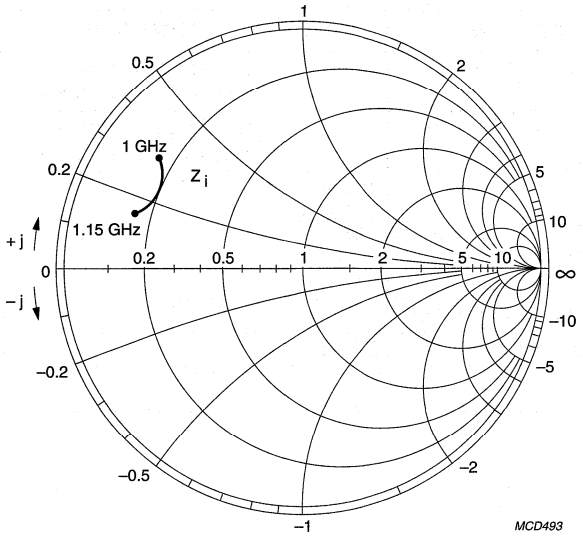
Class C pulse operation; t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz; (In broadband test circuit as shown in Fig.3).

Fig.4 Load power as a function of input power.



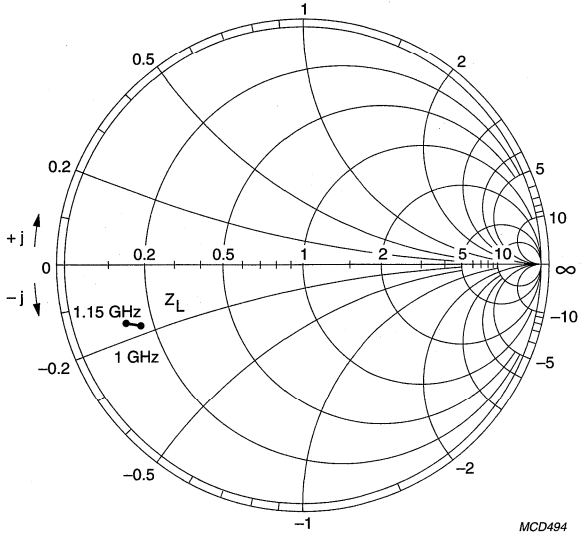
Class C pulse operation; t_p = 10 μs; δ = 1%; V_{CC} = 50 V; f = 1.09 GHz; (In broadband test circuit as shown in Fig.3).

Fig.5 Collector efficiency as a function of input power.



V_{CC} = 50 V; Z_O = 10 Ω; P_o = 740 W.

Fig.6 Input impedance as a function of frequency, associated with optimum load impedance.



V_{CC} = 50 V; Z_O = 10 Ω; P_o = 740 W.

Fig.7 Optimum load impedance as a function of frequency; associated with input impedance.

NPN microwave power transistor — MZ0912B50Y

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Input and output matching cell allows an easier design of circuits.

APPLICATIONS

Common base, class C, broadband, pulse power amplifier from 960 to 1215 MHz for TACAN application.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with base connected to flange. It is mounted in common base configuration, and specified in class C.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C; t_p = 10 μs; δ = 1%	0.960 to 1.215	50	>50	>7	>42	see Figs 6 and 7

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

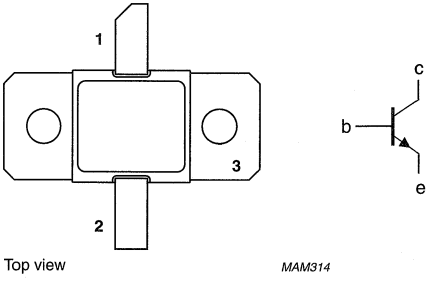


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

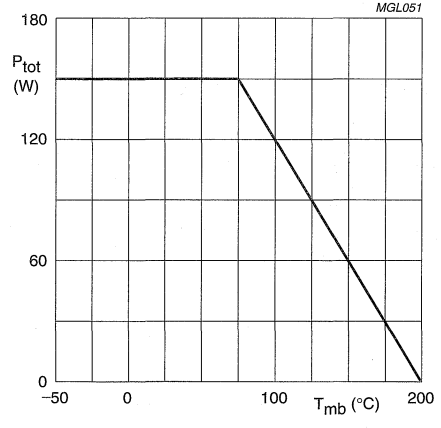
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	3	A
P_{tot}	total power dissipation (peak power)	$T_{mb} = 75\ °C$; $t_p \leq 10\ \mu s$; $\delta \leq 10\%$	–	150	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 10\ \mu s$; $\delta = 10\%$; $P_{tot\ max} = 150$ W.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

T_j = 125 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	CW	4.9	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	CW; note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	notes 1 and 2	0.85	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under nominal pulse microwave operating conditions; t_p = 10 µs; δ = 10%.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 65 V; I_E = 0	20	mA
		V_{CB} = 50 V; I_E = 0	2	mA
I_{CES}	collector cut-off current	V_{CE} = 60 V; R_{BE} = 0 Ω	20	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	200	µA

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C measured in the test jig as shown in Fig.3 and working in class C broadband mode in pulse; note 1.

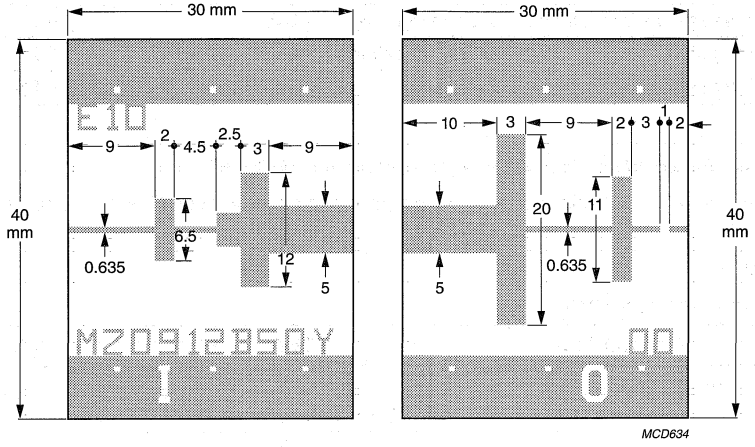
MODE OF OPERATION	f (GHz)	V_{CC} (V)[2]	P_L (W)	G_p (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C; t_p = 10 µs; δ = 10%	0.960 to 1.215	50	>50 typ. 60	>7 typ. 8	>42 typ. 44	see Figs 6 and 7

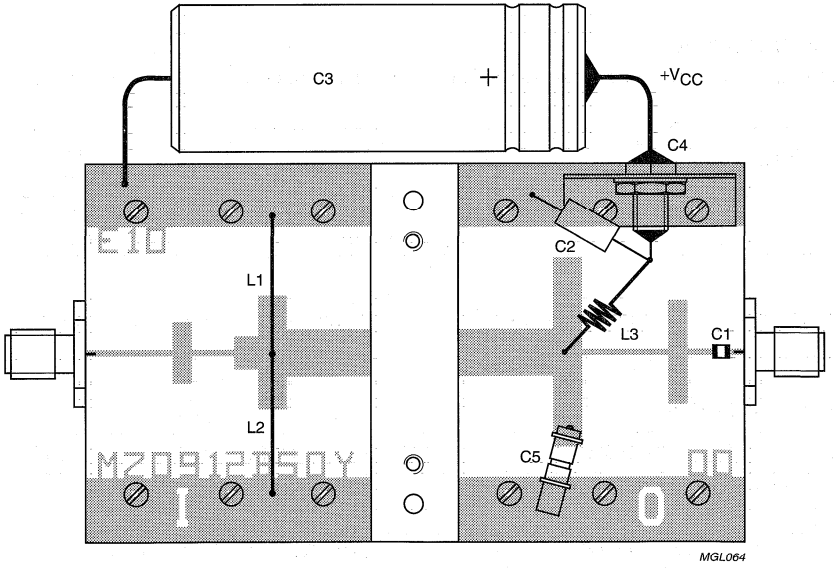
Notes

1. Operating conditions and performance for other pulse formats can be made available on request.
2. V_{CC} during pulse.

List of components (see Fig.3).

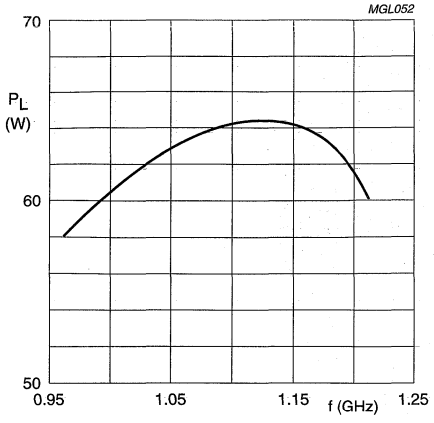
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	0.65 mm diameter copper wire	–	total length = 12 mm; height of loop = 9 mm	–
L3	4 turns 0.65 mm diameter copper wire;	–	int. dia. 3 mm; l = 5 mm	–
C1	capacitor	100 pF	–	ATC, ref. 100A101KP50X
C2	tantalum capacitor	10 µF; 50 V	–	–
C3	electrolytic capacitor	470 µF; 63 V	–	–
C4	feedthrough bypass capacitor	–	–	Erie, ref. 1250-003
C5, C6	variable gigatrim capacitor	0.6 to 4.5 pF	–	Tekelec, ref. 727.1





Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.



V_{CC} = 50 V; t_p = 10 μs; δ = 10%.

Fig.4 Load power as a function of frequency; (In broadband test circuit as shown in Fig.3).

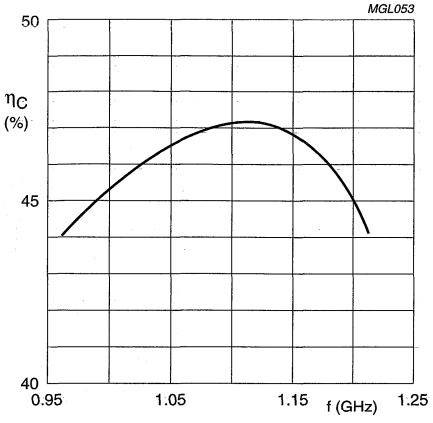
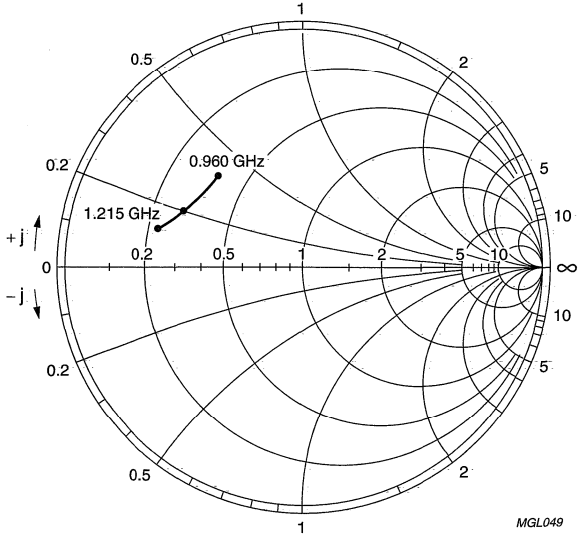
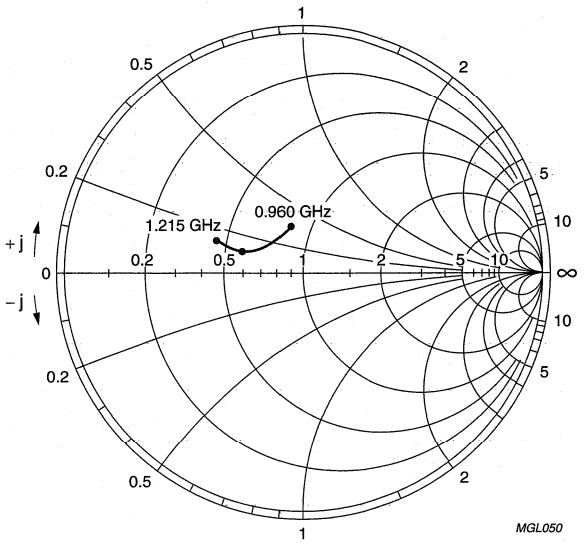


Fig.5 Collector efficiency as a function of frequency; (In broadband test circuit as shown in Fig.3).



V_{CC} = 50 V; Z_o = 10 Ω; P_L = 50 W.

Fig.6 Optimum load impedance as a function of frequency, associated with input impedance.



V_{CC} = 50 V; Z_o = 10 Ω; P_L = 50 W.

Fig.7 Input impedance as a function of frequency, associated with optimum load impedance.

Microwave power transistor PLB16004U

FEATURES

- Diffused emitter ballasting resistors improve excellent current sharing and withstanding a high VSWR
- Interdigitated common-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching networks allow an easier design of circuits.

APPLICATIONS

Intended for use in common-base class C power amplifiers at 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	1.6	28	>4.5	>8.5	>40	see Figs 5 and 6

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

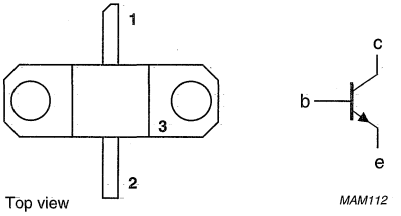


Fig.1 Simplified outline and symbol.

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	DC collector current		–	0.5	A
P_{tot}	total power dissipation	$T_{mb} = 75$ °C	–	9	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.3 mm from ceramic.

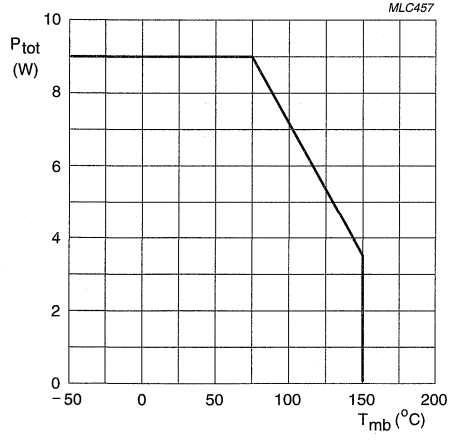


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	11	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.3	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

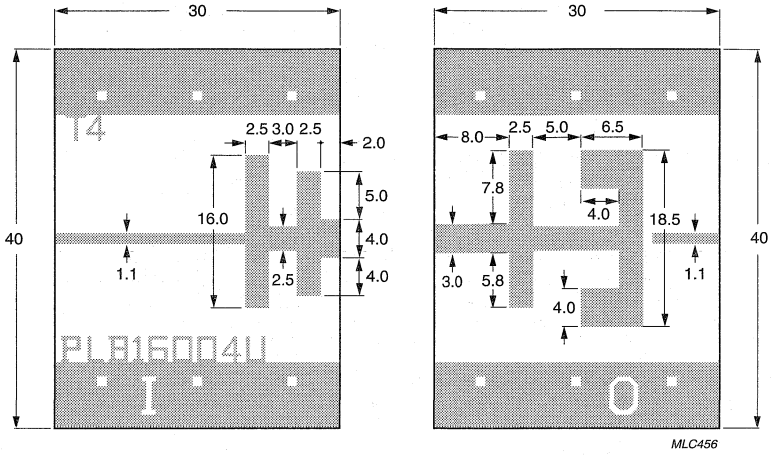
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CES}	collector cut-off current	R_{BE} = 0; V_{CE} = 30 V	–	200	μA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 1 mA; I_E = 0	40	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 1 mA; I_E = 0	40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 1 mA; I_E = 0	3	–	V
h_{FE}	DC current gain	I_C = 300 mA; V_{CE} = 5 V	15	100	

APPLICATION INFORMATION

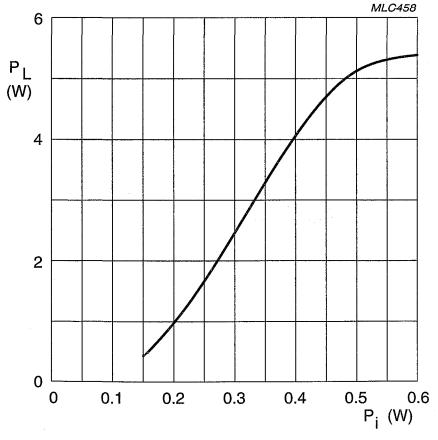
Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	1.6	28	typ. 5	typ. 10	typ. 50	see Figs 5 and 6



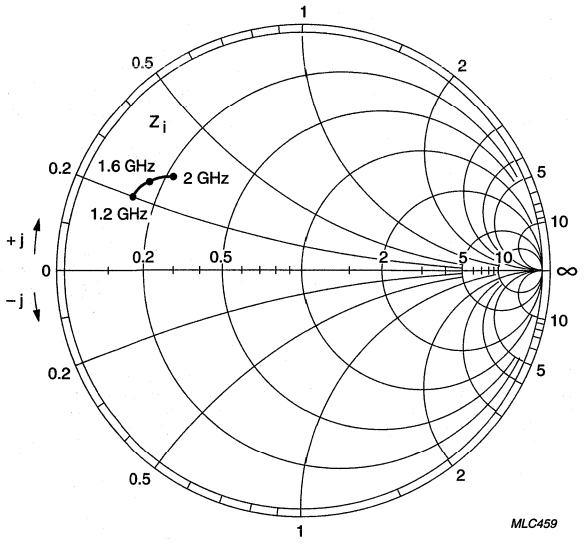
Dimensions in mm.
Substrate: Teflon fibre glass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.3 Narrowband test circuit.



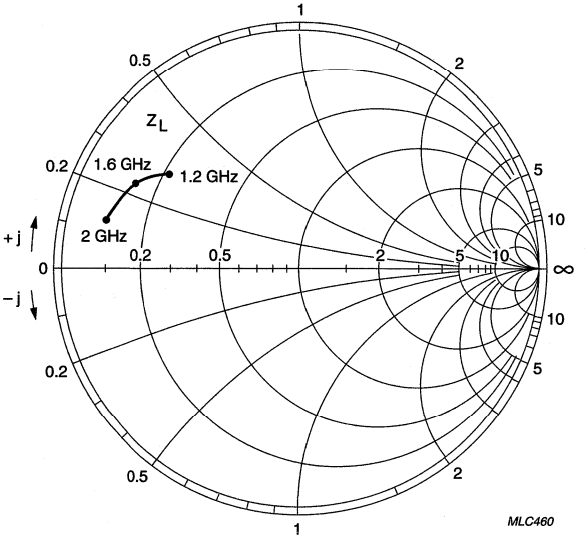
V_{CC} = 28 V; f = 1.6 GHz.

Fig.4 Load power as a function of input power.



V_{CC} = 28 V; Z_o = 50 Ω.

Fig.5 Input impedance as a function of frequency; typical values.



V_{CC} = 28 V; Z_o = 50 Ω.

Fig.6 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor PLB16012U

FEATURES

- Input matching cell allows an easier design of circuits
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common base, class C, power amplifiers at 1.6 GHz. Also suitable for operation in the 1.4 to 1.8 GHz range.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	1.6	28	10	>8	>45	see Figs 5 and 6

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

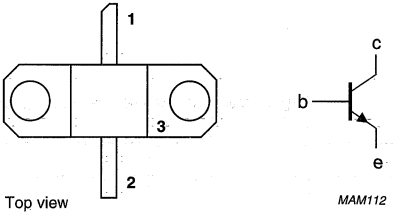


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

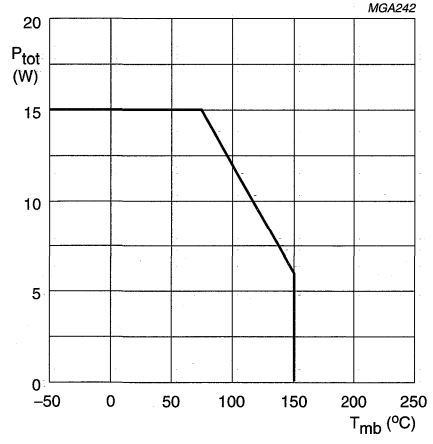
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	0.9	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	15	W
T_{stg}	storage temperature		−65	+150	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

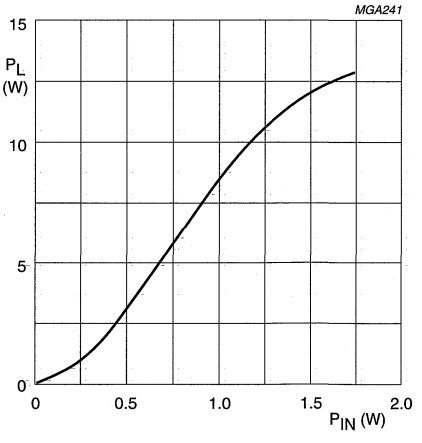
Note

1. Up to 0.3 mm from ceramic.



$P_{tot\ max}$ = 15 W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.



V_{CC} = 28 V; f = 1.6 GHz.

Fig.3 Load power as a function of source power.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	6	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.3	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 28 V; I_E = 0	0.3	mA
		V_{CB} = 35 V; I_E = 0	0.6	mA
I_{CES}	collector cut-off current	V_{CE} = 28 V; R_{BE} = 0 Ω	0.6	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	25	μA

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common base test circuit as shown in Fig.4 and working in CW class C mode.

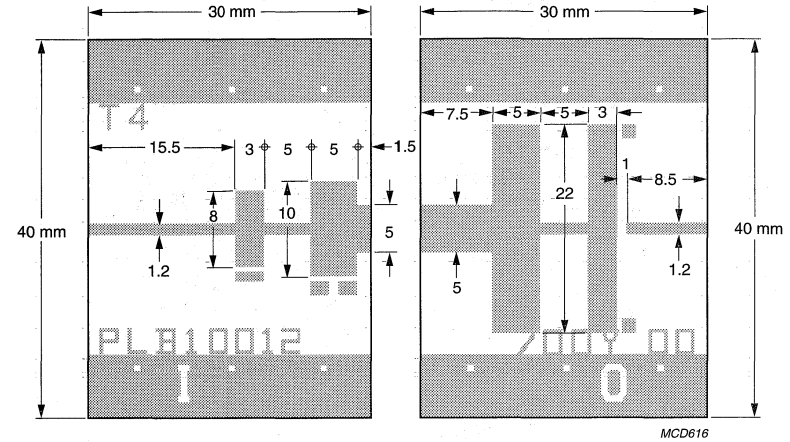
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW) note 1	1.6	28	10	≥8 typ. 9.4	≥45 typ. 60	see Figs 5 and 6
Class C - 100 ms 50%	1.6	28	typ. 15	typ. 9.4	typ. 60	

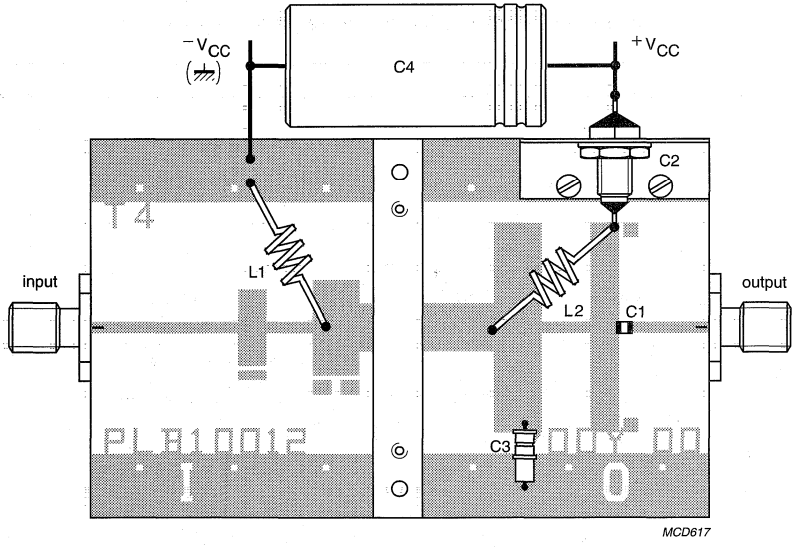
Note

1. May be used for narrowband or broadband amplifiers within the frequency range 1.4 to 1.8 GHz. Operation below 1.4 GHz may damage the transistor due to resonance of the internal output prematching circuit.

List of components (see Fig.4)

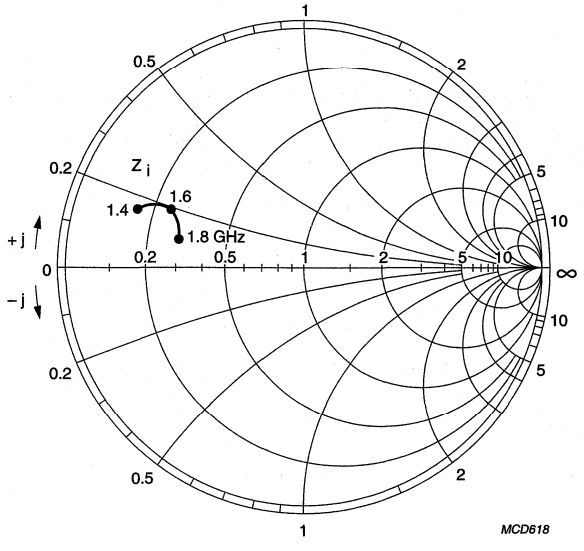
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	5 turns 0.2 mm diameter copper wire		int. dia. = 2 mm	
C1	DC blocking capacitor	100 pF		
C2	feedthrough bypass capacitor			Erie, ref.1250-003
C3	trimmer capacitor	0.6 - 4.5 pF		AT-3-7-271SL
C4	electrolytic capacitor	150 μF, 45 V		





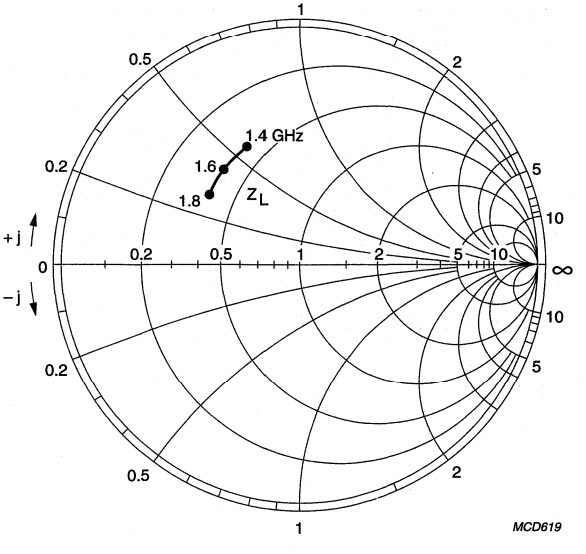
Substrate: Teflon fibre glass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.4 Narrowband test circuit.



V_{CC} = 28 V; Z_o = 10 Ω.

Fig.5 Input impedance as a function of frequency; typical values.



V_{CC} = 28 V; Z_o = 10 Ω.

Fig.6 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor PLB16030U

FEATURES

- Input and output matching cell allows an easier design of circuits
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common base class B power amplifiers at 1.6 GHz. Also suitable for operation in the frequency range 1.4 to 1.8 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT437A glued cap metal ceramic flange package with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class B narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class B (CW)	1.6	28	>30	>7	>45	see Figs 5 and 6

PINNING - SOT437A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

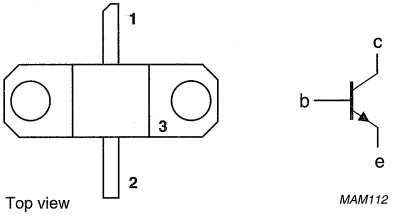


Fig.1 Simplified outline and symbol.

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

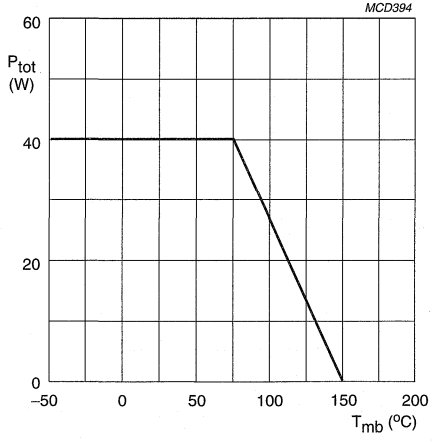
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2.6	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	40	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

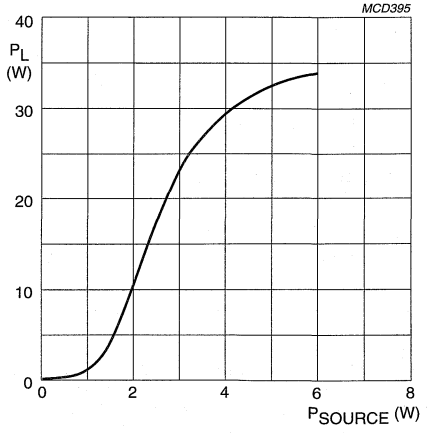
Note

1. Up to 0.3 mm from ceramic.



$P_{tot\ max}$ = 40 W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.



V_{CC} = 28 V; f = 1.6 GHz.

Fig.3 Load power as a function of source power.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	2.4	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.3	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 28 V; I_E = 0	0.9	mA
		V_{CB} = 35 V; I_E = 0	1.8	mA
I_{CES}	collector cut-off current	V_{CE} = 28 V; R_{BE} = 0 Ω	1.8	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	90	μA

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-base test circuit and working in CW class B mode.

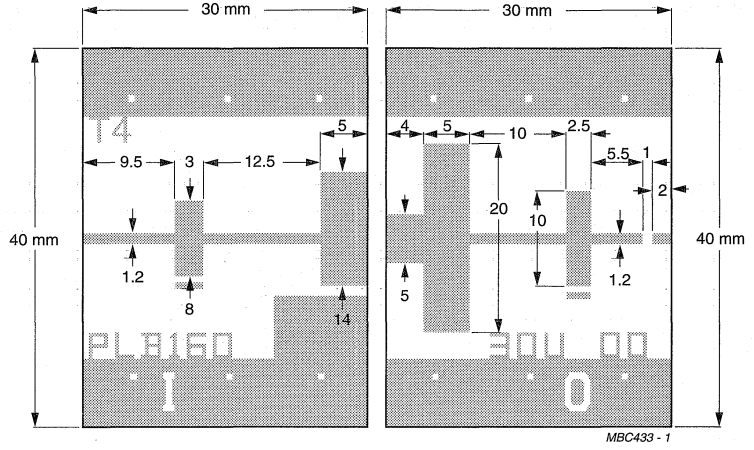
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class B (CW); note 1	1.6	28	≥30	≥7; typ. 8.2	≥45; typ. 52	see Figs 5 and 6
Class B - 100 ms 50%	1.6	28	typ. 38	typ. 8.8	typ. 56	

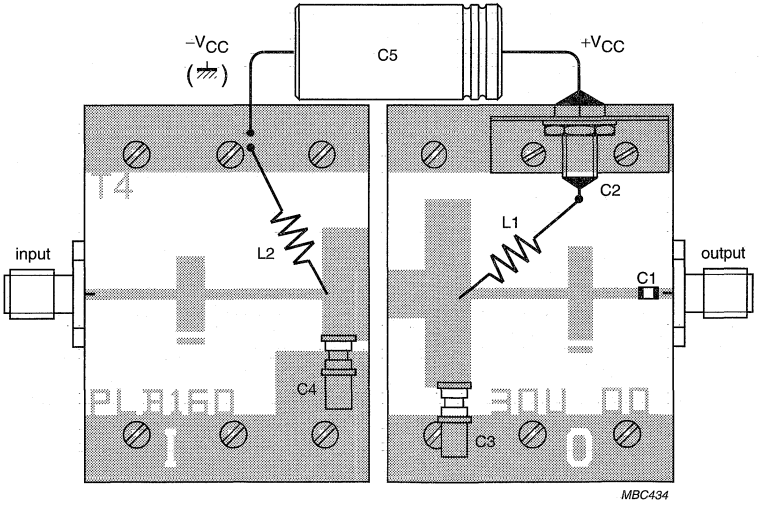
Note

1. May be used for narrowband or broadband amplifiers within the frequency range 1.4 to 1.8 GHz. Operation below 1.4 GHz may damage the transistor due to resonance of the internal output prematching circuit.

List of components (see Fig.4)

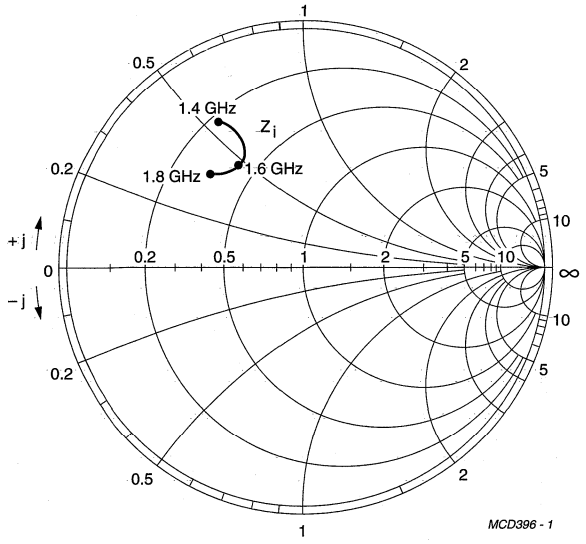
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	5 turns 0.2 mm diameter copper wire		int. dia. 2 mm	
C1	DC blocking capacitor	100 pF		
C2	feedthrough bypass capacitor			Erie, ref.1250-003
C3, C4	trimmer capacitor	0.4 to 2.5 pF		Tekelec AT-3-7281SL
C5	electrolytic capacitor	150 μF		





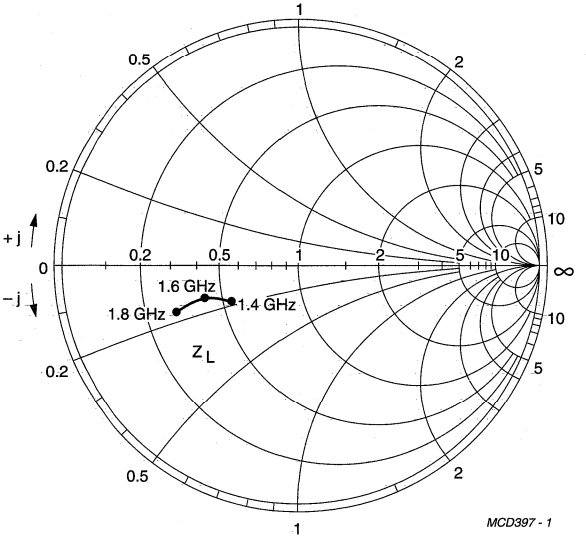
Substrate: Teflon fibreglass.
Thickness: 0.4 mm.
Permittivity: $\varepsilon_r = 2.55$.

Fig.4 Narrowband test circuit.



V_{CC} = 28 V; Z_o = 10 Ω; P_O = 30 W.

Fig.5 Input impedance as a function of frequency; typical values.



V_{CC} = 28 V; Z_o = 10 Ω; P_O = 30 W.

Fig.6 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor — PPC5001T

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance

APPLICATIONS

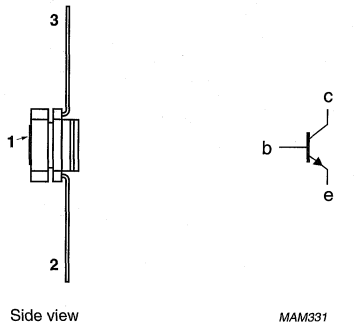
Intended for use in common-collector oscillator circuits in military and professional applications up to 5 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT447A metal ceramic flange package.

PINNING - SOT447A

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Marking code: 395

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in an oscillator circuit up to 5 GHz; typical values.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_C (mA)	P_L (mW)
Class A (CW)	5	20	200	450

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CER}	collector-emitter voltage	R_{BE} = 70 Ω	–	35	V
V_{CEO}	collector-emitter voltage	open emitter	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	0.25	A
P_{tot}	total power dissipation	$T_{amb} \leq 75$ °C	–	4	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. At 0.1 mm from the case.

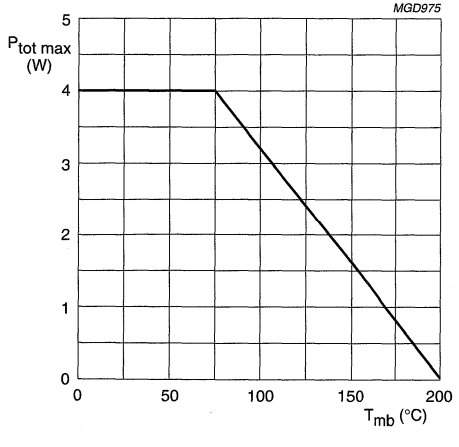


Fig.2 Power dissipation derating as a function of mounting-base temperature.

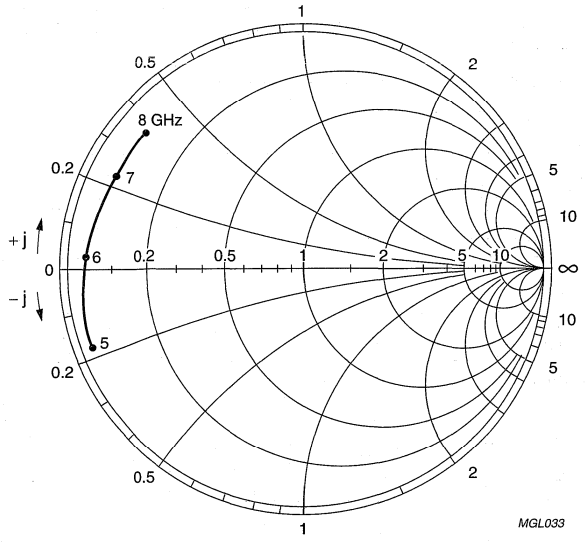
THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	24	K/W

CHARACTERISTICS

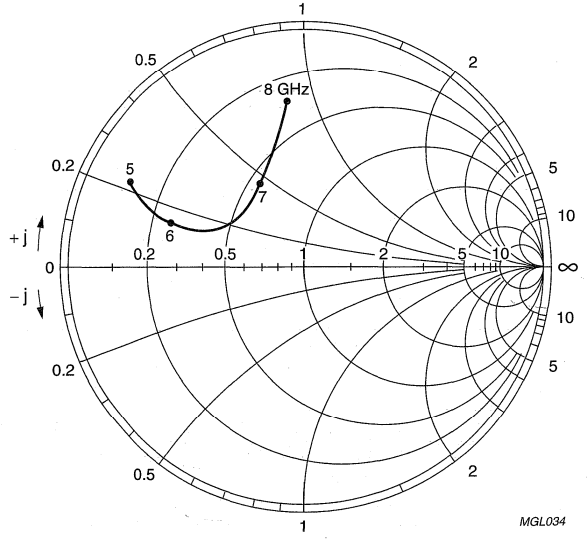
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 24 V; I_E = 0	–	–	100	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	200	nA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 500 μA; I_E = 0	40	–	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 2.5 mA; R_{BE} = 70 Ω	35	–	–	V
C_{cb}	collector-base capacitance	V_{CB} = 18 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.4	–	pF
C_{ce}	collector-emitter capacitance	V_{CE} = 18 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	0.9	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 10 V; V_{EB} = 1 V; $I_C = I_E$ = 0; f = 1 MHz	–	5.5	–	pF



V_{CE} = 20 V; I_C = 200 mA; Z_o = 50 Ω.

Fig.3 Emitter reflection coefficient.



V_{CE} = 20 V; I_C = 200 mA; Z_o = 50 Ω.

Fig.4 Base reflection coefficient

NPN microwave power transistors

PTB23001X; PTB23003X; PTB23005X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Localized thick oxide auto-alignment process and gold sandwich metallization ensure an optimum temperature profile and excellent performance and reliability.

APPLICATIONS

Common-base, class B power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a metal ceramic SOT440A flange package with base connected to the flange.

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

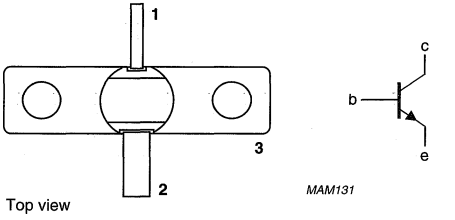


Fig.1 Simplified outline and symbol.

MARKING

TYPE NUMBER	MARKING CODE
PTB23001X	2301X
PTB23003X	2303X
PTB23005X	2305X

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class B circuit.

TYPE NUMBER	MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i (Ω)	Z_L (Ω)
PTB23001X	CW	2	24	≥1	≥7	≥45	8 + j14	8 + j20
PTB23003X	CW	2	24	≥3	≥8.75	≥45	2.5 + j14	8 + j6
PTB23005X	CW	2	24	≥5	≥9.2	≥50	1.9 + j12	7.5 + j3

WARNING1

Product and environmental safety - toxic materials

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

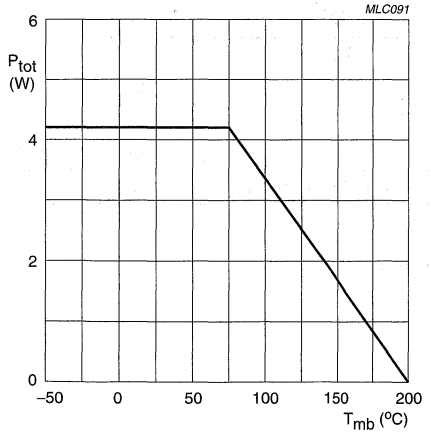
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	40	V
I_C	collector current (DC)				A
	PTB23001X		–	0.25	A
	PTB23003X		–	0.5	A
	PTB23005X		–	0.75	A
P_{tot}	total power dissipation	T_{mb} = 75 °C; f > 1 MHz			
	PTB23001X		–	4.2	W
	PTB23003X		–	7.6	W
	PTB23005X		–	8.7	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

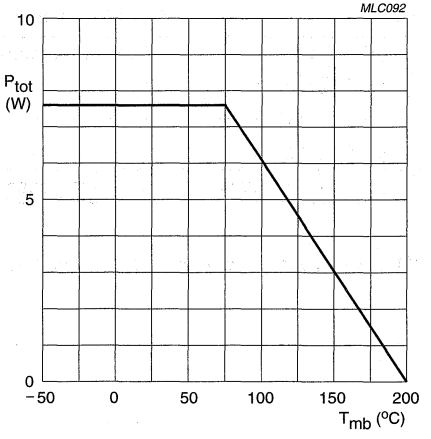
Note

1. Up to 0.3 mm from ceramic.



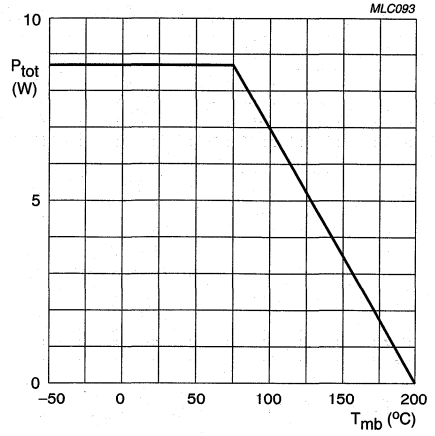
f > 1 MHz.

Fig.2 Power derating curve; PTB23001X.



f > 1 MHz.

Fig.3 Power derating curve; PTB23003X.



f > 1 MHz.

Fig.4 Power derating curve; PTB23005X.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C		
	PTB23001X		22	K/W
	PTB23003X		12	K/W
	PTB23005X		10.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage					
	PTB23001X	I_C = 1 mA; I_E = 0	40	–	–	V
	PTB23003X	I_C = 2 mA; I_E = 0	40	–	–	V
	PTB23005X	I_C = 3 mA; I_E = 0	40	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 0 Ω	40	–	–	V
I_{CBO}	collector cut-off current					
	PTB23001X	V_{CE} = 24 V; I_E = 0	–	–	10	μA
	PTB23003X	V_{CE} = 24 V; I_E = 0	–	–	20	μA
	PTB23005X	V_{CE} = 24 V; I_E = 0	–	–	30	μA
I_{EBO}	emitter cut-off current					
	PTB23001X	V_{EB} = 1.5 V; I_C = 0	–	–	0.2	μA
	PTB23003X	V_{EB} = 1.5 V; I_C = 0	–	–	0.4	μA
	PTB23005X	V_{EB} = 1.5 V; I_C = 0	–	–	0.6	μA
C_{cb}	collector-base capacitance					
	PTB23001X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	2.2	–	pF
	PTB23003X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	3	–	pF
	PTB23005X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	3.8	–	pF
C_{ce}	collector-emitter capacitance					
	PTB23001X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.3	–	pF
	PTB23003X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.6	–	pF
	PTB23005X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.9	–	pF

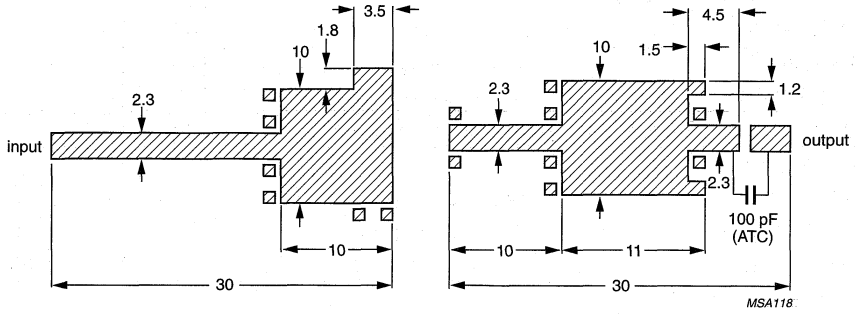
APPLICATION INFORMATION

Microwave performance in a common-base class B selective amplifier circuit; see note 1.

MODE OF OPERATION	TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)
Class B (CW)	PTB23001X	2	24	>1; typ. 1.8	>7; typ. 9	>45; typ. 50
	PTB23003X	2	24	>3; typ. 4	>8.75; typ. 10	>45; typ. 50
	PTB23005X	2	24	>5; typ. 7	>9.2; typ. 11	>40; typ. 50

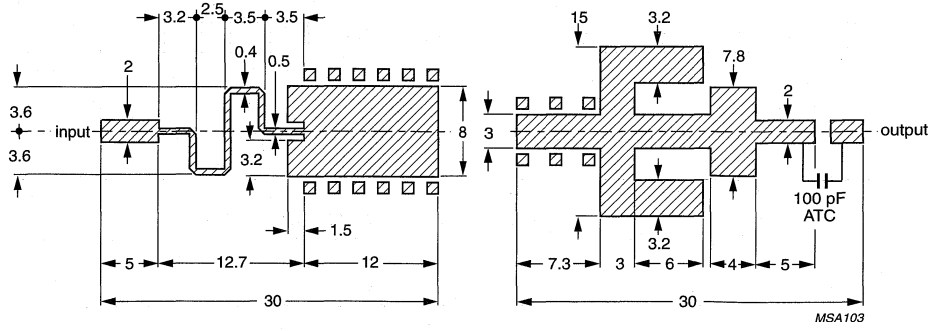
Note

1. Circuit consists of prematching circuit board in combination with complementary input and output slug tuners.



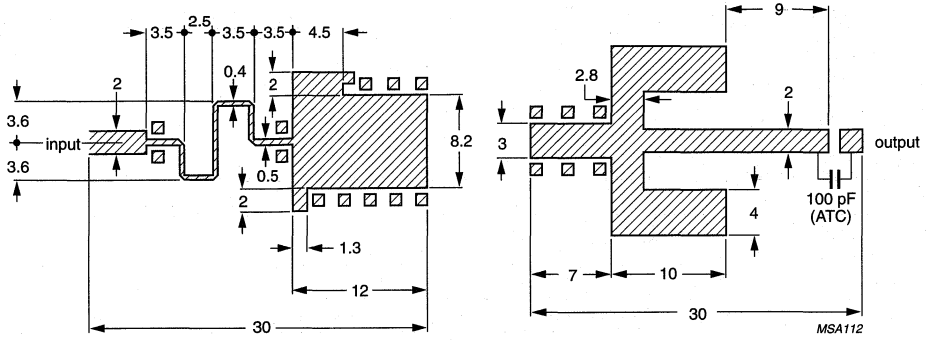
Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper-clad printed board Teflon fibre glass dielectric.

Fig.5 Prematching test circuit board for PTB23001X.



Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper clad printed-circuit board Teflon fibreglass dielectric.

Fig.6 Prematching test circuit board for PTB23003X.



Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper clad printed-circuit board Teflon fibreglass dielectric.

Fig.7 Prematching test circuit board for PTB23005X.

NPN microwave power transistor PTB23002U

FEATURES

- Very high power gain
- Internal input prematching network
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure
- Gold metallization with barrier layer to prevent electromigration and gold diffusion during life
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

Common-base, class C power amplifiers at frequencies up to 2.3 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A hermetically sealed metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class C narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	2.3	28	>2	>9	>45	see Figs 5 and 6

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

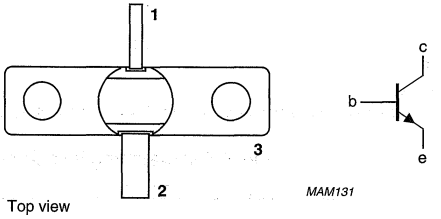


Fig.1 Simplified outline and symbol.

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

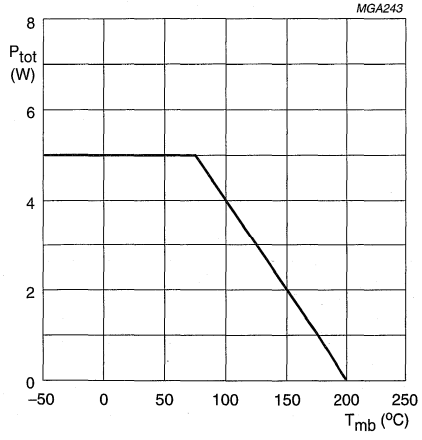
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	0.25	A
P_{tot}	total power dissipation	$T_{mb} = 75$ °C	–	5	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$P_{tot\ max} = 5$ W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

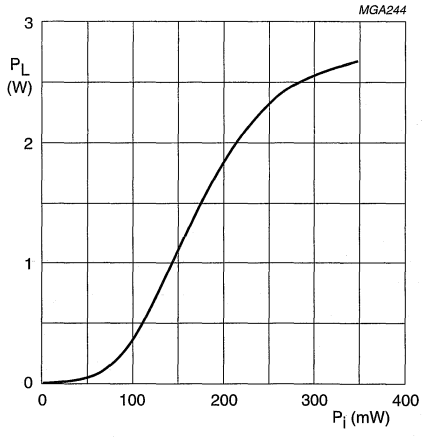


Fig.3 Output power as a function of input power.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	22	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 1 mA; I_E = 0	40	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 1 mA; R_{BE} = 0 Ω	40	–	V
I_{CBO}	collector cut-off current	V_{CE} = 30 V; I_E = 0	–	15	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	1.5	μA

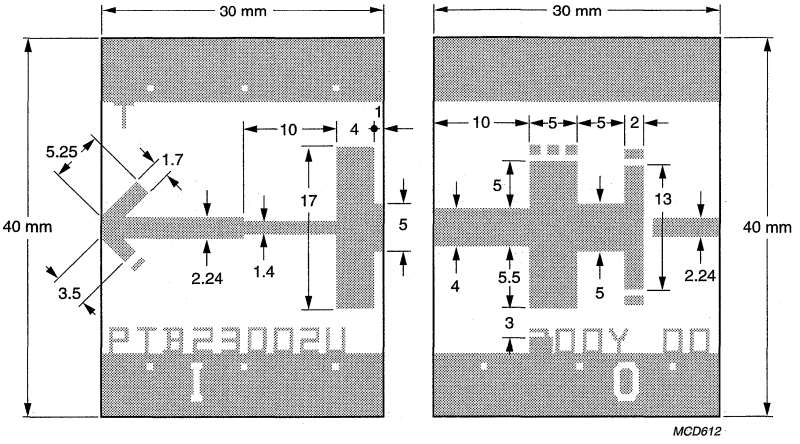
APPLICATION INFORMATION

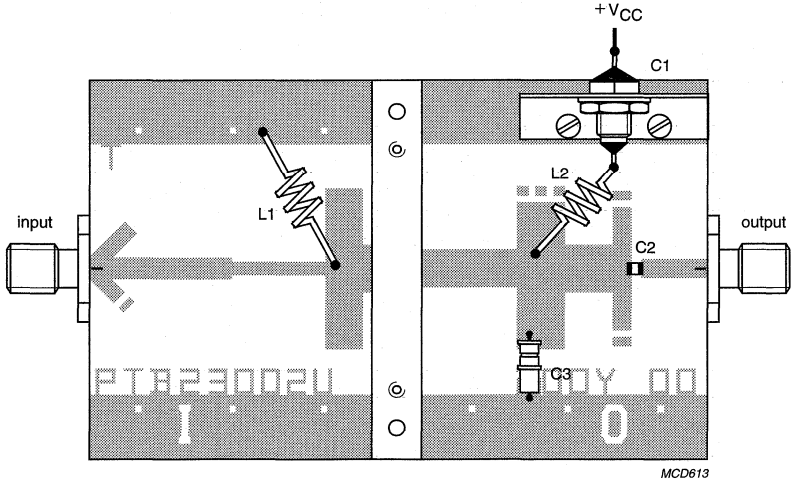
Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.4 and working in CW class C mode.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	2.3	28	≥2; typ. 2.3	≥9; typ. 9.6	≥45; typ. 50	see Figs 5 and 6

List of components (see Fig.4)

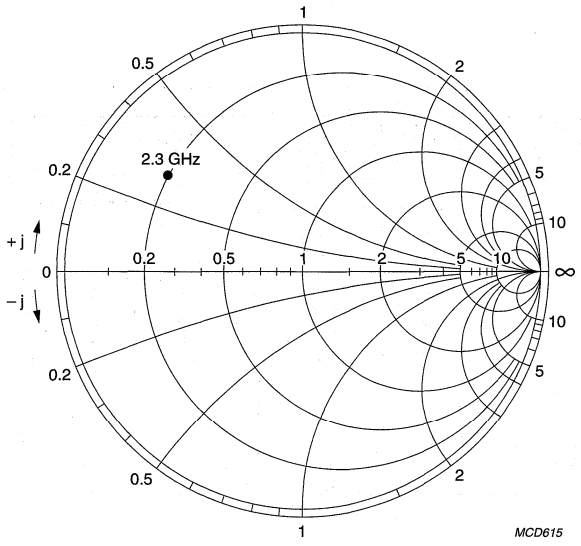
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	3 turns 0.5 mm diameter copper wire		int.dia. = 2 mm	
C1	feedthrough bypass capacitor			Erie, ref.1250-003
C2	DC blocking capacitor	100 pF		
C3	tuning capacitor	0.5 - 5 pF		Tekelec 5855





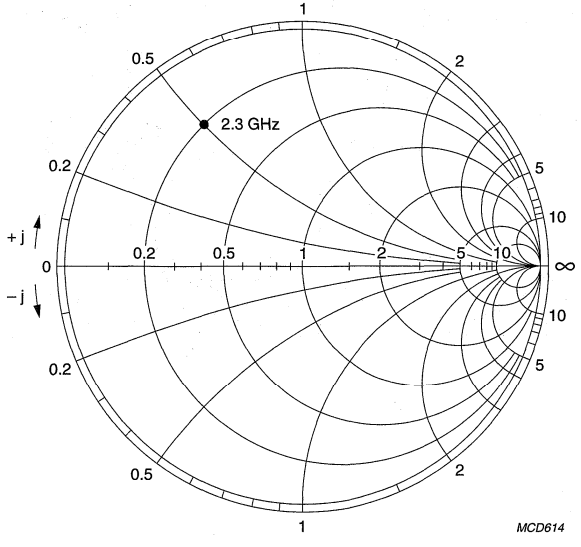
Substrate: PTFE fibreglass.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.54$.

Fig.4 Prematching test circuit.



V_{CC} = 28 V; Z_o = 50 Ω; P_L = 2.3 W.

Fig.5 Input impedance as a function of frequency.



V_{CC} = 28 V; Z_o = 50 Ω; P_L = 2.3 W.

Fig.6 Optimum load impedance as a function of frequency.

Microwave power transistor — PTB23006U

FEATURES

- Very high power gain
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure
- Gold metallization with barrier layer to prevent electromigration and gold diffusion during life
- Multicell geometry improves power sharing and reduces thermal resistance
- Internal input prematching network.

APPLICATIONS

Intended for use in common-base, class C power amplifiers at frequencies up to 2.3 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT440A hermetically sealed metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class C narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class C (CW)	2	28	>5	>9	>40	see Figs 5 and 6

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

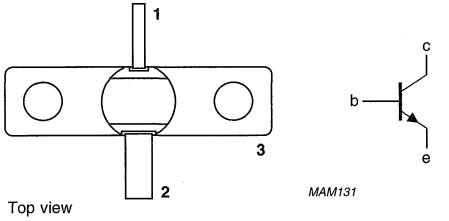


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	0.75	A
P_{tot}	total power dissipation	$T_{mb} = 75$ °C	–	11	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.

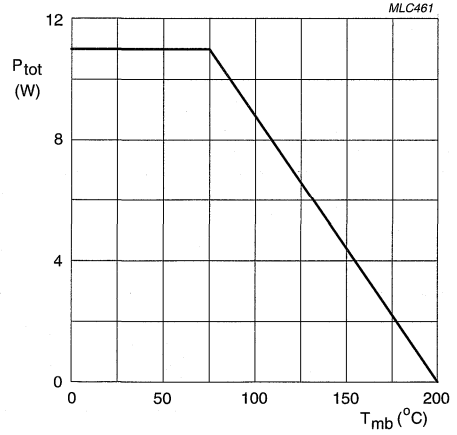


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	8.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

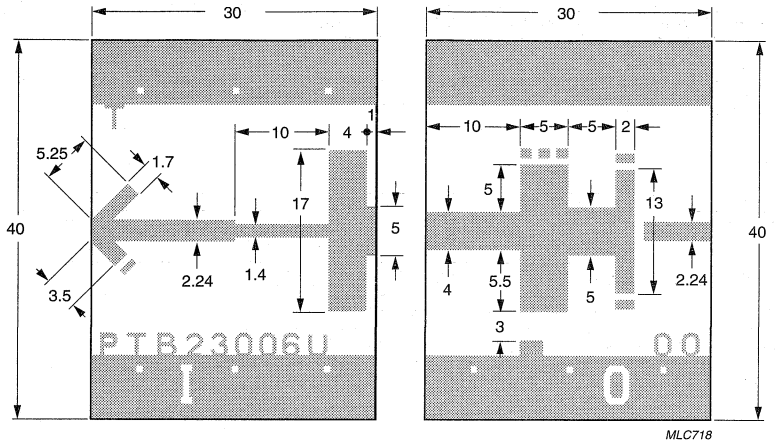
T_{mb} = 25 °C unless otherwise specified.

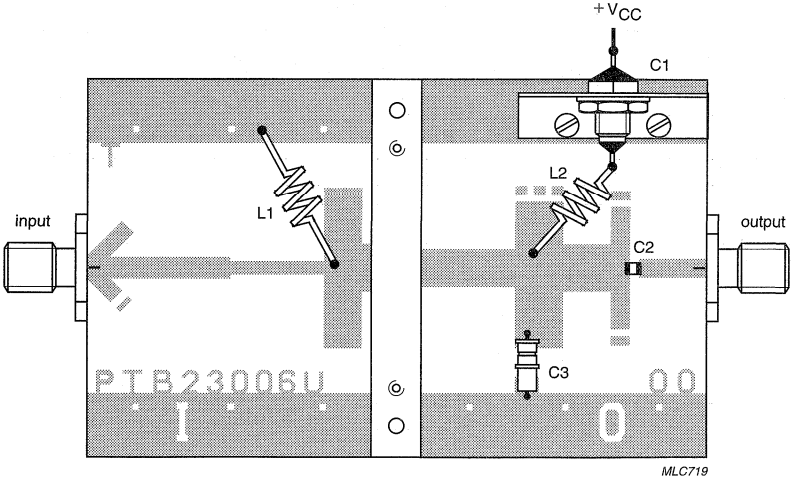
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CES}	collector cut-off current	I_E = 0; V_{CE} = 30 V	–	300	μA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 3 mA; I_E = 0	40	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 3 mA; R_{BE} = 0	40	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 1.5 mA	3	–	V
h_{FE}	DC current gain	I_C = 450 mA; V_{CE} = 3 V	15	150	

APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-base class C test circuit.

MODE OF OPERATION	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
class C (CW)	2	28	>5 typ. 5.8	>9 typ. 10.5	>40 typ. 45	see Figs 5 and 6





Dimensions in mm.
Substrate: PTFE fibreglass.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.54$.

Fig.3 Prematching test circuit.

List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
C1	feedthrough bypass capacitor		Erie1250-003
C2	DC blocking chip capacitor	100 pF	
C3	tuning capacitor	0.5 to 5 pF	Tekelec 5855
L1, L2	3 turns 0.5 mm copper wire; internal diameter = 2 mm		

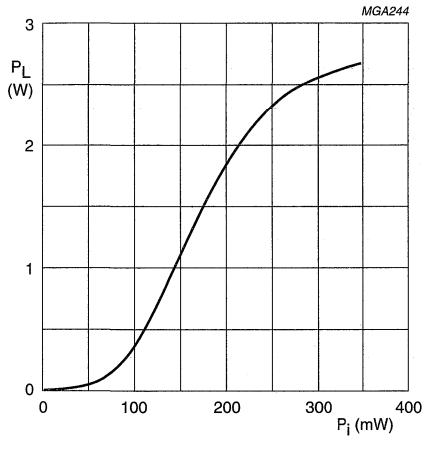
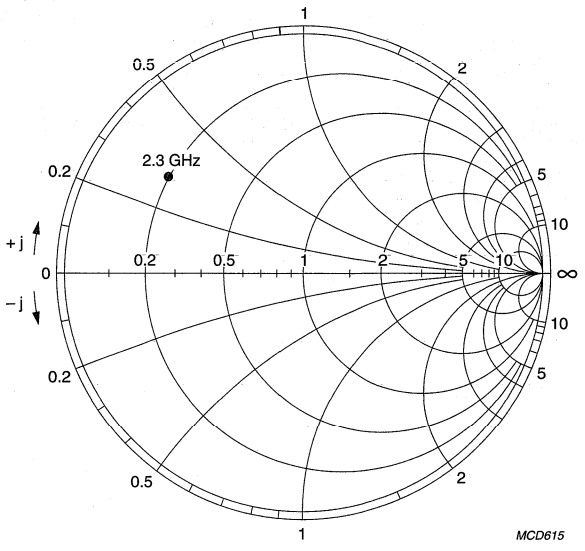
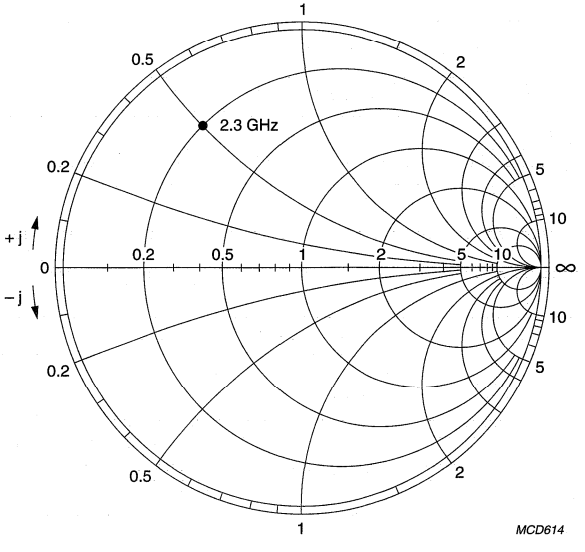


Fig.4 Load power as a function of input power.



V_{CC} = 28 V; Z_o = 50 Ω; P_L = 2.3 W.

Fig.5 Input impedance as a function of frequency.



V_{CC} = 28 V; Z_o = 50 Ω; P_L = 2.3 W.

Fig.6 Optimum load impedance as a function of frequency.

NPN microwave power transistors

PTB32001X; PTB32003X; PTB32005X

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Localized thick oxide auto-alignment process and gold sandwich metallization ensure an optimum temperature profile and excellent performance and reliability.

APPLICATIONS

Common-base, class B power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a metal ceramic SOT440A flange package with base connected to the flange.

MARKING

TYPE NUMBER	MARKING CODE
PTB32001X	3201X
PTB32003X	3203X
PTB32005X	3205X

PINNING - SOT440A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

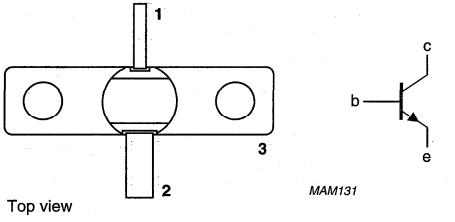


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class B circuit.

TYPE NUMBER	MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i (Ω)	Z_L (Ω)
PTB32001X	CW	3	24	≥1.3	≥8	≥35	15 + j31	5.5 + j10
PTB32003X	CW	3	24	≥2.5	≥8	≥35	5.5 + j29	5 – j2.2
PTB32005X	CW	3	24	≥4.5	≥8	≥35	2.8 + j20	4 – j7

WARNING

Product and environmental safety - toxic materials

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

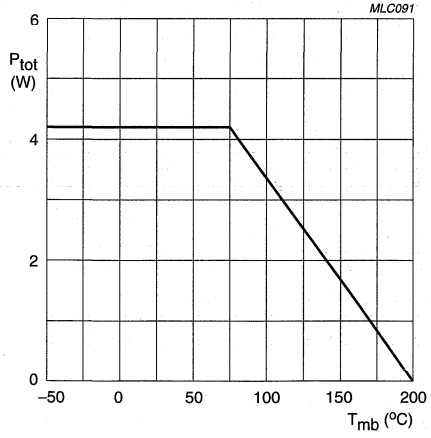
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3.0	V
I_C	collector current (DC)				
	PTB32001X		–	0.25	A
	PTB32003X		–	0.5	A
	PTB32005X		–	0.75	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C; f > 1 MHz			
	PTB32001X		–	4.2	W
	PTB32003X		–	7.6	W
	PTB32005X		–	8.7	W
T_{stg}	storage temperature range		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

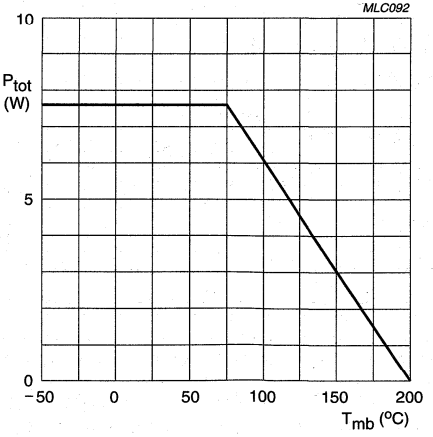
Note

1. Up to 0.3 mm from ceramic.



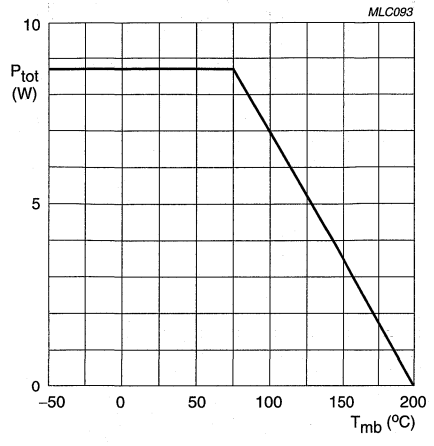
f > 1 MHz.

Fig.2 Power derating curve; PTB32001X.



f > 1 MHz.

Fig.3 Power derating curve; PTB32003X.



f > 1 MHz.

Fig.4 Power derating curve; PTB32005X.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C		
	PTB32001X		22	K/W
	PTB32003X		12	K/W
	PTB32005X		10.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	T_j = 75 °C; note 1	0.7	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage					
	PTB32001X	I_C = 1 mA; I_E = 0	40	–	–	V
	PTB32003X	I_C = 2 mA; I_E = 0	40	–	–	V
	PTB32005X	I_C = 3 mA; I_E = 0	40	–	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 10 mA; R_{BE} = 0 Ω	40	–	–	V
I_{CBO}	collector cut-off current					
	PTB32001X	V_{CE} = 24 V; I_E = 0	–	–	10	μA
	PTB32003X	V_{CE} = 24 V; I_E = 0	–	–	20	μA
	PTB32005X	V_{CE} = 24 V; I_E = 0	–	–	30	μA
I_{EBO}	emitter cut-off current					
	PTB32001X	V_{EB} = 1.5 V; I_C = 0	–	–	0.2	μA
	PTB32003X	V_{EB} = 1.5 V; I_C = 0	–	–	0.4	μA
	PTB32005X	V_{EB} = 1.5 V; I_C = 0	–	–	0.6	μA
C_{cb}	collector-base capacitance					
	PTB32001X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	2.2	–	pF
	PTB32003X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	3	–	pF
	PTB32005X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	3.8	–	pF
C_{ce}	collector-emitter capacitance					
	PTB32001X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.3	–	pF
	PTB32003X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.6	–	pF
	PTB32005X	$I_E = I_C$ = 0; V_{CB} = 24 V; V_{EB} = 1.5 V; f = 1 MHz	–	0.9	–	pF

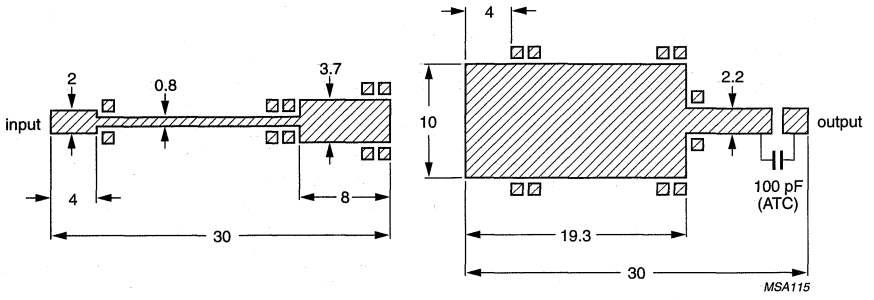
APPLICATION INFORMATION

Microwave performance in a common-base class B selective amplifier circuit; see note 1.

MODE OF OPERATION	TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)
Class B (CW)	PTB32001X	3	24	>1.3; typ. 1.8	>8; typ. 9.5	>35; typ. 45
	PTB32003X	3	24	>2.5; typ. 3.0	>8; typ. 9.5	>35; typ. 45
	PTB32005X	3	24	>4.5; typ. 5.5	>8; typ. 9.5	>35; typ. 45

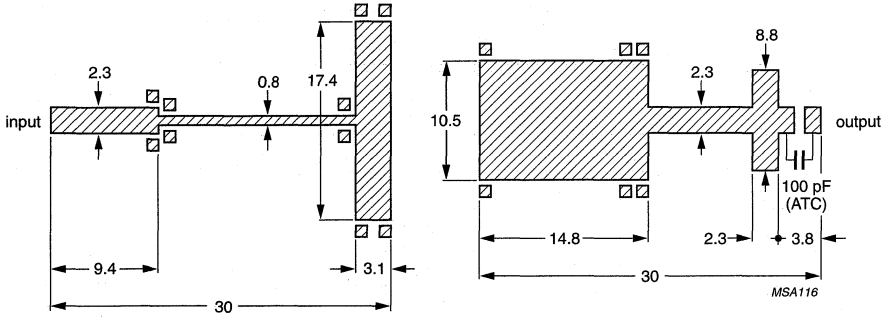
Note

1. Circuit consists of prematching circuit board in combination with complementary input and output slug tuners.



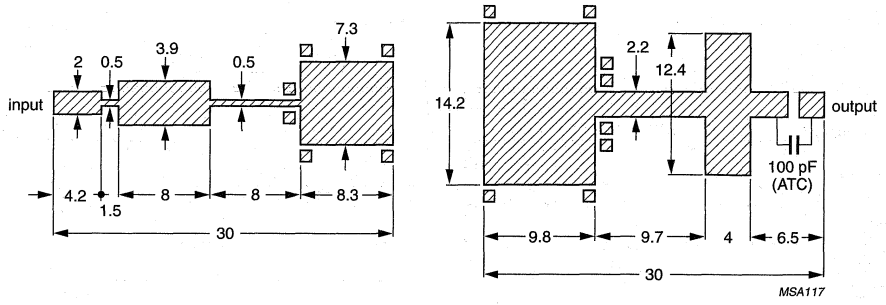
Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper-clad printed-circuit board Teflon fibreglass dielectric.

Fig.5 Prematching test circuit board for PTB32001X.



Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper-clad printed board Teflon fibre glass dielectric.

Fig.6 Prematching test circuit board for PTB32003X.



Dimensions in mm.
Thickness: 0.8 mm.
Permittivity: $\varepsilon_r = 2.55$.
Substrate: circuits on a double copper-clad printed board Teflon fibreglass dielectric.

Fig.7 Prematching test circuit board for PTB32005X.

NPN microwave power transistor PTC4001T

FEATURES

- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very good characteristics stability and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common collector oscillator circuits under CW conditions in military and professional applications up to 5 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave transistor in a SOT440A metal ceramic flange package with collector connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_h = 25 °C in an oscillator circuit up to 3 GHz.

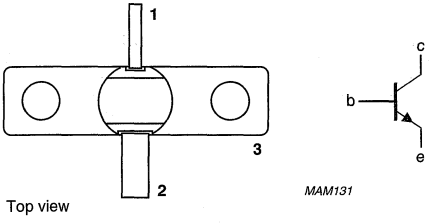
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (mW)	I_C (mA)
class A (CW)	2.88 to 3; note 1	20	≥550	200

Note

1. Oscillating frequency should stabilize in this range.

PINNING - SOT440A

PIN	DESCRIPTION
1	base
2	emitter
3	collector connected to flange



Marking code: 440.

Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{CER}	collector-emitter voltage	R_{BE} = 70 Ω	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	average collector current		–	0.25	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	4	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t < 10 s; note 1	–	235	°C

Note

1. At 0.1 mm from case.

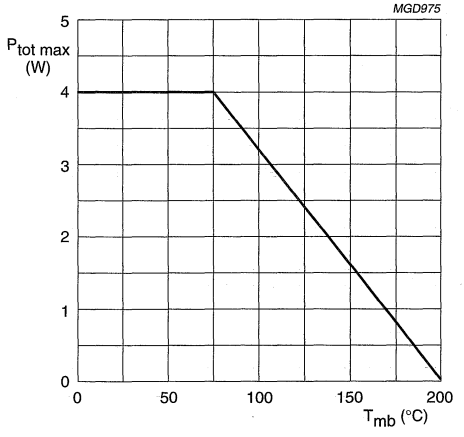
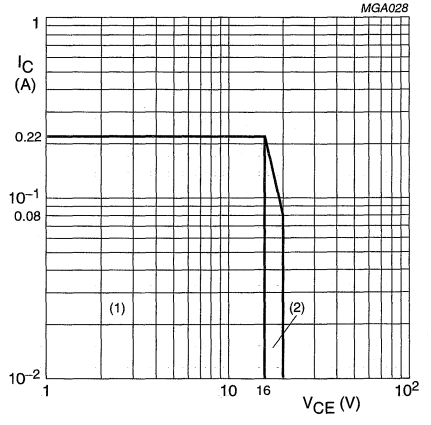


Fig.2 Power derating curve as a function of mounting base temperature.



T_{mb} = 75 °C.
(1) Region of permissible DC operation.
(2) Permissible extension provided R_{BE} < 250 Ω.

Fig.3 DC SOAR.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	22	K/W

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 24 V; I_E = 0	–	100	μA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	0.75	μA
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 500 μA; I_E = 0	40	–	V
$V_{(BR)CER}$	collector-emitter breakdown voltage	I_C = 2.5 mA; R_{BE} = 70 Ω	35	–	V

APPLICATION INFORMATION

Microwave performance up to T_h = 25 °C in a common collector test circuit and working in CW class A.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (mW)	I_C (mA)
class A (CW)	2.88 to 3; note 1	20	550 to 750	200

Note

1. Oscillating frequency should stabilize in this frequency range.

NPN microwave power transistor — PVB42004X

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Local thick oxide and gold sandwich metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

- Intended for use in common base class-B power amplifiers up to 4.2 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a 2-lead rectangular flange package with a ceramic cap (SOT445A) with the common base connected to the flange.

PINNING - SOT445A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

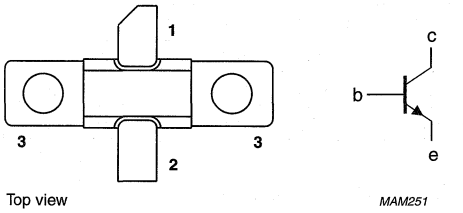


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class-B test circuit.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i (Ω)	Z_L (Ω)
Class-B (CW)	1	24	typ. 13	typ. 11	typ. 60	2.3 + j2.8	7.8 + j11.6
	2	24	typ. 10	typ. 10	typ. 48	1.4 + j9.5	3.9 + j2.6
	3	24	typ. 7.5	typ. 8.8	typ. 30	4.2 + j21	2.3 – j2.5
	4	24	typ. 4	typ. 6	typ. 25	38 – j32	1.9 – j8.5

WARNING

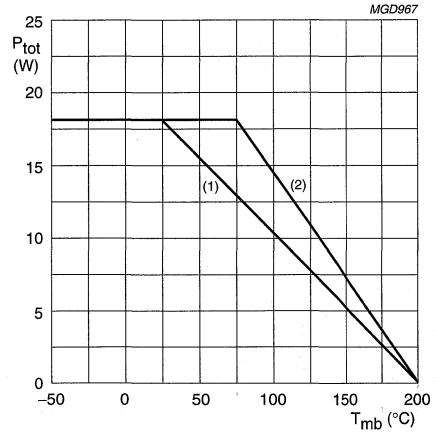
Product and environmental safety - toxic materials

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	40	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current		–	1	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	18	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.1 mm from the case; $t \leq 10$ s	–	235	°C



V_{CE} = 24 V; f > 1 MHz.
(1) VSWR ≥ 5.
(2) VSWR < 3.

Fig.2 Power derating curves as functions of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 75 °C	6.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.7	K/W

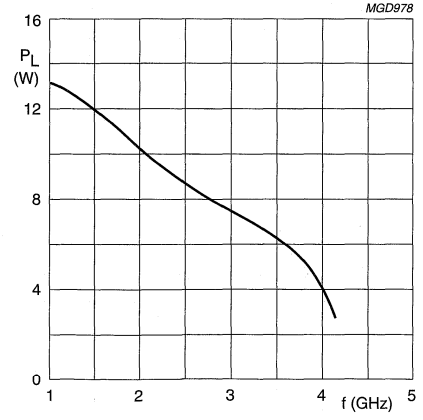
Note

1. See "*Mounting recommendations in the General part of handbook SC15*".

CHARACTERISTICS

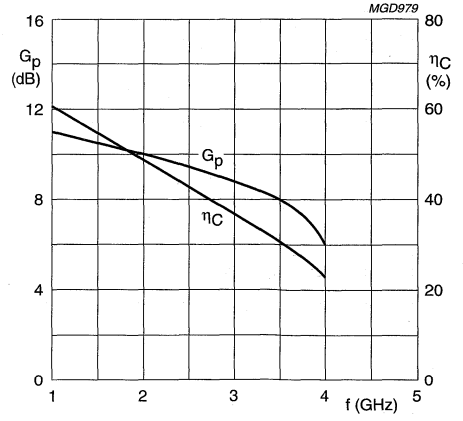
T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 30 mA; R_{BE} = 0	40	–	–	V
I_{CBO}	collector cut-off current	V_{CB} = 24 V; I_E = 0	–	–	50	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	–	1.5	mA
C_{cb}	collector-base capacitance	V_{CB} = 24 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	50	–	pF
C_{ce}	collector-emitter capacitance	V_{CB} = 24 V; V_{EB} = 1.5 V; $I_E = I_C$ = 0; f = 1 MHz	–	1.2	–	pF
C_{eb}	emitter-base capacitance	V_{CB} = 24 V; V_{EB} = 1 V; $I_E = I_C$ = 0; f = 1 MHz	–	30	–	pF



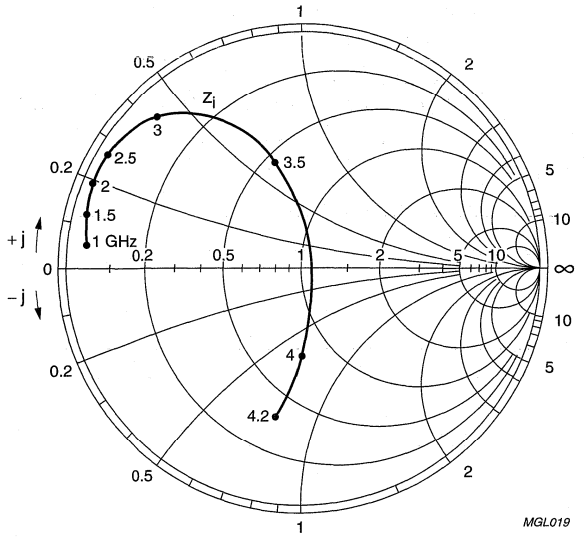
V_{CC} = 24 V; P_S = 1 W.

Fig.3 Load power as a function of frequency.



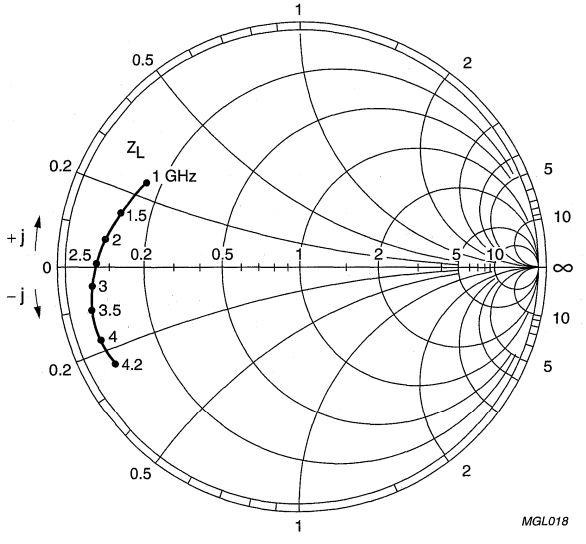
V_{CC} = 24 V; P_S = 1 W.

Fig.4 Power gain and efficiency as functions of frequency.



V_{CC} = 24 V; P_S = 1 W; Z_o = 50 Ω.

Fig.5 Input impedance as a function of frequency; typical values.



V_{CC} = 24 V; P_S = 1 W; Z_o = 50 Ω.

Fig.6 Output impedance as a function of frequency; typical values.

NPN microwave power transistor PXB16050U

FEATURES

- Input and output matching cells allow an easier design of circuits
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Interdigitated structure provides high emitter efficiency
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.

APPLICATIONS

Common-base class C power amplifiers at frequencies between 1.5 and 1.8 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with base connected to the flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C (CW)	1.65	28	>45	>8.5	>45	see Figs 6 and 7

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

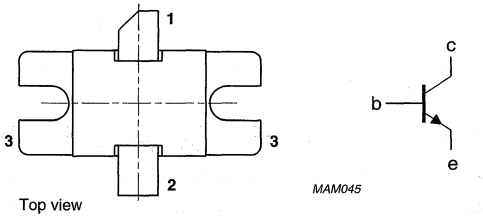


Fig.1 Simplified outline and symbol.

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

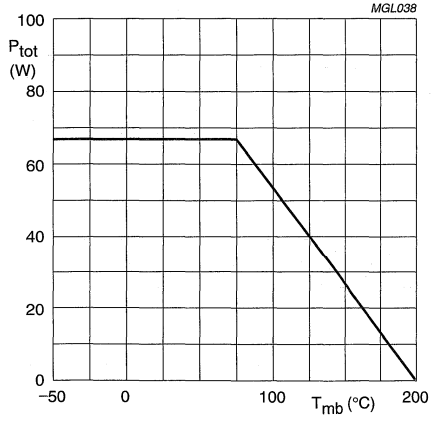
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	45	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	45	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	6	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	67	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

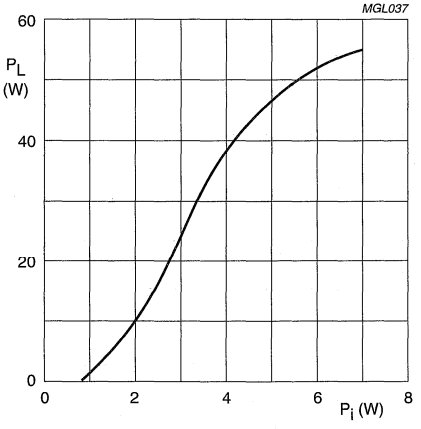
Note

1. Up to 0.2 mm from ceramic.



$P_{tot\ max}$ = 67 W.

Fig.2 Power derating curve.



V_{CC} = 28 V; f = 1.65 GHz.

Fig.3 Load power as a function of input power (see Fig.4).

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 100 °C	1.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15".*

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0	3	mA
		V_{CB} = 45 V; I_E = 0	15	mA
I_{CES}	collector cut-off current	V_{CE} = 30 V; R_{BE} = 0	3	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	300	μA

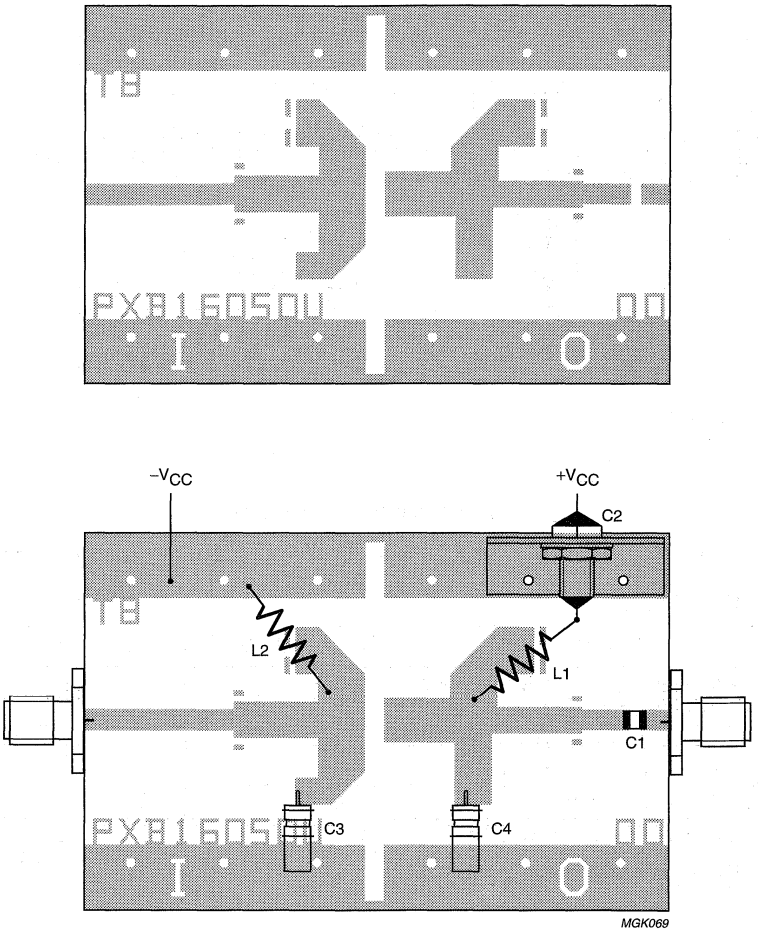
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C measured in the common base test circuit as shown in Fig.4 and working in CW class C mode.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_{po} (dB)	η_C (%)	Z_i/Z_L (Ω)
Class C (CW); see note 1	1.65	28	≥45; typ. 50	≥8.5; typ. 9.5	≥45; typ. 52	see Figs 6 and 7

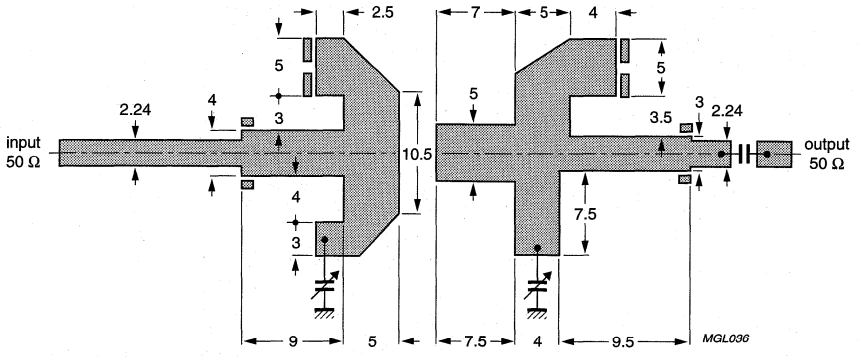
Note

1. Type PXB16050U may be used for narrowband or broadband amplifiers within the frequency range 1.5 to 1.8 GHz. Operation below 1.5 GHz may damage the transistor due to resonance of the internal output prematching circuit.



Substrate: Teflon fibreglass.
Permittivity: $\varepsilon_r = 2.55$.
Thickness: 0.8 mm.
The narrowband test circuit is split into two totally independent halves each being 30 × 40 mm in size.

Fig.4 Narrowband test circuit.

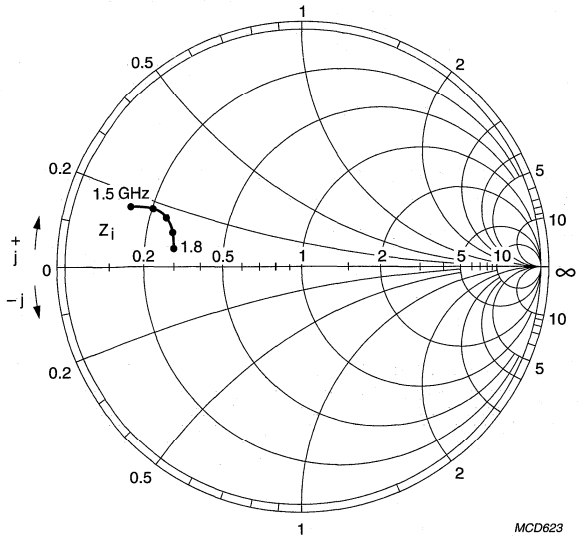


Dimensions in mm.

Fig.5 Narrowband test circuit dimensions.

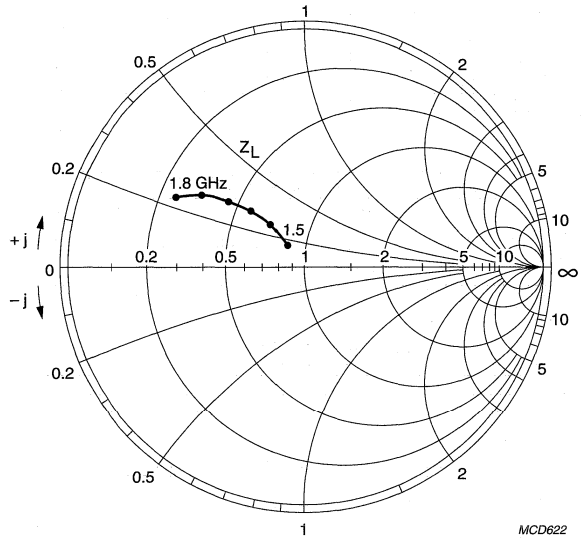
List of components (see Fig.4)

COMPONENT	DESCRIPTION	VALUE	CATALOGUE NO.
L1	4 turns 0.5 mm diameter copper wire internal diameter = 2 mm	–	–
L2	5 turns 0.5 mm diameter copper wire internal diameter = 2 mm	–	–
C1	DC blocking capacitor	100 pF	ATC
C2	feedthrough bypass capacitor	–	Erie 1250-003
C3, C4	trimmer	0.6 to 4.5 pF	Tekelec AT-3-7271SL



V_{CC} = 28 V; Z_O = 10 Ω.

Fig.6 Input impedance as a function of frequency; typical values.



V_{CC} = 28 V; Z_O = 10 Ω.

Fig.7 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistor | PZ1418B15U

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and easy broadband use.

APPLICATIONS

- Common base class-B wideband amplifiers under CW conditions in military and professional applications, and to drive the type PZ1418B30U.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the base connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

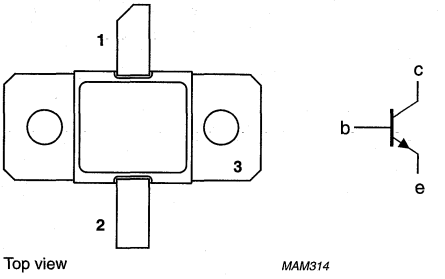


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common base class-B wideband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-B	1.4 to 1.8	28	≥12.5	≥7	≥38	see Figs 6 and 7

WARNING

Product and environmental safety - toxic materials

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	2	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	27	W
T_{stg}	storage temperature		−65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature		–	235	°C

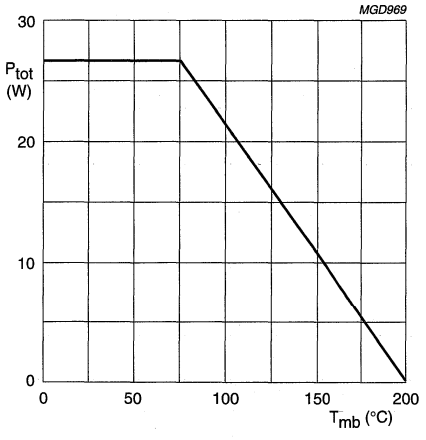


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	4	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

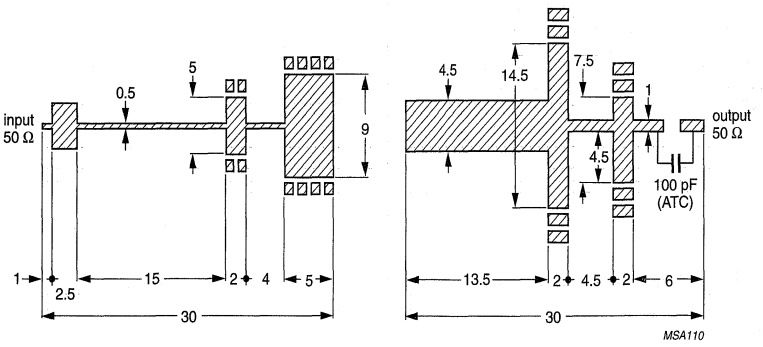
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0	5	mA
		V_{CB} = 30 V; I_E = 0	2.5	mA
I_{CES}	collector cut-off current	V_{CE} = 35 V; R_{BE} = 0	25	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	100	μA

APPLICATION INFORMATION

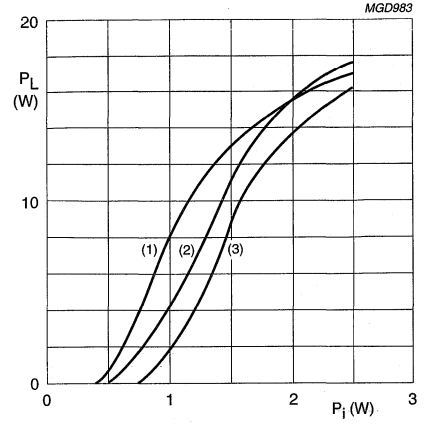
Microwave performance up to T_{mb} = 25 °C in a common base class B wideband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-B	1.4 to 1.8	28	≥12.5 typ. 15	≥7 typ. 7.8	≥38 typ. 45	see Figs 6 and 7



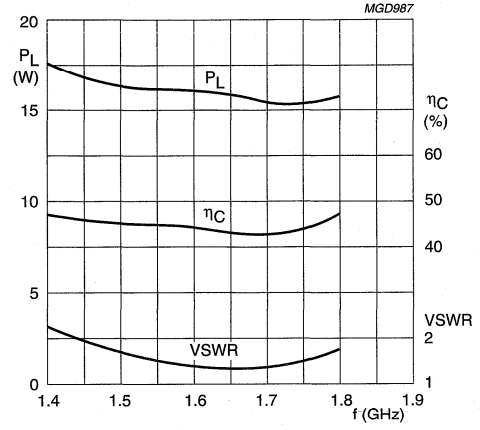
Dimensions in mm.
Substrate: Epsilam printed circuit board.
Thickness: 0.635 mm.
Permittivity: ε_r = 10.

Fig.3 Wideband test circuit board for 1.4 to 1.8 GHz operation.



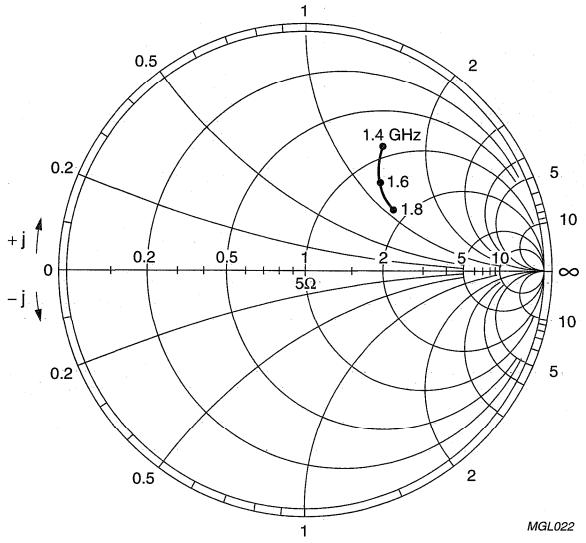
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C.
(1) 1.6 GHz.
(2) 1.4 GHz.
(3) 1.8 GHz.

Fig.4 Load power as a function of input power; typical values.



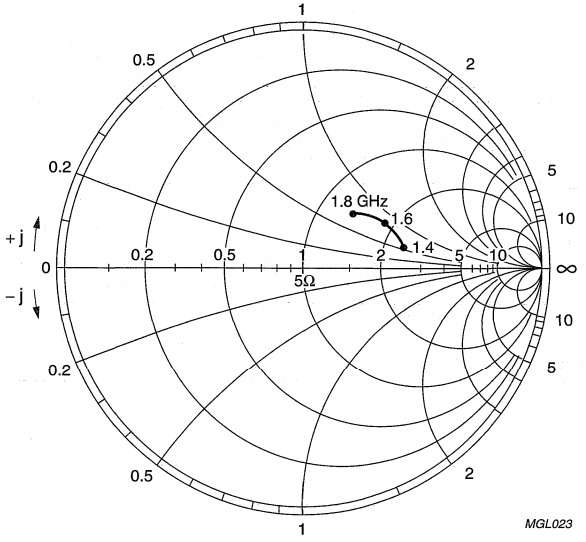
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C; P_i = 2.5 W.

Fig.5 Load power, efficiency and VSWR as functions of frequency; typical values.



$Z_o = 5\ \Omega$.

Fig.6 Input impedance as a function of frequency; typical values.



$Z_o = 5\ \Omega$.

Fig.7 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistors

PZ1418B30U; PZ1721B25U; PZ2024B20U

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output prematching ensures good stability and easy broadband use.

APPLICATIONS

- Common base class-B broadband amplifiers under CW conditions in military and professional applications.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the base connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

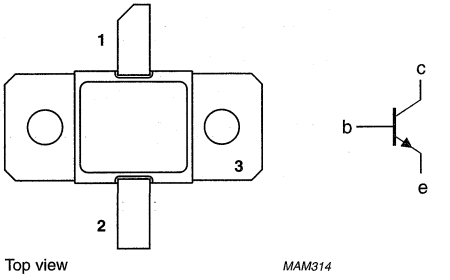


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common base class-B wideband amplifier.

TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
PZ1418B30U	1.4 to 1.8	28	≥27	≥7.3	≥38	see Figs 6 and 7
PZ1721B25U	1.7 to 2.1	28	≥25	≥7	≥35	see Figs 11 and 12
PZ2024B20U	2 to 2.4	28	≥20	≥6	≥35	see Figs 16 and 17

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C	–	45	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature		–	235	°C

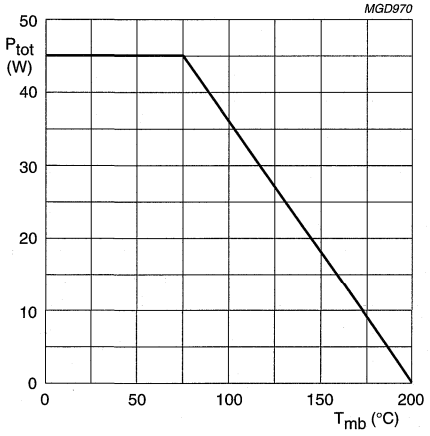


Fig.2 Power derating curve as a function of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	2.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

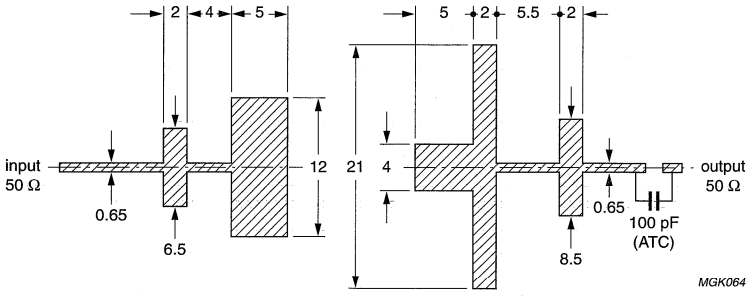
SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0	10	mA
		V_{CB} = 30 V; I_E = 0	5	mA
I_{CES}	collector cut-off current	V_{CE} = 35 V; R_{BE} = 0	50	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	200	μA

APPLICATION INFORMATION

PZ1418B30U

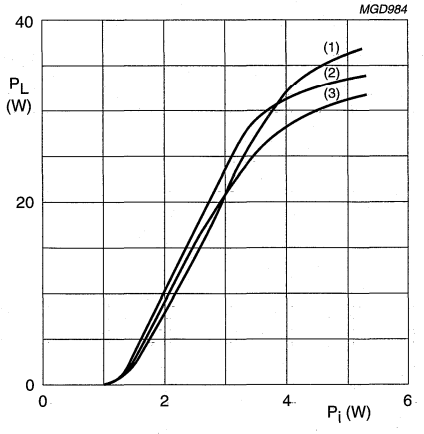
Microwave performance up to T_{mb} = 25 °C in a common base class B wideband amplifier.

TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
PZ1418B30U	1.4 to 1.8	28	≥27 typ. 35	≥7.3 typ. 8.4	≥38 typ. 45	see Figs 6 and 7



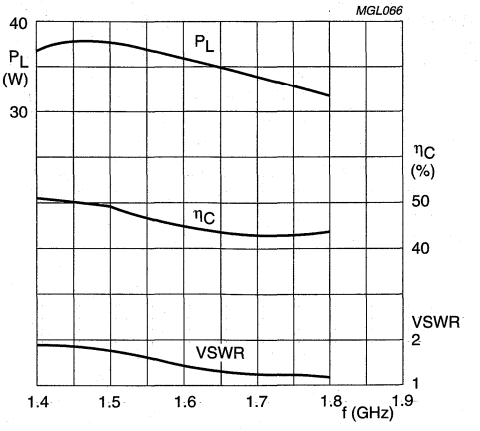
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.635 mm.
Permittivity: ε_r = 10.

Fig.3 Wideband test circuit board for 1.4 to 1.8 GHz operation (PZ1418B30U).



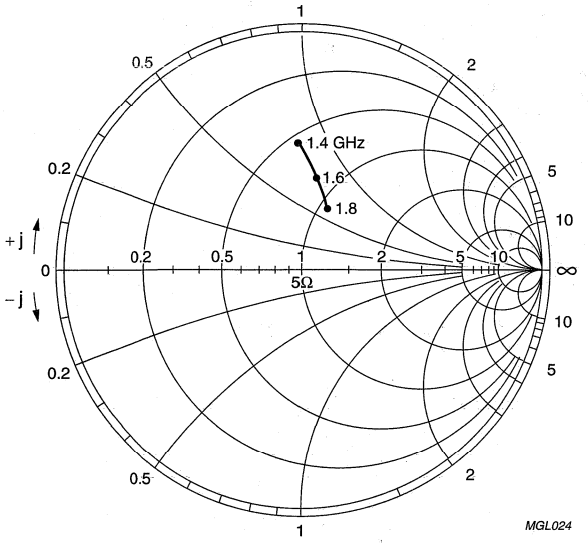
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C.
(1) 1.4 GHz.
(2) 1.6 GHz.
(3) 1.8 GHz.

Fig.4 Load power as a function of input power; typical values for PZ1418B30U.



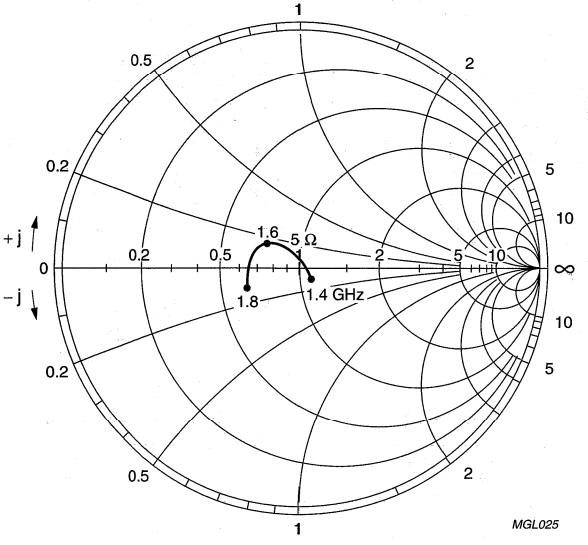
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C; P_i = 5 W.

Fig.5 Load power, efficiency and VSWR as functions of frequency; typical value for PZ1418B30U.



$Z_o = 5\ \Omega$.

Fig.6 Input impedance as a function of frequency; typical values for PZ1418B30U.



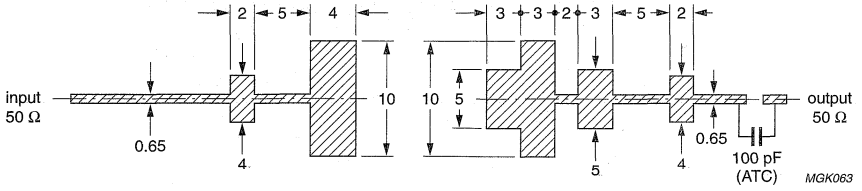
$Z_o = 5\ \Omega$.

Fig.7 Optimum load impedance as a function of frequency; typical values for PZ1418B30U.

PZ1721B25U

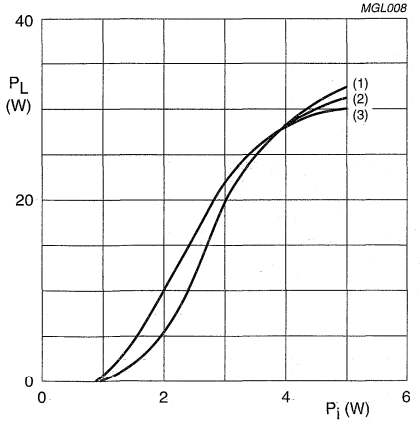
Microwave performance up to T_{mb} = 25 °C in a common base class B wideband amplifier.

TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
PZ1721B25U	1.7 to 2.1	28	≥25 typ. 30	≥7 typ. 7.8	≥35 typ. 44	see Figs 11 and 12



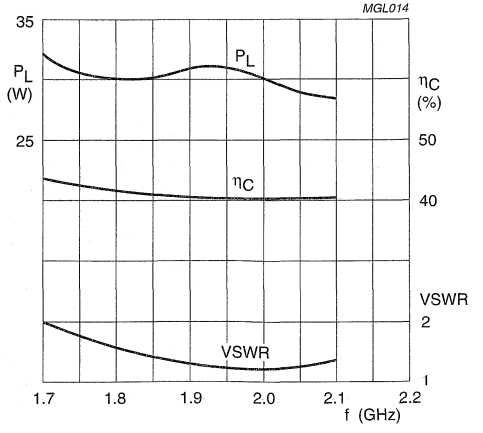
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.635 mm.
Permittivity: ε_r = 10.

Fig.8 Wideband test circuit board for 1.7 to 2.1 GHz operation (PZ1721B25U).



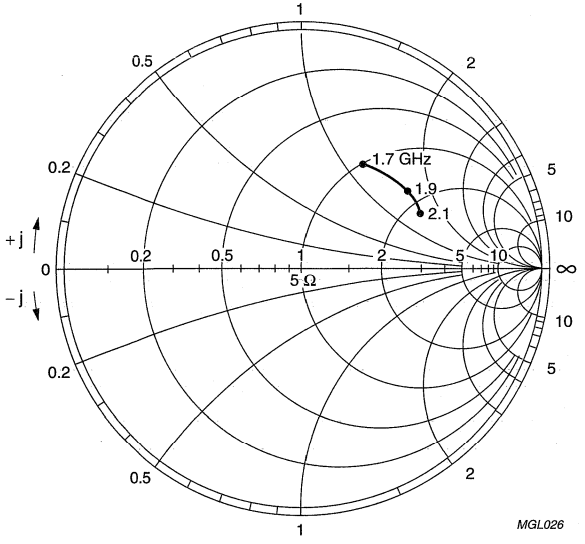
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C.
(1) 1.7 GHz.
(2) 1.9 GHz.
(3) 2.1 GHz.

Fig.9 Load power as a function of input power; typical values for PZ1721B25U.



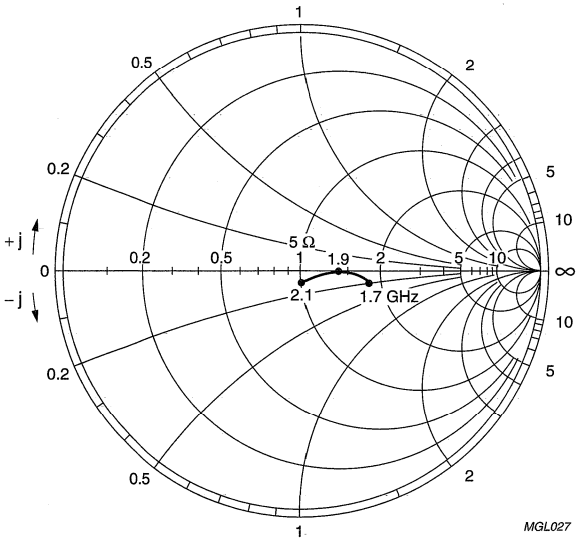
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C; P_i = 5 W.

Fig.10 Load power, efficiency and VSWR as functions of frequency; typical values for PZ1721B25U.



$Z_o = 5\ \Omega$.

Fig.11 Input impedance as a function of frequency; typical values for PZ1721B25U.



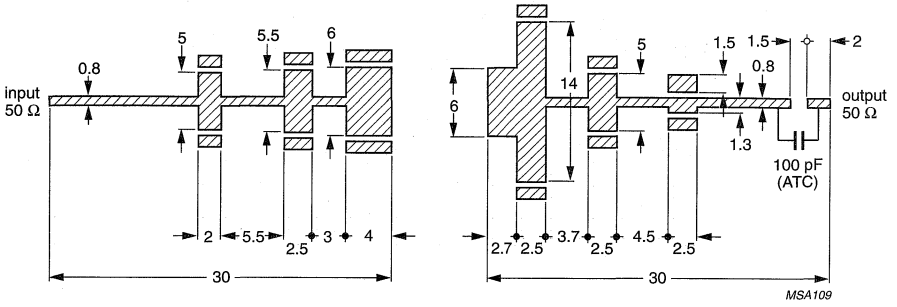
$Z_o = 5\ \Omega$.

Fig.12 Optimum load impedance as a function of frequency; typical values for PZ1721B25U.

PZ2024B20U

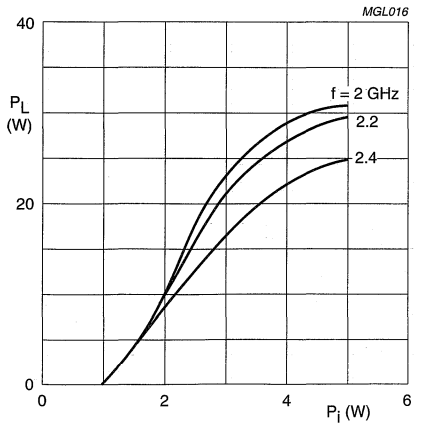
Microwave performance up to T_{mb} = 25 °C in a common base class B wideband amplifier.

TYPE NUMBER	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
PZ2024B20U	2 to 2.4	28	≥20 typ. 26	≥6 typ. 7	≥35 typ. 42	see Figs 16 and 17



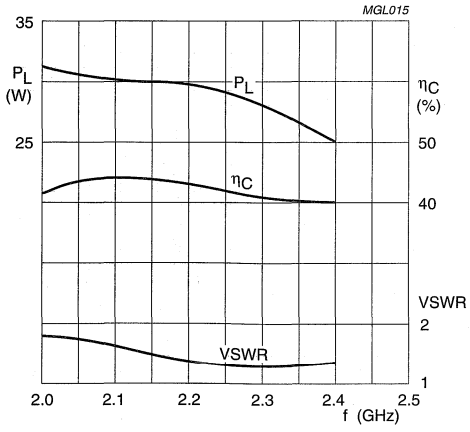
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.635 mm.
Permittivity: ε_r = 10.

Fig.13 Wideband test circuit board for 2 to 2.4 GHz operation (PZ2024B20U).



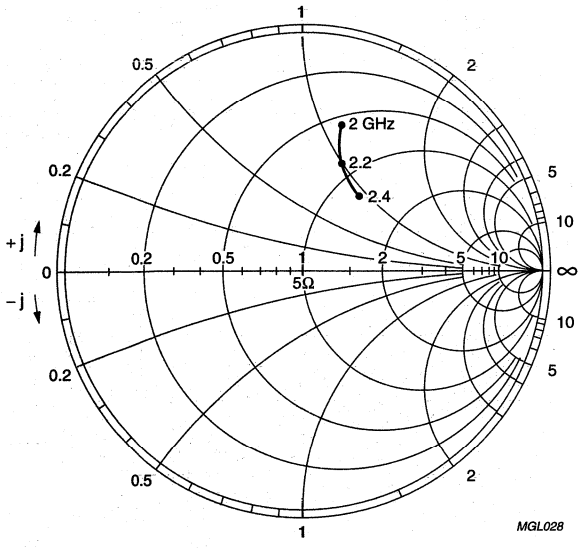
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C.

Fig.14 Load power as a function of input power; typical values for PZ2024B20U.



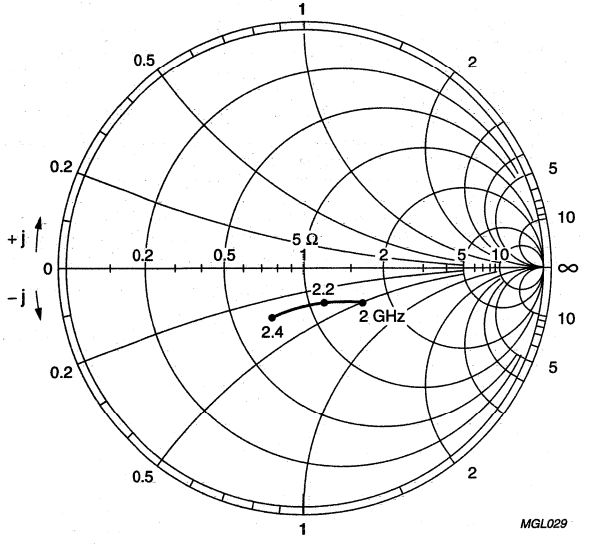
Class-B operation; V_{CC} = 28 V; T_{mb} = 25 °C; P_i = 5 W.

Fig.15 Load power, efficiency and VSWR as functions of frequency; typical values for PZ2024B20U.



$Z_o = 5\ \Omega$.

Fig.16 Input impedance as a function of frequency; typical values for PZ2024B20U.



$Z_o = 5\ \Omega$.

Fig.17 Optimum load impedance as a function of frequency; typical values for PZ2024B20U.

NPN microwave power transistor PZB16035U

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance.
- Input matching cell improves input impedance and allows an easier design of wideband circuits.

APPLICATIONS

- Common base class-B power amplifiers under CW conditions in military and professional applications up to 1.6 GHz.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the base connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

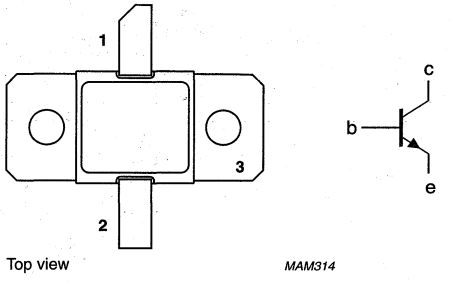


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

RF performance up to T_{mb} = 25 °C in a common base class-B selective amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-B (CW)	1.55	28	≥35	≥8	≥45	see Figs 5 and 6

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	40	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	R_{BE} = 0 Ω	–	35	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	4	A
P_{tot}	total power dissipation	T_{mb} = 75 °C	–	45	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	Up to 0.2 mm from the flange; t < 10 s	–	235	°C

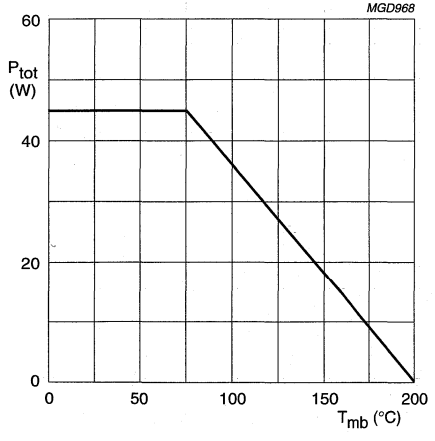


Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base	T_j = 75 °C	2.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	T_j = 75 °C; note 1	0.2	K/W

Note

1. See *"Mounting recommendations in the General part of handbook SC15"*.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 40 V; I_E = 0	–	10	mA
		V_{CB} = 30 V; I_E = 0	–	5	mA
I_{CES}	collector cut-off current	V_{CER} = 35 V; R_{BE} = 0	–	50	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	200	μA
C_{cb}	collector-base capacitance	V_{CB} = 28 V; I_E = I_C = 0	17	–	pF

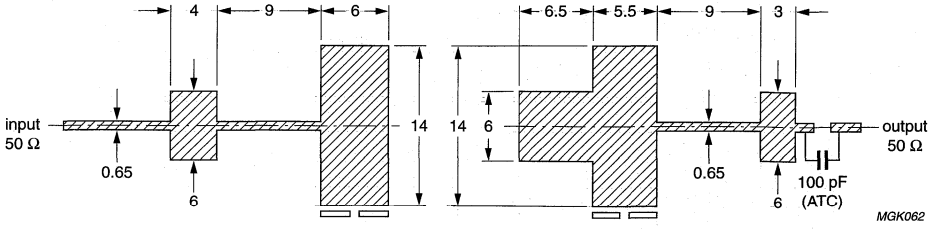
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common base class B selective amplifier; note 1.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class B (CW)	1.55	28	>35; typ. 38	>8; typ. 9.8	>45; typ. 50	see Figs 5 and 6

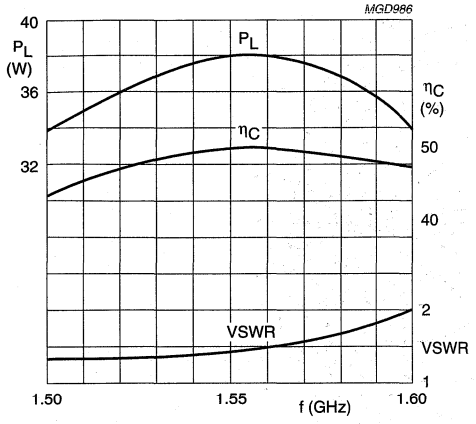
Note

1. Amplifier consists of pre-matching test-circuit with complementary input and output slug tuners.



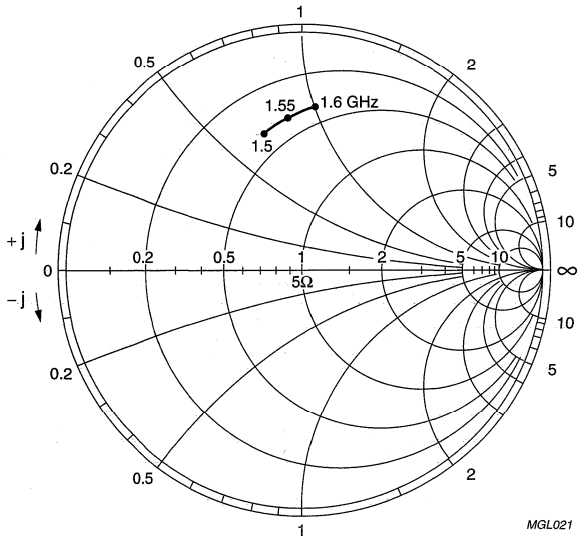
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.65 mm.
Permittivity: ε_r = 10.

Fig.3 Prematching test circuit boards for CW, class B operation at 1.55 GHz.



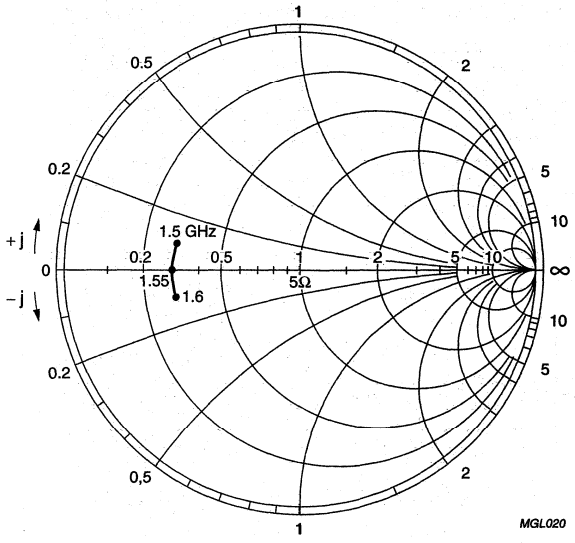
V_{CC} = 28 V; T_{mb} = 25 °C.

Fig.4 Load power, efficiency and VSWR as functions of frequency.



P_L = 38 W; Z_o = 5 Ω.

Fig.5 Input impedance as a function of frequency; typical values.



P_L = 38 W; Z_o = 5 Ω.

Fig.6 Optimum load impedance as a function of frequency; typical values.

NPN microwave power transistors RX1214B80W; RX1214B130Y

FEATURES

- Suitable for short and medium pulse applications up to 1 ms pulse width, 10% duty factor
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance
- Internal input and output prematching networks allow an easier design of circuits.

APPLICATIONS

Common-base class C broadband pulsed power amplifiers for radar applications in the 1.2 to 1.4 GHz band. Also suitable for long pulse, heavy duty operation within this band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common-base class C narrowband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C RX1214B80W	t_p = 500 µs; δ = 10%	1.2 to 1.4	40	≥80	≥7	≥35
Class C RX1214B130Y	t_p = 150 µs; δ = 5%	1.2 to 1.4	50	≥130	≥7	≥35

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

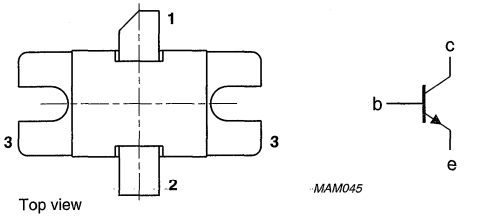


Fig.1 Simplified outline and symbol.

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

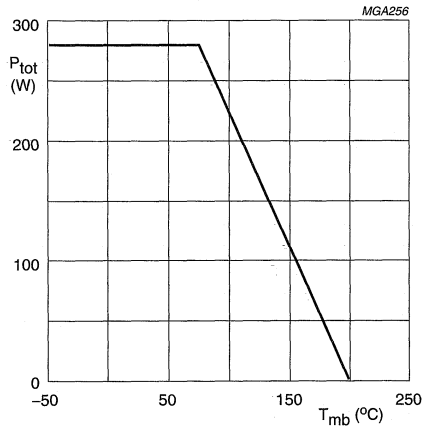
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 150\ \mu s$; $\delta \leq 5\%$	–	9	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 150\ \mu s$; $\delta \leq 5\%$	–	280	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 150\ \mu s$; $\delta = 5\%$; $P_{tot\ max} = 280$ W.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	1.75	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 150 µs; δ = 5%; notes 1 and 2	0.4	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	6	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 1.5 V	–	0.6	mA
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 60 mA; V_{BE} = 0	60	–	V

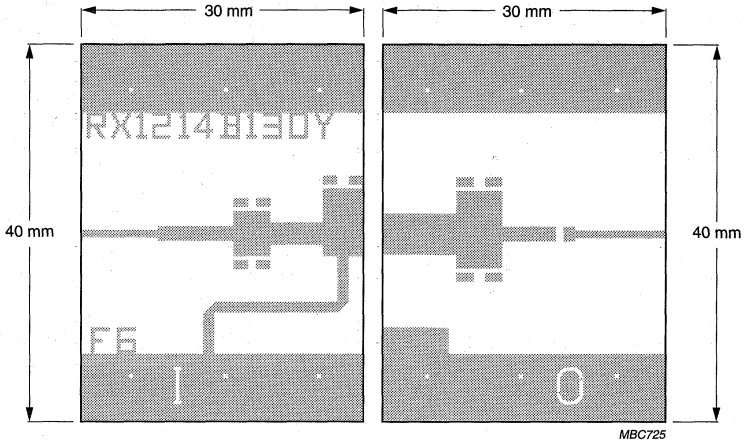
APPLICATION INFORMATION

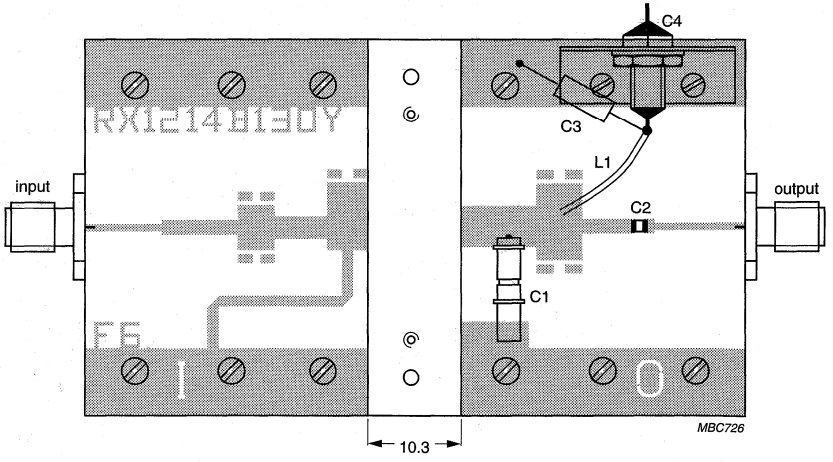
Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 150 µs; δ = 5%	1.2 to 1.4	50	≥130; typ. 140	≥7; typ. 7.5	≥35; typ. 39
	t_p = 500 µs; δ = 10%	1.2 to 1.4	40	typ. 80	typ. 8.5	typ. 40

List of components (see Fig.3)

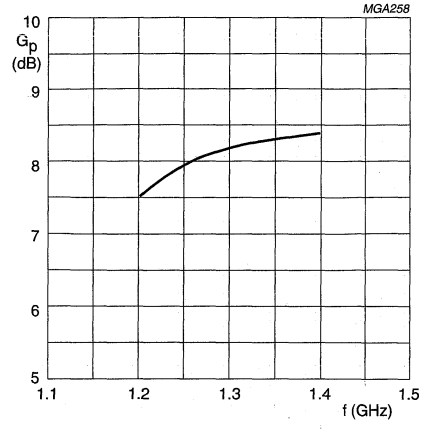
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1	0.5 mm copper wire		total length = 15 mm	
C1	trimmer capacitor	0.6 – 5 pF		Tekelec, ref AT3-7271SL
C2	chip capacitor			
C3	tantalum capacitor	10 µF, 50 V		
C4	feedthrough bypass capacitor			Erie, ref.1250-003





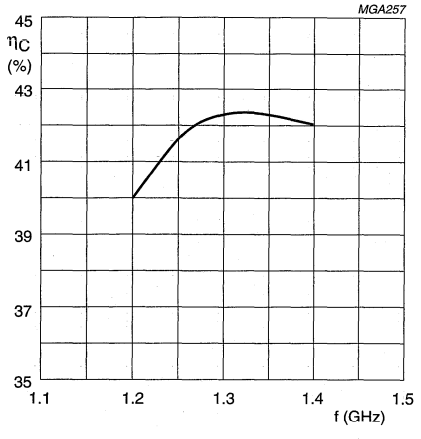
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.



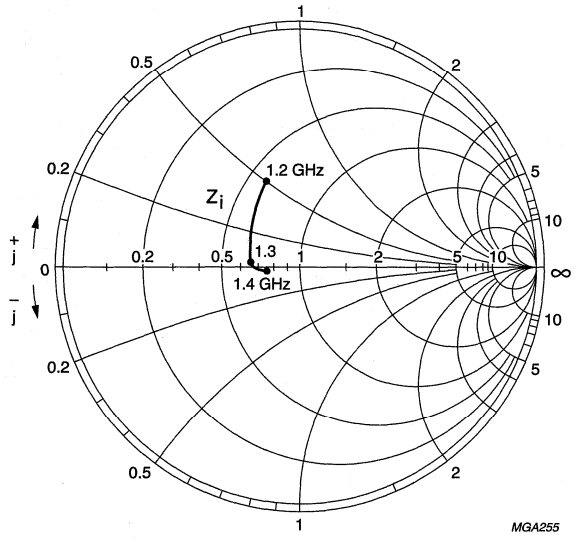
Class C pulse operation; t_p = 500 μs; δ = 5%.
V_{CC} = 50 V; P_O = 130 W.
Broadband test circuit as shown in Fig.3.

Fig.4 Power gain as a function of frequency.



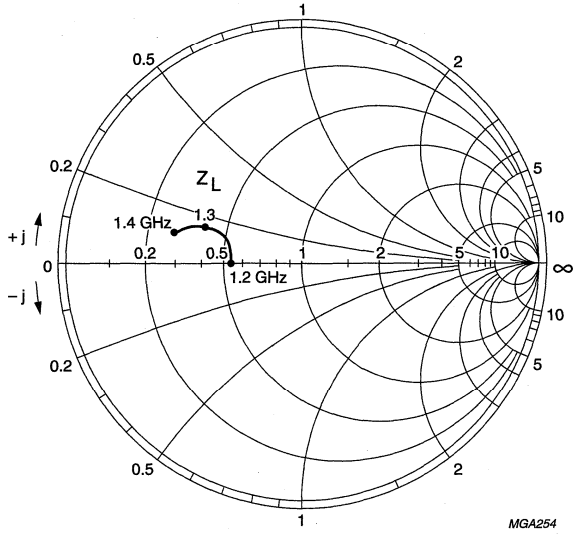
Class C pulse operation; t_p = 500 μs; δ = 5%.
V_{CC} = 50 V; P_O = 130 W.
Broadband test circuit as shown in Fig.3.

Fig.5 Collector efficiency as a function of frequency.



V_{CC} = 50 V; Z_O = 10 Ω; P_{OUT} = 130 W.

Fig.6 Input impedance as a function of frequency, associated with optimum load impedance.



V_{CC} = 50 V; Z_O = 10 Ω; P_{OUT} = 130 W.

Fig.7 Load impedance as a function of frequency, associated with optimum input impedance.

Microwave power transistor — RX1214B170W

FEATURES

- Suitable for short and medium pulse applications up to 1 ms pulse width, 10% duty factor
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance
- Internal input and output prematching networks allow an easier design of circuits.

APPLICATIONS

Intended for use in common-base class C broadband pulsed power amplifiers for radar applications in the 1.2 to 1.4 GHz band. Also suitable for long pulse, heavy duty operation within this band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package, with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrowband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 500 µs; δ = 10%	1.2 to 1.4	42	≥170	≥6.7	≥40

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

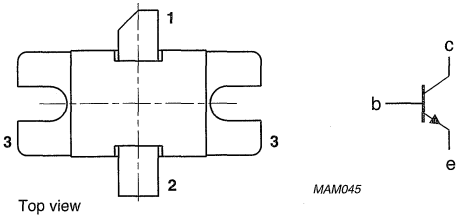


Fig.1 Simplified outline and symbol.

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

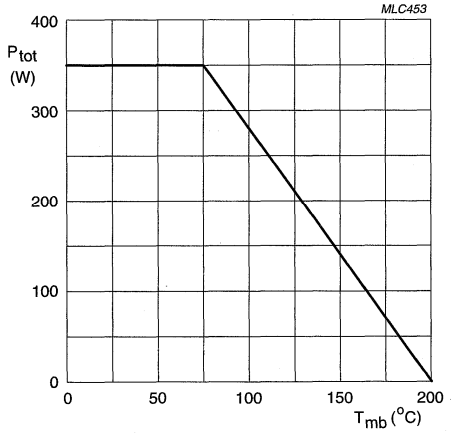
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	$t_p \leq 150$ µs; $\delta \leq 5\%$	–	15	A
P_{tot}	total power dissipation	$T_{mb} \leq 75$ °C; $t_p \leq 150$ µs; $\delta \leq 5\%$	–	350	W
T_{stg}	storage temperature		–65	+200	°C
T_j	junction temperature		–	200	°C
T_{sld}	soldering temperature	t ≤ 10 s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$t_p = 150$ µs; $\delta = 5\%$.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	1.9	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
Z_{th}	thermal impedance from junction to heatsink	t_p = 500 μs; δ = 10%; notes 1 and 2	0.28	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15".*
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 50 V	–	20	mA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = 1.5 V	–	2	mA
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 60 mA; V_{BE} = 0	65	–	V

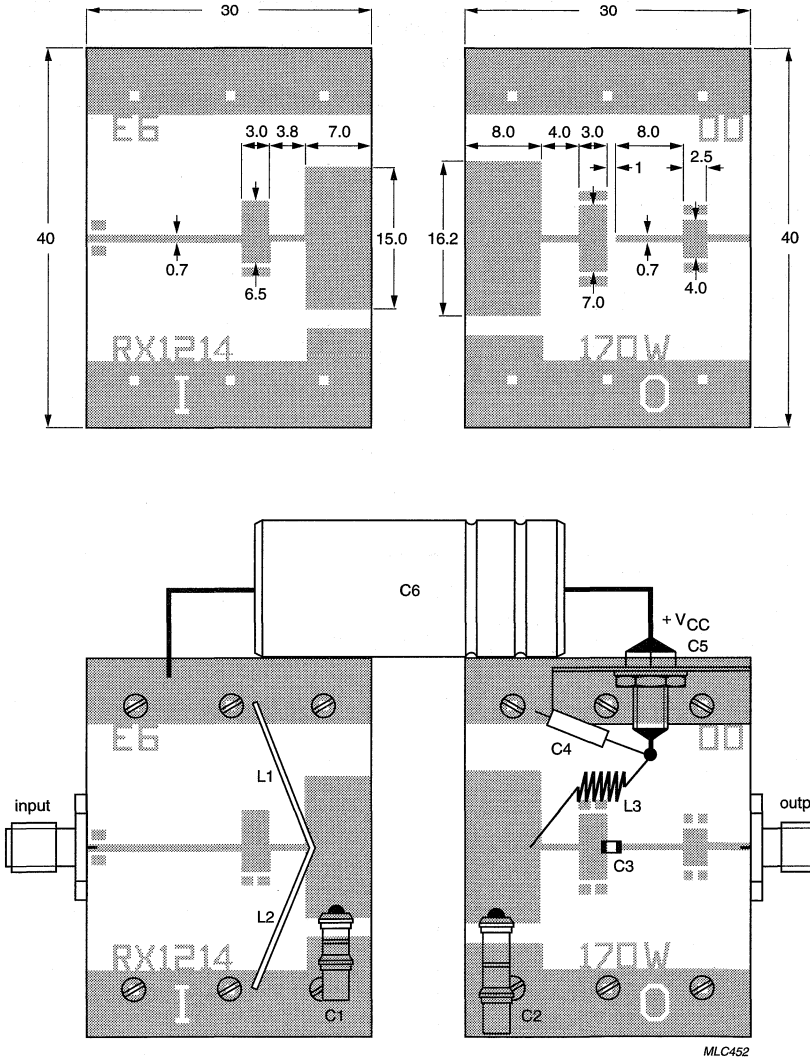
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3; note 1.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 500 μs; δ = 10%	1.2 to 1.4	42	170	≥6.7 typ. 7.2	≥40 typ. 45

Note

1. Equivalent thermal impedance under pulsed microwave operating conditions.

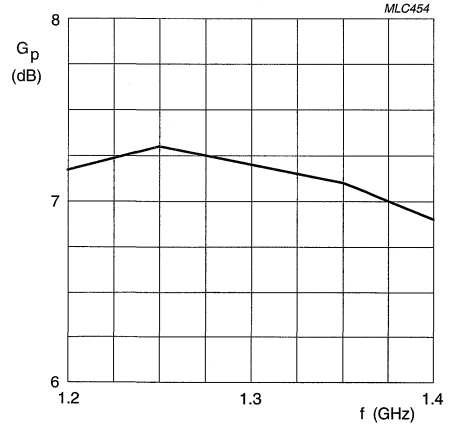


Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Broadband test circuit.

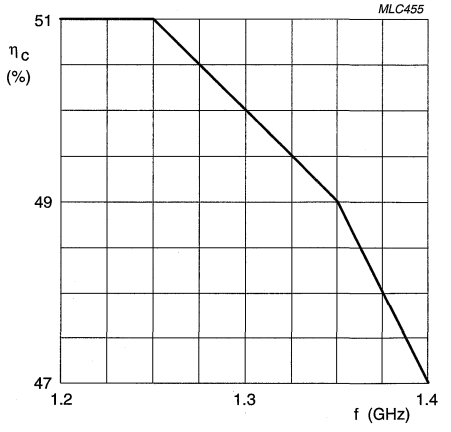
List of components (see Fig.3)

COMPONENT	DESCRIPTION	VALUE	ORDERING INFORMATION
C1	variable gigatrim capacitor	0.6 to 5 pF	Tekelec AT3-7271SL
C2	variable gigatrim capacitor	0.8 to 8 pF	Tekelec 729-1
C3	capacitor	100 pF	ATC 100A101kp50x
C4	tantalum capacitor	10 μF; 50 V	
C5	feedthrough bypass capacitor		Erie 1250-003
L1, L2	0.65 mm copper wire; total length = 24 mm; height of loop = 10 mm		
L3	4 turns 0.65 mm copper wire; total length = 4 mm; internal diameter = 3 mm		



Class C pulse operation.
t_p = 500 μs; δ = 10%; V_{CC} = 42 V; P_o = 170 W.
In broadband test circuit as shown in Fig.3.

Fig.4 Power gain as a function of frequency.



Class C pulse operation.
t_p = 500 μs; δ = 10%; V_{CC} = 42 V; P_o = 170 W.
In broadband test circuit as shown in Fig.3.

Fig.5 Collector efficiency as a function. of frequency.

NPN microwave power transistor — RX1214B300Y

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance
- Internal input and output matching networks for an easy circuit design.

APPLICATIONS

- Common base class-C wideband amplifiers operating under pulsed conditions, recommended for L-band radar applications.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with the base connected to the flange.

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

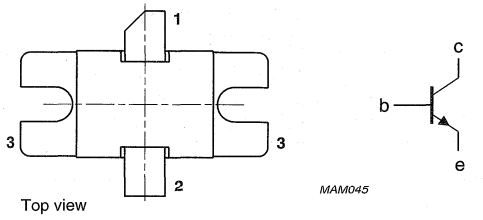


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance at $T_{mb} \leq 25$ °C in a common base class-C wideband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-C t_p = 150 μs; δ = 5 %	1.2 to 1.4	50	≥250	≥7	≥35	see Fig 6

WARNING

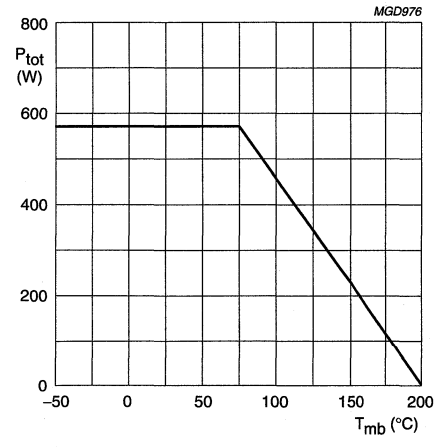
Product and environmental safety - toxic materials

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 150\ \mu s$; $\delta = 5\ \%$	–	21	A
P_{tot}	total power dissipation	$t_p \leq 150\ \mu s$; $\delta = 5\ \%$; $T_{mb} = 75\ °C$	–	570	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.2 mm from case; $t \leq 10$ s	–	235	°C



$t_p = 150\ \mu s$; $\delta = 5\ \%$

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

T_j = 100 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base		0.8	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 150 µs; δ = 5 %; notes 1 and 2	0.22	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under nominal pulse microwave operating conditions.

CHARACTERISTICS

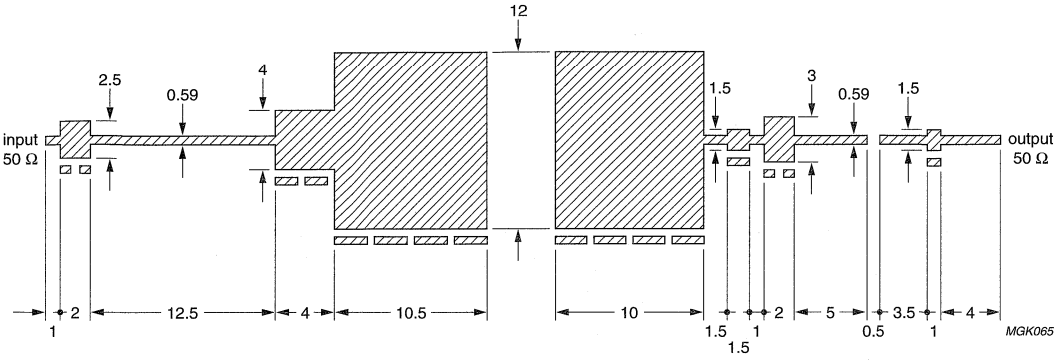
T_{mb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 140 mA; I_E = 0	65	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 140 mA; R_{BE} = 0 Ω	60	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 0; I_E = 20 mA	3	–	V
I_{CBO}	collector cut-off current	V_{CB} = 50 V; I_E = 0	–	14	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	1.4	mA

APPLICATION INFORMATION

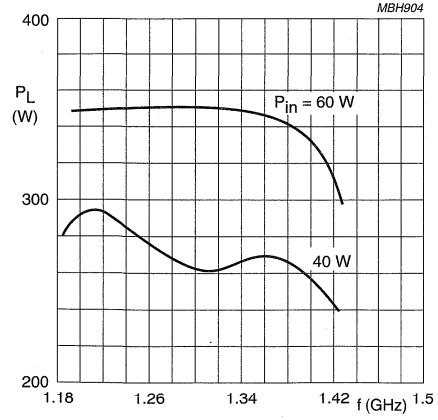
Microwave performance at $T_{mb} \leq 25$ °C in a common base class C wideband amplifier.

MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_P (dB)	η_C (%)	Z_i; Z_L (Ω)
Pulsed t_p = 150 µs; δ = 5 %	1.2 to 1.4	50	≥250 typ. 320	≥7 typ. 8	≥35 typ. 40	see Fig 6
t_p = 300 µs; δ = 10 %	1.2 to 1.4	50	typ. 300	typ. 7.5	typ. 35	see Fig 6



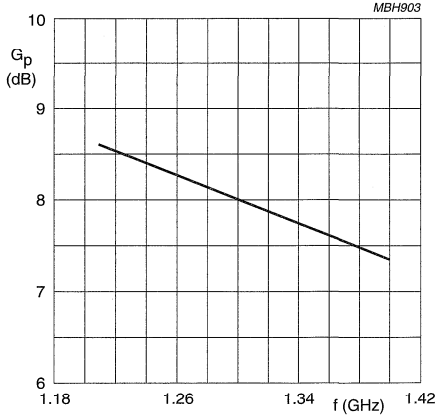
Dimensions in mm.
Substrate: Epsilam printed-circuit board.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Wideband test circuit board for 1.2 to1.4 GHz application.



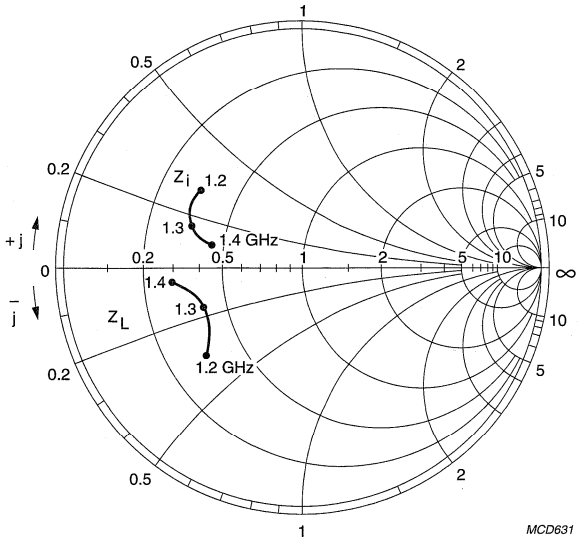
$t_p = 150\ \mu s$; $\delta = 5\ \%$.

Fig.4 Load power as a function of frequency; typical values.



$t_p = 150\ \mu s$; $\delta = 5\ \%$.

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



Z_o = 5 Ω; V_{CC} = 50 V; P_L = 250 W; T_{mb} = 25 °C; t_p = 150 µs; δ = 5 %; class C operation.

Fig.6 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor — RX1214B350Y

FEATURES

- Suitable for short and medium pulse applications up to 1 ms/10%
- Internal input prematching networks allow an easier design of circuits
- Diffused emitter ballasting resistors improve ruggedness
- Interdigitated emitter-base structure provides high emitter efficiency
- Gold metallization with barrier realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance.

APPLICATIONS

Common base, class C, broadband, pulsed power amplifiers for L-Band radar applications in the 1.2 to 1.4 GHz band. Also suitable for medium pulse, heavy duty operation within this band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT439A metal ceramic flange package with base connected to flange.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C broadband amplifier.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 130 µs; δ = 6%	1.2 to 1.4	50	280	≥7	≥40

PINNING - SOT439A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

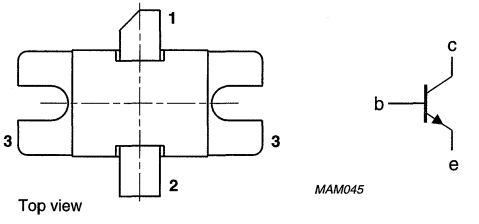


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials

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

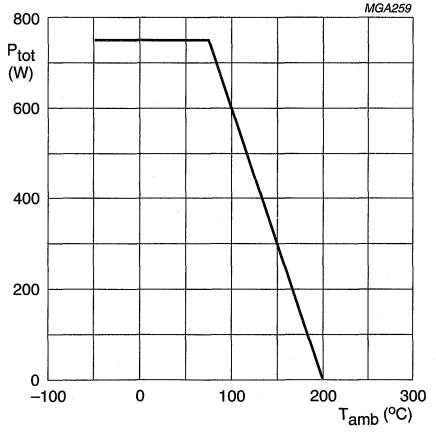
LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	65	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 130\ \mu s$; $\delta \leq 6\%$	–	25	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 30\ \mu s$; $\delta \leq 1\%$	–	750	W
T_{stg}	storage temperature		–65	200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	$t \leq 10$ s; note 1	–	235	°C

Note

1. Up to 0.2 mm from ceramic.



$P_{tot\ max} = 750$ W; $t_p \leq 30\ \mu s$; $\delta \leq 1\%$.

Fig.2 Maximum power dissipation derating as a function of mounting base temperature.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	T_j = 120 °C	1.2	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal impedance from junction to heatsink	t_p = 130 µs; δ = 6%; T_j = 110 °C; notes 1 and 2	0.17	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 50 V; I_E = 0	30	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	3	mA

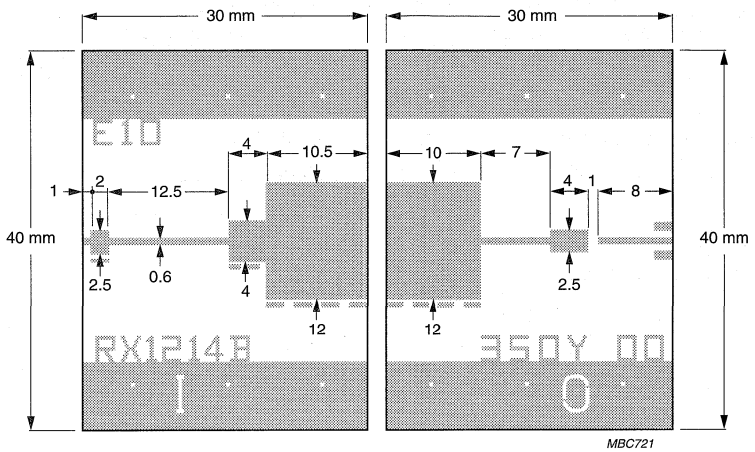
APPLICATION INFORMATION

Microwave performance up to T_{mb} = 25 °C in a common base test circuit as shown in Fig.3.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V) note 1	P_L (W)	G_p (dB)	η_C (%)
Class C	t_p = 130 µs; δ = 6%; note 2	1.2 to 1.4	50	280	≥7; typ. 8	≥40; typ. 44

Notes

1. V_{CC} during pulse.
2. Operating conditions and performances for other pulse formats can be made available on request.



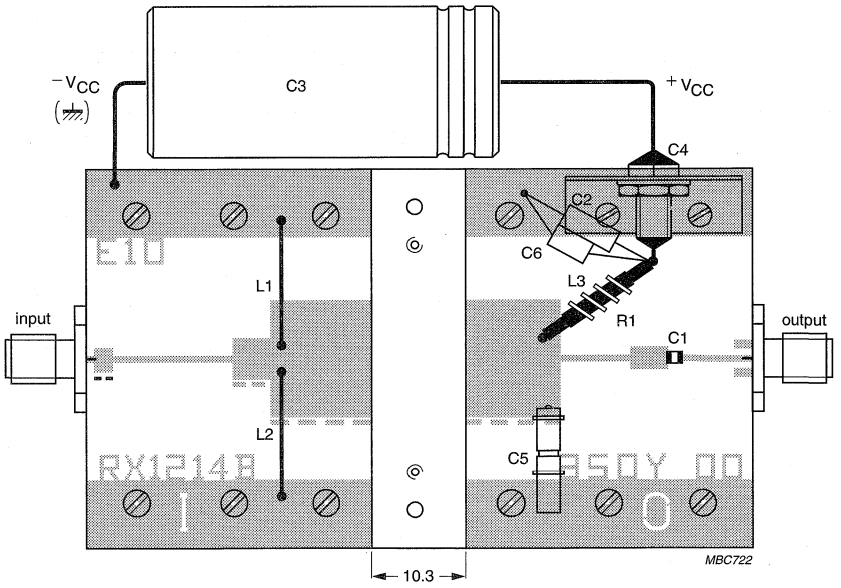
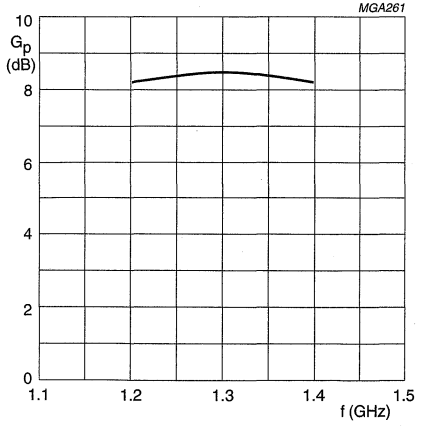


Fig.3 Broadband test circuit.

List of components (see Fig.3)

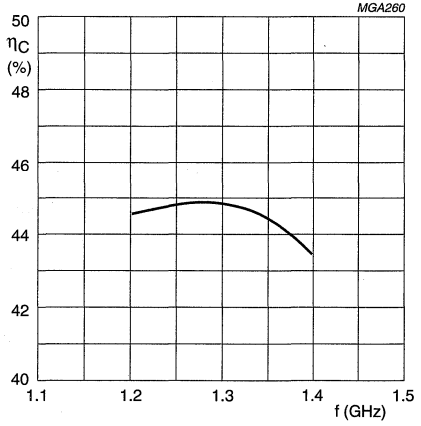
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2, L3	3 turns 0.65 mm diameter copper wire		int dia. = 4 mm; length of turn = 3 mm	
C1	capacitor	100 pF		ATC, ref. 100B101KP50X
C2	tantalum capacitor	10 μF, 50 V		
C3	electrolytic capacitor	470 μF, 63 V		
C4	feedthrough bypass capacitor			Erie, ref.1250-003
C5	variable gigatrim capacitor	0.8 - 8 pF		Tekelec, ref.729.1
C6	capacitor	4.7 nF		
R1	resistor	4.7 Ω		

The test jig consists of two circuits (input and output), each being 30 mm x 40 mm in size. The two circuits are mounted on a 10 mm thick hard aluminium alloy block. A recess should be machined in the aluminium block in which the transistor can be mounted. The mounting surface must be lapped to a surface roughness of Ra <0.5 μm and the sum of the depth of the recess and the thickness of the circuits should not exceed the specified minimum dimension between mounting face and the leads of the transistor. Tolerances on this dimension may be absorbed by placing a gold plated metal shim under the leads, close to the body of the transistor.



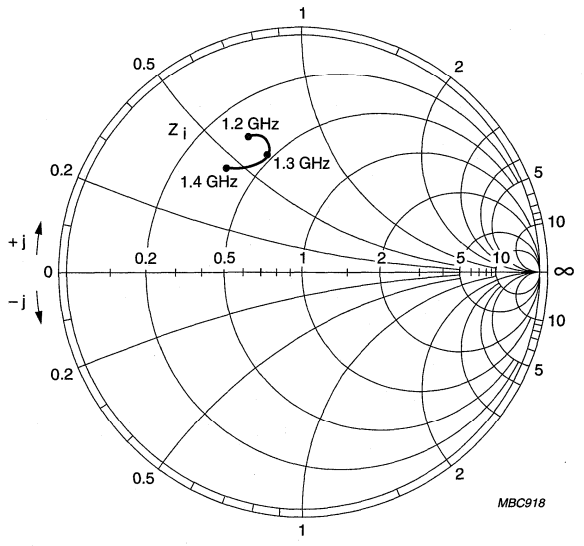
Class C pulse operation; t_p = 130 μs; δ = 6%.
V_{CC} = 50 V; P_O = 280 W.
Broadband test circuit as shown in Fig.3.

Fig.4 Power gain as a function of frequency.



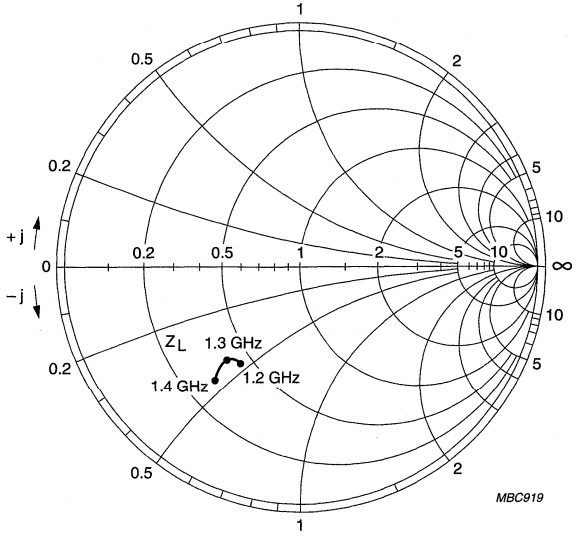
Class C pulse operation; t_p = 130 μs; δ = 6%.
V_{CC} = 50 V; P_O = 280 W.
Broadband test circuit as shown in Fig.3.

Fig.5 Collector efficiency as a function of frequency.



V_{CC} = 50 V; Z_O = 5 Ω; P_O = 280 W.

Fig.6 Input impedance as a function of frequency, associated with optimum load impedance.



V_{CC} = 50 V; Z_O = 5 Ω; P_O = 280 W.

Fig.7 Optimum load impedance as a function of frequency, associated with input impedance.

NPN microwave power transistor RZ1214B35Y

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input matching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

- Common base class-C wideband pulsed power amplifiers for L-band radar applications in the 1.2 to 1.4 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the base connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

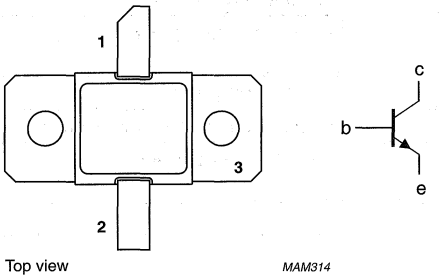


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class-C wideband amplifier.

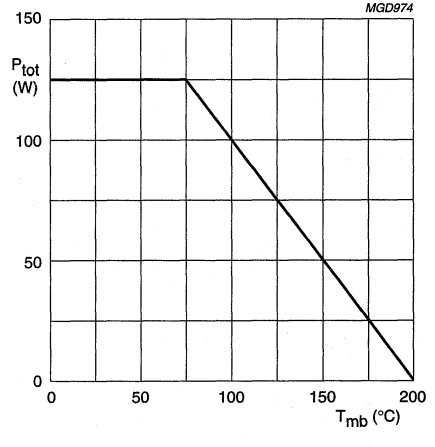
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-C; t_p = 150 μs; δ = 5%	1.2 to 1.4	50	≥35	≥7	≥30	see Fig 4

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 150\ \mu s;\ \delta \leq 5\% \leq$	–	3	A
P_{tot}	total power dissipation	$T_{mb} \leq 75\ °C;$ $t_p \leq 150\ \mu s;\ \delta \leq 5\%$	–	125	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.2 mm from the case; $t \leq 10$ s	–	235	°C



$t_p = 150\ \mu s;\ \delta = 5\%$.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

T_j = 75 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base		5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal resistance from junction to heatsink	t_p = 100 µs; δ = 10 %; notes 1 and 2	1	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15".*
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

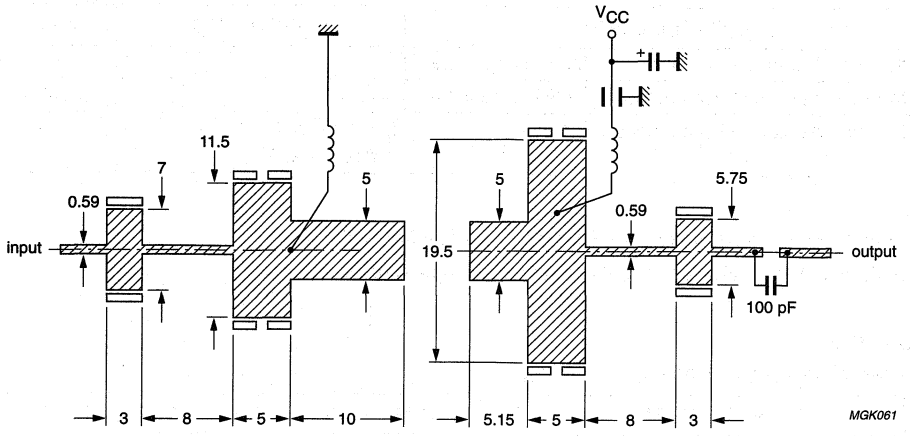
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 20 mA; I_E = 0	65	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 20 mA; R_{BE} = 0	60	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_C = 0; I_E = 3 mA	3	–	V
I_{CBO}	collector cut-off current	V_{CB} = 50 V; I_E = 0	–	2	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	0.2	mA

APPLICATION INFORMATION

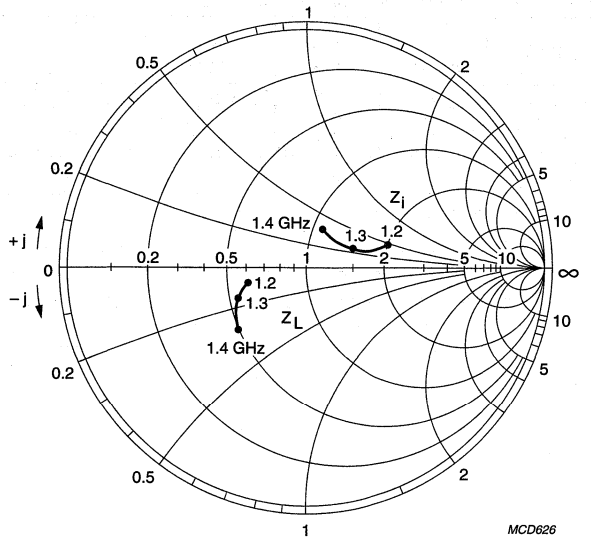
The transistors are 100% tested under the following conditions

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-C	t_p = 150 µs; δ = 5%	1.2 to 1,4	50	typ.40; >35	typ.7.8; >7	typ.35; >35	see Fig 4
	t_p = 300 µs; δ = 10%	1.2 to 1,4	50	typ.40;	typ.7	typ.35	see Fig 4



Dimensions in mm.
Substrate: Epsilam.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.3 Wideband test circuit for class C operation at 1.2 to 1.4 GHz.



Class C operation; $V_{CE} = 50$ V; $P_L = 35$ W; $Z_o = 5\ \Omega$; $t_p = 150\ \mu s$; $\delta = 5\%$.

Fig.4 Input and optimum load impedances as functions of frequency; typical values.

NPN microwave power transistor RZ1214B65Y

FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistor providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry gives good balance of dissipated power and low thermal resistance
- Internal input and output matching ensures good stability and allows an easier design of wideband circuits.

APPLICATIONS

- Intended for use in common base class B wideband pulsed power amplifiers for L-band radar applications in the 1.2 to 1.4 GHz band.

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor in a SOT443A metal ceramic flange package with the base connected to the flange.

PINNING - SOT443A

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

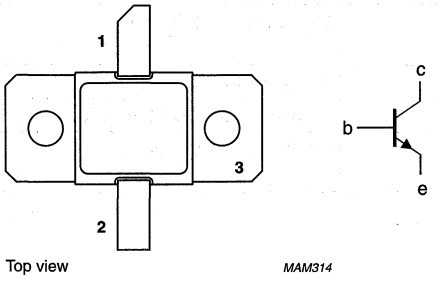


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class B wideband amplifier.

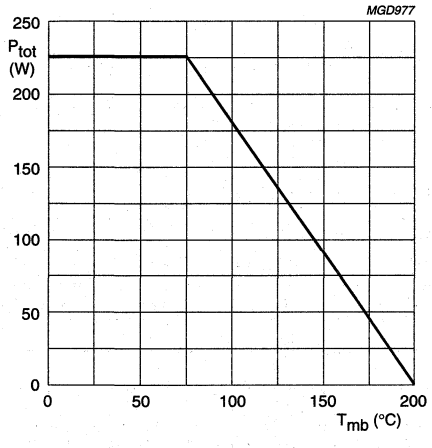
MODE OF OPERATION	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-B; t_p = 150 μs; δ = 5%	1.2 to 1.4	50	≥70	≥7	≥35	see Fig 4

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	–	60	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)	$t_p \leq 150\ \mu s$; $\delta \leq 5\%$	–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 75\ °C$; $t_p \leq 150\ \mu s$; $\delta \leq 5\%$	–	225	W
T_{stg}	storage temperature		–65	+200	°C
T_j	operating junction temperature		–	200	°C
T_{sld}	soldering temperature	at 0.2 mm from the case; $t \leq 10$ s	–	235	°C



$t_p = 150\ \mu s$; $\delta = 5\%$.

Fig.2 Power derating curve.

THERMAL CHARACTERISTICS

T_j = 75 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting-base		2.5	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting-base to heatsink	note 1	0.2	K/W
$Z_{th\ j\text{-}h}$	thermal resistance from junction to heatsink	t_p = 100 μs; δ = 10 %; notes 1 and 2	0.55	K/W

Notes

1. See *"Mounting recommendations in the General part of handbook SC15".*
2. Equivalent thermal impedance under pulsed microwave operating conditions.

CHARACTERISTICS

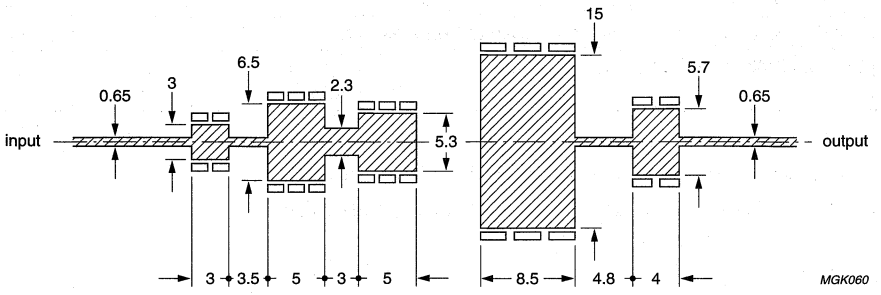
T_{mb} = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 40 mA; I_E = 0	65	–	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 40 mA; R_{BE} = 0	60	–	V
I_{CBO}	collector cut-off current	V_{CB} = 50 V; I_E = 0	–	4	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	–	0.4	mA

APPLICATION INFORMATION

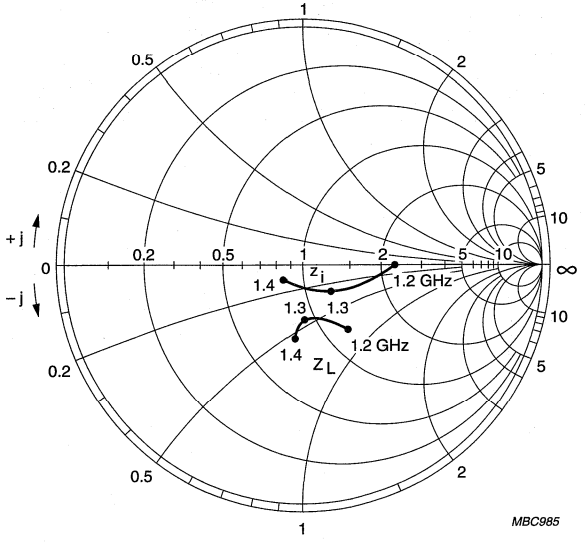
The transistors are 100% tested under the following conditions.

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V)	P_L (W)	G_p (dB)	η_C (%)	Z_i; Z_L (Ω)
Class-B	t_p = 150 μs; δ = 5%	1.2 to 1,4	50	typ.80; >70	typ.7.8; >7	typ.40; >35	see Fig 4
	t_p = 300 μs; δ = 10%	1.2 to 1,4	50	typ.80;	typ.7	typ.30	see Fig 4



Dimensions in mm.
Substrate: Epsilam.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

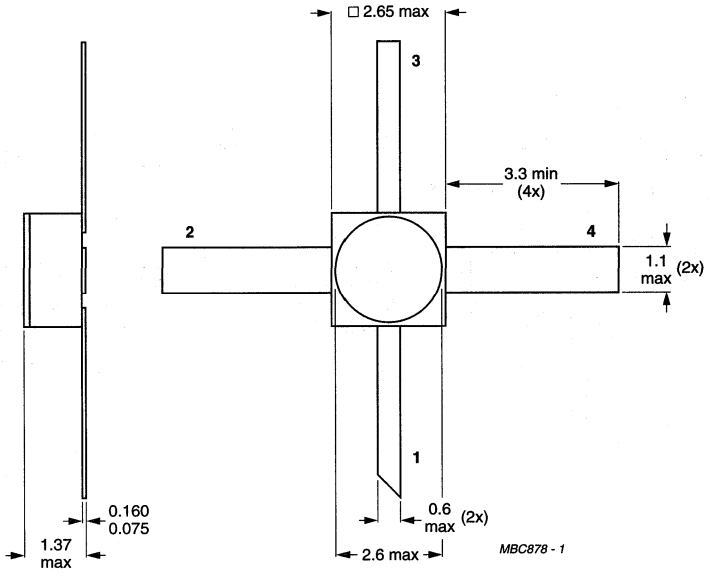
Fig.3 Wideband test circuit for class B operation at 1.2 to 1.4 GHz.



Class B operation; $V_{CE} = 50$ V; $P_L = 65$ W; $Z_o = 5\ \Omega$; $t_p = 150\ \mu s$; $\delta = 5\%$.

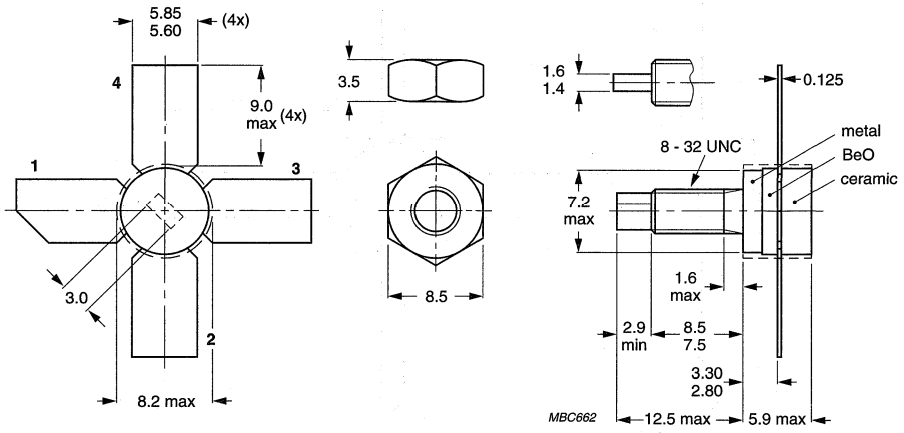
Fig.4 Input and optimum load impedances as functions of frequency; typical values.

PACKAGE OUTLINES



Dimensions in mm.

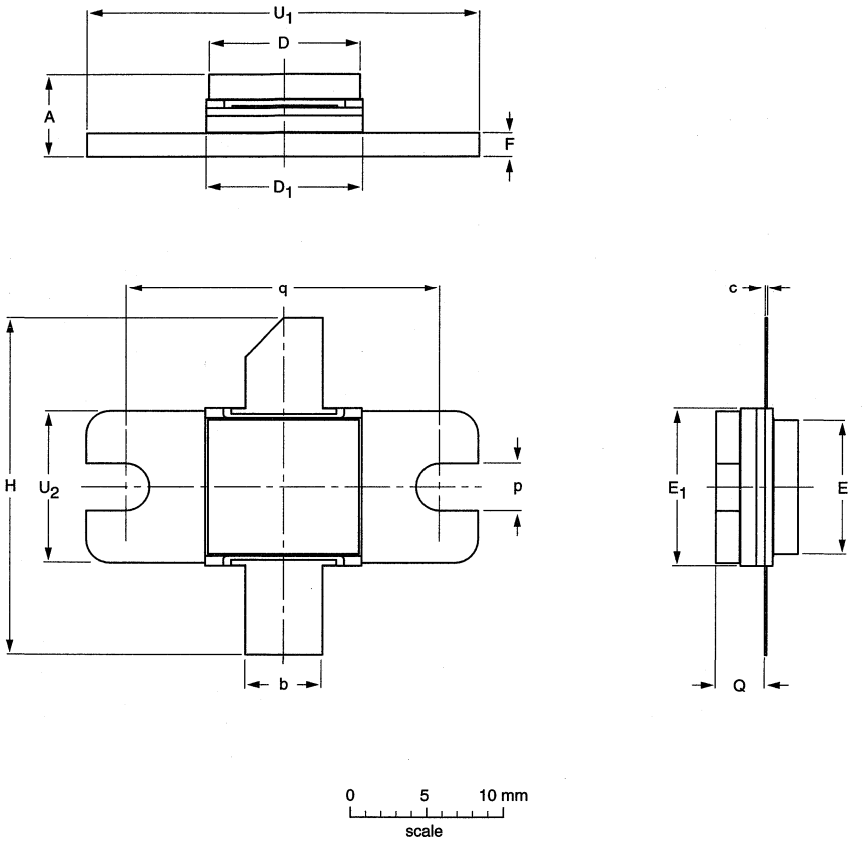
SOT100.



Dimensions in mm.

SOT122A.

Flanged hermetic ceramic package; 2 mounting holes; 2 leads **SOT422A**

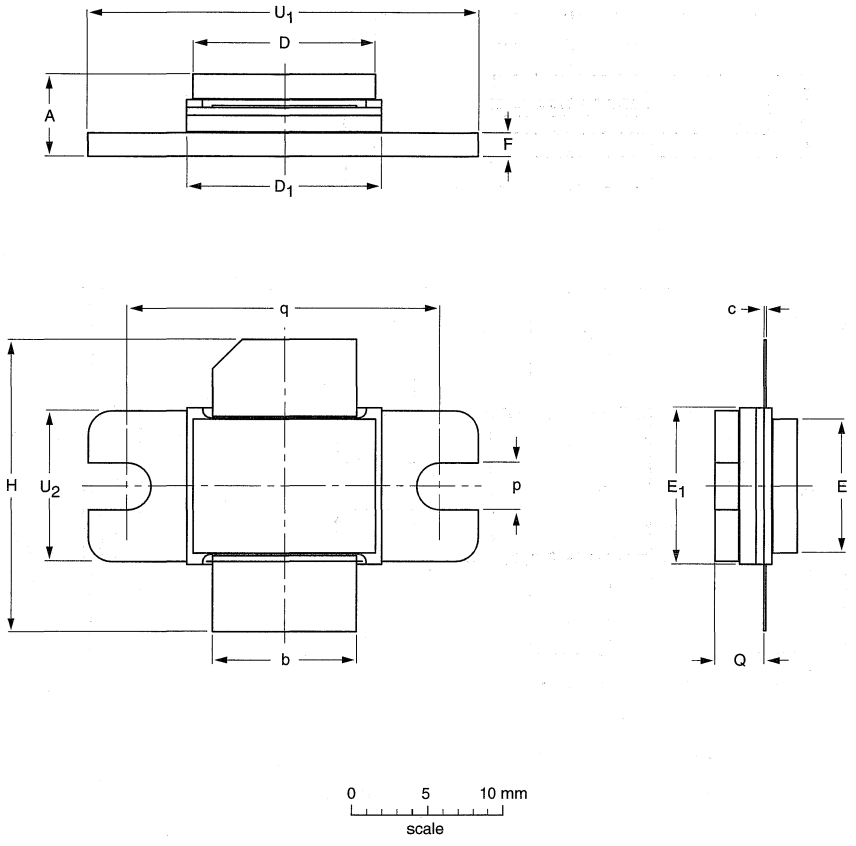


DIMENSIONS (mm are the original dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	p	Q	q	U_1	U_2
mm	5.58 5.04	5.21 4.95	0.16 0.10	9.93 9.67	10.29 10.03	8.77 8.51	10.29 10.03	1.58 1.46	21.97 21.71	3.43 3.17	3.34 2.96	16.64 16.38	22.99 22.73	9.91 9.65

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT422A						97-02-28

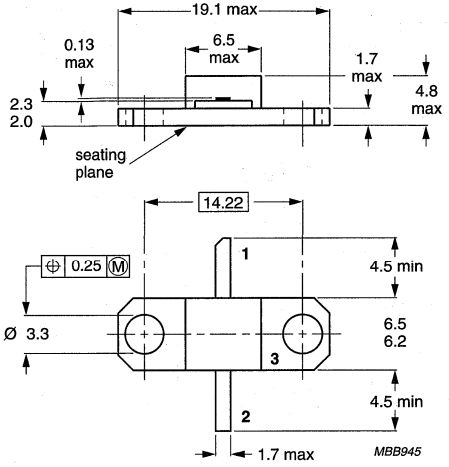
Flanged hermetic ceramic package; 2 mounting holes; 2 leads **SOT423A**



DIMENSIONS (mm are the original dimensions)

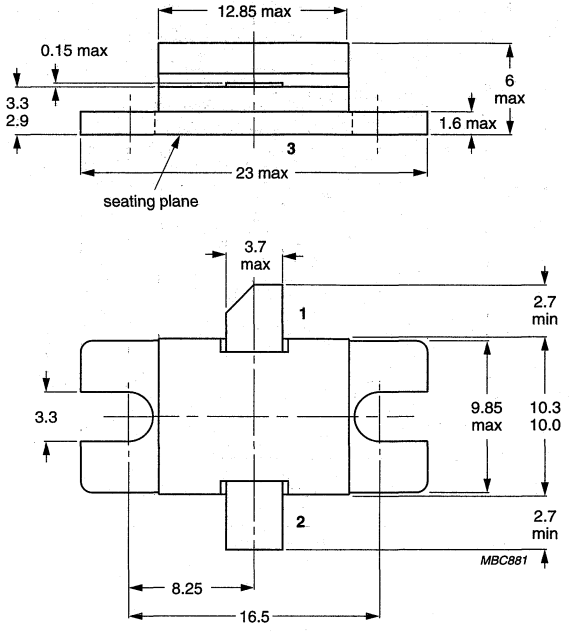
UNIT	A	b	c	D	D_1	E	E_1	F	H	p	Q	q	U_1	U_2
mm	5.58 5.04	9.53 9.27	0.16 0.10	12.02 11.76	12.83 12.57	8.82 8.56	10.29 10.03	1.58 1.46	19.18 18.92	3.43 3.17	3.42 2.88	16.64 16.38	22.99 22.73	9.91 9.65

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT423A						97-02-28



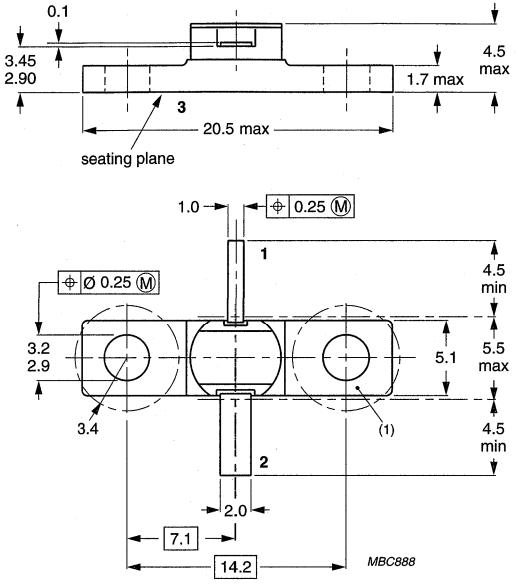
Dimensions in mm.
Torque on nut: max 0.5 Nm.
Recommended screw: M3.
Recommended pitch for mounting screw: 19 mm.

SOT437A.



Dimensions in mm.
Torque on screws: max. 0.4 Nm.
Recommended screw: M3.
Recommended pitch for mounting screws: 19 mm.

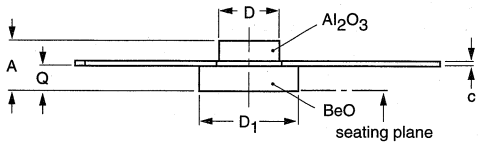
SOT439A.

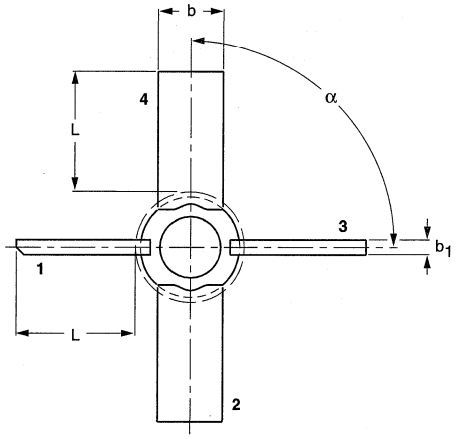


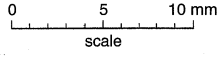
Dimensions in mm.
Torque on screws: max. 0.4 Nm.
Recommended screw: M2.5.

SOT440A.

Studless ceramic package; 4 leads **SOT441A**







DIMENSIONS (mm are the original dimensions)

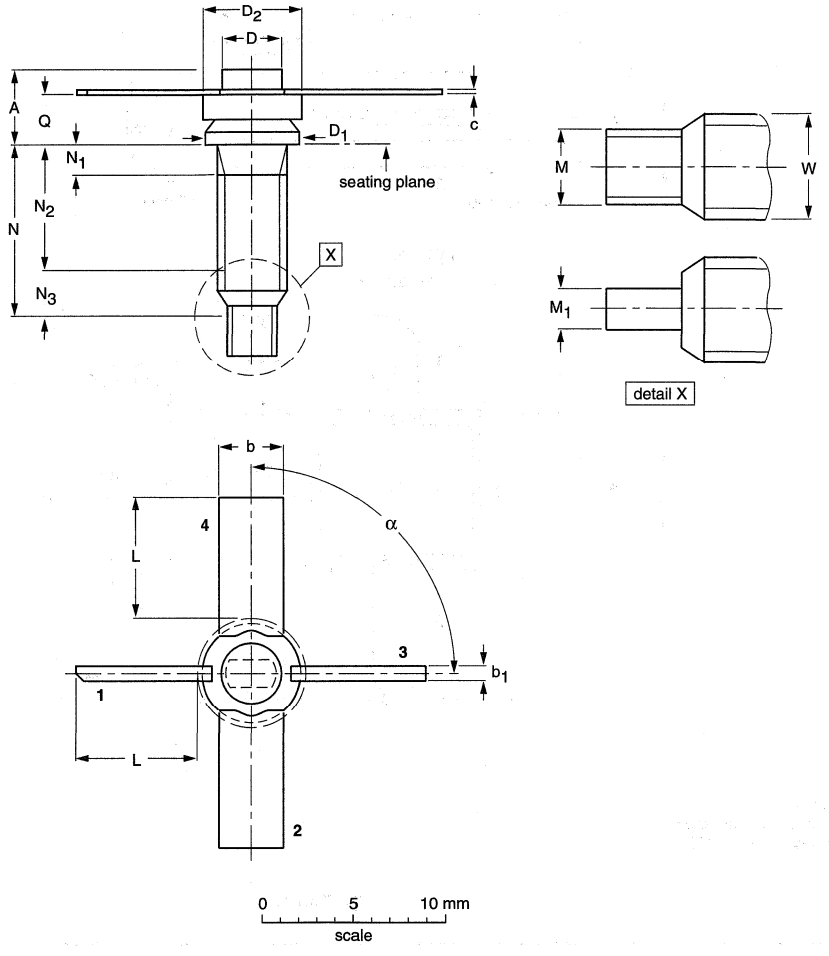
UNIT	A max.	b	b_1	c	D	D_1	L min.	Q	α
mm	2.4	3.2	0.75	0.125	3.38 3.08	5.28 5.12	6	1.3 1.0	90°

Note

1. This device corporates naked beryllium oxide, the dust of witch is toxic.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT441A						97-02-28

Studded ceramic package; 4 leads **SOT442A**



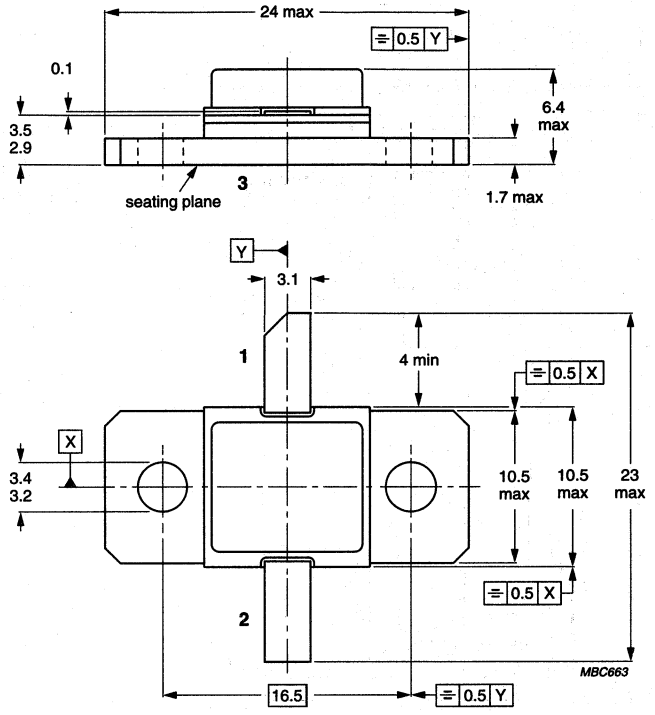
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	b	b_1	c	D	D_1	D_2	L min.	M	M_1	N max.	N_1 max.	N_2	N_3 min	Q	W	α
mm	4.0	3.2	0.75	0.125	3.38 3.08	5.25 5.10	5.28 5.12	6	3.27 3.01	1.6 1.4	12.5	1.6	8.5 7.5	2.9	2.80 2.50	8-32 UNC	90°

Note

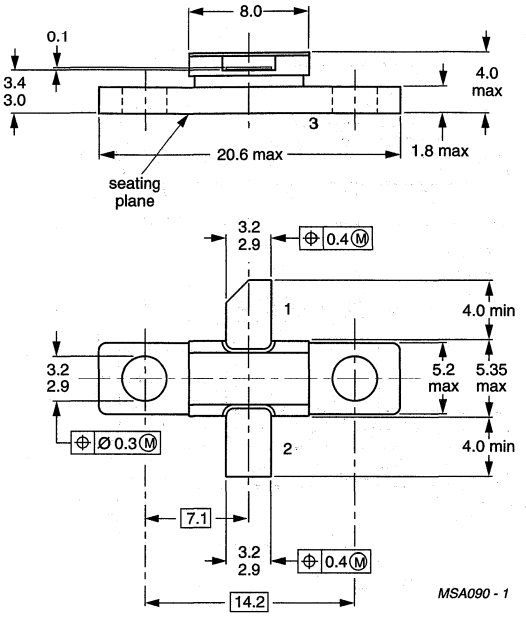
1. This device corporates naked beryllium oxide, the dust of witch is toxic.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT442A						97-02-28



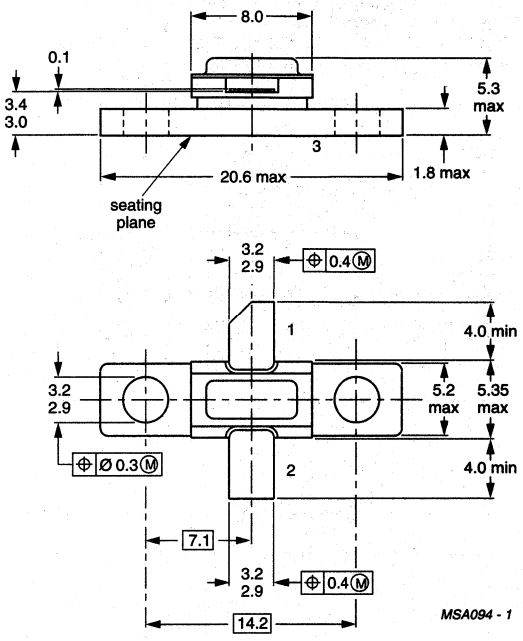
Dimensions in mm.
Torque on screw: Max. 0.5 Nm.
Recommended screw: M3.

SOT443A.



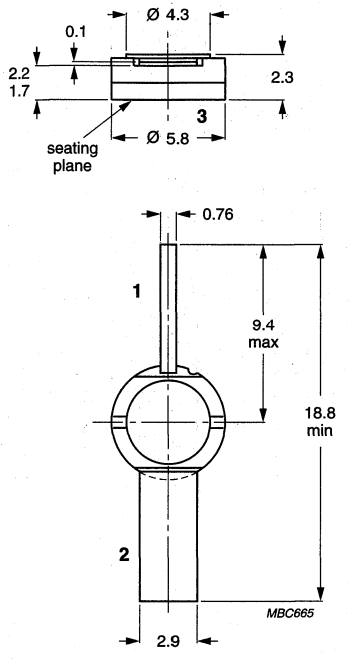
Dimensions in mm.
Torque on screw: Max. 0.4 Nm
Recommended screw: M2.5 or cheesehead 4-40 UNC/2A.

SOT445A.



Dimensions in mm.
Torque on screw: Max. 0.4 Nm
Recommended screw: M2.5 or cheesehead 4-40 UNC/2A.

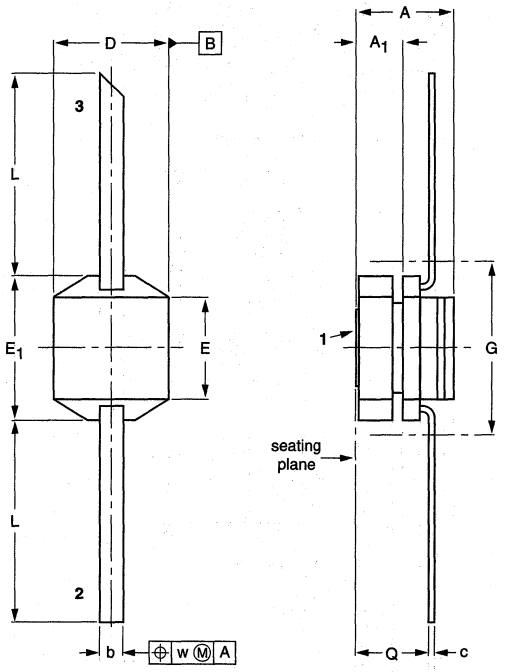
SOT445B.



Dimensions in mm.

SOT446A.

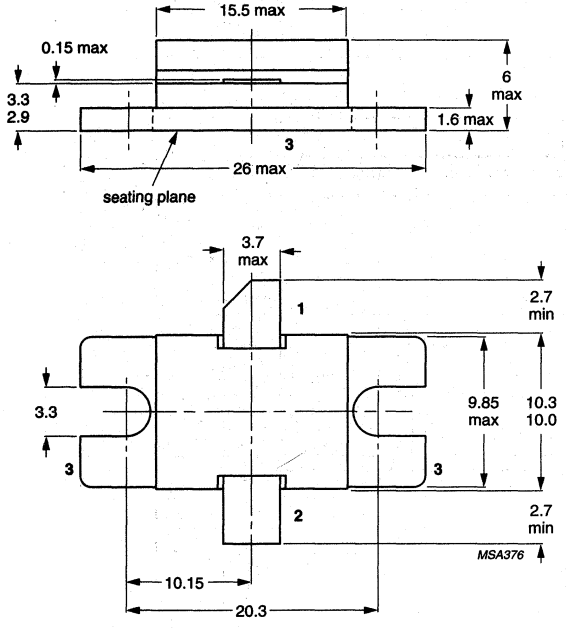
Flangeless ceramic package; 2 leads **SOT447A**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1 max.	b	c	D	E	E_1	G max.	L min.	Q	w
mm	2.8	1.3	0.58	0.1	2.8	2.64 2.38	3.61 3.35	3.8	3.1	1.7	0.2

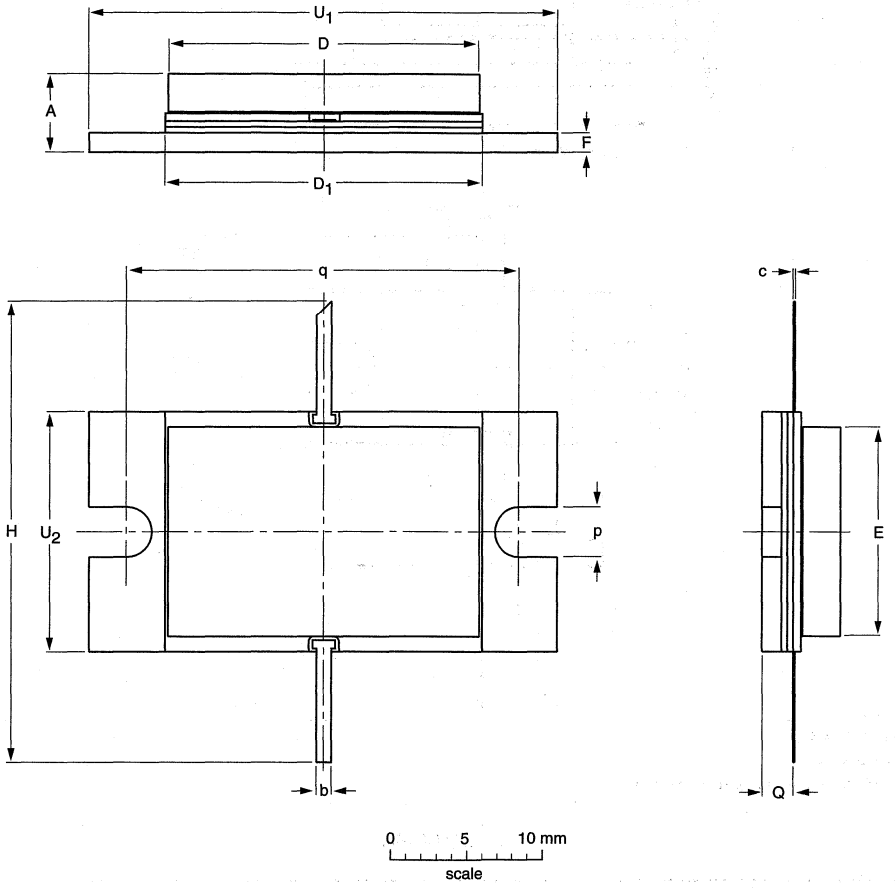
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT447A						97-02-28



Dimensions in mm.
Torque on screws: max. 0.5 Nm.
Recommended screw: M3.
Recommended pitch for mounting screws: 19 mm.

SOT448A.

Flanged hermetic ceramic package; 2 mounting holes; 2 leads **SOT469A**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	c	D	D_1	E	F	H	p	Q	q	U_1	U_2
mm	5.73 4.53	1.12 0.86	0.13 0.07	20.76 20.44	21.11 20.85	13.95 13.63	1.40 1.14	30.61 30.35	3.43 3.17	2.16 1.90	26.14 25.88	31.12 30.86	15.93 15.67

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT469A						97-02-28

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Data handbook system

DATA HANDBOOK SYSTEM

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IC02	Semiconductors for Television and Video Systems
IC03	Semiconductors for Wired Telecom Systems
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IC05	Advanced Low-power Schottky (ALS) Logic
IC06	High-speed CMOS Logic Family
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PC06	Circulators and Isolators

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DC03	Television Tuners, Coaxial Aerial Input Assemblies
DC04	Colour Monitor Tubes
DC05	Flyback Transformers, Mains Transformers and General-purpose FXC Assemblies

Magnetic products

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MA03	Piezoelectric Ceramics Specialty Ferrites
MA04	Dry-reed Switches

Passive components

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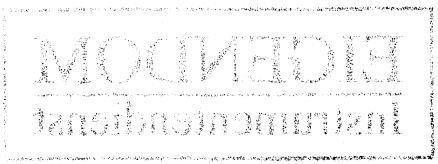

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