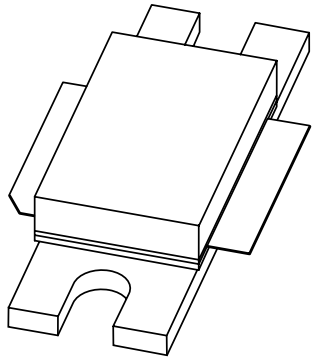
DATA SHEET



BLV2047
UHF power transistor

Product specification
Supersedes data of 1999 Jan 28

1999 Jun 09

Philips
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UHF power transistor BLV2047

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input and output matching for easy design of wideband circuits
- AlN substrate package for environmental safety.

APPLICATIONS

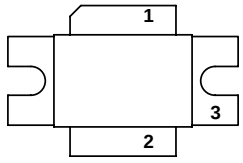
- Common emitter class-AB operation for PCN (Personal Communication Networks) and PCS (Personal Communication Services) base station applications in the 1800 to 2000 MHz frequency range.

DESCRIPTION

NPN silicon planar power transistor in a 2-lead SOT468A flange package with ceramic cap. The emitter is connected to the flange.

PINNING - SOT468A

PIN	DESCRIPTION
1	collector
2	base
3	emitter; connected to flange



Top view MBK200

Fig.1 Simplified outline.

QUICK REFERENCE DATA

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

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)
CW, class-AB	2000	26	60	≥8.5	≥40	–
2-tone, class-AB	f_1 = 2000.0; f_2 = 2000.1	26	60 (PEP)	≥9	≥33	≤–30

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	10	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	270	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	P_{tot} = 270 W; T_{mb} = 25 °C; note 1	0.65	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.25	K/W

Note

1. Thermal resistance is determined under specified RF operating conditions.

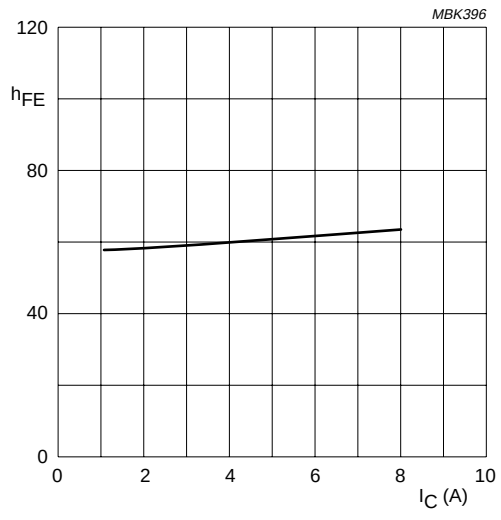
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 40 mA	65	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 120 mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 40 mA	3	–	–	V
I_{CES}	collector leakage current	V_{CE} = 26 V; V_{BE} = 0	–	–	8	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 A	45	–	100	
C_c	collector capacitance	V_{CB} = 26 V; I_E = i_e = 0; f = 1 MHz; note 1	–	72	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	41	–	pF

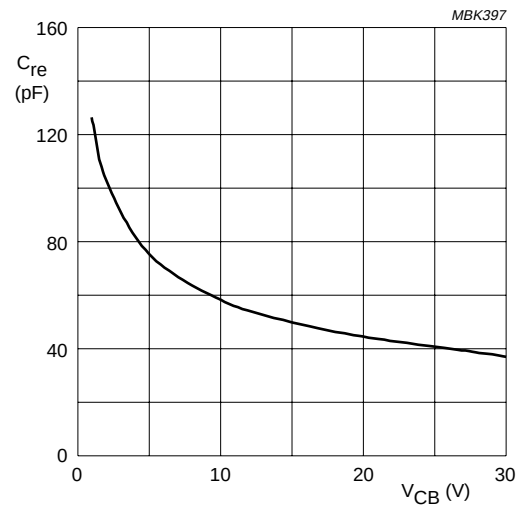
Note

1. Capacitance of die only.



V_{CE} = 10 V.

Fig.2 DC current gain as a function of collector current; typical values.



f = 1 MHz.

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

APPLICATION INFORMATION

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

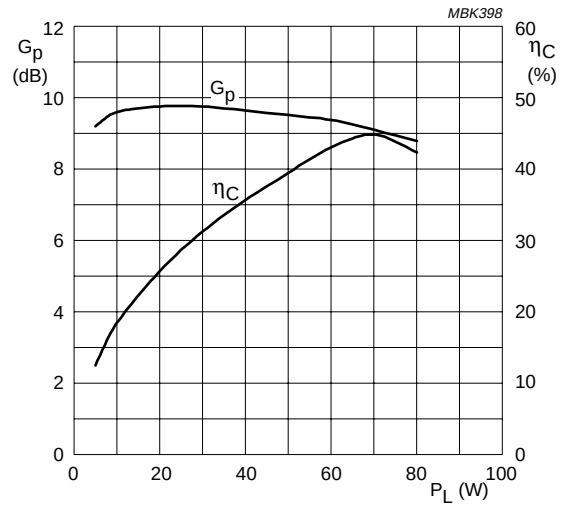
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)
CW, class-AB	2000	26	300	60	≥8.5	≥40	–
2-tone, class-AB	f_1 = 2000.0 f_2 = 2000.1	26	300	60 (PEP)	≥9	≥33	≤–30
CDMA, class-AB	2000	26	500	12.5	typ. 9	typ. 22	≤–46(1)

Note

1. CDMA test signal with peak to average ratio of 11.9 dB. Adjacent Channel Power (ACP) is measured at ±885 kHz offset from the centre of the channel (2000 MHz) using a spectrum analyzer with the resolution set to 30 kHz.

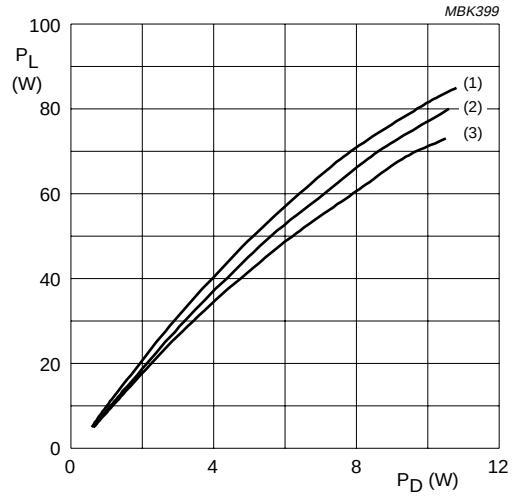
Ruggedness in class-AB operation

The BLV2047 is capable of withstanding a load mismatch corresponding to VSWR = 3 : 1 through all phases under the following conditions: f_1 = 2000.0 MHz; f_2 = 2000.1 MHz; V_{CE} = 26 V; I_{CQ} = 300 mA; P_L = 60 W (PEP); T_{mb} = 25 °C.



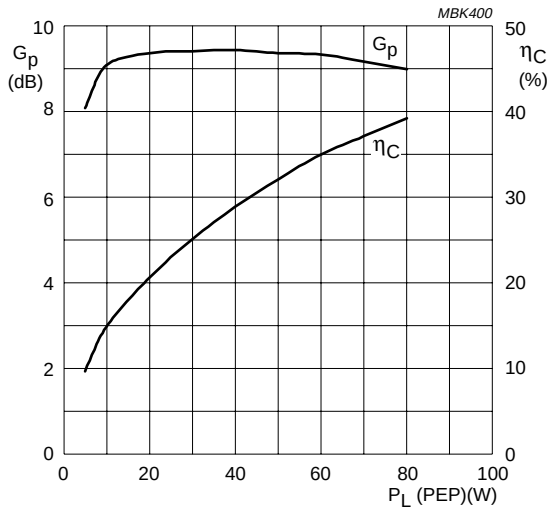
V_{CE} = 26 V; I_{CQ} = 300 mA; f = 2000 MHz.

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



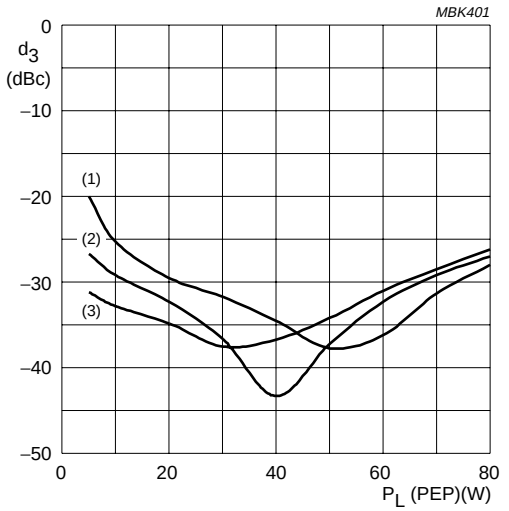
I_{CQ} = 300 mA; f = 2000 MHz.
(1) V_{CE} = 28 V.
(2) V_{CE} = 26 V.
(3) V_{CE} = 24 V.

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



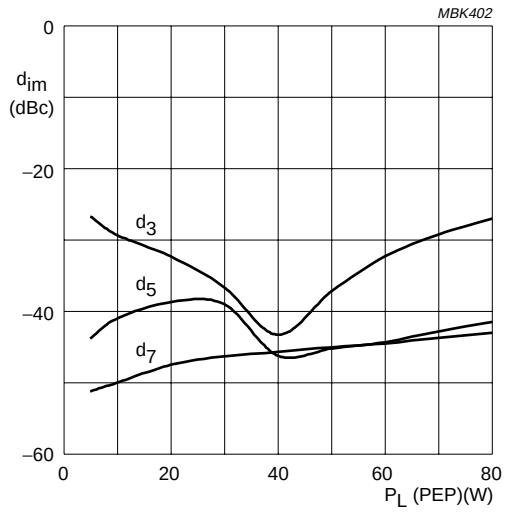
V_{CE} = 26 V; I_{CQ} = 300 mA; f_1 = 2000 MHz; f_2 = 2000.1 MHz.

Fig.6 Power gain and collector efficiency as functions of peak envelope load power; typical values.



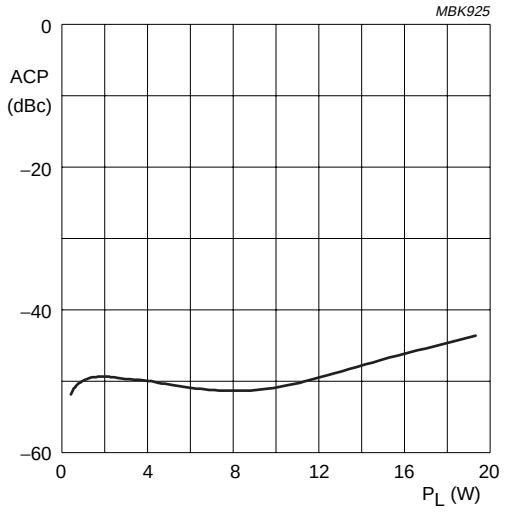
V_{CE} = 26 V; f_1 = 2000 MHz; f_2 = 2000.1 MHz.
(1) I_{CQ} = 100 mA.
(2) I_{CQ} = 300 mA.
(3) I_{CQ} = 500 mA.

Fig.7 Intermodulation products as a function of peak envelope load power; typical values.



V_{CE} = 26 V; I_{CQ} = 300 mA; f_1 = 2000 MHz; f_2 = 2000.1 MHz.

Fig.8 Intermodulation products as a function of peak envelope load power; typical values.



V_{CE} = 26 V; I_{CQ} = 500 mA.
Measured at 885 kHz offset with 30 kHz bandwidth.
CDMA test signal with 11.9 dB peak to average ratio.

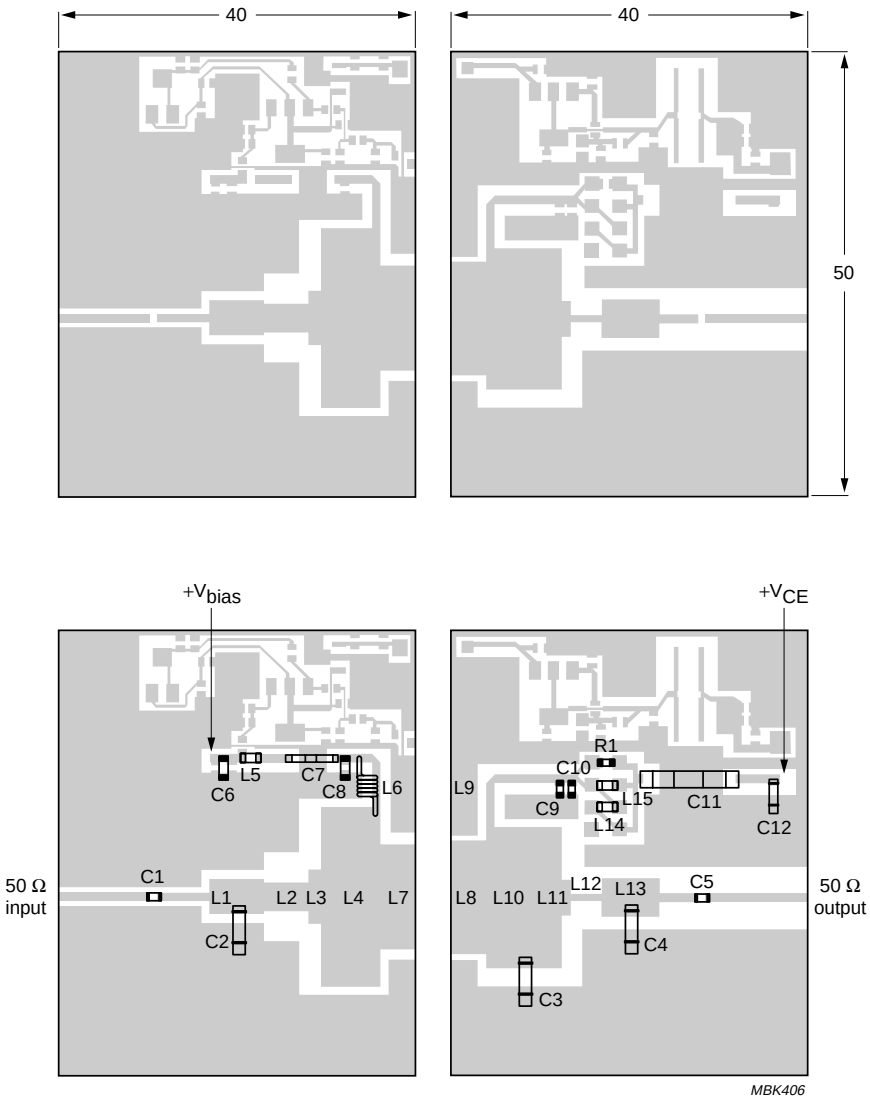
Fig.9 Adjacent channel power as a function of load power; typical values.

List of components (see Figs 10 **and** 11**)**

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8	multilayer ceramic chip capacitor; note 1	22 pF		
C2	Tekelec variable capacitor; type 37291	0.8 to 8 pF		
C3, C4	Tekelec variable capacitor; type 37271	0.6 to 4.5 pF		
C5	multilayer ceramic chip capacitor, note 2	22 pF		
C6, C12	tantalum SMD capacitor	10 μF, 35 V		
C7	feedthrough capacitor	1.5 nF		
C9	multilayer ceramic chip capacitor, note 3	13 pF		
C10	multilayer ceramic chip capacitor, note 3	10 nF		
C11	feedthrough capacitor	3.3 nF		
L1	stripline; note 4	18.8 Ω	length 6.1 mm; width 3.9 mm	
L2	stripline; note 4	21.9 Ω	length 5 mm; width 3.2 mm	
L3	stripline; note 4	13 Ω	length 1.4 mm; width 6.1 mm	
L4	stripline; note 4	4.5 Ω	length 6.6 mm; width 20.2 mm	
L5, L14, L15	grade 4B1 ferroxcube chip-bead			4322 020 34420
L6	4 turns enamelled 1 mm copper wire	30 nH	int.dia. 3 mm; length 7 mm	
L7	stripline; note 4	7.3 Ω	length 4 mm; width 11.8 mm	
L8	stripline; note 4	6.8 Ω	length 4 mm; width 12.8 mm	
L9	stripline; note 4	43.7 Ω	length 12.5 mm; width 1 mm	
L10	stripline; note 4	5.6 Ω	length 8.5 mm; width 15.9 mm	
L11	stripline; note 4	18.8 Ω	length 1 mm; width 3.9 mm	
L12	stripline; note 4	53.3 Ω	length 3.4 mm; width 0.8 mm	
L13	stripline; note 4	17.4 Ω	length 6.5 mm; width 4.3 mm	
R1	standard chip resistor	10 Ω	type 0603	

Notes

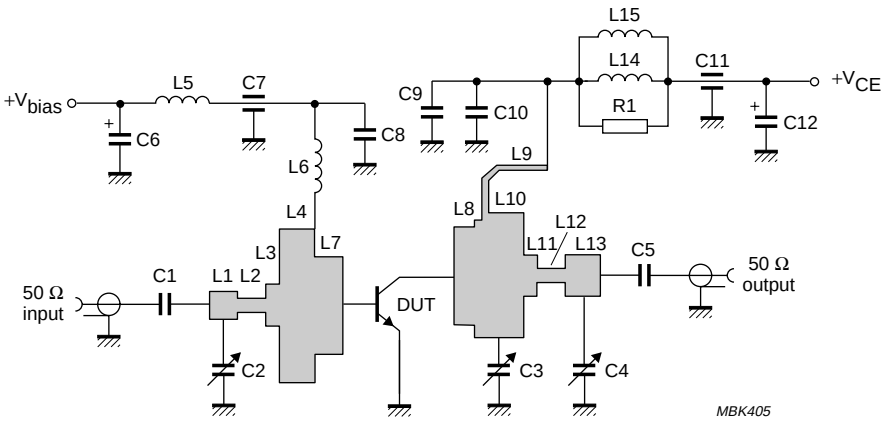
1. American Technical Ceramics type 100A or capacitor of same quality.
2. American Technical Ceramics type 175B or capacitor of same quality.
3. American Technical Ceramics type 100B or capacitor of same quality.
4. The striplines are on a double copper-clad printed-circuit board with Teflon dielectric (ε_r = 6.15); thickness 0.64 mm.



Dimensions in mm.

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

Fig.10 Component layout for 2000 MHz class-AB test circuit.

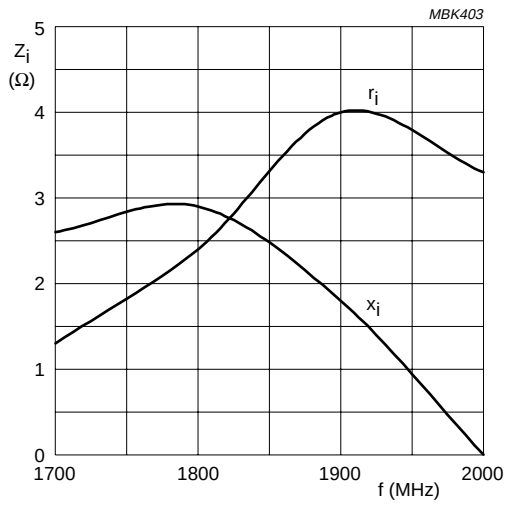


For CDMA measurements:
Replace L5, C7 and C11 by a bridging wire.
Change L6 from 6 turns to 2 turns (same diameter).
Add 4.7 μF, 50 V tantalum capacitor to C12.
Add 100 pF ATC type 100A capacitor to C8.

Fig.11 Class-AB test circuit for 2000 MHz.

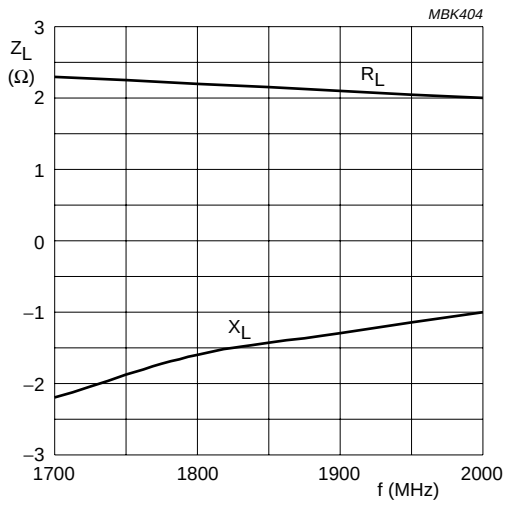
Scattering parameters: V_{CE} = 26 V; I_C = 1 A

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)
1500	0.982	173.3	0.169	131.8	0.031	106.4	0.967	174.6
1600	0.970	172.0	0.227	126.1	0.035	96.0	0.953	174.0
1700	0.947	170.4	0.349	114.3	0.037	93.3	0.929	173.8
1800	0.870	167.5	0.633	85.8	0.036	74.7	0.879	174.2
1850	0.779	169.9	0.838	59.5	0.034	60.4	0.845	178.0
1900	0.775	179.3	0.833	22.7	0.018	47.4	0.902	–177.4
1950	0.863	–178.0	0.644	–6.9	0.011	103.7	0.967	–178.7
2000	0.913	–179.4	0.456	–24.5	0.018	121.2	0.990	179.3
2100	0.950	178.0	0.285	–40.8	0.028	114.7	0.995	176.9
2200	0.955	176.4	0.190	–54.0	0.031	115.2	0.987	175.5
2300	0.955	175.0	0.145	–53.6	0.034	114.7	0.983	175.0
2400	0.948	173.7	0.162	–60.4	0.036	116.7	0.975	174.4
2500	0.937	172.4	0.143	–84.2	0.038	116.8	0.973	173.9



V_{CE} = 26 V; I_{CQ} = 300 mA; P_L = 60 W; T_{mb} = 25 °C.

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

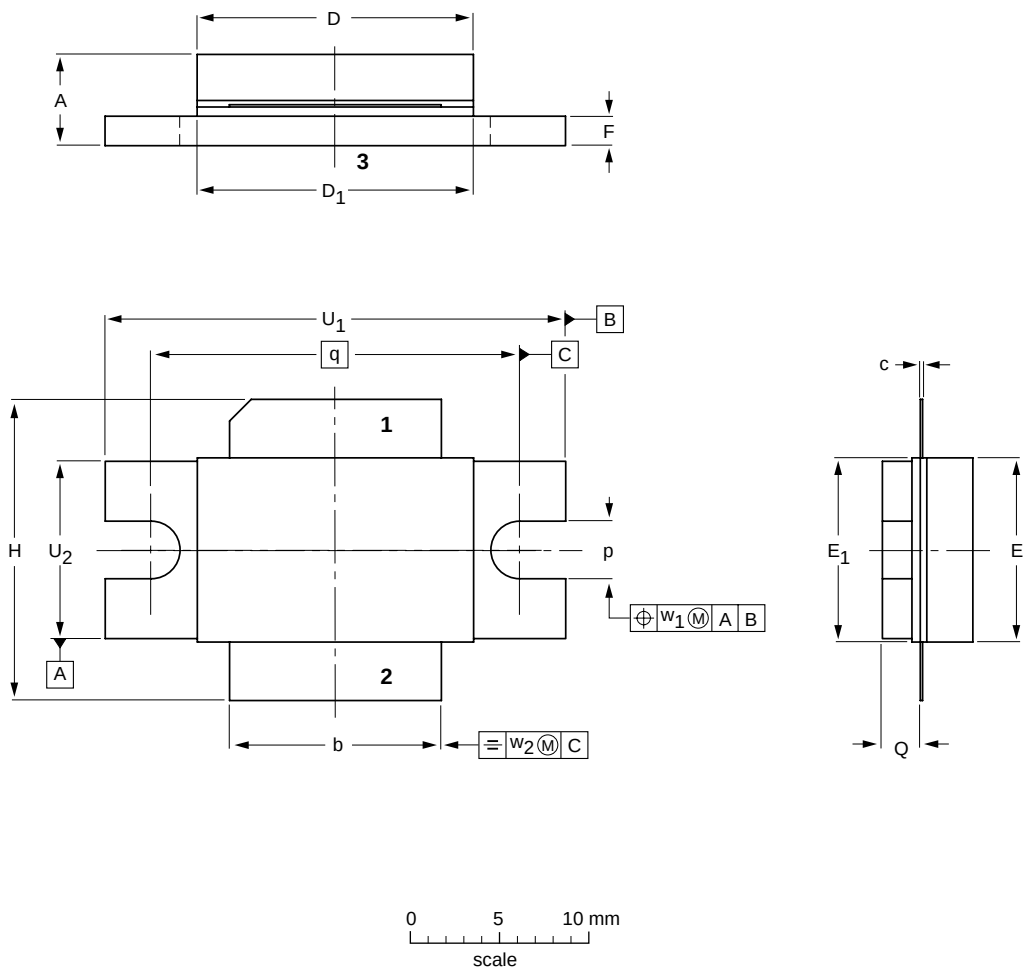


V_{CE} = 26 V; I_{CQ} = 300 mA; P_L = 60 W; T_{mb} = 25 °C.

Fig.13 Load impedance as a function of frequency (series components); typical values.

PACKAGE OUTLINE

Flanged ceramic (AlN) package; 2 mounting holes; 2 leads **SOT468A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	E	E_1	F	H	p	Q	q	U_1	U_2	w_1	w_2
mm	5.23 4.62	11.81 11.58	0.15 0.10	15.39 15,09	15.37 15,11	10.26 10.06	10.29 10.03	1.65 1.60	16.74 16.48	3.30 3.05	2.21 2.06	20.32	25.53 25.27	9.91 9.65	0.254	0.508
inches	0.206 0.182	0.465 0.455	0.006 0.004	0.606 0.594	0.605 0.595	0.404 0.396	0.405 0.395	0.065 0.063	0.659 0.649	0.130 0.120	0.087 0.081	0.800	1.005 0.995	0.390 0.380	0.01	0.02

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT468A						97-12-24

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.	

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Printed in The Netherlands 125002/06/pp12 Date of release: 1999 Jun 09 Document order number: 9397 750 05856

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