DATA SHEET

LLE16120X
NPN microwave power transistor

Product specification
Supersedes data of November 1994

1997 Feb 18

Philips
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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

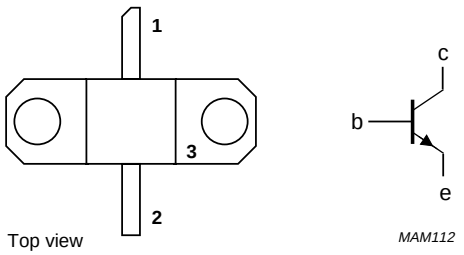


Fig.1 Simplified outline and symbol.

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.

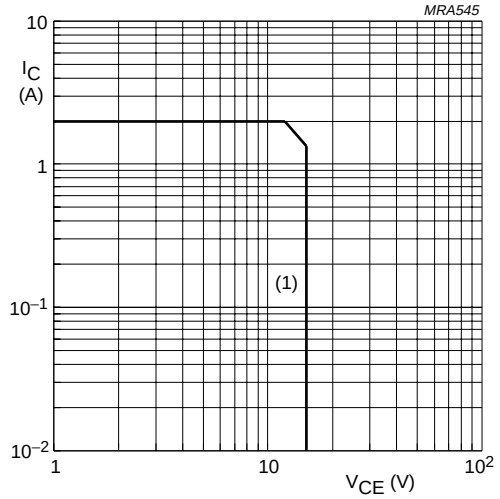
LIMITING VALUES

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

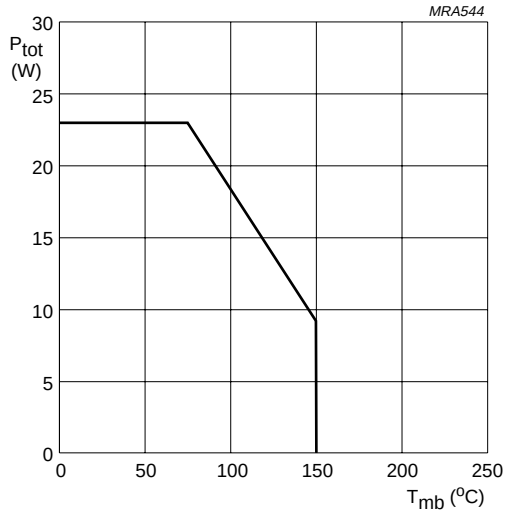
Note

1. Up to 0.2 mm from ceramic.



T_{mb} ≤ 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 SC19a"*.

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	

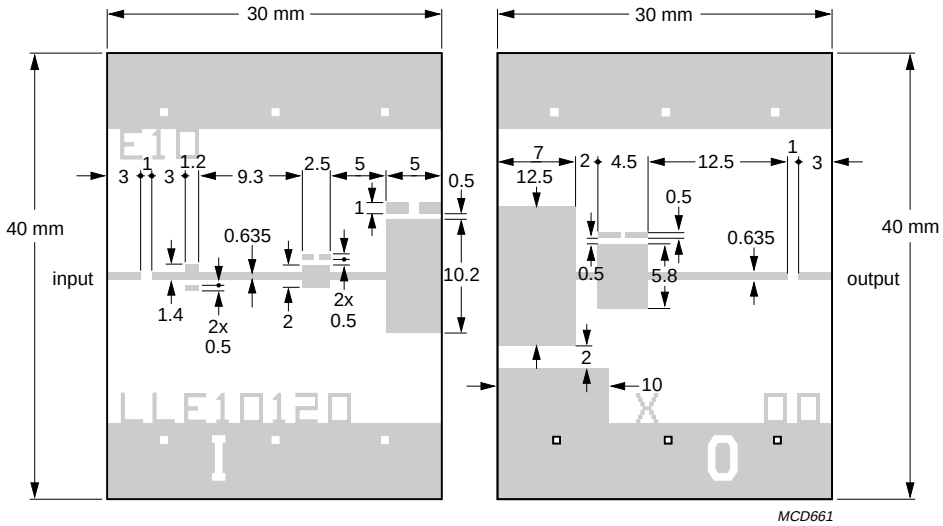
APPLICATION INFORMATION

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.

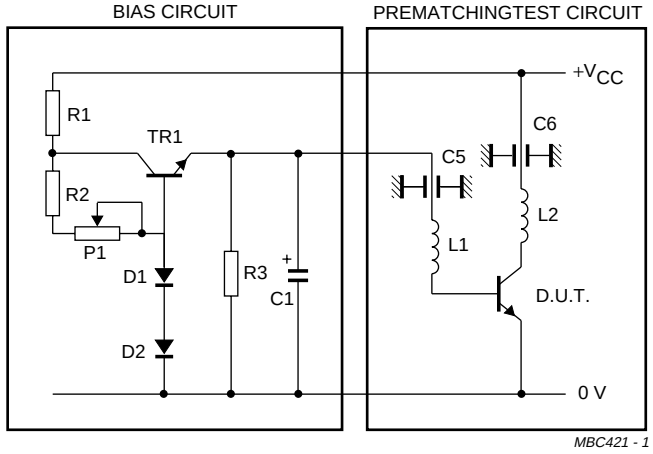
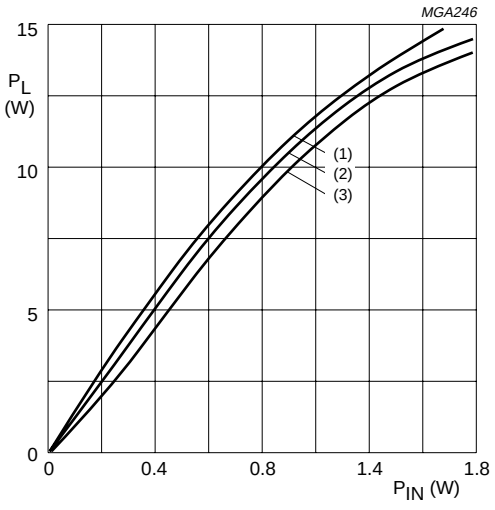
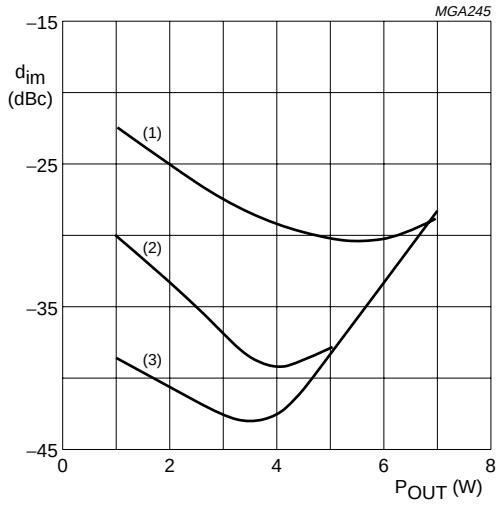


Fig.5 Class AB bias circuit at 1.65 GHz.



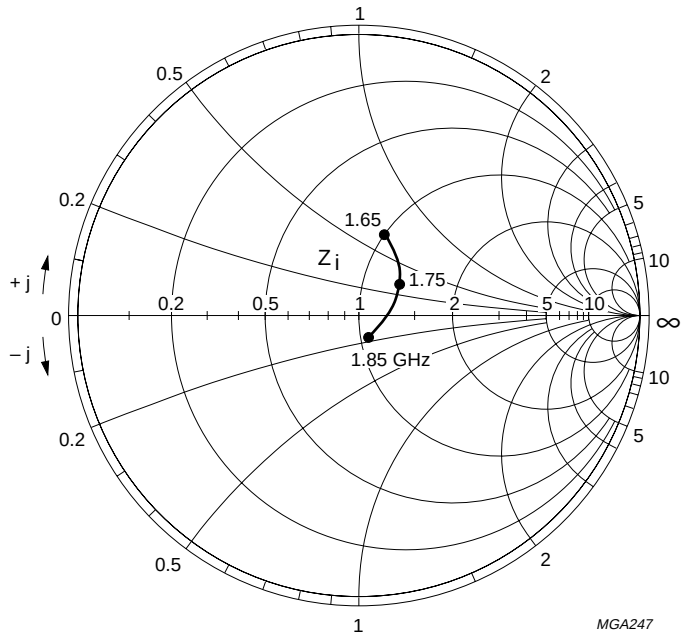
V_{CE} = 24 V; f = 1.65 GHz.
(1) I_{CQ} = 100 mA.
(2) I_{CQ} = 30 mA.
(3) I_{CQ} = 3 mA.

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



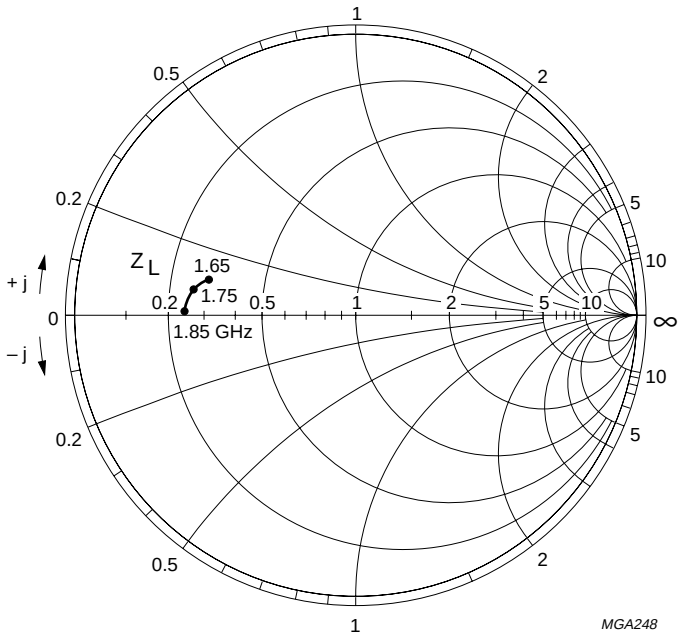
V_{CE} = 24 V; f_1 = 1.65 GHz; f_2 = 1.6502 GHz.
(1) I_{CQ} = 3 mA.
(2) I_{CQ} = 30 mA.
(3) I_{CQ} = 100 mA.

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



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

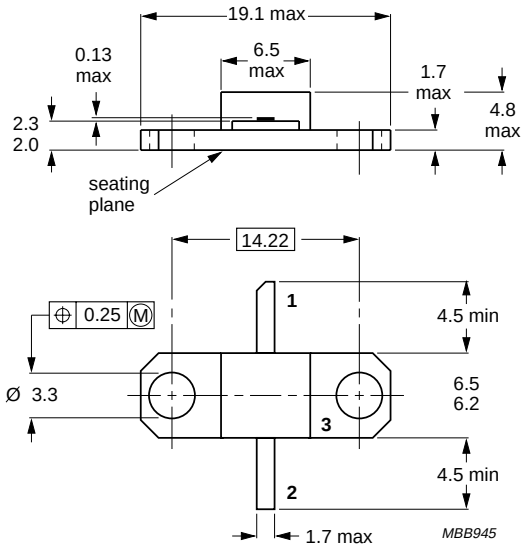
Fig.8 Input impedance as a function of frequency; typical values.



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.

PACKAGE OUTLINE



Dimensions in mm.
Torque on screws: max. 0.5 Nm.
Recommended screw: M3.
Recommended pitch for mounting screw: 19 mm.

Fig.10 SOT437A.

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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NOTES

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Printed in The Netherlands 127147/00/02/pp12 Date of release: 1997 Feb 18 Document order number: 9397 750 01697

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