NPN silicon planar epitaxial microwave power transistor

MX1011B400W

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 good stability of the characteristics and excellent lifetime
- Multicell geometry improves power sharing and reduces thermal resistance.

PINNING - FO-91B

PIN	DESCRIPTION
1	collector
2	emitter
3	base connected to flange

DESCRIPTION

NPN silicon planar epitaxial microwave power transistor intended for use in common base class C pulsed power amplifiers.The transistor has a FO–91B metal ceramic flange package with base connected to flange.

APPLICATIONS

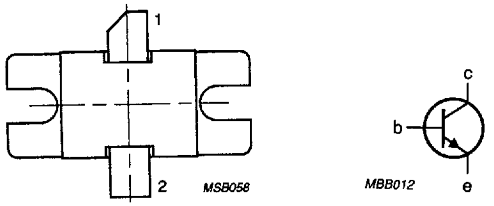
Intended for use in common base class C broadband pulsed power amplifiers for TCAS applications in the 1030 to 1090 MHz band. Also suitable for medium pulse, heavy duty operation within this band.

QUICK REFERENCE DATA

Microwave performance up to T_{mb} = 25 °C in a common base class C narrow band 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	≥ 450	≥ 6.5	≥ 42

PIN CONFIGURATION



Marking code: MX1011B400W

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 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.

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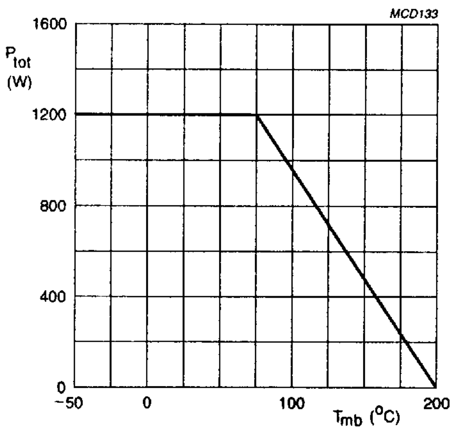
LIMITING VALUES

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	average collector current	$t_p \leq 30\ \mu s$; $\delta \leq 1\%$	–	35	A
P_{tot}	total power dissipation	$T_{mb} < 75\ °C$; $t_p \leq 30\ \mu s$; $\delta \leq 1\%$	–	1200	W
T_{stg}	storage temperature range		–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.



$t_p = 30\ \mu s$; $\delta = 1\ \%$; P_{tot} max = 1200 W.

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

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb}$	from junction to mounting base	T_j = 120 °C	1.2	K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.2	K/W
Z_{th}	from junction to heatsink	t_p = 30 µs; δ = 1 %; T_j = 110 °C; note 1	0.08	K/W

Note

1. 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_{CES}	collector cut-off current	V_{CB} = 50 V	55	mA
I_{EBO}	emitter cut-off current	V_{EB} = 1.5 V; I_C = 0	3	mA

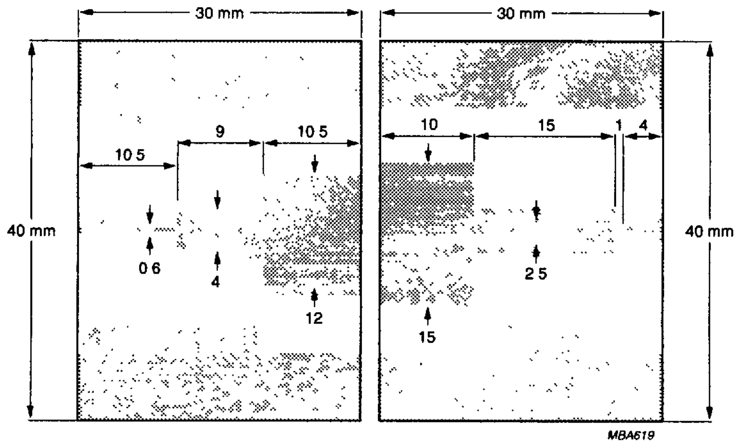
APPLICATION INFORMATION

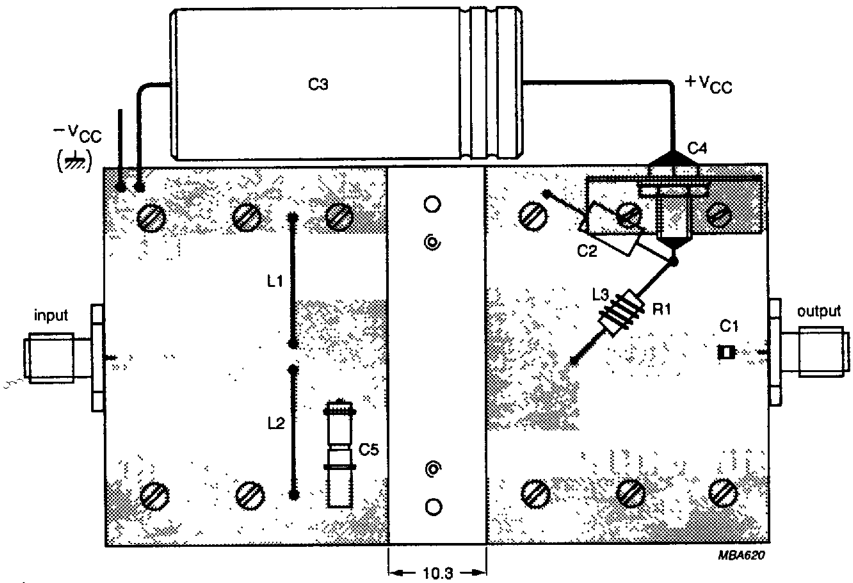
Microwave performance up to T_{mb} = 25 °C in a common-base test circuit as shown in Fig.3 (note 1)

MODE OF OPERATION	CONDITIONS	f (GHz)	V_{CC} (V) note 2	P_L (W)	G_p (dB)	η_C (%)
class C	t_p = 30 µs; δ = 1 %	1.03	45	≥ 450	≥ 6.5; typ. 7.2	≥ 42; typ. 45
	t_p = 250 µs; δ = 6 %	1.09	50	typ. 320	typ. 8	typ. 45

Notes

1. Operating conditions and performance for other pulse formats can be made available on request.
2. V_{CC} during pulse.





Dimensions in mm

Substrate : Epsilam 10

Thickness : 0.635 mm

Permittivity : ε_r = 10

Fig.3 Broadband test circuit.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
L1, L2	0.65 mm copper wire		total length = 12 mm; height of loop = 11 mm	
L3,	4 turns 0.65 mm copper wire		int. dia. 3 mm; length = 4 mm	
C1	capacitor	100 pF		ATC, ref.100A101KP50X
C2	50 V tantalum capicitor	10 µF		
C3	63 V electrolytic capacitor	470 µF		
C4	feedthrough bypass capacitor			Erie, ref.1250-003
C5	variable gigatrim capacitor	0.8 - 8 pF		Tekelec, ref.729.1
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 R_a < 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.

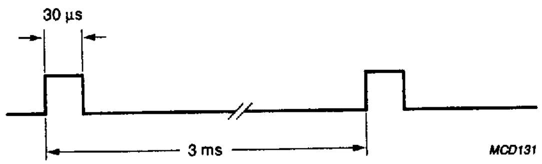


Fig.4 Pulse definition.

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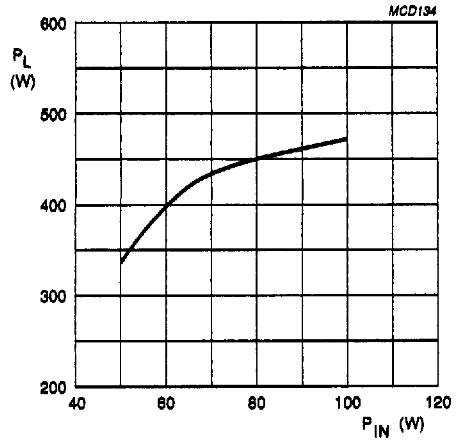
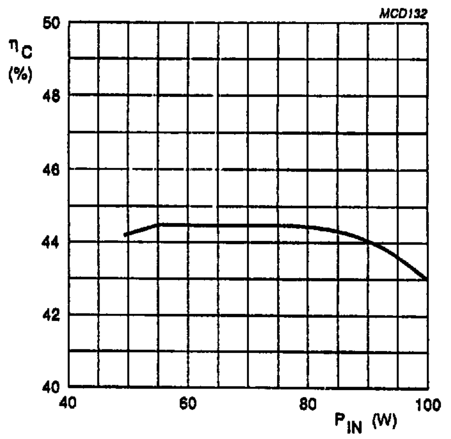


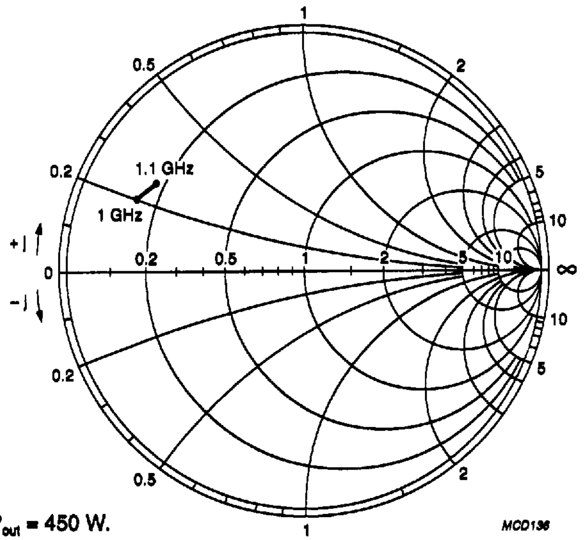
Class C pulse operation; t_p = 30 µs; δ = 1%;
V_{CC} = 45 V; f = 1.03 GHz.
(In broadband test circuit as shown in Fig.3).

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



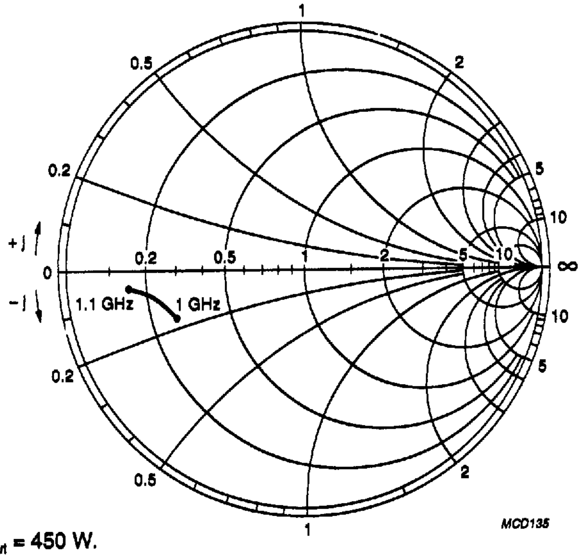
Class C pulse operation; t_p = 30 µs; δ = 1%;
V_{CC} = 45 V; f = 1.03 GHz.
(In broadband test circuit as shown in Fig.3).

Fig.6 Collector efficiency as a function of input power.



V_{CC} = 45 V; Z_O = 10 Ω; P_{out} = 450 W.

Fig.7 Input impedance as a function of frequency, associated with optimum load impedance.



V_{CC} = 45 V; Z_O = 10 Ω; P_{out} = 450 W.

Fig.8 Optimum load impedance as a function of frequency; associated with input impedance.