DATA SHEET

BLT53
UHF power transistor

Product specification

May 1991

Philips
Semiconductors

PHILIPS

UHF power transistor BLT53

FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability
- Withstands full load mismatch.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT122D studless envelope with a ceramic cap. It is designed for common emitter, class-B operation in portable radio transmitters in the 470 MHz communications band. All leads are isolated from the mounting flange.

PINNING - SOT122D

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	7.5	8	> 6	> 60

WARNING

Product and environmental safety - toxic materials

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

PIN CONFIGURATION

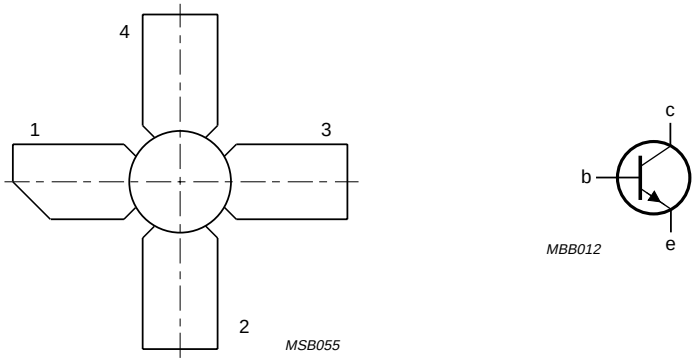


Fig.1 Simplified outline and symbol.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C, $I_{C(AV)}$	collector current	DC or average value	–	2.5	A
I_{CM}	collector current	peak value f > 1 MHz	–	7.5	A
P_{tot}	total power dissipation	RF operation; T_{mb} = 25 °C	–	35.5	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction operating temperature		–	200	°C

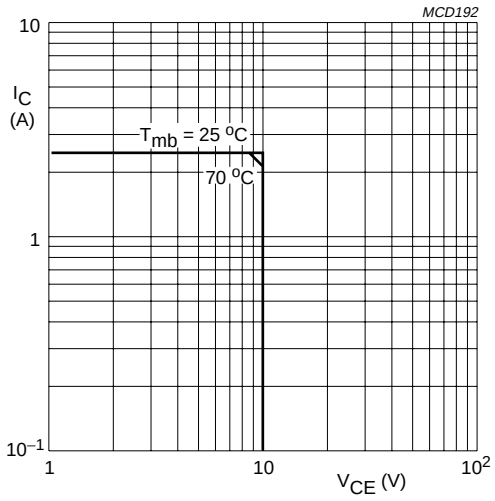
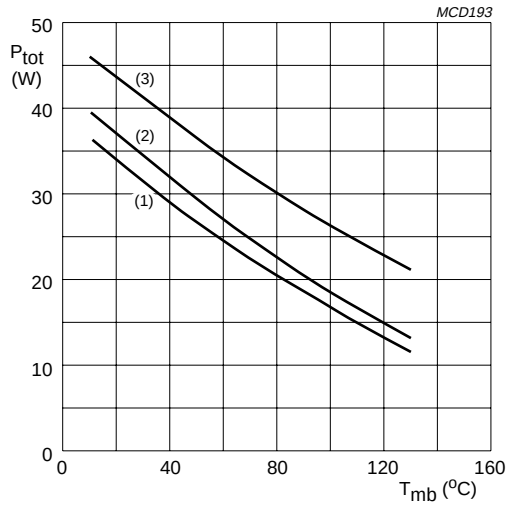


Fig.2 DC SOAR.



(1) Continuous DC operation.
(2) Continuous RF operation (f > 1 MHz).
(3) Short time operation during mismatch (f > 1 MHz).

Fig.3 Power derating curve.

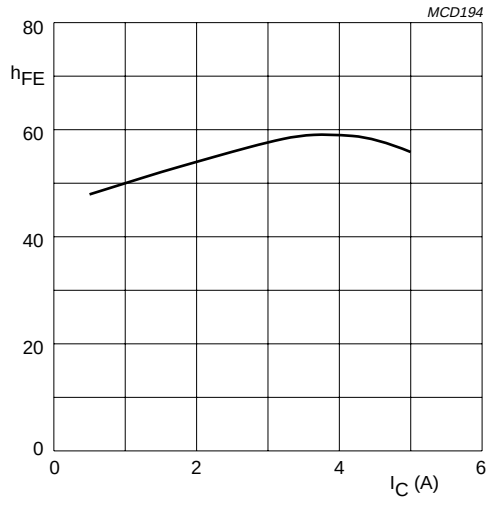
THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$R_{th\ j\text{-}mb(RF)}$	from junction to mounting base	P_{tot} = 35.5 W; T_{mb} = 25 °C	4.9	K/W

CHARACTERISTICS

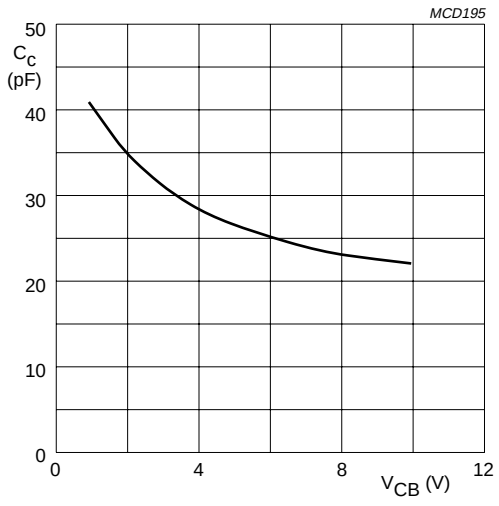
T_j = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 20 mA	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 40 mA	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 4 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{BE} = 0; V_{CE} = 10 V	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 1.2 A	25	–	–	
f_T	transition frequency	V_{CE} = 7.5 V; I_E = 1.6 A	–	3.9	–	GHz
C_c	collector capacitance	V_{CB} = 7.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	24	–	pF
C_{re}	feedback capacitance	V_{CE} = 7.5 V; I_C = 0; f = 1 MHz	–	17	–	pF
$C_{c\text{-}mb}$	collector-mounting base capacitance	f = 1 MHz	–	1.2	–	pF



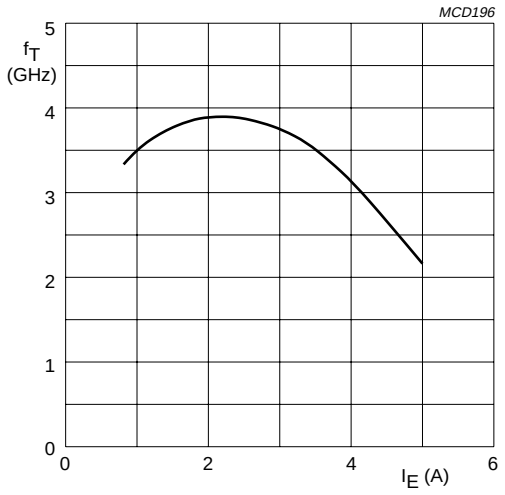
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current, typical values.



$I_E = i_e$ = 0; f = 1 MHz.

Fig.5 Collector capacitance as a function of collector-base voltage, typical values.



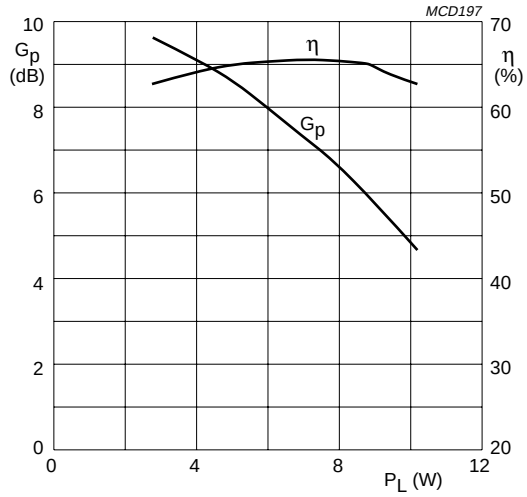
V_{CB} = 7.5 V.

Fig.6 Transition frequency as a function of emitter current, typical values.

APPLICATION INFORMATION

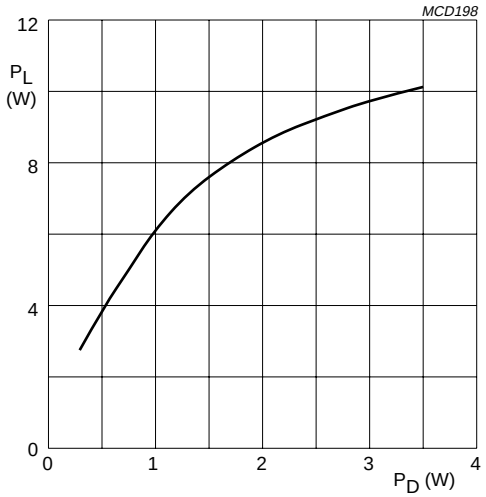
RF performance at T_{mb} = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_c (%)
c.w. class-B	470	7.5	8	> 6 typ. 6.8	> 60 typ. 65



Class-B operation; V_{CE} = 7.5 V; f = 470 MHz.

Fig.7 Gain and efficiency as functions of load power, typical values.



Class-B operation; V_{CE} = 7.5 V; f = 470 MHz.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-B operation

The BLT53 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases at rated output power, up to a supply voltage of 9 V, and f = 470 MHz.

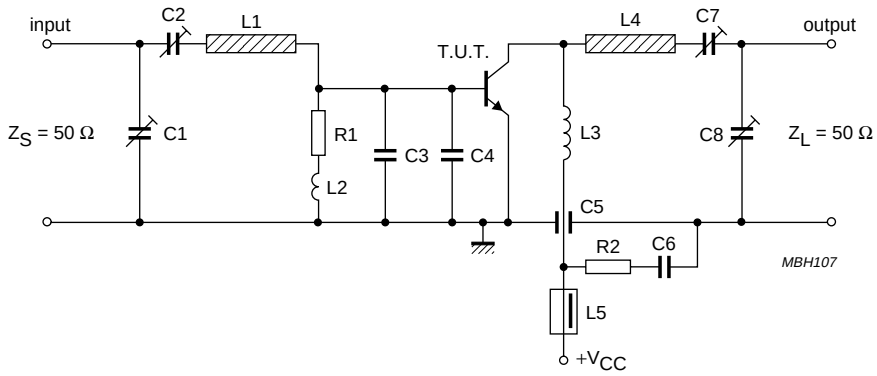


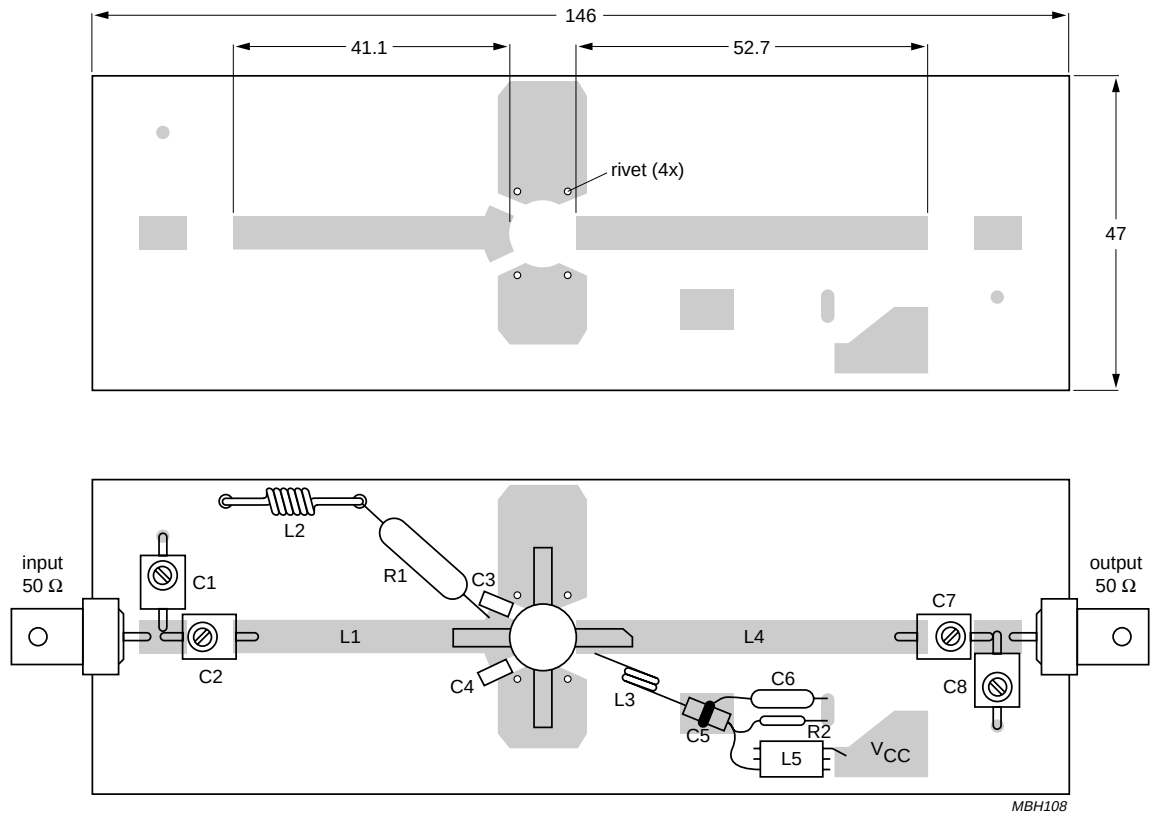
Fig.9 Class-B test circuit at f = 470 MHz.

List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C7, C8	film dielectric trimmer	2 to 9 pF		2222 809 09002
C3, C4	multilayer ceramic chip capacitor	15 pF		
C5	feed-through capacitor	100 pF		
C6	polyester capacitor	33 nF		
L1	stripline (note 1)	44 Ω	41.1 mm × 5 mm	
L2	13 turns closely wound enamelled 0.5 mm copper wire	320 nH	int. dia. 4 mm	
L3	2 turns enamelled 1 mm copper wire		int. dia. 4 mm; pitch 1.5 mm; leads 2 × 5 mm	
L4	stripline (note 1)	44 Ω	52.7 mm × 5 mm	
L5	grade 3B1 Ferroxcube wideband HF choke			4312 020 36640
R1	0.25 W carbon resistor	1 Ω, 5%		
R2	0.25 W carbon resistor	10 Ω, 5%		

Note

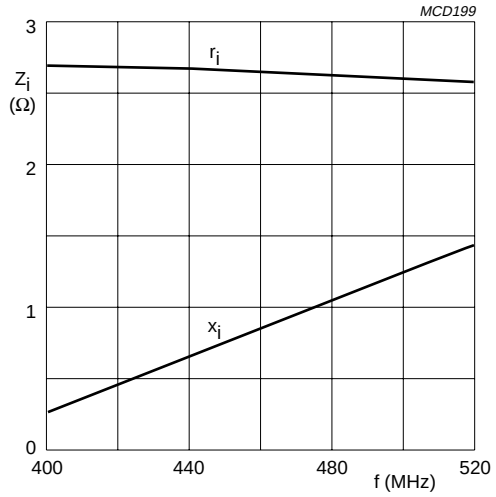
1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.74); thickness $^1/_{16}$ inch.



The circuit and components are situated on one side of a copper-clad PTFE fibre-glass 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 means of hollow rivets.

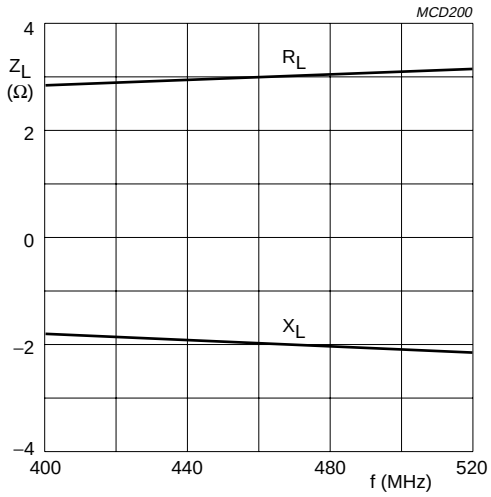
Dimensions in mm.

Fig.10 Component layout for 470 MHz class-B test circuit.



Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.11 Input impedance (series components) as a function of frequency, typical values.



Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.12 Load impedance (series components) as a function of frequency, typical values.

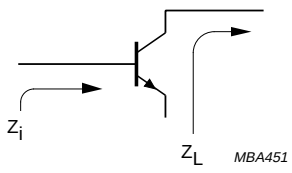
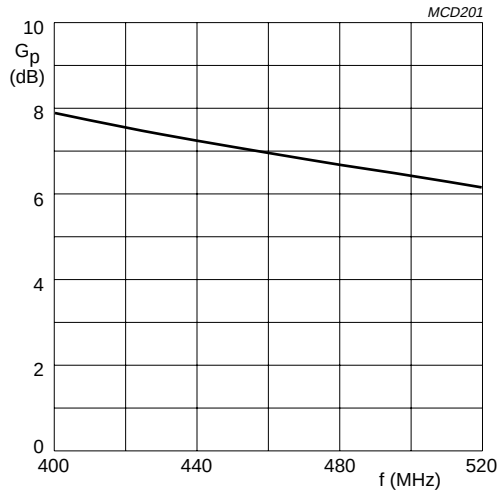


Fig.13 Definition of transistor impedance.

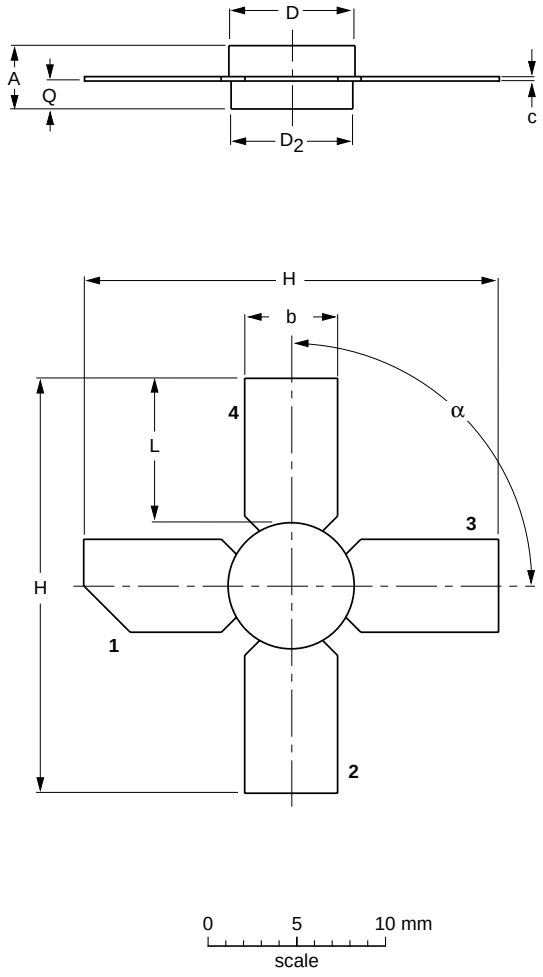


Class-B operation; V_{CE} = 7.5 V; P_L = 8 W.

Fig.14 Power gain as a function of frequency, typical values.

PACKAGE OUTLINE

Studless ceramic package; 4 leads **SOT122D**



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

UNIT	A	b	c	D	D_2	H	L	Q	α
mm	4.17 3.27	5.85 5.58	0.18 0.14	7.50 7.23	7.24 6.98	27.56 25.78	9.91 9.14	1.58 1.27	90°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT122D						97-04-18

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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