# 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) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| 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

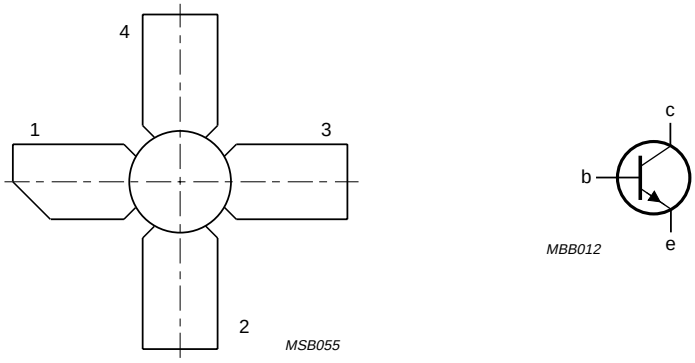



Fig.1 Simplified outline and symbol.

## 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<br>f > 1 MHz | – | 7.5 | A |
| $P_{tot}$ | total power dissipation | RF operation;<br>$T_{mb}$ = 25 °C | – | 35.5 | W |
| $T_{stg}$ | storage temperature range | | –65 | 150 | °C |
| $T_j$ | junction operating temperature | | – | 200 | °C |

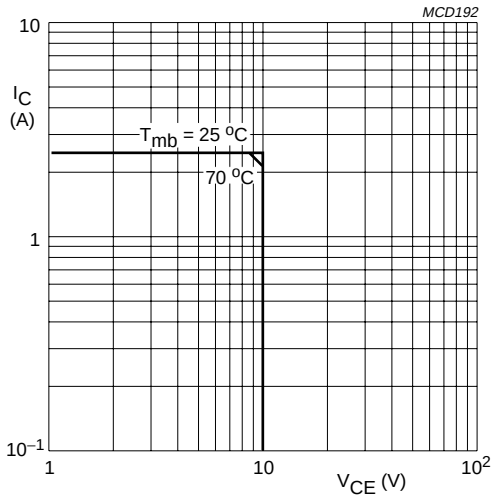
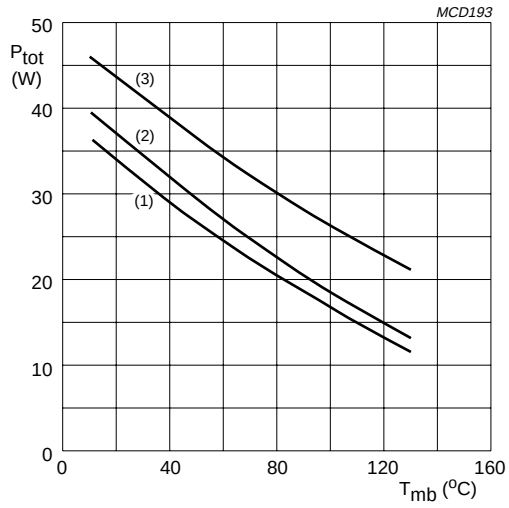



Fig.2 DC SOAR.




(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.

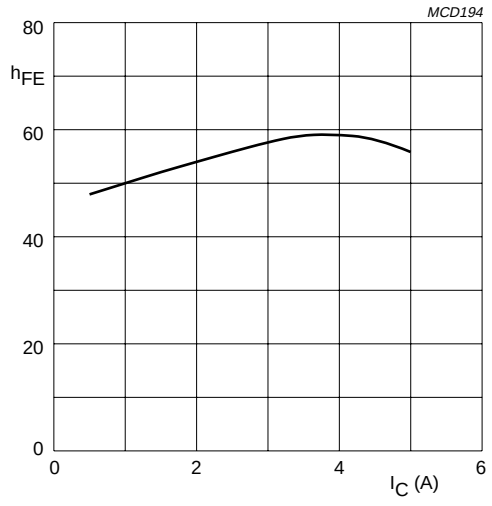
## THERMAL RESISTANCE

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

## CHARACTERISTICS

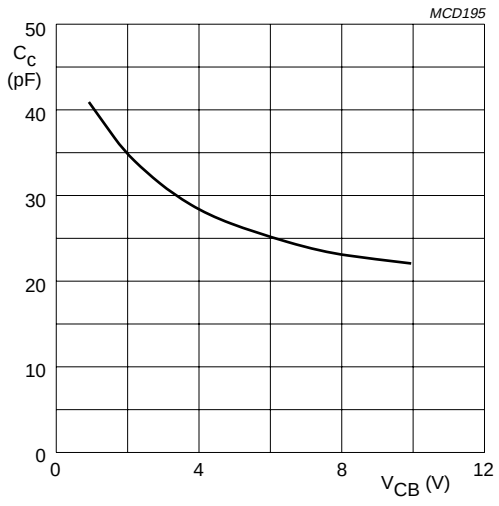
$T_j$ = 25 °C.

| 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 |



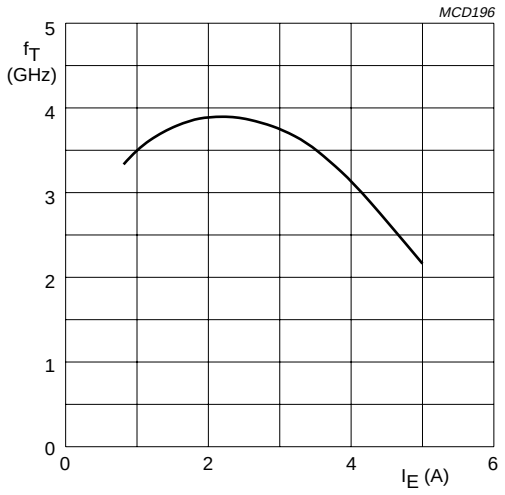

$V_{CE}$ = 5 V.

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.



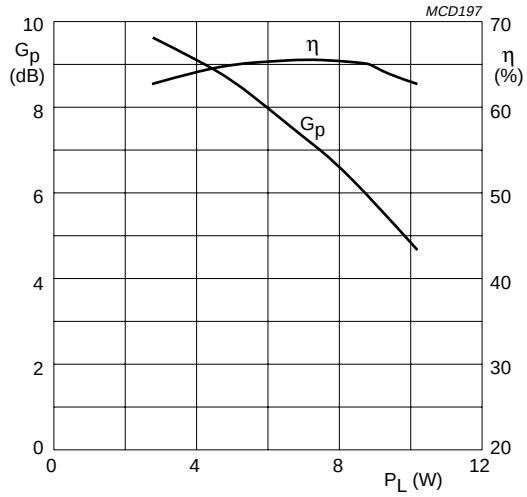

$V_{CB}$ = 7.5 V.

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

## APPLICATION INFORMATION

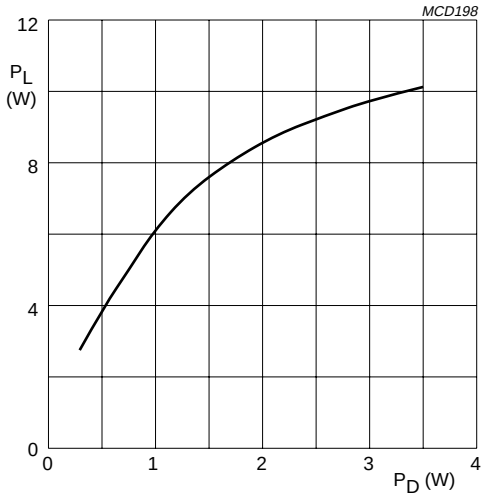
RF performance at $T_{mb}$ = 25 °C in a common emitter test circuit.

| MODE OF OPERATION | f (MHz) | $V_{CE}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| c.w. class-B | 470 | 7.5 | 8 | > 6<br>typ. 6.8 | > 60<br>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.

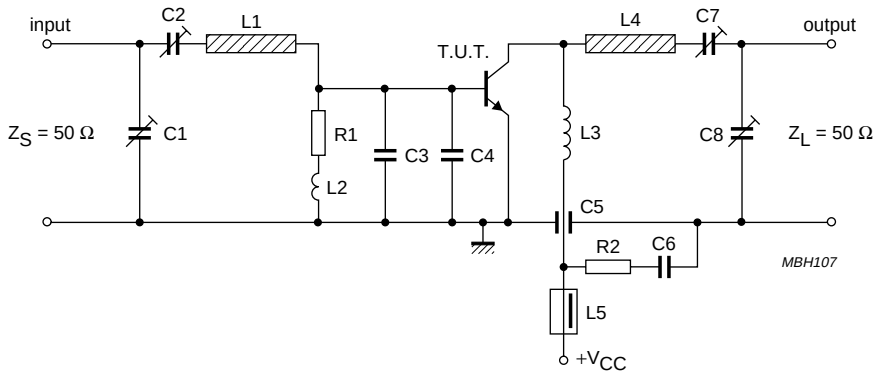


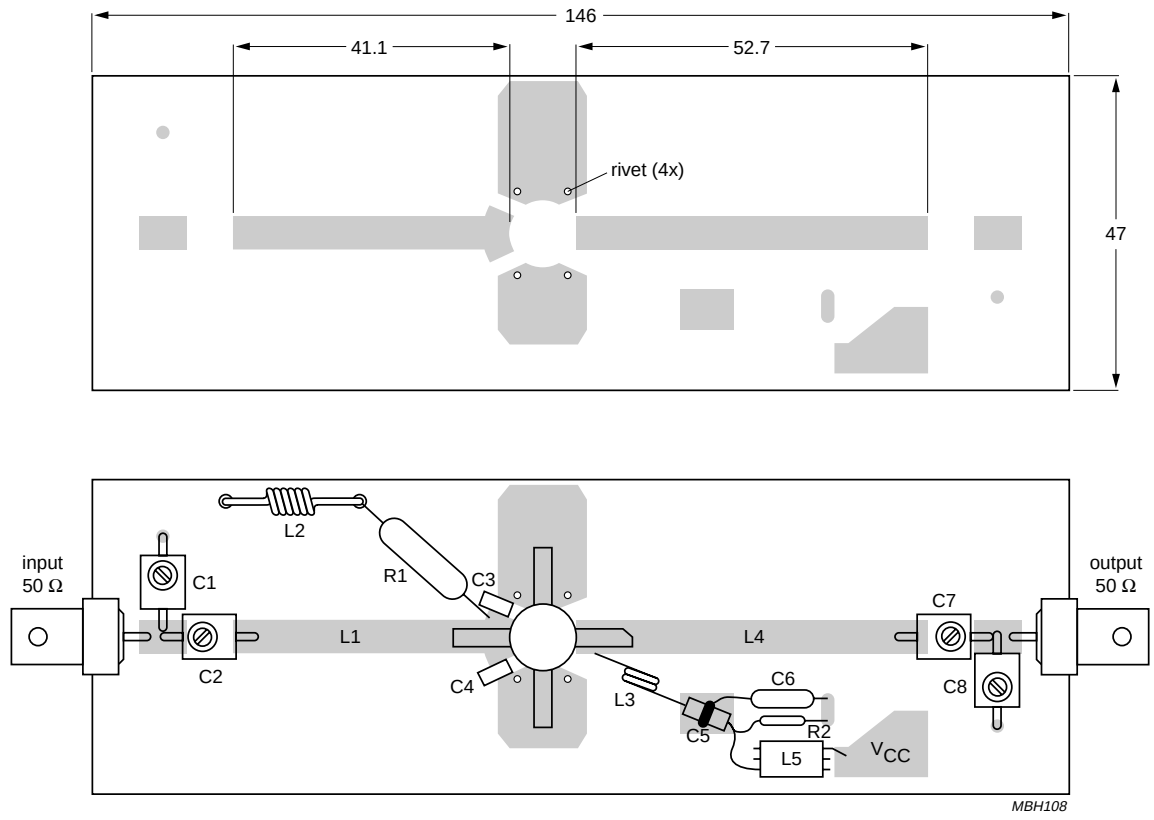

Fig.9 Class-B test circuit at f = 470 MHz.

**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**

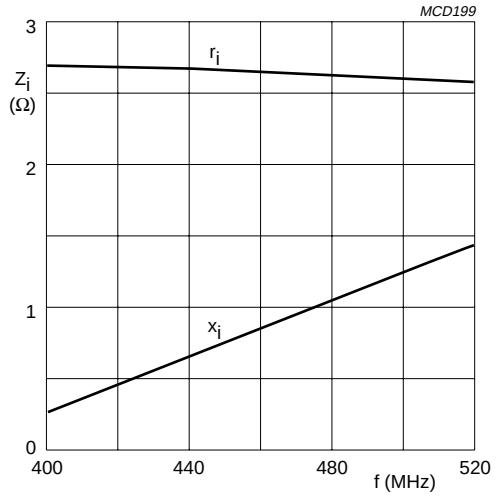
1. The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r$ = 2.74); thickness $^1/_{16}$ inch.




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.

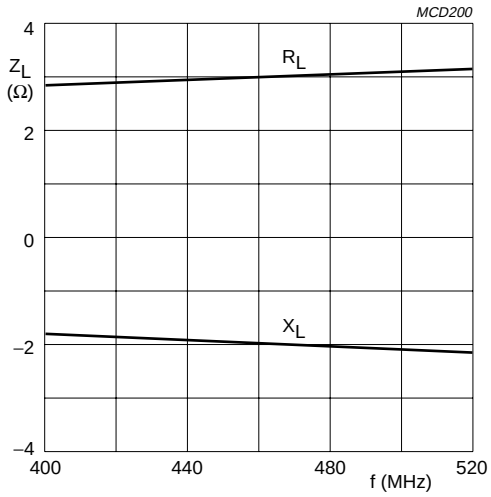
Dimensions in mm.

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.

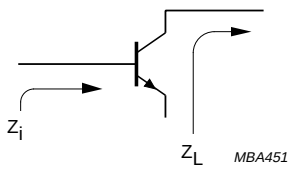
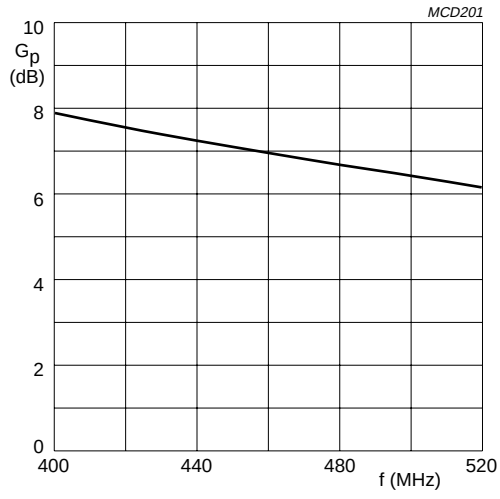



Fig.13 Definition of transistor impedance.

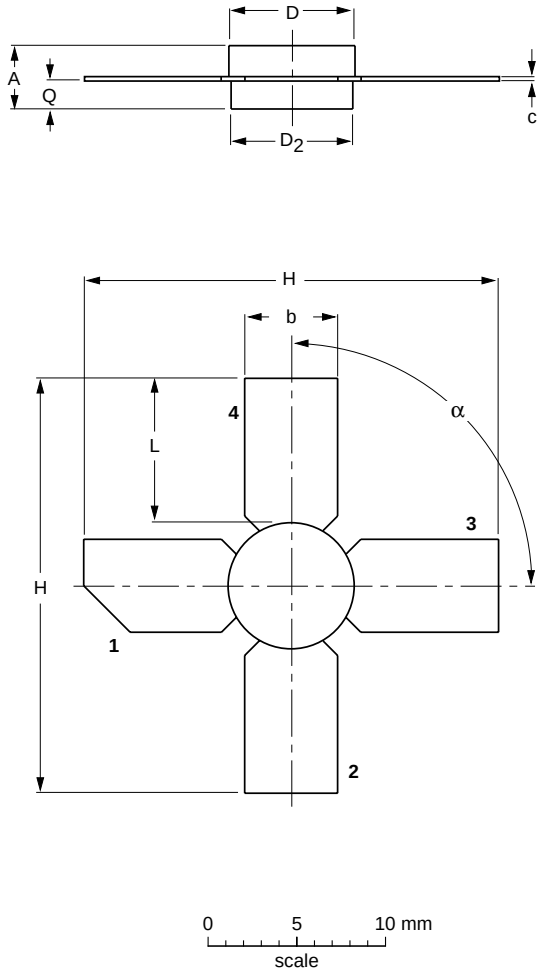



Class-B operation; $V_{CE}$ = 7.5 V; $P_L$ = 8 W.

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<br>3.27 | 5.85<br>5.58 | 0.18<br>0.14 | 7.50<br>7.23 | 7.24<br>6.98 | 27.56<br>25.78 | 9.91<br>9.14 | 1.58<br>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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