# DATA SHEET

# BLV99/SL
## UHF power transistor

Product specification

September 1991

Philips
Semiconductors

PHILIPS

# UHF power transistor BLV99/SL

## FEATURES

- Emitter-ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

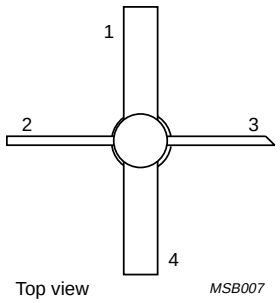
## DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-lead SOT172D envelope with a ceramic cap. It is designed primarily for use as a driver stage in base stations in the 900 MHz communications band. All leads are isolated from the mounting base.

## PINNING - SOT172D

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | base |
| 3 | collector |
| 4 | emitter |

## PIN CONFIGURATION



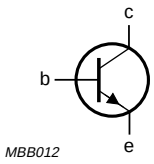




Fig.1 Simplified outline and symbol.

**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. |

## QUICK REFERENCE DATA

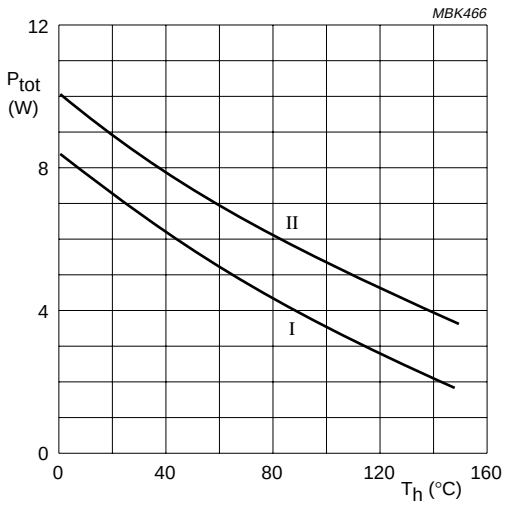
RF performance at $T_{mb}$ = 25 °C in a common emitter class-B test circuit.

| MODE OF OPERATION | f (MHz) | $V_{CE}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| c.w. narrow band | 900 | 24 | 2 | > 8 | > 55 |

## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 50 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 27 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 3.5 | V |
| $I_C$ | collector current | DC value | – | 200 | mA |
| $I_{CM}$ | collector current | peak value<br>f > 1 MHz | – | 600 | mA |
| $P_{tot}$ | total power dissipation | f > 1 MHz;<br>$T_{mb}$ = 50 °C | – | 6 | W |
| $T_{stg}$ | storage temperature range | | –65 | 150 | °C |
| $T_j$ | junction operating temperature | | – | 200 | °C |




(I) Continuous RF operation.
(II) Short time operation during mismatch.

Fig.2 Power/temperature derating curves.

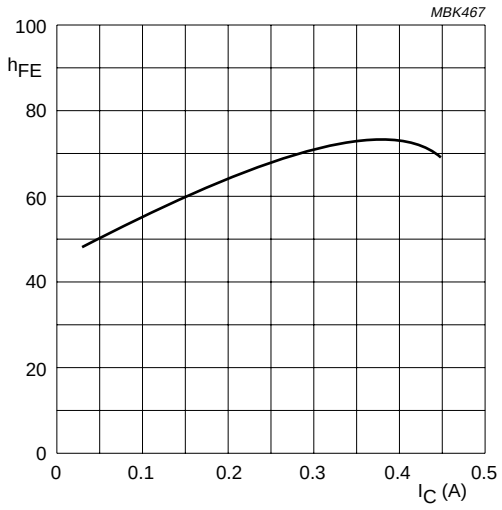
## THERMAL RESISTANCE

| SYMBOL | PARAMETER | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}mb(RF)}$ | from junction to mounting base | $P_L$ = 4.5 W; $T_{mb}$ = 25 °C | 20 | K/W |

## CHARACTERISTICS

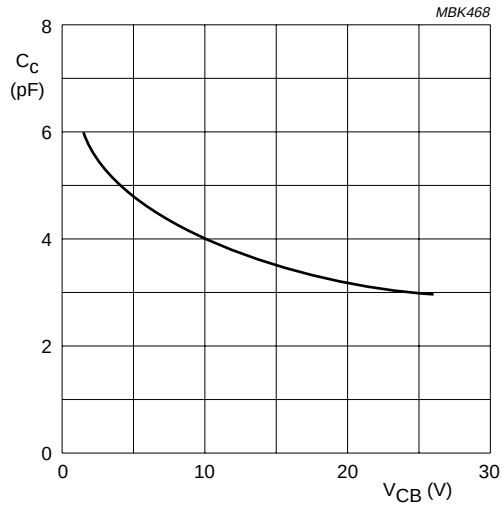
$T_j$ = 25 °C.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = 5 mA | 50 | – | – | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $V_{BE}$ = 0; $I_C$ = 10 mA | 27 | – | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | open collector; $I_E$ = 0.5 mA | 3.5 | – | – | V |
| $I_{CES}$ | collector-emitter leakage current | $V_{BE}$ = 0; $V_{CE}$ = 27 V | – | – | 2 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 20 V; $I_C$ = 150 mA | 25 | – | – | |
| $E_{SBR}$ | second breakdown energy | L = 25 mH; $R_{BE}$ = 10 Ω; f = 50 Hz | 0.5 | – | – | mJ |
| $C_c$ | collector capacitance | $V_{CB}$ = 24 V; $I_E = I_e$ = 0; f = 1 MHz | – | 3 | – | pF |
| $C_{re}$ | feedback capacitance | $V_{CE}$ = 24 V; $I_C$ = 0; f = 1 MHz | – | 1.3 | – | pF |




$V_{CE}$ = 20 V; $T_j$ = 25 °C.

Fig.3 DC current gain as a function of collector current, typical values.



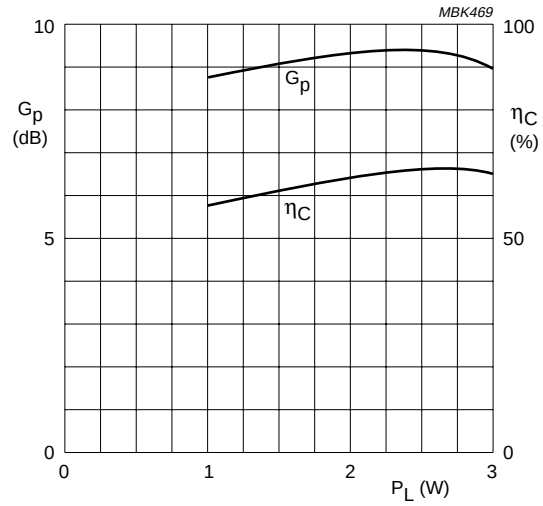

$I_E = i_e$ = 0; f = 1 MHz.

Fig.4 Collector capacitance as a function of collector-base voltage, typical values.

## APPLICATION INFORMATION

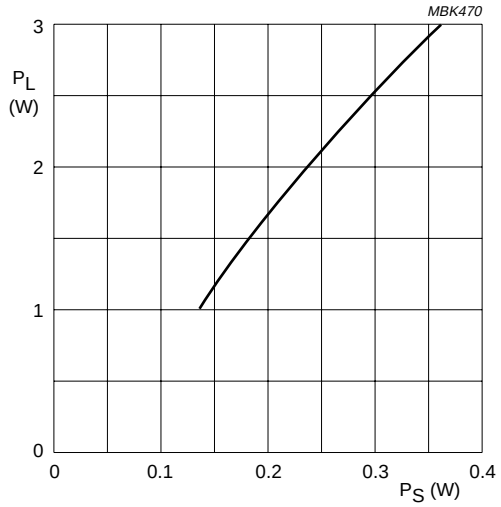
RF performance $T_{mb}$ = 25 °C in a common emitter class-B test circuit.

| MODE OF OPERATION | f (MHz) | $V_{CE}$ (V) | $P_L$ (W) | $G_p$ (dB) | $\eta_c$ (%) |
|---|---|---|---|---|---|
| c.w. narrow band | 900 | 24 | 2 | > 8<br>typ. 9.3 | > 55<br>typ. 63 |




Class-B operation; $V_{CE}$ = 24 V; f = 900 MHz;
$T_{mb}$ = 25 °C.

Fig.5 Gain and efficiency as functions of load power, typical values.




Class-B operation; $V_{CE}$ = 24 V; f = 900 MHz;
$T_{mb}$ = 25 °C.

Fig.6 Load power as a function of drive power, typical values.

### Ruggedness in class-B operation

The BLV99/SL is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions:

$V_{CE}$ = 24 V, f = 900 MHz,
$T_{mb}$ = 25 °C, and rated output power.

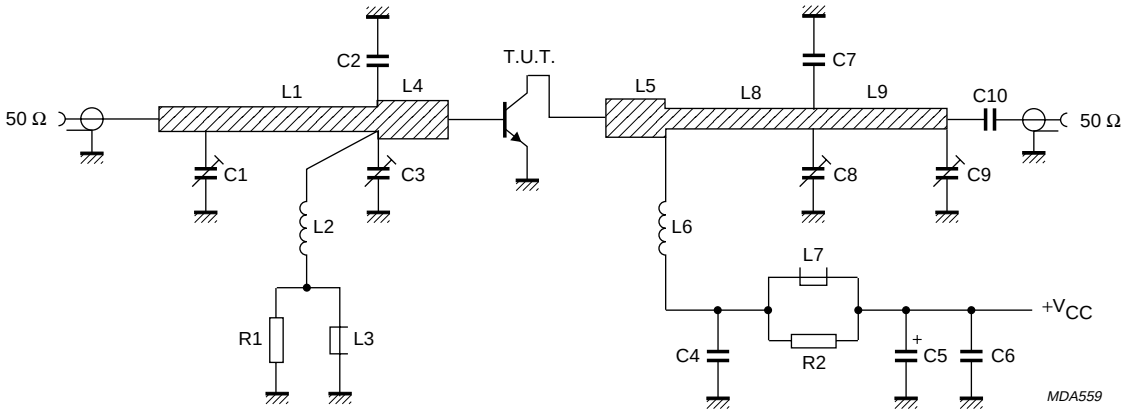


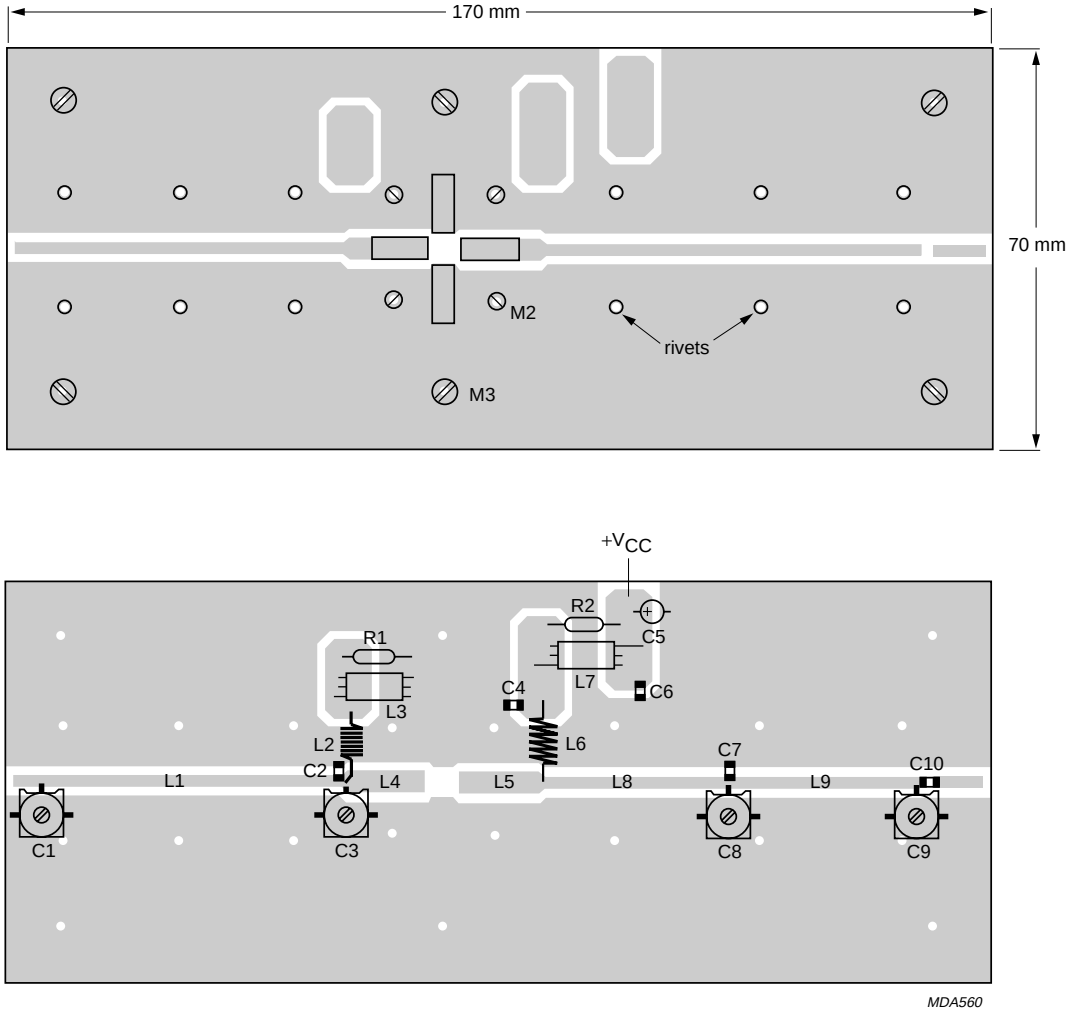

Fig.7 Class-B test circuit at f = 900 MHz.

**List of components (see test circuit)**

| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|---|---|---|---|---|
| C1, C3, C8, C9 | film dielectric trimmer | 1.4 to 5.5 pF | | 2222 809 09001 |
| C2 | multilayer ceramic chip capacitor (note 1) | 4.7 pF | | |
| C4, C6, C10 | multilayer ceramic chip capacitor | 220 pF | | |
| C5 | 63 V electrolytic capacitor | 1 μF | | |
| C7 | multilayer ceramic chip capacitor (note 1) | 2.2 pF | | |
| L1 | stripline (note 2) | 50 Ω | 48 mm × 2.4 mm | |
| L2 | 7 turns enamelled 0.4 mm copper wire | 50 nH | int. dia. 2 mm; leads 2 × 5 mm | |
| L3, L7 | grade 3B Ferroxcube wideband HF choke | | | 4312 020 36642 |
| L4, L5 | stripline (note 2) | 35 Ω | 14 mm × 4 mm; | |
| L6 | 6 turns enamelled 1 mm copper wire | 120 nH | int. dia. 6 mm; length 10 mm; leads 2 × 5 mm | |
| L8 | stripline (note 2) | 50 Ω | 31 mm × 2.4 mm | |
| L9 | stripline (note 2) | 50 Ω | 29 mm × 2.4 mm | |
| R1, R2 | 0.4 W metal film resistor | 10 Ω, 5% | | |

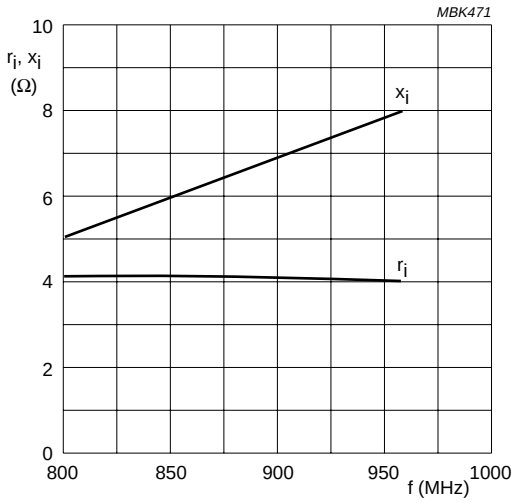
**Notes**

1. American Technical Ceramics type 100A or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ($\varepsilon_r$ = 2.2), thickness $^1/_{32}$ inch.



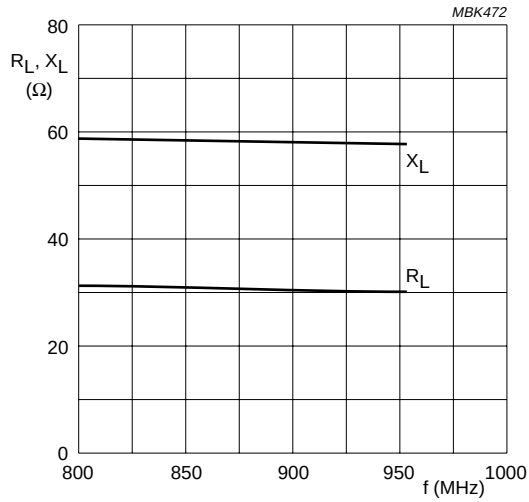

The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws, hollow rivets and copper straps under the emitters.

Fig.8 Component layout for 900 MHz class-B test circuit.




Class-B operation; $V_{CE}$ = 24 V; $P_L$ = 2 W;
$T_{mb}$ = 25 °C.

Fig.9 Input impedance (series components) as a function of frequency, typical values.




Class-B operation; $V_{CE}$ = 24 V; $P_L$ = 2 W;
$T_{mb}$ = 25 °C.

Fig.10 Load impedance (series components) as a function of frequency , typical values.

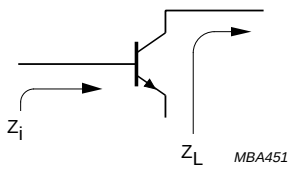
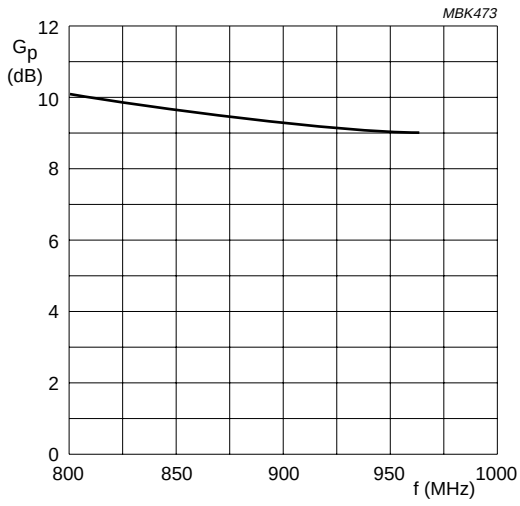



Fig.11 Definition of transistor impedance.

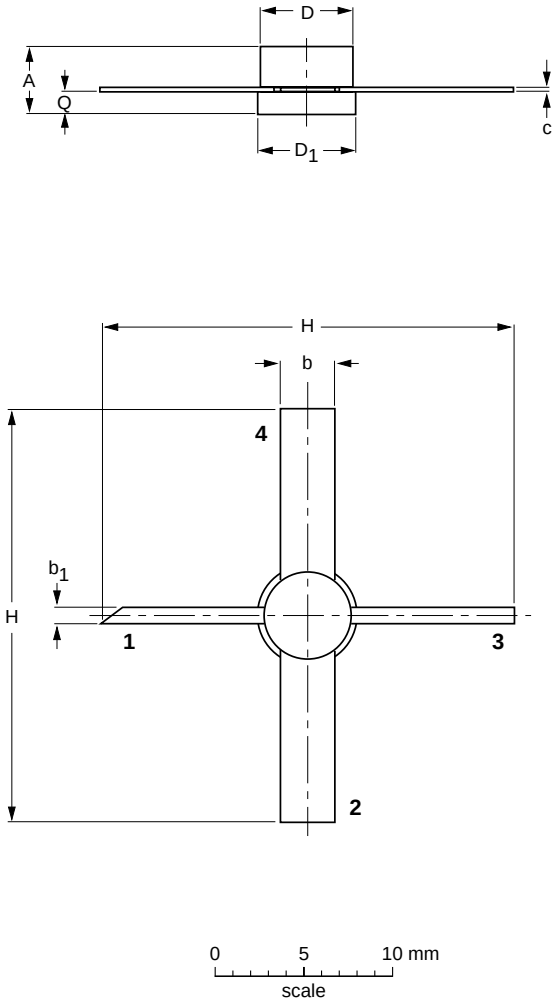



Class-B operation; $V_{CE}$ = 24 V; $P_L$ = 2 W;
$T_{mb}$ = 25 °C.

Fig.12 Power gain as a function of frequency, typical values.

## PACKAGE OUTLINE

**Studless ceramic package; 4 leads** **SOT172D**




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

| UNIT | A | b | $b_1$ | c | D | $D_1$ | H | Q |
|---|---|---|---|---|---|---|---|---|
| mm | 3.71<br>2.89 | 3.31<br>3.04 | 0.89<br>0.63 | 0.16<br>0.10 | 5.20<br>4.95 | 5.33<br>5.08 | 26.17<br>24.63 | 1.15<br>0.88 |
| inches | 0.146<br>0.114 | 0.13<br>0.12 | 0.035<br>0.025 | 0.006<br>0.004 | 0.205<br>0.195 | 0.210<br>0.200 | 1.03<br>0.97 | 0.045<br>0.035 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT172D | | | | | | 97-06-28 |

**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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