

# DATA SHEET

## **BLT92/SL** UHF power transistor

Product specification

May 1989

UHF power transistor

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DESCRIPTION

NPN silicon planar epitaxial transistor primarily intended for use in handheld radio stations in the 900 MHz communications band.

This device has been designed specifically for class-B operation.

FEATURES

- internal input matching capacitor for a high power gain
- gold metallization ensures excellent reliability

The transistor has a 4-lead studless envelope with a ceramic cap (SOT122D). All leads are isolated from the mounting base.

PINNING

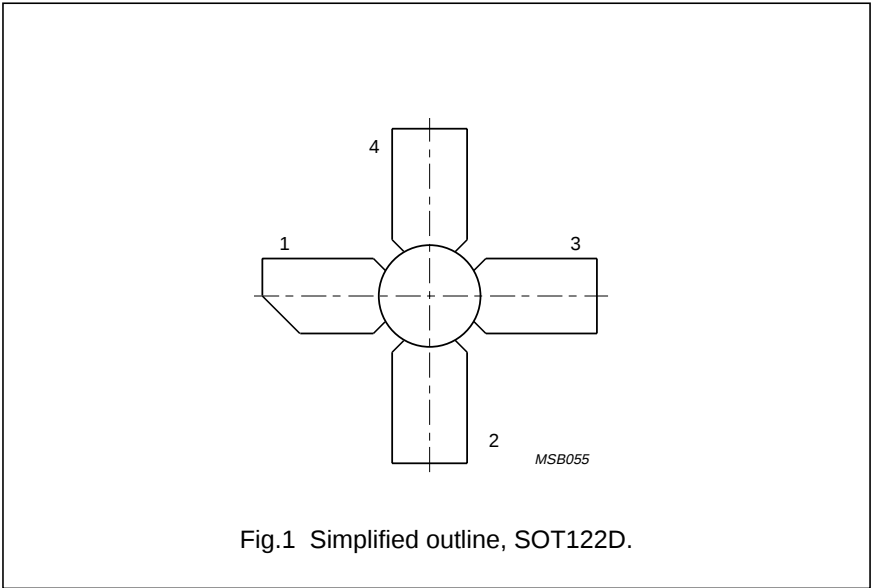
- 1 = collector
- 2 = emitter
- 3 = base
- 4 = emitter

QUICK REFERENCE DATA

RF performance at  $T_{mb} = 25\text{ }^{\circ}\text{C}$  in a common-emitter class-B circuit

| MODE OF OPERATION | $V_{CE}$<br>(V) | f<br>(MHz) | $P_L$<br>(W) | $G_p$<br>(dB) | $\eta_c$<br>(%) |
|-------------------|-----------------|------------|--------------|---------------|-----------------|
| CW (class-B)      | 7.5             | 900        | 3.0          | > 7.0         | > 50            |

PIN CONFIGURATION



**PRODUCT SAFETY** This device incorporates beryllium oxide (BeO), the dust of which is toxic. The device is entirely safe provided that the internal BeO disc is not damaged.

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RATINGS

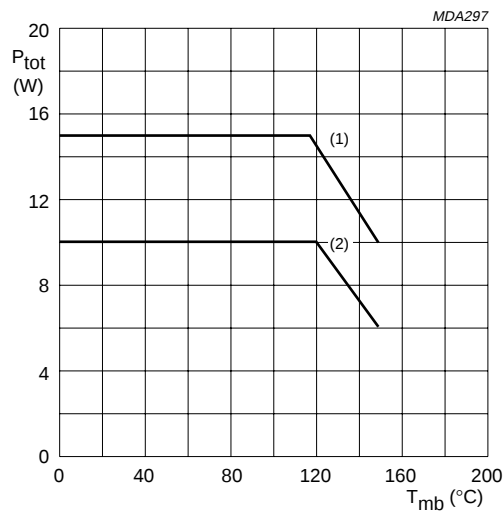
Limiting values in accordance with the Absolute Maximum System (IEC 134)

|                                       |                  |      |                |
|---------------------------------------|------------------|------|----------------|
| Collector-base voltage (open emitter) | $V_{CBO}$        | max. | 20 V           |
| Collector-emitter voltage (open base) | $V_{CEO}$        | max. | 10 V           |
| Emitter-base voltage (open collector) | $V_{EBO}$        | max. | 3.0 V          |
| Collector current                     |                  |      |                |
| DC or average                         | $I_C; I_{C(AV)}$ | max. | 1.2 A          |
| (peak value); $f > 800$ MHz           | $I_{CM}$         | max. | 3.6 A          |
| Total power dissipation               |                  |      |                |
| at $T_{amb} < 120$ °C; $f > 800$ MHz  | $P_{tot}$        | max. | 10 W           |
| Storage temperature range             | $T_{stg}$        |      | −65 to +150 °C |
| Operating junction temperature        | $T_j$            | max. | 200 °C         |

THERMAL RESISTANCE

Dissipation = 10 W;  $T_{mb} = 25$  °C

|                                                 |                    |      |         |
|-------------------------------------------------|--------------------|------|---------|
| From junction to mounting base ( $f > 800$ MHz) | $R_{th\ j-mb(RF)}$ | max. | 6.0 K/W |
|-------------------------------------------------|--------------------|------|---------|



- (1) Short-time RF operation during mismatch ( $f > 800$  MHz).
- (2) Continuous RF operation ( $f > 800$  MHz).

Fig.2 Total power dissipation as a function of temperature.

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CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified

|                                                              |                      |      |        |
|--------------------------------------------------------------|----------------------|------|--------|
| Collector-base breakdown voltage                             |                      |      |        |
| open emitter; I <sub>C</sub> = 10 mA                         | V <sub>(BR)CBO</sub> | >    | 20 V   |
| Collector-emitter breakdown voltage                          |                      |      |        |
| open base; I <sub>C</sub> = 20 mA                            | V <sub>(BR)CEO</sub> | >    | 10 V   |
| Emitter-base breakdown voltage                               |                      |      |        |
| open collector; I <sub>E</sub> = 2 mA                        | V <sub>(BR)EBO</sub> | >    | 3.0 V  |
| Collector cut-off current                                    |                      |      |        |
| V <sub>BE</sub> = 0; V <sub>CE</sub> = 10 V                  | I <sub>CES</sub>     | <    | 5.0 mA |
| Second breakdown energy                                      |                      |      |        |
| L = 25 mH; f = 50 Hz; R <sub>BE</sub> = 10 Ω                 | E <sub>SDR</sub>     | >    | 1.0 mJ |
| DC current gain                                              |                      |      |        |
| I <sub>C</sub> = 600 mA; V <sub>CE</sub> = 5 V               | h <sub>FE</sub>      | >    | 25     |
| Collector capacitance at f = 1 MHz                           |                      |      |        |
| I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 7.5 V | C <sub>c</sub>       | typ. | 11 pF  |
| Feedback capacitance at f = 1 MHz                            |                      |      |        |
| I <sub>C</sub> = 0; V <sub>CE</sub> = 7.5 V                  | C <sub>re</sub>      | typ. | 6.0 pF |
| Collector-mounting base capacitance                          | C <sub>c-mb</sub>    | typ. | 1.2 pF |

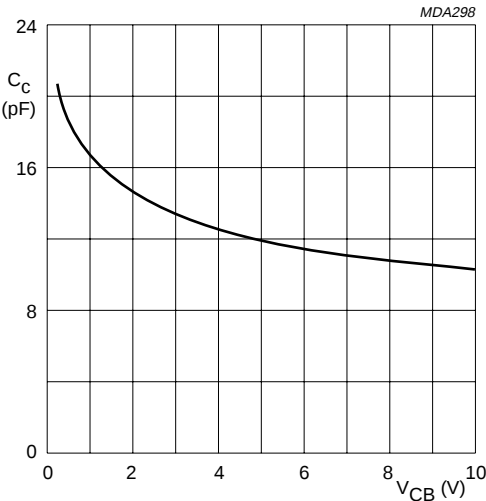


Fig.3 Collector capacitance as a function of collector-base voltage; f = 1 MHz; I<sub>E</sub> = i<sub>e</sub> = 0; typical values.

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## APPLICATION INFORMATION

RF performance in CW operation (common-emitter circuit; class-B);  $f = 900\text{ MHz}$ ;  $T_{mb} = 25\text{ °C}$

| MODE OF OPERATION | $V_{CE}$<br>(V) | $P_L$<br>(W) | $G_p$<br>(dB)     | $\eta_c$<br>(%) |
|-------------------|-----------------|--------------|-------------------|-----------------|
| Class-B; CW       | 7.5             | 3.0          | > 7.0<br>typ. 8.5 | > 50<br>typ. 57 |

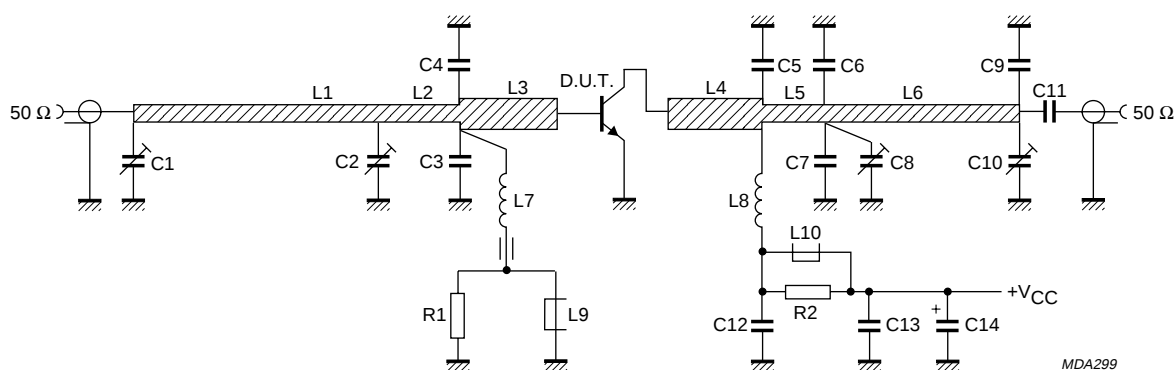


Fig.4 Class-B test circuit at  $f = 900\text{ MHz}$ .

## List of components:

- C1 = C2 = C8 = C10 = 1.4 to 5.5 pF film dielectric trimmer (cat. no. 2222 809 09001)
- C3 = C6 = C7 = 3.3 pF multilayer ceramic chip capacitor<sup>(1)</sup>
- C4 = C5 = C9 = 5.6 pF multilayer ceramic chip capacitor<sup>(1)</sup>
- C11 = C12 = C13 = 180 pF multilayer ceramic chip capacitor
- C14 = 1  $\mu\text{F}$  (35 V) tantalum capacitor
- L1 = 50  $\Omega$  stripline (25 mm  $\times$  2.4 mm)
- L2 = 50  $\Omega$  stripline (11 mm  $\times$  2.4 mm)
- L3 = L4 = 25  $\Omega$  stripline (11.5 mm  $\times$  6.0 mm)
- L5 = 50  $\Omega$  stripline (7.0 mm  $\times$  2.4 mm)
- L6 = 50  $\Omega$  stripline (27.0 mm  $\times$  2.4 mm)
- L7 = 4 turns closely wound enamelled Cu wire (0.4 mm), int. dia.; 3 mm, with ferrite bead (cat. no. 4330 830 32221) over the coldside lead
- L8 = 1 turn Cu wire (1.0 mm); int. dia. 5.5 mm; length 2 mm; leads 2  $\times$  5 mm
- L9 = L10 = Ferroxcube wideband HF choke, grade 3B (cat. no. 4312 020 36642)
- R1 = R2 = 10  $\Omega \pm 5\%$ ; 0.25 W metal film resistor

The striplines on a double Cu-clad printed circuit board with PTFE fibreglass dielectric ( $\epsilon_r = 2.2$ ); thickness 1/32 inch; thickness of copper-sheet 2  $\times$  35  $\mu\text{m}$ .

## Note

1. American Technical Ceramics capacitor type 100 A or capacitor of same quality.

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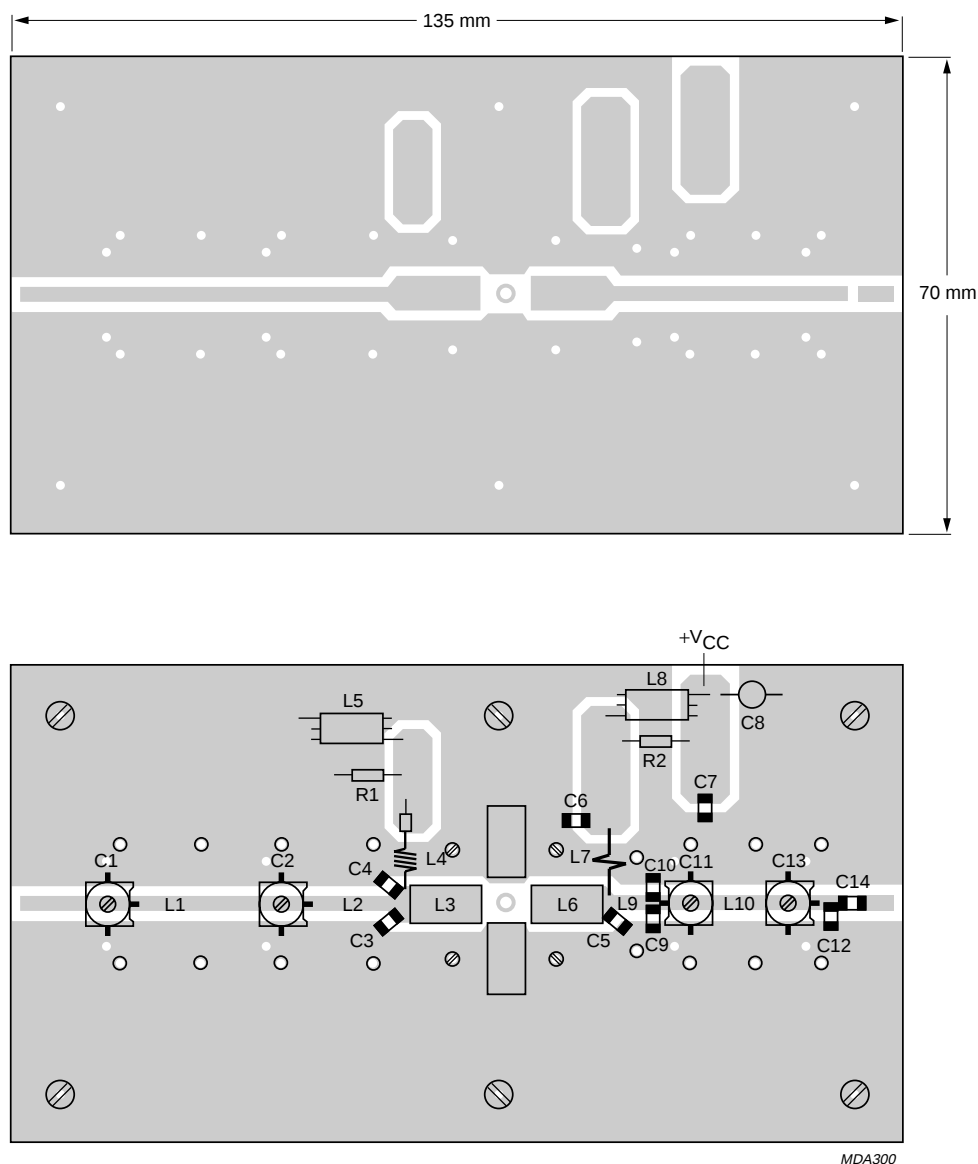


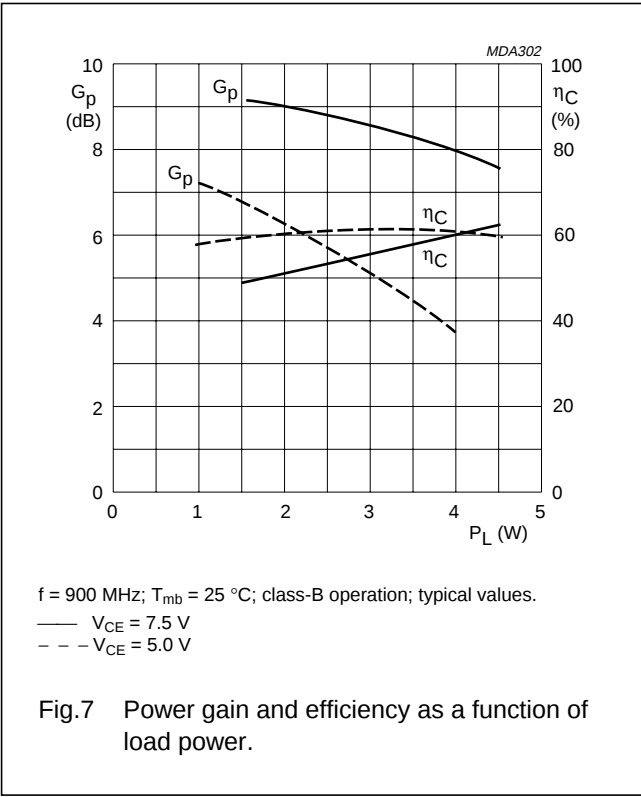
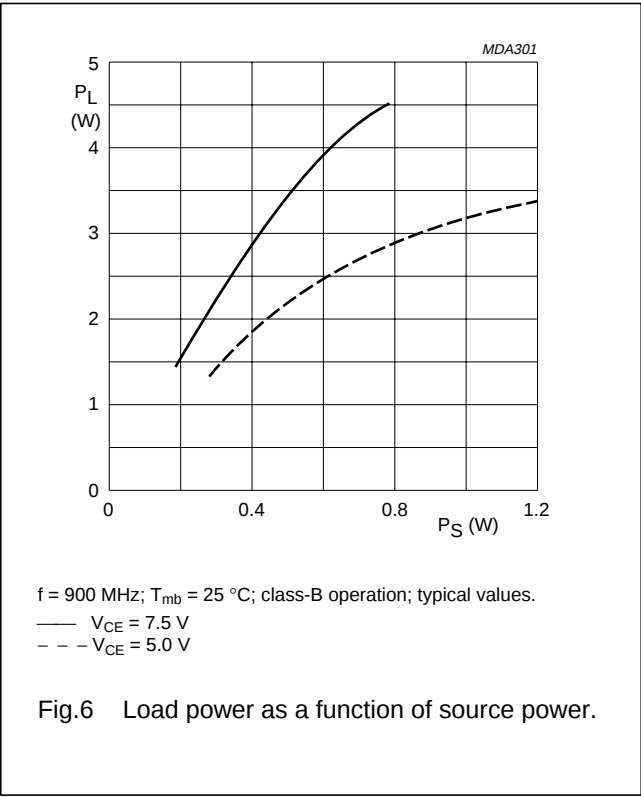
Fig.5 Printed circuit board and component layout for 900 MHz class-B test circuit.

**Note:**

The circuit and the components are on one side of the PTFE fibreglass board; the other side is un-etched copper serving as groundplane. Earth connections are made by hollow rivets and also by fixing-screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the groundplane.

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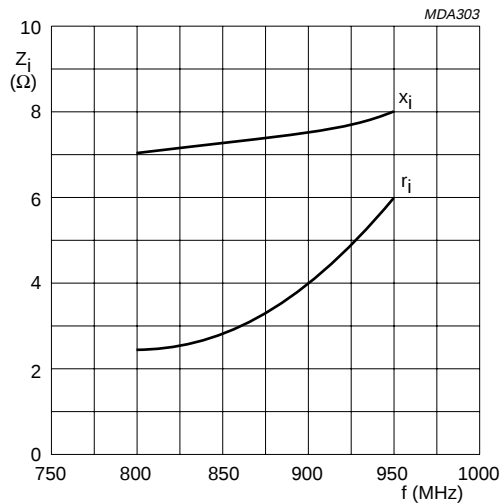


RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 9.0 V at  $T_{mb} = 25^\circ\text{C}$ .

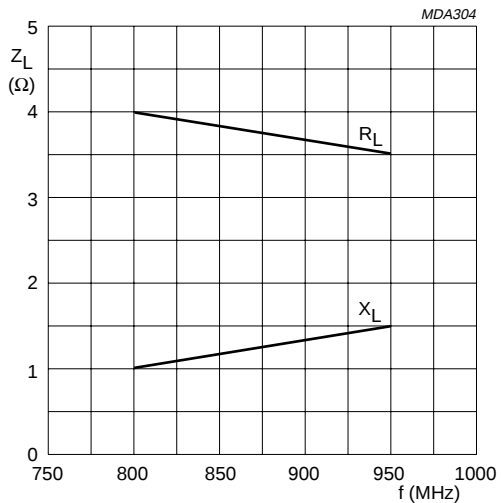
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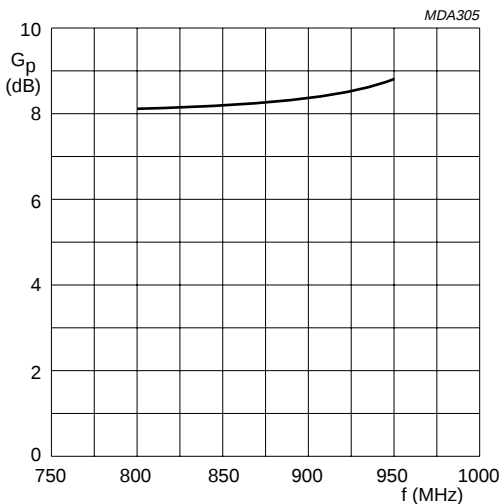
$V_{CE} = 7,5\text{ V}$ ;  $P_L = 3\text{ W}$ ;  $f = 800 - 960\text{ MHz}$ ;  $T_{mb} = 25\text{ }^{\circ}\text{C}$ ;  
class-B operation; typical values.

Fig.8 Input impedance as a function of frequency (series components).



$V_{CE} = 7,5\text{ V}$ ;  $P_L = 3\text{ W}$ ;  $f = 800 - 960\text{ MHz}$ ;  $T_{mb} = 25\text{ }^{\circ}\text{C}$ ;  
class-B operation; typical values.

Fig.9 Load impedance as a function of frequency (series components).



$V_{CE} = 7,5\text{ V}$ ;  $P_L = 3\text{ W}$ ;  $f = 800 - 960\text{ MHz}$ ;  $T_{mb} = 25\text{ }^{\circ}\text{C}$ ;  
class-B operation; typical values.

Fig.10 Power gain as a function of frequency.

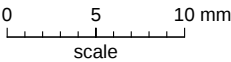
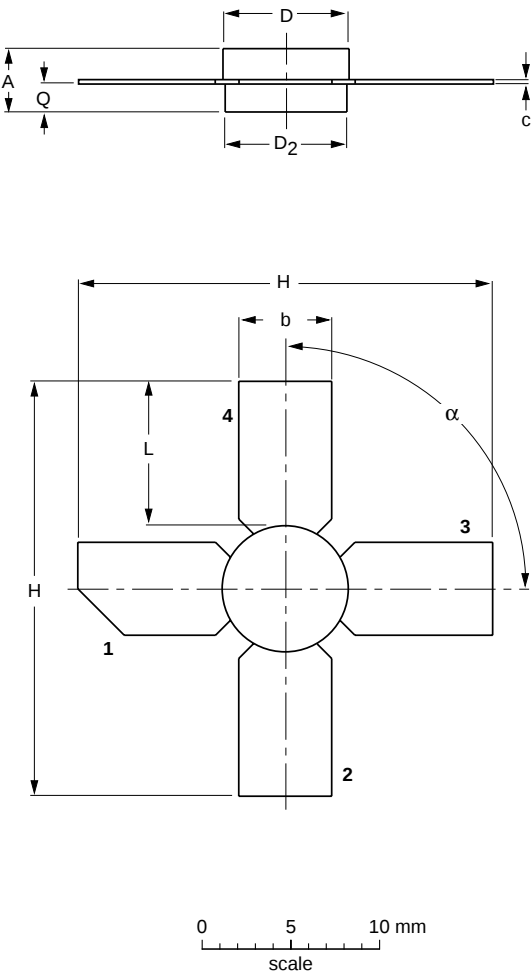
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PACKAGE OUTLINE

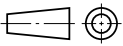
Studless ceramic package; 4 leads

SOT122D



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

| UNIT | A            | b            | c            | D            | D <sub>2</sub> | 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<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE |
|--------------------|------------|-------|------|--|---------------------------------------------------------------------------------------|------------|
|                    | IEC        | JEDEC | EIAJ |  |                                                                                       |            |
| SOT122D            |            |       |      |  |  | 97-04-18   |

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**DEFINITIONS**

| <b>Data Sheet Status</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 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.                                |
| <b>Limiting values</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
| 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. |                                                                                       |
| <b>Application information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |

**LIFE SUPPORT APPLICATIONS**

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