

# DATA SHEET

## **BLT50** UHF power transistor

Product specification

April 1991

# UHF power transistor

# BLT50

## FEATURES

- SMD encapsulation
- Gold metallization ensures excellent reliability.

## DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a SOT223 surface mounted envelope and designed primarily for use in hand-held radio equipment in the 470 MHz communications band.

## PINNING - SOT223

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

## QUICK REFERENCE DATA

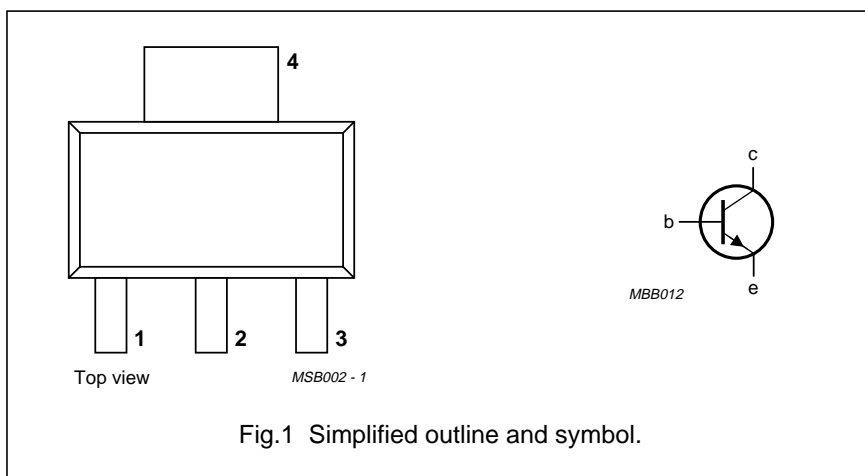
RF performance at  $T_s \leq 60\text{ }^\circ\text{C}$  in a common emitter class-B test circuit (note 1).

| MODE OF OPERATION | f (MHz) | V <sub>CE</sub> (V) | P <sub>L</sub> (W) | G <sub>p</sub> (dB) | $\eta_c$ (%) |
|-------------------|---------|---------------------|--------------------|---------------------|--------------|
| c.w. narrow band  | 470     | 7.5                 | 1.2                | > 10                | > 55         |

## Note

1.  $T_s$  = temperature at soldering point of collector tab.

## PIN CONFIGURATION



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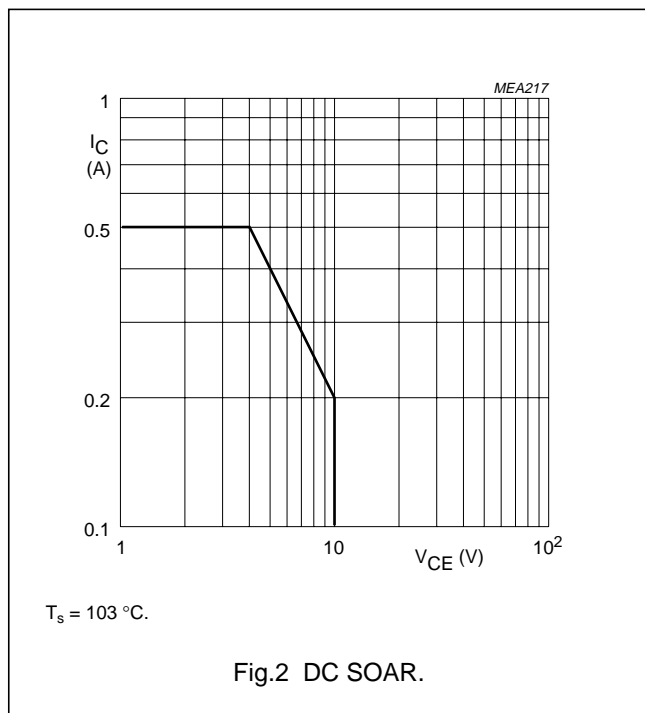
### LIMITING VALUES

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

| SYMBOL           | PARAMETER                      | CONDITIONS                                 | MIN. | MAX. | UNIT |
|------------------|--------------------------------|--|------|------|------|
| $V_{CBO}$        | collector-base voltage         | open emitter                               | –    | 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                        | –    | 500  | mA   |
| $I_{CM}$         | collector current              | peak value<br>$f > 1$ MHz                  | –    | 1.5  | A    |
| $P_{tot}$        | total power dissipation        | $f > 1$ MHz;<br>$T_s = 103$ °C<br>(note 1) | –    | 2    | W    |
| $T_{stg}$        | storage temperature range      |  | –65  | 150  | °C   |
| $T_j$            | operating junction temperature |  | –    | 175  | °C   |

### Note

- $T_s$  = temperature at soldering point of collector tab.



### THERMAL RESISTANCE

| SYMBOL            | PARAMETER                        | CONDITIONS                      | MAX. | UNIT |
|-------------------|----------------------------------|---------------------------------|------|------|
| $R_{th\ j-s(DC)}$ | from junction to soldering point | $P_{tot} = 2$ W; $T_s = 103$ °C | 36   | K/W  |

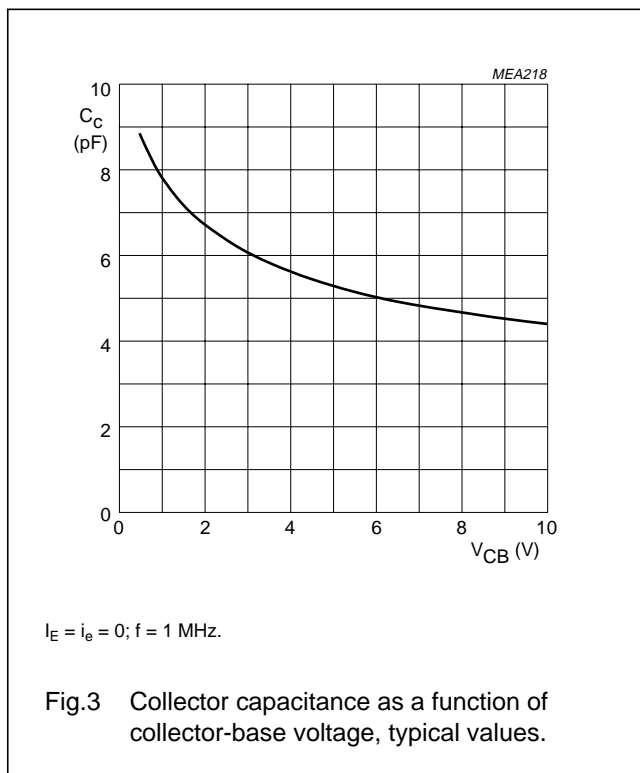
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## CHARACTERISTICS

 $T_j = 25\text{ }^\circ\text{C}$ .

| SYMBOL        | PARAMETER                           | CONDITIONS  | MIN. | TYP. | MAX. | UNIT          |
|---------------|-------------------------------------|---|------|------|------|---------------|
| $V_{(BR)CBO}$ | collector-base breakdown voltage    | open emitter;<br>$I_C = 5\text{ mA}$  | 20   | –    | –    | V             |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | open base;<br>$I_C = 10\text{ mA}$  | 10   | –    | –    | V             |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage      | open collector;<br>$I_E = 1\text{ mA}$                                      | 3    | –    | –    | V             |
| $I_{CES}$     | collector-emitter leakage current   | $V_{BE} = 0$ ;<br>$V_{CE} = 10\text{ V}$                                    | –    | –    | 250  | $\mu\text{A}$ |
| $h_{FE}$      | DC current gain                     | $V_{CE} = 5\text{ V}$ ;<br>$I_C = 300\text{ mA}$                            | 25   | –    | –    |               |
| $E_{SBR}$     | second breakdown energy             | $L = 25\text{ mH}$ ;<br>$R_{BE} = 10\text{ }\Omega$ ;<br>$f = 50\text{ Hz}$ | 0.55 | –    | –    | mJ            |
| $C_c$         | collector capacitance               | $V_{CB} = 7.5\text{ V}$ ;<br>$I_E = I_e = 0$ ;<br>$f = 1\text{ MHz}$        | –    | 4.7  | 6    | pF            |
| $C_{re}$      | feedback capacitance                | $V_{CE} = 7.5\text{ V}$ ;<br>$I_C = 0$ ;<br>$f = 1\text{ MHz}$              | –    | 2.9  | 4.5  | pF            |



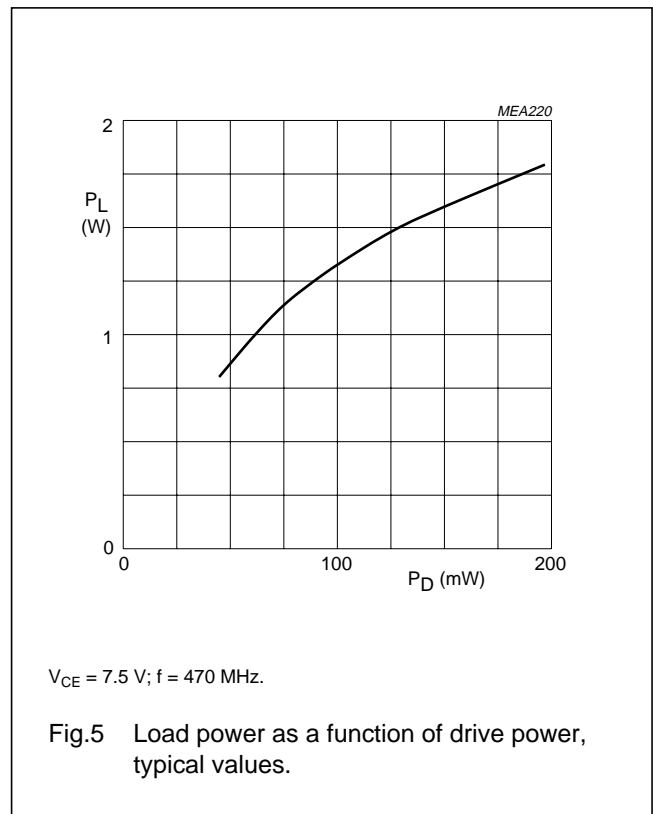
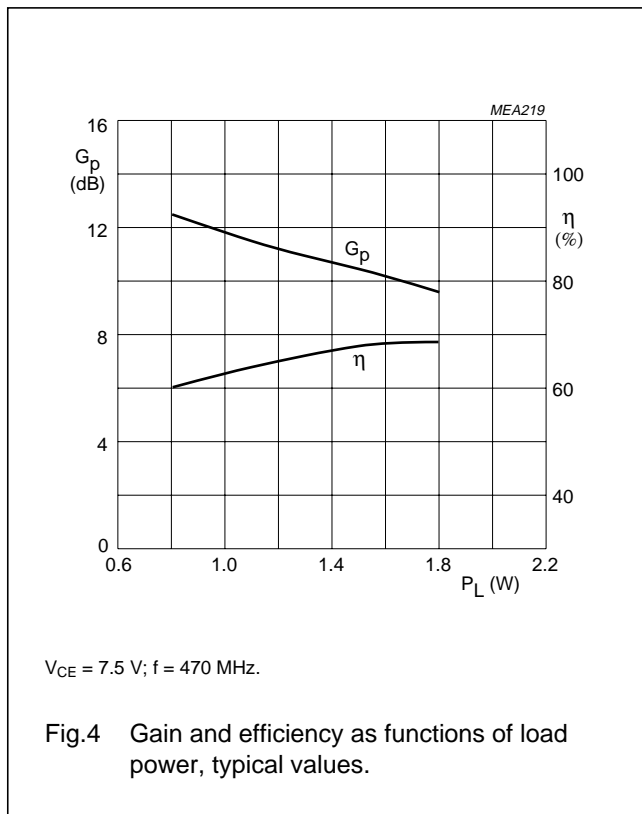
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**APPLICATION INFORMATION**

RF performance at  $T_s \leq 60\text{ }^\circ\text{C}$  in a common emitter class-B test circuit.

| MODE OF OPERATION | f (MHz) | V <sub>CE</sub> (V) | P <sub>L</sub> (W) | G <sub>p</sub> (dB) | $\eta_c$ (%)    |
|-------------------|---------|---------------------|--------------------|---------------------|-----------------|
| c.w. narrow band  | 470     | 7.5                 | 1.2                | > 10<br>typ. 11.2   | > 55<br>typ. 65 |

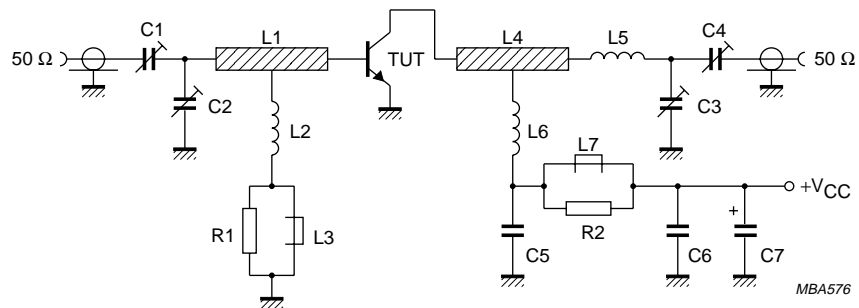


**Ruggedness in class-B operation**

The BLT50 is capable of withstanding a load mismatch corresponding to  $V_{SWR} = 50:1$  through all phases at rated output power, up to a supply voltage of 9 V,  $f = 470\text{ MHz}$  and  $T_s \leq 60\text{ }^\circ\text{C}$ , where  $T_s$  is the temperature at the soldering point of the collector tab.

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Fig.6 Class-B test circuit at  $f = 470$  MHz.

## List of components (see test circuit)

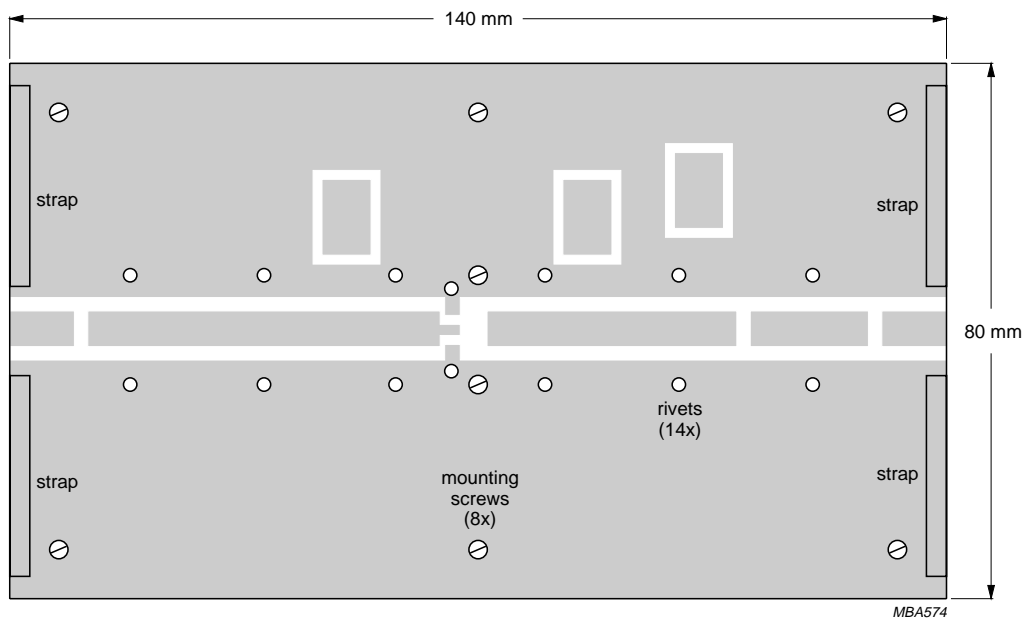
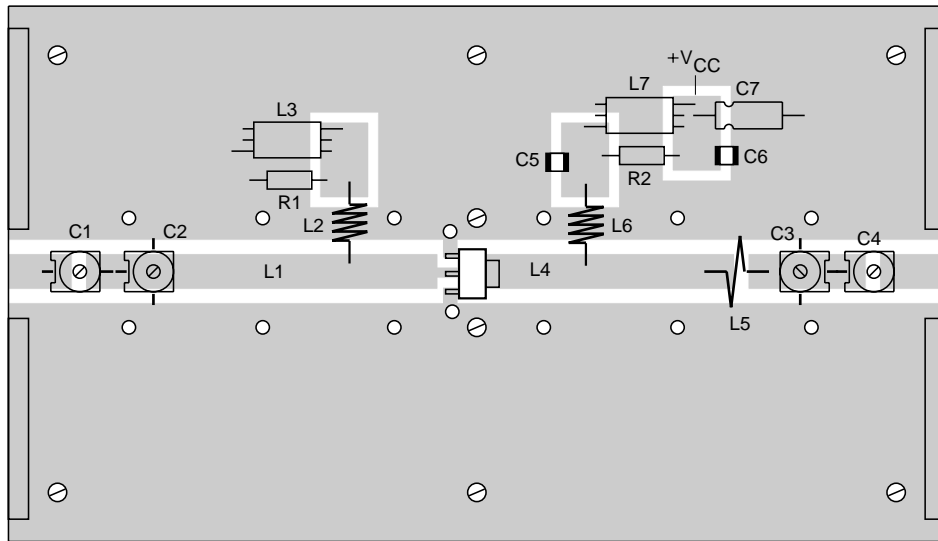
| COMPONENT | DESCRIPTION                                   | VALUE            | DIMENSIONS            | CATALOGUE NO.  |
|-----------|---|------------------|-----------------------|----------------|
| C1        | film dielectric trimmer                       | 1.4 to 5.5 pF    |                       | 2222 809 09004 |
| C2        | film dielectric trimmer                       | 1.4 to 5.5 pF    |                       | 2222 809 09001 |
| C3        | film dielectric trimmer                       | 2 to 9 pF        |                       | 2222 809 09002 |
| C4        | film dielectric trimmer                       | 2 to 9 pF        |                       | 2222 809 09005 |
| C5        | multilayer ceramic chip capacitor<br>(note 1) | 100 pF           |                       |                |
| C6        | multilayer ceramic chip capacitor<br>(note 1) | 1 nF             |                       |                |
| C7        | 63 V electrolytic capacitor                   | 2.2 $\mu$ F      |                       |                |
| L1        | stripline (note 2)                            | 50 $\Omega$      | 54 mm $\times$ 4.7 mm |                |
| L2        | 5 turns enameled 0.4 mm copper<br>wire        |                  | int. dia. 3 mm        |                |
| L3, L7    | grade 3B1 Ferroxcube wideband RF<br>choke     |                  |                       | 4312 020 36640 |
| L4        | stripline (note 2)                            | 50 $\Omega$      | 36 mm $\times$ 4.7 mm |                |
| L5        | 1 turn enameled 1.4 mm copper wire            | 5 nH             | int. dia. 4 mm        |                |
| L6        | 3 turns enameled 0.4 mm copper<br>wire        |                  | int. dia. 3 mm        |                |
| R1, R2    | 0.25 W metal film resistor                    | 10 $\Omega$ , 5% |                       |                |

## Notes

- American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
- The striplines are mounted on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric ( $\epsilon_r = 2.2$ ); thickness  $\frac{1}{16}$  inch.

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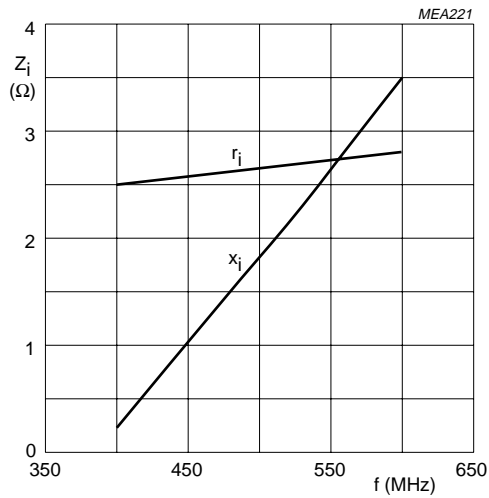


The circuit and components are situated on one side of a copper-clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.7 Component layout for 470 MHz class-B test circuit.

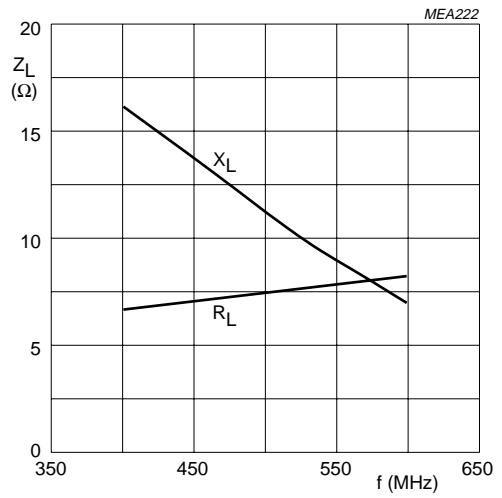
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Class-B operation;  $V_{CE} = 7.5$  V;  $P_L = 1.2$  W.

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



Class-B operation;  $V_{CE} = 7.5$  V;  $P_L = 1.2$  W.

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

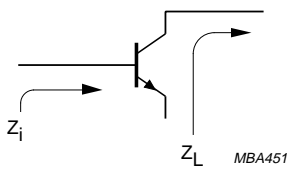
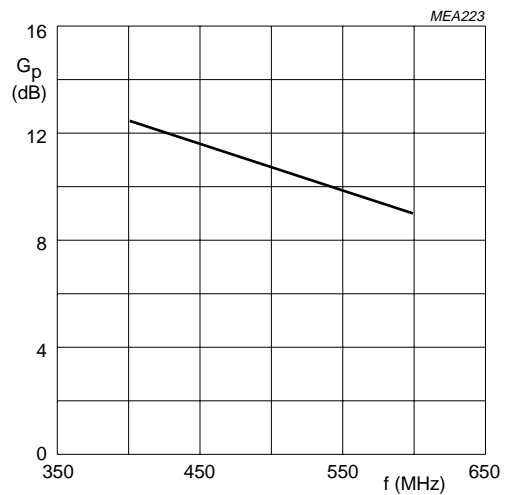


Fig. 10 Definition of transistor impedance.



Class-B operation;  $V_{CE} = 7.5$  V;  $P_L = 1.2$  W.

Fig. 11 Power gain as a function of frequency, typical values.



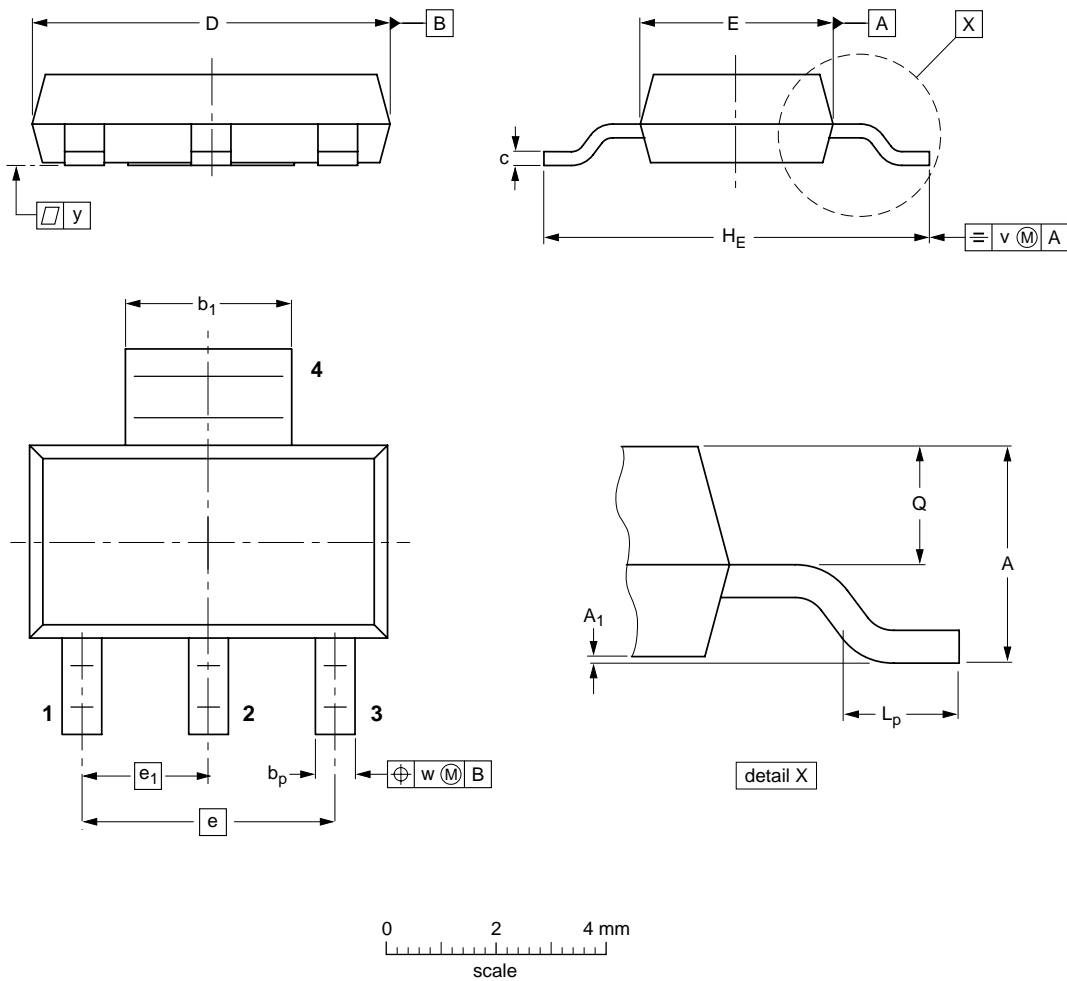
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## PACKAGE OUTLINE

Plastic surface mounted package; collector pad for good heat transfer; 4 leads

SOT223



**DIMENSIONS (mm are the original dimensions)**

| UNIT | A          | A <sub>1</sub> | b <sub>p</sub> | b <sub>1</sub> | c            | D          | E          | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   | y   |
|------|------------|----------------|----------------|----------------|--------------|------------|------------|-----|----------------|----------------|----------------|--------------|-----|-----|-----|
| mm   | 1.8<br>1.5 | 0.10<br>0.01   | 0.80<br>0.60   | 3.1<br>2.9     | 0.32<br>0.22 | 6.7<br>6.3 | 3.7<br>3.3 | 4.6 | 2.3            | 7.3<br>6.7     | 1.1<br>0.7     | 0.95<br>0.85 | 0.2 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES |       |      |  | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|-------|------|--|---------------------|----------------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |                      |
| SOT223          |            |       |      |  |                     | 96-11-11<br>97-02-28 |

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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.   |   |

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