

# DATA SHEET

**BFR92**

**NPN 5 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

## NPN 5 GHz wideband transistor

## BFR92

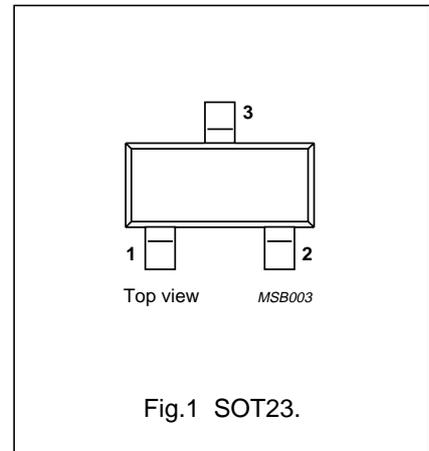
## DESCRIPTION

NPN transistor in a plastic SOT23 envelope primarily intended for use in RF wideband amplifiers and oscillators. The transistor features low intermodulation distortion and high power gain; due to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

PNP complement is BFT92.

## PINNING

| PIN       | DESCRIPTION |
|-----------|-------------|
| Code: P1p |             |
| 1         | base        |
| 2         | emitter     |
| 3         | collector   |



## QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                     | CONDITIONS   | TYP. | MAX. | UNIT |
|-----------|-------------------------------|--|------|------|------|
| $V_{CBO}$ | collector-base voltage        | open emitter   | –    | 20   | V    |
| $V_{CEO}$ | collector-emitter voltage     | open base  | –    | 15   | V    |
| $I_C$     | DC collector current          |  | –    | 25   | mA   |
| $P_{tot}$ | total power dissipation       | up to $T_s = 95\text{ °C}$ ; note 1  | –    | 300  | mW   |
| $f_T$     | transition frequency          | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_j = 25\text{ °C}$  | 5    | –    | GHz  |
| $C_{re}$  | feedback capacitance          | $I_C = 2\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ MHz}$  | 0.4  | –    | pF   |
| $G_{UM}$  | maximum unilateral power gain | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$  | 18   | –    | dB   |
| F         | noise figure                  | $I_C = 2\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$ ; $Z_s = \text{opt.}$   | 2.4  | –    | dB   |
| $V_o$     | output voltage                | $d_{im} = -60\text{ dB}$ ; $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $T_{amb} = 25\text{ °C}$ ; $f_{(p+q-r)} = 493.25\text{ MHz}$ | 150  | –    | mV   |

## 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                           | –    | 15   | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                      | –    | 2    | V    |
| $I_C$     | DC collector current      |                                     | –    | 25   | mA   |
| $P_{tot}$ | total power dissipation   | up to $T_s = 95\text{ °C}$ ; note 1 | –    | 300  | mW   |
| $T_{stg}$ | storage temperature       |                                     | –65  | 150  | °C   |
| $T_j$     | junction temperature      |                                     | –    | 175  | °C   |

## Note

- $T_s$  is the temperature at the soldering point of the collector tab.

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## THERMAL RESISTANCE

| SYMBOL        | PARAMETER   | CONDITIONS                          | THERMAL RESISTANCE |
|---------------|---|-------------------------------------|--------------------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | up to $T_s = 95\text{ °C}$ ; note 1 | 260 K/W            |

## Note

- $T_s$  is the temperature at the soldering point of the collector tab.

## CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise specified.

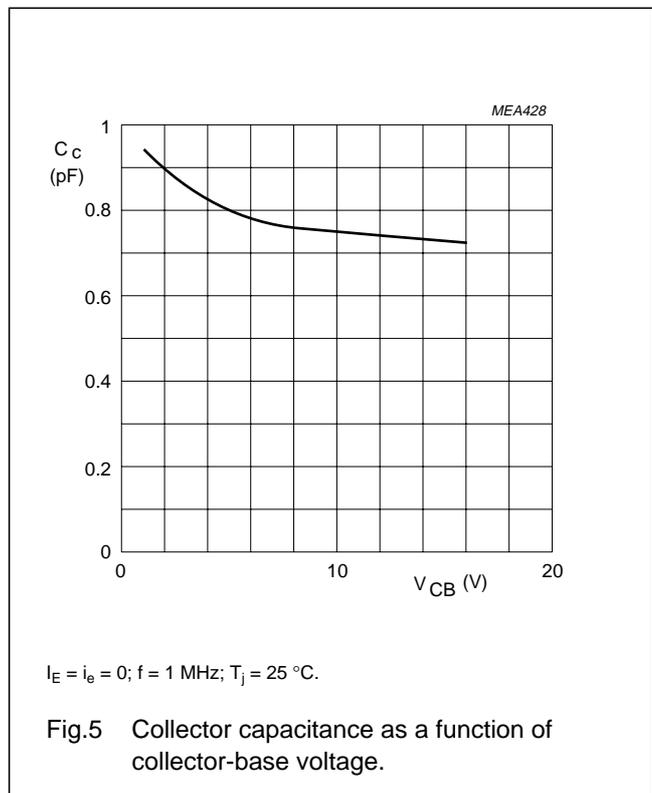
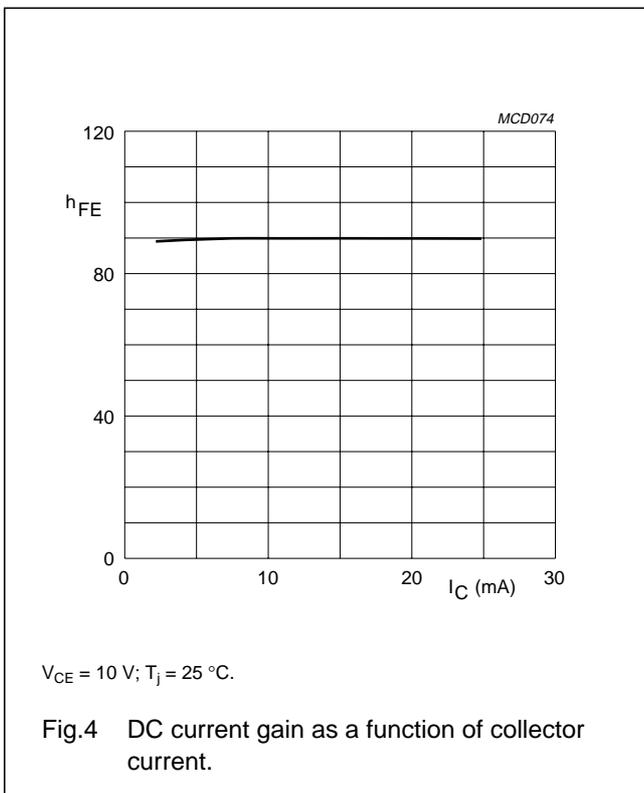
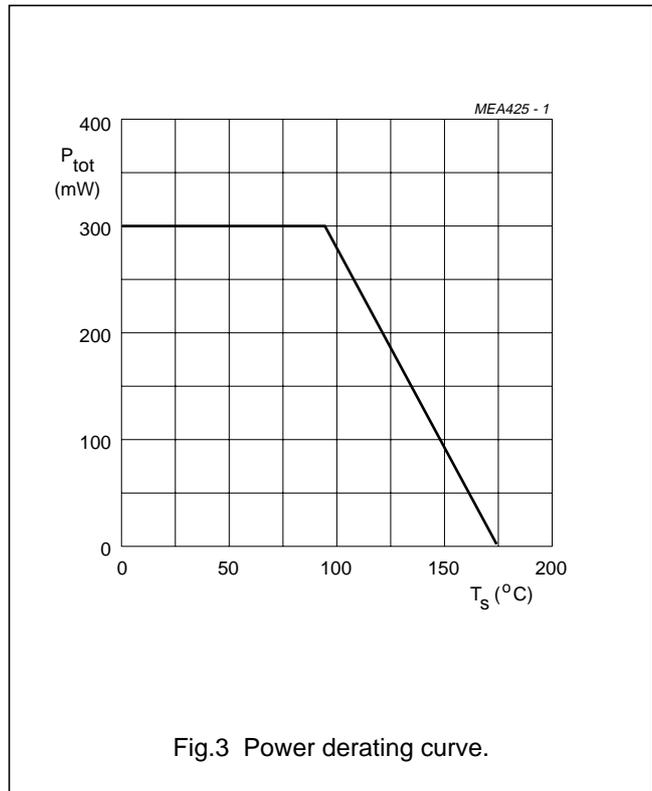
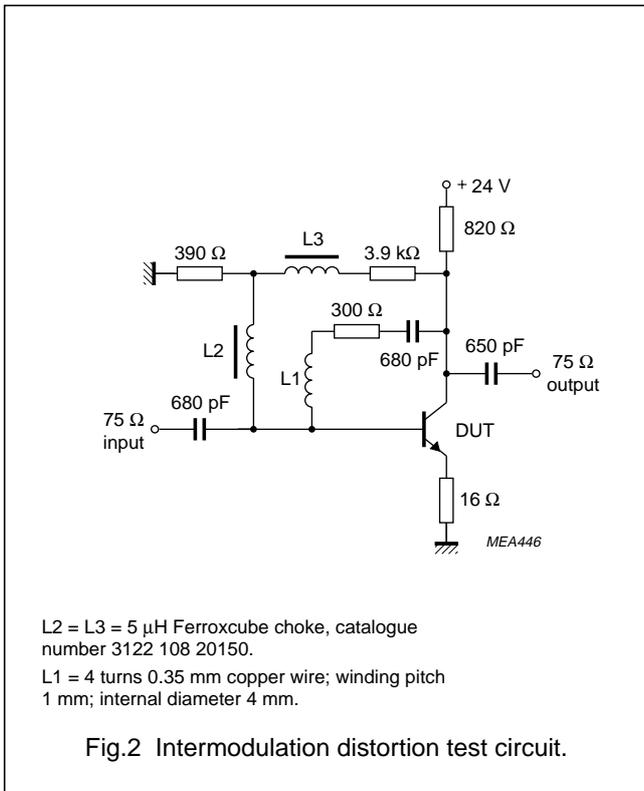
| SYMBOL    | PARAMETER                                 | CONDITIONS  | MIN. | TYP. | MAX. | UNIT |
|-----------|---|---|------|------|------|------|
| $I_{CBO}$ | collector cut-off current                 | $I_E = 0$ ; $V_{CB} = 10\text{ V}$  | –    | –    | 50   | nA   |
| $h_{FE}$  | DC current gain                           | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$   | 40   | 90   | –    |      |
| $f_T$     | transition frequency                      | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$  | –    | 5    | –    | GHz  |
| $C_c$     | collector capacitance                     | $I_E = i_e = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$   | –    | 0.75 | –    | pF   |
| $C_e$     | emitter capacitance                       | $I_C = i_c = 0$ ; $V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$  | –    | 0.8  | –    | pF   |
| $C_{re}$  | feedback capacitance                      | $I_C = 2\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ MHz}$ ;<br>$T_{amb} = 25\text{ °C}$                         | –    | 0.4  | –    | pF   |
| $G_{UM}$  | maximum unilateral power gain<br>(note 1) | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ;<br>$f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$                      | –    | 18   | –    | dB   |
| F         | noise figure (see Fig.2 and note 2)       | $I_C = 2\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ;<br>$T_{amb} = 25\text{ °C}$ ; $Z_s = \text{opt.}$ | –    | 2.4  | –    | dB   |
| $V_o$     | output voltage                            | note 3  | –    | 150  | –    | mV   |

## Notes

- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and  $G_{UM} = 10 \log \left( \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \right)$  dB
- Crystal mounted in a SOT37 envelope (BFR90).
- $d_{im} = -60\text{ dB}$  (DIN 45004B);  $I_C = 14\text{ mA}$ ;  $V_{CE} = 10\text{ V}$ ;  $R_L = 75\ \Omega$ ;  $T_{amb} = 25\text{ °C}$ ;  
 $V_p = V_o$  at  $d_{im} = -60\text{ dB}$ ;  $f_p = 495.25\text{ MHz}$ ;  
 $V_q = V_o - 6\text{ dB}$ ;  $f_q = 503.25\text{ MHz}$ ;  
 $V_r = V_o - 6\text{ dB}$ ;  $f_r = 505.25\text{ MHz}$ ;  
measured at  $f_{(p+q-r)} = 493.25\text{ MHz}$ .

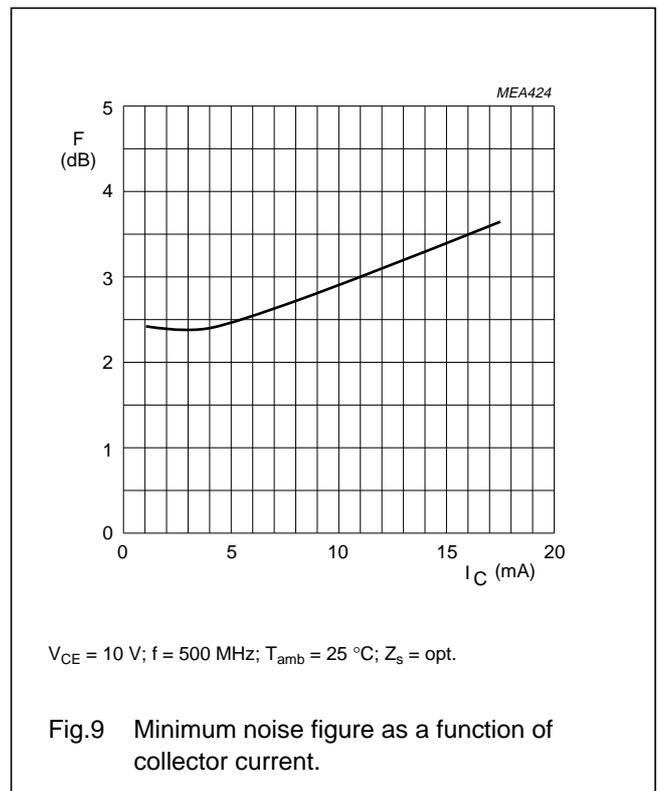
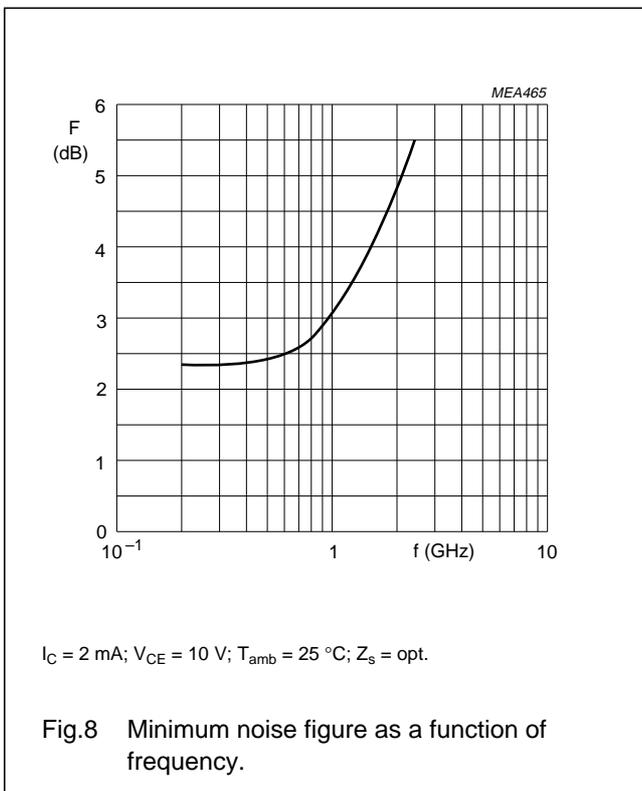
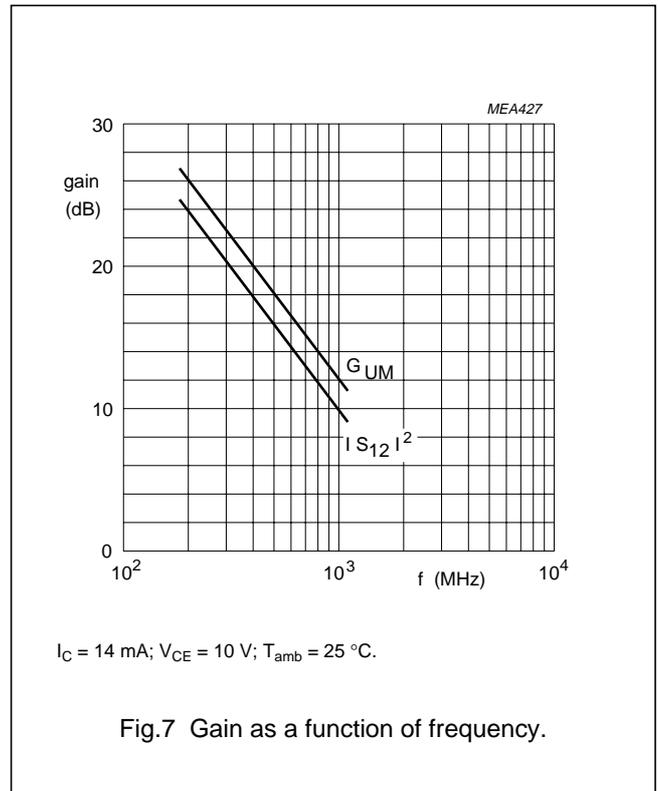
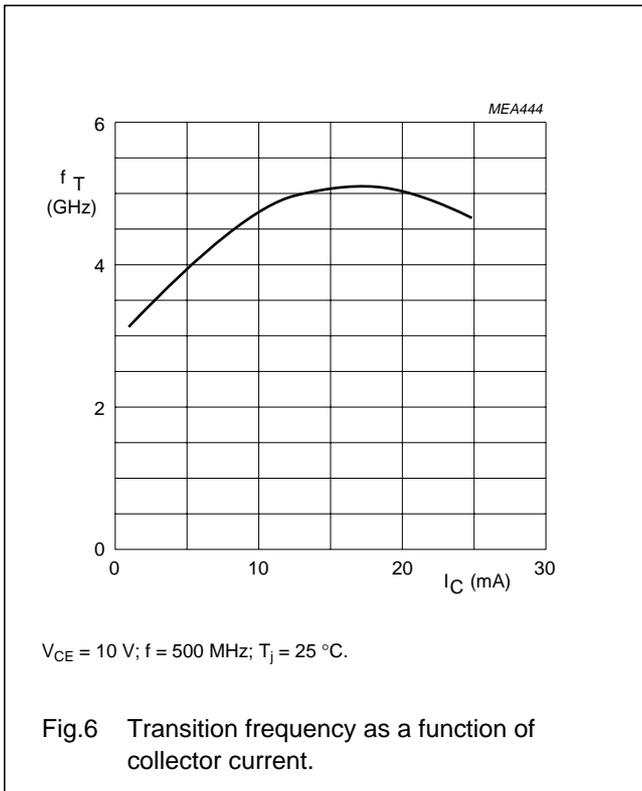
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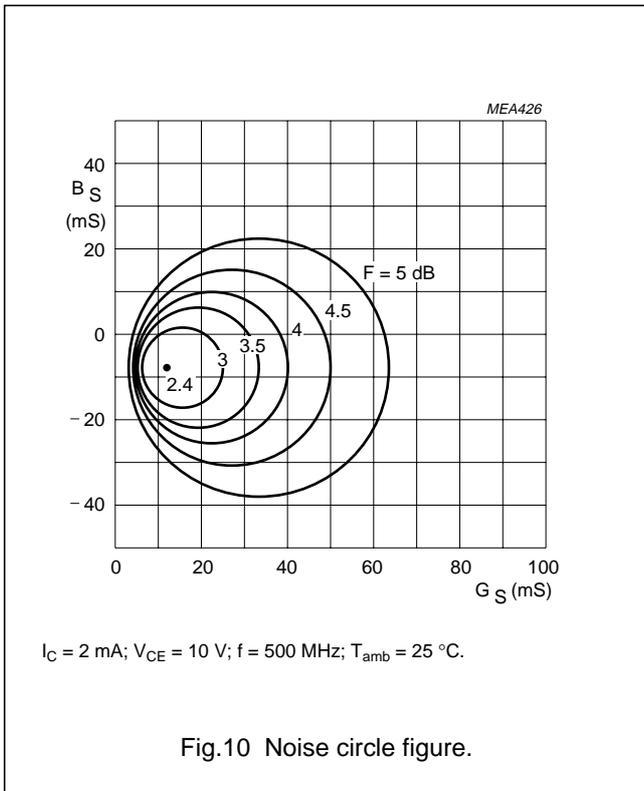
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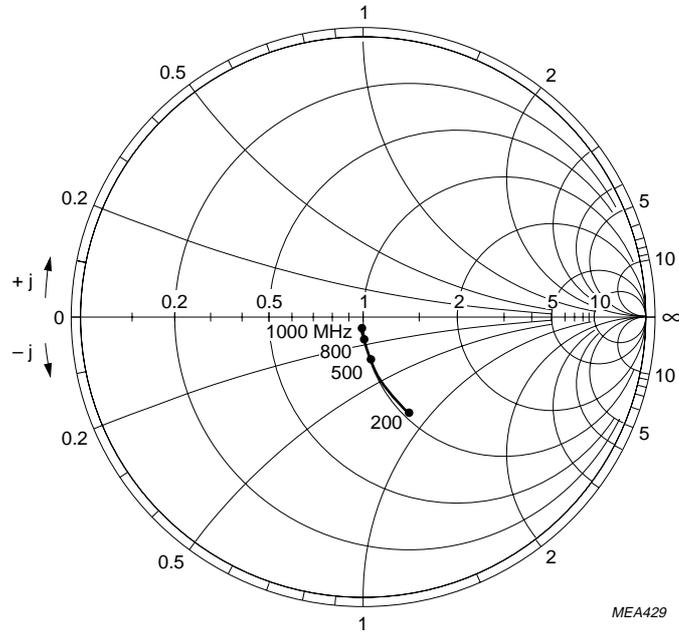
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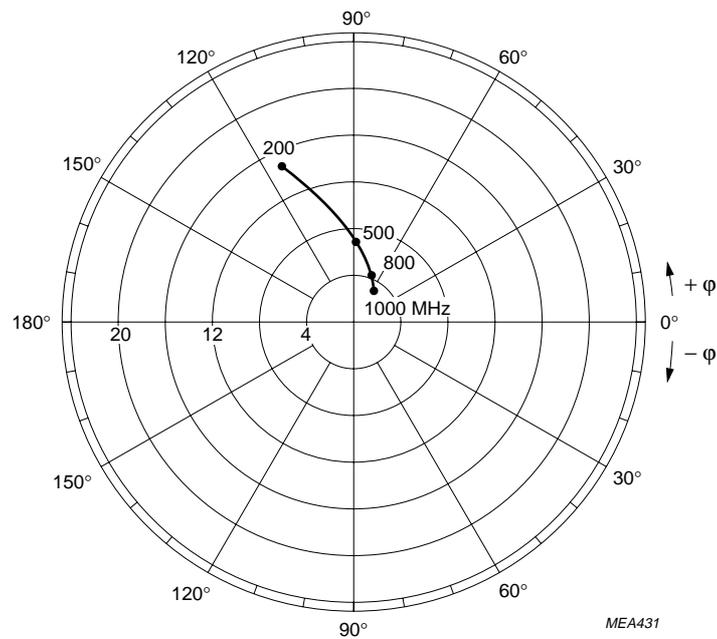
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$I_C = 14 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_0 = 50 \text{ } \Omega$ .

Fig.11 Common emitter input reflection coefficient ( $S_{11}$ ).

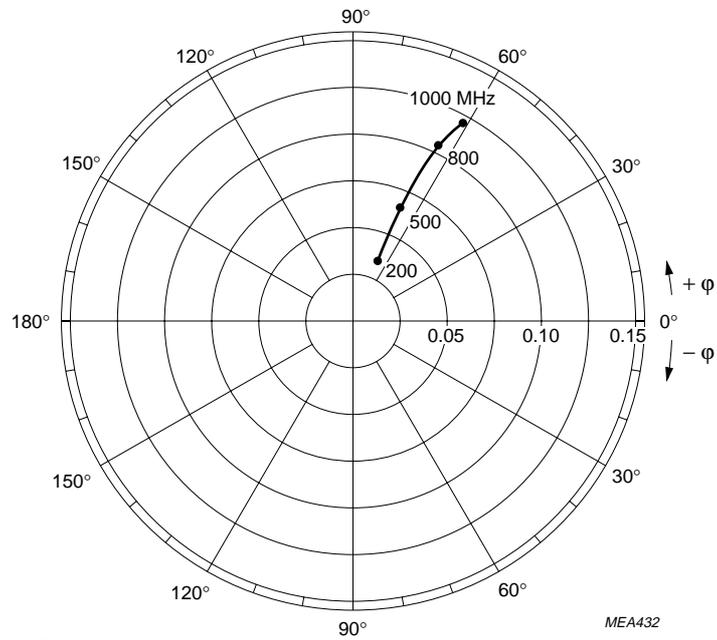


$I_C = 14 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.12 Common emitter forward transmission coefficient ( $S_{21}$ ).

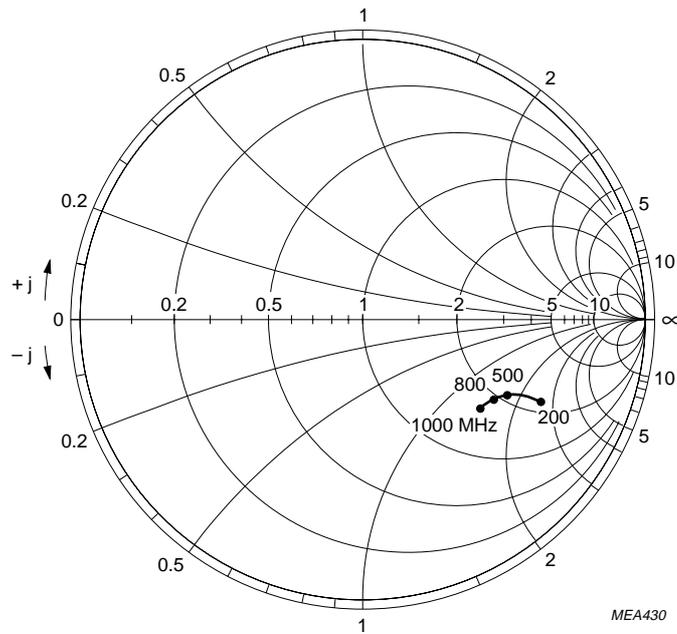
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$I_C = 14 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.13 Common emitter reverse transmission coefficient ( $S_{12}$ ).



$I_C = 14 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_0 = 50 \text{ } \Omega$ .

Fig.14 Common emitter output reflection coefficient ( $S_{22}$ ).

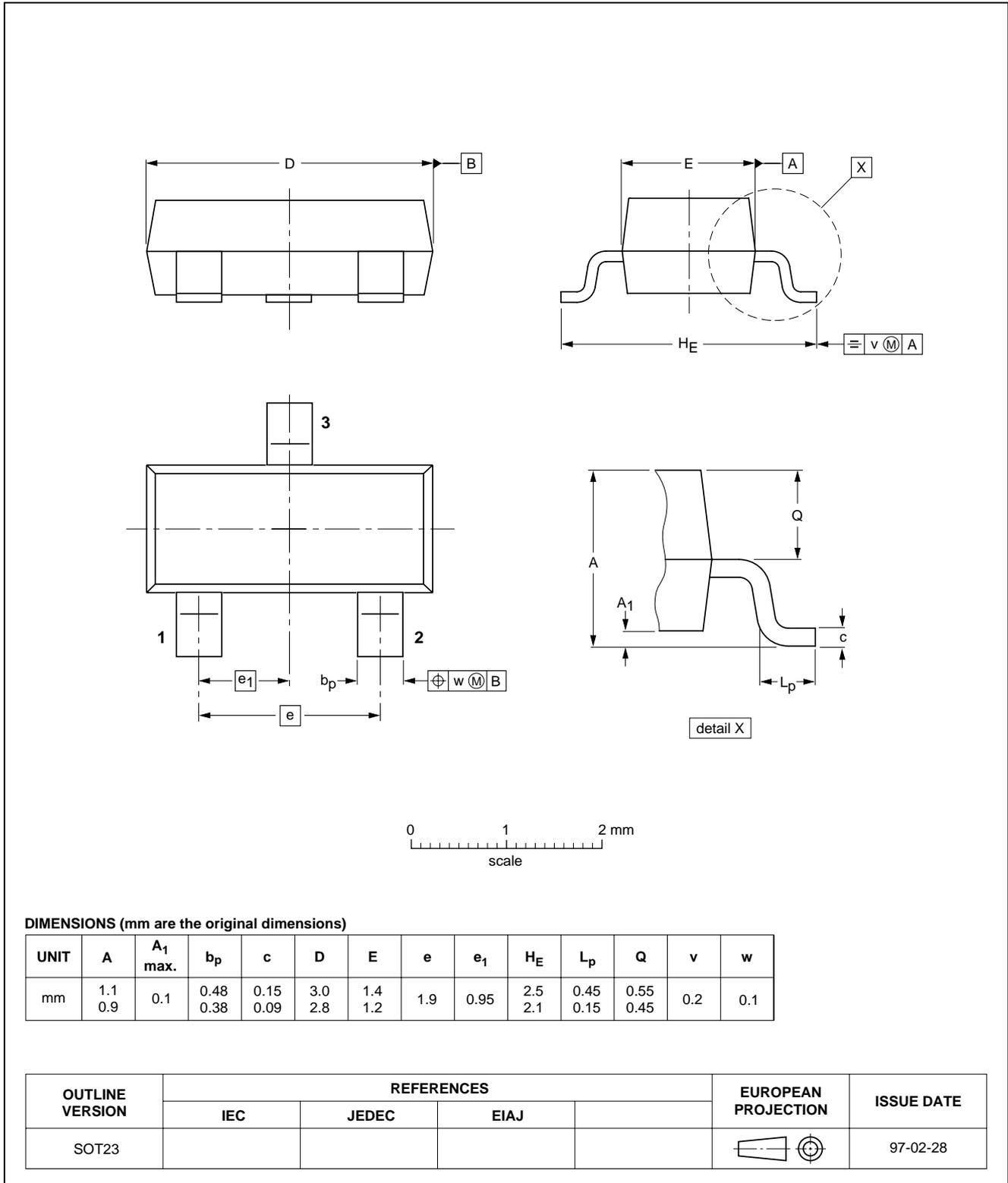
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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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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