

DATA SHEET

BFR93

NPN 5 GHz wideband transistor

Product specification
Supersedes data of September 1995
File under discrete semiconductors, SC14

1997 Oct 29

NPN 5 GHz wideband transistor

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FEATURES

- Very low intermodulation distortion
- High power gain
- Excellent wideband properties and low noise up to high frequencies due to its very high transition frequency.

APPLICATIONS

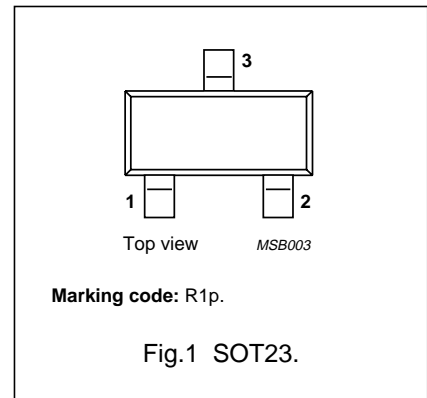
- RF wideband amplifiers and oscillators.

DESCRIPTION

NPN wideband transistor in a plastic SOT23 package.
PNP complement: BFT93.

PINNING

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



QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | TYP. | MAX. | UNIT |
|-----------|-------------------------------|--|------|------|------|
| V_{CBO} | collector-base voltage | open emitter | – | 15 | V |
| V_{CEO} | collector-emitter voltage | open base | – | 12 | V |
| I_C | collector current (DC) | | – | 35 | mA |
| P_{tot} | total power dissipation | $T_s \leq 95\text{ °C}$ | – | 300 | mW |
| C_{re} | feedback capacitance | $I_C = 2\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 1\text{ MHz}$ | 0.8 | – | pF |
| f_T | transition frequency | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$; $T_j = 25\text{ °C}$ | 5 | – | GHz |
| G_{UM} | maximum unilateral power gain | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | 16.5 | – | dB |
| F | noise figure | $I_C = 2\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | 1.9 | – | dB |
| d_{im} | intermodulation distortion | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $R_L = 75\text{ }\Omega$; $V_O = 300\text{ mV}$; $f_p + f_q - f_r = 493.25\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | –60 | – | dB |

LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|---------------------------|----------------------------------|------|------|------|
| V_{CBO} | collector-base voltage | open emitter | – | 15 | V |
| V_{CEO} | collector-emitter voltage | open base | – | 12 | V |
| V_{EBO} | emitter-base voltage | open collector | – | 2 | V |
| I_C | collector current (DC) | | – | 35 | mA |
| P_{tot} | total power dissipation | $T_s \leq 95\text{ °C}$; note 1 | – | 300 | mW |
| T_{stg} | storage temperature | | –65 | +150 | °C |
| T_j | junction temperature | | – | 175 | °C |

Note

1. T_s is the temperature at the soldering point of the collector pin.

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THERMAL CHARACTERISTICS

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

Note

- T_s is the temperature at the soldering point of the collector pin.

CHARACTERISTICS

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

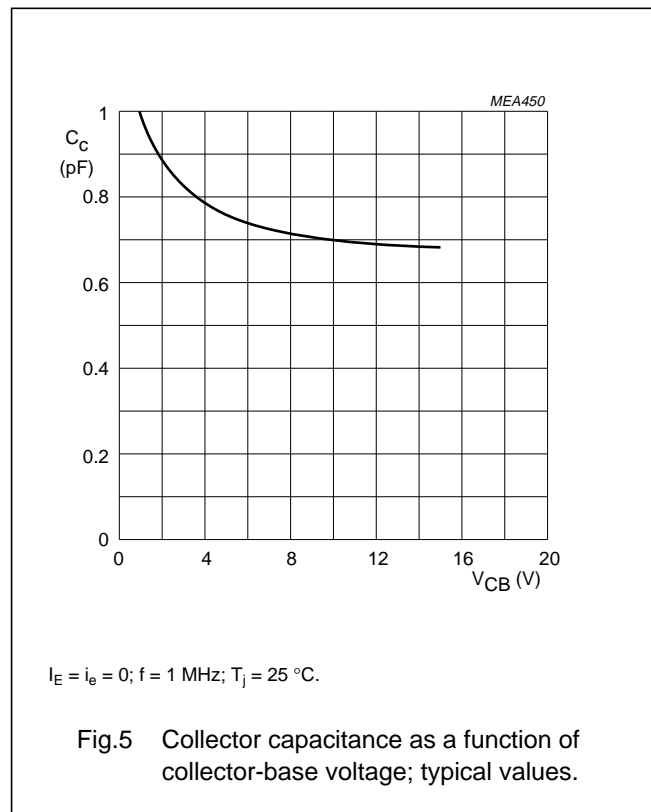
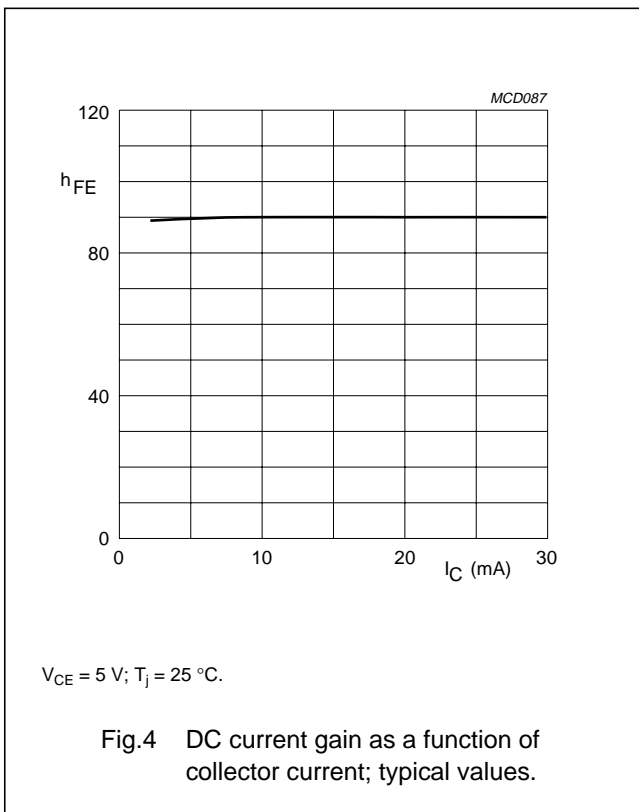
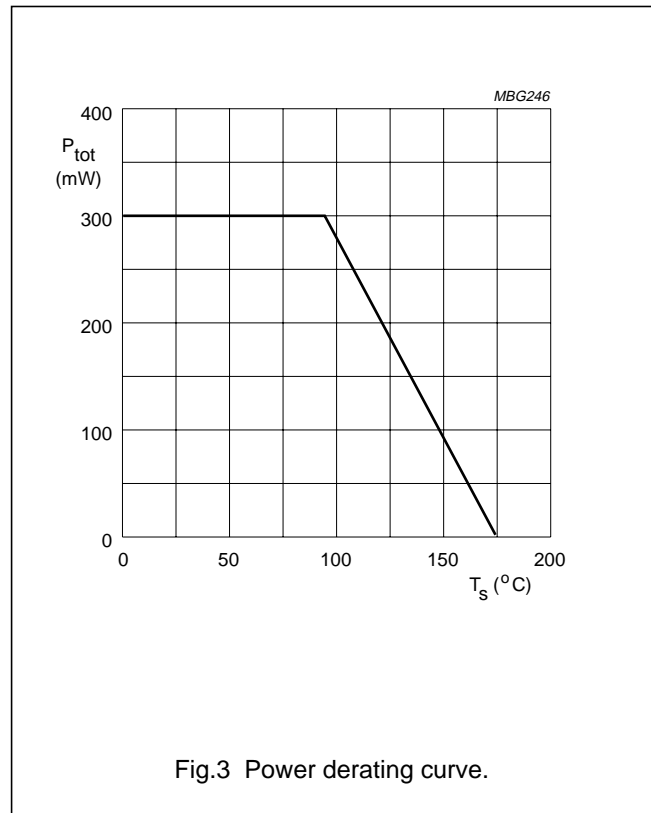
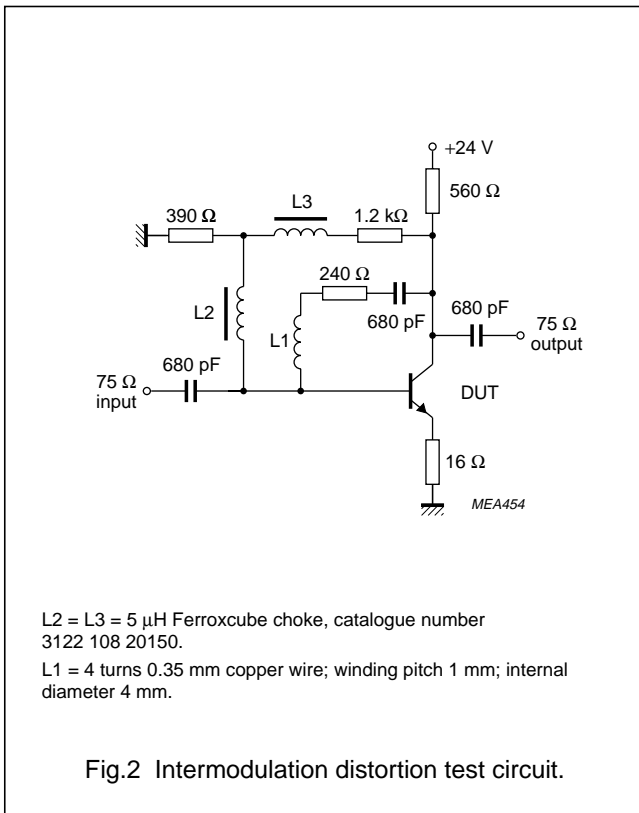
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------|---|--|------|------|------|------|
| I_{CBO} | collector cut-off current | $I_E = 0$; $V_{CB} = 10\text{ V}$ | – | – | 50 | nA |
| h_{FE} | DC current gain | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$ | 40 | 90 | – | |
| C_c | collector capacitance | $I_E = i_e = 0$; $V_{CB} = 10\text{ V}$; $f = 1\text{ MHz}$ | – | 0.7 | – | pF |
| C_e | emitter capacitance | $I_C = i_c = 0$; $V_{EB} = 0.5\text{ V}$; $f = 1\text{ MHz}$ | – | 1.8 | – | pF |
| C_{re} | feedback capacitance | $I_C = 2\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | – | 0.8 | – | pF |
| f_T | transition frequency | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$ | – | 5 | – | GHz |
| G_{UM} | maximum unilateral power gain (note 1) | $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$ | – | 16.5 | – | dB |
| F | noise figure (note 2) | $I_C = 2\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$; $Z_S = \text{opt.}$; $T_{amb} = 25\text{ °C}$ | – | 1.9 | – | dB |
| d_{im} | intermodulation distortion | note 3 | – | –60 | – | dB |

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
- Die mounted in a SOT37 package (BFR91).
- $I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $R_L = 75\ \Omega$; $VSWR < 2$; $T_{amb} = 25\text{ °C}$;
 $V_p = V_O = 300\text{ mV}$ at $f_p = 495.25\text{ MHz}$;
 $V_q = V_O - 6\text{ dB}$ at $f_q = 503.25\text{ MHz}$;
 $V_r = V_O - 6\text{ dB}$ at $f_r = 505.25\text{ MHz}$;
measured at $f_p + f_q - f_r = 493.25\text{ MHz}$.

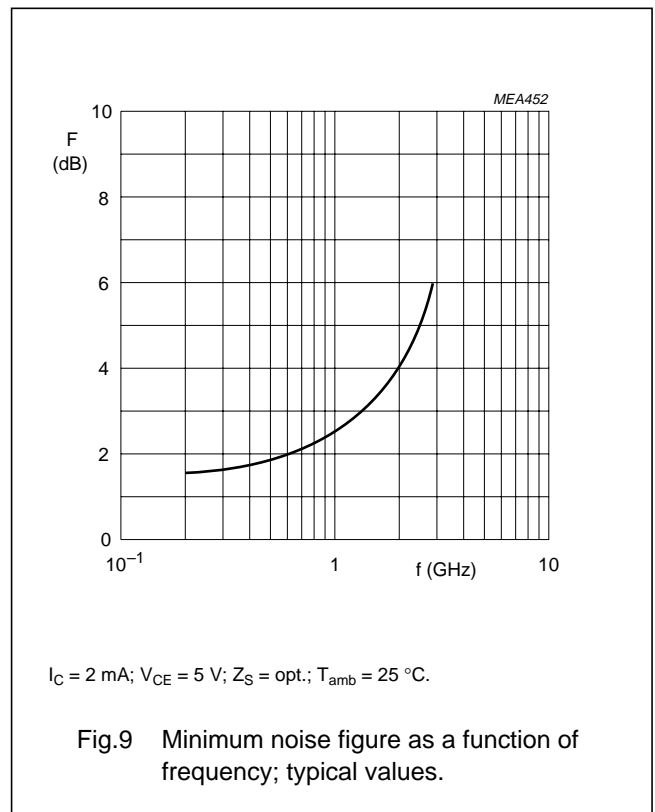
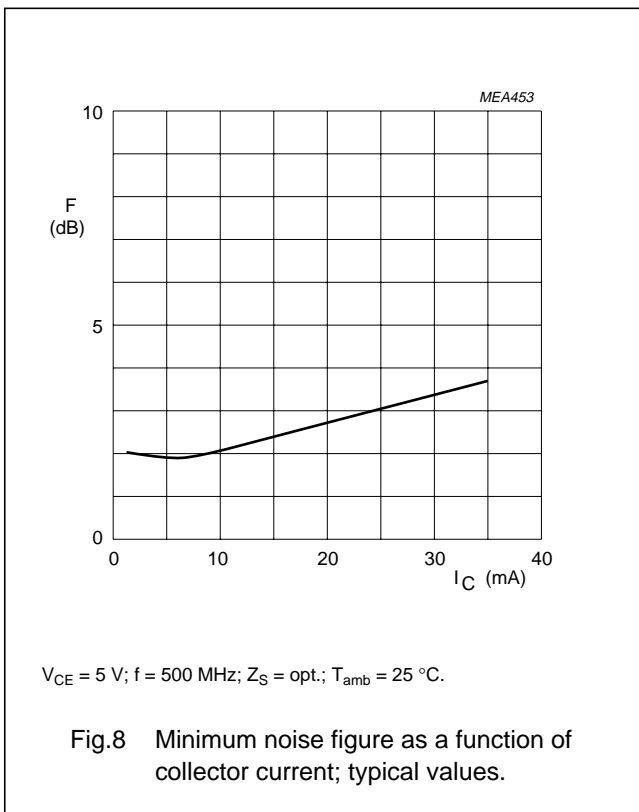
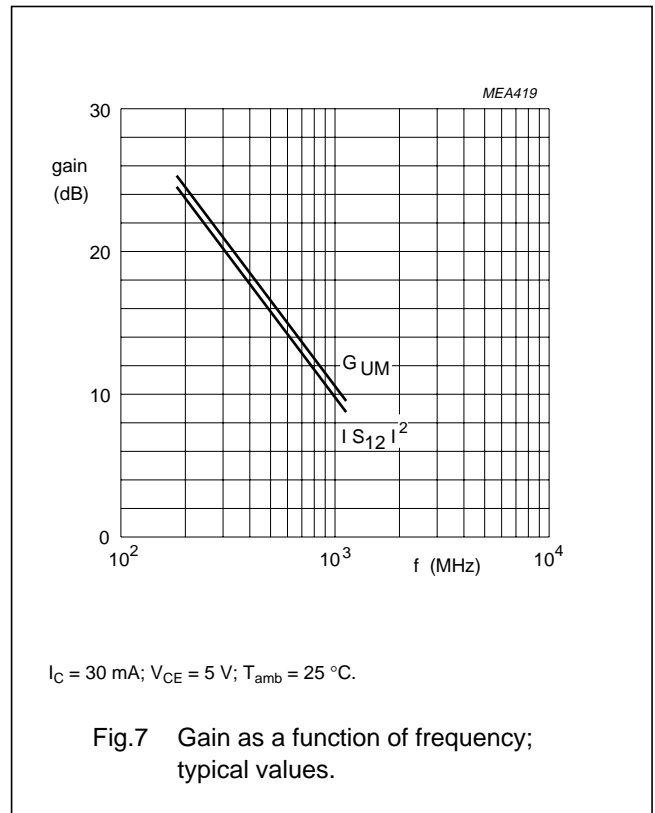
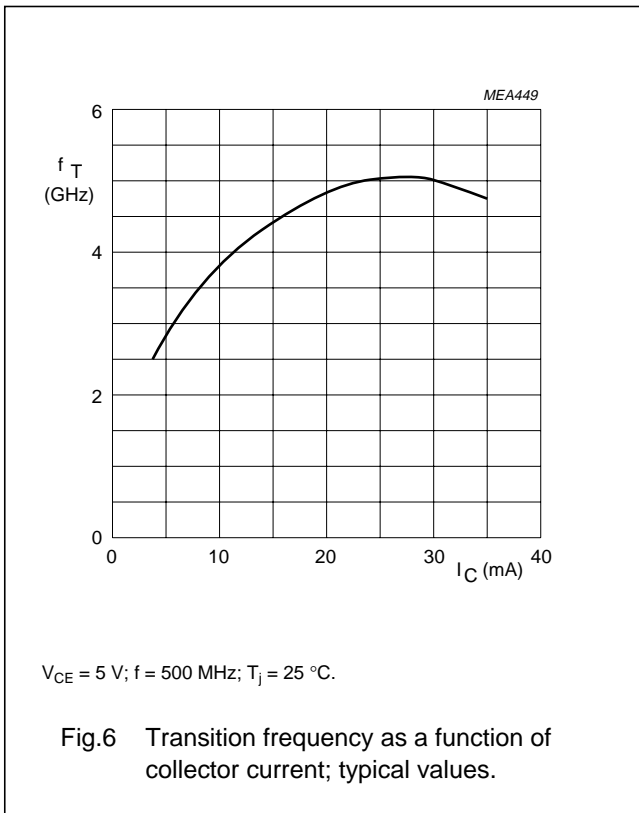
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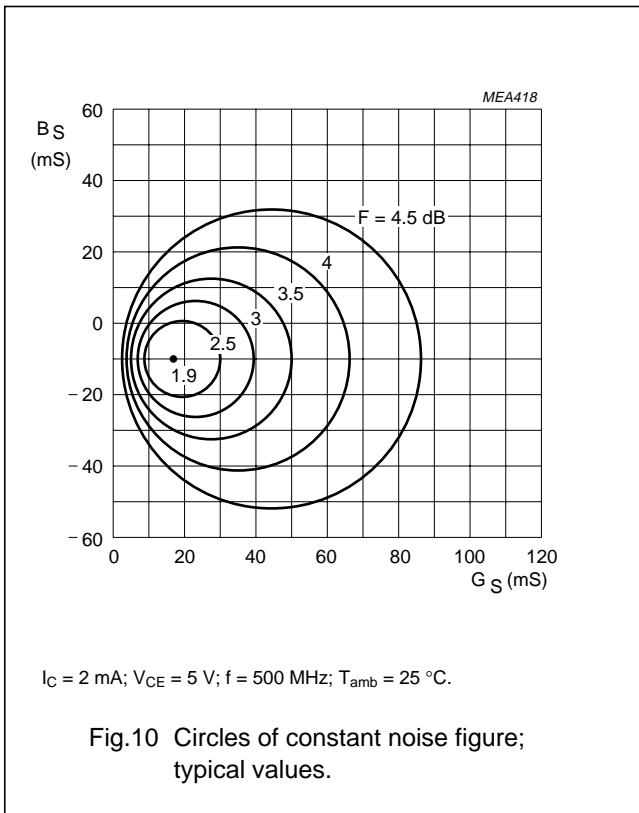
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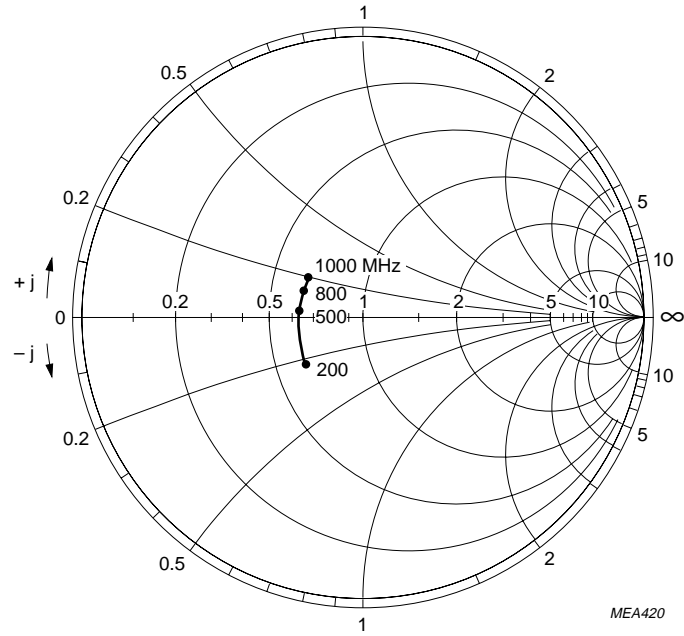
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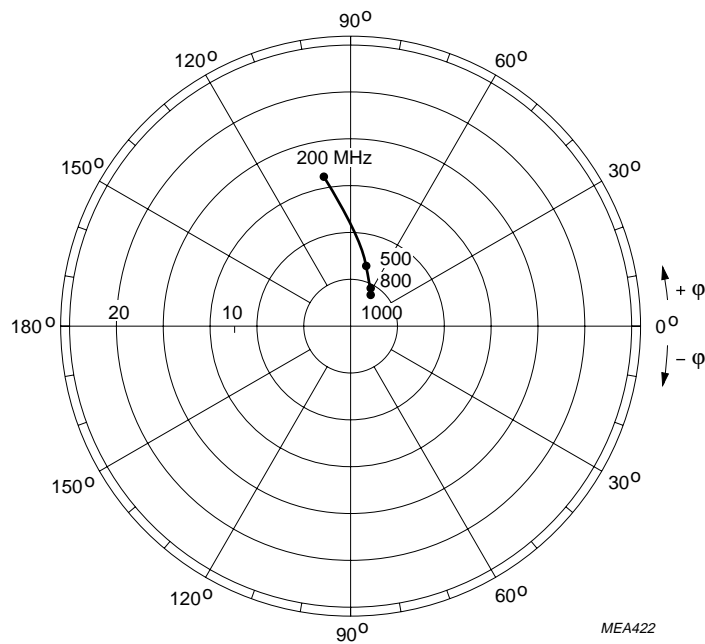
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$I_C = 30 \text{ mA}$; $V_{CE} = 5 \text{ V}$; $Z_0 = 50 \Omega$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

Fig.11 Common emitter input reflection coefficient (S_{11}); typical values.

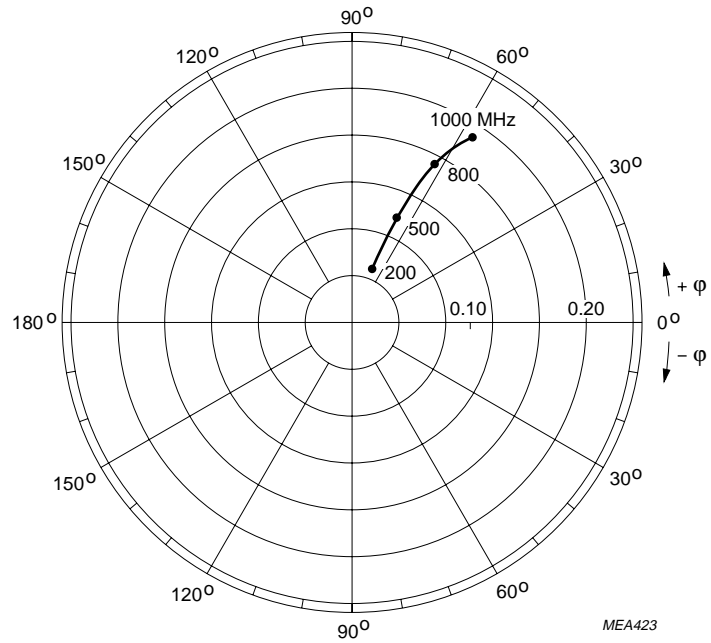


$I_C = 30 \text{ mA}$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

Fig.12 Common emitter forward transmission coefficient (S_{21}); typical values.

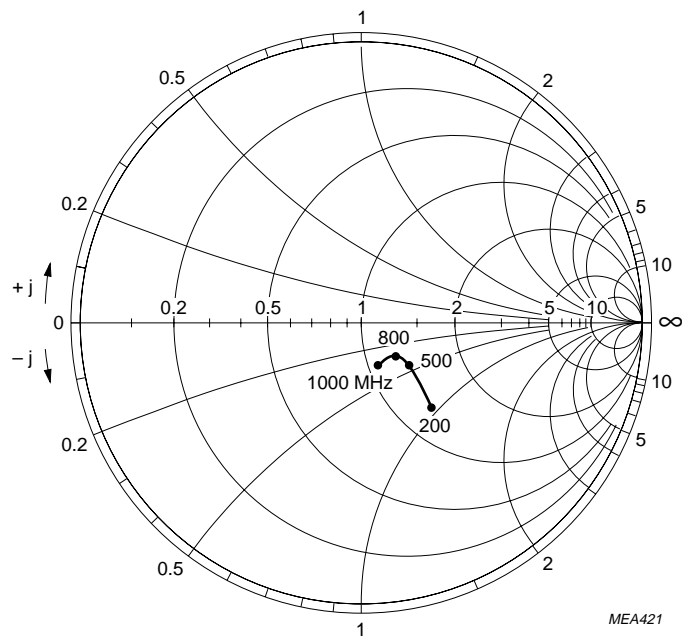
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$I_C = 30 \text{ mA}$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

Fig.13 Common emitter reverse transmission coefficient (S_{12}); typical values.



$I_C = 30 \text{ mA}$; $V_{CE} = 5 \text{ V}$; $Z_0 = 50 \text{ } \Omega$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

Fig.14 Common emitter output reflection coefficient (S_{22}); typical values.

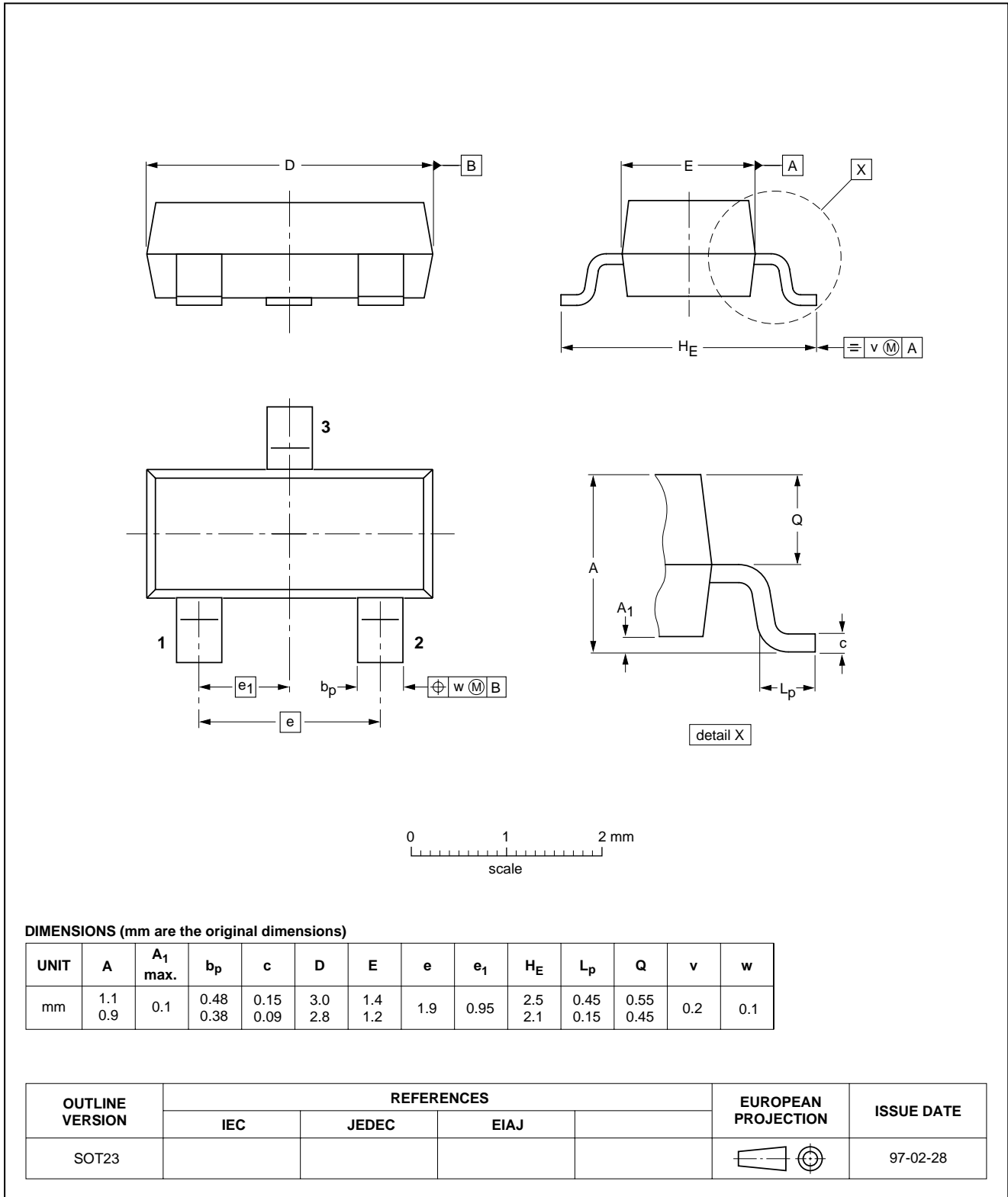
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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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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