

# DATA SHEET

**BFR106**

**NPN 5 GHz wideband transistor**

Product specification

September 1995



# NPN 5 GHz wideband transistor

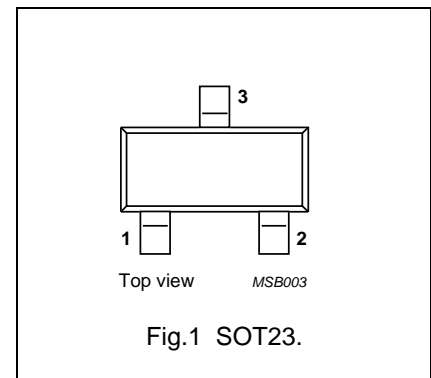
# BFR106

## DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT23 envelope. It is primarily intended for low noise, general RF applications.

## PINNING

| PIN       | DESCRIPTION |
|-----------|-------------|
| Code: R7p |             |
| 1         | base        |
| 2         | emitter     |
| 3         | collector   |



## QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                     | CONDITIONS  | MIN. | 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          |   | –    | –    | 100  | mA   |
| $P_{tot}$ | total power dissipation       | up to $T_s = 70\text{ °C}$ ; note 1   | –    | –    | 500  | mW   |
| $h_{FE}$  | DC current gain               | $I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$ ; $T_{amb} = 25\text{ °C}$   | 25   | 80   | –    |      |
| $f_T$     | transition frequency          | $I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$  | –    | 5    | –    | GHz  |
| $G_{UM}$  | maximum unilateral power gain | $I_C = 30\text{ mA}$ ; $V_{CE} = 6\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$  | –    | 11.5 | –    | dB   |
| $V_o$     | output voltage                | $I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $T_{amb} = 25\text{ °C}$ ; $d_{im} = -60\text{ dB}$ ; $f_{(p+q-r)} = 793.25\text{ MHz}$ | –    | 350  | –    | 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                      | –    | 3    | V    |
| $I_C$     | DC collector current      |                                     | –    | 100  | mA   |
| $P_{tot}$ | total power dissipation   | up to $T_s = 70\text{ °C}$ ; note 1 | –    | 500  | 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 $T_s = 70\text{ °C}$ ; note 1 | 210 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               | $I_E = 0$ ; $V_{CB} = 10\text{ V}$  | –    | –    | 100  | nA   |
| $h_{FE}$  | DC current gain                         | $I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$  | 25   | 80   | –    |      |
| $f_T$     | transition frequency                    | $I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$ ; $f = 500\text{ MHz}$ ;<br>$T_{amb} = 25\text{ °C}$ | –    | 5    | –    | GHz  |
| $C_c$     | collector capacitance                   | $I_E = i_e = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$                                     | –    | 1.5  | –    | pF   |
| $C_e$     | emitter capacitance                     | $I_C = i_c = 0$ ; $V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$                                    | –    | 4.5  | –    | pF   |
| $C_{re}$  | feedback capacitance                    | $I_C = 0$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ MHz}$   | –    | 1.2  | –    | pF   |
| $G_{UM}$  | maximum unilateral power gain (note 1)  | $I_C = 30\text{ mA}$ ; $V_{CE} = 6\text{ V}$ ; $f = 800\text{ MHz}$ ;<br>$T_{amb} = 25\text{ °C}$ | –    | 11.5 | –    | dB   |
| F         | noise figure                            | $I_C = 30\text{ mA}$ ; $V_{CE} = 6\text{ V}$ ; $f = 800\text{ MHz}$ ;<br>$T_{amb} = 25\text{ °C}$ | –    | 3.5  | –    | dB   |
| $d_2$     | second order intermodulation distortion | note 2  | –    | –50  | –    | dB   |
| $V_o$     | output voltage                          | note 3  | –    | 350  | –    | mV   |

## Notes

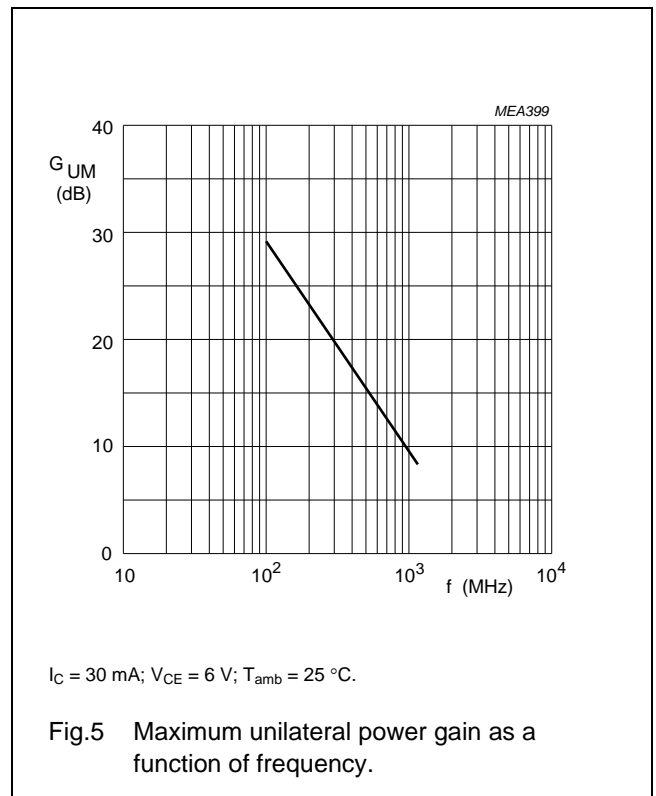
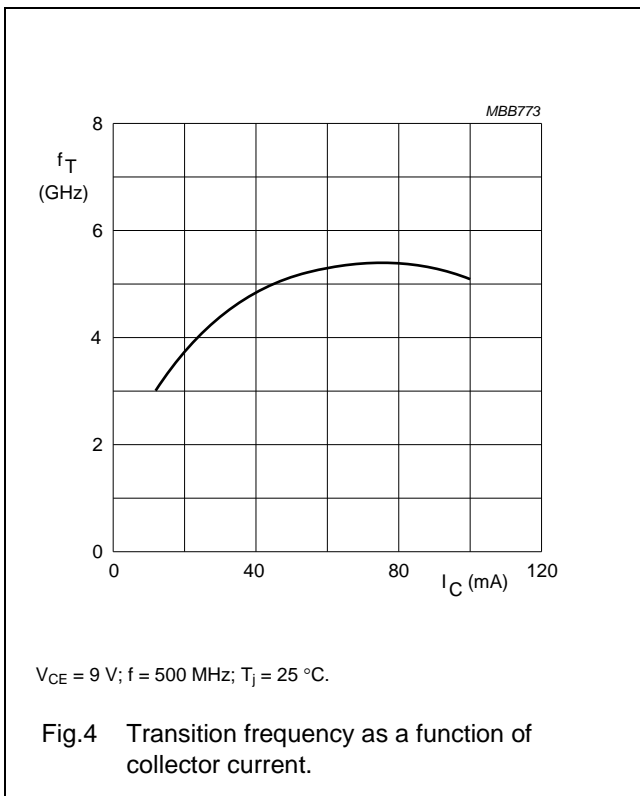
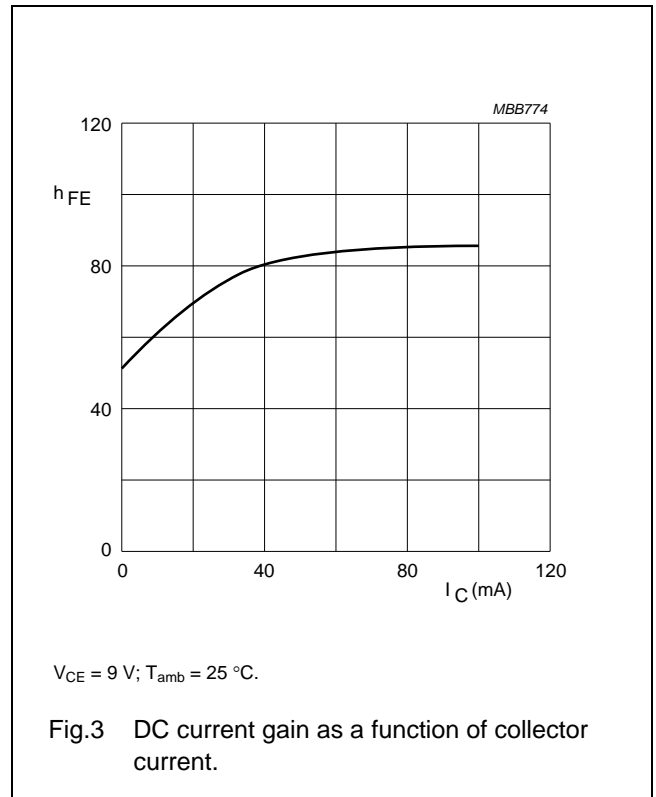
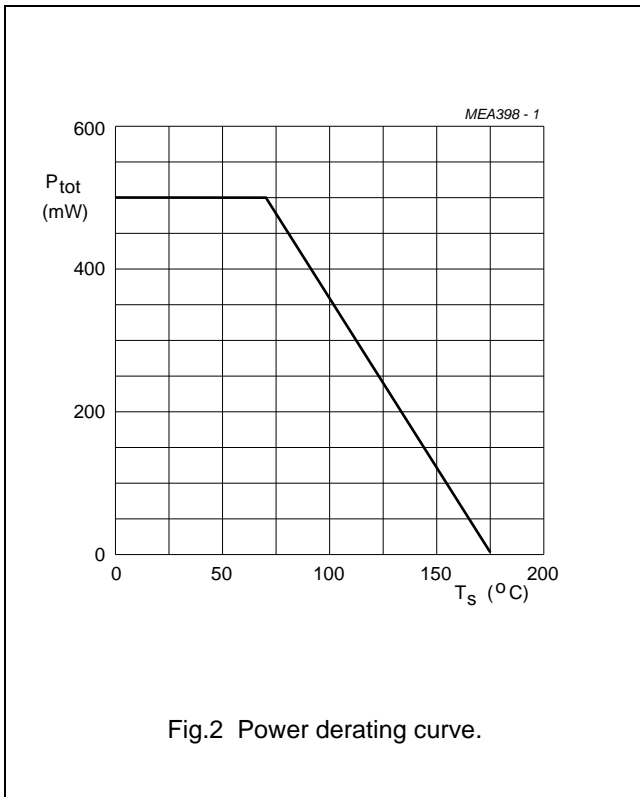
- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and

$$G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \text{ dB.}$$

- $I_C = 30\text{ mA}$ ;  $V_{CE} = 6\text{ V}$ ;  $R_L = 75\ \Omega$ ;  $T_{amb} = 25\text{ °C}$ ;  
 $f_{(p+q)} = 810\text{ MHz}$ ;  $V_o = 100\text{ mV}$ .
- $d_{im} = -60\text{ dB}$  (DIN 45004B);  $I_C = 50\text{ mA}$ ;  $V_{CE} = 9\text{ V}$ ;  $R_L = 75\ \Omega$ ;  $T_{amb} = 25\text{ °C}$ ;  $f_{(p+q-r)} = 793.25\text{ MHz}$ .

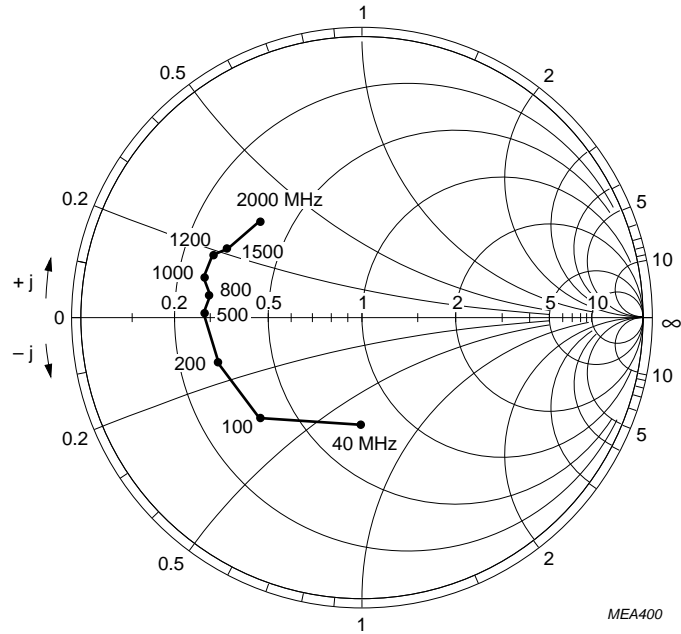
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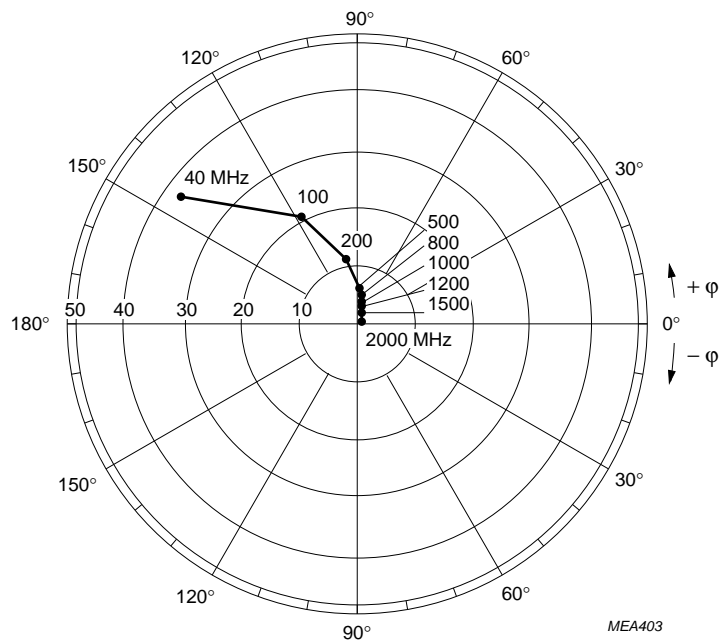
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$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_o = 50 \text{ } \Omega$ .

Fig.6 Common emitter input reflection coefficient ( $S_{11}$ ).

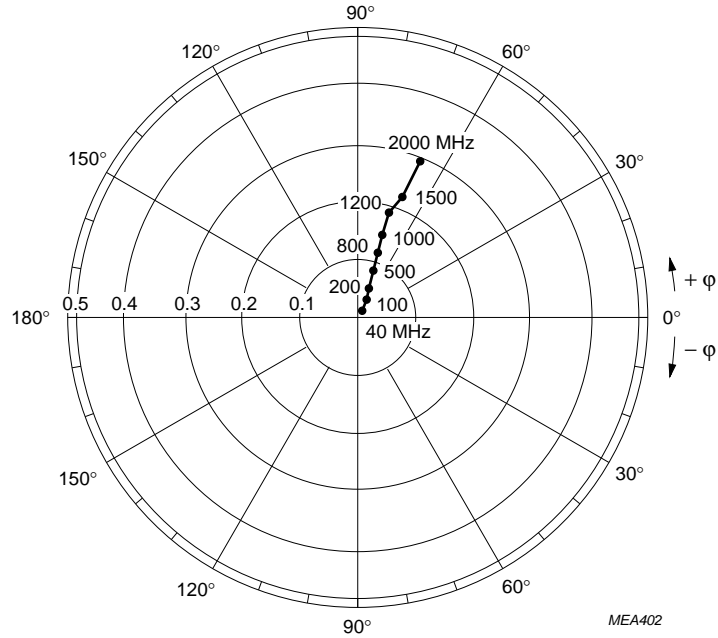


$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.7 Common emitter forward transmission coefficient ( $S_{21}$ ).

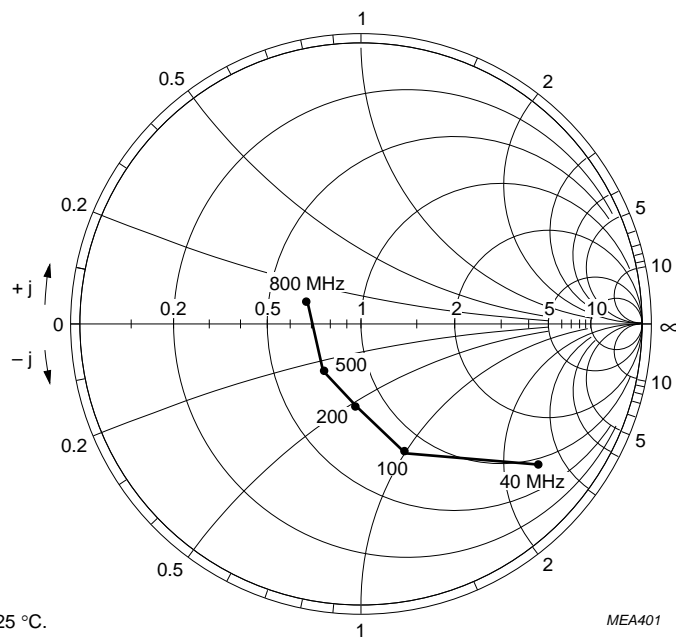
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$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.8 Common emitter reverse transmission coefficient ( $S_{12}$ ).



$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_0 = 50 \text{ } \Omega$ .

Fig.9 Common emitter output reflection coefficient ( $S_{22}$ ).

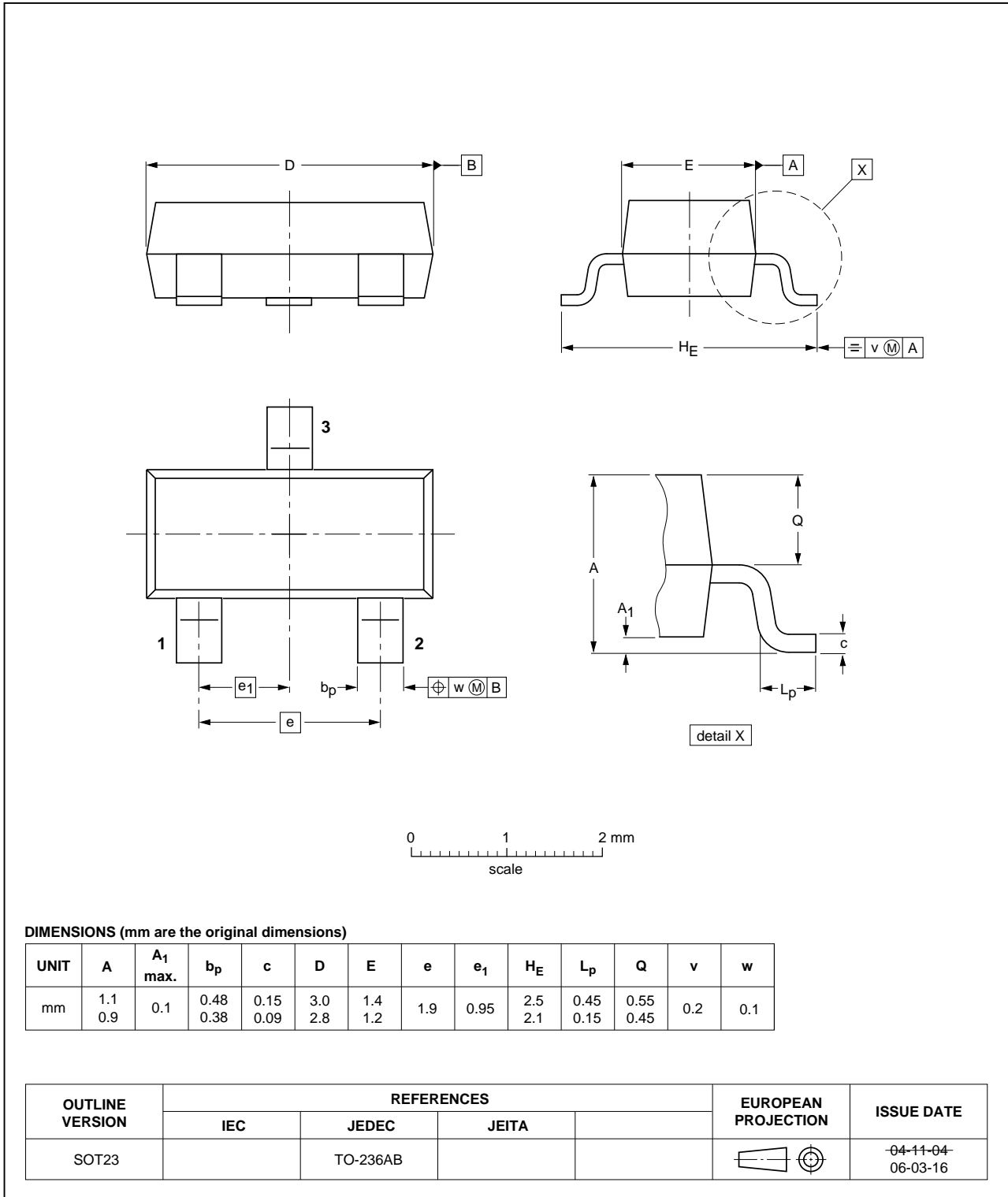
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PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT23



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## DATA SHEET STATUS

| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION  |
|--------------------------------|-------------------------------|---|
| Objective data sheet           | Development                   | This document contains data from the objective specification for product development. |
| Preliminary data sheet         | Qualification                 | This document contains data from the preliminary specification.                       |
| Product data sheet             | Production                    | This document contains the product specification.                                     |

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