

# DATA SHEET

**BFR106**

**NPN 5 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

## NPN 5 GHz wideband transistor

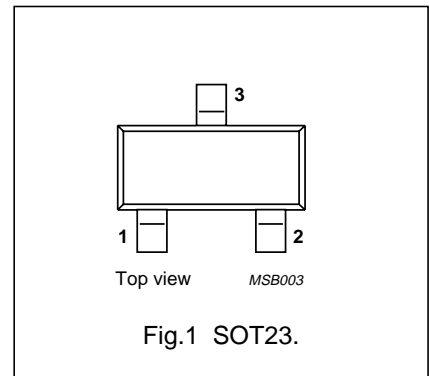
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## DESCRIPTION

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	$I_C = 50\text{ mA}$ ; $V_{CE} = 9\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	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)	$I_C = 30\text{ mA}$ ; $V_{CE} = 6\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	11.5	–	dB
F	noise figure	$I_C = 30\text{ mA}$ ; $V_{CE} = 6\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	3.5	–	dB
$d_2$	second order intermodulation distortion	note 2	–	–50	–	dB
$V_o$	output voltage	note 3	–	350	–	mV

## Notes

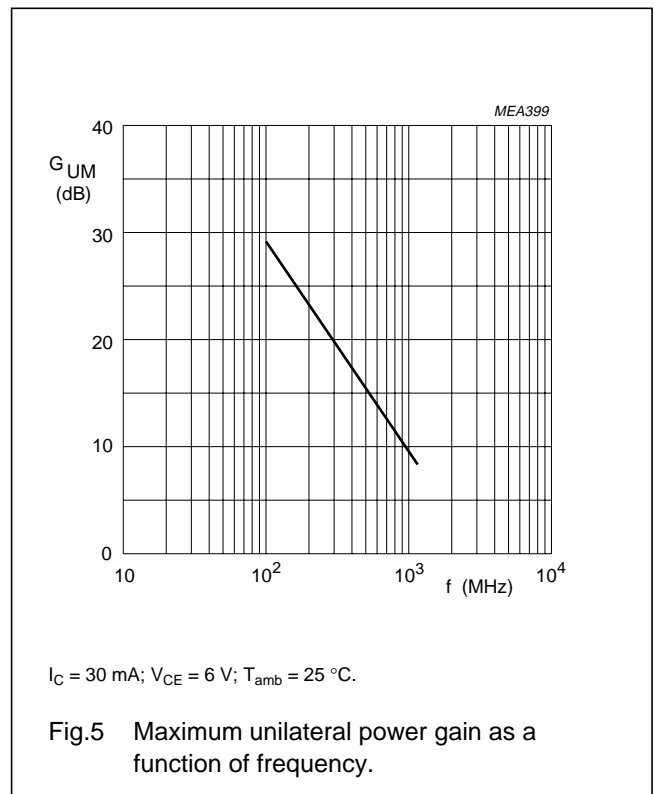
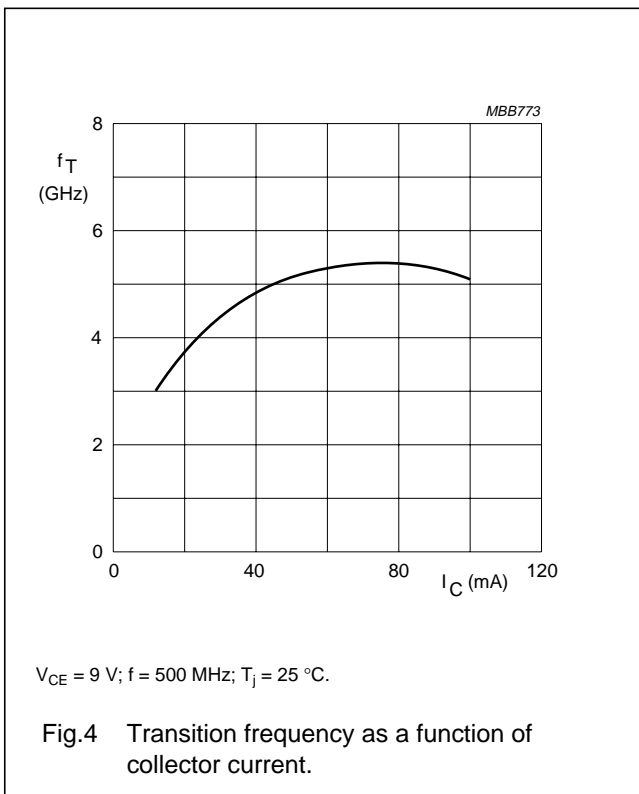
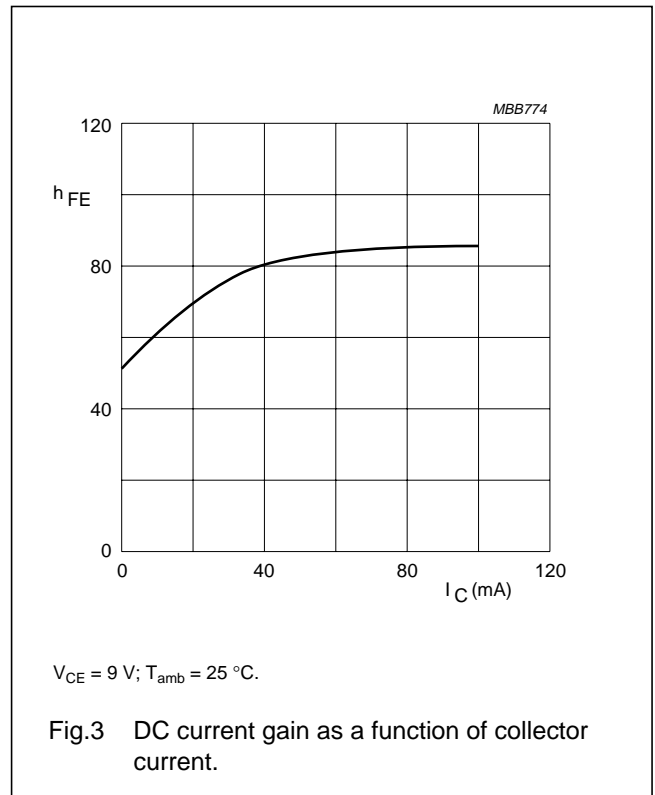
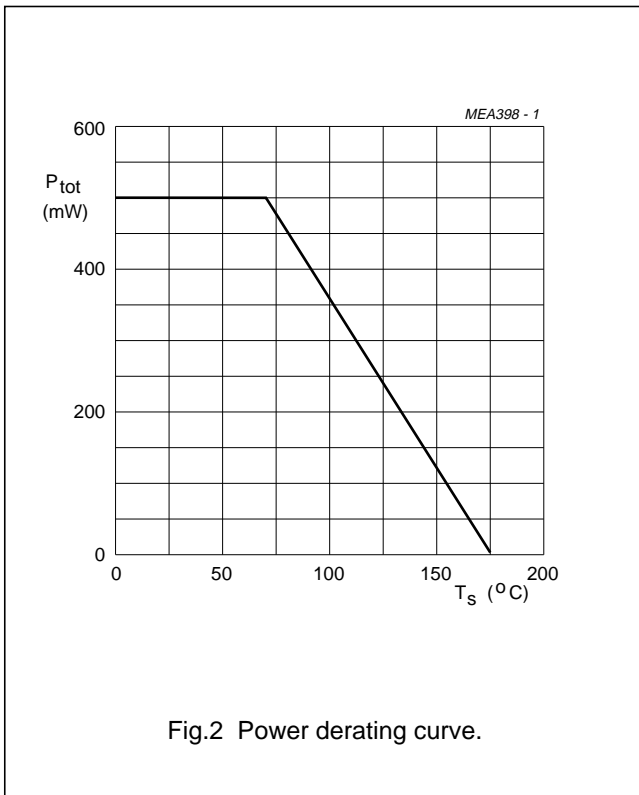
- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and

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

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

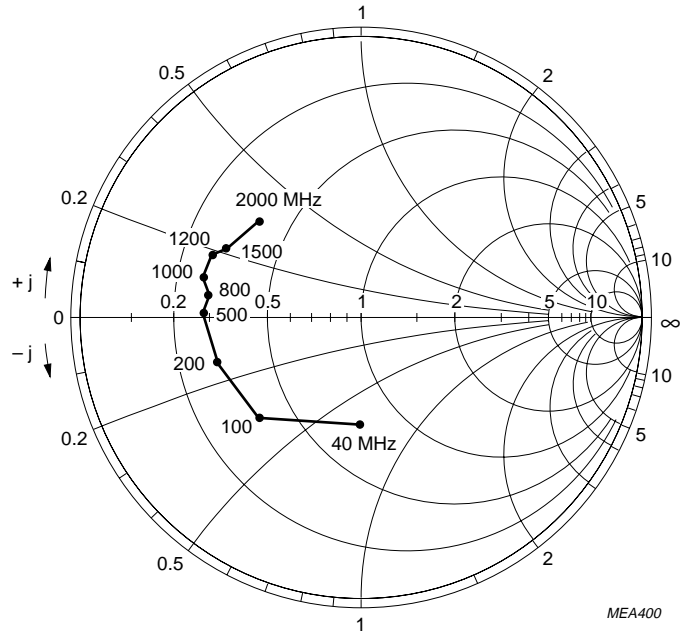
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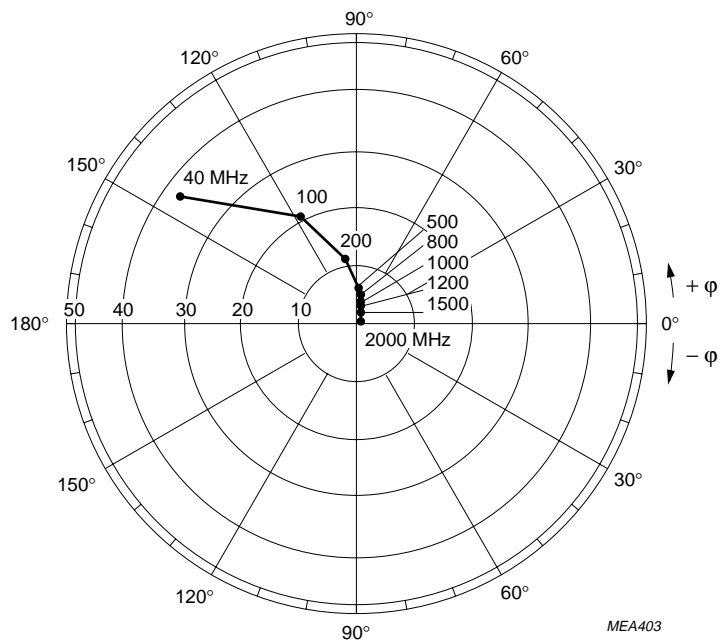
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$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_o = 50 \text{ } \Omega$ .

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

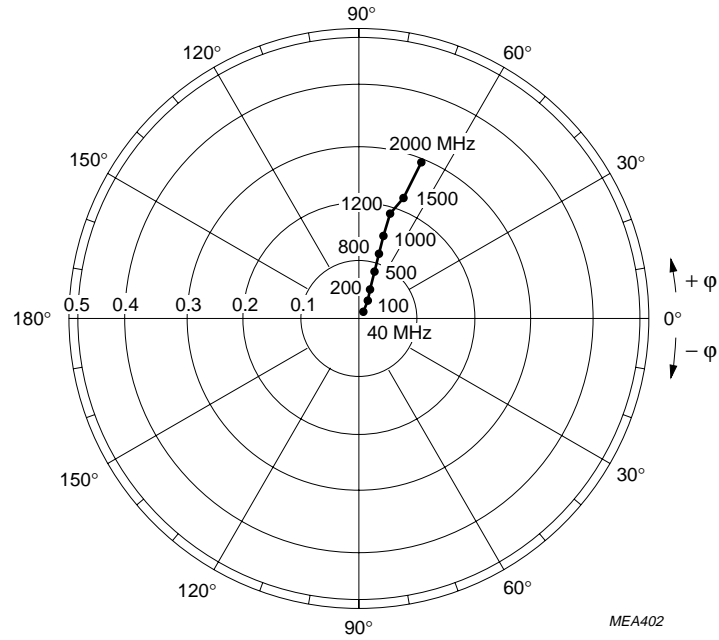


$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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

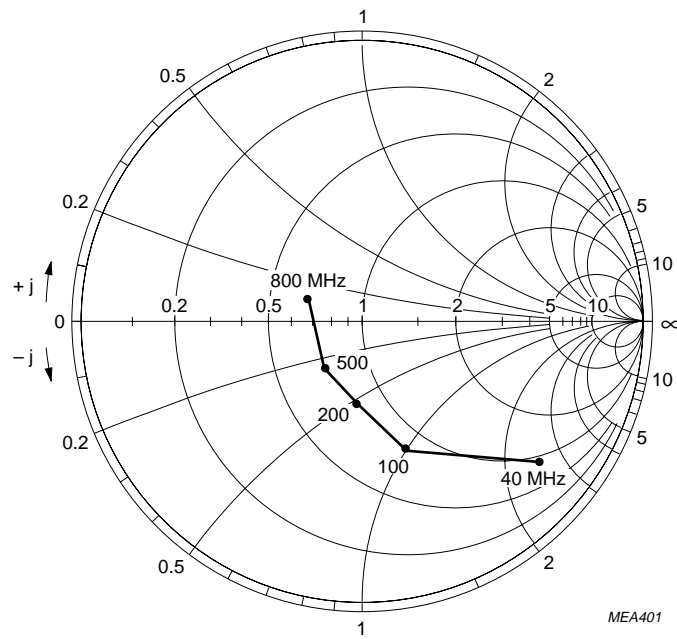
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$I_C = 30 \text{ mA}$ ;  $V_{CE} = 6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



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

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

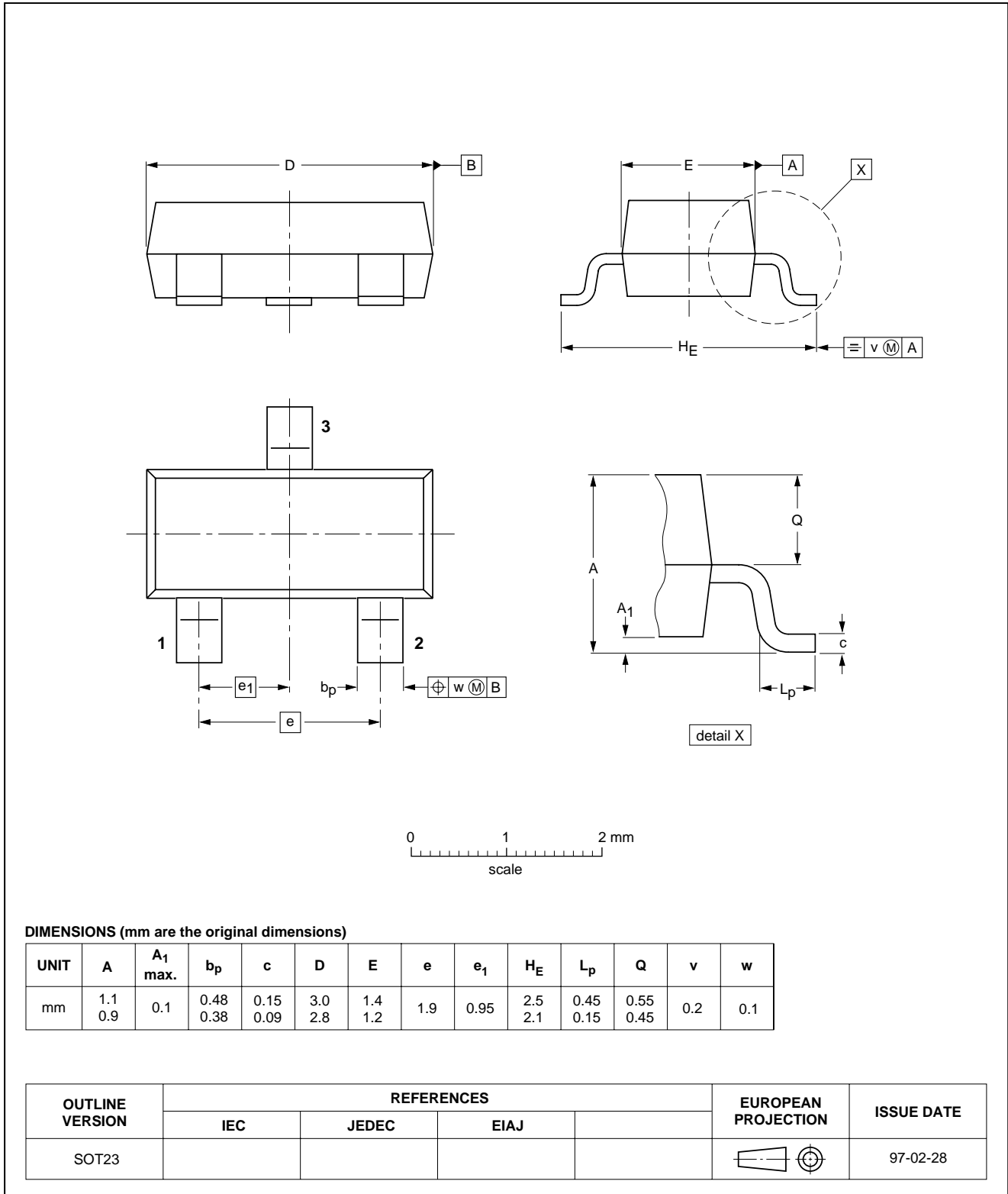
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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**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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