

DATA SHEET

BFR92

NPN 5 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

NPN 5 GHz wideband transistor

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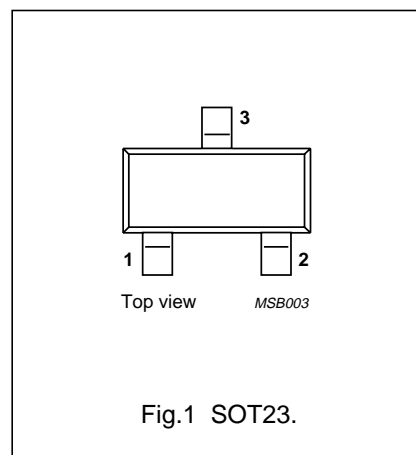
DESCRIPTION

NPN 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 $T_s = 95\text{ }^{\circ}\text{C}$; note 1	—	300	mW
f_T	transition frequency	$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_j = 25\text{ }^{\circ}\text{C}$	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	$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	18	—	dB
F	noise figure	$I_C = 2\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $Z_s = \text{opt.}$	2.4	—	dB
V_o	output voltage	$d_{im} = -60\text{ dB}$; $I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\text{ }\Omega$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f_{(p+q-r)} = 493.25\text{ MHz}$	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 $T_s = 95\text{ }^{\circ}\text{C}$; note 1	—	300	mW
T_{stg}	storage temperature		-65	150	$^{\circ}\text{C}$
T_j	junction temperature		—	175	$^{\circ}\text{C}$

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

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

CHARACTERISTICS

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

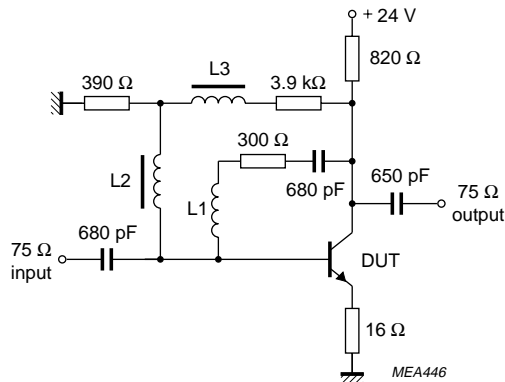
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 10\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$	40	90	–	
f_T	transition frequency	$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$	–	5	–	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	$I_C = 2\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ °C}$	–	0.4	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$	–	18	–	dB
F	noise figure (see Fig.2 and note 2)	$I_C = 2\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$; $Z_s = \text{opt.}$	–	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 $G_{UM} = 10 \log \left(\frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \right) \text{ dB}$
- Crystal mounted in a SOT37 envelope (BFR90).
- $d_{im} = -60\text{ dB}$ (DIN 45004B); $I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\text{ }\Omega$; $T_{amb} = 25\text{ °C}$;
 $V_p = V_o$ 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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L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.
L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.

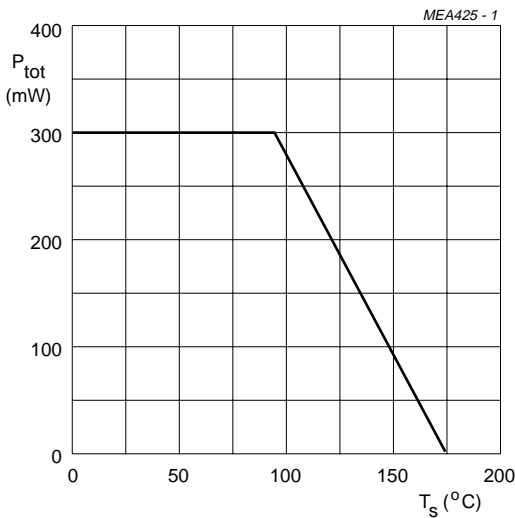
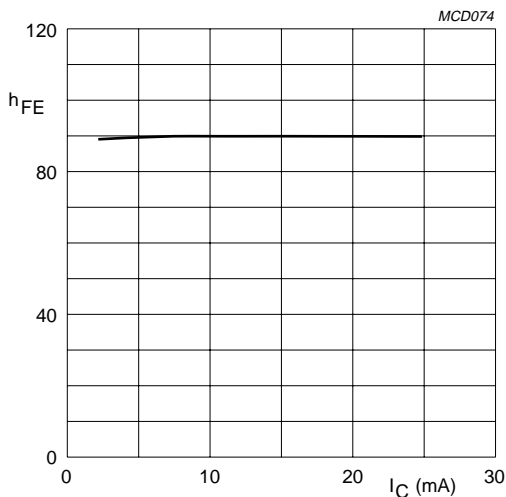
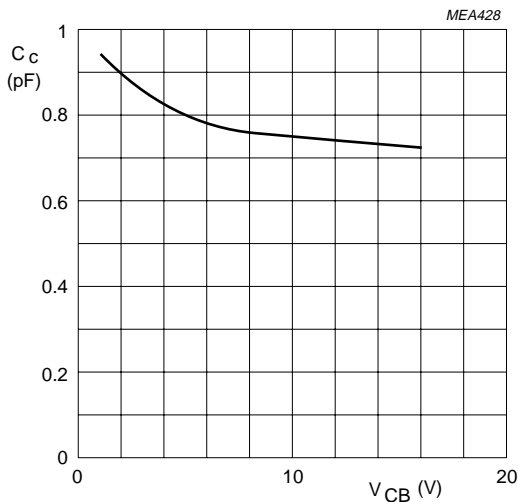


Fig.3 Power derating curve.



V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.

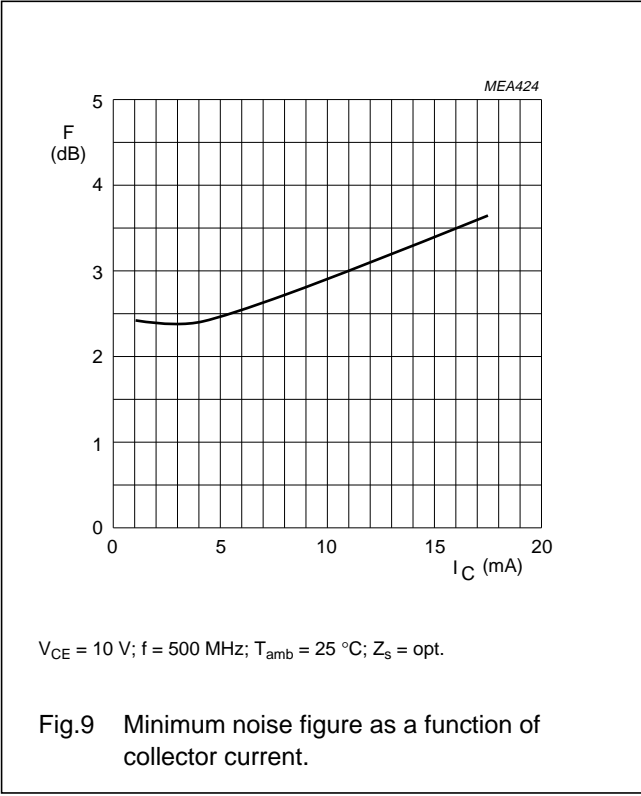
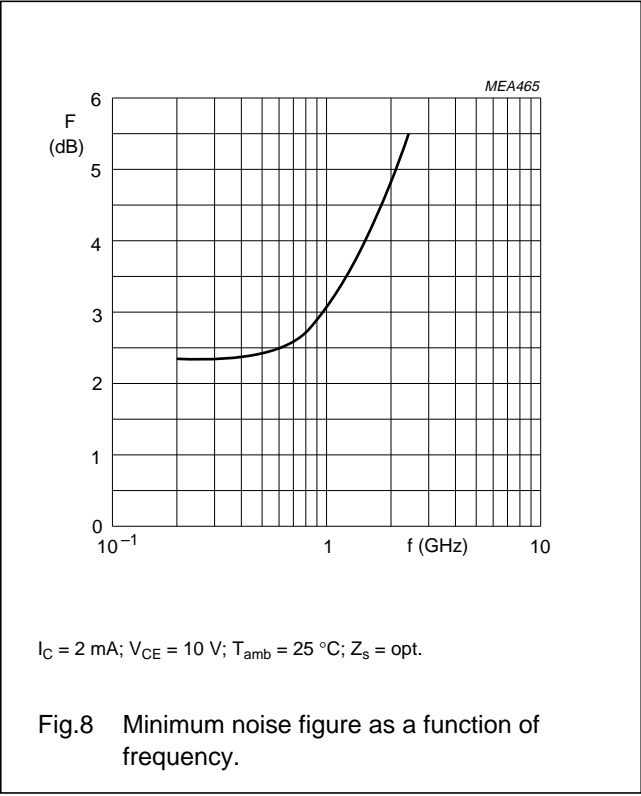
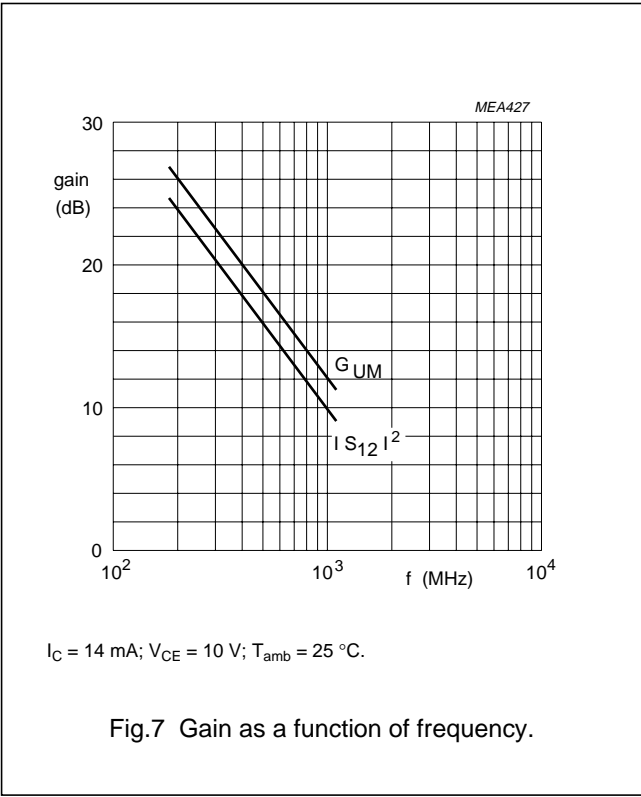
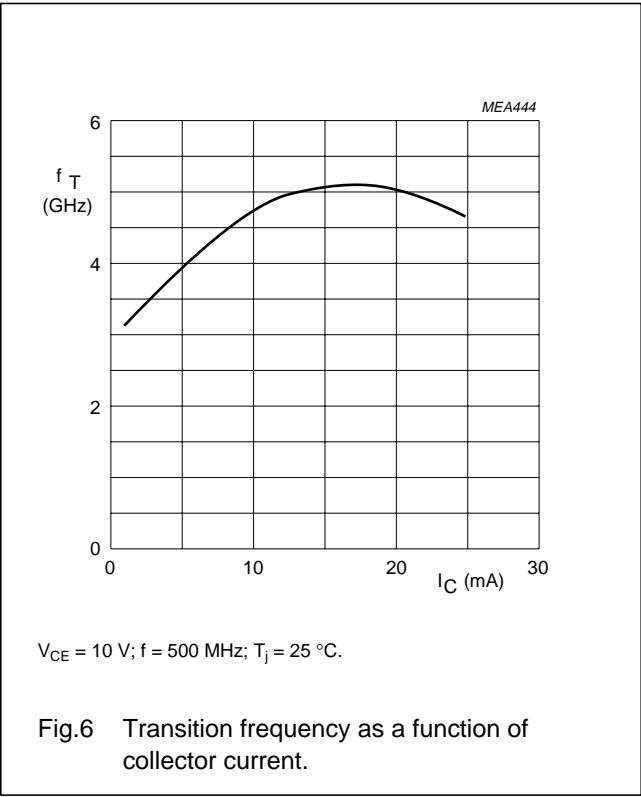


I_E = I_B = 0; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage.

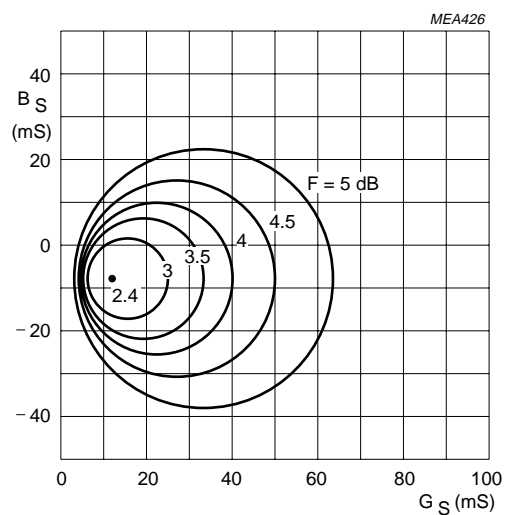
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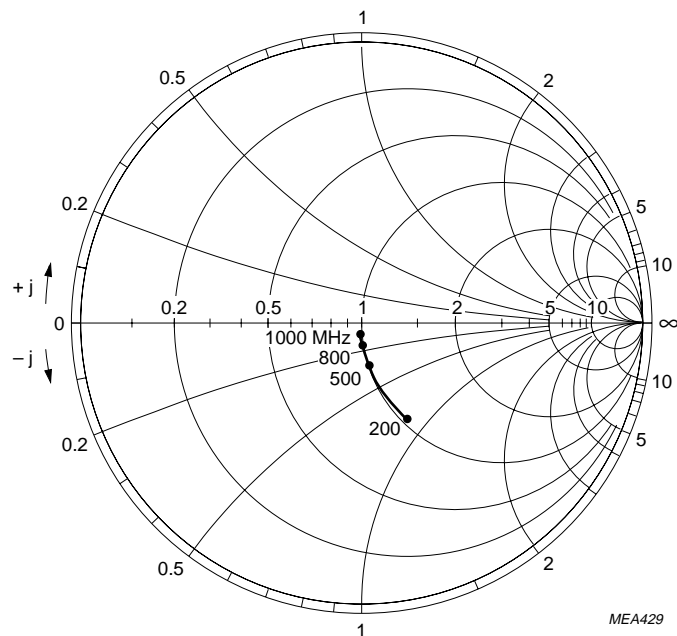


$I_C = 2 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $f = 500 \text{ MHz}$; $T_{amb} = 25^\circ\text{C}$.

Fig.10 Noise circle figure.

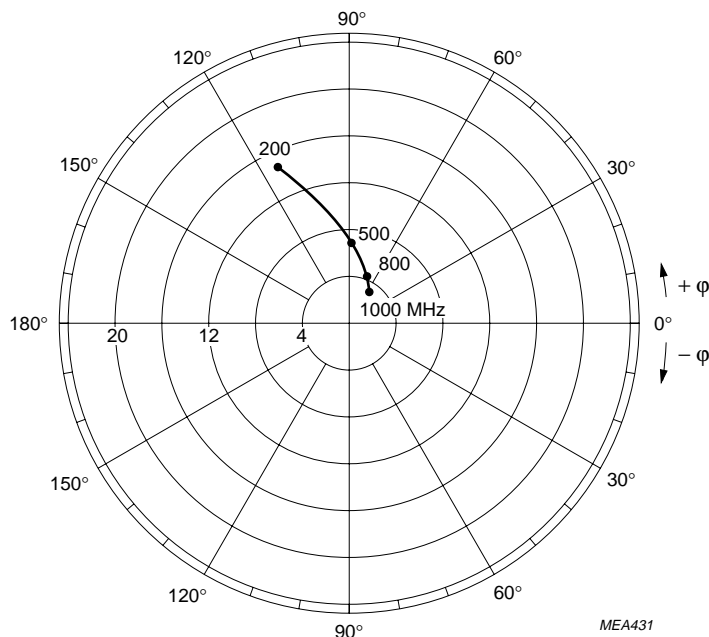
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$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.
 $Z_0 = 50 \text{ }\Omega$.

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

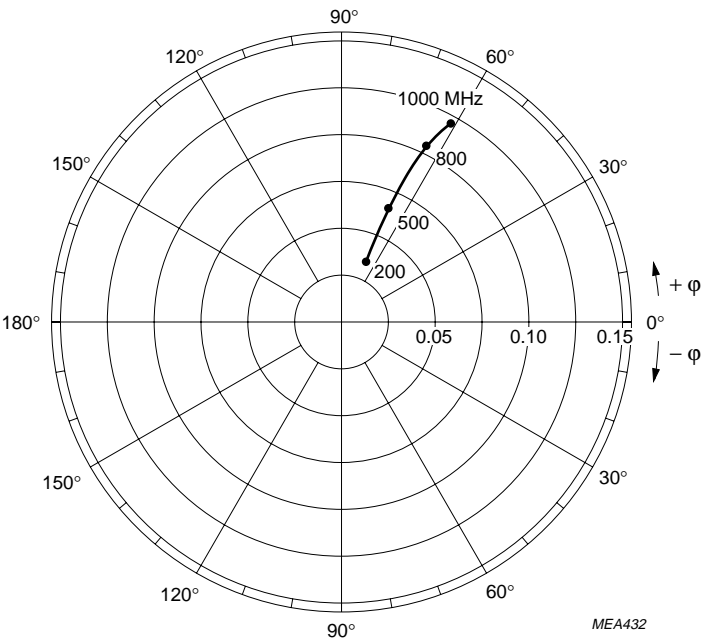


$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

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

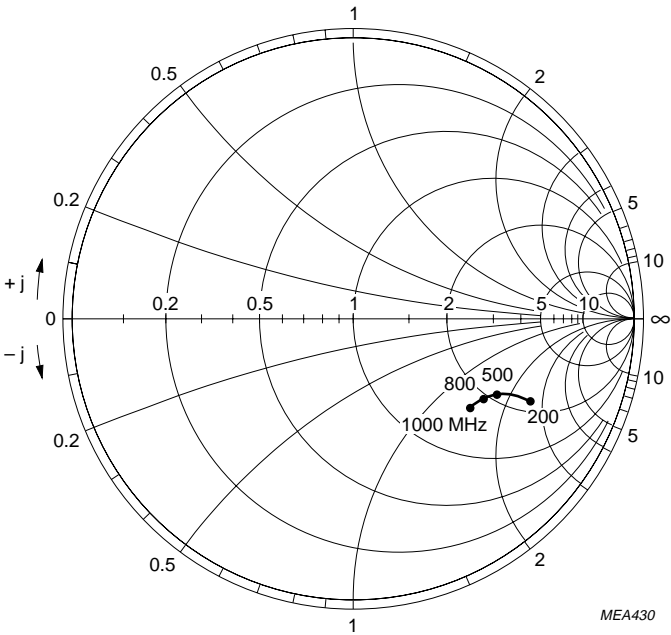
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$I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

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}).

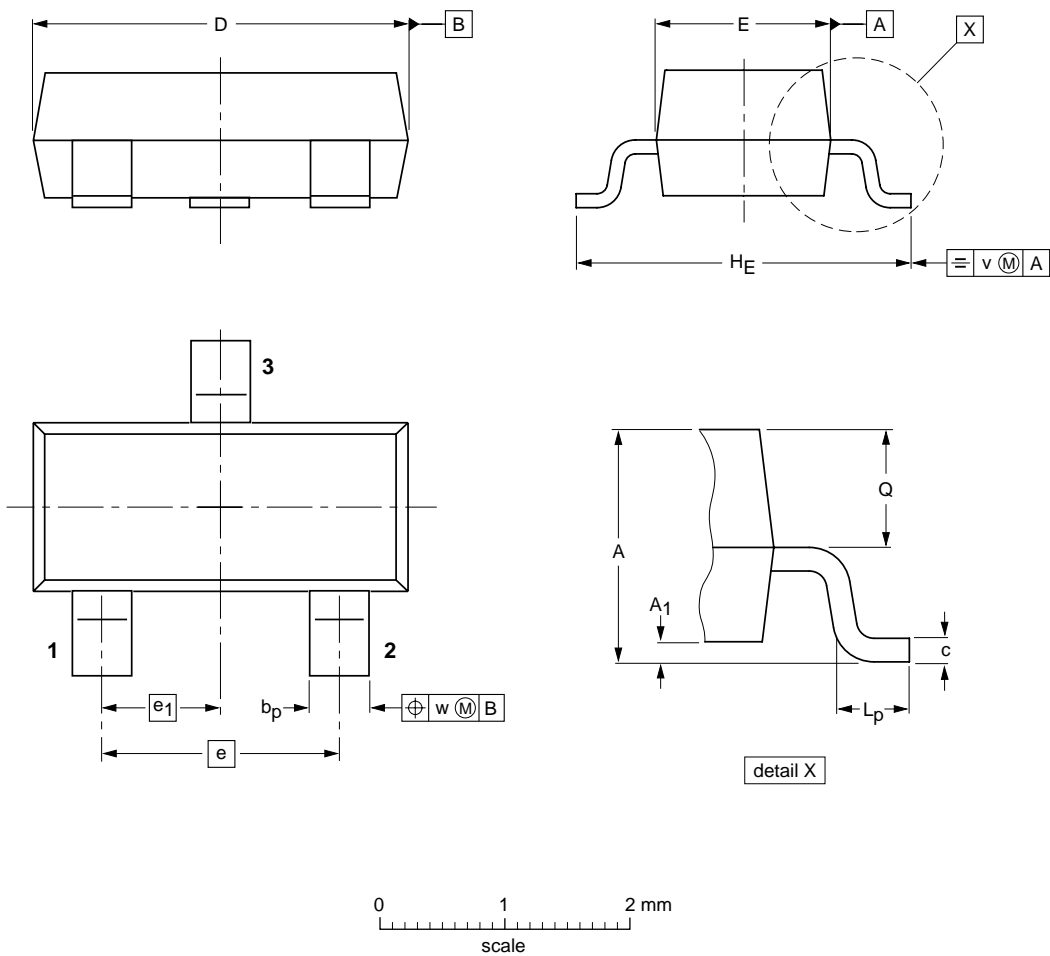
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PACKAGE OUTLINE


Plastic surface mounted package; 3 leads

SOT23



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max.	b _p	c	D	E	e	e ₁	H _E	L _p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23						97-02-28

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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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