

DATA SHEET

BFT93

PNP 5 GHz wideband transistor

Product specification

November 1992



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DESCRIPTION

PNP transistor in a plastic SOT23 envelope.

It is primarily intended for use in RF wideband amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analyzers, etc. 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.

NPN complements are BFR93 and BFR93A.

PINNING

PIN	DESCRIPTION
Code: X1p	
1	base
2	emitter
3	collector

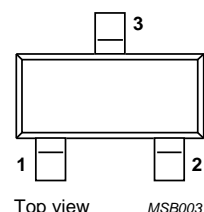


Fig.1 SOT23.

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	DC collector current		—	–35	mA
P_{tot}	total power dissipation	up to $T_s = 95\text{ °C}$; note 1	—	300	mW
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
C_{re}	feedback capacitance	$I_C = -2\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 1\text{ MHz}$	1	—	pF
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	$I_C = -10\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ °C}$	2.4	—	dB
V_o	output voltage	$d_{im} = -60\text{ dB}$; $I_C = -30\text{ mA}$; $V_{CE} = -5\text{ V}$; $R_L = 75\text{ }\Omega$; $f_{(p+q-r)} = 493.25\text{ MHz}$	300	—	mV

Note

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

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LIMITING VALUES

In accordance with the Absolute Maximum 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	DC collector current		–	–35	mA
I_{CM}	peak collector current	$f > 1$ MHz	–	–50	mA
P_{tot}	total power dissipation	up to $T_s = 95$ °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 70$ °C; (note 1)	260 K/W

Note

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

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CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = -5\text{ V}$	–	–	–50	nA
h_{FE}	DC current gain	$I_C = -30\text{ mA}$; $V_{CE} = -5\text{ V}$	20	50	–	
f_T	transition frequency	$I_C = -30\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 500\text{ MHz}$	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = -10\text{ V}$; $f = 1\text{ MHz}$	–	0.95	–	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	$I_C = -2\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 1\text{ MHz}$	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	$I_C = -30\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	16.5	–	dB
F	noise figure	$I_C = -10\text{ mA}$; $V_{CE} = -5\text{ V}$; $f = 500\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	–	2.4	–	dB
V_o	output voltage	see Fig.2 and note 2	–	300	–	mV

Notes

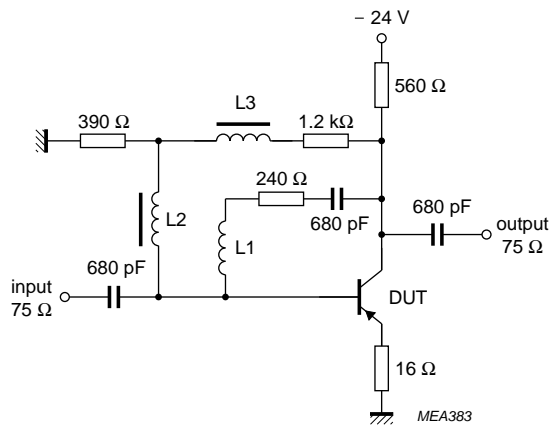
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and

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

2. $d_{im} = -60\text{ dB}$ (DIN 45004B); $I_C = -30\text{ mA}$; $V_{CE} = -5\text{ V}$; $R_L = 75\text{ }\Omega$;
 $V_p = V_o$ 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 $f_{(p+q-r)} = 493.25\text{ MHz}$.

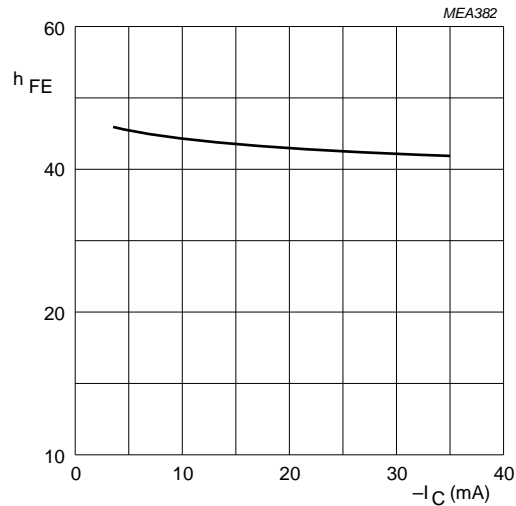
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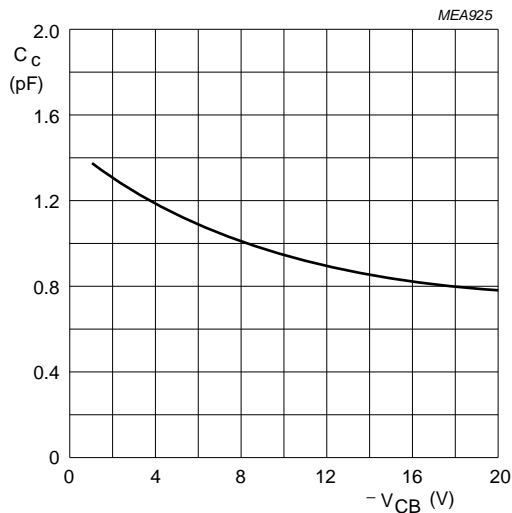
L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.
L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.



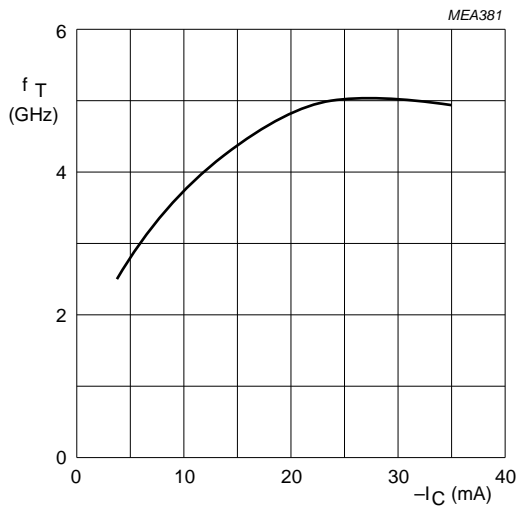
$V_{CE} = -5$ V; $T_j = 25$ °C.

Fig.3 DC current gain as a function of collector current.



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

Fig.4 Collector capacitance as a function of collector-base voltage.

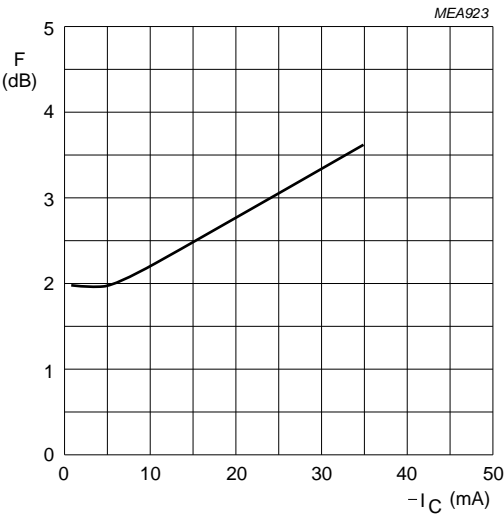


$V_{CE} = -5$ V; $f = 500$ MHz; $T_j = 25$ °C.

Fig.5 Transition frequency as a function of collector current.

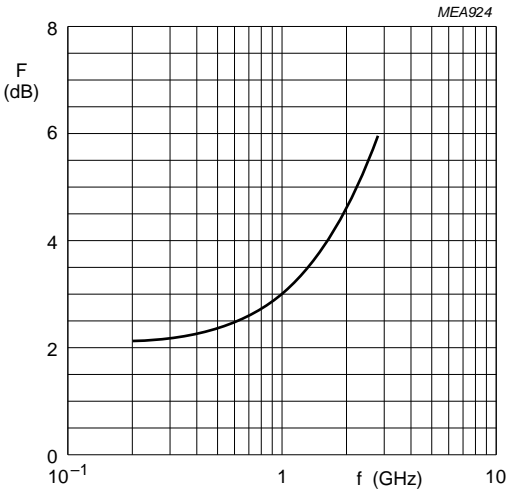
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$V_{CE} = -5\text{ V}$; $Z_s = \text{opt.}$; $f = 500\text{ MHz}$; $T_{\text{amb}} = 25\text{ }^{\circ}\text{C}$.

Fig.6 Minimum noise figure as a function of collector current.



$I_C = -2\text{ mA}$; $V_{CE} = -5\text{ V}$; $Z_s = \text{opt.}$; $T_{\text{amb}} = 25\text{ }^{\circ}\text{C}$.

Fig.7 Minimum noise figure as a function of frequency.

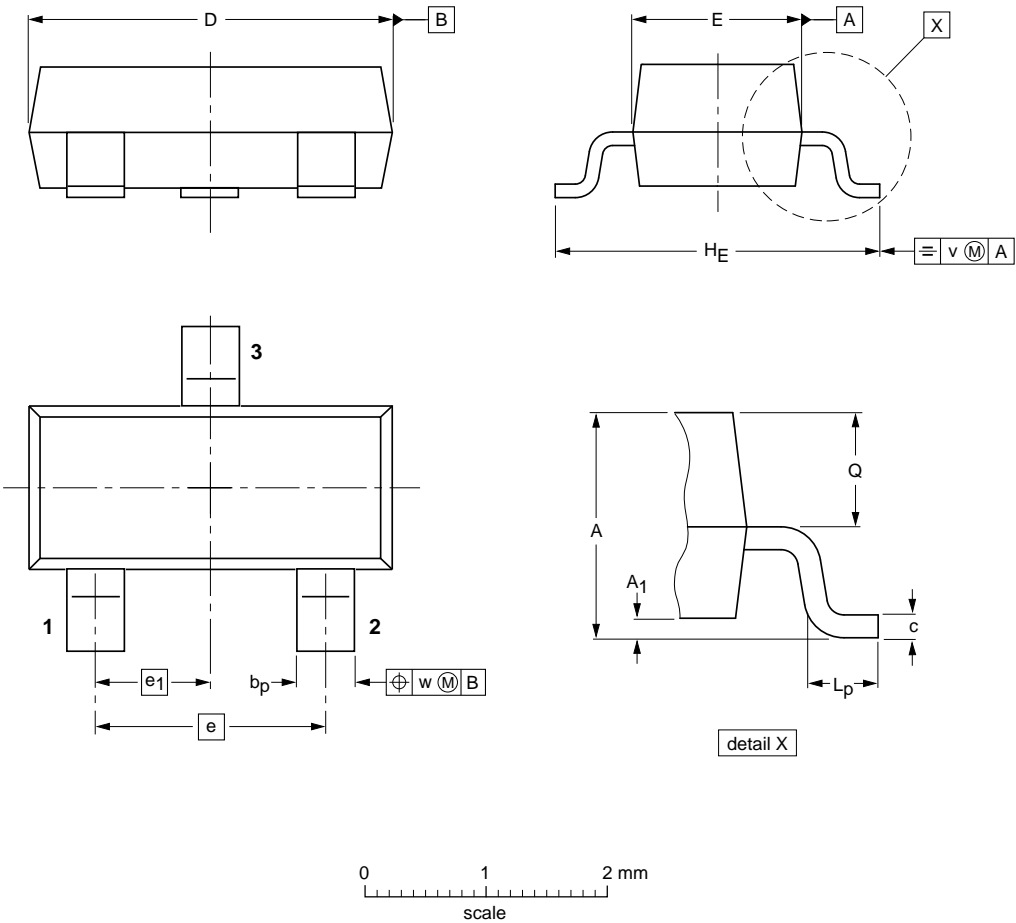
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PACKAGE OUTLINE

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	JEITA			
SOT23		TO-236AB				04-11-04 06-03-16

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DATA SHEET STATUS

DOCUMENT STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾	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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