DATA SHEET

BFT93
PNP 5 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

November 1992

Philips
Semiconductors

PHILIPS

PNP 5 GHz wideband transistor BFT93

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

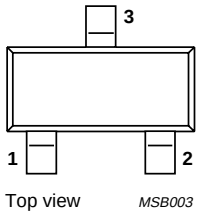


Fig.1 SOT23.

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 °C; note 1	–	300	mW
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C	5	–	GHz
C_{re}	feedback capacitance	I_C = –2 mA; V_{CE} = –5 V; f = 1 MHz	1	–	pF
G_{UM}	maximum unilateral power gain	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	16.5	–	dB
F	noise figure	I_C = –10 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	2.4	–	dB
V_o	output voltage	d_{im} = –60 dB; I_C = –30 mA; V_{CE} = –5 V; R_L = 75 Ω; $f_{(p+q-r)}$ = 493.25 MHz	300	–	mV

Note

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

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
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 70 °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 °C unless otherwise specified.

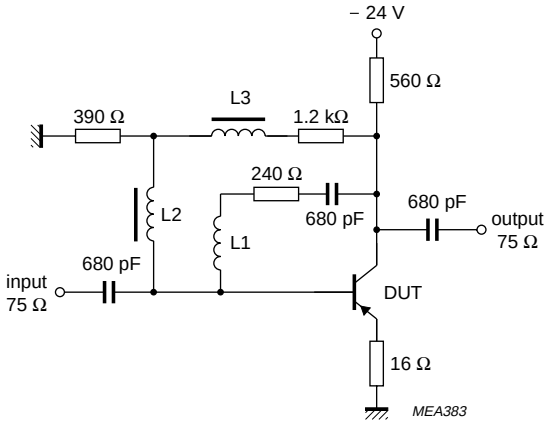
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = –5 V	–	–	–50	nA
h_{FE}	DC current gain	I_C = –30 mA; V_{CE} = –5 V	20	50	–	
f_T	transition frequency	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz	–	5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = –10 V; f = 1 MHz	–	0.95	–	pF
C_e	emitter capacitance	$I_c = i_c$ = 0; V_{EB} = –0.5 V; f = 1 MHz	–	1.8	–	pF
C_{re}	feedback capacitance	I_C = –2 mA; V_{CE} = –5 V; f = 1 MHz	–	1	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = –30 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °C	–	16.5	–	dB
F	noise figure	I_C = –10 mA; V_{CE} = –5 V; f = 500 MHz; T_{amb} = 25 °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

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

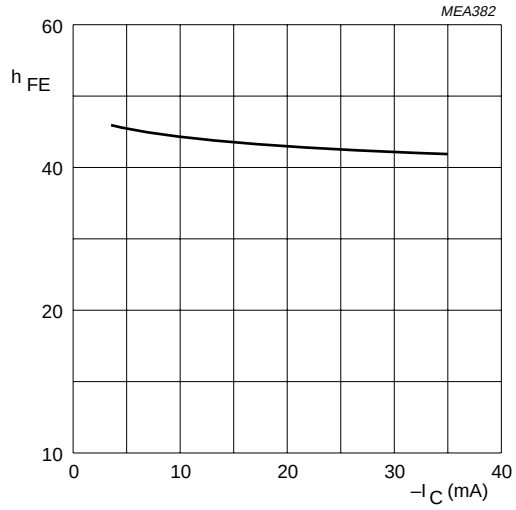
2. d_{im} = –60 dB (DIN 45004B); I_C = –30 mA; V_{CE} = –5 V; R_L = 75 Ω;
   $V_p = V_o$ at d_{im} = –60 dB; f_p = 495.25 MHz;
   $V_q = V_o$ –6 dB; f_q = 503.25 MHz;
   $V_r = V_o$ –6 dB; f_r = 505.25 MHz;
   measured at $f_{(p+q-r)}$ = 493.25 MHz.



L2 = L3 = 5 μH Ferroxcube choke, catalogue number 3122 108 20150.

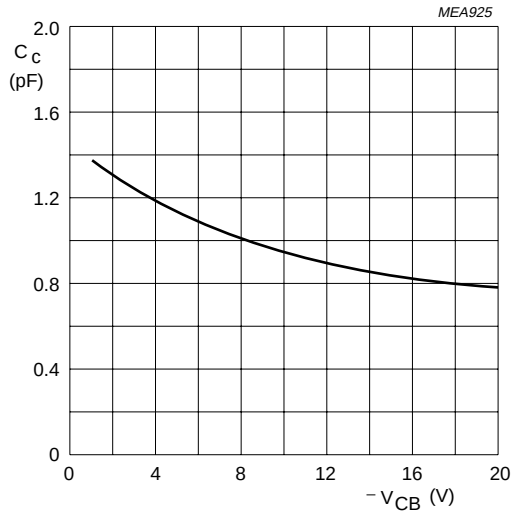
L1 = 4 turns 0.35 mm copper wire; winding pitch 1 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion test circuit.



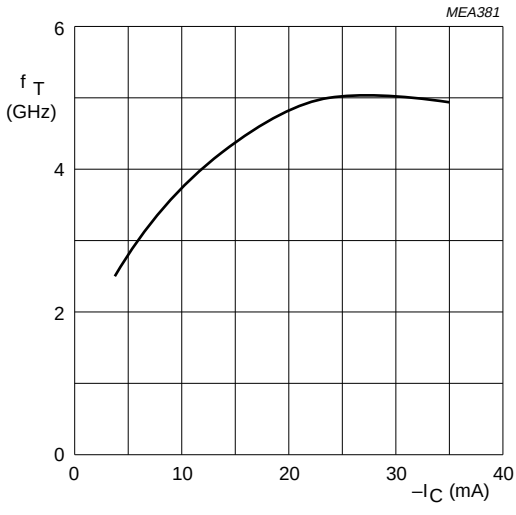
V_{CE} = –5 V; T_j = 25 °C.

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



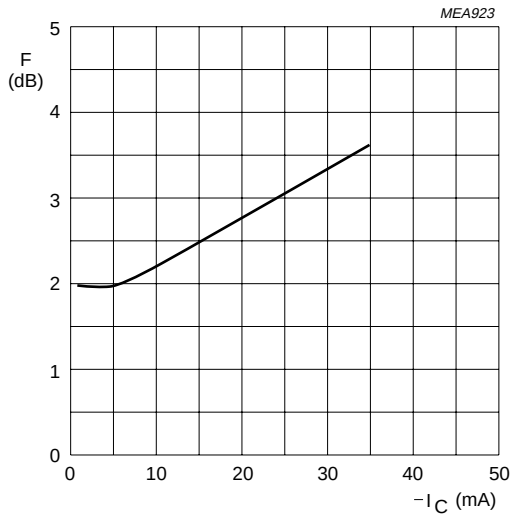
I_E = i_e = 0; f = 1 MHz; T_j = 25 °C.

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



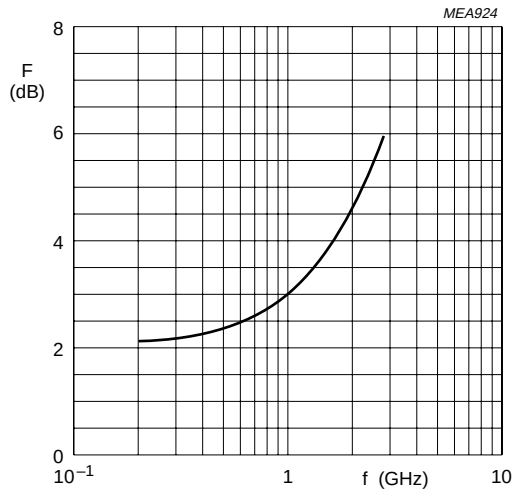
V_{CE} = –5 V; f = 500 MHz; T_j = 25 °C.

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



V_{CE} = –5 V; Z_s = opt.; f = 500 MHz; T_{amb} = 25 °C.

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

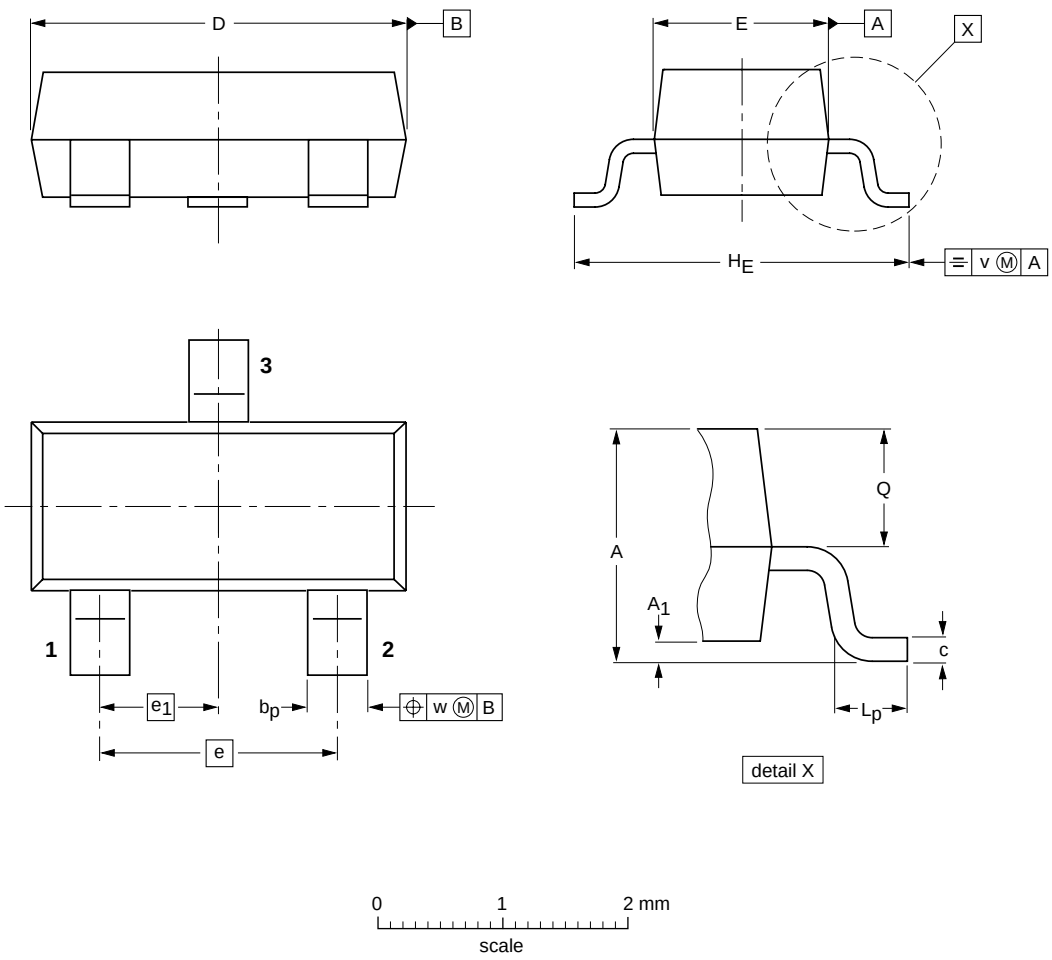


I_C = –2 mA; V_{CE} = –5 V; Z_s = opt.; T_{amb} = 25 °C.

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

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

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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.