

DATA SHEET

BFG94

NPN 6 GHz wideband transistor

Product specification

September 1995



NPN 6 GHz wideband transistor

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FEATURES

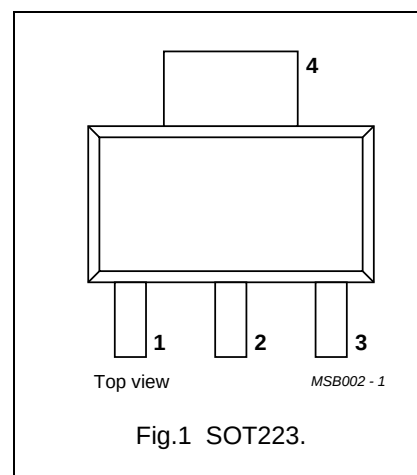
- High power gain
- Low noise figure
- Low intermodulation distortion
- Gold metallization ensures excellent reliability.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope. It is primarily intended for use in communication and instrumentation systems.



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	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		—	—	60	mA
P_{tot}	total power dissipation	up to $T_s = 140\text{ °C}$ (note 1)	—	—	700	mW
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 10\text{ V}$; $f = 1\text{ MHz}$	—	—	0.8	pF
f_T	transition frequency	$I_C = 45\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	4	6	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 45\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	11.5	13.5	—	dB
V_O	output voltage	$I_C = 45\text{ mA}$; $V_{CE} = 10\text{ V}$; $d_{im} = -60\text{ dB}$; $R_L = 75\text{ }\Omega$; $f = 800\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	500	—	mV
P_{L1}	output power at 1 dB gain compression	$I_C = 45\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	21.5	—	dBm

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		–	60	mA
P_{tot}	total power dissipation	up to $T_s = 140\text{ °C}$ (note 1)	–	700	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 $T_s = 140\text{ °C}$ (note 1)	50 K/W

Note

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

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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} = 10 V	–	–	100	nA
h _{FE}	DC current gain	I _C = 30 mA; V _{CE} = 5 V	45	90	–	
		I _C = 45 mA; V _{CE} = 10 V	–	100	–	
C _c	collector capacitance	I _E = i _e = 0; V _{CB} = 10 V; f = 1 MHz	–	0.9	2	pF
C _e	emitter capacitance	I _C = i _e = 0; V _{EB} = 0.5 V; f = 1 MHz	–	2.9	4.5	pF
C _{re}	feedback capacitance	I _C = i _c = 0; V _{CE} = 10 V; f = 1 MHz	–	0.5	0.8	pF
f _T	transition frequency	I _C = 45 mA; V _{CE} = 10 V; f = 1 GHz; T _{amb} = 25 °C	4	–	–	GHz
		I _C = 30 mA; V _{CE} = 5 V; f = 1 GHz; T _{amb} = 25 °C	4	6	–	GHz
G _{UM}	maximum unilateral power gain (note1)	I _C = 45 mA; V _{CE} = 10 V; f = 1 GHz; T _{amb} = 25 °C	11.5	13.5	–	dB
F	minimum noise figure	Γ _s = Γ _{opt} ; I _C = 45 mA; V _{CE} = 10 V; f = 500 MHz	–	2.7	–	dB
		Γ _s = Γ _{opt} ; I _C = 45 mA; V _{CE} = 10 V; f = 1 GHz	–	3	–	dB
V _O	output voltage	note 2	–	500	–	mV
d ₂	second order intermodulation distortion	note 3	–	–51	–	dB
P _{L1}	output power at 1 dB gain compression	I _C = 45 mA; V _{CE} = 10 V; R _L = 50 Ω; T _{amb} = 25 °C; measured at f = 1 GHz	–	21.5	–	dBm
ITO	third order intercept point	note 4	–	34	–	dBm

Notes

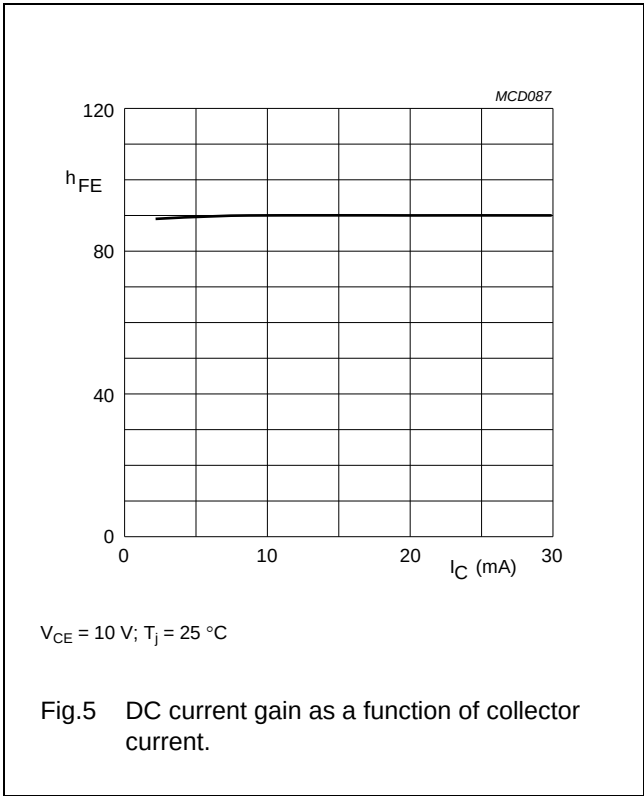
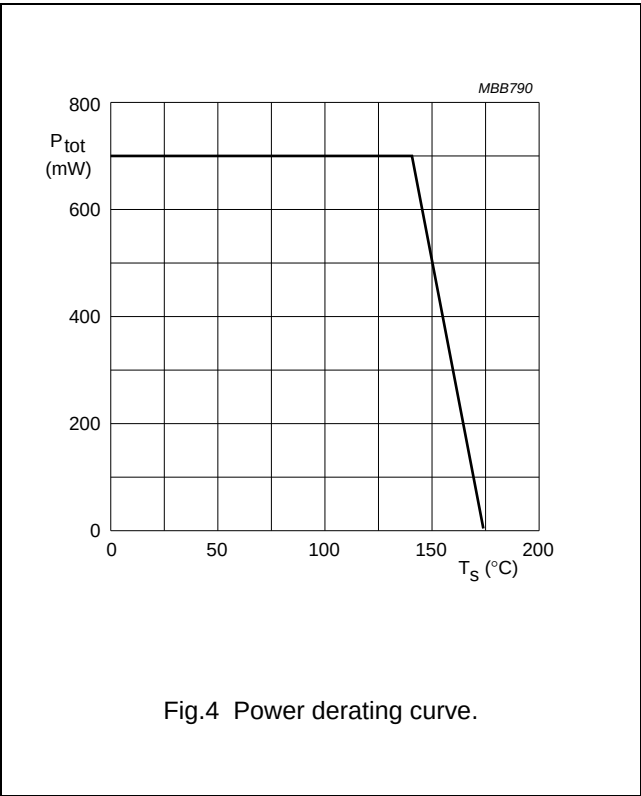
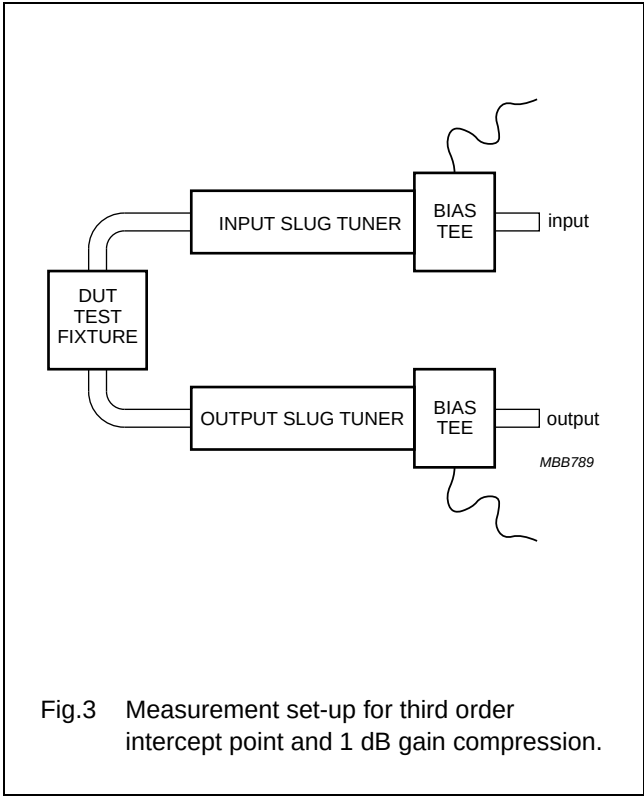
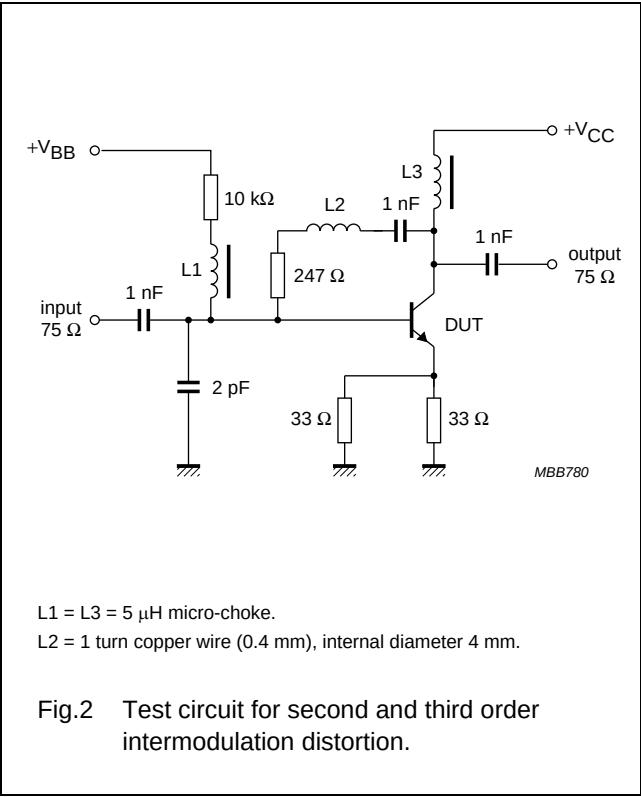
1. G_{UM} is the maximum unilateral power gain, assuming S₁₂ is zero and

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

2. d_{im} = –60 dB (DIN 45004B, par 6.3: 3-tone); I_C = 45 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
V_p = V_O at d_{im} = –60 dB; f_p = 795.25 MHz;
V_q = V_O –6 dB; V_r = V_O –6 dB;
f_q = 803.25 MHz; f_r = 805.25 MHz;
measured at f_(p+q-r) = 793.25 MHz.
3. I_C = 45 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
V_q = V_O = 280 mV;
f_p = 250 MHz; f_q = 560 MHz;
measured at f_(p+q) = 810 MHz.
4. I_C = 45 mA; V_{CE} = 10 V; R_L = 50 Ω; T_{amb} = 25 °C;
f_p = 1000 MHz; f_q = 1001 MHz;
measured at f_(2p-q) and f_(2q-p).

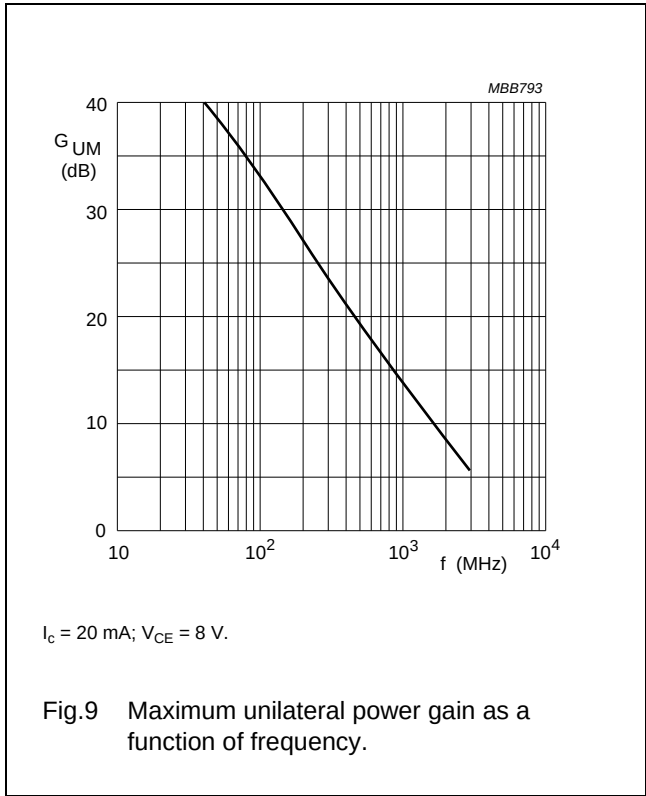
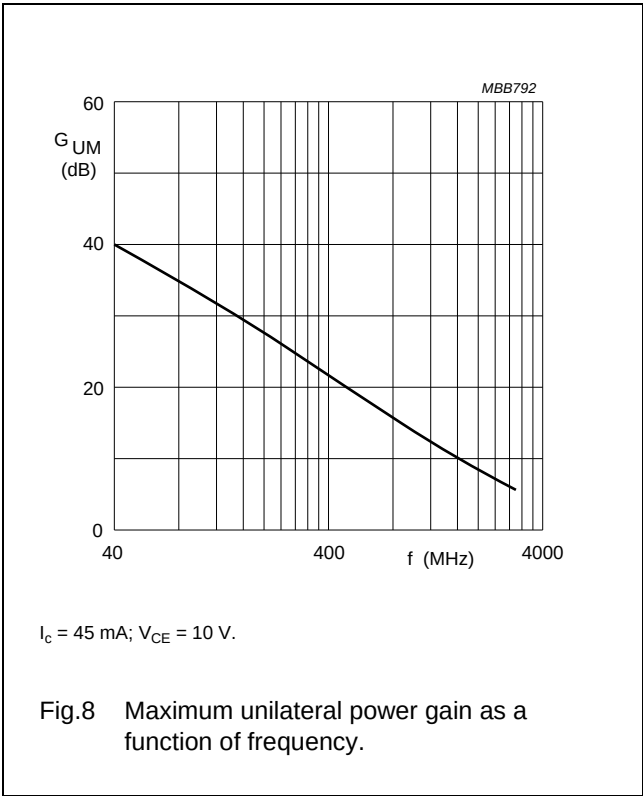
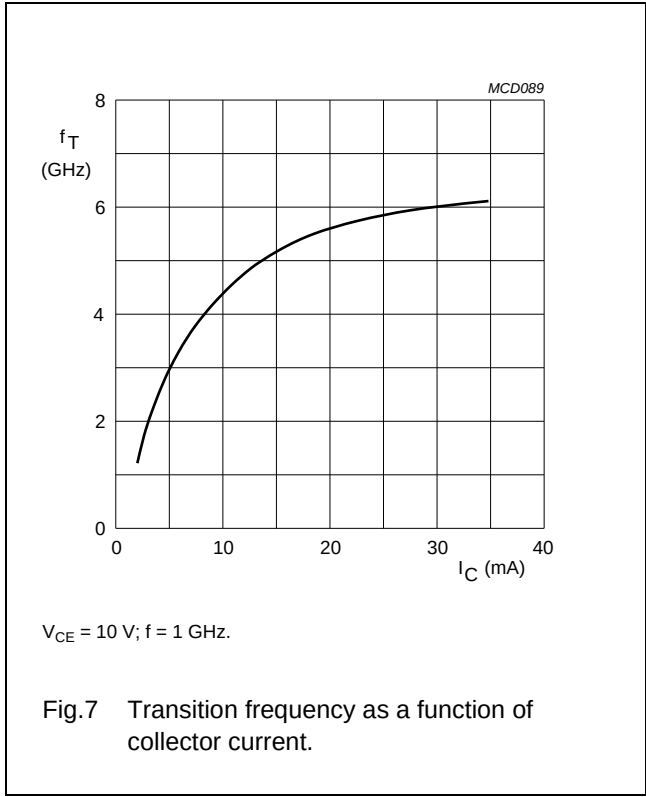
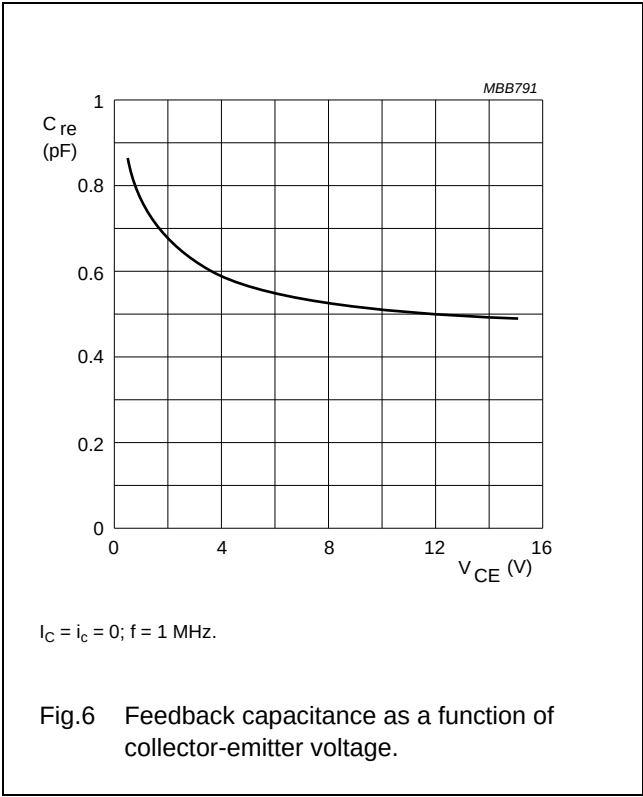
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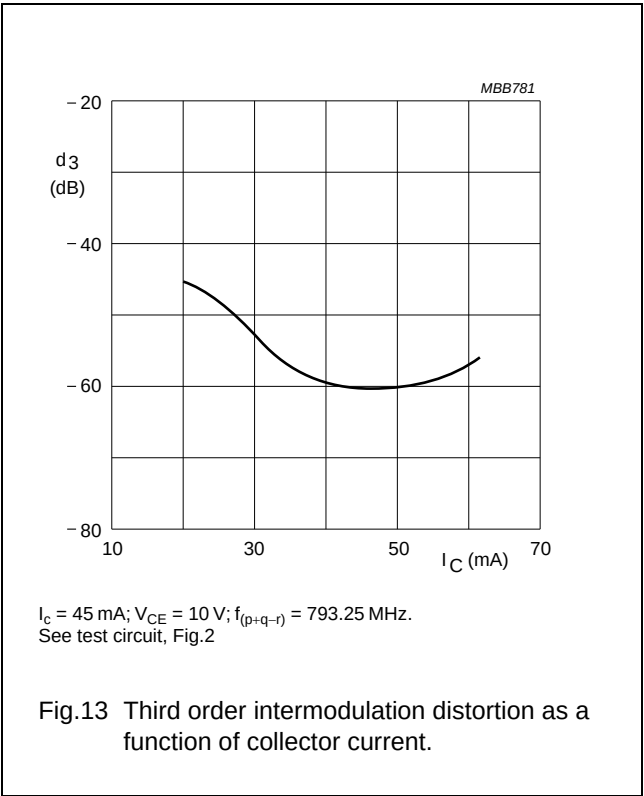
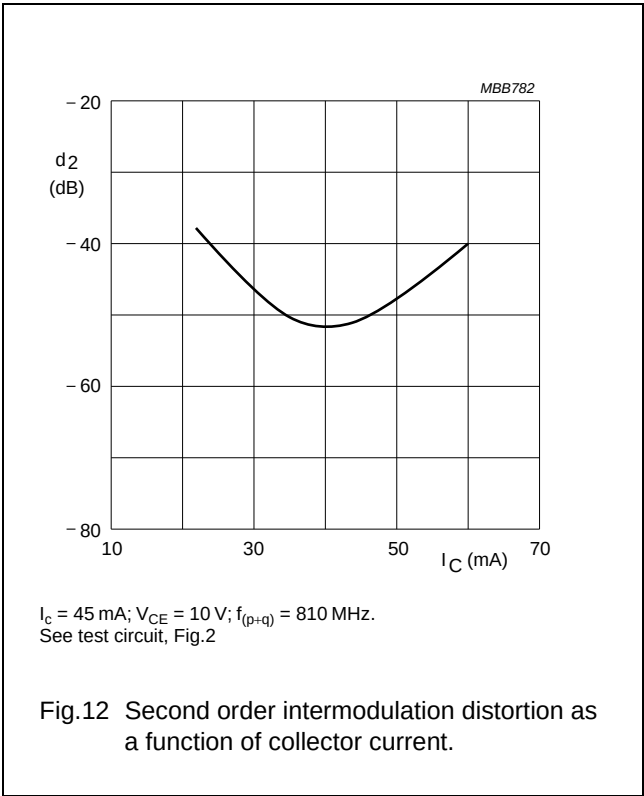
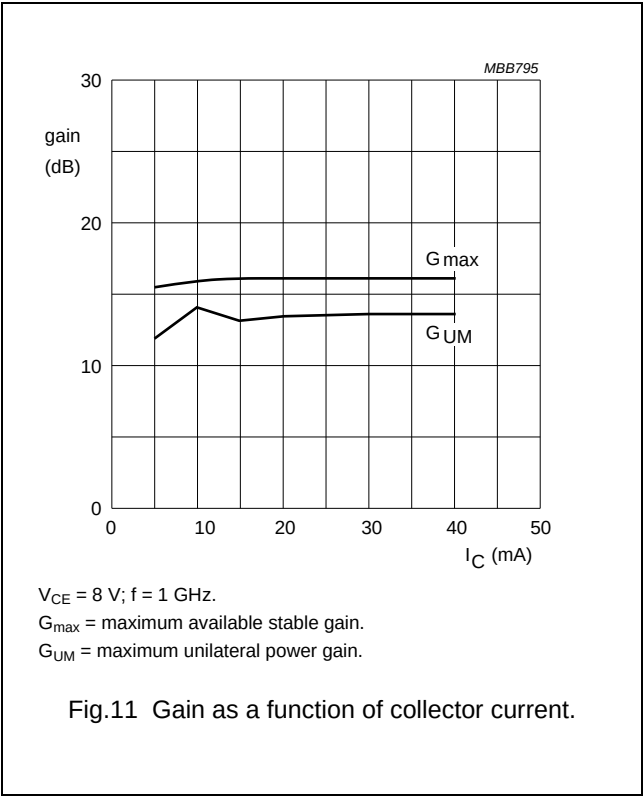
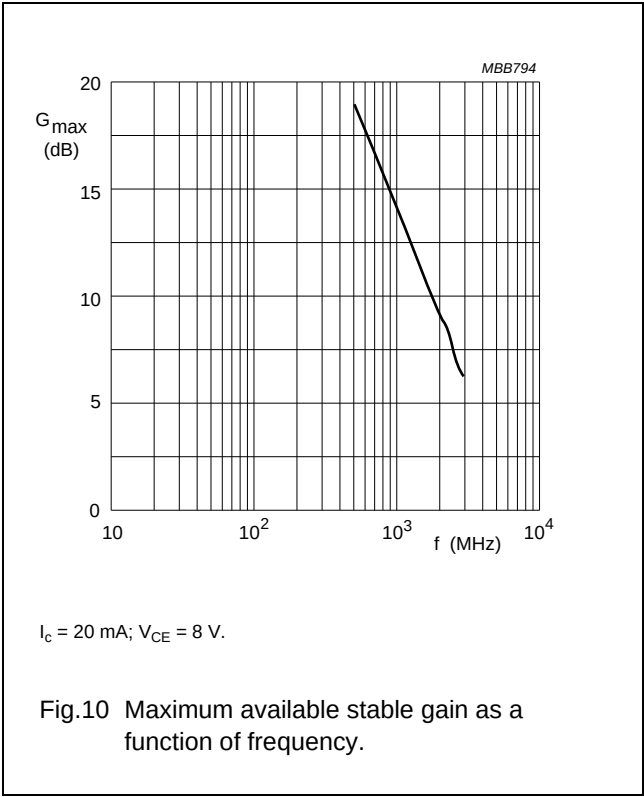
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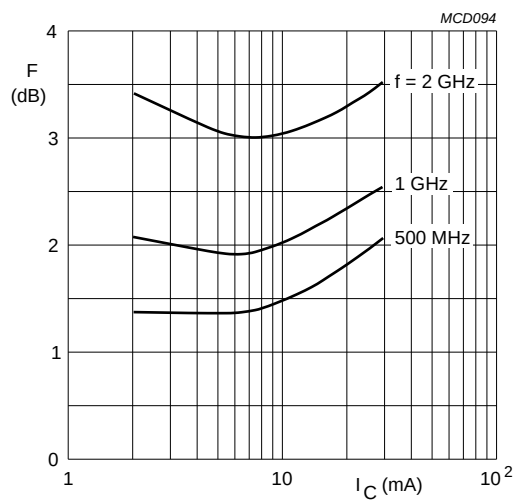
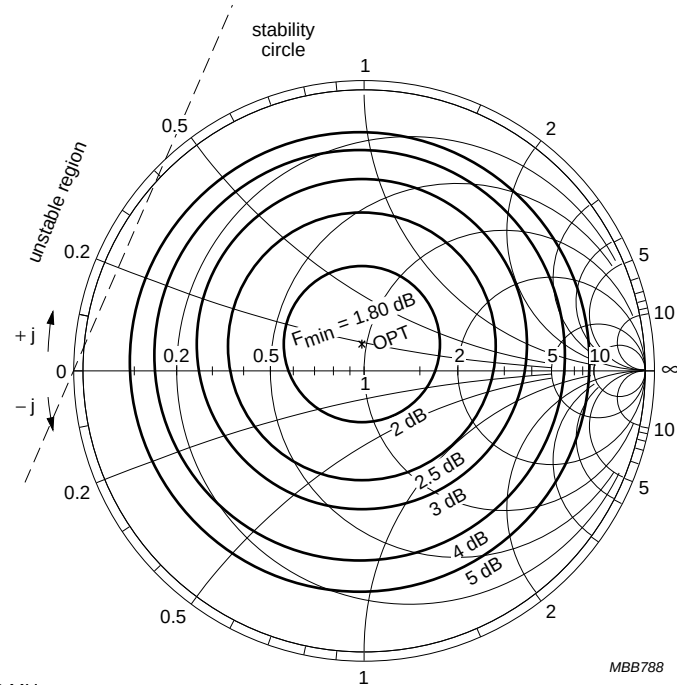
 $V_{CE} = 8 \text{ V.}$

Fig.14 Minimum noise figure as a function of collector current.

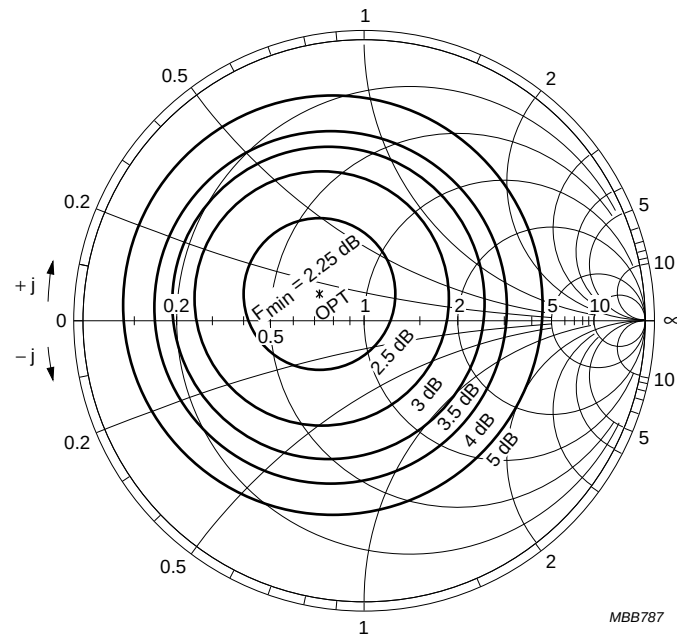
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$I_c = 15 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $f = 500 \text{ MHz}$.

Fig.15 Noise circle.

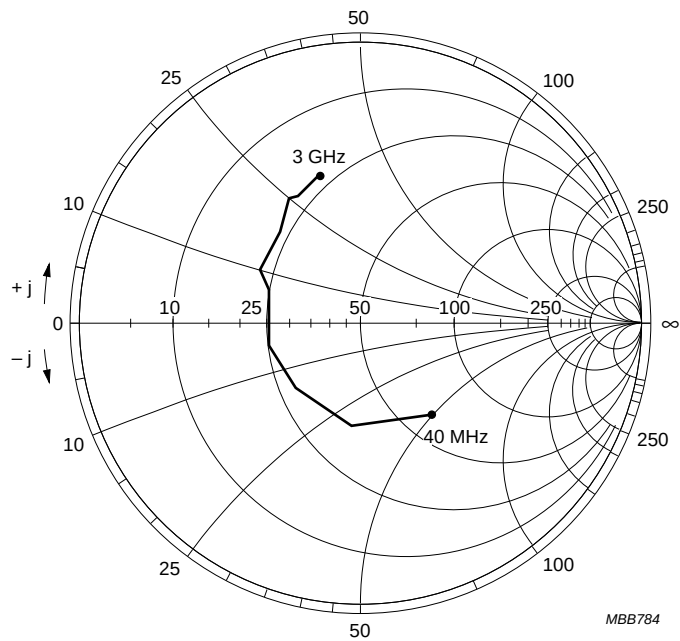


$I_c = 15 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $f = 1 \text{ GHz}$.

Fig.16 Noise circle.

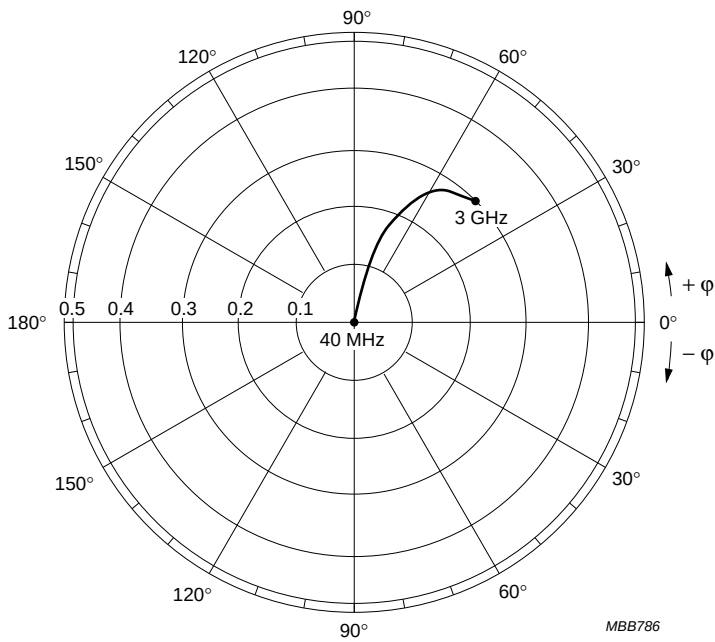
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$I_C = 45 \text{ mA}$; $V_{CE} = 10 \text{ V}$.
 $Z_0 = 50 \Omega$.

Fig.17 Common emitter input reflection coefficient (S_{11}).

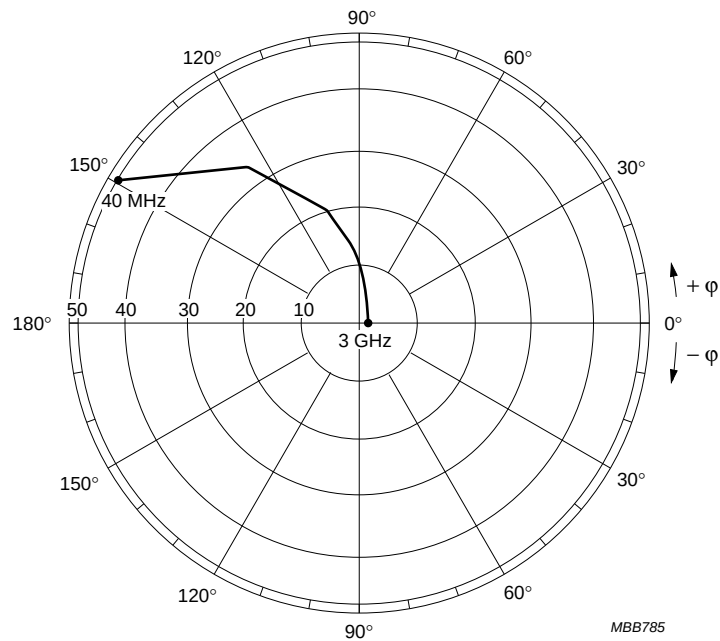


$I_C = 45 \text{ mA}$; $V_{CE} = 10 \text{ V}$.

Fig.18 Common emitter forward transmission coefficient (S_{21}).

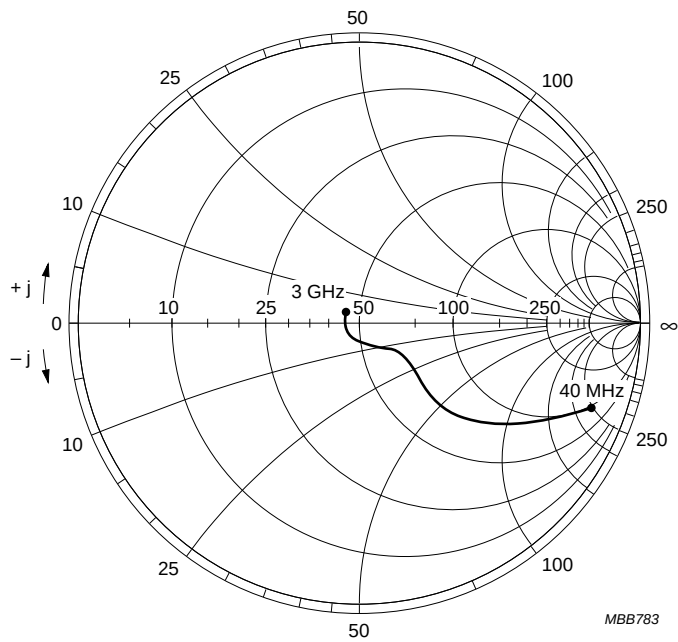
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$I_C = 45 \text{ mA}$; $V_{CE} = 10 \text{ V}$.

Fig.19 Common emitter reverse transmission coefficient (S_{12}).



$I_C = 45 \text{ mA}$; $V_{CE} = 10 \text{ V}$.
 $Z_O = 50 \Omega$.

Fig.20 Common emitter output reflection coefficient (S_{22}).

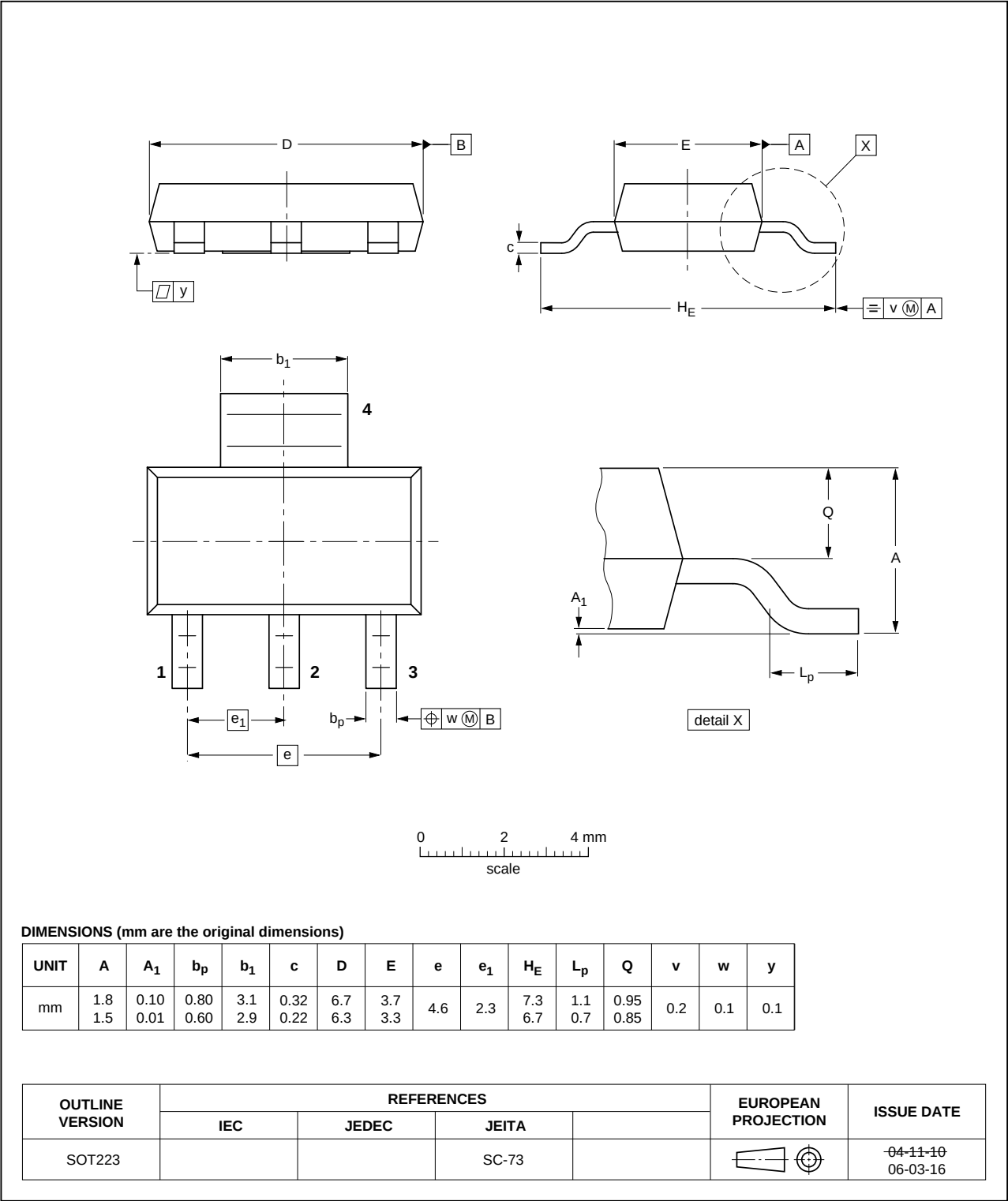
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PACKAGE OUTLINE

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223



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DATA SHEET STATUS

DOCUMENT STATUS ⁽¹⁾	PRODUCT STATUS ⁽²⁾	DEFINITION
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Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
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