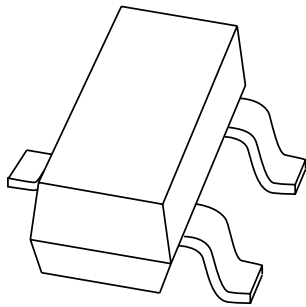


DATA SHEET



BFR540

NPN 9 GHz wideband transistor

Product specification
Supersedes data of 1999 Aug 23

2000 May 30

NPN 9 GHz wideband transistor

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FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

APPLICATIONS

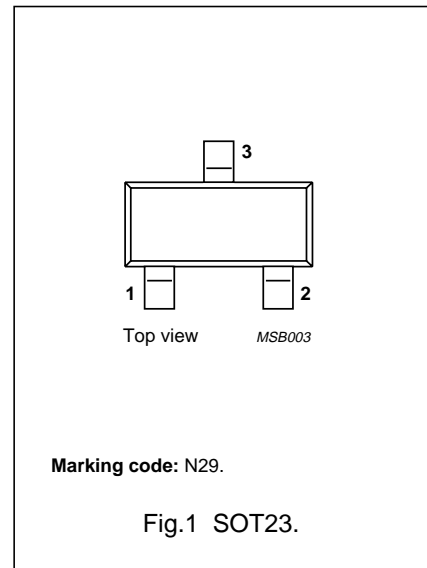
RF front end wideband applications in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, satellite TV tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optic systems.

DESCRIPTION

NPN silicon planar epitaxial transistor in a SOT23 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CB0}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	$T_s \leq 70\text{ °C}$; note 1	–	–	500	mW
h_{FE}	DC current gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$	100	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 8\text{ V}$; $f = 1\text{ MHz}$	–	0.6	–	pF
f_T	transition frequency	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 1\text{ GHz}$	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 900\text{ MHz}$	–	14	–	dB
		$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 2\text{ GHz}$	–	7	–	dB
$ S_{21} ^2$	insertion power gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 900\text{ MHz}$	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 900\text{ MHz}$	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 900\text{ MHz}$	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 2\text{ GHz}$	–	2.1	–	dB

Note

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

NPN 9 GHz wideband transistor

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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	120	mA
P_{tot}	total power dissipation	$T_s \leq 70\text{ °C}$; 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.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	from junction to soldering point	see note 1	260	K/W

Note

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

NPN 9 GHz wideband transistor

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CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0; V_{CB} = 8\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}$	100	120	250	
C_e	emitter capacitance	$I_C = i_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0; V_{CB} = 8\text{ V}; f = 1\text{ MHz}$	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = 0; V_{CB} = 8\text{ V}; f = 1\text{ MHz}$	–	0.6	–	pF
f_T	transition frequency	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; f = 1\text{ GHz}$	–	9	–	GHz
G_{UM}	maximum unilateral power gain; note 1	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 900\text{ MHz}$	–	14	–	dB
		$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 2\text{ GHz}$	–	7	–	dB
$ s_{21} ^2$	insertion power gain	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 900\text{ MHz}$	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}; I_C = 10\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 900\text{ MHz}$	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}; I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 900\text{ MHz}$	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}; I_C = 10\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 2\text{ GHz}$	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; R_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C}; f = 900\text{ MHz}$	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm
V_o	output voltage; note 3	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; Z_L = Z_S = 75\text{ }\Omega; T_{amb} = 25\text{ °C}$	–	550	–	mV

Notes

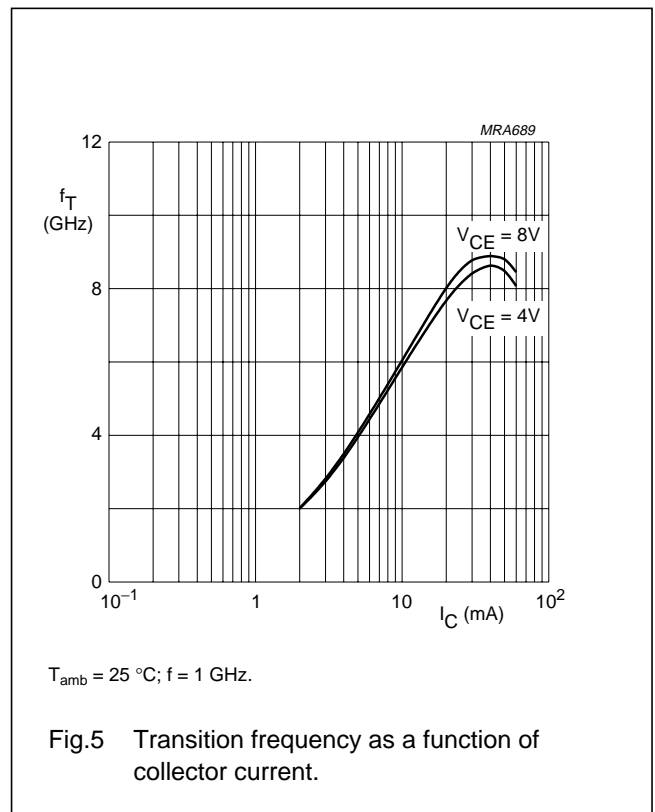
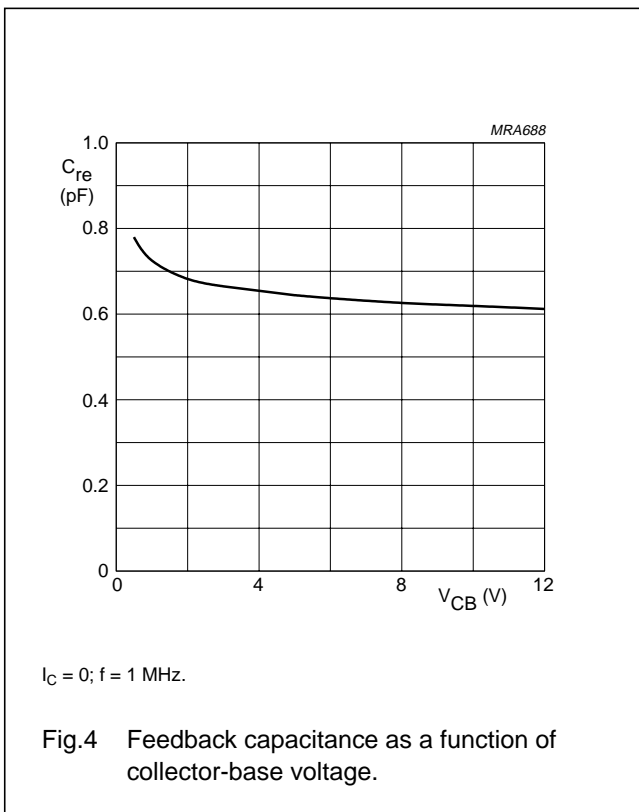
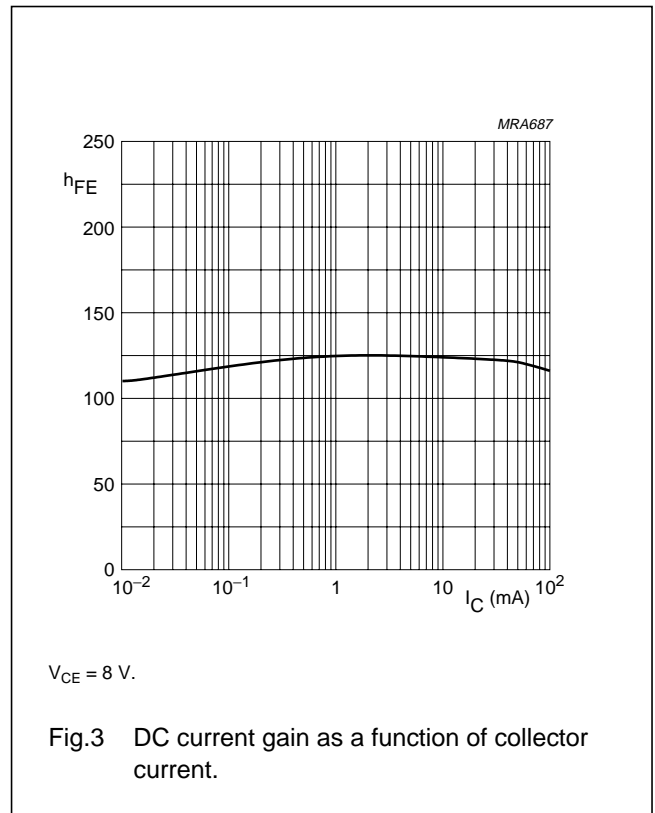
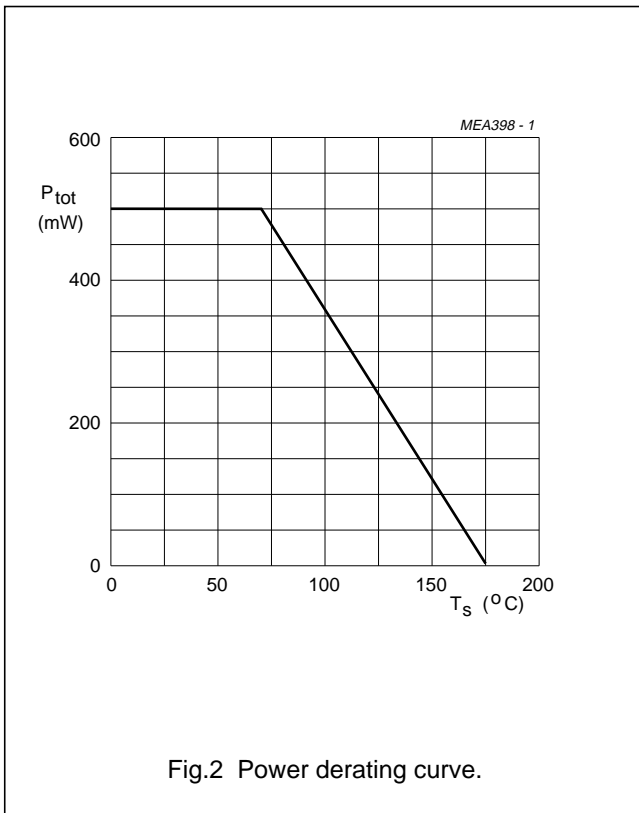
1. G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero and

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

2. $I_C = 40\text{ mA}; V_{CE} = 8\text{ V}; R_L = 50\text{ }\Omega;$
 $T_{amb} = 25\text{ °C}; f = 900\text{ MHz};$
 $f_p = 900\text{ MHz}; f_q = 902\text{ MHz};$
 measured at $f_{(2p-q)} = 898\text{ MHz}$ and $f_{(2q-p)} = 904\text{ MHz}.$
3. $d_{im} = -60\text{ dB}$ (DIN 45004B);
 $V_p = V_o; V_q = V_o - 6\text{ dB}; f_p = 795.25\text{ MHz};$
 $V_R = V_o - 6\text{ dB}; f_q = 803.25\text{ MHz}; f_r = 805.25\text{ MHz};$
 measured at $f_{(p+q-r)} = 793.25\text{ MHz};$ preliminary data.

NPN 9 GHz wideband transistor

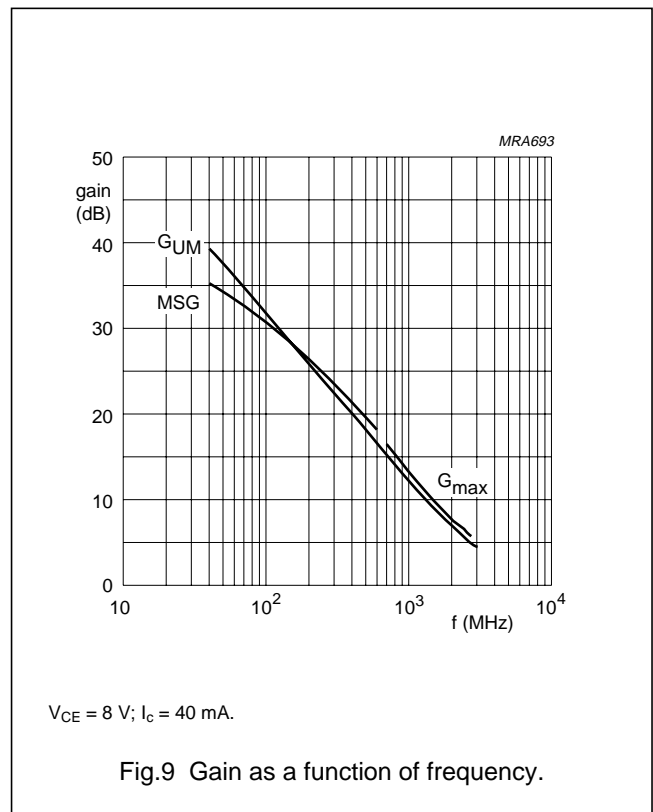
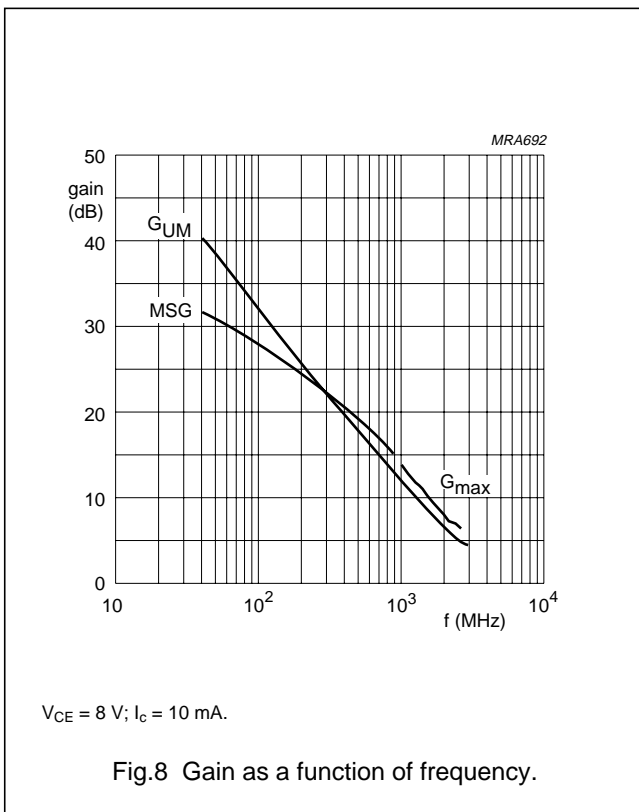
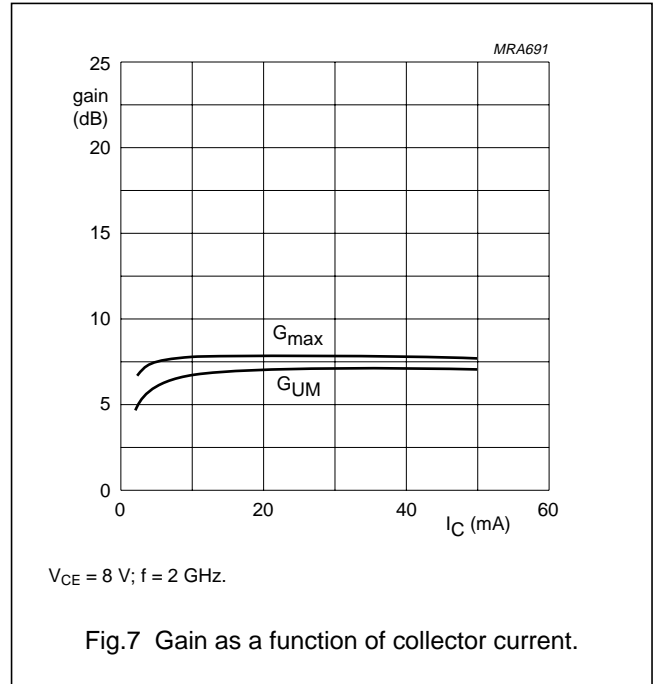
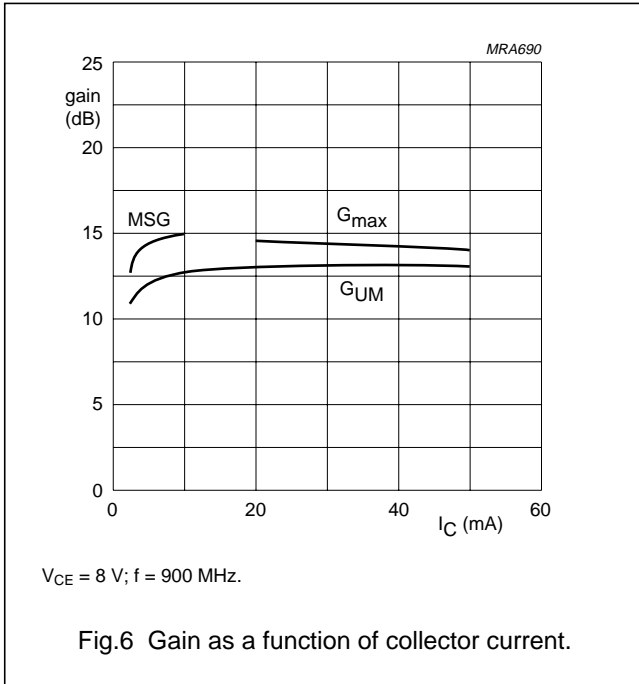
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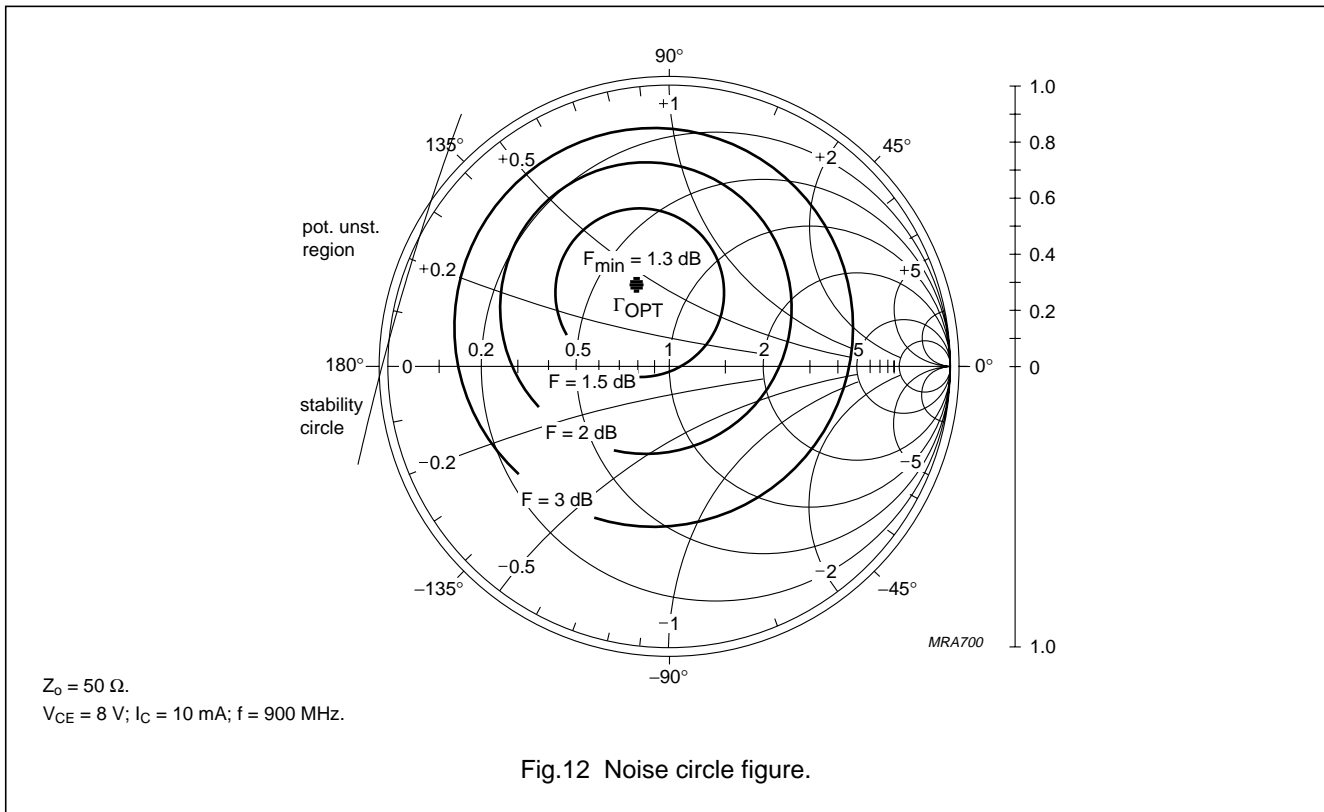
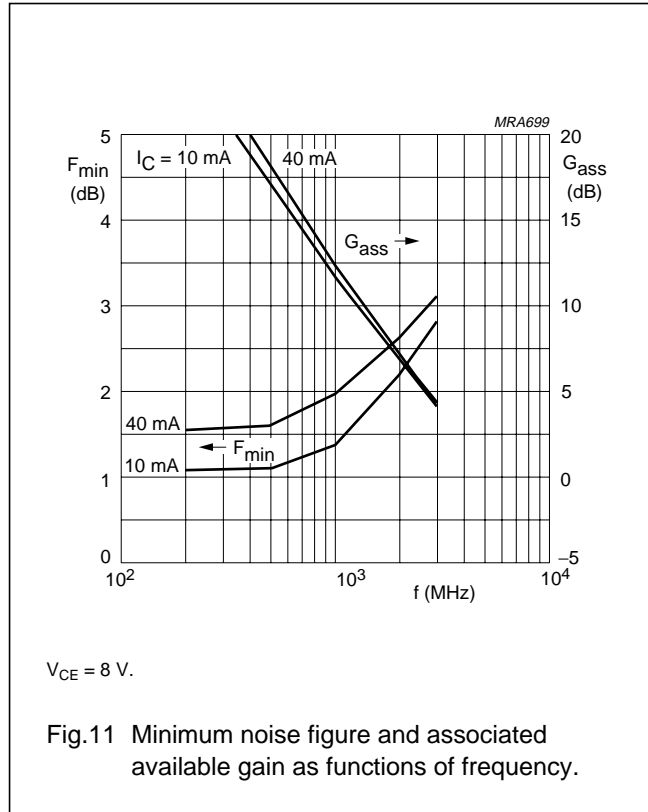
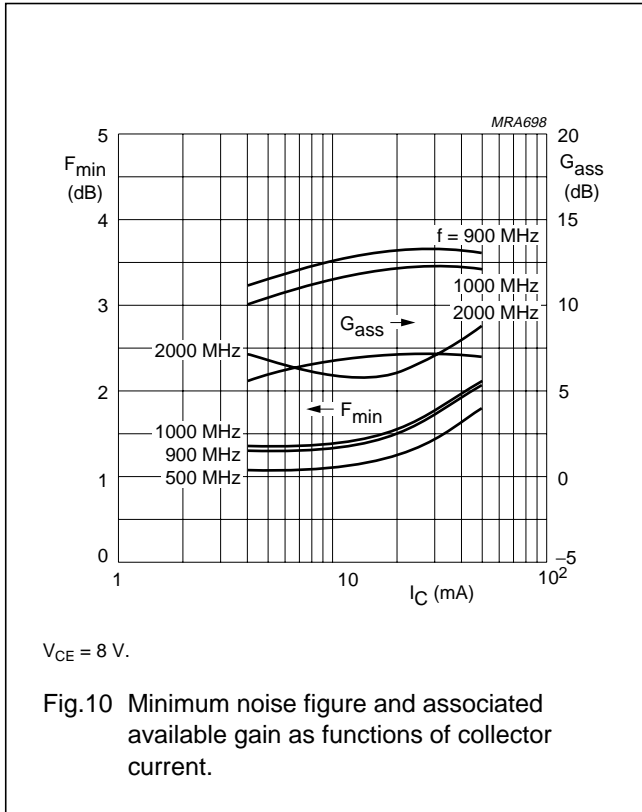
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In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



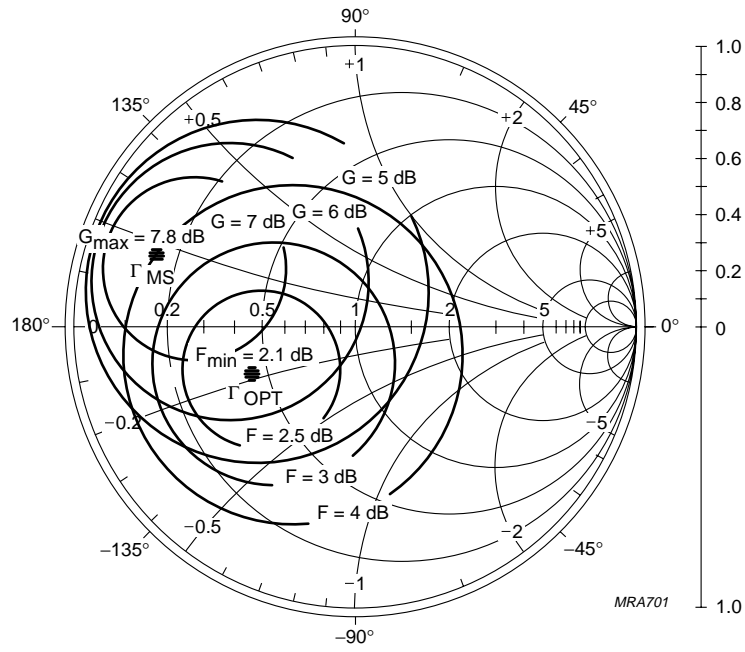
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NPN 9 GHz wideband transistor

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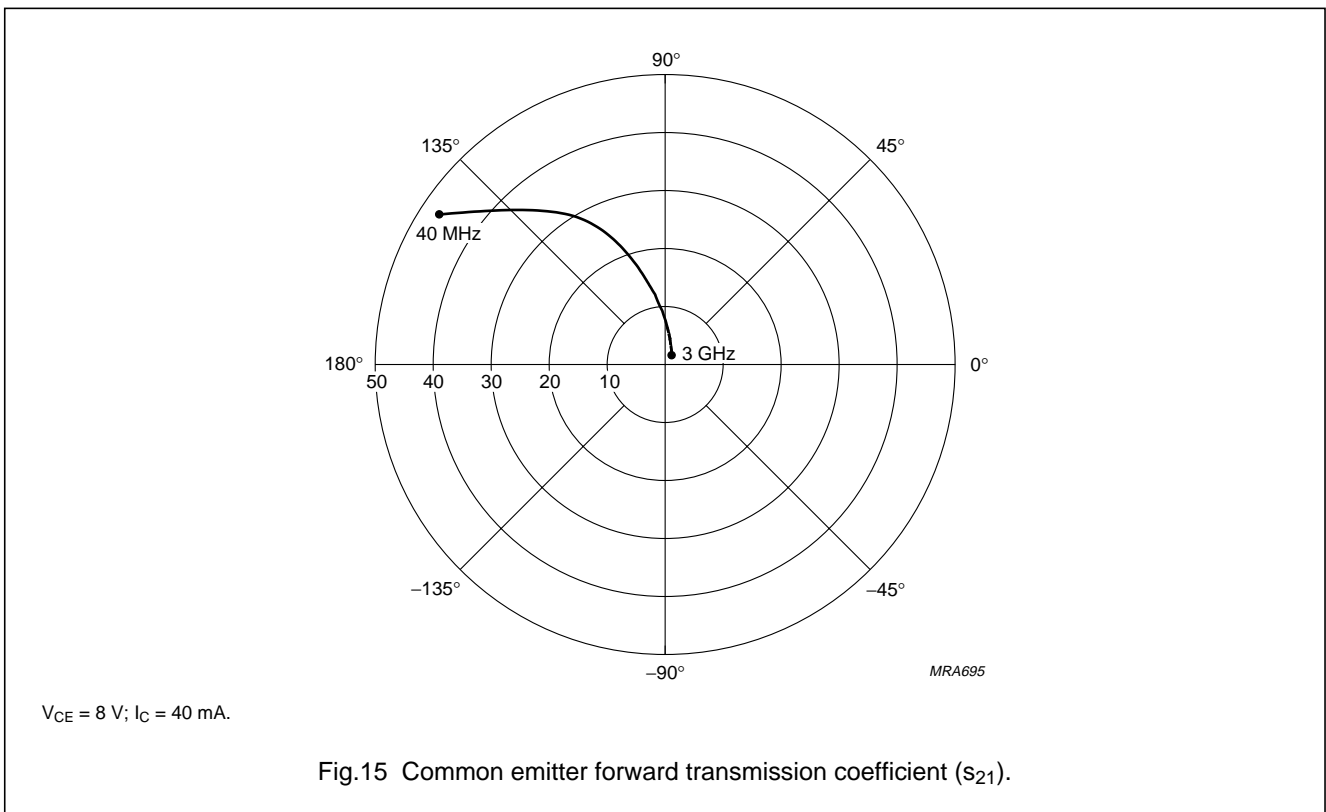
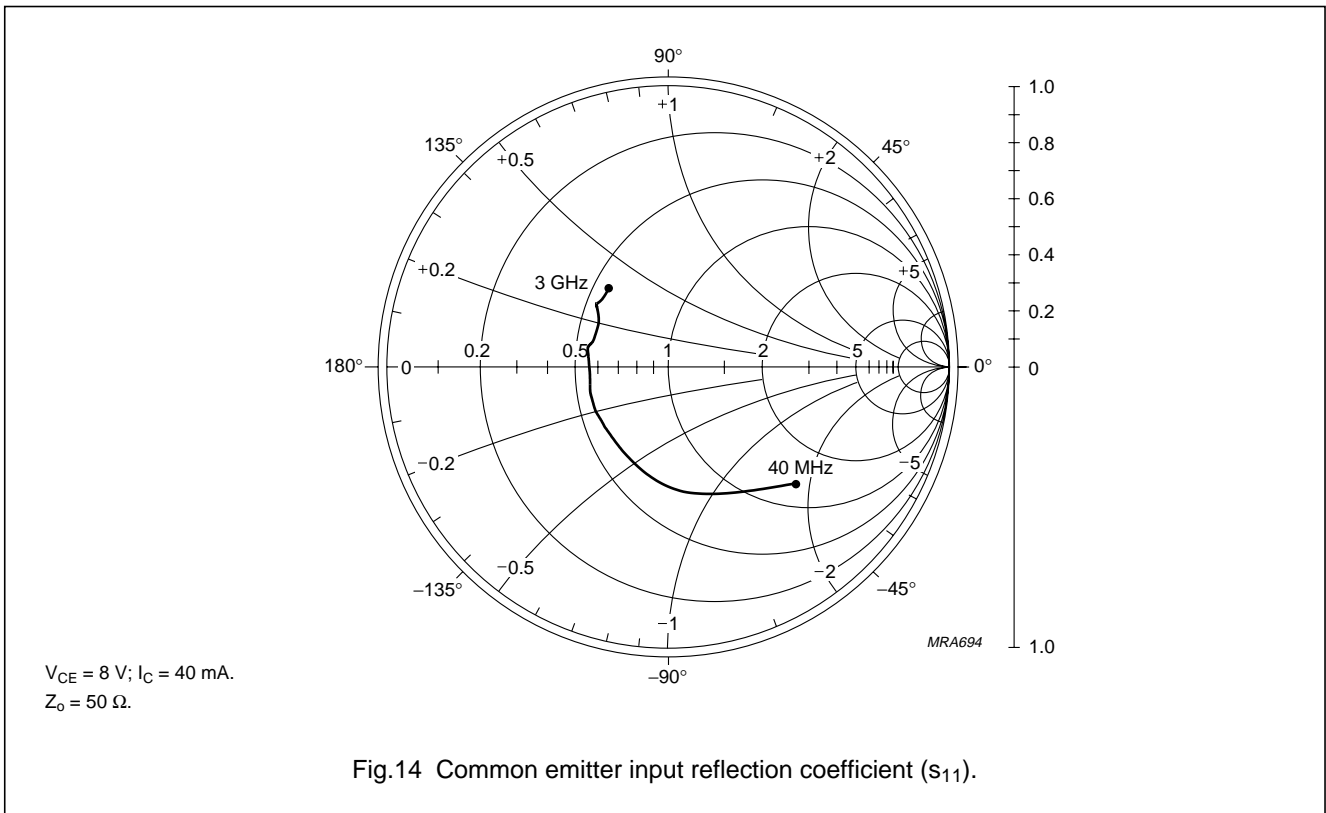


$Z_0 = 50 \Omega$.
 $V_{CE} = 8 \text{ V}$; $I_C = 10 \text{ mA}$; $f = 2000 \text{ MHz}$.

Fig.13 Noise circle figure.

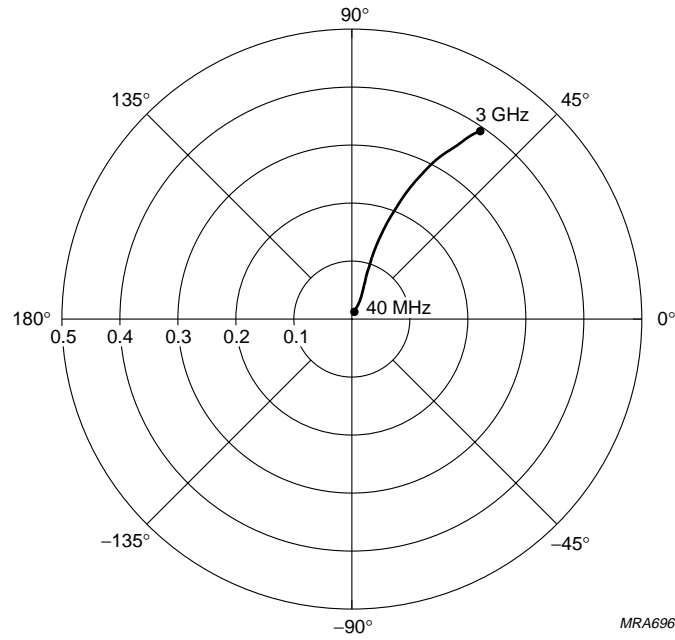
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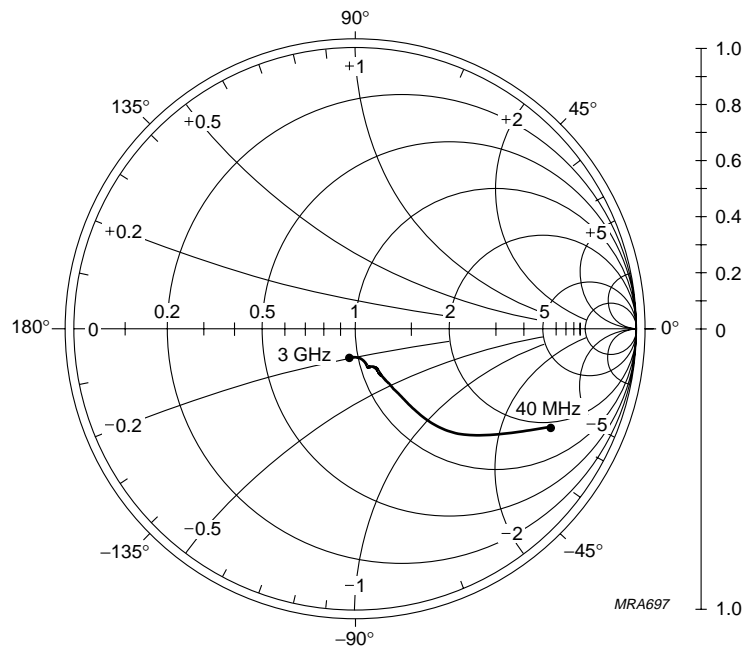
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$V_{CE} = 8\text{ V}; I_C = 40\text{ mA}$.

Fig.16 Common emitter reverse transmission coefficient (s_{12}).



$V_{CE} = 8\text{ V}; I_C = 40\text{ mA}$.
 $Z_o = 50\ \Omega$.

Fig.17 Common emitter output reflection coefficient (s_{22}).

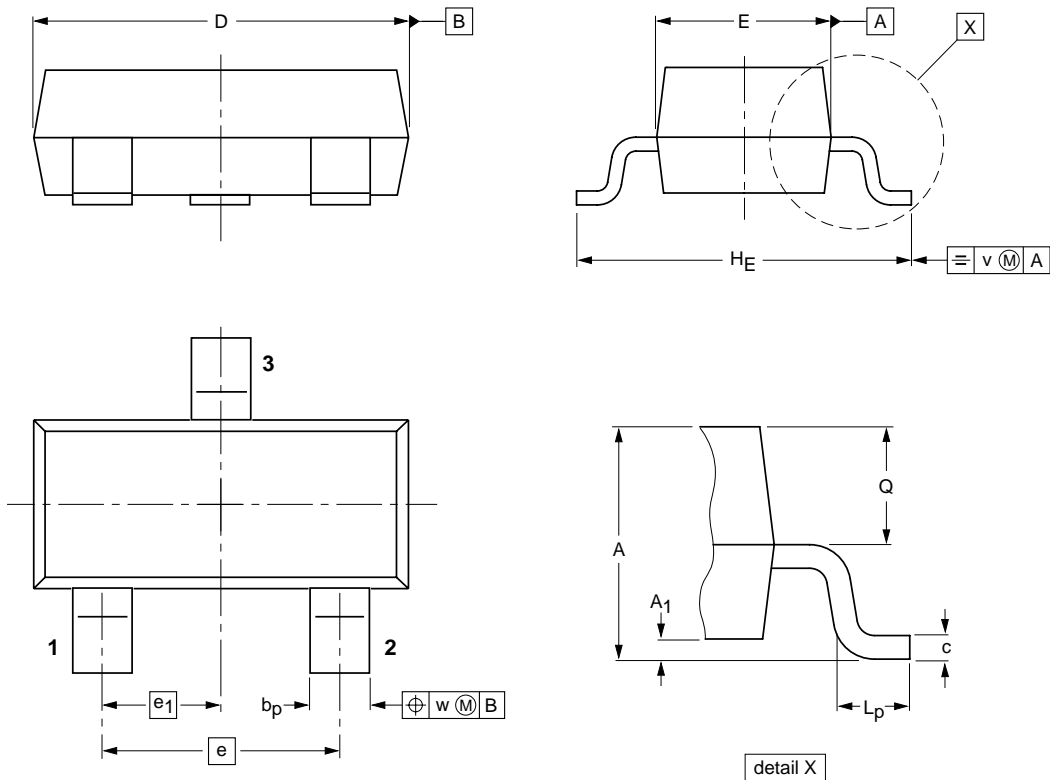
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PACKAGE OUTLINE

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		TO-236AB				97-02-28- 99-09-13

NPN 9 GHz wideband transistor**BFR540****DATA SHEET STATUS**

DATA SHEET STATUS	PRODUCT STATUS	DEFINITIONS ⁽¹⁾
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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NOTES

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