

DATA SHEET

BFR540

NPN 9 GHz wideband transistor

Product specification
Supersedes data of 1995 September

1999 Aug 23

NPN 9 GHz wideband transistor

BFR540

FEATURES

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

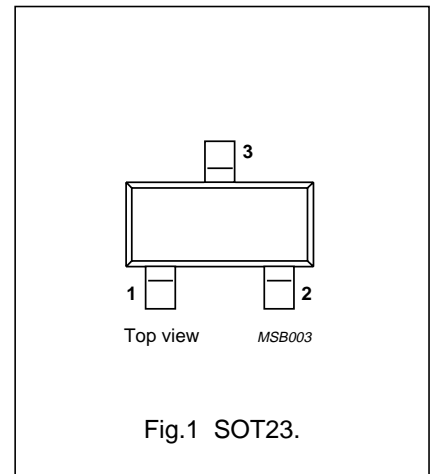
DESCRIPTION

The BFR540 is an npn silicon planar epitaxial transistor, intended for applications in the RF frontend in 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.

The transistor is encapsulated in a plastic SOT23 envelope.

PINNING

PIN	DESCRIPTION
Code: N29	
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	up to $T_s = 70\text{ °C}$; note 1	–	–	500	mW
h_{FE}	DC current gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$	60	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

BFR540

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_{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	up to $T_s = 70\text{ °C}$; note 1	–	500	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	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

BFR540

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	$I_C = 40\text{ mA}; V_{CE} = 8\text{ V}$	60	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

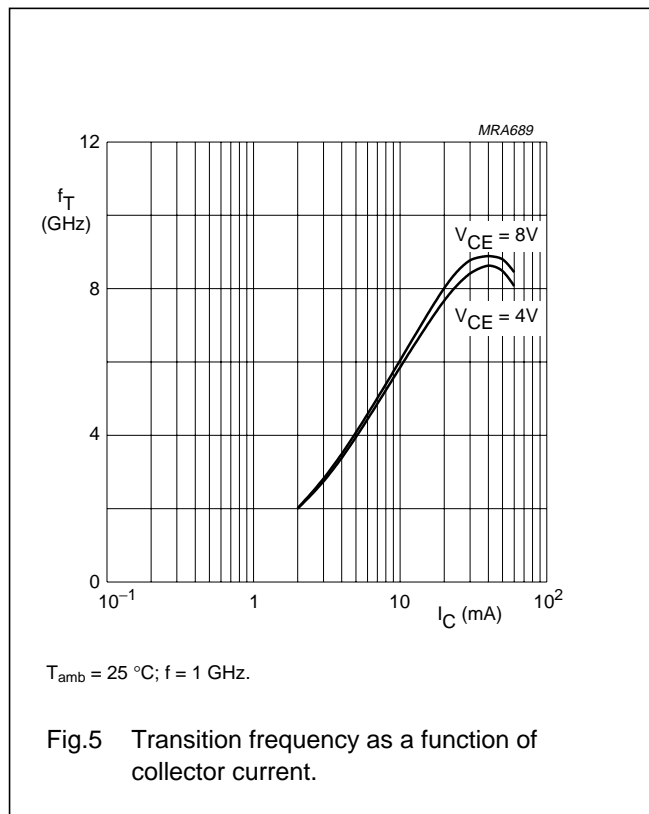
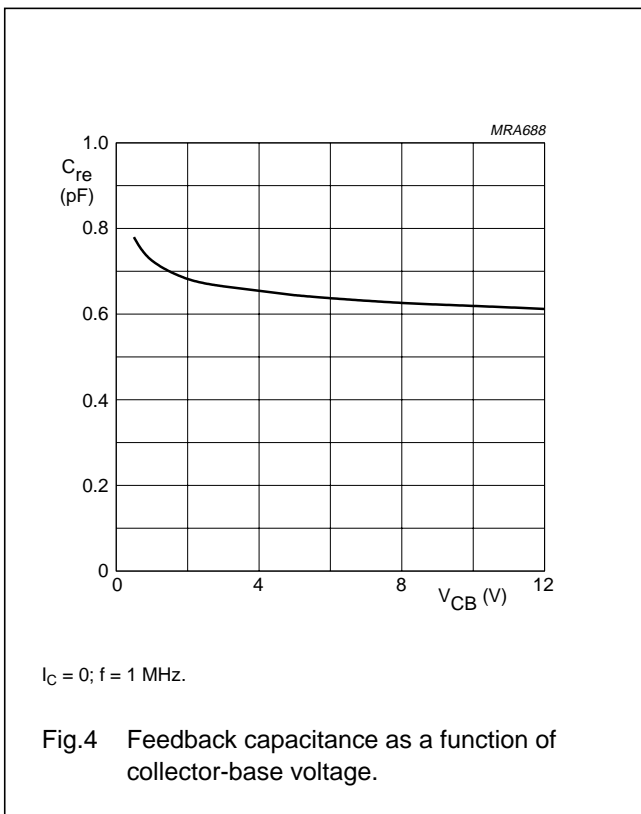
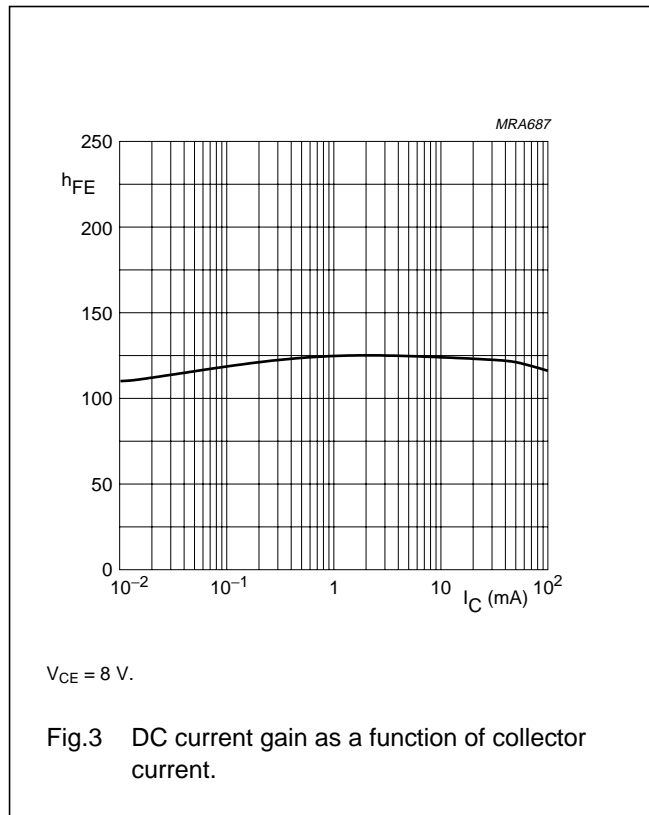
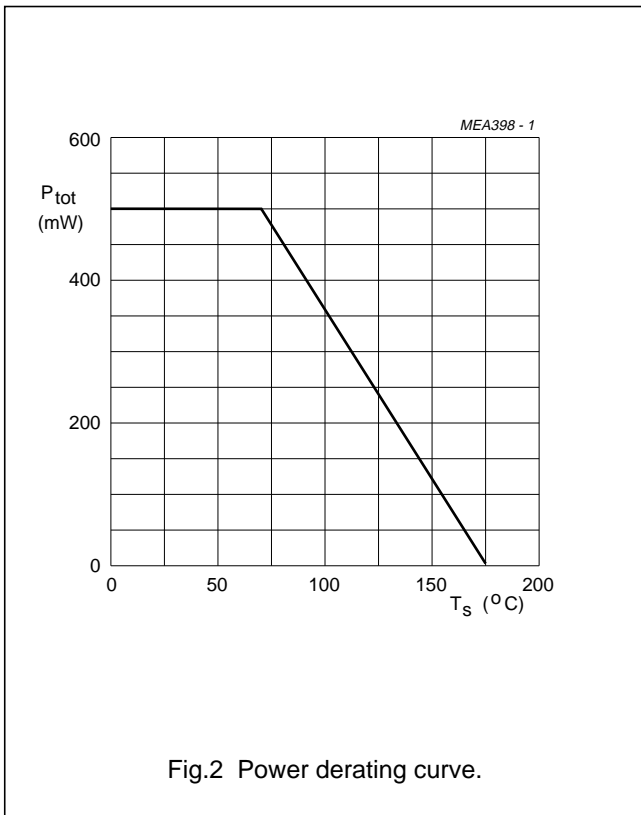
1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and

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

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

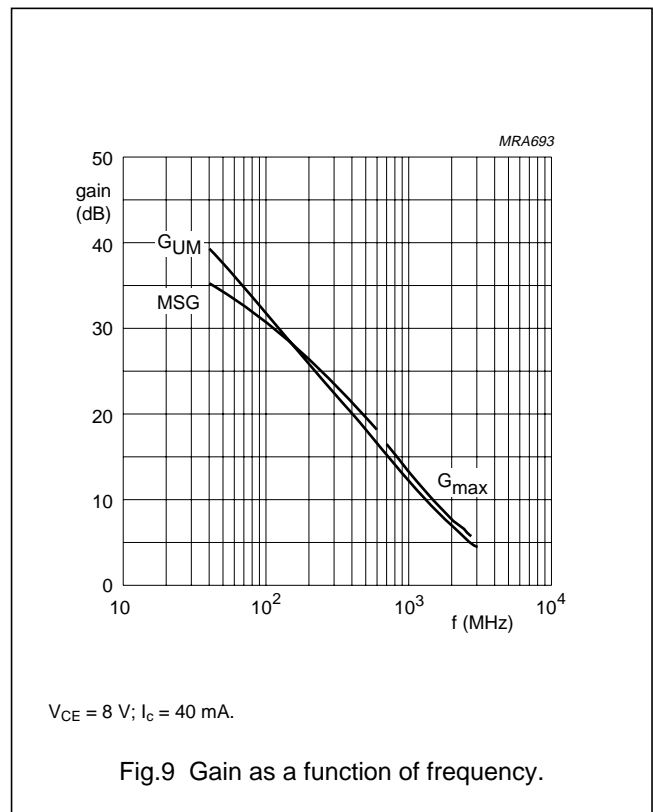
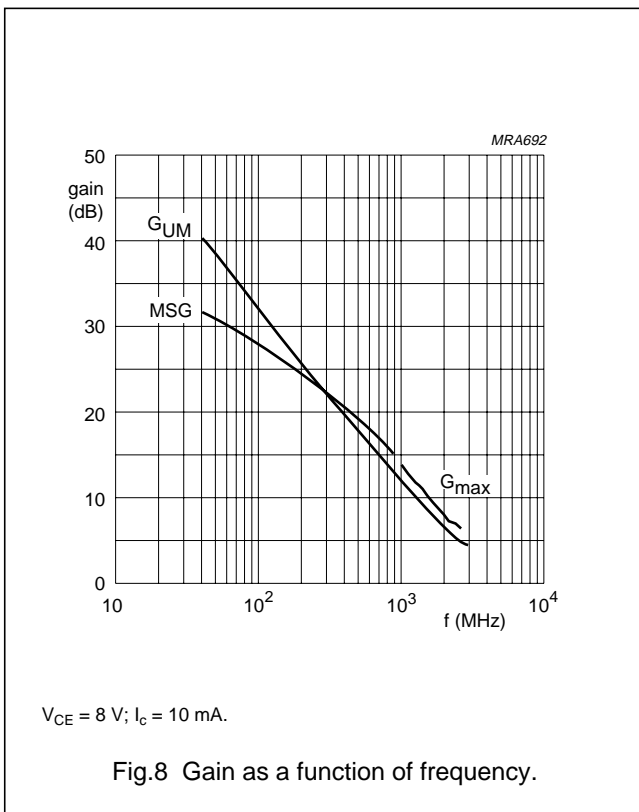
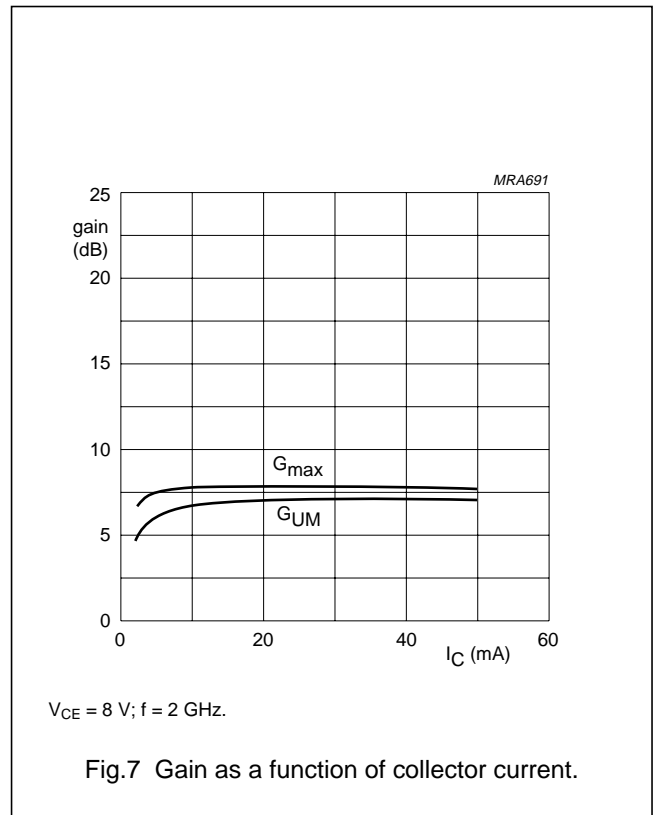
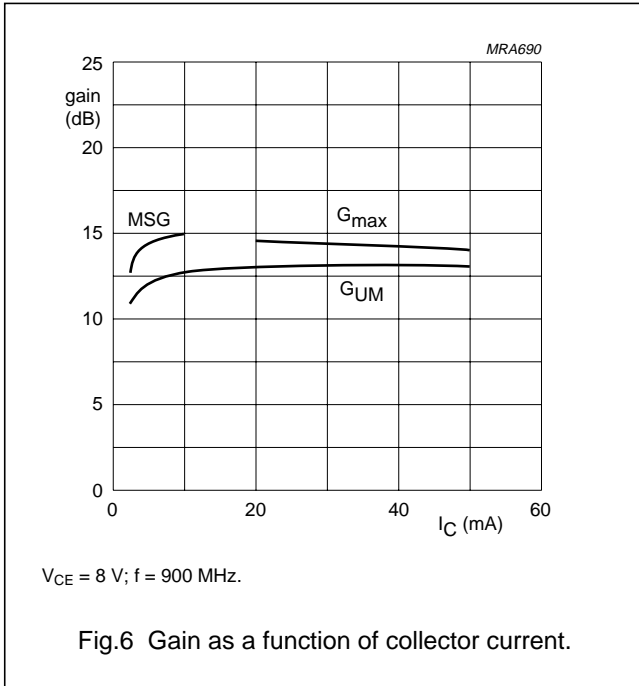
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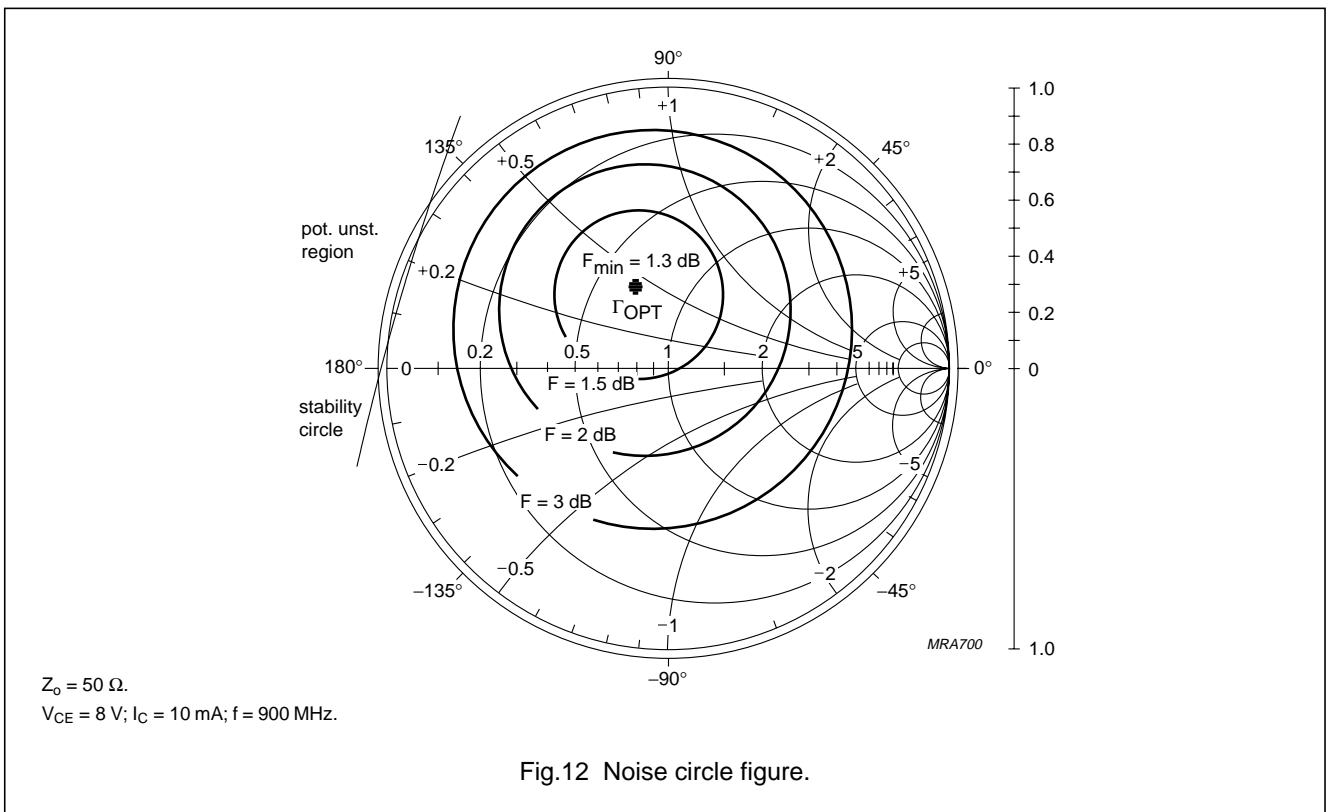
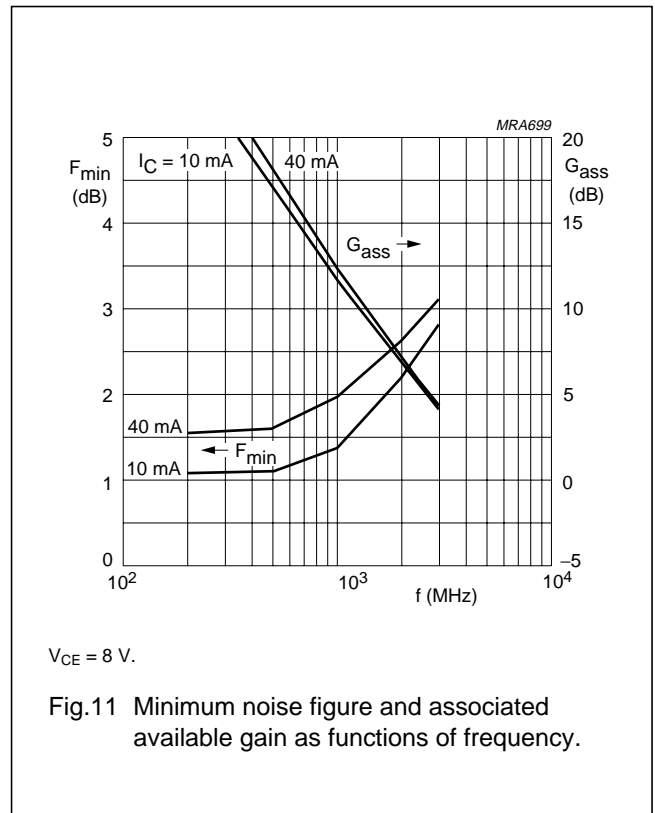
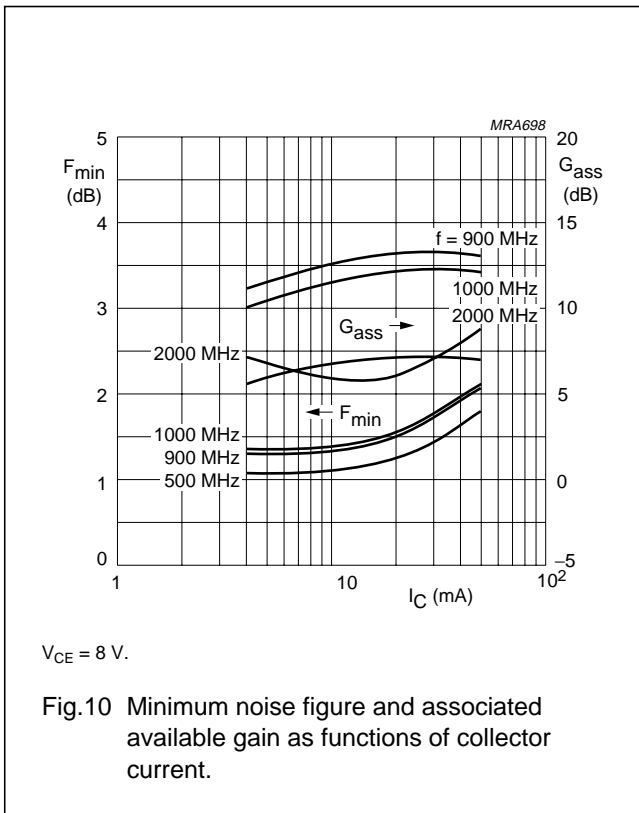
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In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



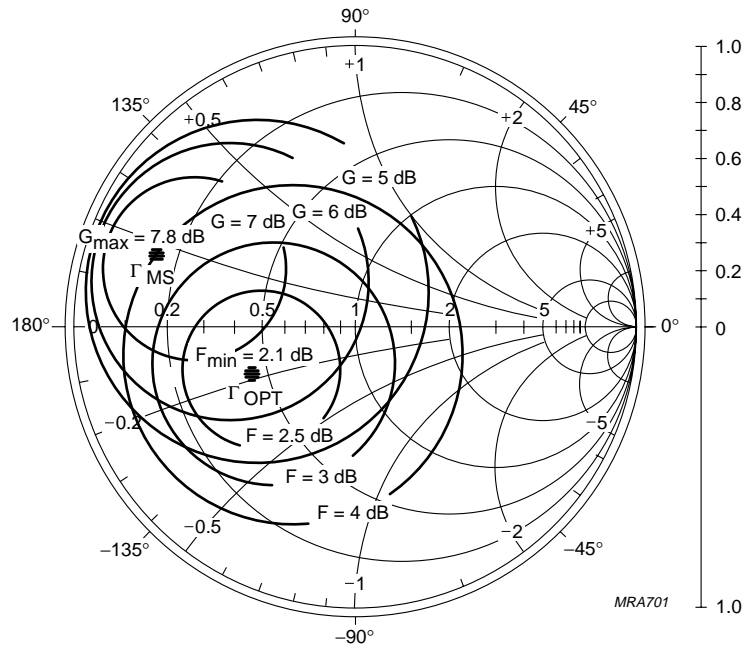
NPN 9 GHz wideband transistor

BFR540



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BFR540



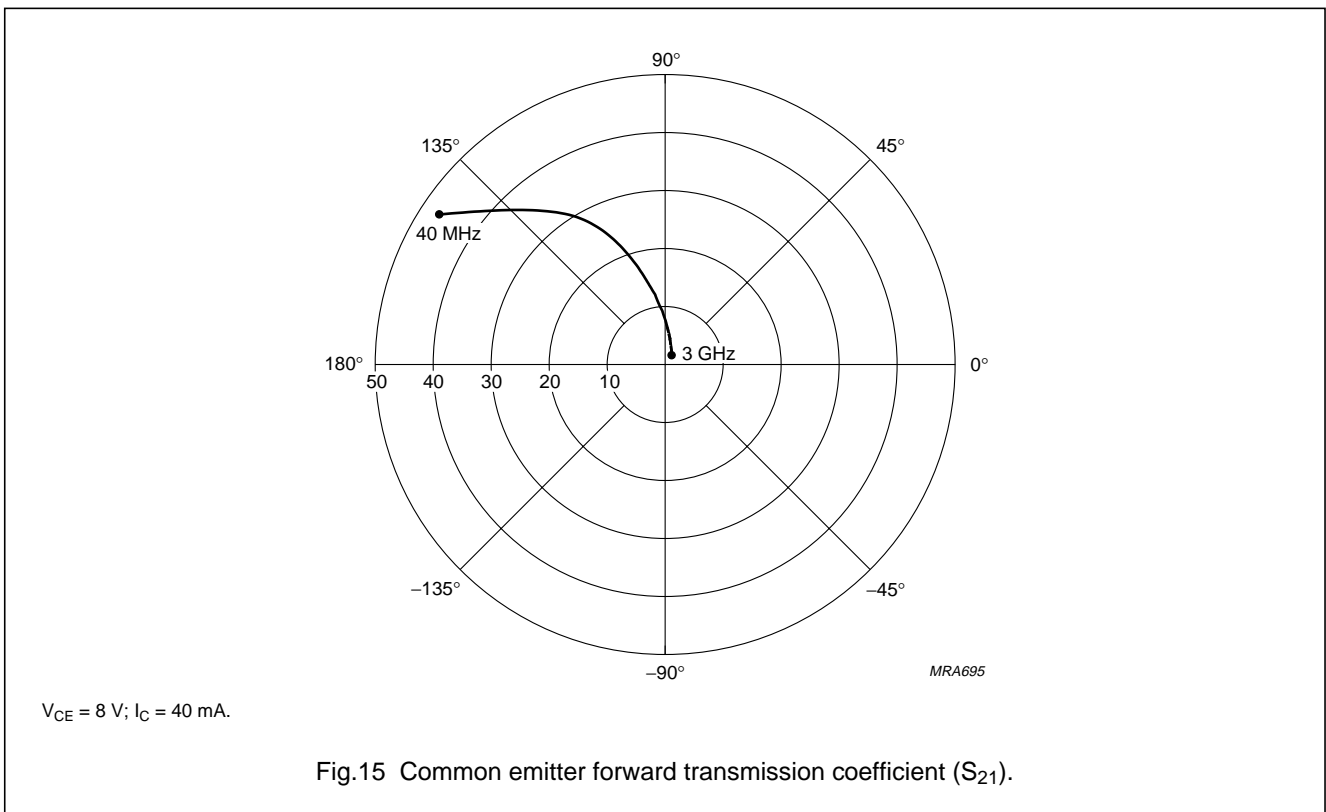
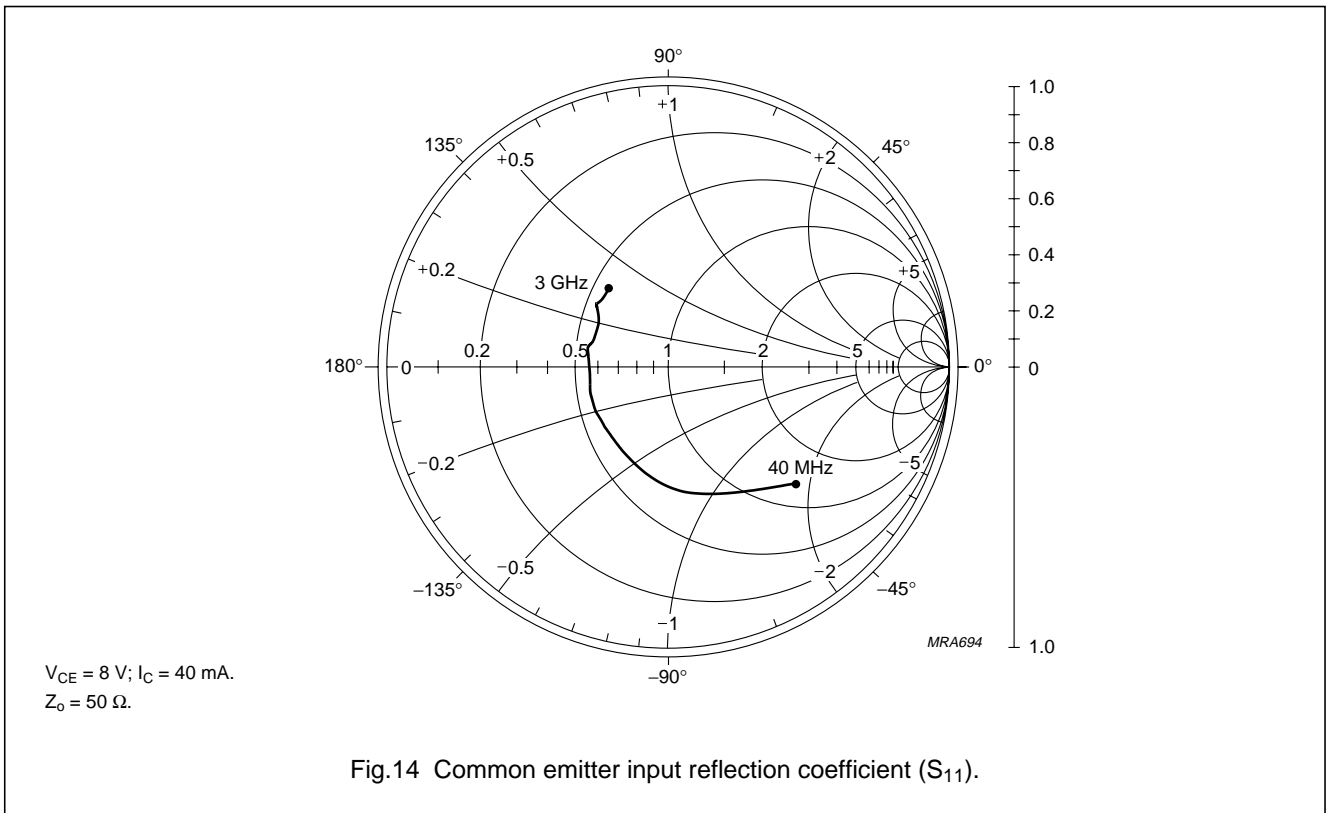
MRA701

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

Fig.13 Noise circle figure.

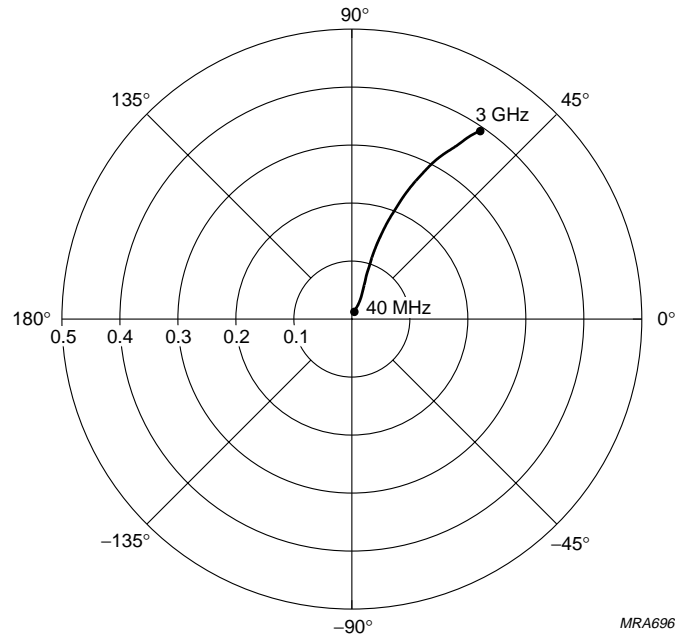
NPN 9 GHz wideband transistor

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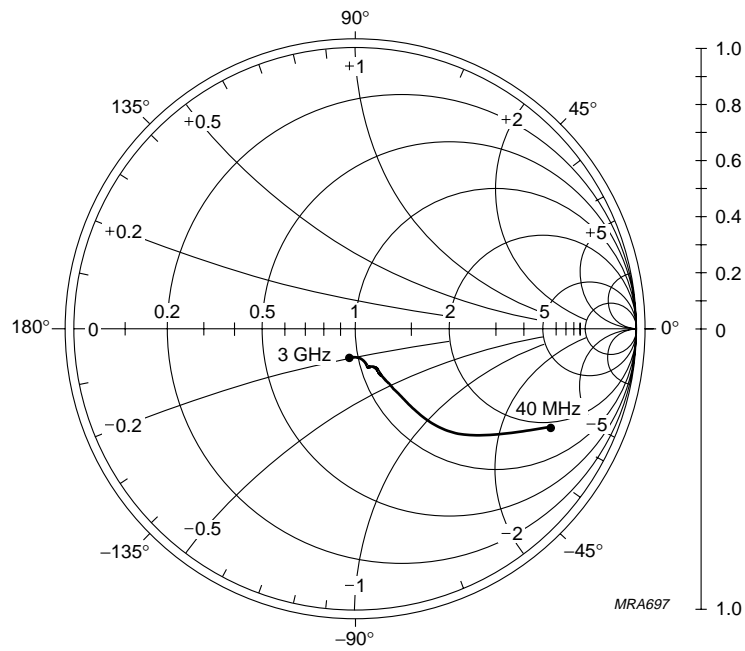
BFR540



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

MRA696

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



$V_{CE} = 8\text{ V}; I_C = 40\text{ mA}$.
 $Z_0 = 50\ \Omega$.

MRA697

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

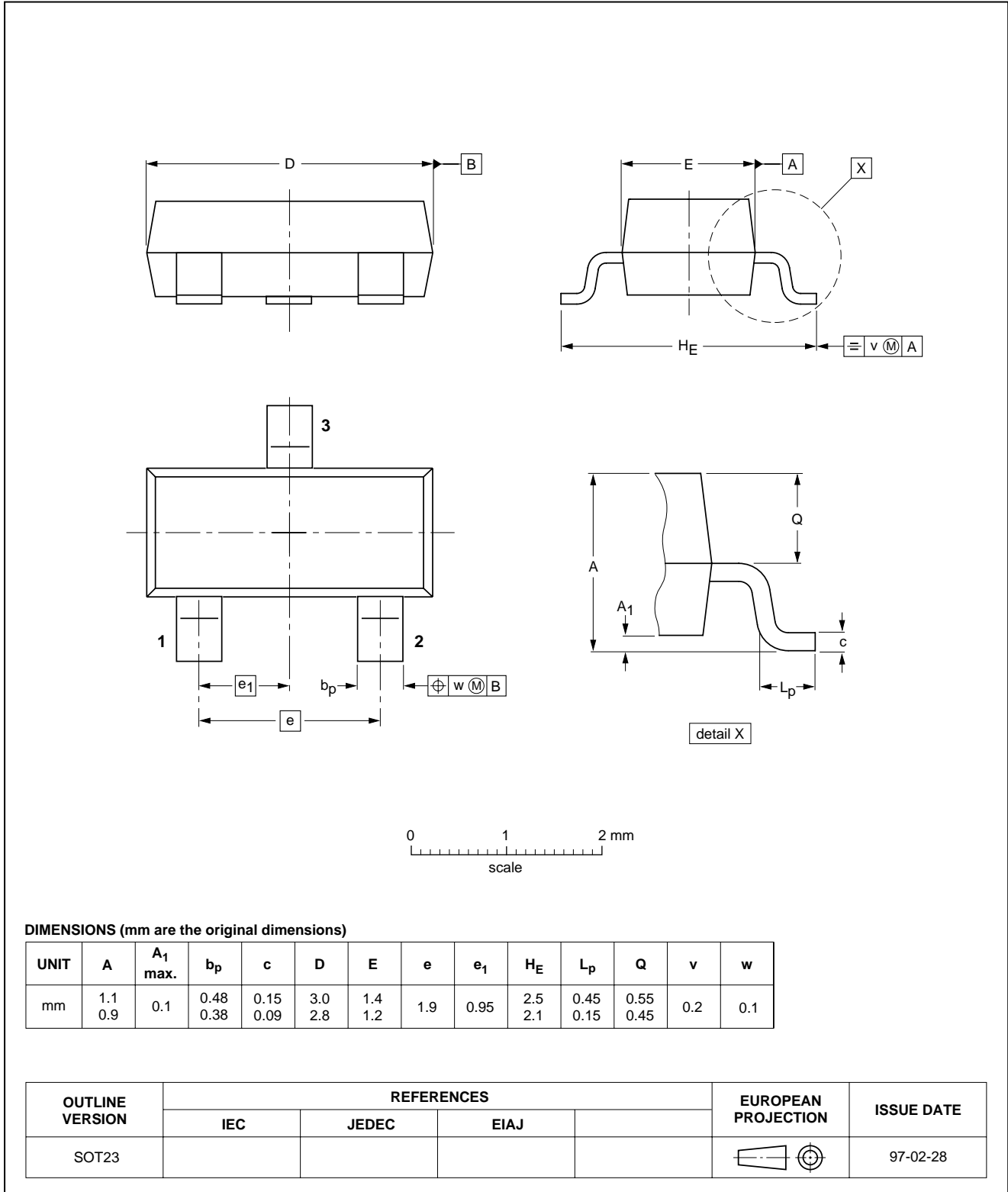
NPN 9 GHz wideband transistor

BFR540

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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BFR540

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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NPN 9 GHz wideband transistor

BFR540

NOTES

NPN 9 GHz wideband transistor

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NOTES

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