

DATA SHEET

BFR505

NPN 9 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

NPN 9 GHz wideband transistor

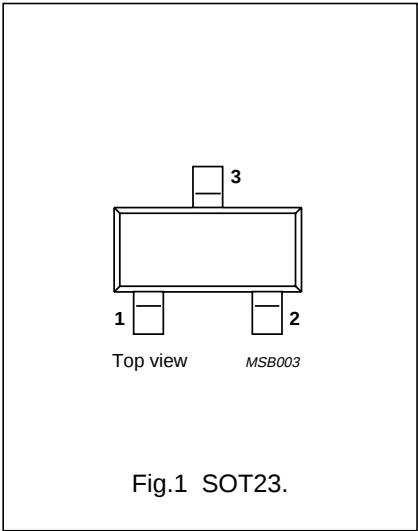
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FEATURES

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

PINNING

PIN	DESCRIPTION
Code: N30	
1	base
2	emitter
3	collector



DESCRIPTION

The BFR505 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, pagers and satellite TV tuners (SATV).

The transistor is encapsulated in a plastic SOT23 envelope.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	—	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	—	—	15	V
I_C	DC collector current		—	—	18	mA
P_{tot}	total power dissipation	up to $T_s = 135\text{ }^{\circ}\text{C}$; note 1	—	—	150	mW
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	—	0.3	—	pF
f_T	transition frequency	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 1\text{ GHz}$	—	9	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	—	17	—	dB
		$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 2\text{ GHz}$	—	10	—	dB
$ S_{21} ^2$	insertion power gain	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	13	14	—	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 1.25\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	—	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	—	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 1.25\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 2\text{ GHz}$	—	1.9	—	dB

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	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage		–	2.5	V
I_C	DC collector current	continuous	–	18	mA
P_{tot}	total power dissipation	up to $T_s = 135\text{ °C}$; note 1	–	150	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-s}$	from junction to soldering point (note 1)	260 K/W

Note

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

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CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CB} = 6\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$	60	120	250	
C_e	emitter capacitance	$I_C = I_{C0}$; $V_{EB} = 0.5\text{ V}$; $f = 1\text{ MHz}$	–	0.4	–	pF
C_c	collector capacitance	$I_E = I_{E0}$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	–	0.4	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6\text{ V}$; $f = 1\text{ MHz}$	–	0.3	–	pF
f_T	transition frequency	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $f = 1\text{ GHz}$	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	–	17	–	dB
		$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 2\text{ GHz}$	–	10	–	dB
$ S_{21} ^2$	insertion power gain	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	13	14	–	dB
F	noise figure	$\Gamma_S = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	–	1.2	1.7	dB
		$\Gamma_S = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	–	1.6	2.1	dB
		$\Gamma_S = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 2\text{ GHz}$	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $R_L = 50\text{ }\Omega$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $f = 900\text{ MHz}$	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

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

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

2. $I_C = 5\text{ mA}$; $V_{CE} = 6\text{ V}$; $R_L = 50\text{ }\Omega$; $T_{amb} = 25\text{ }^{\circ}\text{C}$;
 $f_p = 900\text{ MHz}$; $f_q = 902\text{ MHz}$;
 measured at $f_{(2p-q)} = 898\text{ MHz}$ and $f_{(2q-p)} = 904\text{ MHz}$.

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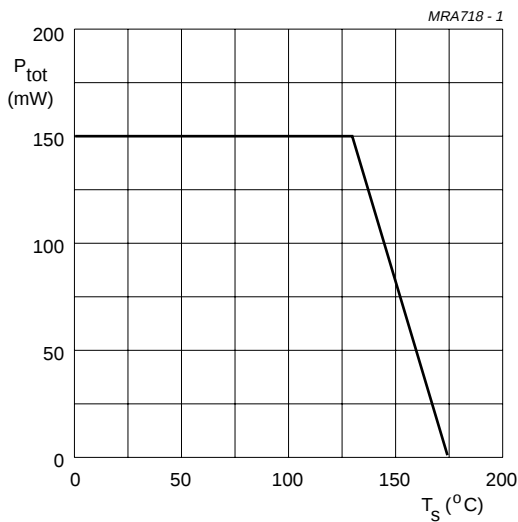
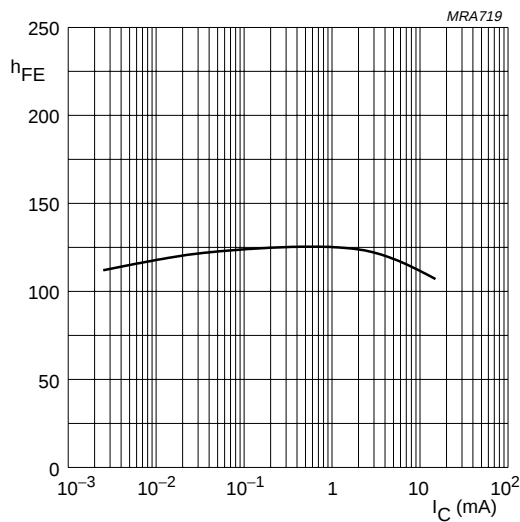
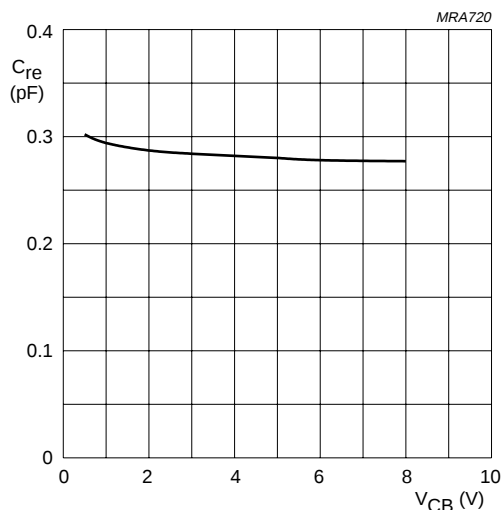


Fig.2 Power derating curve.



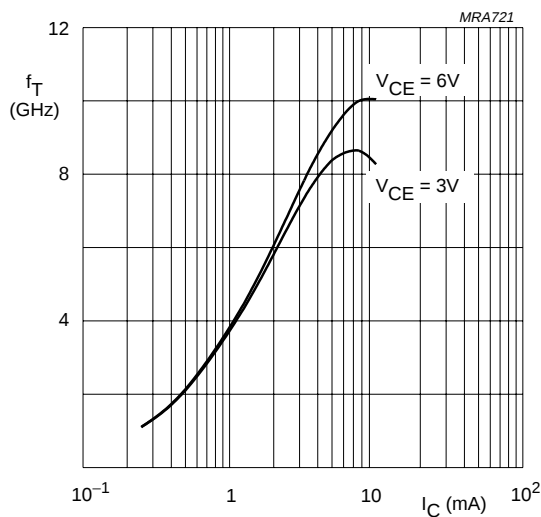
$V_{CE} = 6\text{ V}$.

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



$I_c = 0$; $f = 1\text{ MHz}$.

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

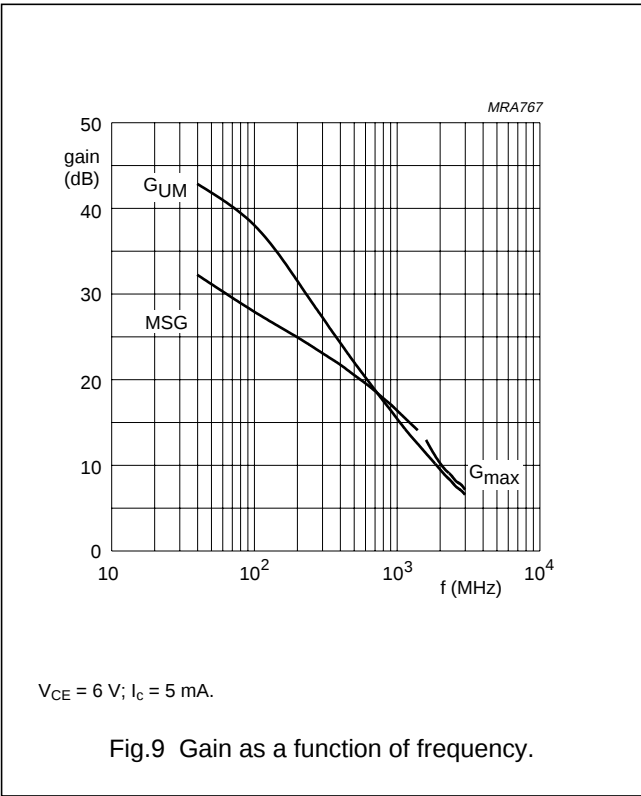
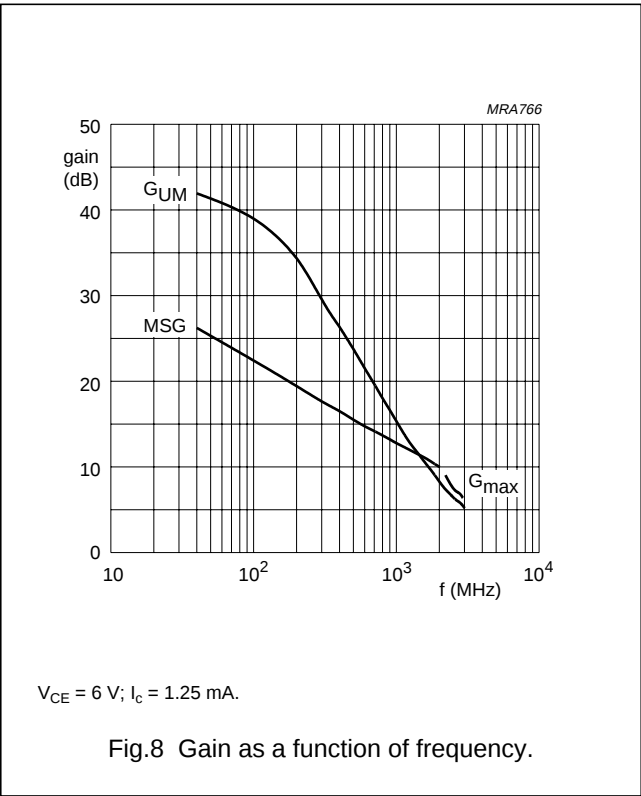
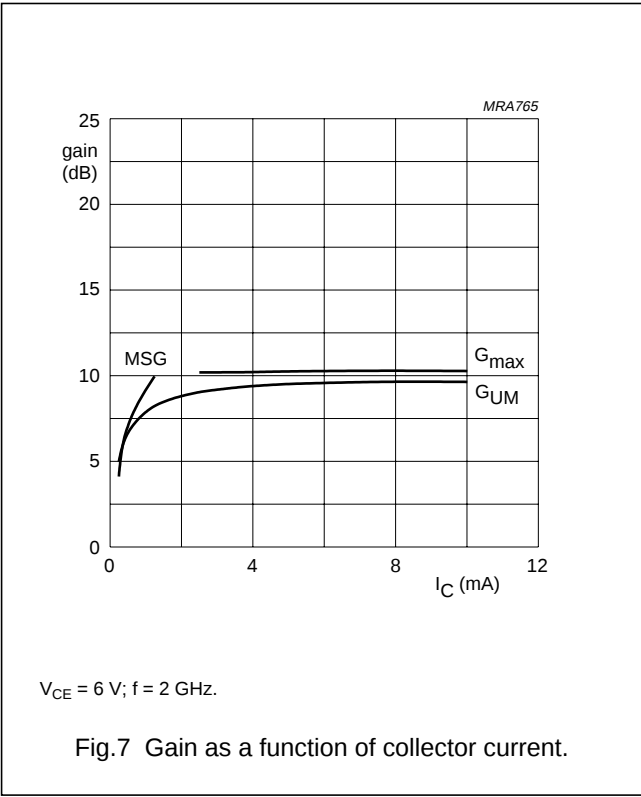
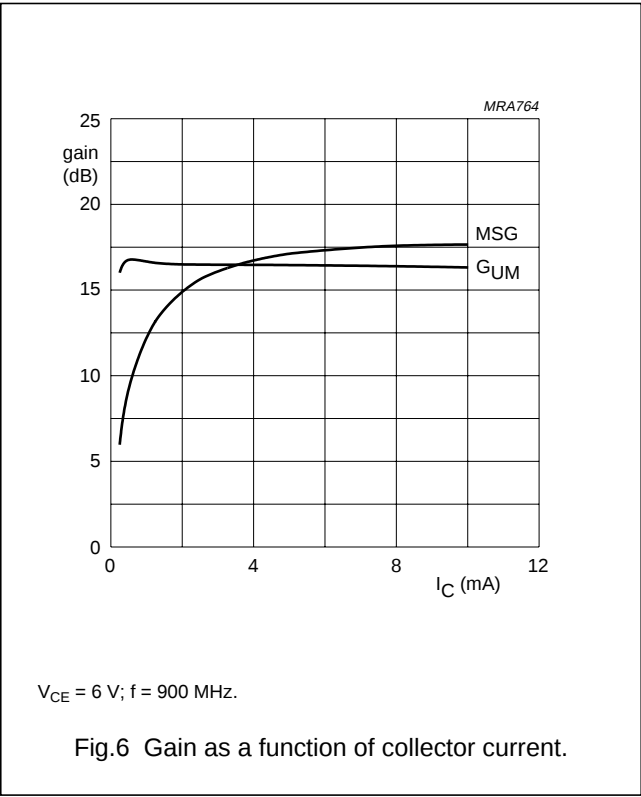


$T_{amb} = 25\text{ °C}$; $f = 1\text{ GHz}$.

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

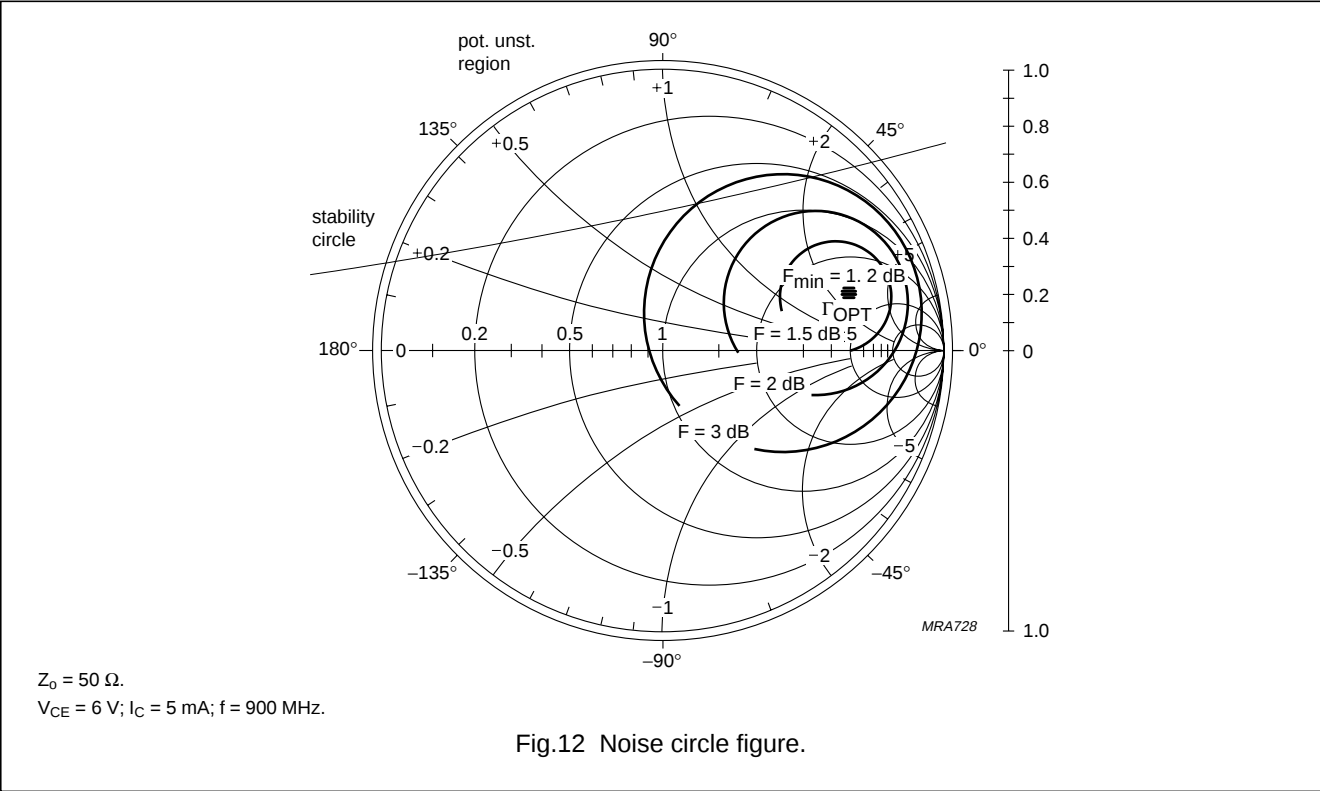
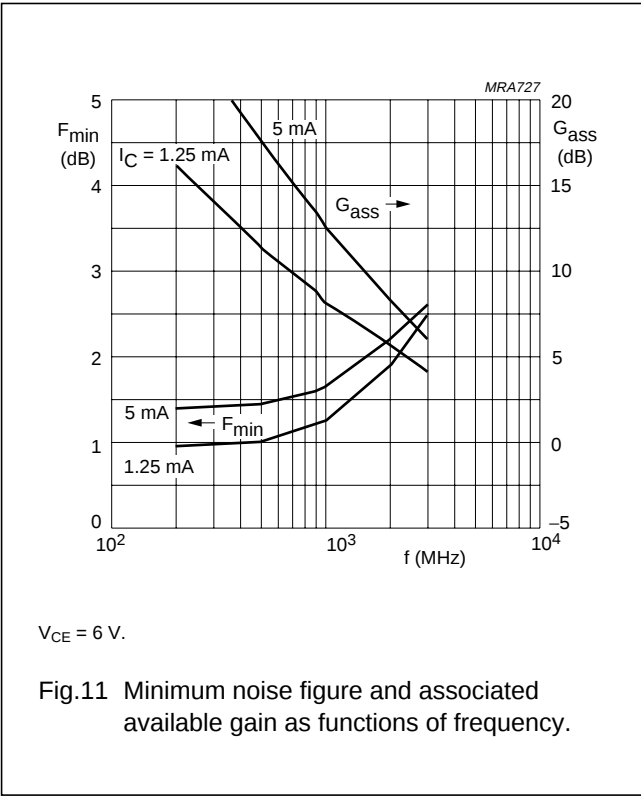
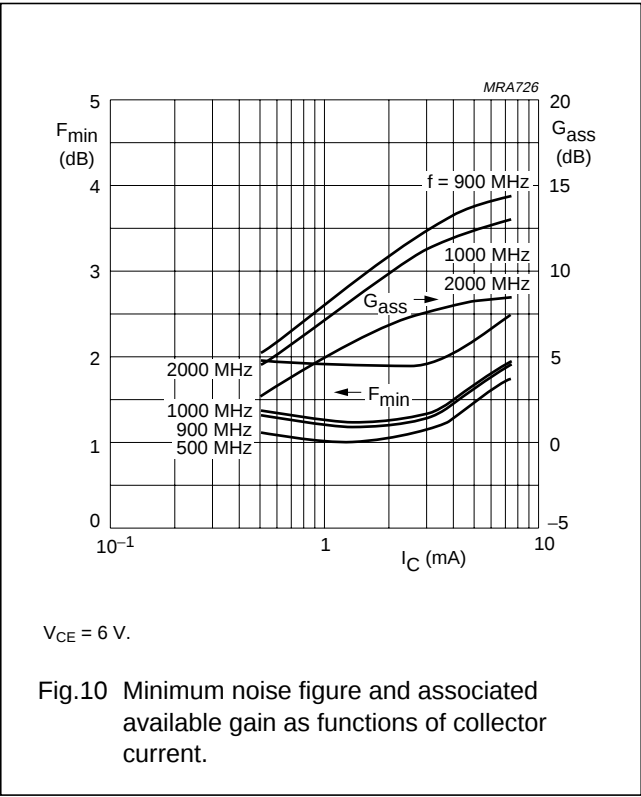
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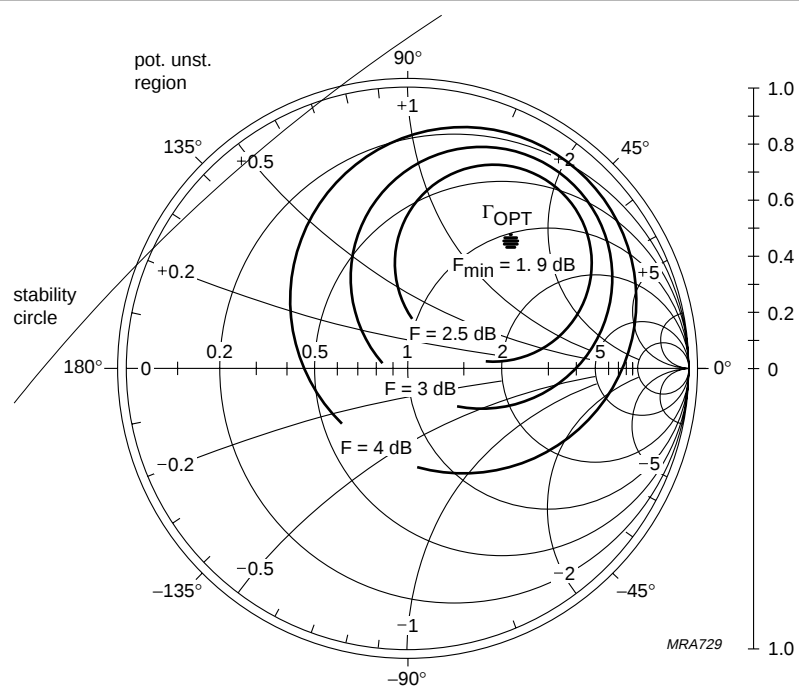
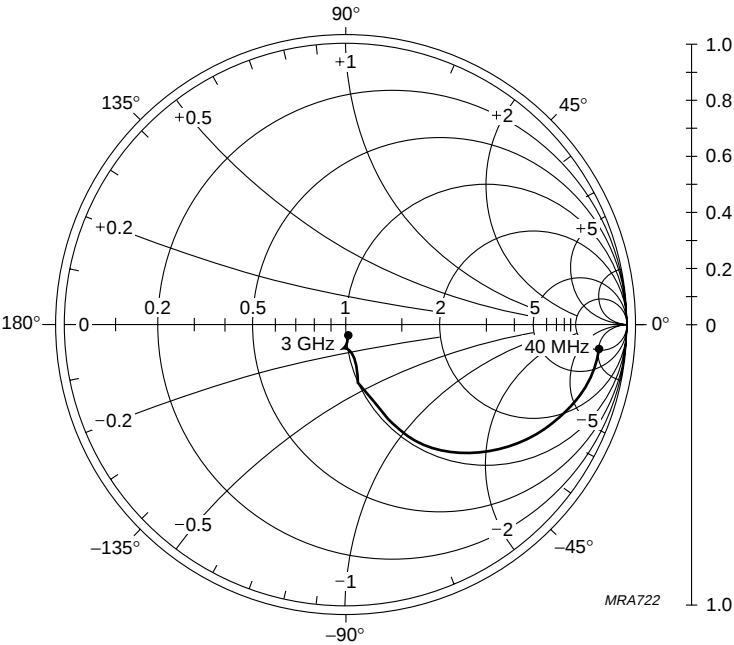
 $Z_0 = 50 \Omega$. $V_{CE} = 6 \text{ V}; I_C = 5 \text{ mA}; f = 2000 \text{ MHz}$.

Fig.13 Noise circle figure.

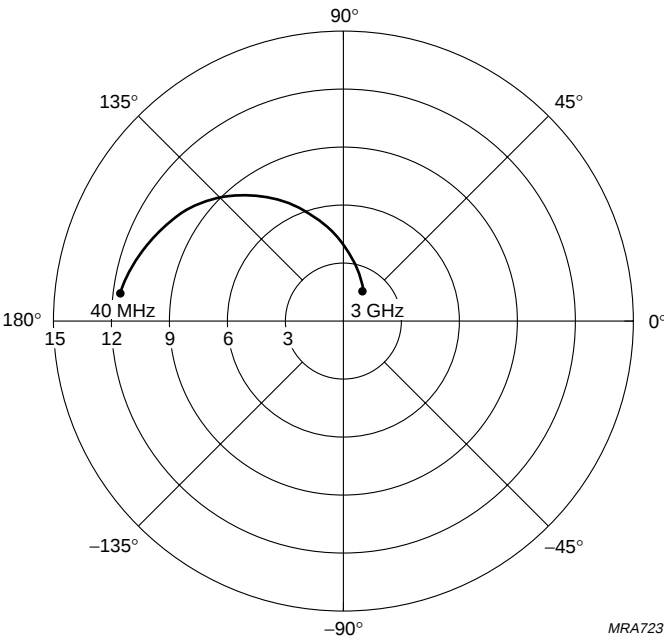
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$V_{CE} = 6\text{ V}$; $I_C = 5\text{ mA}$.
 $Z_0 = 50\ \Omega$.

Fig.14 Common emitter input reflection coefficient (S_{11}).

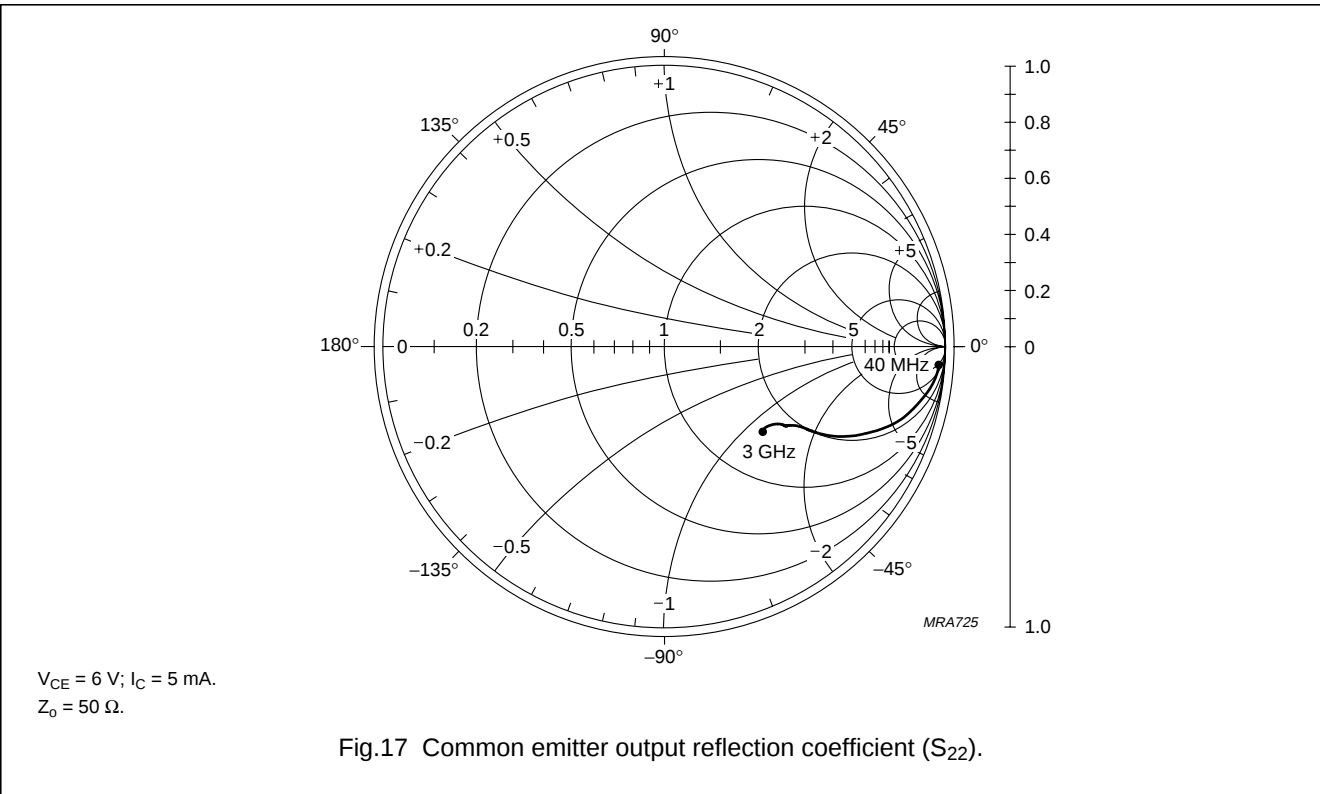
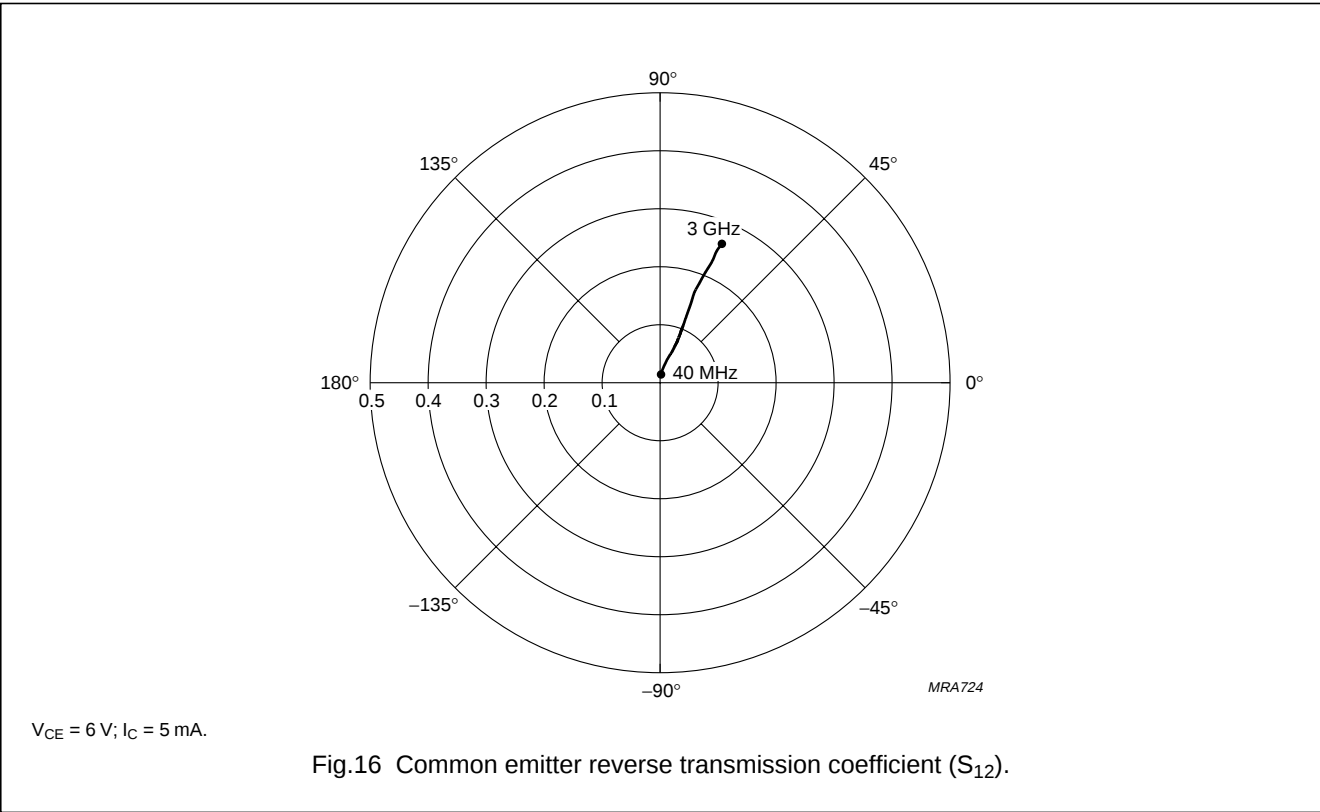


$V_{CE} = 6\text{ V}$; $I_C = 5\text{ mA}$.

Fig.15 Common emitter forward transmission coefficient (S_{21}).

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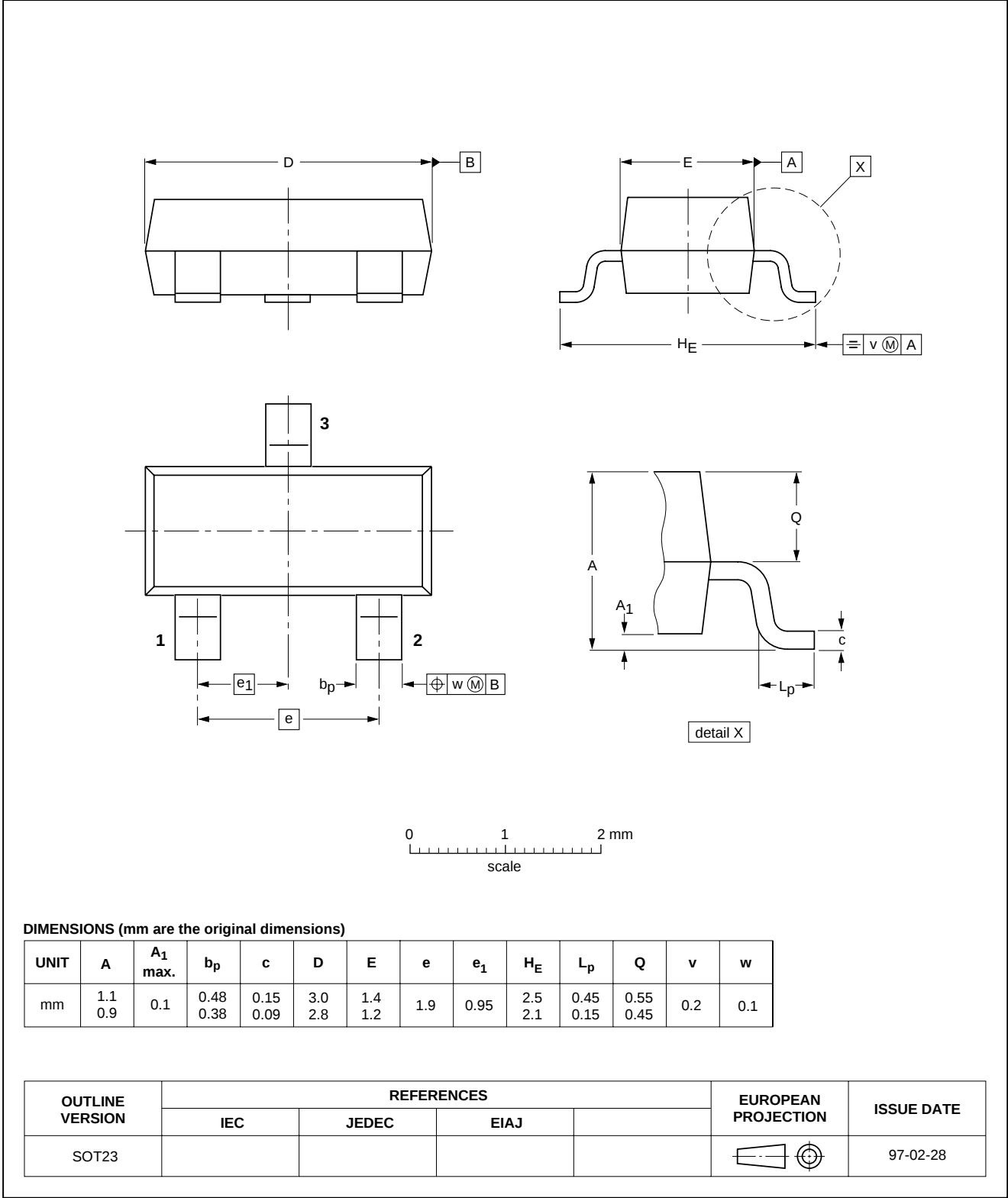
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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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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