

BFR92A

NPN 5 GHz wideband transistor

Rev. 04 — 2 March 2009

Product data sheet

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FEATURES

- High power gain
- Low noise figure
- Low intermodulation distortion.

APPLICATIONS

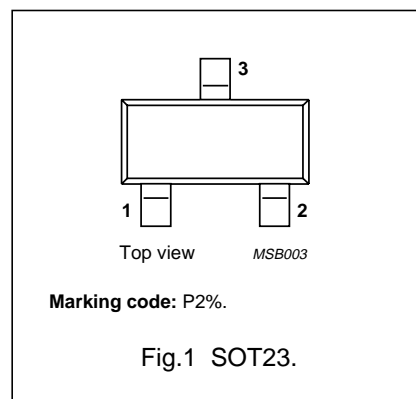
- RF wideband amplifiers and oscillators.

DESCRIPTION

NPN wideband transistor in a plastic SOT23 package.
PNP complement: BFT92.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	20	V
V_{CEO}	collector-emitter voltage		–	15	V
I_C	collector current (DC)		–	25	mA
P_{tot}	total power dissipation	$T_s \leq 95\text{ °C}$	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10\text{ V}$; $f = 1\text{ MHz}$	0.35	–	pF
f_T	transition frequency	$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$	5	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	14	–	dB
		$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	8	–	dB
F	noise figure	$I_C = 5\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $\Gamma_s = \Gamma_{opt}$; $T_{amb} = 25\text{ °C}$	2.1	–	dB
V_O	output voltage	$d_{im} = -60\text{ dB}$; $I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\text{ }\Omega$; $f_p + f_q - f_r = 793.25\text{ MHz}$	150	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	collector current (DC)		–	25	mA
P_{tot}	total power dissipation	$T_s \leq 95\text{ °C}$; note 1; see Fig.3	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C

Note

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

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	$T_s \leq 95\text{ °C}$; note 1	260	K/W

Note

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

CHARACTERISTICS

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

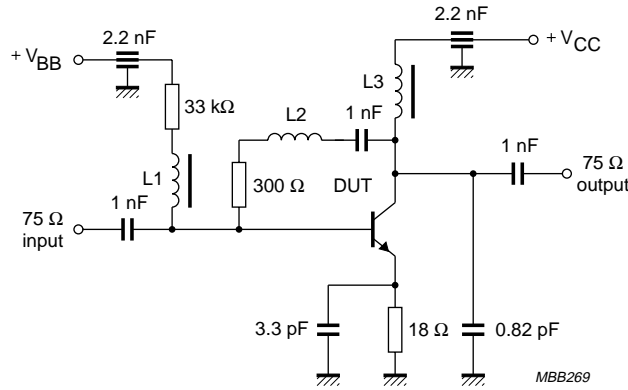
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 10\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; see Fig.4	65	90	135	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 10\text{ V}$; $f = 1\text{ MHz}$; see Fig.5	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 10\text{ V}$; $f = 1\text{ MHz}$	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10\text{ V}$; $f = 1\text{ MHz}$	–	0.35	–	pF
f_T	transition frequency	$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$; see Fig.6	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	–	14	–	dB
		$I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	–	8	–	dB
F	noise figure	$I_C = 5\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 1\text{ GHz}$; $\Gamma_s = \Gamma_{opt}$; $T_{amb} = 25\text{ °C}$; see Figs 13 and 14	–	2.1	–	dB
		$I_C = 5\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 2\text{ GHz}$; $\Gamma_s = \Gamma_{opt}$; $T_{amb} = 25\text{ °C}$; see Figs 13 and 14	–	3	–	dB
V_O	output voltage	notes 2 and 3	–	150	–	mV
d_2	second order intermodulation distortion	notes 2 and 4; see Fig.16	–	–50	–	dB

Notes

- G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \left(\frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \right)$ dB.
- Measured on the same die in a SOT37 package (BFR90A).
- $d_{im} = -60\text{ dB}$ (DIN 45004B); $I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\ \Omega$; $VSWR < 2$; $T_{amb} = 25\text{ °C}$
 $V_p = V_O$ at $d_{im} = -60\text{ dB}$; $f_p = 795.25\text{ MHz}$;
 $V_q = V_O - 6\text{ dB}$; $f_q = 803.25\text{ MHz}$;
 $V_r = V_O - 6\text{ dB}$; $f_r = 805.25\text{ MHz}$;
measured at $f_p + f_q - f_r = 793.25\text{ MHz}$.
- $I_C = 14\text{ mA}$; $V_{CE} = 10\text{ V}$; $R_L = 75\ \Omega$; $VSWR < 2$; $T_{amb} = 25\text{ °C}$
 $V_p = 60\text{ mV}$ at $f_p = 250\text{ MHz}$;
 $V_q = 60\text{ mV}$ at $f_q = 560\text{ MHz}$;
measured at $f_p + f_q = 810\text{ MHz}$.

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L1 = L3 = 5 μH choke.
 L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second harmonic distortion MATV test circuit.

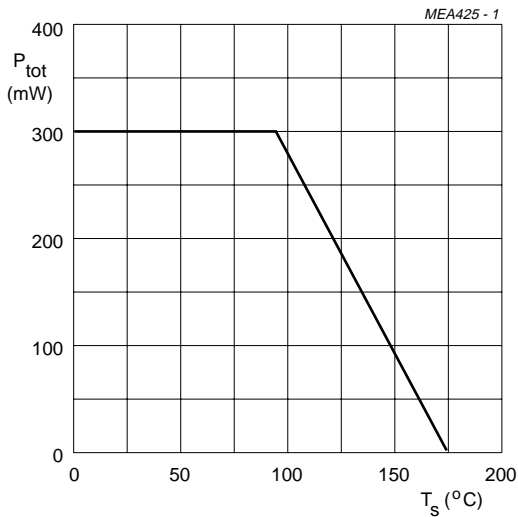
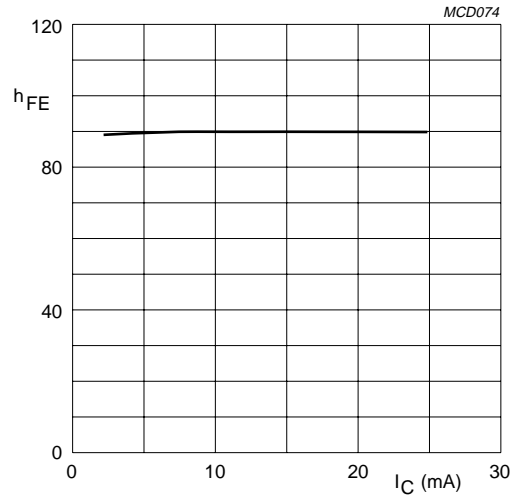


Fig.3 Power derating curve.

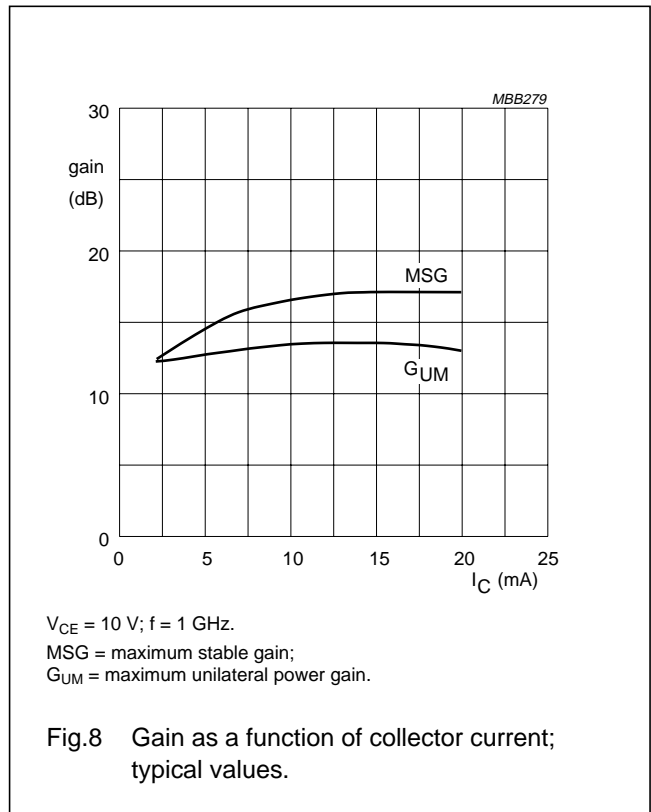
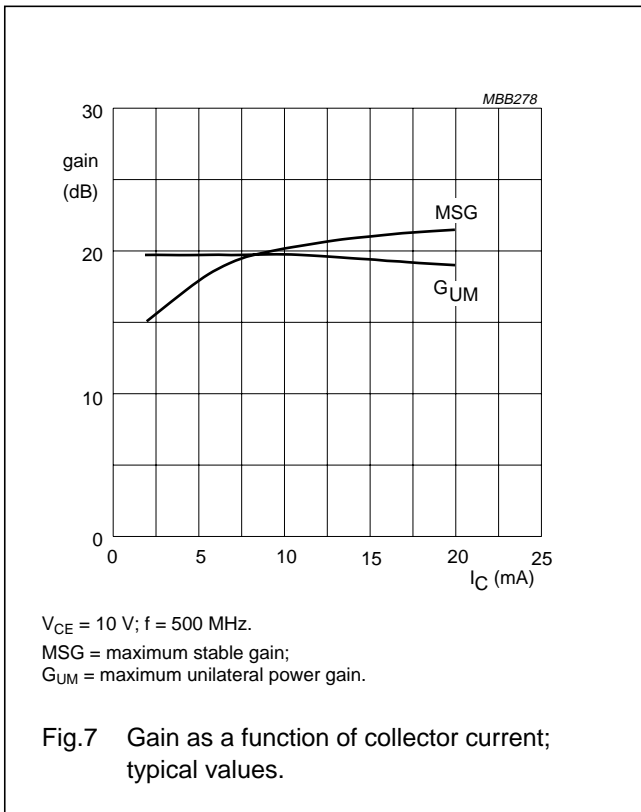
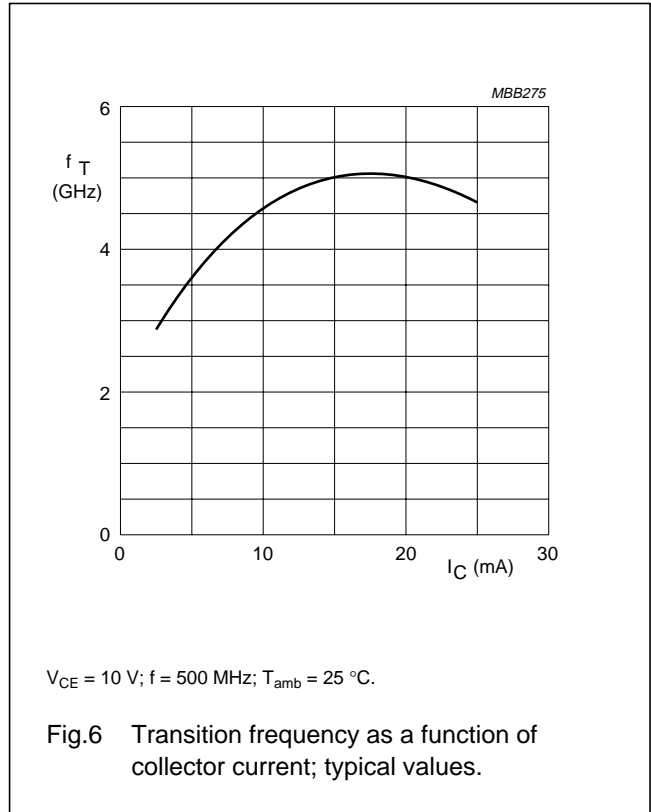
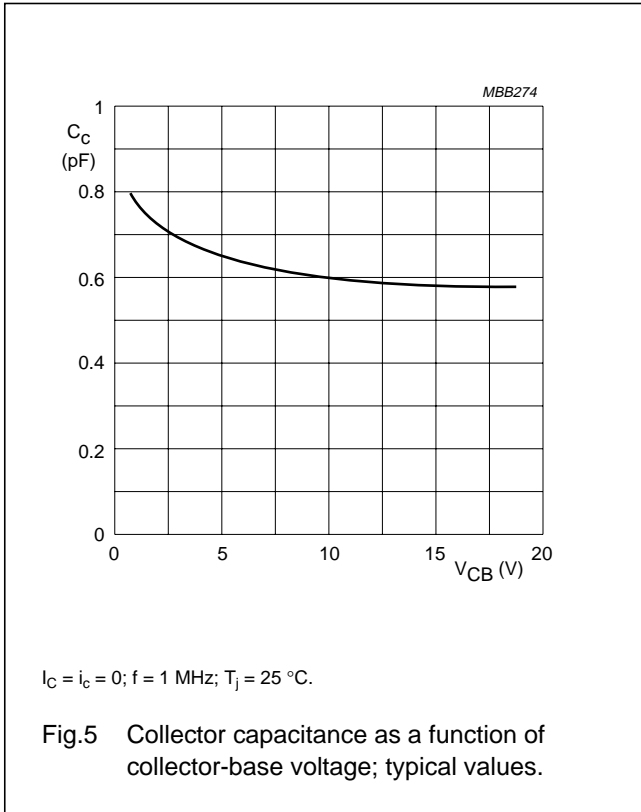


V_{CE} = 10 V; T_J = 25 °C.

Fig.4 DC current gain as a function of collector current; typical values.

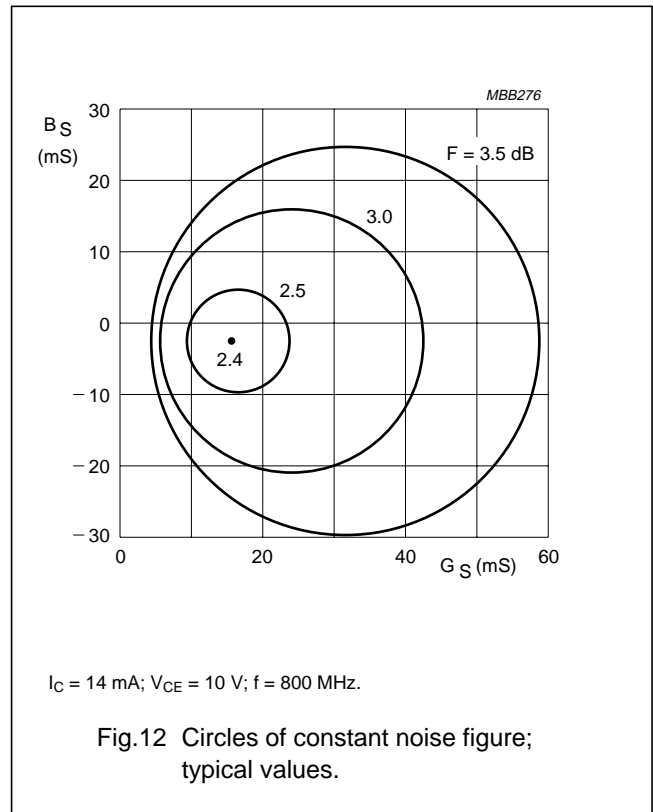
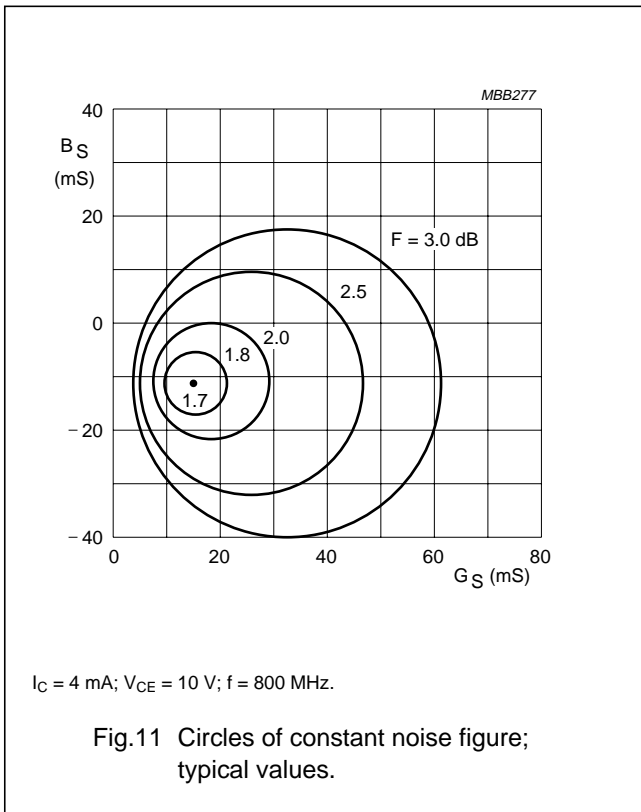
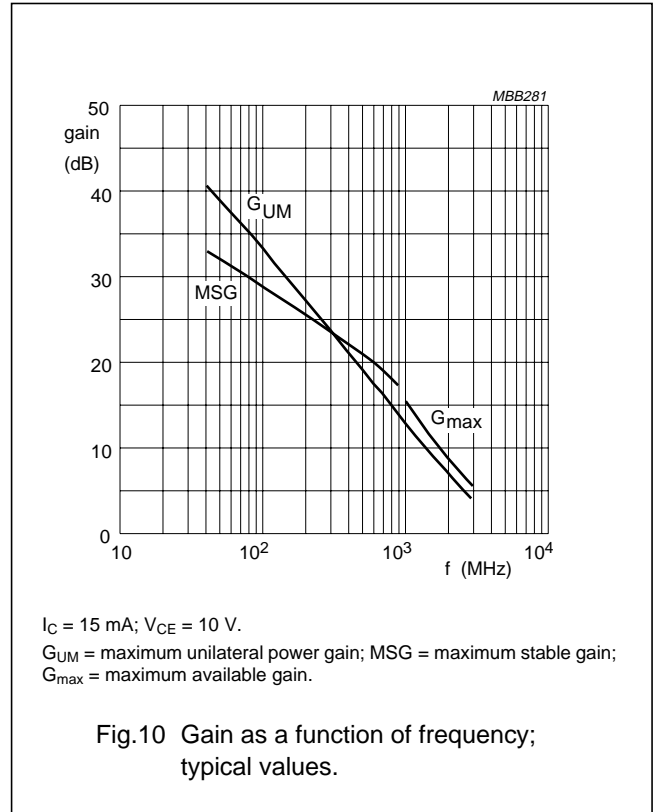
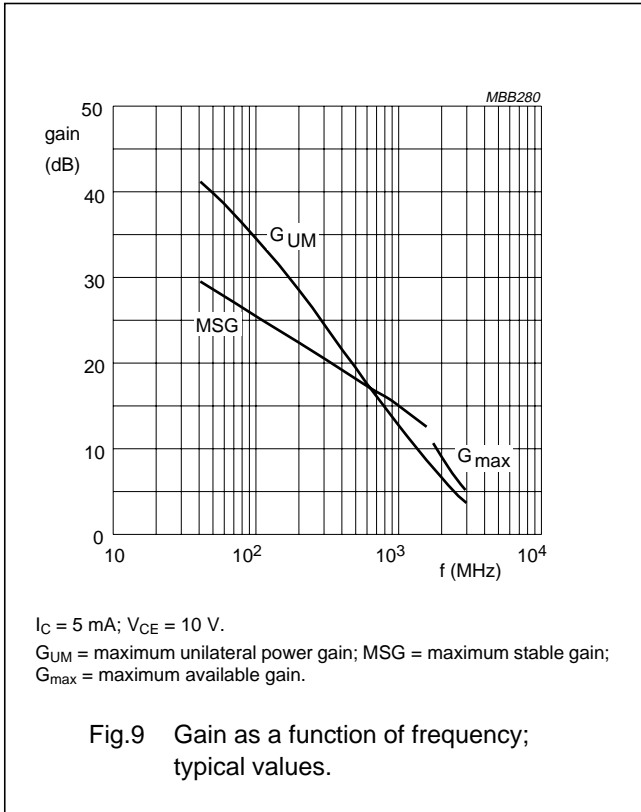
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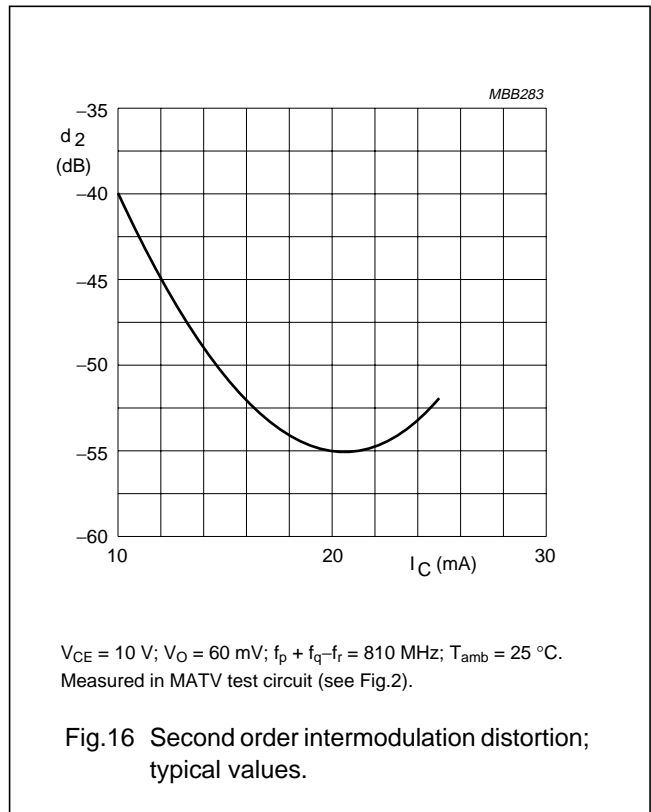
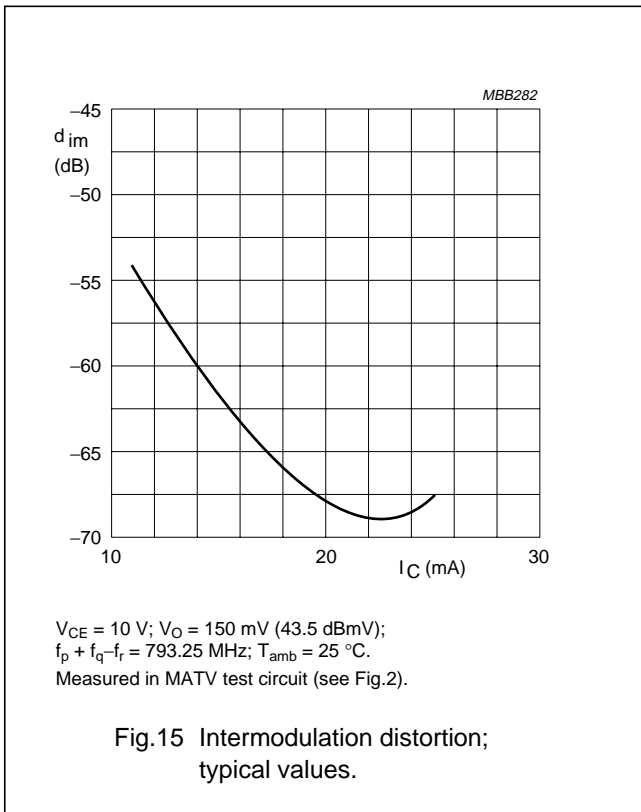
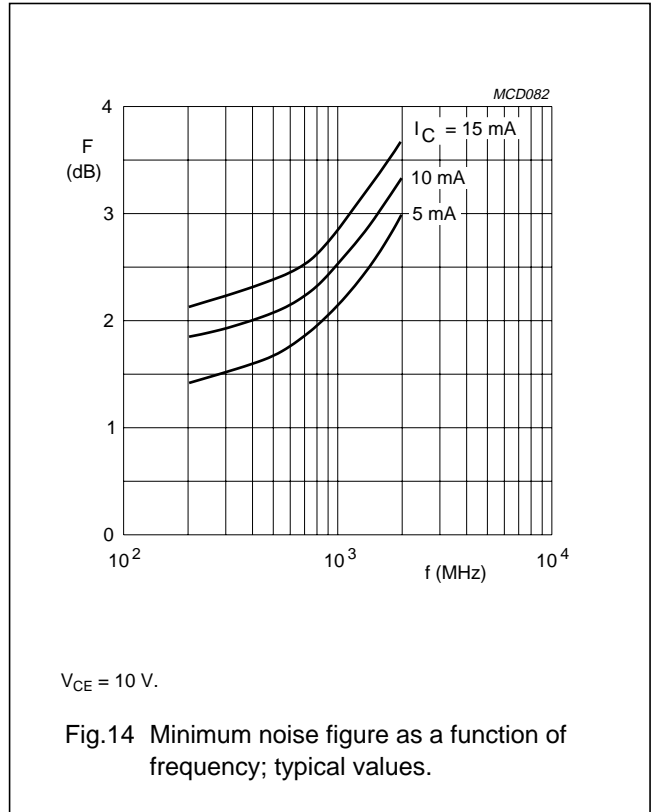
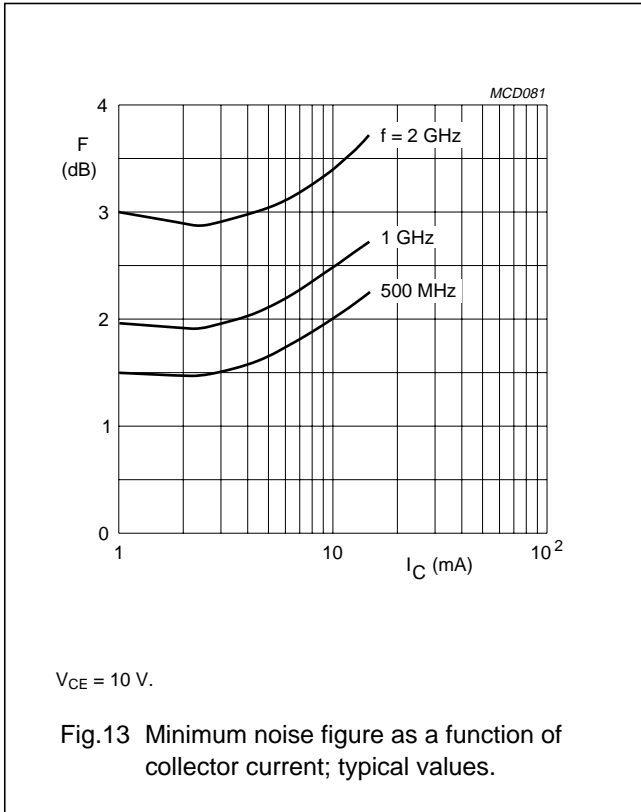
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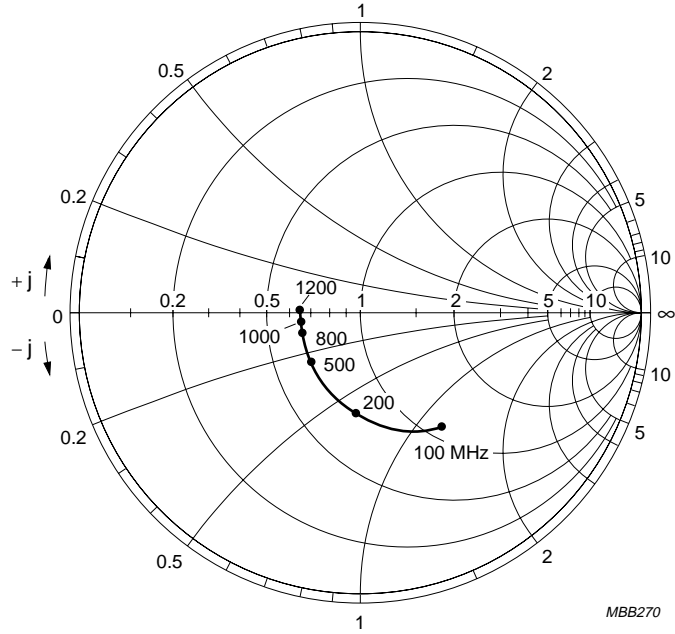
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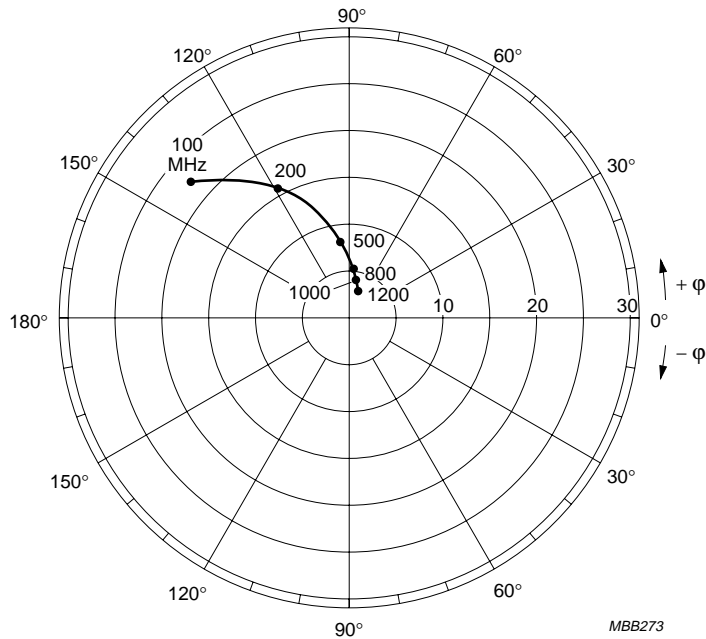
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$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $Z_o = 50 \Omega$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

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

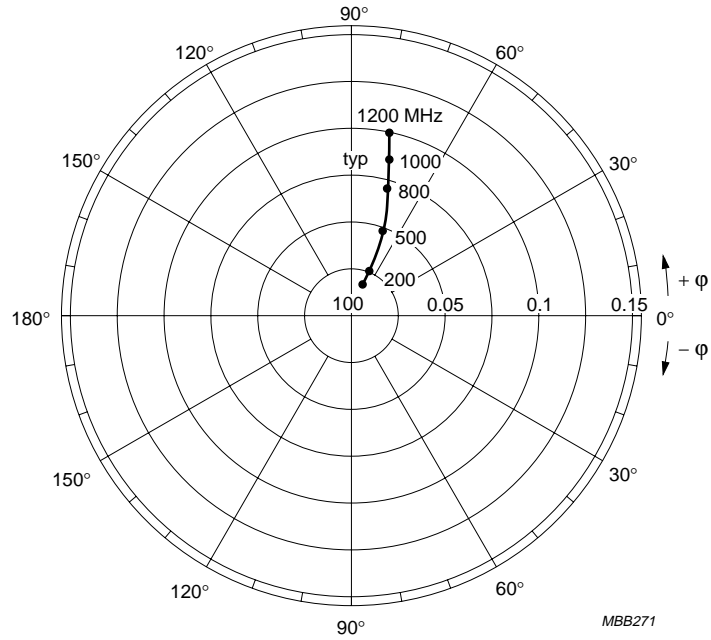


$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

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

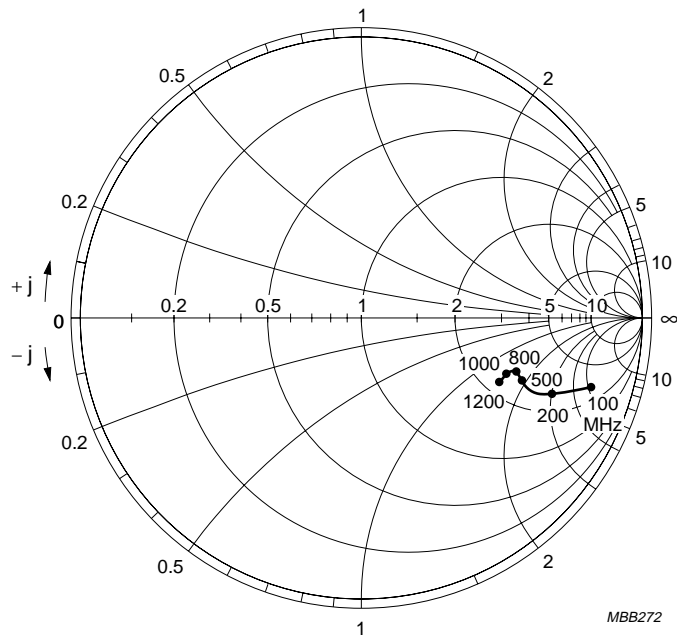
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$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

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



$I_C = 14 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $Z_o = 50 \text{ } \Omega$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

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

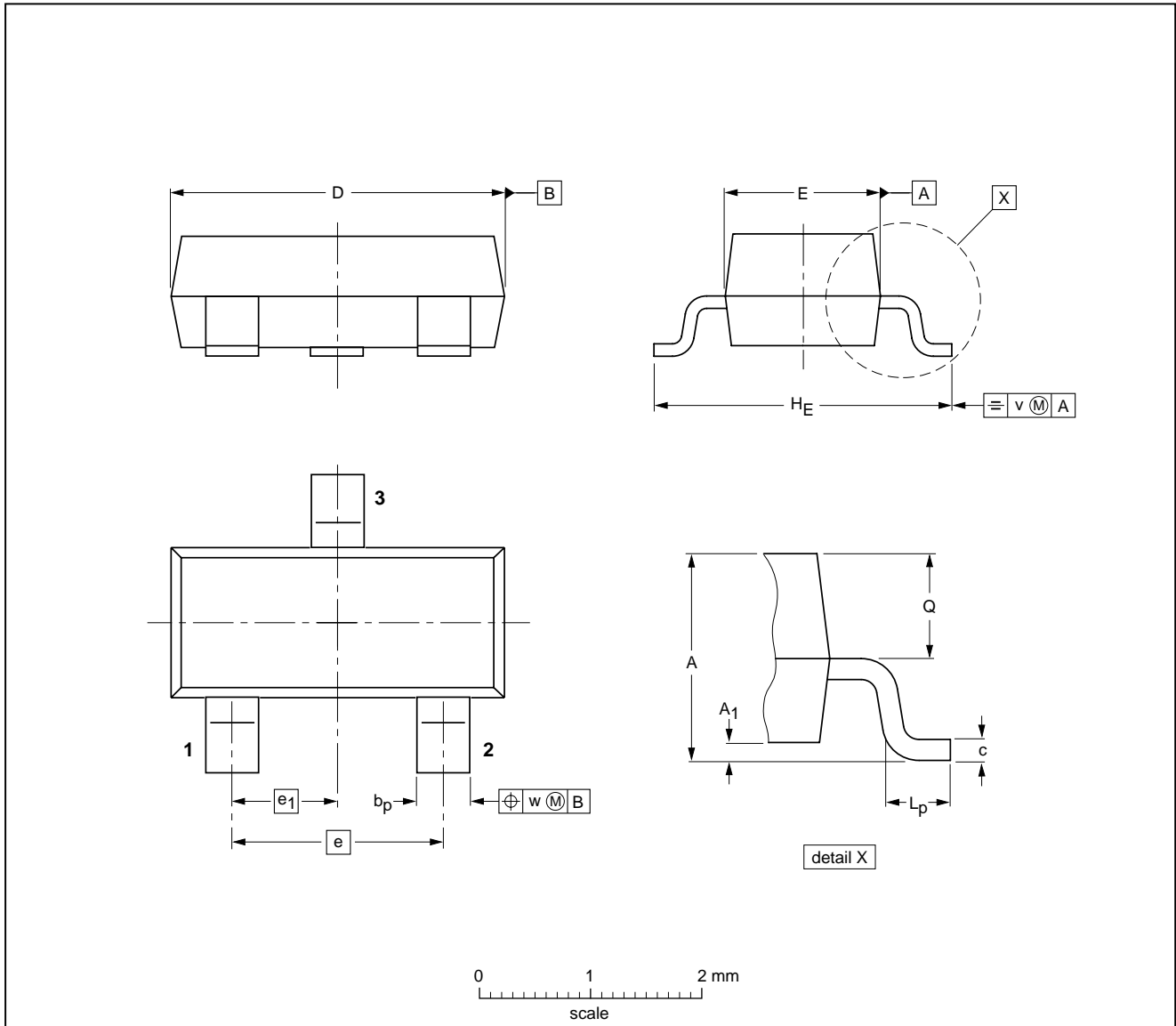
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PACKAGE OUTLINE

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						97-02-28

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Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Revision history

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFR92A_N_4	20090302	Product data sheet	-	BFR92A_N_3
Modifications:	• Fig.1 on page 2; Figure note changed			
BFR92A_N_3	20080307	Product data sheet	-	BFR92A_2
BFR92A_2 (9397 750 02766)	19971029	Product specification	-	BFR92A_1
BFR92A_1	19950901	-	-	-

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