BFG520; BFG520/X; BFG520/XR

NPN 9 GHz wideband transistor

Rev. 04 — 23 November 2007 Product data sheet

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NPN 9 GHz wideband transistor — BFG520; BFG520/X; BFG520/XR

FEATURES

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

DESCRIPTION

NPN silicon planar epitaxial transistors, intended for applications in the RF frontend 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) and repeater amplifiers in fibre-optic systems.

The transistors are encapsulated in 4-pin, dual-emitter plastic SOT143 and SOT143R envelopes.

PINNING

PIN	DESCRIPTION
BFG520 (Fig.1) Code: %MF	
1	collector
2	base
3	emitter
4	emitter
BFG520/X (Fig.1) Code: %ML	
1	collector
2	emitter
3	base
4	emitter
BFG520/XR (Fig.2) Code: %MP	
1	collector
2	emitter
3	base
4	emitter

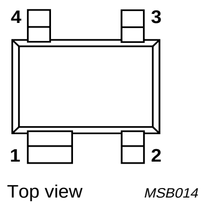


Fig.1 SOT143B.

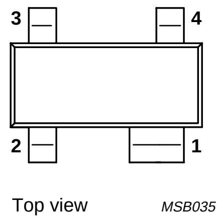


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_c	DC collector current		–	–	70	mA
P_{tot}	total power dissipation	up to T_s = 88 °C; note 1	–	–	300	mW
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V; T_j = 25 °C	60	120	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_c = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB

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_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 88 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 88 °C; note 1	290 K/W

Note

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

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} = 6 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V	60	120	250	
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1	–	pF
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	0.6	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	19	–	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	17	18	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.1	1.6	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	17	–	dBm
ITO	third order intercept point	note 2	–	26	–	dBm
V_o	output voltage	note 3	–	275	–	mV
d_2	second order intermodulation distortion	I_C = 20 mA; V_{CE} = 6 V; V_o = 75 mV; T_{amb} = 25 °C; $f_{(p+q)}$ = 810 MHz	–	–50	–	dB

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 = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.
3. d_{im} = –60 dB (DIN 45004B);
   $V_p = V_o$; $V_q = V_o$ –6 dB; $V_r = V_o$ –6 dB;
   f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz

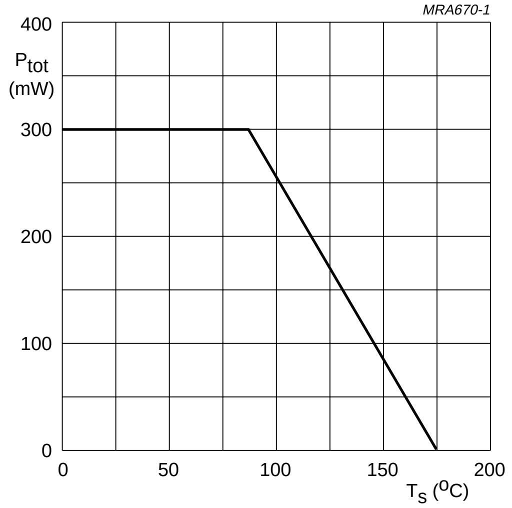
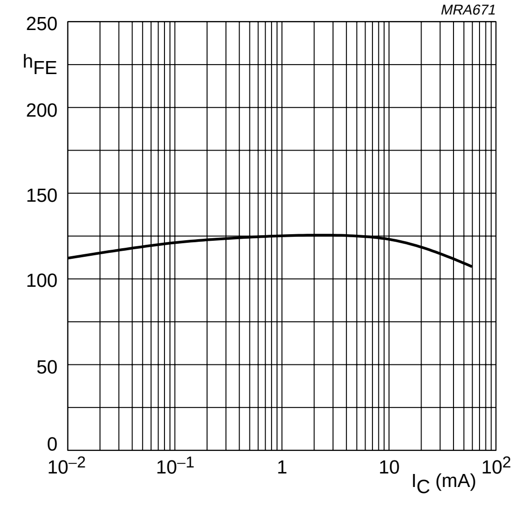
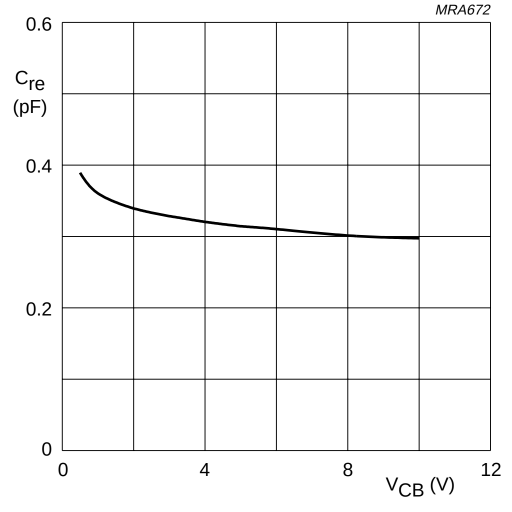


Fig.3 Power derating curve.



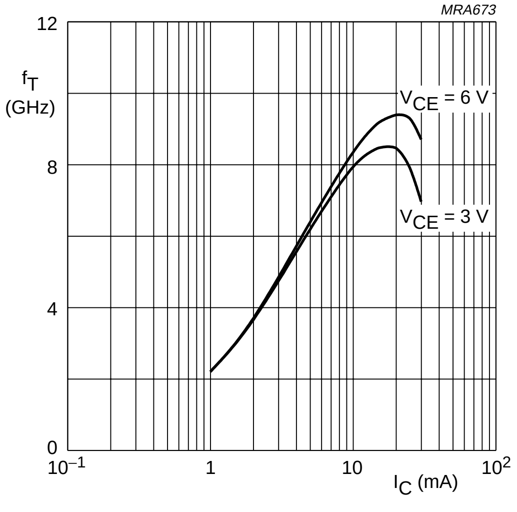
V_{CE} = 6 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

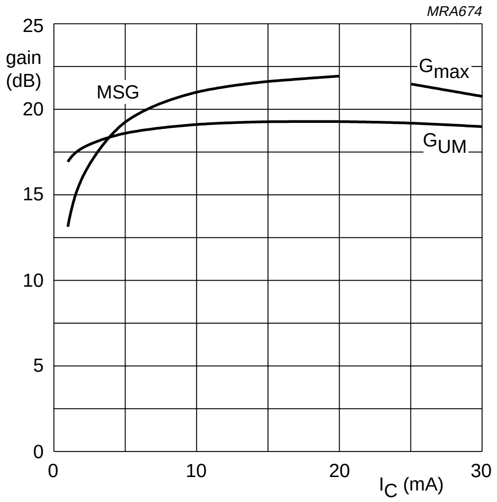
Fig.5 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

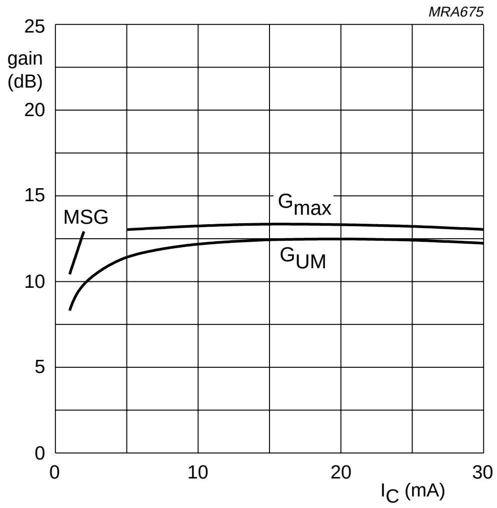
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



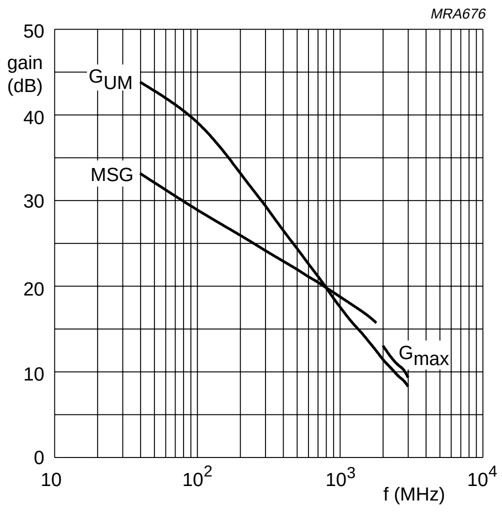
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



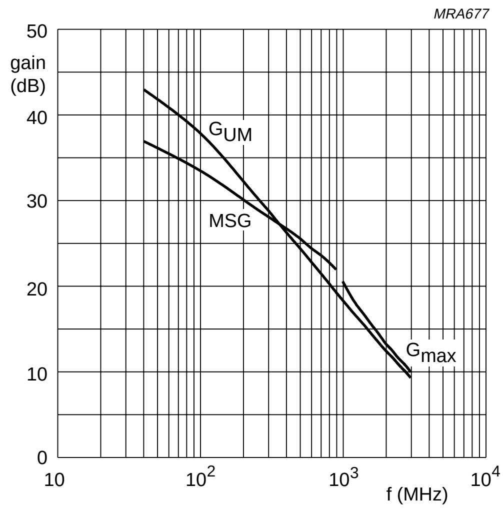
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.8 Gain as a function of collector current.



I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.10 Gain as a function of frequency.

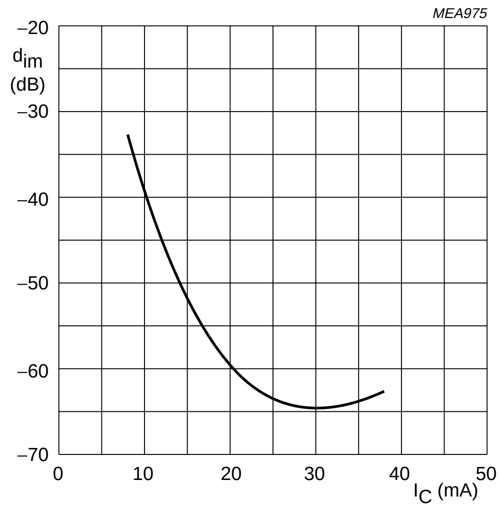


Fig.11 Intermodulation distortion as a function of collector current.

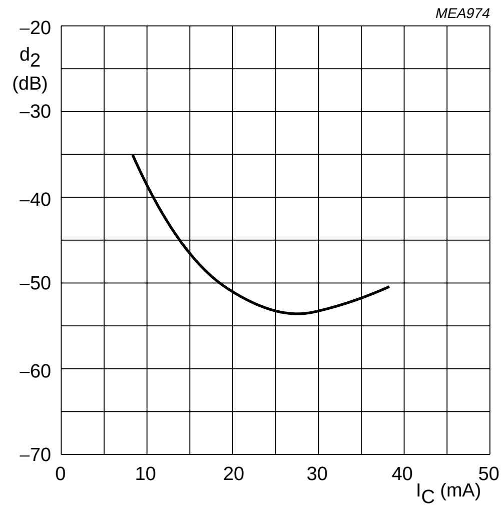
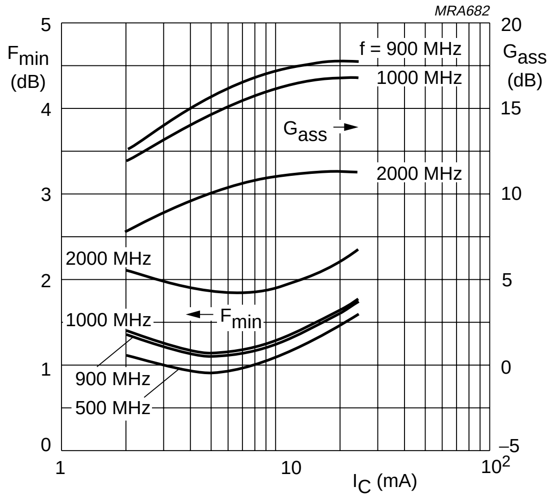
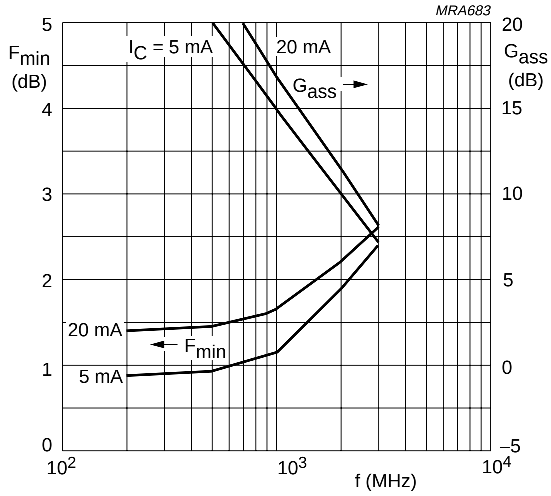


Fig.12 Second order intermodulation distortion as a function of collector current.



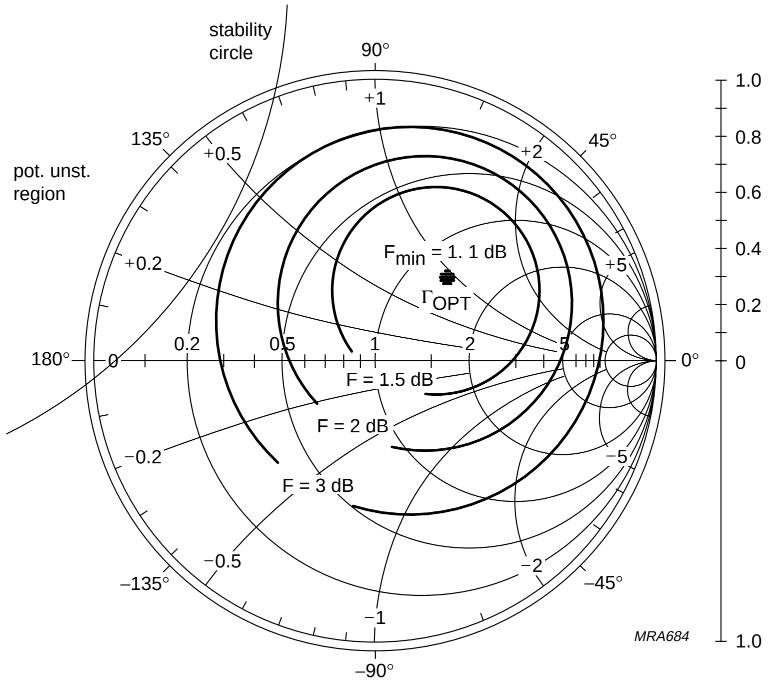
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.13 Minimum noise figure and associated available gain as functions of collector current.



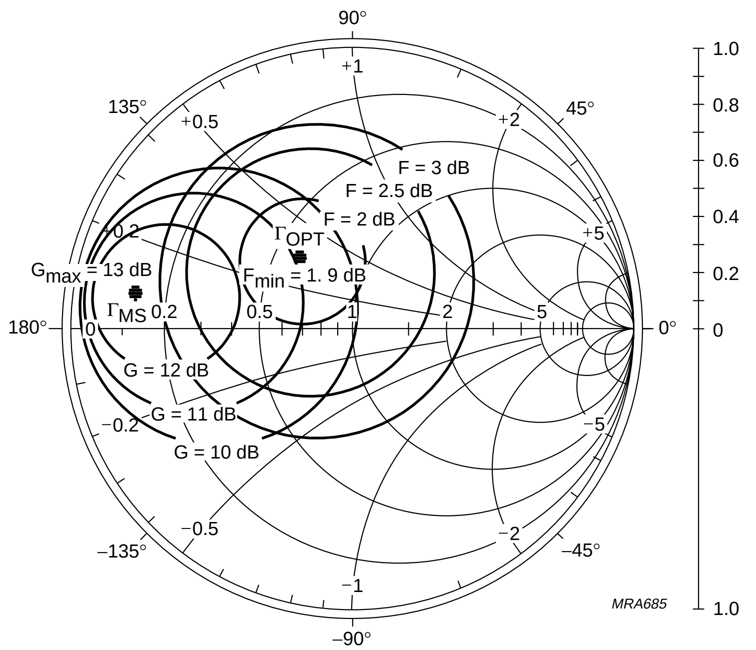
V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.14 Minimum noise figure and associated available gain as functions of frequency.



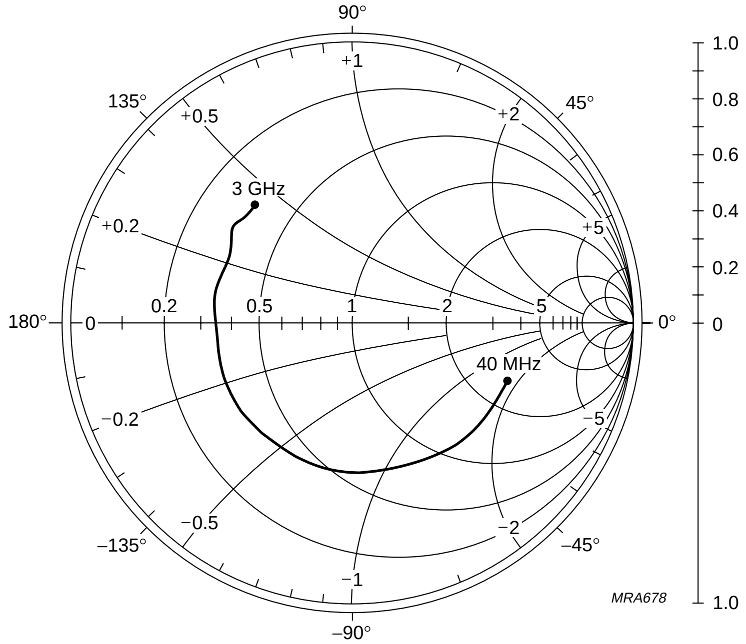
I_C = 5 mA; V_{CE} = 6 V;
f = 900 MHz; Z_o = 50 Ω.

Fig.15 Noise circle figure.



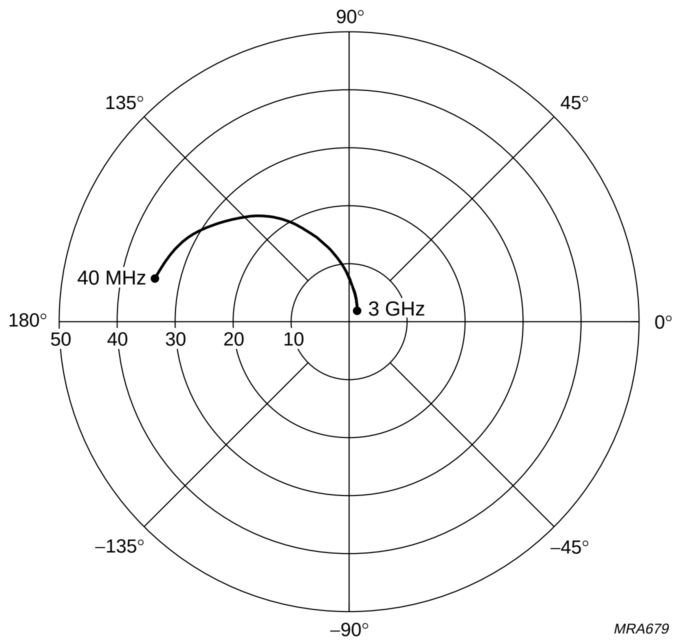
I_C = 5 mA; V_{CE} = 6 V;
f = 2 GHz; Z_o = 50 Ω.

Fig.16 Noise circle figure.



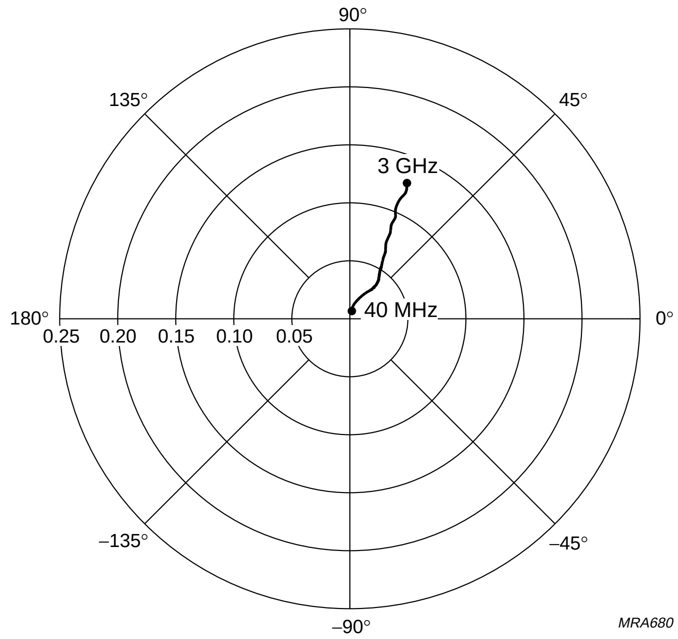
I_C = 20 mA; V_{CE} = 6 V.
Z_o = 50 Ω.

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



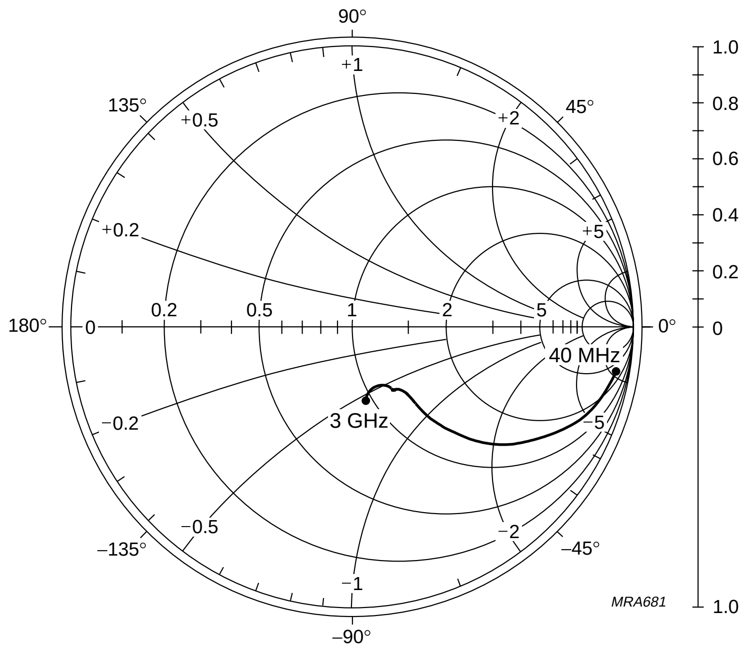
I_C = 20 mA; V_{CE} = 6 V.

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



I_C = 20 mA; V_{CE} = 6 V.

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

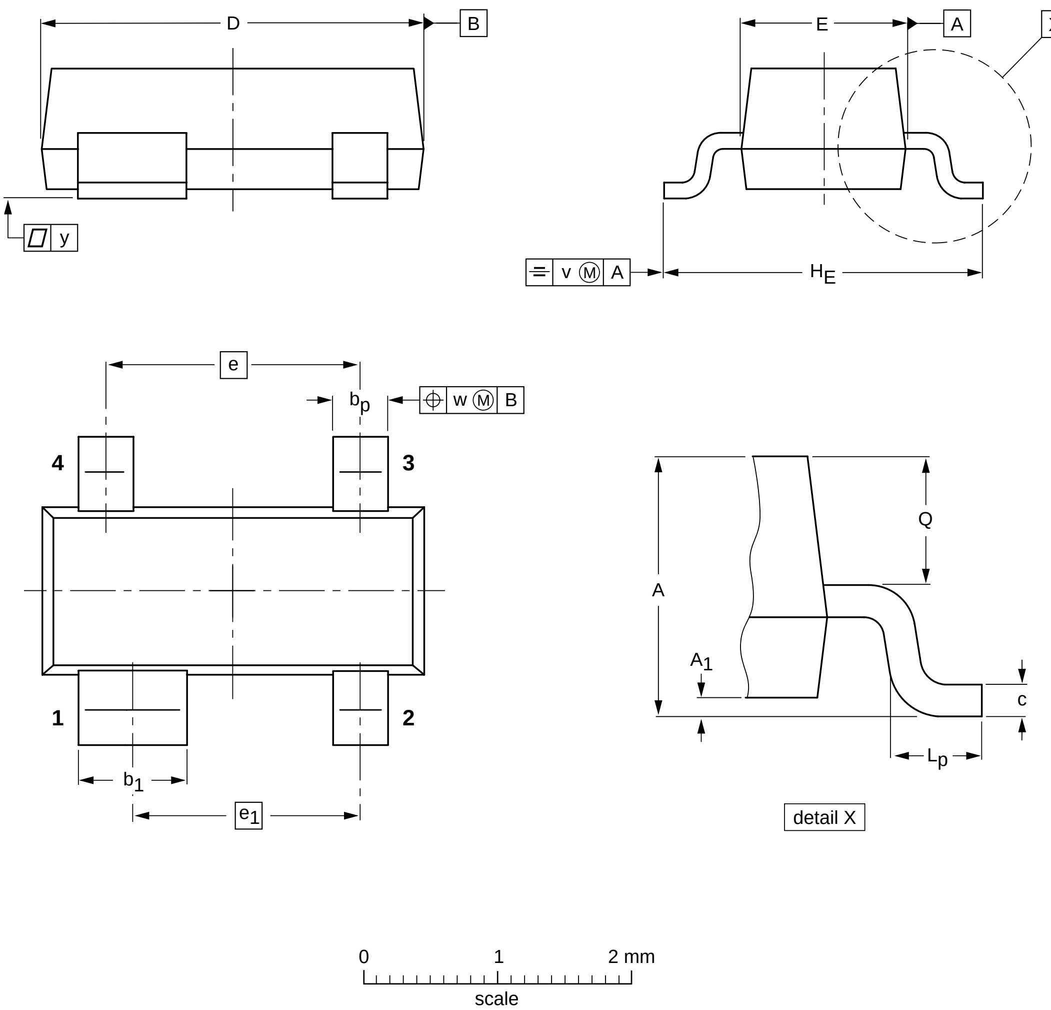


I_C = 20 mA; V_{CE} = 6 V.
Z_o = 50 Ω.

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

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads **SOT143B**

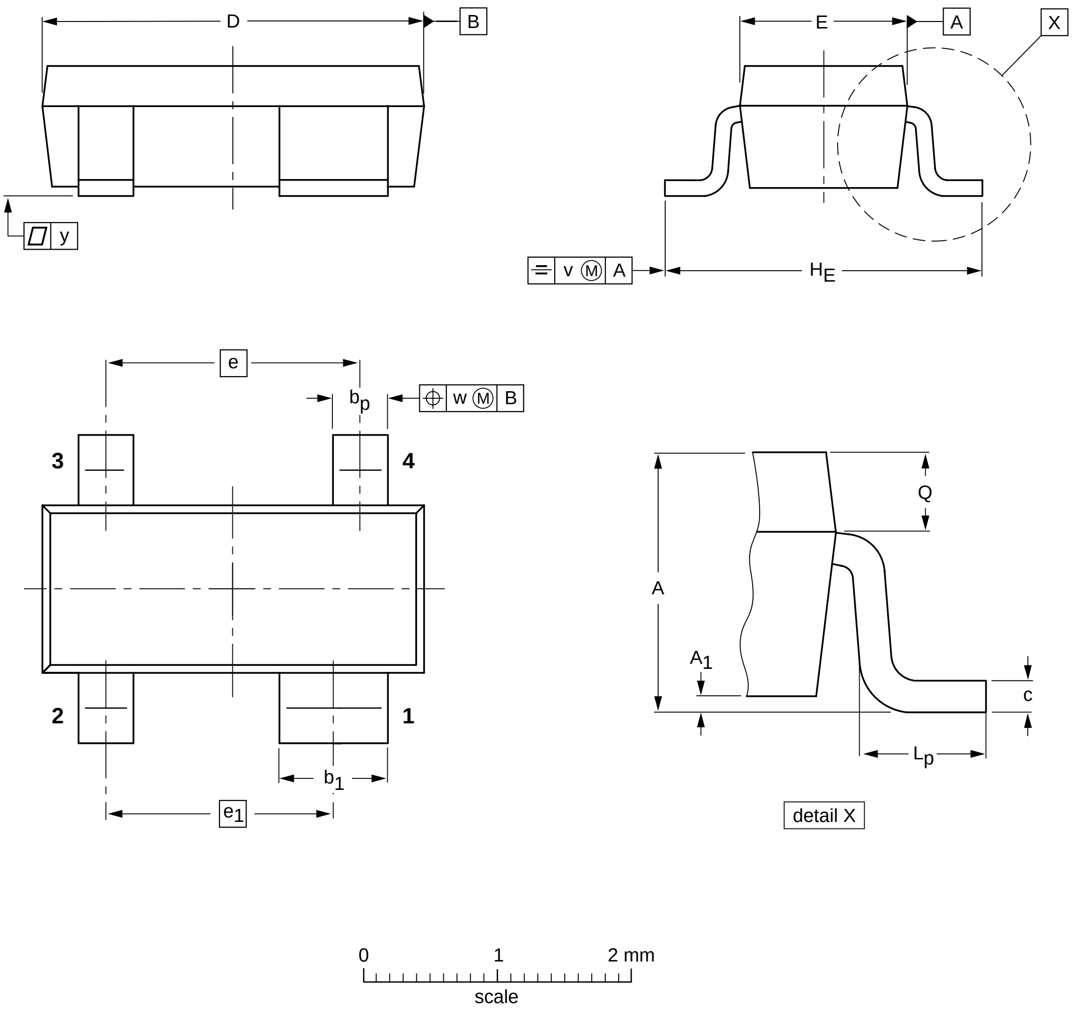


DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1	0.1

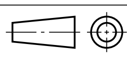
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143B						97-02-28

Plastic surface mounted package; reverse pinning; 4 leads **SOT143R**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.55 0.25	0.45 0.25	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143R						97-03-10

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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.
Product [short] data sheet	Production	This document contains the product specification.

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[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
BFG520XR_N_4	20071123	Product data sheet	-	BFG520XR_CNV_3
Modifications:	• Pinning table on page 2; changed code			
BFG520XR_CNV_3	19950901	Product specification	-	BFG520XR_2
BFG520XR_2	-	Product specification	-	BFG520XR_1
BFG520XR_1	-	-	-	-

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Date of release: 23 November 2007

Document identifier: BFG520XR_N_4