BFG310/XR

NPN 14 GHz wideband transistor

Rev. 2 — 15 September 2011 Product data sheet

1. Product profile

1.1 General description

NPN silicon planar epitaxial transistor in a 4-pin dual-emitter SOT143R plastic package.

1.2 Features and benefits

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

1.3 Applications

- Intended for Radio Frequency (RF) front end applications in the GHz range, such as:
  - analog and digital cellular telephones
  - cordless telephones (Cordless Telephone (CT), Personal Communication Network (PCN), Digital Enhanced Cordless Telecommunications (DECT), etc.)
  - radar detectors
  - pagers
  - Satellite Antenna TeleVision (SATV) tuners
  - repeater amplifiers in fiber-optic systems

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	-	15	V
V_{CEO}	collector-emitter voltage	open base		-	-	6	V
I_C	collector current (DC)			-	-	10	mA
P_{tot}	total power dissipation	$T_{sp} \leq 145$ °C	[1]	-	-	60	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 3 V; T_j = 25 °C		60	100	200	
C_{CBS}	collector-base capacitance	V_{CB} = 5 V; f = 1 MHz; emitter grounded		-	0.17	0.3	pF
f_T	transition frequency	I_C = 5 mA; V_{CE} = 3 V; f = 1 GHz; T_{amb} = 25 °C		-	14	-	GHz

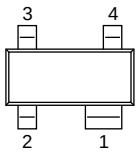
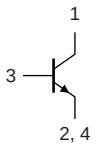
Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
MSG	maximum stable gain	I_C = 5 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C	-	18	-	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 5 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	14	-	dB
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 3 V; f = 2 GHz	-	1	-	dB

[1] T_{sp} is the temperature at the soldering point of the collector pin.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	collector		
2	emitter		
3	base		
4	emitter		

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3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BFG310/XR	SC-61AA	plastic surface mounted package; reverse pinning; 4 leads	SOT143R

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
BFG310/XR	S1*

[1] * = p: made in Hong Kong.

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	15	V
V_{CEO}	collector-emitter voltage	open base		-	6	V
V_{EBO}	emitter-base voltage	open collector		-	2	V
I_C	collector current (DC)			-	10	mA
P_{tot}	total power dissipation	$T_{sp} \leq 145$ °C	[1]	-	60	mW
T_{stg}	storage temperature			−65	+175	°C
T_j	junction temperature			-	175	°C

[1] T_{sp} is the temperature at the soldering point of the collector pin.

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j\text{-}sp)}$	thermal resistance from junction to solder point	$T_{sp} \leq 145$ °C	[1]	530	K/W

[1] T_{sp} is the temperature at the soldering point of the collector pin.

7. Characteristics

Table 7. Characteristics

T_j = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	I_E = 0 A; V_{CB} = 5 V	-	-	15	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 3 V	60	100	200	
C_{CBS}	collector-base capacitance	V_{CB} = 5 V; f = 1 MHz; emitter grounded	-	0.17	0.3	pF
C_{CES}	collector-emitter capacitance	V_{CE} = 5 V; f = 1 MHz; base grounded	-	0.28	-	pF
C_{EBS}	emitter-base capacitance	V_{EB} = 0.5 V; f = 1 MHz; collector grounded	-	0.22	-	pF
f_T	transition frequency	I_C = 5 mA; V_{CE} = 3 V; f = 1 GHz; T_{amb} = 25 °C	-	14	-	GHz
MSG	maximum stable gain	I_C = 5 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C	-	18	-	dB
$\lvert s_{21}\rvert^2$	insertion power gain	I_C = 5 mA; V_{CE} = 3 V; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω				
		f = 1.8 GHz	-	14	-	dB
		f = 3 GHz	-	11	-	dB
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 1 mA; V_{CE} = 3 V; f = 2 GHz	-	1	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	I_C = 5 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	1.8	-	dBm
IP3	third order intercept point	I_C = 5 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	8.5	-	dBm

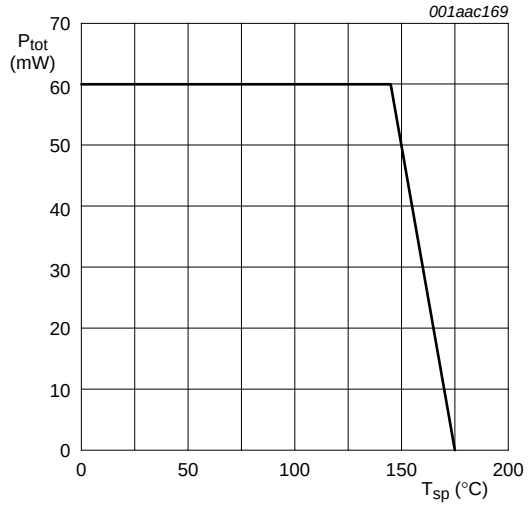


Fig 1. Power derating curve

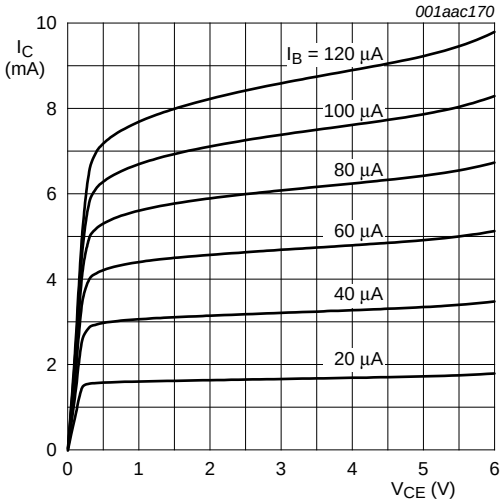
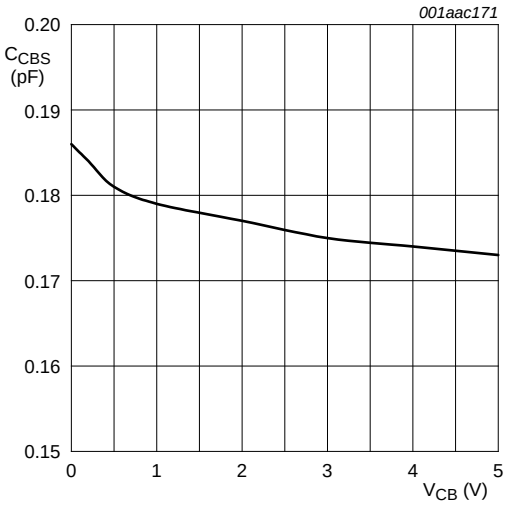
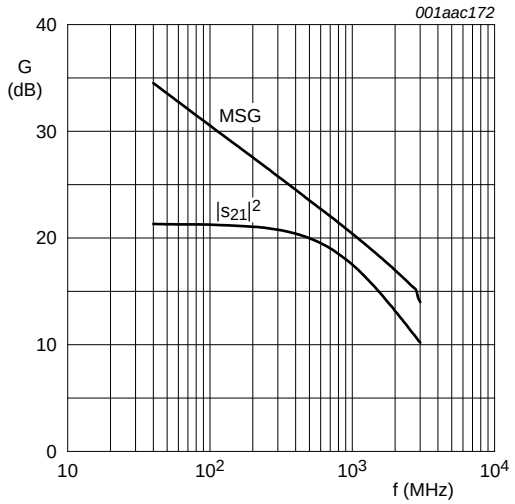


Fig 2. Collector current as a function of collector-emitter voltage; typical values



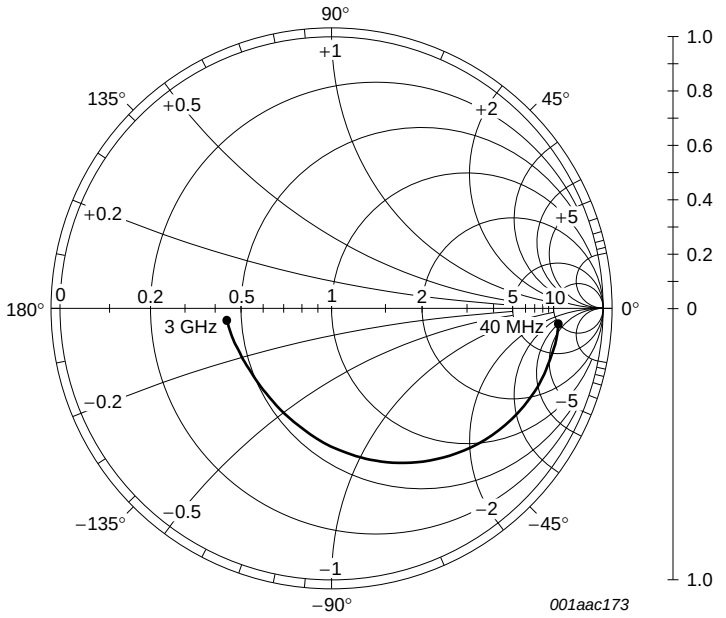
I_C = 0 mA; f = 1 MHz.

Fig 3. Collector-base capacitance as a function of collector-base voltage; typical values



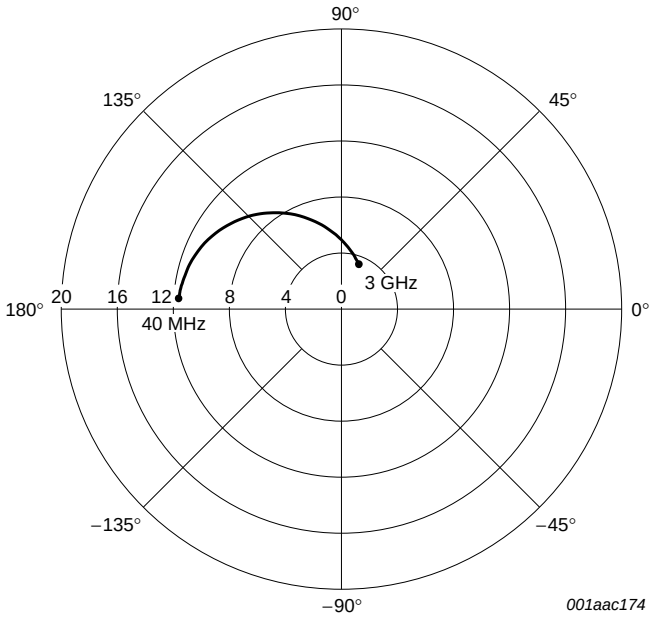
I_C = 5 mA; V_{CE} = 3 V.

Fig 4. Gain as a function of frequency; typical values



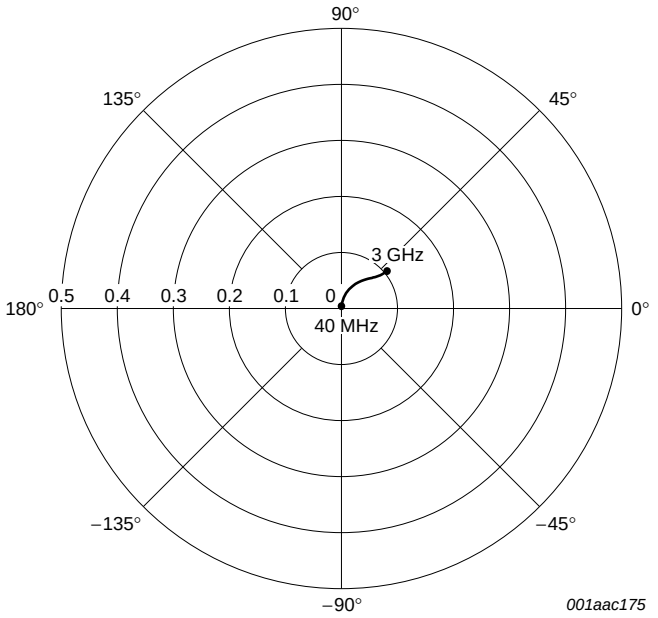
V_{CE} = 3 V; I_C = 5 mA; Z_o = 50 Ω.

Fig 5. Common emitter input reflection coefficient (s_{11}); typical values



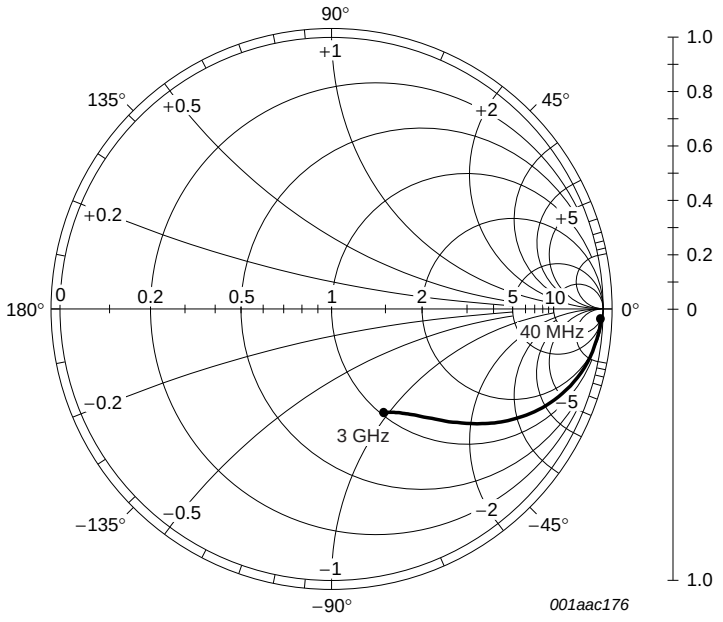
V_{CE} = 3 V; I_C = 5 mA.

Fig 6. Common emitter forward transmission coefficient (s_{21}); typical values



V_{CE} = 3 V; I_C = 5 mA.

Fig 7. Common emitter reverse transmission coefficient (s_{12}); typical values



V_{CE} = 3 V; I_C = 5 mA; Z_o = 50 Ω.

Fig 8. Common emitter output reflection coefficient (s_{22}); typical values

8. Application information

Table 8. SPICE parameters of the BFG310 DIE

Sequence	Parameter	Value	Unit
1	IS	16.17	aA
2	BF	210	-
3	NF	1	-
4	VAF	50	V
5	IKF	59.83	mA
6	ISE	1.726	fA
7	NE	2.114	-
8	BR	6	-
9	NR	1	-
10	VAR	2.3	V
11	IKR	10	A
12	ISC	0	aA
13	NC	1.5	-
14	RB	3.6	Ω
15	RE	2.1	Ω
16	RC	1.6	Ω
17	CJE	115.6	fF
18	VJE	866.3	mV
19	MJE	0.285	-
20	CJC	68.18	fF
21	VJC	601	mV
22	MJC	0.123	-
23	XCJC	1	-
24	FC	0.7	-
25	TF	8.3	ps
26	XTF	10	-
27	VTF	1000	V
28	ITF	150	mA
29	PTF	0	deg
30	TR	0	ns
31	KF	0	-
32	AF	1	-
33	TNOM	25	°C
34	EG	1.014	eV
35	XTB	0	-
36	XTI	8	-
37	Q1.AREA	1	-

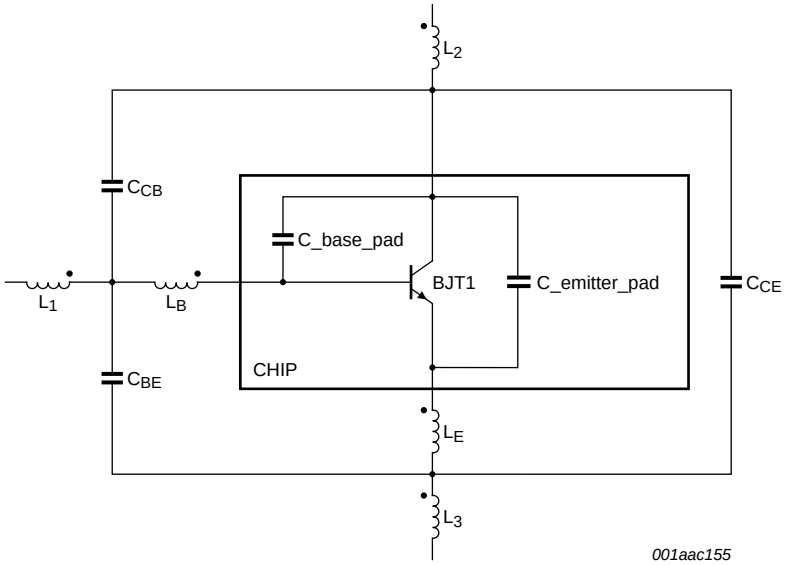


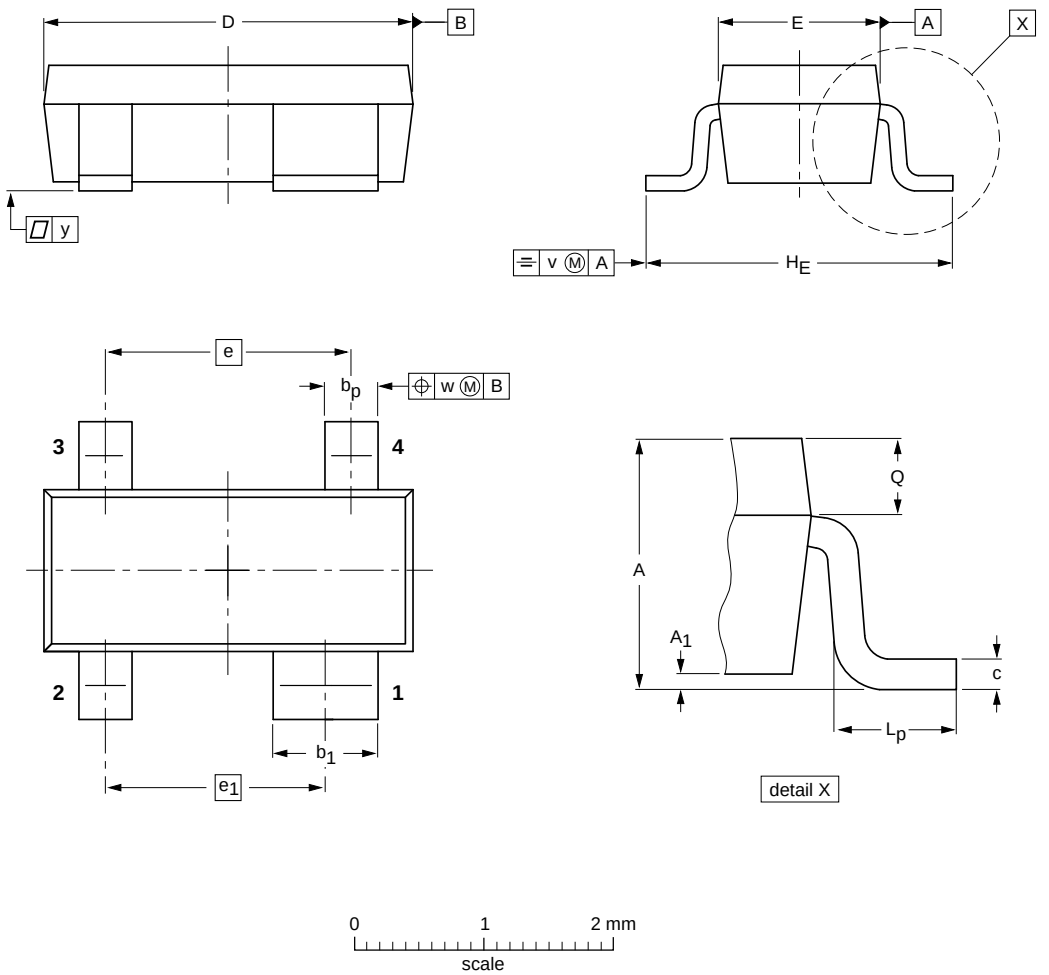
Fig 9. Package equivalent circuit of SOT143R

Table 9. List of components; see Figure 9

Designation	Value	Unit
C_{CB}	17	fF
C_{BE}	84	fF
C_{CE}	191	fF
C_base_pad	67	fF
C_emitter_pad	142	fF
L_B	0.95	nH
L_E	0.40	nH
L_1	0.12	nH
L_2	0.21	nH
L_3	0.06	nH

9. Package outline

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	JEITA			
SOT143R			SC-61AA			~~04-11-16~~ 06-03-16

Fig 10. Package outline SOT143R (SC-61AA)

10. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG310_XR v.2	20110915	Product data sheet	-	BFG310_XR v.1
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package outline drawings have been updated to the latest version.			
BFG310_XR v.1 (9397 750 14244)	20050202	Product data sheet	-	-

11. Legal information

11.1 Data sheet status

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.

[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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13. Contents

1 Product profile 1
1.1 General description 1
1.2 Features and benefits 1
1.3 Applications 1
1.4 Quick reference data 1
2 Pinning information 2
3 Ordering information 2
4 Marking 2
5 Limiting values 3
6 Thermal characteristics 3
7 Characteristics 3
8 Application information 7
9 Package outline 9
10 Revision history 10
11 Legal information 11
11.1 Data sheet status 11
11.2 Definitions 11
11.3 Disclaimers 11
11.4 Trademarks 12
12 Contact information 12
13 Contents 13

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