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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	$T_{sp} \leq 145\text{ °C}$	1	-	60	mW
h_{FE}	DC current gain	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V}; T_j = 25\text{ °C}$	60	100	200	
C_{CBS}	collector-base capacitance	$V_{CB} = 5\text{ V}; f = 1\text{ MHz};$ emitter grounded	-	0.17	0.3	pF
f_T	transition frequency	$I_C = 5\text{ mA}; V_{CE} = 3\text{ V};$ $f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	-	14	-	GHz



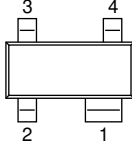
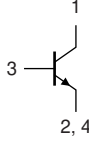
Table 1. Quick reference data ...continued

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

sym086

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

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

7. Characteristics

Table 7. Characteristics

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

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

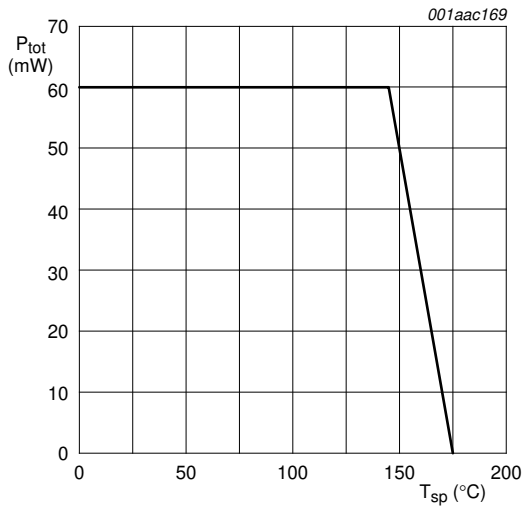


Fig 1. Power derating curve

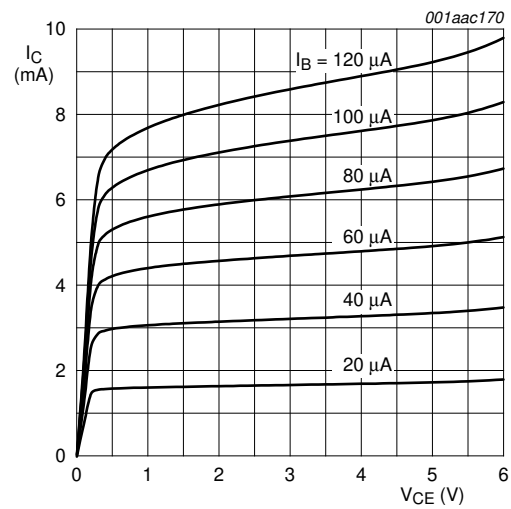
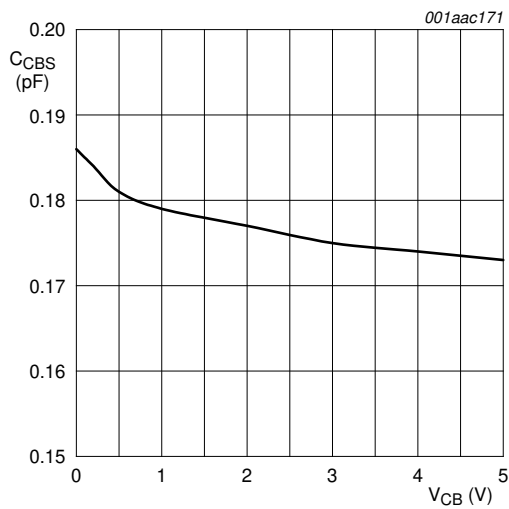
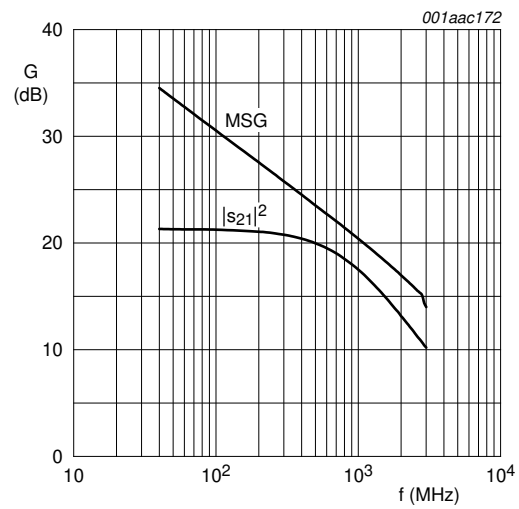


Fig 2. Collector current as a function of collector-emitter voltage; typical values



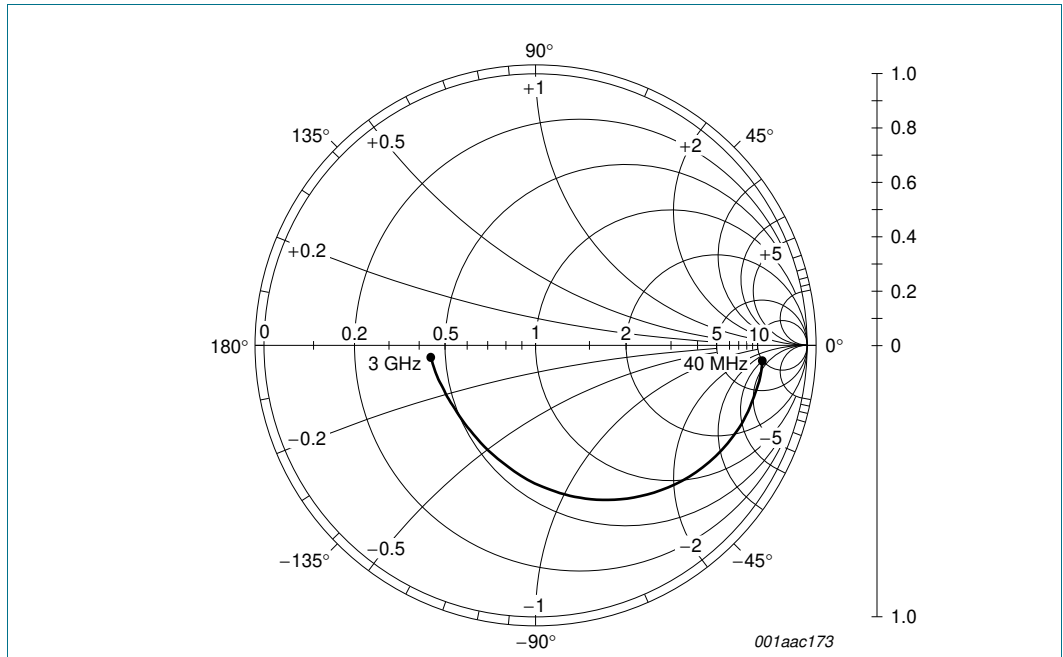
$I_C = 0$ mA; $f = 1$ MHz.

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



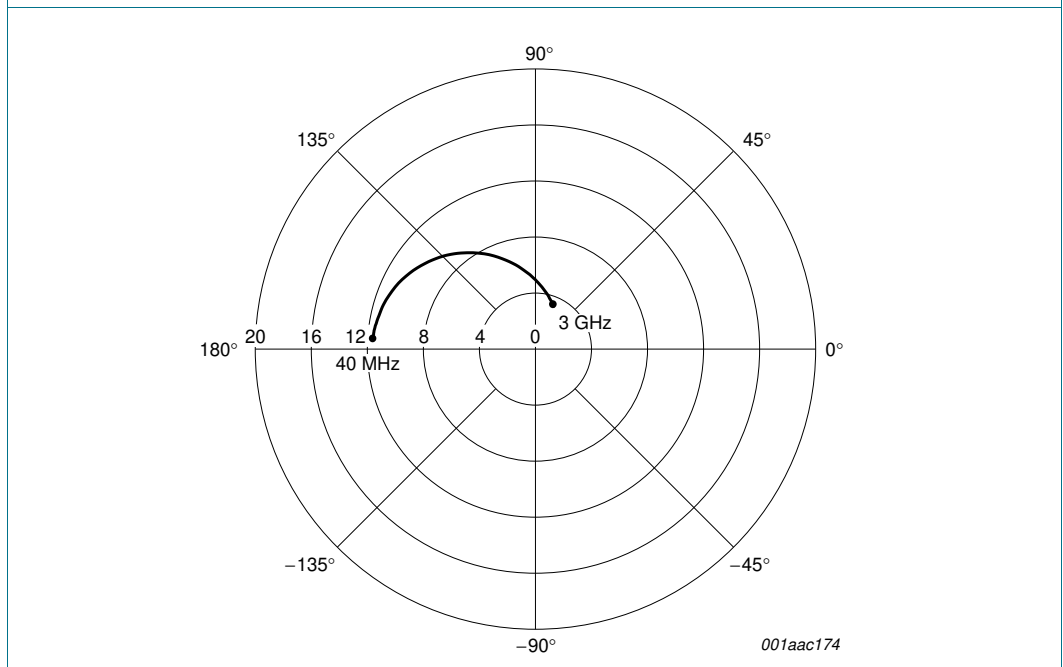
$I_C = 5$ mA; $V_{CE} = 3$ V.

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



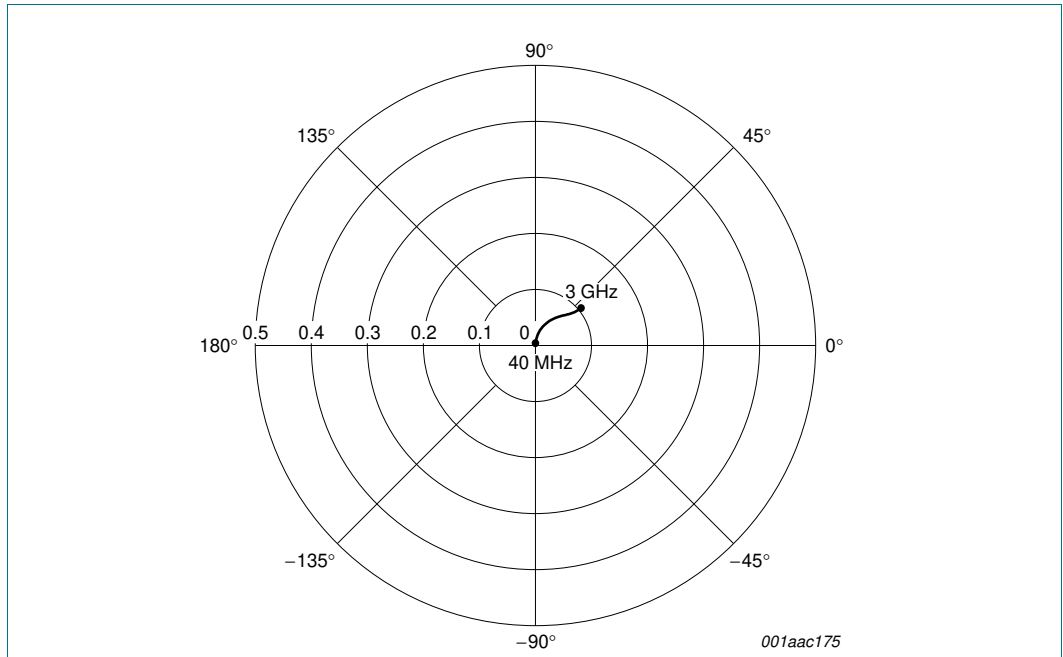
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}; Z_0 = 50\ \Omega.$

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



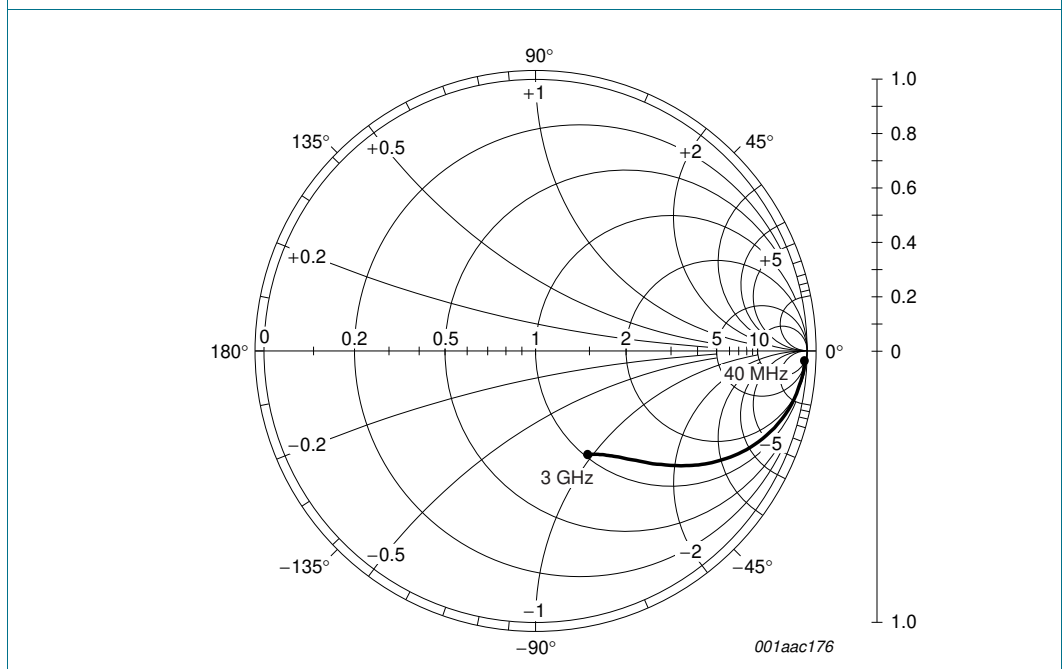
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}.$

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



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

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



$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}; Z_o = 50\ \Omega$.

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	$^{\circ}\text{C}$
34	EG	1.014	eV
35	XTB	0	-
36	XTI	8	-
37	Q1.AREA	1	-

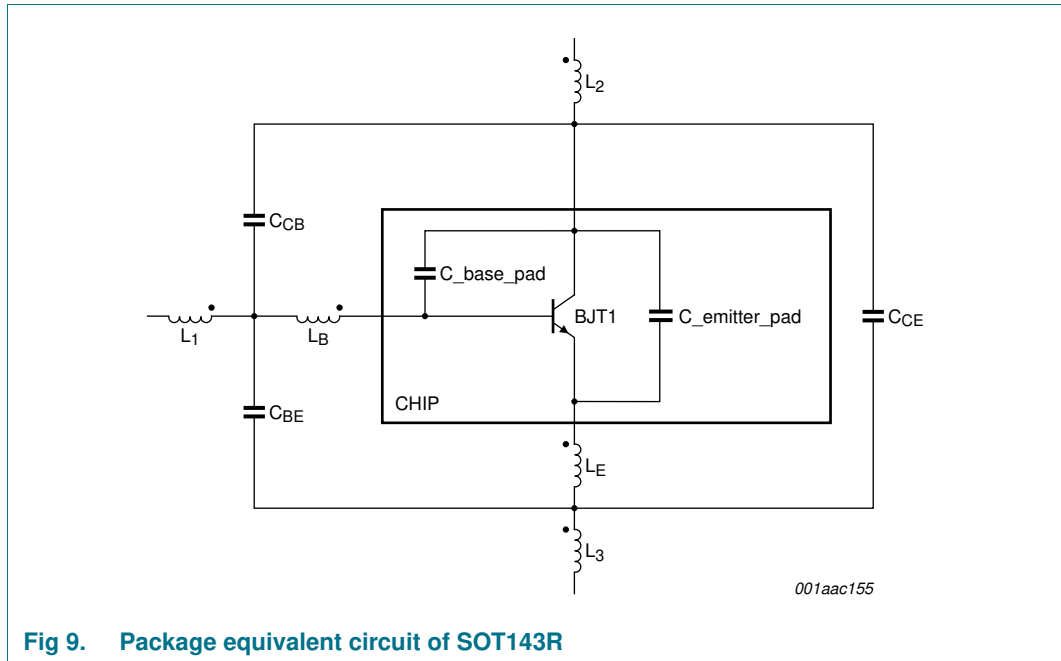


Fig 9. Package equivalent circuit of SOT143R

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

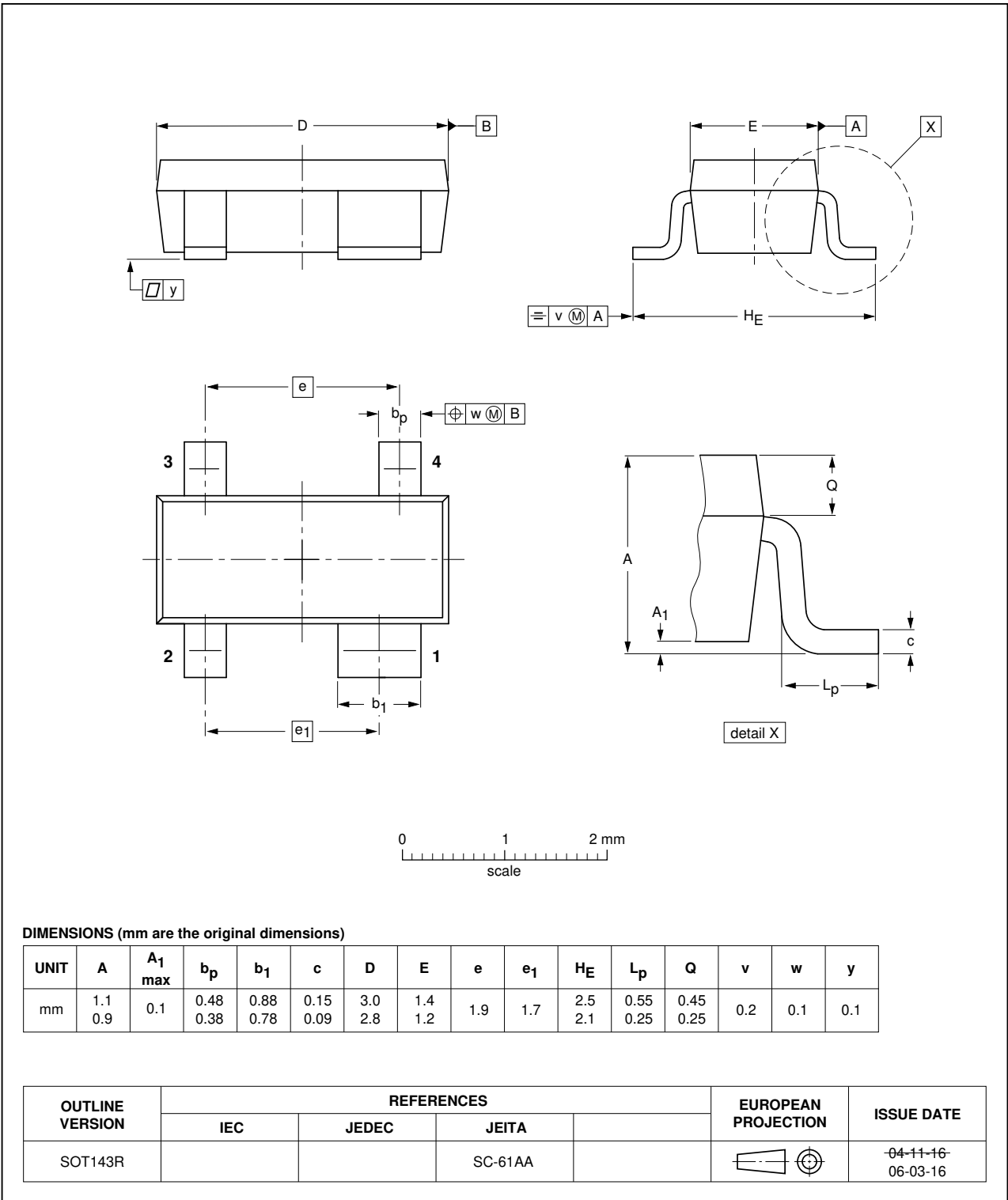


Fig 10. Package outline SOT143R (SC-61AA)

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:		<ul style="list-style-type: none">• 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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