



# 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	$T_{sp} \leq 145\text{ °C}$	<a href="#">[1]</a> -	-	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



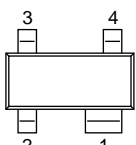
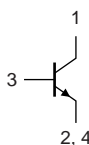
Table 1. Quick reference data ...continued

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 <sup>[1]</sup>
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

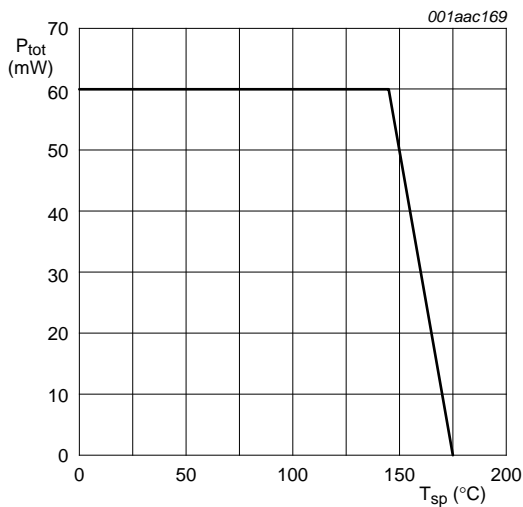


Fig 1. Power derating curve

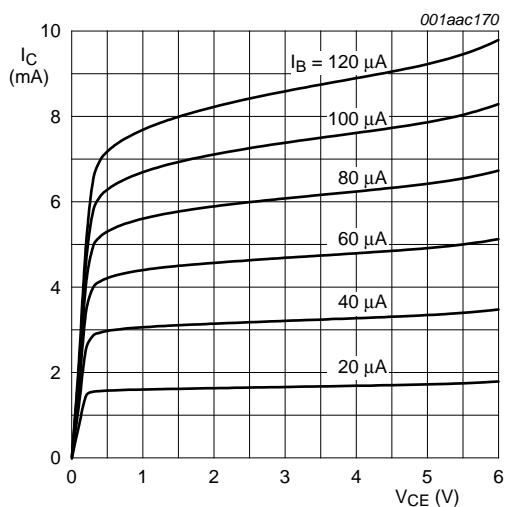
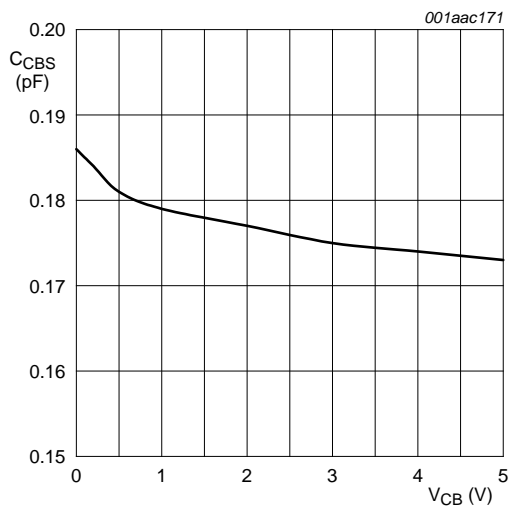
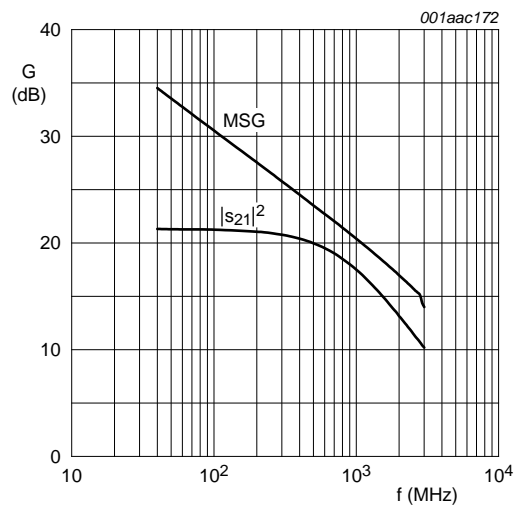


Fig 2. Collector current as a function of collector-emitter voltage; typical values



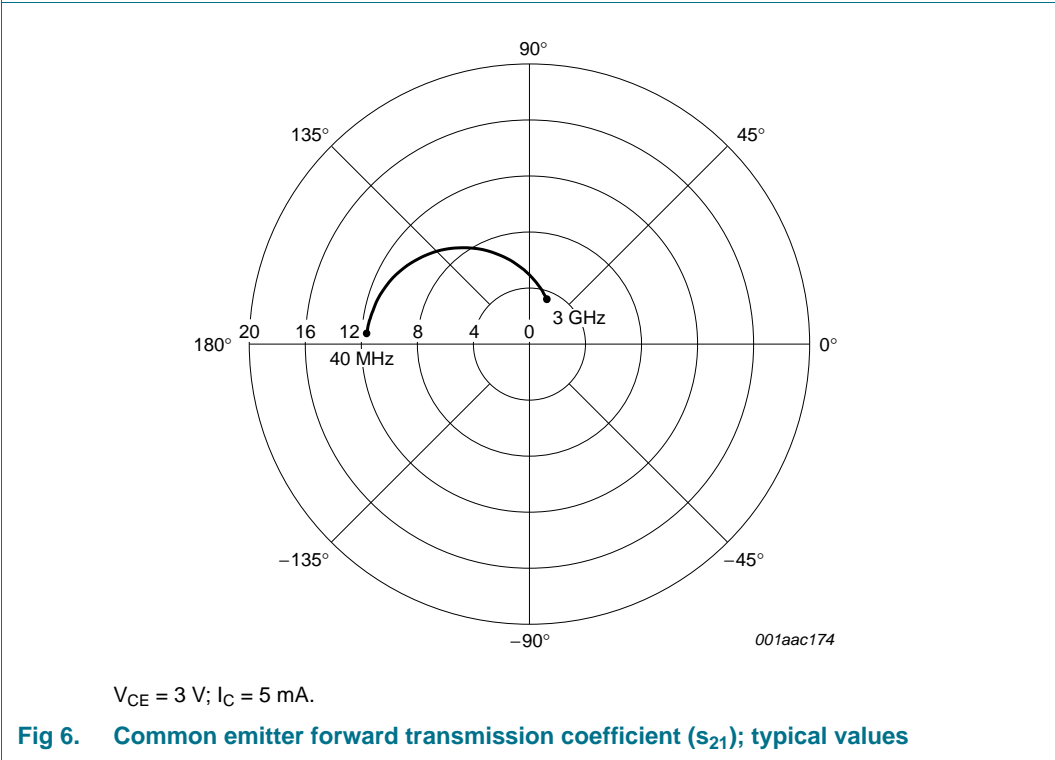
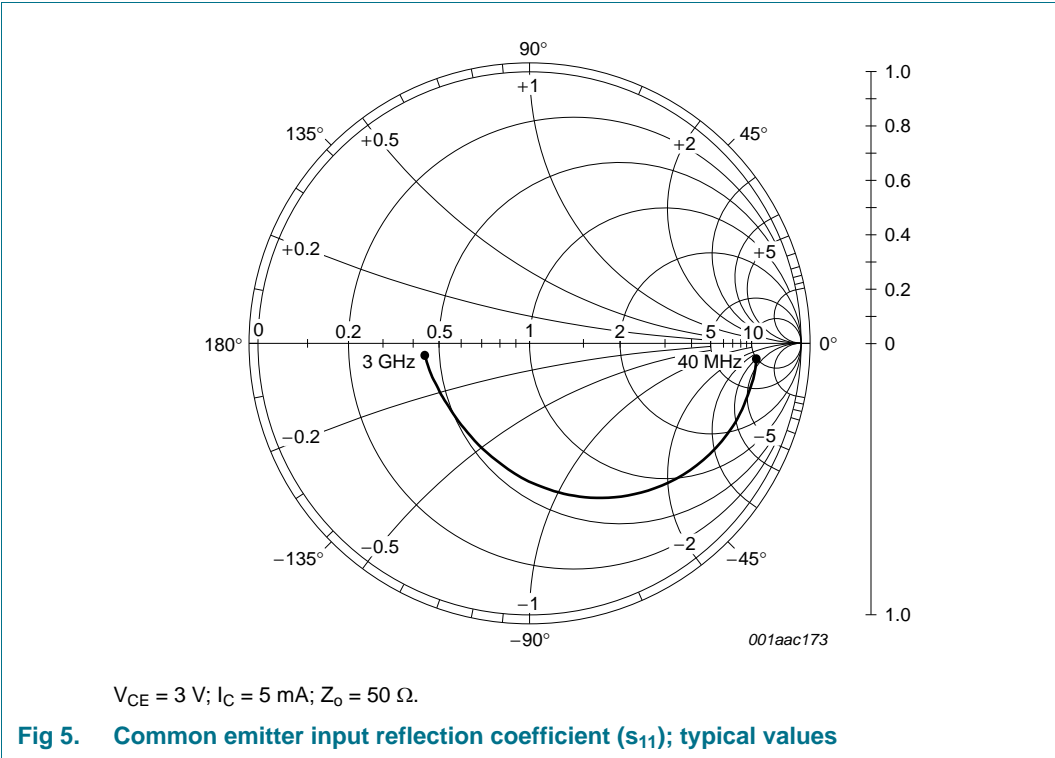
$I_C = 0$  mA;  $f = 1$  MHz.

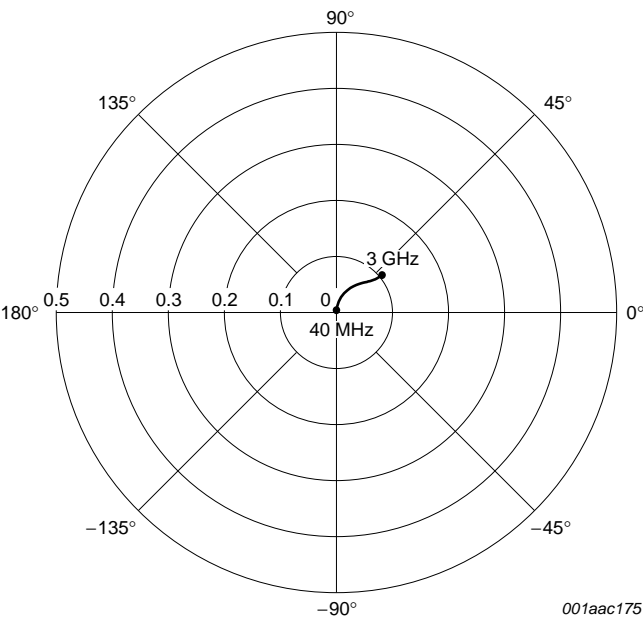
Fig 3. Collector-base capacitance as a function of collector-base voltage; typical values



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

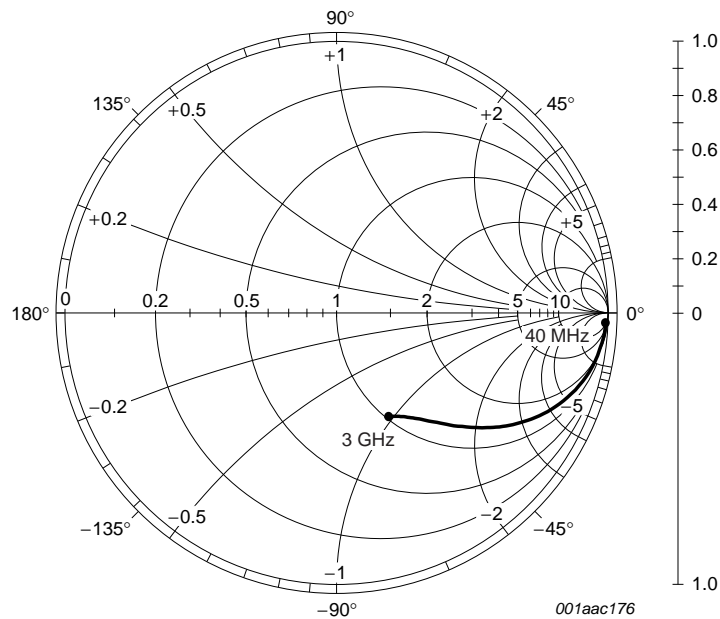
Fig 4. Gain as a function of frequency; typical values





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

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



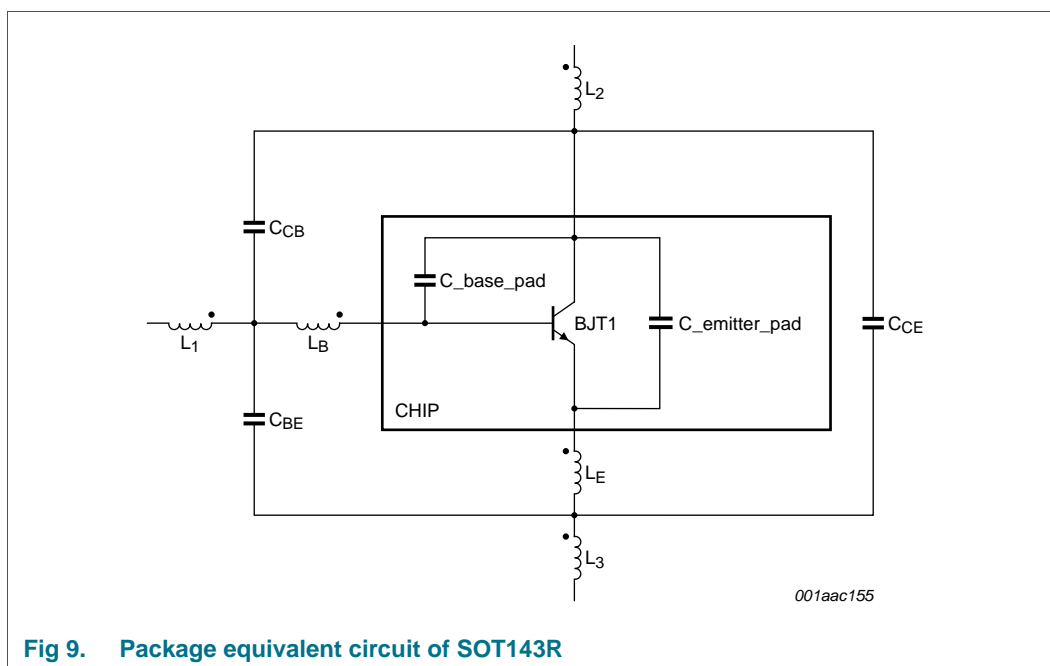
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}; Z_o = 50\text{ }\Omega.$

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	$\Omega$
15	RE	2.1	$\Omega$
16	RC	1.6	$\Omega$
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	-

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

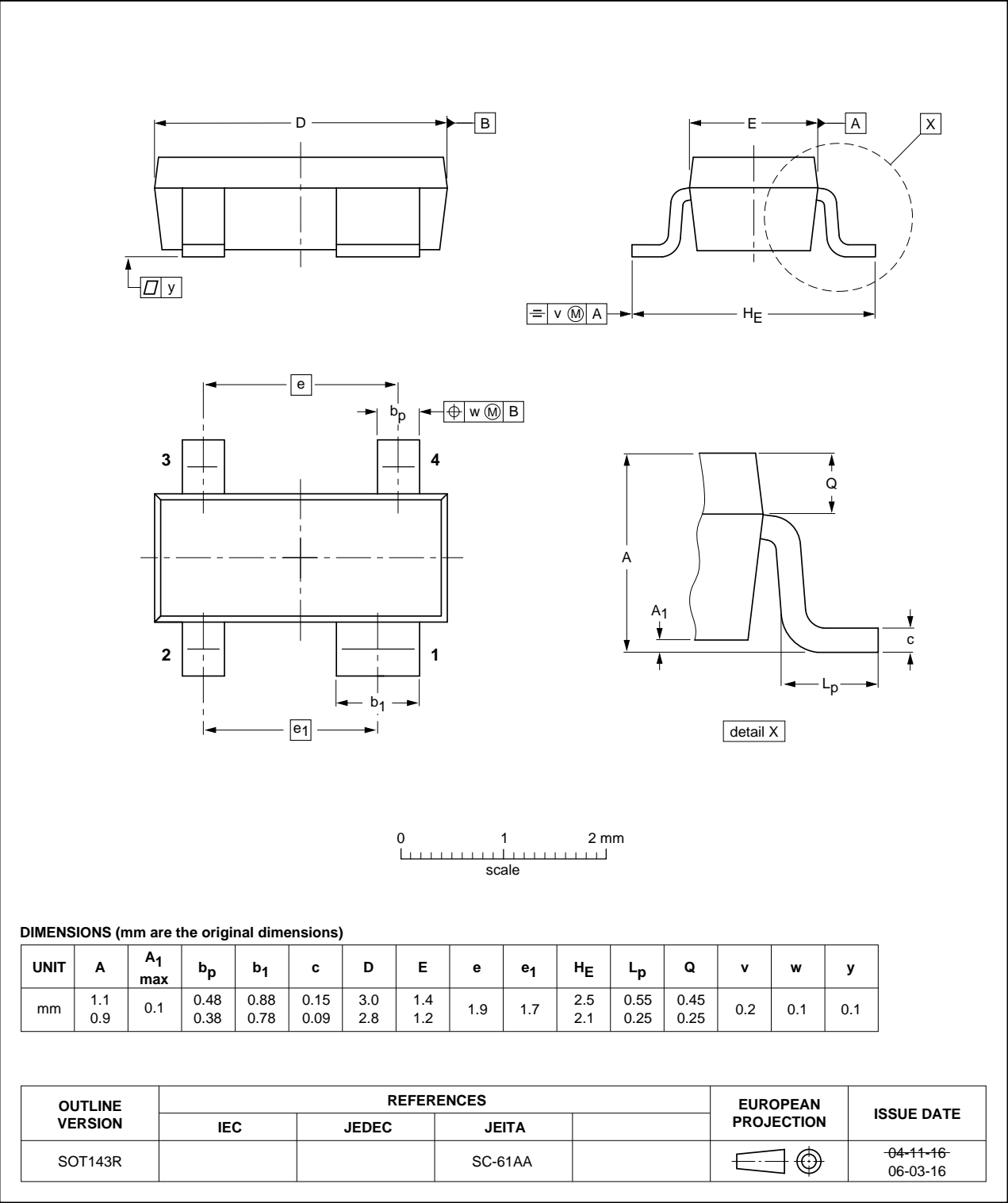


Fig 10. Package outline SOT143R (SC-61AA)

## 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"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• Package outline drawings have been updated to the latest version.</li></ul>			
BFG310_XR v.1 (9397 750 14244)	20050202	Product data sheet	-	-

## 11. Legal information

### 11.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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