

# BFG310/XR

## NPN 14 GHz wideband transistor

Rev. 01 — 2 February 2005

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

- 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	$T_{sp} \leq 145 \text{ }^\circ\text{C}$	[1]	-	60	mW
$h_{FE}$	DC current gain	$I_C = 5 \text{ mA}; V_{CE} = 3 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	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	$I_C = 5 \text{ mA}; V_{CE} = 3 \text{ V};$ $f = 1 \text{ GHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	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 <a href="#">[1]</a>
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	$I_C = 5\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; $Z_S = Z_L = 50\ \Omega$				
		$f = 1.8\text{ GHz}$	-	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	$I_C = 5\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 1.8\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$ ; $Z_S = Z_L = 50\ \Omega$	-	1.8	-	dBm
IP3	third order intercept point	$I_C = 5\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $f = 1.8\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$ ; $Z_S = Z_L = 50\ \Omega$	-	8.5	-	dBm

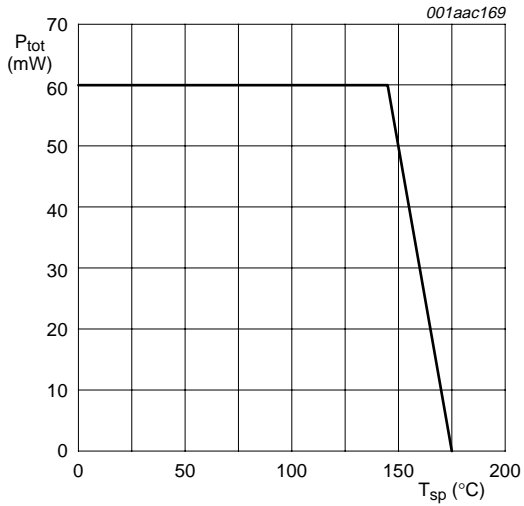


Fig 1. Power derating curve

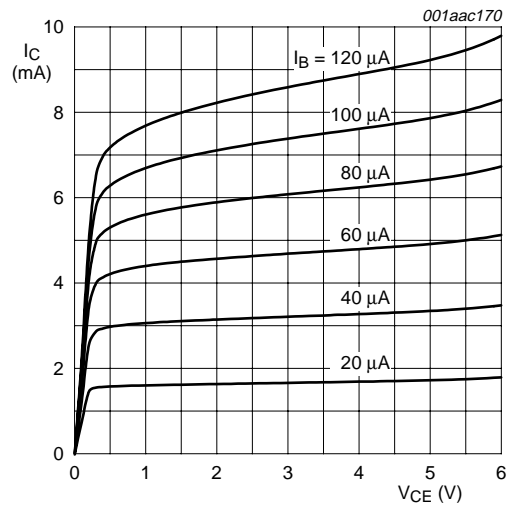
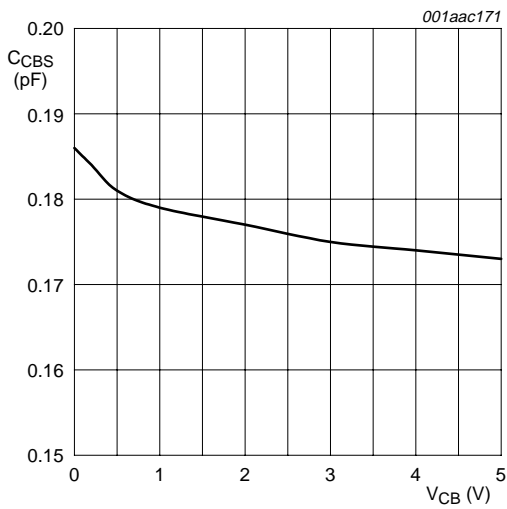
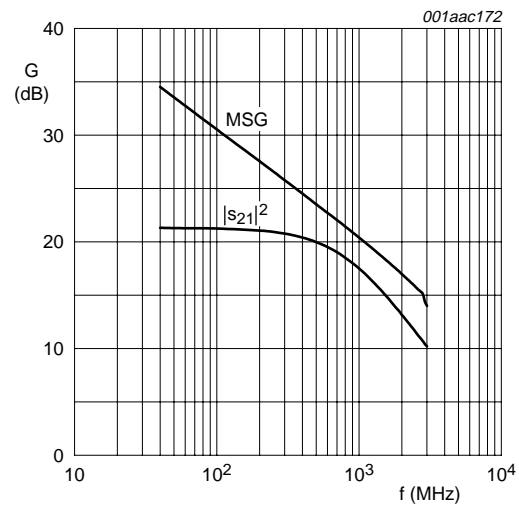


Fig 2. Collector current as a function of collector-emitter voltage; typical values



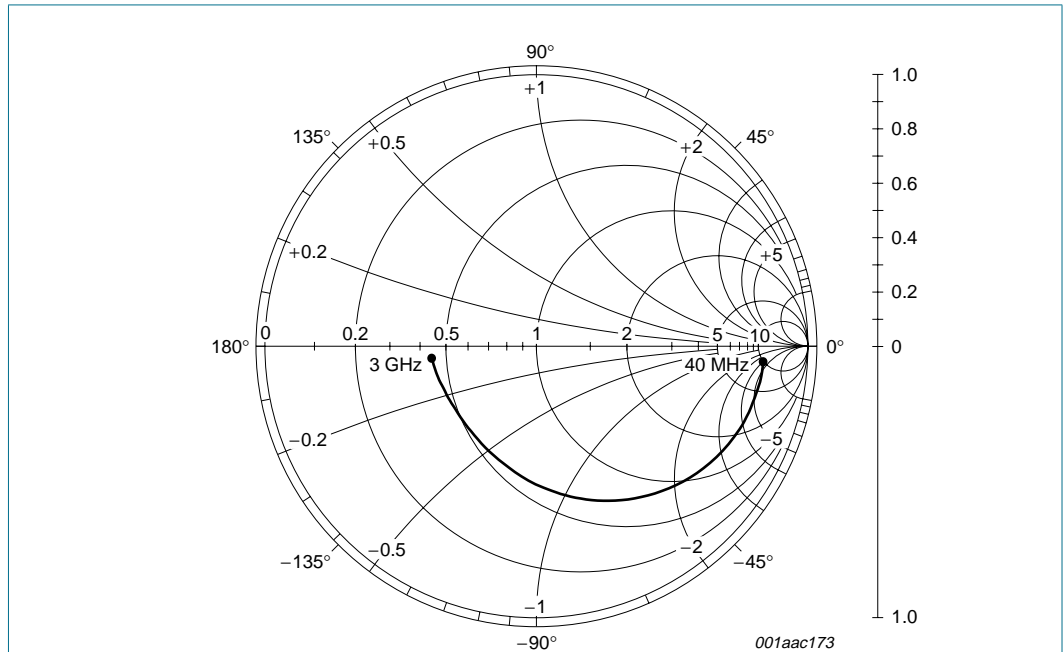
$I_C = 0 \text{ mA}; f = 1 \text{ MHz}.$

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



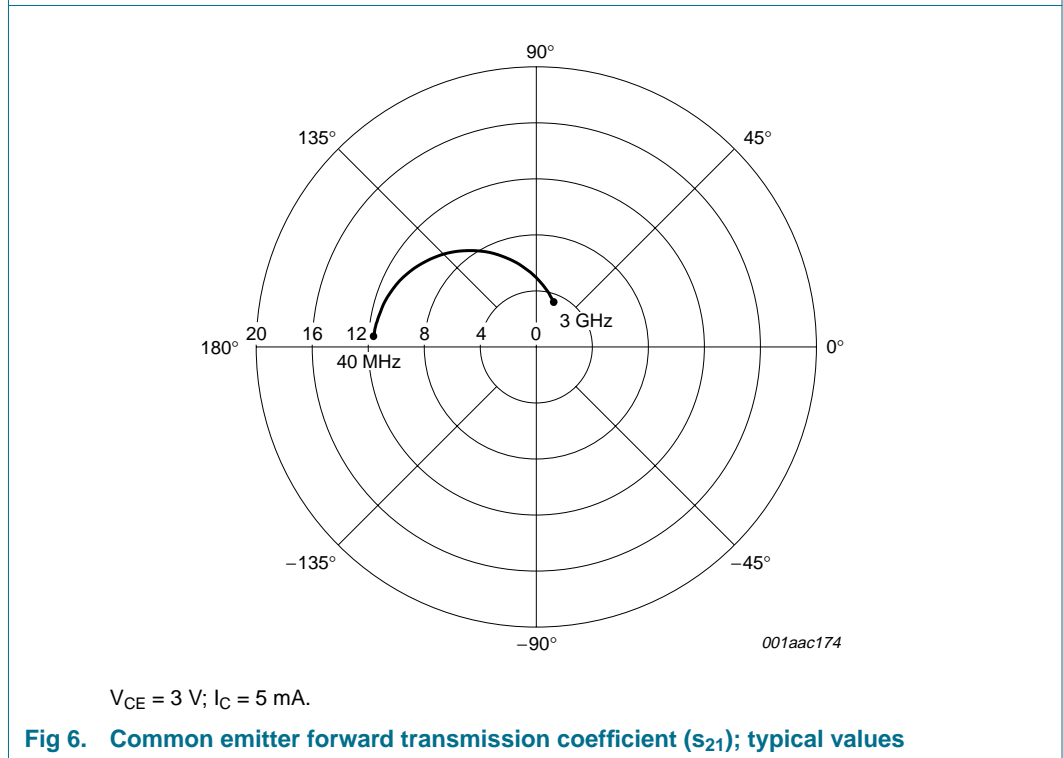
$I_C = 5 \text{ mA}; V_{CE} = 3 \text{ V}.$

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



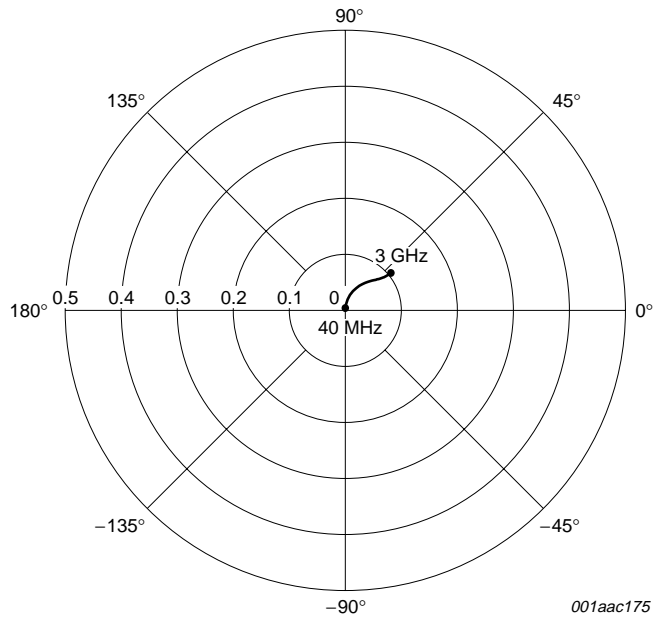
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}; Z_o = 50\ \Omega.$

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



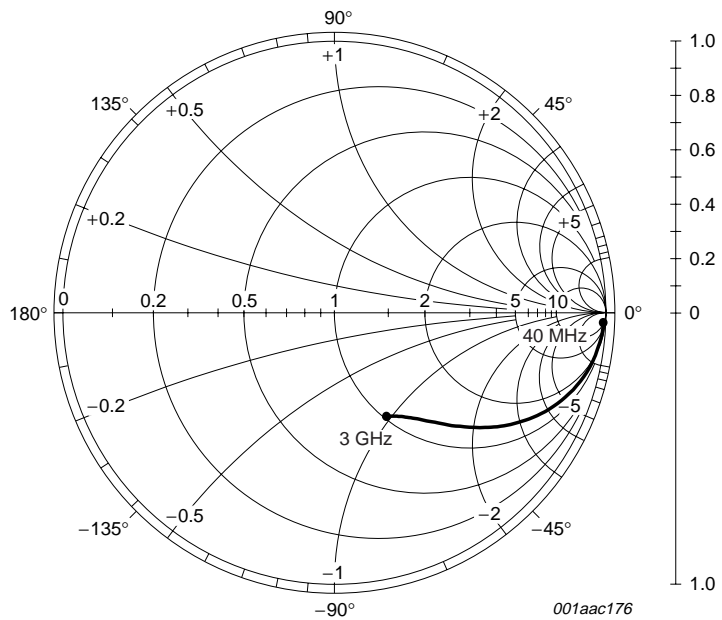
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}.$

**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**



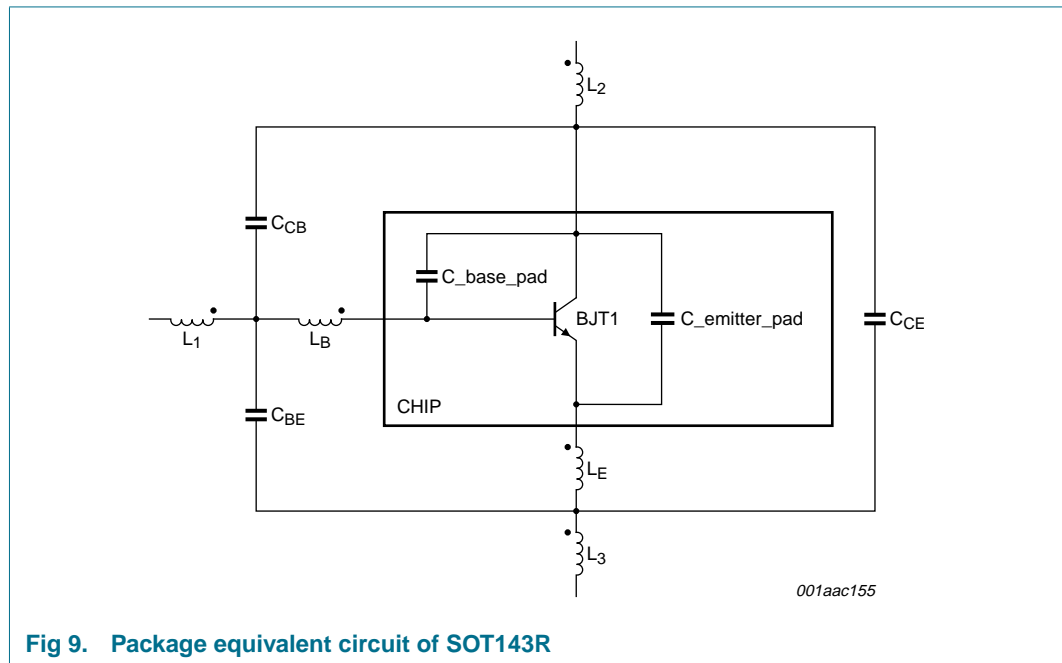
$V_{CE} = 3\text{ V}; I_C = 5\text{ mA}; Z_0 = 50\ \Omega$ .

**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	$\Omega$
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	-



**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

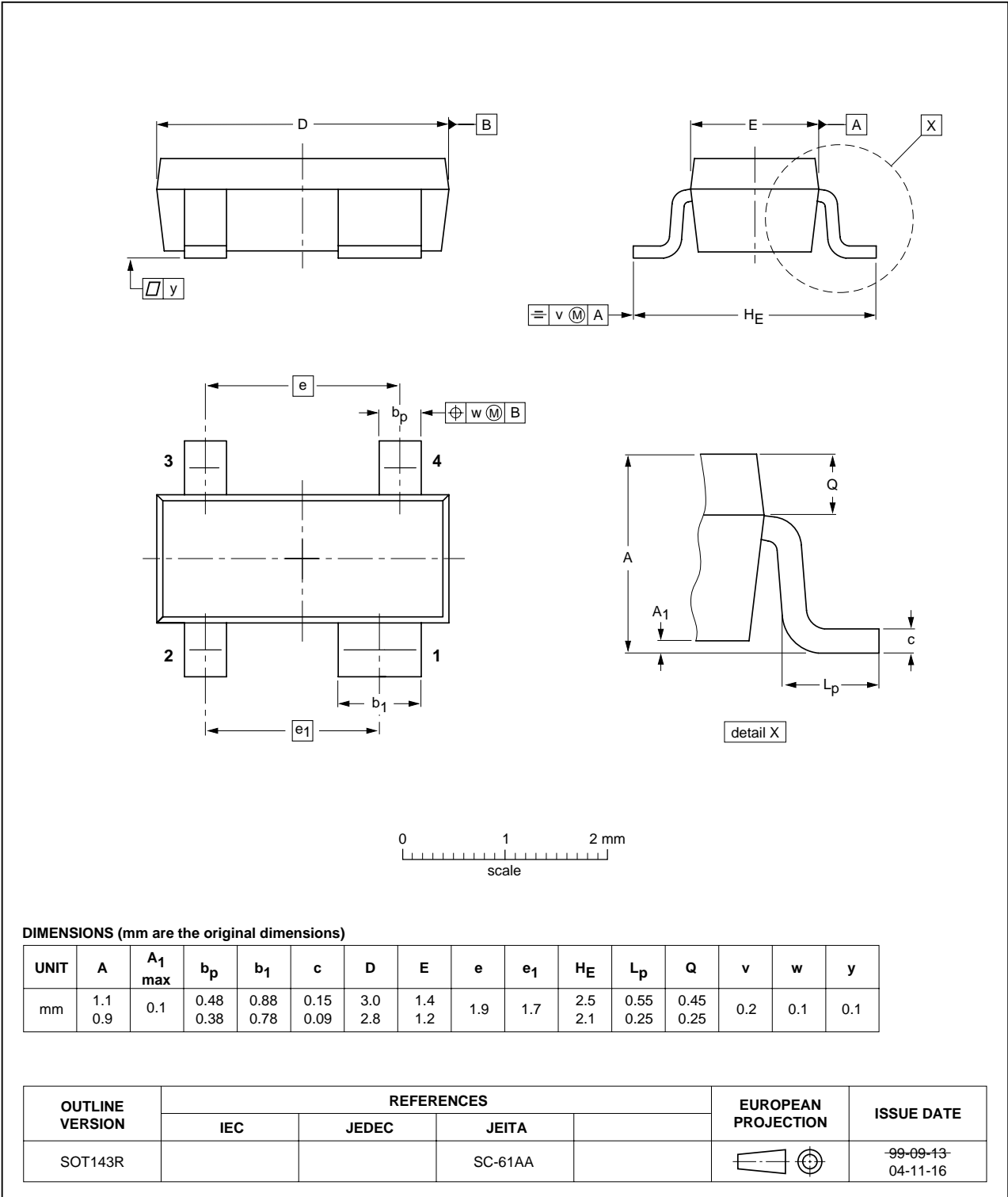


Fig 10. Package outline SOT143R (SC-61AA)



## 10. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BFG310_XR_1	20050202	Product data sheet	-	9397 750 14244	-

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Level	Data sheet status [1]	Product status [2] [3]	Definition
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