

# BGA2002

## MMIC amplifier

Rev. 4 — 9 February 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Silicon Monolithic Microwave Integrated Circuit (MMIC) amplifier consisting of an NPN double polysilicon transistor with integrated biasing for low voltage applications in a plastic, 4-pin dual-emitter SOT343R package.

### 1.2 Features and benefits

- Low current, low voltage
- Very high power gain
- Low noise figure
- Integrated temperature compensated biasing
- Supply and RF output pin combined
- AEC-Q100 qualified, see [Section 8.1](#)

### 1.3 Applications

- LNB IF amplifiers
- General purpose low noise wideband amplifier for frequencies between DC and 2.2 GHz
- High frequency oscillators
- High frequency oscillators
- Satellite televisions tuners (SATV)
- High frequency oscillators

### 1.4 Quick reference data

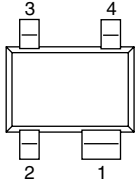
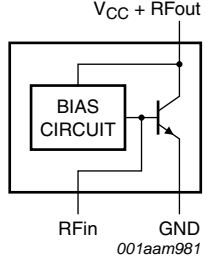
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	-	-	4.5	V
$I_{CC}$	supply current	$V_{bias} = 2.5$ V; RF input AC coupled	3	4.5	6	mA
MSG	maximum stable gain	$V_{bias} = 2.5$ V; $f = 1.8$ GHz; $T_{amb} = 25$ °C	-	19.5	-	dBm
NF	noise figure	$V_{bias} = 2.5$ V; $f = 1.8$ GHz; $\Gamma_S = \Gamma_{opt}$	-	1.3	-	dBm



## 2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	GND		
2, 5	RFIn		
3	GND		
4	$V_{CC} + RF_{out}$		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGA2002	-	plastic surface mounted package; reverse pinning; 4 leads	SOT343R

## 4. Marking

Table 4. Marking

Type number	Marking code	Description
BGA2002	A2*	* = p: made in Hong Kong * = t: made in Malaysia

## 5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	-	4.5	V
$I_{CC}$	supply current	forced by DC voltage on RF input	-	30	mA
$P_{tot}$	total power dissipation	$T_{sp} = 100\text{ °C}$	-	135	mW
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	150	°C

## 6. Thermal characteristics

**Table 6. Thermal characteristics**

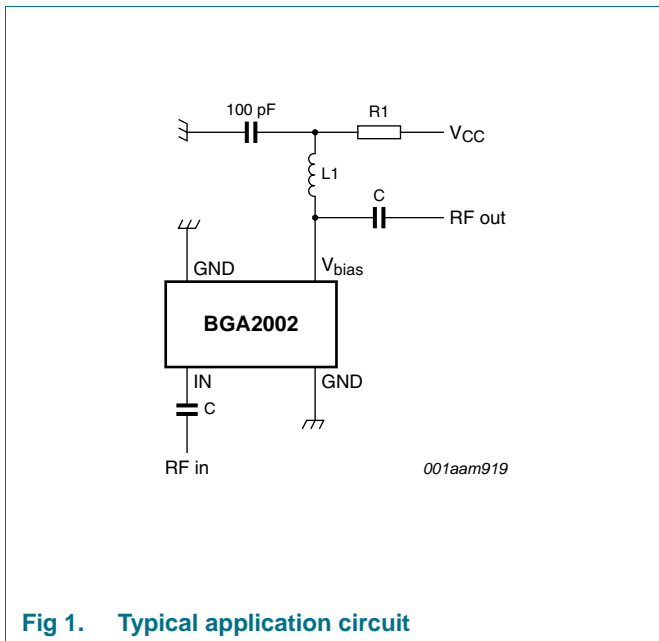
Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	$P_{tot} = 135 \text{ mW}; T_{sp} = 100 \text{ }^\circ\text{C}$	350	K/W

## 7. Characteristics

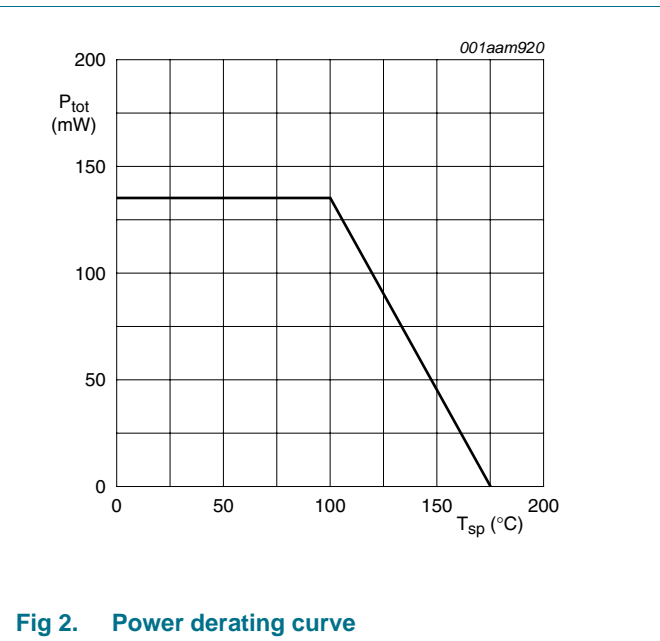
**Table 7. Characteristics**

$V_{bias} = 2.5 \text{ V}; I_{bias} = 4 \text{ mA}; T_{amb} = 25 \text{ }^\circ\text{C};$  unless otherwise specified.

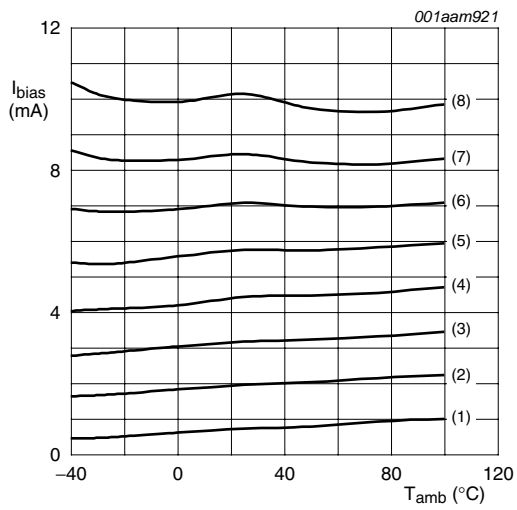
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC}$	supply current	$V_{bias} = 1 \text{ V}$	-	0.7	-	mA
		$V_{bias} = 2.5 \text{ V}$	3	4.5	6	mA
		$V_{bias} = 4.5 \text{ V}$	-	11	-	mA
MSG	maximum stable gain	$f = 900 \text{ MHz}$	-	22	-	dB
		$f = 1800 \text{ MHz}$	-	19.5	-	dB
$ S_{21} ^2$	insertion power gain	$f = 900 \text{ MHz}$	-	18	-	dB
		$f = 900 \text{ MHz}$	-	14	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_{bias} = 4.4 \text{ mA}; f = 900 \text{ MHz}$	-	-2	-	dBm
NF	noise figure	$\Gamma_S = \Gamma_{opt}; f = 900 \text{ MHz}$	-	1.3	-	dB
		$\Gamma_S = \Gamma_{opt}; f = 1800 \text{ MHz}$	-	1.3	-	dB
IP3 <sub>1</sub>	input third-order intercept point	$I_{bias} = 4.4 \text{ mA}; f = 900 \text{ MHz}$	-	-7.4	-	dBm
		$I_{bias} = 4.4 \text{ mA}; f = 1800 \text{ MHz}$	-	-4.5	-	dBm



**Fig 1. Typical application circuit**

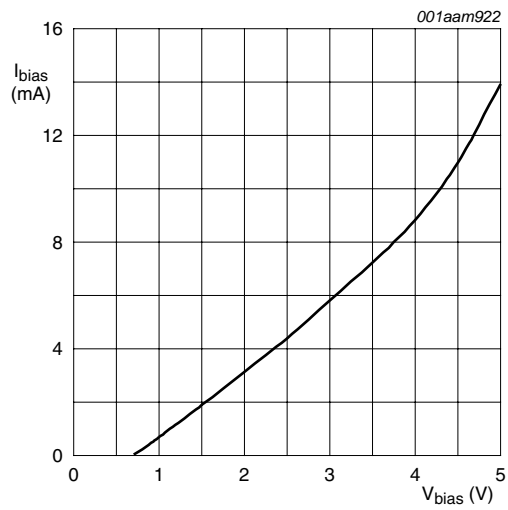


**Fig 2. Power derating curve**

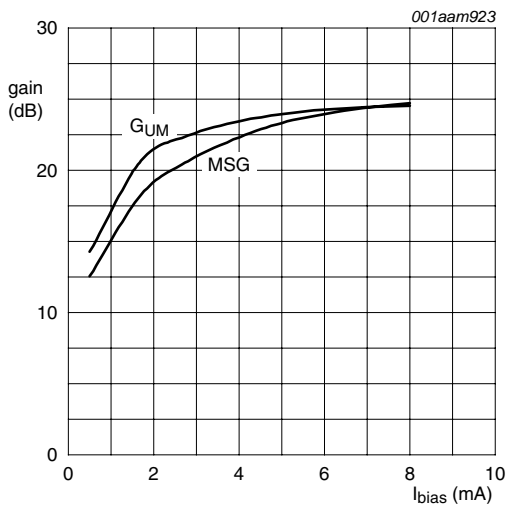


- (1)  $V_{bias} = 1\text{ V}$
- (2)  $V_{bias} = 1.5\text{ V}$
- (3)  $V_{bias} = 2\text{ V}$
- (4)  $V_{bias} = 2.5\text{ V}$
- (5)  $V_{bias} = 3\text{ V}$
- (6)  $V_{bias} = 3.5\text{ V}$
- (7)  $V_{bias} = 4\text{ V}$
- (8)  $V_{bias} = 4.5\text{ V}$

**Fig 3. Bias current as a function of ambient temperature; typical values**

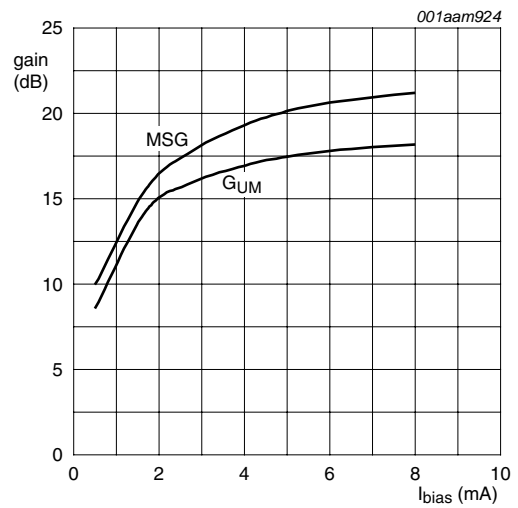


**Fig 4. Bias current as a function of voltage at the output pin; typical values**



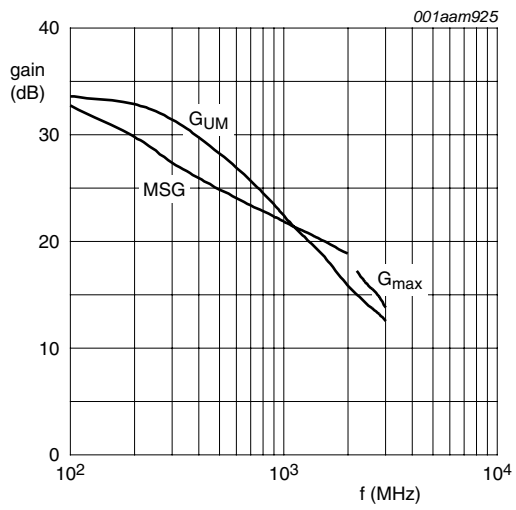
$f = 900\text{ MHz}$ .

**Fig 5. Gain as a function of bias current; typical values**



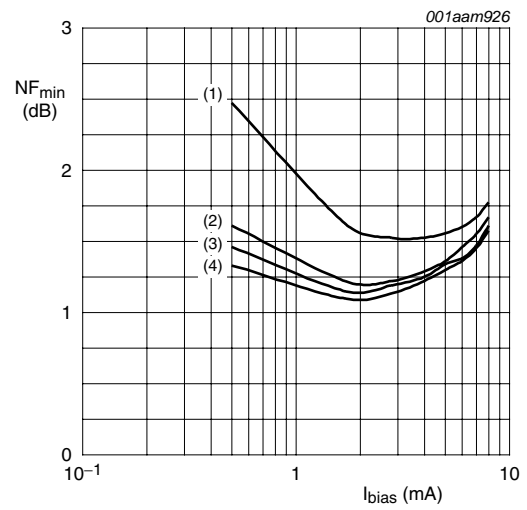
$f = 1800\text{ MHz}$ .

**Fig 6. Gain as a function of bias current; typical values**



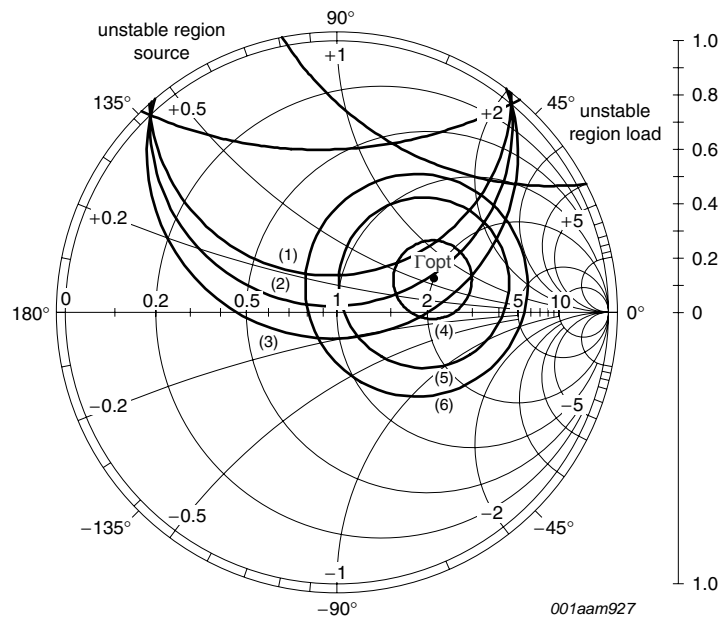
$V_{bias} = 25\text{ V}; I_{bias} = 4\text{ mA}.$

Fig 7. Gain as a function of frequency; typical values



- (1)  $f = 2400\text{ MHz}$
- (2)  $f = 1000\text{ MHz}$
- (3)  $f = 900\text{ MHz}$
- (4)  $f = 1800\text{ MHz}$

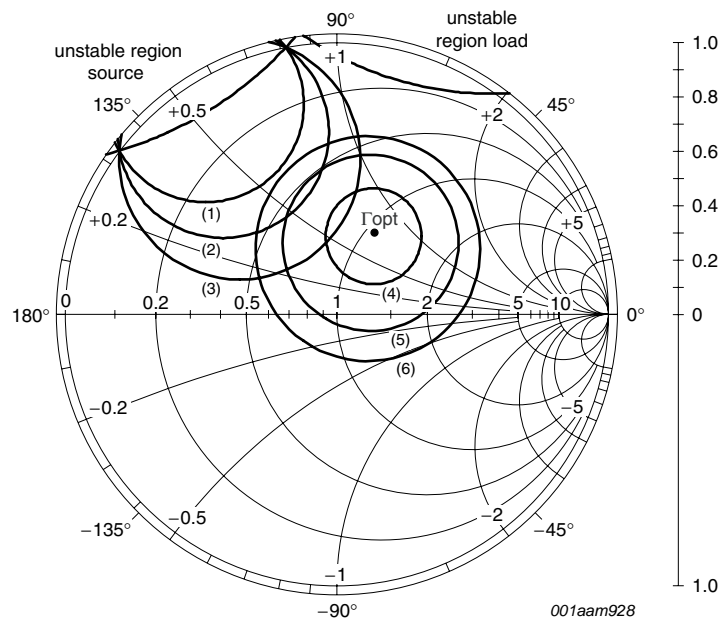
Fig 8. Minimum noise figure as a function of frequency; typical values



$f = 900 \text{ MHz}$ ;  $V_{bias} = 2.5 \text{ V}$ ;  $I_{bias} = 4 \text{ mA}$ ;  $Z_O = 50 \Omega$ .

- (1)  $G = 22 \text{ dB}$
- (2)  $G = 21 \text{ dB}$
- (3)  $G = 20 \text{ dB}$
- (4)  $NF = 1.3 \text{ dB}$
- (5)  $NF = 1.5 \text{ dB}$
- (6)  $NF = 1.7 \text{ dB}$

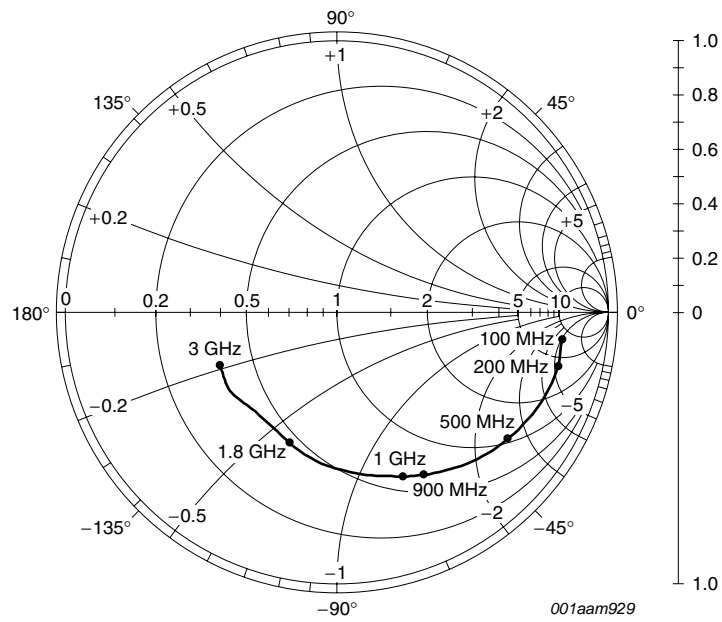
**Fig 9. Noise, stability and gain circles; typical values**



$f = 1800 \text{ MHz}; V_{bias} = 2.5 \text{ V}; I_{bias} = 4 \text{ mA}; Z_O = 50 \Omega.$

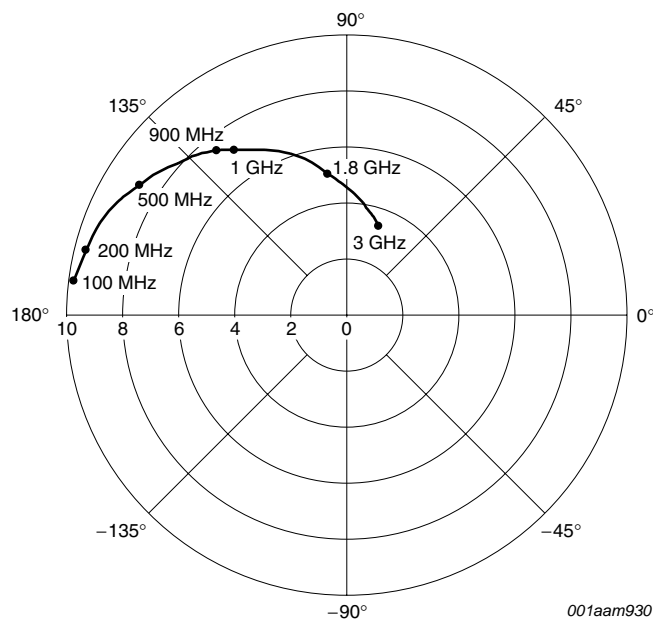
- (1)  $G = 19 \text{ dB}$
- (2)  $G = 18 \text{ dB}$
- (3)  $G = 17 \text{ dB}$
- (4)  $NF = 1.3 \text{ dB}$
- (5)  $NF = 1.5 \text{ dB}$
- (6)  $NF = 1.7 \text{ dB}$

**Fig 10. Noise, stability and gain circles; typical values**



$V_{bias} = 2.5\text{ V}$ ;  $I_{bias} = 4\text{ mA}$ ;  $Z_O = 50\ \Omega$ .

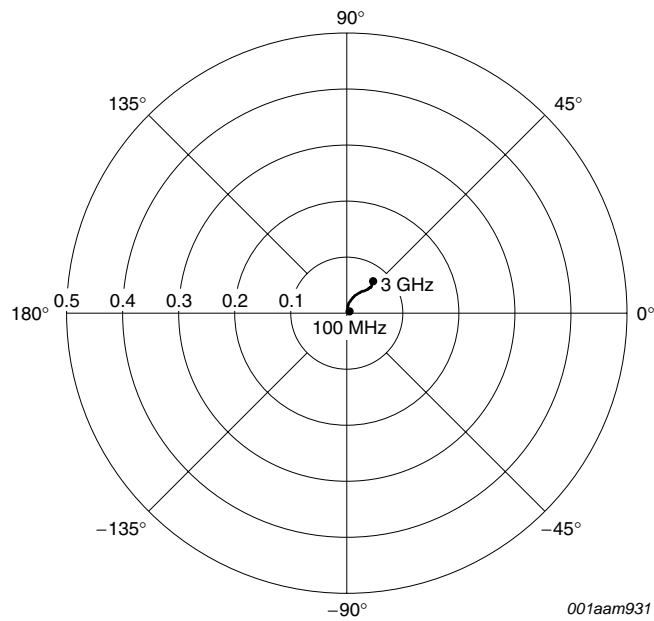
Fig 11. Common emitter input reflection coefficient ( $S_{11}$ ); typical values



$V_{bias} = 2.5\text{ V}$ ;  $I_{bias} = 4\text{ mA}$ ;  $Z_O = 50\ \Omega$ .

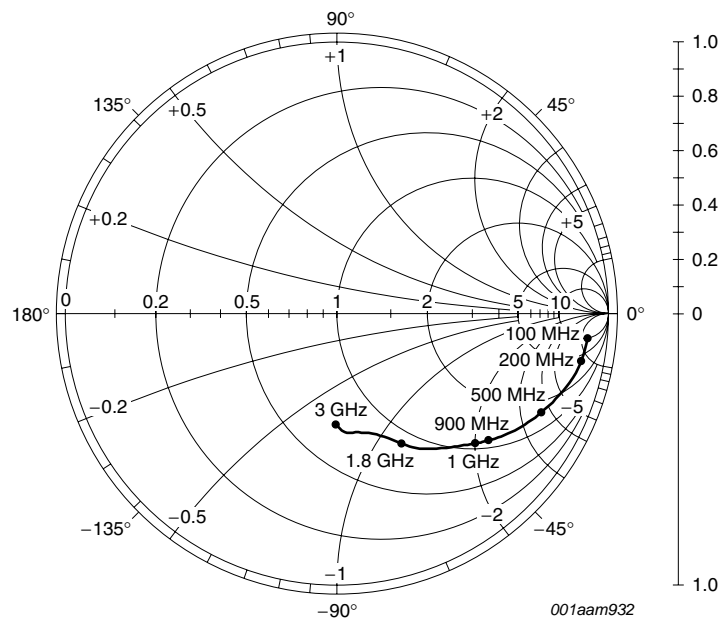
Fig 12. Common emitter forward transmission coefficient ( $S_{21}$ ); typical values





$V_{bias} = 2.5\text{ V}$ ;  $I_{bias} = 4\text{ mA}$ ;  $Z_O = 50\ \Omega$ .

Fig 13. Common emitter reverse transmission coefficient ( $S_{12}$ ); typical values



$V_{bias} = 2.5\text{ V}$ ;  $I_{bias} = 4\text{ mA}$ ;  $Z_O = 50\ \Omega$ .

Fig 14. Common emitter output reflection coefficient ( $S_{22}$ ); typical values

## 8. Test information

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### 8.1 Quality information

All qualification tests are performed according AEC-Q100 except for read point testing, this is done only at room temperature.

9. Package outline

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R

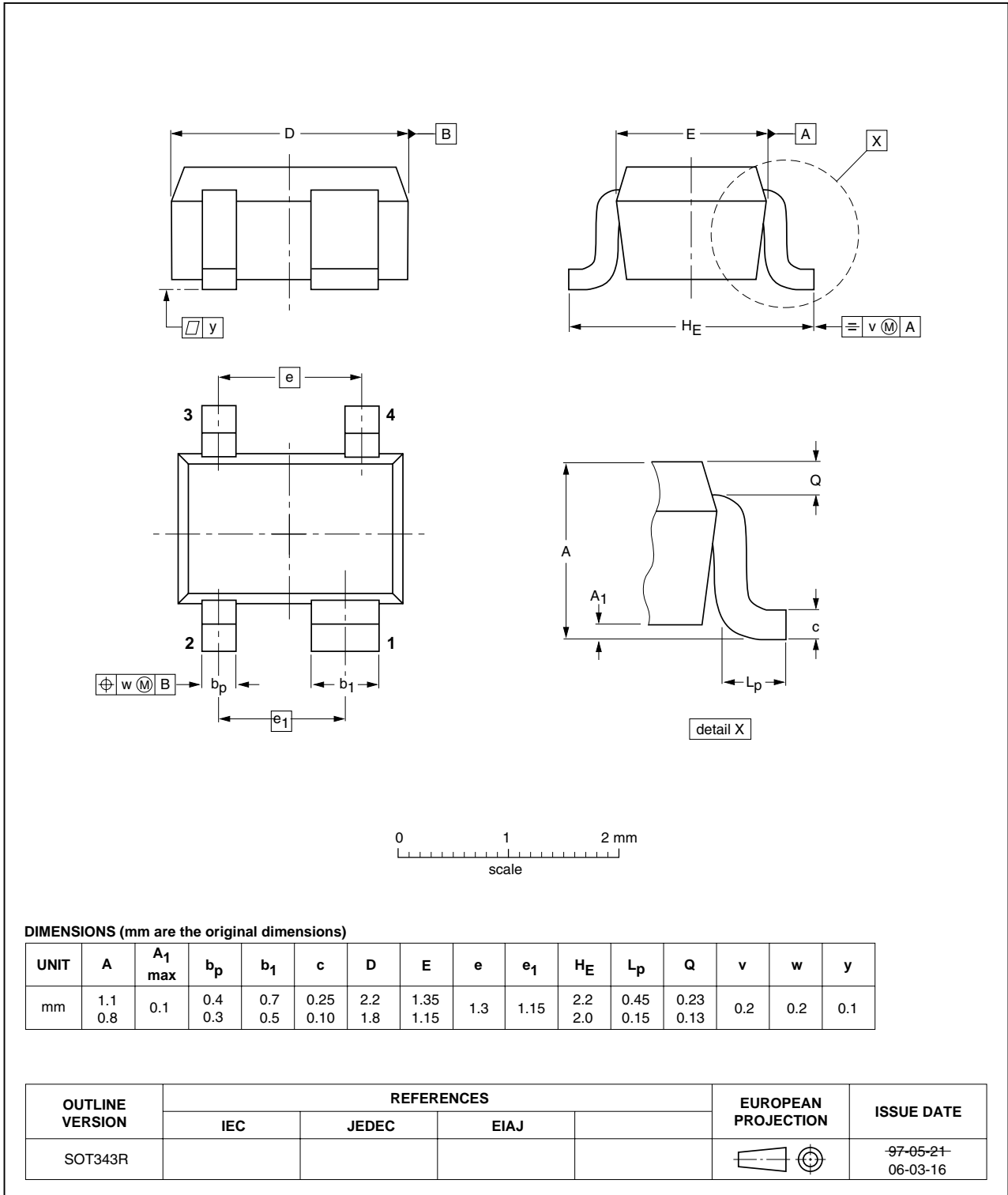


Fig 15. Package outline SOT343R

## 10. Abbreviations

**Table 8. Abbreviations**

Acronym	Description
IF	Intermediate Frequency
LNB	Low-Noise Block converter
NPN	Negative Positive Negative
RF	Radio Frequency

## 11. Revision history

**Table 9. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGA2002 v.4	20110209	Product data sheet	-	BGA2002 v.3
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Section 8 on page 10</a>: has been added.</li> </ul>			
BGA2002 v.3	20101102	Product data sheet	-	BGA2002 v.2
Modifications:	<ul style="list-style-type: none"> <li>• Status changed from objective to product.</li> <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> </ul>			
BGA2002 v.2	19980901	Objective data sheet	-	-

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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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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