

# BGA2869

MMIC wideband amplifier

Rev. 1 — 17 July 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Silicon Monolithic Microwave Integrated Circuit (MMIC) wideband amplifier with internal matching circuit in a 6-pin SOT363 plastic SMD package.

### 1.2 Features and benefits

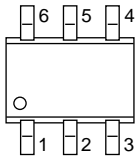
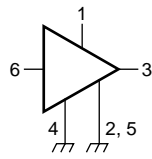
- Internally matched to  $50\ \Omega$
- A gain of 31.7 dB at 950 MHz
- Output power at 1 dB gain compression = 10 dBm at 950 MHz
- Supply current = 24.0 mA at a supply voltage of 5.0 V
- Reverse isolation > 39 dB up to 2150 MHz
- Good linearity with low second order and third order products
- Noise figure = 3.1 dB at 950 MHz
- Unconditionally stable ( $K > 1$ )
- No output inductor required

### 1.3 Applications

- LNB IF amplifiers
- General purpose low noise wideband amplifier for frequencies between DC and 2.2 GHz

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	$V_{CC}$		 sym052
2, 5	GND2		
3	RF_OUT		
4	GND1		
6	RF_IN		

### 3. Ordering information

Table 2. Ordering information

Type number	Package		Version
	Name	Description	
BGA2869	-	plastic surface-mounted package; 6 leads	SOT363

### 4. Marking

Table 3. Marking

Type number	Marking code	Description
BGA2869	MD*	* = - : made in Hong Kong * = p : made in Hong Kong * = W : made in China * = t : made in Malaysia

### 5. Limiting values

Table 4. 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	-0.5	+6.0	V
$I_{CC}$	supply current		-	36	mA
$P_{tot}$	total power dissipation	$T_{sp} = 90\text{ °C}$	-	200	mW
$T_{stg}$	storage temperature		-40	+125	°C
$T_j$	junction temperature		-	125	°C
$P_{drive}$	drive power		-	-19	dBm

### 6. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	$P_{tot} = 200\text{ mW}$ ; $T_{sp} = 90\text{ °C}$	300	K/W

### 7. Characteristics

Table 6. Characteristics

$V_{CC} = 5.0\text{ V}$ ;  $Z_S = Z_L = 50\ \Omega$ ;  $P_i = -34\text{ dBm}$ ;  $T_{amb} = 25\text{ °C}$ ; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		4.5	5.0	5.5	V
$I_{CC}$	supply current		21.8	24.0	26.0	mA

**Table 6. Characteristics ...continued**

$V_{CC} = 5.0\text{ V}$ ;  $Z_S = Z_L = 50\ \Omega$ ;  $P_i = -34\text{ dBm}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ ; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
G <sub>p</sub>	power gain	f = 250 MHz	30.5	31.1	31.7	dB
		f = 950 MHz	31.0	31.7	32.4	dB
		f = 2150 MHz	30.7	32.2	33.6	dB
RL <sub>in</sub>	input return loss	f = 250 MHz	12	14	16	dB
		f = 950 MHz	16	18	20	dB
		f = 2150 MHz	7	13	20	dB
RL <sub>out</sub>	output return loss	f = 250 MHz	10	15	19	dB
		f = 950 MHz	20	21	22	dB
		f = 2150 MHz	8	10	13	dB
ISL	isolation	f = 250 MHz	41	61	81	dB
		f = 950 MHz	46	47	49	dB
		f = 2150 MHz	37	39	42	dB
NF	noise figure	f = 250 MHz	2.6	3.1	3.6	dB
		f = 950 MHz	2.6	3.1	3.5	dB
		f = 2150 MHz	2.8	3.2	3.6	dB
B <sub>-3dB</sub>	-3 dB bandwidth	3 dB below gain at 1 GHz	2.8	3.0	3.2	GHz
K	Rollett stability factor	f = 250 MHz	9	14	19	
		f = 950 MHz	2	3	4	
		f = 2150 MHz	1	1	2	
P <sub>L(sat)</sub>	saturated output power	f = 250 MHz	12	12	13	dBm
		f = 950 MHz	10	12	13	dBm
		f = 2150 MHz	9	10	11	dBm
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	f = 250 MHz	9	10	11	dBm
		f = 950 MHz	9	10	11	dBm
		f = 2150 MHz	8	9	10	dBm
IP3 <sub>I</sub>	input third-order intercept point	P <sub>drive</sub> = -41 dBm (for each tone)				
		f <sub>1</sub> = 250 MHz; f <sub>2</sub> = 251 MHz	-11	-9	-6	dBm
		f <sub>1</sub> = 950 MHz; f <sub>2</sub> = 951 MHz	-11	-9	-7	dBm
		f <sub>1</sub> = 2150 MHz; f <sub>2</sub> = 2151 MHz	-16	-13	-10	dBm
IP3 <sub>O</sub>	output third-order intercept point	P <sub>drive</sub> = -41 dBm (for each tone)				
		f <sub>1</sub> = 250 MHz; f <sub>2</sub> = 251 MHz	20	23	25	dBm
		f <sub>1</sub> = 950 MHz; f <sub>2</sub> = 951 MHz	20	23	25	dBm
		f <sub>1</sub> = 2150 MHz; f <sub>2</sub> = 2151 MHz	16	19	22	dBm
P <sub>L(2H)</sub>	second harmonic output power	P <sub>drive</sub> = -38 dBm				
		f <sub>1H</sub> = 250 MHz; f <sub>2H</sub> = 500 MHz	-69	-67	-65	dBm
		f <sub>1H</sub> = 950 MHz; f <sub>2H</sub> = 1900 MHz	-53	-51	-49	dBm
ΔIM2	second-order intermodulation distance	P <sub>drive</sub> = -38 dBm (for each tone)				
		f <sub>1</sub> = 250 MHz; f <sub>2</sub> = 251 MHz	40	42	44	dBc
		f <sub>1</sub> = 950 MHz; f <sub>2</sub> = 951 MHz	34	36	38	dBc

## 8. Application information

Figure 1 shows a typical application circuit for the BGA2869 MMIC. The device is internally matched to 50 Ω, and therefore does not need any external matching. The value of the input and output DC blocking capacitors C1 and C2 should not be more than 470 pF for applications above 100 MHz. However, when the device is operated below 100 MHz, the capacitor value should be increased.

The location of the 470 pF supply decoupling capacitor (C<sub>dec</sub>) can be precisely chosen for optimum performance.

The PCB top ground plane, connected to pins 2, 4 and 5 must be as close as possible to the MMIC, preferably also below the MMIC. When using via holes, use multiple via holes as close as possible to the MMIC.

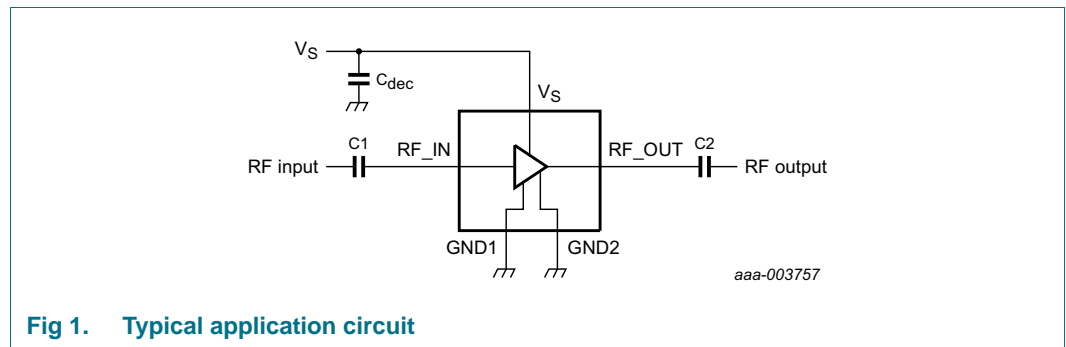


Fig 1. Typical application circuit

### 8.1 Application examples

The MMIC is very suitable as IF amplifier in e.g. LNB's. The excellent wideband characteristics make it an easy building block.

As second amplifier after an LNA, the MMIC offers an easy matching, low noise solution.

### 8.2 Tables

Table 7. Supply current over temperature and supply voltages

Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 4.5 V	23.60	21.80	20.30	mA
		V <sub>CC</sub> = 5.0 V	25.80	24.00	22.40	mA
		V <sub>CC</sub> = 5.5 V	27.80	26.00	24.50	mA

**Table 8. Second harmonic output power over temperature and supply voltages**  
*Typical values.*

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
P <sub>L(2H)</sub>	second harmonic output power	f = 250 MHz; P <sub>drive</sub> = -38 dBm				
		V <sub>CC</sub> = 4.5 V	-58	-67	-68	dBm
		V <sub>CC</sub> = 5.0 V	-72	-67	-61	dBm
		V <sub>CC</sub> = 5.5 V	-64	-60	-58	dBm
		f = 950 MHz; P <sub>drive</sub> = -38 dBm				
		V <sub>CC</sub> = 4.5 V	-69	-55	-50	dBm
		V <sub>CC</sub> = 5.0 V	-55	-51	-48	dBm
		V <sub>CC</sub> = 5.5 V	-51	-49	-46	dBm

**Table 9. Input power at 1 dB gain compression over temperature and supply voltages**  
*Typical values.*

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
P <sub>i(1dB)</sub>	input power at 1 dB gain compression	f = 250 MHz				
		V <sub>CC</sub> = 4.5 V	-21	-21	-21	dBm
		V <sub>CC</sub> = 5.0 V	-20	-20	-20	dBm
		V <sub>CC</sub> = 5.5 V	-19	-20	-20	dBm
		f = 950 MHz				
		V <sub>CC</sub> = 4.5 V	-21	-21	-21	dBm
		V <sub>CC</sub> = 5.0 V	-21	-21	-21	dBm
		V <sub>CC</sub> = 5.5 V	-20	-20	-20	dBm
		f = 2150 MHz				
		V <sub>CC</sub> = 4.5 V	-22	-22	-23	dBm
		V <sub>CC</sub> = 5.0 V	-21	-22	-23	dBm
		V <sub>CC</sub> = 5.5 V	-21	-22	-24	dBm

**Table 10. Output power at 1 dB gain compression over temperature and supply voltages**  
Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
P <sub>L(1dB)</sub>	output power at 1 dB gain compression	f = 250 MHz				
		V <sub>CC</sub> = 4.5 V	9	9	8	dBm
		V <sub>CC</sub> = 5.0 V	11	10	10	dBm
		V <sub>CC</sub> = 5.5 V	12	11	11	dBm
		f = 950 MHz				
		V <sub>CC</sub> = 4.5 V	9	8	8	dBm
		V <sub>CC</sub> = 5.0 V	10	10	9	dBm
		V <sub>CC</sub> = 5.5 V	11	11	10	dBm
		f = 2150 MHz				
		V <sub>CC</sub> = 4.5 V	9	8	6	dBm
		V <sub>CC</sub> = 5.0 V	10	9	7	dBm
		V <sub>CC</sub> = 5.5 V	11	9	7	dBm

**Table 11. Saturated output power over temperature and supply voltages**  
Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
P <sub>L(sat)</sub>	saturated output power	f = 250 MHz				
		V <sub>CC</sub> = 4.5 V	11	11	10	dBm
		V <sub>CC</sub> = 5.0 V	13	12	12	dBm
		V <sub>CC</sub> = 5.5 V	14	13	13	dBm
		f = 950 MHz				
		V <sub>CC</sub> = 4.5 V	11	11	11	dBm
		V <sub>CC</sub> = 5.0 V	12	12	12	dBm
		V <sub>CC</sub> = 5.5 V	14	13	13	dBm
		f = 2150 MHz				
		V <sub>CC</sub> = 4.5 V	10	9	8	dBm
		V <sub>CC</sub> = 5.0 V	11	10	8	dBm
		V <sub>CC</sub> = 5.5 V	12	10	9	dBm

**Table 12. Second-order intermodulation distance over temperature and supply voltages**  
Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit	
			-40	+25	+85		
ΔIM2	second-order intermodulation distance	f <sub>1</sub> = 250 MHz; f <sub>2</sub> = 251 MHz; P <sub>drive</sub> = -38 dBm	V <sub>CC</sub> = 4.5 V	36	39	42	dBc
			V <sub>CC</sub> = 5.0 V	40	42	45	dBc
			V <sub>CC</sub> = 5.5 V	43	45	48	dBc
		f <sub>1</sub> = 950 MHz; f <sub>2</sub> = 951 MHz; P <sub>drive</sub> = -38 dBm	V <sub>CC</sub> = 4.5 V	33	34	36	dBc
			V <sub>CC</sub> = 5.0 V	35	36	37	dBc
			V <sub>CC</sub> = 5.5 V	37	37	37	dBc

**Table 13. Output third-order intercept point over temperature and supply voltages**  
Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit		
			-40	+25	+85			
IP3 <sub>O</sub>	output third-order intercept point	f <sub>1</sub> = 250 MHz; f <sub>2</sub> = 251 MHz; P <sub>drive</sub> = -41 dBm	V <sub>CC</sub> = 4.5 V	21	21	20	dBm	
			V <sub>CC</sub> = 5.0 V	23	23	22	dBm	
			V <sub>CC</sub> = 5.5 V	25	25	24	dBm	
		f <sub>1</sub> = 950 MHz; f <sub>2</sub> = 951 MHz; P <sub>drive</sub> = -41 dBm	V <sub>CC</sub> = 4.5 V	21	21	20	dBm	
			V <sub>CC</sub> = 5.0 V	23	23	22	dBm	
			V <sub>CC</sub> = 5.5 V	25	24	23	dBm	
			f <sub>1</sub> = 2150 MHz; f <sub>2</sub> = 2151 MHz; P <sub>drive</sub> = -41 dBm	V <sub>CC</sub> = 4.5 V	21	19	17	dBm
				V <sub>CC</sub> = 5.0 V	22	19	17	dBm
				V <sub>CC</sub> = 5.5 V	22	20	17	dBm

**Table 14. -3 dB bandwidth over temperature and supply voltages**  
Typical values.

Symbol	Parameter	Conditions	T <sub>amb</sub> (°C)			Unit
			-40	+25	+85	
B <sub>-3dB</sub>	-3 dB bandwidth	V <sub>CC</sub> = 4.5 V	3.15	2.98	2.80	GHz
		V <sub>CC</sub> = 5.0 V	3.14	2.96	2.79	GHz
		V <sub>CC</sub> = 5.5 V	3.12	2.95	2.77	GHz

9. Test information

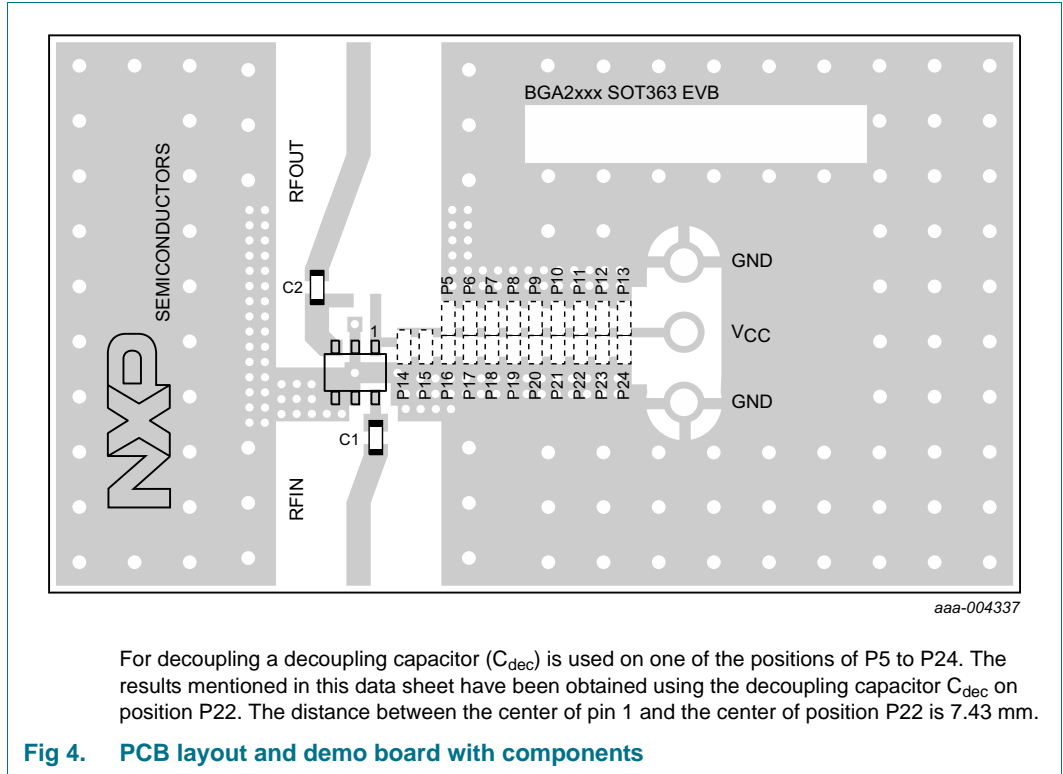


Table 15. List of components used for the typical application

Component	Description	Value	Dimensions	Remarks
C1, C2	multilayer ceramic chip capacitor	470 pF	0603	X7R RF coupling capacitor
P5 to P24 [1]	position for multilayer ceramic chip capacitor $C_{dec}$	470 pF	0603	X7R RF decoupling capacitor
IC1	BGA2869 MMIC		SOT363	

[1] For decoupling a decoupling capacitor ( $C_{dec}$ ) is used on one of the positions of P5 to P24. The results mentioned in this data sheet have been obtained using the decoupling capacitor  $C_{dec}$  on position P22.

10. Package outline

Plastic surface-mounted package; 6 leads

SOT363

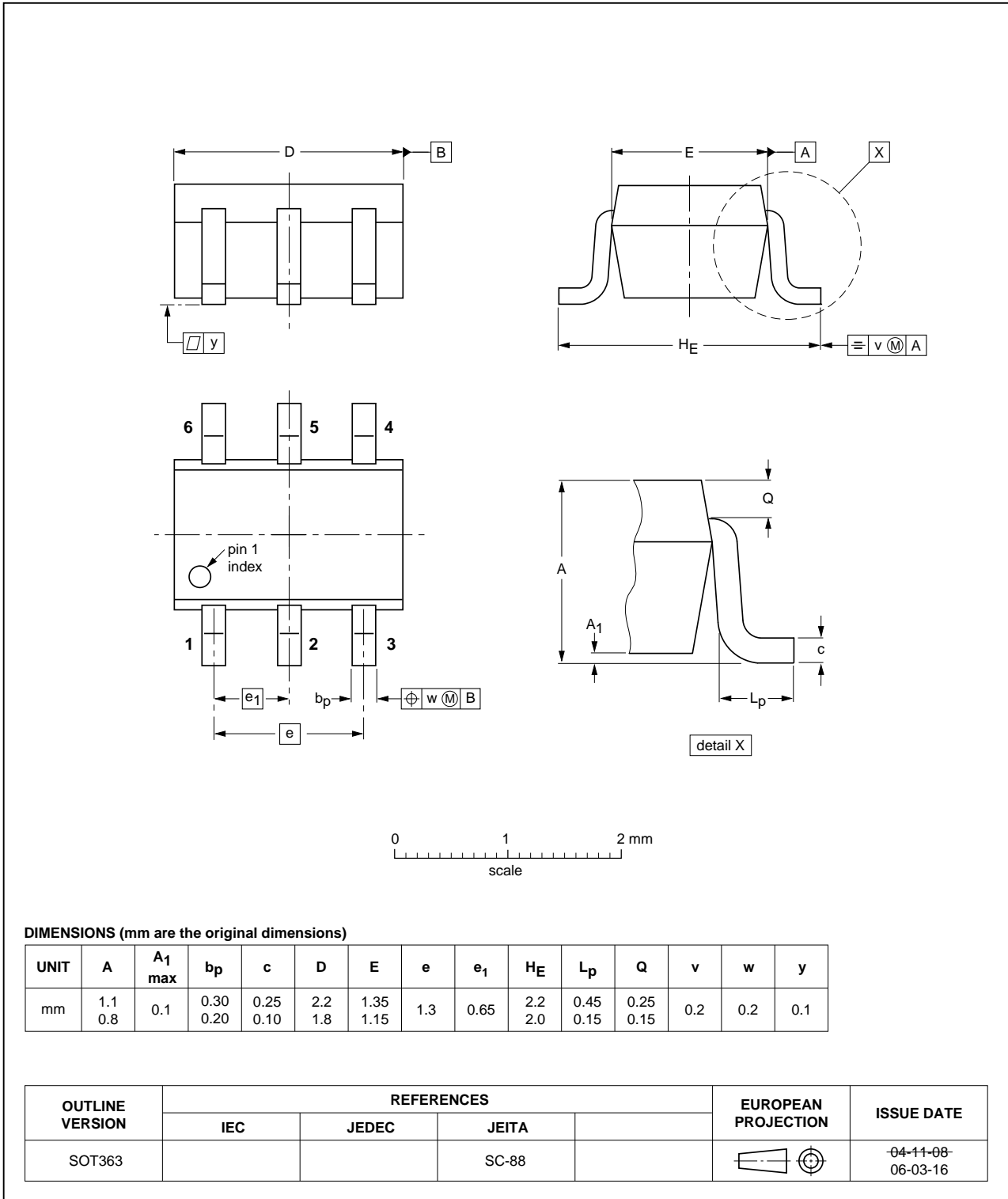


Fig 5. Package outline SOT363

## 11. Abbreviations

Table 16. Abbreviations

Acronym	Description
IF	Intermediate Frequency
LNA	Low-Noise Amplifier
LNB	Low-Noise Block converter
PCB	Printed-Circuit Board
SMD	Surface Mounted Device

## 12. Revision history

Table 17. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGA2869 v.1	20120717	Product data sheet	-	-

## 13. Legal information

### 13.1 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.
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Product [short] data sheet	Production	This document contains the product specification.

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Date of release: 17 July 2012

Document identifier: BGA2869