



# BGS8H2

SiGe:C low-noise amplifier MMIC with bypass switch for LTE

Rev. 4 — 20 August 2018

Product data sheet

## 1 General description

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The BGS8H2 is a Low-Noise Amplifier (LNA) with bypass switch for LTE receiver applications, available in a small plastic 6-pin extremely thin leadless package. The BGS8H2 requires one external matching inductor.

The BGS8H2 delivers system-optimized gain for both primary and diversity applications where sensitivity improvement is required. The high linearity of these low noise devices ensures the required receive sensitivity independent of cellular transmit power level in FDD (Frequency Division Duplex) systems. When receive signal strength is sufficient, the BGS8H2 can be switched off to operate in bypass mode at a 1  $\mu$ A current, to lower power consumption.

The BGS8H2 is optimized for 2300 MHz to 2690 MHz.

## 2 Features and benefits

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- Operating frequency from 2300 MHz to 2690 MHz
- Noise figure = 1.0 dB
- Gain 12.5 dB
- Bypass switch insertion loss of 2.3 dB
- High input 1 dB compression point of -1.5 dBm
- High in band IP<sub>3i</sub> of 4.0 dBm
- Supply voltage 1.5 V to 3.1 V
- Self-shielding package concept
- Integrated supply decoupling capacitor
- Optimized performance at a supply current of 5.8 mA
- Power-down mode current consumption < 1  $\mu$ A
- Integrated temperature stabilized bias for easy design.
- Requires only one input matching inductor
- Input and output DC decoupled
- ESD protection on all pins (HBM > 2 kV)
- Integrated matching for the output
- Available in 6-pins leadless package 1.1 mm x 0.7 mm x 0.37 mm; 0.4 mm pitch: SOT1232
- 180 GHz transit frequency - SiGe:C technology
- Moisture sensitivity level 1



### 3 Applications

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- LNA for LTE reception in smart phones
- Feature phones
- Tablet PCs
- RF front-end modules

## 4 Quick reference data

**Table 1. Quick reference data**

$f = 2350$  MHz,  $V_{CC} = 2.8$  V,  $V_{I(CTRL)} \geq 0.8$  V, and  $T_{amb} = 25$  °C. Input matched to  $50 \Omega$  using a  $2.7$  nH inductor in series. Unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{CC}$	supply voltage	RF input AC coupled	[1]	1.5	-	3.1	V
$I_{CC}$	supply current	in gain mode		3.8	5.8	7.8	mA
		in bypass mode; $V_{I(CTRL)} < 0.3$ V		-	-	1	$\mu$ A
$G_p$	power gain	in gain mode; $f = 2350$ MHz	[2][3]	10.5	12.5	14.5	dB
		in bypass mode; $f = 2350$ MHz	[2][3]	-3.8	-2.3	-0.8	dB
NF	noise figure	in gain mode; $f = 2350$ MHz	[2][3][4]	-	1.0	1.5	dB
$P_{I(1dB)}$	input power at 1 dB gain compression	in gain mode; $f = 2350$ MHz	[2][3]	-5.5	-1.5	-	dBm
$IP3_i$	input third-order intercept point	in gain mode; $f = 2350$ MHz	[2][3]	-1.0	+4.0	-	dBm

[1] Stressed with pulses of 1 s in duration.  $V_{CC}$  connected to a power supply of 2.8 V with 500 mA current limit.

[2] E-UTRA operating band 40 (2300 MHz to 2400 MHz).

[3] Guaranteed by device design; not tested in production.

[4] PCB losses are subtracted.

## 5 Ordering information

**Table 2. Ordering information**

Type number	Package		
	Name	Description	Version
BGS8H2	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1.1 x 0.7 x 0.37 mm	SOT1232
OM17007	EVB	BGS8H2 evaluation board	-

## 6 Marking

**Table 3. Marking code**

Type number	Marking code
BGS8H2	P

## 7 Block diagram

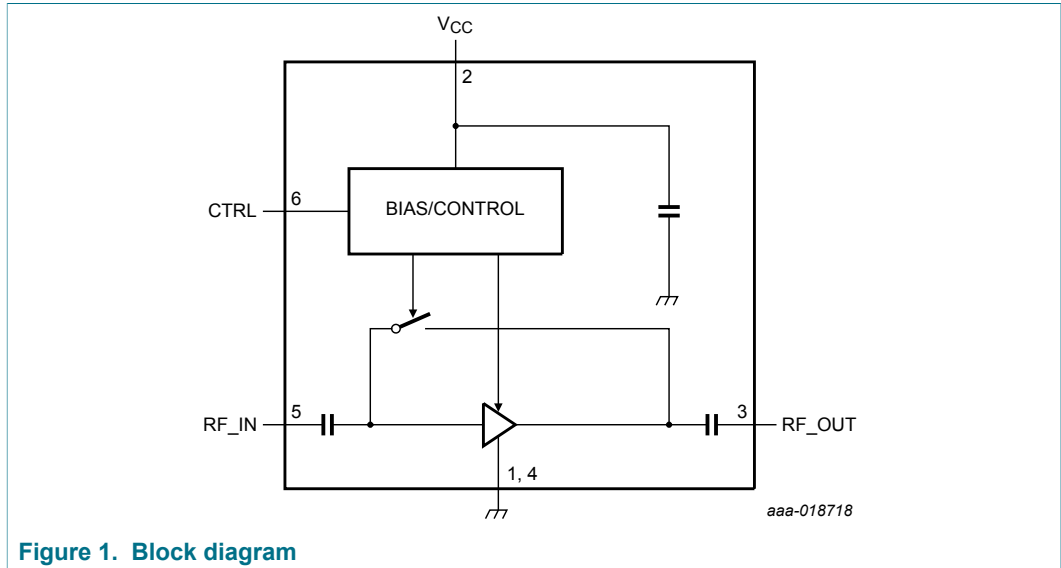


Figure 1. Block diagram

## 8 Pinning information

### 8.1 Pinning

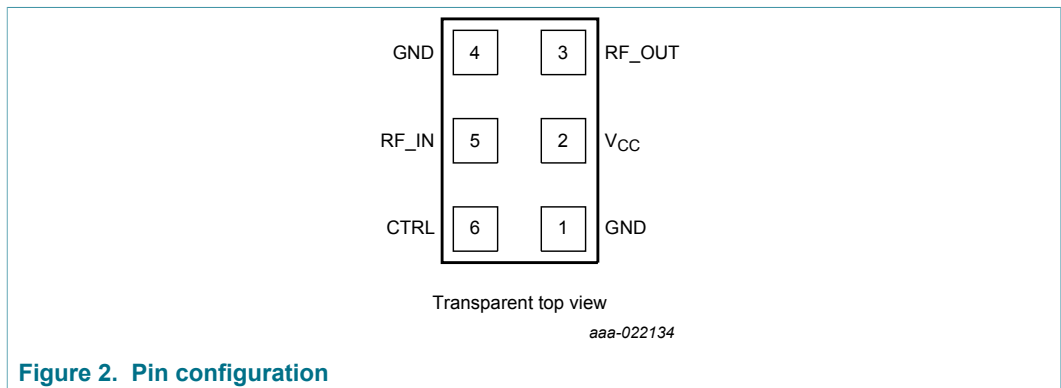


Figure 2. Pin configuration

### 8.2 Pin description

Table 4. Pinning

Symbol	Pin	Description
GND	1	ground
V <sub>CC</sub>	2	supply voltage
RF_OUT	3	RF out
GND_RF	4	ground RF
RF_IN	5	RF in
CTRL	6	gain control, switch between gain and bypass mode

## 9 Limiting values

**Table 5. Limiting values**

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

See legal section: "disclaimers" paragraph "Limiting values".

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>CC</sub>	supply voltage	RF input AC coupled	[1]	-0.5	+5.0	V
V <sub>I(CTRL)</sub>	input voltage on pin CTRL	V <sub>I(CTRL)</sub> < V <sub>CC</sub> + 0.6 V	[1][2]	-0.5	+5.0	V
V <sub>I(RF_IN)</sub>	input voltage on pin RF_IN	DC; V <sub>I(RF_IN)</sub> < V <sub>CC</sub> + 0.6 V	[1][2]	-0.5	+5.0	V
V <sub>I(RF_OUT)</sub>	input voltage on pin RF_OUT	DC; V <sub>I(RF_OUT)</sub> < V <sub>CC</sub> + 0.6 V	[1][2][3]	-0.5	+5.0	V
P <sub>i</sub>	input power		[1]	-	26	dBm
P <sub>tot</sub>	total power dissipation	T <sub>sp</sub> ≤ 130 °C		-	55	mW
T <sub>stg</sub>	storage temperature			-65	+150	°C
T <sub>j</sub>	junction temperature			-	150	°C
V <sub>ESD</sub>	electrostatic discharge voltage	Human Body Model (HBM) according to ANSI/ESDA/JEDEC standard JS-001		-	±2	kV
		Charged Device Model (CDM) according to JEDEC standard JESD22-C101C		-	±1	kV

[1] Stressed with pulses of 1 s in duration. V<sub>CC</sub> connected to a power supply of 2.8 V with 500 mA current limit.

[2] Warning: Due to internal ESD diode protection, to avoid excess current, the applied DC voltage must not exceed V<sub>CC</sub> + 0.6 V or 5.0 V.

[3] The RF input and RF output are AC coupled through internal DC blocking capacitors.

## 10 Recommended operating conditions

**Table 6. Operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage	[1]	1.5	-	3.1	V
T <sub>amb</sub>	ambient temperature		-40	+25	+85	°C
V <sub>I(CTRL)</sub>	input voltage on pin CTRL	OFF state	-	-	0.3	V
		ON state	0.8	-	V <sub>CC</sub>	V

[1] Stressed with pulses of 1 s in duration. V<sub>CC</sub> connected to a power supply with 500 mA current limit.

## 11 Thermal characteristics

**Table 7. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
R <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		225	K/W

## 12 Characteristics

**Table 8. Characteristics at  $V_{CC} = 1.8\text{ V}$**

2300 MHz  $\leq f \leq$  2690 MHz,  $V_{CC} = 1.8\text{ V}$ ,  $V_{I(CTRL)} \geq 0.8\text{ V}$  and  $T_{amb} = 25\text{ }^\circ\text{C}$ . Input matched to 50  $\Omega$  using a 2.7 nH inductor in series. Unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$\Delta\phi$	phase variation	between gain mode and bypass mode					
		f = 2350 MHz	[1]	-8	-	+8	deg
		f = 2655 MHz		-	-	-	deg
<b>Gain mode</b>							
$I_{CC}$	supply current		3.6	5.6	7.6	mA	
$G_p$	power gain	f = 2350 MHz	[1] [2]	10.0	12.0	14.0	dB
		f = 2500 MHz		9.3	11.3	13.3	dB
		f = 2655 MHz	[1] [3]	8.5	10.5	12.5	dB
$RL_{in}$	input return loss	f = 2350 MHz	[2]	-	7.5	-	dB
		f = 2655 MHz	[3]	-	8.0	-	dB
$RL_{out}$	output return loss	f = 2350 MHz	[2]	-	9.0	-	dB
		f = 2655 MHz	[3]	-	7.0	-	dB
ISL	isolation	f = 2350 MHz	[2]	-	22.0	-	dB
		f = 2655 MHz	[3]	-	22.0	-	dB
NF	noise figure	f = 2350 MHz	[1] [2] [4]	-	1.05	1.5	dB
		f = 2655 MHz	[1] [3] [4]	-	1.15	1.6	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 2350 MHz	[1] [2]	-9.5	-5.5	-	dBm
		f = 2655 MHz	[1] [2]	-8.5	-4.5	-	dBm
IP3 <sub>i</sub>	input third-order intercept point	f = 2350 MHz	[1] [2]	-2	+3.0	-	dBm
		f = 2655 MHz	[1] [3]	-2	+3.0	-	dBm
K	Rollett stability factor		1	-	-	-	
$t_{on}$	turn-on time	time from $V_{I(CTRL)}$ ON, to 90 % of the gain		-	-	1.7	$\mu\text{s}$
$t_{off}$	turn-off time	time from $V_{I(CTRL)}$ OFF, to 10 % of the gain		-	-	0.6	$\mu\text{s}$
<b>Bypass mode</b>							
$I_{CC}$	supply current	$V_{I(CTRL)} < 0.3\text{ V}$		-	-	1	$\mu\text{A}$
$G_p$	power gain	f = 2350 MHz	[1] [2]	-3.9	-2.4	-0.9	dB
		f = 2500 MHz	[1]	-4.5	-2.6	-1.1	dB
		f = 2655 MHz	[1] [2]	-4.2	-2.7	-1.2	dB
$RL_{in}$	input return loss	f = 2350 MHz	[2]	-	12.0	-	dB
		f = 2655 MHz	[3]	-	11.0	-	dB
$RL_{out}$	output return loss	f = 2350 MHz	[2]	-	11.0	-	dB
		f = 2655 MHz	[3]	-	11.0	-	dB

- [1] Guaranteed by device design; not tested in production.
- [2] E-UTRA operating band 40 (2300 MHz to 2400 MHz).
- [3] E-UTRA operating band 7 (2620 MHz to 2690 MHz).
- [4] PCB losses are subtracted.

**Table 9. Characteristics at  $V_{CC} = 2.8\text{ V}$**

2300 MHz  $\leq f \leq$  2690 MHz,  $V_{CC} = 2.8\text{ V}$ ,  $V_{I(CTRL)} \geq 0.8\text{ V}$  and  $T_{amb} = 25\text{ }^\circ\text{C}$ . Input matched to 50  $\Omega$  using a 2.7 nH inductor in series. Unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$\Delta\phi$	phase variation	between gain mode and bypass mode					
		f = 2350 MHz	[1]	-8	-	+8	deg
		f = 2655 MHz		-	-	-	deg
<b>Gain mode</b>							
$I_{CC}$	supply current		3.8	5.8	7.8	mA	
$G_p$	power gain	f = 2350 MHz	[1][2]	10.5	12.5	14.5	dB
		f = 2500 MHz		9.9	11.9	13.9	dB
		f = 2655 MHz	[1][3]	9.2	11.2	13.2	dB
$RL_{in}$	input return loss	f = 2350 MHz	[2]	-	8.0	-	dB
		f = 2655 MHz	[3]	-	8.5	-	dB
$RL_{out}$	output return loss	f = 2350 MHz	[2]	-	10.0	-	dB
		f = 2655 MHz	[3]	-	7.0	-	dB
ISL	isolation	f = 2350 MHz	[2]	-	23.0	-	dB
		f = 2655 MHz	[3]	-	23.0	-	dB
NF	noise figure	f = 2350 MHz	[1][2][4]	-	1.00	1.5	dB
		f = 2655 MHz	[1][3][4]	-	1.10	1.6	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f = 2350 MHz	[1][2]	-5.5	-1.5	-	dBm
		f = 2655 MHz	[1][3]	-4.0	0.0	-	dBm
IP3 <sub>i</sub>	input third-order intercept point	f = 2350 MHz	[1][2]	-1.0	+4.0	-	dBm
		f = 2655 MHz	[1][3]	-1.0	+4.0	-	dBm
K	Rollett stability factor		1	-	-		
$t_{on}$	turn-on time	time from $V_{I(CTRL)}$ ON, to 90 % of the gain	-	-	1.3	$\mu\text{s}$	
$t_{off}$	turn-off time	time from $V_{I(CTRL)}$ OFF, to 10 % of the gain	-	-	0.3	$\mu\text{s}$	

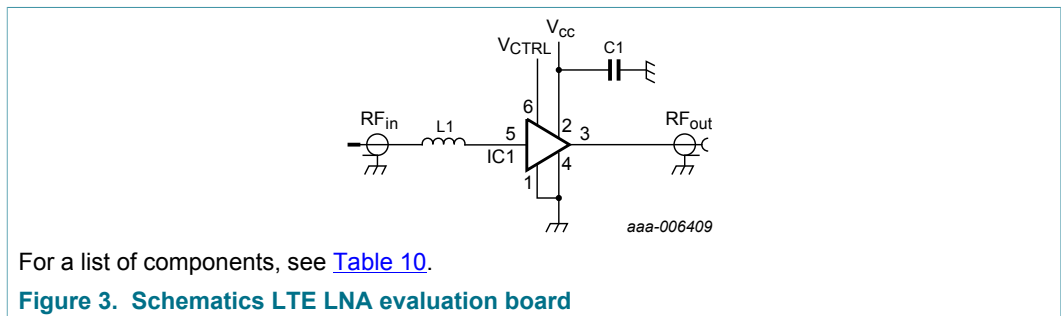


Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Bypass mode</b>							
$I_{CC}$	supply current	$V_{I(CTRL)} < 0.3 \text{ V}$		-	-	1	$\mu\text{A}$
$G_p$	power gain	$f = 2350 \text{ MHz}$	[1][2]	-3.8	-2.3	-0.8	dB
		$f = 2500 \text{ MHz}$	[1]	-4.5	-2.4	-0.9	dB
		$f = 2655 \text{ MHz}$	[1][3]	-4.0	-2.5	-1.0	dB
$RL_{in}$	input return loss	$f = 2350 \text{ MHz}$	[2]	-	12.0	-	dB
		$f = 2655 \text{ MHz}$	[3]	-	12.0	-	dB
$RL_{out}$	output return loss	$f = 2350 \text{ MHz}$	[2]	-	12.0	-	dB
		$f = 2655 \text{ MHz}$	[3]	-	12.0	-	dB

- [1] Guaranteed by device design; not tested in production.
- [2] E-UTRA operating band 40 (2300 MHz to 2400 MHz).
- [3] E-UTRA operating band 7 (2620 MHz to 2690 MHz).
- [4] PCB losses are subtracted.

## 13 Application information

### 13.1 LTE LNA



**Table 10. List of components**

For schematics, see [Figure 3](#).

Component	Description	Value	Remarks
C1	decoupling capacitor	1 $\mu$ F	to suppress power supply noise
IC1	BGS8H2	-	NXP Semiconductors
L1	high-quality matching inductor	2.7 nH	Murata LQW15A

14 Package outline

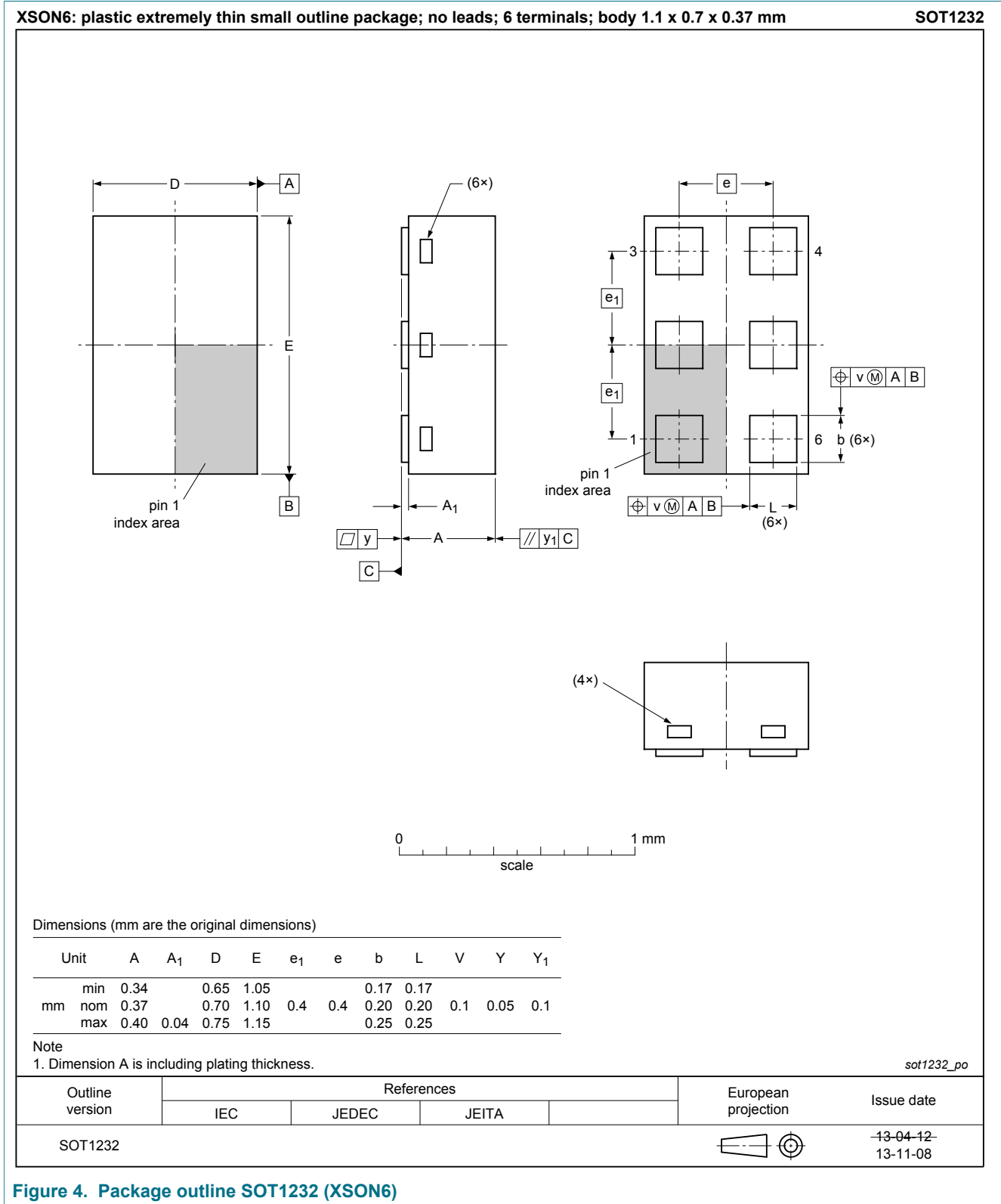



Figure 4. Package outline SOT1232 (XSON6)

## 15 Handling information

CAUTION	
	<p>This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices. Such precautions are described in the <i>ANSI/ESD S20.20</i>, <i>IEC/ST 61340-5</i>, <i>JESD625-A</i>, or equivalent standards.</p>

## 16 Abbreviations

Table 11. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
HBM	Human Body Model
LTE	Long-Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
PCB	Printed-Circuit Board
SiGe:C	Silicon Germanium Carbon

## 17 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGS8H2 v.4	20180820	Product data sheet	-	BGS8H2 v.3
Modifications:	changed status from company confidential to public			
BGS8H2 v.3	20180629	Product data sheet	-	BGS8H2 v.2
Modifications:	changed $V_{I(CTRL)}$ Max ON state value to $V_{CC}$ at recommended operating conditions			
BGS8H2 v.2	20160404	Product data sheet	-	BGS8H2 v.1
Modifications:	<ul style="list-style-type: none"> <li>added phase variation <a href="#">Table 8 on page 5</a> and <a href="#">Table 9 on page 6</a></li> </ul>			
BGS8H2 v.1	20151222	Product data sheet	-	-

## 18 Legal information

### 18.1 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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