



BGS8H2

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

Rev. 4 — 20 August 2018

Product data sheet

1 General description

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 μ A current, to lower power consumption.

The BGS8H2 is optimized for 2300 MHz to 2690 MHz.

2 Features and benefits

- 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_{3i} 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 μ 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

- 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 50Ω 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	μ 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

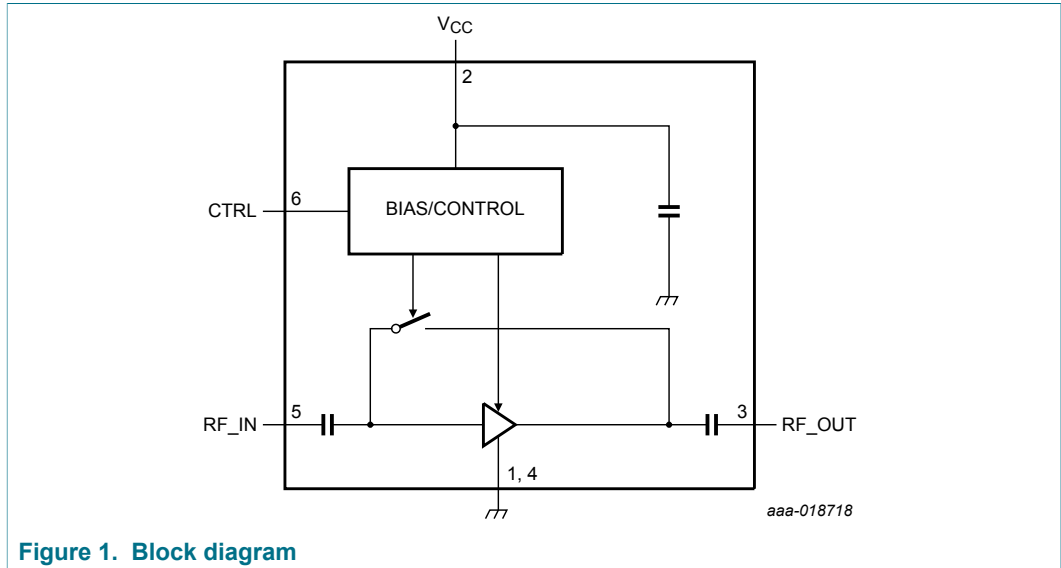


Figure 1. Block diagram

8 Pinning information

8.1 Pinning

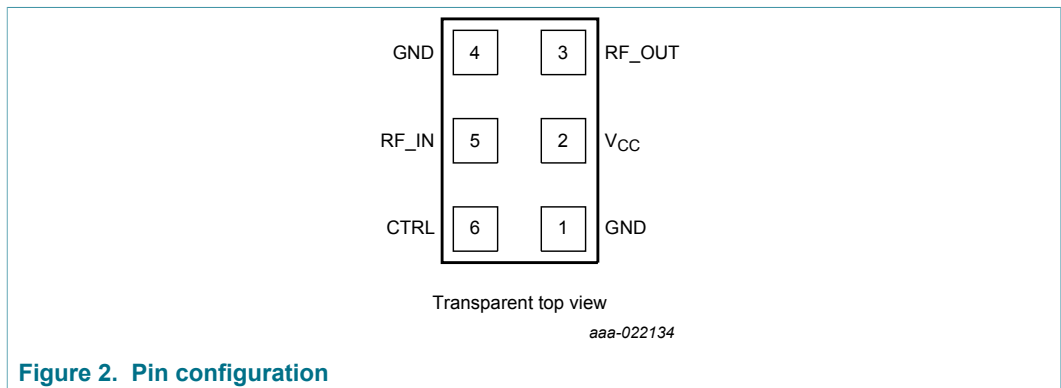


Figure 2. Pin configuration

8.2 Pin description

Table 4. Pinning

Symbol	Pin	Description
GND	1	ground
V _{CC}	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_{CC}	supply voltage	RF input AC coupled	[1]	-0.5	+5.0	V
$V_{I(CTRL)}$	input voltage on pin CTRL	$V_{I(CTRL)} < V_{CC} + 0.6 \text{ V}$	[1][2]	-0.5	+5.0	V
$V_{I(RF_IN)}$	input voltage on pin RF_IN	DC; $V_{I(RF_IN)} < V_{CC} + 0.6 \text{ V}$	[1][2]	-0.5	+5.0	V
$V_{I(RF_OUT)}$	input voltage on pin RF_OUT	DC; $V_{I(RF_OUT)} < V_{CC} + 0.6 \text{ V}$	[1][2][3]	-0.5	+5.0	V
P_i	input power		[1]	-	26	dBm
P_{tot}	total power dissipation	$T_{sp} \leq 130 \text{ }^\circ\text{C}$		-	55	mW
T_{stg}	storage temperature			-65	+150	$^\circ\text{C}$
T_j	junction temperature			-	150	$^\circ\text{C}$
V_{ESD}	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_{CC} 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 $V_{CC} + 0.6 \text{ V}$ 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_{CC}	supply voltage	[1]	1.5	-	3.1	V
T_{amb}	ambient temperature		-40	+25	+85	$^\circ\text{C}$
$V_{I(CTRL)}$	input voltage on pin CTRL	OFF state	-	-	0.3	V
		ON state	0.8	-	V_{CC}	V

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

11 Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	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 Ω 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
Gain mode							
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 _i	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	μs
t_{off}	turn-off time	time from $V_{I(CTRL)}$ OFF, to 10 % of the gain		-	-	0.6	μs
Bypass mode							
I_{CC}	supply current	$V_{I(CTRL)} < 0.3\text{ V}$		-	-	1	μA
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 Ω 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
Gain mode							
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 _i	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	μs	
t_{off}	turn-off time	time from $V_{I(CTRL)}$ OFF, to 10 % of the gain	-	-	0.3	μs	

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Bypass mode							
I_{CC}	supply current	$V_{I(CTRL)} < 0.3 \text{ V}$		-	-	1	μA
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

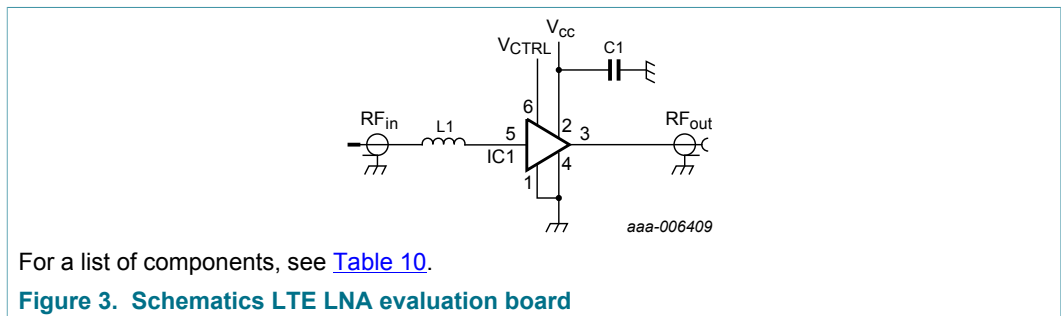


Table 10. List of components

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

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

14 Package outline

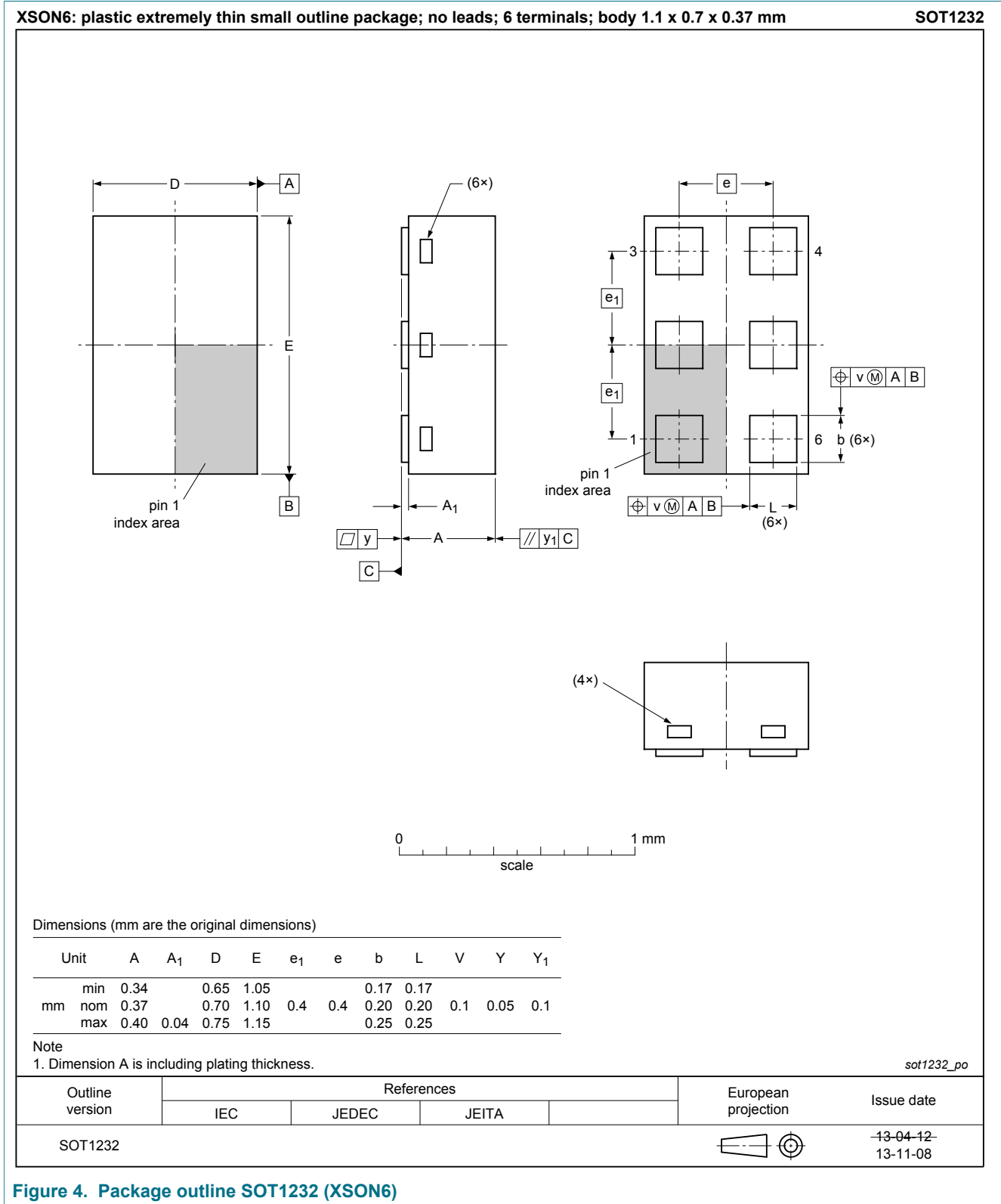



Figure 4. Package outline SOT1232 (XSON6)

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"> added phase variation Table 8 on page 5 and Table 9 on page 6 			
BGS8H2 v.1	20151222	Product data sheet	-	-

18 Legal information

18.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	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>.

18.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

18.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors. In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications. In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for

such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

18.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

1	General description	1
2	Features and benefits	1
3	Applications	2
4	Quick reference data	3
5	Ordering information	3
6	Marking	3
7	Block diagram	4
8	Pinning information	5
8.1	Pinning	5
8.2	Pin description	5
9	Limiting values	6
10	Recommended operating conditions	6
11	Thermal characteristics	6
12	Characteristics	7
13	Application information	10
13.1	LTE LNA	10
14	Package outline	11
15	Handling information	12
16	Abbreviations	12
17	Revision history	12
18	Legal information	13

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2018.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 20 August 2018

Document identifier: BGS8H2