



BGS8324

WLAN LNA + Switch

Rev. 4 — 18 January 2017

Product data sheet

1. General description

The BGS8324 is, also known as the WLAN3001H, a fully integrated Low-Noise Amplifier (LNA) and SP3T switch for Bluetooth path and transmit path. For WLAN applications in the 2.4 GHz to 2.5 GHz ISM band. The BGS8324 is manufactured using NXP's high performance QUBiC eighth generation SiGe:C technology. The BGS8324 couples best-in-class noise figure, linearity and low insertion loss CMOS switches with the process stability and ruggedness that are the hallmarks of SiGe technology. The BGS8324 has a 2.0 mm × 2.0 mm footprint HX2QFN12 package and a thickness of 300 μm.

2. Features and benefits

- Intended for IEEE 802.11b/g/n WLAN application
- Covers full ISM low band 2400 MHz to 2500 MHz
- Noise figure = 2 dB
- Gain 16 dB
- High input 1 dB compression point $P_{i(1dB)}$ of -6 dBm
- High in band IP_{3i} of 7 dBm
- Supply voltage 2.7 V to 5.25 V
- Stand-by mode current consumption at 8 μA for 3.3 V supply voltage
- Optimized performance at a low supply current of 8.3 mA
- Integrated concurrent 5 GHz notch filter
- 5 modes of operation (standby, high gain receive, bypass receive, transmit and Bluetooth modes)
- Integrated matching for input and output
- Requires only one supply decoupling capacitor
- ElectroStatic Discharge (ESD) protection on all pins (HBM > 2 kV)
- Small 12-pin leadless package 2 mm × 2 mm × 0.3 mm; 0.5 mm pitch

3. Applications

- IEEE 802.11b/g/n WiFi, WLAN
- Smartphones, tablets, netbooks and other portable computing devices
- Access points, routers, gateways
- Wireless video
- General-purpose Industrial, Scientific and Medical (ISM) applications



4. Quick reference data

Table 1. Quick reference data

$V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ °C}$; $50\ \Omega$ load, unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|--------------------------------------|----------------------------|------|------|------|---------|
| RF performance at ANT-RX path in high-gain receive mode [1] | | | | | | |
| I_{CC} | supply current | high-gain receive mode [1] | - | 8.3 | 12.0 | mA |
| G_{tr} | transducer power gain | | 13.7 | 16 | 18 | dB |
| NF | noise figure | | - | 2 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | in-band | - | -6 | - | dBm |
| RL_{in} | input return loss | | - | 12 | - | dB |
| RL_{out} | output return loss | | - | 12 | - | dB |
| RF performance at ANT-RX path in bypass receive mode [1] | | | | | | |
| I_{CC} | supply current | bypass receive mode [1] | - | 8 | 15 | μ A |
| G_{tr} | transducer power gain | | -9 | -6 | -4 | dB |
| RF performance at ANT-TX path in transmit mode [1] | | | | | | |
| α_{ins} | insertion loss | | - | 0.8 | - | dB |
| RF performance at ANT-BT path in Bluetooth mode [1] | | | | | | |
| α_{ins} | insertion loss | | - | 0.95 | - | dB |

[1] See [Table 9](#) for the appropriate control signal settings.

5. Ordering information

Table 2. Ordering information

| Type number | Package | | Version |
|-------------|----------|---|-----------|
| | Name | Description | |
| BGS8324 | HX2QFN12 | plastic, thermal enhanced super thin quad flat package; no leads; 12 terminals; body 2.0 x 2.0 x 0.3 mm | SOT1261-1 |

6. Marking

| Type number | Marking code |
|-------------|-----------------------|
| BGS8324 | 24 |
| | YWW: Year & Week code |

7. Functional diagram

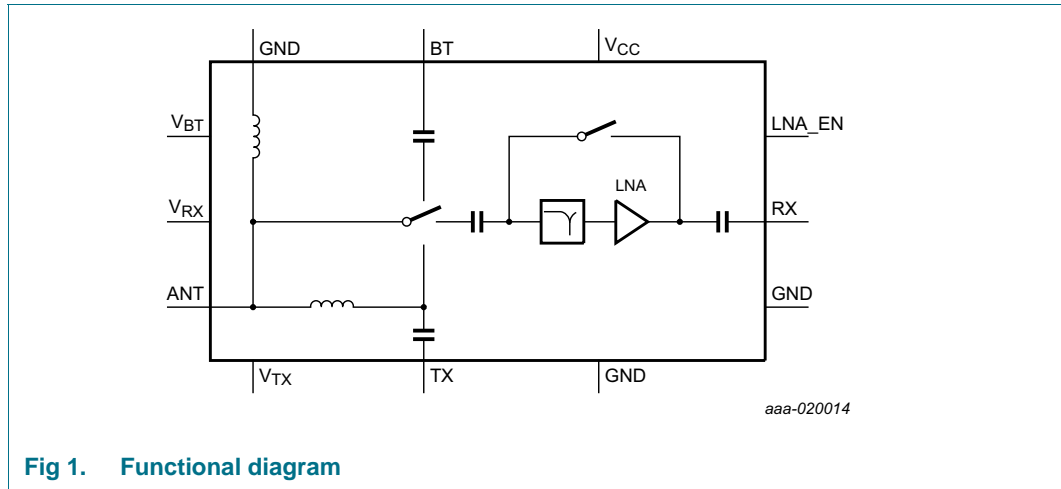


Fig 1. Functional diagram

8. Pinning information

8.1 Pinning

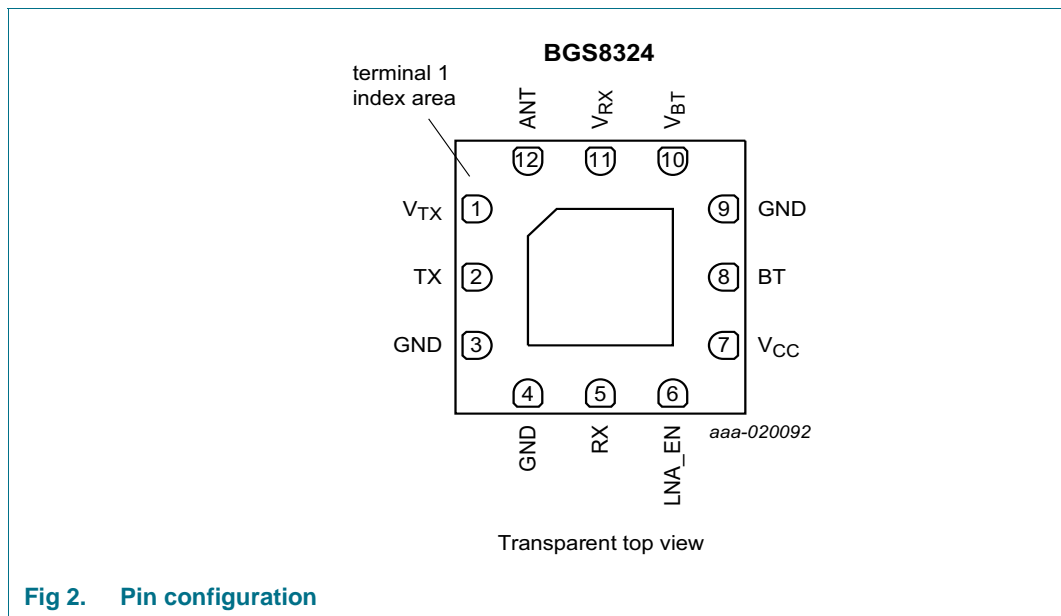


Fig 2. Pin configuration

8.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|-----------------|--------------------------|-----------------------|
| V _{TX} | 1 | transmit mode control |
| TX | 2 | transmit input |
| GND | 3, 4, 9, exposed die pad | ground |
| RX | 5 | receive output |

Table 3. Pin description ...continued

| Symbol | Pin | Description |
|-----------------|-----|--------------------------|
| LNA_EN | 6 | LNA enable |
| V _{CC} | 7 | supply voltage |
| BT | 8 | Bluetooth input / output |
| V _{BT} | 10 | Bluetooth mode control |
| V _{RX} | 11 | receive mode control |
| ANT | 12 | antenna input / output |

9. 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 | | -0.3 | 6 | V |
| I _{CC} | supply current | worst case up to P1dB | - | 16 | mA |
| V _{I(VBT)} | input voltage on pin VBT | see Figure 1 | -0.3 | +4 | V |
| V _{I(VRX)} | input voltage on pin VRX | see Figure 1 | -0.3 | +4 | V |
| V _{I(VTX)} | input voltage on pin VTX | see Figure 1 | -0.3 | +4 | V |
| V _{I(LNA_EN)} | input voltage on pin LNA_EN | | -0.3 | +4 | V |
| P _{i(ANT)} | input power-on pin ANT | high-gain receive mode | - | 7 | dBm |
| | | bypass receive mode | - | 19 | dBm |
| P _{i(TX)} | input power-on pin TX | CW; transmit mode | - | 33 | dBm |
| P _{i(BT)} | input power-on pin BT | CW; Bluetooth mode | - | 22 | dBm |
| T _{amb} | ambient temperature | | -40 | +85 | °C |
| T _j | junction temperature | | -40 | +150 | °C |
| T _{stg} | storage temperature | | -40 | +140 | °C |
| V _{ESD} | electrostatic discharge voltage | human body model [1] | - | ±2000 | V |
| | | charged device model [2] | - | ±500 | V |

[1] According to ANSI/ESDA/JEDEC standard JS-001.

[2] According to JEDEC standard JESD22-C101.

10. Recommended operating conditions

Table 5. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|--------------------------|---------------------|------|-----|------|------|
| f | frequency | | 2400 | - | 2500 | MHz |
| V _{CC} | supply voltage | | 2.7 | 3.3 | 5.25 | V |
| V _{IH} | HIGH-level input voltage | [1] | 1.8 | - | 3.6 | V |
| V _{IL} | LOW-level input voltage | | 0 | - | +0.4 | V |

[1] V_{IH} is the result of an input voltage on that specific pin between 1.8 V and V_{CC} - 0.2 V and 3.6 V maximum.

11. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Unit |
|---------------|---|------------|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | | 250 | K/W |

12. Characteristics

Table 7. DC Characteristics

$V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ °C}$; $50\ \Omega$ load, unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-------------------------------|--|-----|-----|-----|---------------|
| I_{CC} | supply current | high-gain receive mode [1] | - | 8.3 | 12 | mA |
| | | bypass receive mode [1] | - | 8 | 15 | μA |
| | | transmit mode [1] | - | 200 | 300 | μA |
| | | Bluetooth mode [1] | - | 8 | 15 | μA |
| | | standby mode [1] | - | 8 | 15 | μA |
| $I_{ctrl(LNA_EN)}$ | control current on pin LNA_EN | | - | 20 | 30 | μA |
| t_{on} | turn-on time | [2] | - | - | 500 | ns |
| t_{off} | turn-off time | [2] | - | - | 500 | ns |

[1] See [Table 9](#) for the appropriate control signal settings.

[2] From any of three operating modes to another and from 10 % or 90 % of control signal edge to 90 % output level.

Table 8. RF Characteristics

$V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ °C}$; $50\ \Omega$ load, unless otherwise specified. All measurements done on application board (decoupling capacitor 100 nF placed near to V_{CC} pin 7) with SMA connectors as reference plane.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|--------------------------------------|---|------|------|-----|------|
| RF performance at ANT-RX path in high-gain receive mode [1] | | | | | | |
| G_{tr} | transducer power gain | | 13.7 | 16 | 18 | dB |
| $G_{p(flat)}$ | power gain flatness | peak-to-peak over any 40 MHz band | - | - | 0.5 | dB |
| NF | noise figure | | - | 2.0 | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | in-band | - | -6 | - | dBm |
| $IP3_i$ | input third-order intercept point | 20 MHz tone spacing; $P_i = -20\text{ dBm}$ | - | 7 | - | dBm |
| RL_{in} | input return loss | | - | 12 | - | dB |
| RL_{out} | output return loss | | - | 12 | - | dB |
| RF performance at ANT-RX path in bypass receive mode [1] | | | | | | |
| G_{tr} | transducer power gain | | -9 | -6 | -4 | dB |
| $G_{p(flat)}$ | power gain flatness | peak-to-peak over any 40 MHz band | - | - | 0.5 | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | in-band | - | 11.5 | - | dBm |
| $IP3_i$ | input third-order intercept point | 20 MHz tone spacing; $P_i = -3\text{ dBm}$ | - | 22.5 | - | dBm |
| RL_{in} | input return loss | | | 9 | | dB |
| RL_{out} | output return loss | | | 14 | | dB |

Table 8. RF Characteristics ...continued

$V_{CC} = 3.3\text{ V}$; $T_{amb} = 25\text{ °C}$; $50\ \Omega$ load, unless otherwise specified. All measurements done on application board (decoupling capacitor 100 nF placed near to V_{CC} pin 7) with SMA connectors as reference plane.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|--------------------------------------|------------------------------------|-----|------|-----|------|
| RF performance at ANT-TX path in transmit mode [1] | | | | | | |
| α_{ins} | insertion loss | | - | 0.8 | - | dB |
| $G_{p(flat)}$ | power gain flatness | peak-to-peak over any 40 MHz band | - | - | 0.2 | dB |
| ISL | isolation | measured between pin RX and pin TX | 30 | - | - | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | in-band | - | 32 | - | dBm |
| RL_{in} | input return loss | | | 15 | | dB |
| RL_{out} | output return loss | | | 15 | | dB |
| RF performance at ANT-BT path in Bluetooth mode [1] | | | | | | |
| α_{ins} | insertion loss | | - | 0.95 | - | dB |
| $G_{p(flat)}$ | power gain flatness | peak-to-peak over any 40 MHz band | - | - | 0.2 | dB |
| $P_{i(1dB)}$ | input power at 1 dB gain compression | in-band | - | 20 | - | dBm |
| RL_{in} | input return loss | | | 16 | | dB |
| RL_{out} | output return loss | | | 15 | | dB |
| RF performance at ANT-BT path + ANT-RX path in concurrent mode [1] | | | | | | |
| α_{ins} | insertion loss | ANT-BT path | - | 5 | - | dB |
| G_{tr} | transducer power gain | ANT-RX path | - | 12.5 | - | dB |

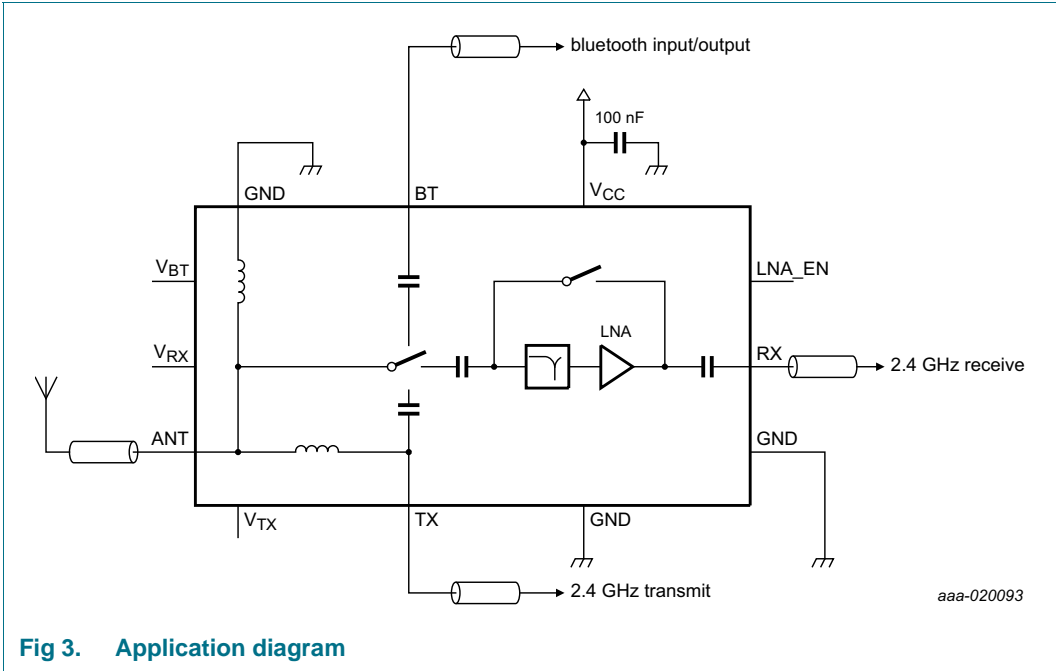
[1] See [Table 9](#) for the appropriate control signal settings.

Table 9. Control signal truth table

Other modes than the ones given in this table are not allowed.

| Control signal setting | | | | Mode of operation | | | | Mode name |
|------------------------|----------|----------|--------|-------------------|--------|--------|-----|------------------------|
| V_{BT} | V_{RX} | V_{TX} | LNA_EN | SP3T switch | | | LNA | |
| pin 10 | pin 11 | pin 1 | pin 6 | ANT-RX | ANT-TX | ANT-BT | | |
| HIGH | HIGH | LOW | HIGH | ON | OFF | ON | ON | concurrent mode |
| LOW | HIGH | LOW | HIGH | ON | OFF | OFF | ON | high-gain receive mode |
| LOW | HIGH | LOW | LOW | ON | OFF | OFF | OFF | bypass receive mode |
| LOW | LOW | HIGH | LOW | OFF | ON | OFF | OFF | transmit mode |
| HIGH | LOW | LOW | LOW | OFF | OFF | ON | OFF | Bluetooth mode |
| LOW | LOW | LOW | LOW | OFF | OFF | OFF | OFF | standby mode |

13. Application information



14. Package outline

HX2QFN12: plastic, thermal enhanced super thin quad flat package; no leads; 12 terminals; body 2.0 x 2.0 x 0.3 mm

SOT1261-1

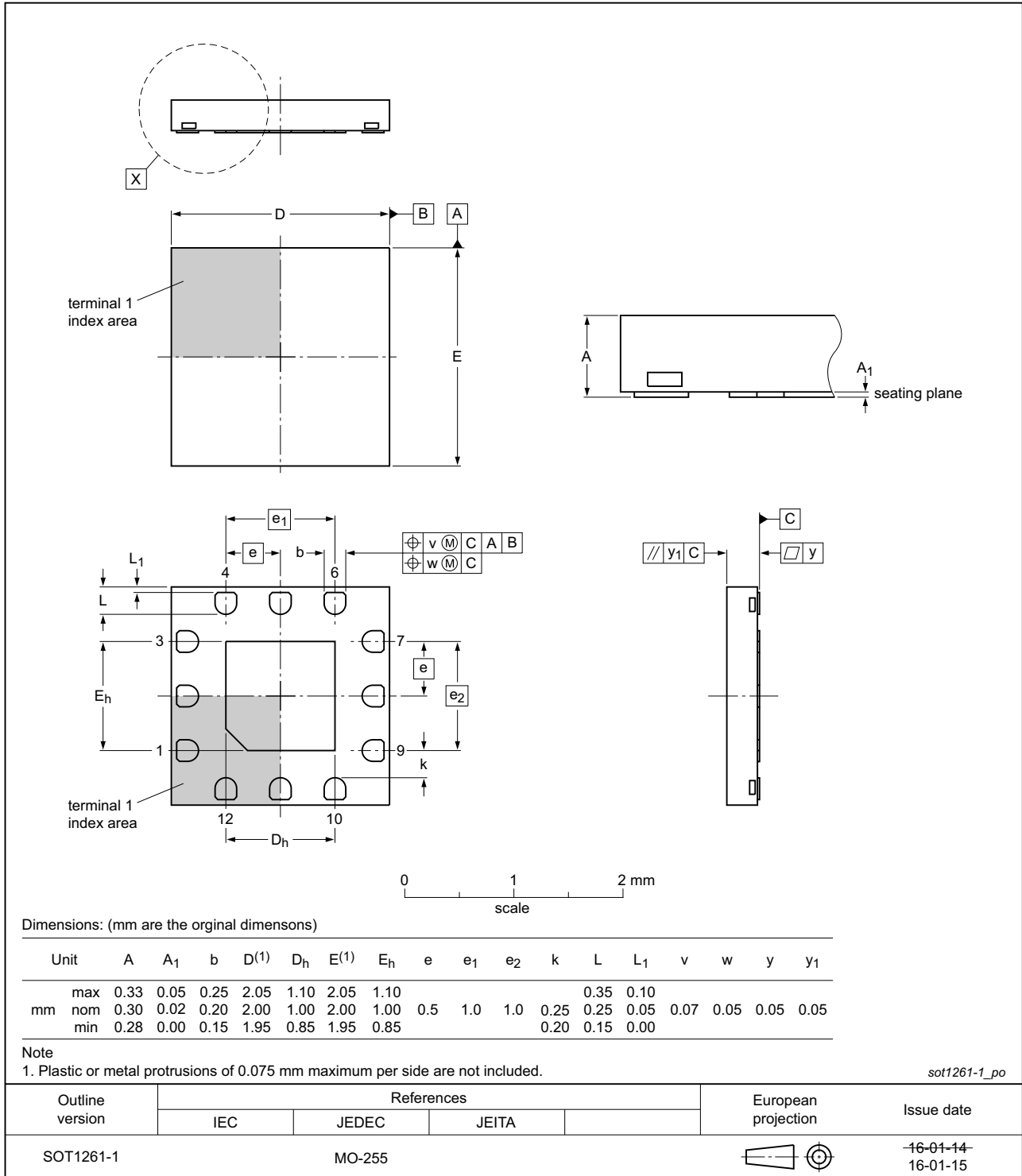


Fig 4. Package outline SOT1261-1 (HX2QFN12)

15. Handling information

15.1 Moisture sensitivity

Table 10. Moisture sensitivity level

| Test methodology | Class |
|------------------|-------|
| JESD-22-A113 | 1 |

15.2 ElectroStatic Discharge (ESD)

CAUTION



This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

16. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal–Oxide Semiconductor |
| CW | Continuous Wave |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| ISM | Industrial, Scientific and Medical |
| LAN | Local Area Network |
| LNA | Low-Noise Amplifier |
| MMIC | Monolithic Microwave Integrated Circuit |
| SiGe:C | Silicon Germanium Carbon |
| SMA | SubMiniature version A |
| SP3T | Single Pole 3 Throw |
| WLAN | Wireless Local Area Network |

17. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|---|------------------------|---------------|-------------|
| BGS8324 v.4 | 20170118 | Product data sheet | - | BGS8324 v.3 |
| Modifications: | <ul style="list-style-type: none"> Section 1 on page 1: added WLAN3001H according to our new naming convention | | | |
| BGS8324 v.3 | 20161215 | Product data sheet | - | BGS8324 v.2 |
| Modifications: | <ul style="list-style-type: none"> Section 6 on page 2: extended table information | | | |
| BGS8324 v.2 | 20160621 | Product data sheet | | BGS8324 v.1 |
| Modifications: | <ul style="list-style-type: none"> Data sheet status changed from Preliminary data sheet to Product data sheet | | | |
| BGS8324 v.1 | 20151221 | Preliminary 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.

19. Contact information

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

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

20. Contents

| | | |
|-----------|---|-----------|
| 1 | General description | 1 |
| 2 | Features and benefits | 1 |
| 3 | Applications | 1 |
| 4 | Quick reference data | 2 |
| 5 | Ordering information | 2 |
| 6 | Marking | 2 |
| 7 | Functional diagram | 3 |
| 8 | Pinning information | 3 |
| 8.1 | Pinning | 3 |
| 8.2 | Pin description | 3 |
| 9 | Limiting values | 4 |
| 10 | Recommended operating conditions | 4 |
| 11 | Thermal characteristics | 5 |
| 12 | Characteristics | 5 |
| 13 | Application information | 7 |
| 14 | Package outline | 8 |
| 15 | Handling information | 9 |
| 15.1 | Moisture sensitivity | 9 |
| 15.2 | ElectroStatic Discharge (ESD) | 9 |
| 16 | Abbreviations | 9 |
| 17 | Revision history | 9 |
| 18 | Legal information | 10 |
| 18.1 | Data sheet status | 10 |
| 18.2 | Definitions | 10 |
| 18.3 | Disclaimers | 10 |
| 18.4 | Trademarks | 11 |
| 19 | Contact information | 11 |
| 20 | Contents | 12 |

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

© NXP Semiconductors N.V. 2017.

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: 18 January 2017

Document identifier: BGS8324