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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
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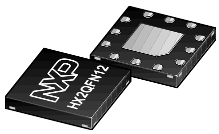



# BGS8324

**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 NXPs 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 $IP3_i$ 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 V; $T_{amb}$ = 25 °C; 50 Ω 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 | μA |
| $G_{tr}$ | transducer power gain | | –9 | –6 | –4 | dB |
| **RF performance at ANT-TX path in transmit mode [1]** | | | | | | |
| $\alpha_{ins}$ | insertion loss | | - | 0.8 | - | dB |
| **RF performance at ANT-BT path in Bluetooth mode [1]** | | | | | | |
| $\alpha_{ins}$ | 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 | | |
|---|---|---|---|
| | Name | Description | Version |
| 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

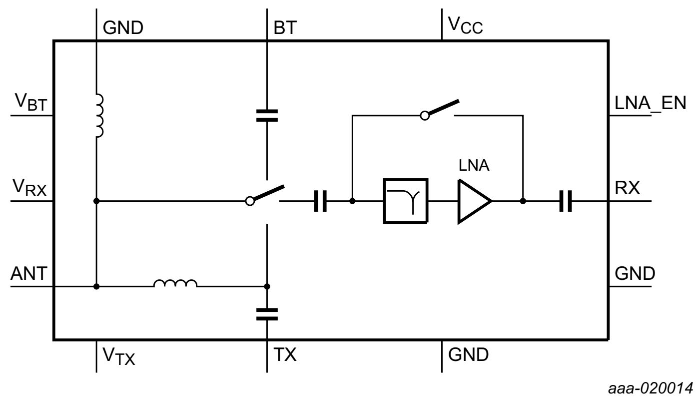



**Fig 1. Functional diagram**

# 8. Pinning information

## 8.1 Pinning

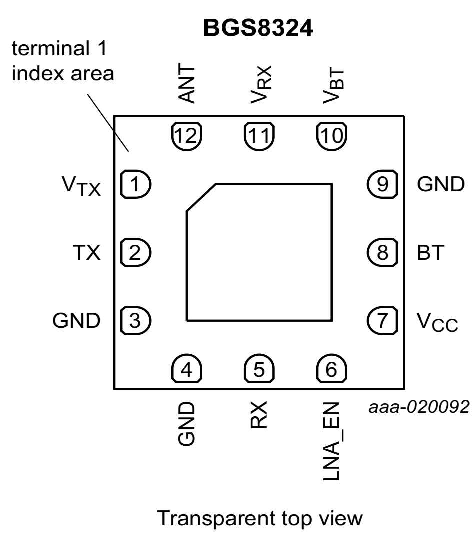



**Fig 2. Pin configuration**

## 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 V; $T_{amb}$ = 25 °C; 50 Ω 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 V; $T_{amb}$ = 25 °C; 50 Ω 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 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 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 V; $T_{amb}$ = 25 °C; 50 Ω 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]** | | | | | | |
| $\alpha_{ins}$ | 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]** | | | | | | |
| $\alpha_{ins}$ | 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]** | | | | | | |
| $\alpha_{ins}$ | 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

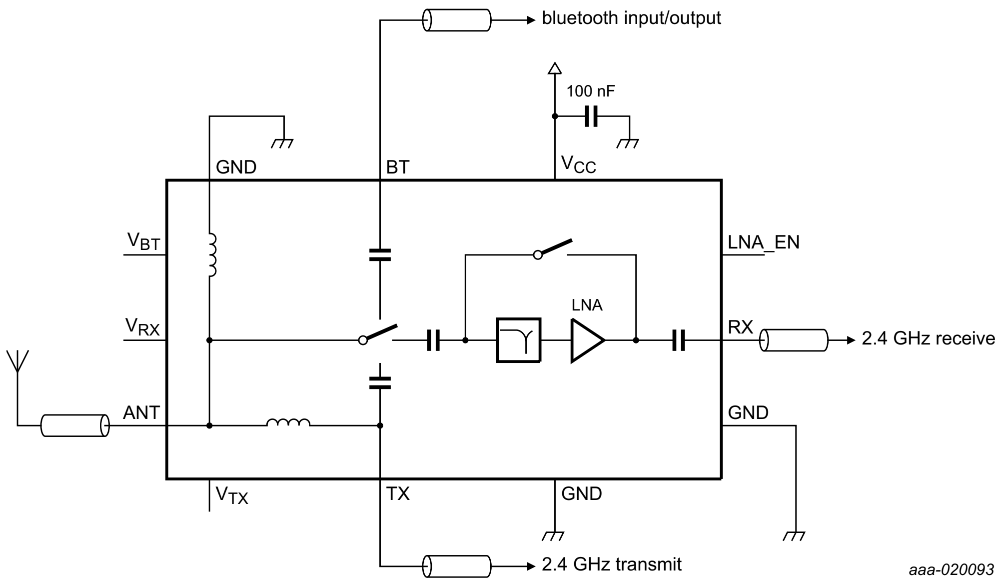
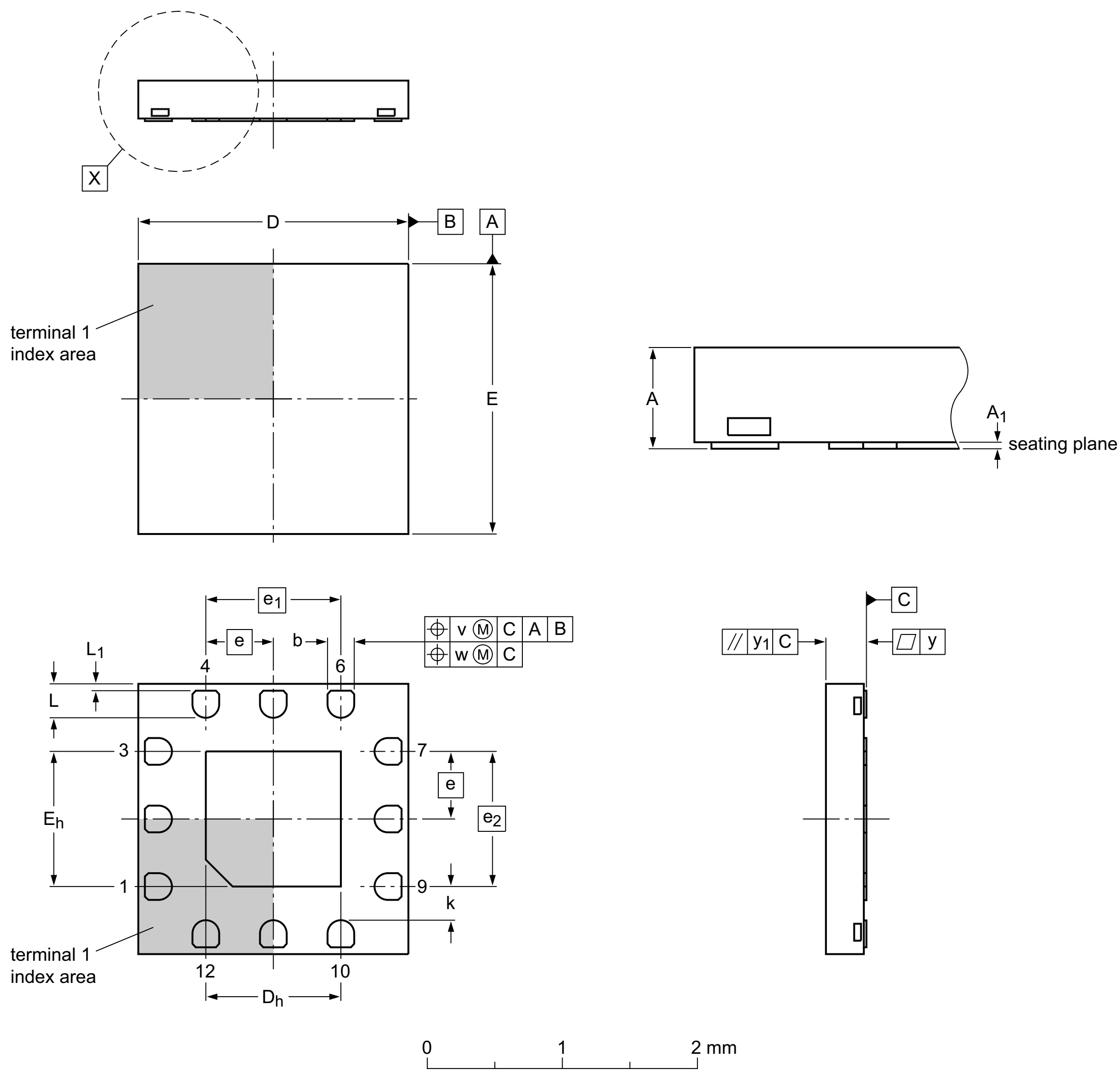



**Fig 3. Application diagram**

## 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**




Dimensions: (mm are the orginal dimensons)

| Unit | | A | $A_1$ | b | $D^{(1)}$ | $D_h$ | $E^{(1)}$ | $E_h$ | e | $e_1$ | $e_2$ | k | L | $L_1$ | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 0.33 | 0.05 | 0.25 | 2.05 | 1.10 | 2.05 | 1.10 | | | | | 0.35 | 0.10 | | | | |
| mm | nom | 0.30 | 0.02 | 0.20 | 2.00 | 1.00 | 2.00 | 1.00 | 0.5 | 1.0 | 1.0 | 0.25 | 0.25 | 0.05 | 0.07 | 0.05 | 0.05 | 0.05 |
| | min | 0.28 | 0.00 | 0.15 | 1.95 | 0.85 | 1.95 | 0.85 | | | | 0.20 | 0.15 | 0.00 | | | | |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot1261-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1261-1 | | MO-255 | | | | ~~16-01-14~~ 16-01-15 |

**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: | • Section 1 on page 1: added WLAN3001H according to our new naming convention | | | |
| BGS8324 v.3 | 20161215 | Product data sheet | - | BGS8324 v.2 |
| Modifications: | • Section 6 on page 2: extended table information | | | |
| BGS8324 v.2 | 20160621 | Product data sheet | | BGS8324 v.1 |
| Modifications: | • 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.

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## 20. Contents





**Date of release: 18 January 2017**
**Document identifier: BGS8324**