

General Description



The BDE-SG1311R3 is a multiprotocol Sub-1 GHz wireless module series that provides two options: BDE-SG1311R3U (U.FL connector version) and BDE-SG1311R3N (RF pad out version). The module supports IEEE 802.15.4g, IPv6-enabled smart objects (6LoWPAN), mioty, proprietary systems, and TI 15.4-Stack (Sub-1 GHz). The module is based on an Arm® Cortex® M4 main processor and optimized for low-power wireless communication and advanced sensing in grid infrastructure, building automation, retail automation, personal electronics and medical applications.

The BDE-SG1311R3 has a software defined radio powered by an Arm® Cortex® M0, which allows support for multiple physical layers and RF standards. The device supports 861 to 1054-MHz frequency band. The module has an efficient built-in PA that supports +14 dBm TX at 24.9 mA current consumption. In RX it has -121 dBm sensitivity and 88 dB blocking ± 10 MHz in SimpleLink™ long-range mode with 2.5-kbps data rate.

The module has a low sleep current of 0.7 μ A with RTC and 32KB RAM retention. Consistent with many customers' 10 to 15 years or longer life cycle requirements. BDE-SG1311R3 integrates all required system-level hardware components including clocks, passives and low-cost PCB design.

Key Features

- Wireless microcontroller
 - Powerful 48-MHz Arm® Cortex®-M4 processor
 - 352KB flash program memory
 - 32KB of ultra-low leakage SRAM
 - 8KB of Cache SRAM (Alternatively available as general-purpose RAM)
 - Programmable radio includes support for 2-(G)FSK, 4-(G)FSK, MSK, OOK, IEEE 802.15.4 PHY and MAC
 - Supports over-the-air upgrade (OTA)
- Low power consumption
 - MCU consumption:
 - ✧ 2.63 mA active mode, CoreMark®
 - ✧ 55 μ A/MHz running CoreMark
 - ✧ 0.7 μ A standby mode, RTC, 32KB RAM
 - ✧ 0.1 μ A shutdown mode, wake-up on pin
 - Radio Consumption:
 - ✧ 5.4 mA RX at 868 MHz
 - ✧ 24.9 mA TX at 14 dBm at 868 MHz
- Wireless protocol support
 - mioty
 - Wireless M-Bus
 - SimpleLink™ TI 15.4-stack
 - 6LoWPAN
 - Proprietary systems
- High performance radio
 - -121 dBm for 2.5-kbps long-range mode
 - -118 dBm at 9.6 kbps narrowband mode, 868 MHz
 - -110 dBm at 50 kbps, 802.15.4, 868 MHz
 - Output power up to +14 dBm with temperature compensation
 - Down to 4 kHz receiver filter bandwidth
- Regulatory compliance (On-going)
 - FCC
 - IC
 - CE-RED
- MCU peripherals
 - Digital peripherals can be routed to any GPIO

- Four 32-bit or eight 16-bit general-purpose timers
- 12-bit ADC, 200 kSamples/s, 8 channels
- 8-bit DAC
- Analog Comparator
- UART, SSI, I2C, I2S
- Real-time clock (RTC)
- Integrated temperature and battery monitor
- Security enablers
 - AES 128-bit cryptographic accelerator
 - True random number generator (TRNG)
- Additional cryptography drivers available in Software Development Kit (SDK)
- Operating range
 - On-chip buck DC/DC converter
 - 1.8-V to 3.8-V single supply voltage
 - -40 to +85°C
- Antenna: PCB antenna
- Package
 - Dimension: 22 mm x 15 mm x 2.15 mm
 - QFM-39 (30 GPIOs)
 - RoHS-compliant package

Applications

- Grid infrastructure
 - Smart Meters – electricity meter, water meter, gas meter, and heat cost allocator
 - Grid communications – wireless communications
 - EV charging infrastructure – AC charging (pile) station
 - Other alternative energy – energy harvesting
- Building automation
 - Building security systems – motion detector, door and window sensor, glass break detector, panic button, electronic smart lock and IP network camera
 - HVAC systems – thermostat, environmental sensor and HVAC controller
 - Fire safety – smoke and head detector, gas detector and fire alarm control panel
- Retail Automation
 - Retail automation & payment applications
 - ✧ electronic shelf labels and portable POS terminal
- Personal Electronics
 - RF remote controls
 - Smart Speakers and Smart Displays
 - Gaming and electronic and robotic toys
 - Wearables (non-medical) and smart trackers
- Wireless Modules
 - Wireless third party modules
 - Wireless communications modules

Contents

| | |
|---|----|
| General Description | 1 |
| Key Features | 1 |
| Applications | 2 |
| Contents | 3 |
| 1. References | 4 |
| 2. Block Diagram | 5 |
| 3. Terminal Configuration and Functions | 6 |
| 3.1 Pin Diagram | 6 |
| 3.2 Pin Attributes and Pin Multiplexing | 6 |
| 4. Specifications | 8 |
| 4.1 Absolute Maximum Ratings | 8 |
| 4.2 Recommended Operating Conditions | 8 |
| 5. Mechanical Specifications | 9 |
| 5.1 Dimensions | 9 |
| 5.2 PCB Footprint | 10 |
| 5.3 Marking | 10 |
| 6. Typical Reflow Profile | 11 |
| 7. Ordering Information | 12 |
| 8. Revision History | 12 |

1. References

- [1] CC1311R3 resources: <https://www.ti.com/product/CC1311R3>

2. Block Diagram

BDE-SG1311R3 module is based on the Texas Instruments CC1311R3 single chip wireless MCU. With integrated clocks, other required passives and antenna connector, it allows faster time to market at reduced development cost.

The module, as seen in Figure 2-1, comprises of:

- 48-MHz XTAL
- 32.768-kHz XTAL
- Power inductors and capacitors
- Pull-up resistor
- Passive balun filter
- Decoupling capacitors

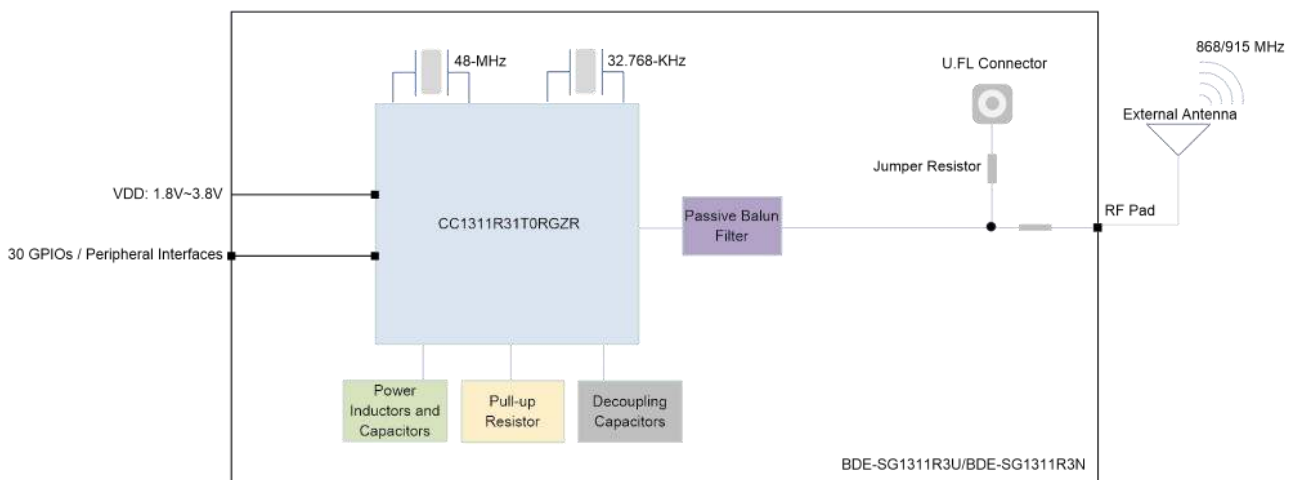


Figure 2-1. BDE-SG1311R3 Module Block Diagram

3. Terminal Configuration and Functions

3.1 Pin Diagram

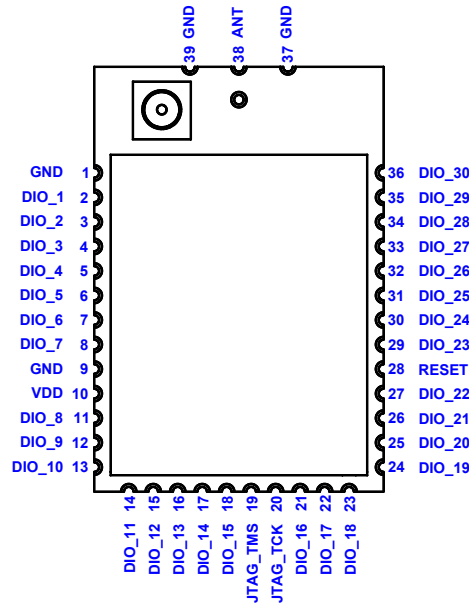


Figure 3-1. Pin Diagram (Top View)

3.2 Pin Attributes and Pin Multiplexing

Table 3-1 describes the definitions of the pins of the module. Pin number of CC1311R3 chip is also stated here, because the VQFN pin is referred to in the software design kit (SDK).

Table 3-1. Pin Description ⁽¹⁾

| Module Pin # | Pin Name | Type | CC1311R3 Pin # | Description |
|--------------|----------|--------|----------------|--|
| 1 | GND | Ground | - | Power ground |
| 2 | DIO_1 | I/O | 6 | GPIO, Sensor Controller |
| 3 | DIO_2 | I/O | 7 | GPIO, Sensor Controller |
| 4 | DIO_3 | I/O | 8 | GPIO, Sensor Controller |
| 5 | DIO_4 | I/O | 9 | GPIO, Sensor Controller |
| 6 | DIO_5 | I/O | 10 | GPIO, Sensor Controller, high-drive capability |
| 7 | DIO_6 | I/O | 11 | GPIO, Sensor Controller, high-drive capability |
| 8 | DIO_7 | I/O | 12 | GPIO, Sensor Controller, high-drive capability |
| 9 | GND | Ground | - | Power ground |
| 10 | VDD | Power | - | Power supply |
| 11 | DIO_8 | I/O | 14 | GPIO |
| 12 | DIO_9 | I/O | 15 | GPIO |
| 13 | DIO_10 | I/O | 16 | GPIO |
| 14 | DIO_11 | I/O | 17 | GPIO |
| 15 | DIO_12 | I/O | 18 | GPIO |
| 16 | DIO_13 | I/O | 19 | GPIO |
| 17 | DIO_14 | I/O | 20 | GPIO |
| 18 | DIO_15 | I/O | 21 | GPIO |
| 19 | JTAG_TMS | I/O | 24 | JTAG TMS, high-drive capability |

| Module Pin # | Pin Name | Type | CC1311R3 Pin # | Description |
|--------------|----------|--------|----------------|--|
| 20 | JTAG_TCK | I | 25 | JTAG TCKC |
| 21 | DIO_16 | I/O | 26 | GPIO, JTAG_TDO, high-drive capability |
| 22 | DIO_17 | I/O | 27 | GPIO, JTAG_TDI, high-drive capability |
| 23 | DIO_18 | I/O | 28 | GPIO |
| 24 | DIO_19 | I/O | 29 | GPIO |
| 25 | DIO_20 | I/O | 30 | GPIO |
| 26 | DIO_21 | I/O | 31 | GPIO |
| 27 | DIO_22 | I/O | 32 | GPIO |
| 28 | RESET | I | 35 | Reset, active-low |
| 29 | DIO_23 | I/O | 36 | GPIO, Sensor Controller, analog capability |
| 30 | DIO_24 | I/O | 37 | GPIO, Sensor Controller, analog capability |
| 31 | DIO_25 | I/O | 38 | GPIO, Sensor Controller, analog capability |
| 32 | DIO_26 | I/O | 39 | GPIO, Sensor Controller, analog capability |
| 33 | DIO_27 | I/O | 40 | GPIO, Sensor Controller, analog capability |
| 34 | DIO_28 | I/O | 41 | GPIO, Sensor Controller, analog capability |
| 35 | DIO_29 | I/O | 42 | GPIO, Sensor Controller, analog capability |
| 36 | DIO_30 | I/O | 43 | GPIO, Sensor Controller, analog capability |
| 37 | GND | Ground | - | Power ground |
| 38 | ANT | - | - | Antenna port (When disconnected with UFL, this port can be used) |
| 39 | GND | Ground | - | Power ground |

Note ⁽¹⁾: For more information, please refer to [CC1311R3](#) datasheet.

4. Specifications

4.1 Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

| PARAMETER | MIN | MAX | UNIT | Notes |
|-----------------------------|------|-------------|------|--|
| VDD | -0.3 | 4.1 | V | |
| Voltage on any digital pins | -0.3 | VDD+0.3≤4.1 | V | |
| Voltage on ADC input | -0.3 | VDDS | V | Voltage scaling enabled |
| | -0.3 | 1.49 | V | Voltage scaling disabled, internal reference |
| | -0.3 | VDD/2.9 | V | Voltage scaling disabled, VDD as reference |
| Storage temperature | -40 | 125 | °C | |

4.2 Recommended Operating Conditions

| PARAMETER | MIN | TYP | MAX | UNIT |
|----------------------------------|-----|-----|-----|-------|
| VDDS | 1.8 | 3.3 | 3.8 | V |
| Operating temperature | -40 | - | 85 | °C |
| Rising supply voltage slew rate | 0 | | 100 | mV/μs |
| Falling supply voltage slew rate | 0 | | 20 | mV/μs |

5. Mechanical Specifications

5.1 Dimensions

The following pages include mechanical, footprint drawings, and marking information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document.

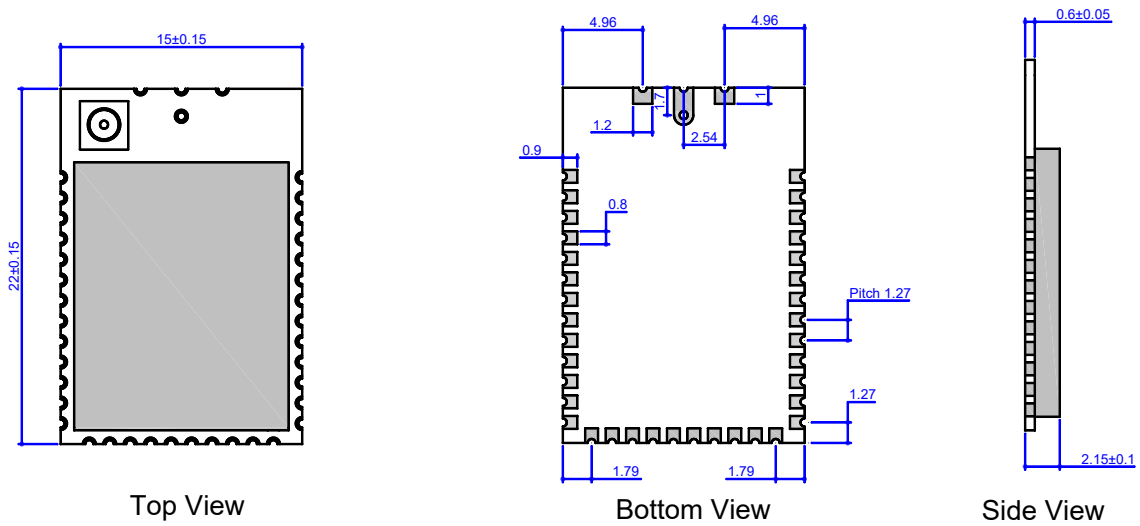
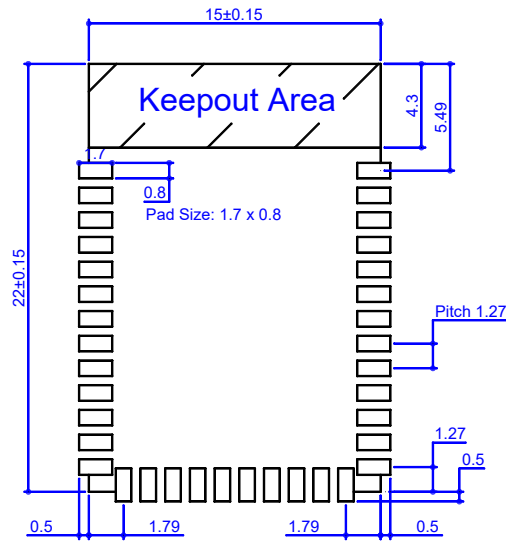


Fig 5-1. Mechanical Drawing

5.2 PCB Footprint



Note:

1. All dimensions are in millimeter
2. Solder mask should be the same or 5% larger than the dimension of the pad
3. Solder paste must be the same as the pin for all peripheral pads. For ground pins, make the solder paste 20% smaller than the pad.

Fig 5-2. Module Footprint Top View

5.3 Marking

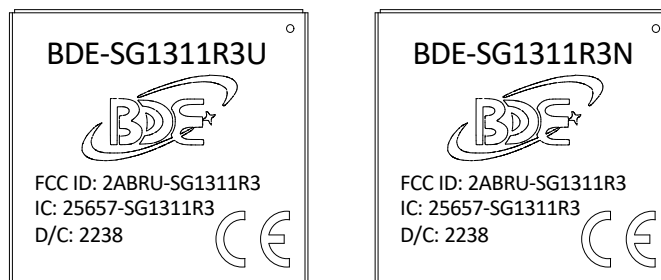


Fig 5-3. Module Marking

6. Typical Reflow Profile

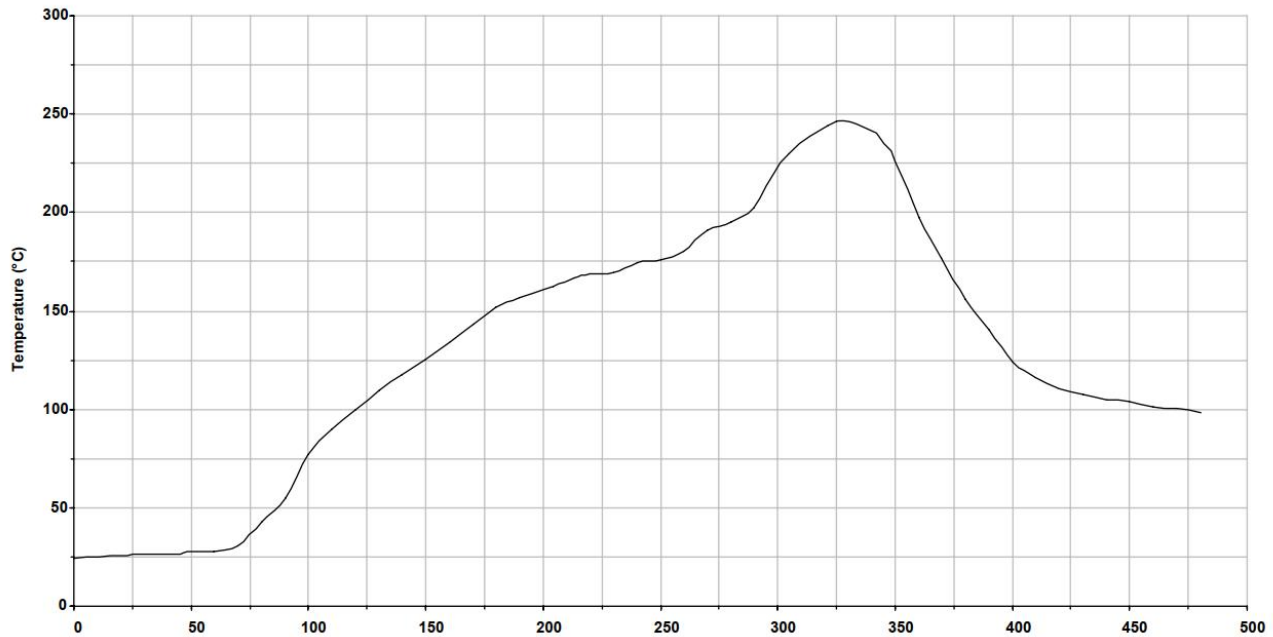


Figure 6-1. Typical Reflow Profile

Key features of the profile:

- Initial ramp = 1-2.5°C/sec to 175°C ±25°C equilibrium
- Equilibrium time = 60 to 180 seconds
- Ramp to maximum temperature (245°C) = 3°C/sec max.
- Time above liquidus temperature (217°C): 45-90 seconds
- Device absolute maximum reflow temperature: 260°C

7. Ordering Information

| Part Number | Size (mm) | Core Chip | Shipping Form | MOQ |
|---------------|----------------|-----------|---------------|-----|
| BDE-SG1311R3U | 22 × 15 × 2.15 | CC1311R3 | Tape & Reel | 1K |
| BDE-SG1311R3N | 22 × 15 × 2.15 | CC1311R3 | Tape & Reel | 1K |

8. Revision History

| Revision | Date | Description |
|----------|-----------------|-----------------|
| V1.0 | 20-October-2022 | Initial Release |

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