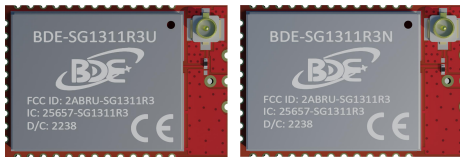## General Description

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 μA 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 μA/MHz running CoreMark
    - 0.7 μA standby mode, RTC, 32KB RAM
    - 0.1 μA 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 andportable 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

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

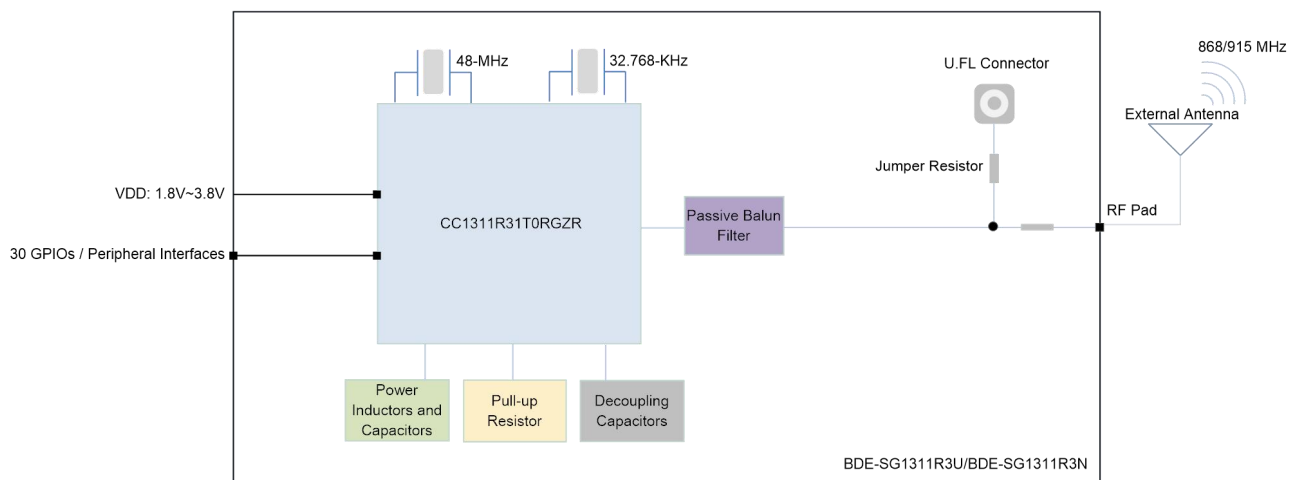- Passive balun filter

- Decoupling capacitors

Figure 2-1. BDE-SG1311R3 Module Block Diagram

3. Terminal Configuration and Functions
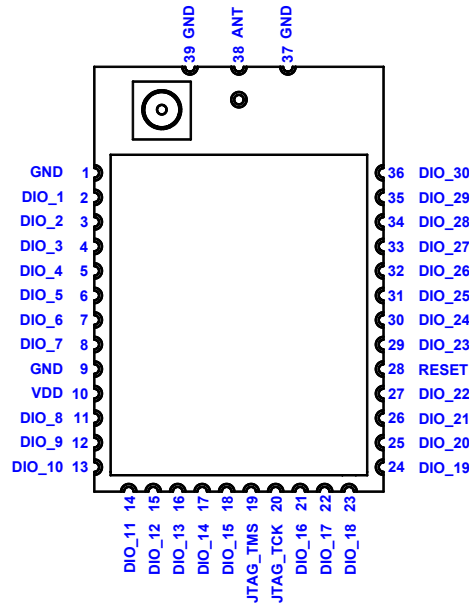
3.1 Pin Diagram

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 TMSC, 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.
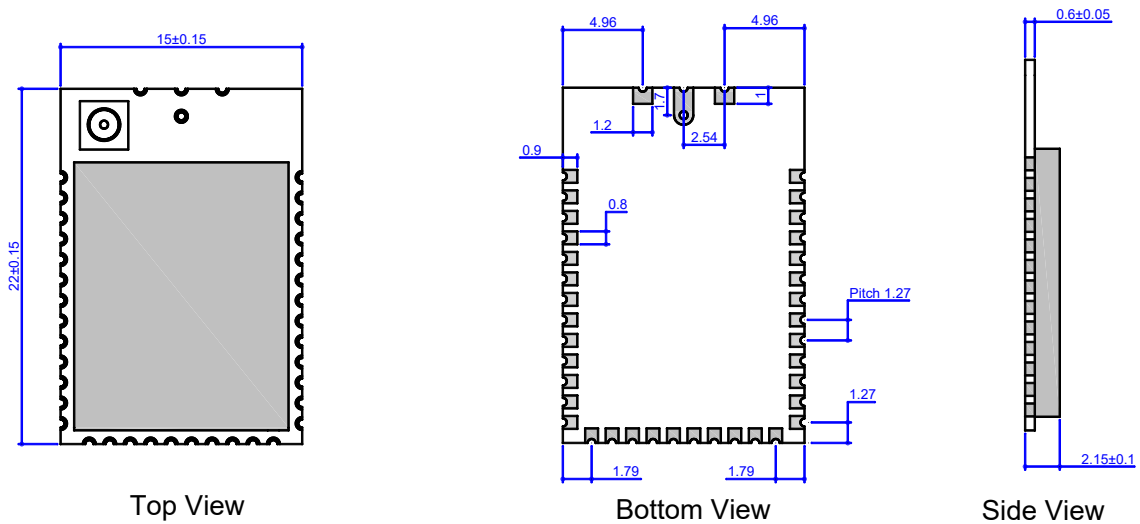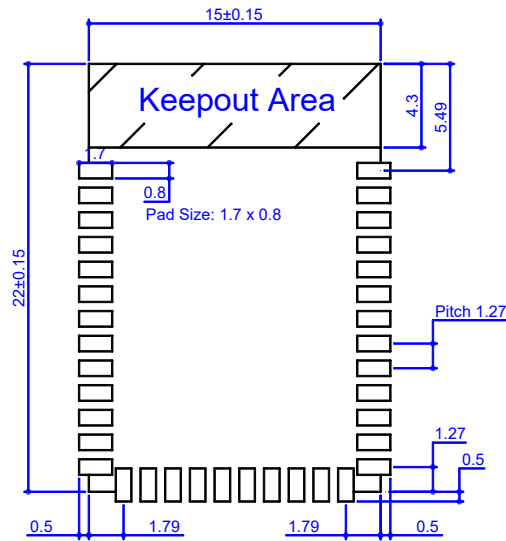

Top View   Bottom View   Side View

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.

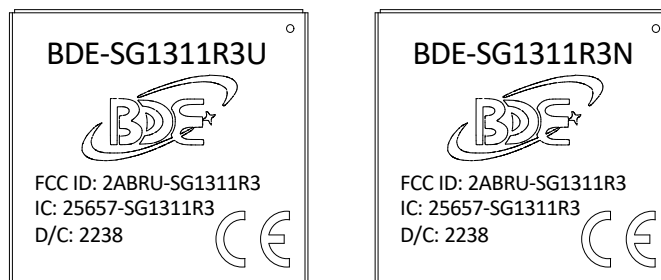**Fig 5-2. Module Footprint Top View**

5.3 Marking

Fig 5-3. Module Marking
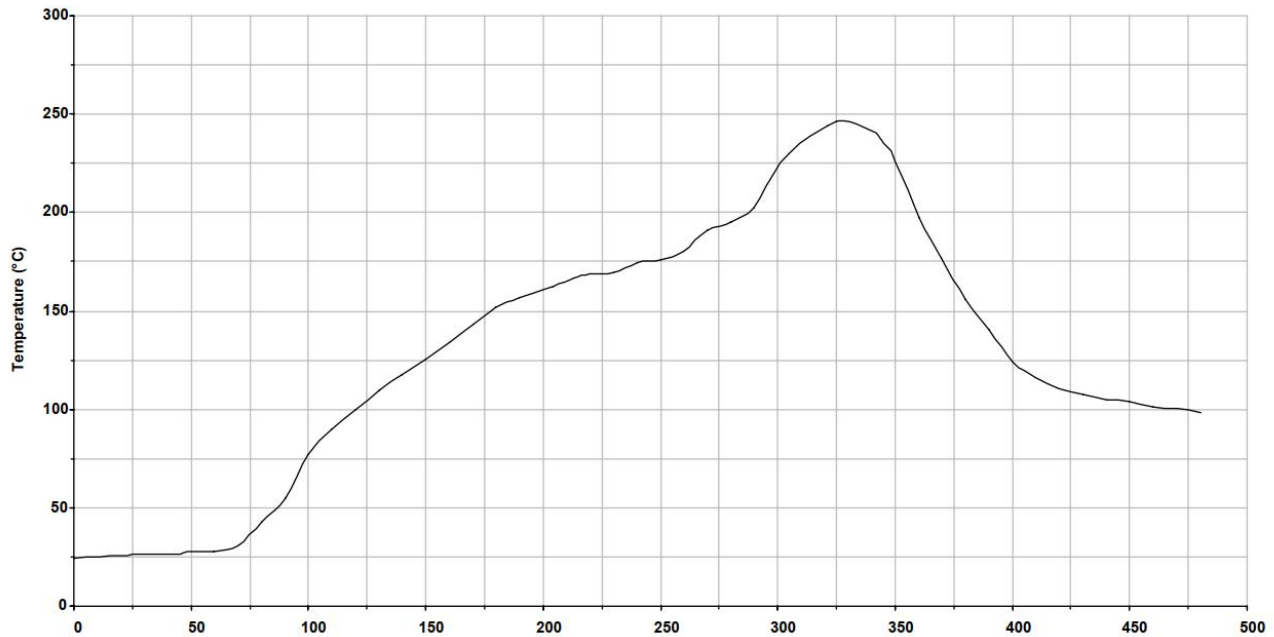
6. Typical Reflow Profile

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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