General Description

BDE-SG1311P3 is a multiprotocol Sub-1 GHz wireless module supporting IEEE 802.15.4g, IPv6-enabled smart objects (6LoWPAN), mioty, Wi-SUN®, proprietary systems, including the 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.

BDE-SG1311P3 has a software defined radio powered by an Arm® Cortex® M0, which allows support for multiple physical layers and RF standards. The module supports 915/868-MHz bands by default. If you want other bands in Sub-1 GHz to be supported, you can contact us for the customization. The module has an efficient built-in PA that supports +14 dBm TX at 24.9 mA and +20 dBm TX at 64 mA. In RX it has -121 dBm sensitivity and 88 dB blocking ±10 MHz in TI's 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.

The module has two options for antenna connection, on board U.FL connector (Part number: BDE-SG1311P3AU) and RF pad output (Part number: BDE-SG1311P3N). The overall dimension of the module is 24.9 mm x 19 mm x 2.15 mm.

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
  - MUC consumption
    - 2.63 mA active mode, CoreMark
    - 55 µA/MHz running CoreMark
    - 0.8 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
    - 64 mA TX at +20 dBm at 915 MHz
- Wireless protocols 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 +20 dBm with temperature compensation
  - Down to 4 kHz receiver filter bandwidth
- Peripherals
  - 23 GPIOs
  - 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
  - Two comparators
  - Programmable current source
  - 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 (By default)
    - ➢ -40 to +105°C (Contact for customization)
- ◼ Antenna
    - ➢ On board U.FL connector (Part Number: BDE-SG1311P3AU)
    - ➢ RF pad output (Part Number: BDE-SG1311P3N)
- ◼ Dimension
    - ➢ 24.9 mm x 19 mm x 2.15 mm
- ◼ Standards Conformance
    - ➢ CE-RED (Europe)
    - ➢ FCC (US)
    - ➢ ISED (Canada)

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 application – 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

Contents

1. Reference

TBD

2. Block Diagram

BDE-SG1311P3 is a power-optimized true system-on-chip (SoC) module. With a 48-MHz and a 32.768-KHz slow clock XTAL and all the passives components, it allows faster time to market at reduced development cost. The module has two options for the antenna connections. One is on board U.FL connector, user can attached a 915/868-MHz external antenna through the connector, but to remember to use the antenna with RP-SMA (Reverse Polarity SMA) connector because this is restricted by the antenna requirement by FCC and ISED. The other option is to connect the antenna through the RF pad to the module on the application board.

Figure 2-1 shows the block diagram of the module.
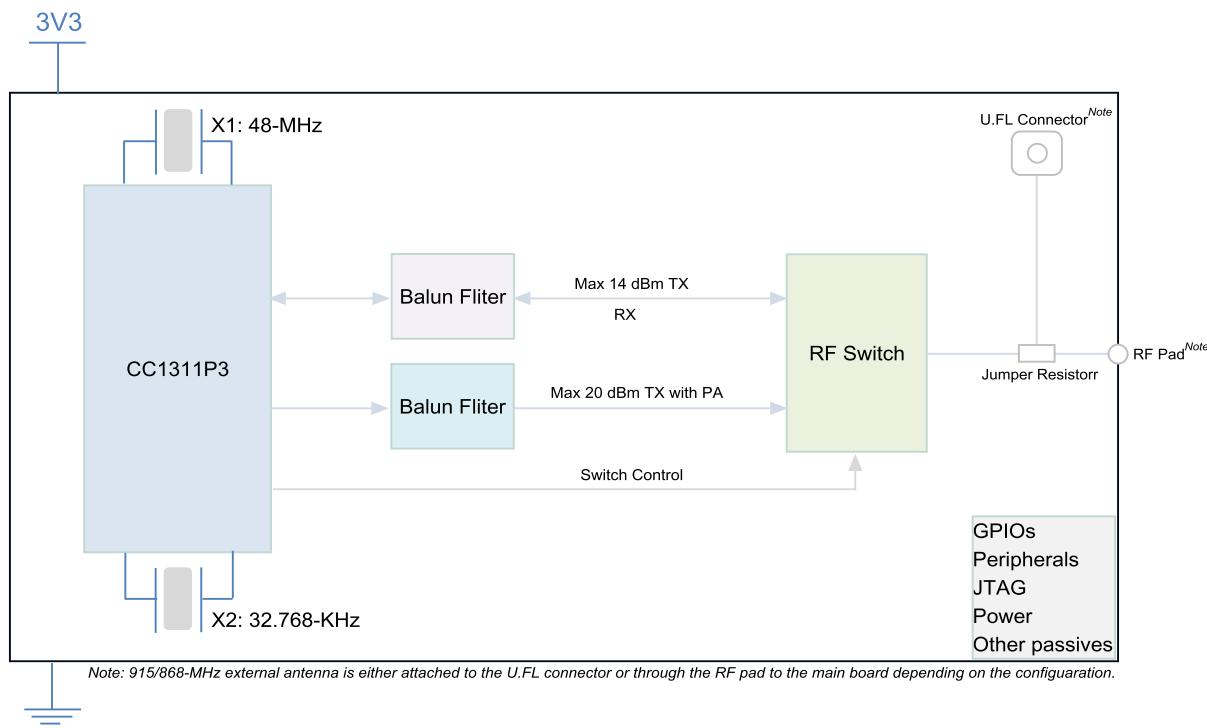
**Figure 2-1. The block diagram of BDE-SG1311P3**

3. Pinout
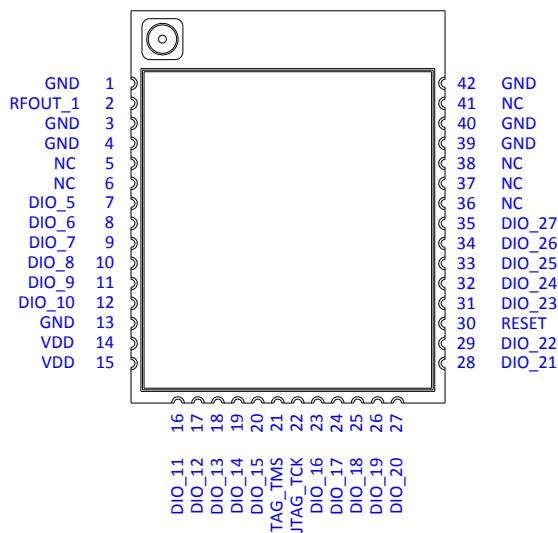
Figure 2-1. Pinout Diagram Top View

Table 2-1 describes the definitions of the pins.

Table 2-1. Pin Description

Pin #	Pin Name	Type	Description
1	GND	GND	Ground
2	RFOUT_1	AIO	RF pad out, connect with a 50 ohm antenna if used
3	GND	GND	Ground
4	GND	GND	Ground
5	NC (Note 1)	-	NC
6	NC	-	NC
7	DIO_5	DIO	Digital GPIO, high-drive capability
8	DIO_6	DIO	Digital GPIO, high-drive capability
9	DIO_7	DIO	Digital GPIO, high-drive capability
10	DIO_8	DIO	Digital GPIO
11	DIO_9	DIO	Digital GPIO
12	DIO_10	DIO	Digital GPIO
13	GND	GND	Ground
14	VDD	Power	Power supply (Note 2)
15	VDD	Power	Power supply
16	DIO_11	DIO	Digital GPIO
17	DIO_12	DIO	Digital GPIO
18	DIO_13	DIO	Digital GPIO
19	DIO_14	DIO	Digital GPIO
20	DIO_15	DIO	Digital GPIO
21	JTAG_TMS	DIO	JTAG TMSC, high-drive capability
22	JTAG_TCK	DI	JTAG TCKC

Pin #	Pin Name	Type	Description
23	DIO_16	DIO	GPIO, JTAG_TDO, high-drive capability
24	DIO_17	DIO	GPIO, JTAG_TDI, high-drive capability
25	DIO_18	DIO	Digital GPIO
26	DIO_19	DIO	Digital GPIO
27	DIO_20	DIO	Digital GPIO
28	DIO_21	DIO	Digital GPIO
29	DIO_22	DIO	Digital GPIO
30	RESET	DI	Reset, active low. Internal 100K ohm pull-up resistor and 0.1uF decoupling capacitor
31	DIO_23	DIO, AI	Digital GPIO, Analog Input
32	DIO_24	DIO, AI	Digital GPIO, Analog Input
33	DIO_25	DIO, AI	Digital GPIO, Analog Input
34	DIO_26	DIO, AI	Digital GPIO, Analog Input
35	DIO_27	DIO, AI	Digital GPIO, Analog Input
36	NC	-	NC
37	NC	-	NC
38	NC	-	NC
39	GND	GND	Ground
40	GND	GND	Ground
41	NC	-	NC
42	GND	GND	Ground

Note 1: NC stands for No Connect; DI stands for Digital Input; DIO stands for Digital Input-Output; AI stands for Analog Input; AIO stands for Analog Input-Output.

Note 2: Refer to 4.2 for recommended operating voltage.

4. Characteristics

All MIN/MAX specification limits are guaranteed by design, production testing and/or statistical characterization. Typical values are based on characterization results at default measurement conditions and are informative only.

Default measurement conditions (unless otherwise specified): V_{DDS} = 3.3 V, T_A = 25 ℃. All radio measurements are performed with standard RF measurement equipment.

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.

Table 4-1. Absolute Maximum Ratings

Parameter	Description	Conditions		Min	Max	Unit
V_{DDS}	Supply voltage	-		-0.3	4.1	V
V_{DIO}	Voltage on any digital pins	-		-0.3	VDDS+0.3, max 4.1	V
V_{AI}	Voltage on ADC input pins	Voltage scaling enabled	-	-0.3	VDDS	V
		Voltage scaling disabled, internal reference	-	-0.3	1.49	
		Voltage scaling disabled, VDDS as reference	-	-0.3	VDDS/2.9	
T_{STG}	Storage temperature		-	-40	150	°C

4.2. Recommended Operating Conditions

Table 4-2. Recommended Operating Conditions

Parameter	Description	Conditions	Min	Typ	Max	Unit
V_{DDS}	Regular	-	1.8	3.3	3.8	V
	Boost mode, VDDR=1.95V, +14 dBm RF output sub-1 GHz power amplifier	-	2.1	3.3	3.8	
	Boost mode, VDDR=1.95V, +20 dBm RF output high power amplifier	-	3.3	3.3	3.8	
T_A	Operating temperature	-	-40	25	85[Note 1]	°C

Note 1: The module can operate at 105°C, please contact for customization.

5. Mechanical Specifications

5.1. Dimensions

The module dimensions are presented in the following figure:
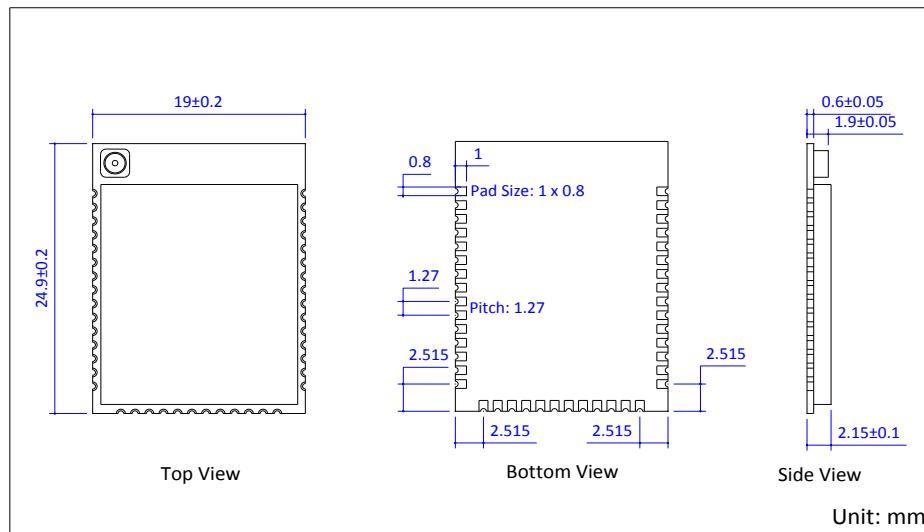
Figure 5-1. Mechanical Drawing

5.2. PCB Footprint

The footprint for the PCB is presented in the following figure:
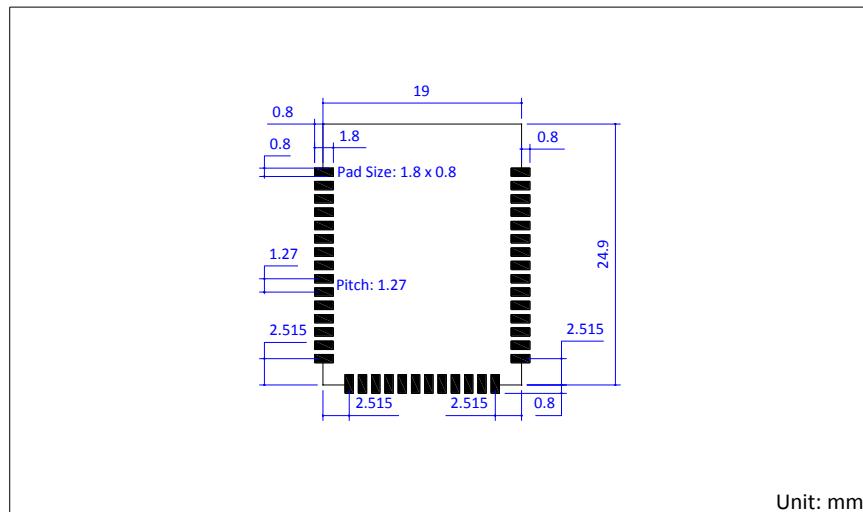
Figure 5-2. Module Footprint Top View

6. Ordering Information

Part Number	Description	Size (mm)	Package	MOQ
BDE-SG1311P3AU	Sub-1 GHz wireless module with PA, operating at 915/868-MHz, with U.FL connector on module	24.9 × 19 × 2.15	Tape & Reel	1000
BDE-SG1311P3N	Sub-1 GHz Wireless Module with PA, operating at 915/868-MHz, with RF pad out	24.9 × 19 × 2.15	Tape & Reel	1000

7. Revision History

Revision	Date	Description
V0.1	18-Jan-2022	Preliminary

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