E73-2G4M04S1F User Manual

RF52811 2.4GHz BLE5.1/IEEE 802.15.4-2006 BLE Module



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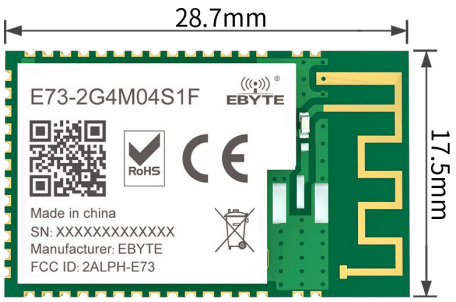
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1. Overview

1.1 Introduction



E73-2G4M04S1F is a small volume chip Bluetooth wireless module independently developed based on nrf52811 chip of Nordic of Norway. It adopts 32mhz industrial crystal oscillator to ensure its industrial characteristics and stable performance.

NRF52811 comes with high-performance ARM CORTEX-M4 core, IEEE 802.15.4-2006 RF transceiver and protocol stack of BLE 5.1. Especially the direction finding function, pushing Bluetooth positioning to a new height. It has rich peripheral resources such as UART, I2C, SPI, ADC, DMA, PWM, etc. The module leads out almost all IO ports. Please check the pin definition for details, so as to facilitate users to carry out multi-directional development. The module can be connected with other antennas through IPEX.

Because the module is a pure hardware SOC module, it can be used only after the user programs it.

1.2 Features

- Support BLE 5.1, all functions of bluetooth 5 and IEEE 802.15.4-2006;
- Maximum transmission power is 2.5mW, is is multi-level adjustable by software;
- Built-in 32.768 kHz clock crystal oscillator;
- Support for the global license-free ISM 2.4GHz band;
- Built in Cortex-M4 core processor with high performance and low power consumption;
- Rich resources, 192KB FLASH, 24KB RAM;
- Support 1.8V~3.6V power supply, more than 3.3V power supply can guarantee the best performance;
- Industrial grade standard design, can work under -40 ~ 85 °C for a long time;
- Under ideal conditions, the communication distance can reach 100m.

1.3 Application

- Smart home and industrial sensors;
- Security system and positioning system;
- Wireless remote control, UAV;
- Wireless Game Remote Controller;
- Health care products;
- Wireless voice, wireless headset;
- Automotive industry applications.

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2. Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min.	Max.	
Power supply（V）	0	3.6	Voltage over 3.6V will cause permanent damage to module
Blocking power（dBm）	-	10	Chances of burn is slim when modules are used in short distance
Operating temperature（℃）	-40	85	Industrial grade

2.2 Operating parameter

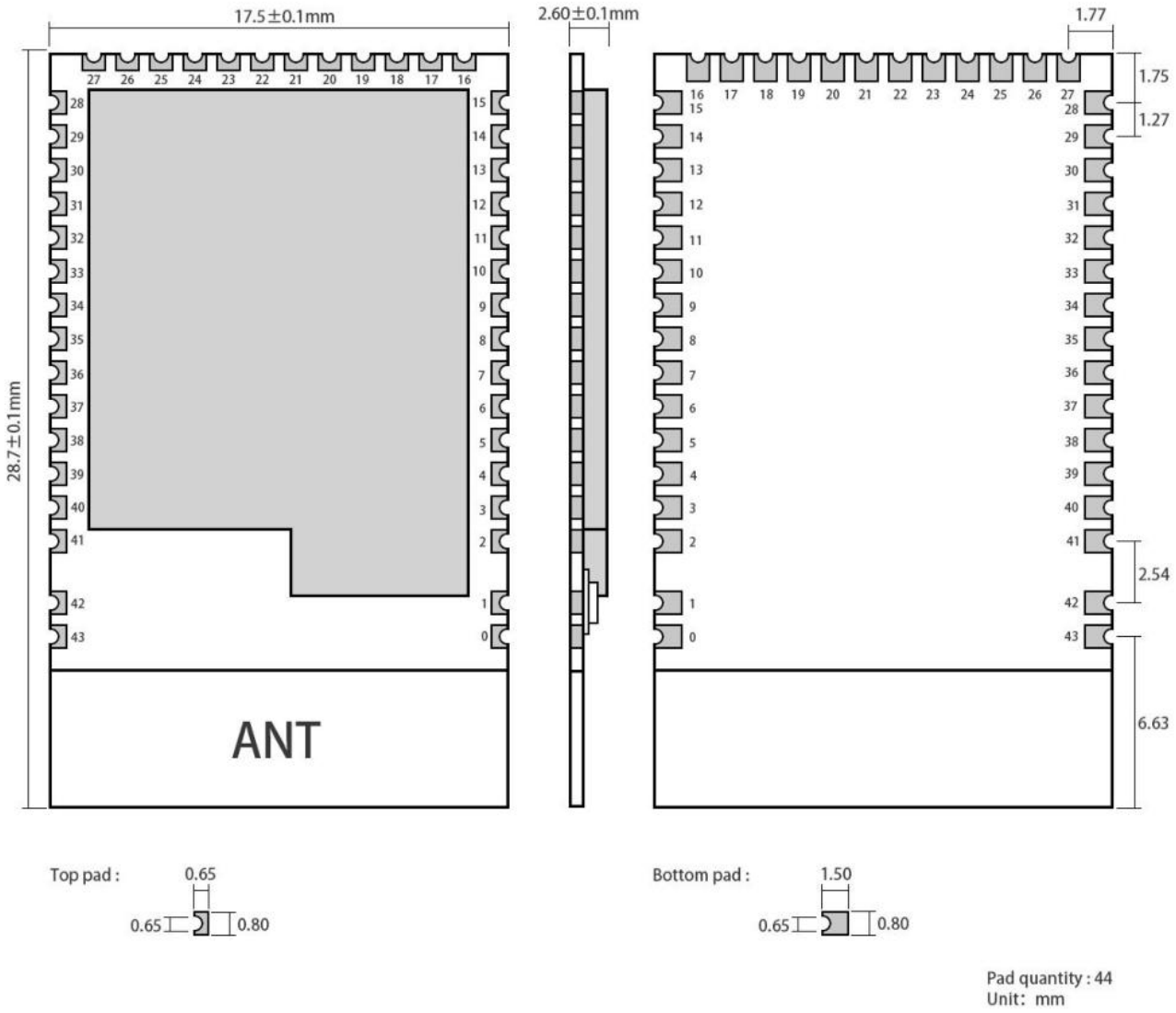
Main parameter		Performance			Remark
		Min.	Typ.	Max.	
Operating voltage（V）		1.8	3.3	3.6	≥3.3 V can ensures output power
Communication level（V）		-	3.0	-	For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	85	Industrial design
Operating frequency（MHz）		2379	2430	2496	Support ISM band
Power consumption	TX current（mA）	-	18	-	Instant power consumption
	RX current（mA）	-	13	-	-
	Sleep current （μA）	-	2	-	Software is shut down
Max Tx power（dBm）		3.8	4	4.1	-
Receiving sensitivity（dBm）		-104dBm @ BLE 125kbps			Long ditance mode
		-97dBm @ BLE 1Mbps			-

Main parameter	Description	Remark
Distance for reference	120m	Test condition：clear and open area, antenna gain: 5dBi, antenna height: 2.5m，air data rate: 1Mbps
Crystal frequency	32MHz / 32.768KHz	
Support protocal	BLE 5.1/IEEE 802.15.4-2006	
Package	SMD	
Connector	1.27mm	
IC	nRF52811-QFAA/QFN48	
FLASH	192KB	
RAM	24KB	
kernel	ARM CORTEX-M4	
Size	17.5 * 23.5 mm	
Antenna	PCB/IPEX	Default PCB antenna; Impedance is about 50 ohms

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3. Size and pin definition



No.	Pin	Pin direction	Description
0	GND	Input	Ground, connected to reference ground of power
1	GND	Input	Ground, connected to reference ground of power
2	GND	Input	Ground, connected to reference ground of power
3	DEC2	-	1.3 V digital power decoupling regulator (see chip manual for details)
4	DEC3	-	Power supply decoupling (see chip manual for details)
5	P0.25	Input/Output	MCU GPIO
6	P0.26	Input/Output	MCU GPIO
7	P0.27	Input/Output	MCU GPIO
8	P0.28	Input/Output	MCU GPIO
9	P0.29	Input/Output	MCU GPIO

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10	P0.30	Input/Output	MCU GPIO
11	P0.31	Input/Output	MCU GPIO
12	DEC4		1.3 V digital power decoupling regulator (see chip manual for details) Input from DC/DC regulator, output from 1.3 V LDO
13	DCC	-	DC / DC regulator output (see chip manual for details)
14	DEC1	-	0.9 V digital power decoupling regulator (see chip manual for details)
15	GND	Input	Ground, connected to reference ground of power
16	VCC	Input	Power supply 1.8～3.6V DC（Note: The voltage higher 3.6V is forbidden）
17	P0.02	Input/Output	MCU GPIO
18	P0.03	Input/Output	MCU GPIO
19	P0.04	Input/Output	MCU GPIO
20	P0.05	Input/Output	MCU GPIO
21	P0.06	Input/Output	MCU GPIO
22	P0.07	Input/Output	MCU GPIO
23	P0.08	Input/Output	MCU GPIO
24	P0.09	Input/Output	MCU GPIO
25	P0.10	Input/Output	MCU GPIO
26	P0.11	Input/Output	MCU GPIO
27	P0.12	Input/Output	MCU GPIO
28	P0.13	Input/Output	MCU GPIO
29	P0.14	Input/Output	MCU GPIO
30	P0.15	Input/Output	MCU GPIO
31	P0.16	Input/Output	MCU GPIO
32	P0.17	Input/Output	MCU GPIO
33	P0.18	Input/Output	MCU GPIO
34	P0.19	Input/Output	MCU GPIO
35	P0.20	Input/Output	MCU GPIO
36	P0.21	Input/Output/RST	MCU GPIO
37	SWDCLK	Input	Serial Line Debugging / Clock Input Debugging and Programming
38	SWDIO	Input	Serial line debugging and programming debugging
39	P0.22	Input/Output	MCU GPIO
40	P0.23	Input/Output	MCU GPIO
41	P0.24	Input/Output	MCU GPIO
42	GND	Input	Ground, connected to reference ground of power
43	GND	Input	Ground, connected to reference ground of power

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4. Basic Operation

4.1 Hardware Design

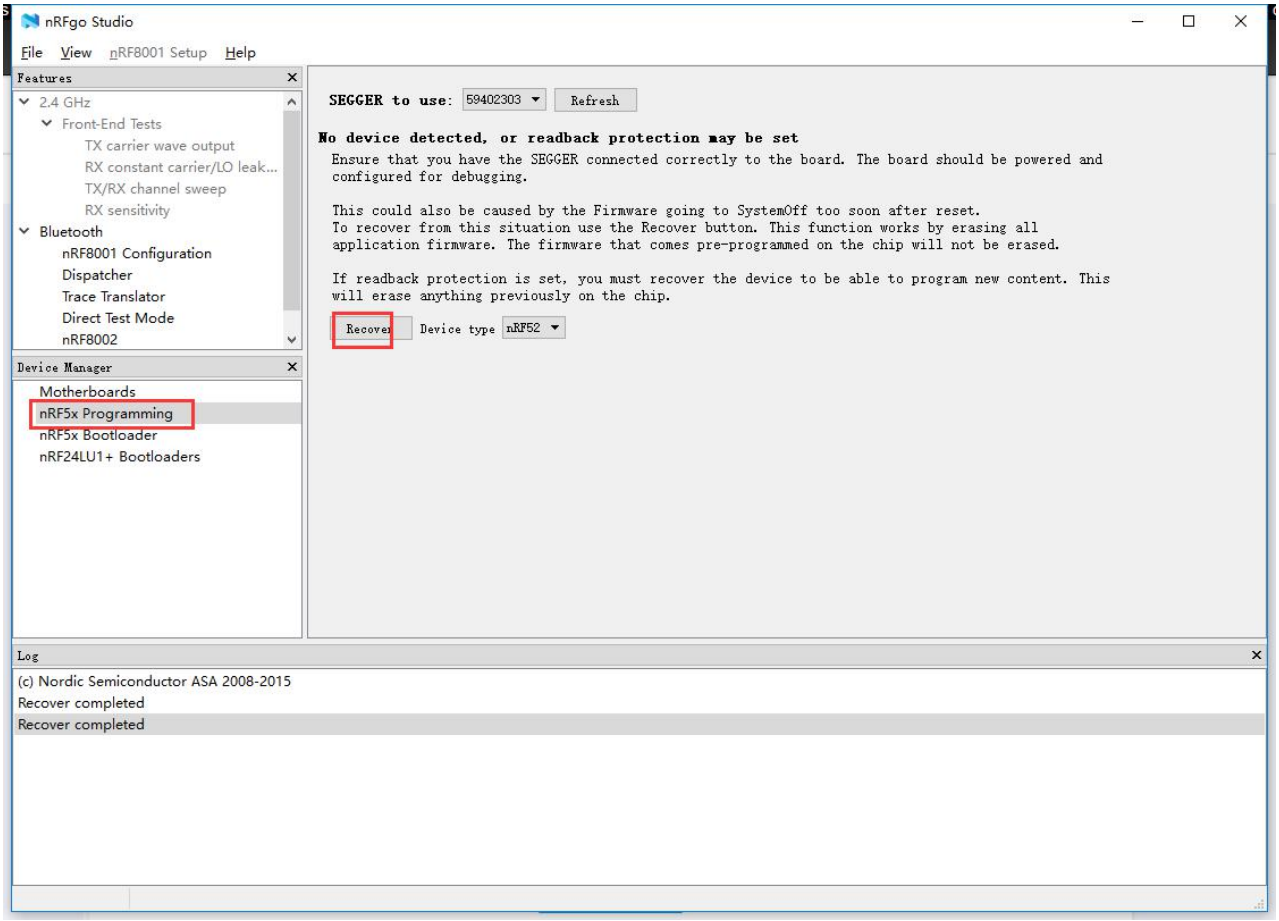
- It is recommended to use DC stabilized power supply to supply power to the module. The power supply ripple coefficient is as small as possible, and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. If the reverse connection is connected, the module may be permanently damaged.
- Please check the power supply to ensure that between the recommended supply voltage, if exceeding the maximum, the module will be permanently damaged.
- Please check the stability of the power supply, the voltage can not be significantly frequent.
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, and the whole machine is beneficial for long-term stable operation.
- The module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference.
- High-frequency digital traces, high-frequency analog traces, and power traces must be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(All copper-covered and well grounded), and must be close to the digital part of the module and routed in the Bottom Layer.
- Assuming the module is soldered or placed in the Top Layer, it is also wrong to randomly route the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees.
- Assume that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power trace), which will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference. If possible, you can do it properly. Isolation and shielding
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage).
- Try to stay away from some physical layers and also have a 2.4GHz TTL protocol, for example: USB3.0
- The antenna mounting structure has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside of the case.
- The antenna must not be installed inside the metal case, which will greatly reduce the transmission distance.

4.2 Software Programming

- The core of this module is nRF52811, which is completely equivalent to nRF52811. Users can operate according to the nRF52811 chip manual (see nRF52811 manual for details).
- Because the officially provided programming tool nRFgo Studio has poor compatibility, it is recommended to use J-LINK-V8 or above for program burning.
- About the issue that the old model can be programmed, while the new model can't be programmed, It is because the new model being added with read/write protection during production. It needs to be properly connected to the line and then use the official nRFgo Studio for Recover (Jlink supports the official nRFgo). Studio), as shown below:

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5.FAQ

5.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- When the power supply at room temperature is lower than the recommended low voltage, the lower the voltage is, the lower the transmitting power is.
- Due to antenna quality or poor matching between antenna and module.

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5.2 Module is easy to damage

- Please check the power supply and ensure it is within the recommended range. Voltage higher than the peak will lead to a permanent damage to the module.
- Please check the stability of power supply and ensure the voltage not to fluctuate too much.
- Please make sure anti-static measures are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range for some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

5.3 High bit error rate

- There are co-channel signal interference nearby, keep away from interference sources or modify frequency, channel to avoid interference.
- The clock waveform on the SPI is not standard. Check whether there is interference on the SPI line. The SPI bus line should not be too long.
- Unsatisfactory power supply may also cause garbled characters, and ensure the reliability of the power supply.
- If the extension cable or feeder is of poor quality or too long, the bit error rate will be high.

6. Welding operation guidance

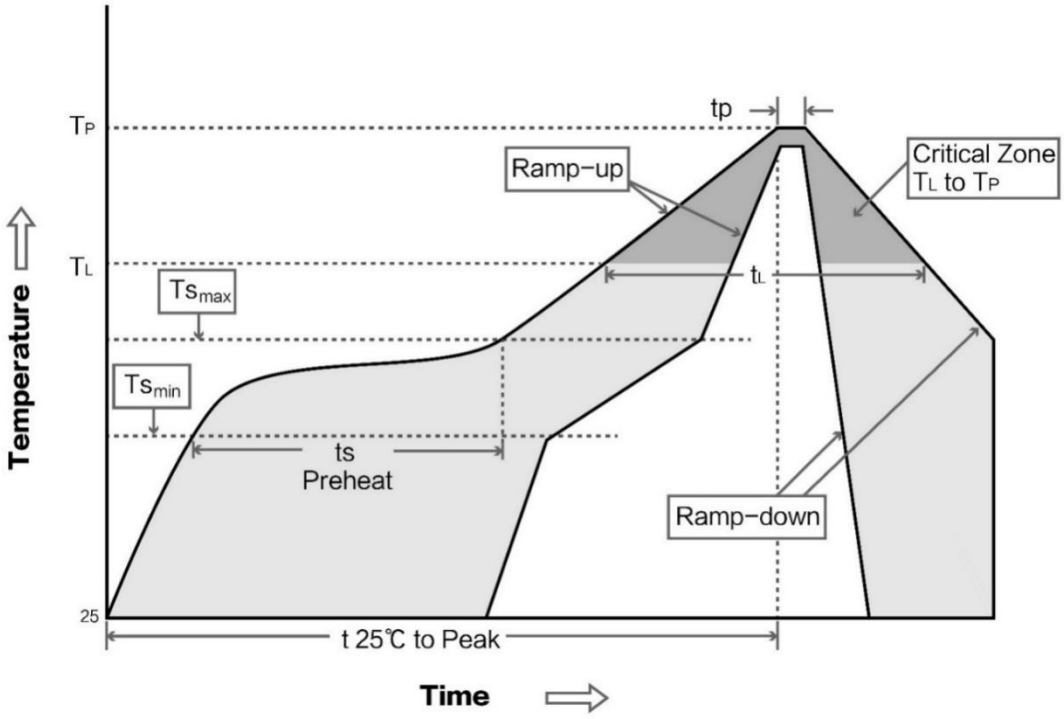
6.1 Reflow Soldering Temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Minimum preheating temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average rising rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above liquidus	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak temperature	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average descent rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time of 25 ° C to peak temperature	6 minutes max	8 minutes max

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6.2 Reflow Soldering Curve



7. Related Model

7.1 E73 Hardware Module

Model	Chip	Proyocol	FLASH	RAM	TX	Size	Antenna
E73-2G4M04S1F	nRF52811	BLE5.1/IEEE 802.15.4-2006	192KB	24KB	4dBm	17.5*28.7mm	PCB/IPEX
E73-2G4M04S1FX	nRF52811	BLE5.1/IEEE 802.15.4-2006	192KB	24KB	4dBm	17.5*28.7mm	IPEX
E73-2G4M04S1B	nRF52832	BLE4.2/5.0	512KB	64KB	4dBm	17.5*28.7mm	PCB/IPEX
E73-2G4M04S1BX	nRF52832	BLE4.2/5.0	512KB	64KB	4dBm	17.5*28.7mm	IPEX
E73-2G4M08S1C	nRF52840	BLE4.2/5.0	1024KB	256KB	8dBm	13*18mm	Ceramic
E73-2G4M08S1CX	nRF52840	BLE4.2/5.0	1024KB	256KB	8dBm	13*18mm	IPEX
E73-2G4M04S1D	nRF52822	BLE4.2	256KB	16KB	4dBm	17.5*28.7mm	PCB/IPEX
E73-2G4M08S1E	nRF52833	BLE5.1、BLE Mesh、Thread、 Zigbee	512KB	128kB	8dBm	13*18mm	Ceramic

7.2 E104 Protocal Module

Model	Chip	Proyocol	Size	Antenna	Features
E104-BT5005A	nRF52805	BLE5.0	9*9mm	Ceramic	master-slave integrated module, small size

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E104-BT5010A	nRF52810	BLE5.0	11.5*16mm	Ceramic	master-slave integrated module
E104-BT5011A	nRF52810	BLE5.1	11.5*16mm	Ceramic	master-slave integrated module, support Long Range
E104-BT5032A	nRF52832	BLE5.0	11.5*16mm	Ceramic	Multi-master and multi-slave coexistence
E104-BT5040U	nRF52840	BLE4.2/5.0	59*18mm	PCB	USB Dongle，support nRF Connect
E104-BT5040UA	nRF52840	BLE4.2/5.0	59*18mm	PCB	USB Dongle，support BLE5.0 packet capture

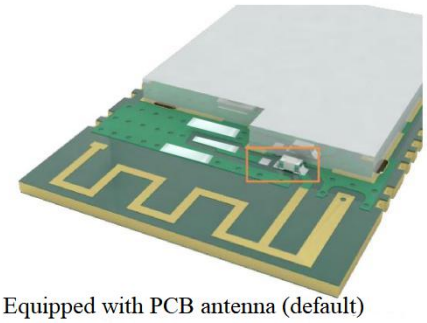
8. Antenna Type

8.1 Antenna recommendation

The antenna plays an important role in the communication process. The inferior antenna often has a great impact on the communication system. Therefore, we recommend some antennas that support our wireless modules and have excellent performance and reasonable price.

Product	Type	Frequency Hz	Gain dBi	Size mm	Wire cm	Interface	Feature
TX2400-NP-5010	Flexible antenna	2.4G	2.0	10*50	-	IPEX	Built-in flexible FPC soft
TX2400-JZ-3	Rubber antenna	2.4G	2.0	30	-	SMA-J	Short straight, omnidirectional
TX2400-JZ-5	Rubber antenna	2.4G	2.0	50	-	SMA-J	Short straight, omnidirectional
TX2400-JW-5	Rubber antenna	2.4G	2.0	50	-	SMA-J	Fixed bend, omnidirectional
TX2400-JK-11	Rubber antenna	2.4G	2.5	110	-	SMA-J	Bendable, omnidirectional
TX2400-JK-20	Rubber antenna	2.4G	3.0	200	-	SMA-J	Bendable, omnidirectional
TX2400-XPL-150	Sucker antenna	2.4G	3.5	150	150	SMA-J	Small sucker antenna, cost effective

8.2 Antenna

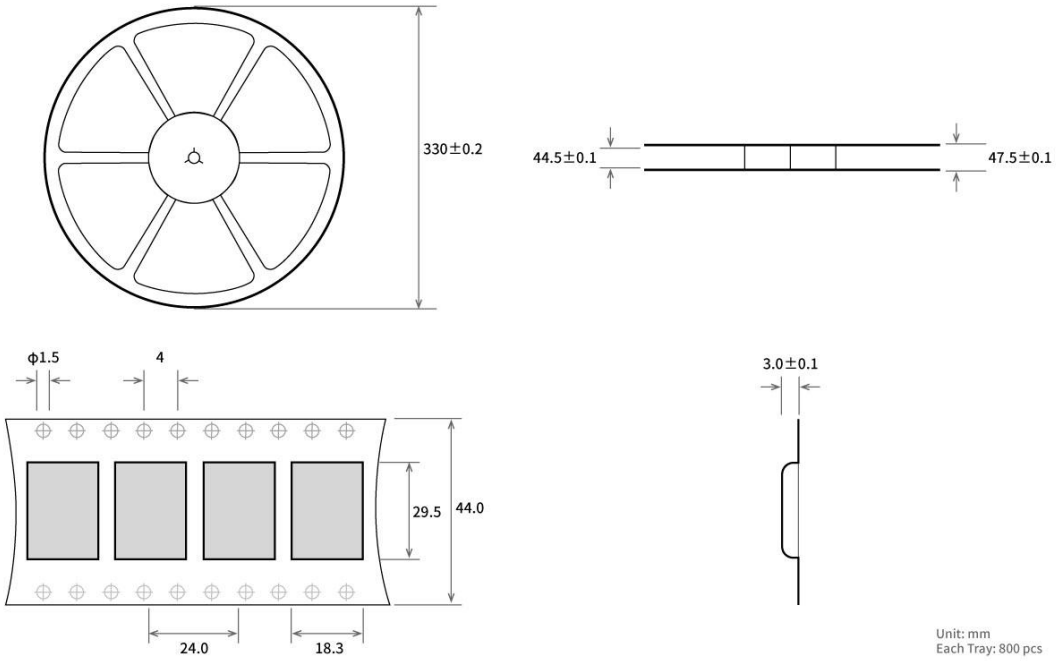


Equipped with PCB antenna (default)

9. Batch packaging

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Revision history

Version	Date	Description	Issued by
1.0	2021-7-15	Initial version	Linson

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