E104-BT55SP User Manual

CC2340R5 2.4GHz BLE 5.3 Low Power Bluetooth Module

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成都亿佰特电子科技有限公司

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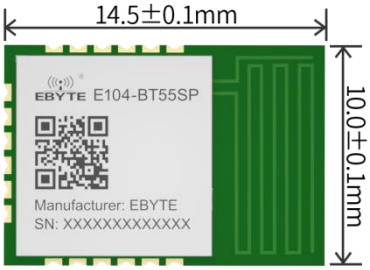
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Chapter 1 Product Overview

1.1 Product introduction



E104-BT55SP is a SMD11-sized, low-power module based on Bluetooth protocol version 5.3, working in the 2.4GHz frequency band. The E104-BT55SP module is developed by Chengdu Ebyte Electronic Technology Co., Ltd. based on the CC2340R52E0RGER chip of Texas Instruments Incorporated (TI). Rich peripheral resources such as I2C, SPI, ADC, DMA, PWM, etc., and all IO ports are led out, which is convenient for users to carry out multi-directional development. A maximum baud rate of 3Mbps is supported.

E104-BT55SP is a hardware platform. There is no program in the factory. Users need to carry out secondary development. For the characteristics of CC2340R52E0RGER chip, please refer to the official Datasheet. The module has maximized the radio frequency characteristics of the chip.

1.2 Features

- Ultra-SMD11 size, only 10x14.5mm;
- Support BLE5.3;
- The maximum transmit power is 8dbm, with temperature compensation, and the software is multi-level adjustable;
- Support global license-free ISM 2.4GHz frequency band;
- Built-in 48MHz clock crystal oscillator;
- Built-in high-performance low-power 48 MHz ARM® Cortex®-M0+ processor;
- Rich resources, 512k FLASH, 36KB RAM;
- Support 1.7 - 3.8V power supply, more than 3.3V power supply can ensure the best performance;
- Industrial-grade standard design, support long-term use at -40 - +85 ℃;
- On-board PCB antenna, no external antenna required.
- Under ideal conditions, the communication distance can reach 170m;
- Support OTA air upgrade function;
- Integrated temperature and battery monitors;
- Equipped with AES-128 cryptography hardware accelerator to reduce the code footprint and execution time of encryption operations;
- Support BLE 5.3, Zigbee, Wi-SUN®, SimpleLink™ TI 15.4-stack, Wireless M-Bus, Sub-1GHz, IEEE 802.15.4, Proprietary systems, Sidewalk, Multiprotocol and other protocols;

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1.3 Application scenarios

- SMDrt home and industrial sensors, etc.;
- Security system, positioning system;
- Wireless remote control, drone;
- Wireless game remote control;
- Healthcare products;
- Wireless voice, wireless headset;
- Automotive industry applications.
- Wearable devices.
- Asset tracking.
- Retail EPOS (Electronic Point of Sale);
- Electronic shelf labels;智能家居以及工业传感器等;

Chapter 2 Specifications

2.1 Limit parameters

Main parameters	Performance		Remark
	Min	Max	
Supply voltage (V)	1.7	3.8	Exceeding 3.8V will permanently burn the module
Blocking power (dBm)	-	10	The probability of burning at close range is SMD11
Working temperature (℃)	-40	+85	Industrial grade

2.2 Working parameters

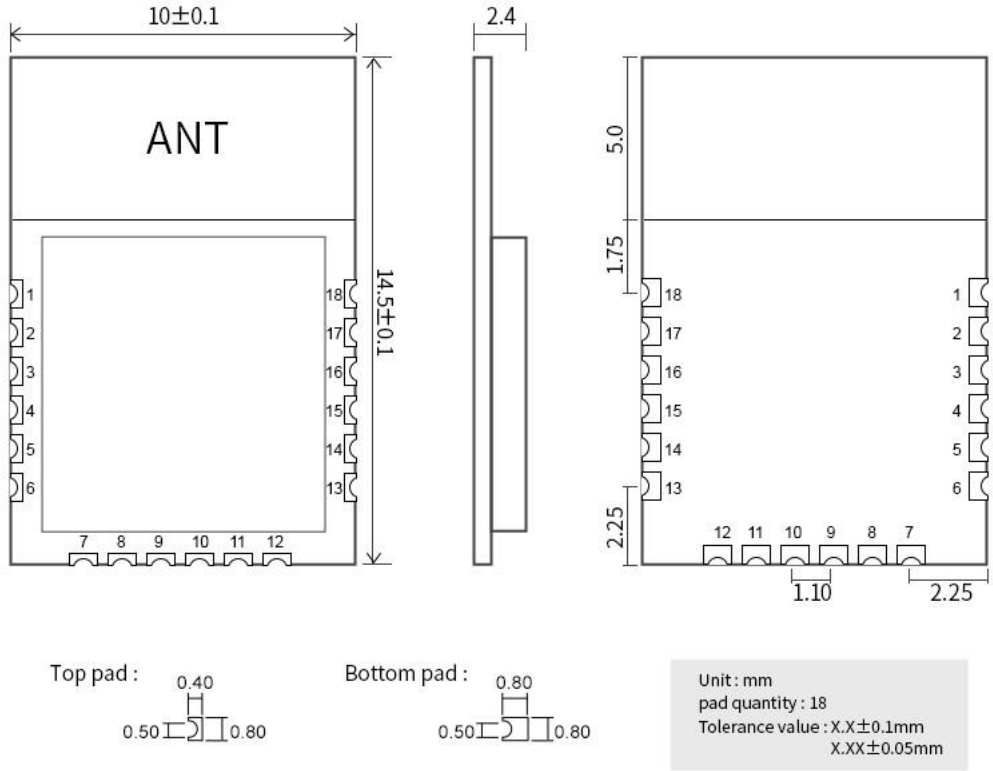
Main parameters		Performance			Remark
		Min	Type	Max	
Normal voltage mode		1.7	3.3	3.8	≥3.3V can guarantee output power
Communication level (V)		-	3.3	-	Risk of burnout with 5V TTL
Working frequency band (MHz)		2402	-	2480	Supports ISM bands
Transmit power (dBm)		-20	0	8	dBm
Power consumption	Receive Sensitivity (dBm)	-	-96	-	Air rate is 1Mbps
	Emission current (mA)	-	11	-	@0dBm
	Receive current (mA)	-	10	-	-
Sleep current (μA)		-	1	-	Default parameters
Low power consumption current (μA)		-	6	-	TX=0dBm interval 1s

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Main parameters	Description	Remark
Reference distance	170m	Clear and open environment, height 2.0 meters, @8dBm, airspeed 1Mbps
Bluetooth protocol	BLE5.3	-
Communication Interface	I/O	-
Packaging method	SMD	-
Dimensions	14.5*10mm	-
RF interface	PCB	Equivalent impedance is about 50Ω
Product weight	0.5g	±0.1g

Chapter 3 Mechanical Dimensions and Pin Definition



Pin	Pin name	Direction	Usage
1	GND	-	Power ground
2	GND	-	Power ground
3	DIO8	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
4	DIO11	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
5	DIO12	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
6	DIO13	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
7	DIO16	Input/Output	GPIO, SWD interface: mode selection or software dedicated,

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			high drive capability
8	DIO17	Input/Output	GPIO, SWD interface: clock, high drive capability
9	DIO20_A11	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
10	DIO21_A10	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
11	DIO24_A7	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
12	VCC	Input	1.7V ~3.8V external power supply
13	GND	-	Power ground
14	RST	Input	Reset, active low, internal pull-up to 3.3V
15	DIO3_X32P	Input/Output	GPIO, 32-kHz external crystal connection, optional TCXO input
16	DIO4_X32N	Input/Output	GPIO, 32-kHz external crystal connection
17	DIO6_A1	Input/Output	Configurable general-purpose IO ports (CC2340R5 manual)
18	GND	-	Power ground

The following I/O pins have high drive capability:

- DIO12
- DIO16
- DIO17
- DIO24_A7

The following I/O pins have analog functions:

- DIO20_A11
- DIO21_A10
- DIO24_A7
- DIO6_ A1

Chapter 4 Development and Use

4.1 Install the development environment

1. Download SDK

Apply for support on the TI official website:
https://www.ti.com.cn/zh-cn/wireless-connectivity/bluetooth/cc2340.html?HQS=epd-con-lpcs-cc2340_2q22-vanity-pp-lp-cn_awr

For details, please refer to the quickstart-guide.html in SDK Support

2. Chip Manual

TI official download link:
https://www.ti.com.cn/zh-cn/wireless-connectivity/bluetooth/cc2340.html?HQS=epd-con-lpcs-cc2340_2q22-vanity-pp-lp-cn_awr

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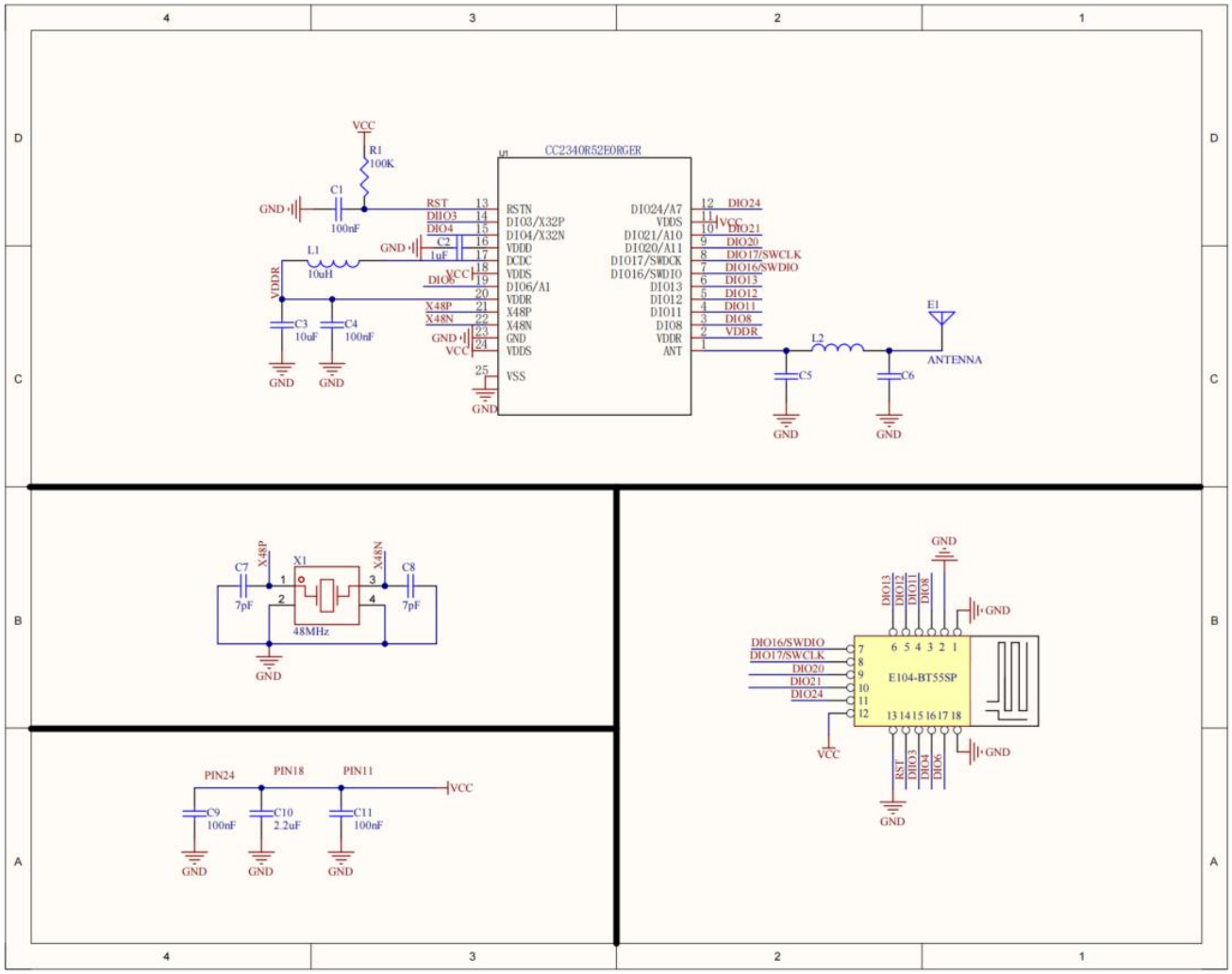
4.2 Program burning

For details of program burning, please refer to quickstart-guide.html in SDK support

Burning tool: XDS110

Chapter 5 Basic Operations

5.1 Hardware Design and Circuit Schematic



- It is recommended to use a DC regulated power supply to supply power to the module, the power supply ripple coefficient should be as SMDll as possible, and the module should be grounded reliably;
- Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module;
- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds

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the maximum value, the module will be permanently damaged;

- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so that the whole machine can work stably for a long time;
- The module should be kept as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the underside of the module. If it is absolutely necessary to pass under the module, assuming that the module is soldered on the Top Layer, lay copper on the Top Layer of the contact part of the module. Copper and well grounded), must be close to the digital part of the module and routed on the Bottom Layer;
- Assuming that the module is soldered or placed on the Top Layer, it is also wrong to arbitrarily route wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;
- Assuming that there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), the performance of the module will also be greatly affected. It is recommended to stay away from the module according to the intensity of the interference. 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 TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great influence on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the casing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly reduce the transmission distance.

Chapter 6 Frequently Asked Questions

6.1 The transmission distance is not ideal

- When there is a straight line communication obstacle, the communication distance will be correspondingly attenuated;
- Temperature, humidity, and co-channel interference will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect close to the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- If there is a metal object near the antenna, or is placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, and the air rate is set too high (the higher the air rate, the closer the distance);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower

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the voltage, the lower the output power;

- The antenna used is poorly matched with the module or the quality of the antenna itself is faulty.

6.2 Module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltages. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- Please ensure anti-static operation during installation and use, and high-frequency components are electrostatically sensitive;
- Please ensure that the humidity during installation and use should not be too high, and some components are humidity-sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.。

6.3 Bit error rate too high

- There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- If the power supply is not ideal, it may also cause garbled characters. Be sure to ensure the reliability of the power supply;
- Poor quality or too long extension lines and feeder lines will also cause a high bit error rate.

Chapter 7 Welding Operation Guidance

7.1 Reflow temperature

When reflow soldering, all temperatures refer to the package center temperature, measured on the package surface facing up (leads are placed down, i.e. the live insects are facing). If the temperature of the module is not measured in the direction of live insects (the lead is placed upward, that is, the direction of dead insects) for reflow soldering, the measured Tp temperature is within ±2° C of the Tp temperature measured in the direction of the live insects, which still meets the requirements of Tc . Otherwise, the temperature curve should be adjusted to meet the requirements of Tc. In order to accurately measure the actual peak temperature of the package body, it is recommended to use the method recommended by JEP140 for furnace temperature testing.

In order to obtain a better welding effect, the production workshop recommends a constant temperature of

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25° C.

When soldered components need to be re-profiled, they should be reflowed with a carrier fixture of the same construction, or verified to have an equivalent thermal load.

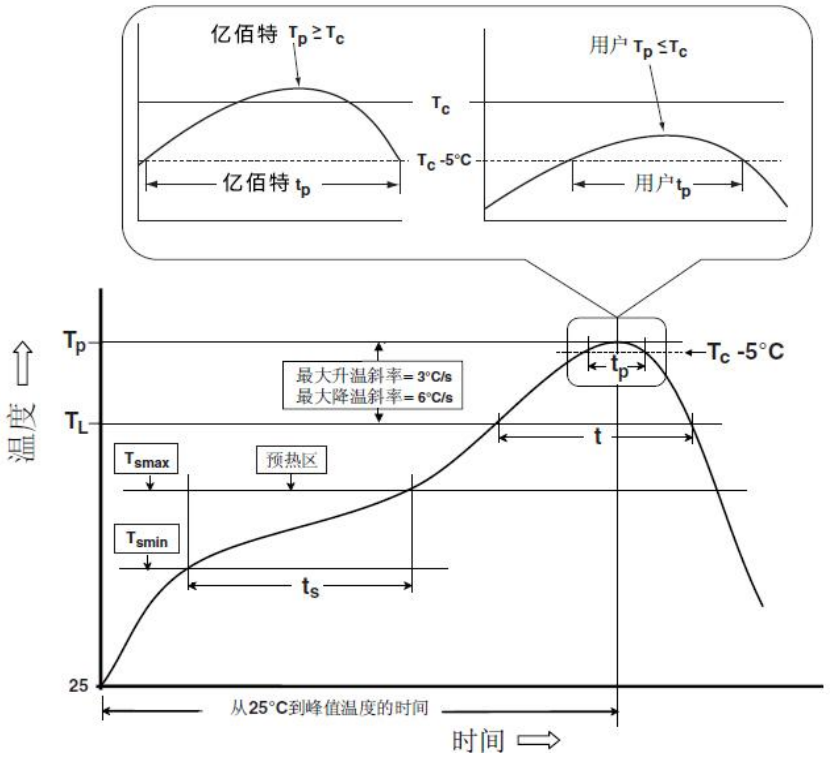
The reflow profiles in this document are some suggestions for soldering only Ebyte modules, and cannot be used to confirm the actual assembly profile of the user. The actual production process of the user should be based on the specific production process, needs and circuit board design to develop the actual production assembly curve, and should not exceed the parameters in the table below.

Reflow Profile Characteristics		Leaded process assembly	Lead-free process assembly
Preheat/Keep Warm	lowest temperature (Tsmin)	100℃	150℃
	maximum temperature (TSMDx)	150℃	200℃
	time (Tsmin~Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL~Tp)		3° C/sec, max	3° C/sec, max
liquidus temperature (TL)		183℃	217℃
Hold time above TL		60~90 seconds	60~90 seconds
Package body peak temperature Tp		The user cannot exceed the temperature indicated on the product's "Moisture Sensitivity" label	The user cannot exceed the temperature indicated on the product's "Moisture Sensitivity" label
Time (Tp) within 5° C of the specified grading temperature (Tc), see the figure below		20 seconds	30 seconds
cooling slope (Tp~TL)		6° C/sec, max	6° C/sec, max
Time from room temperature to peak temperature		6 minutes, maximum	8 minutes, maximum
※The peak temperature (Tp) tolerance definition of the temperature profile is the upper limit of the user			

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7.2 Reflow Soldering Curve



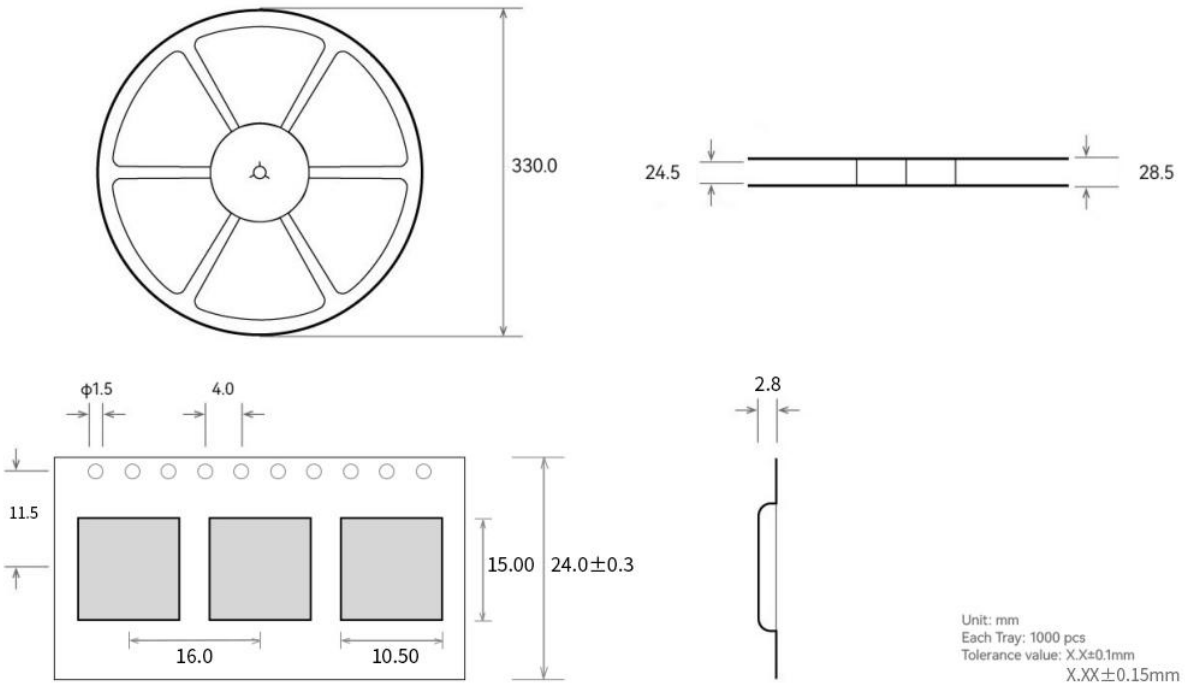
Chapter 8 Related Models

Model	Chip	Frequency Hz	Power dBm	Protocal BLE	Size mm	Package	Antenna
E73-2G4M04S1A	nRF52810	2.4G	4	4.2/5.0	17.5*28.7	SMD	PCB/IPX
E73-2G4M04S1B	nRF52832	2.4G	4	4.2/5.0	17.5*28.7	SMD	PCB/IPX
E83-2G4M03S	nRF5340	2.4G	3	4.2/5.0	16*16	SMD	Ceramic
E73-2G4M04S1D	nRF51822	2.4G	4	4.2	17.5*28.7	SMD	PCB/IPX

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Chapter 9 Bulk Packing



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Revise history

Version	Date	Description	Maintenance
1.0	2022-10-19	original version	Bin

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