E73-2G4M08S1EX

nRF52833 2.4GHz BLE5.1/Bluetooth Mesh/802.15.4/Thread/Zigbee

BLE Module



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Contents

Disclaimer 2
Features 3
1 Introduction 4
1.1 Brief Introduction 4
1.2 Application 4
2 Specification and parameter 5
2.1 Limit parameter 5
2.2 Operating parameter 5
3 Size and pin definition 6
4 Development and Application 9
5 Basic operation 10
5.1 Hardware design and circuit schematic diagram 10
6 FAQ 11
6.1 Communication range is too short 11
6.2 Module is easy to damage 11
6.3 BER(Bit Error Rate) is high 12
7 Production guidance 13
7.1 Reflow soldering temperature 13
7.2 Reflow soldering curve 13
8 E73 series 14
9 Bulk packing 14
Revision history 15
About us 15

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Features

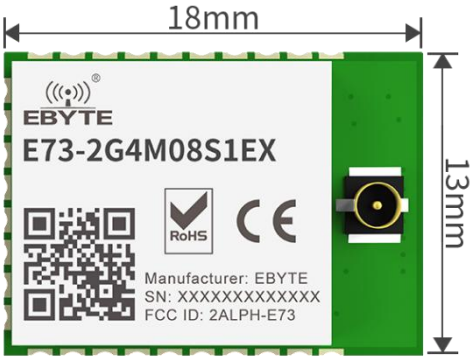
- 13 x 18mm, small size;
- Support Bluetooth 5.1, Bluetooth mesh, 802.15.4, Thread, Zigbee and proprietary 2.4 GHz protocols;
- Maximum transmission power of 6mW, software multi-level adjustable;
- Support the global license- free ISM 2.4GHz band;
- Built-in high performance low power ARM⑧and Cortex⑧-M4 dual core processor;
- Rich resources,512KB FLASH, 128KB RAM;
- Support 1.7V~5.5V power supply, power supply over 3. 3Vcan guarantee the best performance;
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time;
- With IPEX antenna interface, an external antenna is required;
- Under ideal conditions, the communication distance can reach 120m.

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1 Introduction

1.1 Brief Introduction



E73-2G4M08S1EX are wireless Bluetooth modules designed by Chengdu Ebyte which feature small size, low power consumption. It adopt the originally imported RFIC nRF52833 of NORDIC, supporting Bluetooth 5.1, Bluetooth mesh, 802.15.4, Thread, Zigbee and proprietary 2.4 GHz protocols. The chip comes with a high-performance ARM CORTEX-M4 core, taking use of a 32M industrial-grade crystal oscillator, and has abundant peripheral resources such as UART, I2C, SPI, ADC, DMA, and PWM. The module led out most IO Port of nRF52833 for multilateral development. Please see the pin definition for details.

E73-2G4M08S1EX is hardware platform without firmware, so users need to conduct a secondary development.The characteristics of the nRF52833 chip can be found in the official Datasheet. The module has maximized the RF characteristics of the chip.

1.2 Application

- Smart homes and industrial sensors;
- Security system, positioning system;
- Wireless remote control, drone;
- Wireless game remote control;
- 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	5.5	Voltage over 5.5V 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

2.2 Operating parameter

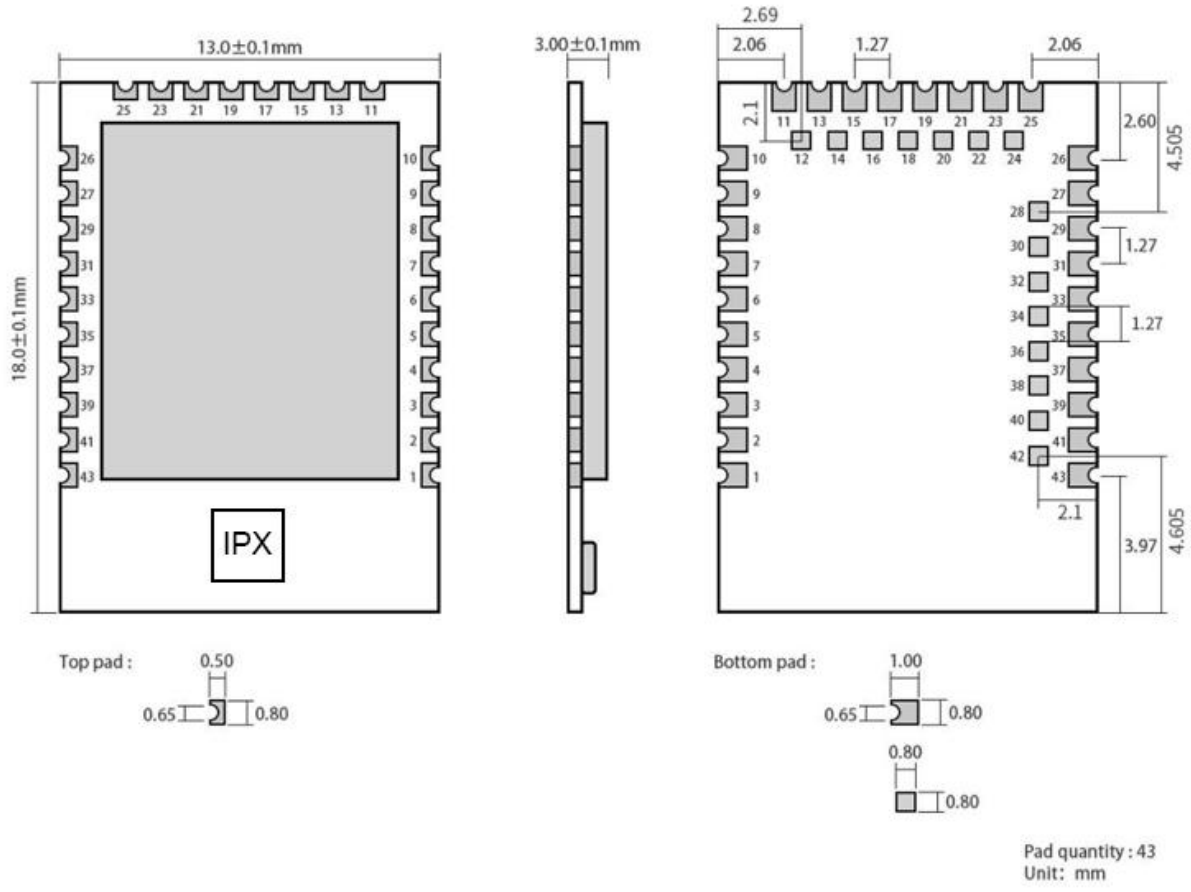
Main parameter		Performance			Remark
		Min	Type	Max	
Operating voltage（V）		1.7	3.3	5.5	≥3.3 V ensures output power
Communication level（V）			3.3		For 5V TTL, it may be at risk of burning down
Operating temperature（℃）		-40	-	+85	Industrial grade
Operating frequency（MHz）		2360	-	2500	Support ISM band
TX current（mA）	TX only run current (DC/DC, 3 V) PRF = +8 dBm		17.05		mA
	TX only run current (DC/DC, 3 V) PRF = +4 dBm		12.68		mA
	TX only run current (DC/DC, 5 V, REG0 out = 3.3 V)PRF = 0 dBm		7.25		mA
	TX only run current (DC/DC, 3 V)PRF = 0 dBm		7.63		mA
	TX only run current (DC/DC, 3 V) PRF = +8 dBm		17.05		mA
RX current（mA）	RX only run current (DC/DC, 3 V) 1 Mbps / 1 Mbps BLE		7.71		mA
	RX only run current (DC/DC, 3 V) 2 Mbps / 2 Mbps BLE		8.27		mA
TX power（dBm）		7	8	9	dBm
Receiving sensitivity（dBm）		-95dBm @ BLE 1Mbps			dBm

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Main parameter	Description	Remark
Reference distance	120m	Test condition：clear and open area,antenna height: 2.5m，air data rate: 1Mbps
Crystal Oscillator	32MHz/32.768KHz	32.768KHz crystal needs external connection
Protocol	BLE5.1/BT MESH	802.15.4, Thread, Zigbee and proprietary 2.4 GHz protocols
Package	SMD	-
Interface	1.27mm	Stamp hole
IC	nRF52833-QIAA/AQFN73	-
FLASH	512KB	-
RAM	128KB	-
Core	ARM® Cortex ® -M4	-
Size	13*18mm	-
Antenna	IPEX	50 ohm impedance

3 Size and pin definition



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Pin No.	Item	Corresponding,chip pin item	Direction	Description
1	NC	B19	-	See details about nrf52833 datasheet on Nordic
2	P1.10	A20	Common I/O	Low frequency I0, standard drive
3	P0.03	B13	Common I/O	Analog input 1, low frequency I/O, standard drive.
4	AI4	B11	Common I/O	Analog input 4
5	GND	-	-	Single ground line , connect to the power reference ground.
6	P1.13	A16	Common I/O	Low frequency I0, standard drive
7	AI0	A12	Common I/O	Analog input 0, low frequency I/O, standard drive.
8	AI5	A10	Common I/O	Analog input 5, low frequency I/O, standard drive.
9	AI7	A8	Common I/O	Analog input 7, low frequency I/O, standard drive.
10	AI6	B9	Common I/O	Analog input 6, low frequency I/O, standard drive.
11	XL1	D2	Common I/O	Connect to 32.768 kHz crystal
12	P0.26	G1	Common I/O	See details about nrf52833 datasheet on Nordic website
13	XL2	F2	Common I/O	Connect to 32.768 kHz crystal
14	P0.06	L1	Common I/O	See details about nrf52833 datasheet on Nordic website
15	AI3	K2	Common I/O	Analog input 3
16	P0.08	N1	Common I/O	See details about nrf52833 datasheet on Nordic website
17	P1.09	R1	Common I/O	See details about nrf52833 datasheet on Nordic website
18	AI2	J1	Common I/O	Analog input 2
19	VCC	-	-	Power supply
20	P12	U1	Common I/O	See details about nrf52833 datasheet on Nordic website
21	GND	-	-	Ground line, connect to the power reference ground
22	P0.07	M2	Common I/O	See details about nrf52833 datasheet on Nordic website
23	VDH	VDDH	-	High voltage power supply
24	GND	-	-	Ground line, connect to the power reference ground
25	DCH	DCCH	-	DC/DC converter output
26	RST	P0.18/RESET	Common I/O	QSPI/CSN/external reset
27	VBS	VBUS	-	USB power supply, 5W input, used to USB3.3V voltage regulator
28	P15	AD10	Common I/O	See details about nrf52833 datasheet on Nordic website
29	D-	D-	-	USB D-
30	P17	AD12	Common I/O	See details about nrf52833 datasheet on Nordic website
31	D+	D+	-	USB D+

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32	P0.20	AD16	Common I/O	See details about nrf52833 datasheet on Nordic website
33	P0.13	AD8	Common I/O	See details about nrf52833 datasheet on Nordic website
34	P0.22	AD18	Common I/O	QSPI
35	P0.24	AD20	Common I/O	-
36	P1.00	AD22	Common I/O	See details about nrf52833 datasheet on Nordic website
37	SWD	SWDIO	-	Serial debug programming port clock
38	P1.02	P1.02	Common I/O	See details about nrf52833 datasheet on Nordic website
39	SWC	AC24	-	Serial debug programming port clock
40	P1.04	U24	Common I/O	Low frequency I/O, standard drive
41	NF1	L24	Common I/O	NFC input
42	P1.06	R24	Common I/O	Low frequency I/O, standard drive
43	NF2	J24	Common I/O	NFC input

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4 Development and Application

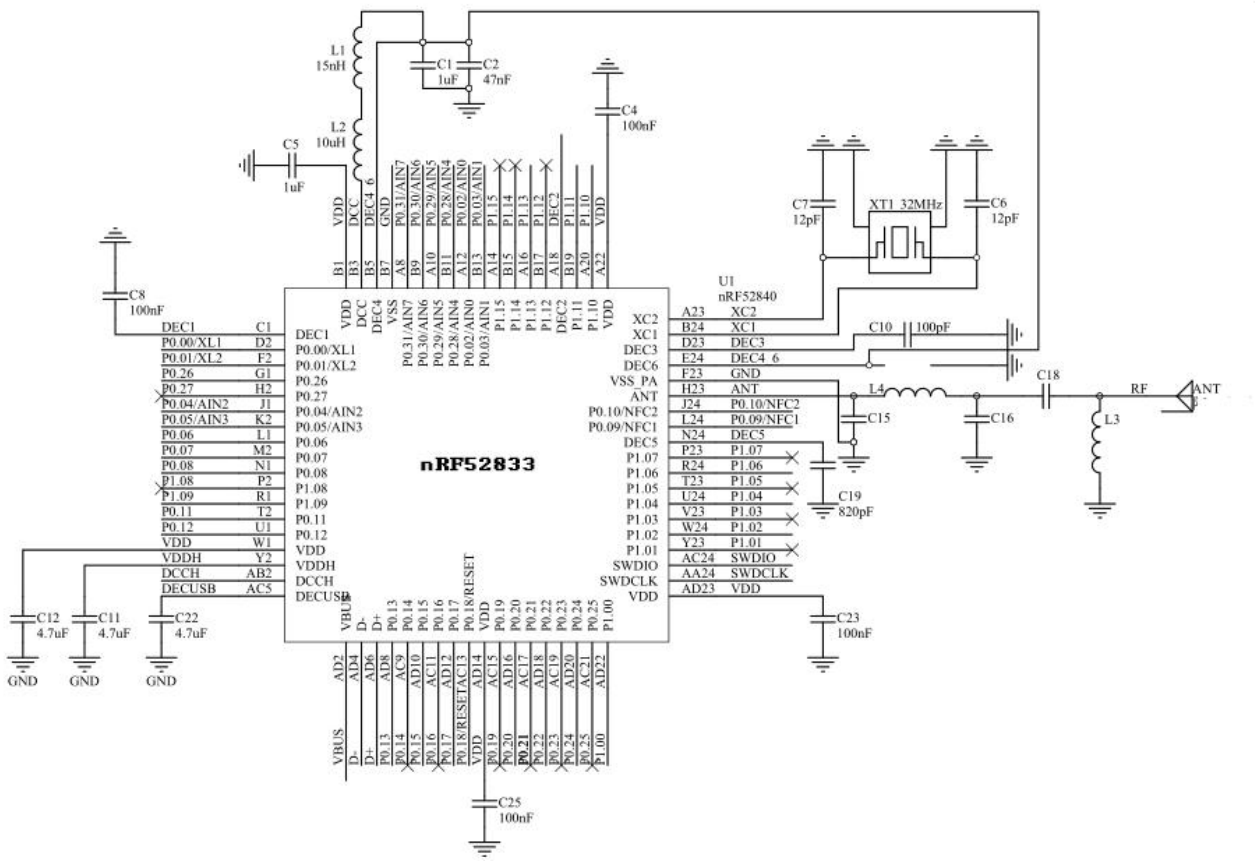
No.	Item	Notes
1	Burn Firmware	1.The module is embedded with ARM MCU. For program downloading, please use the J-LINK downloader.Any other serial port or JTAG、ISP、 ICP are unavailable to download. 2.The burn firmware needs to be completed in two parts. Since the protocol stack provided by NORDIC is not loaded in the program, in the second development, you need to use the official burning tool nRFgo studio to burn the protocol stack, and then use nRFgo studio to bum the hex of the application code; you can also use the official burning tool nRF go studio to burn the protocol stack, and then download it with IAR or KEIL. Website of tool download:https://www.nordicsemi.com/Products/nRF52833 
2	Testing Board	Testing board is not available at present.

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5 Basic operation

5.1 Hardware design and circuit schematic diagram



- It is recommended to use a DC stabilized power supply. The power supply ripple factor 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, reverse connection may cause permanent damage to the module;
- 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. Voltage can 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 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;
- Bottom Layer；
- Bottom Layer High-frequency digital routing, high-frequency analog routing, and power routing 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(well grounded), it must be close to the digital

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part of the module and routed in the Bottom Layer;

- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over 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 (high-frequency digital, high-frequency analog, power traces) around the module that 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 necessary, appropriate isolation and shielding can be done;
- 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 such as TTL protocol at 2.4GHz , for example: USB3.0;
- The mounting structure of antenna 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;
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

6 FAQ

6.1 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);
- The power supply low voltage under room temperature is lower than recommended value, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

6.2 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 source, the voltage cannot fluctuate too much;
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic susceptibility;
- Please ensure the humidity is within limited range, some parts are sensitive to humidity;
- Please avoid using modules under too high or too low temperature.

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6.3 BER(Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- The clock waveform on SPI is not standard, check whether there is interference on the SPI line, and the SPI bus line should not be too long;
- Poor power supply may cause messy code. Make sure that the power supply is reliable;
- The extension line and feeder quality are poor or too long, so the bit error rate is high.

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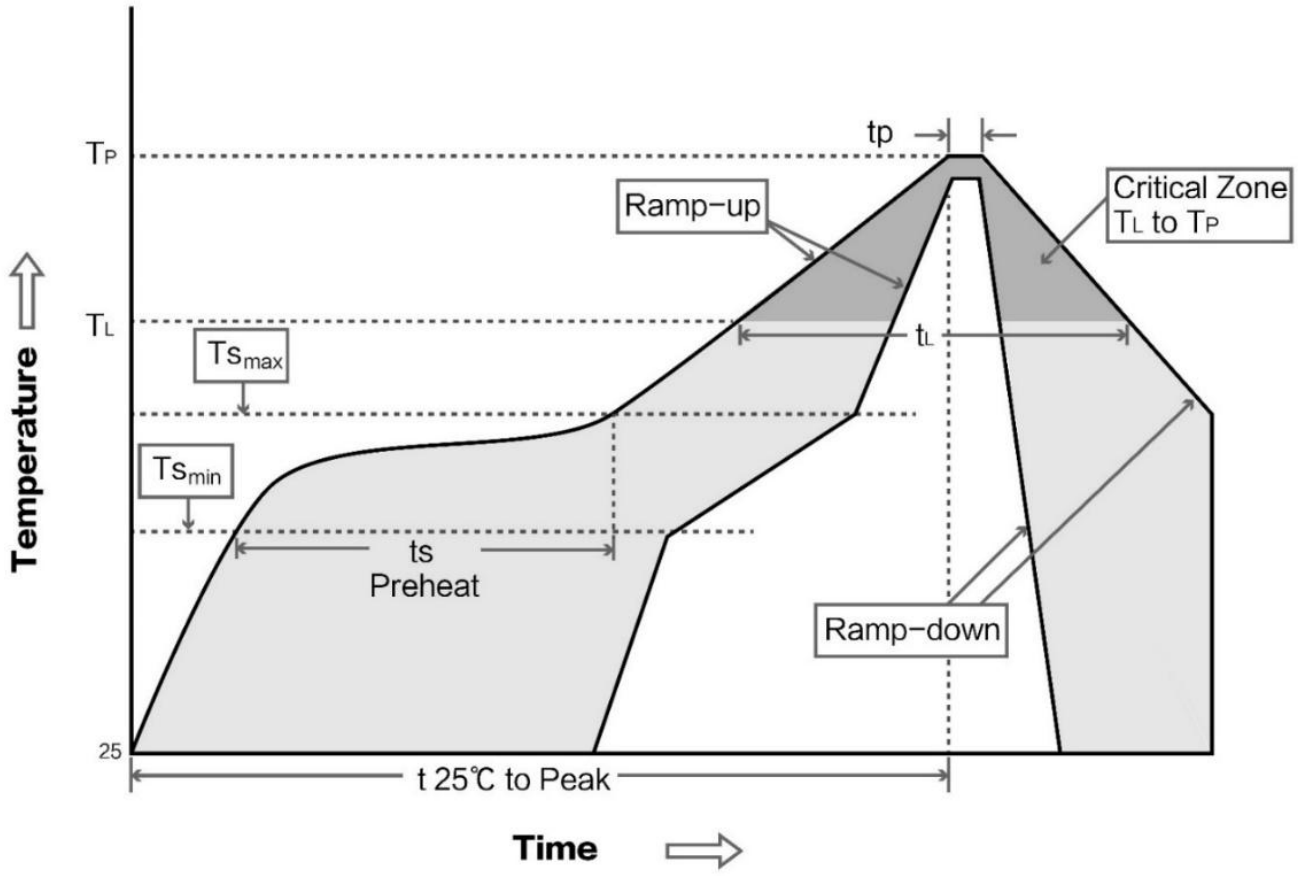
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7 Production guidance

7.1 Reflow soldering temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Min preheating temp.	100℃	150℃
Preheat temperature max (Tsmax)	Mx preheating temp.	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temp.	183℃	217℃
Time（tL）Maintained Above（TL）	Time below liquid phase line	60-90 sec	30-90 sec
Peak temperature（Tp）	Peak temp.	220-235℃	230-250℃
Aveage ramp-down rate（Tp to Tsmax）	Average ramp-down rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time to peak temperature for 25℃	6 minutes max	8 minutes max

7.2 Reflow soldering curve



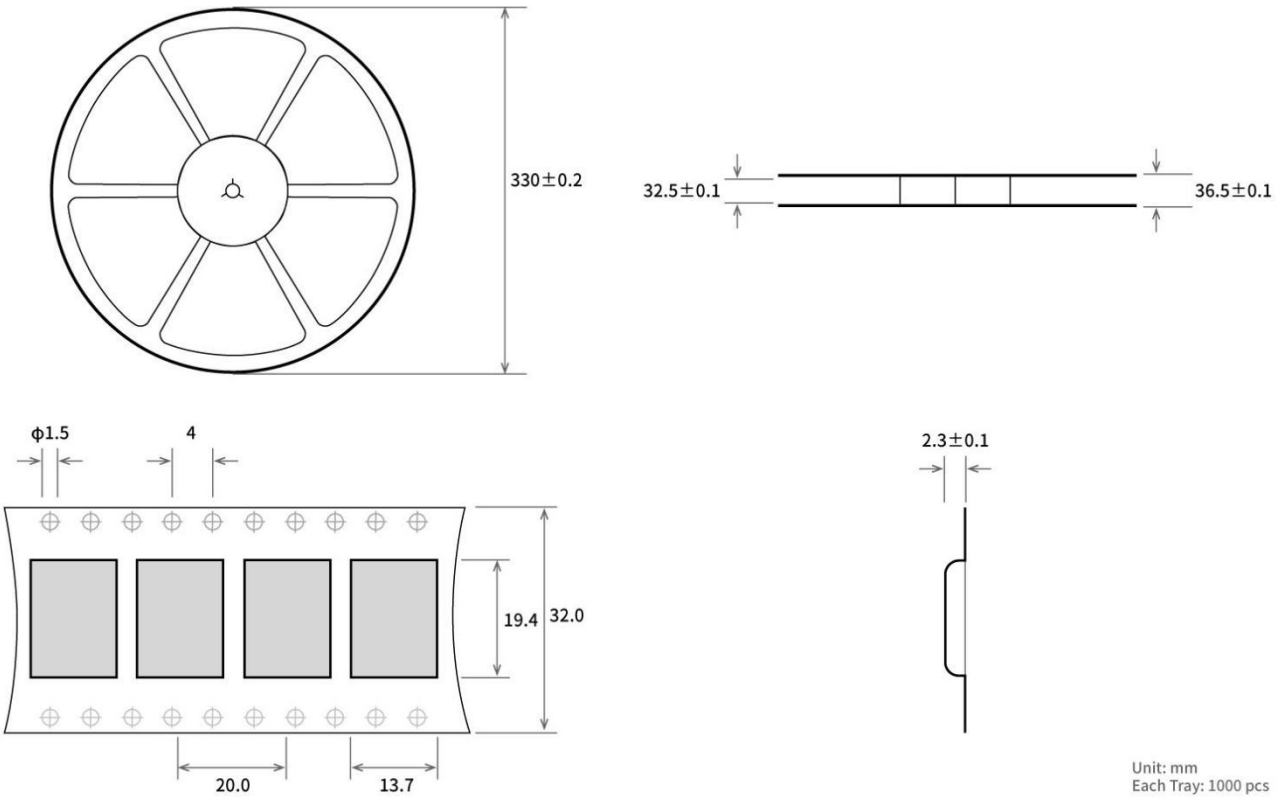
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8 E73 series

Model No.	IC	Frequency Hz	Tx power dBm	Protocol BLE	Size mm	Package	Antenna
E73-2G4M04S1A	nRF52810	2.4G	4	4.2/5.0	17.5*28.7	SMD	PCB/IPEX
E73-2G4M04S1B	nRF52832	2.4G	4	4.2/5.0	17.5*28.7	SMD	PCB/IPEX
E73-2G4M08S1C	nRF52840	2.4G	8	4.2/5.0	13*18	SMD	Ceramic antenna
E73-2G4M04S1D	nRF51822	2.4G	4	4.2	17.5*28.7	SMD	PCB/IPEX
E73-2G4M04S1AX	nRF52810	2.4G	4	4.2/5.0	17.5*23.5	SMD	IPEX
E73-2G4M04S1BX	nRF52832	2.4G	4	4.2/5.0	17.5*23.5	SMD	IPEX

9 Bulk packing



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Revision history

Version	Date	Description	Issued by
1.0	2021-7-16	Initial version	Linson
1.1			
1.2	2023-08-07	error corrected	Bin
1.3	2023-10-07	error corrected	Bin
1.4	2024-06-25	error corrected	Bin

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