E73-2G4M08S1C User Manual

nRF52840 2.4GHz SMD Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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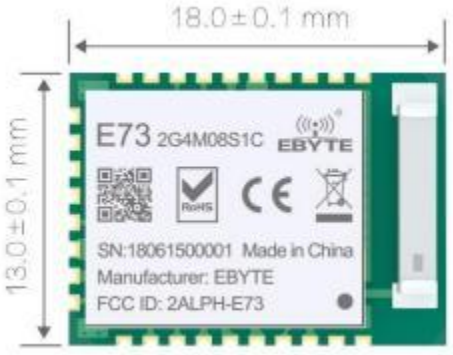
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1 Product overview

1. 1 Brief Introduction



E73-2G4M08S1C are wireless Bluetooth modules designed by Chengdu Ebyte which feature small size, low power consumption. It adopt the originally imported RFIC nRF52840 of NORDIC, supporting BLE 4.2 and BLE 5.0. The chip has high-performance ARM CORTEX-M4F kernel and other peripheral resources, such as UART, I2C, SPI, ADC, DMA, PWM etc. The module led out most IO Port of nRF52840 for multilateral development. Please see the pin definition for details.

E73-2G4M08S1C is hardware platform without firmware, so users need to conduct a secondary development. The characteristics of the nRF52840 chip can be found in the official Datasheet.

1.2 Features

- Small size: 13x18mm;
- Support BLE4.2 and BLE 5.0;
- The measured communication distance is up to 120m;
- Maximum transmission power of 6mW, software multi-level adjustable;
- Support the global license-free ISM 2.4GHz band;
- Built-in high performance low power ARM® and Cortex ® -M4 dual core processor;
- Rich resources, 1024KB FLASH, 256KB RAM;
- Support 1.7V~5.5Vpower supply, power supply over 3.3Vcan guarantee the best performance;
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time;
- Built-in ceramic antenna, no antenna is required for the built-in antenna.

1.3 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 （C）	-40	85	

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 （C）		-40	-	85	Industrial grade
Operating frequency （GHz）		2360	-	2500	Support ISM band
Transmitting current	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 = 0dBm	-	7.25	-	mA
	TX only run current (DC/DC, 3 V)P RF = 0 dBm	-	7.63	-	mA

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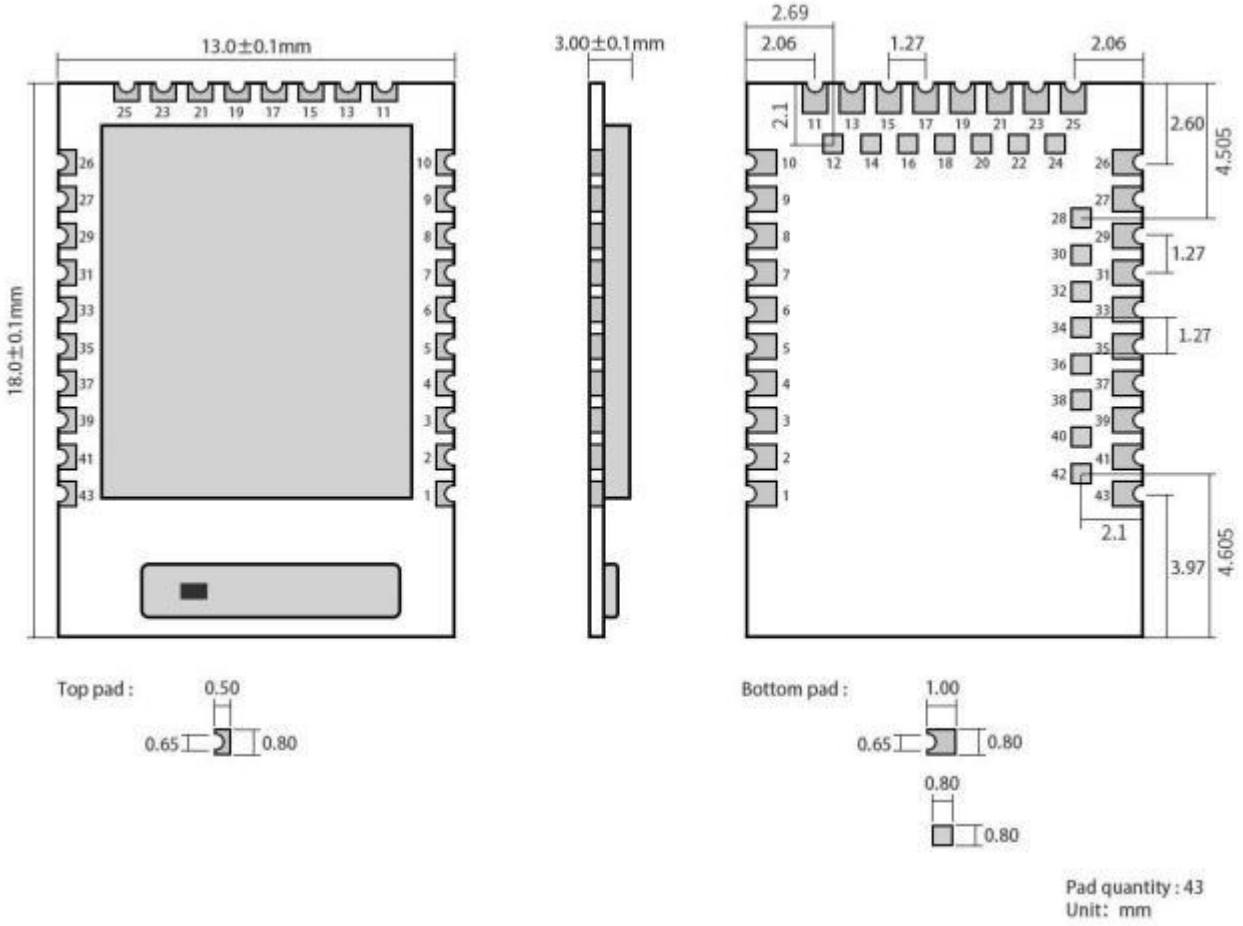
	TX only run current (DC/DC, 3 V) PRF = +8 dBm	-	17.05	-	mA
Receiving current	RX only run current (DC/DC, 3 V) 1 Mbps / 1 Mbps BLE	-	7.71	-	mA
	RX only run current (DC/DC, 3 V) 2 Mbps / 2 Mbps BLE	-	8.27	-	mA
Transmitting power		7	8	9	dBm
Receiving sensitivity		- 103 dBm@BLE 125kbps(long distance mode), -95 dBm@BLE 1M			

Main parameter	Description	Remark
Reference distance	120m	Clear and open area, antenna gain: 5dBi, antenna height: 2.5m ， air data rate: 1Mbps
Crystal Oscillator	32MHz/32.768KHz	**32.768KHz crystal oscillator needs external connection**
Protocol	BLE 4.2/5.0	
Package	SMD	
Interface	1.27mm	Stamp hole/ Ceramic antenna
IC	nRF52840-QIAAC0/ aQFN ™ 73	
FLASH	1024KB	
RAM	256KB	
Core	ARM® Cortex ® -M4	
Size	13.0 * 18.0 mm	
Antenna	ceramic antenna	50 ohm impedance

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3 Size and pin definition



No.	Pin item	Corresponding chip pin item	Pin direction	Application
1	P1. 11	B19	Common I/O	See details about nrf52840 datasheet on Nordic website
2	P1. 10	A20	Common I/O	Low frequency I/O, 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 I/O, 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

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				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 nrf52840 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 nrf52840 datasheet on Nordic website
15	AI3	K2	Common I/O	Analog input 3
16	P0.08	N1	Common I/O	See details about nrf52840 datasheet on Nordic website
17	P1.09	R1	Common I/O	See details about nrf52840 datasheet on Nordic website
18	AI2	J1	Common I/O	Analog input 2
19	VDD	-	-	Power supply
20	P0.12	U1	Common I/O	See details about nrf52840 datasheet on Nordic website
21	GND	-	-	ground line， connect to the power reference ground
22	P0.07	M2	Common I/O	See details about nrf52840 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， 5V input， used to USB3.3V voltage regulator
28	P15	AD10	Common I/O	See details about nrf52840 datasheet on Nordic website
29	D-	D-	-	USB D-
30	P17	AD12	Common I/O	See details about nrf52840 datasheet on Nordic website
31	D+	D+	-	USB D+
32	P0.20	AD16	Common I/O	See details about nrf52840 datasheet on Nordic website
33	P0. 13	AD8	Common I/O	See details about nrf52840 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 nrf52840 datasheet on Nordic website

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37	SWD	SWDIO	-	Serial debug programming port data
38	P1.02	P1.02	Common I/O	See details about nrf52840 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

4 Development and Application

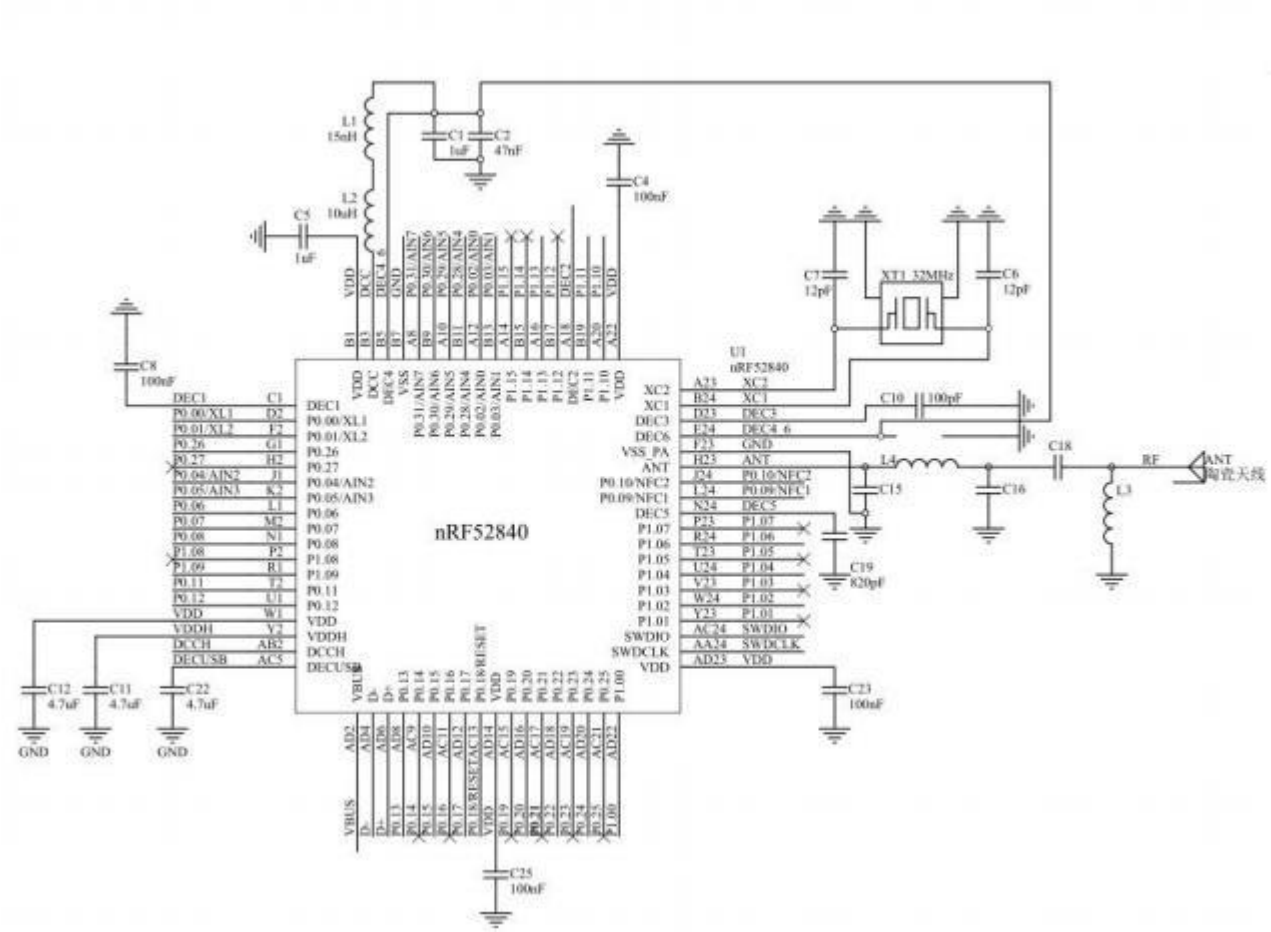
No.	Item	Notes
1	Burn Firmware	1.The module is embedded with ARM MCU. For program downloading, please use the J-LINK downloader. Any other serial port or JTAG 、 ISP 、 ICP are unavailable to download. 1.The burn firmware needs to be completed in two parts. Since the protocol stack provided by NORDIC is 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 burn. The hex of the application code; you can also use the official burning tool nRFgo studio to burn the protocol stack, and then download it with IAR or KEIL. Website of tool download: http://www.nordicsemi.com/eng/Products/Bluetooth-low-energy/nRF52832/(language)/eng-GB 
2	Testing Board	Testing board is not available.

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5 Basic operation

5. 1 Hardware design



- 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 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 part of the module and routed in the Bottom Layer;

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- 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;
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done;
- 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 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.

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6.3 BER(Bit Error Rate) is high

- Here are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- 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.

7 Production guidance

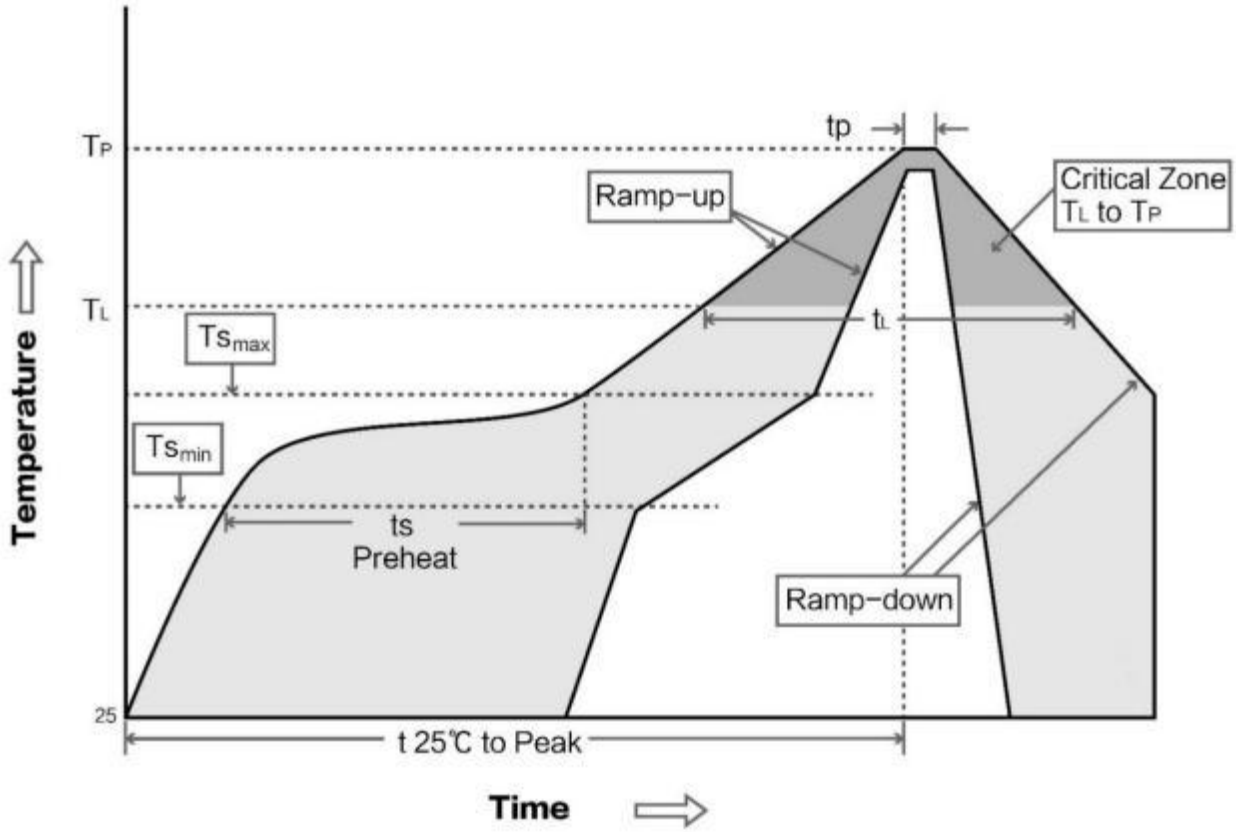
7. 1 Reflow soldering temperature

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

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7.2 Reflow soldering curve



8 E73 series

Model	IC	Frequency Hz	Tx power dBm	Distance km	Protocol	Package	Size mm	Antenna
E73-2G4M08S1C	nRF52840	2.4G	8	0.1	BLE 4.2/5.0	SMD	13.0 * 18.0	Ceramic antenna/ Stamp hole
E73-2G4M04S1A	nRF52810	2.4G	4	0.1	BLE 4.2/5.0	SMD	17.5 * 28.7	PCB/ IPX
E73-2G4M04S1D	nRF51822	2.4G	4	0.1	BLE 4.2	SMD	17.5 * 28.7	PCB/ IPX
E73-2G4M04S1B	nRF52832	2.4G	4	0.1	BLE 4.2/5.0	SMD	17.5 * 28.7	PCB/ IPX

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9 Antenna recommendation

9. 1 Recommendation

The antenna is an important role in the communication process. A good antenna can largely improve the communication system.

Model No.	Type	Connector	Gain dBi	Height	Cable	Feature
TX2400-NP-5010	Flexible Antenna	IPEX	2	50*10mm	-	FPC soft antenna
TX2400-XP-150	Sucker antenna	SMA-J	3.5	15cm	150cm	High Gain
TX2400-JK-20	Rubber antenna	SMA-J	3	200mm	-	Flexible& omnidirectional
TX2400-JK-11	Rubber antenna	SMA-J	2.5	110mm	-	Flexible& omnidirectional
TX2400-JZ-3	Rubber antenna	SMA-J	2	30mm	-	Short straight & omnidirectional

Revision history

Version	Date	Description	Issued by
1.00	2018/8/30	Initial version	huaa
1. 10	2018/9/28	Version split	huaa
1.40	2018/ 11/6	new version update	Huaa
1.5	2019/2/ 19	Content modification	Ray
1.7	2019/8/20	Contect updated	lyl
1.8	2019/ 11/06	Content modification	Ren
1.9	2020/03/30		Ren
2.0	2023/09/08	error corrected	Bin
2.1	2023/10/07	error corrected	Bin
2.4	2025/06/09	error corrected	Bin

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