E72-2G4M05S1F

CC2652RB Multifunctional SoC Wireless Module



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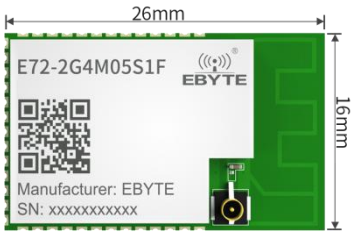
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1 Introduction

1.1 Brief Introduction



E72-2G4M05S1F is a self-developed, multi-protocol, 2.4G, SMD, wireless SoC module based on CC2652RB from TI. The transmit power is 5dBm. Built-in ARM microcontroller and high-performance wireless transceiver. With an integrated BAW (Bulk Acoustic Wave) resonator to generate a radio frequency carrier, so no external 48MHz crystal is required.

The module leads out all IO ports of the MCU. Comes with a powerful 48 MHz Arm ® Cortex ® -M4F processor, an internal integrated power amplifier, powerful peripherals and up to 26 GPIOs, enabling multi-directional development.CC2652RB has the potential to become the best choice of wireless microcontroller for smart home, IoT transformation, and industrial automation in the future.

Since this module is a SoC module, it needs to be programmed by user before it can be used.

1.2 Features

- Powerful 48 MHz Arm ® Cortex ® -M4F processor processor;
- Rich resources, 352KB FLASH, 80KB RAM;
- 1.8-3.8V power supply, over 3.3 V can guarantee the best performance;
- Transmit power 5dBm;
- Under ideal conditions, the communication distance can reach 350m with the external antenna;
- Module contains an external 32.768K low speed crystal oscillator;
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time;
- 2 Pin cJTAG and JTAG debugging;
- Support OTA;
- Wireless protocol: Thread, Zigbee ® , Bluetooth ® 5 Low Energy;
- Receiving sensitivity: –100 dBm for 802.15.4 (2.4 GHz), -102 dBm for Bluetooth 5 Low Energy Coded;

1.3 Application

- Building automation solutions
  - -Building Security System - Motion Detector, electronic intelligent door lock, door and window sensor，Garage door system, gateway
  - -HVAC - Thermostat, wireless, sensor, HVAC system controller, gateway
  - -Fire safety system - smoke and temperature detectors, FACP
  - -Video surveillance - IP webcam
  - -Elevators and escalators - Elevator mains， Elevator and escalator control panel;
- Grid infrastructure

  -Smart meter - Water meter, gas meter, electricity meter and heat cost allocator

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-Grid communication - Wireless communication, remote sensor applications

- Industrial transport - Asset tracking
- Plant automation and control
- Medical
- Electronic Point of Sale (EPOS) - Electronic shelves
- Label (ESL)

2 Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
Power supply（V）	0	3.8	Voltage over 3.8V 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	Type	Max	
Operating voltage（V）		1.8	3.3	3.8	≥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）		2400	-	2480	
Power Consumption	TX current（mA）		11		Instantaneous power consumption @5dBm
	RX current（mA）		8.4		
Max TX power（dBm）		4.5	5	5.5	
Receiving sensitivity（dBm）			-102		Bluetooth 5 Low Energy Coded

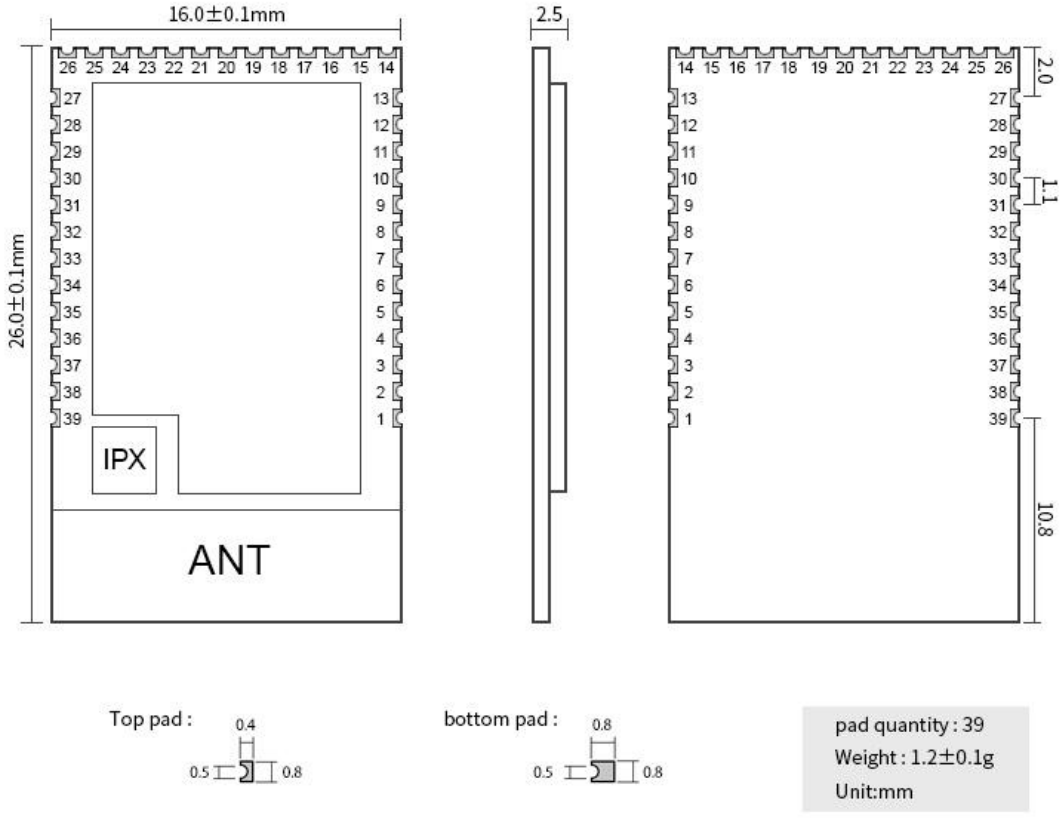
Main parameter	Description	Remark
Distance	350m	Test condition：clear and open area, antenna gain: 5dBi，antenna height: 2.5m，air data rate: 150 kbps
Distance	100m	PCB antenna，air data rate 150kbps
Crystal frequency	48MHz/32.768k	48MHz/low speed 32.768k
Protocol	BLE 5.0	

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	Zigbee Thread	
Package	SMD	
Interface	1.1mm	Stamp hole
IC	CC2652RB1FRGZ	
FLASH	352KB	
RAM	80KB	
Core	Arm ® Cortex ® -M4F	
Size	26*16mm	
Antenna	PCB / IPEX	50Ω impedance

3 Size and pin definition



No.	Item	Direction	Description
1	DIO_3	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
2	DIO_4	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
3	DIO_5	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
4	DIO_6	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)

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5	DIO_7	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
6	DIO_8	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
7	DIO_12	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
8	DIO_13	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
9	DIO_14	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
10	DIO_9	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
11	DIO_10	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
12	DIO_11	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
13	DIO_15	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
14	JTAG_TMSC	Input/Output	JTAG_TMSC
15	JTAG_TCKC	Input	JTAG_TCKC
16	DIO_16	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
17	DIO_17	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
18	DIO_18	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
19	DIO_19	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
20	DIO_20	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
21	DIO_21	Input/Output	Ground, connected to the power reference ground
22	GND	-	Ground, connected to the power reference ground
23	VCC	-	Power supply positive, 1.8V - 3.6V
24	DIO_22	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
25	RESET_N	Input	Reset, active low (see CC2652RB1FRGZ manual for details)
26	DIO_23	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
27	DIO_24	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
28	DIO_25	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
29	DIO_26	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
30	DIO_27	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
31	DIO_28	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
32	DIO_29	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
33	DIO_30	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
34	X48M-N	-	48-MHz crystal oscillator pin 1 (see CC2652RB1FRGZ manual for details)
35	X48M-P	-	48-MHz crystal oscillator pin 2 (see CC2652RB1FRGZ manual for details)
36	DIO_2	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
37	DIO_1	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)
38	DIO_0	Input/Output	Configurable general IO port (see CC2652RB1FRGZ manual for details)

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39	GND	-	Ground, connected to the power reference ground

4 Development

No.	Keyword	Notes
1	Burnprocess	SOC module with GPIO port. The program download uses XDS100 special downloader
2	Test plate	No matched test plate provide now

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;
- 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;
- 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

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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.

5.2 Programming

- The core of this module is CC2630, the user can operate according to the CC2630 chip manual (see CC2630 manual for details).
- Note: the chip used by the module DC/DC.
- Burn program: SOC module, with GPIO port, program download using XDS100 dedicated downloader.
- Program download interface definition:

E72 PIN	XDS100 PORT
JTAG_TMSC	TMS
JTAG_TCKC	TCK
RESET_N	SRSTN
GND	DGND
VCC	TVD



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;

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- 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 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 source, ensure that it is within the recommended supply voltage, voltage higher than the maximum value, will permanent damage 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.

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;
- 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

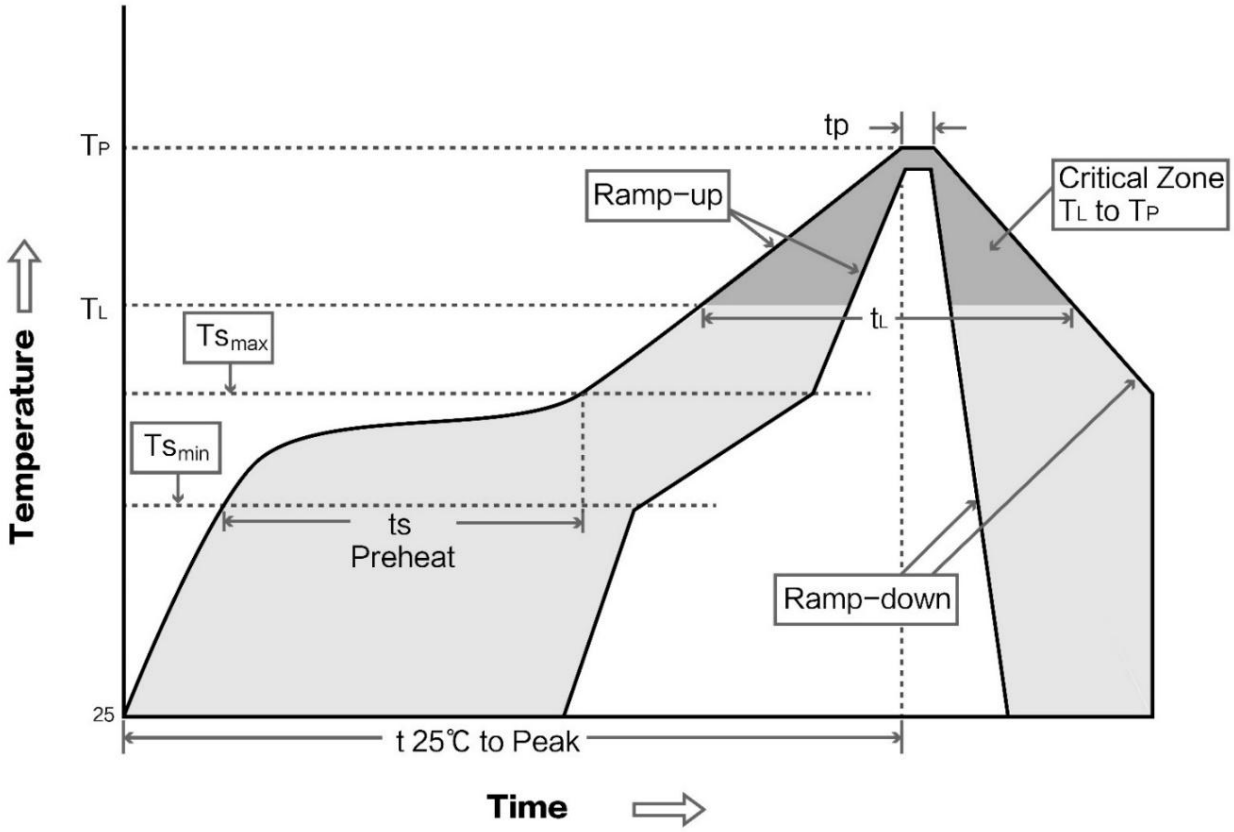
7.1 Reflow soldering temperature

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

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7.2 Reflow soldering curve



8 E72 series

Model No.	IC	Frequency	Tx power	Distance	Size	Protocol	Communication interface
		Hz	dBm	km	mm		
E72-2G4M05S1A	CC2630	2.4G	5	0.5	17.5*28.7	ZigBee	I/O
E72-2G4M23S1A	CC2630	2.4G	23	1.5	17.5*33.5	ZigBee	I/O
E72-2G4M05S1B	CC2640	2.4G	5	0.5	17.5*28.7	BLE 4.2	I/O
E72-2G4M02S2B	CC2640	2.4G	2	0.3	14*23	BLE 4.2	TTL
E72-2G4M20S1E	CC2652P	2.4G	20	0.7	28.7*17.5mm	Multi-protocol	TTL

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9 Antenna recommendation

9.1 Recommendation

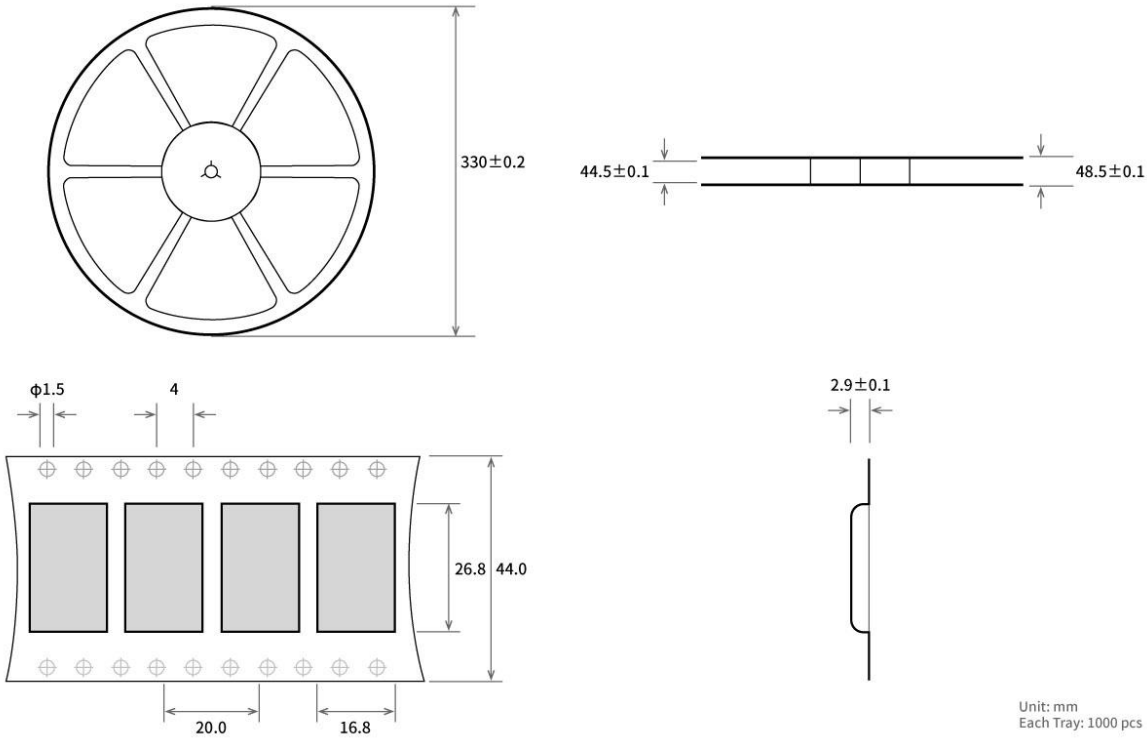
The antenna is an important role in the communication process. A good antenna can largely improve the communication system. Therefore, we recommend some antennas for wireless modules with excellent performance and reasonable price.

Model No.	Type	Frequency	Gain	Size	Cable	Interface	Features
		Hz	dBi	mm	cm		
TX2400-NP-5010	Flexible antenna	2.4G	2.0	10x50	-	IPEX	FPC soft antenna
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 bending，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 performance

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10 Bulk packing



Revision history

Ver.	Date	Describe	Staff
1.0	2020-12-1	Initial version	Linson

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