E72-2G4M20S1E User Manual

CC2652P Multifunctional SoC wireless module

Chengdu Ebyte Electronic Technology Co.,Ltd.

Content

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1. General Introduction

1.1 Brief Introduction

E72-2G4M20S1E is a multi-protocol 2.4GHz SMD wireless system-on-chip module independently developed by TI based on CC2652P produced by TI. The transmit power is 20dBm. It integrates an ARM microcontroller and high-performance wireless transceiver. It uses industrial-grade 48MHz high-precision low-temperature. Floating crystal oscillator.

The module leads all the IO ports of the single-chip microcomputer. The chip comes with a powerful 48 MHz Arm ® Cortex ® -M4F processor, an internal integrated power amplifier, powerful peripherals and up to 26 GPIOs, which can be developed in multiple directions. CC2652P is a wireless microcontroller with great potential to become the future smart furniture, Internet of Things transformation, and industrial automation.。

Because this module is a pure hardware SoC module, users need to program it before use.

1.2 Features

- Built-in high-performance low-power Arm ® Cortex ® -M4F processor, clock speed up to 48MHz;
- Rich resources,352KB FLASH，80KB RAM;
- Support 1.9 ~ 3.8V power supply, power supply greater than 3.3V can ensure the best performance;
- Transmitting power 20dBm;
- Under ideal conditions, the communication distance can reach 700m;
- The module contains 48M high-speed crystal/32.768k low-speed crystal;
- Industry standard design, support long-term use at -40～+85℃;
- 2 pin cJTAG and JTAG debugging
- Support wireless upgrade (OTA)
- Wireless protocol:Thread, Zigbee ® , Bluetooth ® 5 Low Energy,
  IEEE 802.15.4g, IPv6-enabled smart objects
  (6LoWPAN), Wi-SUN ® , proprietary systems,
  SimpleLink™ TI 15.4-Stack (2.4 GHz),
  Dynamic Multiprotocol Manager (DMM) driver.
- Receive sensitivity:–100 dBm for 802.15.4 (2.4 GHz),–105 dBm for Bluetooth 125-kbps (LE Coded PHY)

1.3 Application

- Building automation

  -Building security system-Motion detector, electronic intelligent door lock, door and window sensor, garage door system, gateway

  -HVAC-thermostat, wireless environment, sensors, HVAC system controller, gateway

  -Fire safety system-Smoke and temperature detector, fire alarm control panel (FACP)

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-Video surveillance- IP network camera

-Elevator and escalator-Elevator main, control panel of elevator and escalator;

- Grid infrastructure

  -Smart electric meters-Water meters, gas meters, electric meters and heat cost apportioners

  -Grid communication-Wireless communication. Remote sensor application

  -Other Alternative Energy-Energy Collection
- Industrial Transportation-Asset Tracking
- Factory automation and control
- Medicine
- Electronic Point of Sale (EPOS)-Electronic Shelf
- Label (ESL)

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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）		1.9	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 Consum-ption	TX current（mA）	-	106	-	Instantaneous power consumption @20dBm
	RX current（mA）	-	7.3	-	-
Max TX power（dBm）		19	19.5	20	-
Receiving sensitivity（dBm）		-	-105	-	Bluetooth 125-kbps (LE Coded PHY)

Main parameter	Description	Remark
Reference distance	700m	Test condition：clear and open area, antenna gain: 5dBi， antenna height: 2 m，air data rate: 150 kbps
Crystal frequency	48MHz/32.768k	High speed 48MHz/low speed 32.768k
Protocol	Bluetooth 5 Low Energy Zigbee Thread	-
Package	SMD	-
Interface	1.27mm	Stamp hole
IC	CC2652P1FRGZ	-
FLASH	352KB	-
RAM	80KB	-
Core	Arm ® Cortex ® -M4F	-
Size	28.7*17.5mm	-
Antenna	PCB on-board antenna	50 ohm impedance
Weight	1.9±0.1g	-

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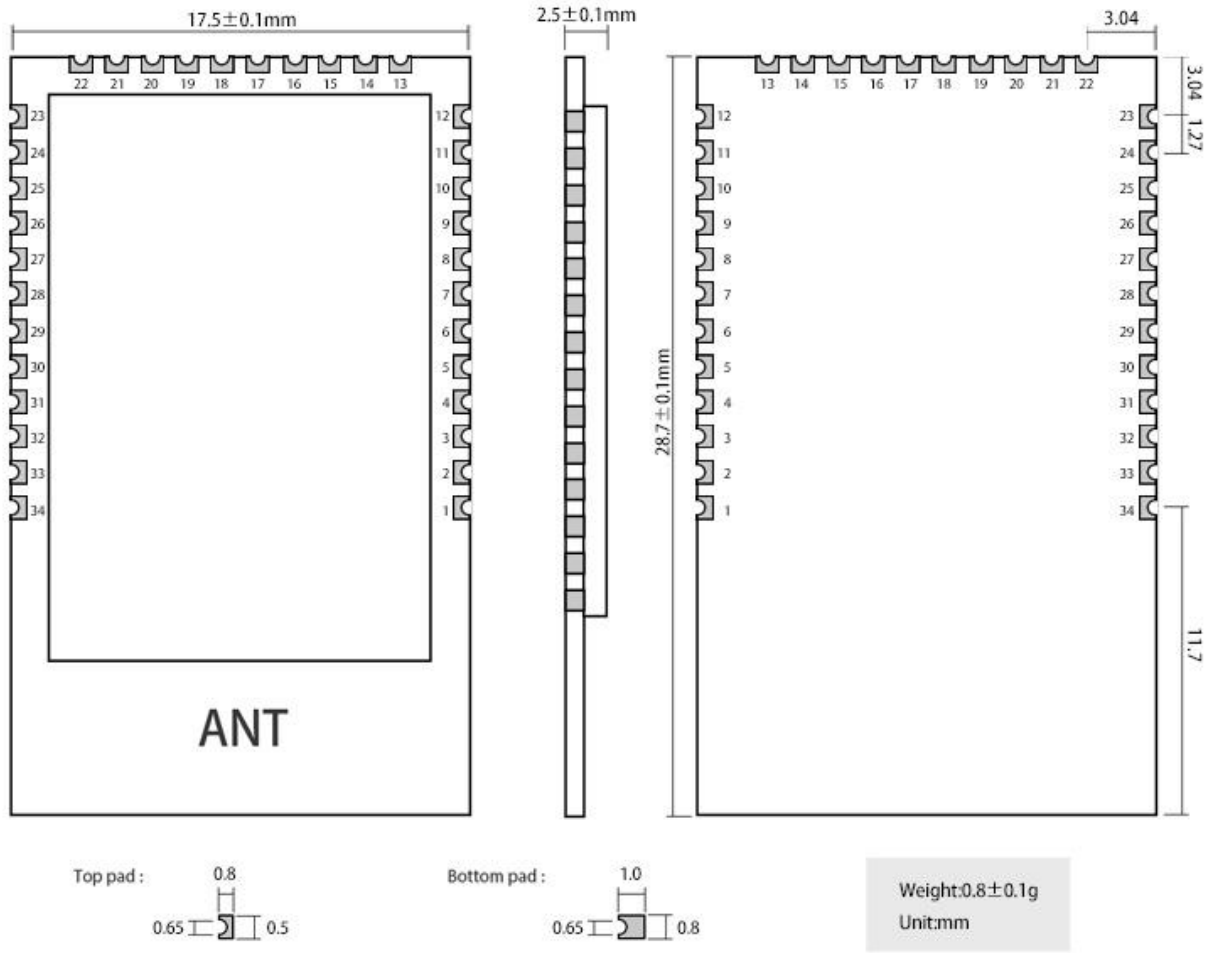
3. Size and Pin Definition



Module pin sequence number	Module pin name	Chip pin	Direction	Description
1	GND	-	-	Ground, connecting to power source referential ground
2	DIO_7	DIO_7	Input/Output	GPIO, high-drive capability(see CC2652P1FRGZ manual for details)
3	DIO_8	DIO_8	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
4	DIO_9	DIO_9	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
5	DIO_10	DIO_10	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
6	DIO_11	DIO_11	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
7	DIO_12	DIO_12	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
8	DIO_13	DIO_13	Input/Output	GPIO(see CC2652P1FRGZ manual for details)

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9	DIO_14	DIO_14	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
10	DIO_15	DIO_15	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
11	GND	-	-	Ground, connecting to power source referential ground
12	GND	-	-	Ground, connecting to power source referential ground
13	JTAG_TMSC	JTAG_TMSC	Input/Output	JTAG TMSC, high-drive capability
14	JTAG_TCKC	JTAG_TCKC	Input	JTAG_TCKC
15	DIO_16	DIO_16	Input/Output	GPIO, JTAG_TDO, high-drive capability(see CC2652P1FRGZ manual for details)
16	DIO_17	DIO_17	Input/Output	GPIO, JTAG_TDI, high-drive capability (see CC2652P1FRGZ manual for details)
17	DIO_18	DIO_18	Input/Output	GPIO (see CC2652P1FRGZ manual for details)
18	DIO_19	DIO_19	Input/Output	GPIO(see CC2652P1FRGZ manual for details)
19	GND	-	Input/Output	Ground, connecting to power source referential ground
20	VCC	-	-	Module power supply is positive reference voltage, voltage range 1.9 ~ 3.8V
21	DIO_20	DIO_20	Input/Output	GPIO (see CC2652P1FRGZ manual for details)
22	DIO_21	DIO_21	Input/Output	GPIO (see CC2652P1FRGZ manual for details)
23	GND	-	Input/Output	Ground, connecting to power source referential ground
24	RESET_N	RESET_N	Input	Reset pin, low level effective.
25	DIO_22	DIO_22	Input/Output	GPIO (see CC2652P1FRGZ manual for details)
26	DIO_23	DIO_23	Input/Output	GPIO, analog capability(see CC2652P1FRGZ manual for details)
27	DIO_24	DIO_24	Input/Output	GPIO, analog capability (see CC2652P1FRGZ manual for details)
28	DIO_25	DIO_25	Input/Output	GPIO, analog capability(see CC2652P1FRGZ manual for details)
29	DIO_26	DIO_26	Input/Output	GPIO, analog capability (see CC2652P1FRGZ manual for details)
30	DIO_27	DIO_27	Input/Output	GPIO, analog capability(see CC2652P1FRGZ manual for details)
31	DIO_28	DIO_28	Input/Output	GPIO, analog capability (see CC2652P1FRGZ manual for details)
32	DIO_29	DIO_29	Input/Output	GPIO, analog capability(see CC2652P1FRGZ manual for details)
33	DIO_30	DIO_30	Input/Output	GPIO, analog capability (see CC2652P1FRGZ manual for details)
34	GND	-	Input/Output	Ground, connecting to power source referential ground

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4. Development and use

No.	Key words	Remark
1	Burning program	The module is an SOC module, with its own GPIO port, and the program download uses the XDS100 special downloader.
2	Test board	Our company does not provide a supporting board 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 that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good

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- 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 Software writing

- The core of this module is CC2652P, and users can operate according to the CC2652P chip manual.
- Note: The chip used in the module is in DC/DC mode

  The module comes with our radio frequency switch, please operate strictly according to the truth table.

  Truth Table:

DIO_6	DIO_5	Transmit(TX)	Receive(RX)
Low	High	ON	OFF
High	Low	OFF	ON

- Burning program: The module is an SOC module and comes with a GPIO port. The program download uses the XDS100 special downloader.
- Program download interface definition:

E72 Pin	XDS100 Interface
JATG_TMSC	TMS
JTAG_TCKC	TCK
RESET_N	SRSTN
GND	DGND
VCC	TVD

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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 source, ensure it is between the recommended supply voltage, voltage higher than the maximum will 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

- 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.

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7. Welding operation 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)	Max 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

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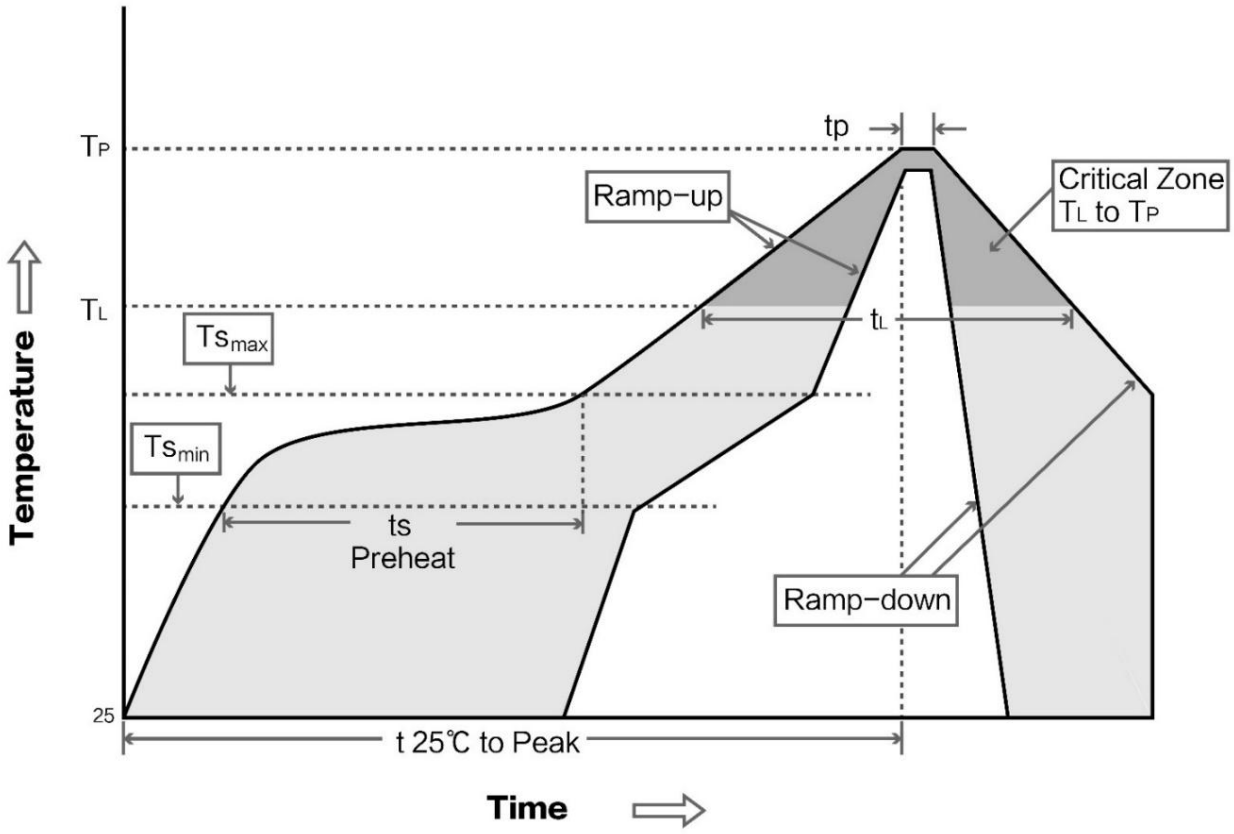
7.2 Reflow soldering curve



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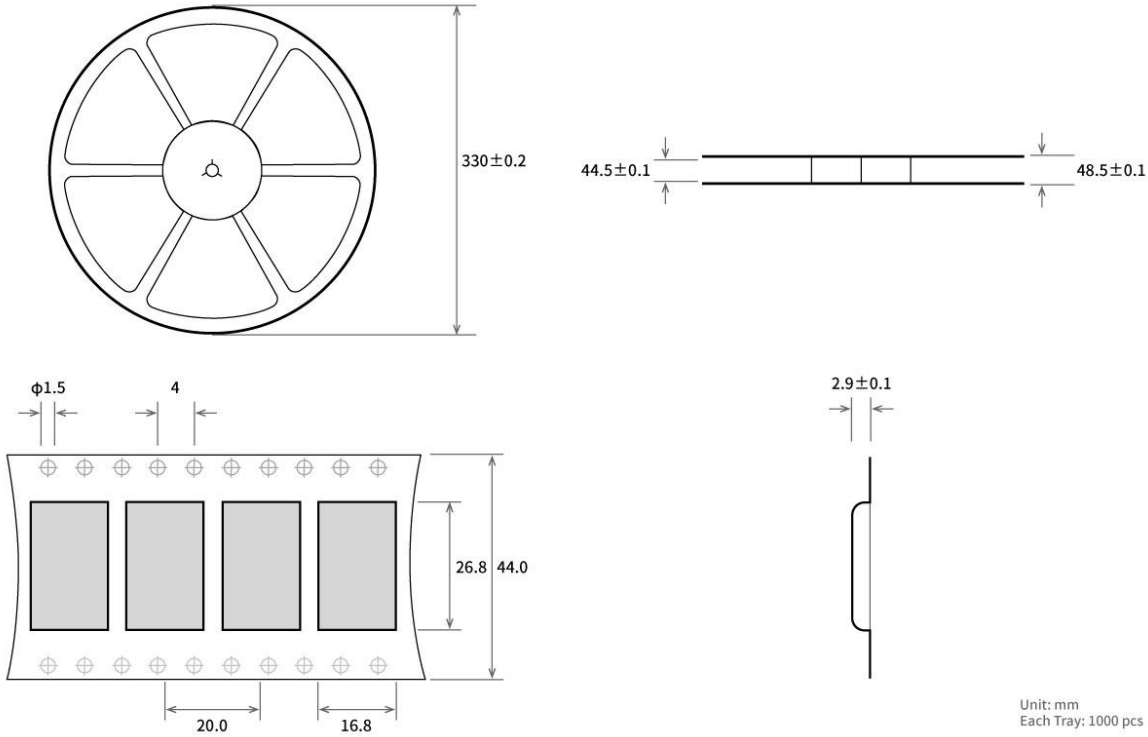
8. Bulk packaging



Revision history

Version	Date	Description	Issued by
1.0	2017-10-16	Initial version	huaa
1.1	2024-01-31	Content revision	Bin

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