E104-2G4U04A

User Manual

CC2540 USB Bluetooth wireless module



成都亿佰特电子科技有限公司
Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Introduction

1.1 Brief introduction



E104-2G4U04A is a small Bluetooth wireless module designed and manufactured by Chengdu Ebyte, USB type (pin spacing 1.27mm). This module has a high-performance PCB on-board antenna, using low power consumption Bluetooth (BLE) SOC solution.

The E104-2G4U04A uses the CC2540 RF chip from Texas Instruments (TI). The chip integrates the 8051 microcontroller and wireless transceiver, and supports the standard BLE4.0 protocol. The module leads all the IO ports of the microcontroller, and integrates the rich peripherals such as DMA\TIMERS\ADC\USART\ I2C\ WDT\ COMP for multi-faceted development.

1.2 Features

- The factory firmware supports the use of TI Packet Sniffer software for packet capture testing;
- The measured communication distance can reach 60m;
- Maximum transmission power of 12.5mW, software multi-level adjustable;
- Support the global license-free ISM 2.4 GHz band;
- Support air date rate of 250k~2Mbps;
- Support 2.0V~3.6V / USB power supply, power supply over 3.3 V can guarantee the best performance;
- Industrial class standard design, support -40 ~ 85 °C for working over a long time;
- Onboard PCB antenna, no need for external antenna.

1.3 Application

- Wearable devices;
- Home security alarm and remote keyless entry;
- Wireless alarm security system;
- Building automation solutions;
- Wireless industrial-grade remote control;
- Health care products;
- Advanced Meter Reading Architecture(AMI);

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2. Specification and parameter

2.1 Limit parameter

Main parameter	Performance		Remark
	Min	Max	
USB power supply (V)	0	5.5	Voltage over 5.5V will cause permanent damage to module
On-board power supply (V)	0	3.6	Voltage over 3.6V 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	

2.2 Operating parameter

Main parameter		Performance			Remark
		Min	Type	Max	
Operating voltage (V)		2.7	5	5.5	USB power supply
Operating voltage (V)		2.0	3.3	3.6	On-board power supply
Communication level (V)			3.3		For 5V TTL, it may be at risk of burning down
Operating temperature (℃)		-40	-	85	Industrial class
Operating frequency (MHz)		2.402	-	2.480	Support ISM band
Power Consump-tion	TX current (mA)		31.5		
	RX current (mA)		22		
	Sleep current (μA)				
Max TX power (dBm)		3.6	4.0	4.5	
Receiving sensitivity (dBm)		-	-94	-	Air data rate is 1MHz

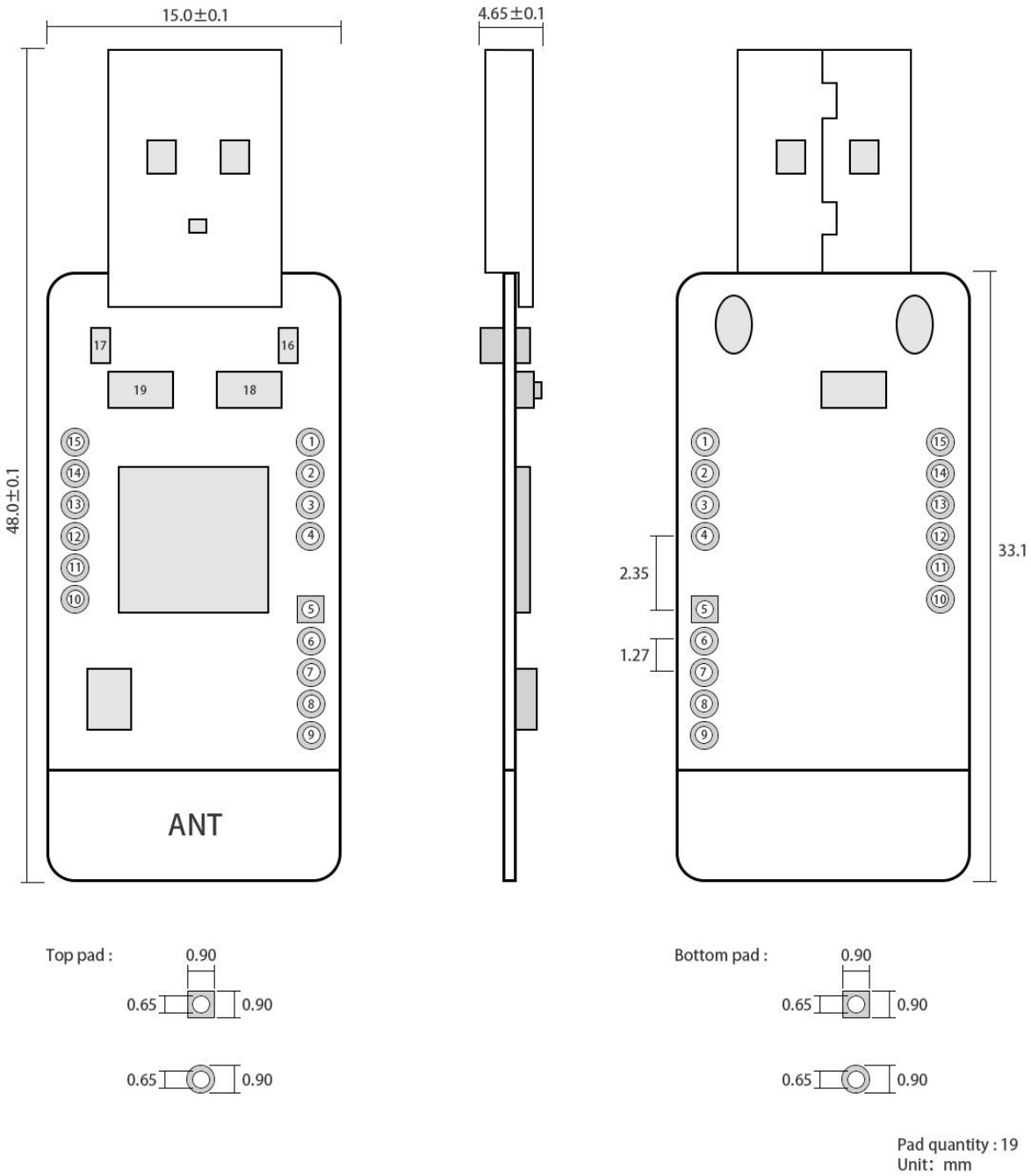
Main parameter	Description	Remark
Reference distance	60 m	Test condition：clear and open area, antenna height: 2.5m, air data rate: 250kbps
Protocol	BLE 4.0	
Power supply	USB	
Interface size	1.27 mm	
IC	CC2540F256RHAR/QFN40	
FLASH	256 KB	

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SRAM	8 KB	
Core	8051 mcu	
Size	59* 18mm	With case

3. Size and pin definition



Pin No.	Item	Direction	Description
1	P1.4	Input/Output	General purpose IO port (see CC2540 datasheet for details)
2	P1.5	Input/Output	General purpose IO port (see CC2540 datasheet for details)

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3	P1.6	Input/Output	General purpose IO port (see CC2540 datasheet for details)
4	P1.7	Input/Output	General purpose IO port (see CC2540 datasheet for details)
5	VCC	Power supply	2.0V-3.6V (please avoid power supply with USB)
6	DD	Input/Output	Program download port P2_1 (see CC2540 chip datasheet for details)
7	DC	Input/Output	Program download port P2_2 (see CC2540 chip datasheet for details)
8	RESET	Input	Reset (there is a reset circuit inside the product)
9	GND	Power supply	Ground
10	P0.2	Input/Output	General purpose IO port (see CC2540 datasheet for details)
11	P0.3	Input/Output	General purpose IO port (see CC2540 datasheet for details)
12	P0.4	Input/Output	General purpose IO port (see CC2540 datasheet for details)
13	P0.5	Input/Output	General purpose IO port (see CC2540 datasheet for details)
14	P0.6	Input/Output	General purpose IO port (see CC2540 datasheet for details)
15	P0.7	Input/Output	General purpose IO port (see CC2540 datasheet for details)
16	LED	Signal indication	Connect to P1.1 of CC2540, high level will drive to light up
17	LED	Signal indication	Connect to P0.0 of CC2540, low level will drive to light up
18	Button	Button	Connect to P1.3 of CC2540, low level active
19	Button	Button	Connect to P1.2 of CC2540, low level active
Please refer to the PCB package file for detailed dimensions.			

4. Notes

No.	Item	Notes
1	Static electricity	High-frequency analog devices are electrostatically sensitive, so avoid human touch on the electronic components on the module. (Our production process is carried out in accordance with the official anti-static standards of the IC manufacturers)
2	Soldering	When soldering, the soldering iron needs to be well grounded. When mass production, the staff should wear a grounded wired electrostatic wristband.
3	Power supply	The quality of the power supply has a great impact on the performance of the module. Please ensure that the power supply of the module has a small ripple and avoid frequent and large jitter of the power supply. A π-type filter (ceramic capacitor / tantalum capacitor + inductor) is recommended.
4	Ground wire	The module ground wire uses a single-point grounding method. It is recommended to use a 0 ohm resistor or a 10 mH inductor, and it should be separated from other parts of the circuit reference ground.
5	Antenna	The antenna mounting structure 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, a good antenna extension cable can be used to extend the antenna to the outside of the case. The antenna should not be mounted inside the metal case, which will result in a shorter transmission distance.

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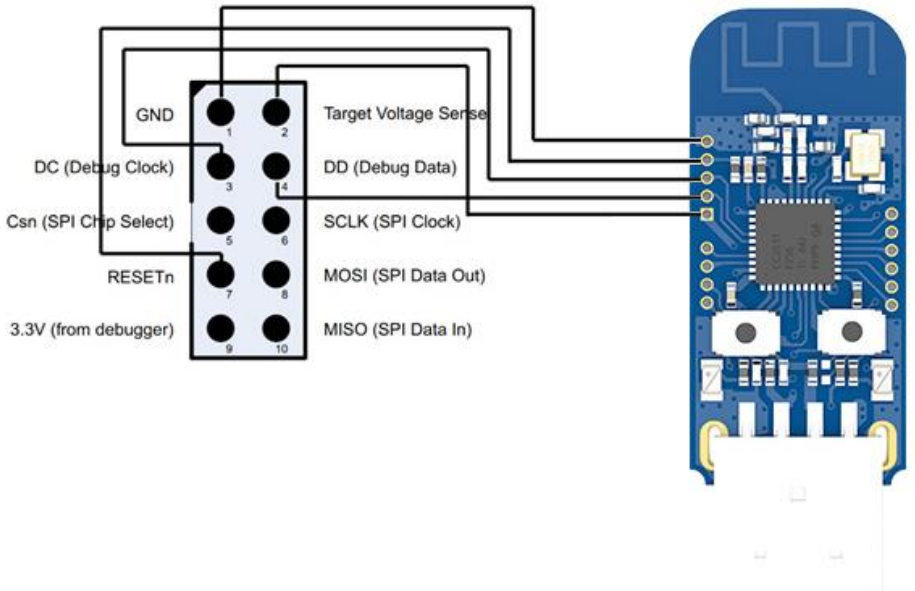
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6	Interference	If there are other frequency band wireless modules in the same product, it is necessary to use the frequency reasonably and shielding to reduce the influence of harmonic interference and intermodulation interference.
7	Crystal oscillator	If there is a crystal oscillator near the board where the module is located, increase the linear distance from the crystal oscillator as much as possible.

5. Development

5.1 Burning program

This module has built-in 8051 microcontroller, program can be downloaded by CC Debugger.



5.2 TI Packet Sniffer

The factory firmware supports the TI Packet Sniffer capture software, and the packet capture test can be performed when you get the module. Packet Sniffer can be used for fast protocol analysis. You can click on this link to download the test: http://www.ebyte.com/pdf-down.aspx?id=1093.

6. Hard design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as

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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 LayerHigh-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;
- 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.

7. FAQ

7.1 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;

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- 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 2.5V, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

7.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V 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.

7.3 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.

8. Production guidance

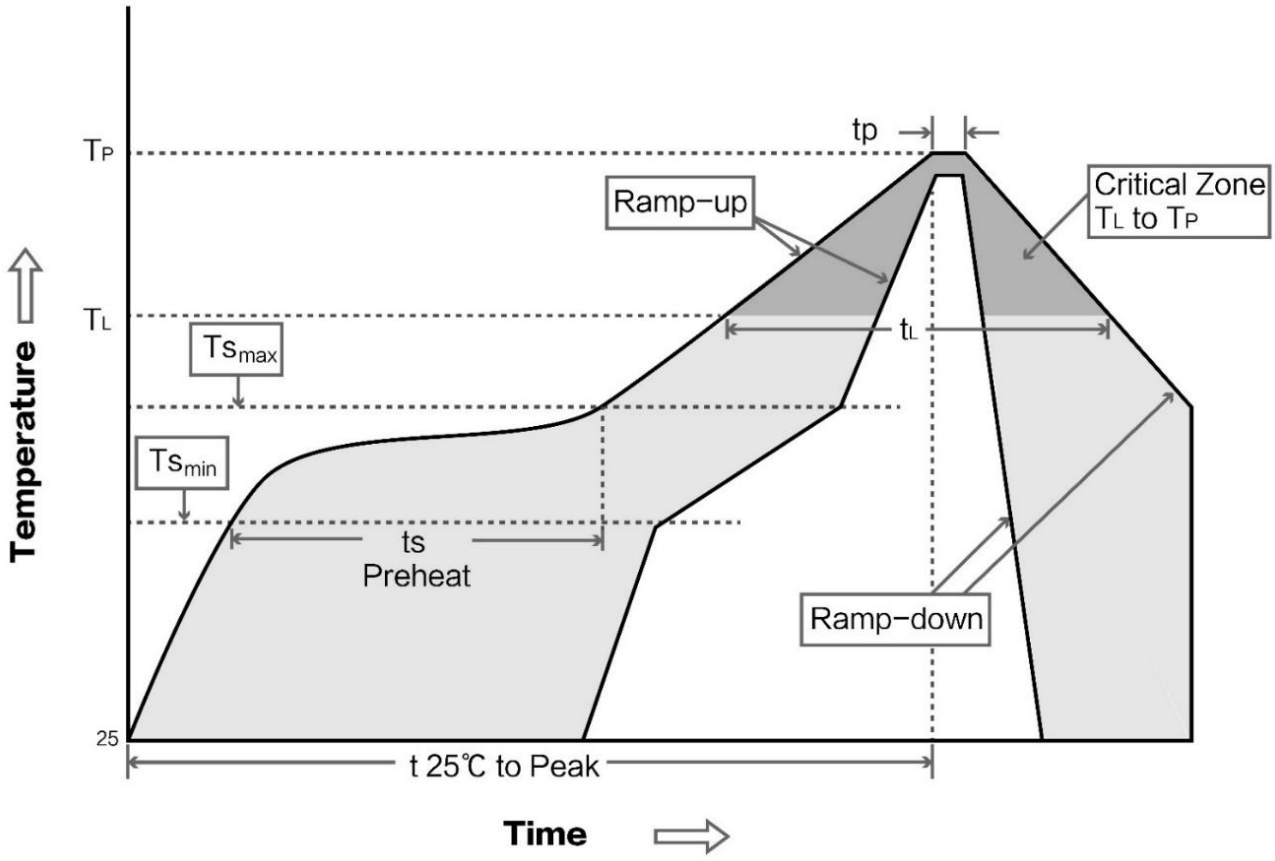
8.1 Reflow soldering temperature

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）	Aveage 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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8.2 Reflow soldering curve



9. E104 series

Model No.	IC	Frequency Hz	Tx power dBm	Distance km	Procotol	Size mm	Antenna
E104-BT01	CC2541	2.4G	0	0.05	BLE 4.2	14 * 22	PCB

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Hotline：4000-330-990
Technical support: support@cdebyte.com
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Web: https://www.cdebyte.com
Address: Building B5, West District Avenue 199, High-tech West District, Chengdu City, Sichuan Province, China

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