E104-BT01

CC2541 2.4GHz BLE 4.0 module

Chengdu Ebyte Electronic Technology Co.,Ltd.

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1. Introduction

1.1. Brief introduction

E104-BT01 is a SMD Bluetooth wireless module, which is SMD type, pin pitch is 1.27mm. the module features with high Performance PCB antenna. This module can use the serial port to send and receive Bluetooth data, which reduces the threshold of Bluetooth applications, it also supports secondary development of users.

The E104-BT01 uses the CC2541 RF chip from Texas Instruments (TI). The chip integrates the 8051 microcontroller and wireless transceiver, and it is suitable for the BLE protocol. The CC2541 is a true on-chip system (SoC) solution optimized for low power consumption and proprietary 2.4GHz applications. The module leads all the IO ports of the MCU, and integrates the transparent transmission function, and master-slave integration, ready to use. Multi-faceted development is possible. It supports serial port command to configure parameters and functions, widely used in wearable devices, home automation, home security, personal health care, smart home appliances, accessories and remote control, automotive, lighting, industrial Internet and other fields.

The E104-BT01 module supports the Bluetooth 4.0 protocol. After simple configuration, it can establish a Bluetooth connection with the master which supports the Bluetooth 4.0 protocol, to achieve transparent transmission of serial data.

1.2 Features

- The module is a master-slave integration, which can realize the connection point-to-point and transparent transmission between modules;
- The slave supports normal broadcast and iBeacon broadcast, and the broadcast content can be dynamically configured to realize personalized broadcast requirements of users;
- Supports broadcast sniffing mode, broadcast information synchronous printing to achieve "broadcast capture" function;
- Supports data indication function for fast wake-up of low-power application MCU;
- Supports MAC address binding between modules to achieve directional connection in multiple slave environments;
- Supports AT command to facilitate MCU user to configure parameters;
- Supports parameters air configuration to realize remote parameters update for APP user ;
- Supports low power mode for battery power supply;
- Supports GPIO input and output function to realize APP wireless switch control;
- Support status printing, real-time feedback running status by serial port, easy for MCU application design;
- Simplify pins connection, all operations can be completed with serial port, supports secondary development.

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1.3 Application

- Wireless meter reading, wireless sensing;
- Smart home;
- Industrial remote control, telemetry;
- Smart buildings;
- Automatic data collection;
- Health sensor;
- Electronic tags;
- Smart wearable device;
- Smart robot.

2. Parameters

2.1 Operating parameter

Main parameter		Performance			Remark
		Min	Typical	Max	
Operating voltage(V)		2.5	3.3	3.6	≥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)		2379	-	2496	Support ISM band
Power Consumption	TX current(mA)	-	14.3	-	@0dBm 3V
	RX current(mA)	-	14.7	-	@3V
	Sleep current (μA)	-	0.5	-	-
Max TX power(dBm)		-	0	-	-
Receiving sensitivity(dBm)		-93.5	-94	-94.5	Air data rate is 1M bps
Air data rate(bps)		250k	-	2M	Controlled via user's programming
Slave broadcast sleep and no connection (@1s Broadcast interval)		-	138.476	-	μA
Slave sleep and with connection (@1s Broadcast interval)		-	2.825	-	mA
Slave broadcast wake up and no connection (@1s Broadcast interval)		-	8.424	-	mA
Slave broadcast wake up and with connection (@1s Broadcast interval)		-	8.885	-	mA
Slave no broadcast sleep and no connection		-	89.337	-	μA

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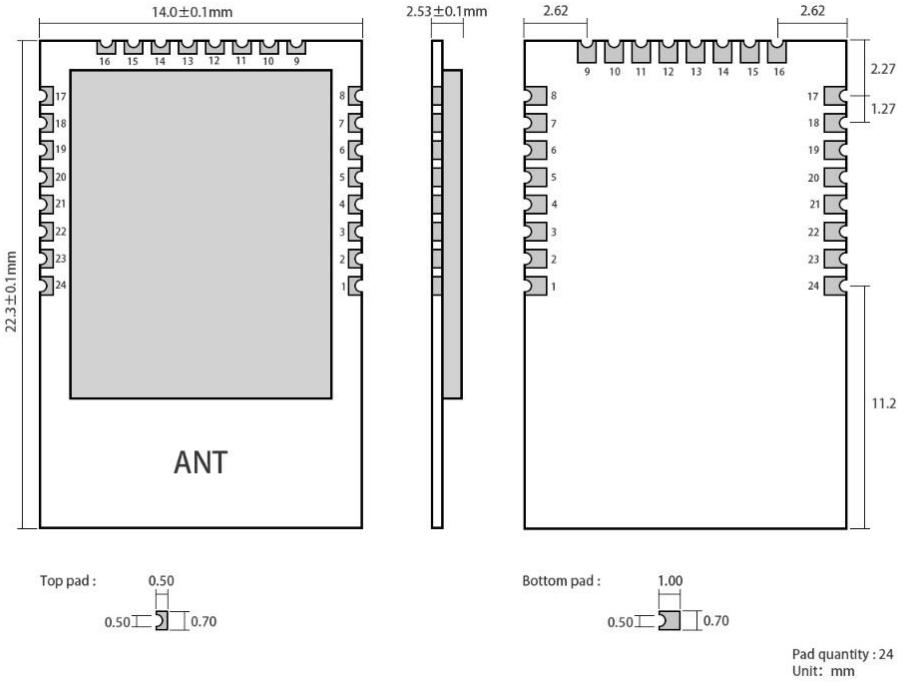
Slave no broadcast wakes up and no connection	-	8.454	-	mA
master scan sleep and no connection	-	3.037	-	mA
master scan wake up and no connection	-	18.711	-	mA

Main parameter	Description	Remark
Reference distance	50m	Test condition: clear and open area, height: 2.5m, air data rate: 250 kbps
Transmitting length	20Byte	
Protocol	BLE4.0	
Communication Interface	UART/IO	TTL, supports secondary development
Packaging	SMD	
Interface size	1.27mm	
Size	14*22mm	
Antenna interface	PCB	Impedance 50 Ω

3. Size and pin definition



No.	Item	Direction	Description	Remark
1	GND	-	Ground	Ground
2	VCC	-	3.3V	Power supply must be 2.0 - 3.6V
3	P2.2	-	Reserved	-
4	P2.1	-	Reserved	-
5	P2.0	I	Mode setting(MOD)	Falling edge: configuration mode; rising edge: transparent mode

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6	P1.7	-	Reserved	-
7	P1.6	-	Reserved	-
8	SCL	I/O	I2C	I2C clock
9	SDA	I/O	I2C	I2C data
10	P1.5	O	Link status(LINK)	It is used to indicate the status of the connection. After the connection is successful, the pin outputs a low level. After the connection is disconnected, the pin outputs a high level
11	P1.4	O	Data indication(DATA)	It is used for serial port transparent transmission data output. The pin is pulled low before data transmission. After the delay is 10ms, the first byte start bit is output. When the last byte output ends, the pin returns to “high level”
12	P1.3		Reserved	-
13	P1.2	I	Wake up(WKP)	Wake up: falling edge; sleep: rising edge. (Because of the jitter eliminating function, please keep the level within 20MS after the edge is generated)
14	P1.1		Reserved	-
15	P1.0		Reserved	-
16	P0.7	O	IO3 output	The output state of this pin can be controlled by the AT command (see the introduction of the AT command for details)
17	P0.6	O	IO2 output	The output state of this pin can be controlled by the AT command (see the introduction of the AT command for details)
18	P0.5	I	Disconnecting (DISC)	Falling edge will disconnect the current connection
19	P0.4	-	Reserved	-
20	P0.3	O	Serial port transmission(TX)	Module transmits serial port data
21	P0.2	I	Serial port reception(RX)	Module receives serial port data
22	P0.1	I	IO1 inout	The output state of this pin can be controlled by the AT command (see the introduction of the AT command for details)
23	P0.0	I	IO0 input	The output state of this pin can be controlled by the AT command (see the introduction of the AT command for details)
24	RESET_N	I	Reset(RST)	When the input level is low, it enters the hardware reset state. When the input level is high, it returns to the normal working state. This function is used for reset operation in emergency situations.

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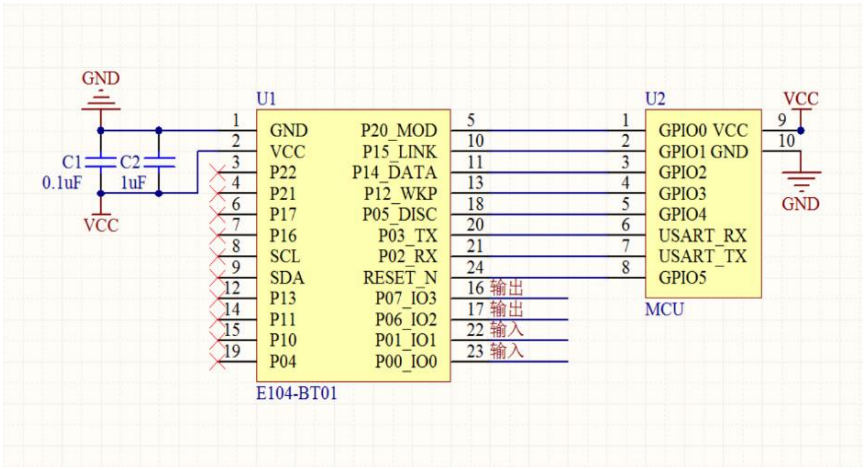
4. Basic operation

4.1 Recommended circuit



- 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 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);

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- 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.

4.2 Working mode

4.2.1 Configuration mode

The configuration mode is used for parameter configuration. Before the module establishes a Bluetooth connection, it is the configuration mode. After the connection is established, it is the transparent transmission mode. In the transparent transmission mode, the falling edge of the pin MOD (P2_0) can be switched to the configuration mode, and the rising edge returns to the transparent transmission mode. The mode switching operation takes effect only in the Bluetooth connection state, that is, the switching operation in the configuration mode is invalid. Any data received by the module RX pin in configuration mode is considered as configuration data.

Note:

1) If the Bluetooth connection has been successfully established, the data sent by the master to the feature channel “MAST CHANNEL” is invalid, and the Bluetooth feature channel “SLAVE CHANNEL” will receive the prompt “CONFIG BUSY”, indicating that the module is in the AT parameter configuration state and cannot transmit data.
2) In configuration mode, some configuration operations are not saved when power off (see the AT command description for details). Other operations will be saved when power off, they will run according to the new configurations after power-on.
3) When switching to configuration mode in the connected state, if disconnected, the module will automatically exit the configuration mode.

4.2.2 Low power mode

In any case, when inputting the rising edge of pin WKP (P1_2), the module enters sleep mode, the module power consumption decreases, and when inputting falling edge switches to the wake-up mode. In the low power mode, the serial port reception will be stopped, but the serial port transmission is still valid, that is, the data received by the Bluetooth can be output normally under the condition of Bluetooth connection.

Note:

1) When the master and slave enter the low power mode, their Bluetooth scanning and Bluetooth broadcast functions are not affected.
2) The command AT+LOGMSG can enable mode feedback. When the module enters sleep mode, the serial port prompts \r\nSTA:sleep\r\n. When switching to the new mode, it prompts \r\nSTA:wakeup\r\n.
3) The AT+ONSLEEP command can be used to set the wake-up mode or low power mode when the module is powered up. The AT+DISCSLEEP command can be used to set whether to switch to low power mode when the Bluetooth connection is disconnected.

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4.2.3 Wake-up mode

In any case, when inputting the falling edge of pin WKP (P1_2) or serial RX pin, the module will automatically wake up and enter the working state. It takes 10 ms from the detection of the falling edge to the wake-up of the module. The transparent transmission function is temporarily disabled until the system wakes up successfully.

Note:

1) If use the serial port RX pin to wake up, the first frame data received by the RX pin is used to awake the module, the first frame is invalid data, it is recommended to use 0x00.

4.3 Data indication

After receiving the data, the module sends data through the serial port. In order to ensure that the user MCU can receive correctly, about 10 ms before the start bit of the first data byte is sent by the serial port of the module, the DATA (P1_4) pin will output a low level to indicate the data is valid (can be used to wake up the external MCU), until the DATA pin returns high after the data is sent.

Note:

1) Indicates that the data output is valid. It can be unable by the command AT+DATDLY. When it is unable, the serial port output has no delay.

4.4 Bluetooth role

The module can be set to work in the Bluetooth master, slave or observer role, and it is activated by the command AT+ROLE and be enabled after reset. The slave role can realize Bluetooth broadcast and receive Bluetooth connection request; the master role can realize broadcast scanning and establish Bluetooth connection; the observer role can realize basic Bluetooth scanning, and the broadcast package can be printed out through the serial port.

Note:

1) Master role, can be dynamically turned on or off the Broadcast scanning by command AT+SCAN. When a valid broadcast packet is found (the transparent transmission service UUID in the broadcast packet is FFF0), and the slave MAC address exists in the binding list (you can use the command AT+BOND to turn off the address binding, and can connect any slaves after turned off), then the master will initiate a Bluetooth connection request, the pin LINK (P1.5) low level indicates that the connection is successfully established.
2) Slave role, can be dynamicaly turned on Bluetooth broadcast by command AT+ADVEN. After receiving the connection request, and the master MAC address exists in the binding list (you can use the command AT+BOND to turn off the address binding, and can connect any masters after turned off), then the Bluetooth connection will be completed automatically, the pin LINK (P1.5) low level indicates that the connection is successfully established.
3) Observer role, the module will automatically perform broadcast scanning after power-on (At this time, AT+SCAN

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configuration will be invalid), and synchronize serial port to send broadcast packet data out, the format is as follows:

MAC	RSSI
6 bytes	1 byte

4.5 Broadcast packet format

The broadcast data can be set to normal broadcast, iBeacon broadcast, and broadcast off by command AT+ADVEN. Users can configure normal broadcast packet and iBeacon broadcast packet. The format is as follows:

Normal broadcast:

Advertising:

Fixed byte	Len	Factory byte	Manufa data
020106	N	0xFF	Configurable, up to 26 bytes
E.g.: 02010608FF43444542595445			

Scan response:

Len	16 bytes UUID	UUID	Len	Broadcast name	Device name
0x03	0x03	0xFFF0	N	0x09	Configurable, up to 22 bytes
E.g.: 0303F0FF0A09453130342D42543031					

iBeacon broadcast:

Advertising:

iBeacon Prefix	UUID	Major	Minor	RSSI
9B	16B/Configurable	2B/Configurable	2B/Configurable	1B/Configurable
E.g.: 0201061AFF4C0002155757572E434445425954452E434F4D0000010002D2				

Note: Please refer to AT command section for details.

4.6 Air configuration

1. After the slave connection is established, the master (mobile APP) sends an AT command via the Bluetooth service feature "CONFIG CHANNEL", which can configure the module parameters over air.
2. "Air configuration" requires password authentication, the command AT+AUTH is used to send authentication information. The Bluetooth service feature "CONFIG CHANNEL" sends the authentication command AT+AUTH, after the authentication succeeds, then it can enter the configuration state.
3. After the authentication is successful, it remains valid until the connection is disconnected.
4. MOD pin has no effect on the air configuration process.
5. The air configuration instructions are detailed in the "AT Command" section.

Note:

1. To modify the air configuration password, you must pass password authentication first.
2. See the Quick Use section for details.

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4.7 Status or event printing

Status printing can be used to feedback module working status or events in real time, and send information out through the serial port, as shown in the following table:

Status	Information
Connection succeeded	\r\n STA:connect\r\n
Disconnection	\r\n STA:disconnect\r\n
System wake-up	\r\n STA:wakeup\r\n
Sleep mode	\r\n STA:sleep\r\n
Configuration mode	\r\n STA:config\r\n
Transmission mode	\r\n STA:transmit\r\n

Note:

1. You can use the command AT+LOGMSG to control whether to enable or disable this function.
2. Status information includes: connection, disconnection, wake-up, sleep, configuration mode, transmission mode.

4.8 Factory parameter setting

The module can be restored to factory settings by the command AT+RESTORE. After the factory settings are restored, the module will automatically reset. The factory parameters are shown in the table below:

Common parameter	Baud rate	19200bps
	Stop bit	1
	Air configuration password	123456
	Data output delay	On
	Bluetooth binding	Off
	MAC binding address	00 00 00 00 00 00
	TX power	0dbm
	Working mode	Wake-up mode
	Low power after disconnection	Off
	Role	Slave
	Status printing	Off
	Minimum connection interval	10 ms
	Maximum connection interval	10 ms
	Connection timed out	5 s
	IO2(P0_6)	Low level
	IO3(P0_7)	Low level
Slave	Broadcast function	Normal broadcast on
	Module name	E104-BT01

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	Broadcast interval	1 s
	Normal broadcast data	02 01 06 08 FF 43 44 45 42 59 54 45 03 03 F0 FF 0A 09 45 31 30 34 2D 42 54 30 31
	Ibeacon broadcast data	02 01 06 1A FF 4C 00 02 15 57 57 57 2E 43 44 45 42 59 54 45 2E 43 4F 4D 00 00 01 00 02 D2
	Factory	CDEBYTE
Master	Scanning	On

5. AT command

5.1 Operating instructions

1. Before sending the command, first ensure that the module is in the wake-up mode and in the configuration state, otherwise the module will not be able to receive the configuration command.
2. All AT commands do not need to add (\r) or (\n).
3. The return result of the AT command ends with \r\n.
4. The response format of the command error is +ERR=[NUM].

Item	Description
-1	Unrecognized command
-2	Incorrect parameter length
-3	Invalid parameter
-4	Air configuration authentication failed
-5	Invalid operation

5.2 AT command

5.2.1 AT test command

Command	Response	Parameter
AT	**+OK**	None

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Note: None

5.2.2 AT+RESET reset command

Command	Response	Parameter
AT+RESET	**+OK**	None
Note: Valid immediately		

5.2.3 AT+RESTORE Factory reset command

Command	Response	Parameter
AT+RESTORE	**+OK**	None
Note: Valid after reset		

5.2.4 AT+BAUD Query and set the serial port baud rate command

Command	Response	Parameter
Query: AT+BAUD?	**+OK=[para]**	Para:0~4 ASCII 0=9600 1=19200 2=38400 3=57600 4=115200
Set: AT+BAUD=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid after reset		

5.2.5 AT+STOPB Query and Set Serial Port Stop Bit command

Command	Response	Parameter
Query: AT+STOPB?	**+OK=[para]**	Para: 0,1 ASCII 0: 1 stop bit 1: 2 stop bit
Set: AT+STOPB=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid after reset, power off preservation		

5.2.6 AT+ROLE Query and Set Bluetooth Role command

Command	Response	Parameter
Query: AT+ROLE?	**+OK=[para]**	Para:0、1、2 ASCII 0: Master 1: Slave 2: Observer
Set: AT+ROLE=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid after reset, power off preservation		

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5.2.7 AT+ADVEN Query and set the broadcast on/off command

Command	Response	Parameter
Query: AT+ADVEN?	**+OK=[para]**	Para:0、1、2 ASCII 0: Broadcast off 1: Normal broadcast 2: iBeacon broadcast
Set: AT+ADVEN=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid after disconnection, power off preservation		

5.2.8 AT+ADVDAT Query and Set Broadcast data command

Command	Response	Parameter
Query: AT+ADVDAT?	**+OK=[para]**	Para: No more than26 bytes HEX
Set: AT+ADVDAT=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next broadcast, power off preservation		

5.2.9 AT+ADVDAT1 Query and Set Broadcast data command (not saved)

Command	Response	Parameter
Query: AT+ADVDAT1?	**+OK=[para]**	Para: No more than26 bytes HEX
Set: AT+ADVDAT1=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next broadcast, power off not preservation		

5.2.10 AT+ADVINTV Query and Set Broadcast interval command

Command	Response	Parameter
Query: AT+ADVINTV?	**+OK=[para]**	Para:32~16000 ASCII E.g.: para=1600 1600*0.625ms=1s
Set: AT+ADVINTV=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next broadcast, power off preservation		

5.2.11 AT+IBCNUUID Query and Set iBeacon UUID command

Command	Response	Parameter
Query: AT+IBCNUUID?	**+OK=[para]**	Para: 16 bytes HEX
Set: AT+IBCNUUID=[para]	**+OK: Succeed**	

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	+ERR=[NUM]: Error	
Note: Valid immediately, power off preservation		

5.2.12 AT+IBCNMAJOR Query and Set iBeacon Major command

Command	Response	Parameter
Query: AT+IBCNMAJOR?	**+OK=[para1]**	Para1: 2 bytes HEX
Set: AT+IBCNMAJOR=[para1]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.13 AT+IBCNMINOR Query and Set iBeacon Minor command

Command	Response	Parameter
Query: AT+IBCNMINOR?	**+OK=[para1]**	Para1: 2 bytes HEX
Set: AT+IBCNMINOR=[para1]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.14 AT+IBCNRSSI Query and Set iBeacon RSSI command

Command	Response	Parameter
Query: AT+IBCNRSSI?	**+OK=[para]**	Para: 1 byte HEX
Set: AT+IBCNRSSI=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.15 AT+NAME Query and Set Broadcast device name command

Command	Response	Parameter
Query: AT+NAME?	**+OK=[para]**	Para: No more than 22 bytes HEX
Set: AT+NAME=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next broadcast, power off preservation		

5.2.16 AT+NAME1 Query and Set Broadcast device name command

Command	Response	Parameter
Query: AT+NAME1?	**+OK=[para]**	Para: No more than 22 bytes HEX
Set: AT+NAME1=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	

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Note: Valid when next broadcast, power off not preservation

5.2.17 AT+CONMIN Query and Set Minimum connection interval command

Command	Response	Parameter
Query: AT+CONMIN?	**+OK=[para]**	Para: ASCII Range: 6~3200 E.g.: 8 8*1.25ms=10ms
Set: AT+CONMIN=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next connection, power off preservation The maximum connection interval must be no less than the minimum connection interval		

5.2.18 AT+CONMAX Query and Set Maximum connection interval

Command	Response	Parameter
Query: AT+CONMAX?	**+OK=[para]**	Para:ASCII Range: 6~3200 E.g.: 8 8*1.25ms=10ms
Set: AT+CONMAX=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next connection, power off preservation The maximum connection interval must be no less than the minimum connection interval		

5.2.19 AT+CONTO Query and Set Connection timeout command

Command	Response	Parameter
Query: AT+CONTO?	**+OK=[para]**	Para: ASCII Range: 100~3200 E.g.: 500 500*10ms=5s
Set: AT+CONTO=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid when next connection, power off not preservation		

5.2.20 AT+DISCON Disconnection conmand

Command	Response	Parameter
Query: AT+DISCON	**+OK**	None
Note: Valid immediately		

5.2.21 AT+CONSTA Query Connection Status Command

Command	Response	Parameter

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Query: AT+CONSTA?	**+OK=[para]**	Para: Connected: Connection established Disconnect: Disconnection
Note: Valid immediately		

5.2.22 AT+DATDLY Query and Set Data Output Delay command

Command	Response	Parameter
Query: AT+DATDLY?	**+OK=[para]**	Para:0、1 ASCII 0: Off 1: On
Set: AT+DATDLY=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.23 AT+MAC Query MAC command

Command	Response	Parameter
Query: AT+MAC?	**+OK=[para]**	Para: 6 bytes MAC address HEX E.g.: F0E1D2C3B4A5
Note: Valid immediately, power off preservation		

5.2.24 AT+PEERMAC Query Connected device MAC command

Command	Response	Parameter
Query: AT+PEERMAC?	**+OK=[para]**	Para: 6 bytes MAC address HEX E.g.: F0E1D2C3B4A5
Note: Valid immediately		

5.2.25 AT+BOND Bonding MAC Address on/off command

Command	Response	Parameter
Query: AT+BOND?	**+OK=[para]**	Para: 0,1 ASCII 0: Off 1: On
Set: AT+BOND=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.26 AT+BONDMAC Query and Set Bonging MAC address command

Command	Response	Parameter
Query: AT+BONDMAC?	**+OK=[para]**	Para: 6 bytes MAC address HEX E.g.: F0E1D2C3B4A5
Set: AT+BONDMAC=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	

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Note: Valid immediately, power off preservation

5.2.27 AT+SCAN Query and Set Broadcast scanning command

Command	Response	Parameter
Query: AT+SCAN?	**+OK=[para]**	Para: 0,1 ASCII 0: Off 1: ON
Set: AT+SCAN=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.28 AT+VER Query Firmware version command

Command	Response	Parameter
Query: AT+VER?	**+OK=[para]**	Para: version number 4 bytes ASCII
Note: Valid immediately		

5.2.29 AT+AUTH Query and Set Air configuration authentication password command

Command	Response	Parameter
Query: AT+AUTH?	**+OK: Succeed** **+ERR=[NUM]: Error**	Para: 6 bytes password ASCII/HEX
Set: AT+AUTH =[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: 1. Valid when next connection, power off preservation 2. Password cannot be modified before authentication succeeding 3. This command is only used in the air configuration		

5.2.30 AT+PWR Query and Set TX power command

Command	Response	Parameter
Query: AT+PWR?	**+OK=[para]**	Para: 0~2 ASCII 0:-23dBm 1:-17dBm 2: 0dBm
Set: AT+PWR =[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.31 AT+ONSLEEP Query and Set Power-on sleep command

Command	Response	Parameter

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Query: AT+ONSLEEP?	**+OK=[para]**	Para: 0、1 ASCII 0: Off 1: On
Set: AT+ONSLEEP=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.32 AT+DISCSLEEP Query and Set Sleep mode after disconnection command

Command	Response	Parameter
Query: AT+DISCSLEEP?	**+OK=[para]**	Para: 0、1 ASCII 0: No changes when disconnection 1: Sleep when disconnection
Set: AT+DISCSLEEP=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.33 AT+SLEEP Immediately enter sleep mode command

Command	Response	Parameter
Query: AT+SLEEP	**+OK**	None
Note: Valid immediately		

5.2.34 AT+LOGMSG Query and Set Running status output command

Command	Response	Parameter
Query: AT+LOGMSG?	**+OK=[para]**	Para: 0、1 ASCII 0: Off 1: On
Set: AT+LOGMSG=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	
Note: Valid immediately, power off preservation		

5.2.35 AT+IO0 Read IO0 input command

Command	Response	Parameter
Query: AT+IO0?	**+OK=[para]**	Para: 1,0 ASCII 1: High level 0: Low level
Note: Valid immediately		

5.2.36 AT+IO1 Read IO1 input command

Command	Response	Parameter
Query: AT+IO1?	**+OK=[para]**	Para: 1,0 ASCII 1: High level

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		0: Low level
Note: Valid immediately		

5.2.37 AT+IO2 Set IO2 output command

Command	Response	Parameter
Query: AT+IO2=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	Para: 1，0 ASCII 1: High level 0: Low level
Note: 1. Valid immediately, power off preservation. 2. IO keeps the set level after the next power-on		

5.2.38 AT+IO3 Set IO3 output command

Command	Response	Parameter
Query: AT+IO3=[para]	**+OK: Succeed** **+ERR=[NUM]: Error**	Para: 1，0 ASCII 1: High level 0: Low level
Note: 1. Valid immediately, power off preservation. 2. IO keeps the set level after the next power-on		

5.3 Bluetooth service

Service UUID	FFF0		
Characteristic value	UUID	Item	Description
SLAVE CHANNEL	FFF1	read / notify	Data Channel from Slave to Master
MAST CHANNEL	FFF2	read / write	Data Channel from Master to Slave
CONFIG CHANNEL	FFF3	read / write / notify	Air Configuration Channel

6. Quick Start

6.1 Transparent transmission between Mobile phone App and module

Use Android phone (system version 4.3 or above) or Apple IPHONE 4s or above, or Ipad with BLE function, to connect and communicate with the module.

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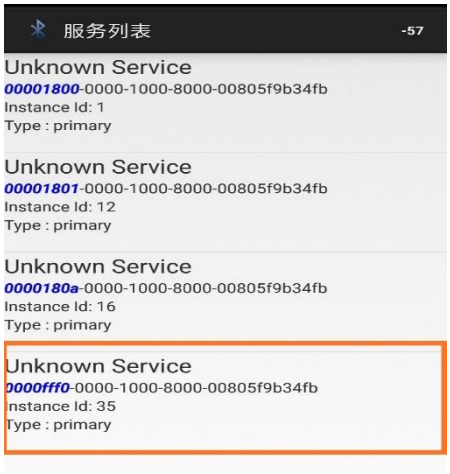
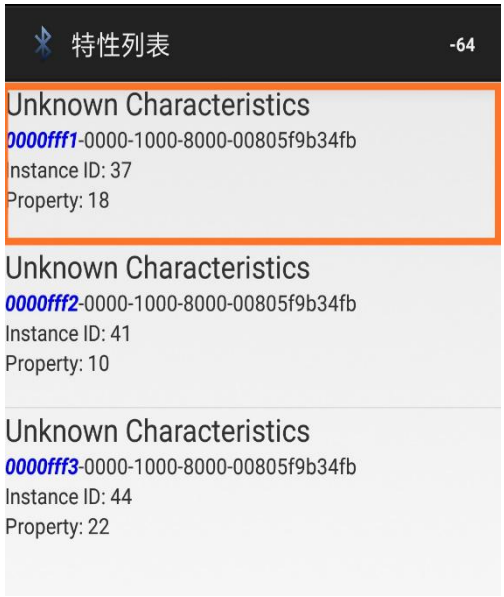
Take an Android phone as an example:

1. Download and install the "BLE Test Tool" App on your Android phone
2. Open the BLE Test Tool, scan nearby broadcast devices, and find the device named "E104-BT01" in the device list..

3. Click the device to connect, you can enter the service list interface of the Bluetooth device.



4. Click on the service with UUID "0000fff0", you can see three channels: fff1, fff2, fff3.
5. Click the fff1 channel and click “Start Notification”. At this time, open the serial debugging tool and send “0123456789” to see the received data on the fff1 channel interface.



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6. Click the fff2 channel, and click "Write", fill in and send "0123456789", you can see the received data in the serial debugging interface.

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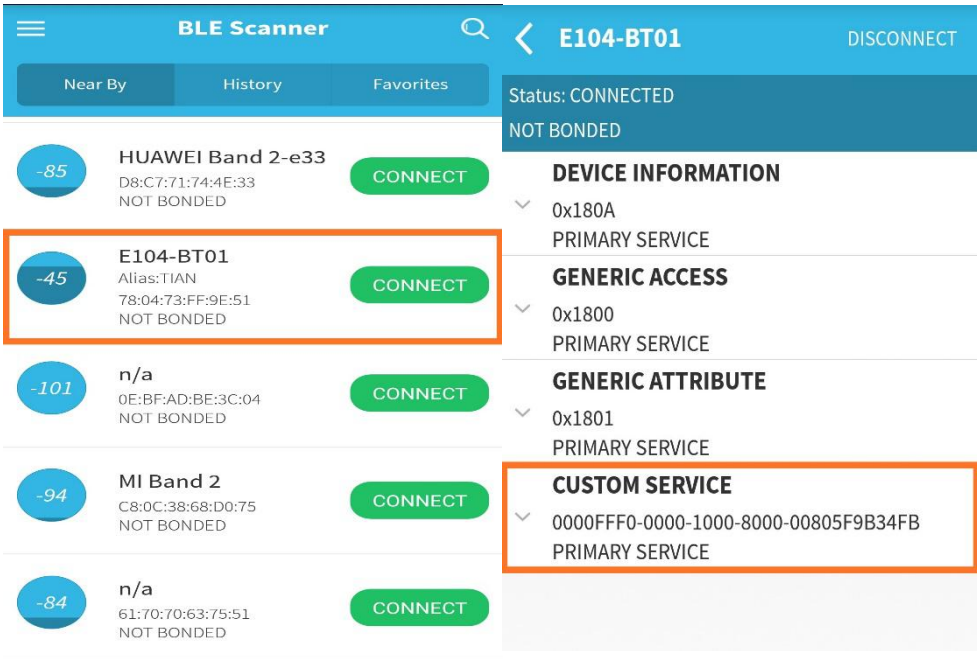
6.2 Mobile phone App air configuration parameters

1. Android operating system, software BLE_Scanner.

2. Open “BLE_Scanner”, scan the nearly broadcast device, find the device named “E104-BT01” in the device list, click “CONNECT” to connect, find and click the service with UUID “FFF0”.



3. First click the "N" icon in the upper right corner of the "FFF3" service, then click the "W" icon, write "AT+AUTH=123456" in the pop-up window, then click "OK".

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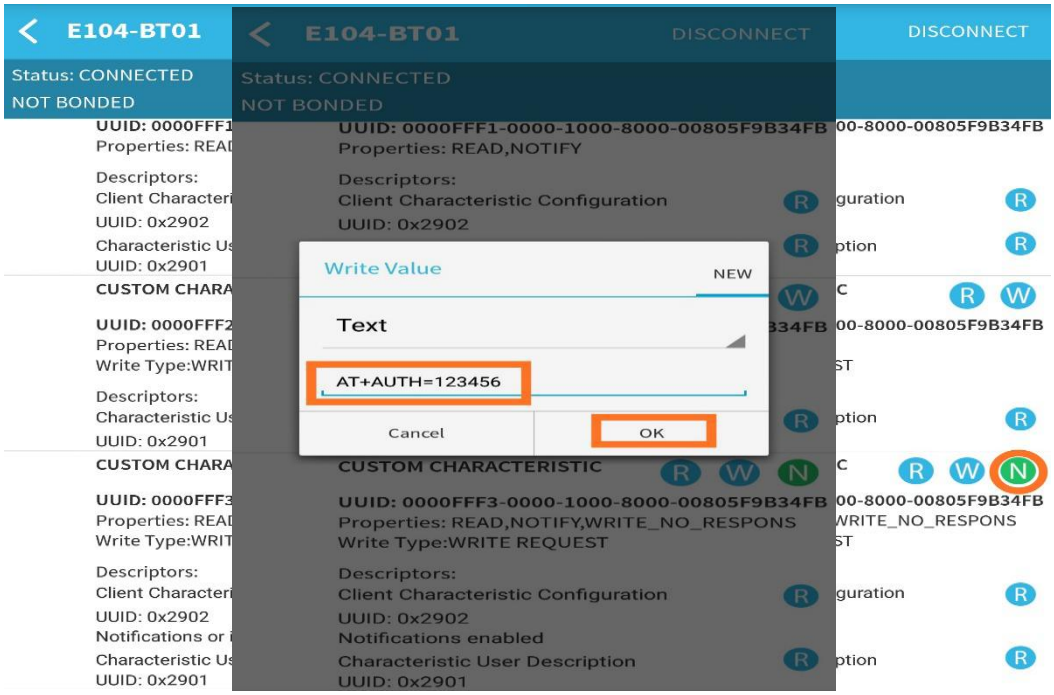
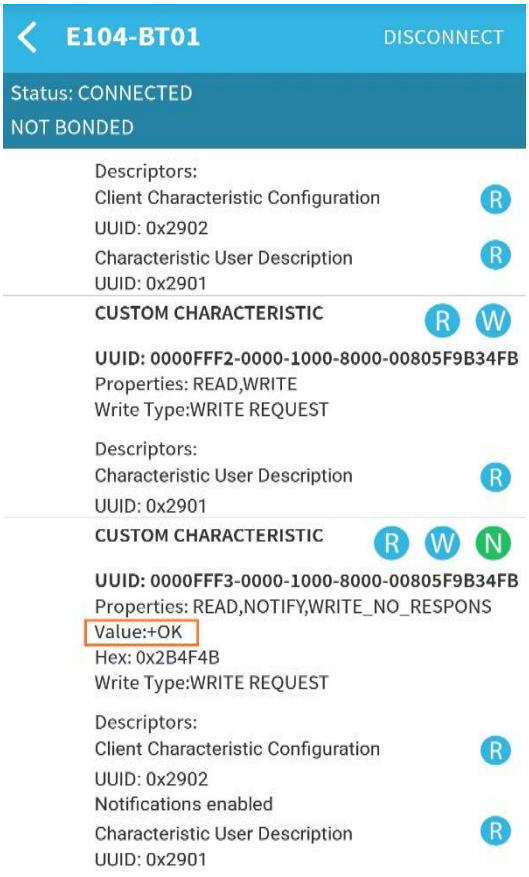


4. When "+:" is returned at "value:", it means that the air configuration authentication is successful. At this time, in the "FFF3" service, all the AT commands can be input after clicking the "W" icon.



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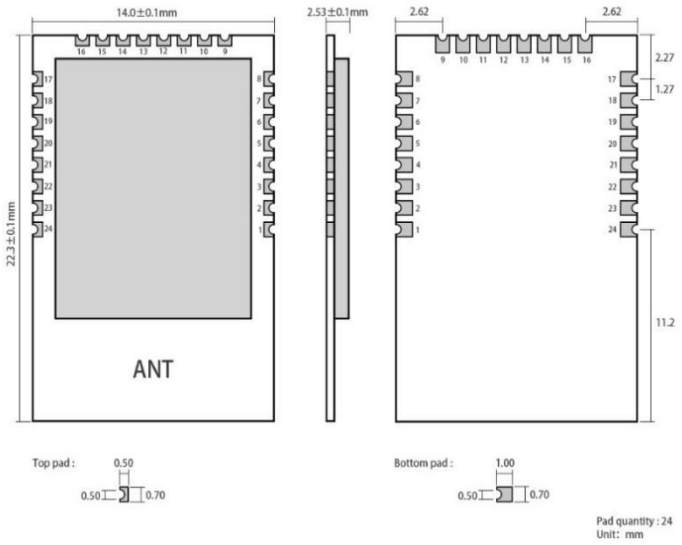
7. Secondary Development

7.1 Pin definition



Pin No.	Item	Direction	Description
1	GND	-	Ground
2	VCC	-	Power supply, 2.0～3.6V
3	P2.2	Input/Output	MCU GPIO
4	P2.1	Input/Output	MCU GPIO
5	P2.0	Input/Output	MCU GPIO
6	P1.7	Input/Output	MCU GPIO
7	P1.6	Input/Output	MCU GPIO
8	SCL	Input/Output	I2C clock
9	SDA	Input/Output	I2C data
10	P1.5	Input/Output	MCU GPIO
11	P1.4	Input/Output	MCU GPIO
12	P1.3	Input/Output	MCU GPIO
13	P1.2	Input/Output	MCU GPIO
14	P1.1	Input/Output	MCU GPIO
15	P1.0	Input/Output	MCU GPIO
16	P0.7	Input/Output	MCU GPIO
17	P0.6	Input/Output	MCU GPIO
18	P0.5	Input/Output	MCU GPIO
19	P0.4	Input/Output	MCU GPIO
20	P0.3	Input/Output	MCU GPIO
21	P0.2	Input/Output	MCU GPIO
22	P0.1	Input/Output	MCU GPIO
23	P0.0	Input/Output	MCU GPIO

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24	RESET_N	Input	Reset

7.2 Program burning

No.	Item	Notes
1	Program burning	Module embedded with 8051 MUC, please use our CC-DeBugger to download the program (click to open the link), cannot use the serial port or any other tools, such as JTAG, ISP, ICP. Users can modify their own functions based on the official TI BLE protocol stack . They can also download the compiled HEX file directly, 
2	Test board	None.

8. FAQ

8.1 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 2.5V, the lower the voltage, the lower the transmitting power;
- Due to antenna quality or poor matching between antenna and module.

8.2 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.

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8.3 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.

9. Production guidance

9.1 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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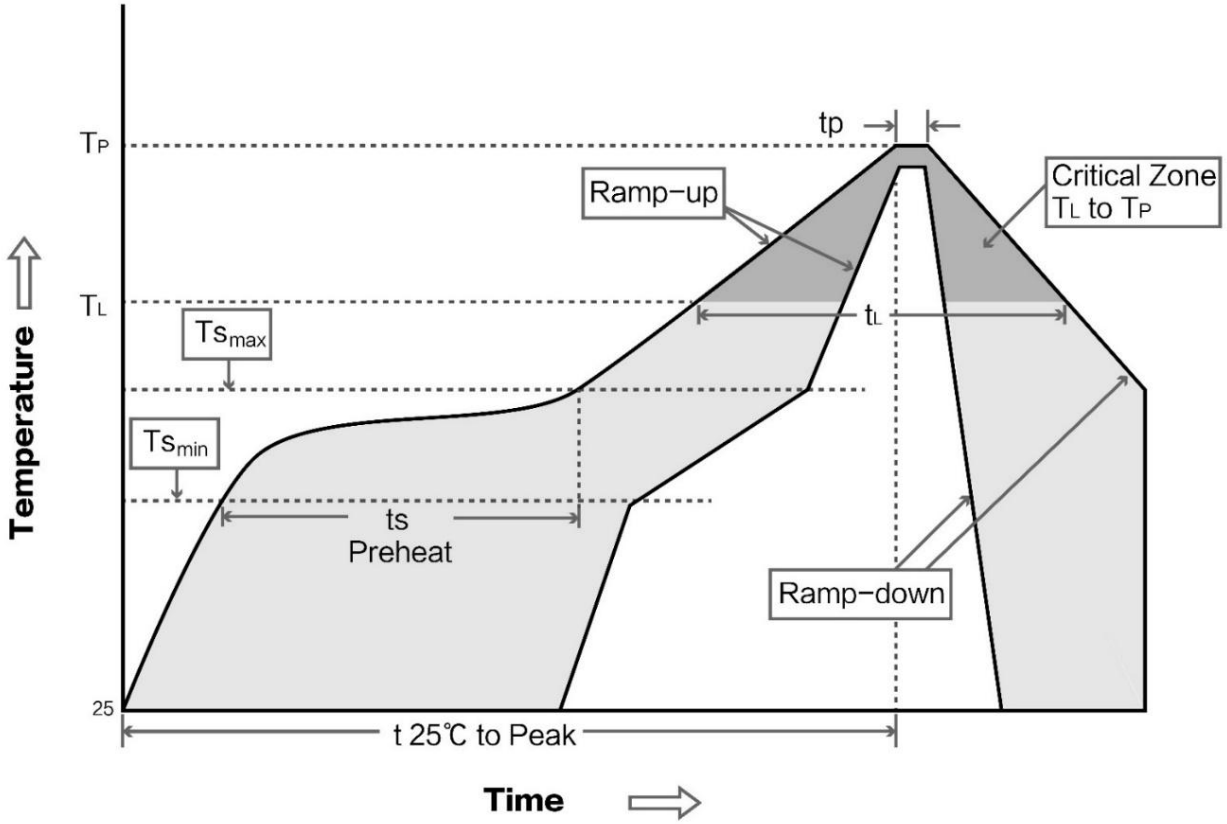
9.2 Reflow soldering curve



10. Bluetooth products

Model No.	IC	Frequency Hz	TX power dBm	Communication interface	Protocol BLE	Size mm	Antenna	Feature
E72-2G4M05S1B	CC2640	2.4G	5	I/O	4.2	17.5*28.7	PCB/IPX	Hardware resources / secondary development
E73-2G4M04S1A	nRF52810	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources / secondary development
E73-2G4M04S1B	nRF52832	2.4G	4	I/O	4.2/5.0	17.5*28.7	PCB/IPX	Hardware resources / secondary development
E73-2G4M08S1C	nRF52840	2.4G	8	I/O	4.2/5.0	13*18	PCB/IPX	Hardware resources / secondary development
E73-2G4M04S1D	nRF51822	2.4G	4	I/O	4.2	17.5*28.7	PCB/IPX	Hardware resources / secondary development
E104-BT01	CC2541	2.4G	0	TTL	4.0	14*22	PCB	Cost-effective / secondary development

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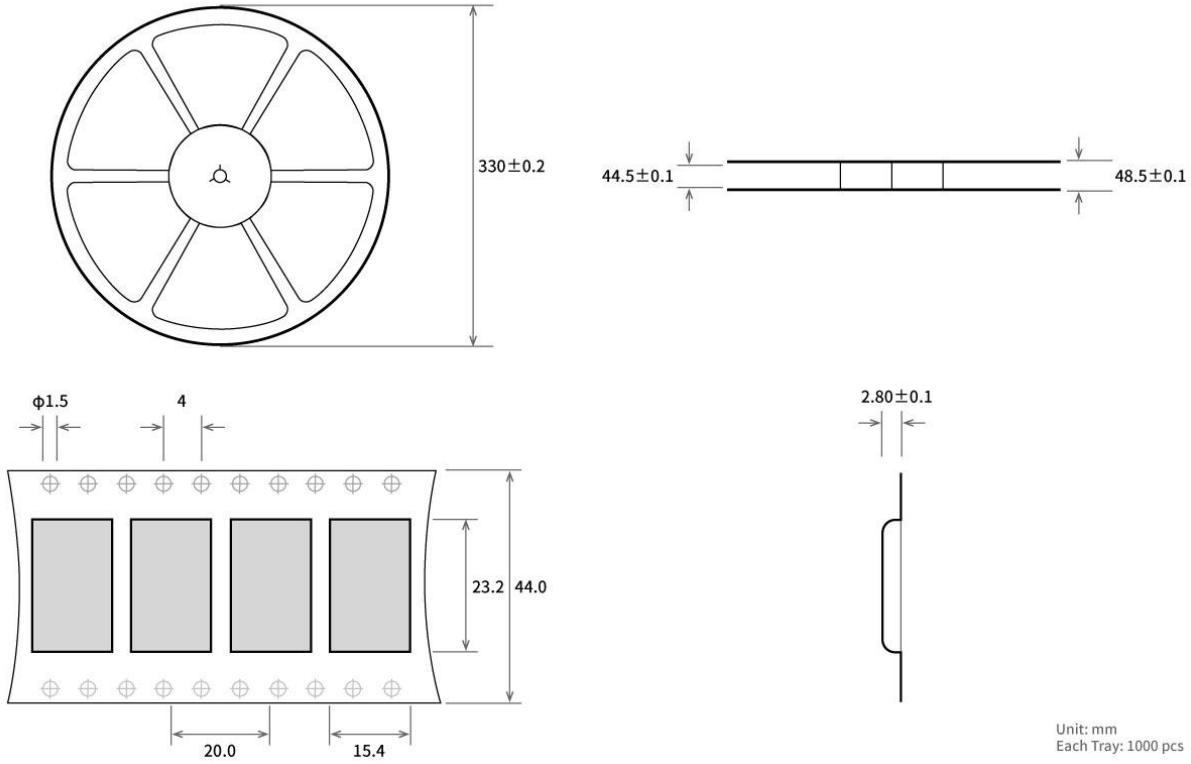
E104-BT02	DA14580	2.4G	0	TTL	4.2	14*22	PCB	Low power consumption High speed transmission
E72-2G4M04S2B	CC2640	2.4G	2	TTL	4.2	14*23	PCB/IPX	Built-in ARM / Multi-role mode
E104-2G4U04A	CC2540	2.4G	0	USB	4.0	18*59	PCB	Dongle / Protocol analyzer

11. Batch packaging method



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Revision history

Version	Date	Description	Issued by
1.0	2016-8-20	Initial version	Huaa
1.1	2017-1-30	Content update	Huaa
1.2	2017-4-1	Content update	Huaa
1.3	2017-8-22	Content update	Huaa
1.4	2018-5-11	Content update	Huaa
1.5	2018-8-4	Content update	Huaa
1.6	2018-11-5	Content update	Huaa
1.7	2019-2-20	Error correction	Ray
1.8	2019-3-11	Version update	All
1.9	2020-05-15		du

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