EWM104-BT41SX/SP User Manual

BLE 5.4 dual-mode Bluetooth slave module



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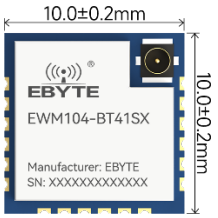
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Chapter 1 Overview

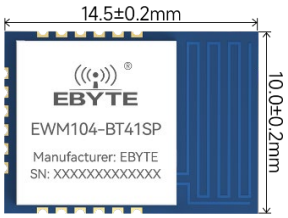
1.1 Product Introduction

The EWM104-BT41SX/SP module is a serial port to dual-mode Bluetooth slave module based on Bluetooth 5.4 version, supporting BLE and SPP protocols, working in the 2.4 GHz frequency band, and can switch freely between BLE and classic Bluetooth. The maximum transmit power of the module is 8dBm.

The EWM104-BT41SX/SP module supports AT command configuration parameters, and the operation is simple and fast. Through this module, traditional low-end serial port devices or devices controlled by MCU can perform wireless data transmission. It is a low-cost, simple and reliable data transmission module. The module includes IPEX and PCB antenna models, and users can choose the appropriate style according to actual needs.



EWM104-BT41SX



EWM104-BT41SP

1.2 Features

- Ultra-low-cost dual-mode Bluetooth slave module;
- Support Bluetooth 5.4 protocol ;
- Support AT command configuration ;
- Support Bluetooth air configuration;
- Support BLE & SPP;
- EWM104-BT41SX has a reserved IPEX-3 antenna, stamp hole package, size 10*10 mm;
- EWM104-BT41SP comes with PCB antenna, stamp hole package, size 10*14.5mm;
- G PIO input/output;
- The communication distance can reach up to 200 meters (8dBm, clear and open environment)
- Global license-free ISM 2.4 GHz frequency band;
- Support 1 ~2Mbps air rate ;

1.3 Application Scenario

- Bluetooth wireless data transmission
- Smart Home
- Industrial Sensing and Wireless Control
- Medical equipment detection and wireless control
- Automated data collection
- Intelligent Robots

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Chapter 2 Specifications

Main parameters		Performance			Remark
		Minimum	Typical Value	Maximum	
Operating voltage (V)		2.0	3.3	3.6	≥ 3.3V can guarantee output power
Communication level (V)		-	3.3	-	Using 5 V TTL will burn out the module
Operating temperature (℃)		- 40	-	+ 85	
Working frequency band (MHz)		2 400	-	2 480	
Power consumption	Dual mode waiting for connection (mA)	-	2.9	29.5	
	SPP off BLE waiting to connect (mA)	-	2.0	29.5	
	BLE Connection (mA)		2.3	27.4	
	BLE connection sending data (mA)		2.3	29.0	
	SPP connection (mA)		2.8	26.6	
	SPP connection sending data (mA)	-	2.9	27.6	
	Sleep power consumption (uA)	-	1.5	-	Turn off all broadcasts
Transmit power (dBm)		0	6.4	8	
Receiving sensitivity (dBm)		-	- 9 3	-	

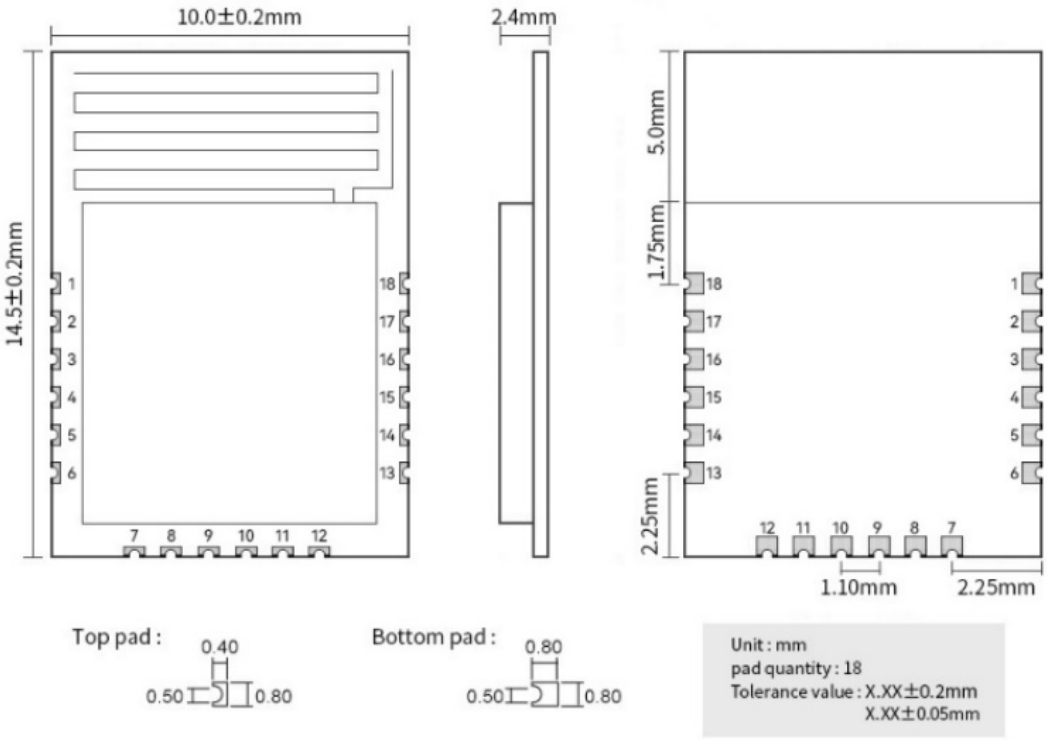
Main parameters		Description	Remark
Reference distance	Connection distance	100m	Transmitting power 8dBm, clear and open environment, antenna height 1 meter
	Communication distance	200m	
Launch length		255 Bytes	SPP/B LE payload 255 bytes
Bluetooth Protocol		V5.4	-
Communication interface		UART serial port	-
Packaging		SMD	-
Interface		1.27 mm	Stamp Holes
Dimensions	E WM 104-BT4 1SX	10 *10 mm	IPEX-3 Antenna Interface
	E WM 104-BT4 1SP	10*14.5mm	PCB Antenna
Antenna interface	E WM 104-BT4 1SX	IPEX 3rd Generation Antenna	Equivalent impedance is about 50 Ω
	E WM 104-BT4 1SP	P CB board mounted antenna	

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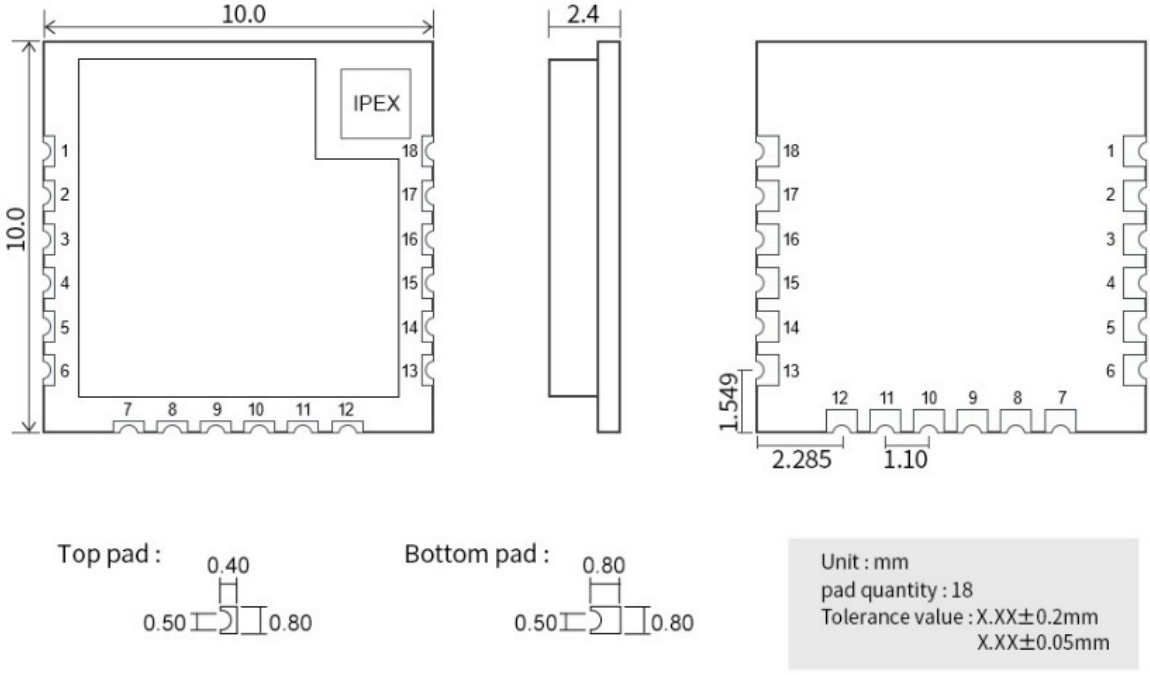
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Chapter 3 Mechanical Dimensions and Pin Definition

EWM104-BT41SP



EWM104-BT41SX



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Pin number	Pin Definition	Pin Direction	Pin Function	Description
1	GND	-	Power Ground	Ground
2	PA8	-	-	Reserved interface
3	PA7	Input	RESTORE	Pull up internally, falling edge, and then maintaining a low level for at least 5 seconds, all parameters are restored to factory settings and the module is automatically restarted.
4	PA2	-	-	Reserved interface
5	PA1	Output	Status Indicator	Connection status indication, high level indicates connected, low level indicates disconnected
6	PA0	Input	-	Reserved interface
7	RST	Input	Reset pin	Low level reset
8	WKP(PB6)	Input	Wake-up pin	The default is low level, low power mode, and all broadcasts are turned off. Pull high to enter normal working mode.
9	RXD(PB5)	Input	Serial Port	Serial port input pin
10	TXD(PB4)	Output	Serial Port	Serial port output pin
11	GND	Input	Power Ground	land
12	VCC	Input	Power positive	power supply
13	VDDIO	-	-	Power supply selection pin (VBAT and VDDIO need to be short-circuited when powered by dry batteries)
14	LDOIN	-	-	GPIO when powered by dry batteries)
15	PB7	Input	Mode	Low level: configuration mode; high level: transparent transmission mode (Only valid after connection is established)
16	USB0DP	-	-	Program download interface
17	USB0DM	-	-	Program download interface
18	GND	-	Power Ground	Ground

Chapter 4 Quick Use

Recommended software for debugging/testing:

- PC serial port tools SSCOM, AccessPort
- Mobile BLE debugging APP Android: BLE debugging assistant IOS: nRF connect, Bluetooth debugging assistant
- Mobile SPP debugging tools Android: Bluetooth serial port debugging assistant, Bluetooth debugging assistant; IOS: does not support SPP

4.1 Serial port tool configuration

- When the module's Bluetooth broadcast is not connected, it is in AT command mode. Configuration query and other operations can be performed through AT commands. When any BLE/SPP Bluetooth broadcast is connected, the module enters transparent transmission mode and AT commands are unavailable.
- Set the serial port tool related configuration (default configuration: 115200,8,1,none,none), as shown below;

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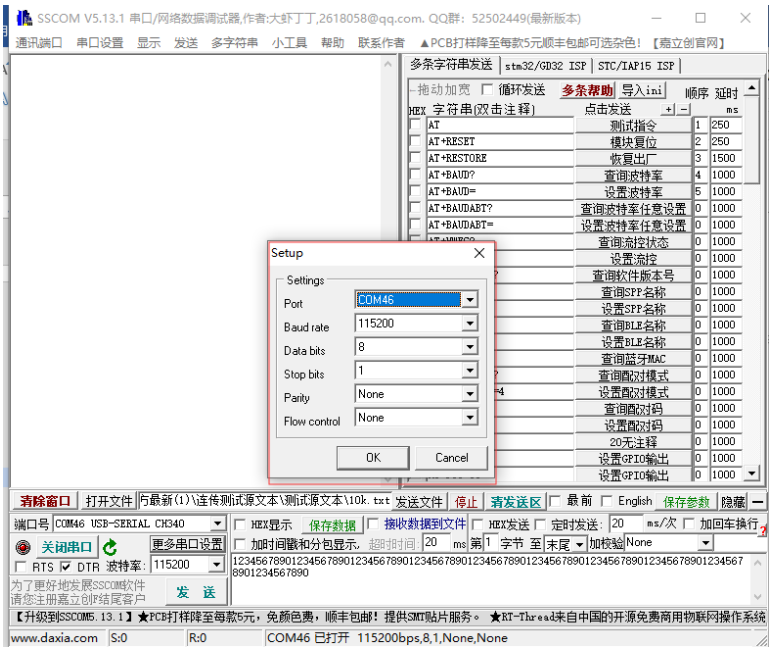


Figure 4-1-1 SSCOM parameter configuration

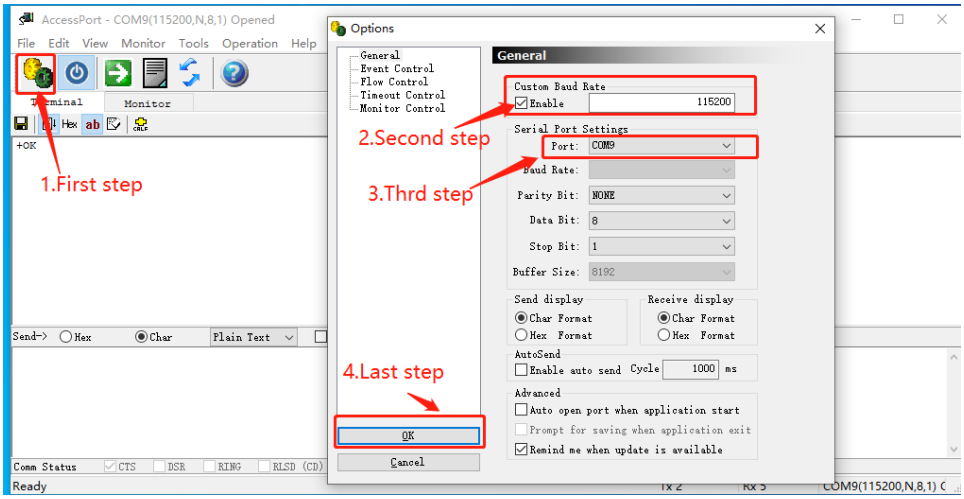


Figure 4-1-2 AccessPort parameter configuration, other parameters are default

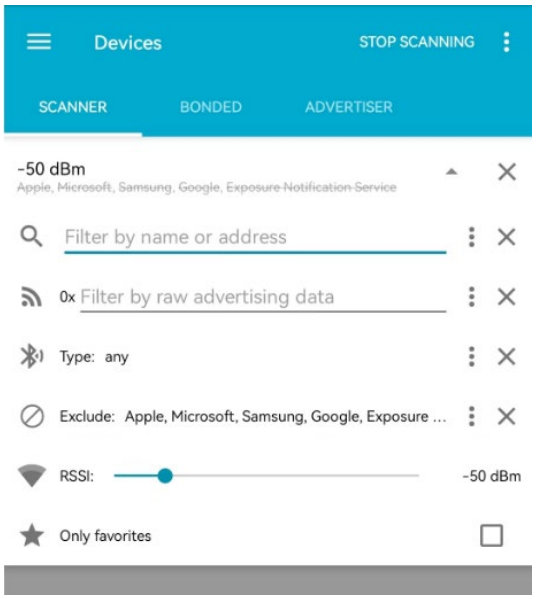
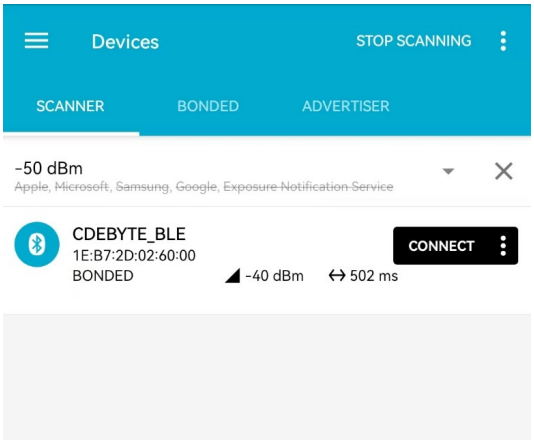
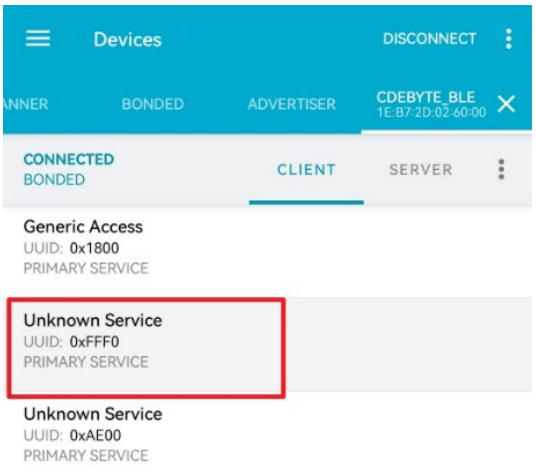
- Follow the instructions shown in the instruction table in 6.4 and the instruction instructions in section 6.2 to send AT commands to configure the module.

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4.2 BLE data transmission and air configuration

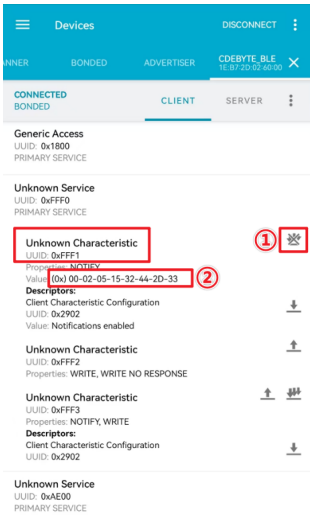
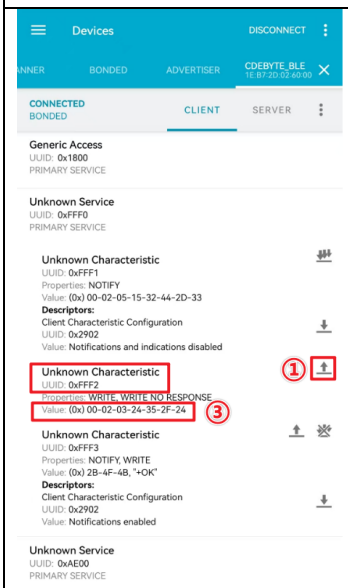
- When only BLE roles are connected, over-the-air configuration can be used
- Open the App " n RF connect ", start scanning devices, find the device "CDEBYTE_BLE", and connect to it.

Filter the Bluetooth module signal to be linked through RSSI	
Connect to the broadcast named "EBYTE BLE"	
After connecting, open the service of 0xFFF0 and start the subsequent operations	

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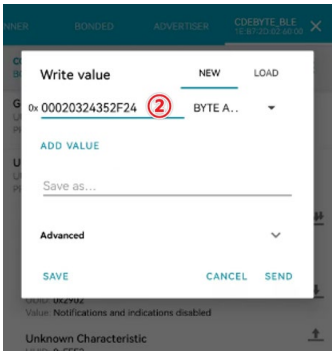
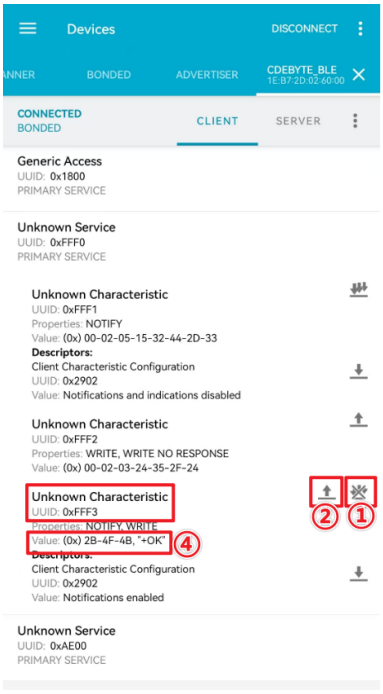
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- Perform a data transfer test.

<table>
<tr><td>Operate</td><td>Mobile</td><td>PC</td></tr>
<tr><td rowspan="2">Open the service with UUID FFF1: APP receives data</td><td>Receive data: Select ①;
The received data will be displayed at the position shown in ②</td><td>Sending Data</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td rowspan="2">Open the service with UUID FFF2: APP sends data</td><td>Send data: Open①;
Fill in the sending data in the position shown in ②;
③The location shown echoes the sent data</td><td></td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

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<table>
<tr><td></td><td>
</td><td></td></tr>
<tr><td rowspan="2">Open the service with UUID FFF 3: Configuration Operation: The module can be configured over the air by sending AT commands via the Bluetooth connection. Please note that the password must be verified before air configuration: see section 5.1</td><td>Send AT command and receive the echo:
Open①Receive data echo;
Open② to edit the content to be sent;
Fill in the instructions in the position shown in ③, and note that the TEST format must be selected;
At position ④, you can view the command operation result echo.</td><td>No data transfer occurs</td></tr>
<tr><td>
</td><td>/</td></tr>
</table>

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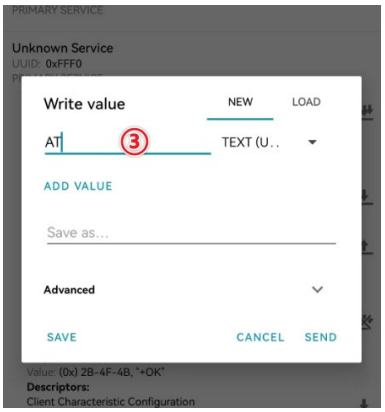


Figure 4-4 RF connect Over-the-air configuration process

- Configure the module according to the instructions shown in the instruction table
- The format of the returned message refers to the instruction table. Some instructions may display several extra 0x00s, which can be ignored.

  When the message returned by an Apple user is too long, such as querying the Bluetooth name, it may only display 22 bytes depending on the APP. In this case, please limit the set value to a reasonable length.

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4.3 SPP Data Transmission

1. Open the SPP Bluetooth serial port APP, search for the Bluetooth name: CDEBYTE_SPP and connect.

Filter the Bluetooth module signal to be linked through RSSI	
Connect to the broadcast named "EBYTE SPP"	

Operate	Mobile	PC
Two-way transparent data transmission	Receiving Data	Sending Data
		
	Sending Data	Receiving Data

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Chapter 5 Functional Description

5.1 Configuration

The module supports two configuration modes: serial port configuration and air configuration (BLE). Before air configuration, you must verify the password through AT+AUTH =123456 (initial password). After verification , the air configuration will take effect. The air configuration authentication cycle is for this connection. If the device is disconnected and reconnected, re-authentication is required.

When not connected, the module is always in configuration mode.

After the connection is successful, the module is currently in configuration mode or data transmission mode according to the MODE pin level. When the MODE pin is high, it is in data transmission mode, and when it is low, it is in configuration mode.

5.2 MAC address binding

Classic Bluetooth supports MAC address binding. If the MAC address binding function is enabled, the device will only connect to the device with the set MAC address .

5.3 Status or event printing

The command AT+LOGMSG is used to configure and enable the serial port printing function of the status information. The status information includes: initialization, connection, and disconnection. The format is as follows:

state	Print information
Connection successful	\r\nSTA:connected:[MAC]\r\n
Disconnection	\r\nSTA:disconnected\r\n

5.4 Classic Bluetooth pairing

Serial number	Pairing Mode	describe	Related AT commands
0	pin code	The phone needs to enter the pairing code	AT+PIN
1	no input output	The phone needs to confirm the pairing request	-
2	Passkey	The module requires a passkey	AT+PASSKEY
3	confirm	After the module displays the "confirmation code", the user confirms it through AT commands	AT+CONFIRM

Pin code pairing requires the mobile phone or computer to enter the PIN code, that is, the PIN code set by the module (AT+PIN command). The connection can be established only after the correct input. If the host is a module, the host and the module can set the same PIN code.

No input and output pairing, only mobile phone confirmation is required.

Passkey pairing mobile phone randomly gives a 6-digit ASCII code, and the module uses the AT+PASSKEY command to input the 6-digit ASCII code to establish a connection.

Confirm the pairing. The mobile phone generates a 6-bit ASCII code and sends it to the module. The module prints +CONFIRM: [6-bit ASCII code] through the serial port. After confirming that they are the same, enter AT+COMFIRM=YES to establish a connection, or AT+COMFIRM=NO to reject the connection request.

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5.5UUID Description

Service UUID	FFF0		
Eigenvalue	UUID	property	describe
SLAVE CHANNEL	FFF1	read/notify	The slave sends data and the host receives data channel
MASTER CHANNEL	FFF2	read/write	The host sends data and the slave receives data channel
CONFIG CHANNEL	FFF3	read/write	Air configuration channel

The 128-bit UUID is 00 00 xx xx 00 00 10 00 80 00 00 80 5f 9b 34 fb xx xx for a 16-bit UUID.

5.6 Packaging mechanism

Regardless of the baud rate of data transmission, it is recommended to perform verification and retransmission processing at the upper layer.

In BLE mode, the serial port of the EWM104-BT41SX/SP module can process a maximum of 255 bytes of data packets at a time, which are packaged into 255 bytes per packet. The data packets sent to the module by the mobile device (Android 5.0 or below) must be sub-packetized (1-255 bytes/packet) by themselves. After the module receives the data packets, it will forward them to the serial port of the module in sequence.

E WM104-BT41SX/SP module in SPP mode, the serial port can receive and process a maximum of 255 bytes of data packets at a time. The data packets sent from the mobile device to the module should be divided into packets (1-255 bytes/packet).

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Chapter 6 AT Commands

6.1 Default Parameters

Baud rate	115200
SPP Name	CDEBYTE_SPP
BLE Name	CDEBYTE_BLE
Pairing code	1234
Pairing Mode	1 (no input output)
Enable MAC binding	closure
Bind MAC	FF FF FF FF FF FF
Status Printing	closure
Air configuration password	123456
16-bit Service UUID	FFF0 ①
16-bit Slave channel uuid	FFF1
16-bit Master channel uuid	FFF2

① :128-bit UUID is 00 00 xx xx 00 00 10 00 80 00 00 80 5f 9b 34 fb
xx xx is a 16-bit UUID.

6.2 Instruction Description

All AT commands do not need to add carriage return (\r) or line feed (\n)

The return result of AT command ends with \r\n (except for HEX return), and the response in the command table in Section 6.3 ends with \r\n.

Command error response format +ERR=[NUM]. (NUM is ASCII)

6.3 AT command error code description

Error code return format —ERROR (error code index number)

NUM	Description	Cause	Workaround
-0	Instruction does not exist	AT command characters are incorrect	Checking Strings
-1	Parameter length error	1、 The total length of the parameters is too long 2、 Parameter length does not meet	According to the AT command manual, check the parameter length according to 'Instructions'
-2	Invalid parameters	The parameter does not meet the value range.	Check the parameter value range by referring to the command
-3	The command exists but the	Only the command was entered, error example: AT+BAUD Correct example: AT+BAUD?	Check the instructions and confirm the operation

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	operation is not supported		
-4	Not connected	The module is not connected	-
-5	Do not allow turning off any baud rate setting	Turn off the baud rate and set the previous baud rate to a value other than the normal baud rate	Before turning off the baud rate setting, set the baud rate to the normal baud rate.
-6	Buffer length exceeded	The total length of the input AT command and parameters is too long	Check that the total length of AT commands and parameters does not exceed 250 bytes
-7	The command is invalid at this time	-	-
-8	Module connected	This command does not support operations in the connected state.	-
-9	No over-the-air configuration authentication	Use AT+AUTH command for authentication before sending commands	
-10	Over-the-air configuration authentication failed	Wrong password	1. Use the correct password 2. Reconfigure via the serial port
-11	Unknown error		-

6.4 Command List

6.4.1 AT test command

Command	Answer
AT	+OK
Description: None	

6.4.2 AT+RESET reset command

Command	Answer
AT+RESET	+OK
Description: Effective immediately	

6.4.3 AT+RESTORE restore factory command

Command	Answer

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AT+RESTORE	+OK
Description: 1、 Restart to take effect. After the setting is successful, restart immediately; 2、 During the factory reset process, any form of reset is prohibited and power is not turned off before the operation is completed.	

6.4.4 AT+BAUD Serial port baud rate

Command		Answer
Query	AT+BAUD?	+OK=[para]
Set up	AT+BAUD=[para]	+OK: Success +ERR=[NUM]:Error
Parameter		

para(ASCII)	Conventional baud rate (bps)
0	2400
1	4800
2	9600
3	19200
4	38400
5	57600
6	115200 (default)
7	230400
8	406800
9	921600
10	1000000

Description	Restart to take effect, save after power off
Example	By default: Query: AT+BAUD? Response: +OK=8 Setting: AT+BAUD=2. Set the baud rate to 9600 Response: +OK

6.4.5 AT+DEVSWVER software version number

Command		Answer
Query	AT+DEVSWVER?	+OK=[para]
Parameter	para(ASCII code): device software version Factory default: V1.0	

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6.4.6 AT+SPPNAME SPP name

Command		Answer
Query	AT+SPPNAME?	+OK=[para]
set up	AT+ SPPNAME =[para]	+ERR=[NUM]: Error
parameter	para(ASCII code):SPP name Factory default: CDEBYTE_SPP	
Description	1. Take effect after restart or BLE disconnection, save after power off 2. The name length is 1 to 31 bytes	

6.4.7 AT+BLENAME BLE broadcast name

Command		Answer
Query	AT+BLENAME?	+OK=[para]
set up	AT+ BLENAME =[para]	+ERR=[NUM]: Error
parameter	para(ASCII code): BLE broadcast name Factory default: CDEBYTE_BLE	
Description	1. Take effect after restart or BLE disconnection, save after power off 2. The length of ASCII code is 1~32 bytes	

6.4.8 AT+MAC SPP MAC address

Command		Answer
Query	AT+MAC?	+OK=[para]
Parameter	para(HEX):MAC address	
Description	Restart immediately after setup is complete Setting the SPP MAC also sets the BLE MAC address. The fourth byte of the BLE MAC address is 1 greater than the SPP address.	
Example	Command: AT+MAC? Return: 2B 4F 4B 3D 14 2D E6 92 88 00 0D 0A (this address is the SPP MAC address) BLE MAC address: 14 2D E6 93 88 00	

6.4.9 AT+PAIRMODE Classic Bluetooth pairing mode

Command		Answer
Query	AT+PAIRMODE?	+OK=[para]
set up	AT+ PAIRMODE =[para]	+OK: Success +ERR=[NUM]: Error
Parameter		

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<table>
<tr><td></td><td>
<table>
<tr><th>para(ASCII)</th><th>describe</th></tr>
<tr><td>0</td><td>Pin code</td></tr>
<tr><td>1</td><td>No input output (default)</td></tr>
<tr><td>2</td><td>passkey</td></tr>
<tr><td>3</td><td>confirm</td></tr>
</table>
</td></tr>
<tr><td>Description</td><td>Restart to take effect, save after power off:
Pairing mode 0: The device has set the PINCODE, and the phone enters the PINCODE during pairing
Pairing Mode 1: Direct Connection (Default Mode)
Pairing mode 2: The phone pops up the passkey, enter the passkey in the serial port, and connect after it is correct
Pairing mode 3: The phone pops up the passkey and forwards it to the serial port. Enter yes/no in the serial port to choose whether to pair.
Now the pairing mode is 3. The device cannot get the passkey of the mobile phone, so it cannot be forwarded to the serial port.</td></tr>
<tr><td>Example</td><td>AT+PAIRMODE=0</td></tr>
</table>

6.4. 10 AT+PIN Classic Bluetooth pairing code

Command		Answer
Query	AT+PIN?	+OK=[para]
set up	AT+PIN=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	para(ASCII): Each value ranges from 1 to 9 Factory default: 1234	
Description	1. The next connection will take effect and will be saved after power failure. 2. The length is 4 bytes	
Example	AT+PIN=1234	

6.4.11 AT+DISCON Disconnect the current connection

Command		Answer
set up	AT+DISCON	+OK: Success +ERR=[NUM]: Error
Description	After a short time, Bluetooth is disconnected	

6.4.12 AT+LOGMSG Running status output

Command		Answer
Query	AT+LOGMSG?	+OK=[para]
set up	AT+LOGMSG=[para]	+OK: Success

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		+ERR=[NUM]: Error
Parameter	<table><tr><th>para(ASCII)</th><th>describe</th></tr><tr><td>0</td><td>Off (default)</td></tr><tr><td>1</td><td>Open</td></tr></table>	
Description	Takes effect immediately and is saved after power failure	
Example	Command: AT+LOGMSG=1 Response: +OK	

6.4.13 AT+CLOSESPP Close SPP

Command		Answer
set up	AT+CLOSESPP	+OK: Success
Description	Effective immediately	

6.4.14 AT + OPENSPP opens SPP

Command		Answer
set up	AT+OPENSPP	+OK: Success
Description	Effective immediately	

6.4.15 AT+STATE Query Bluetooth status

Command		Answer
Query	AT+STATE?	+OK=[para]
Parameter	<table><tr><th>para(ASCII)</th><th>describe</th></tr><tr><td>0</td><td>Dual mode waiting for connection</td></tr><tr><td>1</td><td>SPP Connected</td></tr><tr><td>2</td><td>BLE connected</td></tr><tr><td>3</td><td>SPP is closed</td></tr></table>	

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6.4.16 AT+BOND Enable bonding

Command		Answer
Query	AT+BOND?	+OK=[para]
set up	AT+BOND=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	<table><tr><th>para(ASCII)</th><th>describe</th></tr><tr><td>0</td><td>Binding off (default)</td></tr><tr><td>1</td><td>Binding Enabled</td></tr></table>	
Description	Takes effect immediately and is saved after power failure	
Example	Command: AT+BOND=1 Response: +OK	

6.4. 17 AT+BONDMAC bind MAC address

Command		Answer
Query	AT+BONDMAC?	+OK=[para]
set up	AT+ BONDMAC =[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(HEX):6bytes MAC address	
Description	Takes effect immediately and is saved after power failure	
Example	Command: AT+BONDMAC? Return: 2B 4F 4B 3D CC 34 27 1A 0C D4 Instruction: 41 54 2B 42 4F 4E 44 4D 41 43 3D CC 34 27 1A 0C D4 Return: +OK	

6.4.18 AT+PASSKEY Input pairing key

Command		Answer
set up	AT+ PASSKEY=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(ASCII): 6-bit ASCII code	
Description	Effective immediately The user serial port receives +PASSKEY and uses this command to reply	
Example	Command: AT+PASSKEY=123456	

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	Response: +OK

6.4.19 AT+AUTH Air configuration password authentication

Command		Answer
set up	AT+ AUTH=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(ASCII): 6-bit ASCII code	
Description	1. This command is only used for air certification 2. Default password: 123456	
Example	Command: AT+AUTH=123456 Response: +OK	

6.4. 20 AT+UPDAUTH Reset authentication password

Command		Answer
set up	AT+UPDAUTH =[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(ASCII): 6-bit ASCII code	
Description	The next authentication will take effect and will be saved after power failure	
Example	AT+UPDAUTH=abcdef	

6.4.21 AT+UUID Query UUID

Command		Answer
Query	AT+UUID?	+OK=[para1],[para2],[para3],[para4]
Parameter	para(ASCII): para1:SERVER UUID; para2: SLAVE CHANNEL characteristic UUID; para3: MASTER CHANNEL characteristic UUID; para4: Air configuration channel characteristic UUID	

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6.4.22 AT+UUIDSVR Bluetooth Service UUID

Command		Answer
set up	AT+ UUIDSVR=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(ASCII): UUID value. The value range is 1~65535, and each ASCII code value is 1~9.	
Description	Restart to take effect, save after power off	
Example	AT+UUIDSVR=65520, that is, the service UUID is 0xFFF0	

6.4.23 AT+UUIDCHARA1 SLAVE CHANNEL Characteristic UUID

Command		Answer
set up	AT+ UUIDCHARA1=[para]	+OK: Success +ERR=[NUM]: Error
parameter	Para(ASCII): UUID value. The value range is 1~65535, and each ASCII code value is 1~9.	
Description	1. Restart to take effect, save after power off 2. Slave channel: used for the slave to send data and the host to receive data.	
Example	AT+UUIDCHARA1=65521, that is, the slave channel characteristic UUID value is set to 0xFFF1	

6.4.24 AT+ UUIDCHARA2 MASTER CHANNEL Characteristic UUID

Command		Answer
set up	AT+ UUIDCHARA2=[para]	+OK: Success +ERR=[NUM]: Error
Parameter	Para(ASCII): UUID value. The value range is 1~65535, and each ASCII code value is 1~9.	
Description	1. Restart to take effect, save after power off 2. Host channel. Used for the host to send data and the slave to receive data.	
Example	AT+UUIDCHARA2=65522, that is, the host channel characteristic UUID is set to 0xFFF2	

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Chapter 7 Hardware Design

- It is recommended to use a DC regulated power supply to power the module. The power supply ripple coefficient should be as small as possible and the module should 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 it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged.
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from parts with large electromagnetic interference, such as power supplies, transformers, and high-frequency wiring;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid the bottom of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, ground copper should be laid on the Top Layer of the module contact part (all copper should be laid and well grounded), and it must be close to the digital part of the module and routed on the Bottom Layer ;
- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the module's spurious signal and receiving sensitivity to varying degrees ;
- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If the communication line uses 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 TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Make sure the antenna is exposed and preferably vertically upward. When the module is installed inside the housing, use a high-quality antenna extension cable to extend the antenna to the outside of the housing;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.

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Chapter 8 Frequently Asked Questions

8.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly or the air rate is set too high ;
- The power supply voltage at room temperature is lower than the recommended value. The lower the voltage, the lower the power output .
- The antenna used does not match the module well or the antenna itself has quality issues.

8.2 Modules are vulnerable to damage

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity ;
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

8.3 Bit error rate is too high

- There is interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Extension cables or feeder cables that are of poor quality or are too long can also cause a high bit error rate.

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Chapter 9 Welding Operation Instructions

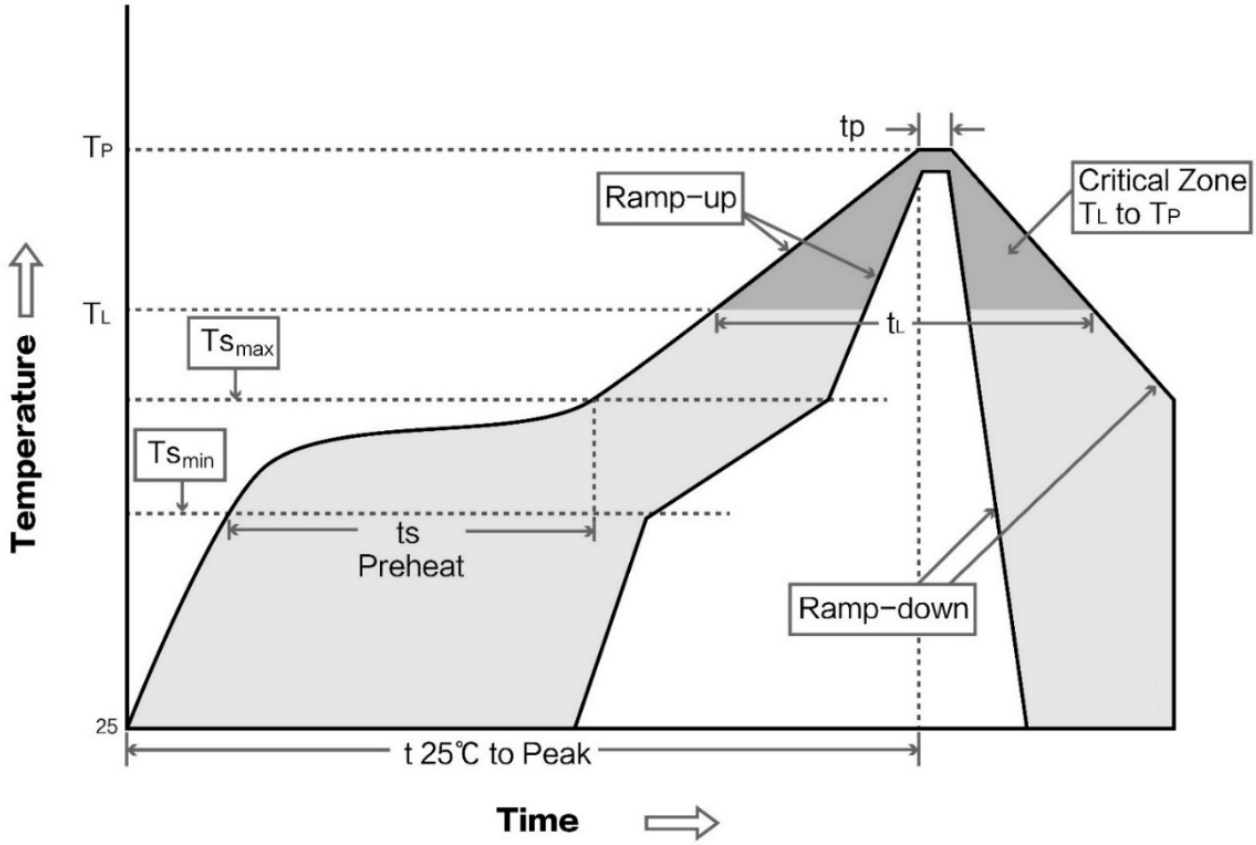
9.1 Reflow temperature

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)	Minimum preheating temperature	100 ℃	150 ℃
Preheat temperature max (Tsmax)	Maximum preheating temperature	150 ℃	200 ℃
Preheat Time (Tsmin to Tsmax)(ts)	Warm-up time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ascent rate	3 ℃ /second max	3 ℃ /second max
Liquid Temperature (TL)	Liquidus temperature	183 ℃	217 ℃
Time(tL)Maintained Above(TL)	Time above liquidus	60-90 sec	30-90 sec
Peak temperature (Tp)	Peak temperature	220-235 ℃	230-250 ℃
Aveage ramp-down rate（Tp to Tsmax）	Average descent rate	6 ℃ /second max	6 ℃ /second max
Time 25 ℃ to peak temperature	25 ℃ to peak temperature	6 minutes max	8 minutes max

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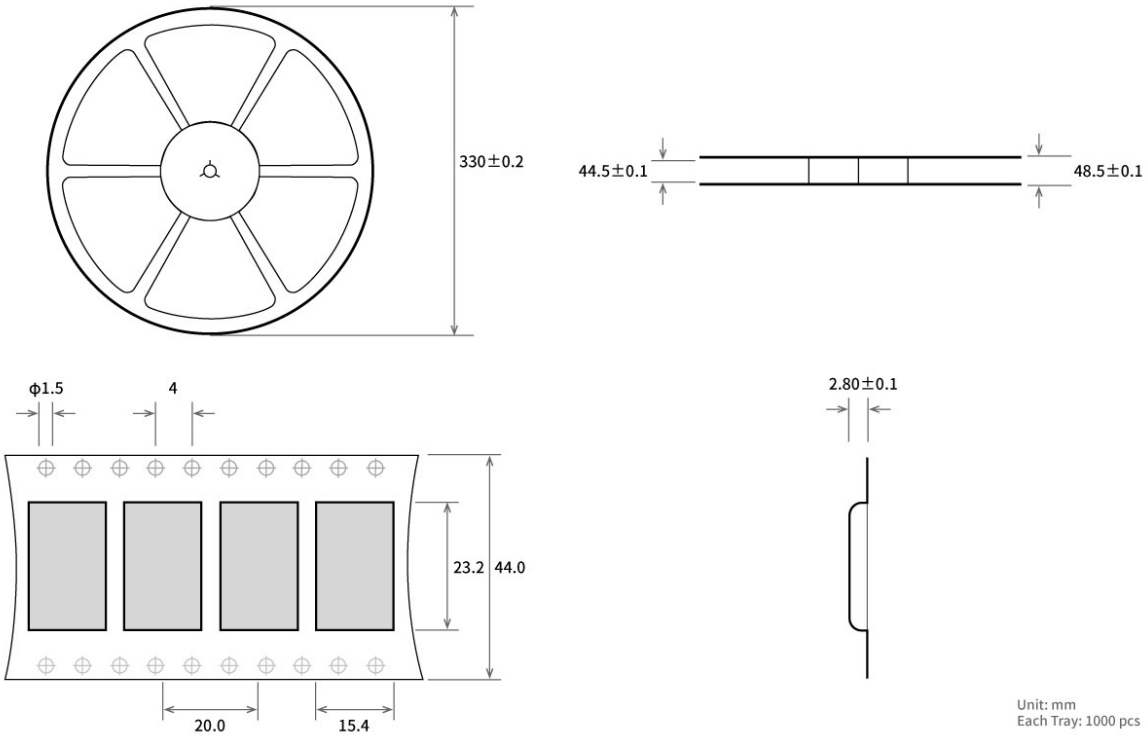
9.2 Reflow Oven Curve



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Chapter 10 Bulk Packaging Methods



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1.0	2025-07-09	Initial release	Lei

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