E103-W11 User Manual

WiFi 6+BLE 5.1 Serial to WiFi Module



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

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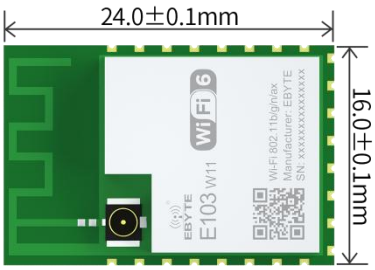
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1Introduction

1.1 Brief Introduction

The E103-W11 is a high-cost-performance wireless module supporting both Wi-Fi and Bluetooth Low Energy (BLE) with a surface-mount compact package, offering precise frequency band coverage 2.4~2.4835GHz. This module supports Wi-Fi compatibility 802.11b/g/n/ax protocols and complies with the 5.1 BLE standard. It integrates complete software and hardware resources for both Wi-Fi and Bluetooth applications, enabling dual connectivity modes: AP (Access Point) and STA (Station) Wi-Fi connections, as well as BLE Bluetooth Low Energy connections.



In terms of hardware configuration, the module is equipped with MCU with the highest operating speed up to 240MHz and built-in 512KB RAM. It not only supports direct data transmission and reception through serial port, greatly reducing the development threshold of wireless applications, but also can stably support cloud connection function, easily adapting to the needs of various wireless scenarios such as smart home and industrial monitoring.

1.2 Features

- Support WiFi 6 and Bluetooth Low Energy BLE 5.1；
- Available for global license-free ISM 2.4GHz frequency band；
- Support high-speed data transparent transmission；
- Support cloud server (MQTT);
- Support STA/AP mode, at least 8 devices' access is supported in AP mode；
- Support network protocols: IPv4, TCP/ UDP；
- Support three Socket roles: TCP Server, TCP Client and UDP；
- Serial communication supported；
- AT commands supported；
- OTA upgrade supported；
- Support for Bluetooth distribution network；
- With superior MIMO technology。

1.3 Application

- Home security alarm and remote keyless entry
- Smart home appliances
- Wireless alarm security system
- Building automation solutions
- Industrial control
- Healthcare products
- Advanced Meter Reading Architecture (AMI)
- Environmental monitoring

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2Specification and parameter.

2.1 RF Parameters

RF parameters	Value	Remark
Working frequency	2400MHz～2480MHz	Support ISM band
transmit power	19.5dBm～20.5dBm	The software is adjustable, available for user self-development and configuration
Baud rate range	160-2000000bps	Default baud rate115200bps
Receive sensitivity	-87dBm	Air rate 500kbps
Wi-Fi version	IEEE 802.11 b/g/n/ax	Modulation technology
Air rate	150Mbps	\
Blocking power	10dBm	The probability of burning at close range is small
Reference distance	300m	Sunny and open, antenna gain 0dBi, onboard PCB antenna.

2.2 Electrical parameters

Main parameters	Performance			Remark
	Min	Typical value	Max	
Working voltage (V)	3	3.3	3.6	≥3V guarantees output power, higher than 3.6V will permanently burn modules
I/O voltage	-0.3	-	3.6	Voltage over 3.6V will cause permanent damage to module I/O
Communication level (V)	-0.3	3.3	3.6	5V TTL will permanently burn the module
Working temperature (℃)	-40	-	+85	Industrial design

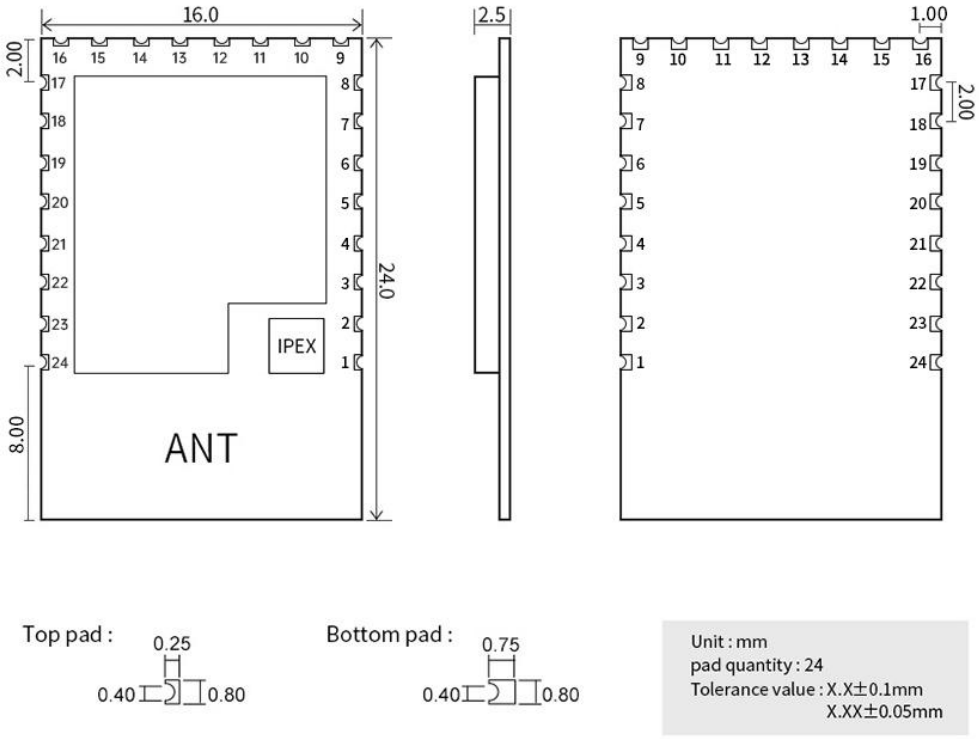
2.3 Hardware parameters

Hardware parameters	Value	Remark
Packaging method	SMD	-
Interface	Stamp hole	Spacing 2.0mm
Communication interface	UART serial port	TTL level
Dimension	16*24mm	--
Net weight	1.3g	±0.1g
RF interface	IPEX/stamp hole	Equivalent impedance is about 50Ω

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3Size and Pin Definition



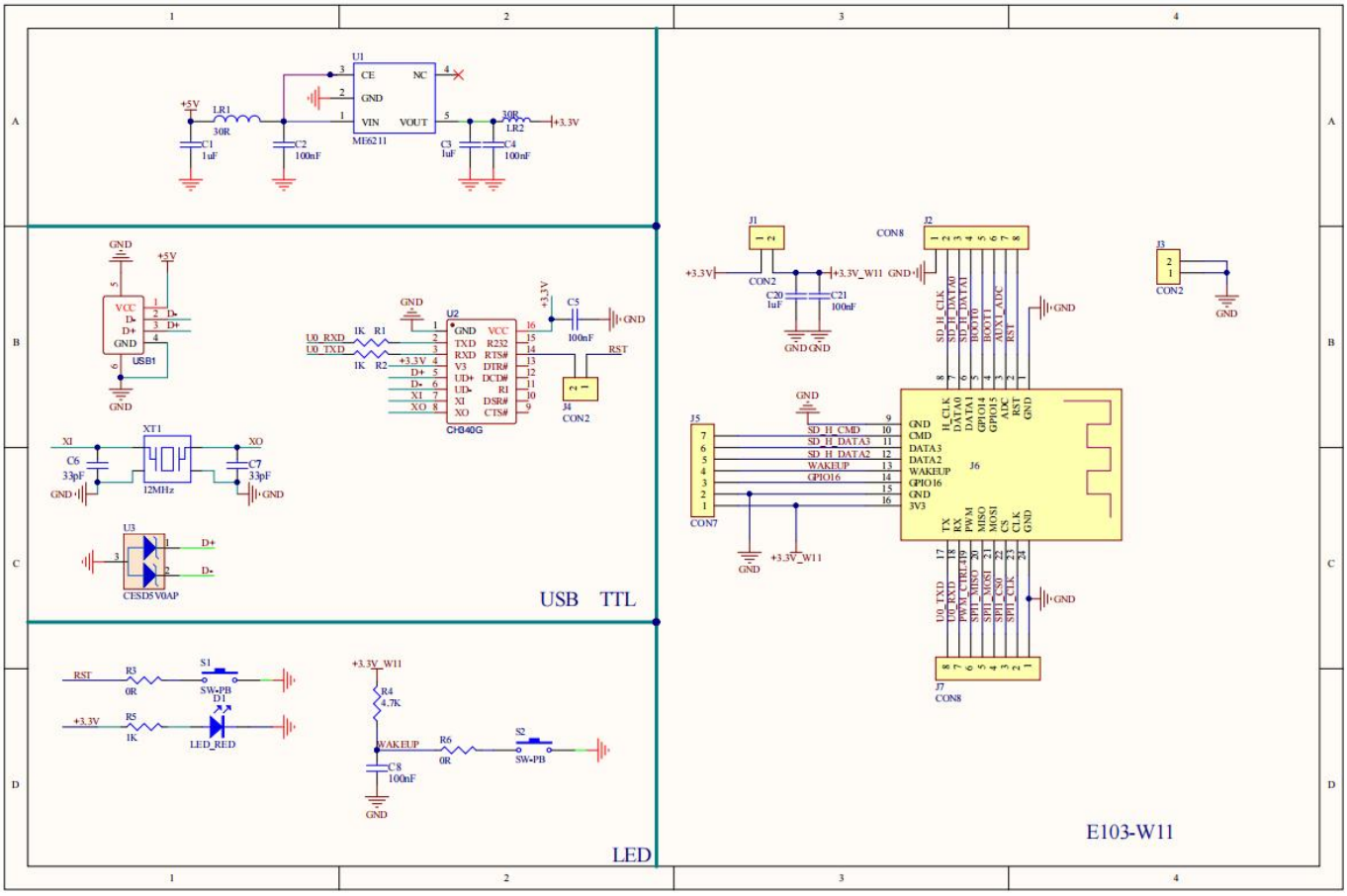
E103-W11 Pin size

Item	Pin name	I/O	Application
1	GND		Ground wire, connected to the power reference ground
2	RST	I	Chip reset input pin, low level reset
3	ADC	I/O	GPIO_NUM_20, it can be used as general GPIO by SYIO series instructions
4	IO1	I/O	GPIO_NUM_15, it can be used as general GPIO by SYIO series instructions
5	IO2	I/O	GPIO_NUM_14, it can be used as general GPIO by SYIO series instructions
6	DATA1	I/O	GPIO_NUM_23, it can be used as general GPIO by SYIO series instructions
7	DATA0	I/O	GPIO_NUM_22, it can be used as general GPIO by SYIO series instructions
8	H_CLK	I/O	GPIO_NUM_13, it can be used as general GPIO by SYIO series instructions
9	GND		Ground wire, connected to the power reference ground
10	CMD	I/O	GPIO_NUM_21, it can be used as general GPIO by SYIO series instructions
11	DATA3	I/O	GPIO_NUM_25, it can be used as general GPIO by SYIO series instructions
12	DATA2	I/O	GPIO_NUM_24, it can be used as general GPIO by SYIO series instructions
13	WAKE	I	Chip reset input pin, low level reset. When using, RC reset pull-up is needed
14	IO3	I/O	GPIO_NUM_16, it can be used as general GPIO by SYIO series instructions
15	GND		Ground wire, connected to the power reference ground
16	VCC		Power input
17	U0_TXD	0	AT serial port, TX of the module, connecting to RX of external TTL
18	U0_RXD	I	AT serial port, RX of the module, connecting to TX of external TTL
19	PWM	I/O	GPIO_NUM_4, it can be used as general GPIO by SYIO series instructions
20	MISO	I/O	GPIO_NUM_3, it can be used as general GPIO by SYIO series instructions
21	MOSI	O	Modulation serial port of E103-W11, LOG_TX, connecting to RX of external TTL
22	CS	I	Modulation serial port of E103-W11, LOG_RX, connecting to TX of external TTL
23	CLK	I/O	GPIO_NUM_0, it can be used as general GPIO by SYIO series instructions
24	GND		Ground wire, connected to the power reference ground

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4Recommended wire diagram



Note: The power supply must be within 3.0~3.6V. In order to ensure the stable operation of the module, it is recommended to select an external LDO with a current greater than 500mA.

5Packaging Requirements

Note: Please use the product package provided on Ebyte official website for secondary development and design.

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6Quick Start

E103-W11 is featured with easy usability. In order that users can quickly familiarize, this section will guide users to configure and communicate with this module in various modes through simple setting.

In this section, tests will use configuration software and the module will echo the currently-sent commands, so that users can quickly know how to use AT command, thereby writing their own AT serial commands (Note: A newline is required after each AT command).

Hardware used in this section:	
1	E103-W11 Wi-Fi module: 1pcs
2	E103-W11 Wi-Fi test board 1 pcs
3	Computer with Wi-Fi function 1 set
4	Router (replaceable by a mobile phone Wi-Fi hotspot) 1 set
Software that will be used in this section (All can be downloaded on Ebyte official website)	
1	E103-W11 network debugging assistant
2	BLE configuration APP
3	Serial Port Assistant Xcom

6.1 Communication with server as TCP client

The following preparations are needed before doing the preliminary work

- Ensure that modules and server can exchange data via ping commands
- Module can operate normally
- E103-W11 network debugging assistant is needed
-

6.1.1 Access to network

AT+CWMODE=1,"s.y" //Switch the module mode to STA and save it to FLASH
AT+CWJAP="Test11","12345678","s.y" //Connect the module to the WiFi with SSID "Test11" and password "12345678"

6.1.2 Switch to communication mode and connect to TCP Server

AT+CIPSTART="TCP","192.168.1.100",1001 //Establish a TCP connection with the tcp sever of 192.168.1.100. If transparent transmission once start is needed,
use the AT+SAVELINK command
AT+CIPMODE=1 //Switch to transparent transmission
AT+CIPSEND // Send data //After the module sends the '>' symbol, transparent transmission is enabled

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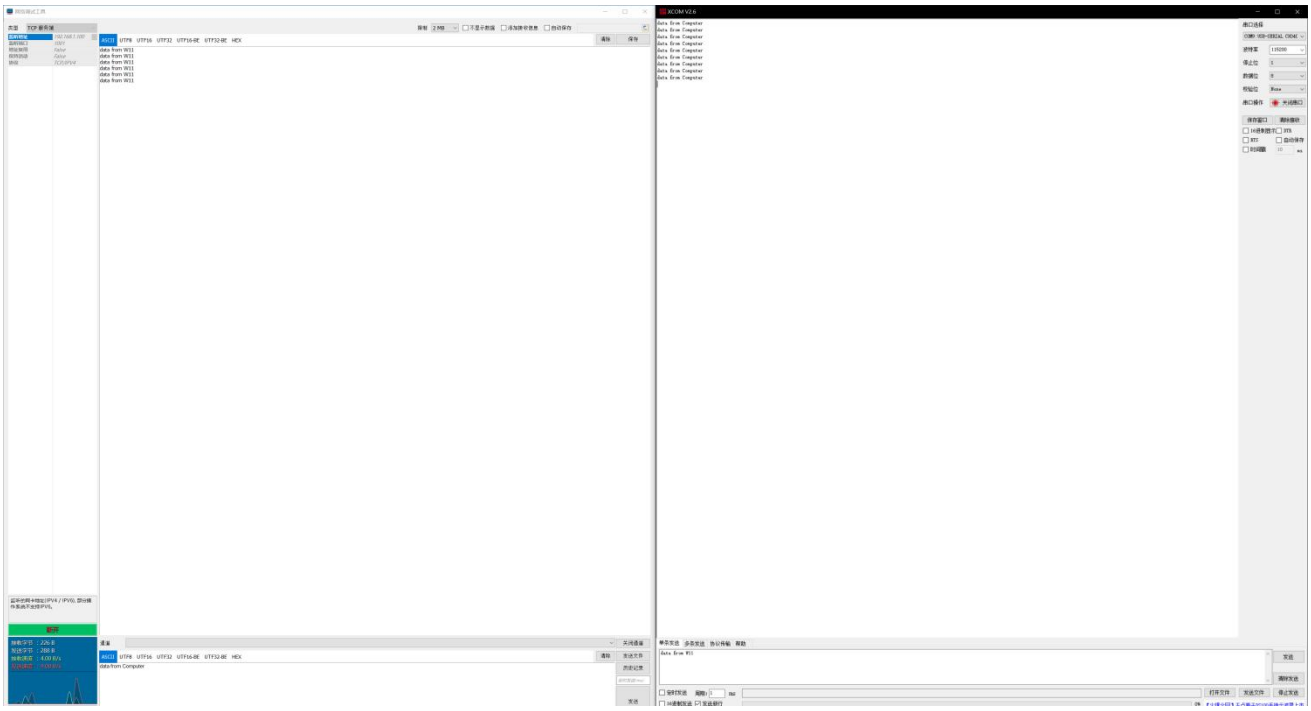


Fig.1 Schematic of module communication mode

6.2 Use BLE for network configuration

Below preparations are needed

- Ensure the module is in STA mode
- Serial Port Assistant Xcom and BLE configuration APP are needed
- The following diagram 1 and diagram 2 are operation schematic

6.2.1 Switch working mode

AT+CWMODE=1,"s.y" //Switch the module mode to STA and save it to FLASH

6.2.2 Enable BLE broadcast

AT+BLEADVSTART

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Diagram 1

```
AT+BLENAME="E103-W11 Test"

OK
AT+BLENAME?
+BLENAME:"E103-W11 V1.0"

OK
AT+BLEADVSTART

OK
AT+CWMODE=1,"s.y"
```

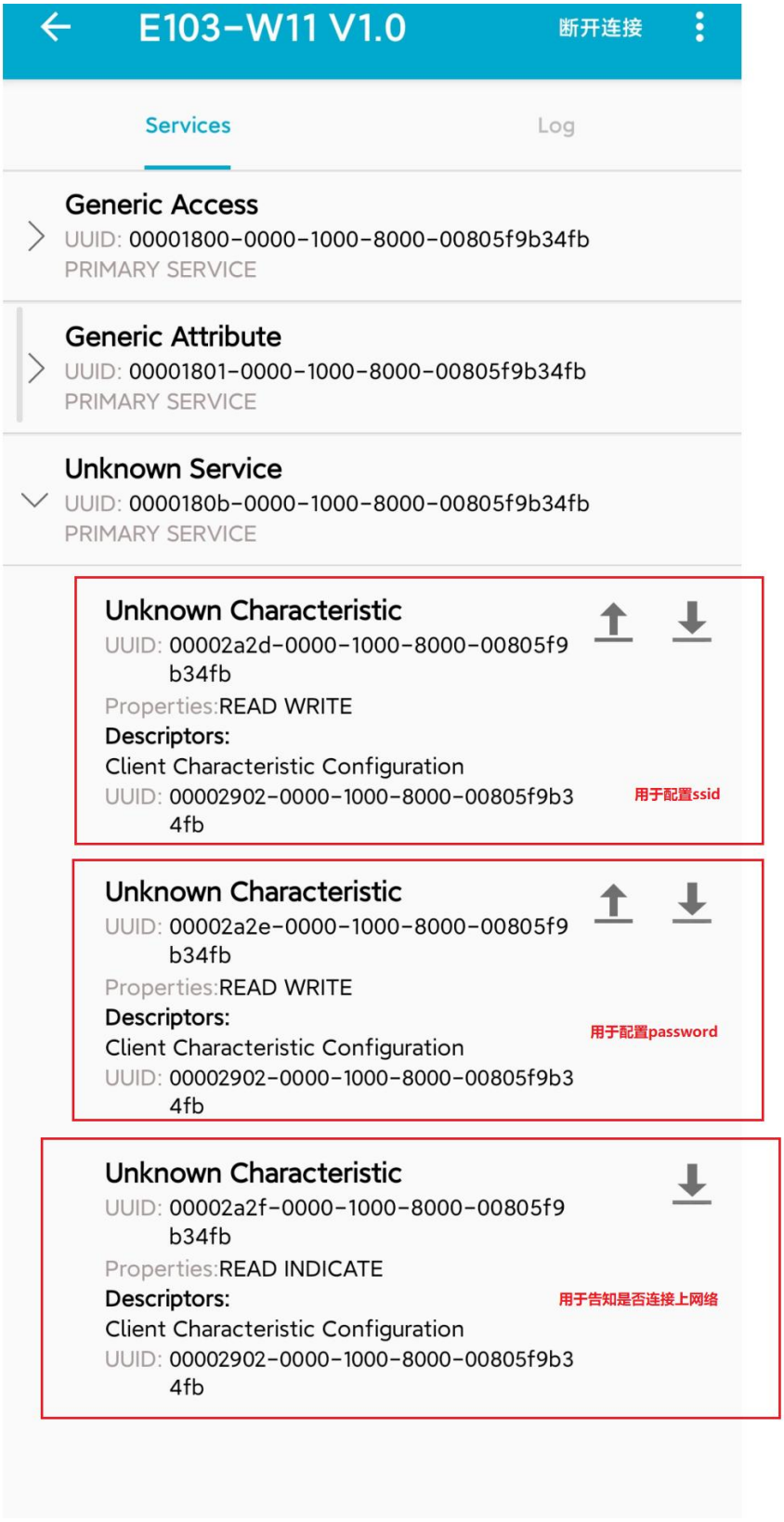
写入信息完成 模组连接Wifi成功

```
OK
SYSTEM_EVENT_STA_CONNECTED
WIFI CONNECTED
SYSTEM_EVENT_STA_GOT_IP
WIFI GOT IP
```

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6.2.3 Description of BLE network configuration interface



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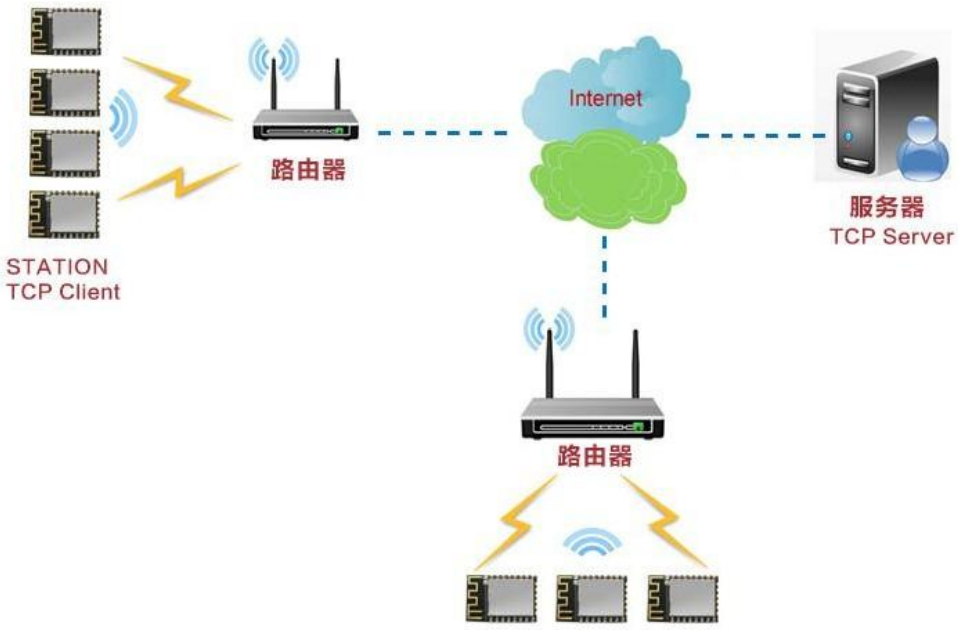
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7Instruction for network configuration

7. 1 Network configuration role

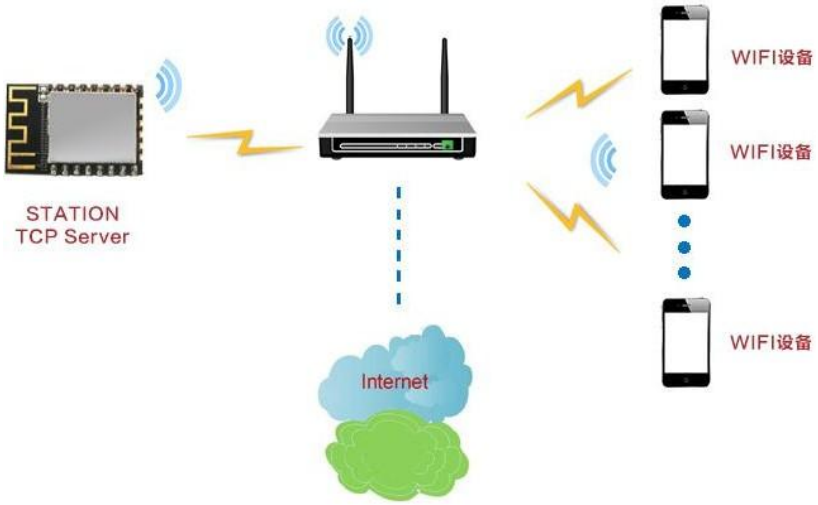
Serial No.	Remark
1	E103-W11 supports AP mode as a physical connection role (equivalent to a router). In STATION mode (it is equivalent to a Wi-Fi device), access of up to 8 Wi-Fi devices in AP mode is supported.
2	E103-W11 includes TCP Server, TCP Client and UDP as Socket role. In TCP Server mode as Socket role. Connection to 5 Sockets is supported. In case of TCP-based connection mechanism, if connected for a long time is needed, please use TCP heartbeat packets.

7. 2 Network configuration model

The module realize connection and communication between a TCP Client and a remote server in STATION mode (typical application)
The model can meet the application requirements of home Internet of things, intelligent meter reading, real-time monitoring, etc. The module is available for real-time exchange data with the network server. User can perform various operations on the module in real time by interacting with the network server.

The module enables a connection between the TCP Server and the Wi-Fi device in STATION mode
This networking model is similar to the first one. The difference is that the module enables a TCP Server instead of a TCP Client in STATION mode. Under the condition of networking, this mode can support up to 5 remote device connections.

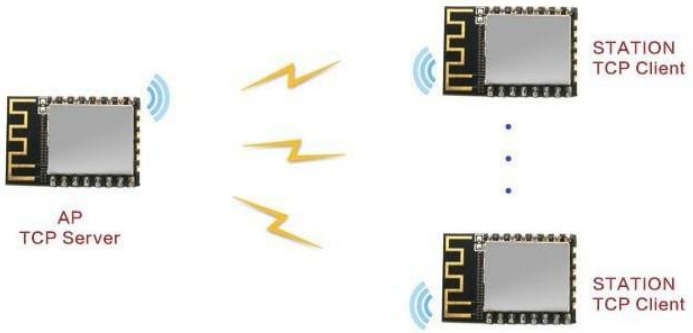
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One module enables TCP Server in AP mode, and other modules enables TCP Client to communicate with each other in STATION mode

This networking model can be referred to as intra-module networking. A module in AP mode can be connected to a maximum of 8 STATIONs, that is, there are up to 9 module devices in the network. Under the condition that the internal networking is completed, the TCP Server can be established on any module, and the remaining 8 modules can use the TCP Client to communicate with it (but the number of clients that can access the TCP server at the same time cannot exceed 5).



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8Hardware design

It is recommended to use a DC regulated power supply to supply power to the module, the power supply ripple coefficient should be as small as possible, and the module should be grounded reliably

Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module

Please check the power supply to ensure that it is between the recommended power supply voltages. 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 and frequently;

When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so that the whole machine can work stably for a long time;

The module should be kept as far away as possible from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference;

High-frequency digital traces, high-frequency analog traces, and power traces must avoid the underside of the module. If it is absolutely necessary to pass under the module, assuming that the module is soldered on the Top Layer, ground copper is placed on the Top Layer of the contact part of the module (all layers). Copper and well grounded), must be close to the digital part of the module and routed on the Bottom Layer;

Assuming that the module is soldered or placed on the Top Layer, it is also wrong to arbitrarily route wires on the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees;

Assuming that there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to stay away from the module according to the intensity of the interference. If the situation allows, appropriate isolation and shielding can be done;

Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), the performance of the module will also be greatly affected. It is recommended to stay away from the module according to the intensity of the interference. Proper isolation and shielding;

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 TTL protocols whose physical layer is also 2.4GHz, for example: USB3.0;

The antenna installation structure has a great influence on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the case, a high-quality antenna extension cable can be used to extend the antenna to the outside of the case

The antenna is not allowed to be installed inside the metal shell, which will greatly reduce the transmission distance.

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9Frequently Asked Questions

9.1 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-frequency interference will increase the communication packet loss rate;

The ground absorbs and reflects radio waves, and the test effect is poor near the ground;

Sea water has a strong ability to absorb radio waves, so the seaside test effect is poor;

If there are metal objects near the antenna or placed in a metal shell, the signal attenuation will be very serious;

The power register is set incorrectly, and the air rate is set too high (the higher the air rate, the closer the distance);

The low voltage of the power supply at room temperature is lower than the recommended value, the lower the voltage, the lower the power output;

The poor matching degree of the antenna and the module or the quality of the antenna itself.

9.2 Module is easy to damage

Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, it will cause permanent damage to the module;

Please check the stability of the power supply, and the voltage cannot fluctuate significantly and frequently;

Please ensure that the installation and use process is anti-static, and high-frequency components are electrostatically sensitive;

Please ensure that the humidity should not be too high during installation and use, and some components are humidity sensitive devices;

If there is no special requirement, it is not recommended to use at too high or too low temperature.

9.3 Bit error rate is too high

There is co-frequency signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;

If the power supply is not ideal, it may also cause garbled characters. Be sure to ensure the reliability of the power supply;

Poor quality or too long extension lines and feeders will also cause high bit error rates.

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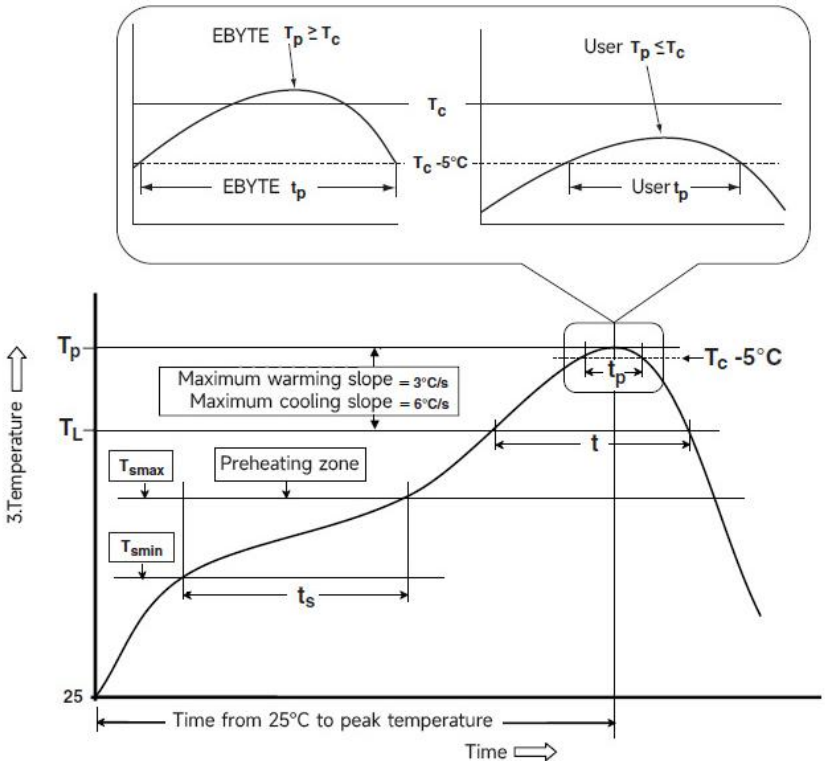
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10Welding Operation Guidance

10.1 Reflow temperature

Profile Feature		Sn-Pb Assembly	Pb-Free Assembly
Preheat/ heat preservation	Min preheating temp. (Tsmin)	100℃	150℃
	Max preheating temp. (Tsmax)	150℃	200℃
	Preheating time (Tsmin~Tsmin)	60-120 sec	60-120 sec
Average ramp-up rate (T_L~T_p)		3℃/second max	3℃/second max
Liquidous Temperature (T_L)		183℃	217℃
Time Maintained Above T_L		60~90 sec	60~90 sec
Peak temperature T_p		Do not exceed the temperature stated on the "damp sensitivity" label.	Do not exceed the temperature stated on the "damp sensitivity" label.
See the figure below for time (Tp) within 5℃ of the specified grading temperature (Tc)		20 sec	30秒 sec
Average ramp-down rate (Tp~T_L)		6℃/second max	6℃/second max
Time 25℃ to peak temperature		6 minutes max	8 minutes max
※The peak temperature (Tp) tolerance definition of the temperature profile is the upper limit			

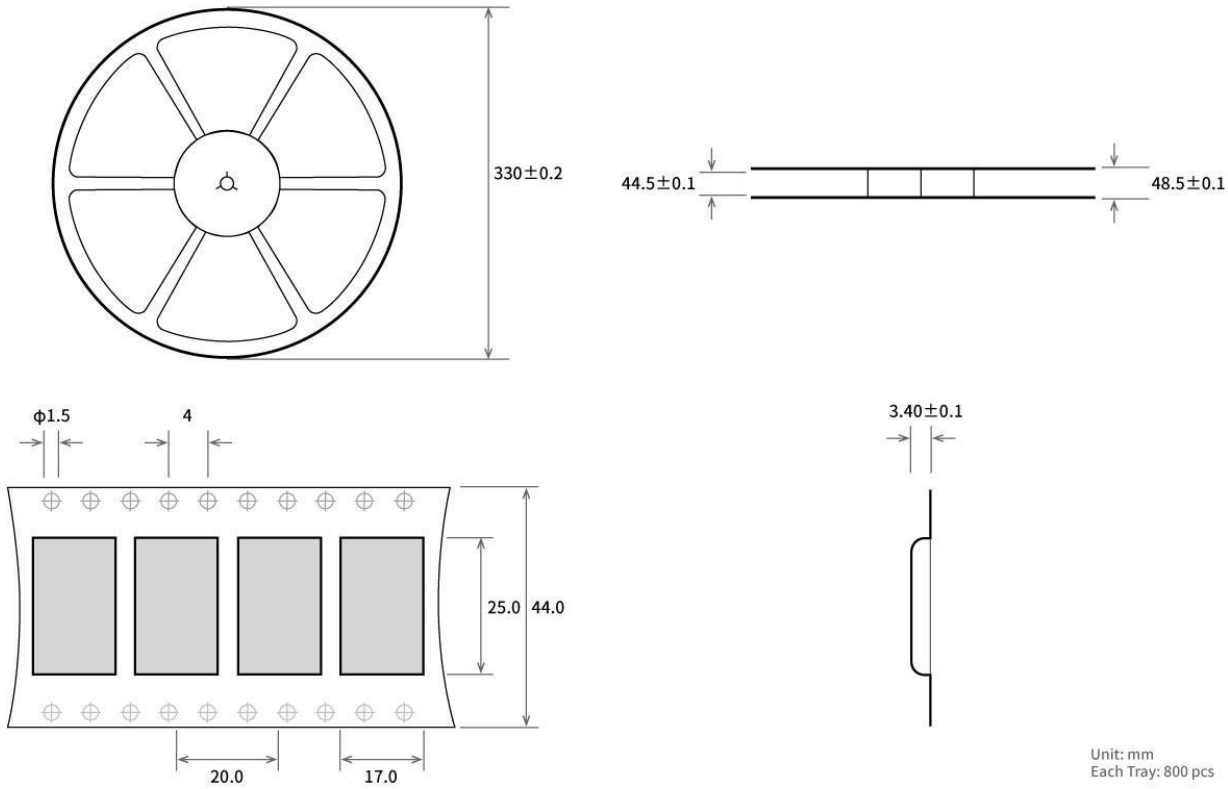
10.2 Reflow profile



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11Batch product packaging



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Revision history

Version	Date	Description	Issued by
V1.0	2022-10-18	Initial version	Hao
V1.1	2023-3-30	Update the pin diagram	Hao
V1.2	2024-1-8	Correct the content	Hao
V1.3	2024-6-18	Correct the content	Hao
V1.4	2025-9-24	Correct the content	Hao

About us

Hoteline: 400-330-990
Technical support: support@cdebyte.com
Official website: https://www.cdebyte.com
Address: B5 Mould Park, 199# Xiqu Ave, High-tech District, Sichuan, China.

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