Link72 Product Specification

CC2652P ZigBee3.0 Self Networking Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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1 Product Overview

1.1 Product Introduction



Link72 (E72-2G4M20S1E) is a ZigBee3.0 ad hoc network wireless module based on CC2652P produced by TI as the core and independently developed by Ebyte . The transmit power is 20dBm . It integrates ARM microcontroller and high-performance wireless transceiver inside. 48MHz high precision low temperature drift crystal oscillator.

The module leads out all the IO ports of the microcontroller, the chip comes with a powerful 48 MHz Arm ® Cortex ® -M4F processor, an internal integrated power amplifier, powerful peripherals and up to 26 GPIOs , supporting secondary development. Link72 (E72-2G4M20S1E) with its own ZigBee3.0 wireless ad hoc network function is very potential to become the preferred wireless microcontroller for future smart furniture, Internet of Things transformation, and industrial automation.

In view of Link72 's powerful hardware processing capability, abundant chip resources and TI 's mature and complete ZigBee underlying protocol system, and considering the cost of establishing a ZigBee network system, we recommend Link72 to appear in the network as a coordinator (ZigBee networks must be managed by the coordinator). established, the same network and only 1 coordinator). In this way, it can be perfectly matched with our company's E180 series, E18 series and other ZigBee products, forming an advantageous network architecture with high, medium and low performance and cost, so Link72 is more suitable for gateway product development. If you have other customization requirements, please consult our sales staff for details.

1.2 Features and functions

- Built-in high-performance low-power Arm ® Cortex ® -M4F processor, 352KB FLASH , 80KB RAM , clock speed up to 48MHz ;
- The module has built-in 48M high-speed crystal oscillator and 32.768k low-speed crystal oscillator;
- The transmit power is 20dBm , under ideal conditions, the communication distance can reach 700m ;
- -low power consumption: in deep sleep mode, the power consumption current can reach 0.6uA ;
- **Serial port baud rate: only supports 230400 , in order to realize a large amount of data interaction, it is more suitable for the coordinator role in the network;**
- **Protocol standard: fully supports ZigBee3.0 transmission protocol, compatible with most products on the market, such as: X meters, X crows, XX Pu and other big-name smart home products;**
- Role switching: The user can switch the device among the three types of coordinator, router and terminal through the serial port command. Note that after the role is switched, it is equivalent to becoming a new device and abandoning the original network;
- Automatic networking: The coordinator automatically forms a network when it is powered on, and routers and terminals automatically search and join the network;
- Automatic routing: The module supports the network routing function, the router and the coordinator carry the network data routing function, and the user can perform multi-hop networking;
- Network self-healing: If the intermediate node of the network is lost, other networks automatically join or maintain the original network

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(the isolated node automatically joins the original network, and the non-isolated node maintains the original network) if the coordinator is lost, there are non-isolated nodes in the original network, and the coordinator can restore the original network. join the original network;

- Automatic retransmission: In the on-demand (unicast) mode, the device will automatically retransmit when it fails to send to the next node, and the number of retransmissions for each message is 2 times;
- Data retention time: When the device is in the state of coordinator and router, the user can set the data retention time by himself, and use it with the terminal in sleep mode to save the data of the terminal device, and send the data to the terminal after the terminal wakes up from sleep. ; Save up to 4 pieces of data, if it exceeds, the first data will be automatically cleared; after the data saving time has passed, the data stack will be automatically cleared.
- Encryption protocol: The module adopts AES 128 -bit encryption function, users can change the network key by themselves, and only devices with the same network key can communicate normally in the network;
- Command format switching: This module supports two modes of HEX command and transparent transmission, which can be easily configured and switched by users.
- **Network topology structure: Support command to query the network topology structure, which is convenient for users to view the current network structure more intuitively, and it is convenient for users to visualize the development later;**
- Restore factory settings: Users can restore the module to factory settings through serial commands.
- Support 2 -wire SWD program debugging / download;
- Support serial BootLoader online firmware upgrade;
- Support other wireless protocols (requires user development) : Thread, Bluetooth ® 5 Low Energy, IEEE 802.15.4g, IPv6-enabled smart objects(6LoWPAN), Wi-SUN ® , proprietary systems, SimpleLink™ TI 15.4-Stack (2.4 GHz), Dynamic Multiprotocol Manager (DMM) driver ;

1.3 Application Scenarios

- home
  - -Smart light control system , smart appliances, PIR smart sensor, smart air conditioner & fresh air system
  - -Electronic smart door locks, door and window sensors, garage door systems, smart gateways
- Building automation
  - - Building security system
  - - HVAC (thermostat)
  - - Fire safety system, smoke and heat detectors, fire alarm control panel (FACP)
  - - Video surveillance, IP network camera
  - - Elevators and escalators, elevator masters, elevator and escalator control panels;
- infrastructure
  - - Smart meters - water, gas, electricity and heat cost sharers
  - - Mesh Communication - Wireless Communication. Remote Sensor App
  - - other alternative energy sources - energy harvesting
- transportation
  - - Asset tracking
- Factory automation and control
- Medicine and Nursing
  - - Hospital bed information system
  - - hospital bed call system
  - - Medicine frame system

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- Electronic Point of Sale (EPOS)
  -Electronic shelf system
  - Label (ESL) system

2 Specifications

2.1 RF Parameters

RF parameters	unit	parameter value	Remark
Working frequency	GHz	2.400 ~ 2.480	Support ISM band
transmit power	dBm	19.5	Software adjustable
blocking power	dBm	0 ~ 10.0	The probability of burning at close range is small
Receive sensitivity	dBm	-106	The air rate is 250kbps
Modulation	-	OQPSK	—
matched impedance	Oh	50	Equivalent impedance of PCB on-board antenna
Measured distance	m	700	Clear and open, 2.5 meters high, air speed 250kBps.

2.2 Electrical parameters

Electrical parameters	minimum	Typical value	maximum value	unit	condition
voltage	1.9	3.3	3.8	IN	More than 3.8V permanently burns the module
communication level	-	3.3	-	IN	Using 5.0V TTL is recommended to add level conversion
Emission current	-	106	-	mA	Instantaneous power consumption @20dBm
receive current	-	7.3	-	mA	——
sleep current	-	0.6	-	μA	software shutdown
Operating temperature	-40	20	85	°C	——
Working humidity	10	60	90	%	——
Storage	-40	20	125	°C	——

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temperature					

2.3 Hardware parameters

Hardware parameters	parameter value	Remark
SoC	CC2652P1FRGZ	Texas Instruments
kernel	Arm ® Cortex ® -M4F	Ultra low power consumption
FLASH	352 KB	——
RAM	80 KB	——
Crystal frequency	48MHz/32.768KHz	External crystal
Size	17.5 * 28.7 * 2.5 mm	width * length * height
Antenna form	PCB Onboard Antenna	Equivalent impedance is about 50 Ω
Communication Interface	UART	2 -wire serial port, baud rate: 230400 (only supported)
Packaging method	SMD	Stamp half hole, hole spacing 1.27mm
Product Weight	1.9±0.1g	——

2.4 Network system parameters

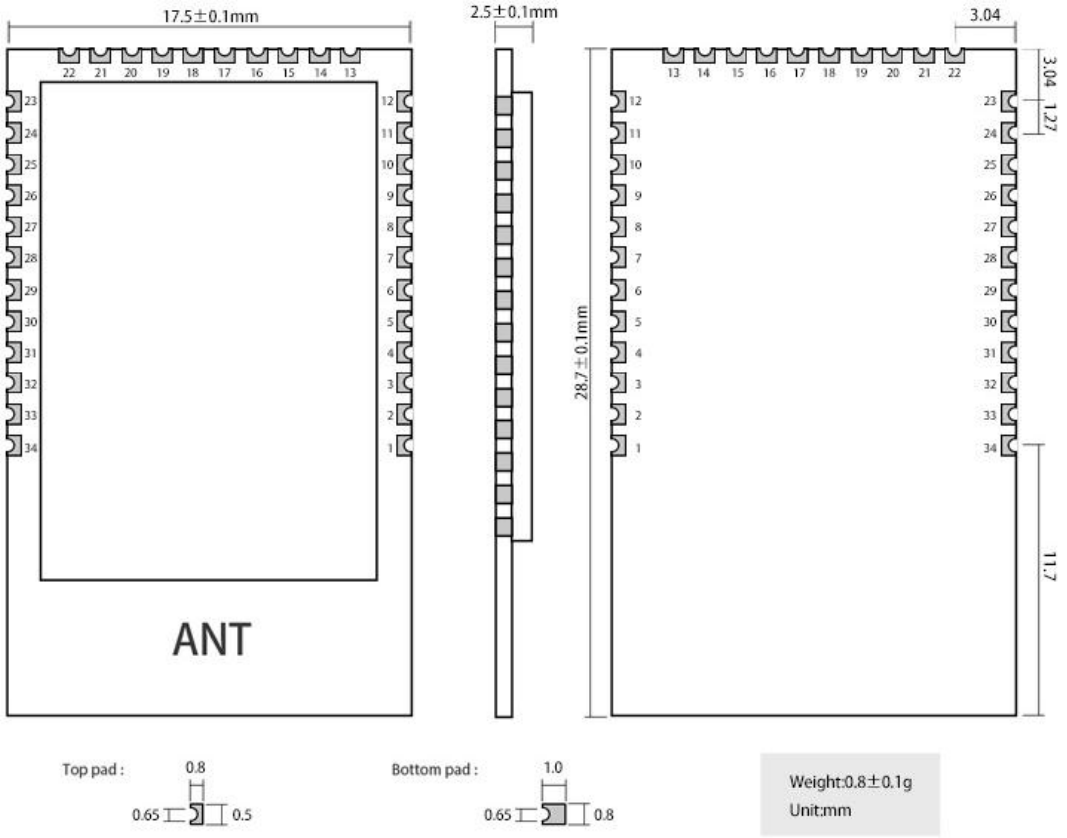
System parameters	parameter value	explain
Total number of network devices (nodes)	≤ 200 _	suggested value;
network routing hierarchy	15 floors	System fixed value;
Number of concurrent data nodes in the network	≤ 7 _	suggested value; 7 nodes send data at the same time, each node sends 30 bytes without packet loss;
The maximum number of child devices connected to the parent device	48 _	System fixed value;
How long the parent device saves the data of the dormant terminal and child devices	7s	System fixed value;
The parent device saves the maximum number of data of the dormant terminal and child devices	24 _	System fixed value;
The parent device saves the maximum number of data of the same dormant terminal and child device	4 _	System fixed value;
Broadcast interval in the network	≥ 200ms	Recommended value to effectively avoid network storms;
Number of retransmissions after fixed-point transmission (on-demand) data transmission fails	2 times	does not include the first transmission; After the first transmission, the feedback (feedback) has not been received in the 6th second , retransmit, the feedback (feedback) has not been received in the 12th second , and the retransmission has not been received until the 18th second (feedback), and the transmission is

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		determined. fail;
Feedback (feedback) data duration	≤ 5s	Generally, feedback (feedback) data can be received within 5 seconds, and if feedback (feedback) is not received within 5 seconds, it can be determined that the transmission fails;

3 Mechanical Dimensions and Pin Definition



pin number	pin name	Pin Orientation	pin usage
1	GND	-	Ground wire, connected to the power reference ground;
2	PART_7	output	STATUS_LED , status indicator, active low. Long light is in standby state, fast blinking means creating a new network or joining a network, 1S periodic blinking means allowing network access;
3	PART_8	-	NC pin, floating;
4	PART_9	-	NC pin, floating;
5	PART_10	-	NC pin, floating;
6	PART_11	-	NC pin, floating;
7	PART_12	enter	UART_RX , serial port input signal pin;
8	PART_13	output	UART_TX , serial port output signal pin;
9	PART_14	-	dangling;
10	PART_15	enter	BOOT_LOADER , active low;

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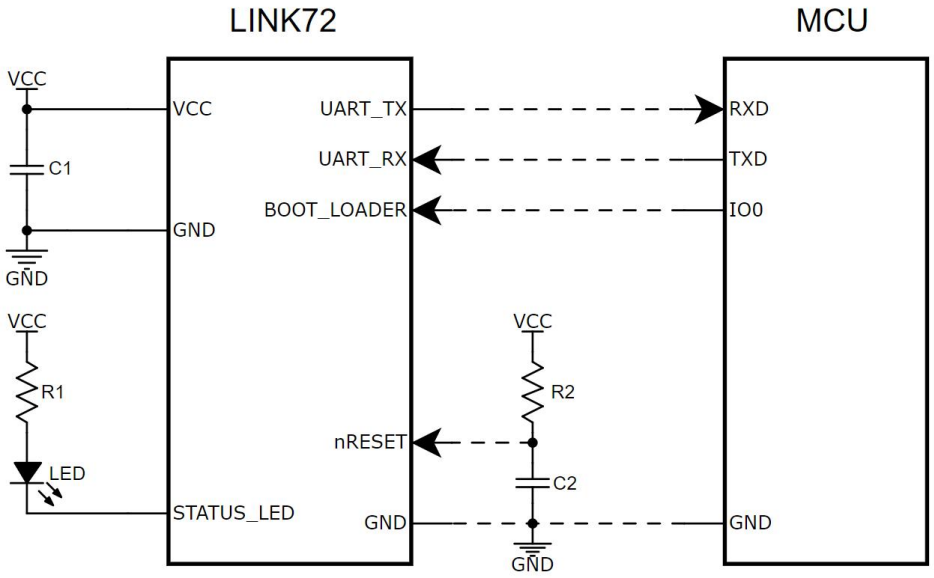
11	GND	-	Ground wire, connected to the power reference ground;
12	GND	-	Ground wire, connected to the power reference ground;
13	JTAG_TMSC	input / output	JTAG_TMSC , if not used, please leave it empty;
14	JTAG_TCKC	input / output	JTAG_TCKC , if not used, please leave it empty;
15	PART_16	input / output	JTAG_TDO , if not used, please leave it empty;
16	PART_17	input / output	JTAG_TDI , if not used, please leave it empty;
17	PART_18	-	NC pin, floating;
18	PART_19	-	NC pin, floating;
19	GND	-	Ground wire, connected to the power reference ground;
20	VCC	-	The module power supply is positive reference power, the voltage range is 1.9 ~ 3.8V ;
twenty one	PART_20	-	NC pin, floating;
twenty two	PART_21	-	NC pin, floating;
twenty three	GND	-	Ground wire, connected to the power reference ground;
twenty four	RESET_N	enter	Reset pin, active low;
25	PART_22	-	NC pin, floating;
26	PART_23	-	NC pin, floating;
27	PART_24	-	NC pin, floating;
28	PART_25	-	NC pin, floating;
29	PART_26	-	NC pin, floating;
30	PART_27	-	NC pin, floating;
31	PART_28	-	NC pin, floating;
32	PART_29	-	NC pin, floating;
33	PART_30	-	NC pin, floating;
34	GND	-	Ground wire, connected to the power reference ground;

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4 Application and Operation

4.1 Recommended circuit diagram



4.2 Network topology

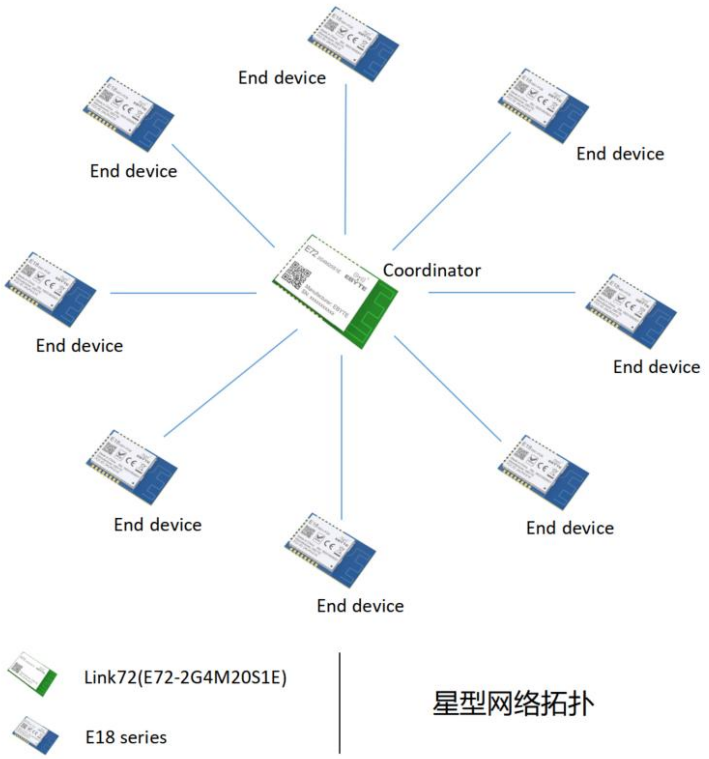
Link72 modules can only be used as coordinator and router devices. The Link72 module supports the ZigBee 3.0 specification and has powerful networking capabilities and interconnection capabilities. Supports up to 200 ZigBee 3.0 devices for networking, and supports networking of ZigBee devices produced by third-party manufacturers such as X meters, X Crows, X Pu, Mc X grams and so on . Link72 module works in ZigBee coordinator mode, supports other ZigBee device networking, and manages all networking nodes through serial port HEX commands. When the device joins the network or exits the network, the Link72 module will generate corresponding messages.

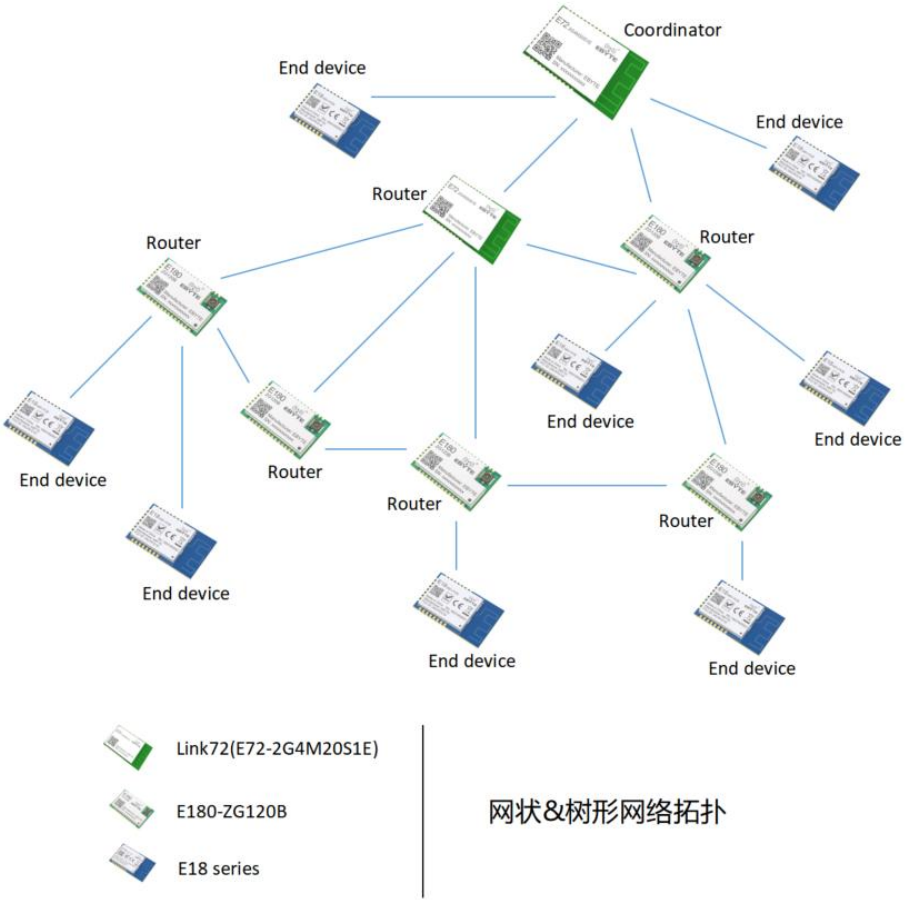
In addition to powerful networking capabilities, Link72 module also has powerful management capabilities: real-time monitoring of device access to the network, network access device address management, device information and status management, and device identification functions, providing data support for users to manage network devices in the background.

At present, our products that support ZigBee3.0 specification include E18 series and E180-ZG120B modules, which together with Link72 modules form a ZigBee3.0 product system with low cost and high processing capacity . The following figure combines our products to show the general ZigBee network application topology.

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4.3 Serial port command operation

Please refer to " Link72_Software_Datasheet " and " Ebyte ZigBee3.0 Module HEX Command Standard Specification" documents.

5 Development and Use

5.1 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, 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 away from parts with large electromagnetic interference such as power supply, transformer, and high-frequency wiring as far as possible;
- 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 , lay copper on the Top Layer of the contact part of the module. 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 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), 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. Proper isolation and shielding;
- TTL protocols whose physical layer is also 2.4GHz , such as: USB3.0 ;
- The antenna installation structure has a great influence on the performance of the module. Make sure that the antenna is exposed and preferably vertically upward. When the module is installed inside the casing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal shell, which will greatly weaken the transmission distance.

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5.2 Software writing

- The core of the module is CC2652P , and users can conduct secondary development in full accordance with the CC2652P chip manual and the relevant protocol stack SDK provided by TI .
  For related protocol stack SDK , please go to TI official website to obtain: www.ti.com/product/CC2652P
- The chip used by the module is in DC/DC mode.
- The module has a built-in RF switch, please operate in strict accordance with the following truth table:

STATUS	PART_5	PART_6
Transmit(TX) Enable	High	Low
Receive(RX) Enable	Low	High
* It is best not to enable the transmitting state and receiving loading at the same time, so as not to damage the module; * The chip pins DIO_5 and DIO_6 have been connected with RF switches inside the module;		

- Please use the dedicated downloader for XDS100 to debug / download the program , and only support the dedicated downloader for XDS100 .
- / download program interface definition :

E72 pin	XDS100 interface
JATG_TMSC	TMS
JTAG_TCKC	TCK
RESET_N	SRSTN
GND	DGND
VCC	TVD



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6 Frequently Asked Questions

6.1 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 will increase the communication packet loss rate;
- The ground absorbs and reflects radio waves, and the test effect close to the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- 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, and the lower the voltage, the lower the output power;
- Use the antenna to match the module poorly or the quality of the antenna itself.

6.2 Module is easily damaged

- 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;
- Please ensure anti-static operation during installation and use, and high-frequency components are electrostatically sensitive;
- Please ensure that the humidity during installation and use should not be too high, and 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.

6.3 The 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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7 Welding Operation Instructions

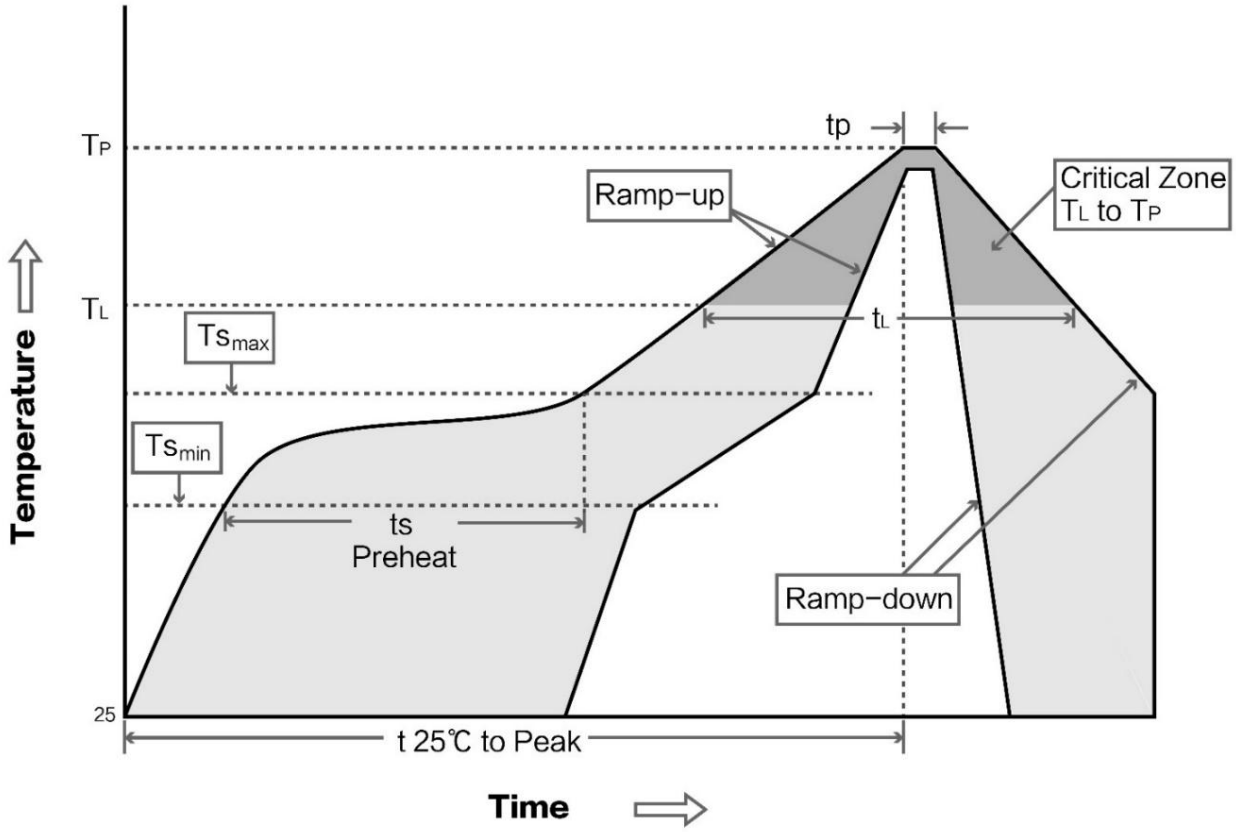
7.1 Reflow soldering temperature

Profile Feature	Curve feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Minimum preheat temperature	100 ℃	150 ℃
Preheat temperature max (Tsmax)	maximum preheat temperature	150 ℃	200 ℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheat time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	average rate of ascent	3℃/second max	3℃/second max
Liquidous 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 rate of descent	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time from 25 ℃ to peak temperature	6 minutes max	8 minutes max

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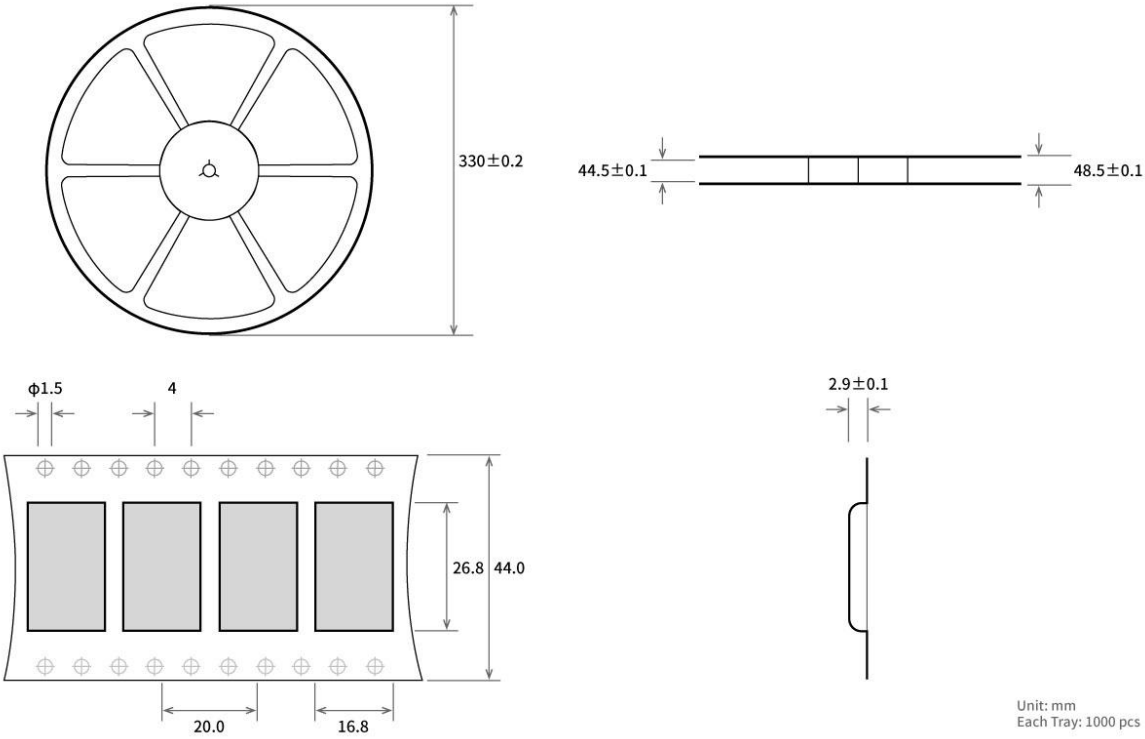
7.2 Reflow Soldering Curve



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8 Bulk Packaging Method



Revise history

Version	revision date	Revision Notes	Maintenance man
1.0	2022-9-4	initial version	And
1.1	2022-10-27	Error correction	Bin

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