E22-400TXXX Product Datasheet

433/470MHz LoRa Wireless module



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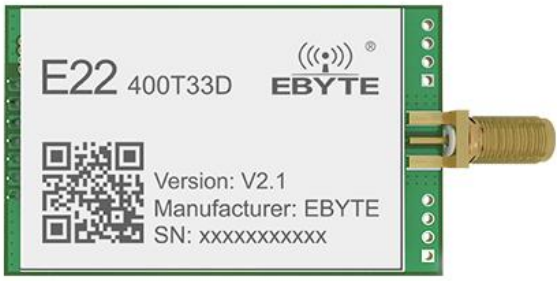
Chapter 1 Product Overview

1.1 Product Introduction

E22-400T33X series is a new generation of LoRa wireless module, the module (UART) is based on SEMTECH high-performance RF chip and research and development, with a variety of transmission methods, working in the (410.125~493.125MHz) frequency band (default 433.125MHz), LoRa spread spectrum technology, TTL level output, support 2Supply voltage from 3V to 5.5V.

The E22-400T33X adopts a new generation of LoRa spread spectrum technology, which is faster, lower power consumption and smaller size; It supports functions such as wake-on-the-air, wireless configuration, carrier monitoring, automatic relay, communication key, etc., supports subcontracting length setting, and can provide customized development services.





1.2 Features

- Based on SEMTECH's high-performance RF chips, a new LoRa spread-spectrum modulation technology was developed, which brings a longer communication distance and stronger anti-interference ability.
- It supports automatic relay networking, multi-level relay is suitable for ultra-long-distance communication, and multiple networks run in the same area at the same time;
- It supports users to set their own communication keys and cannot be read, which greatly improves the confidentiality of user data;
- Support LBT function, listen to the channel environmental noise before transmission, which can greatly improve the communication success rate of the module in harsh environments;
- Support RSSI signal strength indication function for evaluating signal quality, improving communication networks, and ranging;
- Support wireless parameter configuration, send command packets wirelessly, and remotely configure or read wireless module parameters;
- Supports wake-on-air, i.e., ultra-low-power function, suitable for battery-powered applications;
- Support fixed-point transmission, broadcast transmission, channel monitoring;
- It supports deep sleep, and the power consumption of the whole machine in this mode is about 2uA.
- Support global license-free ISM 433MHz frequency band and support 470MHz meter reading frequency band;
- The module has built-in PA+LNA, and the communication distance can reach 16km under ideal conditions.
- The parameters are saved after power-off, and the module will work according to the set parameters after re-powering;

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- Efficient watchdog design, once an exception occurs, the module will automatically restart, and can continue to work according to the previous parameter settings;
- Support 2.4K~62.5kbps data transmission rate;
- Support 2.3~5.5V power supply, more than 3.3V power supply can ensure the best performance;
- Industrial-grade standard design, support long-term use at -40~+85°C;
- The maximum power of the module can reach 2W (33dBm), and the transmission is longer and more stable.

1.3 Application Scenarios

- Home security alarm and remote keyless entry;
- smart home and industrial sensors, etc.;
- wireless alarm security system;
- building automation solutions;
- Wireless industrial-grade remote control;
- healthcare products;
- Advanced Meter Reading Architecture (AMI);
- Automotive applications.

Chapter 2 Specifications

User-programmed control

RF parameters	unit	model		Remark
		E22-400T33S	E22-400T33D	
Working frequency	MHz	410.125 - 493.125		Support ISM frequency band
Transmit power	dBm	33.0±0.5		
blocking power	dBm	0 ~ 10.0		Less likely to be burned if used at close range
Receive sensitivity	dBm	-134±1.0		Air rate 2.4kbps
Measured distance	Km	16		Sunny and open, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.4kbps
Air speed	bps	2.4k~62.5kbps		User Programmed Control

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Industrial grade

Electrical parameters	unit	model		Remark
		E22-400T33S	E22-400T33D	
Operating Voltage	V	3.3~5.5V		High power module ≥5V can guarantee output power
Communication level	V	3.3		Using 5V TTL risks burning out
Emission current	mA	850~1200	850~1200	Instantaneous power consumption
receive current	mA	15	11~15	
Sleep current	uA	2		Software shutdown
Operating temperature	℃	-40 ~ +85		Industrial grade

The module has built-in PA+LNA

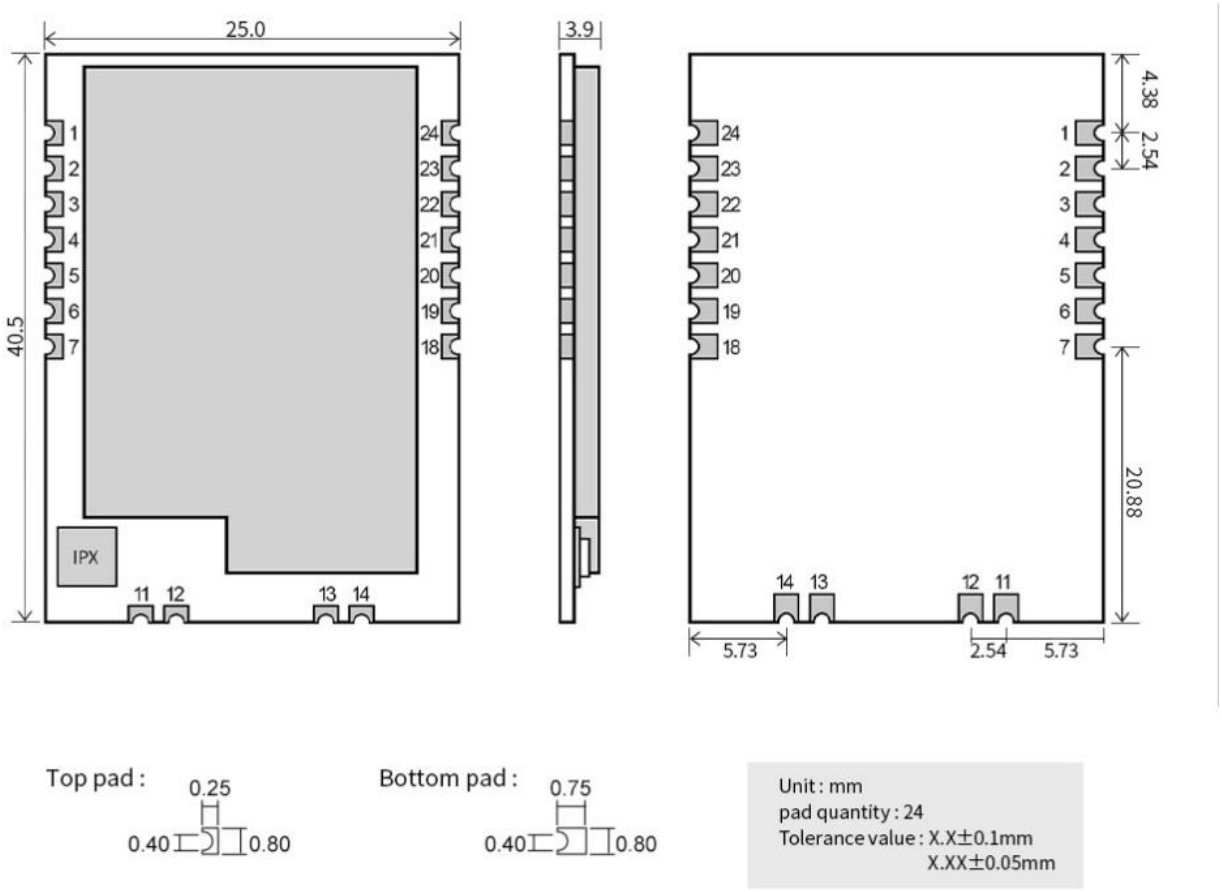
The main parameters	model		Remark
	E22-400T33S	E22-400T33D	
Dimensions	25*40.5mm	37*60mm	
weight	5.7g	25.94g	±0.1
Launch length	240 Byte		Subpackage 32/64/128/240 bytes can be set to be sent through instructions
cache capacity	1000 Byte		
Modulation	LoRa		New generation LoRa modulation technology
Communication Interface	UART serial port		TTL level
Packaging method	SMD type, stamp hole, pitch 2.54mm	Direct plug-in type, pitch 2.54mm	
Interface mode	stamp hole	Straight pin header	
PA+LNA	Available		Module built-in PA+LNA

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Chapter 3 Mechanical Dimensions and Pin Definitions

Main parameters:



RF parameters	unit	Model	remark
1	GND	Input	Module ground wire
2	VCC	Input	Module power supply positive reference, voltage range: 3.3~5.5V DC
3	AUX	Output	Used to indicate the working status of the module; the user wakes up the external MCU and outputs low level during power-on self-test initialization; (can be left floating)
4	TXD	Output	TTL serial port output, connected to the external RXD input pin;
5	RXD	Input	TTL serial port input, connected to the external TXD output pin;
6	M1	Input (very weak pull-up)	Cooperate with M0 to determine the 4 working modes of the module (cannot be left floating, can be grounded if not used)
7	M0	Input (very weak	Cooperate with M1 to determine the 4 working modes of the module

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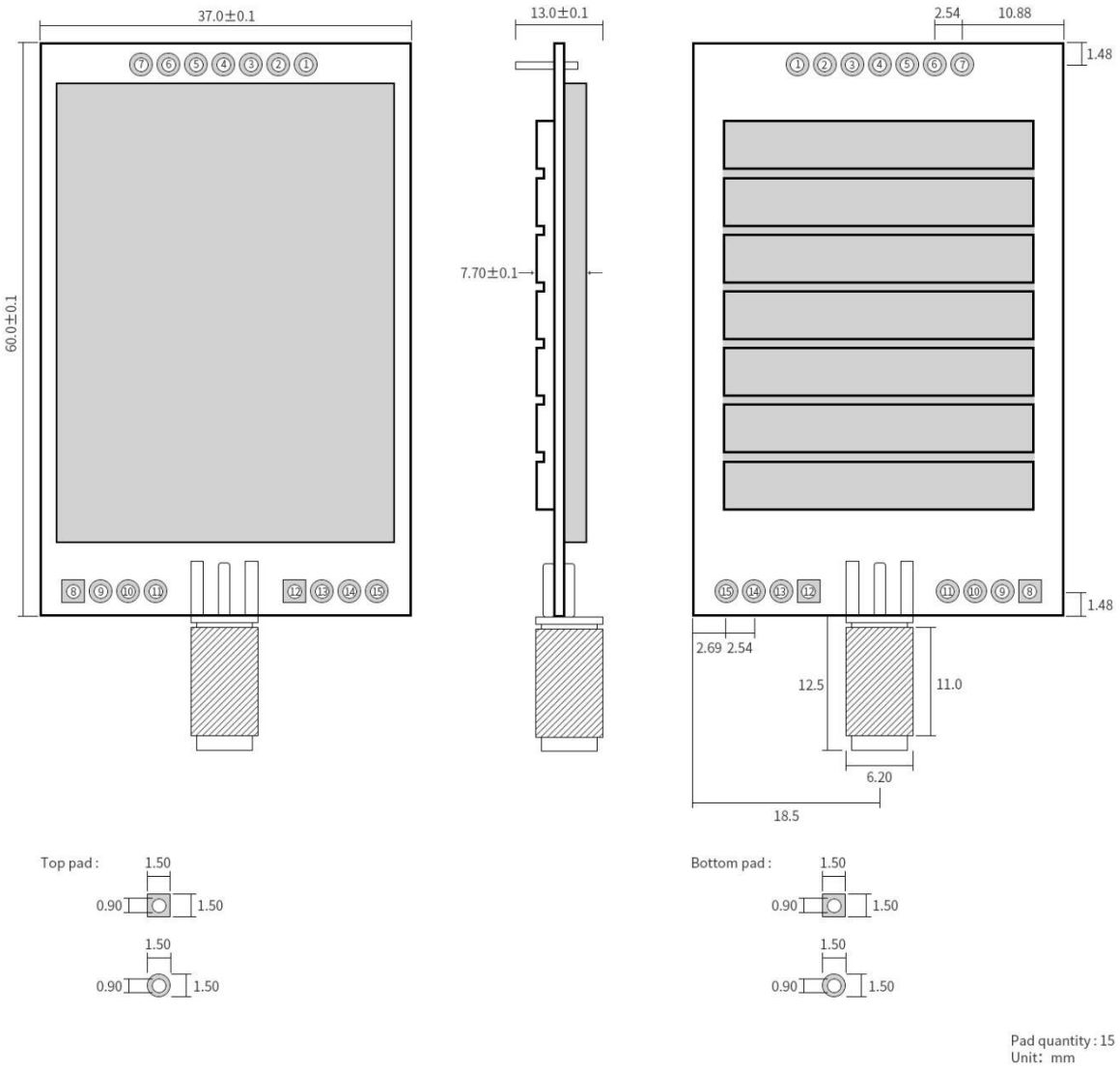
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		pull-up)	(cannot be left floating, can be grounded if not used)
11	ANT	Output	Antenna interface (high frequency signal output, 50 ohm characteristic impedance)
12	GND	-	Fixedly
13	GND	-	Fixedly
14	GND	-	Fixedly
18	NC	-	empty pin
19	NC	-	empty pin
20	NC	-	empty pin
21	NC	-	empty pin
22	RESET	Input	Reset pin when program is loaded (floating, user does not need to connect)
23	GND	Input	Ground pin when program is loaded (floating, user does not need to connect)
24	NC	-	empty pin

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3.5 E22-400T33D Pin definition



Pin number	Pin name	Pin direction	Pin usage
1	M0	Input (very weak pull-up)	Cooperate with M1 to determine the 4 working modes of the module (cannot be left floating, can be grounded if not used)
2	M1	Input (very weak pull-up)	Cooperate with M0 to determine the 4 working modes of the module (cannot be left floating, can be grounded if not used)
3	RXD	Input	TTL serial input, connected to external TXD output pin;
4	TXD	output	TTL serial output, connected to external RXD input pin;
5	AUX	output	It is used to indicate the working state of the module; The user wakes up the external MCU and outputs a low level during power-on POST initialization; (Can be suspended)

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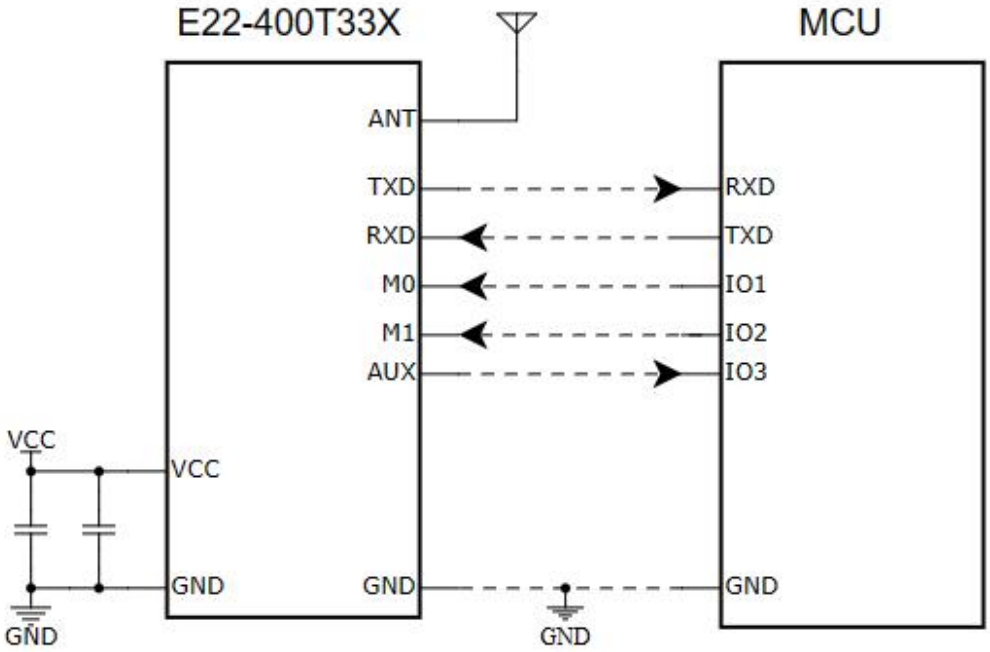
6	VCC	Input	The module power supply is positively referenced, and the voltage range is 3.3~5.5V DC
7	GND	Input	Modular ground
8	Fixing holes		Fixing holes
9	Fixing holes		Fixing holes
10	Fixing holes		Fixing holes
11	Fixing holes		Fixing holes
12	Fixing holes		Fixing holes
13	Fixing holes		Fixing holes
14	Fixing holes		Fixing holes
15	Fixing holes		Fixing holes

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Chapter 4 Wiring diagrams are recommended

4.1 E22-400TXXD

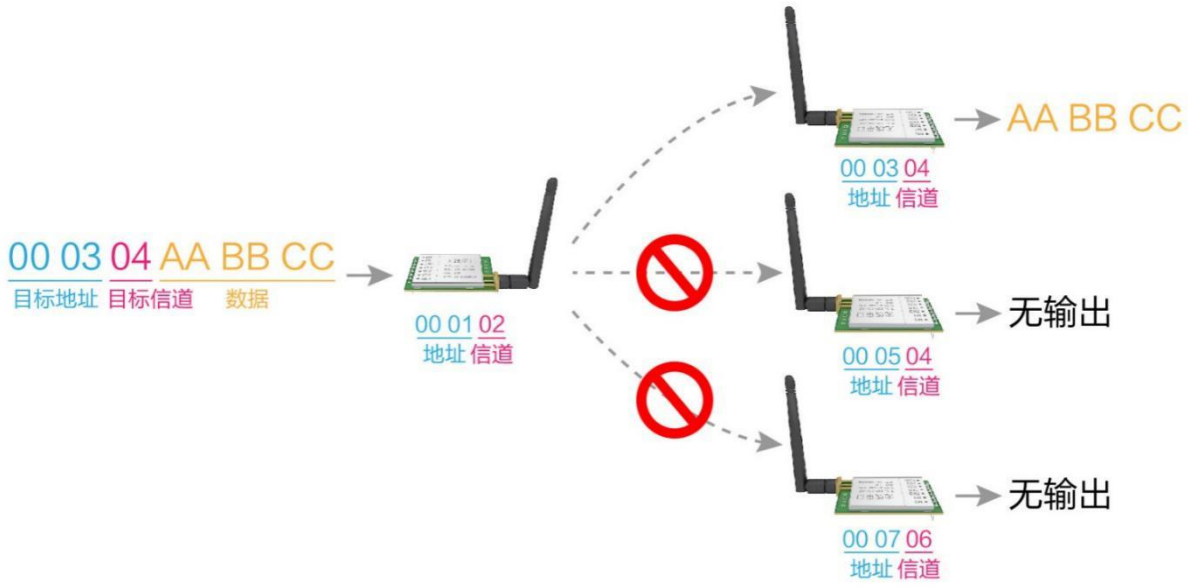


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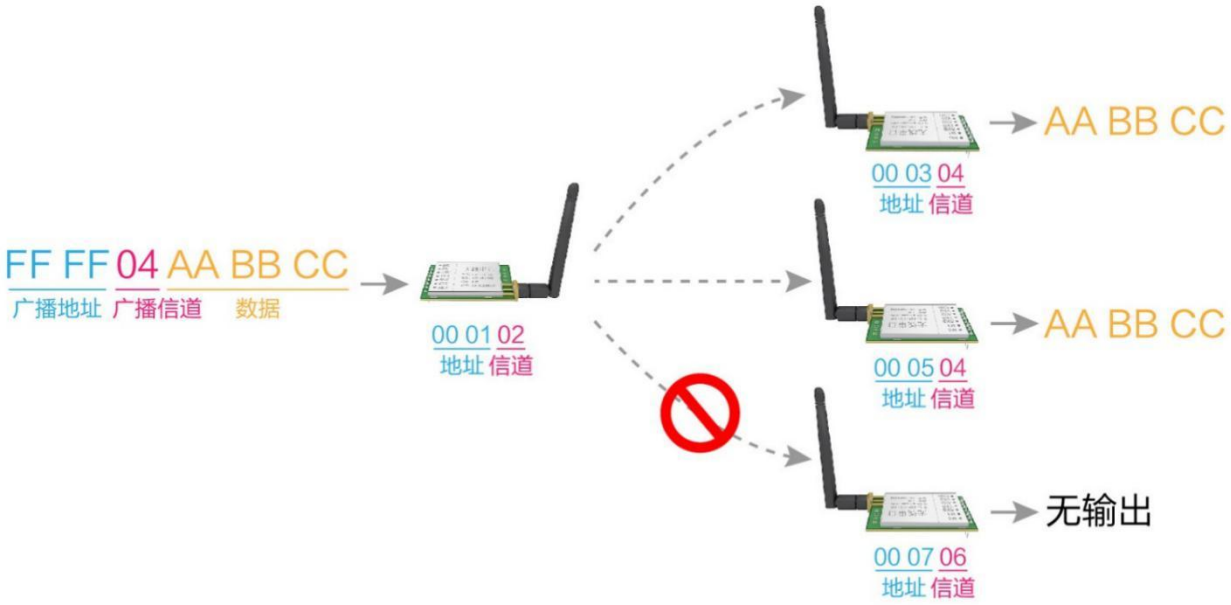
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Chapter 5 Detailed explanation of functions

5.1 Fixed-point launch



5.2 Broadcast Transmission



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5.3 Broadcast Address

- For example, set the address of module A to 0xFFFF and the channel to 0x04.
- When module A is used as a transmitter (same mode, transparent transmission mode), all receiving modules in the 0x04 channel can receive data to achieve the purpose of broadcasting.

5.4 Listening address

- For example, set the address of module A to 0xFFFF and the channel to 0x04.
- When module A is used as a receiver, it can receive all the data under the 0x04 channel to achieve the purpose of monitoring.

5.5 Module Reset

- After the module is powered on, the AUX will output a low level immediately, and perform a hardware self-test, as well as set the working mode according to the user parameters;

In this process, the AUX keeps the level low, and after the AUX outputs the high level, and starts to work normally according to the working mode composed of M1 and M0.

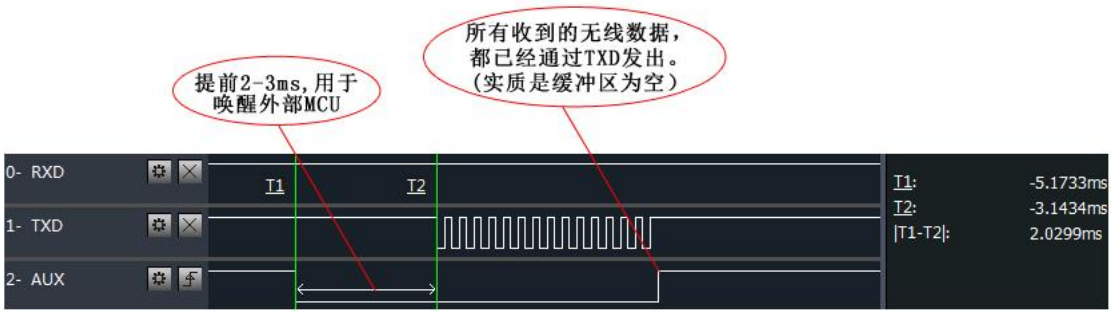
So, the user needs to wait for the AUX to rise as the starting point for the module to work properly.

5.6 AUX in detail

- AUX is used for wireless sending and receiving buffer indication and self-test indication.
- It indicates whether the module has data that has not been transmitted wirelessly, or whether the wireless data that has been received has not been fully transmitted through the serial port, or whether the module is in the process of initializing the self-test.

5.6.1 Serial port data output indication

- Used to wake up an external MCU in hibernation;



模块串口外发数据时，AUX引脚时序图

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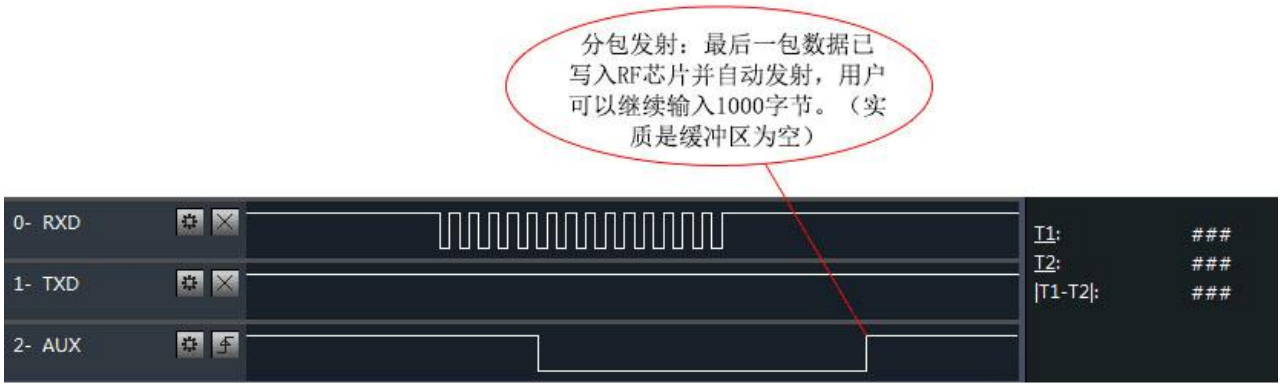
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5.6.2 Wireless Emission Indication

- Empty buffer: The data in the internal 1000-byte buffer is written to the wireless chip (automatically subpackaged); When AUX=1, the user continuously initiates data of less than 1000 bytes and will not overflow.

When AUX=0, the buffer cannot be empty: there is a 1000-byte buffer area inside the module, if all the data has not been written to the wireless chip and the transmission is started, the module may be waiting for the user to enter the data to end (whichever is the timeout), or the wireless packet transmission is in progress.

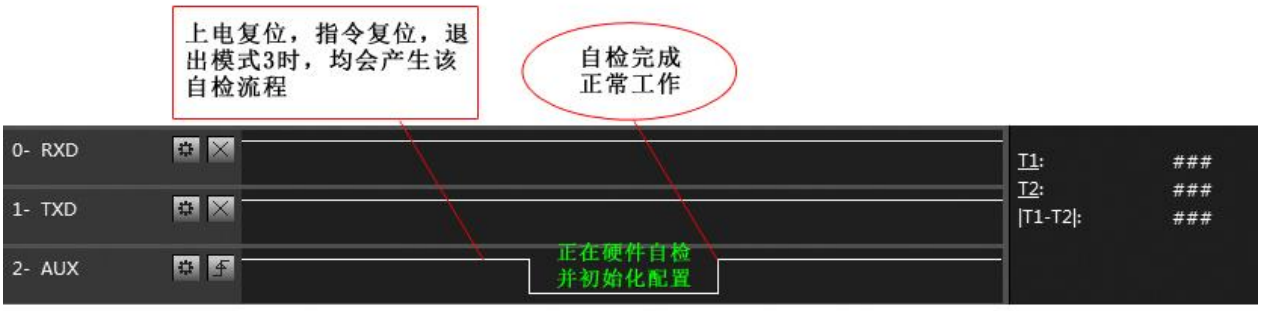
[Note]: AUX=1 does not mean that all the serial port data of the module has been transmitted wirelessly, and the last packet of data may be being transmitted.



模块接收串口数据时，AUX引脚时序图

5.6.3 The module is in the process of being configured

- Only when resetting and exiting sleep mode;



自检期间，AUX引脚时序图

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5.6.4 Precautions

Number	AUX precautions
1	In the above function 1 and function 2, the output low level is preferred, that is, if any output low level condition is met, the AUX will output the low level; When all low-level conditions are not satisfied, the AUX outputs high.
2	When the AUX output is low, it means that the module is busy, and the working mode will not be detected at this time. When the module AUX outputs a high level within 1ms, the mode switching will be completed.
3	After the user switches to the new working mode, it will take at least 2ms on the rising edge of the AUX before the module will actually enter the mode; If the AUX is high all the time, then the mode switch will take effect immediately.
4	When the user enters another mode from mode 3 (sleep mode) or during the reset process, the module resets the user parameters and the AUX output goes low.
5	Due to the characteristics of LoRa modulation mode, the information transmission delay is much longer than that of FSK, so it is recommended that customers do not transmit large amounts of data at low space speed, so as to avoid communication anomalies caused by data loss caused by data accumulation.

Chapter VI Work Mode

The module has four working modes, which are set by pin M1 and M0; The details are shown in the table below：

Mode (0-3)	M1	M0	Schema introduction	remark
0 transmission mode	0	0	Serial port open, wireless open, transparent transmission	Support special command over-the-air configuration
1 WOR mode	0	1	It can be defined as a WOR sender and a WOR receiver	Support wake-on-the-air
2 Configuration mode	1	0	The user can access the registers through the serial port to control the working status of the module	
3 Deep hibernation	1	1	The module goes to sleep	

6.1 Mode switching

No.	remark

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1	● Users can combine M1 and M0 with high and low levels to determine the working mode of the module. Mode switching can be controlled using the MCU's two GPIOs; ● When M1 and M0 are changed: If the module is idle, it can start working according to the new mode after 1 ms; ● If the module has serial port data that has not been transmitted wirelessly, it can enter the new working mode only after the transmission is completed; ● If the module receives the wireless data and sends the data out through the serial port, it needs to be sent before entering the new working mode; ● Therefore, the mode switching can only be effective when the AUX output is 1, otherwise the switching will be delayed.
2	● For example, if a user continuously inputs a large amount of data and switches modes at the same time, the mode switching operation is invalid. The module will process all user data before performing a new pattern detection; ● Therefore, the general recommendation is to check the output status of the AUX pin, wait for the output level to be high for 2 ms before switching.
3	● When a module is switched from other modes to hibernation mode, there is data that has not yet been processed; ● The module will process this data (including sending and sending) before entering sleep mode. This feature can be used for fast sleep, thus saving power consumption; For example, if the transmitter module works in mode 0, the user initiates the serial port data "12345", and then does not have to wait for the AUX pin to be free (high level), it can directly switch to sleep mode, and the user's main MCU will sleep immediately, and the module will automatically send all the user data through the wireless, and then automatically enter sleep within 1ms; ● This saves the working time of the MCU and reduces power consumption.
4	● In the same way, any mode switching can take advantage of this feature, after the module has processed the current mode event, it will automatically enter the new mode within 1ms; In this way, the user is saved from the work of querying AUX, and the purpose of fast switching can be achieved; ● e.g. switching from transmit mode to receive mode; The user MCU can also go to sleep before mode switching, and use the external interrupt function to obtain AUX changes for mode switching.
5	● This operation mode is very flexible and efficient, designed in full accordance with the user's MCU operation convenience, and can reduce the workload of the whole system as much as possible, improve system efficiency, and reduce power consumption.

6.2 Normal Mode (Mode 0)

type	When M0 = 0 and M1 = 0, the module works in mode 0
Transmit	The user can input data through the serial port, and the module will start the wireless transmission.
reception	The wireless receiving function of the module is turned on, and the wireless data will be output through the serial port TXD pin after receiving it.

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6.3 WOR Mode (Mode 1)

type	When M0 = 1 and M1 = 0, the module works in mode 1
Transmit	When defined as the transmitter, a wake-up code is automatically added for a certain period of time before launching
reception	It can receive data normally, and the reception function is equivalent to mode 0

6.4 Configuration Mode (Mode 2)

type	When M0 = 0 and M1 = 1, the module works in mode 2
Transmit	Wireless transmitter is turned off
reception	Wireless reception is turned off
arrangement	The user can access the registers and thus configure the operating status of the module

6.5 Deep Sleep Mode (Mode 3)

type	When M0 = 1 and M1 = 1, the module works in mode 3
Transmit	Wireless data cannot be transmitted.
reception	Unable to receive wireless data.
caution	When entering other modes from sleep mode, the module will reconfigure the parameters, and during the configuration process, the AUX will remain low. After the output, the output level is high, so it is recommended that the user check the rising edge of the AUX.

Chapter 7 Register Read and Write Control

7.1 Instruction Format

In the configuration mode (mode 2: M1=1, M0=0), the list of supported commands is as follows (**only the 9600 and 8N1 formats are supported**).

No.	Instruction format	Detailed description

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1	Set up the registers	Command: C0 + Start Address + Length + Parameters Response: C1 + Start Address + Length + Parameters Example 1: Set the channel to 0x09 Command Start Address Length parameter Send：C0 05 01 09 return：C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time. Send：C0 00 04 12 34 00 61 return：C1 00 04 12 34 00 61
2	Read registers	指令：C1+起始地址+长度 Response: C1 + Start Address + Length + Parameters Example 1: Read the channel Command Start Address Length parameter Send：C1 05 01 return：C1 05 01 09 Example 2: Read the module address, network address, serial port, and airspeed at the same time Send: C1 00 04 return：C1 00 04 12 34 00 61
3	Set up temporary registers	Command: C2 + Start Address + Length + Parameters Response: C1 + Start Address + Length + Parameters Example 1: Set the channel to 0x09 Command Start Address Length parameter Send：C2 05 01 09 return：C1 05 01 09 Example 2: Configure the module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time. Send：C2 00 04 12 34 00 61 return：C1 00 04 12 34 00 61
5	Wireless configuration	Command:：CF CF + 常规指令 Response：CF CF + 常规响应 Example 1: The wireless channel is 0x09 Wireless Command Header Command Start Address Length Parameter Send：CF CF C0 05 01 09 eturn：CF CF C1 05 01 09

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		Example 2: Configure module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K) at the same time. Send：CF CF C0 00 04 12 34 00 61 eturn：CF CF C1 00 04 12 34 00 61
6	Format error	Format error response FF FF FF

7.2 Register description

<table>
<tr><th>No.</th><th>Read and write</th><th>name</th><th colspan="5">description</th><th>remark</th></tr>
<tr><td>00H</td><td>Read/ Write</td><td>ADDH</td><td colspan="5">ADDH（default 0）</td><td rowspan="2">module address high byte and low byte;
Note: When the module address is equal to FFFF, it can be used as a broadcast and listen address, that is, the module will not perform address filtering at this time</td></tr>
<tr><td>01H</td><td>Read/ Write</td><td>ADDL</td><td colspan="5">ADDL（default 0）</td></tr>
<tr><td>02H</td><td>Read/ Write</td><td>NETID</td><td colspan="5">NETID（default 0）</td><td>network addresses, which are used to distinguish networks;
When communicating with each other, it should be set to the same.</td></tr>
<tr><td rowspan="14">03H</td><td rowspan="14">Read/ Write</td><td rowspan="14">REG0</td><td>7</td><td>6</td><td>03H</td><td colspan="2">Read/Write</td><td rowspan="11">For the two modules that communicate with each other, the baud rate of the serial port can be different, and the verification method can also be different;

When sending large data packets consecutively, users need to consider the data blockage caused by the same baud rate, and may even be lost.

It is generally recommended that the baud rate is the same for both parties to the communication.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td colspan="2">The serial baud rate is 1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td colspan="2">The serial baud rate is 2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td colspan="2">The serial baud rate is 4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td colspan="2">The serial baud rate is 9600（default）</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td colspan="2">The serial baud rate is 19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td colspan="2">The serial baud rate is 38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td colspan="2">The serial baud rate is 57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td colspan="2">The serial baud rate is 115200</td></tr>
<tr><td>4</td><td>3</td><td colspan="3">Serial port check digit</td><td rowspan="3">Serial port check digit；</td></tr>
<tr><td>0</td><td>0</td><td colspan="3">8N1（default）</td></tr>
<tr><td>0</td><td>1</td><td colspan="3">8O1</td></tr>
</table>

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			1	0	8E1		
			1	1	8N1（Equivalent to 00）		
			2	1	0	Wireless Air Rate (bps)	The air rate of both parties must be the same; The higher the air rate, the smaller the delay and the shorter the transmission distance.
			0	0	0	Air rate2.4K	
			0	0	1	Air rate 2.4K	
			0	1	0	Air rate 2.4k（default）	
			0	1	1	Air rate 4.8k	
			1	0	0	Air rate 9.6k	
			1	0	1	Air rate 19.2k	
			1	1	0	Air rate 38.4k	
			1	1	1	Air rate 62.5k	
04H	Read/ Write	REG1	7	6	Subcontracting settings		The data sent by the user is less than the length of the package, and the serial port output of the receiver is presented as an uninterrupted continuous output; If the data sent by the user is larger than the length of the package, the serial port of the receiving end will package the output.
			0	0	240 byte（default）		
			0	1	128 byte		
			1	0	64 byte		
			1	1	32 byte		
			5	RSSI Ambient Noise Enabled			Enable command (subpackage setting, transmit power as default parameters, configuration mode): C0 04 01 20; When enabled, the C0 C1 C2 C3 command can be sent in transmission mode or WOR transmit mode Read registers; Register 0x00: Current ambient noise RSSI; Register 0X01: RSSI at the last time data was received (The current channel noise is: dBm = -(256 - RSSI)); 指令格式：C0 C1 C2 C3+起始地址+读取长度； 返回：C1 + 地址+读取长度+读取有效值；如： 发送 C0 C1 C2 C3 00 01 Return C1 00 01 RSSI **(addresses can only start from 00).**
			0	Disabled (default)			
			1	enable			
			4	3	2	retain	
			1	0	Transmit power		Power and current are non-linear, and the power supply efficiency is highest at maximum power; The current does not decrease proportionally with the decrease in power.
			0	0	33dBm（default）		
			0	1	30dBm		
			1	0	27dBm		
			1	1	24dBm		
05H	Read/ Write	REG2	Channel control（CH） 0-83 Each represents a total of 84 channels				Actual frequency= 410.125 + CH *1M
06H	Read/ Write	REG3	7	Enable RSSI bytes			When enabled, the module receives wireless data, which is output via the serial TXD, followed by an RSSI intensity byte.
			0	Disabled (default)			
			1	enable			
			6	Transmission mode			When transmitting at a fixed point, the module

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			0	Transparent Transmission (Default)			will identify the three bytes of the serial port data as: address high + address low + channel, and use it as the wireless transmission target.
			1	Fixed-point transmission			
			5	Relay function			After the relay function is enabled, if the destination address is not the module itself, the module will start forwarding once; In order to prevent data backhaul, it is recommended to use it in conjunction with fixed-point mode. That is, the destination address and the source address are different.
			0	Disable Trunk Function (Default)			
			1	Enable the trunk feature			
			4	LBT enables			When enabled, the wireless data will be monitored before transmission, which can avoid interference to a certain extent, but may cause data delays; The maximum residence time of LBT is 2 seconds, and it will be forcibly emitted when it reaches 2 seconds.
			0	Disabled (default)			
			1	enable			
			3	WOR mode transmit and receive control			Valid for Mode 1 only; 1. In the receiving mode of WOR, the module can modify the delay time after waking up, and the default time is 0; 2. The receiver needs to send the command C0 09 02 03 E8 in configuration mode (C0 is the write command, 09 is the register starter address, 02 is the length, 03 E8 is the set delay, the maximum FFFF is 65535ms, and the wake-up delay is turned off if it is set to 0.) 3. Data can be sent within the time delay
			0	WOR Receiver (Default) It works in WOR monitoring mode, and the monitoring cycle is shown below (WOR cycle), which can save a lot of power consumption.			
			1	WOR transmitter The module transmits and receives when it is turned on, and when transmitting data, a wake-up code for a certain period of time is added.			
			2	1	0	WOR cycle	Valid for Mode 1 only; 1. In the receiving mode of WOR, the module can modify the delay time after waking up, and the default time is 0; 2. The receiver needs to send the command C0 09 02 03 E8 in configuration mode (C0 is the write command, 09 is the register starter address, 02 is the length, 03 E8 is the set delay, the maximum FFFF is 65535ms, and the wake-up delay is turned off if it is set to 0.) 3. Data can be sent within the time delay
			0	0	0	500ms	
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	
			1	0	1	3000ms	
			1	1	0	3500ms	
			1	1	1	4000ms	
07H	Write	CRYPT_H	Key High Byte (Default 0)				Write only, read returns 0; It is used for encryption to avoid being intercepted by similar modules for over-the-air wireless data; These two bytes will be used as the calculation factor to transform and encrypt the over-the-air wireless signal.
08H	Write	CRYPT_L	Key Low Byte (Default 0)				
80H～86H	Read	PID	Product information 7 bytes				Product information 7 bytes

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7.3 Factory default parameters

Model	Factory default parameter values:C0 00 00 62 00 17						
Module model	frequency	address	Channel	Air rate	baud rate	Serial port format	Transmit power
E22-400T33S/D	433.125MHz	0x0000	0x17	2.4kbps	9600	8N1	33dBm

Chapter 8 It is used in trunk networking mode

No.	Description of the trunk mode
1	After setting the trunk mode through the configuration mode, switch to normal mode and the trunk starts working.
2	In relay mode, ADDH and ADDL are no longer used as module addresses, but are respectively corresponding to NETID forwarding pairing, and if one of the networks is received, it will be forwarded to the other network; The network ID of the repeater itself is invalid.
3	In relay mode, the relay module cannot send and receive data and cannot perform low-power operation.
4	When the user enters another mode from mode 3 (sleep mode) or during the reset process, the module resets the user parameters and the AUX output goes low.

Trunk networking rules:

1、Forwarding rules, a relay can forward data between two NETIDs in both directions.

2、In relay mode, ADDH\ADDL is no longer used as the module address, but is forwarded and paired as NETID.

As shown in the figure:

(1) Level 1 relay

"Node 1" has a NET of 08.

NODE 2 NET HAS 33.

The ADDH\ADDL of trunk 1 is 08,33, respectively.

So the signal sent by node 1 (08) can be forwarded to node 2 (33)

At the same time, node 1 and node 2 have the same address, so the data sent by node 1 can be received by node 2.

(2) Secondary relay

The ADDH\ADDL of trunk 2 is 33,05, respectively.

So Trunk 2 can forward Trunk 1's data to the network NETID:05.

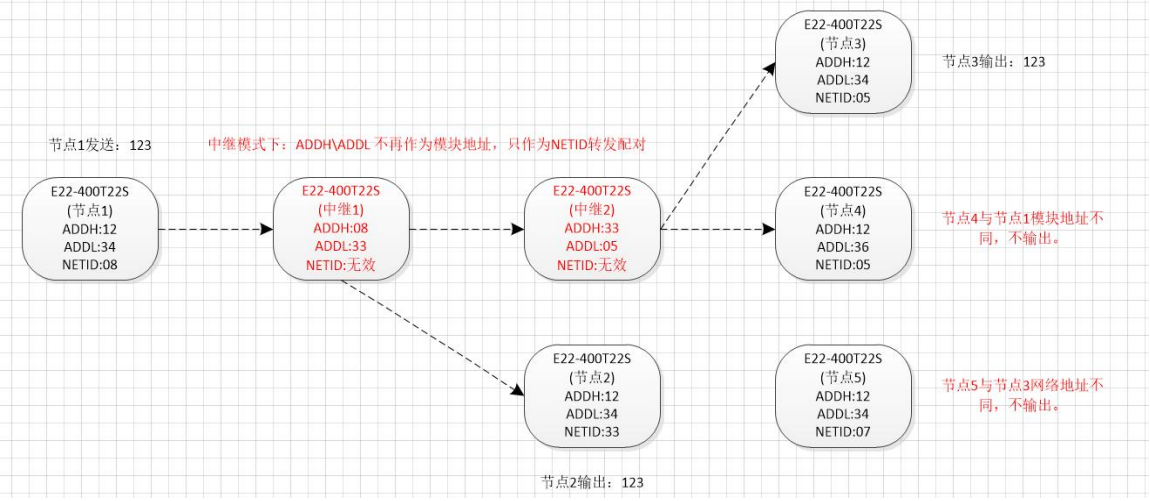
Thus, node 3 and node 4 can receive node 1 data. Node 4 outputs data normally, but node 3 has a different address from node 1, so it does not output data.

(3) Two-way relay

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As shown in the figure, node 2 and 4 can receive the data sent by node 1, and node 1 can also receive the data sent by node 2 and 4.



Chapter 9 Upper Computer Configuration Description

- The following figure shows the display interface of the E22-400T33D configuration host computer, the user can switch to command mode through M0 and M1, and quickly configure and read the parameters on the host computer.



- In the configuration of the host computer, the module address, frequency channel, network ID, and key are all in decimal display mode; The value range of each parameter is as follows:

Network address: 0~65535

Frequency channel: 0~83

Network ID: 0~255

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Key: 0~65535

- When the user uses the host computer to configure the relay mode, special attention needs to be paid to the fact that in the host computer, each parameter is the decimal display mode, so the module address and network ID need to be converted into the base system when filling;

If the network ID input by transmitter A is 02 and the network ID input by receiver B is 10, then when the relay R sets the module address, the hexadecimal value 0X020A converted into the decimal value 522 as the module address filled in by the relay R;

In this case, the address value of the module that needs to be entered in the relay terminal R is 522.

Chapter 10 Hardware Design

- It is recommended to use a DC regulated power supply to supply power to the module, the ripple coefficient of the power supply should be as small as possible, and the module should be reliably grounded;
- Please note that the correct connection of the positive and negative poles of the power supply, such as reverse connection will directly lead to permanent damage to the module, it is recommended to add an anti-reverse circuit in the design.
- Please check the power supply to ensure that it is between the recommended supply voltage, if the maximum value is exceeded, 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 keep more than 30% of the margin, which is conducive to long-term stable operation.
- The module should be kept away from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference as much as possible;
- If it is really necessary to pass under the module, assuming that the module is welded to the top layer, the top layer of the contact part of the module must be close to the digital part of the module and the cable must be routed in the bottom layer;
- Assuming that the module is soldered or placed in the top layer, it is also wrong to route the cables at random in the bottom layer or other layers, which will affect the spurious and receiving sensitivity of the module to varying degrees.
- Assuming that there are devices with large electromagnetic interference around the module, it is recommended to stay away from the module appropriately according to the intensity of the interference, and if the situation allows, appropriate isolation and shielding can be done;
- Assuming that there are traces (high-frequency digital, high-frequency analog, power cables) around the module that have large electromagnetic interference, it will also greatly affect the performance of the module, and it is recommended to stay away from the module appropriately according to the intensity of interference, and if the situation allows, appropriate isolation and shielding can be done;
- If the communication line uses 5V level, it must be connected in series with a 1k-5.1k resistor (not recommended, there is still a risk of damage);
- The antenna installation structure has a great impact on the performance of the module, so it is necessary to ensure that the antenna is exposed and preferably vertically upward;
- When the module is installed inside the chassis, a high-quality antenna extension cable can be used to extend the antenna to the outside of the chassis;
- The antenna must not be installed inside a metal case, as the transmission distance will be greatly reduced.

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Chapter 11 Frequently Asked Questions

11.1 The transmission distance is not ideal

- When there is a straight-line communication barrier, the communication distance will be attenuated accordingly;
- Temperature, humidity, and co-channel interference will lead to an increase in the communication packet loss rate.
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;
- If there is a metal object near the antenna, or if it is placed in a metal shell, the signal attenuation will be very serious;
- The power register is set incorrectly, the air rate is set too high (the higher the air rate, the closer the distance);
- At room temperature, the low voltage of the power supply is lower than the recommended value, and the lower the voltage, the smaller the generating power;
- The antenna is poorly matched with the module or the antenna itself is of poor quality.

11.2 Modules are vulnerable

- Please check the power supply to ensure that it is between the recommended supply voltage, if the maximum value is exceeded, the module will be permanently damaged;
- Please check the stability of the power supply, the voltage should not fluctuate greatly and frequently;
- Please ensure that the installation and use process is anti-static operation, and the electrostatic sensitivity of high-frequency devices;
- Please ensure that the humidity should not be too high during installation and use, and some components are humidity-sensitive devices;
- If there are no special needs, it is not recommended to use it at too high or too low temperatures.

11.3 The bit error rate is too high

- If there is co-channel signal interference nearby, stay away from the interference source or modify the frequency and channel to avoid interference;
- Unsatisfactory power supply may also cause garbled codes, so it is important to ensure the reliability of the power supply;
- Poor or too long extension wires and feeders can also cause high bit error rates.

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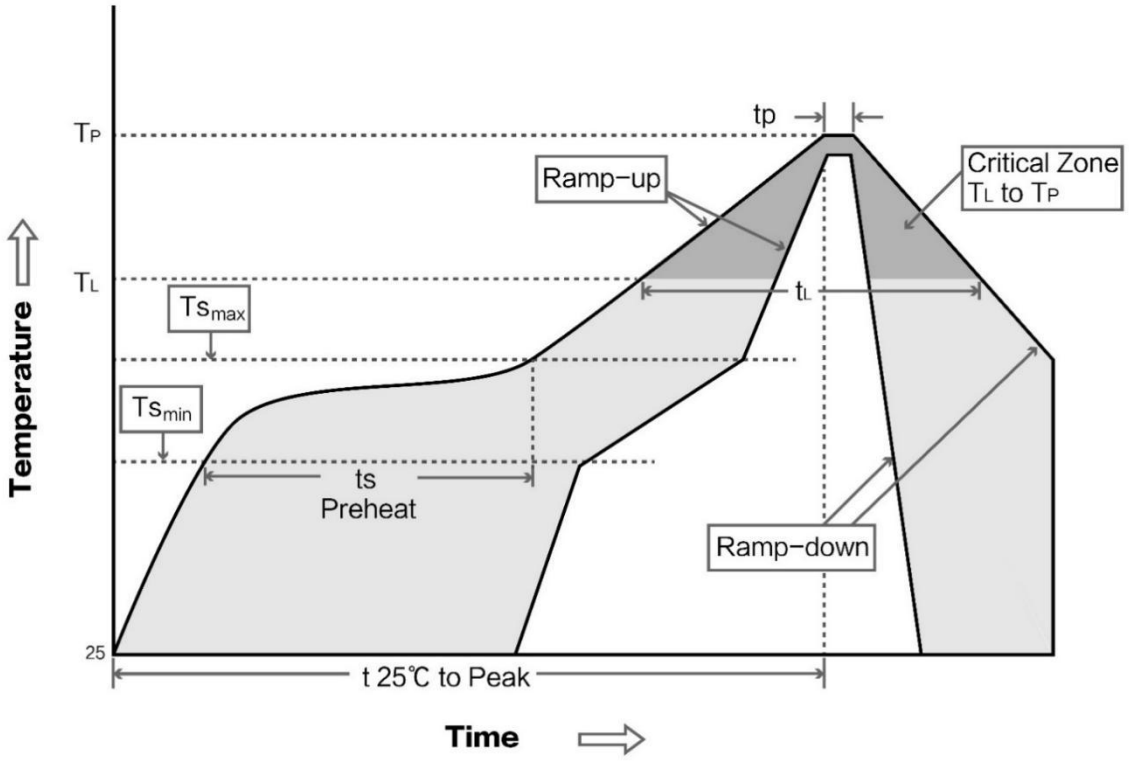
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Chapter 12 Welding Operation Instructions

12.1 Reflow temperature

Profile Feature	Curve features	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min （Tsmin）	Minimum warm-up temperature	100℃	150℃
Preheat temperature max (Tsmax)	Maximum warm-up 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
Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above liquidphase	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

12.2 Reflow soldering curve



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Chapter 13 Antenna Guide

13.1 Antenna Recommendations

Antennas play an important role in the communication process, and often inferior antennas will have a great impact on the communication system, so our company recommends some antennas as antennas that match our wireless modules and have excellent performance and reasonable prices.

Product model	type	Band Hz	interface	gain dBi	Height mm	Feeder cm	Features
TX433-NP-4310	Flexible antennas	433M	焊接	2.0	43.8*9.5	-	Built-in flexible, FPC soft antenna
TX433-JZ-5	Rubber antennas	433M	SMA-J	2.0	52	-	Ultra-short straight, omnidirectional antenna
TX433-JZG-6	Rubber antennas	433M	SMA-J	2.5	62	-	Ultra-short straight, omnidirectional antenna
TX433-JW-5	Rubber antennas	433M	SMA-J	2.0	50	-	Bent glue sticks, omnidirectional antennas
TX433-JWG-7	Rubber antennas	433M	SMA-J	2.5	75	-	Bent glue sticks, omnidirectional antennas
TX433-JK-11	Rubber antennas	433M	SMA-J	2.5	110	-	Bendable glue stick, omnidirectional antenna
TX433-JK-20	Rubber antennas	433M	SMA-J	3.0	210	-	Bendable glue stick, omnidirectional antenna
TX433-XPL-100	Suction cup antenna	433M	SMA-J	3.5	185	100	Small suction cup antenna, cost-effective
TX433-XP-200	Suction cup antenna	433M	SMA-J	4.0	190	200	Neutral suction cup antenna, low loss
TX433-XPH-300	Suction cup antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Rubber antennas	470/490M	SMA-J	2.0	50	-	Ultra-short straight, omnidirectional antenna
TX490-XPL-100	Suction cup antenna	470/490M	SMA-J	3.5	120	100	Small suction cup antenna, cost-effective

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Revision History

version	Date of revision	Revision Notes	Maintainers
1.0	2022-12-30	Initial release	Yan
1.1	2023-2-2	Bug fixes	Yan
1.2	2023-4-10	Bug fixes	Yan
1.3	2023-11-17	Suggested wiring diagram corrections	Hao
1.4	2023-12-29	Content Revisions	Bin
1.5	2024-4-16	Content Revisions	Hao
1.6	2025-2-24	Modified dimensional drawing	Hao
1.7	2026-7-10	Content Revisions	Hao

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