E22-400T37S product specification

SX1268 433/470MHz 5W   LoRa Wireless Module

目录

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Chapter 1 Product Overview

1.1 Product Introduction

E22-400T37S is a new generation of LoR wireless module, based on SX1268 radio frequency chip wireless serial port module (UART), with a variety of transmission methods , working in (410.125~493.125MHz) frequency band (default 433.125MHz), LoRa spread spectrum technology, TTL   Level output, support 4.5 V - 15V   supply voltage.

E22-400T37S adopts a new generation of LoRa spread spectrum technology, compared with the traditional SX1278 scheme, SX1268 is farther, faster, lower power consumption, smaller size; Support air wake-up, wireless configuration, carrier monitoring, automatic relay, communication key and other functions, support subpacket length setting, and can provide customized development services.

1.2 Features and Functions

- Based on SX1268, a new LoRa spread spectrum modulation technology was developed, which brings longer communication distance and stronger anti-interference ability.

- Support 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;

- Support users to set their own communication keys and cannot be read, which greatly improves the confidentiality of user data;

- Support LBT function, listen to 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 to evaluate signal quality and improve communication networks;

- Support wireless parameter configuration, send command data packets through wireless, remotely configure or read wireless module parameters;

- Support over-the-air wake-up, that is, ultra-low-power function, suitable for battery-powered applications;

- Support fixed-point transmission, broadcast transmission, channel monitoring;

- It supports deep sleep in the full power supply range, and the power consumption of the whole machine in this mode is less than 10uA;

- Support the global license-free ISM 433MHz frequency band, support 470MHz meter reading band;

- The module has built-in PA+LNA, and the communication distance can reach 20km under ideal conditions (16Km stable communication measured in urban environment);

- The parameters are saved when power down, and the module will work according to the set parameters after power on again;

- Efficient watchdog design, once an exception occurs, the module will automatically restart and continue to work according to the previous parameter settings;

- Support 0.3K~62.5kbps data transmission rate;

- Support 4.5~15 V wide voltage power supply, full power supply range can ensure 37dBm power output;

- Industrial-grade standard design, support long-term use at -40~+85°C;

- The maximum power of the module can reach 5W (37dBm), and the transmission is farther and more stable.

- The module has built-in undervoltage, overvoltage warning function and built-in warning LED.

- The module has a built-in over-temperature protection function, and automatically stops sending after exceeding the maximum temperature of the module.

- The matrix pad is reserved at the bottom of the module to facilitate the heat dissipation processing of secondary development.

1.3 Application scenarios

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

Chapter II: Specification Parameters

2.1 Limit parameters

Main parameters	performance		remark
	minimum	maximum	
Supply voltage (V).	4.5	15	More than 15V may permanently burn out the module
Blocking power (dBm).	-	10	High-power RF do not communicate in close proximity
Operating temperature (°C).	-40	+85	Industrial grade

2.2 Working parameters

Main parameters		performance			remark
		minimum	Typical value	maximum	
Operating voltage (V).		4.5	5~12V	15	≥5V guarantees output power, and the lower the voltage, the greater the supply current
Communication level (V).		-	3.3	-	Using 5V levels may pose a risk of burnout, requiring level shifting circuitry
Operating temperature (°C).		-40	-	85	Industrial-grade design
Operating frequency band (MHz).		410.125	-	493.125	ISM bands are supported
power consumption	5V transmit current (mA).	2900	3100	3300	Test at 50 ohms impedance, impedance mismatch may cause large current, use 5V power supply, please provide at least 3.5A output power supply
	12V transmit current (mA).	900	1100	1300	Test at 50 ohms impedance, impedance mismatch may cause large current, use 12V power supply, please provide at least 1.5A output power supply
	Receive current (mA).	-	43	-	@DC 12V power supply
	Sleep current (uA).	-	2	-	Software shutdown
Maximum transmit power (dBm).		36	37	37.5	-
Receive sensitivity (dBm).		-125	-126	-127	Air rate 2.4 kbps
Air rate (bps).		0.3k	2.4k	62.5k	User programmatic control
Reference distance		25km			Clear sky, Chengdu downtown, antenna gain 5dBi, antenna height 2.5 meters, airspeed 2.4K.
Emission length		240 Bperform			Subpackets can be sent by command setting 32/64/128/240 bytes

Cache capacity	1000 Byte	-
Modulation mode	LoRa	A new generation of LoRa modulation technology
Communication interface	UART serial port	TTL level
Encapsulation method	SMD	SMD
Interface mode	2.54mm stamp hole	
Form factor	50*30.9mm	
RF interface	IPEX/stamp hole	The characteristic impedance is about 50 ohms

Chapter 3 Mechanical Dimensions and Pin Definition

Top pad : 0.25   0.40 0.80

Bottom pad : 0.75   0.40 0.80
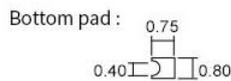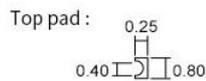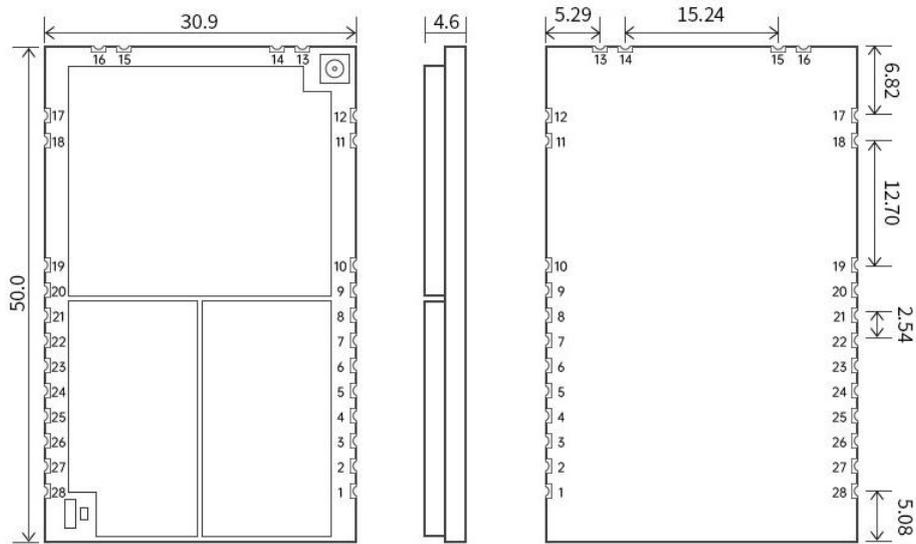
Unit : mm
pad quantity : 56
Tolerance value : X.X±0.1mm
X.XX±0.05mm

serial number	Pins	Pin orientation	remark
1	GND	input	Module ground
2	GND	input	Module ground
3	VCC	input	The module power supply is positively referenced, and the voltage range is 4 5～15V DC
4	VCC	input	The module power supply is positively referenced, and the voltage range is 4 5～15V DC
5	RESET	input	Module reset pin
6	THE	output	Used to indicate the working status of the module; The user wakes up the external MCU and the output is low during POST initialization Level; (Can be suspended)
7	TXD	output	TTL serial output, connected to external RXD input pin;
8	RXD	input	TTL serial input, connected to external TXD output pin;

9	M1	Input (very weak pull-up)	In conjunction with M0，determine the 4 working modes of the module (non-suspended, groundable if not used).
10	M0	Input (very weak pull-up)	In conjunction with M1，determine the 4 operating modes of the module (non-suspended, groundable if not used).
11	GND	input	Module ground
12	GND	input	Module ground
13	ON	output	Antenna interface (high frequency signal output, 50 ohm characteristic impedance).
14	GND	input	Module ground
15	GND	input	Module ground
16	GND	input	Module ground
17	GND	input	Module ground
18	GND	input	Module ground
19	GND	input	Module ground
20	STATE	output	Module status indication output, if no dangling processing is used
21	NC	-	No need to care, dangling handling
22	NC	-	No need to care, dangling handling
23	NC	-	No need to care, dangling handling
24	NC	-	No need to care, dangling handling
25	NC	-	No need to care, dangling handling
26	NC	-	No need to care, dangling handling
27	GND	input	Module ground
28	NC	-	No need to care, dangling handling

Note: The module must be connected to a 50 ohm impedance antenna when transmitting, and no-load transmission may cause permanent damage to the module!!!

Chapter 4 Recommended Connection Diagram
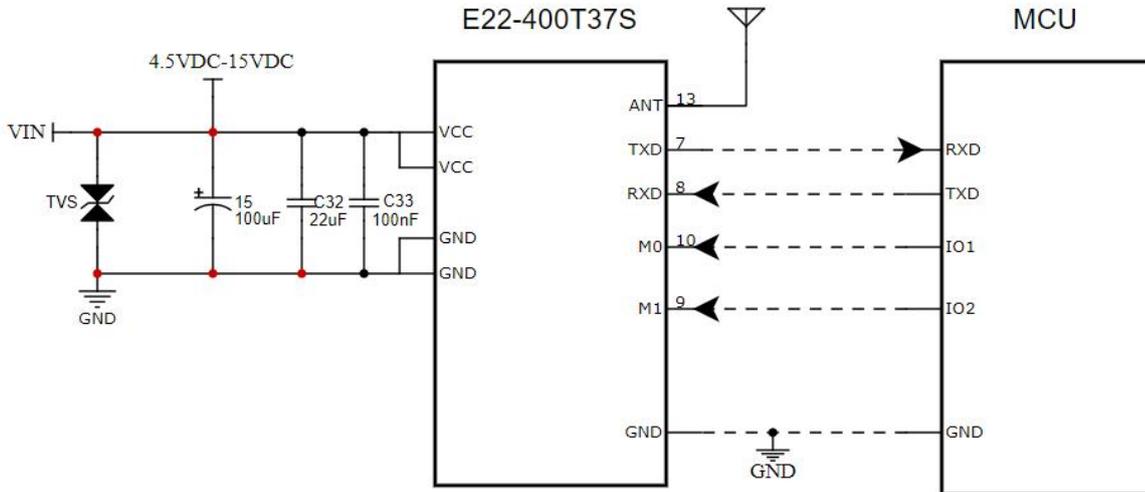
serial number	Brief connection description of the module and the microcontroller (STM8L microcomputer as an example in the figure above).
1	The wireless serial port module is TTL level, please connect with the MTL level MCU.
2	With a 5V microcontroller, please perform level shifting.
3	A capacitor of not less than 47uF should be added to the power input, and the capacitor ESR should be as low as possible to increase the stability of the module.
4	Power protection devices can be added according to actual needs.

Chapter 5 Detailed Explanation of Functions

5.1 Fixed-point launch
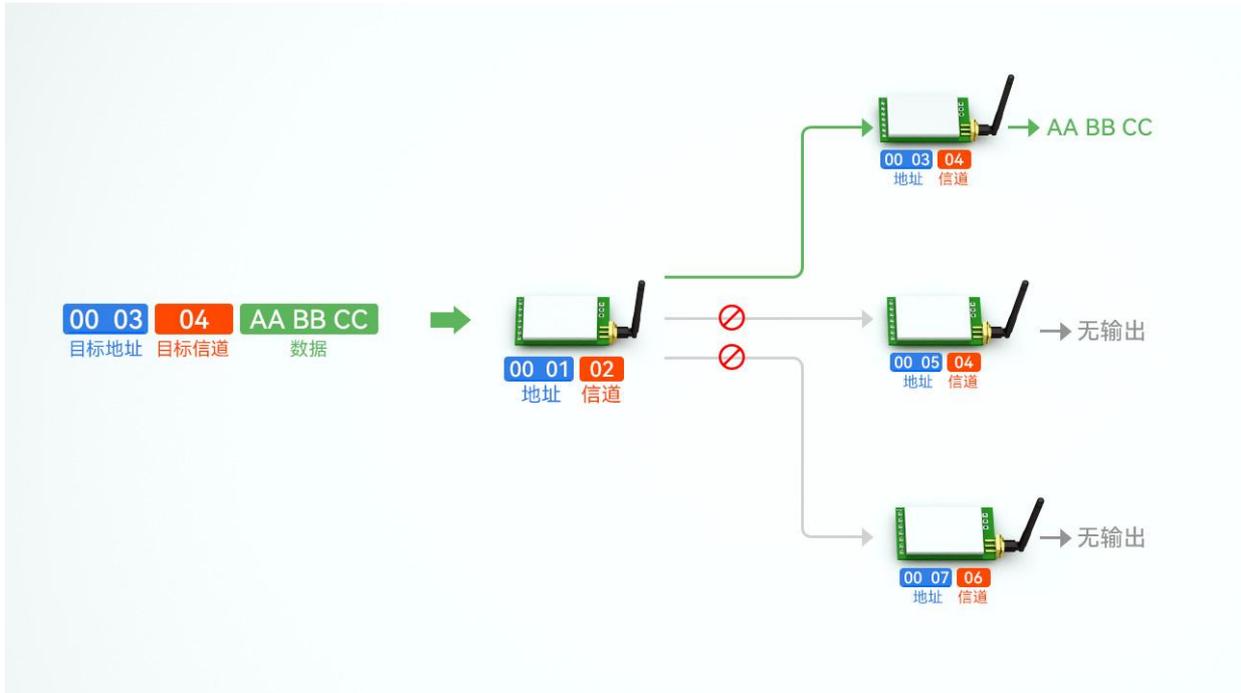
5.2 Broadcast Transmission
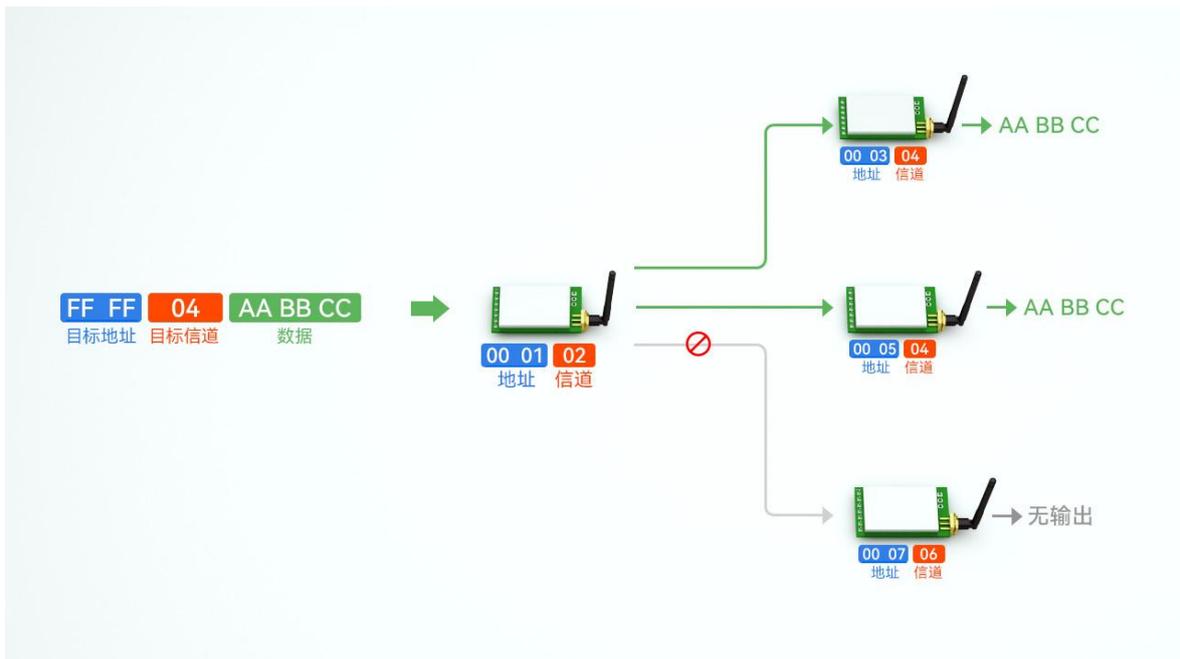
5.3 Broadcast Address

- Example: Set the address of module A to 0xFFFF and the channel to 0x04.
- When module A is used as a transmission (the same mode, transparent transmission mode), all receiving modules under the 0x04 channel can receive data to achieve the purpose of broadcasting.

5.4 Listening Address

- Example: Set the address of module A to 0xFFFF and the channel to 0x04.
- When module A is used as a reception, 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, AUX will immediately output a low level, perform hardware self-test, and set the working mode according to user parameters;
  In this process, the AUX is kept low, and after completion, the AUX output is high, and it starts to work normally according to the working mode combined by M1 and M0;
  Therefore, the user needs to wait for the rising edge of the AUX as the starting point for the module to work properly.

5.6 AUX in detail

- AUX is used for wireless buffering and self-test indications.
- It indicates whether the module has data that has not been transmitted out of the wireless or received wireless data has not been fully sent 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

- for waking up an external MCU in hibernation;

提前2-3ms,用于
唤醒外部MCU

所有收到的无线数据,
都已经通过TXD发出。
(实质是缓冲区为空)
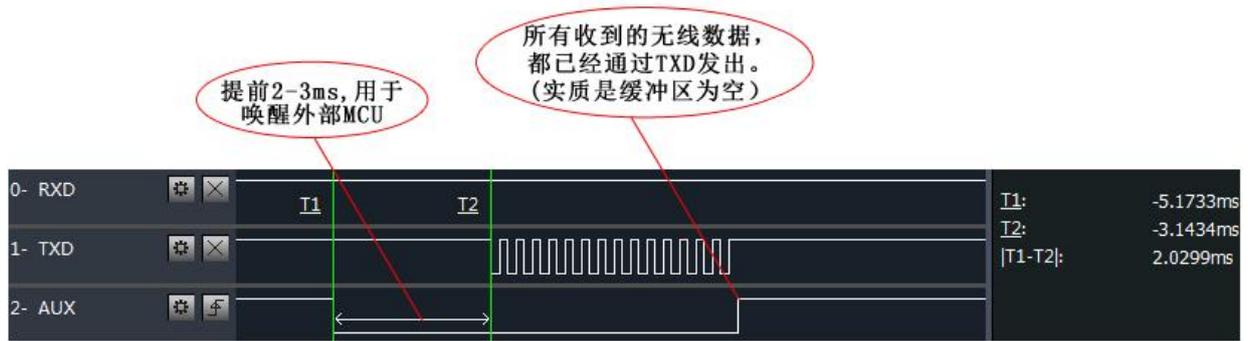
模块串口外发数据时，AUX引脚时序图

5.6.2 Wireless Emission Indication

- Buffer null: the data of the internal 1000-byte buffer is written to the wireless chip (automatic subpacket);

  When AUX=1, the user continuously initiates data less than 1000 bytes and will not overflow;

  When AUX=0, the buffer is not empty: the data of the internal 1000-byte buffer has not been fully written to the wireless chip and the transmission is turned on, and the module may be waiting for the user data to end the timeout, or the wireless subpacket transmission is in progress.

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

分包发射：最后一包数据已
写入RF芯片并自动发射，用户
可以继续输入1000字节。（实
质是缓冲区为空）
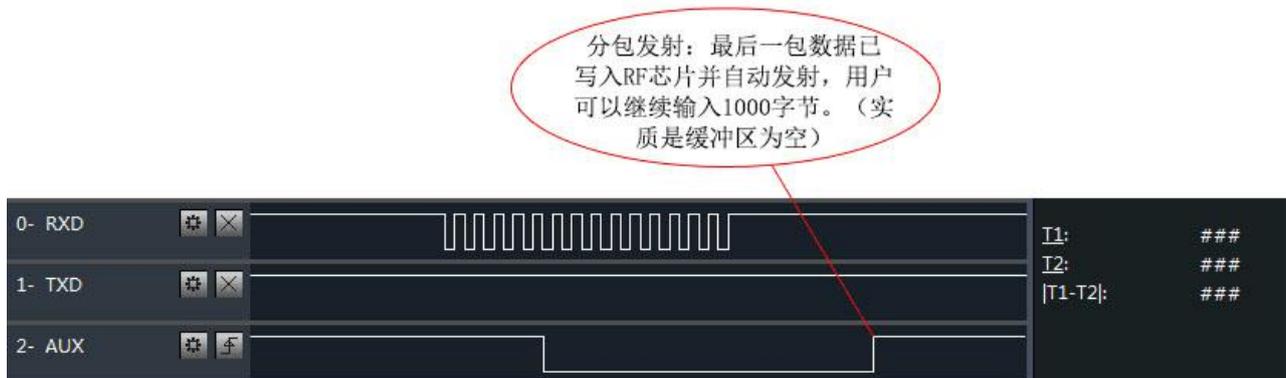
模块接收串口数据时，AUX引脚时序图

5.6.3 Module in the process of configuration

- Only when resetting and exiting sleep mode;
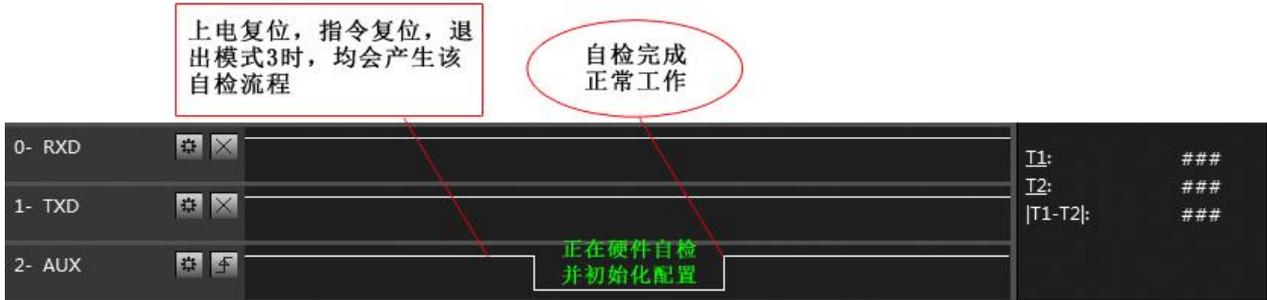
自检期间，AUX引脚时序图

5.6.4 Precautions

serial number	AUX considerations
1	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 conditions are not met, the AUX outputs a high level.
2	When the AUX output is low, it means that the module is busy and the working mode detection will not be carried out at this time; When the module AUX output is high within 1ms, the mode switching work will be completed.
3	After the user switches to the new working mode, at least 2ms after the rising edge of the AUX is required before the module can really enter this mode; If the AUX is kept high, then the mode switch will take effect immediately.
4	When the user enters another mode from mode 3 (sleep mode) or during reset, the module resets the user parameters while the AUX output is low.
5	Due to the characteristics of LoRa modulation, the information transmission delay is much longer than that of FSK, and it is recommended that customers do not transmit large data at low airspeed to avoid communication exceptions caused by data loss caused by data accumulation.

5.7　Detailed explanation of abnormal work status log printing

1.STATE indicator/status indication pin will blink/level according to the table below according to the specific abnormal working state.

Abnormal working state	The threshold for determining the abnormal state	The indicator flashes
Undervoltage	Supply voltage< 4.5V	500ms flashes once/level flip
Overvoltage	Supply voltage> 15V	1s flashes once/level flip
superheating	Module temperature> 120°C	2s flashes once/level flip
Overpressure and overheating	The supply voltage > 15V and the module temperature > 120°C	Always on

2．The module will temporarily turn off the radio frequency transmission function under abnormal working conditions, and will restart the transmission after returning to normal working conditions.

3. The module will print a circular log every 500ms (can be turned on/off) in an abnormal state to inform the user of the current abnormal working status, and the print log format is shown in the following table

Abnormal working state	Print the log format
Undervoltage	FF FF FF 01
Overvoltage	FF FF FF 02
superheating	FF FF FF 03
Overpressure and overheating	FF FF FF 04

Exception log printing enable bit (instruction register 0 4H bit2 bit) 0: off   1: on The   default is 0 (off).

Chapter VI: Work Modes

The module has four operating modes, set by pins M1, M0; Details are shown in the following table:

Mode (0-3).	M1	M0	Introduction to the pattern	remark
0 Transfer mode	0	0	Serial port open, wireless open, transparent transmission	Support special command over-the-air configuration
1 WOR mode	0	1	Can be defined as a WOR sender and a WOR receiver	Supports wake-on-air support
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 sleep	1	1	The module goes into hibernation	

6.1 Mode switching

serial number	remark
1	- Users can combine M1 and M0 high and low levels to determine the module working mode. The MCU's 2 GPIOs can be used to control mode switching; - After changing M1 and M0: if the module is idle, after 1ms, it can start working according to the new mode; - If the serial port data of the module 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, mode switching can only be effective when the AUX outputs 1, otherwise the switching will be delayed.
2	- For example, if the user continuously enters a large amount of data and switches modes at the same time, the switching mode operation is invalid; The module will process all users before performing new mode detection; - Therefore, the general recommendation is: detect the output status of the AUX pin, wait for the output to be high and then switch after 2ms.
3	- When the module is switched from other modes to sleep mode, if there is data that has not been processed; - The module will process this data (including sending and receiving) before entering sleep mode. This feature can be used for fast sleep, thus saving power consumption; For example: 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 idle (high level), can directly switch to sleep mode, and the user's main MCU immediately sleeps, the module will automatically send all user data through the wireless after the module Automatically enter sleep within 1ms; - This saves the working time of the MCU and reduces power consumption.
4	- Similarly, any mode switch can take advantage of this feature, and after the module processes the current mode event, it will automatically enter a new mode within 1ms; This eliminates the need for users to query AUX and can achieve the purpose of fast switching; - For example, switching from transmit mode to receive mode; The user MCU can also go to sleep before the mode switch and use the external interrupt function to obtain the AUX change to perform the mode switch.

5	● This operation mode is very flexible and efficient, designed in full accordance with the user's MCU ease of operation, and can reduce the workload of the entire system as much as possible, improve system efficiency, and reduce power consumption.

6.2 General Mode (Mode 0).

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

6.3 WOR mode (mode 1).

type	When M0 = 1 and M1 = 0, the module operates in mode 1
launch	When defined as a transmitter, the wake-up code is automatically incremented for a certain amount of time before launching
reception	Data can be received normally, and the receiving function is equivalent to mode 0

6.4 Configuration Mode (Mode 2).

type	When M0 = 0 and M1 = 1, the module operates in mode 2
launch	Wireless transmission is off
reception	Wireless reception is off
disposition	The user can access registers to configure the module operating state

6.5 Deep sleep mode (mode 3).

type	When M0 = 1 and M1 = 1, the module operates in mode 3
launch	Wireless data cannot be transmitted.
reception	Unable to receive wireless data.
note	When entering from sleep mode to other modes, the module will reconfigure the parameters, and during the configuration process, A UX remains low; After completion, the output is high, so it is recommended that the user detect 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 instructions is as follows (**when set, only 9600, 8N1 formats** are supported.）：

serial number	Instruction format	Detailed description
1	Set the registers	Instructions: C0 + start address + length + parameter Response: C1 + start address + length + parameter Example 1: Configure the channel to 0x09 　　Directive　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	Instructions: C1 + start address + length Response: C1 + start address + length + parameter Example 1: Read the channel 　　Directive　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 temporary registers	Instructions: C2 + start address + length + parameters Response: C1 + start address + length + parameter Example 1: Configure the channel to 0x09 　　Directive　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	Instructions: CF CF + general instructions Response:　CF CF + regular response Example 1: The wireless configuration channel is 0x09 　　Wireless Instruction Header　Instruction　Start Address　Length　　parameter

		Send: CF　CF C0 05 01 09 Return: CF　CF C1 05 01 09 Example 2: Wireless simultaneous configuration of module address (0x1234), network address (0x00), serial port (9600 8N1), and airspeed (2.4K). Send: CF　CF C0 00 04 12 34 00 61 Return: 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>serial number</th><th>Read and write</th><th>name</th><th colspan="4">description</th><th>remark</th></tr>
<tr><td>00H</td><td>Read /Write</td><td>ADDH</td><td colspan="4">ADTH (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 listening address, that is, the module will not perform address filtering</td></tr>
<tr><td>01H</td><td>Read /Write</td><td>ADDL</td><td colspan="4">ADD (default 0).</td></tr>
<tr><td>02H</td><td>Read /Write</td><td>NETID</td><td colspan="4">NETID (default 0).</td><td>network address, which is used to distinguish the network;
When communicating with each other, it should be set to the same.</td></tr>
<tr><td rowspan="12">03H</td><td rowspan="12">Read /Write</td><td rowspan="12">REG0</td><td>7</td><td>6</td><td>5</td><td>UART serial port rate (bps).</td><td rowspan="10">The two modules that communicate with each other, the serial port baud rate can be different, and the verification method can also be different;

When transmitting large packets continuously, users need to consider data blocking caused by the same baud rate, and may even lose it.

It is generally recommended that the baud rate be the same on both sides of the communication.</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>The serial port baud rate is 1200</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>The serial port baud rate is 2400</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>The serial port baud rate is 4800</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>The serial port baud rate is 9600 (default).</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>The serial port baud rate is 19200</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>The serial port baud rate is 38400</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>The serial port baud rate is 57600</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>The serial port baud rate is 115200</td></tr>
<tr><td colspan="2">4　　　3</td><td></td><td>Serial port check digit</td><td>The serial port mode of the</td></tr>
<tr><td colspan="2">0　　　0</td><td></td><td>8N1 (default).</td><td>communication two sides can be</td></tr>
</table>

				0	1	8O1		different;
				1	0	8E1		
				1	1	8N1 (equivalent to 0 0).		
				2	1	0	Wireless Air Rate (bps).	The air speed on both sides of the communication must be the same; The higher the air rate, the smaller the delay and the shorter the transmission distance.
				0	0	0	Air velocity 0.3K	
				0	0	1	Air velocity 1.2K	
				0	1	0	Air rate 2.4k (default).	
				0	1	1	Air speed 4.8K	
				1	0	0	Air velocity 9.6K	
				1	0	1	Air rate 19.2k	
				1	1	0	Air velocity 38.4K	
				1	1	1	Air velocity 62.5K	
04H	Read /Write	REG1		7	6	Subcontracting settings		The data sent by the user is less than the subpacket length, and the serial port output of the receiving end is presented as an uninterrupted continuous output; The user sends data that is larger than the subpacket length, and the serial port at the receiving end will subpacket the output.
				0	0	240 bytes (default).		
				0	1	128 bytes		
				1	0	64 bytes		
				1	1	32 bytes		
				5		RSSI ambient noise enable		Enable command (subpackage setting, transmit power as default parameter, configuration mode): C0 04 01 20; When enabled, instructions C0 C1 C2 C3 instructions can be sent in transport mode or WOR send mode to read registers; Register 0x00: current ambient noise RSSI; Register 0X01: RSSI when data was last received (The current channel noise is: dBm = -(256 - RSSI)); Instruction format: C0 C1 C2 C3 + start address + read length; Return: C1 + address + read length + read valid value; For example: send C0 C1 C2 C3 00 01 Returns C1 00 01 RSSI **(addresses can only start at 0 0).**
				0		Disabled (default)		
				1		enable		
				4	3	retain		Print corresponding different format logs according to different abnormal work status, see Section 5.7 for details, and the abnormal work status log printing is explained.
				2		Abnormal work status log printing is enabled		
				0		Disabled (default)		
				1		enable		
				1	0	Transmit power		**The module has no power binning**
				0	0	37dBm(默认)		

			0	1	37dBm	
			1	0	37dBm	
			1	1	37dBm	
05H	Read /Write	REG2	Channel Control (CH). 0-83 represents a total of 84 channels, respectively			Actual frequency = 410.125 + CH *1M
06H	Read /Write	REG3	7	Enable RSSI bytes		When enabled, the module receives wireless data, and after the TXD output through the serial port, it will follow an RSSI strength byte.
			0	Disabled (default)		
			1	enable		
			6	Mode of transmission		During fixed-point transmission, the module will recognize the three bytes of serial port data as: address high + address low + channel, and use it as the wireless transmission target.
			0	Transparent transport (default)		
			1	Fixed-point transmission		
			5	Relay functionality		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 relay (default)		
			1	Enable the trunking feature		
			4	IBT enabled		When enabled, wireless data will be monitored before transmission, which can avoid interference to a certain extent, but may bring data delay; The maximum dwell time of LBT is 2 seconds, and it will be forced to issue after two seconds.
			0	Disabled (default)		
			1	enable		
			3	WOR mode transceiver control		Valid only for mode 1; 1. In the receiving mode of WOR, the module can modify the delay time after wake-up, and the default time is 0; 2. The receiving end needs to send the instruction C0 09 02 03 E8 in the configuration mode (C0 is the write command, 09 is the register start address, 02 is the length, 03 E8 is the set delay, maximum FFFF is 65535ms, and if it is set to 0, wake-up delay is turned off.) 3. Data can be sent within the delay
			0	WOR receiver (default). Working in the WOR monitoring mode, the monitoring cycle is described below (WOR cycle), which can save a lot of power consumption.		
			1	WOR transmitter The module sends and receives open, and when transmitting data, a wake-up code for a certain period of time is added.		
			2	1	0	WOR cycle	Valid only for mode 1; Period T= (1+WOR)*500ms, maximum 4000ms, minimum 500ms; The longer the interval between WOR listeners, the lower the average power
			0	0	0	500ms	
			0	0	1	1000ms	
			0	1	0	1500ms	
			0	1	1	2000ms	
			1	0	0	2500ms	

			1	0	1	3000ms	consumption, but the greater the data latency.
			1	1	0	3500ms	
			1	1	1	4000ms	Both the sending and receiving parties must be the same (very important)
07H	write	CRYPT _H	Key high byte (default 0).				Write only, read returns 0; It is used for encryption to avoid interception of over-the-air wireless data by similar modules; Internally, these two bytes will be used as a calculation factor to transform and encrypt the wireless signal in the air.
08H	write	CRYPT _L	Key low byte (default 0).				
80H~86 H	read	PID	Product information 7 bytes				Product information 7 bytes

7.3 Factory default parameters

Model	Factory default parameter values: 00 00 00 62 00 17 03 00 00						
Module model	frequency	address	channel	Air rate	baud rate	Serial port format	Transmit power
E22-400T37S	410.125~ 493.125MH z	0x0000	0x17	2.4kbps	9600	8N1	37dbm

Chapter 8: Use of Relay Networking Mode

serial num ber	Trunk mode description
1	After setting the trunk mode through the configuration mode, switch to normal mode and the trunk starts working.
2	In the trunk mode ADDH, ADDL is no longer used as the module address, but is paired with NETID forwarding, and if one of the networks is received, it is forwarded to another 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 reset, the module resets the user parameters while the AUX output is low.

Description of trunk networking rules:

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

2、In trunk mode, ADDH\ADDL is no longer used as the module address, but as a NETID forwarding pair.

As shown in the picture:

(1) First-level relay

"Node 1" NETID is 08.

"Node 2" NETID is 33.

The ADDH\ADL for Relay 1 are 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\ADTL for Relay 2 is 33,05, respectively.

So trunk 2 can forward the data of trunk 1 to the network NETID:05.

Thus node 3 and node 4 can receive node 1 data. Node 4 outputs data normally, but node 3 and node 1 have different addresses, so data is not output.

(3) Two-way relay

As shown in the figure configuration: node 2 and 4 can receive the data sent by node 1, and   node 1 can also receive the data sent by nodes 2 and 4.
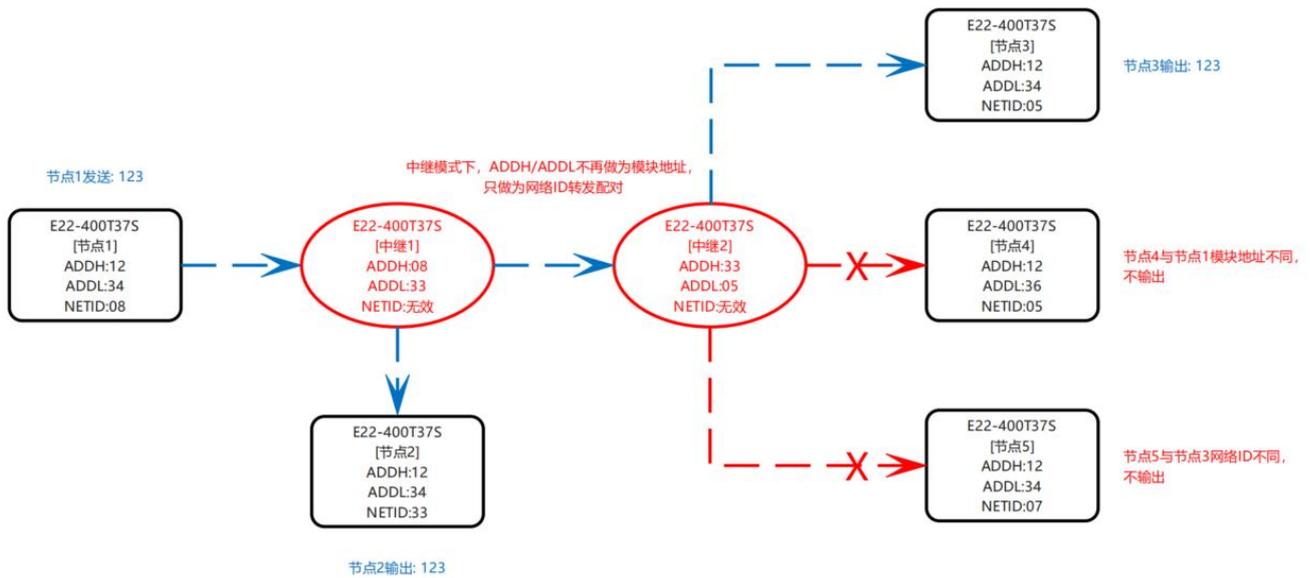
Chapter 9 Instructions for the configuration of the host computer

● The following figure shows the display interface of the E22-400T37S configuration host computer, and the user can switch to command mode through M0 and M1 to quickly configure and read parameters in the upper computer.

● In the configuration host computer, the module address, frequency channel, network ID, and key are all decimal display modes; The value range of each parameter is:

Network address: 0~65535

Frequency channel: 0~83

Network ID: 0~255

Key: 0~65535

● When the user uses the host computer to configure the trunk mode, he needs to pay special attention, because in the host computer, each parameter is the decimal display mode, so the module address and network ID need to be converted when filling;

If the network ID entered by transmitter A is 02 and the network ID entered by receiver B is 10, then the relay terminal R When setting the module address, convert the hexadecimal value 0X020A to the decimal value 522 as the module address filled in by the relay R.

That is, the module address value that needs to be filled in by Relay Side R is 522.

Chapter 10 Hardware Design

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

- Please pay attention to the correct connection of the positive and negative poles of the power supply, such as reverse connection will directly cause permanent damage to the module, it is recommended to design and add an anti-reverse circuit.

- Please check the power supply to ensure that between the recommended supply voltages, exceeding the maximum value will cause permanent damage to the module;

- Please check the stability of the power supply, the voltage cannot fluctuate greatly and 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 work of the whole machine;

- The module should be 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 bottom of the module, 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 module contact part is paved with copper (all paved copper and well grounded), and must be close to the module digital part and routed at the bottom Layer；

- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to route wires randomly 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 will 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;

- Assuming that there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces) will also greatly affect the performance of the module, it is recommended to stay away from the module appropriately according to the intensity of interference, and if the situation permits, appropriate isolation and shielding can be done;

- If the communication line uses 5V level, 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);

- The antenna installation structure has a great impact on the performance of the module, and 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 the metal case, which will greatly weaken the transmission distance.

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 placed in a metal case, 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);
- The low voltage of the power supply at room temperature is lower than the recommended value, and the lower the voltage, the smaller the power;
- The antenna used is poorly matched to the module or the quality of the antenna itself.

11.2   Modules are easily damaged

- Please check the power supply to ensure that between the recommended supply voltages, exceeding the maximum value will cause permanent damage to the module;
- Please check the stability of the power supply, the voltage cannot fluctuate greatly and frequently;
- Please ensure that the installation and use process of anti-static operation, high-frequency devices electrostatic sensitivity;
- 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 need, it is not recommended to use it at too high or too low temperature.

11.3   The bit error rate is too high

- 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 characters, be sure to ensure the reliability of the power supply;
- Poor or long quality extension wires and feeders can also cause high bit error rates.

Chapter 12 Welding Work Instructions

12.1 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 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 rise rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temperature	183℃	217℃
Time（tL）Maintained Above（TL）	Time above the liquid line	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	Time from 25°C to peak temperature	6 minutes　max	8 minutes　max

12.2 Reflow curve
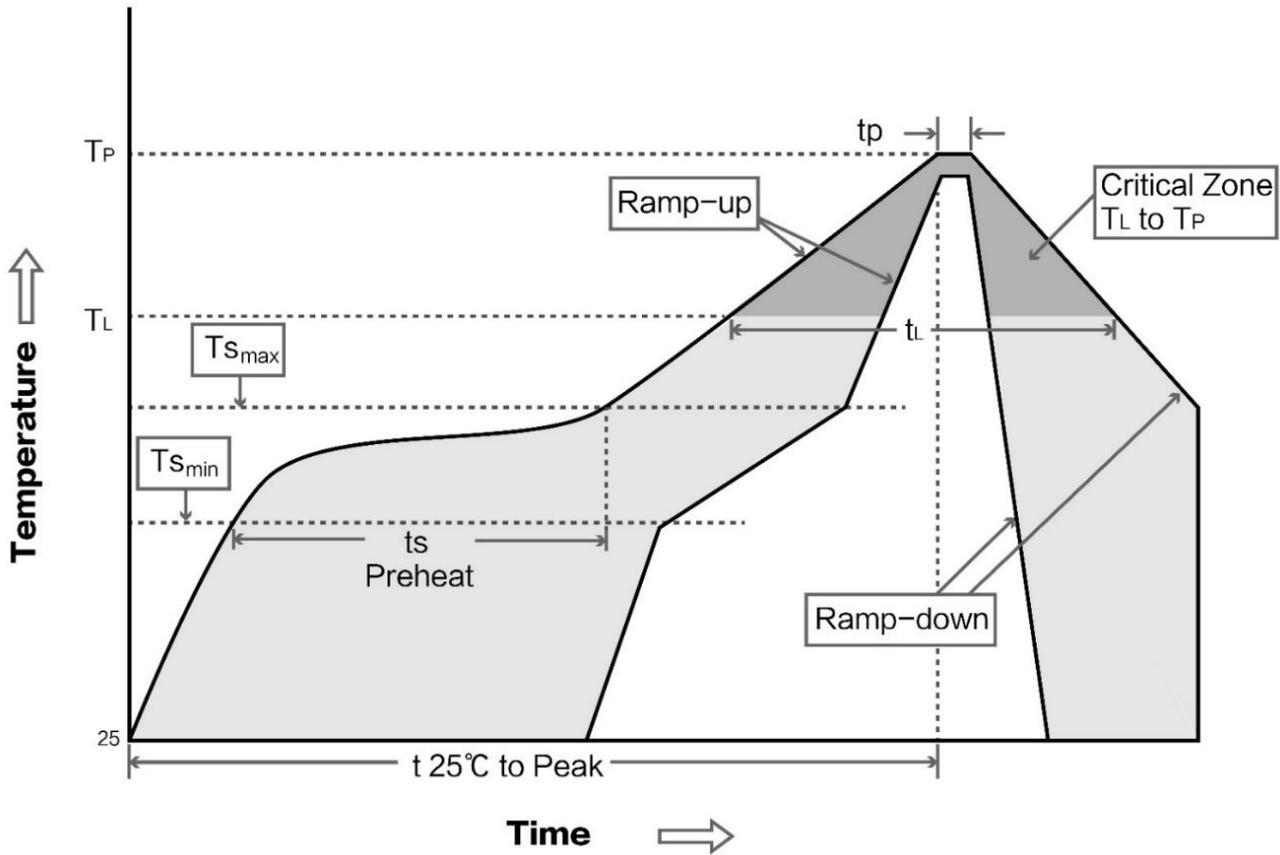
Chapter 13 Related Models

Product model	Chip solution	Carrier frequency Hz	Transmit power dBm	Test distance km	Package form	Product size mm	Communication interface
E22-400T22S	SX1268	433/470M	22	5	SMD	16*26	UART
E22-400T22D	SX1268	433/470M	22	5	Straight in	21*36	UART
E22-400T30S	SX1268	433/470M	30	10	SMD	20*40.5	UART
E22-400T30D	SX1268	433/470M	30	10	Straight in	24*43	UART
E22-900T22S	SX1262	868/915M	22	5	SMD	16*26	UART
E22-900T22D	SX1262	868/915M	22	5	Straight in	21*36	UART
E22-900T30S	SX1262	868/915M	30	10	SMD	20*40.5	UART
E22-900T30D	SX1262	868/915M	30	10	Straight in	24*43	UART
E22-400T33D	SX1268	433/470M	33	12	Straight in	37*60	UART

Chapter 14 Antenna Guidelines

14.1 Antenna Recommendations

Antenna is an important role in the communication process, often inferior antenna will have a great impact on the communication system, so our company recommends some antennas as supporting our wireless module and excellent performance and reasonable price antenna.

Product model	type	Band Hz	interface	gain dBi	height mm	Feeder cm	Functional features
TX433-NP-4310	Flexible antenna	433M	weld	2.0	43.8*9.5	-	Built-in flexible, FPC soft antenna
TX433-JZ-5	Glue stick antenna	433M	SMA-J	2.0	52	-	Ultra-short, straight, omnidirectional antenna
TX433-JZG-6	Glue stick antenna	433M	SMA-J	2.5	62	-	Ultra-short, straight, omnidirectional antenna
TX433-JW-5	Glue stick antenna	433M	SMA-J	2.0	50	-	Curved glue stick, omnidirectional antenna
TX433-JWG-7	Glue stick antenna	433M	SMA-J	2.5	75	-	Curved glue stick, omnidirectional antenna
TX433-JK-11	Glue stick antenna	433M	SMA-J	2.5	110	-	Bendable glue stick, omnidirectional antenna
TX433-JK-20	Glue stick antenna	433M	SMA-J	3.0	210	-	Bendable glue stick, omnidirectional antenna
TX433-XP L-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 for low loss
TX433-XPH-300	Suction cup antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Glue stick antenna	470/490 M	SMA-J	2.0	50	-	Ultra-short, straight, omnidirectional antenna
TX490-XP L-100	Suction cup antenna	470/490 M	SMA-J	3.5	120	100	Small suction cup antenna, cost-effective

Revision history

version	Revision date	Revision Instructions	Maintainers
1.0	2022-12-5	Initial version	Yan
1.1	2023-07-24	Error corrected	Bin
1.2	2023-09-13	Error corrected	Bin
1.3	2023-09-20	Error corrected	Bin

About us

Technical support: support@cdebyte.com

Documents and RF Setting download link:https://www.cdebyte.com

Thank you for using Ebyte products! Please contact us with any questions or suggestions: info@cdebyte.com

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Phone: +86 028- 61543675

Web: https://www.cdebyte.com

Address: B5 Mould Park, 199# Xiqu Ave, High-tech District, Sichuan, China

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