E22-170M Series Product Specifications

SX1262 1 70MHz SMD wireless module

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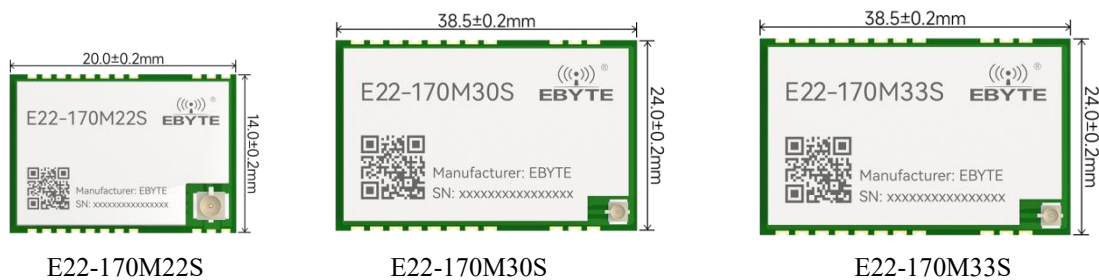
I. Overview

1.1 Introduction

The E22-170M series is an ultra-small 170.125MHz SMD LoRa ™ wireless module independently developed based on the new generation LoRa TM RF chip SX1262 produced by Semtech . As the imported SX1262 is used as the core of the module, the anti-interference performance and communication distance are further improved compared with the previous generation LoRa ™ transceiver.

Because it adopts the new LoRaTM modulation technology, its anti-interference performance and communication distance are far superior to the current FSK and GFSK modulation products. This module is mainly aimed at smart homes, wireless meter reading, scientific research and medical, as well as medium and long-distance wireless communication equipment. This product can cover the applicable frequency range of 150.125~170.125MHz and is backward compatible with SX1278 and SX1276. It uses an industrial-grade high-precision 32MHz active temperature-compensated crystal oscillator (TCXO).

The three modules in the figure below have different packaging and power , and are pure RF transceiver modules . They need to be driven by MCU or use a dedicated SPI debugging tool.

E22-170M22S   E22-170M30S   E22-170M33S

1.2 Features

- Compared with the SX1276 module, the SX1262 module has the significant advantages of lower power consumption, faster speed and longer distance;
- Under ideal conditions, the maximum communication distance measured can reach 16 km;
- There are three modules with different power of 22/30/33dBm to choose from , and they support multi-level adjustment by software;
- Support frequency range 150.125MHz~170.125MHz (default 170.125Mhz) ;
- LoRa ™ mode supports data transmission rates of 0.018-62.5kbps;
- FIFO has large capacity and supports 256Byte data cache;
- Backward compatible with SX1278/SX1276 series RF transceivers;
- Built-in PA+LNA greatly improves communication distance and stability;
- Industrial standard design, supports -40 ~ 85°C long-term use;
- Optional dual antennas (IPEX/stamp hole) facilitate secondary development and integration.

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 remote control;
- Healthcare products;
- Advanced Metering Infrastructure (AMI);
- Automotive industry applications.

II. Specifications

2.1 RF parameters

RF parameters	Unit	Model			Remark
		E22-170M22S	E22-170M30S	E22-170M33S	
Transmit power	dBm	22	30	33	
Reference distance	m	5000	10000	16000	Clear and open air, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.5kbps
Working frequency band	MHz	150.125 ～ 170.125	150.125 ～ 170.125	150.125 ～ 170.125	Factory default 170.125 MHz , channel spacing 250KHz
Air speed	bps	0.018 ～ 62.5k	0.018 ～ 62.5k	0.018 ～ 62.5k	User programmable control

2.2 Electrical parameters

Electrical parameters		Unit	Model			Remark
			E22-170M22S	E22-170M30S	E22-170M33S	
Operating voltage		V	1.8～3.7	3.3～5.5	3.3～5.5	
Communication level		V	3.3	3.3	3.3	Using 5V TTL may burn out
Power consumption	Emission current	mA	119	650	12OO	Instantaneous power consumption
	Receiving current	mA	6.5	14	15	
	Sleep current	μA	0.18	2	2	Software shutdown
Temperature	Operating temperature	℃	-20 ～ ＋8 5			Industrial Grade

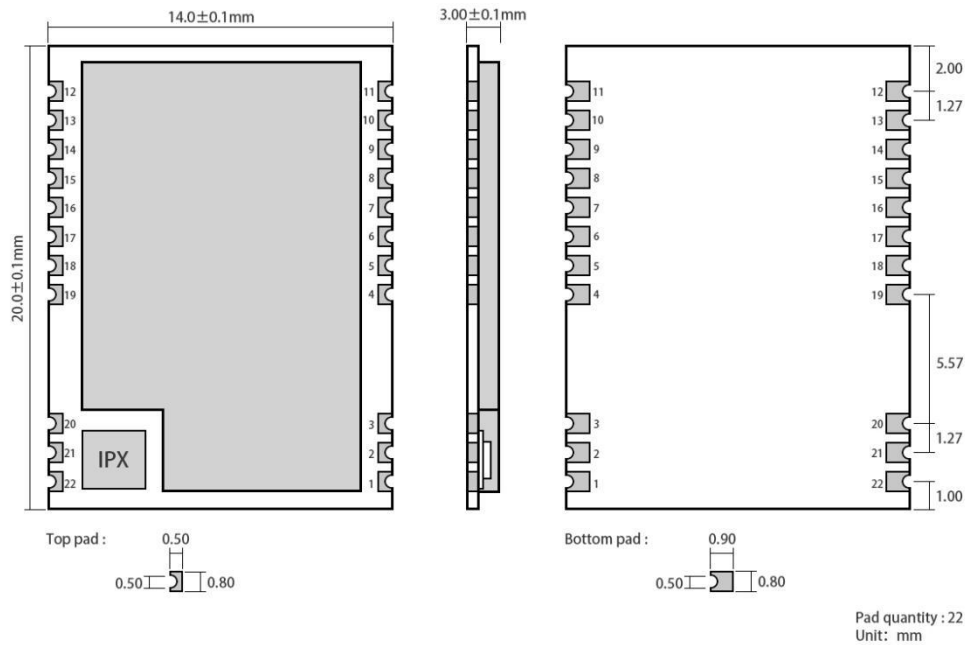|				
	Storage temperature		-40 ～ +125	

Note: When the operating voltage of E22-170M22S is ≥3V, it can meet the output power requirements. When the operating voltage exceeds 3.7V, there is a risk of burning. When the operating voltage of E22-170M30S and E22-170M33S is ≥5V, it can meet the output power requirements. When the operating voltage exceeds 5.5V, there is a risk of burning.

2.3 Hardware Parameters

Hardware Parameters	Model			Remark
	E22-170M22S	E22-170M30S	E22-170M33S	
Chip	SX1262	SX1262	SX1262	
FIFO	256Byte	256Byte	256Byte	Maximum length of a single transmission
Modulation	LoRa ™	LoRa™	LoRa™	Next-generation LoRa™ modulation technology
Interface	Stamp Holes	Stamp Holes	Stamp Holes	Pitch 1.27mm
Communication interface	SPI	SPI	SPI	The reference SPI rate is 3M
Product Net Weight	1.5± 0.2 g	4.9 g ± 0.02 g	5.1 g ± 0.02 g	
Packaging	SMD	SMD	SMD	
Antenna Interface	IPEX first generation /stamp hole	IPEX first generation /stamp hole	IPEX first generation /stamp hole	Characteristic impedance is about 50 ohms
Size	16 * 26 *mm	24*38.5mm	24*38.5mm	

III. Mechanical dimensions and pin definition

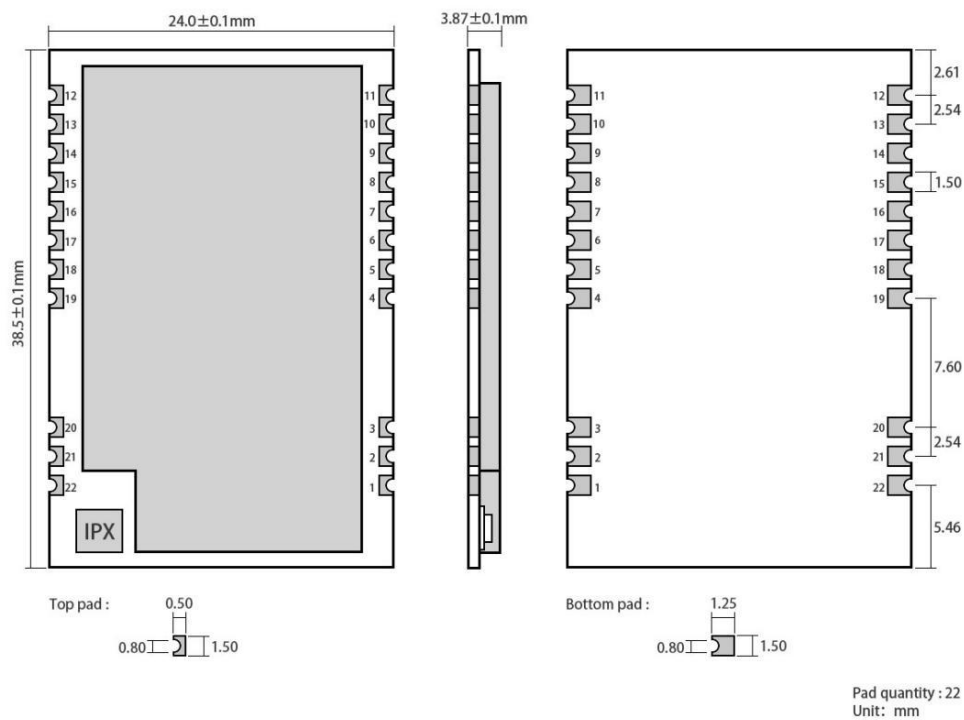## 3.1   E22-170M22S mechanical dimensions and pin definition diagram

Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND	-	Ground wire, connected to the power reference ground
2	GND	-	Ground wire, connected to the power reference ground
3	GND	-	Ground wire, connected to the power reference ground
4	GND	-	Ground wire, connected to the power reference ground
5	GND	-	Ground wire, connected to the power reference ground
6	RXEN	Input	RF switch receiving control pin, connected to external MCU IO, high level is effective
7	TXEN	Input	RF switch transmission control pin, connected to external MCU IO or DIO2, high level is valid
8	DIO2	Input/Output	Configurable general IO port (see SX1262 manual for details) [①]
9	VCC	-	Power supply, range 1.8V~3.7V (it is recommended to add external ceramic filter capacitor)
10	GND	-	Ground wire, connected to the power reference ground
11	GND	-	Ground wire, connected to the power reference ground
12	GND	-	Ground wire, connected to the power reference ground
13	DIO1	Input/Output	Configurable general IO port (see SX1262 manual for details)
14	BUSY	Output	Used for status indication (see SX1262 manual for details)
15	NRST	Input	Chip reset trigger input pin, low level is effective
16	MISO	Output	SPI data output pin

17	MOSI	Input	SPI data input pin
18	SCK	Input	SPI clock input pin
19	NSS	Input	Module chip select pin, used to start an SPI communication
20	GND	-	Ground wire, connected to the power reference ground
21	ANT	-	Antenna interface, stamp hole (50 ohm characteristic impedance)
22	GND	-	Ground wire, connected to the power reference ground

Note ①: If the DIO and TXEN pins are short-circuited, the DIO2 switch control function needs to be enabled in the software.

3.2. E22-170M30S&E22-170M33S mechanical dimensions and pin definition

Pin number	Pin Name	Pin Direction	Pin Purpose
1	GND	-	Ground wire, connected to the power reference ground
2	GND	-	Ground wire, connected to the power reference ground
3	GND	-	Ground wire, connected to the power reference ground
4	GND	-	Ground wire, connected to the power reference ground
5	GND	-	Ground wire, connected to the power reference ground
6	RXEN	Input	RF switch receiving control pin, connected to external microcontroller IO . Table 1 below for logic control and EBYTE official website DEMO for control routines.
7	TXEN	Input	RF switch transmit control pin, connected to external MCU IO or DIO2 (see SX126 2 manual for details). Table 1 below for logic control and EBYTE official website DEMO for control routines.
8	DIO2	Input/Output	Configurable general IO port (see SX126 2 manual for details) ①
9	VCC	-	Power supply, range 2.5 ~ 5.5V (it is recommended to add external ceramic filter capacitor)
10	VCC	-	Power supply, range 2.5 ~ 5.5V (it is recommended to add external ceramic filter capacitor)

11	GND	-	Ground wire, connected to the power reference ground
12	GND	-	Ground wire, connected to the power reference ground
13	DIO1	Input/Output	Configurable general IO port (see SX126 2 manual for details)
14	BUSY	Output	Used for status indication (see SX126 2 manual for details)
15	NRST	Input	Chip reset trigger input pin, low level is effective
16	MISO	Output	SPI data output pin
17	MOSI	Input	SPI data input pin
18	SCK	Input	SPI clock input pin
19	NSS	Input	Module chip select pin, used to start an SPI communication
20	GND	-	Ground wire, connected to the power reference ground
21	ANT	-	Antenna interface, stamp hole (50 Ω characteristic impedance) . Since the module has built-in PA, there is an amplification relationship between the output power of the RF chip SX126 2 (pre-stage) and the actual output power of the module. Please refer to Table 2 below .
22	GND	-	Ground wire, connected to the power reference ground
-	DIO 3	Input/Output	Used internally in the module to power the 32MHZ TCXO crystal oscillator (DIO3 is configured to output 2.2V)

Note ①: If the DIO and TXEN pins are short-circuited, the DIO2 switch control function needs to be enabled in the software.

IV. Basic Operations

4.1 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. Reverse connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged.
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin, which is conducive to long-term stable operation of the whole machine;
- The module should be kept as far away as possible from parts with large electromagnetic interference, such as power supplies, transformers, and high-frequency wiring;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid the bottom of the module. If it is necessary to pass under the module, assuming that the module is soldered on the Top Layer, ground copper should be laid on the Top Layer of the module contact part (all copper should be laid and well grounded), and it must be close to the digital part of the module and routed on the Bottom Layer ;
- Assuming the module is soldered or placed on the Top Layer, it is also wrong to randomly route the wires on the Bottom Layer or other layers, which will affect the module's spurious signal and receiving sensitivity to varying degrees ;
- If there are devices with large electromagnetic interference around the module, it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.

- If there are traces with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, power traces), it will also greatly affect the performance of the module. It is recommended to keep them away from the module according to the intensity of the interference. If possible, appropriate isolation and shielding can be performed.
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage) ;
- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great impact on the performance of the module. Make sure the antenna is exposed and preferably vertically upward. When the module is installed inside the housing, use a high-quality antenna extension cable to extend the antenna to the outside of the housing;
- The antenna must not be installed inside a metal shell, as this will greatly reduce the transmission distance.
- It is recommended to add a 200R protection resistor to the RXD/TXD of the external MCU.

4.2 Software Writing

- The built-in RF chip of this module is SX1262 , and its driving method is exactly the same as SX1262 . Users can operate it completely according to the SX1262 chip manual .
- For more information, please refer to the official SDK program, https://github.com/Lora-net/sx126x_driver , https://github.com/Lora-net/SWSD003 .
- The internal part is an active temperature compensated crystal oscillator TCXO. Pay attention to the configuration of the crystal oscillator in the software driver .

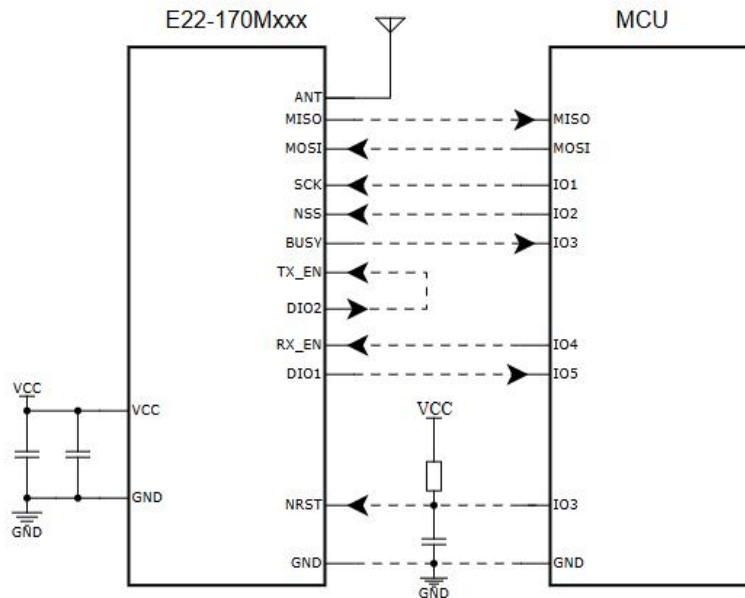**Table 1 [Transceiver state control truth table]**

Radio State Pin	RXEN（Input）	TXEN（Input）	Remark
Send	0	1	* "0": low level * "1": high level * RXEN and TXEN cannot be "1" at the same time.
Receive	1	0	
Low power consumption	0	0	

Table 2 [The RF output power control table]

E22-170M30S		E22-170M33S		Remark
Set power dBm	Actual power dBm	Set power dBm	Actual power dBm	* Test frequency is 170.125 MHz. * The actual power of each module has deviations, and the values in this table are for reference only. * The power settings in this table are only typical values.
22	22	29.64	33.39	
15	14	26.42	30.55	
13	11	24.72	27.87	
11	8	22.77	24.60	

V. Recommended Circuits

5. 1. E22-170M series recommended circuit diagram

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

6.2 Module is easily damaged

- Please check the power supply and make sure it is within the recommended voltage range. If it exceeds the

maximum value, the module may be permanently damaged.

- Please check the power supply stability. The voltage cannot fluctuate greatly or frequently.
- Please ensure anti-static operation during installation and use, as high-frequency components are electrostatically sensitive.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive.
- 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 interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- The clock waveform on SPI is not standard . Check whether there is interference on the SPI line . The SPI bus line should not be too long.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
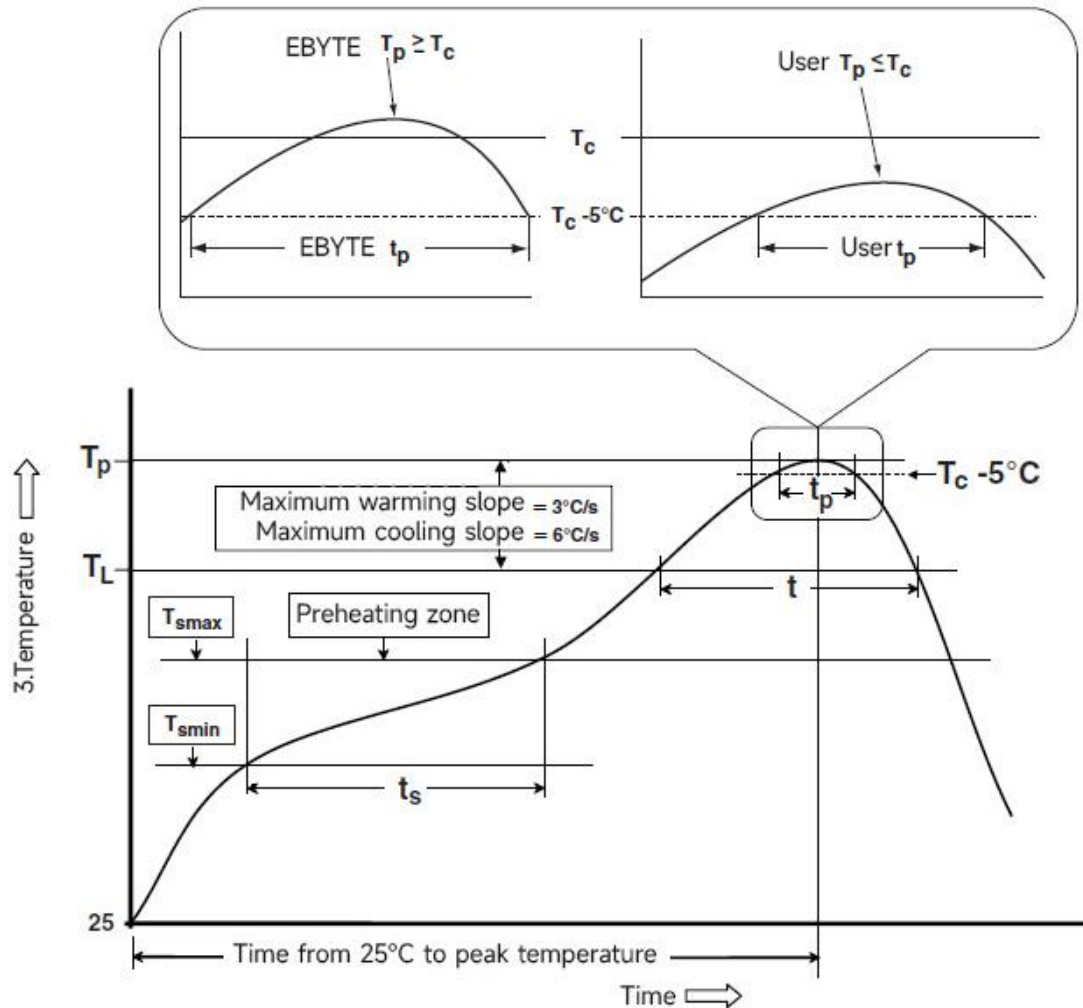- Poor quality or too long extension cables and feeder cables can also cause high bit error rates;

VII. Welding Operation Instructions

7.1 Reflow Temperature

Reflow profile characteristics		Leaded process assembly	Lead-free assembly
Preheating /keeping	Minimum temperature (Tsmin)	100°C	150°C
	Maximum temperature (T smax)	150°C	200°C
	Time (T smin ~T smin)	60-120 seconds	60-120 seconds
Heating slope (T L ~T p)		3°C/sec, max.	3°C/sec, max.
Liquidus temperature (TL)		183°C	217°C
T L above the holding time		60~ 90 seconds	60~ 90 seconds
Package peak temperature Tp		Cannot exceed the temperature stated on the product's "Moisture Sensitivity" label.	Cannot exceed the temperature stated on the product's "Moisture Sensitivity" label.
The time (T p) within 5°C of the specified classification temperature (Tc) is shown in the figure below.		20 seconds	30 seconds
Cooling slope (T p ~T L)		6°C/sec, max.	6°C/sec, max.
Time from room temperature to peak		6 minutes, longest	8 minutes, longest

temperature		

※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user

7.2 Reflow Oven Curve

VIII. Related Models

Product Model	Chip Solution	Carrier frequency Hz	Transmit power dBm	Test distance km	Package	Product size mm	Communication interface
E22-400M22S	SX1268	433/470M	22	5	SMD	14*20	SPI

E22-900M22S	SX1262	868/915M	22	5	SMD	14*20	SPI
E22-900M33S	SX1262	433/470M	33	16	SMD	24*38.5	SPI
E22-900M30S	SX1262	868/915M	30	10	SMD	24*38.5	SPI

IX. Antenna Guide

9.1 Antenna Recommendation

Antennas play an important role in the communication process. Often, poor-quality antennas will have a great impact on the communication system. Therefore, our company recommends some antennas as supporting antennas for our wireless modules with excellent performance and reasonable prices.

Product Model	Type	Frequency band Hz	Interface	Gain dBi	Height mm	Feeder cm	Features
TX170-XP-200	Suction cup antenna	170 M	SMA-J	4.0	500	200	Small suction cup antenna, omnidirectional antenna
TX170-JKD-20	Glue stick antenna	170 M	SMA-J	3.0	200	-	Bend the glue stick, omnidirectional antenna
TX170-JK-11	Glue stick antenna	170 M	SMA-J	2.5	110	-	Bend the glue stick, omnidirectional antenna

Revision History

Version	Revision Date	Revision Notes	Maintainer
V1.0	2025-4-16	Initial release	Hao

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