



E22-M Series Product Specifications

SX126 X LoRa spread spectrum SPI surface mount wireless module



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Chapter 1 Overview

1.1 Introduction

ultra-small, surface-mount LoRa™ wireless modules independently developed based on the new generation LoRa™ RF chip SX126 X^① manufactured by Semtech . Using the original imported SX126 X^① as the module core, compared with the previous generation LoRa™ transceiver, its anti-interference performance and communication range have been further improved.

Thanks to its adoption of the new LoRa™ modulation technology, this module far surpasses current products using FSK and GFSK modulation methods in terms of anti-interference performance and communication range. It is primarily designed for smart homes, wireless meter reading, scientific research and medical applications, and medium- to long-range wireless communication devices. This series of products covers the SUB-1GHz frequency band and is backward compatible with SX1278 and SX1276. An industrial-grade high-precision 32MHz active temperature-compensated crystal oscillator (TCXO) is adopted, except for E22-400MM22S and E22-900MM22S, which use passive crystal oscillators.

The E22-M series products are pure RF transceiver modules , requiring the use of MCU drivers or dedicated SPI debugging tools . For a detailed product [selection comparison table, please see section 2.1 of this document](#) .

1.2 Features and Functions

- SX127 X series modules, the SX126 X^① module has significant advantages in terms of lower power consumption, faster speed, and longer range;
- Under ideal conditions, the measured communication distance can reach up to 16 km.
- It offers three different power modules to choose from: 22/30/33dBm , and supports multi-level software adjustment;
- Supports 170 /433/470/868/915MHz frequency bands ;
- LoRa™ mode, it supports data transmission rates from 0.018 to 62.5 kbps;
- The FIFO has a large capacity and supports 256-byte data caching.
- Backward compatible with SX1278/SX1276 series RF transceivers;
- Built-in PA+LNA significantly improves communication range and stability;
- Equipped with a 32MHz high -precision active temperature-compensated crystal oscillator ,Except for E22-400MM22S and E22-900MM22S;
- Industrial-grade standard design, supports long-term use in temperatures ranging from -40° C to 85°C;
- The option of dual antennas (IPEX/stamp hole) facilitates secondary development and integration for users.

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);
- Applications in the automotive industry.

Note: SX126 X^① generally refers to the two chip models SX1262 and SX1268.

Chapter Two Specifications

2.1 Comparison of E22-T Series Products

category	Product Model	Chip solutions	Carrier frequency ^① Hz	Transmit power ^② dBm	Test distance ^③ km	Product dimensions (mm)	Antenna type ^④
170MHz band module	E22-170M22S	SX1262	150-170	twenty two	6	20 * 14	IPEX -1 / Stamp Hole
	E22-170M30S	SX1262	150-170	30	12	38.5 * 24	IPEX -1 / Stamp Hole
	E22-170M33S	SX1262	150-170	33	16	38.5 * 24	IPEX -1 / Stamp Hole
433MHz band module	E 22- 400 MM 22S	SX1268	410~493M	twenty two	6	10 * 10	stamp perforation
	E 22 - 400 M 22 S	SX1268	410~493M	twenty two	6	20 * 14	IPEX -1 / Stamp Hole
	E 22-400 M 30S	SX1268	410~493M	30	12	38.5 * 24	IPEX -1 / Stamp Hole
	E 22 - 400 M 33S	SX1268	410~493M	33	16	38.5 * 24	IPEX -1 / Stamp Hole
868/915MHz Frequency band module	E 22-900 MM 22S	SX1262	850 ~ 930 M	twenty two	6	10 * 10	stamp perforation
	E 22 - 900 M 22 S	SX1262	850 ~ 930 M	twenty two	6	20 * 14	IPEX -1 / Stamp Hole
	E 22-900 M 30S	SX1262	850 ~ 930 M	30	12	38.5 * 24	IPEX -1 / Stamp Hole
	E 22 - 900 M33S	SX1262	850 ~ 930 M	33	16	38.5 * 24	IPEX -1 / Stamp Hole

Note:

- (1)Carrier frequency^①: Frequency band range can be customized by the user;
- (2)Transmit power^②: 22dBm=158mW/30dBm=1000mW / 33dBm = 2000mW , error range ± 1 dBm, power is adjustable in multiple levels, please see [Chapter 4 of this article for details of power levels](#) ;
- (3)Test distance^③: Clear and open, airspeed 2.4kbps, antenna height 2 meters (for reference only, actual measurement is recommended);
- (4)Antenna type^④: Equivalent impedance approximately 50 Ω ;
- (5)Modules operating on the same frequency band can communicate with each other.

2.2 Basic Parameters

- The E22- M series 22dBm low-power modules are: E22-170M 22 S , E22-400MM22 S , E22-400M22 S , E22-900MM22 S, and E22-900M22 S.
- The E22- M series 30dBm high -power modules are: E22-170M 30S , E22-400M 30S , and E22-900M 30S .
- The E22- M series 30dBm high-power modules are: E22-170M 3 3S , E22-400M 3 3S , and E22-900M 3 3S .

2.2.1 Basic Parameters

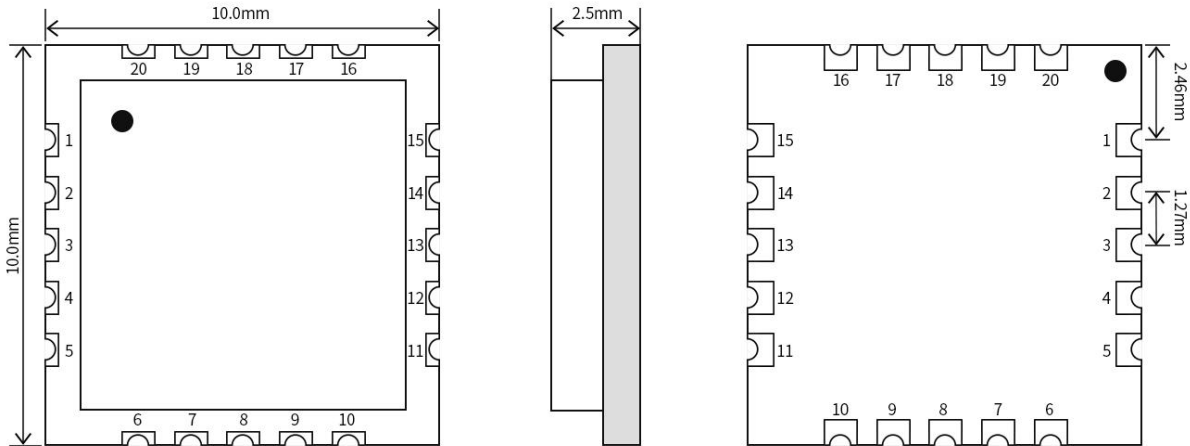
Conditions: Tc=25°C, VCC=5.0V, 170MHz /433MHz/ 470MHz/ 868MHz/915MHz

parameter	describe
Modulation method	Next-generation LoRa™ modulation technology
Interface method	1.27mm stamp perforation
Communication interface	SPI
FIFO	2 56 bytes , maximum length per transmission
Crystal Oscillator	32MHz high-precision active temperature-compensated crystal oscillator (TCXO) (E22-400MM22S and E22-900MM22S adopt 32MHz passive crystal oscillators)
Packaging method	patch
Work environment	
Operating temperature	-40°C~+85°C, industrial grade standard
Operating humidity	10-90%RH
Storage temperature	-40°C~+125°C
RF parameters	
Transmit power	22dBm = 158mW, power adjustable in multiple levels. For details on power levels, please see Chapter 4 of this article.
	30dBm = 1000mW, power adjustable in multiple levels . For details on power levels , please see Chapter 4 of this document.
	3.3 dBm = 2000mW , power adjustable in multiple levels . For details on power levels , please see Chapter 4 of this document.
Operating frequency band	150 MHz ~ 170 MHz , supports frequency band customization
	410 MHz ~ 493 MHz, frequency band customization supported
	850MHz~930MHz, frequency band customization supported

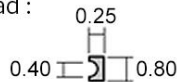
parameter	describe
air speed	0.018~62.5kbps, supports user-programmable control.
Blocking power	10dBm
Electrical parameters	
Power supply voltage	range is 1.8~3.7 V. When the operating voltage is $\geq 3V$, the output power requirement can be met. Operating voltage exceeding 3.7V poses a risk of burnout . This module is suitable for the E22-M series 22dBm low-power modules.
	of 3.3 to 5.5 V, and an operating voltage $\geq 5 V$, the output power requirement can be met . Operating voltages exceeding 5.5 V pose a risk of burnout . Suitable for E22-M series 30 dBm low-power modules.
	of 3.3 to 5.5 V, and an operating voltage $\geq 5 V$, the output power requirement can be met . Operating voltages exceeding 5.5 V pose a risk of burnout . Suitable for E22-M series 33 dBm low-power modules.
Communicati on level	3.3 V
Emission current	100~140mA, instantaneous power consumption @22dBm, suitable for E22- M series 22dBm low power modules
	500 ~620mA, instantaneous power consumption @30dBm, suitable for E22- M series 30dBm high-power modules
	1100~1200 mA, instantaneous power consumption @ 3 3 dBm , suitable for E22 -M series 3 3 dBm high-power modules
Received current	$\approx 7mA$, suitable for E22- M series 22dBm small power modules
	$\approx 14 mA$, suitable for E22 -M series 30 dBm low power modules
	$\approx 1.5 mA$, suitable for E22- M series 3.3 dBm high - power modules
Dormant current	$\approx 0.18 uA$, software shutdown , applicable to E22 -M series 22dBm low-power modules
	$\approx 2 uA$, software shutdown , applicable to E22- M series 30 dBm high-power modules
	$\approx 2 uA$, software shutdown , applicable to E22- M series 3 3 dBm high-power modules

Chapter3 Mechanical dimensions and pin definitions

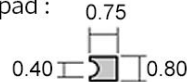
3.1 Mechanical Dimensions and Pin Definitions of E22-400/ 900MM22S



Top pad :



Bottom pad :



Unit : mm

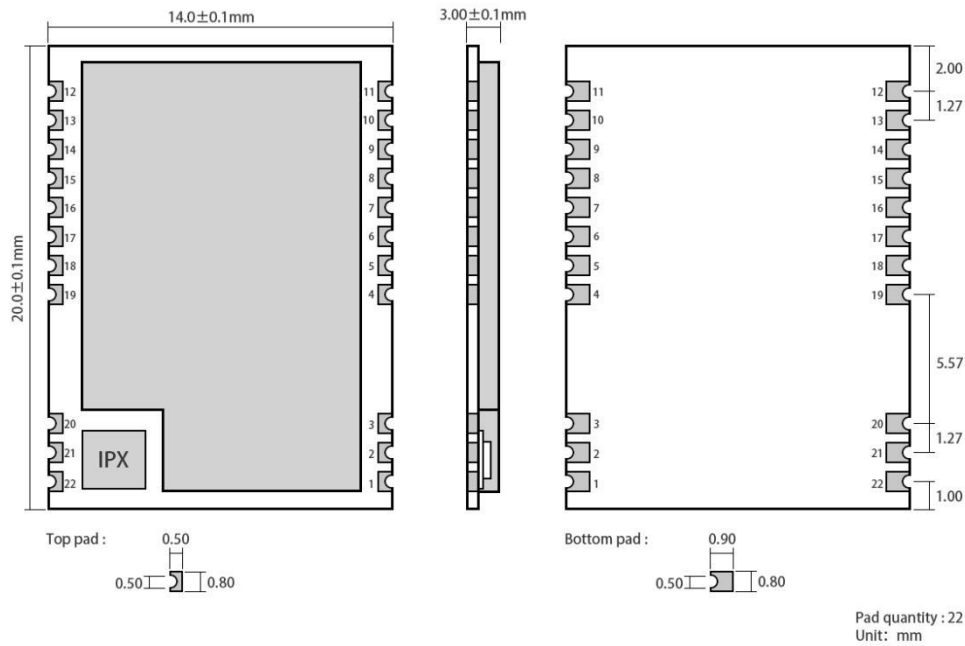
pad quantity : 20

Tolerance value : X.X±0.2mm

X.XX±0.05mm

Pin number	Pin Name	Pin direction	Pin Applications
1	VCC	-	Power supply range: 1.8V~3.7V (external ceramic filter capacitor recommended)
2	GND	-	Ground wire, connected to power reference ground
3	NRST	enter	Chip reset trigger input pin, active low.
4	NC	-	-
5	NC	-	-
6	ANT	-	RF interface, stamp hole
7	GND	-	Ground wire, connected to power reference ground
8	NC	-	-
9	TXEN	enter	The RF switch transmit control pin connects to an external microcontroller's I/O or DIO2 pin; it is active high.
10	RXEN	enter	The RF switch receive control pin connects to an external microcontroller I/O pin; it is active high.
11	BUSY	Output	Used for status indication
12	MISO	Output	SPI data output pin
13	MOSI	enter	SPI data input pin
14	NSS	enter	The module's chip select pin is used to initiate an SPI communication.
15	SCK	enter	SPI clock input pin
16	GND	-	Ground wire, connected to power reference ground
17	NC	-	-
18	DIO 3	Input/Output	Configurable general-purpose I/O ports
19	DIO2	Input/Output	Configurable general-purpose I/O ports
20	DIO1	Input/Output	Configurable general-purpose I/O ports

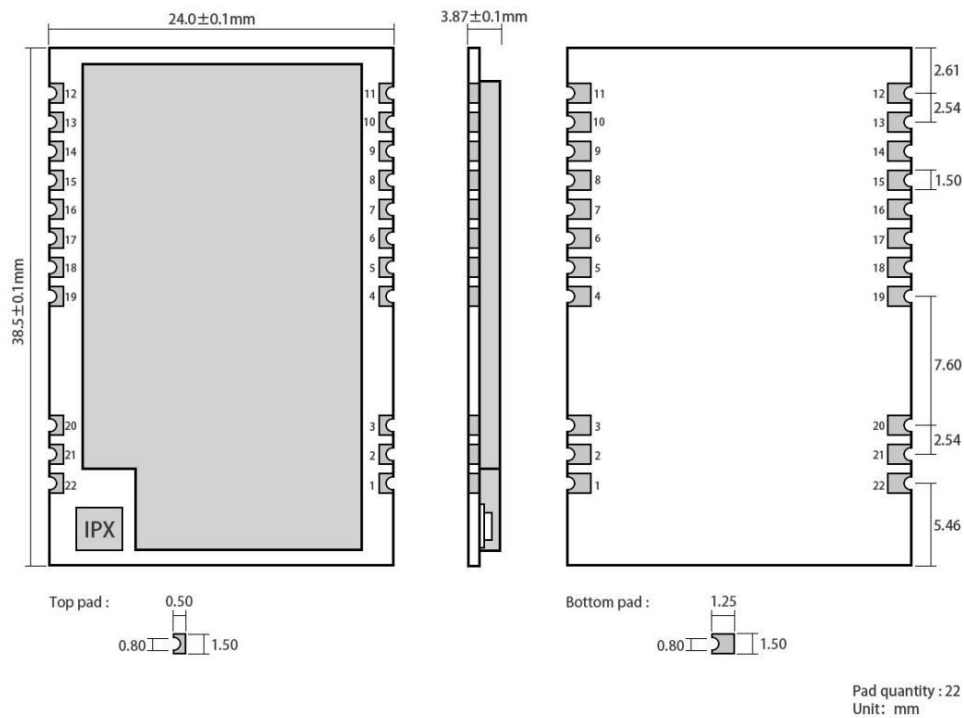
3.2 Mechanical Dimensions and Pin Definitions of E22-170/400/900M22S



Pin number	Pin Name	Pin direction	Pin Applications
1	GND	-	Ground wire, connected to power reference ground
2	GND	-	Ground wire, connected to power reference ground
3	GND	-	Ground wire, connected to power reference ground
4	GND	-	Ground wire, connected to power reference ground
5	GND	-	Ground wire, connected to power reference ground
6	RXEN	enter	The RF switch receive control pin connects to an external microcontroller I/O pin; it is active high.
7	TXEN	enter	The RF switch transmit control pin connects to an external microcontroller's I/O or DIO2 pin; it is active high.
8	DIO2	Input/Output	Configurable general-purpose I/O ports (see SX126 X manual for details) ①
9	VCC	-	Power supply range: 1.8V~3.7V (external ceramic filter capacitor recommended)
10	GND	-	Ground wire, connected to power reference ground
11	GND	-	Ground wire, connected to power reference ground
12	GND	-	Ground wire, connected to power reference ground
13	DIO1	Input/Output	Configurable general-purpose I/O ports (see SX126 X manual for details)
14	BUSY	Output	Used for status indication (see SX1262 manual for details).
15	NRST	enter	Chip reset trigger input pin, active low.
16	MISO	Output	SPI data output pin
17	MOSI	enter	SPI data input pin
18	SCK	enter	SPI clock input pin
19	NSS	enter	The module's chip select pin is used to initiate an SPI communication.
20	GND	-	Ground wire, connected to power reference ground
twenty one	ANT	-	Antenna interface, stamp hole (50 ohms characteristic impedance)
twenty two	GND	-	Ground wire, connected to power reference ground

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

3.3 E22-170/400/900M30S(33S) Mechanical Dimensions and Pin Definitions



Pin number	Pin Name	Pin direction	Pin Applications
1	GND	-	Ground wire, connected to power reference ground
2	GND	-	Ground wire, connected to power reference ground
3	GND	-	Ground wire, connected to power reference ground
4	GND	-	Ground wire, connected to power reference ground
5	GND	-	Ground wire, connected to power reference ground
6	RXEN	enter	The RF switch receives the control pin, which connects to an external microcontroller I/O pin. Please refer to Table 1 below for logic control , and refer to the DEMO on the EBYTE official website for control routines.
7	TXEN	enter	The RF switch transmit control pin is connected to an external microcontroller IO or DIO2 (see SX126 X manual for details). Please refer to Table 1 below for logic control , and refer to the DEMO on the EBYTE official website for control routines.
8	DIO2	Input/Output	Configurable general-purpose I/O ports (see SX126 X manual for details) ^①
9	VCC	-	Power supply range: 2.5V to 5.5V (external ceramic filter capacitor recommended).
10	VCC	-	Power supply range: 2.5V to 5.5V (external ceramic filter capacitor is recommended).
11	GND	-	Ground wire, connected to power reference ground
12	GND	-	Ground wire, connected to power reference ground
13	DIO1	Input/Output	Configurable general-purpose I/O ports (see SX126 X manual for details)
14	BUSY	Output	Used for status indication (see SX126 X manual for details).
15	NRST	enter	Chip reset trigger input pin, active low.
16	MISO	Output	SPI data output pin
17	MOSI	enter	SPI data input pin
18	SCK	enter	SPI clock input pin
19	NSS	enter	The module's chip select pin is used to initiate an SPI communication.
20	GND	-	Ground wire, connected to power reference ground
twenty one	ANT	-	Antenna interface, stamp hole (50Ω characteristic impedance). Because the module has a built-in PA, the output power of the SX126 X RF chip (preamp) is amplified relative to the actual output power of the module. Please refer to Table 2 below .
twenty two	GND	-	Ground wire, connected to power reference ground
-	DIO3	Input/Output	Internally used in the module, it powers a 32MHz TCXO crystal oscillator (DIO3

Pin number	Pin Name	Pin direction	Pin Applications
			configured to output 2.2V).

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

Chapter 4 Basic Operations

4.1 Hardware Design

- It is recommended to use a DC regulated power supply to power this module, with the power supply ripple coefficient as small as possible, and the module must be reliably grounded;
- Please ensure the correct connection of the power supply positive and negative terminals. Reversing the connection may cause permanent damage to the module.
- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.
- When designing power supply circuits for modules, it is often recommended to retain a margin of more than 30% to ensure long-term stable operation of the entire unit.
- The module should be kept as far away as possible from power supplies, transformers, high-frequency traces, and other parts with high electromagnetic interference.
- High-frequency digital traces, high-frequency analog traces, and power traces must avoid the area under the module. If it is absolutely necessary to run under the module, assuming the module is soldered on the Top Layer, lay ground copper on the Top Layer of the module contact area (all copper and well grounded), and run the traces close to the digital part of the module on the Bottom Layer.
- Assuming the module is soldered or placed in the Top Layer, it is also wrong to arbitrarily route traces in the Bottom Layer or other layers, as this will affect the module's stray emissions and reception sensitivity to varying degrees.
- If there are devices around the module that cause significant electromagnetic interference, it will greatly affect the module's performance. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented.
- If there are traces around the module that cause significant electromagnetic interference (high-frequency digital, high-frequency analog, power supply traces), it will greatly affect the module's performance. Depending on the intensity of the interference, it is recommended to keep them away from the module. If possible, appropriate isolation and shielding can be implemented.
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, as there is still a risk of damage).
- The antenna mounting structure has a significant impact on module performance; therefore, it is essential to ensure that the antenna is exposed, ideally vertically upwards. When the module is installed inside the housing, a high-quality antenna extension cable can be used to extend the antenna to the outside of the housing.
- Antennas should never be installed inside a metal casing, as this will greatly reduce the transmission distance.
- It is recommended to add a 200Ω protection resistor to the RXD/TXD of the external MCU.

4.2 Software Development

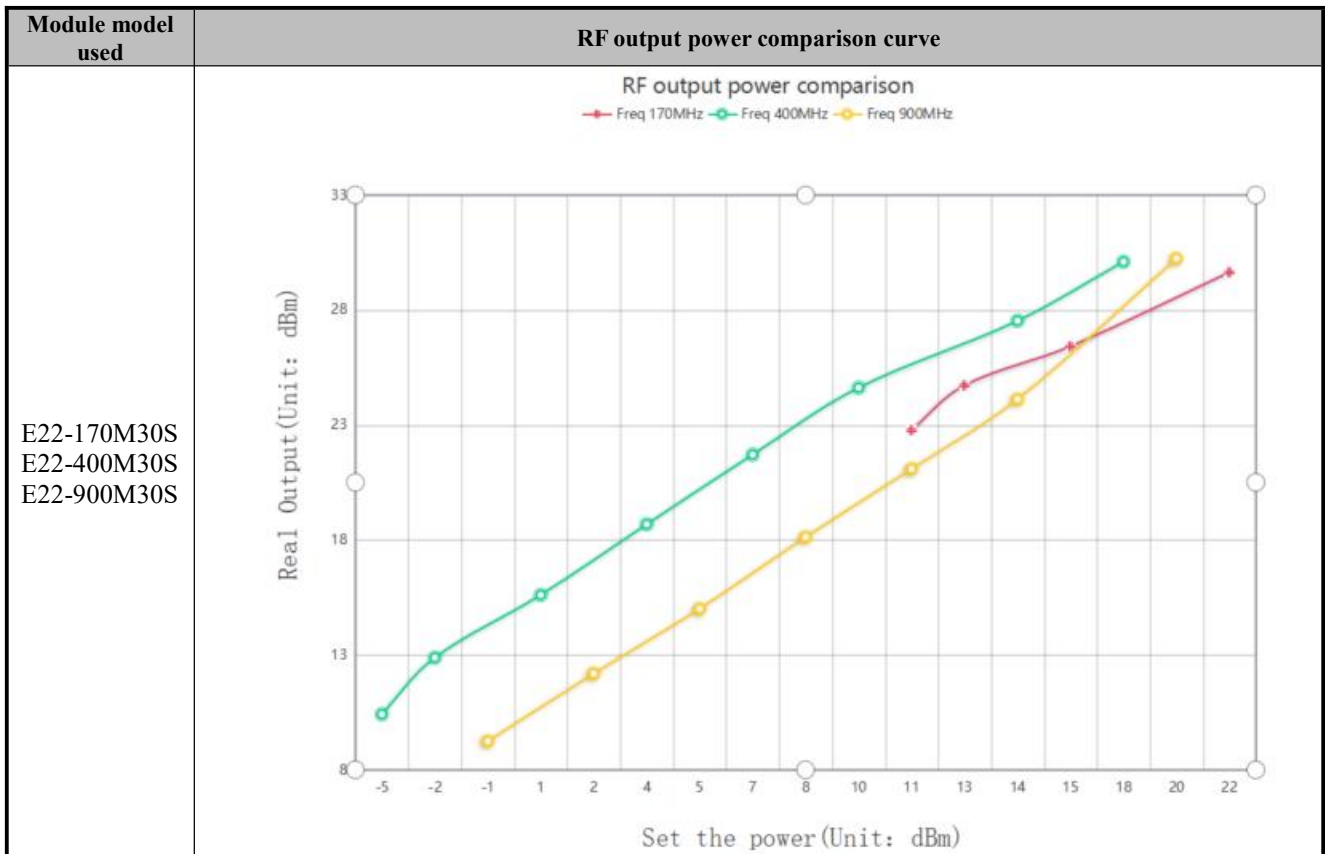
- This module has a built-in RF chip , SX126X , and its driving method is completely equivalent to that of SX126X . Users can operate it in strict accordance with the SX126X chip manual .
- DIO1 and DIO2 are general-purpose I/O ports that can be configured for various functions. DIO2 can be connected to the T/R CTRL but not to the MCU's I/O port. It is used to control the RF switch transmission. See the SX126 X manual for details. If not used, it can be left floating.
- DIO3 is used to power a 32MHz TCXO crystal oscillator (the DIO3 is configured to output 2.2V) .
- For E22-400MM20S and E22-900MM20S, please refer to the DEMO provided on the official website: <https://www.ebyte.com/pdf-down/3090.html>.
- For more information, please refer to the official SDK programs: https://github.com/Lora-net/sx126x_driver and <https://github.com/Lora-net/SWSD003>.
- For more information, please refer to the sample program provided by EBITA : [E22-400MBL-SC LORA Module Development Test Board - Compatible Sub-1G Wireless Module Evaluation Kit](#).
- Internally, it uses an active temperature-compensated crystal oscillator (TCXO). Note the crystal oscillator configuration in the software driver .

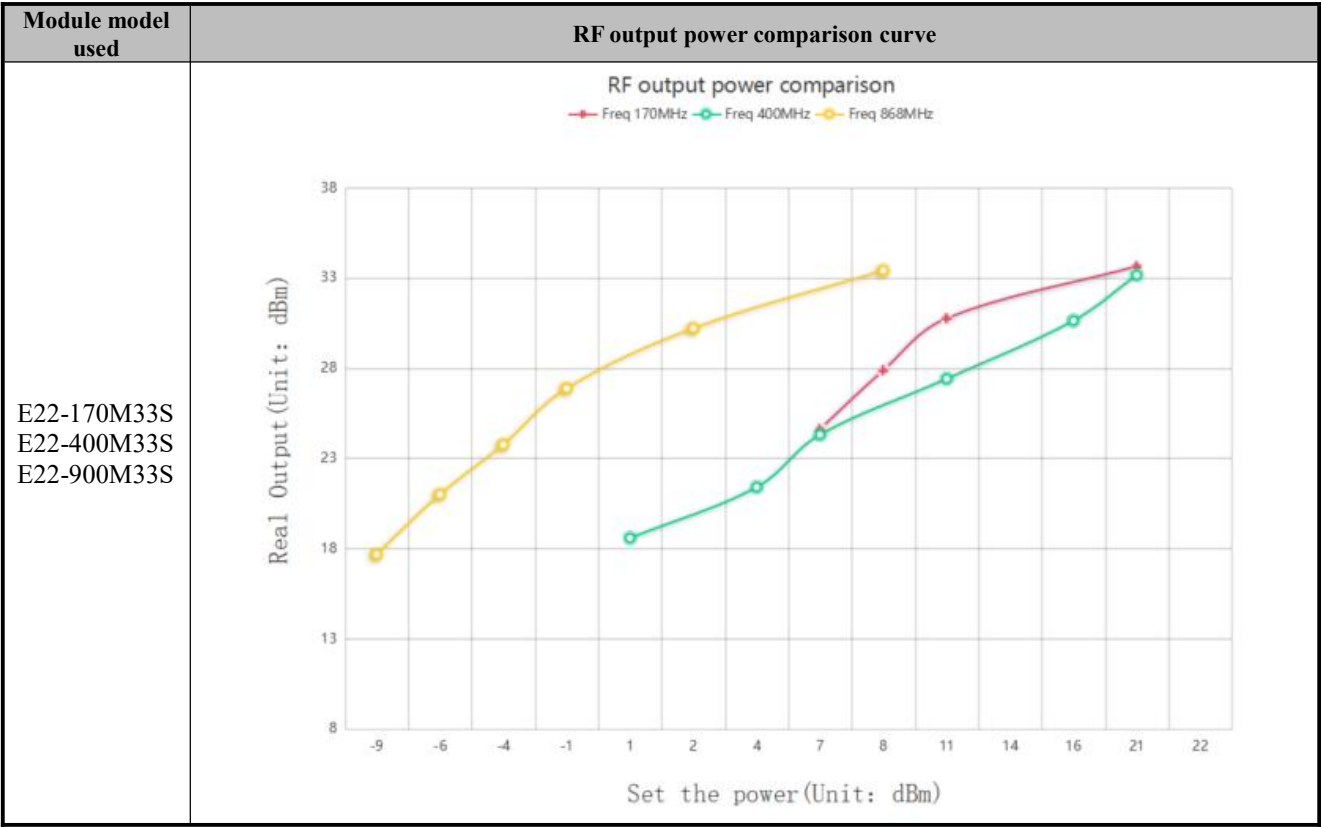
Table 1 [Truth Table for RF Switch Control Logic]

TX EN	RXEN	MODE
1	0	TX
0	1	RX
0	0	CLOSE

Chart 2 [The RF output power control table]

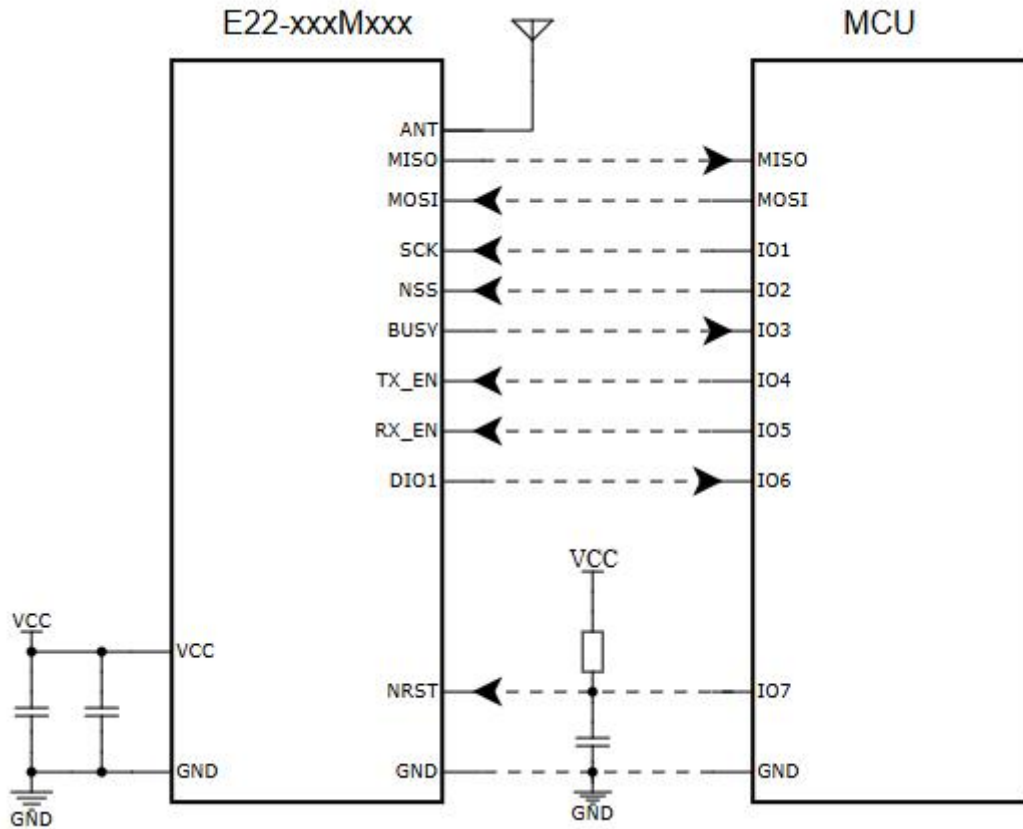
Conditions: Tc = 25°C, VCC = 5.0V





Chapter 5 Recommended Circuits

5.2 Recommended circuit diagram for E22-M series



Chapter 6 Frequently Asked Questions

6.1 Transmission distance is not ideal

- When there are obstacles in line-of-sight communication, the communication distance will be reduced accordingly;
- Temperature, humidity, and co-channel interference can all lead to increased packet loss rates in communications.
- The ground absorbs and reflects radio waves, and the test results are poor when the ground is close to the ground.
- Seawater has a strong ability to absorb radio waves, so tests conducted at the seaside are ineffective.
- If there are metal objects near the antenna, or if it is placed inside a metal casing, the signal attenuation will be very severe.
- Power register settings are incorrect; air speed is set too high (the higher the air speed, the shorter the distance).
- At room temperature, the power supply voltage is lower than the recommended value; the lower the voltage, the lower the power output.
- The antenna may be poorly matched with the module or have quality issues.

6.2 Module is easily damaged

- Please check the power supply and ensure it is within the recommended voltage range. Exceeding the maximum value will cause permanent damage to the module.
- Please check the power supply stability; the voltage should not fluctuate significantly or frequently.
- Please ensure anti-static operation during installation and use, as high-frequency devices are sensitive to electrostatic discharge.
- Please ensure that the humidity is not too high during installation and use, as some components are humidity-sensitive.
- Unless there are special requirements, it is not recommended to use it at excessively high or low temperatures.

6.3 The error rate is too high.

- If there is interference from a co-channel signal nearby, move away from the source of interference or change the frequency or channel to avoid the interference.
- If the clock waveform on the SPI is not standard, check for interference on the SPI line and ensure that the SPI bus traces are not too long.
- An inadequate power supply can also cause garbled characters, so it is essential to ensure the reliability of the power supply.
- Poor quality or excessive length of extension lines or feeders can also lead to a high bit error rate.

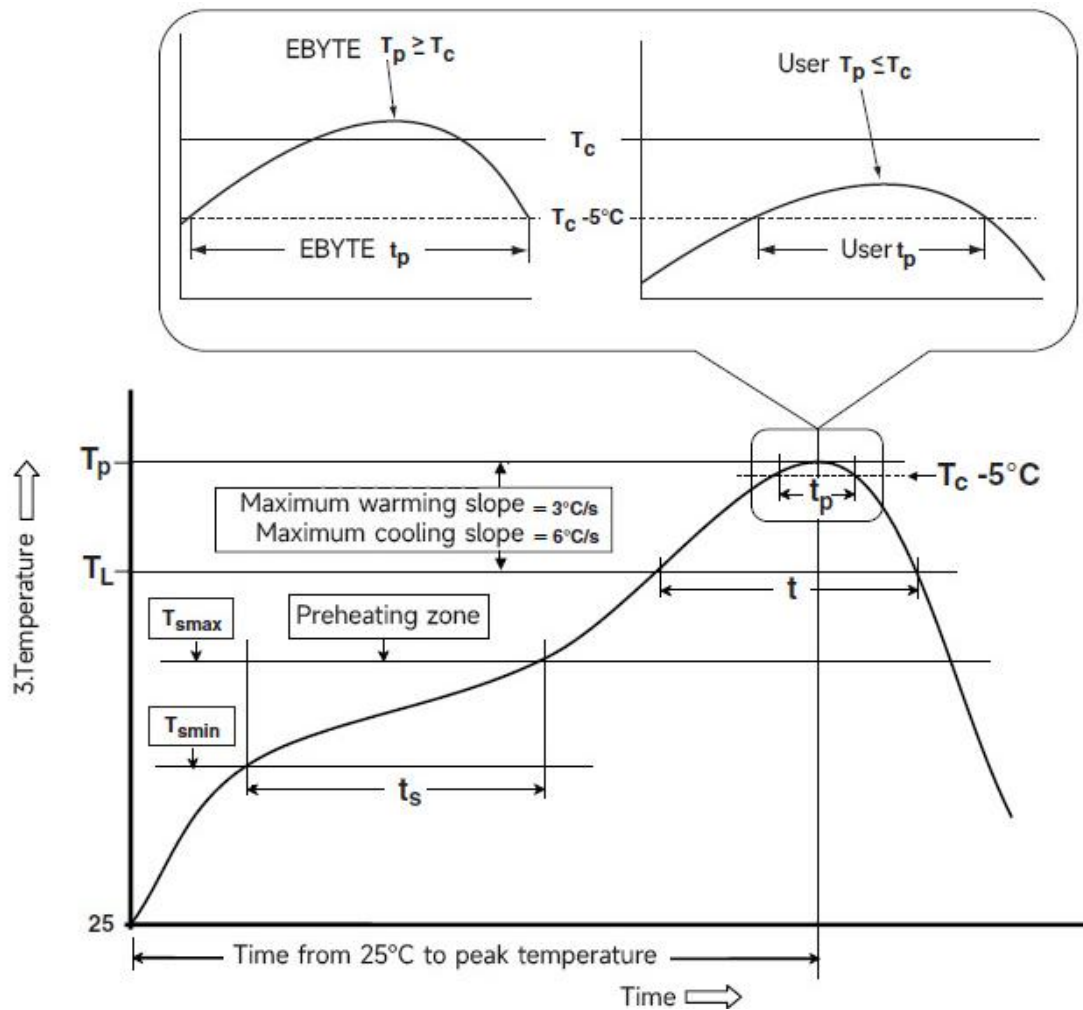
Chapter 7 Welding Operation Instructions

7.1 Reflow soldering temperature

Reflow soldering profile characteristics		Lead-based assembly	Lead-free assembly
Preheating/Insulation	Minimum temperature (T_{smin})	100°C	150°C
	Maximum temperature (T_{smax})	150°C	200°C
	Time ($T_{smin} \sim T_{smin}$)	60-120 seconds	60-120 seconds
Temperature rise slope ($T_L \sim T_p$)		3°C/second, maximum value	3°C/second, maximum value
Liquid phase temperature (T_L)		183°C	217°C
T_L above the holding time		60~ 90 seconds	60~ 90 seconds
Package peak temperature T_p		Users must not exceed the temperature specified on the product's "humidity sensitivity" label.	Users must not exceed the temperature specified on the product's "humidity sensitivity" label.
T_p) within 5°C of the specified grading temperature (T_c) is shown in the figure below.		20 seconds	30 seconds
Cooling slope ($T_p \sim T_L$)		6°C/second, maximum	6°C/second,

	value	maximum value
Time from room temperature to peak temperature	6 minutes, the longest	8 minutes, the longest
* The peak temperature (T_p) tolerance of the temperature profile is defined as the user's upper limit.		

7.2 Reflow Soldering Profile



Chapter 8 Related Models

Product Model	Chip solutions	carrier frequency Hz	Transmit power dBm	Test distance (km)	Packaging	Product dimensions (mm)	Communication interface
E22-230T22S	SX1262	230M	twenty two	5	patch	16*26	TTL
E22-400T22S	SX1262	433/470M	twenty two	5	patch	16*26	TTL
E22-900T22S	SX1262	868/915M	twenty two	5	patch	16*26	TTL
E22-230T30S	SX1262	230M	30	10	patch	25*40.5	TTL
E22-400T30S	SX1262	433/470M	30	10	patch	25*40.5	TTL
E22-900T30S	SX1262	868/915M	30	10	patch	25*40.5	TTL

Chapter 9 Antenna Guide

9.1 Antenna Recommendation

Antennas play a crucial role in communication, and inferior antennas can often have a significant impact on communication systems. Therefore, our company recommends certain antennas that are high-performing and reasonably priced and compatible with our wireless modules.

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	5 00	200	Miniature suction cup antenna, omnidirectional antenna
TX170-JKD-20	Glue rod antenna	170 M	SMA-J	3.0	200	-	Bending a rubber rod, omnidirectional antenna
TX170-JK-11	Glue rod antenna	170 M	SMA-J	2.5	110	-	Bending a rubber rod, omnidirectional antenna
TX433-NP-4310	Flexible antenna	433M	welding	2.0	43.8*9.5	-	Built-in flexible FPC soft antenna
TX433-JZ-5	Glue rod antenna	433M	SMA-J	2.0	52	-	Ultra-short straight omnidirectional antenna
TX433-JZG-6	Glue rod antenna	433M	SMA-J	2.5	62	-	Ultra-short straight omnidirectional antenna
TX433-JW-5	Glue rod antenna	433M	SMA-J	2.0	50	-	Bending a rubber rod, omnidirectional antenna
TX433-JWG-7	Glue rod antenna	433M	SMA-J	2.5	75	-	Bending a rubber rod, omnidirectional antenna
TX433-JK-11	Glue rod antenna	433M	SMA-J	2.5	110	-	Bendable rubber rod, omnidirectional antenna
TX433-JK-20	Glue rod antenna	433M	SMA-J	3.0	210	-	Bendable rubber rod, omnidirectional antenna
TX433-XPL-100	Suction Cup Antenna	433M	SMA-J	3.5	185	100	Miniature 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-XP-300	Suction Cup Antenna	433M	SMA-J	6.0	965	300	Large suction cup antenna, high gain
TX490-JZ-5	Glue rod antenna	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	Miniature suction cup antenna, cost-effective

Revision History

Version	Revision Date	Revision Notes	maintainer
V1.0	2025-10-29	Initial version	Hao
V1.1	2026-1-15	Modified power diagram	Hao
V1.2	2026-2-6	supplementary crystal oscillator description	Hao

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