# E22-M Series Product Specifications

SX126 X LoRa spread spectrum SPI surface mount wireless module



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# 1 Overview

## 1.1 Introduction

E22-M series module 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 FSK and GFSK modulation products 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. It uses an industrial-grade high-precision 32MHz active temperature-compensated crystal oscillator (TCXO) , except for the E22-400MM22S and E22-900MM22S, which are 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

- To the 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;
- It supports 170 /433/470/868/915MHz frequency bands , and also supports customization for different 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;

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- 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.**

# 2 Specifications

## 2.1 Comparison of E22- M Series Products

| category | Product Model | Chip solutions | Crystal type | Carrier frequency ① Hz | Transmit power ② dBm | Test distance ③ km | Product dimensions (mm) | Antenna type ④ |
|---|---|---|---|---|---|---|---|---|
| 170MHz band module | E22-170M22S | SX1262 | 32MHz active | 150～170 M | 22 | 6 | 20 * 14 | IPEX -1 / Stamp Hole |
| | E22-170M30S | SX1262 | 32MHz active | 150～170 M | 30 | 12 | 38.5 * 24 | IPEX -1 / Stamp Hole |
| | E22-170M33S | SX1262 | 32MHz active | 150～170 M | 33 | 16 | 38.5 * 24 | IPEX -1 / Stamp Hole |
| 433MHz band module | E22- 400MM22S | SX1268 | **32MHz passive** | 410～493M | 22 | 6 | 10 * 10 | Stamp Hole |
| | E22- 400MM22S(T) | SX1268 | 32MHz active | 410～493M | 22 | 6 | 10 * 10 | Stamp Hole |
| | E22 - 400M22S | SX1268 | 32MHz active | 410～493M | 22 | 6 | 20 * 14 | IPEX -1 / Stamp Hole |
| | E22-400M30S | SX1268 | 32MHz active | 410～493M | 30 | 12 | 38.5 * 24 | IPEX -1 / Stamp Hole |
| | E22 - 400M33S | SX1268 | 32MHz active | 410～493M | 33 | 16 | 38.5 *24 | IPEX -1 / Stamp Hole |
| 868/915MHz Frequency band module | E22-900MM22S | SX1262 | **32MHz passive** | 850 ～ 930 M | 22 | 6 | 10 * 10 | Stamp Hole |
| | E22-900MM22S (T) | SX1262 | 32MHz active | 850 ～ 930 M | 22 | 6 | 10 * 10 | Stamp Hole |
| | E22 - 900M22S | SX1262 | 32MHz active | 850 ～ 930 M | 22 | 6 | 20 * 14 | IPEX -1 / Stamp Hole |
| | E22-900M30S | SX1262 | 32MHz active | 850 ～ 930 M | 30 | 12 | 38.5 *24 | IPEX -1 / Stamp Hole |
| | E22 - 900M33S⑤ | SX1262 | 32MHz active | 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 ±1dBm, 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 50Ω;

**(5)E22-900M33S⑤ : Maximum transmit power can reach 33dBm, and the output power of the RF chip**

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**cannot exceed 9dBm.**

(6)Modules operating on the same frequency band can communicate with each other.

## 2.2 Basic Parameters

- The E22- M series 22 dBm low-power modules are: E22-170M22S , E22-400MM22S , E22-400MM22S ( T) , E22-400M22S, E22-900MM22S, E22-900MM22S ( T) , and E22-900M22S.
- The E22- M series 30 dBm high - power modules are: E22-170M30S , E22-400M30S , and E22-900M30S .
- The E22- M series 33 dBm high-power modules are: E22-170M33S , E22-400M33S , and E22-900M33S .

### 2.2.1 Basic Parameters

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

| Parameter | Description |
|---|---|
| Modulation method | Next-generation LoRa™ modulation technology |
| Interface method | 1.27mm stamp perforation |
| Communication interface | SPI |
| FIFO | 256 Byte , maximum length sent in a single transaction |
| Crystal Oscillator | 32MHz high-precision active temperature-compensated crystal oscillator **(E22-400MM22S and E22-900MM22S are 32MHz passive crystal oscillators )** |
| Packaging method | Surface mount |
| **Work environment** | |
| Operating temperature | -40℃～+85℃, industrial grade standard |
| Operating humidity | 10-90%RH |
| Storage temperature | -40℃～+125℃ |
| **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 | 150 MHz ~ 170 MHz , supports frequency band customization |

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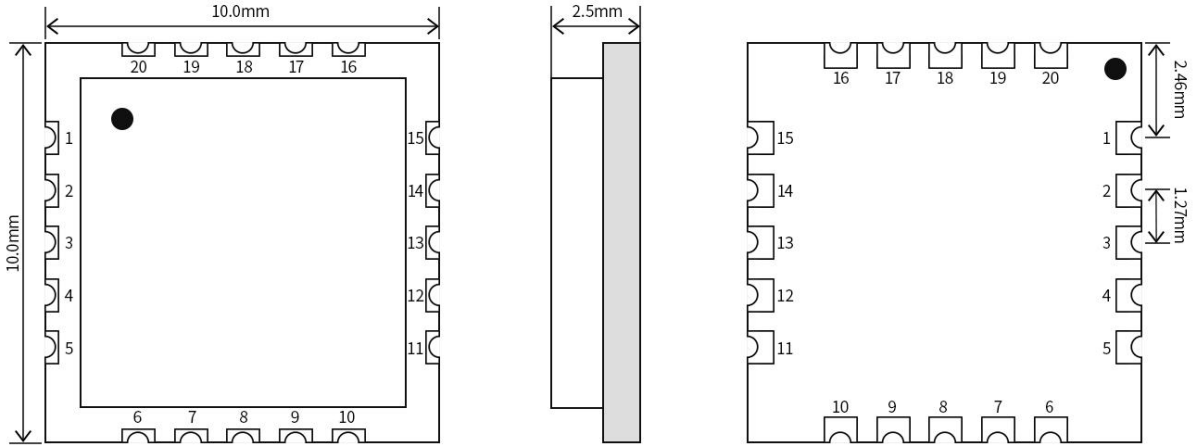
| Parameter | Description |
|---|---|
| Frequency band | 410 MHz ~ 493 MHz , frequency band customization supported |
| | 850MHz～930MHz, frequency band customization supported |
| Air speed | 0.018～62.5kbps, supports user-programmable control. |
| Blocking power | 10dBm |
| **Electrical parameters** | |
| Power supply voltage | is 1.8–3.7 V. When the operating voltage is ≥3V, the output power requirement can be met. Operating voltage exceeding 3.7V poses a risk of burnout . This is suitable for the E22-M series 22dBm low-power modules. |
| | of 3.3 to 5.5 V, and an operating voltage ≥ 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 ≥ 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 . |
| Communication 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 | ≈7mA, suitable for E22- M series 22dBm small power modules |
| | ≈ 14 mA, suitable for E22- M series 30 dBm low power modules |
| | ≈1.5 mA , suitable for E22- M series 3.3 dBm high-power modules |
| Dormant current | ≈ 0.18 uA , software shutdown , applicable to E22- M series 22dBm low-power modules |
| | ≈ 2 uA, software shutdown , applicable to E22- M series 30 dBm high-power modules |
| | ≈ 2 uA , software shutdown , applicable to E22- M series 3 3 dBm high-power modules |

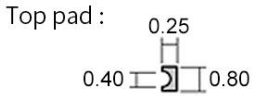
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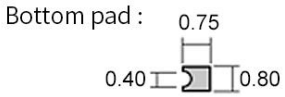

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# 3 Mechanical dimensions and pin definitions

## 3.1 Mechanical Dimensions and Pin Definitions of E22-400/900MM22S & E22-400/900MM22S(T )



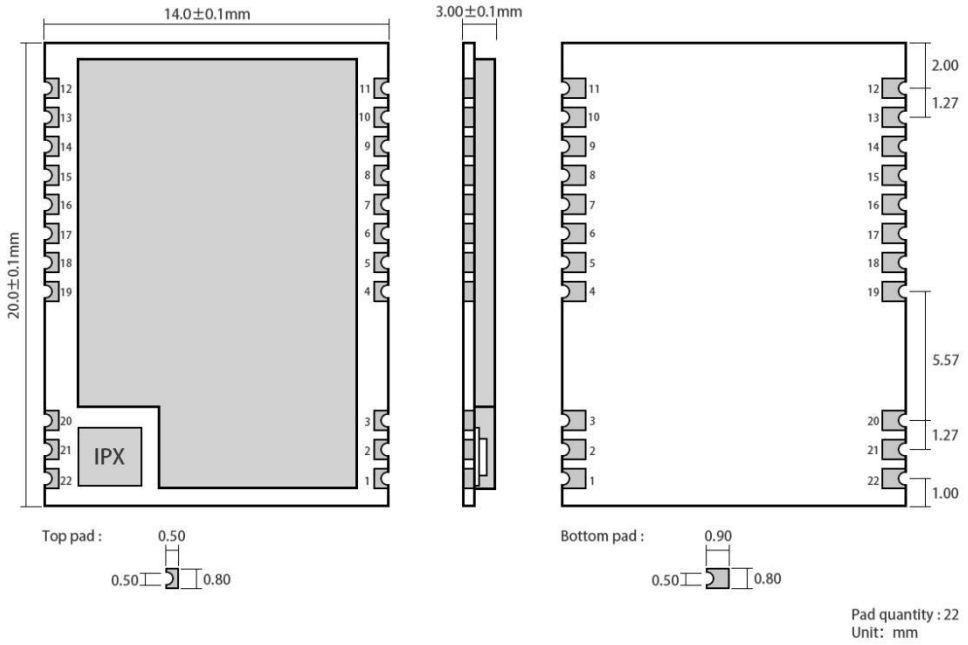

Unit : mm
pad quantity : 20
Tolerance value : X.X±0.2mm
X.XX±0.05mm

| 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; 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 |

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



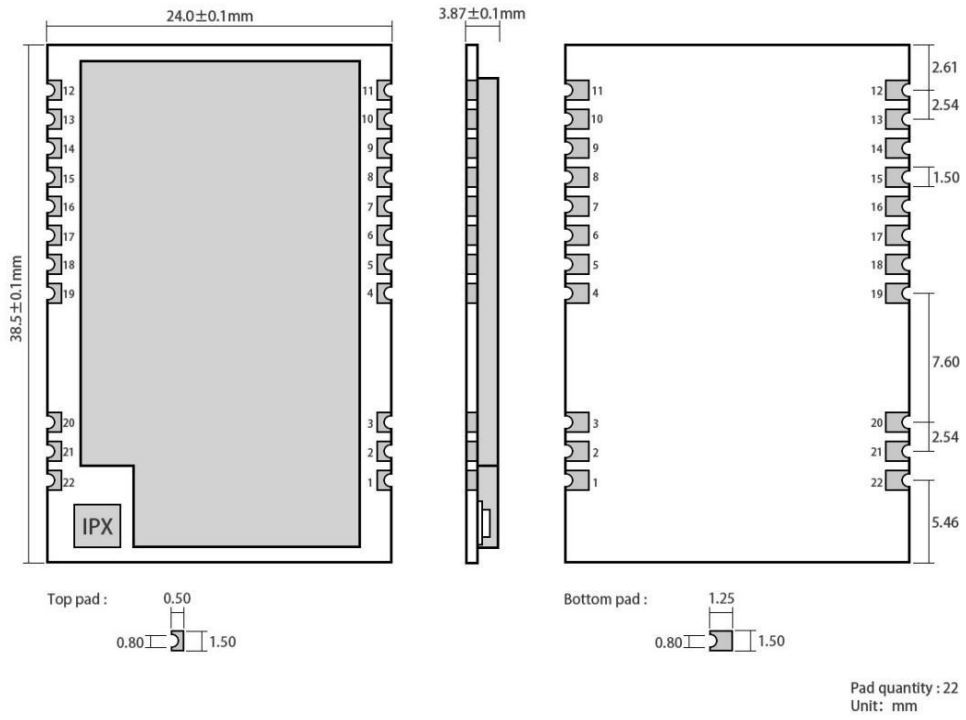

| Pin number | Pin Name | Pin direction | Pin Applications |
|---|---|---|---|
| 1 | GND | - | Ground wire, connected to power reference ground |
| 2 | GND | - | Ground wire, connected to power reference ground |
| 3 | GND | - | Ground wire, connected to power reference ground |
| 4 | GND | - | Ground 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 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 (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.

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# 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.<br>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).<br>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).<br>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 |

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| 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.

# 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 positive and negative power 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.

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## 4.2 Software Development

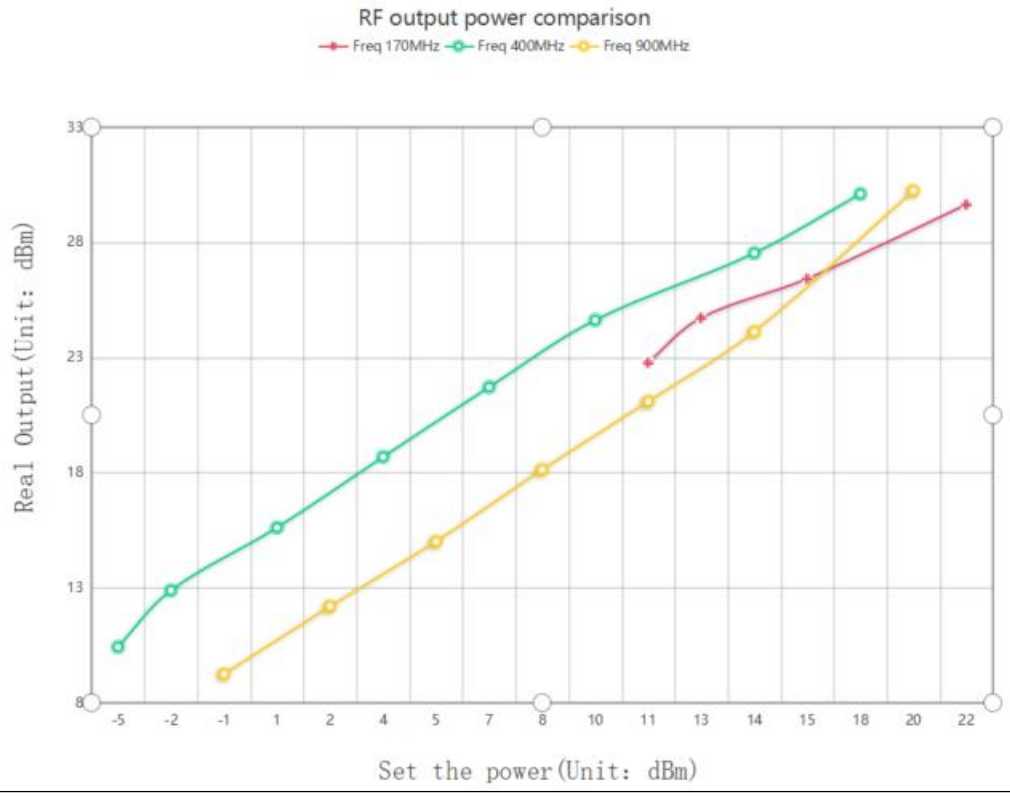
- This module has a built-in RF chip , SX126 X , and its driving method is completely equivalent to that of SX126 X. Users can operate it in strict accordance with the SX126 X chip manual .
- DIO1 and DIO2 are general-purpose I/O ports that can be configured for various functions. DIO2 can be connected 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.
- The DIO3 is used to power a 32MHz TCXO crystal oscillator ( the DIO3 is configured to output 2.2V ) .
- For the 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]**

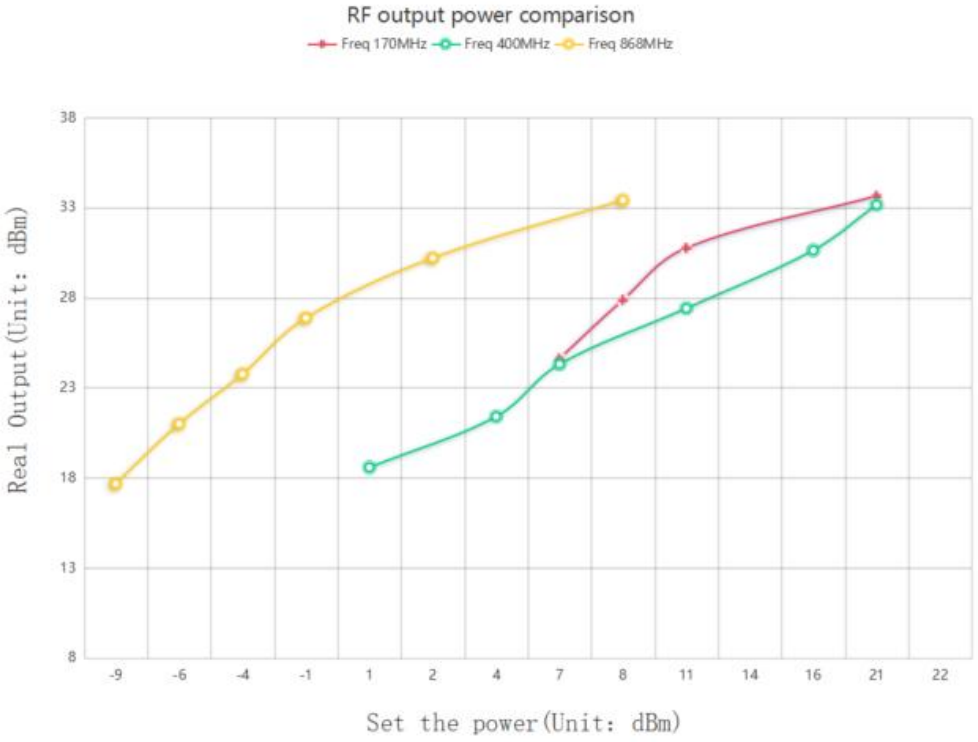
**Conditions: Tc = 25℃, VCC = 5.0V**

| Module | RF output power comparison curve |
|---|---|
| E22-170M30S<br>E22-400M30S<br>E22-900M30S |  |



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| Module | RF output power comparison curve |
|---|---|
| E22-170M33S<br>E22-400M33S<br>E22-900M33S |  |

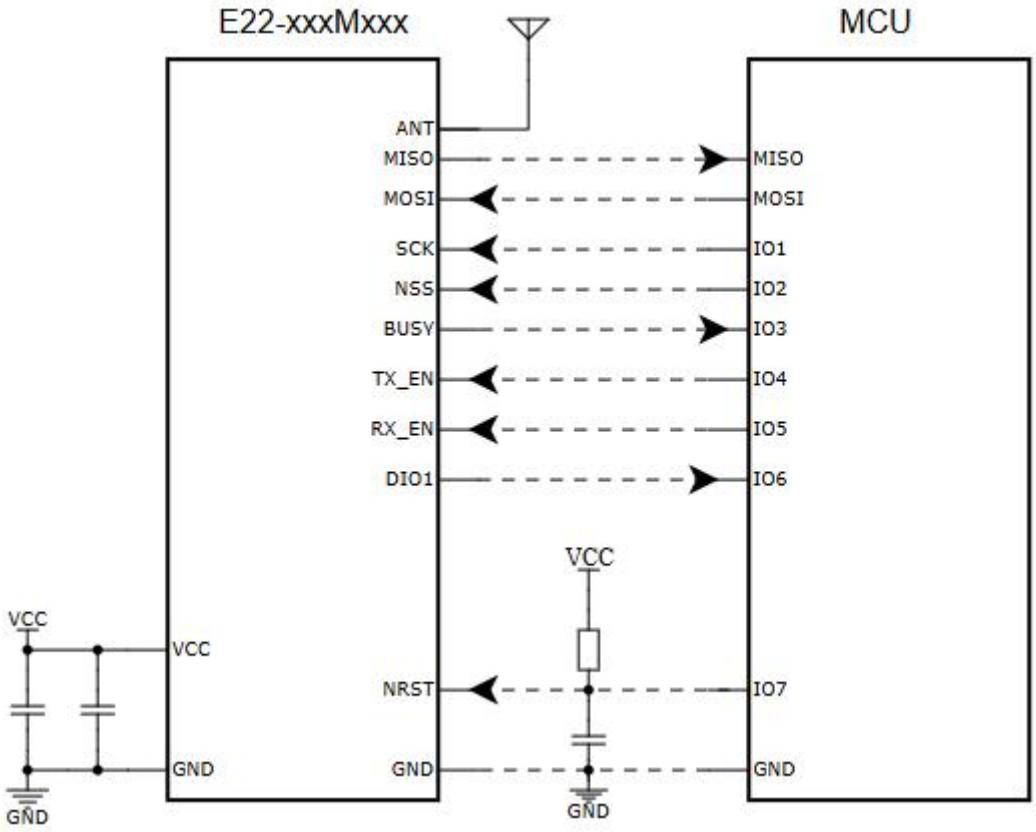


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# 5 Recommended Circuits

## 5.1 Recommended circuit diagram for E22-M series




# 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.

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## 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.

# 7 Welding Operation Instructions

## 7.1 Reflow soldering temperature

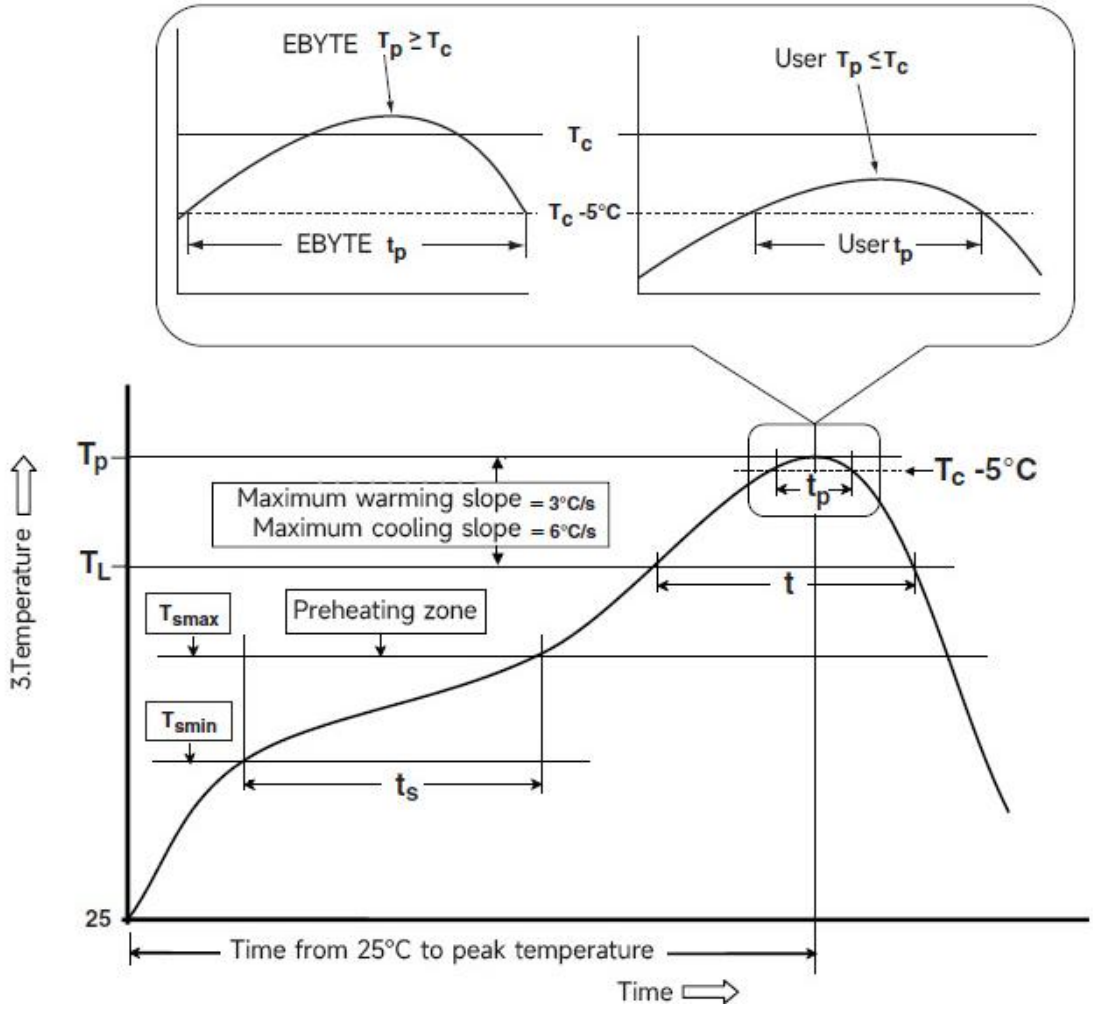
| Reflow soldering profile characteristics | | Lead-based assembly | Lead-free assembly |
|---|---|---|---|
| Preheating/Insulation | Minimum temperature ( Tsmin ) | 100℃ | 150℃ |
| | Maximum temperature (T <sub>smax</sub> ) | 150℃ | 200℃ |
| | Time (T smin ~ T smin ) | 60-120 seconds | 60-120 seconds |
| Temperature rise slope ( TL ~ Tp ) | | 3℃/second, maximum value | 3℃/second, maximum value |
| Liquid phase temperature ( TL ) | | 183℃ | 217℃ |
| T L above the holding time | | 60~ 90 seconds | 60~ 90 seconds |
| Package peak temperature Tp | | 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. |
| Tp ) within 5°C of the specified grading temperature (Tc) is shown in the figure below. | | 20 seconds | 30 seconds |
| Cooling slope ( Tp ~ TL ) | | 6℃/second, maximum | 6℃/second, |

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

## 7.2 Reflow Soldering Profile




# 8 Antenna Guide

## 8.1 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.

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| Product Model | Type | Frequency band Hz | Interface | Gain dBi | Height (mm) | Feeder cm | Features |
|---|---|---|---|---|---|---|---|
| TX170-XP-200 | Suction Cup Antenna | 170M | 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-XPH-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 |
| TX868-JKS-IPX20 | Glue rod antenna | 868M | IPEX-1 | 3.0 | 197 | 200 | Bendable rubber rod, omnidirectional antenna |
| TX868-JZLW-15 | Glue rod antenna | 868M | IPEX-1 | 3.0 | 165 | 150 | Bendable rubber rod, omnidirectional antenna |
| TX868-XPL-100 | Suction Cup Antenna | 868M | SMA-J | 3.5 | 290 | 100 | Miniature suction cup antenna, cost-effective |
| TX868-JKD-20 | Glue rod antenna | 868M | SMA-J | 3.0 | 170 | - | Bendable rubber rod, omnidirectional antenna |
| TX915-JKS-IPX20 | Glue rod antenna | 915M | IPEX-1 | 3.0 | 197 | 200 | Bendable rubber rod, omnidirectional antenna |
| TX915-JZLW-15 | Glue rod antenna | 915M | IPEX-1 | 3.0 | 1 5 5 | 150 | Bendable rubber rod, omnidirectional antenna |
| TX915-JKD-20 | Glue rod antenna | 915M | SMA-J | 3.5 | 200 | - | Bendable rubber rod, omnidirectional antenna |
| TX915-XPL-100 | Suction Cup Antenna | 915M | SMA-J | 3.5 | 2 6 0 | 100 | Miniature suction cup antenna, cost-effective |

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# Revision History

| Version | Revision Date | Revision Notes | maintainer |
|---|---|---|---|
| V1.0 | 2025-10-29 | Initial version | Hao |
| V1.1 | 2026-1-15 | Corrected power rating chart | Hao |
| V1.2 | 2026-02-06 | Supplement crystal oscillator description | Hao |
| V1.3 | 2026-3-16 | Corrected content description | Hao |
| V1.4 | 2026-9-2 | Corrected content description | Hao |
| V1.5 | 2026-9-18 | have been added : E 2 2- 400 MM 22S (T) and E 2 2- 900 MM 22S (T). Several descriptions in the manual have been revised . | Hao |

# About us

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