



E22P-xxxMxxS User Manual

SX1262 868/915MHz 1W SPI SMD LoRa module



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1 Overview

1.1 Introduction

The E22 P - xxx M3 0 S series module is a SMD LoRa™ wireless module independently developed based on Semtech's high-performance RF chip SX1262 . It has a maximum power of 30dBm and is suitable for the 868 / 915 MHz frequency band . It uses an industrial-grade high-precision active temperature -compensated crystal oscillator.

Since the imported SX1262 is used as the core of the module, a radio frequency front-end module (RF FEM) is added on the original basis. The module includes a power amplifier (PA), a low noise amplifier (LNA) and a radio frequency switch, so that the maximum transmission power reaches 30dBm and the receiving sensitivity is further improved. The overall communication stability is greatly improved compared with products without power amplifiers and low noise amplifiers. Compared with the previous generation of LoRa™ transceivers, the anti-interference performance and communication distance have been improved, further widening the gap with products with FSK and GFSK modulation methods.

Since this module is a pure RF transceiver module, it needs to be driven by an MCU or a dedicated SPI debugging tool.

1.2 Features

- Compared with the SX1278 module, the SX1262 module has the significant advantages of lower power consumption, faster speed and longer distance;
- Under ideal conditions, the communication distance can reach 12 km ;
- Built-in PA+LNA +SWA greatly improves communication distance and communication stability;
- ESD protection design, high efficiency of module use;
- The module is equipped with radio frequency front-end module, and the overall communication performance is high;
- 32MHz industrial grade high precision active temperature compensated crystal oscillator
- Maximum transmission power 30dBm , software adjustable in multiple levels;
- Supports 868/915 MHz frequency bands ;
- Support multiple modulation modes, LoRa™/GFSK;
- LoRa™ mode supports data transmission rates of 0.3 k to 62.5 kbps;
- G FSK mode supports data transmission rate up to 300kbps;
- Backward compatible with SX1278/SX1276 series RF transceivers;
- FIFO has large capacity and supports 255Byte data cache;
- New SF5 spreading factor to support dense networks;
- Supports 3.3 ~ 5.5V power supply, and the best performance can be guaranteed when the power supply is greater than 5V;
- Industrial-grade standard design, supports long-term use at -40~+85°C;
- Dual antennas are optional (IPEX/stamp hole), which is convenient for users to carry out secondary development and facilitate integration;
- With FCC, CE, ROHS and other related certifications.

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;
- Advanced Metering Infrastructure (AMI);
- Automotive industry applications.

2 Specifications

2.1 RF parameters

| RF parameters | unit | model | | Remark |
|------------------------|------|--------------|--------------|---|
| | | E22P-868M30S | E22P-915M30S | |
| Transmit power | dBm | 30 | 30 | Support software multi-level adjustable |
| Reference distance | m | 12000 | 12000 | Clear and open air, antenna gain 5dBi, antenna height 2.5 meters, air rate 2.4 kbps |
| Working frequency band | MHz | 863.3-873.3 | 902-928 | Support ISM band |
| Air speed | bps | 0.3 k~62.5 k | 0.3 k~62.5 k | LoRa modulation mode, user programming control |

2.2 Electrical parameters

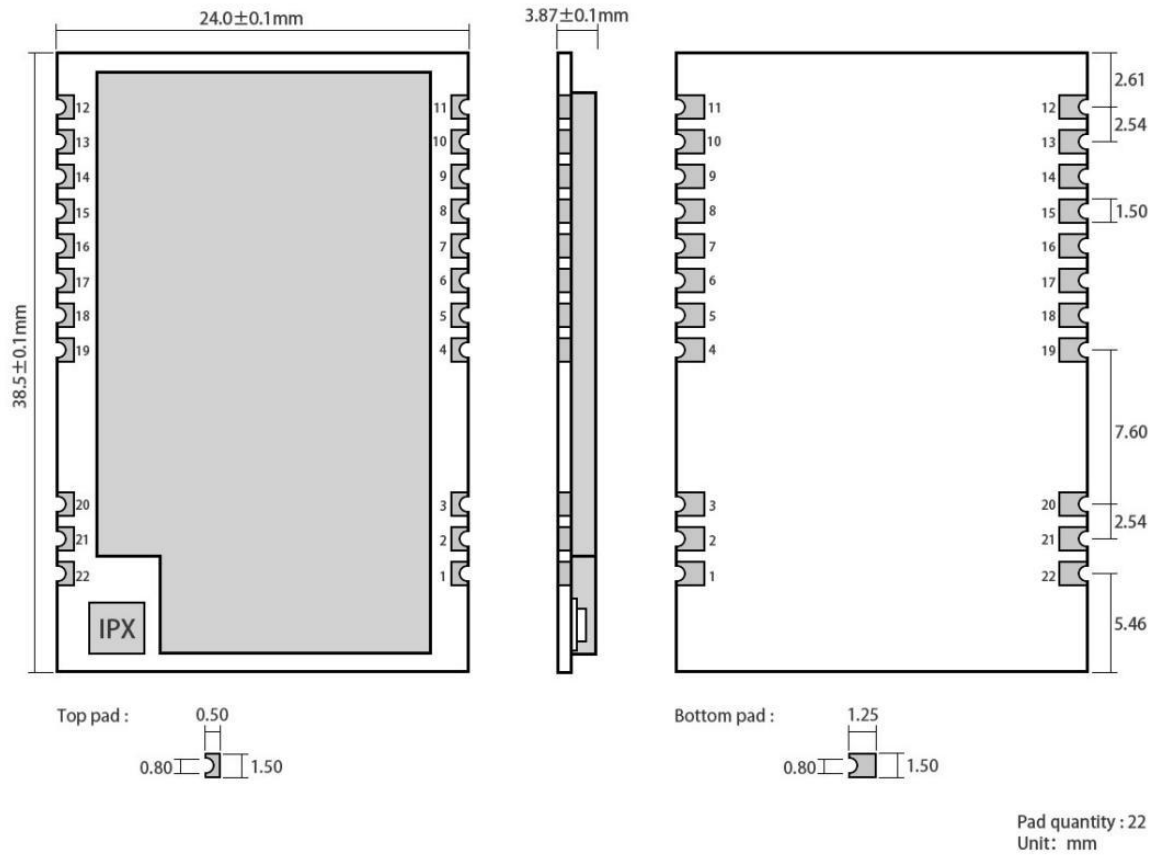
| Electrical parameters | unit | model | | Remark |
|-----------------------|------|--------------|--------------|---|
| | | E22P-868M30S | E22P-915M30S | |
| Operating voltage | V | 3.3~5.5 | 3.3~5.5 | When the operating voltage is $\geq 5V$, the output power requirement can be met. When the operating voltage exceeds 5.5V, there is a risk of burning. |
| Communication level | V | 3.3 | 3.3 | Using 5V TTL may burn out |

| | | | | | |
|-------------------|-----------------------|----|--------------|--------------|-------------------------------------|
| Power consumption | Emission current | mA | 610 | 640 | Instantaneous power consumption @5V |
| | Receiving current | mA | twenty three | twenty three | |
| | Sleep current | μA | 3 | 3 | Software shutdown |
| temperature | Operating temperature | °C | -40 ~ + 85 | | Industrial Grade |
| | Storage temperature | | -40 ~ +125 | | |

2.3 Hardware Parameters

| Hardware Parameters | model | | Remark |
|-------------------------|--------------------|--------------------|--|
| | E22P-868M30S | E22P-915M30S | |
| chip | SX1262 | SX1262 | - |
| FIFO | 255Byte | 25 5 Byte | Maximum length of a single transmission |
| Crystal frequency | 32MHz | 32MHz | High-precision active temperature compensated crystal oscillator |
| Modulation | LoRa(recommended) | LoRa(recommended) | Next-generation LoRa™ modulation technology |
| Interface | Stamp Holes | Stamp Holes | Pitch 2.54 mm |
| Communication interface | SPI | SPI | 0~10Mbps |
| Product Net Weight | 5.1 | 5.1 | Tolerance ±0.02g |
| Packaging | SMD | SMD | - |
| Antenna interface | Stamp hole/IPEX -1 | Stamp hole/IPEX -1 | Characteristic impedance is about 50 ohms |
| size | 38.5*24mm | 38.5*24mm | Error value ±0.2mm |

3 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 | EN | enter | RF enable control pin, connected to external MCU IO, high level is effective |
| 7 | T/R CTRL | Input /Output | RF transmission and reception control pin, high level for transmission, low level for reception, connected to external microcontroller IO or DIO2 |
| 8 | DIO2 | Input/Output | Configurable general IO port (see SX1262 manual for details) |
| 9 | VCC | | Power supply, range 3.3 ~ 5.5V (it is recommended to add external ceramic filter capacitor) |
| 10 | VCC | | Power supply, range 3.3 ~ 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 SX1262 manual for details) |
| 14 | BUSY | Output | Used for status indication (see SX1262 manual for details) |
| 15 | NRST | enter | Chip reset trigger input pin, low level is effective |
| 16 | MISO | Output | SPI data output pin |
| 17 | MOSI | enter | SPI data input pin |
| 18 | SCK | enter | SPI clock input pin |
| 19 | NSS | enter | Module chip select pin, used to start an SPI communication |
| 20 | GND | | Ground wire, connected to the power reference ground |
| twenty one | ANT | | Antenna interface, stamp hole (50Ω characteristic impedance) |
| twenty two | GND | | Ground wire, connected to the power reference ground |

4 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 is laid on the Top Layer of the module contact part (all copper is 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.

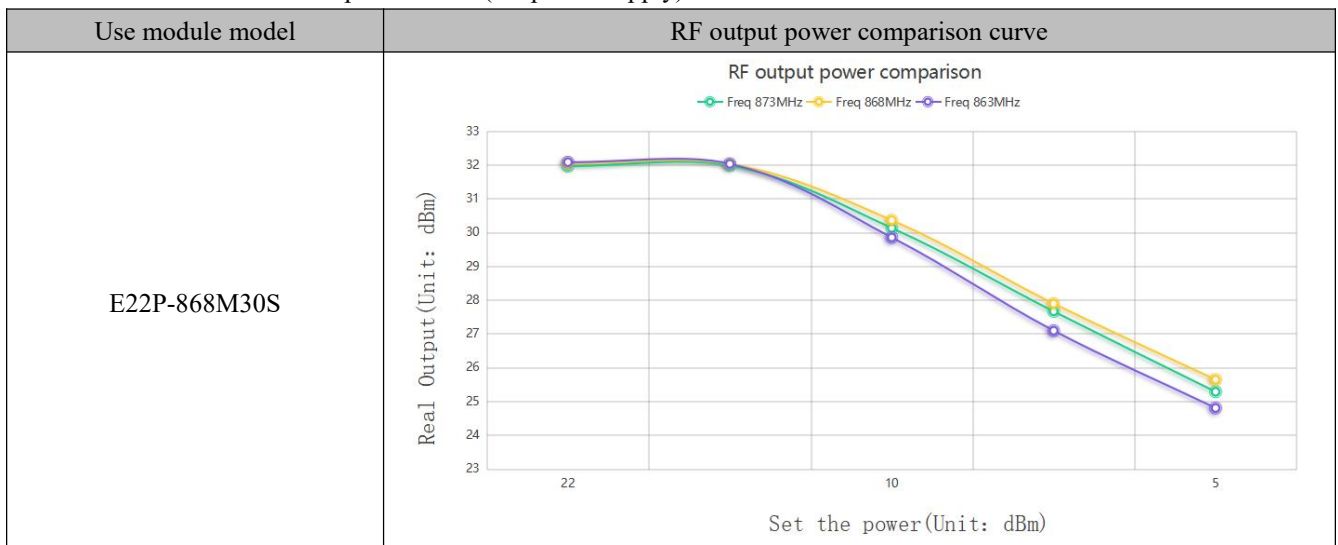
- If the communication line uses 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage);
- Try to stay away from some TTL protocols whose physical layer is also 2.4GHz, such as USB3.0;
- The antenna installation structure has a great impact on the 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

- This module is SX1268/SX1262+PA+LNA , and its driving mode is completely the same as SX1268/SX1262 . Users can operate it completely according to the SX1268/SX1262 chip manual; it should be noted that PA_EN and T/R CTRL of RF_switch are connected together, and LNA_EN and EN of RF_switch are connected together, so users only need to control T/R CTRL when sending, and use T/R CTRL when receiving.
- DIO1 and DIO2 are general IO ports that can be configured with multiple functions. DIO2 can be connected to T/R CTRL and not to the MCU's IO port. It is used to control the RF switch transmission. For details, see the SX1262 manual. If not used, it can be left floating. T/R CTRL and EN cannot be high at the same time, and the level states should be opposite.
- DIO3 is used internally to power a 32MHz TCXO crystal oscillator (DIO3 is configured to output 1.8V) .
- Chengdu Ebyte Electronic Technology Co., Ltd. also provides sample code for users to refer to:
<https://www.ebyte.com/pdf-down/3485.html>
- RF switch control logic truth table:

| EN | T/R CTRL | MODE |
|----|----------|-------|
| 1 | 1 | TX |
| 1 | 0 | RX |
| 0 | X | CLOSE |

- Power classification comparison chart(5V power supply):

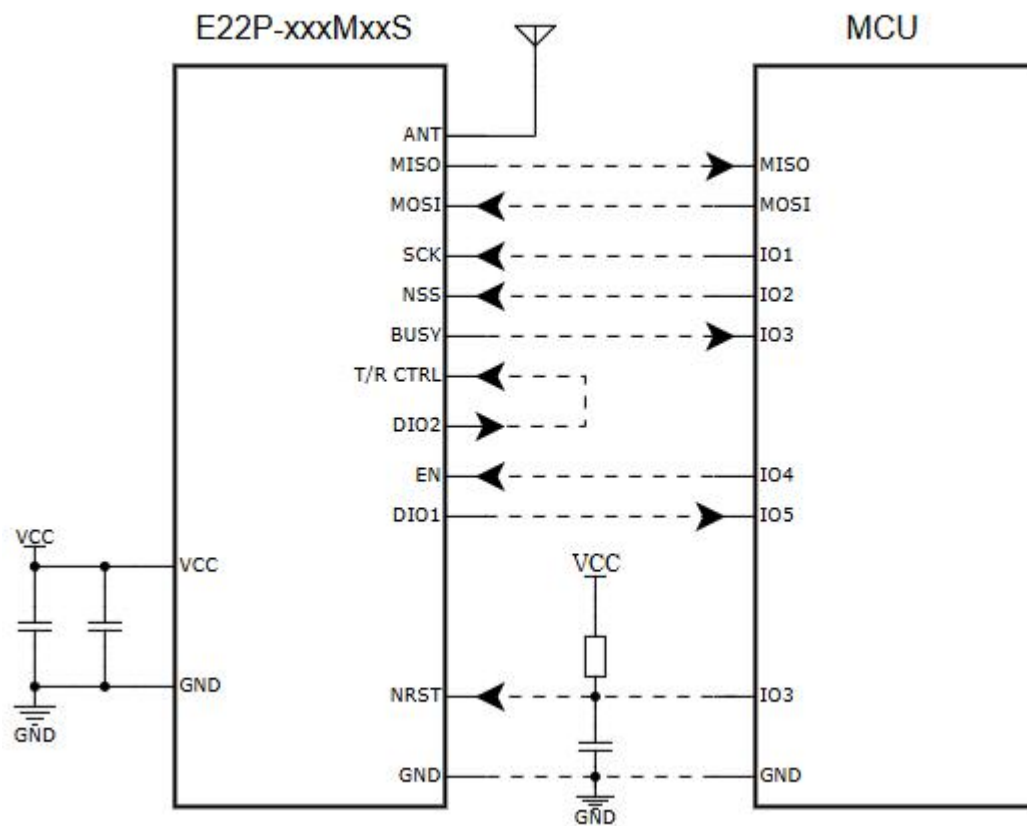


E22P-915M30S



5 Basic Applications

5.1 Recommended Circuit



6 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 test 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 Modules are vulnerable to damage

- 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.
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity;
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

6.3 Bit Error Rate is Too High

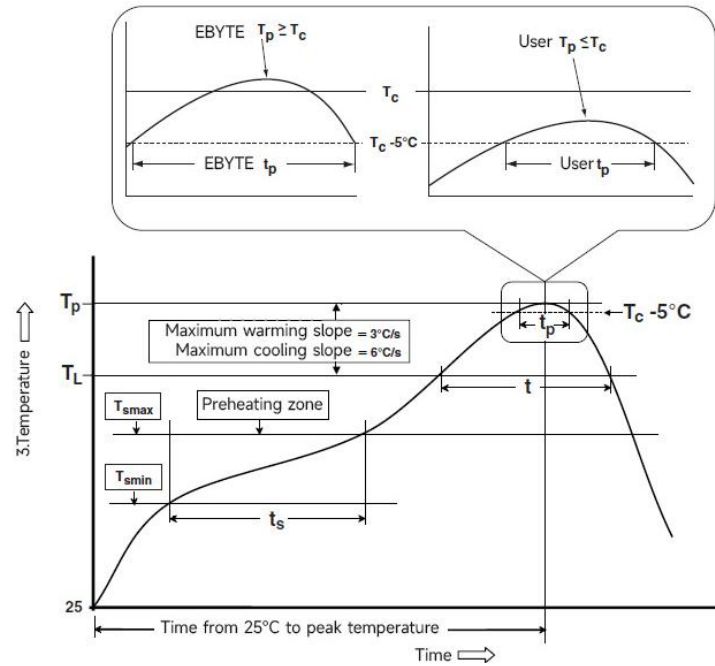
- There is interference from the same frequency signal nearby. Stay away from the interference source or change the frequency or channel to avoid interference.
- The clock waveform on SPI is not standard. Check whether there is interference on the SPI line. The SPI bus line should not be too long.
- An unsatisfactory power supply may also cause garbled characters, so the reliability of the power supply must be ensured;
- Extension cables or feeder cables that are of poor quality or are too long can also cause a high bit error rate.

7 Welding Operation Instructions

7.1 Reflow Temperature

| Reflow profile characteristics | | Leaded process assembly | Lead-free assembly |
|--|--|---|---|
| Preheating/keepin g | Minimum temperature (T _{min}) | 100°C | 150°C |
| | Maximum temperature (T _{max}) | 150°C | 200°C |
| | Time (T _{min} ~T _{min}) | 60-120 seconds | 60-120 seconds |
| Heating slope (TL~Tp) | | 3°C/sec, max. | 3°C/sec, max. |
| Liquidus temperature (TL) | | 183°C | 217°C |
| Keep time above TL | | 60~ 90 seconds | 60~ 90 seconds |
| Package peak temperature Tp | | Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label. | Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label. |
| The time (Tp) within 5°C of the specified classification temperature (Tc) is shown in the figure below. | | 20 seconds | 30 seconds |
| Cooling slope (Tp~TL) | | 6°C/sec, max. | 6°C/sec, max. |
| Time from room temperature to peak temperature | | 6 minutes, longest | 8 minutes, longest |
| ※ The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user | | | |

7.2 Reflow Oven Curve



8 Related Models

| Product Model | Chip Solution | Carrier frequency Hz | Transmit power dBm | Test distance km | Package | Product size mm | Communication interface |
|---------------|---------------|----------------------|--------------------|------------------|---------|-----------------|-------------------------|
| E22-400M22S | SX1262 | 433/470M | twenty two | 7 | Patches | 14*20 | SPI |
| E22-900M22S | SX1262 | 868/915M | twenty two | 7 | Patches | 14*20 | SPI |
| E22-900M33S | SX1262 | 433/470M | 33 | 16 | Patches | 24*38.5 | SPI |
| E22-900M30S | SX1262 | 868/915M | 30 | 12 | Patches | 24*38.5 | SPI |
| E22-230T22S | SX1262 | 230M | twenty two | 5 | Patches | 16*26 | TTL |
| E22-400T22S | SX1262 | 433/470M | twenty two | 5 | Patches | 16*26 | TTL |
| E22-900T22S | SX1262 | 868/915M | twenty two | 5 | Patches | 16*26 | TTL |
| E22-230T30S | SX1262 | 230M | 30 | 10 | Patches | 25*40.5 | TTL |
| E22-400T30S | SX1262 | 433/470M | 30 | 10 | Patches | 25*40.5 | TTL |
| E22-900T30S | SX1262 | 868/915M | 30 | 10 | Patches | 25*40.5 | TTL |

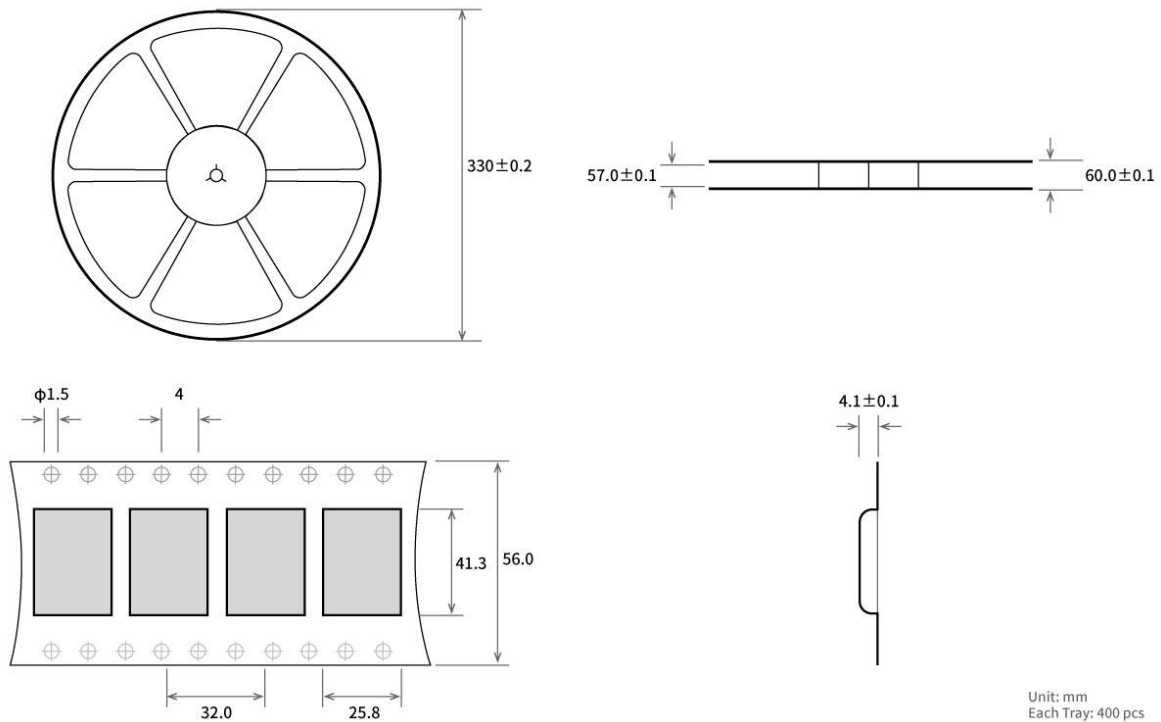
9 Antenna Guide

9.1 Antenna Recommendations

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 | high mm | Feeder cm | Features |
|---------------|---------------------|----------------------|-----------|-------------|------------|--------------|---|
| TX433-NP-4310 | Flexible Antenna | 433M | welding | 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 | - | Bend the glue stick, omnidirectional antenna |
| TX433-JWG-7 | Glue stick antenna | 433M | SMA-J | 2.5 | 75 | - | Bend the 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-XPL-100 | Suction cup antenna | 433M | SMA-J | 3.5 | 185 | 100 | Small suction cup antenna, cost-effective |
| TX433-XP-200 | Suction cup antenna | 433M | SMA-J | 4.0 | 190 | 200 | Neutral suction cup antenna, low loss |
| TX433-XP-300 | Suction cup antenna | 433M | SMA-J | 6.0 | 965 | 300 | Large suction cup antenna, high gain |
| TX490-JZ-5 | Glue stick 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 | Small suction cup antenna, cost-effective |

10 Bulk Packaging Methods



Revision History

| Version | Revision Date | Revision Notes | Maintainer |
|---------|---------------|----------------|------------|
| 1.0 | 2025-7-16 | Manual Release | Hao |

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