



E22-400M33S User Manual

SX1268 433/470MHz 2W SPI Chip LoRa Module



Content

| | |
|---|----|
| DISCLAIMER | 3 |
| 1. OVERVIEW | 4 |
| 1.1 INTRODUCTION | 4 |
| 1.2 FEATURES | 4 |
| 1.3 APPLICATION SCENARIOS | 5 |
| 2. SPECIFICATION PARAMETERS | 5 |
| 2.1 LIMIT PARAMETERS | 5 |
| 2.2 WORKING PARAMETERS | 5 |
| 3. MECHANICAL DIMENSIONS AND PIN DEFINITION | 6 |
| 4. BASIC OPERATION | 7 |
| 4.1 HARDWARE DESIGN | 7 |
| 4.2 SOFTWARE WRITING | 8 |
| 5. BASIC APPLICATIONS | 9 |
| 5.1 BASIC CIRCUITS | 9 |
| 6. FREQUENTLY ASKED QUESTIONS | 9 |
| 6.1 COMMUNICATION RANGE IS TOO SHORT | 9 |
| 6.2 MODULE IS EASY TO DAMAGE | 10 |
| 6.3 BER IS TOO HIGH | 10 |
| 7. WELDING WORK INSTRUCTION | 10 |
| 7.1 REFLOW TEMPERATURE | 10 |
| 7.2 REFLOW PROFILE | 10 |
| 8. RELATED MODELS | 11 |
| 9. ANTENNA GUIDE | 12 |
| 9.1 ANTENNA RECOMMENDATIONS | 12 |
| 10. BATCH PACKING METHOD | 13 |
| REVISION HISTORY | 14 |
| ABOUT US | 14 |

Disclaimer

EBYTE reserves all rights to this document and the information contained herein. Products, names, logos and designs described herein may in whole or in part be subject to intellectual property rights. Reproduction, use, modification or disclosure to third parties of this document or any part thereof without the express permission of EBYTE is strictly prohibited.

The information contained herein is provided “as is” and EBYTE assumes no liability for the use of the information. No warranty, either express or implied, is given, including but not limited, with respect to the accuracy, correctness, reliability and fitness for a particular purpose of the information. This document may be revised by EBYTE at any time. For most recent documents, visit www.ebyte.com.

1. Overview

1.1 Introduction

E22-400M33S is based on the new generation of LoRa™ RF chip SX1268 produced by Semtech in the United States as the core of independent research and development of the maximum power of 2W and suitable for 433/470MHz SMD LoRa™ wireless module, using industrial-grade high-precision 32MHz crystal oscillator.

Since the original imported SX1268 is used as the core of the module, the power amplifier (PA) and low noise amplifier (LNA) are built in on top of the original one, which makes the maximum transmitting power reach 2W and further improve the receiving sensitivity, and the overall communication stability is greatly improved compared with the products without power amplifier and low noise amplifier. Compared with the previous generation of LoRa™ transceivers, the anti-interference performance and communication distance have been improved, further widening the gap with products of FSK and GFSK modulation methods. The product can cover an ultra-wide applicable frequency range from 410 to 493MHz and is backward compatible with SX1278 and SX1276.

As this module is pure RF transceiver module, it needs to use MCU driver or use special SPI debugging tool.



1.2 Features

- Compared with the SX1278 module, the SX1268 module has the significant advantages of lower power consumption, higher speed and longer distance.
- Communication distance up to 16km under ideal conditions.
- Built-in PA+LNA, which substantially improves the communication distance and communication stability.
- Maximum transmitting power of 2W, adjustable in multiple levels by software.
- Support for global license-free ISM 433/470MHz band.
- Support multiple modulation modes, LoRa™/FSK/GFSK/MSK/GMSK/OOK;
- Support data transmission rate from 0.018k to 62.5kbps in LoRa™ mode.
- FSK mode support for data rates up to 300kpbs.
- Downward compatibility with SX1278/SX1276 series RF transceivers.
- Large FIFO capacity, supporting 256 Byte data cache.
- A new SF5 spread spectrum factor introduced to support dense networks.
- support for 3.3 to 5.5V power supply, greater than 5V power supply are available to ensure the best performance.
- Industrial-standard design, supporting extended use at -40 to +85° C.
- Dual antennas optional (IPEX/stamp hole) for user-friendly secondary development and easy integration.

1.3 Application Scenarios

- Home security alarms and remote keyless entry.
- Smart home as well as industrial sensors, etc..
- Wireless alarm security systems.
- Building automation solutions.
- Wireless industrial grade remote controls.
- Advanced meter reading architecture (AMI).
- Automotive industry applications.

2. Specification parameters

2.1 Limit parameters

| Main parameters | Performance | | Remarks |
|----------------------------|---------------|---------------|--|
| | Minimum value | Maximum value | |
| Supply Voltage (V) | 0 | 5.5 | Permanent module burnout above 5.5V |
| Blocking power (dBm) | - | 10 | The probability of burning is small when used in close proximity |
| Operating temperature (°C) | -40 | +85 | Industrial Grade |

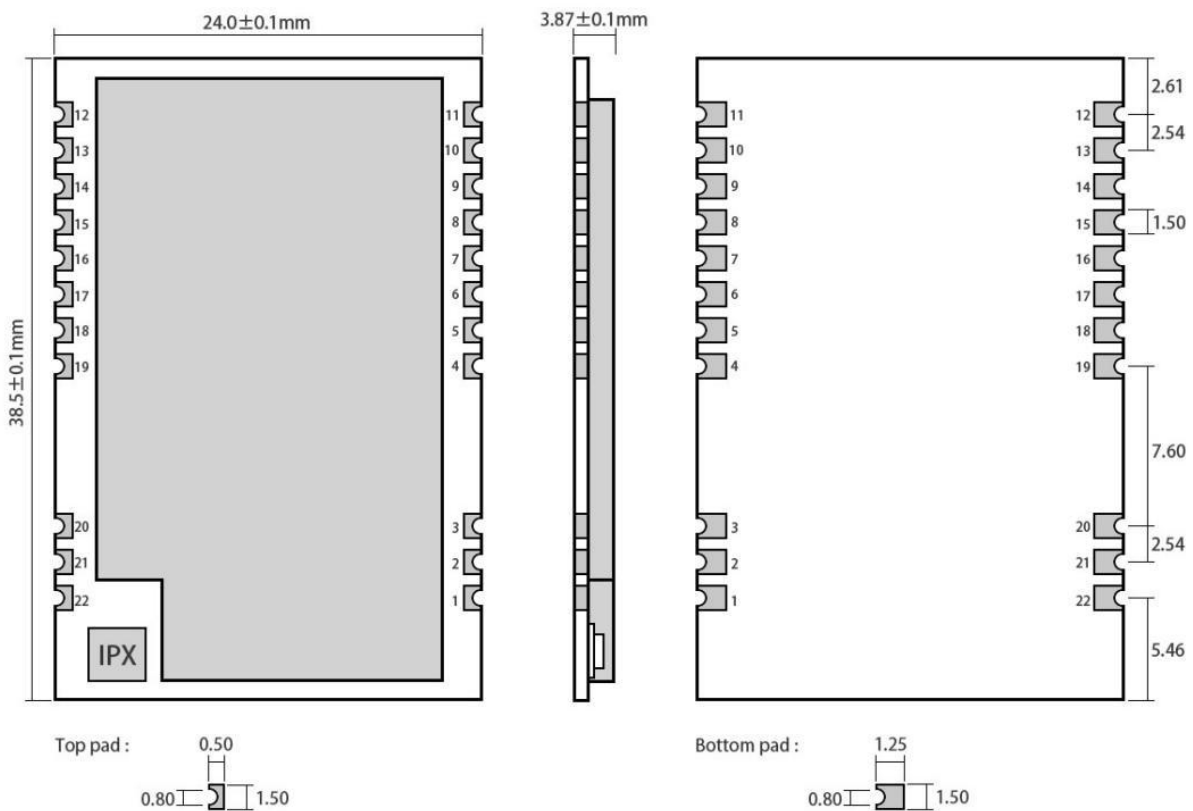
2.2 Working parameters

| Main parameters | | Performance | | | Remarks |
|----------------------------------|------------------------|---------------|----------------|---------------|---------------------------------|
| | | Minimum value | Typical values | Maximum value | |
| Operating Voltage (V) | | 3.3 | 5.0 | 5.5 | ≥5.0V Guaranteed output power |
| Communication level (V) | | | 3.3 | | Risk of burnout with 5V TTL |
| Operating temperature (°C) | | -40 | - | +85 | Industrial grade design |
| Operating Frequency Band (MHz) | | 410 | 433/470 | 493 | ISM band support |
| Power consumption | Emission current (mA) | | 1200 | | Instantaneous power consumption |
| | Receiving current (mA) | | 14 | | |
| | Dormant current (uA) | | 2 | | Software shutdown |
| Maximum transmitting power (dBm) | | 32.5 | 33.0 | 33.5 | |
| Reception sensitivity (dBm) | | -124 | -125 | -126 | Airspeed 0.3kbps |

| | | | | |
|----------------|--------|---|-------|-------------------------|
| airspeed (bps) | 0.6k | - | 300k | User-programmed control |
| | 0.018k | - | 62.5k | User-programmed control |

| Main parameters | Description | Remarks |
|-------------------------|------------------|--|
| Reference Distance | 16km | Clear and open, antenna gain 5dBi, antenna height 2.5m, air rate 0.3kbps |
| FIFO | 256Byte | Maximum length of a single transmission |
| Crystal Frequency | 32MHz | |
| Modulation mode | LoRa(Recomm end) | |
| Packaging method | SMD | |
| Interface method | 2.54mm | Stamp Holes |
| Communication Interface | SPI | 0 ~ 10Mbps |
| Dimension | 38.5*24mm | |
| Antenna Interface | Stamp Holes/IPEX | Equivalent impedance about 50Ω |
| Weight | 4.9g | ±0.1g |

3. Mechanical dimensions and pin definition



Pad quantity : 22
Unit: mm

| Pin Serial Number | Pin Name | Pin Orientation | Pin Usage |
|-------------------|----------|-----------------|-----------|
|-------------------|----------|-----------------|-----------|

| | | | |
|----|------|--------------|---|
| 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 | Input | RF switch receive control pin, connected to external microcontroller IO, active high |
| 7 | TXEN | Input | RF switch transmit control pin, connected to external microcontroller IO or DIO2, active high |
| 8 | DIO2 | Input/Output | Configurable general purpose IO port (see SX1268 manual for details) |
| 9 | VCC | | Power supply, range 3.3 to 5.5V (it is recommended to increase the external ceramic filter capacitor) |
| 10 | VCC | | Power supply, range 3.3 to 5.5V (it is recommended to increase the external ceramic filter capacitor) |
| 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 IO port (see SX1268 manual for details) |
| 14 | BUSY | Output | For status indication (see SX1268 manual for details) |
| 15 | NRST | Input | Chip reset trigger Input pin, active low |
| 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 to start an SPI communication |
| 20 | GND | | Ground wire, connected to power reference ground |
| 21 | ANT | | Antenna connector, stamp hole (50Ω characteristic impedance) |
| 22 | GND | | Ground wire, connected to power reference ground |

4. Basic operation

4.1 Hardware Design

- Recommend using a DC regulated power supply to power the module with as small a ripple coefficient as possible, and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative terminals of the power supply, as a reversed connection may cause permanent damage to the module.
- Please check the power supply to ensure that it is between the recommended supply voltage, if it exceeds the maximum value it may cause permanent damage to the module.
- Please check the stability of the power supply, the voltage should not fluctuate significantly and frequently.
- When designing the power supply circuit for the module, it is often recommended to retain more than 30% margin

to have the whole machine conducive to long-term stable operation.

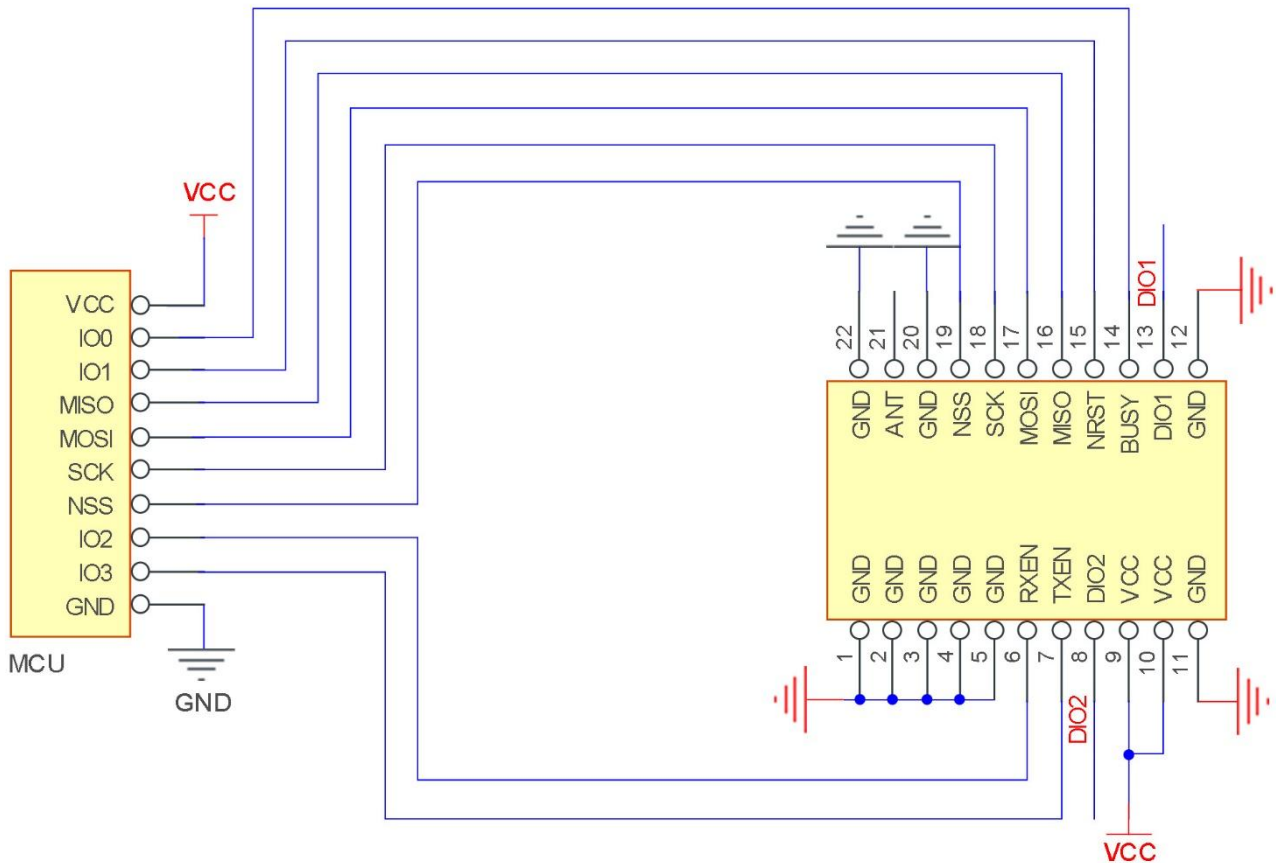
- modules should be as far away as possible from the power supply, transformers, high-frequency alignments and other parts of the electromagnetic interference.
- High-frequency digital alignment, high-frequency analog alignment, power supply alignment must be avoided below the module, if it is necessary to pass below the module, assuming that the module is soldered in the Top Layer, in the module contact part of the Top Layer pavement copper (all pavement copper and good grounding), must be close to the digital part of the module and alignment in the Bottom Layer.
- Assuming that the module is soldered or placed in the Top Layer, it is also wrong to run wires randomly in the Bottom Layer or other layers, which will affect the spurious and reception sensitivity of the module to varying degrees.
- Assuming that there are large electromagnetic interference devices around the module will also greatly affect the performance of the module, according to the strength of the interference is recommended to be properly away from the module, if the situation allows the appropriate isolation and shielding.
- Assuming that there are large electromagnetic interference alignments around the module (high-frequency digital, high-frequency analog, power supply alignments) will also greatly affect the performance of the module, according to the intensity of the interference, it is recommended to keep away from the module, and if the situation permits, appropriate isolation and shielding can be done.
- communication line if the use of 5V level, must be connected in series with 1k-5.1k resistors (not recommended, there is still a risk of damage).
- try to stay away from some of the physical layer is also 2.4GHz TTL protocol, for example: USB3.0.
- Antenna mounting structure has a big impact on the module performance, make sure the antenna is exposed, preferably vertically up. When the module is installed inside the case, you can use a high quality antenna extension cable to extend the antenna to the outside of the case.
- The antenna must not be installed inside the metal case, it will cause the transmission distance to be greatly weakened.
- It is recommended to add 200R protection resistors to the RXD/TXD of the external MCU.

4.2 Software Writing

- This module is SX1268/SX1262+PA+LNA, its driving method is fully equivalent to SX1268/SX1262, users can operate exactly according to SX1268/SX1262 chip book.
- DIO1 and DIO2 are general-purpose IO ports, which can be configured for various functions; among them, DIO2 can be connected to TXEN and not to the MCU IO port for controlling RF switch emission, see SX1262 manual for details, which can be suspended if not used.
- Internal use DIO3 for 32MHz TCXO crystal power supply (DIO3 configuration output 1.8V)

5. Basic Applications

5.1 Basic Circuits



6. Frequently Asked Questions

6.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- The power supply low voltage is lower than recommended under room temperature. The lower the voltage is, the smaller the transmitting power is.
- Due to antenna quality or poor matching between antenna and module.

6.2 Module is easy to damage

- Please check the power supply to ensure that it is within the recommended value. If it exceeds the maximum value, the module will be permanently damaged;
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure anti-static measures are taken when installing and using, high frequency devices have electrostatic susceptibility.
- Please ensure the humidity is within limited range, some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

6.3 BER is too high

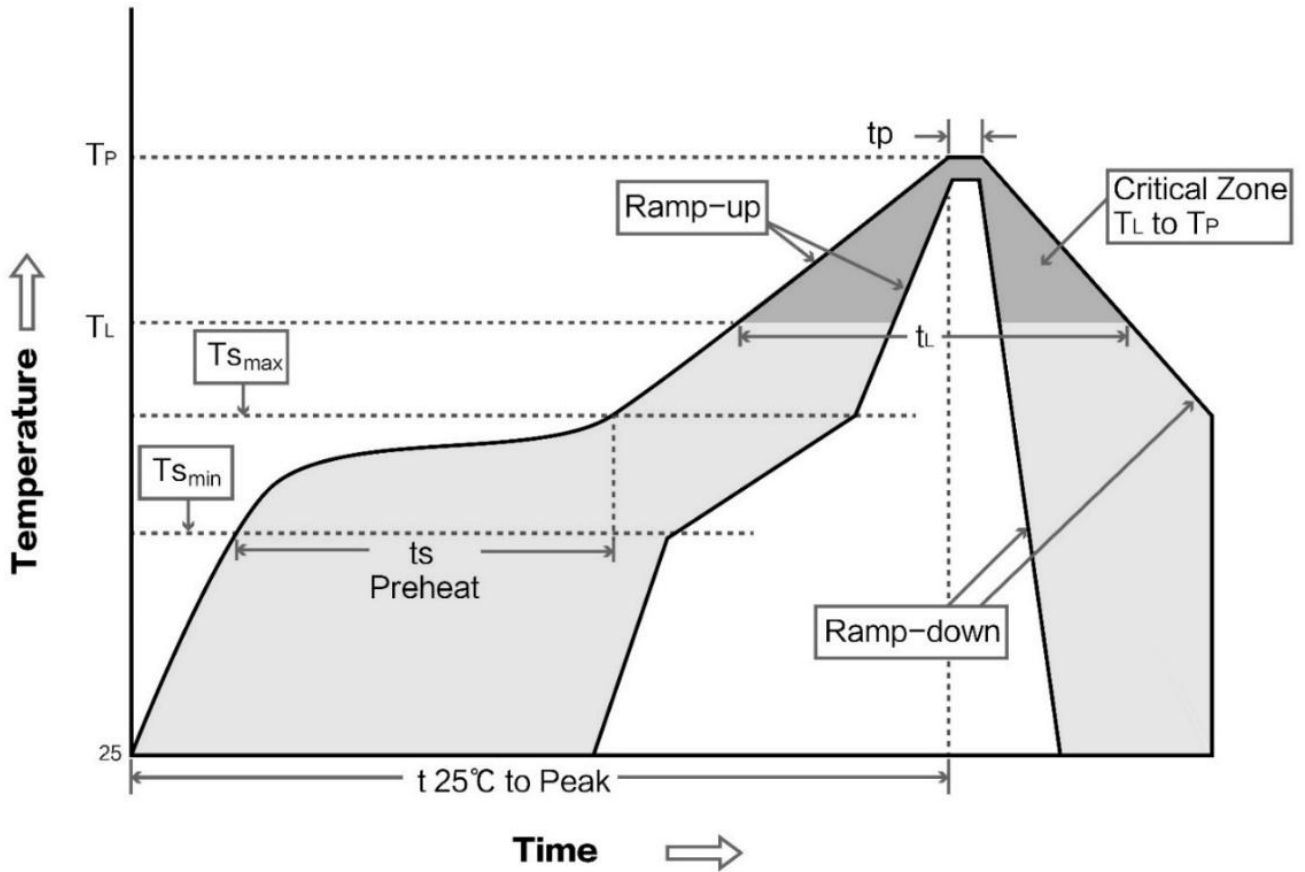
- There is interference from the same frequency signal nearby, stay away from the interference source or modify the frequency and channel to avoid interference.
- The clock waveform on the SPI is not standard, check whether there is interference on the SPI line, and the SPI bus alignment should not be too long.
- Unsatisfactory power supply may also cause garbled code, be sure to ensure the reliability of the power supply.
- Poor quality or too long extension cable or feeder line may also cause high BER.

7. Welding work instruction

7.1 Reflow Temperature

| Profile Feature | Curve characteristics | Sn-Pb Assembly | Pb-Free Assembly |
|---|------------------------------------|----------------|------------------|
| Solder Paste | Solder Paste | Sn63/Pb37 | Sn96.5/Ag3/Cu0.5 |
| Preheat Temperature min (T _{smin}) | Minimum preheating temperature | 100°C | 150°C |
| Preheat temperature max (T _{smax}) | Maximum preheating temperature | 150°C | 200°C |
| Preheat Time (T _{smin} to T _{smax})(ts) | Warm-up time | 60-120 sec | 60-120 sec |
| Average ramp-up rate(T _{smax} to T _p) | Average rise rate | 3°C/second max | 3°C/second max |
| Liquidous Temperature (TL) | liquid phase temperature | 183°C | 217°C |
| Time (t _L) Maintained Above (TL) | Time above the liquid phase line | 60-90 sec | 30-90 sec |
| Peak temperature (T _p) | Peak temperature | 220-235°C | 230-250°C |
| Average ramp-down rate (T _p to T _{smax}) | Average drop rate | 6°C/second max | 6°C/second max |
| Time 25°C to peak temperature | Time from 25°C to peak temperature | 6 minutes max | 8 minutes max |

7.2 Reflow Profile



8. Related Models

| SKU | Chip | Frequency Hz | Transmitting power dBm | Test Distance km | Package | Size mm | Communication Interface |
|-----------------------------|--------|-----------------|------------------------------|------------------------|---------|------------|-------------------------|
| E22-400M22S | SX1268 | 433/470M | 22 | 7 | SMD | 14*20 | SPI |
| E22-900M22S | SX1262 | 868/915M | 22 | 7 | SMD | 14*20 | SPI |
| E22-400M33S | SX1268 | 433/470M | 33 | 16 | SMD | 24*38.5 | SPI |
| E22-900M30S | SX1262 | 868/915M | 30 | 12 | SMD | 24*38.5 | SPI |
| E22-230T22S | SX1262 | 230M | 22 | 5 | SMD | 16*26 | TTL |
| E22-400T22S | SX1268 | 433/470M | 22 | 5 | SMD | 16*26 | TTL |
| E22-900T22S | SX1262 | 868/915M | 22 | 5 | SMD | 16*26 | TTL |
| E22-230T30S | SX1262 | 230M | 30 | 10 | SMD | 25*40.5 | TTL |
| E22-400T30S | SX1268 | 433/470M | 30 | 10 | SMD | 25*40.5 | TTL |
| E22-900T30S | SX1262 | 868/915M | 30 | 10 | SMD | 25*40.5 | TTL |

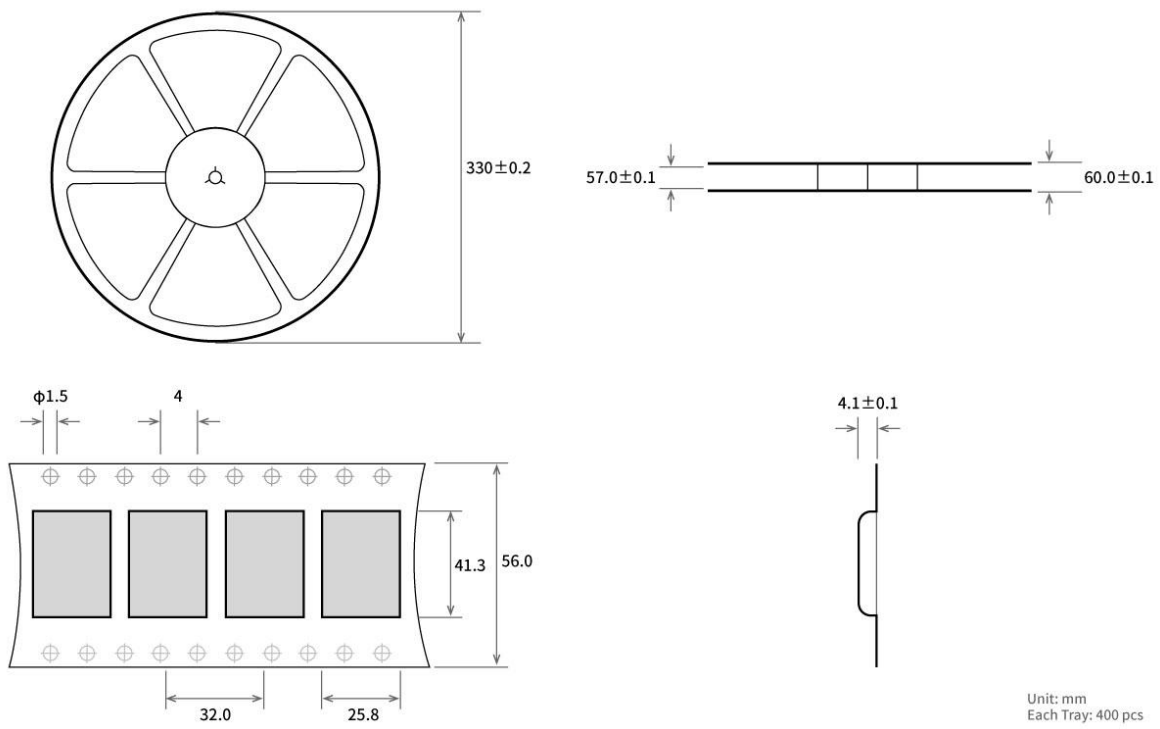
9. Antenna Guide

9.1 Antenna Recommendations

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

| SKU | Type | Frequency Hz | Interface | Gain dBi | Height mm | Feeders cm | Function |
|---|------------------------|-----------------|-----------|-------------|--------------|---------------|--|
| TX433-NP-431 0 | 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, Omni-directional Antenna |
| TX433-JZG-6 | Glue Stick Antenna | 433M | SMA-J | 2.5 | 62 | - | Ultra Short Straight, Omni-directional Antenna |
| TX433-JW-5 | Glue Stick Antenna | 433M | SMA-J | 2.0 | 50 | - | Bendable glue stick, omni-directional antenna |
| TX433-JWG-7 | Glue Stick Antenna | 433M | SMA-J | 2.5 | 75 | - | Bendable glue stick, omni-directional antenna |
| TX433-JK-11 | Glue Stick Antenna | 433M | SMA-J | 2.5 | 110 | - | 可 Bendable glue stick, omni-directional antenna |
| TX433-JK-20 | Glue Stick Antenna | 433M | SMA-J | 3.0 | 210 | - | 可 Bendable glue stick, omni-directional antenna |
| TX433-XPL-10 0 | Suction cup antenna | 433M | SMA-J | 3.5 | 185 | 100 | Small Suction cup antenna, Cost effectiveness |
| TX433-XP-200 | Suction cup antenna | 433M | SMA-J | 4.0 | 190 | 200 | Middle Suction cup antenna, Low loss |
| TX433-XP-30 0 | Suction cup antenna | 433M | SMA-J | 6.0 | 965 | 300 | Big Suction cup antenna, High Gain |
| TX490-JZ-5 | Glue Stick Antenna | 470/490M | SMA-J | 2.0 | 50 | - | Ultra Short Straight, Omni-directional Antenna |
| TX490-XPL-10 0 | Suction cup antenna | 470/490M | SMA-J | 3.5 | 120 | 100 | Small Suction cup antenna, Cost effectiveness |

10. Batch packing method



Revision history

| Version | Revision Date | Revision Notes | Maintaining people |
|---------|---------------|-----------------------|--------------------|
| 1.0 | 2022-10-20 | Manual Release | Yan |
| 1.1 | 2022-12-6 | Bug fixes | Yan |
| 1.2 | 2023-7-12 | Bug fixes | Hao |
| 1.3 | 2023-8-25 | Bug fixes | Bin |
| 1.4 | 2025-3-3 | Change module picture | LAU |

About us

Technical support: support@cdebyte.com

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

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

Official hotline: 028-61543675 ext. 821

Web: <https://www.cdebyte.com>

Address: , Building B5, Mould Industrial Park, 199# Xiqu Ave, High-tech Zone, Chengdu, 611731, Sichuan, China



Chengdu Ebyte Electronic Technology Co.,Ltd.