



# LOM202A

***DATA SHEET /REV0.7***

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## Document Information

|                    |                             |
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## Revision History

| <b>Version</b> | <b>Note</b>                                                                                                                                                                   |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.1            | Created.                                                                                                                                                                      |
| 0.2            | Updated Power Spec, Schematic.<br>Serial Number Rule and Label.                                                                                                               |
| 0.3            | Change the model name.                                                                                                                                                        |
| 0.4            | Change the sleep current consumption.<br>Redefine Table 5-1: LOM202A Pinout Table.                                                                                            |
| 0.5            | Add Recommended PCB design guide and update label design                                                                                                                      |
| 0.6            | Add Notice (Chapter. 10)                                                                                                                                                      |
| 0.7            | Change pinout description (Table 5-1)<br>Change frequency range information of variant model name (table 4-5)<br>Change label design (Section 7)<br>Delete Serial Number rule |

## Aim of this Document

The aim of this document is to give a detailed product description including interfaces, features and performance of the radio module LOM202A.

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# 1 Introduction

The LOM202A is a compact, low power, bidirectional radio module for the 863MHz ~ 928 MHz frequency band using Semtech's LoRa™ modulation technology. The module provides ultra-long range spread spectrum communication and high interference immunity whilst minimising current consumption.

This LOM202A is a highly-integrated, low power, bi-directional radio transceiver module optimized for use in the 917 MHz ISM and the 868 MHz ETSI frequency bands.

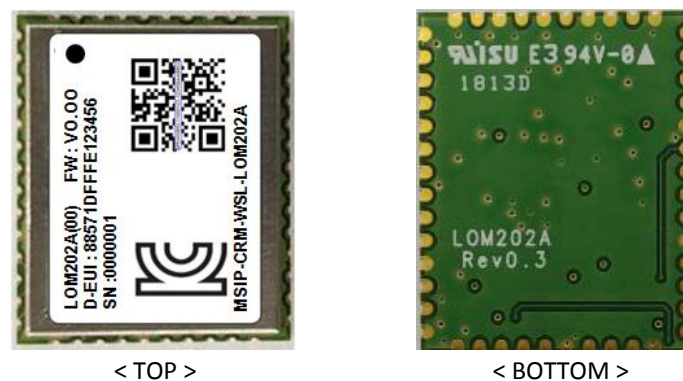


Figure 1-1: Picture of LOM202A (LOM202A00)

***“This device may cause radio interference while in use and may cause harmful interference from other devices”***

## 1.1 Key Features

- Compact module 15 x 18 x 2.2mm. (Typ.)
- LoRa™ modulation technology.
- Sensitivity down to -136dBm.
- UART and SPI interface.
- Low-Power Long Range Transceiver operating in the 917 MHz ISM and the 868MHz ETSI frequency band
- Supply voltage range from 3.0 to 3.6V.
- RF interface optimized to 50 Ω.
- Output Power Level up to +14dBm
- STM32L071CZY6TR

## 1.2 Applications

- Automated Meter Reading.
- Wireless Networks.
- Home-, Building- and Industrial Automation.
- Industrial Monitoring and Control
- Wireless Sensors.
- Wireless Alarm and Security Systems.

## 2 Module Overview

The LOM202A is an ultra-long range, high-performance, pre-certified module for wireless communication. It includes all necessary passive components for wireless communication as depicted in the following figure.

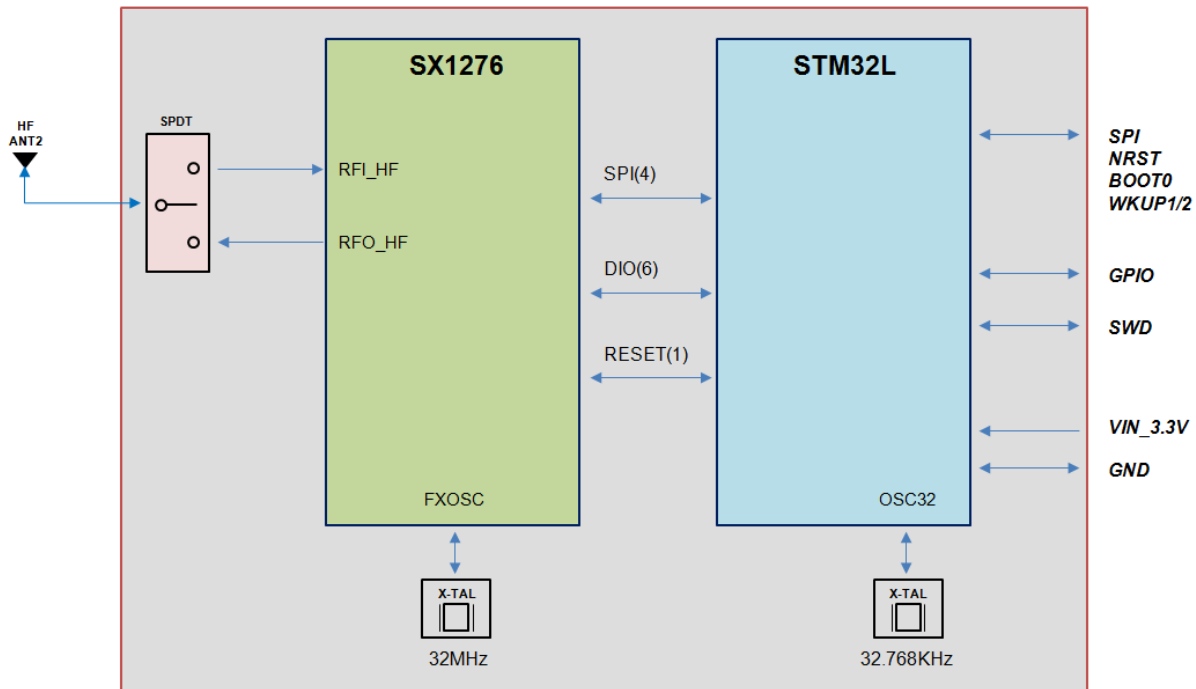


Figure 2-1: Block Diagram of Radio Module LOM202A

The LOM202A uses Semtech's patented LoRa modulation technique which combines spread spectrum modulation and forward error correction techniques to increase the range and robustness of radio communication links compared with traditional FSK or OOK based modulation. Typically examples of LOM202A receive performances are given in the following table.

| SF   | 125kHz | 250kHz | 500kHz | Unit |
|------|--------|--------|--------|------|
| SF6  | -118   | -115   | -111   | dBm  |
| SF7  | -123   | -120   | -116   | dBm  |
| SF8  | -126   | -123   | -119   | dBm  |
| SF9  | -129   | -125   | -122   | dBm  |
| SF10 | -132   | -128   | -125   | dBm  |
| SF11 | -133   | -130   | -128   | dBm  |
| SF12 | -136   | -133   | -130   | dBm  |

Table 2-1: Typically Radio Performance of LOM202A

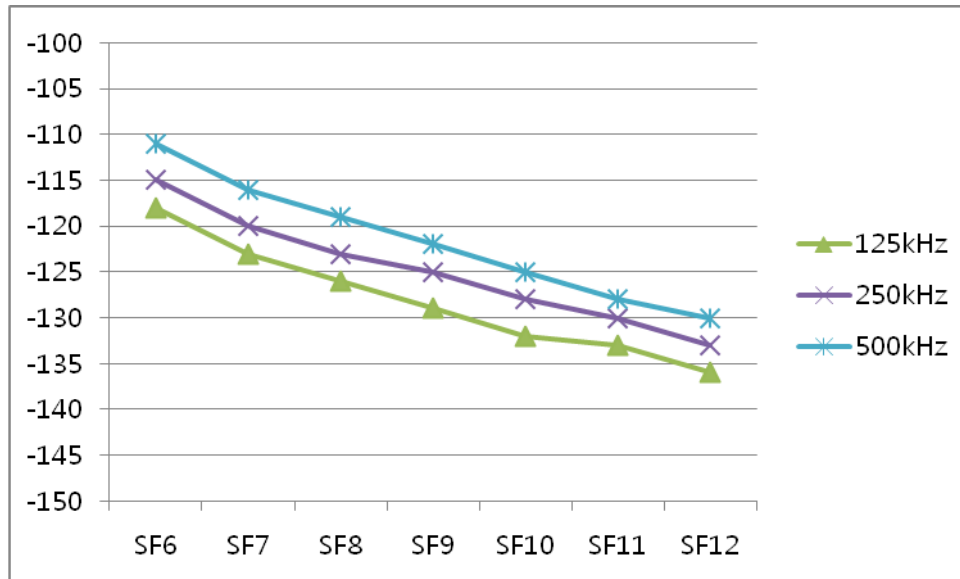


Figure 2-1: Typically Radio Performance Graph of LOM202A

The wide range of capabilities provided by the LOM202A can be tested by using our EVB.

### 3 LoRa Modulation Technique

The LOM202A uses Semtech's LoRa proprietary spread spectrum modulation technique. This modulation, in contrast to conventional modulation techniques, permits an increase in link budget and increased immunity to in-band interference. It achieves sensitivities 8 dB better than FSK modulation.

LoRa also provides significant advantages in both blocking and selectivity, solving the traditional design compromise between range, interference immunity and energy consumption.

In LoRa mode the LOM202A offers three bandwidth options of 125 kHz, 250 kHz, and 500 kHz with spreading factors ranging from 7 to 12.

The spread spectrum LoRa modulation is performed by representing each bit of payload information by multiple chips of information. The rate at which the spread information is sent is referred to as the symbol rate ( $R_s$ ), the ratio between the nominal symbol rate and chip rate is the spreading factor and represents the number of symbols sent per bit of information. The range of parameters which can be configured are given in the following tables.

| Spreading Factor | Chips/Symbol | SNR/[dB] |
|------------------|--------------|----------|
| 7                | 128          | -7.5     |
| 8                | 256          | -10      |
| 9                | 512          | -12.5    |
| 10               | 1024         | -15      |
| 11               | 2048         | -17.5    |
| 12               | 4096         | -20      |

*Table 3-1: Spreading Factors of Sx1272*

Note that the spreading factor must be known in advance on both transmit and receive sides of the radio link as different spreading factors are orthogonal to each other. Note also the resulting signal to noise ratio (SNR) required at the receiver input. It is the capability to receive signals with negative SNR that increases the sensitivity, so link budget and range, of the LoRa receiver.

To further improve the robustness of the radio link LOM202A provides cyclic error coding with different coding rates. With using this coding scheme forward error detection and correction can be applied.

| Coding Rate | Cyclic Coding Rate | Overhead Ratio |
|-------------|--------------------|----------------|
| 1           | 4/5                | 1.25           |
| 2           | 4/6                | 1.5            |
| 3           | 4/7                | 1.75           |
| 4           | 4/8                | 2              |

*Table 3-2: Coding Rate of LOM202A*

## 4 Electrical Characteristics

In the following different electrical characteristics of the LOM202A are listed. Furthermore details and other parameter ranges are available on request.

- Note: Stress exceeding of one or more of the limiting values listed under “Absolute Maximum Ratings” may cause permanent damage to the radio module

### 4.1 Absolute Maximum Ratings

| Parameter                                                       | Condition | Min | Typ. | Max | Unit |
|-----------------------------------------------------------------|-----------|-----|------|-----|------|
| Supply Voltage (VDD)                                            |           | 3.0 | 3.3  | 3.6 | V    |
| Storage Temperature                                             |           | -40 | -    | +85 | °C   |
| Operating Temperature                                           |           | -30 | -    | +70 | °C   |
| RF Input Power                                                  |           |     |      | +10 | dBm  |
| Notes:                                                          |           |     |      |     |      |
| 1) Unless otherwise noted, all voltages are with respect to GND |           |     |      |     |      |

Table 4-1: Absolute Maximum Ratings

### 4.2 Global Electrical Characteristics

T = 25°C, VDD = 3.3 V (typ.) if nothing else stated

| Parameter                                                       | Condition                           | Min | Typ.   | Max | Unit |
|-----------------------------------------------------------------|-------------------------------------|-----|--------|-----|------|
| Supply Voltage (VDD)                                            | Note 1                              | 3.0 | 3.3    | 3.6 | V    |
| Current Consumption                                             | Sleep                               |     | 1.4    | 10  | uA   |
|                                                                 | Receive                             |     | 18     |     | mA   |
|                                                                 | Transmit<br>RF power level<br>10dBm |     | 36     |     | mA   |
| Operation Clock Frequency                                       | Transceiver                         |     | 32     |     | MHz  |
|                                                                 | MCU RTC                             |     | 32.768 |     | kHz  |
| Notes:                                                          |                                     |     |        |     |      |
| 1) Unless otherwise noted, all voltages are with respect to GND |                                     |     |        |     |      |

Table 4-2: General Characteristics



### 4.3 Module Interface Characteristics

T = 25°C, VDD = 3.3 V (typ.) if nothing else stated

| Parameter                              | Condition                | Min      | Typ.  | Max     | Unit |
|----------------------------------------|--------------------------|----------|-------|---------|------|
| Digital output voltage<br>(high level) | All I/Os                 | 0.7VDD   |       |         | V    |
| Digital output voltage<br>(low level)  | TC, FT, FTf, RST I/Os    |          |       | 0.3VDD  | V    |
|                                        | BOOT0                    |          |       | 0.14VDD |      |
| Digital input voltage<br>(high level)  | $I_{IO} = -4 \text{ mA}$ | VDD-0.45 |       |         | V    |
|                                        |                          |          |       |         | V    |
| Digital input voltage<br>(low level)   | $I_{IO} = +4 \text{ mA}$ |          |       | 0.45    | V    |
| UART baud rate                         |                          |          | 115.2 |         | kbps |

Table 4-3: Module Interface Characteristics

### 4.4 RF Characteristics

#### 4.4.1 Output Power vs. Power table

| Power table                                       |                           |
|---------------------------------------------------|---------------------------|
| Input Power / dBm                                 | Output Power (Typ.) / dBm |
| 0                                                 | -1.3                      |
| 1                                                 | -0.3                      |
| 2                                                 | 0.8                       |
| 3                                                 | 1.9                       |
| 4                                                 | 3.0                       |
| 5                                                 | 4.1                       |
| 6                                                 | 5.2                       |
| 7                                                 | 6.3                       |
| 8                                                 | 7.5                       |
| 9                                                 | 8.8                       |
| 10                                                | 9.9                       |
| 11                                                | 11.1                      |
| 12                                                | 12.0                      |
| 13                                                | 12.9                      |
| 14                                                | 13.5                      |
| Note:<br>TX : S/F7, 125KHz BW, Frequency 922.7MHz |                           |

Table 4-4: Output Power vs. Power table

#### 4.4.2 Transmitter RF Characteristics

The LOM202A has an excellent transmitter performance as given by Table 4-5

\* T = 25°C, VDD = 3.3 V (typ.), 917 MHz if nothing else stated

| Parameter                                                                                                                                                                                             | Condition    | Min | Typ. | Max | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----|------|-----|------|
| Frequency Range <sup>(1)</sup>                                                                                                                                                                        |              | 863 | -    | 928 | MHz  |
| RF Output Power                                                                                                                                                                                       | 917 MHz Band |     |      | 14  | dBm  |
| Modulation Techniques                                                                                                                                                                                 | LoRa™        |     |      |     |      |
| TX Frequency Tolerance                                                                                                                                                                                | 25°C         | -   | ±20  | -   | ppm  |
| Note (1) : Frequency range<br>- LOM202A00: 917MHz ~ 923.5MHz<br>- LOM202AZ0 : KR920-923<br>- LOM202A01 : 863MHz ~ 928MHz<br>- LOM202A10 : EU863-870<br>- LOM202A20 : US902-928<br>- LOM202A30 : AS923 |              |     |      |     |      |

Table 4-5: Transmitter RF Characteristics

## 5 Module Package

In the following the LOM202A module package is described. This description includes the LOM202A pinout as well as the modules dimensions. Furthermore a recommendation for a suitable footprint is given, which should be used for further mounting on appropriate carrier boards.

## 5.1 Pinout Description

Figure 5-1 depicts a description of the LOM202A's pads on the bottom side. The figure shows the module with its pinout in top view (right figure). A detailed description of the individual pins can be found in Table 5-1: LOM202A Pinout Table.

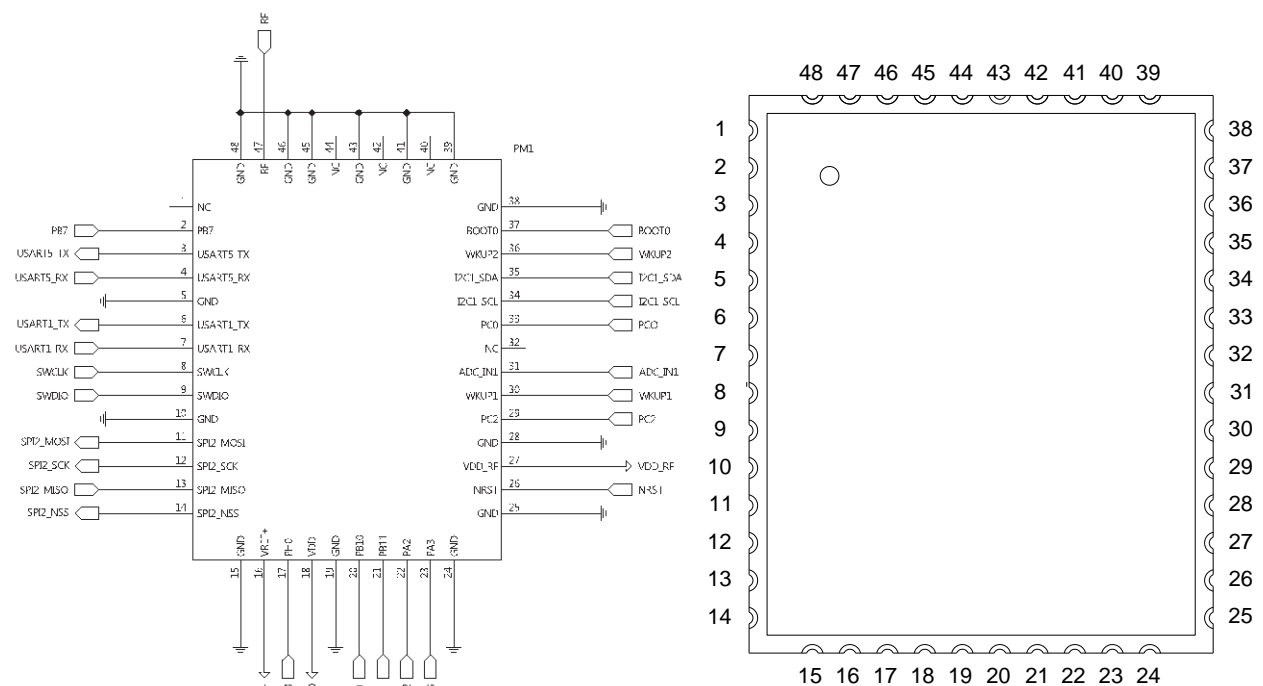


Figure 5-1: Description of LOM202A module pins and top view

| PIN | PIN Name  | PIN Type | MCU Pin | Description                                   |
|-----|-----------|----------|---------|-----------------------------------------------|
| 1   | NC        | -        | -       | Not connection                                |
| 2   | PB7       | I/O      | PB7     | Boot Loader (High Active)                     |
| 3   | USART5_TX | I/O      | PB3     | UART TX                                       |
| 4   | USART5_RX | I/O      | PB4     | UART RX                                       |
| 5   | GND       | Supply   | -       | Ground connection                             |
| 6   | USART1_TX | I/O      | PA9     | UART TX for Firmware download                 |
| 7   | USART1_RX | I/O      | PA10    | UART RX for Firmware download                 |
| 8   | SWCLK     | I/O      | PA14    | SWCLK                                         |
| 9   | SWDIO     | I/O      | PA13    | SWDIO                                         |
| 10  | GND       | Supply   | -       | Ground connection                             |
| 11  | SPI2_MOSI | I/O      | PB15    | sleep state: 0, Normal(wake-up) state:1       |
| 12  | NC        | -        | -       | Not connection                                |
| 13  | NC        | -        | -       | Not connection                                |
| 14  | SPI2_NSS  | I/O      | PB12    | Payload data bit 3 (TBD)                      |
| 15  | GND       | Supply   | -       | Ground connection                             |
| 16  | VREF+     | Supply   | VREF+   | Positive reference voltage                    |
| 17  | NC        | -        | -       | Not connection                                |
| 18  | VDD       | Supply   |         | Supply voltage                                |
| 19  | GND       | Supply   | -       | Ground connection                             |
| 20  | PB10      | I/O      | PB10    | Payload data bit 0 (TBD)                      |
| 21  | PB11      | I/O      | PB11    | Payload data bit 1 (TBD)                      |
| 22  | NC        | -        | -       | Not connection                                |
| 23  | PA3       | I/O      | PA3     | Payload data bit 4 ~ 15 (TBD)                 |
| 24  | GND       | Supply   | -       | Ground connection                             |
| 25  | GND       | Supply   | -       | Ground connection                             |
| 26  | NRST      | I/O      | NRST    | Reset                                         |
| 27  | VDD_RF    | Supply   | -       | SX1276 Supply voltage                         |
| 28  | GND       | Supply   | -       | Ground connection                             |
| 29  | PC2       | I/O      | PC2     | Battery Level 12bit (TBD)                     |
| 30  | WKUP1     | I/O      | PA0     | Wake Up: Rising Edge, Payload data bit2 (TBD) |
| 31  | NC        | -        | -       | Not connection                                |
| 32  | NC        | -        | -       | Not connection                                |
| 33  | NC        | -        | -       | Not connection                                |

| PIN | PIN Name | PIN Type | MCU Pin | Description                                          |
|-----|----------|----------|---------|------------------------------------------------------|
| 34  | NC       | -        | -       | Not connection                                       |
| 35  | NC       | -        | -       | Not connection                                       |
| 36  | NC       | -        | -       | Not connection                                       |
| 37  | NC       | -        | -       | Not connection                                       |
| 38  | GND      | Supply   | -       | Ground connection                                    |
| 39  | GND      | Supply   | -       | Ground connection                                    |
| 40  | NC       | -        | -       | Not connection                                       |
| 41  | GND      | Supply   | -       | Ground connection                                    |
| 42  | NC       | -        | -       | Not connection                                       |
| 43  | GND      | Supply   | -       | Ground connection                                    |
| 44  | NC       | -        | -       | Not connection                                       |
| 45  | GND      | Supply   | -       | Ground connection                                    |
| 46  | GND      | Supply   | -       | Ground connection                                    |
| 47  | RF       | I/O      | -       | External 50Ω port for monostatic antenna connection. |
| 48  | GND      | Supply   | -       | Ground connection                                    |

Table 5-1: LOM202A Pinout Table

## 5.2 Module Dimensions

The outer dimensions of the LOM202A are given by Figure 5-2.

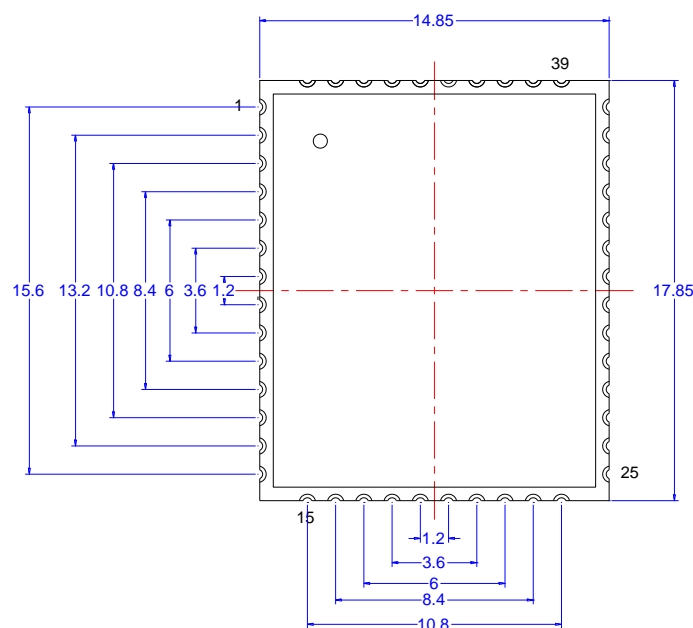


Figure 5-2: Outer Dimensions of the LOM202A (top view)

### 5.3 Recommended Footprint

According to Chapter 5.2, a recommendation for the footprint of the LOM202A is given by Figure 5-3.

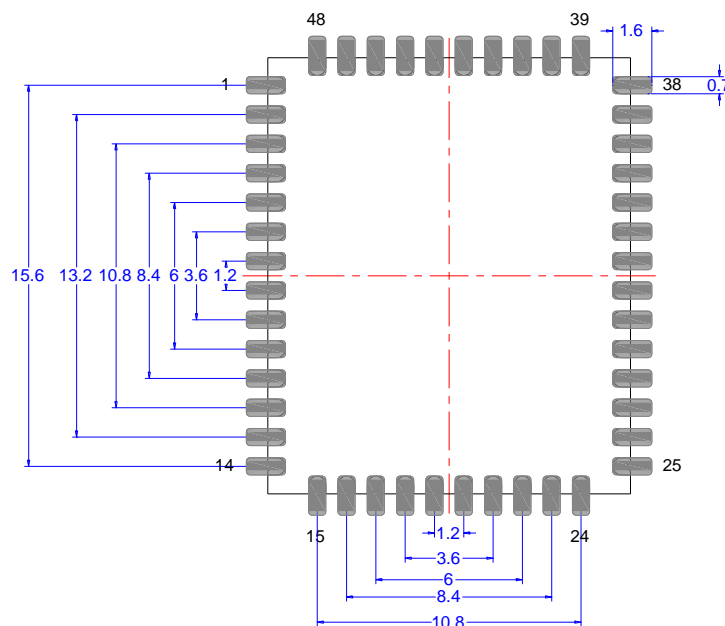
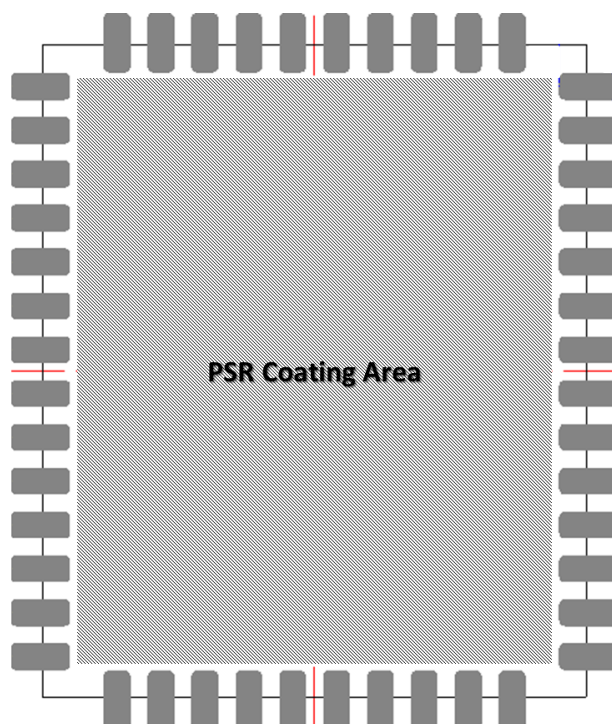


Figure 5-3: Recommended footprint of the LOM202A (top view)

### 5.4 Recommended PCB design guide

To protect a contact short or electrical shock when LOM202A module is mounted on customer's board, we recommend PSR ink-coating of top side at module mount area on customer's board as Figure 5-4.



## 6 Integration Guide

The LOM202A provides 48 connectors as described in Chapter 5. For integrating the LOM202A into an environment, a typically circuit as given in Chapter 6.1 can be used.

### 6.1 Typical Application Schematic

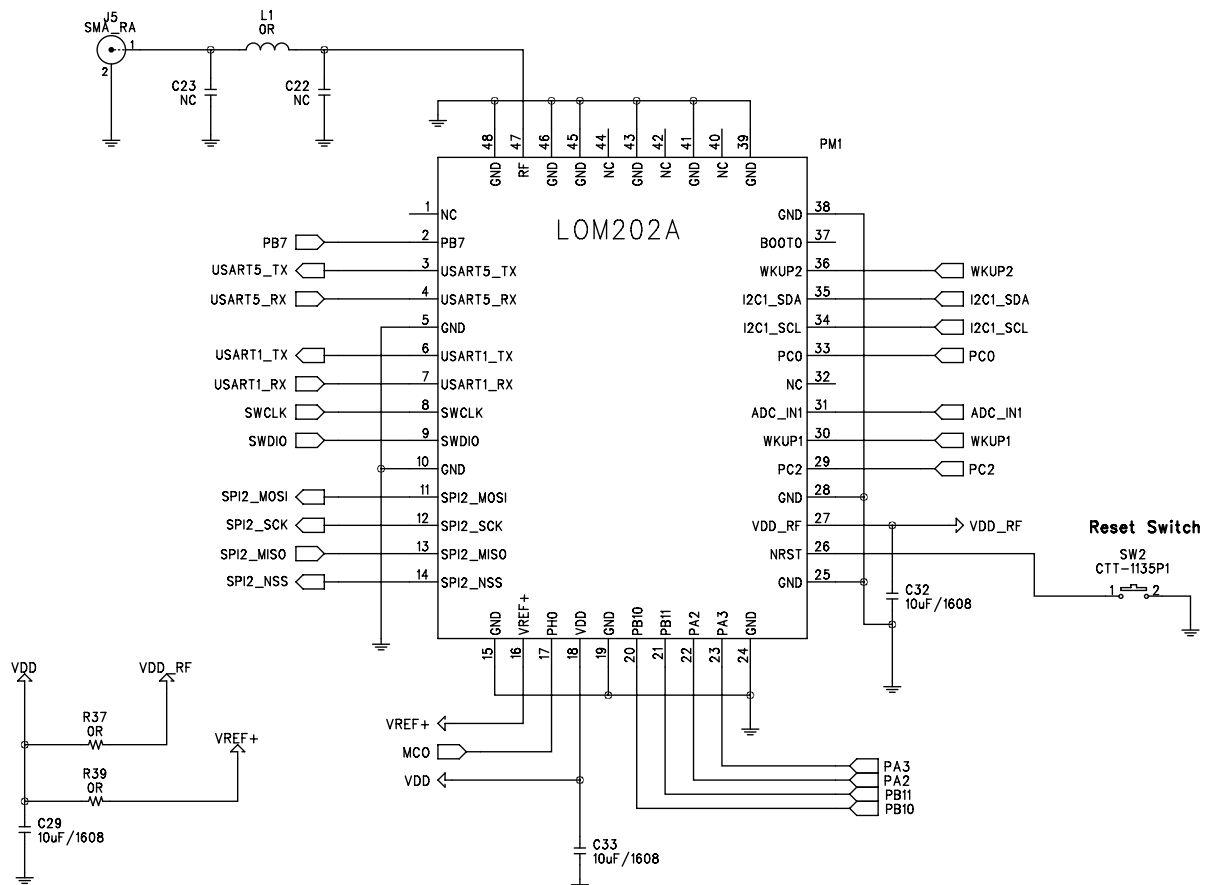


Figure 6-1: Typical Application Schematic for LOM202A

## 7 Label

### LOM202A00 Label (Size : 15 x 11mm)



### LOM202A Regulatory Certification

|        |                      |
|--------|----------------------|
| KC     | MSIP-CRM-WSL-LOM202A |
| TELEC  | 011-170063           |
| CE RED | Certified            |
| FCC    | TBD                  |
| IC     | TBD                  |
| ANATEL | TBD                  |

### LOM202A Product Information

|                     | Label Description Example |
|---------------------|---------------------------|
| Product Part Number | WSLOM202A00               |
| D-EUI               | 702C1FFFE123456           |
| Lot Number          | LACJA1001                 |

### LOM202A OR-code Information



|                     | QR Code info.               |
|---------------------|-----------------------------|
| Product Part Number | 9 digits, LOM202AXX         |
| D-EUI               | 16 digits, XXXXXXXXXXXXXXXX |



## 8 Packing

TBD

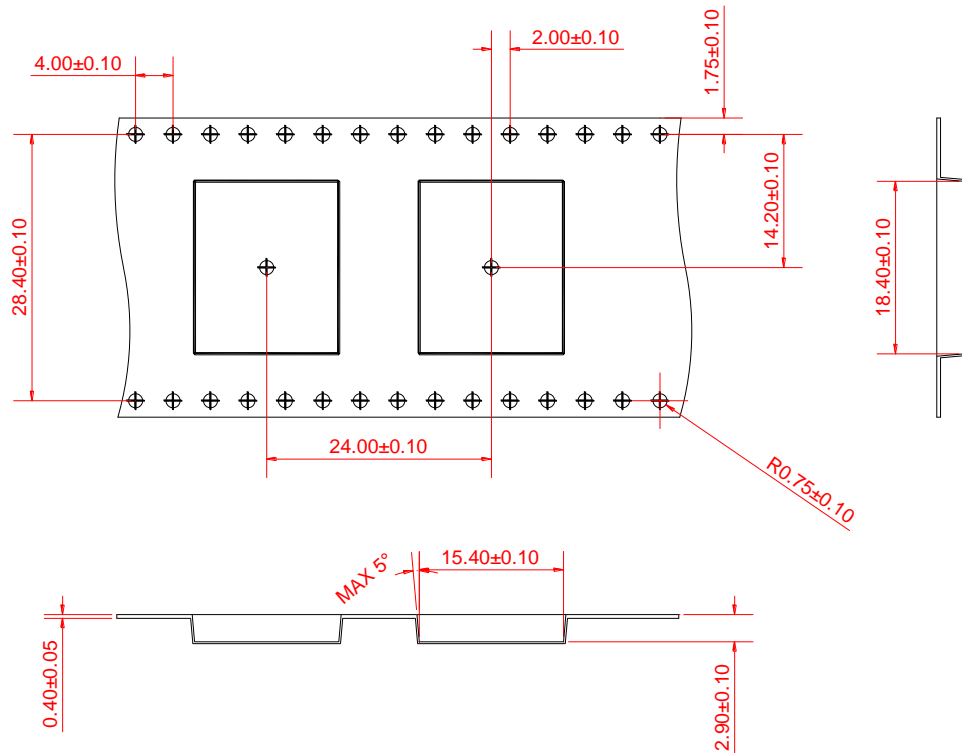
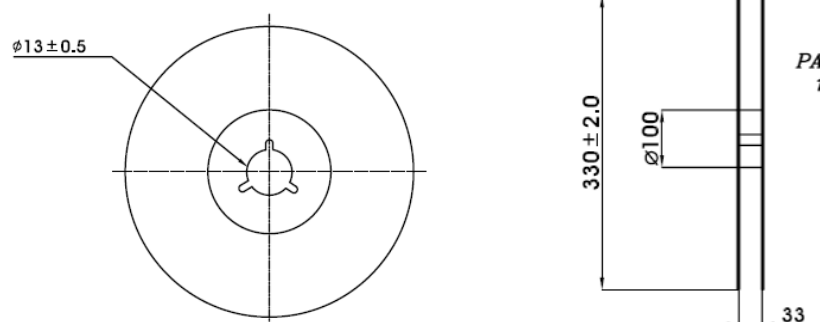


Figure 7: Reel packing of LOM202A



## 9. Notice

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