



LSM110A

High-Power Module

DATA SHEET / REV0.2

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Document Information

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| 0.0 | Preliminary. |
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Aim of this Document

The aim of this document is to give a detailed product description including interfaces, features and performance of the module LSM110A.

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1 Introduction

The LSM110A is a compact, low power, bidirectional radio module for the LoRa™ & Sigfox modulation technology. The module provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

This LSM110A is a highly-integrated, low power, bi-directional radio transceiver module optimized for use in the sub-1GHz ISM bands.

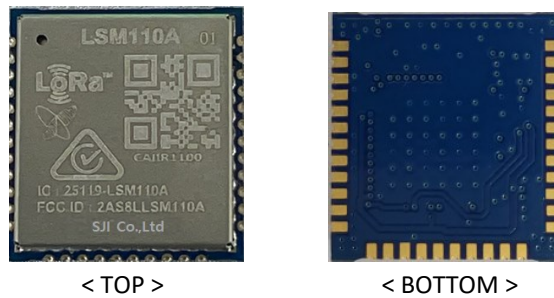


Figure 1-1: Picture of LSM110A

1.1 Key Features

- Compact module 14 x 15 x 2.8mm. (Typ.)
- LoRa™ modulation technology.
- Sigfox modulation technology.
- Sensitivity down to -129dBm@LoRa(BW=500KHz, SF=12)
-124dBm@Sigfox(0.6Kbps)
- UART interface.
- Low-Power Long Range Transceiver operating in the sub-1GHz ISM band
- Supply voltage range from 1.8 to 3.6V.
- RF interface optimized to 50 Ω.
- Output Power, programmable up to +22dBm
- STM32WLE5CC

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 Description

The LSM110A is an ultra-long range, high-performance, pre-certified module for wireless communication. The module is solder-able like a SMD component and can easily be mounted on a simple carrier board with a minimum of required external connections.

This module supports LoRa™ & Sigfox, and can be converted to LoRa mode and Sigfox mode with commands.

It includes all necessary passive components for wireless communication as depicted in the following figure.

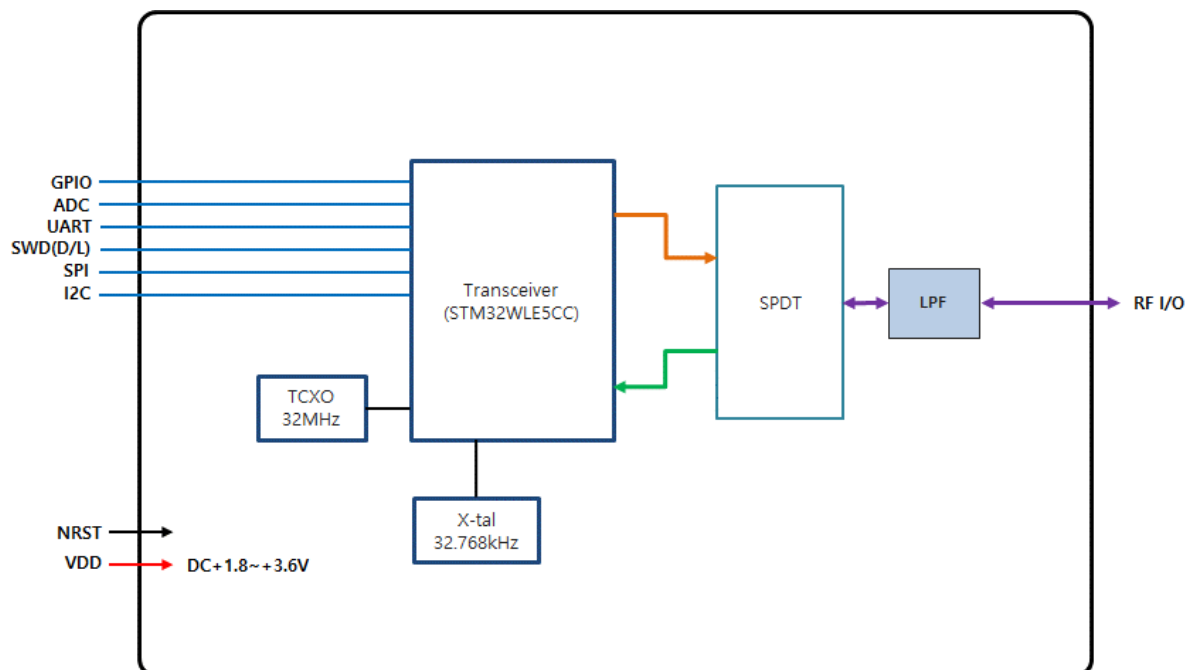


Figure 2-1: Block Diagram

3 Electrical Characteristics

In the following different electrical characteristics of the LSM110A are listed.

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

3.1 Absolute Maximum Ratings

| Parameter | Condition | Min | Typ. | Max | Unit |
|-----------------------|-----------|-----|------|-----|------|
| Supply Voltage (VDD) | | 0 | 3.3 | 3.9 | V |
| Storage Temperature | | -40 | - | +85 | °C |
| Operating Temperature | | -30 | - | +85 | °C |
| RF Input Power | | | | +0 | dBm |
| ESD | | -2 | | +2 | kV |

Notes:
1) Unless otherwise noted, all voltages are with respect to GND

Table 3-1-1: Absolute Maximum Ratings

3.2 General 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 | 1.8 | 3.3 | 3.6 | V |
| Current Consumption | Sleep(stop2) | | 1.8 | 5 | uA |
| | Receive | | 5 | | mA |
| | Transmit (RF power +21dBm) | | 123 | | 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 3-2-1: General Characteristics

3.3 Module Interface Characteristics

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|--------|------------------------------|-------------------|---------|-----|---------|------|
| VIL | I/O input low-level voltage | 1.8V < VDD < 3.6V | | | 0.3xVDD | V |
| VIH | I/O input High-level voltage | | 0.7xVDD | | | V |
| Vhys | input hysteresis | | | 200 | | mV |
| BR | UART baud rate | | | 9.6 | | kbps |

Table 3-3-1: Module Interface Characteristics

3.4 RF Characteristics

3.4.1 Transmitter

<LoRa>

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

| Parameter | Condition | Min | Typ. | Max | Unit |
|--|-----------|-------|------|-------|------|
| Frequency Range ⁽¹⁾ | US | 902 | - | 928 | MHz |
| | AU | 915 | - | 928 | MHz |
| | AS1 | 920.5 | - | 923.5 | MHz |
| RF Output Power | | | 21 | | dBm |
| Modulation Techniques | LoRa™ | | | | |
| TX Frequency Tolerance | 25°C | -2.5 | - | 2.5 | ppm |
| Note(1): Frequency range(MHz) - US902-928 - AU915-928 - AS923 | | | | | |

Table 3-4-1-1: LoRa Transmitter Spec.

<Sigfox>

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

| Parameter | Condition | Min | Typ. | Max | Unit |
|---|-----------|---------|-------|---------|------|
| Frequency Range ⁽¹⁾ | RC2 | 902.104 | 902.2 | 902.296 | MHz |
| | RC4 | 920.704 | 920.8 | 920.896 | MHz |
| RF Output Power | | | 21 | | dBm |
| Modulation Techniques | Sigfox | | | | |
| TX Frequency Tolerance | 25°C | -2.5 | - | 2.5 | ppm |
| Note(1): Frequency range(MHz) - RC2 902.2 +/-0.096 - RC4 920.8 +/-0.096 | | | | | |

Table 3-4-1-2: Sigfox Transmitter Spec.

3.4.2 Receive Sensitivity

<LoRa>

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

| Item | 125KHz | | 250KHz | | 500KHz | | Unit |
|------|----------|----------|----------|----------|----------|----------|------|
| | 902.3MHz | 923.3MHz | 902.3MHz | 923.3MHz | 902.3MHz | 923.3MHz | |
| SF7 | -125 | -125 | -122 | -121 | -118 | -118 | dBm |
| SF8 | -127 | -127 | -125 | -125 | -120 | -120 | dBm |
| SF9 | -131 | -131 | -128 | -127 | -123 | -123 | dBm |
| SF10 | -133 | -133 | -130 | -131 | -126 | -126 | dBm |
| SF11 | -135 | -135 | -132 | -133 | -128 | -127 | dBm |
| SF12 | -138 | -137 | -135 | -135 | -130 | -129 | dBm |

Table 3-4-2-1: LoRa Receive Sensitivity

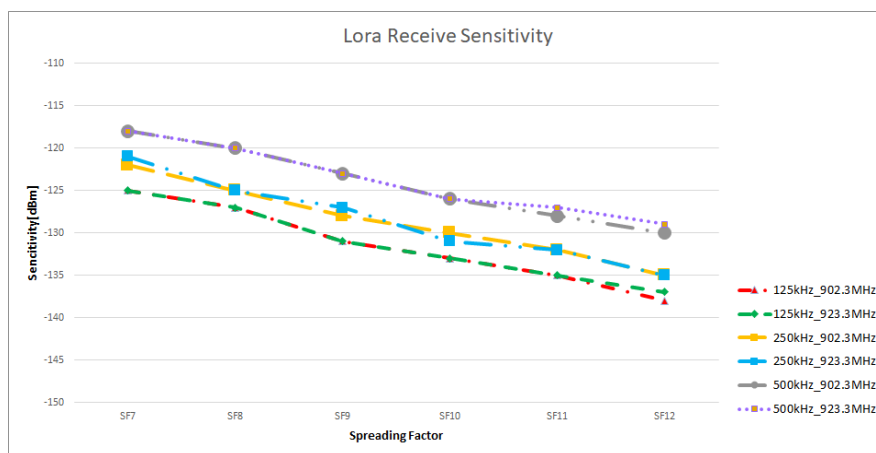


Figure 3-4-2-1: LoRa Receive Sensitivity Graph

<Sigfox>

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

| Item | Frequency(MHz) | Sensitivity(0.6Kbps) | Unit |
|------|----------------|----------------------|------|
| RC2 | 905.2 | -124.5 | dBm |
| RC4 | 922.3 | -124 | dBm |

Table 3-4-2-2: Sigfox Receive Sensitivity

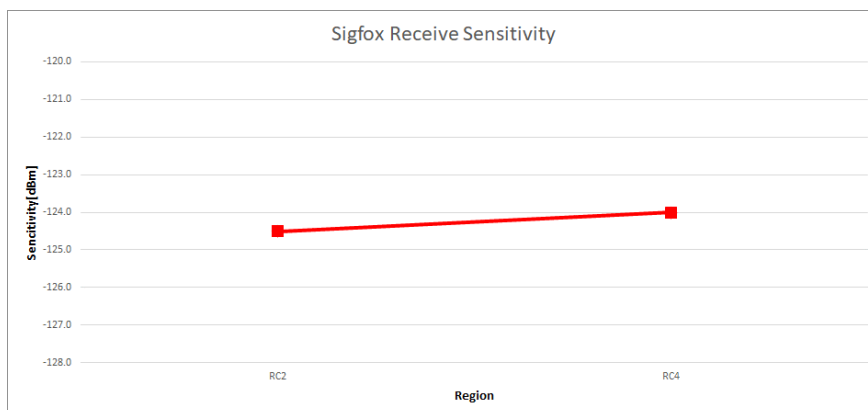


Figure 3-4-2-2: Sigfox Receive Sensitivity Graph

3.4.3 Output Power vs. Setting Value

<LoRa>

| Setting Value ⁽¹⁾ | Output Power (Typ.) / dBm | | | |
|------------------------------|---------------------------|----------|----------|----------|
| | 902.3MHz | 908.9MHz | 915.2MHz | 927.8MHz |
| 15 | 14.2 | 14.1 | 14 | 13.9 |
| 16 | 15.2 | 15.1 | 15 | 14.9 |
| 17 | 16.3 | 16.2 | 16.1 | 16.0 |
| 18 | 17.5 | 17.5 | 17.4 | 17.2 |
| 19 | 18.6 | 18.6 | 18.4 | 18.2 |
| 20 | 19.7 | 19.6 | 19.5 | 19.4 |
| 21 | 20.7 | 20.7 | 20.6 | 20.4 |
| 22 | 21.3 | 21.3 | 21.2 | 21.1 |

Note(1): Available setting Value(0~22)

Table 3-4-3-1: LoRa Output Power vs. Setting Value

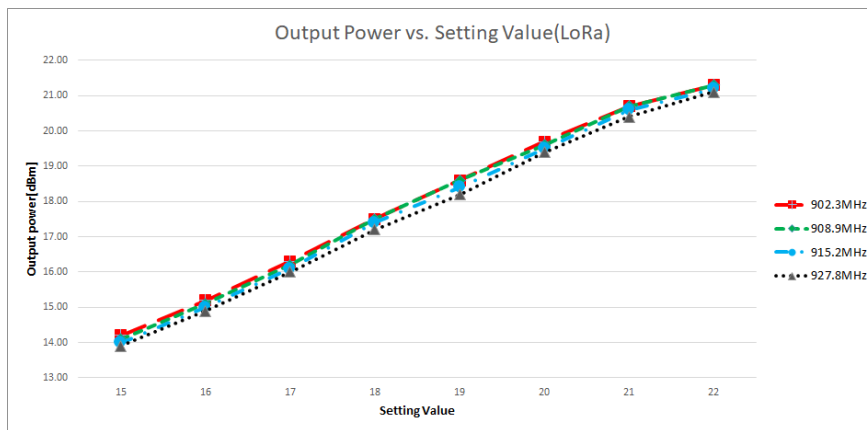


Figure 3-4-3-1: LoRa Output Power vs. Setting Value Graph

<Sigfox>

| Setting Value ⁽¹⁾ | Output Power (Typ.) / dBm | |
|------------------------------|---------------------------|----------|
| | 902.2MHz | 920.8MHz |
| 15 | 14.2 | 14.1 |
| 16 | 15.2 | 15.0 |
| 17 | 16.3 | 16.1 |
| 18 | 17.5 | 17.3 |
| 19 | 18.6 | 18.4 |
| 20 | 19.7 | 19.5 |
| 21 | 20.8 | 20.6 |
| 22 | 21.3 | 21.2 |

Note(1): Available setting Value(0~22)

Table 3-4-3-2: Sigfox Output Power vs. Setting Value

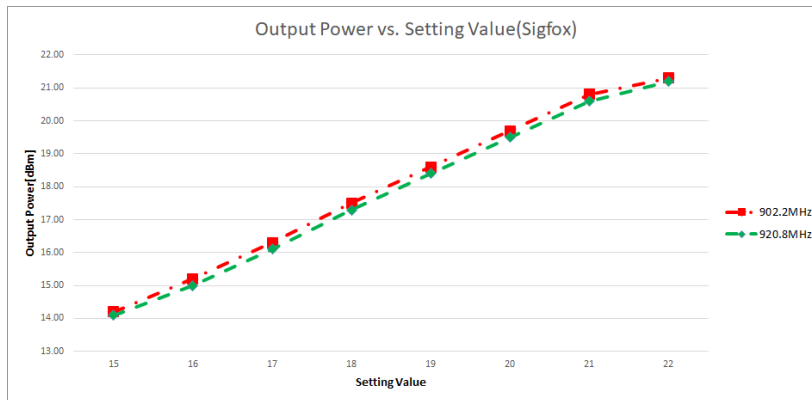


Figure 3-4-2: Sigfox Output Power vs. Setting Value Graph

3.4.4 Output Power vs. Input Voltage(VDD) table

<LoRa>

| Input Voltage(VDD) | Output Power (Typ.) / dBm | | | |
|--------------------|---------------------------|----------|----------|----------|
| | 902.3MHz | 908.9MHz | 915.2MHz | 927.8MHz |
| 1.8 | 16.5 | 16.4 | 16.3 | 16.1 |
| 2.0 | 17.3 | 17.3 | 17.2 | 17.1 |
| 2.3 | 18.6 | 18.5 | 18.4 | 18.2 |
| 2.5 | 19.2 | 19.1 | 19.0 | 18.9 |
| 3.0 | 20.5 | 20.4 | 20.4 | 20.2 |
| 3.3 | 21.3 | 21.3 | 21.2 | 21.1 |
| 3.6 | 21.7 | 21.7 | 21.6 | 21.5 |

Note:

Table 3-4-4-1: LoRa Output Power vs. Input Voltage

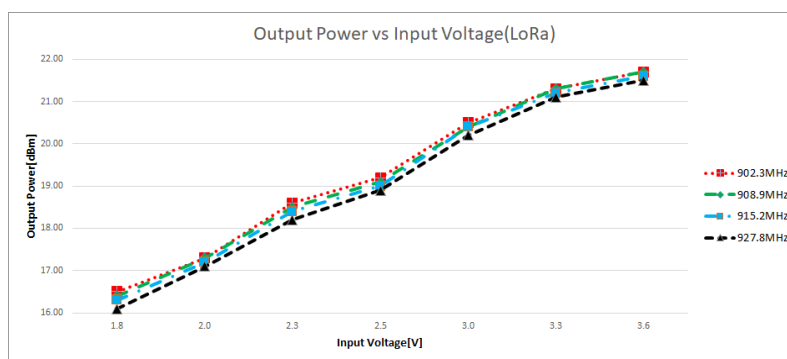


Figure 3-4-4-1: LoRa Output Power vs. Input Voltage Graph

<Sigfox>

| Input Voltage(VDD) | Output Power (Typ.) / dBm | |
|--------------------|---------------------------|----------|
| | 902.2MHz | 920.8MHz |
| 1.8 | 16.4 | 16.2 |
| 2.0 | 17.4 | 17.2 |
| 2.3 | 18.6 | 18.4 |
| 2.5 | 19.2 | 19.1 |
| 3.0 | 20.5 | 20.4 |
| 3.3 | 21.3 | 21.2 |
| 3.6 | 21.8 | 21.6 |

Note:

Table 3-4-4-2: Sigfox Output Power vs. Input Voltage

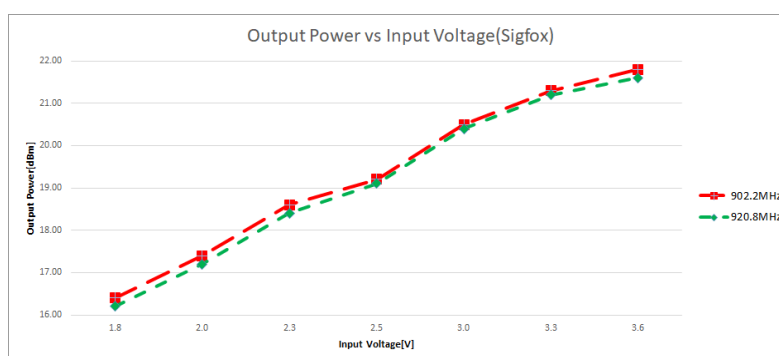


Figure 3-4-4-2: Sigfox Output Power vs. Input Voltage Graph

3.4.5 Output Power vs. Temp. table

<LoRa>

| Temp. / °C | Output Power (Typ.) / dBm | | | |
|------------|---------------------------|----------|----------|----------|
| | 902.3MHz | 908.9MHz | 915.2MHz | 927.8MHz |
| -30 | 21.7 | 21.7 | 21.6 | 21.6 |
| 25 | 21.3 | 21.3 | 21.2 | 21.1 |
| 85 | 20.5 | 20.4 | 20.4 | 20.3 |

Note:

Table 3-4-5-1: LoRa Output Power vs. Temp.

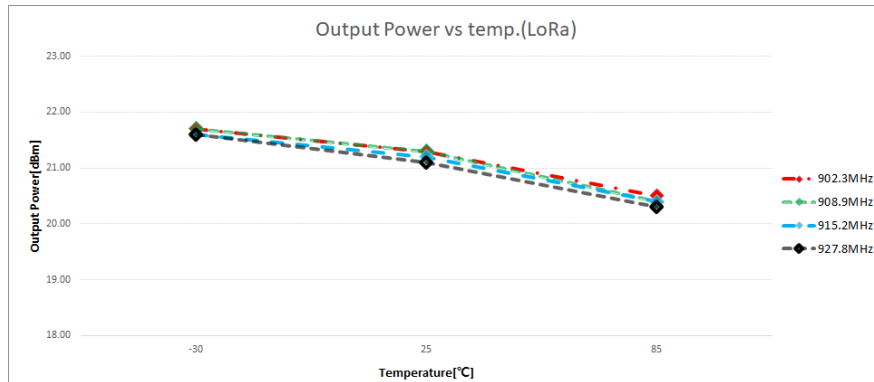


Figure 3-4-5-1: LoRa Output Power vs. Temp. Graph

<Sigfox>

| Temp. / °C | Output Power (Typ.) / dBm | |
|------------|---------------------------|----------|
| | 902.2MHz | 920.8MHz |
| -30 | 21.7 | 21.6 |
| 25 | 21.3 | 21.2 |
| 85 | 20.5 | 20.4 |

Note:

Table 3-4-5-2: Sigfox Output Power vs. Temp.

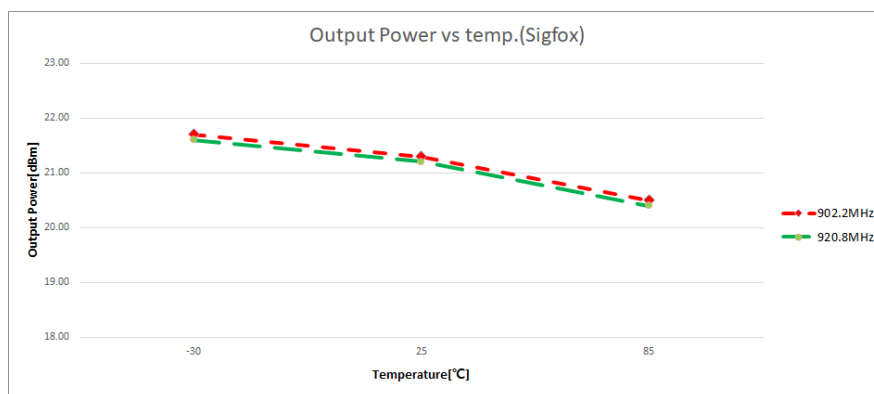


Figure 3-4-5-2: Sigfox Output Power vs. Temp. Graph

4 Inspection

<LoRa>

| Parameter | Condition | Min | Typ. | Max | Unit |
|------------------------|------------------|------|------|------|------|
| RF Output Power | 902.3MHz | 19 | - | 23 | dBm |
| | 928MHz | 19 | - | 23 | dBm |
| TX Frequency Tolerance | 25°C | -2.5 | - | 2.5 | ppm |
| Receive Sensitivity | <10%(SF7/125KHz) | - | - | -123 | dBm |

<Sigfox>

| Parameter | Condition | Min | Typ. | Max | Unit |
|------------------------|-----------|------|------|------|------|
| RF Output Power | 902.2MHz | 19 | - | 23 | dBm |
| | 920.8MHz | 19 | - | 23 | dBm |
| TX Frequency Tolerance | 25°C | -2.5 | - | 2.5 | ppm |
| Receive Sensitivity | <10% | - | - | -123 | dBm |

5 Module Package

In the following the LSM110A module package is described. This description includes the LSM110A 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 5-1-1 depicts a description of the LSM110A's pads on the Module 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 5-1-1: Pinout Table.

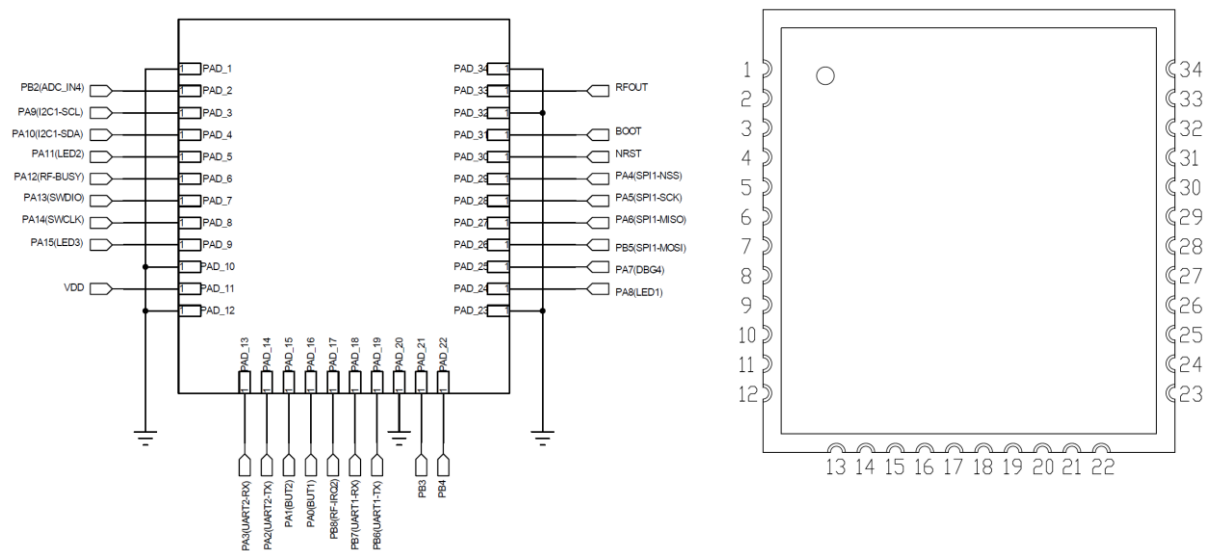


Figure 5-1-1: Description of module pins and top view

| PIN | PIN Name | PIN Type | MCU Pin | Description |
|-----|----------|----------|---------|--|
| 1 | GND | | | Ground |
| 2 | PB2 | I/O | PB2 | General purpose IO, selectable ADC functionality |
| 3 | PA9 | I/O | PA9 | General purpose IO, selectable I2C(SCL) functionality |
| 4 | PA10 | I/O | PA10 | General purpose IO, selectable I2C(SDA) functionality |
| 5 | PA11 | I/O | PA11 | General purpose IO, selectable I2C2(SDA) functionality |
| 6 | PA12 | I/O | PA12 | General purpose IO, selectable I2C2(SCL) functionality |
| 7 | PA13 | I/O | PA13 | Serial-Wire Debug Data(FW Down-load) |

| | | | | |
|----|-------|-----|-------|---|
| 8 | PA14 | I/O | PA14 | Serial-Wire Debug Clock(FW Down-load) |
| 9 | PA15 | I/O | PA15 | General purpose IO |
| 10 | GND | | | Ground |
| 11 | VDD | P | | Power Supply(+1.8V ~ +3.6V) |
| 12 | GND | | | Ground |
| 13 | PA3 | I/O | PA3 | USART2 RX Data |
| 14 | PA2 | I/O | PA2 | USART2 TX Data |
| 15 | PA1 | I | PA1 | Wake-up, General purpose IO |
| 16 | PA0 | I/O | PA0 | General purpose IO |
| 17 | PB8 | I/O | PB8 | General purpose IO |
| 18 | PB7 | I/O | PB7 | USART1 RX Data |
| 19 | PB6 | I/O | PB6 | USART1 TX Data |
| 20 | GND | | | Ground |
| 21 | PB3 | I/O | PB3 | General purpose IO |
| 22 | PB4 | I/O | PB4 | General purpose IO |
| 23 | GND | | G | Ground |
| 24 | PA8 | I/O | PA8 | General purpose IO |
| 25 | PA7 | I/O | PA7 | General purpose IO |
| 26 | PB5 | I/O | PB5 | General purpose IO, selectable SPI1 MOSI functionality |
| 27 | PA6 | I/O | PA6 | General purpose IO, selectable SPI1 MISO functionality |
| 28 | PA5 | I/O | PA5 | General purpose IO, selectable SPI1 SCK functionality |
| 29 | PA4 | I/O | PA4 | General purpose IO, selectable SPI1 NSS functionality |
| 30 | NRST | I/O | NRST | IC Reset |
| 31 | BOOT | I/O | BOOT0 | IC BOOT0(Internal pull-down 10Kohm resistor) |
| 32 | GND | | | Ground |
| 33 | RFOUT | A | | RF input/output |
| 34 | GND | | | Ground |

Table 5-1-1: Pinout Table

5.2 Module Dimensions

The outer dimensions of the LSM110A are given by Figure 5-2-1.

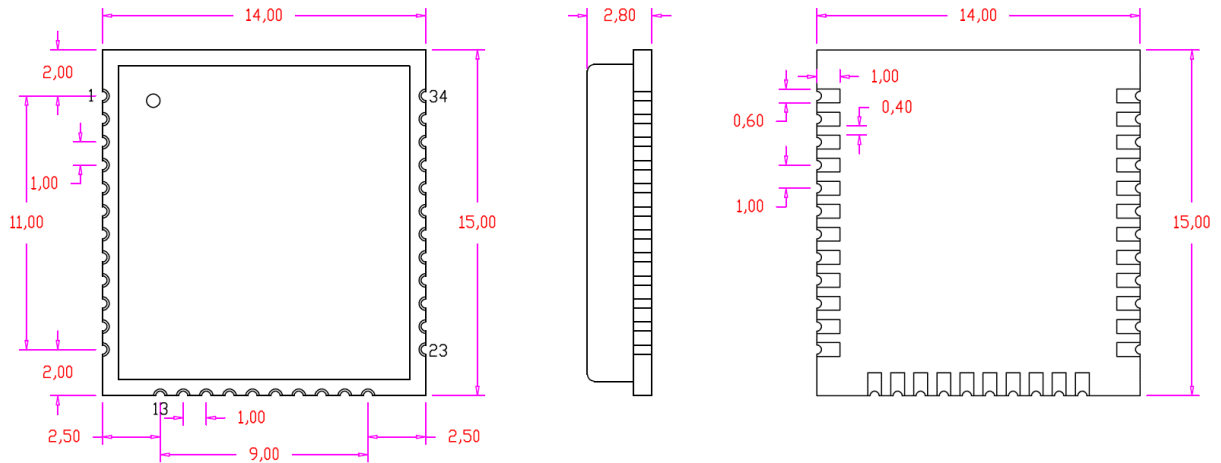


Figure 5-2-1: Outer Dimensions

5.3 Recommended Footprint

According to Chapter 5.2, a recommendation for the footprint of the LSM110A is given by Figure 5-3-1.

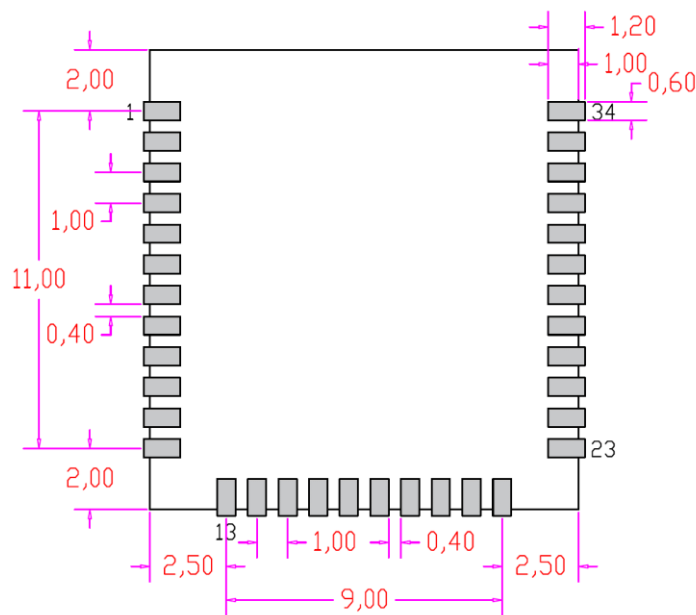


Figure 5-3-1: Recommended footprint (top view)

5.4 Recommended PCB design guide

To protect a contact short or electrical shock when LSM110A 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 5-4-1.

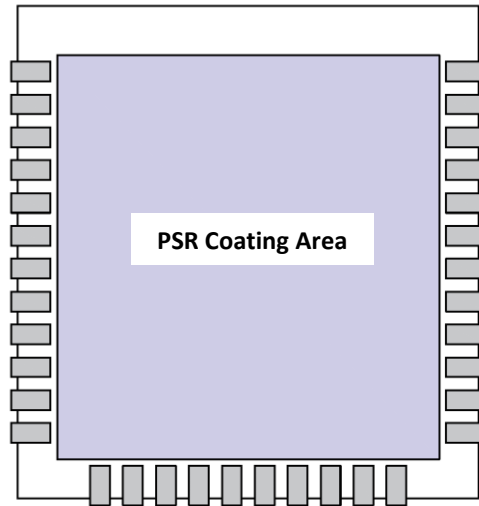
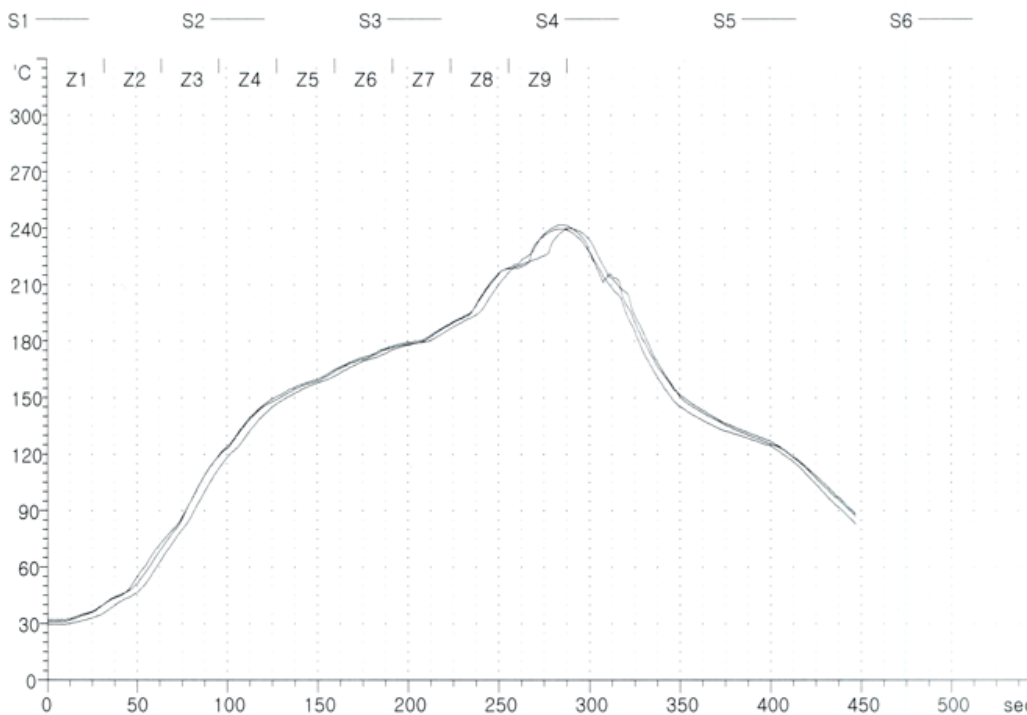


Figure 5-4-1: PSR ink Coating of mount board

5.5 Reflow Profile of Module

Temperature Profile

| Checked at 2022-02-22 19:33:59 | | Job No: LSM110A | | Batch No: C-LINE | | | | | | | | | |
|---|-------|------------------------------|--------|---------------------|------|------------------|------|--------------|---------|--------------|---------|---------|---------|
| Customer: 성지산업 | | Battery Voltage: 4.12 V (OK) | | Solder Type: H/F | | | | | | | | | |
| Internal Temp: 59.5 °C (OK) | | Sample Time: 0.5 sec | | Total Samples: 4000 | | | | | | | | | |
| Channels: S1 S2 S3 S4 S5 S6 | | | | | | | | | | | | | |
| Zone Setting Temperature | | | | | | | | | | | | | |
| | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 | Z7 | Z8 | Z9 | | | | |
| Upper | 150 | 160 | 170 | 180 | 190 | 200 | 220 | 250 | 285 | | | | |
| Lower | 150 | 160 | 170 | 180 | 190 | 200 | 220 | 250 | 285 | | | | |
| Length | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | | | | |
| Machine No : | | | | | | | | | | | | | |
| Line Speed : 0.75 m/min | | | | | | | | | | | | | |
| Line Length : 3600 mm | | | | | | | | | | | | | |
| Temperature Analysis & Temperature Zone | | | | | | | | | | | | | |
| | Max°C | at-sec | ov-220 | T1-s | T2-s | T3-s | T4-s | T5-s | T1-°C/s | T2-°C/s | T3-°C/s | T4-°C/s | T5-°C/s |
| S1 | 241.7 | 285.5 | 45.5 | 56.0 | 83.5 | 66.5 | 45.5 | 0.0 | +1.1 | +0.7 | +0.5 | +0.2 | +0.0 |
| S2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 |
| S3 | 239.6 | 283.0 | 40.5 | 56.5 | 84.5 | 65.0 | 40.5 | 0.0 | +1.1 | +0.7 | +0.5 | +0.2 | +0.0 |
| S4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 |
| S5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 |
| S6 | 239.9 | 290.0 | 47.0 | 54.5 | 84.5 | 65.0 | 47.0 | 0.0 | +1.2 | +0.7 | +0.5 | +0.2 | +0.0 |
| T1: 50 ~ 100 °C | | | | T2: 100 ~ 170 °C | | T3: 170 ~ 200 °C | | T4: 220 ~ °C | | T5: 0 ~ 0 °C | | | |



SEILIECO

SMP-306

Printed at 2022-02-22 19:34:09

| SPEC | Pre-heat | Soak | Ramp | PEAK |
|--------|-----------|------------|-----------|-------|
| | 50~100°C | 100~170°C | 220°C 이상 | 240°C |
| | 1~2°C/sec | 60~100 sec | 30~50 sec | ±5°C |
| Result | 1.13 | 84 | 44.3 | 239.4 |
| | OK | OK | OK | OK |

6 Integration Guide

The LSM110A provides 34 connectors as described in Chapter 6. For integrating the LSM110A into an environment, a typically circuit as given in Chapter 6.1 can be used.

6.1 Typical Application Schematic

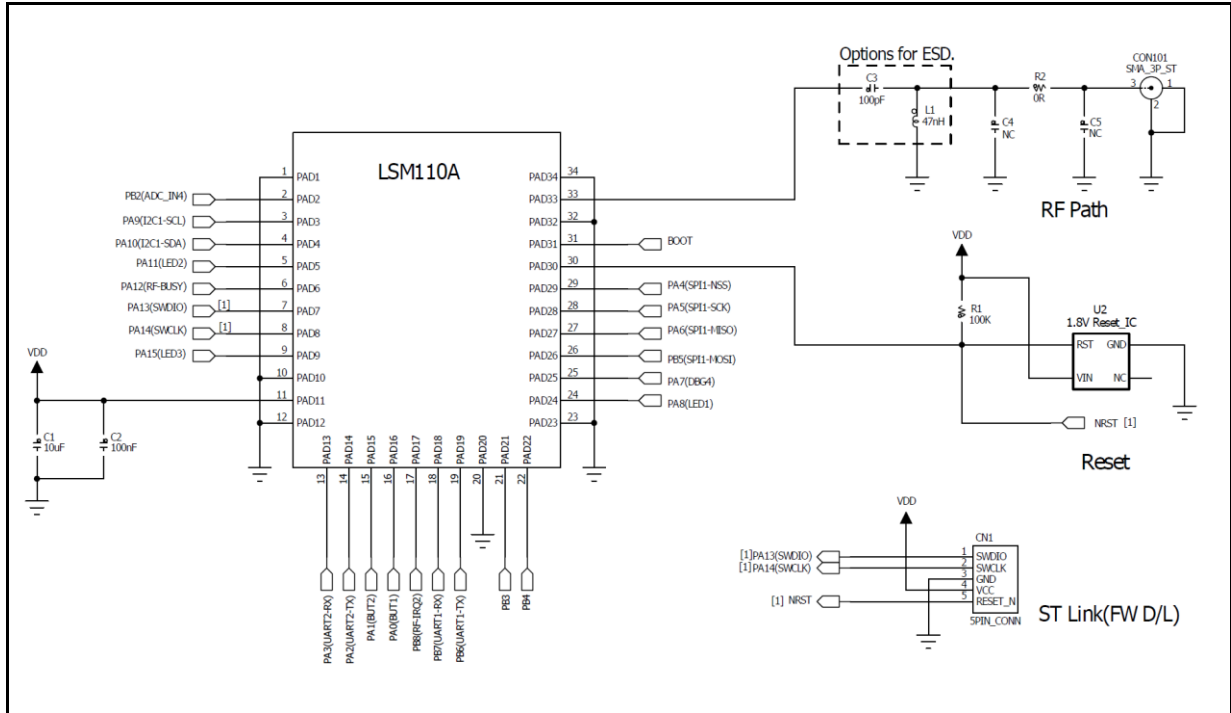


Figure 6-1-1: Typical Application Schematic

7 Laser Marking(Label)



LSM110A Regulatory Certification



| | |
|------------------|---|
| LoRa™ | US902-928 Certified AU915-928 Certified AS923-1 Certified LoRaWAN Specification Version: V1.0.4 LoRaWAN Regional Parameters Version: RP002-V1.0.1 |
| Sigfox Verified™ | RC2/ RC4 Certified(M_008B_3FA8_01) |
| FCC | 2AS8LLSM110A |
| IC | 25119-LSM110A |
| RCM | POC22342 |

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

LSM110A Lot, No(9digits) Information

CAHIR1101

| Digits | Lot, No info | Description |
|--------|----------------------|--|
| 1 | Model App. Type | C : LoRa+Sigfox |
| 2 | Manufacture Area | A: Korea, C: Vietnam |
| 3 | Product Year | 2021: H, 2022: I, 2023: J ... |
| 4 | Product Month | Jan: A, Feb:B ... Oct: J, Nov: K, Dec: L |
| 5 | Product Day | 1, 2, 3 ... A, B, C ... T, U, V |
| 6~7 | Model Initial Number | 11: LSM110A |
| 8~9 | Lot Serial Number | 00, 01, 02 ... (1Lot serial: 1box) |

LSM110A QR-code(18digits) Information



| Digits | QR code info | Description |
|--------|----------------|--|
| 1~4 | Model code | 110A: LSM110A |
| 5 | Assembly site | X: Korea, W: Vietnam |
| 6 | Product Year | 2021: G, 2022: H, 2023: J ... (except "I", "O") |
| 7 | Product Month | Jan: 1, Feb:2 ... Oct: A, Nov: B, Dec: C |
| 8 | Product Day | 1, 2, 3 ... A, B, C ... V, W, X(except "I", "O") |
| 9~11 | HW version | V0.1: R01 V0.2:R02 ... |
| 12 | SW Application | Global: 0 |
| 13 | SW version | V1.0.0: 0, V1.0.1: 1 ... |
| 14~17 | Serial Number | 4digits |
| 18 | Customer | Default: G |

8 Packing

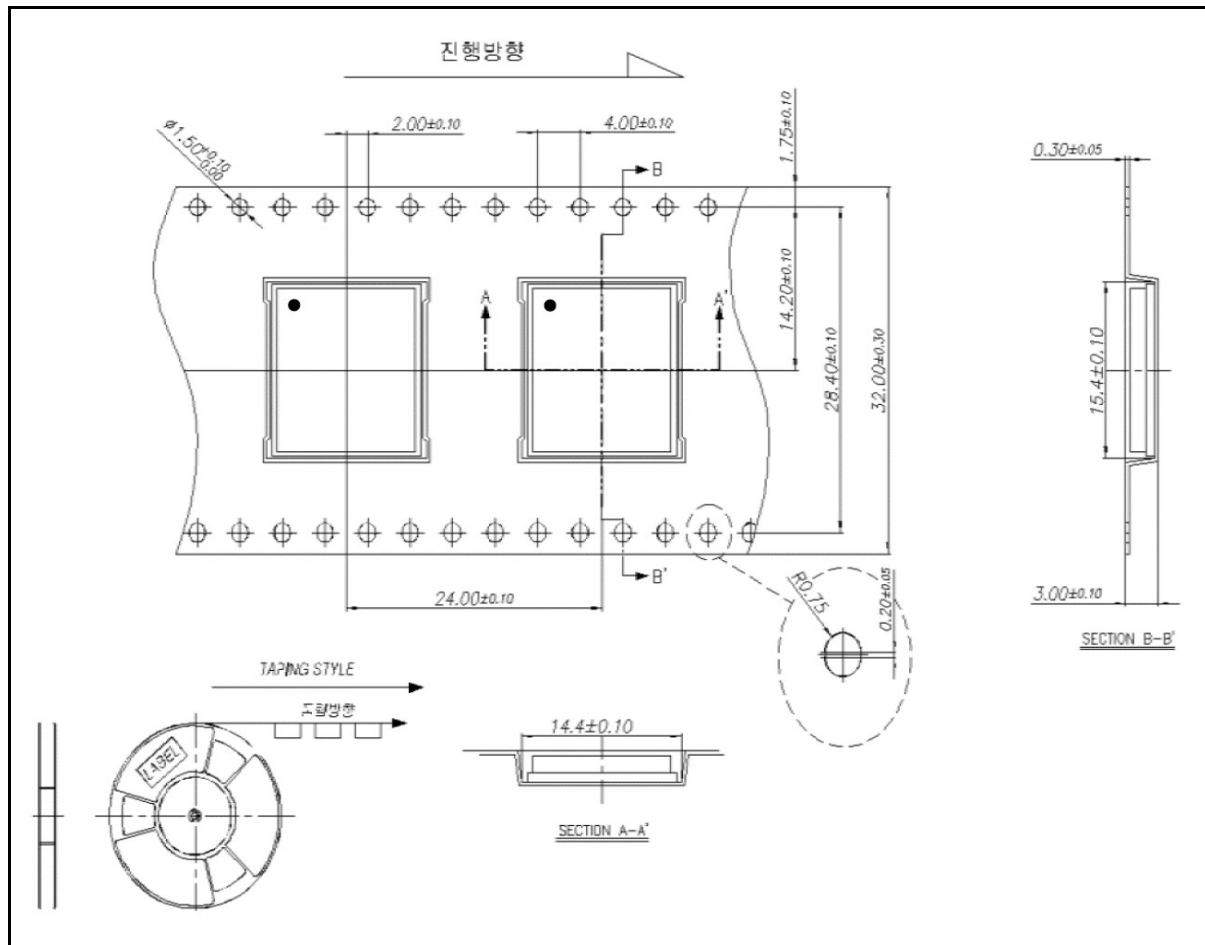


Figure 8-1: Reel packing

* Reel Bobbin size: 330x80x32mm(13" Reel)

* Packing Q'ty: 500ea

9. Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications.

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ESD Warning



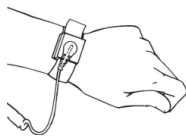
This modules are ESD sensitive devices, appropriate precautions should be taken during the module assembly in the final product. Mechanical impact and harsh tools must be avoided during the module assembly in the final product.

Product ESD specification:

- HBM $\pm 2\text{kV}$

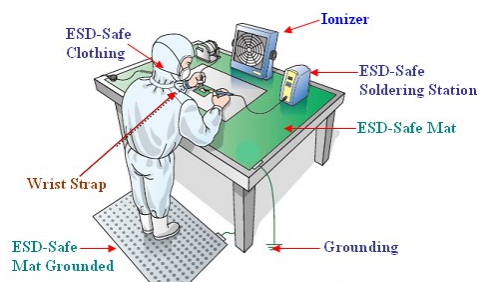
The following precautions must be taken:

- Do not open the protective conductive packaging until you have use the following, and are at an approved anti-static work station.



- Use a conductive wrist strap attached to a good earth ground.

- If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe.
- If possible, use SMT equipment(reflow) when making prototype boards.
- Use an approved anti-static mat to cover your work surface.



- Always discharge yourself by touching a grounded bare metal surface or approved anti-static mat before picking up an ESD - sensitive electronic component.