㈜에스제이아이
SJI CO.,LTD

LSM110A

High-Power Module

DATA SHEET / REV0.1

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Document Information

File name	DS_LSM110A_R01_220602.pdf
Created	2022-06-02
Total pages	24page

Revision History

Revision	Note
0.0	Preliminary.
0.1	Initial Release

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.

Table of Contents

1 Introduction

The LSM110A is a compact, low power, bidirectional radio module for the 902MHz ~ 928 MHz frequency band using 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.

(Option)

< TOP > < BOTTOM >

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.

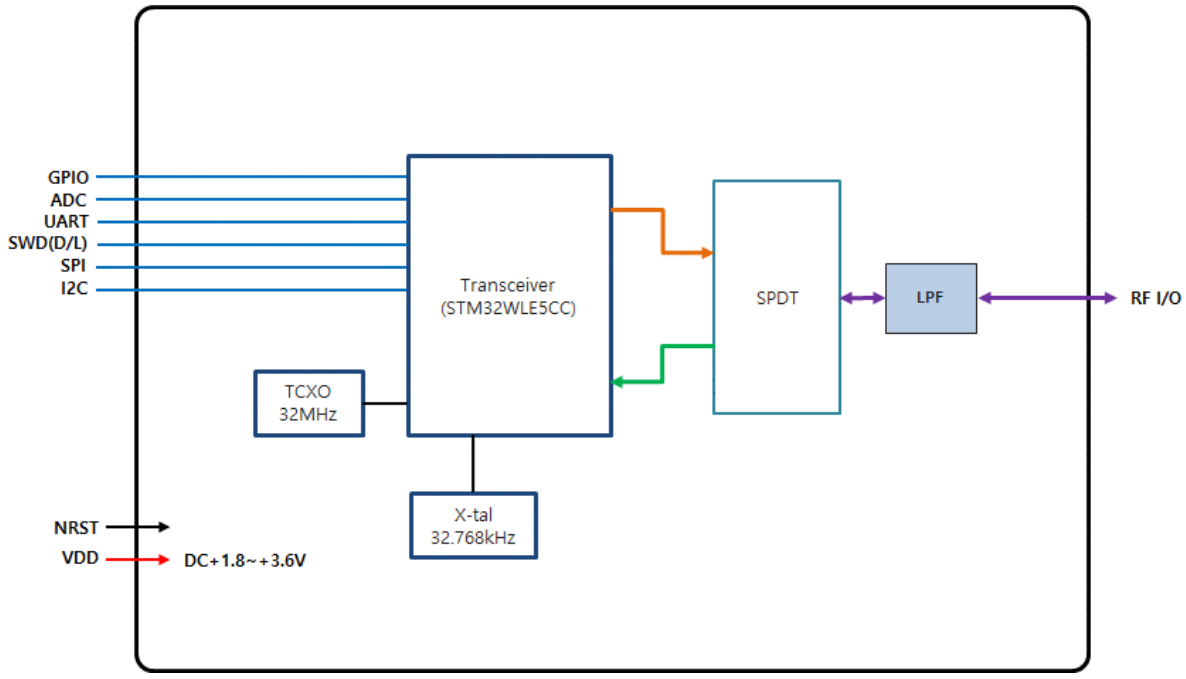


Figure 2-1: Block Diagram

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)		902	-	928	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					

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)		902	-	928	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±0.0.096 - 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
	868.3MHz	923.3MHz	868.3MHz	923.3MHz	868.3MHz	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

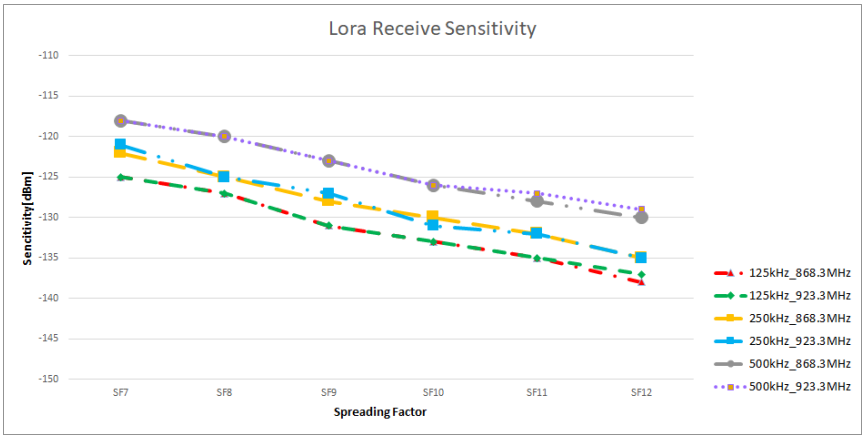


Figure 3-4-2-1: LoRa Receive Sensitivity Graph

<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

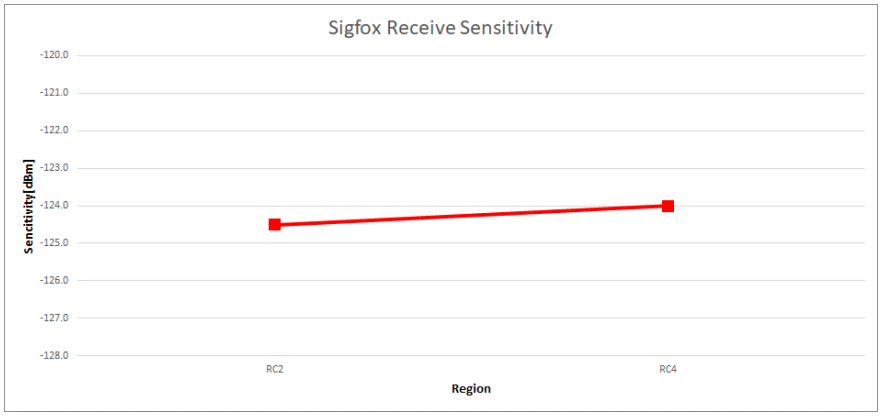


Figure 3-4-2-2: Sigfox Receive Sensitivity Graph

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

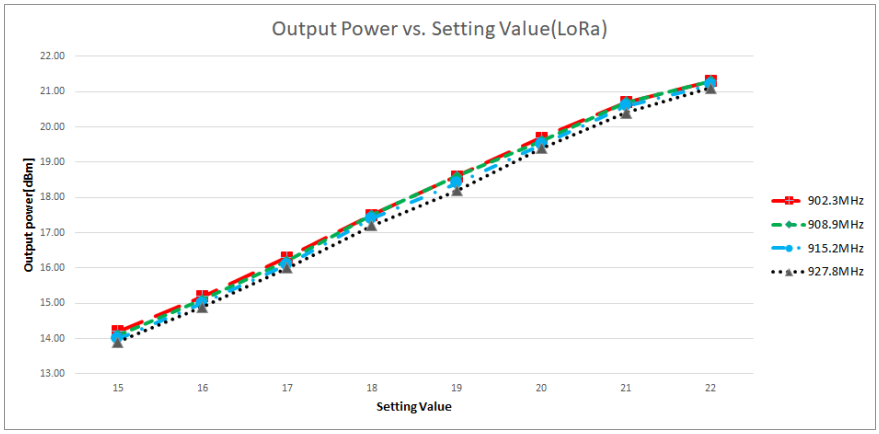


Figure 3-4-3-1: LoRa Output Power vs. Setting Value Graph

<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

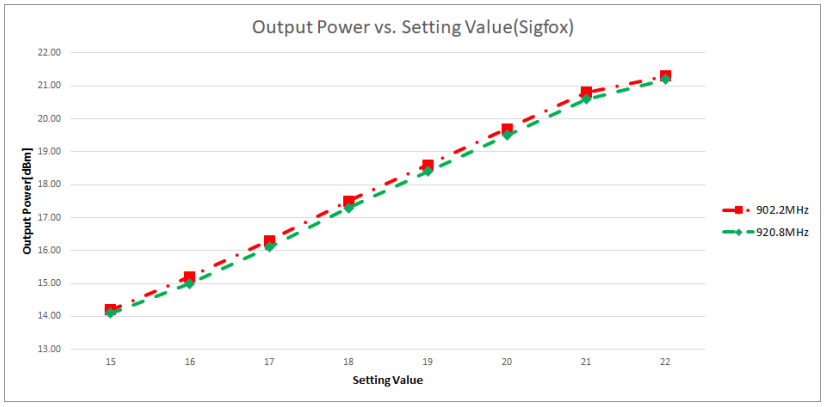


Figure 3-4-2: Sigfox Output Power vs. Setting Value Graph

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

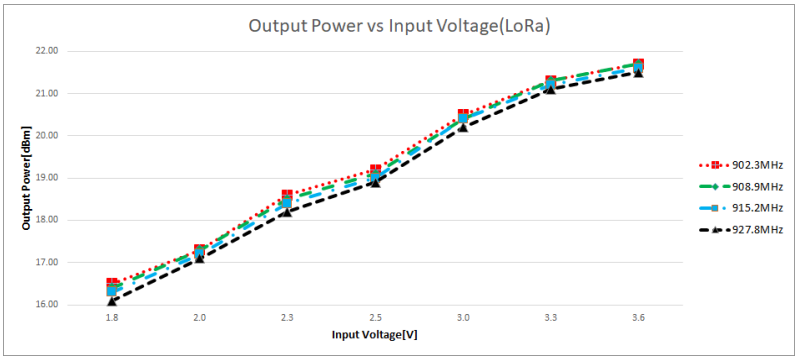


Figure 3-4-4-1: LoRa Output Power vs. Input Voltage Graph

<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

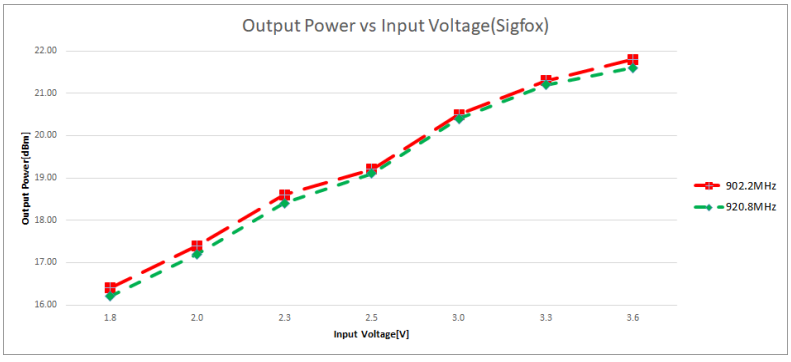


Figure 3-4-4-2: Sigfox Output Power vs. Input Voltage Graph

3.4.5 Output Power vs. Temp. table

<LoRa>

Temp. / ℃	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.

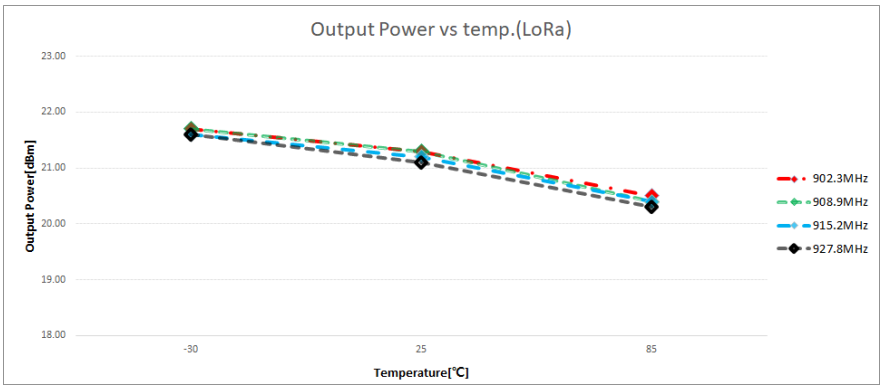


Figure 3-4-5-1: LoRa Output Power vs. Temp. Graph

<Sigfox>

Temp./ ℃	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.

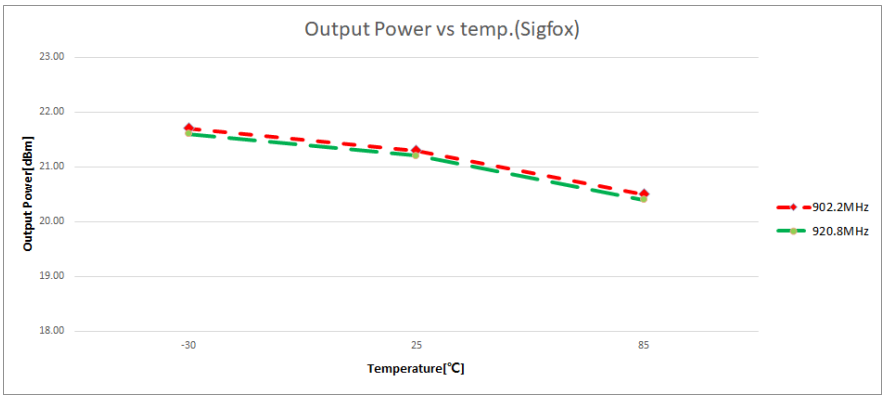


Figure 3-4-5-2: Sigfox Output Power vs. Temp. Graph

4 Inspection

<LoRa>

Parameter	Condition	Min	Typ.	Max	Unit
RF Output Power	868MHz	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.

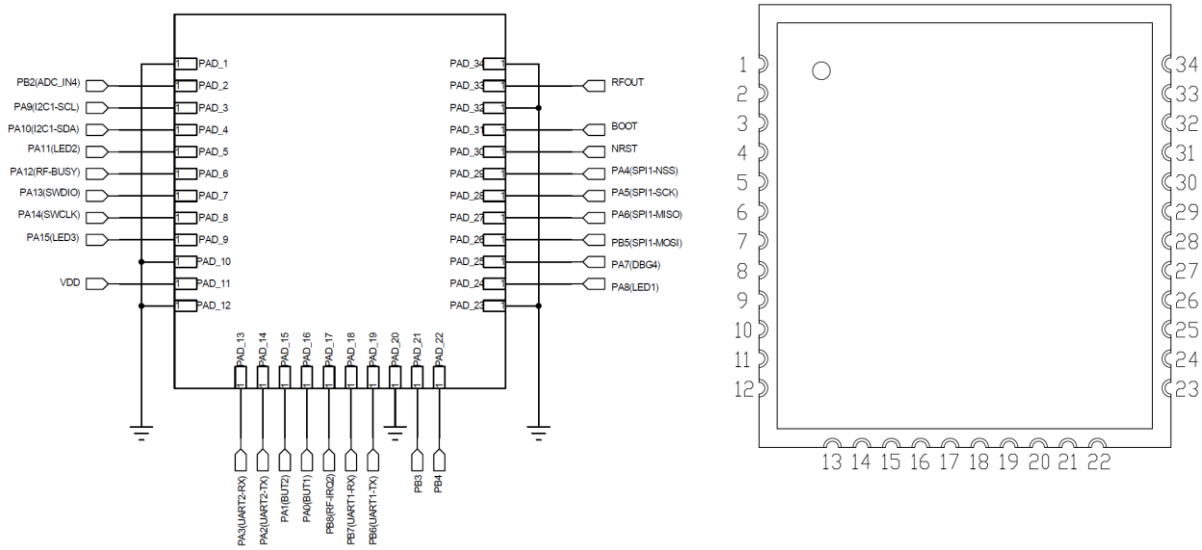


Figure 5-1-1: Description of module pins and top view

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.

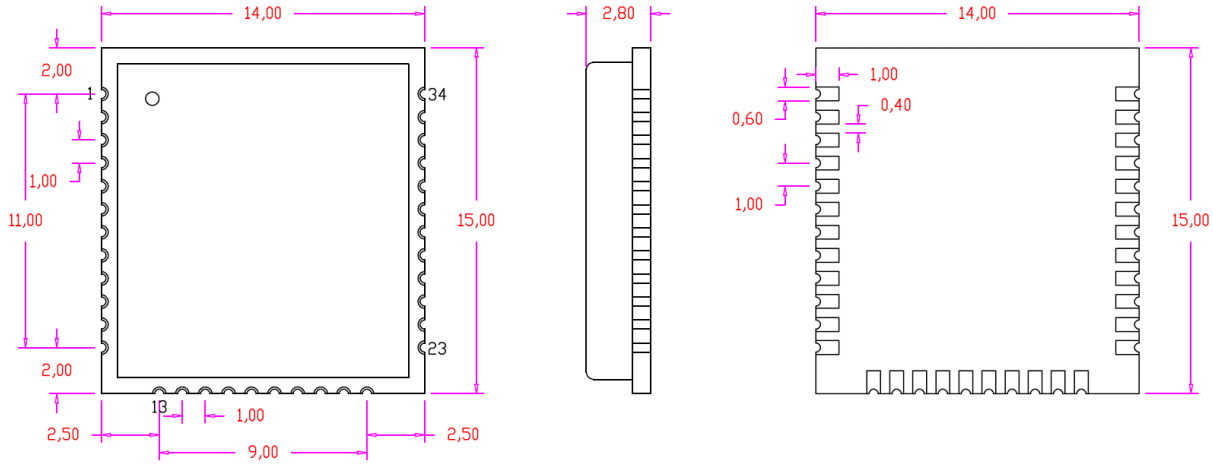


Figure 5-2-1: Outer Dimensions

5.3 Recommended Footprint

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

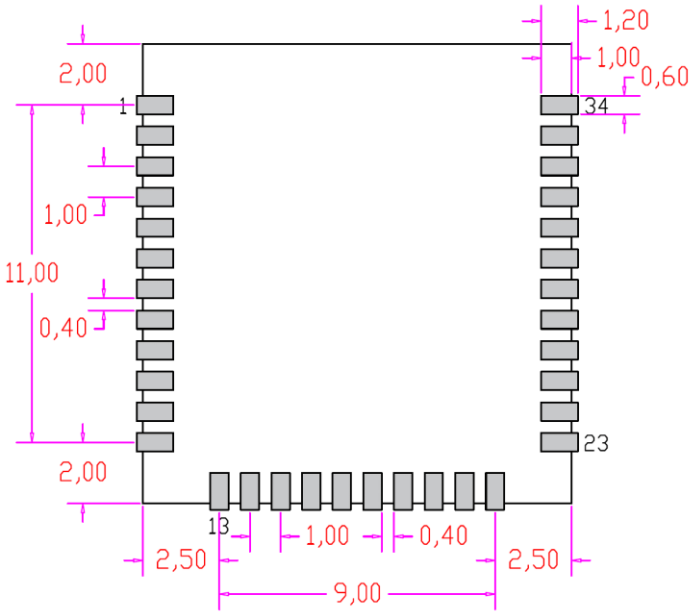


Figure 5-3-1: Recommended footprint (top view)

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.

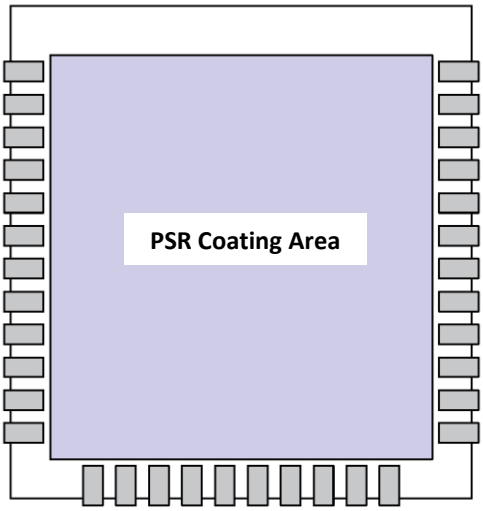
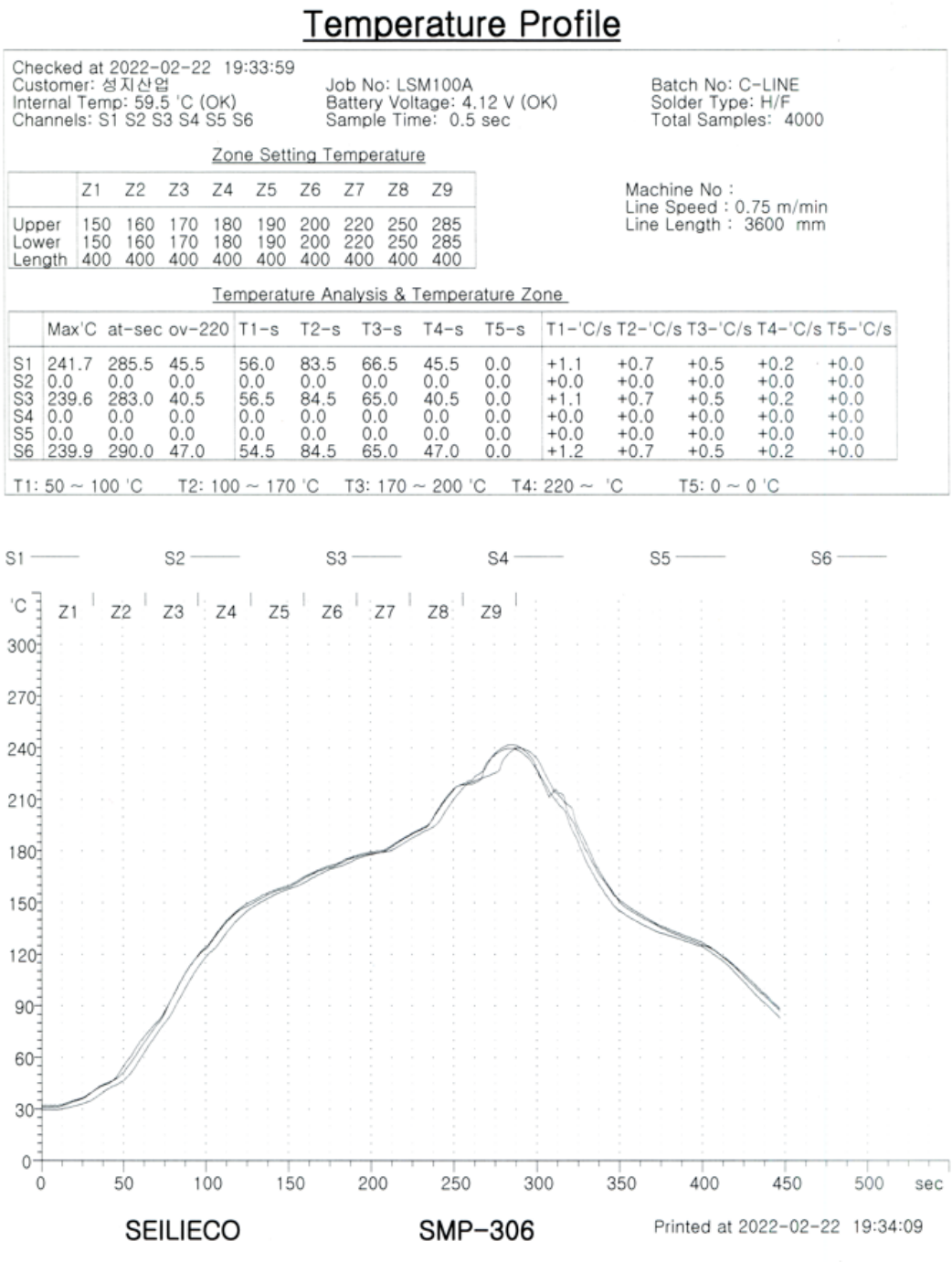


Figure 5-4-1: PSR ink Coating of mount board

5.5 Reflow Profile of Module



Temperature Profile

Checked at 2022-02-22 19:33:59
Customer: 성지산업
Internal Temp: 59.5 'C (OK)
Channels: S1 S2 S3 S4 S5 S6
Job No: LSM100A
Battery Voltage: 4.12 V (OK)
Sample Time: 0.5 sec
Batch No: C-LINE
Solder Type: H/F
Total Samples: 4000

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

	Pre-heat	Soak	Ramp	PEAK
SPEC	**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

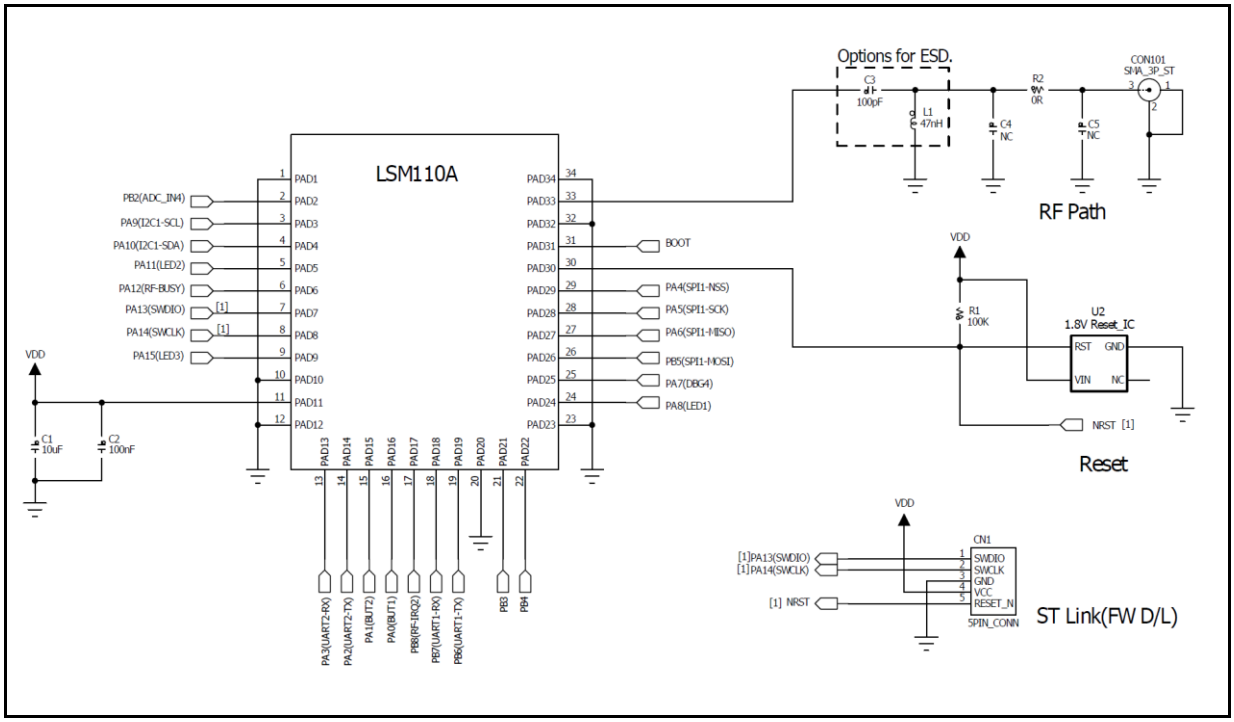
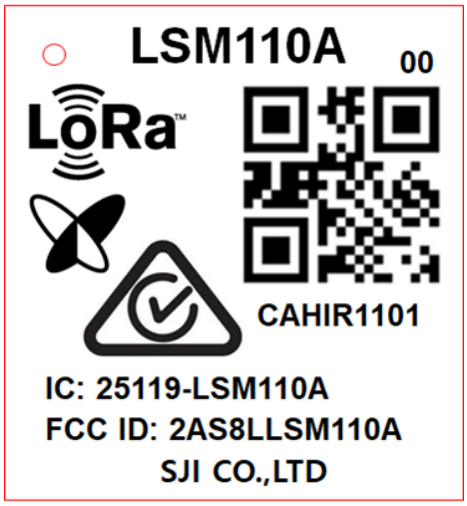


Figure 6-1-1: Typical Application Schematic

7 Laser Marking(Label)



LSM110A Regulatory Certification

LoRa™	US902-928 Certified AU915-928 Certified 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	TBD(not certified)

"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

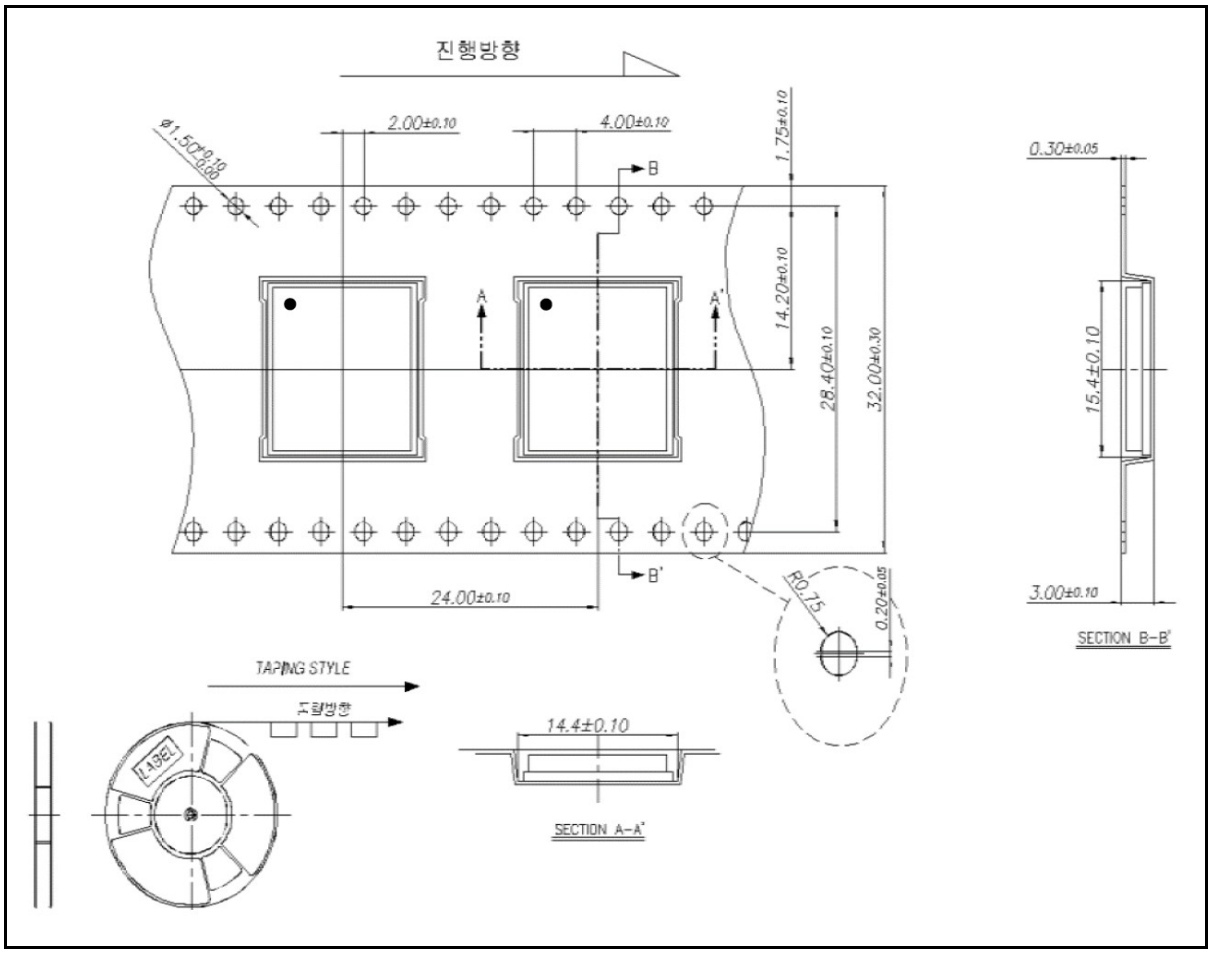


Figure 8-1: Reel packing

* 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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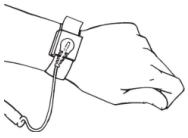
ESD Warning

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 ±2kV

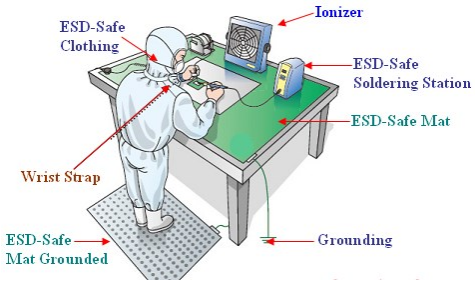
The following precautions must be taken:

• 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.