



# LSM100A

P/N : WSLSM100A00

***DATA SHEET / REV0.8***

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## Document Information

<b>File name</b>	DS_LSM100A_R08_230922.pdf
<b>Created</b>	2023-09-22
<b>Total pages</b>	24page

## Revision History

<b>Revision</b>	<b>Note</b>
0.0	Preliminary
0.1	Initial Release
0.2	Reflow Profile added.
0.3	F/W changed(1.0.0 -> 1.0.1)
0.4	F/W changed(1.0.1 -> 1.0.2)
0.5	Company name changed(SJI Co.,Ltd.)
0.6	Telec certified, F/W changed(1.0.2 -> 1.0.3)
0.7	Laser-Marking Design Changed.
0.8	QR-code info redefine.

## Aim of this Document

The aim of this document is to give a detailed product description including interfaces, features and performance of the module LSM100A.

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# 1 Introduction

The LSM100A 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 LSM100A 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 LSM100A

## 1.1 Key Features

- Compact module 14 x 15 x 2.8mm. (Typ.)
- LoRa™ modulation technology.
- Sigfox modulation technology.
- Sensitivity down to -136dBm@LoRa(BW=125KHz, 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 Level up to +15dBm
- 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 LSM100A 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.

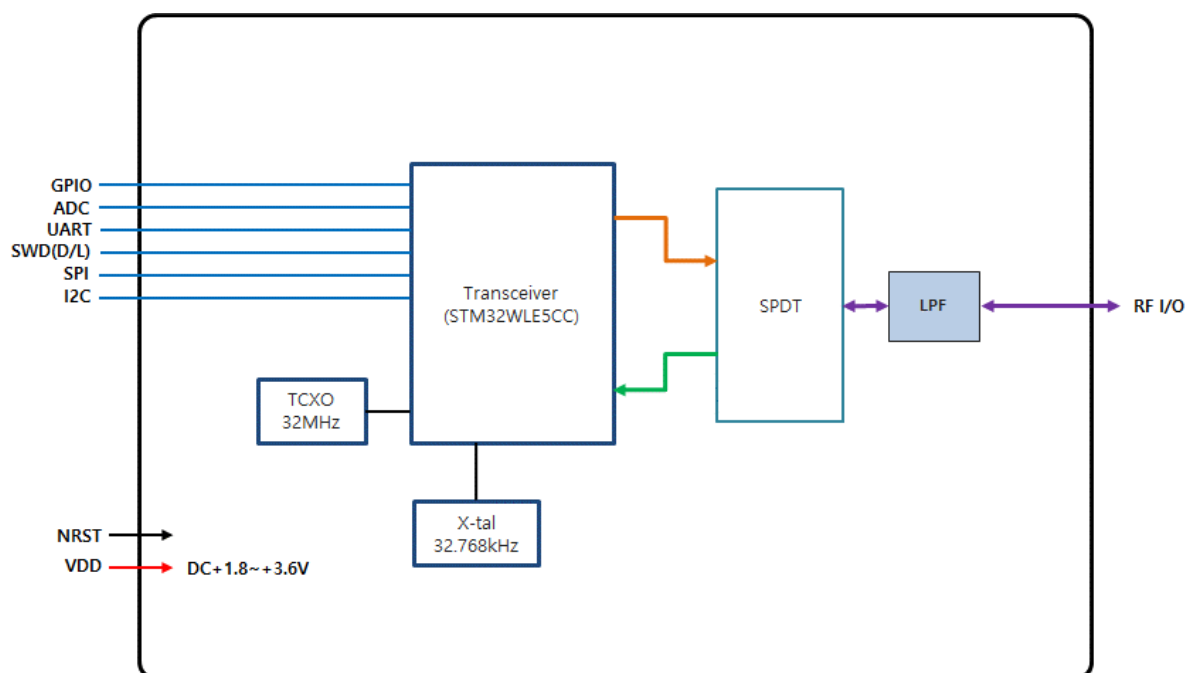


Figure 2-1: Block Diagram

### 3 Electrical Characteristics

In the following different electrical characteristics of the LSM100A 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 +14dBm)		27		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 <sup>(1)</sup>		863	-	928	MHz
RF Output Power	EU	12	14	-	dBm
	AS923-1	11	13	-	
Modulation Techniques	LoRa™				
TX Frequency Tolerance	25°C	-2.5	-	2.5	ppm
Note (1) : Frequency range - EU863-870 - AS923-1 - KR920-923(not certified)					

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 <sup>(1)</sup>		863	-	928	MHz
RF Output Power	RC1	12	14	-	dBm
	RC3	11	13	-	
Modulation Techniques	Sigfox				
TX Frequency Tolerance	25°C	-2.5	-	2.5	ppm

Note (1) : Frequency range

- RC1 868.13±0.096
- RC3 923.20±0.096
- RC5 923.30±0.096(not certified)
- RC6 865.20±0.096(not certified)
- RC7 868.80±0.096(not certified)

*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

SF	125kHz	250kHz	500kHz	Unit
SF7	-123	-120	-115	dBm
SF8	-126	-122	-118	dBm
SF9	-128	-125	-121	dBm
SF10	-131	-128	-123	dBm
SF11	-134	-131	-125	dBm
SF12	-136	-132	-128	dBm

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

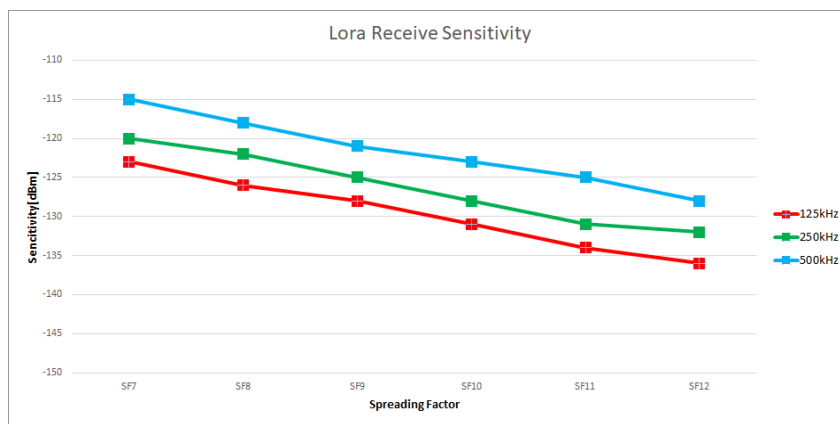


Figure 3-4-2-1: LoRa Receive Sensitivity Graph

<Sigfox>

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

Zone	Frequency(MHz)	Sensitivity(0.6Kbps)	Unit
RC1	869.525	-125	dBm
RC3	922.2	-124	dBm
RC5	922.3	-124	dBm
RC6	866.3	-125	dBm
RC7	869.1	-125	dBm

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

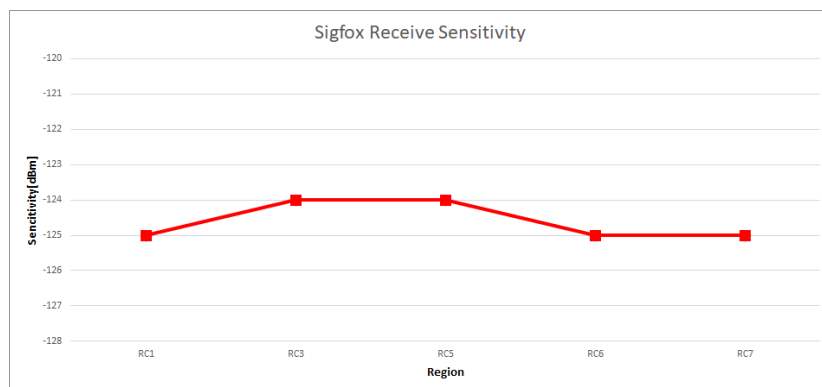


Figure 3-4-2-2: Sigfox Receive Sensitivity Graph

### 3.4.3 Output Power vs. Setting Value

<LoRa>

Setting Value	Output Power (Typ.) / dBm			
	863MHz	868MHz	923MHz	928MHz
10	9.97	10.03	10.07	10.05
11	10.86	10.92	11.00	10.97
12	11.62	11.68	11.81	11.79
13	12.44	12.48	12.69	12.67
14	13.18	13.23	13.54	13.53
15	14.08	14.12	14.34	14.32

Note:

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

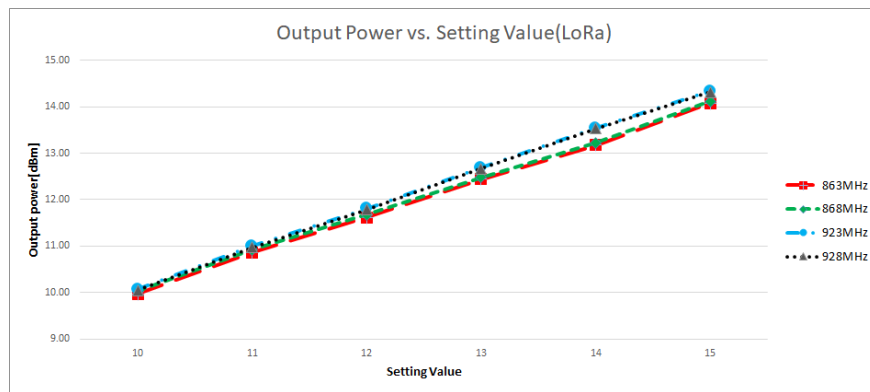


Figure 3-4-3-1: LoRa Output Power vs. Setting Value Graph

<Sigfox>

Setting Value	Output Power (Typ.) / dBm		
	865.2MHz	868.13MHz	923.3MHz
10	9.98	10.05	9.98
11	10.88	10.94	10.87
12	11.62	11.70	11.71
13	12.44	12.50	12.58
14	13.18	13.25	13.43
15	14.07	14.15	14.22

Note:

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

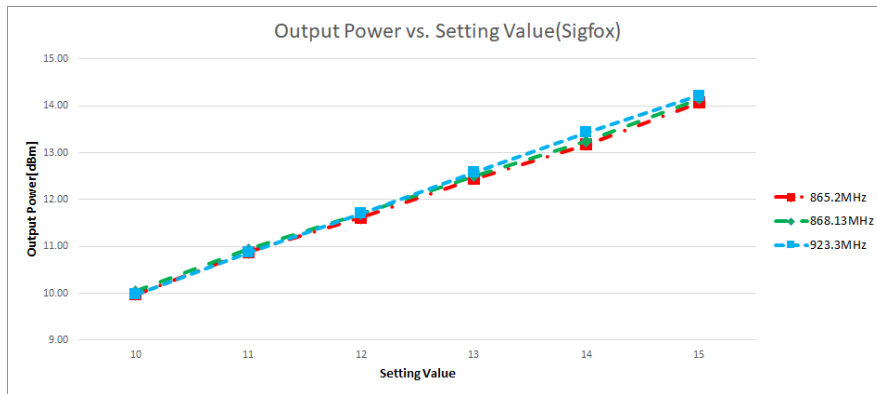


Figure 3-4-2: Sigfox Output Power vs. Setting Value Graph

### 3.4.4 Output Power vs. Input Voltage(VDD) table

<LoRa>

Input Voltage(VDD)	Output Power (Typ.) / dBm			
	863MHz	868MHz	923MHz	928MHz
1.8	14.04	14.09	14.30	14.25
2.0	14.06	14.11	14.32	14.27
2.3	14.07	14.12	14.34	14.29
2.5	14.08	14.13	14.35	14.30
3.0	14.09	14.14	14.36	14.31
3.3	14.10	14.15	14.37	14.32
3.6	14.10	14.15	14.37	14.32

Note:

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

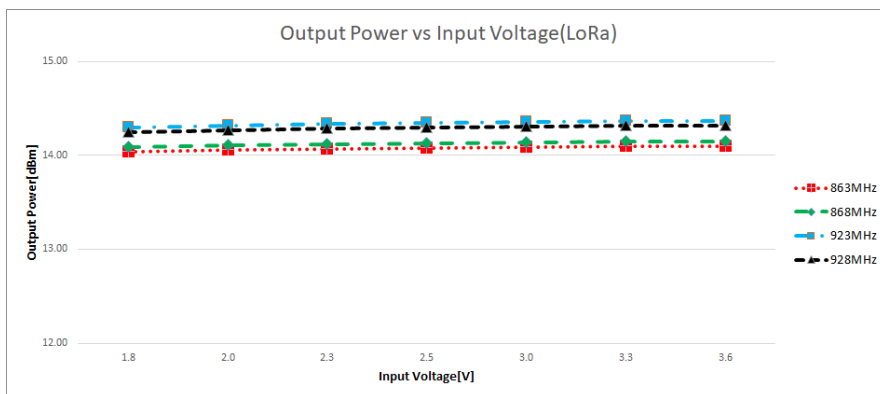


Figure 3-4-4-1: LoRa Output Power vs. Input Voltage Graph

<Sigfox>

Input Voltage(VDD)	Output Power (Typ.) / dBm		
	865.2MHz	868.13MHz	923.3MHz
1.8	14.02	13.99	14.20
2.0	14.05	14.00	14.23
2.3	14.07	14.01	14.24
2.5	14.07	14.02	14.25
3.0	14.08	14.03	14.26
3.3	14.09	14.04	14.27

3.6	14.09	14.04	14.27
Note:			

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

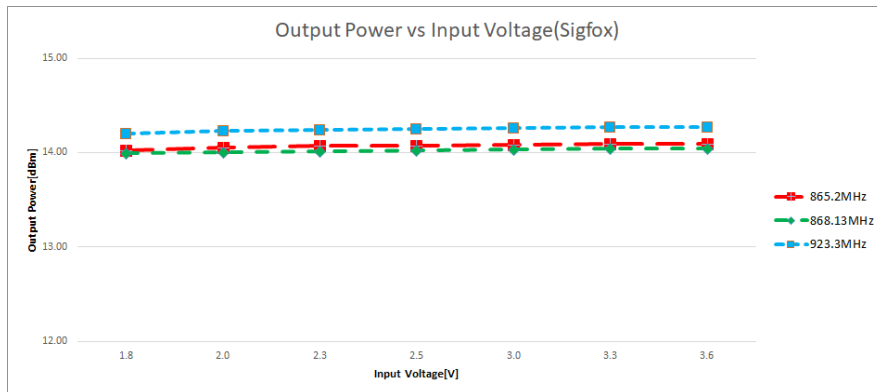


Figure 3-4-4-2: Sigfox Output Power vs. Input Voltage Graph

### 3.4.5 Output Power vs. Temp. table

<LoRa>

Temp. / °C	Output Power (Typ.) / dBm			
	863MHz	868MHz	923MHz	928MHz
-30	14.58	14.60	14.80	14.77
25	14.09	14.13	14.36	14.32
85	13.46	13.47	13.72	13.74

Note:

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

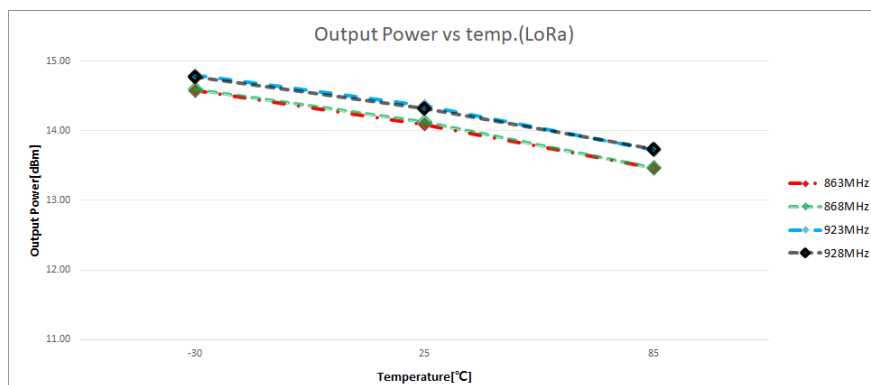


Figure 3-4-5-1: LoRa Output Power vs. Temp. Graph

<Sigfox>

Temp table			
Temp./ °C	Output Power (Typ.) / dBm		
	865.2MHz	868.13MHz	923.3MHz
-30	14.61	14.55	14.70
25	14.10	14.06	14.25
85	13.51	13.47	13.68

Note:

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

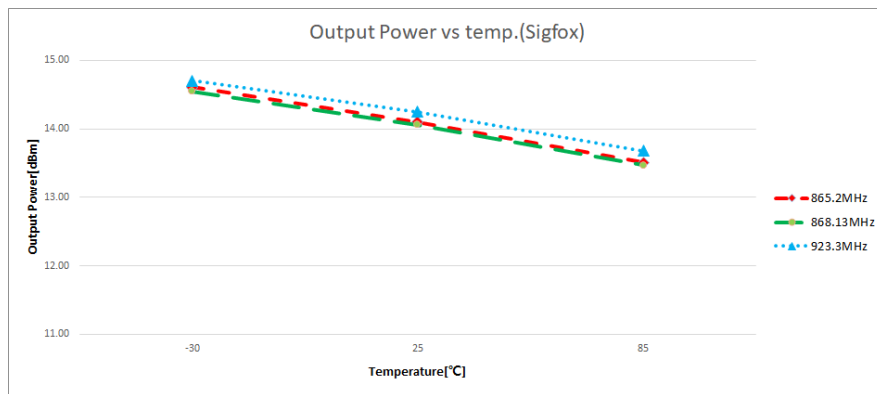


Figure 3-4-5-2: Sigfox Output Power vs. Temp. Graph

## 4 Module Package

In the following the LSM100A module package is described. This description includes the LSM100A 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.

### 4.1 Pinout Description

Figure 4-1-1 depicts a description of the LSM100A'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 4-1-1: Pinout Table.

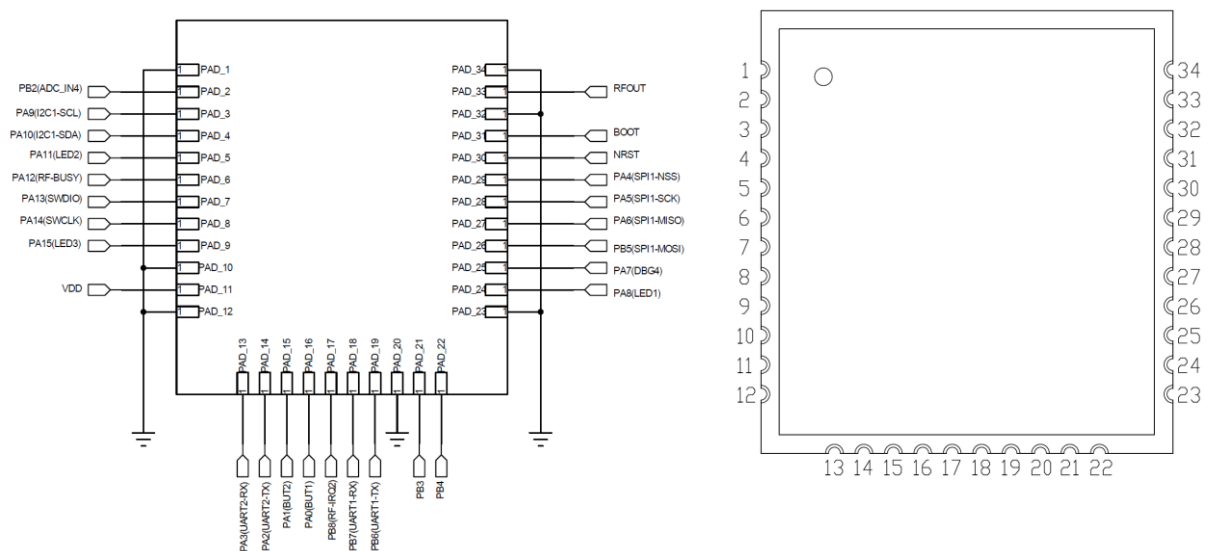


Figure 4-1-1: Description of module pins and top view

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 4-1-1: Pinout Table





## 4.4 Recommended PCB design guide

To protect a contact short or electrical shock when LSM100A 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 4-4-1.

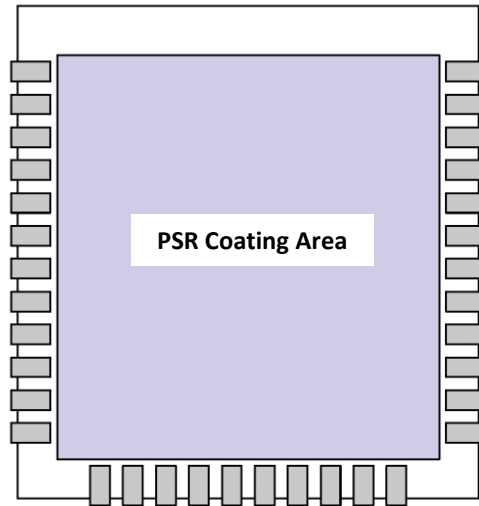


Figure 4-4-1: PSR ink Coating of mount board

### 4.5 Reflow Profile of Module

## Temperature Profile

Checked at 2022-02-22 19:33:59		Job No: LSM100A		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					

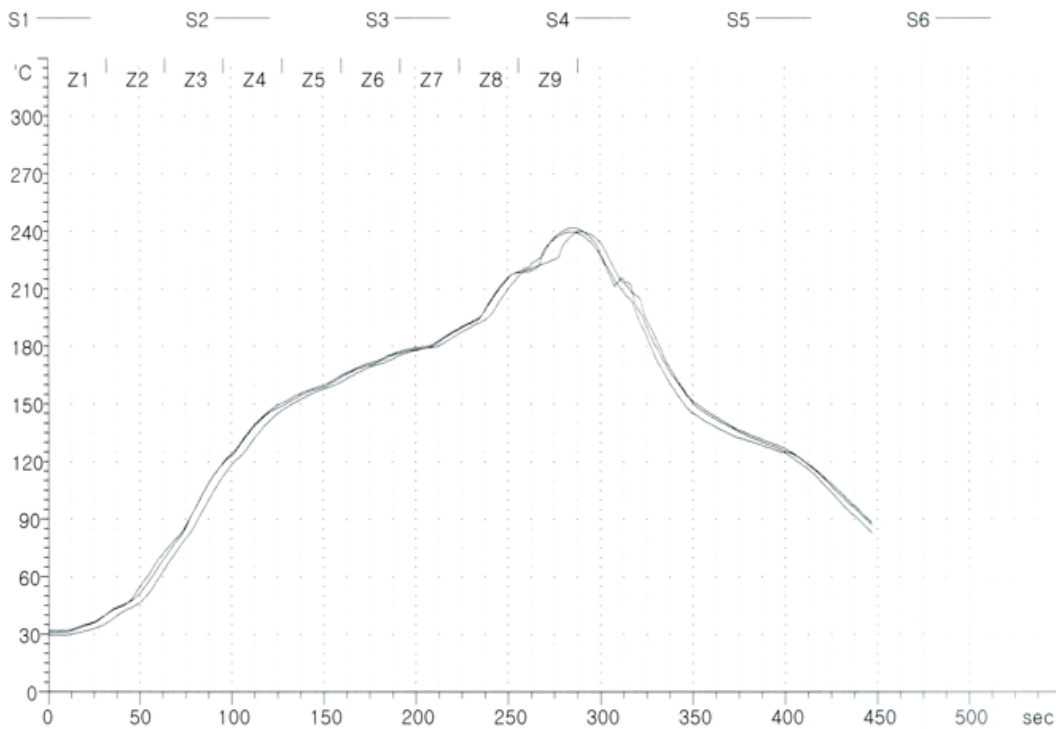
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9
Upper	150	160	170	180	190	200	220	250	285
Lower	150	160	170	180	190	200	220	250	285
Length	400	400	400	400	400	400	400	400	400

	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

## 5 Integration Guide

The LSM100A provides 34 connectors as described in Chapter 5. For integrating the LSM100A into an environment, a typically circuit as given in Chapter 5.1 can be used.

### 5.1 Typical Application Schematic

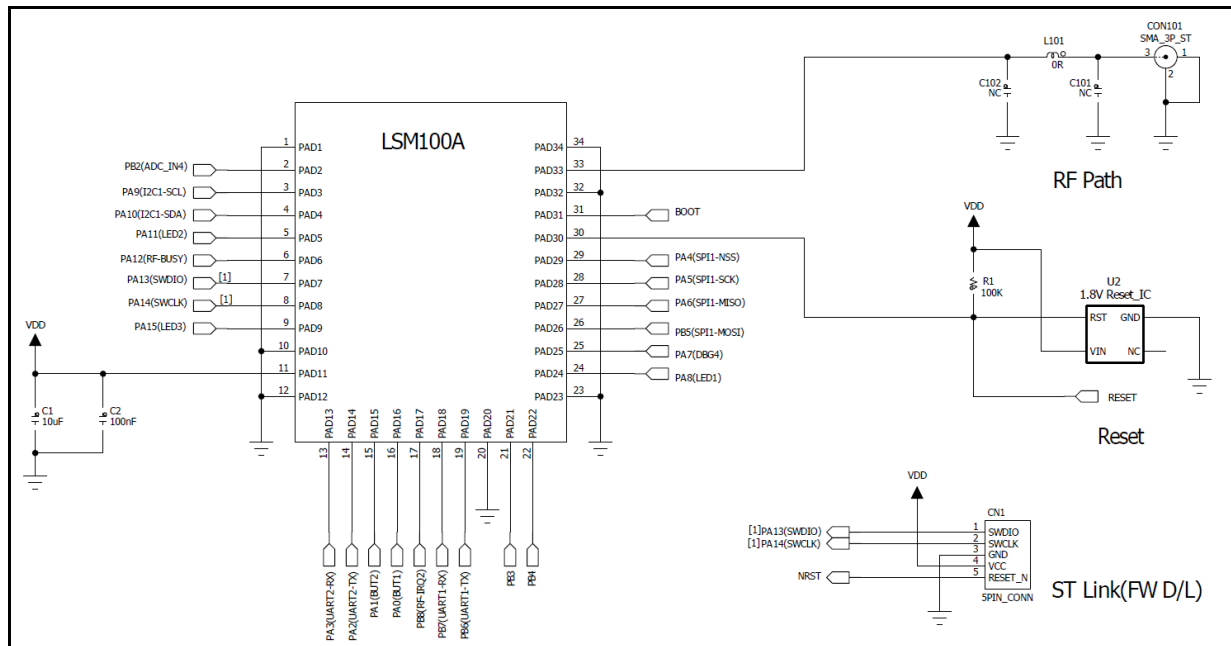


Figure 5-1-1: Typical Application Schematic

## 6 Laser Marking(Label)



### LSM100A Regulatory Certification



LoRa™	EU863-870 Certified AS923-1 Certified LoRaWAN Specification Version: V1.0.4 LoRaWAN Regional Parameters Version: RP002-V1.0.1
Sigfox Verified™	RC1 Certified(M_008B_7257_01) RC3 Certified(M_008B_7257_01)
CE RED	Certified
TELEC	Certified(R 020-230081)
KC	TBD(not certified)

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

### LSM100A Lot, No(9digits) Information

## CAHIR1001

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	10: LSM100A
8~9	Lot Serial Number	00, 01, 02 ... (1Lot serial: 1box)

## LSM100A QR-code(18digits) Information



Digits	QR code info	Description
1~4	Model code	100A: LSM100A
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	Default	0
13	Default	0
14~17	Serial Number	4digits
18	Customer	Default: G

# 7 Packing

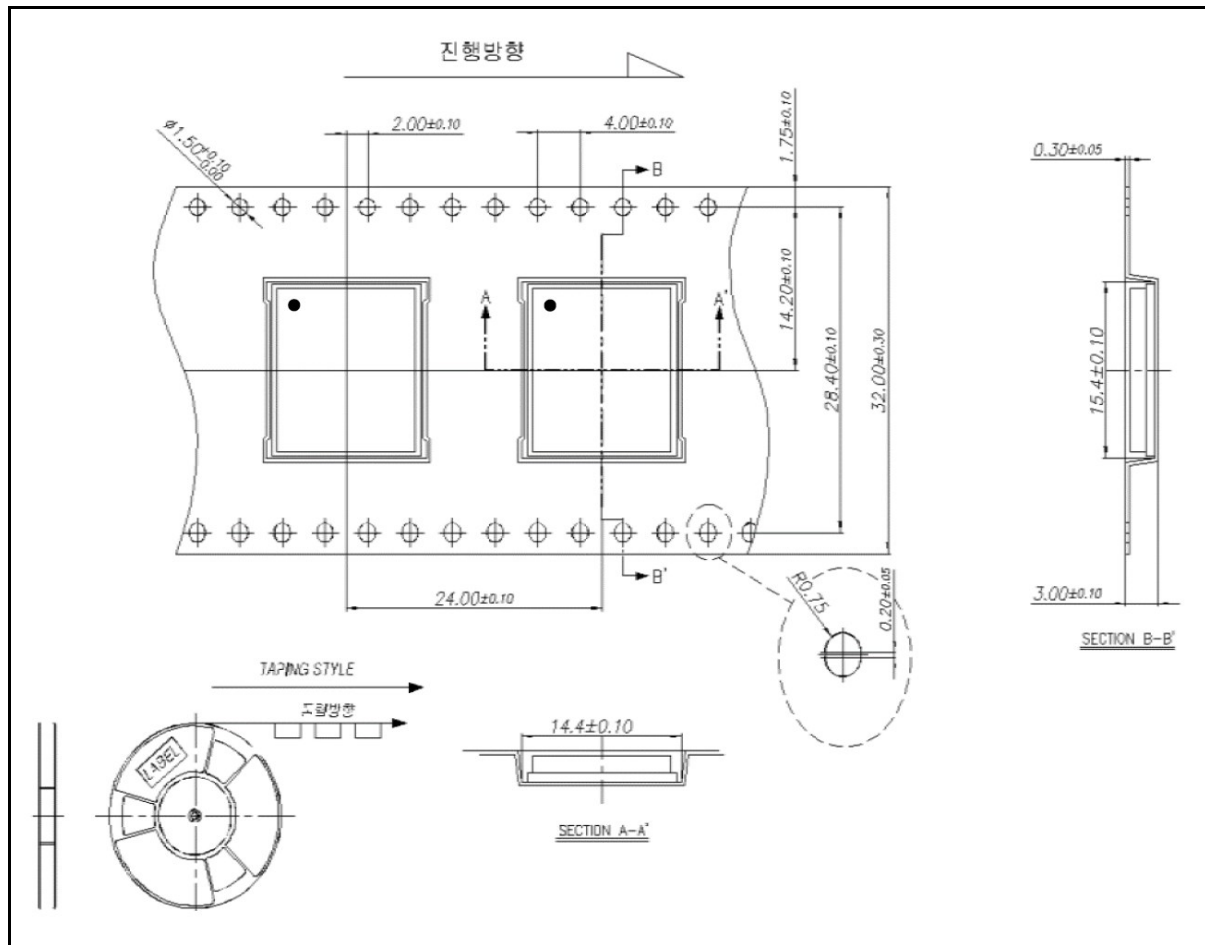


Figure 7-1: Reel packing

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

\* Packing Q'ty: 500ea

## 8. 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.