

# LoRa Module

## MS21SF1

### Datasheet

V 1.1.0

Applicable Product Model
MS21SF1-LLCC68
MS21SF1-SX1262

# Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Vinle	2023.08.29	
1.1.0	Addition of modules TX, RX mode control	Vinle	2023.09.29	

# MS21SF1-LLCC68/SX1262

**Low-power, ultra-long-range, Small and easy to operate, high-sensitivity**



MS21SF1 module is based on Semtech's LoRa wireless half-duplex transceiver chip, LLCC68/SX1262, and supports global ISM frequencies. It is a low-power, ultra-long-range, small and easy-to-use SPI-interfaced LoRa® transceiver module, with a current of only 4.7mA in receive mode, and achieves a high +22dBm transmission power through the internal integrated high-efficiency power amplifier. Higher reception sensitivity down to -146dBm, compliance with the physical layer requirements of the LoRaWAN® standard specification, and support for LoRa® P2P (points-to-point ). Supporting customers in the rapid set-up of their private, long-range LoRa® networks.

## ■ Features

- Non-MCU Control, external MCU is required to connect and control through SPI interface
- Programmable bit rates, with bit rates reaching up to 62.5 kbps for both LoRa and FSK modulation
- Transmission Range up to 5KM
- Support SPI interface, can be connected directly to a variety of MCUs Application

## ■ Application

- Security and early warning equipment
- Instrumentation
- smart metering
- Agricultural sensors
- Retail Store Sensor street

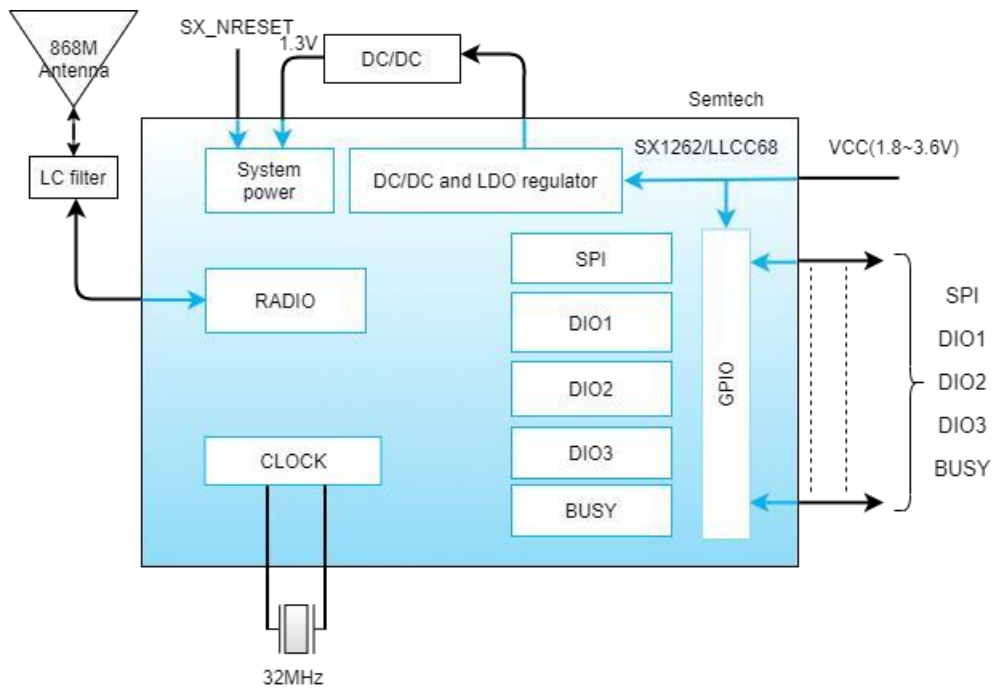
## ■ Key parameter

<b>Chip Model</b>	LLCC68/SX1262	<b>Antenna</b>	IPEX
<b>Module size</b>	16.4x15x3mm	<b>GPIO</b>	5
<b>Receiving Sensitivity</b>	-146dBm	<b>Transmission Power</b>	+22dBm
<b>Current(TX)</b>	118mA	<b>Current(RX)</b>	4.7mA

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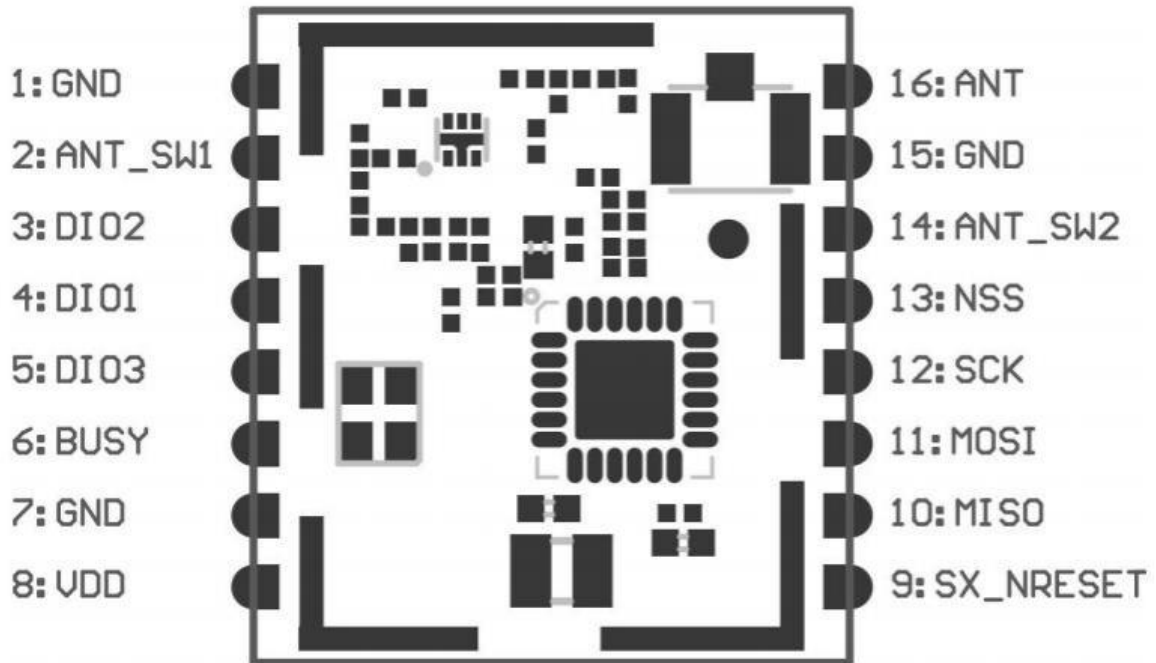
# 1 Block Diagram



# 2 Electrical Specification

Parameter	Values	Notes
Operation Voltage	1.7V-3.7V	To ensure RF work, supply voltage suggest not lower than 3.3V
Operation Temperature	-40°C~+85°C	
Transmission Power	+22dBm	Configurable
ISM Frequency	150~960MHz	Optional, default 868MHZ
Current(RX)	4.7mA	RX mode
Current(TX)	118mA	TX mode
Module Dimension	16.4x15x3mm	
Quantity of IO Port	5	

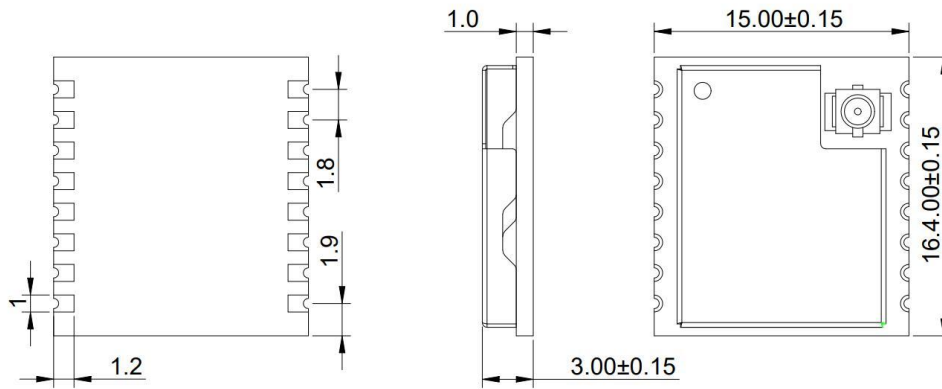
### 3 Pin Description



## 4 Pin Definition

Number	Symbol	Type	Function description	Notes
1	GND	-	Grounded	
2	ANT_SW1	SWITCH	Antenna switch control	RF TX signal Control Switch, connect the external MCU IO or DIO2, and the high level is valid
3	DIO2	I/O	Multi-purpose digital I/O / RF Switch control	
4	DIO1	I/O	Multi-purpose digital I/O	
5	DIO3	I/O	Multi-purpose digital I/O - external TCXO supply voltage	
6	BUSY	O	Busy instruct	
7	GND	-	Ground	
8	VDD	I	Input voltage for power amplifier regulator	Power supply to voltage 3.3V
9	SX_NRESET	I/O	Reset signal	Active low
10	MISO	O	SPI Slave output	
11	MOSI	I	SPI Slave input	
12	SCK	I	SPI clock	
13	NSS	I	SPI chip select (CS)	
14	ANT_SW2	SWITCH	Antenna switch control	
15	GND	-	Grounded	RF switch receiving control pin, connected to external MCU IO, active at high level
16	ANT	-	Antenna connect pin	

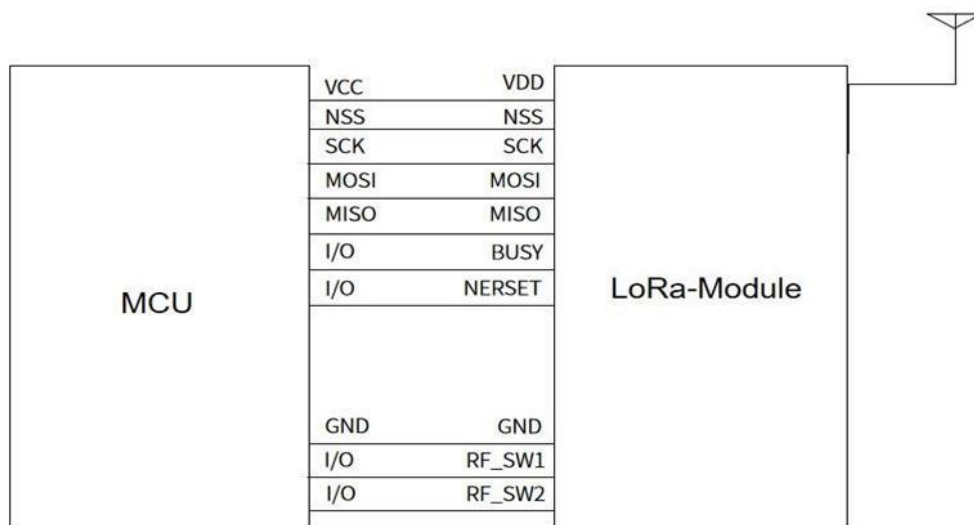
## 5 Mechanical Drawing



\* (Default unit: mm    Default tolerance: ±0.1)

## 6 Module Connection Description

### 6.1 Connection diagram





### 6.2 Power supply

The chip-sets operating voltage range is 1.8V-3.6V, to ensure normal use, the power supply voltage shall be 3.3V as far as possible.

### 6.3 SPI Interface character

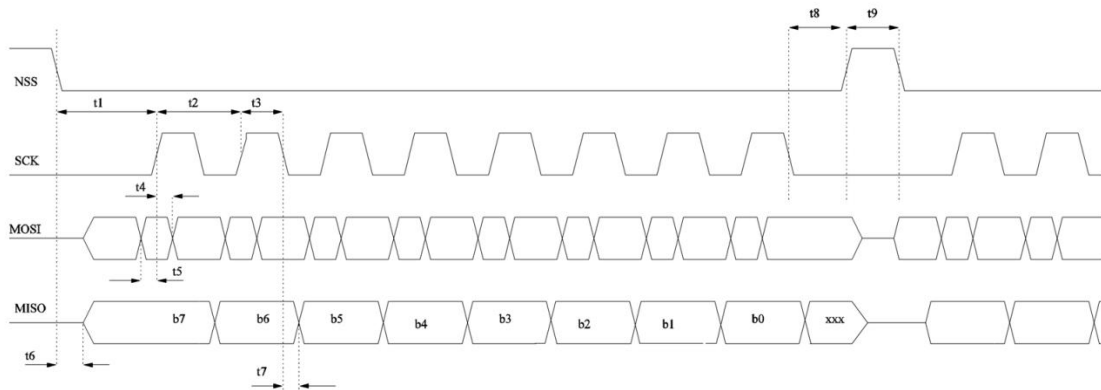
The SPI runs on an external SCK clock, allowing it to reach 16MHz.

Transmission is initiated when the NSS pin level goes low. When NSS is high, MISO is in a high impedance state.

SPI Timing Requirements (The chip implements only the Slave side function.)

Symbol	Description	Minimum	Typical	Maximum	unit
t1	NSS falling edge to SCK setup time	32	-	-	ns
t2	SCK period	62.5	-	-	ns
t3	SCK high time	31.25	-	-	ns
t4	MOSI to SCK hold time	5	-	-	ns
t5	MOSI to SCK setup time	5	-	-	ns
t6	MOSI to SCK setup time	0	-	15	ns
t7	SCK falling to MISO delay	0	-	15	ns
t8	SCK to NSS rising edge hold time	31.25	-	-	ns
t9	NSS high time	125	-	-	ns
t10	NSS falling edge to SCK setup time when switching from SLEEP to STDBY_RC mode	100	-	-	s
t11	NSS falling to MISO delay when switching from SLEEP to STDBY_RC mode	0	-	150	s

**Active Timing**



**6.3.1 DIO with IRQ control**

Commands Controlling the Radio IRQs and DIOs(At least one DIO is required for IRQ, and BUSY cable is also required to be used compulsorily) .

Command	Operate code	Parameters	Description
SetDioIrqParams	0x08	IrqMask[15:0], Dio1Mask[15:0], Dio2Mask[15:0], Dio3Mask[15:0],	Configure the IRQ and the DIOs attached to each IRQ
GetIrqStatus	0x12	-	Get the values of the triggered IRQs
ClearIrqStatus	0x02	-	Clear one or several of the IRQs
SetDIO2AsRfSwitchCtrl	0x9D	Enable	Configure radio to control an RF switch from DIO2
SetDIO3AsTcxoCtrl	0x97	tcxoVoltage, timeout[23:0]	Configure the radio to use a TCXO controlled by DIO3

**6.3.2 Module TX,RX Mode controls**

In ANT\_SW1 and DIO2 connection Point, the two connection points are IO pin and external MCU GPIO for detecting TX and RX level pins, ANT\_SW2 is the synchronization control pin:

- 1) When IO pin detects a high level, pin ANT\_SW2 sets the level to low, the mode is TX mode .
- 2) When IO pin detects a low level, pin ANT\_SW2 sets the level to high, the mode is RX mode

Mode	IO	ANT_SW2
TX	1	0
RX	0	1

**Module power consumption description**

The following power consumption test is conducted under the normal temperature condition when the power supply voltage is 3.3V. The power consumption in the 915MHz frequency band is measured.

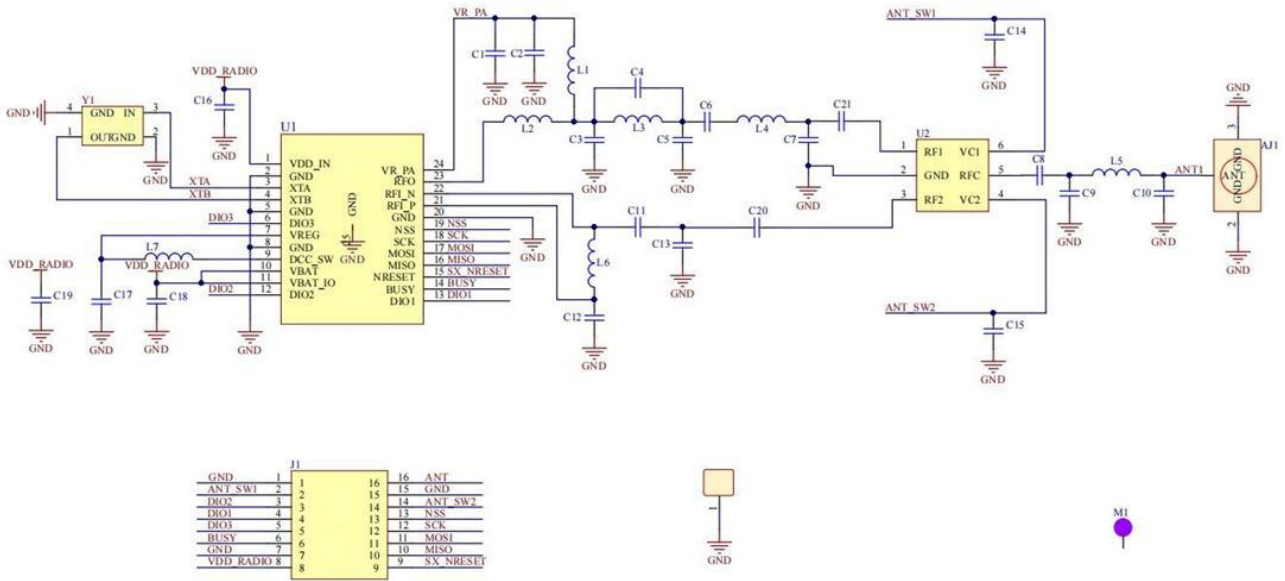
In TX Mode, the power consumption is as follows: (transmission BW is 125kHz, transmission power is+22dBm.

Mode \ Power	SF Mode	Peak	Avg
TX	SF7	112.01mA	98.60mA
	SF12	123.32mA	115.62mA

In RX Mode SleepMode, Power consumption as below: (Receiving BW is 125kHz, Transmission power is +22dBm)

Mode \ Power	Peak	Avg
Sleep	538.41uA	538.41uA
RX	4.76mA	4.76mA

# 7 Electrical Schematic



**Notice:** Before placing an order, please confirm the specific configuration required with the salesperson.

## 8 PCB Layout

Module antenna area couldn't have GND plane or metal cross line, couldn't place components nearby. It is better to make hollow out or clearance treatment or place it on the edge of PCB board.

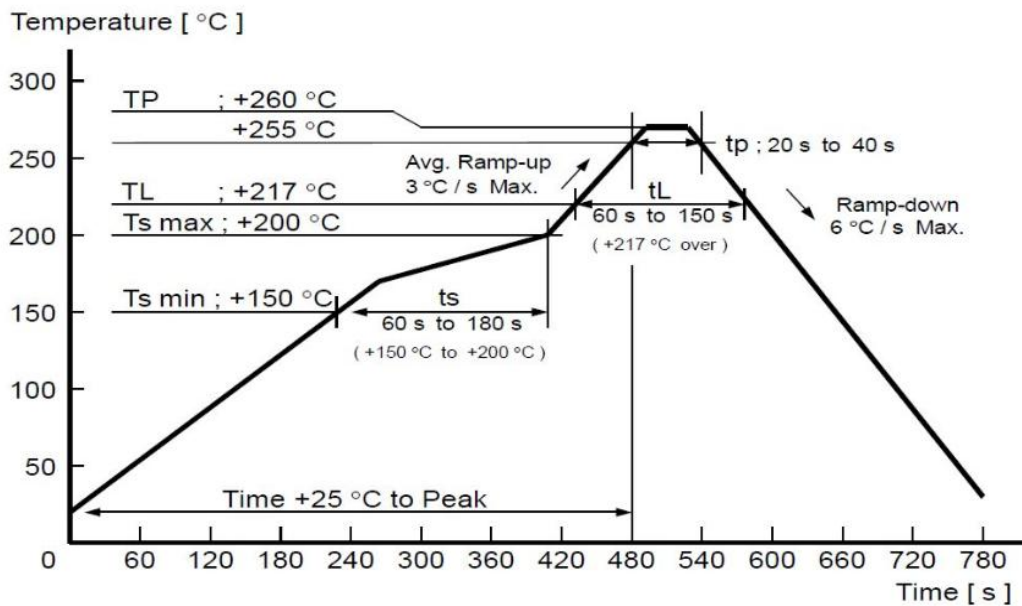
### Layout notes:

- 1) Preferred Module antenna area completely clearance and not be prevented by metals, otherwise it will influence antenna's effect (as above DWG. indication).
- 2) Cover the external part of module antenna area with copper as far as possible to reduce the main board's signal cable and other disturbing.
- 3) It is preferred to have a clearance area of 4 square meter or more area around the module antenna (including the shell) to reduce the influence to antenna.
- 4) Device should be grounded well to reduce the parasitic inductance.
- 5) Do not cover copper under module's antenna in order to avoid affect signal radiation or lead to transmission distance affected.
- 6) Antenna should keep far from other circuits to prevent radiation efficiency reduction or affects the normal operation of other lines.
- 7) Module should be placed on edge of circuit board and keep a distance away from other circuits.
- 8) Suggesting to use magnetic beads to insulate module's access power supply.

## 9 Reflow and Soldering

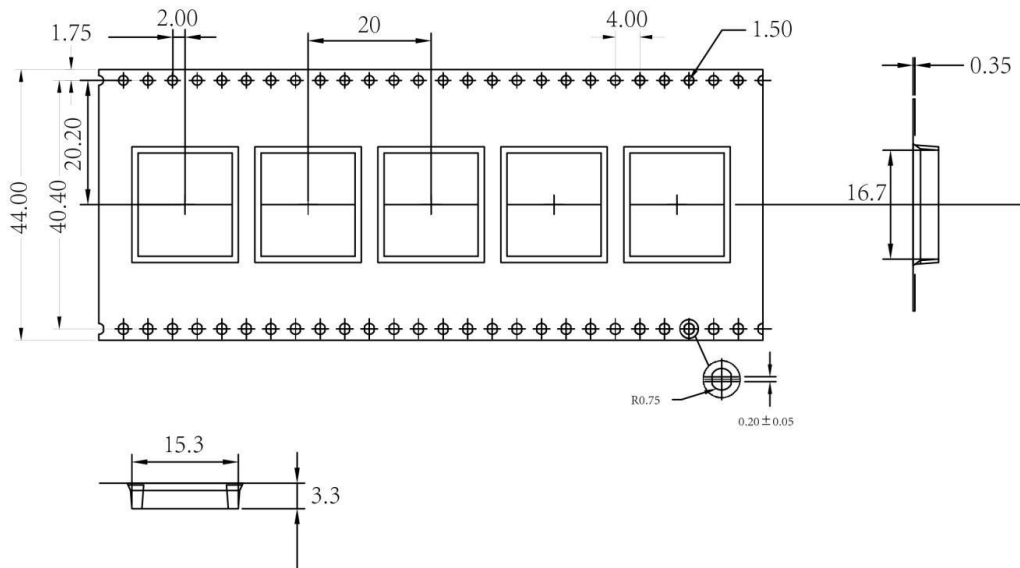
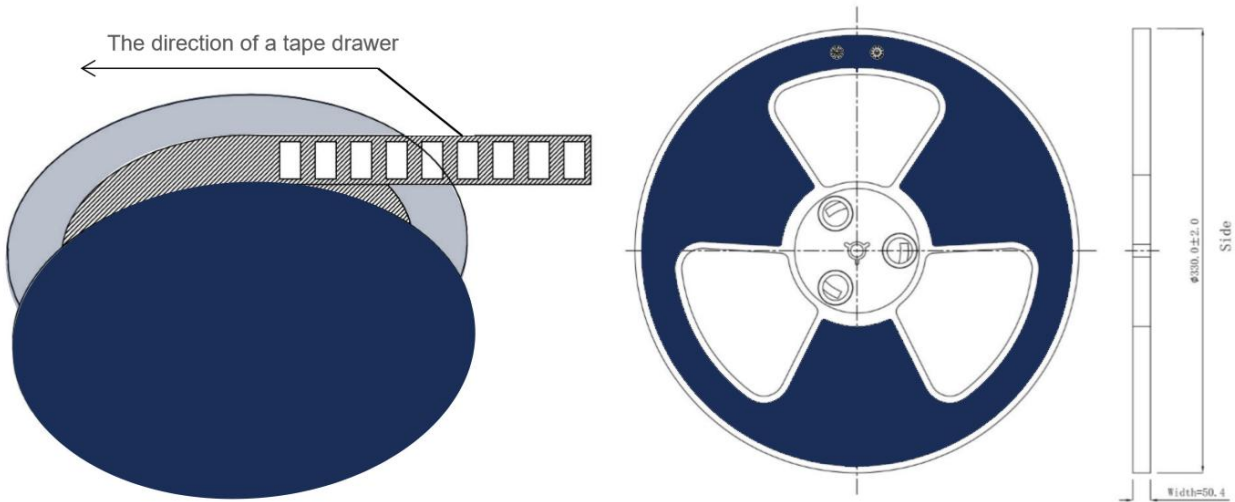
1) Do SMT according to above reflow oven temperature deal curve. Max. Temperature is 260°C;

Refer to IPC/JEDEC standard; Peak TEMP<260°C; Times: ≤2 times, suggest only do once reflow soldering on module surface in case of SMT double pad involved. Contact us if special crafts involved.



- 2) Suggesting to make 0.2mm thickness of module SMT for partial ladder steel mesh, then make the opening extend 0.8mm
- 3) After unsealing, it cannot be used up at one time, should be vacuumed for storage, couldn't be exposed in the air for long time. Please avoid getting damp and soldering-pan oxidizing. If there are 7 to 30 days interval before using online SMT, suggest to bake at 65-70 °C for 24 hours without disassembling the tape.
- 4) Before using SMT, please adopt ESD protection measure.

# 10 Package Information



\* (Default unit: mm    Default tolerance:  $\pm 0.1$ )

Packing detail	Specification	Net weight	Gross weight	Dimension
Quantity	850PCS	935g	1475g	W=44mm, T=0.35mm

**\* Note:** Default weight tolerance all are within 10g (except the special notes)

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Cognizant of our commitment to quality, we operate our own factory equipped with state-of-the-art production facilities and a meticulous quality management system. We hold certifications for ISO9001, ISO14001, ISO27001, OHSAS18001, BSCI.

Every product undergoes stringent testing, including transmit power, sensitivity, power consumption, stability, and aging tests. Our fully automated module production line is now in full operation, boasting a production capacity in the millions, capable of meeting high-volume production demands.

## ● Contact Us

Shenzhen Minewsemi Co., Ltd. is committed to swiftly delivering top-quality connectivity modules to our customers. For assistance and support, please feel free to contact our relevant personnel, or contact us as follows:

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