

# LoRaWAN Module |

**MS23SF1**

**Datasheet**

V 1.0.0

Applicable Product Model
MS23SF1

# Version Note

Version	Details	Contributor(s)	Date	Notes
1.0.0	First edit	Vinle	2022.12.28	

# MS23SF1-STM32WLE5CC

**Low-power, ultra-long-range, small and easy to operate, high-sensitivity, support LoRaWAN**



MS23SF1 Module is selected from ST LoRaWAN STM32WLE5CC, Wireless Half duplex transceiver chips, which supports global frequency ISM. It is a typical LoRa®WAN transceiver module, that supports multiple interfaces. The current in receive mode is only 4.2mA. It can achieve transmission power up to +20.5dBm with higher reception sensitivity, and 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

- Small dimension, built-in 48MHz Arm Cortex-M4
- Programmable bit rate, 64KB internal RAM, 256KB Flash
- Transmission Range up to 5KM
- Multi-IO port, support GPIO24
- Tx Power maximum up to +20.5dBm, RSSI -146dBm

## ■ Application

- Smart Metering
- Auto Buildings
- Agriculture Sensor
- Retail Sensor

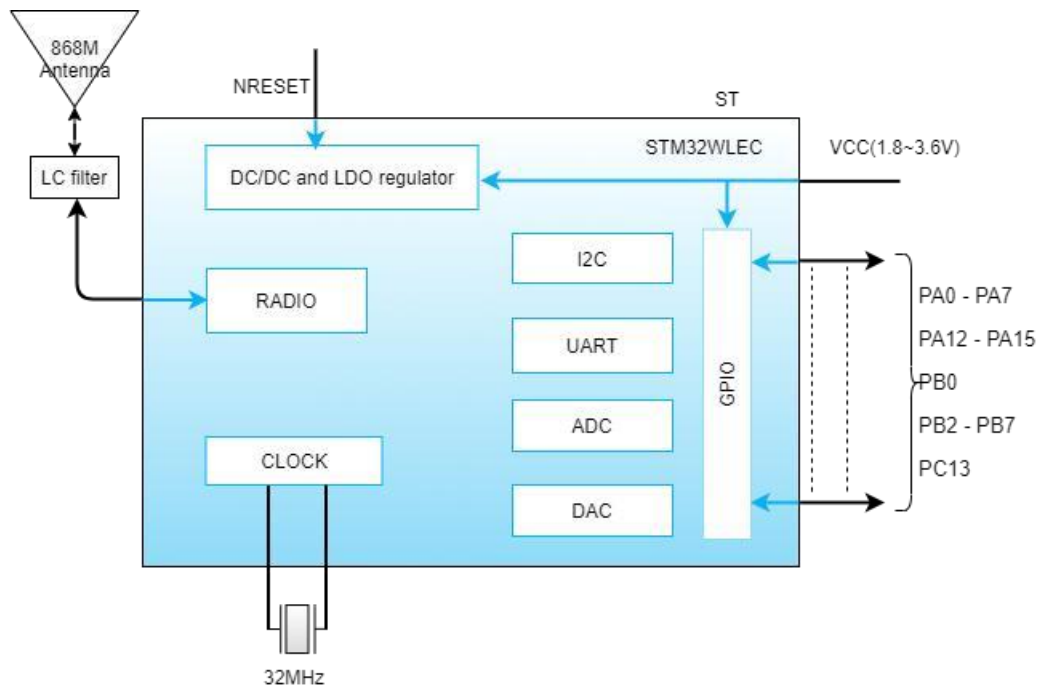
## ■ Key parameter

<b>Chip Model</b>	STM32WLE5CC	<b>Antenna</b>	None
<b>Module size</b>	20.72x19.13x3mm	<b>GPIO</b>	24
<b>Flash</b>	256KB	<b>RAM</b>	64KB
<b>Receiving Sensitivity</b>	-146dBm	<b>Transmission Power</b>	+20.5dBm
<b>Current(TX)</b>	120mA	<b>Current(RX)</b>	4.2mA

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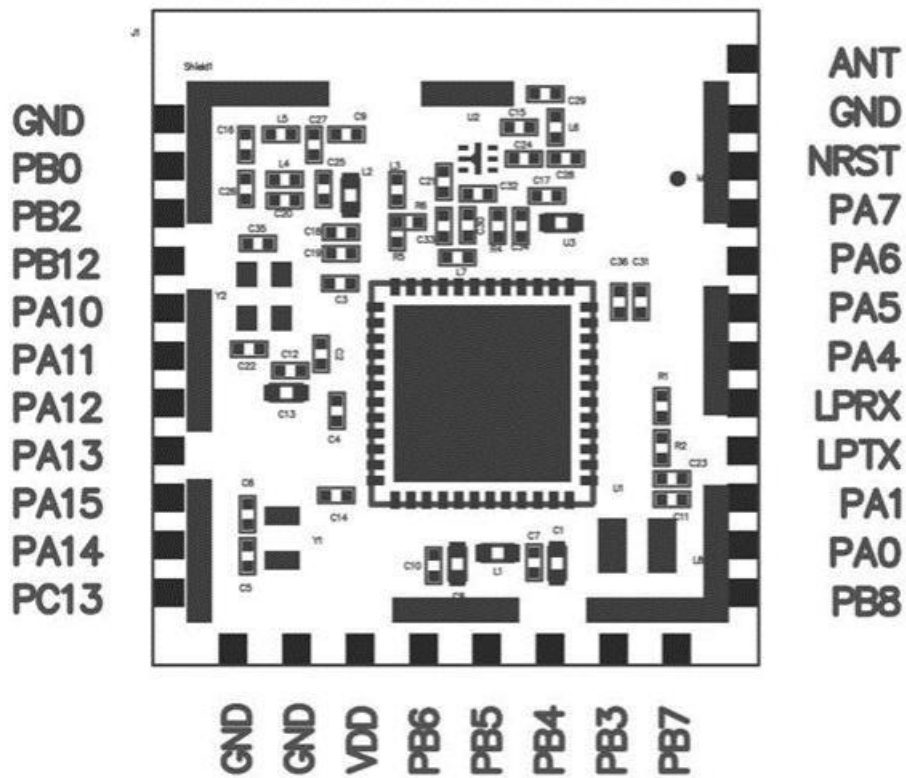
### 1 Block Diagram



### 2 Electrical Specification

Parameter	Values	Notes
Operation Voltage	1.8V-3.6V	To ensure RF work, supply voltage suggest not lower than 3.3V
Operation Temperature	-40°C~+85°C	
Transmission Power	+20.5dBm	Optional 14dBm
ISM Frequency	150~960MHz	Optional, Default 868MHz
Current(RX)	4.2mA	Rx mode
Current(TX)	120mA	Max. in Tx mode
Module Dimension	20.72x19.13x3mm	
Quantity of IO Port	24	

### 3 Pin Description



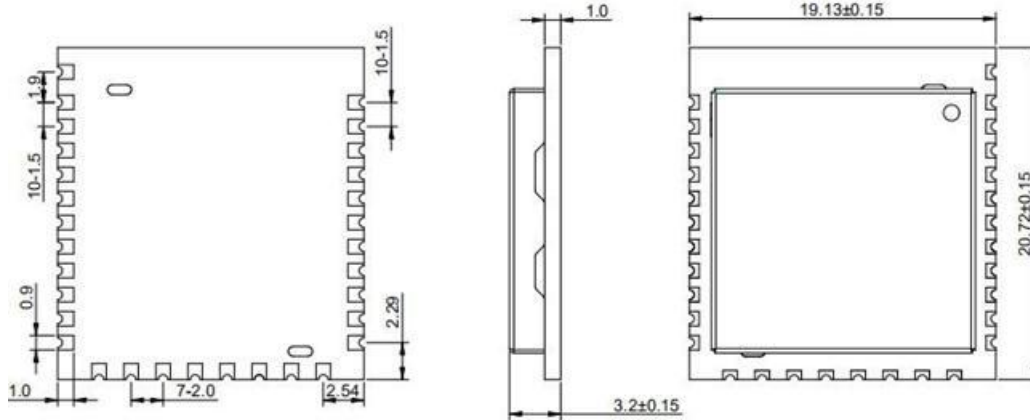
### 4 Pin Definition

Number	Symbol	Definition	Description	Notes
1	GND	-	Ground	
2	PB0	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
3	PB2	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
4	PB12	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
5	PA10	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
6	PA11	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
7	PA12	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
8	PA13	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
9	PA15	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
10	PA14	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
11	PC13	I	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
12	GND	-	Grounded	
13	GND	-	Grounded	
14	VDD	I	Power supply	
15	PB6	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
16	PB5	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
17	PB4	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
18	PB3	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)

19	PB7	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
20	PB8	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
21	PA0	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
22	PA1	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
23	LPTX	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
24	LPRX	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
25	PA4	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
26	PA5	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
27	PA6	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
28	PA7	I/O	Multi-functional digital I/O interface	Configurable general purpose IO interface (Check STM32WLE5CCU6 manual for details)
29	NRST	I/O	Reset	Module reset
30	GND	-	Grounded	
31	ANT	I/O	Antenna Connection	RF Antennas Access



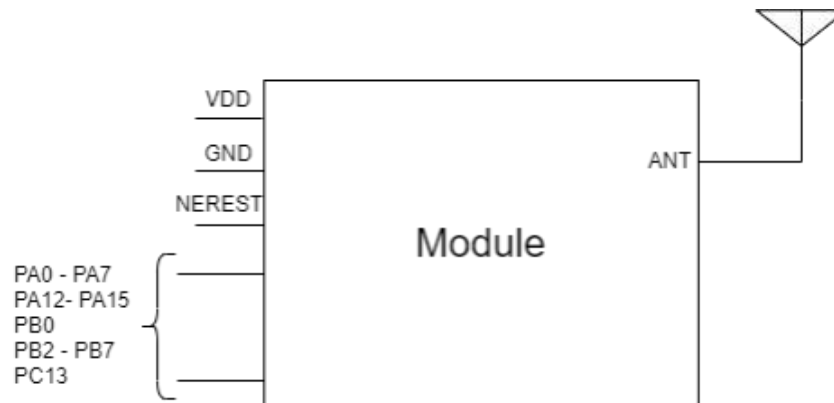
## 5 Mechanical Drawing



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

## 6 Module Operation Instruction

### 6.1 Demonstration of module application



#### 6.1.1 Power supply

The operation voltage is 1.8V-3.6V, to ensure a stable function, supply voltage should be 3.3V as far as possible.

#### 6.1.2 Module consumption description

The power consumption test below is tested at a power supply voltage of 3.3V and normal temperature. 868MHz transmit BW is 125kHz, transmit power is +20.5dBm, Tx mode SF12 frequency band power consumption.

Status	Power	SF Mode	Peak	Avg
TX		SF12	86.41mA	77.19mA

### 6.1.3 software development

For LoRaWAN™ development, please download and refer to the instructions in ST's [STM32CubeWL](#) library file, and use stm32cubemx software to generate the protocol stack project of the relevant development platform;

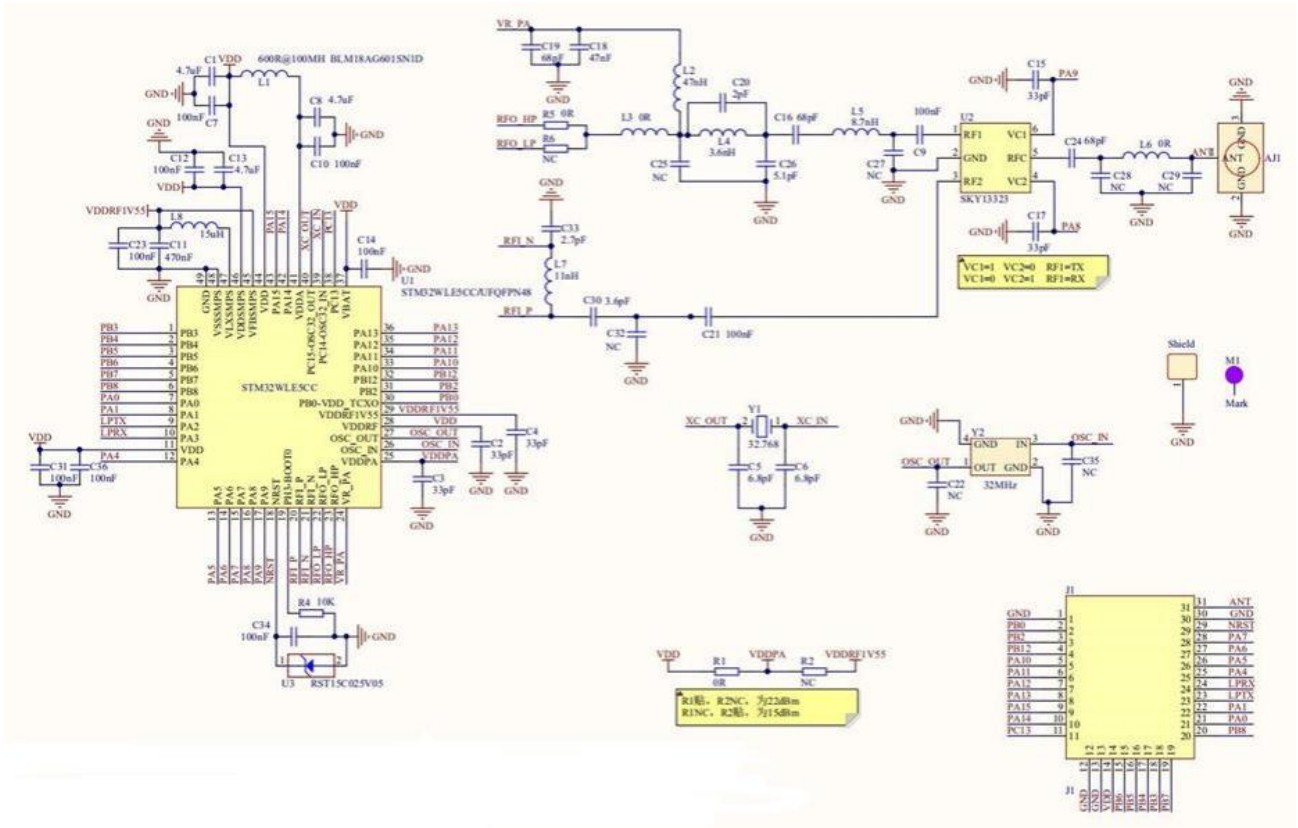
The PA8 and PA9 pins are used as the internal control RF switch of the module, which are RF\_TXEN and RF\_RXEN respectively, and the modes are shown in the figure below.

Generally, it is not recommended to enable RX and TX at the same time. When transmitting, TX is enable and RX is disable ; When receiving, RX is enable and TX is disable.

Mode	PA9	PA8
RF_TXEN	1	0
RF_RXEN	0	1

**Notice:** At present, the supported firmware is "LoRaWAN Transparent Firmware" and "AT Firmware (for demo use)".

# 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.

**Notice:** Refer to examples as below, and highly suggest to use the first design and the adjustment of modules antenna design according to the first wiring.

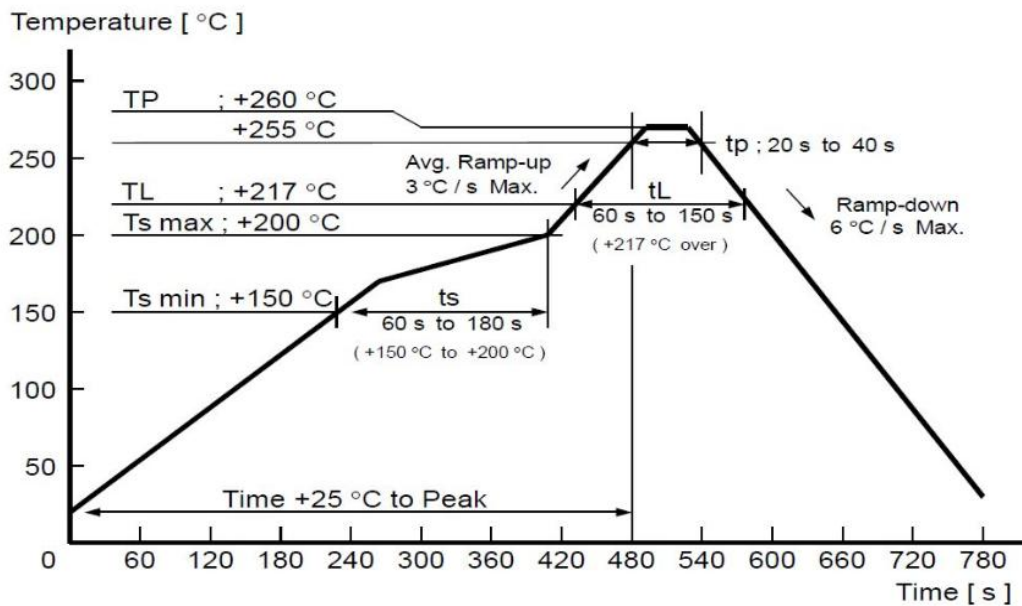
### Layout notes:

- 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

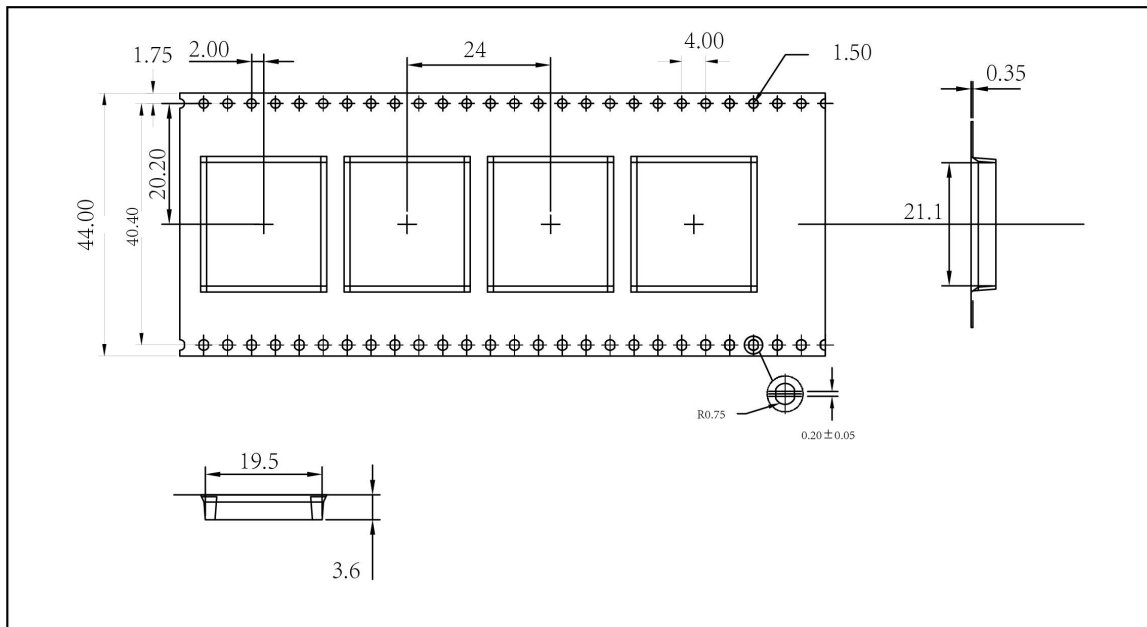
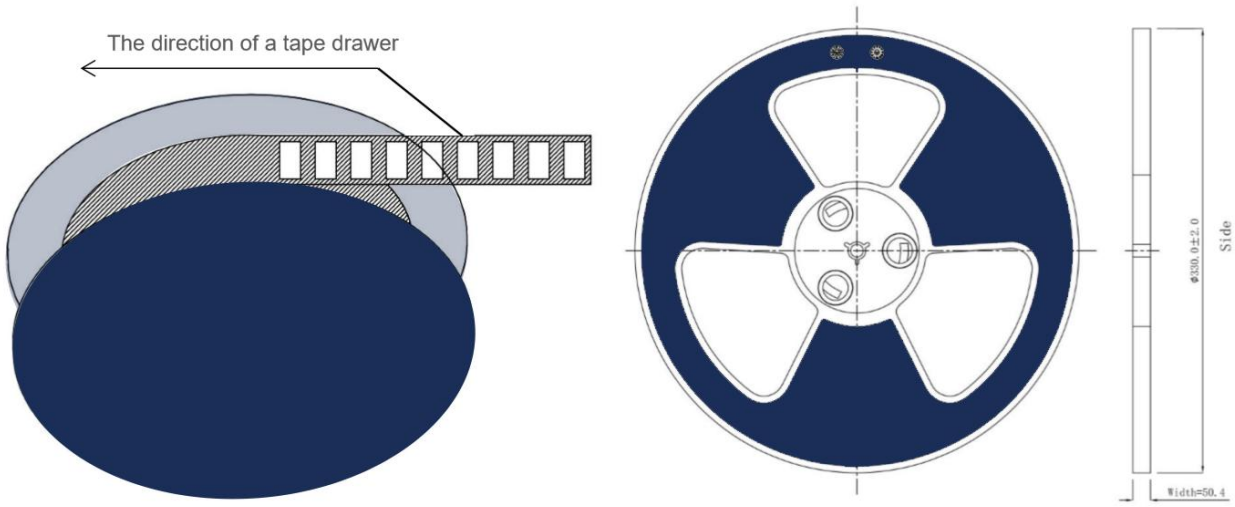
1) Do SMT according to above reflow oven temperature deal curve. Max. Temperature is 260°C;

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: ±0.1)

Packing detail	Specification	Net weight	Gross weight	Dimension
Quantity	750PCS	1395g	1935g	W=44mm, T=0.35mm

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

## ● Quality

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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