

LoRa Module

MS21SF1

Specification V1.0

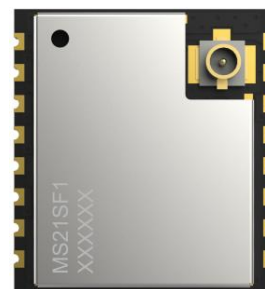
MinewSemi

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- ◆ Nordicsemi Strategy Partner
- ◆ Bluetooth SIG Associated Member
- ◆ Fira Alliance Adopter Member

Semtech SX1262

LoRa Module

MS21SF1



IPEX

MS21SF1 Module is selected from Semtech LoRa SX1262, Wireless Half duplex transceiver chips, which supports global frequency ISM. It is a typical LoRa® transceiver module, that features low- power, ultra- long range and easy to use SPI interface. The current in receive mode is only 4.7mA. It can achieve transmission power up to +22dBm with higher reception sensitivity, and down to -146dBm, which through the internal integration of high-efficiency power amplifiers. Compliant with LoRaWAN physical layer requirement standard specification, it supports LoRa® P2P(per-to-per)communication, enabling customers to quickly establish private long-range LoRa ® network point.

MS21SF1 Module is suitable for various application scenarios that require remote data collection and low power consumption.

MS21SF1 Basic Parameters			
Model	MS21SF1	Antenna	IPEX
ChipSet	Semtech SX1262	Dimension	16.4*15*3mm
RSSI	-146dBm	Tx. Power	+22dBm
TX Current	8.2mA	Rx Current	4.7mA
GPIO	5	Firmware	None
Application	Smart Metering, Auto Buildings, Agriculture Sensor, Smart Cities, Retail Sensor		

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1 Product Introduction

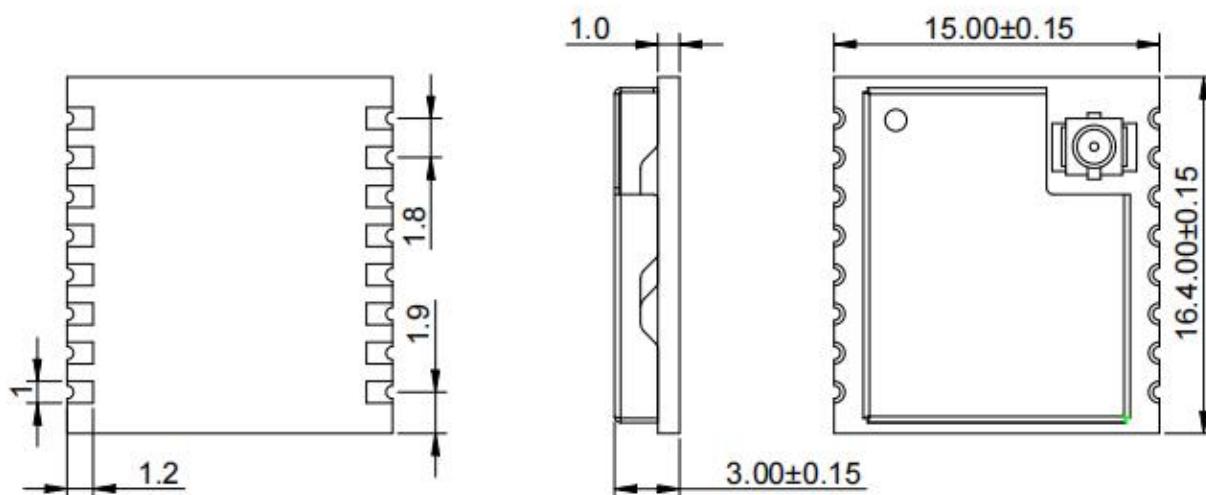
MS21SF1 is Wireless Half duplex transceiver LoRa module, supports FSK, GFSK, LoRa modulation and demodulation working mode, supports P2P Data transmission of communication. Devices default is Non-Firmwave module and Non-MCU, external MCU is required to connect and control through SPI interface. It has ultra-long range communication transmission and ultra-low power consumption, the current in receive mode is only 4.7mA, the current under the maximum power in the transmission mode is only 118mA, and the voltage is 3.1V.

Semtech Patent LoRa™ Modulation technology also has obvious advantages in anti-interference and long-distance transmission, which solves the problem that traditional design schemes can not give consideration to distance, anti-interference and power consumption at the same time.

Features :

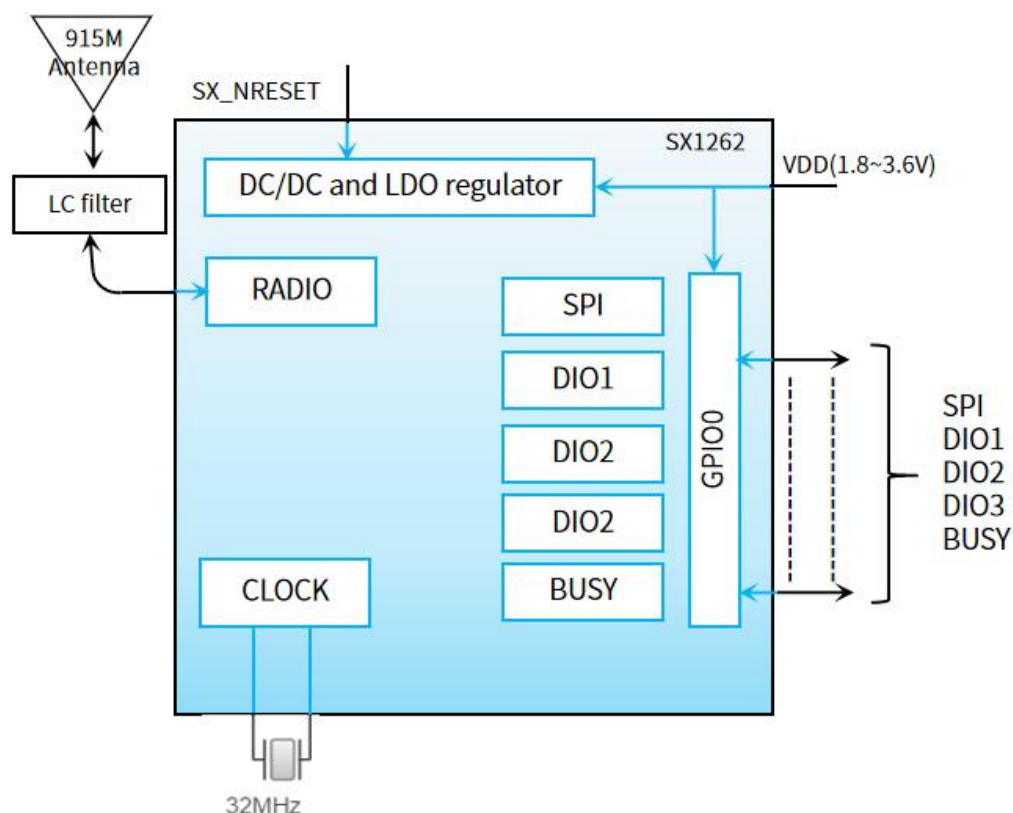
- Non-MCU Control, external MCU is required to connect and control through SPI interface
- Programmable bit rate up to 62.5 kbps LoRa and 300 kbps FSK
- Transimtion Range up to 3KM
- Support SPI interface,It can be directly connected to various MCU for use
- Tx Power maximum up to +22dBm,RSSI -146dBm

2 Mechanical Drawing



(unit: mm Tolerance: +/- 0.1, default)

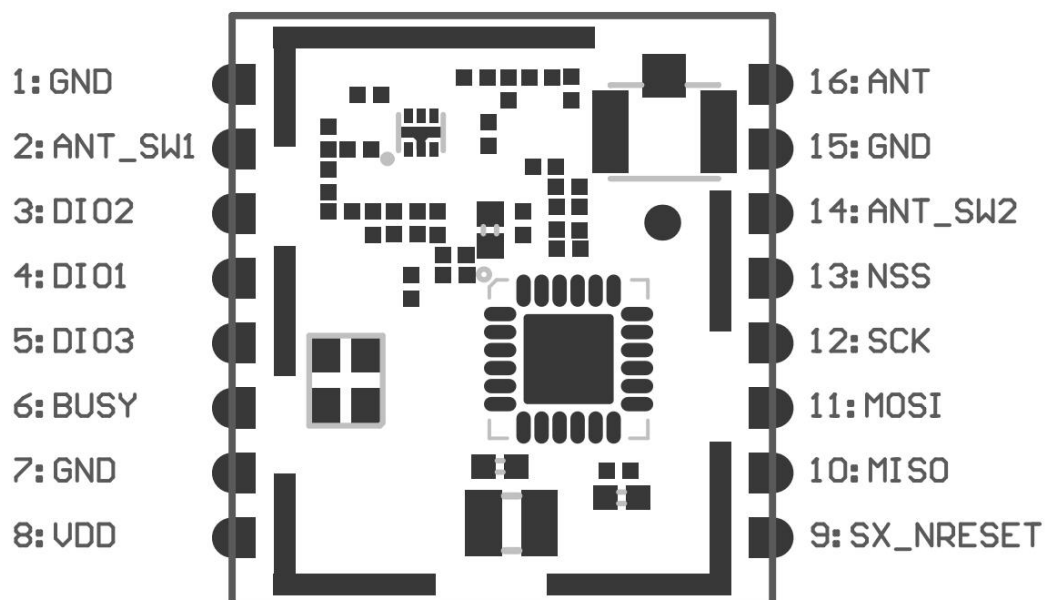
3 Block Diagram



4 Electrical Specification

Parameter	Values	Notes
Operating Voltage	1.8V-3.7V	To ensure RF operation, 3.3V power supply voltage is recommended
Operating Temperature	-40°C~+85°C	
Tx. Power	+22dBm	setting
ISM Frequency	150~960MHz	option
RX Current	4.7mA	Rx mode
TX Current	8.2mA	
Dimension	16.4*15*3mm	
GPIO	5	DIO1、DIO2、DIO3、BUSY、SX_NRESET

5 Pin Description

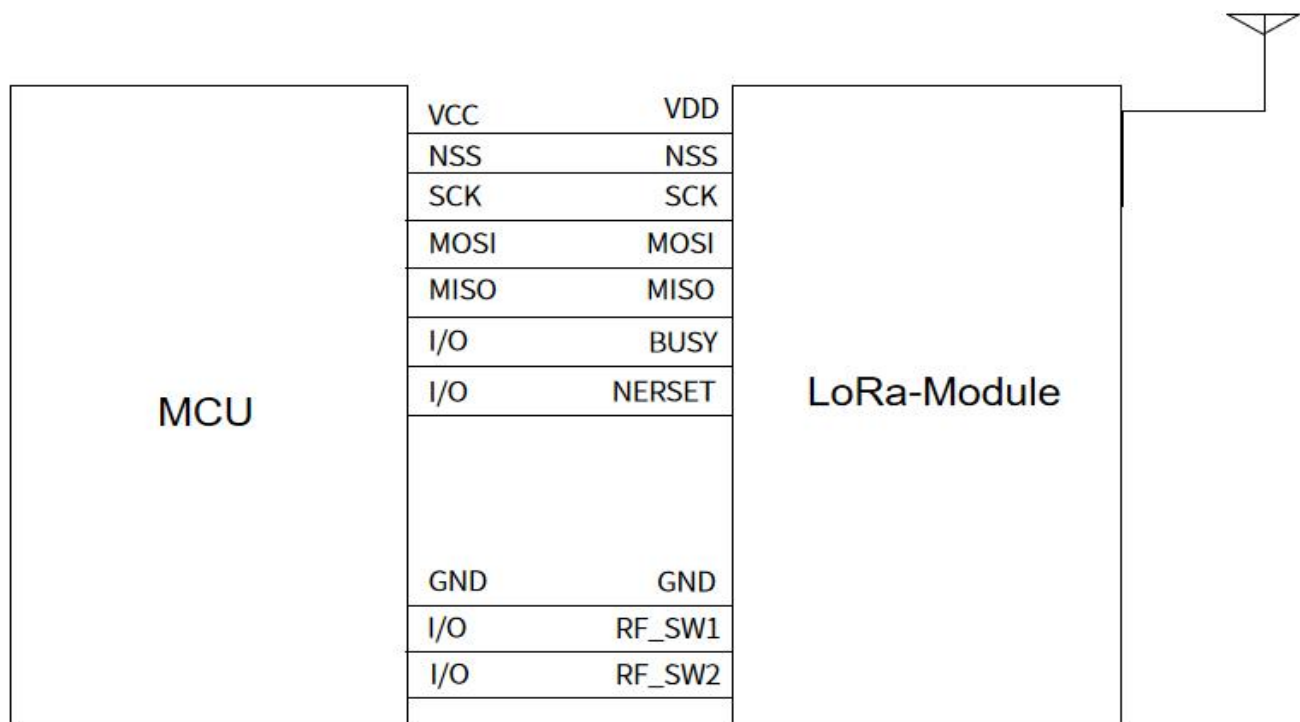


6 Pin Definition

Item	Symbol	Definition	Description	Note
1	GND	-	Ground	
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	NC	-	NC pin	
13	SCK	I	SPI clock	
14	NSS	I	SPI Slave Select	
15	ANT_SW2	SWITCH	RF antenna control	RF switch receiving control pin, connected to external MCU IO, active at high level
16	ANT	-	Antenna connect pin	

7 Module Operation Instruction

7.1 Demonstration of module application



7.1.1 Power supply

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

7.1.2 SLP interface character

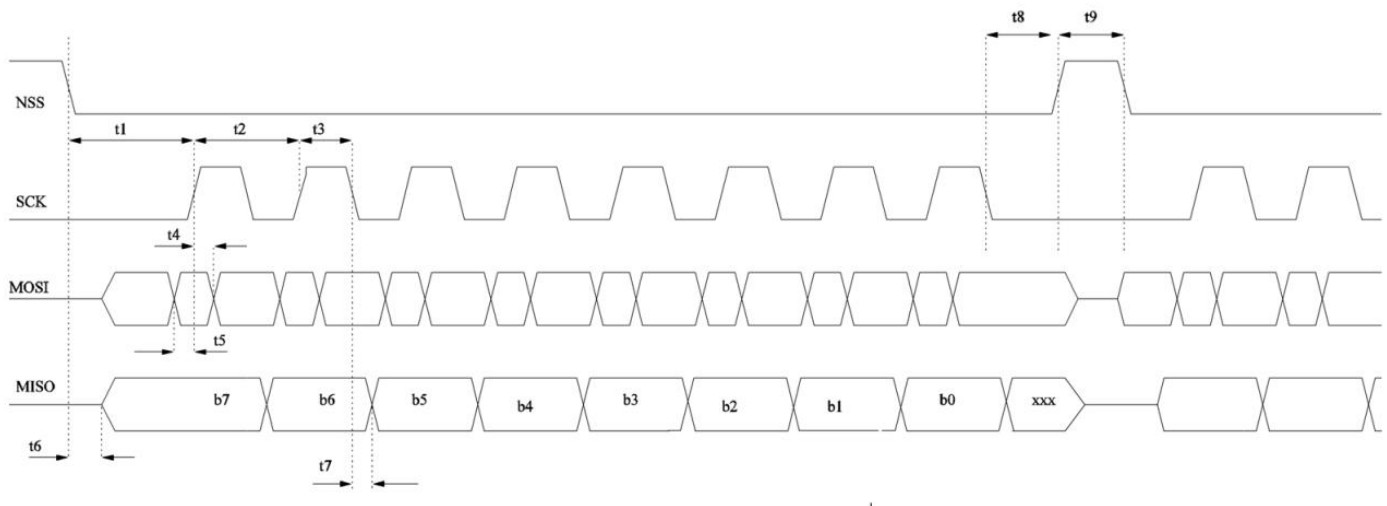
SPI runs on an external SCK clock, enabling it to reach a rate of 16MHz.

The transmission starts when the NSS pin level becomes low. When the NSS is high level, the MISO is in a high impedance state.

SPI Timing Requirements(the chip-set only realizes the slave 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



7.1.3 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	Opcode	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

Module power consumption description

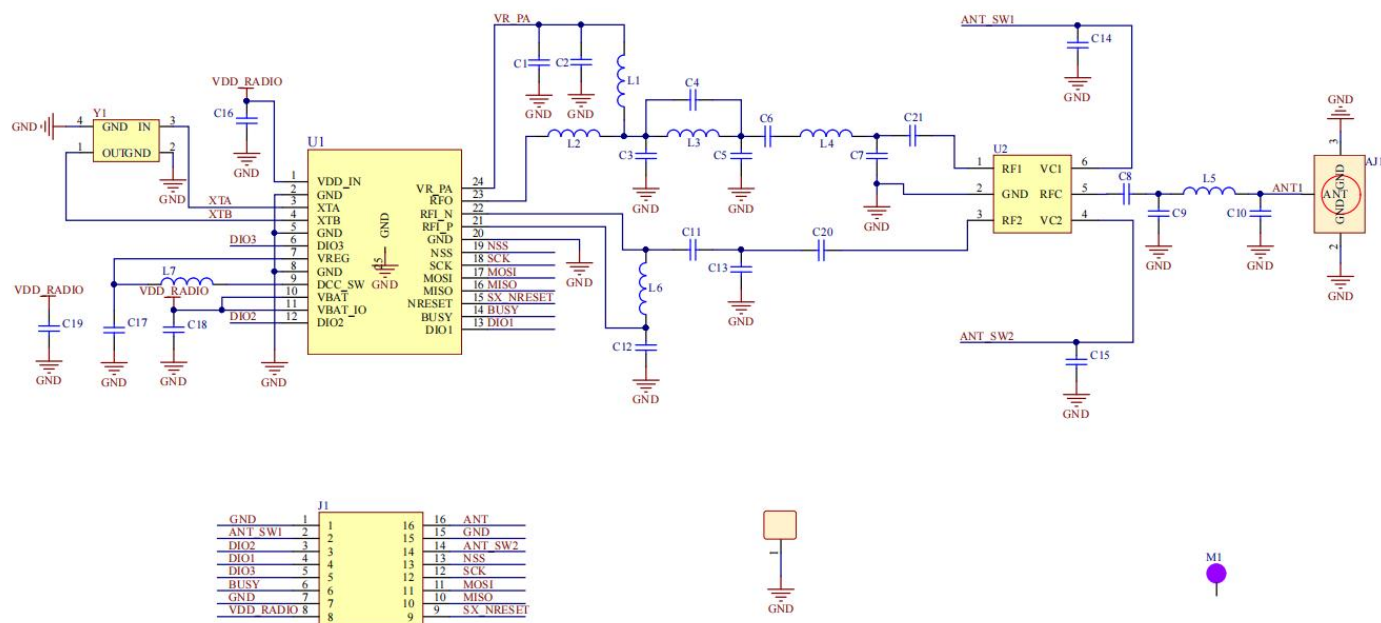
The following power consumption test is conducted under the normal temperature condition when the power supply voltage is 3.3V. The power consumption in the 915MHz frequency band is measured. In TX Mode, the power consumption is as follows: (transmission BW is 125kHz, transmission power is +22dBm).

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	0.85uA
RX		4.76mA	4.22mA

8 Electrical Schematic



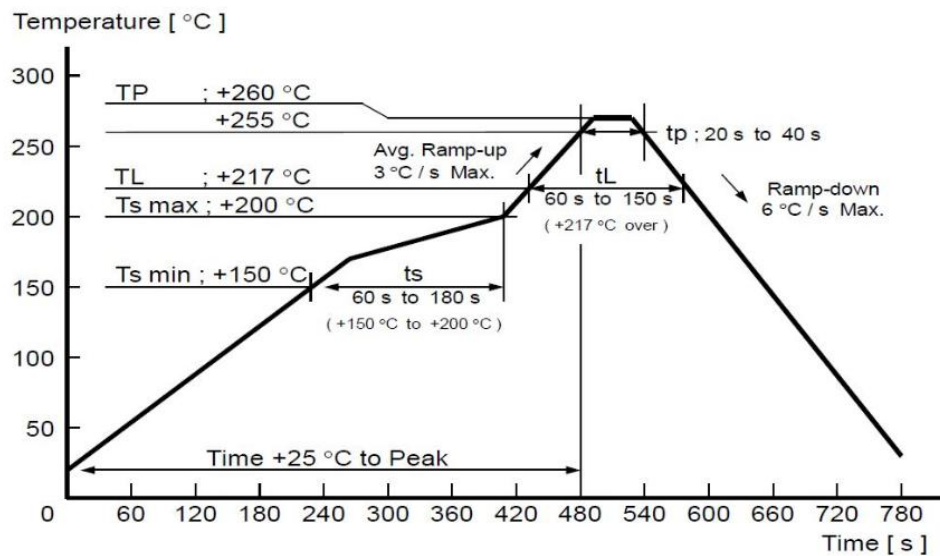
9 PCB Layout

No GND plane or metal cross wiring is allowed in the module antenna area, no components can be placed nearby, It is better to hollow out or headroom area, or lay up PCB edges.

Layout Propose:

- 1) The module antenna area must be completely headroom, No metal blocking is allowed, Otherwise, the antenna effect will be affected;
- 2) Outside the module antenna area, try to lay up copper to the full, to reduce the board signal line or other interference;
- 3) Module Antenna area all around (contain housing) ,it is better to have a headroom area of 4mm and above, to reduce its impact on the antenna;
- 4) Devices shall be well grounded, reduce parasitic inductance;
- 5) Do not lay copper under the module antenna area, In case it affects the signal radiation, the transmission distance is affected;
- 6) The antenna should be placed away from other circuits, prevent the radiation efficiency from decreasing and affecting the normal use of other circuits;
- 7) The module shall be placed at the edge of the circuit board as far as possible, away from other circuits;
- 8) It is recommended to use magnetic beads to isolate the power supply of the module.

10 Reflow and Soldering



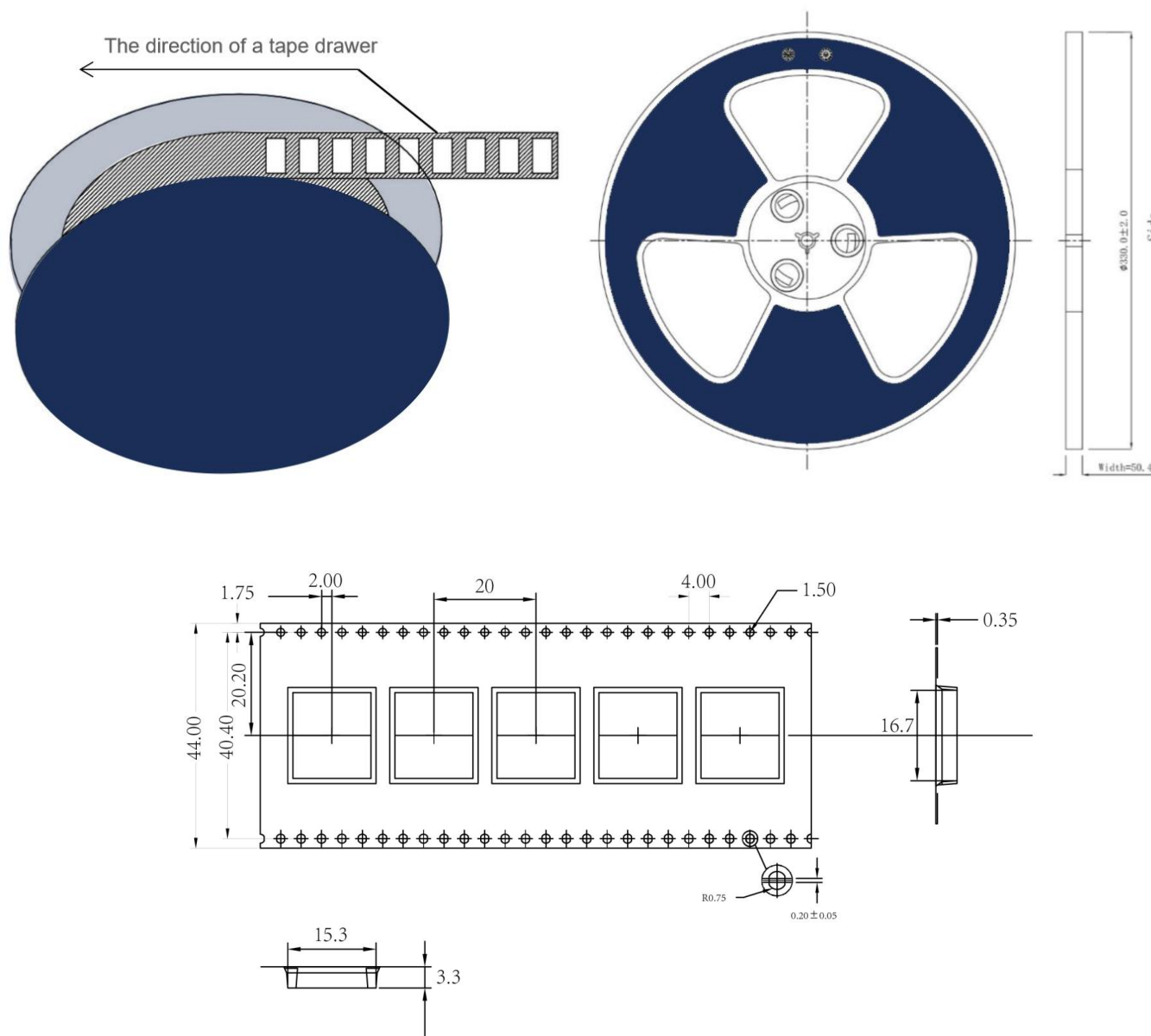
Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmín)	100°C	150°C
Preheat Temperature max (Tsmáx)	150°C	200°C
Preheat Time (Tsmín to Tsmáx)(ts)	60-120 sec	60-120 sec
Average ramp-up rate (Tsmáx to Tp)	3°C/second max	3°C/second max
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60-90 sec	30-90 sec
Peak Temperature (Tp)	220-235°C	230-250°C
Average ramp-down rate (Tp to Tsmáx)	6°C/second max	6°C/second max
Time 25°C to peak temperature	6 minutes max	8 minutes max

Important:

- When SMT involves double-sided patch, it is recommended that the module surface be reflowed only once.
- For module SMT, it is recommended to make a partial stepped stencil with a thickness of 0.2mm, and the stencil hole should be extended by 0.8mm size.
- After opening the package, it should be stored in vacuum environment. Module should not be exposed to the air for a long time to prevent moisture and pad oxidation. If there is an interval of 7 to 30 days during SMT process, it is recommended to bake it with reel at 65-70 degrees for 24 hours before using for SMT again.

11 Package Information

11.1 Package dimension



* (Unit: mm Tolerance: ± 0.1)

Item	QTY	Net Weight	Gross Weight	Size
MS21SF1	850PCS	TDB	TDB	W=44mm,T=0.35mm

Notice: Default weight error within 10g.

11.2 Part number description

Each module is with different code no. To devine whether with 32.768k or not, with on-board antenna or external antenna, the code no. will be marked on the metal shield, description as below:

Part No. in the first line		MS21SF1	Part No. in the second line	3N62AI
MS21SF1	Model No			
1	Antenna Type		1	PCB Antenna
			2	Ceramic Antenna (Chip)
			3	IPEX Connector (1st Generation)
Y	32.768KHz		Y	With 32.768K Crystal Oscillaor
			N	Without 32.768K Crystal Oscillator
10	SoC		05	m1805,nRF52805
			08	TLSR8208
			10	nRF52810
			20	nRF52820
			32	nRF52832
			33	nRF52833
			40	nRF52840,nRF5340
			C3	ESP32-C3FN4
			62	SX1262
A	SoC Package		A	=AA
			B	=AB
			C	=AC
I	RF Signal Output		I	internal
			E	external

12 Quality Disclaimer

The factory has passed the ISO9001 quality management system, ISO14001 environmental management system and OAHS18001 occupational health and safety assessment . Each product has been rigorously tested (transmission power test, sensitivity test, power consumption test, stability test, aging test, etc.).

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- All specifications are subject to change without notice.
- Please do not use this specification for produce, sell or illegal purpose without MinewSemi's authorization.
- MinewSemi have right to interpret all the items above.

13 Revision History

Version	Change	Contributor	Data	Notes
1.0	First edition	Vincle	2022.09.29	

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