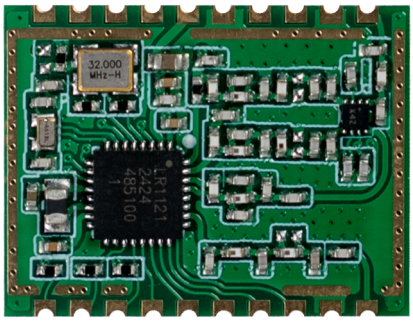
RFM92LRW Multi-Band LoRa Transceiver Module

General Description

RFM92LRW is an ultra-low power, long range LoRa® transceiver that provides support for terrestrial ISM band communications in the sub-GHz and global 2.4GHz spectrum, as well as S-Band support for satellite connectivity. The RFM92LRW supports LoRa and (G)FSK modulation on both sub-GHz and 2.4GHz bands, as well as Sigfox® modulation on sub-GHz bands, and Long Range Frequency Hopping Spread Spectrum (LR-FHSS) on sub-GHz, 1.9-2.1GHz Satellite, and 2.4GHz ISM bands.



It is designed for long battery life with just 8mA of active receive current consumption. It can transmit up to +22dBm with highly efficient integrated power amplifiers.

These devices support LoRa® modulation for LPWAN use cases and (G)FSK modulation for legacy use cases. The devices are highly configurable to meet different application requirements utilizing the global LoRaWAN standard or proprietary protocols. The devices are designed to comply with the physical layer requirements of the LoRaWAN specification released by the LoRa Alliance.

Features

- Frequency Band: 150 - 960MHz (sub-GHz),1.9-2.1GHz S-band, 2.4GHz ISM band
- (G)FSK, (G)MSK, LoRa modulation
- Maximum Transmit Power:

  22dBm @ Sub-GHz, High Power Mode、14dBm @ Sub-GHz, Low Power Mode
  13dBm @ 2.4G
- RX Sensitivity:

  -138dBm @ Sub-GHz @ BW=125kHz, SF=12、-114dBm @ 2.4G @ BW=406kHz, SF=7
- TX Current: 30mA @14dBm Sub-GHz、110mA @22dBm Sub-GHz、 28mA @13dBm 2.4G
- RX Current: 8mA @Sub-GHz、6.8mA @2.4G

Applications

- Automatic meter Reading
- Home Security & Building automation
- ISM Band Data Communication
- Industrial Monitoring & Controlling
- Security System
- Remote Control Application
- Intelligent Instrument
- Supply Chain & Logistics
- Intelligent Agriculture
- Smart City
- Retailing
- Asset Tracking
- Smart Lighting System
- Smart Parking
- Environmental Monitoring
- Health Monitoring

Product Pinout

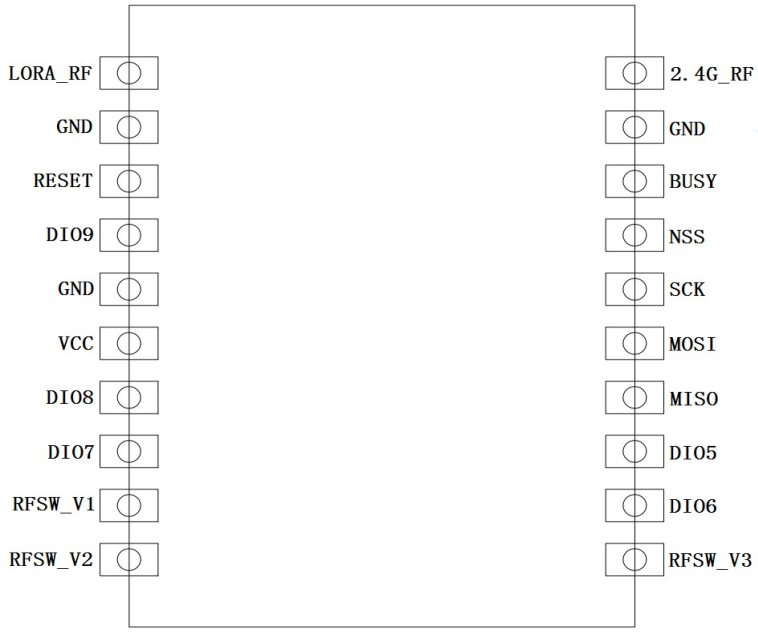


Figure 1. Top View

Table1. Module Pin Definition

Pin No.	Pin Name	Type	Description
1	LORA_RF[1]	I/O	ANT_LoRa_SUBG
2	GND	-	Ground
3	RESET	I	Reset
4	DIO9	O	IRQ
5	GND	-	Ground
6	VCC	-	Power supply:1.8V-3.7V
7	DIO8	I/O	GPIO
8	DIO7[2]	I/O	GPIO(internally connected to RFSW_V3 inside the module),default NC
9	RFSW_V1[3]	I	RF switch V1(internally connected to DIO5 inside the module),default NC
10	RFSW_V2[4]	I	RF switch V2(internally connected to DIO6 inside the module),default NC
11	RFSW_V3[5]	I	RF switch V3(internally connected to DIO7 inside the module),default NC
12	DIO6[6]	I/O	GPIO(internally connected to RFSW_V2 inside the module), default NC
13	DIO5[7]	I/O	GPIO(internally connected to RFSW_V1 inside the module), default NC
14	MISO	I/O	SPI Data input
15	MOSI	I/O	SPI Data output
16	SCK	I/O	SPI Clock input
17	NSS	I/O	SPI Chip select input
18	BUSY	O	Busy indicator
19	GND	-	Ground
20	2.4G_RF[8]	I/O	ANT_LoRa_2.4G

Note：

[1] It is recommended to reserve a π-type matching circuit externally for the LORA_RF pin of the module. The specific parameters shall be matched according to the corresponding antenna.

[2] No connection required. If DIO7 is to be used as GPIO, a non-connected version must be customized. The MCU shall reserve an IO pin to connect to RFSW_V3 for controlling the RF switch.

[3] Reserved interface, no connection required. When customizing the version not connected to DIO7, the MCU shall reserve an IO pin to connect to this pin for controlling the RF switch.

[4] Reserved interface, no connection required. When customizing the version not connected to DIO6, the MCU shall reserve an IO pin to connect to this pin for controlling the RF switch.

[5] Reserved interface, no connection required. When customizing the version not connected to DIO5, the MCU shall

reserve an IO pin to connect to this pin for controlling the RF switch.

[6] No connection required. If DIO6 is to be used as GPIO, a non-connected version must be customized. The MCU shall reserve an IO pin to connect to RFSW_V2 for controlling the RF switch.

[7] No connection required. If DIO5 is to be used as GPIO, a non-connected version must be customized. The MCU shall reserve an IO pin to connect to RFSW_V1 for controlling the RF switch.

[8] It is recommended to reserve a π-type matching circuit externally for the 2.4G_RF pin of the module. The specific parameters shall be matched according to the corresponding antenna.

RF Switch Control Logic

DIO5/RFSW_V1	DIO6/RFSW_V2	DIO7/RFSW_V3	RF Status
0	0	0	No RF signal output (LORA_RF port)
0	0	1	RX (LORA_RF port)
0	1	0	TX (LORA_RF low-power mode)
1	0	0	TX (LORA_RF high-power mode)

Hardware Parameters

Parameter	Value	Remarks
Crystal Oscillator Frequency	32MHz	Built-in passive crystal oscillator in the module
Module Size	23×17.5×2mm	Length × Width × Height
Antenna Type	Stamp Hole	Sub-GHz/2.4GHz dual antenna interface design
Communication Interface	SPI	Communication level 1.8-3.7V, 3.3V is recommended to ensure data reliability
Packaging Method	SMD/Stamp Hole	Pin pitch 2mm, see 6.1 Module Size for details
Operating Temperature	-40~85℃	-
Operating Humidity	10~90%	-

Table 2. Hardware Parameters

Absolute Maximum Ratings

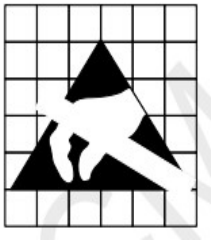
Test Conditions: Unless otherwise specified, supply voltage 3.3V, operating temperature 25℃, crystal oscillator frequency 32MHz, passive crystal oscillator.

LoRa Packet Error Rate (PER)=1%, BWL=125kHz, PL=10 bytes, preamble=8 symbols, error correction code CR=4/5, CRC on payload enabled, explicit header.

Parameter	Symbol	Condition	Min	Typical	Max	Unit
Supply Voltage	V_{DD}	-	-0.5	-	3.9	V
RF Input Power	Pmr	-	-	10	-	dBm
Storage Temperature	Tmr	-	-55	-	125	℃
ESD Rating	ESD_HBM	Human Body Model	-	2	-	kV

Note
[1]: Exceeding the absolute maximum ratings may cause permanent damage to the module. This value is the maximum withstand level; the module's function will not be affected when exposed to this condition for a short time, but long-term exposure may impair the module's reliability.

Table 3. Absolute Maximum Ratings[1]



WARNING! ESD sensitive device. ESD protection measures must be taken when handling the chip to avoid performance degradation or functional loss of the chip.

DC Characteristics

Parameter	Symbol	Condition		Min	Typical	Max	Unit
Operating Supply Voltage	V_{DD}			1.8		3.7	V
Operating Frequency	F_C	Different matching networks required			434		MHz
					868		MHz
					915		MHz
Maximum Transmit Power [1]	P_{out}	Low Power Mode	RFM92LRW-434S2		14		dBm
			RFM92LRW-868S2		14		dBm
			RFM92LRW-915S2		14		dBm
		High Power Mode	RFM92LRW-434S2		22		dBm
			RFM92LRW-868S2		22		dBm
			RFM92LRW-915S2		22		dBm
		2.4GHz			13		dBm
Tx Current	I_{TX}	434MHz , Pout=14dBm			30		mA
		868MHz , Pout=14dBm			30		mA
		915MHz , Pout=14dBm			30		mA
		434MHz , Pout=22dBm			110		mA
		868MHz , Pout=22dBm			125		mA
		915MHz , Pout=22dBm			110		mA
		2.4G , Pout=13dBm			28		mA
Rx Sensitivity	SENS	RxBoosted=1 434MHz,BWL=125kHz,SF=7			-126		dBm
		RxBoosted=1 434MHz,BWL=125kHz,SF=12			-138		dBm
		RxBoosted=1 868MHz,BWL=125kHz,SF=7			-126		dBm
		RxBoosted=1 868MHz,BWL=125kHz,SF=12			-138		dBm
		RxBoosted=1 915MHz,BWL=125kHz,SF=7			-126		dBm
		RxBoosted=1 915MHz,BWL=125kHz,SF=12			-138		dBm
		RxBoosted=1 2.4G,BWL=406kHz,SF=7			-114		dBm
RX Current	I_{RX}	434MHz			8		mA
		868MHz			8		mA
		915MHz			8		mA
		2.4G			6.8		mA
Sleep Current	I_{Sleep}				1		uA
Data Rate	BR_{FSK}	Bit rate, FSK		0.6		300[2]	kb/s

		Minimum modulation index 0.5, configurable by programming				
	BR_{LORA}	Raw data rate,LoRa,sub-GHz SF12,BWL=125kHz,CR=4/5		0.292		kb/s
		Raw data rate,LoRa,sub-GHz SF5,BWL=500kHz,CR=4/5		62.5		kb/s
		Raw data rate,LoRa,RFIO_HF 2.4GHz SF12,BWL=203kHz,CR=4/5		0.476		kb/s
		Raw data rate,LoRa,RFIO_HF 2.4GHz SF5,BWL=812kHz,CR=4/5		101.5		kb/s

Note

[1] : The module has a transmit power of up to 22dBm; continuous transmission will cause significant temperature rise, which may affect the accuracy of the on-board crystal oscillator during wireless transmission and lead to communication failure. For application scenarios with extremely low data rates, or operating in high temperature (above 75℃) or low temperature (below -25℃) environments, it is recommended to select the module with a TCXO crystal oscillator for more stable communication performance. When using the TCXO version, the internal registers of module need to be configured via software to enable TCXO power supply.

[2]: The maximum bit rate is assumed to be proportional to the RF frequency; for example, 300kb/s in the 869/915MHz band, and only 50kb/s in the 150MHz band.

Table 4. DC Characteristics

Reference Design

Note that all schematics shown in this section are partial schematics, maybe not listing ALL required components.

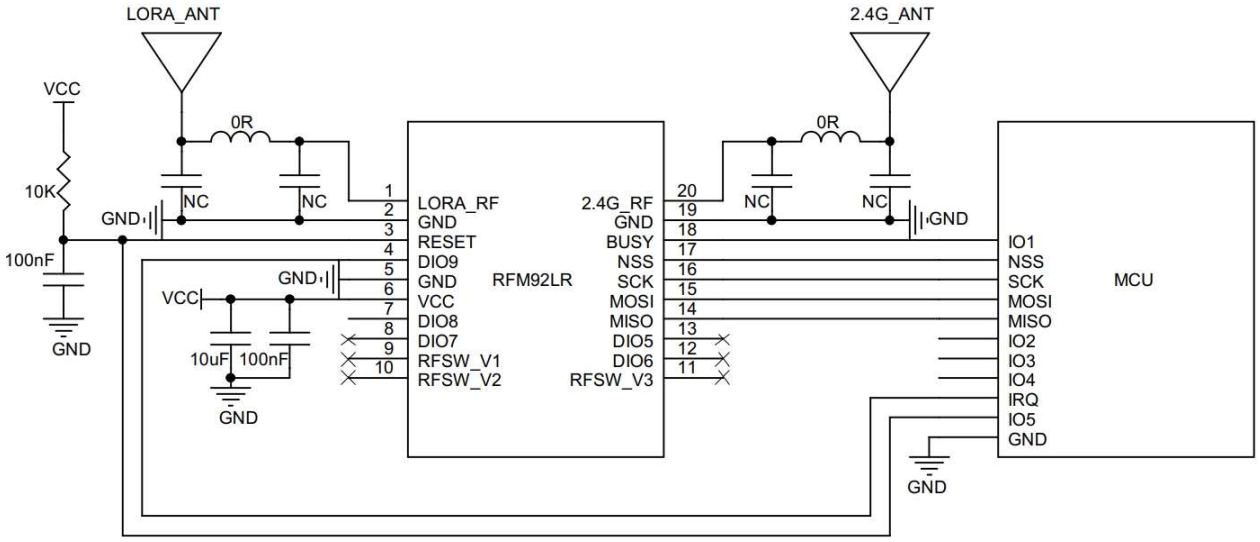


Figure 2. Reference Schematic For Typical Application

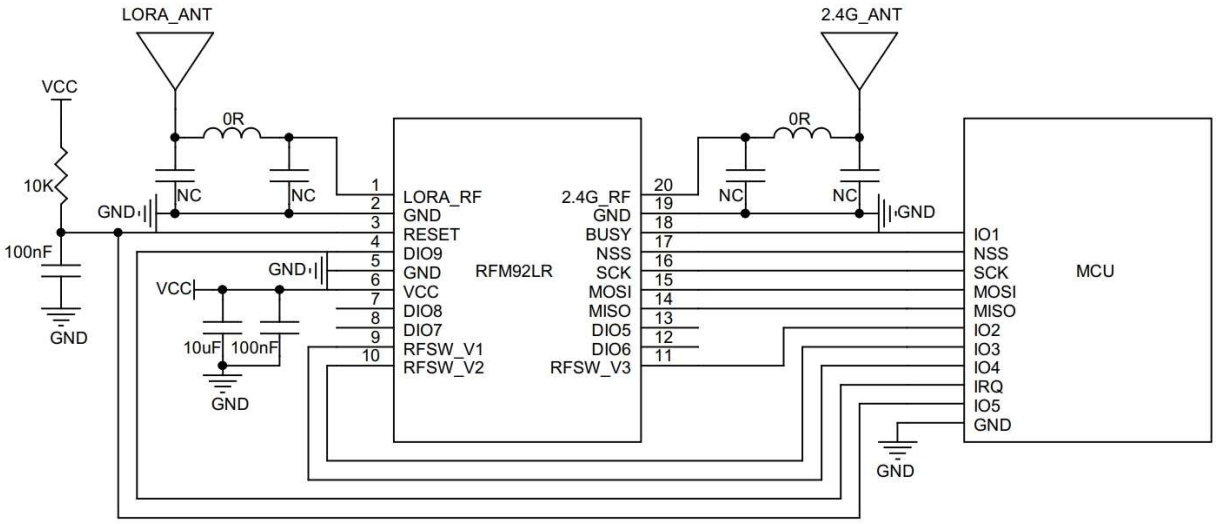


Figure 3. Reference Schematic For Multi-IO Application

Note:

1. Pins marked with × cannot be used as general-purpose IO ports.
2. In Typical Application Circuit 2, there is no internal connection between DIO7 and RFSW_V3, DIO6 and RFSW_V2, or DIO5 and RFSW_V1 inside the module. This configuration allows DIO5, DIO6, and DIO7 to be used as regular IO ports.
3. The π-network parameters for the LORA_RF and 2.4G_RF pins are default values. The actual parameters shall be adjusted according to the corresponding antenna matching.

Module Size

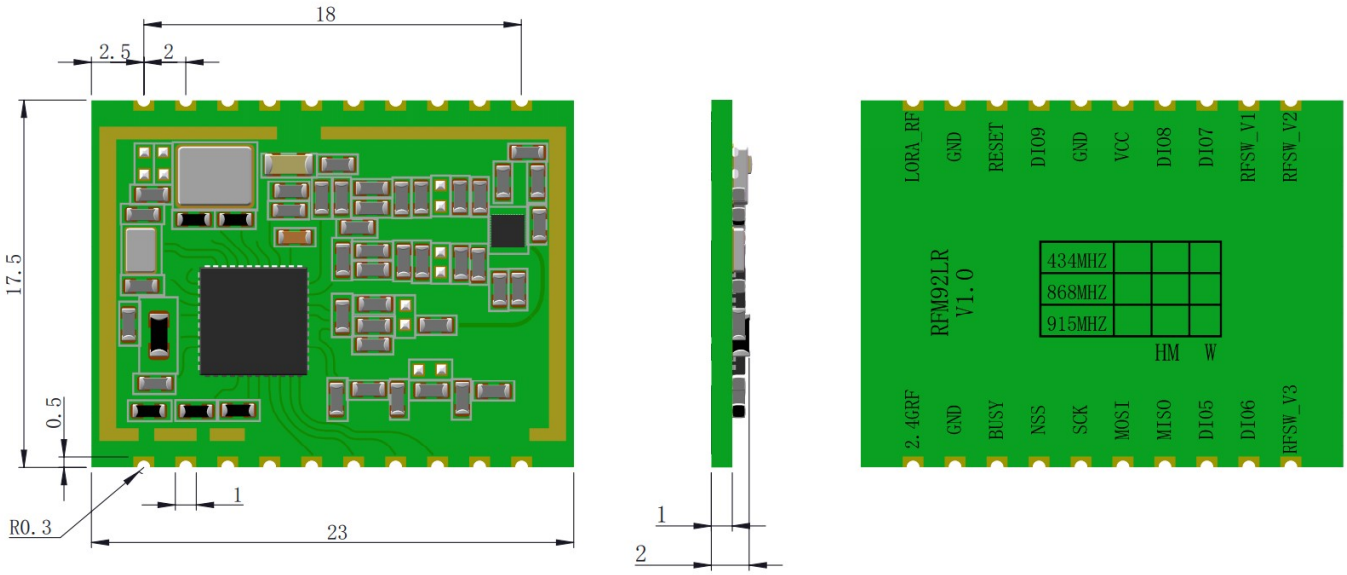


Figure 4. Module Size (Unit: mm)

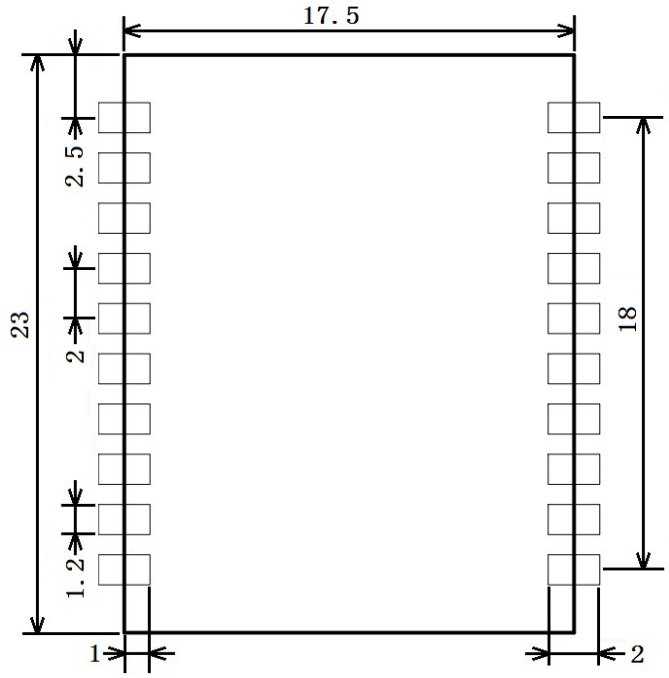
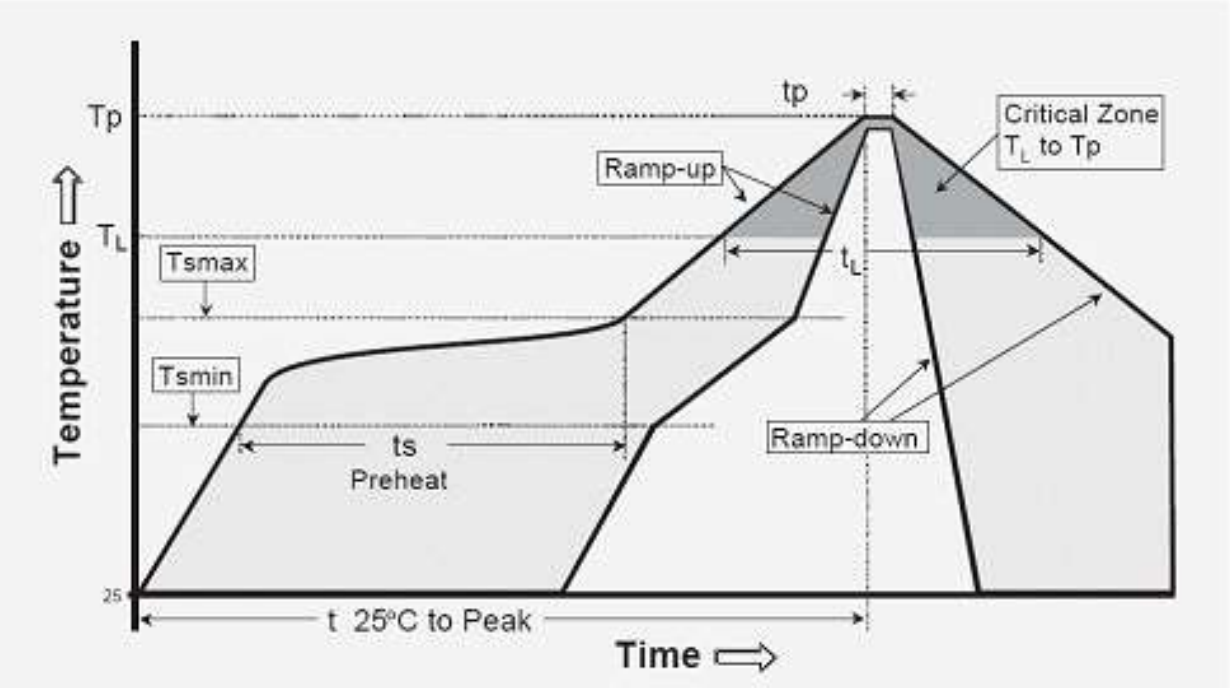


Figure 5. Recommend package dimensions(Unit: mm)

Reflow soldering temperature curve

It is recommended to comply with the related IPC standards and depend on the actual curve of the solder paste to setup the reflow soldering temperature curve.



Pre-heating temperature - Minimum temperature (Tsmin) - Maximum temperature (Tsmax) - Warm-up time (ts)	 150 ℃ 200 ℃ 60 ~ 180 sec
Temperature ramping rate for preheating to the peak temperature（TL-TP）	3 ℃/sec (maximum)
Soldering time - Soldering temperature - Time to reach above the melting point	60 ~ 90 sec 217 ℃ 60 ~ 150 sec
Peak temperature	240 +/- 5 ℃
Soldering time for peak temperature +/- ℃	10~30 sec
Cooling rate	6 ℃/sec (maximum)
Full soldering time	8 min (maximum)

Notes

- The wettability of lead-free solder materials is worse than that of tin-lead eutectic materials, and the melting zone temperature is higher. To achieve better soldering results and protect the solder joints from oxidation, use nitrogen protection during reflow soldering.
- For double-sided products, avoid reflow soldering with the module facing downward (that is, the module should be soldered during the second reflow soldering) to prevent the components on the module from falling off or shifting.
- The module needs to be fully tinned, and it is recommended to use a stepped steel mesh with a thickness of 0.15MM or above.
- When the module must be re-soldered, we recommend manual soldering to avoid possible damage to the module caused by multiple reflow soldering processes.
- Customers should develop welding processes that comply with the above tips based on actual production conditions.

Ordering Information

Model No.	Working Frequency
RFM92LRW-434S2	434MHz & 2.4G
RFM92LRW-868S2	868MHz & 2.4G
RFM92LRW-915S2	915MHz & 2.4G

Revision History

Version	Date	Description
V1.0	2025.2.13	Initial release
V1.1	2025.9.10	Update Receiving Sensitivity Parameters

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