Lierda L-WSMVP10-99PN4 Hardware Design

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Document revision history

Version	Date	Authors	Reviewer	Description of change
Rev1.0	2023-05-18	XL		Initial Version

Safety instructions

It is the user's responsibility to follow the relevant regulations of other countries regarding wireless communication modules and equipment and the specific regulations of the environment in which they are used. By following the safety principles below, you can ensure personal safety and help protect the product and the working environment from potential damage. We will not be liable for any damage caused by the customer's failure to comply with these regulations.

	Safety on the road comes first! When you are driving, do not use handheld mobile devices unless they have a hands-free function. Please stop before you make a phone call!
	Please turn off your mobile device before boarding the aircraft. The wireless function of the mobile terminal is prohibited on board the aircraft to prevent interference with the aircraft communication system. Ignoring this reminder may lead to flight safety or even violate the law.
	When in a hospital or health care setting, note if there are restrictions on the use of mobile devices. RF interference can cause medical equipment to malfunction, so it may be necessary to turn off mobile devices.
	Mobile devices do not guarantee a valid connection in all cases, for example when the mobile device has no phone bill or the SIM is invalid. When you encounter these situations in an emergency, please remember to use the emergency call and make sure your device is on and in an area with sufficient signal strength.
	Your mobile device will receive and transmit RF signals when it is turned on, and RF interference will occur when it is near a TV, radio, computer or other electronic device.
	Keep mobile terminal equipment away from flammable gases. When you are near a gas station, oil depot, chemical plant or explosive workplace, turn off your mobile terminal equipment. Operating electronic devices in any potentially explosive location is a safety hazard.

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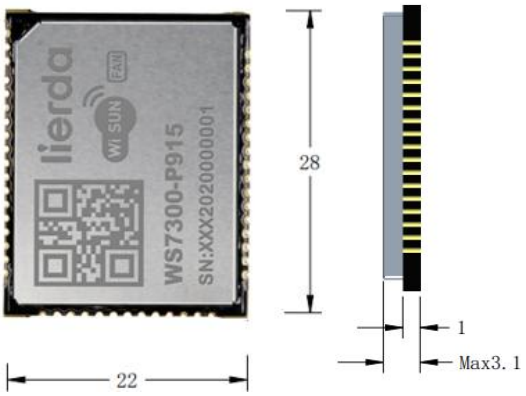
1 Introduction

The content of this document mainly describes in detail the hardware parameters, pin function descriptions, interface function definitions, mechanical dimensions, production process requirements, etc. of L-WSMVP10-99PN4. By reading this document, users can quickly familiarize themselves with the hardware design-related content of this product.

2 Product Overview



L-WSMVP10-99PN4 module is a Wi-SUN wireless communication module designed based on chip VC7300BU, with interoperable, reliable and high speed features, advanced wireless mesh (Mesh) communication technology, meeting Wi-SUN standard, widely used in wireless intelligent public networks and related applications.

2.1 Key Features

-Operating frequency bands

- 902~928MHz

-Modulation method

- Support GFSK modulation method

-High link budget

- Sensitivity up to:

-110dBm@PER10%/50kbps/h=1

-Typical value of transmit power:

29dBm

-Communication interface

- Serial port

-Protocol Standards

- Wi-SUN PHY Specification

-Height rate

- Communication rate of 50~300 kbps

-Supports OTA

-Supply voltage

- Input voltage:DC4.7V~5.2(5V typical)

-Transmit current:Typ.600mA(@29dB)

- Receiving current：Typ.38mA

-Ultra small size

- 28.0mm*22.0mm*3.1mm

-Applicable scenarios

-Smart meters

-Smart Home

-Sensor Networks

-Smart Street Light etc.

2.2 Functional Block Diagram

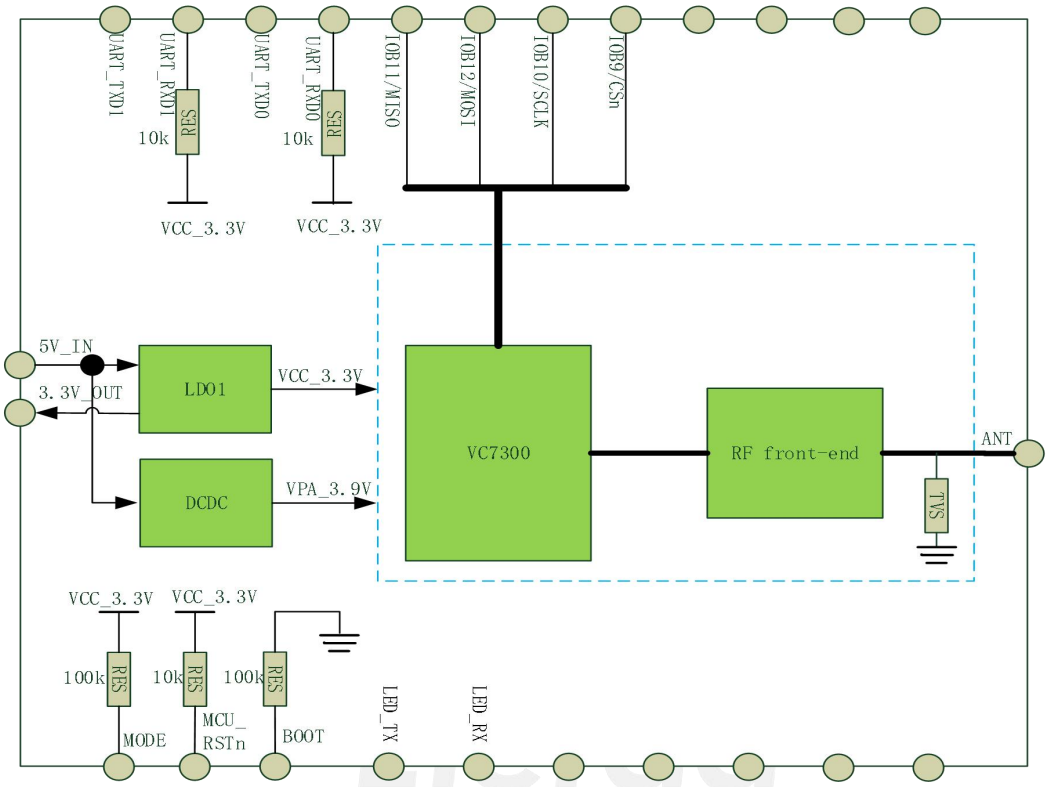


Figure 2 . 1 Internal block diagram of WS7300 series modules

Note: The above block diagram is only used to indicate the internal architecture of the modules.

2.3 Pinouts

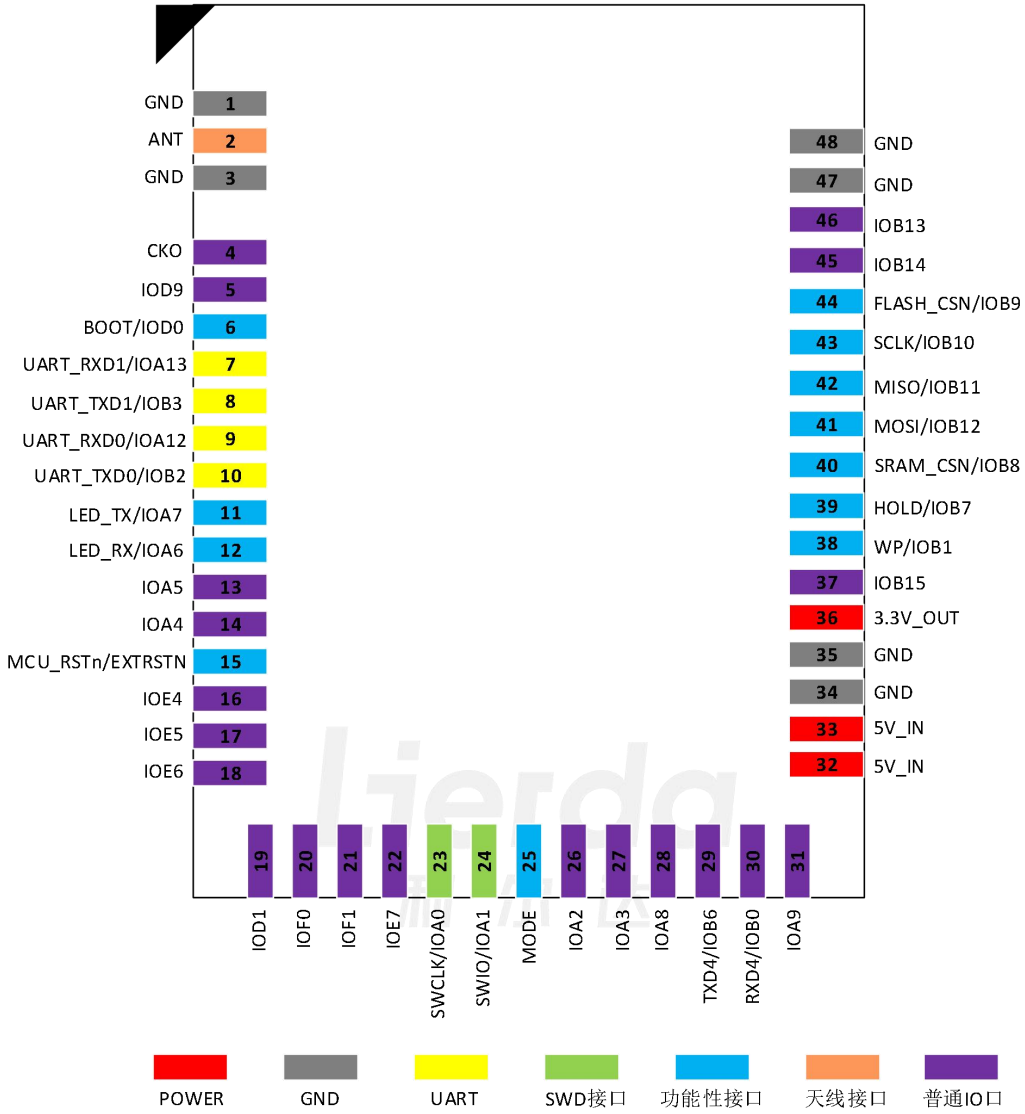


Figure 2 . 2 Pinout diagram

2.4 Module Pins Description

2.4.1 Power supply

Table 2- 1 Power Supply Pin Description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
5V_IN	32 33	Module power input	PI	V_{max} = 5.2V V_{type} = 5V V_{min} = 4.7V	Non-5V power supply affects current consumption
3.3V_OUT	36	Module provides power output	PO	V_{type} =3.3V I_{omax} = 10mA	Customers are advised to use this pin for level conversion or low current applications
GND	1,3,34,35,47,48	Ground	G	-	-

2.4.2 Serial port

Table 2- 2 Serial port pin description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
UART_RXD1	7	Debugging the serial port	I	R_{pu} = 10k	RX internal pull-up, debug serial port, baud rate 115200, parity bit NONE data bit 8 stop bit 1
UART_TXD1	8	Debugging the serial port	O	-	
UART_RXD0	9	Data serial port	I	R_{pu} = 10k	RX internal pull-up, main serial port, baud rate 115200, parity bit NONE data bit 8 stop bit 1
UART_TXD0	10	Data serial port	O	-	

2.4.3 SWD interface

Table 2- 3 SWD Pin Description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
SWCLK	23	SWD Clock signal	I/O	-	MODE = 0 This pin is the SWCLK function MODE = 1 This pin is a general purpose IO,IOA1
SWIO	24	SWD data signal	I/O	-	MODE = 0 This pin is the SWIO function MODE = 1 This pin is a general purpose IO,IOA0

Note: Customers are advised to lead the SWD interface to improve production efficiency if mass production.

2.4.4 Functional Interface

Table 2- 4 Module Function Interface Description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
MCU_RSTn	15	Reset Pin	I	R_{pu} =10k	Internal pull-up, active low
BOOT	6	Start-up method selection	I	R_{pd} =100k	Internal drop-down. BOOT = 0. Embedded flash boot. BOOT = 1. Internal ROM boot
MODE	25	Mode Selection	I	R_{pu} = 100k	Internal pull-up. MODE = 0: Debug mode MODE = 1: Normal mode

LED_TX	11	Communication instructions	O	-	This pin is pulled low when data is sent from the data serial port
LED_RX	12	Communication instructions	O	-	This pin is pulled low when data is received on the data serial port
SRAM_CSn	40	SRAM chip select signal	O	-	Chip select signal for SRAM
IOB12_MOSI	41	SPI MOSI	O	-	SPI MOSI
IOB11_MISO	42	SPI MISO	I	-	SPI MISO
IOB10_SCLK	43	SPI CLK	O	-	SPI CLK
IOB9_CSn	44	Flash chip select signal	I	-	Chip select signal for Flash
HOLD	39	-	O	-	FLASH Write Protect Pins
WP	38	-	O	-	FLASH HOLD Pin

2.4.5 Antenna Interface

Table 2- 5 Antenna Pin Description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
ANT	2	Antenna Pins	I/O	50Ω impedance	The maximum input power of the module does not exceed 0dBm, otherwise it may lead to module damage

Note: The VSWR at the RF output of the module should be less than 3.

2.4.6 Other interfaces

Table 2- 6 Module Other Interface Description

Pin Name	Pin No.	Description	Pin Type	DC Characteristics	Remark
CKO	4	Clock signal output	O	-	Overhang

IOD9	5	GPIO	I/O	-	Overhang
IOA5	13	GPIO/ External Interrupt 5	I/O	-	Overhang
IOA4	14	GPIO/ External Interrupt 4	I/O	-	Overhang
IOE4	16	GPIO/ ADC channel 4	I/O	-	Overhang
IOE5	17	GPIO/ ADC channel 5	I/O	-	Overhang
IOE6	18	GPIO/ ADC channel 6	I/O	-	Overhang
IOD1	19	GPIO	I/O	-	Overhang
IOF0	20	GPIO	I/O	-	Overhang
IOF1	21	GPIO	I/O	-	Overhang
IOE7	22	GPIO/ ADC channel 7	I/O	-	Overhang
IOA2	26	GPIO/ External Interrupt 2	I/O	-	Overhang
IOA3	27	GPIO/ External Interrupt 3	I/O	-	Hanging in the air
IOA8	28	GPIO/ External Interrupt 8	I/O	-	Overhang
TXD4	29	GPIO/Serial port 4	I/O	-	Overhang
RDX4	30	GPIO/Serial port 4	I/O	-	Overhang
IOA9	31	GPIO/ External Interrupt 9	I/O	-	Overhang
IOB15	37	GPIO	I/O	-	Overhang
IOB14	45	GPIO/IIC SDA	I/O	-	Overhang
IOB13	46	GPIO/IIC SCL	I/O	-	Overhang

Specific multiplexing functions can be referred to the VC7300BU specification, which can be used by users according to their needs.

Remarks

Pin type: "O"=Output, "I"= Input, "P"=Power, "G "=Ground

2.5 Module Timing Description

2.5.1 Power supply

To ensure proper operation of the module, it is only allowed to power up again when all pins have dropped below 0.3V after a power failure.

2.5.2 Reset

The module will be reset when the MCU_RSTn pin is pulled low for more than 50ms, so the user can use an external key or IO to achieve a low level pulse lasting 50ms to reset the module. It is recommended that customers add a 100pF capacitor to ground near the module pins to reduce interference.

2.5.3 Serial port burn-in

The module needs to enter the serial burn mode using the BOOT and MCU-RSTn pins, the timing is to pull down MCU-RSTn→ pull up BOOT→ pull up MCU-RSTn→ pull down BOOT, the key point of the timing MCU-RSTn rising edge during the BOOT needs to remain high this feature.

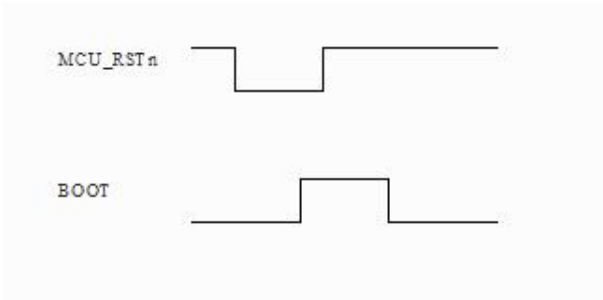


Figure 2 . 3 Timing diagram for entering burn-in mode

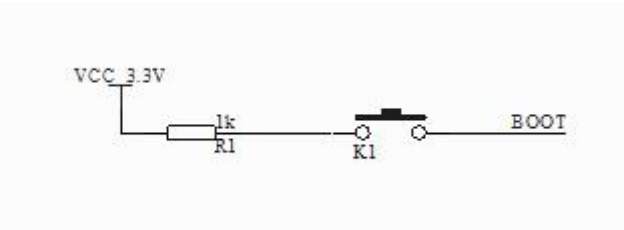


Figure 2 . 4 BOOT pin circuit

3 Specification parameters

3.1 Absolute maximum limit value

Table 3- 1 Absolute maximum limit values

Main parameters	Minimum value	Typical values	Maximum value	Unit	Remarks
Supply Voltage	-0.3	-	+5.5	V	-
Maximum RF input power	-	-	0	dBm	-

3.2 Working parameters

Table 3- 2 Operating ratings

Main parameters	Minimum value	Typical values	Maximum value	Unit	Remark
Operating Voltage	4.7	5	5.2	V	-
Operating temperature	-40	-	85	℃	-
Storage temperature	-40	-	85	℃	-

Table 3- 3 Digital Logic Level Characteristics

Main parameters	Minimum value	Typical values	Maximum value	V_{DDIO}	Remark
V_{IH} (V)	2.0	-	-	3.3V	-
V_{IL} (V)	-	-	0.3 V_{DDIO}	3.3V	-
V_{OH} (V)	2.4	-	-	3.3V	-
V_{OL} (V)	-	-	0.8	3.3V	-
IO pull current (mA)	-	4	-	3.3V	-
IO filling current (mA)	-	4	-	3.3V	-

Table 3 -Table 3 4 Operating Parameters

Main parameters	Minimum value	Typical values	Maximum value	Remarks
Operating voltage(V)	4.7	5	5.2	Non-5V power supply can work normally, but power consumption will have an impact
Turn-off voltage(V)	-		0.3	Voltage below 0.3V needs to last for 100ms before complete power down
Operating frequency band (MHz)	902	915	928	Customer-defined operating frequency
Frequency bias (kHz)	-5	-	5	Factory frequency bias
Launch power consumption (mA)	500	600	750	Factory power value launch, connected to 50 ohm load test (launch instantaneous maximum)
Receiving power consumption (mA)	32	38	45	Continuous reception status
Transmit Power (dBm)	28	29	30	Customer-defined transmitting power
Receiving Sensitivity (dBm)	-	-110	-108	PER10%/50kbps/h = 1/GFSK
Communication rate (kbps)	-	50	300	-
Modulation method	GFSK			-
Interface Type	Stamp hole			1.27mm Spacing
Communication protocols	UART			-
Interface Level	3.3V			-
Dimension(mm)	28*22*3.1			-
RF port characteristic impedance (Ω)	50			-

Remarks

(1) The data test conditions in the table are based on an input voltage of 5V, temperature of 25°C, relative humidity of 20%, and a frequency point of 915MHz, unless otherwise specified.

(2) If the module is in transmitting state for a long time, the frequency bias will change due to the temperature effect.

(3) The table shows the power values when transmitting at the maximum transmit power under 50kbps/h = 1/GFSK modulated wave condition.

3.3 Reliability testing

Reliability testing is the activity performed to evaluate the product's ability to maintain functional reliability under all environments such as expected use, transportation or storage during a specified lifetime. It is to expose the product to natural or artificial environmental conditions to withstand their effects in order to evaluate the performance of the product under the environmental conditions of actual use, transportation and storage, and to analyze and study the degree of influence of environmental factors and their mechanism of action.

L-WSMVP10-99PN4 reliability test items are as follows:

Table 3 - 5 Reliability Test

Test Items	Test environment conditions	Reference Standards	Conclusion
Storage temperature	Temperature: 85℃±2℃ Time: 24hrs Temperature: -40 ℃±2℃ Time: 24hrs	GB-T2423.1 GB-T2423.2	Pass
Operating temperature	Temperature: 85℃±2℃ Time: 2hrs Temperature: -40 ℃±2℃ Time: 2hrs	GB-T2423.1 GB-T2423.2	Pass
Hot and cold start	Temperature: 85℃±2℃ Time: 24hrs Temperature: -40 ℃±2℃ Time: 24hrs	GB-T2423.1 GB-T2423.2	Pass
Constant Humidity and Heat	High temperature and high humidity: 85℃,95%RH ,48 hours	GB-T2423.3	Pass
Cold & Heat Shock	Temperature: -40℃±2℃ Time: 30mins Temperature target value 85℃±2℃ Time: 30mins Total 50 cycles	GB/T 2423.22	Pass

Remarks

Detailed data is available in the reliability test report.

3.4 Reference Design

See the Lierda L-WSMVP10-99PN4 Hardware Reference Design Manual for details.

4 Production and Packaging information

4.1 Production welding

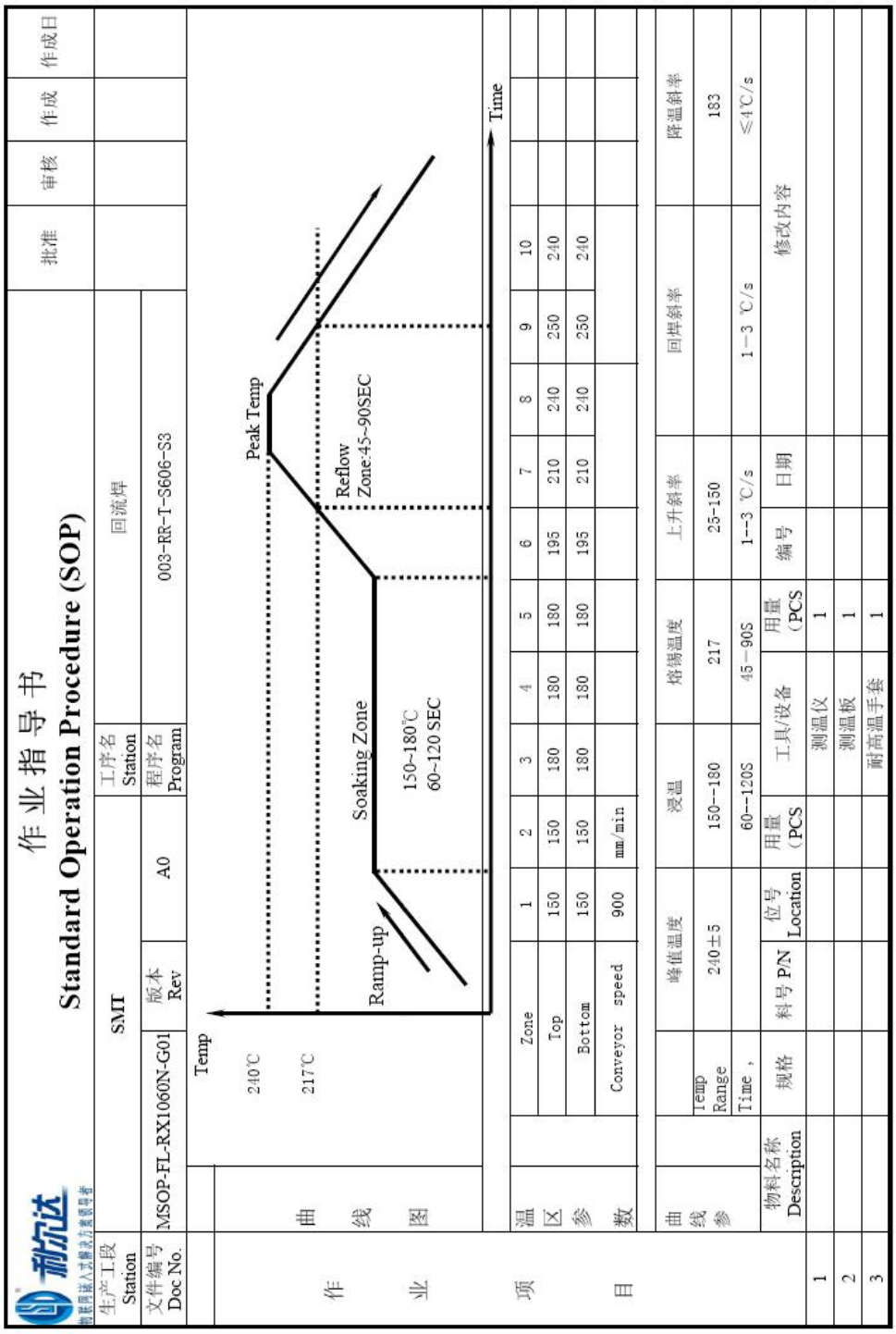


Figure 4 . 1 Reflow soldering operation instruction

Note: This work instruction is only suitable for lead-free work and is for reference only.

4.2 Product packaging instructions

Modules are shipped in vacuum reel-sealed form.

Packing method :Carrier tape

ITEM	W	F	E1	D0	D1	P0	P2	T
DIM	44.0	20.20	1.75	1.50	2.0	4.00	2.00	0.3
TOLE	+0.30 -0.30	+0.10 -0.10	+0.10 -0.10	+0.10 -0.00	+0.20 -0.20	+0.10 -0.10	+0.15 -0.15	+0.05 -0.05

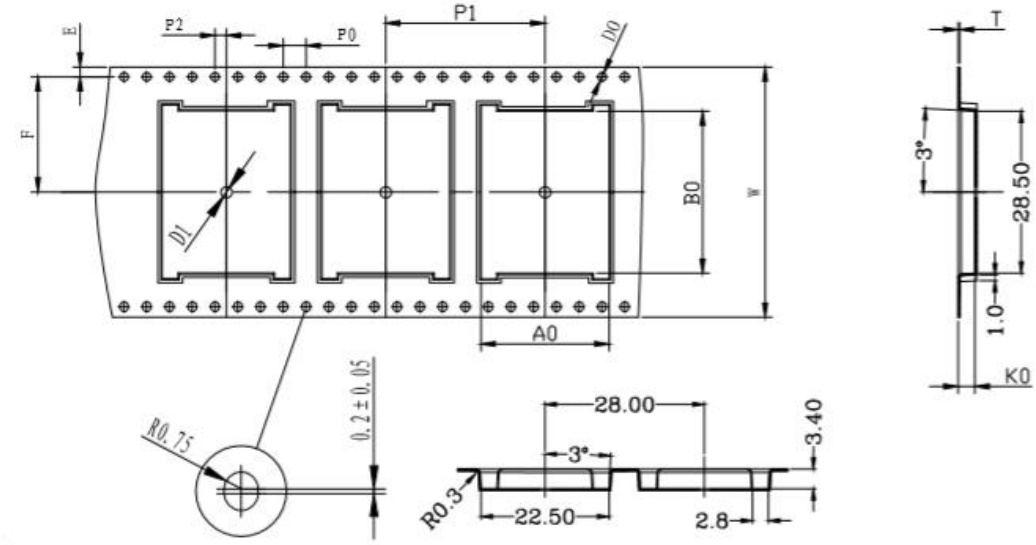


Figure 4 . 2 Carrier tape specifications

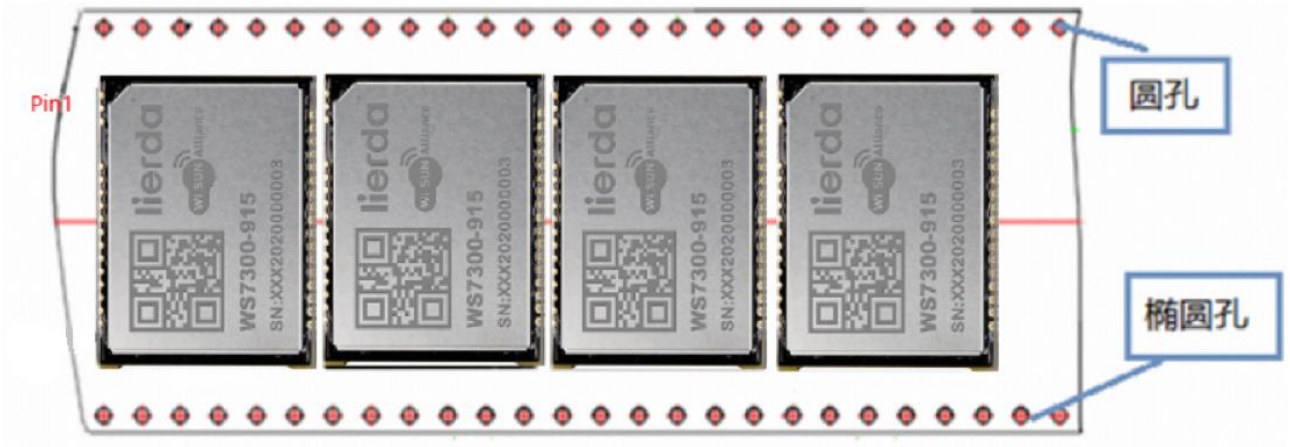


Figure 4 . 3 Schematic diagram of product placement direction

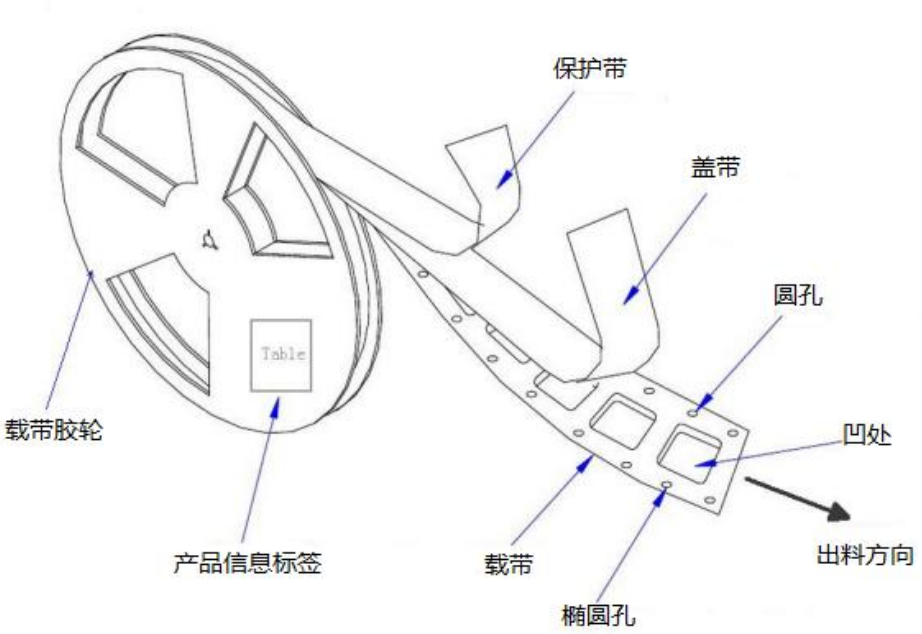


Figure 4．4 Schematic diagram of product packaging

RF Exposure Information and Statement

When using the product, maintain a distance of 20cm from the body to ensure compliance with RF exposure requirements.

This device complies with part 15 of the FCC rules . Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help

- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2AOFDWS7300 .
Additionally, the following statement should be included on the label and in the final product's user manual: "This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interferences, and
(2) this device must accept any interference received, including interference that may cause undesired operation."

The module is allowed to be installed in mobile and portable applications

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end‐use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.
Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user

FCC ID:2AOFDWS7300