Leader of IoT Embedded Solution Provider

LSD4BT-S98B

Product Specification

Product Name：S98 BLE Standard Module (External Antenna With PA)

Part Number：LSD4BT-S98BSTD001

Version: Rev03

Lierda Science&Technology Group Co.,Ltd

Document Revision History

Number	Revision description	Version	Revision date
1	Initial version	Rev01	2020-5-28
2	Update power consumption and tansmission distance data	Rev02	2020-6-11
3	Supplement the power consumption in different broadcast and connection interval states, supplement the PA control pin logic, update the size chart	Rev03	2020-7-28

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1 Overview

Lierda S98B Bluetooth module is a low-power and high-performance Bluetooth module based on the Nordic platform. Its hardware interface is designed as stamp holes. The size is small and all ports are drawn out for easy use. The antenna interface of the module also reserves pads, which is convenient for customers to customize different external antennas according to different needs, and can help you reduce software and hardware investment, and easily complete the development of Bluetooth applications.

Table1-1 Part Number Description

Part Number	Description
LSD4BT-S98BSTD001	This type of product use external antenna and does not include software. For products with software, please communicate with the sales about the specific part number and MPQ information.

1.1 Features

- Operating voltage: 1.8-3.6 V
- Working frequency: 2402 MHz~2480 MHz
- Transmit power: 21.5dBm max(@3.3V)
- Sensitivity: -100dBm (@3.3V)

1.2 Applications

- Peripheral products for smartphones and tablets
- Wireless sensor networks such as smart meters and data collection
- Wireless wearable bluetooth device
- Intelligent cloud platform and ecological access
- Smart lights, smart homes, smart cities

2 Specifications

Table2-1 Absolute maximum ratings

Symbol	Value		Remarks
	Min	Max	
Voltage input(V)	0	3.9	
Working temperature(℃)	-40	85	
ESD(KV)	/	4	All PINS, HBM MODE
ESD(KV)	/	0.5	All PINS, CDM MODE

Table2-2 Operating parameters@25℃, 3.3V

Symbol		Value			Remarks
		Min	Typ	Max	
Voltage input(V)		1.8	3.3	3.6	The ripple of the power supply must be within 30mV peak-to-peak
Working temperature(℃)		-40	/	85	Normal communication
Working frequency (MHz)		2402	/	2480	ISM frequency band
Number of channels		/	40	/	BLE standard channels
Power consumption	Emission current (mA)	/	130	/	I=130@Pout=17.5dBm, MCU 64MHZ, Continuous TX I=180@Pout=20.5dBm, MCU 64MHZ, Continuous TX
	Receive current (mA)	/	15	/	MCU 64MHZ, Continuous RX
	Sleep current (uA)	/	3	/	
Transmit power (dBm)		-18	17.5	21.5	17.5dBm@ Configure to -4dBm in the software 20.5dBm@ Configure to 0dBm in the software
Sensitivity (dBm)		/	-100	/	BLE 1Mbps

Protocol	BLE 5.1	
Hardware interface	1.27 mm spacing, 3 sides are all stamp holes	
Communication distance 1	120m	120m@ Configure to -4dBm in the software, with FPC antenna 160m@ Configure to 0dBm in the software, with FPC antenna

1. The "communication distance" is affected by the surrounding environment, air humidity and other factors. The distance is measured through the communication between the mobile phone and the module, and is for reference only.

Table2-3 Output power table @25℃

Software configuration(dBm)	Module output power dBm(3.3V)	Module output power dBm(3V)	Module output power dBm(2.7V)
2	21.7	21	19.7
0	20.5	19.9	19
-4	17.5	17.4	16.9
-8	14.4	14.5	14.4
-12	10.5	10.6	10.6
-16	6.3	6.4	6.4
-20	1.9	1.9	1.9
-40	-18	-18.1	-18.2

Pic2-1 Output power graph @25℃

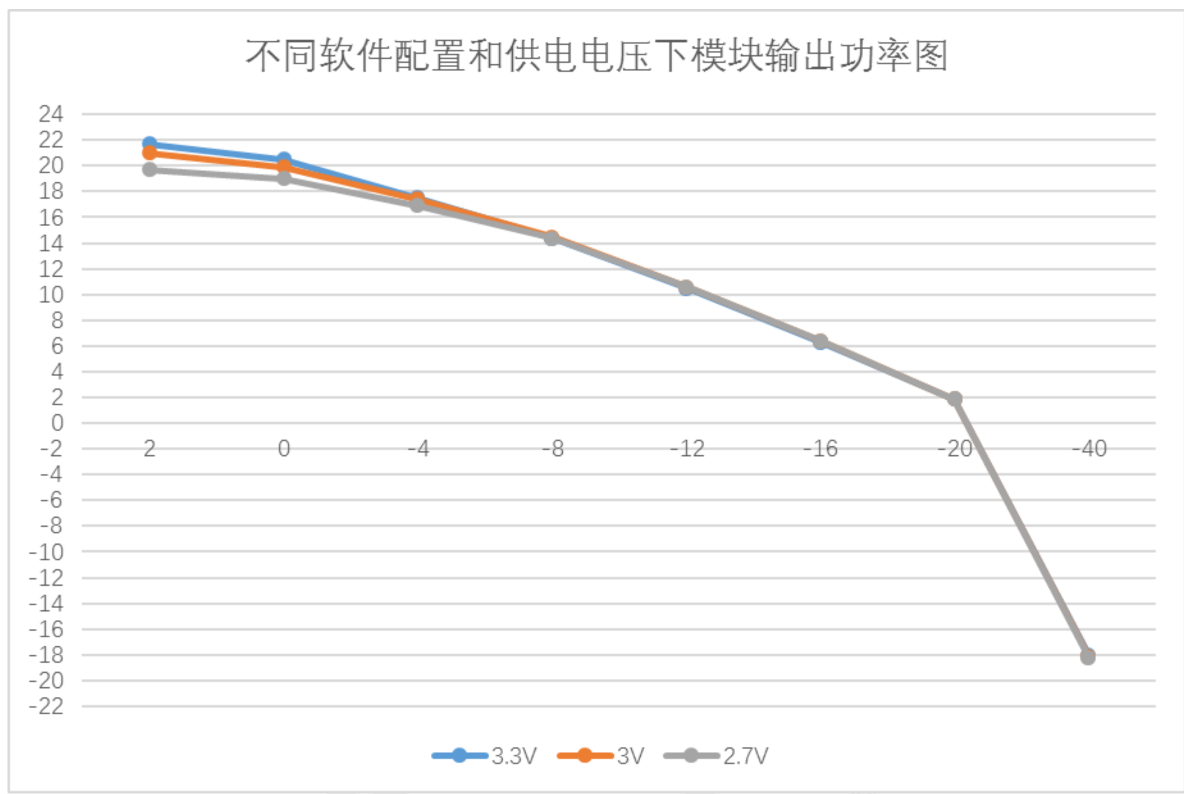


Table2-4 Power consumption under different broadcast intervals (7Byte data by default)

Mode	Average power consumption(μ A)	Broadcast interval(ms)
Broadcast mode (-4dBm configuration, 3.3V)	806	100
	590	200
	175	500
	122	700
	87	1000
	46	2000
	32	3000
	21	5000
	17	7000
	13	10000

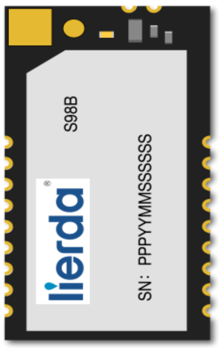
Table2-5 Power consumption under different connection intervals (empty packets)

Mode	Average power consumption(μA)	Connecting interval(ms)
Connecting mode (-4dBm configuration, 3.3V)	172	100
	94	200
	40	500
	30	700
	22	1000
	14	2000
	12	3000
	10	4000

3 Layout and interface

3.1 Dimensions

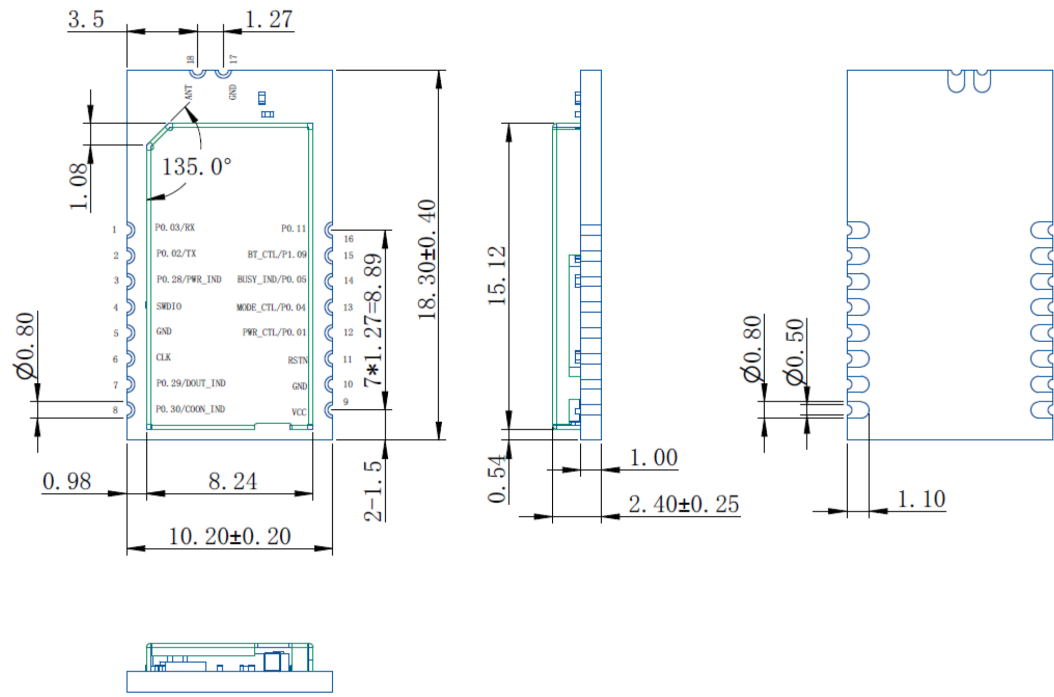
The outline diagram of LSD4BT-S98B is shown in Figure 3-1:



Pic3-1 LSD4BT-S98B Physical picture

The R,C,L materials and PCB of this product have optional materials. Under the premise of meeting the performance, the appearance and color of the materials may be different. The actual product shall prevail. The main materials (main chip, crystal oscillator, etc.) have no replacement models, changes will be notified in advance

The overall dimensions of the LSD4BT-S98B module are shown in Figure 3-2:



Pic3-2 LSD4BT-S98B Outline drawing

The dimensional tolerances not marked in the figure are in accordance with the GB/T1804-m standard.

3.2 Hardware interface

The following figure shows the pin number of the module and the corresponding pin description:

Pic3-3 Pin number diagram

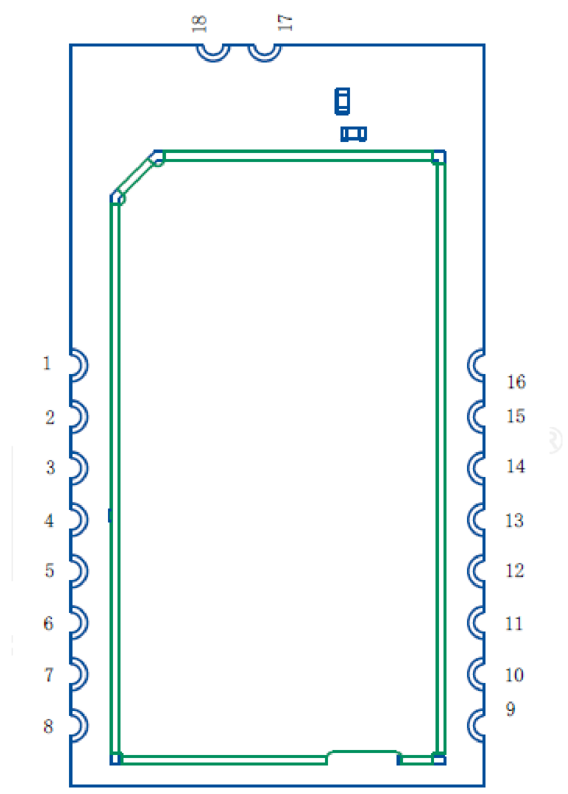


Table3-1 LSD4BT-S98B Pin function

Pin	Name	Function	Remark
1	P0.03/AIN1	Normal IO/ADC	
2	P0.02/AIN0	Normal IO/ADC	
3	P0.28/AIN4	Normal IO/ADC	
4	SWDIO	Programming port	
5	GND	Ground	
6	SWDCLK	Programming clock	
7	P0.29/AIN5	Normal IO/ADC	
8	P0.30/AIN6	Normal IO/ADC	
9	VCC	Power supply	Ripple <30mV, Current >250mA

10	GND	Ground	
11	RSTN	Reset	
12	P0.01	Normal IO	
13	P0.04/AIN2	Normal IO/ADC	
14	P0.05/AIN3	Normal IO/ADC	
15	P1.09	Normal IO	
16	P0.11	Normal IO	
17	GND	Ground	
18	ANT	RF out	Connect to external antenna

3.3 Internal PA control logic

The module contains MCU and PA. P0.17 of MCU is connected to TX_EN of PA, and P0.15 is connected to RX_EN of PA. The logical relationship between the state of PA and TX_EN and RX_EN is shown in the following table:

Table3-2 Internal PA control logic

TX_EN	RX_EN	PA Mode
1	X	Transmit
0	1	Receive
0	0	Shutdown

Note:

‘1’ represents a high level >1.2V;

‘0’ represents a low level <0.3V;

‘X’ represents any state.

4 Application note

4.1 Notes for typical applications

1. Module power supply

The ripple of the power supply has a significant impact on the performance of the module. Excessive ripple may affect the success rate of communication. We recommend that the peak-to-peak value of the power supply ripple is less than 30mV, and try to use LDO power supply. If you must use DCDC power supply, you must control the ripple at the output end of the DCDC power supply.

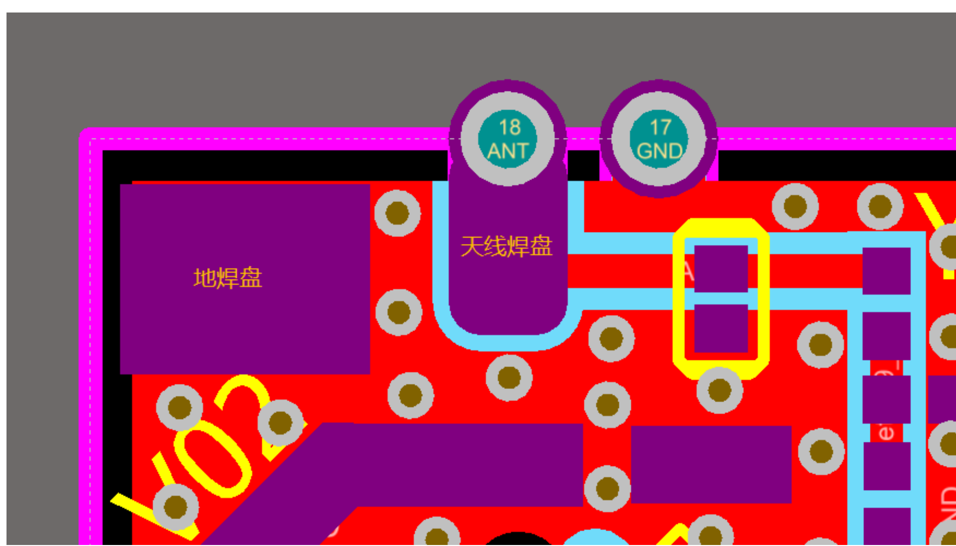
An external PA is used inside the module, and the peak current of the module is 200mA. Therefore, the driving current of the power supply of the module should be above 250mA.

2. External antenna

The antenna interface of the S98 module provides customers with two options for external antennas: one is to DIP an external FPC antenna directly at the antenna pad of the module; the other is to place an SMA adapter or IPEX seat on the customer’s PCB, then install the external antenna on it.

2.1 FPC antenna welding

As shown in Figure 4-1, customers can directly DIP external FPC antennas at the antenna pads and ground pads. Please pay attention to the paste position of the FPC antenna. Try to stay away from metal, relays, large capacitors and other devices. A certain radiation clearance area should be reserved for the antenna in the customer's product structure.



Pic4-1 FPC antenna welding

2.2 SMA or IPEX interface

You can also use the antenna interface (stamp hole) of the module. Reserve a π matching network on the PCB, lead the RF signal to the SMA or IPEX interface, and then connect the external antenna. As shown in Figure 4-2 below, the RF trace impedance needs to be controlled to 50Ω, and the relationship between the width of the impedance line and the copper spacing and board thickness is shown in Figure 4-3.

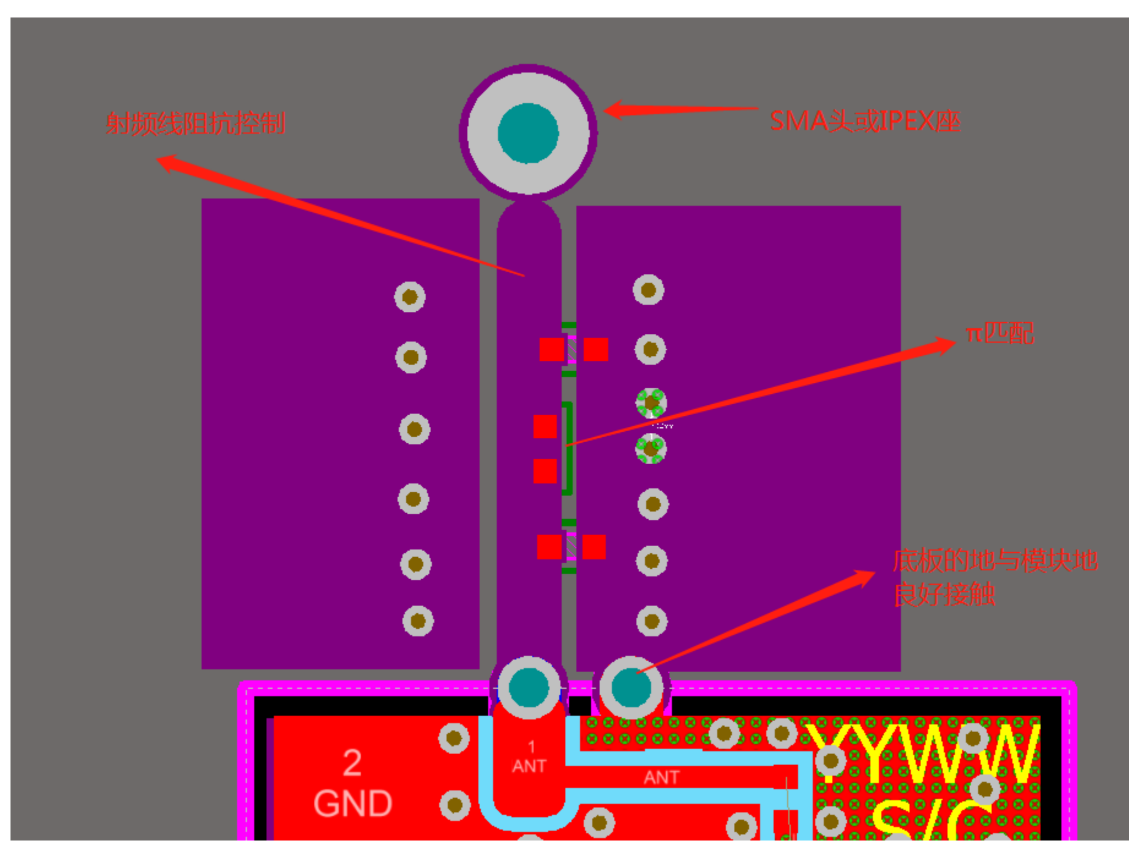


图 4-2 SMA 头或 IPEX 座转接天线

FR4双面板推荐值

(H=板厚，W=线宽,D=走线与敷铜间距)：

H=1.0mm, W=0.8mm, D=0.2mm

H=1.0mm, W=1.0mm, D=0.254mm（推荐）

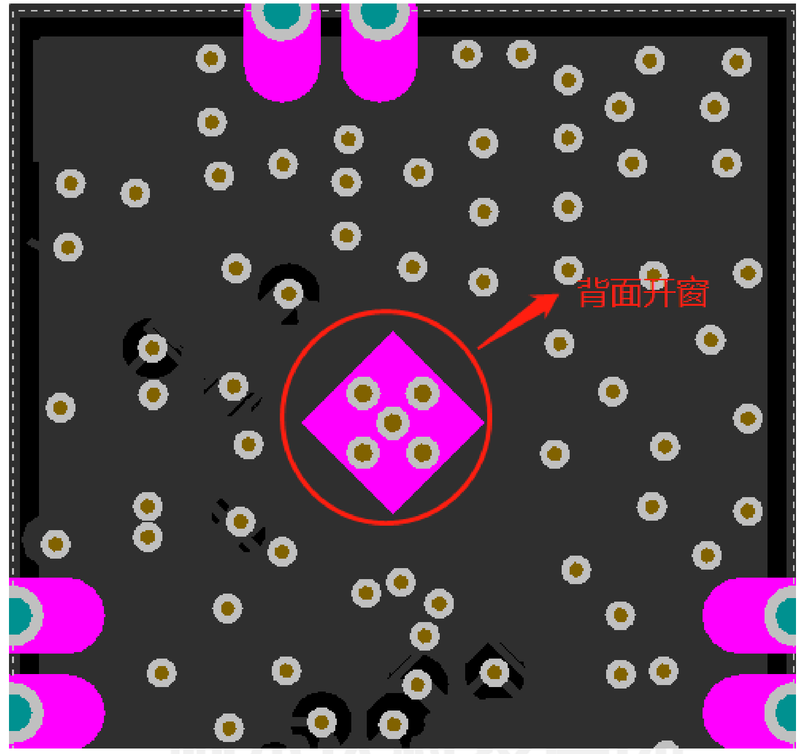
H=1.2mm, W=1.0mm, D=0.2mm（推荐）

H=1.6mm, W=1.0mm, D=0.2mm（推荐）

Pic4-3 50 ohm impedance line routing recommendations

3. Pads on the back of the module

Due to the large amount of heat generated when the PA is working, we have opened a window on the thermal pad of the PA on the back of the module. You need to avoid this area on your PCB, and do not expose copper or place power vias to avoid short circuits.



Pic4-4 Window on the back of the module

4. ESD protection

You need to pay attention to the electrostatic protection of the module when designing the product (see Table 2-1). Add an electrostatic protection circuit to a place that is easily accessible to the human body, and take protective measures in the manufacturing process of the product.

5 Production guidance

5.1 Production guide

It is recommended to use SMT machine for patching, and the patching is completed within 24 hours after unpacking, otherwise the vacuum packaging must be re-evacuated to avoid dampness leading to poor patching.

If the package contains a humidity indicator card, it is recommended to determine whether the module needs to be baked according to the humidity card indicator. The conditions for baking are as follows:

Baking temperature: 125℃±5℃;

Alarm temperature: 130℃;

After cooling <36℃ under natural conditions, SMT patch can be carried out;

If it is more than 3 months after unpacking, you need to pay special attention to whether the product is damp, because the PCB uses an immersion gold process, unpacking for more than 3 months may cause the pad to oxidize, and may cause problems such as false soldering and missing soldering during patching.

In order to ensure the qualified rate of reflow soldering, it is recommended to sample 10% of the products for visual inspection and AOI inspection for the first time to ensure the reasonableness of furnace temperature control, device adsorption method, and placement method;

In the whole production process, all operators must wear electrostatic gloves;

5.2 Location requirements

It is recommended that the thickness of the green oil at the module position of the backplane be less than 0.02mm, to avoid the excessive thickness that causes the module to be unable to effectively contact the solder paste, which will affect the soldering quality.

In addition, it is necessary to consider that no other devices can be placed within 2mm of the interface board module position to ensure the maintenance of the module.

5.3 Stencils

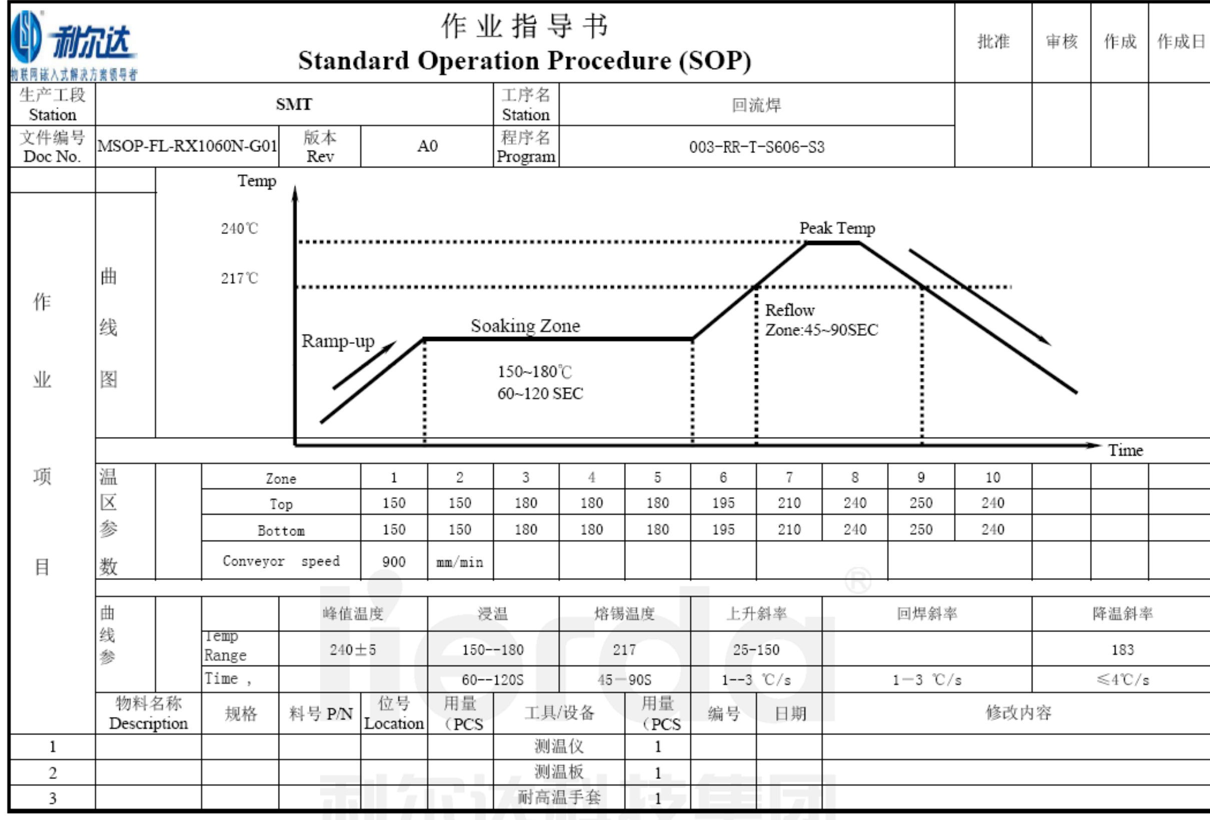
The thickness of the stencil on the bottom plate is in principle selected according to the package type of the components on the board, and the following requirements should be paid attention to:

The position of the module pad can be locally thickened to 0.15~0.20mm to avoid

empty soldering;

5.4 Reflow soldering guidance

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



利尔达 物联网嵌入式解决方案领导者	作业指导书 Standard Operation Procedure (SOP)			批准	审核	作成	作成日
生产工段 Station	SMT	工序名 Station	回流焊				
文件编号 Doc No.	MSOP-FL-RX1060N-G01	版本 Rev A0	程序名 Program 003-RR-T-S606-S3				

作业项目 — 曲线图

温区参数

Zone	1	2	3	4	5	6	7	8	9	10
Top	150	150	180	180	180	195	210	240	250	240
Bottom	150	150	180	180	180	195	210	240	250	240
Conveyor speed	900	mm/min								

曲线参

	峰值温度	浸温	熔锡温度	上升斜率	回焊斜率	降温斜率
Temp Range	240±5	150--180	217	25-150		183
Time ,		60--120S	45—90S	1--3 ℃/s	1—3 ℃/s	≤4℃/s

	物料名称 Description	规格	料号 P/N	位号 Location	用量（PCS	工具/设备	用量（PCS	编号	日期	修改内容
1						测温仪	1			
2						测温板	1			
3						耐高温手套	1			

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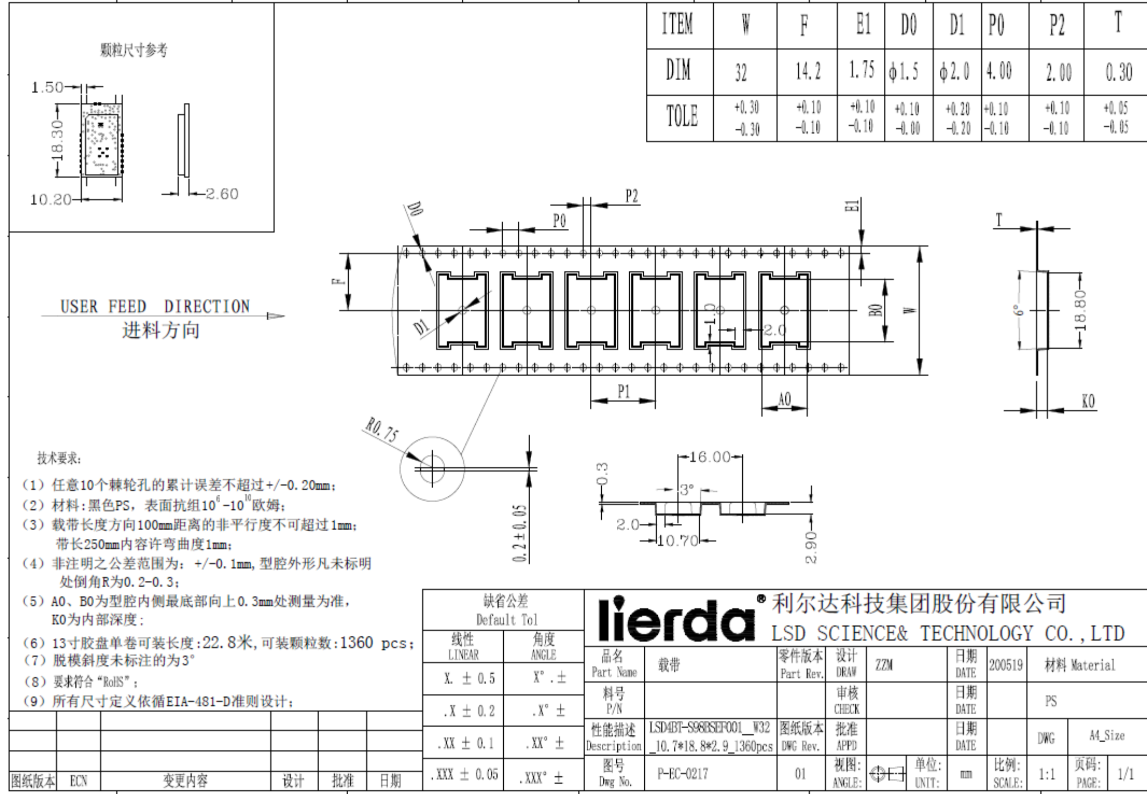
6 Packaging

6.1 Packing

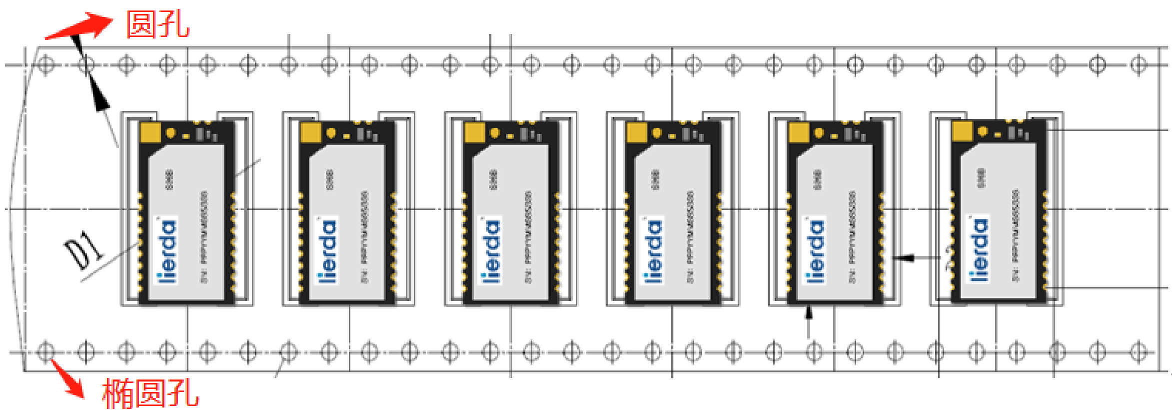
■ Reel　　☐ Foam　　☐ Electrostatic bag

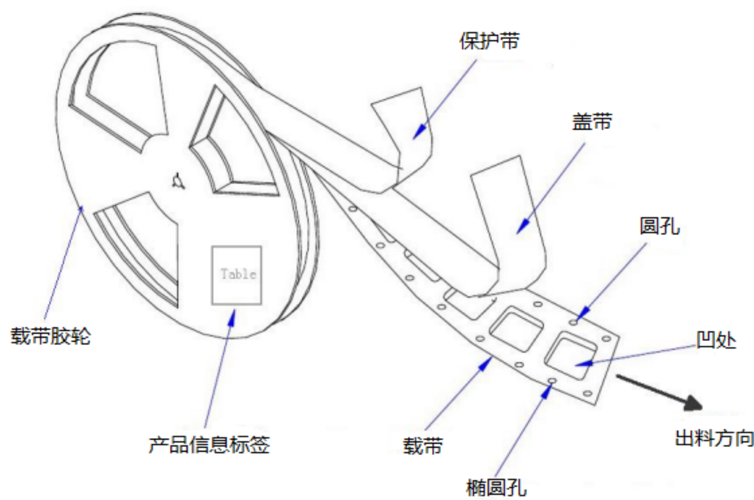
6.2 Reel size



6.3 Placement direction

Schematic diagram of the module orientation in the reel package:





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