

LSD4BT-S98B

Product Specification

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

Part Number: LSD4BT-S98BSTD001

Version: Rev03

Document Revision History

Number	Revision description	Version	Revision date
1	Initial version	Rev01	2020-5-28
2	Update power consumption and transmission 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(°C)	-40	85	
ESD(KV)	/	4	All PINS, HBM MODE
ESD(KV)	/	0.5	All PINS, CDM MODE

Table2-2 Operating parameters@25°C, 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(°C)	-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°C

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°C

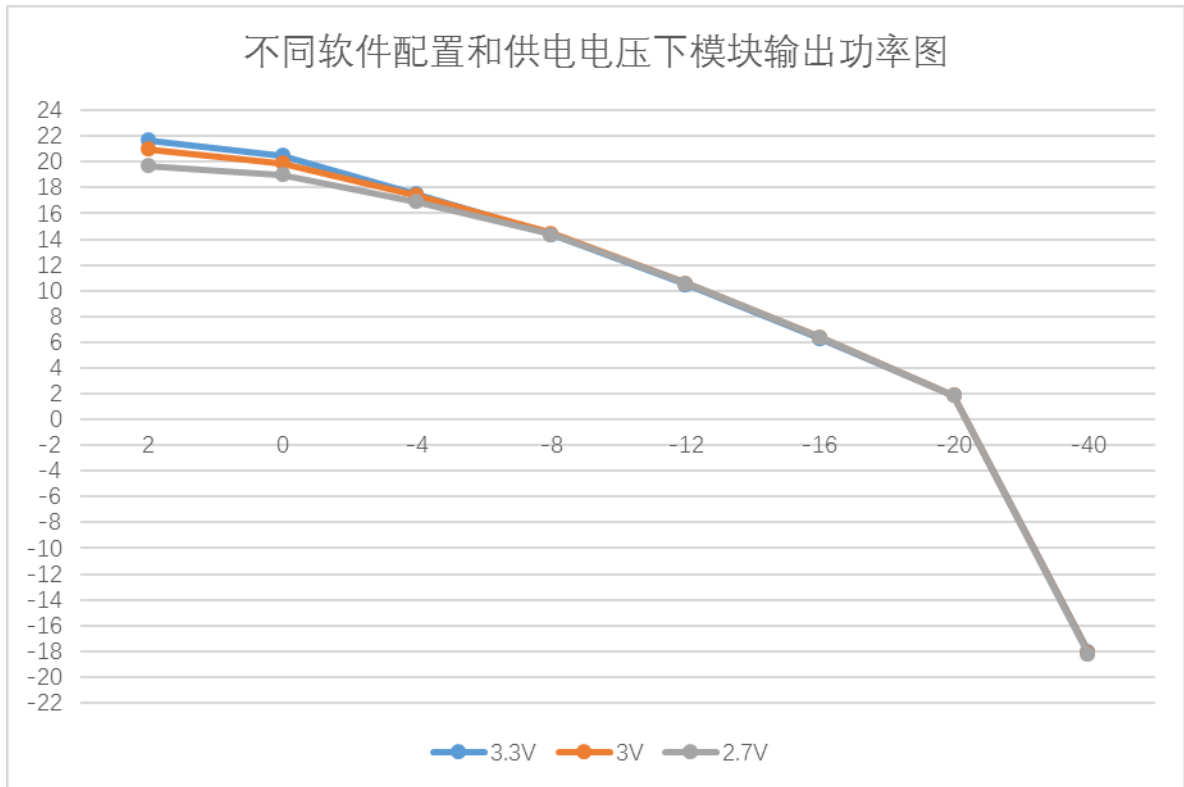


Table2-4 Power consumption under different broadcast intervals (7Byte data by default)

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)

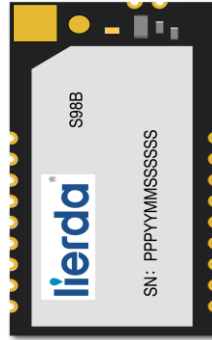
Mode	Average power consumption(μ A)	Connecting interval(ms)
Connecting mode (-4dBm configuration, 3.3V)	172	100
	94	200
	40	500
	30	700
	22	1000
	14	2000
	12	3000
	10	4000



3 Layout and interface

3.1 Dimensions

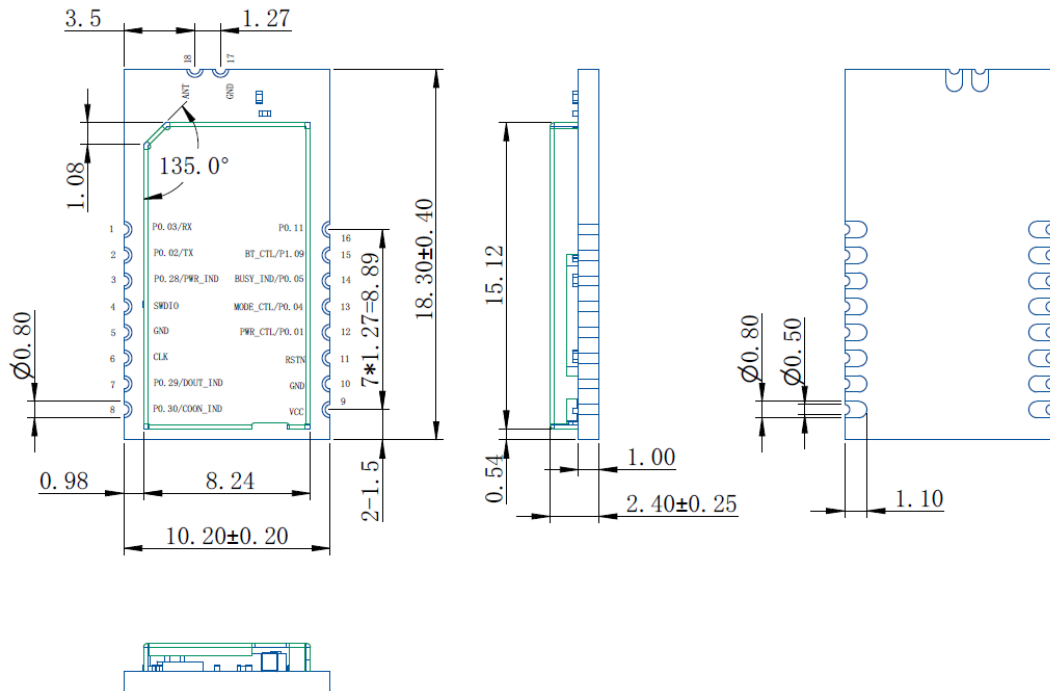
The outline diagram of LSD4BT-S98B is shown in Figure 3-1:



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

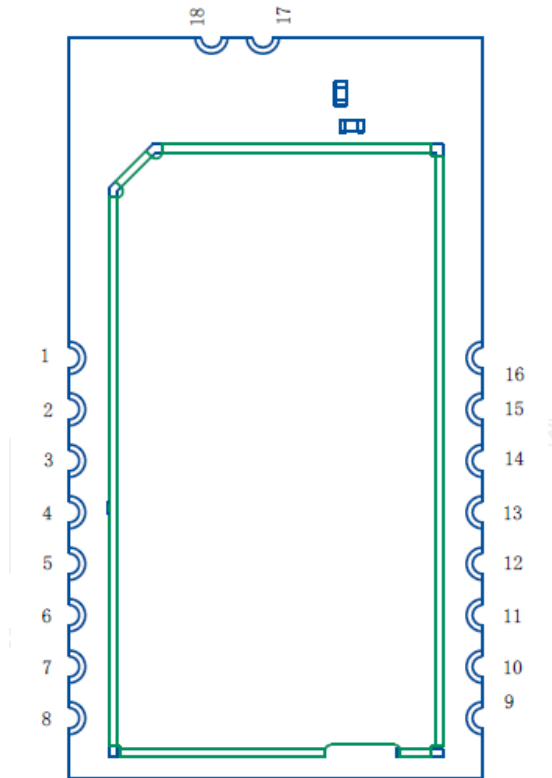


Table3-1 LSD4BT-S98B Pin function

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.

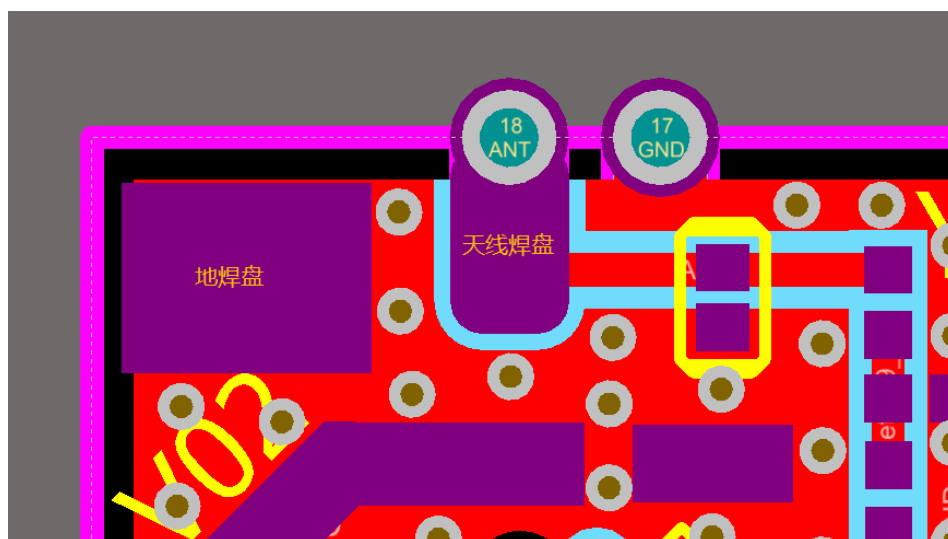
An external PA is used inside the module, and the peak current of the module is 200mA. Therefore, the driving current of the power supply of the module should be above 250mA.

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.

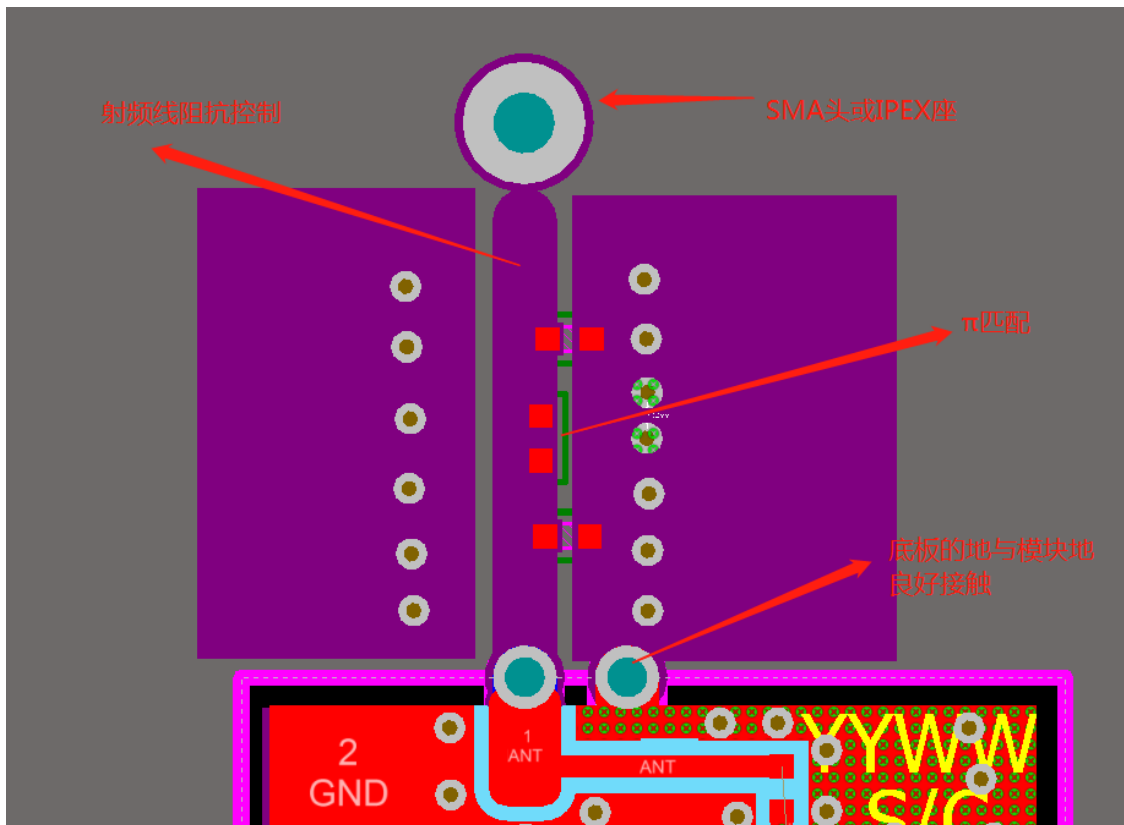


图 4-2 SMA 头或 IPEX 座转接天线

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)

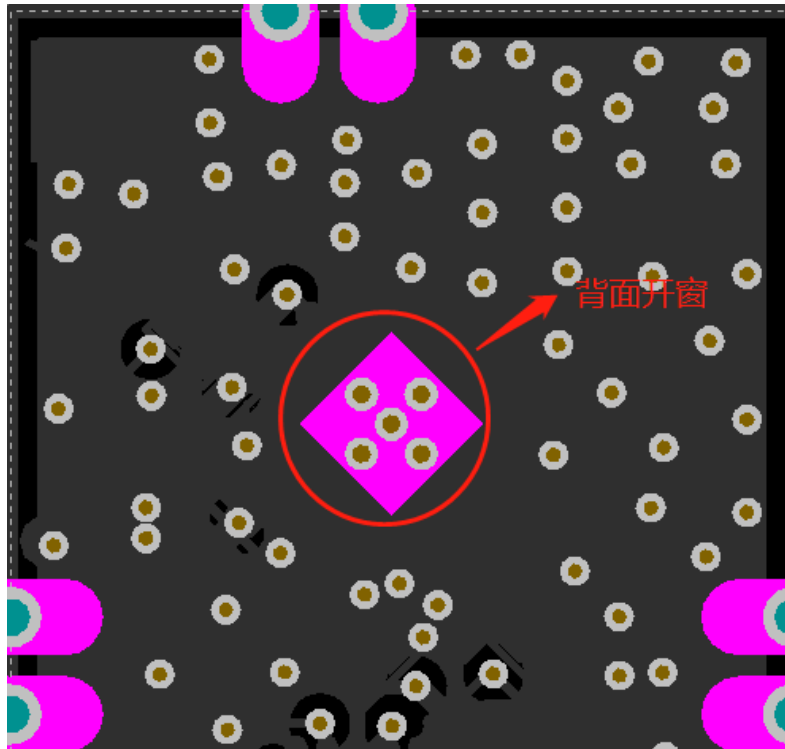
H=1.2mm, W=1.0mm, D=0.2mm (推荐)

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: $125^{\circ}\text{C}\pm 5^{\circ}\text{C}$;

Alarm temperature: 130°C ;

After cooling $<36^{\circ}\text{C}$ 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


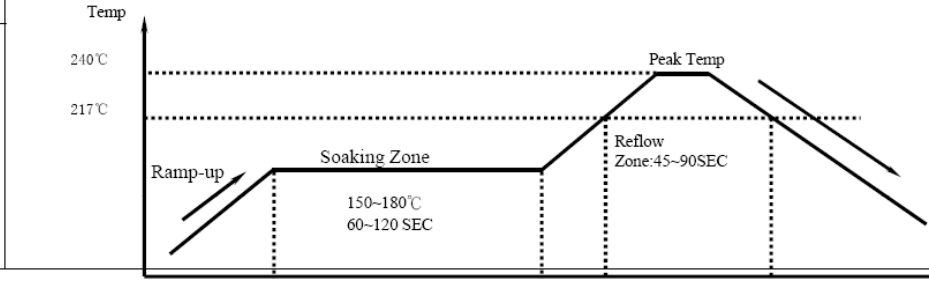
The thickness of the stencil on the bottom plate is in principle selected according to the package type of the components on the board, and the following requirements should be paid attention to:

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.

 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									
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	180	195	210	240	250	240			
	Bottom	150	150	180	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	1-3 °C/s			183				
	Time		60--120S			45-90S	1--3 °C/s	1-3 °C/s			≤4°C/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									

6 Packaging

6.1 Packing

Reel

Foam

Electrostatic bag

6.2 Reel size

颗粒尺寸参考

ITEM	W	F	E1	D0	D1	P0	P2	T
DIM	32	14.2	1.75	φ1.5	φ2.0	4.00	2.00	0.30
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	+0.10 -0.10	+0.05 -0.05

USER FEED DIRECTION
进料方向

技术要求:

- 任意10个棘轮孔的累计误差不超过 $\pm 0.20\text{mm}$;
- 材料:黑色PS, 表面抗组 10^6-10^8 欧姆;
- 载带长度方向100mm距离的非平行度不可超过1mm; 带长250mm内容许弯曲度1mm;
- 非注明之公差范围为: $\pm 0.1\text{mm}$, 型腔外形凡未标明处倒角R为0.2-0.3;
- A0、B0为型腔内侧底部向上0.3mm处测量为准, K0为内部深度;
- 13寸胶盘单卷可装长度:22.8米,可装颗粒数:1360 pcs;
- 脱模斜度未标注的为 3°
- 要求符合“Ra1S”;
- 所有尺寸定义依循EIA-481-D准则设计;

线性 LINEAR		角度 ANGLE	
Default Tol			
.X	± 0.5	.X°	\pm
.X	± 0.2	.X°	\pm
.XX	± 0.1	.XX°	\pm
.XXX	± 0.05	.XXX°	\pm

lierda 利尔达科技集团股份有限公司

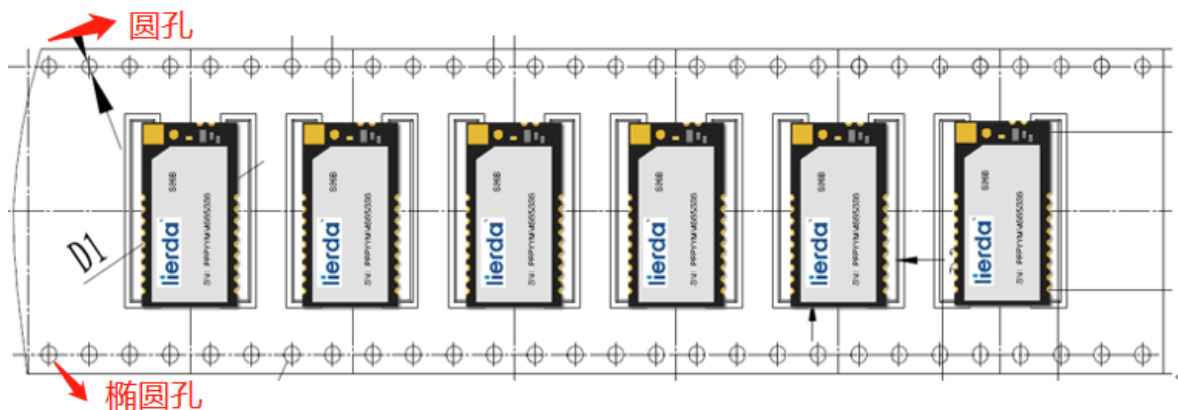
LSD SCIENCE & TECHNOLOGY CO., LTD

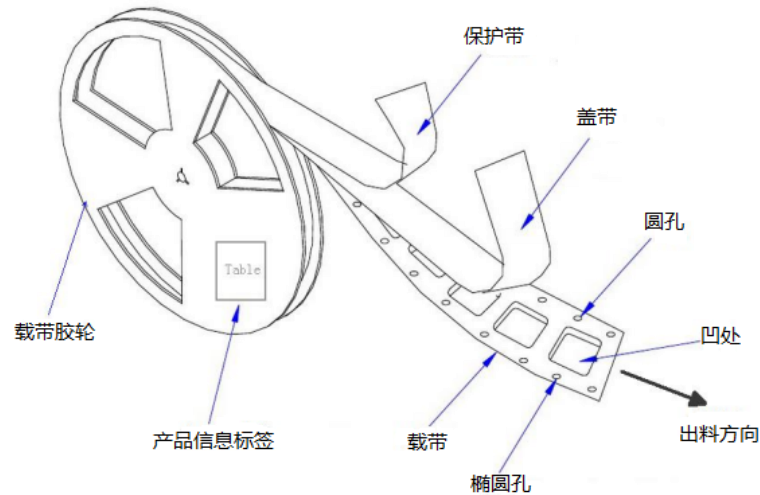
品名 Part Name	载带	零件版本 Part Rev.	设计 DRAW	日期 DATE	200519	材料 Material	
料号 P/N		审核 CHECK	日期 DATE			PS	
性能描述 Description	LSD4WT-S080SEF001_W32 _J0_7*18.8*2.9_1360pcs	图纸版本 DWG Rev.	批准 APPD	日期 DATE		DWG	A_Size
图号 Dwg No.	P-EC-0217	01	视图: 1/1	单位: mm	比例: 1:1	页码: 1/1	

图纸版本 ECN	变更内容	设计	批准	日期
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6.3 Placement direction

Schematic diagram of the module orientation in the reel package:





Warn users

You are welcome to use the products of Lierda Technology Group Co., Ltd. Before using our products, please read this warning first. If you have started to use it, you have read and accepted this warning. Lierda Technology Group Co., Ltd. reserves the right of final interpretation and modification of all the materials provided, and subject to change without notice.

利尔达科技集团

FCC Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

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: N8NLS4BT-S98.

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.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé.

Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

