

E95 Series products

User Manual



Product name: E95 BLE Module

Model: LSD4BT-E95ASTD001,

LSD4BT-E95ALSP001

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Chapter 1 Overview

The E95 standard hardware module is a high-performance IoT Bluetooth transceiver based on the NORDIC Bluetooth SOC nRF52 series (supporting Bluetooth 5.0). The module uses a stamp-type interface; the package is compatible with the E66 module (Pin-to-Pin) and supports both external antennas and on-board antennas. The product has the characteristics of low power consumption, small size and strong anti-interference ability.

Based on the optimized Bluetooth SDK provided by Lierda, users can easily develop Bluetooth applications, shorten the development cycle, and help you seize market opportunities.

1.1 module features

- Bluetooth 5.0
- ARM® Cortex®-M4 32-bit processor, 64 MHz
- 192 KB Flash + 24 KB RAM
- LEmode: 1Mbps\2Mbps
- Link Budget: 99dB(1Mbps)
- Receive sensitivity: -95dB
- Output power: MAX 4dBm
- RSSI accuracy: 1dB
- Working voltage: 1.7-3.6V
- Number of configurable GPIO : 10
- ADC accuracy: 12bit / 200 ksps
- 50 Ω RF port1
- Programmable peripheral interface-PPI
- DC-DC work mode

1.2 Application

- 2.4GHz low power Bluetooth system;
- Low-power peripherals such as PC, tablet, mobile phone, and handset(HID, remote controller, etc.);
- Consumer electronics such as sport and health care;
- Wireless sensor networks such as smart meters and data acquisition;
- Intelligent cloud platform and ecologic access(WeChat, QQ IOT, Jingdong, Ali,

Xiaomi, etc.);

- Smart home, LAN, interactive devices, beacon lights.



Chapter 2 Application note

2.1 Antenna design guide

If you have high requirements for communication distance, an external antenna can be used. The IO port required to use the external antenna is PIN27 (ANT). The original antenna position under the module must be completely copper.

The figure below shows the circuit from the module ANT Pin to the external antenna. The red thick line should guarantee 50Ω impedance control. Keep the line as short as possible, do not hit the hole, do not take the acute line. Place more GND vias around the RF traces.

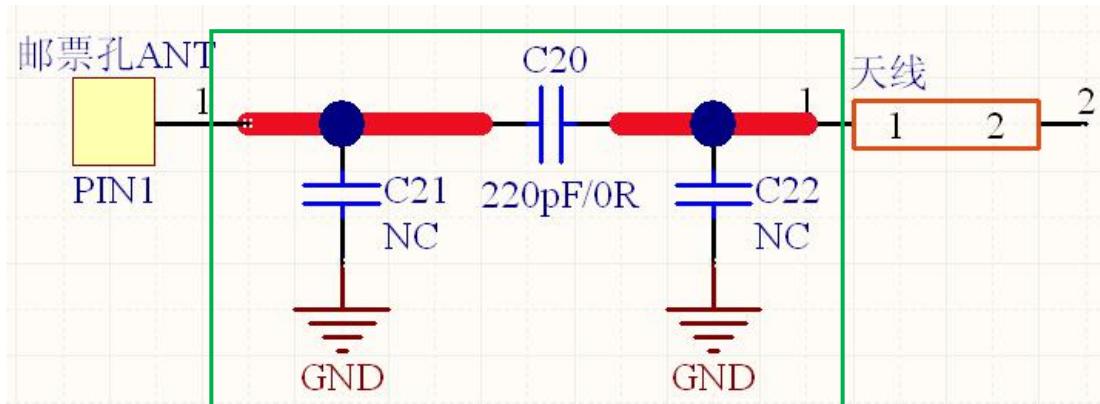


Figure 4-1 Schematic diagram of external antenna impedance matching circuit

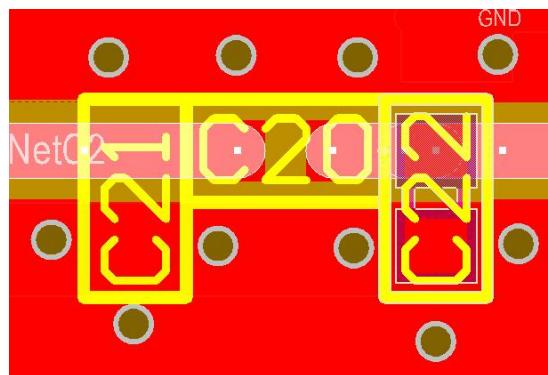


Figure 4-2 External antenna impedance matching circuit PCB schematic and routing instructions

The highlight of the trace should control the impedance of 50Ω , the relationship between board thickness and line width, line spacing can be referred to:

Recommended value of FR4 Double panel:

(H =plate thickness, W =line width, D = Trace and copper spacing)

$H=1.0\text{mm}$, $W=0.8\text{mm}$, $D=0.2\text{mm}$

H=1.0mm, W=1.0mm, D=0.254mm(recommended)

H=1.2mm, W=1.0mm, D=0.2mm(recommended)

H=1.6mm, W=1.0mm, D=0.2mm (recommended)

(More design support is available to Lierda Technology Consulting)

2.2 Backplane layout considerations

A large clearance area is required around the antenna. Clearance refers to the open area in the projected area of the vertical plane of the antenna (both upper and lower ranges must be considered). In the range of the projection area of the antenna, whether it is patch or side-insertion, do not lay the ground (especially the on-board antenna), do not have metal or devices, and keep the antenna clearance to improve the radiation efficiency of the antenna.

The height (distance) between the antenna and the motherboard is also an important consideration. In general, the antenna needs to be at least 10mm above the main board, and at least 5mm in extreme environments. When the height of the antenna is less than 8 mm, the radiation efficiency of the antenna is limited.

The RF part of the module should not be avoided by the metal cavity. The distance between the RF part and the interference source should be more than 10mm. Common sources of interference are: battery (including electrical connection), capacitor, inductor, button, oscillator, power cord, Metal-containing screws or nuts, CPU, LCD, transformer, speaker, camera, product communication interface cable, power circuit, motor, etc.

If the PCB antenna is used, the PCB antenna should be on the edge of the PCB on the entire substrate. The spacing around the PCB antenna should be 10mm. The layers around the antenna should not be copper, trace or arranged. If there are multiple antennas, the distance between the antennas should be as far as possible to avoid co-channel interference and intermodulation interference;

Users should pay attention to the design. In the area where the Bottom layer has window opening for the antenna pad, no via hole can be placed to prevent short circuit.

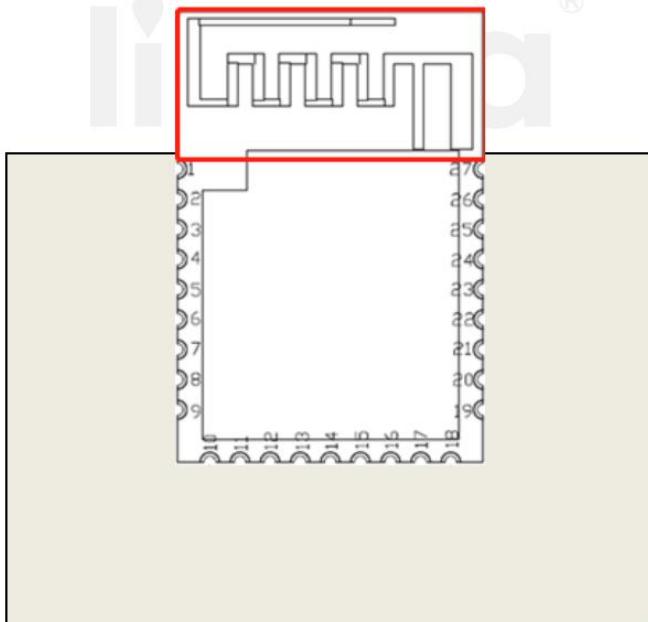


Figure 4-3 Module recommended reference placement

Note: When designing, users should pay attention to that there is a window opening area (that is, exposed copper) in the test pad for testing the RF performance of the Bottom layer of the module product. As shown in the picture, the position of the green box is the position of the test point, and the specific size refers to the actual object

2.3 Precautions

1. Power supply

It is recommended to use the DC stabilized power supply to supply power to the module. The power supply ripple is as small as possible. Generally, the ripple is less than 30mV. Excessive ripple may cause low sensitivity and poor connection quality. And the Bluetooth transmit signal will be coupled into the interference signal, causing the RF indicator to exceed the Bluetooth specification. In severe cases, it will be unable to connect and communicate. Try to use LDO to supply power to the module. The LDO should be away from the DC-DC power supply and inductance to prevent DC-DC radiation from contaminating the LDO's power supply. The module needs to be grounded reliably, and please pay attention to the correct connection of the positive and negative poles of the power supply. If a reversed connection is made, the module may be permanently damaged.

2. ESD electrostatic protection

Users should pay attention to the static requirements of the product when designing, see Table 2-1, and add static protection measures when designing the terminal product.

Chapter 3 Production guidance

3.1 Production guide

It is recommended to use SMT machine patch, and the patch should be completed within 24 hours after unpacking, otherwise it is necessary to re-vacuate the package to avoid the bad condition caused by moisture..

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

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

Set alarm temperature to 130°C ;

After cooling $<36^{\circ}\text{C}$ under natural conditions, the SMT patch can be performed;

If the unpacking time is more than 3 months, special attention should be paid to whether the product is damp or not. Because the PCB immersion gold process may cause the pad to oxidize for more than 3 months, it may cause problems such as rosin joint and dry joint.

In order to ensure the reflow soldering pass rate, it is recommended to extract 10% of the products for visual inspection and AOI testing for the first time to ensure the correctness of furnace temperature control, device adsorption mode and placement method.

Operators at all stations in the entire production process must wear electrostatic gloves.

3.2 Module requirements for floor position

It is recommended that the green oil thickness of the bottom plate module position is less than 0.02mm, to avoid excessive thickness, and the high height module cannot effectively contact the solder paste to affect the welding quality.

In addition, the module needs to reserve 2mm space around to ensure the maintenance of it.

3.3 Steel stencil design

The thickness of the steel stencil is selected according to the package type of the device in the board. It is necessary to focus on the following requirements:

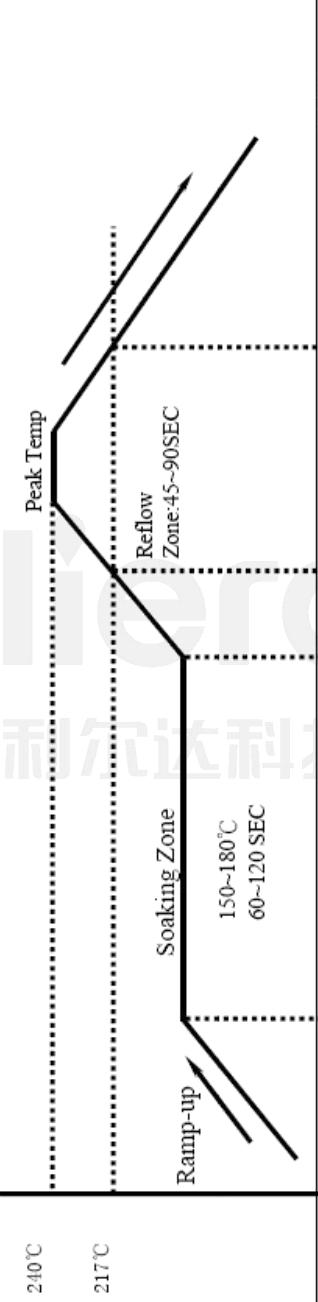
The module pad position can be locally thickened to 0.15~0.20mm to avoid rosin joint.



3.4 Reflow soldering instructions

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	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				
作业 曲线 图	Temp	240°C	217°C			Peak Temp			
温区参数 项目	Zone	1	2	3	4	5	6	7	8
Top	150	150	180	180	195	210	240	250	240
Bottom	150	150	180	180	195	210	240	250	240
Conveyor speed	900	mm/min							
曲线参数 项目	Temp Range	240±5	150—180	217	25—150	1—3 °C/s	1—3 °C/s	1—3 °C/s	1—3 °C/s
物料名称 Description	规格	料号 PN	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			



FCC Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. 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: N8NLSD4BT-E95.

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

IC Statement

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 radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The product complies 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.