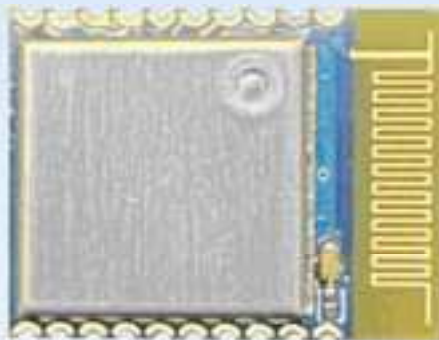


Product Specification



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Note: Revision History

Revision	Date	Comment
V1.0	2021-7	First release

1. Overview

1.1 Product Introduction

BLE5101 is a Bluetooth-to-serial transceiver module based on Bluetooth protocol version 5.1, coexistence of master and slave roles, small size, low power consumption, and the working signal frequency band is 2.4GHz.

The BLE5101 module is developed by Shenzhen NiceRF Wireless Technology Co., Ltd. The module supports the coexistence of master and slave roles, can connect to the master and slave at the same time, and can flexibly set the number of master and slave connections, and can support up to 20 connections. Maximum support for data transmission at 115200bps baud rate. The module uses AT commands to set parameters, and the operation is simple and easy to use. Modules can be widely used in smart wear, smart home, automobiles, lighting, smart automation data collection, smart control, wireless sensing, electronic tags and other scenarios.

FCC ID:2AD66-BLE5101

1.2 Features

- Support Bluetooth BLE5.1 protocol
- Support the coexistence of master and slave roles, and can connect multiple masters and slaves at the same time, up to 20 connections
- Support 2 working modes of configuration and transparent transmission
- Support over-the-air upgrade (OTA DFU)
- Support multiple serial port parameter configuration
- Support automatic broadcasting, scanning, connection
- Support manual connection and automatic connection 2 connection methods
- The maximum MTU is 247 bytes
- Support custom 16-bit UUID, including one Service uuid and two Characteristic uuid, which can be flexibly configured and compatible with similar BLE products
- Maximum communication distance 70m
- Support custom modification of the local mac address
- Support mac address binding, up to 8

devices (regardless of master and slave)

- Support low power sleep

1.3 Application

- Wireless meter reading wireless sensor
- Smart home
- Industrial remote control, telemetry
- Smart buildings, smart buildings
- Automated data collection
- Health sensor
- Smart wearable device
- Smart robot
- Wireless sensing
- Electronic tags
- Intelligent control

2. Precautions for use

2.1 BLE description

2.1.1 MTU

Refers to the payload size of BLE air single packet data. The MTU of the BLE4.0/4.1 protocol is 27 bytes, which can be expanded to 251 bytes from the MTU of BLE4.2 and higher. In actual use, the single packet data is MTU-3, that is, the user can send a maximum of 24 bytes using BLE4.0/4.1 protocol single packet, and BLE4.2 and higher versions can be expanded to 247 bytes.

It should be noted that in actual applications, the MTU of different devices will be different.

2.2 Precautions for module application

2.2.1 Judgment conditions for the role of master and slave

When the module actively scans and connects to other Bluetooth devices, the module assumes the role of the master in this connection; when the module is connected by other Bluetooth devices due to broadcasting itself, the module acts as the slave in this connection.

2.2.2 Response of distance to data transmission rate

The module uses PCB antenna. Compared with ceramic antennas, BLE wireless signals have stronger transmitting and receiving capabilities with external antennas. Nevertheless, the data transmission speed of the module will still be attenuated due to the increase in distance.

2.2.3 Module data transmission speed changes

The data transmission speed of the module will decrease as the distance increases. And because the module sends data in the form of polling connections, when there are multiple connections, the total data sending time will vary due to the distance and the number of connections. In the case of multiple connections, it is recommended to add a certain delay between each packet of data.

2.2.4 Module current may be too high in low power consumption mode

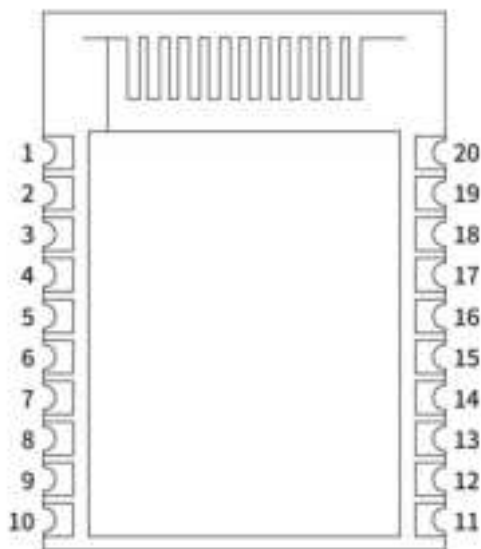
When the module is connected, the connection will remain undisconnected in low power consumption mode, so the current of the module may be slightly higher, but it is always less than

Parameter	Min.	Typ.	Max.	Unit	Condition
Operation Conditions					
Working voltage range	1.71	3.3	4.3	V	
Operating temperature range	-40		60	°C	
Current Consumption					
Receive current		7.1		mA	
Emission current		7.4		mA	
Sleep current		< 7.5		uA	
Idle current		< 6.58		mA	Idle state: refers to no connection, no broadcasting/scanning of the module
RF Parameter					
Frequency Range	2400		2483.5	MHz	
Transmit power	-16		10	dBm	
Receiving sensitivity		-95		dBm	

100uA.

3. Electrical Characteristics

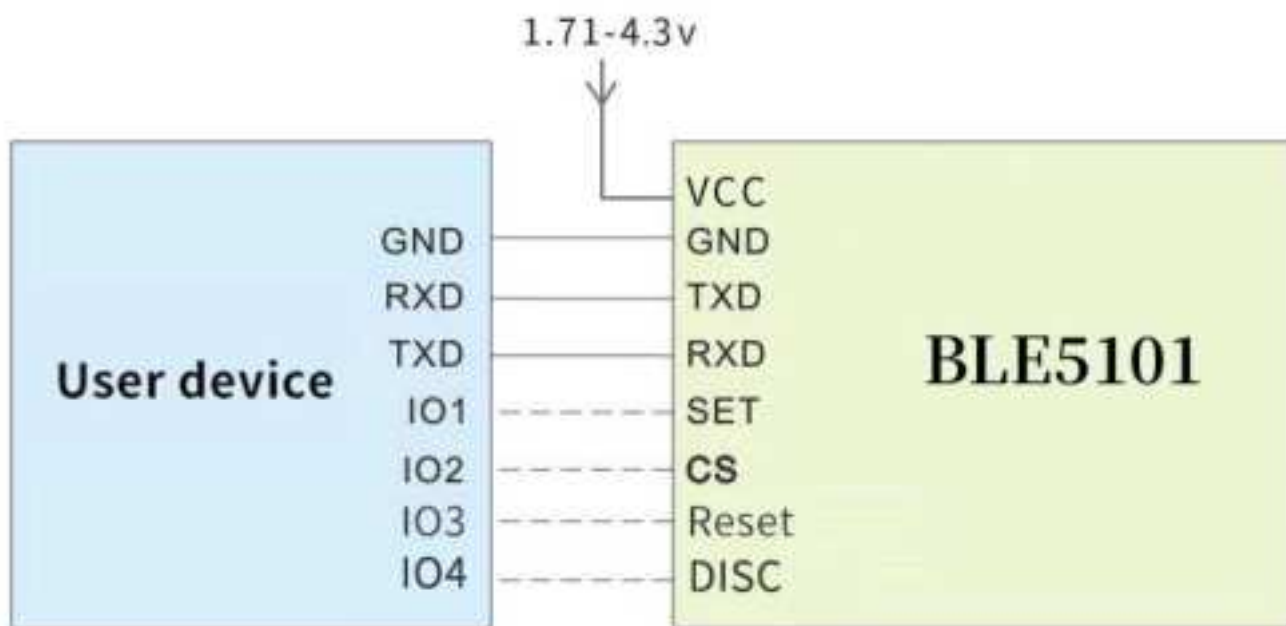
4. Pin definition



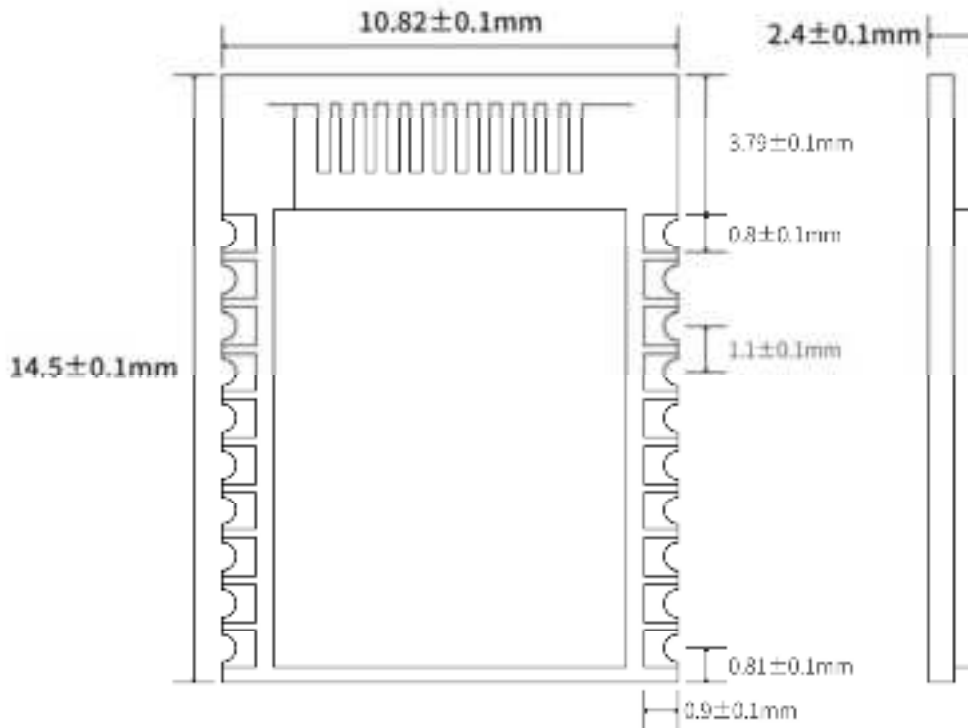
Pin NO.	Pin name	I/O	Pin function	Description
1,9	GND		GND	Power ground
2	NC			Dangling feet
3	SWCLK		SWCLK/GPIO	Connect to internal IO, used to burn program, it can be used as normal IO when running
4	SWDIO		SWDIO/GPIO	Connect to internal IO, used to burn program, it can be used as normal IO when running
5	PA00	I	CS	Module sleep pin CS (low level work, high level sleep, default high level)
6	PA1	I	SET	Module configuration pin SET (high level during normal communication, enter configuration mode when SET pin is pulled low, default high level)
7	PD5	O	USART1_TX	Module serial data transmission pin TXD (level voltage is up to 3.3V)
8	PD4	I	USART1_RX	Module serial data receiving pin RXD (level voltage up to 3.3V)

10	VCC		VCC	Connect to the positive pole of the power supply (1.71-4.3V)
11	PD7	O	CS_DETECTION	Sleep status indicator pin (low level when sleeping, high level when working)
12	RESET	I	RESET	Module reset pin, high level reset, there is a pull-down resistor inside.
13	PD6	O	MODE_DETECTION	Working status indicator pin (high-level output is broadcast state, low-level output is non-broadcast state)
14	PC5	I/O	PC5	GPIO
15	PA3	I/O	PA3	GPIO
16	PA2	I/O	PA2	GPIO
17	PA7	I	DISC	Bluetooth connection enable pin, pull down to disconnect the Bluetooth connection, the default high level
18	PA6	I/O	PA6	GPIO
19	PA4	I/O	GPIO	GPIO
20	PA5	O	SET_DETECTION	Output high level is transparent transmission mode, output low level is AT configuration mode

5. Typical application circuit



6. Mechanical size (unit: mm)



7. Function Description

7.1 Role description

The module supports three roles: master, slave, and master-slave coexist. These three types can be modified by sending AT command AT+CONS.

The module supports up to 20 connections, supports transparent transmission, and supports manual and automatic connections.

7.1.1 Host

- Command AT+CONS=x,y. When the value of y is greater than 0, the host role is enabled and the scanning function can be used.
- In configuration mode, send command AT+SCAN to start scanning, which is used to manually connect to the slave;

- In the transparent transmission mode, the module will automatically scan the connected slaves.
- Supports one-master and multiple-slave connections. The maximum number of connections depends on the AT+CONS command, and the maximum number is not more than 20.
- When the number of connected slaves reaches the set maximum value, the module will stop scanning and all scanning functions will be invalid until any slave is disconnected.

7.1.1.1 Host connection strategy

The module filters broadcast packets by service UUID.

UUID filtering is based on the content filtering configured by AT+UUID, and this condition cannot be closed.

The module will analyze the scanned broadcast packet during scanning. If the broadcast packet contains Service UUID and the UUID is the same as the Service UUID of the module itself, the module will automatically initiate a connection. After the connection is established, the module as the host role will try to read the Characteristic UUID under the Service UUID of the peer device. If the module does not read the Service UUID and the Characteristic UUID under it, or the UUID value read does not match the module itself, the module will automatically disconnect its connection.

This filter condition applies to manual connection and automatic connection.

7.1.2 Slave

- Command AT+CONS=x,y. When the value of x is greater than 0, the slave role is enabled and the broadcast function can be used.
- Send command AT+MODE=A in configuration mode to start broadcasting.
- In the transparent transmission mode, the module will automatically broadcast itself.
- Support one-slave multi-master connection. The maximum number of connections depends on the AT+CONS command, and the maximum number is not more than 20.
- The broadcast content includes the device name, mac address, and Service UUID required for transparent data transmission.
- When the number of connected hosts reaches the set maximum value, the module will stop

broadcasting itself, and all broadcasting functions will be invalid until any host connection is disconnected.

7.2 Power mode

The module supports 2 power modes: low power consumption mode and wake-up mode.

7.2.1 Low power mode

Low power consumption mode means that when the module enters this mode, the BLE function will continue to run, turn off some peripherals, stop broadcasting and scanning, in order to minimize the power consumption of the module when it is running.

How to enter the low-power mode: pull up the CS pin, when the indicator pin is pulled low, it means that it has entered the low-power mode.

How to exit the low-power mode: pull down the CS pin.

In low-power mode, when there is an undisconnected connection, such as the module receives data from the opposite end, or when the connection status changes, the module will temporarily wake up and process related tasks. After the task is completed, the module will enter immediately when there is no task temporarily. Sleep.

7.2.2 Wake mode

Wake-up mode refers to the state when the module is operating normally outside of the low-power mode, and all peripherals and functions are operating normally.

How to wake up: pull down the CS pin.

7.3 Data transparent transmission

Data transparent transmission means that the data received by the serial port is sent to the peer device via BLE without any processing, or the data received by BLE is output to the serial port without any processing.

All data is transmitted in ASCII format. The module sends the data to every connected Bluetooth device through polling connection when the data is transparently transmitted. Under extreme conditions, it cannot be guaranteed that every device will receive the data.

Do not only send the data "+++r\n" within 50ms during data transparent transmission, otherwise the module will enter the configuration mode due to misoperation.

7.4 UUID description

Service UUID	FFF0		
Characteristic UUID	UUID	Attributes	Description
	FFF1	Read/Notify	The slave sends, the host receives the data channel
	FFF2	Write/Write no response	The host sends and the slave receives data channels

The UUID values listed in the table can be modified by AT commands, except for UUID attributes.

7.5 Connection handle

1. Normally, the connection handle of the module is the number of the specified link (0-19). In principle, the handle of the module connection may not be the same each time.
2. In the case of a multi-master and multi-slave connection, each module on the connection handle may have a master role or a slave role, depending on the connection.
3. The designated link can be operated through AT commands.

7.6 Air upgrade (OTA DFU)

The module supports over-the-air upgrade of firmware, and the best functional experience can be obtained through over-the-air upgrade. Users can also customize the firmware they need.

For specific upgrade steps, please refer to Chapter 9 Quick Use.

8. AT command

The module must enter the configuration mode to send AT commands, otherwise the commands will not respond.

8.1 Instructions

- All AT commands are transmitted in ASCII format.
- Command sending format: all commands begin with "AT" and end with "\r\n". Commands must be capitalized except for parameters.
- Command return format: return the relevant string corresponding to the sent command, all ending with "\r\n".
- The sending interval of each AT command should be more than 50ms.
- Entering the configuration mode will temporarily disable the low power consumption mode (CS pin function is invalid).
- In configuration mode, in order to prevent data interference, data sent from other devices will not be displayed.

8.2 How to enter and exit configuration mode

1) How to enter:

1. In the transparent transmission mode, "+++ \r\n" is sent separately within 50ms. In the configuration mode entered in this way, the serial port parameter configuration is the same as the transparent transmission mode.

2. The transparent transmission mode pulls down the SET pin. In the configuration mode entered in this way, the serial port parameters will be reconfigured (115200 bps, 8 databits, 1 stopbit, None parity).

2) How to log out:

1. Send the command "AT+EXIT\r\n" in configuration mode.
2. Pull high when the SET pin is low.
3. When exiting the configuration mode, the serial port parameters will be restored to the same configuration as the transparent transmission mode.

8.3 Error code

When the command sent does not meet certain conditions, the module will return an error in the format "+ERROR=<Error num>\r\n".

Error num	Description	Wrong reason	Solution
-1	Instruction does not exist	AT command characters are wrong	Check AT command string format
-2	Not connected	No connection is established by the module	The slave sends, the host receives the data channel
-3	The maximum number of host connections has been reached	The number of hosts connected to the module has reached the maximum value or the DISC pin is pulled low	Modify the number of connectable hosts through the command AT+CONS; check whether the DISC pin is high
-4	The maximum number of slave connections has been reached	The number of slaves connected to the module has reached the maximum	Modify the number of connectable slaves by command AT+CONS
-5	Parameter error	The command format is wrong or the parameter is not within the value range	Compare the instruction to determine the instruction format and value range
-6	Busy	The module is executing an instruction	Wait for the instruction operation to complete
-7	Link does not exist	The module does not have a connection handle corresponding to the link number	Operate other link numbers or wait for the link number to be used before operating
-8	The bound device is full	All devices with binding records are connected	
-9	Failed to enter upgrade mode	The module is not configured in IDLE state in advance	Send AT+MODE=I command before entering upgrade mode

8.4 Status printing

The serial port will output status during some operations.

Status	Print information	
Connection succeeded	Establish a connection as a host	\r\n[SLAVE CONNECT]\r\n
	Establish a connection as a slave	\r\n[MASTER CONNECT]\r\n
Disconnect	The peer device as the host	\r\n[MASTER DISCONNECT]\r\n
	The peer device acts as a slave	\r\n[SLAVE DISCONNECT]\r\n
Enter configuration mode	\r\n[ENTER AT MODE]\r\n	

Exit configuration mode	\r\n[EXIT AT MODE]\r\n
Enter low power mode	\r\n[ENTER SLEEP]\r\n
Exit low power mode	\r\n[EXIT SLEEP]\r\n

8.5 AT command set

8.5.1 Test instruction

instruction	response
AT	OK
Description: None	

8.5.2 AT+FLASH Save instruction

instruction	response
AT+FLASH	OK
Description	After setting the parameters of some commands, you need to send the command to save it uniformly, and it will take effect permanently when the module is started next time. These instructions are: AT+NAME、AT+MAC、AT+UART、AT+TXPOWER、AT+ADVINT、AT+UUID、AT+CONS、AT+ENATMODE.

8.5.3 AT+RESET Reset command

instruction	response
AT+RESET	OK
Note: Take effect immediately, and the module will be reset and restarted immediately.	

8.5.4 AT+DEFAULT Reset

instruction	response
AT+DEFAULT	OK
<p>Note: After sending this command, the module will restore the data to the default parameters and restart automatically.</p> <p>The default value of the parameter can be set:</p> <p>AT+NAME: BLE5101</p> <p>AT+MAC: 65:12:6e:1b:4a:32</p>	


```

AT+UART: 8,1,0,0
AT+TXPOWER: 0
AT+ADVINT:0
AT+UUID: FFF0, FFF1, FFF2
AT+CONS: 10,10
AT+ENATMODE: 1

```

8.5.5 AT+VERSION Query the firmware version number

instruction		response
AT+VERSION?		+VERSION=<param>
Description	<param>: module firmware version number	

8.5.6 AT+NAME Modify module name

instruction		response
Inquire	AT+NAME?	+NAME=<param>
Set up	AT+NAME=<param>	OK
Description	<param>: device name string, no more than 16 characters Default value: BLE5101	

8.5.7 AT+MAC Modify the local MAC address of the module

instruction		response
Inquire	AT+MAC?	+MAC=<param>
Set up	AT+MAC=<param1>	OK
Description	<param>: the mac address of the device <param1>: The mac address to be modified, but without a semicolon Default value: 65:12:6e:1b:4a:32 Note: If there is no connection to the module when the mac address is modified, the module will immediately change its mac address to apply to the next Bluetooth connection. (Only valid during current operation. If you do not send AT+FLASH command to save, the module will still use the original mac address when it is powered on next time)	
Example	Send: AT+MAC=aabbcc112233\r\n Return: OK\r\n Description: Modify the local mac address to aa:bb:cc:11:22:33	

8.5.8 AT+UART Modify the serial port parameters of the module's transparent transmission mode

instruction		response	
Inquire	AT+UART?	+UART=<param>,<param1>,<param2>,<param3>	
Set up	AT+UART=<param>,<param1>,<param2>,<param3>	OK	
Description	Parameter	Description	Ranges
	<param>	Serial port baud rate	1: 2400bps 2: 4800bps 3: 9600bps 4: 14400bps 5: 19200bps 6: 38400bps 7: 57600bps 8: 115200bps (default value)
	<param1>	Data bit	0: 7bits 1: 8bits (default value)
	<param2>	Check Digit	0: NONE (default value) 1: EVEN 2: ODD
	<param3>	Stop bit	0: 1bit (default value) 1: 2bit
	Note: Modifying the serial port parameters will take effect immediately in the transparent transmission mode, but if you do not send the AT+FLASH command to save, the module will still use the original serial port parameters when it is powered on next time.		

8.5.9 AT+TXPOWER modify the transmit power of the module

instruction		response
Inquire	AT+TXPOWER?	+TXPOWER=<param>
Set up	AT+TXPOWER=<param>	OK
Description	<param>: 0: 10 dbm (default value) 1: 6dbm 2: 3 dbm	

	3: 0 dbm 4: -3 dbm 5: -7 dbm 6: -10 dbm 7: -16 dbm
--	--

8.5.10 AT+ADVINT Modify the broadcast interval

instruction		response
Inquire	AT+ADVINT?	+ADVINT=<param>
Set up	AT+ADVINT= <param>	OK
Description	<param>: 0: 50ms (default value) 1: 100ms 2: 200ms 3: 500ms 4: 1000ms 5: 2000ms	

8.5.11 AT+UUID Modify service UUID

instruction		response
Inquire	AT+UUID?	+UUID=<param>,<param1>,<param2>
Set up	AT+UUID=<param>, <param1>,<param2>	OK
Description	<param>:Service UUID <param1>:Characteristic UUID (read,notify) <param2>:Characteristic UUID (write,write no response) Value range: 0000-FFFF Default value: FFF0, FFF1, FFF2	

8.5.12 AT+CONS Modify the number of connectable devices

instruction		response
Inquire	AT+CONS?	+CONS=<param>,<param1>
Set up	AT+CONS=<param>,<param1>	OK
Description	<param>: the number of masters that can be connected, and the module acts as a slave;	

	<p><param1>: The number of slaves that can be connected, and the module serves as the master.</p> <p>The maximum number of modules that can be connected is 20, so <param> + <param1> ≤ 20. When <param>=0, the module will be disabled as a slave and cannot use any broadcast function; when <param1>=0, the module will be disabled as a master and cannot use any scanning and active connection functions. Through this command, the number of connected devices of the module can be flexibly adjusted.</p>
Example	<p>Command: AT+CONS=0,<x>\r\n</p> <p>Return: OK\r\n</p> <p>Description: Set the module as one master and multiple slaves. <x> can be any integer from 0 to 20.</p>

8.5.13 AT+ENATMODE Modify the module power-on default mode

instruction		response
Inquire	AT+ENATMODE ?	+ENATMODE=<param>
Set up	AT+ENATMODE =<param>	OK
Description	<p><param>:</p> <p>0: The configuration mode is not entered by default when powering on, and the module will automatically scan, broadcast, and connect to devices;</p> <p>1: Enter the configuration mode by default when powering on (default value)</p>	

8.5.14 AT+MODE Modify the status in the module configuration mode

instruction		response
Inquire	AT+MODE?	+MODE=<param>
Set up	AT+MODE=<param>	OK
Description	<p><param>:</p> <p>I: IDLE state, the module is not connected in this state, and no broadcasting or scanning operations are performed</p> <p>S: STATIC state, the module remains connected in this state, but does not do broadcast and scan operations</p> <p>A: ADVERTISING state, the module continues to do broadcast operations in this state</p> <p>C: CONNECTING state. In this state, the module will try to scan and connect to the device with the binding record.</p> <p>U: UPDATE status, used for air upgrade.</p> <p>Note: When entering the configuration mode, if the module is not connected, the default is IDLE state, if there is a connection, it is STATIC state. The IDLE status and STATIC</p>	

	status will dynamically change depending on the number of connections established by the module. After entering the UPDATE state, the module will only accept the two commands "AT+MODE?\r\n" and "AT+MODE=I\r\n".
--	--

8.5.15 AT+SCAN Module scan instruction

instruction	response
AT+SCAN	
Description	After sending this command, the module will enter the scanning state for 10 seconds, and print out all the scanned device information. Up to 10 device information can be printed. In this state, some AT commands cannot be used. Send this command again in this state to end the scan earlier.
Example	<p>Command: AT+SCAN\r\n</p> <p>Return: OK\r\n</p> <p>SCANS\r\n</p> <p>+SCAN: address:11:22:33:44:55:66 type:0 rssi:77\r\n</p> <p>+SCAN: address:aa:bb:cc:dd:ee:ff type:1 rssi:88\r\n</p> <p>...</p> <p>+SCANE\r\n</p> <p>Description: Scan example. address is the mac address of the scanned module; type is the type of the module mac address; rssi is the signal strength of the opposite module.</p> <p>Command: AT+SCAN\r\n</p> <p>Return: OK\r\n</p> <p>SCANS\r\n</p> <p>+SCAN: address:11:22:33:44:55:66 type:0 rssi:77\r\n</p> <p>Command 1: AT+SCAN\r\n --scan command to be sent again halfway</p> <p>+SCANSTOP\r\n</p> <p>+SCANE\r\n</p> <p>Note: An example of interrupt scanning, a +SCANSTOP response will be returned when the scanning ends early.</p>

8.5.16 AT+CONA Connect Bluetooth device through mac address

instruction	response
AT+CONA=<param>,<param1>	OK
Description	<p><param>: the mac address of the Bluetooth device to be connected</p> <p><param1>: The mac address type of the Bluetooth device to be connected</p> <p>Note: This command is to scan first and then connect. If the device is not scanned, the module will not connect. This command may fail to connect.</p>
Example	Command: AT+CONA=112233445566,0\r\n

	Return: OK Description: As a host, try to establish a connection with a Bluetooth device with a Mac address of 11:22:33:44:55:66 and an address type of 0.
--	---

8.5.17 AT+LINK View connected device information

instruction	response
AT+LINK	
Description	After sending the instruction, the module will print the related information of the connected device, including link number, mac address, address type, master-slave type. If there is no connection to the module, this command will return an error.
Example	Command: AT+LINK\r\n Return: +LINK=0, role:0, address:11:22:33:44:55:66, type:0\r\n +LINK=1, role:1, address:aa:bb:cc:dd:ee:ff, type:1\r\n ... OK\r\n Note: Each connection returned contains 4 parameters: link number, role (0: master; 1: slave), mac address, and mac address type.

8.5.18 AT+SEND Send data to a single device through the link number

instruction	response
AT+SEND=<param>,<param1>	OK
Description	<param>: link number <param1>: The sent data. The content contained in a set of double quotation marks. The content sent can only be any combination of numbers, letters, and punctuation (up to 50 bytes, it is recommended to use the serial port when the baud rate is high).
Example	Command: AT+SEND=1, "1234abcd"\r\n Return: OK Description: Send data 1234abcd to the peer device with the link number 1.

8.5.19 AT+BOND Send a binding request to a single device through the link number

instruction	response
AT+BOND=<param>	OK
Description	<param>: link number Note: Each module can store up to 8 device binding data (regardless of master and slave). If there are more than 8, the binding request initiated will be invalid. After the binding is successful, more reliable data transmission can be obtained.

8.5.20 AT+DISC Disconnect Bluetooth connection by link number

instruction	response
AT+DISC=<param>	OK
Description	<p><param>: link number</p> <p>After successful disconnection, the serial port will output status. Note: If you do not enter the link number, it will be regarded as disconnecting all connections</p>
Example	<p>Command: AT+DISC=1\r\n</p> <p>Return: OK\r\n</p> <p>Note: Disconnect the Bluetooth connection with link number 1.</p> <p>Command: AT+DISC=\r\n</p> <p>Return: OK\r\n</p> <p>Note: Disconnect all Bluetooth connections</p>

8.5.21 AT+READBOND Read bound device information

instruction	response
AT+READBOND	
Description	After sending this command, the module will output all bound device information, up to 8 devices.
Example	<p>Command: AT+READBOND\r\n</p> <p>Return: +REBOND=address:112233445566, type:0\r\n</p> <p>+REBOND=address:aabbccddeeff, type:0\r\n</p> <p>...</p> <p>OK\r\n</p>

8.5.22 AT+CLRBOND Delete binding information

instruction	response
AT+CLRBOND=<param>,<param1>	OK
Description	<p><param>: The mac address of the binding information to be deleted</p> <p><param1>: mac address type</p> <p>If you do not enter <param> and <param1>, all binding information will be regarded as deleted.</p>
Example	<p>Command: AT+CLRBOND=112233445566,0\r\n</p> <p>Return: OK\r\n</p> <p>Description: Delete the binding information of the device whose mac address is 11:22:33:44:55:66</p> <p>Command: AT+CLRBOND=\r\n</p> <p>Return: OK\r\n</p>

Description: Delete all binding information

9. Quick guide

9.1 Quick to use

9.1.1 Environmental preparation

Hardware: 2 BLE5101 modules

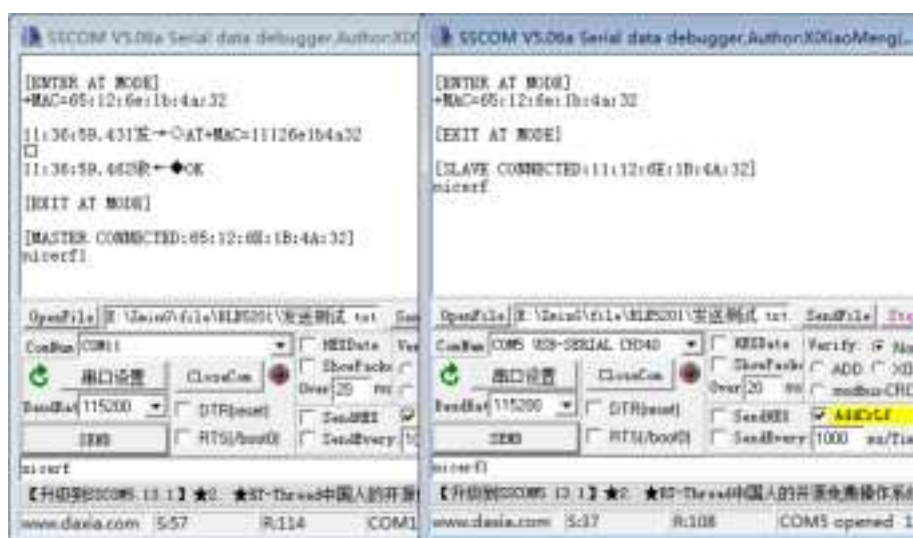
Software: SSCOM serial debugging assistant

Note: Since the CS pin of the module is high by default, and the low-power mode is active high, it is necessary to pull down the CS pin in advance to use all the functions of the module normally.

When the module is used for the first time, it enters the configuration mode by default. You need to use the AT+MAC command to modify the module's own mac address to ensure that the module's mac address is unique. The module cannot actively connect to a Bluetooth device with the same mac address as its own.

9.1.2 Auto connect

When the module is powered on, it enters the configuration mode and sends the command "AT+EXIT\r\n" to exit the configuration mode. When both modules are in the transparent transmission mode, the Bluetooth connection will be automatically established. After the connection is established, data can be transmitted transparently.

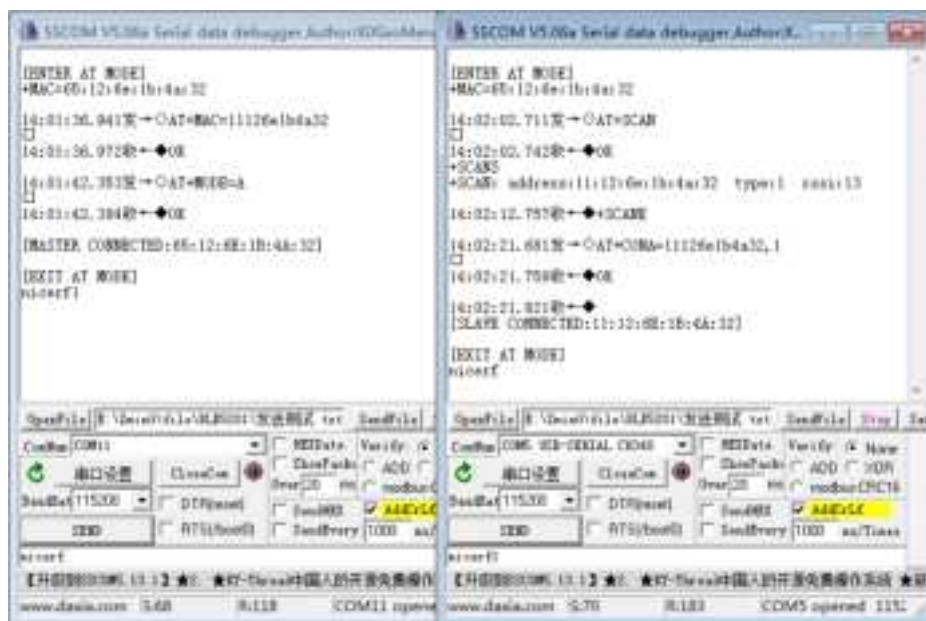


9.1.3 Manually connect

When the module is in the configuration mode, it is idle and does not perform broadcast or scanning operations. At this time, manual connection can be used.

Send the command "AT+MODE=A" to module A to start broadcasting, and then send the command "AT+SCAN" to module B to start scanning. Module B will scan and print out the device information of Module A.

Send the connection establishment command AT+CONA to module B and wait for the connection to be established. After the connection is successfully established, send the command "AT+EXIT" to both modules to exit the configuration mode, and then the data can be transparently transmitted.



9.1.4 Disconnect

Pull down the DISC pin, or use the AT+DISC command in the configuration mode to disconnect the current connection.

When the DISC pin continues to be pulled low, the module will not perform broadcast or scanning operations and cannot establish a connection until the DISC pin returns to high level.

Use the latter method to disconnect the specified connection when there are multiple connections.

9.2 Air upgrade

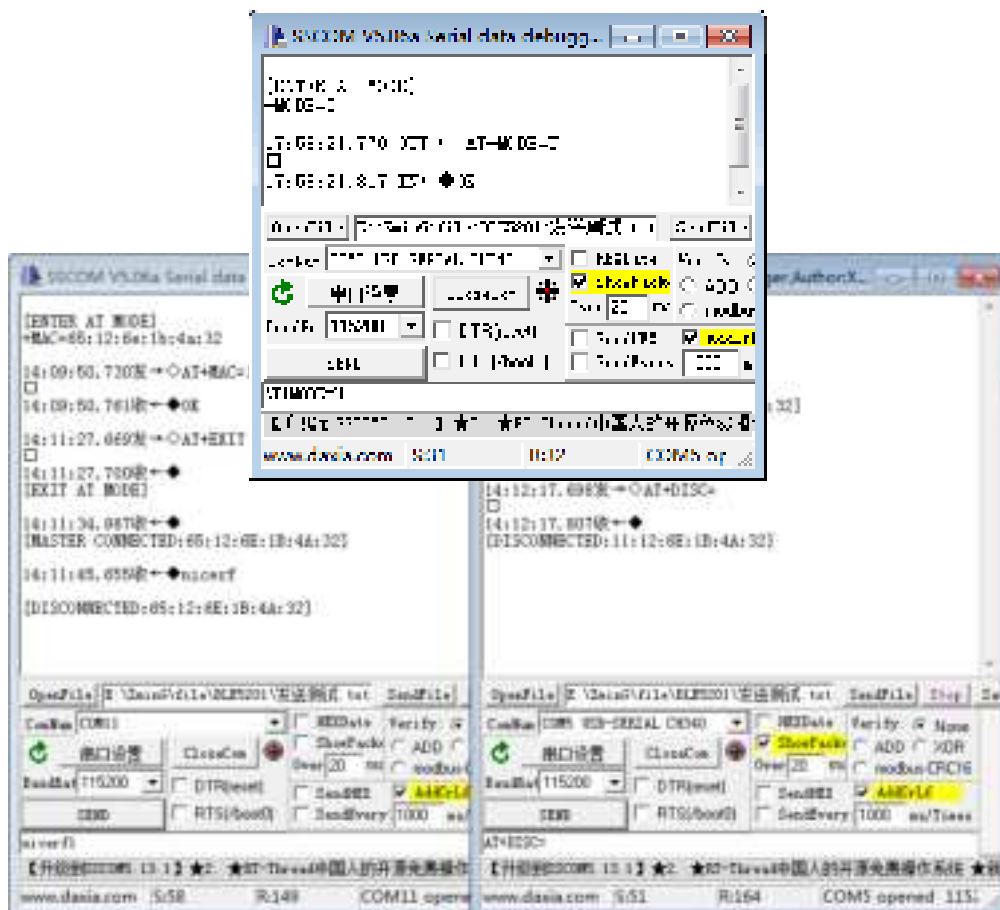
9.2.1 Environmental preparation

Hardware: 1 BLE5101 module

Software: SSCOM serial port debugging assistant, 1 firmware to be upgraded, mobile phone app "Fr8010 OTA"

9.2.2 Upgrade steps

1. If the module is in transparent transmission mode, send the command "+++\r\n" to the module or pull down the SET pin to enter the configuration mode.
2. Make sure that the module is not connected to other Bluetooth devices and the module is in IDLE state. If yes, send the command "AT+MODE=I\r\n" to disconnect all Bluetooth connections.
3. Send the command "AT+MODE=U\r\n" to enter the upgrade mode.



4. Open the mobile phone app "Fr8010 OTA", you can see a device name prefixed with "OTA-xxxxxx" in the scan result, click connect.



5. After the connection is established, select the firmware file for upgrading, and then click Write.



6. After the firmware file is transferred, the module will automatically restart, and the firmware upgrade is now complete.

➤ **FCC statements**

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 or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

The device has been evaluated to meet general RF exposure requirement, The device can be used in portable exposure condition without restriction. Federal Communication Commission (FCC) Radiation Exposure Statement Power is so low that no RF exposure calculation is needed.

➤ **CE**

This device is a low-power radio transmitter and receiver. As recommended by international guidelines, the device meets applicable national SAR limits of 2.0W/kg (10g).10g SAR: meets low-power exclusion level, SAR test is not required.

This product can be used across EU member states.

EU Regulatory Conformance

Hereby, NiceRF Wireless Technology Co., Ltd. Corporation declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

For the declaration of conformity, visit the Web site <http://www.nicerf.com> certification.



This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users.
2. The transmitter module may not be co-located with any other transmitter or antenna. As long as the two conditions above are met, additional transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for the installed module.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Federal Communications Commission of the U.S. Government (FCC) and the Canadian Government authorizations are no longer considered valid and the FCC ID and IC ID cannot be used on the final product. In these circumstances, the OEM integrator shall be responsible for re-evaluating the end-product (including the transmitter) and obtaining a separate FCC and IC authorization in the U.S. and Canada.

OEM Integrators - End Product Labeling Considerations:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains, FCC ID: 2AD66-LORA128XF27. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

OEM Integrators - End Product Manual Provided to the End User:

The OEM integrator shall not provide information to the end user regarding how to install or remove this RF module in end product user manual. The end user manual must include all required regulatory information and warnings as outlined in this document.