

TPL3135 BLE Module Datasheet

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1、 Introduction

TPL3131 is a BLE 5 low power Bluetooth module, which can be widely used in short distance wireless Bluetooth communication. It has the characteristics of small size, low power consumption, strong anti-interference ability and long transmission distance.

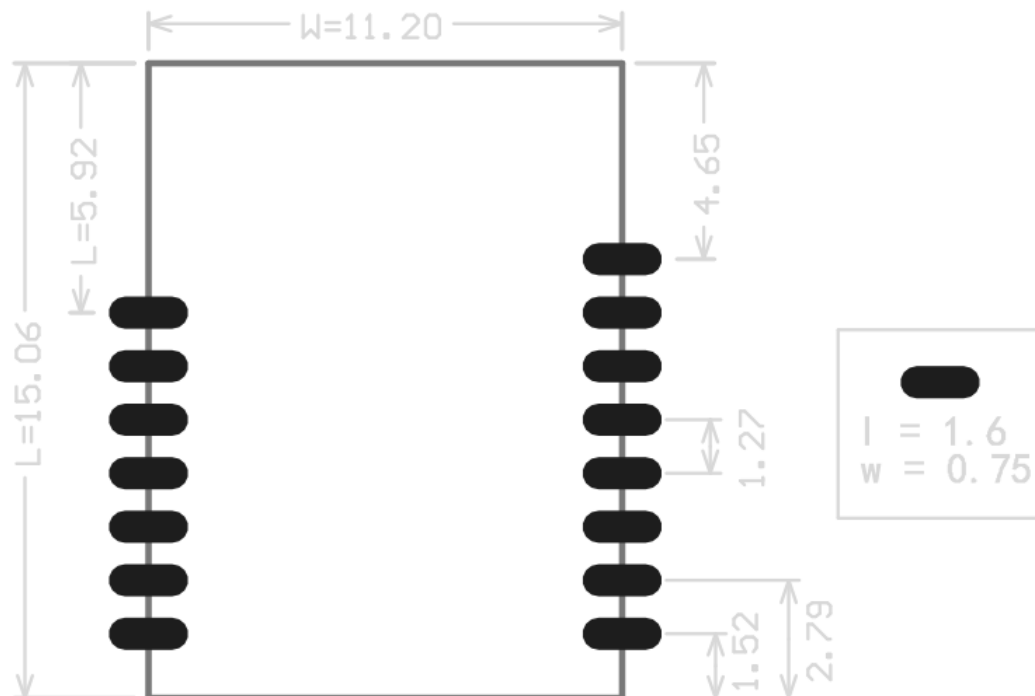
The other main features of the module are as follows:

- Built in 256KB flash, 64KB SRAM
- compliant with Bluetooth 5 standard, which can support various Profile configurations.
- Support low power Bluetooth data transparent transmission
- Support AT command control
- Support ibeacon function
- Support ble mesh function
- Support online OTA upgrade module firmware
- Support PCB antenna and reserve external antenna interface
- Ultra small package

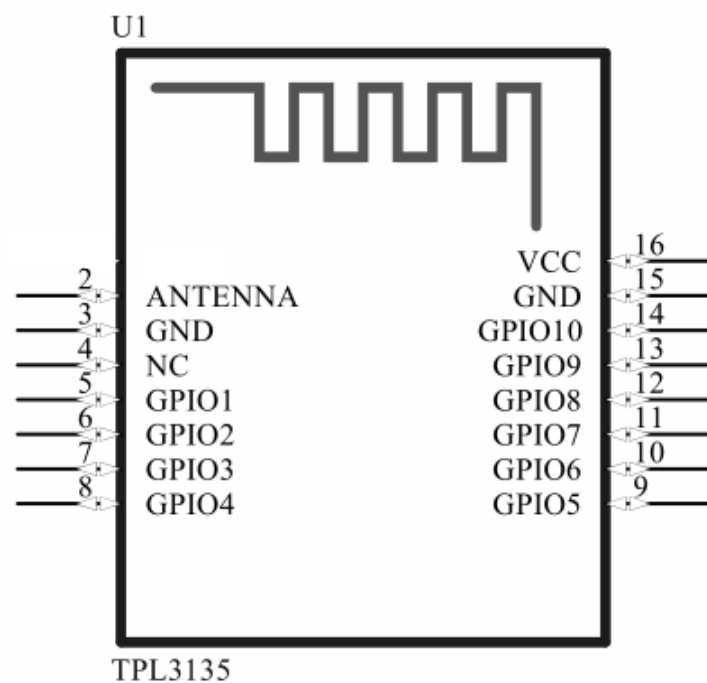
2、Module Parameters

Item	Parameters
Module Name	TPL3135
Package	SMT (Stamp Hole)
Size	11.20x15.06 (±0.2)MM
Voltage Range	1.9V~3.5V , Recommend 3.3V
Wireless Standard	Bluetooth 5.0
Frequency Range	2400~2483.5MHz
Output Power	10dBm
Sensitivity	-92dBm
Default Communication interface	UART
FLASH Size	256KB
RAM Size	64KB
GPIO Number	10
Work Temperature	-40°C~+85°C
Storage Temperature	-40°C~+125°C

3、Module Size

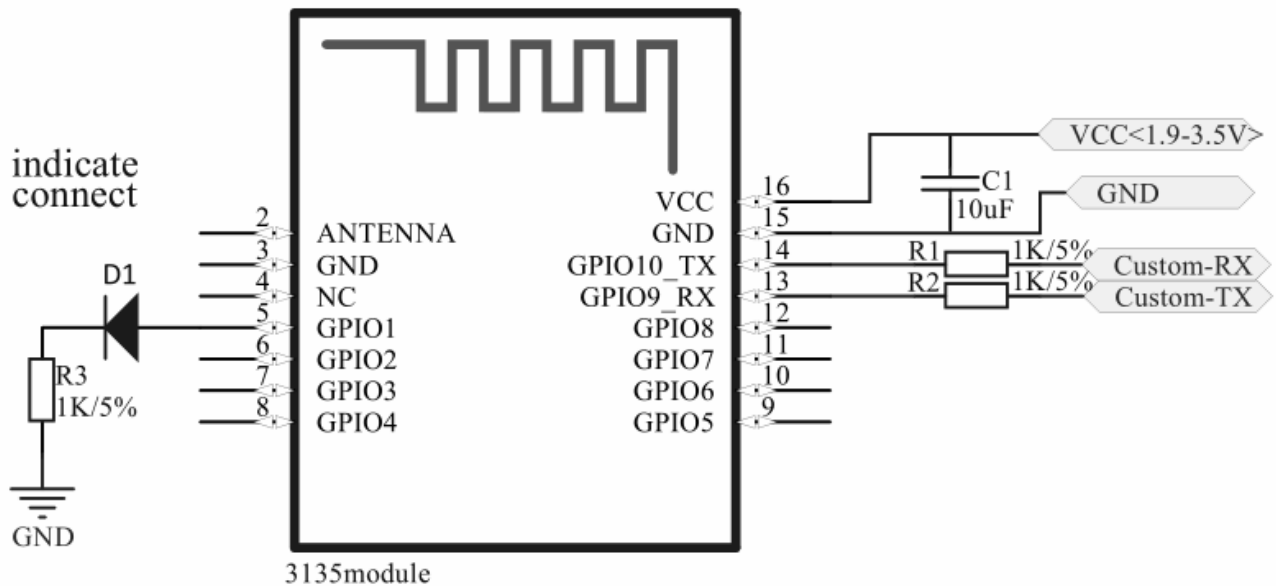


4、Pin Definition



number	name	Pin	Function	Remarks
2	ANTENNA	AnalogExternal RF antenna outgoing pin		
3	GND	GND	Ground	
4	NC			
5	GPIO1	Digital I/O	GPIO	Connection status indication pin
6	GPIO2	Digital I/O	GPIO	
7	GPIO3	Digital I/O	GPIO	
8	GPIO4	Digital I/O	GPIO/ADC3	
9	GPIO5	Digital I/O	GPIO/ADC0	
10	GPIO6	Digital I/O	GPIO	
11	GPIO7	Digital I/O	GPIO	
12	GPIO8	Digital I/O	GPIO	
13	GPIO9	Digital I/O	GPIO/ADC3/UART_RX	UART_RX
14	GPIO10	Digital I/O	GPIO/ADC3/UART_TX	UART_TX
15	GND	GND	GND	
16	VCC	Power	1.9V-3.5V , Recommend 3.3V	

5、 Reference Design



Explanation:

- GPIO1 is the connection status indicator pin. If the power consumption is not sensitive, it is recommended to pull it out to connect a light for later debugging or maintenance to check whether the Bluetooth module is connected.

6、 Hardware Design Considerations

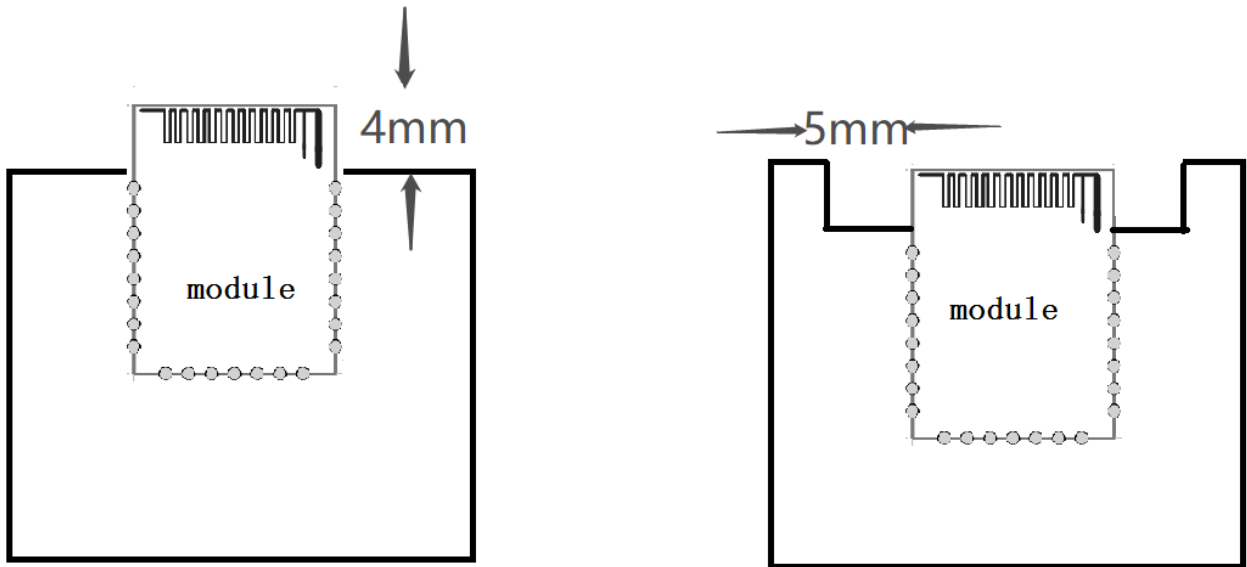
6.1、 Module placement requirements on the bottom plate

(1) In order to meet the performance of the antenna on board, it is forbidden to place metal parts around the antenna, away from high frequency devices. Avoid using metal in the product housing and keep metal screw inside away from the RF part of the module.

(2) Pay attention to the layout of the module on the soleplate, and minimize the impact of the soleplate on the performance of the module PCB antenna.

The following are suggested: Option 1: Place the module at the edge of the motherboard and the antenna area extends beyond the edge of the motherboard. Option 2: Place the module at the edge of the motherboard, which empties an area at the antenna position. Option 3: If the above scheme is limited and cannot be implemented, make sure that the area of the module PCB antenna and the area of 5 mm extension

need to be cleared (copper, wiring and placement of components are strictly prohibited).

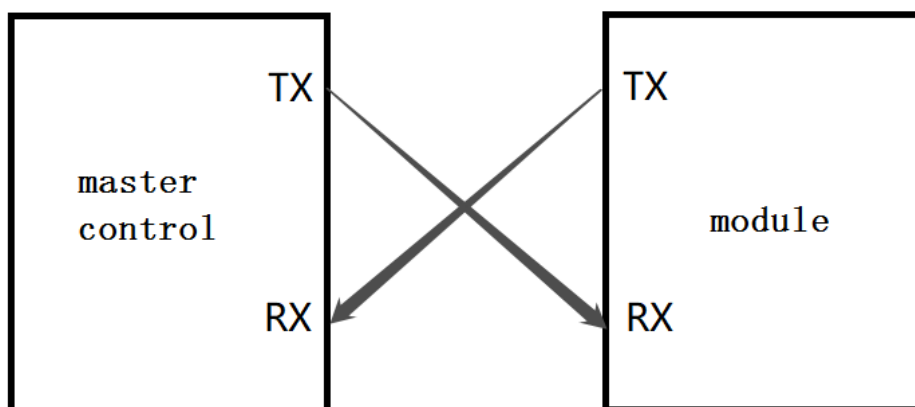


6.2、 power supply requirements

(1) It is recommended to use DC regulator power supply to supply power to the module. The power ripple factor is as small as possible and the module needs to be grounded reliably. Please note that the correct connection between the positive and negative poles of the power supply, such as reverse connection may cause permanent damage to the module. (2) Check the power supply to ensure that between the recommended supply voltage, if the maximum value is exceeded, the module will be permanently damaged; check the power supply stability, the voltage should not fluctuate significantly and frequently; (3) Recommend 3.3V voltage, LDO power supply is recommended; if using DC-DC, ripple control is recommended within 30mV. The DC-DC power supply circuit suggests reserving the position of the dynamic response capacitance to optimize the output ripple when the load varies greatly.

6.3、 UART Communication

UART communication between module and master MCU through serial port supports full duplex transmission and reception of TX and RX.



7、 AT instruct

1、 AT Instruction description

(1) Matters needing attention

- All instructions must be capitalized ;
- All instructions must end with <CR><LF> ;
- The return of all instructions starts with<CR><LF>and ends with<CR><LF>;
- <CR>: carriage return, ASCII= r, HEX=0x0D< LF>: newline, ASCII indicates n, HEX indicates 0x0A.

(2) Command message

AT instruction type	Instruction format	explain
Execute instructions	AT+<Instruction name><CR><LF>	Parameters execute specific instruction behaviors and get specific results
Query instruction	AT+<Instruction name>=? <CR><LF>	Query instruction current value
Set command	AT+<Instruction name>=<parameter><CR><LF>	Set user-defined parameter values

(3) Response message

AT instruction typeResponse string		explain
Execute instructions	<CR><LF>+<Instruction name><CR><LF>OK<CR><LF>	Command execution succeeded
Execute instructions	<CR><LF>+<Instruction name><CR><LF>ERROR<CR><LF>	Command execution failed
Execute command query command/set command	<CR><LF>+<Instruction name>:<CR><LF>OK<CR><LF>	Command execution succeeded
Execute command query command/set command	<CR><LF>+<Instruction name>:<CR><LF>ERROR<CR><LF>	Command execution failed

(4) Instruction example

	String sent by serial port	HEX data sent by serial port
Instruct	AT+BAUD=115200\r\n	41 54 2B 42 41 55 44 3D 31 31 35 32 30 30 0D 0A 0D 0A
return	\r\n+BAUD:115200\r\nOK\r\n	0D 0A 2B 42 41 55 44 3A 31 31 35 32 30 30 0D 0A 4F 4B 0D 0A

2、 AT Instrument Set

Number	Instruction name	Function description	Function description
1	NULL	Serial port test	Effective immediately
2	BAUD	Modify or query the serial port baud rate	Save Flash and take effect immediately
3	GETVER	Get firmware version information	Effective immediately
4	RESET	Restart the module	Effective immediately
5	RESTORE	Restore factory settings	Save Flash and restart to take effect
6	BAUD	Modify or query the baud rate of Bluetooth serial port	Save Flash and take effect immediately
7	RFPOWER	Set or query Bluetooth transmission power	Save Flash and take effect immediately
8	BLENAME	Modify or query the Bluetooth name	Save Flash and take effect immediately
9	BLEMAC	Modify or query Bluetooth MAC address	Save Flash and restart to take effect
10	ADVSTART	Modify or query Bluetooth broadcast status	No Save Flash and take effect immediately
11	ADVINT	Modify or query the Bluetooth broadcast interval	Save Flash and restart to take effect
12	ADVDATA	Modify or query the customized data of Bluetooth radio	不Save Flash and take effect immediately
13	BLECONT	Modify or query Bluetooth connectivity	Save Flash and restart to take effect
14	BLECONINT	Modify or query Bluetooth connection interval	Save Flash and take effect immediately
15	BLECONOUT	Modify or query Bluetooth connection timeout	Save Flash and take effect immediately
16	BLEADVUUID	Modify or query the Bluetooth radio service UUID	Save Flash and take effect immediately
17	BLESERVUUID	Modify or query the Bluetooth main service UUID	Save Flash and take effect immediately
18	BLENOTIFUUID	Modify or query the UUID of Bluetooth pass-through service	Save Flash and take effect immediately

Number	Instruction name	Function description	Function description
19	BLEWRITEUUID	Modify or query the UUID of Bluetooth sending service	Save Flash and take effect immediately

3、AT Instruct detailed description

(1) BLE universal instrument

3.1 AT

Instruct	AT
Function	Serial port test
Typical examples	AT\r\n
Respond	\r\nOK\r\n

3.2 AT+GETVER

Instruct	AT+GETVER
Function	Get firmware version information
Typical examples	AT+GETVER\r\n
Respond	\r\n+VER:V01.01.01\r\nOK\r\n

3.3 AT+RESET

Instruct	AT+RESET
Function	Restart the module
Typical examples	AT+RESET\r\n
Respond	\r\n+RESET\r\nOK\r\n

3.4 AT+RESTORE

Instruct	AT+RESTORE
Function	Restore factory settings
Typical examples	AT+RESTORE\r\n
Respond	\r\n+RESTORE\r\nOK\r\n

(2) BLEparameterInstruct

3.5 AT+BAUD

Instruct	AT+BAUD
Function	Set or query the baud rate of Bluetooth serial port
Form	Query instruction : AT+BAUD=? Set command : AT+BAUD=
Typical examples	AT+BAUD=115200\r\n
Respond	success return : \r\n+BAUD:<115200> \r\nOK\r\nfail return : \r\n+BAUD:<11520> \r\nERR\r\n
parameter	Supported baud rate : 4800,9600,14400,19200,38400,57600,115200

3.6 AT+RFPOWER

Instruct	AT+RFPOWER
Function	Set or query Bluetooth transmission power
Form	Query instruction : AT+RFPOWER=? Set command : AT+RFPOWER=
Typical examples	AT+RFPOWER=0\r\n
Respond	success return : \r\n+RFPWR:0 \r\nOK\r\nfail return : \r\n+RFPWR:5 \r\nERR\r\n
parameter	0 : 4dBm, 1 : 0dBm, 2 : -6dBm, 3 : -20dBm, 4 : 10dBm

3.7 AT+BLENAME

Instruct	AT+BLENAME
Function	Modify or query the Bluetooth name
Form	Query instruction : AT+BLENAME=? Set command : AT+BLENAME=
Typical examples	AT+BLENAME=TPL3135\r\n
Respond	success return : \r\n+BLENAME:TPL3135 \r\nOK\r\nfail return : \r\n+BLENAME:TPL31350000000000000000000000000000 \r\nERR\r\n
parameter	The maximum length of parameter cannot exceed 27 bytes

3.8 AT+BLEMAC

Instruct	AT+BLEMAC
Function	Modify or query the MAC address of Bluetooth
Form	Query instruction : AT+BLEMAC=? Set command : AT+BLEMAC=
Typical examples	AT+BLEMAC=545000010001\r\n
Respond	success return : \r\n+BLEMAC:545000010001 \r\nOK\r\nfail return : \r\n+BLEMAC:54500001000100 \r\nERR\r\n
parameter	Parameter is ASCII code Form. If any letter must be capitalized, the length must be 12 bytes!

(3) BLE broadcastInstruct

3.9 AT+ADVSTART

Instruct	AT+ADVSTART
Function	Modify or query Bluetooth broadcast status
Form	Query instruction : AT+ADVSTART=? Set command : AT+ADVSTART=
Typical examples	AT+ADVSTART=1\r\n
Respond	success return : +ADVSTART:1 OK fail return : +ADVSTART:3 ERR
parameter	1: Turn off broadcasting, 0: Turn on broadcasting

3.10 AT+ADVINT

Instruct	AT+ADVINT
Function	1: Turn off broadcast, 0: Turn on broadcast to modify or query Bluetooth broadcast interval
Form	Query instruction : AT+ADVINT=? Set command : AT+ADVINT=
Typical examples	AT+ADVINT=80\r\n
Respond	success return : \r\n+ADVINT:80 \r\nOK\r\n fail return : \r\n+ADVINT:30 \r\nERR\r\n
parameter	Parameter range is 32-6400 (broadcast interval is 20ms-4s)
Attention	1: Turn off the broadcast, 0: Turn on the broadcast to modify or query the Bluetooth broadcast interval. The parameter is the actual broadcast interval divided by 0.625. For example, if the broadcast interval is set to 20ms, the parameter is 32

3.11 AT+ADVDATA

Instruct	AT+ADVDATA
Function	Modify or query Bluetooth broadcast data
Form	Query instruction : AT+ADVDATA=? Set command : AT+ADVDATA=
Typical examples	AT+ADVDATA=80\r\n
Respond	success return : \r\n+ADVDATA:545022070501 \r\nOK\r\n fail return : \r\n+ADVDATA:54500001000 \r\nERR\r\n
parameter	Modify or query the Bluetooth broadcast data parameter as ASCII format, and the maximum length cannot exceed 44 bytes
Attention	Modify or query the broadcast content of the Bluetooth broadcast data whose parameter is ASCII code Form, and the maximum length cannot exceed 44 bytes. The set data is FF field, which will be converted to hexForm

(4) BLE Connect Instrument

3.12 AT+BLECONT

Instruct	AT+BLECONT
Function	Modify or query Bluetooth connectivity
Form	Query instruction : AT+BLECONT=? Set command : AT+BLECONT=
Typical examples	AT+BLECONT=1\r\n
Respond	success return : \r\n+BLECONT:1 \r\nOK\r\n fail return : \r\n+BLECONT:2 \r\nERR\r\n
parameter	0: Can be connected, 1: Cannot be connected

3.13 AT+BLECONINT

Instruct	AT+BLECONINT
Function	Modify or query the connection interval of Bluetooth
Form	Query instruction : AT+BLECONINT=? Set command : AT+BLECONINT=
Typical examples	AT+BLECONINT=12,24\r\n
Respond	success return : \r\n+BLECONINT:12,24 \r\nOK\r\n fail return : \r\n+BLECONINT:24,12 \r\nERR\r\n
parameter	The range of parameter is 6-3199 (connection interval is 7.5ms-4s)
Attention	Modify or query the Bluetooth connection interval parameter1 is the minimum connection interval, parameter2 is the maximum connection interval, and parameter2 should be greater than or equal to parameter1 parameter is the actual connection interval divided by 1.25. For example, if the connection interval is set to 15ms, then parameter is 12

3.14 AT+BLECONOUT

Instruct	AT+BLECONOUT
Function	Modify or query Bluetooth connection timeout
Form	Query instruction : AT+BLECONOUT=? Set command : AT+BLECONOUT=
Typical examples	AT+BLECONOUT=10\r\n
Respond	success return : \r\n+BLECONOUT:10 \r\nOK\r\n fail return : \r\n+BLECONOUT:4000 \r\nERR\r\n
parameter	Parameter range is 10-3000 (connection timeout is 100ms-30s)
Attention	The parameter is the actual timeout divided by 10. For example, if the connection timeout is set to 500ms, the parameter is 50

(5) BLE Service Instrument

3.15 AT+BLEADVDUUUID

Instruct	AT+BLEADVDUUUID
Function	Modify or query the UUID of Bluetooth radio
Form	Query instruction : AT+BLEADVDUUUID=? Set command : AT+BLEADVDUUUID=
Typical examples	AT+BLEADVDUUUID=EEE0\r\n
Respond	success return : \r\n+BLEADVDUUUID:EEE0 \r\nOK\r\nfail return : \r\n+BLEADVDUUUID:EEE12 \r\nERR\r\n
parameter	The length of parameter must be four bytes
Attention	Currently, only standard UUIDs are supported

3.16 AT+BLESERVUUUID

Instruct	AT+BLESERVUUUID
Function	Modify or query the UUID of the Bluetooth main service
Form	Query instruction : AT+BLESERVUUUID=? Set command : AT+BLESERVUUUID=
Typical examples	AT+BLESERVUUUID=EEE0\r\n
Respond	success return : \r\n+BLESERVUUUID:EEE0 \r\nOK\r\nfail return : \r\n+BLESERVUUUID:EEE00 \r\nERR\r\n
parameter	The length of parameter must be four bytes
Attention	Currently, only standard UUIDs are supported

3.17 AT+BLENOTIFUUID

Instruct	AT+BLENOTIFUUID
Function	Modify or query the UUID of the Bluetooth transparent reporting service
Form	Query instruction : AT+BLENOTIFUUID=? Set command : AT+BLENOTIFUUID=
Typical examples	AT+BLENOTIFUUID=EEE1\r\n
Respond	success return : \r\n+BLENOTIFUUID:EEE1 \r\nOK\r\nfail return : \r\n+BLENOTIFUUID:EEE1 \r\nERR\r\n
parameter	The length of parameter must be four bytes
Attention	Currently, only standard UUIDs are supported

3.18 AT+BLEWRITEUUID

Instruct	AT+BLEWRITEUUID
Function	Modify or query the UUID of the Bluetooth distribution service
Form	Query instruction : AT+BLEWRITEUUID=? Set command : AT+BLEWRITEUUID=
Typical examples	AT+BLEWRITEUUID=EEE2\r\n
Respond	success return : \r\n+BLEWRITEUUID:EEE2 \r\nOK\r\nfail return : \r\n+BLEWRITEUUID:EEE2 \r\nERR\r\n
parameter	The length of parameter must be four bytes
Attention	Currently, only standard UUIDs are supported

(7) Broadcast BLE status Instruct

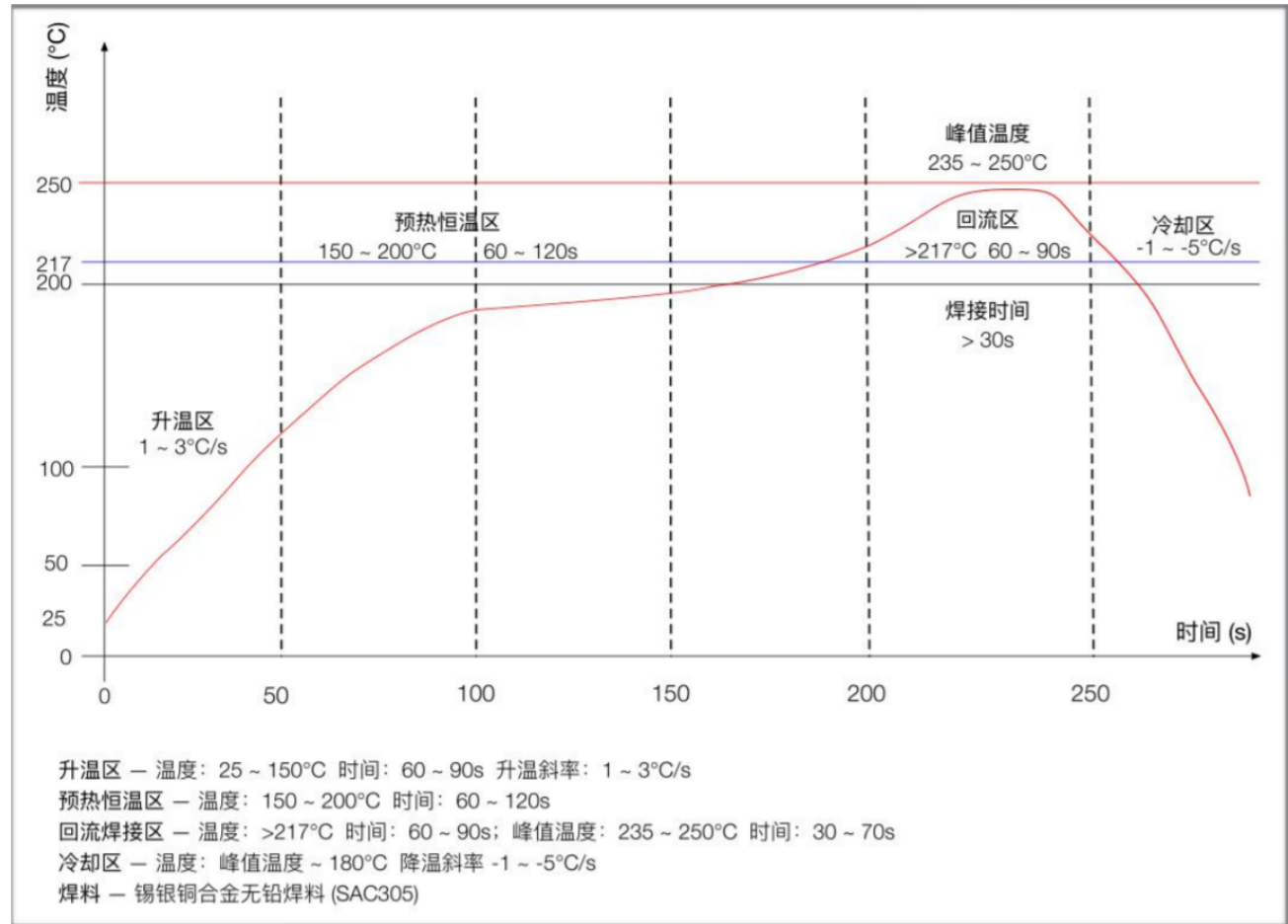
3.19 +BLECONN

Typical examples	+BLECONN\r\nOK
explain	BLE connection serial port printing information

3.20 +BLEDISCONN

Typical examples	+BLEDISCONN\r\nOK
explain	BLE Disconnect the serial port to print information

7、Reflow Profile



FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Integral antenna with antenna gain 3 dBi

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.

Any Changes or modifications not expressly approved by the party responsible for compliance 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.

FCC Radiation Exposure Statement

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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2AZYO-TPL3135 Or Contains FCC ID: 2AZYO-TPL3135”

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

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.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with modular approval should perform the test of radiated & conducted emission and spurious emission,etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 ,15B Class B requirement, then the host can be sold legally.