APAC Opto Electronics Inc.

AO-1504 / AO-1504A BLE to UART Module

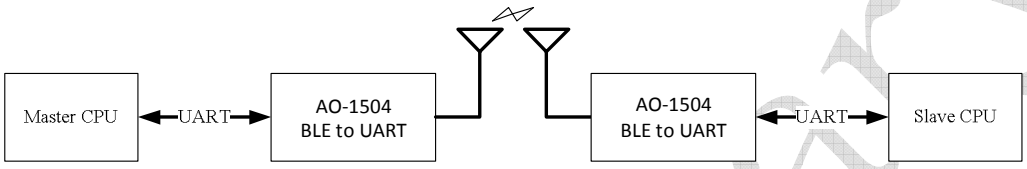
Operation Manual

Contents

APAC Opto Electronics Inc.
3 Tzu Chiang Road, Hsinchu Industrial Park
Hukow, Hsinchu Hsien, Taiwan 303
TEL: +886-3-5986799
FAX: +886-3-5986655
Website: www.apacoe.com.tw

1. Introduction

Simplicity is the major design issue of this module. Users can set this module by regarding it as the usual UART. Thus, even users who are unfamiliar with RF technology can make use of this product easily.



Both AO-1504/AO-1504A are Bluetooth Low Energy named BLE to UART modules that use the advanced TI CC2541 chip. The difference between AO-1504 and AO-1504A is that the former, which has built-in high performance PCB micro strip antenna, is suitable for applications with small dimensions. The AO-1504A, which requires external antenna, is appropriate for industrial applications in adverse environments. It is noted that the AO-1504/AO-1504A module is an extension of our product AO-1502 BLE module. The distinct feature of AO-1504/ AO-1504A is that the application program suitable for UART protocol has been encoded in it. This can simplify the installation and operation of the module. Consequently, the period of design and development for new products can be shortened.

2. Features

The major distinct features of AO-1504/AO-1504A BLE to UART module include: (i) easy use; (ii) can be set as the usual UART, thus can be used in conjunction with any microprocessor; (iii) small size; (iv) has built-in high performance PCB antenna, the communication distance is 50 meters in regular environments, and 150 meters in benign environments.

The AO-1504/AO-1504A module can be used indoors or outdoors. They are suitable for various applications, such as machine-to-machine data transfer, wireless sensor networks, or smart light control. In addition, the module can be used in conjunction with the CC Debugger of TI Encoder. Then, users can encode and compile programs by themselves. This makes the module a valuable assistant for the development of Bluetooth low energy systems.

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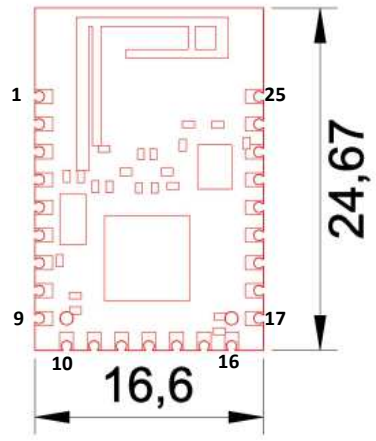
3. Dimensions and Pin Assignments



Pin	Function	Pin	Function	Pin	Function
1	GND	10	P10 (SCL)	17	P10
2	P20	11	P11 (SDA)	18	P07
3	REST_N	12	P13	19	P06
4	P22	13	P12	20	P05
5	P21	14	P11	21	P04
6	P17	15	P03 (UART TX)	22	P01
7	P16	16	P02 (UART RX)	23	P00 (NET LED)
8	P15			24	VDD 3.3V
9	P14			25	GND

P20 is reserved and not connected.
P00 (NET LED) is active high.

Note: 1. Connection of Pin 10~16 is required for AO-1504/AO-1504A BLE to UART module, leave the remaining pins open (internal pull high).
2. Pin assignments are defined by the users if reprogrammed.

4. AT Command

4.1. Factory Default Setting

Device Name: APAC_BLE_SPPSwitches
Baud: 19200, N, 8, 1
Pin code: 000000
Bi-directional transparent version: UART ←→ BLE

4.2. AT Command Format

Uppercase AT command format, string format representation, without any other symbol (e.g. \r or \n).

On Transmit version: Only accept AT Command from UART interface when Bluetooth device is not connected with remote device.

On Remote version: Can accept AT Command from UART interface when Bluetooth Device is not connected with remote device, Also can accept AT Command from remote Bluetooth device when connected that.

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(1) Test Command

Send	Receive	Parameter
AT	OK	None

(2) Inquiry/Set baud rate

Send	Receive	Parameter
AT+BAUD?	OK+Get: [Para1]	Para1: Baud rate No. 0--- 9600 bps 1--- 19200 bps 2--- 38400 bps 3--- 57600 bps 4--- 115200 bps Default: 1(19200)
AT+BAUD[Para1]	OK+Set: [Para1]	

(3) Reset module

Send	Receive	Parameter
AT+RESET	OK	None

(4) Inquiry/Set Master and Slave Role

Send	Receive	Parameter
AT+ROLE?	OK+Get: [Para1]	Para1: 0 = Master 1 = Slave Default: 1
AT+ROLE[Para1]	OK+Set: [Para1]	

(5) Inquiry/Set Pin Code

Send	Receive	Parameter
AT+PIN?	OK+Get: [Para1]	Para1 is Pin Code, 000000~999999 Default: 000000
AT+PIN=	OK+Set: [Para1]	

(6) Inquiry RSSI Value

Send	Receive	Parameter
AT+RSSI?	RSSI -dB: [Para1]	Para1 is RSSI value

Note: this command only used by Remote device query when connected. Para1 is negative value, if the is smaller, the greater the signal strength.

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(7) Inquiry Device MAC Address

Send	Receive	Parameter
AT+ADDR?[Para1]	OK+Get: [Para2]	Para1 is Local or Remote Local: Para1 = L Remote: Para1 = R Para2 = 0x112233445566

(8) Discovery New Device

Send	Receive	Parameter
AT+SCAN	Devices Found 1 0x78A547079DA	Para1 is Local or Remote Local: Para1 = L Remote: Para1 = R Para2 = 0x112233445566

(9) Inquiry/Set Module Working Mode

Send	Receive	Parameter
AT+MODE?	OK+Get: [Para1]	Para1 is 0: enable UART mode 1: disable UART mode Default: 0
AT+MODE[Para1]	OK+Set: [Para1]	

(10) Inquiry/Set Output Power

Send	Receive	Parameter
AT+TXPW?	OK+Get: [Para1]	Para1 is power level 0: 0 dBm 1: -6 dBm 2: -23 dBm Default: 0
AT+TXPW[Para1]	OK+Set: [Para1]	

(11) Write Data (Characteristic Value)

Send	Receive	Parameter
AT+WRITE[Para1]	OK+WRITE [Para1]	Para1 is write data Format: 0x30

(12) Inquiry/Set Device Name

Send	Receive	Parameter
AT+NAME?	OK+Get: [Para1]	Para1 is device name Default: APAC_BLE_SPPSwitches
AT+NAME[Para1]	OK+Set: [Para1]	

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(13) Connect Assignment BLE Device

Send	Receive	Parameter
AT+CON[Para1]	OK+CONN[Para2]	Para1 is device index Para2 is A, E, F A: connecting E: connected error F: connected fail

(14) Disconnect BLE Device

Send	Receive	Parameter
AT+DISCON	OK+DISCONN	

(15) Inquiry/Set iBeacon Broadcast Time

Send	Receive	Parameter
AT+TIBE?	OK+Get: [Para1]	Paral：000000~009999 000000 keep on broadcast Other values within second Default: 000180
AT+TIBE[Para1]	OK+Set: [Para1]	

4.3. Notification

(1) Data power-down saving function: the most of AT command sets have saving the settings function when power up.

(2) During the parent transmission, each data packet should not exceed 20 bytes. The higher the serial transmission rate, the longer the packet interval requirement. Notice that wireless transmission all has the problem of packet loss rate, and this need to increase data in the application layer checksum packet loss retransmission.

(3) The Characteristic UUID definition is read and written shared 0xFFF1, Master end 0xFFF1 and Slave side for data transceiver.

(4) LED connection indicator, use P0.0.
Before connection: turn off
After connection: turn on

(5) Uart baud rate is defaulted as 19200bps, no parity check, and 1 stop bit. It works at is the bi-directional full-duplex mode.

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5. Operating Examples:

(1) Switch to Master mode

Send： **AT+ROLE0\r\n**

Reply: **OK+Set: Central**

CC2541 Ready to Starting

Successfully switch to BLE master

(2) Inquiry master or slave mode

Send: **AT+ROLE?\r\n**

Reply: **OK+Get: Central**

(3) Scan Slave Device

Send: AT+SCAN\r\n

Reply: **Discovering...**

Devices Found 1: 0x78A5047079DA

<- To Select

(4) Connect to the slave device

Send: **AT+CON1\r\n**

Reply: **OK+CONNA**

0x78A5047079DA

Connected: 0x78A5047079DA

Simple Svc Found

Param Update

(5) Disconnect the slave device

Send: **AT+DICON\r\n**

Reply: **OK+DISCONN**

Disconnected: Reason: 22

Note: after disconnected, the master device will return to manually connecting status.

6. Antenna Characteristics and Installation Notes

To ensure optimum Tx/Rx efficiency for the antenna, users of the AO-1504 / AO-1504A should follow the following notes:

- Don’t encapsulate the AO-1504 module in a metallic box. This does not apply to the AO-1504A, which has external antenna.
- Install the module in an erect posture to ensure good antenna radiation pattern.
- Don’t put any inductive element within 30mm distance of the module.

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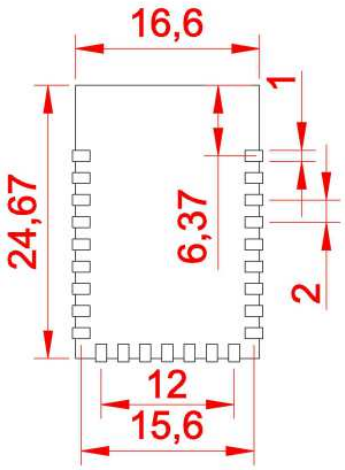
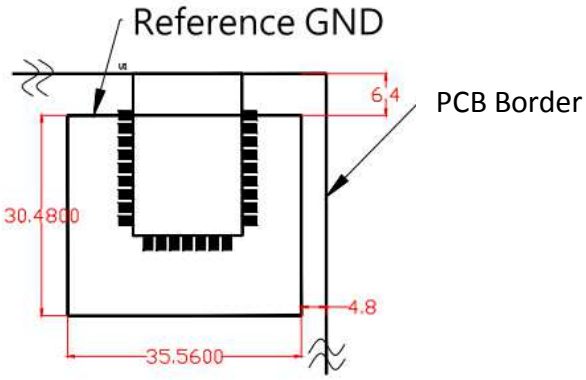
- Refrain from condensation of damp or dew.
- To ensure the PCB antenna efficiency of the module, you are advised to layout the PCB based on the following illustration.

(unit=mm)



- For clearance around the module and reference ground of the antenna radiiation (Reference GND), please refer to and follow the illustration displayed below. In addition, the material for the major board must be FR4 1.6mm.

(unit=mm)



- Refer to the figures and illustrations shown below for basic electronic circuit application.

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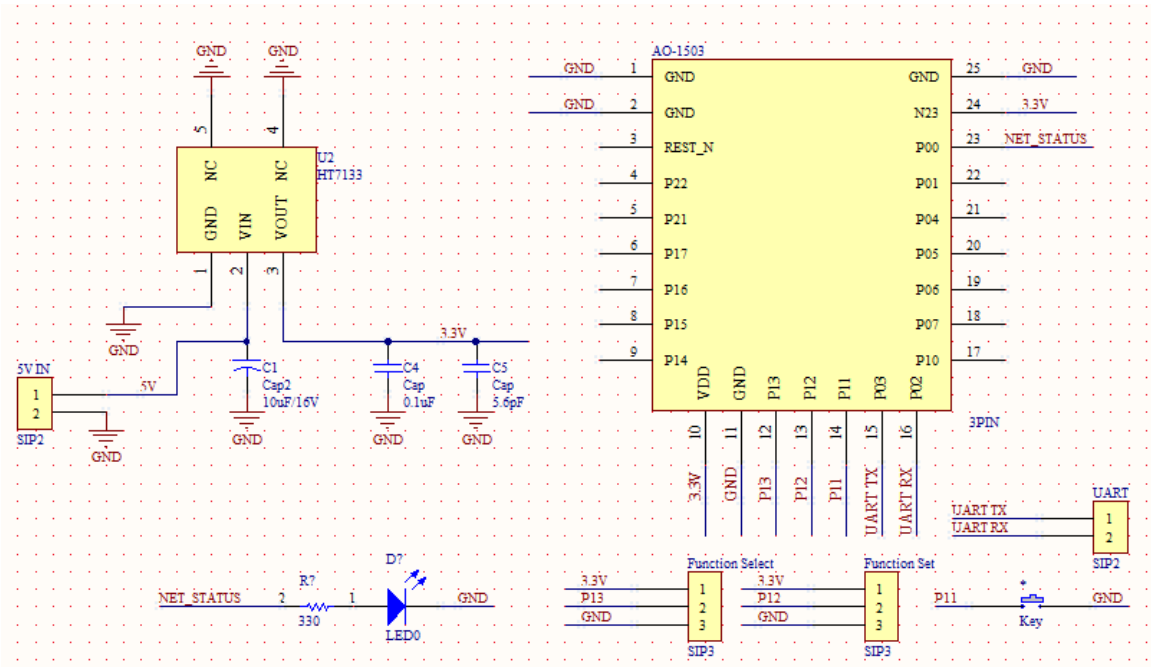

Note:

P00 is the LED which indicates the network status.

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