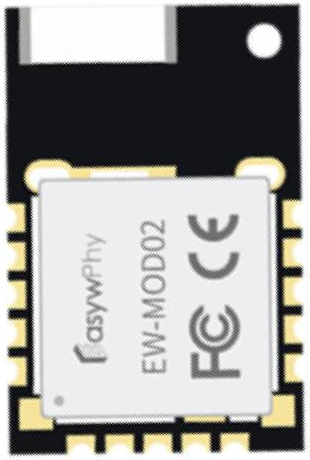
BLM-MOD02

BLE 5.1 Module User Programming Guide
V1.0



Content

1. Introduction

This document applies to the module model BLM-MOD02. BLM-MOD02 is a low-power, small-size, low-cost and cost-effective single-mode Bluetooth module with the latest BLE 5.1 protocol stack built in to provide stability for the interaction between the target device and the mobile APP The two-way data transparent transmission.

1.1 Basic Characteristics

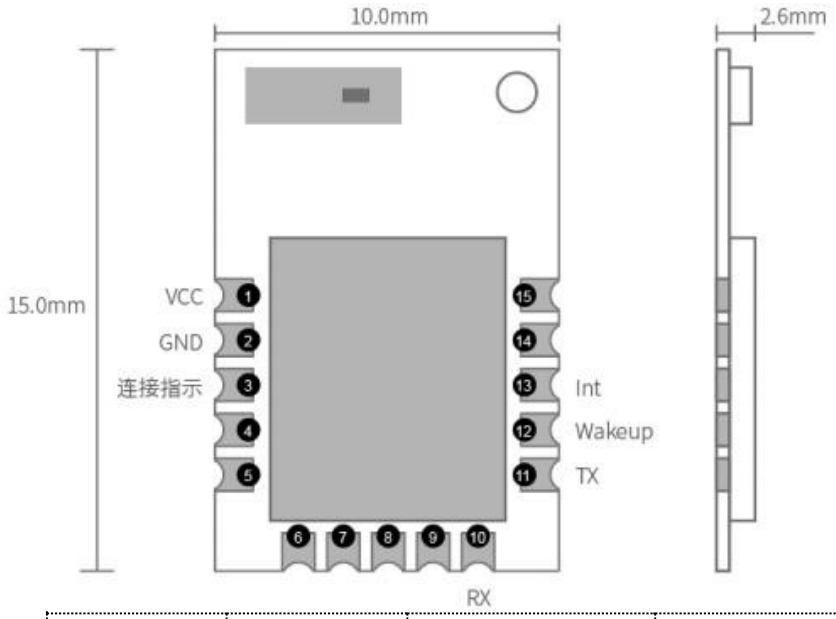
- Chip model: Dailog14531.
- Chip core: ARM Cortex -M0 32 processor, and carrying FPU coprocessor, clocked at 16 MHz.
- Storage space: 144KB ROM/48KB RAM/32K OTP.
- Transmitting power: -19.5 ~ +2.5dBm, the default is 0dBm.
- The highest sensitivity: -94dBm.
- BOOT time: 35ms (cold start to TX active state)
- Maximum number of connections: 3 (master or slave)
- Broadcast interval: 100ms-10s, the default is 100ms.
- Transmission distance: 100m.
- Support equipment: IOS7.0 and above, Android4.3 and above.
- Standby current: 2uA, average value.
- Sleep mode: 0.2uA.
- Protocol stack support: BLE5.1.
- Working temperature: -40-85°C.
- Storage temperature: -40-125°C.
- Peripheral interface: UART/SPI/I2C/PWM/ADC, etc.
- Physical rate: 1Mbps/2Mbps (default 1Mbps).

1.2 Default parameters

Default Parameter			
No	Item	Detail	Example
1	Broadcast Name	EW+MAC add	EW010203040506
2	Broadcast Interval	100ms	
3	Connect Interval	20ms	
4	Baud rate	921600bps	
5	RX	P0.5	
6	TX	P0.6	
7	WAKEUP	P0.7	
8	INT	P0.8	
10	Status	P0.11	
11	MTU	247 byte	

2. Module Function

2.1 Pin Definition

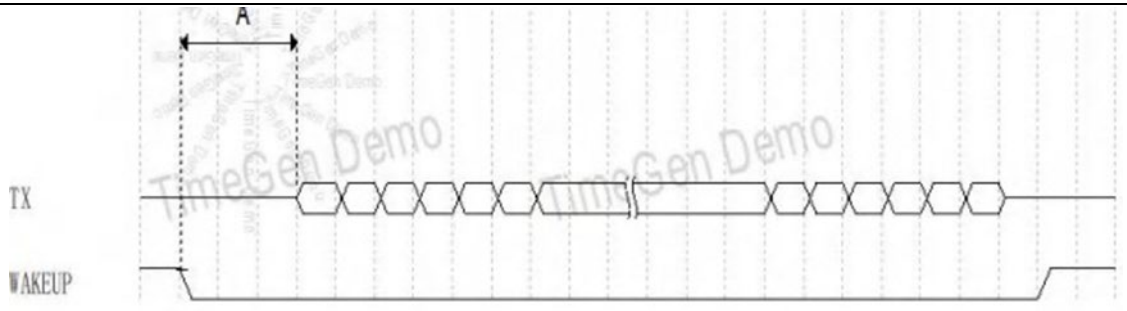


Pin No	Pin Name	Function	Throughput (default)	Throughput Function
1	VCC	VCC	VCC	Positive pole
2	GND	GND	GND	Negative pole
3	P11	GPIO	CONNECT (putout)	Connection indication, active low
4	P10	GPIO	RESET	RESET（Not yet open）

5	P00	GPIO	\	
6	P01	GPIO	\	
7	P02	GPIO	\	
8	P03	GPIO	\	
9	P04	GPIO	\	
10	P05	GPIO	RX	UART-RX
11	P06	GPIO	TX	UART-TX
12	P07	GPIO	WAKEUP	Module reception is allowed, low level is effective
13	P08	GPIO	INT	Module sending is allowed, low level is valid
14	P09	GPIO	SET DEFAULT	Restore the default configuration, active low (not yet open)
15	GND	GND	GND	Negative pole

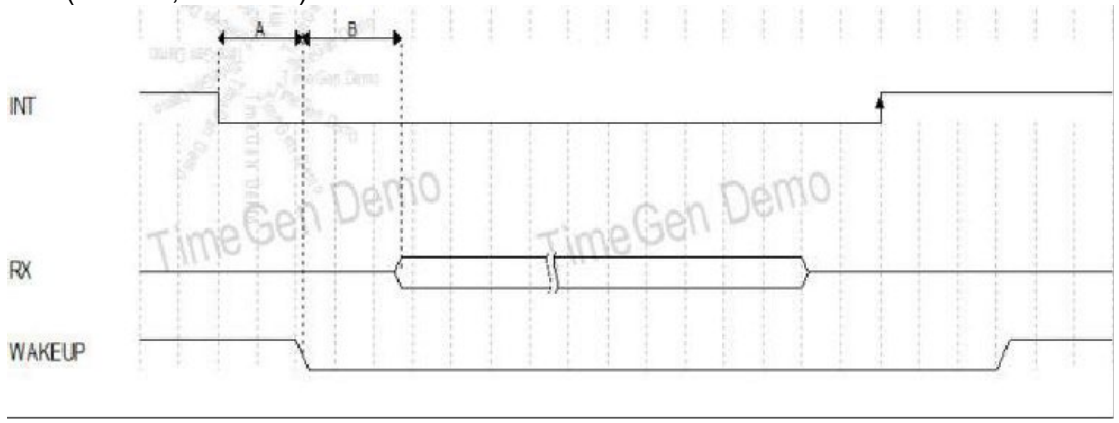
2.2 Send Data

When sending data to the Bluetooth module from the MCU, first pull down the WAKEUP signal to wake up the module, wait for the module to wake up (A), and then send data to the receiving end of the module. After sending, pull up WAKEUP and let the module go to sleep To save power consumption, the timing diagram is as follows (A >= 1ms):



2.3 Receive Data

In sleep state, INT is high and WAKEUP is also high. Once the MCU detects the falling edge of the INT signal, it indicates that the module receives data and needs to receive data immediately. At this time, the MCU is awakened by the falling edge of INT, and then the internal serial port is initialized. After receiving the data, when ready, pull down WAKEUP to prepare to receive the data of the module. When the data is received, the INT signal will be pulled high, indicating that the module data has been sent completely. If the MCU needs to enter the sleep state at this time to reduce power consumption, You can directly pull up the WAKEUP signal, a complete receiving sequence is as follows (A> 1ms, B> 10ms):



2. 4 INT Signal

Once the module receives data, it will immediately pull the INT signal low, and the falling edge will be valid. Once the module data is sent, it will immediately pull the INT signal high. When wakeup is high, it means the module is in sleep state and the INT signal will continue to be low. When wakeup is low, it means that the module is in the wake-up state. The INT signal will determine the length of the INT signal pull-down time as the serial data is sent. Once the data is sent, the INT signal will be pulled high immediately, so it is in the wake-up state. , You can judge whether the data has been received by judging the INT high level state or the state of the MCU's internal serial port to receive the data.

2.5 UUID

Parameter Configuration Service UUID Description

No	UUID Type	UUID	Description	Length	Characteristic
1	service UUID	0xa247a39b0a3d42c180d1ea762753c6a0	\	250	
2	Characteristics UUID	0xa247a39b0a3d42c180d1ea762753c6a1	Remote Version	66	read
3	Characteristics UUID	0xa247a39b0a3d42c180d1ea762753c6a2	Discover elements cmd	130	write/notify
4	Characteristics UUID	0xa247a39b0a3d42c180d1ea762753c6a3	Write elements Command	133	write/notify
5	Characteristics UUID	0xa247a39b0a3d42c180d1ea762753c6a4	Read elements Command	132	write/notify

Throughput Data Service UUID Description					
No	UUID Type	UUID	Description	Length	Characteristic
1	Service UUID	0x1000	Throughput Service	\	read
2	Characteristics UUID	0x1001	APP Write	250	Write with no response
3	Characteristics UUID	0x1002	APP Receive	250	Notify
4	Characteristics UUID	0x1003	AT Command	1	Write with no response/ Notify

2.6 APP sends data to the module

The APP sends data to the module through the characteristic value channel 0x1001. The sending method is "Write with no response". After the APP establishes a connection with the module and obtains the 0x1001 service, you can start writing business data to the module. In order to prevent data packet loss, the write interval must be greater than the link interval between the APP and the module. If you need to confirm that the data has been written to the module, you can also use it.

2.7 Module sends data to APP

The module sends data to the APP terminal through the characteristic value channel 0x1002. The sending method is NOTIFY. After the APP establishes a connection

with the module, the APP must enable the NOTIFY enable (CCCD is set to ENABLE state) as soon as possible. The module data will only be enabled after the NOTIFY is normally enabled. It can be sent to the APP, and then the APP can receive the business data of the module.

2.8 Packet length

The default interactive MTU length of the module is 251 bytes, and the actual effective length is 247 bytes. This is the maximum data length. The final data interaction length depends on the characteristics of the mobile phone. Usually, 247 bytes are valid for Android phones. IOS phones default after interaction. 185 bytes are valid (early IOS version). Regardless of the MCU or APP side, when using the module, try not to use data packets that exceed the length for data interaction to avoid packet loss and sub-packaging.

3. Parameter Configuration

3.1 Command list

Comm-and Code	Function	Command	Default Setting	serial port	SPI	I2C	APP	Read	Write	Off electricity save
\	Handshake instruction	AT	\	√	×	×	×	×	√	×
0x0100	Broadcast interval (Min)	AT+P0100	160	√	×	×	√	√	×	×
0x0101	Broadcast interval (Max)	AT+P0101	160	√	×	×	√	√	√	√

0x0102	Broadcast channel	AT+P0102	7	√	×	×	√	×	√	×
0x0201	MTU Programming	AT+P0201	247	√	×	×	√	×	√	×
0x0300	Connection interval (Min)	AT+P0300	20	√	×	×	√	√	×	×
0x0301	Connection interval (Max)	AT+P0301	20	√	×	×	√	√	√	√
0x0302	Connection Delay Setting	AT+P0302	0	√	×	×	√	√	√	√
0x0303	Connection timeout setting	AT+P0303	1000	√	×	×	√	√	√	√
0x0400	Broadcast data	AT+P0400	1aff4c00021501122334 45566778899aabbcc ddeeff001000400c3	√	×	×	√	√	√	√
0x0401	Broadcast data length	AT+P0401	27	√	×	×	√	√	√	√
0x0402	Scan response data	AT+P0402	\	√	×	×	√	√	√	√
0x0403	Scan response data length	AT+P0403	0	√	×	×	√	√	√	√
0x0404	Device name	AT+P0404	EW+MAC add	√	×	×	√	√	√	√
0x0405	Device name length	AT+P0405	14	√	×	×	√	√	√	√
0x0406	Serial port baud rate	AT+P0406	8	√	×	×	√	√	√	√
0x0700	Serial RX	AT+P0700	P0.5	√	×	×	√	√	√	√

0x0701	Serial port TX GPIO	AT+P0701	P0.6	√	×	×	√	√	√	√
0x0702	WAKEUP GPIO	AT+P0702	P0.7	√	×	×	√	√	√	√
0x0703	INT GPIO	AT+P0703	P0.8	√	×	×	√	√	√	√
0x0705	External wake-up pin polarity	AT+P0705	0	√	×	×	√	√	√	√

Comm-and Code	Function	Command	Default Setting	serial port	SPI	I2C	APP	Read	Write	Off electricity save
0x0706	External wake-up pin debounce	AT+P0706	0	√	×	×	√	√	√	√
0x0707	Active status pin	AT+P0707	P0.10	√	×	×	√	√	√	√
0x0708	MCU wake-up pin	AT+P0708	P0.9	√	×	×	√	√	√	√
0x0709	Power-on reset pin	AT+P0709	P0.0	√	×	×	√	√	√	√
0x070A	Power-on reset pin polarity	AT+P070A	1	√	×	×	√	√	√	√
0x070B	Power-on reset pin timeout	AT+P070B	0	√	×	×	√	√	√	√
0x070E	Connection status pin	AT+P070E	P0.11	√	×	×	√	√	√	√

Note: AT commands all end with \r\n, converted to hex as 0x41 0x54 0x0d 0x0a.

3.2 BLM-MOD02 Command Example:

Broadcast Interval:

Minimum Broadcast Interval:

Successful:	Failed:
→AT+P0100=0A{CR}{LF}	→AT+P0100=FFFF{CR}{LF}
←OK{CR}{LF}	←E2{CR}{LF}

Maximum Broadcast Interval

Successful:	Failed:
→AT+P0101=0A{CR}{LF}	→AT+P0101=FFFF{CR}{LF}
←OK{CR}{LF}	←E2{CR}{LF}

Read Broadcast Interval

Minimum Broadcast Interval:	Maximum Broadcast Interval:
→AT+P0100=?{CR}{LF}	→AT+P0101=? {CR}{LF}
←0A{CR}{LF}	←0A{CR}{LF}

Note: "→" from the MCU to the module side means sending, and "←" from the module side to the MCU side means replying.

The return status is as follows:

Return Value Description		
No	Return character	Description
0	“AT+OK”	Handshake signal or successful operation
1	“E0”	Parameter is too long
2	“E1”	Invalid command sequence number
3	“E2”	Unknown command
4	“E3”	Invalid parameter length
5	“E4”	Invalid parameter content

Handshake instruction (AT)

The purpose of this command is to confirm whether the module is working normally and the serial port is unblocked.

Successful:	**Failed:**
→AT{CR}{LF}	→AT{CR}{LF}
←AT+OK{CR}{LF}	←Nothing feedback

Broadcast interval setting

Broadcast interval, the value range: 32-16384, each unit is 625us, corresponding to the broadcast interval 20ms-10.24s, the default is 160 (100), take the minimum interval as an example (the maximum interval is AT+P0101)	
Successful:	**Failed:**
→AT+P0100=32{CR}{LF}	→AT+P0100=32{CR}{LF}
←AT+OK{CR}{LF}	←E1{CR}{LF}

Broadcast channel settings

The function of this command is to set the broadcast channel. A total of 3 channels can be set. The setting method is as follows: Set the channel parameters, the default value is 0x07, which means all channels. In actual applications, different channels can be selected according to the use to filter the channels. To improve the accuracy of the RSSI signal, the setting method is as follows		
Read Channel	**Successful:**	**Failed:**
→AT+P0102=?{CR}{LF}	→AT+P0102=01{CR}{LF}	→AT+P0102=08{CR}{LF}
←01{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Channel Setting Value Description		
No	Value	Description
1	0X01	37 channel
2	0X02	38 channel
3	0X03	37 & 38 channels
4	0X04	39 channels
5	0X05	37 & 39 channels
6	0X06	38&39 channels
7	0X07	All channels

MTU setting

Set the communication packet length, the default length is 247 (maximum 251 bytes), the actual effective length is 244 bytes (maximum 248), the host or mobile phone must support BLE4.2 or higher to enable MTU interaction		
Read MTU	**Successful:**	**Failed:**
→AT+P0201=?{CR}{LF}	→AT+P0201=F4{CR}{LF}	→AT+P0201=FF{CR}{LF}
←F4{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Connection interval setting

Minimum connection interval

Set the minimum range of the connection interval, the default is 20 (25ms), the value range: 6-3200, each unit is 1.25ms, corresponding to 7.5ms-4s, the parameters need to be filled in in the form of hex		
Read Connection Interval	**Successful:**	**Failed:**
→AT+P0300=?{CR}{LF}	→AT+P0300=14{CR}{LF}	→AT+P0300=14{CR}{LF}

←14{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Maximum connection interval

Set the maximum range of the link interval, the default is 24 (30ms), the value range: 6-3200, each unit is 1.25ms, corresponding to 7.5ms-4s, the parameters need to be filled in in the form of hex		
Read Connection Interval	**Successful:**	**Failed:**
→AT+P0301=?{CR}{LF}	→AT+P0301=14{CR}{LF}	→AT+P0301=14{CR}{LF}
←14{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Connection delay

Number of skips: Set the number of skips for connection events, default 0, value range: 0-499, parameters need to be filled in hex form.		
Read Connection delay	**Successful:**	**Failed:**
→AT+P0302=?{CR}{LF}	→AT+P0302=00{CR}{LF}	→AT+P0302=00{CR}{LF}
←00{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Connection timed out

Connection timeout time: Set the connection timeout time, the default is 1000, the value range: 10-3200, each unit is 10ms, corresponding to 100ms-32s, the parameters need to be filled in in the form of hex		
Read Connection timed out	**Successful:**	**Failed:**

→AT+P0303=?{CR}{LF}	→AT+P0303=4E84{CR}{LF}	→AT+P0302=4E84{CR}{LF}
←4E84{CR}{LF}	←AT+OK{CR}{LF}	←E1{CR}{LF}

Broadcast data settings

This command is used to set the broadcast data except the broadcast header. The broadcast header occupies 3 bytes. The content is: 0x02, 0x01, 0x06. The length of other data is 28 bytes. The default is a combination of the UUID field and the manufacturer field. For example, the service UUID of this module is 0x1000, the corresponding data is 0x03,0x03,0x0010, the manufacturer field combination: 0x10,0x Ff,0x0100,0x010203040506, where "0x010203040506" is the MAC address, and the parameters need to be filled in hex format. The settings are as follows

Read Broadcast	**Modify Broadcast Data**	**Setting Broadcasting Length**
→**AT+P0400=?{CR}{LF}**	→AT+P0400=0303001010FF0100010203040506{CR}{LF}	→AT+P0401=0E{CR}{LF}
←**0303001010FF0100010203040506{CR}{LF}**	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} /←E1{CR}{LF}

The iBeacon format setting method is as follows

Eg: 0201061AFF4C000215 01122334455667788 99AABBCCDDEEFF0 0100 0400 C3 iBeacon prefix fields cannot be set, all fields are set in hex format				
0201061AFF4C000215	01122334455667788 99AABBCCDDEEFF0	0100	0400	C3
iBeacon prefix	Proximity UUID	Major	Minor	measured TX power

Scan response data settings

This command is used to set the scan response packet data, the usual attachment parameters, such as the local name field and other required fields, the parameters need to be filled in hex form. The settings are as follows		
Read Sanning data	**Setting data**	**Setting data Length**
→AT+P0402=?{CR}{LF}	→AT+P0402=0303001010FF0100010203040506{CR}{LF}	→AT+P0402=0E{CR}{LF}
←0303001010FF0100010203040506{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} /←E1{CR}{LF}

Device name setting

This command is used to set the name of the device consists of 2 parts, one is "device name", the other is "local name" field, this command automatically completes the setting of 2 parts, the default name is: EW+MAC address structure, such as: EW010203040506, the maximum length is 20 bytes, and the "local name" field part depends on the broadcast content setting. For example, set the device name "1234" and convert it to hex. The setting method is as follows:		
Read Name	**Setting device name**	**Setting device name Length**
→AT+P0404=?{CR}{LF}	→AT+P0404=30313233{CR}{LF}	→AT+P0405=04{CR}{LF}
←30313233{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} /←E1{CR}{LF}

Serial port baud rate

Baud Rate Setting		
Item	Baud Rate	Notice
1	9600bps	
2	19200bps	
3	38400bps	
4	57600bps	
5	115200bps	
6	230400bps	
7	460800bps	
8	921600bps	Default Setting

This command is used to set the serial port baud rate of the device, refer to Table 4 for the value, converted to hex. The setting method is as follows	
Read Baud Rate	**Setting device name**
→AT+P0406=?{CR}{LF}	→AT+P0406=08{CR}{LF}
←08{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}

Serial port pin settings

This command is used to set the serial port pin of the device. Refer to the previous hardware pin diagram for the value, converted to hex. The setting method is as follows			
RX	**TX**	**wakeup**	**INT**
→AT+P0700=05{CR}{LF}	→AT+P0701=06{CR}{LF}	→AT+P0702=06{CR}{LF}	→AT+P0703=06{CR}{LF}
←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} /←E1{CR}{LF}	←AT+OK{CR}{LF} /←E1{CR}{LF}

Read RX	**Read TX**	**Read wakeup**	**Read INT**
→AT+P0700=?{CR}{LF}	→AT+P0701=?{CR}{LF}	→AT+P0702=?{CR}{LF}	→AT+P0703=?{CR}{LF}
←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}

Connection status pin settings

This command is used to set the link status indicator pin of the module. The low level indicates the link, and the high level indicates the link has been disconnected. The setting method of converting to hex is as follows:	
Read Status	Setting Status pin
→AT+P070E=?{CR}{LF}	→AT+P070E=0B{CR}{LF}
←0B{CR}{LF}	←AT+OK{CR}{LF} / ←E1{CR}{LF}