
1. Features

MR-BLE001 is a small-sized, low-cost Bluetooth BLE standard transparent transmission module developed by Yulu. The module supports BLE (Up to Bluetooth 5.0). The built-in 512kB FLASH supports dynamic stack and protocol profile configuration, and product functions can be configured through software, providing ultimate flexibility. Both hardware OTA upgrades and multi-boot switching are supported, allowing for convenient product feature rollouts and upgrades.

The module features are as follows:

- ▶ Built-in high performance 32-bit MCU RSIC @48M , 512KB Flash, 32KB SRAM
- ▶ Compliant with Bluetooth 5.0, RF link data up to 2Mbps
- ▶ transmit power:2.2dBm
- ▶ Support UART interface, expand all I/O ports of the chip
- ▶ Support APP parameter configuration
- ▶ Stamp hole pin + 4pin terminal interface, easy and reliable welding
- ▶ Ultra-small package: 23x12.6mm, board thickness 1.0mm
- ▶ Working temperature: -40℃~+85℃

The MR-BLE001 module only needs to connect VCC, GND, TX, RX four wires to complete the data transparent transmission function; it can also be applied to many small-sized accessories or fitness products through the stamp hole. It can easily realize the interconnection of users' Bluetooth devices, data transmission and other various applications.

1.1 Application field

- ▶Smart jump rope, abdominal wheel and other fitness accessories
- ▶Smart treadmill, spinning bike and other fitness equipment
- ▶Smart Home Products
- ▶Industrial control equipment

2 Electrical Specifications

 Rated parameters

Item	Symbol	Min	Typical	Max	Unit
Input voltage （4pin ）	VCC1	3.1	3.3	12.5	V
Input voltage	VCC2	2.8	3.3	3.6	V
Serial port voltage	TX/RX		3.0	3.3	V
storage temperature	T-STR	-65	25	150	℃
Soldering temperature	T-SLD			260	℃

Notice:

- 1) The listed electrical characteristics are target specifications and are for reference only. Some data may be updated based on actual testing.
 - 2) The voltage values shown are based on the GND inside the module. Any voltage exceeding the "Maximum Ratings" may cause permanent damage to the device.
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■ Working current

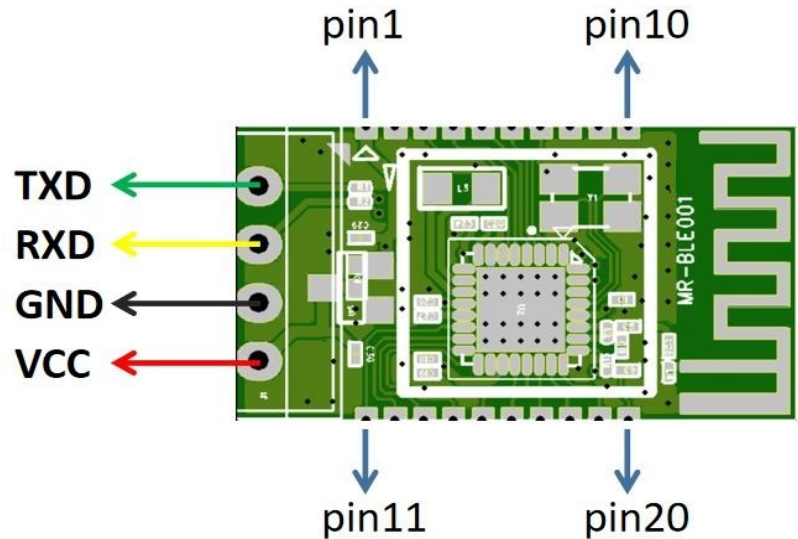
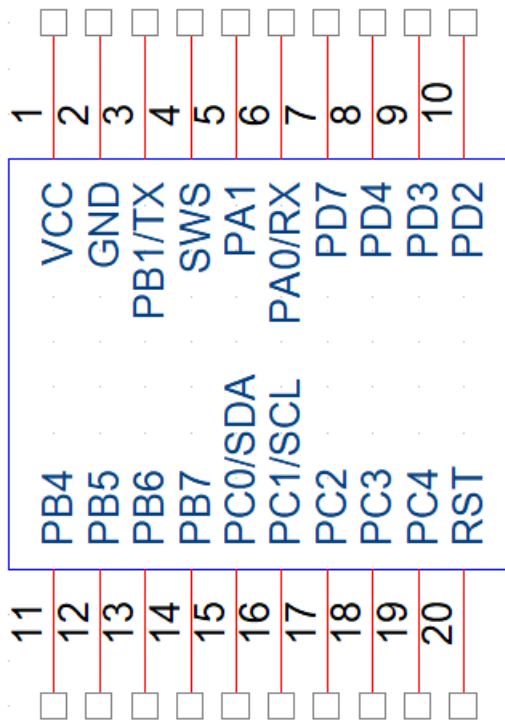
Item	Symbol	Min	Typical	Max	Unit
RX current	Irx		5.3		mA
TX current	Itx		4.8		mA
sleep state	Istandby		1.2		uA

Note: Power consumption test conditions: Whole Module Working @0dBm With DCDC enable

■ RF parameters

Item	Symbol	Min	Typical	Max	Unit
Frequency Range	Freq.	2402	-	2480	MHz
data rate	BLE 1Mbps, $\pm 250\text{kHz}$ deviation BLE 2Mbps, $\pm 500\text{kHz}$ deviation				

3. Foot Description



Interface description

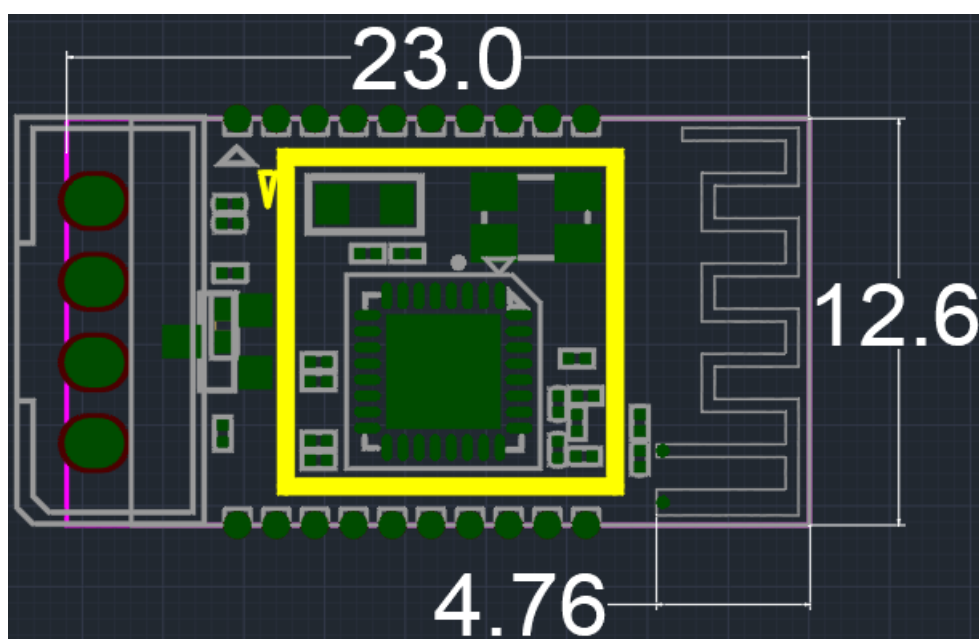
Pin #	Name	Type	Description
1	VCC	PWR	3.3V Powered
2	GND	PWR	ground pin
3	PB1_UTX	I/O	PWM4 output / UART_TX / Antenna select pin 2 / Low power comparator input / SAR ADC input / GPIO PB[1]
4	SWS	I/O	Single wire slave/ UART_RTS / GPIO PA[7]

5	PA1	I/O	DMIC clock / UART 7816 clock / I2S clock / GPIO PA[1]
6	PA0_URX	I/O	DMIC data input / PWM0 inverting output / UART_RX / GPIO PA[0]
7	PD7	I/O	SPI clock (I2C_SCK) / I2S bit clock / UART 7816 TRX (UART_TX) / GPIO PD[7]
8	PD4	I/O	Single wire master / I2S serial data output / PWM2 inverting output / GPIO PD[4]
9	PD3	I/O	PWM1 inverting output / I2S serial data input / UART 7816 TRX (UART_TX) / GPIO PD[3]
10	PD2	I/O	SPI chip select (Active low) / I2S left right channel select / PWM3 output / GPIO PD[2]
11	PB4	I/O	SDM positive output 0 / PWM4 output / Low power comparator input / SAR ADC input / GPIO PB[4]

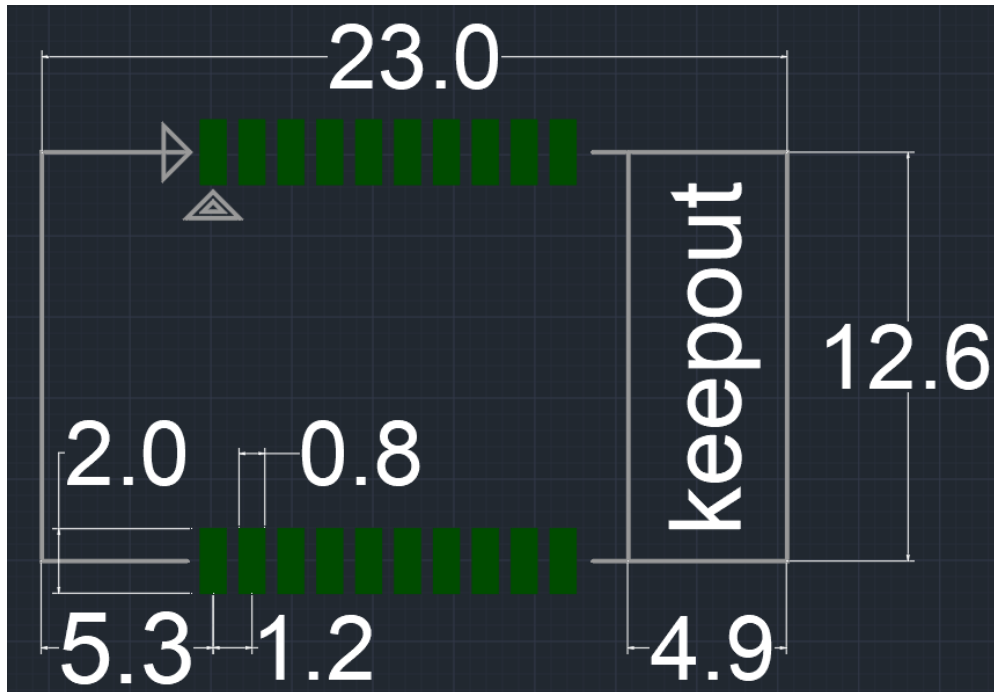
12	PB5	I/O	SDM negative output 0 / PWM5 output / Low power comparator input / SAR ADC input / GPIO PB[5]
13	PB6	I/O	SDM positive output 1 / SPI data input (I2C_SDA) / UART_RTS / Low power comparator input / SAR ADC input / GPIO PB[6]
14	PB7	I/O	SDM negative output 1 / SPI data output / UART_RX / Low power comparator input / SAR ADC input / GPIO PB[7]
15	PC0_SDA	I/O	I2C serial data / PWM4 inverting output / UART_RTS / PGA left channel positive input / GPIO PC[0]
16	PC1_SCL	I/O	I2C serial clock / PWM1 inverting output / PWM0 output / PGA left channel negative input / GPIO PC[1]
17	PC2	I/O	PWM0 output / UART 7816 TRX

			(UART_TX) / I2Cserial data / (optional) 32kHz crystal output / PGAright channel positive input / GPIO PC[2]
18	PC3	I/O	PWM1 output / UART_RX / I2C serial clock / (optional)32kHz crystal input / PGA right channel negative input / GPIO PC[3]
19	PC4	I/O	PWM2 output / UART_CTS / PWM0 inverting output / SAR ADC input / GPIO PC[4]
20	RST	RESET	Power on reset, active low

4. Module Measurement



5. Reference PCB Package



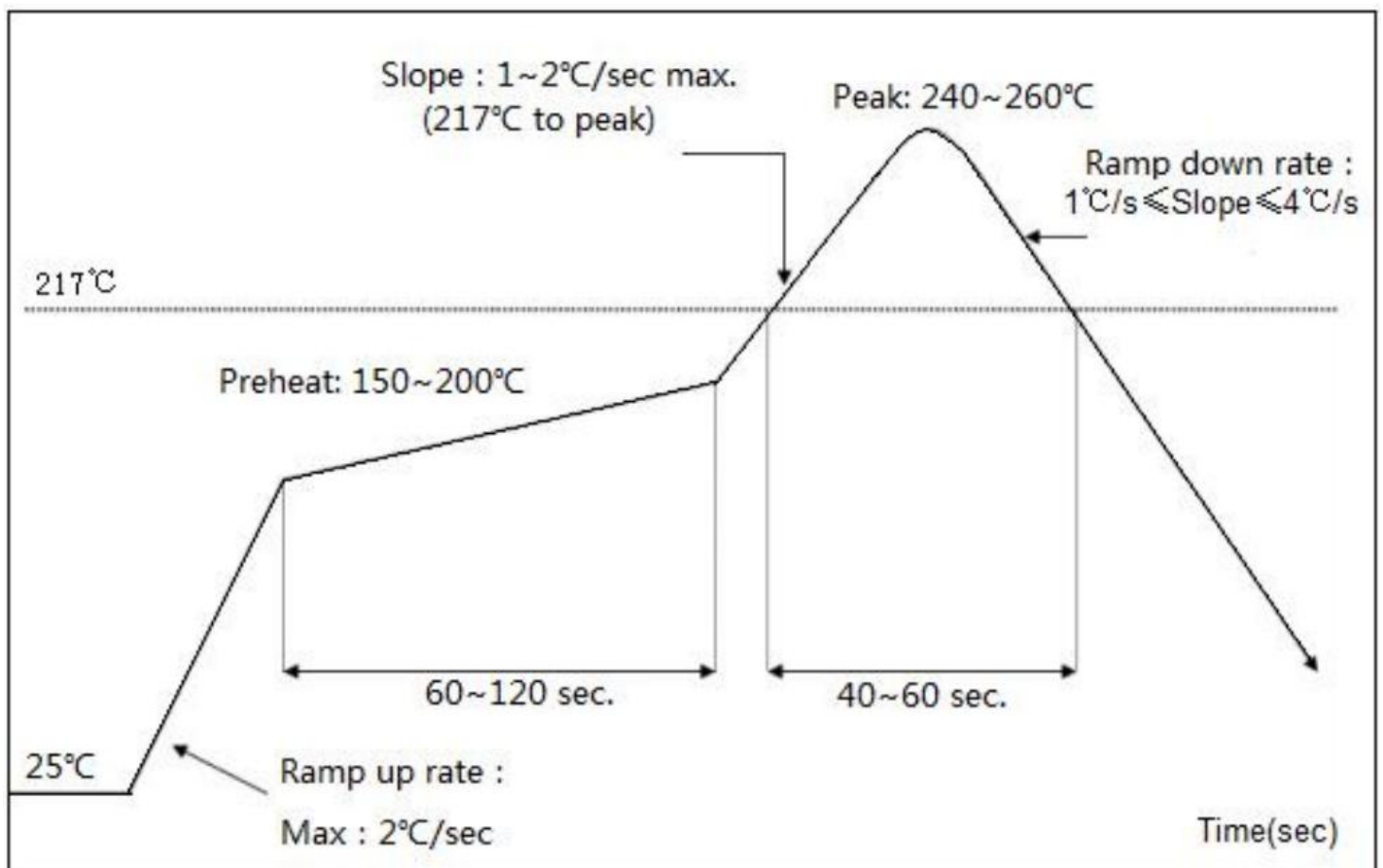
The Bluetooth operating frequency is 2.4GHz, and the influence of various factors on wireless transceiver should be avoided as much as possible.

- Notice: ▶ Avoid using metal for the part of the product housing that
- ▶ The metal screws inside the product should be kept away from the RF part of the module.

► To maximize RF performance, user board layout should follow the following recommendations: 1) Antenna clearance area: the user board located directly under the antenna area of the module cannot have any copper foil (including power, ground, signal layers). 2) Module location: Ideally, the module should be arranged in a corner of the user's mainboard, and the PCB antenna is located at the far end of the mainboard. This position minimizes the antenna clearance area

6. Furnace parameters

■ Refer to the following settings for the furnace parameters :



Temperature range	Time	Key parameters
Preheat zone(<150℃)	60-120S	Ramp up rate:≤2S
Uniform temperature zone(150-200℃)	60-120S	Ramp up rate:<1S
Recirculation zone(>217℃)	40-60S	Peak:240-260℃
Cooling zone	Ramp down rate:1℃/s≤Slope≤4℃/s	

FCC Statement

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

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body. This transmitter must not be located or operating in conjunction with any other antenna or transmitter.

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.
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OEM Guidance

1. Applicable FCC rules

This module has been tested and found to comply with part 15.247 requirements for Modular Approval.

2. The specific operational use conditions

This module can be used in IoT devices. The input voltage to the module is nominally 3.3V DC. The operational ambient temperature of the module is -40 to 85 degree C. Only the embedded PCB antenna is allowed. Any other external antenna is prohibited.

3. Limited module procedures

N/A

4. Trace antenna design

N/A

5. RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body. This transmitter must not be located or operating in conjunction with any other antenna or transmitter.

6. Antenna

Antenna type :PCB Antenna; Antenna Max. Peak Gain 3.65 dBi

7. Label and compliance information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2A6QW-AMR-BLE001 "

The FCC ID can be used only when all FCC ID compliance requirements are met.

8. Information on test modes and additional testing requirements

a)The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

b)The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

c)If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .

9. Additional testing, Part 15 Subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publiclyavailable drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled.

Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details.