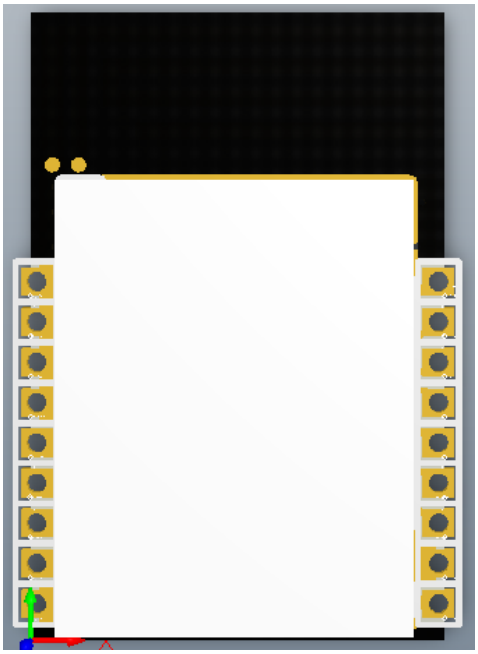
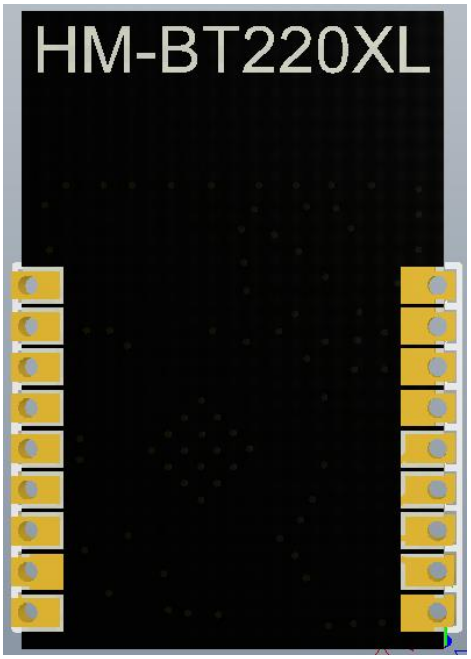
Bluetooth Low Energy (BLE)

Data Transmission Module

HM-BT220XL





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1 Product Overview

HM-BT220XL is a BLE data transmission module, based on a BLE 5.2 SoC chip (ARM Cortex-M33 32-bit processor, up to 76.8MHz working frequency), embedded with a 2.4GHz transceiver, equipped with an on-board PCB antenna. The module communicates with an external MCU to quickly set up wireless connection and data transmission between BLE slave devices and BLE master devices (such as mobile phones and tablets). The external MCU has a low resource occupation and the development process is very easy.

2 Module Features

- Based on ARM Cortex-M33 32-bit processor;
- Supports Bluetooth Low Energy 5.2 protocol;
- Up to 512KB of FLASH and 32KB of RAM;
- Support 10 general-purpose I/O ports, configurable mapping and flexible peripherals;
- Can be used as a BLE data transmission module or as an MCU alone;
- Support a universal serial interface UART communication;
- Support AT instruction sets;
- The length of data packet from serial port is up to 240byte (the large packet will be automatically distributed);
- Support APP to adjust the BLE connection interval, but the data will not be saved after power is off (dynamic power consumption adjustment);
- Support external RTC real-time clock;

3 Electrical Characteristics

- Working Voltage: 1.71V-3.8V
- Working Temperature: -40℃～+85℃
- Modulation Mode: GFSK Gaussian Frequency Shift Keying
- Modulation Frequency: 2402MHz-2483.5MHz
- Maximum Transmit Power: 0dBm/+6dBm
- Receive Current: 3.6mA @1Mbps GFSK
- Emission Current:4.1mA@0dBm
- Emission Current:8.2mA@6dBm
- Low Power Consumption Mode Current: 27uA/MHz in Active Mode @76.8MHz
- Deep Sleep Mode Current: 1.4uA @EM2 Deep Sleep
- Receiving Sensitivity: -98.9dBm @1Mbps GFSK

4 Module Function Description

After the module is started, it will automatically broadcast. The mobile device that has opened a specific APP will scan and connect with the module. After successful connection, the module can be operated through the BLE protocol. The external MCU can carry out wireless communication with the mobile device through the serial port of the module, and the external MCU can also send the control commands to change the communication parameters through the serial port of module. The user's data format is defined by the upper application. The mobile device can send data to the module through the APP, and then the data will be send to the external MCU through the serial port of module. After the module receives the data packet from the external

MCU, it will automatically forward it to the connected mobile device. The user needs to complete the code design of the external MCU and APP running on the mobile device.

5 Application Diagram

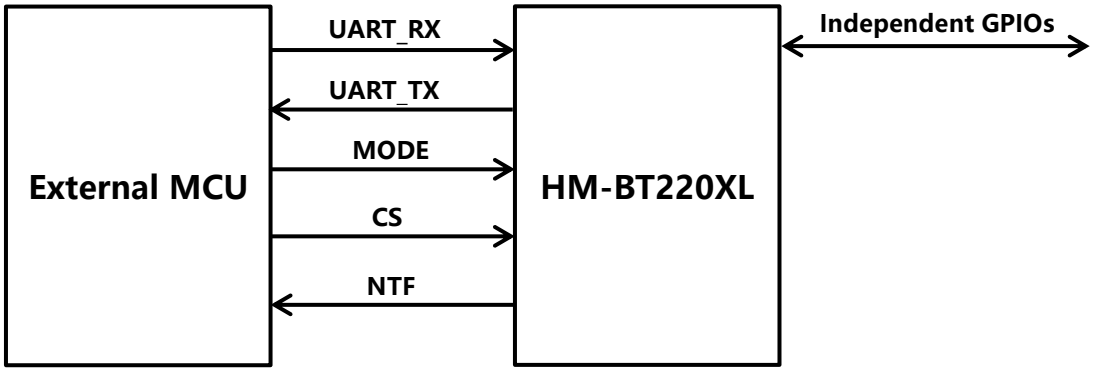

Figure 1 Schematic between HM-BT220XL and External MCU

6 Module Pin

6.1 Module Pinout

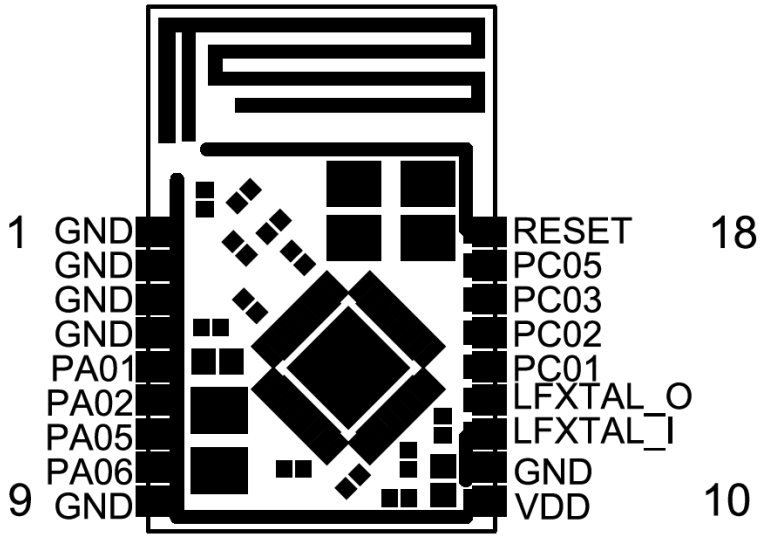

Figure 2 Module Pinout (Top View)

6.2 Module Pin Definition

PinNo	PinName	Type	Description
1	GND	DG	Power Ground
2	GND	DG	Power Ground
3	GND	DG	Power Ground
4	GND	DG	Power Ground
5	PA01	I/O	SWCLK; Serial Clock for Debugging and Programming
6	PA02	I/O	SWDIO; Serial Data for Debugging and Programming
7	PA05	I/O	General GPIO
8	PA06	I/O	General GPIO
9	GND	DG	Power Ground
10	VDD	DV	Power Supply 3.3V
11	GND	DG	Power Ground
12	PD1	I/O	LFXTAL_I external connection 32.768KHz crystal input
13	PD0	I/O	LFXTAL_O external connection 32.768KHz crystal output
14	PC01	I/O	UART RXD
15	PC02	I/O	UART TXD
16	PC03	I/O	General GPIO
17	PC05	I/O	General GPIO
18	RESET	I/O	Reset Pin; Active Low

Table 1 Module Pin Definition

Special instructions for Transmission firmware:

Pin 17 PC05 is Run Mode Pin “MODE” : High Level is AT mode; Low Level is transparent mode.

Pin 8 PA06 is Selection Pin “CS” : Low valid.

Pin 16 PC03 is Notification Pin “NTF”.

7 Module Size

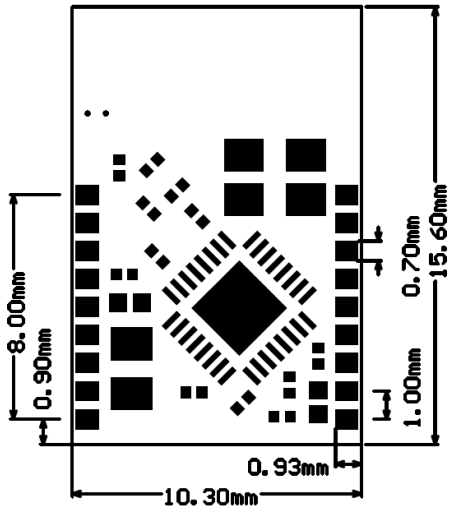

Figure 3 HM-BT220X Module Size

8 Selection Guide

Model / Parameter	HM-BT2204L	HM-BT2202L	HM-BT2201L
Transmit Power	6dBm	6dBm	0dBm
FLASH	512KB	352KB	352KB
Operating Frequency	76.8MHz	76.8MHz	38.4MHz
Air Rate	1Mbps、2Mbps、500kbps、125Kbps	1Mbps、2Mbps	1Mbps、2Mbps
Mesh	supported	Not supported	Not supported

9 Hardware Design Considerations

1. It is recommended to use DC regulated power supply to supply power to the module. The ripple coefficient of the power supply shall be as small as possible, and the module shall be reliably grounded; Please pay attention to the correct connection of the positive and negative poles of the power supply. If reversed, the module may be permanently

damaged;

2. Please check the power supply to ensure that it is between the recommended power supply voltage. Exceeding the maximum value will cause permanent damage to the module; Please check the stability of the power supply, and the voltage shall not fluctuate greatly and frequently;

3. When designing the power supply circuit for the module, it is recommended to reserve more than 30% margin, which is conducive to the long-term and stable operation of the whole machine; The module shall be far away from the power supply, transformer, high-frequency wiring and other parts with large electromagnetic interference as far as possible;

4. The high-frequency digital wiring, high-frequency analog wiring and power wiring must avoid the lower part of the module. If it is really necessary to pass under the module, it is assumed that the module is welded on the Top Layer and laid on the Top Layer of the module contact part (all copper is laid and well grounded). The wiring must be close to the digital part of the module and laid on the Bottom Layer;

5. Assuming that the module is welded or placed in the Top Layer, it is also wrong to randomly route in the Bottom Layer or other Layers, which will affect the stray and receiving sensitivity of the module to varying degrees;

6. Assuming that there are devices with large electromagnetic interference around the module, which will also greatly affect the performance of the module. According to the intensity of interference, it is recommended to stay away from the module properly. If the situation allows, appropriate isolation and shielding can be done;

7. Assuming that there are wires with large electromagnetic interference around the module (high-frequency digital, high-frequency analog and power wiring) which will also greatly affect the performance of the module. According to the intensity of interference, it is recommended to stay away from the module properly, and appropriate isolation and shielding can be done if possible;

8. If 5V level is used for communication line, level conversion circuit must be used;

9. Try to stay away from some physical layers of the TTL protocol, which is also 2.4 GHz band, such as USB3.0.

10. Refer to the following figure for module antenna layout:

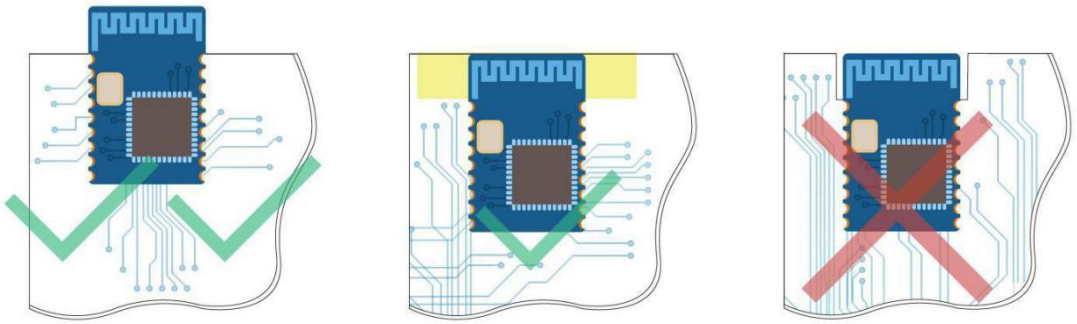

Figure 4 PCB Routing Suggestions

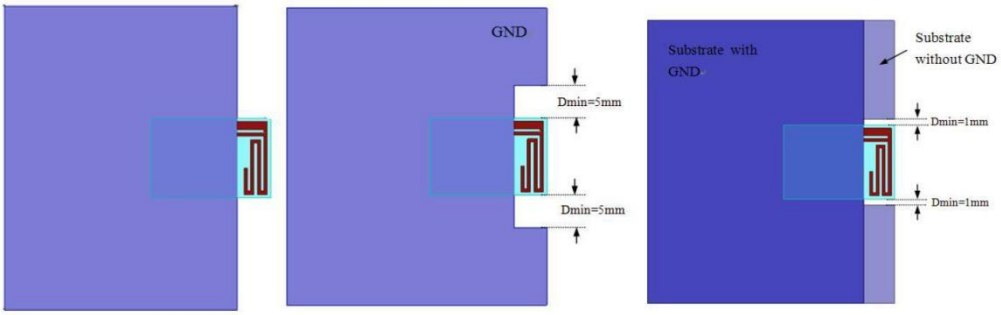

Figure 5 PCB Layout Suggestions

10 Common Problem

10.1 Transmission Distance is not ideal

1. When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly; Temperature, humidity and co frequency interference will

increase the communication packet loss rate; The ground absorbs and reflects radio waves, and the test effect near the ground is poor;

2. Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor;

3. If there are metal objects near the antenna or placed in a metal shell, the signal attenuation will be very serious;

4. Power register setting error and air rate setting too high (the higher the air rate is, the closer the distance is);

5. At room temperature, the power supply voltage is lower than the recommended value, and the lower the voltage is, the smaller the transmission power is;

6. The matching degree between the antenna and the module is poor, or the quality of the antenna itself is defective.

10.2 Fragile - Unusually damaged

1. Please check the power supply to ensure that it is between the recommended power supply voltage. Exceeding the maximum value will cause permanent damage to the module; Please check the stability of the power supply, and the voltage shall not fluctuate greatly and frequently;

2. Please ensure anti-static operation during installation and use. High frequency devices are electrostatic sensitive devices;

3. Please ensure that the humidity should not be too high during installation and use, and some components are humidity sensitive devices; If there is no special demand, it is not recommended to use at too high or too low temperature.

10.3 Error Rate is too high

1. There is co-frequency signal interference nearby, stay away from the interference source

or modify the frequency and channel to avoid interference;

2. If the power supply is not ideal, it may also cause garbled code. Be sure to ensure the reliability of the power supply;

3. If the quality of extension lines and feeders is too poor or too long, the Error Rate will also be high.

11 Reflow Soldering Conditions

1. Heating method: conventional convection or IR convection;

2. Allowable reflow times: 2 times, based on the following reflow soldering (conditions) (see the figure below);

3. Temperature curve: reflow welding shall follow the following temperature curve (see the figure below);

4. Maximum temperature: 245 ° C.

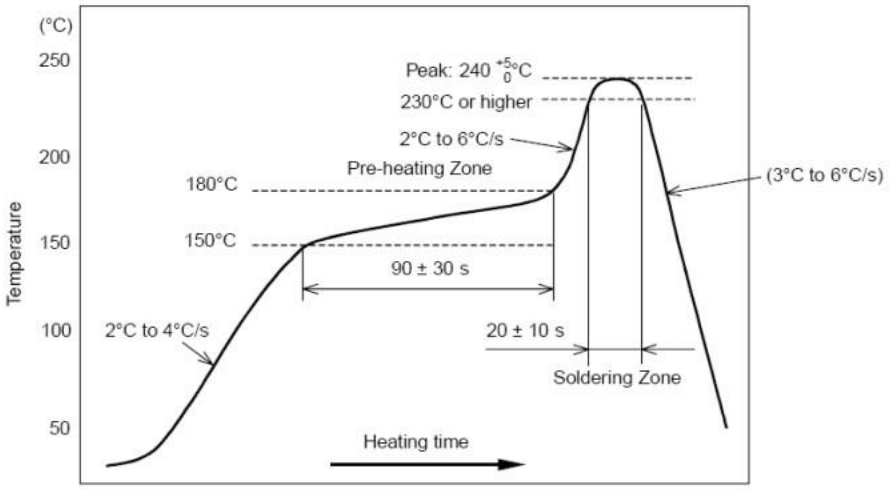

Figure 6 Welding heat resistance temperature curve of components (welding points)

12 Electrostatic Discharge Warning

Modules will be damaged due to electrostatic discharge. It is recommended that all modules should be handled under the following 3 preventive measures:

1. Anti static measures must be followed, and the module cannot be held with bare hands.

2. The module must be placed in an area that can prevent static electricity.

3. The antistatic circuit at high voltage input or high frequency input should be considered in product design.

Static electricity may result in subtle performance degradation to the failure of the whole equipment. Due to very small parameter changes, the equipment may not meet the value limits of its certification requirements, so the module will be more vulnerable to damage

13 Version Of File

Model	Version	Remark
HM-BT220XL	V1.0	Initial Version

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