Matter Module Specification
HM-MT7201

Content

1　Product Overview

The HM-MT7201 is a Matter over Wi-Fi wireless communication module operating in the 2.4 GHz frequency band. It features a highly integrated single-chip solution combining Wi-Fi 802.11b/g/n and Bluetooth Low Energy (BLE) technologies, specifically engineered for compact dimensions. Equipped with a powerful 32-bit MCU and a comprehensive array of peripheral interfaces, this module serves as an ideal choice for advanced Internet of Things (IoT) applications.

Utilizing cutting-edge design techniques and process technologies, the module delivers high integration and minimal power consumption within an ultra-compact package, making it suitable for smart lighting systems, smart home devices, indoor positioning solutions, and other sophisticated IoT implementations.

The HM-MT7201 Wi-Fi module incorporates a PCB antenna and supports wireless communication protocols including Matter IoT platform, Wi-Fi, and BLE. It enables the development of Matter over Wi-Fi end devices, empowering customers to seamlessly upgrade existing wireless smart home devices to meet Matter-compliant standards.

2 Module Features

Core MCU Specifications

- 32-bit MCU with 160 MHz maximum frequency

- On-chip memory

- 2 MB embedded Flash and support up to 16MB external SPI Flash

- 288 KB RAM

Wireless Protocol Support

- Matter over Wi-Fi

- Wi-Fi: IEEE 802.11 b/g/n

- Bluetooth Low Energy (BLE) 5.2

Debugging & Firmware Interfaces

- UART-based firmware upgrade

- JTAG debugging interface

Peripheral Interfaces

Communication:

- 1× SPI

- 2× UART

- 1× I2C

- 1× GDMA (General-Purpose DMA)

Timing/Control:

- 6× 32-bit PWM channels

- 6× 32-bit timers

- 1× Watchdog timer

- 1× Real-Time Clock (RTC)

Analog & Security:

- ADC (Analog-to-Digital Converter)

- 1× Temperature sensor

- 1× True Random Number Generator (TRNG)

Wi-Fi Features:

- Radio: 1×1 SISO (Single-Input Single-Output)

- Bandwidth: 20 MHz channel support

Performance:

- Transmit power: up to +19 dBm

- Receiver sensitivity: down to -99 dBm

- Modes: STA (Station), AP (Access Point), AP+STA coexistence

Advanced Support:

- STBC (Space-Time Block Coding) for improved robustness

BLE 5.2 Features

Data Rates:

- 1 Mbps (LE 1M PHY)

- 2 Mbps (LE 2M PHY)

- Long-range: 125 kbps (LE Coded PHY S=8) and 500 kbps (LE Coded PHY S=2)

Functionality:

- Advertising Extensions

- Integrated Bluetooth/Wi-Fi Coexistence with Packet Traffic Arbitration (PTA)

Clock Management

- External Oscillator: 26 MHz crystal (X26M)

- Internal Oscillators:

- 26–160 MHz Digitally Controlled Oscillator (DCO)

- 32 kHz Ring Oscillator (ROSC)

- Frequency Synthesis: 480 MHz DPLL (Digital Phase-Locked Loop)

Power Management

- Operating Voltage: 2.7 V to 3.6 V (VBAT supply range)

Protection & Regulation:

- On-chip Power-On Reset (POR)

- Brown-Out Detector (BOD)

- Integrated LDO (Low-Dropout Regulator)

3 Electrical Characteristics

Table 3-1 List of electrical parameters

Parameter	State	Minimum	Typical	Maximum	Unit
Module Model	HM-MT7201				
Package	Three rows of stamp holes				
Size	(20.3±0.10)x(15.3±0.10)x(2.60±0.10) With shield cover				mm
SPI Flash	Built-in 2MB				
Interface	UART/HSPI/I2C/I2S/GPIO/PWM				
I/O	18				
Serial Baud rate	2	300	115200	600000	bps
Antenna	Onboard PCB antenna				
Spectrum Range	802.11 b/g/n	2412		2484	MHz
Channel Bandwidth	802.11 b/g/n	20	20	20	MHz
Receiving Sensitivity	1 Mbps DSSS		-99		dBm
	2 Mbps DSSS		-96		dBm
	11 Mbps DSSS		-90		dBm
	6 Mbps OFDM		-92		dBm
	54 Mbps OFDM		-76		dBm
	MCS0		-92		dBm
	MCS7		-74		dBm
Maximum Transmit Power	1 Mbps DSSS		19		dBm
	11 Mbps DSSS		19		dBm
	6 Mbps OFDM		20		dBm
	54 Mbps OFDM		17		dBm
	MCS0		19		dBm
	MCS7		16		dBm
Maximum receive level @ 2.4 GHz	5.5, 11 Mbps (8% PER, 1024octets)			10	dBm
	6 ~54 Mbps (10% PER, 1024octets)			5	dBm
	MCS0~7 (10% PER, 4096 octets)			2	dBm
BLE Specification	Operating frequency range	2402	-	2480	MHz
	Max Tx Power	6	8	10	dBm
	Sensitivity 30.8% PER		-98		dBm
Working temperature	-	-40		+85	℃
Working Voltage	VCC	2.7	3.3	3.6	V

4 Module Function Description

By simply designing the interface to integrate the HM-MT7201 Wi-Fi module into smart home terminal devices (such as fans, lights, switches, sockets, door locks, motorized curtains, doorbells, thermostats, etc.), existing smart home devices can be upgraded to Matter-compliant devices. Users can scan the QR code on the Matter device using smart home apps like Apple's Home app and effortlessly complete Bluetooth-based network commissioning in just a few steps, enabling the device to join an existing Matter network.

Matter devices developed based on the HM-MT7201 Wi-Fi module can seamlessly integrate with smart home ecosystems including Apple Home, Amazon Alexa, Google Home, and Samsung SmartThings. This significantly streamlines product development cycles, accelerates time-to-market, and effectively enhances user experience.

5 Module Application Example

Developing Matter products using HOPERF's Matter over Wi-Fi module is exceptionally straightforward, primarily involving two operational approaches:

The first is the Serial Port External Host Control Solution, where the host controller communicates with the Matter module via serial port protocols. This effectively segregates Matter firmware functionalities from product-specific features. The module application diagram is depicted in Figure 5.1.

The second approach employs the SoC Integration Method, where both Matter firmware and product functionalities are implemented directly through the primary SoC integrated on the module.
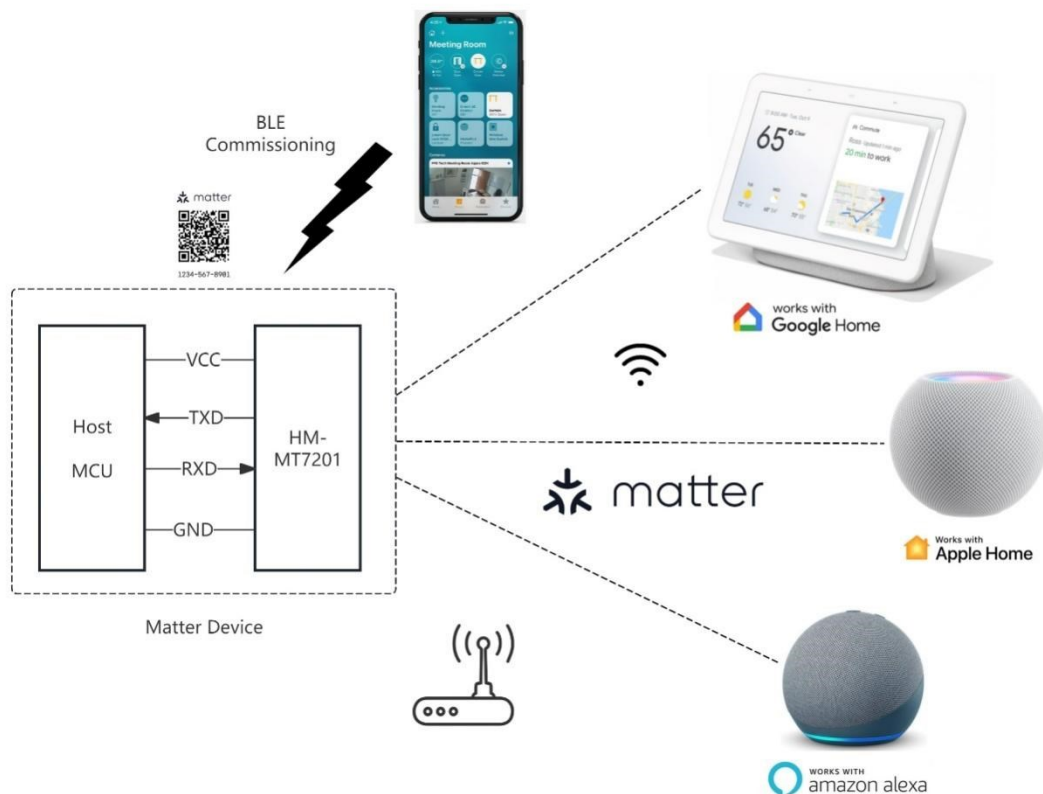

Figure 5.1 Module Application Diagram – Serial Port External Host Control Solution
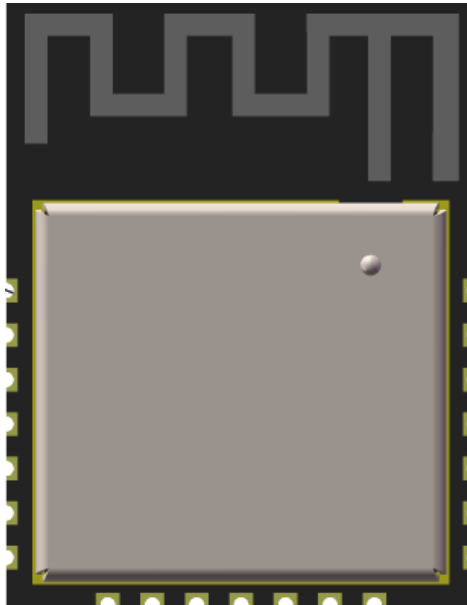
6 Module Interfaces
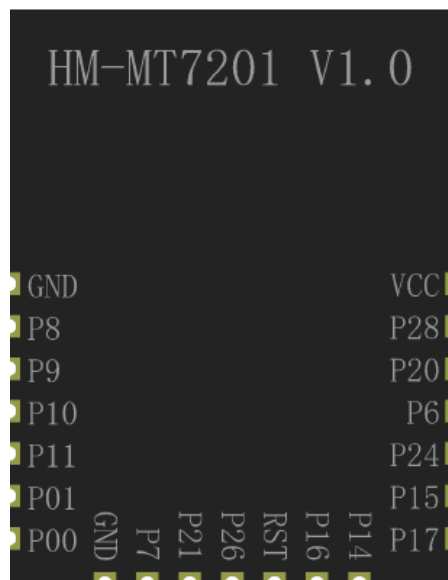
6.1 Module Footprint

Figure 6.1 Top View

Figure 6.2 Bottom View

6.2 Pin Definition

Table 6.1 HM-MT7201 Module Pin Definitions

Pin No.	Pin Name	Type	Description
1	VCC	DV	Power
2	P28	I/O	P28/ADC4
3	P20	I/O	P20/ADC3
4	P06	I/O	PA06/CLK13M/PWM0/TCK/ANT0
5	P24	I/O	P24/LPO_CLK/PWM4/ANTLSB/SCL/ADC2
6	P15	I/O	P15/CSN/ANT1/SCL
7	P17	I/O	P17/MISO/ANT3/SDA
8	P14	I/O	P14/SCK/ANT0
9	P16	I/O	P16/MOSI/ANT2
10	RST	I/O	Reset(Active low)
11	P26	I/O	P26/PWM5/ANTMSB/SDA/ADC1
12	P21	I/O	During system reboot, grounding P21 enters ATE mode.
13	P07	I/O	P07/PWM1/TMS/ANT1
14	GND	DG	Ground
15	P00	I/O	P00/TXEN/UART2-RX
16	P01	I/O	P01/RXEN/ADC5/UART2-TX
17	P11	I/O	PA11/UART1-TX
18	P10	I/O	PA10/ADC6/UART1-RX
19	P09	I/O	P09/PWM3/TDO/ANT3
20	P08	I/O	P08/PWM2/TDI/ANT2/CLK26M
21	GND	DG	Ground

Note:

1. During development, ensure P21 is not pulled low during system reboot, as this will prevent normal system startup.

2. UART1 serves as the firmware programming interface (non-configurable) and is default configured for debug output.

3. UART2 is default configured as the communication port for external MCU connectivity.

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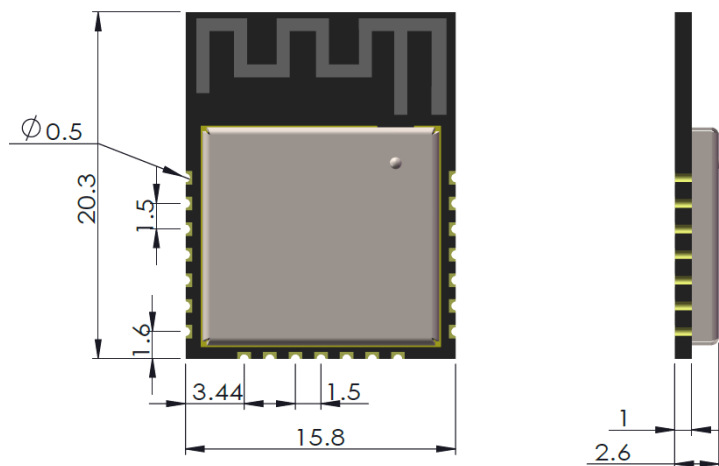
7 Module Dimensions

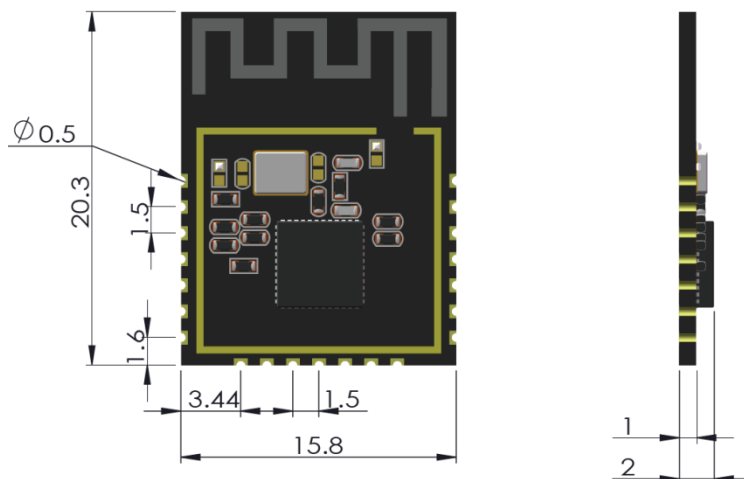Figure 7.1 Module dimensions of HM-MT7201 with shield cover

Figure 7.2 Module dimensions of HM-MT7201 without shield cover

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8 Hardware Design Considerations

1. It is recommended to supply the module with DC voltage power supply as small as possible and the module should be reliably grounded; Please pay attention to the correct connection of the positive and negative poles of the power supply, if the reverse connection may cause permanent damage to the module;

2. Please check the power supply to ensure that exceeding the maximum value will cause permanent damage to the module; Please check the stability of the power supply and the voltage cannot fluctuate substantially and frequently;

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

4. High-frequency digital routing, high-frequency analog wiring, and power wiring must avoid below the module, if have to go through the module, assuming that the module is welded in the Top Layer, Top Layer in the contact part of the module (all copper and good grounding), wiring must be close to the digital part of the module, and line in Bottom Layer;

5. Assuming that the module is welded or placed in Top Layer, it is wrong to walk at the Bottom Layer or other layers, which will affect the stray and receiving sensitivity of the module to different degrees;

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

7. Suppose that there is a wiring around the module with large electromagnetic interference (high-frequency digital, high-frequency simulation, power wiring) that will also greatly affect the performance of the module. According to the strength of

interference, it is recommended to stay away from the module, and appropriate isolation and shielding can be done;

8. If the communication line uses a 5V level, the level conversion circuit must be used;

9. Keep away from some TTLs with 2.4 GHz bands, such as USB 3.0;

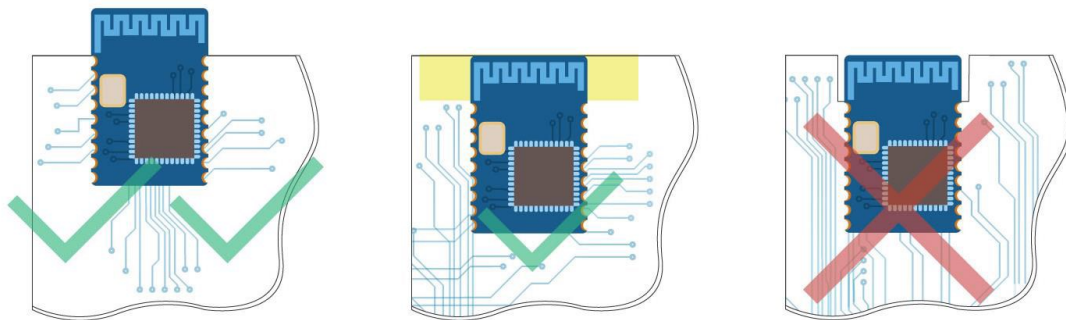10. Refer to the following figure for the module antenna layout:
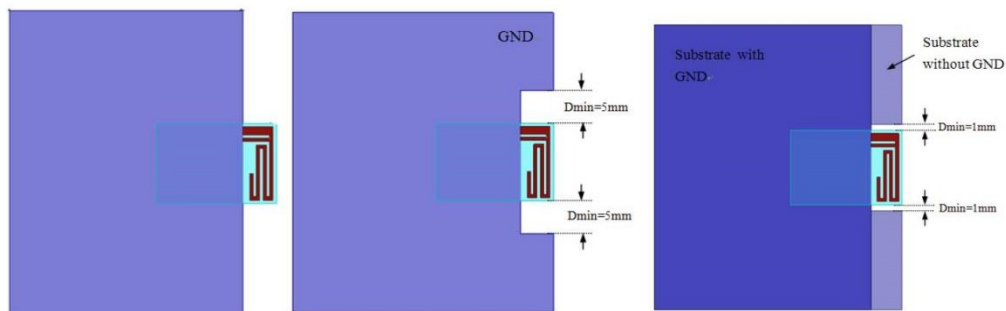
Figure 8.1 PCB routing recommendations

Figure 8.2 PCB layout recommendations

9 Frequently Asked Questions

9.1 An unsatisfactory transmission distance

1. When there is a linear communication obstacle, the communication distance will decay accordingly; Temperature, humidity, and same frequency interference will increase the communication packet loss rate; Poor ground absorbs and reflect radio waves, close to the ground;

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

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

4. The power register setting is wrong and the air rate setting is too high (the higher the air rate, the closer the distance);

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

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

9.2 Easy to damage —— abnormal damage

1. Please check the power supply to ensure that exceeding the maximum value will cause permanent damage to the module; Please check the stability of the power supply and the voltage cannot fluctuate substantially and frequently;

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

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

9.3 The BER rate is too high

1. Have the same frequency signal interference nearby, stay away from the interference source, or modify the frequency and channel to avoid the interference;

2. The power supply is not ideal and may also cause code jumble, be sure to ensure the reliability of the power supply;

3. The extension line, feeder quality is too poor or too long, and will also cause a high bit error rate.

10 Reflux Welding Conditions

1. Heating method: conventional convection or IR convection;

2. Number of allowable reflow welding: 2 times, based on the following reflow welding (conditions) (see the figure below);

3. Temperature curve: reflow welding should follow the following temperature curve (see the figure below);
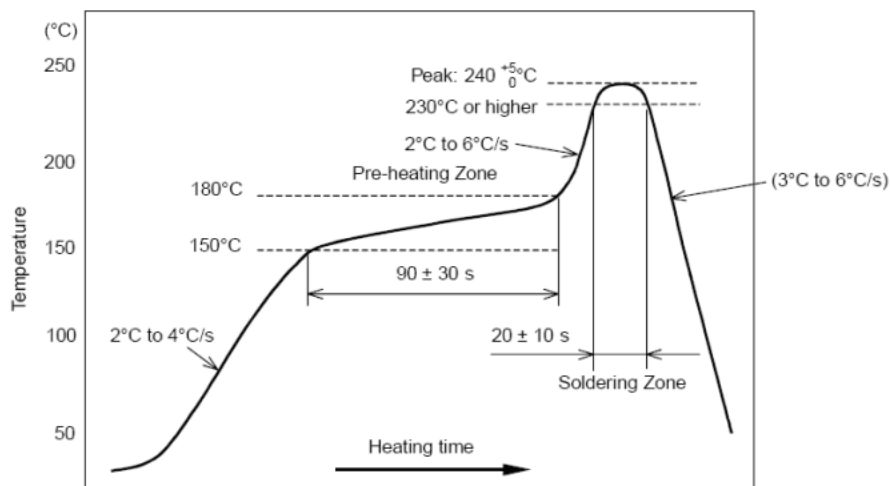
4. Maximum temperature: 245°C.

Figure 10.1 Welding heat resistance temperature curve of components (welding points)

11 Electrostatic Discharge Warning

The module is damaged due to static release and it is recommended that all modules be treated under the following 3 precautions:

1. Must follow the anti-static measures, can not hold the module.

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

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

Electrostatics may result in subtle performance degradation to the entire device failure. Because very small parameter changes may cause the device to not meet the value limit of its certification requirements, the module will be more vulnerable to damage.

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12 Document Change Record

Table 12.1 Document change record

Document version	Change description	Date updated
V1.0	First release	2025.05.18

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