Manuals+ — User Manuals Simplified.

HOPERF HMMT2401 Matter Module

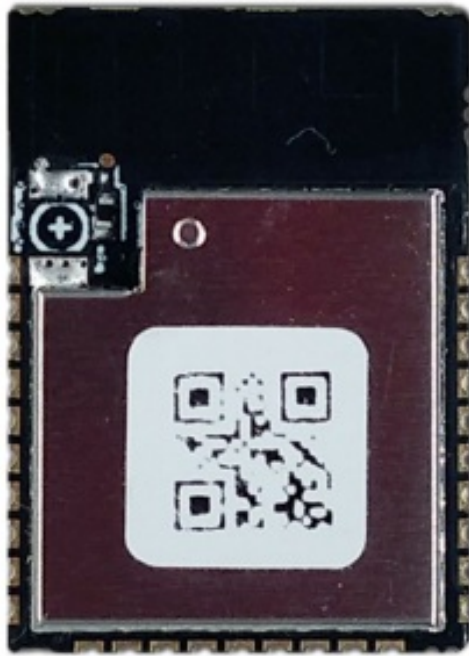# HOPERF HMMT2401 Matter Module Owner's Manual

Contents

HOPERF

HOPERF HMMT2401 Matter Module

Specifications

- Supports Matter, OpenThread, Zigbee, Bluetooth Low Energy (BLE 5.3), Multi-protocol
- 1536 kB FLASH program memory and 256 KB RAM data memory
- 2.4 GHz radio operation
- Secure Vault for enhanced security
- Operating voltage range: 1.71V to 3.8V
- Operating temperature range: -40°C to +125°C
- Modulation mode: 2 (G) FSK with full configuration shaping, OQPSK DS, (G) MSK
- Modulation frequency: 2402MHz-2483.5MHz

Product Usage Instructions

Hardware Design Considerations

1. Supply the module with a DC voltage power supply as small as possible and ensure reliable grounding.
2. Check the power supply to avoid exceeding the maximum value to prevent permanent damage.
3. Maintain stability in the power supply to prevent substantial and frequent voltage fluctuations.
4. Include more than 30% allowance in the power supply circuit design for long-term stable operation.
5. Avoid high-frequency digital routing, high-frequency analog wiring, and power wiring below the module.

Module Interfaces

The module features various pin definitions including GPIO, UART TXD, UART RXD, Power supply, Ground, and Reset.

Module Dimensions

The module dimensions vary with or without a shield cover for different design requirements.

Product Overview

The HM-MT2401 is a Matter over Thread wireless communication module based on the 2.4 GHz frequency band. It includes a high-performance, highly integrated RF processing chip EFR32MG24, inside a low-power 32-bit ARM® Cortex®-M33 core, 1536kB Flash, 256kB RAM, and rich in peripheral resources, equipped with an integrated PCB antenna and an external antenna holder, support for wireless communication technologies such as Matter, Thread, and BLE. The HM-MT2401 can be used to develop the Matter over Thread end device, enabling the original non-Matter wireless devices can be easily upgraded to Smart Home devices that meet Matter standards.

Module Features

- High-performance 32-bit 78.0 MHz ARM® Cortex®-M33 with DSP instructions and floating-point unit for efficient signal processing
- Support Matter, OpenThread, Zigbee, Bluetooth Low Energy (BLE 5.3), Multi-protocol
- 1536 kB FLASH program memory and 256 KB RAM data memory
- 2.4 GHz radio operation
- Secure Vault
    - Hardware Cryptographic Acceleration for AES128/192/256, ChaCha20-Poly1305, SHA-1, SHA-2/256/384/512, ECDSA+ECDH(P-192, P-256, P-384, P-521), Ed25519 and Curve25519, J-PAKE, PBKDF2
    - True Random Number Generator (TRNG)
    - ARM® TrustZone®
    - Secure Boot (Root of Trust Secure Loader)
    - Secure Debug Unlock
    - DPA Countermeasures
    - Secure Key Management with PUF
    - Anti-Tamper
    - Secure Attestation
- Wide selection of MCU peripheral devices
- Support for the internal RTC live clock
- Certified by FCC / CE
- Compliance with the ROHS / REACH / CA Prop 65 standards

Electrical Characteristics

- Operating voltage range: 1.71V to 3.8V
- Operating temperature range: -40℃ ~ +125℃
- Modulation mode: 2 (G) FSK with fully configuration shaping, OQPSK DSSS, (G) MSK
- Modulation frequency: 2402MHz-2483.5MHz
- Receiving sensitivity:
    - 105.4-dBm sensitivity @ 250 kbps O-QPSK DSSS
    - 105.7 dBm sensitivity @ 125 kbps GFSK
    - 97.6 dBm sensitivity @ 1 Mbps GFSK
    - 94.8 dBm sensitivity @ 2 Mbps GFSK
- TX Power up to + 19.5 dBm

- Low system energy consumption:
  - 4.4 mA RX current (1 Mbps GFSK)
  - 5.1 mA RX current (250 kbps O-QPSK DSSS)
  - 5 mA TX current @ 0 dBm output power
  - 19.1 mA TX current @ 10 dBm output power
  - 156.8 mA TX current @ 19.5 dBm output power
  - 33.4 µA/MHz in Active Mode (EM0) at 39.0 MHz
  - 1.3 µA EM2 Deep Sleep current (16 kB RAM retention and RTC running from LFRCO)

Module Function Description

Through a simple interface design to integrate the HM-MT2401 module into Smart Home end devices (such as lighting, switches, plugs, door locks, curtain motors, doorbells, thermostats, temperature sensors, and other end devices), the original end device can be upgraded to Matter devices that meet the Matter standard specifications. Users can scan the QR code of the Matter device through the Smart Home App such as Apple Home App. After several simple steps, the users can easily commission the Matter device through BLE, to add it to the existing Matter network. The Matter devices developed based on the HM-MT2401 module can be seamlessly added to the Smart Home ecosystems such as Google Home, Apple Homekit, Amazon Alexa, and Samsung SmartThings, greatly simplifying the customer product development cycle, accelerating the product launch, and effectively improving the user experiences.

Module Application Example

It is very simple to develop Matter products using HOPERF's Matter module. It is mainly divided into two working methods: one is to connect a MCU through the UART. The MCU and Matter module communicate through the serial port protocol, which can well distinguish the Matter firmware functions and product functions. The module application diagram is shown in Figure 5.1; The second is the SoC method, that is, both Matter firmware functions and product functions are implemented by the SoC on the module

Figure 5.1 One of the application example for the module

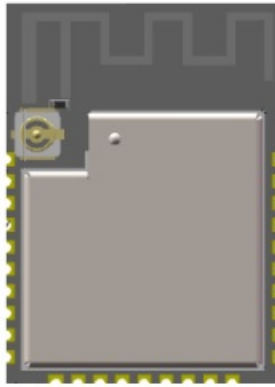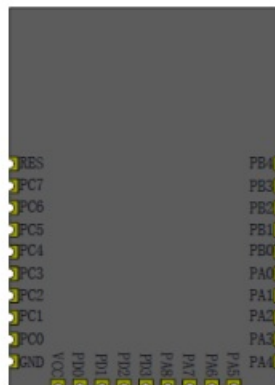## Module Interfaces

Module Footprint

Figure 6.1 Top View

Figure 6.2 Bottom View

Pin Definition

Pin No.	Pin Name	Type	Description
1	PB4	I/O	GPIO
2	PB3	I/O	GPIO

3	PB2	I/O	GPIO
4	PB1	I/O	GPIO
5	PB0	I/O	GPIO
6	PA0	I/O	GPIO
7	PA1	I/O	SWCLK
8	PA2	I/O	SWDIO
9	PA3	I/O	GPIO
10	PA4	I/O	GPIO
11	PA5	DO	PA5; UART TXD
12	PA6	DI	PA6; UART RXD
13	PA7	I/O	GPIO
14	PA8	I/O	GPIO
15	PD3	I/O	GPIO
16	PD2	I/O	GPIO
17	PD1	I/O	GPIO
18	PD0	I/O	GPIO
19	VCC	DV	Power supply
20	GND	DG	Ground
21	PC0	I/O	GPIO
22	PC1	I/O	GPIO
23	PC2	I/O	GPIO
24	PC3	I/O	GPIO
25	PC4	I/O	GPIO
26	PC5	I/O	GPIO
27	PC6	I/O	GPIO
28	PC7	I/O	GPIO
29	RES	I/O	Reset

Module Dimensions

Figure 7.1 Module dimensions of HM-MT2401 with shield cover

Figure 7.2 Module dimensions of HM-MT2401 without shield cover

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;

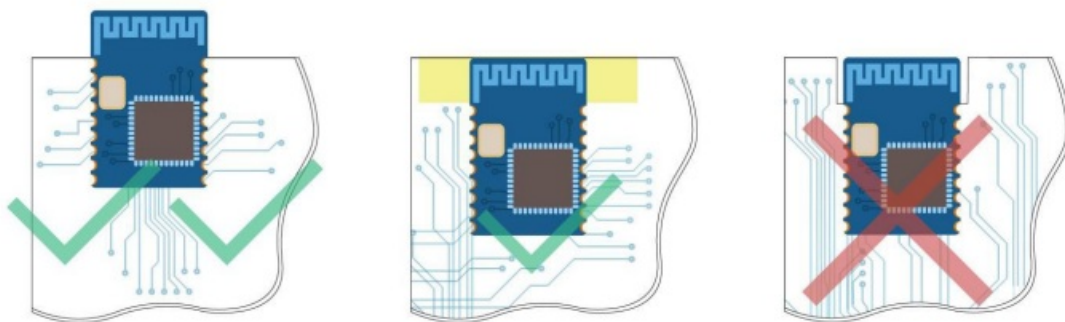10. Refer to the following figure for the module antenna layout
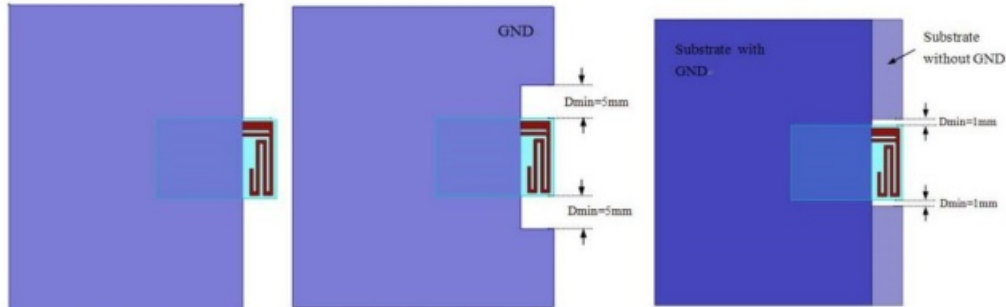

Figure 8.1 PCB routing recommendations

Figure 8.2 PCB layout recommendations

FAQ

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 andreflect 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. he matching degree of the antenna and the module is poor, or the quality of the antenna itself is problematic.

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

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 rat

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);
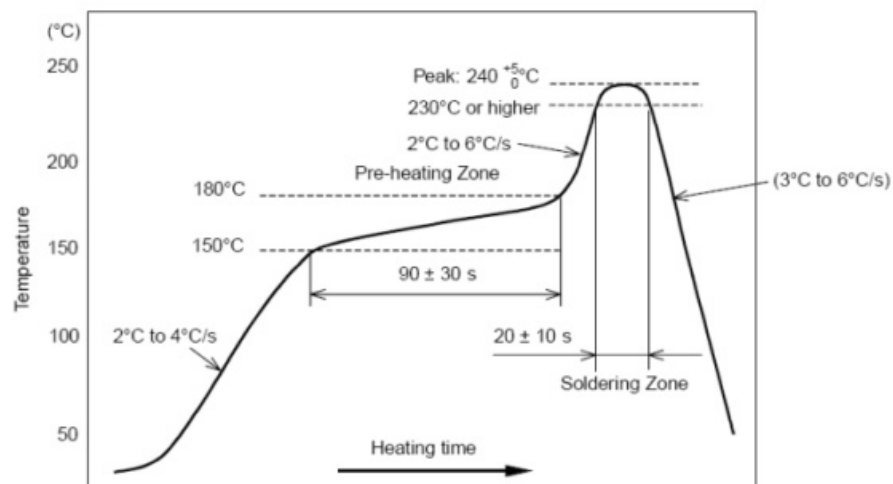4. Maximum temperature: 245°C.

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

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. ust 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.

Document Change Record

Table 12.1 Document change record

Document version	Change description	Date updated
V1.0	First release	2023.7.23
V1.1	Add descriptions for Module application example	2023.9.30

Certification

FCC Statement

1. 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. (2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 frequence 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.

The device has been evaluated to meet general RF exposure requirements. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body. The Module is designed to comply with the FCC statement. FCC ID is 2ASEO-HMMT2401. The host system using the Module should have a label indicating it contains the modular's FCC ID: 2ASEO-HMMT2401. This radio module must not installed to co-locate and operating simultaneously with other radios in host system additional testing and equipment authorization may be required to operating simultaneously with other radio. The Module and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device.

The modular must be installed in the host that is assigned by Company name: Shenzhen HOPE Microelectronics Co., Ltd, Model no.: HM-MT2401. If other host types used would need further evaluation and possible C2PC if they are not significantly similar to the one tested The WIFI Module is designed for a compact PCB design. It should be installed and operated with host or other minimum distance of 20 centimeters between the radiator and your body." To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 1 dBi in the 2.4G band. The module uses an IPEX antenna interface and ping angle interface antenna, this antenna is sold with the module.

Notice to OEM integrator

- The end user manual shall include all required regulatory information/warning as shown in this manual.
- The OEM integrator is responsible for testing their end product for any additional compliance requirements required with this module installed.
- If the final product contains circuits of other FCC PART 15 Subparts, the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.
- The intended use is generally not for the general public, it is generally for industry/commercial use. The connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter that is not normally required, the user has no access to the connector. Installation must be controlled. Installation requires special training.
- This device complies with Part 15 of the FCC Rules.
- This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body

ISED Statement

The Module is designed to comply with the ISED statement. ISED Certification Number is 24999-HMMT2401. The host system using the Module should have a label indicating it contains the modular's IC: 24999-HMMT2401. This radio module must not installed to co-locate and operating simultaneously with other radios in host system additional testing and equipment authorization may be required to operating simultaneously with other radio. The Module and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Contact

- Shenzhen Hope Microelectronics Co., Ltd.
- Address: 30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China
- Tel: + 86-0755-82973805
- Email: **sales@hoperf.com**
- Website: **https://www.hoperf.com/**
- **www.hoperf.com**

Documents / Resources

HOPERF Matter Module Specification HM-MT2401	**HOPERF HMMT2401 Matter Module** [pdf] Owner's Manual HMMT2401 Matter Module, HMMT2401, Matter Module, Module

References

- **H** **HOPERF - Reliable original manufacturer of IoT key components**
- **H** **HOPERF - Reliable original manufacturer of IoT key components**
- **User Manual**