



HT-HC02S

AT Command Wi-Fi HaLow Passthrough



<https://heltec.org>

Documents

Rev. 1.0

P 1/14

May 2025

Heltec Automation © Limited standard files

Document version

Version	Time	Description	Remark
Rev. 1.0.0.0	2024-12-16	P-Development version	Richard
Rev.1.0.0.1	2025-10-29	First Version	Richard

Copyright Notice

All contents in the files are protected by copyright law, and all copyrights are reserved by Chengdu Heltec Automation Technology Co., Ltd. (hereinafter referred to as Heltec). Without written permission, all commercial use of the files from Heltec are forbidden, such as copy, distribute, reproduce the files, etc., but non-commercial purpose, downloaded or printed by individual are welcome.

Disclaimer

Chengdu Heltec Automation Technology Co., Ltd. reserves the right to change, modify or improve the document and product described herein. Its contents are subject to change without notice. These instructions are intended for you use.

Content

HT-HC02S	1
Document version	2
Copyright Notice	2
Disclaimer	2
Content	3
1. Overview	4
1.1 Introduction	4
1.2 Product Features	4
1.3 Application	5
2. Pin description	6
2.1 Pin Layout	6
2.2 Pin description	7
3. Specifications	9
3.1 Generic Parameter	9
3.2 Wi-Fi HaLow Parameters	错误！未定义书签。
3.3 Power Parameters	10
4. Hardware Dimensions	12
4.1Physical dimensions	错误！未定义书签。
5. Resource	14
5.1Relevant resource	14
5.2 Heltec Contact Information	14

1. Overview

1.1 Introduction

The [HC02 WiFi HaLow](#) transparent transmission module is built on the ESP32-S3 and MM6108Q chips and can be directly controlled via UART AT commands without the need for an SDK. With its compact size and 1.27mm stamp hole interface, it can be easily integrated into your PCB. Operating in the license-free Sub-1GHz band, Wi-Fi HaLow supports a transmission distance of 1-2 km and a maximum physical layer over-the-air data rate of up to 32.5Mbps.^① This effectively addresses the short transmission range of traditional Wi-Fi and the slow transmission rates of other IoT technologies, making the HC02 an ideal choice for IoT application development.

1.2 Product Features

- ESP32-S3FN8 + MM6108IQ.
- Support AT command control.
- Channel bandwidth options of 1/2/4/8 MHz.
- Long-distance transmission capability, the range can reach 1km and further within the visual distance.
- High data rate, single-stream max PHY air data rate of 32.5 Mbps .
- Support Sub-1 GHz frequency bands, frequency range: 902~928 MHz.
- Max output power: 21±1dBm.
- Rich pin, 1.27mm stamp hole design, easy to integrate.
- -40°C to 85°C maximum operating temperature range.

^① The maximum over-the-air rate is 32Mbps, and after deducting protocol overhead, the actual rate retains approximately 60%.

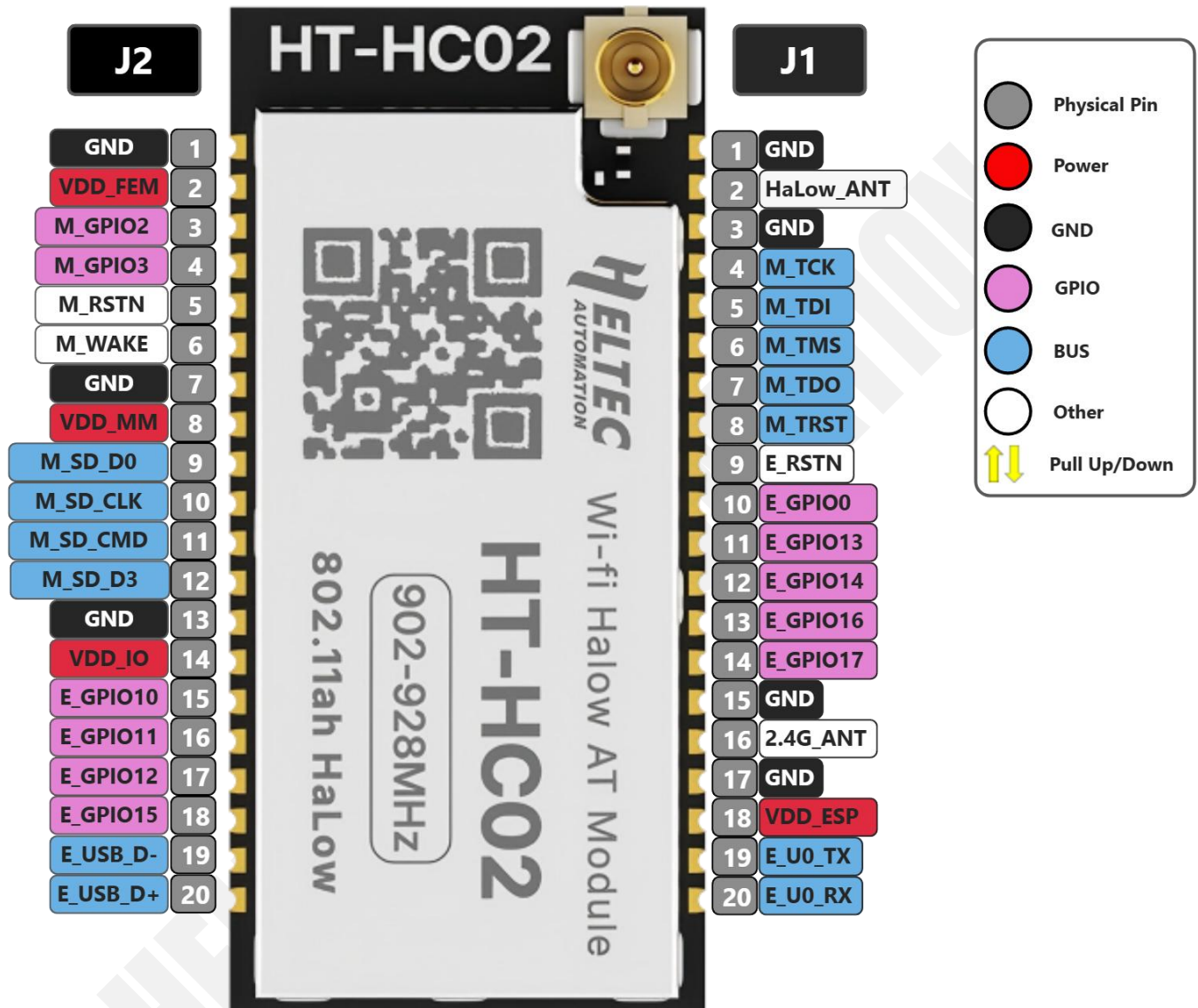
1.3 Application

Wi-Fi HaLow can seamlessly integrate with traditional Wi-Fi or Ethernet networks and is suitable for most IoT scenarios, especially those requiring long-range high-speed transmission

- Remote camera monitoring
- Industrial automation control
- Asset management and tracking
- Smart home
- Smart city
- Smart farming
- Construction Site Management
- Wi-Fi/Ethernet/Wi-Fi_HaLow extension and bridging
- WiFi HaLow device development
- Proximity sensors
- Rural internet access
- Autonomous driving
- Mobile phone location
- Environmental monitoring
- Unmanned supermarket
- Commodity management
- Intelligent lighting controls
- Digital transformation of legacy equipment

2. Pin Description

2.1 Pin Layout



2.2 Pin description

J1

NO.	Name	Type	Description
1	GND	Ground	Ground
2	Halow_ANT	RF	Wi-Fi HaLow Antenna
3	GND	Ground	Ground
4	M_TCK	I/O	MM6108 JTAG TCK
5	M_TDI	I/O	MM6108 JTAG TDI
6	M_TMS	I/O	MM6108 JTAG TMS
7	M_TDO	I/O	MM6108 JTAG TDO
8	M_TRST	I/O	MM6108 JTAG Reset
9	E_RSTN	I	ESP32 Reset, Active low
10	E_GPIO0	I/O	ESP32 GPIO0
11	E_GPIO13	I/O	ESP32 GPIO13
12	E_GPIO14	I/O	ESP32 GPIO14
13	E_GPIO16	I/O	ESP32 GPIO16
14	E_GPIO17	I/O	ESP32 GPIO17
15	GND	Ground	Ground
16	2.4G_ANT	RF	ESP32 2.4G Antenna
17	GND	Ground	Ground
18	VDD_ESP	Power	ESP32 Power
19	E_U0_TX	I/O	ESP32 UART0_TX, ESP32 GPIO43
20	E_U0_RX	I/O	ESP32 UART0_RX, ESP32 GPIO44

J2

NO.	Name	Type	Description
1	GND	Ground	Ground
2	VDD_FEM	Power	FEM Power
3	M_GPIO2	I/O	MM6108 GPIO2
4	M_GPIO3	I/O	MM6108 GPIO3
5	M_RSTN	I	MM6108 Reset, Active low
6	M_WAKE	I	MM6108 Wake
7	GND	Ground	Ground
8	VDD_MM	Power	MM6108 Power
9	M_SD_D0	I/O	MM6108 SDIO Data0
10	M_SD_CLK	I/O	MM6108 SDIO Clock
11	M_SD_CMD	I/O	MM6108 SDIO Command
12	M_SD_D3	I/O	MM6108 SDIO Data3
13	GND	Ground	Ground
14	VDO_IO	Power	MM6108 Digital IO Power
15	E_GPIO10	I/O	ESP32 GPIO10
16	E_GPIO11	I/O	ESP32 GPIO11
17	E_GPIO12	I/O	ESP32 GPIO12
18	E_GPIO15	I/O	ESP32 GPIO15
19	USB_D-	I/O	ESP32 USB_D-, ESP32 GPIO19
20	USB_D+	I/O	ESP32 USB_D+, ESP32 GPIO20

3. Specifications

3.1 Generic Parameter

Table 3.1 General specification

Parameters	Description
MCU	ESP32-S3FN8
Memory	384KB ROM; 512KB SRAM; 16KB RTC SRAM; 8MB Flash
Chip	MM6108IQ
Wi-Fi Standard	IEEE 802.11ah
Frequency	902~928 MHz
Bandwidth	1/2/4/8MHz
Max. output power	21±1 dBm
Power Supply	3.3, ≥500mA
Interface	IPEX4.0(WiFi HaLow ANT); 2*20*1.27 Header Pins
Operating temperature	-40 ~ +85°C
Operating humidity	10% ~ 90%, no-condensing
Dimensions	32*15*2.7mm

3.3 Power Parameters

3.3.1 Recommended Operating Conditions

Parameter	Min	Typical	Max	Unit
VDD_ESP	3.0	3.3	3.6	V
VDD_FEM	3.0	3.3	3.6	V
VDD_MM	3.0	3.3	3.6	V
VDD_IO	1.62	3.3	3.6	V

3.3.2 Power Consumption

Parameter	Condition VDD_ESP/FEM/MM/IO=3.3V	Min	Typical	Max	Unit
TX current	1M MCS0@21dBm		225		mA
TX current	1M MCS7@17dBm		155		mA
TX current	2M MCS0@21dBm		212		mA
TX current	2M MCS7@17dBm		135		mA
TX current	4M MCS0@21dBm		193		mA
TX current	4M MCS7@17dBm		131		mA
TX current	8M MCS0@21dBm		184		mA
TX current	8M MCS7@17dBm		128		mA
RX current			75		mA
Sleep current			2		mA

3.4 RF Specifications

3.4.1 Receiver sensitivities

Table3.4.1 Receiver sensitivities

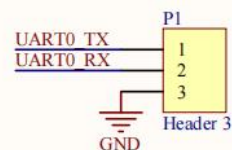
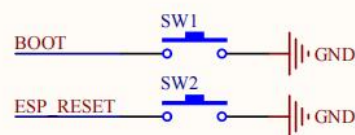
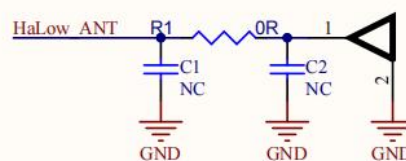
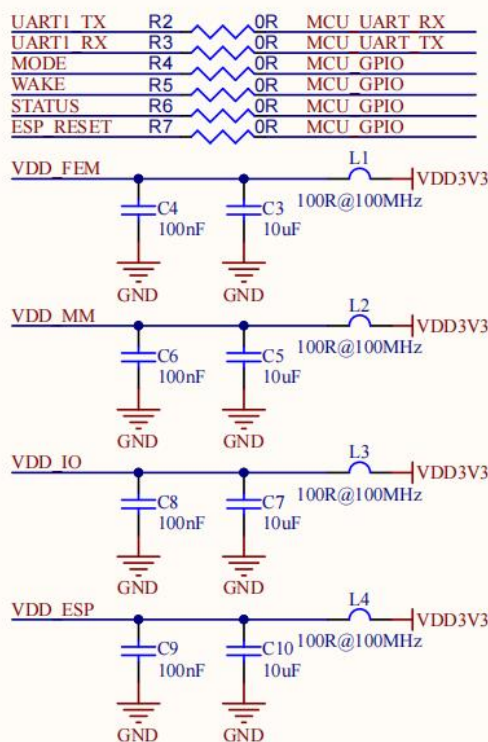
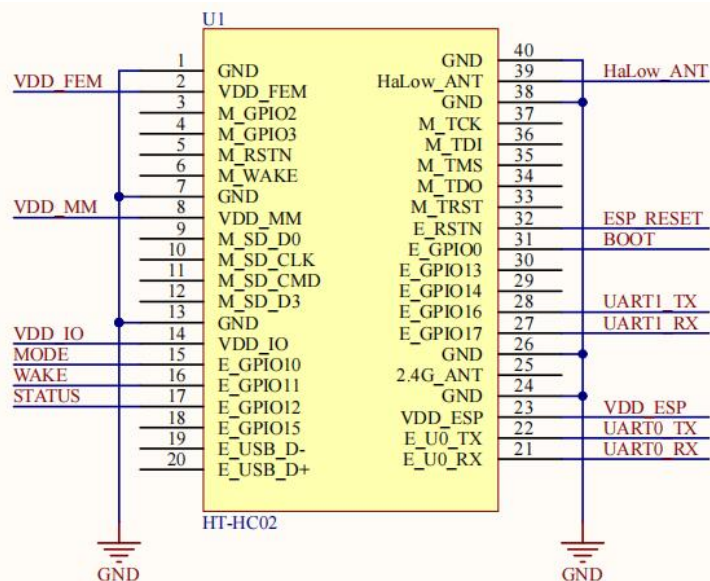
	1 MHz	2 MHz	4 MHz	8 MHz
MCS0	-105	-103	-100	-96
MCS1	-102	-100	-96	-92
MCS2	-99	-97	-94	-90
MCS3	-96	-94	-90	-87
MCS4	-93	-90	-87	-84
MCS5	-89	-87	-83	-79
MCS6	-88	-85	-82	-78
MCS7	-86	-83	-80	-76

3.4.2 Transmitter Power

Table3.4.2 Transmitter power

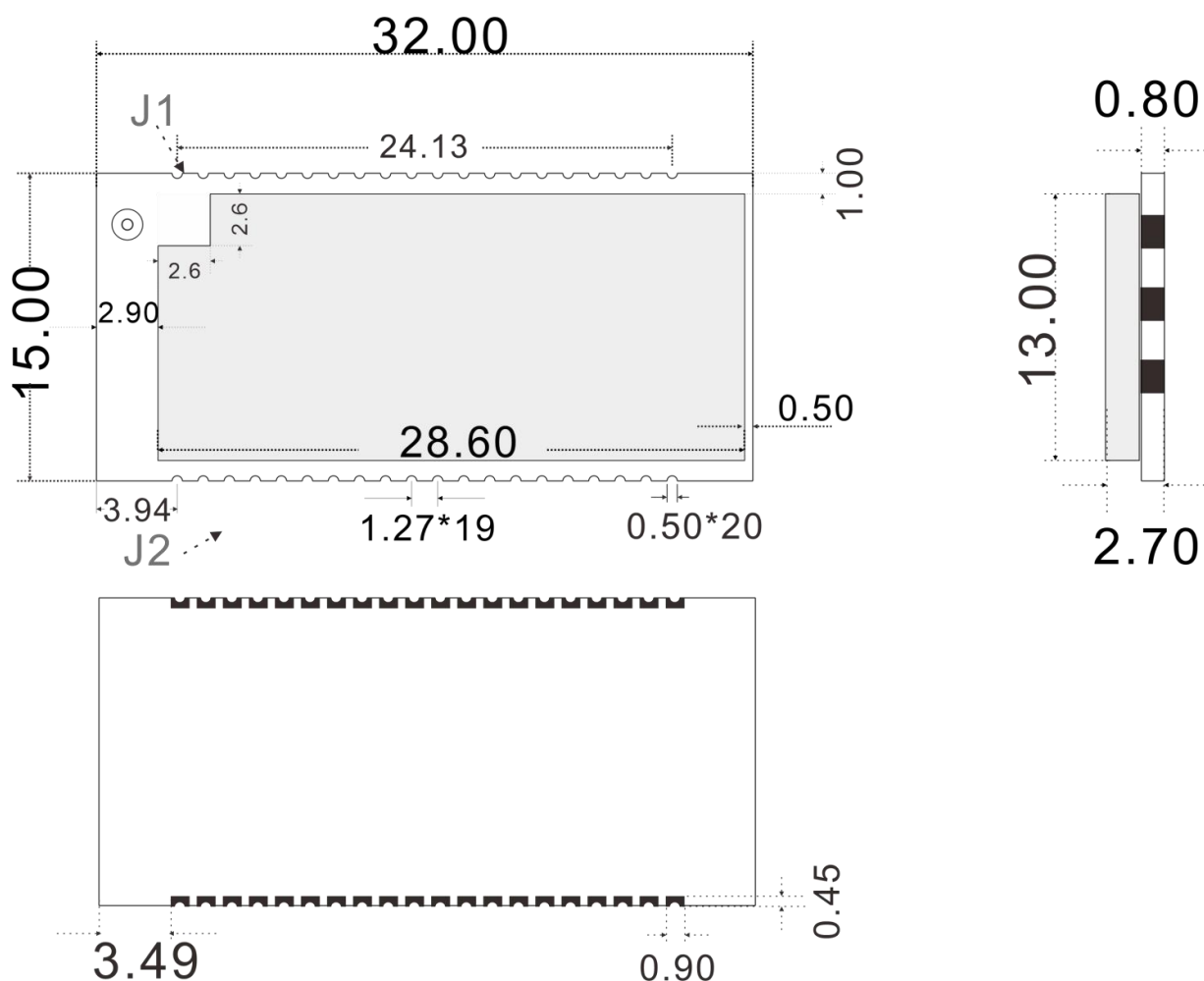
BW		Min(dBm)	Typical(dBm)	Max(dBm)
1MHz	MCS0	20	21	22
	MCS7	16	17	18
2MHz	MCS0	20	21	22
	MCS7	16	17	18
4MHz	MCS0	20	21	22
	MCS7	16	17	18
8MHz	MCS0	20	21	22
	MCS7	16	17	18

4. HT-HC02 Reference Design

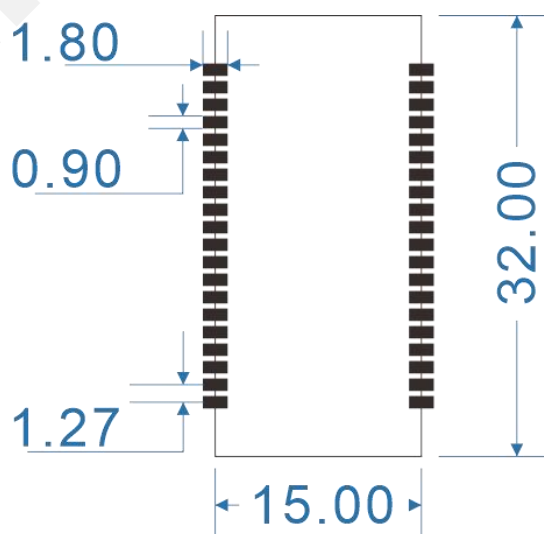


5. Hardware Dimensions

5.1 Dimension



5.2 Recommended Footprint



6. Resource

6.1 Relevant resource

- [HC02 Design&User Guide](#)
- [Heltec Module Footprint/HT-HC02](#)
- [AT Command Manual](#)

6.2 Heltec Contact Information

Heltec Automation Technology Co., Ltd

Chengdu, Sichuan, China

Email: support@heltec.cn

Phone: +86-028-62374838

<https://heltec.org>