HT-HC01P

WiFi HaLow Module

With Mini PCIe Interface

Document version

Version	Time	Description	Remark
Rev. 1.0	2024-10-16	P-Development version	Richard

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Content

1 Description

1.1 Overview

HT-HC01P is a mini PCIe interface version of the HC01 Wi-Fi Hallow module, which greatly simplifies its application on PCBs. It operates at a frequency range of 902–928 MHz, with a maximum data rate of 32.5 Mbps and a transmission range of up to 1–2 km. It includes an ultra-long-range PA, a high-linearity LNA, a T/R switch, and a 32 MHz crystal oscillator.

Compliant with the IEEE 802.11ah standard, it allows for extended sleep and idle states without frequent wake-ups, significantly reducing power consumption. This makes it an ideal choice for IoT devices and other battery-powered applications.

1.2 Features

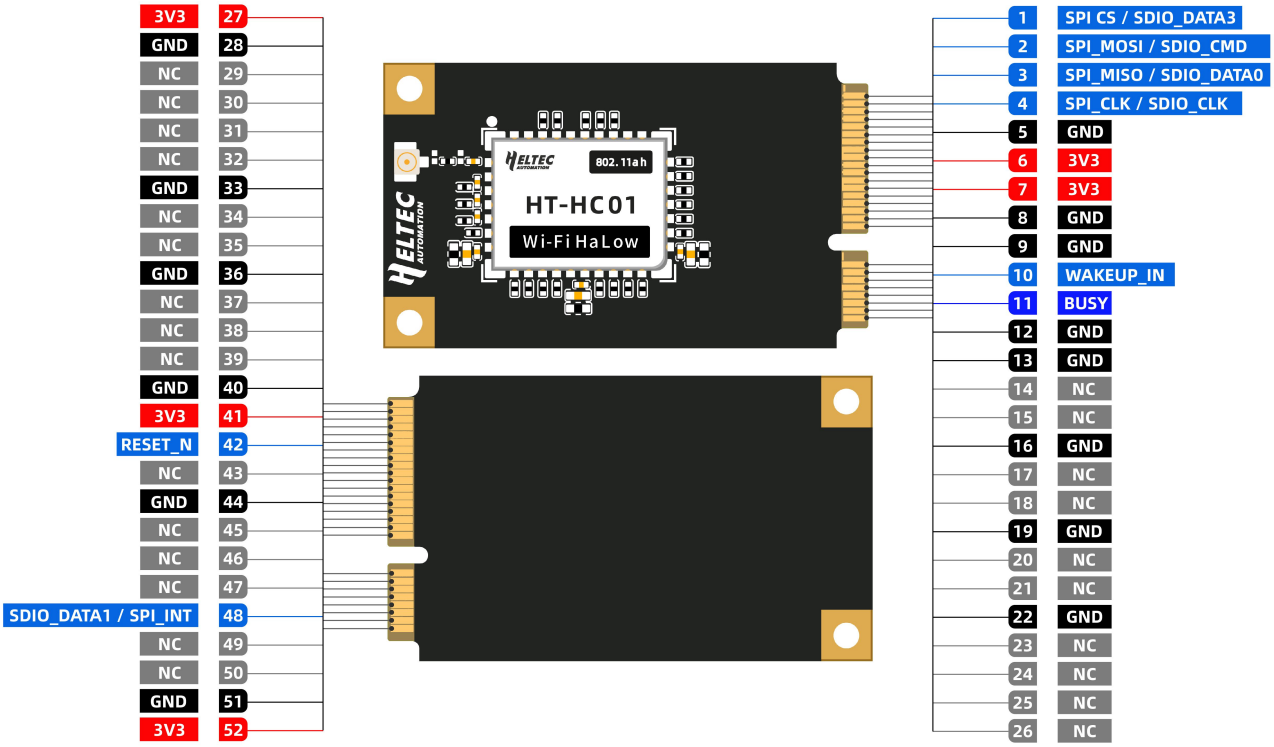
- Long-range transmission, up to 1km or and further within the visual distance.
- Channel bandwidth options of 1/2/4/8 MHz.
- High data rate, single-stream max rate of 32.5 Mbps @ 8 MHz or 15 Mbps @ 4 MHz.
- Support Sub-1 GHz frequency bands, frequency range: 902~928 MHz.
- Max output power:21dBm.
- 802. 11ah OFDM PHY supporting WFA HaLow certification.
- 802. 11ah MAC supporting WFA HaLow certification.
- Hibernate mode (internal / external wake).
- Integrated DC-DC converter supporting a voltage supply from 3.0V to 3.6V.
- Wide spectrum of security features.

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



J1

PAD	Description	Type
1	NC	
3	NC	
5	NC	
7	NC	
9	GND	
11	NC	
13	NC	
15	GND	

17	NC	
19	NC	
21	GND	
23	NC	
25	NC	
27	GND	
29	GND	
31	BUSY	
33	WAKEIP_IN	
35	GND	
37	GND	
39	3V3	
41	3V3	
43	GND	
45	SPI_CLK	SDIO_CLK
47	SPI_MISO	SDIO_DATA0
49	SPI_MOSI	SDIO_CMD
51	SPI_CS	SDIO_DATA3

J2

PAD	Description	Type
2	3V3	
4	GND	

6	NC	
8	NC	
10	SPI_INT	SDIO_DATA1
12	NC	
14	NC	
16	NC	
18	GND	
20	NC	
22	RESET_N	
24	3V3	
26	GND	
28	NC	
30	NC	
32	NC	
34	GND	
36	NC	
38	NC	
40	GND	
42	NC	
44	NC	
46	NC	
48	NC	
50	GND	

52	3V3	

3 Specifications

3.1 General Specifications

Table 3.1 General specifications

Parameters	Description
Main Chip	MM6108IQ
WiFi Standard	IEEE 802.11ah
Frequency Band	902-928MHz
Modulation Mode	OFDM,BPSK, QPSK, 16QAM, 64QAM
Band Width	1/2/4/8MHz
Power Supply Voltage	3.3V
Operating temperature	-40 ~ 85℃
Connector	Mini PCIe
Antenna Connector	IPEX1.0
Operating humidity	10% ~ 90%, no-condensing
Dimensions	50.95*30.00*3.75 mm
Max Data Rate	32.5 Mbps @ 8 MHz

3.2 Electrical characteristics

3.2.4.1 Transmit power consumption

Table3.2.4.1 Transmit power consumption

Mode	Condition: $V_{BAT}/V_{VDDIO}/V_{DD\_FEM}$=3.3V, 102.4ms Beacon Interval	VBAT Current			VDD_FEM			Unit
		Min	TYP	Max	Min	TYP	Max	
Transmit current (MCS0, 21dBm, 100% D.C.)	1 MHz channel	54	57	73	151	152	162	mA
	2 MHz channel	54.5	60	73	150.5	152	159.5	mA
	4 MHz channel	60.5	66	79.5	146.5	151	156	mA
	8 MHz channel	71	78	91.5	142.5	147	153	mA
Transmit current (MCS7,17dBm, 100% D.C.)	1 MHz channel	48	51	62.5	98.5	104	112	mA
	2 MHz channel	51.5	55	66.5	97.5	104	112	mA
	4 MHz channel	57	62	73	93.5	102	108.5	mA
	8 MHz channel	68	72	84	91	99	105.5	mA

3.2.4.2 Receive power consumption

Table3.2.4.2 Receive power consumption

Mode	Condition VBAT/VDDIO/VDD_FEM=3.3V	VBAT Current			VDD_FEM			Unit
		Min	TYP	Max	Min	TYP	Max	
Listen	1 MHz channel	25	26	35.5	4	4.5	4.7	mA
	2 MHz channel	26	28	35				
	4 MHz channel	30	32	40				

	8 MHz channel	35	37	45.5				
Active receive MCS7	1 MHz channel	26.5	26	35.5				
	2 MHz channel	30	30	39.5				
	4 MHz channel	37.5	40	49				
	8 MHz channel	54	53	67				
Active receive MCS0	1 MHz channel	28	26	37				
	2 MHz channel	29.5	28	38.5				
	4 MHz channel	36	36	47				
	8 MHz channel	50	48	62.5				

3.2.4.3 Sleep Power

Table3.2.4.3 Sleep power

Mode	Condition VBAT/VDDIO/VDD_FEM =3.3V	VBAT			VFEM			Unit
		Min	TYP	Max	Min	TYP	Max	
Snooze	RC Oscillator on, Memory retained, configurable wake up timer	9.5	27	370	0.001	0.05	0.55	μA
Deep sleep	RC Oscillator on, configurable wake up timer	0.8	1	1.8	0.001	0.05	0.55	μA
Hibernate	Power off, wait for external interrupt	0.03	0.05	1	0.001	0.05	0.55	μA

3.2.4.3 DTIM3 power consumption

Table3.2.4.3 DTIM3 power consumption

Mode	Condition: $V_{BAT}/V_{VDDIO}/V_{DD\_FEM}$=3.3V, 102.4ms Beacon Interval	VBAT			VFEM			Unit
		Min	TYP	Max	Min	TYP	Max	
S1G beacons	1 MHz channel	380	395	420	45	47	55	μA
	2 MHz channel	380	395	420	45	47	55	μA
	4 MHz channel	260	280	320	24	25	30	μA
	8 MHz channel	260	280	320	24	25	30	μA
S1G beacons with proprietary	1 MHz channel	170	190	250	12	13	43	μA
	2 MHz channel	170	190	250	12	13	43	μA

DTIM signaling1	4 MHz channel	155	190	200	8	9	20	µA
	8 MHz channel	155	190	200	8	9	20	µA

3.2.4.4 DTIM10 power consumption

Table3.2.4.4 DTIM10 power consumption

Mode	Condition: $V_{BAT}/V_{DDIO}/V_{DD\_FEM}$=3.3V, 102.4ms Beacon Interval	VBAT			VFEM			Unit
		Min	TYP	Max	Min	TYP	Max	
S1G beacons	1 MHz channel	140	155	240	14	15	16	µA
	2 MHz channel	140	155	240	14	15	16	µA
	4 MHz channel	100	115	130	8	8	9	µA
	8 MHz channel	100	115	130	8	8	9	µA
S1G beacons with proprietary DTIM signaling2	1 MHz channel	85	95	195	4	5	6	µA
	2 MHz channel	85	95	195	4	5	6	µA
	4 MHz channel	75	90	110	3	5	6	µA
	8 MHz channel	75	90	110	3	5	6	µA

3.3 RF characteristics

3.3.1 Receiver sensitivities

Table3.3.1 Receiver sensitivities

MCS index	Modulation scheme	Coding rate	Phy rate (kbps) per BW				Minimum Receive sensitivity (dBm) per BW			
			1MHz	2MHz	4MHz	8MHz	1MHz	2MHz	4MHz	8MHz
0	BPSK	1/2	333	722	1500	3250	-105	-103	-101	-97
1	QPSK	1/2	667	1444	3000	6500	-102	-100	-97	-93
2	QPSK	3/4	1000	2167	4500	9750	-99	-97	-95	-91
3	16-QAM	1/2	1333	2889	6000	13000	-96	-94	-91	-88
4	16-QAM	3/4	2000	4333	9000	19500	-93	-90	-88	-85
5	64-QAM	2/3	2667	5778	12000	26000	-89	-87	-84	-80
6	64-QAM	3/4	3000	6500	13500	29250	-88	-85	-83	-79
7	64-QAM	5/6	3333	7222	15000	32500	-87	-84	-81	-77
10	BPSK	1/2 x 2	167	N/A			-107	N/A		

3.3.2 Transmission power

Table3.3.2 Transmission power

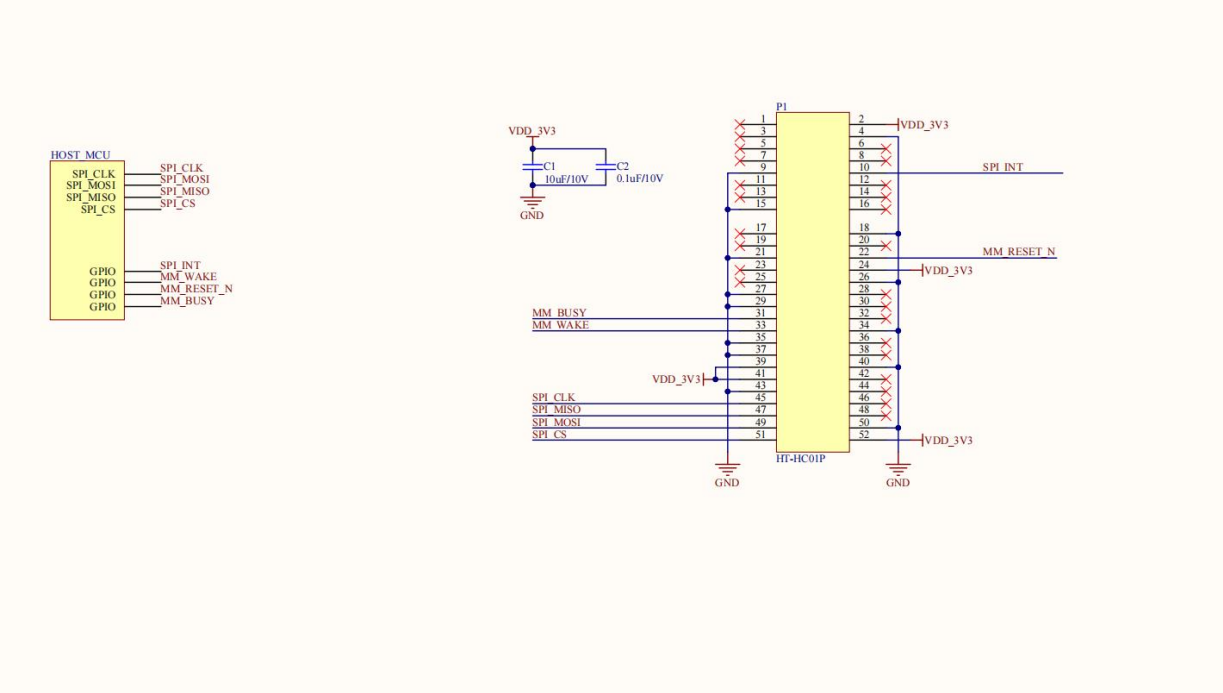
Tx output power (1, 2 MHz BW)	Min (dBm)	Typical (dBm)	Max (dBm)
MCS 0	20	21	22
MCS 7	16	17	18.5
Tx output power (4 MHz BW)	**Min (dBm)**	**Typical (dBm)**	**Max (dBm)**
MCS 0	20.5	21	22
MCS 7	16	17	18
Tx output power (4 MHz BW)	**Min (dBm)**	**Typical (dBm)**	**Max (dBm)**
MCS 0	20.5	21	22
MCS 7	16	17	18

4 Reference Design

When selecting a CPU host to interface via SPI, consider the following recommendations to achieve the best throughput:

- The host should support level-triggered interrupts.
- The host should support full-duplex SPI mode.
- The host should support DMA backed transactions on the SPI bus.

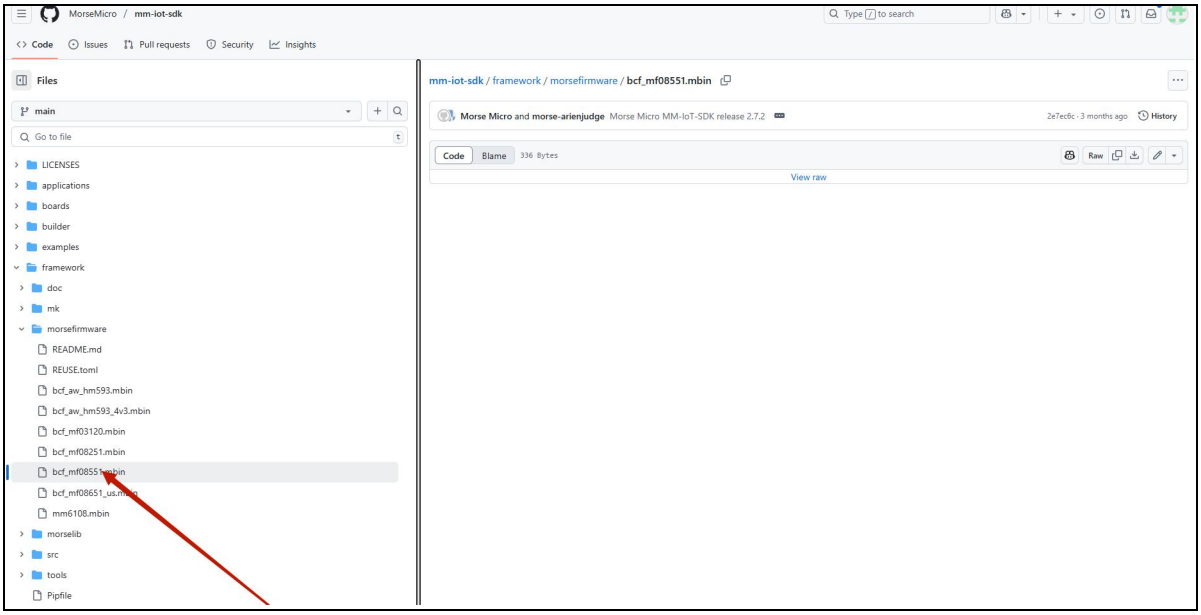
Standard SPI can achieve up to 25 Mbps at 50 MHz but this will reduce significantly if there is no DMA support. For example, an SPI interface with an 8-byte buffer per transaction might only achieve 2Mbps throughput on the SPI bus.



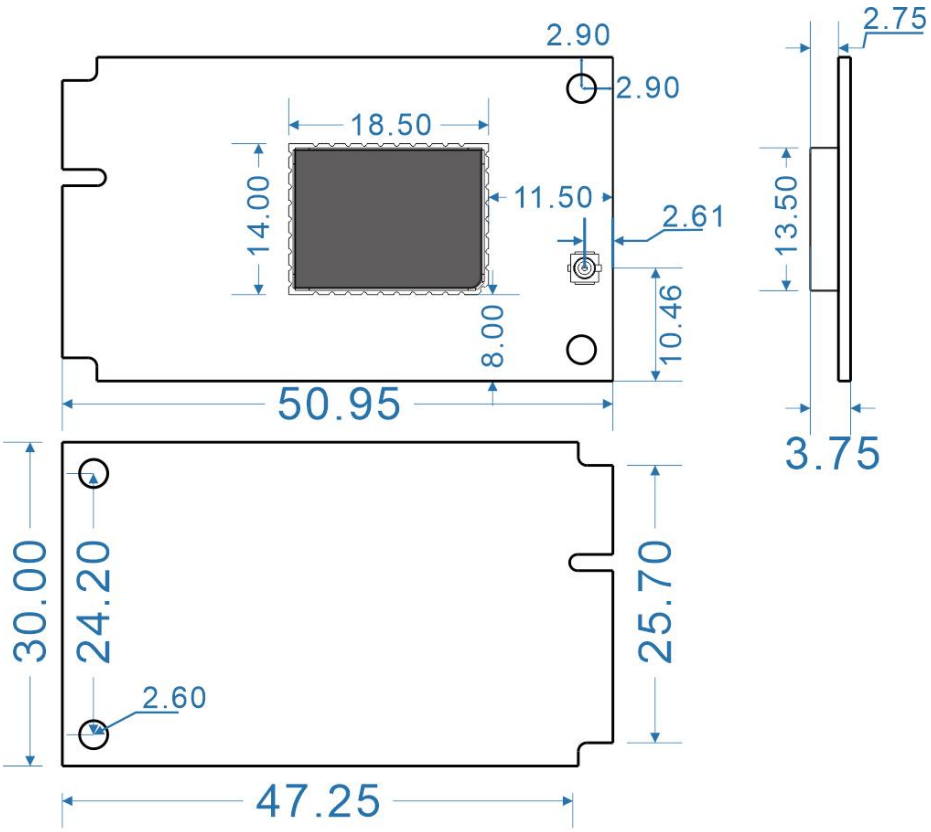
5 SDK

Morse Micro

We recommend using the official Morse Micro development environment. Please ensure to select the "bcf_mf08551.bin" configuration file, as other configuration files may result in abnormal RF power output.



6 Hardware Dimensions



7 Resource

7.1Relevant resources

- Documents Page: Heltec Products Operation Documention
- Reference Design: https://resource.heltec.cn/download/HT-HC01P/Reference_design

7.2 Heltec Contact Information

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