



HT-HR01

Pi-CamLow

Raspberry Pi HAT

with Camera and Wi-Fi HaLow



<https://heltec.org>

Document version

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

Pi-CamLow	1
Document version	2
Copyright Notice	2
Disclaimer	2
Content	3
1 Description	4
1.1 Overview	4
1.2 Features	5
2. Pin description	6
3 Specifications	8
3.1 Generic Parameter	8
3.2 Wi-Fi HaLow Parameters	8
3.3 RF Characteristics	11
3.4 Camera Parameters	12
4 Get Started	13
5 Hardware Dimensions	14
5.1 Board dimensions (unit: mm)	14
6 Resource	15
6.1 Relevant resource	15
6.2 Heltec Contact Information	15

1 Description

1.1 Overview

Pi-CamLow is a Raspberry Pi HAT(Hardware Attached on Top) that integrates Wi-Fi HaLow module and a 5MP camera. Using the firmware we provided, the board allows you to transfer camera data remotely at high speed through Wi-Fi HaLow technology, while running Wi-Fi HaLow bridge, gateway, Mesh networking, and other functions^①.

The HT-HC01 module provides Wi-Fi HaLow communication for Pi-CamLow. This module operates in the 902-928 MHz frequency band, in compliance with the IEEE 802.11ah standard. It offers a maximum transmission speed of 32.5Mbps@8M, a maximum transmission power of 21 dBm, and a transmission range of 1–2 km.

We believe that the excellent data transfer of Wi-Fi HaLow combined with the powerful camera will provide more possibilities for your Raspberry PI development and application.

^① The current firmware version tests are all conducted on Raspberry PI 4B.

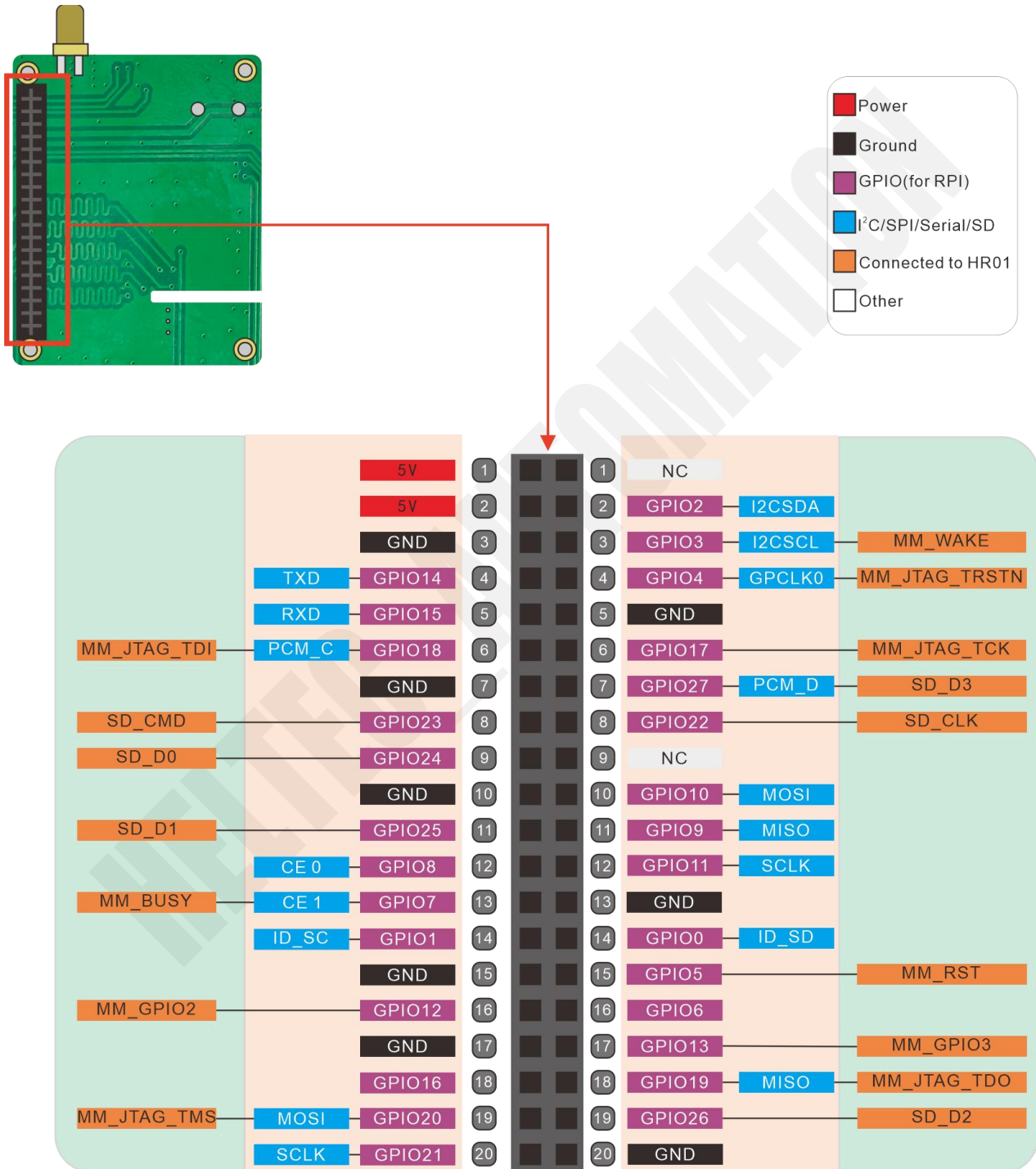
1.2 Features

- Raspberry Pi HAT, onboard 40-pin Female Header, Specifically designed for Raspberry Pi, making integration and installation easy.
- **Provides firmware**
 - Compatible with Raspberry Pi.
 - Enable all key Wi-Fi HaLow functionalities.
 - Along with a camera display UI.
- **Excellent Wi-Fi HaLow RF performance**
 - Compliant with the IEEE 802.11ah standard, operating in the 902-928MHz frequency band.
 - Supports long-distance transmission, with a range of up to 1-2km.
 - High-speed transmission, with a maximum of 32 Mbps@8M and up to 150 kbps at extreme distances.
 - Low power consumption design with strong penetration capabilities, suitable for complex environments.
- **Powerful camera capabilities**
 - 5MP DVP camera.
 - Supports dynamic and static images at 2592x1944 resolution
 - Features a 62° field of view, F2.4 aperture, and 30FPS@24MHz video transmission.
 - Output formats include YCBCR4:2:2, RGB565, and RAWRGB.
 - Adopts 4G+IR650 optical structure with features such as auto exposure and auto gain control to meet diverse imaging needs.

<https://heltec.org>

2 Pin description

The pins on this HAT are fully compatible with the Raspberry Pi, so you only need to know the pin mapping between the module's functional pins and the Raspberry Pi pins



HT-HR01 and Raspberry Pi Pin Mapping

Raspberry pin	Function
GPIO7	MM_BUSY
GPIO12	MM_GPIO2
GPIO13	MM_GPIO3
GPIO22	SD_CLK
GPIO23	SD_CMD
GPIO24	SD_D0
GPIO25	SD_D1
GPIO26	SD_D2
GPIO27	SD_D3
GPIO17	MM_JTAG_TCK
GPIO20	MM_JTAG_TMS
GPIO18	MM_JTAG_TDI
GPIO19	MM_JTAG_TDO
GPIO4	MM_JTAG_TRSTN
GPIO3	MM_WAKE
GPIO5	MM_RST

3 Specifications

3.1 General Parameter

Table 3.1 General specification

Parameters	Description
Wi-Fi HaLow Module	HT-HC01
Wi-Fi HaLow	IEEE 802.11ah
Interface	2*20 female Header Pins, SMA ANT connector
Power supply	5V
Operating temperature	-20~ +70°C ^②
Operating humidity	10% ~ 90%, no-condensing
Dimensions	65*56mm

3.2 Wi-Fi HaLow Parameters

3.2.1 Wi-Fi HaLow general parameters

Table 3.2.1 Wi-Fi HaLow general parameters

Parameter	Description
Module	HT-HC01
Wi-Fi Standard	IEEE 802.11ah
Frequency	902-928 MHz
Data Rate	32.5 Mbps @ 8 MHz
Band Width	1/2/4/8MHz

^② This temperature is the optimal temperature range for the camera to work.

Receiver sensitivities	Table3.2.3
Transmitter Power	Table3.2.4

3.2.2 Wi-Fi HaLow Transmit power consumption

Table3.2.2 Transmit power consumption

Mode	Condition: V _{BAT} /V _{DDIO} /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

3.2.3 Wi-Fi HaLow Receive power consumption

Table3.2.3 Receive power consumption

Mode	Condition V _{BAT} /V _{DDIO} /V _{DD_FEM} =3.3V	VBAT Current			VDD_FEM			Unit
		Min	TYP	Max	Min	TYP	Max	
Listen	1 MHz channel	25	26	35.5				mA
	2 MHz channel	26	28	35				mA

<https://heltec.org>

	4 MHz channel	30	32	40				mA
	8 MHz channel	35	37	45.5				mA
Active receive MCS7	1 MHz channel	26.5	26	35.5	4	4.5	4.7	mA
	2 MHz channel	30	30	39.5				mA
	4 MHz channel	37.5	40	49				mA
	8 MHz channel	54	53	67				mA
Active receive MCS0	1 MHz channel	28	26	37				mA
	2 MHz channel	29.5	28	38.5				mA
	4 MHz channel	36	36	47				mA
	8 MHz channel	50	48	62.5				mA

3.2.4 Sleep Power

Table3.2.4.2 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

3.3 RF Characteristics

3.4.1 Receiver sensitivities

Table3.4.1 Receiver sensitivities

Minimum Receive sensitivity (dBm) per BW			
1 MHz	2 MHz	4 MHz	8 MHz
-105	-103	-101	-97
-102	-100	-97	-93
-99	-97	-95	-91
-96	-94	-91	-88
-93	-90	-88	-85
-89	-87	-84	-80
-88	-85	-83	-79
-87	-84	-81	-77
-107	N/A		

3.4.2 Transmitter Power

Table3.4.1 Transmitter power

BW		Min(dBm)	Typical(dBm)	Max(dBm)
1/2MHz	MCS 0	20	21	22
	MCS 7	16	17	18.5
4MHz	MCS 0	20.5	21	22
	MCS 7	16	17	18
8MHz	MCS 0	20.5	21	21.5
	MCS 7	15.5	17	17.5

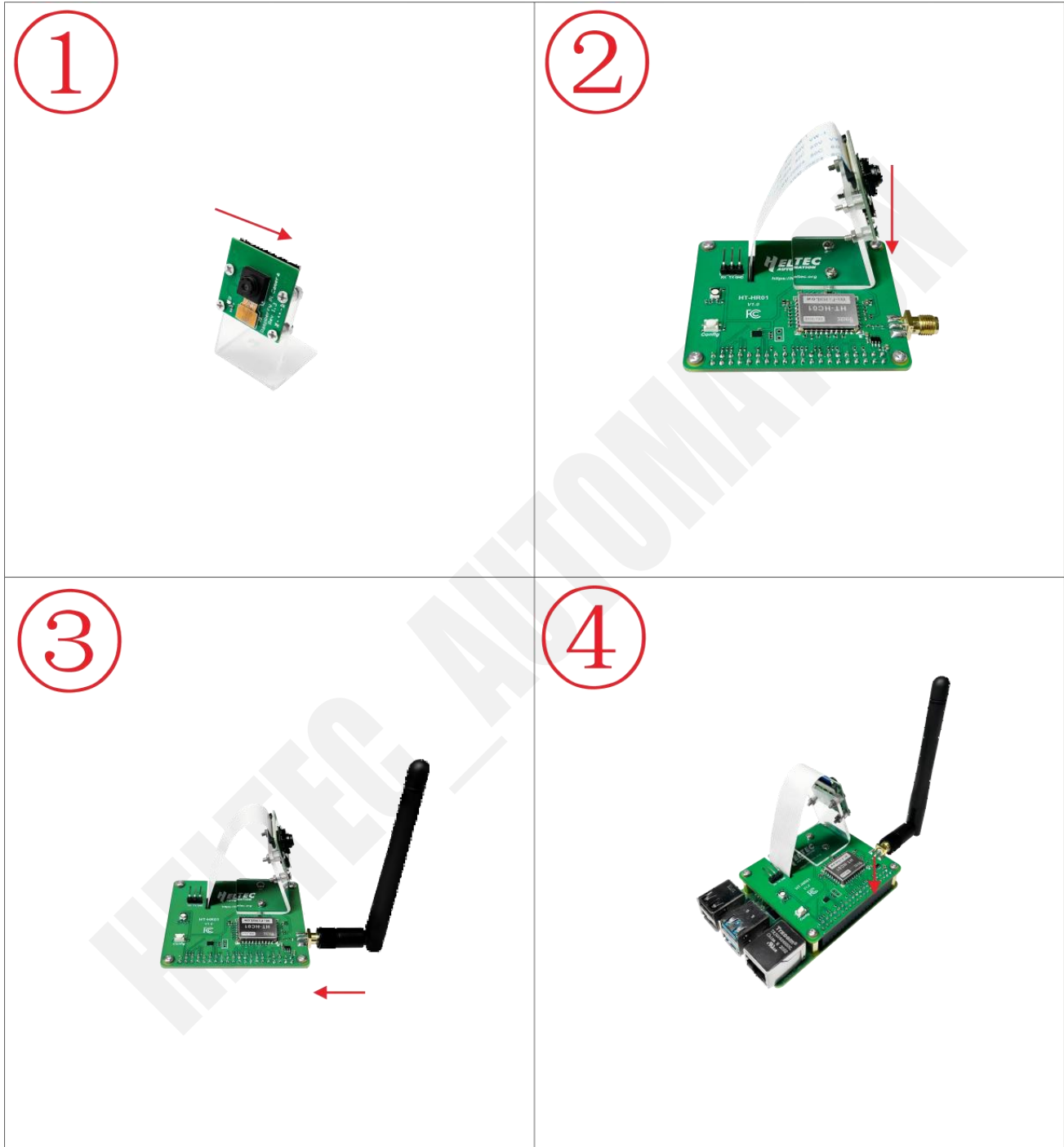
3.4 Camera Parameters

Table 3.4 Camera parameters

Parameter	Description
Pixel Resolution	5MP
Interface	DVP
resolution	2592x1944
image format	VGA
Color Depth	24-bit true color
Focusing Range	0.3mm
Optical Structure	4G+IR650
Field of View (FOV)	62°
Aperture	F2.4
Distortion	<1%
Image Transmission Rate	30FPS@24MHz
Output Signals	YCBCR4:2:2, RGB565, RAWRGB
Operating Voltage	1.7V~3.0V
Operating Temperature	-20°C to 70°C
Power Consumption	90mW (active), 30μW (standby)
Camera PCB Dimension	25*24*9mm ³

4 Get Started

4.1 Hardware connection



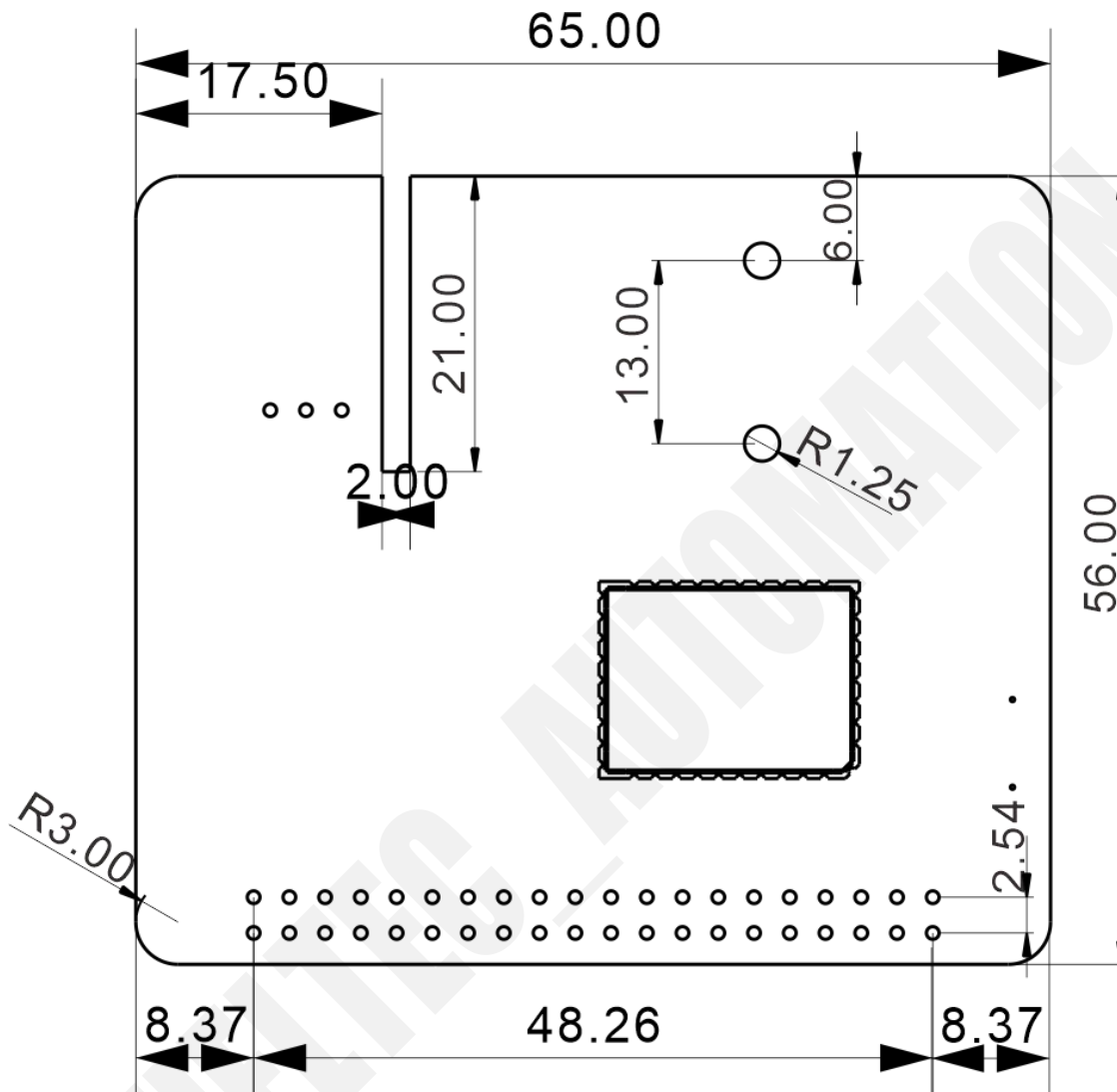
4.2 Firmware instructions and getting Started guide

Please refer to the [Pi-CamLow usage guide](#)

<https://heltec.org>

5 Hardware Dimensions

5.1 PCB dimensions (unit: mm)



6 Resource

6.1 Relevant resource

- Documents Page: [Heltec Products Operation Documentation](#)
- Schematic diagram: [Listing directory /download/HT-HR01/Schematic_diagram](#)
- Resource station: resource.heltec.cn

6.2 Heltec Contact Information

Heltec Automation Technology Co., Ltd

Chengdu, Sichuan, China

Email: support@heltec.cn

Phone: +86-028-62374838

<https://heltec.org>