

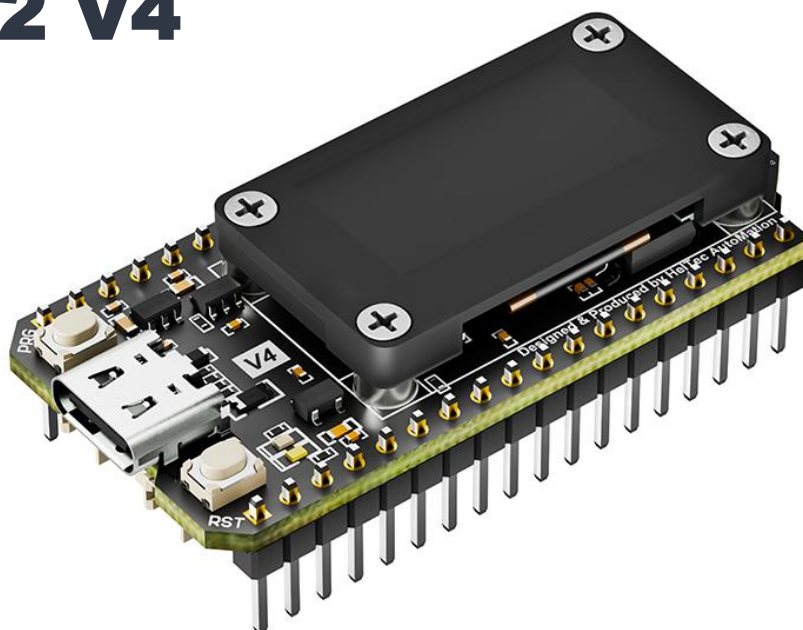


WiFi LoRa 32 V4

Wi-Fi/Bluetooth/LoRa

Battery Management

0.96inch OLED





Document Version

Version	Time	Description	Remark
V4.1.0	2025-08-11	Internal beta version	Richard
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1. Introduction

1.1 Overview

Heltec WiFi LoRa 32 V4 is a fully upgraded version of the classic LoRa development board. Since its initial launch in 2017, this product series has been highly favored by developers and makers. Building upon the powerful features of its predecessors, the V4 version introduces comprehensive optimizations in Transmit Power, power management, expandability and other hardware design. It is suitable for various IoT applications such as smart cities, agricultural monitoring, smart homes, industrial control, security systems, and wireless meter reading, providing developers with a more efficient and flexible development experience.

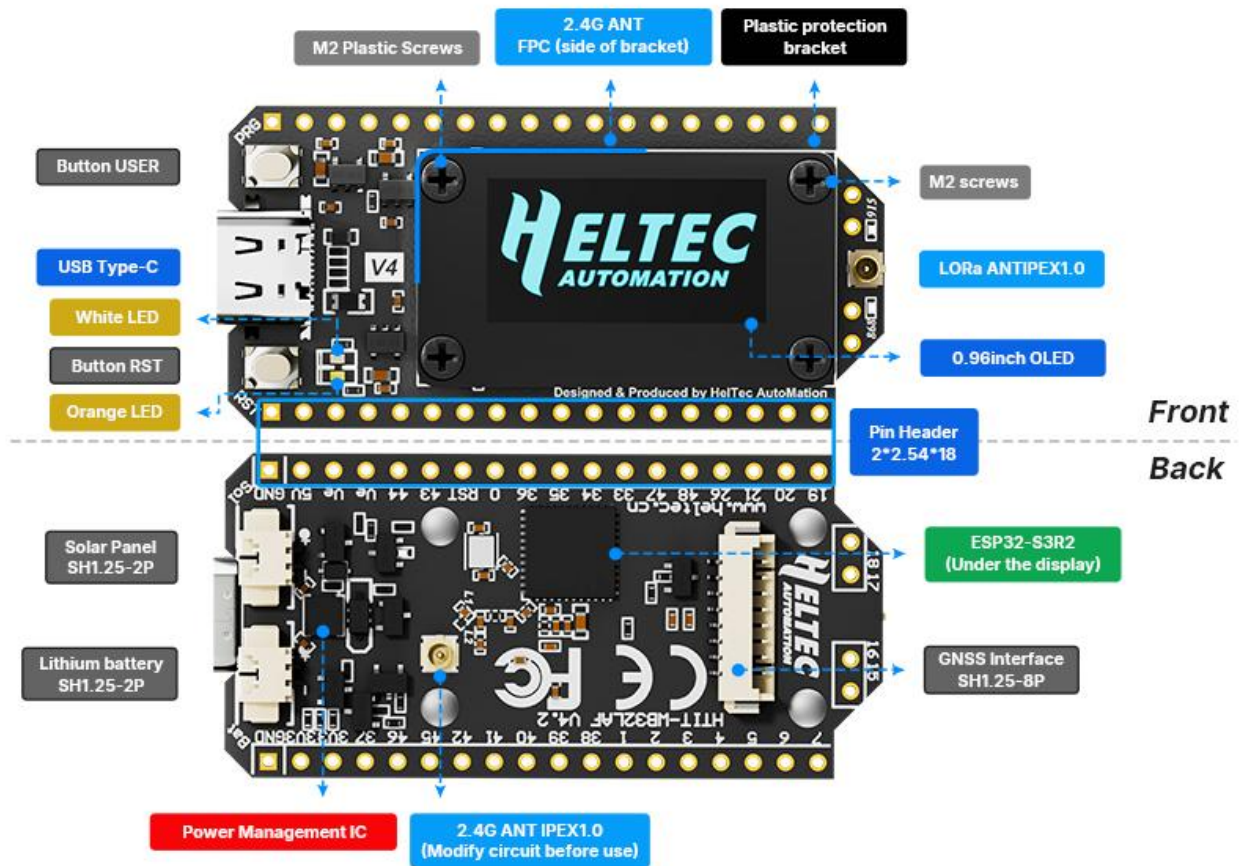
1.2 Features

- Base on **ESP32-S3R2 & SX-1262**, supports **Wi-Fi b/g/n, BLE**, and **LoRa** communication.
- **2MB PSRAM** and **16MB external Flash**, more suitable for UI and complex system .
- Form factor and **pin compatibility** with WiFi LoRa 32 V3.
- PC **casing protects** the screen and integrates **FPC 2.4G antenna**.
- Added SH1.25-2P **solar panel interface**.
- Optimized **lithium battery management**.
- Added SH1.25-8Pin **GNSS interface**.
- **USB Type-C** interface with integrated voltage regulation, ESD protection, short-circuit protection, and RF isolation design;
- Low power consumption is less than **20μA**.

1.3 Application Scenarios

- Environmental Sensor
- Industrial Internet of Things
- Asset Tracking
- Remote Meter Reading
- Smart Agriculture
- Wireless Alarm
- Innovative Projects and Geek Application

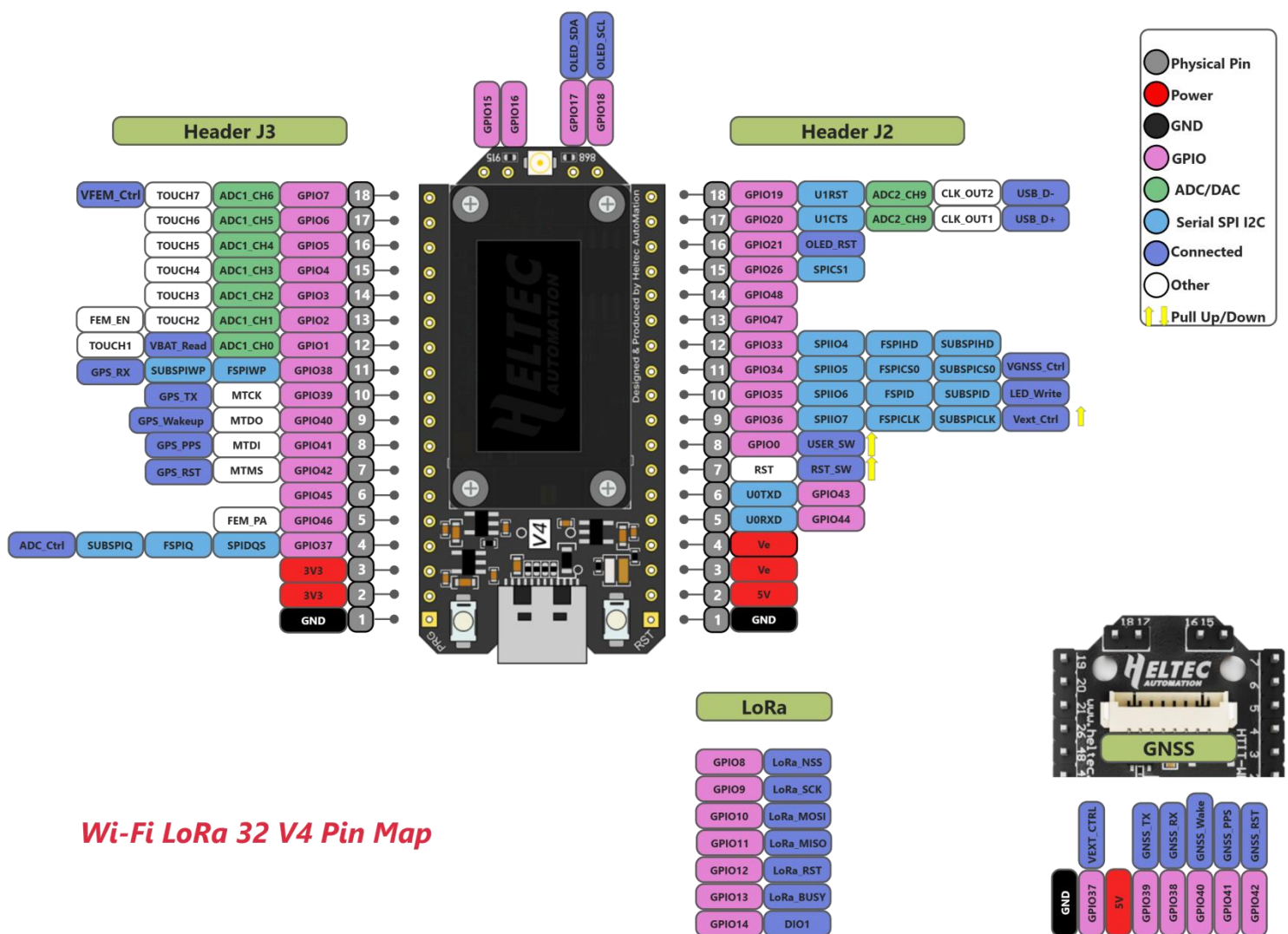
1.4 Components



2. Pin Definition

2.1 Pin Layout

The following figure shows some common information and descriptions of the WiFi LoRa 32 pins. For more detailed functional information about each pin, please refer to the ESP32 chip manual. [ESP32-S3 MCU Datasheet](#).



Wi-Fi LoRa 32 V4 Pin Map

2.2 Pin Description

2.2.1 Header J2

Table 2.2.1: Pin description

No.	Name	Type				Function
1	GND	G				Ground
2	5V	P				5V Power Supply
3	Ve	P				Output 3.3V
4	Ve	P				Output 3.3V
5	RX	I/O			IO MUX	GPIO44 , U0RXD
6	TX	I/O			IO MUX	GPIO43 , U0TXD
7	RST	I				CHIP_PU, Reset Button
8	0	I/O			IO MUX	GPIO0 , PRG Button
9	36	I/O			IO MUX	GPIO36 , SPIIO7, FSPICLK, SUBSPICLK, Vext_Ctrl
10	35	I/O			IO MUX	GPIO35 , SPIIO6, FSPID, SUBSPID, LED
11	34	I/O			IO MUX	GPIO34 , SPIIO5, FSPICS0, SUBSPICS0
12	33	I/O			IO MUX	GPIO33 , SPIIO4, FSPIHD, SUBSPIHD
13	47	I/O			IO MUX	GPIO47 , SPICLK_P_DIFF, SUBSPICLK_P_DIFF
14	48	I/O			IO MUX	GPIO48 , SPICLK_N_DIFF, SUBSPICLK_N_DIFF
15	26	I/O			IO MUX	GPIO26 , SPICS1
16	21	I/O		RTC	IO MUX	GPIO21 , OLED RST
17	20	I/O	Analog	RTC	IO MUX	GPIO20 , U1CTS , ADC2_CH9 , USB_D+
18	19	I/O	Analog	RTC	IO MUX	GPIO19 , U1RTS , ADC2_CH8 , USB_D-

2.2.2 Header J3

Table 2.2.2: Pin description

No.	Name	Type				Function
1	GND	P				Ground.
2	3V3	P				3.3V Power Supply
3	3V3	P				3.3V Power Supply
4	37	I/O			IO MUX	GPIO37 , SPIDQS, FSPIQ, SUBSPIQ, ADC Ctrl
5	46	I/O			IO MUX	GPIO46
6	45	I/O			IO MUX	GPIO45
7	42	I/O			IO MUX	GPIO42 , MTMS, GNSS_RST
8	41	I/O			IO MUX	GPIO41 , MTDI, GNSS_PPS
9	40	I/O			IO MUX	GPIO40 , MTDO, GNSS_Wakeup
10	39	I/O			IO MUX	GPIO39 , MTCK, GNSS_TX
11	38	I/O			IO MUX	GPIO38 , FSPIWP, SUBSPIWP, GNSS_RX
12	1	I/O	Analog	RTC	IO MUX	GPIO1 , ADC1_CH0 , TOUCH1 , VBAT_Read ¹
13	2	I/O	Analog	RTC	IO MUX	GPIO2 , ADC1_CH1 , TOUCH2
14	3	I/O	Analog	RTC	IO MUX	GPIO3 , ADC1_CH2 , TOUCH3
15	4	I/O	Analog	RTC	IO MUX	GPIO4 , ADC1_CH3 , TOUCH4
16	5	I/O	Analog	RTC	IO MUX	GPIO5 , ADC1_CH4 , TOUCH5
17	6	I/O	Analog	RTC	IO MUX	GPIO6 , ADC1_CH5 , TOUCH6
18	7	I/O	Analog	RTC	IO MUX	GPIO7 , ADC1_CH6 , TOUCH7 , V_FEM_Control

¹ ADC1_CH0 is used to read the lithium battery voltage, the ADC_CTRL(37) pin needs to be pulled high. the voltage of the lithium battery is:

$$VBAT = 100 / (100+390) * VADC_IN1$$



2.2.3 Additional Pins

Table 2.2.3: Additional Pin

No.	Name	Type				Function
1	18	I/O	Analog	RTC	IO MUX	GPIO18 , OLED_SCL
2	17	I/O	Analog	RTC	IO MUX	GPIO17 , OLED_SDA
3	16	I/O	Analog	RTC	IO MUX	GPIO16 , XTAL_32K_N
4	15	I/O	Analog	RTC	IO MUX	GPIO15 , XTAL_32K_P

2.2.4 Peripherals (I2C/SPI/UART/I2S/PWM/etc.)

ESP32-S3 can integrates a rich set of peripherals. To learn more about on-chip components, please refer to [ESP32-S3 MCU Datasheet](#).

Owing to the **GPIO Matrix** and **IOMUX** capabilities, the vast majority of GPIO pins can be configured for functions such as I2C, SPI, I2S, PWM or UART. For specific pin assignments and IOMUX correspondences, please refer to the list of pins marked with IOMUX functionality in Appendix Tables [2.2.1](#) and [2.2.2](#).

Note: The original functionality of the reconfigured pins will be affected. Please select appropriate pins for your application. Such as OLED has occupied one I2C interface, while LoRa and Flash have each utilized a separate SPI interface.

3. Specifications

3.1 General specifications

Table 3.1: General specifications

Parameters	Description
Master Chip	ESP32-S3R2
LoRa Chip	SX-1262
Frequency	902~928 MHz
Max. Receiving Sensitivity	-137 dBm
Wi-Fi	802.11 b/g/n, up to 150Mbps
Bluetooth	Bluetooth LE, Bluetooth 5, Bluetooth mesh
OLED	SSD1315 (0.96Inch, 128*64 resolution)
Power Supply	5V@USB/Solar, 3.3-4.2V@Battery
Hardware Resource	7*ADC1 + 2*ADC2, 7*Touch, 3*UART, 2*I2C, 2*I2S, 4*SPI, etc.
Memory	384KB ROM; 512KB SRAM; 16KB RTC SRAM; 16MB Flash; 2MB PSRAM
Interface	USB Type-C; SH1.25-2P lithium battery interface; SH1.25-2P solar panel interface; 2*IPEX1.0 ANT(LoRa&2.4G); 2*18*2.54 Header Pins, 2*2*2.54 Header Pins
Operating Temperature	-40~85℃(OLED operating temperature: -40~ 70℃)
Dimensions	51.7 * 25.4* 10.7mm

3.2 Power Supply

USB or 5V can only be connected to one of them. When either USB or 5V input is connected, the solar panel and lithium battery can be connected simultaneously.



Table 3.2: Power supply

Power Supply Mode	Minimum	Typical	Maximum	Company
Type-C USB($\geq 500\text{mA}$)	4.7	5	6	V
Lithium battery($\geq 250\text{mA}$)	3.3	3.7	4.2	V
5V pin($\geq 500\text{mA}$)	4.7	5	6	V
3V3 pin($\geq 150\text{mA}$)	2.7	3.3	3.5	V
Solar Panel	4.7	5	6	V

3.3 Power Output

When using **VE** for external power supply, the **VextCtrl(GPIO36)** pin needs to be pulled high.

Table 3.3: Power output

Pin	Minimum	Typical	Maximum	Company
3.3V			500	mA
5V@USB			500	mA
Ve			500	mA



3.4 Power Consumption(25℃)

Table 3.4: Power consumption

Mode	Condition	Min.	Typical	Max.	Unit
WiFi Scan	USB powered		119		mA
WiFi AP	USB powered		170		mA
BT	USB powered		115		mA
TX	USB powered		750		mA
RX	TX disabled; RX enabled		75		mA
Sleep	USB powered		2		mA
	Battery powered		20		μ A
	3.3V header powered		20		μ A
Charging	USB@5V		500		mA

3.5 LoRa RF Characteristics

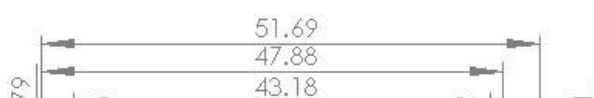
3.5.1Receiving Sensitivity

The following table gives typically sensitivity level.

Table3.5.2: Receiving sensitivity

Signal Bandwidth/[KHz]	Spreading Factor	Sensitivity/[dBm]
125	SF12	-137
125	SF10	-131
125	SF7	-122

4.Dimensions





5.FCC Statement

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 frequency 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.

To assure continued compliance, any changes or modifications not expressly approved by the party.

Responsible for compliance could void the user's authority to operate this equipment. (Example- use only shielded interface cables when connecting to computer or peripheral devices).

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:



- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Radiation Exposure Statement:

The equipment complies with FCC Radiation exposure limits set forth for uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

6. Resource

6.1 Relevant Resource

- [User Guide](#)
- [SDK](#)
 - [Heltec ESP \(ESP32 & ESP8266\) framework](#)
 - [Heltec ESP32 library](#)
- [Schematic diagram](#)
- [Downloadable resource](#)

6.2 Contact Information

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