



## HTIT-WS V3

# LoRa Node Development Kit





## Document version

Version	Time	Description	Remark
V1.0	2022-11-16	Documents creating	肖鸿



## 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

HTIT-WS_V3.....	1
Document version .....	2
Copyright Notice .....	3
Disclaimer.....	3
Content.....	4
1. Description .....	5
1.1 Overview .....	5
1.2 Product features.....	6
2. Pin Definition .....	8
2.1 Pin assignment .....	8
2.2 Pin description .....	8
3. Specifications .....	11
3.1 General specifications.....	11
3.2 Power supply.....	12
3.3 Power output .....	12
3.4 Power characteristics .....	12
3.5 LoRa RF characteristics.....	13
3.5.1 Transmit power .....	13
3.5.2 Receiving sensitivity .....	13
3.6 Operation Frequencies.....	14
4. Hardware resource.....	15
4.1 Physical dimensions .....	15
5. Resource.....	16
5.1 Relevant Resource.....	16
5.2 Contact Information.....	16



# 1. Description

## 1.1 Overview

HTIT-WS is a development board for Wi-Fi, Bluetooth and LoRa. Its functions are basically the same as “WiFi Lora 32”, except that the screen is reduced to 0.49 inch and a shielding shell is added.

The HTIT-WS is composed up of an MCU (ESP32-S3FN8) and Semtech LoRa Transceivers (SX1262), perfectly support Arduino®. Users can easily carry out secondary development and application.

The V3 version is upgraded as follows:

Table 1.1-1: Version comparison

	HTIT-WS (V2)	HTIT-WS (V3)
<b>MCU</b>	ESP32-D0	ESP32-S3
<b>LoRa Chip</b>	SX1276	SX1262
<b>USB Socket</b>	Micro USB	Type C
<b>Crystal Oscillator</b>	Ordinary crystal oscillator	High precision temperature compensated crystal oscillator
<b>Low power features in deep sleep</b>	800uA	<10uA
<b>Other</b>		Better impedance matching of RF circuits.



Wireless Stick Lite are available in two product variants:

Table 1.1-2: Product model list

No.	Model	Description
1	HTIT-WS-LF	470~510MHz working LoRa frequency, used for China mainland (CN470) LPW band.
2	HTIT-WS-HF	For EU868, IN865, US915, AU915, AS923, KR920 and other LPW networks with operating frequencies between 863~928MHz.

## 1.2 Product features

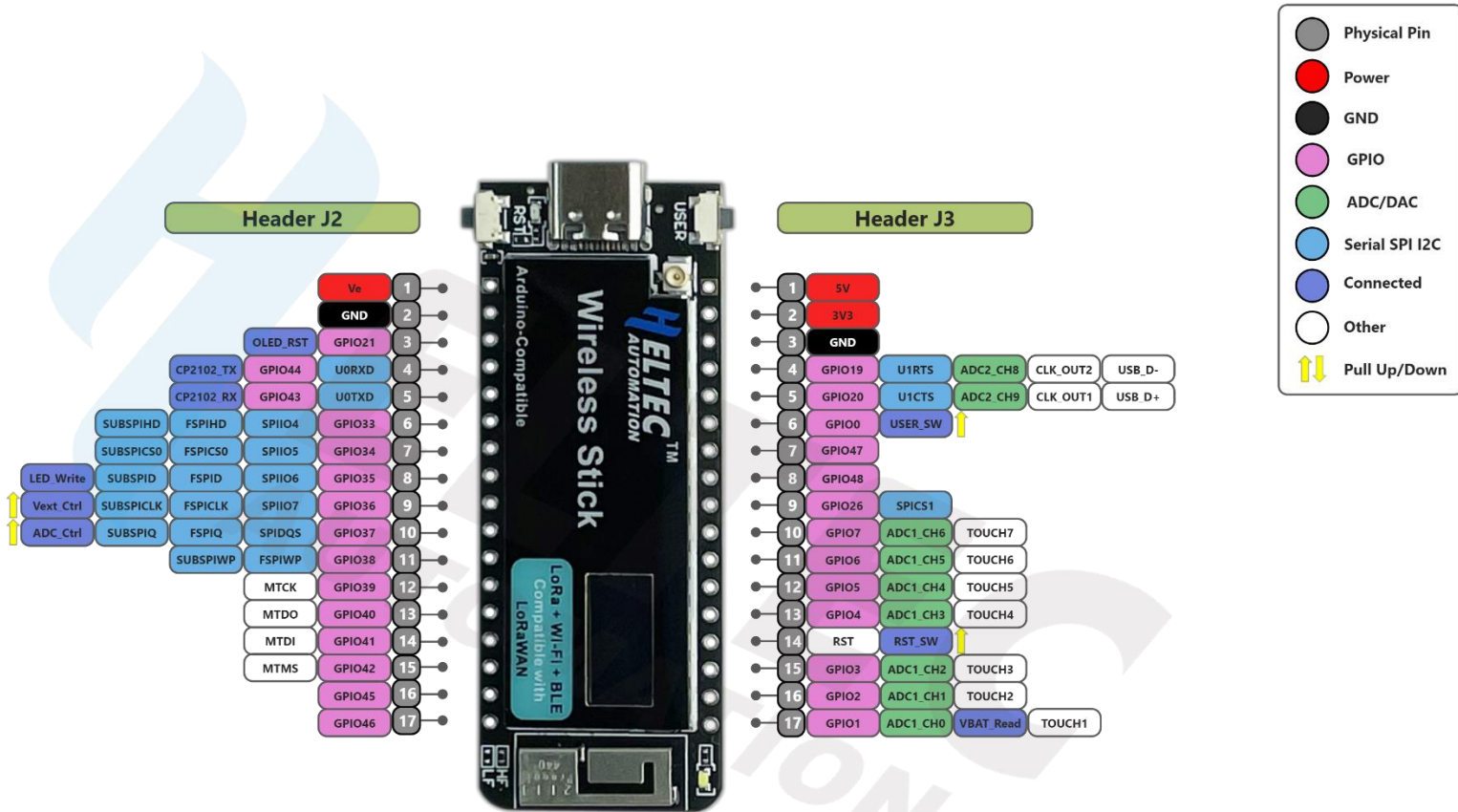
- Microprocessor: ESP32-S3FN8 (Xtensa® 32-bit LX7 dual core processor, five stage pipeline rack Structure, main frequency up to 240 MHz).
- SX1262 LoRa node chip.
- Type-C USB interface with a complete voltage regulator, ESD protection, short circuit protection, RF shielding, and other protection measures.
- Onboard SH1.25-2 battery interface, integrated lithium battery management system (charge and discharge management, overcharge protection, battery power detection, USB / battery power automatic switching).
- Integrated WiFi, LoRa, Bluetooth three network connections, onboard Wi-Fi, Bluetooth dedicated 2.4GHz metal spring antenna, reserved IPEX (U.FL) interface for LoRa use.



- Onboard 0.49-inch 128\*64 dot matrix OLED display, which can be used to display debugging information, battery power, and other information.
- Integrated CP2102 USB to serial port chip, convenient for program downloading, debugging information printing.
- Support the [Arduino development environment](#).
- We provide [ESP32 + LoRaWAN](#) protocol Arduino® library, this is a standard LoRaWAN protocol that can communicate with any LoRa gateway running the LoRaWAN protocol. In order to make this code running, a unique license is needed. it can be found on [this page](#);
- With good RF circuit design and low-power design.

## 2. Pin Definition

### 2.1 Pin assignment



HTIT-WS\_V3 Pin map



### 2.2 Pin description

- Header J2

Table 2.2-1: Pin description

No.	Name	Type	Function
1	Ve	P	Output 3.3V, power supply for external sensor.
2	GND	P	Ground.

<https://heltec.org>





3	21	I/O	GPIO21, OLED RST
4	RX	I/O	GPIO44, U0RXD, connected to CP2102 TXD.
5	TX	I/O	GPIO43, U0RXD, connected to CP2102 RXD.
6	33	I/O	GPIO33, SPIO4, FSPIHD, SUBSPIHD.
7	34	I/O	GPIO34, SPIO5, FSPICS0, SUBSPICS0.
8	35	I/O	GPIO35, SPIO6, FSPID, SUBSPID, LED Write Ctrl.
9	36	I/O	GPIO36, SPIO7, FSPICK, SUBSPICK, Vext Ctrl.
10	37	I/O	GPIO37, SPIDQS, FSPIQ, SUBSPIQ, ADC Ctrl.
11	38	I/O	GPIO38, FSPIWP, SUBSPIWP.
12	39	I/O	GPIO39, MTCK.
13	40	I/O	GPIO40, MTDO.
14	41	I/O	GPIO41, MTDI.
15	42	I/O	GPIO42, MTMS.
16	45	I/O	GPIO45.
17	46	I/O	GPIO46.

**Header J3**

Table 2.2-2: Pin description

No.	Name	Type	Function
1	5V	P	5V Power Supply.
2	3V3	P	3.3V Power Supply.
3	GND	P	Ground.



<b>4</b>	19	I/O	GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, USB_D <sup>-1</sup> .
<b>5</b>	20	I/O	GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D <sup>+2</sup> .
<b>6</b>	0	I/O	GPIO0, connected to USER switch.
<b>7</b>	47	I/O	GPIO47, SPICLK_P_DIFF, SUBSPICLK_P_DIFF.
<b>8</b>	48	I/O	GPIO48, SPICLK_N_DIFF, SUBSPICLK_N_DIFF.
<b>9</b>	26	I/O	GPIO26, SPICS1.
<b>10</b>	7	I/O	GPIO7, ADC1_CH6, TOUCH7.
<b>11</b>	6	I/O	GPIO6, ADC1_CH5, TOUCH6.
<b>12</b>	5	I/O	GPIO5, ADC1_CH4, TOUCH5.
<b>13</b>	4	I/O	GPIO4, ADC1_CH3, TOUCH4.
<b>14</b>	RST	I	CHIP_PU, connected to RST switch.
<b>15</b>	3	I/O	GPIO3, ADC1_CH2, TOUCH3.
<b>16</b>	2	I/O	GPIO2, ADC1_CH1, TOUCH2.
<b>17</b>	1	I/O	GPIO1, ADC1_CH0, TOUCH1, Read VBAT Voltage <sup>3</sup> .

<sup>1</sup> DN pin connectable to USB socket, solder R3

<sup>2</sup> DP pin connectable to USB socket, solder R29

<sup>3</sup> ADC1\_CH0 is used to read the lithium battery voltage, the voltage of the lithium battery is:

$$V_{BAT} = 100 / (100+390) * V_{ADC\_IN1}$$



### 3. Specifications

#### 3.1 General specifications

Table 3.1: General specifications

Parameters	Description
Master Chip	ESP32-S3FN8 (Xtensa® 32-bit lx7 dual core processor)
LoRa Chipset	SX1262
USB to Serial Chip	CP2102
Frequency	470~510 MHz, 863~928 MHz
Max. TX Power	21 ± 1 dBm
Max. Receiving sensitivity	-139 dBm
Wi-Fi	802.11 b/g/n, up to 150Mbps
Bluetooth	Bluetooth LE: Bluetooth 5, Bluetooth mesh
Display	0.49-inch OLED
Hardware Resource	7*ADC1 + 2*ADC2; 7*Touch; 3*UART; 2*I2C; 2*SPI; etc.
Memory	384KB ROM; 512KB SRAM; 16KB RTC SRAM; 8MB SiP Flash
Interface	Type-C USB; 2*1.25 lithium battery interface; LoRa ANT(IPEX1.0); 2*17*2.54 Header Pin
Battery	3.7V lithium battery power supply and charging
Operating temperature	-20 ~ 70 °C
Dimensions	58.08 * 22.6* 8.2 mm



### 3.2 Power supply

Except when USB or 5V Pin is connected separately, lithium battery can be connected to charge it. In other cases, only a single power supply can be connected.

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

### 3.3 Power output

Table 3.3: Power output

Output Pin	Minimum	Typical	Maximum	Company
3.3V Pin			500	mA
5V Pin (USB Powered only)			500	mA
Vext Pin			350	mA

### 3.4 Power characteristics

Table 3.4: Power characteristics

Mode	Condition	Min.	Typical	Max.	Company
WiFi Scan	USB powered		115		mA
WiFi AP	USB powered		150		mA
BT	USB powered		115		mA



<b>TX</b>	14dBm, USB powered, 868		200		mA
	17dBm, USB powered, 868		210		mA
	22dBm, USB powered, 868		230		mA
<b>RX</b>	TX disabled; RX enabled		90		mA
<b>sleep</b>	USB powered		2		mA
	VBAT/battery powered		15		uA
	3.3V header powered		10		uA

### 3.5 LoRa RF characteristics

#### 3.5.1 Transmit power

Table3.5.1: Transmit power

Operating frequency band	Maximum power value/[dBm]
<b>470~510</b>	21 ± 1
<b>867~870</b>	21 ± 1
<b>902~928</b>	21 ± 1

#### 3.5.2 Receiving sensitivity

The following table gives typically sensitivity level of the HTIT-WS.

Table3.5.2: Receiving sensitivity

Signal Bandwidth/[KHz]	Spreading Factor	Sensitivity/[dBm]
<b>125</b>	SF12	-139
<b>125</b>	SF10	-130
<b>125</b>	SF7	-124

<https://heltec.org>



### 3.6 Operation Frequencies

HTIT-WS supports LoRaWAN frequency channels and models corresponding table.

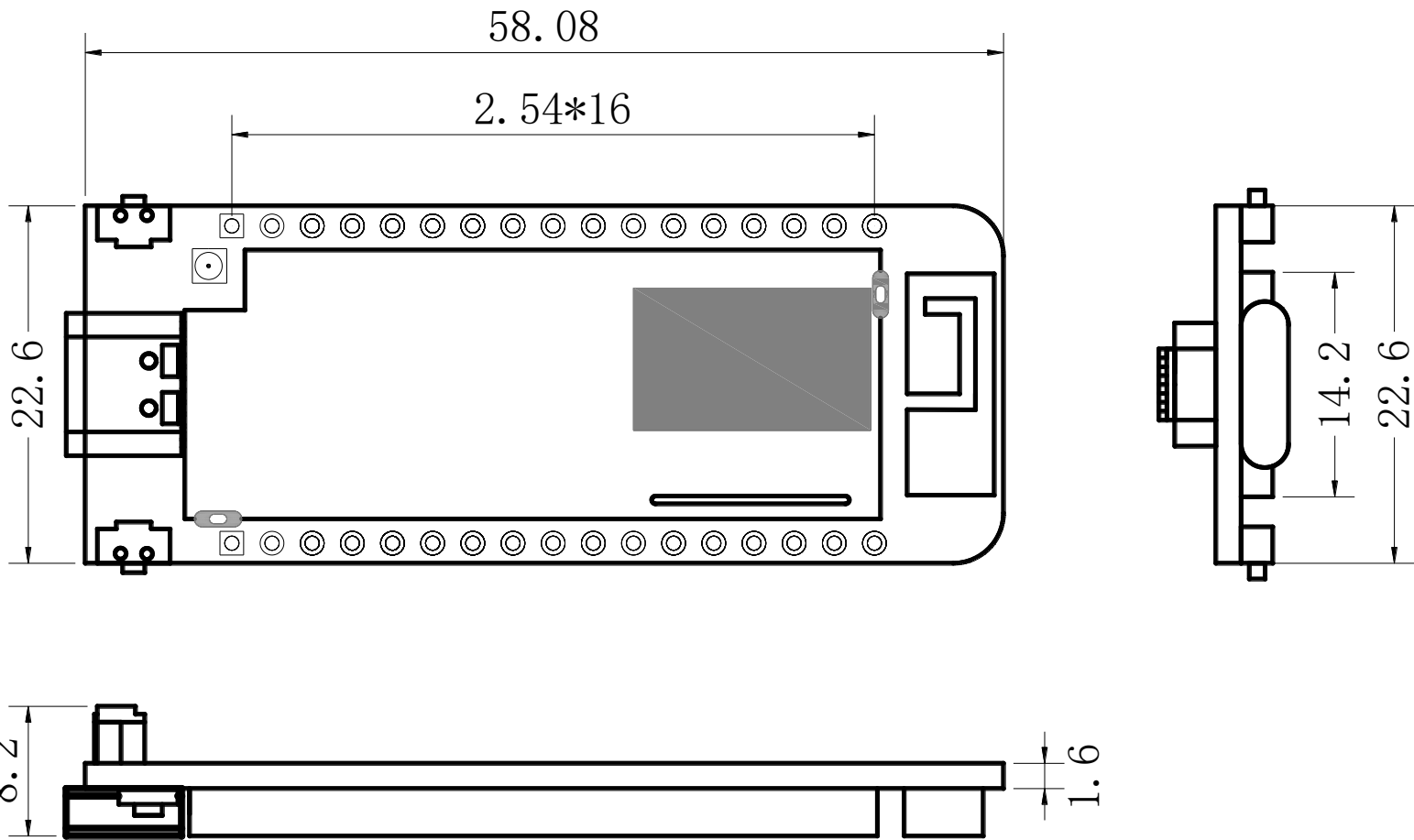
Table3.6: Operation Frequencies

Region	Frequency (MHz)	Model
<b>EU433</b>	433.175~434.665	HTIT-WS-LF
<b>CN470</b>	470~510	HTIT-WS-LF
<b>IN868</b>	865~867	HTIT-WS-HF
<b>EU868</b>	863~870	HTIT-WS-HF
<b>US915</b>	902~928	HTIT-WS-HF
<b>AU915</b>	915~928	HTIT-WS-HF
<b>KR920</b>	920~923	HTIT-WS-HF
<b>AS923</b>	920~925	HTIT-WS-HF



## 4. Hardware resource

### 4.1 Physical dimensions





## 5. Resource

### 5.1 Relevant Resource

- Source Code
  - [Heltec ESP \(ESP32 & ESP8266\) framework](#) (Already included Heltec ESP32 LoRaWAN library)
  - [Heltec ESP32 library](#)
- [Schematic diagram](#)
- [Pin map](#)
- [Downloadable resource](#)

### 5.2 Contact Information

Heltec Automation Technology Co., Ltd

Chengdu, Sichuan, China

Email: [support@heltec.cn](mailto:support@heltec.cn)

Phone: +86-028-62374838

<https://heltec.org>