# Wireless Tracker V2

## WiFi/BLE/LoRa/GNSS

## Development Board

# Document Version

| Version | Time | Description | Remark |
|---------|------|-------------|--------|
| V2.3 | 2025-9-5 | TX power upgraded from 21±1 dBm to 28±1 dBm. | Ashley |

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# contents

# 1. Description

## 1.1 Overview

**Wireless Tracker V2** integrates the Semtech SX1262 LoRa transceiver and UC6580 GNSS module, powered by the high-performance ESP32-S3FN8 platform to deliver reliable long-range communication and high-precision positioning in a compact, developer-friendly IoT solution.

With its maximum TX power increased to 28 ±1 dBm (upgraded from 21 ±1 dBm), combined with an upgraded RF front-end architecture and optimized PCB layout, Wireless Tracker V2 achieves extended communication range, enhanced signal penetration, improved link robustness, and greater overall system stability—making it ideal for demanding and large-scale tracking deployments.
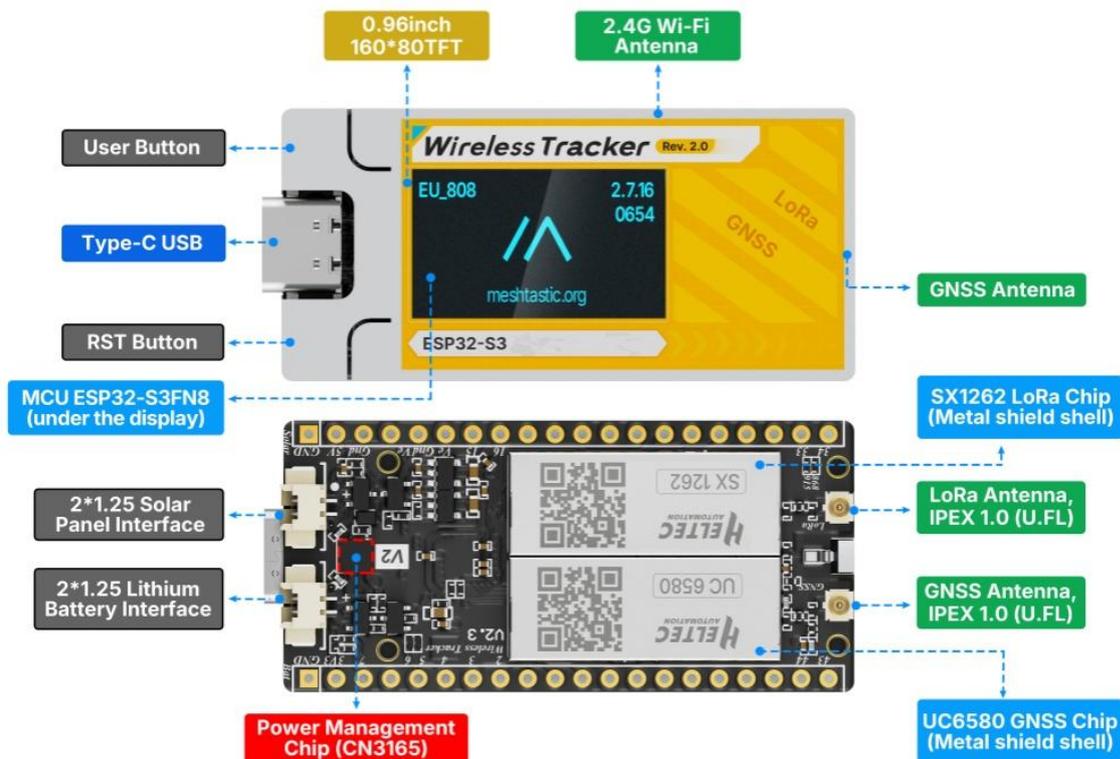
## 1.2    Upgrade and Enhancement

■ Maximum TX Power: Increased from 21 ± 1 dBm to 28 ± 1 dBm, enabling extended communication range and improved link reliability.

■ FEM Upgrade: Replaced the RF front-end module to support higher output power and enhance transmission efficiency and receiver sensitivity.

■ RF Filter Added: Added an RF filter to improve EMC performance.

■ GNSS Active Antenna Upgrade: Enhanced with an upgraded low-noise amplifier (LNA) to achieve stronger signal reception and higher positioning accuracy.

■ SX1262 Ground Optimization: Implemented full ground shielding around the SX1262 to improve RF stability and reduce interference.

■ Ground Structure Redesign: Adopted a unified ground plane to optimize return paths and enhance anti-interference performance.

■ LoRa Pin Layout Optimization: Adjusted GPIO33 and GPIO34 routing to reduce layer crossover and minimize signal interference near the LoRa driver pins.

■ Power Layout Optimization: Improved power trace routing and minimized adjacent-layer crossover to enhance system stability.

■ Header Footprint Update: Reduced the package size of the last four header pins and updated the PCB footprint to improve manufacturability.

■ Display Protection: Equipped with a dedicated plastic bracket to provide additional mechanical protection for the screen during operation.

■ Solar Interface Added: Newly added solar power interface to support sustainable outdoor operation and extended battery life.

## 1.3　Product Features

✧ ESP32-S3FN8+SX1262+UC6580 Chipset, supports Wi-Fi, LoRa, Bluetooth, GNSS.

✧ High-power version with LoRa transmission power increased to 28±1dBm.

✧ Low power design of dual-frequency multi-system based on 22nm technology.

✧ Supports L1, supports GPS, GLONASS, BDS, Galileo, NAVIC, QZSS multi-system joint positioning.1

✧ Type-C USB interface with a complete voltage regulator, ESD protection, short circuit protection, RF shielding, and other protection measures.

✧ Onboard SH1.25-2 lithium battery and solar interfaces with integrated management for charging, overcharge protection, power monitoring, and automatic USB/battery switching.

✧ Onboard Wi-Fi, Bluetooth dedicated 2.4GHz metal spring antenna, reserved IPEX (U.FL) interface for LoRa and GNSS use.

✧ Onboard 0.96-inch 80×160 RGB TFT-LCD for displaying debugging, battery status, and more, equipped with a dedicated plastic bracket for added protection.

✧ The GNSS active antenna is enhanced with an upgraded low-noise amplifier (LNA), providing stronger signal reception and improved positioning accuracy.

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[1] See the GNSS module manual for details on supported projects.

# 2. Pin Definition

## 2.1 Pin Assignment
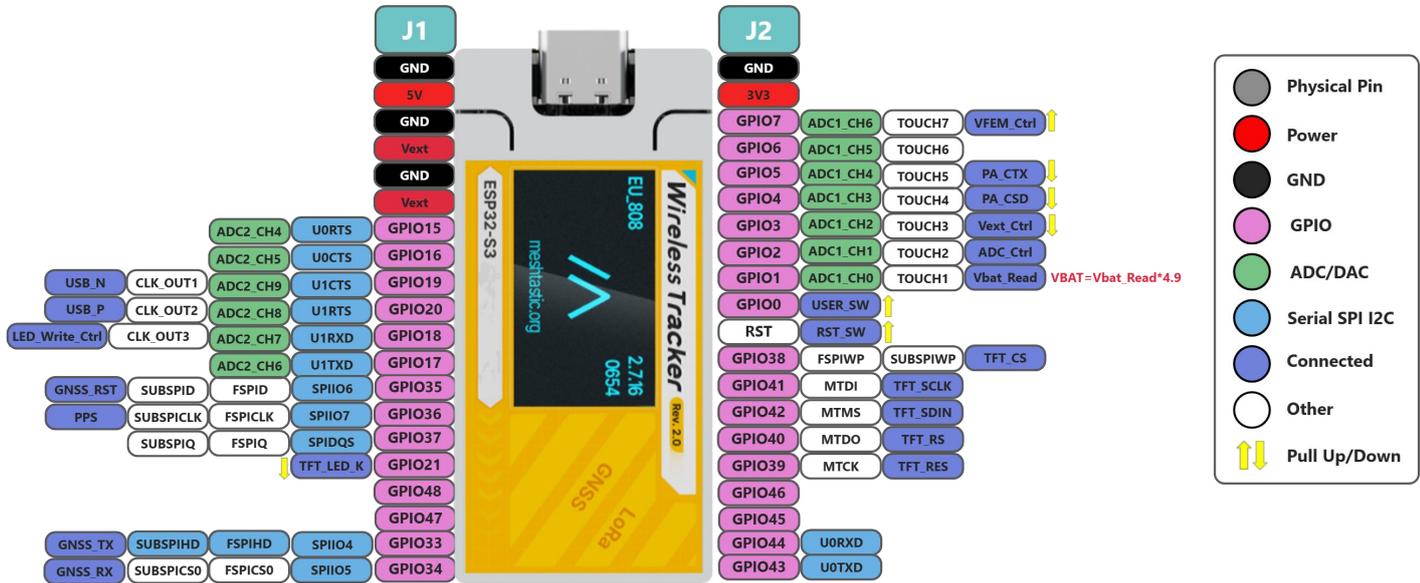


HT-Tracker_V2 Pin map

## 2.2　Pin Interface
### 2.2.1　Header J1

<div align="right">Table 2-2-1: Pin description</div>

| NO. | NAME | TYPE | FUNCTION |
|:---:|:---:|:---:|---|
| 1 | GND | P | Ground |
| 2 | 5V | P | Power Supply 5V |
| 3 | GND | P | Ground |
| 4 | Vext | P | Power supply for built-in TFT and GNSS, 3.3V |
| 5 | GND | P | Ground |
| 6 | Vext | P | Power supply for built-in TFT and GNSS, 3.3V |
| 7 | GPIO15 | I/O | U0RTS, ADC2_CH4, XTAL_32K_P |
| 8 | GPIO16 | I/O | U0CTS, ADC2_CH5, XTAL_32K_N |
| 9 | GPIO19 | I/O | CLK_OUT2, ADC2_CH8, U1RTS, USB_N |
| 10 | GPIO20 | I/O | CLK_OUT1, ADC2_CH9, U1CTS, USB_P |
| 11 | GPIO18 | I/O | U1RXD, ADC2_CH7, CLK_OUT3, LED_Write_Ctrl |
| 12 | GPIO17 | I/O | U1TXD, ADC2_CH6 |
| 13 | GPIO35 | I/O | SPIO6, FSPID, SUBSPID, GNSS_RST |
| 14 | GPIO36 | I/O | SPIO7,FSPICLK, SUBSPICLK, PPS |
| 15 | GPIO37 | I/O | SPIDQS, FSPIQ, SUBSPIQ |
| 16 | GPIO21 | I/O | TFT_LED_K |
| 17 | GPIO48 | I/O | XTAL_P |
| 18 | GPIO47 | I/O | XTAL_N |
| 19 | GPIO33 | I/O | SPIIO4, FSPIHD, SUBSPIHD, GNSS_TX |
| 20 | GPIO34 | I/O | SPIO5, FSPICS0, SUBSPICS0, GNSS_RX |

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## 2.2.2 Header J2

Table 2-2-2: Pin description

| NO. | NAME | TYPE | FUNCTION |
|---|---|---|---|
| 1 | **GND** | **P** | Ground |
| 2 | **3V3** | **P** | Output **3.3V** |
| 3 | **GPIO7** | **I/O** | ADC1_CH6, TOUCH7 |
| 4 | **GPIO6** | **I/O** | ADC1_CH5, TOUCH6 |
| 5 | **GPIO5** | **I/O** | ADC1_CH4, TOUCH5 |
| 6 | **GPIO4** | **I/O** | ADC1_CH3, TOUCH4, **PA_CSD** |
| 7 | **GPIO3** | **I/O** | ADC1_CH2, TOUCH3, **Vext_Ctrl** |
| 8 | **GPIO2** | **I/O** | ADC1_CH1, TOUCH2, **ADC_Ctrl** |
| 9 | **GPIO1** | **I/O** | ADC1_CH0, TOUCH1, **Vbat_Read** |
| 10 | **GPIO0** | **I/O** | USER_SW |
| 11 | **RST** | **I/O** | RST_SW |
| 12 | **GPIO38** | **I/O** | FSPIWP, SUBSPIWP, **TFT_CS** |
| 13 | **GPIO41** | **I/O** | MTDI, **TFT_SCLK** |
| 14 | **GPIO42** | **I/O** | MTMS, **TFT_SDIN** |
| 15 | **GPIO40** | **I/O** | MTMS, **TFT_RS** |
| 16 | **GPIO39** | **I/O** | MTMS, **TFT_RES** |
| 17 | **GPIO46** | **I/O** | **PA_CPS** |
| 18 | **GPIO45** | **I/O** | |
| 19 | **GPIO44** | **I/O** | U0RXD |
| 20 | **GPIO43** | **I/O** | U0TXD |

# 3. Specifications

## 3.1　General Specifications

<div align="right">Table 3-1: General specifications</div>

| Parameters | Description |
|---|---|
| **MCU** | ESP32-S3FN8 (Xtensa® 32-bit LX7 dual-core processor) |
| **LoRa Chip** | SX1262 |
| **GNSS Chip** | UC6580 |
| **Charging IC** | CN3165 |
| **Frequency** | 863~928 MHz |
| **Max TX Power** | 28 ± 1dBm |
| **Receiving sensitivity** | -135 dBm |
| **Wi-Fi** | IEEE 802.11 b/g/n |
| **Bluetooth** | Bluetooth 5.0, Bluetooth LE, Bluetooth Mesh |
| **Interface** | USB Type-C; 1.25 mm Lithium Battery Connector; 1.25 mm Solar Panel Connector; LoRa Antenna (IPEX / U.FL); GNSS Antenna (IPEX / U.FL) |
| **Battery** | Supports 3.7V Lithium Battery and Solar Panel |
| **Operating temperature** | -20 ~ 70℃ |
| **Dimensions** | 53.00mm* 25.40mm* 9.37mm |

## 3.2  Power Supply

The Lithium battery can be charged when USB or 5V is not connected. Only one power source should be used at a time.

| Power Supply Mode | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|
| USB Type-C(≥500mA) | 4.7 | 5 | 6 | V |
| Lithium Battery(≥250ma) | 3.3 | 3.7 | 4.2 | V |
| 5V Pin(≥500ma) | 4.7 | 5 | 6 | V |
| 3V3 Pin(≥150ma) | 2.7 | 3.3 | 3.5 | V |

## 3.3  Power Output

Table 3-3: Power Output

| Output Pin | Current | Unit |
|---|---|---|
| 3v3 Pin | 500 | mA |
| 5V Pin (USB Powered Only) | 500 | mA |
| Vext Pin | 350 | mA |

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## 3.4 Power Characteristics

| Mode | USB power | VBAT/battery powered | Unit |
|---|---|---|---|
| **Wi-Fi Scan** | 79 | 75 | mA |
| **Wi-Fi AP** | 140 | 139 | mA |
| **BT** | 66 | 64 | mA |
| **GNSS** | 130 | 127 | mA |
| **Sleep** | **1.2mA** | **21μA** | |

## 3.5 LoRa Receiving Sensitivity

The following table gives typically sensitivity level of the Wireless Trackerr-(L/H).

| Signal bandwidth/[kHz] | Spreading factor | Sensitivity/[dBm] |
|---|---|---|
| 125 | SF12 | -135 |
| 125 | SF10 | -130 |
| 125 | SF7 | -124 |

## 3.6    Operation Frequencies

Wireless Tracker supports LoRaWAN frequency channels and models corresponding table.

Table3-6: Operation Frequencies

| Region | Frequency (MHz) | Model |
|---|---|---|
| IN868 | 865~867 | Wireless Tracker-HF |
| EU868 | 863~870 | Wireless Tracker-HF |
| US915 | 902~928 | Wireless Tracker-HF |
| AU915 | 915~928 | Wireless Tracker-HF |
| KR920 | 920~923 | Wireless Tracker-HF |
| AS923 | 920~925 | Wireless Tracker-HF |

## 3.7    GNSS Characteristics

Basic Information of the GNSS Module

Table3-7: Basic information

| Channel | 96 |
|---|---|
| Update frequency | Max 10 Hz |
| Data format | NMEA-0183，Unicore，RTCM 3.x |
| Frequency point | BDS: B2a |
| | GPS: L1 |
| | GLONASS: G1 |
| | Galileo: E1+E5a |
| | QZSS: L1 |
| | SBAS: L1 |

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# 4. Mechanical Specification
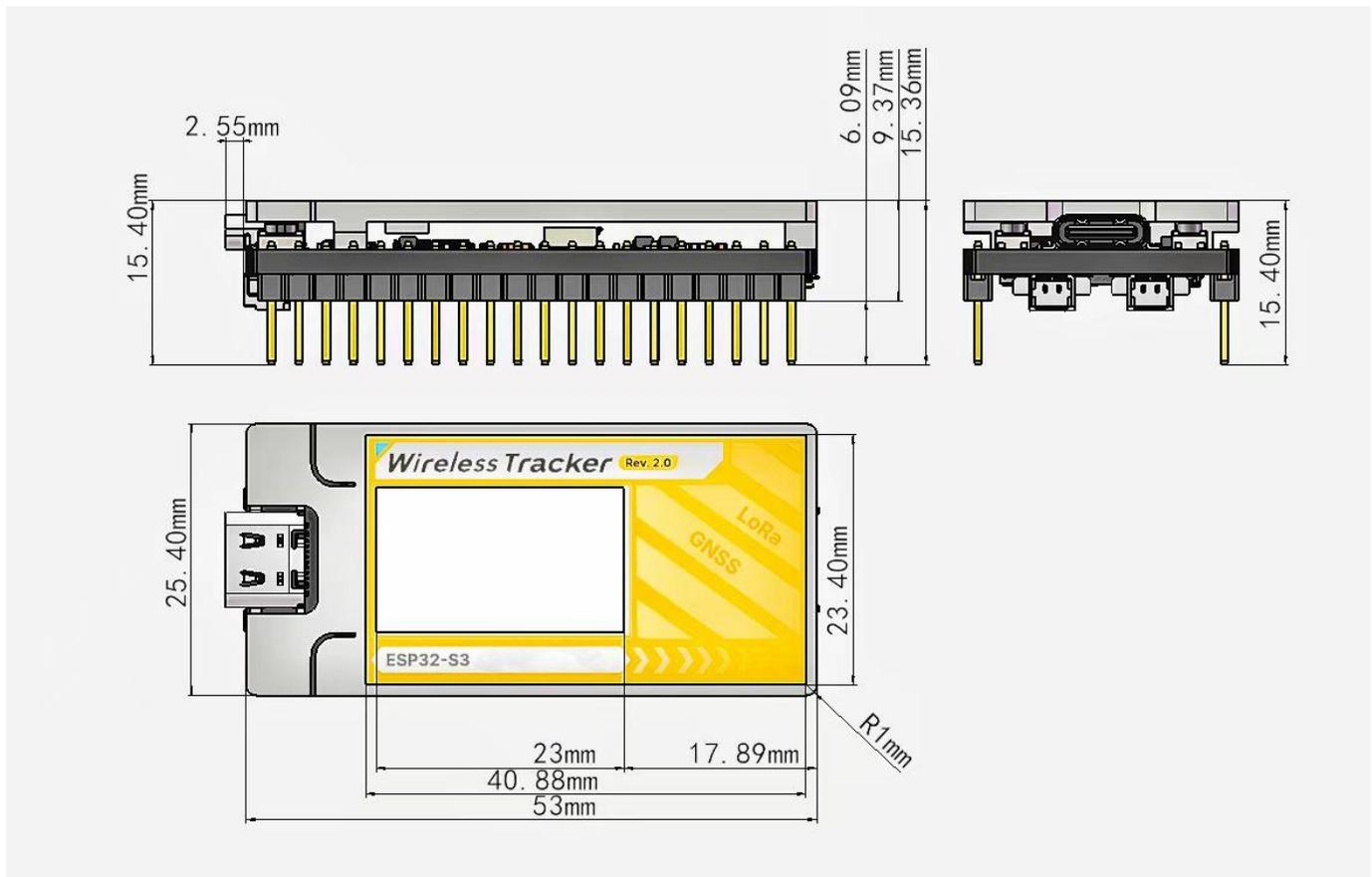
# 5. Resource

## 5.1　Relevant Resource

- [Heltec_ESP32 Framework](#)
- [Heltec LoRaWAN test server based on SnapEmu](#)
- [User Guide](#)
- [GNSS Datasheet](#)
- [Display Datasheet](#)

## 5.2　Contact Information

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