Wireless Tracker

Wi-Fi/LoRa/BLE/GNSS(L5)

Development Kit

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Document version

Version	Time	Description	Remark
V1.0	2023-05-16	Documents creating	肖鸿
V1.1	2022-05-21	Document structure update	Aaron

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Content

1. Description

1.1   Overview

Wireless Tracker is a development kit based on ESP32-S3FN8. It integrates both SX1262 and UC6580 to provide fast GNSS solution for IoT. It can track any object and then upload that data wirelessly by Wi-Fi, Bluetooth, LoRa.

Wireless Tracker supports L1 + L5/L2, and supports GPS, GLONASS, BDS, Galileo, NAVIC, QZSS multi-system joint positioning. It is perfectly compatible with Arduino, can be widely used in development such as bicycle sharing services, tracking pets or livestock, locating vehicles, tracking children, etc.

Wireless Tracker are available in two product variants:

Table 1.1: Product model list

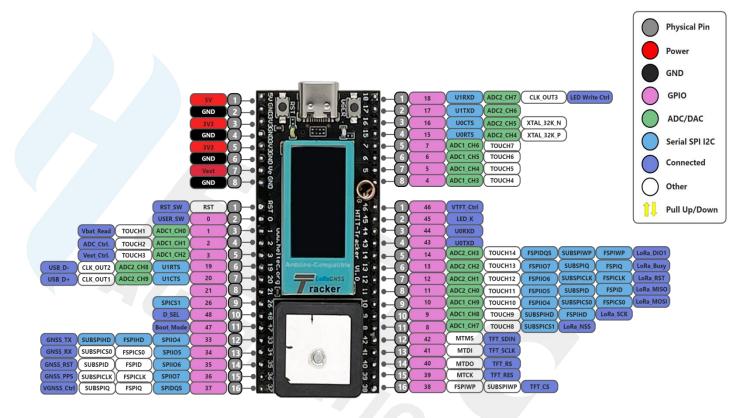| No.	Model	Description
1	Wireless Tracker-LF	470~510MHz working LoRa frequency, used for China mainland (CN470) LPW band.
2	Wireless Tracker-HF	For EU868, IN865, US915, AU915, AS923, KR920 and other LPW networks with operating frequencies between 863~928MHz.

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1.2　Product features

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

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

➢ Supports L1 + L5/L2, supports GPS, GLONASS, BDS, Galileo, NAVIC, QZSS multi-system joint positioning.

➢ 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).

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

➢ Onboard 0.96-inch 128*64 dot matrix OLED display, which can be used to display debugging information, battery power, and other information.

➢ Support the Arduino development environment.

2. Pin Definition

2.1   Pin assignment

HT-Tracker_V1 Pin map

2.2 Pin description

Header J2

Table 2-2-1: Pin description

No.	Name	Type	Function
1	GND	P	Ground.
2	5V	P	5V Power Supply.
3	Ve	P	Output 3.3V, power supply for external sensor.
4	Ve	P	Output 3.3V, power supply for external sensor.
5	RX	I/O	GPIO44, U0RXD, connected to CP2102 TXD.
6	TX	I/O	GPIO43, U0RXD, connected to CP2102 RXD.
7	RST	I	CHIP_PU, connect to RST switch.
8	0	I/O	GPIO0, connect to PRG switch.
9	36	I/O	GPIO36, SPIIO7, FSPICLK, SUBSPICLK, Vext Ctrl.
10	35	I/O	GPIO35, SPIIO6, FSPID, SUBSPID, LED Write Ctrl.
11	34	I/O	GPIO34, SPIIO5, FSPICS0, SUBSPICS0.
12	33	I/O	GPIO33, SPIIO4, FSPIHD, SUBSPIHD.
13	47	I/O	GPIO47, SPICLK_P_DIFF, SUBSPICLK_P_DIFF.
14	48	I/O	GPIO48, SPICLK_N_DIFF, SUBSPICLK_N_DIFF.
15	26	I/O	GPIO26, SPICS1.
16	21	I/O	GPIO21, OLED RST.
17	20	I/O	GPIO20, U1CTS, ADC2_CH9, CLK_OUT1, USB_D+[1].
18	19	I/O	GPIO19, U1RTS, ADC2_CH8, CLK_OUT2, USB_D-[2].

[1] DP pin connectable to USB socket, solder R29

[2] DN pin connectable to USB socket, solder R3

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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	GPIO37, SPIDQS, FSPIQ, SUBSPIQ.
5	46	I/O	GPIO46.
6	45	I/O	GPIO45.
7	42	I/O	GPIO42, MTMS.
8	41	I/O	GPIO41, MTDI.
9	40	I/O	GPIO40, MTDO.
10	39	I/O	GPIO39, MTCK.
11	38	I/O	GPIO38, FSPIWP, SUBSPIWP.
12	1	I/O	GPIO1, ADC1_CH0[3], TOUCH1, Read VBAT Voltage.
13	2	I/O	GPIO2, ADC1_CH1, TOUCH2.
14	3	I/O	GPIO3, ADC1_CH2, TOUCH3.
15	4	I/O	GPIO4, ADC1_CH3, TOUCH4.
16	5	I/O	GPIO5, ADC1_CH4, TOUCH5.
17	6	I/O	GPIO6, ADC1_CH5, TOUCH6.
18	7	I/O	GPIO7, ADC1_CH6, TOUCH7.

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[3] ADC1_CH0 is used to read the lithium battery voltage, the voltage of the lithium battery is:

$$VBAT = 100 / (100+390) * VADC\_IN1$$

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
GNSS Chipset	UC6580
Frequency	470~510MHz, 863~923MHz
Max TX Power	21 ± 1dBm
Receiving sensitivity	-139dBm
Wi-Fi	802.11 b/g/n, up to 150Mbps
Bluetooth	Bluetooth LE: Bluetooth 5, Bluetooth mesh
Interface	Type-C USB; 2*1.25 lithium battery interface; LoRa ANT(IPEX); GNSS ANT(IPEX);2*18*2.54 Header Pin
Battery	3.7V lithium battery power supply and charging
Operating temperature	-20 ~ 70℃
Dimensions	65.48 * 28.06* 13.52mm

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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(≥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	electric current	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	USB powered		VBAT/battery powered	Unit
Wi-Fi Scan	100		74	mA
Wi-Fi AP	150		111	mA
BT	102		75	mA
GNSS	120		89	mA
TX	14dbm	200	148	mA
	17dbm	220	163	mA
	22dbm	240	178	mA
RX	TX disabled; RX enabled	80	59	mA
sleep	2mA		15 μA	

3.5   LoRa RF characteristics

3.5.1 Transmit power

Table3-5-1: Transmit power

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

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3.5.2 Receiving sensitivity

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

Table3-5-2: Receiving sensitivity

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

3.5.3 Operation Frequencies

Wireless Tracker supports LoRaWAN frequency channels and models corresponding table.

Table3-5-3: Operation Frequencies

Region	Frequency (MHz)	Model
EU433	433.175~434.665	Wireless Tracker-LF
CN470	470~510	Wireless Tracker-LF
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

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3.6　GNSS Characteristics

3.6.1　Basic information

Table3-6-1: Basic information

Channel	96
Update frequency	Max 20 HZ
Data format	NMEA-0183, Unicore
Frequency point	BDS: B1l, B1C, B2b, B2a
	GPS: L1/L1C, L2C, L5
	GLONASS: L1, L2
	Galileo: E1B/C, E5b, E5a
	QZSS: L1, L2, L5
	SBAS: L1
	NAVIC: L5

3.6.2 Accuracy and TTFF[2]

Table3-6-2: Accuracy and TTFF[2]

Positional accuracy(CEP95)	<1m
1PPS	15ns
Speed accuracy	0.1m/s
Cold boot	24s
Warm boot	1s
Recapture	1s

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3.6.3 Sensitivity (Unit: dBm)

Talbe3-6-2: Sensitivity

Sensitivity	GNSS	BDS	GPS	GAL	GLONASS
Cold boot	-148	-146	-148	-144	-144
Warm boot	-156	-155	-155	-154	-148
Trace	-165	-163	-165	-163	-158
Recapture	-156	-154	-156	-154	-152

4. Typical hardware connections

4.1   Physical dimensions

5. Resource

5.1 Relevant Resource

- Heltec ESP (ESP32 & ESP8266) framework (Already included Heltec ESP32 LoRaWAN library)

- Heltec LoRaWAN test server based on TTS V3

- User Manual Document

5.2 Contact Information

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