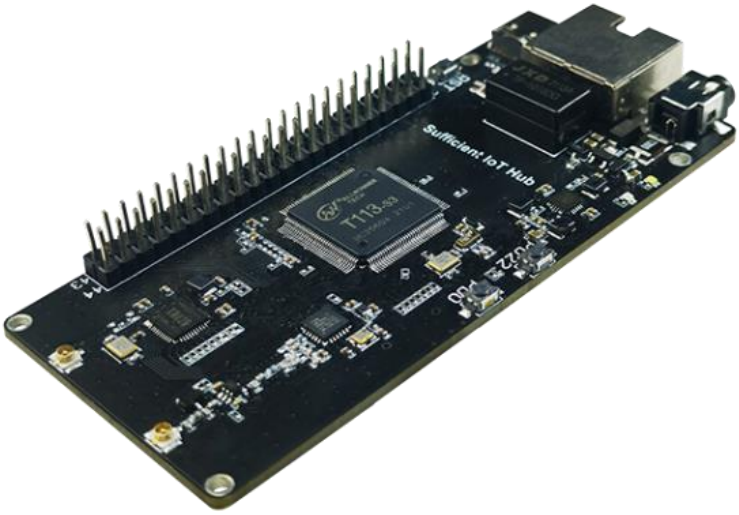
Sufficient IoT Hub

A Linux Based IoT Terminal Device



Document version

Version	Time	Description	Remark
Rev. 1.0	2022-12-14	Documents creating	Navi
Rev. 1.1	2023-3-1	Information update	Aaron Lee

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1. Sufficient IoT Hub Overview

The Sufficient IoT Hub is a Linux system-in-package with a dual-core 64-bit ARM A7 processor running at 1GHz and 128MB of DDR3. This is an IoT-only device that includes LoRa, Wi-Fi, and Bluetooth. We created a dedicated **Sufficient IoT OS** for it, which also includes **a CLI application and web UI to operate onboard resources directly**. So that even if the user has no programming experience, they can efficiently operate PWM, I2C, SPI, LoRa, and other protocols to develop whatever they desire.

It can, for instance, be used to read sensor data from I2C and transmit it via LoRaWAN, as an MQTT broker, as a LoRa Server in a local area network, or even as a LoRa gateway via an expansion panel.

Sufficient IoT Hub are available in the following product variants:

Table 1.1 Product model list

No.	Model	Description
1	Sufficient IoT Hub (LF)	433~510MHz working LoRa Node frequency, used for China mainland (CN470) LPW band.
2	Sufficient IoT Hub (HF)	For EU868, IN865, US915, AU915, AS923, KR920 and other LPW networks with operating frequencies between 863~928MHz.

1.1 Product Features

- Allwinner T1113-S3 processor, Dual-Core ARM Cortex™-A7 800MHz CPU.
  - 128MB SiP DDR3 RAM, Micro TF card slot.
  - Work with **Sufficient IoT OS**, a dedicated OS for this device, it's based on Linux (5.4.61 Kernel, 32-bits) Debian 10 Operating system.
  - Built in **Sufficient IoT application**, allow user to operate onboard resources efficiently.
- On-board Peripherals
  - XR829 (Wi-Fi and Bluetooth capabilities available)
  - SX1262 (provides LoRa node functionality)
- On-Board Interface
  - One 10/100M Ethernet interface (RJ45 connector)
  - One TF card slot
  - A three-wire debug serial port
  - One 5V power input connector
  - One USB HOST Type C interface
  - A TWI interface
  - Two universal UART interfaces
  - One SPI interface
  - One ADC interface
  - Two PWM interfaces
- Interact
  - A reset button
  - Two functional button

- ✧ A power light.
- ✧ A user-defined light

- ➢ Input power：+5V or +3.3V
- ➢ Operating temperature：-40°C～85 °C
- ➢ Encryption chip.

2. Specifications

2.1 General specifications

Table 2-1: General specifications

Parameters	Description
MCU	Dual-Core ARM CortexTM-A7 CPU, 800MHz.
LoRa Chip	SX1262
LoRa Frequency	863～870MHz, 902～928MHz, 470～510MHz
LoRa Max. TX Power	21 ± 1 dBm
Wi-Fi	802.11 b/g/n
Ethernet	100M RJ45 socket
Supply voltage	+5V, +3.3V
Power consumption	Max. ≈ 150mA, standby ≈ 100mA
Operating temperature	-40 ~ 85 ℃
Dimensions	90 x 41 x 11 mm
Clock Inputs	● OSC -- 32.768KHz external crystal. ● DCXO -- 24MHz external crystal.

2.2 Operating conditions

2.2.1 Power supply range

Except when USB or 5V Pin is connected separately, only a single power supply can be connected.

Table 2-2: Power supply range

Power supply mode	Minimum	Typical	Maximum	Company
5V Power Adapter(≥500mA)	4.7	5	5.5	V
Type-C USB(≥500mA)	4.7	5	5.5	V
5V Pin (≥500mA)	4.7	5	5.5	V

2.2.2 Power output

Table 2-3: Power output

Output Pin	Minimum	Typical	Maximum	Company
5V Pin			2000	mA
3.3V Pin			2000	mA

2.2.3 Power characteristics

Table 2-4: Power characteristics

Mode	Condition	Min.	Typical	Max.	Company
IDLE	USB powered		98		mA
Wi-Fi	USB powered		110		mA
Ethernet	USB powered		100		mA
SX1262_TX	22dBm, USB powered		150		mA
SX1262_RX	USB powered		108		mA

2.3 LoRa RF characteristics

2.3.1 Transmit power

Table 2-5 Transmit power

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

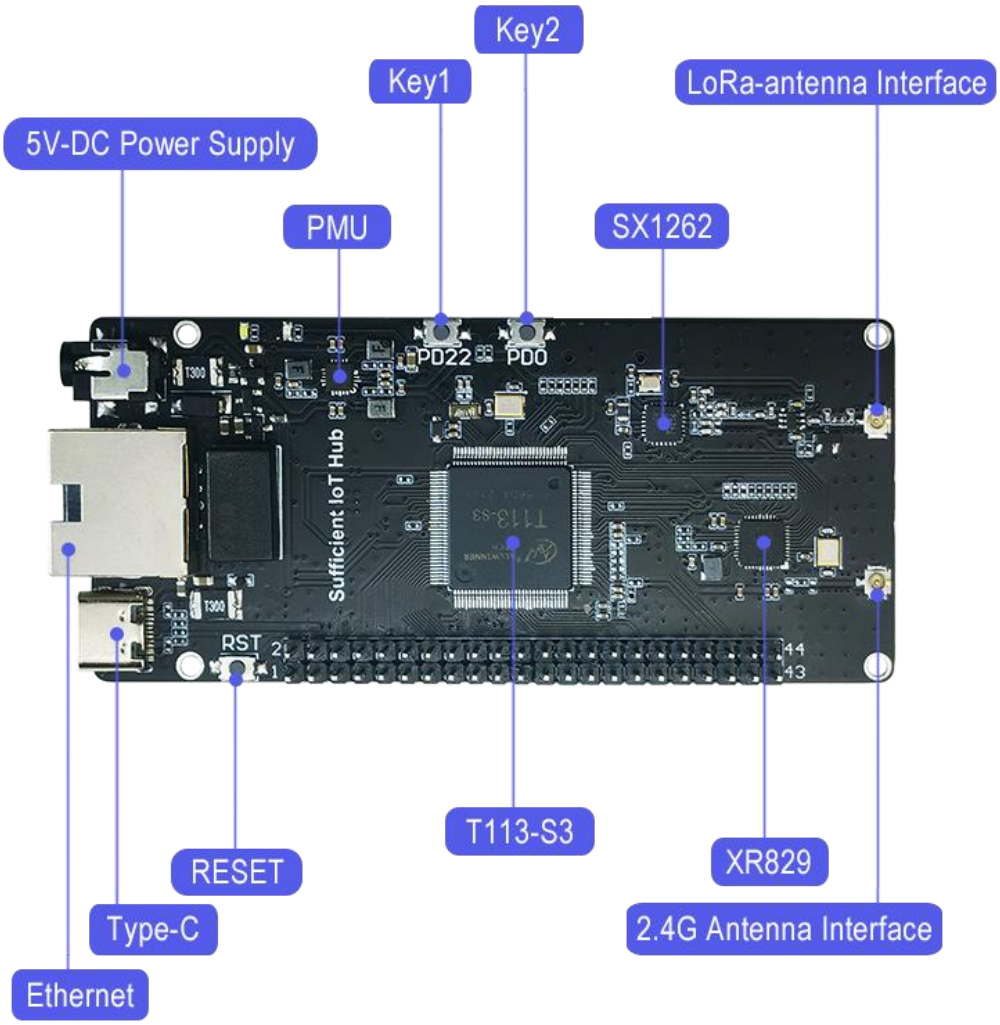
2.3.2 Receiving sensitivity

The following table gives typically sensitivity level of the Sufficient IoT Hub (L/H).

Table 2-6: Receiving sensitivity.

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

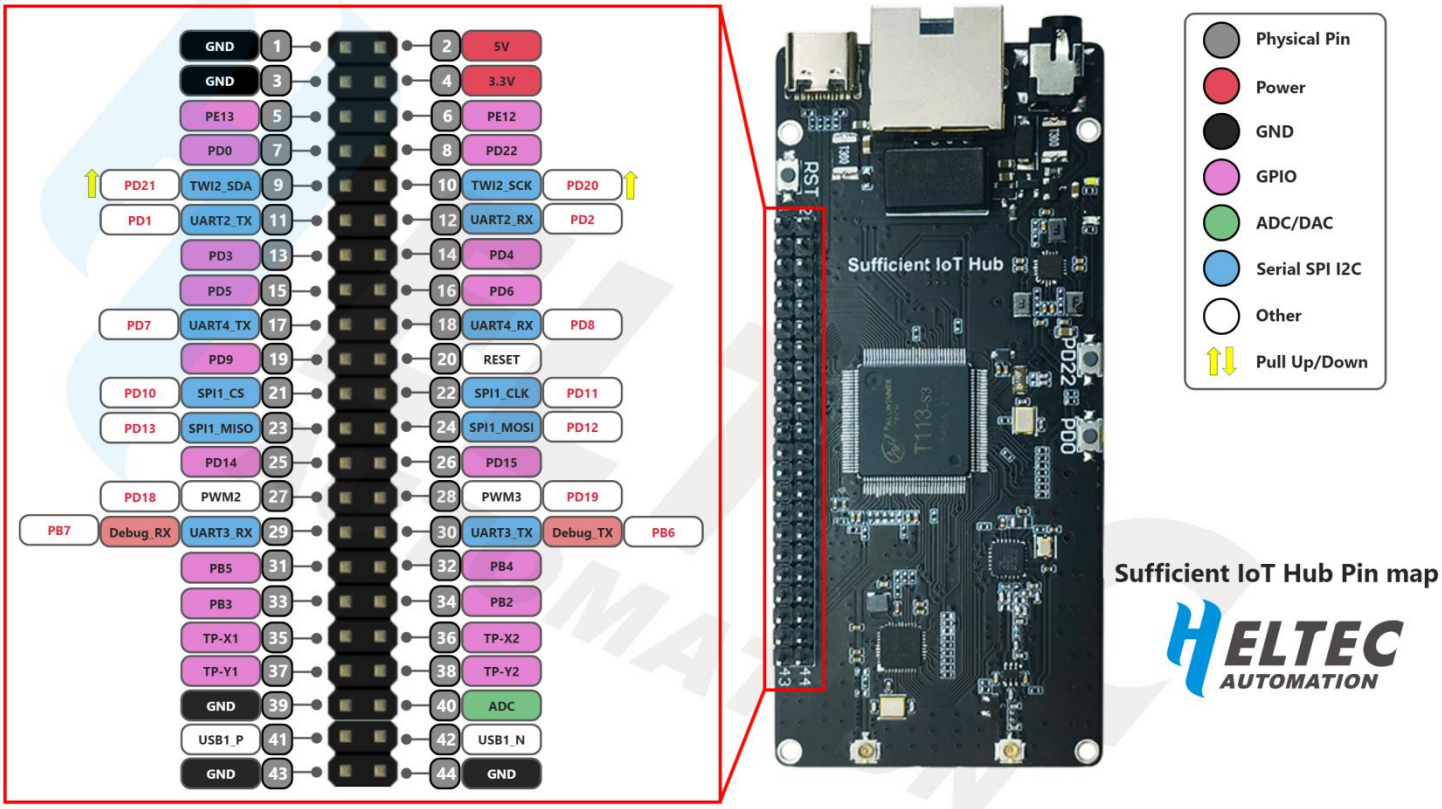
2.5 Onboard Resource



2.6 Pin definition

2.6.1 Pin assignment

2.6.2 Pin description



* The function described in red font is only for illustration, indicating that the pin has been used for special functions and cannot be used as GPIO.

General purpose GPIO row of 32 pin ports. They allow you to integrate Sufficient IoT Hub into your projects, and these expansion ports can be configured for many different purposes.

Table 2-7: Sufficient IoT Hub pin description

No.	Name	Type	Function[1]	GPIO NUM (PA0=0)[2]
1	GND	P	Ground.	-
2	5V	P	Input/Output 5V.	-
3	GND	P	Ground	-
4	3.3V	P	Output 3.3V, power supply for external device.	-
5	PE13	I/O	PE13	141
6	PE12	I/O	PE12	140
7	PD0	I/O	PD0, User key.	96
8	PD22	I/O	PD22, User key.	118
9	TWI2_SDA	I/O	PD21 , TWI2_SDA	-
10	TWI2_SCK	I/O	PD20 , TWI2_SCK	-
11	UART2_TX	I/O	PD1 , UART2_TX	-
12	UART2_RX	I/O	PD2 , UART2_RX	-
13	PD3	I/O	PD3	99
14	PD4	I/O	PD4	100
15	PD5	I/O	PD5	101
16	PD6	I/O	PD6	102
17	UART4_TX	I/O	PD7 , UART4_TX	-
18	UART4_RX	I/O	PD8 , UART4_RX	-
19	PD9	I/O	PD9	105
20	RESET	I, OD	Reset Signal (low active)	-
21	SPI1_CS	I/O	PD10 , SPI1_CS	-
22	SPI1_CLK	I/O	PD11 , SPI1_CLK	-
23	SPI1_MISO	I/O	PD13 , SPI1_MISO	-
24	SPI1_MOSI	I/O	PD12 , SPI1_MOSI	-
25	PD14	I/O	PD14	110
26	PD15	I/O	PD15	111
27	PD18	I/O	PD18, PWM2	-

[1] The function described in red font is only for illustration, indicating that the pin has been used for special functions and cannot be used as GPIO.

[2] GPIO number in system, the calculation formula is: M * 32 + n (M is pin group, A=0, B=1, etc.). For example -- PB2: 1 * 32 + 2 = 34.

28	PD19	I/O	PD19, PWM3	-
29	UART3_RX	I/O	PB7, UART3_RX, debug RX	-
30	UART3_TX	I/O	PB6, UART3_TX, debug TX	-
31	PB5	I/O	PB5	37
32	PB4	I/O	PB4	36
33	PB3	I/O	PB3	35
34	PB2	I/O	PB2	34
35	TP-X1	AI	TP-X1	-
36	TP-X2	AI	TP-X2	-
37	TP-Y1	AI	TP-Y1	-
38	TP-Y2	AI	TP-Y2	-
39	GND	P	Ground	-
40	ADC	AI	ADC	-
41	USB1_P	A I/O	USB1_P	-
42	USB1_N	A I/O	USB1_N	-
43	GND	P	Ground	-
44	GND	P	Ground	-

3. Extended Interface

3.1 Power connector

The Sufficient IoT Hub requires an operating voltage of 5V and an operating current of 500mA DC. Most 5V-DC adapters with 2.1mm inner aperture plugs can be used to drive the Sufficient IoT Hub today.

3.2 Ethernet Interface

This is a standard RJ45 Ethernet connector which facilitates your project to access the Internet. You can connect it directly to your router or you can connect it to your computer to share the Wi-Fi network.

3.3 Reset button

The reset button is used to reboot the board, and the most logical way to trigger a

reboot operation is in the operating system; using a hardware reboot may corrupt the files being processed. Of course, if your system is no longer able to respond to software commands, the reset button is the only way to trigger a reboot.

3.4 Debugging Interface

The development board uses serial port 3 (PB6, PB7) as the debug output serial port, the baud rate of the serial port is 115200, connect the serial port 3 to the computer above the serial software, you can see the printout.

3.5 USB Host Port

The Sufficient IoT Hub is equipped with a USB Host port.

3.6 MicroSD card slot

Instead of a hard drive like a computer, the Sufficient IoT Hub uses a Micro SD as a hard drive to store the operating system, programs and personal data.

4. System

Sufficient IoT OS is an operating system specially optimized for this product. Based on Linux 5.4.61 Kernel, Debian10, we have made a lot of tailoring and optimization on the operating system for the hardware platform, making it very suitable for working with this set of hardware.

In addition, we also prepared a set of Sufficient IoT Application, make it easier for users to operate its hardware resources. The Sufficient IoT Application include a CLI model and a web UI model.

```
(Top)
                    HelTec LoRaWAN Kconfig configuration
    LoRaWAN region choices (AS923 region)  --->
    LoRaWAN class choices (class A mode)  --->
    LoRaWAN preamble length (Preamble length equal to 8)  --->
    LoRaWAN network access method (Over The Air Activation)  --->
    LoRaWAN debug level (Print frequency and DIO)  --->
    LoRaWAN upload data selection (fixed data)  --->
    LoRaWAN channels mask  --->
    LoRaWAN duty cycle  --->
    LoRaWAN app port  --->
    LoRaWAN other options configuration  --->
    HelTec LoRaWAN license  --->

[Space/Enter] Toggle/enter  [ESC] Leave menu           [S] Save
[O] Load                    [?] Symbol info            [/] Jump to symbol
[F] Toggle show-help mode   [C] Toggle show-name mode  [A] Toggle show-all mode
[Q] Quit (prompts for save) [D] Save minimal config (advanced)
```

```
(Top) → LoRaWAN region choices
                    HelTec LoRaWAN Kconfig configuration
(X) AS923 region
( ) AU915 region
( ) CN470 region
( ) CN779 region
( ) EU433 region
( ) EU868 region
( ) KR920 region
( ) IN865 region
( ) US915 region
( ) US915_HYBRID region
( ) AU915 SB2 region
( ) AS923 AS1 region
( ) AS923 AS2 region

[Space/Enter] Toggle/enter  [ESC] Leave menu           [S] Save
[O] Load                    [?] Symbol info            [/] Jump to symbol
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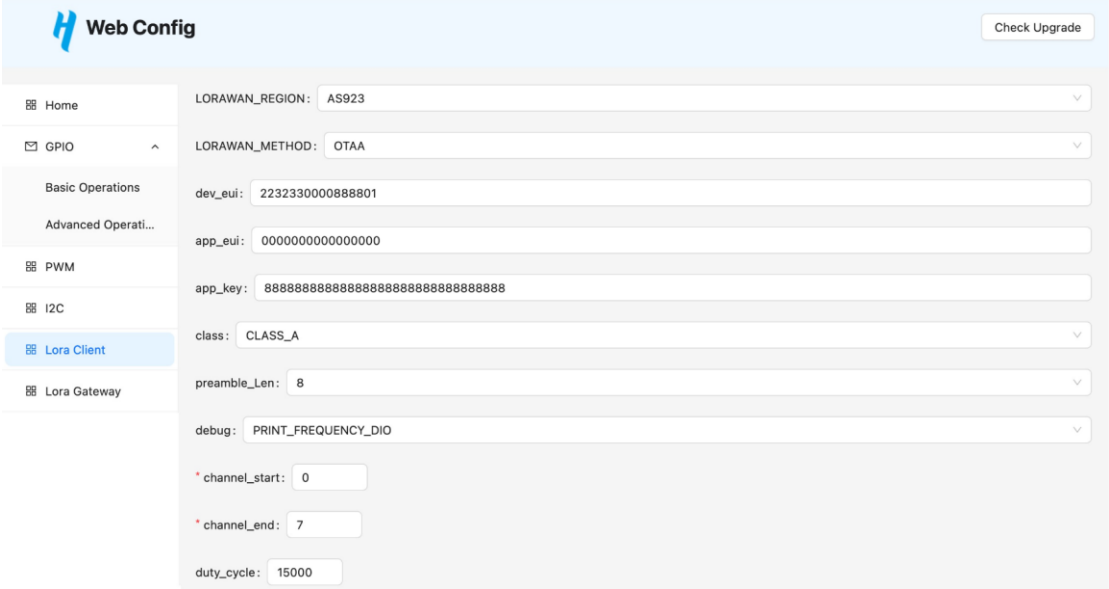
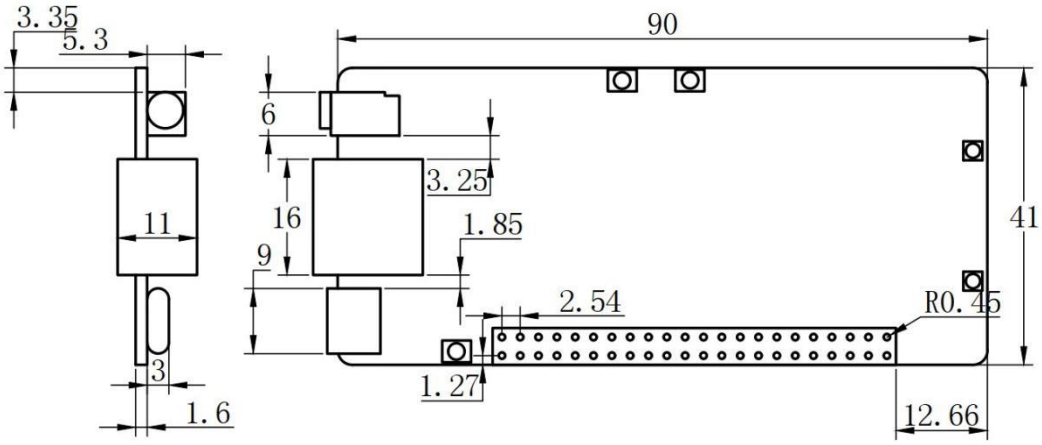


5. Typical hardware features

5.1 Physical dimensions



6. Resource

6.1 Relevant resource

- User manual
- Datasheet

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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 enviroment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

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