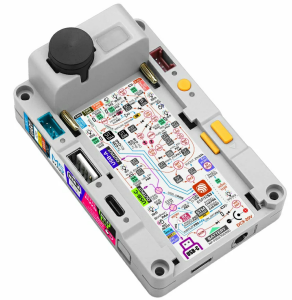
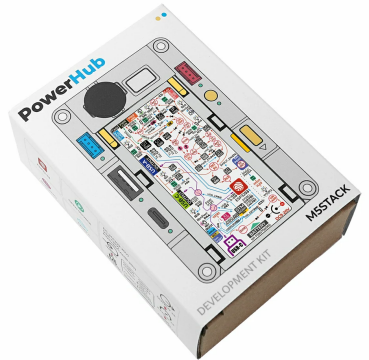
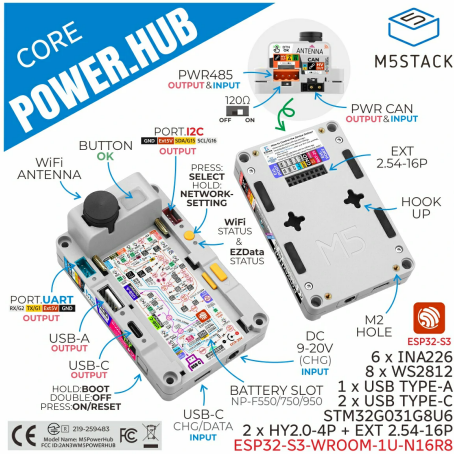
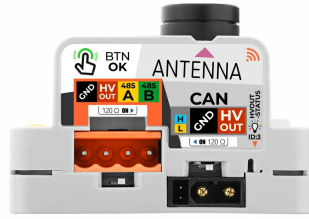
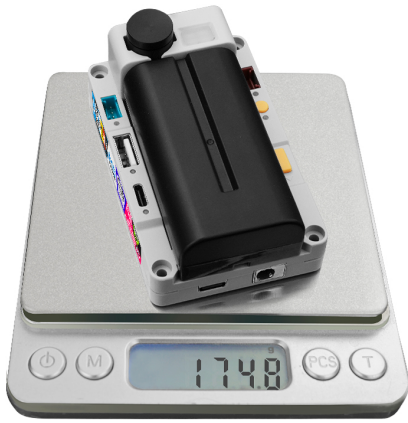


# PowerHub

SKU:C148/K148







## Description

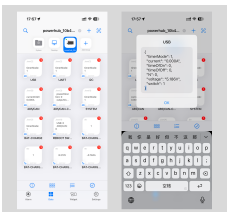
**PowerHub** is a programmable controller integrating multi-channel power management. It adopts the ESP32-S3-WROOM-1U-N16R8 main control module equipped with a dual-core Xtensa LX7 processor (up to 240MHz), supporting 2.4 GHz Wi-Fi, with 16MB Flash and 8MB PSRAM onboard. A built-in STM32G031G8U6 coprocessor, combined with multiple INA226 voltage/current detection ICs and electronic switch design, enables precise management of power states for multiple expansion interfaces, achieving accurate power consumption control and providing low-power wake-up functionality for the whole device. The USB Type-C port can be used for program download and USB OTG functions. Inside, a USB interface switch allows the bottom USB port to be switched to the front USB Type-A or USB Type-C interface for convenient expansion of USB peripherals. The device features an efficient power management system, supporting multiple power supply modes (DC power + 2S battery power + PWR485/PWR CAN input power). It is equipped with 2x HY2.0-4P Grove ports, RS485, and CAN communication interfaces, facilitating connections to various sensors and industrial control devices. Suitable for industrial automation control, smart home, and other scenarios, it provides developers with stable and reliable IoT solutions.

## Tutorial



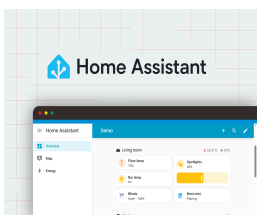
### Arduino IDE

This tutorial explains how to program and control PowerHub using Arduino IDE.



### Factory Firmware User Guide

This tutorial introduces the usage of PowerHub's factory firmware, including button operations, controlling interface on/off through the EZData app or web page, and methods for monitoring voltage and current data.



### Home Assistant

This article shows how to add PowerHub into your Home Assistant

## Features

- ESP32-S3-WROOM-1U-N16R8 main control core
- Supports low-power timed wake-up
- USB Type-A / USB Type-C expansion interfaces
- 2 x HY2.0-4P expansion ports
- 2.54-16P expansion bus interface
- RS485 communication interface (with built-in 120Ω terminal resistor switch)
- CAN bus communication interface (with built-in 120Ω terminal resistor switch)
- 2.4 GHz SMA mini antenna
- Multiple power supply modes:
  - PWR485/PWR CAN input power
  - 2S battery power supply
  - DC 7 ~ 20V power supply
- Human-machine interaction:
  - Multi-channel status indicator lights
  - 3 x physical buttons
- Multiple mounting methods:
  - Magnetic design for mounting on metal surfaces
  - Rear cross mounting holes for wall installation
  - Lego mounting holes
  - M2 screw holes

## | Includes

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### Product Note

The PowerHub Kit is an integrated set equipped with a removable NP-F550 lithium battery, while the standard PowerHub does not include a battery and requires an external power source or separate battery purchase.

## | PowerHub (SKU:C148)

- 1 x PowerHub

## | PowerHub Kit (SKU:K148)

- 1 x PowerHub
- 1 x NP-F550 2000mAh removable battery

## | Applications

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- Industrial automation
- Smart home

## | Specifications

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Specification	Parameter
SoC	ESP32-S3-WROOM-1U-N16R8@Dual-core Xtensa LX7 processor, up to 240MHz
MCU	STM32G031G8U6
Flash	16MB
PSRAM	8MB
Wi-Fi	2.4 GHz Wi-Fi
RTC	RTC Chip: RX8130CE, RTC supercapacitor specification: 70000 $\mu$ F/3.3V, size $\Phi$ 4.8x1.4mm
Expansion Ports	2 x HY2.0-4P + EXT 2.54-16P
RS485 Port	Spec: VH3.96-4P, with 120 $\Omega$ terminal resistor switch Reverse power input voltage: DC 9 ~ 20V
CAN Port	Spec: XT30 (2+2), with 120 $\Omega$ terminal resistor switch Reverse power input voltage: DC 9 ~ 20V
USB Ports	1 x USB Type-A, 2 x USB Type-C
RGB LED	8 x WS2812
Antenna Spec	Size 15 x 14mm, SMA (female thread, female core) connector, 2.4 GHz band, 2dB gain, VSWR $\leq$ 1.8
Compatible Battery	NP-F550/750/950, 2S lithium battery @ 7.4V
DC Power Input	Voltage: DC 9 ~ 20V, spec: 5.5 x 2.1mm, polarity: inner positive, outer negative
Operating Temp.	0 ~ 40 $^{\circ}$ C
Product Size	88.0 x 56.0 x 38.5mm
Product Weight	PowerHub: 71.0g PowerHub Kit (with battery): 174.8g
Package Size	110.0 x 73.0 x 42.0mm
Gross Weight	PowerHub: 105.5g PowerHub Kit (with battery): 208.2g

## Interface Output Capability

Power Supply Method	Output Method	Output Capability
USB Power Supply (No Battery, No DC)	PORT.A (Red)	200mA@4.77V
	PORT.C (Blue)	300mA@4.74V
	USB Type-A	400mA@4.70V
	USB Type-C	300mA@4.74V
	EXT 2.54-16P 5V	400mA@4.72V
	RS485	410mA@11.72V
	CAN	410mA@11.71V
DC Power Jack Supply (Ext.PORT Power)	PORT.A (Red)	500mA@4.70V
	PORT.C (Blue)	600mA@4.74V
	USB Type-A	700mA@4.71V
	USB Type-C	600mA@4.71V
	EXT 2.54-16P 5V	800mA@4.72V
	RS485	1700mA@11.57V
	CAN	1700mA@11.57V
2S Battery Power Supply	PORT.A (Red)	1100mA@4.72V
	PORT.C (Blue)	1300mA@4.81V
	USB Type-A	1300mA@4.92V
	USB Type-C	1300mA@4.82V
	EXT 2.54-16P 5V	1300mA@5.02V
	RS485	1400mA@11.59V
	CAN	1400mA@11.56V
RS485 / CAN Power Input	PORT.A (Red)	390mA@4.70V
	PORT.C (Blue)	570mA@4.70V
	USB Type-A	600mA@4.70V
	USB Type-C	520mA@4.70V
	Ext.PORT_5VOUT	700mA@4.70V

# | Learn

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## | Download Mode

Connect the device to the computer using a USB-C data cable, press and hold the side BtnPWR button for 3 seconds until the indicator light next to the black antenna flashes blue multiple times. At this point, the device enters download mode.



## | Charging Instructions

### Charging Instructions

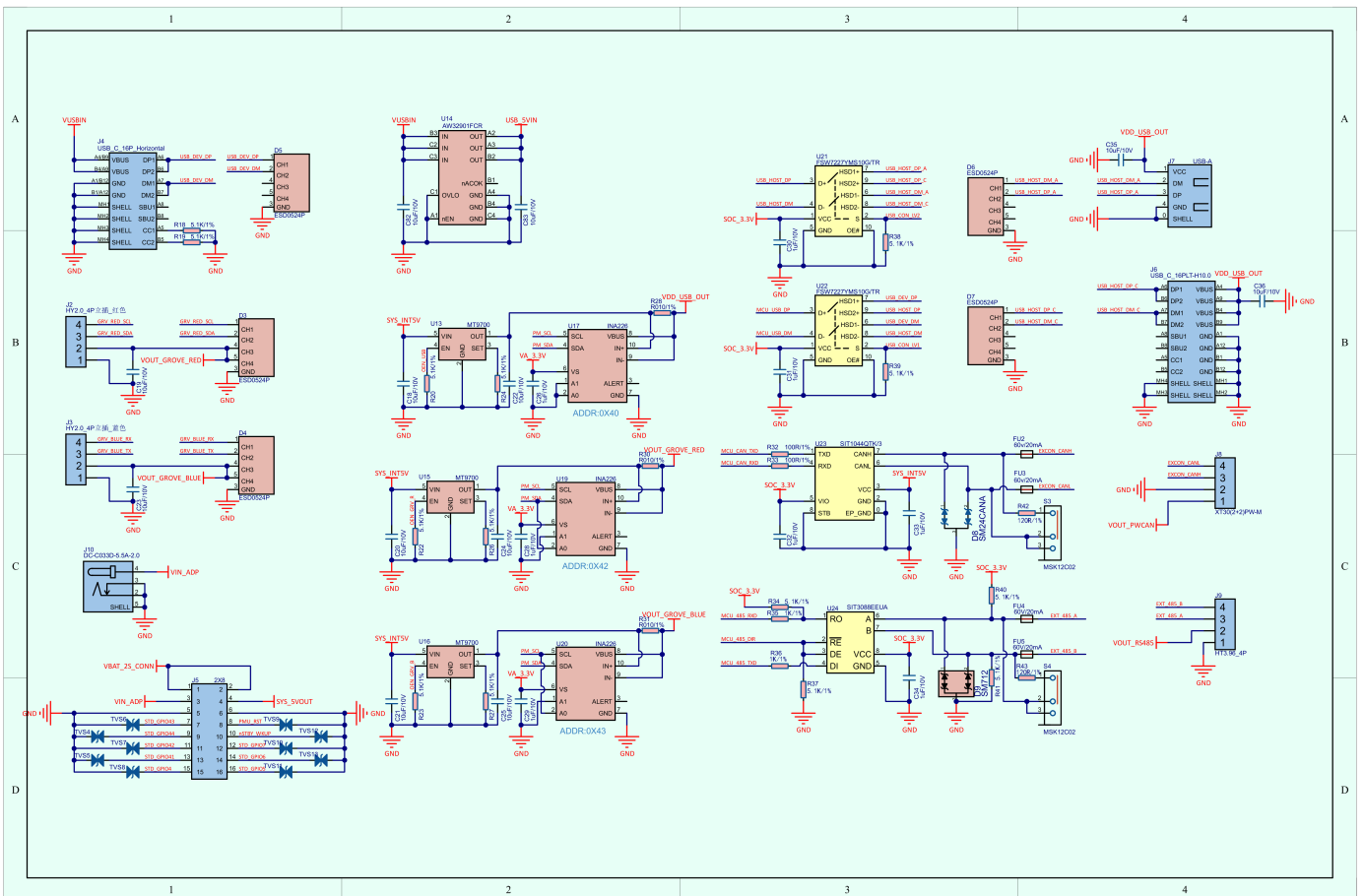
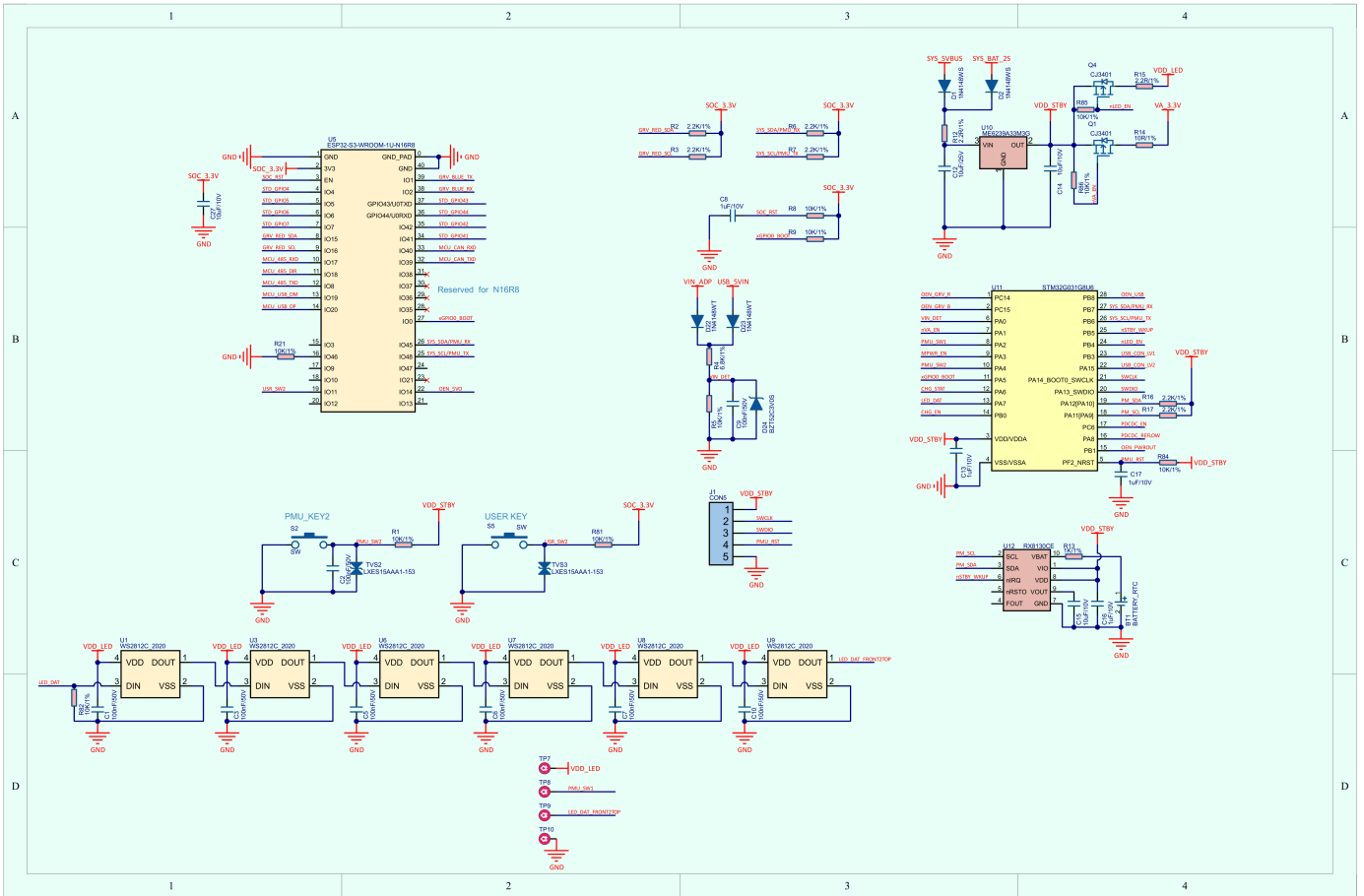
When the battery is over-discharged and its voltage drops below 6V, it enters protection mode. Before recharging, remove the battery, reset the device, reinstall it, and then charge via the device's USB Type-C port.

During the initial charging phase, since the battery is still in protection mode, the charging chip trickle-charges with a small current. This state lasts several minutes, depending on the battery voltage level. Once the voltage rises above 6V, the chip automatically switches to normal charging mode.

## | Schematics

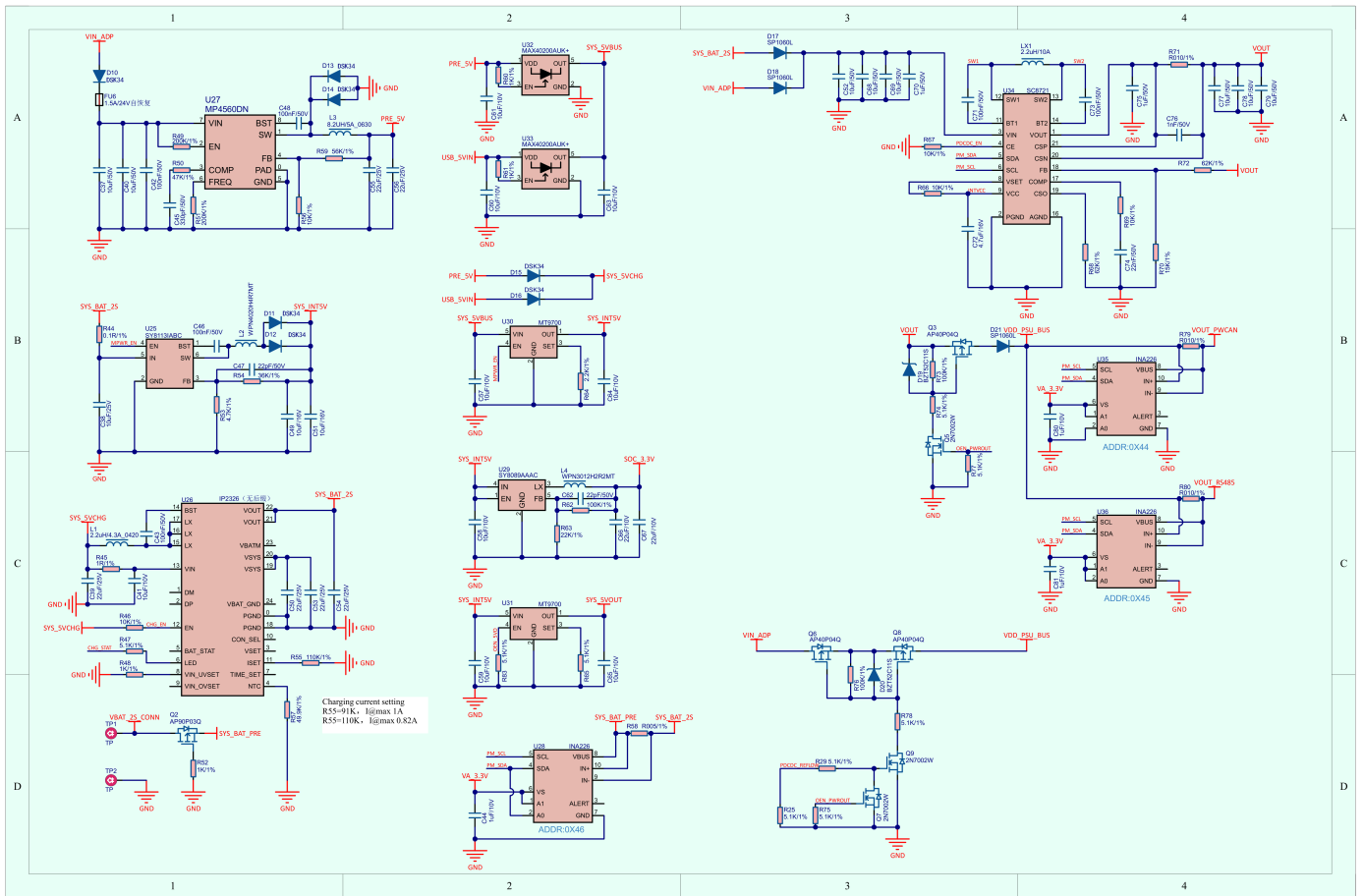
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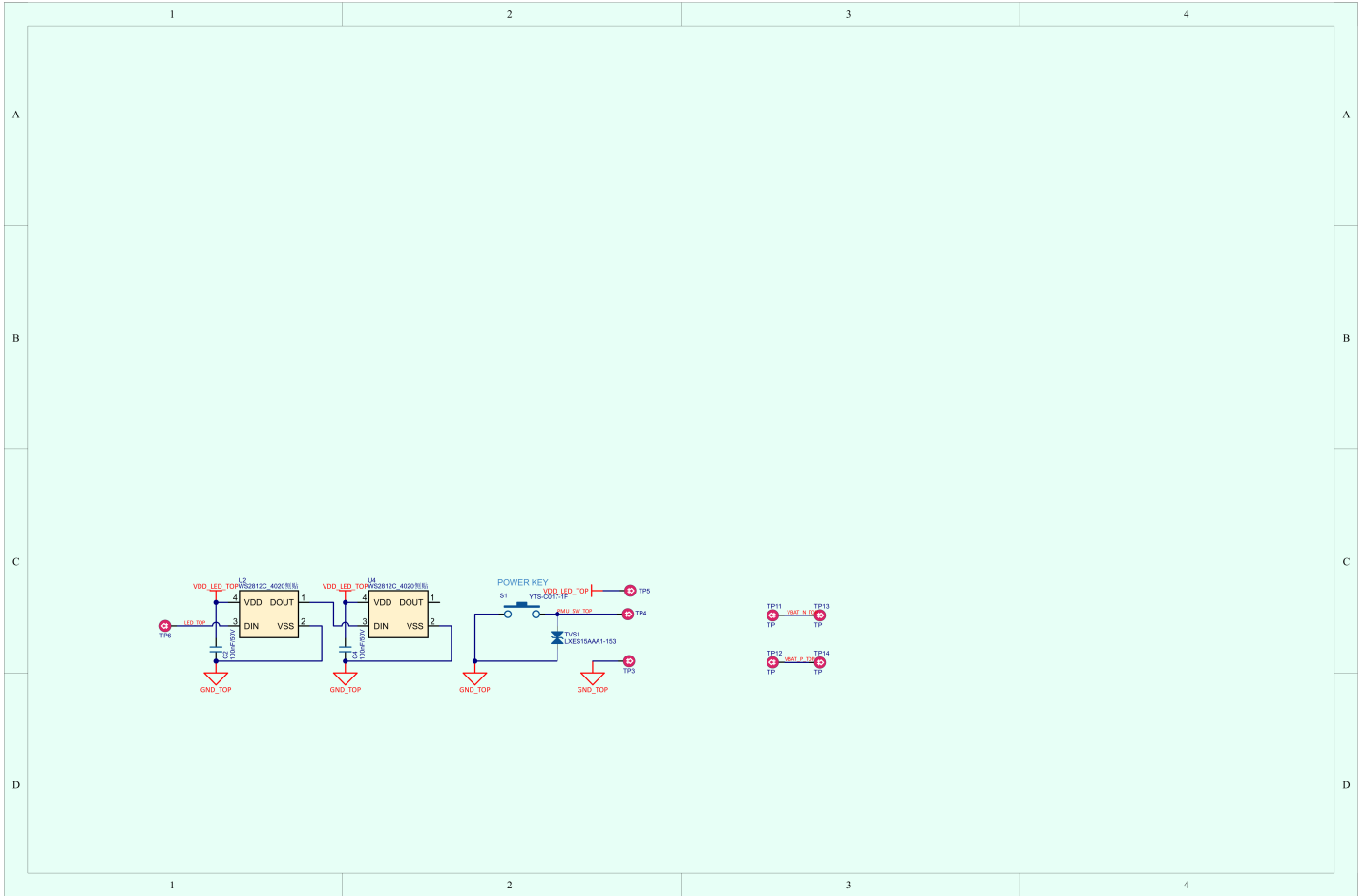
- [PowerHub Mainboard Schematics PDF](#)
- [PowerHub Baseboard Schematics PDF](#)











## PinMap

### RS485 & CAN

ESP32-S3	G8	G18	G17	G39	G40
RS485	MCU_485_TXD	MCU_485_DIR	MCU_485_RXD		
CAN				MCU_CAN_TXD	MCU_CAN_RXD

ESP32-S3	G11
User Button	USR_SW2 (Yellow round button)

ESP32-S3	G19	G20
USB	MCU_USB_DM	MCU_USB_DP

### STM32G031

ESP32-S3	G45	G48	G0
STM32G031	SYS_SDA	SYS_CL	G0_BOOT

## RGB LED & PMU Button

STM32G031	PA7	PB4	PA4	PA2
WS2812C	LED_DATA	LED_EN	PMU_SW2 (side button)	PMU_SW1 (top translucent button)

## USB

STM32G031	PB3	PA15
USB_SWITCH_L1	USB_CON_LV1	
USB_SWITCH_L2		USB_CON_LV2

PowerHub's USB interface adopts a two-level switch design:

- ESP32-S3 is directly connected to the bottom USB Type-C port of the device.
- USB\_CON\_LV1: Controls ESP32-S3 USB pins connection to the bottom USB Type-C port, or routing to the USB\_CON\_LV2 switch.
- USB\_CON\_LV2: Controls routing from USB\_CON\_LV1 to the front USB Type-C port or USB Type-A port.

### USB Port Power Supply Note

The bottom USB Type-C port only supports input power, while the front USB Type-C / USB Type-A ports only support output power.

## Power Manager

STM32G031	PA12	PA11
INA226(0x40) - USB	PM_SDA	PM_SCL
INA226(0x42) - PORT.A	PM_SDA	PM_SCL
INA226(0x43) - PORT.C	PM_SDA	PM_SCL
INA226(0x44) - PWRCAN	PM_SDA	PM_SCL
INA226(0x45) - PWR485	PM_SDA	PM_SCL
INA226(0x46) - Battery	PM_SDA	PM_SCL
SC8721	PM_SDA	PM_SCL
RX8130CE(0x32)	PM_SDA	PM_SCL

STM32G031	PA1	PA0	PB8	PC14	PC15	PB1	PA8	PC6
INA226_PWR	nVA_EN							
DC_INPUT_DETECTOR		VIN_DET						
USB_PWR			OEN_USB					
PORT.A_PWR				OEN_GRV_R				
PORT.C_PWR					OEN_GRV_B			
RS485_CAN_PWR						OEN_PWROUT	PDCDC_REFLOW	
SC8721_DCDC_PWR								PDCDC_EN

### RS485 & CAN Port Output Power Config

When using the SC8721 buck-boost power supply for forward output, INA226\_PWR must be enabled. RS485\_CAN\_PWR enables OEN\_PWROUT for forward output, enables SC8721\_DCDC\_PWR, and PDCDC\_REFLOW must be held low.

## RS485 & CAN Port Reverse Power to Main Unit Config

In this mode, disable SC8721, set OEN\_PWRROUT low, and PDCDC\_REFLOW high. This allows external power to backfeed to the host via the PWRCAN or PWR485 ports.

ESP32-S3	G14
EXT 2.54-16P 5V PWR	OEN_5VO

STM32G031	PB0	PA6	PB5
CHARGE	CHG_EN	CHG_STAT	
WAKE_UP			nSTBY_WAKE_UP

## HY2.0-4P

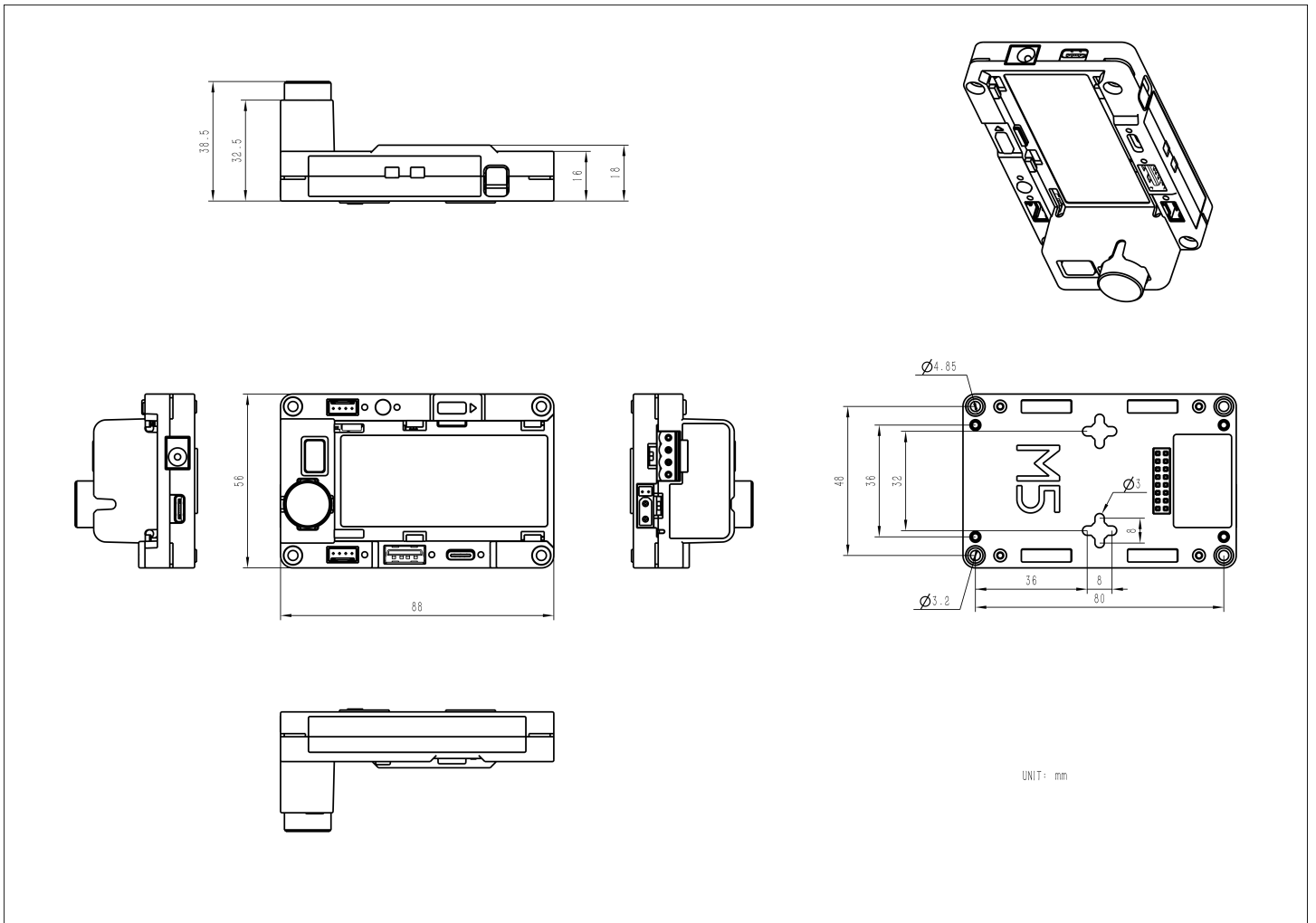
HY2.0-4P	Black	Red	Yellow	White
PORT.A	GND	5V	G15	G16
PORT.C	GND	5V	G1	G2

## EXT 2.54-16P

PIN	LEFT	RIGHT	PIN
BAT-2S	1	2	BAT-2S
HVIN	3	4	5VOUT
GND	5	6	GND
G43	7	8	RST
G44	9	10	nWKUP
G42	11	12	G7
G41	13	14	G6
G4	15	16	G5

## Model Size

- [PowerHub Model Size PDF](#)



## Datasheets

- [ESP32-S3-WROOM-1U-N16R8](#)
- [INA226](#)
- [RX8130CE Datasheet](#)
- [RX8130CE Register Manual](#)

## Softwares

### Arduino

- [PowerHub Arduino M5Unified Library](#)
- [PowerHub Arduino M5GFX Library](#)

### ESP-IDF

- [PowerHub Factory Firmware Source Code](#)

### PlatformIO

```
[env:m5stack-powerhub]
platform = espressif32@6.10.0
board = esp32s3box
framework = arduino
upload_speed = 1500000
monitor_speed = 115200
board_build.arduino.partitions = default_16MB.csv
board_build.arduino.memory_type = qio_opi
build_flags =
  -DESP32S3
  -DBOARD_HAS_PSRAM
  -DCORE_DEBUG_LEVEL=5
  -DARDUINO_USB_CDC_ON_BOOT=1
  -DARDUINO_USB_MODE=1
lib_deps =
  https://github.com/m5stack/M5Unified.git#develop
  https://github.com/m5stack/M5GFX.git#develop
```

## | Internal Firmware

- [PowerHub Internal Firmware](#)

## | Protocol

- [PowerHub STM32 Internal Firmware Protocol](#)
- [PowerHub STM32 Register Table](#)

## | Video

- 
- [PowerHub Product Introduction and Case Demonstration](#)

[EN\\_C148\\_K148\\_PowerHub\\_video.mp4](#)