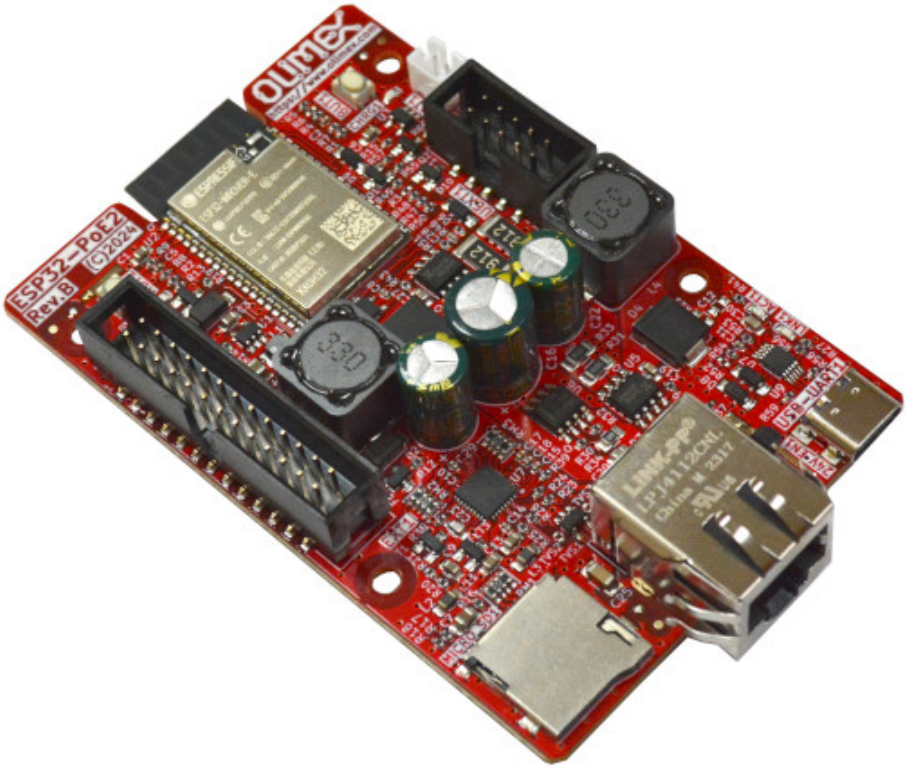


ESP32-POE2

User Manual

Document revision 2.5, September 2025 **www.olimex.com**

Table of Contents

Introduction to ESP32-POE2

ESP32-POE2 is an upgraded version of the popular ESP32-PoE board with more power output capabilities. ESP32-POE2 is an IoT based on ESP32-WROVER-E WIFI/BLE/Ethernet development board with Power-Over-Ethernet feature. The ESP32-POE2 allows 25W power negotiation and can provide 24V/12V/5V/3.3V to additional equipment connected to it.

The PoE in ESP32-POE2 is handled by TPS2378 chip that is IEEE 802.3af-compliant, including pre-standard (legacy) PoE support.

The PoE powering requires at least 37V DC to operate successfully. The board can take power from the Ethernet cable and can be expanded with sensors and additional peripherals. Perfect solution for Internet-of-Things projects.

The board is considered Open Source Hardware, design files are released under CERN Open Hardware Licence Version 2 - Strongly Reciprocal. Design files can be found at our GitHub.

Software is released under GPL V3 License and documentation is released under CC BY-SA 4.

+ **Important notice:** ESP32-POE2 has **no galvanic isolation** on Ethernet's power supply, this might be a problem for ground loops. This also means that when you program the board via the micro USB connector the Ethernet cable should be disconnected (if you have power over the Ethernet enabled)! Any board with own external power supply attached to ESP32-POE2 can be dangerous. Consider using Olimex USB-ISO to protect your computer and board from accidental short circuit.

ESP32-POE2 features

- ESP32-WROVER-E-N4R8 - WiFi and bluetooth module with 4MB flash, 8MB PSRAM
- CE-RED and LVD certification
- Original design by OLIMEX Ltd
- Low power design - 200uA consumption in deep sleep
- Ethernet 100Mb interface with IEEE 802.3 PoE support
- USB-C connector for ESP32 programming
- MicroSD card working in 1 bit mode (3 more GPIOs)
- LiPo battery charger with LiPo battery connector
- Battery level monitor pin on ADC
- External power supply detection pin on ADC
- Total output for external circuits - 25W max, max power distributed as follows:
  - 0.75A at 24V or 1.5A at 12V (selectable by jumper);
  - 1.5A at 5V;
  - 1A at 3.3V.
- UEXT connector
- EXT connector
- User button
- Reset button
- PCB dimensions: (59 x 90)mm ~ (2.32 x 3.54)in

PoE standard

ESP32-POE2 follows the original IEEE 802.3af PoE standard and provides up to 25 W of DC power (PoE requires minimum 44 V DC and 350 mA). Only 23 W is assured to be available at the powered device as some power dissipates in the cables.

The board requires networking equipment that complies with IEEE 802.3af. It is **STRONGLY** recommended to use **isolated PoE equipment**.

The differences between ESP32-POE2 and ESP32-POE-ISO:

ESP32-POE-ISO has limited output voltage range. There are only 5V and 3.3V outputs available, while ESP32-POE2 has also 12V DC or 24V DC.

ESP32-POE2 is not galvanically isolated which means that it's not safe to connect it to other devices which use non isolated power supply.

+ YOU SHOULD NOT CONNECT ESP32-POE2 to computer's USB port while it's powered by Ethernet POE!!! If you connect USB while ESP32-POE2 is powered by Ethernet you will damage the board or your computer or both. This also voids the warranty!

+ The board is susceptible to grounds loops. Make sure your PoE network equipment is isolated. Measure for voltage difference between different grounds before attaching devices to ESP32-POE2.

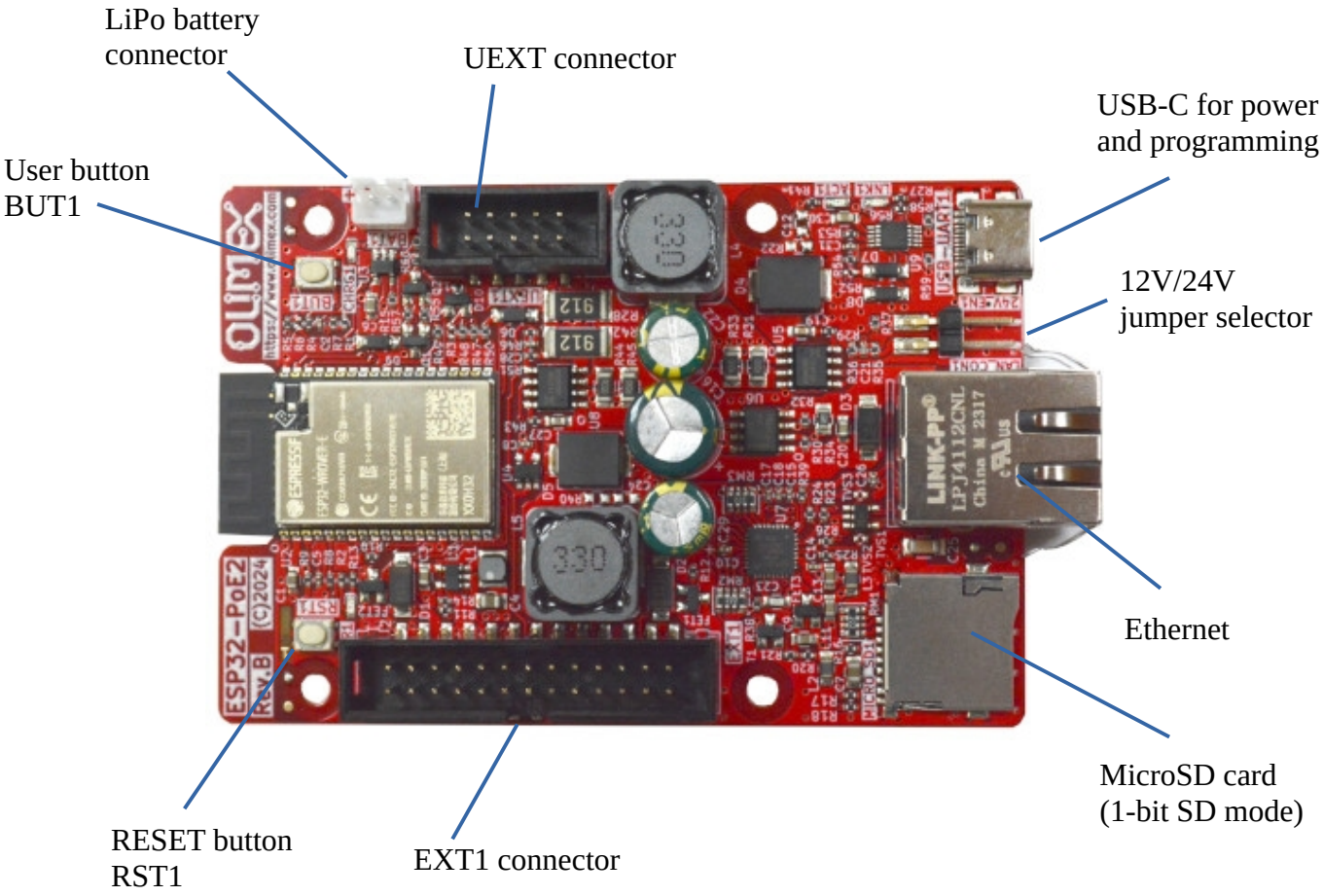
+ The most optimal setup for the board is being connected just to the PoE Ethernet cable and all attached peripherals are attached only to ESP32-POE2. No sources of power with different grounds should be attached at the same time. Additional boards that are attached to ESP32-POE2 and are also attached to other sources of power supply (being powered from other sources) can also cause problems!

Order codes for ESP32-POE2 and accessories:

ESP32-POE2	Commercial temperature grade 0-70C board with internal antenna
USB-CABLE-A-TO-C-1M	1 meter USB-A to USB-C cable for ESP32-POE2 power and programming
Ethernet-CABLE-1M	1 meter Cat 5e Gigabit Ethernet cable with not shielded RJ45 connectors
BOX-ESP32-POE2	Plastic box for ESP32-POE2
BATTERY-LIPO1400mAh	Lipo battery 3.7V 1400mAh – note these batteries can be shipped only by ground so we can deliver only to EU destinations.
UEXT modules	Different sensors, relays, LCDs, RTC, GSM, GPS, accessories which can be connected to UEXT connector

HARDWARE

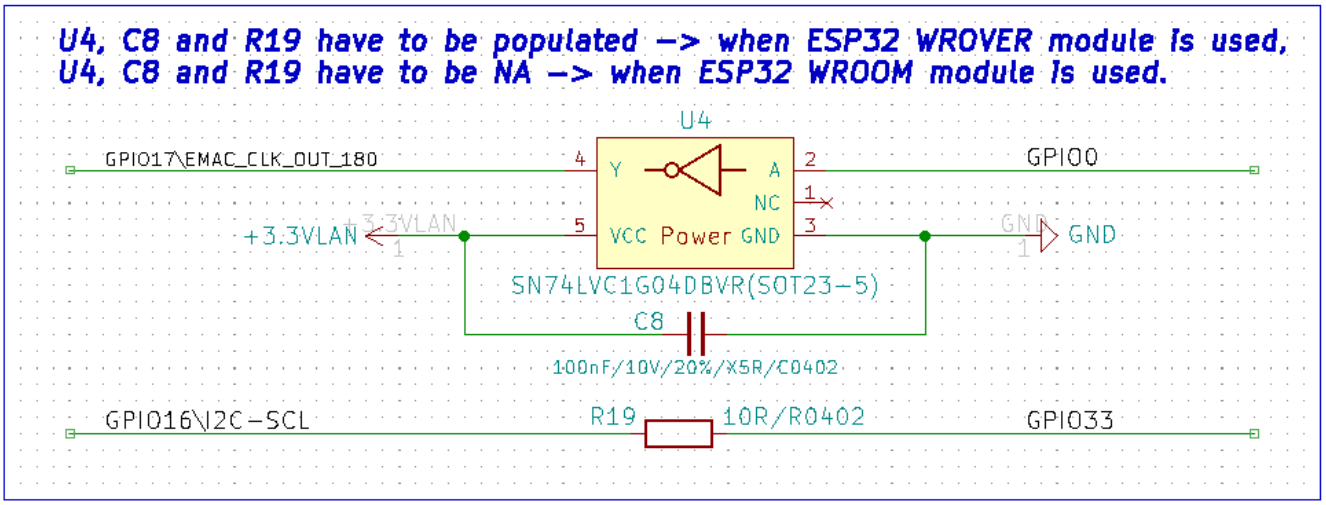
ESP32-POE2 layout:



ESP32-POE2 GPIOs:

+ ESP32 chip and modules have very good pin multiplexing. You can define any free GPIO pin for almost any goal.
+ ESP32-POE2 uses WROVER chip, and it uses GPIO16 and GPIO17 for PSRAM. This is important when you are defining the pins for the Ethernet.

ESP32-POE2 with WROVER module remaps GPIO16 to GPIO33 (so, for example, at UEXT pin #5 you have GPIO33 instead of GPIO16) and GPIO17 to GPIO0 (this is the Ethernet clock source).

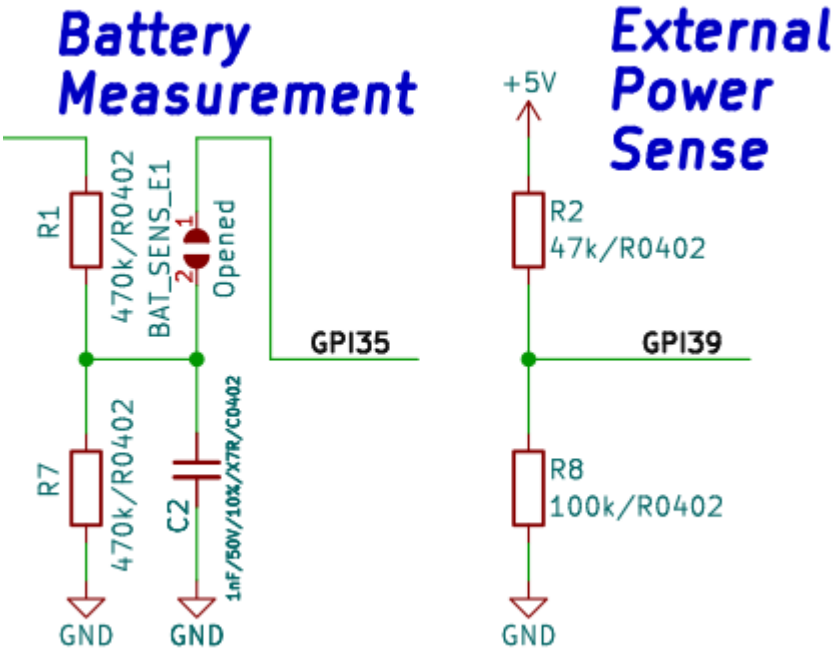


Power sense and battery level measurement:

- External power sense available on GPI39

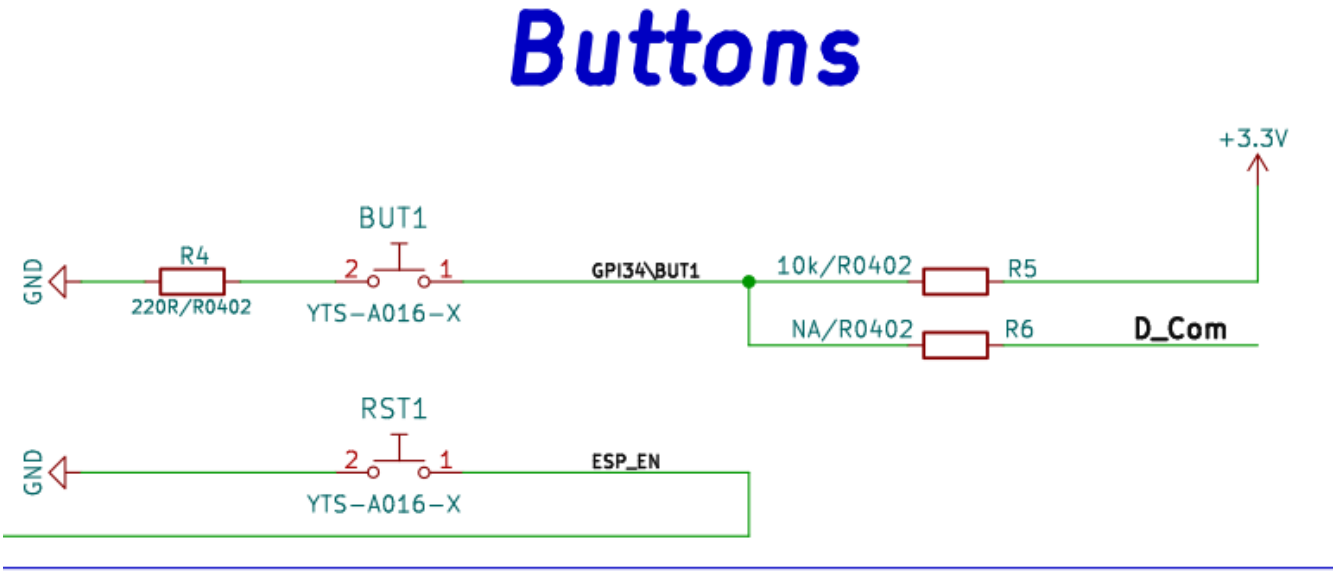
- Battery measurement disabled by default (for an additional free GPIO), but can be enabled by SMT jumper change

- Close SMT jumper BAT_SENS_E1 (solder its pads together) to enable battery measurement on GPI35.

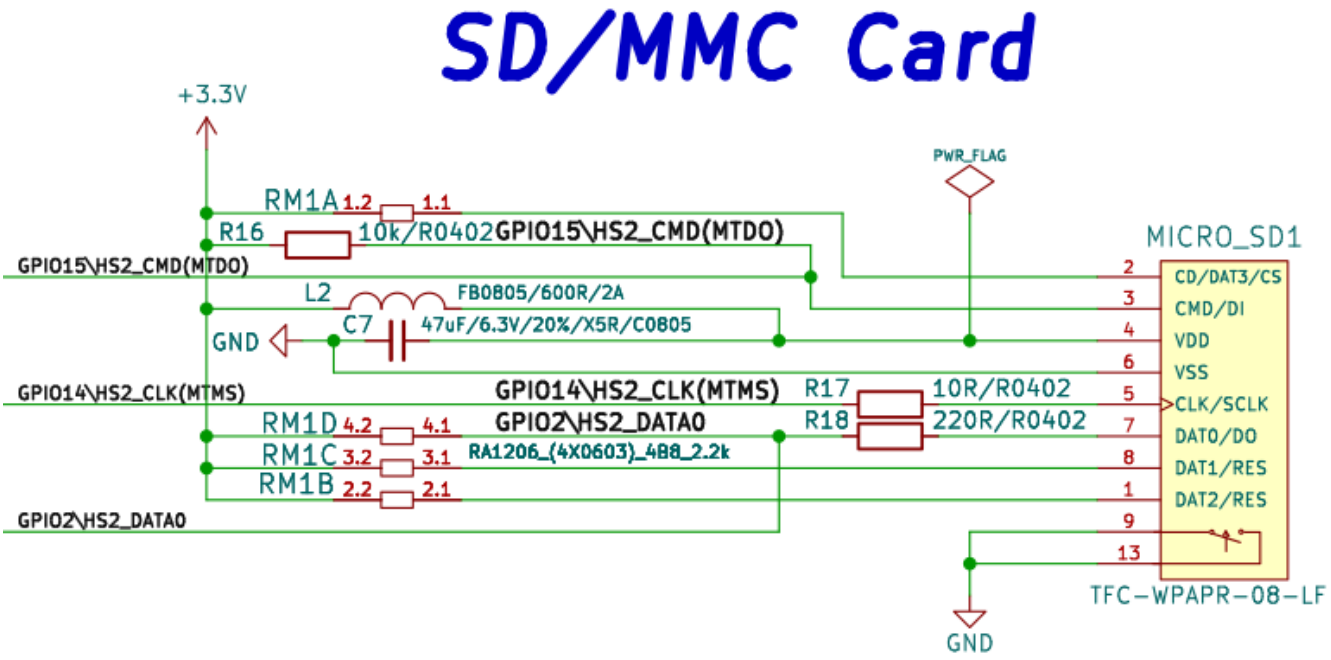


GPIO Buttons:

By default button BUT1 is user button since the board automatically enters bootloader mode. However, BUT1 can be configured as BOOT button if you solder R6 pads together (or if you solder 0R resistor in 0402 package on same R6 pads). BOOT button can then be used to manually force boot mode.

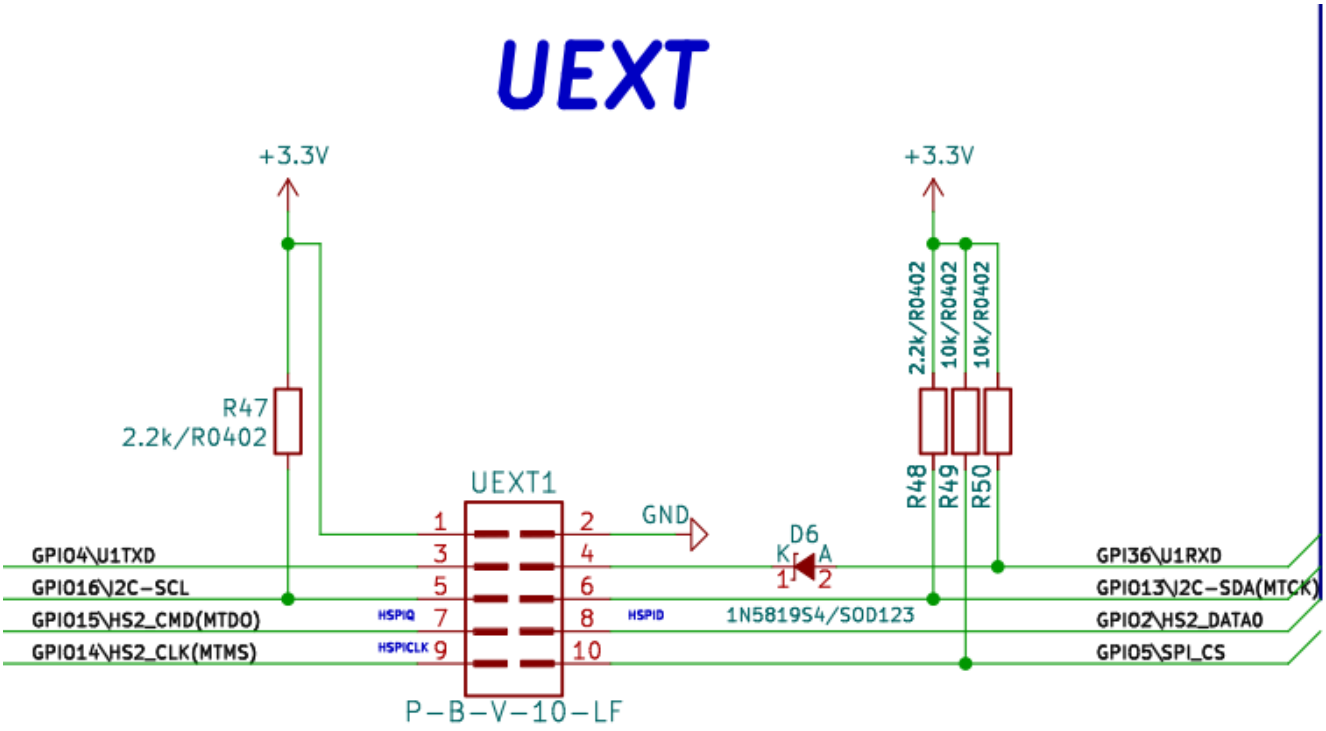


SD card connector (1-bit SD interface):

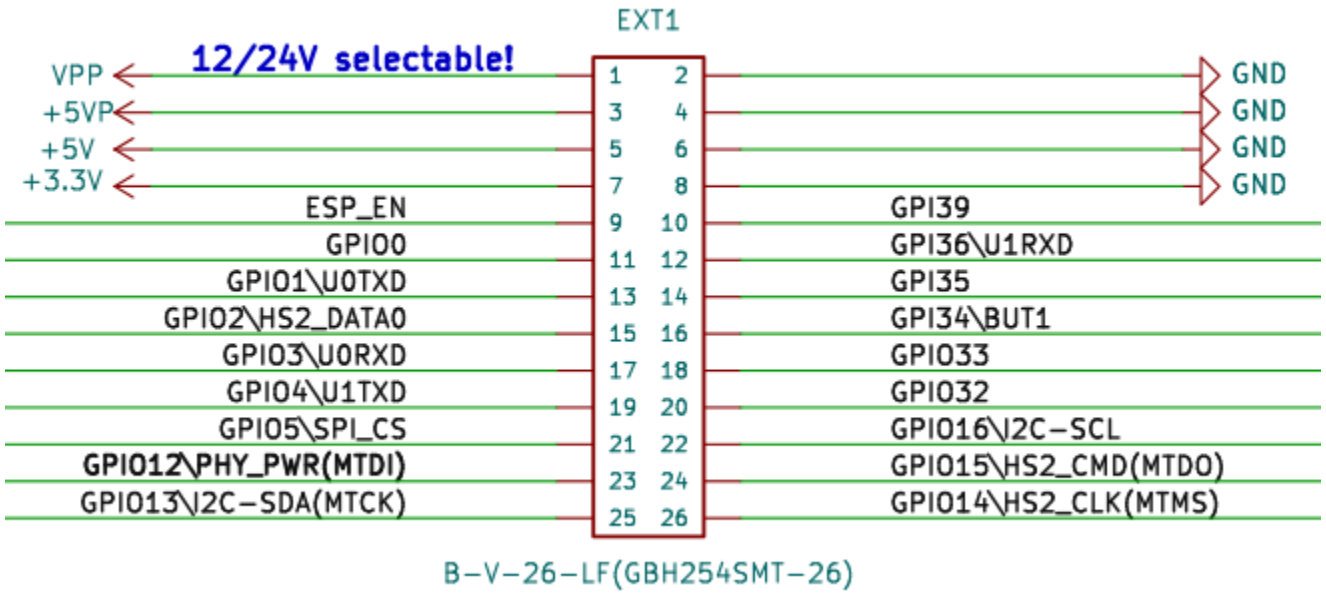


UEXT connector:

Notice that GPIO16 is replaced by GPIO33 in boards with ESP32-WROVER-E module.



EXT1 connector:



POWER SUPPLY:

VPP selectable 12V/1.5A or 24V/0.75A output from PoE, depending on 24V_E1 PTH jumper state

+5VP 5V/1.5A output from PoE

+5V 1. can be output or input;

2. when board is connected to USB or to Ethernet PoE this line can be used as output and power other circuits;

3. if you want to use as input i.e. to power the board from external 5V on this pin sure board is not connected to the USB!

+3.3V output which can source up to 0.5A @ 3.3V i.e. (1.65W)

GPIOs:

ESP_EN resets ESP32 module;

GPIO0 is used for Ethernet clock;

GPIO16, **GPIO17** are used for the PSRAM;

GPIO1 is used for the serial line and programming;

GPIO2, **GPIO14**, **GPIO15** are used for the SD-card, if no SD card is present these are free to use

GPIO2, **GPIO4**, **GPIO5**, **GPIO13**, **GPIO14**, **GPIO15**, **GPIO33, GPIO36** are shared on both UEXT and EXT1,2 headers so if you use them at one connector do not use at the other

GPI39 is used to measure external power supply voltage

GPI34 is connected to used button and have 10K pullup

GPI35 is free to use but can be connected to measure the LiPo battery voltage if SENS_BAT_E1 solder jumper

Notice that pins named GPI* can only be inputs (unlike GPIO*).

ESP32-POE2 schematics:

ESP32-POE2 latest schematic is on GitHub

ESP32-POE2 power supply:

ESP32-POE2 can be powered by 4 sources:

- Ethernet PoE, notice this is class 4 PoE device requires at least 12.95W and can go up to 25.5W
- USB-C connector
- LiPo battery
- EXT1 pin 5 (+5V) note that this signal is connected to USB 5V signal so when you power with this pin you should not connect the board to the USB!

Power consumption of ESP32-POE2 is between 50 and 200mAdepend on the operation mode.

A LiPo battery gets charged automatically from other sources of power with about 100mA.

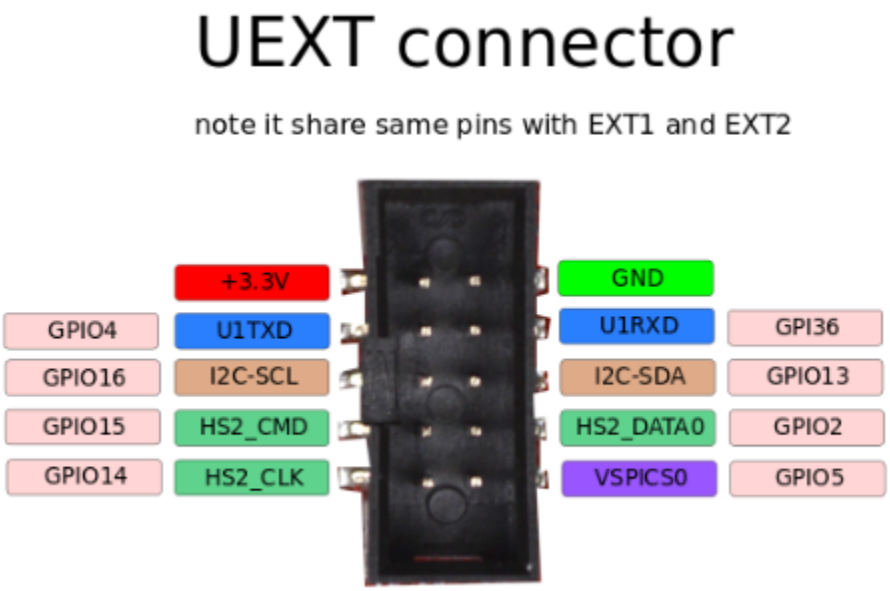
When the LiPo battery is attached and external power supply is missing internal DCDC step-up converter and switching circuit automatically powers ESP32-POE2 from the battery. 1400mAh battery will provide about 8 hours of stand alone operation.

+The LiPo battery connector is JST 2.0 mm connector and with Olimex's battery polarity. If you use batteries from other manufacturers please make PLUS and MINUS are connected properly as you may damage the board!!!

UEXT connector:

UEXT connector stands for Universal EXTension connector and contain +3.3V, GND, I2C, SPI, UART signals. It is usually used to attach external modules without soldering.

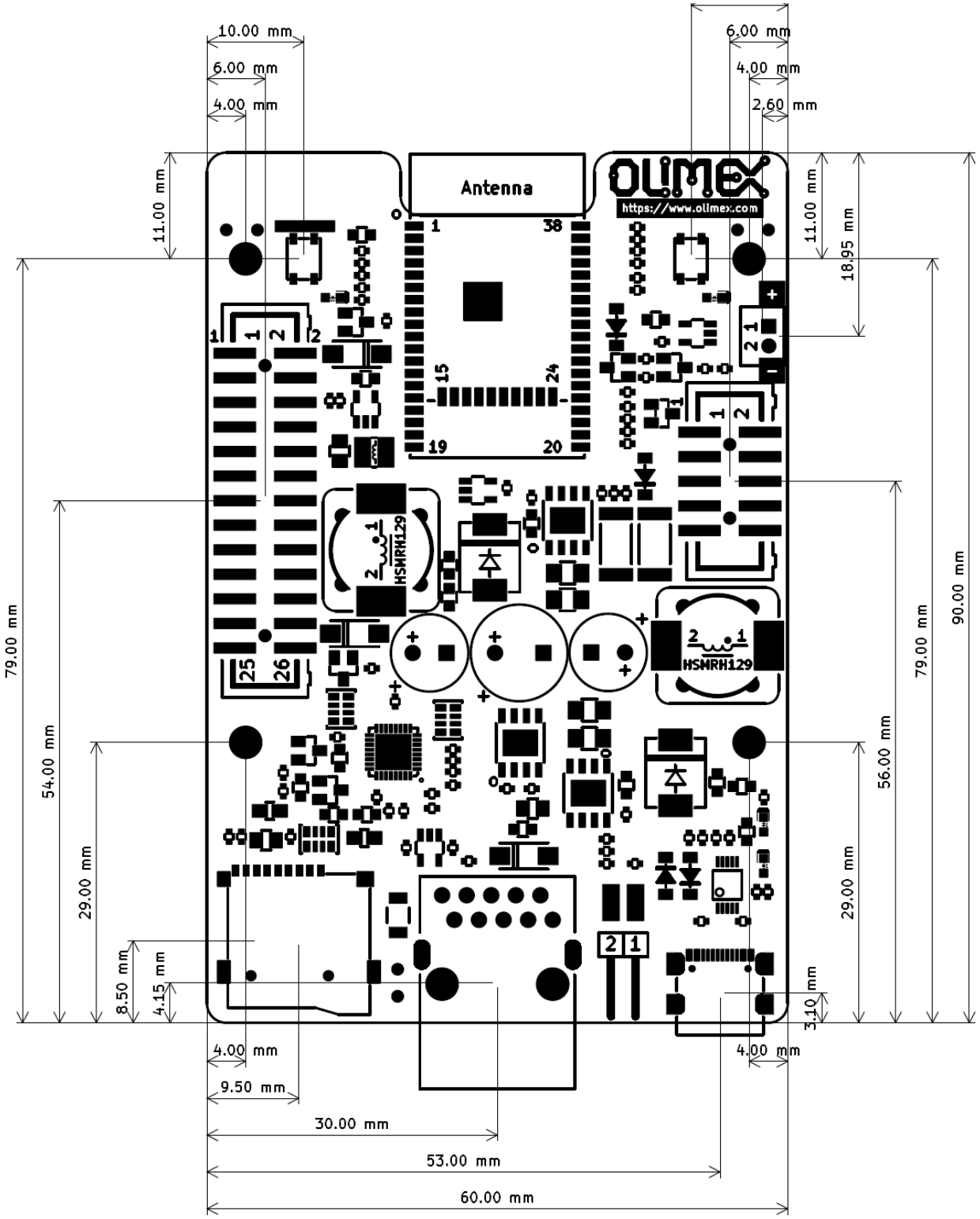
UEXT is 0.1” 2.54mm step boxed plastic connector. All signals are with 3.3V levels.



GPIO16 is replaced by GPIO33 in boards with ESP32 WROVER module.

Olimex has developed number of MODULES with this connector. There are temperature, humidity, pressure, magnetic field, light sensors. Modules with LCDs, LED matrix, Relays, Bluetooth, Zigbee, WiFi, GSM, GPS, RFID, RTC, EKG, sensors and etc.

DIMENSIONS


10.00 mm
6.00 mm
4.00 mm
6.00 mm
4.00 mm
2.60 mm
11.00 mm
11.00 mm
18.95 mm
Antenna
OLIMEX
https://www.olimex.com
1
38
15
24
19
20
HSMRH129
HSMRH129
25
26
79.00 mm
54.00 mm
29.00 mm
8.50 mm
4.15 mm
79.00 mm
90.00 mm
56.00 mm
29.00 mm
3.10 mm
4.00 mm
9.50 mm
30.00 mm
53.00 mm
60.00 mm
4.00 mm

SOFTWARE:

ESP32-POE2 uses same software as ESP32-POE which is very popular board and supported by

- Espressif ESP-IDF
- MicroPython
- Arduino IDE
- Esphome
- PlatformIO

In Arduino IDE make sure to enable the PSRAM in the board selector (when board is with ESP32-WROVER-E)!

For the Ethernet operation make sure to properly set the GPIO for the Ethernet clock and the pin for the power enable pin! GPIO12 is used as PHY power pin and GPIO0 is used as clock output pin (when board uses ESP32-WROVER-E module). Under Arduino defines should be like (must be defined before ETH.h):

```
#ifndef ETH_PHY_TYPE
#define ETH_PHY_TYPE  ETH_PHY_LAN8720
#define ETH_PHY_ADDR  0
#define ETH_PHY_MDC  23
#define ETH_PHY_MDIO  18
#define ETH_PHY_POWER  12
#define ETH_CLK_MODE ETH_CLOCK_GPIO0_OUT
#endif

#include <ETH.h>
```

FAQ:

- **Help! Ethernet is not working always upon power-up. If I press the reset or power cycle the board a few times sometimes it starts working. Is my device faulty?**

  It is probably because your software didn’t utilize the PHY_PWR pin (GPIO12) properly. This behavior happens when the PHY controller (LAN8720) gets powered before the ESP32 module can generate the PHY clock. What your software should do is hold the LAN8720 in reset for few milliseconds via the PHY_PWR pin and release it from reset only after PHY clock is already generated by the ESP32 module. Simple software workarounds that can be tested are adding delay before Ethernet initialization or toggling GPIO12 to reset only the Ethernet chip until connection is restored.

- **Where are I2C, UART, SPI pins exposed?**

  The ESP32 chip has very advanced multiplexing and you can define any free GPIO pin for I2C, UART, SPI operation as long as you are within the maximum supported (some penalties to SPI's maximum frequency apply, when not using the dedicated pins). Notice that some ESP32 pins can only be inputs. Double check if the pins you want to use are free. Defining pins for another function is a purely software effort.

- **I provide 24V to the Ethernet of ESP32-POE2's but it doesn't seem powered. What is the problem?**

  TPS2375PW (Si3402) would NOT work with 24V DC. The recommended voltage is 48V DC and the minimum is around 37V DC. For more info refer to TPS2375PW's (Si3402-B's) datasheet.

- **I power the board from the battery connector. The LEDs remain off. Is it broken?**

  Probably not. This is a low-power design. The LEDs would not turn on when operating on battery to save power. You need other ways to determine if it works or not. For example, something over the serial lines or over the Ethernet (with no PoE enabled else it would get powered from there).

- **What is the power delivery mode of these boards? Is it mode A or mode B?**

  ESP32-POE2 uses LAN connector that is compatible with both mode A or mode B. Either one is fine.

- **What is the PoE class of ESP32-POE2?**

  ESP32-POE2 is set for class PoE class 4 operation (12.95W-25.5W). Class 4 operation might require more current since it requires at least 12.95W up to 25.5W, if you have trouble with

powering multiple devices from the same switch then refer to the schematic and unsolder the resistor R34 to switch back to class 0 operation. (0.44W to 12.95W).

Document Revision History

Revision 2.5 September 2025

-Add FAQ section

Revision 2.4 March 2025

-Minor improvements and fixes

Revision 2.3 August 2024

-Additional notes about software setup for Ethernet and board selection

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Revision 2.2 May 2024

-Fixed mistakes in GPIO descriptions

Revision 2.2 May 2024

-Fixed mistakes in GPIO descriptions

Revision 2.1 May 2024

- Added dimensions

- Spelling improvements

Revision 2.0 May 2024

- Fixed wrong info about ESP32 module – the board is manufactured with WROVER module, not WROOM;

- Clarified warnings about isolation;

- Added some extra info about different GPIOs;

- Spelling improvements.

Revision 1.0 April 2024