ESP32-Ethernet-Kit V1.0 Getting Started Guide

This guide shows how to get started with the ESP32-Ethernet-Kit development board and also provides informa on about its func onality and configura on op ons.

The ESP32-Ethernet-Kit is an Ethernet-to-Wi-Fi development board that enables Ethernet devices to be interconnected over Wi-Fi. At the same me, to provide more flexible power supply op ons, the ESP32-Ethernet-Kit also supports power over Ethernet (PoE).

What You Need

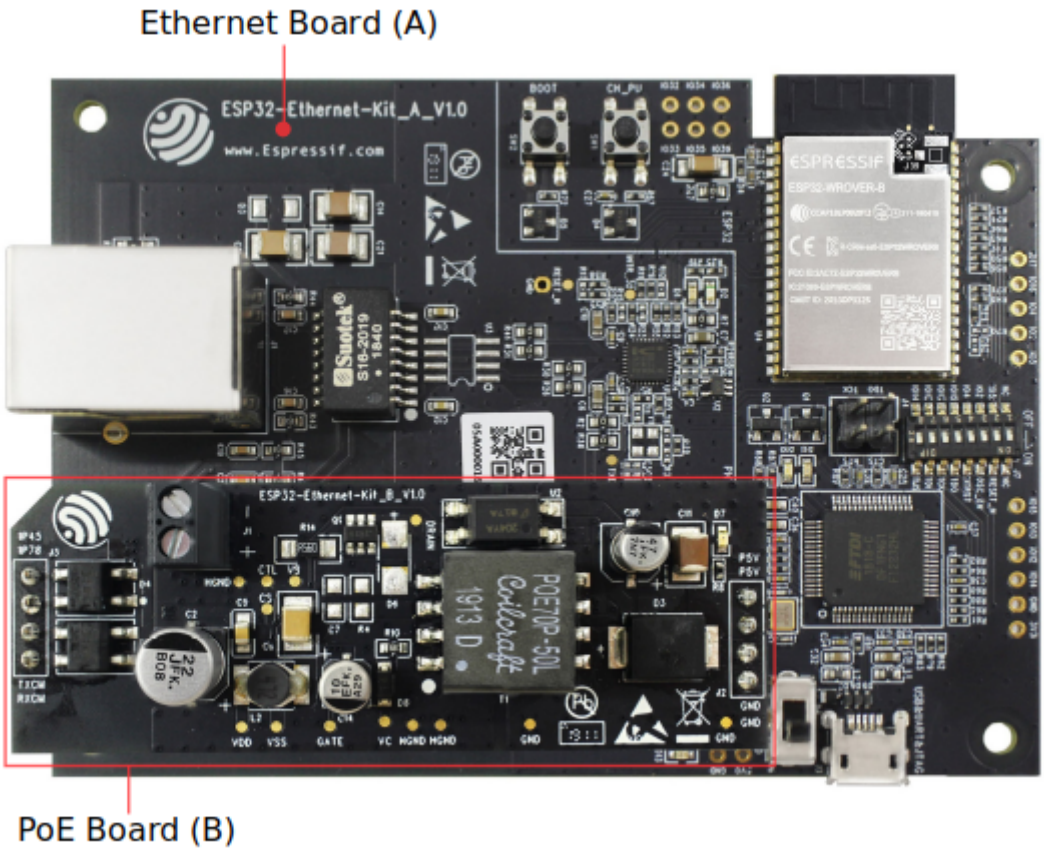
- ESP32-Ethernet-Kit V1.0 board
- USB 2.0 A to Micro B Cable
- Computer running Windows, Linux, or macOS

You can skip the introduction sections and go directly to Section Start Application Development.

Overview

ESP32-Ethernet-Kit is an ESP32-based development board produced by Espressif.

It consists of two development boards, the Ethernet board A and the PoE board B, The Ethernet board (A) contains Bluetooth / Wi-Fi dual-mode ESP32-WROVER-B module and IP101GRI, a Single Port 10/100 Fast Ethernet Transceiver (PHY). The PoE board (B) provides power over Ethernet functionality. The A board can work independently, without the board B installed.

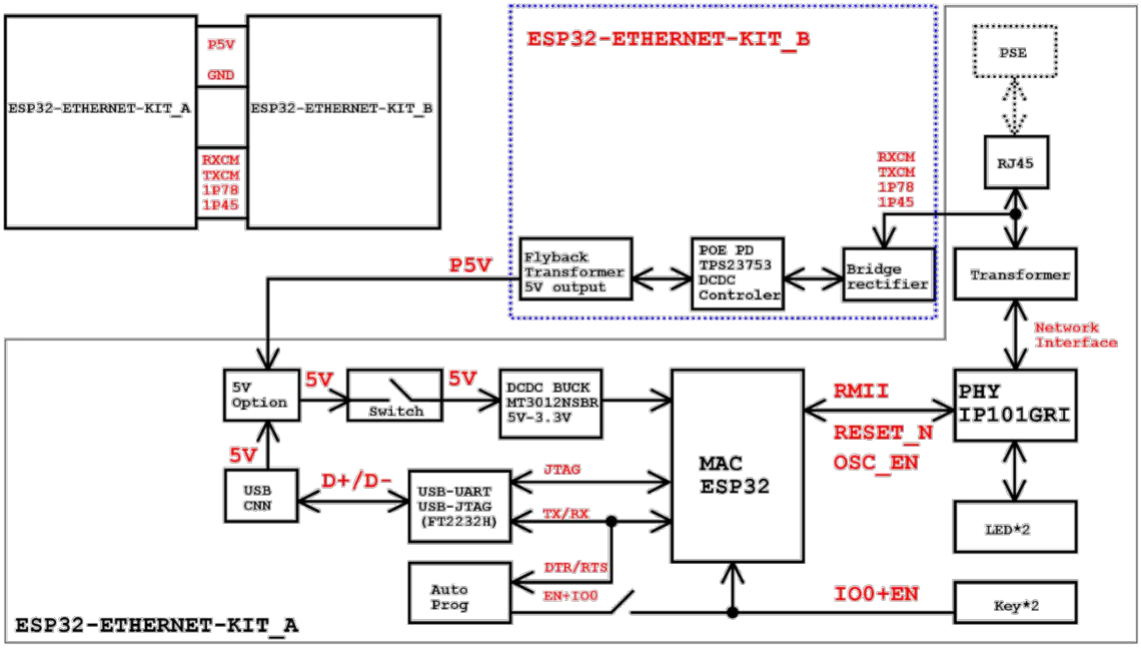


ESP32-Ethernet-Kit V1.0

For the application loading and monitoring the Ethernet board (A) also features FTDI FT2232HL chip - an advanced multi-interface USB bridge. This chip enables to use JTAG for direct debugging of ESP32 through the USB interface without a separate JTAG debugger.

Functionality Overview

The block diagram below shows the main components of ESP32-Ethernet-Kit and their interconnections.

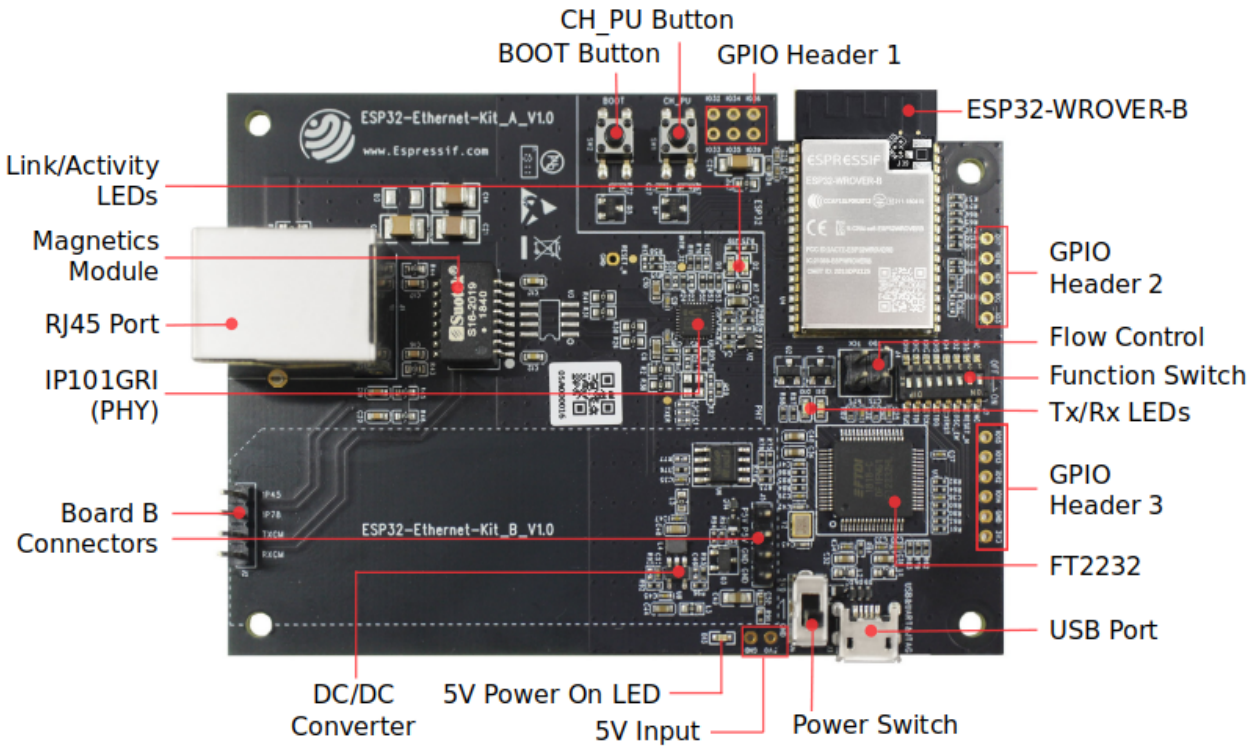


ESP32-Ethernet-Kit block diagram

Functional Description

The following two figures and tables describe the key components, interfaces, and controls of the ESP32-Ethernet-Kit.

Ethernet Board (A)



ESP32-Ethernet-Kit - Ethernet board (A) layout (click to enlarge)

The table below provides description starting from the picture's top right corner and going clockwise.

Key Component	Description
ESP32-WROVER-B	This ESP32 module features 64-Mbit PSRAM for flexible extended storage and
GPIO Header 2	Five unpopulated through-hole solder pads to provide access to selected GPIOs
Flow Control	A jumper header with access to the board signals. For details, see Flow Control.
Function Switch	A DIP switch used to configure the functionality of selected GPIOs of ESP32. F
Tx/Rx LEDs	Two LEDs to show the status of UART transmission.
GPIO Header 3	Provides access to some GPIOs of ESP32 that can be used depending on the pc
FT2232	The FT2232 chip serves as a multi-protocol USB-to-serial bridge which can be p
USB Port	USB interface. Power supply for the board as well as the communication interfa
Power Switch	Power On/Off Switch. Toggling toward the **Boot** button powers the board on, t
5V Input	The 5V power supply interface can be more convenient when the board is oper
5V Power On LED	This red LED turns on when power is supplied to the board, either from USB or
DC/DC Converter	Provided DC 5 V to 3.3 V conversion, output current up to 2A.
Board B Connectors	A pair male header pins for mounting the PoE board (B).
IP101GRI (PHY)	The physical layer (PHY) connection to the Ethernet cable is implemented using
RJ45 Port	Ethernet network data transmission port.
Magnetics Module	The Magnetics are part of the Ethernet specification to protect against faults an
Link/Activity LEDs	Two LEDs (green and red) that respectively indicate the "Link" and "Activity" sta
BOOT Button	Download button. Holding down **BOOT** and then pressing **CH_PU** initiates Firm
CH_PU Button	Reset button.
GPIO Header 1	This header provides six unpopulated through-hole solder pads connected to sp

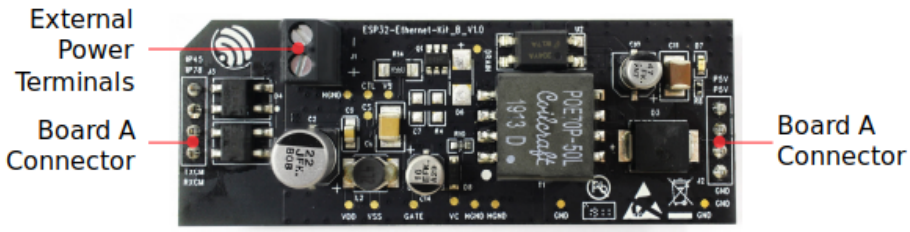
PoE Board (B)

This board coverts power delivered over the Ethernet cable (PoE) to provide a power supply for the Ethernet board (A). The main components of the PoE board (B) are shown on the block diagram under Functionality Overview.

The PoE board (B) has the following features:

- Support for IEEE 802.3at
- Power output: 5 V, 1.4 A

To take advantage of the PoE functionality the **RJ45 Port** of the Ethernet board (A) should be connected with an Ethernet cable to a switch that supports PoE. When the Ethernet board (A) detects 5 V power output from the PoE board (B), the USB power will be automatically cut off.



ESP32-Ethernet-Kit - PoE board (B) layout (click to enlarge)

Key Component	Description
Board A Connector	Four female header pins for mounting this board onto Ethernet board (A).
External Power Terminals	Optional power supply to the PoE board (B).

Setup Options

This section describes options to configure the ESP32-Ethernet-Kit hardware.

Function Switch

The functions for specific GPIO pins can be selected with the Function Switch.

DIP SW	GPIO Pin	Pin Functionality if DIP SW is ON
1	GPIO14	Connected to FT2232 to provide JTAG functionality
2	GPIO12	Connected to FT2232 to provide JTAG functionality
3	GPIO13	Connected to FT2232 to provide JTAG functionality
4	GPIO15	Connected to FT2232 to provide JTAG functionality
5	GPIO4	Connected to FT2232 to provide JTAG functionality
6	GPIO2	Connected to on-board 25 MHz oscillator
7	GPIO5	Connected to RESET_N input of IP101GRI

DIP SW	GPIO Pin	Pin Functionality if DIP SW is ON
8	n/a	

You can make a certain GPIO pin available for other purposes by putting its DIP SW to the Off position.

Flow Control

This is a 2 x 2 jumper pin header intended for the UART flow control.

.	Signal	Comment
1	MTDO	GPIO13, see also Function Switch
2	MTCK	GPIO15, see also Function Switch
3	RTS	RTS signal of FT2232
4	CTS	CTS signal of FT2232

GPIO Allocation

This section describes allocation of ESP32 GPIOs to specific interfaces or functions of the ESP32-Ethernet-Kit.

IP101GRI (PHY) Interface

The allocation of the ESP32 (MAC) pins to IP101GRI (PHY) is shown in the table below.

.	ESP32 Pin (MAC)	IP101GRI (PHY)
RMII Interface		
1	GPIO21	TX_EN
2	GPIO19	TXD[0]
3	GPIO22	TXD[1]
4	GPIO25	RXD[0]
5	GPIO26	RXD[1]
6	GPIO27	CRS_DV
7	GPIO0	REF_CLK
Serial Management Interface		

.	ESP32 Pin (MAC)	IP101GRI (PHY)
8	GPIO23	MDC
9	GPIO18	MDIO
PHY Reset		
10	GPIO5	Reset_N

Note

Except for REF_CLK, the allocation of all pins under the *RMII Interface* is fixed and cannot be changed either through IOMUX or GPIO Matrix.

GPIO Header 1

This header exposes some GPIOs that are not used elsewhere on the ESP32-Ethernet-Kit.

.	ESP32 Pin
1	GPIO32
2	GPIO33
3	GPIO34
4	GPIO35
5	GPIO36
6	GPIO39

GPIO Header 2

This header contains the GPIOs with specific RMII functionality (except GPIO2). Depending on the situation, specific Ethernet applications might require this functionality.

.	ESP32 Pin	RMII Function	Comments
1	GPIO17	EMAC_CLK_180	See note 1
2	GPIO16	EMAC_CLK_OUT	See note 1
3	GPIO4	EMAC_TX_ER	
4	GPIO2	n/a	See note 2

.	ESP32 Pin	RMII Function	Comments
5	GPIO5	EMAC_RX_CLK	See note 2

Note

1. The ESP32 pins GPIO16 and GPIO17 are not broken out to the ESP32-WROVER-B module and therefore not available for use. If you need to use these pins, please solder a module without SPIRAM memory inside, e.g. the ESP32-WROOM-32D or ESP32-SOLO-1.
2. Functionality depends on the settings of the Function Switch.

GPIO Header 3

The functionality of GPIOs connected to this header depends on the settings of the Function Switch.

.	ESP32 Pin
1	GPIO15
2	GPIO13
3	GPIO12
4	GPIO14
5	GND
6	3V3

GPIO Allocation Summary

ESP32-WROVER-B	IP101GRI	UART	JTAG	GPIO	Comments
S_VP				IO36	
S_VN				IO39	
IO34				IO34	
IO35				IO35	
IO32				IO32	
IO33				IO33	
IO25	RXD[0]				

ESP32-WROVER-B	IP101GRI	UART	JTAG	GPIO	Comments
IO26	RXD[1]				
IO27	CRS_DV				
IO14			TMS	IO14	
IO12			TDI	IO12	
IO13		RTS	TCK	IO13	
IO15		CTS	TDO	IO15	
IO2				IO2	See notes 1 and 3 below
IO0	REF_CLK				See notes 2 and 3 below
IO4			nTRST	IO4	
IO16				IO16 (NC)	See note 4 below
IO17				IO17 (NC)	See note 4 below
IO5	Reset_N			IO5	
IO18	MDIO				
IO19	TXD[0]				
IO21	TX_EN				
RXD0		RXD			
TXD0		TXD			
IO22	TXD[1]				
IO23	MDC				

Note

1. GPIO2 is used to enable external oscillator of the PHY.
2. GPIO0 is a source of 50 MHz reference clock for the PHY. The clock signal is first inverted, to account for transmission line delay, and then supplied to the PHY.
3. To prevent affecting the power-on state of GPIO0 by the clock output on the PHY side, the PHY external oscillator is enabled using GPIO2 after ESP32 is powered up.
4. The ESP32 pins GPIO16 and GPIO17 are not broken out to the ESP32-WROVER-B module and therefore not available for use. If you need to use these pins, please solder a module without SPIRAM memory inside, e.g. the ESP32-WROOM-32D or ESP32-SOLO-1.

Start Application Development

Before powering up your ESP32-Ethernet-Kit, please make sure that the board is in good condi on with no obvious signs of damage.

Initial Setup

1. Set the **Func on Switch** on the Ethernet board (A) to its default posi on by turning all the switches to **ON**.
2. To simplify flashing and tes ng the applica on, do not install any jumpers and do not connect any signals to the board headers.
3. The PoE board (B) can now be plugged in, but do not connect external power to it.
4. Connect the Ethernet board (A) to the PC with a USB cable.
5. Turn the **Power Switch** from GND to 5V0 posi on, the **5V Power On LED** should light up.

Now to Development

Proceed to Get Started, where Sec on Installa on Step by Step will quickly help you set up the development environment and then flash an example project onto your board.

Move on to the next sec on only if you have successfully completed all the above steps.

Configure and Load the Ethernet Example

After se ng up the development environment and tes ng the board, you can configure and flash the ethernet/ethernet example. This example has been created for tes ng Ethernet func onality. It supports different PHY, including **IP101GRI** installed on ESP32-Ethernet-Kit V1.0 board.