ESP-WROVER-KIT V4.1 Getting Started Guide

[中文]

This guide shows how to get started with the ESP-WROVER-KIT V4.1 development board and also provides information about its functionality and configuration options. For the description of other ESP-WROVER-KIT versions, please check ESP32 Hardware Reference.

What You Need

- ESP-WROVER-KIT V4.1 board
- USB 2.0 cable（A to Micro-B)
- Computer running Windows, Linux, or macOS

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

Overview

ESP-WROVER-KIT is an ESP32-based development board produced by Espressif.

ESP-WROVER-KIT features the following integrated components:

- ESP32-WROVER-B module
- LCD screen
- MicroSD card slot

Its another distinguishing feature is the embedded 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. ESP-WROVER-KIT makes development convenient, easy, and cost-effective.

Most of the ESP32 I/O pins are broken out to the board's pin headers for easy access.

> ❶ Note
>
> ESP32's GPIO16 and GPIO17 are used as chip select and clock signals for PSRAM. By default, the two GPIOs are not broken out to the board's pin headers in order to ensure reliable performance.
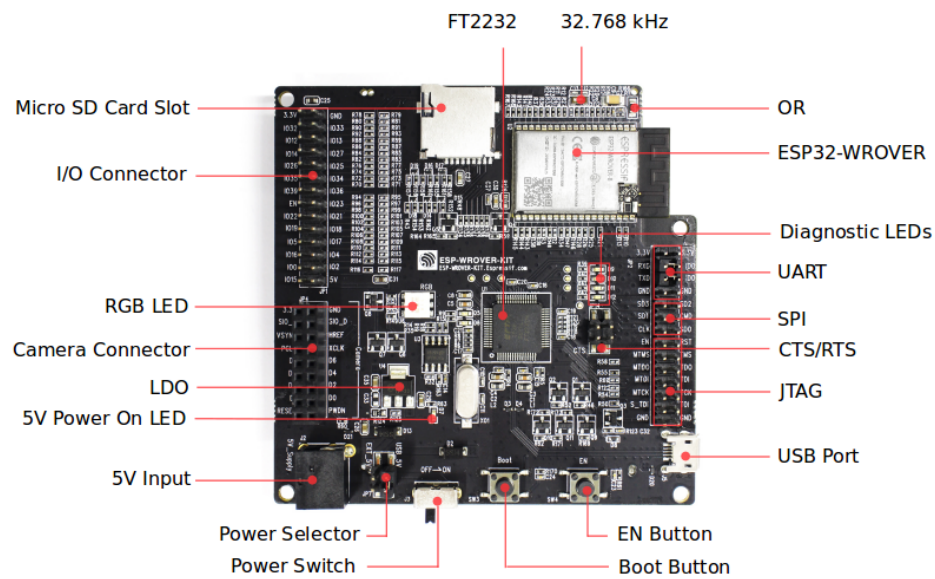
Functionality Overview

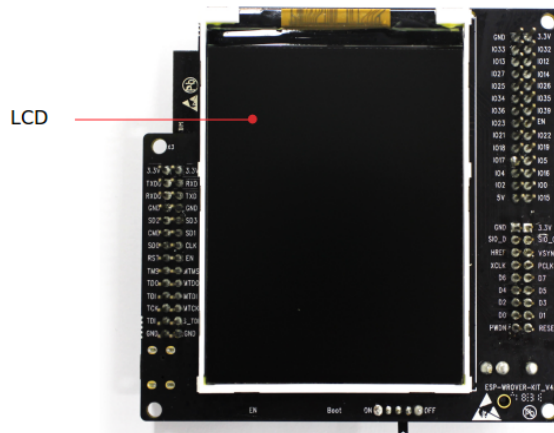The block diagram below shows the main components of ESP-WROVER-KIT and their interconnections.
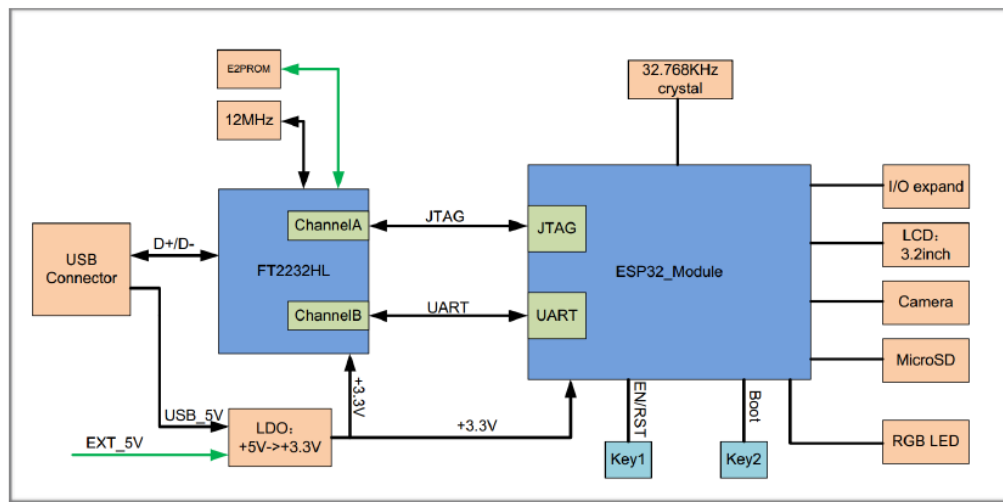
ESP-WROVER-KIT block diagram

Functional Description

The following two figures and the table below describe the key components, interfaces, and controls of the ESP-WROVER-KIT board.

ESP-WROVER-KIT board layout - front

LCD

ESP-WROVER-KIT board layout - back

The table below provides description in the following manner:

- Starting from the first picture's top right corner and going clockwise
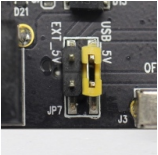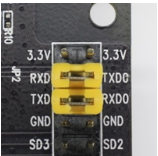- Then moving on to the second picture

Key Component	Description
FT2232	The FT2232 chip serves as a multi-protocol USB-to-serial bridge which c
32.768 kHz	External precision 32.768 kHz crystal oscillator serves as a clock with low
0R	Zero-ohm resistor intended as a placeholder for a current shunt, can be d
ESP32-WROVER-B	This ESP32 module features 64-Mbit PSRAM for flexible extended storage
Diagnostic LEDs	Four red LEDs connected to the GPIO pins of FT2232. Intended for futur
UART	Serial port. The serial TX/RX signals of FT2232 and ESP32 are broken ou
SPI	By default, ESP32 uses its SPI interface to access flash and PSRAM memo
CTS/RTS	Serial port flow control signals: the pins are not connected to the circuitry
JTAG	JTAG interface. JTAG signals of FT2232 and ESP32 are broken out to the
USB Port	USB interface. Power supply for the board as well as the communication
EN Button	Reset button.
Boot Button	Download button. Holding down **Boot** and then pressing **EN** initiates Firr
Power Switch	Power On/Off Switch. Toggling toward the **Boot** button powers the board
Power Selector	Power supply selector interface. The board can be powered either via US
5V Input	5V power supply interface for a standard coaxial power connector, 5.5 x
5V Power On LED	This red LED turns on when power is supplied to the board, either from **U**
LDO	NCP1117(1A). 5V-to-3.3V LDO. NCP1117 can provide a maximum curre

Camera Connector	Camera interface, a standard OV7670 camera module.
RGB LED	Red, green and blue (RGB) light emitting diodes (LEDs), can be controlled
I/O Connector	All the pins on the ESP32 module are broken out to pin headers. You can

Key Component	Description
MicroSD Card Slot	Useful for developing applications that access MicroSD card for data stor...
LCD	Support for mounting and interfacing a 3.2" SPI (standard 4-wire Serial Pe...

Setup Options

There are three jumper blocks available to set up the board functionality. The most frequently required options are listed in the table below.

Header	Jumper Setting	Description of Functionality
JP7		Power ESP-WROVER-KIT via an external power supply
JP7		Power ESP-WROVER-KIT via USB
JP2		Enable JTAG functionality
JP2		Enable UART communication
JP14		Enable RTS/CTS flow control for serial communication

Allocation of ESP32 Pins

Some pins / terminals of ESP32 are allocated for use with the onboard or external hardware. If that hardware is not used, e.g., nothing is plugged into the Camera (JP4) header, then these GPIOs can be used for other purposes.

Some of the pins, such as GPIO0 or GPIO2, have multiple functions and some of them are shared among onboard and external peripheral devices. Certain combinations of peripherals cannot work together. For example, it is not possible to do JTAG debugging of an application that is using SD card, because several pins are shared by JTAG and the SD card slot.

In other cases, peripherals can coexist under certain conditions. This is applicable to, for example, LCD screen and SD card that share only a single pin GPIO21. This pin is used to provide D/C (Data / Control) signal for the LCD as well as the CD (Card Detect) signal read from the SD card slot. If the card detect functionality is not essential, then it may be disabled by removing R167, so both LCD and SD may operate together.

For more details on which pins are shared among which peripherals, please refer to the table in the next section.

Main I/O Connector / JP1

The JP1 connector consists of 14x2 male pins whose functions are shown in the middle two "I/O" columns of the table below. The two "Shared With" columns on both sides describe where else on the board a certain GPIO is used.

Shared With		I/O	I/O	Shared With
n/a		3.3V	GND	n/a
NC/XTAL		IO32	IO33	NC/XTAL
JTAG, MicroSD		IO12	IO13	JTAG, MicroSD
JTAG, MicroSD		IO14	IO27	Camera
Camera		IO26	IO25	Camera, LCD
Camera		IO35	IO34	Camera
Camera		IO39	IO36	Camera
JTAG		EN	IO23	Camera, LCD
Camera, LCD		IO22	IO21	Camera, LCD, MicroSD
Camera, LCD		IO19	IO18	Camera, LCD
Camera, LCD		IO5	IO17	PSRAM
PSRAM		IO16	IO4	LED, Camera, MicroSD
Camera, LED, Boot		IO0	IO2	LED, MicroSD
JTAG, MicroSD		IO15	5V	

Legend:

- NC/XTAL - 32.768 kHz Oscillator
- JTAG - JTAG / JP2
- Boot - Boot button / SW2
- Camera - Camera / JP4
- LED - RGB LED
- MicroSD - MicroSD Card / J4
- LCD - LCD / U5
- PSRAM - ESP32-WROVER-B's PSRAM

32.768 kHz Oscillator

.	ESP32 Pin
1	GPIO32
2	GPIO33

ⓘ **Note**

Since GPIO32 and GPIO33 are connected to the oscillator by default, they are not connected to the JP1 I/O Connector to maintain signal integrity. This allocation may be changed from the oscillator to JP1 by desoldering the zero-ohm resistors from positions R11 / R23 and re-soldering them to positions R12 / R24.

SPI Flash / JP2

.	ESP32 Pin
1	CLK / GPIO6
2	SD0 / GPIO7
3	SD1 / GPIO8
4	SD2 / GPIO9
5	SD3 / GPIO10
6	CMD / GPIO11

❶ Important

The module's flash bus is connected to the jumper block JP2 through zero-ohm resistors R140 ~ R145. If the flash memory needs to operate at the frequency of 80 MHz, for reasons such as improving the integrity of bus signals, you can desolder these resistors to disconnect the module's flash bus from the pin header JP2.

JTAG / JP2

.	ESP32 Pin	JTAG Signal
1	EN	TRST_N
2	MTMS / GPIO14	TMS
3	MTDO / GPIO15	TDO
4	MTDI / GPIO12	TDI
5	MTCK / GPIO13	TCK

Camera / JP4

.	ESP32 Pin	Camera Signal
1	n/a	3.3V
2	n/a	Ground
3	GPIO27	SIO_C / SCCB Clock
4	GPIO26	SIO_D / SCCB Data
5	GPIO25	VSYNC / Vertical Sync
6	GPIO23	HREF / Horizontal Reference
7	GPIO22	PCLK / Pixel Clock
8	GPIO21	XCLK / System Clock
9	GPIO35	D7 / Pixel Data Bit 7
10	GPIO34	D6 / Pixel Data Bit 6
11	GPIO39	D5 / Pixel Data Bit 5
12	GPIO36	D4 / Pixel Data Bit 4
13	GPIO19	D3 / Pixel Data Bit 3
14	GPIO18	D2 / Pixel Data Bit 2

.	ESP32 Pin	Camera Signal
15	GPIO5	D1 / Pixel Data Bit 1
16	GPIO4	D0 / Pixel Data Bit 0
17	GPIO0	RESET / Camera Reset
18	n/a	PWDN / Camera Power Down

- Signals D0 .. D7 denote camera data bus

RGB LED

.	ESP32 Pin	RGB LED
1	GPIO0	Red
2	GPIO2	Green
3	GPIO4	Blue

MicroSD Card

.	ESP32 Pin	MicroSD Signal
1	MTDI / GPIO12	DATA2
2	MTCK / GPIO13	CD / DATA3
3	MTDO / GPIO15	CMD
4	MTMS / GPIO14	CLK
5	GPIO2	DATA0
6	GPIO4	DATA1
7	GPIO21	CD

LCD / U5

| .	ESP32 Pin	LCD Signal
1	GPIO18	RESET
2	GPIO19	SCL
3	GPIO21	D/C
4	GPIO22	CS
5	GPIO23	SDA
6	GPIO25	SDO
7	GPIO5	Backlight

Start Application Development

Before powering up your ESP-WROVER-KIT, please make sure that the board is in good condition with no obvious signs of damage.

Initial Setup

Please set only the following jumpers shown in the pictures below:

- Select USB as the power source using the jumper block JP7.
- Enable UART communication using the jumper block JP2.

Power up from USB port	Enable UART communication
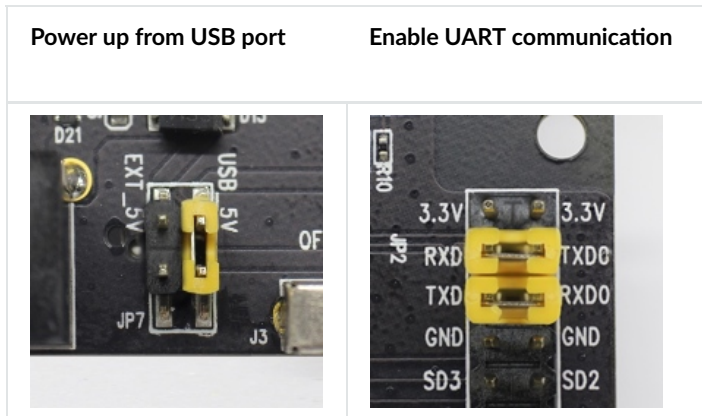
Do not install any other jumpers.

Turn the **Power Switch** to ON, the **5V Power On LED** should light up.

Now to Development

Please proceed to Get Started, where Section Installation Step by Step will quickly help you set up the development environment and then flash an example project onto your board.

Related Documents

- ESP-WROVER-KIT V4.1 schematic (PDF)
- ESP-WROVER-KIT V4.1 layout (DXF) may be opened online with Autodesk Viewer
- ESP32 Datasheet (PDF)
- ESP32-WROVER-B Datasheet (PDF)
- JTAG Debugging
- ESP32 Hardware Reference

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