

ESP32-C3

esp-dev-kits Documentation



Release master
Espressif Systems
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This document provides detailed user guides and examples for ESP32-C3 series development boards.

Note: For the full list of Espressif development boards, please go to [ESP DevKits](#).

Chapter 1

ESP32-C3-DevKitC-02

ESP32-C3-DevKitC-02 is an entry-level development board based on [ESP32-C3-WROOM-02](#) or [ESP32-C3-WROOM-02U](#), general-purpose modules with 4 MB SPI flash. This board integrates complete Wi-Fi and Bluetooth® Low Energy functions.

1.1 ESP32-C3-DevKitC-02

This user guide will help you get started with ESP32-C3-DevKitC-02 and will also provide more in-depth information.

ESP32-C3-DevKitC-02 is an entry-level development board based on [ESP32-C3-WROOM-02](#) or [ESP32-C3-WROOM-02U](#), general-purpose modules with 4 MB SPI flash. This board integrates complete Wi-Fi and Bluetooth® Low Energy functions.

Most of the I/O pins are broken out to the pin headers on both sides for easy interfacing. Developers can either connect peripherals with jumper wires or mount ESP32-C3-DevKitC-02 on a breadboard.

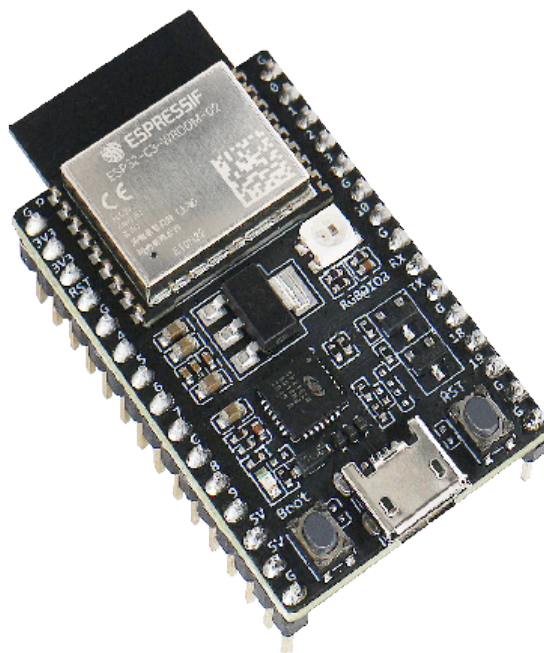


Fig. 1: ESP32-C3-DevKitC-02

The document consists of the following major sections:

- *Getting Started*: Overview of ESP32-C3-DevKitC-02 and hardware/software setup instructions to get started.
- *Hardware Reference*: More detailed information about the ESP32-C3-DevKitC-02's hardware.
- *Hardware Revision Details*: Revision history, known issues, and links to user guides for previous versions (if any) of ESP32-C3-DevKitC-02.
- *Related Documents*: Links to related documentation.

1.1.1 Getting Started

This section provides a brief introduction of ESP32-C3-DevKitC-02, instructions on how to do the initial hardware setup and how to flash firmware onto it.

Description of Components

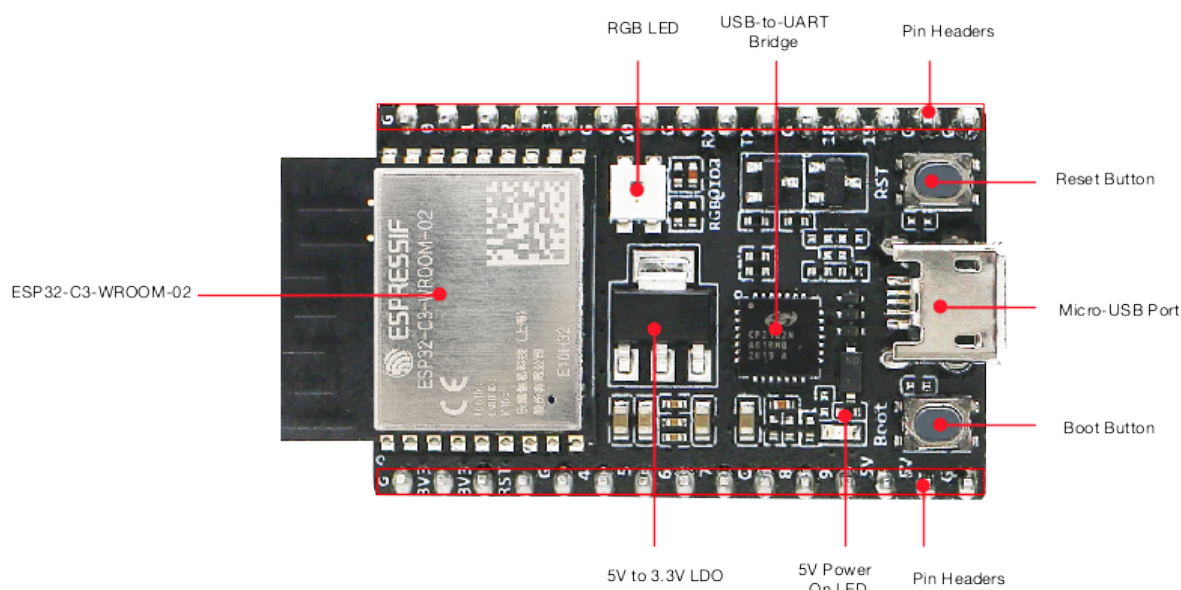


Fig. 2: ESP32-C3-DevKitC-02 (with the ESP32-C3-WROOM-02 module) - front

The key components of the board are described in a counter-clockwise direction.

| Key Component | Description |
|---|---|
| ESP32-C3-WROOM-02 or ESP32-C3-WROOM-02U | ESP32-C3-WROOM-02 and ESP32-C3-WROOM-02U are powerful and general-purpose Espressif modules that offer Wi-Fi and Bluetooth Low Energy coexistence. ESP32-C3-WROOM-02 has a PCB antenna, while ESP32-C3-WROOM-02U has an external antenna connector. They both integrate a 4 MB SPI flash. |
| 5 V to 3.3 V LDO | Power regulator that converts a 5 V supply into a 3.3 V output. |
| 5 V Power On LED | Turns on when the USB power is connected to the board. |
| Pin Headers | All available GPIO pins (except for the SPI bus for flash) are broken out to the pin headers on the board. For details, please see Header Block . |
| Boot Button | Download button. Holding down Boot and then pressing Reset initiates Firmware Download mode for downloading firmware through the serial port. |
| Micro-USB Port | USB interface. Power supply for the board as well as the communication interface between a computer and the ESP32-C3 chip. |
| Reset Button | Press this button to restart the system. |
| USB-to-UART Bridge | Single USB-to-UART bridge chip provides transfer rates up to 3 Mbps. |
| RGB LED | Addressable RGB LED, driven by GPIO8. |

Start Application Development

Before powering up your ESP32-C3-DevKitC-02, please make sure that it is in good condition with no obvious signs of damage.

Required Hardware

- ESP32-C3-DevKitC-02
- USB 2.0 cable (Standard-A to Micro-B)
- Computer running Windows, Linux, or macOS

Note: Be sure to use an appropriate USB cable. Some cables are for charging only and do not provide the needed data lines nor work for programming the boards.

Software Setup Please proceed to [ESP-IDF Get Started](#), which will quickly help you set up the development environment then flash an application example onto your board.

Contents and Packaging

Retail Orders If you order a few samples, each ESP32-C3-DevKitC-02 comes in an individual package in either antistatic bag or any packaging depending on your retailer.

For retail orders, please go to <https://www.espressif.com/en/contact-us/get-samples>.

Wholesale Orders If you order in bulk, the boards come in large cardboard boxes.

For wholesale orders, please check [Espressif Product Ordering Information](#) (PDF)

1.1.2 Hardware Reference

Block Diagram

The block diagram below shows the components of ESP32-C3-DevKitC-02 and their interconnections.

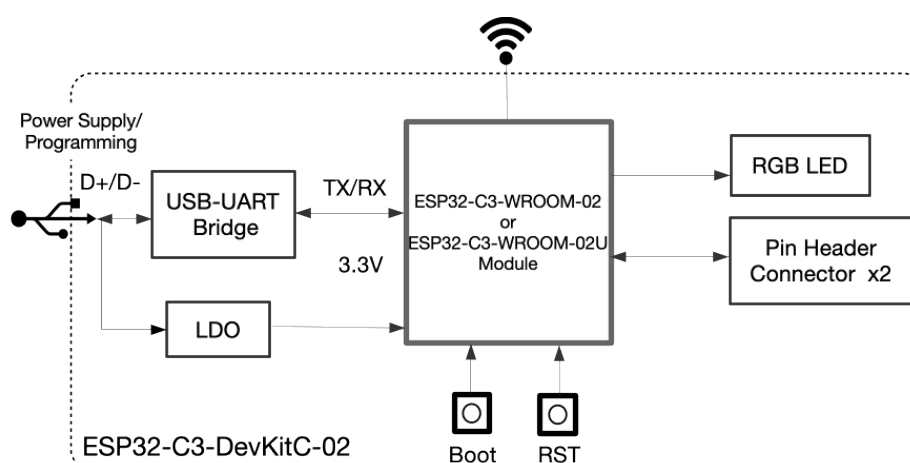


Fig. 3: ESP32-C3-DevKitC-02 (click to enlarge)

Power Supply Options There are three mutually exclusive ways to provide power to the board:

- Micro-USB Port, default power supply
- 5V and GND pin headers
- 3V3 and GND pin headers

It is recommended to use the first option: Micro-USB Port.

Header Block

The two tables below provide the **Name** and **Function** of the pin headers on both sides of the board (J1 and J3). The pin header names are shown in *ESP32-C3-DevKitC-02 (with the ESP32-C3-WROOM-02 module) - front*. The numbering is the same as in the [ESP32-C3-DevKitC-02 Schematic \(PDF\)](#).

J1

| No. | Name | Type ¹ | Function |
|-----|------|-------------------|-------------------------------|
| 1 | G | G | Ground |
| 2 | 3V3 | P | 3.3 V power supply |
| 3 | 3V3 | P | 3.3 V power supply |
| 4 | RST | I | CHIP_PU |
| 5 | G | G | Ground |
| 6 | 4 | I/O/T | GPIO4, ADC1_CH4, FSPIHD, MTMS |
| 7 | 5 | I/O/T | GPIO5, ADC2_CH0, FSPIWP, MTDI |
| 8 | 6 | I/O/T | GPIO6, FSPICLK, MTCK |
| 9 | 7 | I/O/T | GPIO7, FSPID, MTDO |
| 10 | G | G | Ground |
| 11 | 8 | I/O/T | GPIO8 ² , RGB LED |
| 12 | 9 | I/O/T | GPIO9 ² |
| 13 | 5V | P | 5 V power supply |
| 14 | 5V | P | 5 V power supply |
| 15 | G | G | Ground |

J3

| No. | Name | Type ² | Function |
|-----|------|-------------------|--------------------------------------|
| 1 | G | G | Ground |
| 2 | 0 | I/O/T | GPIO0, ADC1_CH0, XTAL_32K_P |
| 3 | 1 | I/O/T | GPIO1, ADC1_CH1, XTAL_32K_N |
| 4 | 2 | I/O/T | GPIO2 ² , ADC1_CH2, FSPIQ |
| 5 | 3 | I/O/T | GPIO3, ADC1_CH3 |
| 6 | G | G | Ground |
| 7 | 10 | I/O/T | GPIO10, FSPICS0 |
| 8 | G | G | Ground |
| 9 | RX | I/O/T | GPIO20, U0RXD |
| 10 | TX | I/O/T | GPIO21, U0TXD |
| 11 | G | G | Ground |
| 12 | 18 | I/O/T | GPIO18, USB_D- |
| 13 | 19 | I/O/T | GPIO19, USB_D- |
| 14 | G | G | Ground |
| 15 | G | G | Ground |

Pin Layout

¹ P: Power supply; I: Input; O: Output; T: High impedance.

² GPIO2, GPIO8, and GPIO9 are strapping pins of the ESP32-C3 chip. These pins are used to control several chip functions depending on binary voltage values applied to the pins during chip power-up or system reset. For description and application of the strapping pins, please refer to Section Boot Configurations in [ESP32-C3 Datasheet](#).

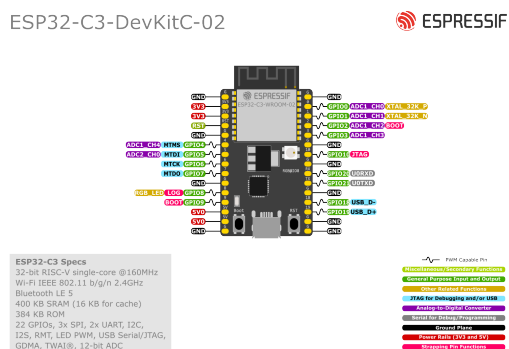


Fig. 4: ESP32-C3-DevKitC-02 Pin Layout (with the ESP32-C3-WROOM-02 module, click to enlarge)

1.1.3 Hardware Revision Details

No previous versions available.

1.1.4 Related Documents

- [ESP32-C3 Datasheet \(PDF\)](#)
- [ESP32-C3-WROOM-02 & ESP32-C3-WROOM-02U Datasheet \(PDF\)](#)
- [ESP32-C3-DevKitC-02 Schematic \(PDF\)](#)
- [ESP32-C3-DevKitC-02 PCB Layout \(PDF\)](#)
- [ESP32-C3-DevKitC-02 Dimensions \(PDF\)](#)
- [ESP32-C3-DevKitC-02 Dimensions source file \(DXF\)](#) - You can view it with [Autodesk Viewer](#) online

For further design documentation for the board, please contact us at sales@espressif.com.

Chapter 2

ESP32-C3-DevKitM-1

ESP32-C3-DevKitM-1 is an entry-level development board based on [ESP32-C3-MINI-1](#) or [ESP32-C3-MINI-1U](#), modules named for its small size. This board integrates complete Wi-Fi and Bluetooth® Low Energy functions.

2.1 ESP32-C3-DevKitM-1

This user guide will help you get started with ESP32-C3-DevKitM-1 and will also provide more in-depth information. ESP32-C3-DevKitM-1 is an entry-level development board based on [ESP32-C3-MINI-1](#) or [ESP32-C3-MINI-1U](#) modules, which are named for their compact size. This board integrates complete Wi-Fi and Bluetooth® Low Energy functions.

Most of the I/O pins on the module are broken out to the pin headers on both sides of this board for easy interfacing. Developers can either connect peripherals with jumper wires or mount ESP32-C3-DevKitM-1 on a breadboard.

The document consists of the following major sections:

- *Getting Started*: Overview of ESP32-C3-DevKitM-1 and hardware/software setup instructions to get started.
- *Hardware Reference*: More detailed information about the ESP32-C3-DevKitM-1's hardware.
- *Hardware Revision Details*: Revision history, known issues, and links to user guides for previous versions (if any) of ESP32-C3-DevKitM-1.
- *Related Documents*: Links to related documentation.

2.1.1 Getting Started

This section provides a brief introduction of ESP32-C3-DevKitM-1, instructions on how to do the initial hardware setup and how to flash firmware onto it.

Description of Components

The key components of the board are described in a counter-clockwise direction.

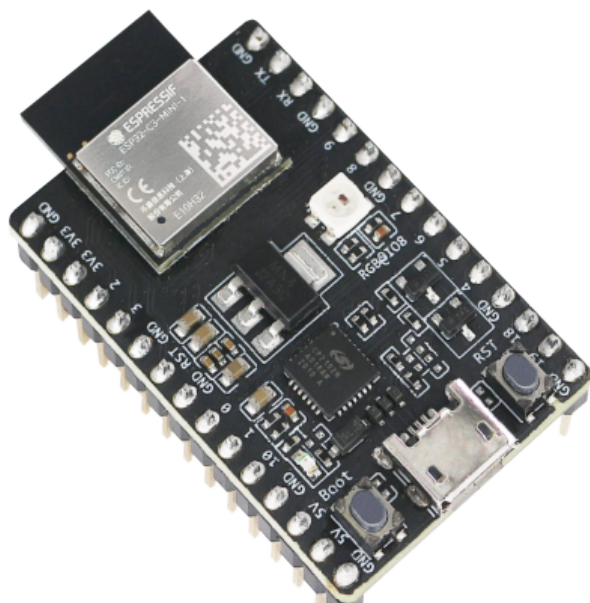


Fig. 1: ESP32-C3-DevKitM-1

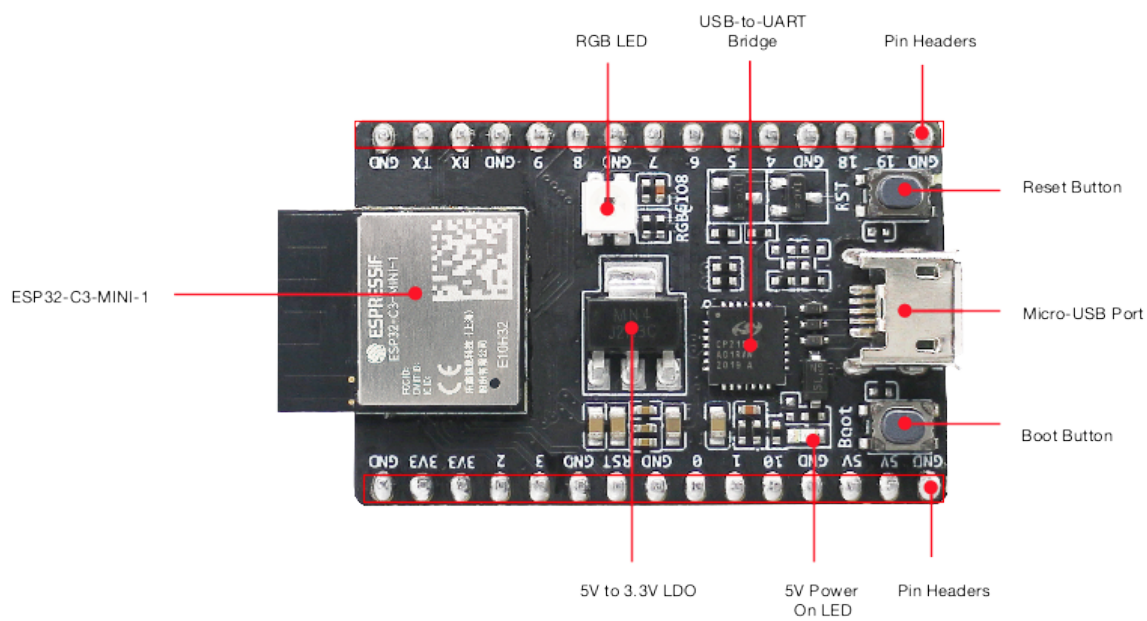


Fig. 2: ESP32-C3-DevKitM-1 (with the ESP32-C3-MINI-1 module) - front

| Key Component | Description |
|-------------------------------------|---|
| ESP32-C3-MINI-1 or ESP32-C3-MINI-1U | ESP32-C3-MINI-1 and ESP32-C3-MINI-1U are general-purpose Wi-Fi and Bluetooth Low Energy combo modules. ESP32-C3-MINI-1 comes with an on-board PCB antenna, whereas ESP32-C3-MINI-1U comes with an external antenna connector. They both have a flash of 4 MB, integrated inside the chip's package. |
| 5 V to 3.3 V LDO | Power regulator that converts a 5 V supply into a 3.3 V output. |
| 5 V Power On LED | Turns on when the USB power is connected to the board. |
| Pin Headers | All available GPIO pins (except for the SPI bus for flash) are broken out to the pin headers on the board. For details, please see Header Block . |
| Boot Button | Download button. Holding down Boot and then pressing Reset initiates Firmware Download mode for downloading firmware through the serial port. |
| Micro-USB Port | USB interface. Power supply for the board as well as the communication interface between a computer and the ESP32-C3 series of chips. |
| Reset Button | Press this button to restart the system. |
| USB-to-UART Bridge | Single USB-UART bridge chip provides transfer rates up to 3 Mbps. |
| RGB LED | Addressable RGB LED, driven by GPIO8. |

Start Application Development

Before powering up your ESP32-C3-DevKitM-1, please make sure that it is in good condition with no obvious signs of damage.

Required Hardware

- ESP32-C3-DevKitM-1
- USB 2.0 cable (Standard-A to Micro-B)
- Computer running Windows, Linux, or macOS

Note: Be sure to use an appropriate USB cable. Some cables are for charging only and do not provide the needed data lines nor work for programming the boards.

Software Setup Please proceed to [ESP-IDF Get Started](#), which will quickly help you set up the development environment then flash an application example onto your board.

Contents and Packaging

Retail Orders If you order one or several samples, each ESP32-C3-DevKitM-1 comes in an individual package in either antistatic bag or any packaging depending on your retailer.

For retail orders, please go to <https://www.espressif.com/en/contact-us/get-samples>.

Wholesale Orders If you order in bulk, the boards come in large cardboard boxes.

For wholesale orders, please check [Espressif Product Ordering Information](#) (PDF)

2.1.2 Hardware Reference

Block Diagram

The block diagram below shows the components of ESP32-C3-DevKitM-1 and their interconnections.

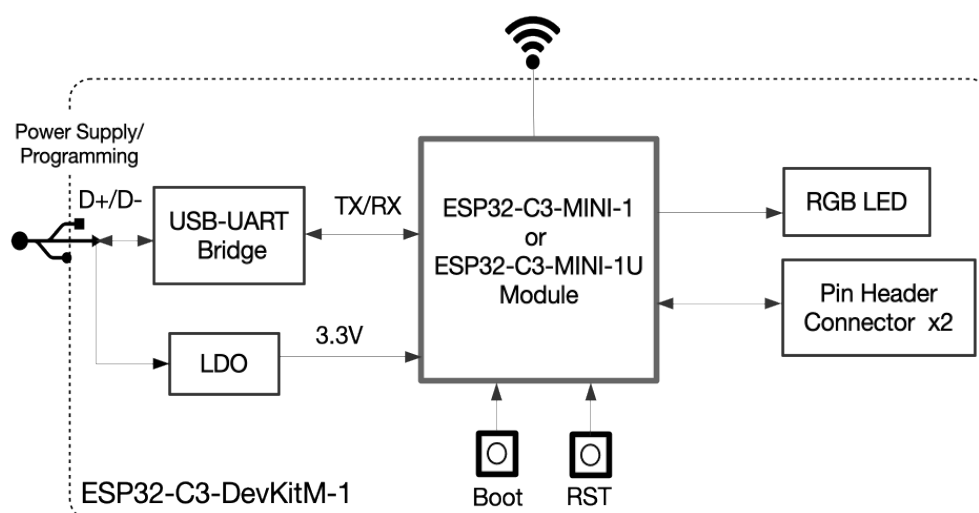


Fig. 3: ESP32-C3-DevKitM-1 (click to enlarge)

Power Supply Options There are three mutually exclusive ways to provide power to the board:

- Micro-USB Port, default power supply
- 5V and GND pin headers
- 3V3 and GND pin headers

It is recommended to use the first option: Micro-USB Port.

Header Block

The two tables below provide the **Name** and **Function** of the pin headers on both sides of the board (J1 and J3). The pin header names are shown in *ESP32-C3-DevKitM-1 (with the ESP32-C3-MINI-1 module) - front*. The numbering is the same as in the [ESP32-C3-DevKitM-1 Schematic \(PDF\)](#).

J1

| No. | Name | Type ¹ | Function |
|-----|------|-------------------|--------------------------------------|
| 1 | GND | G | Ground |
| 2 | 3V3 | P | 3.3 V power supply |
| 3 | 3V3 | P | 3.3 V power supply |
| 4 | IO2 | I/O/T | GPIO2 ² , ADC1_CH2, FSPIQ |
| 5 | IO3 | I/O/T | GPIO3, ADC1_CH3 |
| 6 | GND | G | Ground |
| 7 | RST | I | CHIP_PU |
| 8 | GND | G | Ground |
| 9 | IO0 | I/O/T | GPIO0, ADC1_CH0, XTAL_32K_P |
| 10 | IO1 | I/O/T | GPIO1, ADC1_CH1, XTAL_32K_N |
| 11 | IO10 | I/O/T | GPIO10, FSPICS0 |
| 12 | GND | G | Ground |
| 13 | 5V | P | 5 V power supply |
| 14 | 5V | P | 5 V power supply |
| 15 | GND | G | Ground |

¹ P: Power supply; I: Input; O: Output; T: High impedance.

² GPIO2, GPIO8, and GPIO9 are strapping pins of the ESP32-C3 series of chips. These pins are used to control several chip functions depending on binary voltage values applied to the pins during chip power-up or system reset. For description and application of the strapping pins, please refer to Section Boot Configurations in [ESP32-C3 Datasheet](#).

2.1.4 Related Documents

- [ESP32-C3 Datasheet \(PDF\)](#)
- [ESP32-C3-MINI-1 & ESP32-C3-MINI-1U Datasheet \(PDF\)](#)
- [ESP32-C3-DevKitM-1 Schematic \(PDF\)](#)
- [ESP32-C3-DevKitM-1 PCB Layout \(PDF\)](#)
- [ESP32-C3-DevKitM-1 Dimensions \(PDF\)](#)
- [ESP32-C3-DevKitM-1 Dimensions source file \(DXF\)](#)

For further design documentation for the board, please contact us at sales@espressif.com.

Chapter 3

ESP32-C3-LCDkit

ESP32-C3-LCDkit is a development board designed for wildlife protection. It is used to evaluate and verify the application of the ESP32-C3 screen. And it is composed of mainboard and subboard.

3.1 ESP32-C3-LCDkit

This user guide will help you get started with ESP32-C3-LCDkit and will also provide more in-depth information.

The document consists of the following sections:

- *Board Overview*: Overview of the board hardware/software.
- *Start Application Development*: How to set up hardware/software to develop applications.
- *Hardware Reference*: More detailed information about the board's hardware.
- *Hardware Revision Details*: This is the first revision of this board released.
- *Sample Request*: How to get a sample board.
- *Related Documents*: Links to related documentation.

3.1.1 Board Overview

ESP32-C3-LCDkit is an ESP32-C3-based evaluation development board with an SPI interface display. It also has an integrated rotary encoder switch and features screen interaction. Due to its low cost, low power consumption, and high performance, ESP32-C3 satisfies the basic GUI interaction needs, gaining ground in scenarios with small screen sizes.

Feature List

The main features of the board are listed below:

- **Module Embedded**: ESP32-C3-MINI-1 module with 4 MB flash and 400 KB SRAM
- **Display**: Compatibility with various subboards and support for displays with I2C and SPI interfaces. Please refer to *LCD Subboards* for more information
- **Rotary Encoder Switch**: Key switches and 360° rotation for on-screen GUI control
- **Infrared module**: Infrared transmitter and infrared receiver for infrared wireless control
- **Audio**: On-board audio amplifier and speaker for audio playback
- **USB**: USB Type-C download/debug



Fig. 1: ESP32-C3-LCDkit with ESP32-C3-MINI-1 Module

Block Diagram

The block diagram below shows the components of ESP32-C3-LCDkit and their interconnections.

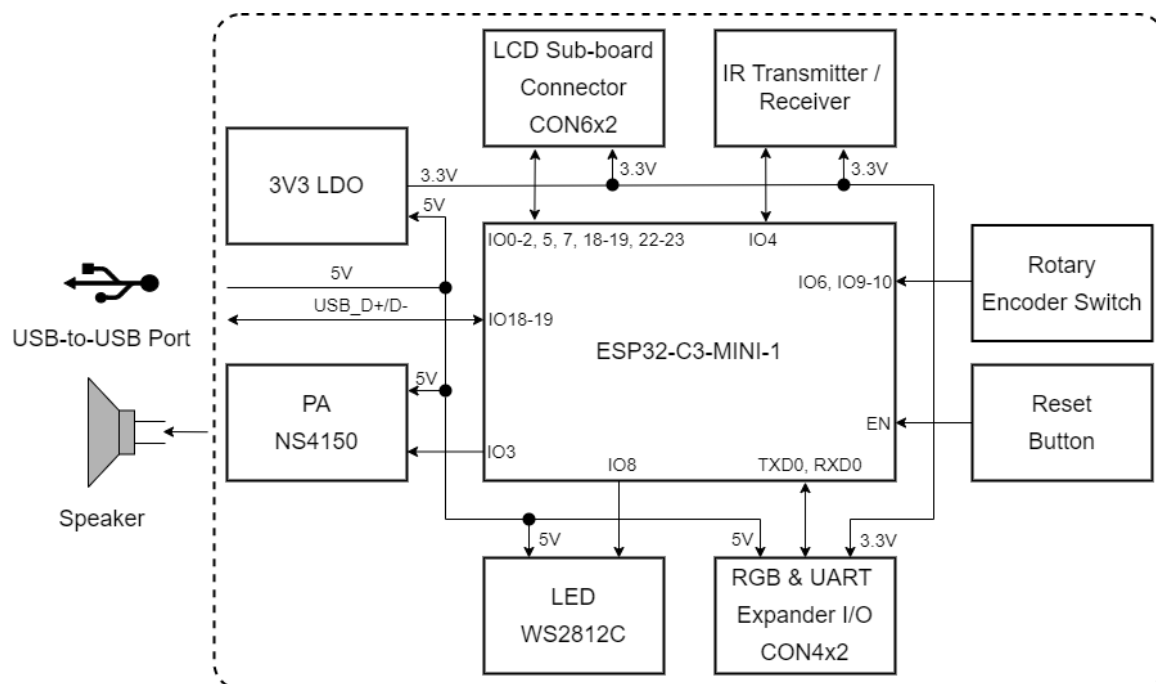


Fig. 2: ESP32-C3-LCDkit Block Diagram (Click to Enlarge)

Description of Components

ESP32-C3-LCDkit is a development board designed for wildlife protection. It contains a mainboard and a subboard.

Mainboard **ESP32-C3-LCDkit_MB** is the core of the kit, which integrates the ESP32-C3-MINI-1 module and provides ports for connection to the LCD subboard.

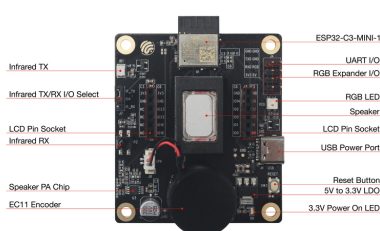


Fig. 3: ESP32-C3-LCDkit - Front (Click to Enlarge)

The key components of the board are described in a clockwise direction.

| Key Component | Description |
|----------------------------|--|
| ESP32-C3-MINI-1 Module | ESP32-C3-MINI-1 is a generic Wi-Fi + Bluetooth LE MCU module that is built around the ESP32-C3 series of SoCs. It is integrated with 4 MB flash and 400 KB SRAM. |
| UART & RGB Expander I/O | Connects the system power supply pins and UART and RGB data pins via a 2.54 mm pitch pin header. |
| RGB LED | Supports configuring the RGB LED display to indicate status or behavior. |
| Speaker | Supports speaker playback through an audio power amplifier. |
| LCD Display Connector | Connects the 1.28" LCD subboard via a 2.54 mm pitch female header. |
| USB Power Port | Provides power to the entire system. It is recommended to use at least a 5V/2A power adapter to ensure a stable power supply. Used for USB communication between the PC side and the ESP32-C3-MINI-1 module. |
| Reset Button | Press this button to reset the system. |
| 5V-to-3.3V LDO | Low Dropout Regulator (LDO). |
| 3.3 V Power On LED | Indicates the status of the system power supply. |
| EC11 Rotary Encoder Switch | Features both a 360° rotary encoder and a key switch to enable control of the on-screen GUI. |
| Speaker PA Chip | Supports speaker playback. |
| Infrared RX | Receives external infrared signals. |
| Infrared TX/RX I/O Select | Select the infrared RX/TX function via a 2.54 mm pitch pin header and jumper caps. |
| Infrared TX | Sends out infrared signals. |

LCD Subboards The **ESP32-C3-LCDkit_DB** subboard supports a 1.28" LCD screen with SPI interface and 240x240 resolution. The driver chip used for this screen is GC9A01.

Software Support

The ESP32-C3-LCDkit development framework is **ESP-IDF**. ESP-IDF is a FreeRTOS-based SoC development framework with a bunch of components including LCD, ADC, RMT, and SPI. An example is provided for ESP32-C3-LCDkit under the folder **Examples**. You can configure project options by entering `idf.py menuconfig` in the example directory.

3.1.2 Start Application Development

This section provides instructions on how to do hardware and software setup and flash firmware onto the board to develop your own application.

Required Hardware

- 1 x ESP32-C3-LCDkit_MB
- 1 x LCD subboard
- 1 x USB 2.0 cable (standard Type-A to Type-C)
- 1 x PC (Windows, Linux, or macOS)

Note: Please make sure to use the appropriate USB cable. Some cables can only be used for charging, not for data transfer or program flashing.

Hardware Setup

Prepare the board for loading of the first sample application:



Fig. 4: ESP32-C3-LCDkit_DB - Front (Click to Enlarge)



Fig. 5: ESP32-C3-LCDkit_DB - Back (Click to Enlarge)

1. Connect the LCD subboard to the **LCD Display Connector**.
2. Plug in the USB cable to connect the PC with the board.
3. The LCD lights up and you can now control GUI through the rotary encoder switch.

Now the board is ready for software setup.

Software Setup

To learn how to quickly set up your development environment, please go to [Get Started > Installation](#).

For more software information on developing applications, please go to [Software Support](#).

3.1.3 Hardware Reference

This section provides more detailed information about the board's hardware.

GPIO Allocation

The table below provides the allocation of GPIOs exposed on terminals of ESP32-C3-MINI-1 module to control specific components or functions of the board.

Table 1: ESP32-C3-MINI-1 GPIO Allocation

| Pin | Pin Name | Function |
|-----|----------|----------|
| 1 | GND | Ground |
| 2 | GND | Ground |

continues on next page

Table 1 – continued from previous page

| Pin | Pin Name | Function |
|-------|----------|--------------------|
| 3 | 3V3 | 3.3 V power supply |
| 4 | NC | No connection |
| 5 | IO2 | LCD_D/C |
| 6 | IO3 | AUDIO_PA |
| 7 | NC | No connection |
| 8 | EN | Reset |
| 9 | NC | No connection |
| 10 | NC | No connection |
| 11 | GND | Ground |
| 12 | IO0 | LCD_SDA |
| 13 | IO1 | LCD_SCL |
| 14 | GND | Ground |
| 15 | NC | No connection |
| 16 | IO10 | ENCODER_A |
| 17 | NC | No connection |
| 18 | IO4 | IR_RX/IR_TX |
| 19 | IO5 | LCD_BL_CTRL |
| 20 | IO6 | ENCODER_A |
| 21 | IO7 | LCD_CS |
| 22 | IO8 | RGB_LED |
| 23 | IO9 | ENCODER_SW |
| 24 | NC | No connection |
| 25 | NC | No connection |
| 26 | IO18 | USB_DN |
| 27 | IO19 | USB_DP |
| 28 | NC | No connection |
| 29 | NC | No connection |
| 30 | RXD0 | Reserved |
| 31 | TXD0 | Reserved |
| 32-35 | NC | No connection |
| 36-53 | GND | Ground |

Power Distribution

The development board is powered via the USB-to-USB port:

Output system power supply:

Infrared TX/RX Select

Since the Infrared TX and Infrared RX modules share the same signal line on the chip, it is required to short-circuit specific pins in Infrared TX/RX Select Port via jumper caps to choose between the TX/RX function:

C6 Module Compatibility Design

ESP32-C3-LCDkit development board uses the ESP32-C3-MINI-1 module by default, with resistors R2, R4, R5, and R35 connected to the mainboard:

The development board is also designed to be compatible with the ESP32-C6-MINI-1 module, where resistors R2, R4, R5, and R35 need to be removed and resistors R13 and R14 need to be connected.

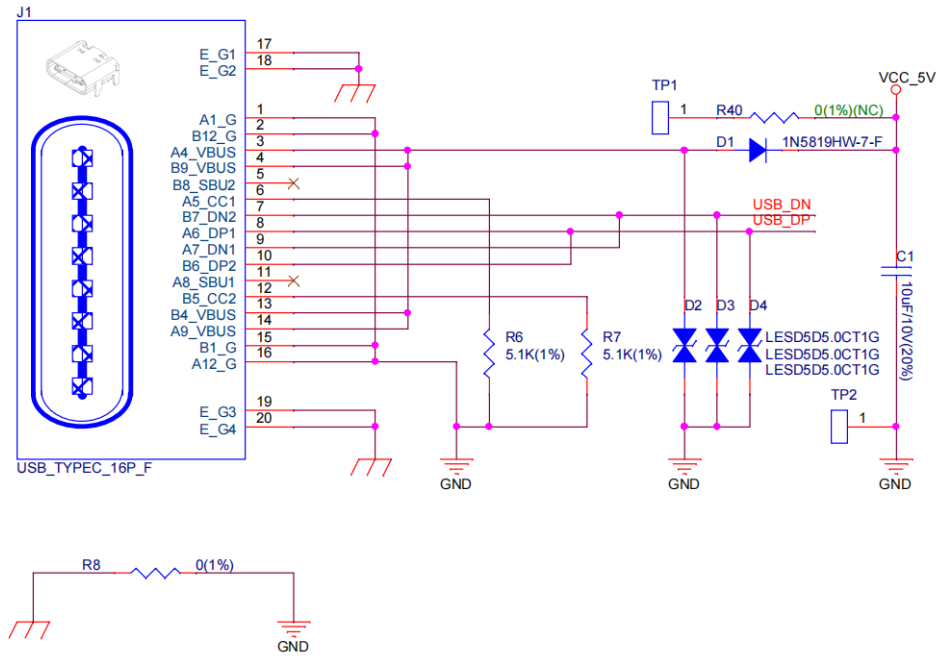


Fig. 6: ESP32-C3-LCDkit - USB-to-USB Power Supply

3V3 LDO

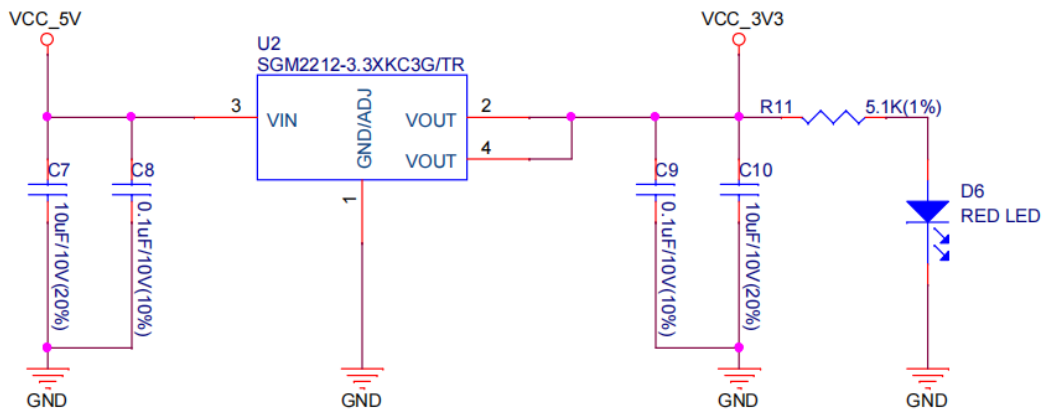


Fig. 7: ESP32-C3-LCDkit - System Power Supply

IR Receiver

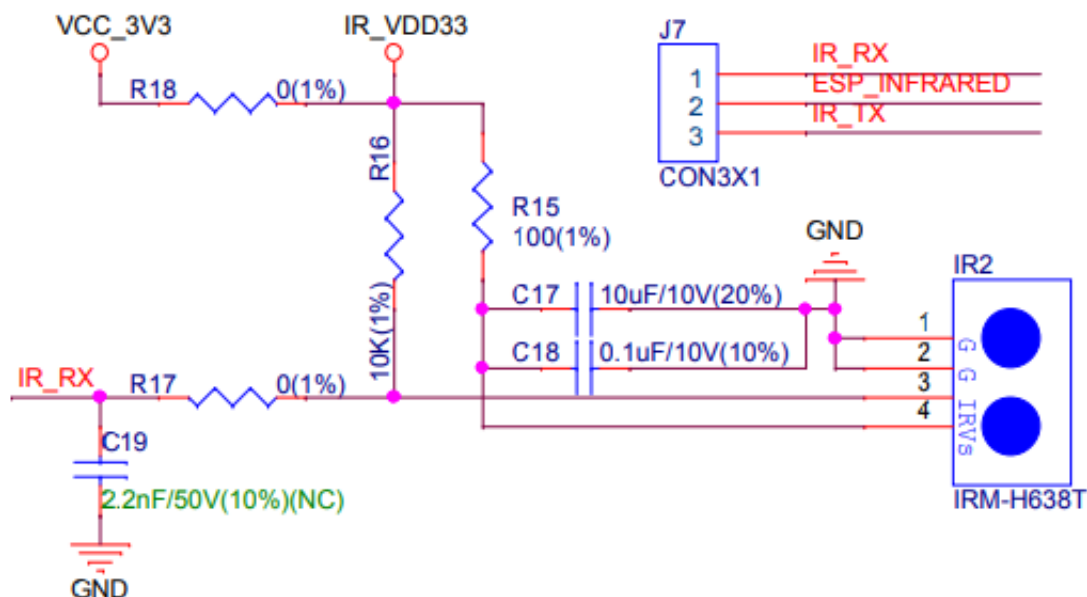


Fig. 8: ESP32-C3-LCDkit - Infrared RX Module

IR Transmitter

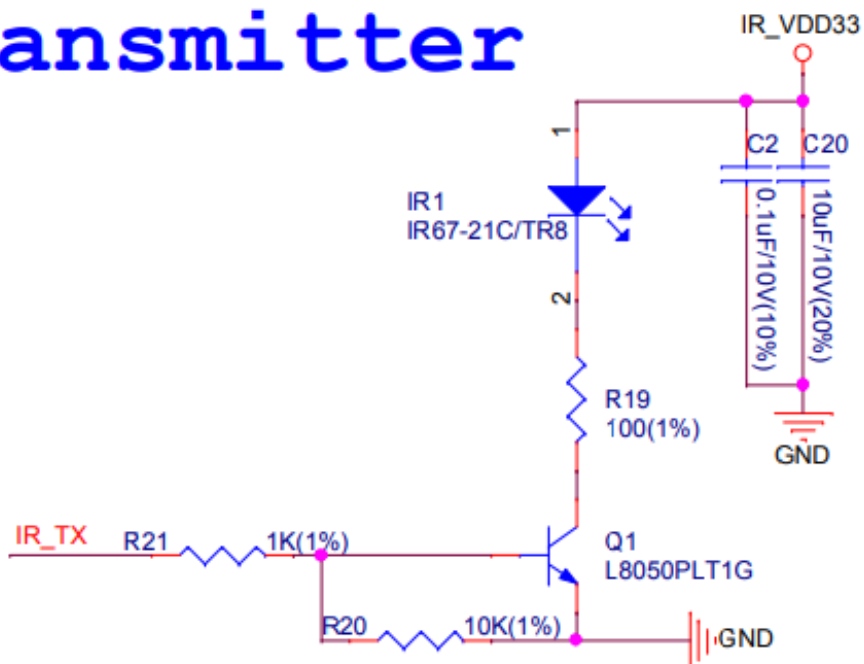


Fig. 9: ESP32-C3-LCDkit - Infrared TX Module

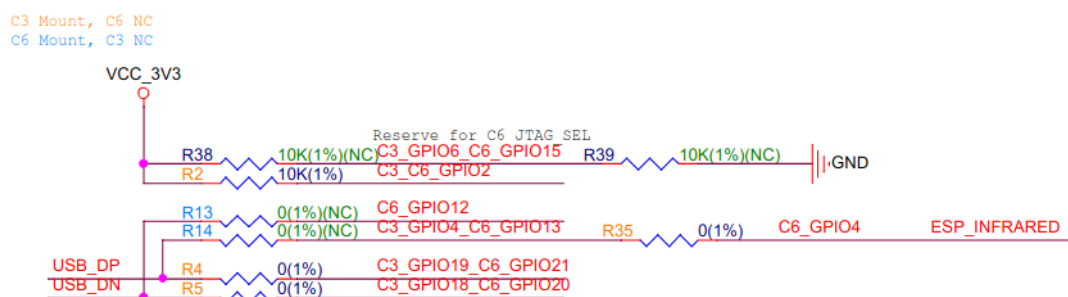


Fig. 10: ESP32-C3-LCDkit - C3/C6 Resistor Settings

Hardware Setup Options

Automatic Download After the development board is powered on, press the rotary encoder switch and Reset button, then release Reset first and the encoder second, to put the ESP development board into download mode.

3.1.4 Hardware Revision Details

- ESP32-C3-LCD-Ev-Board: This older-version board is an engineering sample and is minimally maintained by Espressif. For historical documentation for this board, please refer to *ESP32-C3-LCD-Ev-Board User Guide*.

3.1.5 Sample Request

ESP32-C3 is a cost-effective and industry-leading low-power performance solution for building rotary or small displays driven by an SPI interface. For sample requests, please contact us at sales@espressif.com.

3.1.6 Related Documents

Please download the following documents from [the HTML version of esp-dev-kits Documentation](#).

- ESP32-C3 Datasheet
- ESP32-C3-MINI-1 Datasheet
- ESP Product Selector
- ESP32-C3-LCDkit_MB Schematics
- ESP32-C3-LCDkit_MB PCB Layout
- ESP32-C3-LCDkit_DB Schematics
- ESP32-C3-LCDkit_DB PCB Layout
- ESP32-C6-LCDkit_DB Schematics
- ESP32-C6-LCDkit_DB PCB Layout
- 1.28_TFT_240x240_SPI_Display
- Infrared Transmitter (IR67-21CTR8)
- Infrared Receiver (IRM-H638TTR2)
- Audio Amplifier (NS4150)
- RGB LED (WS2812B)
- 2415 Voice Cavity Horn

For further design documentation for the board, please contact us at sales@espressif.com.

ESP32-C3-LCD-Ev-Board

This user guide will help you get started with ESP32-C3-LCD-Ev-Board and will also provide more in-depth information.

The document consists of the following sections:

- *Board Overview*: Overview of the board hardware/software.
- *Start Application Development*: How to set up hardware/software to develop applications.
- *Hardware Reference*: More detailed information about the board's hardware.
- *Hardware Revision Details*: This is the first revision of this board released.
- *Sample Request*: How to get a sample board.
- *Related Documents*: Links to related documentation.

Board Overview ESP32-C3-LCD-Ev-Board is an ESP32-C3-based evaluation development board with an SPI interface display. It also has an integrated rotary encoder switch and features screen interaction. Due to its low cost, low power consumption, and high performance, ESP32-C3 satisfies the basic GUI interaction needs, gaining ground in scenarios with small screen sizes.



Fig. 11: ESP32-C3-LCD-Ev-Board with ESP32-C3-MINI-1 Module

Feature List The main features of the board are listed below:

- **Module Embedded**: ESP32-C3-MINI-1 module with 4 MB flash and 400 KB SRAM
- **Display**: Compatibility with various subboards and support for displays with I2C and SPI interfaces. Please refer to *LCD Subboards* for more information
- **Rotary Encoder Switch**: Key switches and 360° rotation for on-screen GUI control
- **USB**: USB Type-C download/debug

Block Diagram The block diagram below shows the components of ESP32-C3-LCD-Ev-Board and their inter-connections.

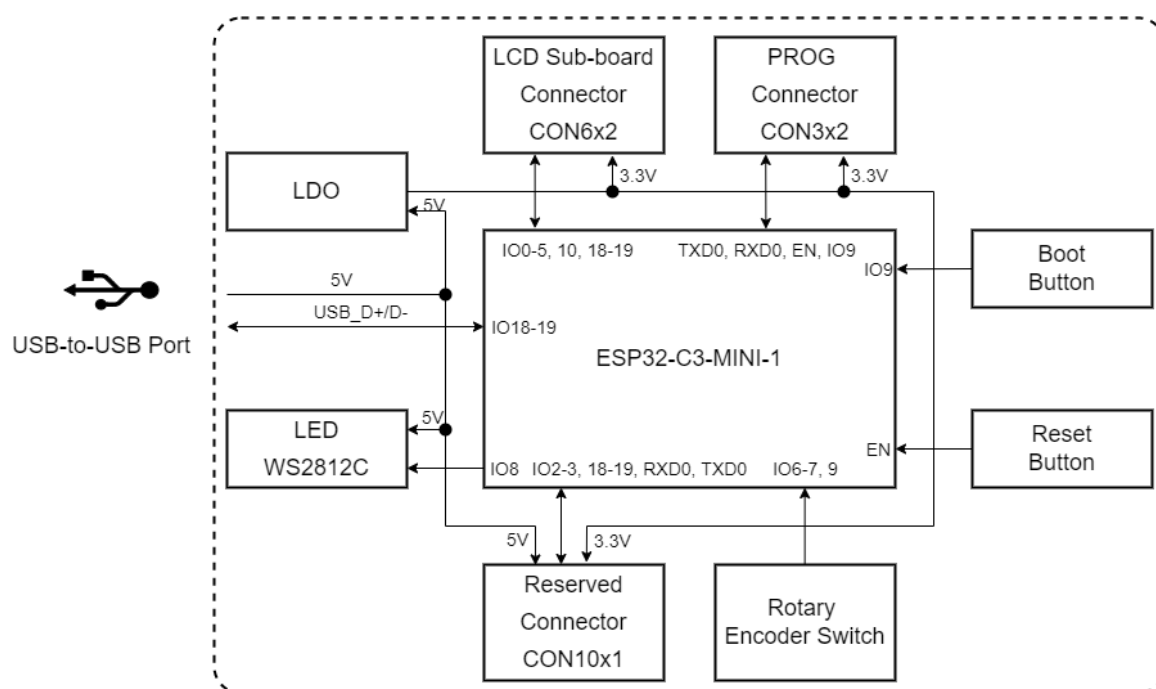


Fig. 12: ESP32-C3-LCD-Ev-Board Block Diagram (Click to Enlarge)

Description of Components The ESP32-C3-LCD-Ev-Board development board consists of a mainboard and a subboard.

Mainboard **ESP32-C3-LCD-Ev-Board_MB** is the core of the kit, which integrates the ESP32-C3-MINI-1 module and provides ports for connection to the LCD subboard.

The key components of the board are described in a counter-clockwise direction.

| Key Component | Description |
|------------------------|--|
| ESP32-C3-MINI-1 Module | ESP32-C3-MINI-1 is a generic Wi-Fi + Bluetooth LE MCU module that is built around the ESP32-C3 series of SoCs. It is integrated with 4 MB flash and 400 KB SRAM. |
| Reset Button | Press this button to reset the system. |
| Reserved IO Connector | Connects the system power supply pins and some reserved module pins via a 2.54 mm pitch connector. |
| LED | Supports configuring the RGB LED display to indicate status or behavior. |
| ESP-Prog Connector | Connects the Program interface of ESP-Prog for firmware download and debugging via a 1.27 mm pitch connector. |
| Power Switch | Power Toggle ON/OFF: Toggle ON to power on the board and OFF to power off the board. |
| USB-to-USB Port | Provides power to the entire system. It is recommended to use at least a 5V/2A power adapter to ensure a stable power supply. Used for USB communication between the PC side and the ESP32-C3-MINI-1 module. |
| Screen Connector | Connects the 1.28" LCD subboard via a 2.54 mm pitch connector. |
| Rotary Encoder Switch | Features both a 360° rotary encoder and a key switch to enable control of the on-screen GUI. |
| Boot Button | Holding down the Boot key and momentarily pressing the Reset key initiates the firmware upload mode. Then you can upload firmware through the serial port or USB. |

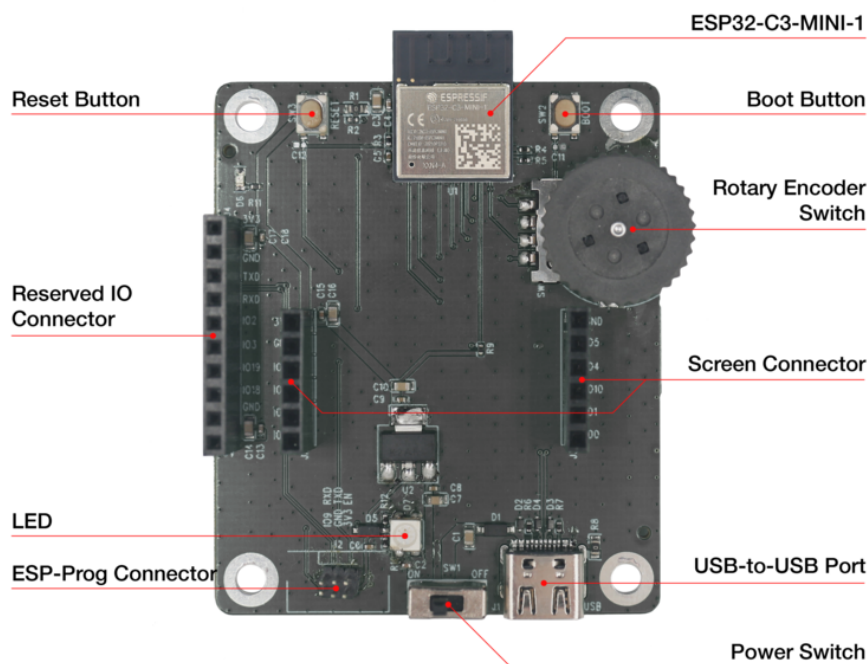


Fig. 13: ESP32-C3-LCD-Ev-Board - Front (Click to Enlarge)

LCD Subboards The **ESP32-C3-LCD-Ev-Board_DB** subboard supports a 1.28" LCD screen with SPI interface and 240x240 resolution. The driver chip used for this screen is GC9A01.

Software Support The ESP32-C3-LCD-Ev-Board development framework is [ESP-IDF](#). ESP-IDF is a FreeRTOS-based SoC development framework with a bunch of components including LCD, ADC, RMT, and SPI.

Start Application Development This section provides instructions on how to do hardware and software setup and flash firmware onto the board to develop your own application.

Required Hardware

- 1 x ESP32-C3-LCD-Ev-Board_MB
- 1 x LCD subboard
- 1 x USB 2.0 cable (standard Type-A to Type-C)
- 1 x PC (Windows, Linux, or macOS)

Note: Please make sure to use the appropriate USB cable. Some cables can only be used for charging, not for data transfer or program flashing.

Hardware Setup Prepare the board for loading of the first sample application:

1. Connect the LCD subboard to the **LCD Board Connector**.
2. Plug in the USB cable to connect the PC with the board.
3. The LCD lights up and you can start to interact with it.

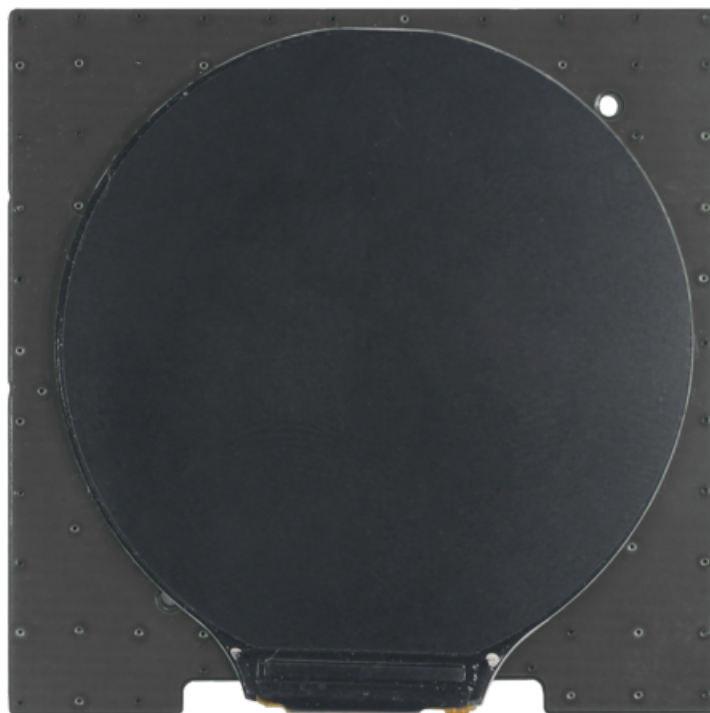


Fig. 14: ESP32-C3-LCD-Ev-Board_DB - Front (Click to Enlarge)

Now the board is ready for software setup.

Software Setup To learn how to quickly set up your development environment, please go to [Get Started > Installation](#).

For more software information on developing applications, please go to [Software Support](#).

Hardware Reference This section provides more detailed information about the board's hardware.

GPIO Allocation The table below provides the allocation of GPIOs exposed on terminals of ESP32-C3-MINI-1 module to control specific components or functions of the board.

Table 2: ESP32-C3-MINI-1 GPIO Allocation

| Pin | Pin Name | Function |
|-----|----------|---------------|
| 1 | GND | Ground |
| 2 | GND | Ground |
| 3 | 3V3 | Power supply |
| 4 | NC | No connection |
| 5 | IO2 | Reserved |
| 6 | IO3 | Reserved |
| 7 | NC | No connection |
| 8 | EN | Reset |
| 9 | NC | No connection |
| 10 | NC | No connection |
| 11 | GND | Ground |

continues on next page

Table 2 – continued from previous page

| Pin | Pin Name | Function |
|-------|----------|------------------|
| 12 | IO0 | LCD_SDA |
| 13 | IO1 | LCD_SCL |
| 14 | GND | Ground |
| 15 | NC | No connection |
| 16 | IO10 | LCD_CS |
| 17 | NC | No connection |
| 18 | IO4 | LCD_D/C |
| 19 | IO5 | LCD_BL_CTRL |
| 20 | IO6 | ENCODER_B |
| 21 | IO7 | ENCODER_A |
| 22 | IO8 | LED |
| 23 | IO9 | BOOT, ENCODER_SW |
| 24 | NC | No connection |
| 25 | NC | No connection |
| 26 | IO18 | Reserved |
| 27 | IO19 | Reserved |
| 28 | NC | No connection |
| 29 | NC | No connection |
| 30 | RXD0 | RXD0 |
| 31 | TXD0 | TXD0 |
| 32-35 | NC | No connection |
| 36-53 | GND | Ground |

Power Distribution The development board is powered via the USB-to-USB port:

Output system power supply:

Hardware Setup Options

Automatic Download There are two ways to put the development board into download mode.

- Press the Boot and Reset buttons. Release the Reset button first and then the Boot button.
- Controls the status of the EN and IO9 pins of the ESP development board by ESP-Prog.

Hardware Revision Details No previous revisions.

Sample Request Not available.

Related Documents Please download the following documents from [the HTML version of esp-dev-kits Documentation](#).

- [ESP32-C3 Datasheet](#)
- [ESP32-C3-MINI-1 Datasheet](#)
- [ESP Product Selector](#)
- [ESP32-C3-LCD_EV_Board-MB Schematics](#)
- [ESP32-C3-LCD_EV_Board-MB PCB Layout](#)
- [ESP32-C3-LCD_EV_Board-DB Schematics](#)
- [ESP32-C3-LCD_EV_Board-DB PCB Layout](#)

For further design documentation for the board, please contact us at sales@espressif.com.

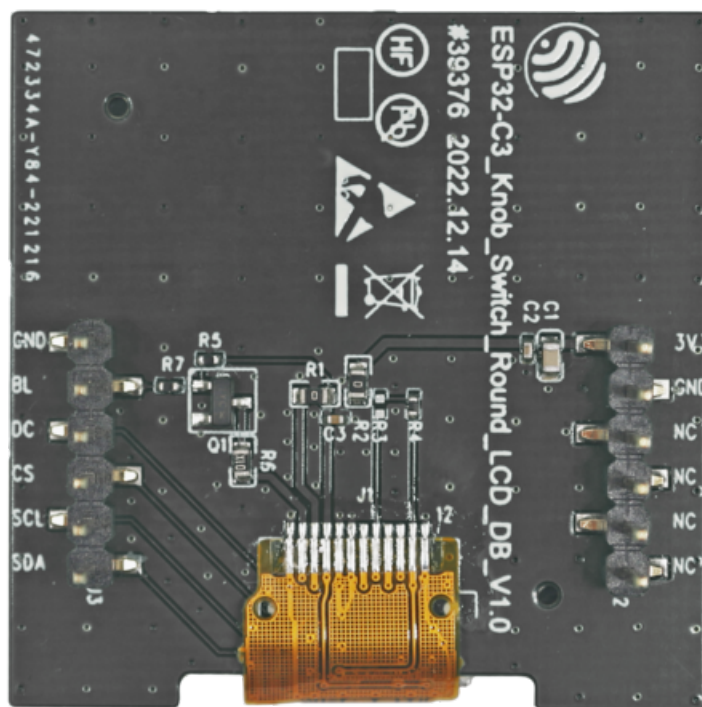


Fig. 15: ESP32-C3-LCD-Ev-Board_DB - Back (Click to Enlarge)

USB

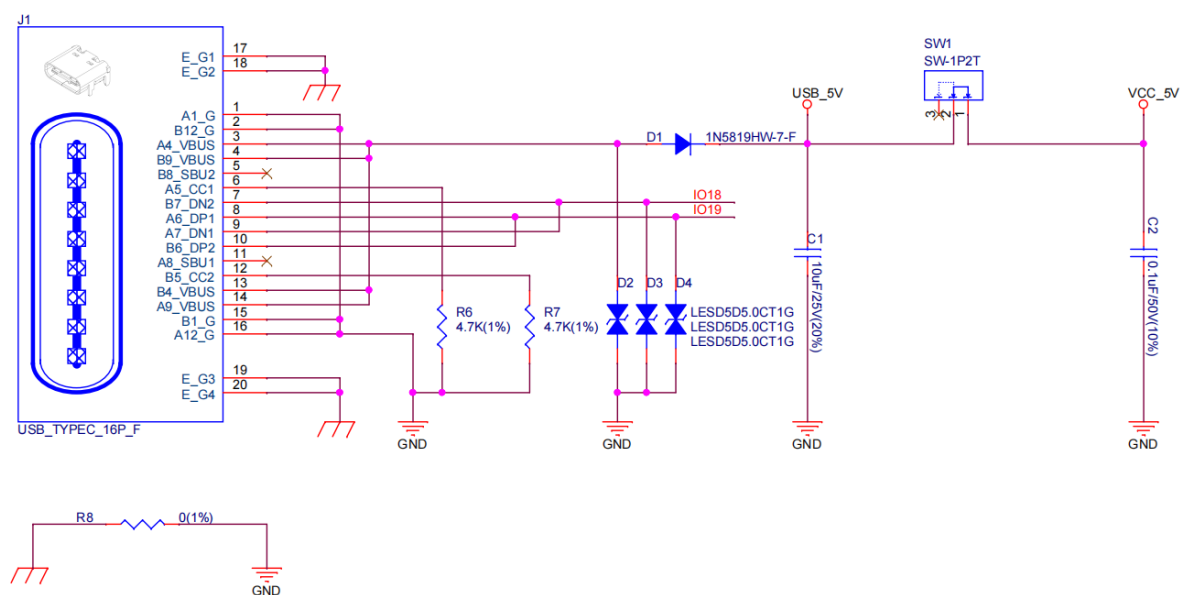


Fig. 16: ESP32-C3-LCD-Ev-Board - USB-to-USB Power Supply

3V3 LDO

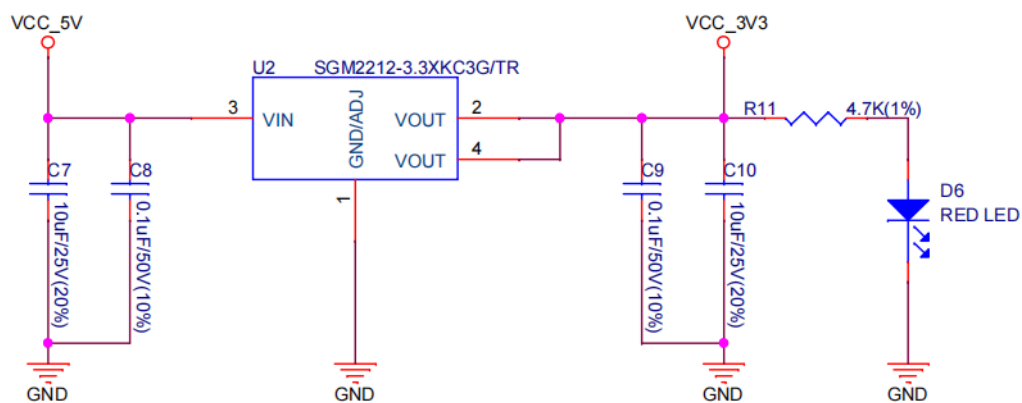
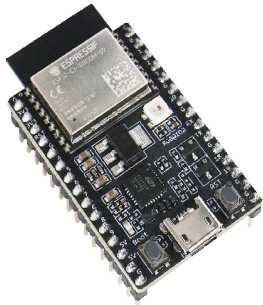
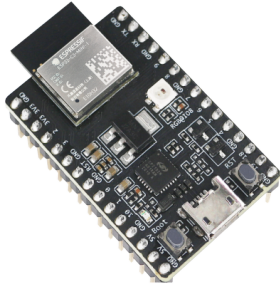



Fig. 17: ESP32-C3-LCD-Ev-Board - System Power Supply

| ESP32-C3 Development Boards | |
|---|---|
|  |  |
| ESP32-C3-DevKitC-02 | ESP32-C3-DevKitM-1 |
|  | |
| ESP32-C3-LCDkit | |

Chapter 4

Related Documentation and Resources

4.1 Related Documentation

- [ESP32-C3 Datasheet](#) –Specifications of the ESP32-C3 hardware.
- [ESP32-C3 Technical Reference Manual](#) –Detailed information on how to use the ESP32-C3 memory and peripherals.
- [ESP32-C3 Hardware Design Guidelines](#) –Guidelines on how to integrate the ESP32-C3 into your hardware product.
- [ESP32-C3 Product/Process Change Notifications \(PCN\)](#)
<https://espressif.com/en/support/documents/pcns?keys=ESP32-C3>
- [ESP32-C3 Advisories](#) –Information on security, bugs, compatibility, component reliability.
<https://espressif.com/en/support/documents/advisories?keys=ESP32-C3>
- [Certificates](#)
<https://espressif.com/en/support/documents/certificates>
- [Documentation Updates and Update Notification Subscription](#)
<https://espressif.com/en/support/download/documents>

4.2 Developer Zone

- [ESP-IDF Programming Guide for ESP32-C3](#) –Extensive documentation for the ESP-IDF development framework.
- [ESP-IoT-Solution Programming Guide](#) - Extensive documentation for the ESP-IoT-Solution development framework.
- [ESP-FAQ](#) - A summary document of frequently asked questions released by Espressif.
- [ESP-IDF and other development frameworks on GitHub](#).
<https://github.com/espressif>
- [ESP32 BBS Forum](#) –Engineer-to-Engineer (E2E) Community for Espressif products where you can post questions, share knowledge, explore ideas, and help solve problems with fellow engineers.
<https://esp32.com/>
- [The ESP Journal](#) –Best Practices, Articles, and Notes from Espressif folks.
<https://blog.espressif.com/>
- [See the tabs SDKs and Demos, Apps, Tools, AT Firmware](#).
<https://espressif.com/en/support/download/sdks-demos>

4.3 Products

- ESP32-C3 Series SoCs –Browse through all ESP32-C3 SoCs.
<https://espressif.com/en/products/socs?id=ESP32-C3>
- ESP32-C3 Series Modules –Browse through all ESP32-C3-based modules.
<https://espressif.com/en/products/modules?id=ESP32-C3>
- ESP32-C3 Series DevKits –Browse through all ESP32-C3-based devkits.
<https://espressif.com/en/products/devkits?id=ESP32-C3>
- ESP Product Selector –Find an Espressif hardware product suitable for your needs by comparing or applying filters.
<https://products.espressif.com/#/product-selector>

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Chapter 5

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