

ESP32-S3-LCD-EV-Board

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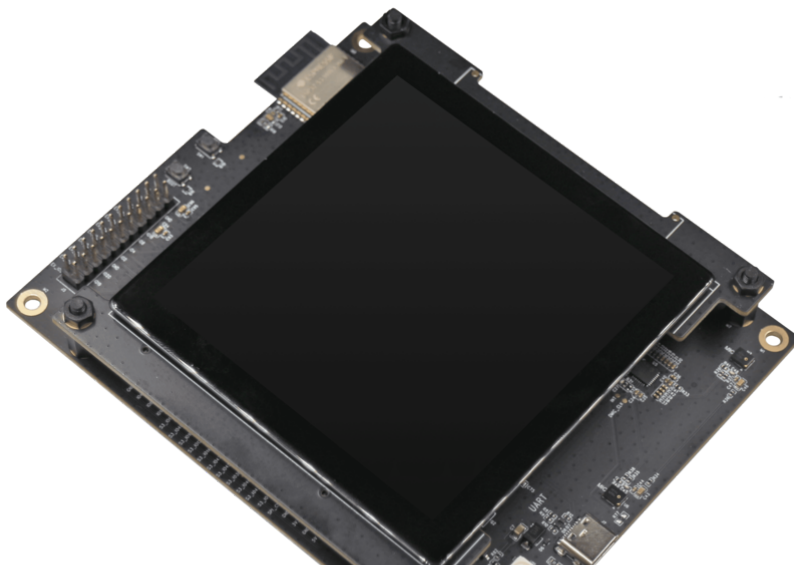
This user guide will help you get started with ESP32-S3-LCD-EV-Board and will also provide more in-depth information.

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-S3-LCD-EV-Board is an ESP32-S3-based development board with a touchscreen. Together with different subboards, ESP32-S3-LCD-EV-Board can drive LCDs with IIC, SPI, 8080, and RGB interfaces. It houses dual array microphones, supports voice recognition and near/far-field voice wake-up, and features screen and voice interaction. The board caters to development needs for touchscreen products with different resolutions and interfaces. Currently, we have two boards available: ESP32-S3-LCD-EV-Board with 480x480 LCD and ESP32-S3-LCD-EV-Board with 800x480 LCD.



ESP32-S3-LCD-EV-Board with 800x480 LCD



ESP32-S3-LCD-EV-Board with 800x480 LCD

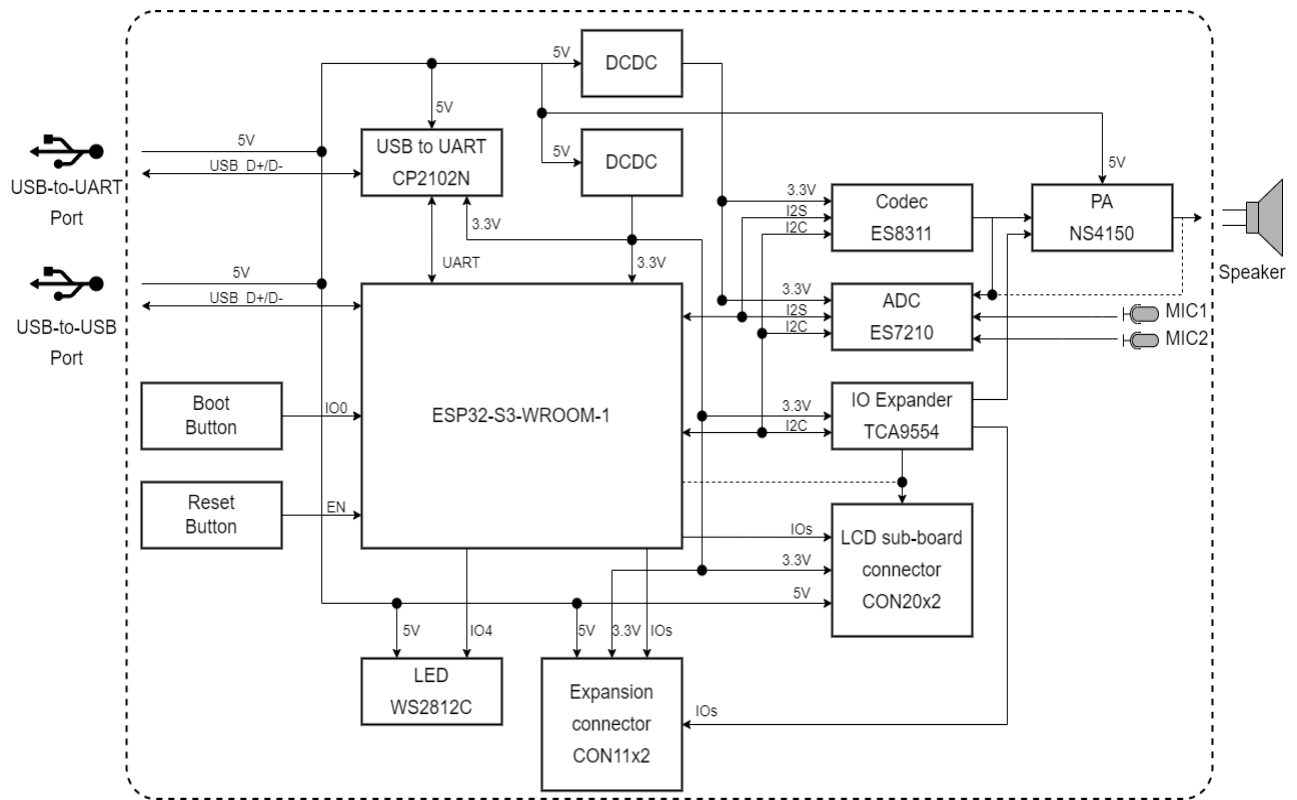
Feature List

The main features of the board are listed below:

- **Module Embedded:** ESP32-S3-WROOM-1 module with 16 MB flash and 8 MB PSRAM
- **Display:** Compatibility with various subboards and support for displays with **RGB** , **8080** , **SPI** , and **I2C** interfaces. Please refer to [LCD Subboards](#) for more information
- **Audio:** Audio Codec + ADC amplifier and dual microphones
- **USB:** USB to serial port chip plus USB Type-C download/debug

Block Diagram

The block diagram below shows the components of ESP32-S3-LCD-EV-Board and their interconnections.



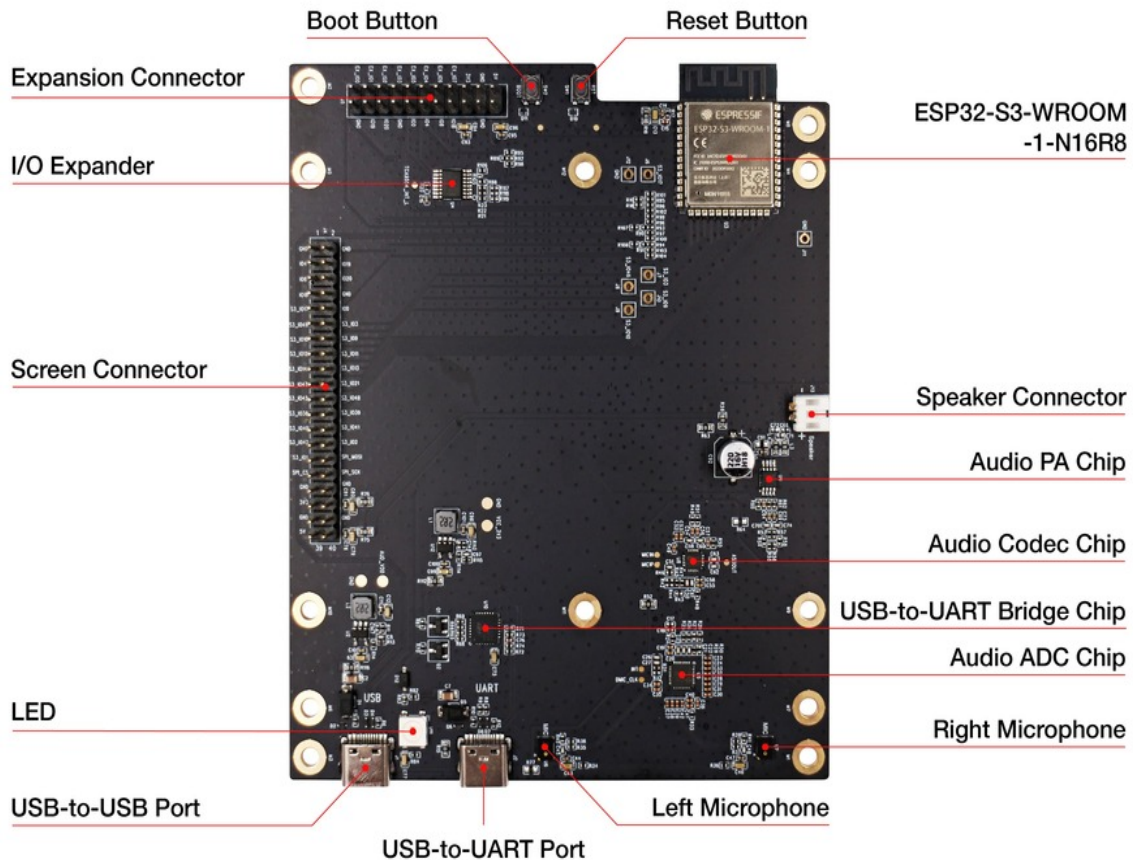
ESP32-S3-LCD-EV-Board Block Diagram (Click to Enlarge)

Description of Components

The ESP32-S3-LCD-EV-Board development board consists of a mainboard and a subboard.

Mainboard

ESP32-S3-LCD-EV-Board-MB is the core of the kit, which integrates the ESP32-S3-WROOM-1 module and provides ports for connection to the LCD subboard.



ESP32-S3-LCD-EV-Board-MB - Front (Click to Enlarge)

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

Key Component	Description
ESP32-S3-WROOM-1-N16R8 Module	ESP32-S3-WROOM-1-N16R8 is a generic Wi-Fi + Bluetooth
Reset Button	Press this button to reset the system.
Boot Button	Holding down the Boot key and momentarily pressing the
Expansion Connector	Provides connections for all I/O expander pins, all power
I/O Expander	TCA9554 is a device that provides 8 bits of general purpose
LCD Board Connector	Three different types of LCD subboards can be connected
LED	Supports configuring the RGB LED display to indicate status
USB-to-USB Port	Provides power to the entire system (choose either USB-to-USB or
USB-to-UART Port	Provides power to the entire system (choose either USB-to-USB or
Left Microphone	On-board microphone, connected to ADC.
Right Microphone	On-board microphone, connected to ADC.
Audio ADC Chip	ES7210 < http://www.everest-semi.com/pdf/ES7210%20PB

Key Component	Description
USB-to-UART Bridge Controller	CP2102N, the single-chip USB-to-UART bridge controller
Audio Codec Chip	ES8311 is a low-power mono audio codec that includes a
Audio Amplifier	NS4150 is a low EMI, 3 W mono class D audio amplifier
Speaker Connector	External speaker playback is possible with the help of the

LCD Subboards

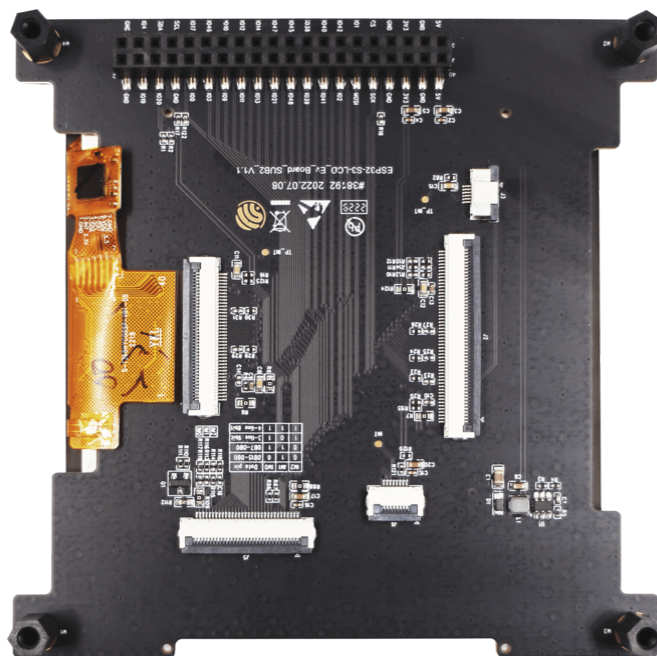
The mainboard can be used together with three different kinds of subboards:

Board Name	Display (Inch)	Resolution (Px)	LCD Driver (Interface)
ESP32-S3-LCD-EV-Board-SUB1	0.96	128 x 64	SSD1315 (I2C)
	2.40	320 x 240	ST7789V (SPI)
ESP32-S3-LCD-EV-Board-SUB2	3.50	480 x 320	ST7796S (8080)
	3.95	480 x 480	GC9503CV (RGB)
ESP32-S3-LCD-EV-Board-SUB3	4.30	800 x 480	ST7262E43 (RGB)

- **ESP32-S3-LCD-EV-Board-SUB1** subboard has two interfaces, which support connection to a 2.4-inch display with the SPI interface or a 0.96-inch display with the I2C interface. This board is not yet configured, so it is not further explained here.
- **ESP32-S3-LCD-EV-Board-SUB2** subboard has two interfaces, which support connection to a display with the RGB interface or a display with the 8080 parallel interface. The current subboard has a 3.95-inch touchscreen with the RGB565 interface and 480x480 resolution. The LCD driver IC is GC9503CV and the touchscreen driver IC is FT5x06.



ESP32-S3-LCD-EV-Board-SUB2 - Front (Click to Enlarge)

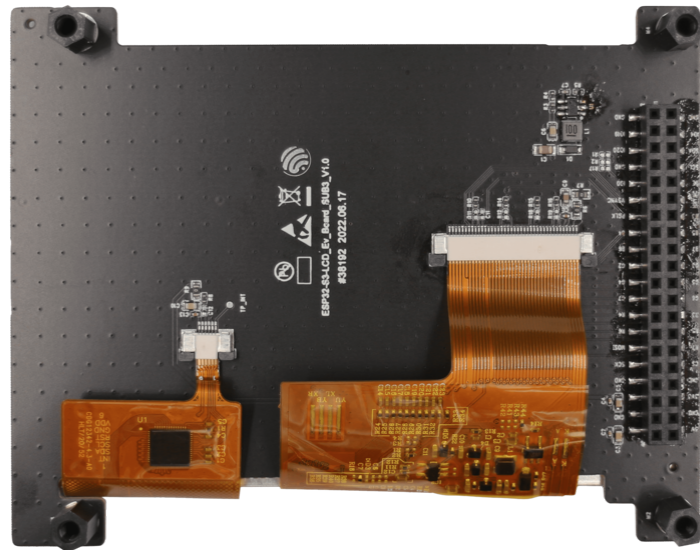


ESP32-S3-LCD-EV-Board-SUB2 - Back (Click to Enlarge)

- **ESP32-S3-LCD-EV-Board-SUB3** subboard only supports a 4.3-inch touchscreen with the RGB565 interface and 800x480 resolution. The LCD driver IC is ST7262E43 and the touchscreen driver IC is GT1151.



ESP32-S3-LCD-EV-Board-SUB3 - Front (Click to Enlarge)



ESP32-S3-LCD-EV-Board-SUB3 - Back (Click to Enlarge)

Software Support

The ESP32-S3-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. An example is provided for ESP32-S3-LCD-EV-Board under the folder [Examples](#). You can configure project options by entering `idf.py menuconfig` in the example directory.

Note

- ESP-IDF v5.1 and above are recommended for development.
- ESP32-S3 RGB driver only supports the 16-bit RGB565 and 8-bit RGB888 interface.
- To enable ESP-IDF with the 120 MHz DDR PSRAM, please see [here](#).

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-S3-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.

Optional Hardware

- 1 x Speaker

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.

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-S3-WROOM-1 module to control specific components or functions of the board.

ESP32-S3-WROOM-1 GPIO Allocation

Pin	Pin Name	Function
1	GND	GND
2	3V3	Power supply
3	EN	RESET
4	IO4	LED
5	IO5	I2S_MCLK
6	IO6	I2S_CODEC_DSDIN
7	IO7	I2S_LRCK
8	IO15	I2S_ADC_SDOUT
9	IO16	I2S_SCLK
10	IO17	LCD_DE
11	IO18	I2C_SCL
12	IO8	I2C_SDA
13	IO19	USB_D-
14	IO20	USB_D+
15	IO3	LCD_VSYNC
16	IO46	LCD_HSYNC
17	IO9	LCD_PCLK
18	IO10	LCD_DATA0
19	IO11	LCD_DATA1
20	IO12	LCD_DATA2
21	IO13	LCD_DATA3
22	IO14	LCD_DATA4
23	IO21	LCD_DATA5
24	IO47	LCD_DATA6
25	IO48	LCD_DATA7
26	IO45	LCD_DATA8

Pin	Pin Name	Function
27	IO0	BOOT
28	IO35	No connection
29	IO36	No connection
30	IO37	No connection
31	IO38	LCD_DATA9
32	IO39	LCD_DATA10
33	IO40	LCD_DATA11
34	IO41	LCD_DATA12
35	IO42	LCD_DATA13
36	RXD0	UART_RXD0
37	TXD0	UART_TXD0
38	IO2	LCD_DATA14
39	IO1	LCD_DATA15
40	GND	GND
41	EPAD	GND

The pins on the I/O expander connected to the module can be used for different functions.

I/O Expander GPIO Allocation

IO Expander Pin	Pin Name	Function
1	A0	GND
2	A1	GND
3	A2	GND
4	P0	PA_CTRL
5	P1	LCD_SPI_CS
6	P2	LCD_SPI_SCK
7	P3	LCD_SPI_MOSI
8	GND	GND
9	P4	Free
10	P5	Free
11	P6	Free
12	P7	Free

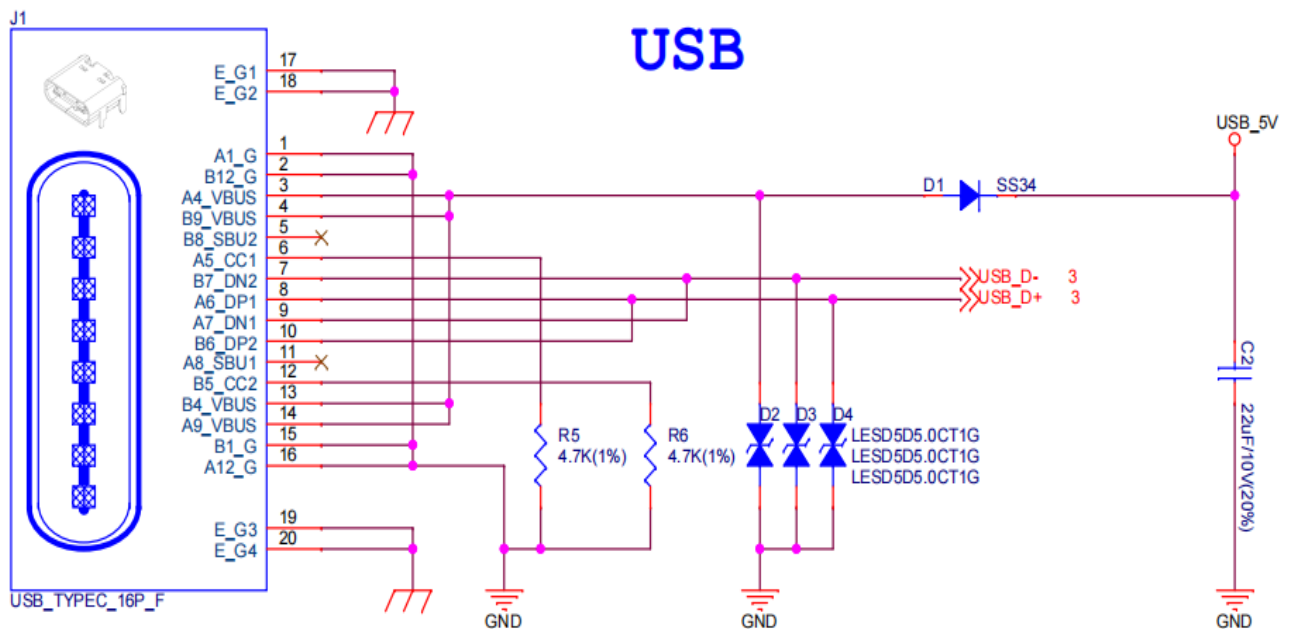
IO Expander Pin	Pin Name	Function
13	INT	No connection
14	SCL	I2C_SCL
15	SDA	I2C_SDA
16	VCC	Supply voltage

Power Distribution

Power Supply over USB

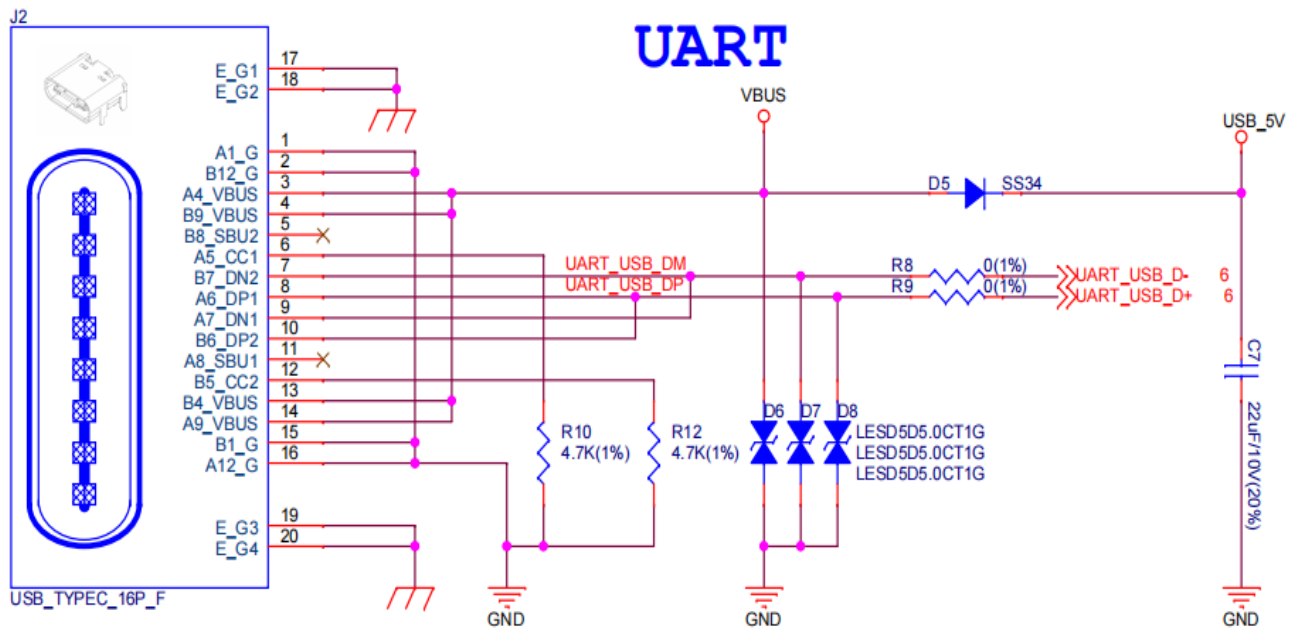
There are two ways to power the development board via USB power port.

- Via **USB-to-USB** port



ESP32-S3-LCD-EV-Board - USB-to-USB Power Supply

- Via **USB-to-UART** port

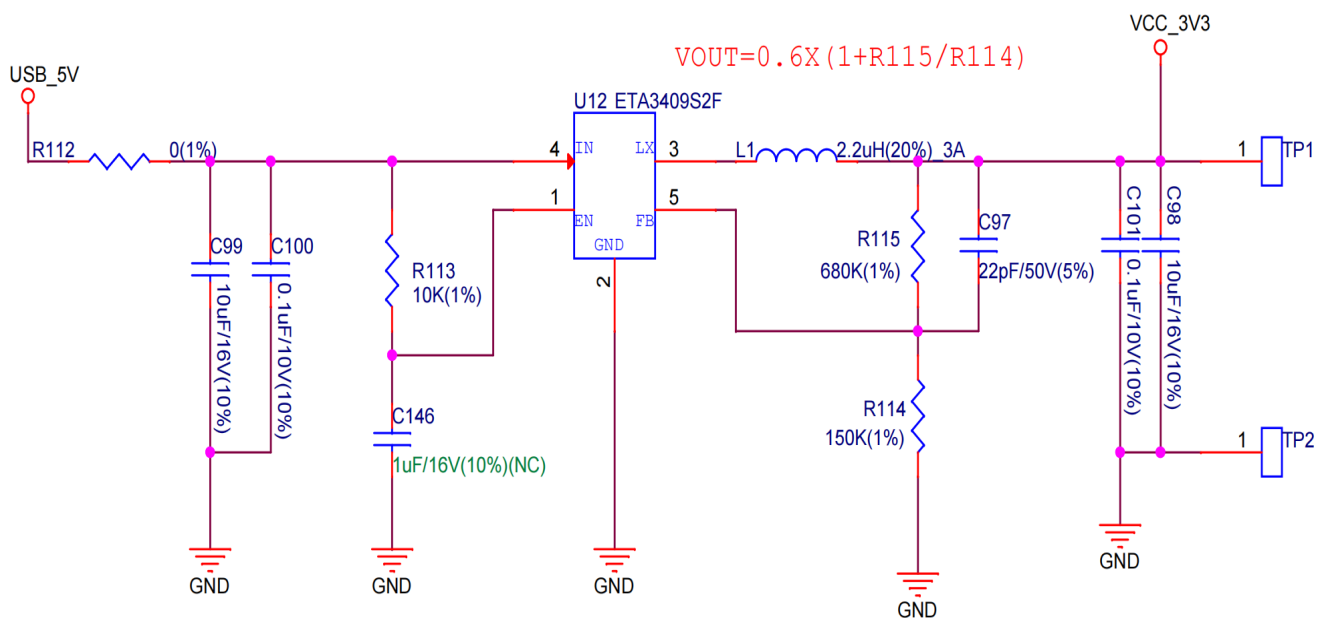


ESP32-S3-LCD-EV-Board - USB-to-UART Power Supply

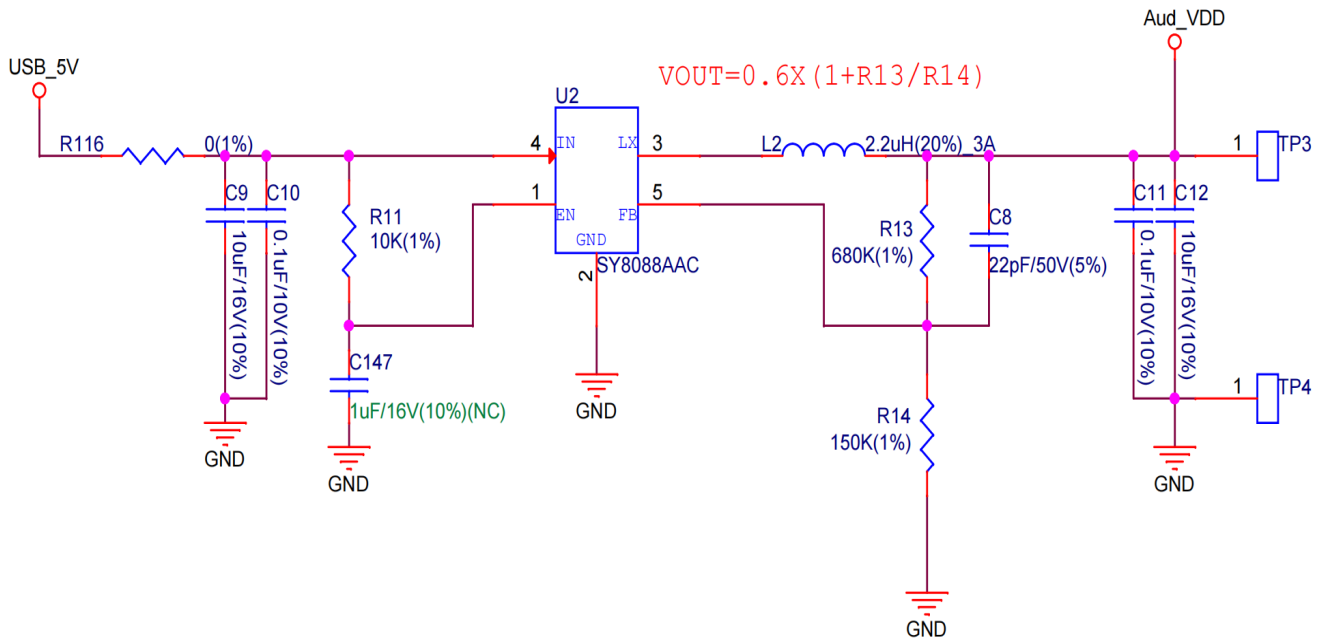
Independent Audio and Digital Power Supply

ESP32-S3-LCD-EV-Board features independent power supplies for the audio components and ESP module. This should reduce noise in the audio signal from digital components and improve the overall performance of the components.

SYS VDD



ESP32-S3-LCD-EV-Board - Digital Power Supply



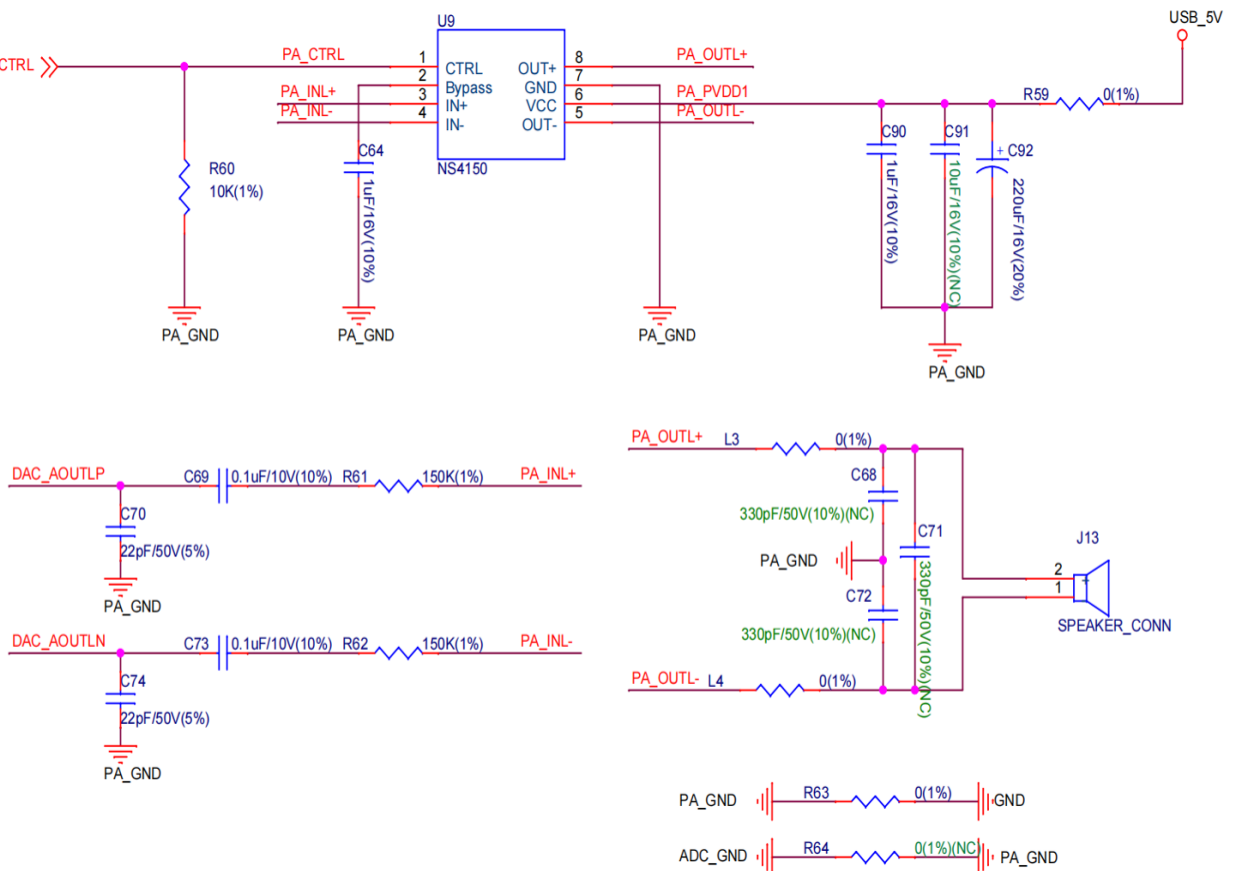
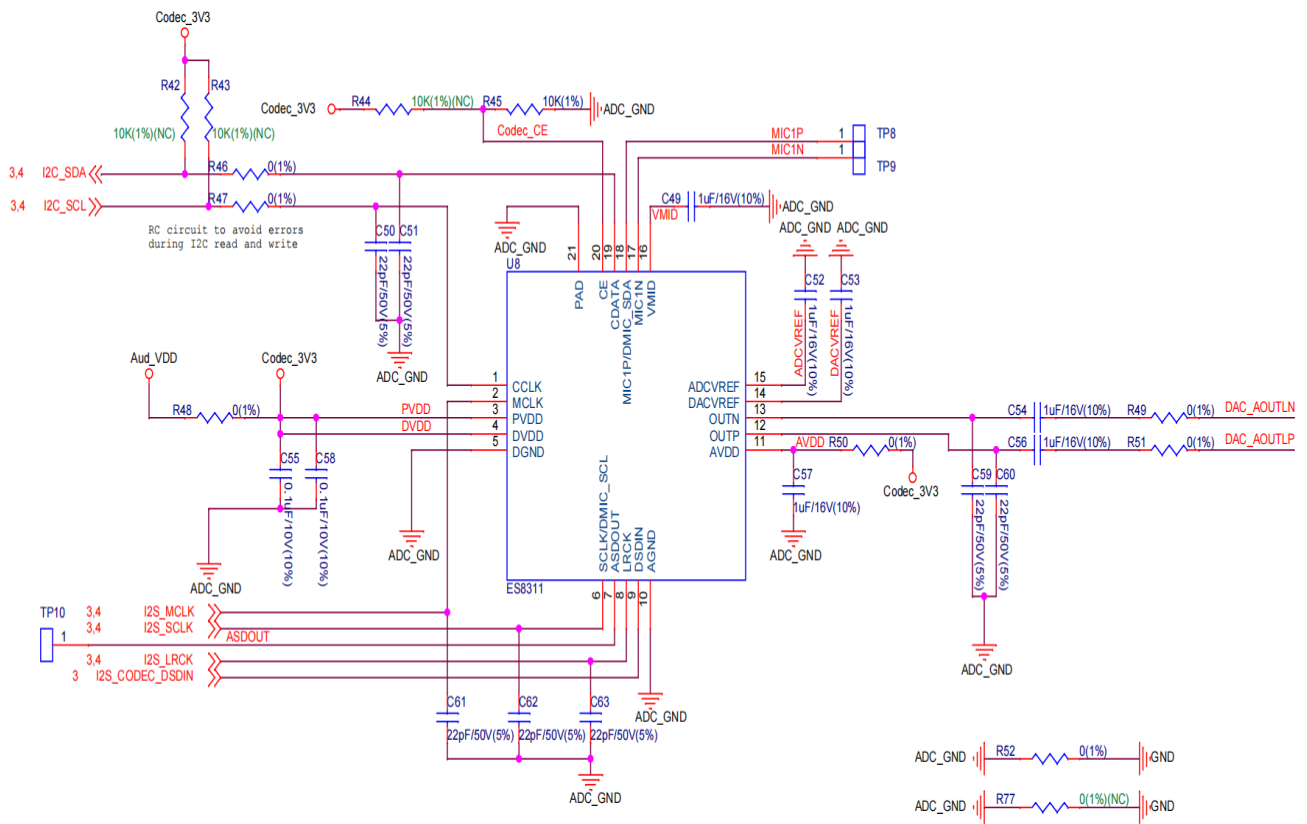
ESP32-S3-LCD-EV-Board - Audio Power Supply

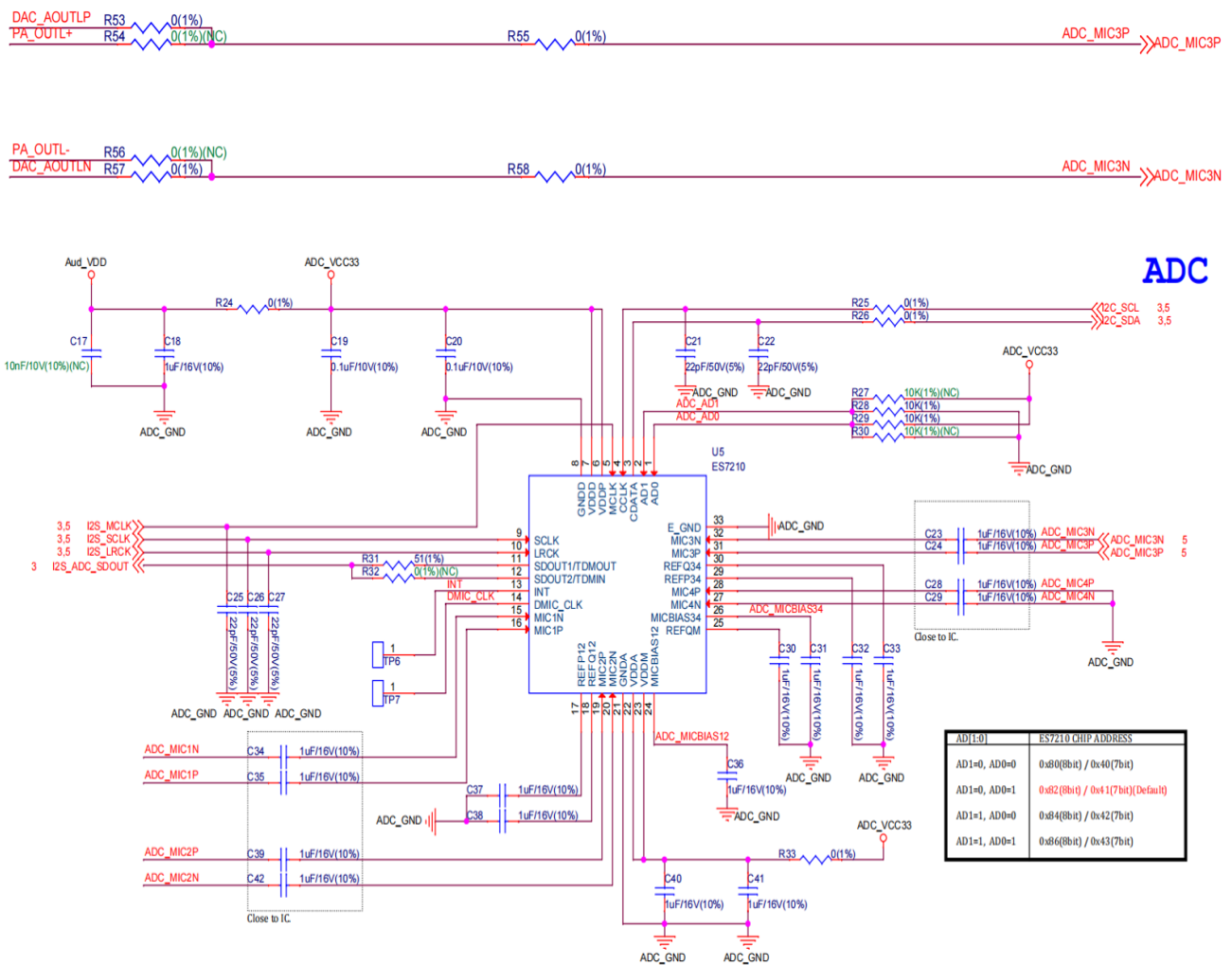
AEC Path

The acoustic echo cancellation (AEC) path provides reference signals for AEC algorithm.

ESP32-S3-LCD-EV-Board provides two compatible echo reference signal source designs. One is Codec (ES8311) DAC output (DAC_AOUTLP/DAC_AOUTLP), the other is PA (NS4150) output (PA_OUT+/PA_OUT+). The former is a default and the recommended selection. Resistors R54 and R56 shown in the figure below should not be installed.

The echo reference signal is collected by ADC_MIC3P/ADC_MIC3N of ADC (ES7210) and then sent back to ESP32-S3 for AEC algorithm.





ESP32-S3-LCD-EV-Board - AEC Reference Signal Collection (Click to Enlarge)

Hardware Setup Options

Automatic Download

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

- Press the Boot and Reset buttons. Release the Reset button first and then the Boot button.
- The download is performed automatically by the software. The software uses the DTR and RTS signals from the serial port to control the status of the EN and IO0 pins.

Hardware Revision Details

No previous revisions.

Sample Request

This development board is suitable for evaluating Espressif's high-performance [HMI Smart Displays Solution](#). For placing orders, please proceed to the Espressif [Online Shop](#).

Related Documents

- [ESP32-S3 Datasheet](#)
- [ESP32-S3-WROOM-1 Datasheet](#)
- [ESP Product Selector](#)
- [ESP32-S3-LCD-EV-Board-MB Schematics](#)
- [ESP32-S3-LCD-EV-Board-MB PCB Layout](#)
- [ESP32-S3-LCD-EV-Board-SUB1 Schematics](#)
- [ESP32-S3-LCD-EV-Board-SUB1 PCB Layout](#)
- [ESP32-S3-LCD-EV-Board-SUB2 Schematics](#)
- [ESP32-S3-LCD-EV-Board-SUB2 PCB Layout](#)
- [ESP32-S3-LCD-EV-Board-SUB3 Schematics](#)
- [ESP32-S3-LCD-EV-Board-SUB3 PCB Layout](#)
- [TCA9554 Datasheet](#)
- [ES7210 Datasheet](#)
- [ES8311 Datasheet](#)

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

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