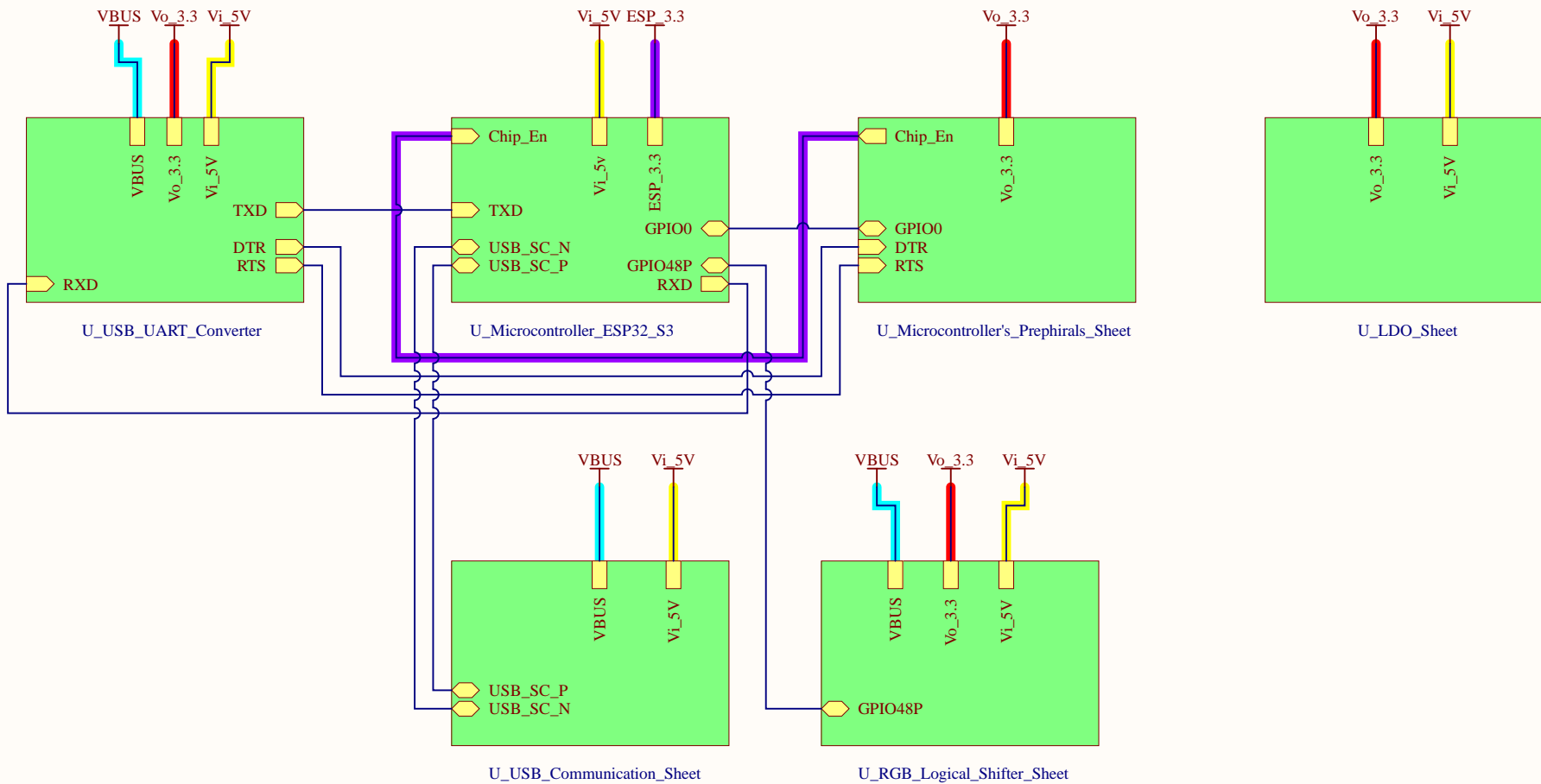
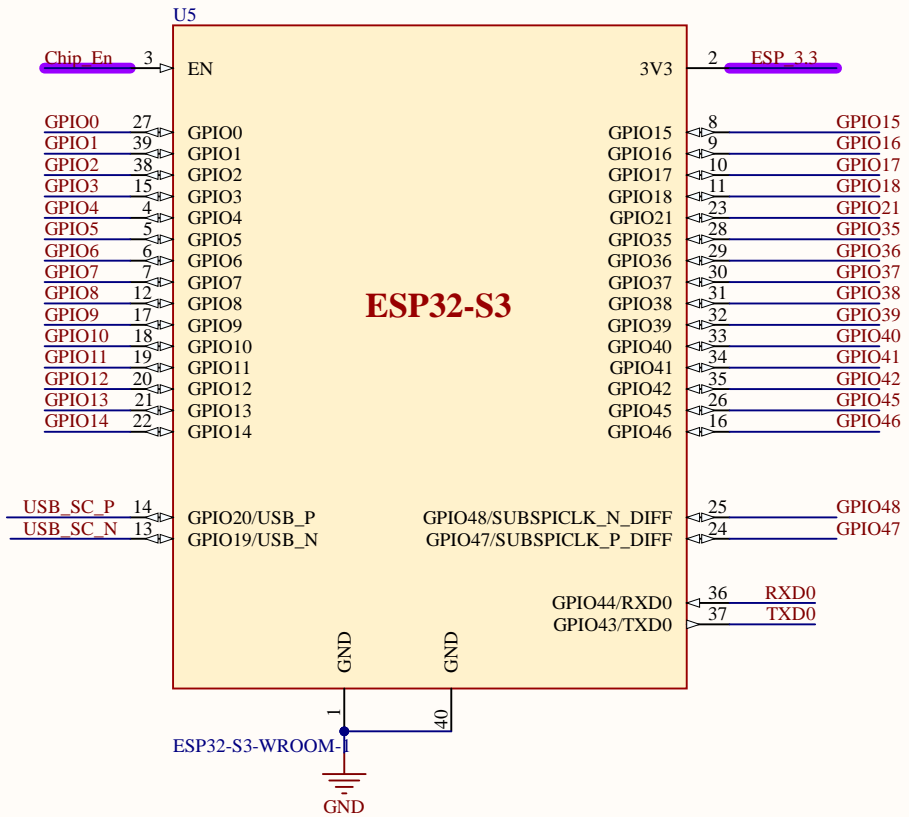


Block Diagram



Title			ESP32 S3 Learning Board	
Size	Number		1	
A			Revision	
Date:		12/30/2024	Sheet of	Abdelrahman Khaled
File:		S:\Development\...\Block Diagram.SchDoc	Drawn By:	Abdelrahman Khaled

ESP32 S3



Enable Pin (Pin number 3):
High: on, enables the chip.
Low: off, the chip power sofft.
Note:Donot leave the EN pin floating.

USB Differential Signals:

Pin 13 (D-) and Pin 14 (D+) form the USB differential pair, these pins transmit and receive USB data using differential signaling, which is a key feature of the USB standard.

90-Ohm Differential Impedance:
The differential pair (D- and D+) must maintain a characteristic differential impedance of 90 ohms.

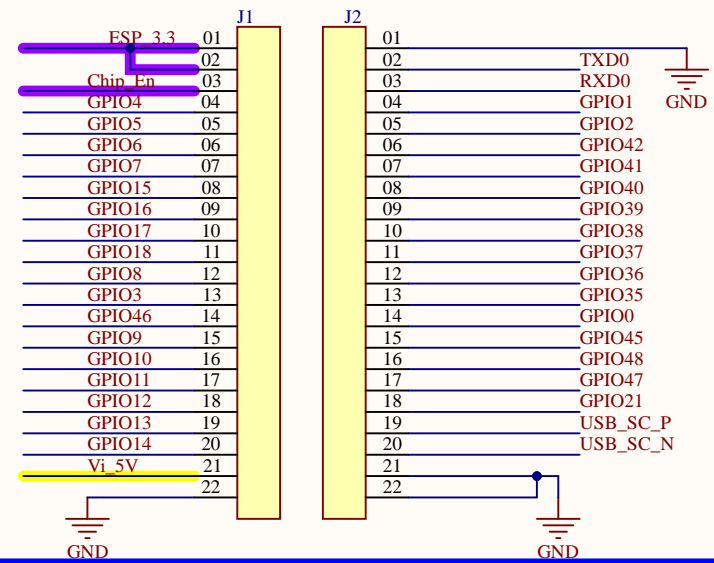
This is a requirement of the USB 2.0 specification to ensure signal integrity and compliance with USB standards.

Note:

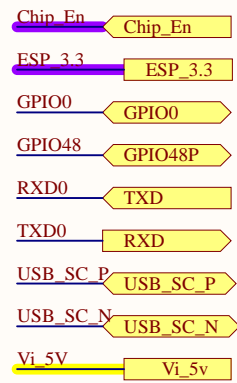
Pins 13 and 14 (D+ and D-) are not strictly required to be routed as a differential pair for USB serial communication, especially at lower speeds like USB full-speed (12 Mbps).

However, it is recommended to route them as a differential pair with proper impedance matching (90 ohms) to ensure signal integrity, reduce noise, and improve reliability.

Headers 2 x 22



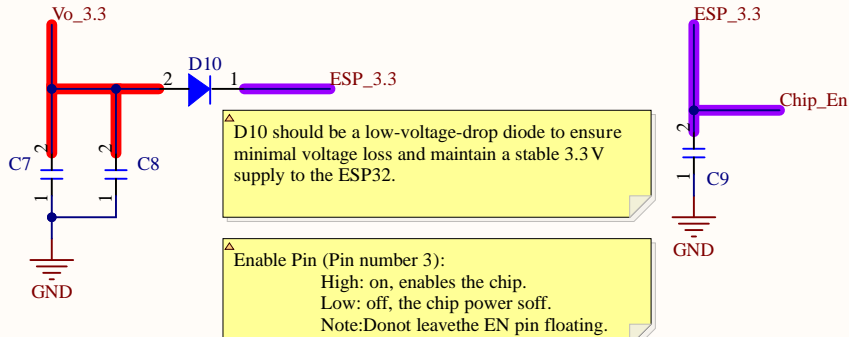
Ports



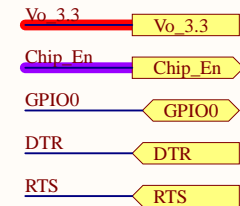
ESP32 S3 Learning Board

Size		Number	Revision
A		2	Abdelrahman Khaled
Date:		12/30/2024	Sheet of
File:		S:\Development\...\Microcontroller_ESP32_S3_SchDoc	Abdelrahman Khaled

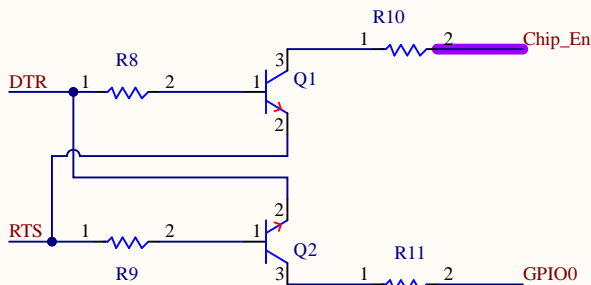
Enabel Pin Connections



Ports



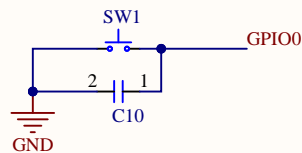
Control Enabling Circuit



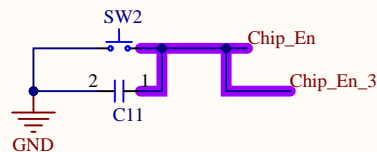
DTR	RTS	EN	IO0
1	1	1	1
0	0	1	1
1	0	0	1
0	1	1	0

R10 and R11 are 0-ohm resistors, but they must be capable of withstanding the power they may encounter during operation. Additionally, these resistors serve as test points and debugging aids,

Boot Switch



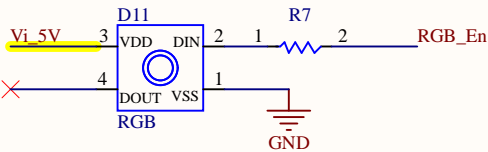
Reset Switch



ESP32 S3 Learning Board

Title	ESP32 S3 Learning Board	
Size	Number	Revision
A	3	Abdelrahman Khaled
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RGB Led

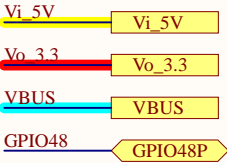


- R7 is a 0-ohm resistor primarily used for debugging and troubleshooting purposes.

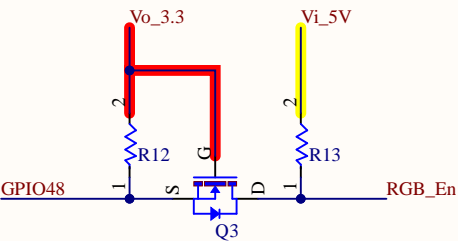
- Although it is a 0-ohm resistor, it must be capable of withstanding the power it may encounter during operation.

You can replace R7 with a diode, where the anode is connected to 5V and the cathode is connected to the DIN pin. This setup is useful for debugging and troubleshooting. In this case, ensure you select a diode with a low forward voltage drop to maintain proper circuit operation.

Ports



Logical Converter (3.3v to 5v) Bi-Directional



This is a bidirectional logic level converter designed using an N-Channel MOSFET. It facilitates the conversion between 3.3V and 5V logic levels in both directions.

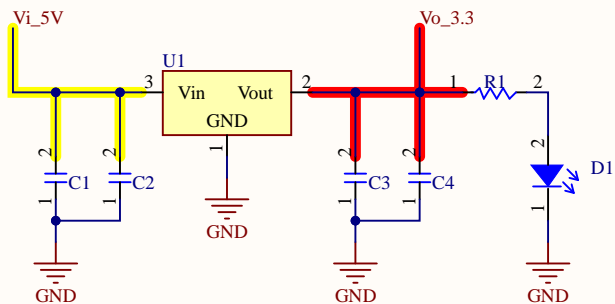
The N-Channel MOSFET should have a low voltage drop on it and the MOSFET should turn on fully with a gate voltage of 3.3V (logic level). This ensures compatibility with the 3.3V GPIO signal driving the gate.

Note:
This RGB module operates with a 5V control signal. However, it can be controlled using a 3.3V signal from the ESP32.
To ensure the RGB control terminal receives the full 5V signal for optimal performance, a logic level converter is used to enhance the signal and maintain the required 5V control voltage.

ESP32 S3 Learning Board

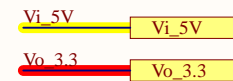
Size	Number	Revision
A	4	Abdelrahman Khaled
Date:	12/30/2024	Sheet of
File:	S:\Development\...\RGB_Logical_Shifter_Schematic.Doc	Abdelrahman Khaled

5V to 3.3V LDO



⚠ You should ensure that the LDO has a low dropout voltage to maintain a stable output of 3.3V. This helps prevent irregular output, ensures a consistent 3.3V supply on the bus, and avoids voltage spikes from the ESP32.

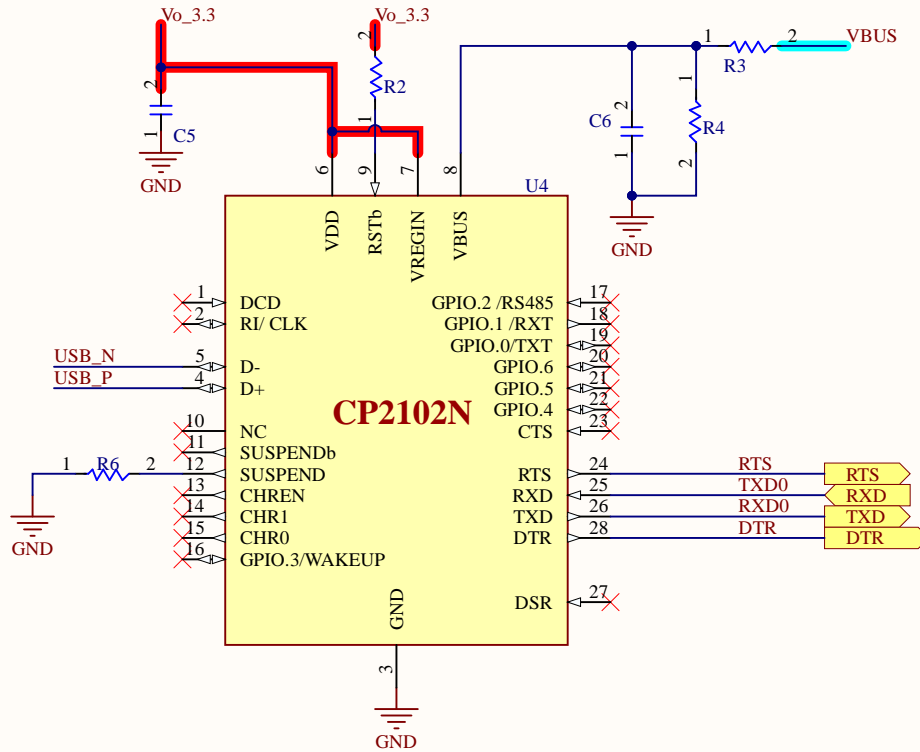
Ports



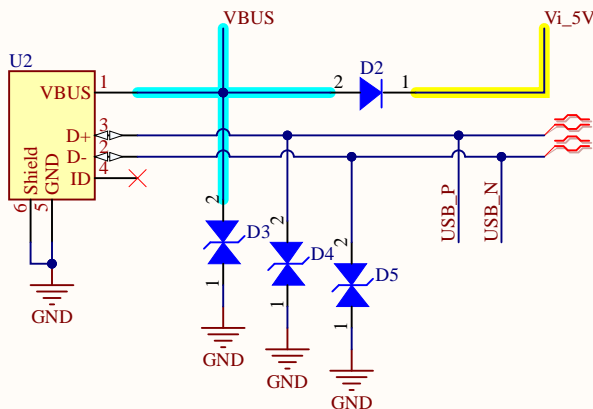
ESP32 S3 Learning Board

Size A	Number 5	Revision Abdelrahman Khaled
Date: 12/30/2024	Sheet of	Drawn By: Abdelrahman Khaled
File: S:\Development\...\LDO_Sheet.SchDoc		

USB 2 UART



USB Feeder to UART Chip



The diode ensures reverse voltage protection and prevents current backflow.

If there's a secondary power source connected to VL5V, the diode ensures that the external power source and the USB VBUS do not conflict or damage the system.

It also protects the USB host from being back-powered by the device.

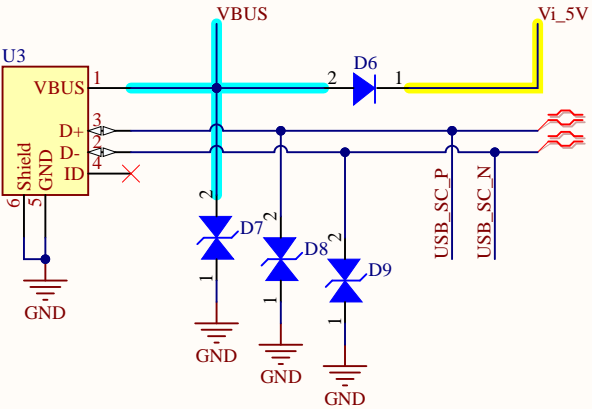
This design allows the system to be powered either from the USB VBUS or another power source tied to VL5V.

It ensures safety and compatibility when multiple power sources (USB and external power) are involved.

For enhanced protection, the diode can be replaced with a P-channel MOSFET. This provides better protection with lower voltage drop, improved efficiency, and higher current-handling capability.

Title		
ESP32 S3 Learning Board		
Size	Number	Revision
A	6	Abdelrahman Khaled
Date:	12/30/2024	Sheet of
File:	S:\Development\...\USB_UART_Converter.SchDoc	By: Abdelrahman Khaled

USB Communication



△ The diode ensures reverse voltage protection and prevents current backflow.

If there's a secondary power source connected to V_{I_5V} , the diode ensures that the external power source and the USB VBUS do not conflict or damage the system.

It also protects the USB host from being back-powered by the device.

This design allows the system to be powered either from the USB VBUS or another power source tied to V_{I_5V} .

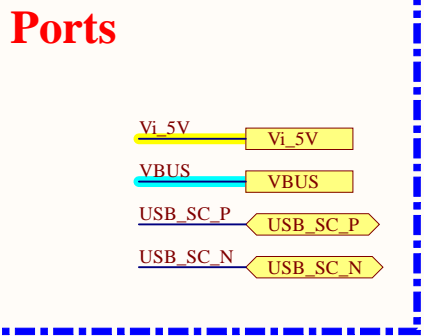
It ensures safety and compatibility when multiple power sources (USB and external power) are involved.

△ For enhanced protection, the diode can be replaced with a P-channel MOSFET. This provides better protection with lower voltage drop, improved efficiency, and higher current-handling capability.

△ The data designed to be diff pair in USB Communication to:

- 1- Noise Immunity
- 2- Signal Integrity

If D+ and D- are not routed as a differential pair, signal quality can degrade due to mismatched impedance, crosstalk, or noise, causing communication errors or device failures.



Title			ESP32 S3 Learning Board	
Size	Number	7		Revision
A				Abdelrahman Khaled
Date:	12/30/2024	Sheet of		
File:	S:\Development\...\USB Communication	Drawn by		Abdelrahman Khaled

Board Stack Report