

OLED Graphic Display Interfacing with ESP32

Organic light-emitting diodes (OLEDs) are a type of high-tech display that employs a film of organic substance sandwiched between two electrodes (anode and cathode), which then generates light when a voltage is placed across the electrodes. An OLED Display's key benefit is that it generates its own illumination and does not require a separate backlight. Since this is the case, OLED displays typically outperform LCD screens in terms of contrast, brightness, and viewing angle.

- 128x64 OLED display is very compact in size, has high contrast pixels, and self-illuminated graphical display.
- There are multiple types of variants available in the market, having different resolutions, communication protocols, and pixel colors.
- These OLED modules are driven by SSD1306 IC which is a driver IC for 128x64 Dot Matrix OLED segments.

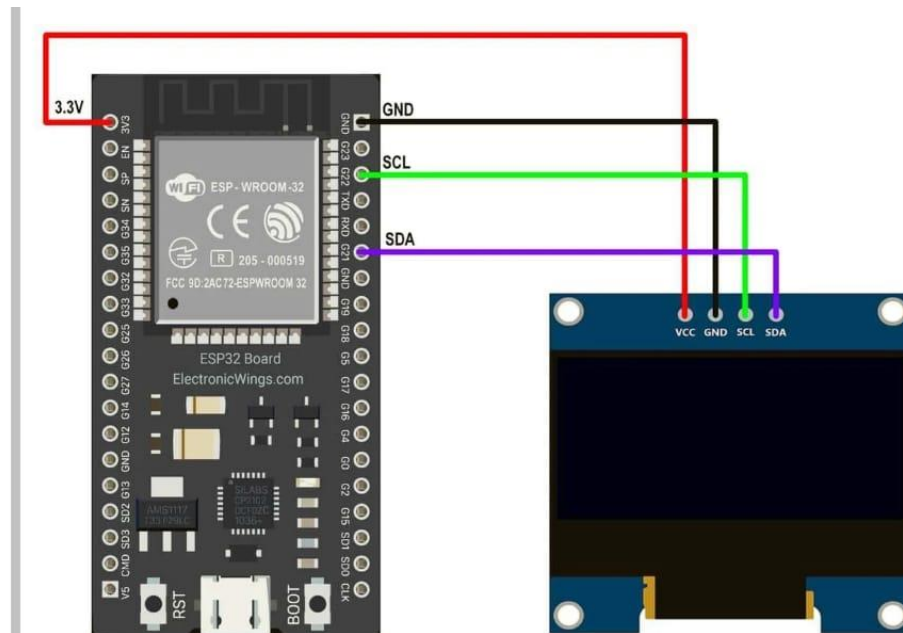
Two different OLED module configurations:

- **7-pin OLED module – SPI/multi-interface type**
- **4-pin 128×64 OLED module – I²C type**

4 PIN 128x64 OLED Display Pin Description

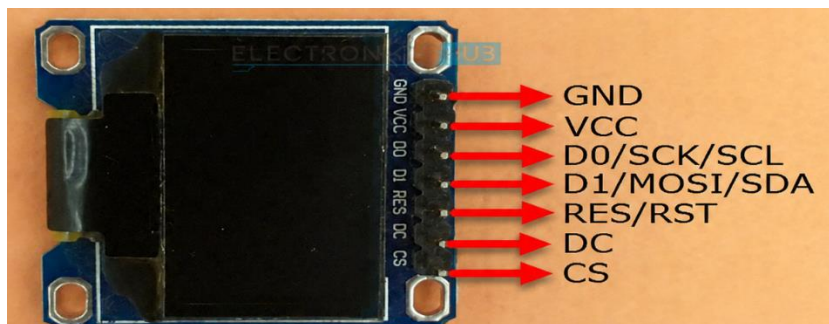


- The above image shows a 128x64 I2C-based OLED module.
- **VCC:** This is the power pin for the module. A supply of 3.3V or 5V can be provided to this pin to power the display.
- **GND:** This is the ground pin for the module.
- **SCL and SDA:** These are the serial clock and serial data pins for I2C communication.



128x64 OLED Display Hardware Connection with ESP32

7-Pin OLED Module – SPI / Multi-Interface Type



Pin	Alternative Name	Function
GND	—	Ground
VCC	—	Power supply
D0	SCK / SCL / CLK	Clock
D1	MOSI / SDA	Data
RES	RST	Reset
DC	A0	Data/Command selection
CS	—	Chip Select

D0 / SCK / SCL / CLK

D0 is used as a clock signal.

In SPI

It functions as:

SCK – Serial Clock

The microcontroller generates clock pulses that synchronize the transmission of data.

In I²C

It may function as:

SCL – Serial Clock Line

Thus, the same physical pin may be labelled differently depending on the interface.

D1 – Data Pin

(D1 / MOSI / SDA)

It is used for data communication.

In SPI

D1 functions as:

MOSI – Master Out, Slave In

The microcontroller sends display data to the OLED through this line.

ESP32 MOSI ————— OLED D1

In I²C

D1 functions as:

SDA – Serial Data Line

Data is transferred between the microcontroller and OLED through SDA.

RES/RST – Reset

RES or RST is the reset pin of the OLED controller.

When the OLED is reset, its controller returns to its initial state.

DC – Data/Command

DC stands for Data/Command.

It tells the OLED controller whether the information being transmitted is:

- A command, or
- Display data

DC = Command



OLED interprets incoming information as a command

DC = Data



OLED interprets incoming information as display data

This separate DC line is commonly associated with SPI-type OLED interfaces.

CS – Chip Select

CS stands for Chip Select.

It is primarily used when the OLED communicates through SPI.

The microcontroller uses CS to select the OLED device.

This is particularly useful when multiple SPI devices share:

- SCK
 - MOSI
 - MISO
- **Connection between a 7-pin OLED display and an ESP32 using the SPI (Serial Peripheral Interface) communication protocol.**

OLED Pin	ESP32 Pin	Function
GND	GND	Ground
VCC	3.3V	Power supply
D0 (SCK)	GPIO18	SPI clock
D1 (MOSI)	GPIO23	SPI data
RES	GPIO17	Reset
DC	GPIO16	Data/Command selection

OLED Pin	ESP32 Pin	Function
CS	GPIO5	Chip Select