

## Learn ESP8266

[ESP8266  
Introduction](#)

[ESP8266  
Arduino IDE  
VS Code and  
PlatformIO](#)

[ESP8266  
Pinout](#)

[ESP8266  
Inputs  
Outputs](#)

[ESP8266  
PWM](#)

[ESP8266  
Analog  
Inputs](#)

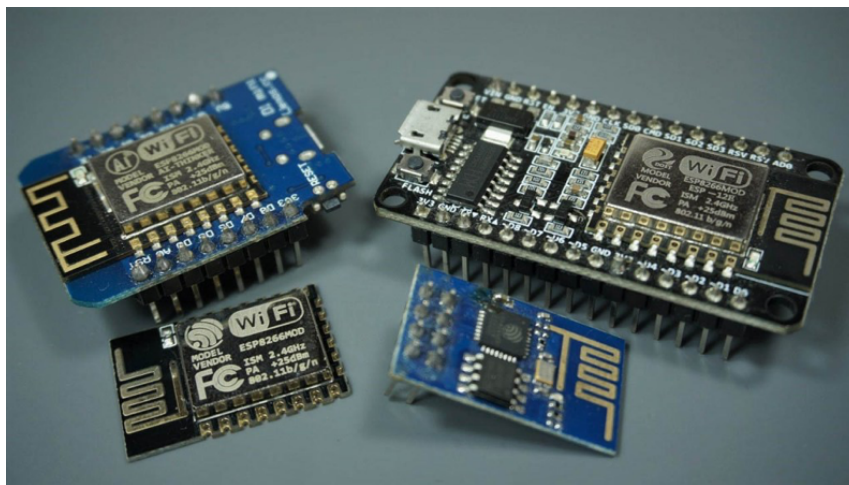
[ESP8266  
Interrupts  
Timers](#)

[ESP8266  
Deep Sleep](#)

[Protocols](#)

# ESP8266 Pinout Reference: Which GPIO pins should you use?

This article is a guide for the ESP8266 GPIOs: pinout diagrams, their functions and how to use them.

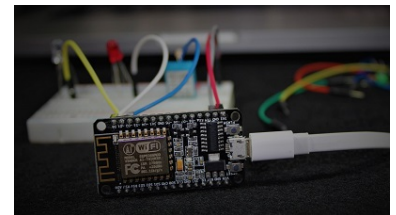


The ESP8266 12-E chip comes with 17 GPIO pins. Not all GPIOs are exposed in all ESP8266 development boards, some GPIOs are not recommended to use, and others have very specific functions.

With this guide, you'll learn how to properly use

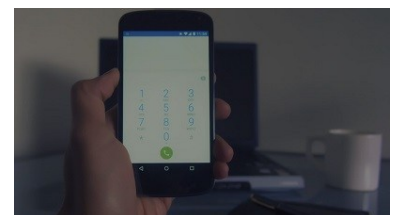


[Visit Maker Advisor  
– Tools and Gear for  
makers, hobbyists  
and DIYers »](#)



[Home Automation  
using ESP8266 eBook  
and video course »](#)

Build IoT and home  
automation projects.



[Build a Home  
Automation System  
from Scratch »](#) With

ESP8266  
Web Server

ESP8266  
MQTT

ESP8266  
ESP-NOW

ESP8266 Wi-  
Fi

ESP8266  
WebSocket

ESP8266  
HTTP GET  
POST

HTTP GET  
Web APIs

HTTP POST  
Web APIs

ESP-NOW  
One-to-  
Many

ESP-NOW  
Many-to-  
One

ESP-NOW  
Two-Way

ESP-NOW  
ESP8266 +  
ESP32

Server-Sent  
Events

Web

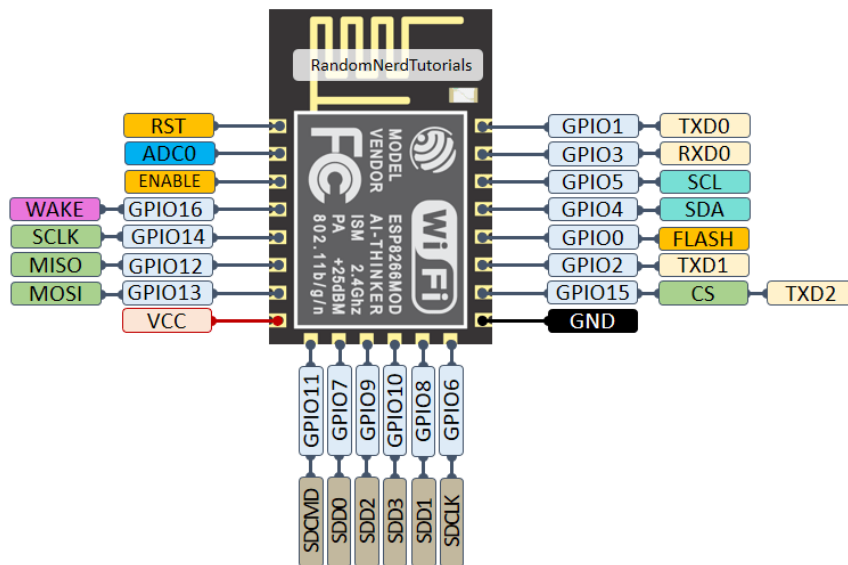
the ESP8266 GPIOs and avoid hours of frustration by using the most suitable pins for your projects.

We also have a guide for the ESP32 GPIOs:  
ESP32 Pinout Reference: Which GPIO pins should you use?

Raspberry Pi,  
ESP8266, Arduino,  
and Node-RED.

## ESP8266 12-E Chip Pinout

The following figure illustrates the ESP8266 12-E chip pinout. Use this diagram if you're using an ESP8266 bare chip in your projects.



**Note:** not all GPIOs are accessible in all development boards, but each specific GPIO works in the same way regardless of the development board you're using. If you're just getting started with the ESP8266, we recommend reading our guide: Getting

[Web Server](#)

that differ in the number of accessible GPIOs, size, form factor, etc...

[Async Web Server](#)

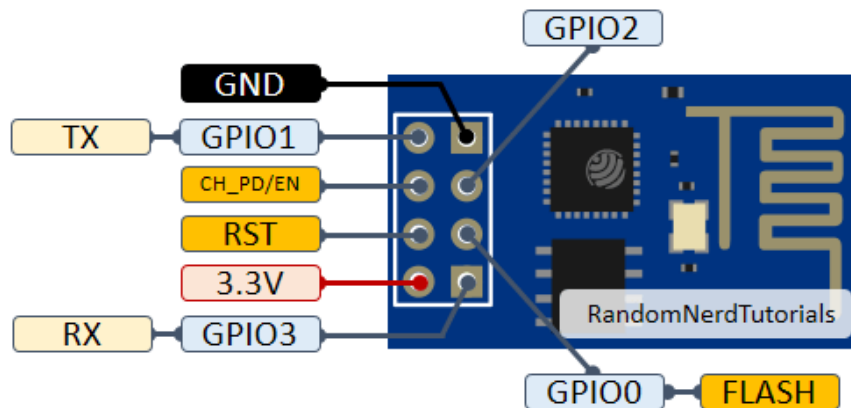
The most widely used ESP8266 boards are the [ESP-01](#), [ESP8266-12E NodeMCU Kit](#), and the [Wemos D1 Mini](#). For a comparison of these board, you can read this guide: [ESP8266 Wi-Fi Development Boards comparison](#).

[Relay Web Server](#)[DHT Web Server](#)[BME280 Web Server](#)

## ESP8266-01 Pinout

[BME680 Web Server](#)

If you're using an ESP8266-01 board, you can use the following GPIO diagram as a reference.

[DS18B20 Web Server](#)[Plot/Chart Web Server](#)[SPIFFS Web Server](#)[Thermostat Web Server](#)[Input Fields Web Server](#)

## ESP8266 12-E NodeMCU Kit

[Images Web Server](#)

The ESP8266 12-E NodeMCU kit pinout diagram is shown below.

[RGB LED Web Server](#)[Momentary](#)

Switch Web  
Server

Physical  
Button Web  
Server

Timer/Pulse  
Web Server

HTTP Auth  
Web Server

ESP8266  
WiFiManager

DIY cloud

ESP8266  
Weather  
Station

Control  
GPIOs

View Sensor  
Readings

ESP8266  
MySQL

ESP8266  
PHP Email

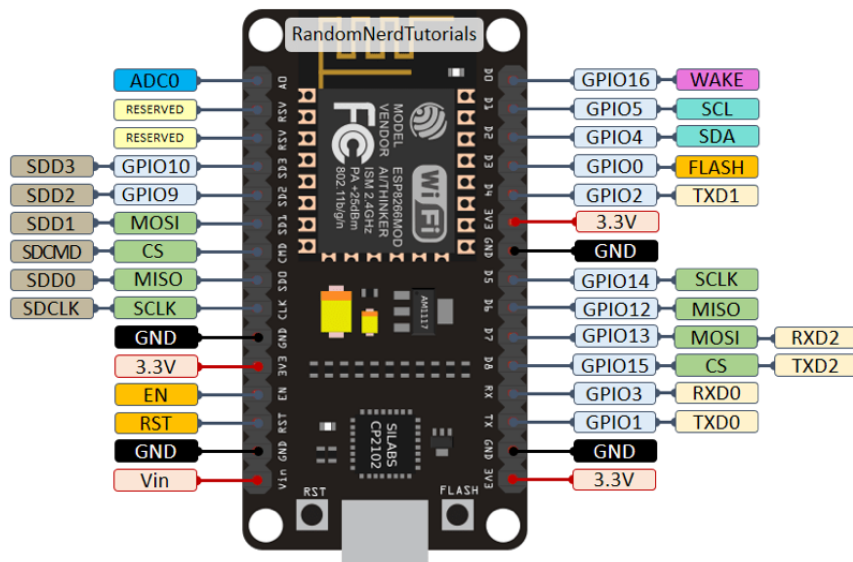
Cloud Node-  
RED

Dashboard

Cloud MQTT  
Broker

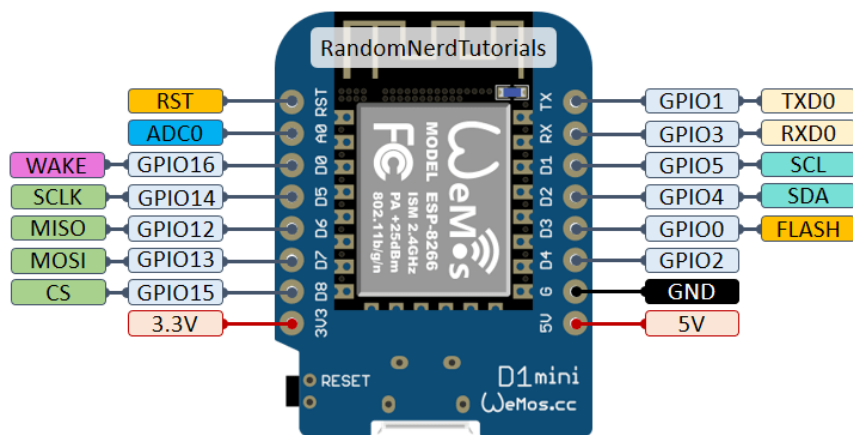
**Modules  
and Sensors**

ESP8266



## Wemos D1 Mini Pinout

The following figure shows the WeMos D1 Mini pinout.



## Download PDF with ESP8266 Pinout Diagrams

We've put together a handy PDF that you can download and print, so you always have the ESP8266 diagrams next to you:

ESP8266 PIR

ESP8266 AC  
PIR

ESP8266  
Reed Switch

ESP8266  
DHT11/DHT  
22

ESP8266  
BME280

ESP8266  
BME680

ESP8266  
DS18B20

ESP8266  
Mains  
Voltage

## Displays

ESP8266  
OLED

ESP8266  
LCD

ESP8266  
Nextion

OLED  
Temperatur  
e

## MQTT

# ESP8266 Peripherals

The ESP8266 peripherals include:

- 17 GPIOs
- SPI
- I2C (implemented on software)
- I2S interfaces with DMA
- UART
- 10-bit ADC

## Best Pins to Use – ESP8266

One important thing to notice about ESP8266 is that the GPIO number doesn't match the label on the board silkscreen. For example, D0 corresponds to GPIO16 and D1 corresponds to GPIO5.

The following table shows the correspondence between the labels on the silkscreen and the GPIO number as well as what pins are the best to use in your projects, and which ones you need to be cautious.

The pins highlighted in green are OK to use. The ones highlighted in yellow are OK to use, but you need to pay attention because they may have unexpected behavior mainly at boot. The pins highlighted in red are not

ESP8266  
MQTT

recommended to use as inputs or outputs.

MQTT  
Output RPi

MQTT DHT  
RPi

MQTT SQLite  
RPi

MQTT  
DHT11/DHT  
22

MQTT  
BME280

MQTT  
DS18B20

### Other Projects

ESP8266  
Alexa

ESP8266  
Google  
Sheets

Multisensor  
Shield

Multisensor  
Shield Node-  
RED

ESP8266  
Daily Task

ESP8266 Wi-  
Fi Button

Label	GPIO	Input	Output	Notes
D0	GPIO16	no interrupt	no PWM or I2C support	HIGH at boot used to wake up from deep sleep
D1	GPIO5	OK	OK	often used as SCL (I2C)
D2	GPIO4	OK	OK	often used as SDA (I2C)
D3	GPIO0	pulled up	OK	connect to FLASH button, boot fail if pulled LOW
D4	GPIO2	pulled up	OK	HIGH at boot connect to on-board LED, boot fails if pulled LOW
D5	GPIO14	OK	OK	SPI

Latching Power Circuit

Telegram Control Outputs

Telegram Sensor Readings

Telegram Detect Motion

Telegram Group

**Useful Guides**

ESP8266 Troubleshooting

ESP8266 Access Point

ESP8266 Fixed IP Address

ESP8266 MAC Address

ESP8266 OTA

ESP8266 Solar Panels

ESP8266

				(SCLK)
<b>D6</b>	<b>GPIO12</b>	OK	OK	SPI (MISO)
<b>D7</b>	<b>GPIO13</b>	OK	OK	SPI (MOSI)
<b>D8</b>	<b>GPIO15</b>	pulled to GND	OK	SPI (CS) Boot fail if pulled HIGH
<b>RX</b>	<b>GPIO3</b>	OK	RX pin	HIGH at boot
<b>TX</b>	<b>GPIO1</b>	TX pin	OK	HIGH at boot debug output at boot, boot fails if pulled LOW
<b>A0</b>	<b>ADC0</b>	Analog Input	X	

Continue reading for a more detailed and in-depth analysis of the ESP8266 GPIOs and its functions.

## GPIOs connected to the Flash Chip

Voltage  
Regulator

ESP8266  
Install SPIFFS

ESP8266  
Time and  
Date

ESP8266  
JSON

## Learn More

Learn ESP32

Learn  
ESP8266

Learn ESP32-  
CAM

Learn  
MicroPython

Learn  
Arduino

Build Web  
Servers  
eBook

ESP8266  
eBook »

GPIO6 to GPIO11 are usually connected to the flash chip in ESP8266 boards. So, these pins are not recommended to use.

## Pins used during Boot

The ESP8266 can be prevented from booting if some pins are pulled LOW or HIGH. The following list shows the state of the following pins on BOOT:

- **GPIO16:** pin is high at BOOT
- **GPIO0:** boot failure if pulled LOW
- **GPIO2:** pin is high on BOOT, boot failure if pulled LOW
- **GPIO15:** boot failure if pulled HIGH
- **GPIO3:** pin is high at BOOT
- **GPIO1:** pin is high at BOOT, boot failure if pulled LOW
- **GPIO10:** pin is high at BOOT
- **GPIO9:** pin is high at BOOT

## Pins HIGH at Boot

There are certain pins that output a 3.3V signal when the ESP8266 boots. This may be problematic if you have relays or other peripherals connected to those GPIOs. The following GPIOs output a HIGH signal on boot:

- GPIO16
- GPIO3
- GPIO1
- GPIO10
- GPIO9



Additionally, the other GPIOs, except GPIO5 and GPIO4, can output a low-voltage signal at boot, which can be problematic if these are connected to transistors or relays. You can [read this article](#) that investigates the state and behavior of each GPIO on boot.

GPIO4 and GPIO5 are the most safe to use GPIOs if you want to operate relays.

## Analog Input

The ESP8266 only supports analog reading in one GPIO. That GPIO is called **ADC0** and it is usually marked on the silkscreen as **A0**.

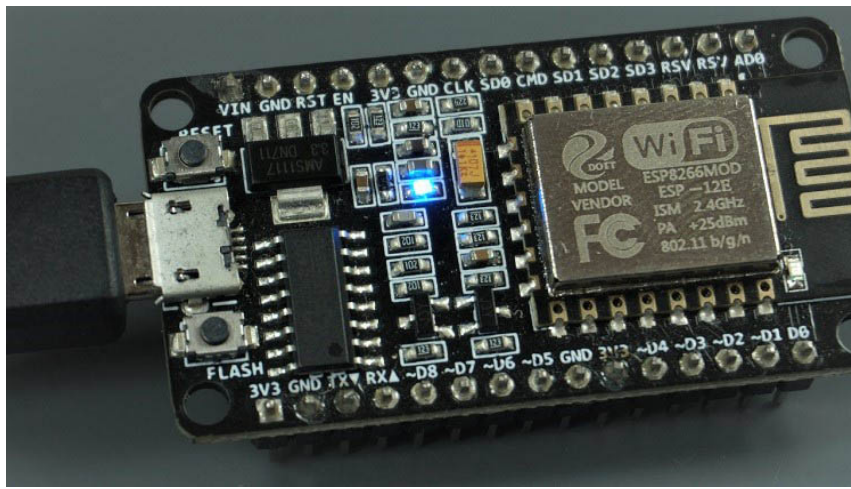
The maximum input voltage of the ADC0 pin is 0 to 1V if you're using the ESP8266 bare chip. If you're using a development board like the ESP8266 12-E NodeMCU kit, the voltage input range is 0 to 3.3V because these boards contain an internal voltage divider.

You can learn how to use analog reading with the ESP8266 with the following guide:

- [ESP8266 ADC – Read Analog Values with Arduino IDE, MicroPython and Lua](#)

## On-board LED

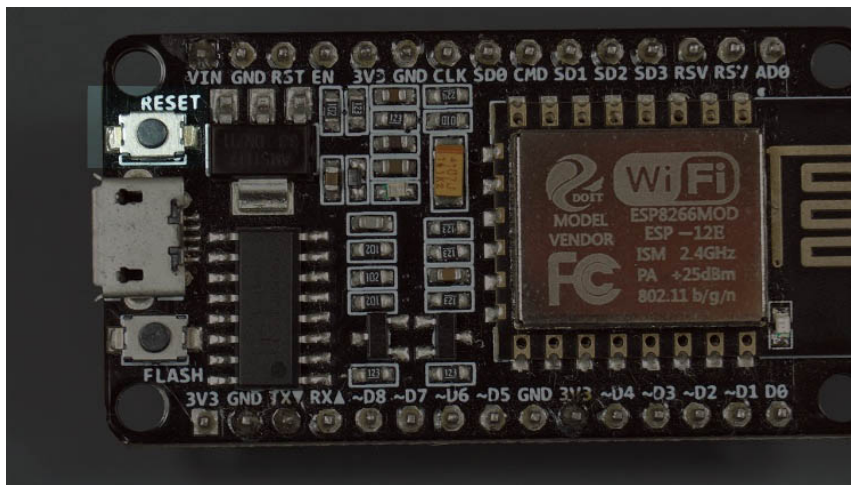
Most of the ESP8266 development boards have a built-in LED. This LED is usually connected to GPIO2.



The LED is connected to a pull-down resistor, so when you send a HIGH signal the LED turns off.

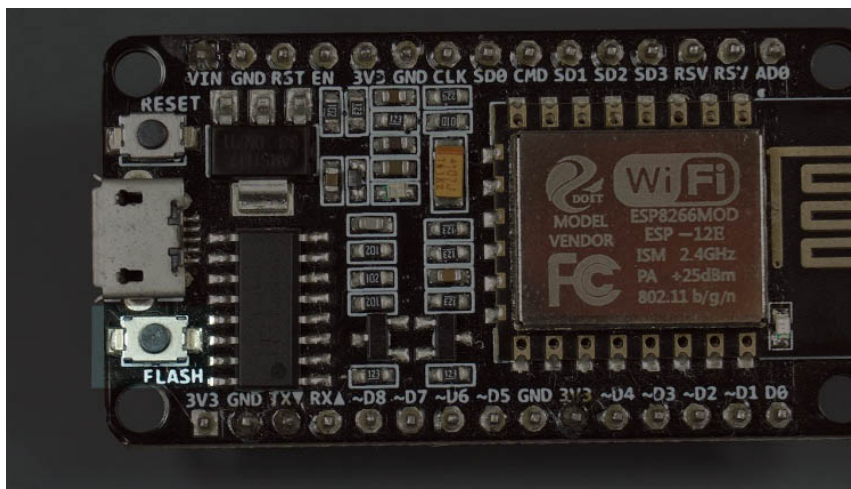
## RST Pin

When the RST pin is pulled LOW, the ESP8266 resets. This is the same as pressing the on-board RESET button.



## GPIO0

When GPIO0 is pulled LOW, it sets the ESP8266 into bootloader mode. This is the same as pressing the on-board FLASH/BOOT button.



## GPIO16

GPIO16 can be used to wake up the ESP8266 from deep sleep. To wake up the ESP8266 from deep sleep, GPIO16 should be connected to the RST pin. Learn how to put the ESP8266 into deep sleep mode:

- [ESP8266 Deep Sleep with Arduino IDE](#)
- [ESP8266 Deep Sleep with MicroPython](#)

## I2C

The ESP8266 doesn't have hardware I2C pins, but it can be implemented in software. So you can use any GPIOs as I2C. Usually, the following GPIOs are used as I2C pins:

- **GPIO5:** SCL
- **GPIO4:** SDA

## SPI

The pins used as SPI in the ESP8266 are:

- **GPIO12:** MISO
- **GPIO13:** MOSI
- **GPIO14:** SCLK
- **GPIO15:** CS

## PWM Pins

ESP8266 allows software PWM in all I/O pins: GPIO0 to GPIO16. PWM signals on ESP8266 have 10-bit resolution. Learn how to use ESP8266 PWM pins:

- [ESP8266 PWM with Arduino IDE](#)
- [ESP8266 PWM with MicroPython](#)

## Interrupt Pins

The ESP8266 supports interrupts in any GPIO, except GPIO16.

- [ESP8266 Interrupts and Timers with Arduino IDE](#)

## Wrapping Up

We hope you've found this guide for the ESP8266 GPIOs useful. If you have some tips on how to use the ESP8266 GPIOs properly, you can write a comment below.

We also have a [similar guide for the ESP32 GPIOs that you can read](#).

If you're getting started with the ESP8266, we have some great content you might be

interested in:

- [Home Automation using ESP8266 \(course\)](#)
- [Getting Started with the ESP8266](#)
- [30+ ESP8266 Projects and Tutorials](#)
- [ESP8266 Web Server Tutorial](#)
- [ESP32 vs ESP8266 – Pros and Cons](#)

Thanks for reading.

 **HIGH-QUALITY PCB**

**ONLY \$5** FOR 10 PIECES

- Rogers, HDI, aluminum and rigid-flex PCB are available now
- Production time 24 hours



**PCB ASSEMBLY**  
Free shipping + Free stencil

**ONLY \$30**

- Component sourcing
- Quality assurance



## [eBook] MicroPython Programming with ESP32 and ESP8266



Learn how to program and build projects with the ESP32 and ESP8266 using MicroPython firmware [DOWNLOAD »](#)

## Recommended Resources