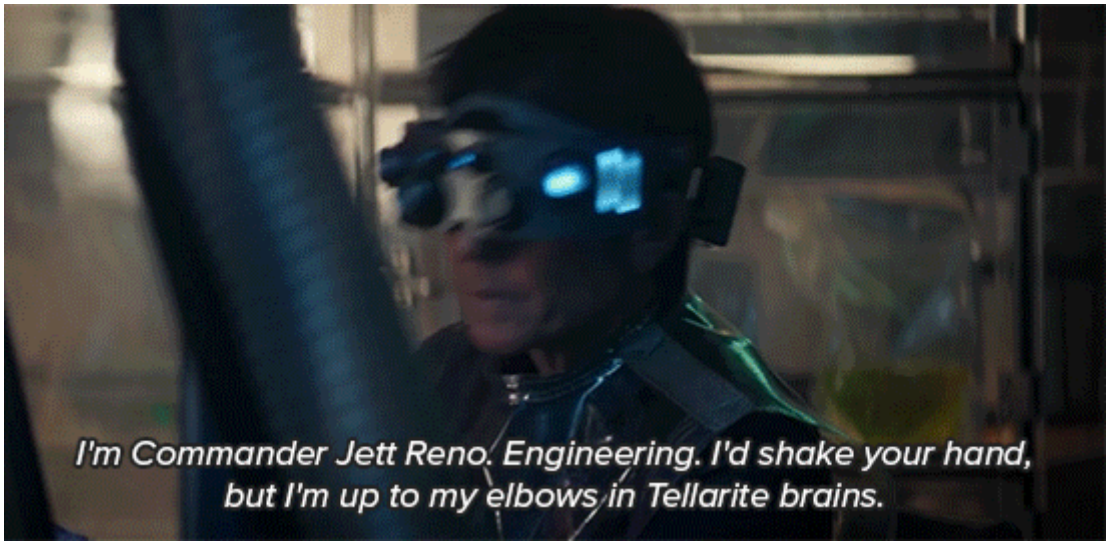
StudioPieters

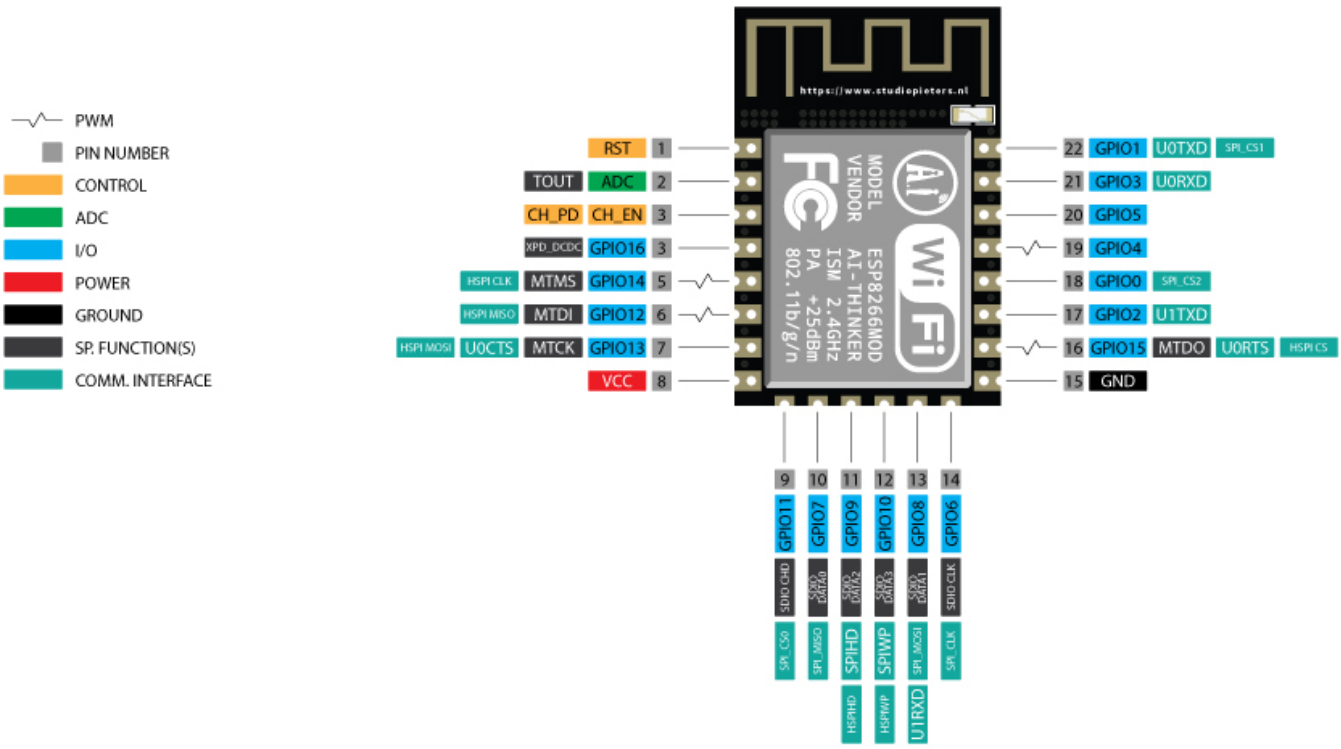
ESP8266 – PinOut

For those that starting with the ESP modules, I have made some pinout diagrams, their functions and how to use them. The ESP8266 12-E chip comes with 17 GPIO pins. Not all GPIO's are exposed in all ESP8266 development boards, some GPIO's are not recommended to use, and others have very specific functions. With this guide, you'll learn how to properly use the ESP8266 GPIO's and avoid hours of frustration by using the most suitable pins for your projects.



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. On the bottom of this blog, you can download the PDF!



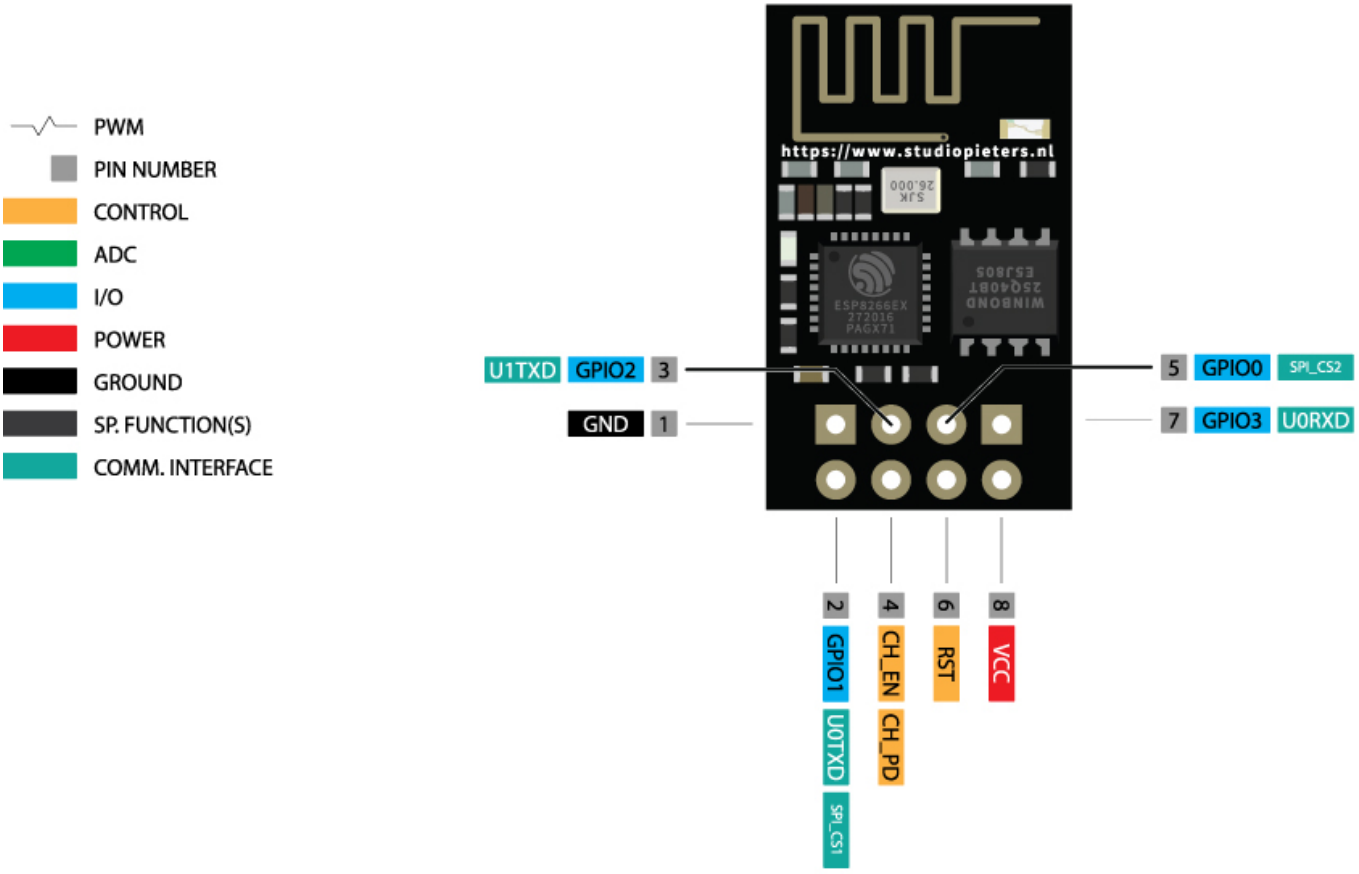
Note: I bought mine ESP8266 12-E chip here

Note: not all GPIO's 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 blog: Getting Started with the ESP8266.

At the moment, there are a wide variety of development boards with the ESP8266 chip that differ in the number of accessible GPIO's, size, form factor, etc...

ESP8266-01 Pinout

If you're using an ESP8266-01 board, you can use the following GPIO diagram as a reference. ESP-01 ESP8266 pinout diagram GPIO's pins. On the bottom of this blog, you can download the PDF!



Note: I bought mine ESP8266 – 01 chip here

ESP8266 Peripherals

The ESP8266 peripherals include:

- **17 GPIO's**
- **SPI**
- **I2C (implemented in software)**
- **I2S interfaces with DMA**
- **UART**
- **10-bit ADC**

Best Pins to Use – ESP8266

One important thing to notice about the 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 nee 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 behaviour, mainly at boot**. The pins highlighted in **red** are not recommended to use as inputs or outputs.

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	connected to FLASH button, boot fails if pulled LOW
D4	GPIO2	pulled up	OK	**HIGH at boot** connected to on-board LED, boot fails if pulled LOW
D5	GPIO14	OK	OK	**SPI** (SCLK)
D6	GPIO12	OK	OK	**SPI** (MISO)
D7	GPIO13	OK	OK	**SPI** (MOSI)
D8	GPIO15	pulled to GND	OK	**SPI** (CS) Boot fails if pulled HIGH
RX	GPIO3	OK	RX pin	**HIGH at boot**
TX	GPIO1	TX pin	OK	**HIGH at boot** debug output at boot, boot f… pulled LOW

A0	ADC0	Analogue Input	X

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

GPIO's connected to the Flash Chip

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**:

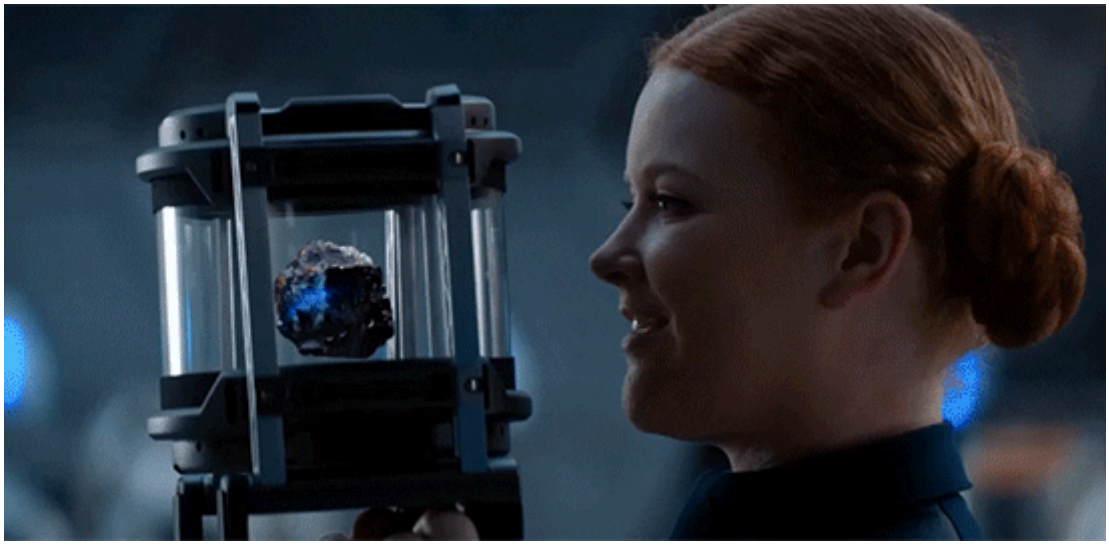
- **GPIO16**: pin is high at BOOT
- **GPIO0**: boot failure if pulled LOW
- **GPIO2**: pin is high on BOOT, boot failure if pulled LOW
- **GPIO15**: boot failure if pulled HIGH
- **GPIO3**: pin is high at BOOT
- **GPIO1**: pin is high at BOOT, boot failure if pulled LOW
- **GPIO10**: pin is high at BOOT
- **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 GPIO's. The following GPIO's output a **HIGH** signal on boot:

- **GPIO16**
- **GPIO3**
- **GPIO1**
- **GPIO10**
- **GPIO9**

Additionally, the other GPIO's, except **GPIO5** and **GPIO4**, can output a low-voltage signal at boot, which can be problematic if these are connected to **transistors or relays**! **GPIO4 and GPIO5 are the safest to use GPIO's if you want to operate relays!**



Analogue Input

The ESP8266 only supports analogue reading in one **GPIO**. That GPIO is called **ADC0, and** it is typically 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 Node MCU kit, the voltage input range is 0 to 3.3V because these boards contain an internal voltage divider.

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**.

I2C

The ESP8266 doesn't have hardware **I2C pins**, but it can be implemented in software. So you can use any GPIO's as I2C. Usually, the following GPIO's 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**.

Interrupt Pins

The ESP8266 supports interrupts in any **GPIO**, except GPIO16.

Downloads

Download your Pinout sheet here.

Download ESP8266 01X PDF

Download ESP8266 12X PDF