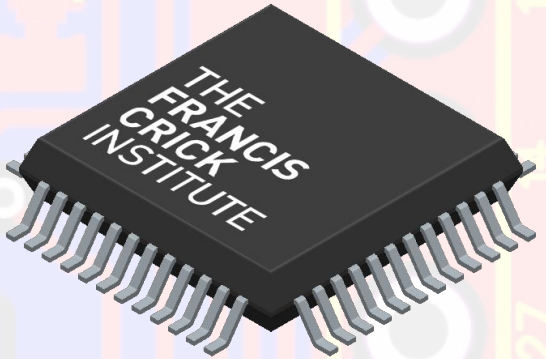
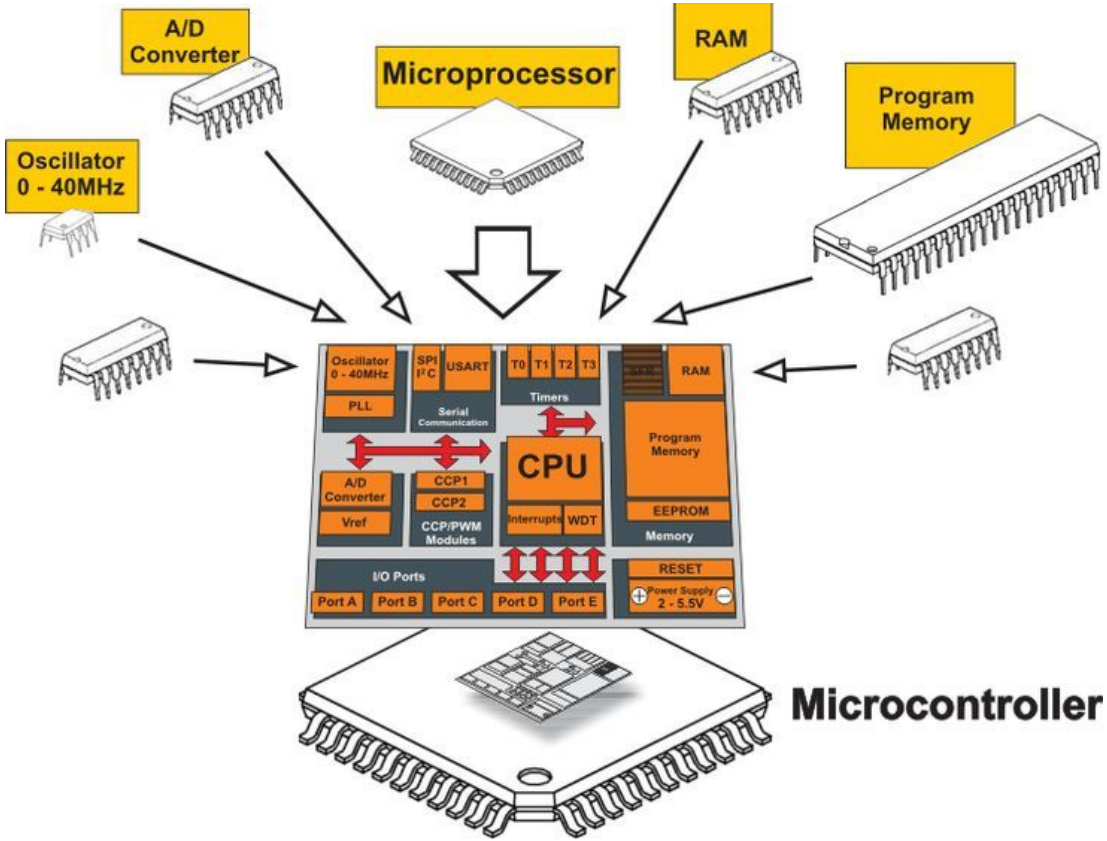


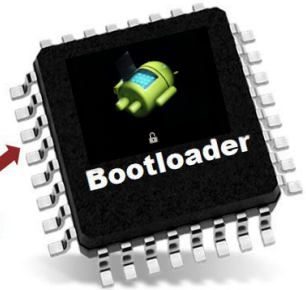
Microcontrollers (2022)

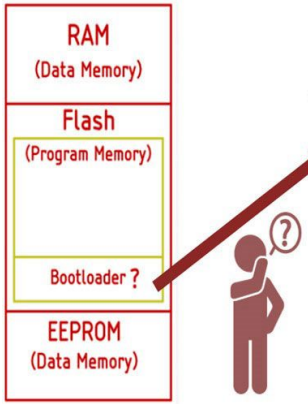
Session 1

Microprocessor vs Microcontroller



How to program a microcontroller





How to program a microcontroller

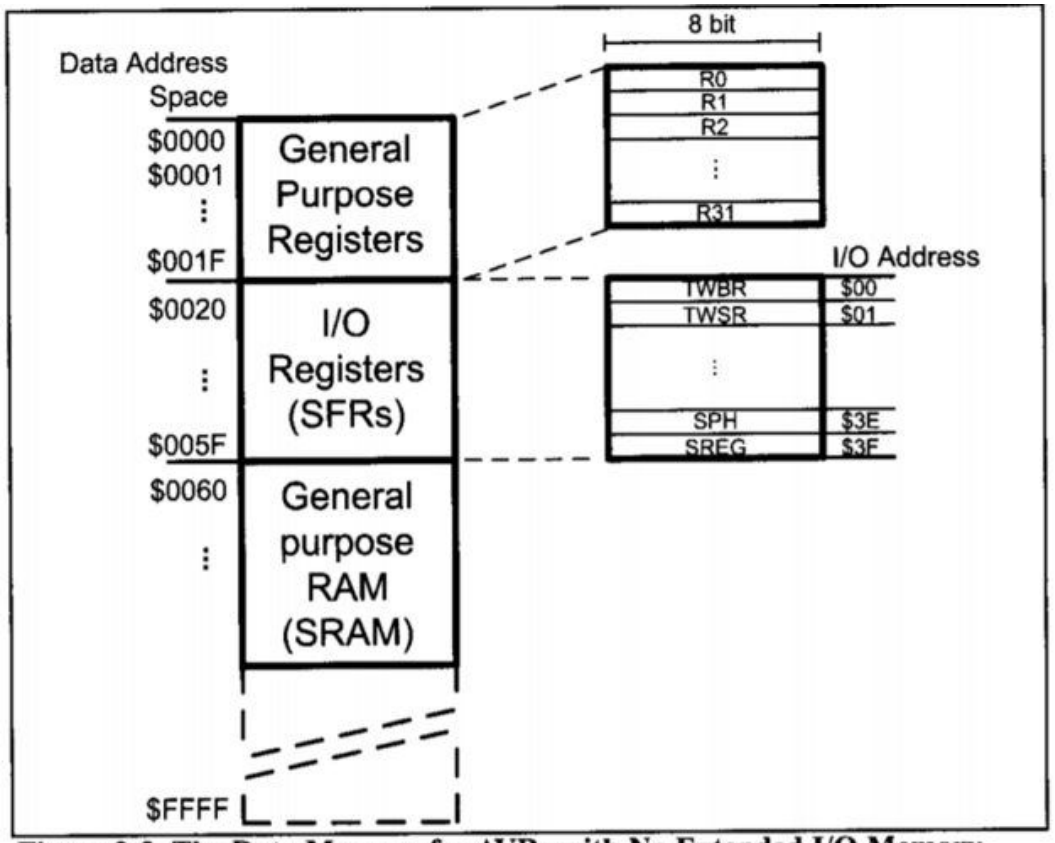
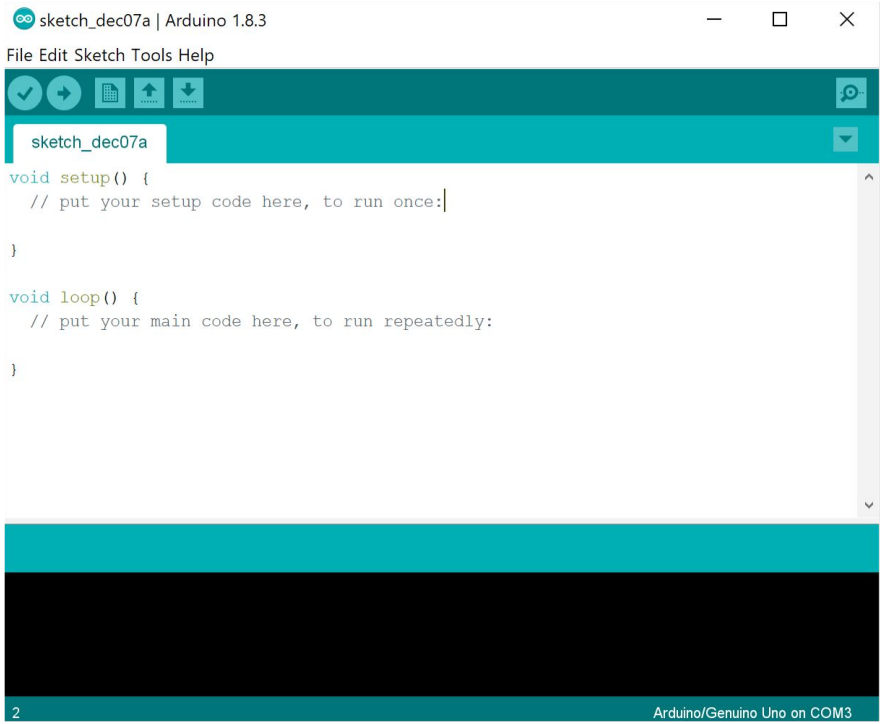
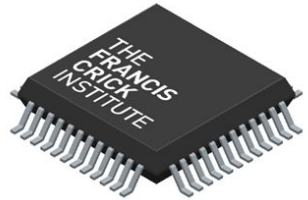


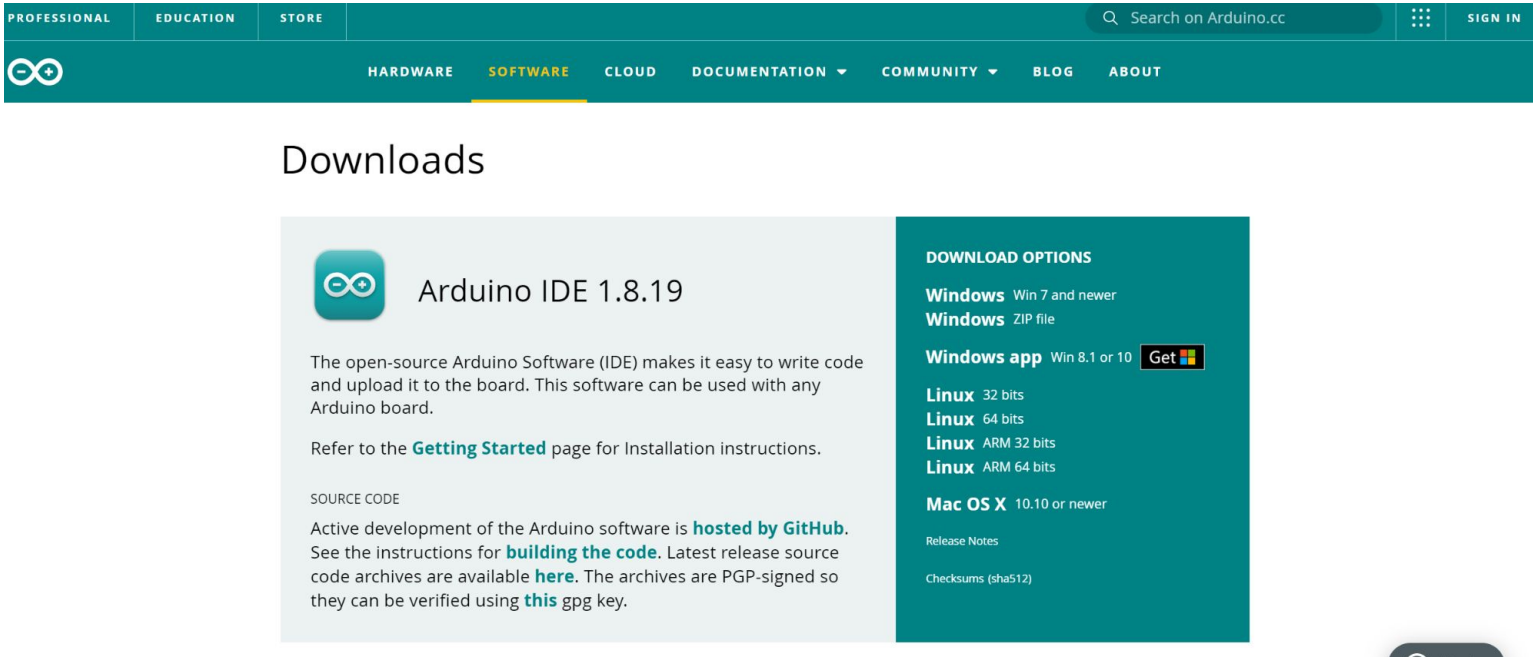
Figure 2-3. The Data Memory for AVRs with No Extended I/O Memory

What is Arduino?



Download the Arduino IDE

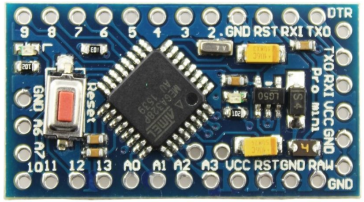




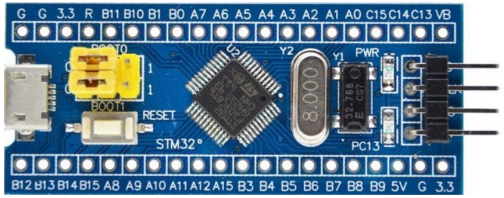
https://www.arduino.cc/en/software

Microcontroller Architectures

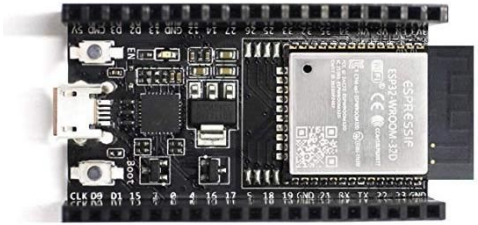
Teensy (ARM)



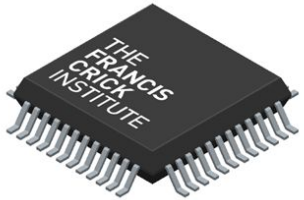
Arduino (Atmel)



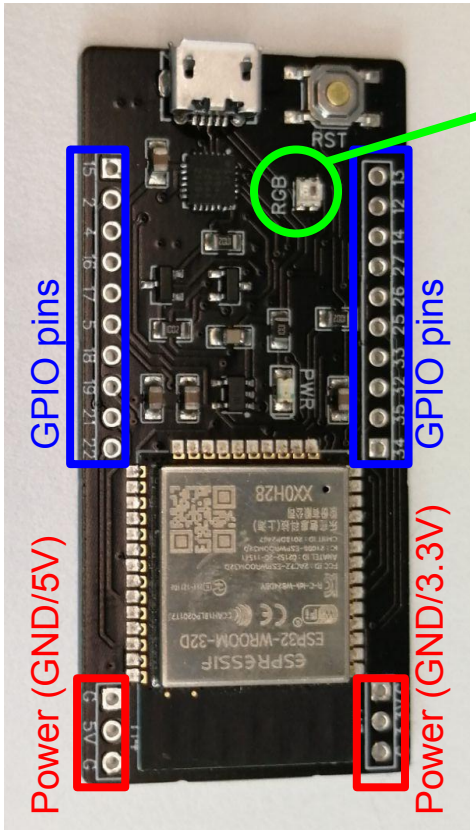
STM32 (ARM)



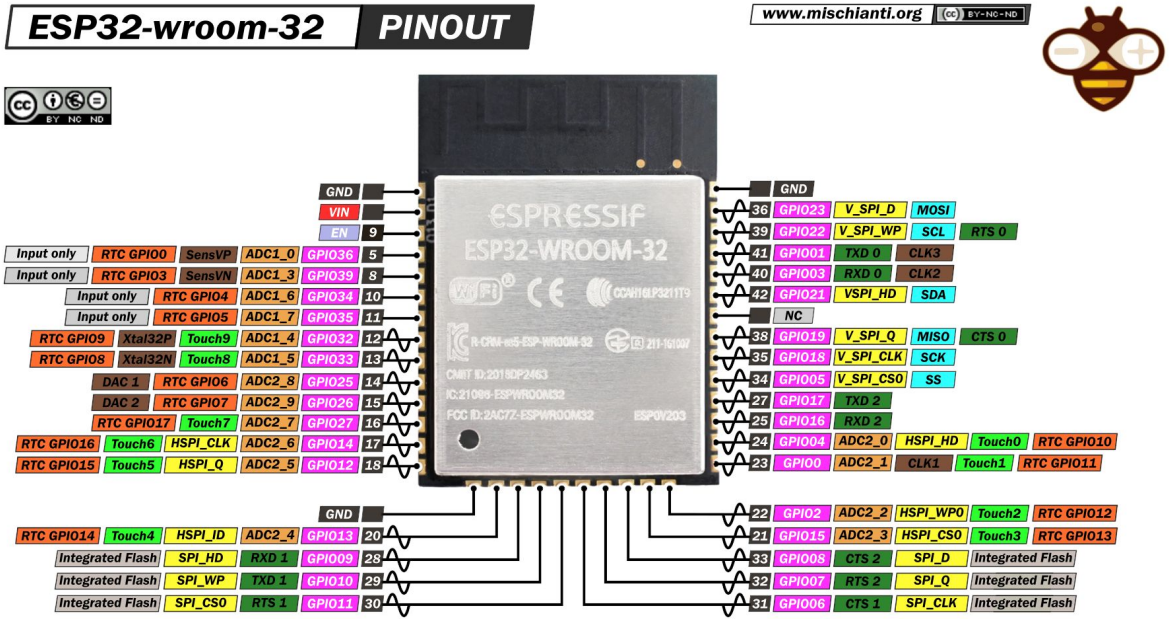
ESP32 (RISC)



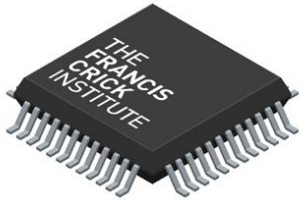
Our devBoard pinout (ESP32-Wroom-32)



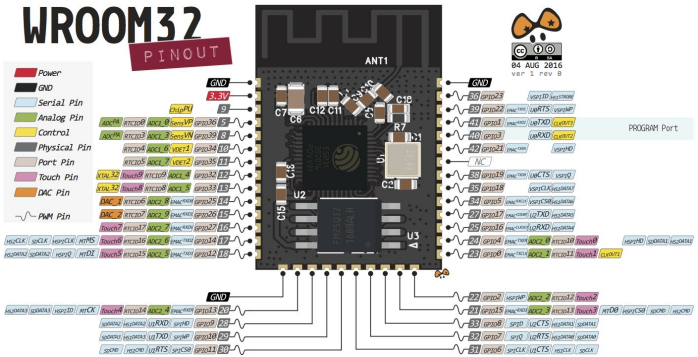
RGB LED connected to GPIO 13



Our devBoard pinout (ESP32-Wroom-32)



- Two Cores!
- 18 Analog-to-Digital Converter (ADC) channels **(GPIO 5,8,10-18 & 20-24)**
- 3 SPI interfaces
- 3 UART interfaces
- 2 I2C interfaces
- 16 PWM output channels
- 2 Digital-to-Analog Converters (DAC) **(GPIO 14 & 15)**
- 2 I2S interfaces
- 10 Capacitive sensing GPIOs **(GPIO 12,13 & 16-18 & 20-24)**

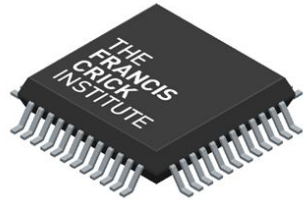


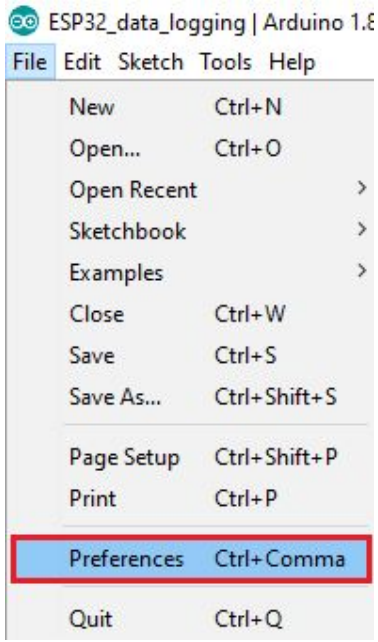
- **GPIO 5,14 and 15** output PWM signal at boot
- **GPIO 35-39** Input only

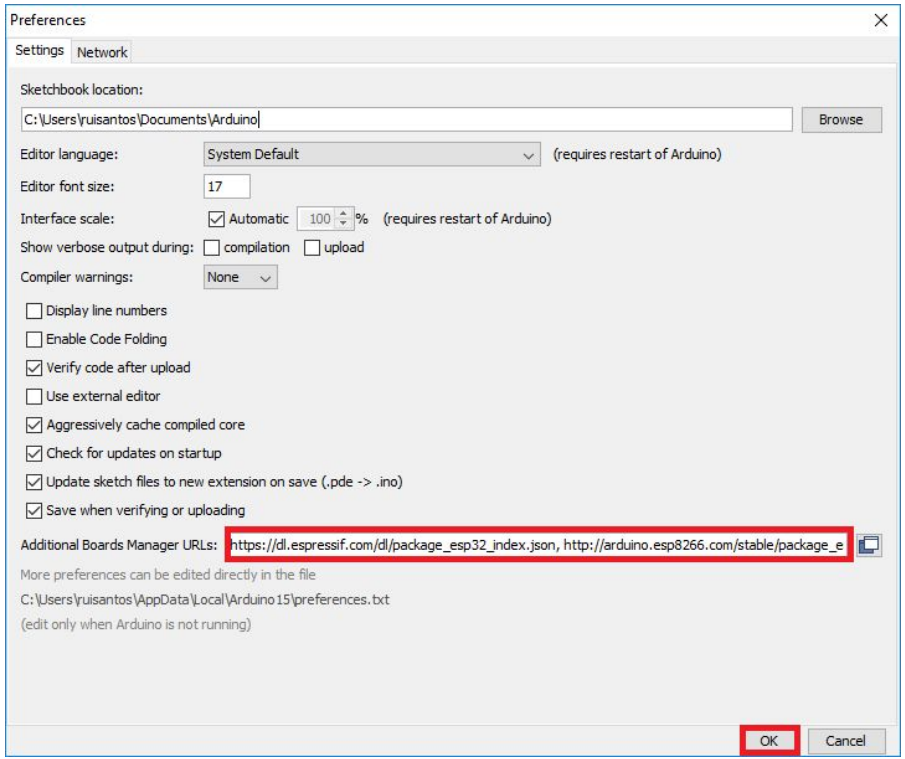
*Plus a little thing called WiFi…
…and Bluetooth… plus two little things…

https://randomnerdtutorials.com/esp32-pinout-reference-gpios/

Download the ESP32 package for the Arduino IDE



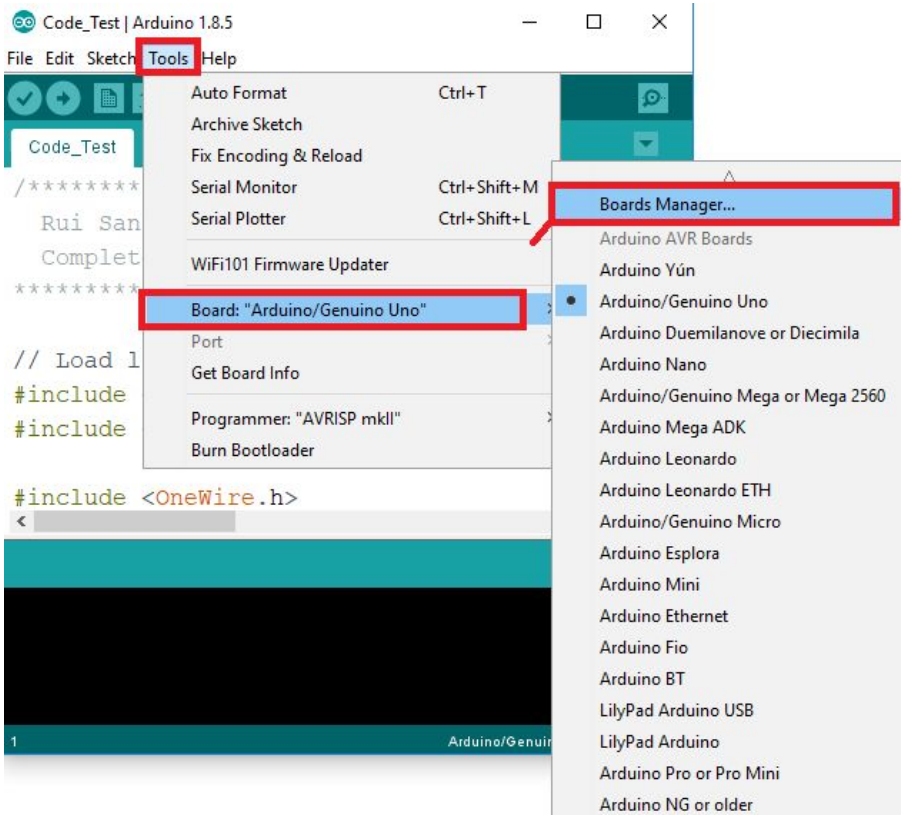


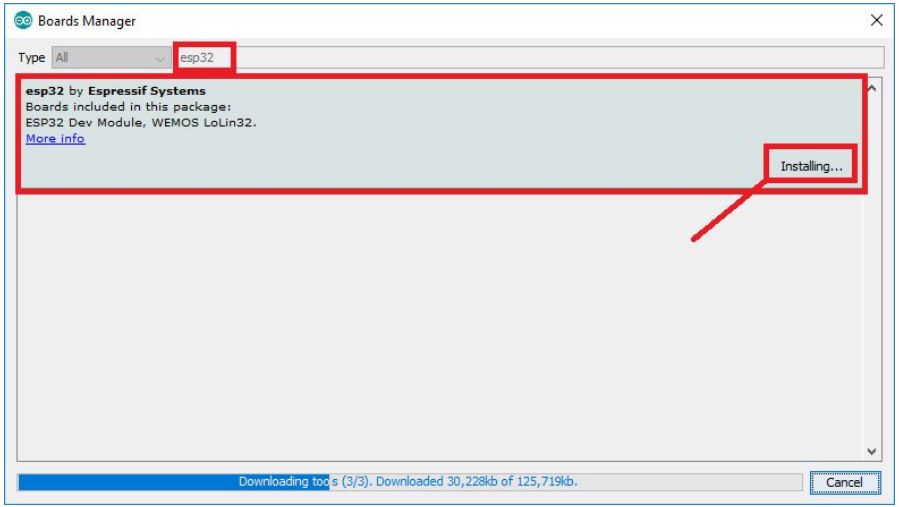


https://dl.espressif.com/dl/package_esp32_index.json

https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/

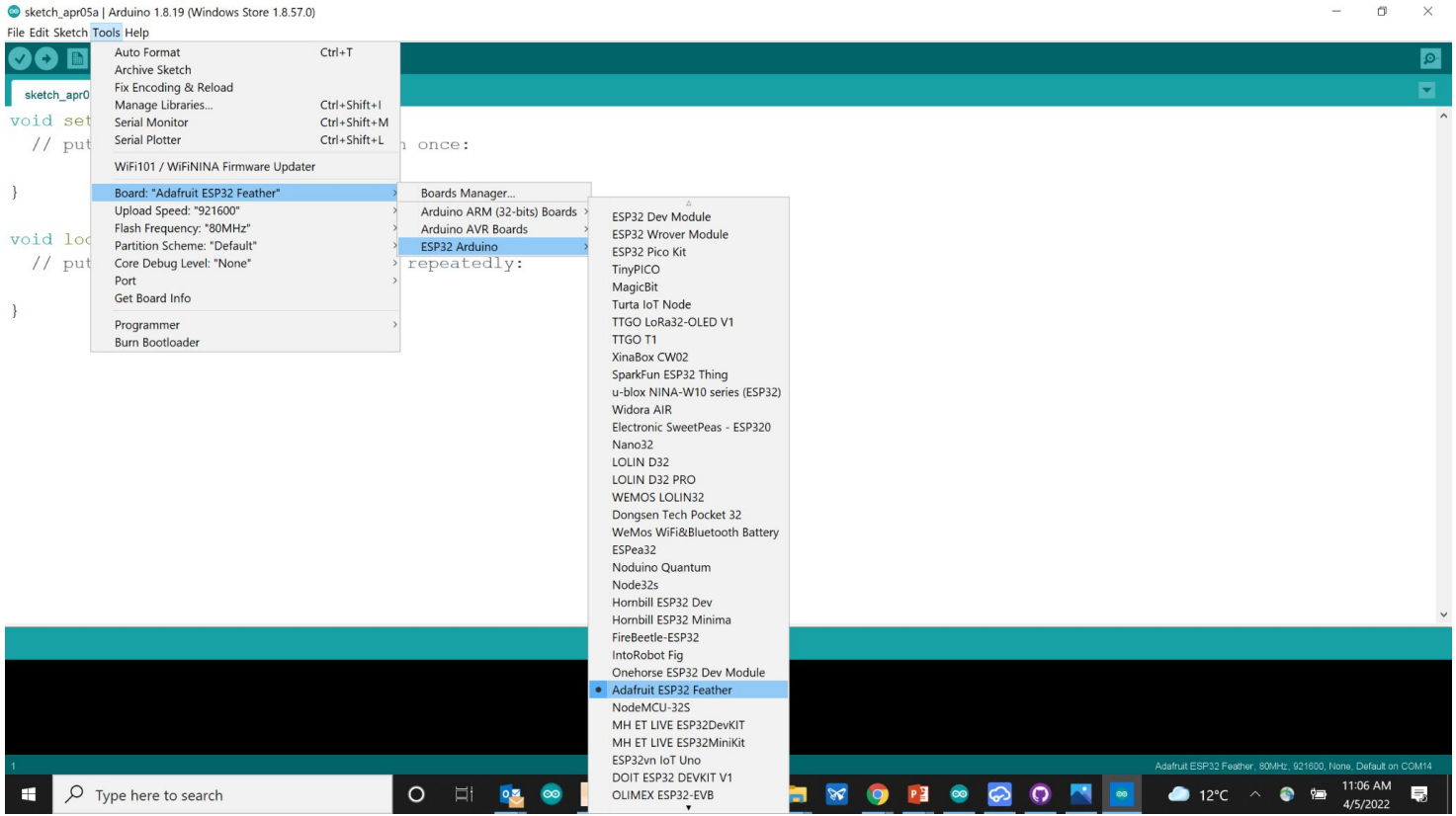
Download the ESP32 package for the Arduino IDE



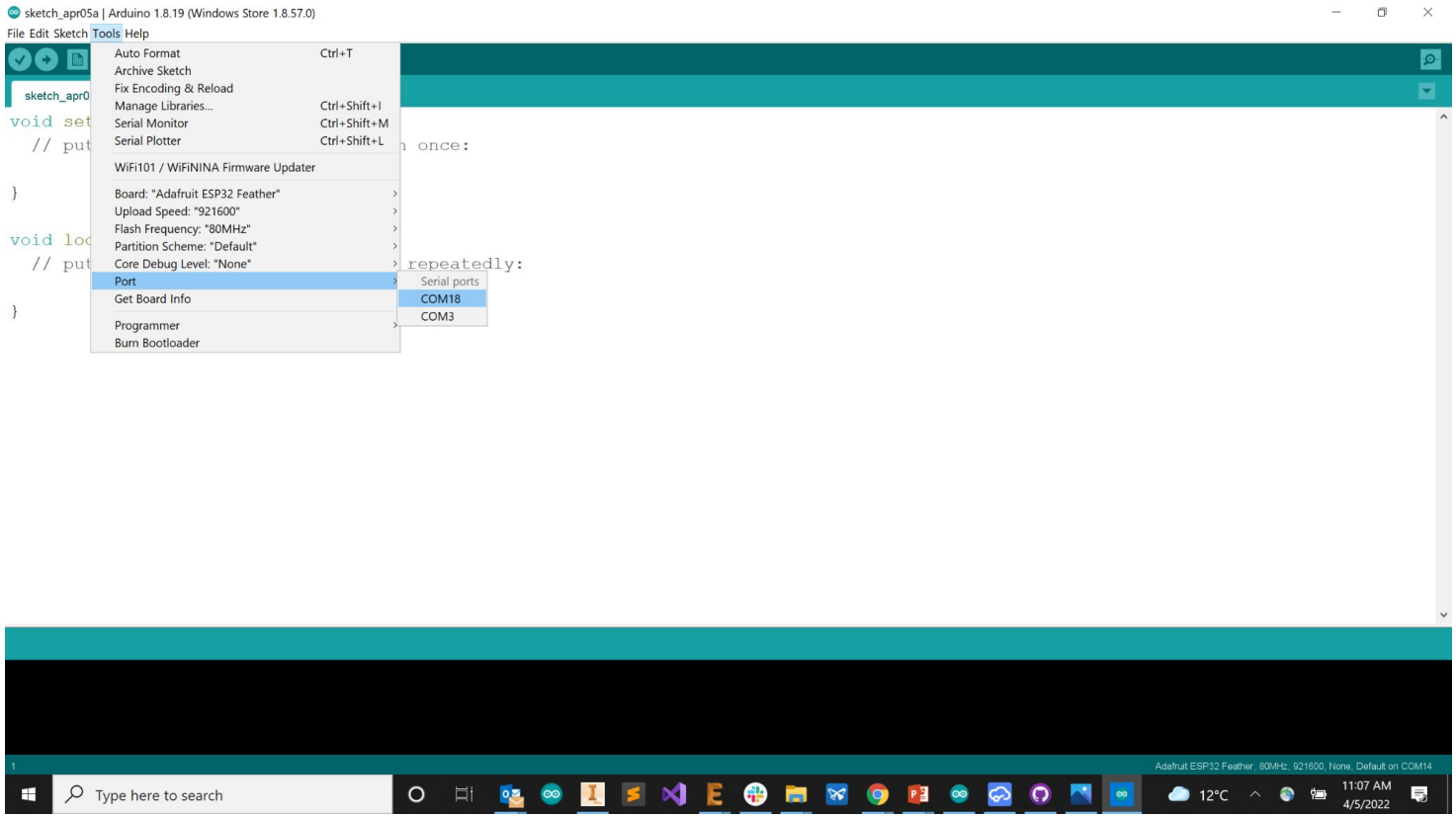


https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/

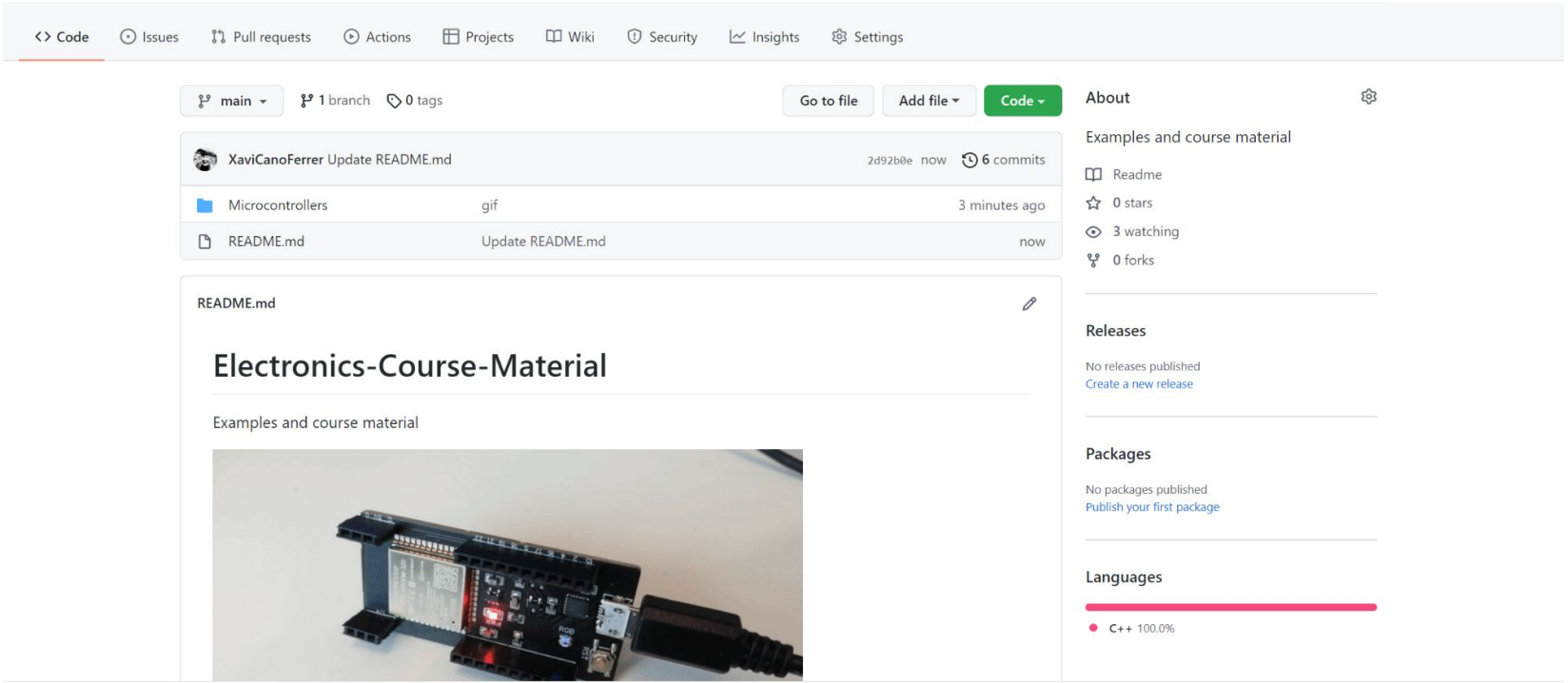
Selecting or board to upload the sketch



Selecting the COM port

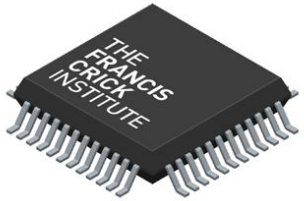


Downloading the first sketches from the course GitHub repository



https://github.com/FrancisCrickInstitute/Electronics-Course-Material

Arduino Sketch typical structure



#include libraries

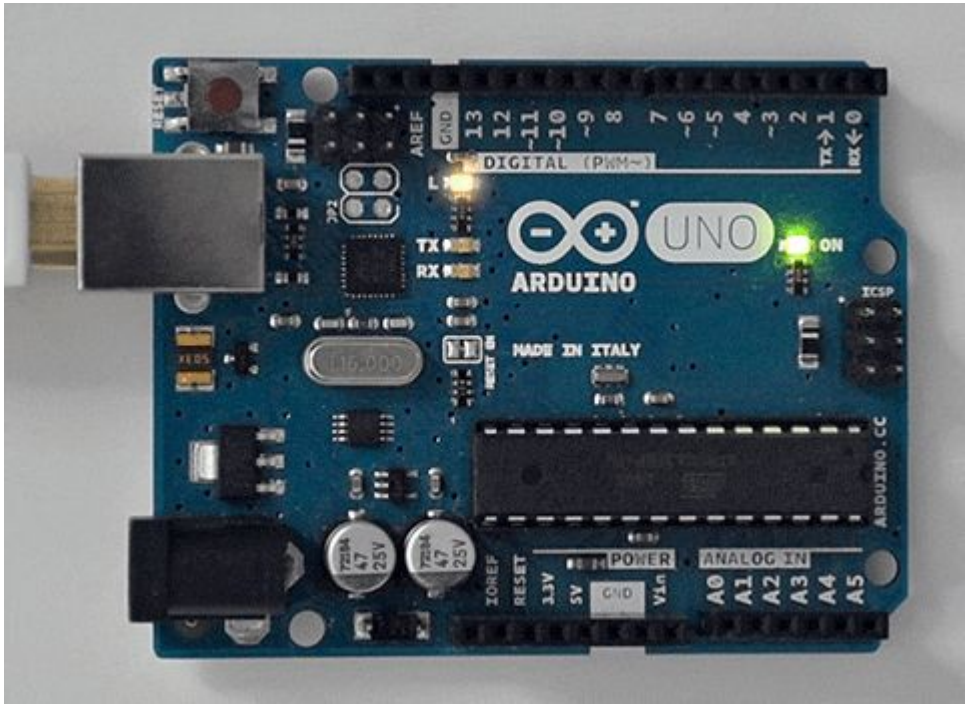
Declare Objects

Global variables

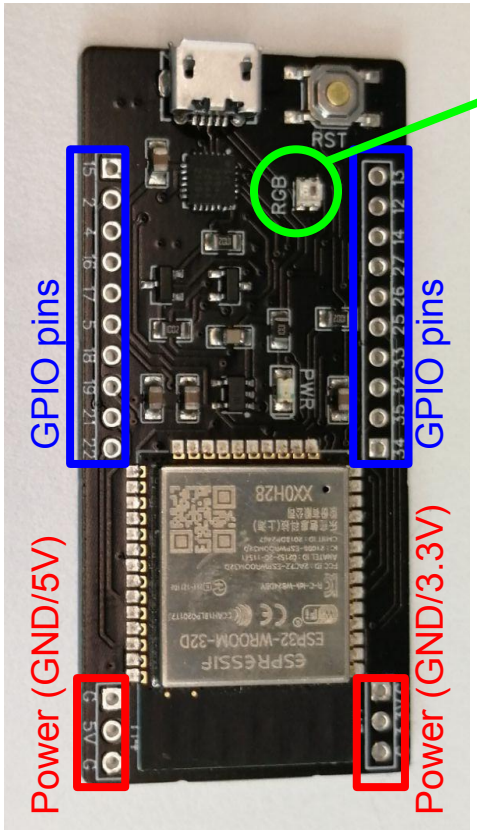
setup() function (It is executed one time)

loop() function (It loops indefinitely)

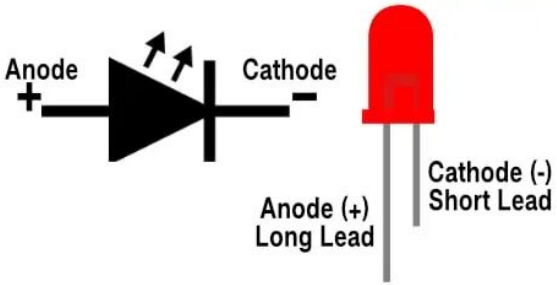
The “Hello World” of hardware



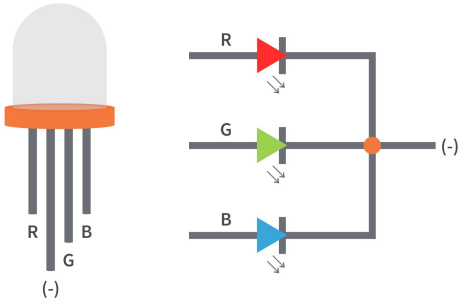
The “Hello World” of our hardware



RGB LED connected to GPIO 13

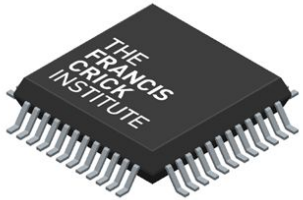


LED (Light Emitting Diode)

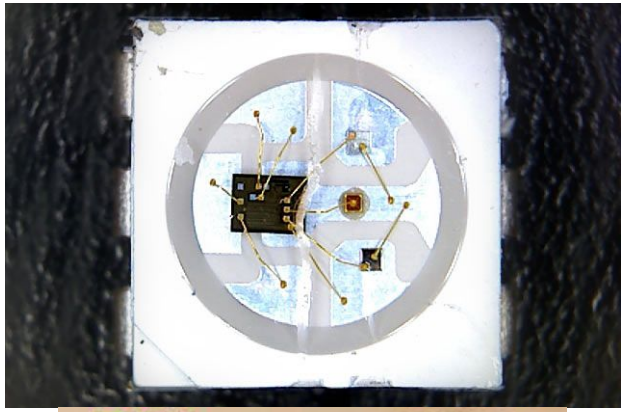


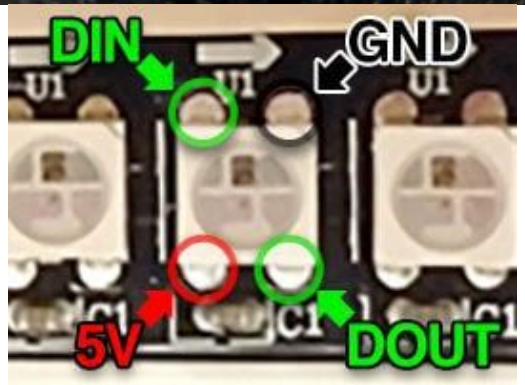
RGB LED composed by the three LED’s

The “Hello World” of our hardware

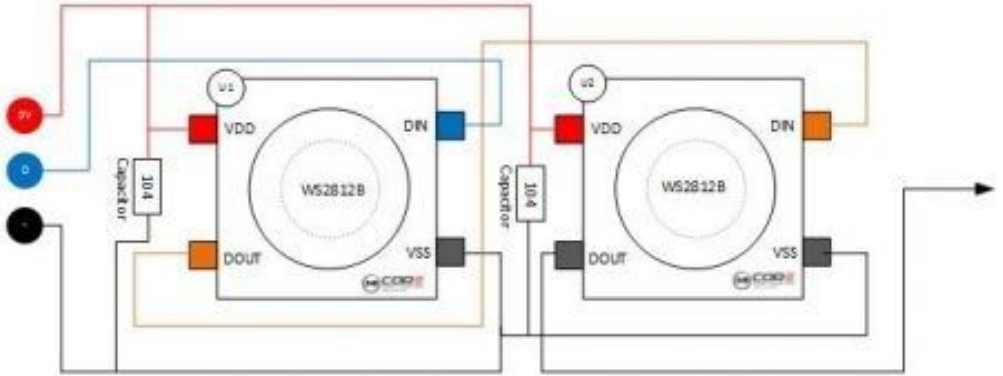


Addressable RGB LED



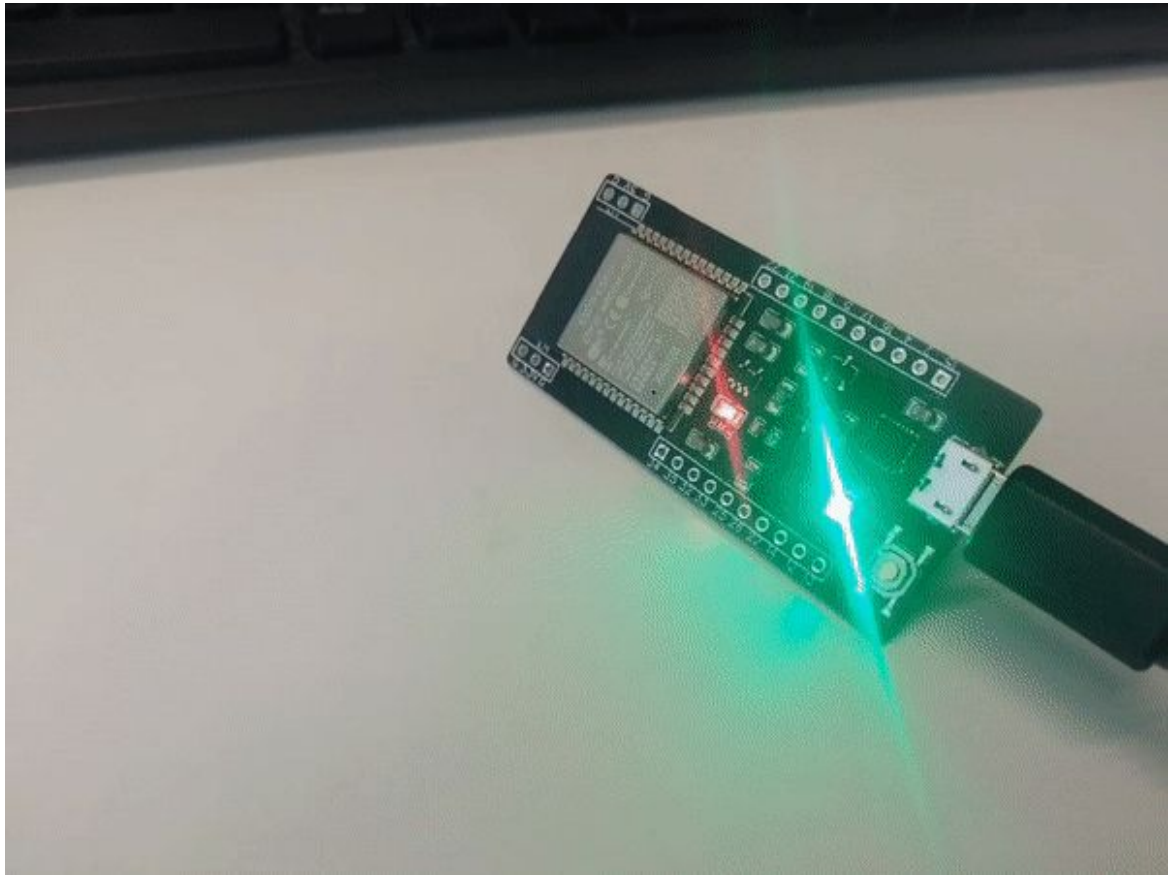


WS2812 LED CHAIN

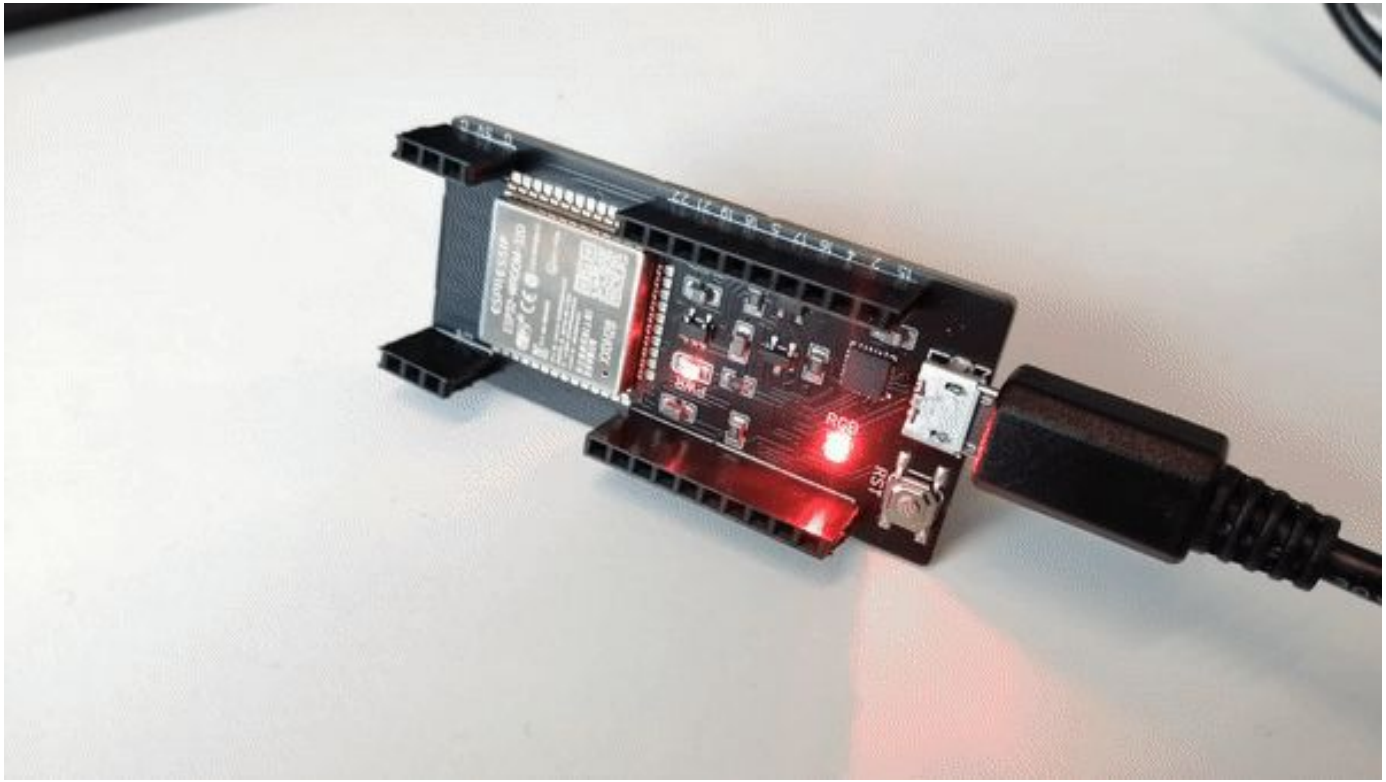


circuitbread.com
make-it.ca
learn.adafruit.com

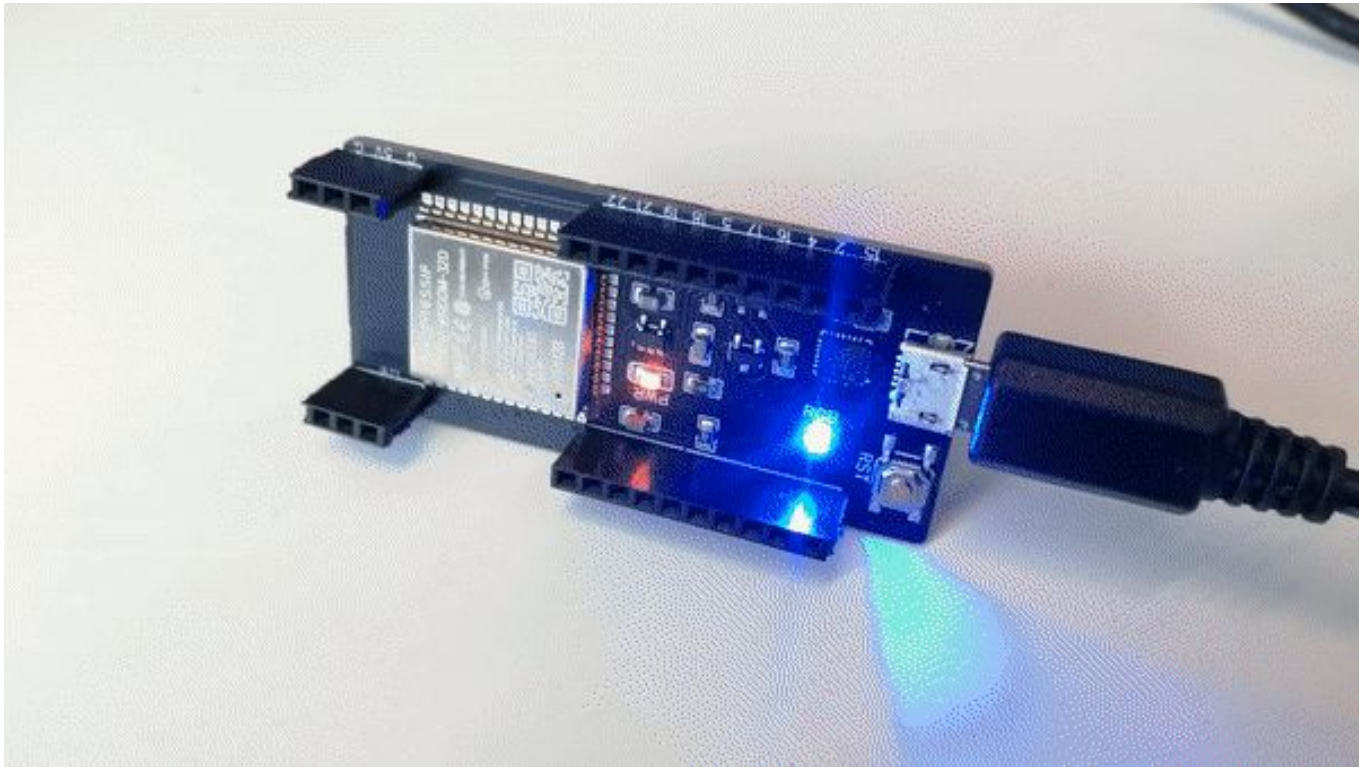
The “Hello World” of our hardware



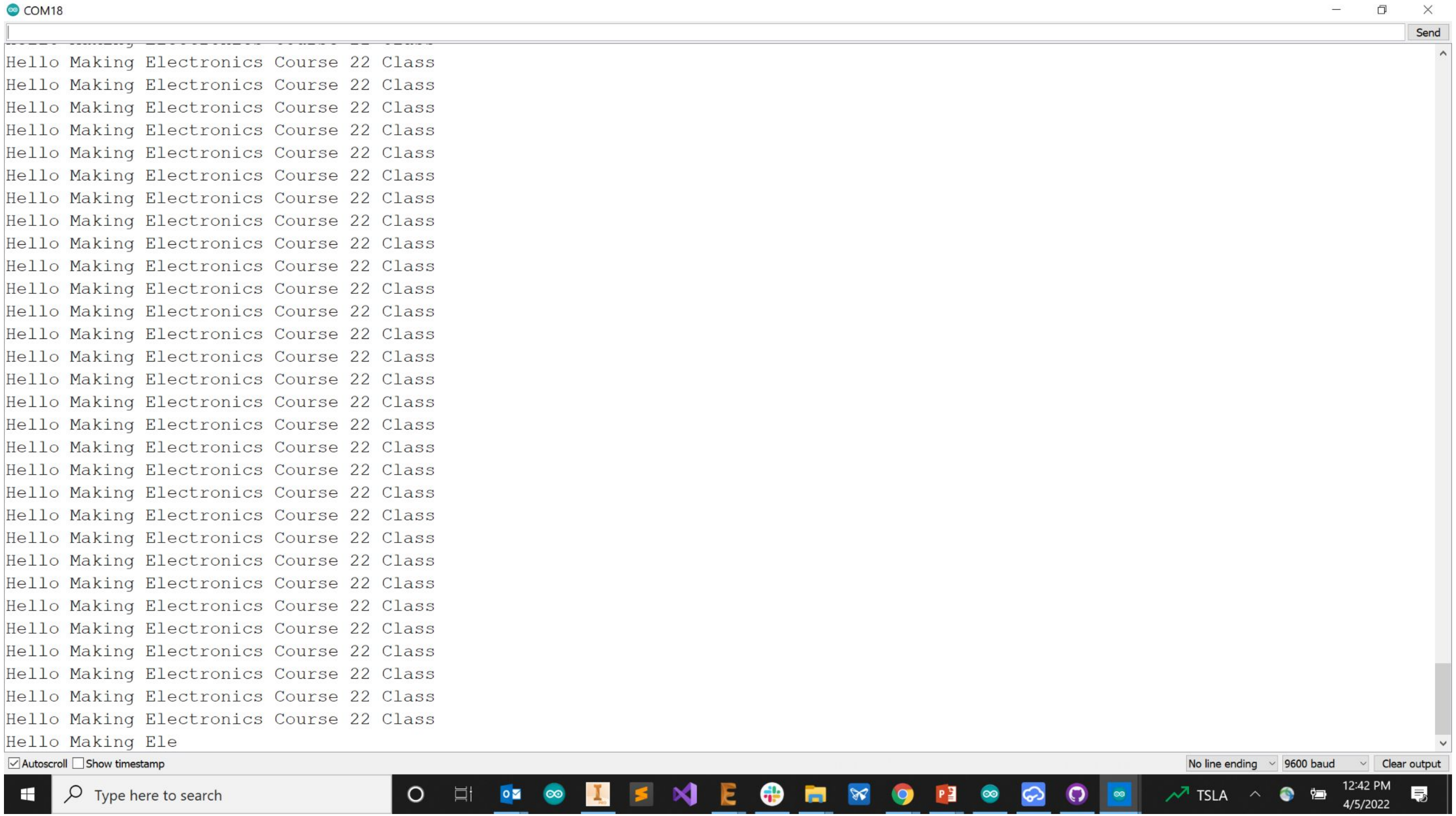
Now let’s give it a heartbeat!



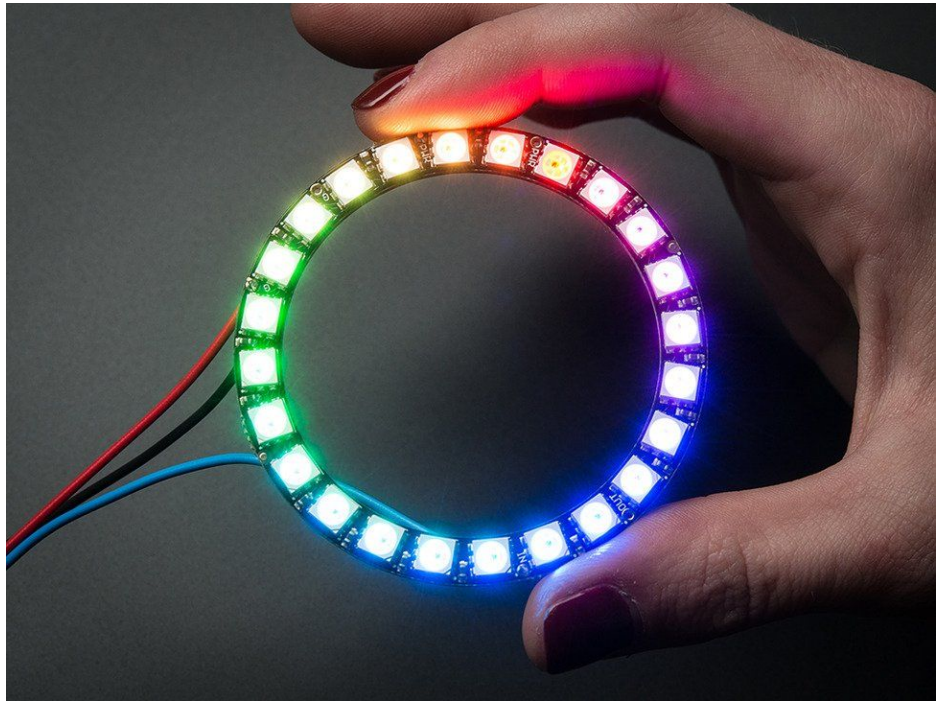
How can we make alternating colours?



The Serial port



Take it up to 11



https://github.com/jasoncoon/esp32-fastled-ble