SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT213- IoT SYSTEM ARCHITECTURE

II ECE / IV SEMESTER

UNIT 2 – MICROCONTROLLER AND INTERFACING TECHNIQUES FOR IoT DEVICES

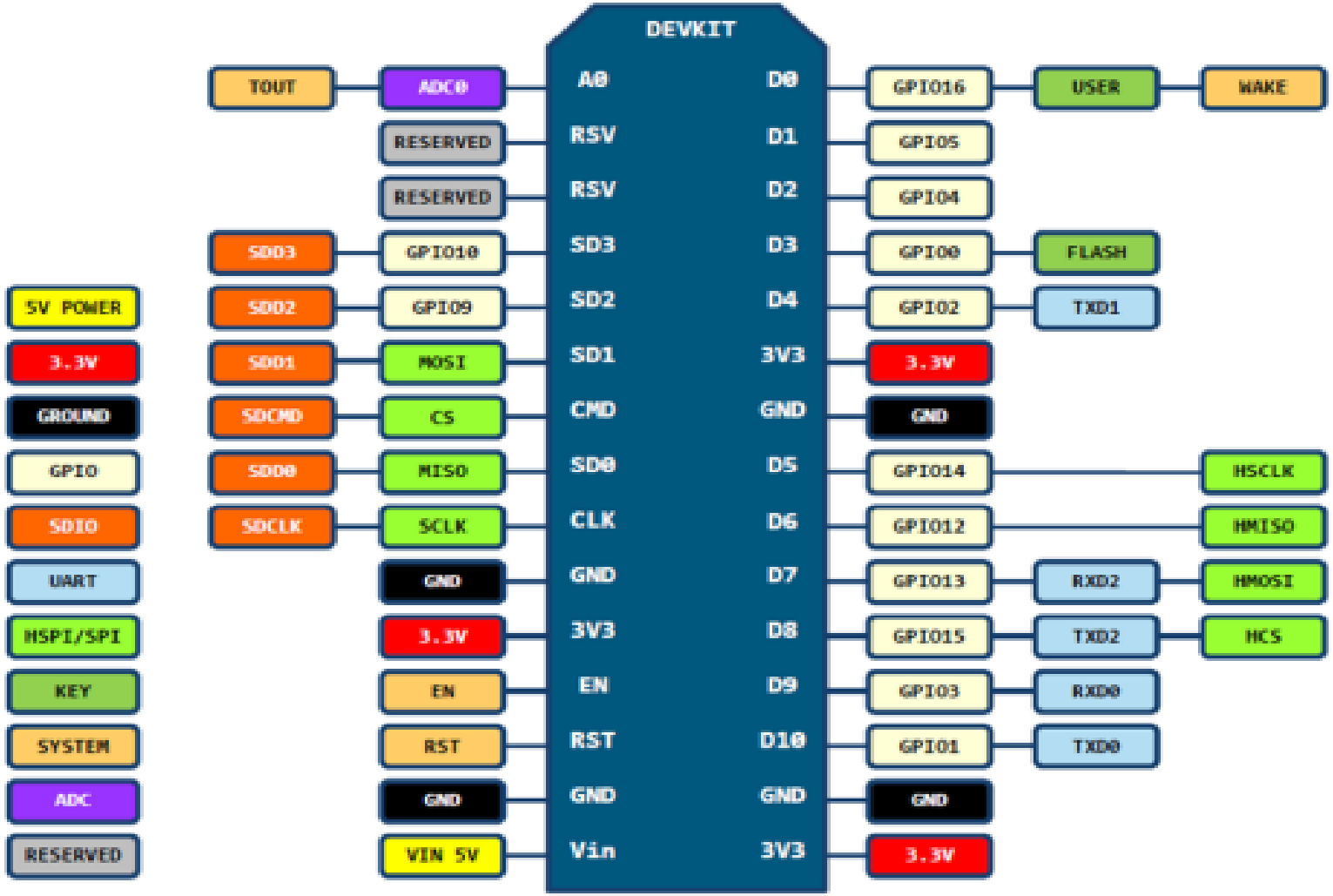
TOPIC 2 –Introduction to NodeMCU

ESP8266 NodeMCU WiFi Development Board

Specification:

- Voltage:3.3V.
- Wi-Fi Direct (P2P), soft-AP.
- Current consumption: 10uA~170mA.
- Flash memory attachable: 16MB max (512K normal).
- Integrated TCP/IP protocol stack.
- Processor: Tensilica L106 32-bit.
- Processor speed: 80~160MHz.
- RAM: 32K + 80K.
- GPIOs: 17 (multiplexed with other functions).
- Analog to Digital: 1 input with 1024 step resolution.
- +19.5dBm output power in 802.11b mode
- 802.11 support: b/g/n.
- Maximum concurrent TCP connections: 5.

ESP8266 NodeMCU



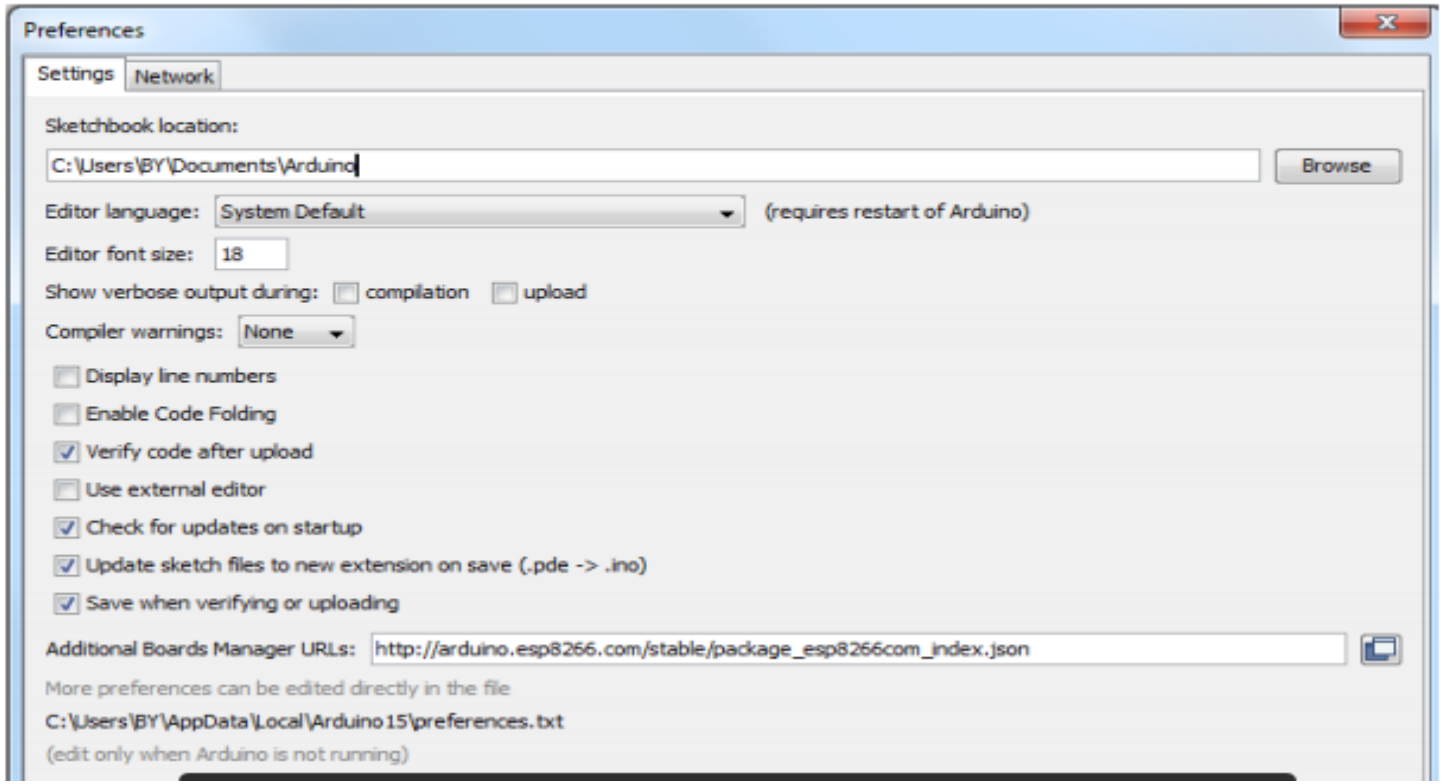
3.1 Install the Arduino IDE 1.6.4 or greater

Download Arduino IDE from Arduino.cc (1.6.4 or greater) - don't use 1.6.2 or lower version! You can use your existing IDE if you have already installed it.

You can also try downloading the ready-to-go package from the ESP8266-Arduino project, if the proxy is giving you problems.

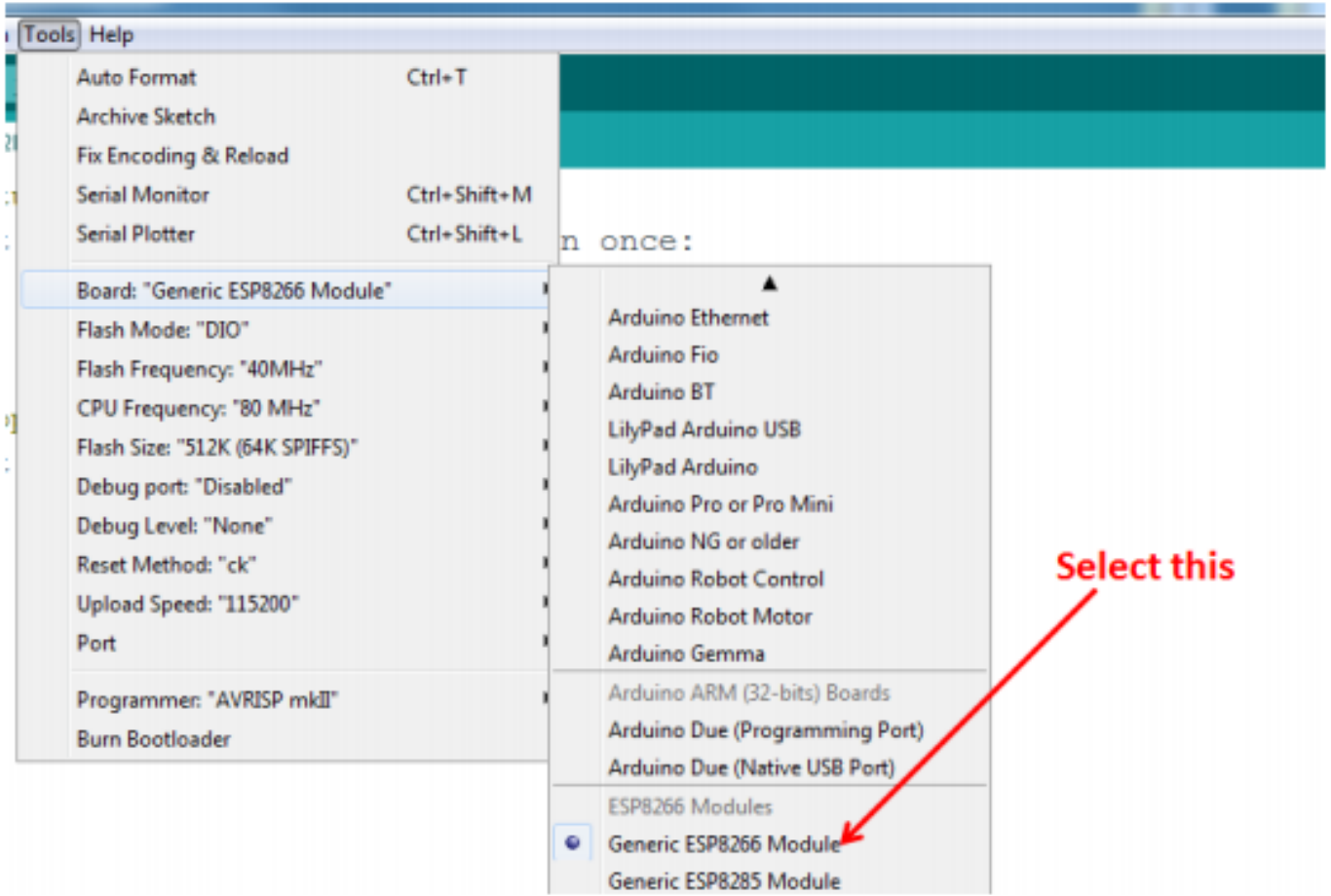
3.2 Install the ESP8266 Board Package

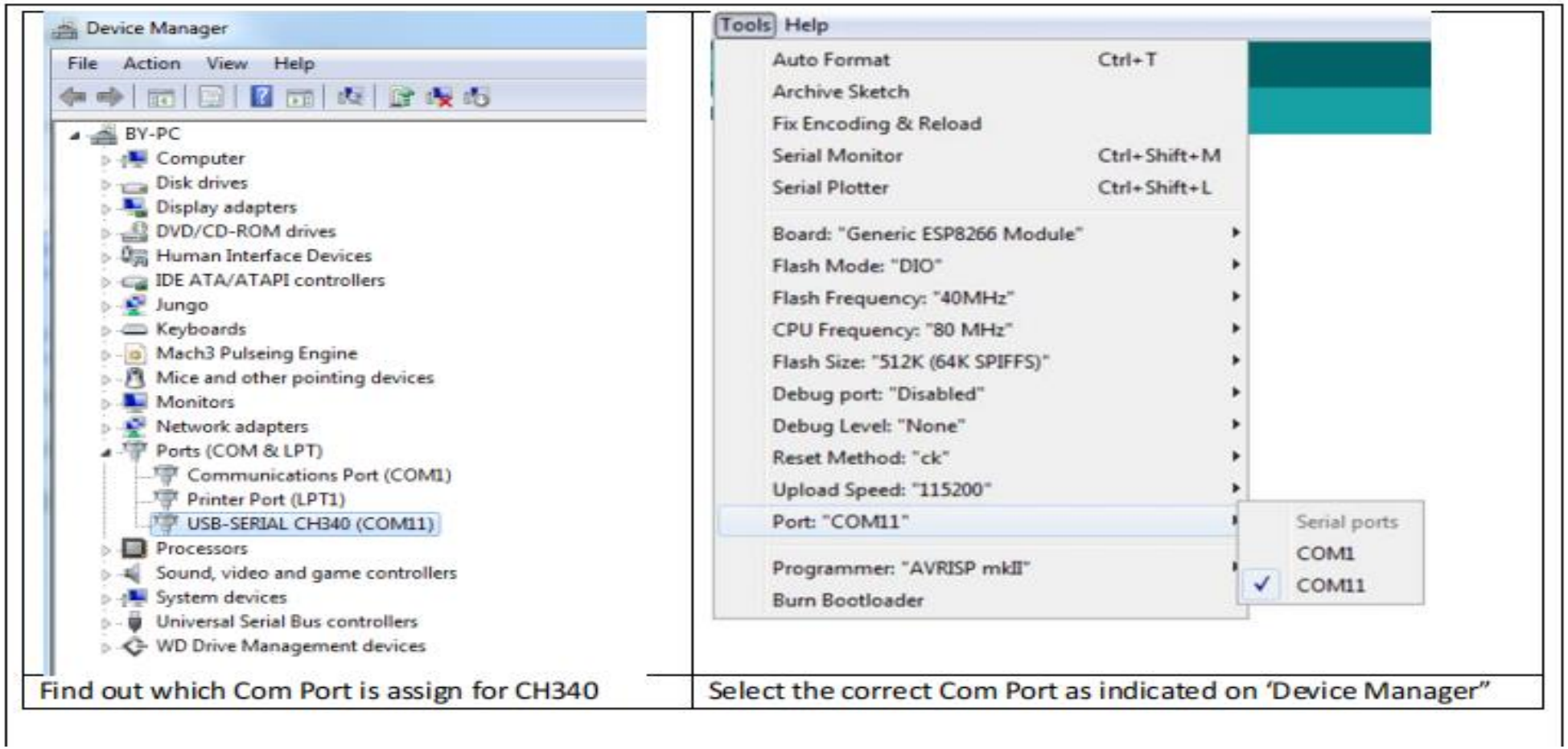
Enter ***http://arduino.esp8266.com/stable/package_esp8266com_index.json*** into *Additional Board Manage* field in the Arduino v1.6.4+ preferences.



3.3 Setup ESP8266 Support

When you've restarted Arduino IDE, select 'Generic ESP8266 Module' from the 'Tools' -> 'Board:' dropdown me





Find out which Com Port is assign for CH340

Select the correct Com Port as indicated on 'Device Manager"

Connecting via WiFi

Connecting via WiFi

We'll begin with the simple blink test.

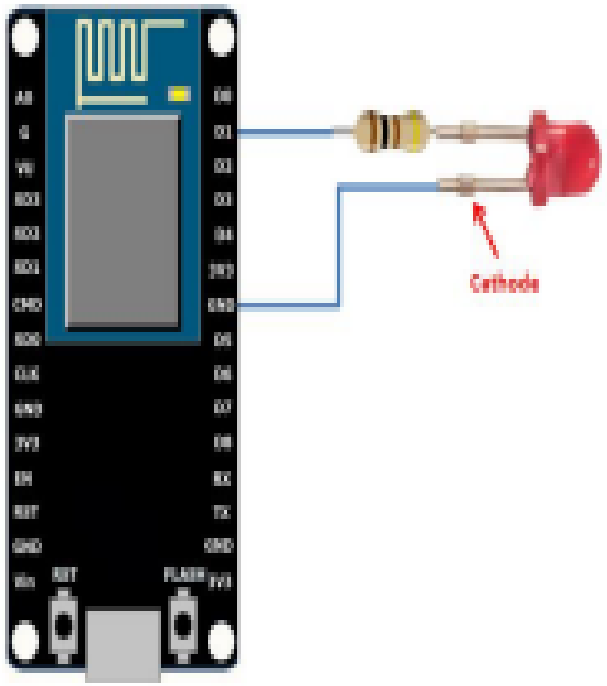
Enter this into the sketch window (and save since you'll have to). Connect a LED as shown in Figure3-1.

```
void setup() {
  pinMode(5, OUTPUT);    // GPIO05, Digital Pin D1
}

void loop() {
  digitalWrite(5, HIGH);
  delay(900);
  digitalWrite(5, LOW);
  delay(500);
}
```

Now you'll need to put the board into bootload mode. You'll have to do this before each upload. There is no timeout for bootload mode, so you don't have to rush!

- Hold down the 'Flash' button.
- While holding down 'Flash', press the 'RST' button.
- Release 'RST', then release 'Flash'

Connecting via WiFi



blinky | Arduino 1.6.7

File Edit Sketch Tools Help

blinky

```
void setup() {
  pinMode(5, OUTPUT);    // GPIO05, Digital Pin D1
}

void loop() {
  digitalWrite(5, HIGH);
  delay(900);
  digitalWrite(5, LOW);
  delay(500);
}
```

Uploading...

```
WARNING: Spurious .github folder in 'Adafruit IO Arduino' library
WARNING: Spurious .tests folder in 'Adafruit IO Arduino' library
WARNING: Spurious .github folder in 'Adafruit MQTT Library' library
WARNING: Spurious .github folder in 'Adafruit IO Arduino' library
WARNING: Spurious .tests folder in 'Adafruit IO Arduino' library
WARNING: Spurious .github folder in 'Adafruit MQTT Library' library

Sketch uses 222,197 bytes (51%) of program storage space. Maximum is 434,160 bytes.
Global variables use 31,572 bytes (38%) of dynamic memory, leaving 50,348 bytes for local v
Uploading 226352 bytes from C:\Users\BY\AppData\Local\Temp\buildb7f3357d9ec338fa2a4043584dd
.......................................................................... [ 36% ]
.....................
```

Generic ESP8266 Module, 80 MHz, 40MHz, DIO, 115200, 512K (64K SPIFF

Connecting via WiFi

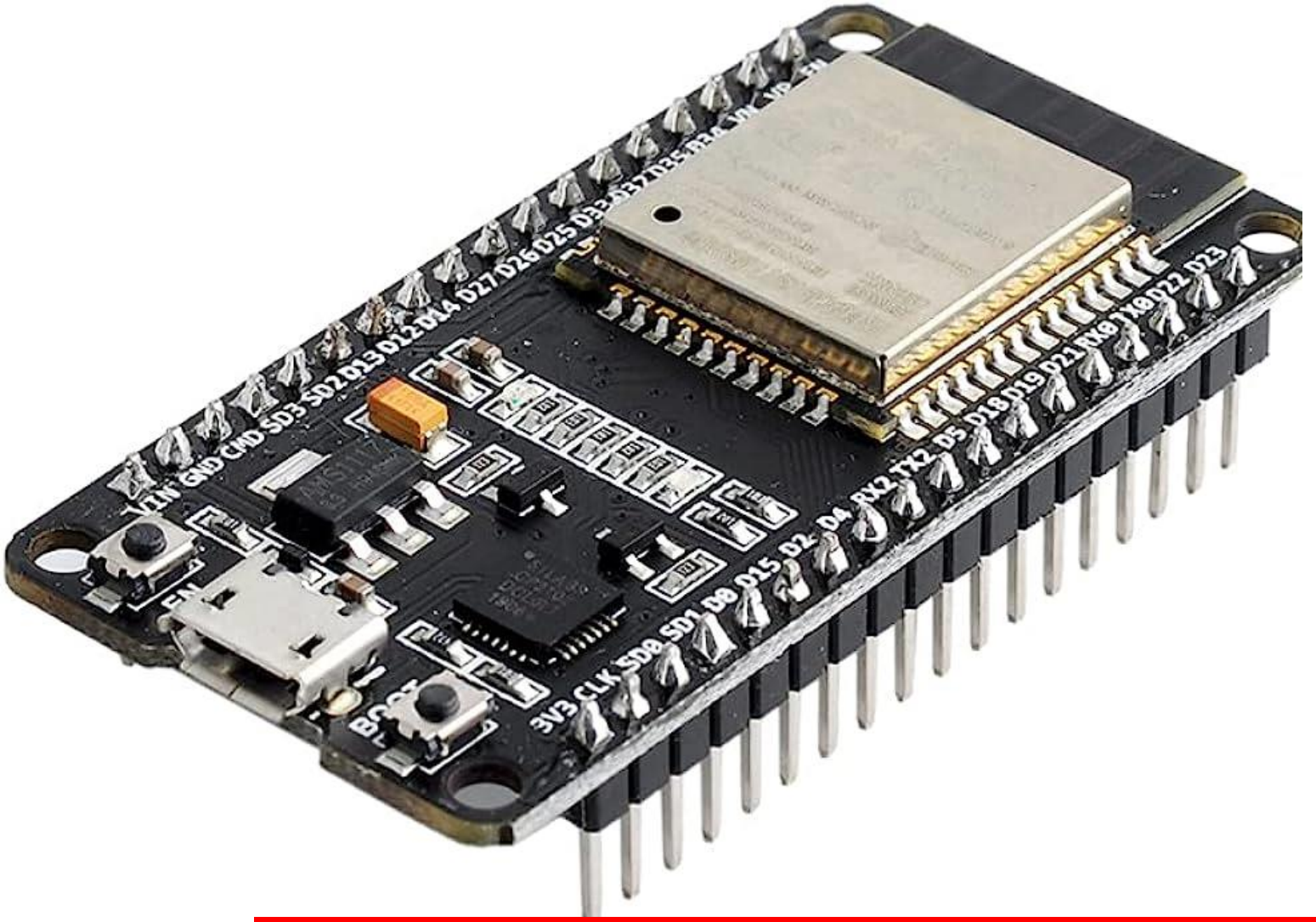
```
*/

#include <ESP8266WiFi.h>

const char* ssid     = "handson";      // key in your own SSID
const char* password = "abc1234";      // key in your own WiFi access point
password
```

```
const char* host = "www.handsontec.com";

void setup() {
  Serial.begin(115200);
  delay(100);

  // We start by connecting to a WiFi network

  Serial.println();
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }

  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}
```

Connecting via WiFi

```
int value = 0;

void loop() {
  delay(5000);
  ++value;

  Serial.print("connecting to ");
  Serial.println(host);

  // Use WiFiClient class to create TCP connections
  WiFiClient client;
  const int httpPort = 80;
  if (!client.connect(host, httpPort)) {
    Serial.println("connection failed");
    return;
  }

  // We now create a URI for the request
  String url = "/projects/index.html";
  Serial.print("Requesting URL: ");
  Serial.println(url);

  // This will send the request to the server
  client.print(String("GET ") + url + " HTTP/1.1\r\n" +
               "Host: " + host + "\r\n" +
               "Connection: close\r\n\r\n");
  delay(500);

  // Read all the lines of the reply from server and print them to Serial
  while(client.available()){
    String line = client.readStringUntil('\r');
    Serial.print(line);
  }

  Serial.println();
  Serial.println("closing connection");
}
```

WHAT IS ESP32



WHAT IS ESP32

- ESP32 is a series of low cost, low power system on a chip microcontrollers with integrated Wi-Fi & dual-mode Bluetooth.
- CPU: Xtensa Dual-Core 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS
- - Memory: 520 KiB SRAM
- - Wireless connectivity:
- + Wi-Fi: 802.11 b/g/n/e/i
- + Bluetooth: v4.2 BR/EDR and BLE

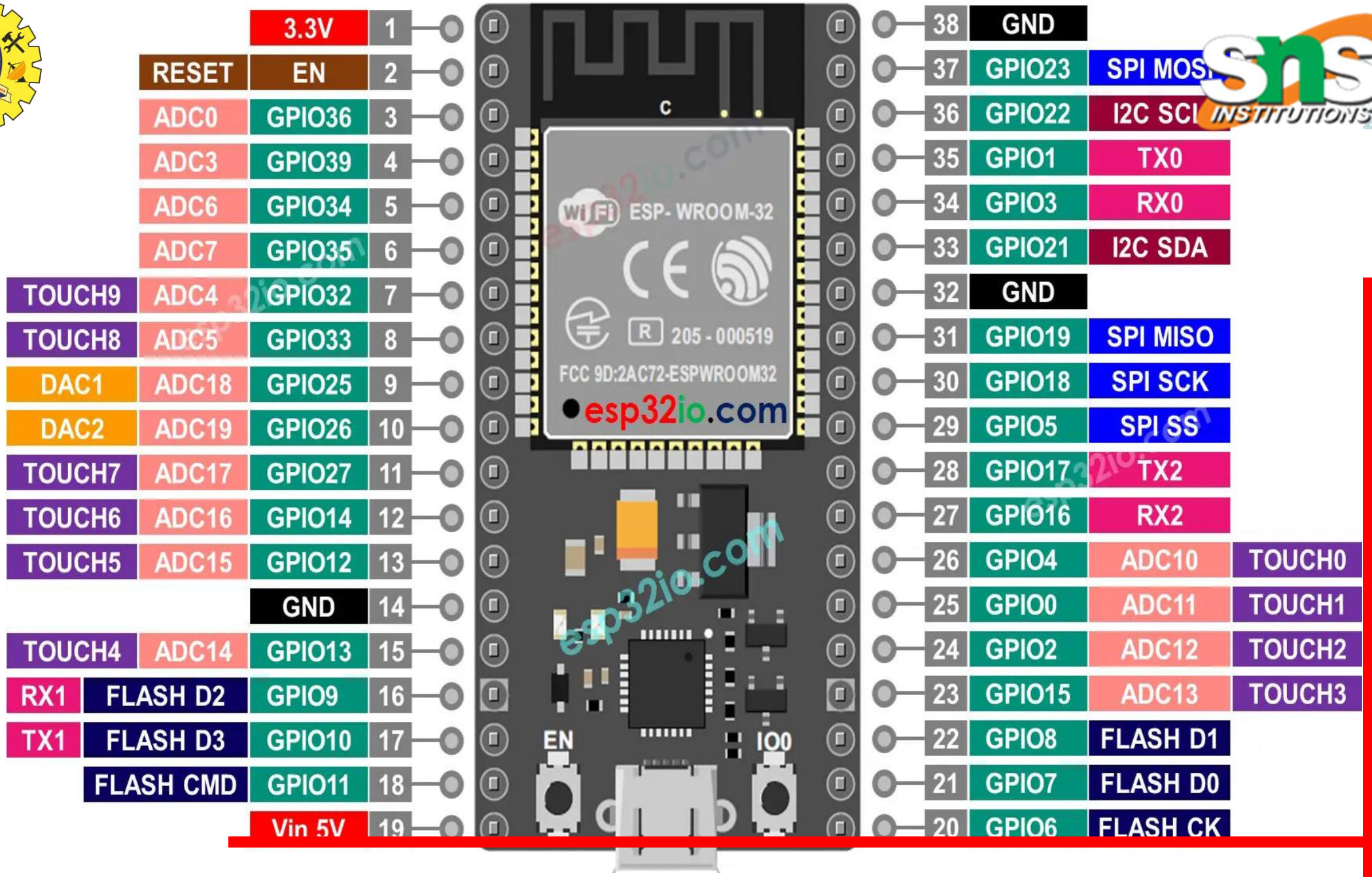
WHAT IS ESP32?

- Integrated Crystal– 40 MHz
- Module Interfaces– UART, SPI, I2C, PWM, ADC, DAC, GPIO, pulse counter, capacitive touch sensor
- Integrated SPI flash– 4 MB
- ROM– 448 KB (for booting and core functions)
- SRAM– 520 KB
- Integrated Connectivity Protocols– WiFi, Bluetooth, BLE
- On–chip sensor– Hall sensor
- Operating temperature range– –40 – 85 degrees Celsius
- Operating Voltage– 3.3V
- Operating Current– 80 mA (average)

ESP Boards

Adafruit ESP32 Feather, Sparkfun ESP32 Thing, NodeMCU-32S, Wemos LoLin32,

ESP32


3.3V 1
RESET EN 2
ADC0 GPIO36 3
ADC3 GPIO39 4
ADC6 GPIO34 5
ADC7 GPIO35 6
TOUCH9 ADC4 GPIO32 7
TOUCH8 ADC5 GPIO33 8
DAC1 ADC18 GPIO25 9
DAC2 ADC19 GPIO26 10
TOUCH7 ADC17 GPIO27 11
TOUCH6 ADC16 GPIO14 12
TOUCH5 ADC15 GPIO12 13
GND 14
TOUCH4 ADC14 GPIO13 15
RX1 FLASH D2 GPIO9 16
TX1 FLASH D3 GPIO10 17
FLASH CMD GPIO11 18
Vin 5V 19
38 GND
37 GPIO23 SPI MOSI
36 GPIO22 I2C SCL
35 GPIO1 TX0
34 GPIO3 RX0
33 GPIO21 I2C SDA
32 GND
31 GPIO19 SPI MISO
30 GPIO18 SPI SCK
29 GPIO5 SPI SS
28 GPIO17 TX2
27 GPIO16 RX2
26 GPIO4 ADC10 TOUCH0
25 GPIO0 ADC11 TOUCH1
24 GPIO2 ADC12 TOUCH2
23 GPIO15 ADC13 TOUCH3
22 GPIO8 FLASH D1
21 GPIO7 FLASH D0
20 GPIO6 FLASH CK
ESP- WROOM-32
205 - 000519
FCC 9D:2AC72-ESPWROOM32
esp32io.com
EN
IO0

The ESP32 peripherals include:

- 18 Analog-to-Digital Converter (ADC) channels
- 3 SPI interfaces
- 3 UART interfaces
- 2 I2C interfaces
- 16 PWM output channels
- 2 Digital-to-Analog Converters (DAC)
- 2 I2S interfaces
- 10 Capacitive sensing GPIOs

ESP32

Input only pin

GPIOs 34 to 39 are GPIs – input only pins. These pins don't have internal pull-up or pull-down resistors. They can't be used as outputs, so use these pins only as inputs:

GPIO 34
GPIO 35
GPIO 36
GPIO 39

SPI flash integrated on the ESP-WROOM-32

GPIO 6 to GPIO 11 are exposed in some ESP32 development boards. However, these pins are connected to the integrated SPI flash on the ESP-WROOM-32 chip and are not recommended for other uses. So, don't use these pins in your projects:

GPIO 6 (SCK/CLK)
GPIO 7 (SDO/SD0)
GPIO 8 (SDI/SD1)
GPIO 9 (SHD/SD2)
GPIO 10 (SWP/SD3)
GPIO 11 (CSC/CMD)

ESP32

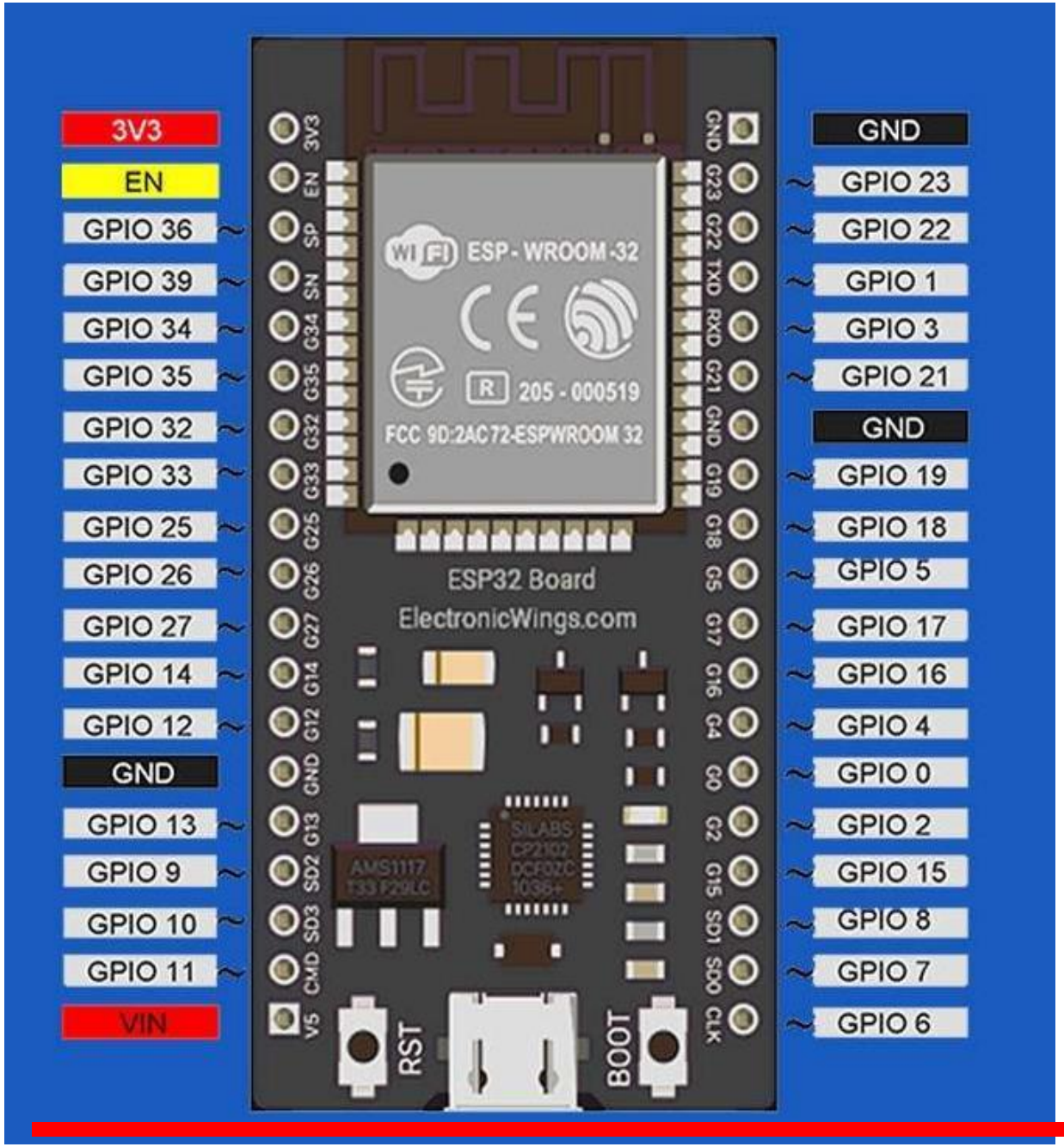
The ESP32 has 10 internal capacitive touch sensors. These can sense variations in anything that holds an electrical charge, like the human skin. So they can detect variations induced when touching the GPIOs with a finger. These pins can be easily integrated into capacitive pads and replace mechanical buttons. The capacitive touch pins can also be used to wake up the ESP32 from deep sleep.

Those internal touch sensors are connected to these GPIOs:
T0 (GPIO 4)
T1 (GPIO 0)
T2 (GPIO 2)
T3 (GPIO 15)
T4 (GPIO 13)
T5 (GPIO 12)
T6 (GPIO 14)
T7 (GPIO 27)
T8 (GPIO 33)
T9 (GPIO 32)

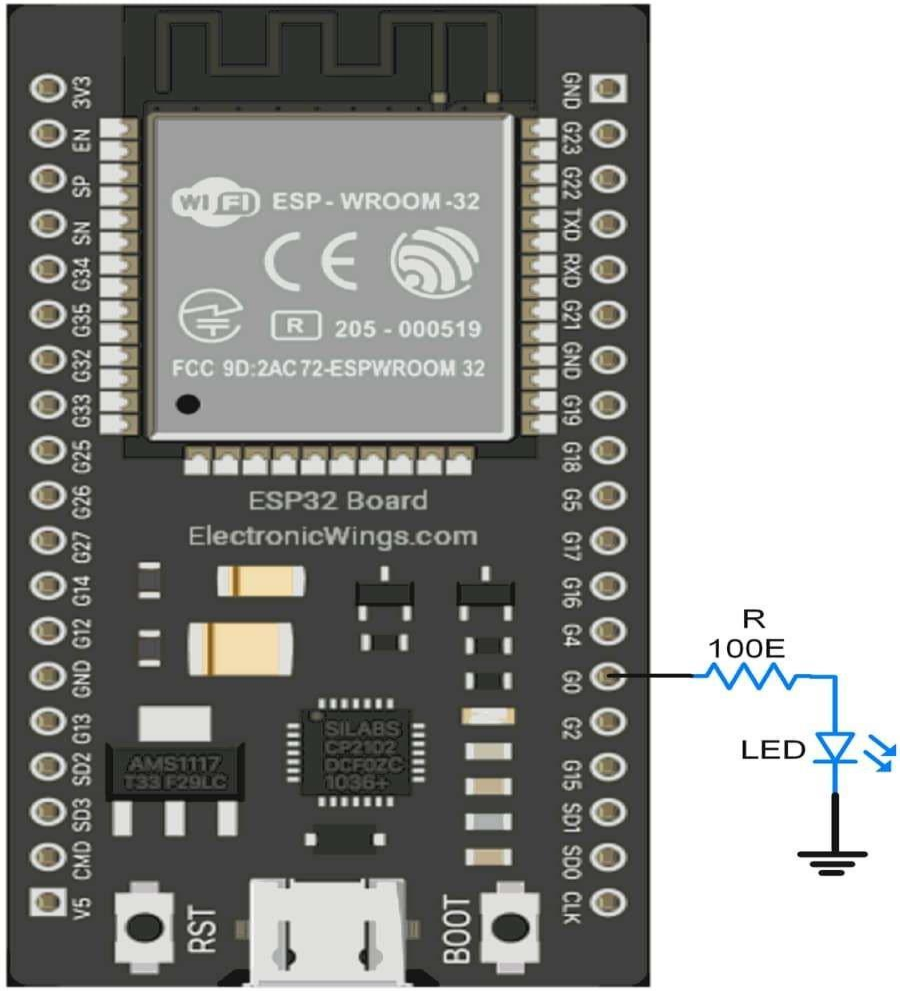
ESP32

- **Analog to Digital Converter (ADC)**
- ADC1_CH0 (GPIO 36)
- ADC1_CH1 (GPIO 37)
- ADC1_CH2 (GPIO 38)
- ADC1_CH3 (GPIO 39)
- ADC1_CH4 (GPIO 32)
- ADC1_CH5 (GPIO 33)
- ADC1_CH6 (GPIO 34)
- ADC1_CH7 (GPIO 35)
- ADC2_CH0 (GPIO 4)
- ADC2_CH1 (GPIO 0)
- ADC2_CH2 (GPIO 2)
- ADC2_CH3 (GPIO 15)
- ADC2_CH4 (GPIO 13)
- ADC2_CH5 (GPIO 12)
- ADC2_CH6 (GPIO 14)
- ADC2_CH7 (GPIO 27)
- ADC2_CH8 (GPIO 25)
- ADC2_CH9 (GPIO 26)

ESP32


3V3
EN
GPIO 36
GPIO 39
GPIO 34
GPIO 35
GPIO 32
GPIO 33
GPIO 25
GPIO 26
GPIO 27
GPIO 14
GPIO 12
GND
GPIO 13
GPIO 9
GPIO 10
GPIO 11
VIN
GND
GPIO 23
GPIO 22
GPIO 1
GPIO 3
GPIO 21
GND
GPIO 19
GPIO 18
GPIO 5
GPIO 17
GPIO 16
GPIO 4
GPIO 0
GPIO 2
GPIO 15
GPIO 8
GPIO 7
GPIO 6
ESP - WROOM -32
205 - 000519
FCC 9D:2AC72-ESPWROOM 32
ESP32 Board
ElectronicWings.com
RST
BOOT

Blink LED Using ESP32



Blink LED Using ESP32

```
void setup()
{
  pinMode(0, OUTPUT);        // sets the digital pin 0 as output
}


void loop()
{
            digitalWrite(0, HIGH);      // sets the digital pin 0 on
            delay(1000);                // waits for a second
            digitalWrite(0, LOW);       // sets the digital pin 0 off
            delay(1000);                // waits for a second
}
```

Blink LED Using ESP32

Output