

Hardware platforms

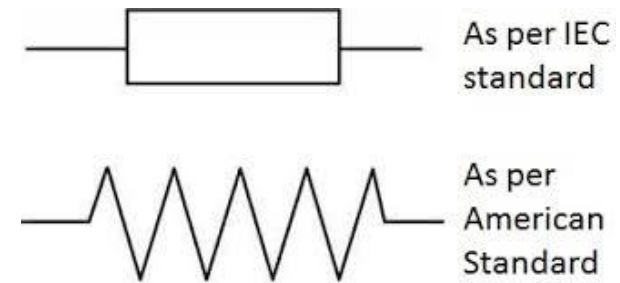
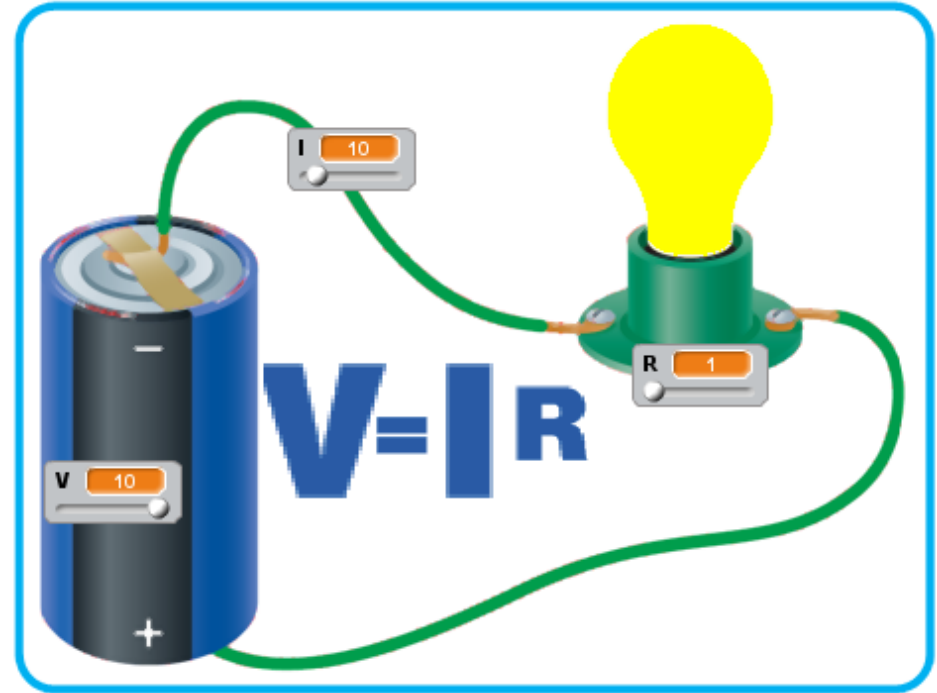
Overview and ESP8266

Some circuit theory

- Ohm's law: voltage, current and resistance
- A word about capacitors and inductors
- Switch (e.g. button)
- LED

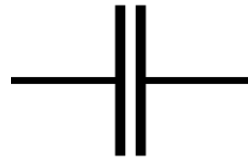
Ohm's law

- Key concept: **resistance (R)**
- $I = V / R$
 - **More** voltage -> **more** current
 - **Less** resistance -> **more** current
- Useful analogy: **water & pipes**
 - Pressure <-> Voltage
 - Flow <-> Current
 - Pipe diameter <-> Resistance
- Resistor element

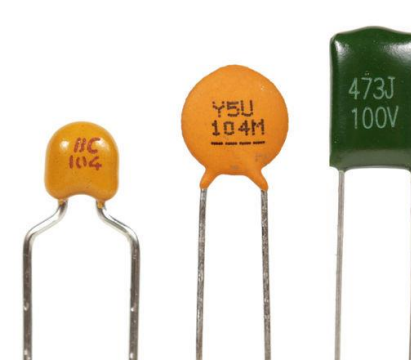


Capacitors & Inductors

- Concept: Energy builds up in time
- Capacitor
 - builds up voltage
 - May be **polarized**
- Inductor
 - builds up current
 - non-polarized
- Common uses:
 - Filter
 - Energy buffer/store



NONPOLARIZED



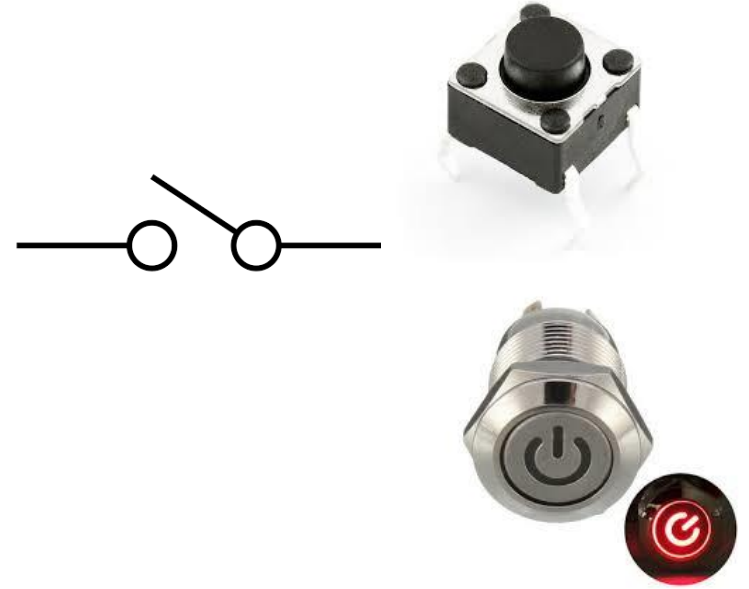
POLARIZED



Switch & LED

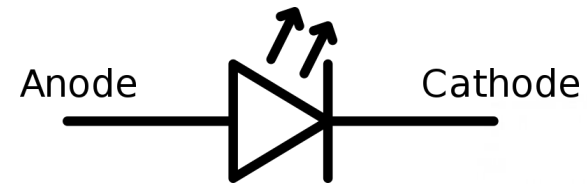
- Switch

- Turns electricity on/off
- May come in many physical forms
- Normally open (NO) vs Normally closed (NC)



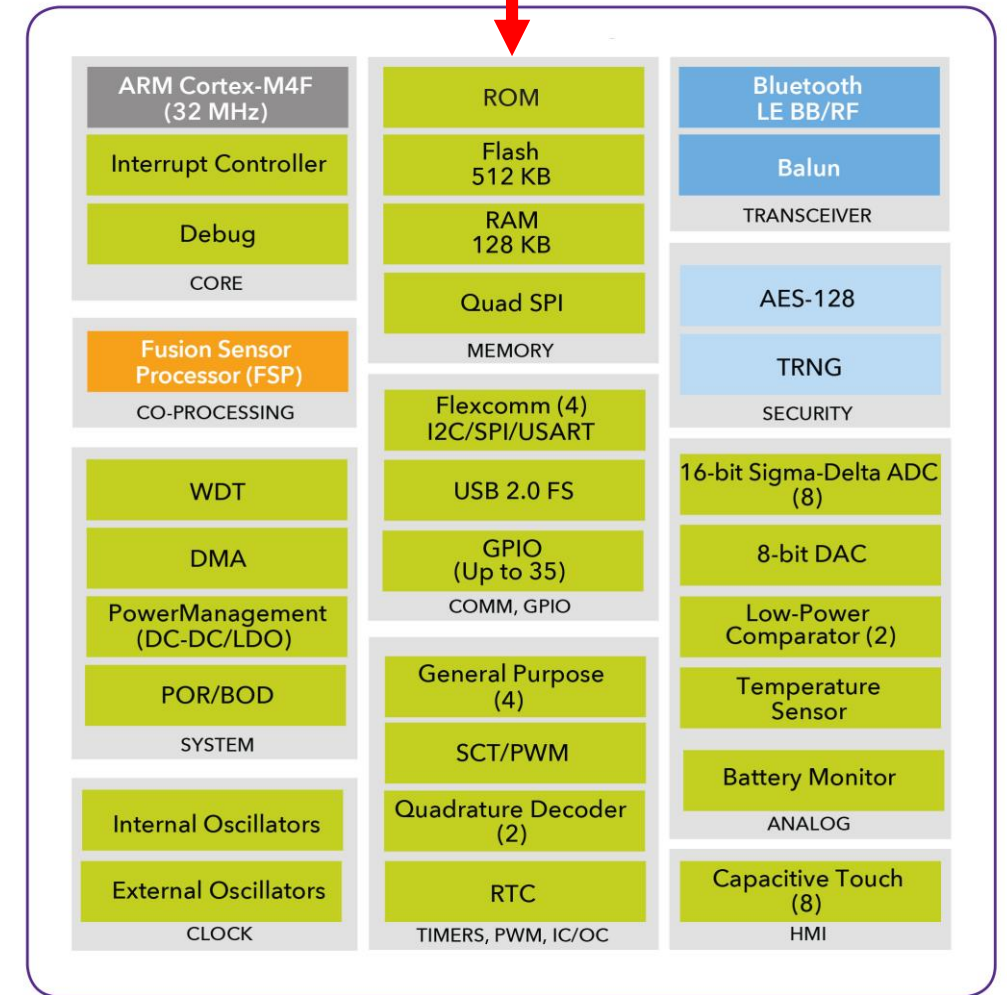
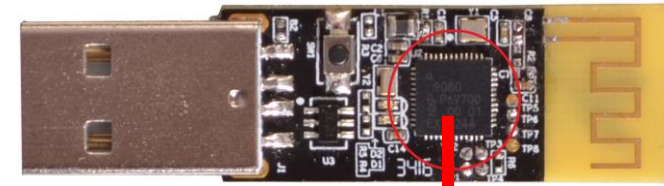
- LED = Light Emitting Diode

- Like a bulb, but **polarity matters**
- Different colors and sizes
- Sometimes more than one in a single package

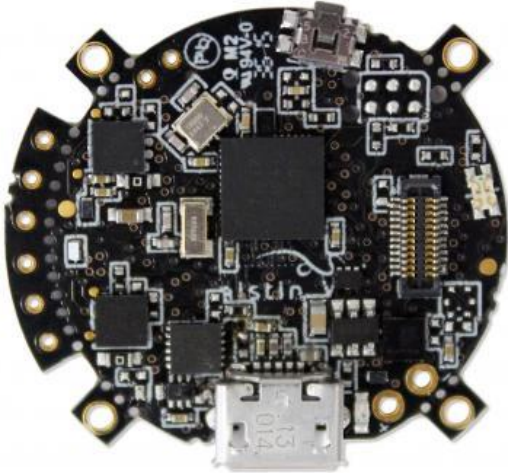


Programmable systems

- System on Chip (SoC)
- System on module (SoM)
- Microcontroller (MCU)
- General purpose I/O (GPIO)
- Analog to digital converter (ADC)
- Over the air (OTA)
- Power on reset (POR)
- Brown out detection (BOD)
- Watchdog timer (WDT)



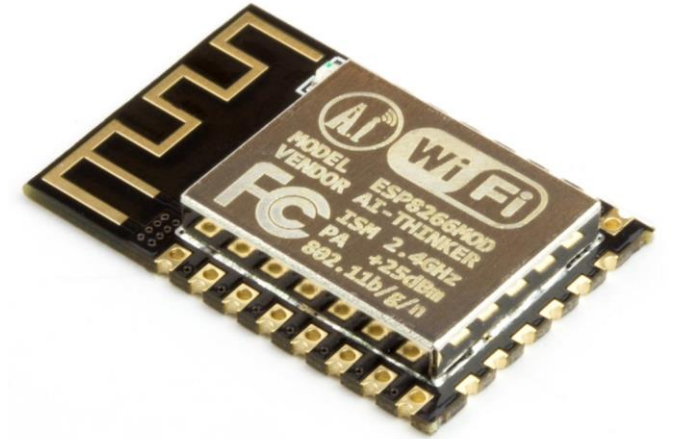
Example: Wearable SoC / SoM



Completely open source - a foundation for your inventions.

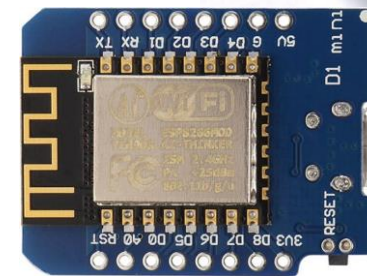
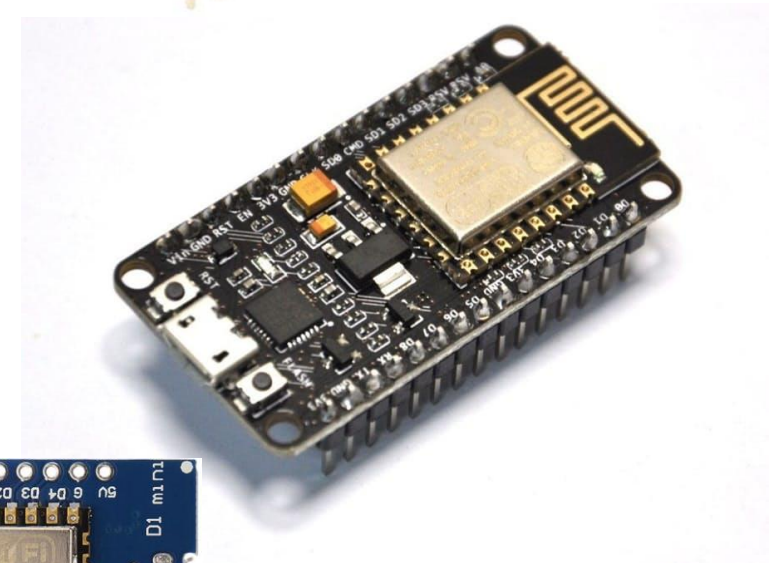
ESP8266: our SoC

- **CPU:** 32 bit, 80/160 MHz
- **RAM:** ~36k
- **Flash:** 4MB (shared, different layouts possible)
- **I/O:** 8 GPIO, 10 bit ADC, PWM, UART, SPI, I2C, I2S
- **Network**
 - WiFi, (WPA/WPA2, STA/AP/STA+AP)
 - TCP/IP (+ HTTP, MQTT etc libs)
- **Operating temperature:** -40 to 125 °C
- **Power usage:** 30 mW (down to 100 uW in deep sleep)



ESP8266: our lab modules

- What's inside?
 - ESP8266
 - MicroUSB
 - Pins, buttons, LED ...
- Power:
 - Spec: 3.3V (2.5 to 3.6)
 - Our module is USB powered
 - GPIOs are 3.3V (5V tolerant ?)
- Programmed C or Arduino



Exercises

1. Print “Hello world”
2. Blink an LED
3. Read a button
4. [Interrupts](#)
5. Advanced (find the docs yourself)
 - [Watchdog](#)
 - [Flash](#) (EEPROM, SPIFFS)
 - [Additional guidelines](#)