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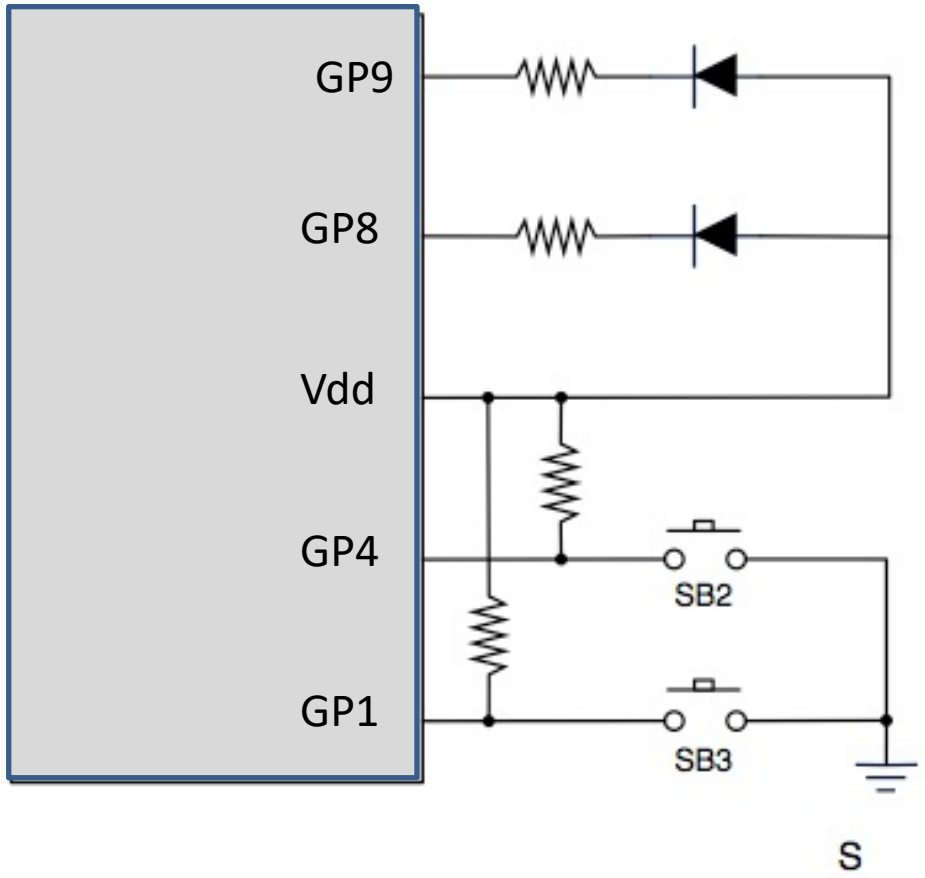
ESP-IDF. GPIO

IoT Node Architecture

GPIO controller

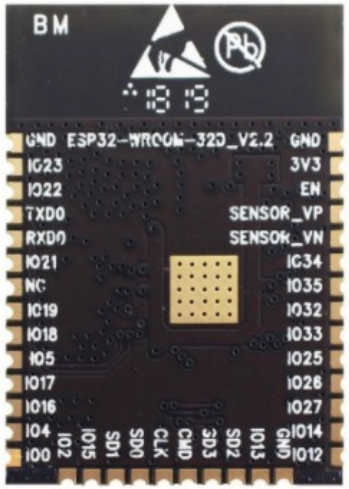
- GPIO - General Purpose Input/Output
  - Controller to use the exposed pins
- GPIO controller to configure each pin...
  - As output (LED, pantallas LCD...)
    - pull-up /pull-down resistance
  - As input (button...)
    - We can configure interruptions (edge, level...)
  - Other specific functions
    - PWM signal generation
    - Become part of a bus
    - ADC / DAC channel

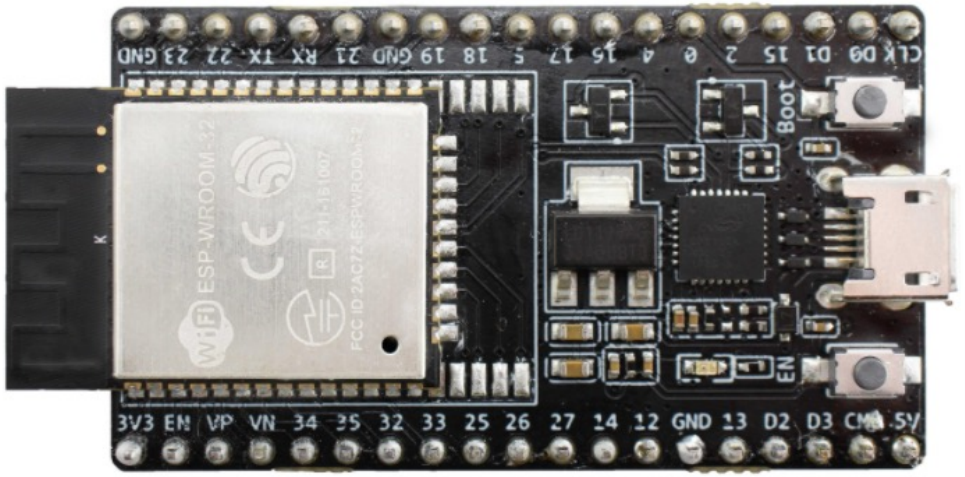
Connecting simple devices



ESP32 – module, pins....

- ESP32 SoC exposes 40 GPIO pads
  - WROOM-32D module exposes 38
    - Some boards like DevKitC exposes those 38
    - Our board does not have a pin strip. Some of them are already routed to buttons, LEDs...





GPIO in ESP-IDF

- FreeRTOS does not have explicit support
  - Each *porting* must provide it
- ESP-IDF API allows to...
  - Configure each pin
    - Direction, pull-up/pull-down, interrupts
  - Write a ‘1’ o ‘0’ to an output pin
  - Read (a ‘1’ o ‘0’) from an input pin
  - Registar an ISR for interrupts in a pin or group of pins

https://docs.espressif.com/projects/esp-idf/en/stable/api-reference/peripherals/gpio.html

Output pin configuration example

```
#define GPIO_OUTPUT_IO_0 18
#define GPIO_OUTPUT_IO_1 19
#define GPIO_OUTPUT_PIN_SEL ((1ULL<<GPIO_OUTPUT_IO_0) | (1ULL<<GPIO_OUTPUT_IO_1))


gpio_config_t io_conf;
io_conf.intr_type = GPIO_PIN_INTR_DISABLE;
io_conf.mode = GPIO_MODE_OUTPUT;
io_conf.pin_bit_mask = GPIO_OUTPUT_PIN_SEL;
io_conf.pull_down_en = 0;
io_conf.pull_up_en = 0;
gpio_config(&io_conf);
```

https://github.com/espressif/esp-idf/blob/release/v4.1/examples/peripherals/gpio/main/gpio_example_main.c

Interrupt based input configuration

```
#define GPIO_INPUT_IO_0 4
#define GPIO_INPUT_IO_1 5
#define GPIO_INPUT_PIN_SEL ((1ULL<<GPIO_INPUT_IO_0) | (1ULL<<GPIO_INPUT_IO_1))

io_conf.intr_type = GPIO_PIN_INTR_POSEDGE;
io_conf.pin_bit_mask = GPIO_INPUT_PIN_SEL;
io_conf.mode = GPIO_MODE_INPUT
conf.pull_up_en = 1; gpio_config(&io_conf);

gpio_install_isr_service(ESP_INTR_FLAG_DEFAULT);
gpio_isr_handler_add(GPIO_INPUT_IO_0, example_isr, (void*) GPIO_INPUT_IO_0);
gpio_isr_handler_add(GPIO_INPUT_IO_1, example_isr, (void*) GPIO_INPUT_IO_1);


static void IRAM_ATTR example_isr(id* arg) {
  uint32_t gpio_num = (uint32_t) arg;
  xQueueSendFromISR(gpio_evt_queue, &gpio_num, NULL);
}
```

https://github.com/espressif/esp-idf/blob/release/v4.1/examples/peripherals/gpio/main/gpio_example_main.c