مرکز آموزش نیـــرا سیستم

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# General Purpose Input/Output (GPIO)

Ali Mirghasemi

# Introduction

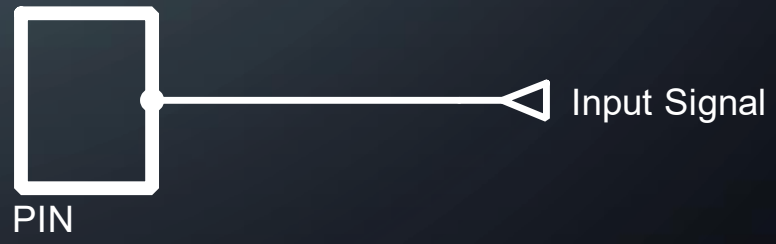
- General Purpose Input/Output (GPIO) is a fundamental feature of microcontrollers that allows them to interface with external devices and sensors.
- GPIO pins can be configured as inputs to read external signals or as outputs to drive signals to external devices.
- The STM32F407 microcontroller offers versatile GPIO capabilities, making it an essential component in a wide range of embedded applications.

# Modes

- Input
  - In input mode, GPIO pins are used to read external signals or states.
  - The STM32F407 provides three input modes: Floating, Pull-Down, and Pull-Up.
- Output
  - In output mode, GPIO pins are used to drive signals to external devices.
  - The STM32F407 offers two output modes: Push-Pull and Open-Drain.

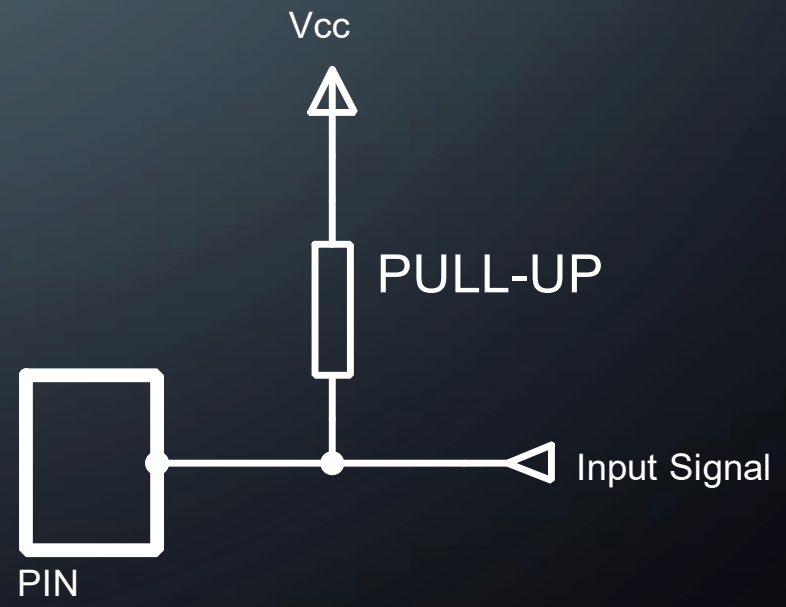
# Input - Float

- Suitable for reading signals from switches or buttons, where the input may be unconnected or disconnected.
- Activate: ?
- Idle: ?



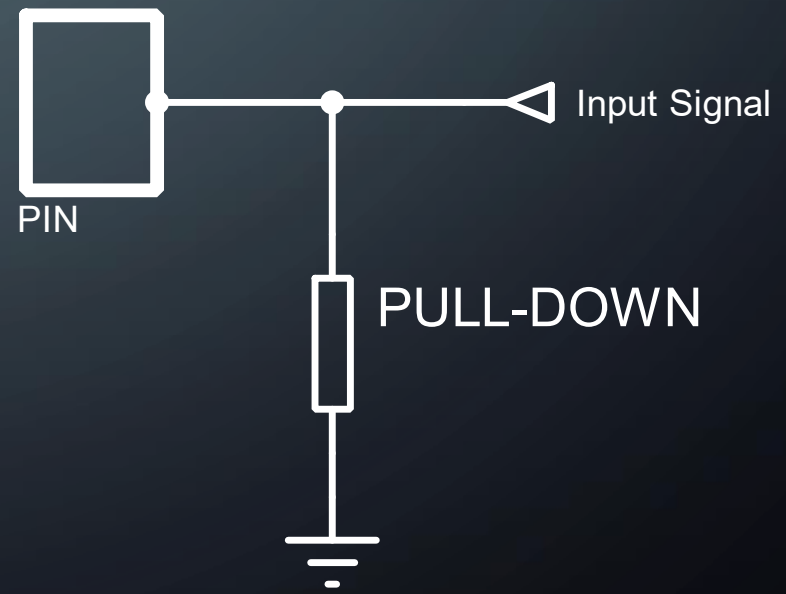
# Input - Pull-Up

- Appropriate for reading signals from devices with open-drain or open-collector outputs that pull the signal high when active. An external pull-up resistor is connected to the pin to pull the signal high when the external device is inactive.
- Activate: Low
- Idle: High



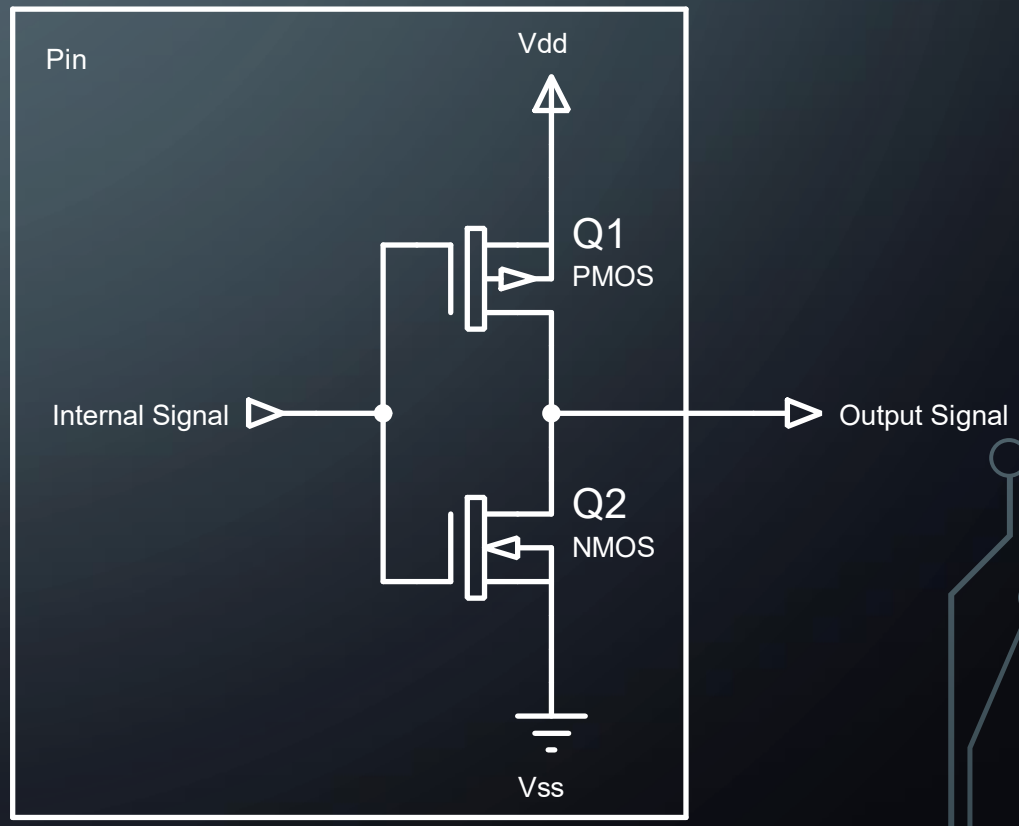
# Input - Pull-Down

- Useful for reading signals from open-drain or open-collector outputs, where an external pull-down resistor pulls the signal low when the external device is inactive.
- Activate: High
- Idle: Low



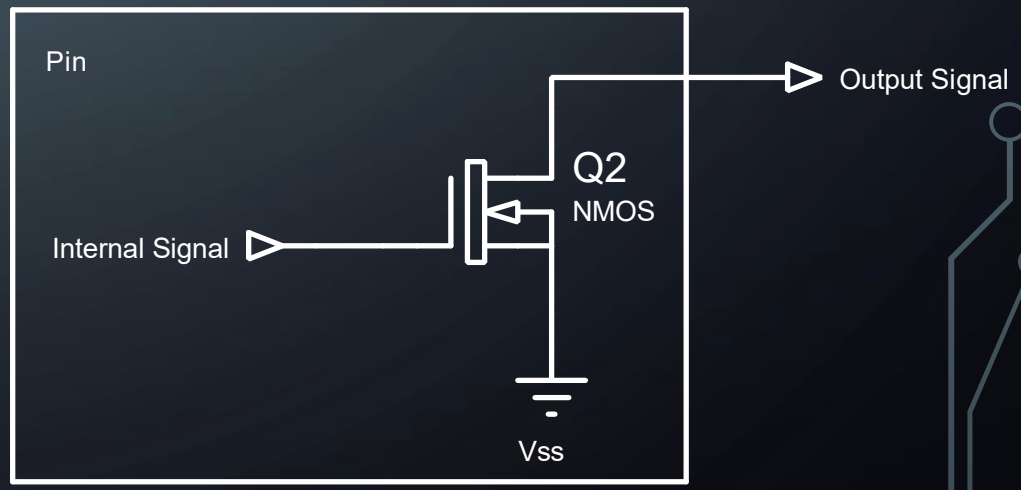
# Output – Push-Pull

- Ideal for driving signals to devices that expect both high and low levels. The pin actively drives both high and low states.



# Output – Open-Drain

- Useful for driving signals to devices that have open-drain or open-collector inputs. The pin actively drives the low state, but external pull-up resistors are required to drive the high state.



# Registers

- **GPIOx_MODER**
  - Determines the mode of the GPIO pin (input, output, alternate function, or analog).
- **GPIOx_OTYPER**
  - Specifies the output type (push-pull or open-drain) of the GPIO pin in output mode.
- **GPIOx_OSPEEDR**
  - Configures the output speed for the GPIO pin in output mode.
- **GPIOx_PUPDR**
  - Configures the pull-up and pull-down resistors for the GPIO pin in input mode.
- **GPIOx_IDR**
  - Reads the input data from the GPIO pin in input mode.
- **GPIOx_ODR**
  - Writes the output data to the GPIO pin in output mode.