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Getting started with GPIO

This article explains what is GPIO and how to use it through examples

Contents

1 GPIO definition

GPIO stands for ***general purpose input/output***. It is a type of pin found on an integrated circuit that does not have a specific function. While most pins have a dedicated purpose, such as sending a signal to a certain component, the function of a GPIO pin is customizable and can be controlled by the software.

2 Configure GPIO for LED toggling

2.1 Objective

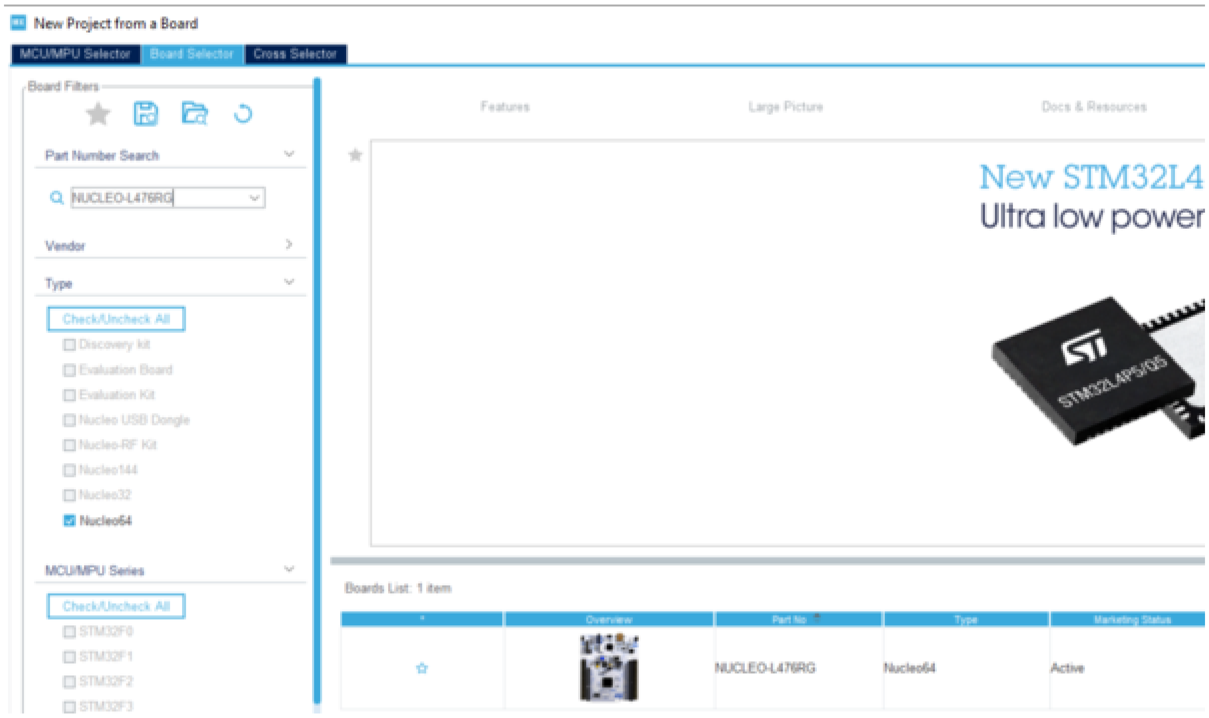
- Learn how to setup the pin and GPIO port in STM32CubeMX
- Modify the code generated by STM32CubeMX and use the HAL functions

2.2 How

- Configure the GPIO pin in STM32CubeMX and generate the code
- Add into the project the HAL_Delay function and HAL_GPIO_Toggle function
- Verify the correct functionality on toggling LED

2.3 Create the project in STM32CubeMX

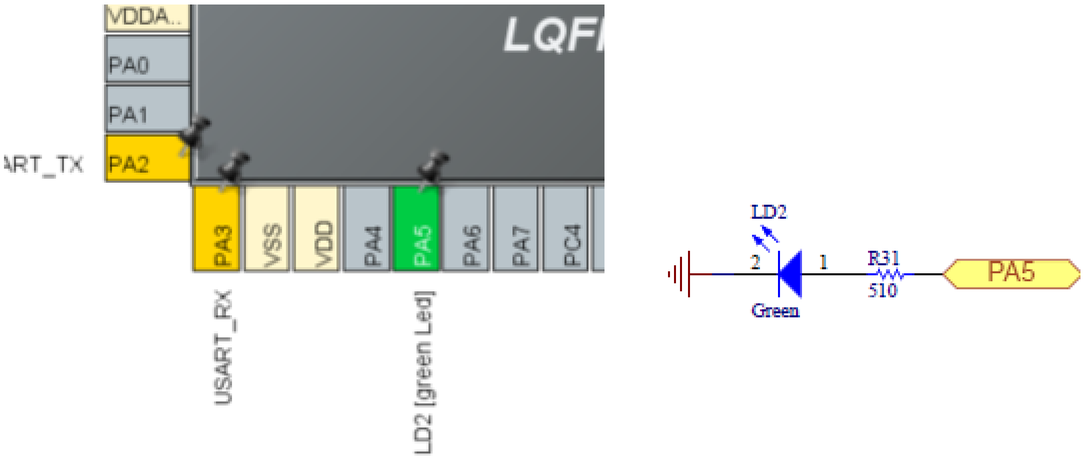
- ***New project*** > ***Access to board selector*** on main panel or ***Menu*** > ***File*** > ***New Project***
- Select NUCLEO-L476RG



Boards List: 1 item

*	Overview	Part No	Type	Marketing Status
☆		NUCLEO-L476RG	Nucleo64	Active

- If you want to start the project with a board, the LED pin is already selected (PA5 on NucleoL476RG. For other boards refer to the user manual)

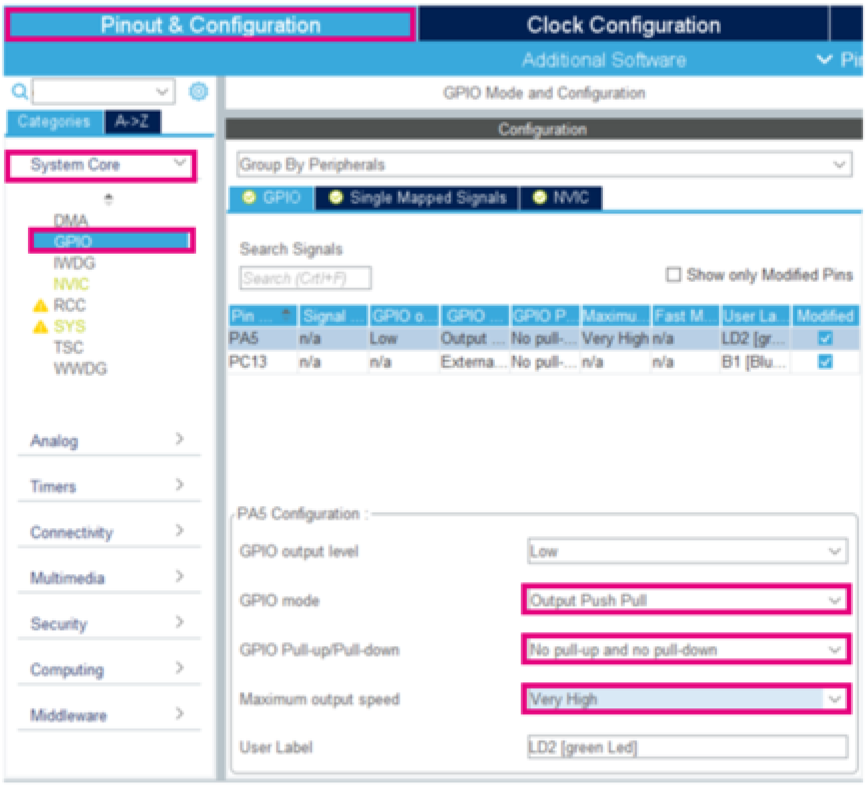


Note: During the download of a firmware package with STM32CubeMX, existing examples can be find at the following path for example:
c:\Users\YourUserName\STM32Cube\Repository\STM32Cube_FW_G0_V1.3.0\Projects\NUCLEO-

G071RB\Examples\GPIO\GPIO_IOToggle\GPIO_IOToggle.ioc and open them with STM32CubeMX.

2.3.1 GPIO configuration

- Select the push-pull mode
- No pull-up and pull-down
- Output speed set to very high is important for faster peripherals such as SPI or USART.



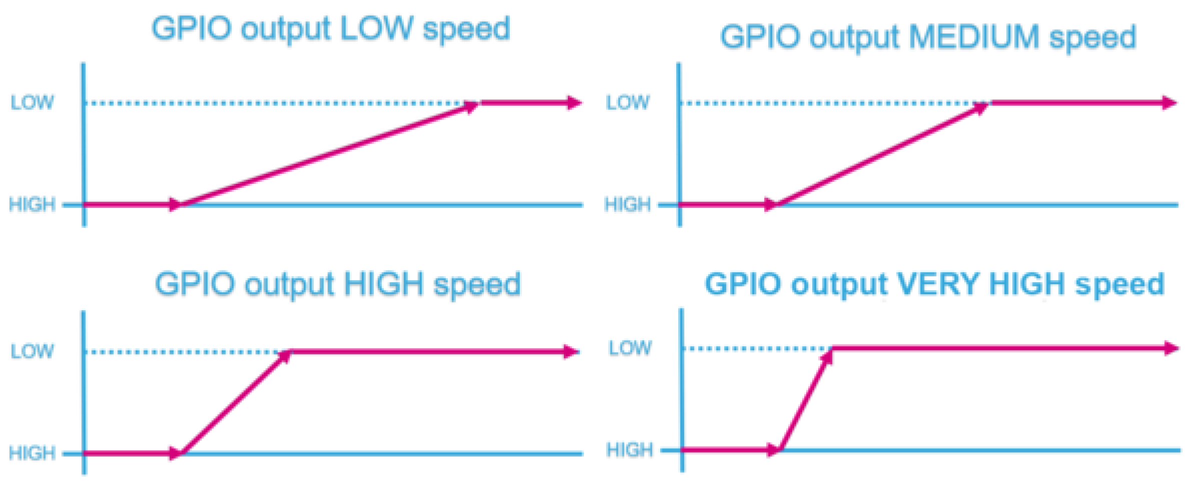
Pin ...	Signal ...	GPIO o...	GPIO ...	GPIO P...	Maximu...	Fast M...	User La...	Modified
PA5	n/a	Low	Output ...	No pull-...	Very High	n/a	LD2 [gr...	✓
PC13	n/a	n/a	Externa...	No pull-...	n/a	n/a	B1 [Blu...	✓

PA5 Configuration :

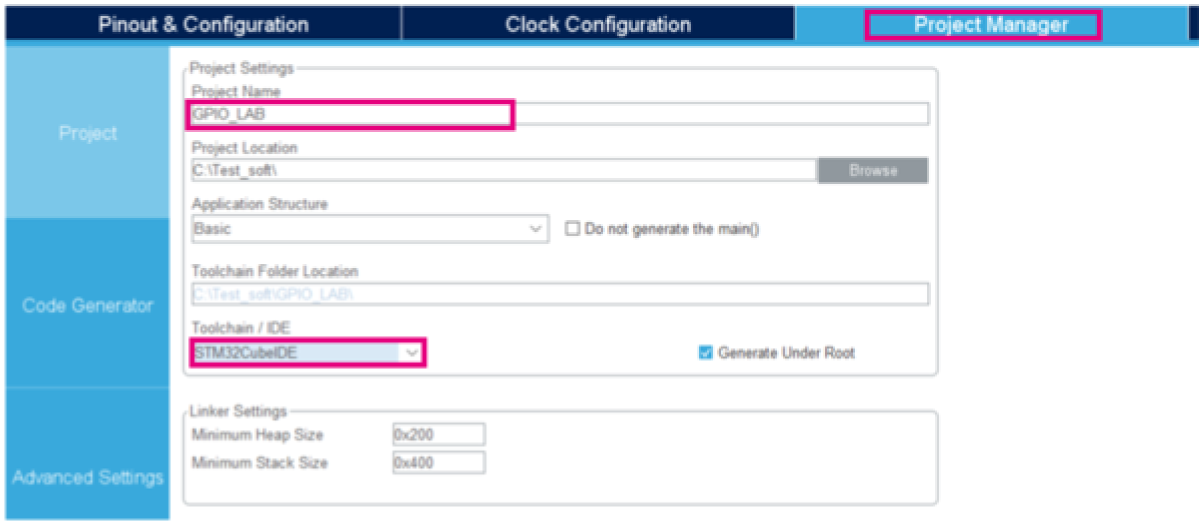
GPIO output level	Low
GPIO mode	Output Push Pull
GPIO Pull-up/Pull-down	No pull-up and no pull-down
Maximum output speed	Very High
User Label	LD2 [green Led]

2.3.2 GPIO (pin) output-speed configuration

- Change the rising and falling edge when the pin state changes from high to low or low to high.
- A higher GPIO speed increases the EMI noise from STM32 and increases the STM32 consumption.
- It is good to adapt the GPIO speed with the peripheral speed. For example toggling GPIO on 1 Hz is ***low*** optimal settings, but with SPI on 45 MHz the ***very high*** must be set..



2.3.3 Set the project details for generation



Project Settings

Project Name: GPIO_LAB

Project Location: C:\Test_soft\

Application Structure: Basic ☐ Do not generate the main()

Toolchain Folder Location: C:\Test_soft\GPIO_LAB\

Toolchain / IDE: STM32CubeIDE ☑ Generate Under Root

Linker Settings

Minimum Heap Size	0x200
Minimum Stack Size	0x400

2.3.4 Open the main.c in our IDE

- We do the LED toggling in a function inside ***main.c***

Information

Between **/* USER CODE BEGIN 3 */** and **/* USER CODE END 3 */** tags

```
/* USER CODE BEGIN 3 */
 /* Infinite loop */
 while (1)
 {
   HAL_GPIO_WritePin(GPIOG, GPIO_PIN_14, GPIO_PIN_SET);
   HAL_Delay(500);

   HAL_GPIO_WritePin(GPIOG, GPIO_PIN_14, GPIO_PIN_RESET);
   HAL_Delay(500);
 }
 /* USER CODE END 3 */
```

2.4 Compile and flash

- Every 500 ms the green LED state changes.

Warning

All GPIOs are able to drive 5 V and 3 V in input mode, but they are only able to generate 3 V in output push-pull mode