

1. Description

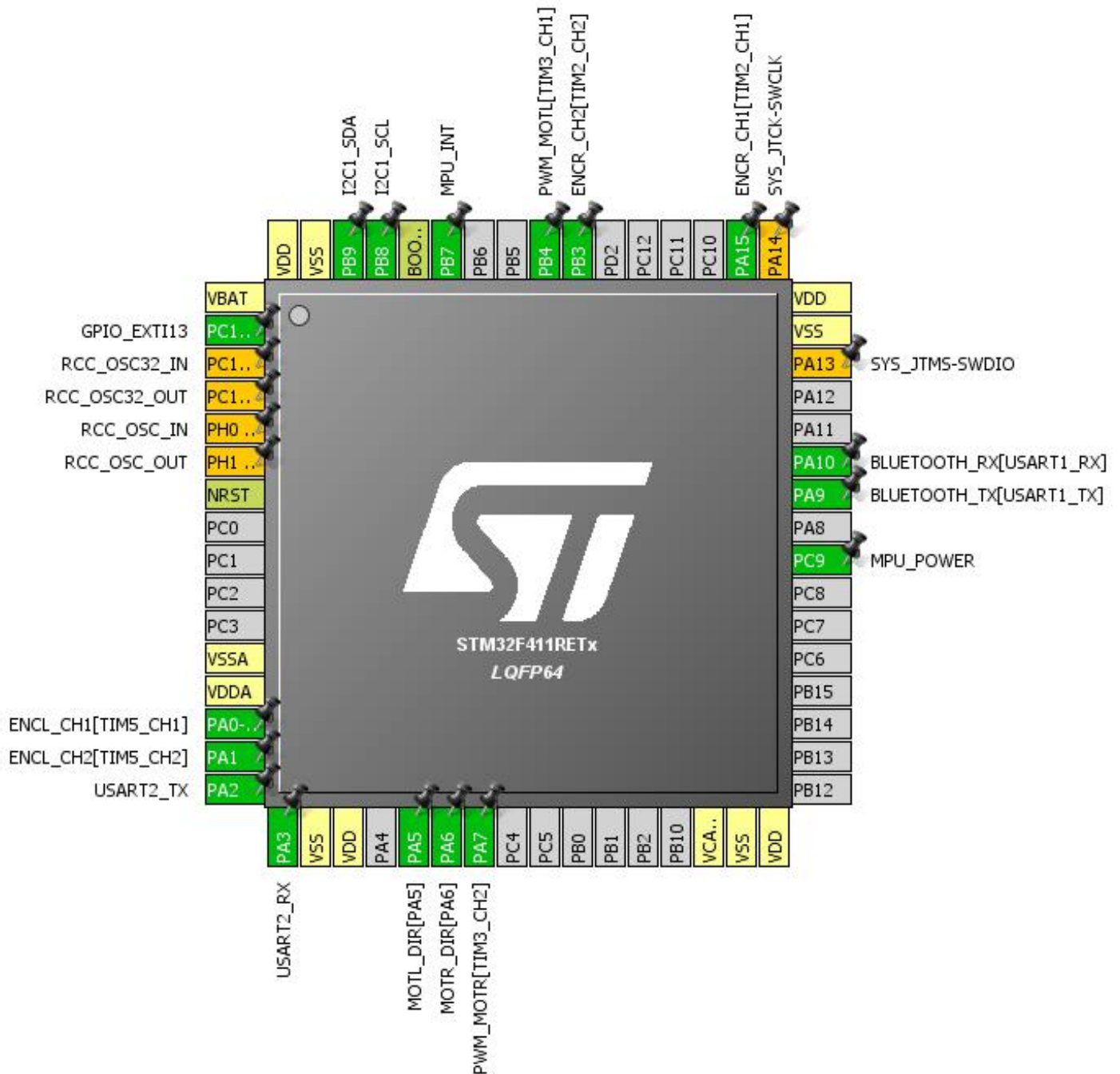
1.1. Project

| | |
|-----------------|--------------------|
| Project Name | CubeBot |
| Board Name | NUCLEO-F411RE |
| Generated with: | STM32CubeMX 4.22.1 |
| Date | 10/21/2018 |

1.2. MCU

| | |
|----------------|---------------|
| MCU Series | STM32F4 |
| MCU Line | STM32F411 |
| MCU name | STM32F411RETx |
| MCU Package | LQFP64 |
| MCU Pin number | 64 |

2. Pinout Configuration



3. Pins Configuration

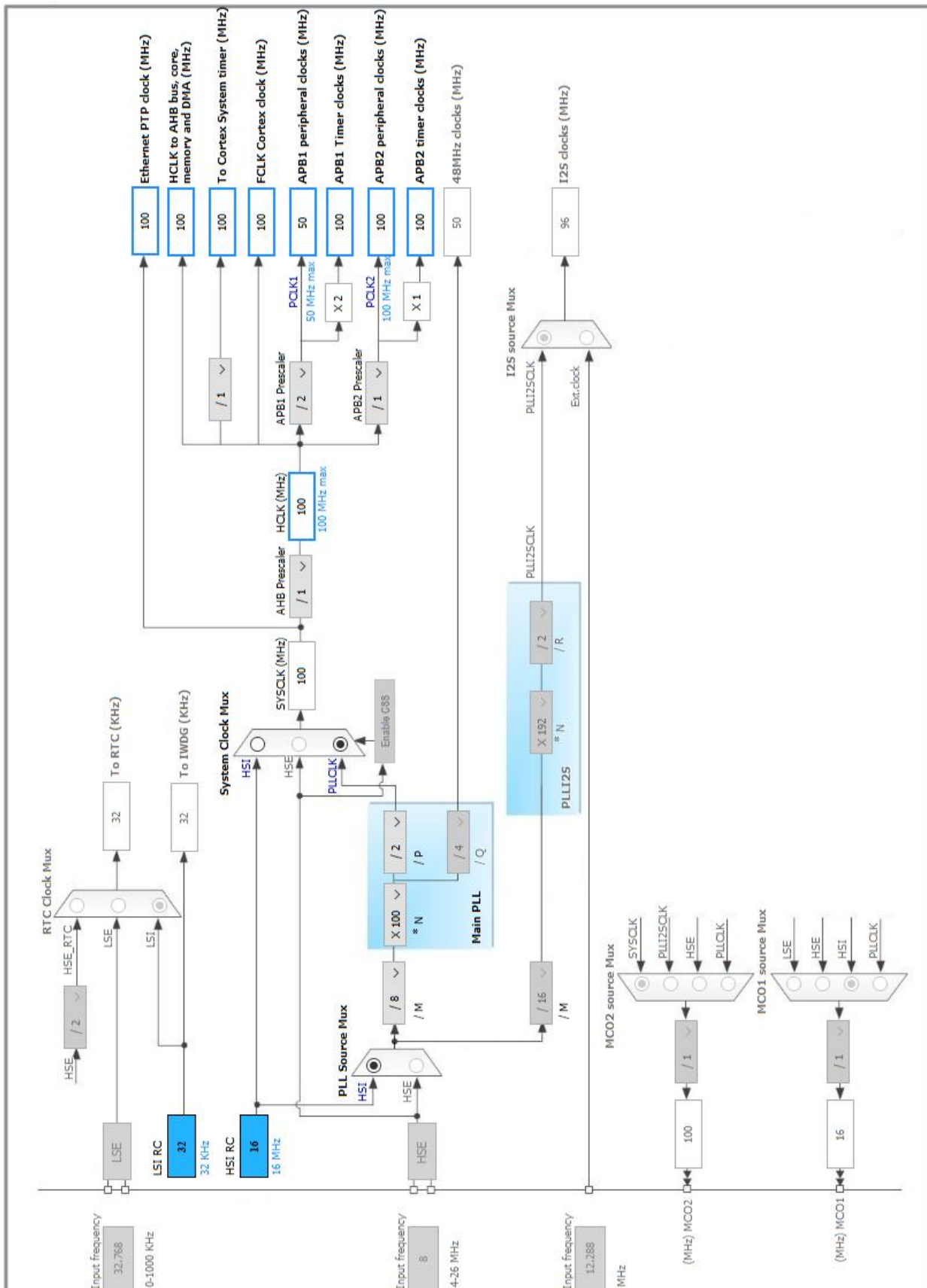
| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|----------------------|---------------------------------------|----------|--------------------------|-------------------------|
| 1 | VBAT | Power | | |
| 2 | PC13-ANTI_TAMP | I/O | GPIO_EXTI13 | |
| 3 | PC14-OSC32_IN * | I/O | RCC_OSC32_IN | |
| 4 | PC15-OSC32_OUT * | I/O | RCC_OSC32_OUT | |
| 5 | PH0 - OSC_IN * | I/O | RCC_OSC_IN | |
| 6 | PH1 - OSC_OUT * | I/O | RCC_OSC_OUT | |
| 7 | NRST | Reset | | |
| 12 | VSSA | Power | | |
| 13 | VDDA | Power | | |
| 14 | PA0-WKUP | I/O | TIM5_CH1 | ENCL_CH1[TIM5_CH1] |
| 15 | PA1 | I/O | TIM5_CH2 | ENCL_CH2[TIM5_CH2] |
| 16 | PA2 | I/O | USART2_TX | |
| 17 | PA3 | I/O | USART2_RX | |
| 18 | VSS | Power | | |
| 19 | VDD | Power | | |
| 21 | PA5 ** | I/O | GPIO_Output | MOTL_DIR[PA5] |
| 22 | PA6 ** | I/O | GPIO_Output | MOTR_DIR[PA6] |
| 23 | PA7 | I/O | TIM3_CH2 | PWM_MOTR[TIM3_CH2] |
| 30 | VCAP1 | Power | | |
| 31 | VSS | Power | | |
| 32 | VDD | Power | | |
| 40 | PC9 ** | I/O | GPIO_Output | MPU_POWER |
| 42 | PA9 | I/O | USART1_TX | BLUETOOTH_TX[USART1_TX] |
| 43 | PA10 | I/O | USART1_RX | BLUETOOTH_RX[USART1_RX] |
| 46 | PA13 * | I/O | SYS_JTMS-SWDIO | |
| 47 | VSS | Power | | |
| 48 | VDD | Power | | |
| 49 | PA14 * | I/O | SYS_JTCK-SWCLK | |
| 50 | PA15 | I/O | TIM2_CH1 | ENCR_CH1[TIM2_CH1] |
| 55 | PB3 | I/O | TIM2_CH2 | ENCR_CH2[TIM2_CH2] |
| 56 | PB4 | I/O | TIM3_CH1 | PWM_MOTL[TIM3_CH1] |
| 59 | PB7 ** | I/O | GPIO_Input | MPU_INT |
| 60 | BOOT0 | Boot | | |
| 61 | PB8 | I/O | I2C1_SCL | |

| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|----------------------|---------------------------------------|----------|--------------------------|-------|
| 62 | PB9 | I/O | I2C1_SDA | |
| 63 | VSS | Power | | |
| 64 | VDD | Power | | |

** The pin is affected with an I/O function

* The pin is affected with a peripheral function but no peripheral mode is activated

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. I2C1

I2C: I2C

5.1.1. Parameter Settings:

Master Features:

| | |
|----------------------|---------------------------|
| I2C Speed Mode | Fast Mode * |
| I2C Clock Speed (Hz) | 400000 |
| Fast Mode Duty Cycle | Duty cycle Tlow/Thigh = 2 |

Slave Features:

| | |
|----------------------------------|----------|
| Clock No Stretch Mode | Disabled |
| Primary Address Length selection | 7-bit |
| Dual Address Acknowledged | Disabled |
| Primary slave address | 0 |
| General Call address detection | Disabled |

5.2. SYS

Timebase Source: SysTick

5.3. TIM1

Clock Source : Internal Clock

5.3.1. Parameter Settings:

Counter Settings:

| | |
|---|----------------|
| Prescaler (PSC - 16 bits value) | 79 * |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value) | 65535 * |
| Internal Clock Division (CKD) | No Division |
| Repetition Counter (RCR - 8 bits value) | 0 |

Trigger Output (TRGO) Parameters:

| | |
|-------------------|--|
| Master/Slave Mode | Enable (sync between this TIM (Master) and its Slaves (through TRGO)) * |
|-------------------|--|

Trigger Event Selection

Update Event *

5.4. TIM2

Combined Channels: Encoder Mode

5.4.1. Parameter Settings:

Counter Settings:

| | |
|---|---------------------|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 32 bits value) | 4294967295 * |
| Internal Clock Division (CKD) | No Division |

Trigger Output (TRGO) Parameters:

| | |
|-------------------------|---|
| Master/Slave Mode | Disable (no sync between this TIM (Master) and its Slaves |
| Trigger Event Selection | Reset (UG bit from TIMx_EGR) |

Encoder:

Encoder Mode

Encoder Mode TI1 and TI2 *

____ Parameters for Channel 1 ____

| | |
|--------------------------|-------------|
| Polarity | Rising Edge |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter | 0 |

____ Parameters for Channel 2 ____

| | |
|--------------------------|-------------|
| Polarity | Rising Edge |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter | 0 |

5.5. TIM3

Clock Source : Internal Clock

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

5.5.1. Parameter Settings:

Counter Settings:

| | |
|---|----------------|
| Prescaler (PSC - 16 bits value) | 9 * |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value) | 65535 * |
| Internal Clock Division (CKD) | No Division |

Trigger Output (TRGO) Parameters:

| | |
|-------------------------|--|
| Master/Slave Mode | Disable (no sync between this TIM (Master) and its Slaves) |
| Trigger Event Selection | Reset (UG bit from TIMx_EGR) |

PWM Generation Channel 1:

| | |
|-----------------------|------------|
| Mode | PWM mode 1 |
| Pulse (16 bits value) | 0 |
| Fast Mode | Disable |
| CH Polarity | High |

PWM Generation Channel 2:

| | |
|-----------------------|------------|
| Mode | PWM mode 1 |
| Pulse (16 bits value) | 0 |
| Fast Mode | Disable |
| CH Polarity | High |

5.6. TIM4

Slave Mode: External Clock Mode 1

Trigger Source: ITR0

5.6.1. Parameter Settings:

Counter Settings:

| | |
|---|----------------|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value) | 65535 * |
| Internal Clock Division (CKD) | No Division |
| Slave Mode Controller | ETR mode 1 |

Trigger Output (TRGO) Parameters:

| | |
|-------------------------|--|
| Master/Slave Mode | Disable (no sync between this TIM (Master) and its Slaves) |
| Trigger Event Selection | Reset (UG bit from TIMx_EGR) |

5.7. TIM5

Combined Channels: Encoder Mode

5.7.1. Parameter Settings:

Counter Settings:

| | |
|---|---------------------|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 32 bits value) | 4294967295 * |
| Internal Clock Division (CKD) | No Division |

Trigger Output (TRGO) Parameters:

| | |
|-------------------------|--|
| Master/Slave Mode | Disable (no sync between this TIM (Master) and its Slaves) |
| Trigger Event Selection | Reset (UG bit from TIMx_EGR) |

Encoder:

Encoder Mode

Encoder Mode TI1 and TI2 *

____ Parameters for Channel 1 ____

| | |
|--------------------------|-------------|
| Polarity | Rising Edge |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter | 0 |

____ Parameters for Channel 2 ____

| | |
|--------------------------|-------------|
| Polarity | Rising Edge |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter | 0 |

5.8. USART1

Mode: Asynchronous

5.8.1. Parameter Settings:

Basic Parameters:

| | |
|-------------|---------------------------|
| Baud Rate | 115200 |
| Word Length | 8 Bits (including Parity) |
| Parity | None |
| Stop Bits | 1 |

Advanced Parameters:

| | |
|----------------|----------------------|
| Data Direction | Receive and Transmit |
| Over Sampling | 16 Samples |

5.9. USART2

Mode: Asynchronous

5.9.1. Parameter Settings:

Basic Parameters:

| | |
|-------------|---------------------------|
| Baud Rate | 115200 |
| Word Length | 8 Bits (including Parity) |
| Parity | None |
| Stop Bits | 1 |

Advanced Parameters:

| | |
|----------------|----------------------|
| Data Direction | Receive and Transmit |
| Over Sampling | 16 Samples |

* User modified value

6. System Configuration

6.1. GPIO configuration

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|-----------------------|----------------|----------------|--|-----------------------------|-------------|--------------------------|
| I2C1 | PB8 | I2C1_SCL | Alternate Function Open Drain | Pull-up | Very High * | |
| | PB9 | I2C1_SDA | Alternate Function Open Drain | Pull-up | Very High * | |
| TIM2 | PA15 | TIM2_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | ENCR_CH1[TIM2_CH1] |
| | PB3 | TIM2_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | ENCR_CH2[TIM2_CH2] |
| TIM3 | PA7 | TIM3_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM_MOTR[TIM3_CH2] |
| | PB4 | TIM3_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWM_MOTL[TIM3_CH1] |
| TIM5 | PA0-WKUP | TIM5_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | ENCL_CH1[TIM5_CH1] |
| | PA1 | TIM5_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | ENCL_CH2[TIM5_CH2] |
| USART1 | PA9 | USART1_TX | Alternate Function Push Pull | Pull-up | Very High * | BLUETOOTH_TX[USART 1_TX] |
| | PA10 | USART1_RX | Alternate Function Push Pull | Pull-up | Very High * | BLUETOOTH_RX[USART 1_RX] |
| USART2 | PA2 | USART2_TX | Alternate Function Push Pull | Pull-up | Very High * | |
| | PA3 | USART2_RX | Alternate Function Push Pull | Pull-up | Very High * | |
| Single Mapped Signals | PC14-OSC32_IN | RCC_OSC32_IN | n/a | n/a | n/a | |
| | PC15-OSC32_OUT | RCC_OSC32_OUT | n/a | n/a | n/a | |
| | PH0 - OSC_IN | RCC_OSC_IN | n/a | n/a | n/a | |
| | PH1 - OSC_OUT | RCC_OSC_OUT | n/a | n/a | n/a | |
| | PA13 | SYS_JTMS-SWDIO | n/a | n/a | n/a | |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | |
| GPIO | PC13-ANTI_TAMP | GPIO_EXTI13 | External Interrupt Mode with Rising edge trigger detection | No pull-up and no pull-down | n/a | |
| | PA5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | MOTL_DIR[PA5] |
| | | | | | | |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|----|-----|-------------|------------------|-----------------------------|---------------|---------------|
| | PA6 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | MOTR_DIR[PA6] |
| | PC9 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | High * | MPU_POWER |
| | PB7 | GPIO_Input | Input mode | Pull-up * | n/a | MPU_INT |

6.2. DMA configuration

nothing configured in DMA service

6.3. NVIC configuration

| Interrupt Table | Enable | Preenmption Priority | SubPriority |
|--|--------|----------------------|-------------|
| Non maskable interrupt | true | 0 | 0 |
| Hard fault interrupt | true | 0 | 0 |
| Memory management fault | true | 0 | 0 |
| Pre-fetch fault, memory access fault | true | 0 | 0 |
| Undefined instruction or illegal state | true | 0 | 0 |
| System service call via SWI instruction | true | 0 | 0 |
| Debug monitor | true | 0 | 0 |
| Pendable request for system service | true | 0 | 0 |
| System tick timer | true | 0 | 0 |
| I2C1 event interrupt | true | 0 | 0 |
| USART1 global interrupt | true | 0 | 0 |
| USART2 global interrupt | true | 0 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| TIM1 break interrupt and TIM9 global interrupt | unused | | |
| TIM1 update interrupt and TIM10 global interrupt | unused | | |
| TIM1 trigger and commutation interrupts and TIM11 global interrupt | unused | | |
| TIM1 capture compare interrupt | unused | | |
| TIM2 global interrupt | unused | | |
| TIM3 global interrupt | unused | | |
| TIM4 global interrupt | unused | | |
| I2C1 error interrupt | unused | | |
| EXTI line[15:10] interrupts | unused | | |
| TIM5 global interrupt | unused | | |
| FPU global interrupt | unused | | |

* User modified value

7. Power Consumption Calculator report

7.1. Microcontroller Selection

| | |
|-----------|---------------|
| Series | STM32F4 |
| Line | STM32F411 |
| MCU | STM32F411RETx |
| Datasheet | 026289_Rev6 |

7.2. Parameter Selection

| | |
|-------------|------|
| Temperature | 25 |
| Vdd | null |

8. Software Project

8.1. Project Settings

| Name | Value |
|-----------------------------------|---|
| Project Name | CubeBot |
| Project Folder | C:\Users\joel\Documents\electronique\STM32_Projects\CubeBot |
| Toolchain / IDE | TrueSTUDIO |
| Firmware Package Name and Version | STM32Cube FW_F4 V1.16.0 |

8.2. Code Generation Settings

| Name | Value |
|---|---------------------------------------|
| STM32Cube Firmware Library Package | Copy only the necessary library files |
| Generate peripheral initialization as a pair of '.c/.h' files | Yes |
| Backup previously generated files when re-generating | Yes |
| Delete previously generated files when not re-generated | No |
| Set all free pins as analog (to optimize the power consumption) | No |