# 1. Description

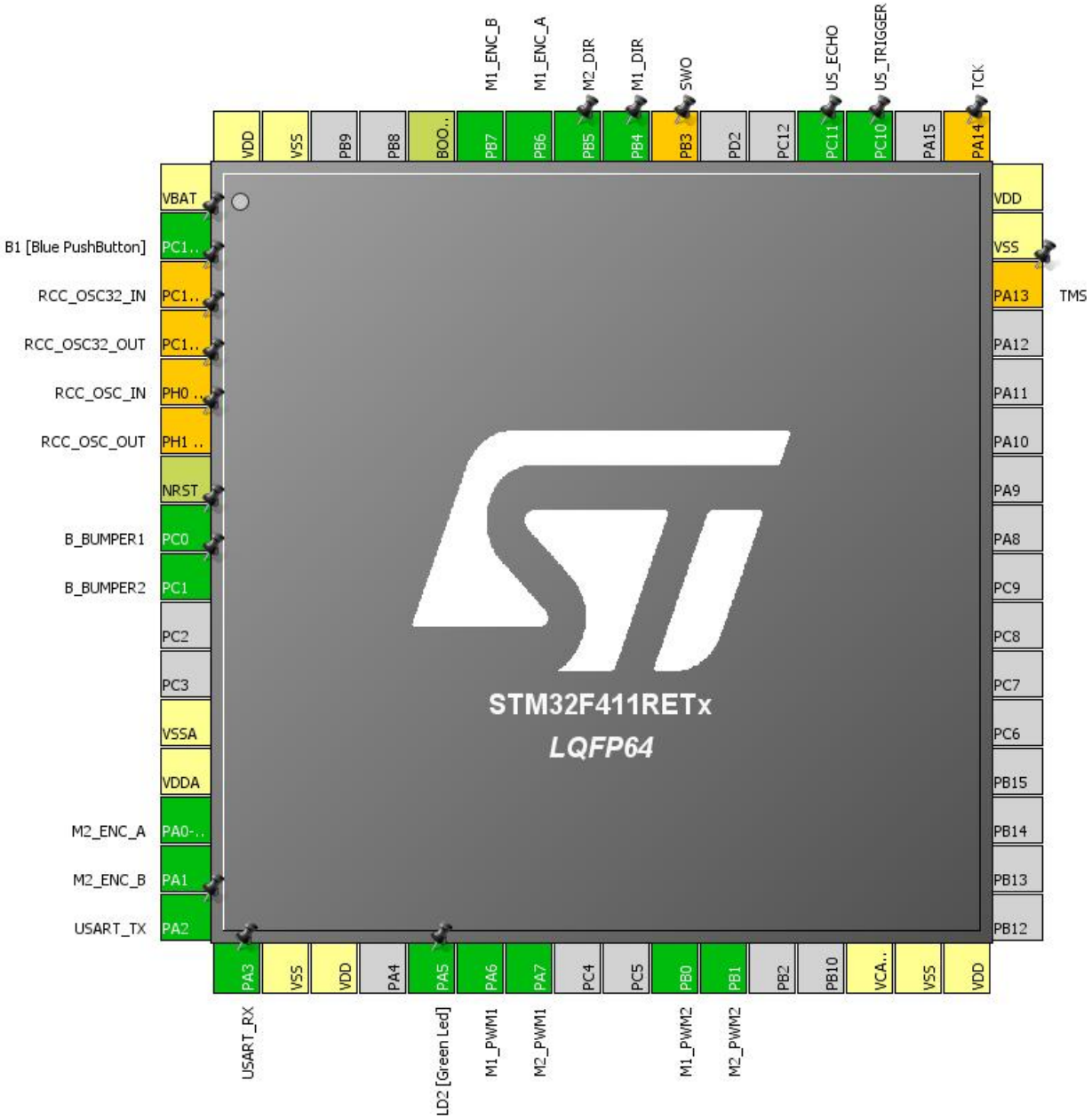
## 1.1. Project

| | |
|---|---|
| Project Name | mprojbot01 |
| Board Name | NUCLEO-F411RE |
| Generated with: | STM32CubeMX 4.23.0 |
| Date | 12/26/2018 |

## 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

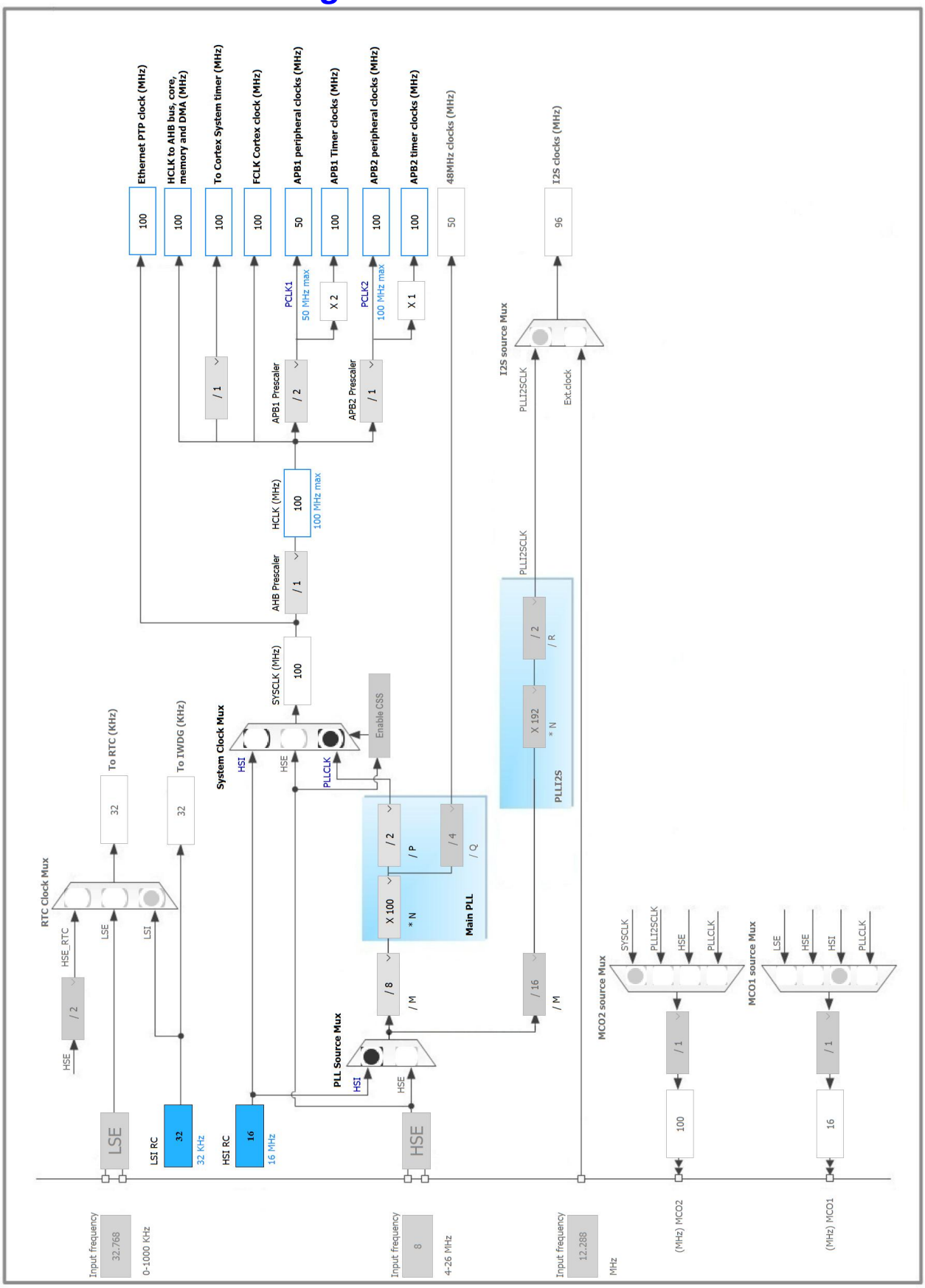
| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 1 | VBAT | Power | | |
| 2 | PC13-ANTI_TAMP | I/O | GPIO_EXTI13 | B1 [Blue PushButton] |
| 3 | PC14-OSC32_IN * | I/O | RCC_OSC32_IN | |
| 4 | PC15-OSC32_OUT * | I/O | RCC_OSC32_OUT | |
| 5 | PH0 - OSC_IN * | I/O | RCC_OSC_IN | |
| 6 | PH1 - OSC_OUT * | I/O | RCC_OSC_OUT | |
| 7 | NRST | Reset | | |
| 8 | PC0 ** | I/O | GPIO_Input | B_BUMPER1 |
| 9 | PC1 ** | I/O | GPIO_Input | B_BUMPER2 |
| 12 | VSSA | Power | | |
| 13 | VDDA | Power | | |
| 14 | PA0-WKUP | I/O | TIM5_CH1 | M2_ENC_A |
| 15 | PA1 | I/O | TIM5_CH2 | M2_ENC_B |
| 16 | PA2 | I/O | USART2_TX | USART_TX |
| 17 | PA3 | I/O | USART2_RX | USART_RX |
| 18 | VSS | Power | | |
| 19 | VDD | Power | | |
| 21 | PA5 ** | I/O | GPIO_Output | LD2 [Green Led] |
| 22 | PA6 | I/O | TIM3_CH1 | M1_PWM1 |
| 23 | PA7 | I/O | TIM3_CH2 | M2_PWM1 |
| 26 | PB0 | I/O | TIM3_CH3 | M1_PWM2 |
| 27 | PB1 | I/O | TIM3_CH4 | M2_PWM2 |
| 30 | VCAP1 | Power | | |
| 31 | VSS | Power | | |
| 32 | VDD | Power | | |
| 46 | PA13 * | I/O | SYS_JTMS-SWDIO | TMS |
| 47 | VSS | Power | | |
| 48 | VDD | Power | | |
| 49 | PA14 * | I/O | SYS_JTCK-SWCLK | TCK |
| 51 | PC10 ** | I/O | GPIO_Output | US_TRIGGER |
| 52 | PC11 | I/O | GPIO_EXTI11 | US_ECHO |
| 55 | PB3 * | I/O | SYS_JTDO-SWO | SWO |
| 56 | PB4 ** | I/O | GPIO_Output | M1_DIR |
| 57 | PB5 ** | I/O | GPIO_Output | M2_DIR |
| 58 | PB6 | I/O | TIM4_CH1 | M1_ENC_A |
| 59 | PB7 | I/O | TIM4_CH2 | M1_ENC_B |

| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 60 | BOOT0 | Boot | | |
| 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. SYS

**Timebase Source: SysTick**

## 5.2. TIM2

**Clock Source : Internal Clock**

### 5.2.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **10 *** |
| 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) |

## 5.3. TIM3

**Channel1: PWM Generation CH1**
**Channel2: PWM Generation CH2**
**Channel3: PWM Generation CH3**
**Channel4: PWM Generation CH4**

### 5.3.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **4096 *** |
| 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 |

**PWM Generation Channel 3:**

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

**PWM Generation Channel 4:**

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

## *5.4. TIM4*

## Combined Channels: Encoder Mode

### 5.4.1. 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 |

**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. TIM5

### Combined Channels: Encoder Mode

### 5.5.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 32 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) |

**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 |

## 5.6. USART2

### Mode: Asynchronous

## 5.6.1. 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 |
|---|---|---|---|---|---|---|
| TIM3 | PA6 | TIM3_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M1_PWM1 |
| | PA7 | TIM3_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M2_PWM1 |
| | PB0 | TIM3_CH3 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M1_PWM2 |
| | PB1 | TIM3_CH4 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M2_PWM2 |
| TIM4 | PB6 | TIM4_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M1_ENC_A |
| | PB7 | TIM4_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M1_ENC_B |
| TIM5 | PA0-WKUP | TIM5_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M2_ENC_A |
| | PA1 | TIM5_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | M2_ENC_B |
| USART2 | PA2 | USART2_TX | Alternate Function Push Pull | Pull-up | **Very High *** | USART_TX |
| | PA3 | USART2_RX | Alternate Function Push Pull | Pull-up | **Very High *** | USART_RX |
| 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 | TMS |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | TCK |
| | PB3 | SYS_JTDO-SWO | n/a | n/a | n/a | SWO |
| GPIO | PC13-ANTI_TAMP | GPIO_EXTI13 | **External Interrupt Mode with Falling edge trigger detection** | No pull-up and no pull-down | n/a | B1 [Blue PushButton] |
| | PC0 | GPIO_Input | Input mode | **Pull-up *** | n/a | B_BUMPER1 |
| | PC1 | GPIO_Input | Input mode | **Pull-up *** | n/a | B_BUMPER2 |
| | PA5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | LD2 [Green Led] |
| | PC10 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | US_TRIGGER |
| | PC11 | GPIO_EXTI11 | | No pull-up and no pull-down | n/a | US_ECHO |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| | | | **External Interrupt Mode with Rising/Falling edge** | | | |
| | PB4 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | M1_DIR |
| | PB5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | M2_DIR |

## *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 |
| USART2 global interrupt | true | 0 | 0 |
| EXTI line[15:10] interrupts | true | 0 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| TIM2 global interrupt | unused | | |
| TIM3 global interrupt | unused | | |
| TIM4 global interrupt | 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 | mprojbot01 |
| Project Folder | C:\Users\Adam\Documents\MyFiles\projects\mprojbot\firmware_stm\mprojbot01 |
| Toolchain / IDE | TrueSTUDIO |
| Firmware Package Name and Version | STM32Cube FW_F4 V1.18.0 |

## 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 | No |
| Backup previously generated files when re-generating | No |
| Delete previously generated files when not re-generated | Yes |
| Set all free pins as analog (to optimize the power consumption) | No |