
STM32
CubeMX

# 1. Description

## 1.1. Project

| | |
|---|---|
| Project Name | LineFollower |
| Board Name | NUCLEO-L476RG |
| Generated with: | STM32CubeMX 6.0.0 |
| Date | 12/08/2025 |

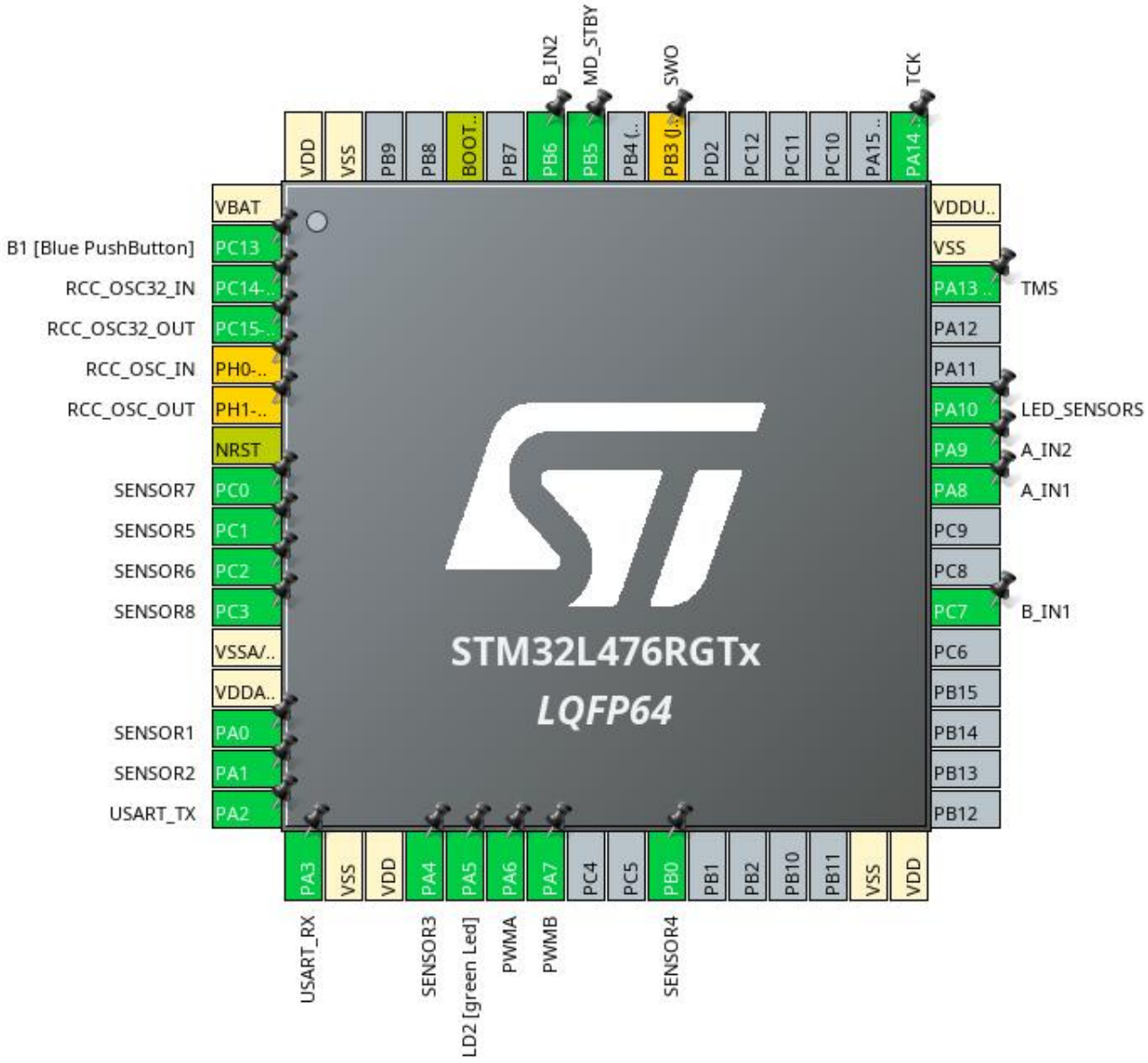
## 1.2. MCU

| | |
|---|---|
| MCU Series | STM32L4 |
| MCU Line | STM32L4x6 |
| MCU name | STM32L476RGTx |
| MCU Package | LQFP64 |
| MCU Pin number | 64 |

## 1.3. Core(s) information

| | |
|---|---|
| Core(s) | Arm Cortex-M4 |

## 2. Pinout Configuration



# 3. Pins Configuration

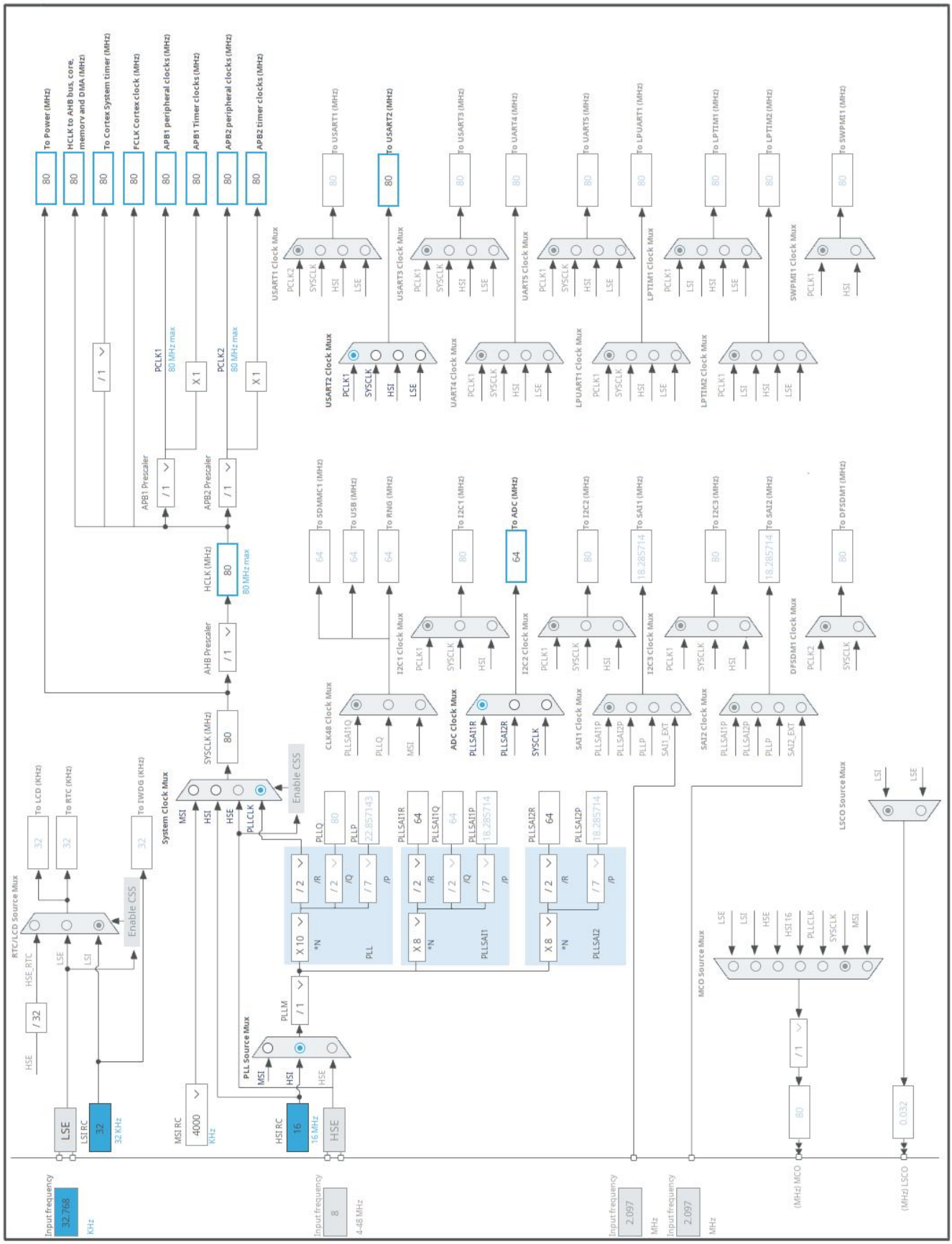
| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 1 | VBAT | Power | | |
| 2 | PC13 | I/O | GPIO_EXTI13 | B1 [Blue PushButton] |
| 3 | PC14-OSC32_IN (PC14) | I/O | RCC_OSC32_IN | |
| 4 | PC15-OSC32_OUT (PC15) | I/O | RCC_OSC32_OUT | |
| 5 | PH0-OSC_IN (PH0) * | I/O | RCC_OSC_IN | |
| 6 | PH1-OSC_OUT (PH1) * | I/O | RCC_OSC_OUT | |
| 7 | NRST | Reset | | |
| 8 | PC0 | I/O | ADC1_IN1 | SENSOR7 |
| 9 | PC1 | I/O | ADC1_IN2 | SENSOR5 |
| 10 | PC2 | I/O | ADC1_IN3 | SENSOR6 |
| 11 | PC3 | I/O | ADC1_IN4 | SENSOR8 |
| 12 | VSSA/VREF- | Power | | |
| 13 | VDDA/VREF+ | Power | | |
| 14 | PA0 | I/O | ADC1_IN5 | SENSOR1 |
| 15 | PA1 | I/O | ADC1_IN6 | SENSOR2 |
| 16 | PA2 | I/O | USART2_TX | USART_TX |
| 17 | PA3 | I/O | USART2_RX | USART_RX |
| 18 | VSS | Power | | |
| 19 | VDD | Power | | |
| 20 | PA4 | I/O | ADC1_IN9 | SENSOR3 |
| 21 | PA5 ** | I/O | GPIO_Output | LD2 [green Led] |
| 22 | PA6 | I/O | TIM3_CH1 | PWMA |
| 23 | PA7 | I/O | TIM3_CH2 | PWMB |
| 26 | PB0 | I/O | ADC1_IN15 | SENSOR4 |
| 31 | VSS | Power | | |
| 32 | VDD | Power | | |
| 38 | PC7 ** | I/O | GPIO_Output | B_IN1 |
| 41 | PA8 ** | I/O | GPIO_Output | A_IN1 |
| 42 | PA9 ** | I/O | GPIO_Output | A_IN2 |
| 43 | PA10 ** | I/O | GPIO_Output | LED_SENSORS |
| 46 | PA13 (JTMS-SWDIO) | I/O | SYS_JTMS-SWDIO | TMS |
| 47 | VSS | Power | | |
| 48 | VDDUSB | Power | | |
| 49 | PA14 (JTCK-SWCLK) | I/O | SYS_JTCK-SWCLK | TCK |
| 55 | PB3 (JTDO-TRACESWO) * | I/O | SYS_JTDO-SWO | SWO |
| 57 | PB5 ** | I/O | GPIO_Output | MD_STBY |

| Pin Number LQFP64 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 58 | PB6 ** | I/O | GPIO_Output | B_IN2 |
| 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. Software Project

## 5.1. Project Settings

| Name | Value |
|---|---|
| Project Name | LineFollower |
| Project Folder | /home/lukaszlysek/STM32CubeIDE/workspace_1.4.0/LineFollower |
| Toolchain / IDE | STM32CubeIDE |
| Firmware Package Name and Version | STM32Cube FW_L4 V1.16.0 |
| Application Structure | Advanced |
| Generate Under Root | Yes |
| Do not generate the main() | No |
| Minimum Heap Size | 0x200 |
| Minimum Stack Size | 0x400 |

## 5.2. Code Generation Settings

| Name | Value |
|---|---|
| STM32Cube MCU packages and embedded software | 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 |
| Keep User Code when re-generating | Yes |
| Delete previously generated files when not re-generated | Yes |
| Set all free pins as analog (to optimize the power consumption) | No |
| Enable Full Assert | No |

## 5.3. Advanced Settings - Generated Function Calls

| Rank | Function Name | IP Instance Name |
|---|---|---|
| 1 | MX_GPIO_Init | GPIO |
| 2 | MX_DMA_Init | DMA |
| 3 | SystemClock_Config | RCC |
| 4 | MX_USART2_UART_Init | USART2 |
| 5 | MX_ADC1_Init | ADC1 |
| 6 | MX_TIM3_Init | TIM3 |

# 6. Power Consumption Calculator report

## 6.1. Microcontroller Selection

| | |
|---|---|
| Series | STM32L4 |
| Line | STM32L4x6 |
| MCU | STM32L476RGTx |
| Datasheet | DS10198_Rev4 |

## 6.2. Parameter Selection

| | |
|---|---|
| Temperature | 25 |
| Vdd | 3.0 |

## 6.3. Battery Selection

| | |
|---|---|
| Battery | Li-SOCL2(A3400) |
| Capacity | 3400.0 mAh |
| Self Discharge | 0.08 %/month |
| Nominal Voltage | 3.6 V |
| Max Cont Current | 100.0 mA |
| Max Pulse Current | 200.0 mA |
| Cells in series | 1 |
| Cells in parallel | 1 |

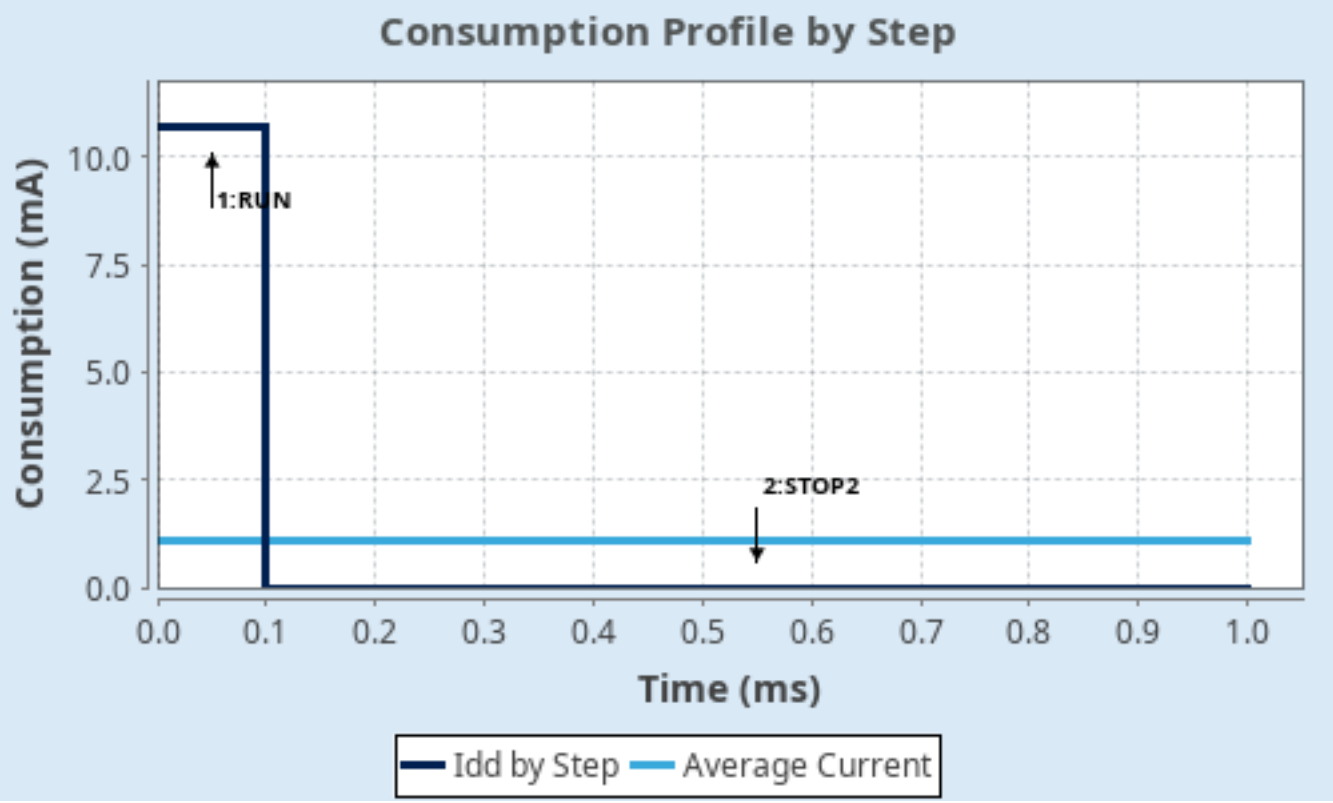
## 6.4. Sequence

| ***Step*** | Step1 | Step2 |
|---|---|---|
| ***Mode*** | RUN | STOP2 |
| ***Vdd*** | 3.0 | 3.0 |
| ***Voltage Source*** | Battery | Battery |
| ***Range*** | Range1-High | NoRange |
| ***Fetch Type*** | SRAM2 | n/a |
| ***CPU Frequency*** | 80 MHz | 0 Hz |
| ***Clock Configuration*** | HSE PLL | ALL CLOCKS OFF |
| ***Clock Source Frequency*** | 4 MHz | 0 Hz |
| ***Peripherals*** | | |
| ***Additional Cons.*** | 0 mA | 0 mA |
| ***Average Current*** | 10.7 mA | 1.18 µA |
| ***Duration*** | 0.1 ms | 0.9 ms |
| ***DMIPS*** | 100.0 | 0.0 |
| ***Ta Max*** | 103.56 | 105 |
| ***Category*** | In DS Table | In DS Table |

## 6.5. Results

| Sequence Time | 1 ms | Average Current | 1.07 mA |
|---|---|---|---|
| Battery Life | 4 months, 10 days, 3 hours | Average DMIPS | 100.0 DMIPS |

## 6.6. Chart


Consumption Profile by Step
Consumption (mA)
10.0
7.5
5.0
2.5
0.0
1:RUN
2:STOP2
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time (ms)
Idd by Step
Average Current

# 7. IPs and Middleware Configuration

## 7.1. ADC1

**IN1: IN1 Single-ended**

**IN2: IN2 Single-ended**

**IN3: IN3 Single-ended**

**IN4: IN4 Single-ended**

**IN5: IN5 Single-ended**

**IN6: IN6 Single-ended**

**IN9: IN9 Single-ended**

**IN15: IN15 Single-ended**

### 7.1.1. Parameter Settings:

**ADCs_Common_Settings:**

| | |
|---|---|
| Mode | Independent mode |

**ADC_Settings:**

| | |
|---|---|
| Clock Prescaler | **Asynchronous clock mode divided by 10 *** |
| Resolution | ADC 12-bit resolution |
| Data Alignment | Right alignment |
| Scan Conversion Mode | Enabled |
| Continuous Conversion Mode | **Enabled *** |
| Discontinuous Conversion Mode | Disabled |
| DMA Continuous Requests | **Enabled *** |
| End Of Conversion Selection | End of single conversion |
| Overrun behaviour | Overrun data preserved |
| Low Power Auto Wait | Disabled |

**ADC_Regular_ConversionMode:**

| | |
|---|---|
| Enable Regular Conversions | Enable |
| Enable Regular Oversampling | Disable |
| Number Of Conversion | **8 *** |
| External Trigger Conversion Source | Regular Conversion launched by software |
| External Trigger Conversion Edge | None |
| Rank | 1 |
| Channel | **Channel 5 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **2 *** |
| Channel | **Channel 6 *** |
| Sampling Time | **640.5 Cycles *** |

| | |
|---|---|
| Offset Number | No offset |
| Rank | **3 *** |
| Channel | **Channel 9 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **4 *** |
| Channel | **Channel 15 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **5 *** |
| Channel | **Channel 2 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **6 *** |
| Channel | **Channel 3 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **7 *** |
| Channel | Channel 1 |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |
| Rank | **8 *** |
| Channel | **Channel 4 *** |
| Sampling Time | **640.5 Cycles *** |
| Offset Number | No offset |

**ADC_Injected_ConversionMode:**

| | |
|---|---|
| Enable Injected Conversions | Disable |

**Analog Watchdog 1:**

| | |
|---|---|
| Enable Analog WatchDog1 Mode | false |

**Analog Watchdog 2:**

| | |
|---|---|
| Enable Analog WatchDog2 Mode | false |

**Analog Watchdog 3:**

| | |
|---|---|
| Enable Analog WatchDog3 Mode | false |

## 7.2. GPIO

## 7.3. RCC

### Low Speed Clock (LSE) : Crystal/Ceramic Resonator

#### 7.3.1. Parameter Settings:

**System Parameters:**

| | |
|---|---|
| VDD voltage (V) | 3.3 |
| Instruction Cache | Enabled |
| Prefetch Buffer | **Enabled *** |
| Data Cache | Enabled |
| Flash Latency(WS) | 4 WS (5 CPU cycle) |

**RCC Parameters:**

| | |
|---|---|
| HSI Calibration Value | 16 |
| MSI Calibration Value | 0 |
| MSI Auto Calibration | Disabled |
| HSE Startup Timout Value (ms) | 100 |
| LSE Startup Timout Value (ms) | 5000 |

**Power Parameters:**

| | |
|---|---|
| Power Regulator Voltage Scale | Power Regulator Voltage Scale 1 |

## 7.4. SYS

### Debug: Serial Wire

### Timebase Source: SysTick

## 7.5. TIM3

### Clock Source : Internal Clock

### Channel1: PWM Generation CH1

### Channel2: PWM Generation CH2

#### 7.5.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **TIM3_PRESCALER *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **TIM3_PERIOD *** |
| Internal Clock Division (CKD) | No Division |
| auto-reload preload | Disable |

**Trigger Output (TRGO) Parameters:**

| | |
|---|---|
| Master/Slave Mode (MSM bit) | Disable (Trigger input effect not delayed) |

| | |
|---|---|
| Trigger Event Selection TRGO | Reset (UG bit from TIMx_EGR) |

**Clear Input:**

| | |
|---|---|
| Clear Input Source | Disable |

**PWM Generation Channel 1:**

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

**PWM Generation Channel 2:**

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

## 7.6. USART2

## Mode: Asynchronous

### 7.6.1. 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 |
| Single Sample | Disable |

**Advanced Features:**

| | |
|---|---|
| Auto Baudrate | Disable |
| TX Pin Active Level Inversion | Disable |
| RX Pin Active Level Inversion | Disable |
| Data Inversion | Disable |
| TX and RX Pins Swapping | Disable |
| Overrun | Enable |
| DMA on RX Error | Enable |
| MSB First | Disable |

*** User modified value**

# 8. System Configuration

## 8.1. GPIO configuration

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| ADC1 | PC0 | ADC1_IN1 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR7 |
| | PC1 | ADC1_IN2 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR5 |
| | PC2 | ADC1_IN3 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR6 |
| | PC3 | ADC1_IN4 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR8 |
| | PA0 | ADC1_IN5 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR1 |
| | PA1 | ADC1_IN6 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR2 |
| | PA4 | ADC1_IN9 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR3 |
| | PB0 | ADC1_IN15 | Analog mode for ADC conversion | No pull-up and no pull-down | n/a | SENSOR4 |
| RCC | PC14-OSC32_IN (PC14) | RCC_OSC32_IN | n/a | n/a | n/a | |
| | PC15-OSC32_OUT (PC15) | RCC_OSC32_OUT | n/a | n/a | n/a | |
| SYS | PA13 (JTMS-SWDIO) | SYS_JTMS-SWDIO | n/a | n/a | n/a | TMS |
| | PA14 (JTCK-SWCLK) | SYS_JTCK-SWCLK | n/a | n/a | n/a | TCK |
| TIM3 | PA6 | TIM3_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWMA |
| | PA7 | TIM3_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | Low | PWMB |
| USART2 | PA2 | USART2_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | USART_TX |
| | PA3 | USART2_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | USART_RX |
| Single Mapped Signals | PH0-OSC_IN (PH0) | RCC_OSC_IN | n/a | n/a | n/a | |
| | PH1-OSC_OUT (PH1) | RCC_OSC_OUT | n/a | n/a | n/a | |
| | PB3 (JTDO- | SYS_JTDO- | n/a | n/a | n/a | SWO |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| | TRACESWO) | SWO | | | | |
| GPIO | PC13 | GPIO_EXTI13 | **External Interrupt Mode with Falling edge trigger detection** | No pull-up and no pull-down | n/a | B1 [Blue PushButton] |
| | PA5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | LD2 [green Led] |
| | PC7 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | B_IN1 |
| | PA8 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | A_IN1 |
| | PA9 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | A_IN2 |
| | PA10 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | LED_SENSORS |
| | PB5 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | MD_STBY |
| | PB6 | GPIO_Output | Output Push Pull | No pull-up and no pull-down | Low | B_IN2 |

## 8.2. DMA configuration

| DMA request | Stream | Direction | Priority |
|---|---|---|---|
| ADC1 | DMA1_Channel1 | Peripheral To Memory | Low |

*ADC1: DMA1_Channel1 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Half Word |
| Memory Data Width: | Half Word |

## 8.3. NVIC configuration

### 8.3.1. NVIC

| Interrupt Table | Enable | Preenmption Priority | SubPriority |
|---|---|---|---|
| Non maskable interrupt | true | 0 | 0 |
| Hard fault interrupt | true | 0 | 0 |
| Memory management fault | true | 0 | 0 |
| Prefetch 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 |
| DMA1 channel1 global interrupt | true | 0 | 0 |
| PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| ADC1 and ADC2 interrupts | unused | | |
| TIM3 global interrupt | unused | | |
| USART2 global interrupt | unused | | |
| EXTI line[15:10] interrupts | unused | | |
| FPU global interrupt | unused | | |

### 8.3.2. NVIC Code generation

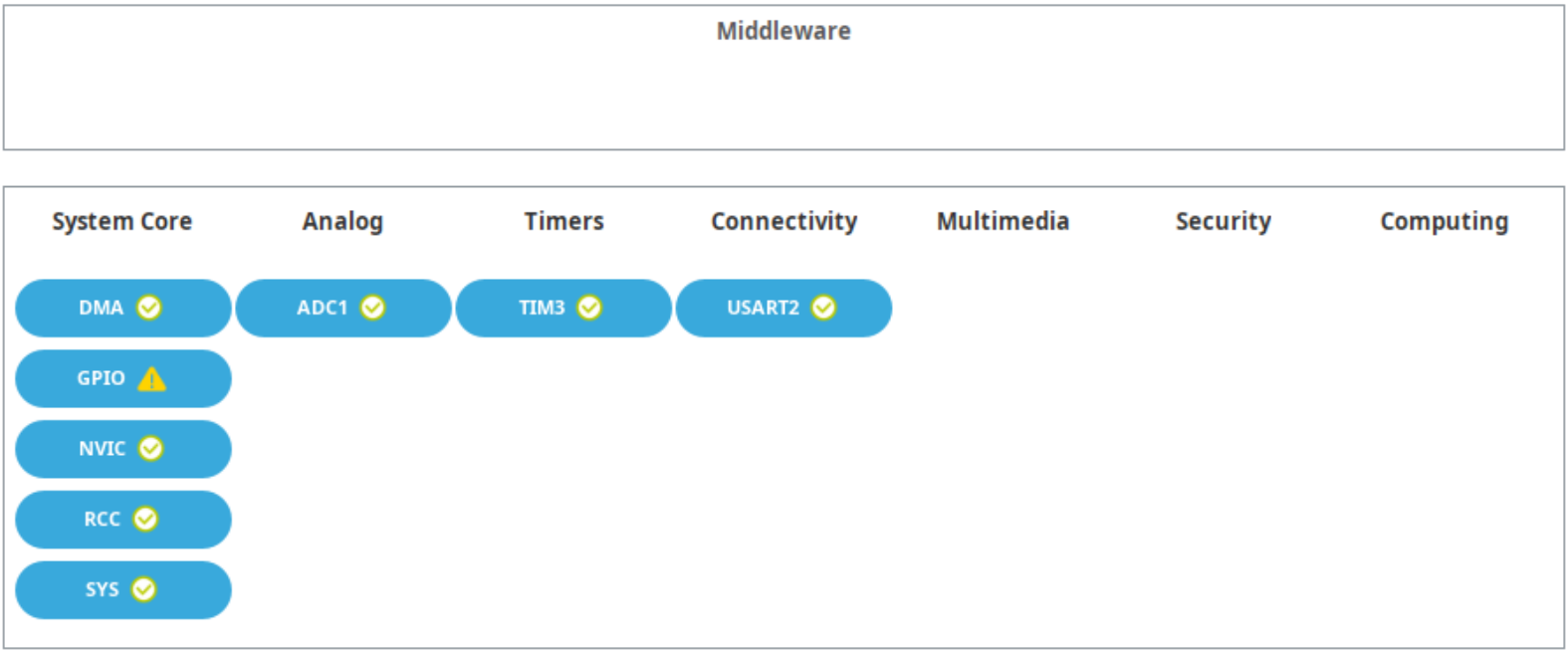
| Enabled interrupt Table | Select for init sequence ordering | Generate IRQ handler | Call HAL handler |
|---|---|---|---|
| Non maskable interrupt | true | true | false |
| Hard fault interrupt | true | true | false |
| Memory management fault | true | true | false |
| Prefetch fault, memory access fault | true | true | false |
| Undefined instruction or illegal state | true | true | false |
| System service call via SWI instruction | true | true | false |
| Debug monitor | true | true | false |
| Pendable request for system service | true | true | false |
| System tick timer | true | true | true |
| DMA1 channel1 global interrupt | true | true | true |

*** User modified value**

# 9. System Views

9.1. Category view

*9.1.1. Current*



## 10. Docs & Resources

| Type | Link |
|---|---|
| Datasheet | http://www.st.com/resource/en/datasheet/DM00108832.pdf |
| Reference manual | http://www.st.com/resource/en/reference_manual/DM00083560.pdf |
| Programming manual | http://www.st.com/resource/en/programming_manual/DM00046982.pdf |
| Errata sheet | http://www.st.com/resource/en/errata_sheet/DM00111498.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00160362.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00167594.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00211314.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00259245.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00264321.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00264342.pdf |
| Application note | http://www.st.com/resource/en/application_note/CD00264379.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00042534.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00072315.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00073742.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00073853.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00080497.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00081379.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00085385.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00087593.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00129215.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00151811.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00160482.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00156964.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00150423.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00209748.pdf |

| | |
|---|---|
| Application note | http://www.st.com/resource/en/application_note/DM00125306.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00141025.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00144612.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00148033.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00209768.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00216518.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00220769.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00227538.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00257177.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00269143.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00272912.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00223574.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00226326.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00236305.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00260952.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00263732.pdf |
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| Application note | http://www.st.com/resource/en/application_note/DM00373474.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00315319.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00371863.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00380469.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00354333.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00395696.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00445657.pdf |

| | |
|---|---|
| Application note | http://www.st.com/resource/en/application_note/DM00493651.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00536349.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00209772.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00476869.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00660597.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00725181.pdf |