
STM32
CubeMX

# 1. Description

## 1.1. Project

| | |
|---|---|
| Project Name | high-voltage |
| Board Name | custom |
| Generated with: | STM32CubeMX 6.4.0 |
| Date | 04/12/2022 |

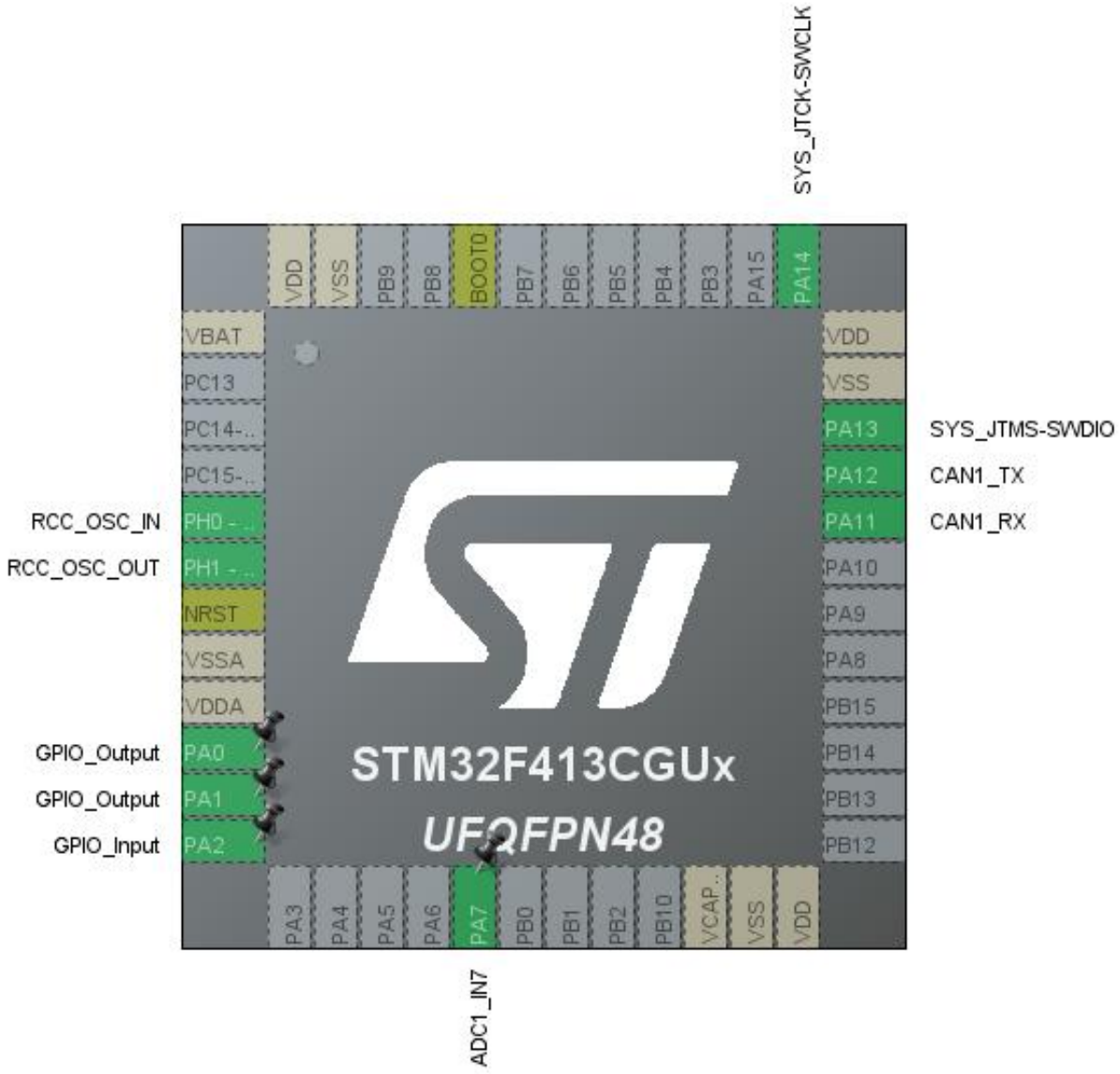
## 1.2. MCU

| | |
|---|---|
| MCU Series | STM32F4 |
| MCU Line | STM32F413/423 |
| MCU name | STM32F413CGUx |
| MCU Package | UFQFPN48 |
| MCU Pin number | 48 |

## 1.3. Core(s) information

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

## 2. Pinout Configuration

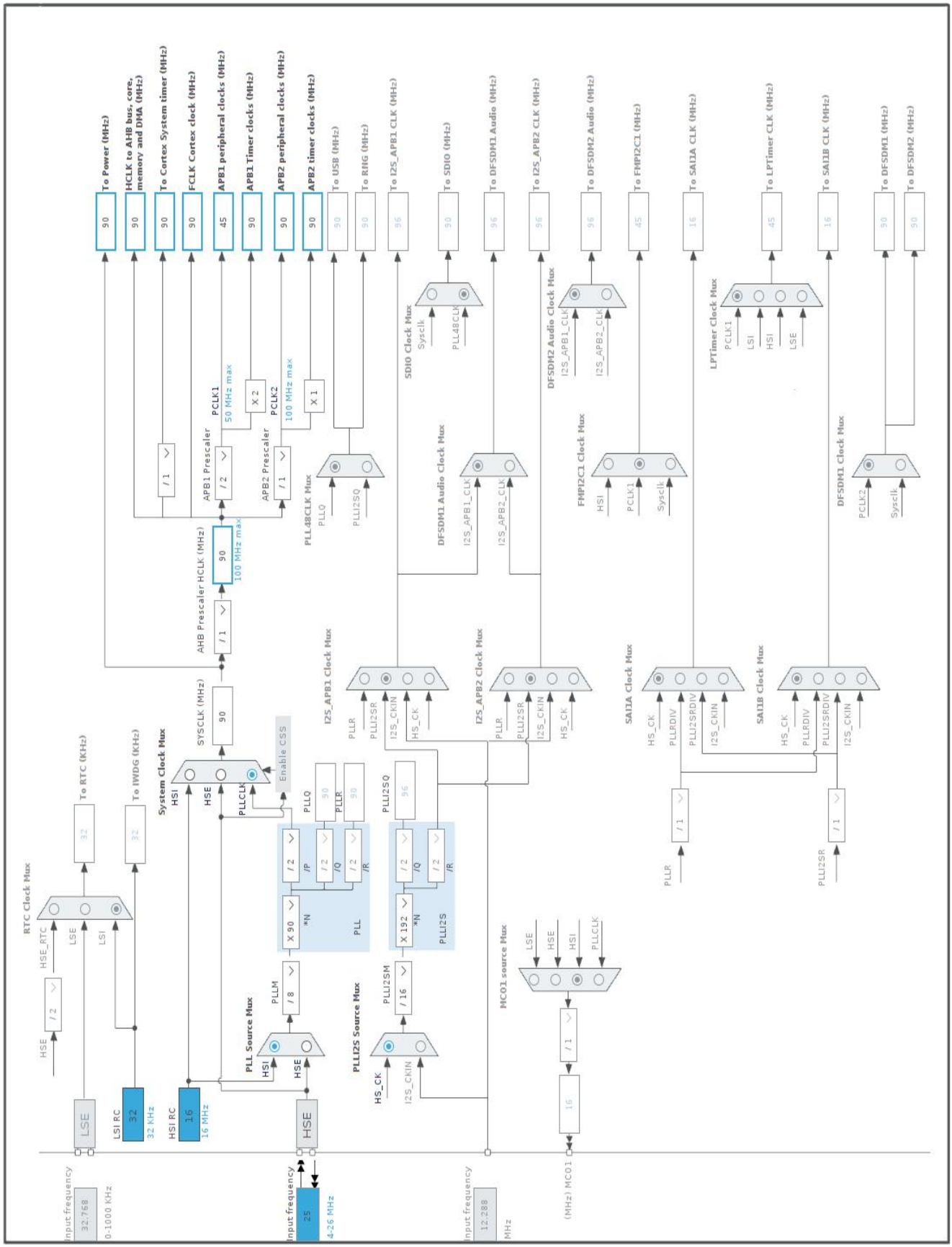


## 3. Pins Configuration

| Pin Number UFQFPN48 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 1 | VBAT | Power | | |
| 5 | PH0 - OSC_IN | I/O | RCC_OSC_IN | |
| 6 | PH1 - OSC_OUT | I/O | RCC_OSC_OUT | |
| 7 | NRST | Reset | | |
| 8 | VSSA | Power | | |
| 9 | VDDA | Power | | |
| 10 | PA0 * | I/O | GPIO_Output | |
| 11 | PA1 * | I/O | GPIO_Output | |
| 12 | PA2 * | I/O | GPIO_Input | |
| 17 | PA7 | I/O | ADC1_IN7 | |
| 22 | VCAP_1 | Power | | |
| 23 | VSS | Power | | |
| 24 | VDD | Power | | |
| 32 | PA11 | I/O | CAN1_RX | |
| 33 | PA12 | I/O | CAN1_TX | |
| 34 | PA13 | I/O | SYS_JTMS-SWDIO | |
| 35 | VSS | Power | | |
| 36 | VDD | Power | | |
| 37 | PA14 | I/O | SYS_JTCK-SWCLK | |
| 44 | BOOT0 | Boot | | |
| 47 | VSS | Power | | |
| 48 | VDD | Power | | |

* The pin is affected with an I/O function

# 4. Clock Tree Configuration



# 5. Software Project

## 5.1. Project Settings

| Name | Value |
|---|---|
| Project Name | high-voltage |
| Project Folder | /home/george/Documents/GitHub/AERO/AERO_2021-2022/HVB/high-voltage |
| Toolchain / IDE | Makefile |
| Firmware Package Name and Version | STM32Cube FW_F4 V1.26.2 |
| Application Structure | Advanced |
| Generate Under Root | No |
| 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 | Peripheral Instance Name |
|---|---|---|
| 1 | MX_GPIO_Init | GPIO |
| 2 | SystemClock_Config | RCC |
| 3 | MX_CAN1_Init | CAN1 |
| 4 | MX_DMA_Init | DMA |
| 5 | MX_ADC1_Init | ADC1 |
| 6 | MX_TIM14_Init | TIM14 |
| 7 | MX_TIM13_Init | TIM13 |

# 6. Power Consumption Calculator report

## 6.1. Microcontroller Selection

| | |
|---|---|
| Series | STM32F4 |
| Line | STM32F413/423 |
| MCU | STM32F413CGUx |
| Datasheet | DS11581_Rev5 |

## 6.2. Parameter Selection

| | |
|---|---|
| Temperature | 25 |
| Vdd | 1.7 |

## 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 |

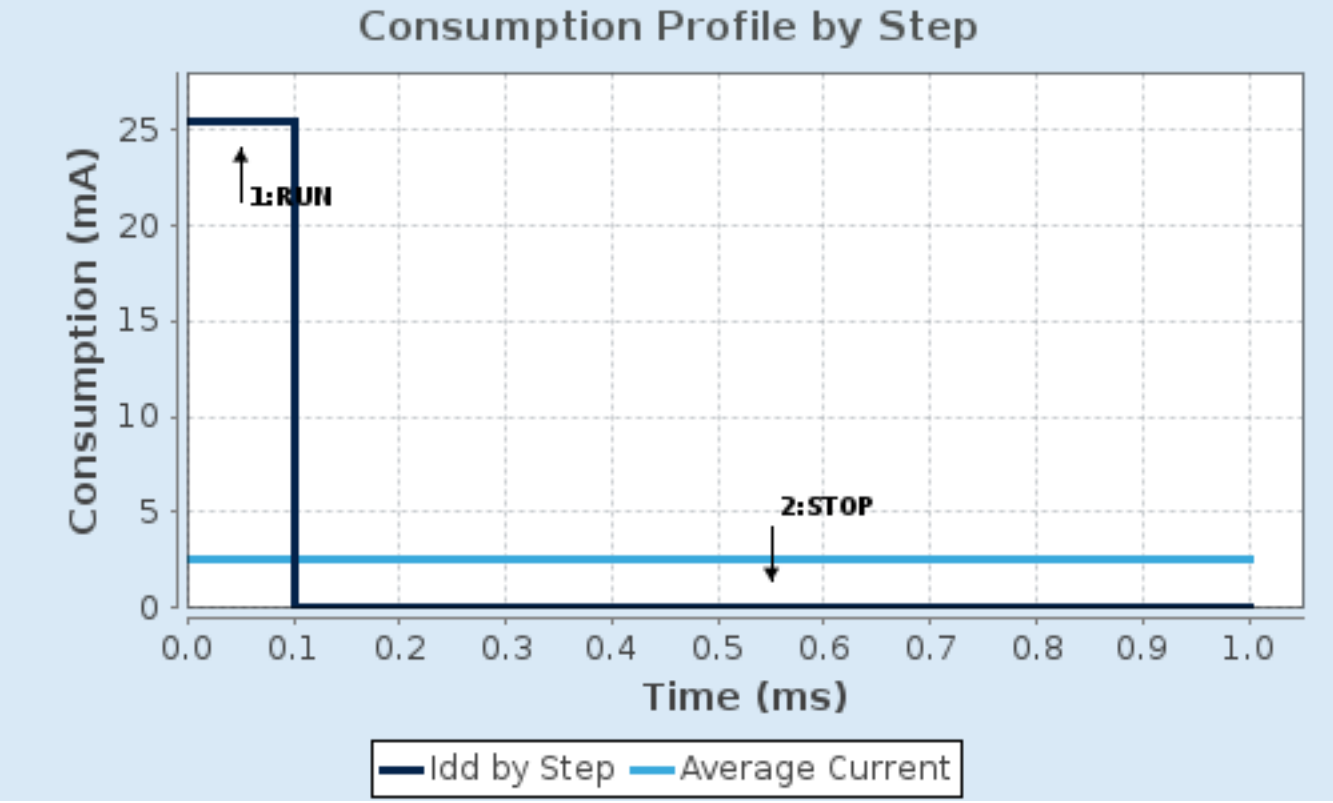
## 6.4. Sequence

| ***Step*** | Step1 | Step2 |
|---|---|---|
| ***Mode*** | RUN | STOP |
| ***Vdd*** | 1.7 | 1.7 |
| ***Voltage Source*** | Battery | Battery |
| ***Range*** | Scale1-High | No Scale |
| ***Fetch Type*** | FLASH/ART/PREFETCH | n/a |
| ***CPU Frequency*** | 100 MHz | 0 Hz |
| ***Clock Configuration*** | HSE PLL | Regulator_LPLV Flash-PwrDwn |
| ***Clock Source Frequency*** | 4 MHz | 0 Hz |
| ***Peripherals*** | | |
| ***Additional Cons.*** | 0 mA | 0 mA |
| ***Average Current*** | 25.4 mA | 15.3 µA |
| ***Duration*** | 0.1 ms | 0.9 ms |
| ***DMIPS*** | 125.0 | 0.0 |
| ***Ta Max*** | 103.62 | 105 |
| ***Category*** | In DS Table | In DS Table |

## 6.5. Results

| Sequence Time | 1 ms | Average Current | 2.55 mA |
|---|---|---|---|
| Battery Life | 1 month, 24 days, 23 hours | Average DMIPS | 125.0 DMIPS |

## 6.6. Chart


Consumption Profile by Step
Consumption (mA)
25
20
15
10
5
0
1:RUN
2:STOP
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. Peripherals and Middlewares Configuration

## 7.1. ADC1

### mode: IN7

#### 7.1.1. Parameter Settings:

**ADCs_Common_Settings:**

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

**ADC_Settings:**

| | |
|---|---|
| Clock Prescaler | PCLK2 divided by 4 |
| Resolution | 12 bits (15 ADC Clock cycles) |
| Data Alignment | Right alignment |
| Scan Conversion Mode | Disabled |
| Continuous Conversion Mode | **Enabled *** |
| Discontinuous Conversion Mode | Disabled |
| DMA Continuous Requests | **Enabled *** |
| End Of Conversion Selection | EOC flag at the end of single channel conversion |

**ADC_Regular_ConversionMode:**

| | |
|---|---|
| Number Of Conversion | 1 |
| External Trigger Conversion Source | Regular Conversion launched by software |
| External Trigger Conversion Edge | None |
| Rank | 1 |
| Channel | Channel 7 |
| Sampling Time | 3 Cycles |

**ADC_Injected_ConversionMode:**

| | |
|---|---|
| Number Of Conversions | 0 |

**WatchDog:**

| | |
|---|---|
| Enable Analog WatchDog Mode | false |

## 7.2. CAN1

### mode: Activated

#### 7.2.1. Parameter Settings:

**Bit Timings Parameters:**

| | |
|---|---|
| Prescaler (for Time Quantum) | **6 *** |
| Time Quantum | **133.33333333333331 *** |
| Time Quanta in Bit Segment 1 | **12 Times *** |
| Time Quanta in Bit Segment 2 | **2 Times *** |

| | |
|---|---|
| Time for one Bit | **1999 *** |
| Baud Rate | **500000 *** |
| ReSynchronization Jump Width | 1 Time |

**Basic Parameters:**

| | |
|---|---|
| Time Triggered Communication Mode | Disable |
| Automatic Bus-Off Management | **Enable *** |
| Automatic Wake-Up Mode | **Enable *** |
| Automatic Retransmission | **Enable *** |
| Receive Fifo Locked Mode | Disable |
| Transmit Fifo Priority | Disable |

**Advanced Parameters:**

| | |
|---|---|
| Operating Mode | Normal |

## 7.3. RCC

## High Speed Clock (HSE): 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) | 3 WS (4 CPU cycle) |

**RCC Parameters:**

| | |
|---|---|
| HSI Calibration Value | 16 |
| TIM Prescaler Selection | 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. TIM13

## mode: Activated

### 7.5.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **9000-1 *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **1000-1 *** |
| Internal Clock Division (CKD) | No Division |
| auto-reload preload | Disable |

## 7.6. TIM14

## mode: Activated

### 7.6.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **9000-1 *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **5000-1 *** |
| Internal Clock Division (CKD) | No Division |
| auto-reload preload | 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 | PA7 | ADC1_IN7 | Analog mode | No pull-up and no pull-down | n/a | |
| CAN1 | PA11 | CAN1_RX | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | |
| | PA12 | CAN1_TX | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | |
| RCC | PH0 - OSC_IN | RCC_OSC_IN | n/a | n/a | n/a | |
| | PH1 - OSC_OUT | RCC_OSC_OUT | n/a | n/a | n/a | |
| SYS | PA13 | SYS_JTMS-SWDIO | n/a | n/a | n/a | |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | |
| GPIO | PA0 | GPIO_Output | Output Push Pull | **Pull-down *** | Low | |
| | PA1 | GPIO_Output | Output Push Pull | **Pull-up *** | Low | |
| | PA2 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | |

## 8.2. DMA configuration

| DMA request | Stream | Direction | Priority |
|---|---|---|---|
| ADC1 | DMA2_Stream0 | Peripheral To Memory | Low |

*ADC1: DMA2_Stream0 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | Disable |
| 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 |
| 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 | 15 | 0 |
| CAN1 RX0 interrupts | true | 0 | 0 |
| TIM8 update interrupt and TIM13 global interrupt | true | 0 | 0 |
| TIM8 trigger and commutation interrupts and TIM14 global interrupt | true | 0 | 0 |
| DMA2 stream0 global interrupt | true | 0 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| ADC1 global interrupt | unused | | |
| CAN1 TX interrupts | unused | | |
| CAN1 RX1 interrupt | unused | | |
| CAN1 SCE interrupt | 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 | false | true | false |
| Hard fault interrupt | false | true | false |
| Memory management fault | false | true | false |
| Pre-fetch fault, memory access fault | false | true | false |
| Undefined instruction or illegal state | false | true | false |
| System service call via SWI instruction | false | true | false |
| Debug monitor | false | true | false |
| Pendable request for system service | false | true | false |
| System tick timer | false | true | true |
| CAN1 RX0 interrupts | false | true | true |
| | | | |

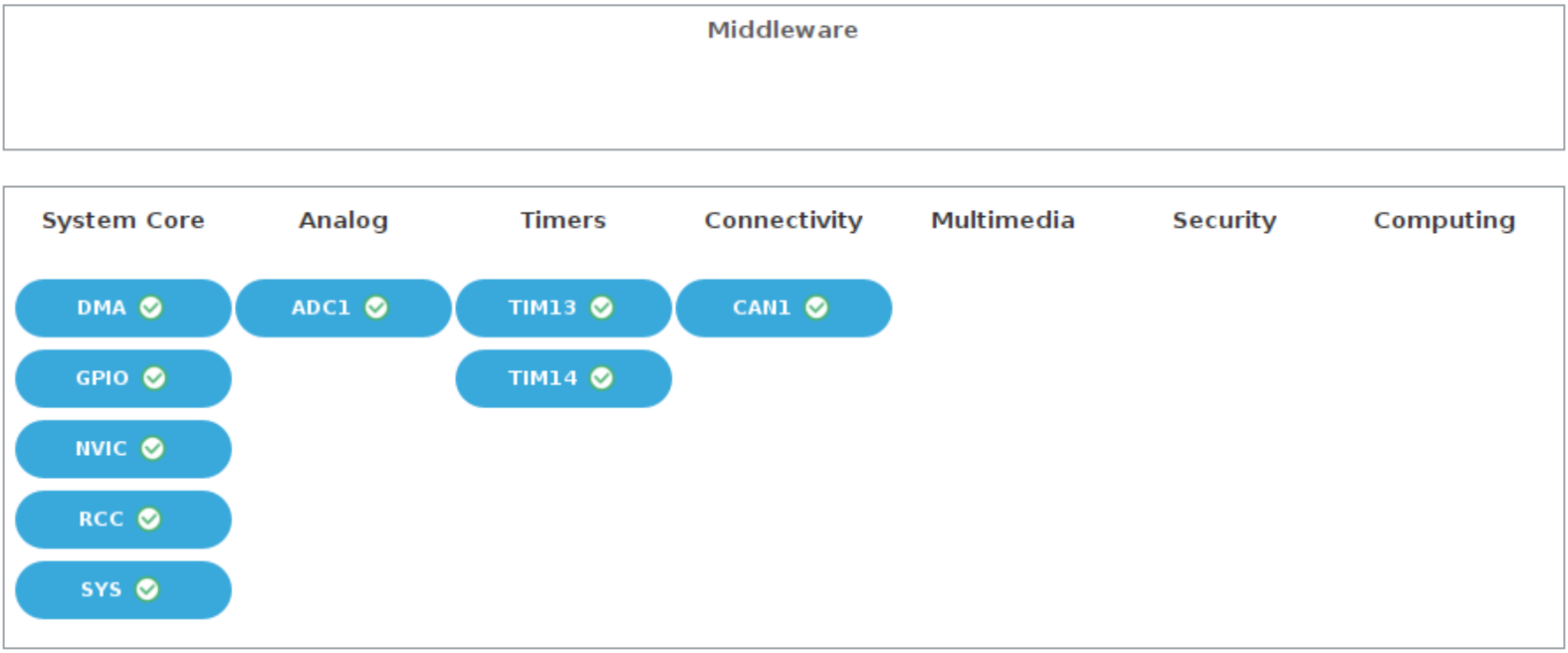
| Enabled interrupt Table | Select for init sequence ordering | Generate IRQ handler | Call HAL handler |
|---|---|---|---|
| TIM8 update interrupt and TIM13 global interrupt | false | true | true |
| TIM8 trigger and commutation interrupts and TIM14 global interrupt | false | true | true |
| DMA2 stream0 global interrupt | false | 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/DM00282249.pdf |
| Reference manual | http://www.st.com/resource/en/reference_manual/DM00305666.pdf |
| Programming manual | http://www.st.com/resource/en/programming_manual/DM00046982.pdf |
| Errata sheet | http://www.st.com/resource/en/errata_sheet/DM00318678.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/CD00249778.pdf |
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| Application note | http://www.st.com/resource/en/application_note/DM00226326.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00227538.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00236305.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00257177.pdf |
| Application note | http://www.st.com/resource/en/application_note/DM00272912.pdf |
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| Application note | http://www.st.com/resource/en/application_note/DM00296349.pdf |
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