



## 1. Description

### 1.1. Project

|                 |                   |
|-----------------|-------------------|
| Project Name    | mech_deck_module  |
| Board Name      | NUCLEO-L476RG     |
| Generated with: | STM32CubeMX 6.2.1 |
| Date            | 04/27/2021        |

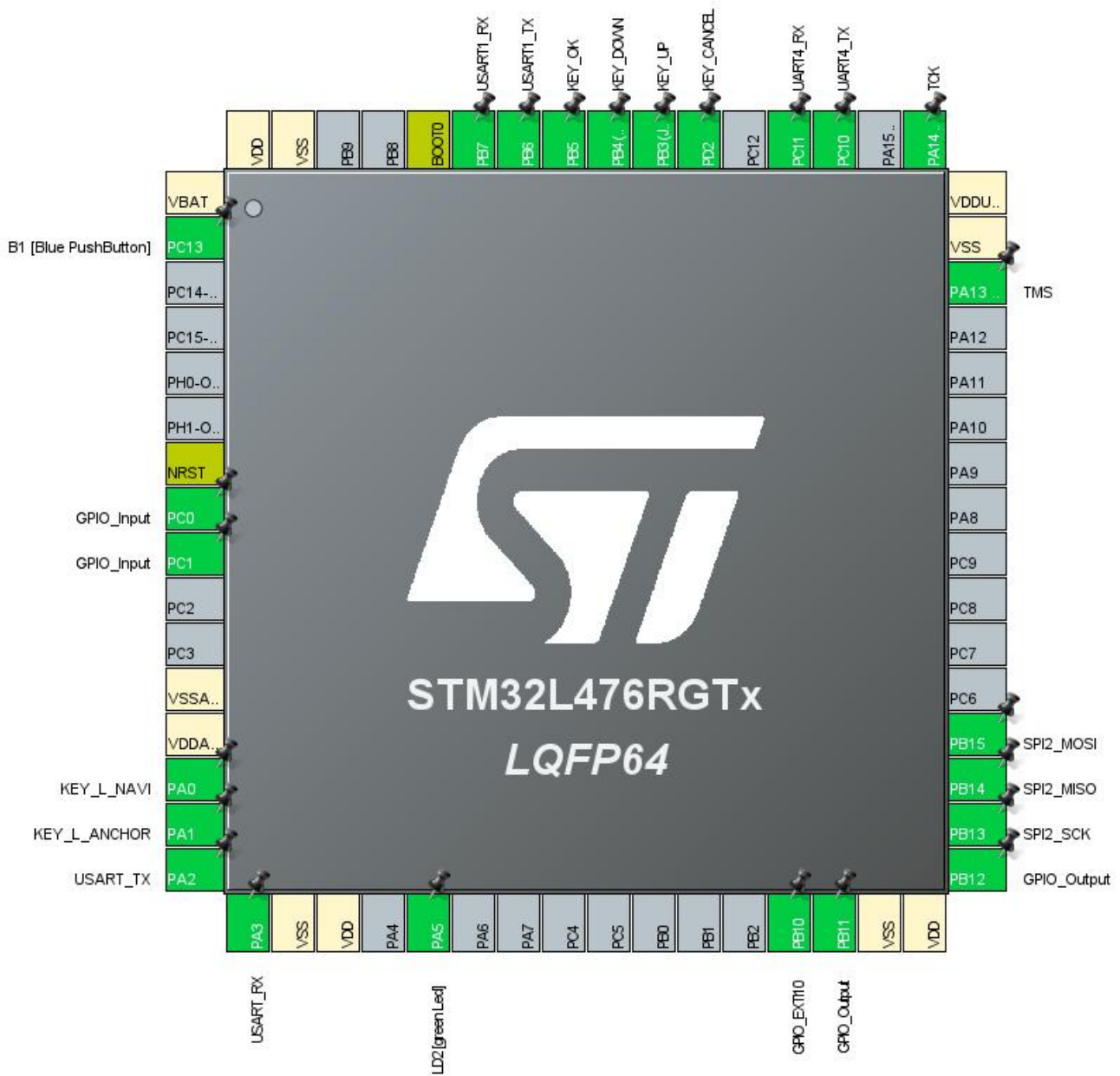
### 1.2. MCU

|                |               |
|----------------|---------------|
| 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



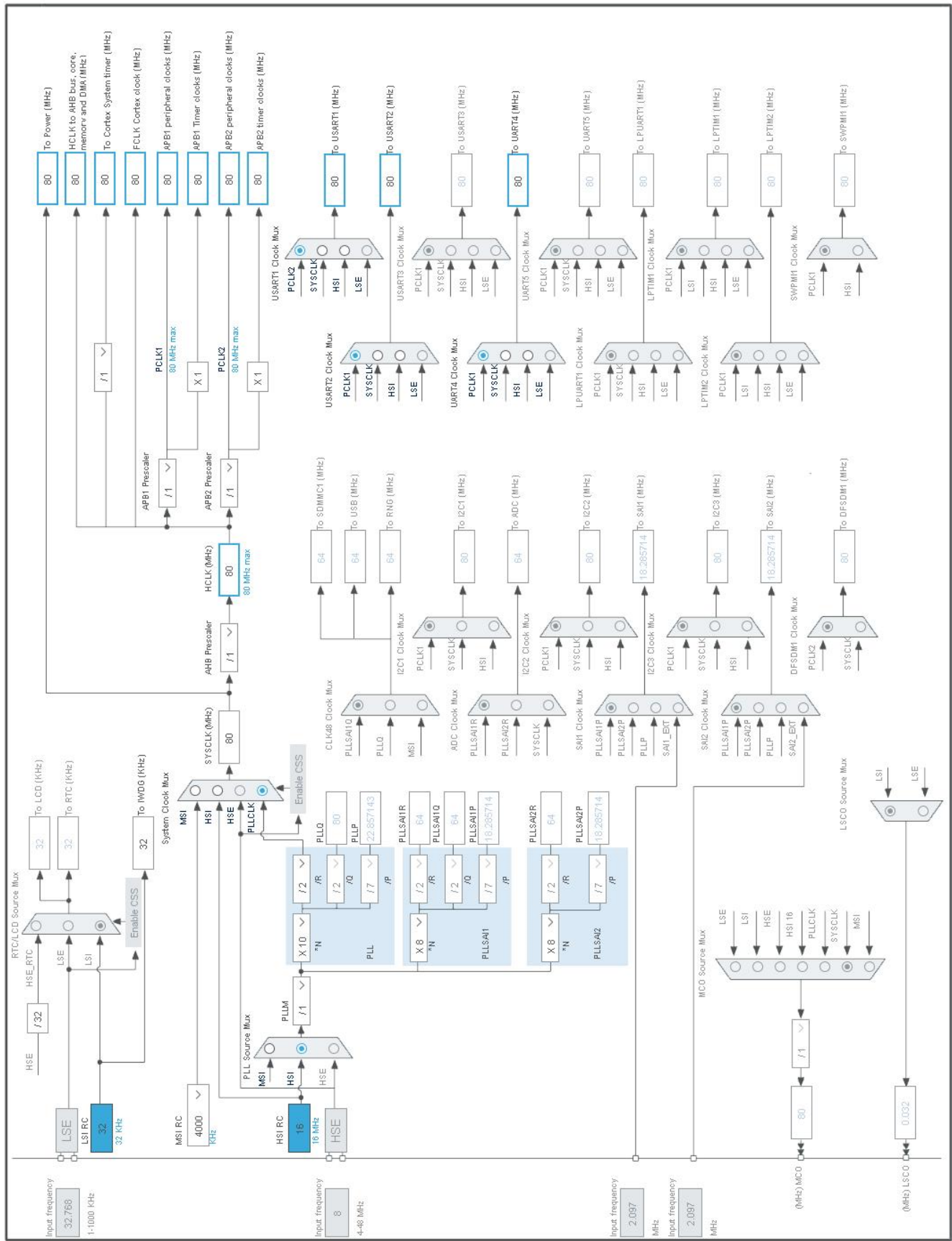
### 3. Pins Configuration

| Pin Number<br>LQFP64 | Pin Name<br>(function after<br>reset) | Pin Type | Alternate<br>Function(s) | Label                |
|----------------------|---------------------------------------|----------|--------------------------|----------------------|
| 1                    | VBAT                                  | Power    |                          |                      |
| 2                    | PC13                                  | I/O      | GPIO_EXTI13              | B1 [Blue PushButton] |
| 7                    | NRST                                  | Reset    |                          |                      |
| 8                    | PC0 *                                 | I/O      | GPIO_Input               |                      |
| 9                    | PC1 *                                 | I/O      | GPIO_Input               |                      |
| 12                   | VSSA/VREF-                            | Power    |                          |                      |
| 13                   | VDDA/VREF+                            | Power    |                          |                      |
| 14                   | PA0 *                                 | I/O      | GPIO_Input               | KEY_L_NAVI           |
| 15                   | PA1 *                                 | I/O      | GPIO_Input               | KEY_L_ANCHOR         |
| 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]      |
| 29                   | PB10                                  | I/O      | GPIO_EXTI10              |                      |
| 30                   | PB11 *                                | I/O      | GPIO_Output              |                      |
| 31                   | VSS                                   | Power    |                          |                      |
| 32                   | VDD                                   | Power    |                          |                      |
| 33                   | PB12 *                                | I/O      | GPIO_Output              |                      |
| 34                   | PB13                                  | I/O      | SPI2_SCK                 |                      |
| 35                   | PB14                                  | I/O      | SPI2_MISO                |                      |
| 36                   | PB15                                  | I/O      | SPI2_MOSI                |                      |
| 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                  |
| 51                   | PC10                                  | I/O      | UART4_TX                 |                      |
| 52                   | PC11                                  | I/O      | UART4_RX                 |                      |
| 54                   | PD2 *                                 | I/O      | GPIO_Input               | KEY_CANCEL           |
| 55                   | PB3 (JTDO-TRACESWO) *                 | I/O      | GPIO_Input               | KEY_UP               |
| 56                   | PB4 (NJTRST) *                        | I/O      | GPIO_Input               | KEY_DOWN             |
| 57                   | PB5 *                                 | I/O      | GPIO_Input               | KEY_OK               |
| 58                   | PB6                                   | I/O      | USART1_TX                |                      |
| 59                   | PB7                                   | I/O      | USART1_RX                |                      |
| 60                   | BOOT0                                 | Boot     |                          |                      |
| 63                   | VSS                                   | Power    |                          |                      |

| Pin Number<br>LQFP64 | Pin Name<br>(function after<br>reset) | Pin Type | Alternate<br>Function(s) | Label |
|----------------------|---------------------------------------|----------|--------------------------|-------|
| 64                   | 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                      | mech_deck_module                        |
| Project Folder                    | D:\projects\windsensor\mech_deck_module |
| Toolchain / IDE                   | STM32CubeIDE                            |
| Firmware Package Name and Version | STM32Cube FW_L4 V1.17.0                 |
| 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   | Yes                                   |
| 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) | Yes                                   |
| 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_UART4_Init       | UART4                    |
| 4    | MX_USART2_UART_Init | USART2                   |
| 5    | MX_IWDG_Init        | IWDG                     |
| 6    | MX_SPI2_Init        | SPI2                     |
| 7    | MX_USART1_UART_Init | USART1                   |

## 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               |



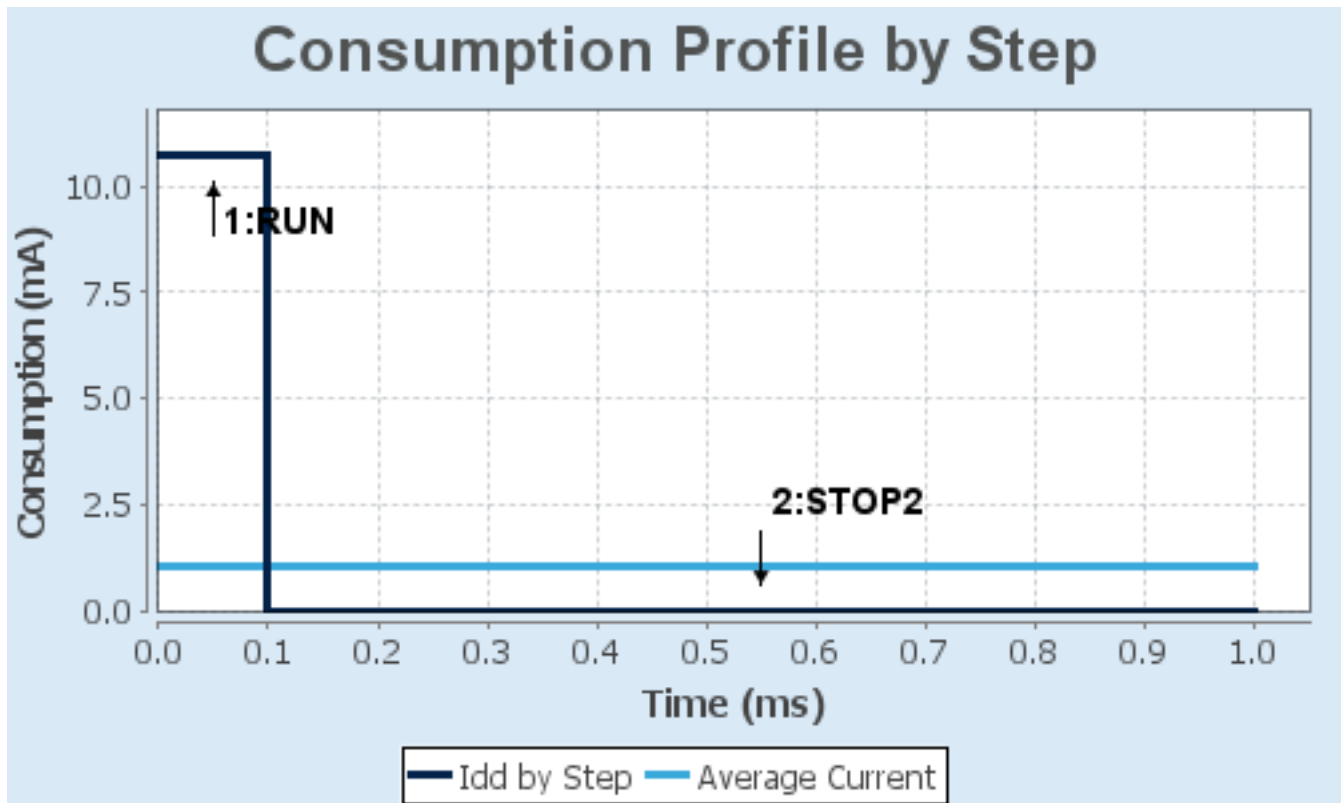
#### 6.4. Sequence

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



## 7. Peripherals and Middlewares Configuration

### 7.1. IWDG

**mode: Activated**

#### 7.1.1. Parameter Settings:

**Watchdog Clocking:**

|                                |      |
|--------------------------------|------|
| IWDG counter clock prescaler   | 4    |
| IWDG window value              | 4095 |
| IWDG down-counter reload value | 4095 |

### 7.2. RCC

#### 7.2.1. Parameter Settings:

**System Parameters:**

|                   |                    |
|-------------------|--------------------|
| VDD voltage (V)   | 3.3                |
| Instruction Cache | Enabled            |
| Prefetch Buffer   | <b>Enabled *</b>   |
| 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 Timeout Value (ms) | 100      |
| LSE Startup Timeout Value (ms) | 5000     |

**Power Parameters:**

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

### 7.3. SPI2

**Mode: Full-Duplex Master**

#### 7.3.1. Parameter Settings:

**Basic Parameters:**

|              |                 |
|--------------|-----------------|
| Frame Format | Motorola        |
| Data Size    | <b>8 Bits *</b> |
| First Bit    | MSB First       |

**Clock Parameters:**

|                           |                      |
|---------------------------|----------------------|
| Prescaler (for Baud Rate) | <b>32 *</b>          |
| Baud Rate                 | <b>2.5 MBits/s *</b> |
| Clock Polarity (CPOL)     | Low                  |
| Clock Phase (CPHA)        | 1 Edge               |

**Advanced Parameters:**

|                 |          |
|-----------------|----------|
| CRC Calculation | Disabled |
| NSSP Mode       | Enabled  |
| NSS Signal Type | Software |

**7.4. SYS**

**Debug: Serial Wire**

**Timebase Source: SysTick**

**7.5. UART4**

**Mode: Asynchronous**

**7.5.1. Parameter Settings:****Basic Parameters:**

|             |                           |
|-------------|---------------------------|
| Baud Rate   | <b>625000 *</b>           |
| Word Length | 8 Bits (including Parity) |
| Parity      | None                      |
| Stop Bits   | 1                         |

**Advanced Parameters:**

|                |                        |
|----------------|------------------------|
| Data Direction | <b>Transmit Only *</b> |
| 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 |

## 7.6. USART1

### 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 |

## 7.7. USART2

### Mode: Asynchronous

#### 7.7.1. 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           |
|--------|-------------------|----------------|--|-----------------------------|-------------|----------------------|
| SPI2   | PB13              | SPI2_SCK       | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
|        | PB14              | SPI2_MISO      | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
|        | PB15              | SPI2_MOSI      | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
| 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                  |
| UART4  | PC10              | UART4_TX       | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
|        | PC11              | UART4_RX       | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
| USART1 | PB6               | USART1_TX      | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
|        | PB7               | USART1_RX      | Alternate Function Push Pull                                       | No pull-up and no pull-down | Very High * |                      |
| 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             |
| GPIO   | PC13              | GPIO_EXTI13    | <b>External Interrupt Mode with Falling edge trigger detection</b> | No pull-up and no pull-down | n/a         | B1 [Blue PushButton] |
|        | PC0               | GPIO_Input     | Input mode   | No pull-up and no pull-down | n/a         |                      |
|        | PC1               | GPIO_Input     | Input mode   | No pull-up and no pull-down | n/a         |                      |
|        | PA0               | GPIO_Input     | Input mode   | <b>Pull-up *</b>            | n/a         | KEY_L_NAVI           |
|        | PA1               | GPIO_Input     | Input mode   | <b>Pull-up *</b>            | n/a         | KEY_L_ANCHOR         |
|        | PA5               | GPIO_Output    | Output Push Pull   | No pull-up and no pull-down | Very High * | LD2 [green Led]      |
|        | PB10              | GPIO_EXTI10    | External Interrupt Mode with Rising edge trigger detection         | No pull-up and no pull-down | n/a         |                      |
|        |                   |                |  |                             |             |                      |

| IP | Pin                 | Signal      | GPIO mode        | GPIO pull/up pull down      | Max Speed             | User Label |
|----|---------------------|-------------|------------------|-----------------------------|-----------------------|------------|
|    | PB11                | GPIO_Output | Output Push Pull | No pull-up and no pull-down | <b>Very High</b><br>* |            |
|    | PB12                | GPIO_Output | Output Push Pull | No pull-up and no pull-down | <b>Very High</b><br>* |            |
|    | PD2                 | GPIO_Input  | Input mode       | <b>Pull-up *</b>            | <b>n/a</b>            | KEY_CANCEL |
|    | PB3 (JTDO-TRACESWO) | GPIO_Input  | Input mode       | <b>Pull-up *</b>            | <b>n/a</b>            | KEY_UP     |
|    | PB4 (NJTRST)        | GPIO_Input  | Input mode       | <b>Pull-up *</b>            | <b>n/a</b>            | KEY_DOWN   |
|    | PB5                 | GPIO_Input  | Input mode       | <b>Pull-up *</b>            | <b>n/a</b>            | KEY_OK     |

## 8.2. DMA configuration

nothing configured in DMA service



### 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           |
| PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38 | unused |                      |             |
| Flash global interrupt   | unused |                      |             |
| RCC global interrupt   | unused |                      |             |
| SPI2 global interrupt  | unused |                      |             |
| USART1 global interrupt  | unused |                      |             |
| USART2 global interrupt  | unused |                      |             |
| EXTI line[15:10] interrupts  | unused |                      |             |
| UART4 global 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            |
| Prefetch 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             |

\* User modified value

## 9. System Views

### 9.1. Category view

#### 9.1.1. Current

| Middleware  |        |        |              |            |          |           |
|-------------|--------|--------|--------------|------------|----------|-----------|
| System Core | Analog | Timers | Connectivity | Multimedia | Security | Computing |
| DMA         |        |        | SPI2         |            |          |           |
| GPIO        |        |        | UART4        |            |          |           |
| IWDG        |        |        | USART1       |            |          |           |
| NVIC        |        |        | USART2       |            |          |           |
| RCC         |        |        |              |            |          |           |
| SYS         |        |        |              |            |          |           |

## 10. Docs & Resources

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

Application note [http://www.st.com/resource/en/application\\_note/DM00125306.pdf](http://www.st.com/resource/en/application_note/DM00125306.pdf)

Application note [http://www.st.com/resource/en/application\\_note/DM00141025.pdf](http://www.st.com/resource/en/application_note/DM00141025.pdf)

Application note [http://www.st.com/resource/en/application\\_note/DM00144612.pdf](http://www.st.com/resource/en/application_note/DM00144612.pdf)

Application note [http://www.st.com/resource/en/application\\_note/DM00148033.pdf](http://www.st.com/resource/en/application_note/DM00148033.pdf)

Application note [http://www.st.com/resource/en/application\\_note/DM00209768.pdf](http://www.st.com/resource/en/application_note/DM00209768.pdf)

Application note [http://www.st.com/resource/en/application\\_note/DM00216518.pdf](http://www.st.com/resource/en/application_note/DM00216518.pdf)

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