
STM32
CubeMX

# 1. Description

## 1.1. Project

| | |
|---|---|
| Project Name | Birth2 |
| Board Name | custom |
| Generated with: | STM32CubeMX 6.10.0 |
| Date | 03/17/2024 |

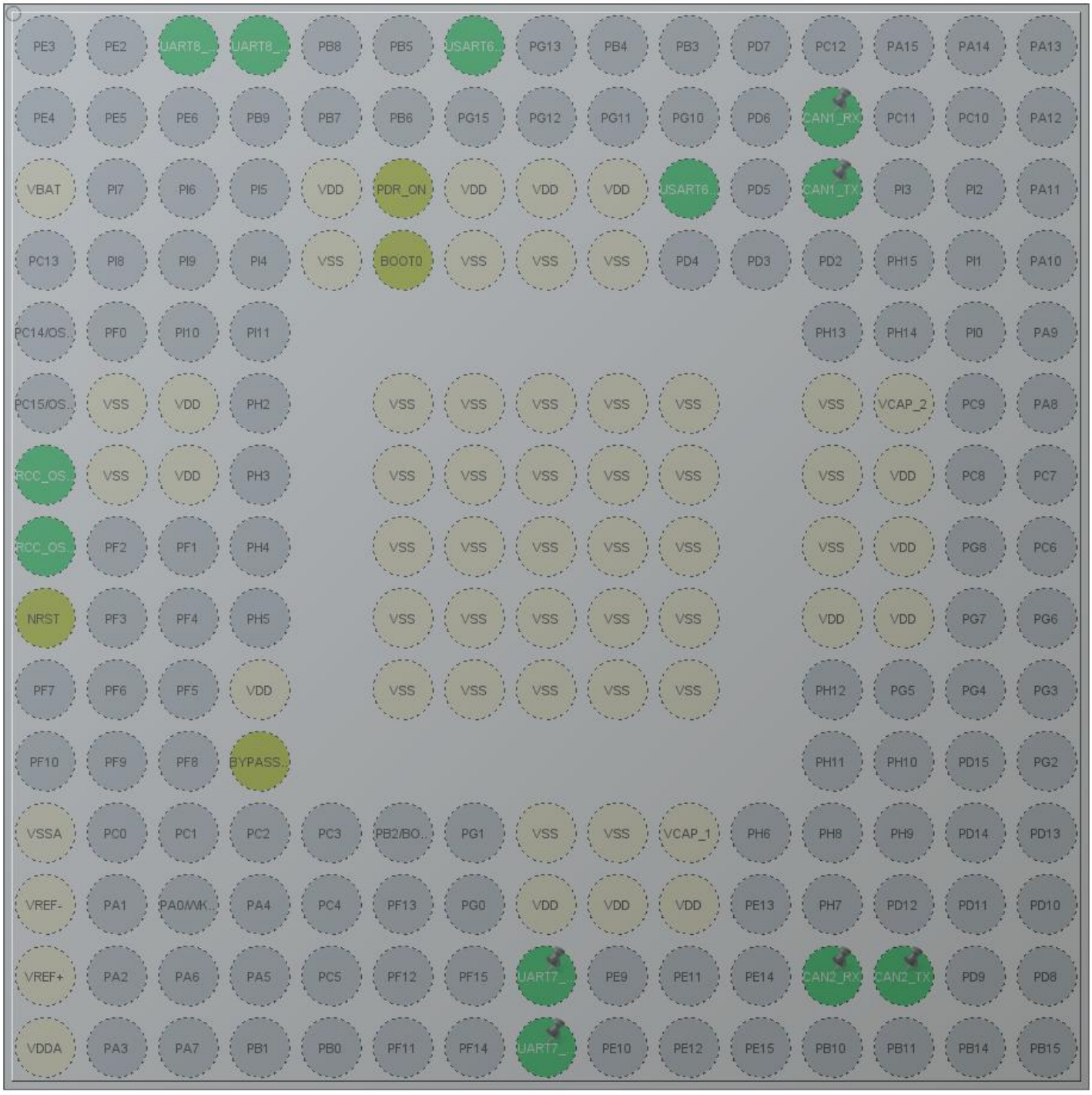
## 1.2. MCU

| | |
|---|---|
| MCU Series | STM32F4 |
| MCU Line | STM32F427/437 |
| MCU name | STM32F427IIHx |
| MCU Package | UFBGA176 |
| MCU Pin number | 201 |

## 1.3. Core(s) information

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

## 2. Pinout Configuration



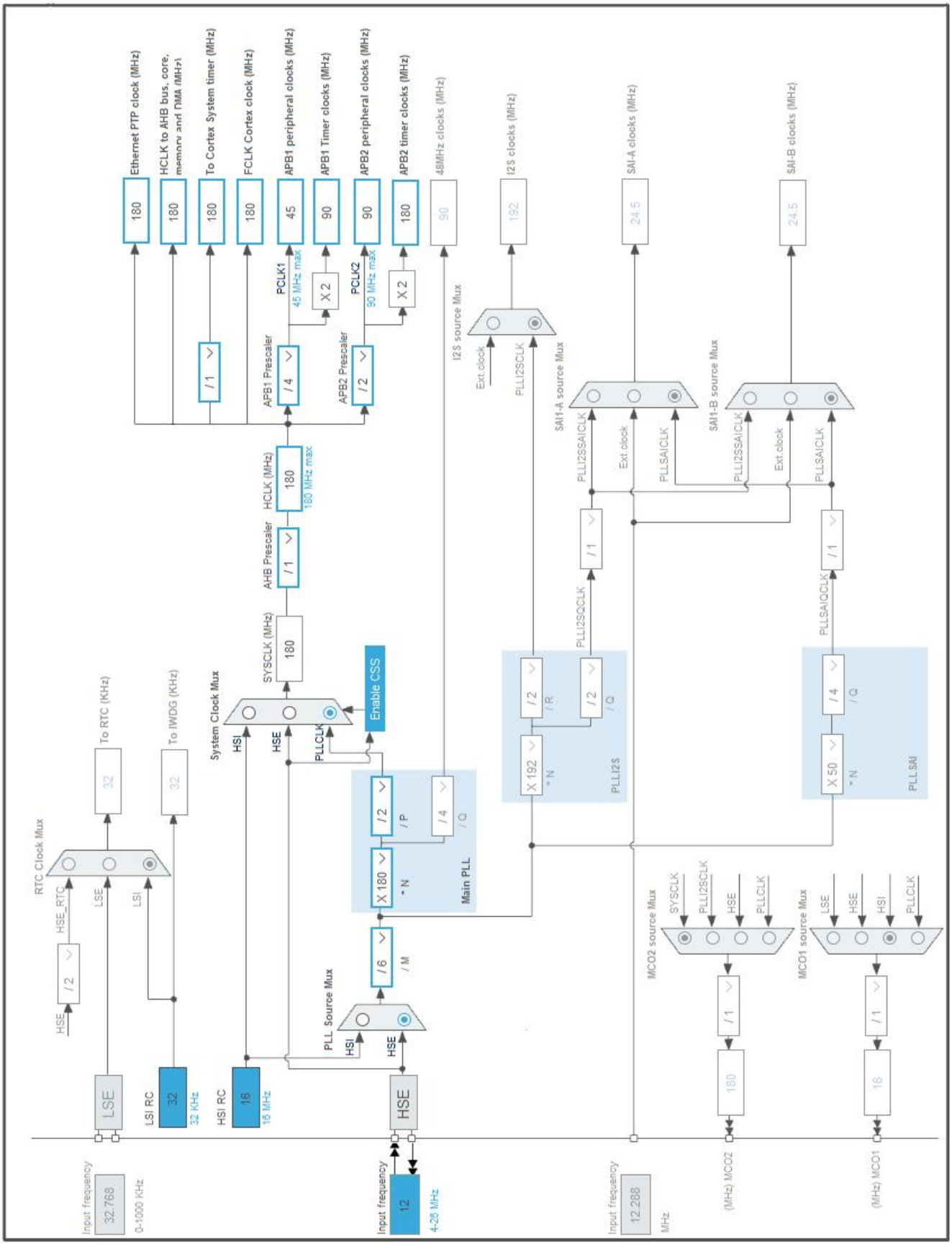

UFBGA176 +25 (Top view)

# 3. Pins Configuration

| Pin Number UFBGA176 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| A3 | PE1 | I/O | UART8_TX | |
| A4 | PE0 | I/O | UART8_RX | |
| A7 | PG14 | I/O | USART6_TX | |
| B12 | PD0 | I/O | CAN1_RX | |
| C1 | VBAT | Power | | |
| C5 | VDD | Power | | |
| C6 | PDR_ON | Reset | | |
| C7 | VDD | Power | | |
| C8 | VDD | Power | | |
| C9 | VDD | Power | | |
| C10 | PG9 | I/O | USART6_RX | |
| C12 | PD1 | I/O | CAN1_TX | |
| D5 | VSS | Power | | |
| D6 | BOOT0 | Boot | | |
| D7 | VSS | Power | | |
| D8 | VSS | Power | | |
| D9 | VSS | Power | | |
| F2 | VSS | Power | | |
| F3 | VDD | Power | | |
| F6 | VSS | Power | | |
| F7 | VSS | Power | | |
| F8 | VSS | Power | | |
| F9 | VSS | Power | | |
| F10 | VSS | Power | | |
| F12 | VSS | Power | | |
| F13 | VCAP_2 | Power | | |
| G1 | PH0/OSC_IN | I/O | RCC_OSC_IN | |
| G2 | VSS | Power | | |
| G3 | VDD | Power | | |
| G6 | VSS | Power | | |
| G7 | VSS | Power | | |
| G8 | VSS | Power | | |
| G9 | VSS | Power | | |
| G10 | VSS | Power | | |
| G12 | VSS | Power | | |
| G13 | VDD | Power | | |

| Pin Number UFBGA176 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| H1 | PH1/OSC_OUT | I/O | RCC_OSC_OUT | |
| H6 | VSS | Power | | |
| H7 | VSS | Power | | |
| H8 | VSS | Power | | |
| H9 | VSS | Power | | |
| H10 | VSS | Power | | |
| H12 | VSS | Power | | |
| H13 | VDD | Power | | |
| J1 | NRST | Reset | | |
| J6 | VSS | Power | | |
| J7 | VSS | Power | | |
| J8 | VSS | Power | | |
| J9 | VSS | Power | | |
| J10 | VSS | Power | | |
| J12 | VDD | Power | | |
| J13 | VDD | Power | | |
| K4 | VDD | Power | | |
| K6 | VSS | Power | | |
| K7 | VSS | Power | | |
| K8 | VSS | Power | | |
| K9 | VSS | Power | | |
| K10 | VSS | Power | | |
| L4 | BYPASS_REG | Reset | | |
| M1 | VSSA | Power | | |
| M8 | VSS | Power | | |
| M9 | VSS | Power | | |
| M10 | VCAP_1 | Power | | |
| N1 | VREF- | Power | | |
| N8 | VDD | Power | | |
| N9 | VDD | Power | | |
| N10 | VDD | Power | | |
| P1 | VREF+ | Power | | |
| P8 | PE8 | I/O | UART7_TX | |
| P12 | PB12 | I/O | CAN2_RX | |
| P13 | PB13 | I/O | CAN2_TX | |
| R1 | VDDA | Power | | |
| R8 | PE7 | I/O | UART7_RX | |

# 4. Clock Tree Configuration



# 5. Software Project

## 5.1. Project Settings

| Name | Value |
|---|---|
| Project Name | Birth2 |
| Project Folder | D:\roboBirth1\Birth2 |
| Toolchain / IDE | MDK-ARM V5 |
| Firmware Package Name and Version | STM32Cube FW_F4 V1.28.0 |
| 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 | 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) | No |
| Enable Full Assert | No |

## 5.3. Advanced Settings - Generated Function Calls

| Rank | Function Name | Peripheral Instance Name |
|---|---|---|
| 1 | SystemClock_Config | RCC |
| 2 | MX_GPIO_Init | GPIO |
| 3 | MX_DMA_Init | DMA |
| 4 | MX_UART7_Init | UART7 |
| 5 | MX_UART8_Init | UART8 |
| 6 | MX_USART6_UART_Init | USART6 |
| 7 | MX_CAN1_Init | CAN1 |
| 8 | MX_CAN2_Init | CAN2 |

# 1. Power Consumption Calculator report

## 1.1. Microcontroller Selection

| | |
|---|---|
| Series | STM32F4 |
| Line | STM32F427/437 |
| MCU | STM32F427IIHx |
| Datasheet | DS9405_Rev9 |

## 1.2. Parameter Selection

| | |
|---|---|
| Temperature | 25 |
| Vdd | 3.3 |

## 1.3. 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 |

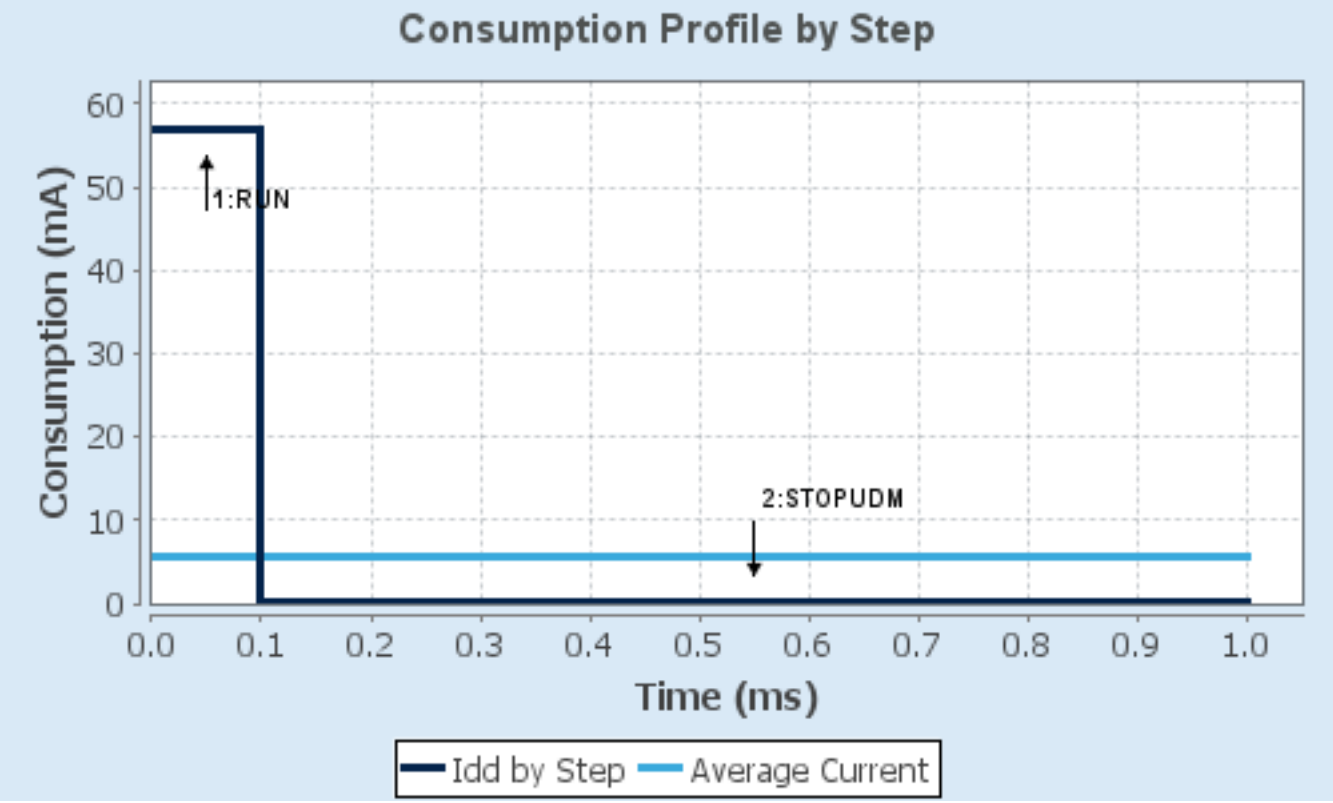
## 1.4. Sequence

| ***Step*** | Step1 | Step2 |
|---|---|---|
| ***Mode*** | RUN | STOP_UDM (Under Drive) |
| ***Vdd*** | 3.3 | 3.3 |
| ***Voltage Source*** | Battery | Battery |
| ***Range*** | Scale1-High | No Scale |
| ***Fetch Type*** | FLASH | n/a |
| ***CPU Frequency*** | 180 MHz | 0 Hz |
| ***Clock Configuration*** | HSE PLL | Regulator_LP Flash-PwrDwn |
| ***Clock Source Frequency*** | 4 MHz | 0 Hz |
| ***Peripherals*** | | |
| ***Additional Cons.*** | 0 mA | 0 mA |
| ***Average Current*** | 57 mA | 100 µA |
| ***Duration*** | 0.1 ms | 0.9 ms |
| ***DMIPS*** | 225.0 | 0.0 |
| ***Ta Max*** | 97.66 | 104.99 |
| ***Category*** | In DS Table | In DS Table |

## 1.5. Results

| Sequence Time | 1 ms | Average Current | 5.79 mA |
|---|---|---|---|
| Battery Life | 24 days, 10 hours | Average DMIPS | 225.0 DMIPS |

## 1.6. Chart


Consumption Profile by Step
Consumption (mA)
60
50
40
30
20
10
0
1:RUN
2:STOPUDM
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

# 2. Peripherals and Middlewares Configuration

## 2.1. CAN1

**mode: Activated**

### 2.1.1. Parameter Settings:

**Bit Timings Parameters:**

| | |
|---|---|
| Prescaler (for Time Quantum) | **5 *** |
| Time Quantum | **111.11111111111111 *** |
| Time Quanta in Bit Segment 1 | **3 Times *** |
| Time Quanta in Bit Segment 2 | **5 Times *** |
| Time for one Bit | 1000 |
| Baud Rate | **1000000 *** |
| ReSynchronization Jump Width | 1 Time |

**Basic Parameters:**

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

**Advanced Parameters:**

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

## 2.2. CAN2

**mode: Activated**

### 2.2.1. Parameter Settings:

**Bit Timings Parameters:**

| | |
|---|---|
| Prescaler (for Time Quantum) | **5 *** |
| Time Quantum | **111.11111111111111 *** |
| Time Quanta in Bit Segment 1 | **3 Times *** |
| Time Quanta in Bit Segment 2 | **5 Times *** |
| Time for one Bit | 1000 |
| Baud Rate | **1000000 *** |
| ReSynchronization Jump Width | 1 Time |

**Basic Parameters:**

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

**Advanced Parameters:**

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

## 2.3. RCC

## High Speed Clock (HSE): Crystal/Ceramic Resonator

### 2.3.1. Parameter Settings:

**System Parameters:**

| | |
|---|---|
| VDD voltage (V) | 3.3 |
| Instruction Cache | Enabled |
| Prefetch Buffer | Enabled |
| Data Cache | Enabled |
| Flash Latency(WS) | 5 WS (6 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 |
| Power Over Drive | Enabled |

## 2.4. SYS

## Timebase Source: TIM6

## 2.5. UART7

## Mode: Asynchronous

### 2.5.1. 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 |

## 2.6. UART8

## Mode: Asynchronous

### 2.6.1. 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 |

## 2.7. USART6

## Mode: Asynchronous

### 2.7.1. 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 |

## 2.8. FREERTOS

## Interface: CMSIS_V1

## 2.8.1. Config parameters:

**API:**

| | |
|---|---|
| FreeRTOS API | CMSIS v1 |

**Versions:**

| | |
|---|---|
| FreeRTOS version | 10.3.1 |
| CMSIS-RTOS version | 1.02 |

**MPU/FPU:**

| | |
|---|---|
| ENABLE_MPU | Disabled |
| ENABLE_FPU | Disabled |

**Kernel settings:**

| | |
|---|---|
| USE_PREEMPTION | Enabled |
| CPU_CLOCK_HZ | SystemCoreClock |
| TICK_RATE_HZ | 1000 |
| MAX_PRIORITIES | 7 |
| MINIMAL_STACK_SIZE | 128 |
| MAX_TASK_NAME_LEN | 16 |
| USE_16_BIT_TICKS | Disabled |
| IDLE_SHOULD_YIELD | Enabled |
| USE_MUTEXES | Enabled |
| USE_RECURSIVE_MUTEXES | Disabled |
| USE_COUNTING_SEMAPHORES | Disabled |
| QUEUE_REGISTRY_SIZE | 8 |
| USE_APPLICATION_TASK_TAG | Disabled |
| ENABLE_BACKWARD_COMPATIBILITY | Enabled |
| USE_PORT_OPTIMISED_TASK_SELECTION | Enabled |
| USE_TICKLESS_IDLE | Disabled |
| USE_TASK_NOTIFICATIONS | Enabled |
| RECORD_STACK_HIGH_ADDRESS | Disabled |

**Memory management settings:**

| | |
|---|---|
| Memory Allocation | Dynamic / Static |
| TOTAL_HEAP_SIZE | 15360 |
| Memory Management scheme | heap_4 |

**Hook function related definitions:**

| | |
|---|---|
| USE_IDLE_HOOK | Disabled |
| USE_TICK_HOOK | Disabled |
| USE_MALLOC_FAILED_HOOK | Disabled |
| USE_DAEMON_TASK_STARTUP_HOOK | Disabled |
| CHECK_FOR_STACK_OVERFLOW | Disabled |

**Run time and task stats gathering related definitions:**

| | |
|---|---|
| GENERATE_RUN_TIME_STATS | Disabled |

| | |
|---|---|
| USE_TRACE_FACILITY | Disabled |
| USE_STATS_FORMATTING_FUNCTIONS | Disabled |

**Co-routine related definitions:**

| | |
|---|---|
| USE_CO_ROUTINES | Disabled |
| MAX_CO_ROUTINE_PRIORITIES | 2 |

**Software timer definitions:**

| | |
|---|---|
| USE_TIMERS | Disabled |

**Interrupt nesting behaviour configuration:**

| | |
|---|---|
| LIBRARY_LOWEST_INTERRUPT_PRIORITY | 15 |
| LIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY | 5 |

**Added with 10.2.1 support:**

| | |
|---|---|
| MESSAGE_BUFFER_LENGTH_TYPE | size_t |
| USE_POSIX_ERRNO | Disabled |

## 2.8.2. Include parameters:

**Include definitions:**

| | |
|---|---|
| vTaskPrioritySet | Enabled |
| uxTaskPriorityGet | Enabled |
| vTaskDelete | Enabled |
| vTaskCleanUpResources | Disabled |
| vTaskSuspend | Enabled |
| vTaskDelayUntil | Disabled |
| vTaskDelay | Enabled |
| xTaskGetSchedulerState | Enabled |
| xTaskResumeFromISR | Enabled |
| xQueueGetMutexHolder | Disabled |
| xSemaphoreGetMutexHolder | Disabled |
| pcTaskGetTaskName | Disabled |
| uxTaskGetStackHighWaterMark | Disabled |
| xTaskGetCurrentTaskHandle | Disabled |
| eTaskGetState | Disabled |
| xEventGroupSetBitFromISR | Disabled |
| xTimerPendFunctionCall | Disabled |
| xTaskAbortDelay | Disabled |
| xTaskGetHandle | Disabled |
| uxTaskGetStackHighWaterMark2 | Disabled |

## 2.8.3. Advanced settings:

**Newlib settings (see parameter description first):**

| | |
|---|---|
| USE_NEWLIB_REENTRANT | Disabled |

**Project settings (see parameter description first):**

| | |
|---|---|
| Use FW pack heap file | Enabled |

*** User modified value**

# 3. System Configuration

## 3.1. GPIO configuration

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| CAN1 | PD0 | CAN1_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PD1 | CAN1_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| CAN2 | PB12 | CAN2_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PB13 | CAN2_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very 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 | |
| UART7 | PE8 | UART7_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PE7 | UART7_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| UART8 | PE1 | UART8_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PE0 | UART8_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| USART6 | PG14 | USART6_TX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |
| | PG9 | USART6_RX | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | |

## 3.2. DMA configuration

| DMA request | Stream | Direction | Priority |
|---|---|---|---|
| UART7_RX | DMA1_Stream3 | Peripheral To Memory | Low |
| UART8_RX | DMA1_Stream6 | Peripheral To Memory | Low |
| USART6_TX | DMA2_Stream6 | Memory To Peripheral | Low |

*UART7_RX: DMA1_Stream3 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | Disable |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Byte |
| Memory Data Width: | Byte |

*UART8_RX: DMA1_Stream6 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | Disable |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Byte |
| Memory Data Width: | Byte |

*USART6_TX: DMA2_Stream6 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | Disable |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Byte |
| Memory Data Width: | Byte |

## 3.3. NVIC configuration

### 3.3.1. 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 | 15 | 0 |
| System tick timer | true | 15 | 0 |
| DMA1 stream3 global interrupt | true | 5 | 0 |
| DMA1 stream6 global interrupt | true | 5 | 0 |
| CAN1 TX interrupts | true | 5 | 0 |
| CAN1 RX0 interrupts | true | 5 | 0 |
| TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts | true | 15 | 0 |
| CAN2 TX interrupts | true | 5 | 0 |
| CAN2 RX0 interrupts | true | 5 | 0 |
| DMA2 stream6 global interrupt | true | 5 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| CAN1 RX1 interrupt | unused | | |
| CAN1 SCE interrupt | unused | | |
| CAN2 RX1 interrupt | unused | | |
| CAN2 SCE interrupt | unused | | |
| USART6 global interrupt | unused | | |
| FPU global interrupt | unused | | |
| UART7 global interrupt | unused | | |
| UART8 global interrupt | unused | | |

### 3.3.2. 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 |
| | | | |

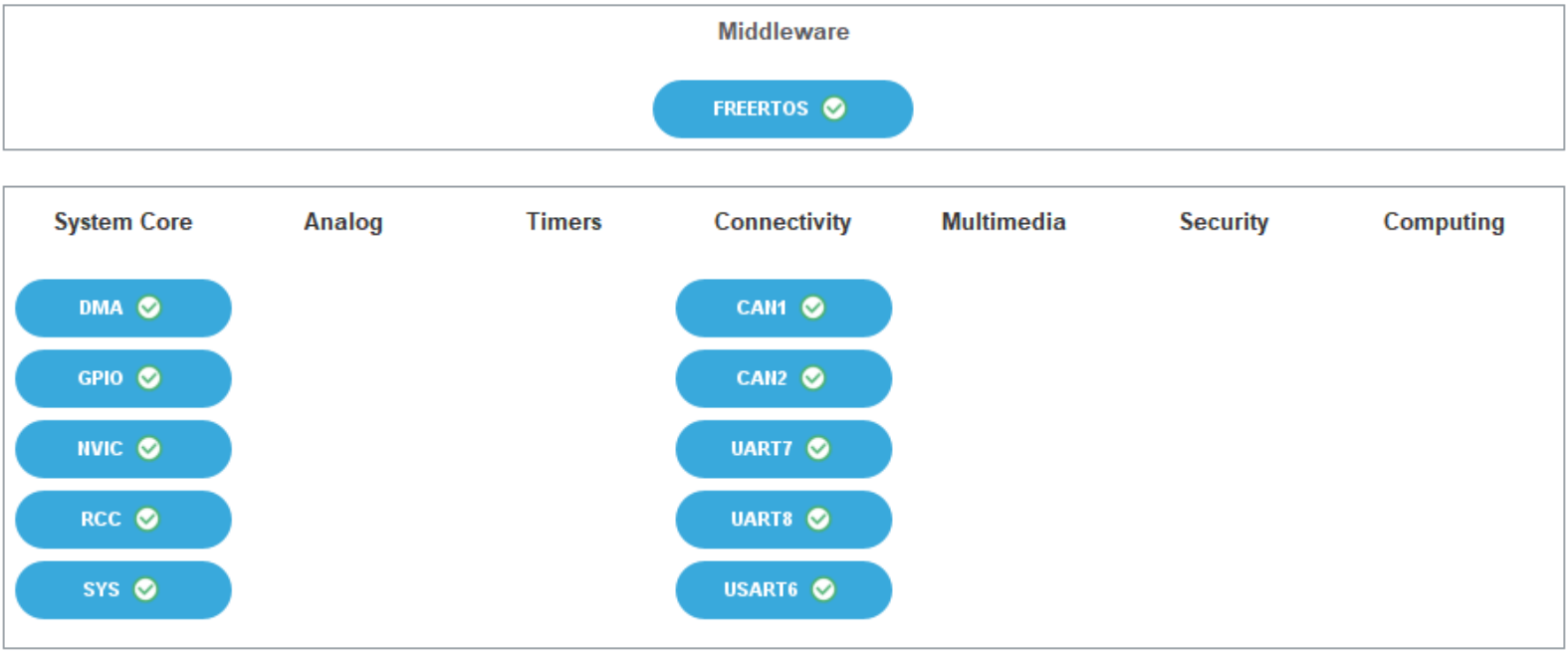
| Enabled interrupt Table | Select for init sequence ordering | Generate IRQ handler | Call HAL handler |
|---|---|---|---|
| Undefined instruction or illegal state | false | true | false |
| System service call via SWI instruction | false | false | false |
| Debug monitor | false | true | false |
| Pendable request for system service | false | false | false |
| System tick timer | false | false | true |
| DMA1 stream3 global interrupt | false | true | true |
| DMA1 stream6 global interrupt | false | true | true |
| CAN1 TX interrupts | false | true | true |
| CAN1 RX0 interrupts | false | true | true |
| TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts | false | true | true |
| CAN2 TX interrupts | false | true | true |
| CAN2 RX0 interrupts | false | true | true |
| DMA2 stream6 global interrupt | false | true | true |

*** User modified value**

# 4. System Views

4.1. Category view

*4.1.1. Current*



# 5. Docs & Resources

| Type | Link |
|---|---|
| BSDL files | https://www.st.com/resource/en/bsdl_model/stm32f427-437_429-439_bsdl.zip |
| IBIS models | https://www.st.com/resource/en/ibis_model/stm32f427-437_429-439_ibis.zip |
| System View Description | https://www.st.com/resource/en/svd/stm32f4_svd.zip |
| Presentations | https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf |
| Presentations | https://www.st.com/resource/en/product_presentation/stm32_eval-tools_portfolio.pdf |
| Presentations | https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf |
| Presentations | https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf |
| Presentations | https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf |
| Brochures | https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf |
| Flyers | https://www.st.com/resource/en/flyer/flstm32nucleo.pdf |
| Flyers | https://www.st.com/resource/en/flyer/flstmcsuite.pdf |
| Flyers | https://www.st.com/resource/en/flyer/flstm32trust.pdf |
| Product Certifications | https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf |

| | |
|---|---|
| Application Notes | https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an2945-stm8s-and-stm32-mcus-a-consistent-832bit-product-line-for-painless-migration-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an3070-managing-the-driver-enable-signal-for-rs485-and-iolink-communications-with-the-stm32s-usart-stmicroelectronics.pdf |
| Application Notes | https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf |
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