# 1. Description

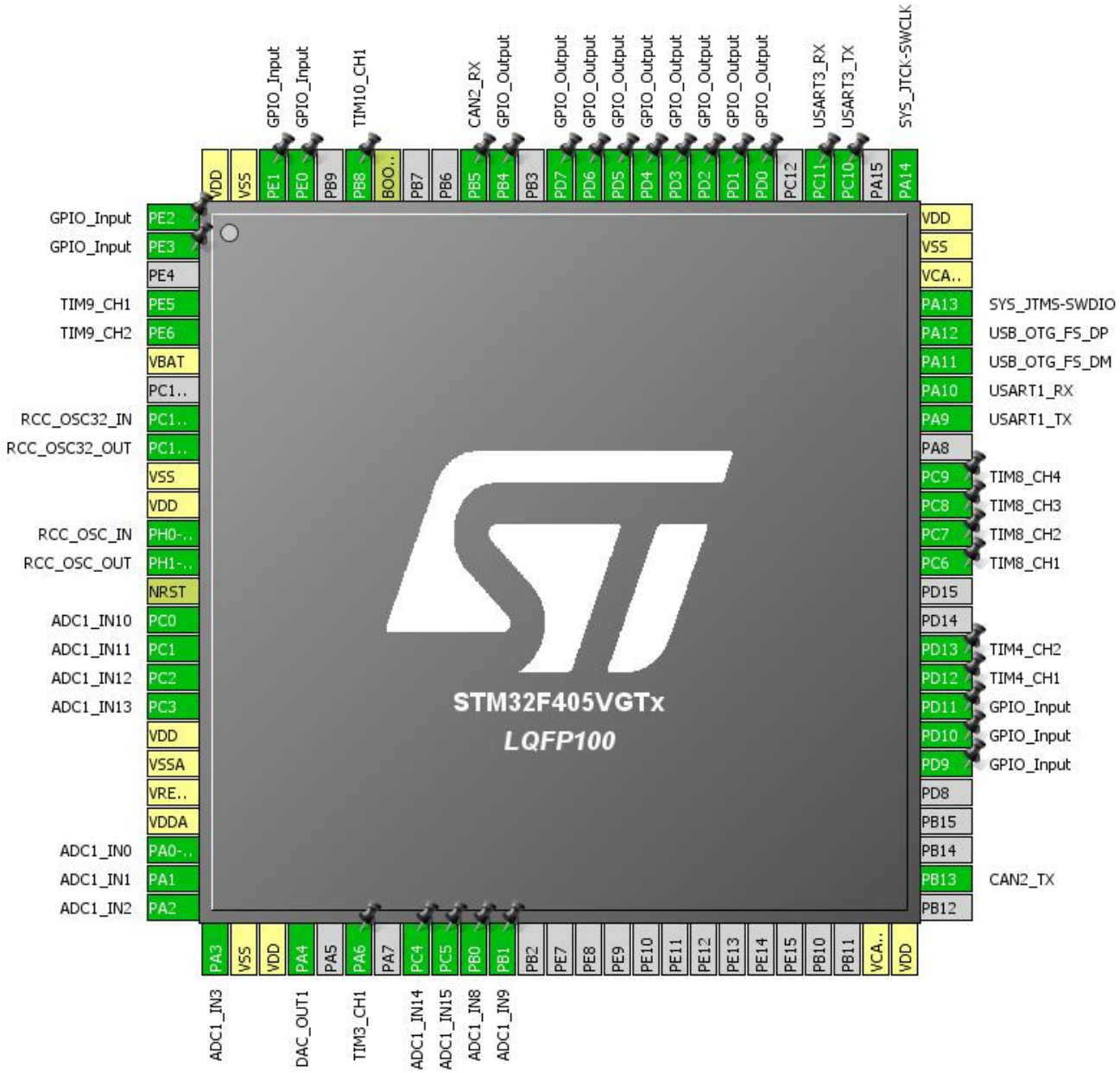
## 1.1. Project

| | |
|---|---|
| Project Name | SkyPulse |
| Board Name | SkyPulse |
| Generated with: | STM32CubeMX 4.23.0 |
| Date | 11/23/2017 |

## 1.2. MCU

| | |
|---|---|
| MCU Series | STM32F4 |
| MCU Line | STM32F405/415 |
| MCU name | STM32F405VGTx |
| MCU Package | LQFP100 |
| MCU Pin number | 100 |

# 2. Pinout Configuration



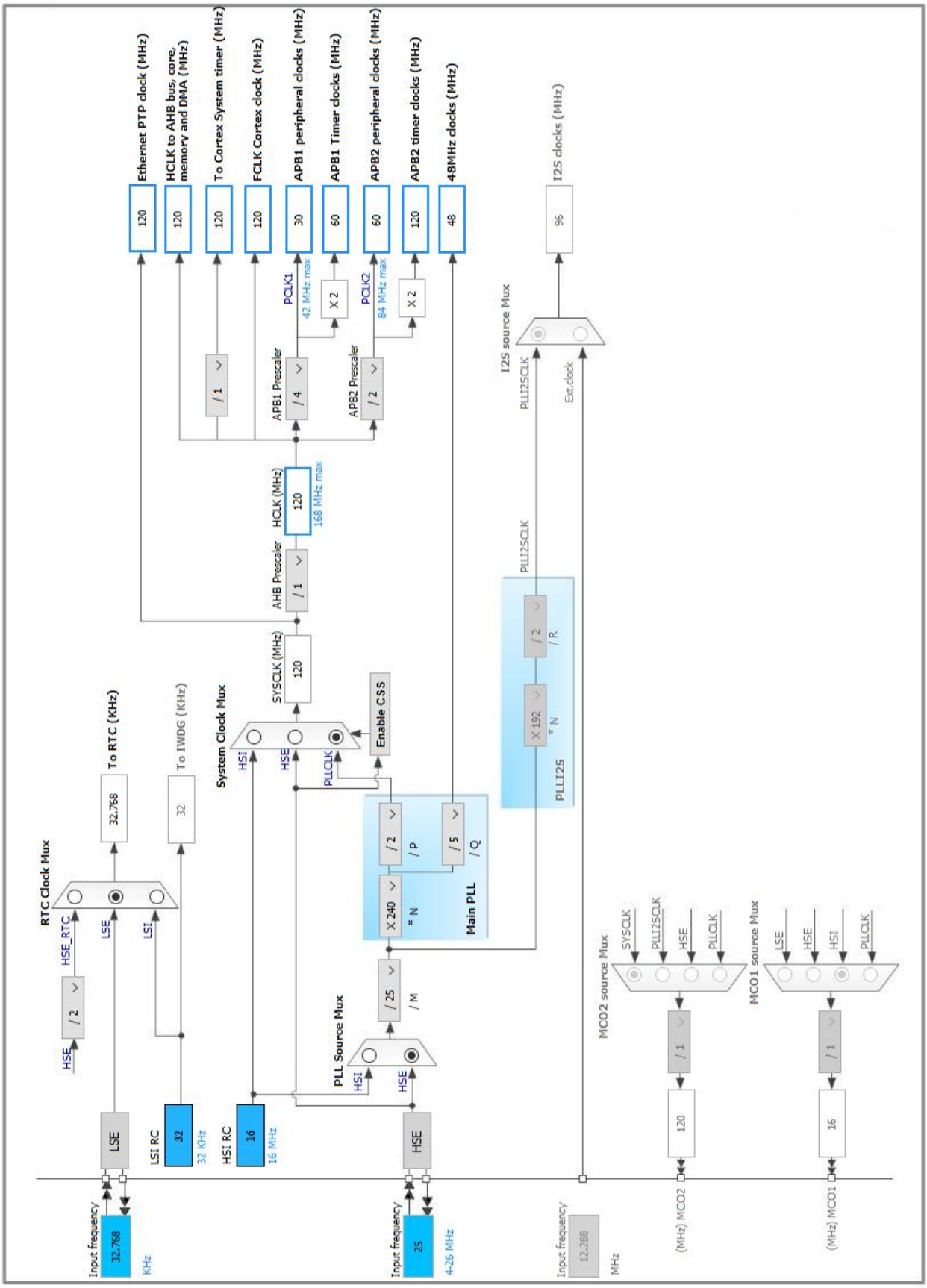
# 3. Pins Configuration

| Pin Number LQFP100 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 1 | PE2 * | I/O | GPIO_Input | FSW2 |
| 2 | PE3 * | I/O | GPIO_Input | FSW3 |
| 4 | PE5 | I/O | TIM9_CH1 | FAN_TACHO1 |
| 5 | PE6 | I/O | TIM9_CH2 | FAN_TACHO2 |
| 6 | VBAT | Power | | |
| 8 | PC14-OSC32_IN | I/O | RCC_OSC32_IN | |
| 9 | PC15-OSC32_OUT | I/O | RCC_OSC32_OUT | |
| 10 | VSS | Power | | |
| 11 | VDD | Power | | |
| 12 | PH0-OSC_IN | I/O | RCC_OSC_IN | |
| 13 | PH1-OSC_OUT | I/O | RCC_OSC_OUT | |
| 14 | NRST | Reset | | |
| 15 | PC0 | I/O | ADC1_IN10 | Psense0 |
| 16 | PC1 | I/O | ADC1_IN11 | Psense1 |
| 17 | PC2 | I/O | ADC1_IN12 | Psense2 |
| 18 | PC3 | I/O | ADC1_IN13 | Psense3 |
| 19 | VDD | Power | | |
| 20 | VSSA | Power | | |
| 21 | VREF+ | Power | | |
| 22 | VDDA | Power | | |
| 23 | PA0-WKUP | I/O | ADC1_IN0 | PUMP_CSENSE |
| 24 | PA1 | I/O | ADC1_IN1 | T1_H2O |
| 25 | PA2 | I/O | ADC1_IN2 | T1_H2O |
| 26 | PA3 | I/O | ADC1_IN3 | _5V |
| 27 | VSS | Power | | |
| 28 | VDD | Power | | |
| 29 | PA4 | I/O | DAC_OUT1 | |
| 31 | PA6 | I/O | TIM3_CH1 | PUMP_TACHO |
| 33 | PC4 | I/O | ADC1_IN14 | Dsense1 |
| 34 | PC5 | I/O | ADC1_IN15 | Dsense2 |
| 35 | PB0 | I/O | ADC1_IN8 | _12V |
| 36 | PB1 | I/O | ADC1_IN9 | _24V |
| 49 | VCAP_1 | Power | | |
| 50 | VDD | Power | | |
| 52 | PB13 | I/O | CAN2_TX | |
| 56 | PD9 * | I/O | GPIO_Input | cwbBUTTON |

| Pin Number LQFP100 | Pin Name (function after reset) | Pin Type | Alternate Function(s) | Label |
|---|---|---|---|---|
| 57 | PD10 * | I/O | GPIO_Input | cwbDOOR |
| 58 | PD11 * | I/O | GPIO_Input | cwbENGM |
| 59 | PD12 | I/O | TIM4_CH1 | _LED1 |
| 60 | PD13 | I/O | TIM4_CH2 | _LED2 |
| 63 | PC6 | I/O | TIM8_CH1 | _BOTTLE_OUT |
| 64 | PC7 | I/O | TIM8_CH2 | _BOTTLE_IN |
| 65 | PC8 | I/O | TIM8_CH3 | _AIR |
| 66 | PC9 | I/O | TIM8_CH4 | _WATER |
| 68 | PA9 | I/O | USART1_TX | |
| 69 | PA10 | I/O | USART1_RX | |
| 70 | PA11 | I/O | USB_OTG_FS_DM | |
| 71 | PA12 | I/O | USB_OTG_FS_DP | |
| 72 | PA13 | I/O | SYS_JTMS-SWDIO | |
| 73 | VCAP_2 | Power | | |
| 74 | VSS | Power | | |
| 75 | VDD | Power | | |
| 76 | PA14 | I/O | SYS_JTCK-SWCLK | |
| 78 | PC10 | I/O | USART3_TX | |
| 79 | PC11 | I/O | USART3_RX | |
| 81 | PD0 * | I/O | GPIO_Output | _RED1 |
| 82 | PD1 * | I/O | GPIO_Output | _GREEN1 |
| 83 | PD2 * | I/O | GPIO_Output | _YELLOW1 |
| 84 | PD3 * | I/O | GPIO_Output | _BLUE1 |
| 85 | PD4 * | I/O | GPIO_Output | _RED2 |
| 86 | PD5 * | I/O | GPIO_Output | _GREEN2 |
| 87 | PD6 * | I/O | GPIO_Output | _YELLOW2 |
| 88 | PD7 * | I/O | GPIO_Output | _BLUE2 |
| 90 | PB4 * | I/O | GPIO_Output | SYS_SHG |
| 91 | PB5 | I/O | CAN2_RX | |
| 94 | BOOT0 | Boot | | |
| 95 | PB8 | I/O | TIM10_CH1 | FAN_PWM |
| 97 | PE0 * | I/O | GPIO_Input | FSW0 |
| 98 | PE1 * | I/O | GPIO_Input | FSW1 |
| 99 | VSS | Power | | |
| 100 | VDD | Power | | |

* The pin is affected with an I/O function

# 4. Clock Tree Configuration



# 5. IPs and Middleware Configuration

## 5.1. ADC1

**mode: IN0**
**mode: IN1**
**mode: IN2**
**mode: IN3**
**mode: IN8**
**mode: IN9**
**mode: IN10**
**mode: IN11**
**mode: IN12**
**mode: IN13**
**mode: IN14**
**mode: IN15**

### 5.1.1. 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 | **Left alignment *** |
| Scan Conversion Mode | **Enabled *** |
| 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 | **12 *** |
| External Trigger Conversion Source | Regular Conversion launched by software |
| External Trigger Conversion Edge | None |
| Rank | 1 |
| Channel | Channel 0 |
| Sampling Time | 3 Cycles |

| | |
|---|---|
| Rank | **2 *** |
| Channel | **Channel 1 *** |
| Sampling Time | 3 Cycles |
| Rank | **3 *** |
| Channel | **Channel 2 *** |
| Sampling Time | 3 Cycles |
| Rank | **4 *** |
| Channel | **Channel 3 *** |
| Sampling Time | 3 Cycles |
| Rank | **5 *** |
| Channel | **Channel 8 *** |
| Sampling Time | 3 Cycles |
| Rank | **6 *** |
| Channel | **Channel 9 *** |
| Sampling Time | 3 Cycles |
| Rank | **7 *** |
| Channel | **Channel 10 *** |
| Sampling Time | 3 Cycles |
| Rank | **8 *** |
| Channel | **Channel 11 *** |
| Sampling Time | 3 Cycles |
| Rank | **9 *** |
| Channel | **Channel 12 *** |
| Sampling Time | 3 Cycles |
| Rank | **10 *** |
| Channel | **Channel 13 *** |
| Sampling Time | 3 Cycles |
| Rank | **11 *** |
| Channel | **Channel 14 *** |
| Sampling Time | 3 Cycles |
| Rank | **12 *** |
| Channel | **Channel 15 *** |
| Sampling Time | 3 Cycles |

### ADC_Injected_ConversionMode:

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

### WatchDog:

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

## *5.2. CAN2*

**mode: Mode**

### 5.2.1. Parameter Settings:

**Bit Timings Parameters:**

| | |
|---|---|
| Prescaler (for Time Quantum) | **4 *** |
| Time Quantum | **133.33333333333334 *** |
| Time Quanta in Bit Segment 1 | **10 Times *** |
| Time Quanta in Bit Segment 2 | **4 Times *** |
| Time for one Bit | **2000 *** |
| ReSynchronization Jump Width | **4 Times *** |

**Basic Parameters:**

| | |
|---|---|
| Time Triggered Communication Mode | Disable |
| Automatic Bus-Off Management | **Enable *** |
| Automatic Wake-Up Mode | Disable |
| No-Automatic Retransmission | Disable |
| Receive Fifo Locked Mode | Disable |
| Transmit Fifo Priority | **Enable *** |

**Advanced Parameters:**

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

## *5.3. DAC*

**mode: OUT1 Configuration**

### 5.3.1. Parameter Settings:

**DAC Out1 Settings:**

| | |
|---|---|
| Output Buffer | Enable |
| Trigger | **Timer 8 Trigger Out event *** |
| Wave generation mode | Disabled |

## 5.4. RCC

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

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

### 5.4.1. 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 |
| HSE Startup Timout Value (ms) | 100 |
| LSE Startup Timout Value (ms) | 5000 |

**Power Parameters:**

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

## 5.5. RTC

**mode: Activate Clock Source**

**mode: Activate Calendar**

### 5.5.1. Parameter Settings:

**General:**

| | |
|---|---|
| Hour Format | Hourformat 24 |
| Asynchronous Predivider value | 127 |
| Synchronous Predivider value | 255 |

**Calendar Time:**

| | |
|---|---|
| Data Format | **Binary data format *** |
| Hours | **15 *** |
| Minutes | **30 *** |
| Seconds | 0 |
| Day Light Saving: value of hour adjustment | Daylightsaving None |
| Store Operation | **Storeoperation Set *** |

**Calendar Date:**

| | |
|---|---|
| Week Day | **Tuesday *** |
| Month | **November *** |
| Date | **7 *** |
| Year | **17 *** |

## *5.6. SYS*

**Debug: Serial Wire**

**Timebase Source: TIM2**

## *5.7. TIM3*

**Channel1: Input Capture direct mode**

### 5.7.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **60 *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | 0 |
| 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 | **Update Event *** |

**Input Capture Channel 1:**

| | |
|---|---|
| Polarity Selection | **Both Edges *** |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter (4 bits value) | **15 *** |

## *5.8. TIM4*

**Channel1: PWM Generation CH1**

**Channel2: PWM Generation CH2**

### 5.8.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | 0 |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **75 *** |
| 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 |

## *5.9. TIM8*

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

### 5.9.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **29 *** |
| Counter Mode | **Center Aligned mode1 *** |
| Counter Period (AutoReload Register - 16 bits value ) | **__PWMRATE *** |
| Internal Clock Division (CKD) | No Division |
| Repetition Counter (RCR - 8 bits value) | 0 |

**Trigger Output (TRGO) Parameters:**

| | |
|---|---|
| Master/Slave Mode | **Enable (sync between this TIM (Master) and its Slaves (through TRGO)) *** |

| | |
|---|---|
| Trigger Event Selection | **Update Event *** |

**Break And Dead Time management - BRK Configuration:**

| | |
|---|---|
| BRK State | Disable |
| BRK Polarity | High |

**Break And Dead Time management - Output Configuration:**

| | |
|---|---|
| Automatic Output State | Disable |
| Off State Selection for Run Mode (OSSR) | Disable |
| Off State Selection for Idle Mode (OSSI) | Disable |
| Lock Configuration | Off |

**PWM Generation Channel 1:**

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

**PWM Generation Channel 2:**

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

**PWM Generation Channel 3:**

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

**PWM Generation Channel 4:**

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

## *5.10. TIM9*

**mode: Clock Source**

**Channel1: Input Capture direct mode**

**Channel2: Input Capture direct mode**

### 5.10.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **60 *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | 0 |
| Internal Clock Division (CKD) | No Division |

**Input Capture Channel 1:**

| | |
|---|---|
| Polarity Selection | **Both Edges *** |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter (4 bits value) | **15 *** |

**Input Capture Channel 2:**

| | |
|---|---|
| Polarity Selection | Rising Edge |
| IC Selection | Direct |
| Prescaler Division Ratio | No division |
| Input Filter (4 bits value) | 0 |

## *5.11. TIM10*

**mode: Activated**

**Channel1: PWM Generation CH1**

### 5.11.1. Parameter Settings:

**Counter Settings:**

| | |
|---|---|
| Prescaler (PSC - 16 bits value) | **29 *** |
| Counter Mode | Up |
| Counter Period (AutoReload Register - 16 bits value ) | **__PWMRATE *** |
| Internal Clock Division (CKD) | No Division |

**PWM Generation Channel 1:**

| | |
|---|---|
| Mode | PWM mode 1 |
| Pulse (16 bits value) | **10 *** |
| Fast Mode | Disable |
| CH Polarity | High |

## 5.12. USART1

### Mode: Asynchronous

#### 5.12.1. 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 |

## 5.13. USART3

### Mode: Asynchronous

#### 5.13.1. Parameter Settings:

**Basic Parameters:**

| | |
|---|---|
| Baud Rate | **57600 *** |
| Word Length | 8 Bits (including Parity) |
| Parity | None |
| Stop Bits | 1 |

**Advanced Parameters:**

| | |
|---|---|
| Data Direction | Receive and Transmit |
| Over Sampling | 16 Samples |

## 5.14. USB_OTG_FS

### Mode: Device_Only

#### 5.14.1. Parameter Settings:

| | |
|---|---|
| Speed | Device Full Speed 12MBit/s |
| Endpoint 0 Max Packet size | 64 Bytes |
| Enable internal IP DMA | Disabled |

| | |
|---|---|
| Low power | Disabled |
| Link Power Management | Disabled |
| VBUS sensing | Disabled |
| Signal start of frame | Disabled |

## *5.15. FATFS*

### mode: User-defined

### 5.15.1. Set Defines:

#### Version:

| | |
|---|---|
| FATFS version | R0.12c |

#### Function Parameters:

| | |
|---|---|
| FS_READONLY (Read-only mode) | Disabled |
| FS_MINIMIZE (Minimization level) | Disabled |
| USE_STRFUNC (String functions) | Enabled with LF -> CRLF conversion |
| USE_FIND (Find functions) | Disabled |
| USE_MKFS (Make filesystem function) | Enabled |
| USE_FASTSEEK (Fast seek function) | Enabled |
| USE_EXPAND (Use f_expand function) | Disabled |
| USE_CHMOD (Change attributes function) | Disabled |
| USE_LABEL (Volume label functions) | Disabled |
| USE_FORWARD (Forward function) | Disabled |

#### Locale and Namespace Parameters:

| | |
|---|---|
| CODE_PAGE (Code page on target) | Latin 1 |
| USE_LFN (Use Long Filename) | **Enabled with dynamic working buffer on the STACK *** |
| MAX_LFN (Max Long Filename) | 255 |
| LFN_UNICODE (Enable Unicode) | ANSI/OEM |
| STRF_ENCODE (Character encoding) | UTF-8 |
| FS_RPATH (Relative Path) | **Enabled with f_getcwd *** |

#### Physical Drive Parameters:

| | |
|---|---|
| VOLUMES (Logical drives) | **2 *** |
| MAX_SS (Maximum Sector Size) | 512 |
| MIN_SS (Minimum Sector Size) | 512 |
| MULTI_PARTITION (Volume partitions feature) | Disabled |
| USE_TRIM (Erase feature) | Disabled |
| FS_NOFSINFO (Force full FAT scan) | 0 |

#### System Parameters:

| | |
|---|---|
| FS_TINY (Tiny mode) | Disabled |

| | |
|---|---|
| FS_EXFAT (Support of exFAT file system) | Disabled |
| FS_NORTC (Timestamp feature) | Dynamic timestamp |
| NORTC_YEAR (Year for timestamp) | 2015 |
| NORTC_MON (Month for timestamp) | 6 |
| NORTC_MDAY (Day for timestamp) | 4 |
| FS_REENTRANT (Re-Entrancy) | Enabled |
| FS_TIMEOUT (Timeout ticks) | 1000 |
| SYNC_t (O/S sync object) | osSemaphoreId |
| FS_LOCK (Number of files opened simultaneously) | 2 |

## *5.16. FREERTOS*

**mode: Enabled**

### 5.16.1. Config parameters:

**Versions:**

| | |
|---|---|
| FreeRTOS version | 9.0.0 |
| CMSIS-RTOS version | 1.02 |

**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 |

**Memory management settings:**

| | |
|---|---|
| Memory Allocation | Dynamic |
| TOTAL_HEAP_SIZE | **0x10000 *** |
| Memory Management scheme | |

| | |
|---|---|
| | **heap_1 *** |

**Hook function related definitions:**

| | |
|---|---|
| USE_IDLE_HOOK | Disabled |
| USE_TICK_HOOK | Disabled |
| USE_MALLOC_FAILED_HOOK | **Enabled *** |
| USE_DAEMON_TASK_STARTUP_HOOK | Disabled |
| CHECK_FOR_STACK_OVERFLOW | **Option2 *** |

**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 |

## 5.16.2. 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 |

## *5.17. USB_DEVICE*

### Class For FS IP: Communication Device Class (Virtual Port Com)

### 5.17.1. Parameter Settings:

**Basic Parameters:**

| | |
|---|---|
| USBD_MAX_NUM_INTERFACES (Maximum number of supported interfaces) | 1 |
| USBD_MAX_NUM_CONFIGURATION (Maximum number of supported configuration) | 1 |
| USBD_MAX_STR_DESC_SIZ (Maximum size for the string descriptors) | 512 |
| USBD_SUPPORT_USER_STRING (Enable user string descriptor) | Disabled |
| USBD_SELF_POWERED (Enabled self power) | Enabled |
| USBD_DEBUG_LEVEL (USBD Debug Level) | 0: No debug message |

**Class Parameters:**

| | |
|---|---|
| USB CDC Rx Buffer Size | 2048 |
| USB CDC Tx Buffer Size | 2048 |

### 5.17.2. Device Descriptor:

**Device Descriptor:**

| | |
|---|---|
| VID (Vendor IDentifier) | 1155 |
| LANGID_STRING (Language Identifier) | English(United States) |
| MANUFACTURER_STRING (Manufacturer Identifier) | STMicroelectronics |

**Device Descriptor FS:**

| | |
|---|---|
| PID (Product IDentifier) | 22336 |
| PRODUCT_STRING (Product Identifier) | STM32 Virtual ComPort |
| SERIALNUMBER_STRING (Serial number) | 00000000001A |
| CONFIGURATION_STRING (Configuration Identifier) | CDC Config |
| INTERFACE_STRING (Interface Identifier) | CDC Interface |

*** User modified value**

# 6. System Configuration

## 6.1. GPIO configuration

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| ADC1 | PC0 | ADC1_IN10 | Analog mode | No pull-up and no pull-down | n/a | Psense0 |
| | PC1 | ADC1_IN11 | Analog mode | No pull-up and no pull-down | n/a | Psense1 |
| | PC2 | ADC1_IN12 | Analog mode | No pull-up and no pull-down | n/a | Psense2 |
| | PC3 | ADC1_IN13 | Analog mode | No pull-up and no pull-down | n/a | Psense3 |
| | PA0-WKUP | ADC1_IN0 | Analog mode | No pull-up and no pull-down | n/a | PUMP_CSENSE |
| | PA1 | ADC1_IN1 | Analog mode | No pull-up and no pull-down | n/a | T1_H2O |
| | PA2 | ADC1_IN2 | Analog mode | No pull-up and no pull-down | n/a | T1_H2O |
| | PA3 | ADC1_IN3 | Analog mode | No pull-up and no pull-down | n/a | _5V |
| | PC4 | ADC1_IN14 | Analog mode | No pull-up and no pull-down | n/a | Dsense1 |
| | PC5 | ADC1_IN15 | Analog mode | No pull-up and no pull-down | n/a | Dsense2 |
| | PB0 | ADC1_IN8 | Analog mode | No pull-up and no pull-down | n/a | _12V |
| | PB1 | ADC1_IN9 | Analog mode | No pull-up and no pull-down | n/a | _24V |
| CAN2 | PB13 | CAN2_TX | Alternate Function Push Pull | **Pull-up *** | **Very High *** | |
| | PB5 | CAN2_RX | Alternate Function Push Pull | **Pull-up *** | **Very High *** | |
| DAC | PA4 | DAC_OUT1 | Analog mode | No pull-up and no pull-down | n/a | |
| RCC | 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 | |
| SYS | PA13 | SYS_JTMS-SWDIO | n/a | n/a | n/a | |
| | PA14 | SYS_JTCK-SWCLK | n/a | n/a | n/a | |
| TIM3 | PA6 | TIM3_CH1 | Alternate Function Push Pull | **Pull-up *** | Low | PUMP_TACHO |
| TIM4 | PD12 | TIM4_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | **Very High *** | _LED1 |
| | PD13 | TIM4_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | **Very High** | _LED2 |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| | | | | | * | |
| TIM8 | PC6 | TIM8_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | _BOTTLE_OUT |
| | PC7 | TIM8_CH2 | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | _BOTTLE_IN |
| | PC8 | TIM8_CH3 | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | _AIR |
| | PC9 | TIM8_CH4 | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | _WATER |
| TIM9 | PE5 | TIM9_CH1 | Alternate Function Push Pull | **Pull-up *** | Low | FAN_TACHO1 |
| | PE6 | TIM9_CH2 | Alternate Function Push Pull | **Pull-up *** | Low | FAN_TACHO2 |
| TIM10 | PB8 | TIM10_CH1 | Alternate Function Push Pull | No pull-up and no pull-down | **High *** | FAN_PWM |
| USART1 | PA9 | USART1_TX | Alternate Function Push Pull | Pull-up | **Very High *** | |
| | PA10 | USART1_RX | Alternate Function Push Pull | Pull-up | **Very High *** | |
| USART3 | PC10 | USART3_TX | Alternate Function Push Pull | Pull-up | **Very High *** | |
| | PC11 | USART3_RX | Alternate Function Push Pull | Pull-up | **Very High *** | |
| USB_OTG_FS | PA11 | USB_OTG_FS_DM | Alternate Function Push Pull | **Pull-down *** | **Very High *** | |
| | PA12 | USB_OTG_FS_DP | Alternate Function Push Pull | **Pull-down *** | **Very High *** | |
| GPIO | PE2 | GPIO_Input | Input mode | **Pull-up *** | n/a | FSW2 |
| | PE3 | GPIO_Input | Input mode | **Pull-up *** | n/a | FSW3 |
| | PD9 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | cwbBUTTON |
| | PD10 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | cwbDOOR |
| | PD11 | GPIO_Input | Input mode | No pull-up and no pull-down | n/a | cwbENGM |
| | PD0 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _RED1 |
| | PD1 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _GREEN1 |
| | PD2 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _YELLOW1 |
| | PD3 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _BLUE1 |
| | PD4 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _RED2 |
| | PD5 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _GREEN2 |
| | PD6 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _YELLOW2 |
| | PD7 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | _BLUE2 |
| | PB4 | GPIO_Output | **Output Open Drain *** | No pull-up and no pull-down | Low | SYS_SHG |
| | PE0 | GPIO_Input | Input mode | **Pull-up *** | n/a | FSW0 |
| | | | | | | |

| IP | Pin | Signal | GPIO mode | GPIO pull/up pull down | Max Speed | User Label |
|---|---|---|---|---|---|---|
| | PE1 | GPIO_Input | Input mode | **Pull-up *** | n/a | FSW1 |

## 6.2. DMA configuration

| DMA request | Stream | Direction | Priority |
|---|---|---|---|
| ADC1 | DMA2_Stream0 | Peripheral To Memory | Low |
| TIM4_UP | DMA1_Stream6 | Memory To Peripheral | Low |
| TIM8_UP | DMA2_Stream1 | Memory To Peripheral | Low |
| USART1_RX | DMA2_Stream5 | Peripheral To Memory | Low |
| USART1_TX | DMA2_Stream7 | Memory To Peripheral | Low |
| USART3_RX | DMA1_Stream1 | Peripheral To Memory | Low |
| USART3_TX | DMA1_Stream3 | Memory To Peripheral | Low |
| DAC1 | DMA1_Stream5 | Memory To Peripheral | 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 |

### *TIM4_UP: DMA1_Stream6 DMA request Settings:*

| | |
|---|---|
| Mode: | Normal |
| Use fifo: | **Enable *** |
| FIFO Threshold: | Full |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Half Word |
| Memory Data Width: | **Byte *** |
| Peripheral Burst Size: | Single |
| Memory Burst Size: | Single |

### *TIM8_UP: DMA2_Stream1 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | **Enable *** |
| FIFO Threshold: | Full |
| Peripheral Increment: | Disable |

| | |
|---|---|
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Half Word |
| Memory Data Width: | **Word *** |
| Peripheral Burst Size: | Single |
| Memory Burst Size: | Single |

### *USART1_RX: DMA2_Stream5 DMA request Settings:*

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

### *USART1_TX: DMA2_Stream7 DMA request Settings:*

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

### *USART3_RX: DMA1_Stream1 DMA request Settings:*

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

### *USART3_TX: DMA1_Stream3 DMA request Settings:*

| | |
|---|---|
| Mode: | Normal |
| Use fifo: | Disable |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |

| | |
|---|---|
| Peripheral Data Width: | Byte |
| Memory Data Width: | Byte |

### *DAC1: DMA1_Stream5 DMA request Settings:*

| | |
|---|---|
| Mode: | **Circular *** |
| Use fifo: | **Enable *** |
| FIFO Threshold: | Full |
| Peripheral Increment: | Disable |
| Memory Increment: | **Enable *** |
| Peripheral Data Width: | Half Word |
| Memory Data Width: | Half Word |
| Peripheral Burst Size: | Single |
| Memory Burst Size: | Single |

## 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 | 15 | 0 |
| System tick timer | true | 15 | 0 |
| DMA1 stream1 global interrupt | true | 5 | 0 |
| DMA1 stream3 global interrupt | true | 5 | 0 |
| DMA1 stream5 global interrupt | true | 5 | 0 |
| DMA1 stream6 global interrupt | true | 5 | 0 |
| TIM1 break interrupt and TIM9 global interrupt | true | 5 | 0 |
| TIM2 global interrupt | true | 0 | 0 |
| TIM3 global interrupt | true | 5 | 0 |
| USART1 global interrupt | true | 5 | 0 |
| USART3 global interrupt | true | 5 | 0 |
| DMA2 stream0 global interrupt | true | 5 | 0 |
| DMA2 stream1 global interrupt | true | 5 | 0 |
| CAN2 TX interrupts | true | 5 | 0 |
| CAN2 RX0 interrupts | true | 5 | 0 |
| CAN2 SCE interrupt | true | 5 | 0 |
| USB On The Go FS global interrupt | true | 5 | 0 |
| DMA2 stream5 global interrupt | true | 5 | 0 |
| DMA2 stream7 global interrupt | true | 5 | 0 |
| PVD interrupt through EXTI line 16 | unused | | |
| Flash global interrupt | unused | | |
| RCC global interrupt | unused | | |
| ADC1, ADC2 and ADC3 global interrupts | unused | | |
| TIM1 update interrupt and TIM10 global interrupt | unused | | |
| TIM4 global interrupt | unused | | |
| TIM8 break interrupt and TIM12 global interrupt | unused | | |
| TIM8 update interrupt and TIM13 global interrupt | unused | | |
| TIM8 trigger and commutation interrupts and TIM14 global interrupt | unused | | |
| TIM8 capture compare interrupt | unused | | |
| | | | |

| Interrupt Table | Enable | Preenmption Priority | SubPriority |
|---|---|---|---|
| TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts | unused | | |
| CAN2 RX1 interrupt | unused | | |
| FPU global interrupt | unused | | |

*** User modified value**

# 7. Power Consumption Calculator report

## 7.1. Microcontroller Selection

| | |
|---|---|
| Series | STM32F4 |
| Line | STM32F405/415 |
| MCU | STM32F405VGTx |
| Datasheet | 022152_Rev8 |

## 7.2. Parameter Selection

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

# 8. Software Project

## 8.1. Project Settings

| Name | Value |
|---|---|
| Project Name | SkyPulse |
| Project Folder | C:\Users\Mocnik\Desktop\skyCube\CubeMx |
| Toolchain / IDE | MDK-ARM V5 |
| Firmware Package Name and Version | STM32Cube FW_F4 V1.17.0 |

## 8.2. Code Generation Settings

| Name | Value |
|---|---|
| STM32Cube Firmware Library Package | Copy all used libraries into the project folder |
| 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 |