

## 1. Description

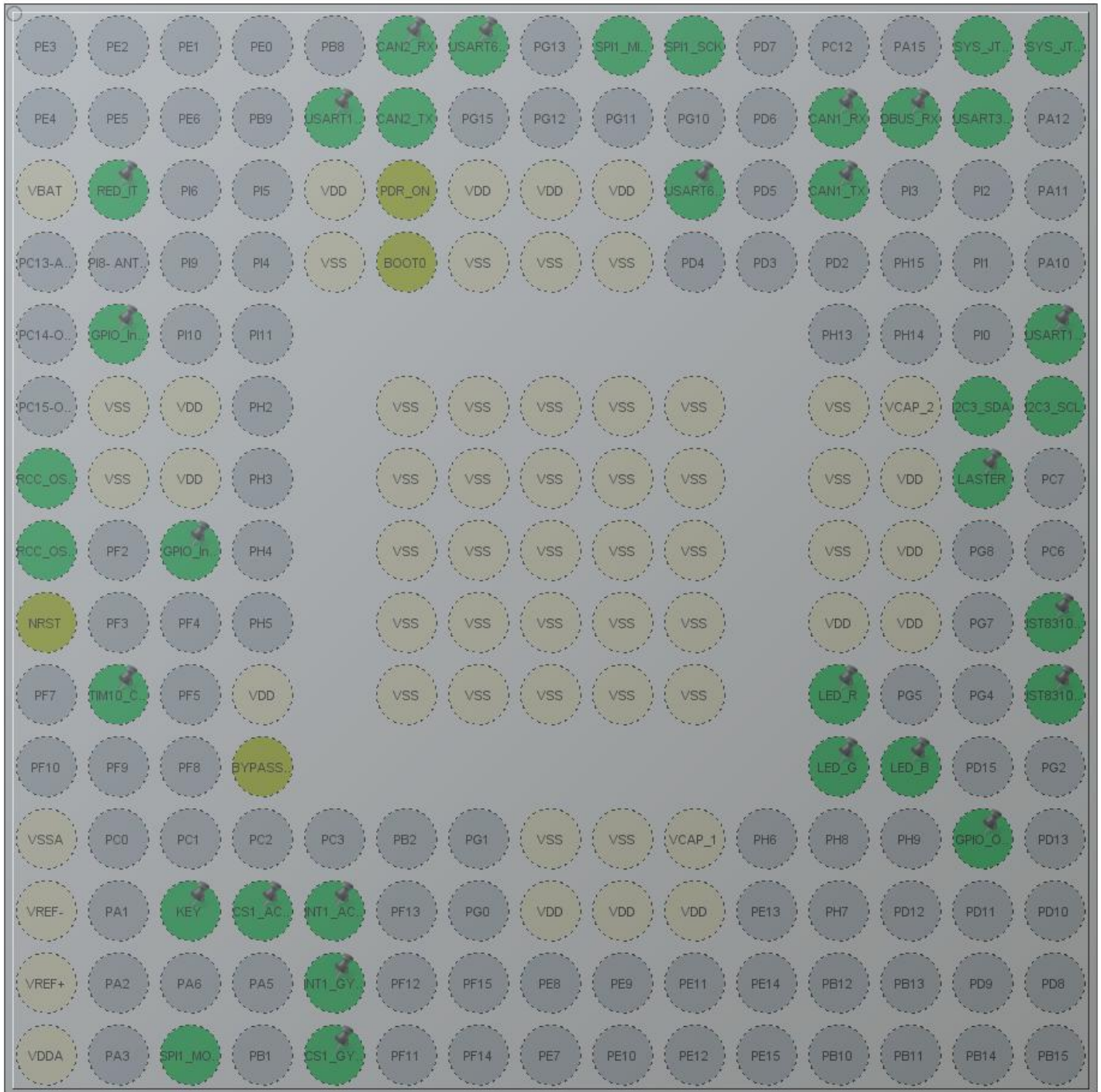
### 1.1. Project

Project Name	Hero_C
Board Name	custom
Generated with:	STM32CubeMX 5.5.0
Date	01/25/2021

### 1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F407/417
MCU name	STM32F407IGHx
MCU Package	UFBGA176
MCU Pin number	201

## 2. Pinout Configuration



UFBGA176 +25 (Top view)

### 3. Pins Configuration

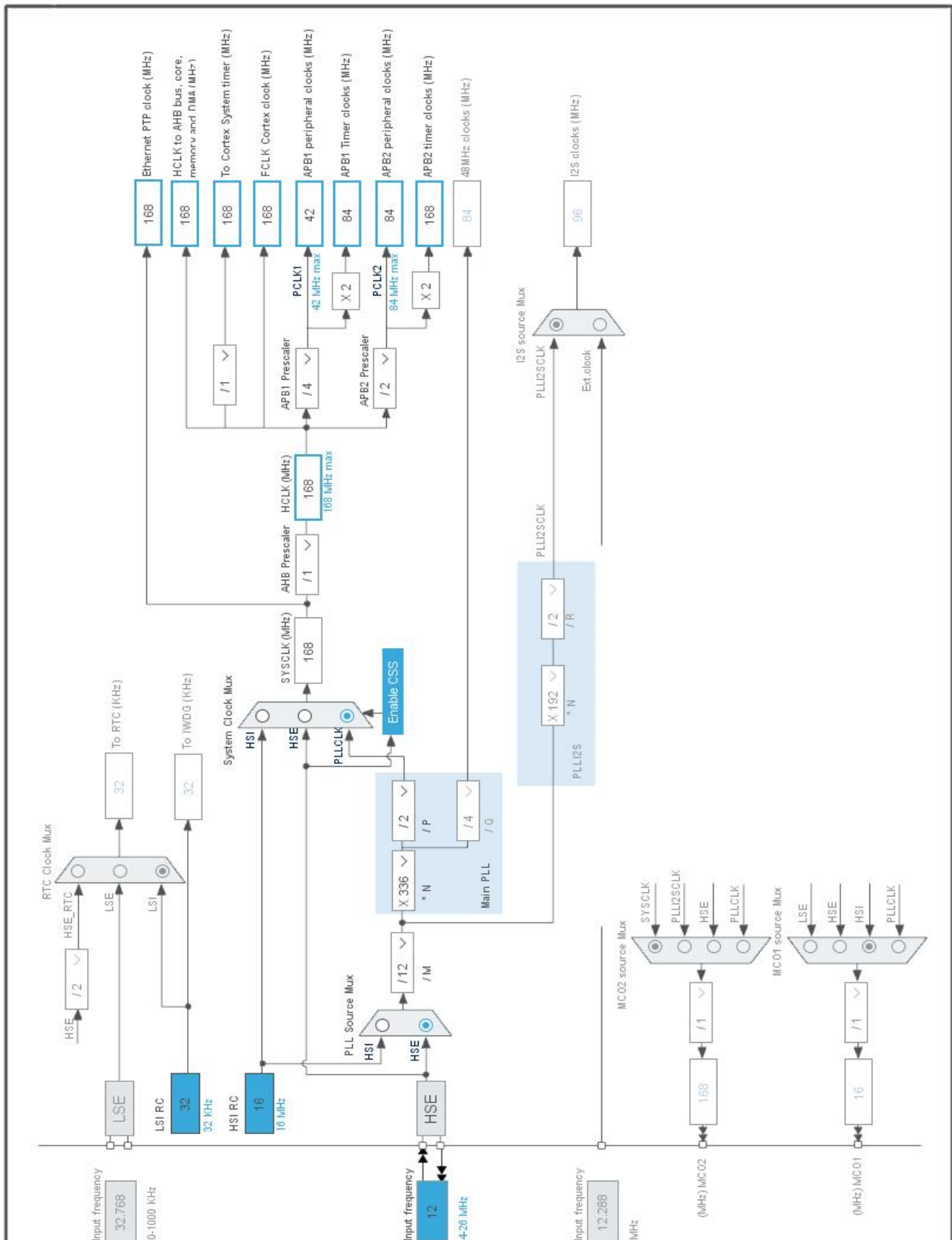
Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
A6	PB5	I/O	CAN2_RX	CAN2_RX
A7	PG14	I/O	USART6_TX	USART6_TX_PC
A9	PB4	I/O	SPI1_MISO	
A10	PB3	I/O	SPI1_SCK	
A14	PA14	I/O	SYS_JTCK-SWCLK	
A15	PA13	I/O	SYS_JTMS-SWDIO	
B5	PB7	I/O	USART1_RX	USART1_RX
B6	PB6	I/O	CAN2_TX	CAN2_TX
B12	PD0	I/O	CAN1_RX	CAN1_RX
B13	PC11	I/O	USART3_RX	DBUS_RX
B14	PC10	I/O	USART3_TX	
C1	VBAT	Power		
C2	PI7	I/O	GPIO_EXTI7	RED_IT
C5	VDD	Power		
C6	PDR_ON	Reset		
C7	VDD	Power		
C8	VDD	Power		
C9	VDD	Power		
C10	PG9	I/O	USART6_RX	USART6_RX_PC
C12	PD1	I/O	CAN1_TX	CAN1_TX
D5	VSS	Power		
D6	BOOT0	Boot		
D7	VSS	Power		
D8	VSS	Power		
D9	VSS	Power		
E2	PF0 *	I/O	GPIO_Input	
E15	PA9	I/O	USART1_TX	USART1_TX
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		

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
F14	PC9	I/O	I2C3_SDA	
F15	PA8	I/O	I2C3_SCL	
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		
G14	PC8 *	I/O	GPIO_Output	LASTER
H1	PH1-OSC_OUT	I/O	RCC_OSC_OUT	
H3	PF1 *	I/O	GPIO_Input	
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		
J15	PG6 *	I/O	GPIO_Output	IST8310_RST
K2	PF6	I/O	TIM10_CH1	
K4	VDD	Power		
K6	VSS	Power		
K7	VSS	Power		
K8	VSS	Power		
K9	VSS	Power		
K10	VSS	Power		
K12	PH12 *	I/O	GPIO_Output	LED_R

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
K15	PG3	I/O	GPIO_EXTI3	IST8310_DRDY
L4	BYPASS_REG	Reset		
L12	PH11 *	I/O	GPIO_Output	LED_G
L13	PH10 *	I/O	GPIO_Output	LED_B
M1	VSSA	Power		
M8	VSS	Power		
M9	VSS	Power		
M10	VCAP_1	Power		
M14	PD14 *	I/O	GPIO_Output	
N1	VREF-	Power		
N3	PA0-WKUP	I/O	GPIO_EXTI0	KEY
N4	PA4 *	I/O	GPIO_Output	CS1_ACCEL
N5	PC4	I/O	GPIO_EXTI4	INT1_ACCEL
N8	VDD	Power		
N9	VDD	Power		
N10	VDD	Power		
P1	VREF+	Power		
P5	PC5	I/O	GPIO_EXTI5	INT1_GYRO
R1	VDDA	Power		
R3	PA7	I/O	SPI1_MOSI	
R5	PB0 *	I/O	GPIO_Output	CS1_GYRO

\* The pin is affected with an I/O function

## 4. Clock Tree Configuration



## 5. Software Project

### 5.1. Project Settings

Name	Value
Project Name	Hero_C
Project Folder	F:\OneDrive - ahqb\rm\Hero_C
Toolchain / IDE	MDK-ARM V5
Firmware Package Name and Version	STM32Cube FW_F4 V1.24.2

### 5.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Copy all used libraries into the project folder
Generate peripheral initialization as a pair of '.c/.h' files	Yes
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

## 6. Power Consumption Calculator report

### 6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F407/417
MCU	STM32F407IGHx
Datasheet	022152_Rev8

### 6.2. Parameter Selection

Temperature	25
Vdd	3.3



## 7. IPs and Middleware Configuration

### 7.1. CAN1

mode: Mode

#### 7.1.1. Parameter Settings:

##### Bit Timings Parameters:

Prescaler (for Time Quantum)	6 *
Time Quantum	142.85714285714286 *
Time Quanta in Bit Segment 1	2 Times *
Time Quanta in Bit Segment 2	4 Times *
ReSynchronization Jump Width	1 Time

##### Basic Parameters:

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

##### Advanced Parameters:

Operating Mode	Normal
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### 7.2. CAN2

mode: Mode

#### 7.2.1. Parameter Settings:

##### Bit Timings Parameters:

Prescaler (for Time Quantum)	6 *
Time Quantum	142.85714285714286 *
Time Quanta in Bit Segment 1	2 Times *
Time Quanta in Bit Segment 2	4 Times *
ReSynchronization Jump Width	1 Time

##### Basic Parameters:

Time Triggered Communication Mode	Disable
Automatic Bus-Off Management	Disable
Automatic Wake-Up Mode	Disable
Automatic Retransmission	Disable

Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	Disable

**Advanced Parameters:**

Operating Mode	Normal
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## 7.3. GPIO

## 7.4. I2C3

### I2C: I2C

#### 7.4.1. Parameter Settings:

**Master Features:**

I2C Speed Mode	<b>Fast Mode *</b>
I2C Clock Speed (Hz)	400000
Fast Mode Duty Cycle	Duty cycle Tlow/Thigh = 2

**Slave Features:**

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

## 7.5. RCC

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

#### 7.5.1. 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
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

**Power Parameters:**

Power Regulator Voltage Scale

Power Regulator Voltage Scale 1

## 7.6. SPI1

**Mode: Full-Duplex Master**

### 7.6.1. Parameter Settings:

**Basic Parameters:**

Frame Format

Motorola

Data Size

8 Bits

First Bit

MSB First

**Clock Parameters:**

Prescaler (for Baud Rate)

**256 \***

Baud Rate

**328.125 KBits/s \***

Clock Polarity (CPOL)

**High \***

Clock Phase (CPHA)

**2 Edge \***

**Advanced Parameters:**

CRC Calculation

Disabled

NSS Signal Type

Software

## 7.7. SYS

**Debug: Serial Wire**

**Timebase Source: TIM2**

## 7.8. TIM4

**Clock Source : Internal Clock**

### 7.8.1. Parameter Settings:

**Counter Settings:**

Prescaler (PSC - 16 bits value)

**839 \***

Counter Mode

Up

Counter Period (AutoReload Register - 16 bits value )

**99 \***

Internal Clock Division (CKD)

No Division

auto-reload preload

Disable

**Trigger Output (TRGO) Parameters:**

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

## 7.9. TIM10

**mode: Activated**

**Channel1: PWM Generation CH1**

### 7.9.1. Parameter Settings:

#### Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	<b>4999 *</b>
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

#### PWM Generation Channel 1:

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

## 7.10. USART1

**Mode: Asynchronous**

### 7.10.1. 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

## 7.11. USART3

**Mode: Asynchronous**

### 7.11.1. Parameter Settings:

**Basic Parameters:**

Baud Rate	100000 *
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

**Advanced Parameters:**

Data Direction	Receive and Transmit
Over Sampling	16 Samples

## 7.12. USART6

**Mode: Asynchronous**

### 7.12.1. 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

## 7.13. FREERTOS

**Interface: CMSIS\_V1**

### 7.13.1. Config parameters:

**API:**

FreeRTOS API	CMSIS v1
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**Versions:**

FreeRTOS version	10.0.1
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
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
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**Interrupt nesting behaviour configuration:**

LIBRARY_LOWEST_INTERRUPT_PRIORITY	15
LIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY	5

### 7.13.2. Include parameters:

#### Include definitions:

vTaskPrioritySet	Enabled
uxTaskPriorityGet	Enabled
vTaskDelete	Enabled
vTaskCleanUpResources	Disabled
vTaskSuspend	Enabled
vTaskDelayUntil	<b>Enabled *</b>
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

**\* User modified value**

## 8. System Configuration

### 8.1. 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 *	CAN1_RX
	PD1	CAN1_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	CAN1_TX
CAN2	PB5	CAN2_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	CAN2_RX
	PB6	CAN2_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	CAN2_TX
I2C3	PC9	I2C3_SDA	Alternate Function Open Drain	Pull-up	Very High *	
	PA8	I2C3_SCL	Alternate Function Open Drain	Pull-up	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	
SPI1	PB4	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PB3	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
SYS	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
TIM10	PF6	TIM10_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART1	PB7	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	USART1_RX
	PA9	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	USART1_TX
USART3	PC11	USART3_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	DBUS_RX
	PC10	USART3_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High	



IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
					*	
USART6	PG14	USART6_TX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	USART6_TX_PC
	PG9	USART6_RX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	USART6_RX_PC
GPIO	PI7	GPIO_EXTI7	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	RED_IT
	PF0	GPIO_Input	Input mode	<b>Pull-up</b> *	n/a	
	PC8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LASTER
	PF1	GPIO_Input	Input mode	<b>Pull-up</b> *	n/a	
	PG6	GPIO_Output	Output Push Pull	<b>Pull-up</b> *	<b>Medium</b> *	IST8310_RST
	PH12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_R
	PG3	GPIO_EXTI3	<b>External Interrupt Mode with Falling edge trigger detection</b>	<b>Pull-up</b> *	n/a	IST8310_DRDY
	PH11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_G
	PH10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_B
	PD14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA0-WKUP	GPIO_EXTI0	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	KEY
	PA4	GPIO_Output	Output Push Pull	<b>Pull-up</b> *	<b>High</b> *	CS1_ACCEL
	PC4	GPIO_EXTI4	<b>External Interrupt Mode with Falling edge trigger detection</b>	<b>Pull-up</b> *	<b>n/a</b>	INT1_ACCEL
	PC5	GPIO_EXTI5	<b>External Interrupt Mode with Falling edge trigger detection</b>	<b>Pull-up</b> *	<b>n/a</b>	INT1_GYRO
	PB0	GPIO_Output	Output Push Pull	<b>Pull-up</b> *	<b>High</b> *	CS1_GYRO

## 8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART3_RX	DMA1_Stream1	Peripheral To Memory	<b>High *</b>
USART6_RX	DMA2_Stream1	Peripheral To Memory	<b>High *</b>
SPI1_RX	DMA2_Stream2	Peripheral To Memory	<b>Very High *</b>
SPI1_TX	DMA2_Stream3	Memory To Peripheral	Low
USART1_RX	DMA2_Stream5	Peripheral To Memory	Low

### 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

### USART6\_RX: DMA2\_Stream1 DMA request Settings:

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

### SPI1\_RX: DMA2\_Stream2 DMA request Settings:

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

### SPI1\_TX: DMA2\_Stream3 DMA request Settings:

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

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

### 8.3. 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
EXTI line0 interrupt	true	0	0
EXTI line3 interrupt	true	0	0
EXTI line4 interrupt	true	0	0
DMA1 stream1 global interrupt	true	5	0
CAN1 RX0 interrupts	true	5	0
EXTI line[9:5] interrupts	true	0	0
TIM2 global interrupt	true	0	0
TIM4 global interrupt	true	5	0
USART1 global interrupt	true	5	0
USART3 global interrupt	true	5	0
DMA2 stream1 global interrupt	true	5	0
DMA2 stream2 global interrupt	true	0	0
DMA2 stream3 global interrupt	true	5	0
CAN2 RX0 interrupts	true	5	0
DMA2 stream5 global interrupt	true	5	0
USART6 global interrupt	true	5	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
CAN1 TX interrupts	unused		
CAN1 RX1 interrupt	unused		
CAN1 SCE interrupt	unused		
TIM1 update interrupt and TIM10 global interrupt	unused		
SPI1 global interrupt	unused		
CAN2 TX interrupts	unused		
CAN2 RX1 interrupt	unused		
CAN2 SCE interrupt	unused		
I2C3 event interrupt	unused		
I2C3 error interrupt	unused		

Interrupt Table	Enable	Preenmption Priority	SubPriority
FPU global interrupt	unused		

\* User modified value

## 9. Software Pack Report

### 9.1. Software Pack selected

Vendor	Name	Version	Component
STMicroelectronics	FreeRTOS	0.0.1	Class : CMSIS Group : RTOS SubGroup : FreeRTOS Version : 10.2.0 Class : RTOS Group : Core Version : 10.2.0