1. Description

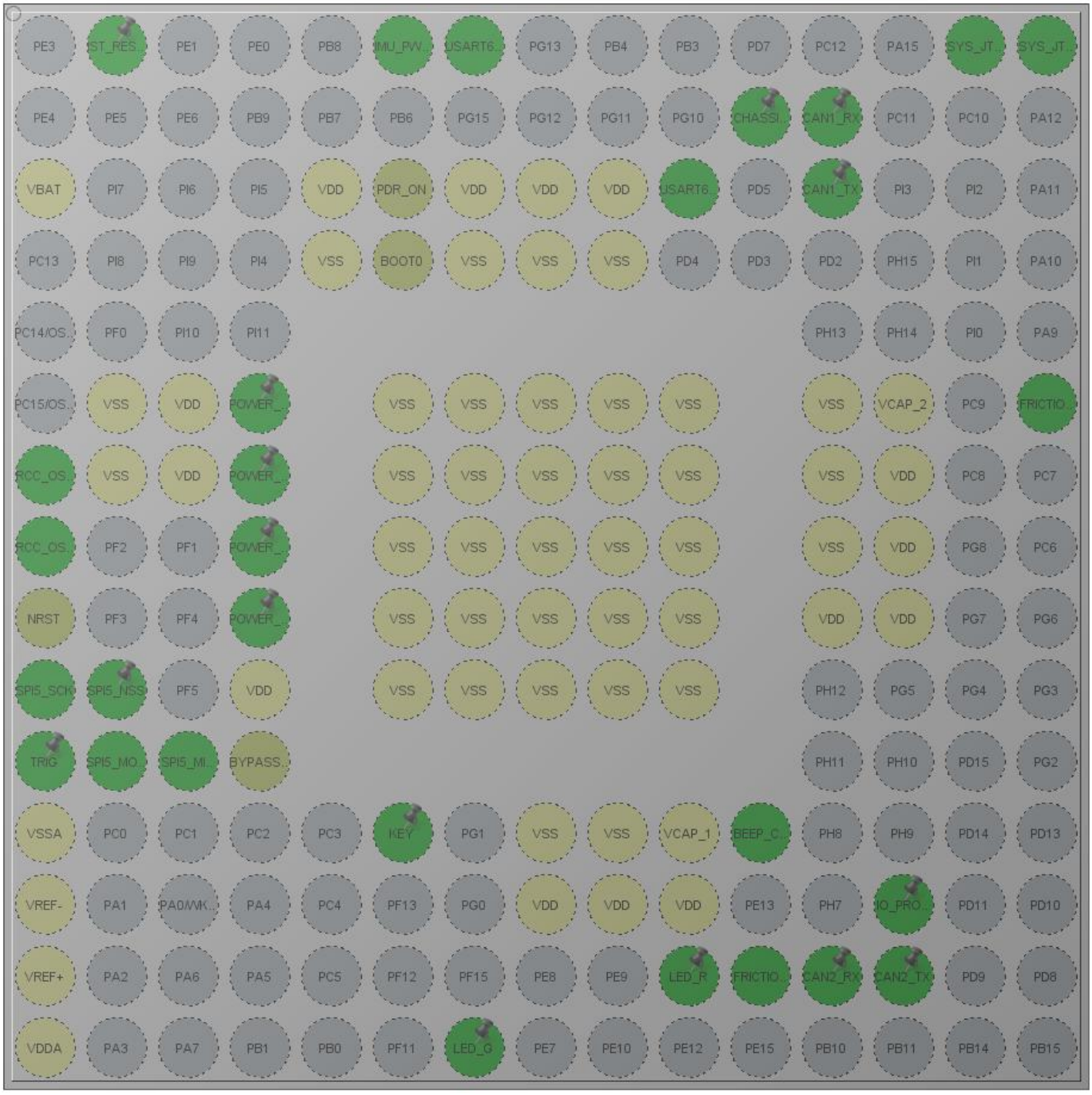
1.1. Project

Project Name	ROBOT
Board Name	custom
Generated with:	STM32CubeMX 5.0.0
Date	02/25/2019

1.2. MCU

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

2. Pinout Configuration



UFBGA176 +25 (Top view)

3. Pins Configuration

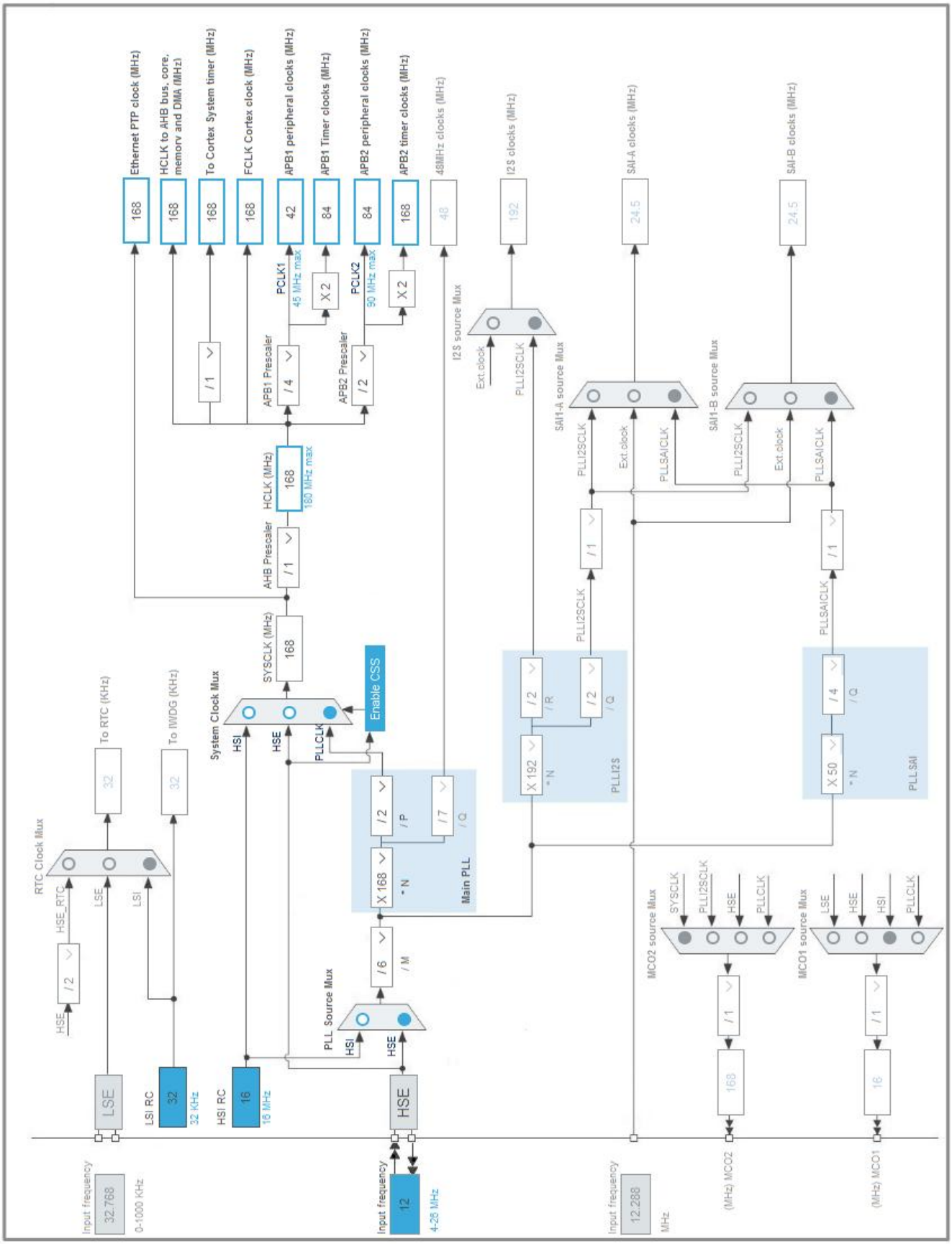
Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
A2	PE2 *	I/O	GPIO_Output	IST_RESET
A6	PB5	I/O	TIM3_CH2	IMU_PWM_PULSE
A7	PG14	I/O	USART6_TX	
A14	PA14	I/O	SYS_JTCK-SWCLK	
A15	PA13	I/O	SYS_JTMS-SWDIO	
B11	PD6 *	I/O	GPIO_Input	CHASSIS_CONFIG
B12	PD0	I/O	CAN1_RX	
C1	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		
F4	PH2 *	I/O	GPIO_Output	POWER_OUT1
F6	VSS	Power		
F7	VSS	Power		
F8	VSS	Power		
F9	VSS	Power		
F10	VSS	Power		
F12	VSS	Power		
F13	VCAP_2	Power		
F15	PA8	I/O	TIM1_CH1	FRICTION_L
G1	PH0/OSC_IN	I/O	RCC_OSC_IN	
G2	VSS	Power		
G3	VDD	Power		
G4	PH3 *	I/O	GPIO_Output	POWER_OUT2
G6	VSS	Power		

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
G7	VSS	Power		
G8	VSS	Power		
G9	VSS	Power		
G10	VSS	Power		
G12	VSS	Power		
G13	VDD	Power		
H1	PH1/OSC_OUT	I/O	RCC_OSC_OUT	
H4	PH4 *	I/O	GPIO_Output	POWER_OUT3
H6	VSS	Power		
H7	VSS	Power		
H8	VSS	Power		
H9	VSS	Power		
H10	VSS	Power		
H12	VSS	Power		
H13	VDD	Power		
J1	NRST	Reset		
J4	PH5 *	I/O	GPIO_Output	POWER_OUT4
J6	VSS	Power		
J7	VSS	Power		
J8	VSS	Power		
J9	VSS	Power		
J10	VSS	Power		
J12	VDD	Power		
J13	VDD	Power		
K1	PF7	I/O	SPI5_SCK	
K2	PF6 *	I/O	GPIO_Output	SPI5_NSS
K4	VDD	Power		
K6	VSS	Power		
K7	VSS	Power		
K8	VSS	Power		
K9	VSS	Power		
K10	VSS	Power		
L1	PF10	I/O	GPIO_EXTI10	TRIG
L2	PF9	I/O	SPI5_MOSI	
L3	PF8	I/O	SPI5_MISO	
L4	BYPASS_REG	Reset		
M1	VSSA	Power		
M6	PB2/BOOT1 *	I/O	GPIO_Input	KEY
M8	VSS	Power		

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
M9	VSS	Power		
M10	VCAP_1	Power		
M11	PH6	I/O	TIM12_CH1	BEEP_CTRL
N1	VREF-	Power		
N8	VDD	Power		
N9	VDD	Power		
N10	VDD	Power		
N13	PD12 *	I/O	GPIO_Output	IO_PROBE
P1	VREF+	Power		
P10	PE11 *	I/O	GPIO_Output	LED_R
P11	PE14	I/O	TIM1_CH4	FRICTION_R
P12	PB12	I/O	CAN2_RX	
P13	PB13	I/O	CAN2_TX	
R1	VDDA	Power		
R7	PF14 *	I/O	GPIO_Output	LED_G

* The pin is affected with an I/O function

4. Clock Tree Configuration



5. Software Project

5.1. Project Settings

Name	Value
Project Name	ROBOT
Project Folder	D:\icra
Toolchain / IDE	MDK-ARM V5
Firmware Package Name and Version	STM32Cube FW_F4 V1.22.0

5.2. 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	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	STM32F427/437
MCU	STM32F427IIHx
Datasheet	024030_Rev9

6.2. Parameter Selection

Temperature	25
Vdd	null

7. IPs and Middleware Configuration

7.1. CAN1

mode: Mode

7.1.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	**7 ***
Time Quantum	**166.66666666666669 ***
Time Quanta in Bit Segment 1	**2 Times ***
Time Quanta in Bit Segment 2	**3 Times ***
ReSynchronization Jump Width	1 Time

Basic Parameters:

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

Advanced Parameters:

Operating Mode	Normal

7.2. CAN2

mode: Mode

7.2.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	**7 ***
Time Quantum	**166.66666666666669 ***
Time Quanta in Bit Segment 1	**2 Times ***
Time Quanta in Bit Segment 2	**3 Times ***
ReSynchronization Jump Width	1 Time

Basic Parameters:

Time Triggered Communication Mode	Disable
Automatic Bus-Off Management	Disable
Automatic Wake-Up Mode	Disable
No-Automatic Retransmission	**Enable ***

Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	**Enable ***

Advanced Parameters:

Operating Mode	Normal

7.3. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

7.3.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	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 Regulatror Voltage Scale	Power Regulator Voltage Scale 1
Power Over Drive	Disabled

7.4. SPI5

Mode: Full-Duplex Master

7.4.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**128 ***
Baud Rate	**656.25 KBits/s ***
Clock Polarity (CPOL)	Low

Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

7.5. SYS

Debug: Serial Wire

Timebase Source: TIM5

7.6. TIM1

Channel1: PWM Generation CH1

Channel4: PWM Generation CH4

7.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**167 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**20000-1 ***
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0

Trigger Output (TRGO) Parameters:

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

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)	**1000 ***
Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

PWM Generation Channel 4:

Mode	PWM mode 1
Pulse (16 bits value)	**1000 ***
Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

7.7. TIM2

Clock Source : Internal Clock

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**83 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**1000-1 ***
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

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

7.8. TIM3

Channel2: PWM Generation CH2

7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**83 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**2000-1 ***
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

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

PWM Generation Channel 2:

Mode	PWM mode 1
Pulse (16 bits value)	0
Fast Mode	Disable

CH Polarity	High

7.9. TIM12

Channel1: PWM Generation CH1

7.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**83 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**20000-1 ***
Internal Clock Division (CKD)	No Division

PWM Generation Channel 1:

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

7.10. USART6

Mode: Asynchronous

7.10.1. Parameter Settings:

Basic Parameters:

Baud Rate	**921600 ***
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

7.11. FREERTOS

mode: Enabled

7.11.1. 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	15360
Memory Management scheme	heap_4

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

7.11.2. 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

*** 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 ***	
	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	
SPI5	PF7	SPI5_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PF9	SPI5_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PF8	SPI5_MISO	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	
TIM1	PA8	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	FRICTION_L
	PE14	TIM1_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	FRICTION_R
TIM3	PB5	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	IMU_PWM_PULSE
TIM12	PH6	TIM12_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	BEEP_CTRL
USART6	PG14	USART6_TX	Alternate Function Push Pull	Pull-up	**Very High ***	
	PG9	USART6_RX	Alternate Function Push Pull	Pull-up	**Very High ***	
GPIO	PE2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	IST_RESET
	PD6	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	CHASSIS_CONFIG
	PH2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	POWER_OUT1
	PH3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	POWER_OUT2
	PH4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	POWER_OUT3

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PH5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	POWER_OUT4
	PF6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI5_NSS
	PF10	GPIO_EXTI10	**External Interrupt Mode with Rising/Falling edge**	**Pull-up ***	n/a	TRIG
	PB2/BOOT1	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	KEY
	PD12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	IO_PROBE
	PE11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_R
	PF14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_G

8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART6_RX	DMA2_Stream1	Peripheral To Memory	Low
USART6_TX	DMA2_Stream6	Memory To Peripheral	Low

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

USART6_TX: DMA2_Stream6 DMA request Settings:

Mode:	Normal
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
CAN1 TX interrupts	true	5	0
CAN1 RX0 interrupts	true	5	0
TIM2 global interrupt	true	5	0
EXTI line[15:10] interrupts	true	5	0
TIM5 global interrupt	true	0	0
DMA2 stream1 global interrupt	true	5	0
CAN2 TX interrupts	true	5	0
CAN2 RX0 interrupts	true	5	0
DMA2 stream6 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 RX1 interrupt	unused		
CAN1 SCE interrupt	unused		
TIM1 break interrupt and TIM9 global interrupt	unused		
TIM1 update interrupt and TIM10 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM3 global interrupt	unused		
TIM8 break interrupt and TIM12 global interrupt	unused		
CAN2 RX1 interrupt	unused		
CAN2 SCE interrupt	unused		
FPU global interrupt	unused		
SPI5 global interrupt	unused		

*** User modified value**

9. Software Pack Report