

1. Description

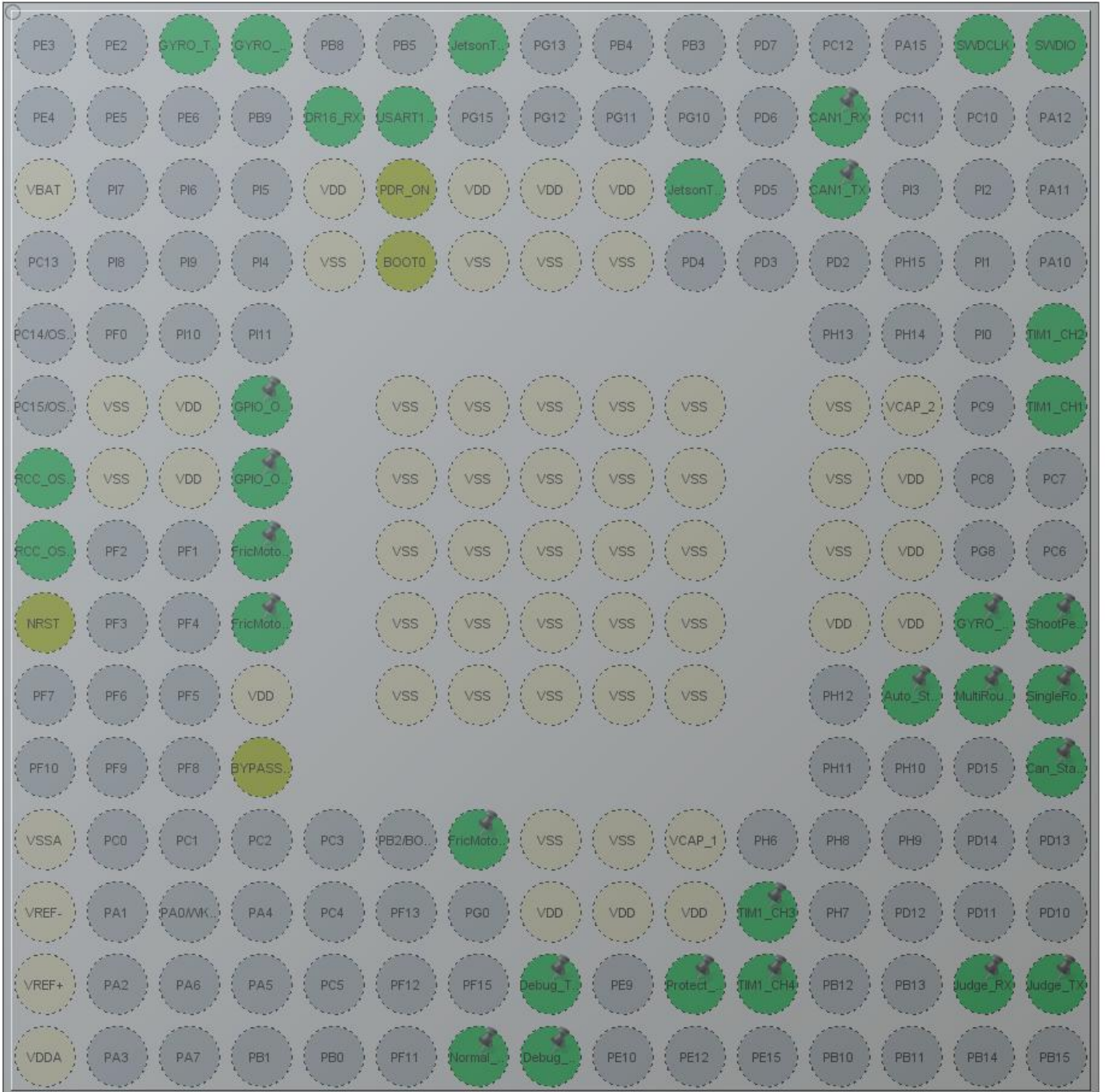
1.1. Project

Project Name	Drone
Board Name	custom
Generated with:	STM32CubeMX 5.4.0
Date	12/02/2019

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

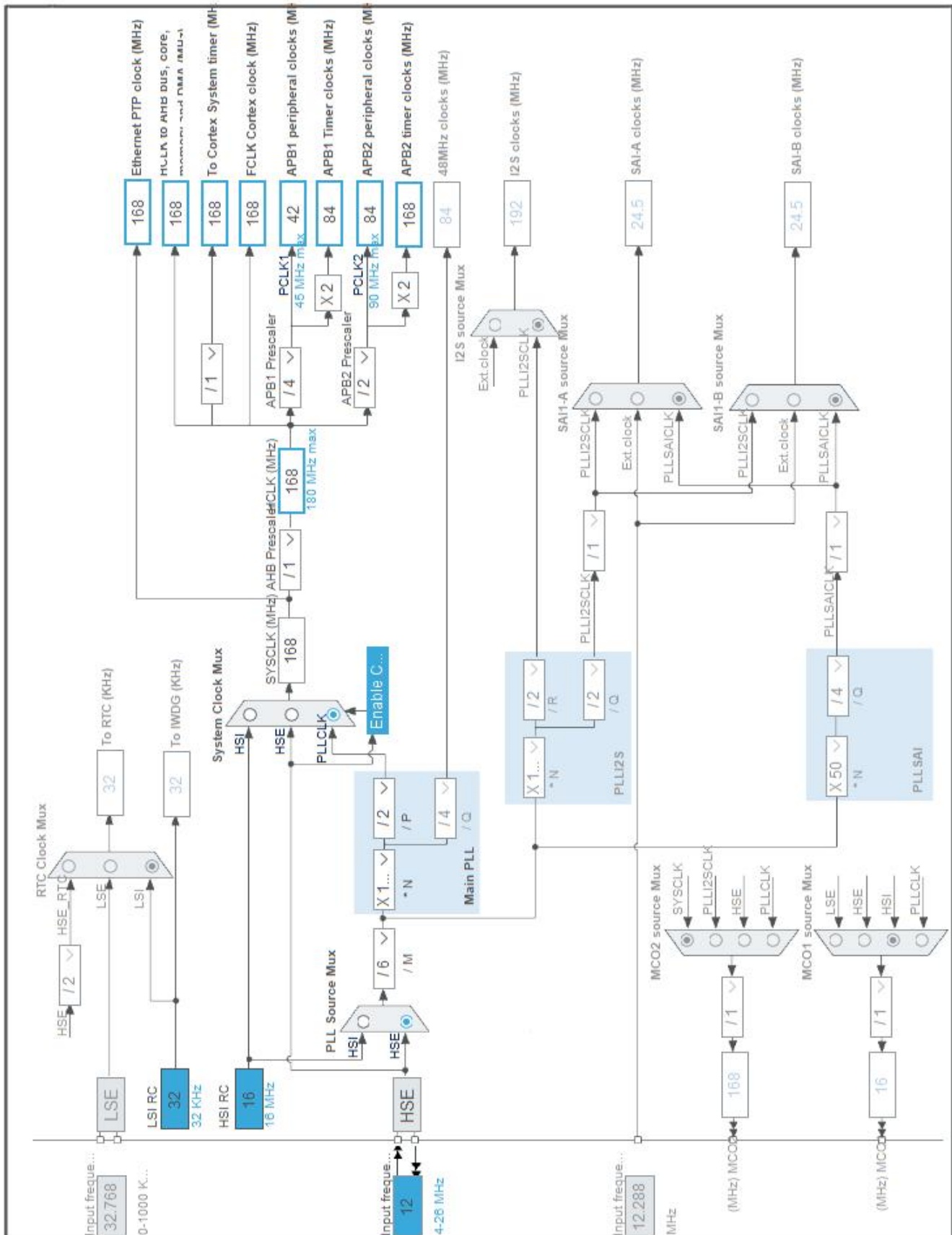
Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
A3	PE1	I/O	UART8_TX	GYRO_TX
A4	PE0	I/O	UART8_RX	GYRO_RX
A7	PG14	I/O	USART6_TX	JetsonTX2_TX
A14	PA14	I/O	SYS_JTCK-SWCLK	SWDCLK
A15	PA13	I/O	SYS_JTMS-SWDIO	SWDIO
B5	PB7	I/O	USART1_RX	DR16_RX
B6	PB6	I/O	USART1_TX	
B12	PD0	I/O	CAN1_RX	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	JetsonTX2_RX
C12	PD1	I/O	CAN1_TX	CAN1_TX
D5	VSS	Power		
D6	BOOT0	Boot		
D7	VSS	Power		
D8	VSS	Power		
D9	VSS	Power		
E15	PA9	I/O	TIM1_CH2	
F2	VSS	Power		
F3	VDD	Power		
F4	PH2 *	I/O	GPIO_Output	
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	
G1	PH0/OSC_IN	I/O	RCC_OSC_IN	
G2	VSS	Power		
G3	VDD	Power		

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
G4	PH3 *	I/O	GPIO_Output	
G6	VSS	Power		
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	FricMotor_Left_Power
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	FricMotor_Right_Power
J6	VSS	Power		
J7	VSS	Power		
J8	VSS	Power		
J9	VSS	Power		
J10	VSS	Power		
J12	VDD	Power		
J13	VDD	Power		
J14	PG7 *	I/O	GPIO_Output	GYRO_Status
J15	PG6 *	I/O	GPIO_Output	ShootPermission_Status
K4	VDD	Power		
K6	VSS	Power		
K7	VSS	Power		
K8	VSS	Power		
K9	VSS	Power		
K10	VSS	Power		
K13	PG5 *	I/O	GPIO_Output	Auto_Status
K14	PG4 *	I/O	GPIO_Output	MultiRound_Status
K15	PG3 *	I/O	GPIO_Output	SingleRound_Status
L4	BYPASS_REG	Reset		
L15	PG2 *	I/O	GPIO_Output	Can_Status

Pin Number UFBGA176	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
M1	VSSA	Power		
M7	PG1 *	I/O	GPIO_Output	FricMotor_Status
M8	VSS	Power		
M9	VSS	Power		
M10	VCAP_1	Power		
N1	VREF-	Power		
N8	VDD	Power		
N9	VDD	Power		
N10	VDD	Power		
N11	PE13	I/O	TIM1_CH3	
P1	VREF+	Power		
P8	PE8	I/O	UART7_TX	Debug_TX
P10	PE11 *	I/O	GPIO_Output	Protect_Status
P11	PE14	I/O	TIM1_CH4	
P14	PD9	I/O	USART3_RX	Judge_RX
P15	PD8	I/O	USART3_TX	Judge_TX
R1	VDDA	Power		
R7	PF14 *	I/O	GPIO_Output	Normal_Status
R8	PE7	I/O	UART7_RX	Debug_RX

* The pin is affected with an I/O function

4. Clock Tree Configuration



5. Software Project

5.1. Project Settings

Name	Value
Project Name	Drone
Project Folder	D:\STMfiles\Drone_2020\Drone
Toolchain / IDE	MDK-ARM V5.27
Firmware Package Name and Version	STM32Cube FW_F4 V1.24.0

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
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	3.3

7. IPs and Middleware Configuration

7.1. CAN1

mode: Mode

7.1.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	3 *
Time Quantum	71.42857142857143 *
Time Quanta in Bit Segment 1	9 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	Enable *
Automatic Wake-Up Mode	Enable *
Automatic Retransmission	Disable
Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	Disable

Advanced Parameters:

Operating Mode	Normal
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7.2. GPIO

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 Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000
Power Parameters:	
Power Regulator Voltage Scale	Power Regulator Voltage Scale 1
Power Over Drive	Disabled

7.4. SYS

Debug: Serial Wire

Timebase Source: SysTick

7.5. TIM1

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

Channel3: PWM Generation CH3

Channel4: PWM Generation CH4

7.5.1. Parameter Settings:

Counter Settings:

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

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

Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

PWM Generation Channel 2:

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

PWM Generation Channel 3:

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

PWM Generation Channel 4:

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

7.6. UART7

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

7.7. UART8

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

7.8. USART1

Mode: Asynchronous

7.8.1. Parameter Settings:

Basic Parameters:

Baud Rate	100000 *
Word Length	8 Bits (including Parity)
Parity	Even *
Stop Bits	1

Advanced Parameters:

Data Direction	Receive Only *
Over Sampling	16 Samples

7.9. USART3

Mode: Asynchronous

7.9.1. 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

7.10. USART6

Mode: Asynchronous

7.10.1. Parameter Settings:

Basic Parameters:

Baud Rate	230400 *
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

Interface: CMSIS_V1

7.11.1. 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	32 *
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	

	Disabled *
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Disabled
USE_COUNTING_SEMAPHORES	Enabled *
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 *
TOTAL_HEAP_SIZE	20480 *
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	Enabled *
USE_TRACE_FACILITY	Enabled
USE_STATS_FORMATTING_FUNCTIONS	Enabled *

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

7.11.2. Include parameters:

Include definitions:

vTaskPrioritySet	Enabled
uxTaskPriorityGet	Enabled
vTaskDelete	Enabled

vTaskCleanUpResources	Disabled
vTaskSuspend	Enabled
vTaskDelayUntil	Enabled *
vTaskDelay	Enabled
xTaskGetSchedulerState	Enabled
xTaskResumeFromISR	Enabled
xQueueGetMutexHolder	Disabled
xSemaphoreGetMutexHolder	Disabled
pcTaskGetTaskName	Disabled
uxTaskGetStackHighWaterMark	Enabled *
xTaskGetCurrentTaskHandle	Enabled *
eTaskGetState	Enabled *
xEventGroupSetBitFromISR	Disabled
xTimerPendFunctionCall	Disabled
xTaskAbortDelay	Disabled
xTaskGetHandle	Enabled *

* 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
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	
SYS	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	SWDCLK
	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	SWDIO
TIM1	PA9	TIM1_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA8	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PE13	TIM1_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PE14	TIM1_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	
UART7	PE8	UART7_TX	Alternate Function Push Pull	Pull-up	Very High *	Debug_TX
	PE7	UART7_RX	Alternate Function Push Pull	Pull-up	Very High *	Debug_RX
UART8	PE1	UART8_TX	Alternate Function Push Pull	Pull-up	Very High *	GYRO_TX
	PE0	UART8_RX	Alternate Function Push Pull	Pull-up	Very High *	GYRO_RX
USART1	PB7	USART1_RX	Alternate Function Push Pull	Pull-up	Very High *	DR16_RX
	PB6	USART1_TX	Alternate Function Push Pull	Pull-up	Very High *	
USART3	PD9	USART3_RX	Alternate Function Push Pull	Pull-up	Very High *	Judge_RX
	PD8	USART3_TX	Alternate Function Push Pull	Pull-up	Very High *	Judge_TX
USART6	PG14	USART6_TX	Alternate Function Push Pull	Pull-up	Very High *	JetsonTX2_TX

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PG9	USART6_RX	Alternate Function Push Pull	Pull-up	Very High *	JetsonTX2_RX
GPIO	PH2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PH3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PH4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FricMotor_Left_Power
	PH5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FricMotor_Right_Power
	PG7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GYRO_Status
	PG6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ShootPermission_Status
	PG5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Auto_Status
	PG4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MultiRound_Status
	PG3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SingleRound_Status
	PG2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Can_Status
	PG1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FricMotor_Status
	PE11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Protect_Status
	PF14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Normal_Status

8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART1_RX	DMA2_Stream2	Peripheral To Memory	High *
USART3_RX	DMA1_Stream1	Peripheral To Memory	Medium *
UART8_RX	DMA1_Stream6	Peripheral To Memory	Very High *

USART1_RX: DMA2_Stream2 DMA request Settings:

Mode: **Circular ***
 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: Normal
 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: 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
DMA1 stream1 global interrupt	true	5	0
DMA1 stream6 global interrupt	true	5	0
CAN1 RX0 interrupts	true	6	0
USART1 global interrupt	true	6	0
USART3 global interrupt	true	6	0
DMA2 stream2 global interrupt	true	5	0
USART6 global interrupt	true	5	0
UART7 global interrupt	true	6	0
UART8 global interrupt	true	6	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 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		
FPU global interrupt	unused		

* User modified value

9. Software Pack Report