1. Description

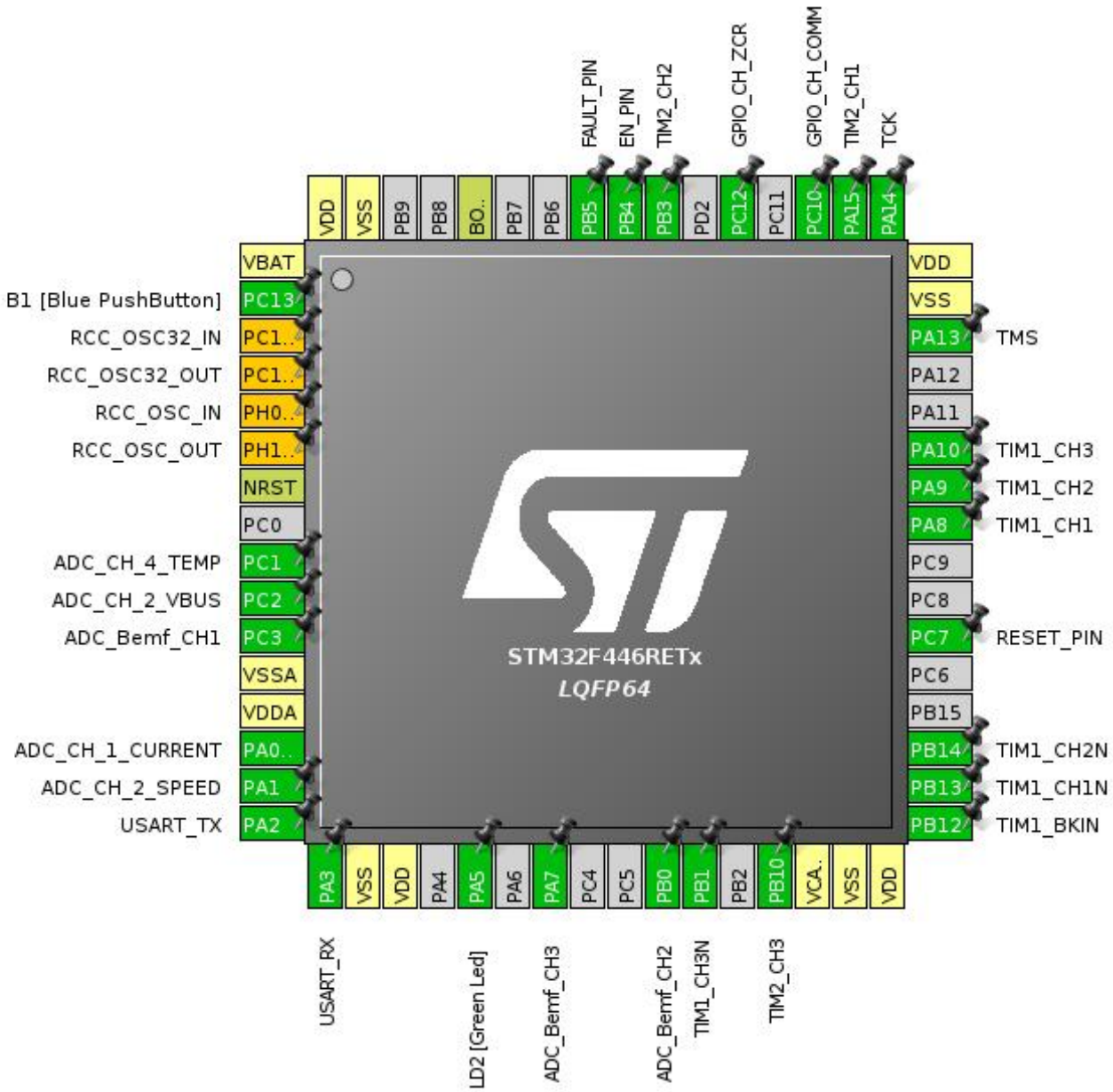
1.1. Project

Project Name	BLDC
Board Name	NUCLEO-F446RE
Generated with:	STM32CubeMX 4.23.0
Date	01/09/2018

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F446
MCU name	STM32F446RETx
MCU Package	LQFP64
MCU Pin number	64

2. Pinout Configuration



3. Pins Configuration

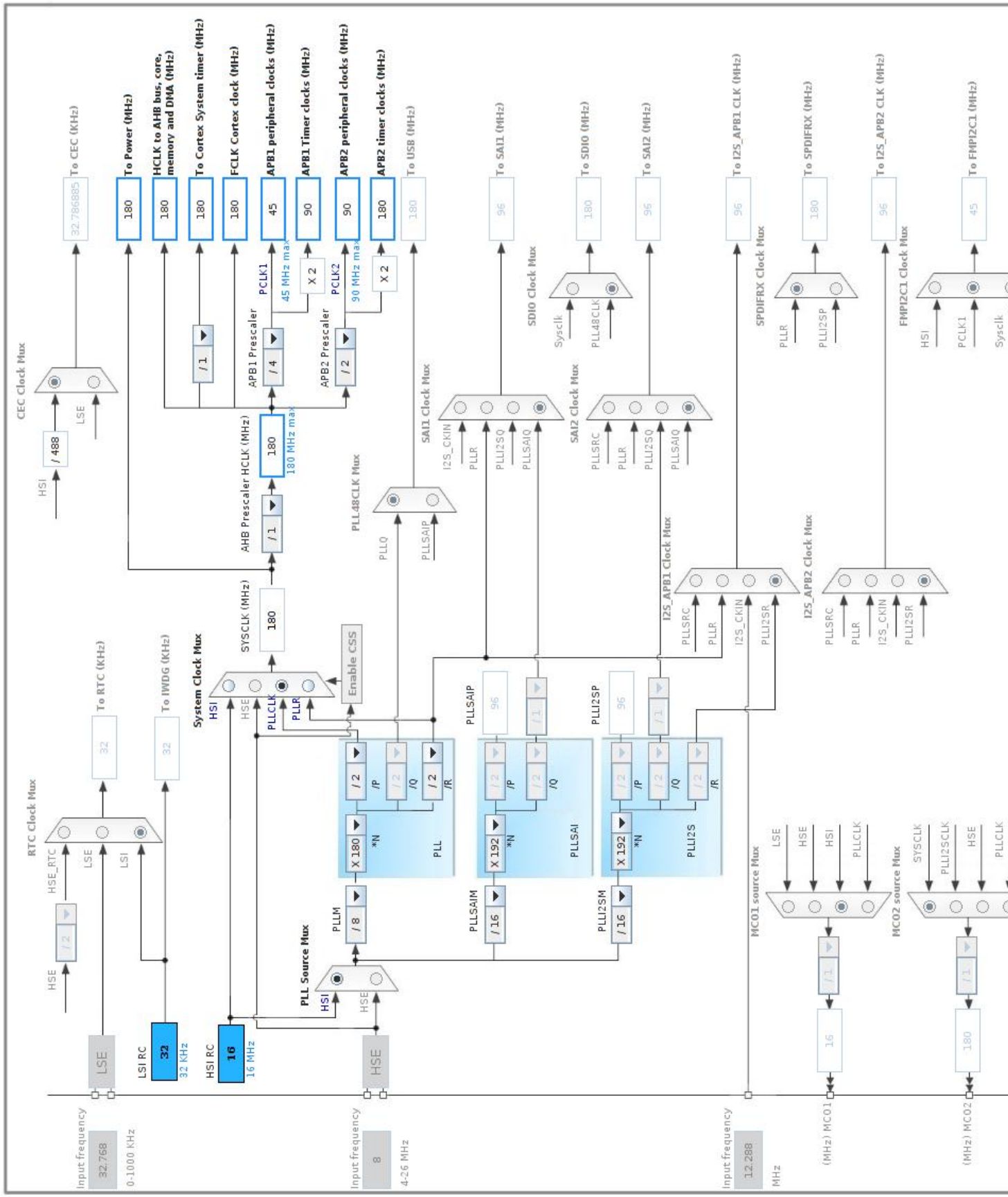
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13	I/O	GPIO_EXTI13	B1 [Blue PushButton]
3	PC14-OSC32_IN *	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT *	I/O	RCC_OSC32_OUT	
5	PH0-OSC_IN *	I/O	RCC_OSC_IN	
6	PH1-OSC_OUT *	I/O	RCC_OSC_OUT	
7	NRST	Reset		
9	PC1	I/O	ADC1_IN11	ADC_CH_4_TEMP
10	PC2	I/O	ADC1_IN12	ADC_CH_2_VBUS
11	PC3	I/O	ADC1_IN13	ADC_Bemf_CH1
12	VSSA	Power		
13	VDDA	Power		
14	PA0-WKUP	I/O	ADC1_IN0	ADC_CH_1_CURRENT
15	PA1	I/O	ADC1_IN1	ADC_CH_2_SPEED
16	PA2	I/O	USART2_TX	USART_TX
17	PA3	I/O	USART2_RX	USART_RX
18	VSS	Power		
19	VDD	Power		
21	PA5 **	I/O	GPIO_Output	LD2 [Green Led]
23	PA7	I/O	ADC1_IN7	ADC_Bemf_CH3
26	PB0	I/O	ADC1_IN8	ADC_Bemf_CH2
27	PB1	I/O	TIM1_CH3N	
29	PB10	I/O	TIM2_CH3	
30	VCAP_1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12	I/O	TIM1_BKIN	
34	PB13	I/O	TIM1_CH1N	
35	PB14	I/O	TIM1_CH2N	
38	PC7 **	I/O	GPIO_Output	RESET_PIN
41	PA8	I/O	TIM1_CH1	
42	PA9	I/O	TIM1_CH2	
43	PA10	I/O	TIM1_CH3	
46	PA13	I/O	SYS_JTMS-SWDIO	TMS
47	VSS	Power		
48	VDD	Power		

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
49	PA14	I/O	SYS_JTCK-SWCLK	TCK
50	PA15	I/O	TIM2_CH1	
51	PC10 **	I/O	GPIO_Output	GPIO_CH_COMM
53	PC12 **	I/O	GPIO_Output	GPIO_CH_ZCR
55	PB3	I/O	TIM2_CH2	
56	PB4 **	I/O	GPIO_Output	EN_PIN
57	PB5 **	I/O	GPIO_Input	FAULT_PIN
60	BOOT0	Boot		
63	VSS	Power		
64	VDD	Power		

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

* The pin is affected with a peripheral function but no peripheral mode is activated

4. Clock Tree Configuration



5. IPs and Middleware Configuration

5.1. ADC1

mode: IN0

mode: IN1

mode: IN7

mode: IN8

mode: IN11

mode: IN12

mode: IN13

mode: Temperature Sensor Channel

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	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	EOC flag at the end of single channel conversion

ADC_Regular_ConversionMode:

Number Of Conversion	1
External Trigger Conversion Source	**Timer 3 Trigger Out event ***
External Trigger Conversion Edge	Trigger detection on the rising edge
Rank	1
Channel	**Channel 7 ***
Sampling Time	3 Cycles

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

5.2. SYS

Debug: Serial Wire

Timebase Source: SysTick

5.3. TIM1

Slave Mode: Trigger Mode

Trigger Source: ITR1

Channel1: Output Compare CH1 CH1N

Channel2: Output Compare CH2 CH2N

Channel3: Output Compare CH3 CH3N

mode: Activate-Break-Input

5.3.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**4095 ***
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
Slave Mode Controller	Trigger Mode

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)

Break And Dead Time management - BRK Configuration:

BRK State	Enable
BRK Polarity	High

Break And Dead Time management - Output Configuration:

Automatic Output State	**Enable ***
Off State Selection for Run Mode (OSSR)	**Enable ***
Off State Selection for Idle Mode (OSSI)	**Enable ***
Lock Configuration	Off
Dead Time	**1 ***

Output Compare Channel 1 and 1N:

Mode	Frozen (used for Timing base)

Pulse (16 bits value)	**2047 ***
CH Polarity	High
CHN Polarity	High
CH Idle State	**Set ***
CHN Idle State	**Set ***

Output Compare Channel 2 and 2N:

Mode	Frozen (used for Timing base)
Pulse (16 bits value)	**1023 ***
CH Polarity	High
CHN Polarity	High
CH Idle State	**Set ***
CHN Idle State	**Set ***

Output Compare Channel 3 and 3N:

Mode	Frozen (used for Timing base)
Pulse (16 bits value)	**511 ***
CH Polarity	High
CHN Polarity	High
CH Idle State	**Set ***
CHN Idle State	**Set ***

5.4. TIM2

Combined Channels: XOR ON / Hall Sensor Mode

5.4.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**126 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**65535 ***
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Output Compare (OC2REF)

Hall Sensor:

Prescaler Division Ratio	No division
Polarity	Rising Edge
Input Filter	**0xF ***
Commutation Delay	**1 ***

5.5. TIM4

mode: Clock Source

5.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**24000 ***
Internal Clock Division (CKD)	No Division

Trigger Output (TRGO) Parameters:

Master/Slave Mode	**Enable (sync between this TIM (Master) and its Slaves (through TRGO)) ***
Trigger Event Selection	**Enable (CNT_EN) ***

5.6. USART2

Mode: Asynchronous

5.6.1. Parameter Settings:

Basic Parameters:

Baud Rate	**19200 ***
Word Length	**9 Bits (including Parity) ***
Parity	**Odd ***
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

*** 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	PC1	ADC1_IN11	Analog mode	No pull-up and no pull-down	n/a	ADC_CH_4_TEMP
	PC2	ADC1_IN12	Analog mode	No pull-up and no pull-down	n/a	ADC_CH_2_VBUS
	PC3	ADC1_IN13	Analog mode	No pull-up and no pull-down	n/a	ADC_Bemf_CH1
	PA0-WKUP	ADC1_IN0	Analog mode	No pull-up and no pull-down	n/a	ADC_CH_1_CURRENT
	PA1	ADC1_IN1	Analog mode	No pull-up and no pull-down	n/a	ADC_CH_2_SPEED
	PA7	ADC1_IN7	Analog mode	No pull-up and no pull-down	n/a	ADC_Bemf_CH3
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	ADC_Bemf_CH2
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	TMS
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	TCK
TIM1	PB1	TIM1_CH3N	Alternate Function Push Pull	**Pull-down ***	Low	
	PB12	TIM1_BKIN	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB13	TIM1_CH1N	Alternate Function Push Pull	**Pull-down ***	Low	
	PB14	TIM1_CH2N	Alternate Function Push Pull	**Pull-down ***	Low	
	PA8	TIM1_CH1	Alternate Function Push Pull	**Pull-down ***	Low	
	PA9	TIM1_CH2	Alternate Function Push Pull	**Pull-down ***	Low	
	PA10	TIM1_CH3	Alternate Function Push Pull	**Pull-down ***	Low	
TIM2	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA15	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB3	TIM2_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART2	PA2	USART2_TX	Alternate Function Push Pull	Pull-up	**Very High ***	USART_TX
	PA3	USART2_RX	Alternate Function Push Pull	Pull-up	**Very High ***	USART_RX
Single Mapped Signals	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	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
GPIO	PC13	GPIO_EXTI13	**External Interrupt Mode with Falling edge trigger detection**	**Pull-up ***	n/a	B1 [Blue PushButton]
	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD2 [Green Led]
	PC7	GPIO_Output	**Output Open Drain ***	No pull-up and no pull-down	Low	RESET_PIN
	PC10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GPIO_CH_COMM
	PC12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	GPIO_CH_ZCR
	PB4	GPIO_Output	**Output Open Drain ***	No pull-up and no pull-down	Low	EN_PIN
	PB5	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	FAULT_PIN

6.2. DMA configuration

nothing configured in DMA service

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	0	0
System tick timer	true	0	0
ADC1, ADC2 and ADC3 interrupts	true	0	0
TIM1 break interrupt and TIM9 global interrupt	true	0	0
TIM1 trigger and commutation interrupts and TIM11 global interrupt	true	0	1
TIM1 capture compare interrupt	true	0	0
TIM2 global interrupt	true	0	0
TIM4 global interrupt	true	0	1
USART2 global interrupt	true	2	1
EXTI line[15:10] interrupts	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM1 update interrupt and TIM10 global interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

7. Power Consumption Calculator report

7.1. Microcontroller Selection

Series	STM32F4
Line	STM32F446
MCU	STM32F446RETx
Datasheet	027107_Rev6

7.2. Parameter Selection

Temperature	25
Vdd	null

8. Software Project

8.1. Project Settings

Name	Value
Project Name	BLDC
Project Folder	/mnt/Data/Documents/workspace_Pacabot/BLDC
Toolchain / IDE	Makefile
Firmware Package Name and Version	STM32Cube FW_F4 V1.18.0

8.2. Code Generation Settings

Name	Value
STM32Cube Firmware Library Package	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