1. Description

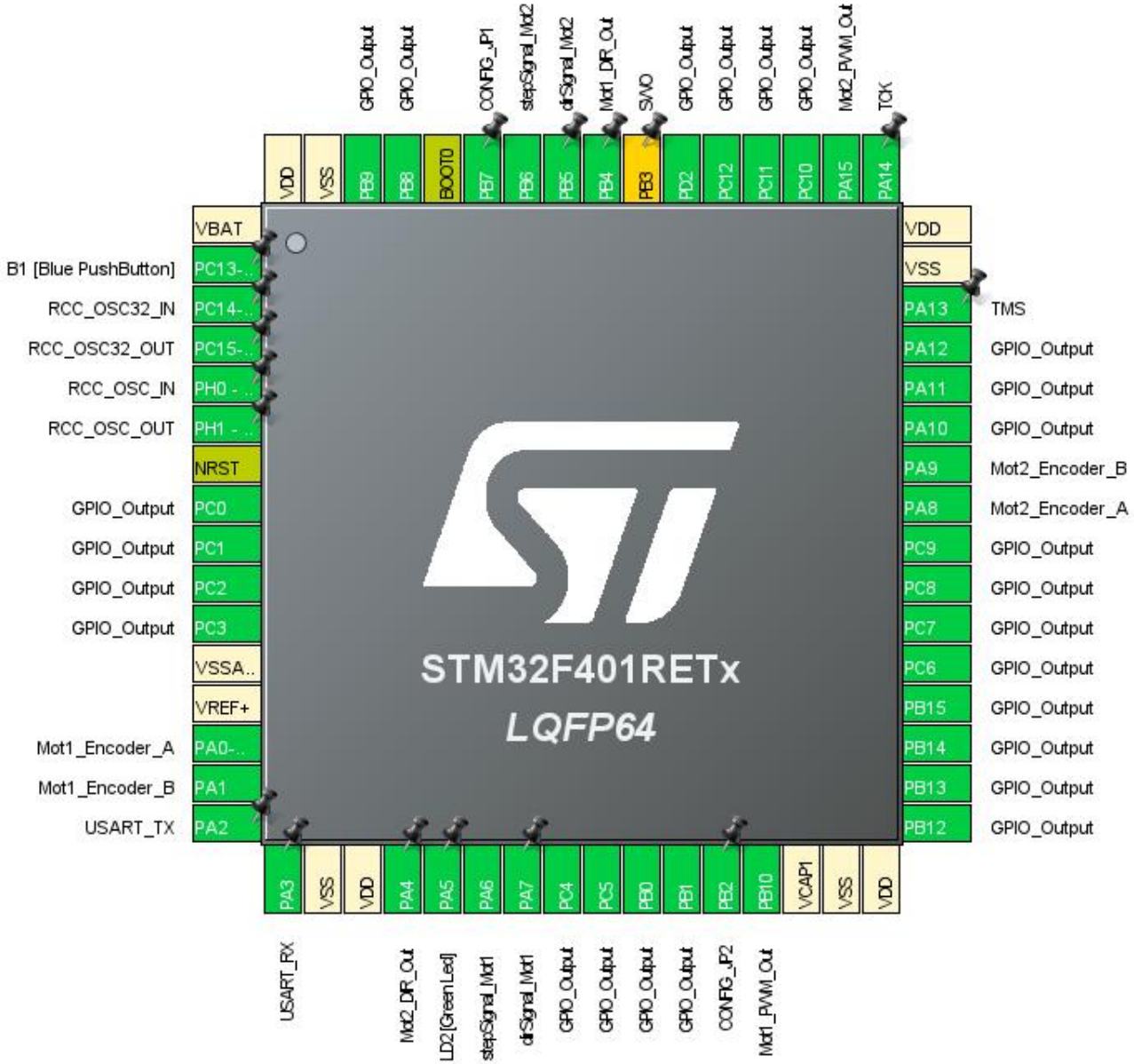
1.1. Project

Project Name	DC_MotorController_stepDir
Board Name	NUCLEO-F401RE
Generated with:	STM32CubeMX 5.6.0
Date	04/12/2020

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F401
MCU name	STM32F401RETx
MCU Package	LQFP64
MCU Pin number	64

2. Pinout Configuration



3. Pins Configuration

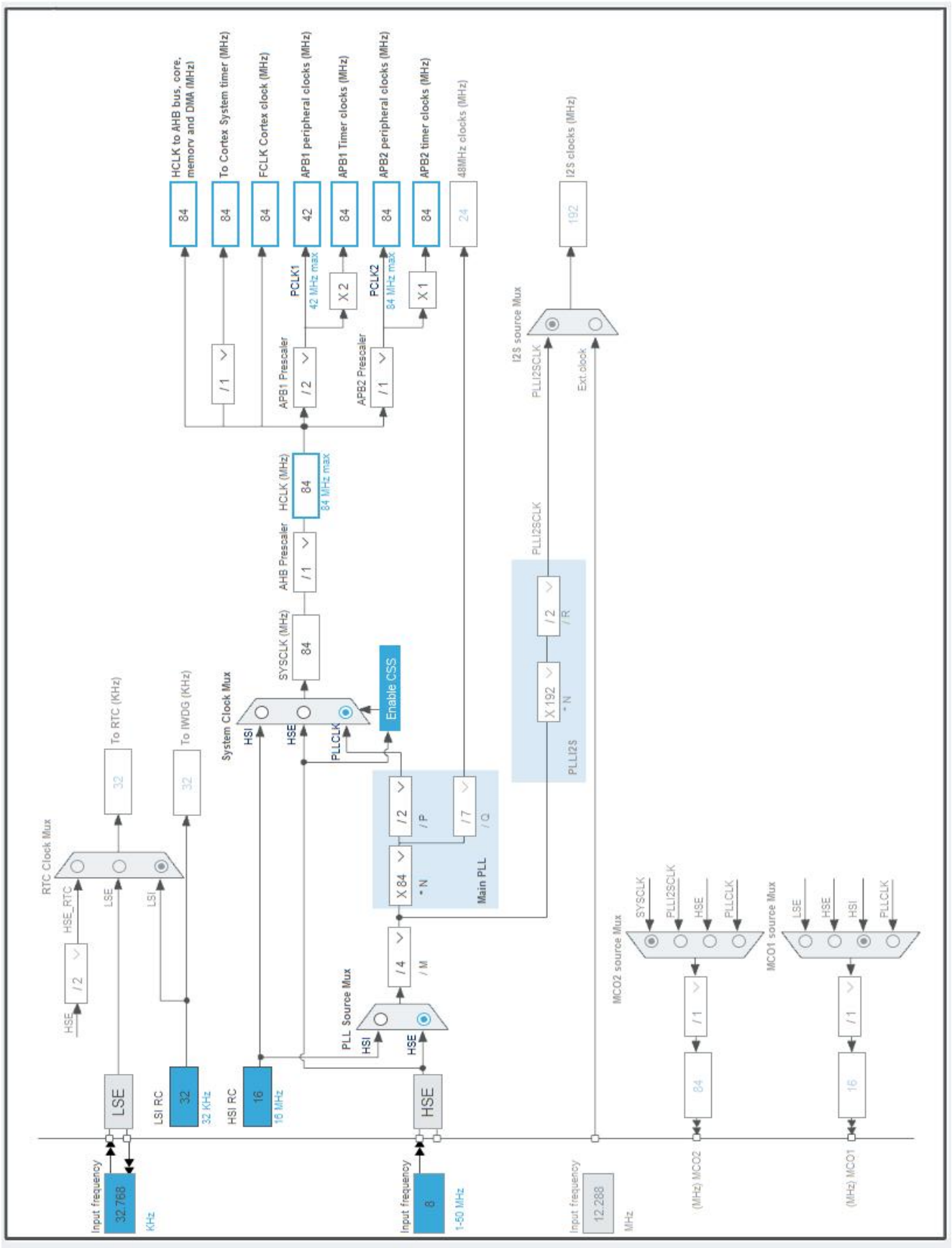
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-ANTI_TAMP	I/O	GPIO_EXTI13	B1 [Blue PushButton]
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	PC0 *	I/O	GPIO_Output	
9	PC1 *	I/O	GPIO_Output	
10	PC2 *	I/O	GPIO_Output	
11	PC3 *	I/O	GPIO_Output	
12	VSSA/VREF-	Power		
13	VREF+	Power		
14	PA0-WKUP	I/O	TIM5_CH1	Mot1_Encoder_A
15	PA1	I/O	TIM5_CH2	Mot1_Encoder_B
16	PA2	I/O	USART2_TX	USART_TX
17	PA3	I/O	USART2_RX	USART_RX
18	VSS	Power		
19	VDD	Power		
20	PA4 *	I/O	GPIO_Output	Mot2_DIR_Out
21	PA5 *	I/O	GPIO_Output	LD2 [Green Led]
22	PA6	I/O	TIM3_CH1	stepSignal_Mot1
23	PA7	I/O	GPIO_EXTI7	dirSignal_Mot1
24	PC4 *	I/O	GPIO_Output	
25	PC5 *	I/O	GPIO_Output	
26	PB0 *	I/O	GPIO_Output	
27	PB1 *	I/O	GPIO_Output	
28	PB2 *	I/O	GPIO_Input	CONFIG_JP2
29	PB10	I/O	TIM2_CH3	Mot1_PWM_Out
30	VCAP1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12 *	I/O	GPIO_Output	
34	PB13 *	I/O	GPIO_Output	
35	PB14 *	I/O	GPIO_Output	
36	PB15 *	I/O	GPIO_Output	

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
37	PC6 *	I/O	GPIO_Output	
38	PC7 *	I/O	GPIO_Output	
39	PC8 *	I/O	GPIO_Output	
40	PC9 *	I/O	GPIO_Output	
41	PA8	I/O	TIM1_CH1	Mot2_Encoder_A
42	PA9	I/O	TIM1_CH2	Mot2_Encoder_B
43	PA10 *	I/O	GPIO_Output	
44	PA11 *	I/O	GPIO_Output	
45	PA12 *	I/O	GPIO_Output	
46	PA13	I/O	SYS_JTMS-SWDIO	TMS
47	VSS	Power		
48	VDD	Power		
49	PA14	I/O	SYS_JTCK-SWCLK	TCK
50	PA15	I/O	TIM2_CH1	Mot2_PWM_Out
51	PC10 *	I/O	GPIO_Output	
52	PC11 *	I/O	GPIO_Output	
53	PC12 *	I/O	GPIO_Output	
54	PD2 *	I/O	GPIO_Output	
55	PB3 **	I/O	SYS_JTDO-SWO	SWO
56	PB4 *	I/O	GPIO_Output	Mot1_DIR_Out
57	PB5	I/O	GPIO_EXTI5	dirSignal_Mot2
58	PB6	I/O	TIM4_CH1	stepSignal_Mot2
59	PB7 *	I/O	GPIO_Input	CONFIG_JP1
60	BOOT0	Boot		
61	PB8 *	I/O	GPIO_Output	
62	PB9 *	I/O	GPIO_Output	
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. Software Project

5.1. Project Settings

Name	Value
Project Name	DC_MotorController_stepDir
Project Folder	D:\CubeIDE_Workspace\DC_MotorController_stepDir
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.25.0

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	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

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F401
MCU	STM32F401RETx
Datasheet	025644_Rev3

6.2. Parameter Selection

Temperature	25
Vdd	3.3

6.3. Battery Selection

Battery	Li-SOCL2(A3400)
Capacity	3400.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	100.0 mA
Max Pulse Current	200.0 mA
Cells in series	1
Cells in parallel	1

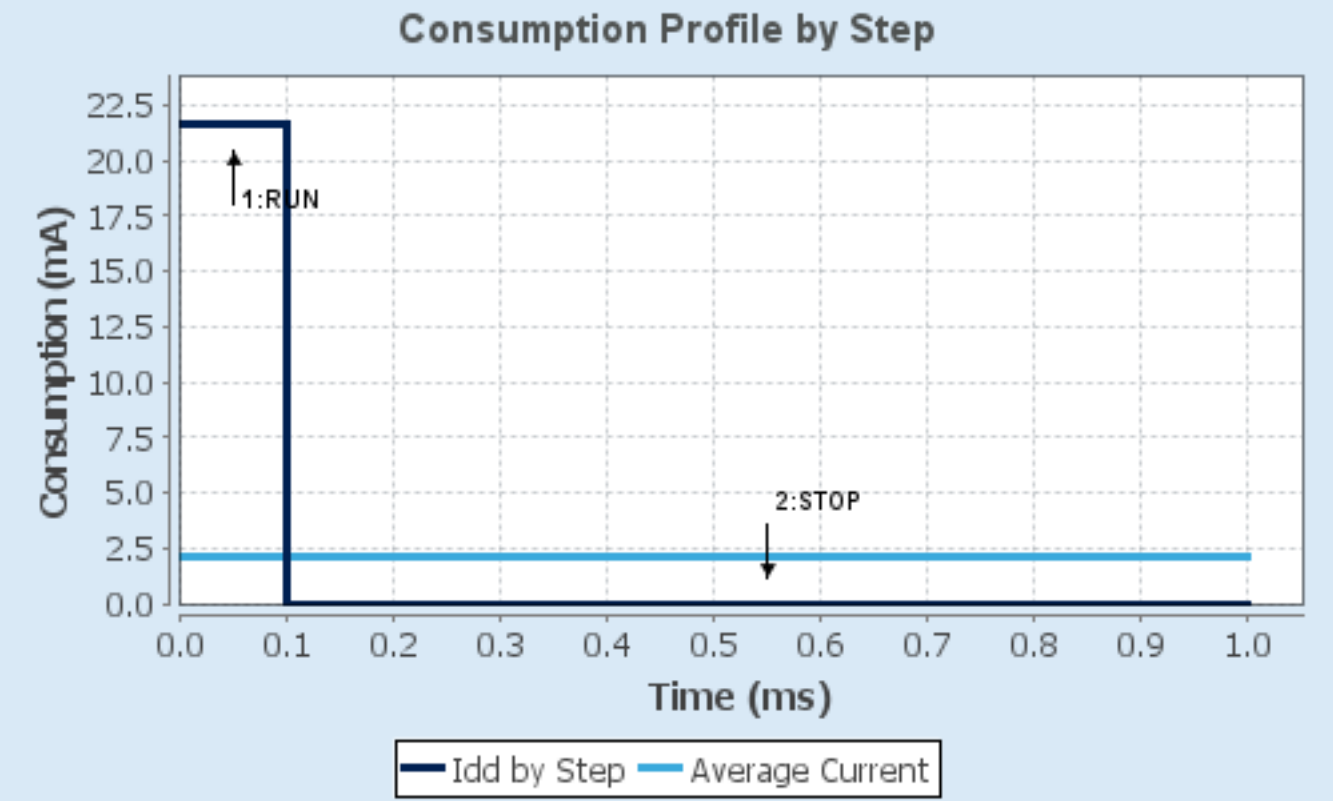
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	Scale2-Medium	No Scale
Fetch Type	FLASH/ART/PREFETCH	n/a
CPU Frequency	84 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LPLV Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	21.6 mA	10 µA
Duration	0.1 ms	0.9 ms
DMIPS	105.0	0.0
Ta Max	101.44	105
Category	In DS Table	In DS Table

6.5. RESULTS

Sequence Time	1 ms	Average Current	2.17 mA
Battery Life	2 months, 4 days, 8 hours	Average DMIPS	105.0 DMIPS

6.6. Chart


Consumption Profile by Step
Consumption (mA)
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
1:RUN
2:STOP
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time (ms)
Idd by Step
Average Current

7. IPs and Middleware Configuration

7.1. CRC

mode: Activated

7.2. GPIO

7.3. RCC

High Speed Clock (HSE): BYPASS Clock Source

Low Speed Clock (LSE) : 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)	2 WS (3 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 Regulator Voltage Scale	Power Regulator Voltage Scale 2

7.4. SYS

Debug: Serial Wire

Timebase Source: TIM10

7.5. TIM1

Combined Channels: Encoder Mode

7.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0

Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**0xFFFF ***
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)

Encoder:

Encoder Mode	**Encoder Mode TI1 and TI2 ***
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	**8 ***
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	**8 ***

7.6. TIM2

Clock Source : Internal Clock

Channel1: PWM Generation CH1

Channel3: PWM Generation CH3

7.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**4-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**1000-1 ***
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)

PWM Generation Channel 1:

Mode	PWM mode 1

Pulse (32 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (32 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

7.7. TIM3

Slave Mode: External Clock Mode 1

Trigger Source: TI1FP1

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**0xFFFF ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable
Slave Mode Controller	ETR mode 1

Trigger Output (TRGO) Parameters:

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

Trigger:

Trigger Polarity	Rising Edge
Trigger Filter (4 bits value)	**11 ***

7.8. TIM4

Slave Mode: External Clock Mode 1

Trigger Source: TI1FP1

7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**0xFFFF ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable
Slave Mode Controller	ETR mode 1

Trigger Output (TRGO) Parameters:

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

Trigger:

Trigger Polarity	Rising Edge
Trigger Filter (4 bits value)	**11 ***

7.9. TIM5

Combined Channels: Encoder Mode

7.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**0xFFFF ***
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)

Encoder:

Encoder Mode	**Encoder Mode TI1 and TI2 ***
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	**8 ***
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	**8 ***

7.10. USART2

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

*** User modified value**

8. System Configuration

8.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
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	TMS
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	TCK
TIM1	PA8	TIM1_CH1	Alternate Function Push Pull	**Pull-up ***	Low	Mot2_Encoder_A
	PA9	TIM1_CH2	Alternate Function Push Pull	**Pull-up ***	Low	Mot2_Encoder_B
TIM2	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	Mot1_PWM_Out
	PA15	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	Mot2_PWM_Out
TIM3	PA6	TIM3_CH1	Alternate Function Push Pull	**Pull-down ***	**High ***	stepSignal_Mot1
TIM4	PB6	TIM4_CH1	Alternate Function Push Pull	**Pull-down ***	**High ***	stepSignal_Mot2
TIM5	PA0-WKUP	TIM5_CH1	Alternate Function Push Pull	**Pull-up ***	Low	Mot1_Encoder_A
	PA1	TIM5_CH2	Alternate Function Push Pull	**Pull-up ***	Low	Mot1_Encoder_B
USART2	PA2	USART2_TX	Alternate Function Push Pull	No pull-up and no pull-down	Low	USART_TX
	PA3	USART2_RX	Alternate Function Push Pull	No pull-up and no pull-down	Low	USART_RX
Single Mapped Signals	PB3	SYS_JTDO-SWO	n/a	n/a	n/a	SWO
GPIO	PC13-ANTI_TAMP	GPIO_EXTI13	**External Interrupt Mode with Falling edge trigger detection**	No pull-up and no pull-down	n/a	B1 [Blue PushButton]
	PC0	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC1	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC2	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC3	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PA4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Mot2_DIR_Out
	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LD2 [Green Led]

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA7	GPIO_EXTI7	**External Interrupt Mode with Rising/Falling edge**	**Pull-down ***	n/a	dirSignal_Mot1
	PC4	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC5	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB0	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB1	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB2	GPIO_Input	Input mode	**Pull-up ***	n/a	CONFIG_JP2
	PB12	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB13	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB14	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB15	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC6	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC7	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC8	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC9	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PA10	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PA11	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PA12	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC10	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC11	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PC12	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PD2	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Mot1_DIR_Out
	PB5	GPIO_EXTI5	**External Interrupt Mode with Rising/Falling edge**	**Pull-down ***	n/a	dirSignal_Mot2
	PB7	GPIO_Input	Input mode	**Pull-up ***	n/a	CONFIG_JP1
	PB8	GPIO_Output	Output Push Pull	**Pull-down ***	Low	
	PB9	GPIO_Output	Output Push Pull	**Pull-down ***	Low	

8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART2_RX	DMA1_Stream5	Peripheral To Memory	Low

USART2_RX: DMA1_Stream5 DMA request Settings:

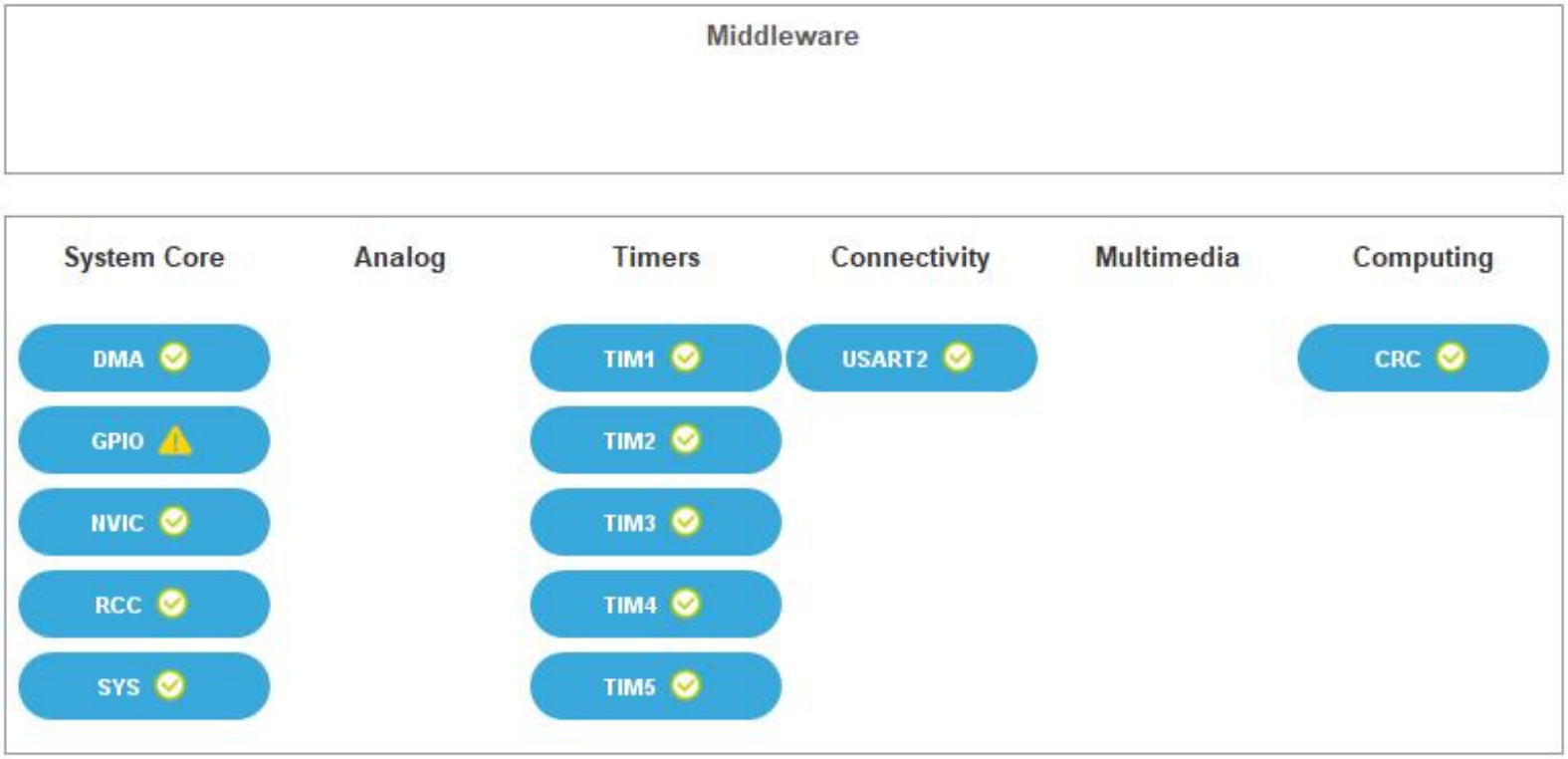
Mode:	Normal
Use fifo:	Disable
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	Byte
Memory Data Width:	Byte

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	0	0
System tick timer	true	0	0
DMA1 stream5 global interrupt	true	0	0
EXTI line[9:5] interrupts	true	0	0
TIM1 update interrupt and TIM10 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM1 break interrupt and TIM9 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
TIM4 global interrupt	unused		
USART2 global interrupt	unused		
EXTI line[15:10] interrupts	unused		
TIM5 global interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

9. Predefined Views - Category view : Current



10. Software Pack Report