1. Description

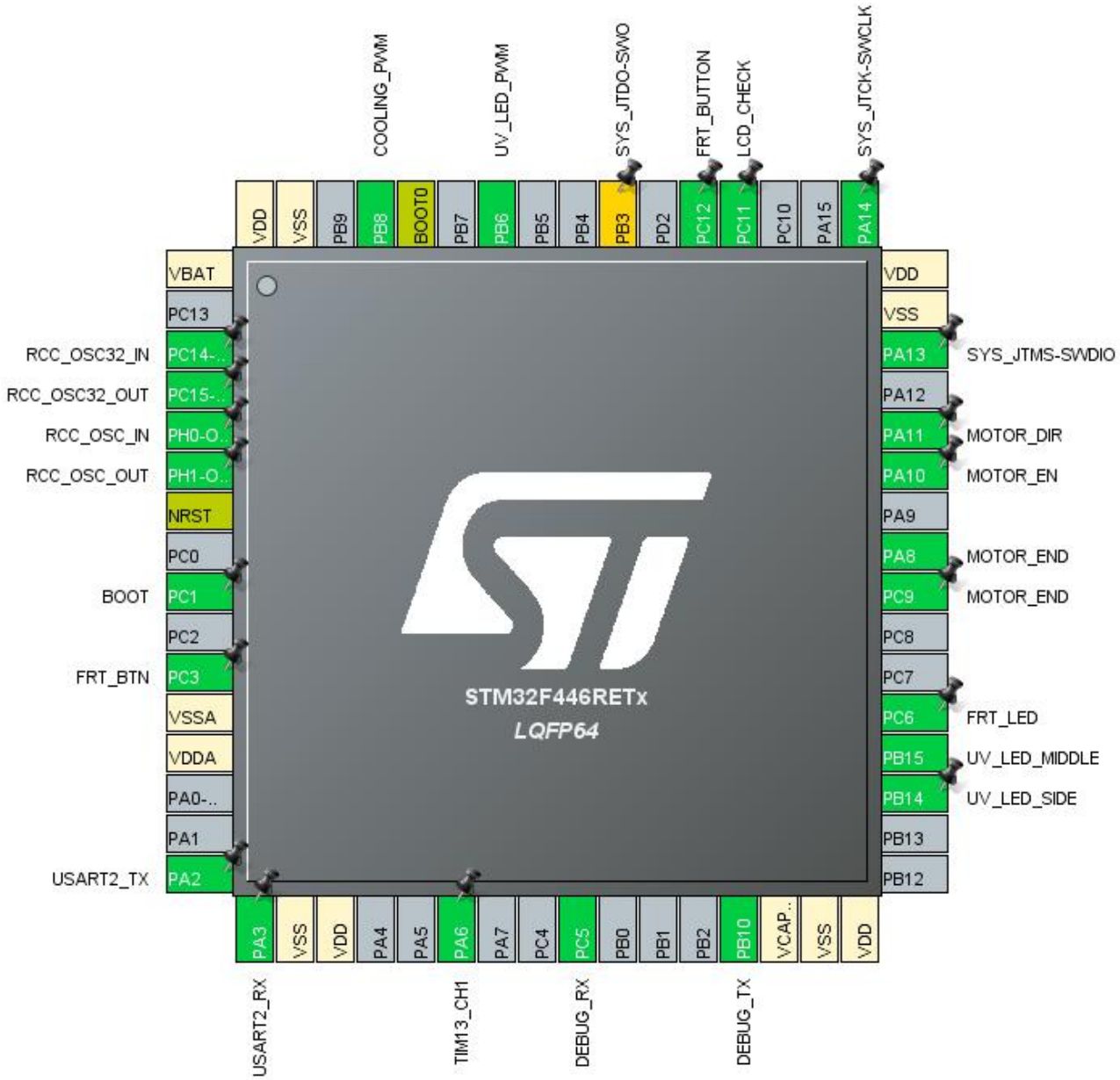
1.1. Project

Project Name	KinematicFW_F446
Board Name	NUCLEO-F446RE
Generated with:	STM32CubeMX 5.3.0
Date	04/27/2020

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

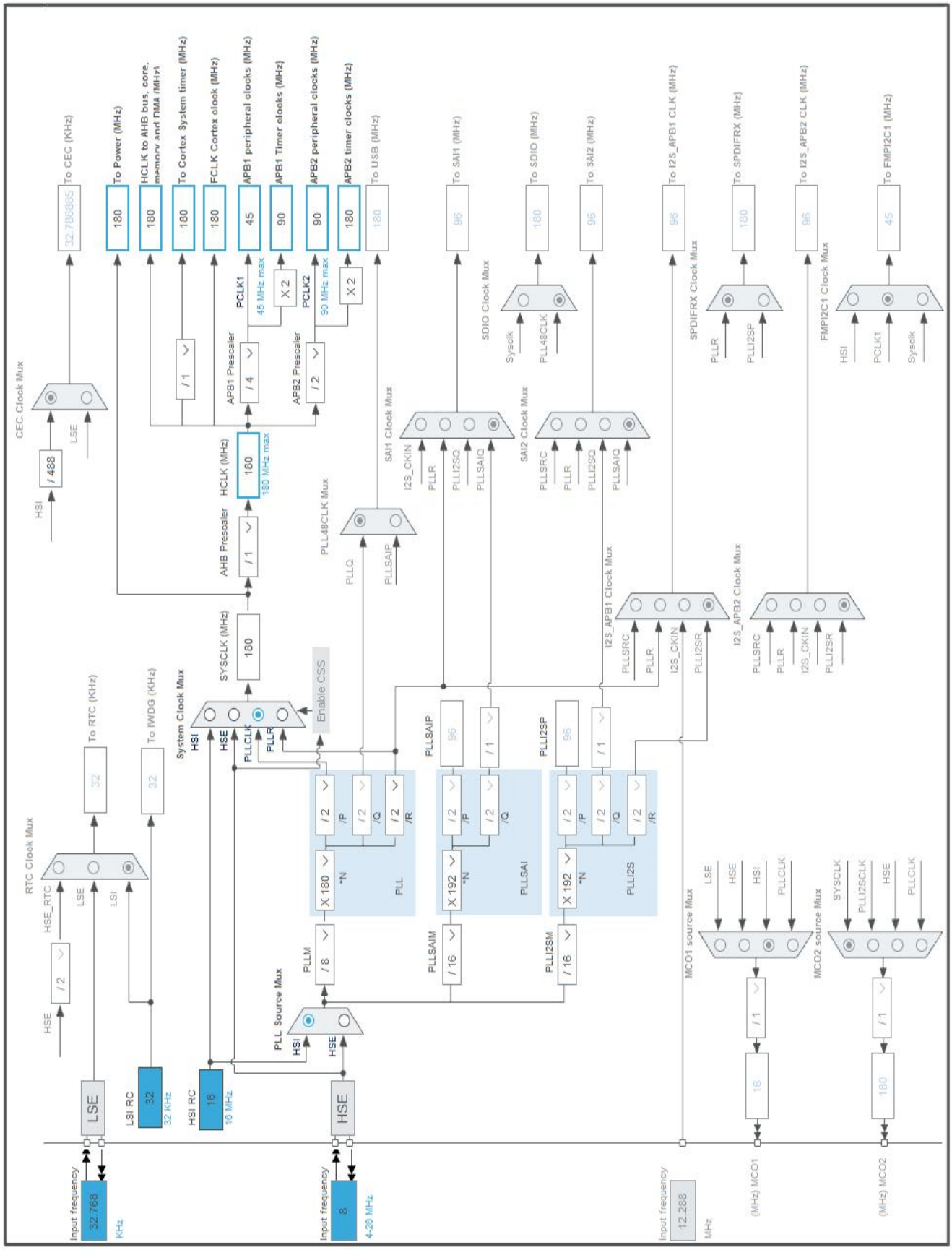
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0-OSC_IN	I/O	RCC_OSC_IN	
6	PH1-OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
9	PC1 *	I/O	GPIO_Output	BOOT
11	PC3 *	I/O	GPIO_Input	FRT_BTN
12	VSSA	Power		
13	VDDA	Power		
16	PA2	I/O	USART2_TX	
17	PA3	I/O	USART2_RX	
18	VSS	Power		
19	VDD	Power		
22	PA6	I/O	TIM13_CH1	
25	PC5	I/O	USART3_RX	DEBUG_RX
29	PB10	I/O	USART3_TX	DEBUG_TX
30	VCAP_1	Power		
31	VSS	Power		
32	VDD	Power		
35	PB14 *	I/O	GPIO_Output	UV_LED_SIDE
36	PB15	I/O	TIM12_CH2	UV_LED_MIDDLE
37	PC6	I/O	TIM3_CH1	FRT_LED
40	PC9	I/O	GPIO_EXTI9	MOTOR_END
41	PA8	I/O	TIM1_CH1	MOTOR_END
43	PA10 *	I/O	GPIO_Output	MOTOR_EN
44	PA11 *	I/O	GPIO_Output	MOTOR_DIR
46	PA13	I/O	SYS_JTMS-SWDIO	
47	VSS	Power		
48	VDD	Power		
49	PA14	I/O	SYS_JTCK-SWCLK	
52	PC11 *	I/O	GPIO_Input	LCD_CHECK
53	PC12 *	I/O	GPIO_Input	FRT_BUTTON
55	PB3 **	I/O	SYS_JTDO-SWO	
58	PB6	I/O	TIM4_CH1	UV_LED_PWM
60	BOOT0	Boot		

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
61	PB8	I/O	TIM10_CH1	COOLING_PWM
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	KinematicFW_F446
Project Folder	D:\CubeMX\KinematicFW
Toolchain / IDE	TrueSTUDIO
Firmware Package Name and Version	STM32Cube FW_F4 V1.24.1

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	STM32F446
MCU	STM32F446RETx
Datasheet	027107_Rev6

6.2. Parameter Selection

Temperature	25
Vdd	3.3

7. IPs and Middleware Configuration

7.1. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

7.1.1. 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	Enabled

7.2. SYS

Debug: Serial Wire

Timebase Source: SysTick

7.3. TIM1

Channel1: PWM Generation CH1

7.3.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**1023 ***
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
Fast Mode	Disable
CH Polarity	High
CH Idle State	Reset

7.4. TIM3

Clock Source : Internal Clock

Channel1: PWM Generation CH1

7.4.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**112 ***
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 (16 bits value)	0
Fast Mode	Disable
CH Polarity	High

7.5. TIM4

Channel1: PWM Generation CH1

7.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**18000 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**100 ***
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 (16 bits value)	0
Fast Mode	Disable
CH Polarity	High

7.6. TIM6

mode: Activated

7.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**10000 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**360-1 ***
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)

7.7. TIM7

mode: Activated

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**9000 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 - 1 ***
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)

7.8. TIM10

mode: Activated

Channel1: PWM Generation CH1

7.8.1. 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
auto-reload preload	Disable

PWM Generation Channel 1:

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

7.9. TIM11

mode: Activated

7.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**10000-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**90-1 ***

Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

7.10. TIM12

Channel2: PWM Generation CH2

7.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**900 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000-1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

PWM Generation Channel 2:

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

7.11. TIM13

mode: Activated

Channel1: PWM Generation CH1

7.11.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**512 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	0
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

PWM Generation Channel 1:

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

7.12. TIM14

mode: Activated

7.12.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**9000 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

7.13. USART2

Mode: Asynchronous

7.13.1. 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

7.14. USART3

Mode: Asynchronous

7.14.1. 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	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
TIM1	PA8	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	MOTOR_END
TIM3	PC6	TIM3_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	FRT_LED
TIM4	PB6	TIM4_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	UV_LED_PWM
TIM10	PB8	TIM10_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	COOLING_PWM
TIM12	PB15	TIM12_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	UV_LED_MIDDLE
TIM13	PA6	TIM13_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART2	PA2	USART2_TX	Alternate Function Push Pull	Pull-up	**Very High ***	
	PA3	USART2_RX	Alternate Function Push Pull	Pull-up	**Very High ***	
USART3	PC5	USART3_RX	Alternate Function Push Pull	Pull-up	**Very High ***	DEBUG_RX
	PB10	USART3_TX	Alternate Function Push Pull	Pull-up	**Very High ***	DEBUG_TX
Single Mapped Signals	PB3	SYS_JTDO-SWO	n/a	n/a	n/a	
GPIO	PC1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BOOT
	PC3	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	FRT_BTN
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	UV_LED_SIDE
	PC9	GPIO_EXTI9	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	MOTOR_END
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MOTOR_EN
	PA11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MOTOR_DIR

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PC11	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	LCD_CHECK
	PC12	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	FRT_BUTTON

8.2. DMA configuration

DMA request	Stream	Direction	Priority
USART2_RX	DMA1_Stream5	Peripheral To Memory	Low
TIM3_CH1/TRIG	DMA1_Stream4	Memory To Peripheral	Low

USART2_RX: DMA1_Stream5 DMA request Settings:

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

TIM3_CH1/TRIG: DMA1_Stream4 DMA request Settings:

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

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 stream4 global interrupt	true	0	0
DMA1 stream5 global interrupt	true	0	0
EXTI line[9:5] interrupts	true	0	0
TIM1 break interrupt and TIM9 global interrupt	true	0	0
TIM1 update interrupt and TIM10 global interrupt	true	0	0
TIM1 trigger and commutation interrupts and TIM11 global interrupt	true	0	0
TIM1 capture compare interrupt	true	0	0
TIM3 global interrupt	true	0	0
TIM4 global interrupt	true	0	0
USART2 global interrupt	true	0	0
USART3 global interrupt	true	0	0
TIM8 break interrupt and TIM12 global interrupt	true	0	0
TIM8 update interrupt and TIM13 global interrupt	true	0	0
TIM8 trigger and commutation interrupts and TIM14 global interrupt	true	0	0
TIM6 global interrupt and DAC1, DAC2 underrun error interrupts	true	0	0
TIM7 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

9. Software Pack Report