1. Description

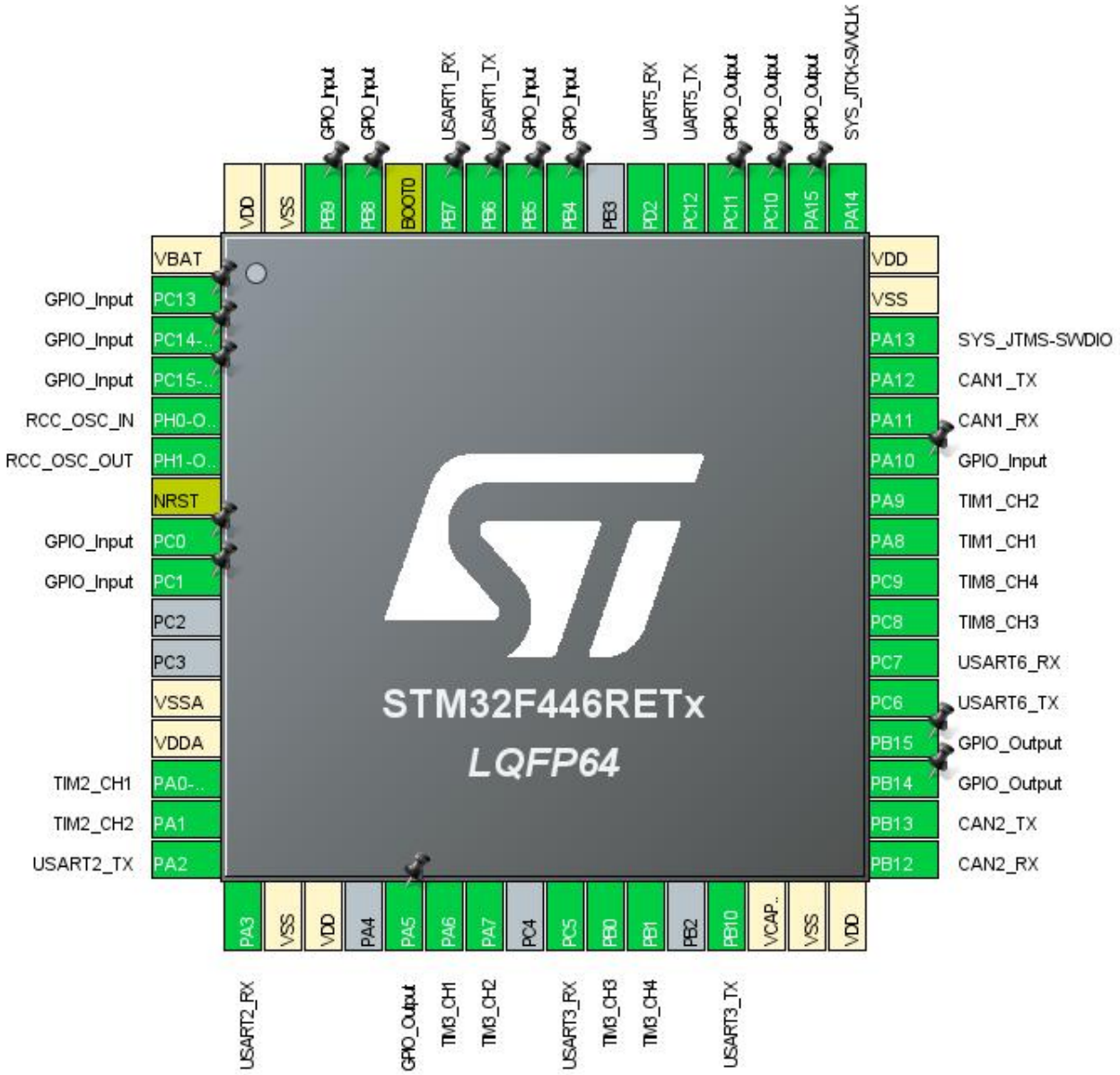
1.1. Project

Project Name	F446_Saramander_Sentry
Board Name	custom
Generated with:	STM32CubeMX 5.5.0
Date	02/25/2020

1.2. MCU

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

2. Pinout Configuration



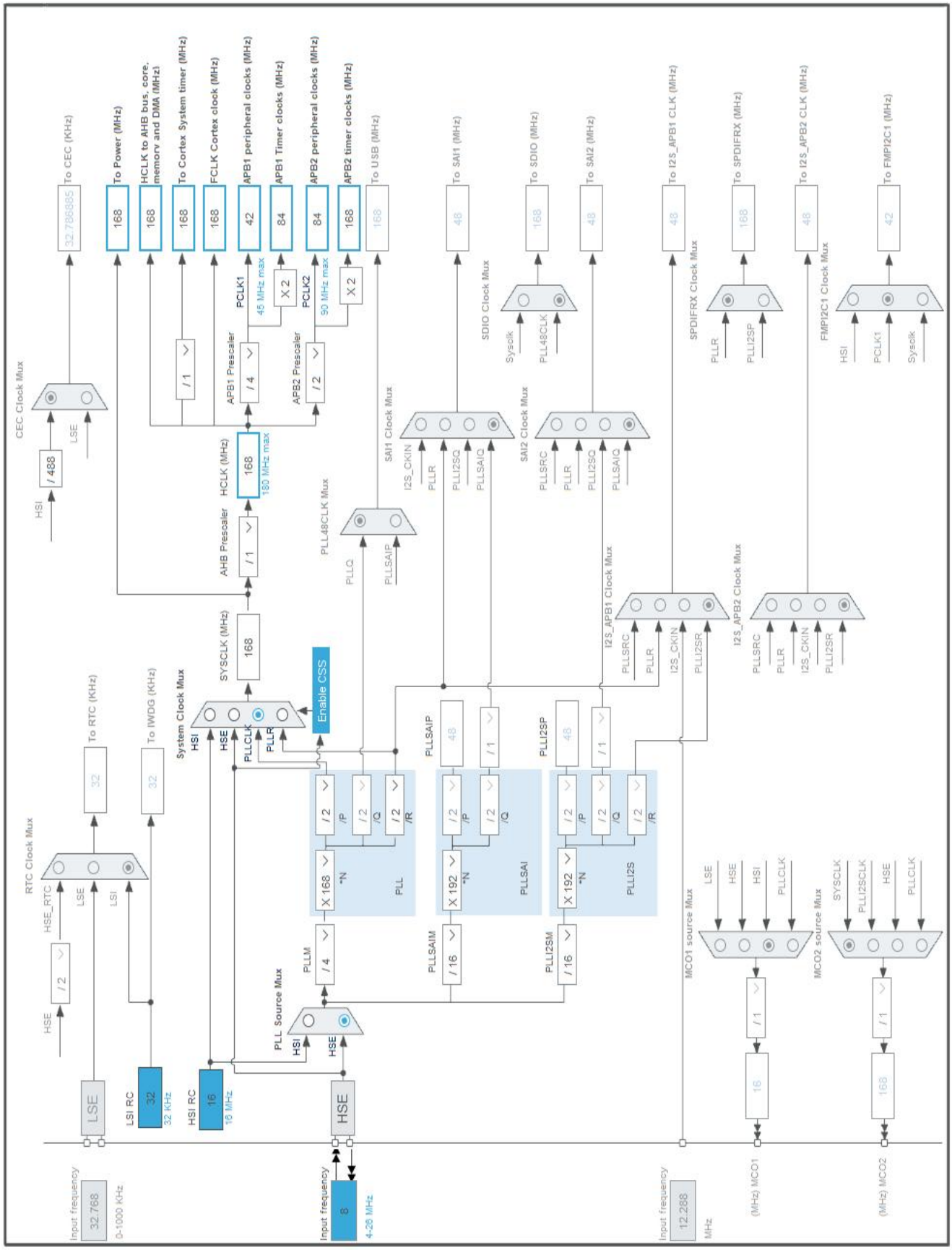
3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13 *	I/O	GPIO_Input	
3	PC14-OSC32_IN *	I/O	GPIO_Input	
4	PC15-OSC32_OUT *	I/O	GPIO_Input	
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_Input	
9	PC1 *	I/O	GPIO_Input	
12	VSSA	Power		
13	VDDA	Power		
14	PA0-WKUP	I/O	TIM2_CH1	
15	PA1	I/O	TIM2_CH2	
16	PA2	I/O	USART2_TX	
17	PA3	I/O	USART2_RX	
18	VSS	Power		
19	VDD	Power		
21	PA5 *	I/O	GPIO_Output	
22	PA6	I/O	TIM3_CH1	
23	PA7	I/O	TIM3_CH2	
25	PC5	I/O	USART3_RX	
26	PB0	I/O	TIM3_CH3	
27	PB1	I/O	TIM3_CH4	
29	PB10	I/O	USART3_TX	
30	VCAP_1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12	I/O	CAN2_RX	
34	PB13	I/O	CAN2_TX	
35	PB14 *	I/O	GPIO_Output	
36	PB15 *	I/O	GPIO_Output	
37	PC6	I/O	USART6_TX	
38	PC7	I/O	USART6_RX	
39	PC8	I/O	TIM8_CH3	
40	PC9	I/O	TIM8_CH4	
41	PA8	I/O	TIM1_CH1	

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
42	PA9	I/O	TIM1_CH2	
43	PA10 *	I/O	GPIO_Input	
44	PA11	I/O	CAN1_RX	
45	PA12	I/O	CAN1_TX	
46	PA13	I/O	SYS_JTMS-SWDIO	
47	VSS	Power		
48	VDD	Power		
49	PA14	I/O	SYS_JTCK-SWCLK	
50	PA15 *	I/O	GPIO_Output	
51	PC10 *	I/O	GPIO_Output	
52	PC11 *	I/O	GPIO_Output	
53	PC12	I/O	UART5_TX	
54	PD2	I/O	UART5_RX	
56	PB4 *	I/O	GPIO_Input	
57	PB5 *	I/O	GPIO_Input	
58	PB6	I/O	USART1_TX	
59	PB7	I/O	USART1_RX	
60	BOOT0	Boot		
61	PB8 *	I/O	GPIO_Input	
62	PB9 *	I/O	GPIO_Input	
63	VSS	Power		
64	VDD	Power		

* The pin is affected with an I/O function

4. Clock Tree Configuration



5. Software Project

5.1. Project Settings

Name	Value
Project Name	F446_Saramander_Sentry
Project Folder	C:\Users\ryouma\Documents\GitHub\RoboMaster_Salamander_okadatech\F446
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.24.2

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. 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
Automatic Retransmission	Disable
Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	Disable

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
Automatic Retransmission	Disable

Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	Disable

Advanced Parameters:

Operating Mode	Normal

7.3. GPIO

7.4. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

7.4.1. 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 Regulator Voltage Scale	Power Regulator Voltage Scale 1
Power Over Drive	Disabled

7.5. SYS

Debug: Serial Wire

Timebase Source: SysTick

7.6. TIM1

Combined Channels: Encoder Mode

7.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0

Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**30000 ***
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
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

7.7. TIM2

Combined Channels: Encoder Mode

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**30000 ***
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
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct

Prescaler Division Ratio	No division
Input Filter	0
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

7.8. TIM3

Channel1: PWM Generation CH1
Channel2: PWM Generation CH2
Channel3: PWM Generation CH3
Channel4: PWM Generation CH4
7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**42 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**20000-1 ***
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 (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

PWM Generation Channel 2:

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

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (16 bits value)	0

Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

PWM Generation Channel 4:

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

7.9. TIM7

mode: Activated

7.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**5-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**16800 ***
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)

7.10. TIM8

Channel3: PWM Generation CH3

Channel4: PWM Generation CH4

7.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**48 ***
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
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 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

7.11. UART5

Mode: Asynchronous

7.11.1. Parameter Settings:

Basic Parameters:

Baud Rate	115200
Word Length	8 Bits (including Parity)
Parity	**Even ***
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

7.12. USART1

Mode: Asynchronous

7.12.1. 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

7.13. 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

7.15. USART6

Mode: Asynchronous

7.15.1. 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
CAN1	PA11	CAN1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA12	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	
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	
	PA9	TIM1_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	
TIM2	PA0-WKUP	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA1	TIM2_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	
TIM3	PA6	TIM3_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA7	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB0	TIM3_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB1	TIM3_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	
TIM8	PC8	TIM8_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC9	TIM8_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	
UART5	PC12	UART5_TX	Alternate Function Push Pull	Pull-up	**Very High ***	
	PD2	UART5_RX	Alternate Function Push Pull	Pull-up	**Very High ***	
USART1	PB6	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PB7	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
USART2	PA2	USART2_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High**	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
					*	
	PA3	USART2_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
USART3	PC5	USART3_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
	PB10	USART3_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
USART6	PC6	USART6_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
	PC7	USART6_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
GPIO	PC13	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PC14-OSC32_IN	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PC15-OSC32_OUT	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PC0	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PC1	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA10	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PA15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PC10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PC11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PB4	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PB5	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PB8	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	
	PB9	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	

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:	**Circular ***
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
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
CAN1 TX interrupt	unused		
CAN1 RX0 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		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
USART1 global interrupt	unused		
USART2 global interrupt	unused		
USART3 global interrupt	unused		
TIM8 break interrupt and TIM12 global interrupt	unused		
TIM8 update interrupt and TIM13 global interrupt	unused		
TIM8 trigger and commutation interrupts and TIM14 global interrupt	unused		
TIM8 capture compare interrupt	unused		
UART5 global interrupt	unused		
TIM7 global interrupt	unused		
CAN2 TX interrupt	unused		
CAN2 RX0 interrupt	unused		
CAN2 RX1 interrupt	unused		
CAN2 SCE interrupt	unused		

Interrupt Table	Enable	Preenmption Priority	SubPriority
USART6 global interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

9. Software Pack Report