1. Description

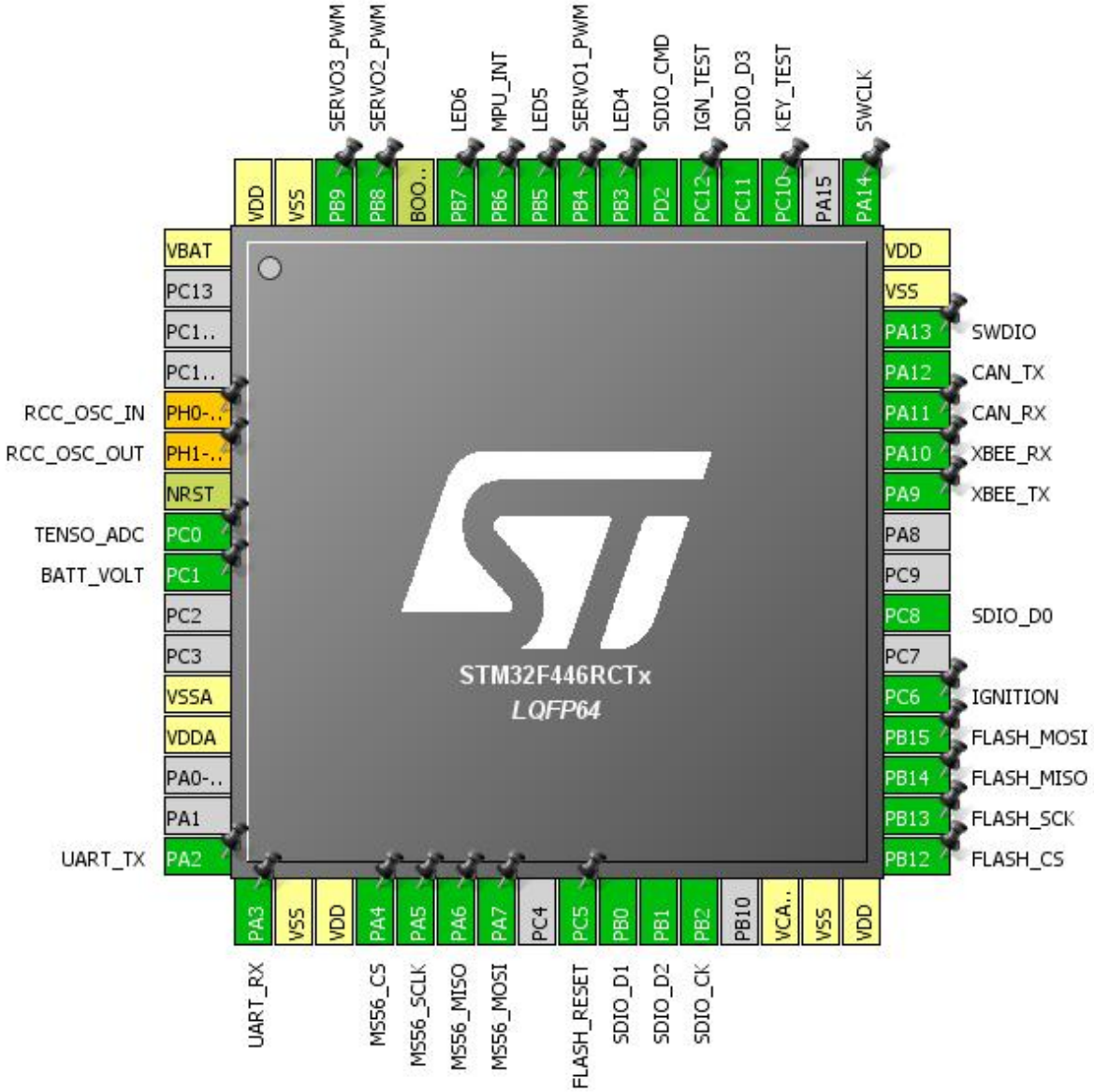
1.1. Project

Project Name	hybrid_rocket_bottom2
Board Name	hybrid_rocket_bottom2
Generated with:	STM32CubeMX 4.25.0
Date	05/03/2018

1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F446
MCU name	STM32F446RCTx
MCU Package	LQFP64
MCU Pin number	64

2. Pinout Configuration



3. Pins Configuration

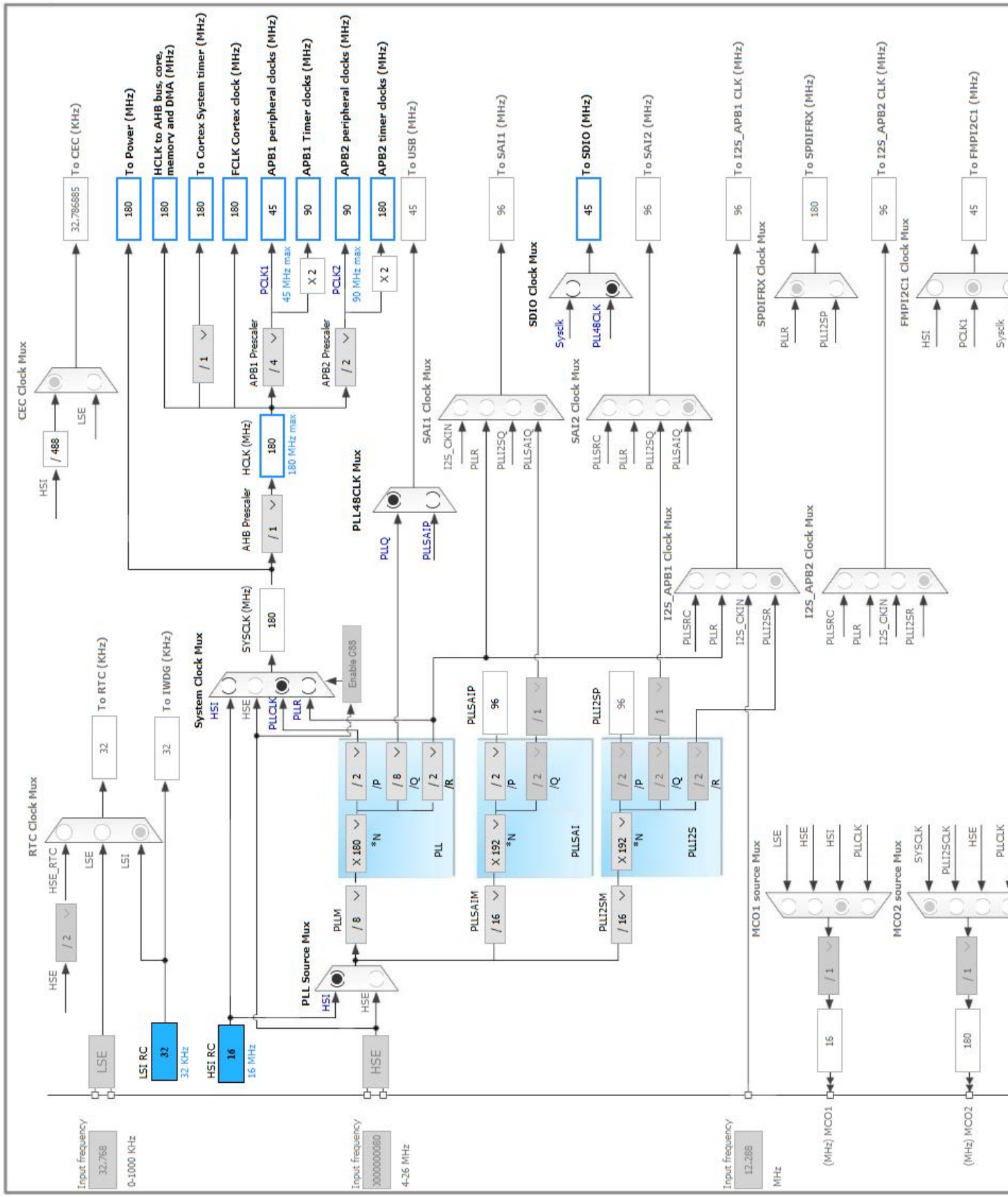
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
5	PH0-OSC_IN *	I/O	RCC_OSC_IN	
6	PH1-OSC_OUT *	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	PC0	I/O	ADC1_IN10	TENSO_ADC
9	PC1	I/O	ADC1_IN11	BATT_VOLT
12	VSSA	Power		
13	VDDA	Power		
16	PA2	I/O	USART2_TX	UART_TX
17	PA3	I/O	USART2_RX	UART_RX
18	VSS	Power		
19	VDD	Power		
20	PA4 **	I/O	GPIO_Output	MS56_CS
21	PA5	I/O	SPI1_SCK	MS56_SCLK
22	PA6	I/O	SPI1_MISO	MS56_MISO
23	PA7	I/O	SPI1_MOSI	MS56_MOSI
25	PC5 **	I/O	GPIO_Output	FLASH_RESET
26	PB0	I/O	SDIO_D1	
27	PB1	I/O	SDIO_D2	
28	PB2	I/O	SDIO_CK	
30	VCAP_1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12 **	I/O	GPIO_Output	FLASH_CS
34	PB13	I/O	SPI2_SCK	FLASH_SCK
35	PB14	I/O	SPI2_MISO	FLASH_MISO
36	PB15	I/O	SPI2_MOSI	FLASH_MOSI
37	PC6 **	I/O	GPIO_Output	IGNITION
39	PC8	I/O	SDIO_D0	
42	PA9	I/O	USART1_TX	XBEE_TX
43	PA10	I/O	USART1_RX	XBEE_RX
44	PA11	I/O	CAN1_RX	CAN_RX
45	PA12	I/O	CAN1_TX	CAN_TX
46	PA13	I/O	SYS_JTMS-SWDIO	SWDIO
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	SWCLK
51	PC10 **	I/O	GPIO_Input	KEY_TEST
52	PC11	I/O	SDIO_D3	
53	PC12 **	I/O	GPIO_Input	IGN_TEST
54	PD2	I/O	SDIO_CMD	
55	PB3 **	I/O	GPIO_Output	LED4
56	PB4	I/O	TIM3_CH1	SERVO1_PWM
57	PB5 **	I/O	GPIO_Output	LED5
58	PB6	I/O	GPIO_EXTI6	MPU_INT
59	PB7 **	I/O	GPIO_Output	LED6
60	BOOT0	Boot		
61	PB8	I/O	TIM2_CH1	SERVO2_PWM
62	PB9	I/O	TIM11_CH1	SERVO3_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. IPs and Middleware Configuration

5.1. ADC1

mode: IN10

mode: IN11

5.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	**PCLK2 divided by 8 ***
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	Regular Conversion launched by software
External Trigger Conversion Edge	None
Rank	1
Channel	Channel 10
Sampling Time	3 Cycles

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

5.2. CAN1

mode: Mode

5.2.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	16
Time Quantum	**355.55555555555554 ***
Time Quanta in Bit Segment 1	1 Time
Time Quanta in Bit Segment 2	1 Time
ReSynchronization Jump Width	1 Time

Basic Parameters:

Time Triggered Communication Mode	Disable
Automatic Bus-Off Management	Disable
Automatic Wake-Up Mode	Disable
No-Automatic Retransmission	Disable
Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	Disable

Advanced Parameters:

Operating Mode	Normal

5.3. CRC

mode: Activated

5.4. SDIO

Mode: SD 4 bits Wide bus

5.4.1. Parameter Settings:

SDIO parameters:

Clock transition on which the bit capture is made	Rising transition
SDIO Clock divider bypass	Disable
SDIO Clock output enable when the bus is idle	Disable the power save for the clock
SDIO hardware flow control	The hardware control flow is disabled
SDIOCLK clock divide factor	0

5.5. SPI1

Mode: Full-Duplex Master

5.5.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**8 ***
Baud Rate	**11.25 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

5.6. SPI2

Mode: Full-Duplex Master

5.6.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**64 ***
Baud Rate	**703.125 KBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

5.7. SYS

Debug: Serial Wire
Timebase Source: SysTick

5.8. TIM2

Clock Source : Internal Clock
Channel1: PWM Generation CH1

5.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**17999 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**99 ***
Internal Clock Division (CKD)	No Division

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
Fast Mode	Disable
CH Polarity	High

5.9. TIM3

Channel1: PWM Generation CH1

5.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**9999 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**8999 ***
Internal Clock Division (CKD)	No Division

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

5.10. TIM6

mode: Activated

5.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**9999 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**8999 ***

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)

5.11. TIM11

mode: Activated

Channel1: PWM Generation CH1

5.11.1. 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

PWM Generation Channel 1:

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

5.12. USART1

Mode: Asynchronous

5.12.1. 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

5.13. USART2

Mode: Asynchronous

5.13.1. 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

5.14. FATFS

mode: SD Card

5.14.1. Set Defines:

Version:

FATFS version	R0.12c

Function Parameters:

FS_READONLY (Read-only mode)	Disabled
FS_MINIMIZE (Minimization level)	Disabled
USE_STRFUNC (String functions)	Enabled with LF -> CRLF conversion
USE_FIND (Find functions)	Disabled
USE_MKFS (Make filesystem function)	Enabled
USE_FASTSEEK (Fast seek function)	Enabled
USE_EXPAND (Use f_expand function)	Disabled
USE_CHMOD (Change attributes function)	Disabled
USE_LABEL (Volume label functions)	Disabled
USE_FORWARD (Forward function)	Disabled

Locale and Namespace Parameters:

CODE_PAGE (Code page on target)	Latin 1
USE_LFN (Use Long Filename)	Disabled
MAX_LFN (Max Long Filename)	255
LFN_UNICODE (Enable Unicode)	ANSI/OEM
STRF_ENCODE (Character encoding)	UTF-8
FS_RPATH (Relative Path)	Disabled

Physical Drive Parameters:

VOLUMES (Logical drives)	1
MAX_SS (Maximum Sector Size)	512
MIN_SS (Minimum Sector Size)	512
MULTI_PARTITION (Volume partitions feature)	Disabled
USE_TRIM (Erase feature)	Disabled
FS_NOFSINFO (Force full FAT scan)	0

System Parameters:

FS_TINY (Tiny mode)	Disabled
FS_EXFAT (Support of exFAT file system)	Disabled
FS_NORTC (Timestamp feature)	Dynamic timestamp
NORTC_YEAR (Year for timestamp)	2015
NORTC_MON (Month for timestamp)	6
NORTC_MDAY (Day for timestamp)	4
FS_REENTRANT (Re-Entrancy)	Disabled
FS_TIMEOUT (Timeout ticks)	1000
SYNC_t (O/S sync object)	osSemaphoreId
FS_LOCK (Number of files opened simultaneously)	2

5.14.2. IPs instances:

SDIO/SDMMC:

SDIO instance	SDIO
Use dma template	**Disabled ***

*** 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	PC0	ADC1_IN10	Analog mode	No pull-up and no pull-down	n/a	TENSO_ADC
	PC1	ADC1_IN11	Analog mode	No pull-up and no pull-down	n/a	BATT_VOLT
CAN1	PA11	CAN1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	CAN_RX
	PA12	CAN1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	CAN_TX
SDIO	PB0	SDIO_D1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PB1	SDIO_D2	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PB2	SDIO_CK	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC8	SDIO_D0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC11	SDIO_D3	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD2	SDIO_CMD	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	MS56_SCLK
	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	MS56_MISO
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	MS56_MOSI
SPI2	PB13	SPI2_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	FLASH_SCK
	PB14	SPI2_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	FLASH_MISO
	PB15	SPI2_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	FLASH_MOSI
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	SWDIO
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	SWCLK
TIM2	PB8	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	SERVO2_PWM
TIM3	PB4	TIM3_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	SERVO1_PWM
TIM11	PB9	TIM11_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	SERVO3_PWM
USART1	PA9	USART1_TX	Alternate Function Push Pull	Pull-up	**Very High ***	XBEE_TX

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA10	USART1_RX	Alternate Function Push Pull	Pull-up	**Very High ***	XBEE_RX
USART2	PA2	USART2_TX	Alternate Function Push Pull	Pull-up	**Very High ***	UART_TX
	PA3	USART2_RX	Alternate Function Push Pull	Pull-up	**Very High ***	UART_RX
Single Mapped Signals	PH0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
GPIO	PA4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MS56_CS
	PC5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FLASH_RESET
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FLASH_CS
	PC6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	IGNITION
	PC10	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	KEY_TEST
	PC12	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	IGN_TEST
	PB3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED4
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED5
	PB6	GPIO_EXTI6	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	MPU_INT
	PB7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED6

6.2. DMA configuration

DMA request	Stream	Direction	Priority
SPI1_RX	DMA2_Stream0	Peripheral To Memory	Low
SPI1_TX	DMA2_Stream3	Memory To Peripheral	Low

SPI1_RX: DMA2_Stream0 DMA request Settings:

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

SPI1_TX: DMA2_Stream3 DMA request Settings:

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

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
SPI1 global interrupt	true	0	0
USART2 global interrupt	true	0	0
TIM6 global interrupt and DAC1, DAC2 underrun error interrupts	true	0	0
DMA2 stream0 global interrupt	true	0	0
DMA2 stream3 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1, ADC2 and ADC3 interrupts	unused		
CAN1 TX interrupt	unused		
CAN1 RX0 interrupt	unused		
CAN1 RX1 interrupt	unused		
CAN1 SCE interrupt	unused		
EXTI line[9:5] interrupts	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM2 global interrupt	unused		
TIM3 global interrupt	unused		
SPI2 global interrupt	unused		
USART1 global interrupt	unused		
SDIO global interrupt	unused		
FPU global interrupt	unused		

*** User modified value**

7. Power Consumption Calculator report

7.1. Microcontroller Selection

Series	STM32F4
Line	STM32F446
MCU	STM32F446RCTx
Datasheet	027107_Rev6

7.2. Parameter Selection

Temperature	25
Vdd	null

8. Software Project

8.1. Project Settings

Name	Value
Project Name	hybrid_rocket_bottom2
Project Folder	D:\Elektronika programowanie\SPACE
Toolchain / IDE	SW4STM32
Firmware Package Name and Version	STM32Cube FW_F4 V1.21.0

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

9. Software Pack Report