
STM32
CubeMX

1. Description

1.1. Project

Project Name	cubemx
Board Name	custom
Generated with:	STM32CubeMX 6.6.1
Date	12/26/2022

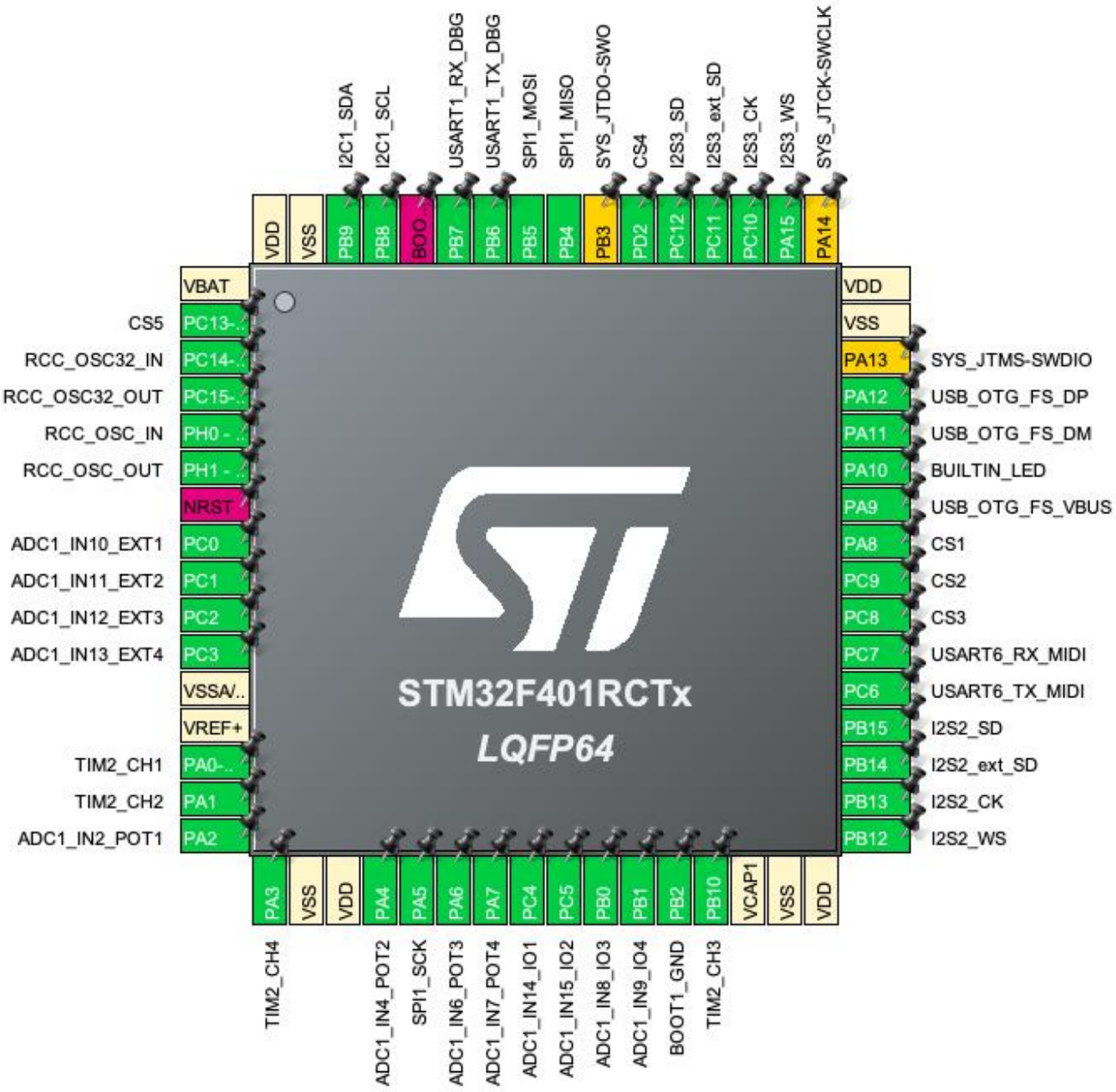
1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F401
MCU name	STM32F401RCTx
MCU Package	LQFP64
MCU Pin number	64

1.3. Core(s) information

Core(s)	Arm Cortex-M4

2. Pinout Configuration



3. Pins Configuration

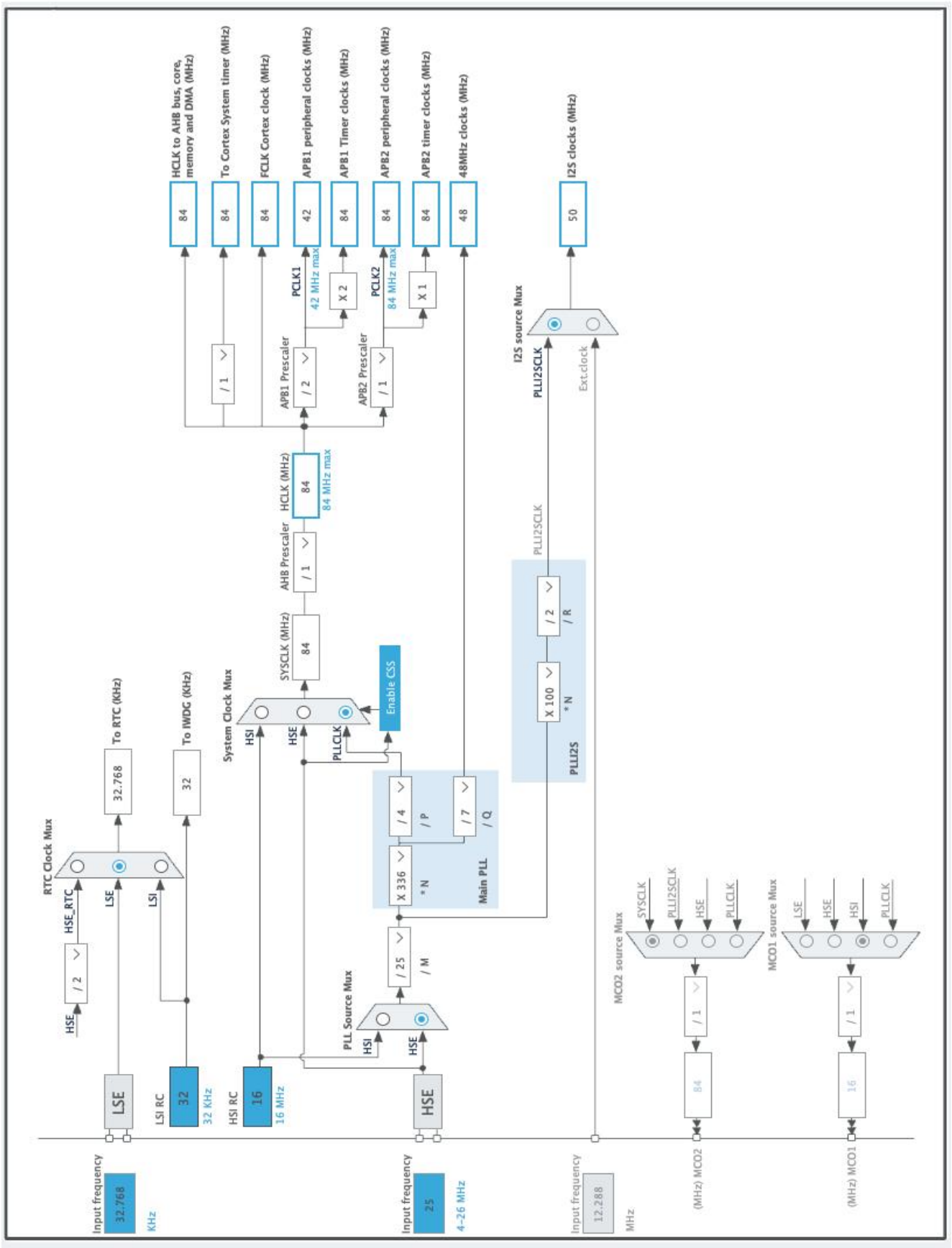
Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-ANTI_TAMP *	I/O	GPIO_Output	CS5
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	PC0	I/O	ADC1_IN10	ADC1_IN10_EXT1
9	PC1	I/O	ADC1_IN11	ADC1_IN11_EXT2
10	PC2	I/O	ADC1_IN12	ADC1_IN12_EXT3
11	PC3	I/O	ADC1_IN13	ADC1_IN13_EXT4
12	VSSA/VREF-	Power		
13	VREF+	Power		
14	PA0-WKUP	I/O	TIM2_CH1	
15	PA1	I/O	TIM2_CH2	
16	PA2	I/O	ADC1_IN2	ADC1_IN2_POT1
17	PA3	I/O	TIM2_CH4	
18	VSS	Power		
19	VDD	Power		
20	PA4	I/O	ADC1_IN4	ADC1_IN4_POT2
21	PA5	I/O	SPI1_SCK	
22	PA6	I/O	ADC1_IN6	ADC1_IN6_POT3
23	PA7	I/O	ADC1_IN7	ADC1_IN7_POT4
24	PC4	I/O	ADC1_IN14	ADC1_IN14_IO1
25	PC5	I/O	ADC1_IN15	ADC1_IN15_IO2
26	PB0	I/O	ADC1_IN8	ADC1_IN8_IO3
27	PB1	I/O	ADC1_IN9	ADC1_IN9_IO4
28	PB2 *	I/O	GPIO_Input	BOOT1_GND
29	PB10	I/O	TIM2_CH3	
30	VCAP1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12	I/O	I2S2_WS	
34	PB13	I/O	I2S2_CK	
35	PB14	I/O	I2S2_ext_SD	
36	PB15	I/O	I2S2_SD	

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
37	PC6	I/O	USART6_TX	USART6_TX_MIDI
38	PC7	I/O	USART6_RX	USART6_RX_MIDI
39	PC8 *	I/O	GPIO_Output	CS3
40	PC9 *	I/O	GPIO_Output	CS2
41	PA8 *	I/O	GPIO_Output	CS1
42	PA9	I/O	USB_OTG_FS_VBUS	
43	PA10 *	I/O	GPIO_Output	BUILTIN_LED
44	PA11	I/O	USB_OTG_FS_DM	
45	PA12	I/O	USB_OTG_FS_DP	
46	PA13 **	I/O	SYS_JTMS-SWDIO	
47	VSS	Power		
48	VDD	Power		
49	PA14 **	I/O	SYS_JTCK-SWCLK	
50	PA15	I/O	I2S3_WS	
51	PC10	I/O	I2S3_CK	
52	PC11	I/O	I2S3_ext_SD	
53	PC12	I/O	I2S3_SD	
54	PD2 *	I/O	GPIO_Output	CS4
55	PB3 **	I/O	SYS_JTDO-SWO	
56	PB4	I/O	SPI1_MISO	
57	PB5	I/O	SPI1_MOSI	
58	PB6	I/O	USART1_TX	USART1_TX_DBG
59	PB7	I/O	USART1_RX	USART1_RX_DBG
60	BOOT0	Boot		
61	PB8	I/O	I2C1_SCL	
62	PB9	I/O	I2C1_SDA	
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	cubemx
Project Folder	/Users/admin/Desktop/projects/ricksynth/board/docs/cubemx
Toolchain / IDE	Makefile
Firmware Package Name and Version	STM32Cube FW_F4 V1.27.1
Application Structure	Advanced
Generate Under Root	No
Do not generate the main()	No
Minimum Heap Size	0x200
Minimum Stack Size	0x400

5.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Add necessary library files as reference in the toolchain project configuration file
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

5.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_ADC1_Init	ADC1
4	MX_CRC_Init	CRC
5	MX_I2C1_Init	I2C1
6	MX_I2S2_Init	I2S2
7	MX_I2S3_Init	I2S3
8	MX_IWDG_Init	IWDG
9	MX_RTC_Init	RTC
10	MX_SPI1_Init	SPI1
11	MX_TIM2_Init	TIM2

Rank	Function Name	Peripheral Instance Name
12	MX_USART1_UART_Init	USART1
13	MX_USART6_UART_Init	USART6
14	MX_USB_DEVICE_Init	USB_DEVICE

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F401
MCU	STM32F401RCTx
Datasheet	DS9716_Rev8

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

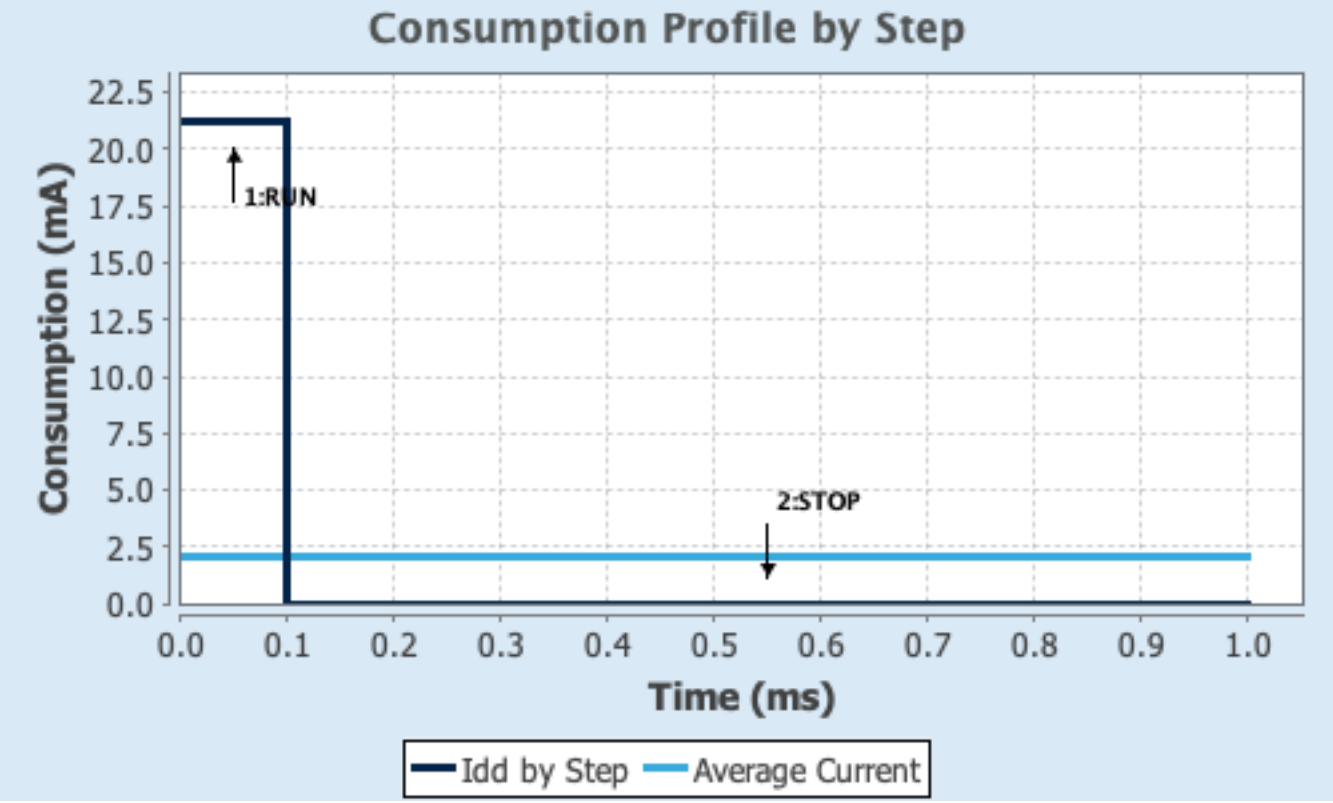
6.4. Sequence

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	21.2 mA	10 µA
Duration	0.1 ms	0.9 ms
DMIPS	105.0	0.0
Ta Max	101.5	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	2.13 mA
Battery Life	2 months, 5 days, 14 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. Peripherals and Middlewares Configuration

7.1. ADC1

mode: IN2

mode: IN4

mode: IN6

mode: IN7

mode: IN8

mode: IN9

mode: IN10

mode: IN11

mode: IN12

mode: IN13

mode: IN14

mode: IN15

7.1.1. 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	Regular Conversion launched by software
External Trigger Conversion Edge	None
Rank	1
Channel	**Channel 4 ***
Sampling Time	3 Cycles

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

7.2. CRC

mode: Activated

7.3. I2C1

I2C: I2C

7.3.1. Parameter Settings:

Master Features:

I2C Speed Mode	Standard Mode
I2C Clock Speed (Hz)	100000

Slave Features:

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

7.4. I2S2

Mode: Full-Duplex Master

7.4.1. Parameter Settings:

Generic Parameters:

Transmission Mode	Mode Master Transmit
Communication Standard	I2S Philips
Data and Frame Format	16 Bits Data on 16 Bits Frame
Selected Audio Frequency	**96 KHz ***
Real Audio Frequency	**97.656 KHz ***
Error between Selected and Real	**1.72 % ***

Clock Parameters:

Clock Source	I2S PLL Clock
Clock Polarity	Low

7.5. I2S3

Mode: Full-Duplex Master

7.5.1. Parameter Settings:

Generic Parameters:

Transmission Mode	Mode Master Transmit
Communication Standard	I2S Philips
Data and Frame Format	16 Bits Data on 16 Bits Frame
Selected Audio Frequency	**96 KHz ***
Real Audio Frequency	**97.656 KHz ***
Error between Selected and Real	**1.72 % ***

Clock Parameters:

Clock Source	I2S PLL Clock
Clock Polarity	Low

7.6. IWDG

mode: Activated

7.6.1. Parameter Settings:

Clocking:

IWDG counter clock prescaler	4
IWDG down-counter reload value	4095

7.7. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

7.7.1. 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

7.8. RTC

mode: Activate Clock Source

7.8.1. Parameter Settings:

General:

Hour Format	Hourformat 24
Asynchronous Predivider value	127
Synchronous Predivider value	255

7.9. SPI1

Mode: Full-Duplex Master

7.9.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	**42.0 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

7.10. SYS

Timebase Source: SysTick

7.11. TIM2

Clock Source : Internal Clock

Channel1: Input Capture direct mode

Channel2: Input Capture direct mode

Channel3: Input Capture direct mode

Channel4: Input Capture direct mode

7.11.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	4294967295
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)

Input Capture Channel 1:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

Input Capture Channel 2:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

Input Capture Channel 3:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

Input Capture Channel 4:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

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. USART6

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. USB_OTG_FS

Mode: Device_Only

mode: Activate_VBUS

7.14.1. Parameter Settings:

Speed	Device Full Speed 12MBit/s
Low power	Disabled
Link Power Management	Disabled
VBUS sensing	Enabled
Signal start of frame	Disabled

7.15. USB_DEVICE

Class For FS IP: Custom Human Interface Device Class (HID)

7.15.1. Parameter Settings:

Class Parameters:

CUSTOM_HID_FS_BINTERVAL	**0x5 ***
USBD_CUSTOM_HID_REPORT_DESC_SIZE (Total length for Report descriptor (IN ENDPOINT))	2
USBD_CUSTOMHID_OUTREPORT_BUF_SIZE (Maximum report buffer size (OUT ENDPOINT))	2

Basic Parameters:

USBD_MAX_NUM_INTERFACES (Maximum number of supported interfaces)	1
USBD_MAX_NUM_CONFIGURATION (Maximum number of supported configuration)	1
USBD_MAX_STR_DESC_SIZ (Maximum size for the string descriptors)	512
USBD_SELF_POWERED (Enabled self power)	Enabled
USBD_DEBUG_LEVEL (USBD Debug Level)	0: No debug message

7.15.2. Device Descriptor:

Device Descriptor:

VID (Vendor IDentifier)	1155
LANGID_STRING (Language Identifier)	English(United States)
MANUFACTURER_STRING (Manufacturer Identifier)	STMicroelectronics

Device Descriptor FS:

PID (Product IDentifier)	**22352 ***
PRODUCT_STRING (Product Identifier)	STM32 Custom Human interface
CONFIGURATION_STRING (Configuration Identifier)	Custom HID Config
INTERFACE_STRING (Interface Identifier)	Custom HID Interface

*** User modified value**

8. System Configuration

8.1. 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	ADC1_IN10_EXT1
	PC1	ADC1_IN11	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN11_EXT2
	PC2	ADC1_IN12	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN12_EXT3
	PC3	ADC1_IN13	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN13_EXT4
	PA2	ADC1_IN2	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN2_POT1
	PA4	ADC1_IN4	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN4_POT2
	PA6	ADC1_IN6	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN6_POT3
	PA7	ADC1_IN7	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN7_POT4
	PC4	ADC1_IN14	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN14_IO1
	PC5	ADC1_IN15	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN15_IO2
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN8_IO3
	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	ADC1_IN9_IO4
I2C1	PB8	I2C1_SCL	Alternate Function Open Drain	No pull-up and no pull-down	**Very High ***	
	PB9	I2C1_SDA	Alternate Function Open Drain	No pull-up and no pull-down	**Very High ***	
I2S2	PB12	I2S2_WS	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB13	I2S2_CK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB14	I2S2_ext_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB15	I2S2_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	
I2S3	PA15	I2S3_WS	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC10	I2S3_CK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC11	I2S3_ext_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC12	I2S3_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	
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	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PB4	SPI1_MISO	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
					*	
	PB5	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
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	
	PA3	TIM2_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART1	PB6	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	USART1_TX_DBG
	PB7	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	USART1_RX_DBG
USART6	PC6	USART6_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	USART6_TX_MIDI
	PC7	USART6_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	USART6_RX_MIDI
USB_OTG_FS	PA9	USB_OTG_FS_VBUS	Input mode	No pull-up and no pull-down	n/a	
	PA11	USB_OTG_FS_DM	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	**Very High** *	
Single Mapped Signals	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
	PB3	SYS_JTDO-SWO	n/a	n/a	n/a	
GPIO	PC13-ANTI_TAMP	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS5
	PB2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	BOOT1_GND
	PC8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS3
	PC9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS2
	PA8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS1
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BUILTIN_LED
	PD2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CS4

8.2. DMA configuration

nothing configured in DMA service

8.3. NVIC configuration

8.3.1. NVIC

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	15	0
USB On The Go FS global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1 global interrupt	unused		
TIM2 global interrupt	unused		
I2C1 event interrupt	unused		
I2C1 error interrupt	unused		
SPI1 global interrupt	unused		
SPI2 global interrupt	unused		
USART1 global interrupt	unused		
SPI3 global interrupt	unused		
USART6 global interrupt	unused		
FPU global interrupt	unused		

8.3.2. NVIC Code generation

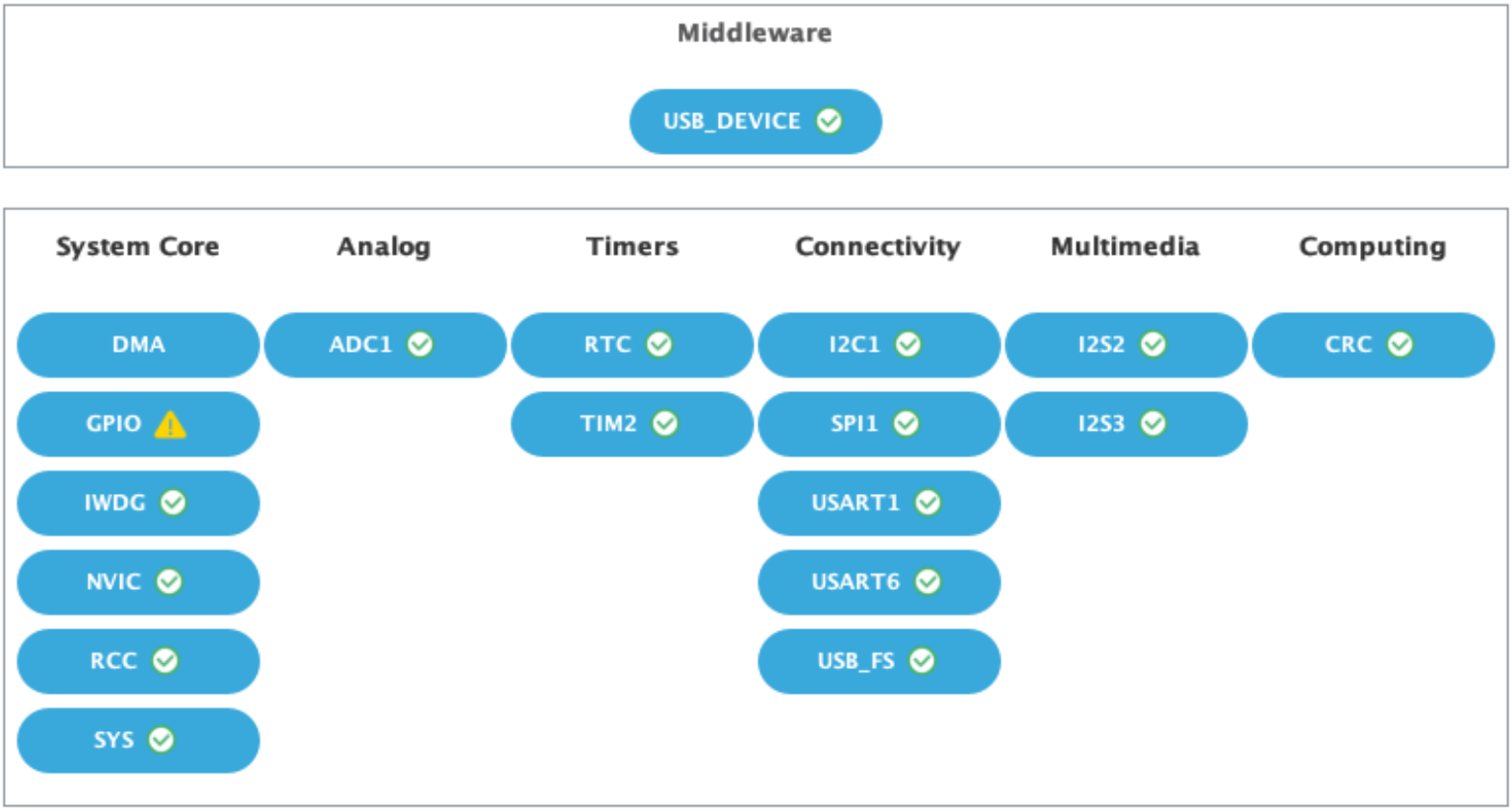
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Pre-fetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	true	false
Debug monitor	false	true	false
Pendable request for system service	false	true	false
System tick timer	false	true	true
USB On The Go FS global interrupt	false	true	true

*** User modified value**

9. System Views

9.1. Category view

9.1.1. Current



10. Docs & Resources

Type	Link
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_eval-tools_portfolio.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf
Training Material	https://www.st.com/resource/en/sales_guide/sg_sc2154.pdf
Flyers	https://www.st.com/resource/en/flyer/flnucleolrwan.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32f4x1.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.pdf
Flyers	https://www.st.com/resource/en/flyer/flstmcsuite.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32trust.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf
Application Notes	https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf
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