



1. Description

1.1. Project

Project Name	Cobot
Board Name	custom
Generated with:	STM32CubeMX 6.6.1
Date	04/30/2023

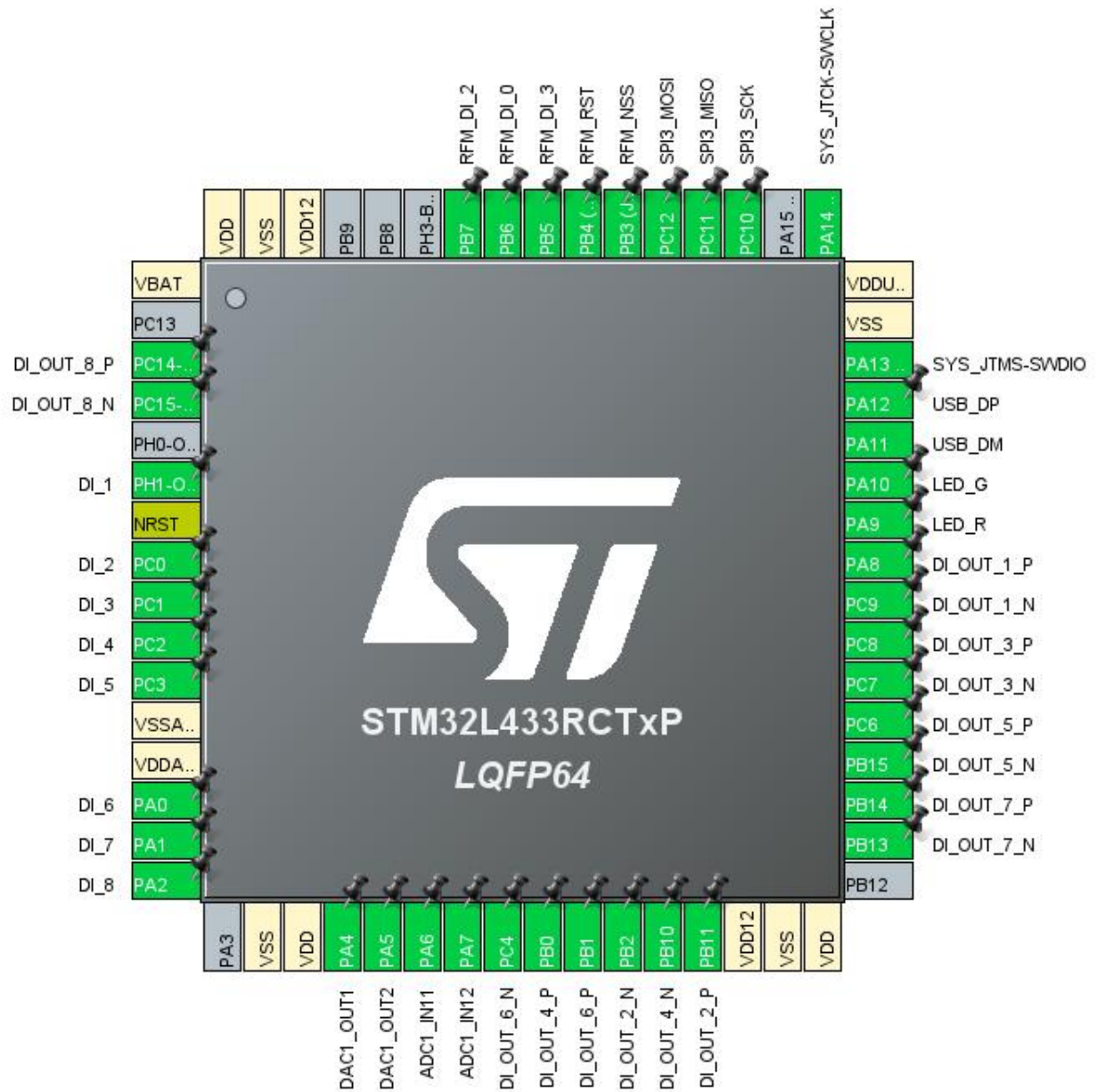
1.2. MCU

MCU Series	STM32L4
MCU Line	STM32L4x3
MCU name	STM32L433RCTxP
MCU Package	LQFP64
MCU Pin number	64

1.3. Core(s) information

Core(s)	Arm Cortex-M4
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2. Pinout Configuration



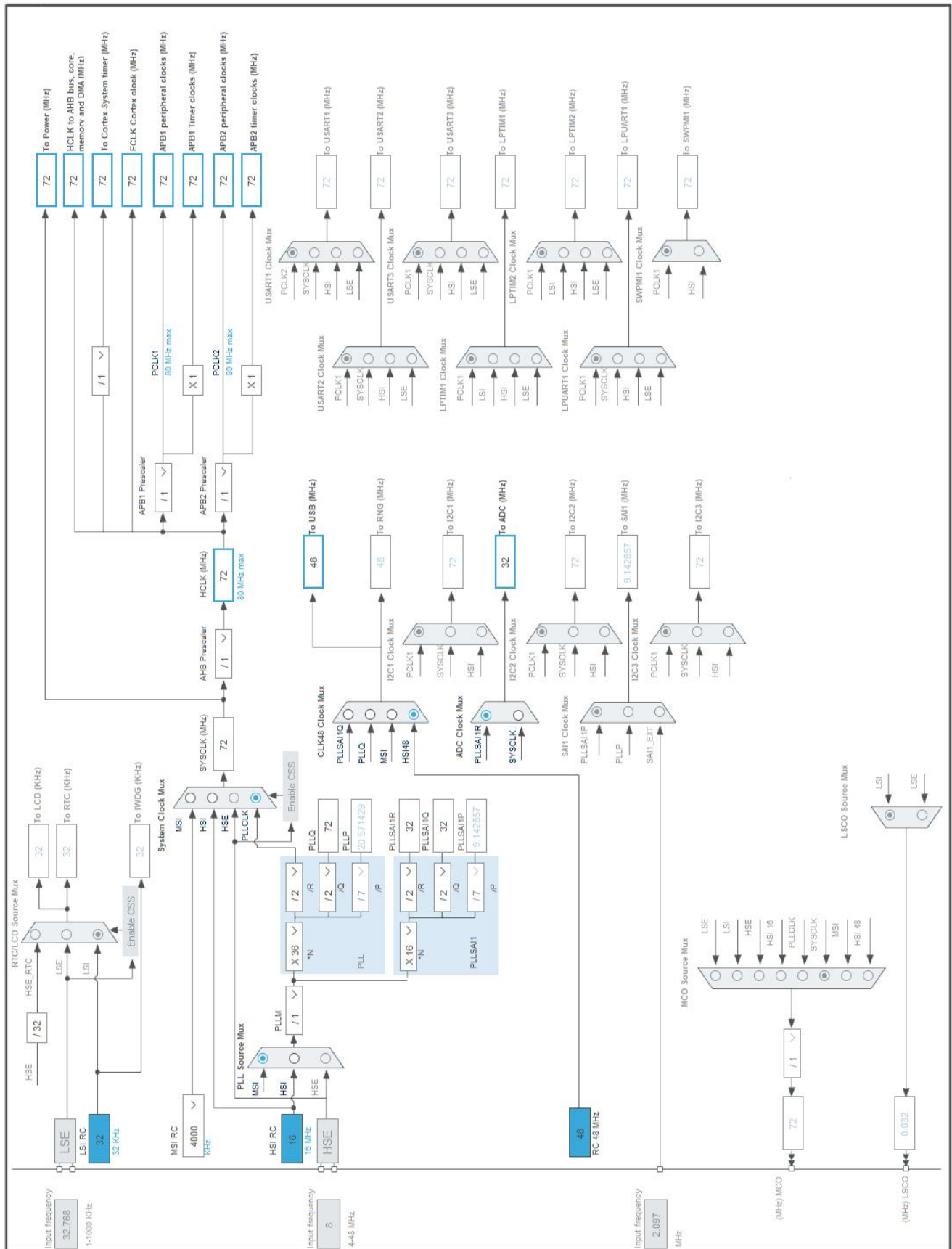
3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
3	PC14-OSC32_IN (PC14) *	I/O	GPIO_Output	DI_OUT_8_P
4	PC15-OSC32_OUT (PC15) *	I/O	GPIO_Output	DI_OUT_8_N
6	PH1-OSC_OUT (PH1) *	I/O	GPIO_Input	DI_1
7	NRST	Reset		
8	PC0 *	I/O	GPIO_Input	DI_2
9	PC1 *	I/O	GPIO_Input	DI_3
10	PC2 *	I/O	GPIO_Input	DI_4
11	PC3 *	I/O	GPIO_Input	DI_5
12	VSSA/VREF-	Power		
13	VDDA/VREF+	Power		
14	PA0 *	I/O	GPIO_Input	DI_6
15	PA1 *	I/O	GPIO_Input	DI_7
16	PA2 *	I/O	GPIO_Input	DI_8
18	VSS	Power		
19	VDD	Power		
20	PA4	I/O	DAC1_OUT1	
21	PA5	I/O	DAC1_OUT2	
22	PA6	I/O	ADC1_IN11	
23	PA7	I/O	ADC1_IN12	
24	PC4 *	I/O	GPIO_Output	DI_OUT_6_N
25	PB0 *	I/O	GPIO_Output	DI_OUT_4_P
26	PB1 *	I/O	GPIO_Output	DI_OUT_6_P
27	PB2 *	I/O	GPIO_Output	DI_OUT_2_N
28	PB10 *	I/O	GPIO_Output	DI_OUT_4_N
29	PB11 *	I/O	GPIO_Output	DI_OUT_2_P
30	VDD12	Power		
31	VSS	Power		
32	VDD	Power		
34	PB13 *	I/O	GPIO_Output	DI_OUT_7_N
35	PB14 *	I/O	GPIO_Output	DI_OUT_7_P
36	PB15 *	I/O	GPIO_Output	DI_OUT_5_N
37	PC6 *	I/O	GPIO_Output	DI_OUT_5_P
38	PC7 *	I/O	GPIO_Output	DI_OUT_3_N
39	PC8 *	I/O	GPIO_Output	DI_OUT_3_P

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
40	PC9 *	I/O	GPIO_Output	DI_OUT_1_N
41	PA8 *	I/O	GPIO_Output	DI_OUT_1_P
42	PA9 *	I/O	GPIO_Output	LED_R
43	PA10 *	I/O	GPIO_Output	LED_G
44	PA11	I/O	USB_DM	
45	PA12	I/O	USB_DP	
46	PA13 (JTMS-SWDIO)	I/O	SYS_JTMS-SWDIO	
47	VSS	Power		
48	VDDUSB	Power		
49	PA14 (JTCK-SWCLK)	I/O	SYS_JTCK-SWCLK	
51	PC10	I/O	SPI3_SCK	
52	PC11	I/O	SPI3_MISO	
53	PC12	I/O	SPI3_MOSI	
54	PB3 (JTDO-TRACESWO) *	I/O	GPIO_Output	RFM_NSS
55	PB4 (NJTRST) *	I/O	GPIO_Output	RFM_RST
56	PB5 *	I/O	GPIO_Output	RFM_DI_3
57	PB6 *	I/O	GPIO_Output	RFM_DI_0
58	PB7 *	I/O	GPIO_Output	RFM_DI_2
62	VDD12	Power		
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	Cobot
Project Folder	C:\Users\marce\Documents\Repos\ViseClampingDevice\Firmware\Cobot
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_L4 V1.17.2
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	Yes
Minimum Heap Size	0x200
Minimum Stack Size	0x400

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
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)	Yes
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_DMA_Init	DMA
4	MX_ADC1_Init	ADC1
5	MX_DAC1_Init	DAC1
6	MX_SPI3_Init	SPI3
7	MX_USB_DEVICE_Init	USB_DEVICE
8	MX_CRC_Init	CRC
9	MX_TIM6_Init	TIM6
10	MX_TIM7_Init	TIM7

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32L4
Line	STM32L4x3
MCU	STM32L433RCTxP
Datasheet	DS11449_Rev3

6.2. Parameter Selection

Temperature	25
Vdd	3.0

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

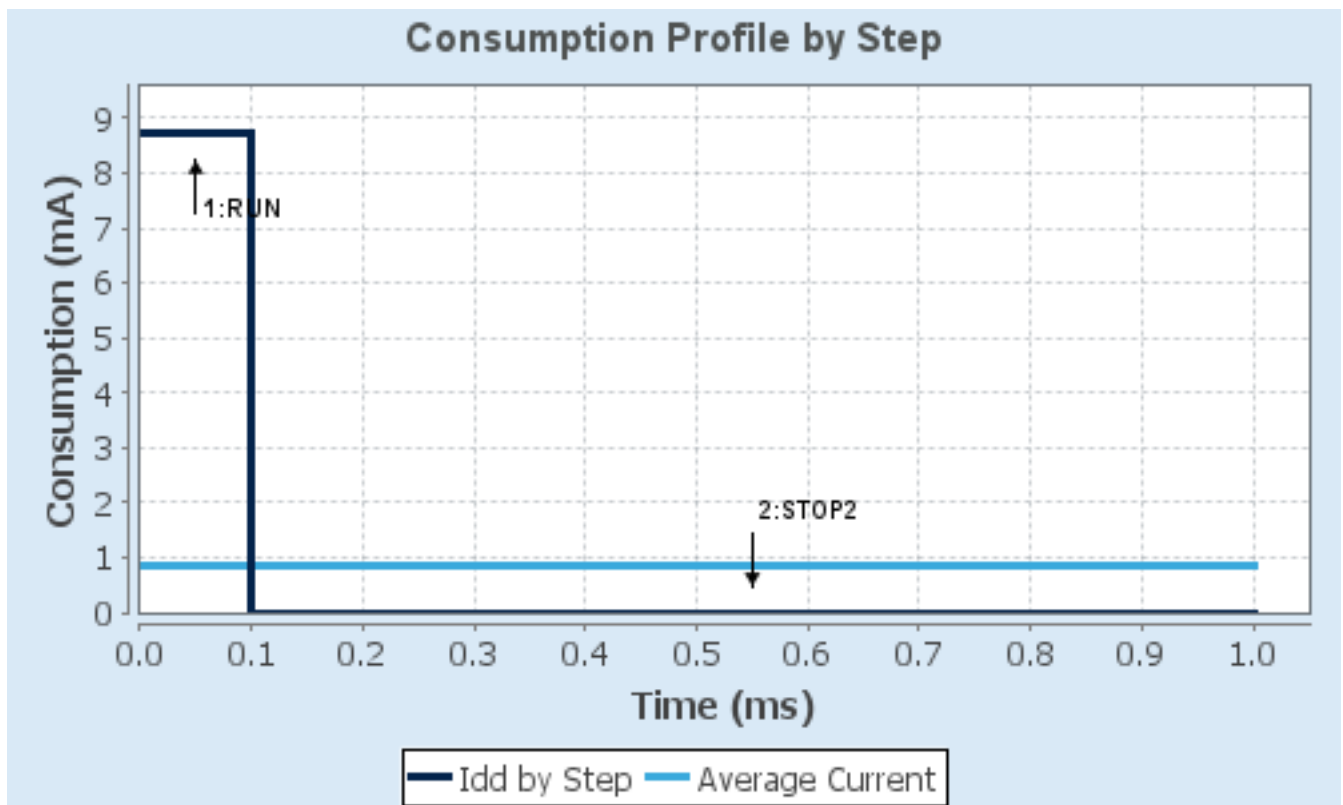
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP2
Vdd	3.0	3.0
Voltage Source	Battery	Battery
Range	Range1-High	NoRange
Fetch Type	SRAM2	n/a
CPU Frequency	80 MHz	0 Hz
Clock Configuration	HSE BYP PLL	ALL CLOCKS OFF
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	8.71 mA	1.06 μ A
Duration	0.1 ms	0.9 ms
DMIPS	100.0	0.0
Ta Max	103.82	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	871.95 μ A
Battery Life	5 months, 9 days, 16 hours	Average DMIPS	100.0 DMIPS

6.6. Chart



7. Peripherals and Middlewares Configuration

7.1. ADC1

IN11: IN11 Single-ended

IN12: IN12 Single-ended

7.1.1. Parameter Settings:

ADC_Settings:

Clock Prescaler	Asynchronous clock mode divided by 1
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	End of single conversion
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Enable Regular Oversampling	Disable
Number Of Conversion	1
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None
<u>Rank</u>	1
Channel	Channel 11
Sampling Time	2.5 Cycles
Offset Number	No offset

ADC_Injected_ConversionMode:

Enable Injected Conversions	Disable
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Analog Watchdog 1:

Enable Analog WatchDog1 Mode	false
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Analog Watchdog 2:

Enable Analog WatchDog2 Mode	false
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Analog Watchdog 3:

Enable Analog WatchDog3 Mode	false
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7.2. CRC

mode: Activated

7.2.1. Parameter Settings:

Basic Parameters:

Default Polynomial State	Enable
Default Init Value State	Enable

Advanced Parameters:

Input Data Inversion Mode	None
Output Data Inversion Mode	Disable
Input Data Format	Bytes

7.3. DAC1

OUT1 connected to: only to external pin

OUT2 connected to: only to external pin

7.3.1. Parameter Settings:

DAC Out1 Settings:

Output Buffer	Enable
Trigger	None
User Trimming	Factory trimming
Sample And Hold	Sampleandhold Disable

DAC Out2 Settings:

Output Buffer	Enable
Trigger	None
User Trimming	Factory trimming
Sample And Hold	Sampleandhold Disable

7.4. RCC

7.4.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Disabled
Data Cache	Enabled
Flash Latency(WS)	4 WS (5 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
MSI Calibration Value	0
MSI Auto Calibration	Disabled
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000
Power Parameters:	
Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

7.5. SPI3

Mode: Full-Duplex Master

7.5.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits *
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	16 *
Baud Rate	4.5 MBits/s *
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSSP Mode	Enabled
NSS Signal Type	Software

7.6. SYS

Debug: Serial Wire

7.7. TIM6

mode: Activated

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	10 *
Counter Mode	Up

Counter Period (AutoReload Register - 16 bits value) **16000 ***
auto-reload preload Disable
Trigger Output (TRGO) Parameters:
Trigger Event Selection Reset (UG bit from TIMx_EGR)

7.8. TIM7

mode: Activated

7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value) **10 ***
Counter Mode Up
Counter Period (AutoReload Register - 16 bits value) **7199 ***
auto-reload preload Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection **Update Event ***

7.9. USB

mode: Device (FS)

7.9.1. Parameter Settings:

Basic Parameters:

Speed Full Speed 12MBit/s
Physical interface Internal Phy
Sof Enable Disabled

Power Parameters:

Low Power Disabled
Link Power Management Disabled
Battery Charging Disabled

7.10. USB_DEVICE

Class For FS IP: Communication Device Class (Virtual Port Com)

7.10.1. Parameter Settings:

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 (USB Debug Level)	0: No debug message
USBD_LPM_ENABLED (Link Power Management)	0: Link Power Management not supported *

Class Parameters:

USB CDC Rx Buffer Size	250 *
USB CDC Tx Buffer Size	250 *

7.10.2. 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)	22336
PRODUCT_STRING (Product Identifier)	STM32 Virtual ComPort
CONFIGURATION_STRING (Configuration Identifier)	CDC Config
INTERFACE_STRING (Interface Identifier)	CDC 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	PA6	ADC1_IN11	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA7	ADC1_IN12	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
DAC1	PA4	DAC1_OUT1	Analog mode	No pull-up and no pull-down	n/a	
	PA5	DAC1_OUT2	Analog mode	No pull-up and no pull-down	n/a	
SPI3	PC10	SPI3_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PC11	SPI3_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PC12	SPI3_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
SYS	PA13 (JTMS-SWDIO)	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14 (JTCK-SWCLK)	SYS_JTCK-SWCLK	n/a	n/a	n/a	
USB	PA11	USB_DM	n/a	n/a	n/a	
	PA12	USB_DP	n/a	n/a	n/a	
GPIO	PC14-OSC32_IN (PC14)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_8_P
	PC15-OSC32_OUT (PC15)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_8_N
	PH1-OSC_OUT (PH1)	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_1
	PC0	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_2
	PC1	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_3
	PC2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_4
	PC3	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_5
	PA0	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_6
	PA1	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_7
	PA2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	DI_8
	PC4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_6_N
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_4_P
	PB1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_6_P

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PB2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_2_N
	PB10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_4_N
	PB11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_2_P
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_7_N
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_7_P
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_5_N
	PC6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_5_P
	PC7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_3_N
	PC8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_3_P
	PC9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_1_N
	PA8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DI_OUT_1_P
	PA9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_R
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_G
	PB3 (JTDO-TRACESWO)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RFM_NSS
	PB4 (NJTRST)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RFM_RST
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RFM_DI_3
	PB6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RFM_DI_0
	PB7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RFM_DI_2

8.2. DMA configuration

DMA request	Stream	Direction	Priority
DAC_CH1	DMA1_Channel3	Memory To Peripheral	Low
DAC_CH2	DMA1_Channel4	Memory To Peripheral	Low
ADC1	DMA1_Channel1	Peripheral To Memory	Low

DAC_CH1: DMA1_Channel3 DMA request Settings:

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

DAC_CH2: DMA1_Channel4 DMA request Settings:

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

ADC1: DMA1_Channel1 DMA request Settings:

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

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
Prefetch 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
DMA1 channel1 global interrupt	true	0	0
DMA1 channel3 global interrupt	true	0	0
DMA1 channel4 global interrupt	true	0	0
TIM7 global interrupt	true	0	0
USB event interrupt through EXTI line 17	true	0	0
PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1 global interrupt	unused		
SPI3 global interrupt	unused		
TIM6 global interrupt, DAC channel1 and channel2 underrun error interrupts	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
Prefetch 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
DMA1 channel1 global interrupt	false	true	true

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
DMA1 channel3 global interrupt	false	true	true
DMA1 channel4 global interrupt	false	true	true
TIM7 global interrupt	false	true	true
USB event interrupt through EXTI line 17	false	true	true

* User modified value

9. System Views

9.1. Category view

9.1.1. Current

10. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32l4_bsd1.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32l4_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32l4_svd.zip
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32l4_bsd1.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32l4_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32l4_svd.zip
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/stm32l4_marketing-pres.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_sc2157.pdf
Brochures	https://www.st.com/resource/en/brochure/brstm32ulp.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32l4.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
Magazine Articles	https://www.st.com/resource/en/magazine/design-elektronik_august2017.pdf
Magazine Articles	https://www.st.com/resource/en/magazine/design-elektronik_october2016.pdf

Product Certifications	https://www.st.com/resource/en/certification_document/sesip-2000002-01-cert.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/sesip-2000002-01-st2.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/psa-certificate_stm32l4.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/an2548-using-the-stm32f0f1f3gxlx-series-dma-controller-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
Application Notes	https://www.st.com/resource/en/application_note/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-mcus-and-mpus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3155-uart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3236-increase-the-number-of-touchkeys-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf

- Application Notes https://www.st.com/resource/en/application_note/an3960-esd-considerations-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4013-stm32-crossseries-timer-overview-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4221-i2c-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4230-stm32-microcontroller-random-number-generation-validation-using-the-nist-statistical-test-suite-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4277-using-stm32-device-pwm-shutdown-features-for-motor-control-and-digital-power-conversion-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4299-improve-conducted-noise-robustness-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4310-sampling-capacitor-selection-guide-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4312-design-with-surface-sensors-for-touch-sensing-applications-on-mcus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4316-tuning-a-touch-sensing-application-on-mcus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4555-getting-started-with-stm32l4-series-and-stm32l4-series-hardware-development-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4566-extending-the-dac-performance-of-stm32-microcontrollers-stmicroelectronics.pdf

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