



1. Description

1.1. Project

Project Name	DriveMoteurC10_2022
Board Name	custom
Generated with:	STM32CubeMX 6.11.1
Date	08/10/2025

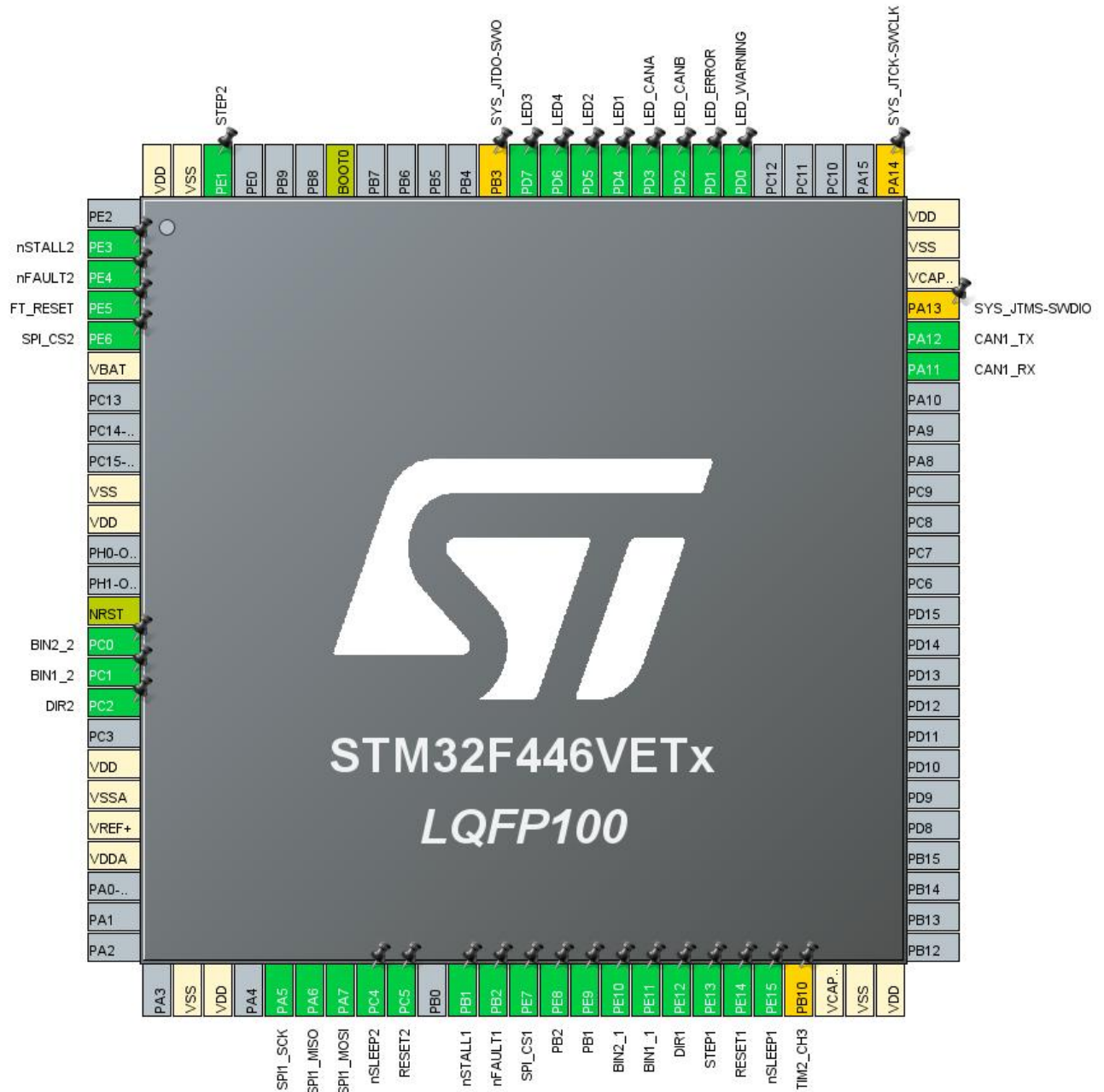
1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F446
MCU name	STM32F446VETx
MCU Package	LQFP100
MCU Pin number	100

1.3. Core(s) information

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



3. Pins Configuration

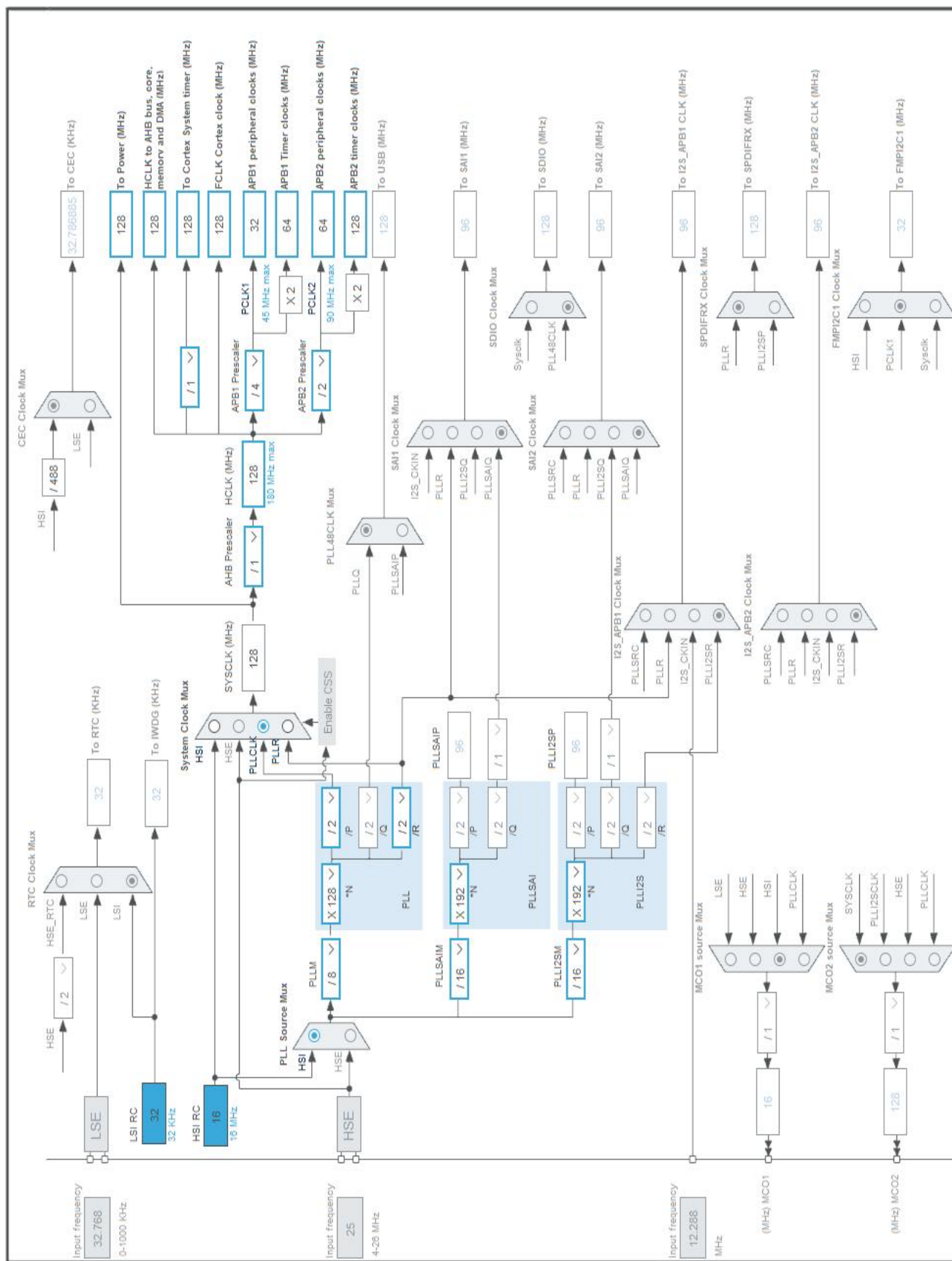
Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
2	PE3 *	I/O	GPIO_Input	nSTALL2
3	PE4 *	I/O	GPIO_Input	nFAULT2
4	PE5 *	I/O	GPIO_Output	FT_RESET
5	PE6 *	I/O	GPIO_Output	SPI_CS2
6	VBAT	Power		
10	VSS	Power		
11	VDD	Power		
14	NRST	Reset		
15	PC0 *	I/O	GPIO_Output	BIN2_2
16	PC1 *	I/O	GPIO_Output	BIN1_2
17	PC2 *	I/O	GPIO_Output	DIR2
19	VDD	Power		
20	VSSA	Power		
21	VREF+	Power		
22	VDDA	Power		
27	VSS	Power		
28	VDD	Power		
30	PA5	I/O	SPI1_SCK	
31	PA6	I/O	SPI1_MISO	
32	PA7	I/O	SPI1_MOSI	
33	PC4 *	I/O	GPIO_Output	nSLEEP2
34	PC5 *	I/O	GPIO_Output	RESET2
36	PB1 *	I/O	GPIO_Input	nSTALL1
37	PB2 *	I/O	GPIO_Input	nFAULT1
38	PE7 *	I/O	GPIO_Output	SPI_CS1
39	PE8	I/O	GPIO_EXTI8	PB2
40	PE9	I/O	GPIO_EXTI9	PB1
41	PE10 *	I/O	GPIO_Output	BIN2_1
42	PE11 *	I/O	GPIO_Output	BIN1_1
43	PE12 *	I/O	GPIO_Output	DIR1
44	PE13 *	I/O	GPIO_Output	STEP1
45	PE14 *	I/O	GPIO_Output	RESET1
46	PE15 *	I/O	GPIO_Output	nSLEEP1
47	PB10 **	I/O	TIM2_CH3	
48	VCAP_1	Power		
49	VSS	Power		

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
50	VDD	Power		
70	PA11	I/O	CAN1_RX	
71	PA12	I/O	CAN1_TX	
72	PA13 **	I/O	SYS_JTMS-SWDIO	
73	VCAP_2	Power		
74	VSS	Power		
75	VDD	Power		
76	PA14 **	I/O	SYS_JTCK-SWCLK	
81	PD0 *	I/O	GPIO_Output	LED_WARNING
82	PD1 *	I/O	GPIO_Output	LED_ERROR
83	PD2 *	I/O	GPIO_Output	LED_CANB
84	PD3 *	I/O	GPIO_Output	LED_CANA
85	PD4 *	I/O	GPIO_Output	LED1
86	PD5 *	I/O	GPIO_Output	LED2
87	PD6 *	I/O	GPIO_Output	LED4
88	PD7 *	I/O	GPIO_Output	LED3
89	PB3 **	I/O	SYS_JTDO-SWO	
94	BOOT0	Boot		
98	PE1 *	I/O	GPIO_Output	STEP2
99	VSS	Power		
100	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	DriveMoteurC10_2022
Project Folder	C:\@chinook\github\DriveMotorC10_2022
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.28.2
Application Structure	Advanced
Generate Under Root	Yes
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	Copy only the necessary library files
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_CAN1_Init	CAN1
4	MX_SPI1_Init	SPI1
5	MX_TIM1_Init	TIM1
6	MX_TIM2_Init	TIM2
7	MX_TIM4_Init	TIM4
8	MX_TIM5_Init	TIM5
9	MX_TIM6_Init	TIM6
10	MX_TIM7_Init	TIM7
11	MX_TIM10_Init	TIM10

1. Power Consumption Calculator report

1.1. Microcontroller Selection

Series	STM32F4
Line	STM32F446
MCU	STM32F446VETx
Datasheet	DS10693_Rev6

1.2. Parameter Selection

Temperature	25
Vdd	3.3

1.3. 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

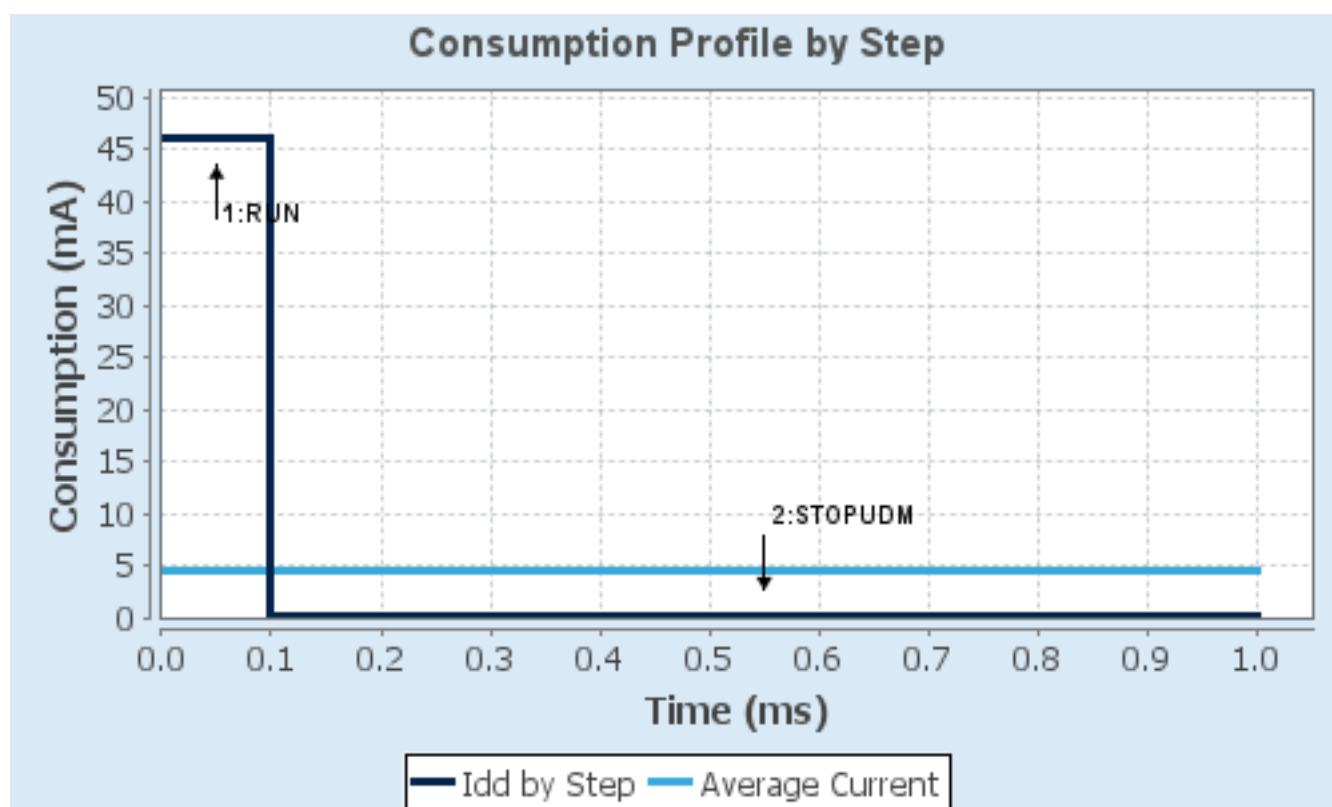
1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP UDM (Under Drive)
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	Scale1-High	No Scale
Fetch Type	RAM/FLASH/REGON/ART/P REFETCH	n/a
CPU Frequency	180 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator LP Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	46 mA	55 μ A
Duration	0.1 ms	0.9 ms
DMIPS	225.0	0.0
Ta Max	98.62	104.99
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	1 ms	Average Current	4.65 mA
Battery Life	1 month	Average DMIPS	225.0 DMIPS

1.6. Chart



2. Peripherals and Middlewares Configuration

2.1. CAN1

mode: Activated

2.1.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	8 *
Time Quantum	250.0 *
Time Quanta in Bit Segment 1	11 Times *
Time Quanta in Bit Segment 2	4 Times *
Time for one Bit	4000 *
Baud Rate	250000 *
ReSynchronization Jump Width	3 Times *

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
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2.2. RCC

2.2.1. Parameter Settings:

System Parameters:

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

RCC Parameters:

HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 2
Power Over Drive	Disabled

2.3. SPI1

Mode: Full-Duplex Master

2.3.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	128 *
Baud Rate	500.0 KBits/s *
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

2.4. SYS

Timebase Source: SysTick

2.5. TIM1

Clock Source : Internal Clock

2.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	48 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	500 *
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Enable *

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

2.6. TIM2

Clock Source : Internal Clock

2.6.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	48 *
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	500 *
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)

2.7. TIM4

Clock Source : Internal Clock

2.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	639 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	4999 *
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)

2.8. TIM5

mode: Clock Source

2.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	63 *
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	0xFFFF *
Internal Clock Division (CKD)	No Division
auto-reload preload	Enable *

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

2.9. TIM6

mode: Activated

2.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	63 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	0 *
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)
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2.10. TIM7

mode: Activated

2.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	480 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	10000 *
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Trigger Event Selection	Reset (UG bit from TIMx_EGR)
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2.11. TIM10

mode: Activated

2.11.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	63 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	2 *
Internal Clock Division (CKD)	No Division
auto-reload preload	Enable *

* User modified value

3. System Configuration

3.1. 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 *	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PA6	SPI1_MISO	Alternate Function Push Pull	Pull-up *	Very High *	
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
Single Mapped Signals	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	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	PE3	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	nSTALL2
	PE4	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	nFAULT2
	PE5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	FT_RESET
	PE6	GPIO_Output	Output Push Pull	Pull-down *	Very High *	SPI_CS2
	PC0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BIN2_2
	PC1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BIN1_2
	PC2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DIR2
	PC4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	nSLEEP2
	PC5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RESET2
	PB1	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	nSTALL1
	PB2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	nFAULT1
	PE7	GPIO_Output	Output Push Pull	Pull-down *	Very High *	SPI_CS1
	PE8	GPIO_EXTI8	External Interrupt Mode with Falling edge trigger detection	No pull-up and no pull-down	n/a	PB2
	PE9	GPIO_EXTI9	External Interrupt	No pull-up and no pull-down	n/a	PB1

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
			Mode with Falling edge trigger detection			
	PE10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BIN2_1
	PE11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BIN1_1
	PE12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DIR1
	PE13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	STEP1
	PE14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RESET1
	PE15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	nSLEEP1
	PD0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_WARNING
	PD1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_ERROR
	PD2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_CANB
	PD3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED_CANA
	PD4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED1
	PD5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED2
	PD6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED4
	PD7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED3
	PE1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	STEP2

3.2. DMA configuration

nothing configured in DMA service

3.3. NVIC configuration

3.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	1	0
Pre-fetch fault, memory access fault	true	1	0
Undefined instruction or illegal state	true	1	0
System service call via SWI instruction	true	1	0
Debug monitor	true	1	0
Pendable request for system service	true	2	0
System tick timer	true	15	0
CAN1 RX0 interrupt	true	1	0
CAN1 RX1 interrupt	true	1	0
EXTI line[9:5] interrupts	true	1	0
TIM1 update interrupt and TIM10 global interrupt	true	0	0
TIM4 global interrupt	true	1	0
TIM6 global interrupt and DAC1, DAC2 underrun error interrupts	true	0	0
TIM7 global interrupt	true	1	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
CAN1 TX interrupt	unused		
CAN1 SCE interrupt	unused		
TIM1 break interrupt and TIM9 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
SPI1 global interrupt	unused		
TIM5 global interrupt	unused		
FPU global interrupt	unused		

3.3.2. 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

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
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
CAN1 RX0 interrupt	false	true	true
CAN1 RX1 interrupt	false	true	true
EXTI line[9:5] interrupts	false	true	true
TIM1 update interrupt and TIM10 global interrupt	false	true	true
TIM4 global interrupt	false	true	true
TIM6 global interrupt and DAC1, DAC2 underrun error interrupts	false	true	true
TIM7 global interrupt	false	true	true

* User modified value

4. System Views

4.1. Category view

4.1.1. Current

Middleware					
System Core	Analog	Timers	Connectivity	Multimedia	Computing
DMA		TIM1 ✓	CAN1 ✓		
GPIO ⚠		TIM2 ✓	SPI1 ✓		
NVIC ✓		TIM4 ✓			
RCC ✓		TIM5 ✓			
SYS ✓		TIM6 ✓			
		TIM7 ✓			
		TIM10 ✓			

5. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f446_bsd.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f446_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f4-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/stm32-stm8_software_development_tools.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf
Brochures	https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.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
Security Bulletin	https://www.st.com/resource/en/technical_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-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/an2945-stm8s-and-stm32-mcus-a-consistent-832bit-product-line-for-painless-migration-

stmicroelectronics.pdf

- Application Notes https://www.st.com/resource/en/application_note/an3070-managing-the-driver-enable-signal-for-rs485-and-iolink-communications-with-the-stm32s-usart-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/an3155-usart-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/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4031-using-the-stm32f2-stm32f4-and-stm32f7-series-dma-controller-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/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4488-getting-started-with-stm32f4xxx-mcu-hardware-development-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4640-peripherals-interconnections-on-stm32f4057xx-stm32f4157xx-stm32f42xxx-stm32f43xxx-stm32f446xx-and-stm32f469479xx-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4655-virtually-increasing-the-number-of-serial-communication-peripherals-in-stm32-applications-stmicroelectronics.pdf

- Application Notes https://www.st.com/resource/en/application_note/an4658-migration-of-applications-from-stm32f429439-lines-to-stm32f446-line-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4739-stm32cube-firmware-examples-for-stm32f4-series-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4750-handling-of-soft-errors-in-stm32-applications-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4776-generalpurpose-timer-cookbook-for-stm32-microcontrollers-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4803-highspeed-si-simulations-using-ibis-and-boardlevel-simulations-using-hyperlynx-si-on-stm32-mcus-and-mpus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4850-stm32-mcus-spreadspectrum-clock-generation-principles-properties-and-implementation-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4989-stm32-microcontroller-debug-toolbox-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4995-using-an-electromyogram-technique-to-detect-muscle-activity-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an5073-receiving-spdif-audio-stream-with-the-stm32f4f7h7-series-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4760-quadspi-interface-on-stm32-microcontrollers-and-microprocessors-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4899-stm32-microcontroller-gpio-hardware-settings-and-lowpower-consumption-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an5612-esd-protection-of-stm32-mcus-and-mpus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4838-introduction-to-

memory-protection-unit-management-on-stm32-mcus-
stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4879-introduction-to-usb-hardware-and-pcb-guidelines-using-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5225-introduction-to-usb-typec-power-delivery-for-stm32-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5537-how-to-use-adc-oversampling-techniques-to-improve-signal-to-noise-ratio-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5036-guidelines-for-thermal-management-on-stm32-applications-stmicroelectronics.pdf

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