
STM32
CubeMX

1. Description

1.1. Project

Project Name	Cetautomatix
Board Name	custom
Generated with:	STM32CubeMX 6.16.1
Date	01/17/2026

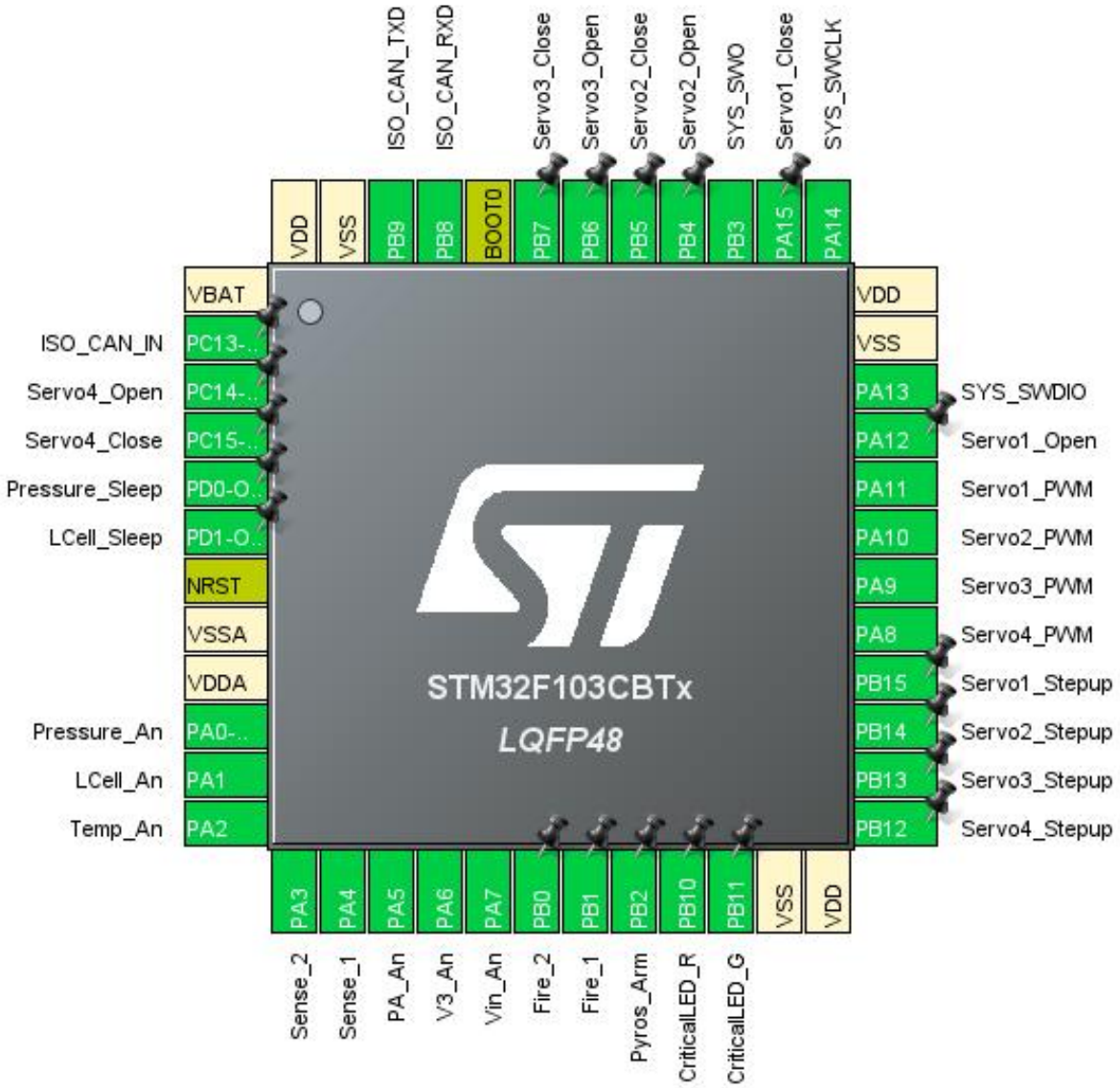
1.2. MCU

MCU Series	STM32F1
MCU Line	STM32F103
MCU name	STM32F103CBTx
MCU Package	LQFP48
MCU Pin number	48

1.3. Core(s) information

Core(s)	Arm Cortex-M3

2. Pinout Configuration



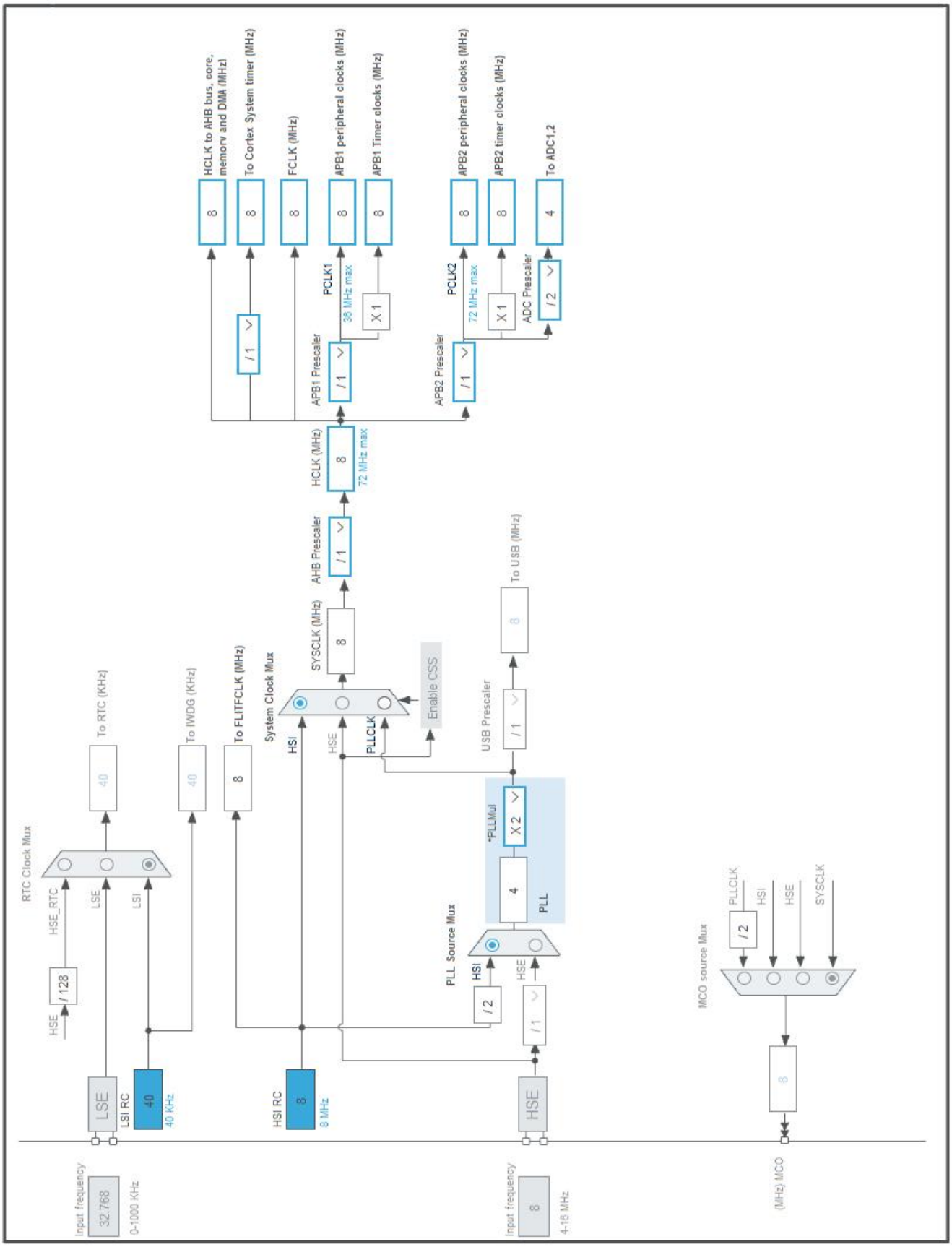
3. Pins Configuration

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-TAMPER-RTC *	I/O	GPIO_Output	ISO_CAN_IN
3	PC14-OSC32_IN *	I/O	GPIO_Input	Servo4_Open
4	PC15-OSC32_OUT *	I/O	GPIO_Input	Servo4_Close
5	PD0-OSC_IN *	I/O	GPIO_Output	Pressure_Sleep
6	PD1-OSC_OUT *	I/O	GPIO_Output	LCell_Sleep
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0-WKUP	I/O	ADC2_IN0	Pressure_An
11	PA1	I/O	ADC2_IN1	LCell_An
12	PA2	I/O	ADC2_IN2	Temp_An
13	PA3	I/O	ADC1_IN3	Sense_2
14	PA4	I/O	ADC1_IN4	Sense_1
15	PA5	I/O	ADC1_IN5	PA_An
16	PA6	I/O	ADC1_IN6	V3_An
17	PA7	I/O	ADC1_IN7	Vin_An
18	PB0 *	I/O	GPIO_Output	Fire_2
19	PB1 *	I/O	GPIO_Output	Fire_1
20	PB2 *	I/O	GPIO_Output	Pyros_Arm
21	PB10 *	I/O	GPIO_Output	CriticalLED_R
22	PB11 *	I/O	GPIO_Output	CriticalLED_G
23	VSS	Power		
24	VDD	Power		
25	PB12 *	I/O	GPIO_Output	Servo4_Stepup
26	PB13 *	I/O	GPIO_Output	Servo3_Stepup
27	PB14 *	I/O	GPIO_Output	Servo2_Stepup
28	PB15 *	I/O	GPIO_Output	Servo1_Stepup
29	PA8	I/O	TIM1_CH1	Servo4_PWM
30	PA9	I/O	TIM1_CH2	Servo3_PWM
31	PA10	I/O	TIM1_CH3	Servo2_PWM
32	PA11	I/O	TIM1_CH4	Servo1_PWM
33	PA12 *	I/O	GPIO_Input	Servo1_Open
34	PA13	I/O	SYS_JTMS-SWDIO	SYS_SWDIO
35	VSS	Power		
36	VDD	Power		

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
37	PA14	I/O	SYS_JTCK-SWCLK	SYS_SWCLK
38	PA15 *	I/O	GPIO_Input	Servo1_Close
39	PB3	I/O	SYS_JTDO-TRACESWO	SYS_SWO
40	PB4 *	I/O	GPIO_Input	Servo2_Open
41	PB5 *	I/O	GPIO_Input	Servo2_Close
42	PB6 *	I/O	GPIO_Input	Servo3_Open
43	PB7 *	I/O	GPIO_Input	Servo3_Close
44	BOOT0	Boot		
45	PB8	I/O	CAN_RX	ISO_CAN_RXD
46	PB9	I/O	CAN_TX	ISO_CAN_TXD
47	VSS	Power		
48	VDD	Power		

* The pin is affected with an I/O function

4. Clock Tree Configuration



1. Power Consumption Calculator report

1.1. Microcontroller Selection

Series	STM32F1
Line	STM32F103
MCU	STM32F103CBTx
Datasheet	DS5319_Rev17

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

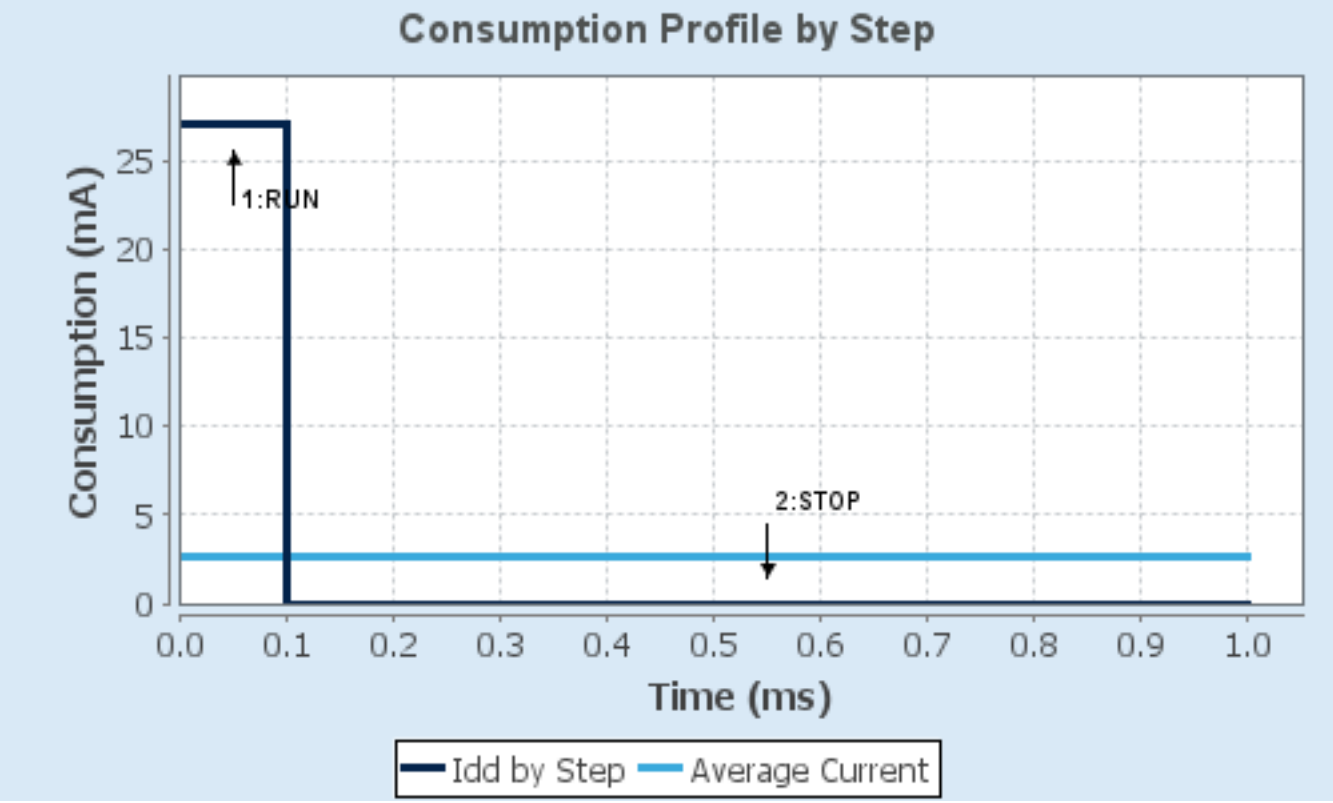
1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	No Scale	No Scale
Fetch Type	FLASH	n/a
CPU Frequency	72 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LP
Clock Source Frequency	8 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	27 mA	14 µA
Duration	0.1 ms	0.9 ms
DMIPS	90.0	0.0
Ta Max	100.1	105
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	1 ms	Average Current	2.71 mA
Battery Life	1 month, 21 days, 17 hours	Average DMIPS	61.0 DMIPS

1.6. Chart


Consumption Profile by Step
Consumption (mA)
25
20
15
10
5
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

2. Software Project

2.1. Project Settings

Name	Value
Project Name	Cetautomatix
Project Folder	C:\programation\ulaval\GAUL\Cetautomatix\Software\STM32CubeIDE\Cetautom
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F1 V1.8.6
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	No
Minimum Heap Size	0x200
Minimum Stack Size	0x400

2.2. 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

2.3. 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_ADC2_Init	ADC2
6	MX_CAN_Init	CAN
7	MX_CRC_Init	CRC
8	MX_TIM1_Init	TIM1

3. Peripherals and Middlewares Configuration

3.1. ADC1

mode: IN3

mode: IN4

mode: IN5

mode: IN6

mode: IN7

3.1.1. Parameter Settings:

ADCs_Common_Settings:	
Mode	Independent mode
ADC_Settings:	
Data Alignment	Right alignment
Scan Conversion Mode	Enabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
ADC_Regular_ConversionMode:	
Enable Regular Conversions	Enable
Number Of Conversion	**5 ***
External Trigger Conversion Source	**Timer 3 Trigger Out event ***
Rank	1
Channel	Channel 3
Sampling Time	**71.5 Cycles ***
Rank	**2 ***
Channel	**Channel 4 ***
Sampling Time	**71.5 Cycles ***
Rank	**3 ***
Channel	**Channel 5 ***
Sampling Time	**71.5 Cycles ***
Rank	**4 ***
Channel	**Channel 6 ***
Sampling Time	**71.5 Cycles ***
Rank	**5 ***
Channel	**Channel 7 ***
Sampling Time	**71.5 Cycles ***
ADC_Injected_ConversionMode:	
Enable Injected Conversions	Disable

WatchDog:

Enable Analog WatchDog Mode	false

3.2. ADC2

mode: IN0

mode: IN1

mode: IN2

3.2.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Data Alignment	Right alignment
Scan Conversion Mode	Enabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Number Of Conversion	**3 ***
External Trigger Conversion Source	**Timer 3 Trigger Out event ***
Rank	1
Channel	Channel 0
Sampling Time	**71.5 Cycles ***
Rank	**2 ***
Channel	**Channel 1 ***
Sampling Time	**71.5 Cycles ***
Rank	**3 ***
Channel	**Channel 2 ***
Sampling Time	**71.5 Cycles ***

ADC_Injected_ConversionMode:

Enable Injected Conversions	Disable

WatchDog:

Enable Analog WatchDog Mode	false

3.3. CAN

mode: Activated

3.3.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	16
Time Quantum	**2000.0 ***
Time Quanta in Bit Segment 1	1 Time
Time Quanta in Bit Segment 2	1 Time
Time for one Bit	**6000 ***
Baud Rate	**166666 ***
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:

Test Mode	Normal

3.4. CRC

mode: Activated

3.5. RCC

3.5.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Prefetch Buffer	Enabled
Flash Latency(WS)	0 WS (1 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

3.6. SYS

Debug: Trace Asynchronous Sw

Timebase Source: SysTick

3.7. TIM1

Clock Source : Internal Clock

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

Channel3: PWM Generation CH3

Channel4: PWM Generation CH4

3.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	65535
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 1:

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 2:

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 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

*** User modified value**

4. System Configuration

4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PA3	ADC1_IN3	Analog mode	n/a	n/a	Sense_2
	PA4	ADC1_IN4	Analog mode	n/a	n/a	Sense_1
	PA5	ADC1_IN5	Analog mode	n/a	n/a	PA_An
	PA6	ADC1_IN6	Analog mode	n/a	n/a	V3_An
	PA7	ADC1_IN7	Analog mode	n/a	n/a	Vin_An
ADC2	PA0-WKUP	ADC2_IN0	Analog mode	n/a	n/a	Pressure_An
	PA1	ADC2_IN1	Analog mode	n/a	n/a	LCell_An
	PA2	ADC2_IN2	Analog mode	n/a	n/a	Temp_An
CAN	PB8	CAN_RX	Input mode	No pull-up and no pull-down	n/a	ISO_CAN_RXD
	PB9	CAN_TX	Alternate Function Push Pull	n/a	**High ***	ISO_CAN_TXD
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	SYS_SWDIO
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	SYS_SWCLK
	PB3	SYS_JTDO-TRACESWO	n/a	n/a	n/a	SYS_SWO
TIM1	PA8	TIM1_CH1	Alternate Function Push Pull	n/a	Low	Servo4_PWM
	PA9	TIM1_CH2	Alternate Function Push Pull	n/a	Low	Servo3_PWM
	PA10	TIM1_CH3	Alternate Function Push Pull	n/a	Low	Servo2_PWM
	PA11	TIM1_CH4	Alternate Function Push Pull	n/a	Low	Servo1_PWM
GPIO	PC13-TAMPER-RTC	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ISO_CAN_IN
	PC14-OSC32_IN	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo4_Open
	PC15-OSC32_OUT	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo4_Close
	PD0-OSC_IN	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Pressure_Sleep
	PD1-OSC_OUT	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LCell_Sleep
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Fire_2
	PB1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Fire_1
	PB2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Pyros_Arm
	PB10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CriticalLED_R
	PB11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CriticalLED_G
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Servo4_Stepup

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Servo3_Stepup
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Servo2_Stepup
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Servo1_Stepup
	PA12	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo1_Open
	PA15	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo1_Close
	PB4	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo2_Open
	PB5	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo2_Close
	PB6	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo3_Open
	PB7	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Servo3_Close

4.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA1_Channel1	Peripheral To Memory	**Medium ***

ADC1: DMA1_Channel1 DMA request Settings:

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

4.3. NVIC configuration

4.3.1. 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
ADC1 and ADC2 global interrupts	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
USB high priority or CAN TX interrupts	unused		
USB low priority or CAN RX0 interrupts	unused		
CAN RX1 interrupt	unused		
CAN SCE interrupt	unused		
TIM1 break interrupt	unused		
TIM1 update interrupt	unused		
TIM1 trigger and commutation interrupts	unused		
TIM1 capture compare interrupt	unused		

4.3.2. NVIC Code generation

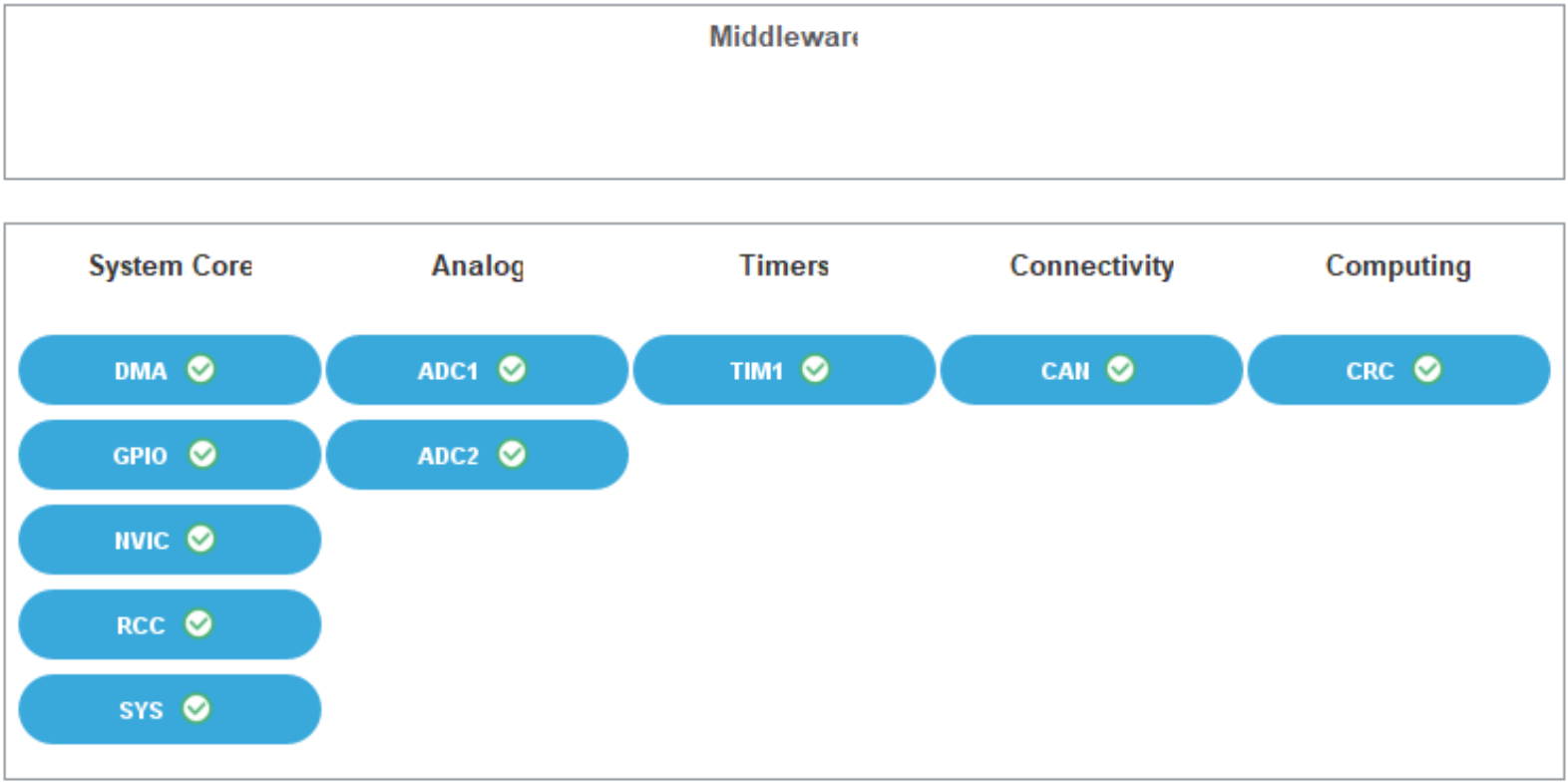
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Prefetch fault, memory access fault	false	true	false
Undefined instruction or illegal 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
ADC1 and ADC2 global interrupts	false	true	true

*** User modified value**

5. System Views

5.1. Category view

5.1.1. Current



6. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f1_bsdl.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f1-ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f1_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
Brochures	https://www.st.com/resource/en/brochure/expansion-boards-for-intelligent-power-switches.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.pdf
Flyers	https://www.st.com/resource/en/flyer/fldpstpfc11120.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/1239988349.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/an2586-getting-started-with-stm32f10xxx-hardware-development-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/an3095-stevalisv002v1-stevalisv002v2-3-kw-gridconnected-pv-system-based-on-the-stm32f103xx-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3108-stlm75-firmware-library-for-the-stm32f10x-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/an3128-stm32-embedded-graphic-objectstouchscreen-library-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/an3422-migration-of-microcontroller-applications-from-stm32f1-to-stm32l1-series-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3427-migrating-a-microcontroller-application-from-stm32f1-to-stm32f2-series-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3429-stm32-proprietary-code-protection-overview-stmicroelectronics.pdf

Application Notes	https://www.st.com/resource/en/application_note/an3970-plm-smartplug-v2-getting-started-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4068-st7580-power-line-communication-systemonchip-design-guide-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4070-250-w-grid-connected-microinverter-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4076-two-or-three-shunt-resistor-based-current-sensing-circuit-design-in-3phase-inverters-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4088-migrating-between-stm32f1-and-stm32f0-series-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4228-migrating-from-stm32f1-series-to-stm32f3-series-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4649-migrating-from-stm32f1-series-to-stm32l4-series--stm32l4-series-microntrollers-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/an4724-stm32cube-firmware-examples-for-stm32f1-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/an4904-migration-of-microcontroller-applications-from-stm32f1-series-to-stm32f4-access-lines-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/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-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
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