



1. Description

1.1. Project

Project Name	Application_Firmware
Board Name	custom
Generated with:	STM32CubeMX 6.6.1
Date	02/11/2024

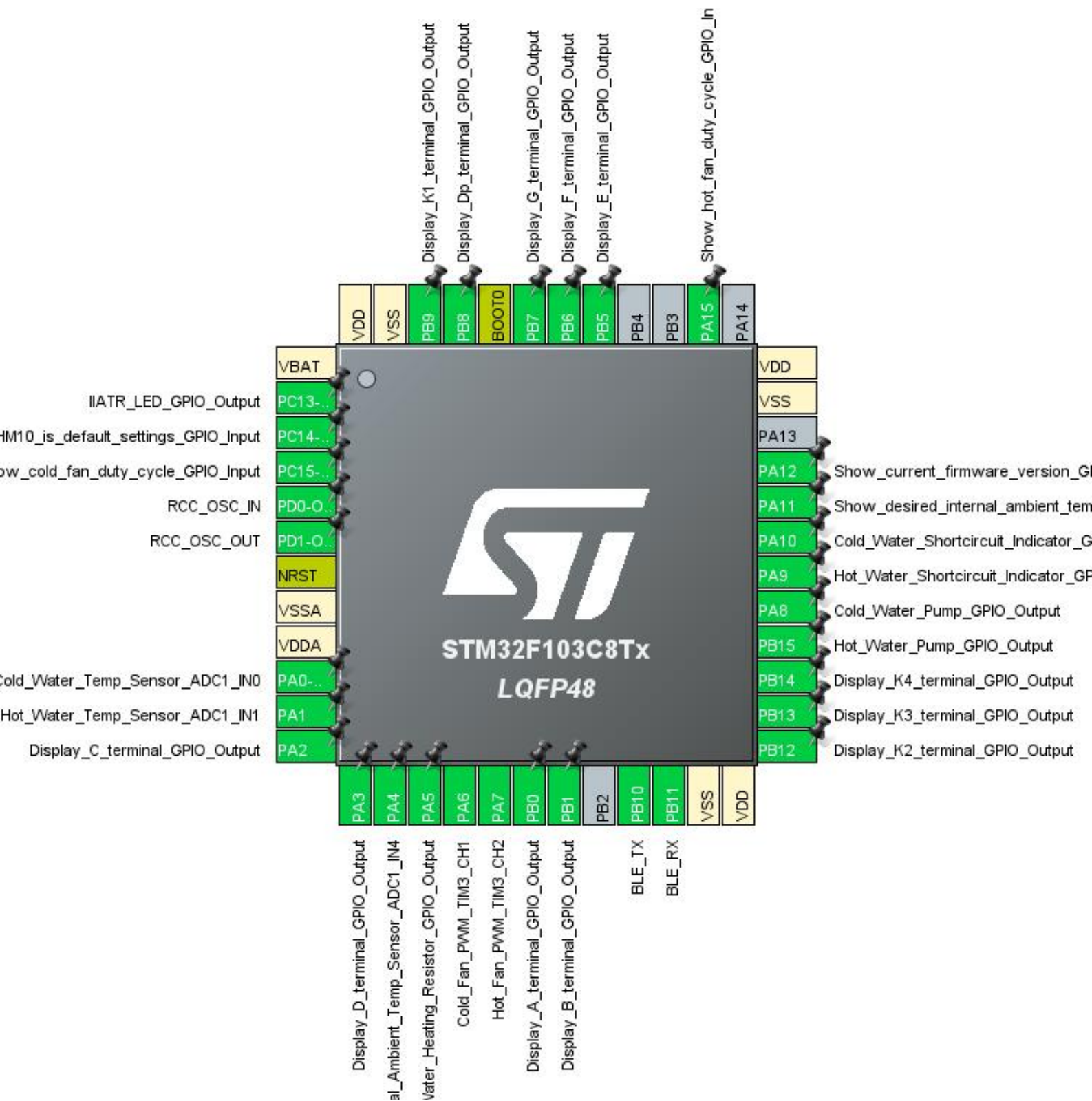
1.2. MCU

MCU Series	STM32F1
MCU Line	STM32F103
MCU name	STM32F103C8Tx
MCU Package	LQFP48
MCU Pin number	48

1.3. Core(s) information

Core(s)	Arm Cortex-M3
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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	IIATR_LED_GPIO_Output
3	PC14-OSC32_IN *	I/O	GPIO_Input	HM10_is_default_settings_ GPIO_Input
4	PC15-OSC32_OUT *	I/O	GPIO_Input	Show_cold_fan_duty_cycle_ GPIO_Input
5	PD0-OSC_IN	I/O	RCC_OSC_IN	
6	PD1-OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0-WKUP	I/O	ADC1_IN0	Cold_Water_Temp_Sensor_ ADC1_IN0
11	PA1	I/O	ADC1_IN1	Hot_Water_Temp_Sensor_ ADC1_IN1
12	PA2 *	I/O	GPIO_Output	Display_C_terminal_GPIO_ Output
13	PA3 *	I/O	GPIO_Output	Display_D_terminal_GPIO_ Output
14	PA4	I/O	ADC1_IN4	Internal_Ambient_Temp_Se nsor_ADC1_IN4
15	PA5 *	I/O	GPIO_Output	Water_Heating_Resistor_G PIO_Output
16	PA6	I/O	TIM3_CH1	Cold_Fan_PWM_TIM3_CH1
17	PA7	I/O	TIM3_CH2	Hot_Fan_PWM_TIM3_CH2
18	PB0 *	I/O	GPIO_Output	Display_A_terminal_GPIO_ Output
19	PB1 *	I/O	GPIO_Output	Display_B_terminal_GPIO_ Output
21	PB10	I/O	USART3_TX	BLE_TX
22	PB11	I/O	USART3_RX	BLE_RX
23	VSS	Power		
24	VDD	Power		
25	PB12 *	I/O	GPIO_Output	Display_K2_terminal_GPIO_ Output
26	PB13 *	I/O	GPIO_Output	Display_K3_terminal_GPIO_ Output

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
27	PB14 *	I/O	GPIO_Output	Display_K4_terminal_GPIO_ Output
28	PB15 *	I/O	GPIO_Output	Hot_Water_Pump_GPIO_O utput
29	PA8 *	I/O	GPIO_Output	Cold_Water_Pump_GPIO_ Output
30	PA9 *	I/O	GPIO_Input	Hot_Water_Shortcircuit_Indi cator_GPIO_Input
31	PA10 *	I/O	GPIO_Input	Cold_Water_Shortcircuit_Ind icator_GPIO_Input
32	PA11 *	I/O	GPIO_Input	Show_desired_internal_amb ient_temperature_GPIO_Inp ut
33	PA12 *	I/O	GPIO_Input	Show_current_firmware_ver sion_GPIO_Input
35	VSS	Power		
36	VDD	Power		
38	PA15 *	I/O	GPIO_Input	Show_hot_fan_duty_cycle_ GPIO_Input
41	PB5 *	I/O	GPIO_Output	Display_E_terminal_GPIO_ Output
42	PB6 *	I/O	GPIO_Output	Display_F_terminal_GPIO_ Output
43	PB7 *	I/O	GPIO_Output	Display_G_terminal_GPIO_ Output
44	BOOT0	Boot		
45	PB8 *	I/O	GPIO_Output	Display_Dp_terminal_GPIO _Output
46	PB9 *	I/O	GPIO_Output	Display_K1_terminal_GPIO_ Output
47	VSS	Power		
48	VDD	Power		

* The pin is affected with an I/O function

5. Software Project

5.1. Project Settings

Name	Value
Project Name	Application_Firmware
Project Folder	C:\Users\cmira\OneDrive\Escritorio\GitHub\MTKATR001_ambient_temperature_r
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F1 V1.8.5
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_USART3_UART_Init	USART3
4	MX_TIM2_Init	TIM2
5	MX_TIM3_Init	TIM3
6	MX_ADC1_Init	ADC1

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F1
Line	STM32F103
MCU	STM32F103C8Tx
Datasheet	DS5319_Rev17

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

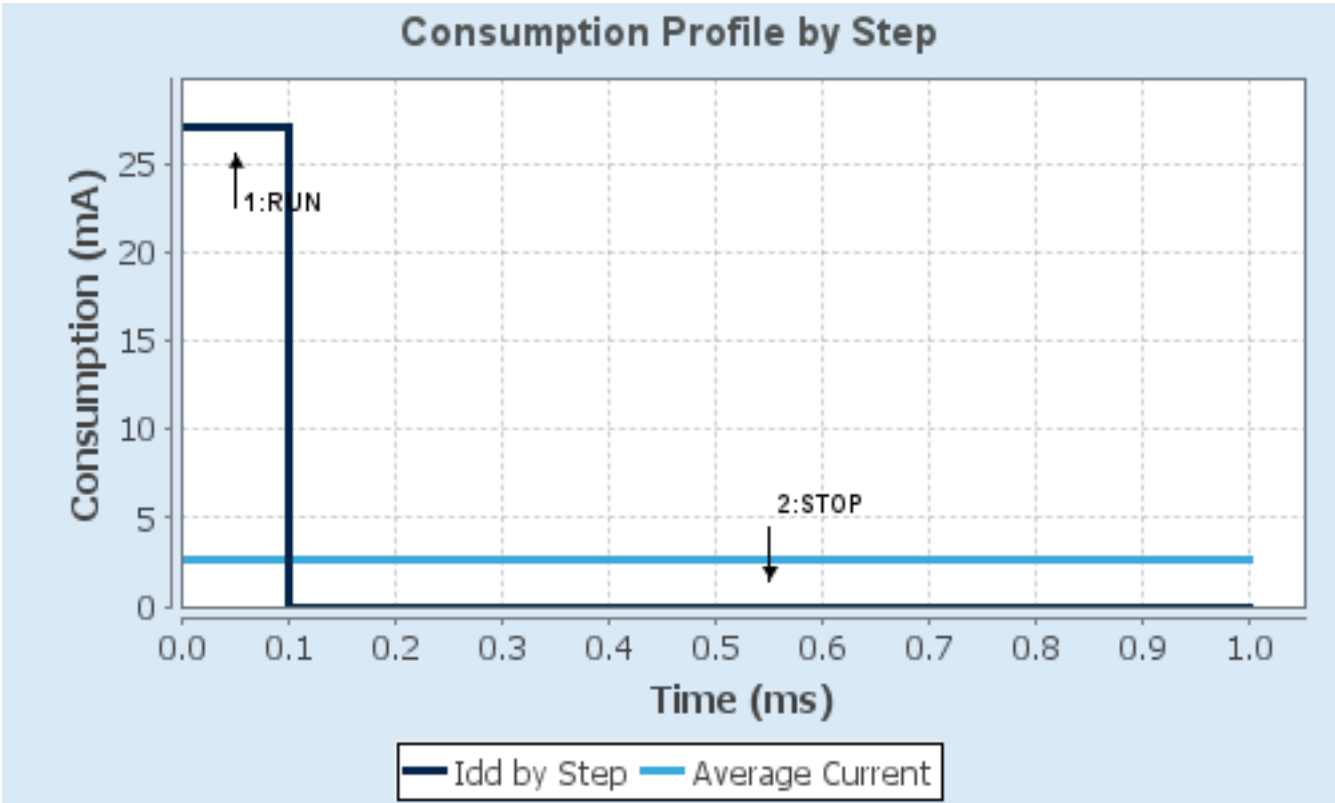
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	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 μ A
Duration	0.1 ms	0.9 ms
DMIPS	90.0	0.0
Ta Max	100.1	105
Category	In DS Table	In DS Table

6.5. Results

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

6.6. Chart



7. Peripherals and Middlewares Configuration

7.1. ADC1

mode: IN0

mode: IN1

mode: IN4

7.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode Independent mode

ADC_Settings:

Data Alignment Right alignment

Scan Conversion Mode Disabled

Continuous Conversion Mode Disabled

Discontinuous Conversion Mode Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions Enable

Number Of Conversion 1

External Trigger Conversion Source Regular Conversion launched by software

Rank 1

Channel Channel 0

Sampling Time **239.5 Cycles ***

ADC_Injected_ConversionMode:

Enable Injected Conversions Disable

WatchDog:

Enable Analog WatchDog Mode false

7.2. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

7.2.1. 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 Timeout Value (ms) 100

LSE Startup Timeout Value (ms) 5000

7.3. SYS

Debug: No Debug

Timebase Source: SysTick

7.4. TIM2

Clock Source : Internal Clock

7.4.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	416-1 *
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)

7.5. TIM3

mode: Clock Source

Channel1: PWM Generation CH1

Channel2: PWM Generation CH2

7.5.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	1818-1 *
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)

PWM Generation Channel 1:

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

PWM Generation Channel 2:

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

7.6. USART3

Mode: Asynchronous

7.6.1. Parameter Settings:

Basic Parameters:

Baud Rate	9600 *
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

*** 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	PA0-WKUP	ADC1_IN0	Analog mode	n/a	n/a	Cold_Water_Temp_Sensor_ADC1_IN0
	PA1	ADC1_IN1	Analog mode	n/a	n/a	Hot_Water_Temp_Sensor_ADC1_IN1
	PA4	ADC1_IN4	Analog mode	n/a	n/a	Internal_Ambient_Temp_Sensor_ADC1_IN4
RCC	PD0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PD1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
TIM3	PA6	TIM3_CH1	Alternate Function Push Pull	n/a	Low	Cold_Fan_PWM_TIM3_CH1
	PA7	TIM3_CH2	Alternate Function Push Pull	n/a	Low	Hot_Fan_PWM_TIM3_CH2
USART3	PB10	USART3_TX	Alternate Function Push Pull	n/a	High *	BLE_TX
	PB11	USART3_RX	Input mode	No pull-up and no pull-down	n/a	BLE_RX
GPIO	PC13-TAMPER-RTC	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	IIATR_LED_GPIO_Output
	PC14-OSC32_IN	GPIO_Input	Input mode	Pull-down *	n/a	HM10_is_default_settings_GPIO_Input
	PC15-OSC32_OUT	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	Show_cold_fan_duty_cycle_GPIO_Input
	PA2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_C_terminal_GPIO_Output
	PA3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_D_terminal_GPIO_Output
	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Water_Heating_Resistor_GPIO_Output
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_A_terminal_GPIO_Output
	PB1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_B_terminal_GPIO_Output
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_K2_terminal_GPIO_Output
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_K3_terminal_GPIO_Output
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_K4_terminal_GPIO_Output

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Hot_Water_Pump_GPIO_Output
	PA8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Cold_Water_Pump_GPIO_Output
	PA9	GPIO_Input	Input mode	Pull-down *	n/a	Hot_Water_Shortcircuit_Indicator_GPIO_Input
	PA10	GPIO_Input	Input mode	Pull-down *	n/a	Cold_Water_Shortcircuit_Indicator_GPIO_Input
	PA11	GPIO_Input	Input mode	Pull-down *	n/a	Show_desired_internal_ambient_temperature_GPIO_Input
	PA12	GPIO_Input	Input mode	Pull-down *	n/a	Show_current_firmware_version_GPIO_Input
	PA15	GPIO_Input	Input mode	Pull-down *	n/a	Show_hot_fan_duty_cycle_GPIO_Input
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_E_terminal_GPIO_Output
	PB6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_F_terminal_GPIO_Output
	PB7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_G_terminal_GPIO_Output
	PB8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_Dp_terminal_GPIO_Output
	PB9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Display_K1_terminal_GPIO_Output

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
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
TIM2 global interrupt	true	0	0
USART3 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1 and ADC2 global interrupts	unused		
TIM3 global interrupt	unused		

8.3.2. NVIC Code generation

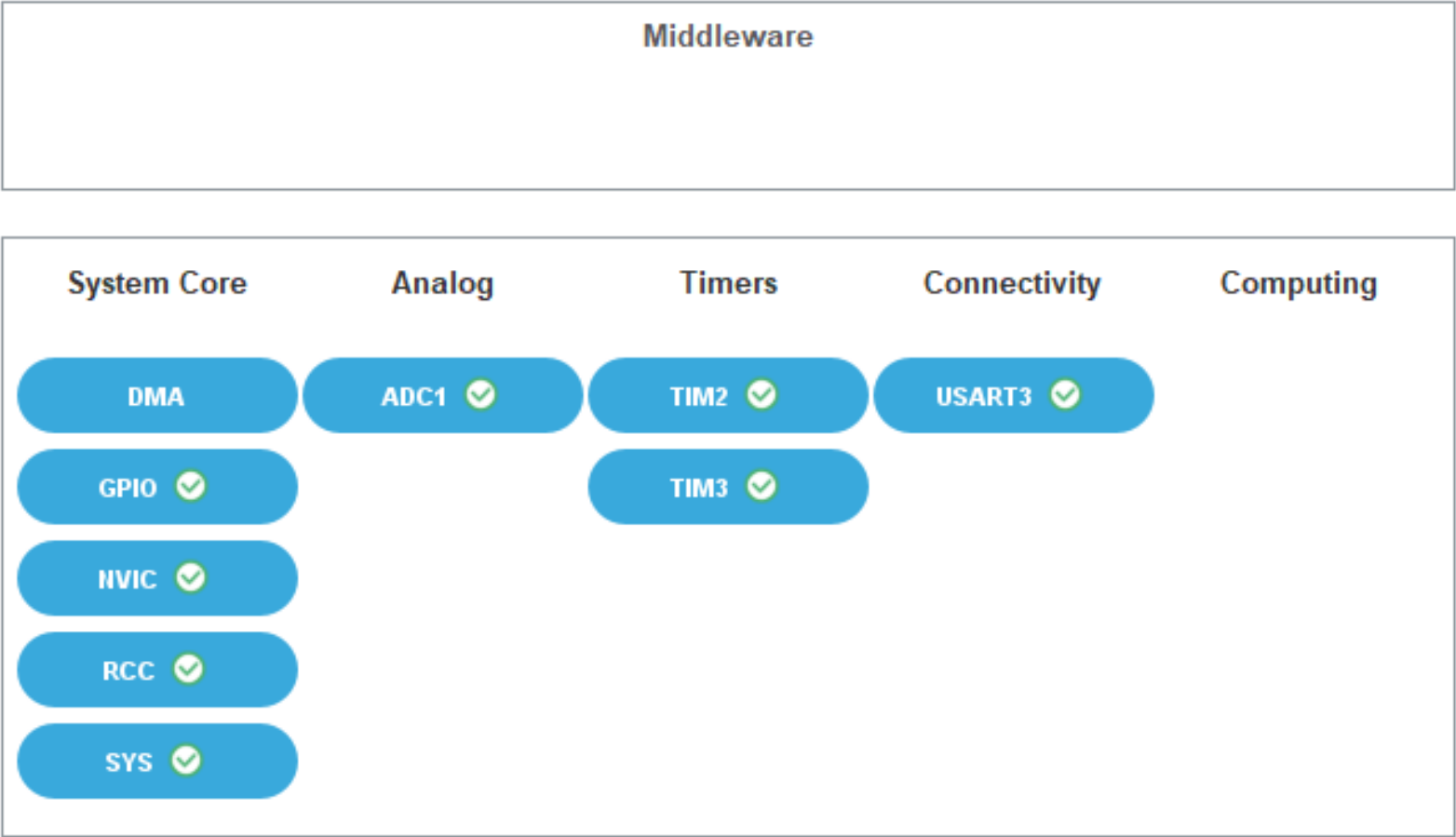
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Prefetch fault, memory access fault	false	true	false
Undefined instruction or illegal 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
TIM2 global interrupt	false	true	true
USART3 global interrupt	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/stm32f1_bsdl.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32ibis.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
Brochures	https://www.st.com/resource/en/brochure/breveco0518.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/flstmcsuite.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
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/an2586-getting-started-with-stm32f10xxx-hardware-development-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2604-stm32f101xx-

and-stm32f103xx-rtc-calibration-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/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/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3155-usart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

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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/an3961-stevalime003v1-demonstration-board-based-on-the-sthv748-ultrasound-pulser-stmicroelectronics.pdf
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- 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/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-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/an4566-extending-the-dac-performance-of-stm32-microcontrollers-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4649-migrating-from-stm32f1-series-to-stm32l4-series--stm32l4-series-microntrrollers-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
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- Application Notes https://www.st.com/resource/en/application_note/an4904-migration-of-microcontroller-applications-from-stm32f1-series-to-stm32f4-access-lines-stmicroelectronics.pdf
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- Application Notes https://www.st.com/resource/en/application_note/an4989-stm32-microcontroller-debug-toolbox-stmicroelectronics.pdf
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- Application Notes https://www.st.com/resource/en/application_note/an5036-thermal-management-guidelines-for-stm32-applications-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an5225-usb-typec-power-delivery-using-stm32-mcus-and-mpus-stmicroelectronics.pdf
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Application Notes https://www.st.com/resource/en/application_note/an1202_freertos_guide-for_related_Tools_freertos_guide-stmicroelectronics.pdf
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& Software

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& Software

Application Notes https://www.st.com/resource/en/application_note/atollic_editing_keyboard_for_related_Tools_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf
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Application Notes https://www.st.com/resource/en/application_note/iar_to_atollic_truestudio_for_related_Tools_migration_guide-truestudio-for-arm-migration-guide-iar-embedded-workbench-to-truestudio-stmicroelectronics.pdf
& Software

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