



## 1. Description

### 1.1. Project

Project Name	digital_clock
Board Name	custom
Generated with:	STM32CubeMX 6.12.0
Date	09/20/2024

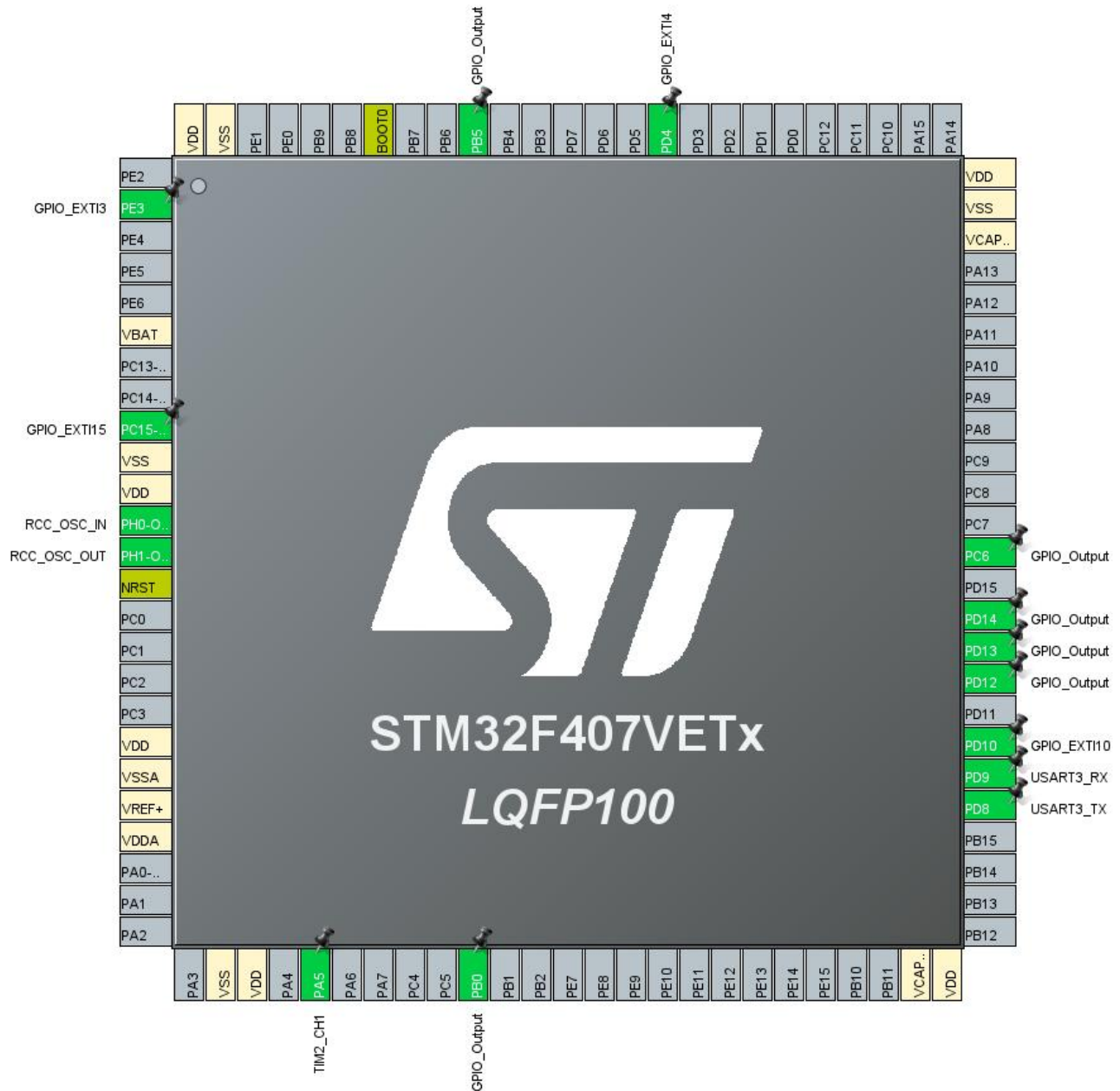
### 1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F407/417
MCU name	STM32F407VETx
MCU Package	LQFP100
MCU Pin number	100

### 1.3. Core(s) information

Core(s)	Arm Cortex-M4
---------	---------------

## 2. Pinout Configuration

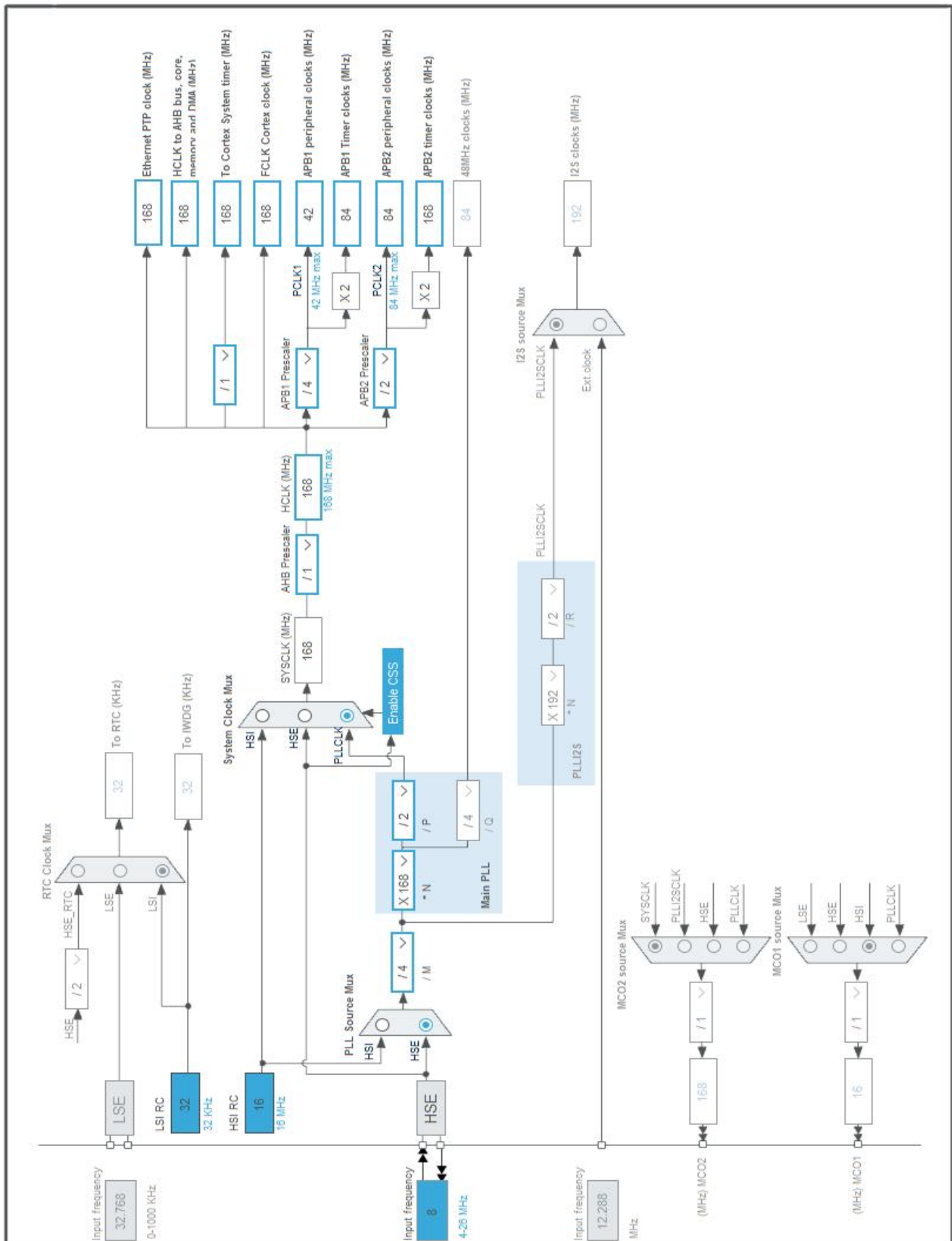


### 3. Pins Configuration

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
2	PE3	I/O	GPIO_EXTI3	
6	VBAT	Power		
9	PC15-OSC32_OUT	I/O	GPIO_EXTI15	
10	VSS	Power		
11	VDD	Power		
12	PH0-OSC_IN	I/O	RCC_OSC_IN	
13	PH1-OSC_OUT	I/O	RCC_OSC_OUT	
14	NRST	Reset		
19	VDD	Power		
20	VSSA	Power		
21	VREF+	Power		
22	VDDA	Power		
27	VSS	Power		
28	VDD	Power		
30	PA5	I/O	TIM2_CH1	
35	PB0 *	I/O	GPIO_Output	
49	VCAP_1	Power		
50	VDD	Power		
55	PD8	I/O	USART3_TX	
56	PD9	I/O	USART3_RX	
57	PD10	I/O	GPIO_EXTI10	
59	PD12 *	I/O	GPIO_Output	
60	PD13 *	I/O	GPIO_Output	
61	PD14 *	I/O	GPIO_Output	
63	PC6 *	I/O	GPIO_Output	
73	VCAP_2	Power		
74	VSS	Power		
75	VDD	Power		
85	PD4	I/O	GPIO_EXTI4	
91	PB5 *	I/O	GPIO_Output	
94	BOOT0	Boot		
99	VSS	Power		
100	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	STM32F4
Line	STM32F407/417
MCU	STM32F407VETx
Datasheet	DS8626_Rev8

### 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

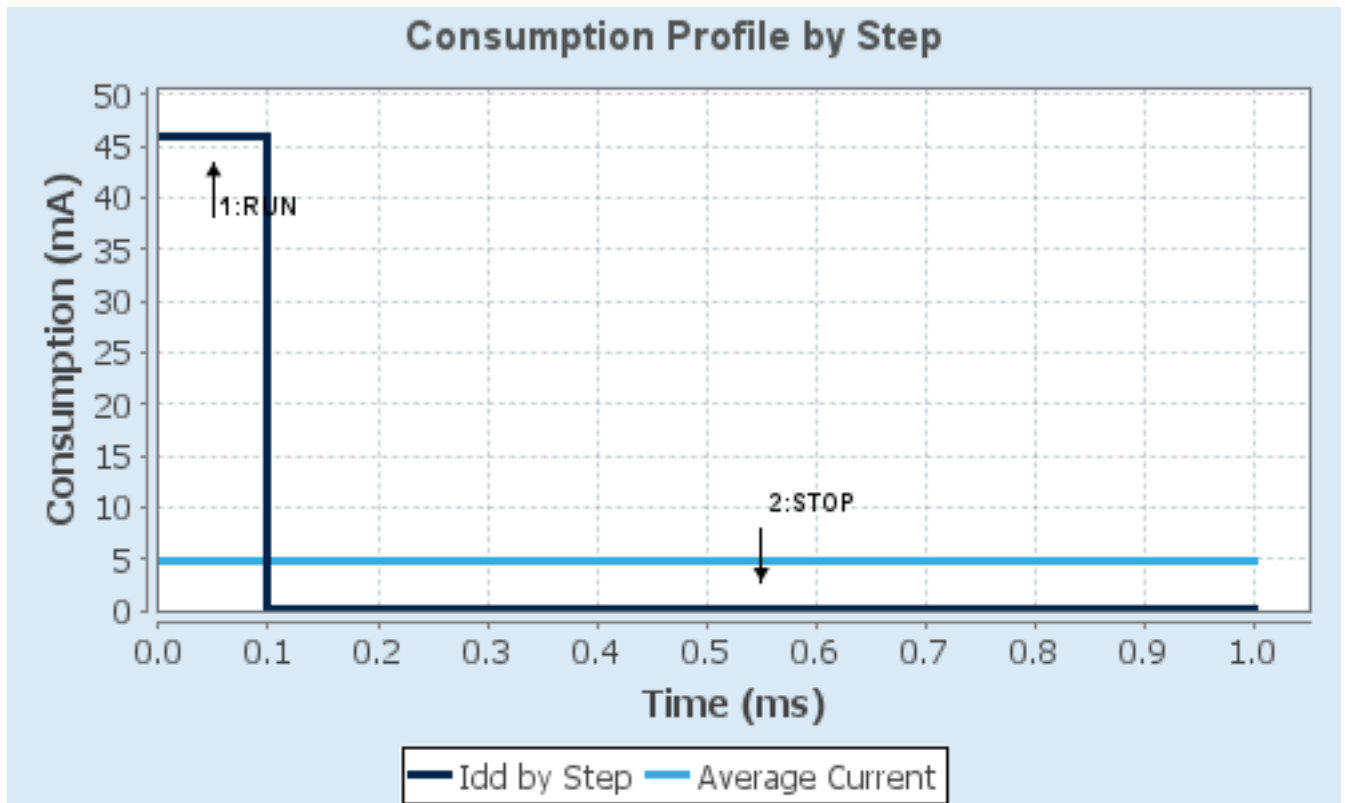
#### 1.4. Sequence

<b>Step</b>	Step1	Step2
<b>Mode</b>	RUN	STOP
<b>Vdd</b>	3.3	3.3
<b>Voltage Source</b>	Battery	Battery
<b>Range</b>	Scale1-High	No Scale
<b>Fetch Type</b>	FLASH	n/a
<b>CPU Frequency</b>	168 MHz	0 Hz
<b>Clock Configuration</b>	HSE PLL	Regulator LP Flash-PwrDwn
<b>Clock Source Frequency</b>	4 MHz	0 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	46 mA	280 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	210.0	0.0
<b>Ta Max</b>	98.47	104.96
<b>Category</b>	In DS Table	In DS Table

#### 1.5. Results

Sequence Time	1 ms	Average Current	4.85 mA
Battery Life	29 days, 4 hours	Average DMIPS	210.0 DMIPS

#### 1.6. Chart





## 2. Software Project

### 2.1. Project Settings

Name	Value
Project Name	digital_clock
Project Folder	C:\Project\digital_clock\digital_clock
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.28.1
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	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)	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_TIM2_Init	TIM2
4	MX_TIM6_Init	TIM6
5	MX_USART3_UART_Init	USART3

## 3. Peripherals and Middlewares Configuration

### 3.1. RCC

#### High Speed Clock (HSE): Crystal/Ceramic Resonator

##### 3.1.1. Parameter Settings:

###### System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	5 WS (6 CPU cycle)

###### RCC Parameters:

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

###### Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1
-------------------------------	---------------------------------

### 3.2. SYS

#### Timebase Source: SysTick

### 3.3. TIM2

#### Clock Source : Internal Clock

#### Channel1: PWM Generation CH1

##### 3.3.1. Parameter Settings:

###### Counter Settings:

Prescaler (PSC - 16 bits value)	41999 *
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value )	9 *
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 (32 bits value)	<b>4 *</b>
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

### 3.4. TIM6

**mode: Activated**

#### 3.4.1. Parameter Settings:

##### **Counter Settings:**

Prescaler (PSC - 16 bits value)	<b>84-1 *</b>
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	<b>1000-1 *</b>
auto-reload preload	Disable

##### **Trigger Output (TRGO) Parameters:**

Trigger Event Selection	Reset (UG bit from TIMx_EGR)
-------------------------	------------------------------

### 3.5. USART3

**Mode: Asynchronous**

#### 3.5.1. 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

**\* User modified value**

## 4. System Configuration

### 4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
RCC	PH0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
TIM2	PA5	TIM2_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART3	PD8	USART3_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PD9	USART3_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
GPIO	PE3	GPIO_EXTI3	<b>External Interrupt Mode with Rising/Falling edge</b>	No pull-up and no pull-down	n/a	
	PC15-OSC32_OUT	GPIO_EXTI15	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PD10	GPIO_EXTI10	<b>External Interrupt Mode with Rising/Falling edge</b>	No pull-up and no pull-down	n/a	
	PD12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PD13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PD14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PC6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PD4	GPIO_EXTI4	<b>External Interrupt Mode with Rising/Falling edge</b>	No pull-up and no pull-down	n/a	
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	

### 4.2. DMA configuration

nothing configured in DMA service

### 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
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
EXTI line3 interrupt	true	0	0
EXTI line4 interrupt	true	0	0
USART3 global interrupt	true	0	0
EXTI line[15:10] interrupts	true	0	0
TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM2 global interrupt	unused		
FPU global 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
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
EXTI line3 interrupt	true	true	true
EXTI line4 interrupt	true	true	true
USART3 global interrupt	true	true	true
EXTI line[15:10] interrupts	true	true	true

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
TIM6 global interrupt, DAC1 and DAC2 underrun error interrupts	true	true	true

\* User modified value

## 5. System Views

### 5.1. Category view

#### 5.1.1. Current

Middleware						
System Core	Analog	Timers	Connectivity	Multimedia	Security	Computing
DMA		TIM2 ✓	USART3 ✓			
GPIO ✓		TIM6 ✓				
NVIC ✓						
RCC ✓						
SYS ✓						

## 6. Docs & Resources

Type	Link
BSDL files	<a href="https://www.st.com/resource/en/bsdl_model/stm32f405-415_407-417_bsdl.zip">https://www.st.com/resource/en/bsdl_model/stm32f405-415_407-417_bsdl.zip</a>
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32f405-415_407-417_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32f405-415_407-417_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32f4-svd.zip">https://www.st.com/resource/en/svd/stm32f4-svd.zip</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32_eval_tools_portfolio.pdf">https://www.st.com/resource/en/product_presentation/stm32_eval_tools_portfolio.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf">https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf">https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf">https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/microcontrollers-stm32h7rs-lines-overview.pdf">https://www.st.com/resource/en/product_presentation/microcontrollers-stm32h7rs-lines-overview.pdf</a>
Brochures	<a href="https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf">https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32nucleo.pdf">https://www.st.com/resource/en/flyer/flstm32nucleo.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstmcsuite.pdf">https://www.st.com/resource/en/flyer/flstmcsuite.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32trust.pdf">https://www.st.com/resource/en/flyer/flstm32trust.pdf</a>
Product Certifications	<a href="https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf">https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf</a>



- Application Notes [https://www.st.com/resource/en/application\\_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf](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/an2945-stm8s-and-stm32-mcus-a-consistent-832bit-product-line-for-painless-migration-stmicroelectronics.pdf](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](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](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](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](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](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](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/an3371-using-the-hardware-realtime-clock-rtc-in-stm32-f0-f2-f3-f4-and-l1-series-of-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3371-using-the-hardware-realtime-clock-rtc-in-stm32-f0-f2-f3-f4-and-l1-series-of-mcus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf](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](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](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/an4073-how-to-improve-adc-accuracy-when-using-stm32f2xx-and-stm32f4xx-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4073-how-to-improve-adc-accuracy-when-using-stm32f2xx-and-stm32f4xx-microcontrollers-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](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/an4221-i2c-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](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](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/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](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](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/an4547-migrating-from-stm32f407xx417xx-to-stm32f427xx429xx437xx439xx-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4547-migrating-from-stm32f407xx417xx-to-stm32f427xx429xx437xx439xx-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4566-extending-the-dac-performance-of-stm32-microcontrollers-stmicroelectronics.pdf](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/an4640-peripherals-interconnections-on-stm32f4057xx-stm32f4157xx-stm32f42xxx-stm32f43xxx-stm32f446xx-and-stm32f469479xx-stmicroelectronics.pdf](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](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/an4739-stm32cube-firmware-examples-for-stm32f4-series-stmicroelectronics.pdf](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](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](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](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/an4821-migrating-from-](https://www.st.com/resource/en/application_note/an4821-migrating-from-)

stm32f405415-line-and-stm32f407417-line-to-stm32l4-series-and-stm32l4-series-microcontrollers-stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an4850-stm32-mcus-spreadspectrum-clock-generation-principles-properties-and-implementation-stmicroelectronics.pdf](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](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](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/an5020-digital-camera-interface-dcml-on-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5020-digital-camera-interface-dcml-on-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf](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](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/an4899-stm32-microcontroller-gpio-hardware-settings-and-lowpower-consumption-stmicroelectronics.pdf](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](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](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](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](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/an2834-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2834-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5537-how-to-use-adc-](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](https://www.st.com/resource/en/application_note/an5036-guidelines-for-thermal-management-on-stm32-applications-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4230-introduction-to-random-number-generation-validation-using-the-nist-statistical-test-suite-for-stm32-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4230-introduction-to-random-number-generation-validation-using-the-nist-statistical-test-suite-for-stm32-mcus-and-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an2867-guidelines-for-oscillator-design-on-stm8afals-and-stm32-mcus-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2867-guidelines-for-oscillator-design-on-stm8afals-and-stm32-mcus-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4013-introduction-to-timers-for-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4013-introduction-to-timers-for-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4277-how-to-use-pwm-shutdown-for-motor-control-and-digital-power-conversion-on-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4277-how-to-use-pwm-shutdown-for-motor-control-and-digital-power-conversion-on-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4759-introduction-to-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4759-introduction-to-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4908-getting-started-with-uart-automatic-baud-rate-detection-for-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4908-getting-started-with-uart-automatic-baud-rate-detection-for-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5156-introduction-to-security-for-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5156-introduction-to-security-for-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5543-guidelines-for-enhanced-spi-communication-on-stm32-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5543-guidelines-for-enhanced-spi-communication-on-stm32-mcus-and-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an1202\\_freertos\\_guide-for-related-tools-freertos-guide-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an1202_freertos_guide-for-related-tools-freertos-guide-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an1602\\_semihosting\\_in\\_truestudio-how-to-do-semihosting-in-truestudio-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an1602_semihosting_in_truestudio-how-to-do-semihosting-in-truestudio-stmicroelectronics.pdf)

& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an1801\\_stm32cubeprog-rammer\\_in\\_truestudio-installing-stm32cubeprogrammer-in-truestudio-](https://www.st.com/resource/en/application_note/an1801_stm32cubeprog-rammer_in_truestudio-installing-stm32cubeprogrammer-in-truestudio-)

& Software	stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/atoilic_editing_keyboard_for_related_Tools/_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/atoilic_editing_keyboard_for_related_Tools/_shortcuts-atollic-editing-keyboard-shortcuts-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="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">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</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/stm32cubemx_installation_in_truestudio-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/stm32cubemx_installation_in_truestudio-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2656-stm32f10xxx-lcd-glass-driver-firmware-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2656-stm32f10xxx-lcd-glass-driver-firmware-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2790-tft-lcd-interfacing-with-the-highdensity-stm32f10xxx-fsmc-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2790-tft-lcd-interfacing-with-the-highdensity-stm32f10xxx-fsmc-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3078-stm32-inapplication-programming-over-the-ic-bus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3078-stm32-inapplication-programming-over-the-ic-bus-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3116-stm32s-adc-modes-and-their-applications-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3116-stm32s-adc-modes-and-their-applications-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3174-implementing-receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-microcontrollers-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3174-implementing-receivers-for-infrared-remote-control-protocols-using-stm32f10xxx-microcontrollers-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3241-qvga-tftlcd-direct-drive-using-the-stm32f10xx-fsmc-peripheral-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3241-qvga-tftlcd-direct-drive-using-the-stm32f10xx-fsmc-peripheral-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3307-guidelines-for-obtaining-iec-60335-class-b-certification-for-any-stm32-application-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3307-guidelines-for-obtaining-iec-60335-class-b-certification-for-any-stm32-application-stmicroelectronics.pdf</a>
for related Tools	
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf</a>
for related Tools	
& Software	

Application Notes [https://www.st.com/resource/en/application\\_note/an3965-stm32f40xstm32f41x-inapplication-programming-using-the-usart-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3965-stm32f40xstm32f41x-inapplication-programming-using-the-usart-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3966-lwip-tcpip-stack-demonstration-for-stm32f4x7-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3966-lwip-tcpip-stack-demonstration-for-stm32f4x7-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3968-stm32f407stm32f417-inapplication-programming-iap-over-ethernet-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3968-stm32f407stm32f417-inapplication-programming-iap-over-ethernet-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3969-eeeprom-emulation-in-stm32f40xstm32f41x-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3969-eeeprom-emulation-in-stm32f40xstm32f41x-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3988-clock-configuration-tool-for-stm32f40xx41xx427x437x-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3988-clock-configuration-tool-for-stm32f40xx41xx427x437x-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3990-upgrading-stm32f4discovery-board-firmware-using-a-usb-key-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3990-upgrading-stm32f4discovery-board-firmware-using-a-usb-key-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4044-floating-point-unit-demonstration-on-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4044-floating-point-unit-demonstration-on-stm32-microcontrollers-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4323-getting-started-with-stemwin-library-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4323-getting-started-with-stemwin-library-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4365-using-stm32f4-mcu-power-modes-with-best-dynamic-efficiency-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4365-using-stm32f4-mcu-power-modes-with-best-dynamic-efficiency-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4435-guidelines-for-](https://www.st.com/resource/en/application_note/an4435-guidelines-for-)

for related Tools obtaining-ulcsaiec-607301603351-class-b-certification-in-any-stm32-  
& Software application-stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an4457-implementing-](https://www.st.com/resource/en/application_note/an4457-implementing-)  
for related Tools an-emulated-uart-on-stm32f4-microcontrollers-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4499-stm32--](https://www.st.com/resource/en/application_note/an4499-stm32--)  
for related Tools nrf51822-bluetooth-low-energy-system-solution-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4657-stm32-](https://www.st.com/resource/en/application_note/an4657-stm32-)  
for related Tools inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4666-parallel-](https://www.st.com/resource/en/application_note/an4666-parallel-)  
for related Tools synchronous-transmission-using-gpio-and-dma-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4678-full-duplex-spi-](https://www.st.com/resource/en/application_note/an4678-full-duplex-spi-)  
for related Tools emulation-for-stm32f4-microcontrollers-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4701-proprietary-](https://www.st.com/resource/en/application_note/an4701-proprietary-)  
for related Tools code-readout-protection-on-microcontrollers-of-the-stm32f4-series-  
& Software stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an4739-stm32cube-](https://www.st.com/resource/en/application_note/an4739-stm32cube-)  
for related Tools firmware-examples-for-stm32f4-series-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4758-proprietary-](https://www.st.com/resource/en/application_note/an4758-proprietary-)  
for related Tools code-readout-protection-on-stm32l4-stm32l4-stm32g4-and-stm32wb-  
& Software series-mcus-stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an4841-digital-signal-](https://www.st.com/resource/en/application_note/an4841-digital-signal-)  
for related Tools processing-for-stm32-microcontrollers-using-cmsis-stmicroelectronics.pdf  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an4968-proprietary-](https://www.st.com/resource/en/application_note/an4968-proprietary-)  
for related Tools code-read-out-protection-pcrop-on-stm32f72xxx-and-stm32f73xxx-  
& Software microcontrollers-stmicroelectronics.pdf

Application Notes [https://www.st.com/resource/en/application\\_note/an5056-integration-](https://www.st.com/resource/en/application_note/an5056-integration-)  
for related Tools guide-for-the-xcubesbsfu-stm32cube-expansion-package-

& Software	stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5360-getting-started-for-related-Tools-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5360-getting-started-for-related-Tools</a>
& Software	stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5361-getting-started-for-related-Tools-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5361-getting-started-for-related-Tools</a>
& Software	stm32cubeide-stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5394-getting-started-for-related-Tools-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5394-getting-started-for-related-Tools</a>
& Software	stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5426-migrating-graphics-middleware-projects-from-stm32cubemx-540-to-stm32cubemx-550-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5426-migrating-graphics-middleware-projects-from-stm32cubemx-540-to-stm32cubemx-550-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5464-position-control-of-a-three-phase-permanent-magnet-motor-using-xcubemcsdk-or-xcubemcsdkful-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5464-position-control-of-a-three-phase-permanent-magnet-motor-using-xcubemcsdk-or-xcubemcsdkful-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5564-getting-started-for-related-Tools-with-projects-based-on-dualcore-stm32wl-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5564-getting-started-for-related-Tools</a>
& Software	stm32cubeide-stmicroelectronics.pdf
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5698-adapting-the-xcubestl-functional-safety-package-for-stm32-iec-61508-compliant-to-other-safety-standards-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5698-adapting-the-xcubestl-functional-safety-package-for-stm32-iec-61508-compliant-to-other-safety-standards-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5731-stm32cubemx-and-stm32cubeide-threadsafe-solution-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5731-stm32cubemx-and-stm32cubeide-threadsafe-solution-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an4502-stm32-smbus-pmbus-expansion-package-for-stm32cube-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an4502-stm32-smbus-pmbus-expansion-package-for-stm32cube-stmicroelectronics.pdf</a>
& Software	
Application Notes	<a href="https://www.st.com/resource/en/application_note/an5952-how-to-use-cmake-in-stm32cubeide-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5952-how-to-use-cmake-in-stm32cubeide-stmicroelectronics.pdf</a>
& Software	



Application Notes for related Tools & Software	<a href="https://www.st.com/resource/en/application_note/an5054-how-to-perform-secure-programming-using-stm32cube-programmer-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an5054-how-to-perform-secure-programming-using-stm32cube-programmer-stmicroelectronics.pdf</a>
Errata Sheets	<a href="https://www.st.com/resource/en/errata_sheet/es0182-stm32f405407xx-and-stm32f415417xx-device-errata-stmicroelectronics.pdf">https://www.st.com/resource/en/errata_sheet/es0182-stm32f405407xx-and-stm32f415417xx-device-errata-stmicroelectronics.pdf</a>
Datasheet	<a href="https://www.st.com/resource/en/datasheet/dm00037051.pdf">https://www.st.com/resource/en/datasheet/dm00037051.pdf</a>
Programming Manuals	<a href="https://www.st.com/resource/en/programming_manual/pm0214-stm32-cortexm4-mcus-and-mpus-programming-manual-stmicroelectronics.pdf">https://www.st.com/resource/en/programming_manual/pm0214-stm32-cortexm4-mcus-and-mpus-programming-manual-stmicroelectronics.pdf</a>
Reference Manuals	<a href="https://www.st.com/resource/en/reference_manual/rm0090-stm32f405415-stm32f407417-stm32f427437-and-stm32f429439-advanced-armbased-32bit-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/reference_manual/rm0090-stm32f405415-stm32f407417-stm32f427437-and-stm32f429439-advanced-armbased-32bit-mcus-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn0516-overview-of-the-stm32f0xf100xxf103xx-and-stm32f2xxf30xf4xx-mcus-pmsm-singledual-foc-sdk-v40-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn0516-overview-of-the-stm32f0xf100xxf103xx-and-stm32f2xxf30xf4xx-mcus-pmsm-singledual-foc-sdk-v40-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1163-description-of-wlcsp-for-microcontrollers-and-recommendations-for-its-use-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1163-description-of-wlcsp-for-microcontrollers-and-recommendations-for-its-use-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1204-tape-and-reel-shipping-media-for-stm32-microcontrollers-in-bga-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1204-tape-and-reel-shipping-media-for-stm32-microcontrollers-in-bga-packages-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1205-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-fpn-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1205-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-fpn-packages-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1206-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-qfp-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1206-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-qfp-packages-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1207-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-so-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1207-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-so-packages-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1208-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-tssop-and-ssop-packages-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1208-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-tssop-and-ssop-packages-stmicroelectronics.pdf</a>
Technical Notes & Articles	<a href="https://www.st.com/resource/en/technical_note/tn1433-reference-device-marking-schematics-for-stm32-microcontrollers-and-microprocessors-">https://www.st.com/resource/en/technical_note/tn1433-reference-device-marking-schematics-for-stm32-microcontrollers-and-microprocessors-</a>

stmicroelectronics.pdf

Technical Notes  
& Articles

[https://www.st.com/resource/en/technical\\_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-stmicroelectronics.pdf](https://www.st.com/resource/en/technical_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-stmicroelectronics.pdf)