



## 1. Description

### 1.1. Project

Project Name	BluePill
Board Name	custom
Generated with:	STM32CubeMX 6.6.1
Date	08/22/2022

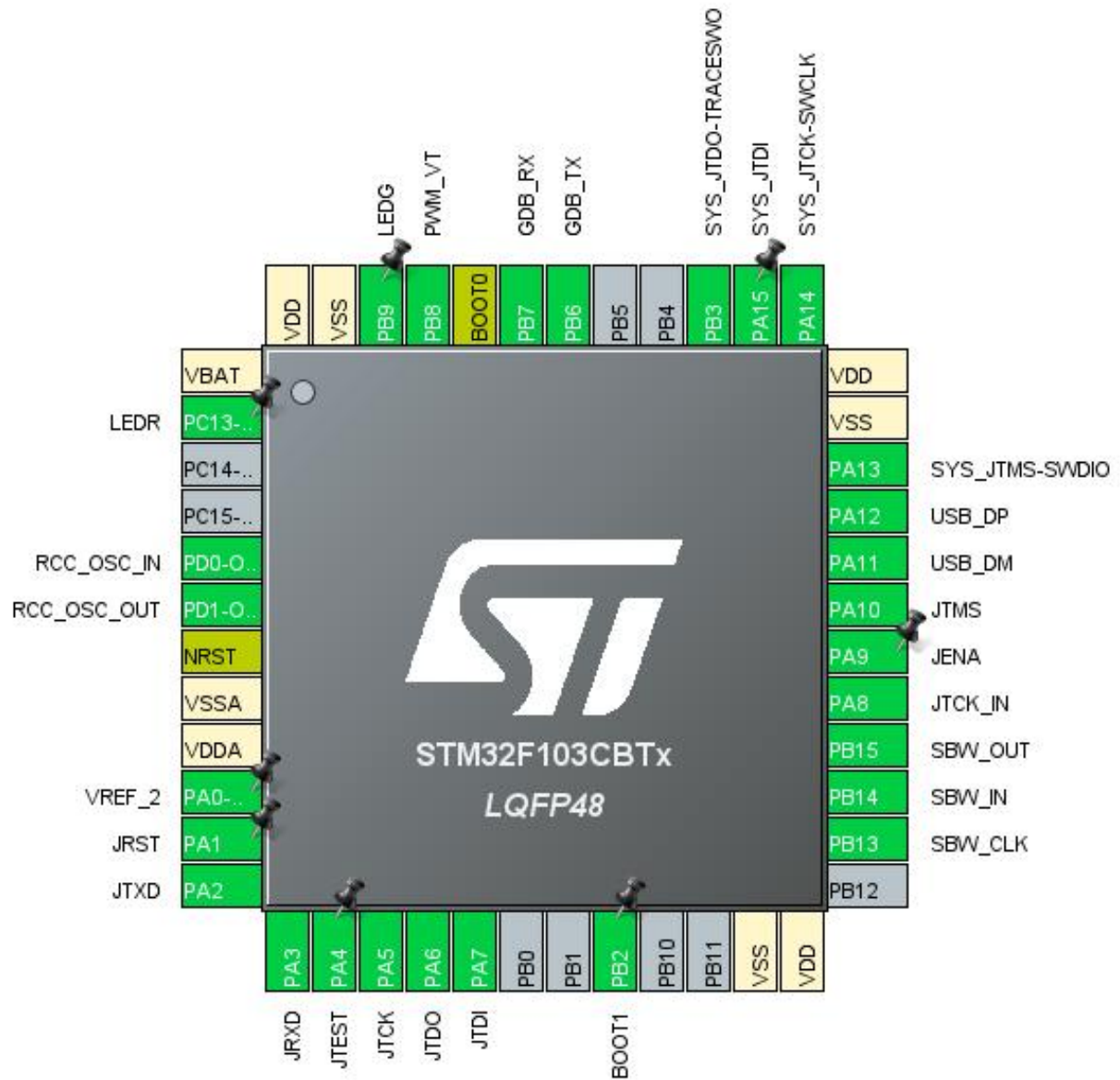
### 1.2. MCU

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
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## 2. Pinout Configuration



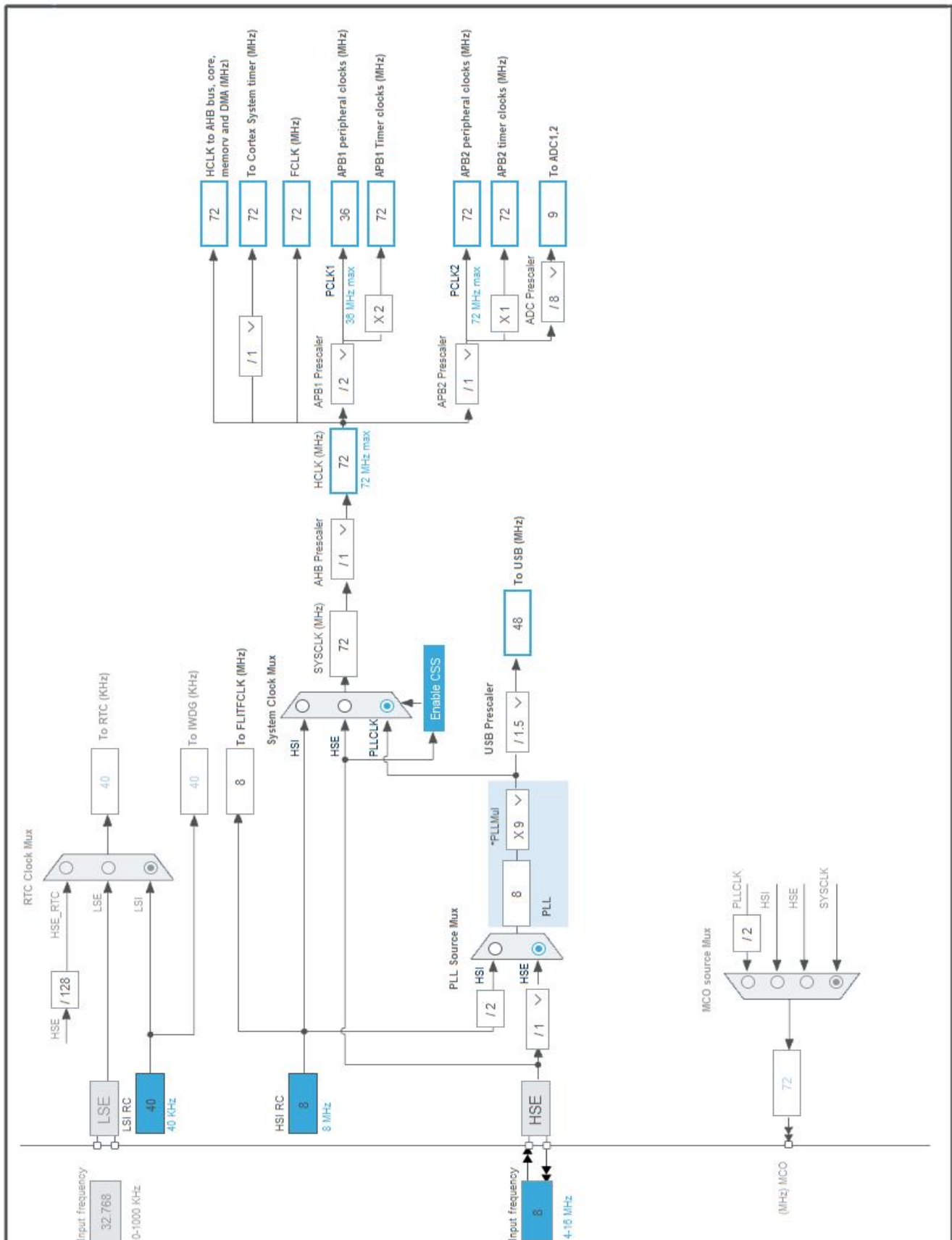
### 3. Pins Configuration

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	LEDR
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	VREF_2
11	PA1 *	I/O	GPIO_Output	JRST
12	PA2	I/O	USART2_TX	JTXD
13	PA3	I/O	USART2_RX	JRXD
14	PA4 *	I/O	GPIO_Output	JTEST
15	PA5	I/O	SPI1_SCK	JTCK
16	PA6	I/O	SPI1_MISO	JTDO
17	PA7	I/O	SPI1_MOSI	JTDI
20	PB2 *	I/O	GPIO_Input	BOOT1
23	VSS	Power		
24	VDD	Power		
26	PB13	I/O	SPI2_SCK	SBW_CLK
27	PB14	I/O	SPI2_MISO	SBW_IN
28	PB15	I/O	SPI2_MOSI	SBW_OUT
29	PA8	I/O	TIM1_CH1	JTCK_IN
30	PA9 *	I/O	GPIO_Output	JENA
31	PA10	I/O	TIM1_CH3	JTMS
32	PA11	I/O	USB_DM	
33	PA12	I/O	USB_DP	
34	PA13	I/O	SYS_JTMS-SWDIO	
35	VSS	Power		
36	VDD	Power		
37	PA14	I/O	SYS_JTCK-SWCLK	
38	PA15 *	I/O	GPIO_Input	SYS_JTDI
39	PB3	I/O	SYS_JTDO-TRACESWO	
42	PB6	I/O	USART1_TX	GDB_TX
43	PB7	I/O	USART1_RX	GDB_RX
44	BOOT0	Boot		
45	PB8	I/O	TIM4_CH3	PWM_VT

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
46	PB9 *	I/O	GPIO_Output	LEDG
47	VSS	Power		
48	VDD	Power		

\* The pin is affected with an I/O function

## 4. Clock Tree Configuration



## 5. Software Project

### 5.1. Project Settings

Name	Value
Project Name	BluePill
Project Folder	P:\github.com\glossy-msp430\Hardware\BlackPill-BMP\CubeMX
Toolchain / IDE	Makefile
Firmware Package Name and Version	STM32Cube FW_F1 V1.8.4
Application Structure	Advanced
Generate Under Root	No
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 all used libraries into the project folder
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_DMA_Init	DMA
4	MX_SPI1_Init	SPI1
5	MX_TIM1_Init	TIM1
6	MX_USB_PCD_Init	USB
7	MX_ADC1_Init	ADC1
8	MX_SPI2_Init	SPI2
9	MX_USART1_UART_Init	USART1
10	MX_USART2_UART_Init	USART2
11	MX_TIM2_Init	TIM2

Rank	Function Name	Peripheral Instance Name
12	MX_TIM4_Init	TIM4



## 6. Power Consumption Calculator report

### 6.1. Microcontroller Selection

Series	STM32F1
Line	STM32F103
MCU	STM32F103CBTx
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

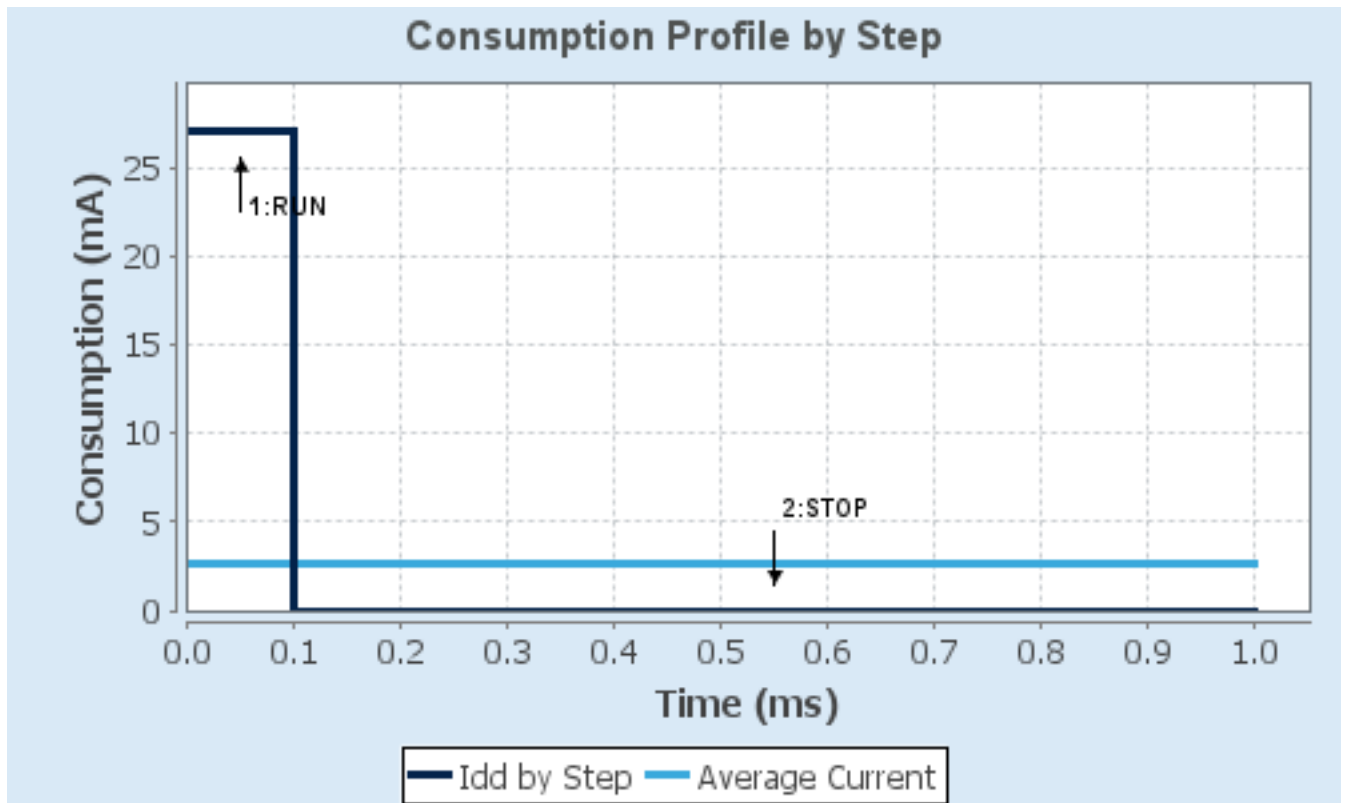
#### 6.4. Sequence

<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>	No Scale	No Scale
<b>Fetch Type</b>	FLASH	n/a
<b>CPU Frequency</b>	72 MHz	0 Hz
<b>Clock Configuration</b>	HSE PLL	Regulator LP
<b>Clock Source Frequency</b>	8 MHz	0 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	27 mA	14 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	90.0	0.0
<b>Ta Max</b>	100.1	105
<b>Category</b>	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**

#### 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 1.5 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) 2 WS (3 CPU cycle)

##### **RCC Parameters:**

HSI Calibration Value 16

HSE Startup Timeout Value (ms) 100

LSE Startup Timeout Value (ms) 5000

### 7.3. SPI1

**Mode: Full-Duplex Master**

#### 7.3.1. Parameter Settings:

**Basic Parameters:**

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

**Clock Parameters:**

Prescaler (for Baud Rate)	2
Baud Rate	<b>36.0 MBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

**Advanced Parameters:**

CRC Calculation	Disabled
NSS Signal Type	Software

### 7.4. SPI2

**Mode: Full-Duplex Master**

#### 7.4.1. Parameter Settings:

**Basic Parameters:**

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

**Clock Parameters:**

Prescaler (for Baud Rate)	2
Baud Rate	<b>18.0 MBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

**Advanced Parameters:**

CRC Calculation	Disabled
NSS Signal Type	Software

## 7.5. SYS

**Debug: Trace Asynchronous Sw**

**Timebase Source: SysTick**

## 7.6. TIM1

**Slave Mode: External Clock Mode 1**

**Trigger Source: TI1FP1**

**Channel3: Output Compare CH3**

### 7.6.1. 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
Slave Mode Controller	ETR mode 1

#### **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

#### **Trigger:**

Trigger Polarity	Rising Edge
Trigger Filter (4 bits value)	0

#### **Output Compare Channel 3:**

Mode	Frozen (used for Timing base)
Pulse (16 bits value)	0
Output compare preload	Disable
CH Polarity	High
CH Idle State	Reset

## 7.7. TIM2

### Channel3: Output Compare No Output

#### 7.7.1. 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
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)

##### Output Compare No Output Channel 3:

Mode	Frozen (used for Timing base)
Pulse (16 bits value)	0
Output compare preload	Disable
CH Polarity	High

## 7.8. TIM4

### mode: Clock Source

### Channel3: Output Compare CH3

#### 7.8.1. 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
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)

##### Output Compare Channel 3:

Mode	Frozen (used for Timing base)
Pulse (16 bits value)	0

Output compare preload	Disable
CH Polarity	High

## 7.9. USART1

### Mode: Asynchronous

#### 7.9.1. 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

## 7.10. USART2

### Mode: Asynchronous

#### 7.10.1. 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

## 7.11. USB

### mode: Device (FS)

#### 7.11.1. Parameter Settings:

##### Basic Parameters:

Speed	Full Speed 12MBit/s
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**Power Parameters:**

Low Power	Disabled
Link Power Management	Disabled
Battery Charging	Disabled

**\* 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	VREF_2
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	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	n/a	High *	JTCK
	PA6	SPI1_MISO	Input mode	No pull-up and no pull-down	n/a	JTDO
	PA7	SPI1_MOSI	Alternate Function Push Pull	n/a	High *	JTDI
SPI2	PB13	SPI2_SCK	Alternate Function Push Pull	n/a	High *	SBW_CLK
	PB14	SPI2_MISO	Input mode	No pull-up and no pull-down	n/a	SBW_IN
	PB15	SPI2_MOSI	Alternate Function Push Pull	n/a	High *	SBW_OUT
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
	PB3	SYS_JTDO-TRACESWO	n/a	n/a	n/a	
TIM1	PA8	TIM1_CH1	Input mode	No pull-up and no pull-down	n/a	JTCK_IN
	PA10	TIM1_CH3	Alternate Function Push Pull	n/a	Low	JTMS
TIM4	PB8	TIM4_CH3	Alternate Function Push Pull	n/a	Low	PWM_VT
USART1	PB6	USART1_TX	Alternate Function Push Pull	n/a	High *	GDB_TX
	PB7	USART1_RX	Input mode	No pull-up and no pull-down	n/a	GDB_RX
USART2	PA2	USART2_TX	Alternate Function Push Pull	n/a	High *	JTXD
	PA3	USART2_RX	Input mode	No pull-up and no pull-down	n/a	JRXD
USB	PA11	USB_DM	n/a	n/a	n/a	
	PA12	USB_DP	n/a	n/a	n/a	
GPIO	PC13-TAMPER-RTC	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LEDR
	PA1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	JRST
	PA4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	JTEST
	PB2	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	BOOT1
	PA9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	JENA
	PA15	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	SYS_JTDI
	PB9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LEDG



## 8.2. DMA configuration

DMA request	Stream	Direction	Priority
TIM1_CH3	DMA1_Channel6	Peripheral To Memory	<b>Very High *</b>
SPI1_RX	DMA1_Channel2	Peripheral To Memory	Low
SPI1_TX	DMA1_Channel3	Memory To Peripheral	Low
TIM2_CH3	DMA1_Channel1	Peripheral To Memory	Low

### TIM1\_CH3: DMA1\_Channel6 DMA request Settings:

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

### SPI1\_RX: DMA1\_Channel2 DMA request Settings:

Mode: Normal  
 Peripheral Increment: Disable  
 Memory Increment: **Enable \***  
 Peripheral Data Width: Byte  
 Memory Data Width: Byte

### SPI1\_TX: DMA1\_Channel3 DMA request Settings:

Mode: Normal  
 Peripheral Increment: Disable  
 Memory Increment: **Enable \***  
 Peripheral Data Width: Byte  
 Memory Data Width: Byte

### TIM2\_CH3: DMA1\_Channel1 DMA request Settings:

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

Memory Data Width:    **Word \***

### 8.3. NVIC configuration

#### 8.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
Prefetch fault, memory access fault	true	0	0
Undefined instruction or illegal state	true	0	0
System service call via SWI instruction	true	0	0
Debug monitor	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	15	0
DMA1 channel1 global interrupt	true	0	0
DMA1 channel2 global interrupt	true	0	0
DMA1 channel3 global interrupt	true	0	0
DMA1 channel6 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		
USB high priority or CAN TX interrupts	unused		
USB low priority or CAN RX0 interrupts	unused		
TIM1 break interrupt	unused		
TIM1 update interrupt	unused		
TIM1 trigger and commutation interrupts	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
TIM4 global interrupt	unused		
SPI1 global interrupt	unused		
SPI2 global interrupt	unused		
USART1 global interrupt	unused		
USART2 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

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
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
DMA1 channel2 global interrupt	false	true	true
DMA1 channel3 global interrupt	false	true	true
DMA1 channel6 global interrupt	false	true	true

\* User modified value

## 9. System Views

### 9.1. Category view

#### 9.1.1. Current



## 10. Docs & Resources

Type	Link
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>
Training Material	<a href="https://www.st.com/resource/en/sales_guide/sg_sc2155.pdf">https://www.st.com/resource/en/sales_guide/sg_sc2155.pdf</a>
Brochures	<a href="https://www.st.com/resource/en/brochure/breveco0518.pdf">https://www.st.com/resource/en/brochure/breveco0518.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flnucleolrwan.pdf">https://www.st.com/resource/en/flyer/flnucleolrwan.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/fldpstpf11120.pdf">https://www.st.com/resource/en/flyer/fldpstpf11120.pdf</a>
Product Certifications	<a href="https://www.st.com/resource/en/certification_document/1239988349.pdf">https://www.st.com/resource/en/certification_document/1239988349.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/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.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/an2548-using-the-stm32f0f1f3gxl-series-dma-controller-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2548-using-the-stm32f0f1f3gxl-series-dma-controller-stmicroelectronics.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2586-getting-started-with-stm32f10xxx-hardware-development-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an2586-getting-started-with-stm32f10xxx-hardware-development-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	<a href="https://www.st.com/resource/en/application_note/an2639-soldering-">https://www.st.com/resource/en/application_note/an2639-soldering-</a>

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](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](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/an3095-stevalisv002v1-stevalisv002v2-3-kw-gridconnected-pv-system-based-on-the-stm32f103xx-stmicroelectronics.pdf](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](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](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](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](https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf)

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