



## 1. Description

### 1.1. Project

Project Name	TIM1_PWM_Check
Board Name	custom
Generated with:	STM32CubeMX 6.6.1
Date	02/16/2023

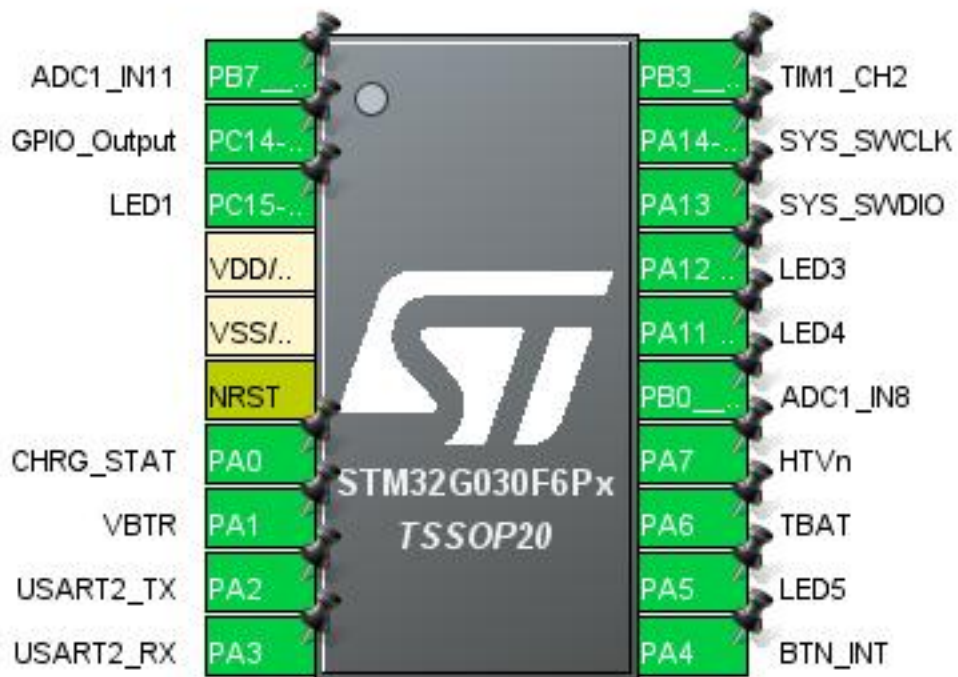
### 1.2. MCU

MCU Series	STM32G0
MCU Line	STM32G0x0 Value line
MCU name	STM32G030F6Px
MCU Package	TSSOP20
MCU Pin number	29

### 1.3. Core(s) information

Core(s)	ARM Cortex-M0+
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## 2. Pinout Configuration

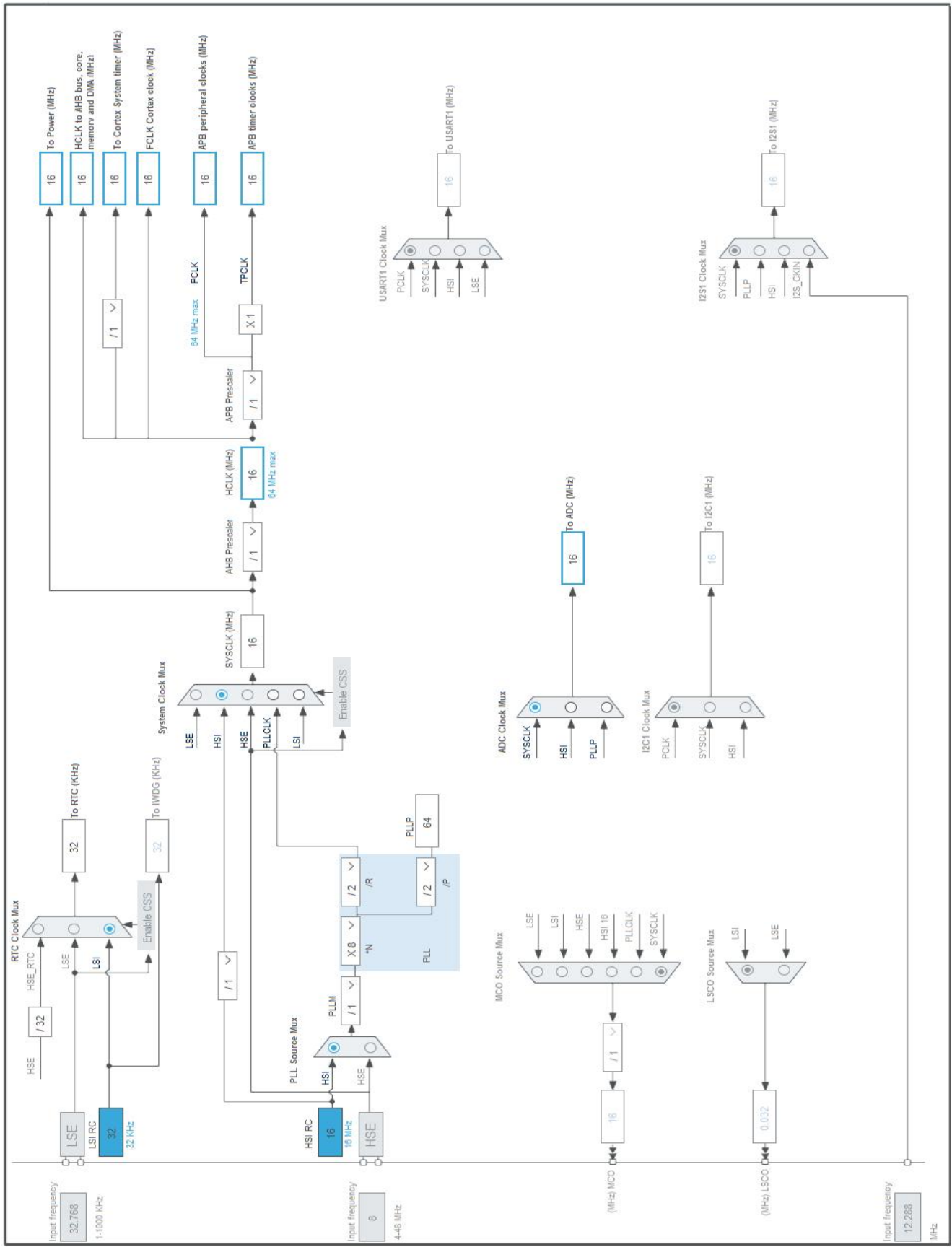


### 3. Pins Configuration

Pin Number TSSOP20	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	PB7	I/O	ADC1_IN11	HTIsn
2	PC14-OSC32_IN (PC14) *	I/O	GPIO_Output	LED6
3	PC15-OSC32_OUT (PC15) *	I/O	GPIO_Output	LED1
4	VDD/VDDA	Power		
5	VSS/VSSA	Power		
6	NRST	Reset		
7	PA0	I/O	GPIO_EXTI0	CHRG_STAT
8	PA1 *	I/O	GPIO_Output	VBTR
9	PA2	I/O	USART2_TX	
10	PA3	I/O	USART2_RX	
11	PA4	I/O	GPIO_EXTI4	BTN_INT
12	PA5 *	I/O	GPIO_Output	LED5
13	PA6	I/O	ADC1_IN6	TBAT
14	PA7	I/O	ADC1_IN7	HTVn
15	PB0	I/O	ADC1_IN8	HTVp
16	PA11 [PA9] *	I/O	GPIO_Output	LED4
17	PA12 [PA10] *	I/O	GPIO_Output	LED3
18	PA13	I/O	SYS_SWDIO	
19	PA14-BOOT0	I/O	SYS_SWCLK	
20	PB3	I/O	TIM1_CH2	HT_CTRL

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

## 4. Clock Tree Configuration



## 5. Software Project

### 5.1. Project Settings

Name	Value
Project Name	TIM1_PWM_Check
Project Folder	C:\Users\melvi\OneDrive\Desktop\test\workspace\TIM1_PWM_Check
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_G0 V1.6.1
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	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)	Yes
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_ADC1_Init	ADC1
5	MX_RTC_Init	RTC
6	MX_TIM17_Init	TIM17
7	MX_TIM14_Init	TIM14
8	MX_TIM16_Init	TIM16
9	MX_TIM3_Init	TIM3
10	MX_TIM1_Init	TIM1
11	MX_USART2_UART_Init	USART2



## 6. Power Consumption Calculator report

### 6.1. Microcontroller Selection

Series	STM32G0
Line	STM32G0x0 Value line
MCU	STM32G030F6Px
Datasheet	DS12991_Rev1

### 6.2. Parameter Selection

Temperature	25
Vdd	3.0

### 6.3. Battery Selection

Battery	Li-SOCL2(AAA700)
Capacity	700.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	10.0 mA
Max Pulse Current	30.0 mA
Cells in series	1
Cells in parallel	1



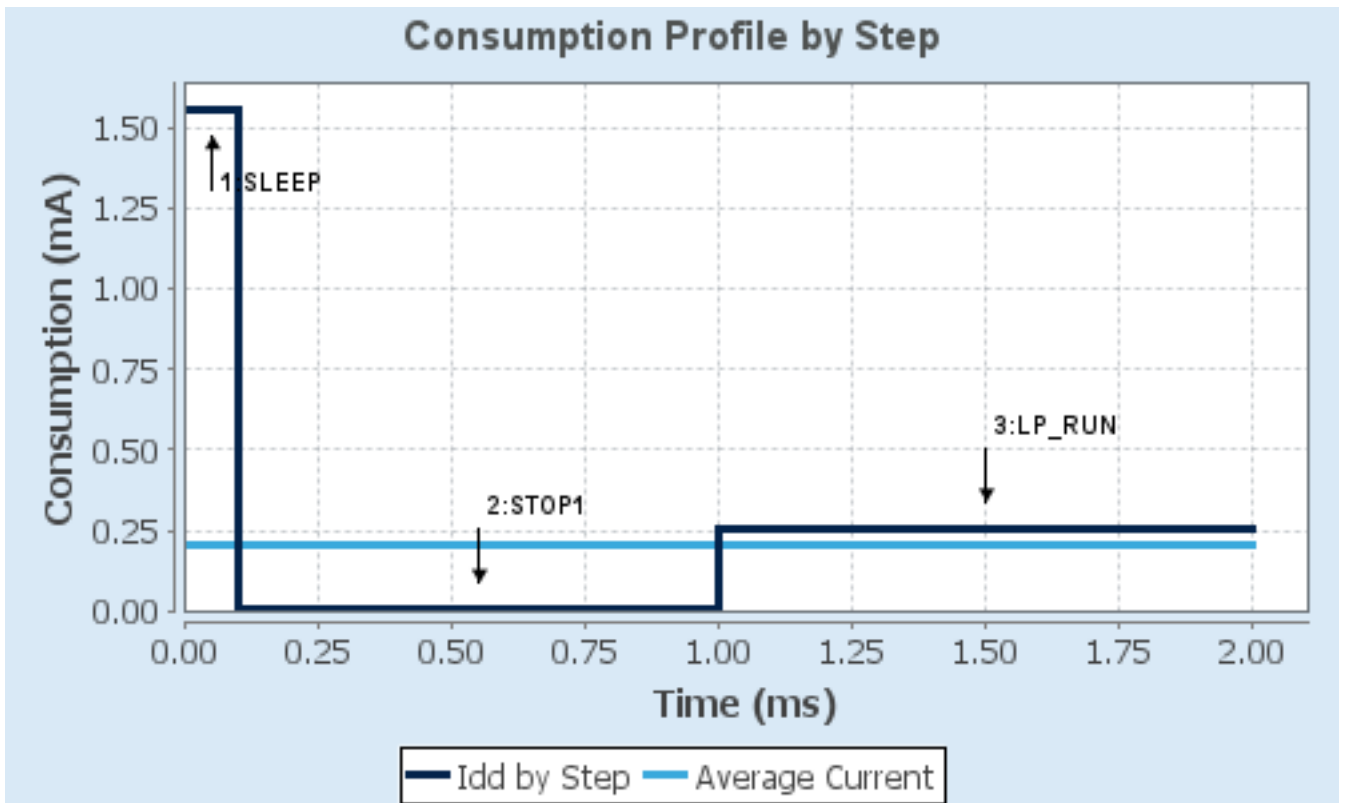
#### 6.4. Sequence

<b>Step</b>	Step1	Step2	Step3
<b>Mode</b>	SLEEP	STOP1	LOWPOWER RUN
<b>Vdd</b>	3.0	3.0	3.0
<b>Voltage Source</b>	Battery	Battery	Battery
<b>Range</b>	Range1-High	NoRange	NoRange
<b>Fetch Type</b>	FLASH	Flash-PowerDown	FLASH
<b>CPU Frequency</b>	64 MHz	16 MHz	500 kHz
<b>Clock Configuration</b>	HSI PLL	HSI	HSI Regulator LP
<b>Clock Source Frequency</b>	16 MHz	16 MHz	500 kHz
<b>Peripherals</b>			ADC1 DBG GPIOA GPIOB IWDG RTC WWDG
<b>Additional Cons.</b>	0 mA	0 mA	0 mA
<b>Average Current</b>	1.56 mA	3.7 $\mu$ A	255.77 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms	1 ms
<b>DMIPS</b>	80.0	0.0	0.625
<b>Ta Max</b>	129.64	130	129.94
<b>Category</b>	In DS Table	In DS Table	Measurements

#### 6.5. Results

Sequence Time	2 ms	Average Current	207.55 $\mu$ A
Battery Life	4 months, 18 days, 8 hours	Average DMIPS	7.840909 DMIPS

#### 6.6. Chart



## 7. Peripherals and Middlewares Configuration

### 7.1. ADC1

mode: IN6

mode: IN7

mode: IN8

mode: IN11

#### 7.1.1. Parameter Settings:

##### **ADC\_Settings:**

Clock Prescaler	Synchronous clock mode divided by 2
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Sequencer	Sequencer set to fully configurable
Scan Conversion Mode	Enabled
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	<b>Enabled *</b>
End Of Conversion Selection	<b>End of sequence of conversion *</b>
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled
Auto Off	Disabled
Oversampling Mode	Disabled

##### **ADC\_Regular\_ConversionMode:**

SamplingTime Common 1	<b>79.5 Cycles *</b>
SamplingTime Common 2	1.5 Cycles
Number Of Conversion	<b>3 *</b>
External Trigger Conversion Source	<b>Timer 1 Trigger Out event 2 *</b>
External Trigger Conversion Edge	Trigger detection on the rising edge
Trigger Frequency	High frequency
<u>Rank</u>	1
Channel	<b>Channel 8 *</b>
Sampling Time	Sampling time common 1
<u>Rank</u>	<b>2 *</b>
Channel	<b>Channel 7 *</b>
Sampling Time	Sampling time common 1
<u>Rank</u>	<b>3 *</b>
Channel	<b>Channel 11 *</b>
Sampling Time	Sampling time common 1

### Analog Watchdog 1:

Enable Analog WatchDog1 Mode false

### Analog Watchdog 2:

Enable Analog WatchDog2 Mode false

### Analog Watchdog 3:

Enable Analog WatchDog3 Mode false

## 7.2. RCC

### 7.2.1. Parameter Settings:

#### System Parameters:

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

#### RCC Parameters:

HSI Calibration Value 64  
HSE Startup Timeout Value (ms) 100  
LSE Startup Timeout Value (ms) 5000

#### Power Parameters:

Power Regulator Voltage Scale Power Regulator Voltage Scale 1

#### Peripherals Clock Configuration:

Generate the peripherals clock configuration TRUE

## 7.3. RTC

**mode: Activate Clock Source**

**mode: Activate Calendar**

**Alarm B: Internal Alarm B**

**WakeUp: Internal WakeUp**

### 7.3.1. Parameter Settings:

#### General:

Hour Format Hourformat 24  
Asynchronous Predivider value 127  
Synchronous Predivider value 255

**Calendar Time:**

Data Format	BCD data format
Hours	0
Minutes	0
Seconds	0
SubSeconds	0
Day Light Saving: value of hour adjustment	Daylightsaving None
Store Operation	Storeoperation Reset

**Calendar Date:**

Week Day	Monday
Month	January
Date	1
Year	0

**Alarm B:**

Hours	0
Minutes	0
Seconds	<b>20 *</b>
Sub Seconds	0
Alarm Mask Date Week day	Disable
Alarm Mask Hours	Disable
Alarm Mask Minutes	Disable
Alarm Mask Seconds	Disable
Alarm Sub Second Mask	All Alarm SS fields are masked.
Alarm Date Week Day Sel	Date
Alarm Date	1

**Wake UP:**

Wake Up Clock	RTCCLK / 16
Wake Up Counter	0

**7.4. SYS**

**mode: Debug**

**7.5. TIM1**

**Clock Source : Internal Clock**

**Channel2: PWM Generation CH2**

7.5.1. Parameter Settings:

**Counter Settings:**

Prescaler (PSC - 16 bits value)	<b>160-1 *</b>
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Counter Mode **Center Aligned mode1 \***

Counter Period (AutoReload Register - 16 bits value ) **100-1 \***

Internal Clock Division (CKD) No Division

Repetition Counter (RCR - 16 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 TRGO Reset (UG bit from TIMx\_EGR)

Trigger Event Selection TRGO2 **Update Event \***

**Break And Dead Time management - BRK Configuration:**

BRK State Disable

BRK Polarity High

BRK Filter (4 bits value) 0

BRK Sources Configuration

- Digital Input Disable

**Break And Dead Time management - BRK2 Configuration:**

BRK2 State Disable

BRK2 Polarity High

BRK2 Filter (4 bits value) 0

BRK2 Sources Configuration

- Digital Input Disable

**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 (OSSl) Disable

Lock Configuration Off

**Clear Input:**

Clear Input Source Disable

**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

**7.6. TIM3**

**mode: Clock Source**

## Channel1: PWM Generation No Output

### mode: One Pulse Mode

#### 7.6.1. Parameter Settings:

##### Counter Settings:

Prescaler (PSC - 16 bits value)	<b>160-1 *</b>
Counter Mode	<b>Center Aligned mode1 *</b>
Counter Period (AutoReload Register - 16 bits value )	<b>100-1 *</b>
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 TRGO	<b>Update Event *</b>

##### Clear Input:

Clear Input Source	Disable
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##### PWM Generation Channel 1:

Mode	<b>PWM mode 2 *</b>
Pulse (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

## 7.7. TIM14

### mode: Activated

#### 7.7.1. Parameter Settings:

##### Counter Settings:

Prescaler (PSC - 16 bits value)	<b>64000 - 1 *</b>
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	65535
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

## 7.8. TIM16

### mode: Activated

### 7.8.1. Parameter Settings:

#### **Counter Settings:**

Prescaler (PSC - 16 bits value)	<b>8000 - 1 *</b>
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	<b>4000 - 1 *</b>
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Disable

### **7.9. TIM17**

#### **mode: Activated**

### 7.9.1. Parameter Settings:

#### **Counter Settings:**

Prescaler (PSC - 16 bits value)	<b>160-1 *</b>
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value )	<b>100-1 *</b>
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Disable

### **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
Single Sample	Disable
ClockPrescaler	1



**Advanced Features:**

TX Pin Active Level Inversion	Disable
RX Pin Active Level Inversion	Disable
Data Inversion	Disable
TX and RX Pins Swapping	Disable
Overrun	Enable
DMA on RX Error	Enable
MSB First	Disable

\* **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	PB7	ADC1_IN11	Analog mode	No pull-up and no pull-down	n/a	HTIsn
	PA6	ADC1_IN6	Analog mode	No pull-up and no pull-down	n/a	TBAT
	PA7	ADC1_IN7	Analog mode	No pull-up and no pull-down	n/a	HTVn
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	HTVp
SYS	PA13	SYS_SWDIO	n/a	n/a	n/a	
	PA14-BOOT0	SYS_SWCLK	n/a	n/a	n/a	
TIM1	PB3	TIM1_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	HT_CTRL
USART2	PA2	USART2_TX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA3	USART2_RX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
GPIO	PC14-OSC32_IN (PC14)	GPIO_Output	Output Push Pull	<b>Pull-up *</b>	Low	LED6
	PC15-OSC32_OUT (PC15)	GPIO_Output	Output Push Pull	<b>Pull-up *</b>	Low	LED1
	PA0	GPIO_EXTI0	<b>External Interrupt Mode with Rising/Falling edge</b>	<b>Pull-up *</b>	n/a	CHRG_STAT
	PA1	GPIO_Output	Output Push Pull	<b>Pull-down *</b>	Low	VBTR
	PA4	GPIO_EXTI4	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	BTN_INT
	PA5	GPIO_Output	Output Push Pull	<b>Pull-up *</b>	Low	LED5
	PA11 [PA9]	GPIO_Output	Output Push Pull	<b>Pull-up *</b>	Low	LED4
	PA12 [PA10]	GPIO_Output	Output Push Pull	<b>Pull-up *</b>	Low	LED3

## 8.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA1_Channel1	Peripheral To Memory	Low
USART2_RX	DMA1_Channel2	Peripheral To Memory	Low
USART2_TX	DMA1_Channel3	Memory To Peripheral	Low

### ADC1: DMA1\_Channel1 DMA request Settings:

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

### USART2\_RX: DMA1\_Channel2 DMA request Settings:

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

### USART2\_TX: DMA1\_Channel3 DMA request Settings:

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

### 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
System service call via SWI instruction	true	0	0
Pendable request for system service	true	0	0
System tick timer	true	3	0
RTC and TAMP interrupts through EXTI lines 19 and 21	true	0	0
EXTI line 0 and line 1 interrupts	true	0	0
EXTI line 4 to 15 interrupts	true	0	0
DMA1 channel 1 interrupt	true	0	0
DMA1 channel 2 and channel 3 interrupts	true	0	0
ADC1 interrupt	true	0	0
TIM1 break, update, trigger and commutation interrupts	true	0	0
TIM1 capture compare interrupt	true	0	0
TIM3 global interrupt	true	0	0
TIM16 global interrupt	true	0	0
TIM17 global interrupt	true	0	0
Flash global interrupt		unused	
RCC global interrupt		unused	
TIM14 global interrupt		unused	
USART2 global interrupt / USART2 wake-up interrupt through EXTI line 26		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
System service call via SWI instruction	false	true	false
Pendable request for system service	false	true	false
System tick timer	false	true	true
RTC and TAMP interrupts through EXTI lines 19 and 21	false	true	true
EXTI line 0 and line 1 interrupts	false	true	true
EXTI line 4 to 15 interrupts	false	true	true
DMA1 channel 1 interrupt	false	true	true
DMA1 channel 2 and channel 3 interrupts	false	true	true

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
ADC1 interrupt	false	true	true
TIM1 break, update, trigger and commutation interrupts	false	true	true
TIM1 capture compare interrupt	false	true	true
TIM3 global interrupt	false	true	true
TIM16 global interrupt	false	true	true
TIM17 global interrupt	false	true	true

\* User modified value

## 9. System Views

### 9.1. Category view

#### 9.1.1. Current

#### Middleware

#### System Core

#### Analog

#### Timers

#### Connectivity

#### Multimedia

#### Computing

DMA ✓

ADC1 ✓

RTC ✓

USART2 ✓

GPIO ✓

TIM1 ✓

NVIC ✓

TIM3 ✓

RCC ✓

TIM14 ✓

SYS ✓

TIM16 ✓

TIM17 ✓

## 10. Docs & Resources

Type	Link
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32g0_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32g0_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32g0_svd.zip">https://www.st.com/resource/en/svd/stm32g0_svd.zip</a>
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32g0_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32g0_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32g0_svd.zip">https://www.st.com/resource/en/svd/stm32g0_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/stm32g0_marketing_pres.pdf">https://www.st.com/resource/en/product_presentation/stm32g0_marketing_pres.pdf</a>
Presentations	<a href="https://www.st.com/resource/en/product_presentation/stm32-usb-c-pd-solutions-presentation.pdf">https://www.st.com/resource/en/product_presentation/stm32-usb-c-pd-solutions-presentation.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>
Training Material	<a href="https://www.st.com/resource/en/training_certification/faecp_stm32g0_cubemx5_edr.pdf">https://www.st.com/resource/en/training_certification/faecp_stm32g0_cubemx5_edr.pdf</a>
Training Material	<a href="https://www.st.com/resource/en/training_certification/faecp_stm32g0_overview_edr.pdf">https://www.st.com/resource/en/training_certification/faecp_stm32g0_overview_edr.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32g0.pdf">https://www.st.com/resource/en/flyer/flstm32g0.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>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstpfc11120.pdf">https://www.st.com/resource/en/flyer/flstpfc11120.pdf</a>

- Application Notes [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)
- Application Notes [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)
- Application Notes [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)
- Application Notes [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)
- 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/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/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/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/an4013-stm32-crossseries-timer-overview-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4013-stm32-crossseries-timer-overview-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)
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