1. Description

1.1. Project

Project Name	Beethoven-clock_master_64KB
Board Name	custom
Generated with:	STM32CubeMX 6.12.1
Date	10/05/2024

1.2. MCU

MCU Series	STM32G0
MCU Line	STM32G0x1
MCU name	STM32G031C8Tx
MCU Package	LQFP48
MCU Pin number	48

1.3. Core(s) information

Core(s)	ARM Cortex-M0+

2. Pinout Configuration
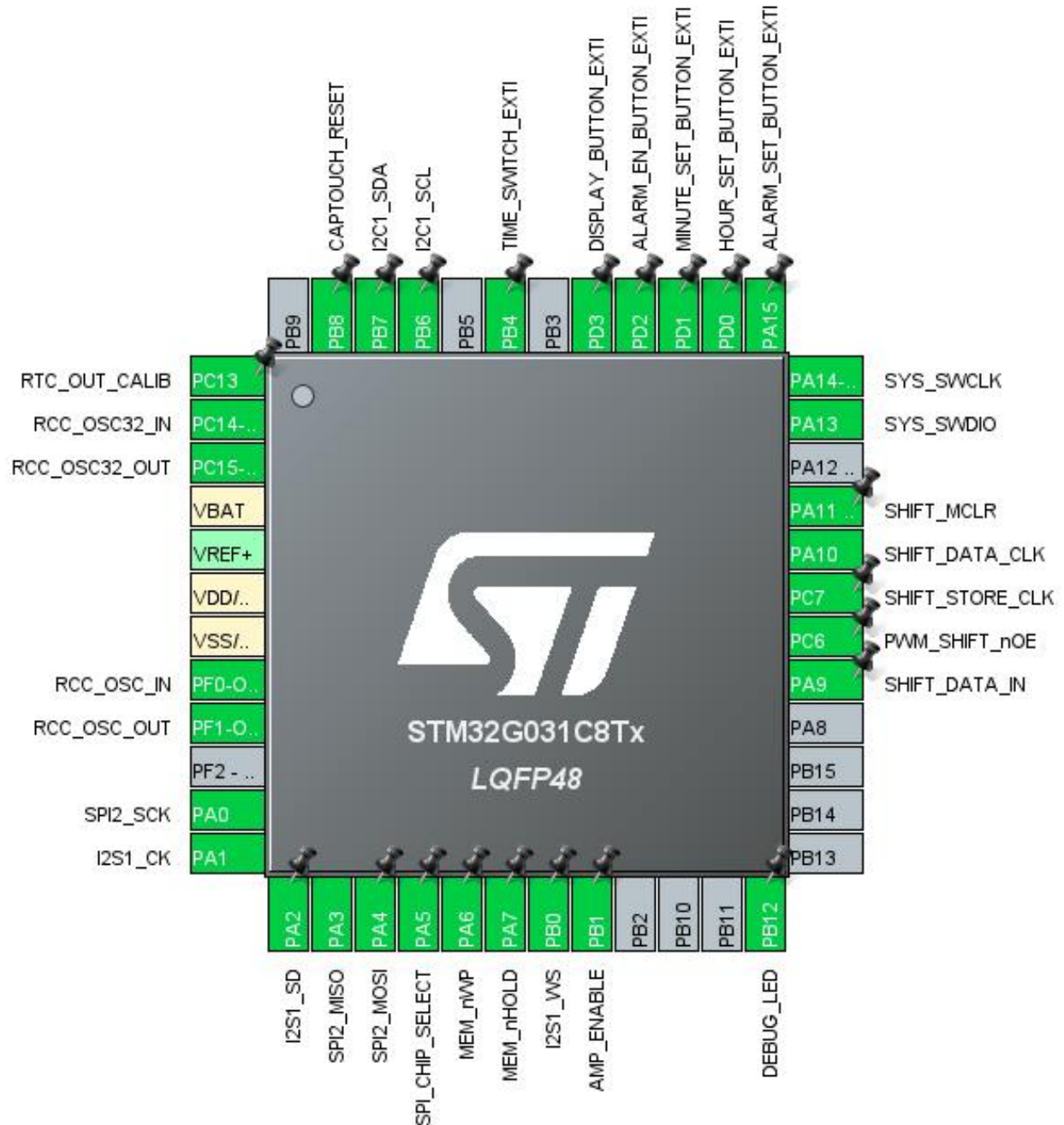
3. Pins Configuration

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	PC13	I/O	RTC_OUT_CALIB	
2	PC14-OSC32_IN (PC14)	I/O	RCC_OSC32_IN	
3	PC15-OSC32_OUT (PC15)	I/O	RCC_OSC32_OUT	
4	VBAT	Power		
6	VDD/VDDA	Power		
7	VSS/VSSA	Power		
8	PF0-OSC_IN (PF0)	I/O	RCC_OSC_IN	
9	PF1-OSC_OUT (PF1)	I/O	RCC_OSC_OUT	
11	PA0	I/O	SPI2_SCK	
12	PA1	I/O	I2S1_CK	
13	PA2	I/O	I2S1_SD	
14	PA3	I/O	SPI2_MISO	
15	PA4	I/O	SPI2_MOSI	
16	PA5 *	I/O	GPIO_Output	SPI_CHIP_SELECT
17	PA6 *	I/O	GPIO_Output	MEM_nWP
18	PA7 *	I/O	GPIO_Output	MEM_nHOLD
19	PB0	I/O	I2S1_WS	
20	PB1 *	I/O	GPIO_Output	AMP_ENABLE
24	PB12 *	I/O	GPIO_Output	DEBUG_LED
29	PA9 *	I/O	GPIO_Output	SHIFT_DATA_IN
30	PC6	I/O	TIM2_CH3	PWM_SHIFT_nOE
31	PC7 *	I/O	GPIO_Output	SHIFT_STORE_CLK
32	PA10 *	I/O	GPIO_Output	SHIFT_DATA_CLK
33	PA11 [PA9] *	I/O	GPIO_Output	SHIFT_MCLR
35	PA13	I/O	SYS_SWDIO	
36	PA14-BOOT0	I/O	SYS_SWCLK	
37	PA15	I/O	GPIO_EXTI15	ALARM_SET_BUTTON_EXTI
38	PD0	I/O	GPIO_EXTI0	HOUR_SET_BUTTON_EXTI
39	PD1	I/O	GPIO_EXTI1	MINUTE_SET_BUTTON_EXTI
40	PD2	I/O	GPIO_EXTI2	ALARM_EN_BUTTON_EXTI
41	PD3	I/O	GPIO_EXTI3	DISPLAY_BUTTON_EXTI
43	PB4	I/O	GPIO_EXTI4	TIME_SWITCH_EXTI

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
45	PB6	I/O	I2C1_SCL	
46	PB7	I/O	I2C1_SDA	
47	PB8 *	I/O	GPIO_Output	CAPTOUCH_RESET

 * The pin is affected with an I/O function

4. Clock Tree Configuration
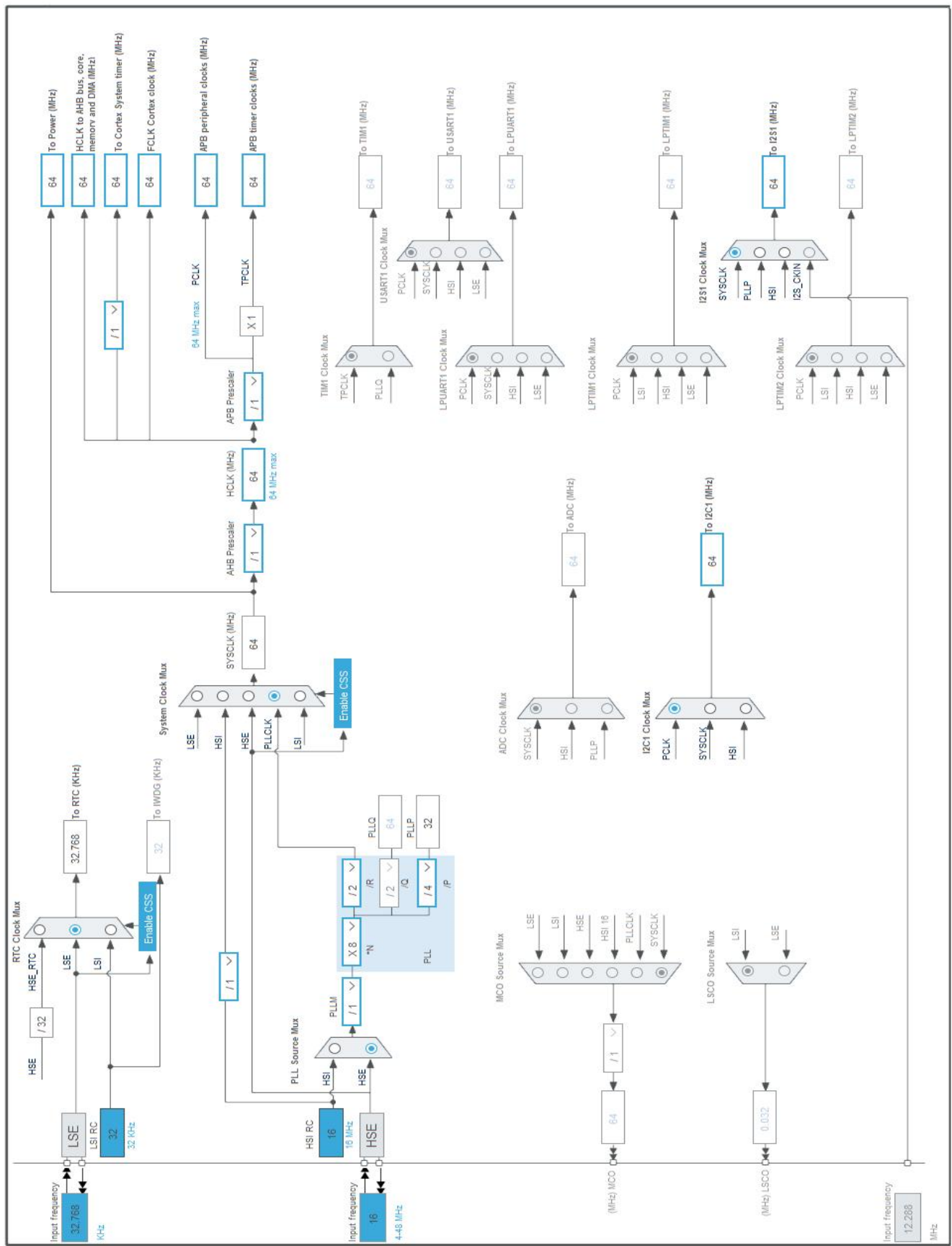
1. Power Consumption Calculator report

1.1. Microcontroller Selection

Series	STM32G0
Line	STM32G0x1
MCU	STM32G031C8Tx
Datasheet	DS12992_Rev0

1.2. Parameter Selection

Temperature	25
Vdd	3.0

1.3. 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

1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP1
Vdd	3.0	3.0
Voltage Source	Battery	Battery
Range	Range1-High	Range1-High
Fetch Type	FLASH	Flash-PowerDown
CPU Frequency	64 MHz	16 MHz
Clock Configuration	HSI PLL	HSI
Clock Source Frequency	16 MHz	16 MHz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	5.25 mA	3.36 µA
Duration	0.1 ms	0.9 ms
DMIPS	80.0	0.0
Ta Max	128.82	130
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	1 ms	Average Current	528.02 µA
Battery Life	1 month, 24 days, 17 hours	Average DMIPS	80.0 DMIPS

1.6. Chart

Consumption Profile by Step
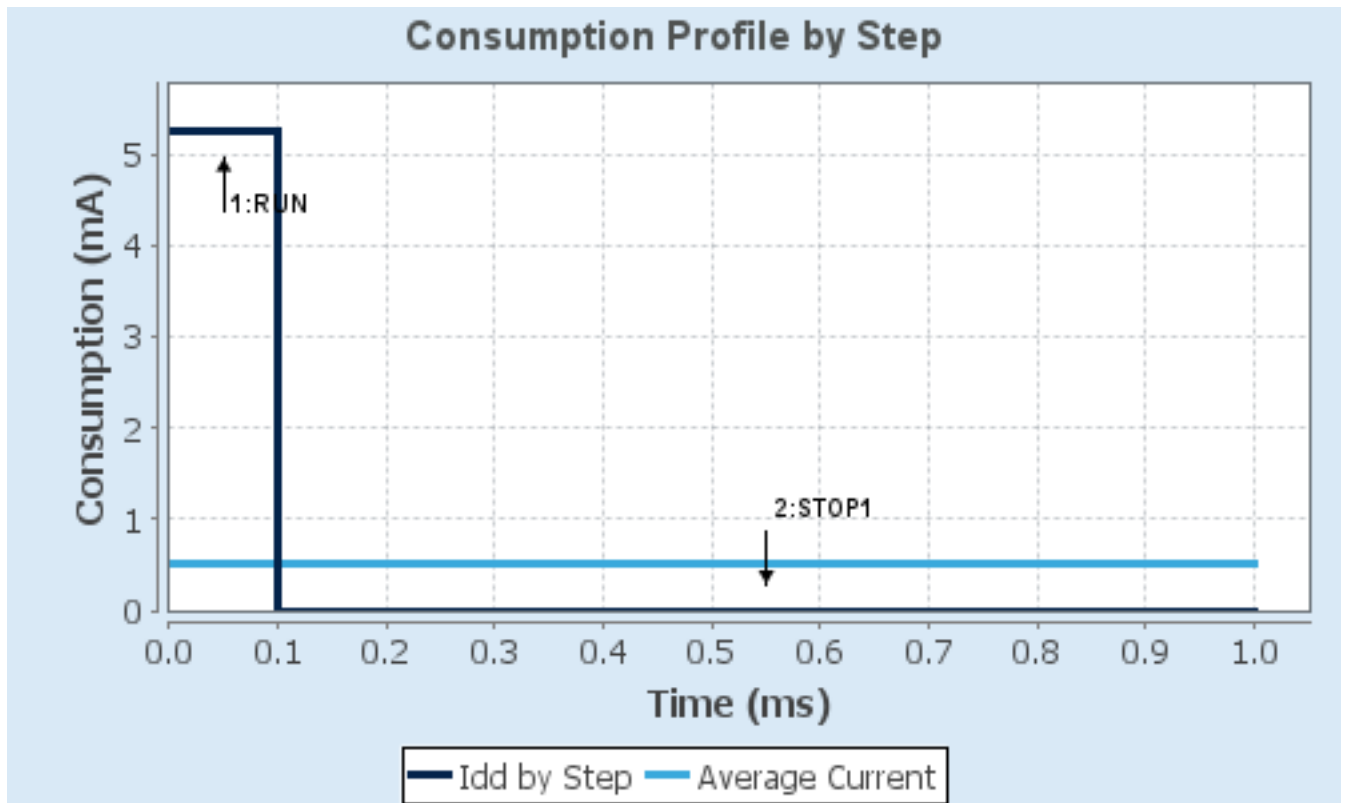
2. Software Project

2.1. Project Settings

Name	Value
Project Name	Beethoven-clock_master_64KB
Project Folder	C:\Lab\beethoven-clock\embedded\Beethoven-clock_master_64KB
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_G0 V1.6.2
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	Yes
Minimum Heap Size	0x200
Minimum Stack Size	0x400

2.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Copy only the necessary library files
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

2.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_DMA_Init	DMA
4	MX_I2C1_Init	I2C1
5	MX_I2S1_Init	I2S1
6	MX_RTC_Init	RTC
7	MX_SPI2_Init	SPI2
8	MX_TIM2_Init	TIM2
9	MX_TIM14_Init	TIM14
10	MX_TIM16_Init	TIM16

3. Peripherals and Middlewares Configuration

3.1. I2C1

I2C: I2C

3.1.1. Parameter Settings:

Timing configuration:

Custom Timing	Disabled
I2C Speed Mode	**Fast Mode ***
I2C Speed Frequency (KHz)	400
Rise Time (ns)	100
Fall Time (ns)	100
Coefficient of Digital Filter	0
Analog Filter	Enabled
Timing	**0x00C12166 ***

Slave Features:

Clock No Stretch Mode	Disabled
General Call Address Detection	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0

3.2. I2S1

Mode: Half-Duplex Master

3.2.1. Parameter Settings:

Generic Parameters:

Transmission Mode	Mode Master Transmit
Communication Standard	I2S Philips
Data and Frame Format	16 Bits Data on 16 Bits Frame
Selected Audio Frequency	**44 KHz ***
Real Audio Frequency	**44.444 KHz ***
Error between Selected and Real	**1.0 % ***

Clock Parameters:

Clock Polarity	Low

3.3. RCC
High Speed Clock (HSE): Crystal/Ceramic Resonator
Low Speed Clock (LSE) : Crystal/Ceramic Resonator
3.3.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	2 WS (3 CPU cycle)

RCC Parameters:

HSI Calibration Value	64
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000
LSE Drive Capability	LSE oscillator low drive capability

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

Peripherals Clock Configuration:

Generate the peripherals clock configuration	TRUE

3.4. RTC
mode: Activate Clock Source
mode: Activate Calendar
Alarm A: Internal Alarm A
Calibration: Calibration 512Hz
3.4.1. Parameter Settings:

General:

Hour Format	**Hourformat 12 ***
Asynchronous Predivider value	127
Synchronous Predivider value	255

Calendar Time:

Data Format	BCD data format
Hours	1
Minutes	0
Seconds	0
SubSeconds	0

Time Format	12 AM
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 A:

Hours	1
Minutes	**1 ***
Seconds	0
Sub Seconds	0
Alarm Mask Date Week day	**Enable ***
Alarm Mask Hours	**Enable ***
Alarm Mask Minutes	Disable
Alarm Mask Seconds	**Enable ***
Alarm Sub Second Mask	All Alarm SS fields are masked.
Alarm Date Week Day Sel	Date
Alarm Date	1

Calibration:

Calibration	Signal has a regular waveform at 512Hz

3.5. SPI2

Mode: Full-Duplex Master

3.5.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**8 ***
Baud Rate	**8.0 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled

| NSSP Mode | Enabled |
| NSS Signal Type | Software |

3.6. SYS
mode: Debug
Timebase Source: SysTick

3.7. TIM2
Channel3: PWM Generation CH3
3.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**800-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**100-1 ***
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 TRGO | Reset (UG bit from TIMx_EGR) |

Clear Input:

| Clear Input Source | Disable |

PWM Generation Channel 3:

Mode	PWM mode 1
Pulse (32 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

3.8. TIM14
mode: Activated
3.8.1. Parameter Settings:

Counter Settings:

| Prescaler (PSC - 16 bits value) | **244*4 *** |
| Counter Mode | Up |

Counter Period (AutoReload Register - 16 bits value)	65535
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

3.9. TIM16
mode: Activated
3.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**58595 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	65535
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	**10 ***
auto-reload preload	Disable

* User modified value

4. System Configuration

4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
I2C1	PB6	I2C1_SCL	Alternate Function Open Drain	No pull-up and no pull-down	Low	
	PB7	I2C1_SDA	Alternate Function Open Drain	No pull-up and no pull-down	Low	
I2S1	PA1	I2S1_CK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA2	I2S1_SD	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB0	I2S1_WS	Alternate Function Push Pull	No pull-up and no pull-down	Low	
RCC	PC14-OSC32_IN (PC14)	RCC_OSC32_IN	n/a	n/a	n/a	
	PC15-OSC32_OUT (PC15)	RCC_OSC32_OUT	n/a	n/a	n/a	
	PF0-OSC_IN (PF0)	RCC_OSC_IN	n/a	n/a	n/a	
	PF1-OSC_OUT (PF1)	RCC_OSC_OUT	n/a	n/a	n/a	
RTC	PC13	RTC_OUT_CALIB	n/a	n/a	n/a	
SPI2	PA0	SPI2_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA3	SPI2_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA4	SPI2_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Low	
SYS	PA13	SYS_SWDIO	n/a	n/a	n/a	
	PA14-BOOT0	SYS_SWCLK	n/a	n/a	n/a	
TIM2	PC6	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down	Low	PWM_SHIFT_nOE
GPIO	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI_CHIP_SELECT
	PA6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MEM_nWP
	PA7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	MEM_nHOLD
	PB1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	AMP_ENABLE
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DEBUG_LED
	PA9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SHIFT_DATA_IN
	PC7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SHIFT_STORE_CLK
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SHIFT_DATA_CLK
	PA11 [PA9]	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SHIFT_MCLR
	PA15	GPIO_EXTI15	**External Interrupt Mode with Falling**	**Pull-up ***	n/a	ALARM_SET_BUTTON_EXTI

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
			edge trigger detection			
	PD0	GPIO_EXTI0	**External Interrupt Mode with Falling edge trigger detection**	**Pull-up ***	n/a	HOUR_SET_BUTTON_EXTI
	PD1	GPIO_EXTI1	**External Interrupt Mode with Falling edge trigger detection**	**Pull-up ***	n/a	MINUTE_SET_BUTTON_EXTI
	PD2	GPIO_EXTI2	**External Interrupt Mode with Falling edge trigger detection**	**Pull-up ***	n/a	ALARM_EN_BUTTON_EXTI
	PD3	GPIO_EXTI3	**External Interrupt Mode with Falling edge trigger detection**	**Pull-up ***	n/a	DISPLAY_BUTTON_EXTI
	PB4	GPIO_EXTI4	**External Interrupt Mode with Rising/Falling edge**	**Pull-up ***	n/a	TIME_SWITCH_EXTI
	PB8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CAPTOUCH_RESET

4.2. DMA configuration

DMA request	Stream	Direction	Priority
SPI2_RX	DMA1_Channel1	Peripheral To Memory	Low
SPI2_TX	DMA1_Channel2	Memory To Peripheral	Low
SPI1_TX	DMA1_Channel3	Memory To Peripheral	**Very High ***

SPI2_RX: DMA1_Channel1 DMA request Settings:

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

SPI2_TX: 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:	**Circular ***
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	**Half Word ***
Memory Data Width:	**Half Word ***

4.3. NVIC configuration

4.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
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
RCC global interrupt	true	0	0
EXTI line 0 and line 1 interrupts	true	0	0
EXTI line 2 and line 3 interrupts	true	1	0
EXTI line 4 to 15 interrupts	true	1	0
DMA1 channel 1 interrupt	true	0	0
DMA1 channel 2 and channel 3 interrupts	true	0	0
TIM16 global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
TIM2 global interrupt	unused		
TIM14 global interrupt	unused		
I2C1 event global interrupt / I2C1 wake-up interrupt through EXTI line 23	unused		
SPI1 global interrupt	unused		
SPI2 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
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
RCC global interrupt	false	true	false
EXTI line 0 and line 1 interrupts	false	true	true
EXTI line 2 and line 3 interrupts	false	true	true
EXTI line 4 to 15 interrupts	false	true	true
DMA1 channel 1 interrupt	false	true	true

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
DMA1 channel 2 and channel 3 interrupts	false	true	true
TIM16 global interrupt	false	true	true

* User modified value

5. System Views

5.1. Category view

5.1.1. Current

6. Docs & Resources

Type	Link
IBIS models	https://www.st.com/resource/en/ibis_model/stm32g0_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32g0-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/stm32g0_marketing_pres.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32-usb-c-pd-solutions-presentation.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-entry-level-graphics.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/flstm32g0.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/flstm32trust.pdf
Flyers	https://www.st.com/resource/en/flyer/fldpstpfc11120.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/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/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

Application Notes https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4221-i2c-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf

Application Notes 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/an4566-extending-the-dac-performance-of-stm32-microcontrollers-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/an4750-handling-of-soft-errors-in-stm32-applications-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4776-generalpurpose-timer-cookbook-for-stm32-microcontrollers-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4803-highspeed-si-simulations-using-ibis-and-boardlevel-simulations-using-hyperlynx-si-on-stm32-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4989-stm32-microcontroller-debug-toolbox-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5096-getting-started-with-stm32g0-series-hardware-development-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5110-stm32cube-
firmware-examples-for-stm32g0-series-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5145-migration-of-
applications-from-stm32f0-series-to-stm32g0-series--
stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4899-stm32-
microcontroller-gpio-hardware-settings-and-lowpower-consumption-
stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5612-esd-protection-
of-stm32-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4991-how-to-wake-
up-an-stm32-microcontroller-from-lowpower-mode-with-the-usart-or-the-
lpuart-stmicroelectronics.pdf

Application Notes 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/an5348-introduction-to-
fdcan-peripherals-for-stm32-product-classes-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

Application Notes https://www.st.com/resource/en/application_note/an4777-how-to-
optimize-power-consumption-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4894-how-to-use-
eeprom-emulation-on-stm32-mcus-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

Application Notes https://www.st.com/resource/en/application_note/an5537-how-to-use-adc-
oversampling-techniques-to-improve-signaltonoise-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

Application Notes https://www.st.com/resource/en/application_note/an5405-how-to-use-

fdcan-bootloader-protocol-on-stm32-mcus-stmicroelectronics.pdf

Application Notes	https://www.st.com/resource/en/application_note/an5690-how-to-use-vrefbuf-peripheral-on-stm32-mcus-and-mpus-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
Application Notes	https://www.st.com/resource/en/application_note/an2548-introduction-to-dma-controller-for-stm32-mcus-stmicroelectronics.pdf
Application Notes	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
Application Notes	https://www.st.com/resource/en/application_note/an4635-how-to-optimize-lpuart-power-consumption-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
Application Notes	https://www.st.com/resource/en/application_note/an4908-getting-started-with-usart-automatic-baud-rater-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
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