



## 1. Description

### 1.1. Project

Project Name	linear_psu
Board Name	custom
Generated with:	STM32CubeMX 6.15.0
Date	09/27/2025

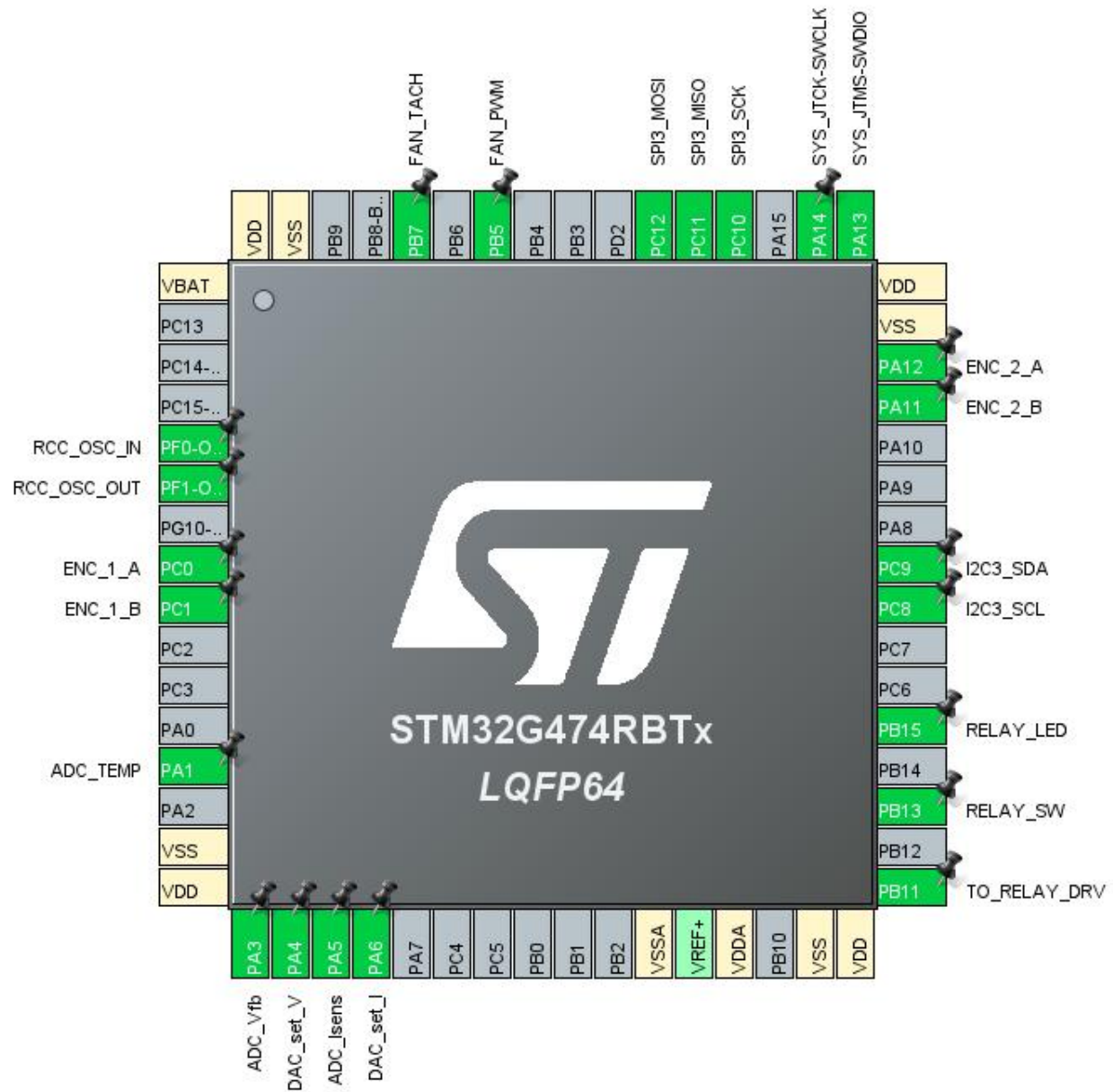
### 1.2. MCU

MCU Series	STM32G4
MCU Line	STM32G4x4
MCU name	STM32G474RBTx
MCU Package	LQFP64
MCU Pin number	64

### 1.3. Core(s) information

Core(s)	ARM Cortex-M4
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## 2. Pinout Configuration

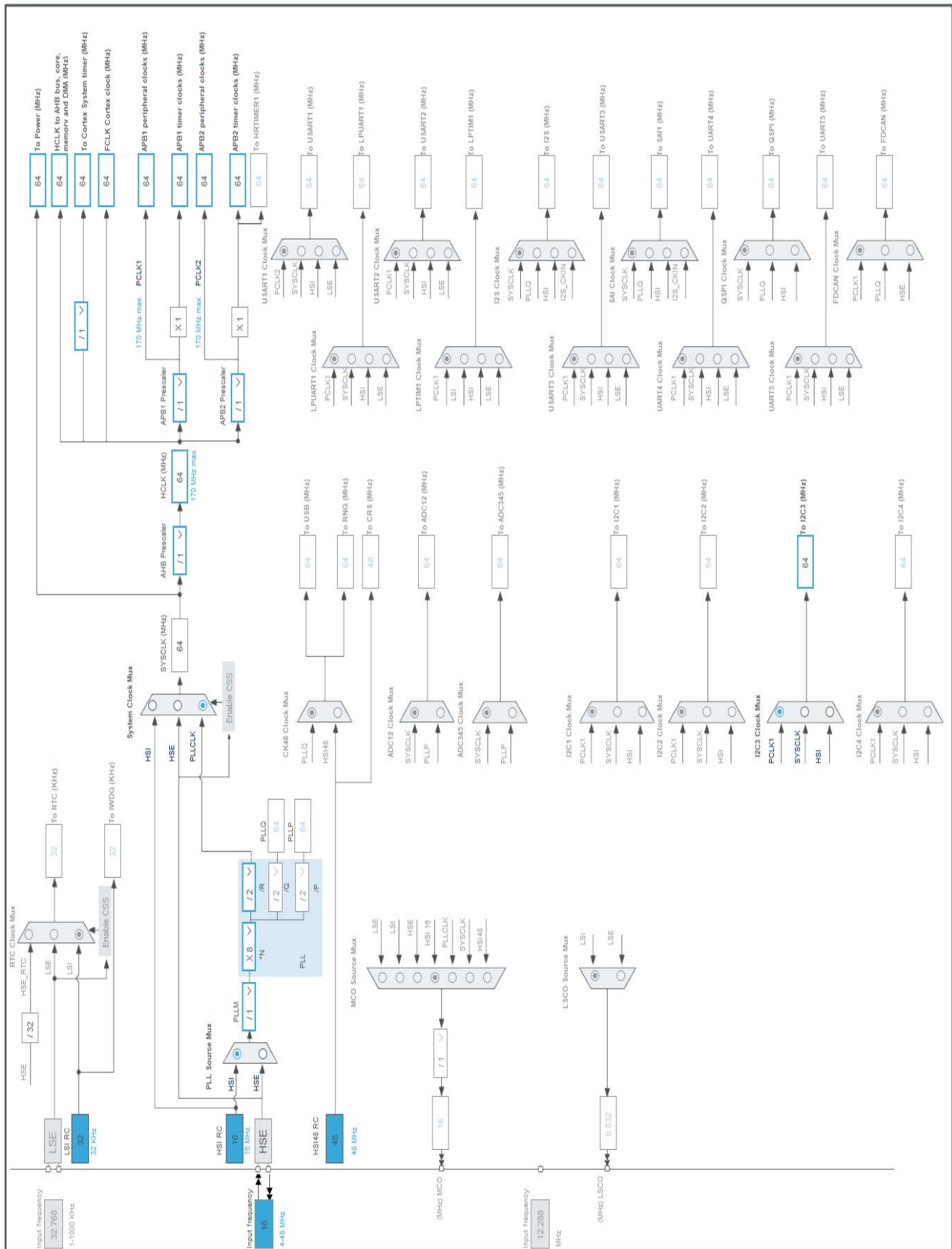


### 3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
5	PF0-OSC_IN	I/O	RCC_OSC_IN	
6	PF1-OSC_OUT	I/O	RCC_OSC_OUT	
8	PC0	I/O	TIM1_CH1	ENC_1_A
9	PC1	I/O	TIM1_CH2	ENC_1_B
13	PA1	I/O	ADC1_IN2	ADC_TEMP
15	VSS	Power		
16	VDD	Power		
17	PA3	I/O	ADC1_IN4	ADC_Vfb
18	PA4	I/O	DAC1_OUT1	DAC_set_V
19	PA5	I/O	ADC2_IN13	ADC_Isens
20	PA6	I/O	DAC2_OUT1	DAC_set_I
27	VSSA	Power		
29	VDDA	Power		
31	VSS	Power		
32	VDD	Power		
33	PB11 *	I/O	GPIO_Output	TO_RELAY_DRV
35	PB13 *	I/O	GPIO_Input	RELAY_SW
37	PB15 *	I/O	GPIO_Output	RELAY_LED
40	PC8	I/O	I2C3_SCL	
41	PC9	I/O	I2C3_SDA	
45	PA11	I/O	TIM4_CH1	ENC_2_B
46	PA12	I/O	TIM4_CH2	ENC_2_A
47	VSS	Power		
48	VDD	Power		
49	PA13	I/O	SYS_JTMS-SWDIO	
50	PA14	I/O	SYS_JTCK-SWCLK	
52	PC10	I/O	SPI3_SCK	
53	PC11	I/O	SPI3_MISO	
54	PC12	I/O	SPI3_MOSI	
58	PB5	I/O	TIM3_CH2	FAN_PWM
60	PB7	I/O	TIM3_CH4	FAN_TACH
63	VSS	Power		
64	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	STM32G4
Line	STM32G4x4
MCU	STM32G474RBTx
Datasheet	DS12288_Rev0

### 1.2. Parameter Selection

Temperature	25
Vdd	3.0

### 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

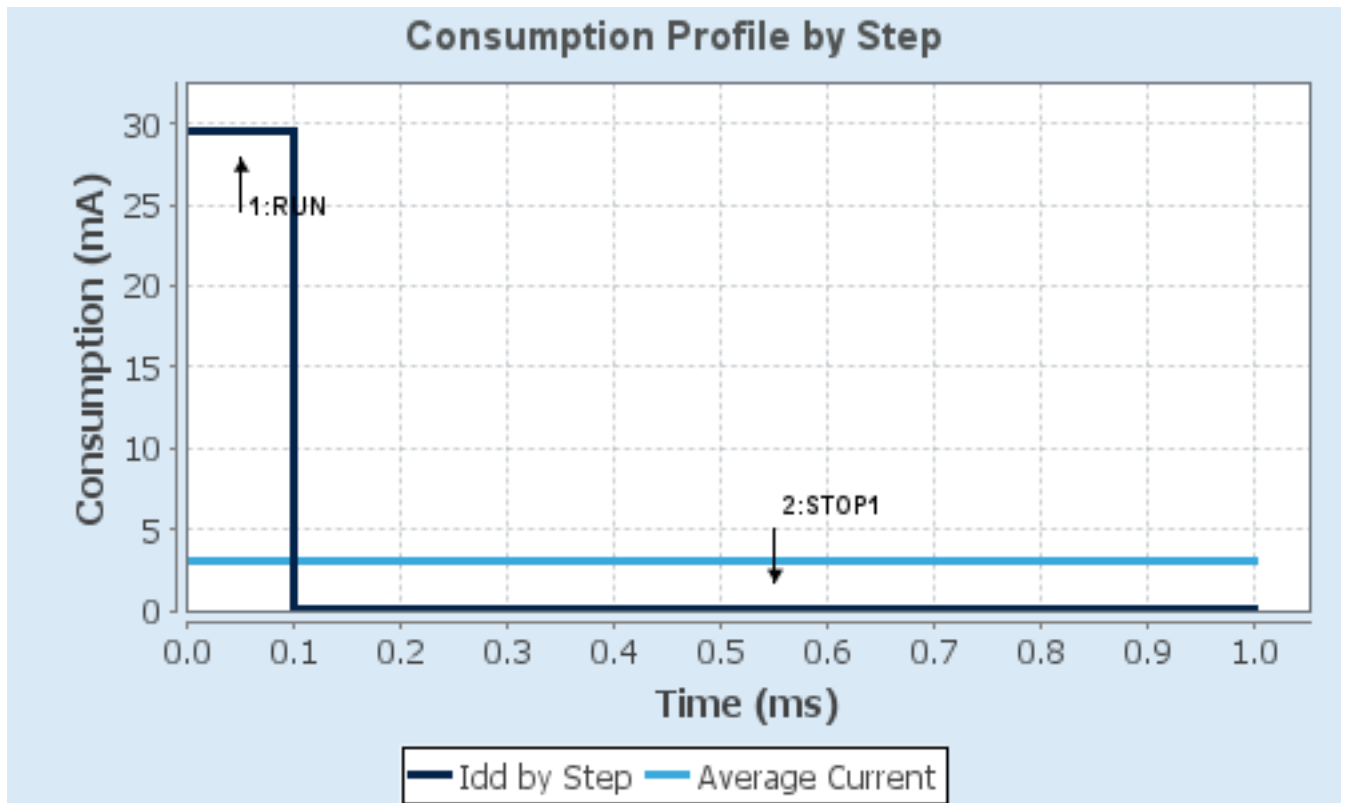
<b>Step</b>	Step1	Step2
<b>Mode</b>	RUN	STOP1
<b>Vdd</b>	3.0	3.0
<b>Voltage Source</b>	Battery	Battery
<b>Range</b>	Range1-Boost	NoRange
<b>Fetch Type</b>	FLASH/DualBank/ART	NA
<b>CPU Frequency</b>	170 MHz	0 Hz
<b>Clock Configuration</b>	HSE BYP PLL	ALL CLOCKS OFF
<b>Clock Source Frequency</b>	4 MHz	0 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	29.5 mA	80.5 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	213.0	0.0
<b>Ta Max</b>	124.25	129.98
<b>Category</b>	In DS Table	In DS Table

#### 1.5. Results

Sequence Time	1 ms	Average Current	3.02 mA
Battery Life	1 month, 16 days, 9 hours	Average DMIPS	212.5 DMIPS

#### 1.6. Chart





## 2. Software Project

### 2.1. Project Settings

Name	Value
Project Name	linear_psu
Project Folder	C:\Users\oiiai\Documents\workspace\linear_psu
Toolchain / IDE	CMake
Firmware Package Name and Version	STM32Cube FW_G4 V1.6.1
Application Structure	Advanced
Generate Under Root	No
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 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

### 2.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_ADC1_Init	ADC1
4	MX_ADC2_Init	ADC2
5	MX_DAC1_Init	DAC1
6	MX_DAC2_Init	DAC2
7	MX_I2C3_Init	I2C3
8	MX_SPI3_Init	SPI3
9	MX_TIM1_Init	TIM1
10	MX_TIM3_Init	TIM3
11	MX_TIM4_Init	TIM4



### 3. Peripherals and Middlewares Configuration

#### 3.1. ADC1

**IN2: IN2 Single-ended**

**IN4: IN4 Single-ended**

##### 3.1.1. Parameter Settings:

##### **ADCs\_Common\_Settings:**

Mode Independent mode

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

Clock Prescaler Synchronous clock mode divided by 2

Resolution ADC 12-bit resolution

Data Alignment Right alignment

Gain Compensation 0

Scan Conversion Mode Disabled

End Of Conversion Selection End of single conversion

Low Power Auto Wait Disabled

Continuous Conversion Mode Disabled

Discontinuous Conversion Mode Disabled

DMA Continuous Requests Disabled

Overrun behaviour Overrun data preserved

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

Enable Regular Conversions Enable

Enable Regular Oversampling Disable

Number Of Conversion 1

External Trigger Conversion Source Regular Conversion launched by software

External Trigger Conversion Edge None

Rank 1

Channel Channel 2

Sampling Time 2.5 Cycles

Offset Number No offset

##### **ADC\_Injected\_ConversionMode:**

Enable Injected Conversions Disable

##### **Analog Watchdog 1:**

Enable Analog WatchDog1 Mode false

##### **Analog Watchdog 2:**

Enable Analog WatchDog2 Mode false

##### **Analog Watchdog 3:**

Enable Analog WatchDog3 Mode false

## 3.2. ADC2

### IN13: IN13 Single-ended

#### 3.2.1. Parameter Settings:

##### ADCs\_Common\_Settings:

Mode Independent mode

##### ADC\_Settings:

Clock Prescaler Synchronous clock mode divided by 2

Resolution ADC 12-bit resolution

Data Alignment Right alignment

Gain Compensation 0

Scan Conversion Mode Disabled

End Of Conversion Selection End of single conversion

Low Power Auto Wait Disabled

Continuous Conversion Mode Disabled

Discontinuous Conversion Mode Disabled

DMA Continuous Requests Disabled

Overrun behaviour Overrun data preserved

##### ADC\_Regular\_ConversionMode:

Enable Regular Conversions Enable

Enable Regular Oversampling Disable

Number Of Conversion 1

External Trigger Conversion Source Regular Conversion launched by software

External Trigger Conversion Edge None

Rank 1

Channel Channel 13

Sampling Time 2.5 Cycles

Offset Number No offset

##### ADC\_Injected\_ConversionMode:

Enable Injected Conversions Disable

##### Analog Watchdog 1:

Enable Analog WatchDog1 Mode false

##### Analog Watchdog 2:

Enable Analog WatchDog2 Mode false

##### Analog Watchdog 3:

Enable Analog WatchDog3 Mode false

### 3.3. DAC1

#### OUT1 mode: Connected to external pin only

##### 3.3.1. Parameter Settings:

###### DAC Out1 Settings:

Mode selected	Normal Mode
Output Buffer	Enable
DAC High Frequency	Mode Automatic
DMA Double Data	Disable
Signed Format	Disable
Trigger	None
Trigger2	None
User Trimming	Factory trimming

### 3.4. DAC2

#### OUT1 mode: Connected to external pin only

##### 3.4.1. Parameter Settings:

###### DAC Out1 Settings:

Mode selected	Normal Mode
Output Buffer	Enable
DAC High Frequency	Mode Automatic
DMA Double Data	Disable
Signed Format	Disable
Trigger	None
Trigger2	None
User Trimming	Factory trimming

### 3.5. I2C3

#### I2C: I2C

##### 3.5.1. Parameter Settings:

###### Timing configuration:

Custom Timing	Disabled
I2C Speed Mode	Standard Mode
I2C Speed Frequency (KHz)	100

Rise Time (ns)	100
Fall Time (ns)	100
Coefficient of Digital Filter	0
Analog Filter	Enabled
Timing	<b>0x10B17DB5 *</b>

**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

### 3.6. RCC

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

##### 3.6.1. Parameter Settings:

**System Parameters:**

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Disabled
Data Cache	Enabled
Flash Latency(WS)	2 WS (3 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
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**Peripherals Clock Configuration:**

Generate the peripherals clock configuration	TRUE
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### 3.7. SPI3

#### Mode: Full-Duplex Master

##### 3.7.1. Parameter Settings:

**Basic Parameters:**

Frame Format	Motorola
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Data Size	4 Bits
First Bit	MSB First

#### Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	<b>32.0 MBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

#### Advanced Parameters:

CRC Calculation	Disabled
NSSP Mode	Enabled
NSS Signal Type	Software

### 3.8. SYS

#### Debug: Serial Wire

**Timebase Source: SysTick**

**mode: save power of non-active UCPD - deactive Dead Battery pull-up**

### 3.9. TIM1

#### Combined Channels: Encoder Mode

##### 3.9.1. Parameter Settings:

#### Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Dithering	Disable
Counter Period (AutoReload Register - 16 bits value )	65535
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	Reset (UG bit from TIMx_EGR)

#### Encoder:

Encoder Mode	Encoder Mode TI1
Slave Mode Preload Activation	Disable
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct



Prescaler Division Ratio	No division
Input Filter	0
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

### 3.10. TIM3

#### Channel2: PWM Generation CH2

#### Channel4: Input Capture direct mode

##### 3.10.1. Parameter Settings:

##### Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Dithering	Disable
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 TRGO	Reset (UG bit from TIMx_EGR)

##### Clear Input:

Clear Input Source	Disable
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##### PWM Generation Channel 2:

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

##### Input Capture Channel 4:

Polarity Selection	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter (4 bits value)	0

### 3.11. TIM4

#### Combined Channels: Encoder Mode

##### 3.11.1. Parameter Settings:

###### Counter Settings:

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Dithering	Disable
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 TRGO	Reset (UG bit from TIMx_EGR)

###### Encoder:

Encoder Mode	Encoder Mode T11
Slave Mode Preload Activation	Disable
____ Parameters for Channel 1 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0
____ Parameters for Channel 2 ____	
Polarity	Rising Edge
IC Selection	Direct
Prescaler Division Ratio	No division
Input Filter	0

\* User modified value

## 4. System Configuration

### 4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PA1	ADC1_IN2	Analog mode	No pull-up and no pull-down	n/a	ADC_TEMP
	PA3	ADC1_IN4	Analog mode	No pull-up and no pull-down	n/a	ADC_Vfb
ADC2	PA5	ADC2_IN13	Analog mode	No pull-up and no pull-down	n/a	ADC_Isens
DAC1	PA4	DAC1_OUT1	Analog mode	No pull-up and no pull-down	n/a	DAC_set_V
DAC2	PA6	DAC2_OUT1	Analog mode	No pull-up and no pull-down	n/a	DAC_set_I
I2C3	PC8	I2C3_SCL	Alternate Function Open Drain	No pull-up and no pull-down	Low	
	PC9	I2C3_SDA	Alternate Function Open Drain	No pull-up and no pull-down	Low	
RCC	PF0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PF1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
SPI3	PC10	SPI3_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC11	SPI3_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PC12	SPI3_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Low	
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
TIM1	PC0	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENC_1_A
	PC1	TIM1_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENC_1_B
TIM3	PB5	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	FAN_PWM
	PB7	TIM3_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	FAN_TACH
TIM4	PA11	TIM4_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENC_2_B
	PA12	TIM4_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	ENC_2_A
GPIO	PB11	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TO_RELAY_DRV
	PB13	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	RELAY_SW
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RELAY_LED

### 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
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
PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/38/39/40/41	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
ADC1 and ADC2 global interrupt	unused		
TIM1 break interrupt and TIM15 global interrupt	unused		
TIM1 update interrupt and TIM16 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM17 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM3 global interrupt	unused		
TIM4 global interrupt	unused		
SPI3 global interrupt	unused		
TIM6 global interrupt, DAC1 and DAC3 channel underrun error interrupts	unused		
TIM7 global interrupt, DAC2 and DAC4 channel underrun error interrupts	unused		
FPU global interrupt	unused		
I2C3 event interrupt / I2C3 wake-up interrupt through EXTI line 27	unused		
I2C3 error 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

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Prefetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	true	false
Debug monitor	false	true	false
Pendable request for system service	false	true	false
System tick timer	false	true	true

\* User modified value

## 5. System Views

### 5.1. Category view

#### 5.1.1. Current

Middleware							
System Core	Analog	Timers	Connectivity	Multimedia	Security	Computing	Utilities
DMA	ADC1 ✓	TIM1 ✓	I2C3 ✓				
GPIO ✓	ADC2 ✓	TIM3 ✓	SPI3 ✓				
IVVIC ✓	DAC1 ✓	TIM4 ✓					
RCC ✓	DAC2 ✓						
SYS ✓							

## 6. Docs & Resources

Type	Link
BSDL files	<a href="https://www.st.com/resource/en/bsdl_model/stm32g4_bsdل.zip">https://www.st.com/resource/en/bsdl_model/stm32g4_bsdل.zip</a>
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32g4_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32g4_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32g4_svd.zip">https://www.st.com/resource/en/svd/stm32g4_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-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>
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-stm32g4-series-product-overview.pdf">https://www.st.com/resource/en/product_presentation/microcontrollers-stm32g4-series-product-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/flstm32g4.pdf">https://www.st.com/resource/en/flyer/flstm32g4.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/flstm32trust.pdf">https://www.st.com/resource/en/flyer/flstm32trust.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flpowerstbd.pdf">https://www.st.com/resource/en/flyer/flpowerstbd.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/fldpstpf11120.pdf">https://www.st.com/resource/en/flyer/fldpstpf11120.pdf</a>
Security Bulletin	<a href="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</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1709-emc-design-">https://www.st.com/resource/en/application_note/an1709-emc-design-</a>

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](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/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/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/an4232-getting-started-with-analog-comparators-for-stm32f3-series-and-stm32g4-series-devices-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4232-getting-started-with-analog-comparators-for-stm32f3-series-and-stm32g4-series-devices-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/an4296-use-stm32f3stm32g4-ccm-sram-with-iar-embedded-workbench-keil-mdkarm-stmicroelectronics-stm32cubeide-and-other-gnubased-toolchains-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4296-use-stm32f3stm32g4-ccm-sram-with-iar-embedded-workbench-keil-mdkarm-stmicroelectronics-stm32cubeide-and-other-gnubased-toolchains-stmicroelectronics.pdf)

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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>
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User Manuals	<a href="https://www.st.com/resource/en/user_manual/um3167-stm32g4-series-">https://www.st.com/resource/en/user_manual/um3167-stm32g4-series-</a>

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