



1. Description

1.1. Project

Project Name	Weerstation
Board Name	custom
Generated with:	STM32CubeMX 6.4.0
Date	02/20/2022

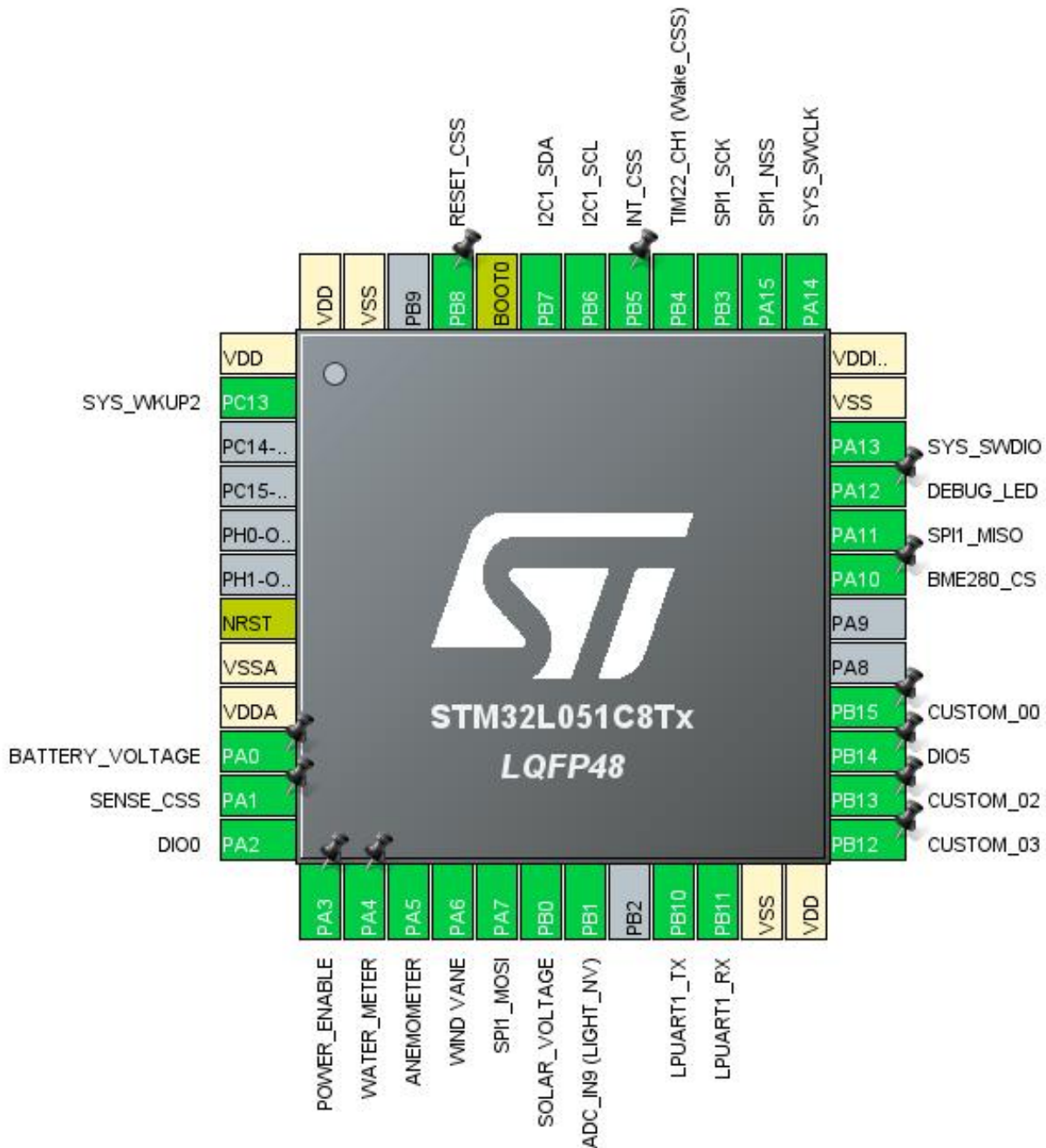
1.2. MCU

MCU Series	STM32L0
MCU Line	STM32L0x1
MCU name	STM32L051C8Tx
MCU Package	LQFP48
MCU Pin number	48

1.3. Core(s) information

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



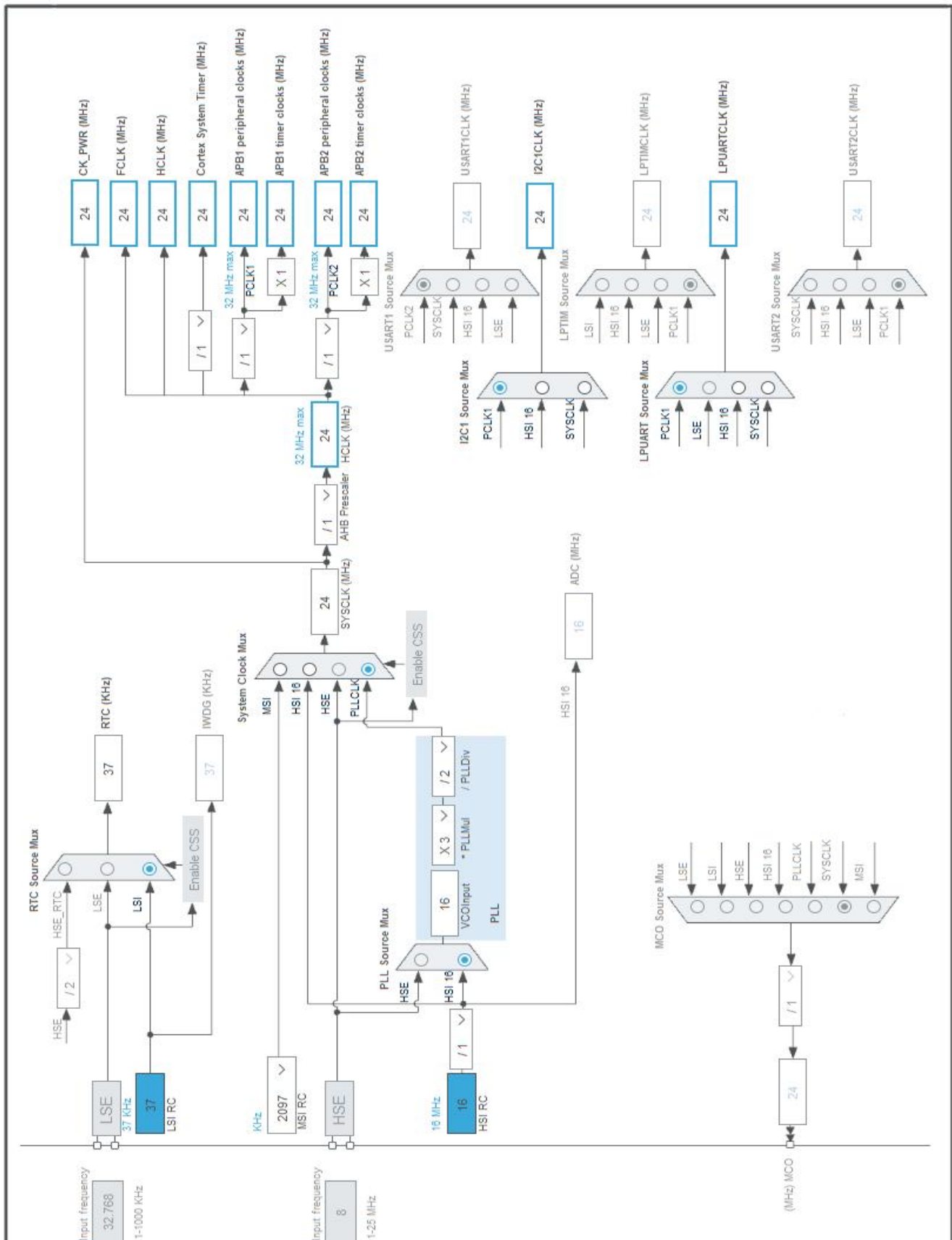
3. Pins Configuration

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VDD	Power		
2	PC13	I/O	SYS_WKUP2	
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0	I/O	ADC_IN0	BATTERY_VOLTAGE
11	PA1	I/O	TIM2_CH2	SENSE_CSS
12	PA2	I/O	TIM21_CH1	DIO0
13	PA3	I/O	TIM2_CH4	POWER_ENABLE
14	PA4	I/O	GPIO_EXTI4	WATER_METER
15	PA5	I/O	ADC_IN5	ANEMOMETER
16	PA6	I/O	ADC_IN6	WIND_VANE
17	PA7	I/O	SPI1_MOSI	
18	PB0	I/O	ADC_IN8	SOLAR_VOLTAGE
19	PB1	I/O	ADC_IN9	ADC_IN9 (LIGHT_NV)
21	PB10	I/O	LPUART1_TX	
22	PB11	I/O	LPUART1_RX	
23	VSS	Power		
24	VDD	Power		
25	PB12 *	I/O	GPIO_Output	CUSTOM_03
26	PB13 *	I/O	GPIO_Output	CUSTOM_02
27	PB14	I/O	TIM21_CH2	DIO5
28	PB15 *	I/O	GPIO_Output	CUSTOM_00
31	PA10 *	I/O	GPIO_Output	BME280_CS
32	PA11	I/O	SPI1_MISO	
33	PA12 *	I/O	GPIO_Output	DEBUG_LED
34	PA13	I/O	SYS_SWDIO	
35	VSS	Power		
36	VDDIO2	Power		
37	PA14	I/O	SYS_SWCLK	
38	PA15	I/O	SPI1_NSS	
39	PB3	I/O	SPI1_SCK	
40	PB4	I/O	TIM22_CH1	TIM22_CH1 (Wake_CSS)
41	PB5 *	I/O	GPIO_Input	INT_CSS
42	PB6	I/O	I2C1_SCL	
43	PB7	I/O	I2C1_SDA	

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
44	BOOT0	Boot		
45	PB8 *	I/O	GPIO_Output	RESET_CSS
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	Weerstation
Project Folder	C:\Users\jacco\Desktop\Weerstation
Toolchain / IDE	EWARM V8.32
Firmware Package Name and Version	STM32Cube FW_L0 V1.12.1
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	MX_GPIO_Init	GPIO
2	SystemClock_Config	RCC
3	MX_ADC_Init	ADC
4	MX_I2C1_Init	I2C1
5	MX_LPUART1_UART_Init	LPUART1
6	MX_SPI1_Init	SPI1
7	MX_TIM2_Init	TIM2
8	MX_TIM22_Init	TIM22
9	MX_TIM21_Init	TIM21
10	MX_RTC_Init	RTC

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32L0
Line	STM32L0x1
MCU	STM32L051C8Tx
Datasheet	DS10184_Rev7

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

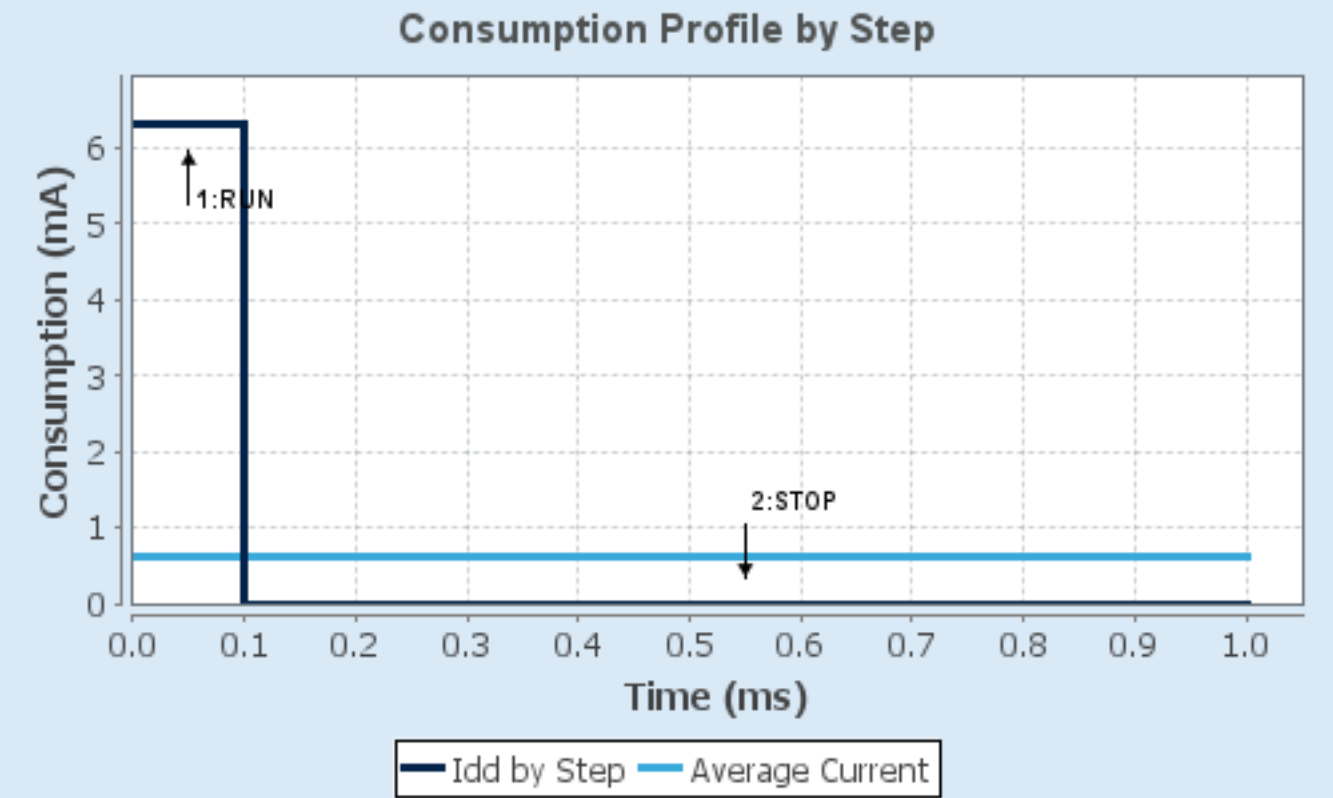
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.0	3.0
Voltage Source	Battery	Battery
Range	Range1-High	NoRange
Fetch Type	FLASH	n/a
CPU Frequency	32 MHz	0 Hz
Clock Configuration	HSEBYP PLL	ALL CLOCKS OFF
Clock Source Frequency	16 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	6.3 mA	410 nA
Duration	0.1 ms	0.9 ms
DMIPS	30.0	0.0
Ta Max	103.96	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	630.37 μ A
Battery Life	1 month, 15 days, 19 hours	Average DMIPS	30.4 DMIPS

6.6. Chart



7. Peripherals and Middlewares Configuration

7.1. ADC

mode: IN0

mode: IN5

mode: IN6

mode: IN8

mode: IN9

mode: Temperature Sensor Channel

7.1.1. Parameter Settings:

ADC_Settings:

Clock Prescaler	Synchronous clock mode divided by 2
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Direction	Forward
Continuous Conversion Mode	Disabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Disabled
End Of Conversion Selection	End of single conversion
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled
Low Frequency Mode	Disabled
Auto Off	Disabled
Oversampling Mode	Disabled

ADC_Regular_ConversionMode:

Sampling Time	1.5 Cycles
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None

WatchDog:

Enable Analog WatchDog Mode	false
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7.2. I2C1

I2C: I2C

7.2.1. Parameter Settings:

Timing configuration:

I2C Speed Mode	Standard Mode
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I2C Speed Frequency (KHz)	100
Rise Time (ns)	0
Fall Time (ns)	0
Coefficient of Digital Filter	0
Analog Filter	Enabled
Timing	0x00506682 *

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

7.3. LPUART1

Mode: Asynchronous

7.3.1. Parameter Settings:

Basic Parameters:

Baud Rate	209700
Word Length	7 Bits (including Parity)
Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Single Sample	Disable

Advanced Features:

Auto Baudrate Mode	Disable
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

7.4. RCC

7.4.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Buffer Cache	Enabled
Prefetch	Disabled
Preread	Enabled
Flash Latency(WS)	1 WS (2 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
MSI Calibration Value	0
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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7.5. RTC

mode: Activate Clock Source

mode: Activate Calendar

7.5.1. 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
Day Light Saving: value of hour adjustment	Daylightsaving None
Store Operation	Storeoperation Reset

Calendar Date:

Week Day	Monday
Month	January
Date	1
Year	0

7.6. SPI1

Mode: Full-Duplex Master

Hardware NSS Signal: Hardware NSS Output Signal

7.6.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	12.0 MBits/s *
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Output Hardware

7.7. SYS

mode: Debug Serial Wire

mode: System Wake-Up 2

Timebase Source: SysTick

7.8. TIM2

Channel2: Output Compare CH2

Channel4: Output Compare CH4

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 2:

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

Output Compare Channel 4:

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

7.9. TIM21

Channel1: Output Compare CH1

Channel2: Output Compare CH2

7.9.1. 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 1:

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

Output Compare Channel 2:

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

7.10. TIM22

Channel1: Output Compare CH1

7.10.1. 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 1:

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

* User modified value

8. System Configuration

8.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC	PA0	ADC_IN0	Analog mode	No pull-up and no pull-down	n/a	BATTERY_VOLTAGE
	PA5	ADC_IN5	Analog mode	No pull-up and no pull-down	n/a	ANEMOMETER
	PA6	ADC_IN6	Analog mode	No pull-up and no pull-down	n/a	WIND VANE
	PB0	ADC_IN8	Analog mode	No pull-up and no pull-down	n/a	SOLAR_VOLTAGE
	PB1	ADC_IN9	Analog mode	No pull-up and no pull-down	n/a	ADC_IN9 (LIGHT_NV)
I2C1	PB6	I2C1_SCL	Alternate Function Open Drain	No pull-up and no pull-down	Very High *	
	PB7	I2C1_SDA	Alternate Function Open Drain	No pull-up and no pull-down	Very High *	
LPUART1	PB10	LPUART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PB11	LPUART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
SPI1	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PA11	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PA15	SPI1_NSS	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
	PB3	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Very High *	
SYS	PC13	SYS_WKUP2	n/a	n/a	n/a	
	PA13	SYS_SWDIO	n/a	n/a	n/a	
	PA14	SYS_SWCLK	n/a	n/a	n/a	
TIM2	PA1	TIM2_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	SENSE_CSS
	PA3	TIM2_CH4	Alternate Function Push Pull	No pull-up and no pull-down	Low	POWER_ENABLE
TIM21	PA2	TIM21_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	DIO0
	PB14	TIM21_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	DIO5
TIM22	PB4	TIM22_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	TIM22_CH1 (Wake_CSS)
GPIO	PA4	GPIO_EXTI4	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	WATER_METER
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CUSTOM_03
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CUSTOM_02
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	CUSTOM_00
	PA10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BME280_CS

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	DEBUG_LED
	PB5	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	INT_CSS
	PB8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RESET_CSS

8.2. DMA configuration

nothing configured in DMA service

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
PVD interrupt through EXTI line 16	unused		
Flash and EEPROM global interrupt	unused		
RCC global interrupt	unused		
EXTI line 4 to 15 interrupts	unused		
ADC, COMP1 and COMP2 interrupts (COMP interrupts through EXTI lines 21 and 22)	unused		
TIM2 global interrupt	unused		
TIM21 global interrupt	unused		
TIM22 global interrupt	unused		
I2C1 event global interrupt / I2C1 wake-up interrupt through EXTI line 23	unused		
SPI1 global interrupt	unused		
LPUART1 global interrupt / LPUART1 wake-up interrupt through EXTI line 28	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

* User modified value

9. System Views

9.1. Category view

9.1.1. Current

Middleware					
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System Core	Analog	Timers	Connectivity	Multimedia	Computing
DMA	ADC ✓	RTC ✓	I2C1 ✓		
GPIO ✓		TIM2 ✓	LPUART1 ✓		
IVVIC ✓		TIM21 ✓	SP1 ✓		
RCC ✓		TIM22 ✓			
SYS ✓					

10. Docs & Resources

Type	Link
Datasheet	http://www.st.com/resource/en/datasheet/DM00108219.pdf
Reference manual	http://www.st.com/resource/en/reference_manual/DM00108282.pdf
Programming manual	http://www.st.com/resource/en/programming_manual/DM00104451.pdf
Errata sheet	http://www.st.com/resource/en/errata_sheet/DM00114897.pdf
Application note	http://www.st.com/resource/en/application_note/CD00160362.pdf
Application note	http://www.st.com/resource/en/application_note/CD00167594.pdf
Application note	http://www.st.com/resource/en/application_note/CD00211314.pdf
Application note	http://www.st.com/resource/en/application_note/CD00259245.pdf
Application note	http://www.st.com/resource/en/application_note/CD00264342.pdf
Application note	http://www.st.com/resource/en/application_note/CD00264379.pdf
Application note	http://www.st.com/resource/en/application_note/DM00042534.pdf
Application note	http://www.st.com/resource/en/application_note/DM00072315.pdf
Application note	http://www.st.com/resource/en/application_note/DM00073742.pdf
Application note	http://www.st.com/resource/en/application_note/DM00073853.pdf
Application note	http://www.st.com/resource/en/application_note/DM00081379.pdf
Application note	http://www.st.com/resource/en/application_note/DM00085385.pdf
Application note	http://www.st.com/resource/en/application_note/DM00087593.pdf
Application note	http://www.st.com/resource/en/application_note/DM00108286.pdf
Application note	http://www.st.com/resource/en/application_note/DM00112257.pdf
Application note	http://www.st.com/resource/en/application_note/DM00129215.pdf
Application note	http://www.st.com/resource/en/application_note/DM00145318.pdf
Application note	http://www.st.com/resource/en/application_note/DM00150423.pdf
Application note	http://www.st.com/resource/en/application_note/DM00151811.pdf
Application note	http://www.st.com/resource/en/application_note/DM00158601.pdf
Application note	http://www.st.com/resource/en/application_note/DM00160482.pdf

Application note http://www.st.com/resource/en/application_note/DM00206898.pdf

Application note http://www.st.com/resource/en/application_note/DM00209725.pdf

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Application note http://www.st.com/resource/en/application_note/DM00315319.pdf

Application note http://www.st.com/resource/en/application_note/DM00327191.pdf

Application note http://www.st.com/resource/en/application_note/DM00354244.pdf

Application note http://www.st.com/resource/en/application_note/DM00355687.pdf

Application note http://www.st.com/resource/en/application_note/DM00380469.pdf

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Application note http://www.st.com/resource/en/application_note/DM00493651.pdf

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Application note http://www.st.com/resource/en/application_note/DM00660597.pdf

Application note http://www.st.com/resource/en/application_note/DM00725181.pdf