
STM32
CubeMX

1. Description

1.1. Project

Project Name	BMScableL431
Board Name	custom
Generated with:	STM32CubeMX 6.3.0
Date	08/08/2021

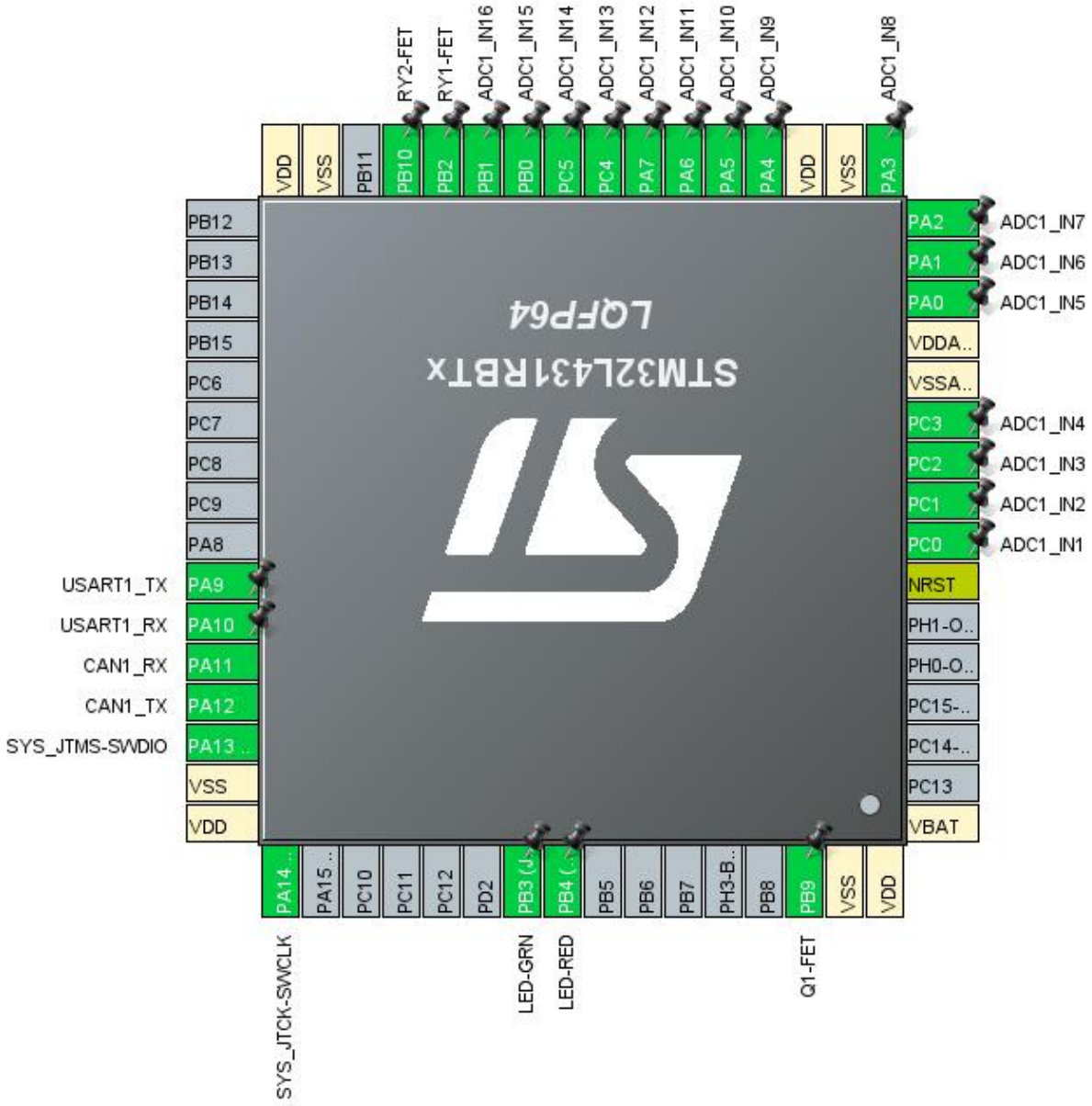
1.2. MCU

MCU Series	STM32L4
MCU Line	STM32L4x1
MCU name	STM32L431RBTx
MCU Package	LQFP64
MCU Pin number	64

1.3. Core(s) information

Core(s)	Arm Cortex-M4

2. Pinout Configuration



(Rotated +180°)

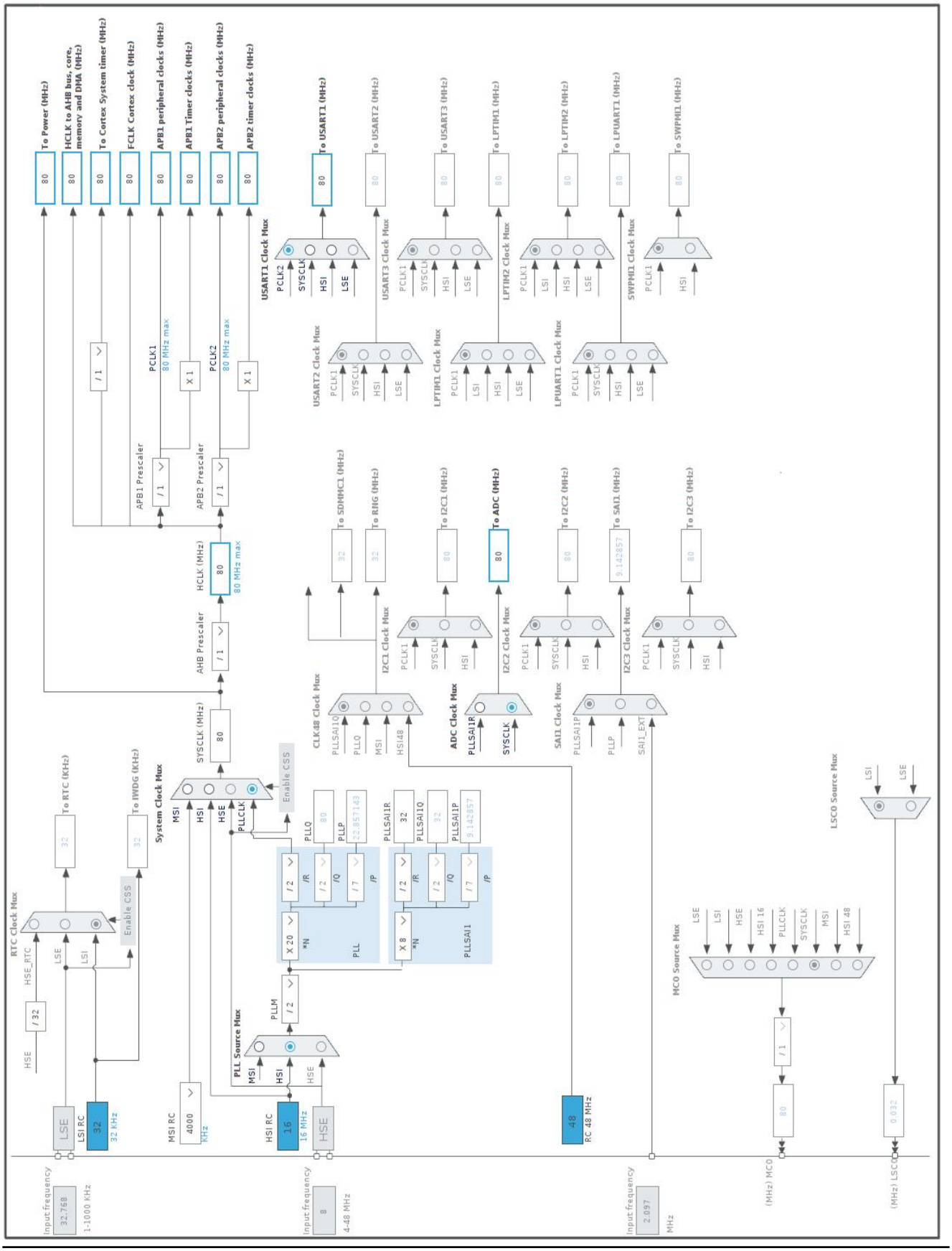
3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
7	NRST	Reset		
8	PC0	I/O	ADC1_IN1	
9	PC1	I/O	ADC1_IN2	
10	PC2	I/O	ADC1_IN3	
11	PC3	I/O	ADC1_IN4	
12	VSSA/VREF-	Power		
13	VDDA/VREF+	Power		
14	PA0	I/O	ADC1_IN5	
15	PA1	I/O	ADC1_IN6	
16	PA2	I/O	ADC1_IN7	
17	PA3	I/O	ADC1_IN8	
18	VSS	Power		
19	VDD	Power		
20	PA4	I/O	ADC1_IN9	
21	PA5	I/O	ADC1_IN10	
22	PA6	I/O	ADC1_IN11	
23	PA7	I/O	ADC1_IN12	
24	PC4	I/O	ADC1_IN13	
25	PC5	I/O	ADC1_IN14	
26	PB0	I/O	ADC1_IN15	
27	PB1	I/O	ADC1_IN16	
28	PB2 *	I/O	GPIO_Output	RY1-FET
29	PB10 *	I/O	GPIO_Output	RY2-FET
31	VSS	Power		
32	VDD	Power		
42	PA9	I/O	USART1_TX	
43	PA10	I/O	USART1_RX	
44	PA11	I/O	CAN1_RX	
45	PA12	I/O	CAN1_TX	
46	PA13 (JTMS-SWDIO)	I/O	SYS_JTMS-SWDIO	
47	VSS	Power		
48	VDD	Power		
49	PA14 (JTCK-SWCLK)	I/O	SYS_JTCK-SWCLK	
55	PB3 (JTDO-TRACESWO) *	I/O	GPIO_Output	LED-GRN
56	PB4 (NJTRST) *	I/O	GPIO_Output	LED-RED

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
62	PB9 *	I/O	GPIO_Output	Q1-FET
63	VSS	Power		
64	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	BMScableL431
Project Folder	/home/deh/GliderWinchItems/BMScable/pcb/BMScableL431
Toolchain / IDE	Makefile
Firmware Package Name and Version	STM32Cube FW_L4 V1.17.0
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	MX_DMA_Init	DMA
3	SystemClock_Config	RCC
4	MX_ADC1_Init	ADC1
5	MX_USART1_UART_Init	USART1
6	MX_CAN1_Init	CAN1

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32L4
Line	STM32L4x1
MCU	STM32L431RBTx
Datasheet	DS11453_Rev1

6.2. Parameter Selection

Temperature	25
Vdd	3.0

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

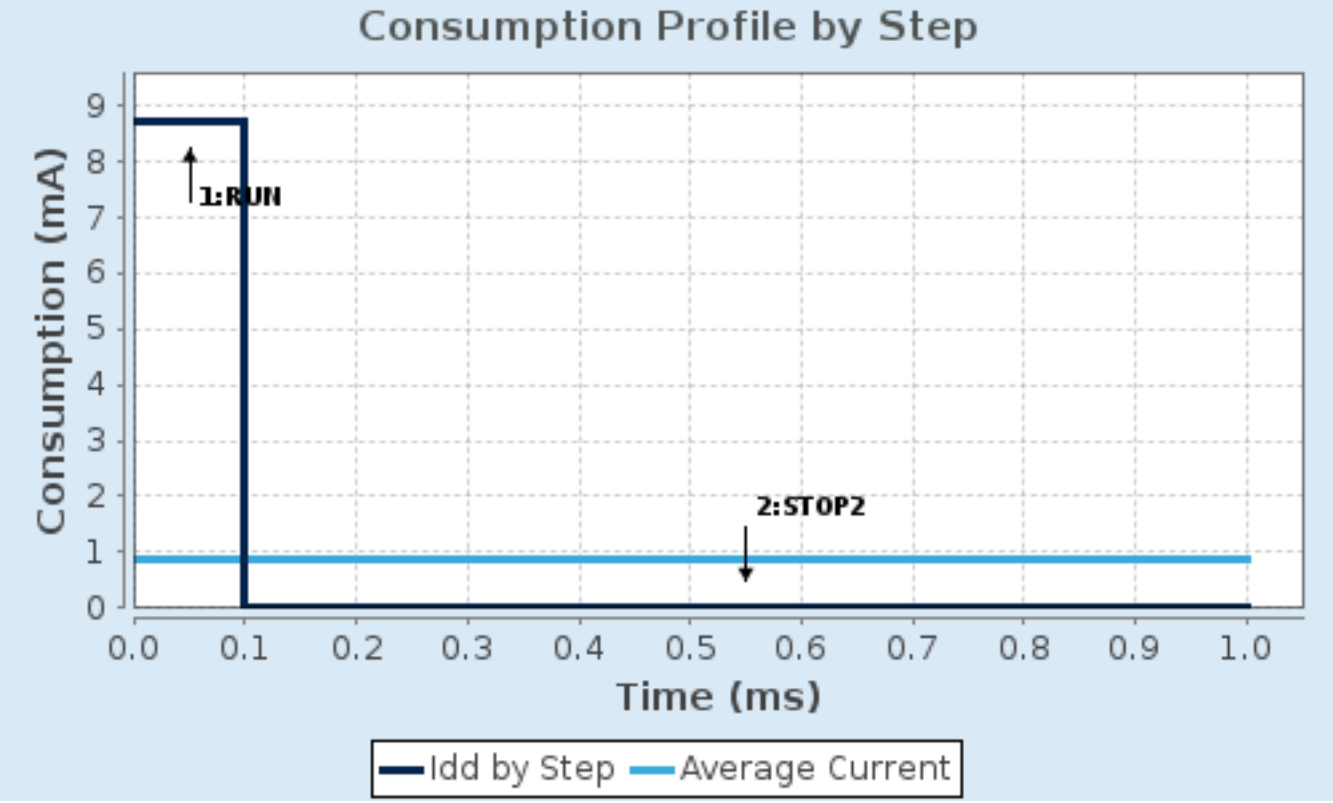
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP2
Vdd	3.0	3.0
Voltage Source	Battery	Battery
Range	Range1-High	NoRange
Fetch Type	SRAM2	n/a
CPU Frequency	80 MHz	0 Hz
Clock Configuration	HSE BYP PLL	ALL CLOCKS OFF
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	8.71 mA	1.06 µA
Duration	0.1 ms	0.9 ms
DMIPS	100.0	0.0
Ta Max	103.82	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	871.95 µA
Battery Life	5 months, 9 days, 16 hours	Average DMIPS	100.0 DMIPS

6.6. Chart


Consumption Profile by Step
Consumption (mA)
9
8
7
6
5
4
3
2
1
0
1:RUN
2:STOP2
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Time (ms)
Idd by Step
Average Current

7. Peripherals and Middlewares Configuration

7.1. ADC1

IN1: IN1 Single-ended
IN2: IN2 Single-ended
IN3: IN3 Single-ended
IN4: IN4 Single-ended
IN5: IN5 Single-ended
IN6: IN6 Single-ended
IN7: IN7 Single-ended
IN8: IN8 Single-ended
IN9: IN9 Single-ended
IN10: IN10 Single-ended
IN11: IN11 Single-ended
IN12: IN12 Single-ended
IN13: IN13 Single-ended
IN14: IN14 Single-ended
IN15: IN15 Single-ended
mode: IN16 Single-ended
IN17: Temperature Sensor Channel
mode: Vrefint Channel

7.1.1. Parameter Settings:

ADC_Settings:

Clock Prescaler	**Asynchronous clock mode divided by 4 ***
Resolution	ADC 12-bit resolution
Data Alignment	Right alignment
Scan Conversion Mode	Enabled
Continuous Conversion Mode	**Enabled ***
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	**Enabled ***
End Of Conversion Selection	**End of sequence of conversion ***
Overrun behaviour	Overrun data preserved
Low Power Auto Wait	Disabled

ADC_Regular_ConversionMode:

Enable Regular Conversions	Enable
Enable Regular Oversampling	**Enable ***
Oversampling Right Shift	No bit shift for oversampling

Oversampling Ratio	**Oversampling ratio 8x ***
Regular Oversampling Mode	Oversampling Resumed Mode
Triggered Regular Oversampling	Single trigger for all oversampled conversions
Number Of Conversion	**16 ***
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None
Rank	1
Channel	Channel 1
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**2 ***
Channel	**Channel 2 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**3 ***
Channel	**Channel 3 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**4 ***
Channel	**Channel 4 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**5 ***
Channel	**Channel 5 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**6 ***
Channel	**Channel 6 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**7 ***
Channel	**Channel 7 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**8 ***
Channel	**Channel 8 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset

Rank	**9 ***
Channel	**Channel 9 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**10 ***
Channel	**Channel 10 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**11 ***
Channel	**Channel 11 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**12 ***
Channel	**Channel 12 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**13 ***
Channel	**Channel 13 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**14 ***
Channel	**Channel 14 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**15 ***
Channel	**Channel 15 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Rank	**16 ***
Channel	**Channel 16 ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset

ADC_Injected_ConversionMode:

Enable Injected Conversions	**Enable ***
Enable Injected Oversampling	**Enable ***
Oversampling Right Shift	No bit shift for oversampling
Oversampling Ratio	**Oversampling ratio 8x ***

Number Of Conversions	**2 ***
External Trigger Source	External Trigger on injected channels are disabled (Auto-injection mode selected)
External Trigger Conversion Edge	None
Injected Conversion Mode	**Auto Injected Mode ***
Injected Queue	Injected Queue Disable
Rank	1
Channel	**Channel Vrefint ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Monitored by	None
Rank	**2 ***
Channel	**Channel Temperature Sensor ***
Sampling Time	**247.5 Cycles ***
Offset Number	No offset
Monitored by	None

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. CAN1

mode: Activated

7.2.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	**20 ***
Time Quantum	**250.0 ***
Time Quanta in Bit Segment 1	**2 Times ***
Time Quanta in Bit Segment 2	**5 Times ***
Time for one Bit	**2000.00 ***
Baud Rate	**500000 ***
ReSynchronization Jump Width	1 Time

Basic Parameters:

Time Triggered Communication Mode	Disable
Automatic Bus-Off Management	Disable

Automatic Wake-Up Mode	Disable
Automatic Retransmission	Disable
Receive Fifo Locked Mode	Disable
Transmit Fifo Priority	**Enable ***

Advanced Parameters:

Operating Mode	Normal

7.3. RCC

7.3.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Disabled
Data Cache	Enabled
Flash Latency(WS)	4 WS (5 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
MSI Calibration Value	0
MSI Auto Calibration	Disabled
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

7.4. SYS

Debug: Serial Wire

Timebase Source: TIM15

7.5. USART1

Mode: Asynchronous

7.5.1. 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

Advanced Features:

Auto Baudrate	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

7.6. FREERTOS

Interface: CMSIS_V2

7.6.1. Config parameters:

API:

FreeRTOS API	CMSIS v2

Versions:

FreeRTOS version	10.3.1
CMSIS-RTOS version	2.00

MPU/FPU:

ENABLE_MPU	Disabled
ENABLE_FPU	**Enabled ***

Kernel settings:

USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	56
MINIMAL_STACK_SIZE	128
MAX_TASK_NAME_LEN	**32 ***
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Enabled
USE_COUNTING_SEMAPHORES	Enabled

QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Disabled
ENABLE_BACKWARD_COMPATIBILITY	Enabled
USE_PORT_OPTIMISED_TASK_SELECTION	Disabled
USE_TICKLESS_IDLE	Disabled
USE_TASK_NOTIFICATIONS	Enabled
RECORD_STACK_HIGH_ADDRESS	**Enabled ***

Memory management settings:

Memory Allocation	Dynamic / Static
TOTAL_HEAP_SIZE	**16384 ***
Memory Management scheme	**heap_3 ***

Hook function related definitions:

USE_IDLE_HOOK	Disabled
USE_TICK_HOOK	Disabled
USE_MALLOC_FAILED_HOOK	Disabled
USE_DAEMON_TASK_STARTUP_HOOK	Disabled
CHECK_FOR_STACK_OVERFLOW	Disabled

Run time and task stats gathering related definitions:

GENERATE_RUN_TIME_STATS	Disabled
USE_TRACE_FACILITY	Enabled
USE_STATS_FORMATTING_FUNCTIONS	Disabled

Co-routine related definitions:

USE_CO_ROUTINES	Disabled
MAX_CO_ROUTINE_PRIORITIES	2

Software timer definitions:

USE_TIMERS	Enabled
TIMER_TASK_PRIORITY	2
TIMER_QUEUE_LENGTH	10
TIMER_TASK_STACK_DEPTH	256

Interrupt nesting behaviour configuration:

LIBRARY_LOWEST_INTERRUPT_PRIORITY	15
LIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY	5

Added with 10.2.1 support:

MESSAGE_BUFFER_LENGTH_TYPE	size_t
USE_POSIX_ERRNO	Disabled

CMSIS-RTOS V2 flags:

USE_OS2_THREAD_SUSPEND_RESUME	Enabled
USE_OS2_THREAD_ENUMERATE	Enabled
USE_OS2_EVENTFLAGS_FROM_ISR	Enabled
USE_OS2_THREAD_FLAGS	Enabled
USE_OS2_TIMER	Enabled

USE_OS2_MUTEX	Enabled

7.6.2. Include parameters:

Include definitions:

vTaskPrioritySet	Enabled
uxTaskPriorityGet	Enabled
vTaskDelete	Enabled
vTaskCleanUpResources	Disabled
vTaskSuspend	Enabled
vTaskDelayUntil	Enabled
vTaskDelay	Enabled
xTaskGetSchedulerState	Enabled
xTaskResumeFromISR	Enabled
xQueueGetMutexHolder	Enabled
xSemaphoreGetMutexHolder	Disabled
pcTaskGetTaskName	Disabled
uxTaskGetStackHighWaterMark	Enabled
xTaskGetCurrentTaskHandle	Enabled
eTaskGetState	Enabled
xEventGroupSetBitFromISR	**Enabled ***
xTimerPendFunctionCall	Enabled
xTaskAbortDelay	Disabled
xTaskGetHandle	Disabled
uxTaskGetStackHighWaterMark2	Disabled

7.6.3. Advanced settings:

Newlib settings (see parameter description first):

USE_NEWLIB_REENTRANT	**Enabled ***

Project settings (see parameter description first):

Use FW pack heap file	Enabled

*** 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	PC0	ADC1_IN1	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PC1	ADC1_IN2	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PC2	ADC1_IN3	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PC3	ADC1_IN4	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA0	ADC1_IN5	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA1	ADC1_IN6	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA2	ADC1_IN7	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA3	ADC1_IN8	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA4	ADC1_IN9	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA5	ADC1_IN10	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA6	ADC1_IN11	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PA7	ADC1_IN12	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PC4	ADC1_IN13	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PC5	ADC1_IN14	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PB0	ADC1_IN15	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
	PB1	ADC1_IN16	Analog mode for ADC conversion	No pull-up and no pull-down	n/a	
CAN1	PA11	CAN1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA12	CAN1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
SYS	PA13 (JTMS-SWDIO)	SYS_JTMS-SWDIO	n/a	n/a	n/a	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA14 (JTCK-SWCLK)	SYS_JTCK-SWCLK	n/a	n/a	n/a	
USART1	PA9	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA10	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
GPIO	PB2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RY1-FET
	PB10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RY2-FET
	PB3 (JTDO-TRACESWO)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED-GRN
	PB4 (NJTRST)	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LED-RED
	PB9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Q1-FET

8.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA1_Channel1	Peripheral To Memory	Low
USART1_RX	DMA1_Channel5	Peripheral To Memory	Low
USART1_TX	DMA1_Channel4	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

USART1_RX: DMA1_Channel5 DMA request Settings:

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

USART1_TX: DMA1_Channel4 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
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	15	0
System tick timer	true	15	0
DMA1 channel1 global interrupt	true	5	0
DMA1 channel4 global interrupt	true	5	0
DMA1 channel5 global interrupt	true	5	0
ADC1 global interrupt	true	5	0
TIM1 break interrupt and TIM15 global interrupt	true	15	0
USART1 global interrupt	true	5	0
PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/35/36/37/38	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
CAN1 TX interrupt	unused		
CAN1 RX0 interrupt	unused		
CAN1 RX1 interrupt	unused		
CAN1 SCE interrupt	unused		
FPU 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
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	false	false
Debug monitor	false	true	false
Pendable request for system service	false	false	false
System tick timer	false	false	true

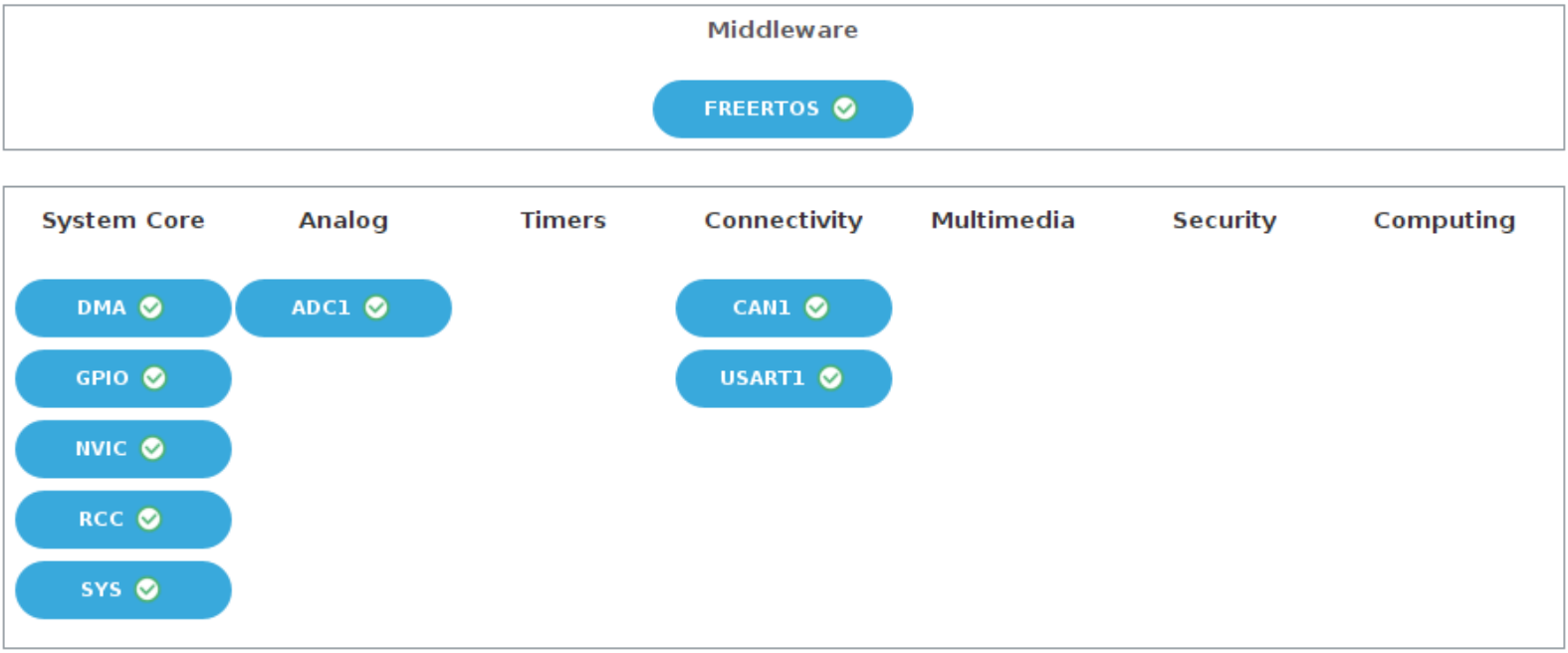
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
DMA1 channel1 global interrupt	false	true	true
DMA1 channel4 global interrupt	false	true	true
DMA1 channel5 global interrupt	false	true	true
ADC1 global interrupt	false	true	true
TIM1 break interrupt and TIM15 global interrupt	false	true	true
USART1 global interrupt	false	true	true

*** User modified value**

9. System Views

9.1. Category view

9.1.1. Current



10. Docs & Resources

Type	Link
Datasheet	http://www.st.com/resource/en/datasheet/DM00257211.pdf
Reference manual	http://www.st.com/resource/en/reference_manual/DM00151940.pdf
Programming manual	http://www.st.com/resource/en/programming_manual/DM00046982.pdf
Errata sheet	http://www.st.com/resource/en/errata_sheet/DM00218224.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/CD00264321.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/DM00080497.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/DM00125306.pdf
Application note	http://www.st.com/resource/en/application_note/DM00129215.pdf
Application note	http://www.st.com/resource/en/application_note/DM00141025.pdf
Application note	http://www.st.com/resource/en/application_note/DM00144612.pdf
Application note	http://www.st.com/resource/en/application_note/DM00148033.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/DM00156964.pdf
Application note	http://www.st.com/resource/en/application_note/DM00160482.pdf
Application note	http://www.st.com/resource/en/application_note/DM00209748.pdf
Application note	http://www.st.com/resource/en/application_note/DM00209768.pdf
Application note	http://www.st.com/resource/en/application_note/DM00209772.pdf
Application note	http://www.st.com/resource/en/application_note/DM00216518.pdf
Application note	http://www.st.com/resource/en/application_note/DM00220769.pdf
Application note	http://www.st.com/resource/en/application_note/DM00226326.pdf
Application note	http://www.st.com/resource/en/application_note/DM00227538.pdf
Application note	http://www.st.com/resource/en/application_note/DM00236305.pdf
Application note	http://www.st.com/resource/en/application_note/DM00257177.pdf
Application note	http://www.st.com/resource/en/application_note/DM00260952.pdf
Application note	http://www.st.com/resource/en/application_note/DM00263732.pdf
Application note	http://www.st.com/resource/en/application_note/DM00269143.pdf
Application note	http://www.st.com/resource/en/application_note/DM00269146.pdf
Application note	http://www.st.com/resource/en/application_note/DM00272912.pdf
Application note	http://www.st.com/resource/en/application_note/DM00311483.pdf
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/DM00354333.pdf
Application note	http://www.st.com/resource/en/application_note/DM00355687.pdf
Application note	http://www.st.com/resource/en/application_note/DM00367673.pdf
Application note	http://www.st.com/resource/en/application_note/DM00380469.pdf
Application note	http://www.st.com/resource/en/application_note/DM00395696.pdf
Application note	http://www.st.com/resource/en/application_note/DM00445657.pdf
Application note	http://www.st.com/resource/en/application_note/DM00476869.pdf
Application note	http://www.st.com/resource/en/application_note/DM00493651.pdf
Application note	http://www.st.com/resource/en/application_note/DM00536349.pdf
Application note	http://www.st.com/resource/en/application_note/DM00660597.pdf

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