
STM32
CubeMX

1. Description

1.1. Project

Project Name	OpenTelem_Aux
Board Name	custom
Generated with:	STM32CubeMX 6.4.0
Date	01/11/2022

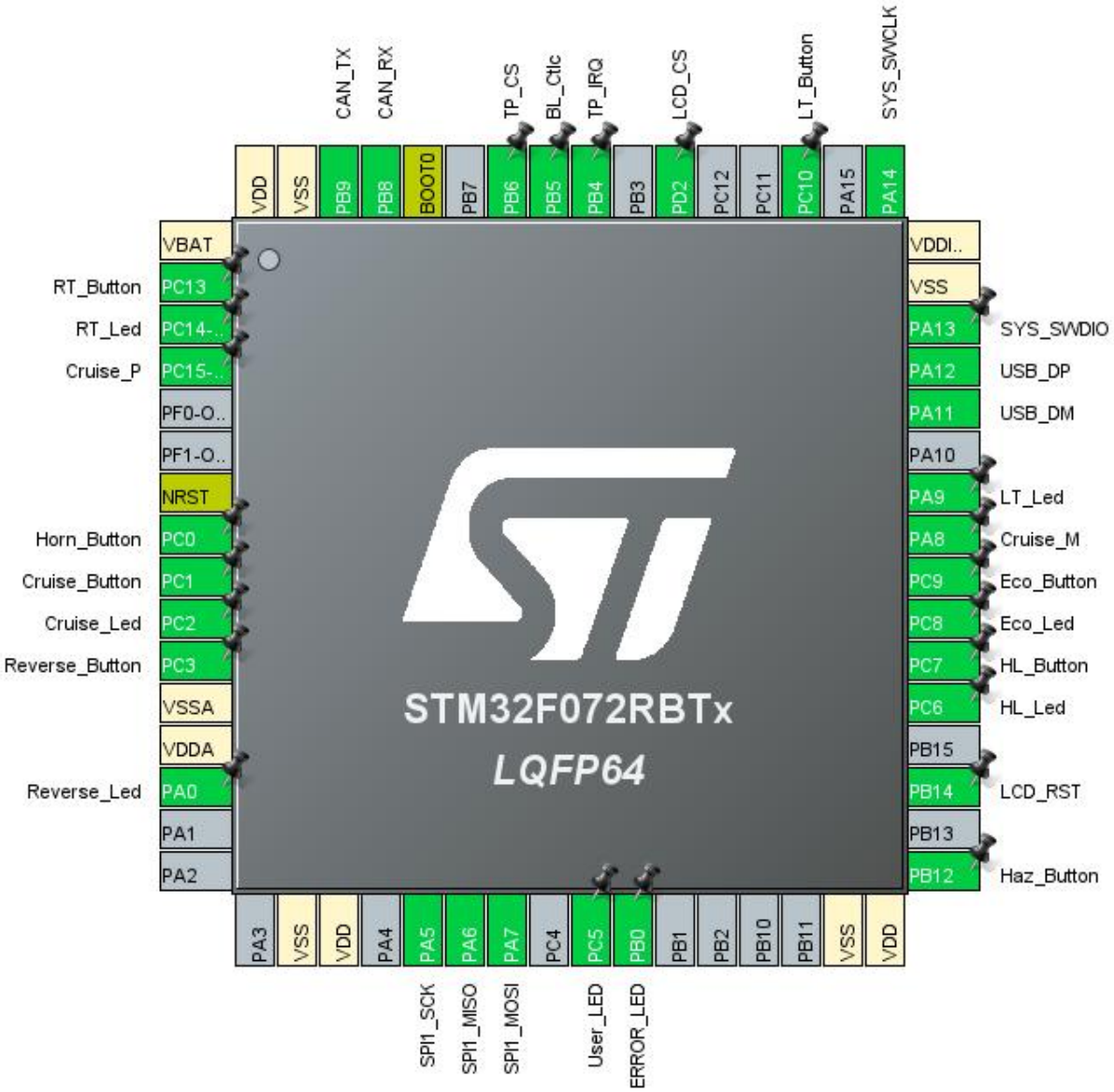
1.2. MCU

MCU Series	STM32F0
MCU Line	STM32F0x2
MCU name	STM32F072RBTx
MCU Package	LQFP64
MCU Pin number	64

1.3. Core(s) information

Core(s)	Arm Cortex-M0

2. Pinout Configuration



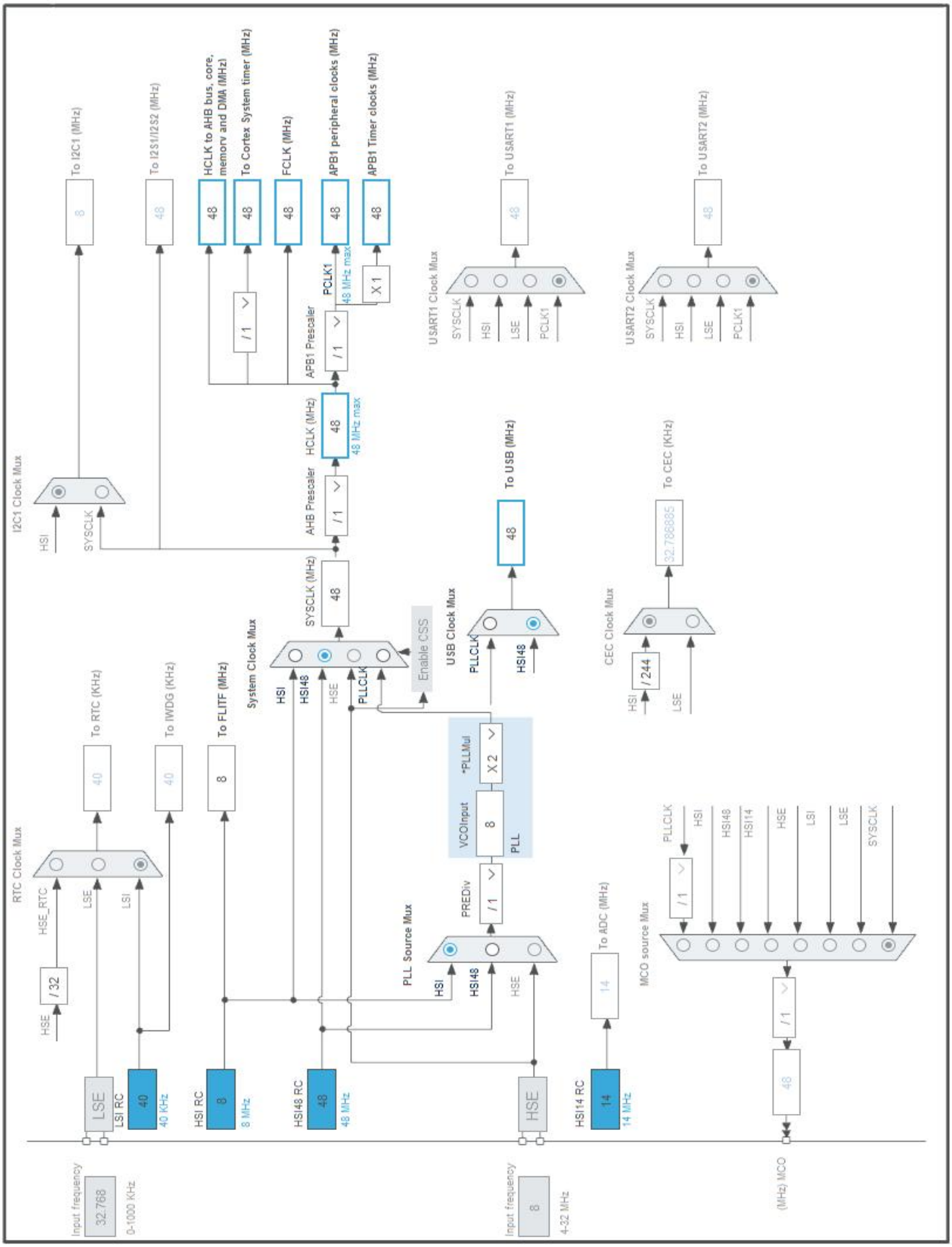
3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13	I/O	GPIO_EXTI13	RT_Button
3	PC14-OSC32_IN *	I/O	GPIO_Output	RT_Led
4	PC15-OSC32_OUT	I/O	GPIO_EXTI15	Cruise_P
7	NRST	Reset		
8	PC0	I/O	GPIO_EXTI0	Horn_Button
9	PC1	I/O	GPIO_EXTI1	Cruise_Button
10	PC2 *	I/O	GPIO_Output	Cruise_Led
11	PC3	I/O	GPIO_EXTI3	Reverse_Button
12	VSSA	Power		
13	VDDA	Power		
14	PA0 *	I/O	GPIO_Output	Reverse_Led
18	VSS	Power		
19	VDD	Power		
21	PA5	I/O	SPI1_SCK	
22	PA6	I/O	SPI1_MISO	
23	PA7	I/O	SPI1_MOSI	
25	PC5 *	I/O	GPIO_Output	User_LED
26	PB0 *	I/O	GPIO_Output	ERROR_LED
31	VSS	Power		
32	VDD	Power		
33	PB12	I/O	GPIO_EXTI12	Haz_Button
35	PB14 *	I/O	GPIO_Output	LCD_RST
37	PC6 *	I/O	GPIO_Output	HL_Led
38	PC7	I/O	GPIO_EXTI7	HL_Button
39	PC8 *	I/O	GPIO_Output	Eco_Led
40	PC9	I/O	GPIO_EXTI9	Eco_Button
41	PA8	I/O	GPIO_EXTI8	Cruise_M
42	PA9 *	I/O	GPIO_Output	LT_Led
44	PA11	I/O	USB_DM	
45	PA12	I/O	USB_DP	
46	PA13	I/O	SYS_SWDIO	
47	VSS	Power		
48	VDDIO2	Power		
49	PA14	I/O	SYS_SWCLK	
51	PC10	I/O	GPIO_EXTI10	LT_Button

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
54	PD2 *	I/O	GPIO_Output	LCD_CS
56	PB4	I/O	GPIO_EXTI4	TP_IRQ
57	PB5 *	I/O	GPIO_Output	BL_Ctlc
58	PB6 *	I/O	GPIO_Output	TP_CS
60	BOOT0	Boot		
61	PB8	I/O	CAN_RX	
62	PB9	I/O	CAN_TX	
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	OpenTelem_Aux
Project Folder	C:\Users\georg\STM32CubeIDE\SolarGators\OpenTelem_Aux
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F0 V1.11.3
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	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_CAN_Init	CAN
4	MX_SPI1_Init	SPI1
5	MX_USB_DEVICE_Init	USB_DEVICE

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F0
Line	STM32F0x2
MCU	STM32F072RBTx
Datasheet	DS9826_Rev5

6.2. Parameter Selection

Temperature	25
Vdd	3.6

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

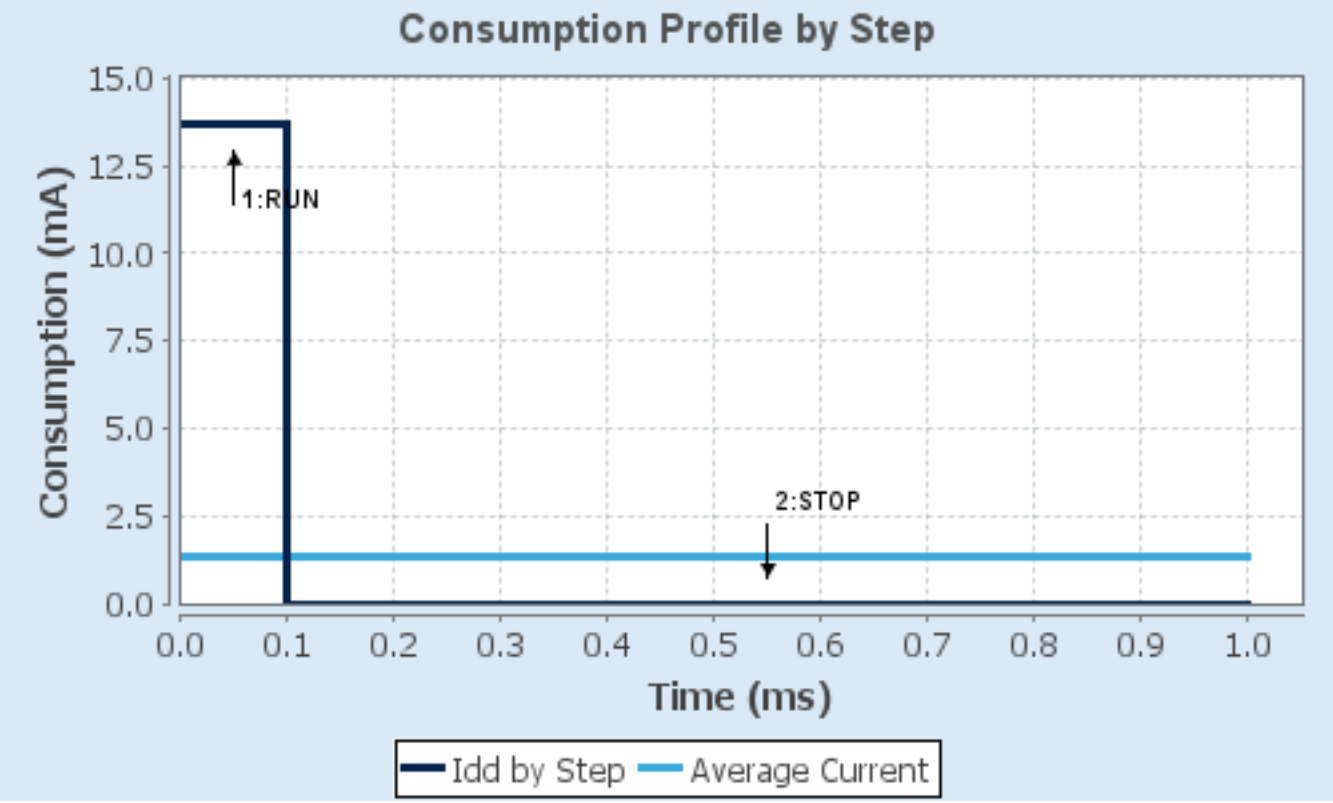
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.6	3.6
Voltage Source	Battery	Battery
Range	No Scale	No Scale
Fetch Type	FLASH	n/a
CPU Frequency	48 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LP
Clock Source Frequency	8 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	13.66 mA	6.5 µA
Duration	0.1 ms	0.9 ms
DMIPS	0.0	0.0
Ta Max	102.84	105
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	1.37 mA
Battery Life	3 months, 11 days, 17 hours	Average DMIPS	0.0 DMIPS

6.6. Chart


Consumption Profile by Step
Consumption (mA)
15.0
12.5
10.0
7.5
5.0
2.5
0.0
1:RUN
2:STOP
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. CAN

mode: Activated

7.1.1. Parameter Settings:

Bit Timings Parameters:

Prescaler (for Time Quantum)	**6 ***
Time Quantum	**125.0 ***
Time Quanta in Bit Segment 1	**13 Times ***
Time Quanta in Bit Segment 2	**2 Times ***
Time for one Bit	**2000 ***
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	Disable

Advanced Parameters:

Operating Mode	Normal

7.2. RCC

7.2.1. Parameter Settings:

System Parameters:

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

RCC Parameters:

HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

7.3. SPI1

Mode: Full-Duplex Master

7.3.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	**8 Bits ***
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**4 ***
Baud Rate	**12.0 MBits/s ***
Clock Polarity (CPOL)	**High ***
Clock Phase (CPHA)	**2 Edge ***

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

7.4. SYS

mode: Debug Serial Wire

Timebase Source: TIM1

7.5. USB

mode: Device (FS)

7.5.1. Parameter Settings:

Basic Parameters:

Speed	Full Speed 12MBit/s
Physical interface	Internal Phy

Power Parameters:

Low Power	Disabled
Link Power Management	Disabled

7.6. FREERTOS

Interface: CMSIS_V2

7.6.1. Config parameters:

API:

FreeRTOS API	CMSIS v2

Versions:

FreeRTOS version	10.0.1
CMSIS-RTOS version	2.00

Kernel settings:

USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	56
MINIMAL_STACK_SIZE	128
MAX_TASK_NAME_LEN	16
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	Disabled

Memory management settings:

Memory Allocation	Dynamic / Static
TOTAL_HEAP_SIZE	3072
Memory Management scheme	heap_4

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

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	Disabled
eTaskGetState	Enabled
xEventGroupSetBitFromISR	Disabled
xTimerPendFunctionCall	Enabled
xTaskAbortDelay	Disabled
xTaskGetHandle	Disabled

7.6.3. Advanced settings:

Newlib settings (see parameter description first):

USE_NEWLIB_REENTRANT	Disabled

Project settings (see parameter description first):

Use FW pack heap file	Enabled

7.7. USB_DEVICE

Class For FS IP: Communication Device Class (Virtual Port Com)

7.7.1. Parameter Settings:

Basic Parameters:

USBD_MAX_NUM_INTERFACES (Maximum number of supported interfaces)	1
USBD_MAX_NUM_CONFIGURATION (Maximum number of supported configuration)	1
USBD_MAX_STR_DESC_SIZ (Maximum size for the string descriptors)	512
USBD_SELF_POWERED (Enabled self power)	Enabled
USBD_DEBUG_LEVEL (USBD Debug Level)	0: No debug message

Class Parameters:

USB CDC Rx Buffer Size	1000
USB CDC Tx Buffer Size	1000

7.7.2. Device Descriptor:

Device Descriptor:

VID (Vendor IDentifier)	1155
LANGID_STRING (Language Identifier)	English(United States)
MANUFACTURER_STRING (Manufacturer Identifier)	STMicroelectronics

Device Descriptor FS:

PID (Product IDentifier)	22336
PRODUCT_STRING (Product Identifier)	STM32 Virtual ComPort
CONFIGURATION_STRING (Configuration Identifier)	CDC Config
INTERFACE_STRING (Interface Identifier)	CDC Interface

*** User modified value**

8. System Configuration

8.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
CAN	PB8	CAN_RX	Alternate Function Push Pull	No pull-up and no pull-down	**High ***	
	PB9	CAN_TX	Alternate Function Push Pull	No pull-up and no pull-down	**High ***	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**High ***	
	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**High ***	
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**High ***	
SYS	PA13	SYS_SWDIO	n/a	n/a	n/a	
	PA14	SYS_SWCLK	n/a	n/a	n/a	
USB	PA11	USB_DM	n/a	n/a	n/a	
	PA12	USB_DP	n/a	n/a	n/a	
GPIO	PC13	GPIO_EXTI13	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	RT_Button
	PC14-OSC32_IN	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	RT_Led
	PC15-OSC32_OUT	GPIO_EXTI15	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Cruise_P
	PC0	GPIO_EXTI0	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Horn_Button
	PC1	GPIO_EXTI1	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Cruise_Button
	PC2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Cruise_Led
	PC3	GPIO_EXTI3	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Reverse_Button
	PA0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Reverse_Led
	PC5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	User_LED
	PB0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ERROR_LED
	PB12	GPIO_EXTI12	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Haz_Button
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LCD_RST
	PC6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	HL_Led
	PC7	GPIO_EXTI7	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	HL_Button
	PC8	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Eco_Led
	PC9	GPIO_EXTI9	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Eco_Button
	PA8	GPIO_EXTI8	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	Cruise_M

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
	PA9	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LT_Led
	PC10	GPIO_EXTI10	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	LT_Button
	PD2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	LCD_CS
	PB4	GPIO_EXTI4	External Interrupt Mode with Rising edge trigger detection	No pull-up and no pull-down	n/a	TP_IRQ
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	BL_Ctlc
	PB6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TP_CS

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	3	0
System tick timer	true	3	0
EXTI line 0 and 1 interrupts	true	3	0
EXTI line 2 and 3 interrupts	true	3	0
EXTI line 4 to 15 interrupts	true	3	0
TIM1 break, update, trigger and commutation interrupts	true	3	0
HDMI-CEC and CAN interrupts / HDMI-CEC wake-up interrupt through EXTI line 27	true	3	0
USB global interrupt / USB wake-up interrupt through EXTI line 18	true	3	0
PVD and VDDIO2 supply comparator interrupts through EXTI lines 16 and 31	unused		
Flash global interrupt	unused		
RCC and CRS global interrupts	unused		
SPI1 global interrupt	unused		

8.3.2. NVIC Code generation

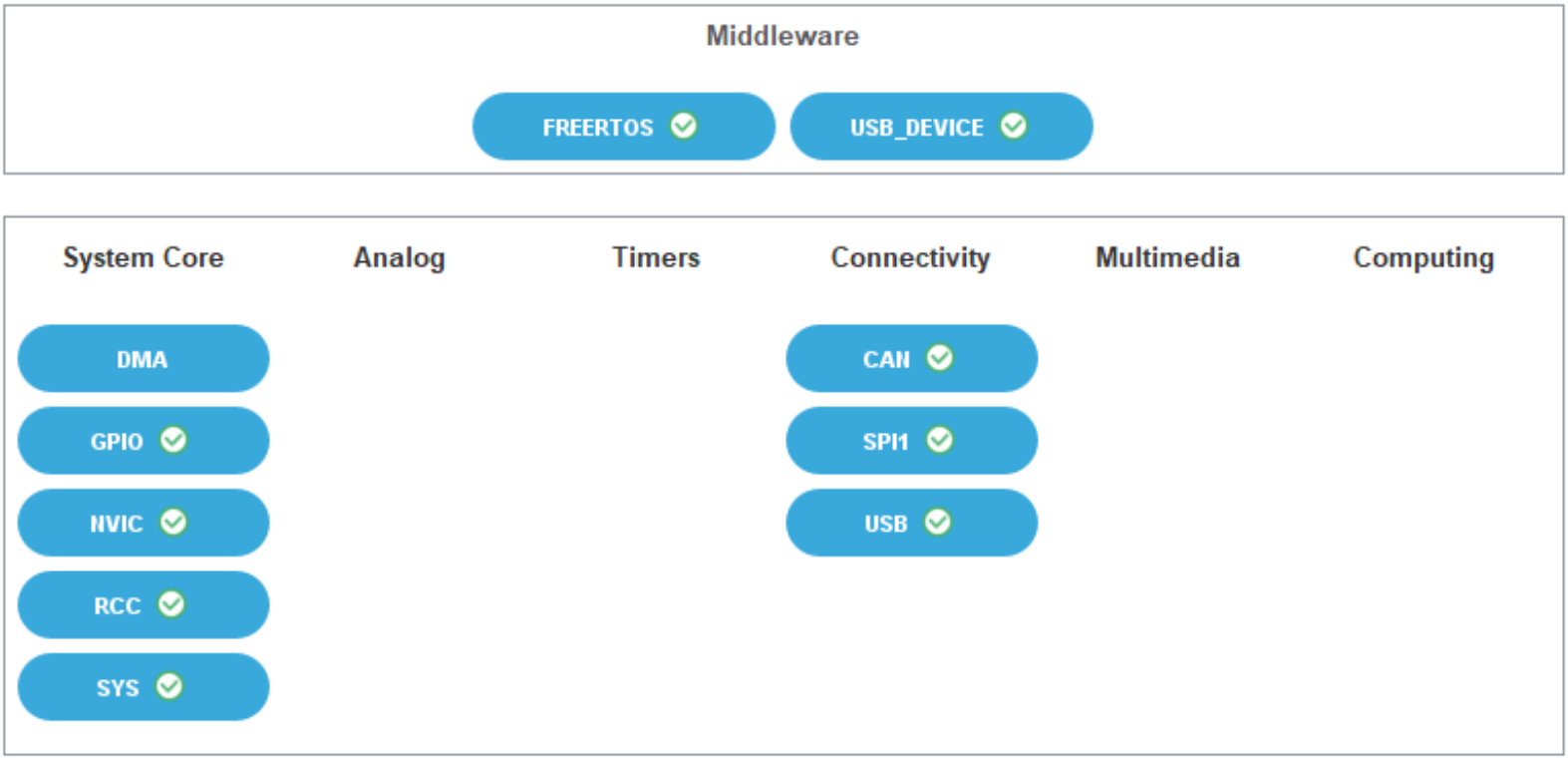
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
System service call via SWI instruction	false	false	false
Pendable request for system service	false	false	false
System tick timer	false	false	true
EXTI line 0 and 1 interrupts	false	true	true
EXTI line 2 and 3 interrupts	false	true	true
EXTI line 4 to 15 interrupts	false	true	true
TIM1 break, update, trigger and commutation interrupts	false	true	true
HDMI-CEC and CAN interrupts / HDMI-CEC wake-up interrupt through EXTI line 27	false	true	true
USB global interrupt / USB wake-up interrupt through EXTI line 18	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/DM00090510.pdf
Reference manual	http://www.st.com/resource/en/reference_manual/DM00031936.pdf
Programming manual	http://www.st.com/resource/en/programming_manual/DM00051352.pdf
Errata sheet	http://www.st.com/resource/en/errata_sheet/DM00096495.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/CD00249778.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/DM00024853.pdf
Application note	http://www.st.com/resource/en/application_note/DM00025071.pdf
Application note	http://www.st.com/resource/en/application_note/DM00042534.pdf
Application note	http://www.st.com/resource/en/application_note/DM00051986.pdf
Application note	http://www.st.com/resource/en/application_note/DM00052530.pdf
Application note	http://www.st.com/resource/en/application_note/DM00053084.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/DM00080497.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/DM00129215.pdf
Application note	http://www.st.com/resource/en/application_note/DM00145318.pdf
Application note	http://www.st.com/resource/en/application_note/DM00160482.pdf

Application note	http://www.st.com/resource/en/application_note/DM00188145.pdf
Application note	http://www.st.com/resource/en/application_note/DM00189562.pdf
Application note	http://www.st.com/resource/en/application_note/DM00210690.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/DM00236305.pdf
Application note	http://www.st.com/resource/en/application_note/DM00257177.pdf
Application note	http://www.st.com/resource/en/application_note/DM00296349.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/DM00355687.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/DM00483659.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/DM00725181.pdf