



## 1. Description

### 1.1. Project

Project Name	NucleoCC2
Board Name	NUCLEO-WL33CC2
Generated with:	STM32CubeMX 6.13.0
Date	03/26/2025

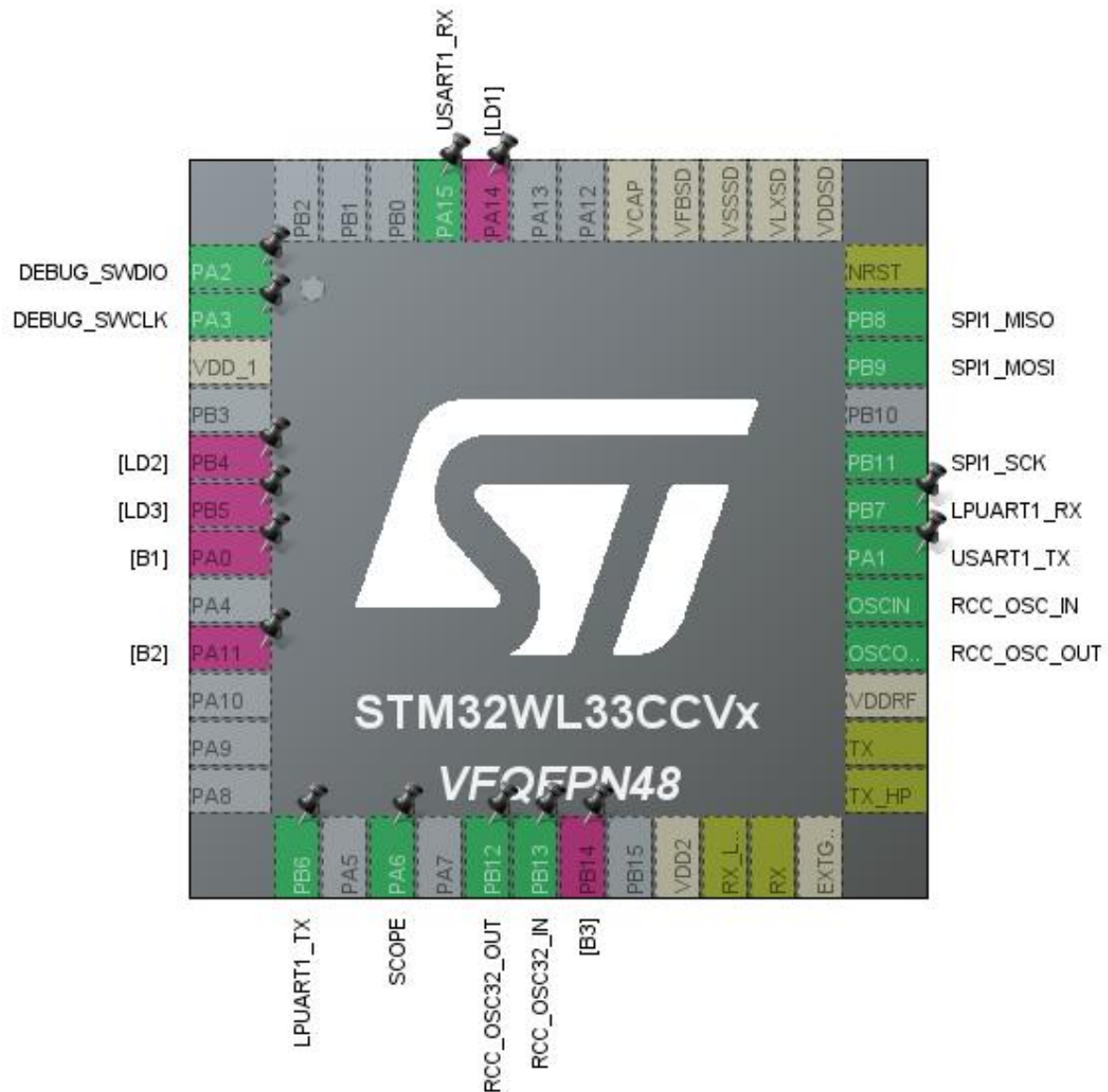
### 1.2. MCU

MCU Series	STM32WL3
MCU Line	STM32WLx3
MCU name	STM32WL33CCVx
MCU Package	VFQFPN48
MCU Pin number	48

### 1.3. Core(s) information

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

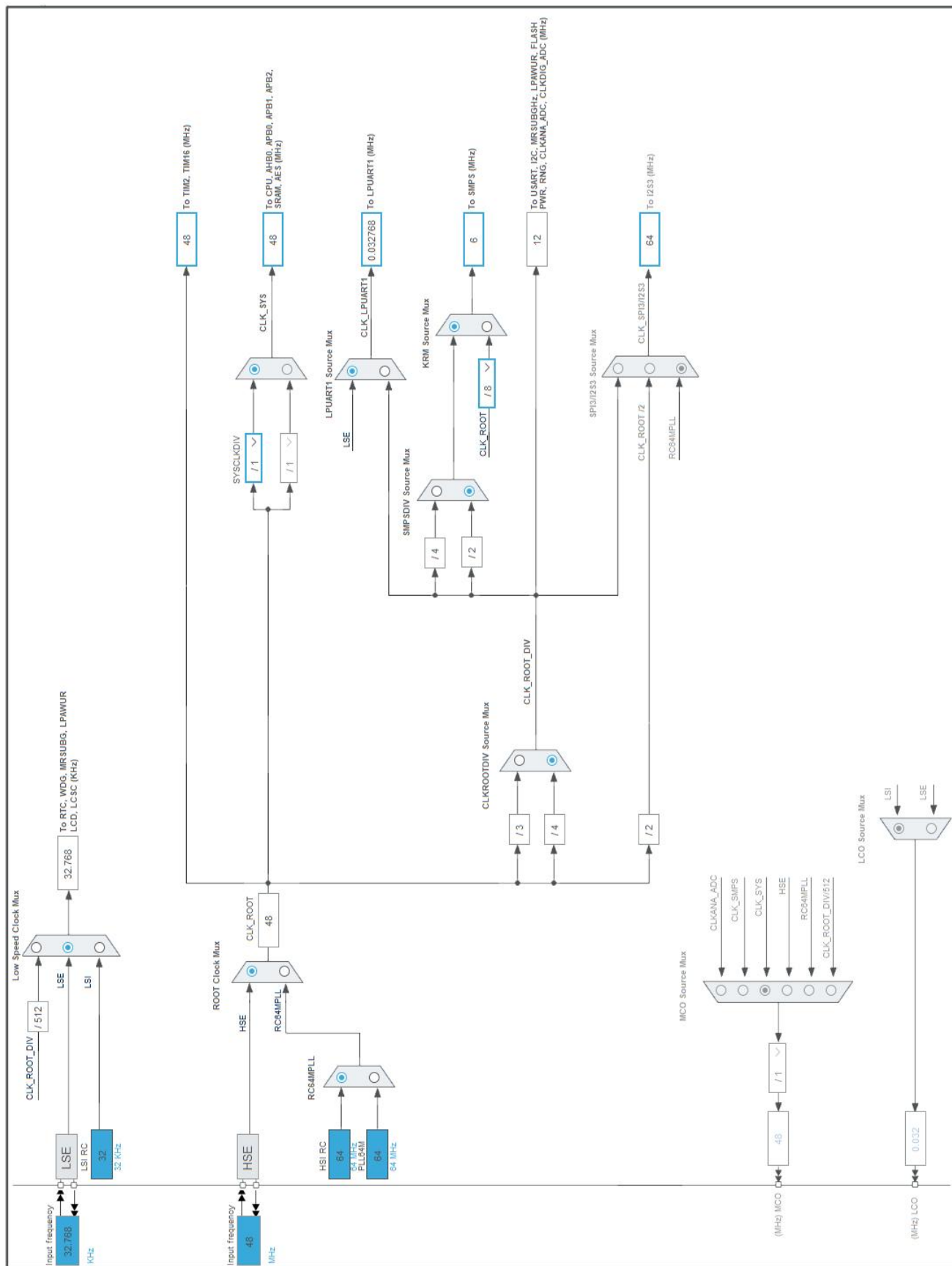


### 3. Pins Configuration

Pin Number VFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	PA2	I/O	DEBUG_SWDIO	
2	PA3	I/O	DEBUG_SWCLK	
3	VDD_1	Power		
5	PB4	I/O		
6	PB5	I/O		
7	PA0	I/O		
9	PA11	I/O		
13	PB6	I/O	LPUART1_TX	
15	PA6 *	I/O	GPIO_Output	SCOPE
17	PB12	I/O	RCC_OSC32_OUT	
18	PB13	I/O	RCC_OSC32_IN	
19	PB14	I/O		
21	VDD2	Power		
22	RX_LPAWUR	Reset		
23	RX	Reset		
24	EXTGND	Power		
25	TX_HP	Reset		
26	TX	Reset		
27	VDDRF	Power		
28	OSCOUT	MonoIO	RCC_OSC_OUT	
29	OSCIN	MonoIO	RCC_OSC_IN	
30	PA1	I/O	USART1_TX	
31	PB7	I/O	LPUART1_RX	
32	PB11	I/O	SPI1_SCK	
34	PB9	I/O	SPI1_MOSI	
35	PB8	I/O	SPI1_MISO	
36	NRST	Reset		
37	VDDSD	Power		
38	VLXSD	Power		
39	VSSSD	Power		
40	VFBSD	Power		
41	VCAP	Power		
44	PA14	I/O		
45	PA15	I/O	USART1_RX	

\* The pin is affected with an I/O function

## 4. Clock Tree Configuration



## 1. Power Consumption Calculator report

### 1.1. Microcontroller Selection

Series	STM32WL3
Line	STM32WLx3
MCU	STM32WL33CCVx
Datasheet	DS000000_Rev1

### 1.2. Parameter Selection

Temperature	25
Vdd	3.3

### 1.3. Battery Selection

Battery	Li-SOCL2(DD36000)
Capacity	36000.0 mAh
Self Discharge	0.08 %/month
Nominal Voltage	3.6 V
Max Cont Current	450.0 mA
Max Pulse Current	1000.0 mA
Cells in series	1
Cells in parallel	1

#### 1.4. Sequence

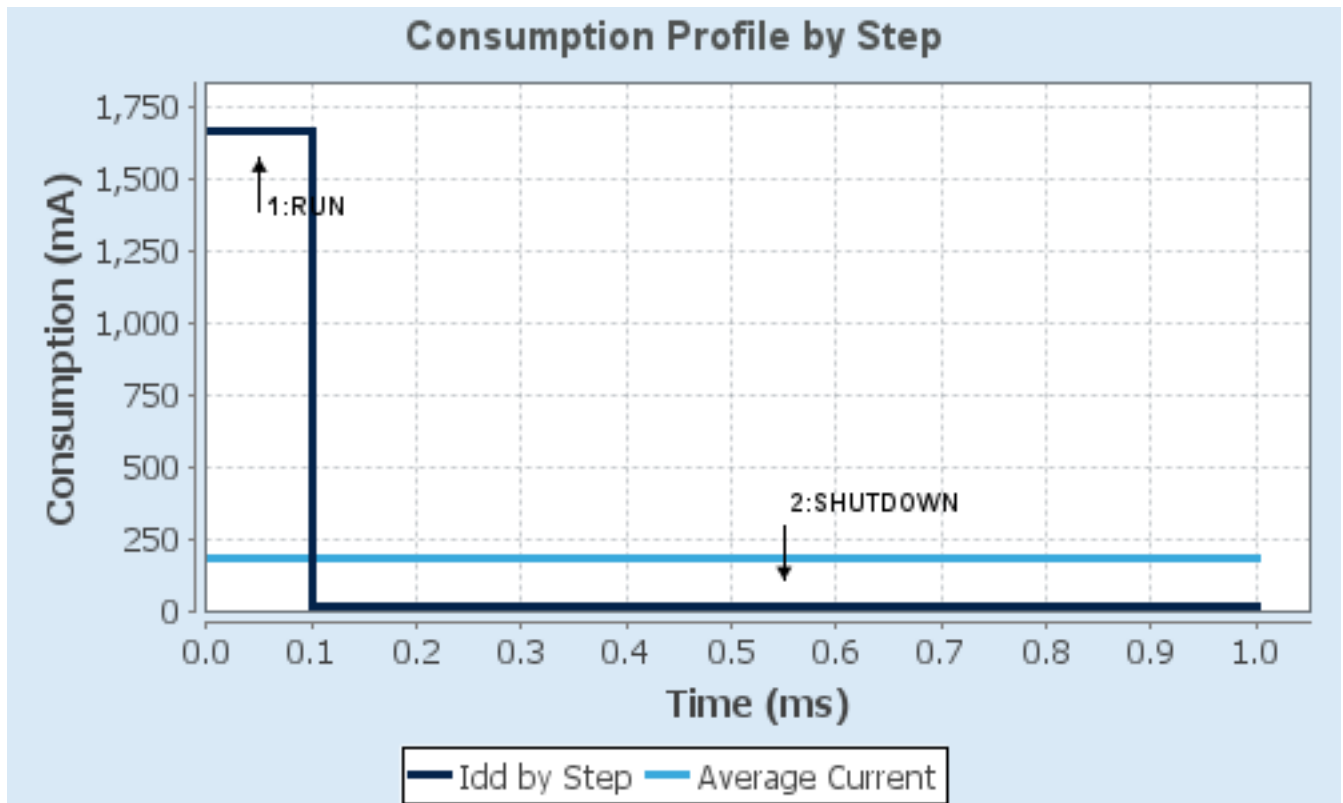
<b>Step</b>	Step1	Step2
<b>Mode</b>	RUN	SHUTDOWN
<b>Vdd</b>	3.3	3.3
<b>Voltage Source</b>	Battery	Battery
<b>Range</b>	NaN/SMPS	NaN
<b>Fetch Type</b>	FLASH	FLASH
<b>CPU Frequency</b>	64 Hz	0 Hz
<b>Clock Configuration</b>	RC64MPLL ALL RAM RETENTION	ALL_OFF
<b>Clock Source Frequency</b>	48 Hz	48 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	1.659 A	14 mA
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	0.0	0.0
<b>Ta Max</b>	125	125
<b>Category</b>	In DS Table	In DS Table

#### 1.5. Results

Sequence Time	1 ms	Average Current	178.5 mA
Battery Life	8 days, 9 hours	Average DMIPS	8.0E-6 DMIPS

#### 1.6. Chart





## 2. Software Project

### 2.1. Project Settings

Name	Value
Project Name	NucleoCC2
Project Folder	C:\Projects\Amateur Projects\MicroController Projects\ST Micro
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_WL3 V1.0.0
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	No
Minimum Heap Size	0x000
Minimum Stack Size	0xC00

### 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_MRSUBG_Init	MRSUBG
5	MX_USART1_UART_Init	USART1
6	MX_CRC_Init	CRC
7	MX_LPUART1_UART_Init	LPUART1
8	MX_RTC_Init	RTC
9	MX_SPI1_Init	SPI1



## 3. Peripherals and Middlewares Configuration

### 3.1. CRC

**mode: Activated**

#### 3.1.1. Parameter Settings:

##### **Basic Parameters:**

Default Polynomial State	Enable
Default Init Value State	Enable

##### **Advanced Parameters:**

Input Data Inversion Mode	None
Output Data Inversion Mode	Disable
Input Data Format	Bytes

### 3.2. DEBUG

**mode: Debug**

### 3.3. LPUART1

**Mode: Asynchronous**

#### 3.3.1. Parameter Settings:

##### **Basic Parameters:**

Baud Rate	<b>9600 *</b>
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

##### **Advanced Parameters:**

Data Direction	Receive and Transmit
Single Sample	Disable
ClockPrescaler	1
Fifo Mode	<b>FIFO mode enable *</b>
Txfifo Threshold	1 eighth full configuration
Rxfifo Threshold	1 eighth full configuration

##### **Advanced Features:**

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

### 3.4. MRSUBG

**mode: Activated**

#### 3.4.1. Configuration:

##### **Radio:**

IFrequencyBase	<b>445750000 *</b>
xModulationSelect	<b>MOD_4FSK *</b>
IDatarate	<b>100000 *</b>
IFreqDev	<b>25000 *</b>
IBandwidth	<b>200000 *</b>
dsSsExp	<b>0</b>
outputPower	<b>14 *</b>
PADrvMode	<b>PA_DRV_TX_HP *</b>

##### **Packet:**

Packet Format	<b>802.15.4 Packet *</b>
Modulation	<b>MOD_4FSK *</b>
PreambleLength	<b>16 *</b>
FCSType	<b>FCS_32BIT *</b>
Whitening	<b>Disable *</b>
FecType	<b>FEC_15_4_G_RSC *</b>
FrameLength	<b>0</b>

### 3.5. NUCLEO-WL33CC2

**mode: Human Machine Interface**

#### 3.5.1. Human Machine Interface:

##### **Led:**

USER LED BLUE (LD1)	<b>true *</b>
USER LED GREEN (LD2)	<b>true *</b>
USER LED RED (LD3)	<b>true *</b>

##### **Button:**

USER B1	<b>Mode EXTI *</b>
USER B2	<b>Mode EXTI *</b>
USER B3	<b>Mode EXTI *</b>
<b>VCOM:</b>	
Virtual Com Port	false
<b>Demonstration code:</b>	
Generate demonstration code	Disabled

### 3.6. NUCLEO-WL33CC2

#### mode: Human Machine Interface

##### 3.6.1. Human Machine Interface:

<b>Led:</b>	
USER LED BLUE (LD1)	<b>true *</b>
USER LED GREEN (LD2)	<b>true *</b>
USER LED RED (LD3)	<b>true *</b>
<b>Button:</b>	
USER B1	<b>Mode EXTI *</b>
USER B2	<b>Mode EXTI *</b>
USER B3	<b>Mode EXTI *</b>
<b>VCOM:</b>	
Virtual Com Port	false
<b>Demonstration code:</b>	
Generate demonstration code	Disabled

### 3.7. PWR

#### mode: Privilege attributes

##### 3.7.1. PWR Privilege :

<b>Privilege PWR:</b>	
PWR Privilege	Disable

##### 3.7.2. PWR\_APC:

#### **APC\_pull-up/-down configuration:**



Store Operation	Storeoperation Reset
<b>Calendar Date:</b>	
Week Day	Monday
Month	January
Date	1
Year	0
<b>Alarm A:</b>	
Hours	<b>12 *</b>
Minutes	<b>15 *</b>
Seconds	<b>10 *</b>
Alarm Mask Date Week day	Disable
Alarm Mask Hours	Disable
Alarm Mask Minutes	Disable
Alarm Mask Seconds	Disable
Alarm Sub Second Mask	All Alarm SS fields are masked.
Alarm Date Week Day Sel	Date
Alarm Date	1
<b>Wake UP:</b>	
Wake Up Clock	RTCCLK / 16
Wake Up Counter	0

### 3.10. SPI1

#### Mode: Full-Duplex Slave

##### 3.10.1. Parameter Settings:

###### Basic Parameters:

Frame Format	Motorola
Data Size	<b>8 Bits *</b>
First Bit	MSB First

###### Clock Parameters:

Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

###### Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software



### 3.11. SYS

**Timebase Source: TIM2**

### 3.12. USART1

**Mode: Asynchronous**

#### 3.12.1. 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
ClockPrescaler	1
Fifo Mode	Disable
Txfifo Threshold	1 eighth full configuration
Rxfifo Threshold	1 eighth full configuration

##### **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

### 3.13. FREERTOS

**Interface: CMSIS\_V2**

#### 3.13.1. Config parameters:

##### **API:**

FreeRTOS API	CMSIS v2
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##### **Versions:**

FreeRTOS version	10.6.2
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CMSIS-RTOS version 2.00

**MPU/FPU:**

ENABLE\_MPU Disabled

ENABLE\_FPU Disabled

**Kernel settings:**

USE\_PREEMPTION Enabled

CPU\_CLOCK\_HZ SystemCoreClock

TICK\_RATE\_HZ 1000

MAX\_PRIORITIES 56

USE\_SB\_COMPLETED\_CALLBACK 0

USE\_MINI\_LIST\_ITEM 1

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 **16384 \***

HEAP\_CLEAR\_MEMORY\_ON\_FREE 0

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

**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

### 3.13.2. 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 Disabled  
 xTimerPendFunctionCall Enabled  
 xTaskAbortDelay Disabled  
 xTaskGetHandle Disabled  
 uxTaskGetStackHighWaterMark2 **Enabled \***

### 3.13.3. 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**

## 4. System Configuration

### 4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
DEBUG	PA2	DEBUG_SWDI0	Alternate Function Push Pull	Pull-up	Low	
	PA3	DEBUG_SWCLK	Alternate Function Push Pull	Pull-down	Very High	
LPUART1	PB6	LPUART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB7	LPUART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
RCC	PB12	RCC_OSC32_OUT	n/a	n/a	n/a	
	PB13	RCC_OSC32_IN	n/a	n/a	n/a	
	OSCOUT	RCC_OSC_OUT	n/a	n/a	n/a	
	OSCIN	RCC_OSC_IN	n/a	n/a	n/a	
SPI1	PB11	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB9	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PB8	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	Low	
USART1	PA1	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
	PA15	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	Low	
GPIO	PA6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SCOPE

## 4.2. DMA configuration

DMA request	Stream	Direction	Priority
USART1_TX	DMA1_Channel1		Low
SPI1_RX	DMA1_Channel2		Low
SPI1_TX	DMA1_Channel3		Low

### USART1\_TX: DMA1\_Channel1 DMA request Settings:

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

### SPI1\_RX: DMA1\_Channel2 DMA request Settings:

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

### SPI1\_TX: DMA1\_Channel3 DMA request Settings:

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

### 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	3	0
System tick timer	true	3	0
SPI1 interrupt	true	1	0
USART1 Interrupt	true	1	0
LPUART1 Interrupt	true	1	0
TIM2 global interrupt	true	3	0
RTC interrupt	true	1	0
GPIOA interrupt	true	1	0
GPIOB interrupt	true	1	0
DMA global interrupt	true	1	0
MRSUBG interrupt	true	1	0
FLASH (CFI) global Interrupt	unused		
RCC interrupt	unused		
MRSUBG Busy interrupt	unused		
MRSUBG TX/RX Sequence interrupt	unused		
MRSUBG CPU Wakeup interrupt	unused		
MRSUBG Wakeup 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	false	false
Pendable request for system service	false	false	false
System tick timer	false	false	true
SPI1 interrupt	false	true	true
USART1 Interrupt	false	true	true
LPUART1 Interrupt	false	true	true
TIM2 global interrupt	false	true	true
RTC interrupt	false	true	true
GPIOA interrupt	false	true	true
GPIOB interrupt	false	true	true
DMA global interrupt	false	true	true

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
MRSUBG interrupt	false	true	true

\* User modified value



## 5. System Views

### 5.1. Category view

#### 5.1.1. Current

Middleware										
FREERTOS										
System Core	Analog	Timers	Connectivity	Multimedia	Security	Computing	Trace and Debug	Power and Thermal	Utilities	Bsp
CORTEX_M0+		RTC	LPUART1			CRC	DEBUG	PWR		NUCLEO-WL33...
DMA			MRSUBG							
GPIO			SPH							
IIVIC			USART1							
RCC										
SYS										

## 6. Docs & Resources

Type	Link
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32wl_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32wl_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32wl3-svd.zip">https://www.st.com/resource/en/svd/stm32wl3-svd.zip</a>
Bill of Materials	<a href="https://www.st.com/resource/en/bill_of_materials/mb2158-bom.zip">https://www.st.com/resource/en/bill_of_materials/mb2158-bom.zip</a>
Bill of Materials	<a href="https://www.st.com/resource/en/bill_of_materials/mb2168-bom.zip">https://www.st.com/resource/en/bill_of_materials/mb2168-bom.zip</a>
Bill of Materials	<a href="https://www.st.com/resource/en/bill_of_materials/mb2218-bom.zip">https://www.st.com/resource/en/bill_of_materials/mb2218-bom.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2158-bdp.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2158-bdp.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2158-manufacturing.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2158-manufacturing.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2168-bdp.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2168-bdp.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2168-manufacturing.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2168-manufacturing.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2218-bdp.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2218-bdp.zip</a>
Board Manufacturing Specifications	<a href="https://www.st.com/resource/en/board_manufacturing_specification/mb2218-manufacturing.zip">https://www.st.com/resource/en/board_manufacturing_specification/mb2218-manufacturing.zip</a>
Schematic Pack	<a href="https://www.st.com/resource/en/schematic_pack/mb2158-stdes-wl3c4eew-a01-schematic.zip">https://www.st.com/resource/en/schematic_pack/mb2158-stdes-wl3c4eew-a01-schematic.zip</a>
Schematic Pack	<a href="https://www.st.com/resource/en/schematic_pack/mb2168-stdes-wl3c2sll-a01-schematic.zip">https://www.st.com/resource/en/schematic_pack/mb2168-stdes-wl3c2sll-a01-schematic.zip</a>
Schematic Pack	<a href="https://www.st.com/resource/en/schematic_pack/mb2218-stdes-">https://www.st.com/resource/en/schematic_pack/mb2218-stdes-</a>

	wl3c4ssh-a01-schematic.zip
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-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/stm32cubemonitor-wireless-longrange_rftest.pdf">https://www.st.com/resource/en/product_presentation/stm32cubemonitor-wireless-longrange_rftest.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-stm32wl3-wireless-product-line-overview.pdf">https://www.st.com/resource/en/product_presentation/microcontrollers-stm32wl3-wireless-product-line-overview.pdf</a>
Brochures	<a href="https://www.st.com/resource/en/brochure/beyond-the-wires-exploring-bluetooth-and-lorawan-connectivity.pdf">https://www.st.com/resource/en/brochure/beyond-the-wires-exploring-bluetooth-and-lorawan-connectivity.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flnucleolrwan.pdf">https://www.st.com/resource/en/flyer/flnucleolrwan.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/flstm32wl3x.pdf">https://www.st.com/resource/en/flyer/flstm32wl3x.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf</a>
Application Notes	<a href="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</a>
Application Notes	<a href="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</a>
Application Notes	<a href="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</a>
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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](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](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/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf](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/an5406-how-to-build-a-lora-application-with-stm32cubewl-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5406-how-to-build-a-lora-application-with-stm32cubewl-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5408-migrating-from-stm32l0-stm32l1-and-stm32l4-series-associated-with-sx12xx-transceivers-to-stm32wl-series-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5408-migrating-from-stm32l0-stm32l1-and-stm32l4-series-associated-with-sx12xx-transceivers-to-stm32wl-series-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5409-stm32cube-mcu-package-examples-for-stm32wl-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5409-stm32cube-mcu-package-examples-for-stm32wl-series-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5457-rf-matching-network-design-guide-for-stm32wl-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5457-rf-matching-network-design-guide-for-stm32wl-series-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5480-how-to-build-a-sigfox-application-with-stm32cubewl-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5480-how-to-build-a-sigfox-application-with-stm32cubewl-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5568-ultralowpower-features-of-stm32wl-series-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5568-ultralowpower-features-of-stm32wl-series-microcontrollers-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5664-rssi-and-snr-for-lora-modulation-on-stm32wl-series-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5664-rssi-and-snr-for-lora-modulation-on-stm32wl-series-stmicroelectronics.pdf)

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Application Notes [https://www.st.com/resource/en/application\\_note/an5042-how-to-calibrate-the-hse-clock-for-rf-applications-on-stm32-wireless-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5042-how-to-calibrate-the-hse-clock-for-rf-applications-on-stm32-wireless-mcus-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](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/an4894-how-to-use-eeeprom-emulation-on-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4894-how-to-use-eeeprom-emulation-on-stm32-mcus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an5886-guidelines-for-design-and-board-assembly-of-land-grid-array-packages-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5886-guidelines-for-design-and-board-assembly-of-land-grid-array-packages-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an5036-guidelines-for-thermal-management-on-stm32-applications-stmicroelectronics.pdf](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/an5690-how-to-use-vrefbuf-peripheral-on-stm32-mcus-and-mpus-stmicroelectronics.pdf](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](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/an2867-guidelines-for-oscillator-design-on-stm8afals-and-stm32-mcusmpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2867-guidelines-for-oscillator-design-on-stm8afals-and-stm32-mcusmpus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4013-introduction-to-timers-for-stm32-mcus-stmicroelectronics.pdf](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](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/an4759-introduction-to-using-the-hardware-realtime-clock-rtc-and-the-tamper-management-unit-tamp-with-stm32-mcus-stmicroelectronics.pdf](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-uart-automatic-baud-rater-detection-for-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4908-getting-started-with-uart-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](https://www.st.com/resource/en/application_note/an5156-introduction-to-security-for-stm32-mcus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an5543-guidelines-for-enhanced-spi-communication-on-stm32-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5543-guidelines-for-enhanced-spi-communication-on-stm32-mcus-and-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/cd00211314-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/cd00211314-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack2-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack2-mcus-and-mpus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5920-guidelines-for-designing-a-uart-bootloader-protocol-for-stm32wl3-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5920-guidelines-for-designing-a-uart-bootloader-protocol-for-stm32wl3-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5973-guidelines-for-bringing-up-on-stm32wl3x-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5973-guidelines-for-bringing-up-on-stm32wl3x-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5923-how-to-optimize-the-rf-board-layout-for-stm32wl3x-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5923-how-to-optimize-the-rf-board-layout-for-stm32wl3x-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an5931-introduction-to-etsi-compliance-test-at-868-mhz-srd-band-for-stm32wl33xx-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5931-introduction-to-etsi-compliance-test-at-868-mhz-srd-band-for-stm32wl33xx-mcus-stmicroelectronics.pdf)

Application Notes [https://www.st.com/resource/en/application\\_note/an4657-stm32-inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4657-stm32-inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf)  
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Application Notes [https://www.st.com/resource/en/application\\_note/an5360-getting-started-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5360-getting-started-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an5394-getting-started-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5394-getting-started-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf)  
for related Tools  
& Software

Application Notes [https://www.st.com/resource/en/application\\_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbp-d-sink-application-with-stm32cubemx-stmicroelectronics.pdf)  
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