



## 1. Description

### 1.1. Project

Project Name	F411_HW_SPI_UART
Board Name	custom
Generated with:	STM32CubeMX 6.10.0
Date	10/16/2024

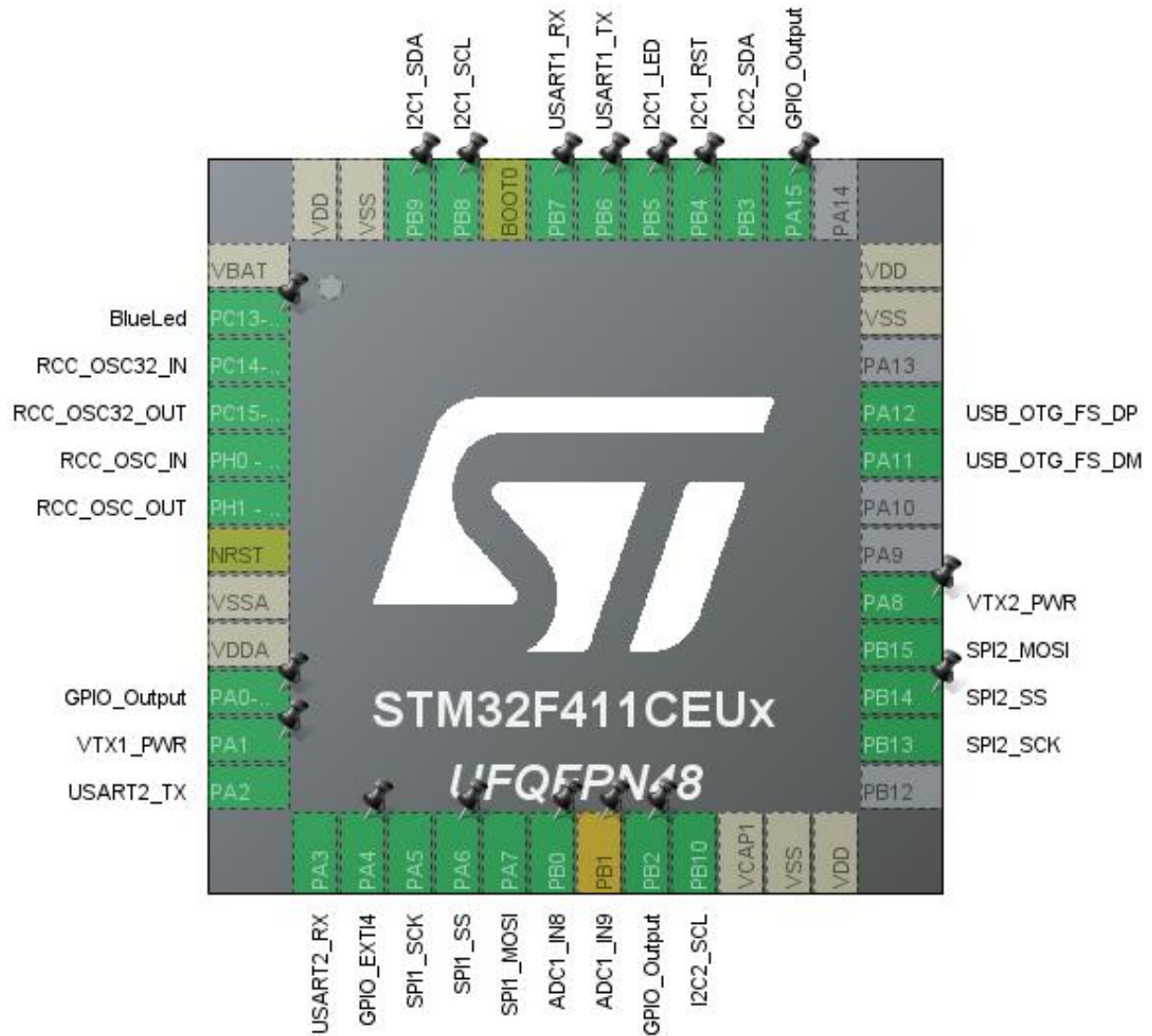
### 1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F411
MCU name	STM32F411CEUx
MCU Package	UFQFPN48
MCU Pin number	48

### 1.3. Core(s) information

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



### 3. Pins Configuration

Pin Number UFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-ANTI_TAMP *	I/O	GPIO_Output	BlueLed
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
10	PA0-WKUP *	I/O	GPIO_Output	
11	PA1 *	I/O	GPIO_Output	VTX1_PWR
12	PA2	I/O	USART2_TX	
13	PA3	I/O	USART2_RX	
14	PA4	I/O	GPIO_EXTI4	
15	PA5	I/O	SPI1_SCK	
16	PA6 *	I/O	GPIO_Output	SPI1_SS
17	PA7	I/O	SPI1_MOSI	
18	PB0	I/O	ADC1_IN8	
19	PB1 **	I/O	ADC1_IN9	
20	PB2 *	I/O	GPIO_Output	
21	PB10	I/O	I2C2_SCL	
22	VCAP1	Power		
23	VSS	Power		
24	VDD	Power		
26	PB13	I/O	SPI2_SCK	
27	PB14 *	I/O	GPIO_Output	SPI2_SS
28	PB15	I/O	SPI2_MOSI	
29	PA8 *	I/O	GPIO_Output	VTX2_PWR
32	PA11	I/O	USB_OTG_FS_DM	
33	PA12	I/O	USB_OTG_FS_DP	
35	VSS	Power		
36	VDD	Power		
38	PA15 *	I/O	GPIO_Output	
39	PB3	I/O	I2C2_SDA	
40	PB4 *	I/O	GPIO_Output	I2C1_RST
41	PB5 *	I/O	GPIO_Output	I2C1_LED

Pin Number UFQFPN48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
42	PB6	I/O	USART1_TX	
43	PB7	I/O	USART1_RX	
44	BOOT0	Boot		
45	PB8	I/O	I2C1_SCL	
46	PB9	I/O	I2C1_SDA	
47	VSS	Power		
48	VDD	Power		

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

\*\* The pin is affected with a peripheral function but no peripheral mode is activated



## 5. Software Project

### 5.1. Project Settings

Name	Value
Project Name	F411_HW_SPI_UART
Project Folder	D:\STM Project\Mirror5_8G\F411_HW_SPI_UART
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.27.1
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 only the necessary library files
Generate peripheral initialization as a pair of '.c/.h' files	Yes
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	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_DMA_Init	DMA
4	MX_TIM2_Init	TIM2
5	MX_USART2_UART_Init	USART2
6	MX_USB_DEVICE_Init	USB_DEVICE
7	MX_CRC_Init	CRC
8	MX_FATFS_Init	FATFS
9	MX_I2C2_Init	I2C2
10	MX_SPI1_Init	SPI1
11	MX_USART1_UART_Init	USART1

Rank	Function Name	Peripheral Instance Name
12	MX_I2C1_Init	I2C1
13	MX_SPI2_Init	SPI2
14	MX_ADC1_Init	ADC1



## 1. Power Consumption Calculator report

### 1.1. Microcontroller Selection

Series	STM32F4
Line	STM32F411
MCU	STM32F411CEUx
Datasheet	DS10314_Rev6

### 1.2. Parameter Selection

Temperature	25
Vdd	1.7

### 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

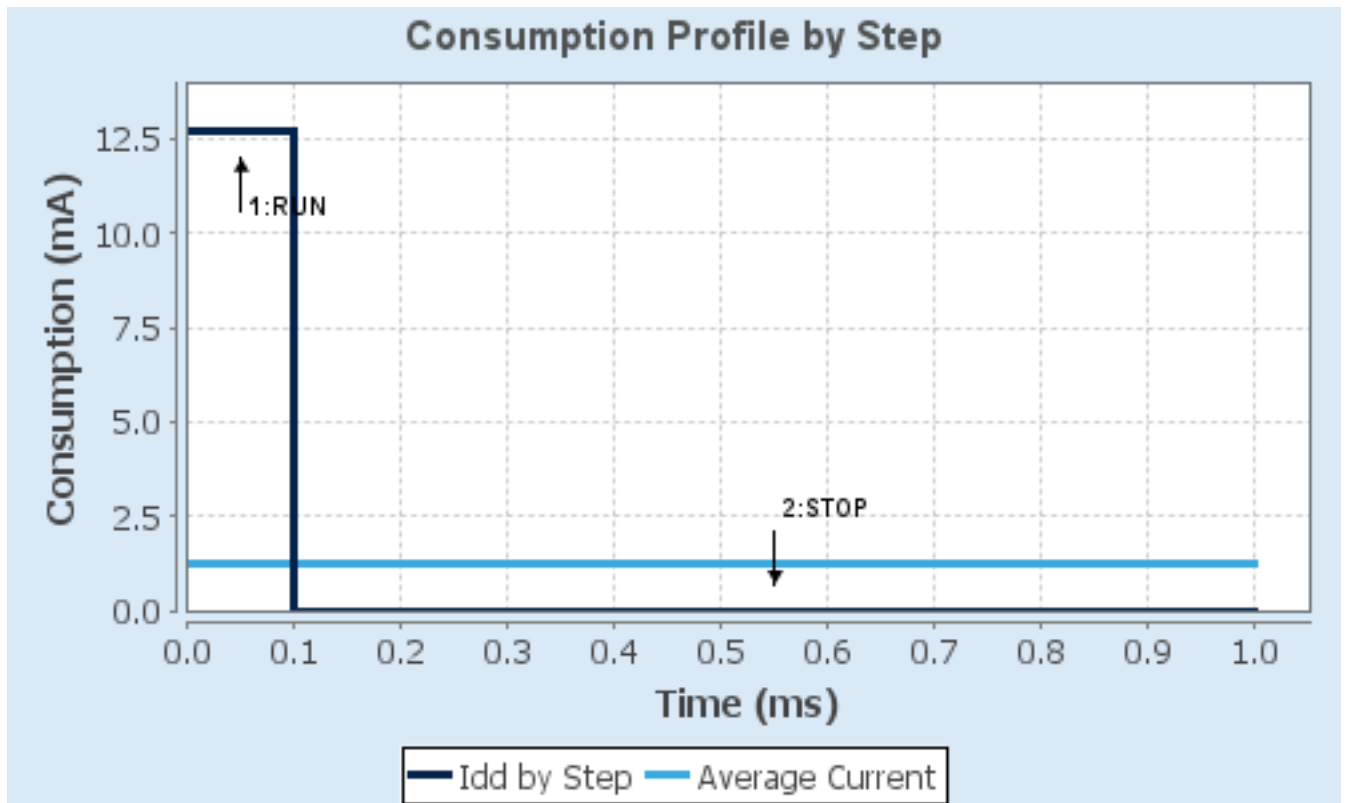
#### 1.4. Sequence

<b>Step</b>	Step1	Step2
<b>Mode</b>	RUN	STOP
<b>Vdd</b>	1.7	1.7
<b>Voltage Source</b>	Battery	Battery
<b>Range</b>	Scale1-High	No Scale
<b>Fetch Type</b>	SRAM	n/a
<b>CPU Frequency</b>	100 MHz	0 Hz
<b>Clock Configuration</b>	HSE PLL	Regulator_LPLV Flash-PwrDwn
<b>Clock Source Frequency</b>	4 MHz	0 Hz
<b>Peripherals</b>		
<b>Additional Cons.</b>	0 mA	0 mA
<b>Average Current</b>	12.7 mA	9 $\mu$ A
<b>Duration</b>	0.1 ms	0.9 ms
<b>DMIPS</b>	125.0	0.0
<b>Ta Max</b>	104.31	105
<b>Category</b>	In DS Table	In DS Table

#### 1.5. Results

Sequence Time	1 ms	Average Current	1.28 mA
Battery Life	3 months, 19 days, 6 hours	Average DMIPS	125.0 DMIPS

#### 1.6. Chart



## 2. Peripherals and Middlewares Configuration

### 2.1. ADC1

mode: IN8

mode: Vrefint Channel

#### 2.1.1. Parameter Settings:

##### ADCs\_Common\_Settings:

Mode Independent mode

##### ADC\_Settings:

Clock Prescaler PCLK2 divided by 2

Resolution 12 bits (15 ADC Clock cycles)

Data Alignment Right alignment

Scan Conversion Mode Enabled

Continuous Conversion Mode **Enabled \***

Discontinuous Conversion Mode Disabled

DMA Continuous Requests Disabled

End Of Conversion Selection EOC flag at the end of single channel conversion

##### ADC\_Regular\_ConversionMode:

Number Of Conversion **2 \***

External Trigger Conversion Source Regular Conversion launched by software

External Trigger Conversion Edge None

Rank 1

Channel Channel 8

Sampling Time 3 Cycles

Rank **2 \***

Channel Channel 8

Sampling Time 3 Cycles

##### ADC\_Injected\_ConversionMode:

Number Of Conversions 0

##### WatchDog:

Enable Analog WatchDog Mode false

### 2.2. CRC

mode: Activated

### 2.3. I2C1

## I2C: I2C

### 2.3.1. Parameter Settings:

#### Master Features:

I2C Speed Mode	Standard Mode
I2C Clock Speed (Hz)	100000

#### Slave Features:

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

## 2.4. I2C2

## I2C: I2C

### 2.4.1. Parameter Settings:

#### Master Features:

I2C Speed Mode	Standard Mode
I2C Clock Speed (Hz)	100000

#### Slave Features:

Clock No Stretch Mode	Disabled
Primary Address Length selection	7-bit
Dual Address Acknowledged	Disabled
Primary slave address	0
General Call address detection	Disabled

## 2.5. RCC

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

**Low Speed Clock (LSE) : Crystal/Ceramic Resonator**

### 2.5.1. Parameter Settings:

#### System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled

Flash Latency(WS)	0 WS (1 CPU cycle)
<b>RCC Parameters:</b>	
HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timeout Value (ms)	100
LSE Startup Timeout Value (ms)	5000
<b>Power Parameters:</b>	
Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

## 2.6. SPI1

### Mode: Half-Duplex Master

#### 2.6.1. Parameter Settings:

<b>Basic Parameters:</b>	
Frame Format	Motorola
Data Size	8 Bits
First Bit	<b>LSB First *</b>
<b>Clock Parameters:</b>	
Prescaler (for Baud Rate)	<b>128 *</b>
Baud Rate	<b>187.5 KBits/s *</b>
Clock Polarity (CPOL)	<b>High *</b>
Clock Phase (CPHA)	<b>2 Edge *</b>
<b>Advanced Parameters:</b>	
CRC Calculation	Disabled
NSS Signal Type	Software

## 2.7. SPI2

### Mode: Half-Duplex Master

#### 2.7.1. Parameter Settings:

<b>Basic Parameters:</b>	
Frame Format	Motorola
Data Size	8 Bits
First Bit	<b>LSB First *</b>
<b>Clock Parameters:</b>	
Prescaler (for Baud Rate)	<b>256 *</b>

Baud Rate	<b>46.875 KBits/s *</b>
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge
<b>Advanced Parameters:</b>	
CRC Calculation	Disabled
NSS Signal Type	Software

## 2.8. SYS

**Timebase Source: SysTick**

## 2.9. TIM2

**Clock Source : Internal Clock**

### 2.9.1. Parameter Settings:

#### **Counter Settings:**

Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value )	4294967295
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)

## 2.10. USART1

**Mode: Asynchronous**

### 2.10.1. Parameter Settings:

#### **Basic Parameters:**

Baud Rate	<b>4800 *</b>
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	<b>2 *</b>

#### **Advanced Parameters:**

Data Direction	Receive and Transmit
Over Sampling	16 Samples

## 2.11. USART2

### Mode: Asynchronous

#### 2.11.1. 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
Over Sampling	16 Samples

## 2.12. USB\_OTG\_FS

### Mode: Device\_Only

#### 2.12.1. Parameter Settings:

Speed	Device Full Speed 12MBit/s
Low power	Disabled
Link Power Management	Disabled
VBUS sensing	Disabled
Signal start of frame	Disabled

## 2.13. FATFS

### mode: User-defined

#### 2.13.1. Set Defines:

##### Version:

FATFS version	R0.12c
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##### Function Parameters:

FS_READONLY (Read-only mode)	Disabled
FS_MINIMIZE (Minimization level)	Disabled
USE_STRFUNC (String functions)	Enabled with LF -> CRLF conversion
USE_FIND (Find functions)	Disabled



USE_MKFS (Make filesystem function)	Enabled
USE_FASTSEEK (Fast seek function)	Enabled
USE_EXPAND (Use f_expand function)	Disabled
USE_CHMOD (Change attributes function)	Disabled
USE_LABEL (Volume label functions)	Disabled
USE_FORWARD (Forward function)	Disabled

#### Locale and Namespace Parameters:

CODE_PAGE (Code page on target)	Latin 1
USE_LFN (Use Long Filename)	Disabled
MAX_LFN (Max Long Filename)	255
LFN_UNICODE (Enable Unicode)	ANSI/OEM
STRF_ENCODE (Character encoding)	UTF-8
FS_RPATH (Relative Path)	Disabled

#### Physical Drive Parameters:

VOLUMES (Logical drives)	1
MAX_SS (Maximum Sector Size)	512
MIN_SS (Minimum Sector Size)	512
MULTI_PARTITION (Volume partitions feature)	Disabled
USE_TRIM (Erase feature)	Disabled
FS_NOFSINFO (Force full FAT scan)	0

#### System Parameters:

FS_TINY (Tiny mode)	Disabled
FS_EXFAT (Support of exFAT file system)	Disabled
FS_NORTC (Timestamp feature)	Dynamic timestamp
FS_REENTRANT (Re-Entrancy)	Disabled
FS_TIMEOUT (Timeout ticks)	1000
FS_LOCK (Number of files opened simultaneously)	2

## 2.14. USB\_DEVICE

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

#### 2.14.1. 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	2048
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USB CDC Tx Buffer Size

2048

2.14.2. 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

## 3. System Configuration

### 3.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	
I2C1	PB8	I2C1_SCL	Alternate Function Open Drain	<b>Pull-up *</b>	<b>Very High *</b>	
	PB9	I2C1_SDA	Alternate Function Open Drain	<b>Pull-up *</b>	<b>Very High *</b>	
I2C2	PB10	I2C2_SCL	Alternate Function Open Drain	<b>Pull-up *</b>	<b>Very High *</b>	
	PB3	I2C2_SDA	Alternate Function Open Drain	<b>Pull-up *</b>	<b>Very High *</b>	
RCC	PC14-OSC32_IN	RCC_OSC32_IN	n/a	n/a	n/a	
	PC15-OSC32_OUT	RCC_OSC32_OUT	n/a	n/a	n/a	
	PH0 - OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PH1 - OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
SPI2	PB13	SPI2_SCK	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
	PB15	SPI2_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
USART1	PB6	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
	PB7	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
USART2	PA2	USART2_TX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
	PA3	USART2_RX	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High *</b>	
USB_OTG_	PA11	USB_OTG_FS_	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b>	

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
FS		DM			*	
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	<b>Very High</b> *	
Single Mapped Signals	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	
GPIO	PC13-ANTI_TAMP	GPIO_Output	<b>Output Open Drain *</b>	No pull-up and no pull-down	Low	BlueLed
	PA0-WKUP	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA1	GPIO_Output	<b>Output Open Drain *</b>	No pull-up and no pull-down	Low	VTX1_PWR
	PA4	GPIO_EXTI4	<b>External Interrupt Mode with Falling edge trigger detection</b>	No pull-up and no pull-down	n/a	
	PA6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>High *</b>	SPI1_SS
	PB2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>High *</b>	
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>High *</b>	SPI2_SS
	PA8	GPIO_Output	<b>Output Open Drain *</b>	No pull-up and no pull-down	Low	VTX2_PWR
	PA15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>High *</b>	
	PB4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>Medium *</b>	I2C1_RST
	PB5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	<b>Medium *</b>	I2C1_LED

### 3.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA2_Stream0	Peripheral To Memory	Low

#### ADC1: DMA2\_Stream0 DMA request Settings:

Mode: **Circular \***  
Use fifo: Disable  
Peripheral Increment: Disable  
Memory Increment: **Enable \***  
Peripheral Data Width: Half Word  
Memory Data Width: Half Word

### 3.3. NVIC configuration

#### 3.3.1. 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
Pre-fetch 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
EXTI line4 interrupt	true	0	0
ADC1 global interrupt	true	0	0
TIM2 global interrupt	true	0	0
I2C1 event interrupt	true	0	0
I2C1 error interrupt	true	0	0
I2C2 event interrupt	true	0	0
I2C2 error interrupt	true	0	0
SPI1 global interrupt	true	0	0
SPI2 global interrupt	true	0	0
USART1 global interrupt	true	0	0
USART2 global interrupt	true	0	0
DMA2 stream0 global interrupt	true	0	0
USB On The Go FS global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
FPU global interrupt	unused		

#### 3.3.2. 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
Pre-fetch 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

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Pendable request for system service	false	true	false
System tick timer	false	true	true
EXTI line4 interrupt	false	true	true
ADC1 global interrupt	false	true	true
TIM2 global interrupt	false	true	true
I2C1 event interrupt	false	true	true
I2C1 error interrupt	false	true	true
I2C2 event interrupt	false	true	true
I2C2 error interrupt	false	true	true
SPI1 global interrupt	false	true	true
SPI2 global interrupt	false	true	true
USART1 global interrupt	false	true	true
USART2 global interrupt	false	true	true
DMA2 stream0 global interrupt	false	true	true
USB On The Go FS global interrupt	false	true	true

\* User modified value

## 4. System Views

### 4.1. Category view

#### 4.1.1. Current

Middleware					
<div>FATFS </div> <div>USB_DEVICE </div>					
System Core	Analog	Timers	Connectivity	Multimedia	Computing
DMA	ADC1	TIM2	I2C1		CRC
GPIO			I2C2		
NVIC			SPI1		
RCC			SPI2		
SYS			USART1		
			USART2		
			USB_FS		



## 5. Docs & Resources

Type	Link
BSDL files	<a href="https://www.st.com/resource/en/bsdl_model/stm32f411_bsd.zip">https://www.st.com/resource/en/bsdl_model/stm32f411_bsd.zip</a>
IBIS models	<a href="https://www.st.com/resource/en/ibis_model/stm32f411_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32f411_ibis.zip</a>
System View Description	<a href="https://www.st.com/resource/en/svd/stm32f4_svd.zip">https://www.st.com/resource/en/svd/stm32f4_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-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>
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/flstm32f4x1.pdf">https://www.st.com/resource/en/flyer/flstm32f4x1.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/flstmcsuite.pdf">https://www.st.com/resource/en/flyer/flstmcsuite.pdf</a>
Flyers	<a href="https://www.st.com/resource/en/flyer/flstm32trust.pdf">https://www.st.com/resource/en/flyer/flstm32trust.pdf</a>
Product Certifications	<a href="https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf">https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.pdf">https://www.st.com/resource/en/application_note/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.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/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</a>
Application Notes	<a href="https://www.st.com/resource/en/application_note/an2639-soldering-">https://www.st.com/resource/en/application_note/an2639-soldering-</a>

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