STM32
CubeMX

1. Description

1.1. Project

Project Name	horus_fw
Board Name	custom
Generated with:	STM32CubeMX 6.12.0
Date	08/23/2024

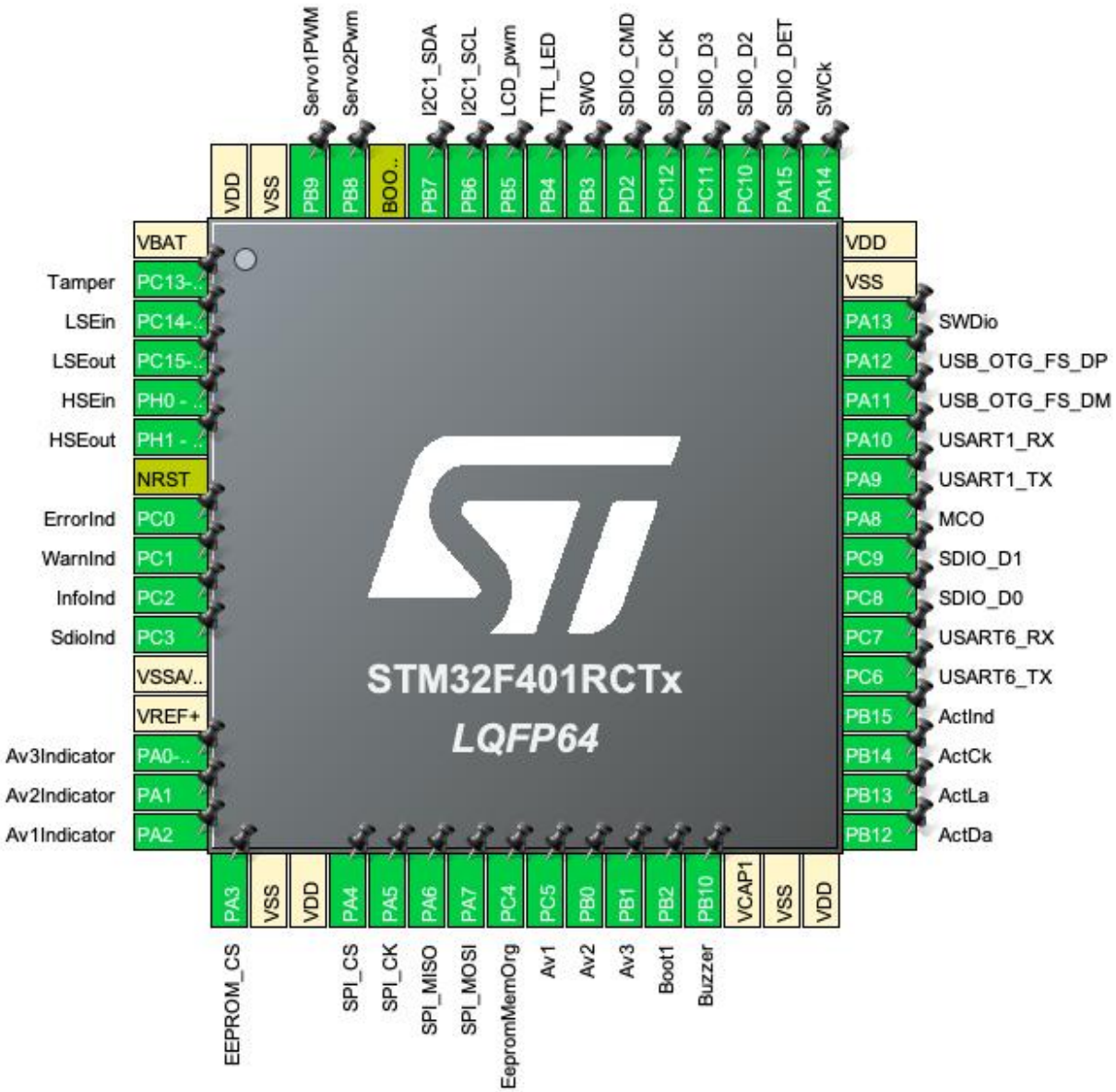
1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F401
MCU name	STM32F401RCTx
MCU Package	LQFP64
MCU Pin number	64

1.3. Core(s) information

Core(s)	Arm Cortex-M4

2. Pinout Configuration



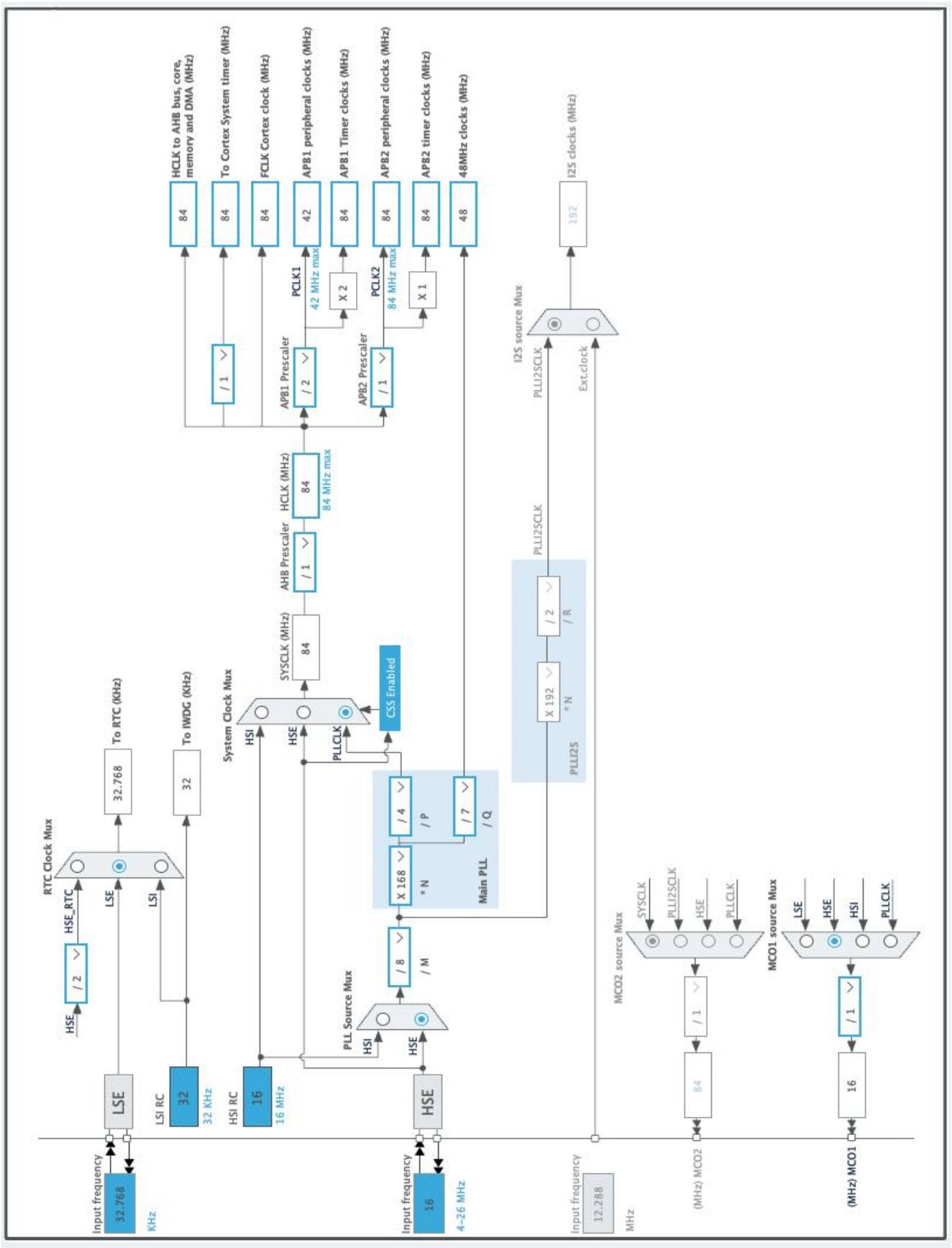
3. Pins Configuration

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
2	PC13-ANTI_TAMP	I/O	RTC_AF1	Tamper
3	PC14-OSC32_IN	I/O	RCC_OSC32_IN	LSEin
4	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	LSEout
5	PH0 - OSC_IN	I/O	RCC_OSC_IN	HSEin
6	PH1 - OSC_OUT	I/O	RCC_OSC_OUT	HSEout
7	NRST	Reset		
8	PC0 *	I/O	GPIO_Output	ErrorInd
9	PC1 *	I/O	GPIO_Output	WarnInd
10	PC2 *	I/O	GPIO_Output	InfoInd
11	PC3 *	I/O	GPIO_Output	SdioInd
12	VSSA/VREF-	Power		
13	VREF+	Power		
14	PA0-WKUP *	I/O	GPIO_Output	Av3Indicator
15	PA1 *	I/O	GPIO_Output	Av2Indicator
16	PA2 *	I/O	GPIO_Output	Av1Indicator
17	PA3 *	I/O	GPIO_Output	EEPROM_CS
18	VSS	Power		
19	VDD	Power		
20	PA4 *	I/O	GPIO_Output	SPI_CS
21	PA5	I/O	SPI1_SCK	SPI_CK
22	PA6	I/O	SPI1_MISO	SPI_MISO
23	PA7	I/O	SPI1_MOSI	SPI_MOSI
24	PC4 *	I/O	GPIO_Output	EepromMemOrg
25	PC5	I/O	ADC1_IN15	Av1
26	PB0	I/O	ADC1_IN8	Av2
27	PB1	I/O	ADC1_IN9	Av3
28	PB2 *	I/O	GPIO_Analog	Boot1
29	PB10 *	I/O	GPIO_Output	Buzzer
30	VCAP1	Power		
31	VSS	Power		
32	VDD	Power		
33	PB12 *	I/O	GPIO_Output	ActDa
34	PB13 *	I/O	GPIO_Output	ActLa
35	PB14 *	I/O	GPIO_Output	ActCk
36	PB15 *	I/O	GPIO_Output	ActInd

Pin Number LQFP64	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
37	PC6	I/O	USART6_TX	
38	PC7	I/O	USART6_RX	
39	PC8	I/O	SDIO_D0	
40	PC9	I/O	SDIO_D1	
41	PA8	I/O	RCC_MCO_1	MCO
42	PA9	I/O	USART1_TX	
43	PA10	I/O	USART1_RX	
44	PA11	I/O	USB_OTG_FS_DM	
45	PA12	I/O	USB_OTG_FS_DP	
46	PA13	I/O	SYS_JTMS-SWDIO	SWDio
47	VSS	Power		
48	VDD	Power		
49	PA14	I/O	SYS_JTCK-SWCLK	SWCk
50	PA15 *	I/O	GPIO_Input	SDIO_DET
51	PC10	I/O	SDIO_D2	
52	PC11	I/O	SDIO_D3	
53	PC12	I/O	SDIO_CK	
54	PD2	I/O	SDIO_CMD	
55	PB3	I/O	SYS_JTDO-SWO	SWO
56	PB4 *	I/O	GPIO_Output	TTL_LED
57	PB5	I/O	TIM3_CH2	LCD_pwm
58	PB6	I/O	I2C1_SCL	
59	PB7	I/O	I2C1_SDA	
60	BOOT0	Boot		
61	PB8	I/O	TIM10_CH1	Servo2Pwm
62	PB9	I/O	TIM11_CH1	Servo1PWM
63	VSS	Power		
64	VDD	Power		

* The pin is affected with an I/O function

4. Clock Tree Configuration



1. Power Consumption Calculator report

1.1. Microcontroller Selection

Series	STM32F4
Line	STM32F401
MCU	STM32F401RCTx
Datasheet	DS9716_Rev8

1.2. Parameter Selection

Temperature	25
Vdd	3.3

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

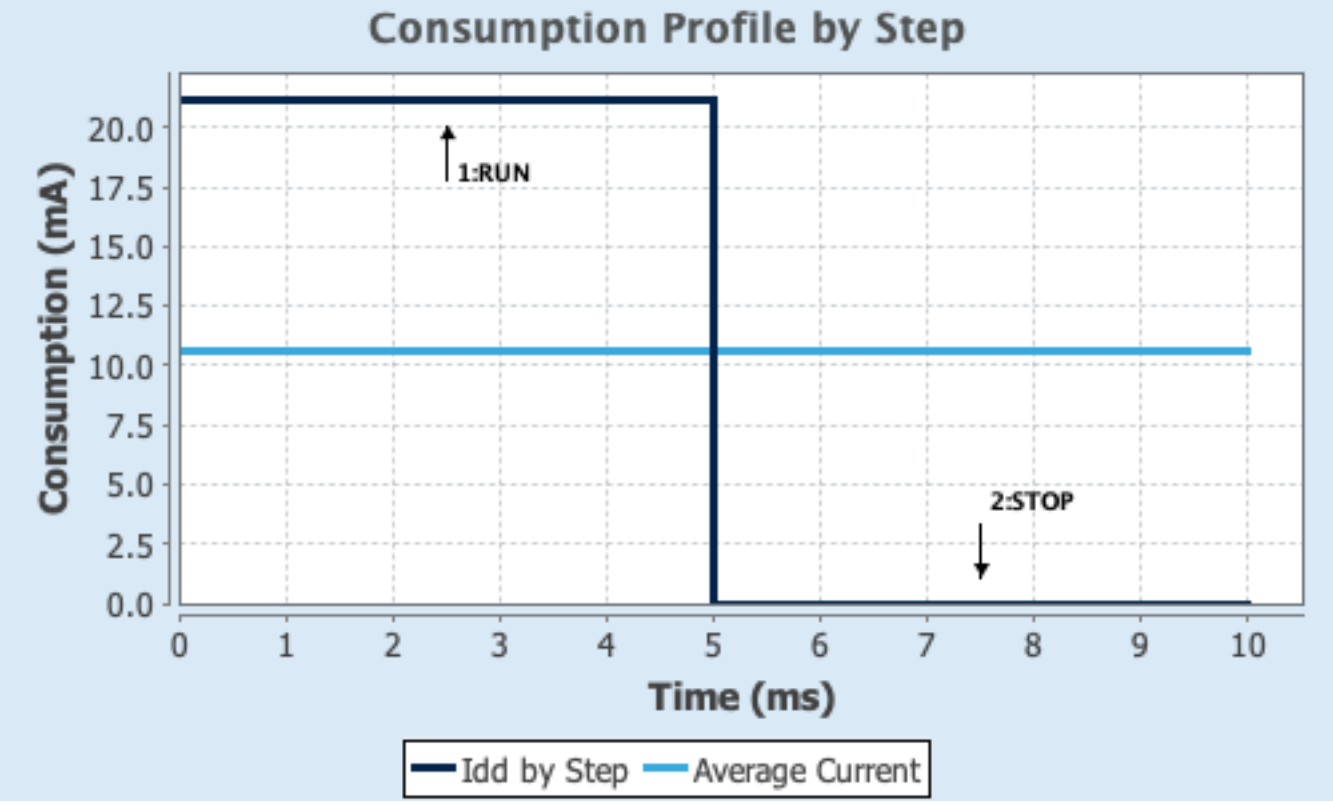
1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	Scale2-Medium	No Scale
Fetch Type	FLASH/ART/PREFETCH	n/a
CPU Frequency	84 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LPLV Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	21.2 mA	10 µA
Duration	5 ms	5 ms
DMIPS	105.0	0.0
Ta Max	101.5	105
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	10 ms	Average Current	10.6 mA
Battery Life	13 days, 8 hours	Average DMIPS	105.0 DMIPS

1.6. Chart


Consumption Profile by Step
Consumption (mA)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
1:RUN
2:STOP
0
1
2
3
4
5
6
7
8
9
10
Time (ms)
Idd by Step
Average Current

2. Software Project

2.1. Project Settings

Name	Value
Project Name	horus_fw
Project Folder	/Users/alybadawy/vexuf/horus_fw
Toolchain / IDE	CMake
Firmware Package Name and Version	STM32Cube FW_F4 V1.28.0
Application Structure	Advanced
Generate Under Root	No
Do not generate the main()	No
Minimum Heap Size	0x800
Minimum Stack Size	0x1000

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	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

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_RTC_Init	RTC
5	MX_ADC1_Init	ADC1
6	MX_I2C1_Init	I2C1
7	MX_SDIO_SD_Init	SDIO
8	MX_FATFS_Init	FATFS
9	MX_SPI1_Init	SPI1
10	MX_TIM4_Init	TIM4
11	MX_TIM5_Init	TIM5

Rank	Function Name	Peripheral Instance Name
12	MX_TIM9_Init	TIM9
13	MX_USART1_UART_Init	USART1
14	MX_USART6_UART_Init	USART6
15	MX_TIM3_Init	TIM3
16	MX_USB_DEVICE_Init	USB_DEVICE
17	MX_TIM10_Init	TIM10
18	MX_TIM11_Init	TIM11
19	MX_IWDG_Init	IWDG

3. Peripherals and Middlewares Configuration

3.1. ADC1

mode: IN8

mode: IN9

mode: IN15

mode: Temperature Sensor Channel

mode: Vrefint Channel

3.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	**PCLK2 divided by 8 ***
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	**Enabled ***
End Of Conversion Selection	EOC flag at the end of single channel conversion

ADC_Regular_ConversionMode:

Number Of Conversion	**5 ***
External Trigger Conversion Source	Regular Conversion launched by software
External Trigger Conversion Edge	None
Rank	1
Channel	**Channel Vrefint ***
Sampling Time	**56 Cycles ***
Rank	**2 ***
Channel	**Channel Temperature Sensor ***
Sampling Time	**144 Cycles ***
Rank	**3 ***
Channel	**Channel 15 ***
Sampling Time	**56 Cycles ***
Rank	**4 ***
Channel	Channel 8
Sampling Time	**56 Cycles ***
Rank	**5 ***

Channel	**Channel 9 ***
Sampling Time	**56 Cycles ***

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

3.2. I2C1

I2C: I2C

3.2.1. 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

3.3. IWDG

mode: Activated

3.3.1. Parameter Settings:

Clocking:

IWDG counter clock prescaler	**64 ***
IWDG down-counter reload value	**2500 ***

3.4. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

mode: Master Clock Output 1

3.4.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	2 WS (3 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
TIM Prescaler Selection	Disabled
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 2

3.5. RTC

mode: Activate Clock Source

mode: Activate Calendar

Alarm A: Internal Alarm

Alarm B: Internal Alarm

WakeUp: Internal WakeUp

mode: Tamper 1

3.5.1. Parameter Settings:

General:

Hour Format	Hourformat 24
Asynchronous Predivider value	127
Synchronous Predivider value	255

Calendar Time:

Data Format	BCD data format
Hours	**15 ***
Minutes	**20 ***
Seconds	0
Day Light Saving: value of hour adjustment	Daylightsaving None
Store Operation	**Storeoperation Set ***

Calendar Date:

Week Day

	Tuesday *
Month	**July ***
Date	**30 ***
Year	**24 ***

Alarm A:

Hours	0
Minutes	0
Seconds	0
Sub Seconds	0
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

Alarm B:

Hours	0
Minutes	0
Seconds	0
Sub Seconds	0
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

Wake UP:

Wake Up Clock	RTCCLK / 16
Wake Up Counter	0

Tamper:

Filter	Disabled
Sampling Frequency	Sampling Frequency = RTCCLK / 32768
Precharge Duration	Precharge Duration = 1 RTCCLK cycle
Tamper Pull Up	Enabled
Time Stamp On Tamper Detection	Time Stamp on Tamper Detection event saved
Tamper 1 Trigger	Rising Edge

3.6. SDIO

Mode: SD 4 bits Wide bus

3.6.1. Parameter Settings:

SDIO parameters:

Clock transition on which the bit capture is made	Rising transition
SDIO Clock divider bypass	Disable
SDIO Clock output enable when the bus is idle	**Enable the power save for the clock ***
SDIO hardware flow control	The hardware control flow is disabled
SDIOCLK clock divide factor	0

3.7. SPI1

Mode: Full-Duplex Master

3.7.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	**256 ***
Baud Rate	**328.125 KBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

3.8. SYS

Debug: Trace Asynchronous Sw

Timebase Source: TIM1

3.9. TIM3

Clock Source : Internal Clock

Channel2: PWM Generation CH2

3.9.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**84 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 - 1 ***
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)

PWM Generation Channel 2:

Mode	PWM mode 1
Pulse (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

3.10. TIM4
mode: Clock Source
Channel1: Output Compare No Output

3.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**8400 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 - 1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

Output Compare No Output Channel 1:

Mode	**Toggle on match ***
Pulse (16 bits value)	**1000-1 ***
Output compare preload	Disable
CH Polarity	High

3.11. TIM5

mode: Clock Source

3.11.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**8400 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 bits value)	**100000 - 1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Reset (UG bit from TIMx_EGR)

3.12. TIM9

mode: Clock Source

Channel1: Output Compare No Output

3.12.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**8400 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**10000 - 1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	**Enable ***

Output Compare No Output Channel 1:

Mode	**Toggle on match ***
Pulse (16 bits value)	**10000 - 1 ***
Output compare preload	Disable
CH Polarity	High

3.13. TIM10

mode: Activated

Channel1: PWM Generation CH1

3.13.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**1680 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 - 1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

PWM Generation Channel 1:

Mode	PWM mode 1
Pulse (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

3.14. TIM11

mode: Activated

Channel1: PWM Generation CH1

3.14.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**1680 - 1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000 - 1 ***
Internal Clock Division (CKD)	No Division
auto-reload preload	Disable

PWM Generation Channel 1:

Mode	PWM mode 1
Pulse (16 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

3.15. USART1

Mode: Asynchronous

3.15.1. 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

3.16. USART6

Mode: Asynchronous

3.16.1. 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

3.17. USB_OTG_FS

Mode: Device_Only

3.17.1. Parameter Settings:

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

3.18. FATFS

mode: SD Card

3.18.1. Set Defines:

Version:

FATFS version	R0.12c

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

Locale and Namespace Parameters:

CODE_PAGE (Code page on target)	Latin 1
USE_LFN (Use Long Filename)	**Enabled with static working buffer on the BSS ***
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)	**4096 ***
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)	**Enabled ***
FS_NORTC (Timestamp feature)	Dynamic timestamp
FS_REENTRANT (Re-Entrancy)	Disabled
FS_TIMEOUT (Timeout ticks)	1000
FS_LOCK (Number of files opened simultaneously)	2

3.18.2. Advanced Settings:

SDIO/SDMMC:

SDIO instance	SDIO
Use dma template	**Enabled ***
BSP code for SD	Generic

3.18.3. Platform Settings:

Detect_SDIO	PA15

3.19. USB_DEVICE

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

3.19.1. 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	1024
USB CDC Tx Buffer Size	1024

3.19.2. Device Descriptor:

Device Descriptor:

VID (Vendor IDentifier)	1155
LANGID_STRING (Language Identifier)	English(United States)
MANUFACTURER_STRING (Manufacturer Identifier)	**VexUF By Aly Badawy ***

Device Descriptor FS:

PID (Product IDentifier)	**61858 ***
PRODUCT_STRING (Product Identifier)	**VexUF:Horus Serial Interface ***
CONFIGURATION_STRING (Configuration Identifier)	CDC Config
INTERFACE_STRING (Interface Identifier)	CDC Interface

*** User modified value**

4. System Configuration

4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
ADC1	PC5	ADC1_IN15	Analog mode	No pull-up and no pull-down	n/a	Av1
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	Av2
	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	Av3
I2C1	PB6	I2C1_SCL	Alternate Function Open Drain	No pull-up and no pull-down	**Very High ***	
	PB7	I2C1_SDA	Alternate Function Open Drain	No pull-up and no pull-down	**Very High ***	
RCC	PC14-OSC32_IN	RCC_OSC32_IN	n/a	n/a	n/a	LSEin
	PC15-OSC32_OUT	RCC_OSC32_OUT	n/a	n/a	n/a	LSEout
	PH0 - OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	HSEin
	PH1 - OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	HSEout
	PA8	RCC_MCO_1	Alternate Function Push Pull	No pull-up and no pull-down	Low	MCO
RTC	PC13-ANTI_TAMP	RTC_AF1	n/a	n/a	n/a	Tamper
SDIO	PC8	SDIO_D0	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC9	SDIO_D1	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC10	SDIO_D2	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC11	SDIO_D3	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PC12	SDIO_CK	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
	PD2	SDIO_CMD	Alternate Function Push Pull	No pull-up and no pull-down	Very High	
SPI1	PA5	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	SPI_CK
	PA6	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	SPI_MISO
	PA7	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	SPI_MOSI
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	SWDio
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	SWCk
	PB3	SYS_JTDO-SWO	n/a	n/a	n/a	SWO

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
TIM3	PB5	TIM3_CH2	Alternate Function Push Pull	No pull-up and no pull-down	Low	LCD_pwm
TIM10	PB8	TIM10_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	Servo2Pwm
TIM11	PB9	TIM11_CH1	Alternate Function Push Pull	No pull-up and no pull-down	Low	Servo1PWM
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 ***	
USART6	PC6	USART6_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PC7	USART6_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
USB_OTG_FS	PA11	USB_OTG_FS_DM	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA12	USB_OTG_FS_DP	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
GPIO	PC0	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ErrorInd
	PC1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	WarnInd
	PC2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	InfoInd
	PC3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SdioInd
	PA0-WKUP	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Av3Indicator
	PA1	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Av2Indicator
	PA2	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Av1Indicator
	PA3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	EEPROM_CS
	PA4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	SPI_CS
	PC4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	EepromMemOrg
	PB2	GPIO_Analog	Analog mode	No pull-up and no pull-down	n/a	Boot1
	PB10	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	Buzzer
	PB12	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ActDa
	PB13	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ActLa
	PB14	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ActCk
	PB15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	ActInd
	PA15	GPIO_Input	Input mode	No pull-up and no pull-down	n/a	SDIO_DET
	PB4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	TTL_LED

4.2. DMA configuration

DMA request	Stream	Direction	Priority
ADC1	DMA2_Stream4	Peripheral To Memory	Low
SDIO	DMA2_Stream3	Peripheral To Memory	Low
USART1_RX	DMA2_Stream2	Peripheral To Memory	Low
USART6_RX	DMA2_Stream1	Peripheral To Memory	Low
USART6_TX	DMA2_Stream6	Memory To Peripheral	Low
USART1_TX	DMA2_Stream7	Memory To Peripheral	Low

ADC1: DMA2_Stream4 DMA request Settings:

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

SDIO: DMA2_Stream3 DMA request Settings:

Mode:	**Peripheral Flow Control ***
Use fifo:	**Enable ***
FIFO Threshold:	Full
Peripheral Increment:	Disable
Memory Increment:	**Enable ***
Peripheral Data Width:	**Word ***
Memory Data Width:	Word
Peripheral Burst Size:	**4 Increment ***
Memory Burst Size:	4 Increment

USART1_RX: DMA2_Stream2 DMA request Settings:

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

Memory Data Width:	Byte

USART6_RX: DMA2_Stream1 DMA request Settings:

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

USART6_TX: DMA2_Stream6 DMA request Settings:

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

USART1_TX: DMA2_Stream7 DMA request Settings:

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

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
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
RTC tamper and timestamp interrupts through EXTI line 21	true	0	0
RCC global interrupt	true	0	0
ADC1 global interrupt	true	0	0
TIM1 break interrupt and TIM9 global interrupt	true	0	0
TIM1 update interrupt and TIM10 global interrupt	true	15	0
TIM1 trigger and commutation interrupts and TIM11 global interrupt	true	0	0
TIM3 global interrupt	true	0	0
TIM4 global interrupt	true	0	0
SPI1 global interrupt	true	0	0
USART1 global interrupt	true	0	0
RTC alarms A and B interrupt through EXTI line 17	true	0	0
SDIO global interrupt	true	0	0
TIM5 global interrupt	true	0	0
DMA2 stream1 global interrupt	true	0	0
DMA2 stream2 global interrupt	true	0	0
DMA2 stream3 global interrupt	true	0	0
DMA2 stream4 global interrupt	true	0	0
USB On The Go FS global interrupt	true	0	0
DMA2 stream6 global interrupt	true	0	0
DMA2 stream7 global interrupt	true	0	0
USART6 global interrupt	true	0	0
FPU global interrupt	true	0	0
PVD interrupt through EXTI line 16	unused		
RTC wake-up interrupt through EXTI line 22	unused		
Flash global interrupt	unused		
I2C1 event interrupt	unused		

Interrupt Table	Enable	Preenmption Priority	SubPriority
I2C1 error 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	true
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
Pendable request for system service	false	true	false
System tick timer	false	true	true
RTC tamper and timestamp interrupts through EXTI line 21	false	true	true
RCC global interrupt	false	true	false
ADC1 global interrupt	false	true	true
TIM1 break interrupt and TIM9 global interrupt	false	true	true
TIM1 update interrupt and TIM10 global interrupt	false	true	true
TIM1 trigger and commutation interrupts and TIM11 global interrupt	false	true	true
TIM3 global interrupt	false	true	true
TIM4 global interrupt	false	true	true
SPI1 global interrupt	false	true	true
USART1 global interrupt	false	true	true
RTC alarms A and B interrupt through EXTI line 17	false	true	true
SDIO global interrupt	false	true	true
TIM5 global interrupt	false	true	true
DMA2 stream1 global interrupt	false	true	true
DMA2 stream2 global interrupt	false	true	true
DMA2 stream3 global interrupt	false	true	true
DMA2 stream4 global interrupt	false	true	true
USB On The Go FS global interrupt	false	true	true
DMA2 stream6 global interrupt	false	true	true
DMA2 stream7 global interrupt	false	true	true
USART6 global interrupt	false	true	true
FPU global interrupt	false	true	false

*** User modified value**

5. System Views

5.1. Category view

5.1.1. Current

6. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f401_bsdl.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f401_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f4-svd.zip
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_embedded_software_solutions.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_eval-tools_portfolio.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32_stm8_functional-safety-packages.pdf
Presentations	https://www.st.com/resource/en/product_presentation/stm32-stm8_software_development_tools.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32-family-overview.pdf
Presentations	https://www.st.com/resource/en/product_presentation/microcontrollers-stm32h7rs-lines-overview.pdf
Brochures	https://www.st.com/resource/en/brochure/products-and-solutions-for-plcs-and-smart-i-os.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32f4x1.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.pdf
Flyers	https://www.st.com/resource/en/flyer/flstmcsuite.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32trust.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf
Application Notes	https://www.st.com/resource/en/application_note/an1709-emc-design-guide-for-stm8-stm32-and-legacy-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2606-stm32-microcontroller-system-memory-boot-mode-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2639-soldering-

	recommendations-and-package-information-for-leadfree-ecopack-mcus-and-mpus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2945-stm8s-and-stm32-mcus-a-consistent-832bit-product-line-for-painless-migration-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3070-managing-the-driver-enable-signal-for-rs485-and-iolink-communications-with-the-stm32s-usart-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3154-can-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3155-usart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3156-usb-dfu-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf
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Application Notes	https://www.st.com/resource/en/application_note/an4031-using-the-stm32f2-stm32f4-and-stm32f7-series-dma-controller-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4221-i2c-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4229-how-to-implement-a-vocoder-solution-using-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4286-spi-protocol-

	used-in-the-stm32-bootloader-stmicroelectronics.pdf
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Application Notes	https://www.st.com/resource/en/application_note/an4566-extending-the-dac-performance-of-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4616-migrating-from-stm32f401-and-stm32f411-lines-to-stm32l4-series-and-stm32l4-series-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4646-peripheral-interconnections-on-stm32f401-and-stm32f411-lines-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4655-virtually-increasing-the-number-of-serial-communication-peripherals-in-stm32-applications-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4739-stm32cube-firmware-examples-for-stm32f4-series-stmicroelectronics.pdf
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Application Notes	https://www.st.com/resource/en/application_note/an4850-stm32-mcus-spreadspectrum-clock-generation-principles-properties-and-implementation-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4904-migration-of-microcontroller-applications-from-stm32f1-series-to-stm32f4-access-lines-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4989-stm32-microcontroller-debug-toolbox-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4995-using-an-electromyogram-technique-to-detect-muscle-activity-

	stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf
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Application Notes	https://www.st.com/resource/en/application_note/an5852-migrating-from-stm32f401-stm32f410-and-stm32f411-to-stm32h503-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4879-introduction-to-usb-hardware-and-pcb-guidelines-using-stm32-mcus-stmicroelectronics.pdf
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Application Notes	https://www.st.com/resource/en/application_note/an2834-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf
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	oscillator-design-on-stm8afals-and-stm32-mcusmpus-stmicroelectronics.pdf
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& Software	
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Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4435-guidelines-for-obtaining-ulcsaiec-607301603351-class-b-certification-in-any-stm32-application-stmicroelectronics.pdf
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Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4499-stm32--nrf51822-bluetooth-low-energy-system-solution-stmicroelectronics.pdf
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Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4701-proprietary-code-readout-protection-on-microcontrollers-of-the-stm32f4-series-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4739-stm32cube-firmware-examples-for-stm32f4-series-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4758-proprietary-code-readout-protection-on-stm32l4-stm32l4-stm32g4-and-stm32wb-series-mcus-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4841-digital-signal-processing-for-stm32-microcontrollers-using-cmsis-stmicroelectronics.pdf

Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4968-proprietary-code-read-out-protection-pcrop-on-stm32f72xxx-and-stm32f73xxx-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5056-integration-guide-for-the-xcubesbsfu-stm32cube-expansion-package-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5360-getting-started-with-projects-based-on-the-stm32mp1-series-in-stm32cubeide-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5394-getting-started-with-projects-based-on-the-stm32l5-series-in-stm32cubeide-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5418-how-to-build-a-simple-usbpd-sink-application-with-stm32cubemx-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5426-migrating-graphics-middleware-projects-from-stm32cubemx-540-to-stm32cubemx-550-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5464-position-control-of-a-threephase-permanent-magnet-motor-using-xcubemcsdk-or-xcubemcsdkful-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5564-getting-started-with-projects-based-on-dualcore-stm32wl-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5698-adapting-the-xcubestl-functional-safety-package-for-stm32-iec-61508-compliant-to-other-safety-standards-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5731-stm32cubemx-and-stm32cubeide-threadsafe-solution-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4502-stm32-

for related Tools & Software	smbuspmbus-expansion-package-for-stm32cube-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5952-how-to-use-cmake-in-stm32cubeide-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5054-how-to-perform-secure-programming-using-stm32cubeprogrammer-stmicroelectronics.pdf
Device Option Lists	https://www.st.com/resource/en/device_option_list/opl_stm32f401_256k.zip
Errata Sheets	https://www.st.com/resource/en/errata_sheet/es0222-stm32f401xb-and-stm32f401xc-device-errata-stmicroelectronics.pdf
Datasheet	https://www.st.com/resource/en/datasheet/dm00086815.pdf
Programming Manuals	https://www.st.com/resource/en/programming_manual/pm0214-stm32-cortexm4-mcus-and-mpus-programming-manual-stmicroelectronics.pdf
Reference Manuals	https://www.st.com/resource/en/reference_manual/rm0368-stm32f401xbc-and-stm32f401xde-advanced-armbased-32bit-mcus-stmicroelectronics.pdf
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn0516-overview-of-the-stm32f0xf100xxf103xx-and-stm32f2xxf30xf4xx-mcus-pmsm-singledual-foc-sdk-v40-stmicroelectronics.pdf
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Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1205-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-fpn-packages-stmicroelectronics.pdf
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