
STM32
CubeMX

1. Description

1.1. Project

Project Name	LineTrackingCarV2
Board Name	custom
Generated with:	STM32CubeMX 6.8.1
Date	05/16/2023

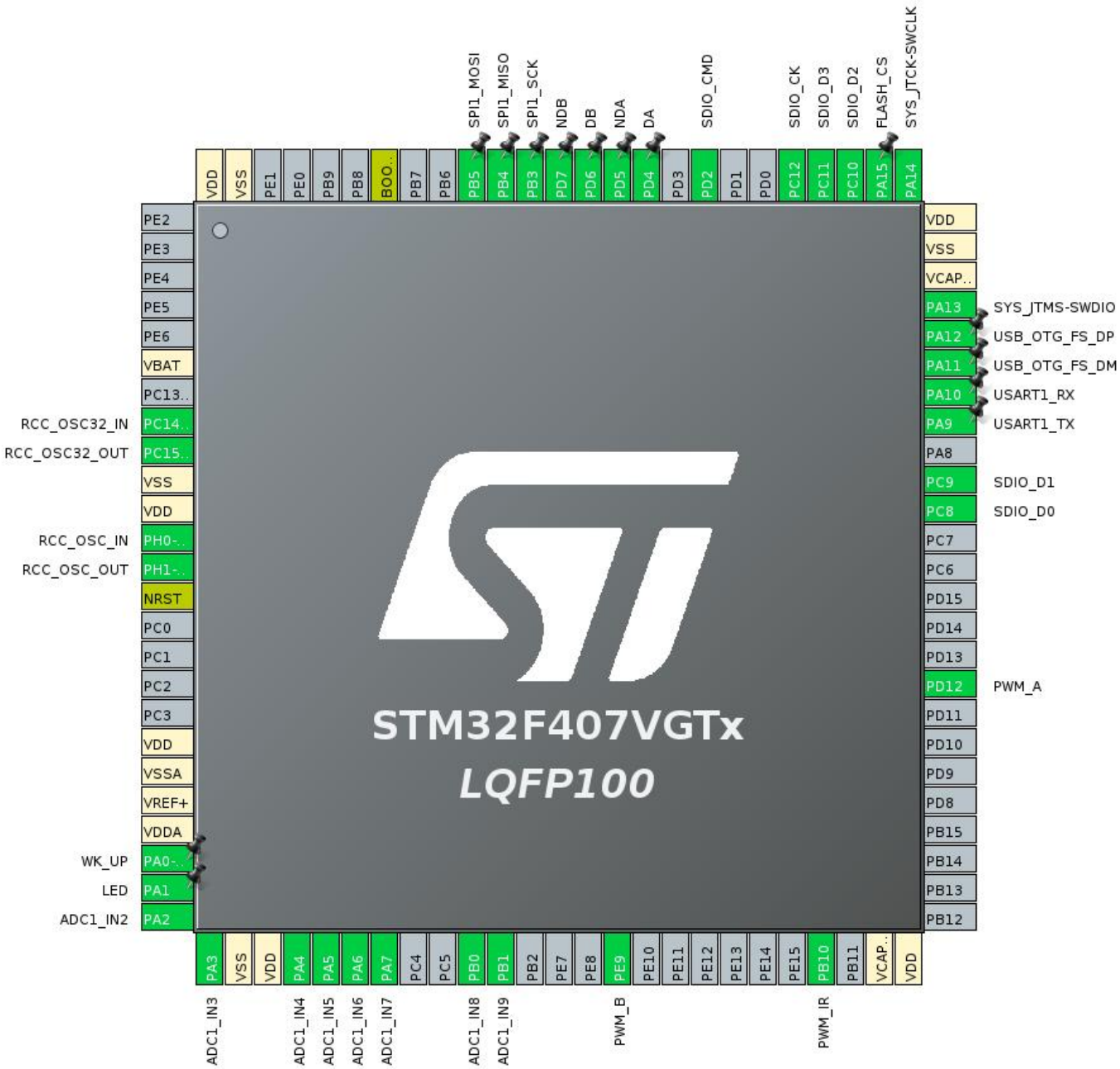
1.2. MCU

MCU Series	STM32F4
MCU Line	STM32F407/417
MCU name	STM32F407VGTx
MCU Package	LQFP100
MCU Pin number	100

1.3. Core(s) information

Core(s)	Arm Cortex-M4

2. Pinout Configuration



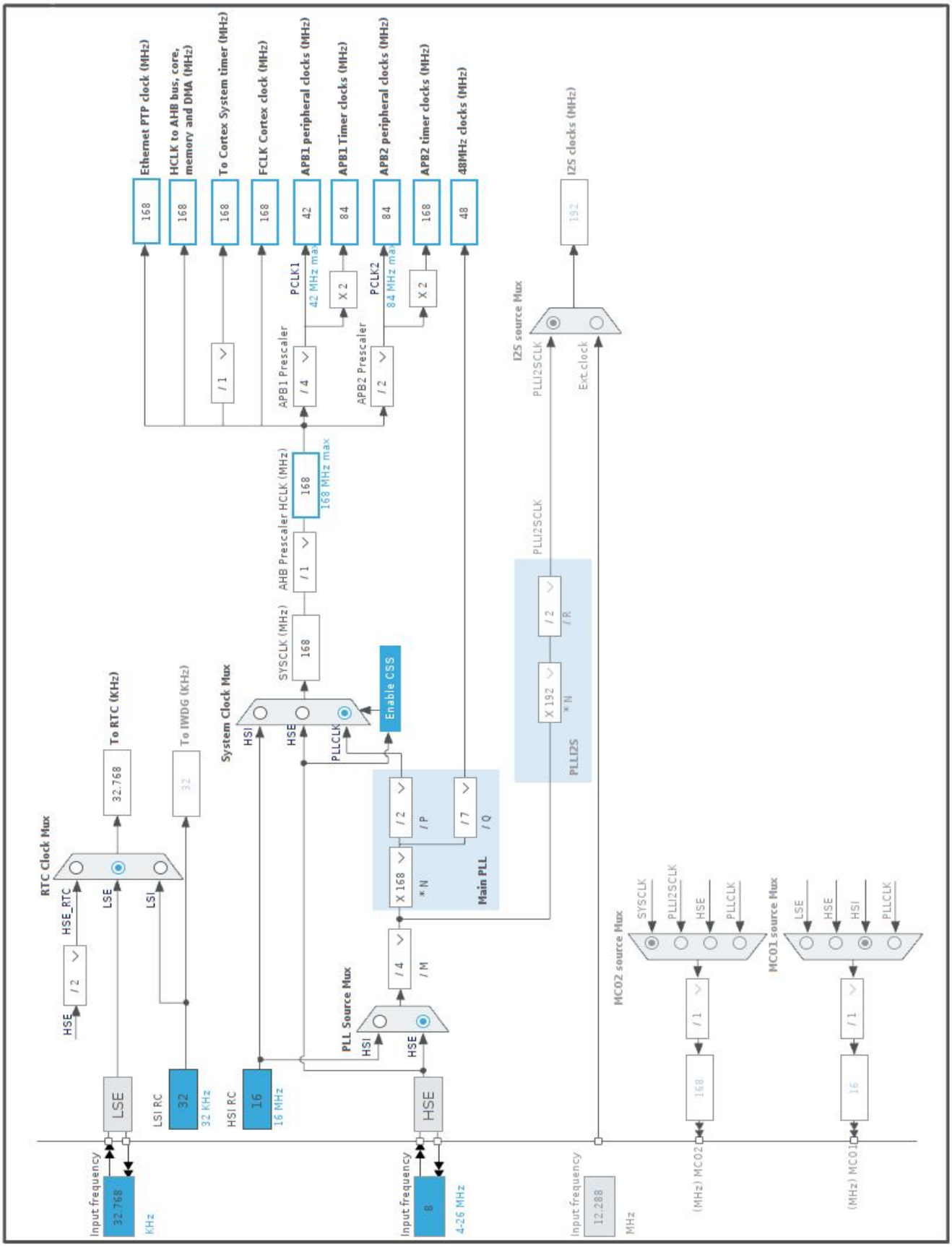
3. Pins Configuration

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
6	VBAT	Power		
8	PC14-OSC32_IN	I/O	RCC_OSC32_IN	
9	PC15-OSC32_OUT	I/O	RCC_OSC32_OUT	
10	VSS	Power		
11	VDD	Power		
12	PH0-OSC_IN	I/O	RCC_OSC_IN	
13	PH1-OSC_OUT	I/O	RCC_OSC_OUT	
14	NRST	Reset		
19	VDD	Power		
20	VSSA	Power		
21	VREF+	Power		
22	VDDA	Power		
23	PA0-WKUP *	I/O	GPIO_Input	WK_UP
24	PA1 *	I/O	GPIO_Output	LED
25	PA2	I/O	ADC1_IN2	
26	PA3	I/O	ADC1_IN3	
27	VSS	Power		
28	VDD	Power		
29	PA4	I/O	ADC1_IN4	
30	PA5	I/O	ADC1_IN5	
31	PA6	I/O	ADC1_IN6	
32	PA7	I/O	ADC1_IN7	
35	PB0	I/O	ADC1_IN8	
36	PB1	I/O	ADC1_IN9	
40	PE9	I/O	TIM1_CH1	PWM_B
47	PB10	I/O	TIM2_CH3	PWM_IR
49	VCAP_1	Power		
50	VDD	Power		
59	PD12	I/O	TIM4_CH1	PWM_A
65	PC8	I/O	SDIO_D0	SDIO_D0
66	PC9	I/O	SDIO_D1	SDIO_D1
68	PA9	I/O	USART1_TX	
69	PA10	I/O	USART1_RX	
70	PA11	I/O	USB_OTG_FS_DM	
71	PA12	I/O	USB_OTG_FS_DP	
72	PA13	I/O	SYS_JTMS-SWDIO	

Pin Number LQFP100	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
73	VCAP_2	Power		
74	VSS	Power		
75	VDD	Power		
76	PA14	I/O	SYS_JTCK-SWCLK	
77	PA15 *	I/O	GPIO_Output	FLASH_CS
78	PC10	I/O	SDIO_D2	SDIO_D2
79	PC11	I/O	SDIO_D3	SDIO_D3
80	PC12	I/O	SDIO_CK	SDIO_CK
83	PD2	I/O	SDIO_CMD	SDIO_CMD
85	PD4 *	I/O	GPIO_Output	DA
86	PD5 *	I/O	GPIO_Output	NDA
87	PD6 *	I/O	GPIO_Output	DB
88	PD7 *	I/O	GPIO_Output	NDB
89	PB3	I/O	SPI1_SCK	
90	PB4	I/O	SPI1_MISO	
91	PB5	I/O	SPI1_MOSI	
94	BOOT0	Boot		
99	VSS	Power		
100	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	LineTrackingCarV2
Project Folder	/work/14-LHC/LineTrackingCarV2
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F4 V1.27.1
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	MX_DMA_Init	DMA
3	SystemClock_Config	RCC
4	MX_RTC_Init	RTC
5	MX_SDIO_SD_Init	SDIO
6	MX_FATFS_Init	FATFS
7	MX_SPI1_Init	SPI1
8	MX_ADC1_Init	ADC1
9	MX_TIM8_Init	TIM8
10	MX_USB_DEVICE_Init	USB_DEVICE
11	MX_USART1_UART_Init	USART1

Rank	Function Name	Peripheral Instance Name
12	MX_TIM1_Init	TIM1
13	MX_TIM2_Init	TIM2
14	MX_TIM4_Init	TIM4

6. Power Consumption Calculator report

6.1. Microcontroller Selection

Series	STM32F4
Line	STM32F407/417
MCU	STM32F407VGTx
Datasheet	DS8626_Rev8

6.2. Parameter Selection

Temperature	25
Vdd	3.3

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

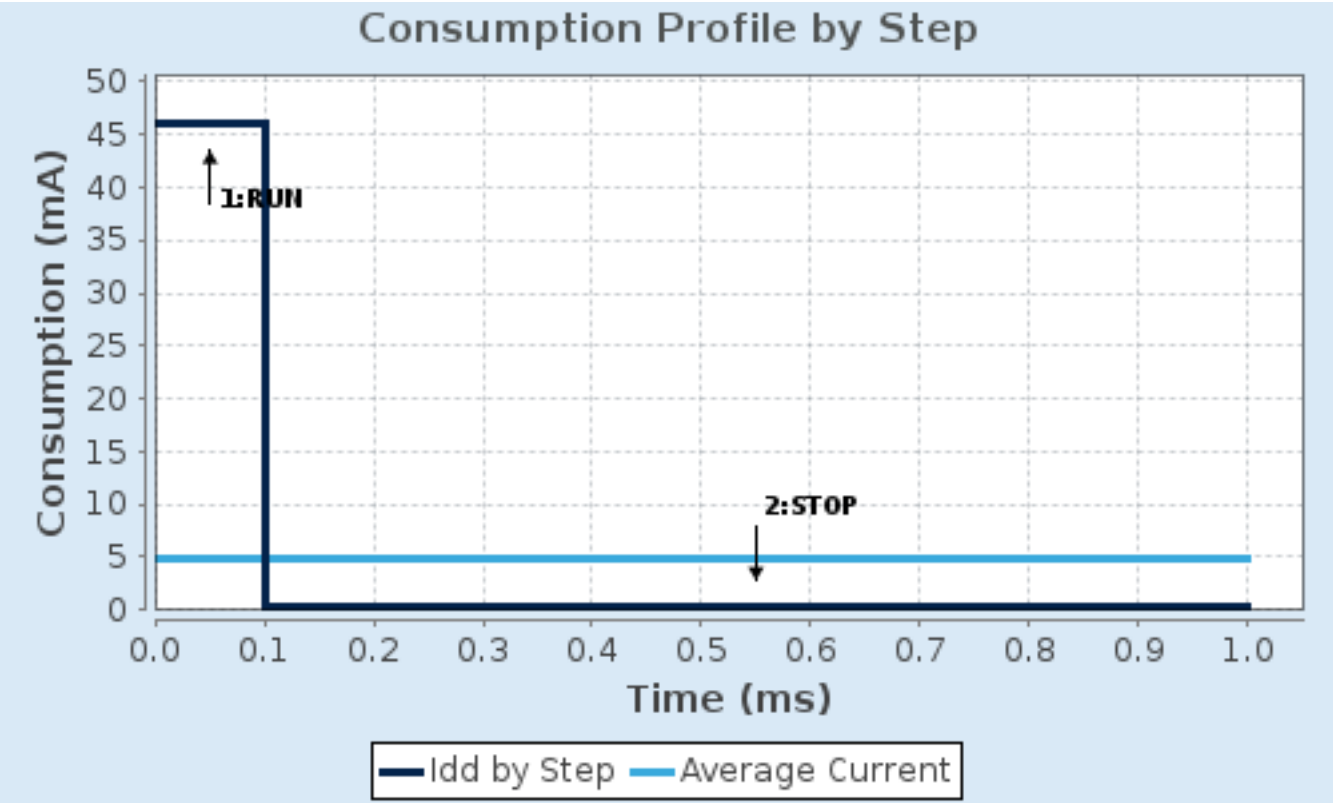
6.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	Scale1-High	No Scale
Fetch Type	FLASH	n/a
CPU Frequency	168 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LP Flash-PwrDwn
Clock Source Frequency	4 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	46 mA	280 µA
Duration	0.1 ms	0.9 ms
DMIPS	210.0	0.0
Ta Max	98.47	104.96
Category	In DS Table	In DS Table

6.5. Results

Sequence Time	1 ms	Average Current	4.85 mA
Battery Life	29 days, 4 hours	Average DMIPS	210.0 DMIPS

6.6. Chart


Consumption Profile by Step
Consumption (mA)
50
45
40
35
30
25
20
15
10
5
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. ADC1

mode: IN2

mode: IN3

mode: IN4

mode: IN5

mode: IN6

mode: IN7

mode: IN8

mode: IN9

7.1.1. Parameter Settings:

ADCs_Common_Settings:

Mode	Independent mode

ADC_Settings:

Clock Prescaler	PCLK2 divided by 4
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	**8 ***
External Trigger Conversion Source	**Timer 8 Trigger Out event ***
External Trigger Conversion Edge	Trigger detection on the rising edge
Rank	1
Channel	Channel 2
Sampling Time	**144 Cycles ***
Rank	**2 ***
Channel	**Channel 3 ***
Sampling Time	**144 Cycles ***
Rank	**3 ***
Channel	**Channel 4 ***
Sampling Time	**144 Cycles ***
Rank	**4 ***

Channel	**Channel 5 ***
Sampling Time	**144 Cycles ***
Rank	**5 ***
Channel	**Channel 6 ***
Sampling Time	**144 Cycles ***
Rank	**6 ***
Channel	**Channel 7 ***
Sampling Time	**144 Cycles ***
Rank	**7 ***
Channel	**Channel 8 ***
Sampling Time	**144 Cycles ***
Rank	**8 ***
Channel	**Channel 9 ***
Sampling Time	**144 Cycles ***

ADC_Injected_ConversionMode:

Number Of Conversions	0

WatchDog:

Enable Analog WatchDog Mode	false

7.2. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

Low Speed Clock (LSE) : Crystal/Ceramic Resonator

7.2.1. Parameter Settings:

System Parameters:

VDD voltage (V)	3.3
Instruction Cache	Enabled
Prefetch Buffer	Enabled
Data Cache	Enabled
Flash Latency(WS)	5 WS (6 CPU cycle)

RCC Parameters:

HSI Calibration Value	16
HSE Startup Timout Value (ms)	100
LSE Startup Timout Value (ms)	5000

Power Parameters:

Power Regulator Voltage Scale	Power Regulator Voltage Scale 1

7.3. RTC

mode: Activate Clock Source

7.3.1. Parameter Settings:

General:

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

7.4. SDIO

Mode: SD 4 bits Wide bus

7.4.1. 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	Disable the power save for the clock
SDIO hardware flow control	The hardware control flow is disabled
SDIOCLK clock divide factor	0

7.5. SPI1

Mode: Full-Duplex Master

7.5.1. Parameter Settings:

Basic Parameters:

Frame Format	Motorola
Data Size	8 Bits
First Bit	MSB First

Clock Parameters:

Prescaler (for Baud Rate)	2
Baud Rate	**42.0 MBits/s ***
Clock Polarity (CPOL)	Low
Clock Phase (CPHA)	1 Edge

Advanced Parameters:

CRC Calculation	Disabled
NSS Signal Type	Software

7.6. SYS

Debug: Serial Wire

Timebase Source: TIM14

7.7. TIM1

Clock Source : Internal Clock

Channel1: PWM Generation CH1

7.7.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**168-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**1000-1 ***
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
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)

Break And Dead Time management - BRK Configuration:

BRK State	Disable
BRK Polarity	High

Break And Dead Time management - Output Configuration:

Automatic Output State	Disable
Off State Selection for Run Mode (OSSR)	Disable
Off State Selection for Idle Mode (OSSI)	Disable
Lock Configuration	Off

PWM Generation Channel 1:

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

7.8. TIM2

Clock Source : Internal Clock

Channel3: PWM Generation CH3

7.8.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**336-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 32 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 3:

Mode	PWM mode 1
Pulse (32 bits value)	0
Output compare preload	Enable
Fast Mode	Disable
CH Polarity	High

7.9. TIM4

Clock Source : Internal Clock

Channel1: PWM Generation CH1

7.9.1. 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 1:

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

7.10. TIM8

Clock Source : Internal Clock

7.10.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	**84-1 ***
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	**100-1 ***
Internal Clock Division (CKD)	No Division
Repetition Counter (RCR - 8 bits value)	0
auto-reload preload	Disable

Trigger Output (TRGO) Parameters:

Master/Slave Mode (MSM bit)	**Enable (Trigger delayed for master/slaves simultaneous start) ***
Trigger Event Selection	**Update Event ***

7.11. USART1

Mode: Asynchronous

7.11.1. 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

7.12. USB_OTG_FS

Mode: Device_Only

7.12.1. Parameter Settings:

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

7.13. FATFS

mode: SD Card

7.13.1. 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)	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)	**Enabled with dynamic working buffer on the STACK ***
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)	Enabled
FS_TIMEOUT (Timeout ticks)	1000
USE_MUTEX	Disabled
SYNC_t (O/S sync object)	osSemaphoreId
FS_LOCK (Number of files opened simultaneously)	2

7.13.2. Advanced Settings:

SDIO/SDMMC:

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

7.14. FREERTOS

Interface: CMSIS_V1

7.14.1. Config parameters:

API:

FreeRTOS API	CMSIS v1

Versions:

FreeRTOS version	10.3.1
CMSIS-RTOS version	1.02

MPU/FPU:

ENABLE_MPU	Disabled
ENABLE_FPU	Disabled

Kernel settings:

USE_PREEMPTION	Enabled
CPU_CLOCK_HZ	SystemCoreClock
TICK_RATE_HZ	1000
MAX_PRIORITIES	7

MINIMAL_STACK_SIZE	128
MAX_TASK_NAME_LEN	16
USE_16_BIT_TICKS	Disabled
IDLE_SHOULD_YIELD	Enabled
USE_MUTEXES	Enabled
USE_RECURSIVE_MUTEXES	Disabled
USE_COUNTING_SEMAPHORES	**Enabled ***
QUEUE_REGISTRY_SIZE	8
USE_APPLICATION_TASK_TAG	Disabled
ENABLE_BACKWARD_COMPATIBILITY	Enabled
USE_PORT_OPTIMISED_TASK_SELECTION	Enabled
USE_TICKLESS_IDLE	Disabled
USE_TASK_NOTIFICATIONS	Enabled
RECORD_STACK_HIGH_ADDRESS	Disabled

Memory management settings:

Memory Allocation	**Dynamic ***
TOTAL_HEAP_SIZE	**40960 ***
Memory Management scheme	heap_4

Hook function related definitions:

USE_IDLE_HOOK	**Enabled ***
USE_TICK_HOOK	Disabled
USE_MALLOC_FAILED_HOOK	**Enabled ***
USE_DAEMON_TASK_STARTUP_HOOK	Disabled
CHECK_FOR_STACK_OVERFLOW	**Option2 ***

Run time and task stats gathering related definitions:

GENERATE_RUN_TIME_STATS	**Enabled ***
USE_TRACE_FACILITY	Enabled
USE_STATS_FORMATTING_FUNCTIONS	**Enabled ***

Co-routine related definitions:

USE_CO_ROUTINES	Disabled
MAX_CO_ROUTINE_PRIORITIES	2

Software timer definitions:

USE_TIMERS	Enabled
TIMER_TASK_PRIORITY	2
TIMER_QUEUE_LENGTH	10
TIMER_TASK_STACK_DEPTH	256

Interrupt nesting behaviour configuration:

LIBRARY_LOWEST_INTERRUPT_PRIORITY	15
LIBRARY_MAX_SYSCALL_INTERRUPT_PRIORITY	5

Added with 10.2.1 support:

MESSAGE_BUFFER_LENGTH_TYPE	size_t
USE_POSIX_ERRNO	Disabled

7.14.2. Include parameters:

Include definitions:

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

7.14.3. Advanced settings:

Newlib settings (see parameter description first):

USE_NEWLIB_REENTRANT	**Enabled ***

Project settings (see parameter description first):

Use FW pack heap file	Enabled

7.15. USB_DEVICE

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

7.15.1. 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
USB CDC Tx Buffer Size	2048

7.15.2. 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
ADC1	PA2	ADC1_IN2	Analog mode	No pull-up and no pull-down	n/a	
	PA3	ADC1_IN3	Analog mode	No pull-up and no pull-down	n/a	
	PA4	ADC1_IN4	Analog mode	No pull-up and no pull-down	n/a	
	PA5	ADC1_IN5	Analog mode	No pull-up and no pull-down	n/a	
	PA6	ADC1_IN6	Analog mode	No pull-up and no pull-down	n/a	
	PA7	ADC1_IN7	Analog mode	No pull-up and no pull-down	n/a	
	PB0	ADC1_IN8	Analog mode	No pull-up and no pull-down	n/a	
	PB1	ADC1_IN9	Analog mode	No pull-up and no pull-down	n/a	
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	
SDIO	PC8	SDIO_D0	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_D0
	PC9	SDIO_D1	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_D1
	PC10	SDIO_D2	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_D2
	PC11	SDIO_D3	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_D3
	PC12	SDIO_CK	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_CK
	PD2	SDIO_CMD	Alternate Function Push Pull	**Pull-up ***	Very High	SDIO_CMD
SPI1	PB3	SPI1_SCK	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PB4	SPI1_MISO	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PB5	SPI1_MOSI	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
TIM1	PE9	TIM1_CH1	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	PWM_B
TIM2	PB10	TIM2_CH3	Alternate Function Push Pull	No pull-up and no pull-down		PWM_IR

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
					Very High *	
TIM4	PD12	TIM4_CH1	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	PWM_A
USART1	PA9	USART1_TX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
	PA10	USART1_RX	Alternate Function Push Pull	No pull-up and no pull-down	**Very High ***	
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	PA0-WKUP	GPIO_Input	Input mode	**Pull-down ***	n/a	WK_UP
	PA1	GPIO_Output	Output Push Pull	**Pull-up ***	Low	LED
	PA15	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Very High ***	FLASH_CS
	PD4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Very High ***	DA
	PD5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Very High ***	NDA
	PD6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Very High ***	DB
	PD7	GPIO_Output	Output Push Pull	No pull-up and no pull-down	**Very High ***	NDB

8.2. DMA configuration

DMA request	Stream	Direction	Priority
SDIO_RX	DMA2_Stream6	Peripheral To Memory	**Medium ***
SDIO_TX	DMA2_Stream3	Memory To Peripheral	**Medium ***
ADC1	DMA2_Stream0	Peripheral To Memory	**High ***
USART1_TX	DMA2_Stream7	Memory To Peripheral	**Medium ***

SDIO_RX: DMA2_Stream6 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

SDIO_TX: 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

ADC1: DMA2_Stream0 DMA request Settings:

Mode:	Normal
Use fifo:	Disable
Peripheral Increment:	Disable
Memory Increment:	

	Enable *
Peripheral Data Width:	Half Word
Memory Data Width:	Half Word

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

8.3. NVIC configuration

8.3.1. NVIC

Interrupt Table	Enable	Preenmption Priority	SubPriority
Non maskable interrupt	true	0	0
Hard fault interrupt	true	0	0
Memory management fault	true	0	0
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	15	0
System tick timer	true	15	0
ADC1, ADC2 and ADC3 global interrupts	true	5	0
USART1 global interrupt	true	5	0
TIM8 break interrupt and TIM12 global interrupt	true	5	0
TIM8 update interrupt and TIM13 global interrupt	true	5	0
TIM8 trigger and commutation interrupts and TIM14 global interrupt	true	15	0
SDIO global interrupt	true	5	0
DMA2 stream0 global interrupt	true	6	0
DMA2 stream3 global interrupt	true	5	0
USB On The Go FS global interrupt	true	5	0
DMA2 stream6 global interrupt	true	5	0
DMA2 stream7 global interrupt	true	5	0
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM1 break interrupt and TIM9 global interrupt	unused		
TIM1 update interrupt and TIM10 global interrupt	unused		
TIM1 trigger and commutation interrupts and TIM11 global interrupt	unused		
TIM1 capture compare interrupt	unused		
TIM2 global interrupt	unused		
TIM4 global interrupt	unused		
SPI1 global interrupt	unused		
TIM8 capture compare interrupt	unused		
FPU global interrupt	unused		

8.3.2. NVIC Code generation

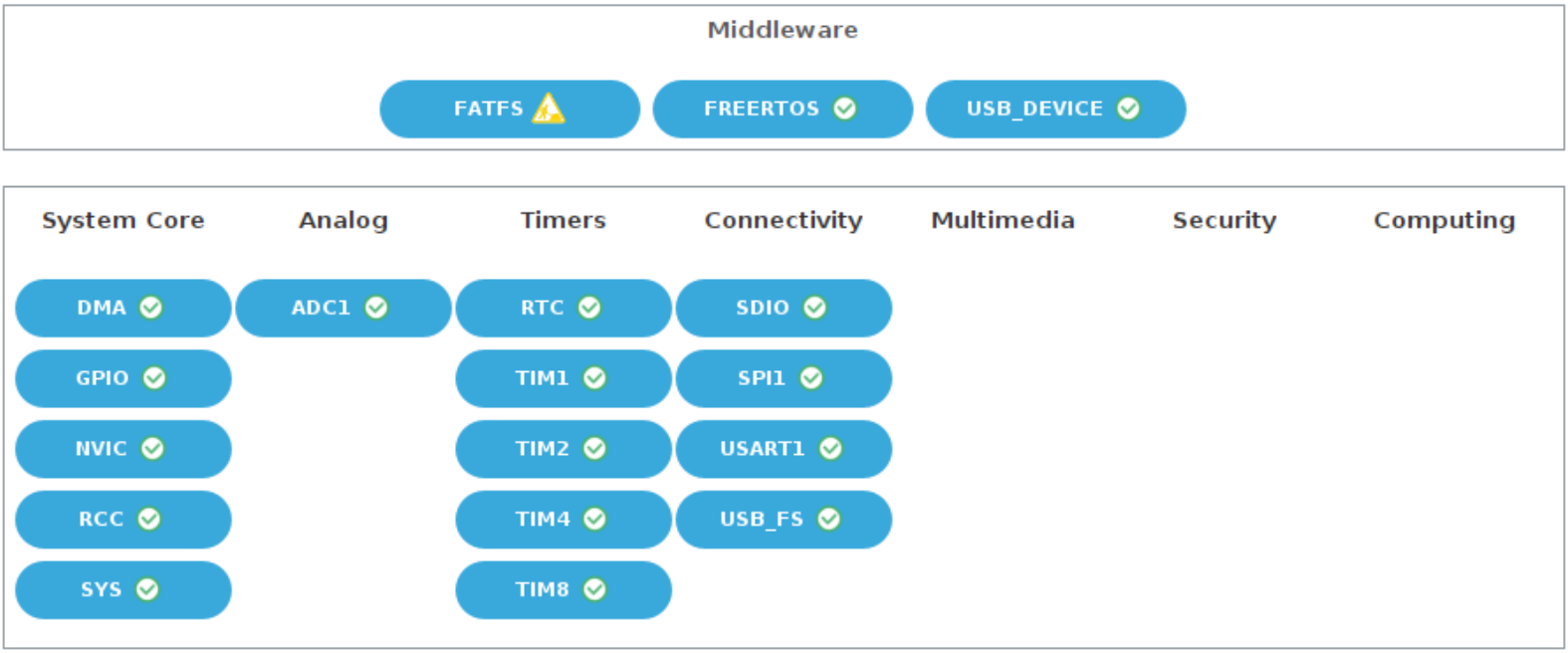
Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Pre-fetch fault, memory access fault	false	true	false
Undefined instruction or illegal state	false	true	false
System service call via SWI instruction	false	false	false
Debug monitor	false	true	false
Pendable request for system service	false	false	false
System tick timer	false	false	true
ADC1, ADC2 and ADC3 global interrupts	false	true	true
USART1 global interrupt	false	true	true
TIM8 break interrupt and TIM12 global interrupt	false	true	true
TIM8 update interrupt and TIM13 global interrupt	false	true	true
TIM8 trigger and commutation interrupts and TIM14 global interrupt	false	true	true
SDIO global interrupt	false	true	true
DMA2 stream0 global interrupt	false	true	true
DMA2 stream3 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

*** User modified value**

9. System Views

9.1. Category view

9.1.1. Current



10. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f405-415_407-417_bsdl.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f405-415_407-417_ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f4_svd.zip
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f405-415_407-417_bsdl.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f405-415_407-417_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
Training Material	https://www.st.com/resource/en/sales_guide/sg_sc2154.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/an1181-electrostatic-discharge-sensitivity-measurement-stmicroelectronics.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/an2834-how-to-get-the-best-adc-accuracy-in-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2867-oscillator-design-guide-for-stm8afals-stm32-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/an3371-using-the-hardware-realtime-clock-rtc-in-stm32-f0-f2-f3-f4-and-l1-series-of-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf

Application Notes	https://www.st.com/resource/en/application_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4013-stm32-crossseries-timer-overview-stmicroelectronics.pdf
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/an4073-how-to-improve-adc-accuracy-when-using-stm32f2xx-and-stm32f4xx-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4076-two-or-three-shunt-resistor-based-current-sensing-circuit-design-in-3phase-inverters-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/an4230-stm32-microcontroller-random-number-generation-validation-using-the-nist-statistical-test-suite-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4277-using-stm32-device-pwm-shutdown-features-for-motor-control-and-digital-power-conversion-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4488-getting-started-with-stm32f4xxxx-mcu-hardware-development-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4547-migrating-from-stm32f407xx417xx-to-stm32f427xx429xx437xx439xx-stmicroelectronics.pdf
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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
Application Notes	https://www.st.com/resource/en/application_note/an4821-migrating-from-stm32f405415-line-and-stm32f407417-line-to-stm32l4-series-and-stm32l4-series-microcontrollers-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4838-managing-memory-protection-unit-in-stm32-mcus-stmicroelectronics.pdf
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	electromyogram-technique-to-detect-muscle-activity-stmicroelectronics.pdf
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Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3364-migration-and-compatibility-guidelines-for-stm32-microcontroller-applications-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3965-stm32f40xstm32f41x-inapplication-programming-using-the-usart-stmicroelectronics.pdf

Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3966-lwip-tcpip-stack-demonstration-for-stm32f4x7-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3968-stm32f407stm32f417-inapplication-programming-iap-over-ethernet-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3969-eeprom-emulation-in-stm32f40xstm32f41x-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3988-clock-configuration-tool-for-stm32f40xx41xx427x437x-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3990-upgrading-stm32f4discovery-board-firmware-using-a-usb-key-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3997-audio-playback-and-recording-using-the-stm32f4discovery-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an3998-pdm-audio-software-decoding-on-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4044-floating-point-unit-demonstration-on-stm32-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4323-getting-started-with-stemwin-library-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4365-using-stm32f4-mcu-power-modes-with-best-dynamic-efficiency-stmicroelectronics.pdf
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
Application Notes	https://www.st.com/resource/en/application_note/an4457-implementing-

for related Tools & Software	an-emulated-uart-on-stm32f4-microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4499-stm32--nrf51822-bluetooth-low-energy-system-solution-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4502-stm32-smbuspmbus-embedded-software-expansion-for-stm32cube-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4657-stm32-inapplication-programming-iap-using-the-usart-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4666-parallel-synchronous-transmission-using-gpio-and-dma-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an4678-full-duplex-spi-emulation-for-stm32f4-microcontrollers-stmicroelectronics.pdf
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
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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	https://www.st.com/resource/en/application_note/an4968-proprietary-code-read-out-protection-pcrop-on-stm32f72xxx-and-stm32f73xxx-

& Software	microcontrollers-stmicroelectronics.pdf
Application Notes for related Tools & Software	https://www.st.com/resource/en/application_note/an5054-secure-programming-using-stm32cubeprogrammer-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

Errata Sheets	https://www.st.com/resource/en/errata_sheet/es0182-stm32f405407xx-and-stm32f415417xx-device-limitations-stmicroelectronics.pdf
Datasheet	https://www.st.com/resource/en/datasheet/dm00037051.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/rm0090-stm32f405415-stm32f407417-stm32f427437-and-stm32f429439-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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