



1. Description

1.1. Project

Project Name	F103_C_28BYJ-48_StepMotor_ULN2003
Board Name	custom
Generated with:	STM32CubeMX 6.14.1
Date	08/12/2026

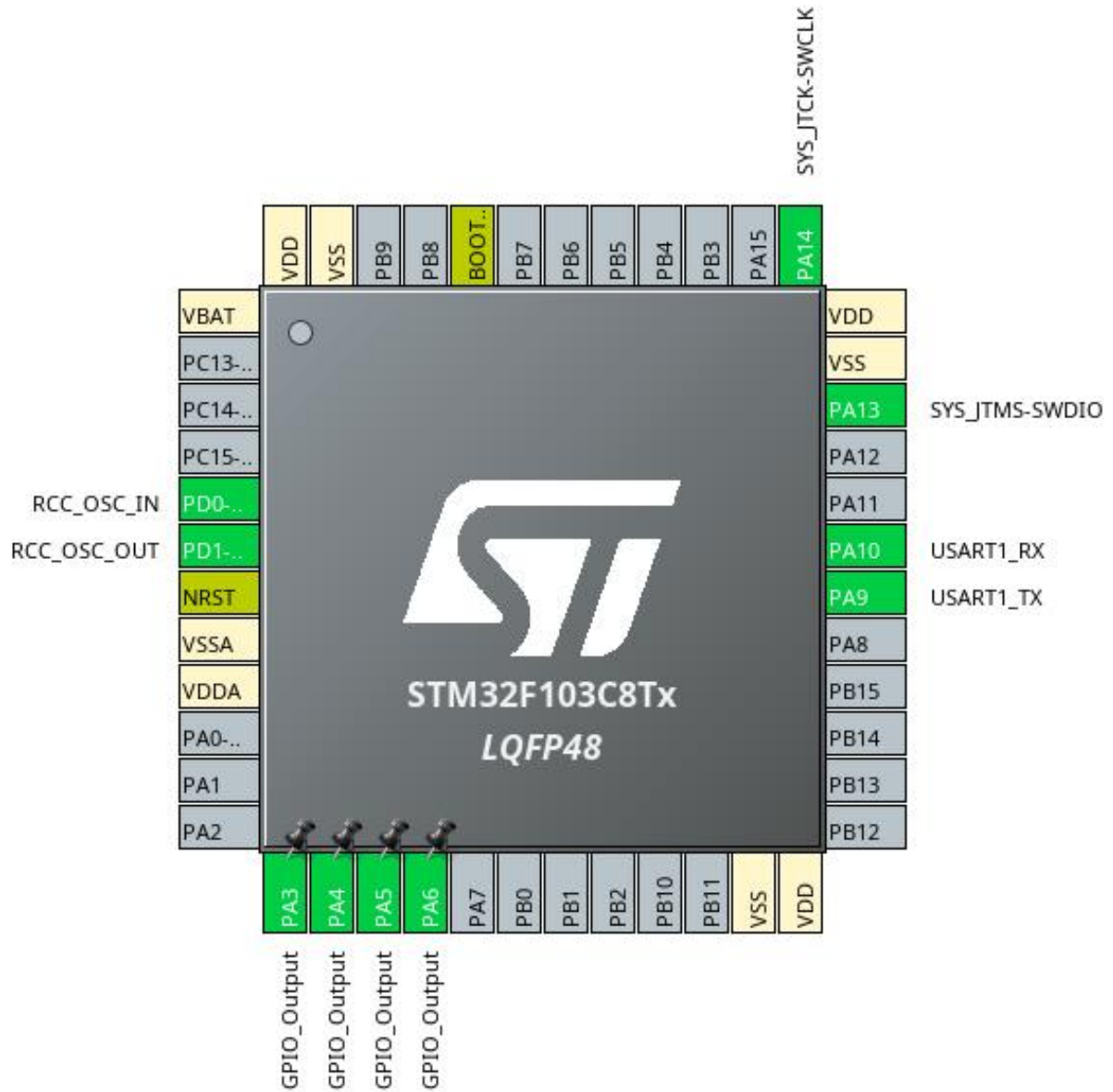
1.2. MCU

MCU Series	STM32F1
MCU Line	STM32F103
MCU name	STM32F103C8Tx
MCU Package	LQFP48
MCU Pin number	48

1.3. Core(s) information

Core(s)	Arm Cortex-M3
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2. Pinout Configuration

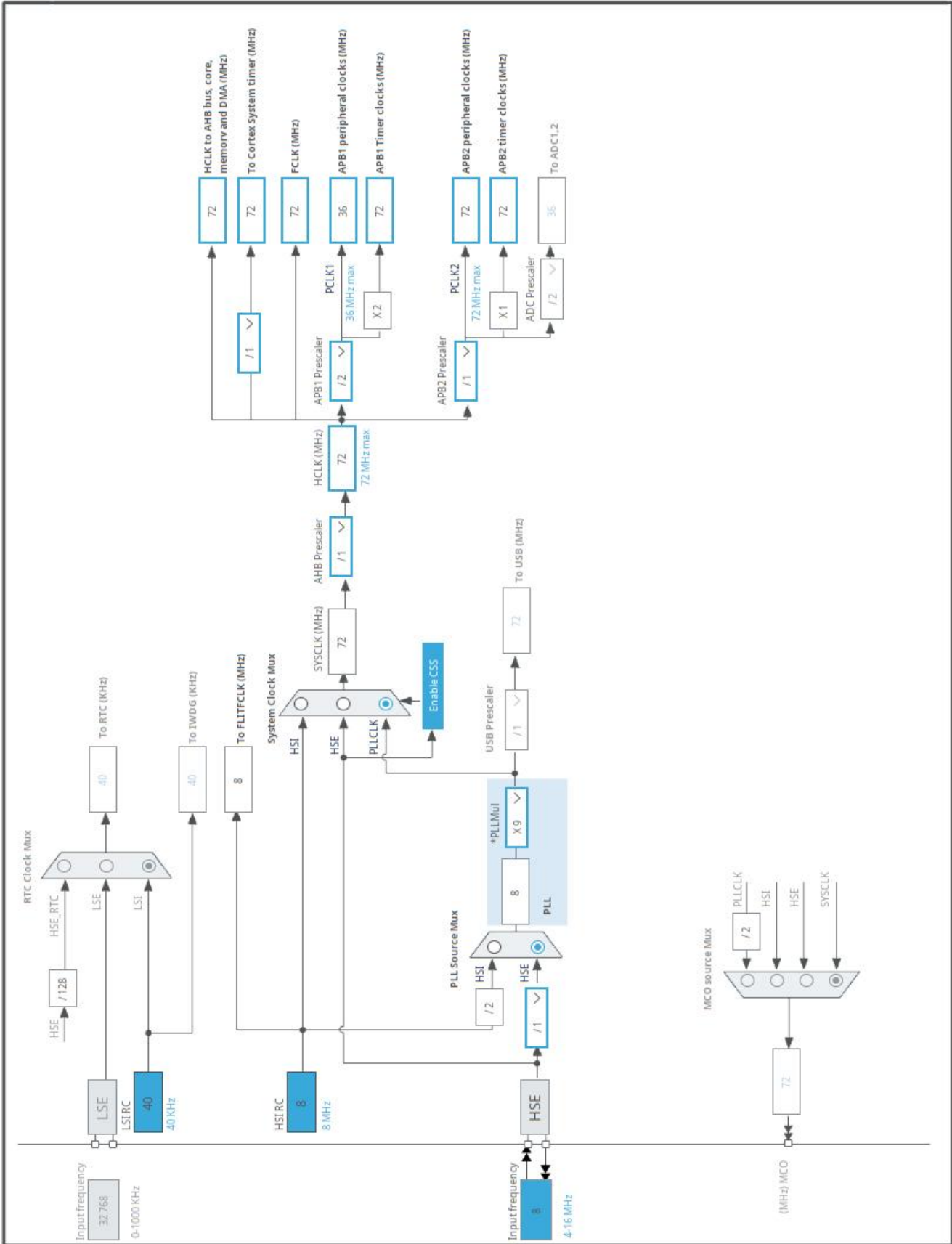


3. Pins Configuration

Pin Number LQFP48	Pin Name (function after reset)	Pin Type	Alternate Function(s)	Label
1	VBAT	Power		
5	PD0-OSC_IN	I/O	RCC_OSC_IN	
6	PD1-OSC_OUT	I/O	RCC_OSC_OUT	
7	NRST	Reset		
8	VSSA	Power		
9	VDDA	Power		
13	PA3 *	I/O	GPIO_Output	
14	PA4 *	I/O	GPIO_Output	
15	PA5 *	I/O	GPIO_Output	
16	PA6 *	I/O	GPIO_Output	
23	VSS	Power		
24	VDD	Power		
30	PA9	I/O	USART1_TX	
31	PA10	I/O	USART1_RX	
34	PA13	I/O	SYS_JTMS-SWDIO	
35	VSS	Power		
36	VDD	Power		
37	PA14	I/O	SYS_JTCK-SWCLK	
44	BOOT0	Boot		
47	VSS	Power		
48	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	STM32F1
Line	STM32F103
MCU	STM32F103C8Tx
Datasheet	DS5319 Rev17

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

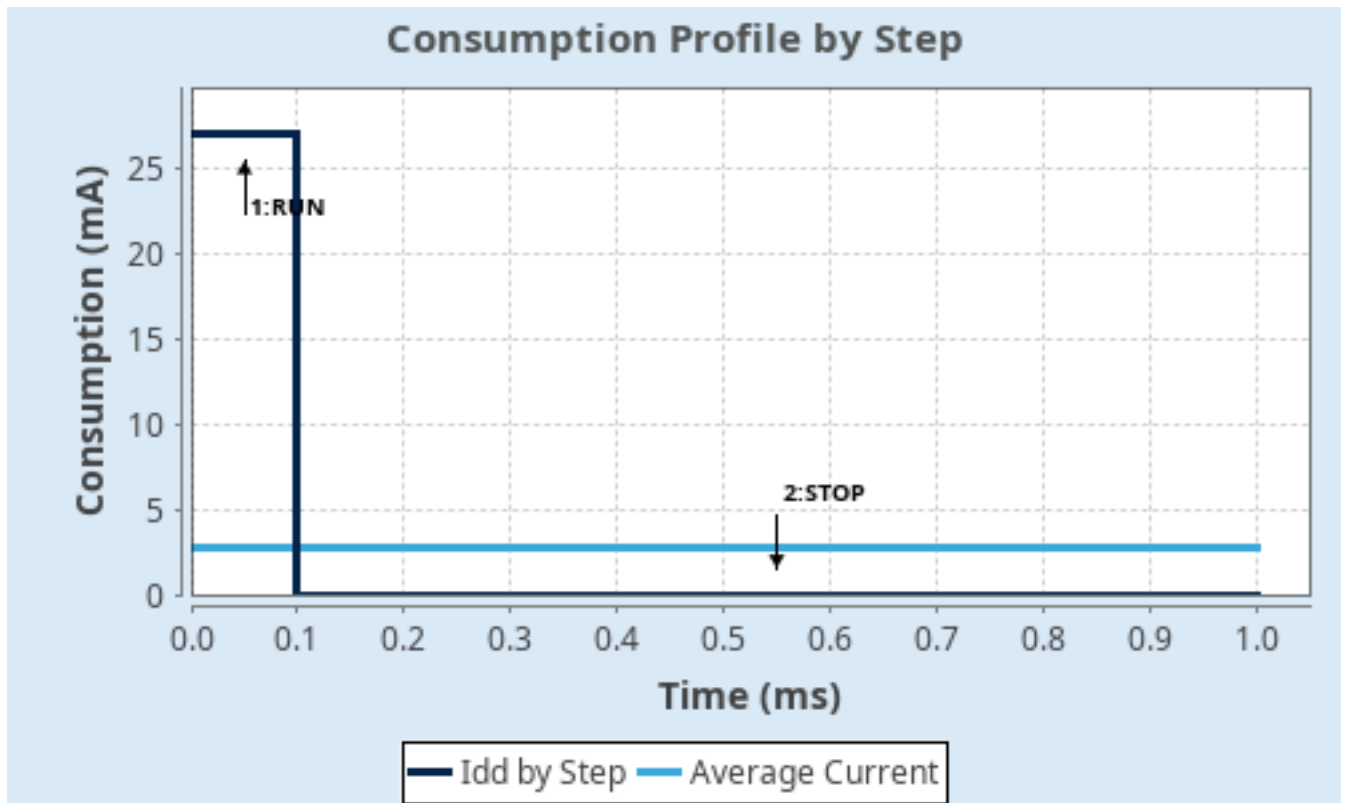
1.4. Sequence

Step	Step1	Step2
Mode	RUN	STOP
Vdd	3.3	3.3
Voltage Source	Battery	Battery
Range	No Scale	No Scale
Fetch Type	FLASH	n/a
CPU Frequency	72 MHz	0 Hz
Clock Configuration	HSE PLL	Regulator_LP
Clock Source Frequency	8 MHz	0 Hz
Peripherals		
Additional Cons.	0 mA	0 mA
Average Current	27 mA	14 μ A
Duration	0.1 ms	0.9 ms
DMIPS	90.0	0.0
Ta Max	100.1	105
Category	In DS Table	In DS Table

1.5. Results

Sequence Time	1 ms	Average Current	2.71 mA
Battery Life	1 month, 21 days, 17 hours	Average DMIPS	61.0 DMIPS

1.6. Chart



2. Software Project

2.1. Project Settings

Name	Value
Project Name	F103_C_28BYJ-48_StepMotor_ULN2003
Project Folder	/home/johng/STM32CubeIDE/workspace_1.15.4/F103_C_28BYJ-
Toolchain / IDE	STM32CubeIDE
Firmware Package Name and Version	STM32Cube FW_F1 V1.8.7
Application Structure	Advanced
Generate Under Root	Yes
Do not generate the main()	No
Minimum Heap Size	0x200
Minimum Stack Size	0x400

2.2. Code Generation Settings

Name	Value
STM32Cube MCU packages and embedded software	Copy only the necessary library files
Generate peripheral initialization as a pair of '.c/.h' files	No
Backup previously generated files when re-generating	No
Keep User Code when re-generating	Yes
Delete previously generated files when not re-generated	Yes
Set all free pins as analog (to optimize the power consumption)	No
Enable Full Assert	No

2.3. Advanced Settings - Generated Function Calls

Rank	Function Name	Peripheral Instance Name
1	SystemClock_Config	RCC
2	MX_GPIO_Init	GPIO
3	MX_USART1_UART_Init	USART1
4	MX_TIM2_Init	TIM2

3. Peripherals and Middlewares Configuration

3.1. RCC

High Speed Clock (HSE): Crystal/Ceramic Resonator

3.1.1. Parameter Settings:

System Parameters:

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

RCC Parameters:

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

3.2. SYS

Debug: Serial Wire

Timebase Source: SysTick

3.3. TIM2

Clock Source : Internal Clock

3.3.1. Parameter Settings:

Counter Settings:

Prescaler (PSC - 16 bits value)	72-1 *
Counter Mode	Up
Counter Period (AutoReload Register - 16 bits value)	65535
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)

3.4. USART1

Mode: Asynchronous

3.4.1. Parameter Settings:

Basic Parameters:

Baud Rate	19200 *
Word Length	8 Bits (including Parity)
Parity	None
Stop Bits	1

Advanced Parameters:

Data Direction	Receive and Transmit
Over Sampling	16 Samples

*** User modified value**

4. System Configuration

4.1. GPIO configuration

IP	Pin	Signal	GPIO mode	GPIO pull/up pull down	Max Speed	User Label
RCC	PD0-OSC_IN	RCC_OSC_IN	n/a	n/a	n/a	
	PD1-OSC_OUT	RCC_OSC_OUT	n/a	n/a	n/a	
SYS	PA13	SYS_JTMS-SWDIO	n/a	n/a	n/a	
	PA14	SYS_JTCK-SWCLK	n/a	n/a	n/a	
USART1	PA9	USART1_TX	Alternate Function Push Pull	n/a	High *	
	PA10	USART1_RX	Input mode	No pull-up and no pull-down	n/a	
GPIO	PA3	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA4	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA5	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	
	PA6	GPIO_Output	Output Push Pull	No pull-up and no pull-down	Low	

4.2. DMA configuration

nothing configured in DMA service

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
Prefetch 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
PVD interrupt through EXTI line 16	unused		
Flash global interrupt	unused		
RCC global interrupt	unused		
TIM2 global interrupt	unused		
USART1 global interrupt	unused		

4.3.2. NVIC Code generation

Enabled interrupt Table	Select for init sequence ordering	Generate IRQ handler	Call HAL handler
Non maskable interrupt	false	true	false
Hard fault interrupt	false	true	false
Memory management fault	false	true	false
Prefetch 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

* User modified value

5. System Views

5.1. Category view

5.1.1. Current

Middleware

System Core

DMA

GPIO

NVIC

RCC

SYS

Analog

Timers

TIM2

Connectivity

USART1

Computing

6. Docs & Resources

Type	Link
BSDL files	https://www.st.com/resource/en/bsdl_model/stm32f1_bsd.zip
IBIS models	https://www.st.com/resource/en/ibis_model/stm32f1-ibis.zip
System View Description	https://www.st.com/resource/en/svd/stm32f1_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
Flyers	https://www.st.com/resource/en/flyer/flstm32nucleo.pdf
Flyers	https://www.st.com/resource/en/flyer/flstm32c5.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/1239988349.pdf
Product Certifications	https://www.st.com/resource/en/certification_document/stm32_authentication_can.pdf
Security Bulletin	https://www.st.com/resource/en/technical_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-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/an2586-getting-started-with-stm32f10xxx-hardware-development-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an2604-stm32f101xx-and-stm32f103xx-rtc-calibration-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/an3095-stevalisv002v1-stevalisv002v2-3-kw-gridconnected-pv-system-based-on-the-stm32f103xx-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3108-stlm75-firmware-library-for-the-stm32f10x-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3128-stm32-embedded-graphic-objectstouchscreen-library-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/an3422-migration-of-microcontroller-applications-from-stm32f1-to-stm32l1-series-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3427-migrating-a-microcontroller-application-from-stm32f1-to-stm32f2-series-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3429-stm32-proprietary-code-protection-overview-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an3961-stevalime003v1-demonstration-board-based-on-the-sthv748-ultrasound-pulser-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4070-250-w-grid-connected-microinverter-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/an4088-migrating-between-stm32f1-and-stm32f0-series-microcontrollers-

stmicroelectronics.pdf

- Application Notes https://www.st.com/resource/en/application_note/an4228-migrating-from-stm32f1-series-to-stm32f3-series-microcontrollers-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4649-migrating-from-stm32f1-series-to-stm32l4-series--stm32l4-series-micronrollers-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/an4724-stm32cube-firmware-examples-for-stm32f1-series-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4750-handling-of-soft-errors-in-stm32-applications-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4803-highspeed-si-simulations-using-ibis-and-boardlevel-simulations-using-hyperlynx-si-on-stm32-mcus-and-mpus-stmicroelectronics.pdf
- 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/an5027-interfacing-pdm-digital-microphones-using-stm32-mcus-and-mpus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4899-stm32-microcontroller-gpio-hardware-settings-and-lowpower-consumption-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an5612-esd-protection-of-stm32-mcus-and-mpus-stmicroelectronics.pdf
- Application Notes https://www.st.com/resource/en/application_note/an4838-introduction-to-memory-protection-unit-management-on-stm32-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
- Application Notes https://www.st.com/resource/en/application_note/an5225-introduction-to-

usb-typec-power-delivery-for-stm32-mcus-and-mpus-
stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5537-how-to-use-adc-oversampling-techniques-to-improve-signal-to-noise-ratio-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an2548-introduction-to-dma-controller-for-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4013-introduction-to-timers-for-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4277-how-to-use-pwm-shutdown-for-motor-control-and-digital-power-conversion-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4908-getting-started-with-uart-automatic-baud-rate-detection-for-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5156-introduction-to-security-for-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5543-guidelines-for-enhanced-spi-communication-on-stm32-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/cd00211314-how-to-optimize-the-adc-accuracy-in-the-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an2639-soldering-recommendations-and-package-information-for-leadfree-ecopack2-mcus-and-mpus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an3154-how-to-use-can-protocol-in-bootloader-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an4566-how-to-extend-the-dac-performance-on-stm32-mcus-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an5647-the-goertzel-algorithm-to-compute-individual-terms-of-the-discrete-fourier-transform-dft-in-stm32-products-stmicroelectronics.pdf

Application Notes https://www.st.com/resource/en/application_note/an2606-introduction-to

[system-memory-boot-mode-on-stm32-mcus-stmicroelectronics.pdf](https://www.st.com/resource/en/system-memory-boot-mode-on-stm32-mcus-stmicroelectronics.pdf)

Application Notes	https://www.st.com/resource/en/application_note/an5036-guidelines-for-thermal-management-on-stm32-mcus-and-mpus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3126-how-to-use-dac-for-audio-and-waveform-generation-on-stm32-mcus-and-mpus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3155-how-to-use-uart-protocol-in-bootloader-on-stm32-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an3156-how-to-use-usb-dfu-protocol-in-bootloader-on-stm32-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4776-how-to-use-generalpurpose-timer-peripheral-on-stm32-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an4989-introduction-to-debug-toolbox-for-stm32-mcus-stmicroelectronics.pdf
Application Notes	https://www.st.com/resource/en/application_note/an6363-introduction-to-clock-requirements-and-calibration-for-stm32-mcus-stmicroelectronics.pdf
Device Option Lists	https://www.st.com/resource/en/device_option_list/opl_stm32f103_64k.zip
Errata Sheets	https://www.st.com/resource/en/errata_sheet/es096-stm32f101x8b-stm32f102x8b-and-stm32f103x8b-mediumdensity-device-limitations-stmicroelectronics.pdf
Datasheet	https://www.st.com/resource/en/datasheet/cd00161566.pdf
Programming Manuals	https://www.st.com/resource/en/programming_manual/pm0056-stm32f10xxx20xxx21xxx1xxxx-cortexm3-programming-manual-stmicroelectronics.pdf
Programming Manuals	https://www.st.com/resource/en/programming_manual/pm0075-stm32f10xxx-flash-memory-microcontrollers-stmicroelectronics.pdf
Reference Manuals	https://www.st.com/resource/en/reference_manual/rm0008-stm32f101xx-stm32f102xx-stm32f103xx-stm32f105xx-and-stm32f107xx-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

Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1163-description-of-wlcsp-for-microcontrollers-and-recommendations-for-its-use-stmicroelectronics.pdf
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
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1206-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-qfp-packages-stmicroelectronics.pdf
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1207-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-so-packages-stmicroelectronics.pdf
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1208-tape-and-reel-shipping-media-for-stm8-and-stm32-microcontrollers-in-tssop-and-ssop-packages-stmicroelectronics.pdf
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1433-reference-device-marking-schematics-for-stm32-microcontrollers-and-microprocessors-stmicroelectronics.pdf
Technical Notes & Articles	https://www.st.com/resource/en/technical_note/tn1204-tape-and-reel-shipping-media-for-stm32-devices-in-bga-packages-stmicroelectronics.pdf
User Manuals	https://www.st.com/resource/en/user_manual/um1561-stevalisv003v1-firmware-user-manual-stmicroelectronics.pdf
User Manuals	https://www.st.com/resource/en/user_manual/um1573-st7540-power-line-modem-firmware-stack-stmicroelectronics.pdf