



## 1. Description

### 1.1. Project

|                 |                    |
|-----------------|--------------------|
| Project Name    | barami_project01   |
| Board Name      | NUCLEO-G431RB      |
| Generated with: | STM32CubeMX 6.15.0 |
| Date            | 08/07/2025         |

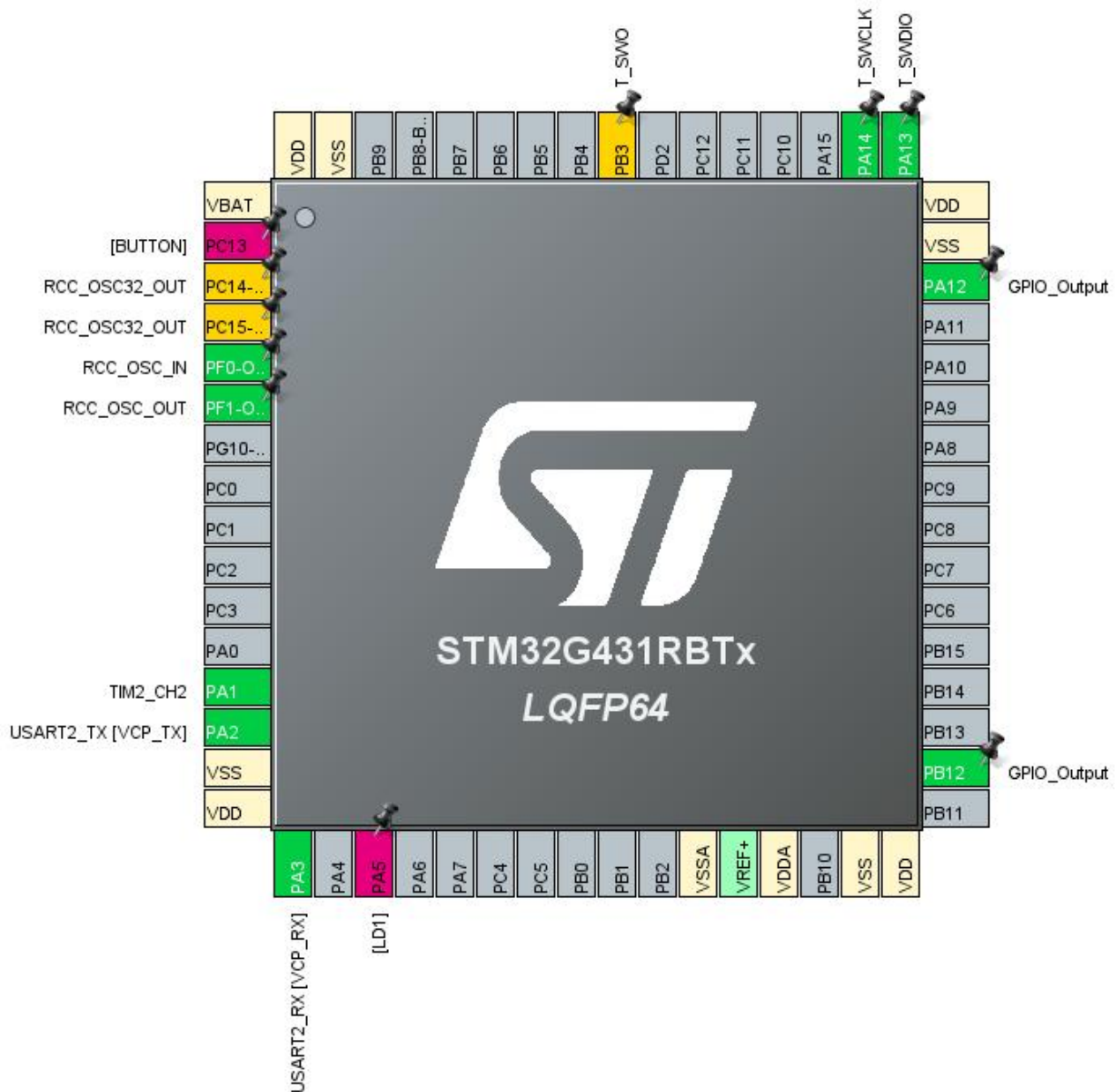
### 1.2. MCU

|                |               |
|----------------|---------------|
| MCU Series     | STM32G4       |
| MCU Line       | STM32G4x1     |
| MCU name       | STM32G431RBTx |
| 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<br>LQFP64 | Pin Name<br>(function after<br>reset) | Pin Type | Alternate<br>Function(s) | Label         |
|----------------------|---------------------------------------|----------|--------------------------|---------------|
| 1                    | VBAT                                  | Power    |                          |               |
| 2                    | PC13                                  | I/O      |                          |               |
| 3                    | PC14-OSC32_IN *                       | I/O      | RCC_OSC32_IN             | RCC_OSC32_OUT |
| 4                    | PC15-OSC32_OUT *                      | I/O      | RCC_OSC32_OUT            | RCC_OSC32_OUT |
| 5                    | PF0-OSC_IN                            | I/O      | RCC_OSC_IN               | RCC_OSC_IN    |
| 6                    | PF1-OSC_OUT                           | I/O      | RCC_OSC_OUT              | RCC_OSC_OUT   |
| 13                   | PA1                                   | I/O      | TIM2_CH2                 |               |
| 14                   | PA2                                   | I/O      | USART2_TX                |               |
| 15                   | VSS                                   | Power    |                          |               |
| 16                   | VDD                                   | Power    |                          |               |
| 17                   | PA3                                   | I/O      | USART2_RX                |               |
| 19                   | PA5                                   | I/O      |                          |               |
| 27                   | VSSA                                  | Power    |                          |               |
| 29                   | VDDA                                  | Power    |                          |               |
| 31                   | VSS                                   | Power    |                          |               |
| 32                   | VDD                                   | Power    |                          |               |
| 34                   | PB12 **                               | I/O      | GPIO_Output              |               |
| 46                   | PA12 **                               | I/O      | GPIO_Output              |               |
| 47                   | VSS                                   | Power    |                          |               |
| 48                   | VDD                                   | Power    |                          |               |
| 49                   | PA13                                  | I/O      | SYS_JTMS-SWDIO           | T_SWDIO       |
| 50                   | PA14                                  | I/O      | SYS_JTCK-SWCLK           | T_SWCLK       |
| 56                   | PB3 *                                 | I/O      | SYS_JTDO-SWO             | T_SWO         |
| 63                   | VSS                                   | Power    |                          |               |
| 64                   | 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



## 1. Power Consumption Calculator report

### 1.1. Microcontroller Selection

|           |               |
|-----------|---------------|
| Series    | STM32G4       |
| Line      | STM32G4x1     |
| MCU       | STM32G431RBTx |
| Datasheet | DS12589_Rev0  |

### 1.2. Parameter Selection

|             |     |
|-------------|-----|
| Temperature | 25  |
| Vdd         | 3.0 |

### 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               |

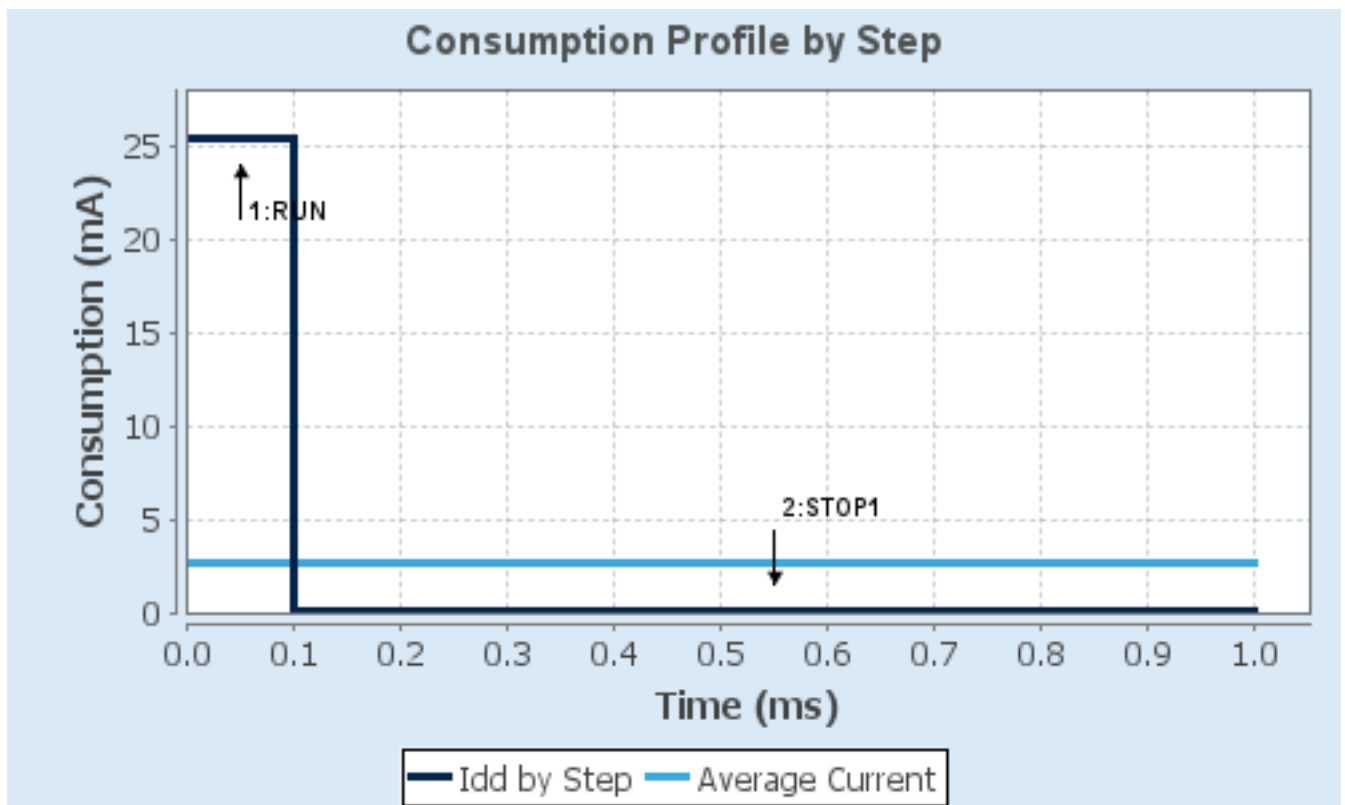
#### 1.4. Sequence

|                               |              |                |
|-------------------------------|--------------|----------------|
| <b>Step</b>                   | Step1        | Step2          |
| <b>Mode</b>                   | RUN          | STOP1          |
| <b>Vdd</b>                    | 3.0          | 3.0            |
| <b>Voltage Source</b>         | Battery      | Battery        |
| <b>Range</b>                  | Range1-Boost | NoRange        |
| <b>Fetch Type</b>             | FLASH/ART    | NA             |
| <b>CPU Frequency</b>          | 170 MHz      | 0 Hz           |
| <b>Clock Configuration</b>    | HSE BYP PLL  | ALL CLOCKS OFF |
| <b>Clock Source Frequency</b> | 4 MHz        | 0 Hz           |
| <b>Peripherals</b>            |              |                |
| <b>Additional Cons.</b>       | 0 mA         | 0 mA           |
| <b>Average Current</b>        | 25.5 mA      | 59 $\mu$ A     |
| <b>Duration</b>               | 0.1 ms       | 0.9 ms         |
| <b>DMIPS</b>                  | 213.0        | 0.0            |
| <b>Ta Max</b>                 | 125.03       | 129.99         |
| <b>Category</b>               | In DS Table  | In DS Table    |

#### 1.5. Results

|               |                               |                 |             |
|---------------|-------------------------------|-----------------|-------------|
| Sequence Time | 1 ms                          | Average Current | 2.6 mA      |
| Battery Life  | 1 month, 23 days,<br>22 hours | Average DMIPS   | 212.5 DMIPS |

#### 1.6. Chart





## 2. Software Project

### 2.1. Project Settings

| Name                              | Value  |
|-----------------------------------|--|
| Project Name                      | barami_project01   |
| Project Folder                    | C:\Users\nexttd\STM32CubeIDE\workspace_1.19.0\barami_project01 |
| Toolchain / IDE                   | STM32CubeIDE   |
| Firmware Package Name and Version | STM32Cube FW_G4 V1.6.1   |
| 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_TIM2_Init        | TIM2                     |
| 4    | MX_USART2_UART_Init | USART2                   |

## 3. Peripherals and Middlewares Configuration

### 3.1. NUCLEO-G431RB

#### mode: Human Machine Interface

##### 3.1.1. Human Machine Interface:

**Led:**

USER LED GREEN (LD1) **true \***

**Button:**

USER BUTTON **Mode EXTI \***

**VCOM:**

Virtual Com Port **true \***

**Demonstration code:**

Generate demonstration code Enabled

### 3.2. RCC

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

##### 3.2.1. Parameter Settings:

**System Parameters:**

|                   |                    |
|-------------------|--------------------|
| VDD voltage (V)   | 3.3                |
| Instruction Cache | Enabled            |
| Prefetch Buffer   | Disabled           |
| Data Cache        | Enabled            |
| Flash Latency(WS) | 4 WS (5 CPU cycle) |

**RCC Parameters:**

|                                |      |
|--------------------------------|------|
| HSI Calibration Value          | 64   |
| HSE Startup Timeout Value (ms) | 100  |
| LSE Startup Timeout Value (ms) | 5000 |

**Power Parameters:**

|                               |                                       |
|-------------------------------|---------------------------------------|
| Power Regulator Voltage Scale | Power Regulator Voltage Scale 1 boost |
|-------------------------------|---------------------------------------|

**Peripherals Clock Configuration:**

|  |      |
|--|------|
| Generate the peripherals clock configuration | TRUE |
|--|------|

### 3.3. SYS

## Debug: Serial Wire

Timebase Source: SysTick

mode: save power of non-active UCPD - deactive Dead Battery pull-up

### 3.4. TIM2

Clock Source : Internal Clock

Channel2: PWM Generation CH2

#### 3.4.1. Parameter Settings:

##### Counter Settings:

|   |             |
|---|-------------|
| Prescaler (PSC - 16 bits value)                       | 18-1 *      |
| Counter Mode  | Up          |
| Dithering   | Disable     |
| 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 TRGO | Reset (UG bit from TIMx_EGR)               |

##### Clear Input:

|                    |         |
|--------------------|---------|
| Clear Input Source | Disable |
|--------------------|---------|

##### PWM Generation Channel 2:

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

### 3.5. USART2

Mode: Asynchronous

#### 3.5.1. Parameter Settings:

##### Basic Parameters:

|             |                           |
|-------------|---------------------------|
| Baud Rate   | 115200                    |
| Word Length | 8 Bits (including Parity) |
| Parity      | None                      |
| Stop Bits   | 1                         |

##### Advanced Parameters:

|                  |                             |
|------------------|-----------------------------|
| Data Direction   | Receive and Transmit        |
| Over Sampling    | 16 Samples                  |
| Single Sample    | Disable                     |
| ClockPrescaler   | 1                           |
| Fifo Mode        | Disable                     |
| Txfifo Threshold | 1 eighth full configuration |
| Rxfifo Threshold | 1 eighth full configuration |

**Advanced Features:**

|                               |         |
|-------------------------------|---------|
| Auto Baudrate                 | Disable |
| TX Pin Active Level Inversion | Disable |
| RX Pin Active Level Inversion | Disable |
| Data Inversion                | Disable |
| TX and RX Pins Swapping       | Disable |
| Overrun                       | Enable  |
| DMA on RX Error               | Enable  |
| MSB First                     | Disable |

\* **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                   | PF0-OSC_IN     | RCC_OSC_IN     | n/a                          | n/a                         | n/a       | RCC_OSC_IN    |
|                       | PF1-OSC_OUT    | RCC_OSC_OUT    | n/a                          | n/a                         | n/a       | RCC_OSC_OUT   |
| SYS                   | PA13           | SYS_JTMS-SWDIO | n/a                          | n/a                         | n/a       | T_SWDIO       |
|                       | PA14           | SYS_JTCK-SWCLK | n/a                          | n/a                         | n/a       | T_SWCLK       |
| TIM2                  | PA1            | TIM2_CH2       | Alternate Function Push Pull | No pull-up and no pull-down | Low       |               |
| USART2                | PA2            | USART2_TX      | Alternate Function Push Pull | No pull-up and no pull-down | Low       |               |
|                       | PA3            | USART2_RX      | Alternate Function Push Pull | No pull-up and no pull-down | Low       |               |
| Single Mapped Signals | PC14-OSC32_IN  | RCC_OSC32_IN   | n/a                          | n/a                         | n/a       | RCC_OSC32_OUT |
|                       | PC15-OSC32_OUT | RCC_OSC32_OUT  | n/a                          | n/a                         | n/a       | RCC_OSC32_OUT |
|                       | PB3            | SYS_JTDO-SWO   | n/a                          | n/a                         | n/a       | T_SWO         |
| GPIO                  | PB12           | GPIO_Output    | Output Push Pull             | No pull-up and no pull-down | Low       |               |
|                       | PA12           | 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   | 0                    | 0           |
| EXTI line[15:10] interrupts   | true   | 0                    | 0           |
| PVD/PVM1/PVM2/PVM3/PVM4 interrupts through EXTI lines 16/38/39/40/41    | unused |                      |             |
| Flash global interrupt  | unused |                      |             |
| RCC global interrupt  | unused |                      |             |
| TIM2 global interrupt   | unused |                      |             |
| USART2 global interrupt / USART2 wake-up interrupt through EXTI line 26 | unused |                      |             |
| FPU 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             |
| EXTI line[15:10] interrupts             | false                             | true                 | true             |

\* User modified value

## 5. System Views

### 5.1. Category view

#### 5.1.1. Current

Middleware

| System Core | Analog | Timers | Connectivity | Multimedia | Security | Computing | Utilities | Bsp            |
|-------------|--------|--------|--------------|------------|----------|-----------|-----------|----------------|
| DMA         |        | TIM2   | USART2       |            |          |           |           | HUCLE0-G431... |
| GPIO        |        |        |              |            |          |           |           |                |
| NVIC        |        |        |              |            |          |           |           |                |
| RCC         |        |        |              |            |          |           |           |                |
| SYS         |        |        |              |            |          |           |           |                |

## 6. Docs & Resources

| Type                    | Link  |
|-------------------------|---|
| BSDL files              | <a href="https://www.st.com/resource/en/bsdl_model/stm32g4_bsd1.zip">https://www.st.com/resource/en/bsdl_model/stm32g4_bsd1.zip</a>   |
| IBIS models             | <a href="https://www.st.com/resource/en/ibis_model/stm32g4_ibis.zip">https://www.st.com/resource/en/ibis_model/stm32g4_ibis.zip</a>   |
| System View Description | <a href="https://www.st.com/resource/en/svd/stm32g4_svd.zip">https://www.st.com/resource/en/svd/stm32g4_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-usb-c-pd-solutions-presentation.pdf">https://www.st.com/resource/en/product_presentation/stm32-usb-c-pd-solutions-presentation.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>   |
| Presentations           | <a href="https://www.st.com/resource/en/product_presentation/microcontrollers-stm32g4-series-product-overview.pdf">https://www.st.com/resource/en/product_presentation/microcontrollers-stm32g4-series-product-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/flstm32g4.pdf">https://www.st.com/resource/en/flyer/flstm32g4.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/flstm32trust.pdf">https://www.st.com/resource/en/flyer/flstm32trust.pdf</a>   |
| Flyers                  | <a href="https://www.st.com/resource/en/flyer/fldpstpf11120.pdf">https://www.st.com/resource/en/flyer/fldpstpf11120.pdf</a>   |
| Security Bulletin       | <a href="https://www.st.com/resource/en/technical_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1489-security-bulletin-tn1489stpsirt-physical-attacks-on-stm32-and-stm32cube-firmware-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 [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)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3126-audio-and-waveform-generation-using-the-dac-in-stm32-products-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an3155-uart-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an3155-uart-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](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/an4221-i2c-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](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/an4232-getting-started-with-analog-comparators-for-stm32f3-series-and-stm32g4-series-devices-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4232-getting-started-with-analog-comparators-for-stm32f3-series-and-stm32g4-series-devices-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4286-spi-protocol-used-in-the-stm32-bootloader-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4296-use-stm32f3stm32g4-ccm-sram-with-iar-embedded-workbench-keil-mdkarm-stmicroelectronics-stm32cubeide-and-other-gnubased-toolchains-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4296-use-stm32f3stm32g4-ccm-sram-with-iar-embedded-workbench-keil-mdkarm-stmicroelectronics-stm32cubeide-and-other-gnubased-toolchains-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](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/an4750-handling-of-soft-errors-in-stm32-applications-stmicroelectronics.pdf](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/an4776-generalpurpose-timer-cookbook-for-stm32-microcontrollers-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4776-generalpurpose-timer-cookbook-for-stm32-microcontrollers-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4803-highspeed-si-simulations-using-ibis-and-boardlevel-simulations-using-hyperlynx-si-on-stm32-mcus-and-mpus-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an4803-highspeed-si-simulations-using-ibis-and-boardlevel-simulations-using-hyperlynx-si-on-stm32-mcus-and-mpus-stmicroelectronics.pdf)
- Application Notes [https://www.st.com/resource/en/application\\_note/an4989-stm32-microcontroller-debug-toolbox-stmicroelectronics.pdf](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/an5027-interfacing-pdm-](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/an5093-getting-started-with-stm32g4-series--hardware-development-boards-stmicroelectronics.pdf](https://www.st.com/resource/en/application_note/an5093-getting-started-with-stm32g4-series--hardware-development-boards-stmicroelectronics.pdf)
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| Technical Notes & Articles | <a href="https://www.st.com/resource/en/technical_note/tn1433-reference-device-marking-schematics-for-stm32-microcontrollers-and-microprocessors-stmicroelectronics.pdf">https://www.st.com/resource/en/technical_note/tn1433-reference-device-marking-schematics-for-stm32-microcontrollers-and-microprocessors-stmicroelectronics.pdf</a>                   |
| User Manuals               | <a href="https://www.st.com/resource/en/user_manual/um3167-stm32g4-series-ulcsaiec-607301603351-selftest-library-user-guide-stmicroelectronics.pdf">https://www.st.com/resource/en/user_manual/um3167-stm32g4-series-ulcsaiec-607301603351-selftest-library-user-guide-stmicroelectronics.pdf</a>   |